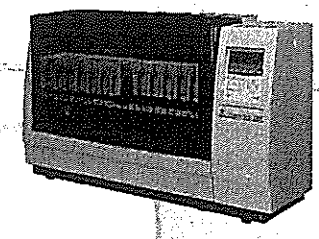
Sakura

Tissue-Tek® DRS™ 2000

Slide Stainer



COMPUTER-ASSISTED FLEXIBILITY FOR
UNMATCHED PRODUCTIVITY

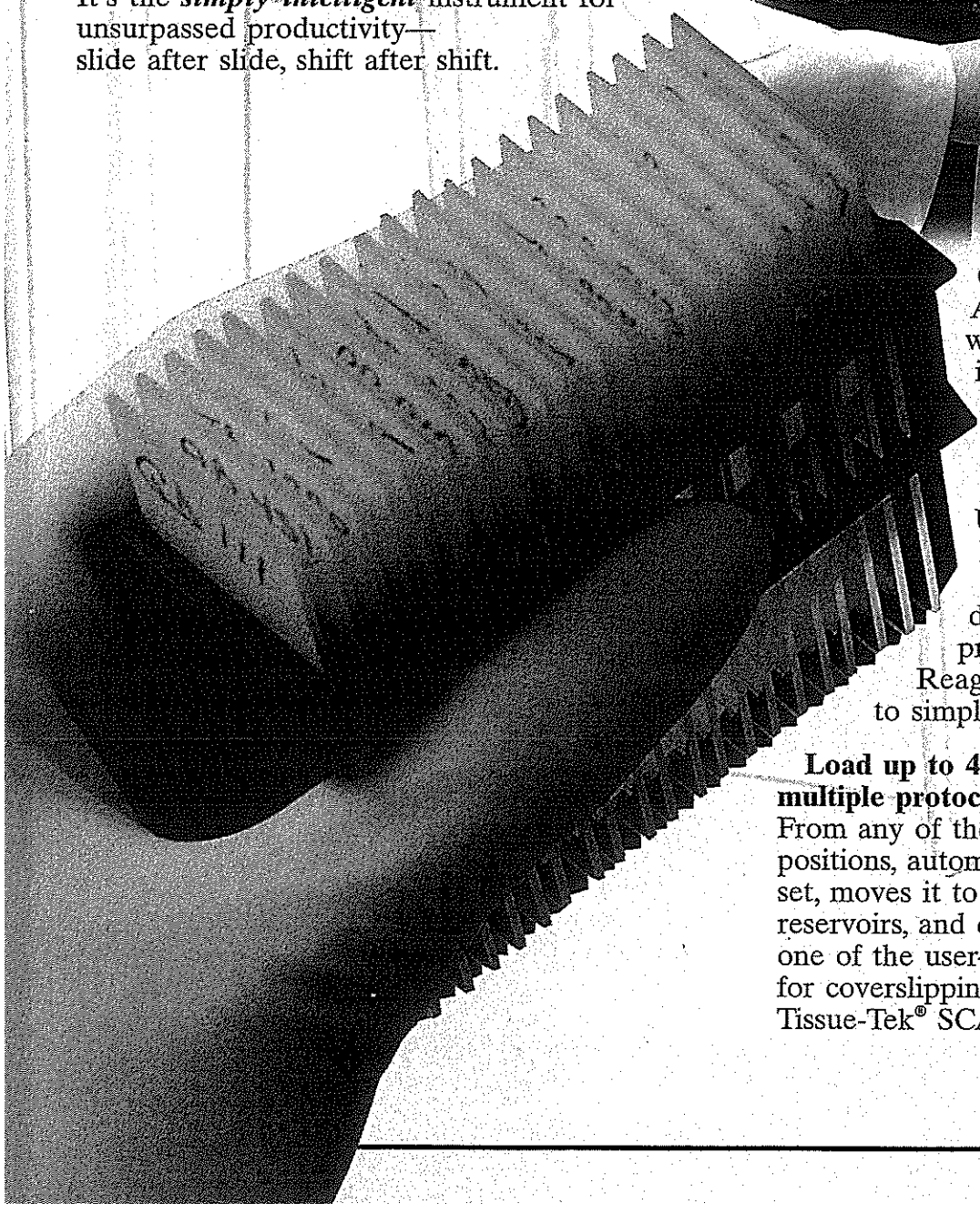
SAKURA

Simply intelligent

Sakura Tissue-Tek® DRS™ 2000 Slide Stainer

The Tissue-Tek® DRS™ 2000 Slide Stainer delivers multiple staining protocols in a true random-access mode. Based on current workload demands, the system can handle up to 11 sets of 40 slides at a time. The operator selects from the 20 methods stored in memory, presses START...***and walks away***.

It's the ***simply intelligent*** instrument for unsurpassed productivity—
slide after slide, shift after shift.



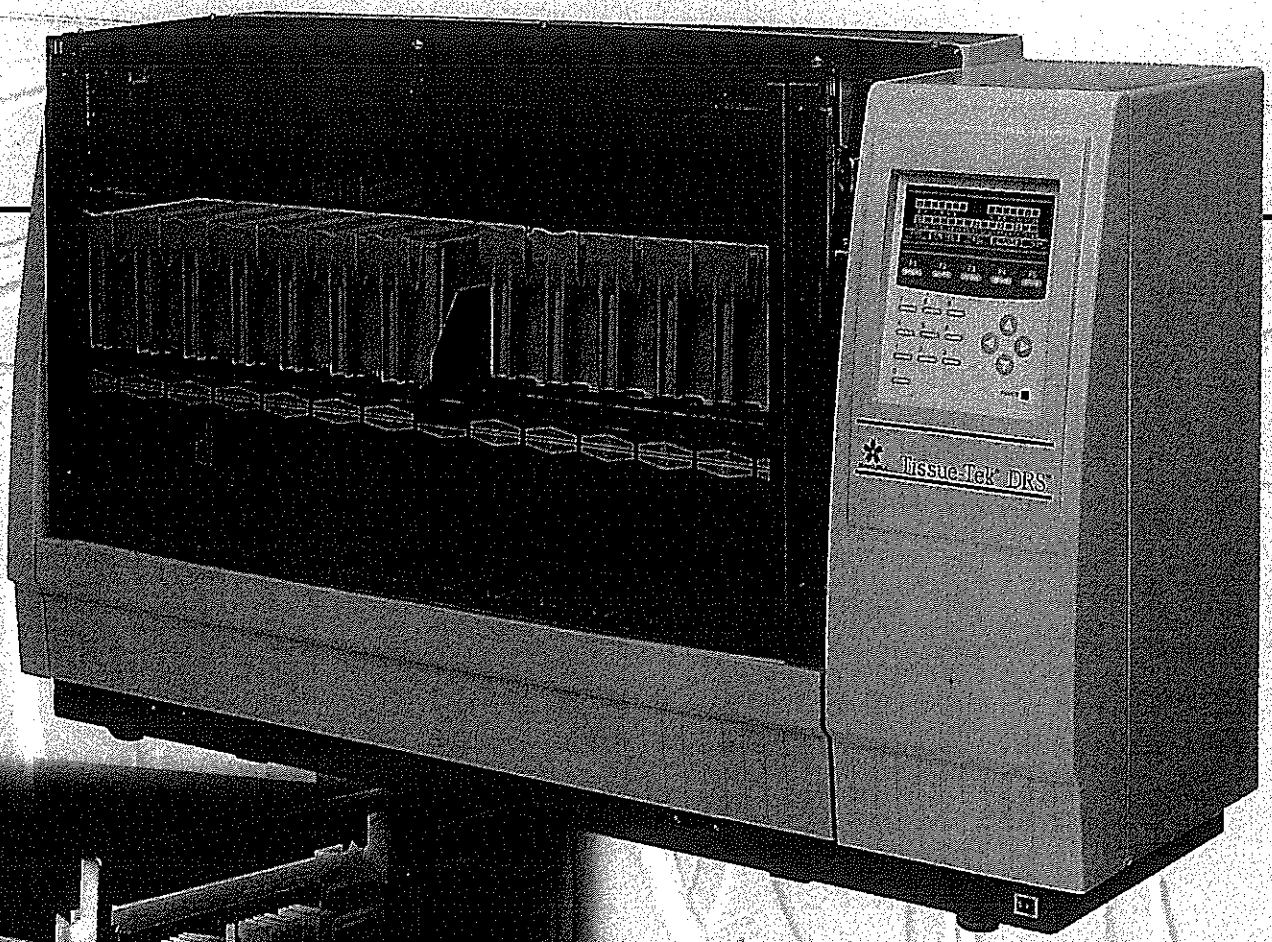
The Tissue-Tek® DRS™ 2000 Slide Stainer features:

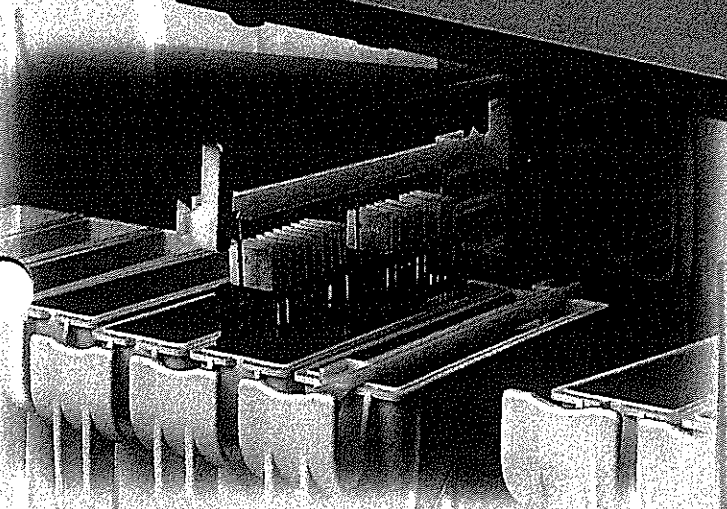
27 reservoirs, 1 drying station
Advanced design flow increases productivity and efficiency in a space-saving, ingenious two-level design. Occupies only about 6 sq ft (0.5 m^2) of benchtop area.

Graphical Process Monitor
At a glance, quickly know where a slide basket is in the instrument, thanks to the Process Monitor Screen. For each basket, also obtain the time remaining in the process.

Up to 20 user-defined protocols
Each program can be specially sequenced to perform up to 50 different steps. Define individual program and reagent names. Reagent use is software controlled to simplify QA procedures.

Load up to 440 slides with multiple protocols...and walk away
From any of the two user-defined Start positions, automatically picks up each basket set, moves it to all programmed solution/wash reservoirs, and delivers the baskets to either one of the user-defined End positions, ready for coverslipping (fully compatible with Tissue-Tek® SCA™ Coverslipper).

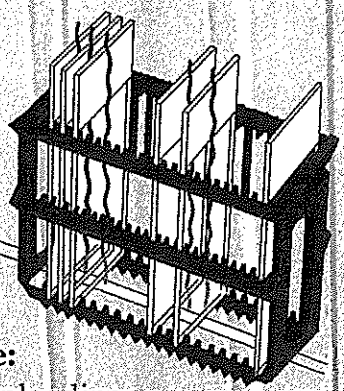




- Interactive software for ease of operation
- Ergonomic, lab-friendly fume control system
- Monitoring of reagent usage
- Precise control of every step of the program
- Agitation independently selectable for each reservoir
- Based upon the proven Tissue-Tek® DRS™ technology (MTBF of 9.2 years[1])

Program multiple protocols—easily and accurately
Interactive, push-button programming for truly automated operation using user-defined names.

Unique, precise washing technique
Ensures superior staining performance for both cytology and histology. Each slide is in contact with a gentle jet of water, precisely metered.



Additional features include:

- Intelligent loading and unloading for productivity and efficiency
- New Enhanced Wash feature to avoid excess staining when using highly concentrated solutions

1. Mean Time Between Failure. Data on file, Sakura Finetek U.S.A., Inc.

Tissue-Tek® DRS™ 2000
Slide Stainer

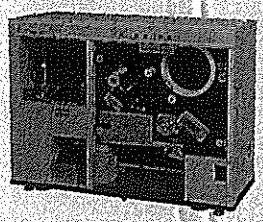
Computer-assisted flexibility for unmatched productivity

Specifications

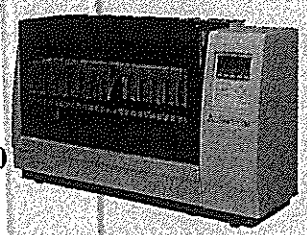
Product No.	4929
Slide capacity:	40 in two baskets
Handling capacity:	Up to 11 sets of 40 slides
Memory:	20 programs, 50 program names, and 100 solution names
Program steps:	Up to 50
Immersion times:	1 sec to 99 min 59 sec
Reservoir positions:	27 + 1 drying position
Reservoir volume:	650 mL
Drying station range:	30°C to 65°C
Width:	115 cm (45 in)
Depth:	49 cm (19 in)
Height:	66 cm (26 in)
Weight:	90 kg (198 lbs)

Perfect companion instruments

The Tissue-Tek® SCA™ Coverslipper delivers up to 20 coverslipped slides per minute — up to 1,200 slides per hour. Load the same baskets as the Tissue-Tek® DRS™ 2000 Slide Stainer for reduced handling, greater efficiency — and walk away. It's the ***simply productive*** instrument for unsurpassed efficiency.



Tissue-Tek® SCA™ Coverslipper



Tissue-Tek® DRS™ 2000 Slide Stainer

The Tissue-Tek® DRS™ 2000 Slide Stainer delivers multiple staining protocols in a true computer-assisted, random-access mode. Handles up to 11 groups of 40 slides at a time with unsurpassed quality for both histology and cytology. True automation without compromising quality.

Contact your Sakura Specialist for more information about the Tissue-Tek® DRS™ 2000 Slide Stainer and the Tissue-Tek® SCA™ Coverslipper.

SAKURA

Proven Reliability

Sakura Finetek U.S.A., Inc.
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Torrance, CA 90501 U
Phone: (800) 725-8

Visit our web site at www.sakuraus.com

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Printed in USA

SAKURA®

Tissue-Tek® DRS 2000

Automatic Slide Stainer

Service Manual

Manufactured for:
Sakura Finetechnical Co., Ltd., Tokyo, 103, Japan
Sakura Finetek U.S.A., Inc., Torrance, CA 90501 USA
Sakura Finetek Europe B.V., Zoeterwoude, Netherlands
Made in U.S.A.

Information contained in this service manual is designed for use by properly trained service personnel using appropriate tools and test equipment. If you do not possess the proper training or tools, do not attempt to service this instrument.

0000033-01

CHAPTER *PAGE*

Service Manual

DRS 2000

DRS 2000-B	(AC100V)
DRS 2000S-B	(AC100V)
DRS 2000J-B1	(AC110-120V)
DRS 2000J-B2	(AC220-240V)
DRS 2000A-B1	(AC110-120V)
DRS 2000E-B2	(AC220-240V)

DRS 2000-D	(AC100V)
DRS 2000S-D	(AC100V)
DRS 2000J-D1	(AC110-120V)
DRS 2000A-D1	(AC110-120V)
DRS 2000E-D2	(AC220-240V)

This manual is a service manual for the Sakura Automatic Staining System DRS 2000. Before performing maintenance work, please read this manual carefully to fully understand the system.

Do not perform maintenance until confirming that the power supply is off, the power supply cord is disconnected, and the power indicator is completely off. However, some adjustments and checks cannot be done unless the power supply is on. In such a case, take care to prevent electric shock and accidents due to unexpected operation of the system.

Do not place or drop conductive objects onto the control board. Even while the power supply is off, power is supplied to some part of the memory from the battery unit to protect the data to operate the system.

Always use specified parts when replacing parts. A system failure or an accident may occur if parts other than the specified parts are used.

Chapter 1 General Information

1-1 General Specifications

What is described herein is the outline of specifications. Always refer to the specifications as to details of specifications.

(1) Differences in Rated Power Input according to Model

1. 100 V Models
   - DRS-2000-B : AC100V (50/60Hz) : 0.5A
   - DRS 2000S-B : AC100V (50/60Hz) : 0.5A
   - DRS-2000-D : AC100V (50/60Hz) : 4.4A*
   - DRS 2000S-D : AC100V (50/60Hz) : 4.4A*
   - DRS 2000A-B1 : AC115V (60Hz) : 0.5A
   - DRS 2000A-D1 : AC115V (60Hz) : 5.0A*
   - DRS 2000J-B1 : AC110V-AC120V (50/60Hz) : 0.5A
   - DRS 2000J-D1 : AC110V-AC120V (50/60Hz) : 5.0A*
2. 200 V Models
   - DRS 2000J-B2 : AC220V-AC240V (50/60Hz) : 0.3A
   - DRS 2000E-B2 : AC220V-AC240V (50/60Hz) : 0.3A
   - DRS 2000J-D2 : AC220V-AC240V (50/60Hz) : 2.5A*
   - DRS 2000E-D2 : AC220V-AC240V (50/60Hz) : 2.5A*

   * Indicates a system with a dryer.

   100 V models and 200 V models differ as to the below items:
   - Power supply input power supply power cord set
   - Power supply fuse
   - Power supply fuse holder unit
   - Connection of two drying heater units to be used on an optional dryer (connection of terminal block short-circuit cable JPs to be used on the dryer unit terminal)

     To be parallel connected for 100 V models

     To be serial connected for 200 V models

(2) General Outline

Body Size: 1,150 (W) x 490 (D) x 660 (H) mm
Body Weight: Approx. 101 kg (approx. 120 kg during operation)
Rated Voltage: Refer to (1) Differences in Rated Power Input according to Model above.
Rated Current: Refer to (1) Differences in Rated Power Input according to Model above.
Insulation Class: Class I Type B equipment (JIS T1001)
Class I (IEC1010-1)
Insulation harmony: Installation Category II Contamination 2 (IEC1010-1)

1-2 Facility Requirements

(1) Mechanical Requirements

1. Place to Install
   Required space for installation: 1,150 (W) x 490 (D) mm
   Requirements for installation base: One to support a load of 130 kg or more
2. Water supply requirements
   Quality of water to use: City water
   Dynamic pressure of water to use: 0.098 to 0.441 MPa (1.0 to 4.5 kgf/cm^2)
   Maximum static pressure of water to use: 0.833 MPa (8.5 kgf/cm^2)
   Temperature of water to use: Below 30°C (no freezing)
   Nominal diameter: Over 15A
3. Drain requirements: Indirect draining, Drain capacity Over 15 l/min.

(2) Electrical Requirements

1. 100 V Models
   - DRS-2000-B: Below AC100±10%, 50/60 Hz, Over 0.5A, 15 A, AC 125 V plug with an earth line of over Class 3 grounding work
   - DRS-2000S-B: Below AC100±10%, 50/60 Hz, Over 0.5A, 15 A, AC 125 V plug with an earth line of over Class 3 grounding work
   - DRS-2000-D: Below AC100±10%, 50/60 Hz, Over 4.4A, 15 A, AC 125 V plug with an earth line of over Class 3 grounding work
   - DRS-2000A-B1: Below AC115±10%, 50/60 Hz, Over 0.5A, plug with an earth line of over Class 3 grounding work or equivalent
   - DRS-2000J-D1: Below AC115±10%, 50/60 Hz, Over 5.0A, plug with an earth line of over Class 3 grounding work or equivalent
   - DRS-2000-B1: AC99V (110V-10%) to AC126V (120V+5%) 50/60Hz, Over 0.5A, plug with an earth line of over Class 3 grounding work or equivalent
   - DRS-2000J-D1: AC99V (110V-10%) to AC126V (120V+5%) 50/60Hz, Over 5.0A plug with an earth line of over Class 3 grounding work or equivalent
2. 200V Models
   - DRS-2000J-B2: AC198V (220V-10%) to AC264V (240V+10%) 50/60Hz, Over 0.3A plug with an earth line of over Class 3 grounding work or equivalent
   - DRS-2000E-B2: AC198V (220V-10%) to AC264V (240V+10%) 50/60Hz, Over 0.3A plug with an earth line of over Class 3 grounding work or equivalent
   - DRS-2000J-D2: AC198V (220V-10%) to AC264V (240V+10%) 50/60Hz, Over 2.5A plug with an earth line of over Class 3 grounding work or equivalent
   - DRS-2000E-D2: AC198V (220V-10%) to AC264V (240V+10%) 50/60Hz, Over 2.5A plug with an earth line of over Class 3 grounding work or equivalent

1-3 Environment

(1) Use Environment

- Ambient Temperature: 10 to 40°C
- Relative Humidity 30 to 85% RH (no condensation)
- Pressure 70 to 106 KPa

(2) Storage Environment

- Ambient Temperature: -20 to 65°C
- Relative Humidity 20 to 90% RH (no condensation)
- Pressure 50 to 106 KPa

(3) Others

- Height of drain hose Below the connection port of the instrument along the entire length
- Bending of drain hose Partial bending may be allowed in a horizontal direction, but no bending is allowed in a vertical direction.
- Drain outlet space Over 100 mm (in accordance with Water Supply/Drain Facilities Standards HASS206-1991)

1-4 How to Start

In addition to the normal activation (to turn on the power supply switch only), DRS-2000 may be activated in one of the following means:

(1) **Turn on the power supply while pressing 0 on the ten key.**
The product inspection program will be executed.

(2) **Turn on the power supply while pressing 1 on the ten key.**
The setup mode will be executed.

(3) **Turn on the power supply while pressing Function Key "F2."**
All the data, except for data set in EEPROM, will be initialized to those values set when shipped out of the factory.

(4) **Turn on the power supply while pressing Function Key "F3."**
Only the information on the specimens being stained will be initialized. To be used when the machine cannot be successfully returned to operation upon power recovery.

(5) **Turn on the power supply while pressing Function Key "F5."**
EEPROM will be initialized, and all other data will be initialized to those values set when shipped out of the factory (EEPROM will be different from that at the time of shipment from the factory).

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Chapter 2 Theory of Operations

DRS-2000 consists of the following functional sections:

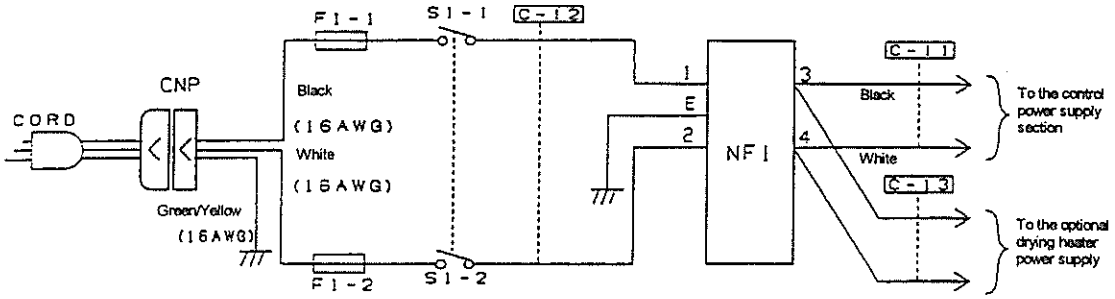
1. Power supply section
2. Control power supply section
3. Control board
4. Operating panel
5. Driver section
6. Cover section
7. Door section
8. Water supply/Washing/Draining Section
9. Exhaust unit
10. External signal input/output section
11. battery unit
12. RS-232C interface section
13. Dryer

2-1 Power Supply Input

It turns on/off (S1) the power supply, protects the system against excess current (F1), and reduces noise of the power supply line (NF1).

The power supply input section is composed of the following components:

Block diagram
Power supply input



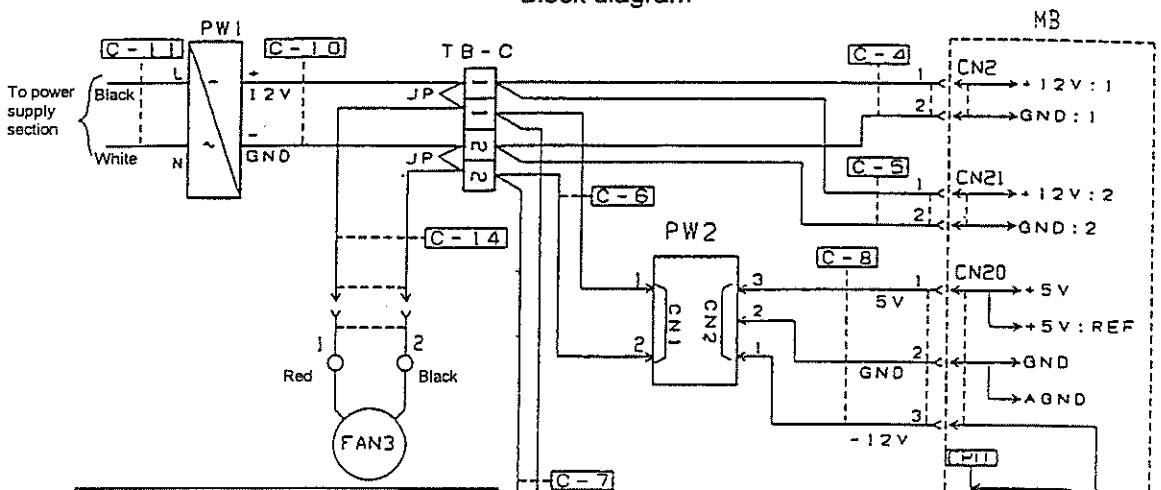
*1 100 V and 200 V models use different parts.

	Mark	Descriptions
*1	CORD	Power supply cord set
	CNP	Power supply connector unit
*1	F1	Power supply fuse
*1		Power supply fuse holder unit
	S1	Power supply switch
	NF1	Noise filter
	C-11	Switching regulator input cable
	C-12	Noise filter input cable
	C-13	Dryer power supply cable

2-2 Power Supply for Control

Various power supplies required to control the system are generated by AC power supply supplied into the power supply input section.

Block diagram



Mark	Descriptions
PW1	Switching regulator
PW2	Power supply board
MB	Control board
LCD	LCD unit
INV	LCD inverter unit
VR	LCD brightness adjustment unit
FAN3	Board cooling fan unit
TB-C	DC power supply terminal
C-4	12 V (input/output) power supply cable
C-5	12 V (motor) power supply cable
C-6	DC-DC converter input cable
C-7	Inverter input cable
C-8	DC-DC inverter output cable
C-9	Inverter output cable
C-10	Switching regulator output cable
C-11	Switching regulator input cable
C-14	Fan input cable
JP	Terminal block short-circuit cable

The control power supply is composed of the following components:

1. PW1 (Switching regulator)
2. PW2 (Power supply board)
3. INV (LCD inverter unit)
4. FAN3 (Board cooling fan unit)
5. C-4 (12 V (input/output) power supply cable)
6. C-5 (12 V (motor) power supply cable)
7. C-6(DC-DC converter input cable)
8. C-7(Inverter input cable)
9. C-8 (DC-DC converter output cable)
10. C-9 (Inverter output cable)
11. C-10 (Switching regulator output cable)
12. C-11 (Switching regulator input cable)
13. JP (Terminal block short-circuit cable)

(1) PW1 (Switching regulator)

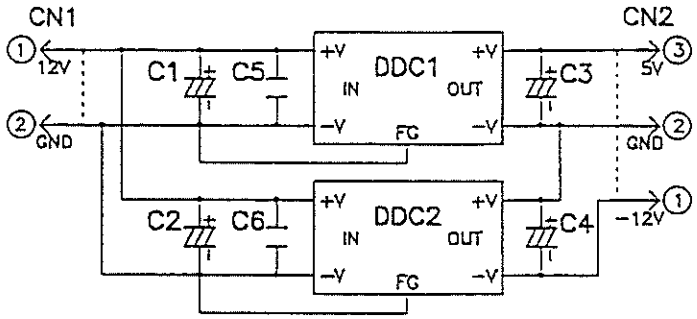
+12 V DC stabilizing power is supplied to the following four sections:

1. +12 V: 1
   To drive sensors, solenoid, solenoid valves, exhaust fans, optional dryer.
2. +12 V: 2
   To drive motors.
3. For PW2 input
4. For INV (LCD back light power supply) input

(2) PW2 (Power supply board)

A power supply board to generate +5V, +5V: REF and -12V for the control board.

Block diagram



Respective DC-DC converters are used to generate power from +12V output of PW1. However, +5V for logic and +5V: REF for analog are separated on the control board by means of printed patterns. -12V is used for LCD brightness adjustment.

(3) INV (LCD inverter unit)

A LCD back light power supply. AC 450V (maximum) is generated from DC+12V input. However, it will be 900V (typically) during no load conditions.

(4) **FAN3 (Board cooling fan unit)**
Cooling fans for control board, power supply board, etc. Power is supplied from the switching regulator to drive the fan. Neither controlling nor monitoring of operation is performed.

(5) **C-4 (12 V (input/output) power supply cable)**
Supply cable to supply 12V (+12V:1) to drive sensors, solenoids, solenoid valves, exhaust fans, and to control the optional dryers.

(6) **C-5 (12 V (motor) power supply cable)**
Supply cable to supply 12V (+12V:1) for driving motor to the control board.

(7) **C-6 (DC-DC converter input cable)**
Supply cable to supply 12V to the two DC-DC converters on the power supply board.

(8) **C-7 (Inverter input cable)**
Supply cable to supply 12V to the LCD inverter unit.

(9) **C-8 (DC-DC converter output cable)**
Supply cable to supply +5V and -12V generated by the two DC-DC converter on the power board to the control board.

(10) **C-9 (Inverter output cable)**
Power supply cable to supply LCD back light power generated by the LCD inverter unit to the LCD unit back light.

(11) **C-10 (Switching regulator output cable)**
Power supply cable to connect 12V generated from the switching regulator to the relay terminal (TB-C) provided for branching to respective blocks.

(12) **C-11 (Switching regulator input cable)**
Input cable for the switching regulator.

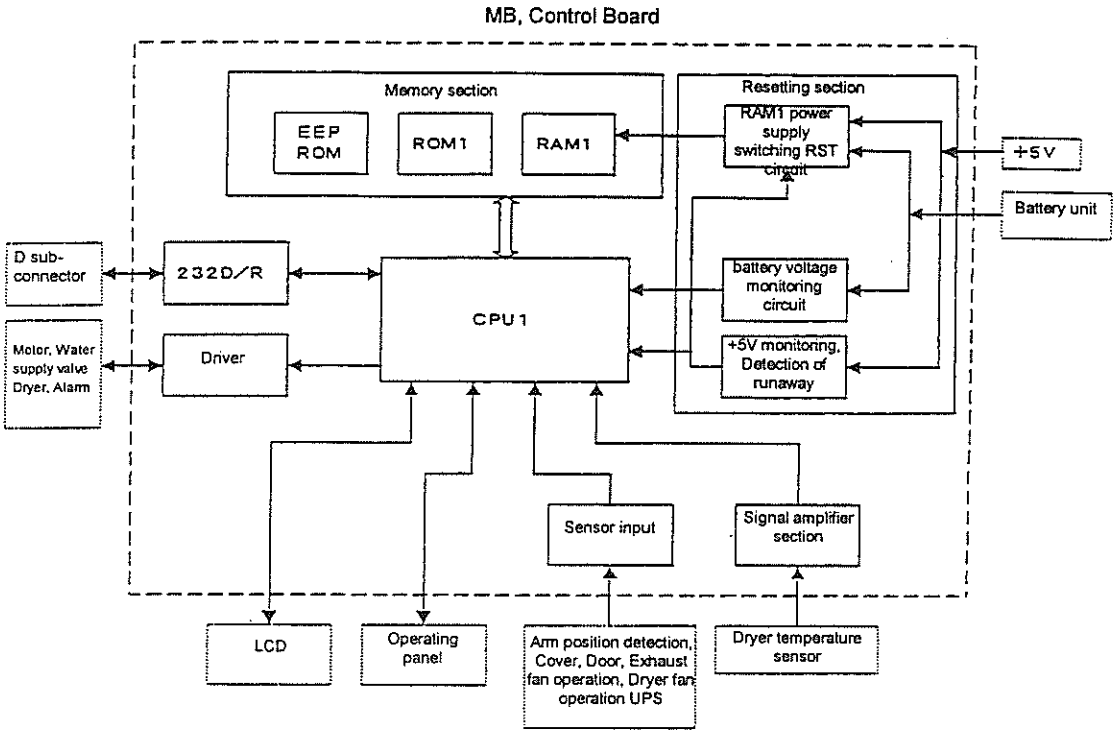
(13) **JP (Terminal block short-circuit cable)**
Cable to short-circuit terminals on the terminal block.

The above are power supplies for control.
As for MB (control board), LCD (LCD unit) and VR (LCD brightness adjustment unit), please refer to 2-3 Control Board and 2-4 Operating Panel below.

2-3 Control Board

A board to control the entire system. All sensors and driving parts are connected to this board.

Block Diagram



The in-board is composed of the following blocks:

(1) CPU1

(2) Memory section

(3) 232D/R

(4) Reset section
+5V monitor and runaway detection circuit
RAM1 power supply switching & reset circuit
Battery voltage monitor circuit

(5) Sensor input section

(6) Signal amplifier section

(7) Driver section

(1) CPU1

A 16-bit micro-controller for control. All inputs from sensors, etc. go into this controller and all signals for control go out hereof.

(2) Memory section

All data are stored here.

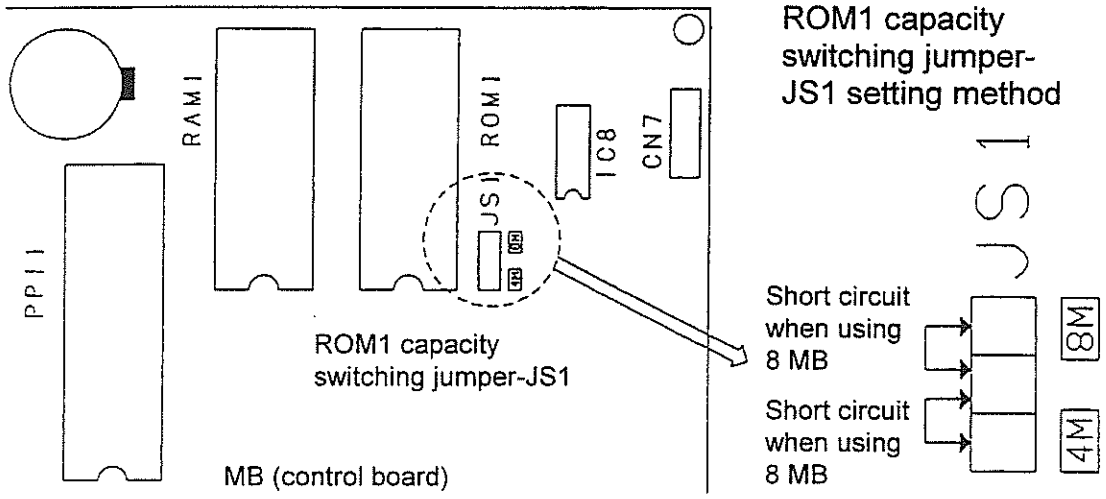
The memory section is composed of the following blocks:

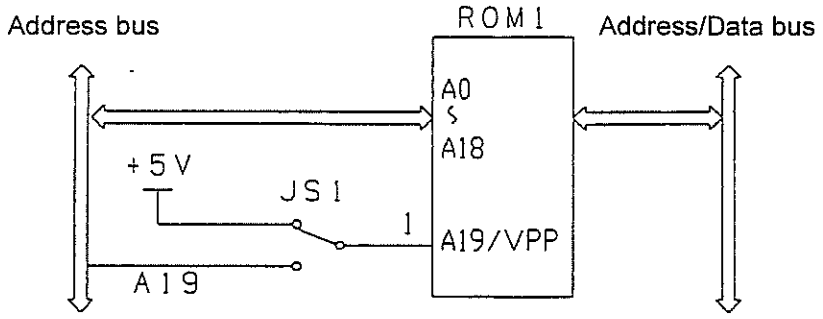
1. ROM1

A control program is stored in ROM1.

The contents stored here will be kept even while power is turned off.

Block diagram





By switching the jumper pin (JS1) on the control board, No.1 pin on ROM1 will be connected to 5V or Address 19. When set on the 4MB side (refer to the drawing above), No.1 pin on ROM1 will be connected to 5V for 4MB setting. When set n the 8MB side (refer to the drawing above), No.1 pin on ROM1 will be connected to Address 19 for 8MB setting. By setting as above, either 4MB or 8MB will be selected from two ROMs.

2. RAM1

Data necessary for controlling, and data set by user (staining program, solution, etc.) are stored in RAM1. Data stored in RAM1 will be destroyed when power supply to RAM1 is discontinued. However, even if an operation stops (the power is turned off), the data (staining program, solution, etc.) required to operate the system again is saved. Therefore, power will be supplied to RAM1 from the battery unit (reservoir) connected externally to the control board to protect the data. Thus, if the system is turned off without any battery left, the data stored will be destroyed.

3. EEPROM

Data on system environment setting items to be set by user is stored in EEPROM. The data will remain stored even when the power is turned off.

4. Memory initialization

a. Initialization of RAM1 (SRAM)

There are four ways of initialization as shown below:

- The battery unit is removed, and the power supply is turned off. VBAT line and GND (Pins 16 and 32 on RAM1) is short circuited.

  In this case, the data stored in RAM1 (refer to the table below) will become "0."

  When the power supply is turned on in a normal way, a default value will be set. The solution positioning list and the solution names by languages need to be set again.

  * When VBAT line and GND are short circuited with the power supply or battery unit connected, the system may get troubles.

- While depressing "F2", turn on the power or execute "Set-Up 3. Initialize of SRAM" for inspection program.

  In this case, the data stored in RAM 1 (refer to the table below) will become default values. The solution positioning list and the solution names by languages need to be set again.

- While depressing "F5," turn on the power.

  In this case, not only the data stored in RAM 1 (refer to the table below) will become default values, but also EEPROM data will become default values.

  * If this operation is executed, normal operation may not be done unless the EEPROM data is correctly set. This operation should not be performed at customer sites.

Data and Default Values stored in RAM1

Item	Default values	Setting method
Staining program		Environment setting
Solution positioning list		Environment setting
Solution names by languages		Environment setting
Sample No.	0	Environment setting
Batch/continuous selection	Continuous	Environment setting
Mix width	25 mm	Setup program
# of mix	3 times	Setup program
Mix speed	3	Setup program
Drying temperature	65°C	Setup program
Washing refreshing time	1 min.	Setup program
# of enhanced wash	3	Setup program
Enhanced wash speed	5	Setup program
Key click sound	Yes	Setup program
Printer setting	CR	Setup program
Printer error	Recognition	Setup program
Print timing	Automatic	Setup program
Error data	Clear	Setup program

a Initialization of EEPROM

* If EEPROM data is initialized, normal operation cant not be performed unless the data is correctly set again. This operation should not be performed at customer sites.
There are two ways as shown below:
Execute "Set-Up 2. Initialize of EEPROM" for inspection program.
In this case, the offset data stored in EEPROM will become "0."
Depressing "F5," turn on the power supply.
In this case, not only the offset data stored in EEPROM will become "0" and other data (refer to the table below) will become default values, but also RAM1 data will become default values.

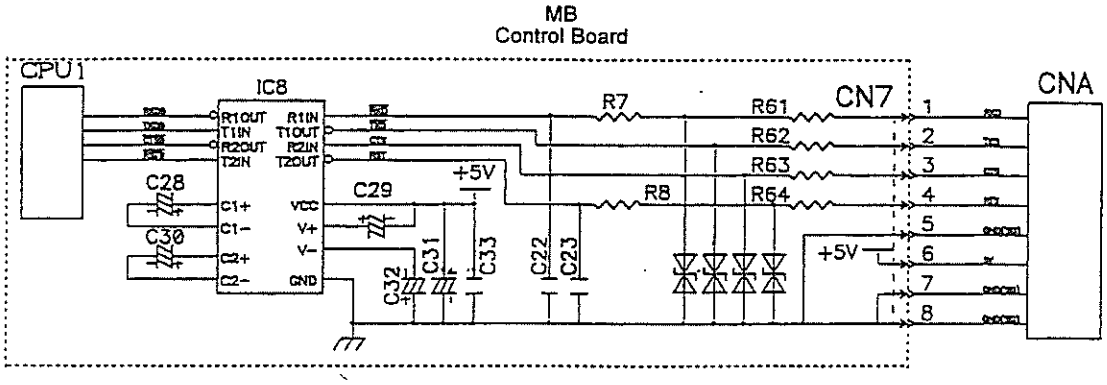
Data Stored in EEPROM, and Default Values

Items	Default values	Setting method
Offset information		Product inspection program Test 2 1. Carrier
UPS	None	Setup program
PRT	None	Setup program
Language	English	Setup program
Dryer	None	Setup program

(3) 232D/R

Driver and receiver for serial communication (RS232C). Here, signal voltage conversion is done for serial communication.

Block Diagram



0V or 5V signals (TXD, RTS) from CPU1 are converted to +12V or -12V in the driver/receiver section (IC8). Also, +12V or -12V signals (RXD, CTS) coming from outside of the system are converted to 0V or 5V signals in the driver/receiver and are inputted into CPU1.

Signals between CPU1 and external equipment are voltage-converted in the 232 receiver/driver (IC8) as shown below:

CPU1↔IC8	IC8↔CNA
Low	+12V
High	-12V

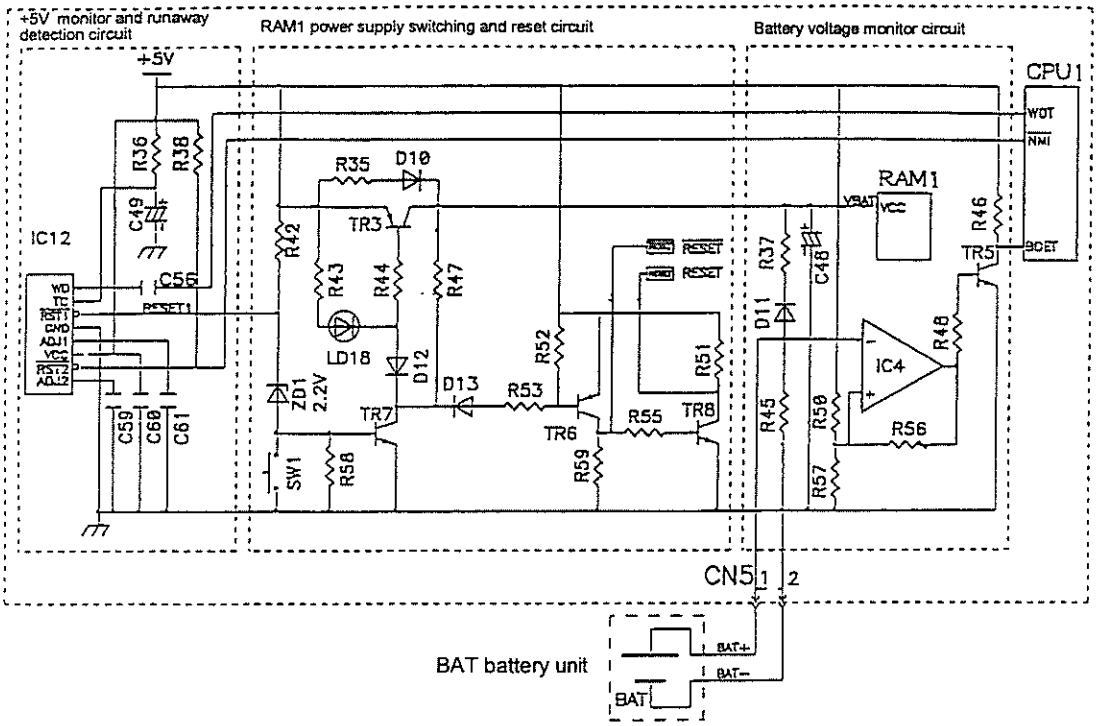
Refer to Related Paragraph 2-12 RS-232C Interface.

(4) Reset section

The section resets the system, switches the RAM1 power supply, and monitors the voltage of the battery unit.

Block Diagram

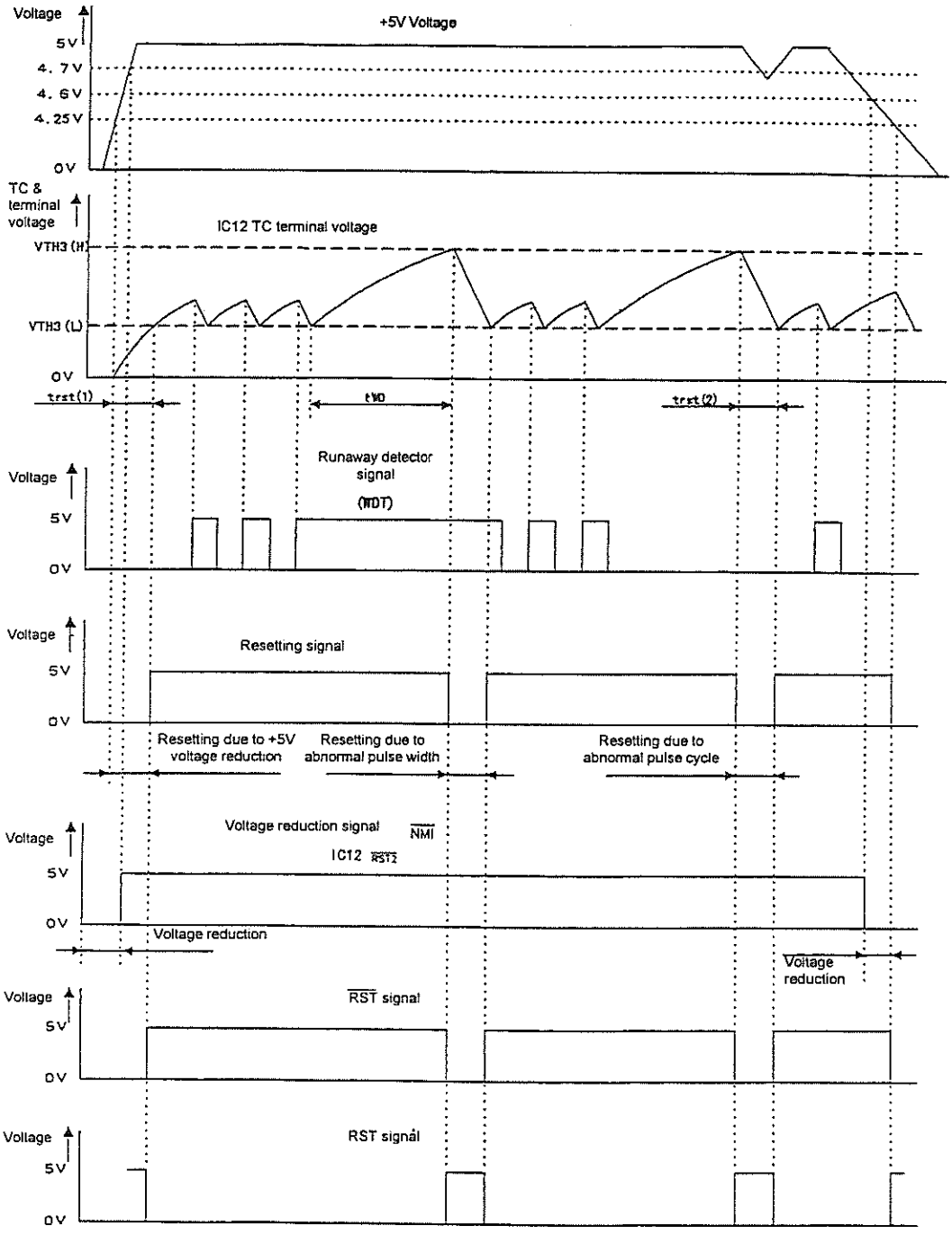
MB, Control Board



The reset section is composed of the following blocks:

1. +5V monitor and runaway detection circuit
2. RAM1 power supply switching and resetting circuit
3. Battery voltage monitor circuit

Each Signal Timing



trst (1): Reset timer 1 (for system reset)

trst (2): Reset timer 2 (reset time)

tWD: Duration from reset (IC12 RST1) cancellation to reset again. If there are no WDT signals during this duration, the state will be interpreted as runaway, and the system will be reset.

$\overline{NMI}$: Abnormal voltage signal. High above 4.7V, and Low below 4.6V instead of +5V. CPU1 will judge voltage normal when this signal is High.

Equations to calculate time:

trst (1): 0.51 x C49 x R36 = 94 ms

trst (2): 1000 x C49 x In (4 x R36 1000 - 1) ÷ (2.R36 ÷1000-3) = 5 ms

tWD: 1.1 x C49 x R36 = 202 ms

1. +5V monitor and runaway detection circuit

   Monitors +5 power supply and runaway of CPU1.

   a. Monitors +5V

      IC12 makes Voltage Reduction Signal $\overline{NM1}$ (IC12 $\overline{RST2}$) Low when +5V power supply is less than 4.6V, and makes NM1 $\overline{High}$ when it is over 4.7V. CPU1 judges voltage reduction when this signal is Low. Apart from this, IC12 makes RES ET1 (IC12 RST1) $\overline{High\ at}$ tRST (1)(94 ms) after +5V reaching 4.25V. When +5V is less than 4.25V, RESET1 is Low. rRST (1) time is very important as the system resetting is done due to this RESET1 signal. The voltage of +5V line that the circuit stably operates is 5V±10%. However, the cancellation of the system reset (RESET1 is High) is related to the time, tRST(1) after +5V line reaches 4.25V. It is necessary to have a sufficient time, taking power supply rise characteristics into consideration. When this time is short and if RESET1 becomes High before the circuit reaching a voltage for stable operation and the reset is cancelled, fault operation may result.

   b. Detection of runaway

      When CPU1 does not output signal WDT within a specified time of tWD (202 ms) + trst (2)(5ms) = 207 ms in operation, it is judged that the system is in a runaway condition, and the system is reset with Reset 1 as Low.

2. RAM1 power supply switching and reset circuit

   In order to protect data in RAM1 with signal Reset 1 from +5V Monitor and Runaway Detector Circuit, the power supply for RAM1 is kept switched to the battery unit until reset cancellation. This signal makes signal RESET for system resetting Low, and makes RESET High to reset the system.

   When RESET1 becomes Low or SW1 is On (in a system reset condition), TR7 is turned off, TR3 and TR6 are turned off, and LD18 goes off. When TR3 is turned off, the power supply to the VBA line is switched to the battery unit from +5V. As TR6 is turned off, RESET signal $\overline{becomes}$ Low. In addition, as TR6 is turned off, TR8 is turned off, and RESET signal becomes High. With RESET signal and $\overline{RESET}$ signal, the system is reset to the initial conditions.

3. Battery voltage monitor circuit.

   Monitors the voltage of the battery unit to protect data in RAM1, and outputs an alarm to CPU1 when the voltage is below 3V.

   IC4 outputs High when the battery voltage becomes less than 3V. As TR5 is turned on with this High signal, the abnormal voltage reduction signal BDET becomes Low. CPU1 judges that battery capacity is insufficient when BDET becomes Low.

(5) Sensor input section

Sensor data from outside the control board is input into CPU1 via the sensor input section.

(6) Signal amplifier section

Signals from the dryer temperature sensor is amplified and corrected here and are put into CPU1.

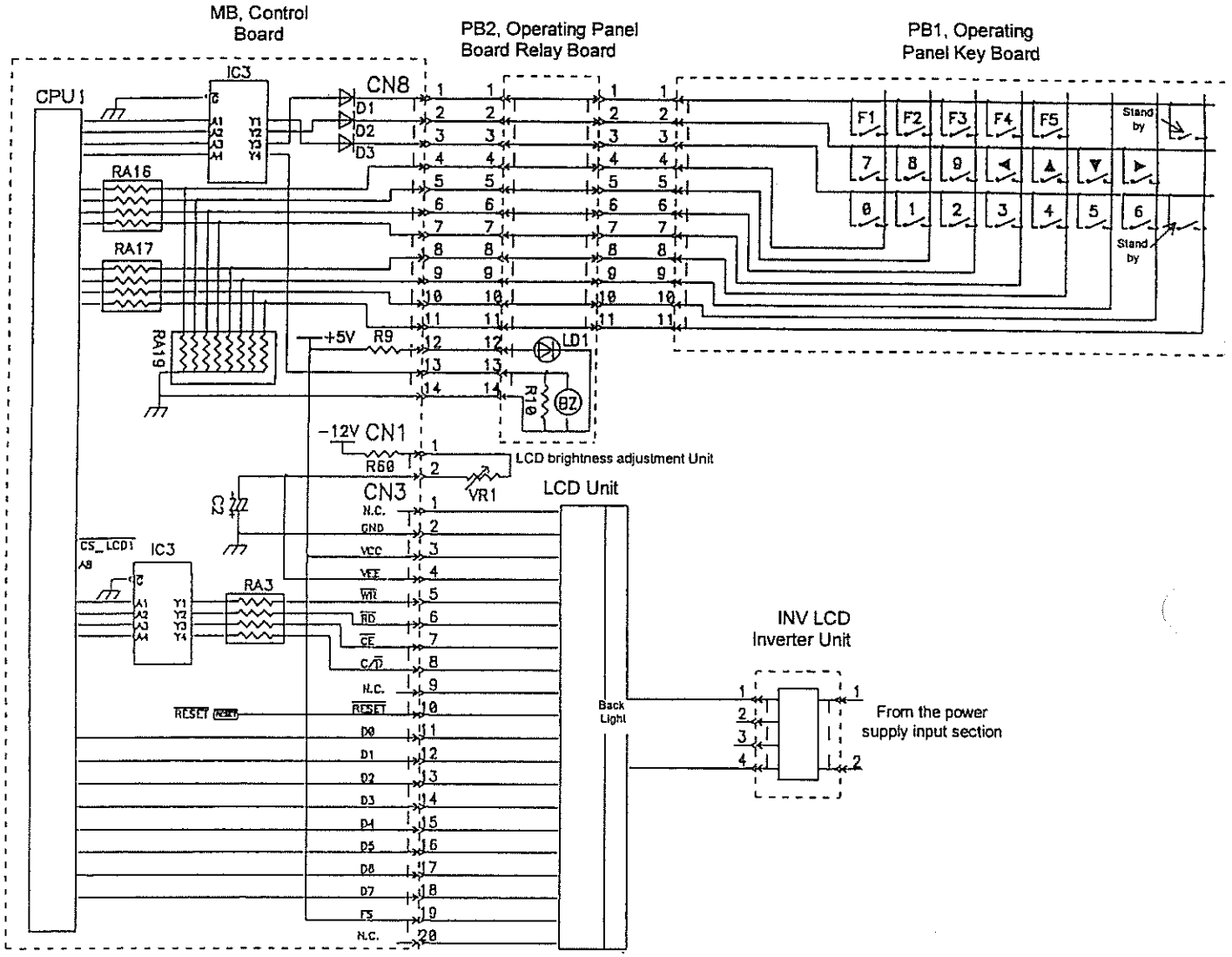
(7) Driver section

Control signals coming from CPU1 are power-converted here and are outputted into each driver section connected to outside the control board.

2-4 Operating Panel

The operating panel is used to enter and display data necessary to operate the system.

Block Diagram

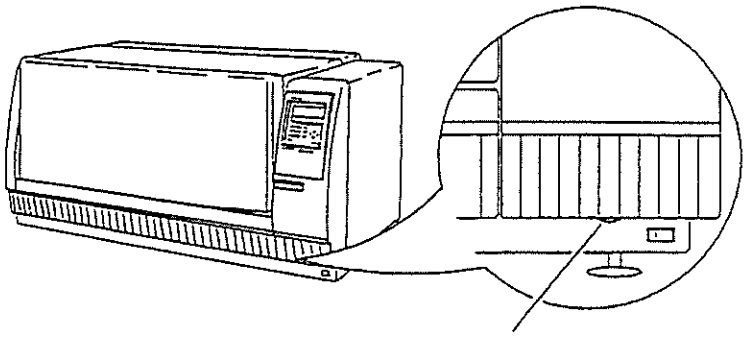


The control panel is composed of the following blocks:

(1) LCD unit
(2) LCD brightness adjustment unit
(3) Control panel key board
(4) Control panel relay board

(1) LCD Unit

The LCD unit displays various data for the user as controlled by CPU1 on the control board. The LCD unit is composed of a LCD body and a cold cathode ray tube back light. The LCD body is connected directly to the control board without going through the operating panel relay board. The back light is directly connected to the LCD inverter unit on the control power supply section. It goes on when it gets power from the LCD inverter unit. LCD brightness changes considerably with temperature changes. When the LCD is not clearly seen, rotate the brightness adjustment knob on the right bottom of the front panel (LCD brightness adjustment unit VR1) to make it clearly seen.



(2) LCD Brightness Adjustment Unit

This LCD Brightness Adjustment Unit is used to adjust brightness. The back light is provided for sharp brightness. In addition, to enhance LCD brightness, -12V and the adjusting volume located on the right bottom of the body allow adjustment of brightness. The above-mentioned brightness adjusting knob may be turned right or left to adjust the volume. CPU1 has nothing to do with brightness adjustment, but the adjustment volume is connected to the LCD section via the control board. Illumination on the LCD display may be adjusted by changing the value of resistor inserted between the LCD power supply VEE and -12V. Even providing the same resistance value, illumination could differ considerably as the transparency of liquid crystal changes in response to the ambient temperature due to its property. In order to keep illumination adjustment within a reasonable range even when temperature changes, a variable resistor (VR1) is used in addition to a fixed resistor on the control board. By controlling this variable resistor, the total resistance may be controlled within a range of 1 to 2 kilo ohms.

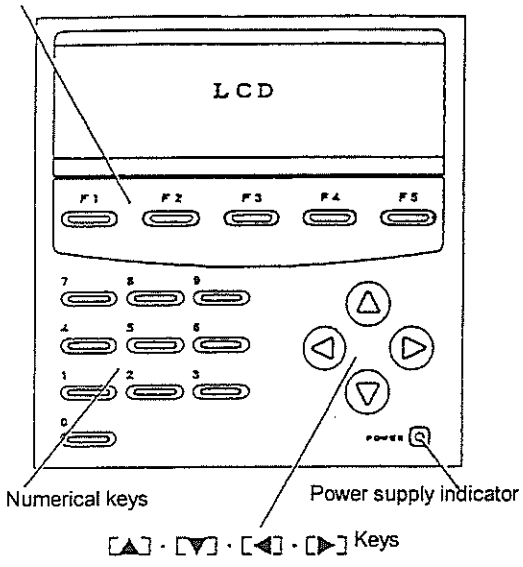
Fixed resistor (R60): 1 kilo ohm
Variable resistors (VR1): 1 kilo ohms (variable within 0 to 1 kilo ohms)

(3) Control Panel key board

The data input key switches are on the panel sheet. Data entered via key switches are inputted into CPU1 via the control panel relay board.

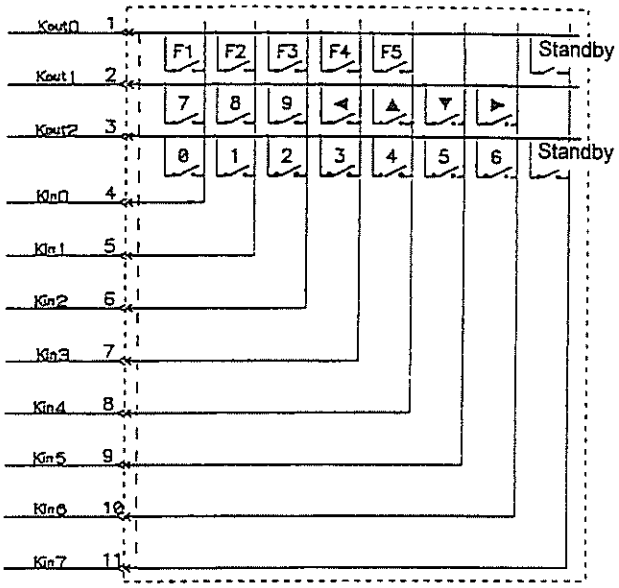
External view of control panel

Function keys (F1 - F5)



The power supply indicator is located on the operating control relay board.

Control panel key board.

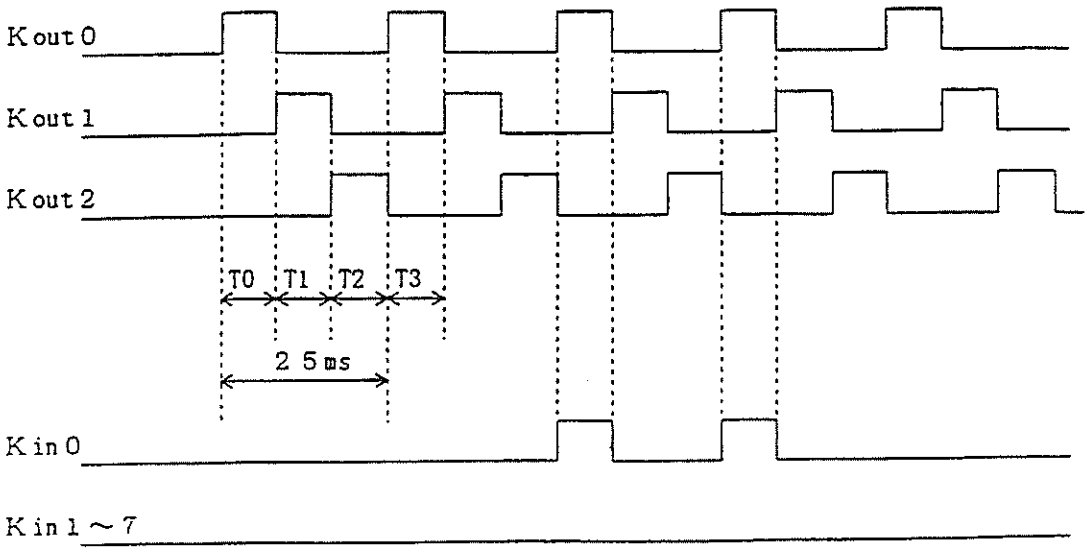


- Key data reading

  The control panel key board is composed of 3 x 8 key matrix, and key scanning is performed constantly at the frequency of 25 ms (Refer to the key scanning timing shown below.) In other words, the keys (maximum of eight keys) connected to the lines of Kout 0 through 2 are candidates to be selected in turn at the frequency of 25 ms, and key data of eight keys (Kin 0 to 7) are read into CPU1. When a key is depressed at a certain timing, High data of the source line is input to CPU1 via the switch and the applicable key scan source line (Kin 0 to 7). CPU1 identifies keys by combining this key data and output data from key scan source line (Kout 0 to 2).

  When a key data reading Kin0 is High (Refer to the key scanning timing shown below), CPU1 judges that F1 key has been depressed if Kout0 is at the timing of High, 7 key has been depressed if Kout1 is at the timing of High or 0 key has been depressed if Kout 2 is at the timing of High. To prevent fault operation due to chattering, however, only key input is valid when a key is judged to have been depressed consecutively through two scans (in case of the scan timing shown below).

Key scan timing (When F1 key is depressed)

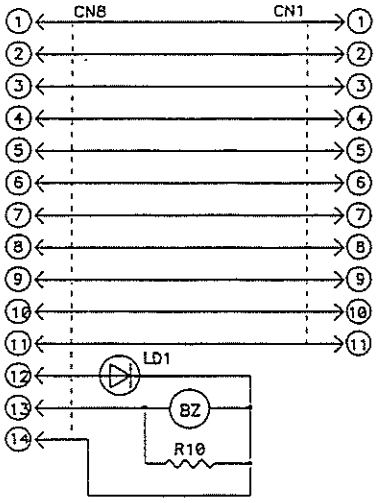


(4) Control Panel Relay Board

A power supply indicator (LD1), a buzzer (BZ), a control board connecting connector (CN8) and a key board relay connector (CN1) are on the control panel relay board. Both the indicator and the buzzer are activated by +5V supplied from the control board. The indicator goes on when power is supplied, but the buzzer is controlled by CPU1. As the buzzer employs a separate excitation system (the buzzer is turned on and off from outside to vibrate the vibrating sheet inside the buzzer to generate buzzer sound), the buzzer sound may be changed by changing the frequency of on/off. DRS-2000 uses four different frequencies according to contents to inform:

- Caution (key operation errors, etc.): 384 Hz
- Alarm (emergency measures are not required): 640 Hz
- End (To inform completion of measures): 800 Hz
- Abnormal (emergency measures are required) 1600 Hz

Operating Panel Relay Board Circuit Diagram



2-5 Driving Unit

This driving unit transfers adapters. The driving unit is composed of the following blocks:

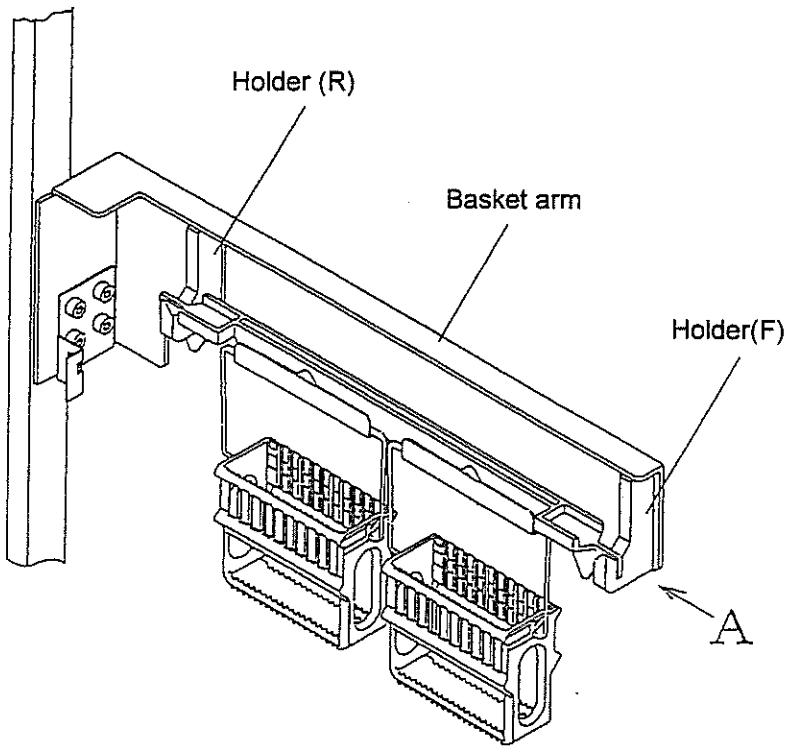
(1) Carrier Unit
(2) Driving Source Unit
(3) Carrier Position Detection Unit

(1) Carrier Unit

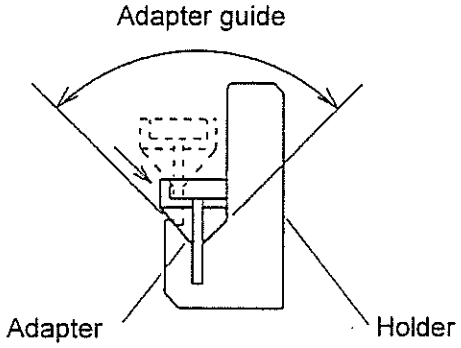
The carrier unit is a mechanism with a holder which hold and transfer arms.

1. Holder Unit

The basket arm holds an adapter with two holders to transfer it to each reservoir. The holder is provided with an adapter guide. When the carrier moves upward in the reservoir, this slope allows the adapter to slide into the holder center to be accommodated within the holder even when the adapter tip is not at the center of the holder (shown with dotted lines in the figure below).



Holder unit looked at from A



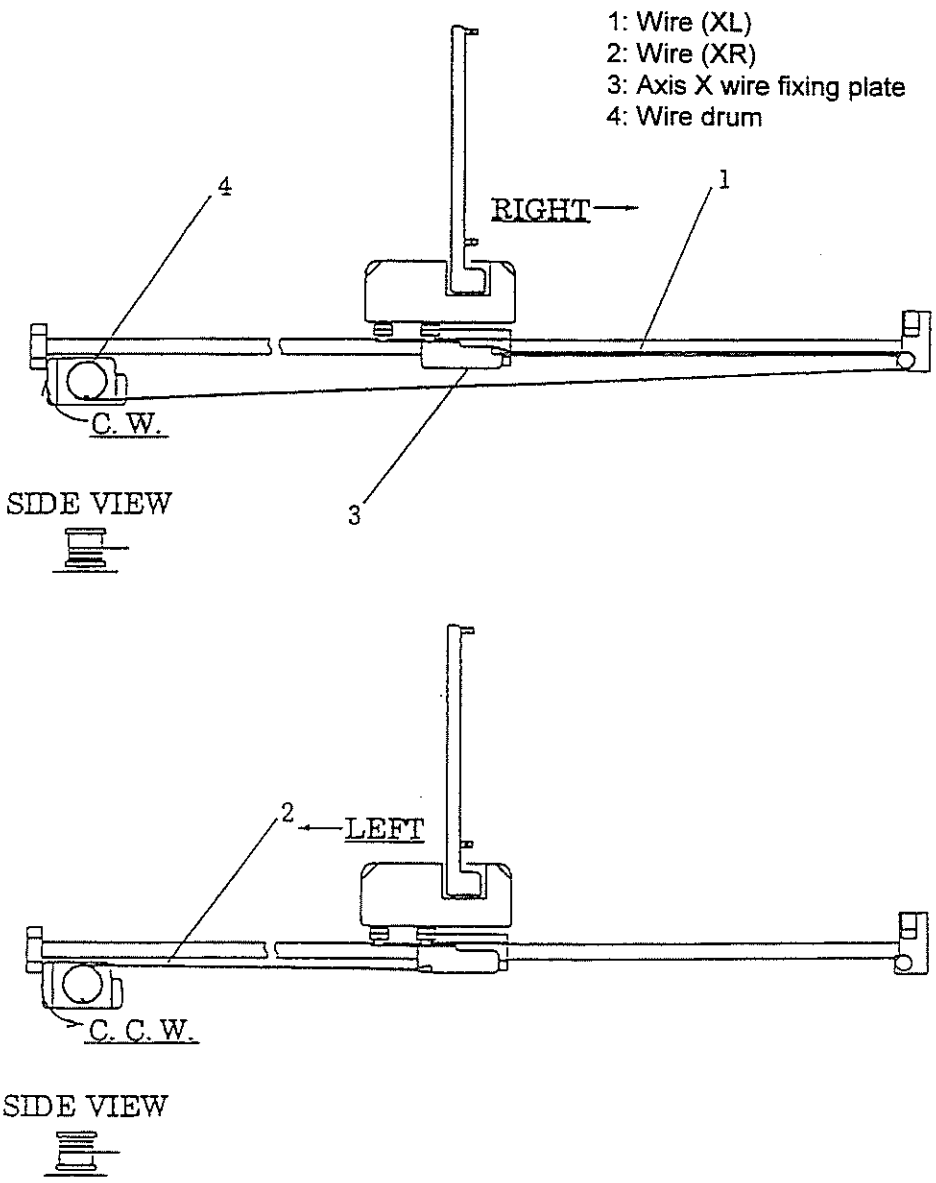
2. Carrier Unit Transfer Mechanism

Each axis has two driving wires, which transmit power from the stepping motor to transfer the carrier.

a. Axis X Transfer Mechanism

One end of wire is fixed on the wire fixing plate (Figure: Axis X Transfer Mechanism No.3) and the other end of wire is fixed on the Axis X stepping motor wire drum (Figure: No.4). The route of driving wire is shown in the figure. The wire (XL)(Figure No.1) is wound on the wire drum and the carrier moves rightward when looked at from the back of the system when the stepping motor rotates clockwise. The same applies to the wire (XR)(Figure No.2). When the stepping motor rotates counterclockwise, the carrier moves leftward when looked at from the back of the system. The wire drum is so designed that the carrier moves as much as 113.097 mm when it rotates once. As the driving pulse per wire drum rotation is 1600 pulses, the carrier moves as much as 0.0706 mm per pulse of Axis X.

Axis X transfer mechanism



b. Axis Z Transfer Mechanism

One end of two wires are fixed on the wire tensioner (Figure: Axis Z Transfer Mechanism, No.5), and the other end is fixed on the wire drum of the Axis Z stepping motor. The route of driving wire is shown in the figure. The wire (Z top)(Figure No.1) is wound on the wire drum and the carrier moves upward along the LM guide when the stepping motor rotates clockwise. The same applies to the wire (Z bottom)(Figure: No.2). When the stepping motor rotates counterclockwise, the carrier moves downward. The wire drum is so designed that the carrier moves as much as 156.548 mm when it rotates once (The pulley mechanism achieves an axis reduction ratio of 1/2.) As the driving pulse per wire drum rotation is 800 pulses, the carrier moves as much as 0.0706 mm per pulse, which is the same as the carrier transfer per pulse with the Axis X.

DRS 2000 Wire Alignment

Pulley diagram – Rear View of Unit - PUT ARM TO FAR RIGHT (REAR BOARD FOLLOWING THIS PAGE VIEW)

--------⑧-------⑨--Z axis pulley upper frame (fig. 3 #2)

Z axis relay pulley support (fig. 4 #10

①

---④----------Two pulleys mounted on arm pulley mounting plate (fig 3 #6)

⑦

Z axis relay ulley support (fig 4 #9)

②------⑥--Two pulleys each mounted on Z axis pulley mounting plate (fig. 4 #3)

------③------⑤--Z axis pulley lower frame (fig. 3 #3)

X Axis left Driving Wire (Long, Red, Fig. 12 #1)

- Anchor wire on right side (rear view) of X axis driving wire bracket (fig. 12 #3)
- Wrap around horizontal pulley mounted on driving wire base (fig. 4 #12) front to back.
- Anchor wire on bottom of driving wire drum (fig. 12 #4).
- Wrap wire counter-clockwise (move drum clockwise) until robotic arm is tight to right side of unit.

X Axis Right Driving Wire (Short, Black, Fig. 12 #2)

- Anchor wire on top of driving wire drum.
- Wrap one turn clockwise.
- Anchor wire on left side of X axis driving wire bracket.
- Tension adjustment is done by adjusting tension screw (fig. 4 #39).

Z Axis Upper Driving Wire (Long, Blue, fig. 13 #1)

- Secure driving wire drum (fig. 13 #4) from movement by wedging cardboard or other material behind drum.
- Anchor wire in front panel port of driving wire drum.
- Wrap four turns clockwise.
- Under pulley #1
- Around front pulley #2
- Around pulley #3
- Around front pulley #4
- Around pulley #5
- Around front pulley #6
- Anchor at top of wire tensioner (fig. 4 #14)

AXIS X
← HORIZONTAL →

AXIS Z
↓ VERTICAL ↑

Z Axis Lower Driving Wire (Short, Green, Fig. 13 #2)

- Anchor wire on rear panel port of driving wire drum.
- Wrap 6 1/2 turns counter-clockwise
- Around pulley #7
- Around rear pulley #2
- Around pulley #8
- Around rear pulley #4
- Around pulley #9
- Around rear pulley #6
- Anchor at bottom of wire tensioner

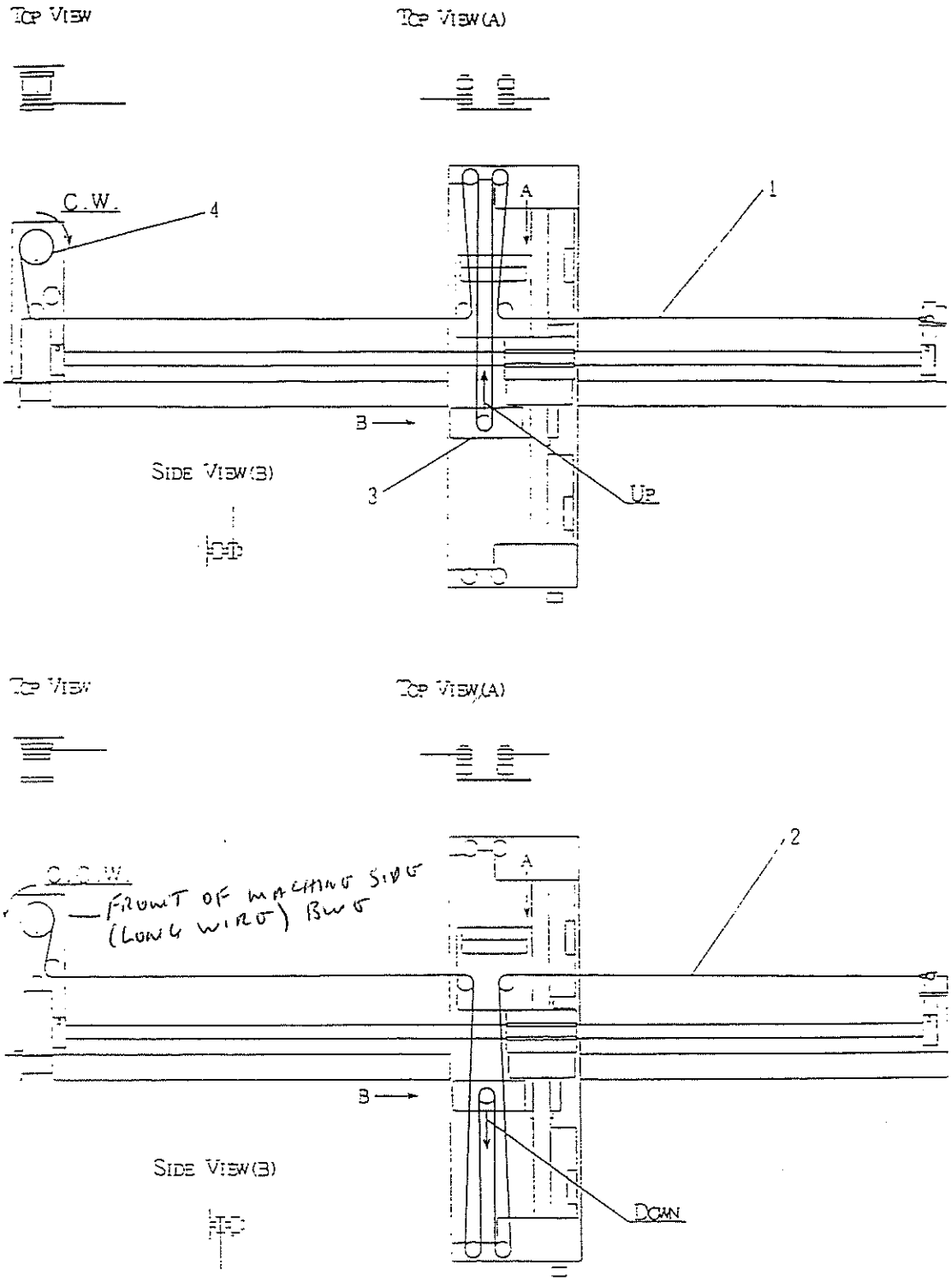
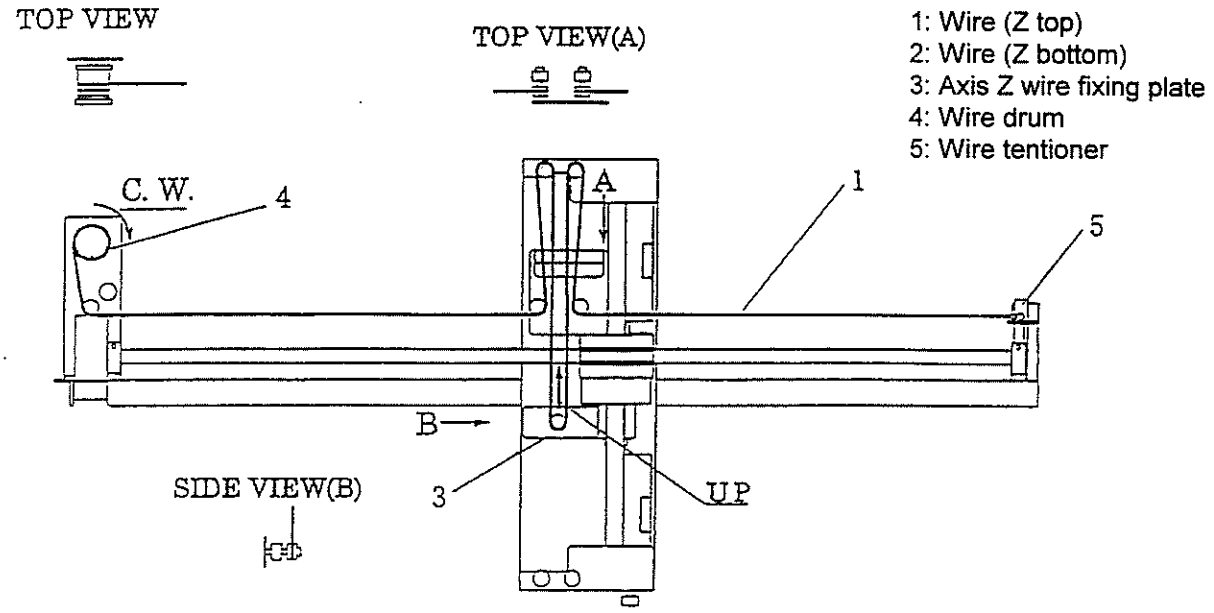
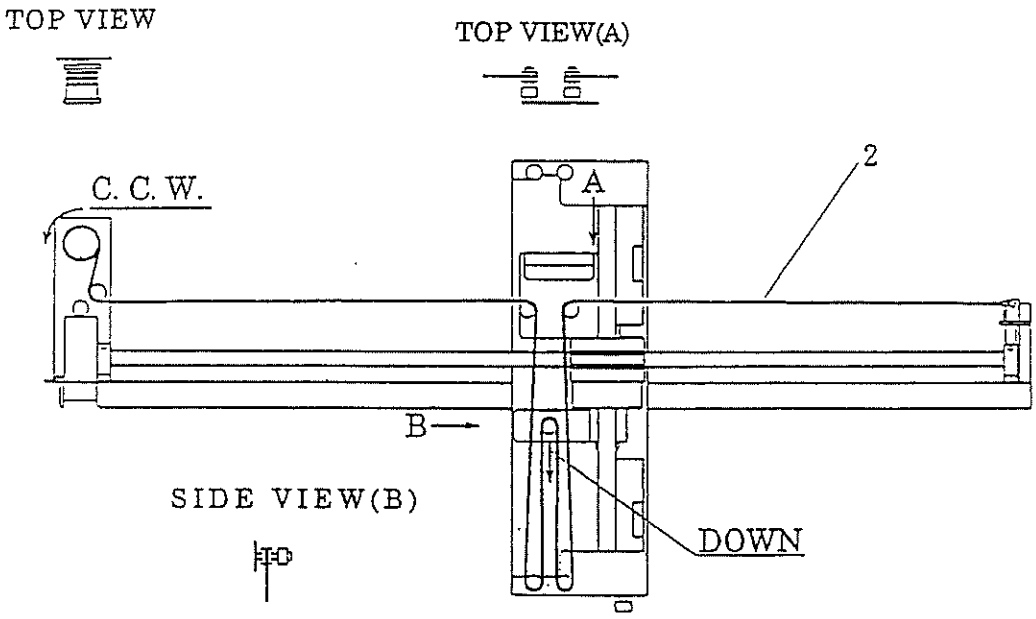

TOP VIEW
TOP VIEW(A)
C.W.
4
A
1
B
SIDE VIEW(B)
3
UP
TOP VIEW
TOP VIEW(A)
C.W.
FRONT OF MACHINE SIDE
(LONG WIRE) BUS
A
2
B
SIDE VIEW(B)
DOWN

Fig.13

Axis Z transfer mechanism

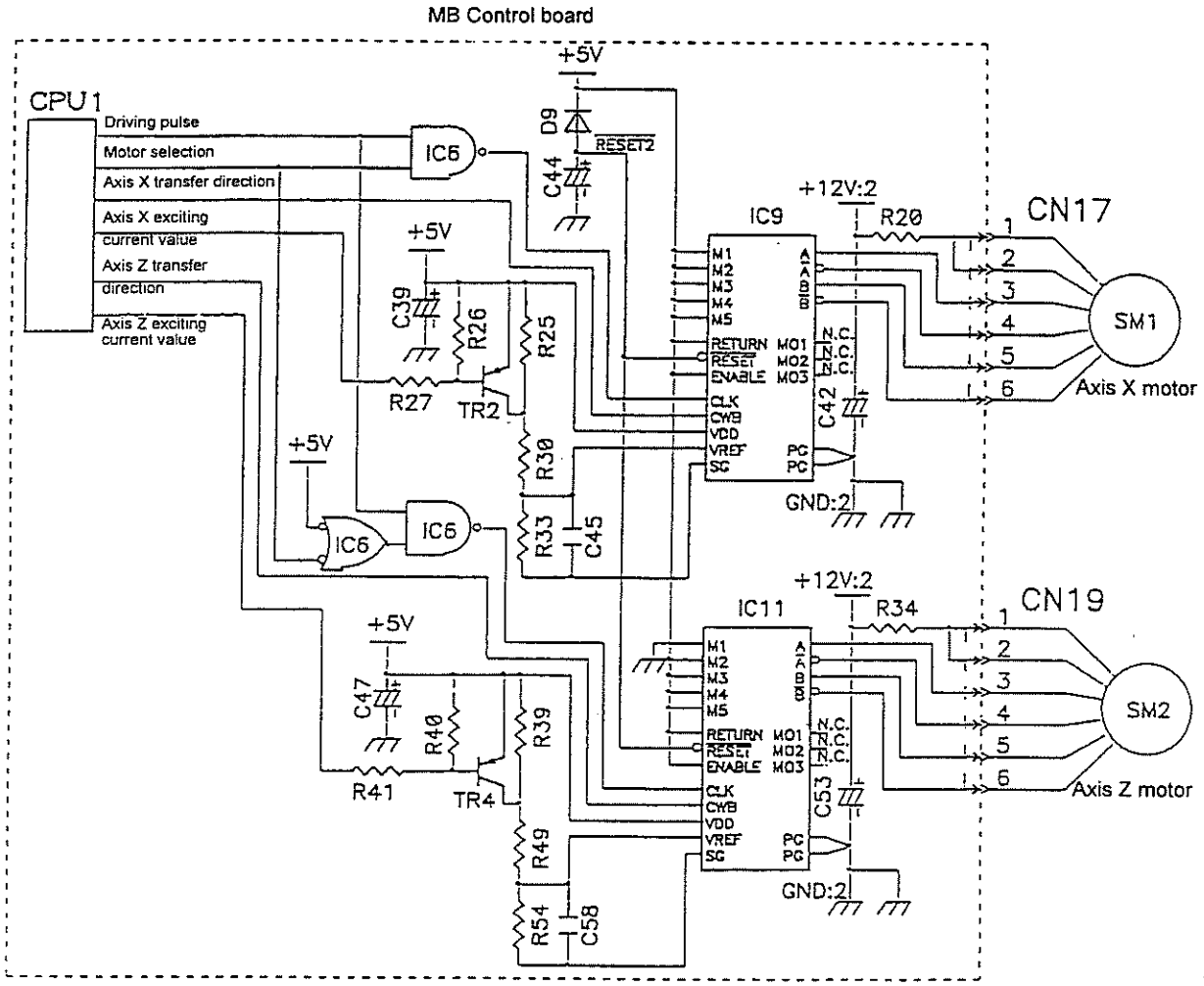




(2) Driving Source Unit

The driving source unit controls the stepping motor which transfers the carrier both horizontally (Axis X direction) and vertically (Axis Z direction). The motor driving pulse of Axes X and Z uses the common signal, and either Axis X or Axis Z is selected by the motor selection signal. Therefore, both axes cannot be transferred simultaneously. When the motor selection signal is High. Axis X is transferred, and when it is Low, Axis Z is transferred.

Block Diagram



As the motor performs micro-stepping driving of constant current control with IC9 (Axis X) and IC10 (Axis Z), high torque and smooth carrier transfer are achieved. There are two types of motor exciting current, one for driving and one for holding. For driving, high current is used to generate high torque, and for holding, low current is used to suppress heat generation in the motor. The motor control circuit is composed of the same components both for Axes X and Z (Resistors R25, r33, R39 and R49 for setting driving current have different values), but motor controlling method differs. (The difference in control will be mentioned later.)

* Motor hold refers to a state in which driving pulses are not outputted, and excitation current is supplied to the motor to keep the motor in a static state.

The motor remains in a static state (no carrier transfer) as there are no changes in phase if no driving pulses are generated even if it is excited. The motor in a static state is kept in a hold state with low current to prevent carrier from easily being transferred after positioning. When it is not in a hold state, it is in the same state as if the power supply is off, and the carrier easily moves.

As driving pulses are common signals for both Axis X and Z motors, either Axis X or Z is selected with the motor selection signal before driving pulses are outputted when driving the motor. When the motor selection signal is High, driving pulses are outputted only to IC9 (CLK signal of IC10 is fixed to Low with IC6) to select the Axis X driving motor. As it is not the Axis Z motor not excited then, only a phase (cannot be specified) remains excited (in a hold state) with low current. Reversely, when the motor selection signal is Low, driving pulses are outputted only to IC10 (contrary to what happens during Axis X driving, CLK signal of IC9 is fixed to Low by IC6), and the Axis Z driving motor is selected. As it is not Axis X driving motor not excited as in the case mentioned above (during Axis X driving), only a phase (cannot be specified) remains excited (in a hold state) with low current.

Driving pulses (transfer data) from CPU1, and transfer direction signals (direction signals) and excitation current signals (driving current signals) are power-converted by IC9 or IC10 to be outputted to the motor as excitation current. The transfer data contains transfer speed and the amount of transfer. The transfer speed is determined by the pulse frequency of driving pulses, with a higher frequency resulting in a higher transfer speed. The amount of transfer is determined by the number of driving pulses. Both in IC9 and IC10, the voltage obtained from excitation current is compared with the reference voltage VREF to control excitation current so that it is always of the specified value. Also, by changing this reference voltage, it is possible to change the value of excitation current. DRS-2000 allows to select one from two types of current (one for driving and the other for holding) by switching the reference voltage by means of respective excitation current signals of X and Z.

When Axis X excitation current signals are High, the transistor TR2 is turned off, and the reference voltage VREF is determined by the voltage dividing ratio of the resistors R25, R30 and R33. When signals are Low, the transistor is turned on, and the reference voltage is determined by the voltage dividing ratio of the resistors R30 and R33.

The same is applicable to Axis Z. When Axis Z excitation current signals are High, the transistor TR4 is turned off, and the reference voltage is determined by the voltage dividing ratio of the resistors R39, R49 and R54. When signals are Low, the transistor is turned on, and the reference voltage is determined by the voltage dividing ratio of the resistors R49 and R54.

Both for Axes X and Z, when signals are Low, the reference voltage gets higher, and excitation current takes a higher value of current. In any state other than holding state, driving is effected with this high value of current.

The power supply for CPU1 and the control IC is +5V, and the power supply for driving the motor is +12V (+12V:2).

Signals and State of Motor

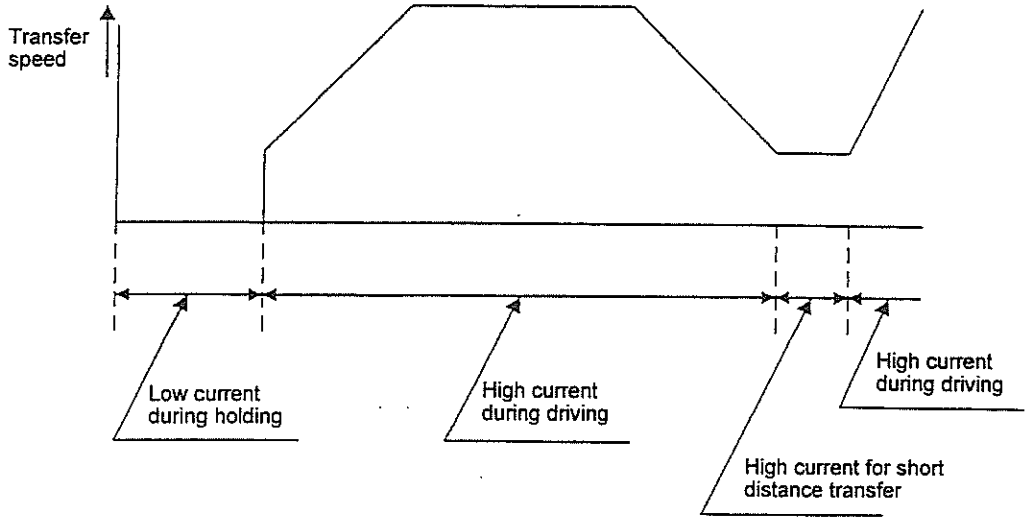
Motor Selection		Transfer Direction		Excitation Current Value	
State of Signal	What to be Driven	High	Low	High	Low
High	Axis X	Rightward transfer	Leftward transfer	Low current value 0.51A	High current value 1.94A
Low	Axis Z	Upward transfer	Downward transfer	Low current value 0.48A	High current value 1.03A

The Axis X and Z motors have a somewhat different motor excitation pattern due to difference in the setting (M1 pin) of IC9 and IC10. For Axis X, it is called 2W1-2 phase excitation. For Axis Z, it is called W1-2 phase excitation. (Refer to the timing for CLK of the Axis X and Z motors.)
Axis X requires twice as much CLK (driving pulses) as that of Axis Z for the motor to obtain the same angle rotation as Axis Z. As Axis Z uses a pulley, the carrier transfer distance is a half of that with Axis X. In order to get the same carrier transfer distance as that with Axis X, it is necessary to input the same number of CLK (driving pulses).

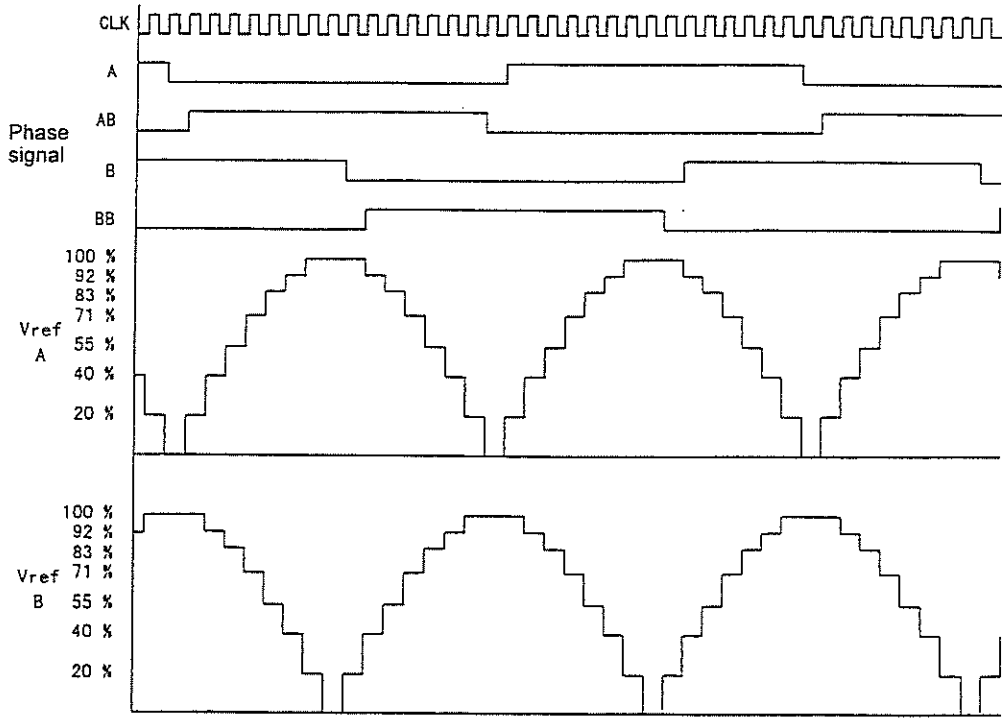
1. Axis X Motor

   Two types of speed are provided for Axis X transfer: Low (the same speed as the starting frequency) and High. Low speed transfer is for starting and short distance transfer (transfer to the next reservoir, horizontal transfer to catch or release a basket). In all other cases, Axis X transfers at a high speed.

Axis X Transfer Speed and Excitation Current



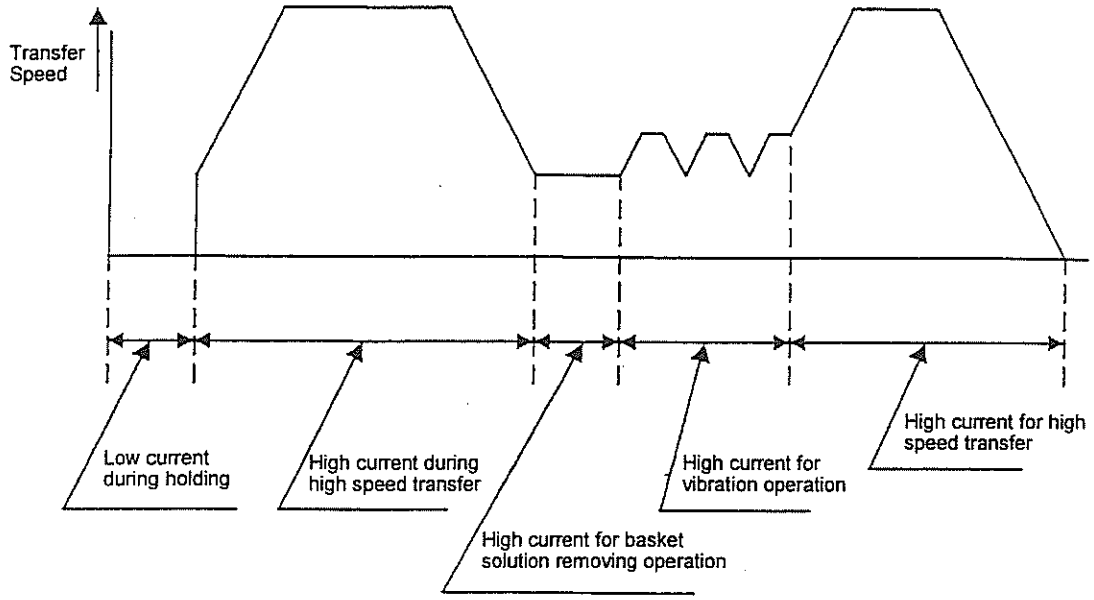
Timing of Axis X Motor for CLK (Driving Pulses)



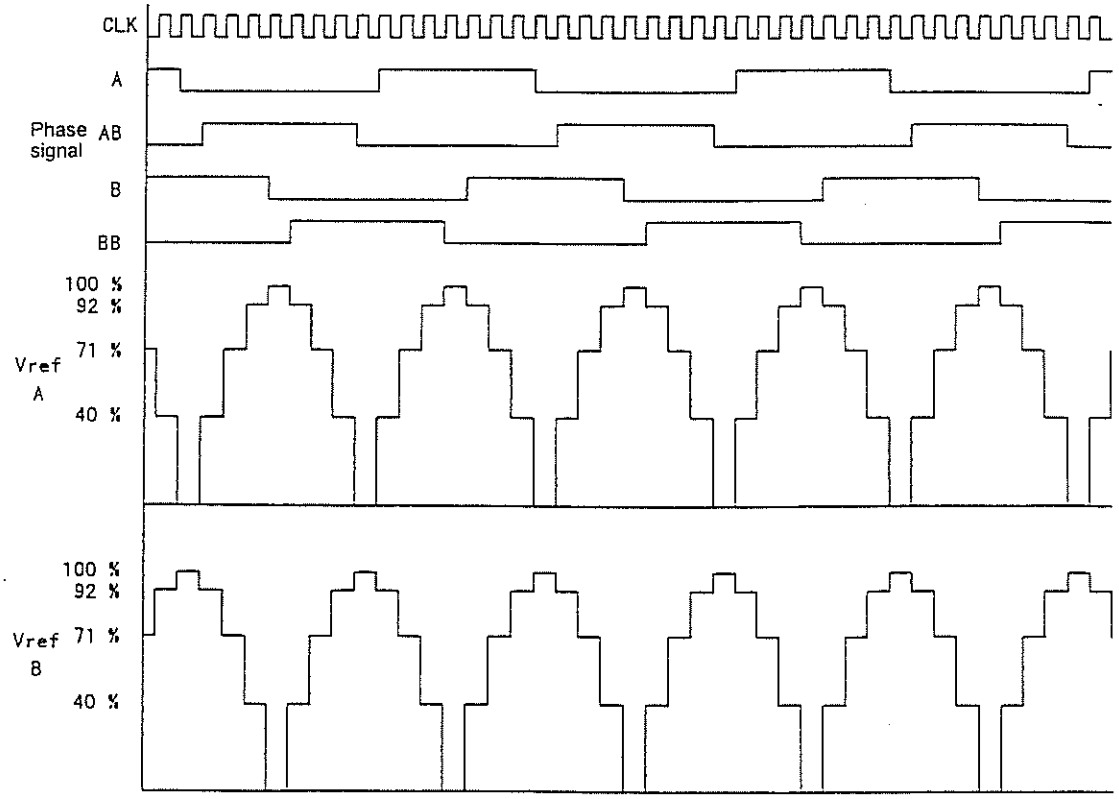
2. Axis Z Motor

Three types of speed are provided for Axis Z transfer: Low (the same speed as the starting frequency), Middle and High. Low speed is for starting and for fully lifting a basket out of the solution reservoir in an operation to remove solution from the basket. Middle speed is for vertical transfer in agitation. High speed is for any other operations.

Axis Z Transfer Speed and Excitation Current

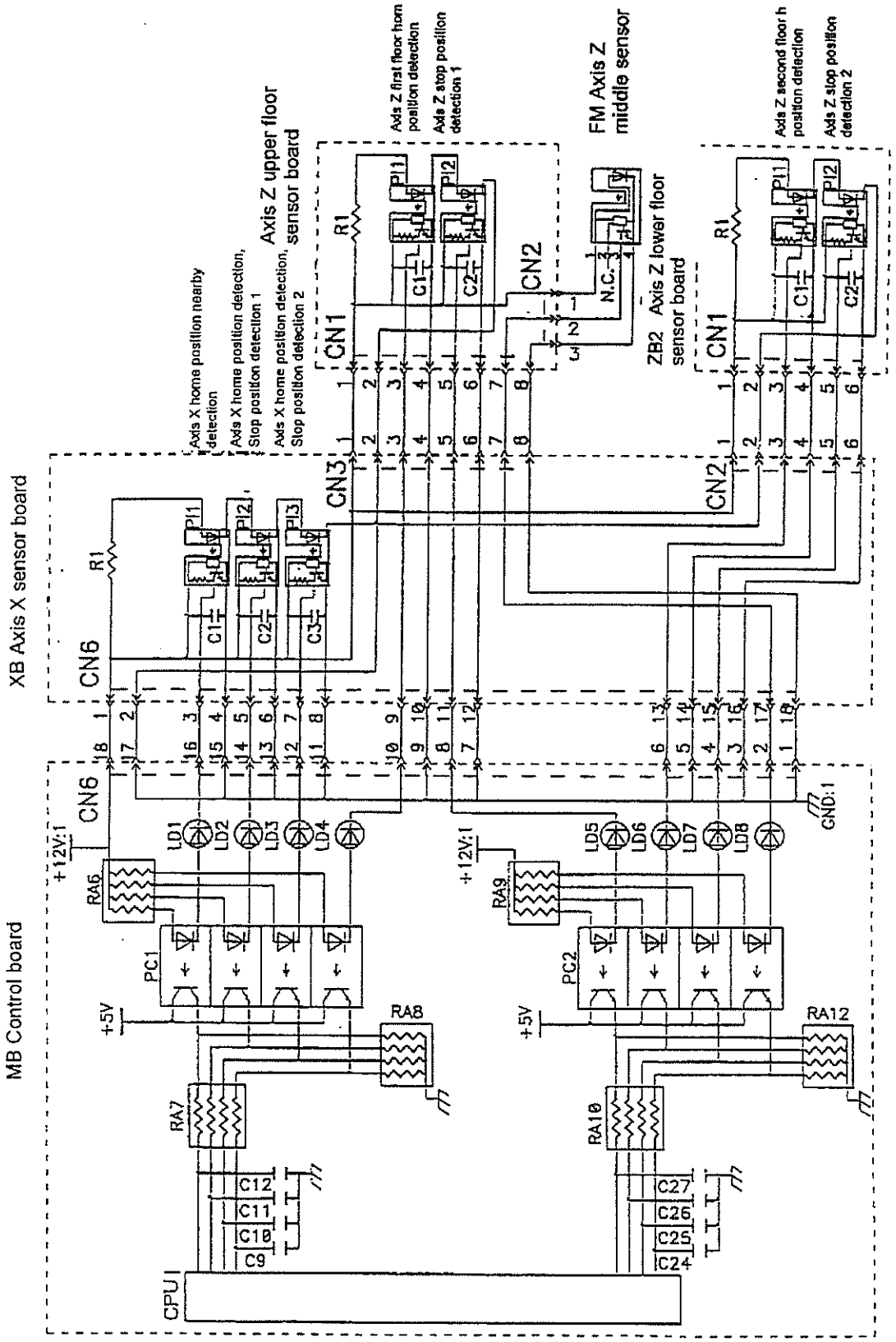


Timing of Axis Z Motor for CLK (Driving Pulses)



(3) **Carrier Position Detector Unit (X, Z)**
The sensor detects carrier position.

Block Diagram



The carrier position sensor is composed of an Axis X sensor board, an Axis Z upper floor sensor board, an Axis Z lower floor sensor board, and an Axis Z middle sensor. The Axis X sensor board is used to detect the left and right positions of the carrier. The Axis Z sensor board is used to detect the home position (a possible range of horizontal transfer of carrier with the basket being held) and the lower limit (a possible range of horizontal transfer of basket catch or release) of the carrier on the first floor or second floor. The Axis Z middle sensor is used to judge upward or downward movement of the carrier on the Axis Z when the home position is detected.

* In addition to the origin mentioned above, a vertical position is provided, to which the carrier is allowed to move horizontally when it is not holding a basket. It is a standby position which is 84 mm below the upper position on each floor (Axis Z home position sensor).

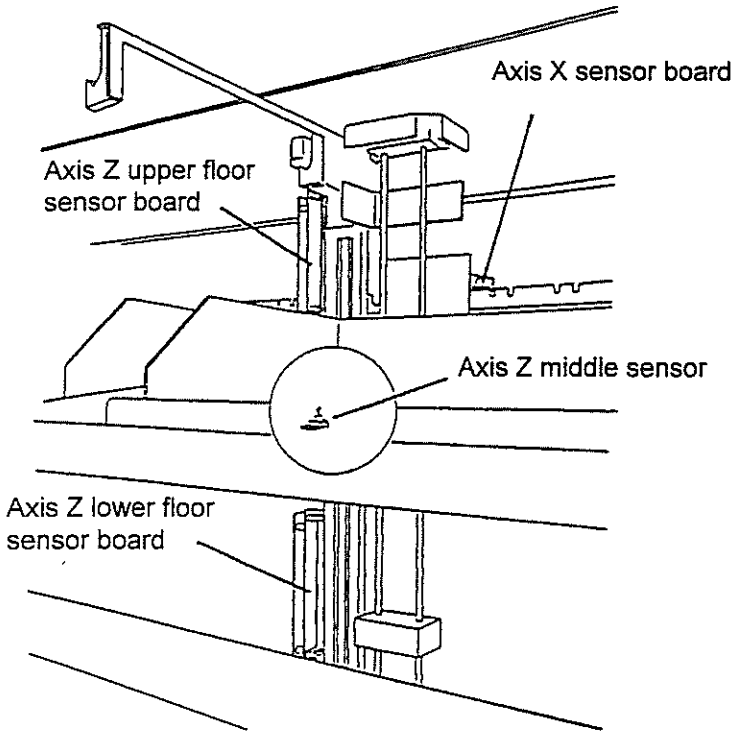
  When CPU1 starts a horizontal transfer, it starts a horizontal transfer after it transfers the carrier vertically up to whichever is closer. It is to transfer the carrier to the target position within a shortest time.

A total of eight sensors are provided. They have the same sensor circuit, and only differ in detecting point. Axis X related detection is done with three photo interrupters attached on the back of the carrier moving to detect the slits on the system. Axis Z related detection is done with the light screen on the carrier (Axis Z light screen for the home position and lower limit position sensor, basket arm for Axis Z middle sensor) moving to shield the five photo interrupters fixed on the system.

When each position sensor board is connected as shown in the figure, +12V (+12V:1) is supplied to the light projecting side of each sensor PI (photo interrupter) from the control board (to the Axis Z sensor board via the Axis X sensor board), and it remains illuminated. If there is nothing to block the sensor, the light reaches the light receiving side (signal output), the circuit closes and LDs 1 through 7 for checking movement are turned on. These signals are converted to voltage after being converted to light in the photo couplers PC1 and PC2 (PC1 and PC2 each have four photo couplers built in them), and are input into CPU1 as voltage signals. However, the fixed position is when the light is off for Axis X, and the fixed position is when the light is on for Axis Z. For details, refer to "On the Combination of Slit and Sensor" mentioned below. The power supply voltage from the sensor to the photo coupler light projecting side is +12V (+12V:1), and the power supply voltage from the photo coupler light receiving side to CPU1 is +5V.

When there are problems between the photo coupler output side and CPU1, signals are not normally transmitted even if the LED for checking operation is turned on.

Position of Each Sensor Board (Cover Z (1) and (2) are removed to allow checking of each sensor.)



1. Axis X Sensor Board

An axis X sensor board is located on the back of the carrier. It detects the home position, and the carrier position in each reservoir. With individual signals, however, it is not possible to identify a reservoir where the carrier is at the fixed position of Axis X. The reservoir is identified by combining accumulated driving pulses for driving the motor (refer to Axes X and Z Motors below) from the home position, and sensor signals.

The axis X sensor board is composed of the following blocks:

a. Home position proximity nearby detection (PI1)
b. Stop position detection 1 (PI2), stop position detection 2 (PI3)
c. Home position detection (common to both stop position detection 1 and 2)

a. Home position proximity detection (PI1)

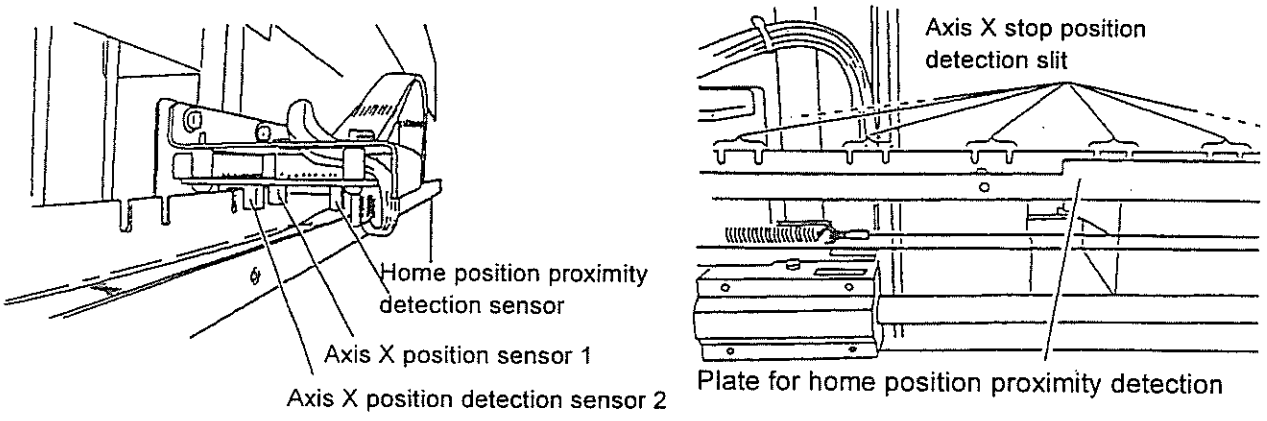
This is to judge if the carrier is positioned on the left or right of the up and down section when looked at from the back of the system.

When the carrier is on the left of the system (when looked at from the back of the system) and when the light of Sensor PI1 (photo interrupter) is transmitted, the sensor output is High, the photo coupler PC1 (PC1 has four photo couplers built in it) is turned off, LD1 for checking operation is turned off and Low is inputted into CPU1. Reversely, when the carrier is on the right of the system and the light of PI1 is blocked, the sensor output is Low, PCi is turned on, LD1 is turned on, and High is inputted into CPU1.

b. Stop position detection 1 (PI2), stop position detection 2 (PI3)
It is to detect at detection points provided on each solution reservoir a point to catch baskets or release them. Points on each reservoir are determined by a combination of two sensors. Refer to "On the Combination of Slit and Sensor" mentioned below.
When the carrier is at the slit position and the light of the sensors PI2 and 3 (photo interrupter) is transmitted, the sensor output is high, the photo coupler PC1 is turned off, LD2 and 3 for operational verifications are turned off and Low is inputted to CPU1. On the contrary, when the carrier is not positioned other than the slit and the light of the PI2 and 3 is interrupted, the sensor output is Low, PC1 is turned on, LD2 and 3 are turned on, and High is inputted into CPU1.

c. Home position detection (common to both stop position detection 1 and 2)
A sensor for stop position detection 1 and 2 is used when the carrier position returns to the home position. A position is established by a combination of two sensors. Refer to "On the Combination of Slit and Sensor" mentioned below.

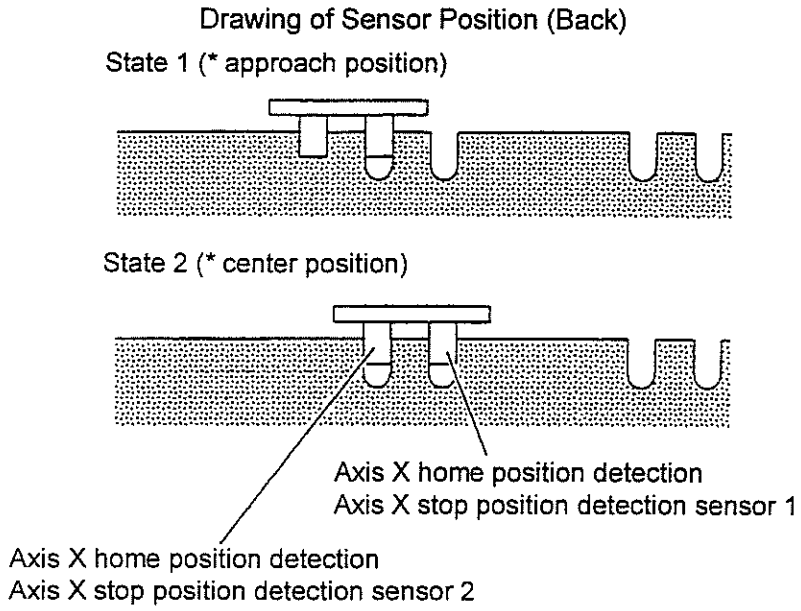
Details of Axis X Sensor Position



Meaning of LED ON/OFF

Name of Sensor	Carrier Position	State of XB Board PI	PI Output	State of PC	State of LED	CPU1 Input
Axis X home position proximity sensor	System right	XB board PI1 transmit	High	OFF	LD1 off	Low
	System left	XB board PI1 light block	Low	ON	LD1 on	High
Axis X stop position detection 1 sensor Axis X home position	Slit position	XB board PI2 transmit	High	OFF	LD2 off	Low
	Other than slit	XB board PI2 light block	Low	ON	LD2 on	High
Axis X stop position detection 2 sensor Axis X home position	Slit position	XB board PI3 transmit	High	OFF	LD3 off	Low
	Other than slit	XB board PI3 light blocked	Low	ON	LD3 on	High

On the Combination of Slit and Sensor



* Refer to Chapter 2 "5 (4) Carrier basic movement pattern" for the definitions of approach and center.

• On the state 1

When the sensor is in this state, CPU1 judges that the carrier is at the approach position of each reservoir. Upward movement to get a basket or downward movement after releasing a basket is done at this position.

• On the state 2

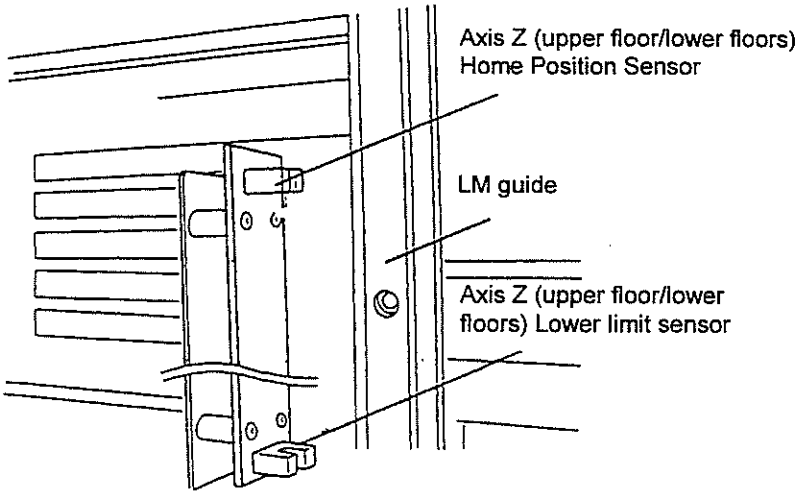
When the sensor is in this state, CPU1 judges that the carrier is at the center of each reservoir. Upward and downward movement of the carrier holding a basket is done at this position.

Combination of Axis X Home Position Detection/Axis X Stop Position Detection 1, 2 and Carrier Position

Sensor Position	Axis X Home Position Detection Axis X Stop Position Detection 1 Sensor	Axis X Home Position Detection Axis X Stop Position Detection 2 Sensor	Meaning
State 1	Off (slit position)	On (position other than slit)	Approach position
State 2	Off (slit position)	Off (slit position)	Center position

2. Axis Z Upper and Lower Floor Sensor Boards and Axis Z Middle Sensor

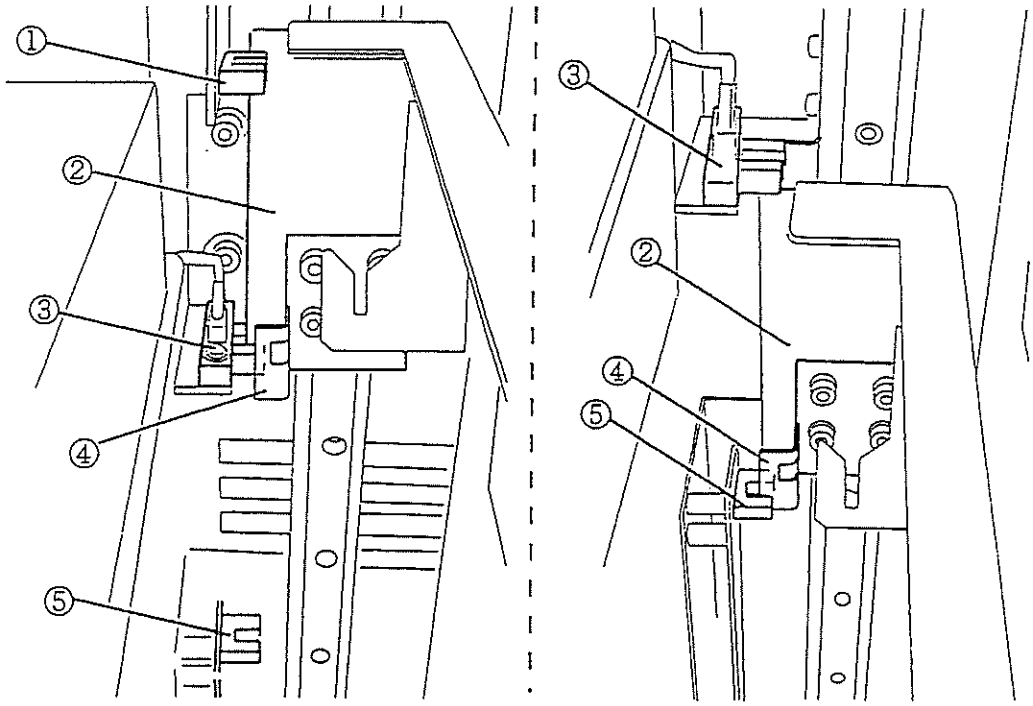
Details of Axis Z upper floor/lower floors



Axis Z Carrier Position

State 1
when the axis Z middle sensor
is light-blocked

State 2
when the axis Z middle sensor
is light-transmitted



1. Axis Z upper floor lower limit sensor
2. Basket arm (common light block screen for basket arm and Axis Z middle sensor)
3. Axis Z middle sensor
4. Axis Z light screen plate (Sensors for the axis Z upper floor home position, axis Z upper floo lower limit, axis Z bottom floor home position, axis Z lower floor lower limit are light-blocked
5. Axis Z lower floor home position sensor

a. Axis Z upper floor Sensor Board

The axis Z upper floor sensor board detects carrier home position or lower limit, and checks the position of the carrier when it returns to the home position.

The axis Z upper floor sensor is composed of the following blocks:

- Home position detection
- Lower limit detection

• Home position detection

This is for judging whether a basket has been fully lifted out of the solution reservoir. The carrier holding baskets starts a horizontal movement after they are raised up to this home position. When the light of the sensor PI1 (photo interrupter) on the axis Z upper floor sensor board is blocked by the axis Z light screen plate (Axis Z Carrier Position, No.4), the sensor output is Low, the photo coupler PC1 is turned on, LD4 for checking operation is turned on, and the CPU1 input is High. When this signal is High, CPU1 judges that the carrier is at the upper floor home position.

• Lower limit detection

This is for detecting a position for horizontal movement to catch or release a basket in each solution reservoir on the upper floor.

When the light of the sensor PI2 (photo interrupters) on the axis Z upper floor sensor board is blocked by the axis Z light screen plate (Axis Z Carrier Position, No.4) the sensor output is Low, the photo coupler PC2 (PC2 has four photo couplers built in it) is turned on, LD5 for checking operation is turned on, and the CPU1 input is High. When this signal is High, CPU1 judges that the carrier is at the lower floor limit lower position.

b. Axis Z Middle Sensor

This sensor is for judging whether to move the carrier upward or downward when detecting the home position. When the light of the sensor FM (photo interrupter) connected to the axis Z upper floor sensor board is blocked by the light screen plate (Axis Z Carrier Position, No.2)(Axis Z Carrier Position, State), the sensor output is Low, the photo coupler PC2 is turned on, LD8 for checking operation is turned on, and the CPU1 input is High. When this signal is High, CPU1 judges that the carrier is at the middle of the upper and lower floors. In this case, other home position detection starts after moving to the lower floor home position. In this case, the lower floor home position sensor is the home position.

Reversely, when the light of the sensor is transmitted (Axis Z Carrier Position, State) the sensor output is High, the photo coupler PC2 is turned off, LD8 for checking operation is turned off, and the CPU1 input is Low. When this signal is Low, CPU1 judges that the carrier is between the home position sensor on the upper floor or lower floor and the lower limit sensor. In this case, home position detection starts after moving to the home position sensor on the upper floor or lower floor.

c. Axis Z Lower Floor Sensor Board

This sensor board detects the home position or lower limit of the carrier on the lower floor.

The axis Z lower floor sensor board is composed of the following blocks:

- Home position detection
- Lower limit detection
- Origin detection

This is to determine whether baskets have been fully lifted out of the solution reservoir. The carrier holding baskets start horizontal movement after climbing up to this home position. When the light of the sensor PI1 (photo interrupter) on the axis Z lower floor sensor board is blocked by the axis Z light screen plate (Axis Z Carrier Position, No.4), the sensor output is Low, the photo coupler PC2 is turned on, LD6 for checking operation is turned on, and the CPU1 input is High. When this signal is High, CPU1 judges that the carrier is at the lower floor home position.

- Lower limit detection

  This is to detect a position to horizontally move to catch or release a basket within a lower floor solution reservoir.

  When the light of the sensor PI2 (photo interrupter) on the axis Z lower floor sensor board is blocked by the axis Z light screen plate (Axis Z Carrier Position, No.4), the sensor output is Low, the photo coupler PC2 is turned on, LD7 for checking operation is turned on, and the CPU1 input is High. When this signal is High, CPU1 judges that the carrier is at the lower floor lower limit position.

Carrier Position and State of Each Element

Sensors	Carrier Position	State of PI	PI Output	State of PC	State of LED	CPU1 Input
Axis Z upper floor home position sensor	Upper floor home position	ZB1 board PI1 light blocked	Low	ON	LD4 on	High
	Other than upper home position	ZB1 board PI1 light-transmitted	High	OFF	LD4 off	Low
Axis Z Upper Floor lower limit sensor	Upper floor lower limit	ZB1 board PI2 light blocked	Low	ON	LD5 on	High
	Other than upper floor lower limit	ZB1 board PI2 light-transmitted	High	OFF	LD5 off	Low
Axis Z lower floor home position sensor	Lower floor origin	ZB2 board PI1 light blocked	Low	ON	LD6 on	High
	Lower floor	ZB2 board PI1 light-transmitted	High	Off	LD6 off	Low
Axis Z lower floor lower limit sensor	Lower floor lower limit	ZB2 board PI2 light blocked	Low	On	LD7 on	High
	Other than lower floor lower limit	ZB2 board PI2 light-transmitted	High	OFF	LD7 off	Low
Axis Z middle sensor	Between upper and lower floors	ZB1 board FM light blocked	Low	ON	LD8 on	High
	Between home position sensor on the upper or lower floor and lower limit sensor	ZB1 board FM light-transmitted	High	OFF	LD8 off	Low

(4) Carrier Transfer (Axis X and Z Motor Control) Method

1. Method to Return to the Home Position

As the carrier cannot move simultaneously both in axis X and Z directions, it first returns to the home position on the axis Z. Then, it returns to the home position on the axis X.

a. Procedures to Return to the Home Position on the Axis Z

1) When the axis Z middle sensor is light blocked, it is judged that the carrier is on the lower floor, and the carrier continues to move downward until the light of the home position sensor on the lower floor is blocked.

* In this case, the home position sensor on the lower floor is the home position.

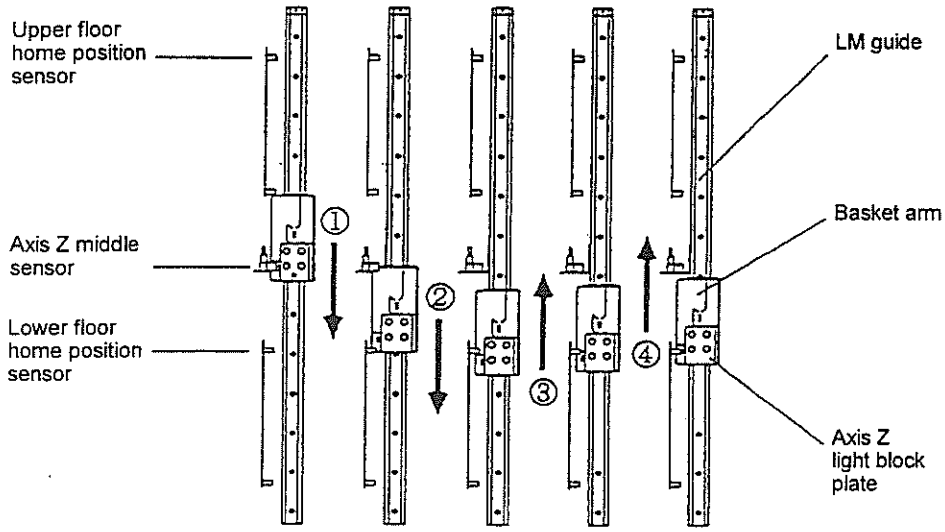
1)' All of the axis Z middle sensor and home position sensors on the upper and lower floors are light-transmitted, the carrier continues to rise until the home position sensor on the upper or lower floor is light blocked. Then, it is judged whether it is on the upper or lower floor.

* When return to the home position starts at the home position sensor on the lower floor, the home position sensor on the bottom sensor is the home position. When return to the home position starts at the home position sensor on the upper floor, the home position sensor on the upper floor is the home position.

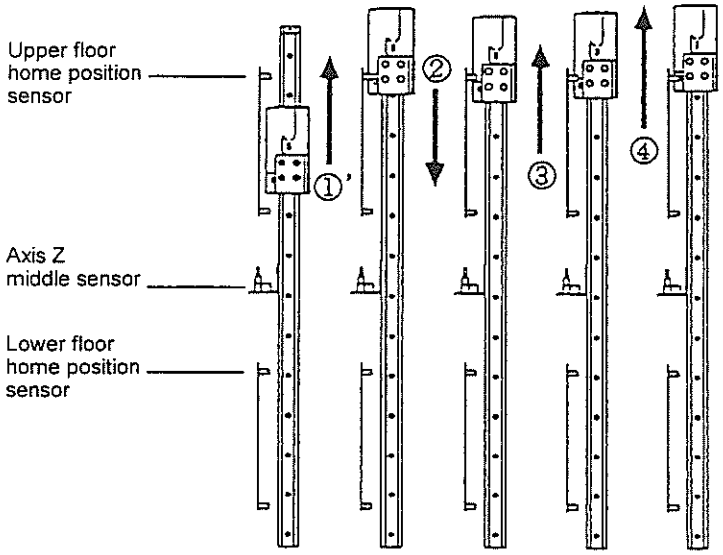
2) The carrier continues to go down until the home position sensor which is light blocked in 1) (or 1)' above) becomes light-transmitted.
3) Thereafter, the carrier rises until the home position sensor mentioned above becomes light blocked again.
4) The point approximately 7 mm above the light blocked point is the home position on the axis Z.

Return of the Origin on the Axis Z

When the Axis Z Middle Sensor Is light screened



When Both Upper and Lower Floor Home Position Sensors Are Light-Transmitted



b. Procedures to Return to the Home Position on the Axis X

1) When the home position proximity sensor is light blocked, the carrier is transferred rightward (toward the operating panel) until the home position proximity sensor is light-transmitted.

1)' When the home position proximity sensor is light-transmitted, the carrier is transferred leftward until the home position proximity sensor is light blocked.
This point is made to the left home position.

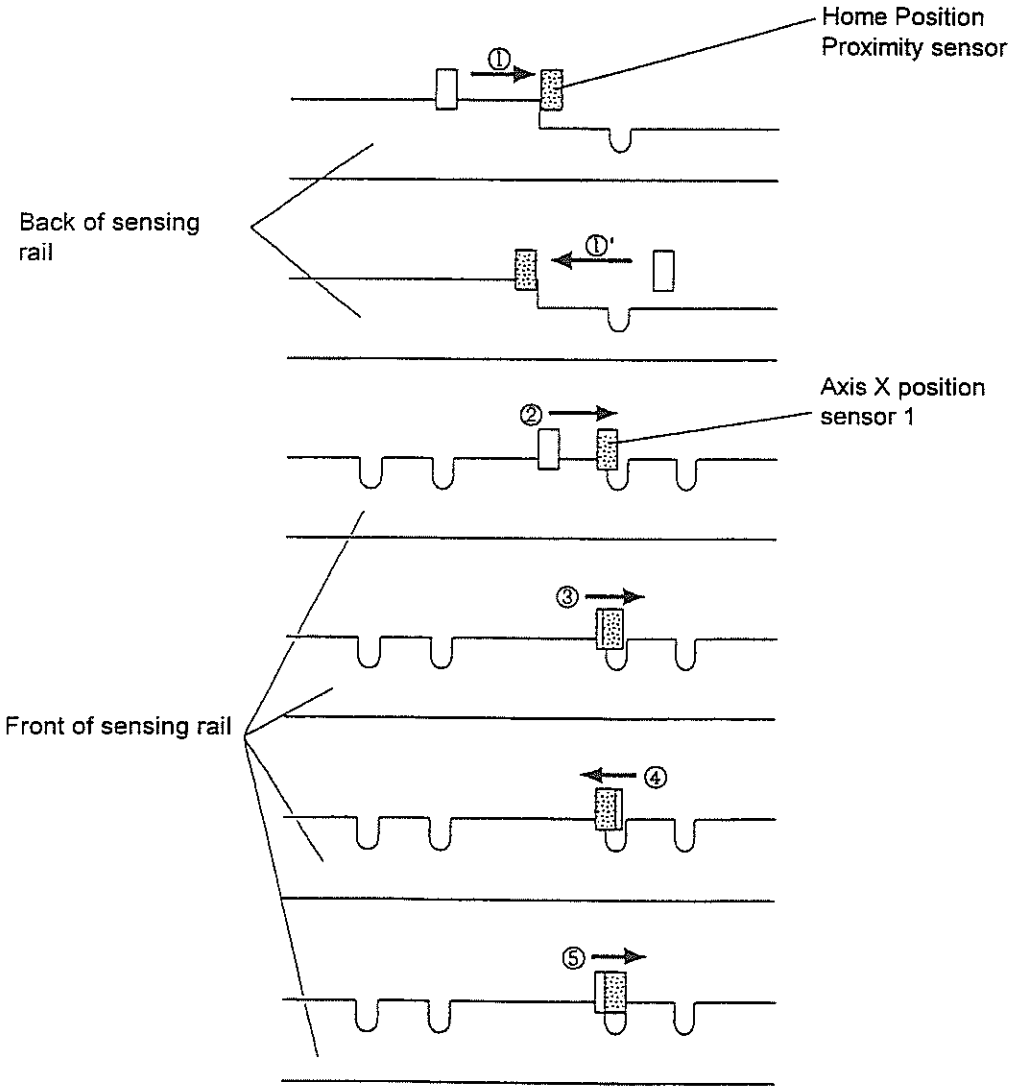
2) The carrier moves rightward until the axis X position sensor 1 (on the left side looked at from the front) is light-transmitted.

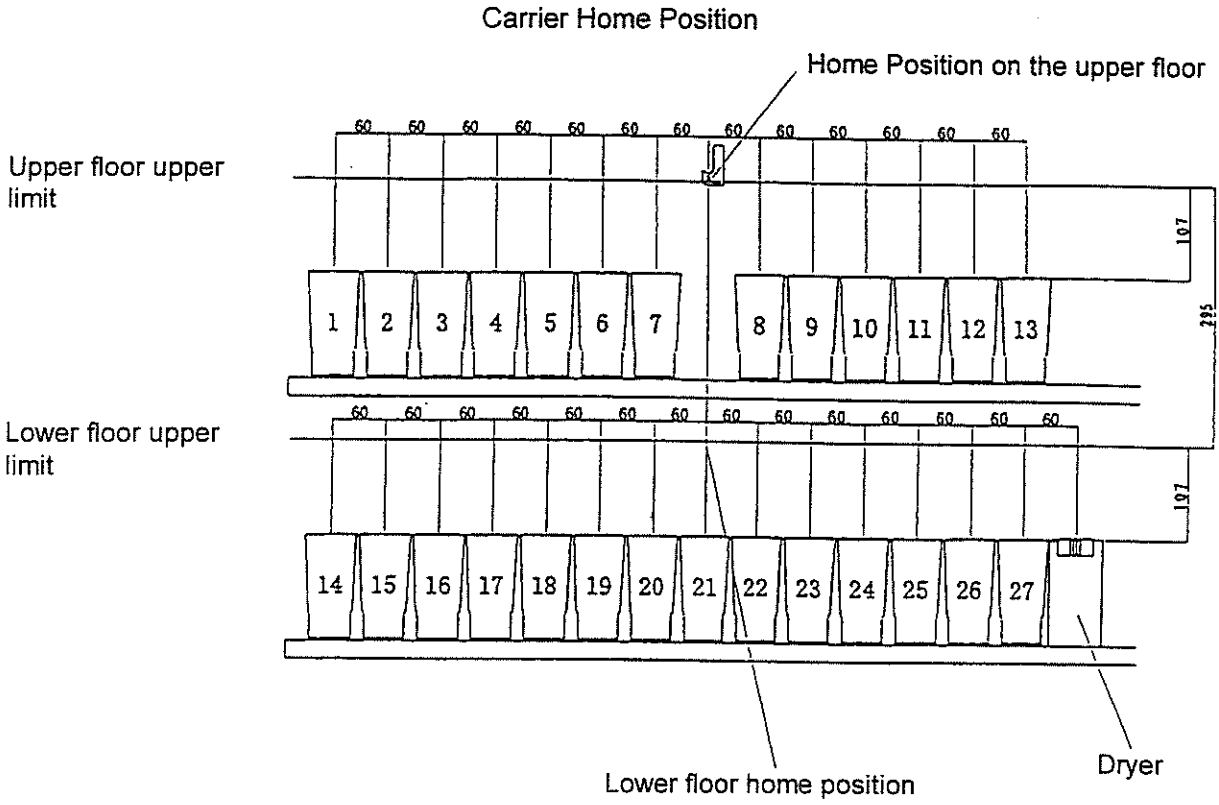
3) The carrier moves rightward for five pulses from the point where the sensor becomes light-transmitted.

4) The carrier moves leftward until the axis X position sensor 1 (on the left side looked at from the front) is light blocked.

5) The travel distance to the slit center is calculated, and the carrier moves rightward that much.
This point will be the axis X home position.

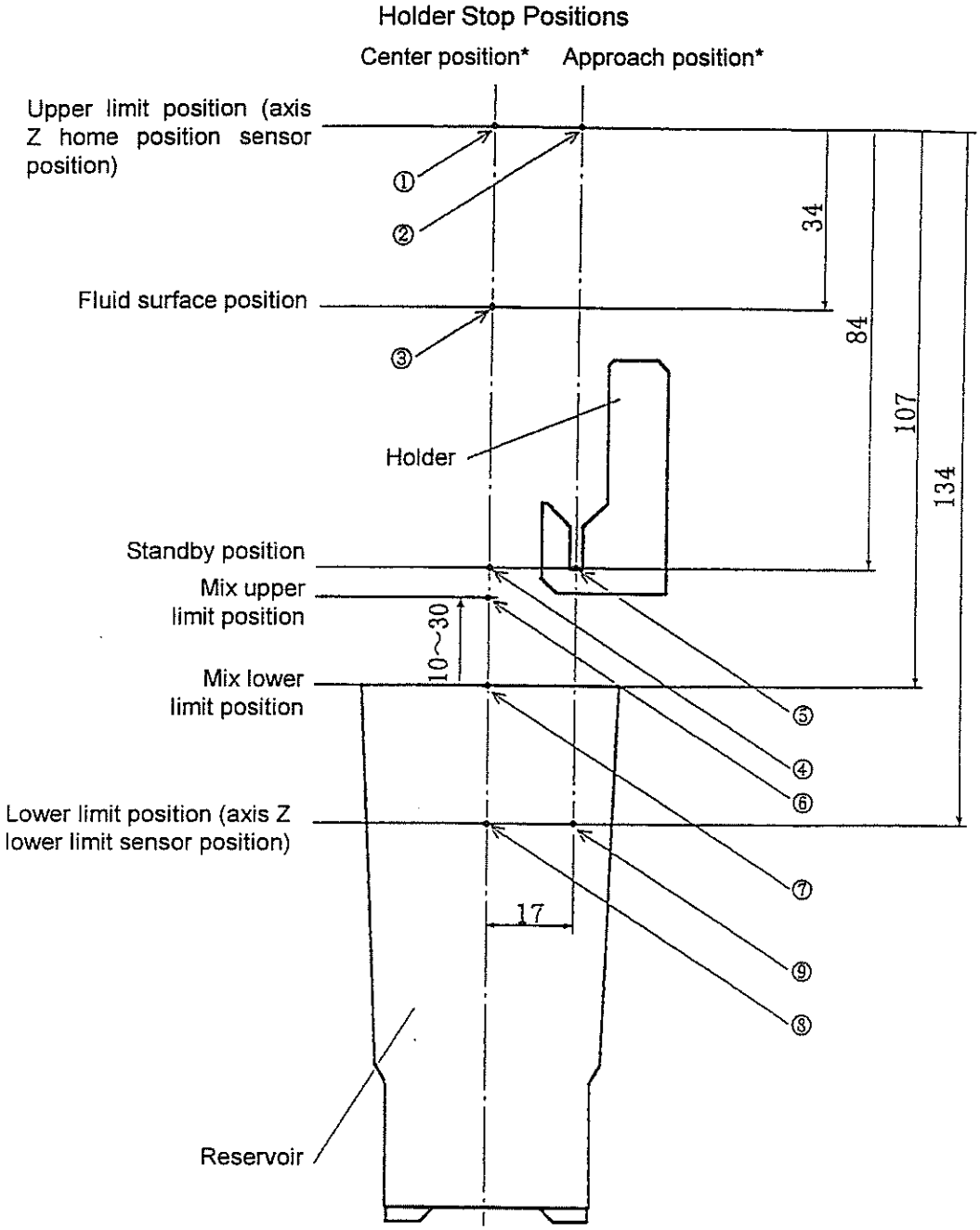
Return to the Home Position on the Axis Z




Carrier Home Position
Home Position on the upper floor
Upper floor upper limit
Lower floor upper limit
60 60 60 60 60 60 60 60 60 60 60 60 60
1 2 3 4 5 6 7 8 9 10 11 12 13
14 15 16 17 18 19 20 21 22 23 24 25 26 27
107
295
107
Lower floor home position
Dryer

2. Carrier Basic Transfer Pattern

The carrier always moves with the home position (refer to (3) Return to the Home Position for details) as a reference. The carrier stops at points indicated by black points in each reservoir below.

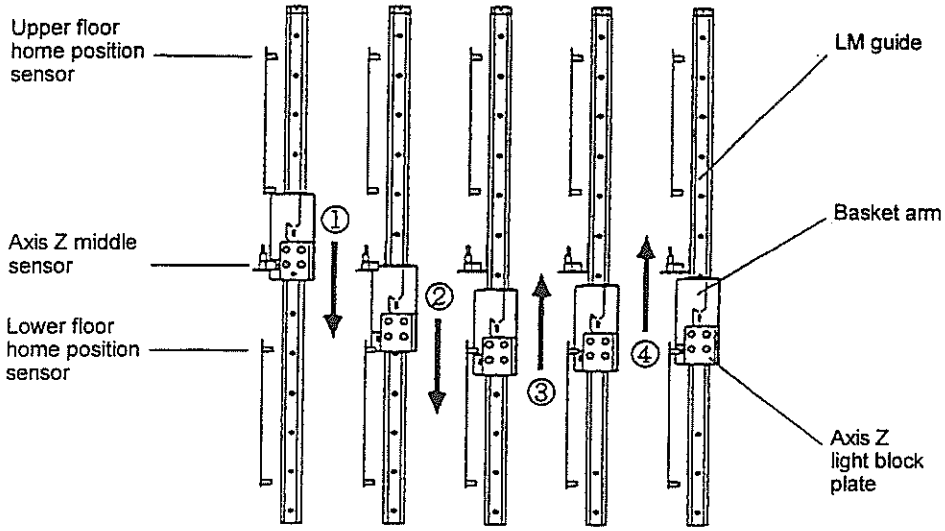


* As for the state of the sensors at the center and approach positions, refer to 5 (3) Sensor Positions in Axis X Sensor Board of this chapter.

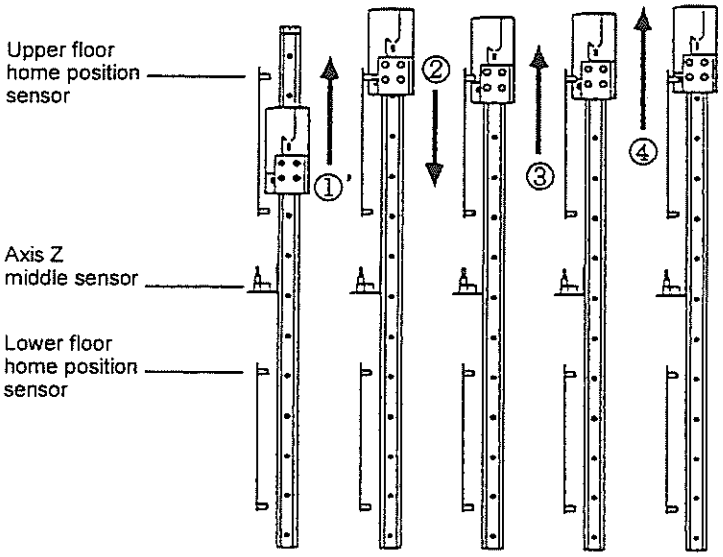
2) The carrier continues to go down until the home position sensor which is light blocked in 1) (or 1)' above) becomes light-transmitted.
3) Thereafter, the carrier rises until the home position sensor mentioned above becomes light blocked again.
4) The point approximately 7 mm above the light blocked point is the home position on the axis Z.

Return of the Origin on the Axis Z

When the Axis Z Middle Sensor Is light screened



When Both Upper and Lower Floor Home Position Sensors Are Light-Transmitted



b. Procedures to Return to the Home Position on the Axis X

1) When the home position proximity sensor is light blocked, the carrier is transferred rightward (toward the operating panel) until the home position proximity sensor is light-transmitted.

1)' When the home position proximity sensor is light-transmitted, the carrier is transferred leftward until the home position proximity sensor is light blocked.
This point is made to the left home position.

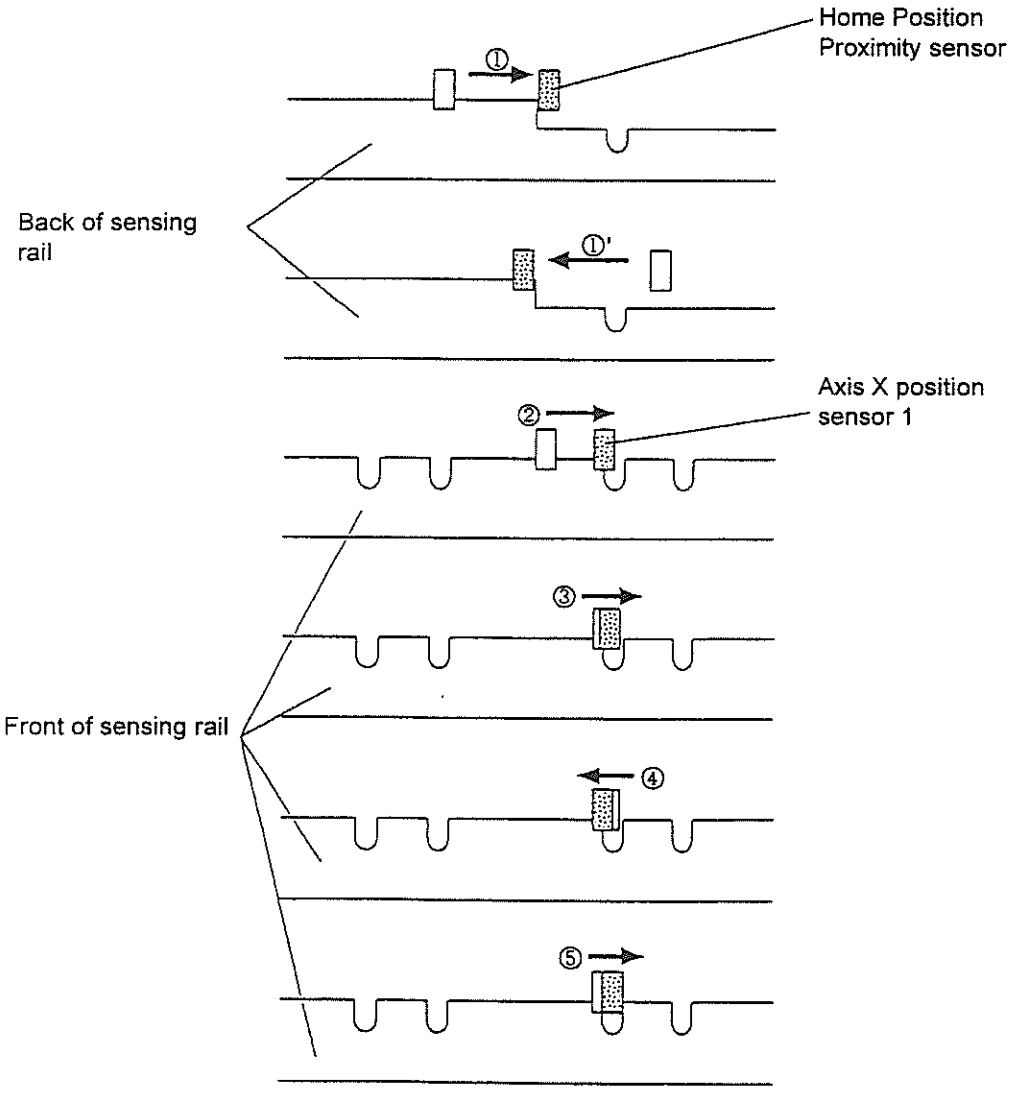
2) The carrier moves rightward until the axis X position sensor 1 (on the left side looked at from the front) is light-transmitted.

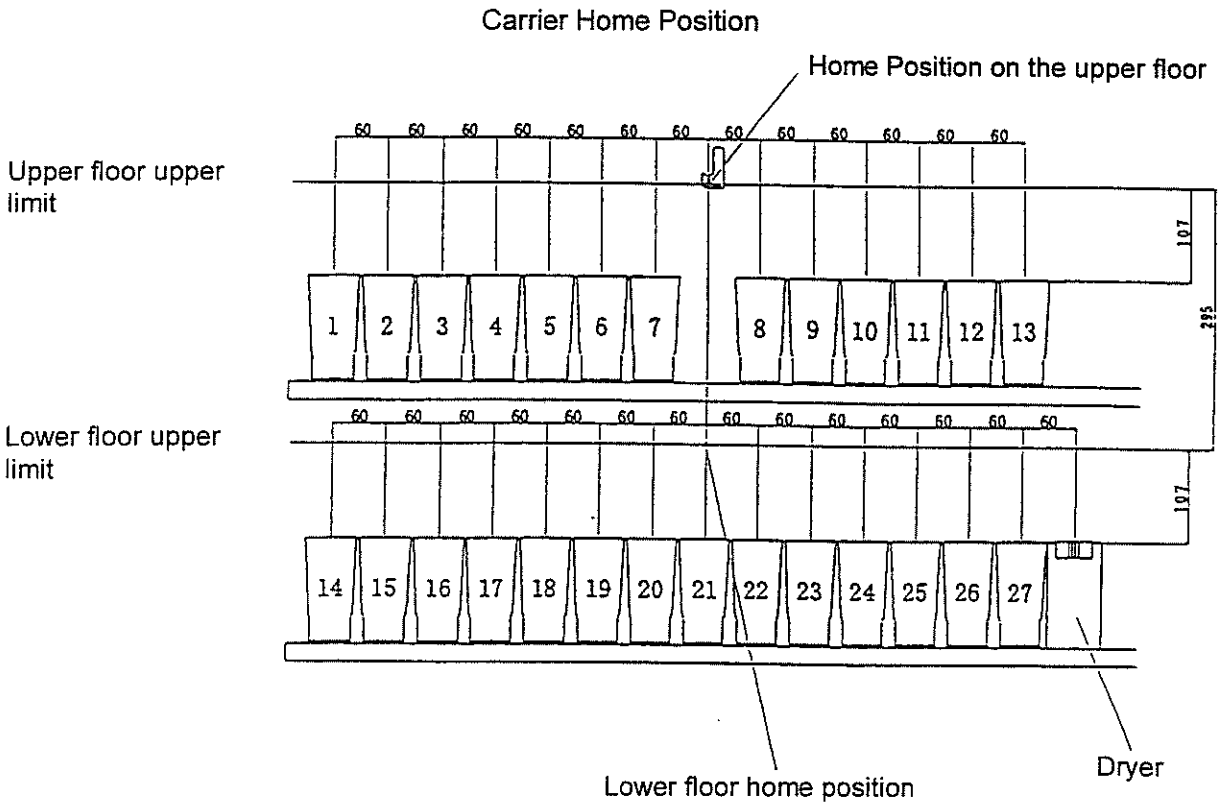
3) The carrier moves rightward for five pulses from the point where the sensor becomes light-transmitted.

4) The carrier moves leftward until the axis X position sensor 1 (on the left side looked at from the front) is light blocked.

5) The travel distance to the slit center is calculated, and the carrier moves rightward that much.
This point will be the axis X home position.

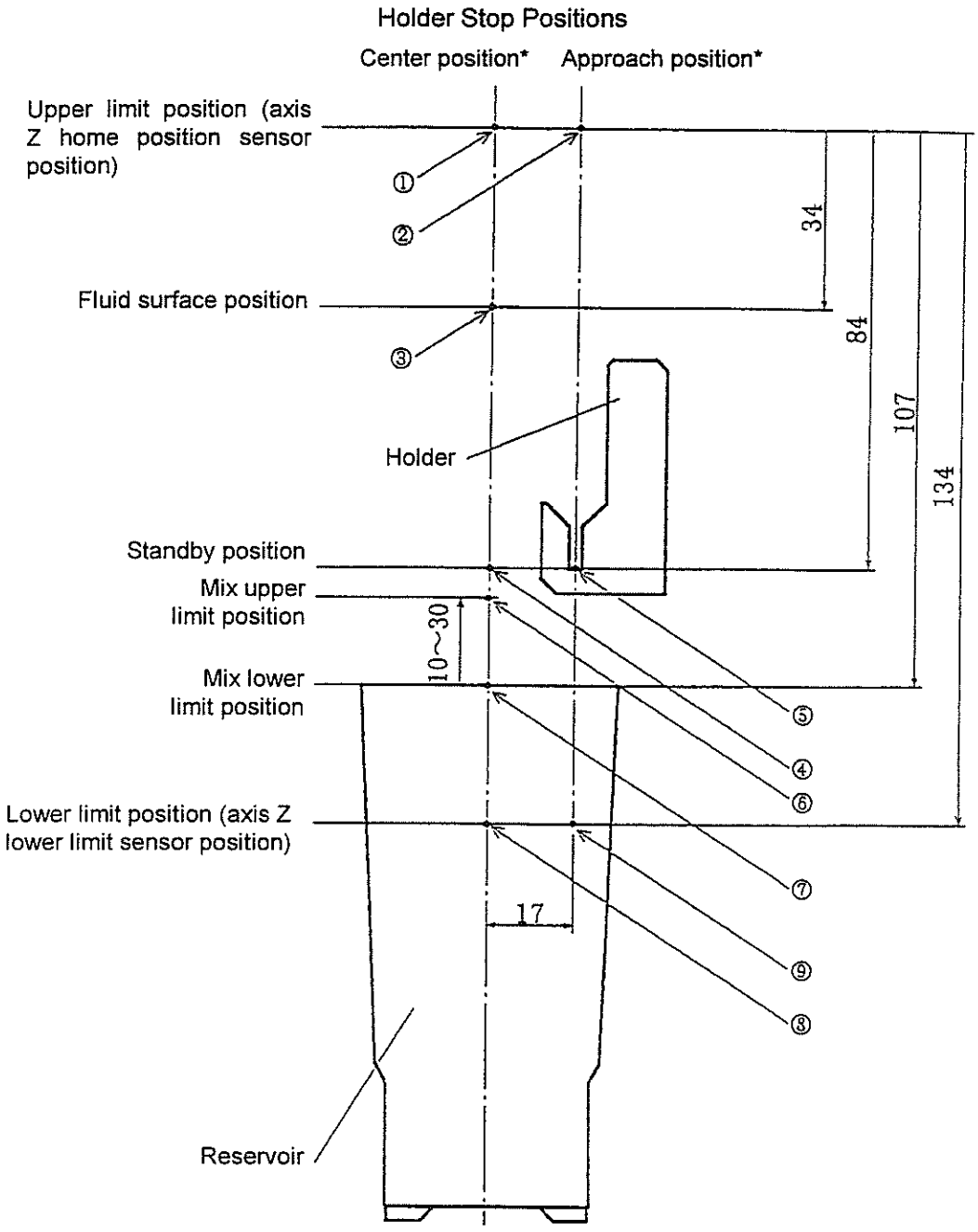
Return to the Home Position on the Axis Z




Carrier Home Position
Home Position on the upper floor
Upper floor upper limit
Lower floor upper limit
60 60 60 60 60 60 60 60 60 60 60 60 60
107
295
1 2 3 4 5 6 7 8 9 10 11 12 13
14 15 16 17 18 19 20 21 22 23 24 25 26 27
Lower floor home position
Dryer

2. Carrier Basic Transfer Pattern

The carrier always moves with the home position (refer to (3) Return to the Home Position for details) as a reference. The carrier stops at points indicated by black points in each reservoir below.



* As for the state of the sensors at the center and approach positions, refer to 5 (3) Sensor Positions in Axis X Sensor Board of this chapter.

The stop positions are designated as below:

1. Upper limit center position
2 Upper limit approach position
3 Fluid surface position
4 Standby center position
5 Standby approach position
6 Mix upper limit position
7 Mix lower limit position
8 Lower limit center position
9 Lower limit approach position

Carrier transfer is effected by the following seven combinations of basic movement patterns:

a. Movement to the basket transfer starting point.
b. Basket transfer movement.
c. Floor transfer movement.
d. Mix movement.
e. Enhanced wash movement.
f. Basket releasing movement.
g. Basket releasing movement (temporary stop, etc.)

a. Movement to the basket transfer starting point.

This is a movement to transfer the holder to the transfer starting position in a transfer starting reservoir when transferring an adapter being stain processed in a reservoir. Following this movement, the basket is transferred (Refer to b. Basket transfer movement below.) For this transfer, there are two different transfer routes to be used in accordance with the then holder position:

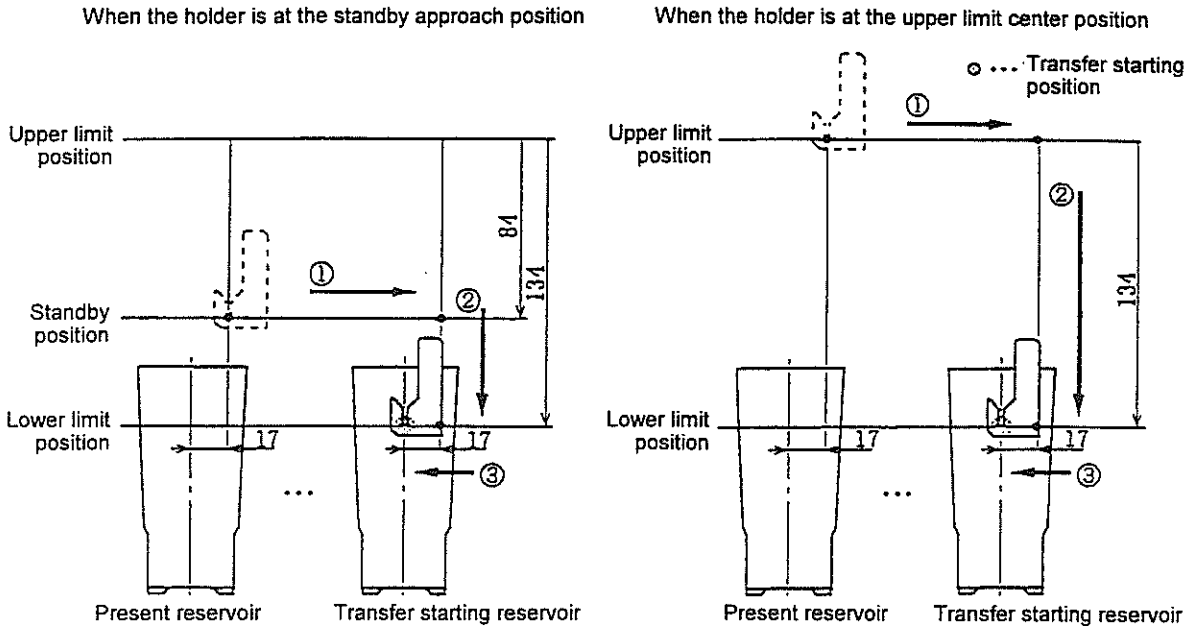
<When the holder is at the standby approach position>

1) Standby approach position (present reservoir) → Standby approach position (transfer starting reservoir)
2) Standby approach position (transfer starting reservoir) → Lower limit approach position (transfer starting reservoir)
3) Lower limit approach position (transfer starting reservoir) → Lower limit center position (transfer starting reservoir)

<When the holder is at the upper limit center position>

1) Upper limit center position (present reservoir) → Upper limit approach position (transfer starting reservoir)
2) Upper limit approach position (transfer starting reservoir) → Lower limit approach position (transfer starting reservoir)
3) Lower limit approach position (transfer starting reservoir) → Lower limit center position (transfer starting reservoir)

Movement Up to Basket Transfer Starting Position

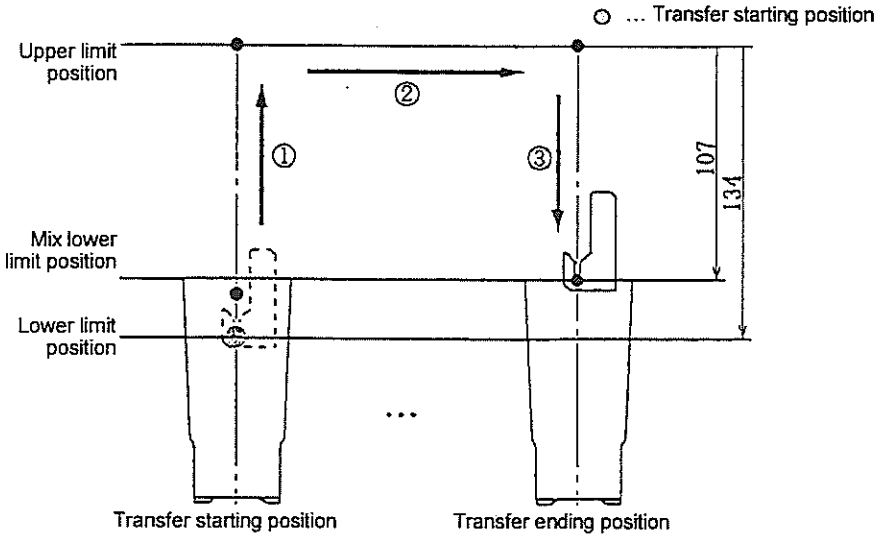


b. Basket transfer movement.

This is to transfer baskets being stain processed in a reservoir. This is done following the above-mentioned movement of a. Movement to the basket transfer starting point. It takes the route mentioned below:

1) Lower limit center position (transfer starting position) → Upper limit center position (transfer starting position)
2) Upper limit center position (transfer starting position) → Upper limit center position (transfer ending position)
3) Upper limit center position (transfer ending position) → Mix lower limit position (transfer ending position)

Basket Transfer Movement

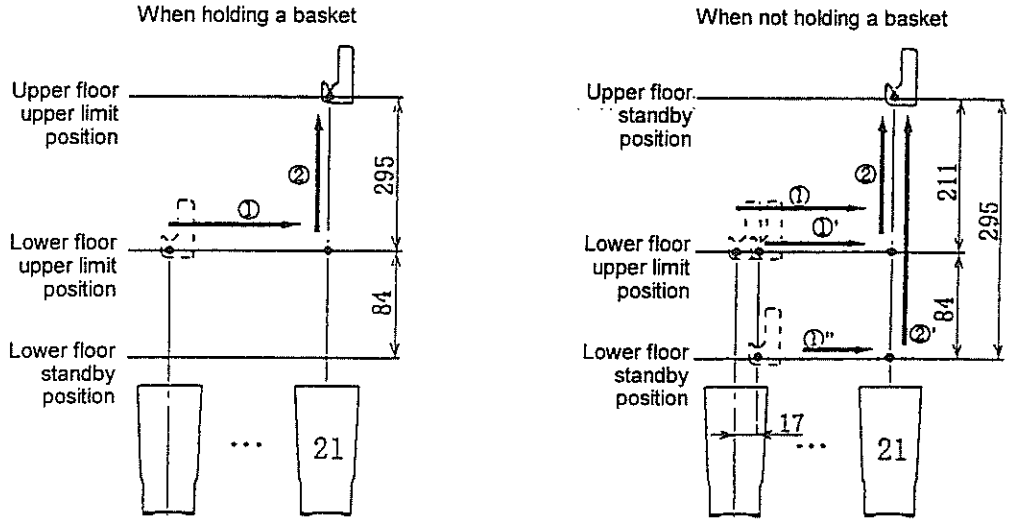


c. Floor transfer movement.

The carrier moves from the upper floor to the lower floor, or from the lower floor to the upper floor. This transfer movement is done during a. Movement to the basket transfer starting point and b. Basket transfer movement described above.

The transfer route differs depending on whether the holder is holding a basket or not. Below is an example of the holder moving from the lower floor to the upper floor.

Floor Transfer Movement



<When holding a basket>

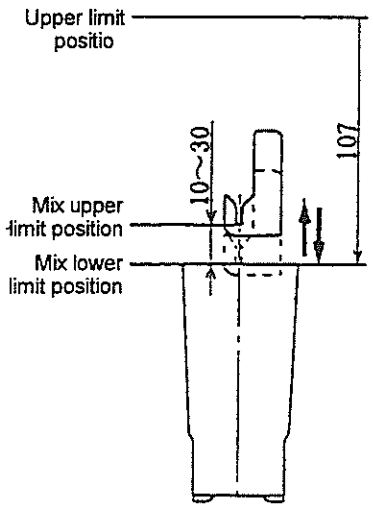
1) Lower floor (upper floor) upper limit center→Lower floor (upper floor) home position
2) lower floor (upper floor) home position→Upper floor (lower floor) home position

<When not holding a basket>

- When a holder is at the lower floor (upper floor) upper limit center position
  1) Lower floor (upper floor) upper limit center position → Lower floor (upper floor) home position
  2) Lower floor (upper floor) home position → Upper floor (lower floor) home position
- When a holder is at the lower floor (upper floor) upper limit approach position
  1)' Lower floor (upper floor) upper limit approach position→Lower floor (upper floor) home position
  2) Lower floor (upper floor) home position→Upper floor (lower floor) home position
- When a holder is at the lower floor (Upper Floor) standby approach position
  1)" Lower floor (upper floor) standby approach position→Lower floor (Upper Floor) standby center position (Reservoir 21 center)
  2)' Lower floor (upper floor) standby center position (Reservoir 21 center)→Upper floor (lower floor) standby center position (on the Reservoir 21 center line)

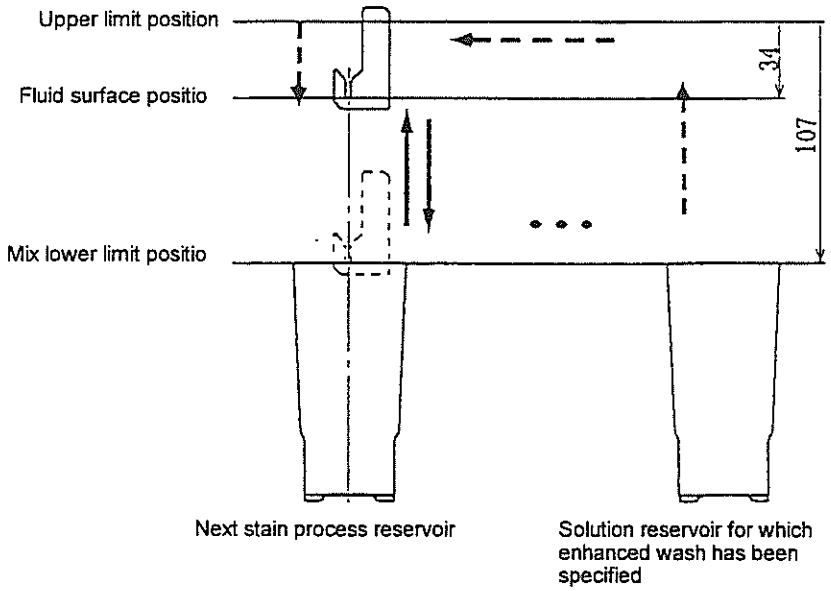
d. Mix movement.
This is done to mix the baskets up and down to uniformly stain tissues on the slide glass. The mix width can be set within the range of 10 to 30 mm.

Mix Movement



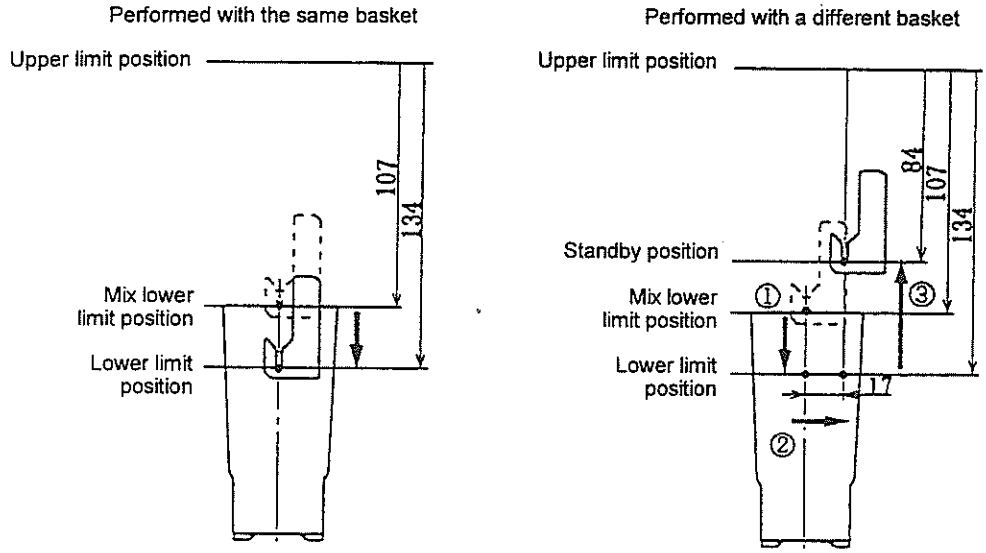
e. Enhanced wash movement.
When "Enhanced wash" is specified prior to starting of stain, this operation is done in the solution reservoir next to one for which enhanced wash has been specified. This operation fully immerses the baskets, and immediately lift them out of the solution completely. This operation enhances cleaning of the solution on the basket from the preceding reservoir with the solution in the present reservoir.

Enhanced Wash Movement



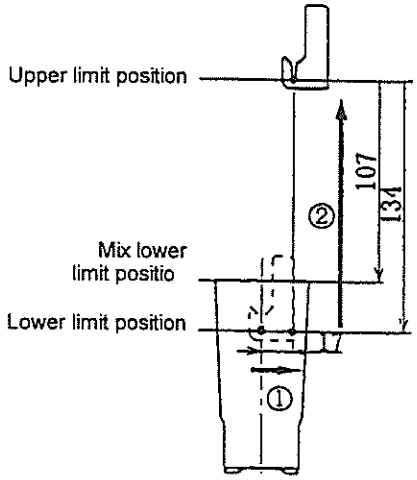
f. Basket releasing movement.
Following the transfer of the basket, it is released in a solution reservoir or a washing reservoir. (As for the transfer operations, refer to b. Basket transfer movement.)
A basket is transferred as below:
<When the next operation is performed with the same basket>
1) Mix lower limit position → Lower limit center position
<When the next operation is performed with a different basket>
1) Mix lower limit position → Lower limit center position
2) Lower limit center position → Lower limit approach position
3) Lower limit approach position → Standby approach position

Basket Releasing Movement



g. Basket releasing movement (temporary stop, etc.)
This is for temporarily stopping a carrier. After releasing the basket in a reservoir, the carrier moves up to the upper limit approach position.

Basket Releasing Movement (temporary stop, etc.)



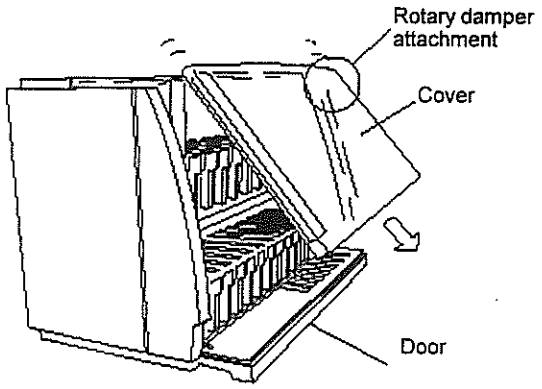
2-6 Cover Section

The cover prevents spreading of harmful fume (xylene, etc) in the solutions out of the system, and prevents the user from coming into contact with the carrier during instrument run. The cover section is composed of cover unit, a top cover, a cover lever attaching plate, a gas damper, etc. The cover unit is composed of a cover, a cover lever, a slide rail, a rotary damper, a rack, etc. A cover open/close sensor (micro-switch) is provided on the power supply box. It detects open/close by means of switch on/off on the cover sensor plate.

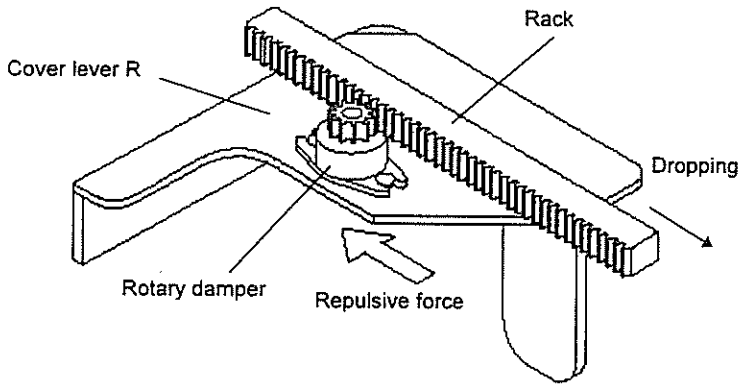
(1) Rotary Damper Rack

It prevents the cover from suddenly dropping on the slide rail when the cover is closed. The rotary damper rack is composed of a rotary damper fixed on the cover level R and a rack fixed on the cover. The rotary damper utilizes the viscosity of silicon oil. When the cover is inclined to close it, the rotary damper gets a repulsive force to slowly close the cover. Almost no repulsive power is generated, however, when the cover is pushed upward to open it, allowing smooth pushing upward of the cover.
When the internal part of the rotary damper or its gear is damaged, the cover suddenly drops. This sudden drop may lead to an accident. The rotary damper needs to be replaced periodically.

Rotary Damper and Other Components



Detail of Rotary Damper Attachment

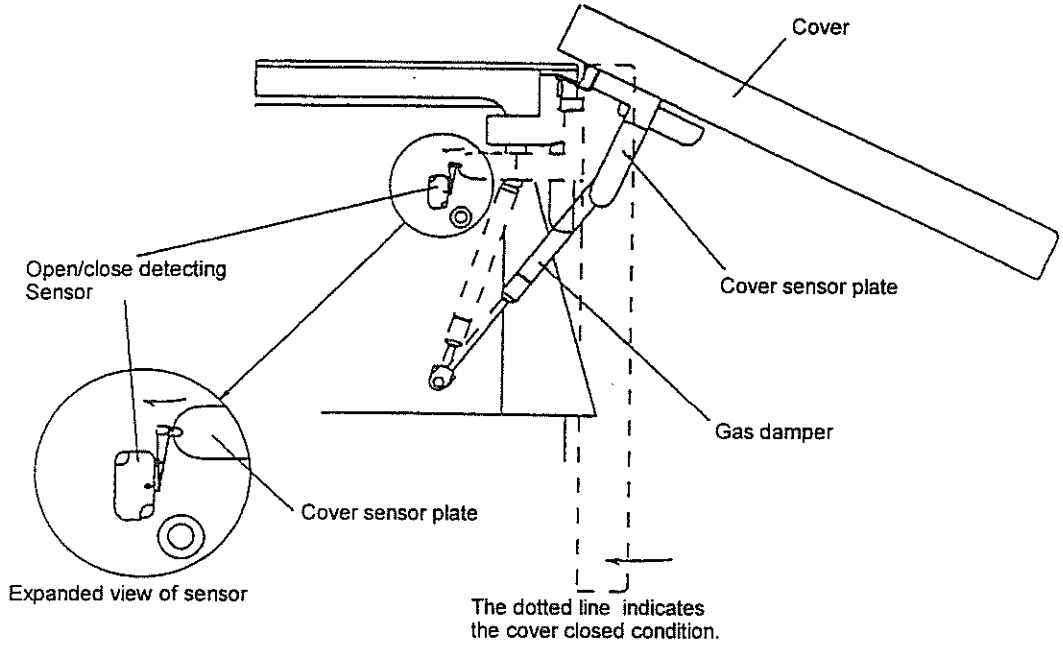


(2) **Gas Damper**

The gas damper controls sudden movement of the cover, and reduces the load occurring when the cover opens, using the expanding force. The gas damper has a cylinder filled with oil and compressed gas. It is designed that the piston rod projected out of one end goes out and comes in to change the load. The structure allows to control the speed of expansion and contraction, and to reduce shock.

The damper should be fixed with the rod facing downward. When necessary to replace parts, take care not to install parts in wrong direction.

Gas Damper and Cover Sensor

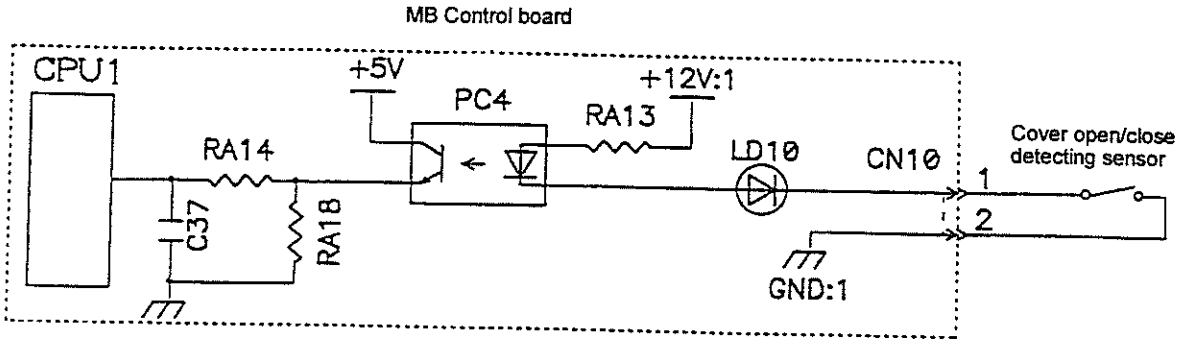


(3) **Cover Open/Close Detecting Sensor**

The sensor detects opening /closing of the cover. When the cover is closed, the cover sensor plate pushes the hinge. As a result, the limit switch RS1 (to detect cover opening/closing) is turned on, and the circuit is closed. Thus, the photo coupler PC4 (PC4 has four photo couplers built in it) is turned on, and LD10 for checking operation is turned on, and High is inputted into CPU1.

The power supply voltage from the limit switch to the photo coupler input side is +12V (+12V:1), and the power supply voltage from the photo coupler output side to CPU1 is +5V. When there are any troubles between the photo coupler output side and CPU1, signals are not correctly transmitted even if the LED for checking operation is turned on.

Block Diagram



State of Parts

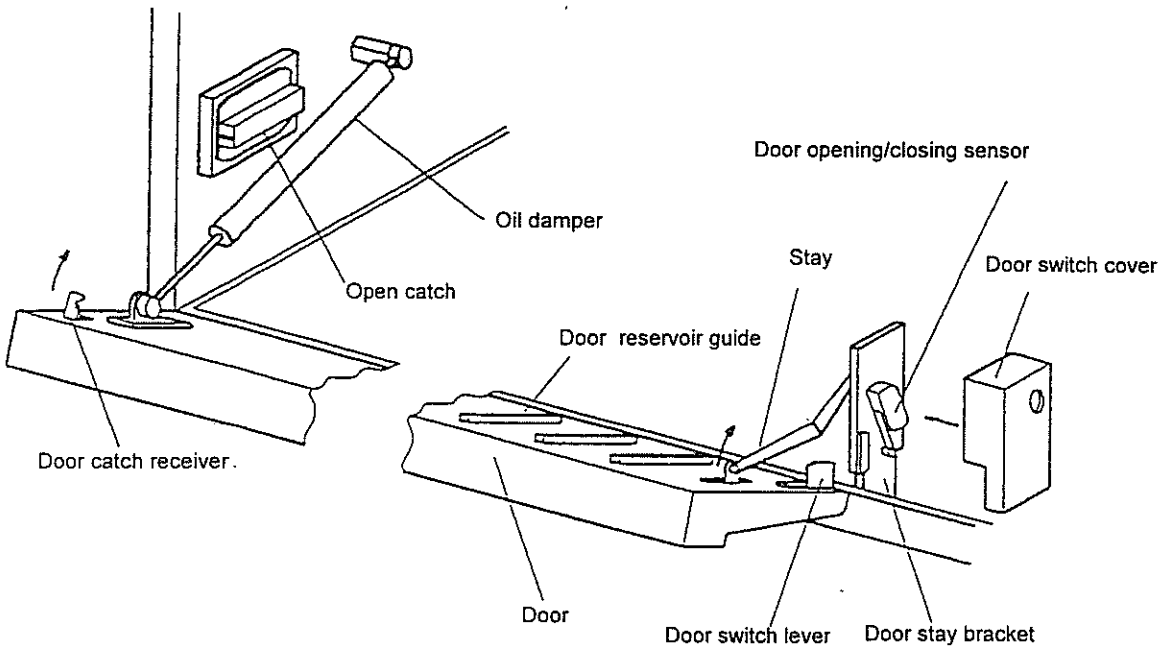
Sensors	State of Cover	State of Sensor	State of LED	CPU1 Input
Cover sensor RS1	Open	Open	LD10 off	Low
	Close	Short-circuited	LD10 on	High

2-7 Door Section

The door prevents spreading of harmful fume (xylene, etc) in the solutions out of the system, and determines the position of the reservoir by closing it.

The door section is composed of a door unit, an open catch, a door catch receiver, a stay, a door stay bracket, oil damper, etc. The door unit is composed of a door, a door switch lever, and door reservoir guides. A sensor (micro switch) is provided on the door stay metal to detect opening/closing of the door. It detects opening/closing by means of switch on/off of the door switch lever.

Door Section



(1) Oil Damper

It prevents the door from suddenly dropping on the slide rail when the door is closed. The oil damper utilizes the viscosity of oil. When the door is inclined to close it, the oil damper gets a repulsive force to slowly open the door. Almost no repulsive power is generated, however, when the door is pushed upward to close it, allowing smooth closing of the door.

When the internal part of the oil damper is damaged, the door suddenly drops. This sudden drop may lead to an accident. The oil damper, therefore, needs to be replaced periodically.

(2) Open Catch and Door Catch Receiver

They are to keep the door closed.

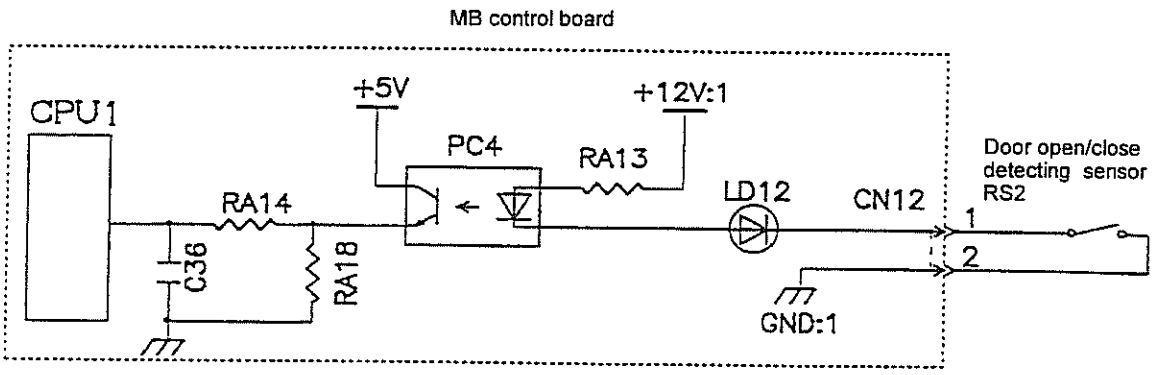
When the door is closed, the door catch receiver is locked within the open catch, and the door is kept closed. To open it, push the door in to release the door catch receiver from the open catch. With this operation, the door opens.

(3) Door Open/Close Detecting Sensor

The sensor detects opening/closing of the door. When the door is closed, the door switch lever pushes the switch hinge. As a result, the limit switch RS2 is turned on, and the circuit is closed. Thus, the photo coupler PC4 (PC4 has four photo couplers built in it) is turned on, LD12 (Door open/close detection) is turned on, and High is inputted into CPU1.

The power supply voltage from the limit switch to the photo coupler input side is +12V (+12V:1), and the power supply voltage from the photo coupler output side to CPU1 is +5V. When there are any troubles between the photo coupler output side and CPU1, signals are not correctly transmitted even if the LED for checking operation is turned on.

Block Diagram

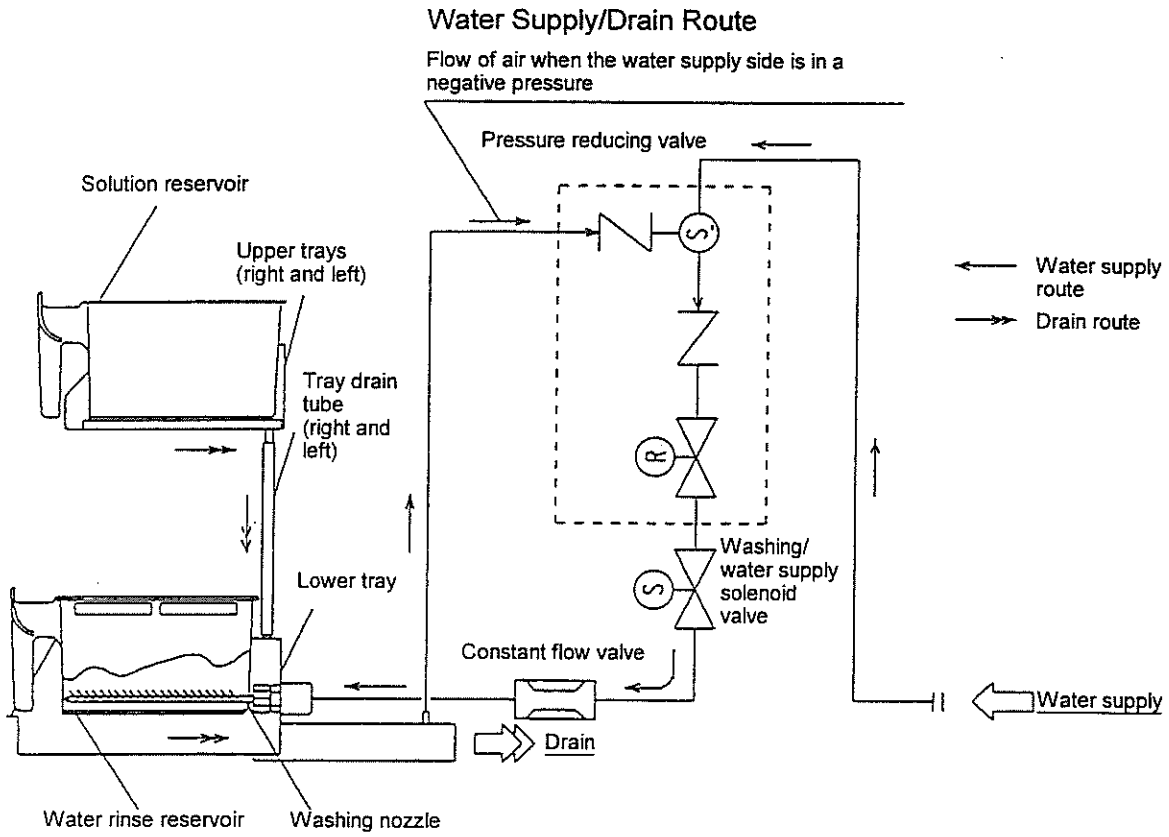


State of Parts

Sensors	State of Cover	State of Sensor	State of LED	CPU1 Input
Door sensor RS2	Open	Open	LD12 off	Low
	Close	Short-circuited	LD12 on	High

2-8 Water Supply/ Washing/Draining Section

This section supplies water to the water rinse reservoir, and drain solutions and water from the upper and lower trays.

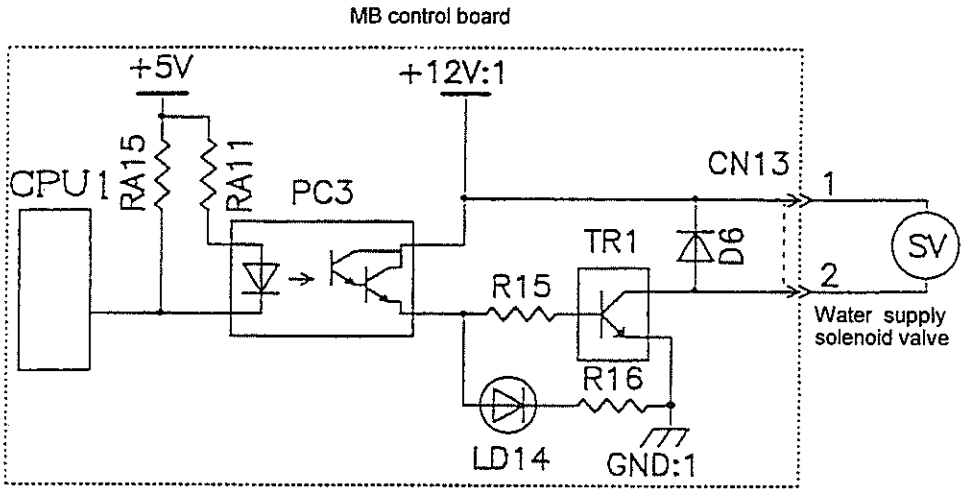


(1) Water Supply/Washing Section

The water supply/washing section is composed of a washing unit (pressure reducing valve, washing/water supply solenoid valve), a manifold unit (constant flow valve, manifold, washing nozzle), and a lower tray unit. It flows from the washing unit through the manifold unit. The washing unit is connected to the facility water tap to get water supply. Water thus supplied is depressurized to a certain level of pressure (0.85 kgf/cm^2) within the water piping by the pressure reducing valve. During the execution of a stain, the washing/water supply solenoid valve opens 30 seconds before washing, and water is supplied to the washing reservoir from the washing nozzle via the constant flow valve. The constant flow valve maintains a constant flow of water. With DRS-2000, it maintains a flow rate of 11 liters/min. Water supplied flows out through the over flow outlet to be replaced with fresh water. Water continues to be supplied for a certain duration after the baskets are taken out of the washing reservoir. This duration of additional water supply is called "Refreshing Time,"meaning the time to replace water in the reservoir with fresh water. A refreshing time (within a range of 30 to 90 seconds) is set during environment setting. The washing reservoir has a hole of 1 mm in diameter on the bottom through which water is constantly drained. It takes about 20 minutes (designed time) to fully drain the reservoir from the filled condition.

1. Washing unit
   a. Pressure reducing valve
      This valve maintains the supply water pressure at a certain level (0.85 kgf/cm^2). This pressure reducing valve has a strainer built in it to remove foreign materials from the water being supplied. It is also provided with a vacuum breaker. This vacuum breaker is used to suck air from the drain piping to prevent water and solutions from flowing back to the primary side (this phenomenon is called reverse siphon action) when the primary side is in a negative pressure.
   b. Washing/Water Supply Solenoid Valve
      The solenoid valve opens and closes the water supply piping on the washing reservoir.

Block Diagram



When CPU1 outputs Low, the photo coupler PC3 is turned on, and LD14 for checking operation is turned on. In addition, the driver TR1 is turned on, and the water supply solenoid valve opens. When CPU1 outputs High, all the elements are turned off (LD14 is turned off) and the water supply solenoid valve closes.

The power supply to CPU1 and to the photo coupler input side is +5V, and the power supply from the photo coupler output side to the water supply valve is +12V (+12V:1).

CPU1 Output and State of Each Element

CPU1 Output	PC3	LD14	TR1	SV
Low	On	On	On	Open
High	Off	Off	Off	Closed

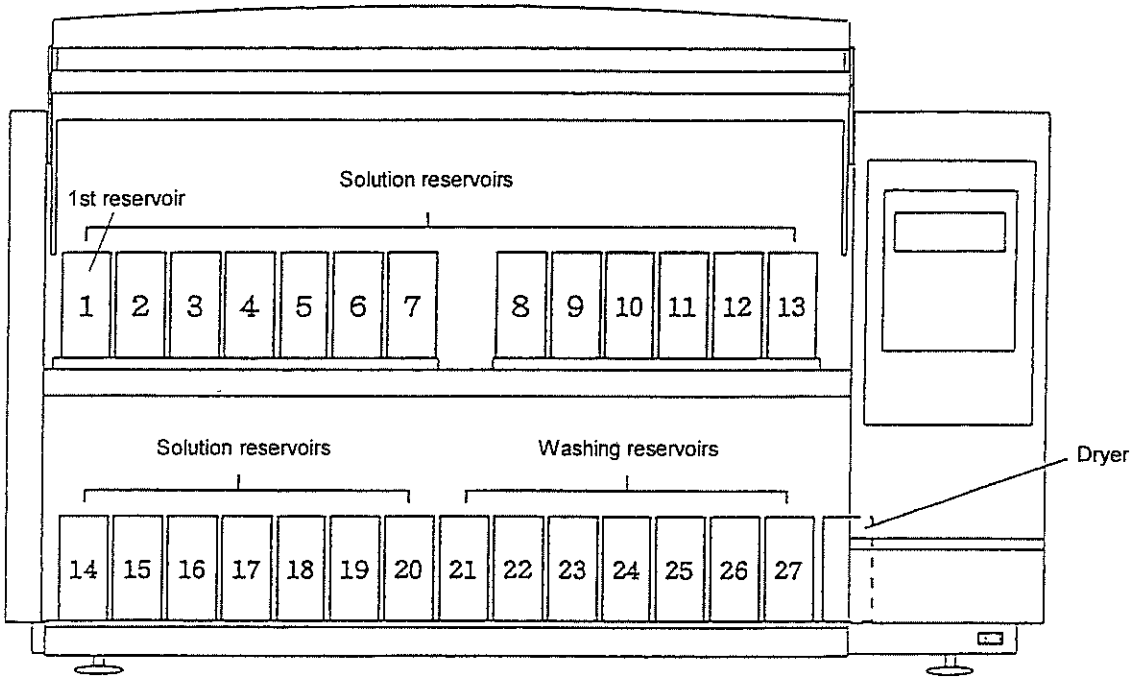
2. Manifold Unit
   a. Constant Flow Valve
      The valve maintains a constant flow of water supply. With the DRS-2000, it maintains a flow rate of 11 liters/min.
   b. Manifold
      A washing nozzle is provided here to supply water to each washing nozzle.
   c. Washing Nozzle
      Water is supplied to the washing reservoir through this nozzle.

3. Tray Unit

It holds solution and water rinse reservoirs. It also receives water overflowing from water rinse reservoirs or solution overflowing from solution reservoirs.

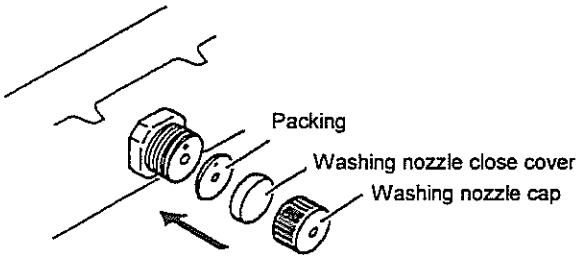
There are two floors of trays: upper and lower floors. The upper tray accommodates a total of 13 reservoirs (seven on the left, six on the right), and the lower tray accommodates a total of 14 reservoirs. A total of 27 reservoirs can be arranged. The solution reservoirs are positioned from Station 1 to 20. Two to five water rinse stations can be arranged within Station 21 to 27.

Arrangement of Reservoir

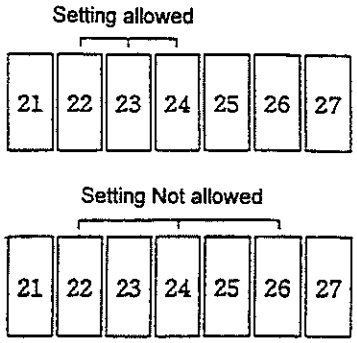


Those reservoirs not being used as washing reservoirs should be capped, with the washing nozzle removed. (Refer to the drawing below.) When using a reservoir as a solution reservoir, its washing nozzle should be closed covered, and the washing reservoir should be replaced with the solution reservoir. Washing reservoirs should be arranged in a consecutive manner. For example, when arranging three washing reservoirs, the 22nd, 23rd and 24th reservoirs can be arranged, but the 22nd, 23rd and 26th reservoirs can not be arranged in this order. (Refer to the drawing below.) The factory setting for the washing reservoirs are Station21 to 23. Stations 24 to 27 are close covered. When provided with a dryer (optional at the factory), a dryer is provided next to the 27th reservoir.

Attaching a washing nozzle cap



Example of Arrangement of Washing Reservoirs

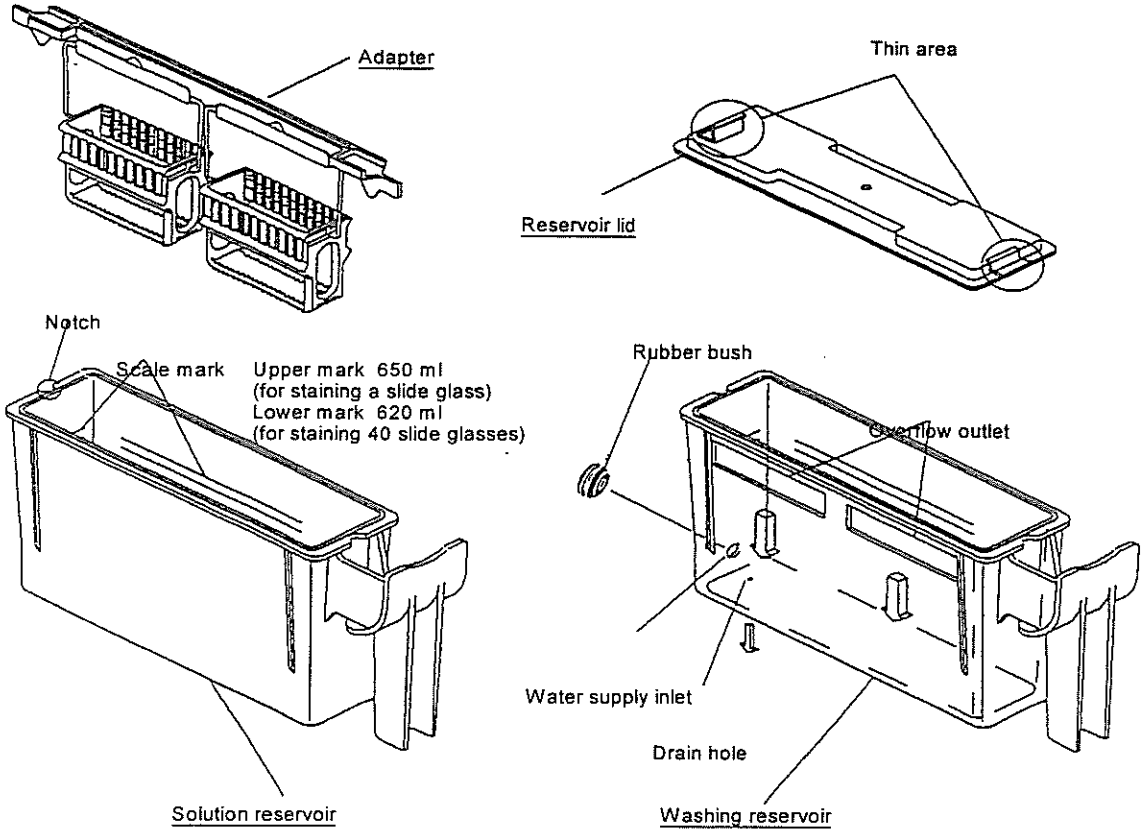


a Reservoir

This reservoir is used for stain process.

There are two types of reservoirs: one for solutions and one for washing. They are of the same size, and both have two scale marks inside. The scale marks indicate a standard volume of solution. The upper mark indicates the volume of solution (650 ml) for staining a slide glass, and the lower mark indicates the volume of solution (620 ml) for staining 40 slide glasses. When this standard volume of solution is exceeded, the adapter gets soaked in the solution, and there is a possibility of some solution being transferred to other solution reservoir. The washing reservoir has a water supply inlet, overflow outlets and a drain hole. A water supply nozzle is inserted through the water supply inlet to supply water into the washing reservoir. The water supply inlet is provided with a rubber bush to prevent leak. This rubber bush needs to be periodically replaced as it may cause water leakage when it gets worn out. Two overflow outlets are provided on the reservoir sides. Water is overflown through these outlets to replace it with fresh one. The drain hole of 1 mm in diameter is located on the reservoir bottom. Through this hole, water is constantly drained. The reservoir has notches to accommodate an adapter onto the center of the reservoir. The lids are provided to prevent solutions from being evaporated. Use the lid without fail when the solutions are not used. There are two thin areas on backsides of lid. (the areas where circled in the illustration) Even if the adapters are put into the reservoir, it is designed to put the lid on the reservoir by cutting them off. Cut them by plies if necessary. An optional lid is provided to cover a number of reservoirs together (there are two types of lid: one for six reservoirs, one for seven reservoirs).

Solution reservoir, Washing reservoir, Reservoir cover



(2) **Draining Section**

Solution and water drop from the basket to accumulate in the upper and lower trays when the basket arm moves. Water supplied into the washing reservoir flows into the lower tray through the overflow outlets and the hole on the reservoir bottom. Drain water accumulated in the upper tray flows into the lower tray via two drain tubes. Then drain water from the upper and lower trays is together drained through the drain pipe behind the system.

2-9 Exhausting Unit

The exhaust unit is located on the back of the system to prevent spreading of harmful fume (xylene, etc) in the solutions out of the system. Harmful fume is caught by activated carbon filter and is exhausted into the atmosphere by the fan. The exhaust unit is composed of the following components:

(1) Fume control box

(2) Activated carbon filter

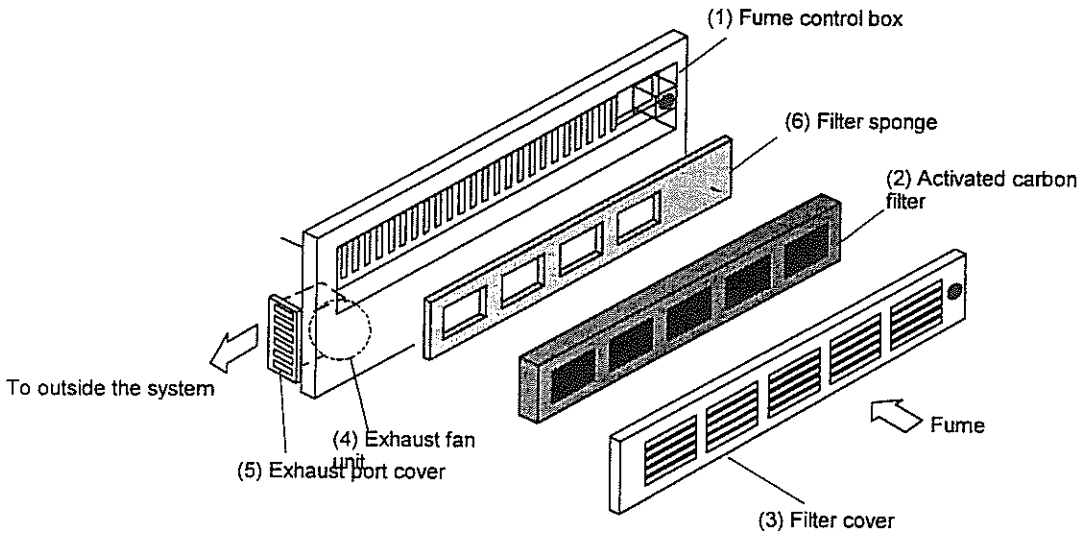
(3) Filter cover

(4) Exhaust fan unit

(5) Exhaust port cover

(6) Filter sponge

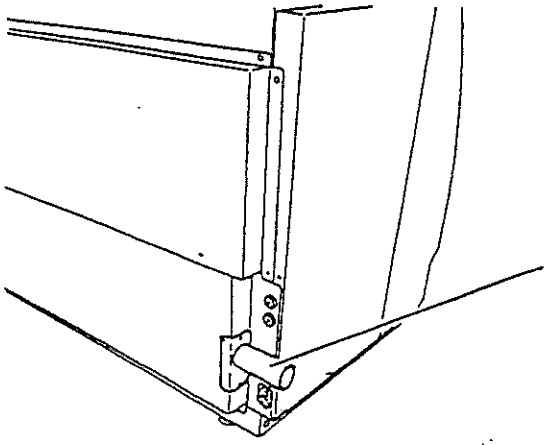
*When using an activated carbon filter in a wooden case, (6) filter sponge is not required.



Fume inside the system is sucked into the fume control box from the filter cover via the activated carbon filter, to be exhausted into the atmosphere through the exhaust outlet cover. Then, harmful fume in the fume is caught onto the activated carbon filter. As the activated carbon filter catches harmful gases, its capacity to catch them gets lower. It is therefore necessary to periodically replace it. (once per months of use). If it is used with its capacity having got low, harmful fume will be released into the atmosphere.

By replacing the exhaust port cover with an fume connecting adapter (option), an exhaust duct can be connected. (Refer to the exploded view drawing and the parts list).

When using a connecting adapter

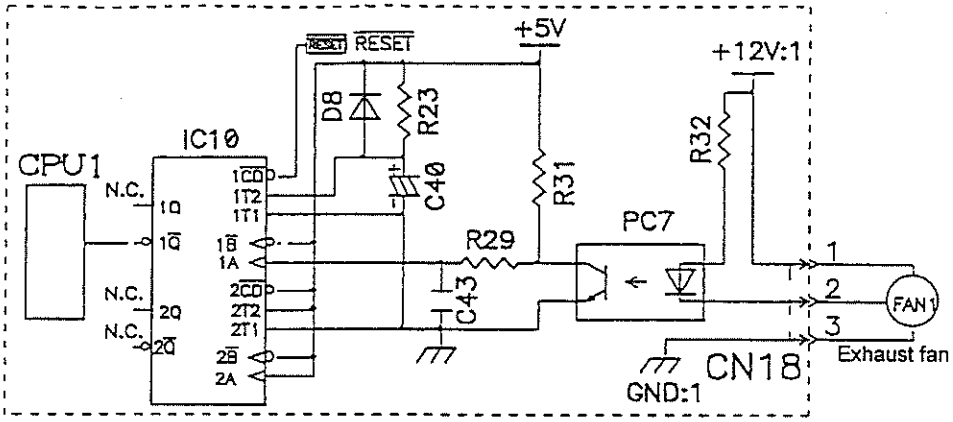


The exhaust unit operates while the system power supply is on. Operation of the exhaust fan is constantly monitored by CPU1 on the control board.

(1) Exhaust Fan Unit Control

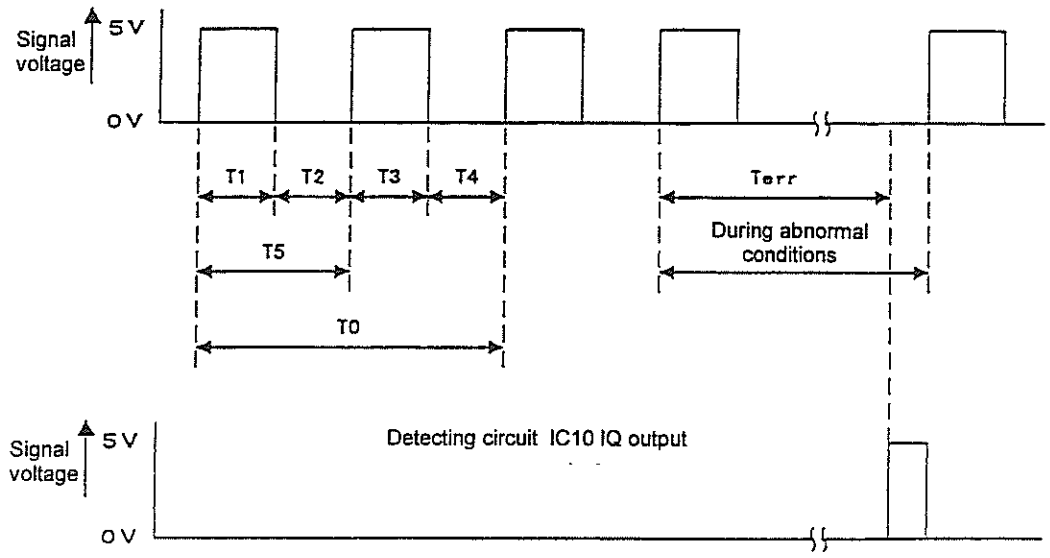
Block Diagram

MB control board



While the system is operating, the exhaust fan gets +12V (+12V:1) from the control board. Although CPU1 does not control the operation of the exhaust fan, it constantly monitors the operation of the exhaust fan using pulse signals to be output while the fan is in operation. During a normal operation, a pulse signal is output from the fan at an interval of T5 (refer to the drawing below). IC18 measures the interval of this pulse signal, and when there is no pulse signal coming from the fan within a certain time Terr (set at 128.5 ms in DRS-2000) to be determined by the values of R23 and C40, it is judged that some abnormal conditions exist. CPU1 outputs High to notify an occurrence of abnormal conditions.

Exhaust Fan Operating Signal (IC10 1A Input)



Default values are calculated by the following formulas:

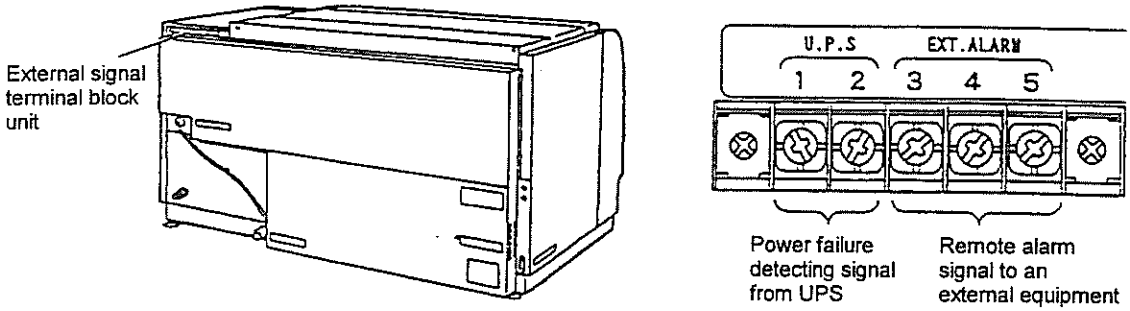
- Pulse width and pulse frequency to be outputted from the exhaust fan
  T1 to T4 $1 \div 4T0 = 60 \div 4N$ (sec.)
  N: Fan rotation (r.p.m.) 2,400 rpm with DRS-2000
  $= 60 \div 9600 = 6.25$ (msec.)
  Therefore, the pulse frequency T5 is 12.5 (msec.)
- Reference time Terr for judgment by IC18
  Terr = 0.7 x C40 x R23 = 0.7 x 6.8 μF 2 x 27 kohms= 128.5 msec.

If no abnormal conditions exist, T5 is 12.5 msec, which is approximately equal to 1/10 of Terr. Some margin is provided, taking unstable conditions at starting into consideration.

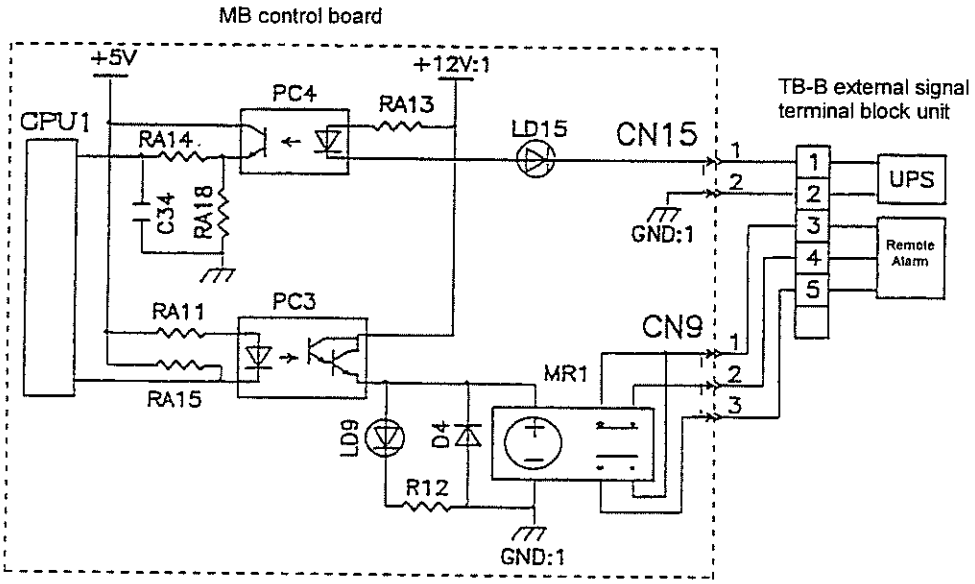
2-10 External Signal Input/Output Section

This section is composed of a section to receive power failure signals from the uninterrupted power supply (UPS) and a section to output alarm signals to outside the system.

Connection of External Input/Output Signals



Block Diagram



(1) Power Failure Signal Input Section

An UPS may be installed outside the system as an option. It is necessary to set existence or non existence of UPS on the setup screen. Incorrect setting may result in occurrence of abnormal condition (Error No.10). When using a UPS, power failure signals from the UPS are connected to Nos.1 and 2 of the terminal block TB-B on the rear of the system. It has to be a non-voltage contact which allows a current of higher than 12 mA (the designed driving current for PC4 and LD15 is approx. 10 mA) to flow. For connection, a two-lead wire of 20AWG should be used. It should be less than 3 meters long.

Operation of each part during power failure

While power failure signals are coming, no addition of specimens may be made.

- When no dryer is used
  Normal operation for five minutes. If power recovers meantime, normal operation continues. Power-off error if power does not recover within five minutes. (Specimens will be placed in one of the reservoirs.) Thereafter, the operation resuming key is used to start operation following power recovery.
- When a dryer is used
  When power failure signals are received, the drying heater is turned off. The rest of operations are the same as mentioned for the case without a dryer.

If the system is set for using a UPS, LD15 for checking operation is turned off when power fails and the contact with an external device (UPS) opens (Nos. 1 and 2 pins of TB-B). In addition, the photo coupler PC4 is turned off and CPU1 receives Low to judges that a power failure has occurred.
The power supply voltage of CPU1 and the output side of the photo coupler is +5V, and the input side of the photo coupler and the power supply voltage of the LED is +12V (+12V:1).
When there are problems in CPU1 or in the photo coupler, signals will not be normally transmitted even if the LED for checking operation is turned on.

CPU1 Input and LED, and State of UPS

CPU1 input	LD15	Nos.1 and 2 pins of TB-B	State of UPS
High	On	Short-circuited	Power supplied
Low	Off	Open	Power failure

(2) Remote Alarm Output Section

This is a no-voltage contact output to take an alarm out of the system when an error of stopping stain operation (other than battery low, error in printer, exhaust fan, or dryer) occurs. This signal allows to monitor abnormal occurrences at a distance from the system.
When taking out signals, this section is connected to Nos. 3 and 4 or Nos. 3 and 5 (No.3 for both cases) of the terminal block TB-B. The rated voltage of the load should be less than 30 Vr.ms.s, 60 Vd.c, and the rated current should be less than 1A and more than 10 mA. The contact between Nos. 3 and 4 is normally closed (short-circuited) and the contact between Nos.3 and 5 is normally open. For connection, use a 20AWG, two-lead cable of less than 10 m long.
When abnormal conditions occur, CPU1 outputs Low, the photo coupler PC3 is turned on, and LD9 for checking operation is turned on. In addition, the coil of MR1 is excited to drive the relay contact (to open the contact between Nos.3 and 4 of TB-B, and to close the contact between Nos.3 and 5 of TB-B).
When there are problems in the relay, it will not operate correctly even if the LED for checking operation is turned on.

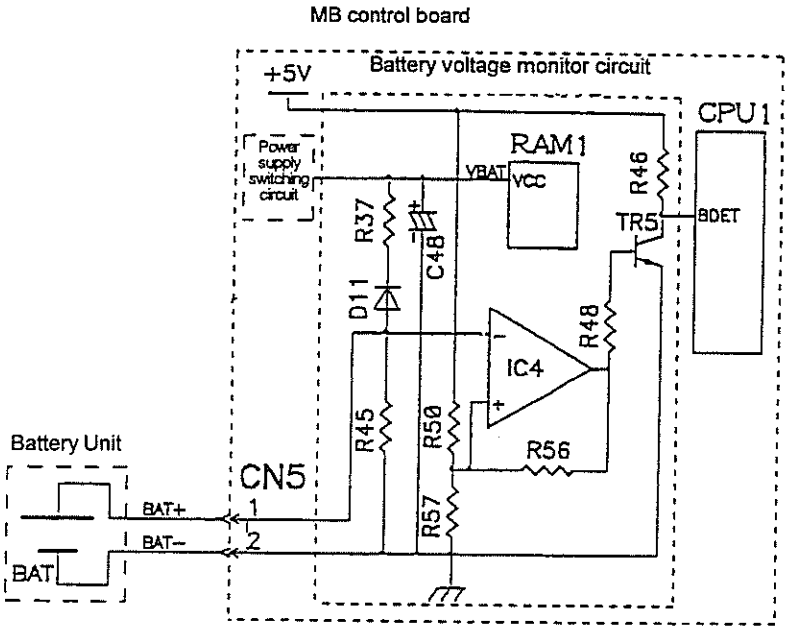
CPU1 and LED, and State of System

CPU1 output	PC3	LD15	MR1	Nos.3 and 4 pins of TB-B	Nos.3 and 5 pins of TB-B	State of System
High	Off	Off	Stop	Short-circuited	Open	Normal
Low	On	On	Operate	Open	Short-circuited	Abnormal

2-11 Battery Unit

This battery unit is provided to protect data in RAM1 which is a part of the memory on the control board.

Block Diagram



The battery unit uses a thionyl chloride lithium battery (this battery cannot be charged). In order to protect data, the battery unit (VBAT) requires a voltage of more than 2 V, and this battery is monitored by the battery voltage monitor circuit during operation. IC4 compares the reference voltage to be input into the plus side with the voltage of the battery unit to be input into the primary side. If it judges that the battery voltage is below 3V, IC4 outputs High. As TR5 is turned on by this High signal, the voltage low abnormal signal BDET becomes Low. When BDET is Low, CPU1 judges that the battery unit does not have a sufficient capacity, and alarms abnormal conditions. If the power supply is kept off for an extended period of time when there exist abnormal conditions, data will not be protected. It is therefore necessary to promptly replace the battery unit. When the battery unit is disconnected with the power supply off, data will be protected for 16 seconds (calculated assuming the worst conditions) by the capacitor (C48) on the control board. Replace the battery unit within this time period.

The battery has a nominal capacity of 1200 mAh and RAM1 requires a backup current of 5μA. Theoretically, therefore, it is not necessary to replace the battery unit during the time period as calculated below:

Battery lasting time period = 1200/5 = 240000 hours = 10000 days = 333.3 months = 27.8 years

This is a time period for a completely new battery unit at the ambient temperature of 25°C, and thus the actual lasting time period differs depending on the ambient temperature and the remaining capacity of battery unit. DRS-2000 guarantees for three years after production as a battery unit is connected during manufacturing. When the ambient temperature is 70 and the other conditions are unchanged, RAM1 requires 30 ℓA as its backup current. The battery will last for about 4.6 years in this case.

Battery Capacity and State of Signal

Signal	Sufficient capacity	Insufficient capacity
IC4 output	Low	High
BDET signal	High	Low

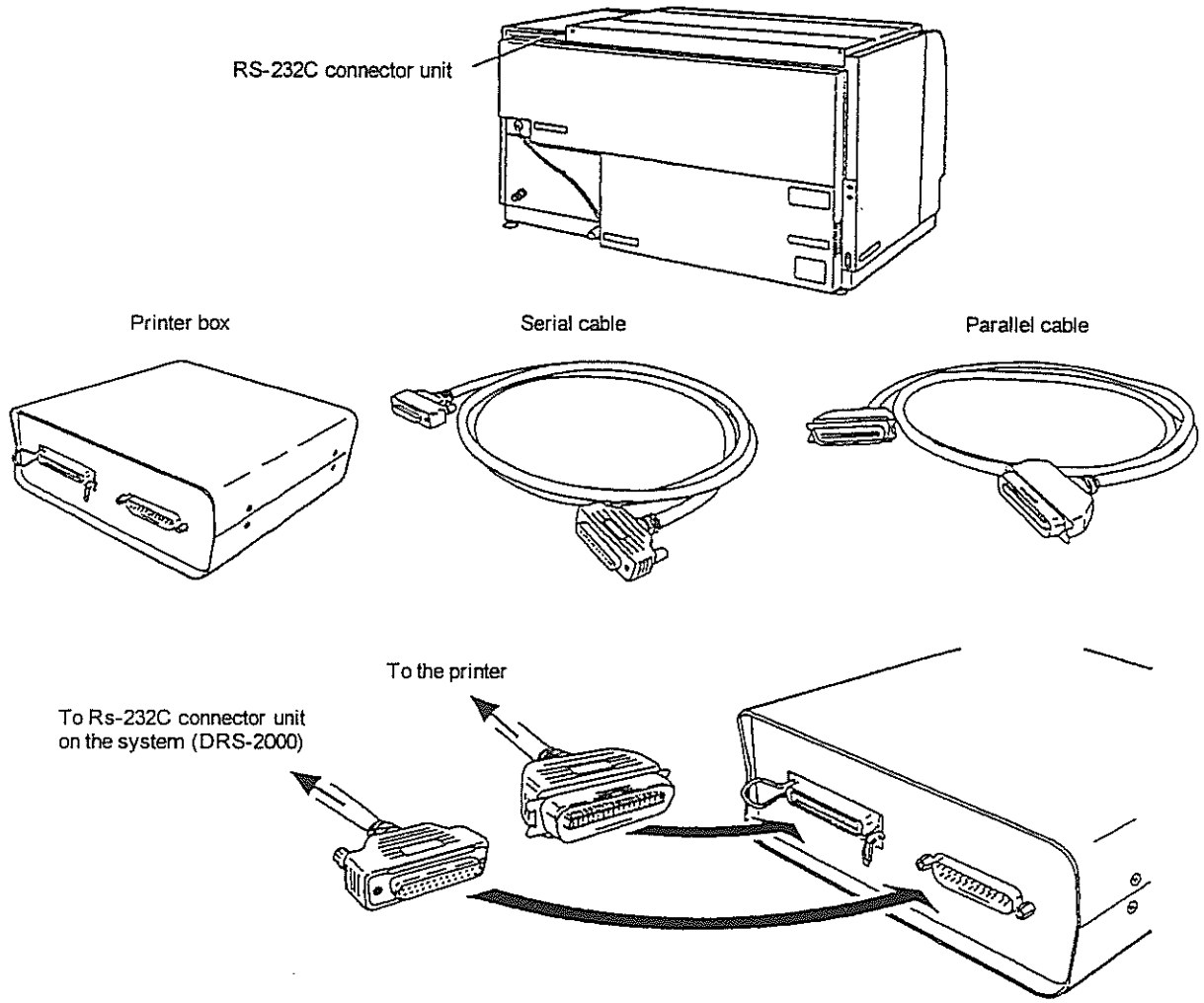
Switching of the power supply to the VBAT line (+5V or battery unit) is done, in the power supply switching circuit, by signals from the resetting circuit. The VBAT line gets power supply from +5V while resetting is cancelled, and from the battery unit while resetting (also while the power supply is off). As for the reset circuit, refer to 2-3 (4) Resetting Section above.

2-12 RS-232 Interface Section

This is provided for communication with the optional printer box under (in accordance with) the RS-232C standards. The printer box is connected to the RS-232C connector unit (D sub-connector) on the rear using the dedicated serial cable supplied with the printer box.

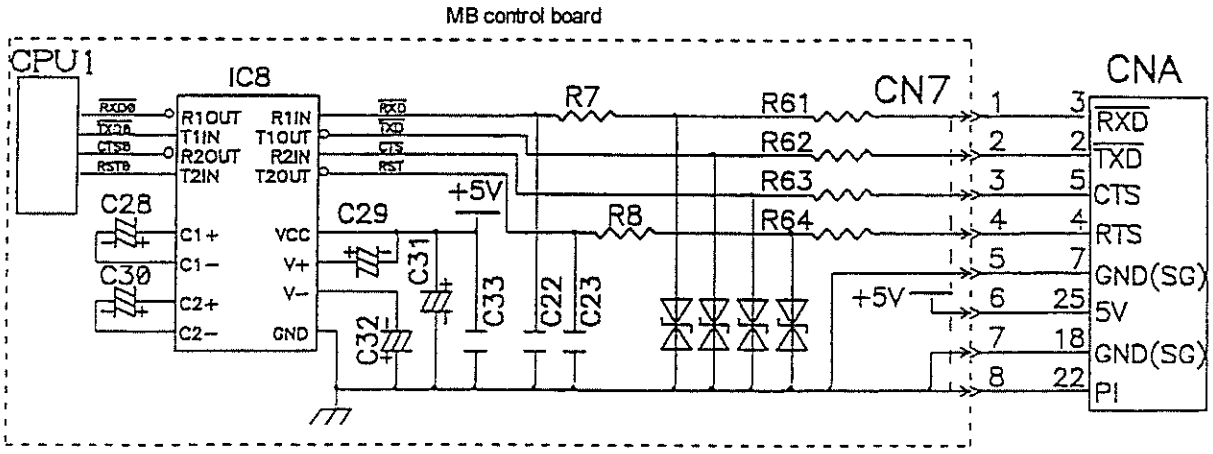
By connecting the printer using the optional printer box, it become possible to print various data.

Connection of Printer Box and Printer



This RS-232C connector unit is connected to the control board with the relay cable.

Block Diagram



As serial communication uses a handshaking function (to stop transmission for each frame of reception until CPU has read receiving data), a total of eight lines are used: two data lines, two control lines, three GND lines and one +5V line.

Data lines: TxD (serial transmitting data)
RxD (serial receiving data)

Control lines: CTS (transmission possible)
RTS (transmission requested)

RS-232C Connector Pins Layout and Signal Names

Pin No.	Signal name		Signal direction	Functions	Signal type	Remarks
	Abbreviation of common use	US abbreviation	Body - End			
1	FG	-		Security grounding or cable shield		
2	$\overline{TxD}$	SD	→	Transmitting data	Data	
3	$\overline{RxD}$	RD	←	Receiving data	Data	
4	RTS	RS	→	Transmission requested	Control	
5	CTS	CS	←	Transmission possible	Control	
6	DSR	DR	←	Data set ready (DTR and internal connection)	Control	
7	GND	SG		Grounding for signals		
8-9	Not used					
10	GND	SG		Grounding for signals		
11-17	Not used					
18	GND	SG		Grounding for signals		
19	Not used					
20	DTR	ER	→	Data terminal ready (DSR and internal connection)	Control	
21	Not used					
22	RI			To make it invalid by connecting to GND		
23-24	Not used					
25	+5V			Power supply for the board		

Signals between CPU1 and external equipment are voltage-converted by 232 receiver/driver IC8 as below.

CPU1↔IC8	IC8↔CNA
Low	+12V
High	-12V

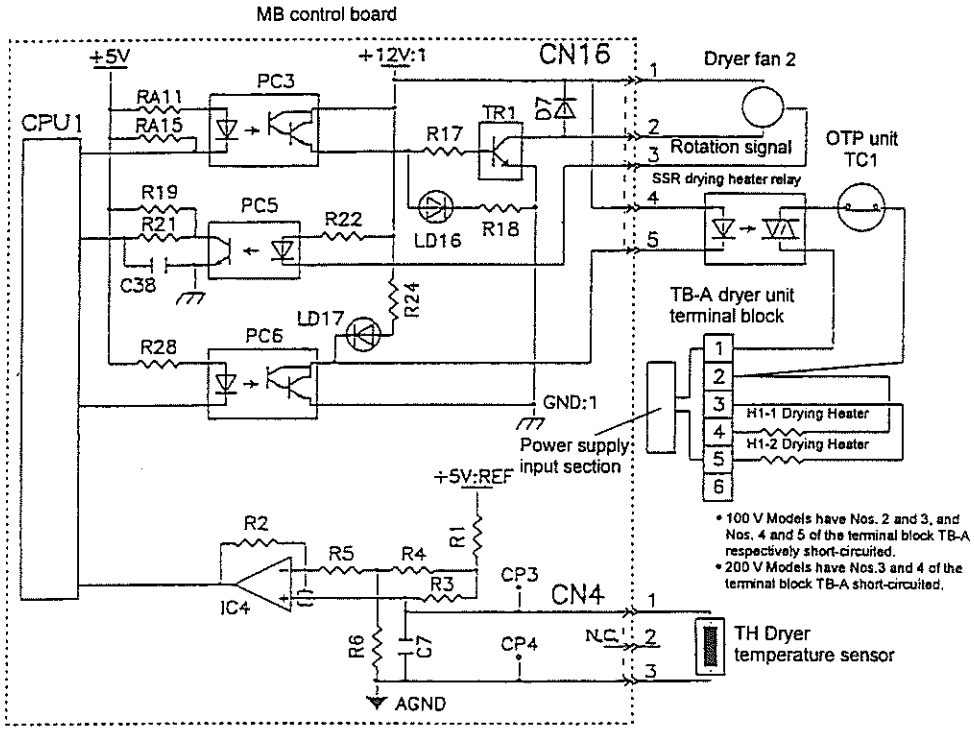
*As the printer box gets power supply from DRS-2000 mainframe, make sure to use the serial cable specified.

2-13 Dryer (optional)

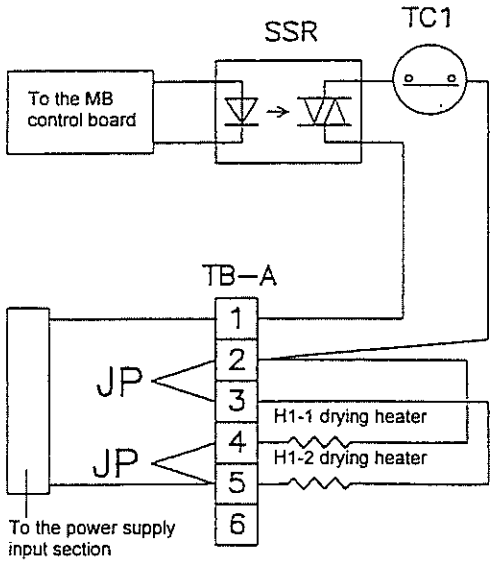
This dryer is used to hot-air dry slides after completion of staining process. It is installed as an optional item at the factory. It is composed of the following blocks:

(1) Dryer Fan Unit
(2) Drying Heater Relay Unit, Drying Reservoir Heater, OTP Unit
(3) Dryer Temperature Sensor

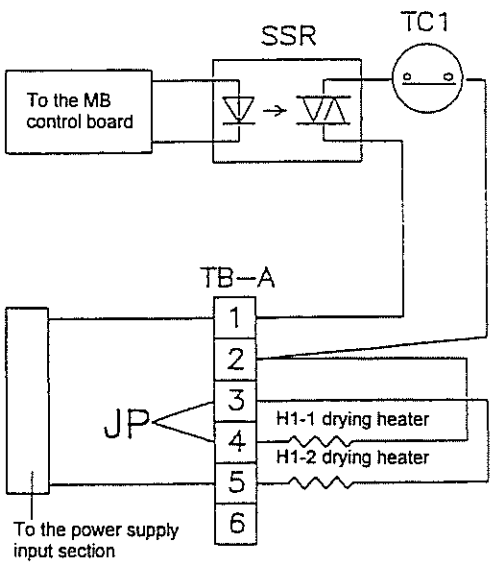
Block diagram



Heater Connection for 100V Models



Heater Connection for 200V Models



(1) Dryer Fan Unit

This unit blows air into the dryer. On/off control of the dryer fan, and monitoring of its rotation are done by CPU1 on the control board.

1. Driving Control Section

When CPU1 outputs Low, the photo coupler PC3 is turned on, LCD 16 for checking operation is turned on and TR1 is also turned on. When TR1 is turned on, power is supplied to the dryer fan to drive the fan.

The power supply for CPU1 and the photo coupler PC3 input side is +5V, and the driving power supply for signals from the photo coupler PC5 output to the dryer fan is +12V (+12V:1).

CPU1 Output and State of Elements

CPU1 output	LD16	TR1	Fan2
High	Off	Off	Stop
Low	On	On	In operation

2. Rotation Detecting Section

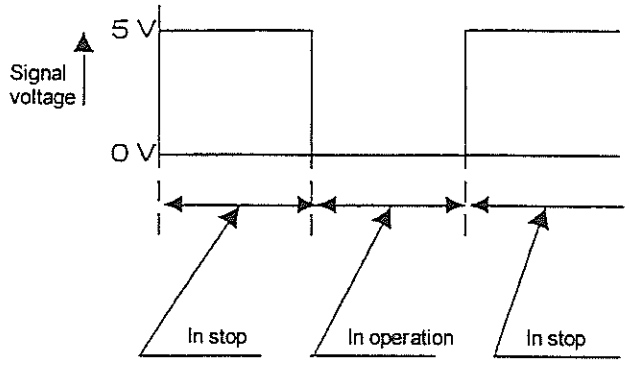
Using signals from the fan (refer to the drawing below), operation is monitored. The fan generates Low signals while it is operating, and the photo coupler PC5 is turned on and CPU1 receives Low signals.

When the fan is not in operation, the fan generates High signals, and the photo coupler PC5 is turned off, and CPU1 receives High signals.

CPU1 compares the state of this rotation signal with the fan driving signal mentioned above to judge whether the fan is operating normally or abnormally.

The power supply for CPU1 and the photo coupler PC5 output side is +5V, and the power supply from the photo coupler PC5 input side to the fan is +12V (+12V:1).

Dryer Fan Operating Signals



State of Fan 2 and Rotation Detecting Signals

Fan 2	Rotation signal	CPU1 input
Stop	High	High
In operation	Low	Low

State of Signals and Judgment of Normal/Abnormal

Judgment	CPU1 output Fan control signals	CPU1 input Rotation detecting signals
Normal	High (in operation)	High (in operation)
	Low (in stop)	Low (in stop)
Abnormal	High (in operation)	Low (in stop)
	Low (in stop)	High (in operation)

(2) Drying Heater Relay Unit, Drying Heater, OTP Unit

This section is for preventing abnormal temperature rising due to in-dryer heating and/or equipment troubles. CPU1 controls on/off of the heater to keep the dryer temperature within the range set on the operating panel (setting range: 30°C - 65°C). Dryer temperature information to control the heater is obtained from the dryer temperature sensor TH. In order to prevent abnormal rising of heater temperature, an OTP unit TC1 is provided. This unit is activated in response to in-dryer temperature without any relation to CPU1 control, and directly blocks power supply to the heater. Resetting of the OTP unit is done by the reset switch provided on the dryer.

100 V and 200 V models have a heater unit of the same specification (AC115V, 220W), but they differ in the way they connect the heater (short-circuit connecting method of TB-A)(refer to the Block Diagram above). 100 V models have two units connected in parallel, and 200 V models have two units connected in series.

When CPU1 outputs Low and the photo coupler PC6 is turned on, LD17 is turned on and SSR is turned on. If there are no abnormal conditions in the OPT unit, this time power is supplied to the heater.

The power supply for CPU1 and the photo coupler PC6 output side is +5V, and the power supply from the photo coupler PC5 output side to the SSR input side is +12V (+12V:1). The power supply from the SSR output side to the heater has the same level of voltage as the power supply input section.

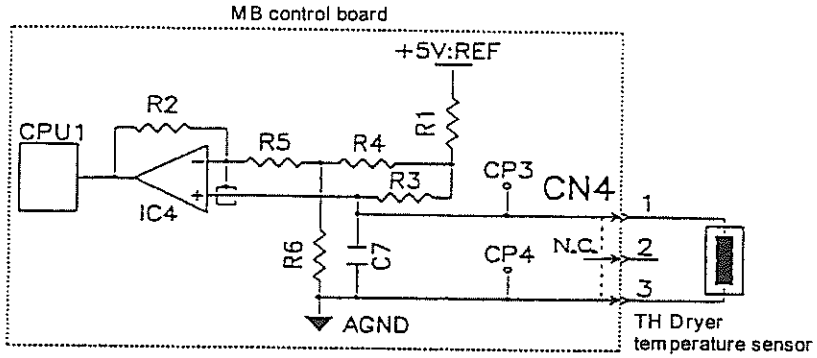
CPU1 Output and State of Elements

CPU1 output	PC6	LD17	SSR	Heater
High	Off	Off	Off	Off
Low	On	On	On	On

(3) Dryer Temperature Sensor

This is to know in-dryer temperature.

Block Diagram



Changes in the resistance value of the dryer temperature sensor TH is converted to voltage in the signal amplification IC4. The voltage signals thus converted are then amplified and corrected to be sent as analog voltage signals to CPU1. CPU1 controls dryer temperature based on the information thus obtained.

Thermister is a thermally sensitive resistor. Its resistance value changes considerably as shown below in response to temperature changes. The relationship between the temperature and electric resistance of NTC thermister (with a negative temperature coefficient) may be shown by the following equation:

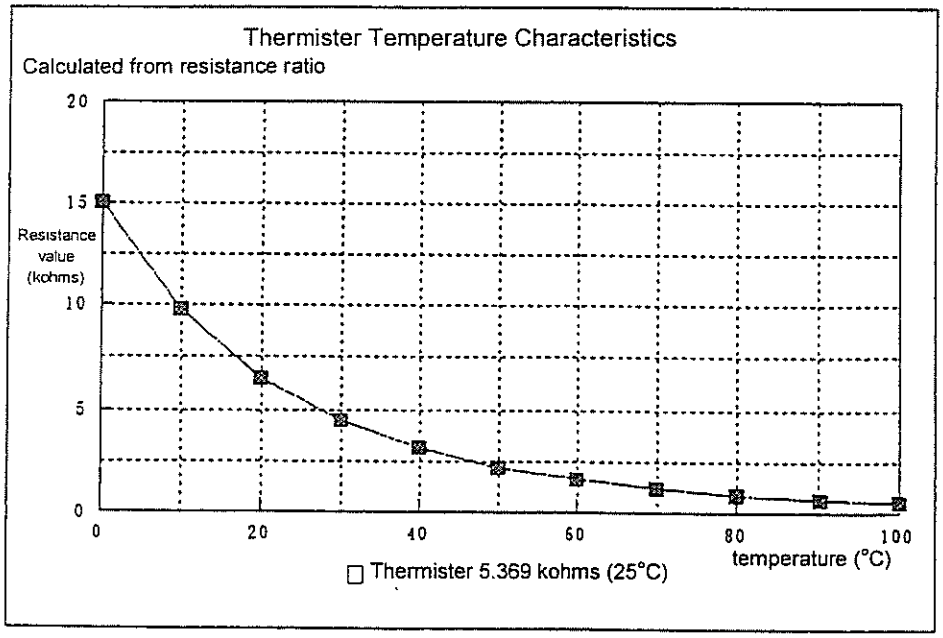
$$R = R_0 \cdot \exp\left(B\left(\frac{1}{t+273} - \frac{1}{t_0+273}\right)\right)$$

Ro: Resistance value when the temperature is t0 (25°C)
5.369 kohms for DRS-2000

B: Thermister constant
3450 for DRS-2000

t0: 25°C

t: Temperature



Thermister temperature (°C)	5.369 kohms Resistance value (ohms)
0	15499.7
10	9917.2
20	6541.7
30	4435.3
40	3082.8
50	2191.5
60	1590.1
70	1175.6
80	884.1
90	675.4
100	523.5

As seen from the temperature characteristics table above, the resistance value changes non-linearly, and thus cannot be directly used. Thus, the temperature sensor circuit performs correction to make calculation results linear. IC4 output voltage at each temperature is as shown below:

Temperature (°C)	Vout (V)		
	min	typ	max
0	2.702	3.068	3.448
10	2.429	2.756	3.095
20	2.105	2.388	2.682
30	1.748	1.987	2.235
40	1.384	1.58	1.784
50	1.038	1.193	1.356
60	0.727	0.845	0.971
70	0.469	0.545	0.627
80	0.253	0.295	0.339
90	0.077	0.09	0.105
100	-0.066	-0.074	-0.083

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Chapter 3 Disassembling/Assembling/Adjustment

3-1 General

This Chapter describes adjustment, disassembly and assembly of components when they fail. This Chapter is organized as below:

(1) Tools to Use
   1. Tools for general work
   2. Tools for wiring
   3. Measuring apparatus
   4. Indirect parts

(2) Adjustment
   1. Front cover sensor unit
   2. Door switch unit
   3. Carrier unit axis X position adjustment
   4. Axis X driving wire tensile adjustment
   5. Axis Z driving wire tensile adjustment
   6. Axis Z middle sensor
   7. Reservoir stopper
   8. Reservoir guide
   9. Slide guide
   10. Brightness adjustment knob
   11. Adjustable feet
   12. Sensing rail

(3) Replacement of Parts
   1. Outer Casing
   2. Operating panel unit
   3. Cover section
   4. Door section
   5. Base (bottom) surrounding area
   6. Driving section
   7. Tray
   8. Washing/water supply
   9. Power supply box section
   10. Exhaust unit
   11. Dryer (optional at the factory)

When troubles occur in the system, follow the steps below:

1. Check the conditions of troubles.
2. Follow the trouble shooting (refer to Chapter 5) to determine the cause.
3. Turn off the power supply, and disconnect the power supply cord from the socket.
4. Close the water supply valve on the facility.
5. Remove the solution reservoirs, washing reservoirs and baskets out of the system, if necessary.
6. Remove the water supply hose, and drain the water supply piping and drain piping, if necessary.
7. Carry out adjustment, repair and replacement with reference to this Chapter.
8. Upon completion of assembly, check if the system operates normally.
9. Clean the system and its surrounding area.

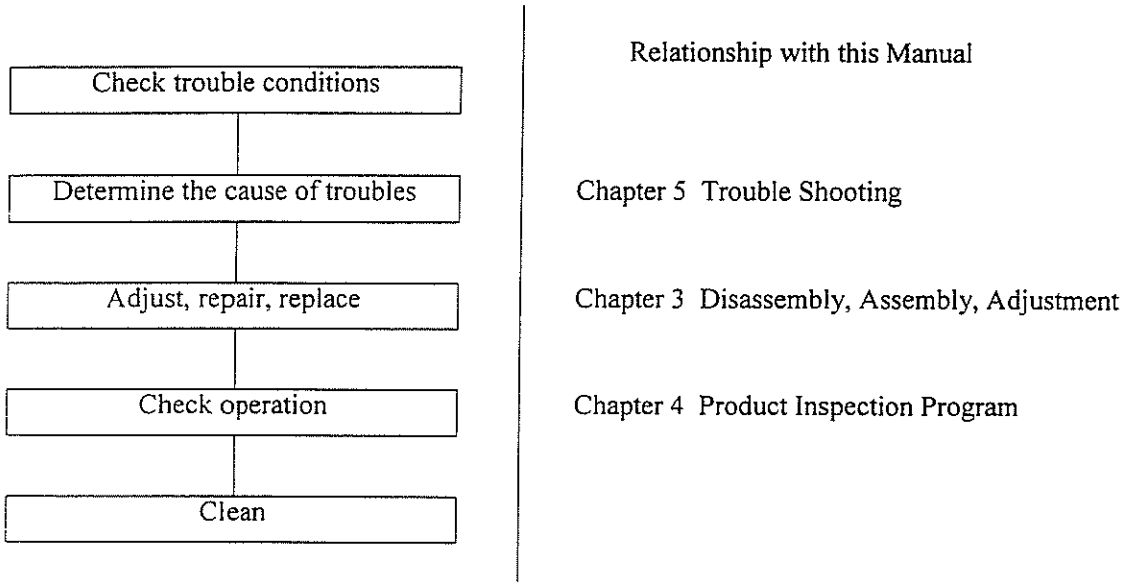


Figure 3-1 Work Flow When Troubles Occur

3-2 Tools to Use

Tools to use in disassembling, assembling or adjusting this system are listed below:

(1) Tools for General Work
1. Phillips screw driver (ISO No.1)
2. Phillips screw driver (ISO No.2)
3. Minus driver (Nominal: 4.5 × 50)
4. Phillips stable driver (for ISO No.2)
5. Socket driver (for M3)
6. Socket driver (for M4)
7. Socket driver (for M5)
8. Hex wrench set
9. Spanner (nominal: 5.5)
10. Spanner (nominal: 7)
11. Spanner (nominal: 8)
12 Spanner (nominal: 13)
13. Monkey wrench (nominal: 200)
14. Radio pliers

(2) Tools for wiring work
1. Nipper
2. Wire stripper
3. Crimping tool
4. IC pulling-out tool
5. Soldering iron
6. Solder
7. Short-circuiting cable

(3) Measuring Tools
1. Tension meter (recommended meter: Shimpo Industry's DTM-5KB)
2. Tester
3. Scale

(4) Indirect Parts
1. Band (small)(Kitagawa Industry's SKB-1MH)
2. Band (large)(Kitagawa Industry's SKB-3MH)
3. Screw lock (Loctite)
4. Sealing tape (vulcatape 8 mm × 10m)
5. Silicon grease
6. Gap tape (Cemedain's 10 × 15 × 4m)
7. Grease

3-3 Adjustment

This section explains adjustment necessary for normal operation of the system.

(1) Front Cover Switch

Tool to use: Phillips screw driver (ISO No.2)
Measuring tool: Scale

[1] Requirement

In the process of closing the cover, the cover sensor should be turned on when the distance between the cover and the upper base is 16 mm. (Refer to Figure 3.2.)

[2] Adjustment

When the product inspection program (TEST 1 4. Sensors) is executed, switch on/off is displayed on the operating panel.

1) Activate the product inspection program.
2) Place the scale on the upper base. Close the cover slowly. Check where the cover switch is turned on.
3) Loosen the fixing screws on the cover sensor plate.
   - Cross-recessed pan head small screw (Sems B) M4 × 8 1
   - Cross-recessed flat head small screw M3 × 15 2
3) Move the cover sensor plate back and forth, and temporarily fasten the fixing screws.
4) Open and close the cover, and check if the cover opening/closing detecting unit turns on and off at the specified point.
5) Fasten the cover sensor plate fixing screws.

[3] Checking

- The cover sensor plate should be on the roller center line of the cover opening/closing detecting unit.
- The cover sensor plate should be approximately at the center of the cover sensor cover opening section when the cover is closed.

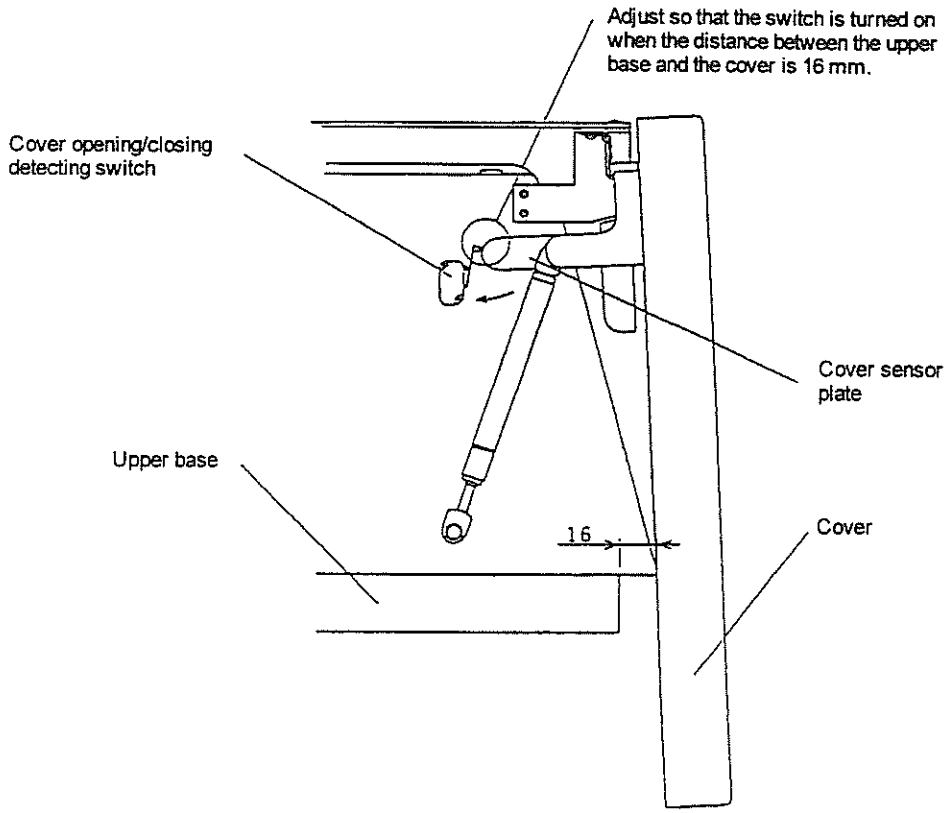


Figure 3-2 Adjustment of Cover Opening/Closing Detecting Switch

(2) **Door Opening/Closing Detecting Switch**

Tools to use: Phillips screw driver (ISO No.2)

Measuring tools: scale

[1] Requirement

When closing the door, there should be a distance of 15 to 20 mm between the point where the door opening/closing detecting switch is turned on, and the point where the door is closed.

[2] Adjustment

When the product inspection program (TEST 1 4. Sensors) is executed, switch on/off is displayed on the operating panel.

1) The point where the door open/close detecting switch is turned on in the process of closing the door is marked with a pencil, etc. on the side of the outer casing (1).

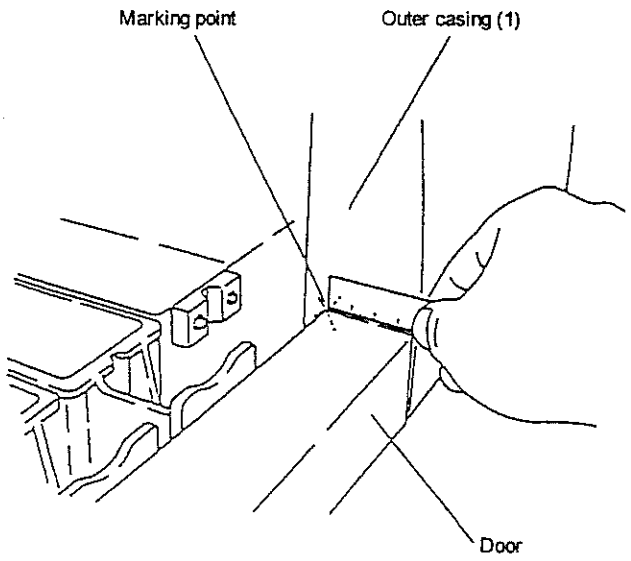


Figure 3-3 Making Point to Indicate Door Position

2) Slowly open the door, and mark the door position, on the outer casing (1), where the door open/close detecting switch is turned off to indicate the door position.
3) Loosen the screws fixing the door open/close detecting switch, and rotate the switch for adjustment. In order to bring the door SW lever to the center of the door open/close detecting switch, loosen the lever fixing screws and move the lever left or right.

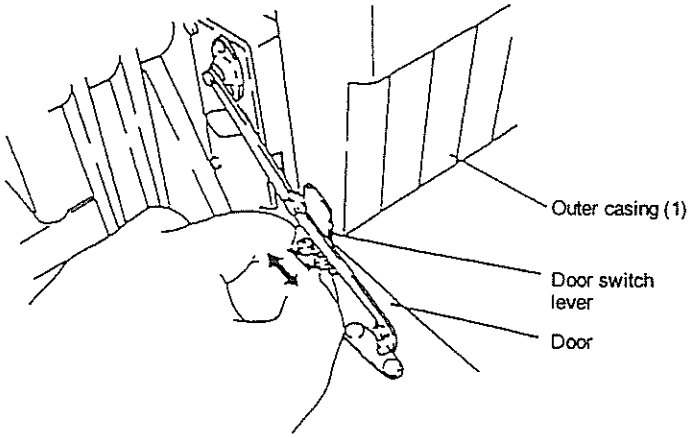


Figure 3-4 Adjustment of Door Open/Close Detecting Switch

4) Again mark the point, on the side of the outer casing (1), where the switch is turned on to indicate the door position, and check if the distance between the position of the door closed and the door position is 15-20 mm.
5) After adjustment, fasten the screws fixing the SW cover.

[3] Check
- Check that the door SW lever is approximately at the center of the door SW cover gap when the door is closed.

(3) Carrier Unit Axis X Position Adjustment

Tools to use: Phillips screw driver (ISO No.2)

Parts: Screw lock (Loctite)

[1] Requirement

Adapters should be smoothly accommodated into the solution reservoirs on the trays of upper and lower floor.

[2] Adjustment

1) Adjustment of lower tray

a. Place a solution reservoir in station 21, and bring the holder holding an adapter to the center of the solution reservoir.

b. Keeping the condition under 1) above, move the axis X sensor bracket so that the axis X home position adjusting notch at the center of the sensing rail is mated to the axis X home position sensor.

- Move the axis X sensor board after removing the fixing screw (cross-recessed pan- head small screws /M4 × 8. Sems B 2).

c. Activate the product inspection program (Test 2 Carrier 6. Stations), and check if the adapter is smoothly accommodated into the reservoir.

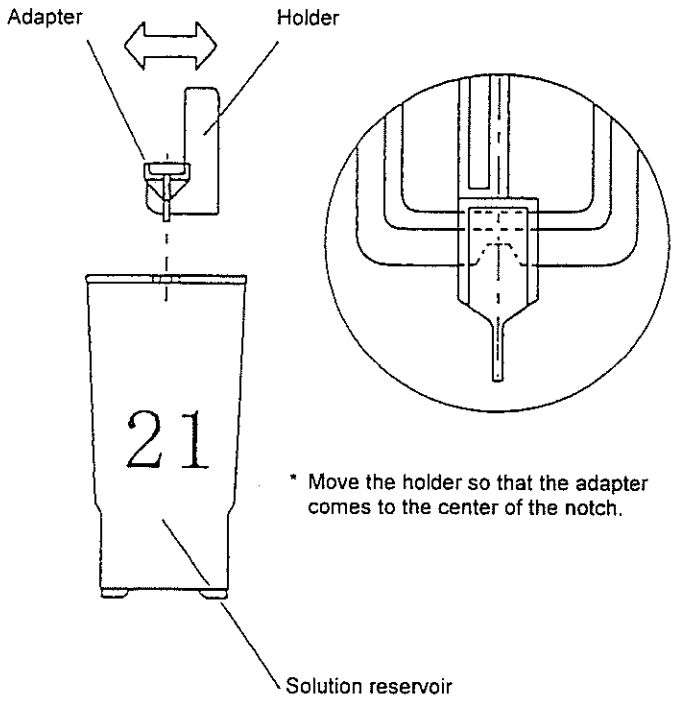


Figure 3-5 Axis X Home Position Adjustment

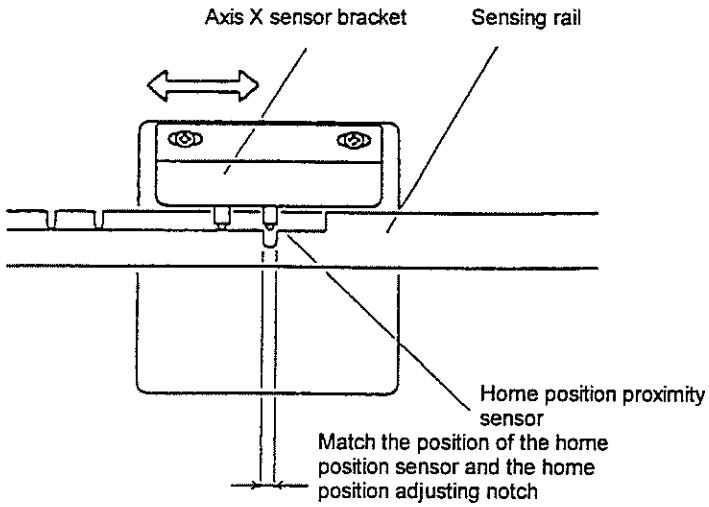


Figure 3-6 Axis X Home Position Adjustment

2) Adjustment of Left Tray
   a. Bring the home position proximity sensor to Station 1 adjusting angular hole located on the right side of the sensing rail (when looked at from the back).
   b. Keeping the condition under 1) above, place a solution reservoir in Station 1, and move the left tray so that the holder holding an adapter comes roughly to the center of the solution reservoir.
   c. Activate the product inspection program (Test 2 Carrier 6. Stations), and check if the adapter is smoothly accommodated into the reservoir.
3) Adjustment of Right Tray
   a. Bring the home position proximity sensor to Station 13 adjusting notch located on the left side of the sensing rail (when looked at from the back).
   b. Keeping the condition under 1) above, place a solution reservoir in Station 13, and move the right tray so that the holder holding an adapter comes roughly to the center of the solution reservoir.
   c. Activate the product inspection program (Test 2 Carrier 6. Stations), and check that the adapter is smoothly accommodated into the reservoir.

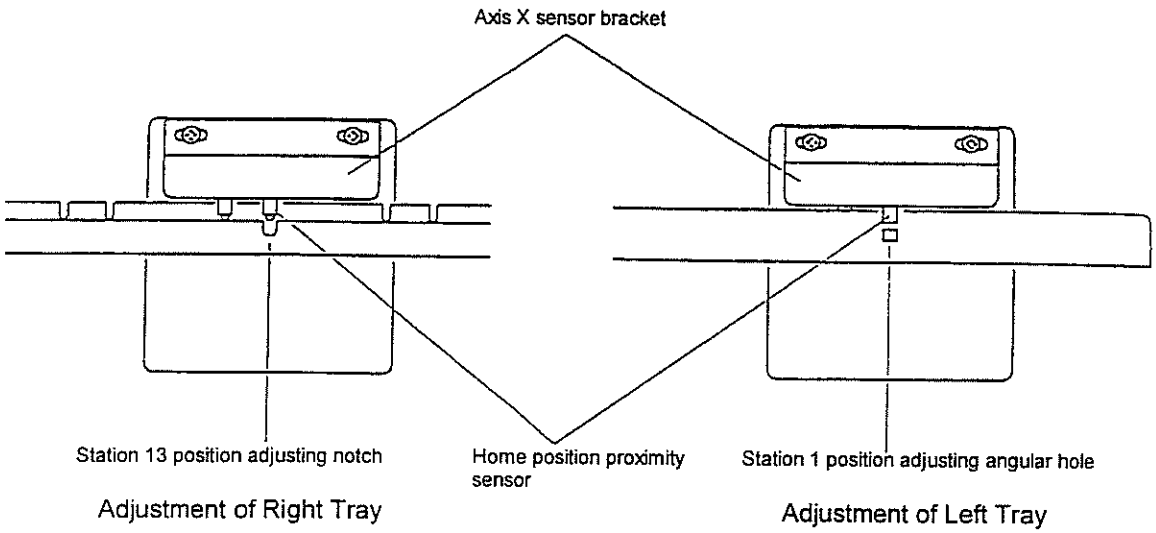


Figure 3-7 Adjustment of Upper Tray

4) Then, Activate the product inspection program (Test 2 Carrier 7. Continuous), and check if the adapter is smoothly accommodated into the reservoir both in the upper and lower trays.

(4) Axis X Driving Wire Tensile Adjustment

Tools to use: Phillips screw driver (ISO No.2)
Spanner (nominal: 7)
Spanner (nominal: 8)
Torque wrench

Measuring tools: Tension meter (recommended meter: Shimpo Industry's DTM-5KB)

[1] Requirement

Tension on the wire on the rear of the system should be 2500±100 gf when measured approximately at the middle of the axis X stepping motor and the carrier unit.

[2] Measuring tension

As wire tension differs considerably depending on measuring conditions, measurement should be made according to the conditions shown below:

a. Position of the driving section when making measurement
   - The carrier unit at the center on the axis X
   - The holder unit on the bottom

b. Operation required prior to measurement

   Make sure to manually move the carrier unit along the entire length of the system more than once when measuring tension following adjustment of the adjusting screws on the wire tensioner. Unless this is done, the measurement result could be different from the actual tension as the wire tension is not averaged.

Caution: When manually moving the driving section, turn off the power supply and hold the base of the basket arm. If the tip of the basket is held, the arm may gets deformed.

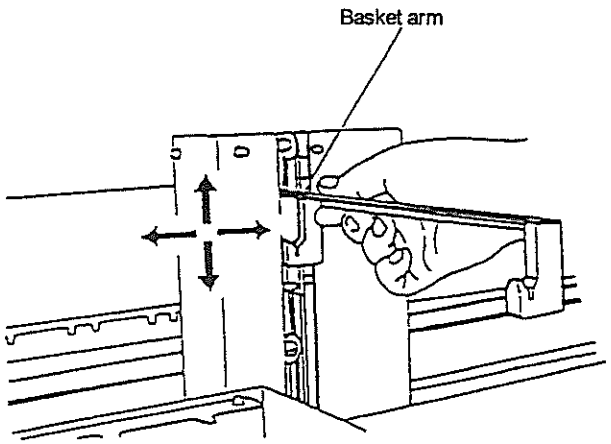


Figure 3-8 The Part to Hold When Moving the Carrier Unit

c. Measuring point

Measurement should be done at the point shown below (approximately at the middle of the axis X stepping motor and the carrier unit):

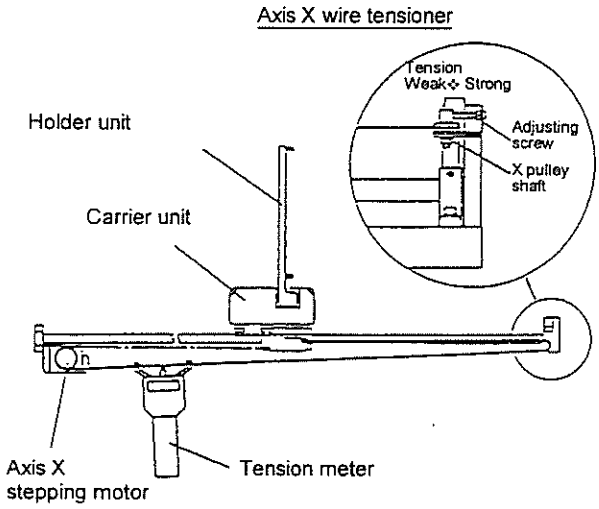


Figure 3-9 Tension Adjustment of Driving Wire (Axis X)

d. Measurement

Place the tension meter on the wire from the back of the system.

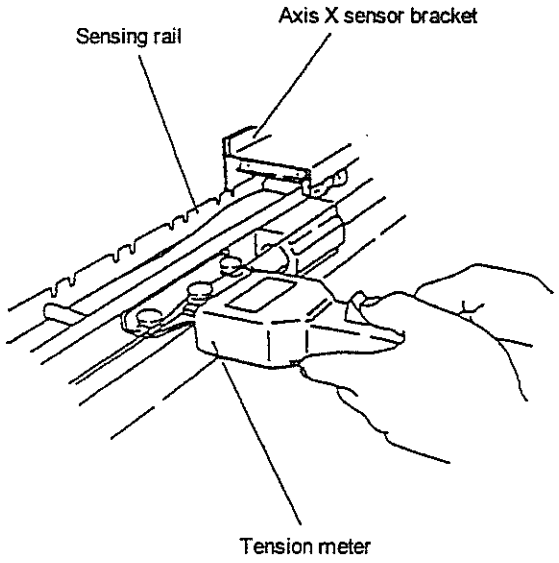


Figure 3-10 Tension Measurement of Driving Wire (Axis X)

Caution: Make sure to keep the tension meter in a horizontal position not to apply any extra force onto the wire. Otherwise, the tension meter may indicate an incorrect value.

1. Adjustment
   1) Measure the tension on wire (Refer to Item)
   2) Loosen the nut (hex nut (1 type), M5, 1 pce) fixing the X pulley shaft.
   3) Loosen the nut (hex nut (1 type), M4, 1 pce) fixing the adjusting screw.
   4) Rotate the adjusting screw to move the X pulley shaft left and right for tension adjustment.
   5) After adjustment, fasten the nut to fix the pulley shaft. Then, fasten the nut to fix the adjusting screw.

(5) Axis Z Driving Wire Tensile Adjustment

Tools to use: Phillips screw driver (ISO No.2)
Spanner (nominal: 7)
Spanner (nominal: 8)
Torque wrench

Measuring tool: Tension meter (recommended meter: Shimpo Industry's DTM-5KB)

[1] Requirement

Tension on the wire in the front of the system should be 2500±100 gf when measured approximately at the middle of the axis Z stepping motor and the carrier unit.

[2] Measuring tension

As wire tension differs considerably depending on measuring conditions, measurement should be made according to the conditions shown below:

a. Position of the driving section when making measurement
   - The carrier unit at the center on the axis X
   - The holder unit on the bottom

b. Operation required for measurement

Make sure to manually move the carrier unit along the entire height of the system more than once when measuring tension following adjustment of the adjusting screws on the wire tensioner. Unless this is done, the measurement result could be different from the actual tension as the wire tension is not averaged.

Caution: When manually moving the driving section, turn off the power supply and hold the base of the basket arm. If the tip of the basket is held, the arm may gets deformed. (Refer to the drawing of 3-3 (3).)

c. Measuring point

Measurement should be done at the point shown below (approximately at the middle of the axis Z stepping motor and the carrier unit):

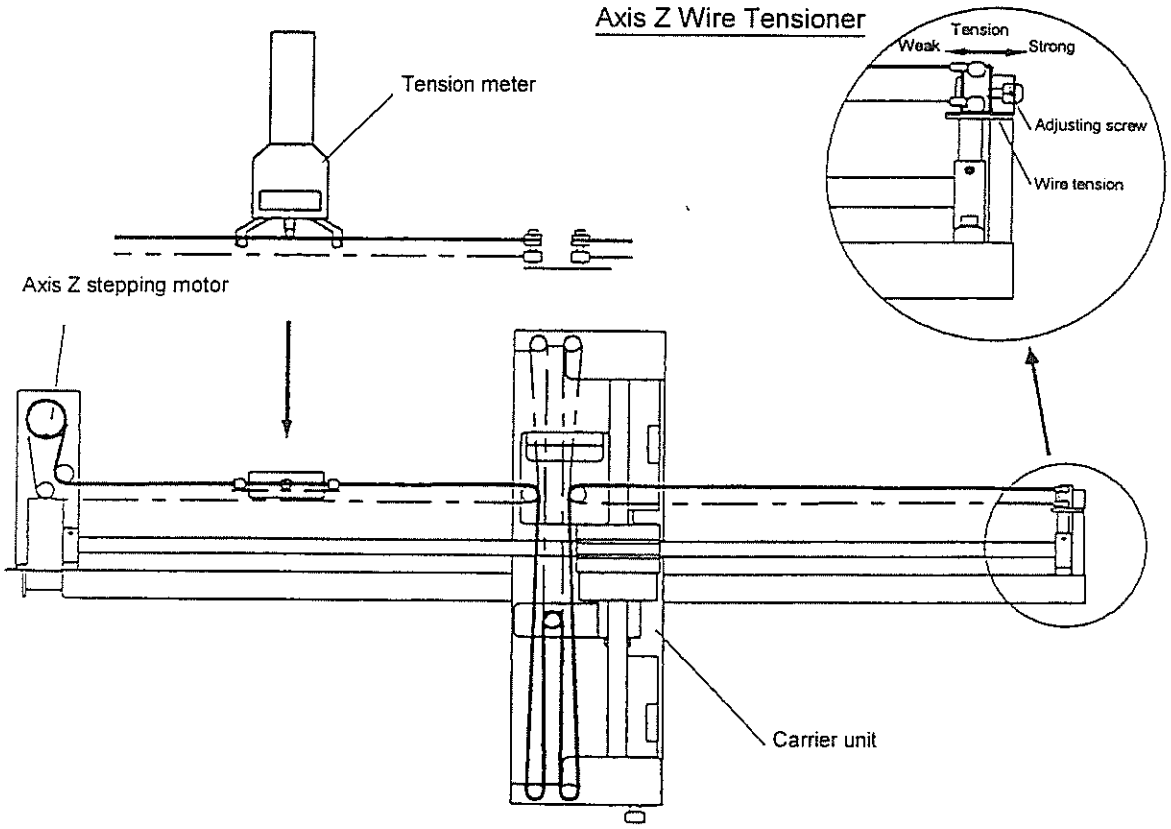


Figure 3-11 Tension Adjustment of Driving Wire (Axis Z)

d. Measurement

Place the tension meter on the wire from the front of the system.

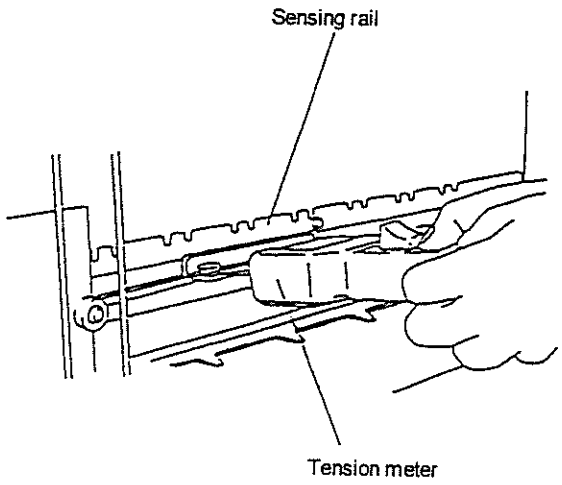


Figure 3-12 Tension Measurement of Driving Wire (Axis Z)

Caution: Make sure to keep the tension meter in a horizontal position not to apply any extra force onto the wire. Otherwise, the tension meter may indicate an incorrect value.

1. Adjustment

1) Measure the tension on wire (Refer to Item)
2) Loosen the nut (hex nut M5 × 10) fixing the wire tensioner.
3) Loosen the nut (hex nut (1 type), M4, 1) fixing the adjusting screw.
4) Rotate the adjusting screw to move the wire tensioner left and right for tension adjustment.
5) After adjustment, fasten the nut to fix the wire tensioner. Then, fasten the nut to fix the adjusting screw.

(6) Axis Z Middle Sensor

Tools to use: Phillips screw driver (ISO No.2)
Measuring tools: Scale

[1] Requirement

The distance between the axis Z middle sensor bottom and the upper side of basket arm linear guide installation surface should be 6.3 ± 0.5 mm when the upper limit sensor of the axis Z lower floor sensor unit is brought to the angular hole on the axis Z light block plate. (Refer to the drawing below.)

[2] Adjustment

1) Remove the cover Z (1).
2) Vertically slide the holder unit to mate the upper limit sensor of the axis Z lower floor sensor unit to the vertical position of the angular hole on the axis Z light block plate.
3) Keeping the condition under 2) above, measure the distance between the basket arm and the axis Z middle sensor to check if it is 6.3 ± 0.5 mm.
4) When the measured distance is not within the specified range, loosen the screw fixing the axis Z middle sensor bracket, slide the sensor bracket vertically, and make adjustment so that the measured distance comes within the range.
5) After adjustment, fasten the screw to fix the axis Z middle sensor bracket.

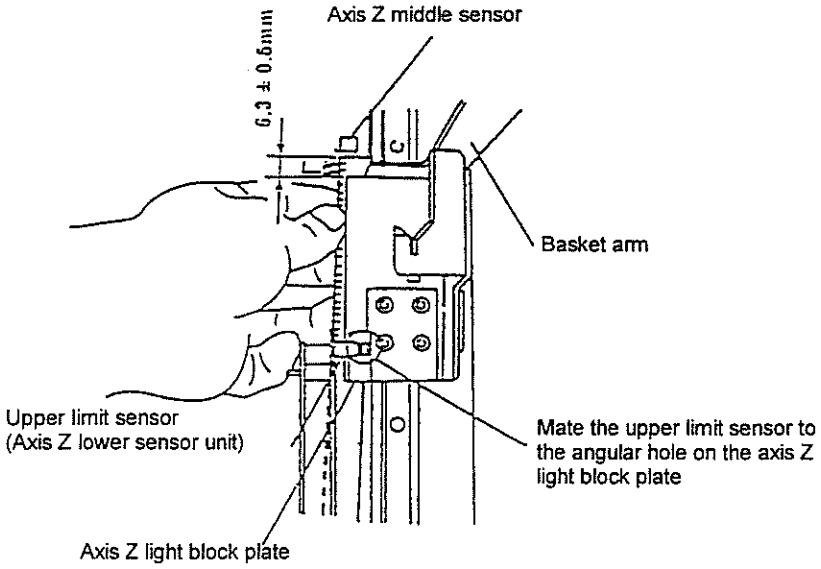


Figure 3-13 Adjustment of Axis Z Middle Sensor

(7) **Reservoir Stopper**

This adjustment is applicable both to the upper and lower trays.

Tools to use: Phillips screw driver (ISO No.2)

[1] Requirement

There should be a distance of 12 mm between the internal side of the tray right side plate and the reservoir stopper right end, and a distance of 2 mm between the internal side of the tray rear plate and the reservoir stopper back end surface. (Refer to the drawing below.)

[2] Adjustment

1) Measure the dimensions between the reservoir stopper and the tray.
2) The reservoir stopper may be moved back and forth and left and right. Loosen the fixing screws for the direction in which the stopper is to be moved.
3) Move the reservoir stopper and adjust it to the position shown on the drawing below.
4) After adjustment, fasten the fastening screws.

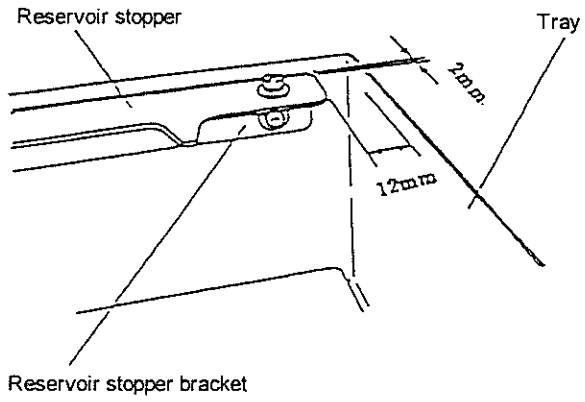


Figure 3-14 Adjustment of Reservoir Stopper

(8) Reservoir Guide

This adjustment is applicable to both right and left trays on the upper floor.

Tools to use: Phillips screw driver (ISO No.2)

[1] Requirement

The distance between the reservoir stopper and the reservoir guide should be 186 to 187 mm.

[2] Adjustment

1) Using the scale, measure the distance between the reservoir stopper and the reservoir guide at two points: tray right and left end reservoirs.
2) Loosen the screw fixing the reservoir guide, and move the guide back and forth for adjustment.
3) After adjustment, fasten the fastening screws.

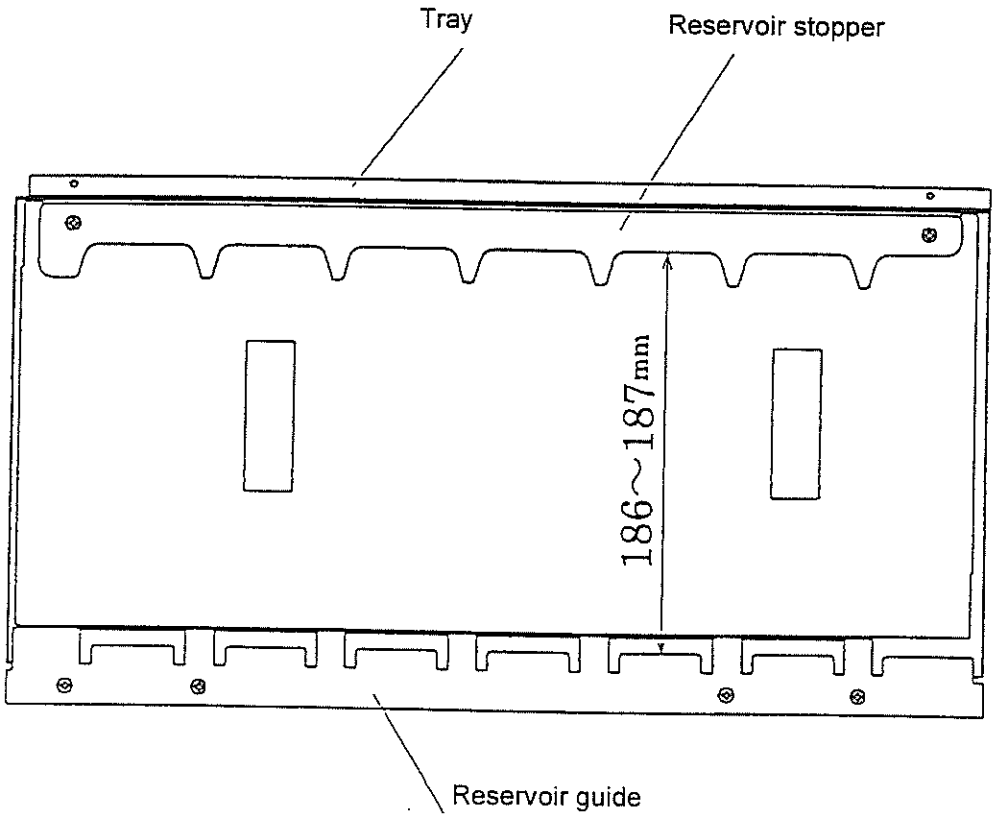


Figure 3-15 Adjustment of Reservoir Guide

(9) Slide Guide

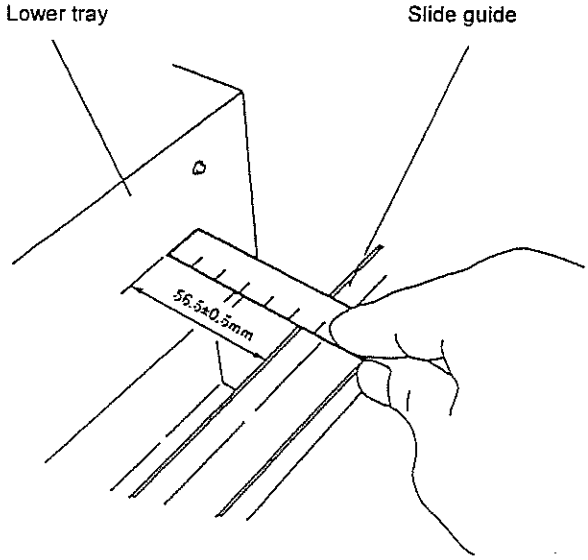
Tools to use: Phillips screw driver (ISO No.2)

[1] Requirement

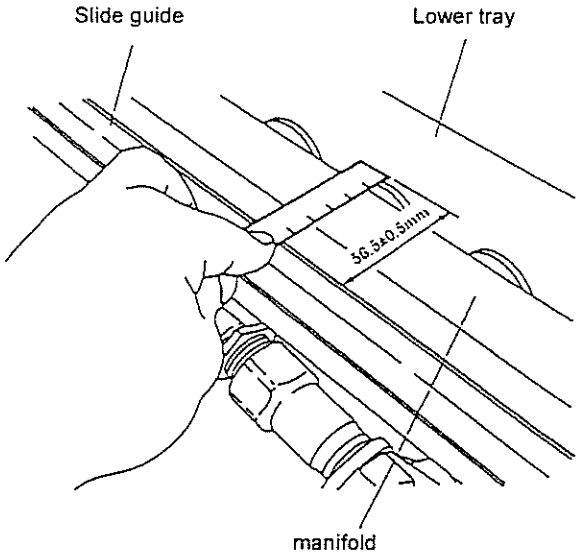
The distance between the lower tray back outer surface and the slide guide should be 56.5 ± 0.5 mm.

[2] Adjustment

1) Measure the distance between the lower tray back outer surface and the slide guide at two points (tray right and left ends). (Refer to the drawing below.)
2) Loosen the slide guide fixing bolt (upset hex bolt SW, with a washer, M5 × 10, 3pcs), and move the slide guide to achieve the specified dimensions.
3) After adjustment, fasten the fixing bolt.



a. Measurement at the Right End Looked at from the Back



b. Measurement at the Left End Looked at from the Back

Figure 3-16 Measurement of Slide Guide Position

(10) Brightness Adjustment Knob

Tools to use: Hex wrench (nominal: 2)

Measuring tools: Scale

[1] Requirement

The gap between the knob and the bottom base should be 1 mm.

[2] Adjustment

1) Place the scale on the bottom base to measure its gap from the knob.
2) Loosen the knob fixing screw (screw with a hex hole (concave tip) M4 × 8), and move the knob back and forth.
3) After adjustment, fasten the fixing screw.

Caution: If this gap is larger than 1 mm, the knob interferes with the outer casing (1), and the outer casing (1) cannot be installed.

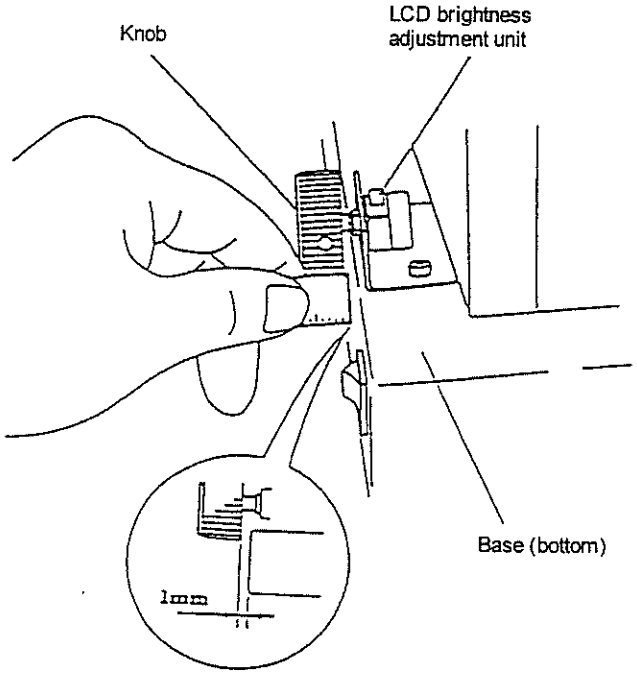


Figure 3-17 Adjustment of brightness adjustment Knob

(11) Adjustable Foot

[1] Requirement

Adjust the adjustable foot to maintain the system in a level position.

[2] Adjustment

Rotate the adjustable foot to adjust the height. If it is rotated clockwise, its get lower, and if it is rotated counterclockwise, it gets higher. It can be adjusted within a range of 19 to 37 mm.

Caution: • *Unless properly adjusted, draining cannot be made sufficiently, and water may get accumulated in the lower tray.*

• *When it gets higher than 37 mm, the adjustable foot will be dislocated from the system. This is a very dangerous situation. Take a caution when setting high.*

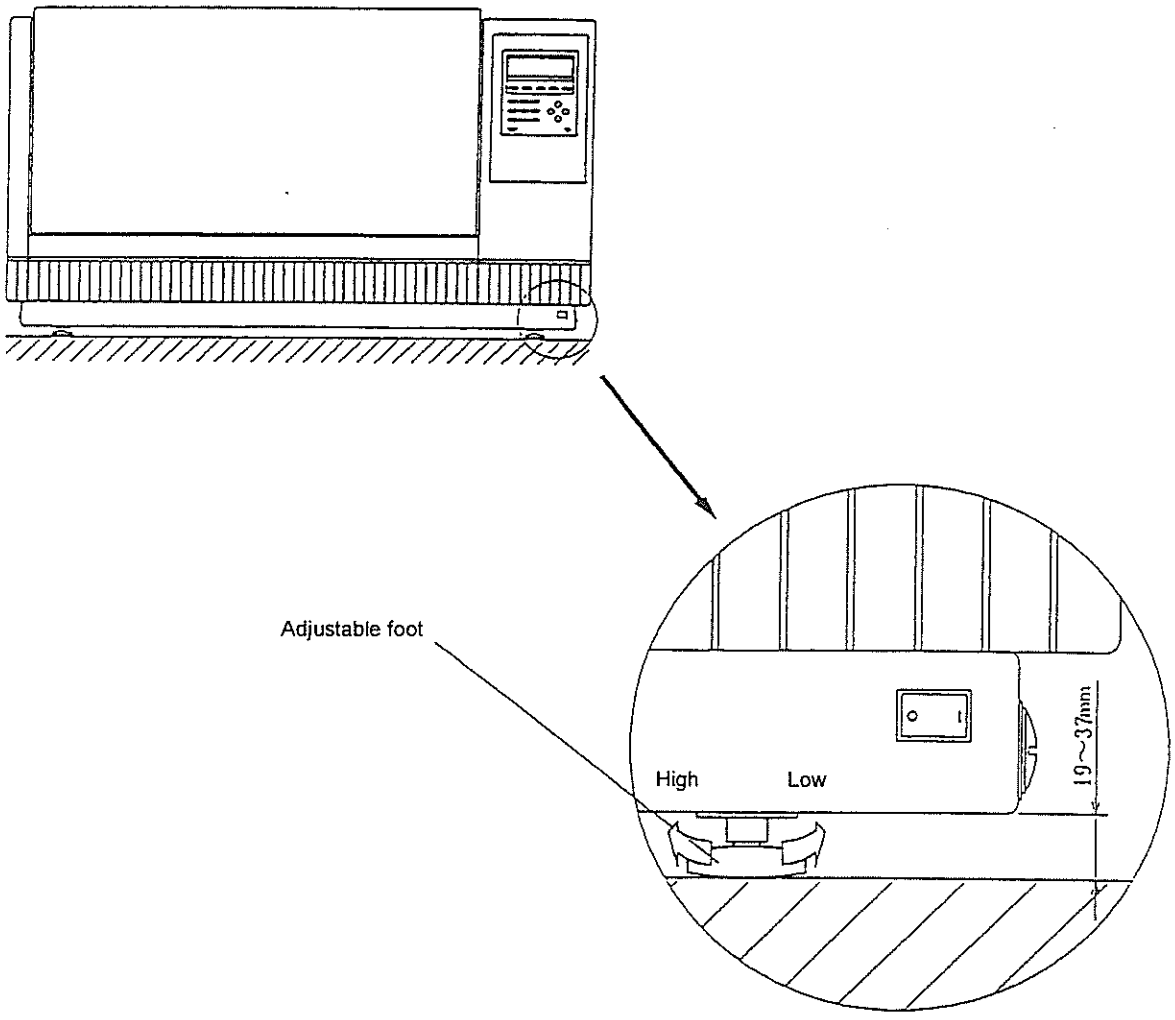


Figure 3-18 System Level Adjustment

(12) Sensing Rail

Tools to use: Phillips screw driver (ISO No.2)

Measuring tools: Scale

[1] Requirement

The left end surface of the angular hole on the sensing rail front should meet the right end surface of the right tray on the upper floor. (Refer to the drawing below.)

[2] Adjustment

1) Place the scale on the right end surface of the right tray on the upper floor to measure its position in relation to the left end surface of the angular hole.
2) Loosen the screw fixing the sensing rail and adjust the sensing rail so that it comes to the specified position.

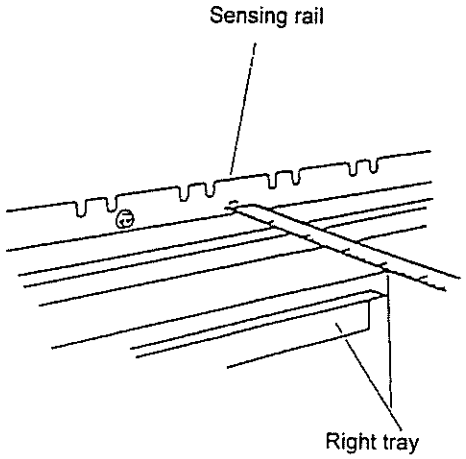


Figure 3-19 Adjustment of Sensing Rail

Check: After adjustment, measure the distance between the sensing rail and the axis X sensor bracket at three points of left, right and middle to check if it is 35 ± 1 mm. If the distance is not within the range, loosen the screw fixing the sensing rail, and adjust the position of the sensing rail. Thereafter, move the carrier unit along the entire length to check if the axis X sensor unit does not come into contact with the sensing rail.

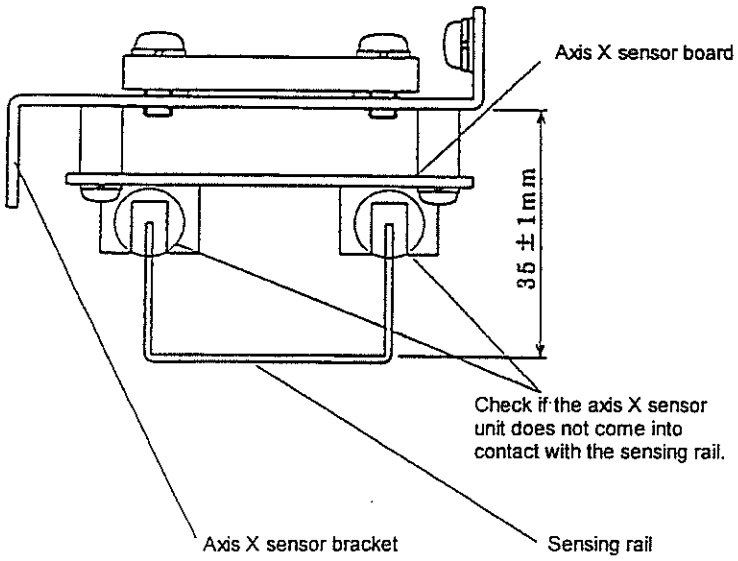


Figure 3-20 Sensing Rail and Axis X Sensor Unit

3-4 Replacement of Parts

This section explains replacement of parts.

(1) Outer Casings

Tools to use: Phillips screw driver (ISO No.2)

Refer to Figures 1 and 8 of "Exploded View and Parts List"

[1] Outer Casing (2) (Figures 1-18 of Appendix "Exploded View and Parts List)

a. Disassembly

1) Remove the fixing screws

- cross-recessed pan headed small screws (Sems C) M4 × 8: 4 pcs
  cross-recessed pan headed small screws (Sems A) M4 × 8: 2 pcs

2) Remove the outer casing.

- Lift the outer casing with hands, remove the outer casing guide pin on the base (bottom), and remove the outer casing, tilting the system toward right.

Caution: Take care not to damage the outer casing.

b. Assembly

Follow the steps for disassembly in a reversed order.

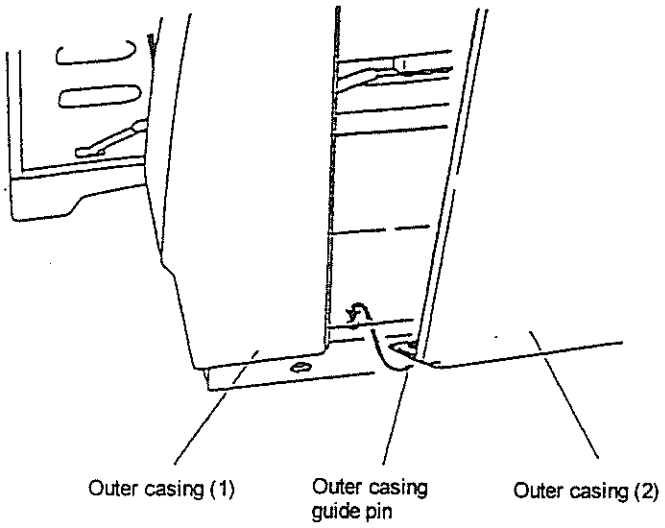


Figure 3-21 Installation of Outer Casing (2)

[2] Outer Casing (1) (Figure 1-17 of Appendix "Exploded View and Parts List)

a. Disassembly

1) Remove the outer casing (2) (Refer to 3-4 (1) [1].)
2) Remove the box cover (1) (Fig. 8-6).
   • Remove seven cross-recessed pan headed small screws (Sems A) M4 × 8.
3) Remove the connectors on the control board.
   CN3
   CN8
   C-9 (inverter output cable)
4) Remove the screws fixed on the power supply box upper surface. Remove the earth line.
   • Remove two cross-recessed pan headed small screws (Sems B) M4 × 15.
5) Remove the grounding line fixing screw on the upper base, and remove the earth line.
   • Remove a cross-recessed pan headed small screws (Sems B)M4 × 8.
6) Remove the outer casing.
   • Lift the outer casing with hands, remove to two outer casing guide pins on the base (bottom) and remove the outer casing, pulling the outer casing to the front.

Caution: Take care not to damage the outer casing.

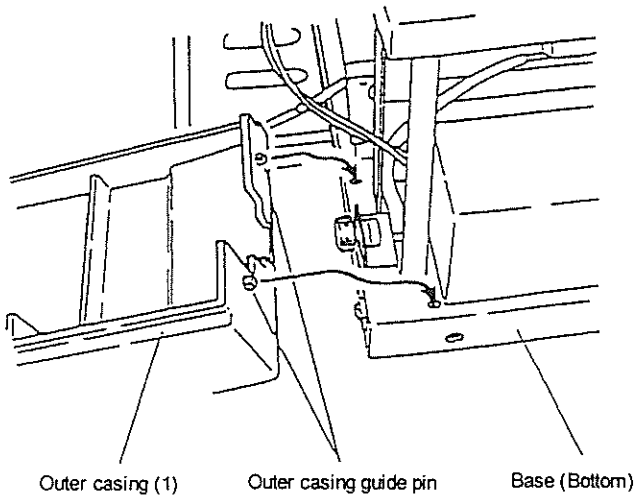


Figure 3-22 Removal of Outer Casing (1)

b. Assembly

Follow the steps for disassembly in a reversed order.

[3] Rear Plate (Figures 1-25 of Appendix "Exploded View and Parts List)

a. Disassembly

1) Remove the fixing screws, and the outer casing.
   • Remove 11 cross-recessed pan head small screws (Sems C)/M4 × 8.

Caution: Remove the screw close to the center on the top last. In this way, the rear plate will not tilt to make the work easier. When removing the screws, make sure to hold them with a hand to prevent the rear plate from dropping down, and from being damaged.

b. Assembly

Follow the above-stated steps in a reversed order.

[4] Outer casing (4)(Figures 1-20 of Appendix "Exploded View and Parts List)

a. Disassembly

1) Remove the rear plate. (Refer to 3-4 (1) [3].

2) Remove the fixing screws and remove the outer casing.

• Two cross-recessed pan head small screws (Sems A)/M4 × 8, and
Two cross-recessed pan head small screws (Sems B)/M4 × 8.

b. Assembly

Follow the steps for disassembly in a reversed order.

[5] Outer casing (3)(Figures 1-19 of Appendix "Exploded View and Parts List)

a. Disassembly

1) Remove the fixing screws and remove the outer casing.

• Two cross-recessed pan head small screws (Sems B)/M4 × 8, and
A cross-recessed pan head small screw (Sems B)/M4 × 12.

b. Assembly

Follow the steps for disassembly in a reversed order.

(2) Operating Panel Unit

[1] Operating Panel Relay Board (Figures 1-27 of Appendix "Exploded View and Parts List")

Tools to use: Phillips screw driver (ISO No.2)

Refer to Fig. 1 of "Exploded View and Parts List."

a. Disassembly

1) Remove the outer casings (2) and (1). (Refer to 3-4 (1) [1] , [2]).

2) Remove the flexible cable.

• Slide the FFC connector toward the arrow mark and unlock the cable to remove it.

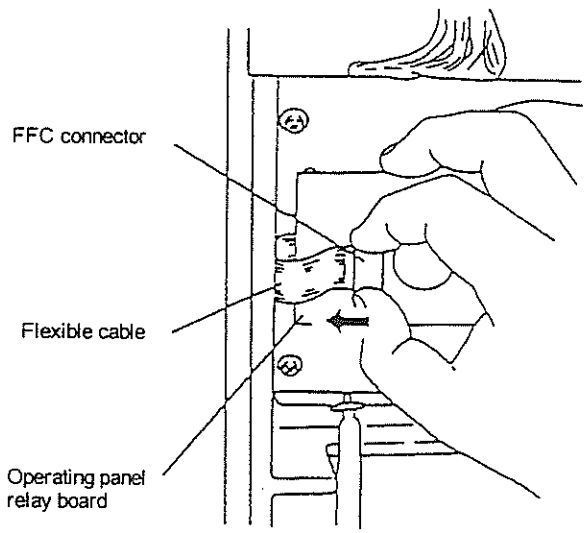


Figure 3-23 Removal of Flexible Cable

3) Remove the fixing screw, and remove the relay board.
   • Remove four cross-recessed pan head small screws (Sems B)/M3 × 6.

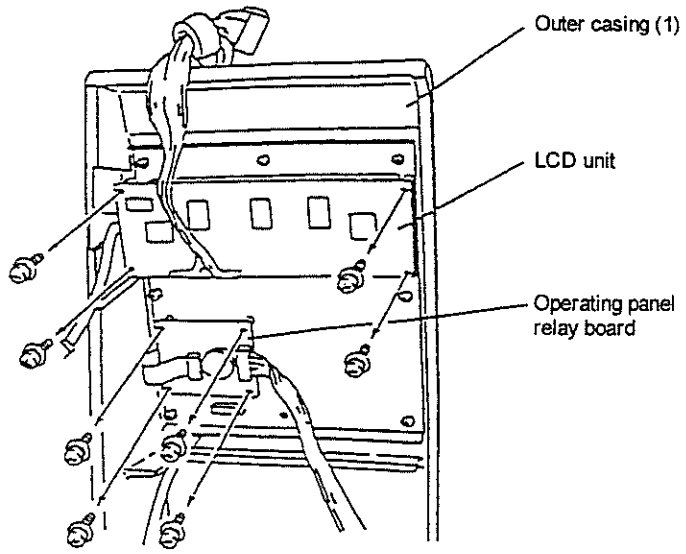


Figure 3-24 Removal of Operating Panel Relay Board and LCD Unit

b. Assembly

Follow the steps for disassembly in a reversed order.

Caution: Slide the FFC connector to the opposite direction in disassembling, and insert the cable keeping the conducting part of the flexible cable upward. After inserting the cable, slide the connector and lock the cable.

[2] LCD Unit (Figures 1-28 of Appendix "Exploded View and Parts List")
Tools to use: Phillips screw driver (ISO No.2)
Refer to Fig. 1 of "Exploded View and Parts List."

a. Disassembly

1) Remove the outer casings (2) and (1). (Refer to 3-4 (1) [1] , [2]).
2) Remove the fixing screws and remove the LCD unit.
   • Remove four cross-recessed pan head small screws (Sems B)/M3 × 6.

b. Assembly

Follow the steps for disassembly in a reversed order.

[3] Operating Panel key board (Figures 1-29 of Appendix "Exploded View and Parts List")
Tools to use: Phillips screw driver (ISO No.2)
Refer to Fig. 1 of "Exploded View and Parts List."

a. Disassembly

1) Remove the outer casings (2) and (1). (Refer to 3-4 (1) [1] , [2])
2) Remove the LCD unit. (Refer to 3-4 (2) [2].)
3) Remove the operating panel relay board. (Refer to 3-4 (2) [1].)

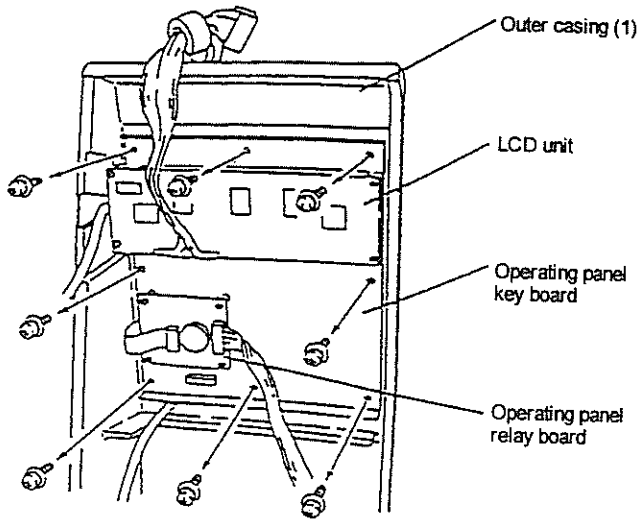


Figure 3-25 Removal of Operating Panel key board

b. Assembly

Follow the steps for disassembly in a reversed order.

Caution: Install the outer casing (1) onto the LCD unit after placing flat washers (nominal: 4) onto fixing screws between the outer casing (1) and the LCD unit. Otherwise, the membrane sheet may expand due to temperature changes, and may come up.

[4] LCD brightness adjustment Unit (Figures 2-13 of Appendix "Exploded View and Parts List")

Tools to use: Phillips screw driver (ISO No.2)
Spanner (nominal: 13)

Refer to Figures. 2 and 8 of "Exploded View and Parts List."

a. Disassembly

1) Remove the outer casings (2) and (1). (Refer to 3-4 (1) 1),2)).
2) Remove the box cover (1)(Fig. 8-6).
   • Remove seven cross-recessed pan head small screws/M4 × 8.
3) Remove the connectors on the control board.
   • CN1
4) Remove the knob (Fig. 2-14).
   • Remove a hex recessed female screw (tip recessed)/M4 × 8.
5) Remove the brightness adjustment unit.
   • Remove a hex nut/M8.

b. Assembly

Follow the steps for disassembly in a reversed order.

Caution: When fixing the knob onto the brightness adjustment unit, move back and forth and fix the knob so that the gap between the knob and the base is 1 mm.

c. Adjustment and Check

<What to Check>

* Turn on the power supply and rotate the knob. Illumination on the operating panel should change, and should be freely adjustable.

(3) Cover Section

[1] Rotary Damper (Fig. 1-31 of Appendix "Exploded View and Parts List")

Tools to use: Phillips screw driver (ISO No.1)
Phillips screw driver (ISO No.2)

Refer to Fig. 1 of "Exploded View and Parts List."

a. Disassembly

1) Remove the cover (Fig. 1-1).
   - Remove four cross-recessed truss screws/M4 × 10.

2) Remove the rotary damper.
   - Remove two cross-recessed pan head small screws (Sems B)/M3 × 6.

b. Assembly

1) Fix the rotary damper.
   - Fasten two cross-recessed pan head small screws (Sems B)/M3 × 6.

2) Move the slide rail (Fig. 1-33) to a side, and loosen the screws fixing the rack (Fig. 1-11).

3) Move the rack to engage it with the pinion (damper), and temporarily fasten the fixing screws.

Caution: Take care not to too mush press the rack against the damper. Otherwise, the damper shaft may get damaged.

4) Move the slide rail back and forth several times, and check if the rack and the pinion are in a correct engagement. Then, fasten the rack fixing screws.

5) Move the slide rail to the other side, and repeat Steps 2) through 4).

6) Install the cover.
   - Fix four cross-recessed pan head small screws/M4 × 10.

c. Adjustment and Check

<What to Check>

- Move the slide rail back and forth, and check if the slide rail moves smoothly, and it is engaged normally with the pinion. If the pinion rotates freely, adjust the rack position once again.
- Check if the rotary damper shaft is not bent.

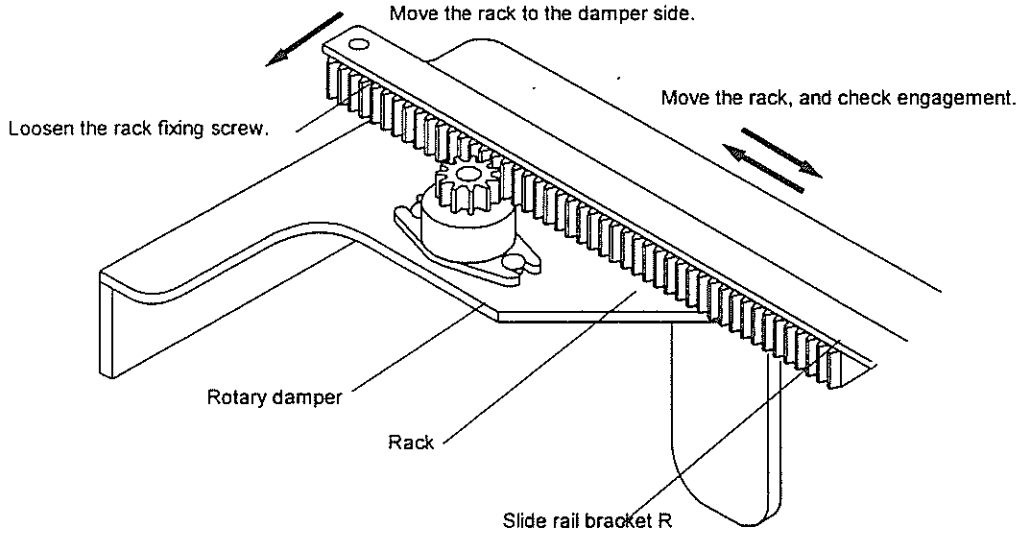


Figure 3-26 Rack Position Adjustment

[2] Gas Damper (Fig. 1-32 of Appendix "Exploded View and Parts List")

Tools to use: Radio pliers
Minus driver (Nominal: 4.5 × 50)

Refer to Fig. 1 of "Exploded View and Parts List."

a. Disassembly

1) Remove the cover

2) Remove the gas damper.
   - Remove two E rings and two plain washer /size d.6 SUS.

b. Assembly

Follow the steps for disassembly in a reversed order.

Caution:
- *Make sure to install the gas damper so that the rod faces downward.*
- *Make sure to insert a plain washer onto the E ring. If directly fixed onto the E ring without a plain washer, the gas damper fixing base may get damaged by the E ring as it is made of plastic.*

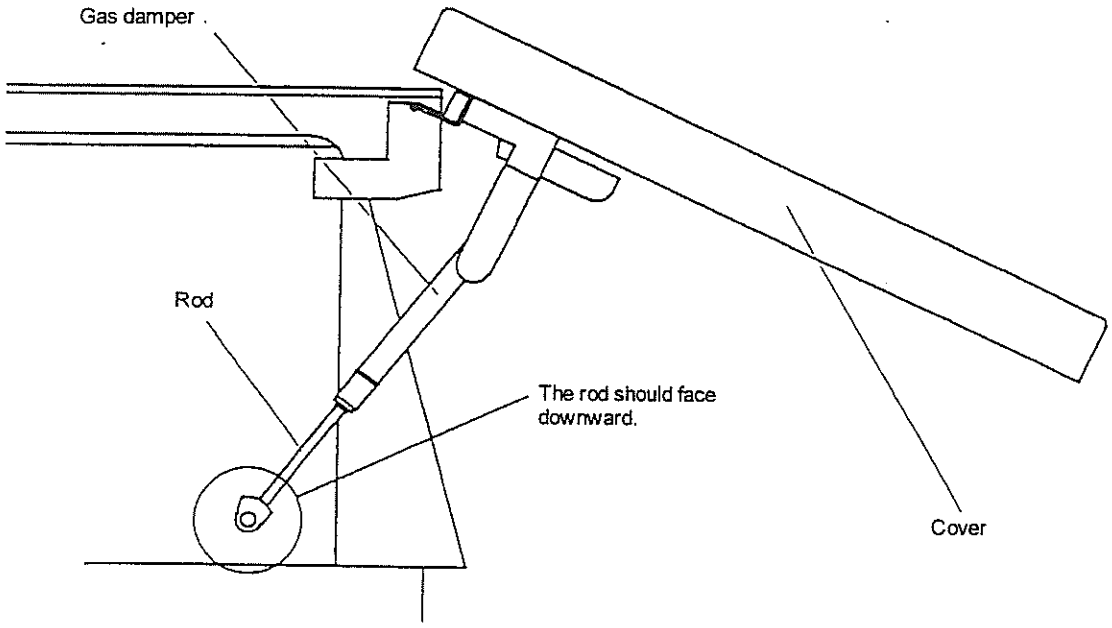


Figure 3-27 Gas Damper Surrounding Area

[3] Cover Open/Close detecting Switch Unit (Fig. 8-14 of Appendix "Exploded View and Parts List")

Tools to use: Phillips screw driver (ISO No.2)

Refer to Fig. 8 of "Exploded View and Parts List."

a. Disassembly

1) Remove the outer casings (2) and (1). (Refer to 3-4 (1) [1] , [2]).

2) Remove the box cover (1) (Fig. 8-6).
   - Remove seven cross-recessed pan head small screws (Sems A)/M4 × 8.

3) Remove the cover sensor cover (Fig. 8-1).
   - Remove four cross-recessed pan head small screws (Sems A)/M3 × 6.

4) Remove the connector on the control board.
   - CN10

5) Remove the sensor unit.
   - Remove two cross-recessed small screws/M3 × 25.

b. Assembly

Follow the steps for disassembly in a reversed order.

c. Adjustment and Check

<Adjustment>

Make adjustment as under 3-3 (1).

(4) Door Section

[1] Oil Damper (Fig. 5-21 of Appendix "Exploded View and Parts List")

Tools to use: Radio pliers
Minus driver (Nominal: 4.5 × 50)

Refer to Fig. 5 of "Exploded View and Parts List."

a. Disassembly

1) Open the door (Fig. 5-1), and remove the oil damper.
   - Remove two E rings (Nominal:4) and two plain washers (Nominal:6).

b. Assembly

Follow the steps for disassembly in a reversed order.

Caution: • *Make sure to insert a plain washer onto the E ring. If directly fixed onto the E ring without a plain washer, the gas damper fixing base may get damaged by the E ring as it is made of plastic.*

c. Adjustment and Check

<What to Check>

- Open and close the door several times to check the door moves smoothly.

[2] Open Catch (Fig. 5-23 of Appendix "Exploded View and Parts List")

Tools to use: Phillips screw driver (ISO No.1)
Phillips screw driver (ISOl: No.2)

Refer to Fig. 5 of "Exploded View and Parts List."

a. Disassembly

1) Remove the open catch.
   - Remove two cross-recessed pan head small screws (Sems B)/M3 × 8 and two cross-recessed small screws/M2 × 5.

b. Assembly

Follow the steps for disassembly in a reversed order.

c. Adjustment and confirmation

<Adjustment>

After setting the solution and the washing, reservoirs adjust the open catch position so that the door can be smoothly opened without scratching the reservoirs.

Caution:
- *When adjustment is not successful, remove the outer casing (4), loosen the screw fixing the door catch block, and tilt the door catch block for about five degrees from the horizontal position.*
- *As a basis, the door should open and close anywhere along the entire length of door. If the door should be deformed, however, it may be sufficient if the left half can be opened and closed, but the right half cannot be opened or closed.*

KIT TO CONVERT METAL TO PLASTIC DOOR LATCH F60-374-00

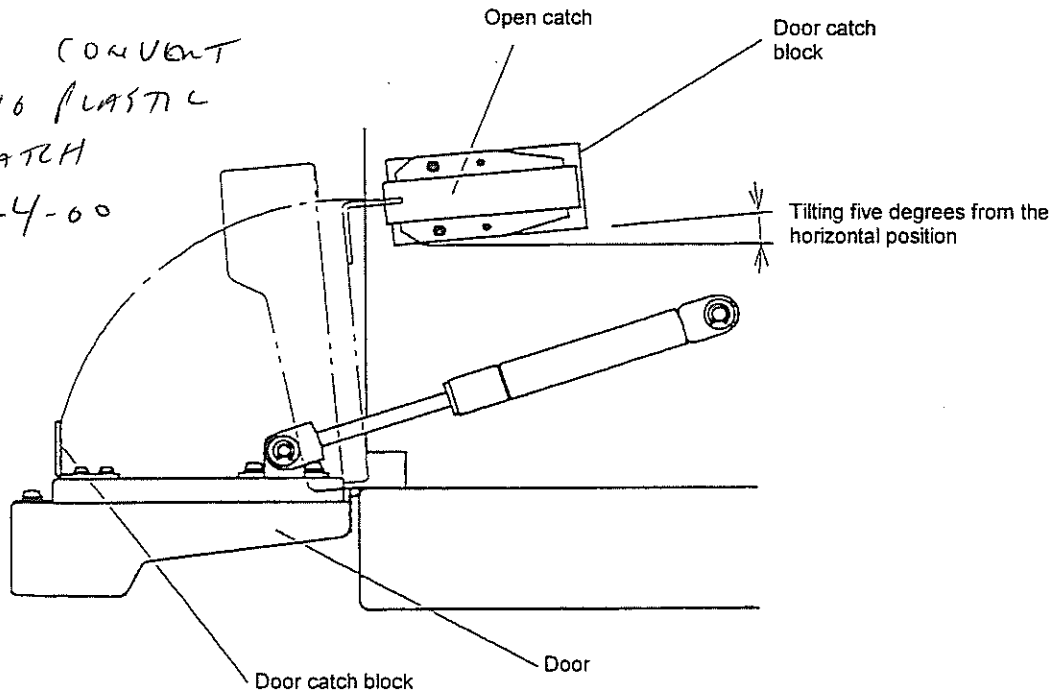


Figure 3-28 Adjustment of Open Catch

[3] Door Open/Close Detecting Switch Unit (Fig. 5-20 of Appendix "Exploded View and Parts List")

Tools to use: Phillips screw driver (ISO No.2)

Refer to Figs. 5 and 8 of "Exploded View and Parts List."

a. Disassembly

1) Remove the outer casings (2) and (1). Refer to 3-4 (1) [1] , [2].

2) Remove the box cover (1).
   - Remove seven cross-recessed pan head small screws (Sems A)/M4 × 8.

3) Remove the connectors on the control board.
   - CN 12.

4) Remove the door SW cover (Fig. 5-11).
   - Remove three cross-recessed pan head small screws (Sems A)/M3 × 6.

5) Remove the door sensor unit.
   - Remove two cross-recessed pan head small screws (Sems B)/M3 × 15.

b. Assembly

Follow the steps for disassembly in a reversed order.

c. Adjustment and Check

<Adjustment>

Make adjustment as under 3-3 (2).

(5) Base (bottom) Surrounding Part

[1] Power Supply Switch (Appendix "Exploded View/Parts List," Fig. 2-33)

Tools to use: Minus driver (nominal: 4.5 × 50)

Refer to Fig. 2 of Appendix "Exploded View/Parts List."

a. Disassembly

1) Remove the power supply switch.
   - Insert the minus driver between the base (bottom) and the power supply switch to pull it out while wrenching it.

Caution: Although it is possible to pull out the wiring as much as 50 mm, it should not be forcibly pulled out as it may lead to disconnection.

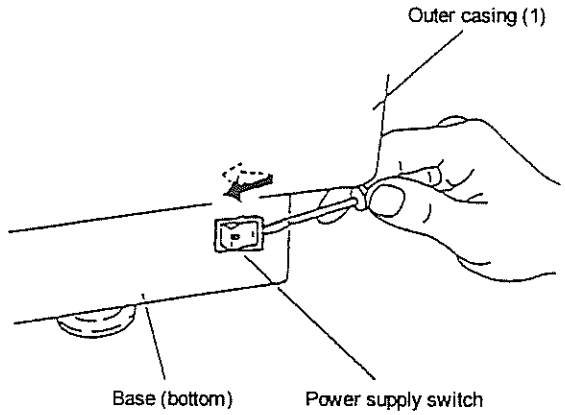


Figure 3-29 Removal of Power Supply Switch

2) Remove the wire on the switch.

b. Assembly

1) Connect the wire to the switch.

2) Insert the switch into the body.

- Check the direction of the switch, and insert it into the body.

(6) Driving Section

[1] Axis X Driving Wire

Tools to use: Phillips screw driver (ISO No.2)
Spanner (nominal: 7, 8)
Torque wrench

Measuring tools: Tension meter (recommended equipment: Shimpo Industry's DTM-5KB)

Refer to Figs. 4 and 12 of Appendix "Exploded View/Parts List."

a. Disassembly

1) Remove the rear panel. Refer to 3-4 (1) [3]

2) Loosen the X pulley shaft fixing screw on the wire tensioner and the adjusting screw, remove the X pulley shaft to inside the system, to remove the wire from the pulley.

3) Remove the wire (XL) (Fig. 4-19).

- Remove the wire terminal from the Axis X wire bracket, and remove the wire end from the wire drum (Fig. 4-15).

4) Remove the wire (XR) (Fig. 4-20).

- Remove the wire terminal from the Axis X wire bracket, and remove the wire end from the wire drum (Fig. 4-15)

b. Assembly

Check: Before installing the wire, check if there is no abnormal condition on the wire.

- That the wire covering is not peeled.
- That the wire is not bent.
- That the wire itself is not damaged.
- That the terminal crimped contact is not damaged.

1) Install the wire (XR).

1. Move the carrier unit about 50 mm from the right end looked at from the back of the system.
2. Rotate the wire drum so that the wire end installation groove on the wire drum face the back of the system.

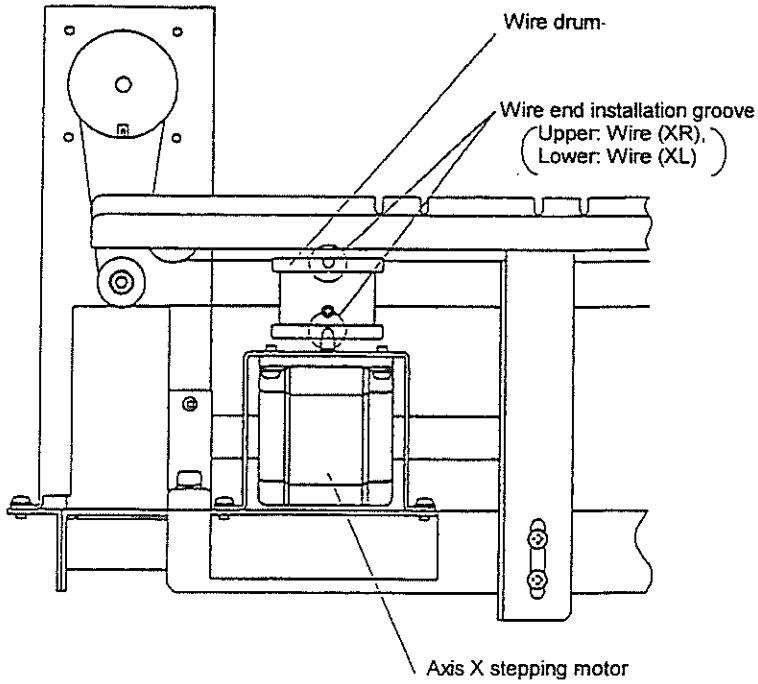


Figure 3-30 Direction of the Wire Drum When the Driving Wire is Installed

3. Hook the wire end on the upper wire end installation groove, and rotate the wire 1.5 times clockwise.

Caution: Take care so that wire does not come onto each other when winding the wire on the wire drum.

4. Fix the wire terminal on the Axis X wire bracket.

Check: • *After fixing the wire terminal, check if the terminal moves freely.*

• *After installing the wire, move the carrier unit to the right end, and check if the wire is wound more than one rotation on the wire drum.*

2) Stretch the wire (XL).

1. Move the carrier unit to the position about 50 mm away from the left end looked at from the back of the machine.
2. Hook the wire end on the wire end installation groove on the wire drum, and rotate the wire 2.5 times counterclockwise.

Caution: Take care when winding the wire on the wire drum so that the wire does not come onto each other.

3. Hang the wire on the pulley shaft X and fix the wire terminal on the axis X bracket.

Confirm • *After fixing the wire, confirm that the terminal moves freely.*

• *After installing the wire, move the carrier unit to the left end, and confirm if the wire is wound more than once on the wire drum.*

3) Adjust wire tension. Refer to 3-3 (3).

4) Install the rear panel. Refer to 3-4 (1) [3].

[2] Axis Z Driving Wire

Tools to use: Phillips screw driver (ISO No.2)
Spanner (nominal: 7, 8)
Torque wrench
Measuring tools: Tension meter (recommended meter: Shimpo Industry's DTM-5KB)
Refer to Figs. 4 and 13 of "Exploded View and Parts List."

a. Disassembly

1) Remove the outer casing (2), and remove the rear panel. Refer to 3-4 (1) [1] , [3].
2) Loosen the X pulley shaft fixing screw on the wire tensioner and the adjusting screw, move the X pulley shaft to inside the system, and loosen the wire.
3) Remove the wire (above Z) (Fig. 4-21).
   - Remove the wire terminal from the wire tensioner, and remove the wire end from the wire drum.
4) Remove the wire (below Z) (Fig. 4-22).
   - Remove the wire terminal from the wire tensioner, and remove the wire end from the wire drum.

b. Assembly

Check: Before installing the wire, check that there is no abnormal condition on the wire.
- That the wire covering is not peeled.
- That the wire is not bent.
- That the wire itself is not damaged.
- That the terminal crimped contact is not damaged.

1) Install the wire (below Z).
   1. Move the carrier unit about 20 mm from the top end.
   2. Rotate the wire drum so that the wire installation groove on the wire drum faces upward.

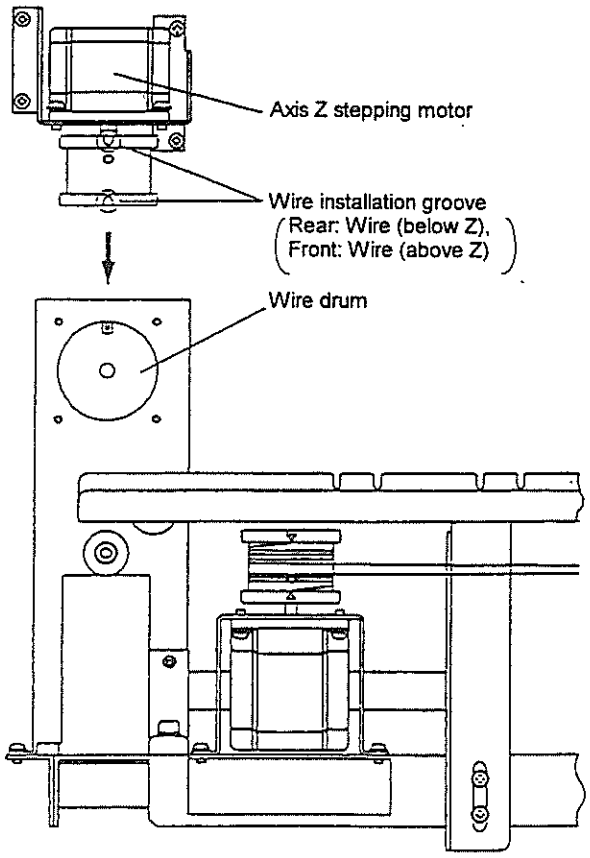


Figure 3-31 Direction of the Wire Drum When Installing the Driving Wire

3. Hook the wire end on the lower wire end attaching groove, and rotate the wire 1.5 times clockwise.

Caution: Take care so that wire does not come onto each other when winding the wire on the wire drum.

4. Install the wire with reference to the wire route chart (Fig. 13), and fix the wire terminal onto the wire tensioner.

* In so doing, keep the wire tensioner to the left looked at from the back of the machine.

Check: • *After fixing the wire terminal, check if the terminal moves freely.*

• *After installing the wire, move the carrier unit to the top end, and check if the wire is wound more than one rotation on the wire drum.*

2) Install the wire (above Z).

1. Move the holder unit to the position about 20 mm away from the top end.
2. Rotate the wire drum so that the wire end installation groove on the wire drum faces upward.
3. Hook the wire end on the lower wire end installation groove, and rotate the wire 2.5 times counterclockwise.

Caution: Take care when winding the wire on the wire drum so that the wire does not come onto each other.

4. Install the wire with reference to the wire route chart (Fig. 13), and fix the wire terminal onto the wire tensioner.

Confirm • *After fixing the wire, confirm if the terminal moves freely.*

• *After installing the wire, move the carrier unit to the bottom, and confirm if the wire is wound more than once n the wire drum.*

3) Adjust wire tension. Refer to 3-3 (4).

4) Install the outer casing (2), and the rear panel. Refer to 3-4 (1) [1], [3].

[3] Weight Wire (Appendix "Exploded View/Parts List," Fig. 3-16)

Tools to use: Phillips screw driver (ISO No.2)
Spanner (nominal: 7)

Refer to Fig. 3 of Appendix "Exploded View/Parts List."

a. Disassembly

1) Remove the outer casing (2) and the rear panel. Refer to 3-4 (1) [1] , [3].

2) Remove the cover Z (2). (Fig. 3-14)
• Remove four cross-recessed pan head small screws (Sems B)/M4 × 8.

3) Remove the weight wire.
• Remove the wire end shaft.

Caution: When removing the balance weight (Fig. 3-8) from the wire terminal, make sure to hold the balance weight with hands. Otherwise, the balance weight may fall down.

[4] Axis X Stepping Motor Unit (Appendix "Exploded View/Parts List," Fig. 4-27)

Tools to use: Phillips screw driver (ISO No.2)
Hex wrench (nominal: 2)

Refer to Figs. 4 and 8 of Appendix "Exploded View/Parts List."

a. Disassembly

1) Remove the outer casing (2) and the rear panel. Refer to 3-4 (1) [1] , [3].

2) Remove the box cover (1) (Fig. 8-6).
• Remove seven cross-recessed pan head small screws (Sems A)/M4 × 8.

3) Remove the connector on the control board.
• CN17

4) Remove the driving wire (Axis X). Refer to 3-4 (6) [1] .

5) Remove the Axis X motor bracket (Fig. 4-11)
• Remove three cross-recessed pan head small screws (Sems B)/M4 × 8.

6) Remove the wire drum (Fig. 4-15) from the motor bracket.
• Loosen two hex recessed screws (tip recessed)/M4 × 8.

7) Remove the motor unit from the motor bracket.
• Remove four cross-recessed pan head small screws (Sems A)/M4 × 8.

b. Assembly

Follow the steps for disassembly in a reversed order.

Caution: • *Install the wire drum so that its gap with the motor bracket is 5 mm. (Refer to the drawing below.)*

• *Apply the screw lock onto the fixing screw, insert the motor packing between the base and the bracket, and then install the motor bracket.*

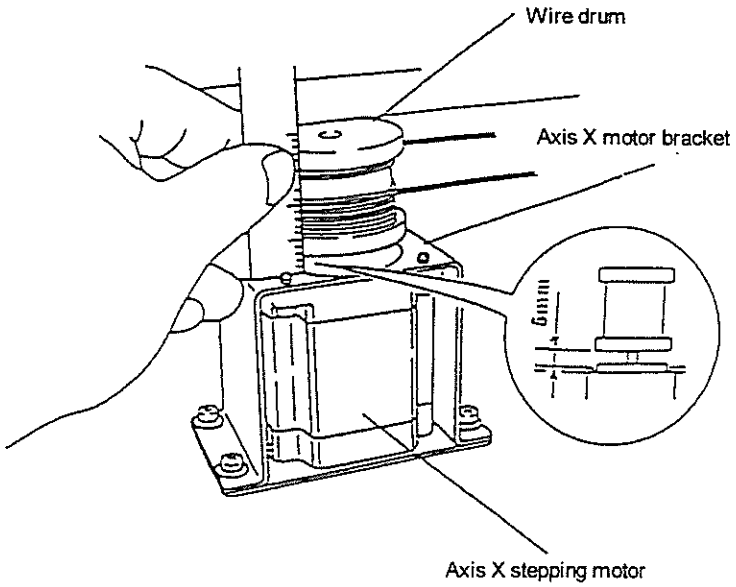


Figure 3-32 Gap between the Wire Drum and the Motor Bracket

[5] Axis Z Stepping Motor Unit (Appendix "Exploded View/Parts List," Fig. 4-28)

Tools to use: Phillips screw driver (ISO No.2)
Hex wrench (nominal: 2)

Refer to Figs. 4 and 8 of Appendix "Exploded View/Parts List."

a. Disassembly

1) Remove the outer casing (2) and the rear panel. Refer to 3-4 (1) [1] , [3].
2) Remove the box cover (1) (Fig. 8-6).
   • Remove seven cross-recessed pan head small screws (Sems A)/M4 × 8.
3) Remove the connector on the control board.
   • CN19
4) Remove the driving wire (Axis Z). Refer to 3-4 (6) [2].
5) Remove the Axis Z motor bracket (Fig. 4-11).
   • Remove four cross-recessed pan head small screws (Sems B)/M4 × 8.
6) Remove the wire drum (Fig. 4-15) from the motor bracket.
   • Loosen two hex recessed screws (tip recessed)/M4 × 8.
7) Remove the motor unit from the motor bracket.
   • Remove four cross-recessed pan head small screws (Sems A)/M4 × 8.

b. Assembly

Follow the steps for disassembly in a reversed order.

Caution: • *Install the wire drum so that its gap with the motor bracket is 5 mm. (Refer to the drawing below.)*

• *Apply the screw lock onto the fixing screw, insert the motor packing between the base and the bracket, and then install the motor bracket.*

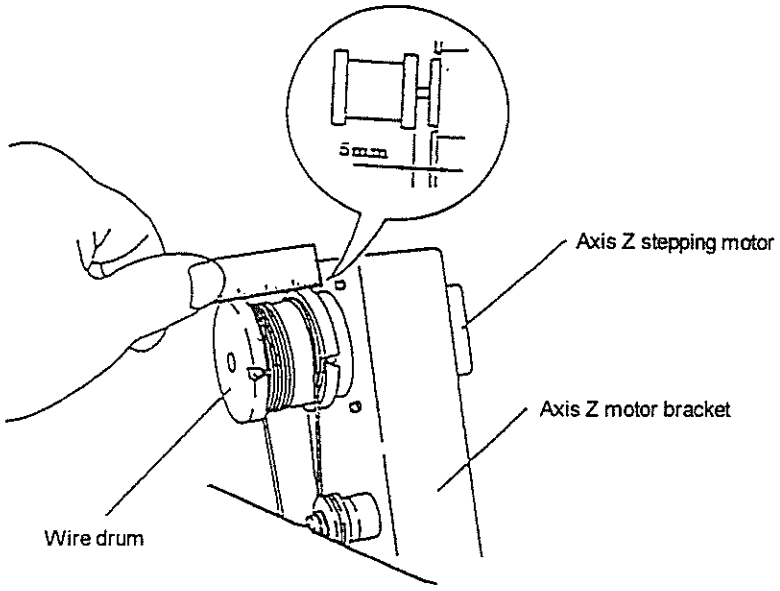


Figure 3-33 Gap between the Wire Drum and the Axis Z Wire Bracket

[6] Axis X Sensor Board (Appendix "Exploded View/Parts List," Fig. 4-26)

Tools to use: Phillips screw driver (ISO No.2)
Stably phillips screw driver (ISO No.2)

Refer to Fig. 4 of Appendix "Exploded View/Parts List."

a. Disassembly

1) Remove the outer casing (2) and the rear panel. Refer to 3-4 (1) [1] , [3].
2) Remove the laminated cable (Fig. 4-62) from the sensor board.
   • Loosen two cross-recessed pan head small screws (Sems B)/M4 × 8.
3) Remove the axis X sensor bracket (Fig. 4-4)
   • Remove two cross-recessed pan head small screws (Sems B)/M4 × 8.
4) Remove the axis X sensor relay cable (Fig. 4-63).
5) Remove the sensor board from the sensor bracket.
   • Remove four cross-recessed pan head small screws (Sems A)/M3 × 6.

b. Assembly

Follow the steps for disassembly in a reversed order.

* After assembly, carry out offset adjustment.

[7] Axis Z upper floor sensor board (Appendix "Exploded View/Parts List," Fig. 3-21)

Tools to use: Phillips screw driver (ISO No.2)

Refer to Fig. 3 of Appendix "Exploded View/Parts List."

a. Disassembly

1) Remove the rear panel. Refer to 3-4 (1) [3]..
2) Remove the wires on the sensor board.
   • CN1 (Axis Z upper floor sensor relay cable)
   • CN2 (Axis Z middle sensor unit)
3) Remove the cover Z (1) (Fig. 3-13).
   • Loosen four cross-recessed pan head small screws (Sems B)/M4 × 8.
4) Remove the upper floor axis Z sensor bracket (Fig. 3-5).
   • Remove two cross-recessed pan head small screws (Sems A)/M4 × 8.
5) Remove the sensor board from the sensor bracket.
   • Remove four cross-recessed pan head small screws (Sems A)/M3 × 6.

b. Assembly

Follow the steps for disassembly in a reversed order.

Caution: Install the sensor bracket, paying attention to the direction of the sensor board (the connector pin should face the back of the machine.)

[8] Axis Z lower floor sensor board (Appendix "Exploded View/Parts List," Fig. 3-22)
Tools to use: Phillips screw driver (ISO No.2)
Refer to Fig. 3 of Appendix "Exploded View/Parts List."

a. Disassembly

1) Remove the rear panel. Refer to 3-4 (1) [3].
2) Remove the wires on the sensor board.
   • CN1 (Axis Z lower floor sensor relay cable)
3) Remove the cover Z (1) (Fig. 3-13).
   • Remove four cross-recessed pan head small screws (Sems B)/M4 × 8.
4) Remove the lower floor axis Z sensor bracket (Fig. 3-5).
   • Remove two cross-recessed pan head small screws (Sems A)/M4 × 8.
5) Remove the sensor board from the sensor bracket.
   • Remove four cross-recessed pan head small screws (Sems A)/M3 × 6.

b. Assembly

Follow the steps for disassembly in a reversed order.

Caution: Install the sensor bracket, paying attention to the direction of the sensor board (the connector pin should face the back of the machine.)

[9] Axis Z middle sensor unit (Appendix "Exploded View/Parts List," Fig. 3-20)
Tools to use: Phillips screw driver (ISO No.2)
Refer to Fig. 3 of Appendix "Exploded View/Parts List."

a. Disassembly

1) Remove the rear panel. Refer to 3-4 (1) [3].
2) Remove the cover Z (1) (Fig. 3-13).
3) Remove the connector on the axis Z upper floor sensor board.
   • CN2

4) Remove the axis Z middle sensor bracket (Fig. 3-18).
   • Remove two cross-recessed pan head small screws (Sems A)/M4 × 8.
5) Remove the axis Z middle sensor unit from the sensor bracket.
   • Remove two cross-recessed pan head small screws (Sems A)/M3 × 10.

b. Assembly

Follow the steps for disassembly in a reversed order.

c. Adjustment and Check

<Adjustment>

Check the positions of the sensor unit and basket arm. Refer to 3-3 (5).

[10] Axis X sensor relay cable (Appendix "Exploded View/Parts List," Fig. 4-63)

Tools to use: Phillips screw driver (ISO No.2)
Parts: Gap tape (Cemedine's 10 × 15 × 4m)
Refer to Fig. 4 of Appendix "Exploded View/Parts List."

a. Disassembly

1) Remove the outer casing (2) and the rear panel. Refer to 3-4 (1) [1] , [3].
2) Remove the box cover (1) (Fig. 8-6).
   • Remove seven cross-recessed pan head small screws (Sems A)/M4 × 8.
3) Remove the connector on the control board.
   • CN6

Caution: Remove the cable from the connector only after sliding the actuator toward the arrow, and unlocking. Never forcibly pull out the cable. Otherwise it may be damaged. (Refer to Fig. 3-35.)

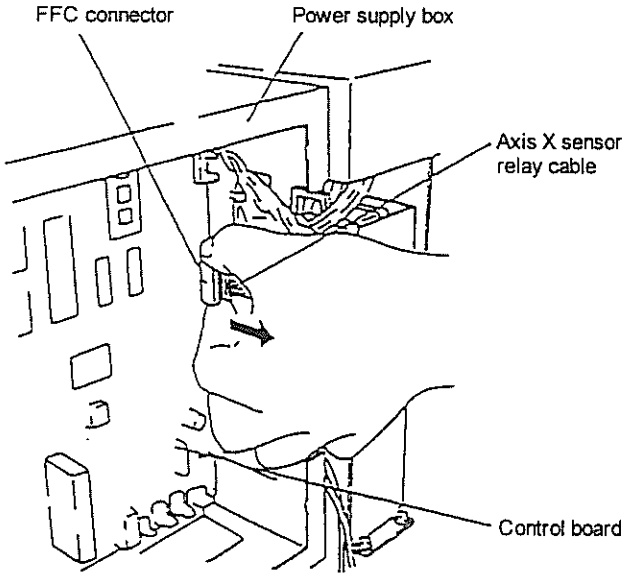


Figure 3-34 Removal of Axis X sensor relay cable

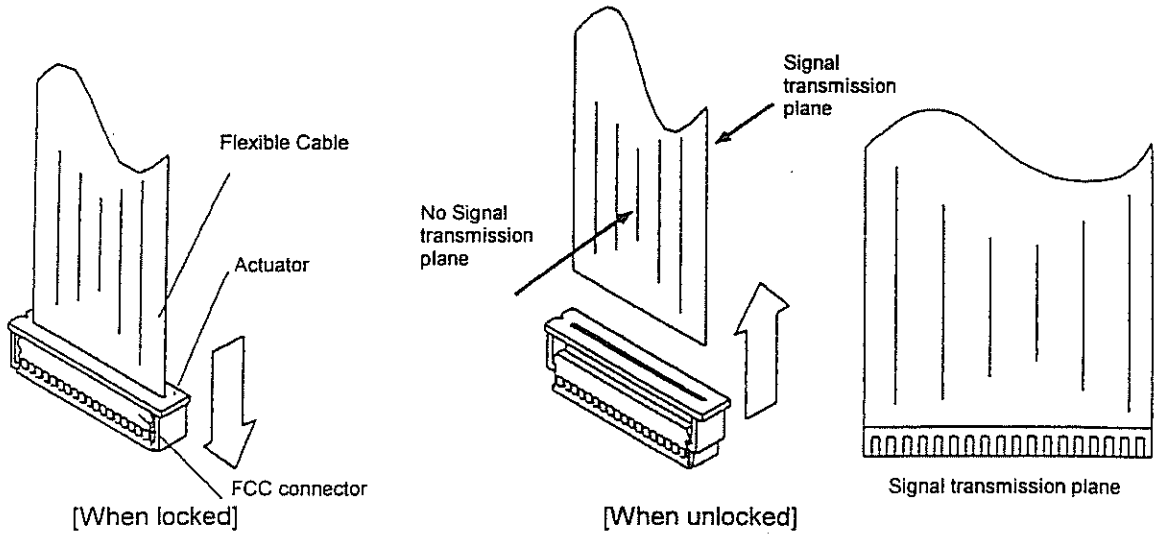


Figure 3-35 Removal of Flexible Cable

4) Remove the laminated cable (Fig. 4-62) from the axis X sensor bracket.
   - Unfasten two cross-recessed pan head small screws (Sems B)/M4 × 8.
5) Remove the axis X sensor bracket (Fig. 4-4)
   - Remove two cross-recessed pan head small screws (Sems B)/M4 × 8.
6) Remove the sensor relay cable.

b. Assembly

Follow the steps for disassembly in a reversed order.

Caution: The cable has both signal transmission and no signal transmission planes. When inserting the cable into the FFC connector, pay attention to the direction of cable. After inserting the cable, make sure to lock it. (Refer to Fig. 3-35.)

[11] Laminated Cable (Appendix "Exploded View/Parts List," Fig. 4-62)

Tools to use: Phillips screw driver (ISO No.2)
Stably phillips screw driver (ISO No.2)
Hex wrench (nominal: 3)

Parts: Gap tape (Cemedine's 10 × 15 × 4m)

Refer to Fig. 4 of Appendix "Exploded View/Parts List."

a. Disassembly

1) Remove the rear panel. Refer to 3-4 (1) [3].
2) Remove the laminated cable.
   - Remove two cross-recessed pan head small screws (Sems B)/M4 × 8 and
   - Remove two hex recessed bolts

b. Assembly

Follow the steps for disassembly in a reversed order.

[12] LM Guide (Appendix "Exploded View/Parts List," Fig. 3-17)

Tools to use: Phillips screw driver (ISO No.2)
Hex wrench (nominal)

Refer to Fig. 3 of Appendix "Exploded View/Parts List."

a. Disassembly

1) Remove the rear panel.
   - Remove two hex recessed bolts/M6 × 15.
2) Remove the driving wires (Axes X and Z). Refer to 3-4 (6) [1] , [2].
3) Remove the covers Z (1) and (2).
   - Remove two hex recessed bolts/M4 × 8.
4) Remove the axis Z light block screen and the basket arm.
5) Remove the LM guide.
   - Remove seven hex recessed bolts/M3 × 12.

b. Assembly

Follow the steps for disassembly in a reversed order.

Caution: • *Install the LM guide stoppers on both ends of the LM rail.*
• *Never remove the LM block from the LM rail. Otherwise the balls come out.*

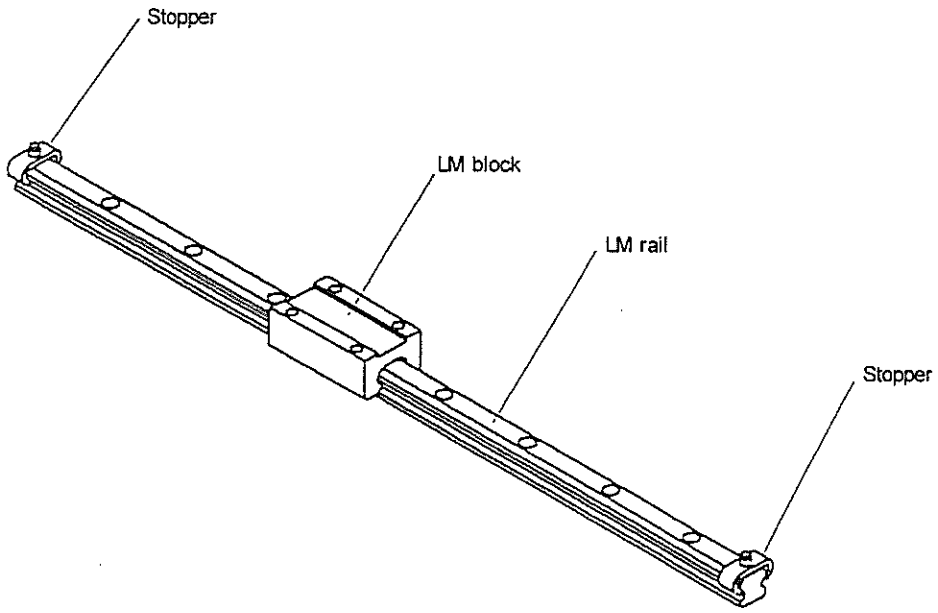


Figure 3-35 LM Guide

(7) Tray

[1] Tray Drain Tube (Appendix "Exploded View/Parts List," Fig. 6-11)

Tools to use: Phillips screw driver (ISO No.2)

Refer to Fig. 6 of Appendix "Exploded View/Parts List."

a. Disassembly

1) Loosen the hose clamp (Fig. 6-12).

- Loosen the upper and lower clamps with the driver.

2) Remove the tray drain tube.

b. Assembly

Follow the steps for disassembly in a reversed order.

c. Adjustment and Check

<What to Check>

- There should be no leakage from the tube.

[2] Rubber Bush (washing reservoir)

Tools to use: Minus driver (nominal: 4 .5 × 50)

a. Disassembly

1) Insert the minus driver between the washing reservoir and the rubber bush, and pull the rubber bush.

b. Assembly

1) Insert the rubber bush into the washing reservoir.

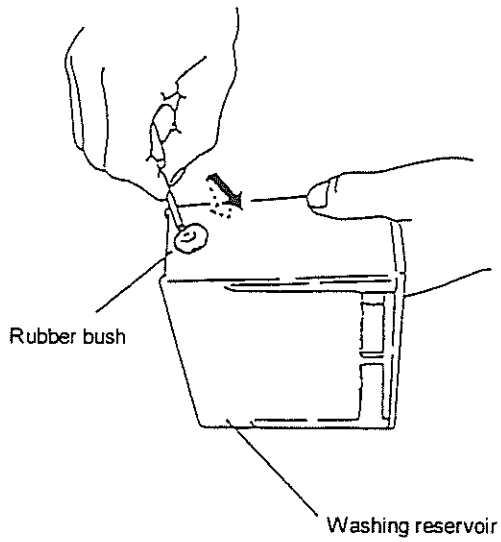


Figure 3-36 Removal of Rubber Bush

(8) Washing/Water Supply

[1] Water Supply/Washing Solenoid Valve (Appendix "Exploded View/Parts List," Fig. 7-11)

Tools to use: Phillips screw driver (ISO No.2)
Spanner (nominal: 8)
Monkey wrench (nominal: 200)

Refer to Fig. 7 of Appendix "Exploded View/Parts List."

a. Disassembly

1) Remove the outer casing (2) and the rear panel. Refer to 3-4 (1) [1] , [3].

2) Remove the box cover (1) (Fig. 8-6).
   - Remove seven cross-recessed pan head screws (Sems A)/M4 × 8.

3) Remove the connector on the control board.
   - CN13

4) Remove the water supply connection plate (Fig. 7-8).
   - Remove four cross-recessed pan head screws (Sems B)/ M4 × 8 and two upset hex bolts SW, with a washer, M5 × 10.

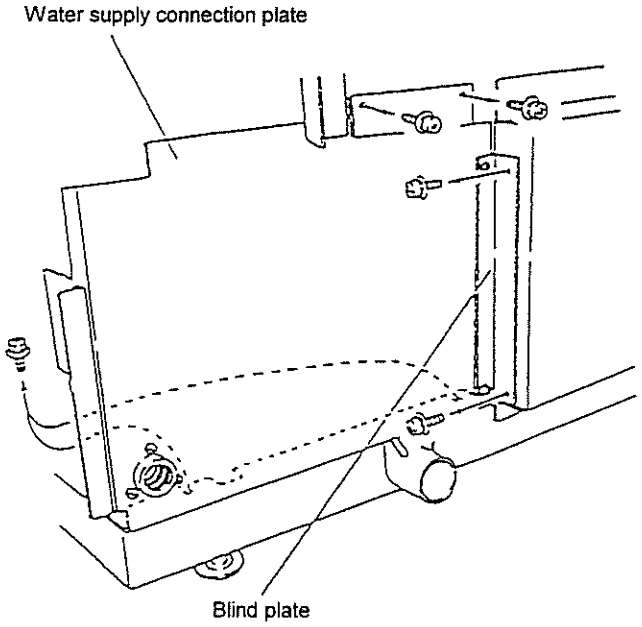


Figure 3-37 Removal of Water Supply Connection Plate

5) Remove the solenoid valve unit from the water supply connection plate.
   - Remove two cross-recessed pan head screws (Sems B)/ M4 × 8.

b. Assembly

Follow the steps for disassembly in a reversed order.

[2] Decompression Valve (Appendix "Exploded View/Parts List," Fig. 7-15)

Tools to use: Phillips screw driver (ISO No.2)
Spanner (nominal: 8)

Refer to Fig. 7 of Appendix "Exploded View/Parts List."

a. Disassembly

1) Remove the outer casing (2) and the rear panel. Refer to 3-4 (1) [1] , [3].
2) Remove the water supply connection plate.
   • Remove four cross-recessed pan head screws (Sems B)/ M4 × 8 and two upset hex bolts SW, with a washer, M5 × 10.
3) Remove the solenoid valve unit from the water supply connection plate.
   • Remove two cross-recessed pan head screws (Sems B)/ M4 × 8.
4) Disassemble the piping, and remove the decompression valve.

b. Assembly

Follow the steps for disassembly in a reversed order.

[3] Vinyl Tetron Hose (Appendix "Exploded View/Parts List," Fig. 7-26)

Tools to use: Phillips screw driver (ISO No.2)
Spanner (nominal: 8)

Refer to Fig. 7 of Appendix "Exploded View/Parts List."

a. Disassembly

1) Remove the outer casing (2) and the rear panel. Refer to 3-4 (1) [1] , [3].
2) Remove the water supply connection plate.
   • Remove four cross-recessed pan head screws (Sems B)/ M4 × 8 and two upset hex bolts SW, with a washer, M5 × 10.
3) Loosen the hose clamp.
4) Remove the vinyl Tetron hose.

b. Assembly

Follow the steps for disassembly in a reversed order.

[4] Vinyl Tube (Appendix "Exploded View/Parts List," Fig. 7-27)

Tools to use: Radio pliers

Refer to Fig. 7 of Appendix "Exploded View/Parts List."

a. Disassembly

1) Remove the hose clamp with the radio pliers.
2) Remove the hose.

b. Assembly

Follow the steps for disassembly in a reversed order.

Caution: Make sure to install the hose clamp on the decompression valve side.

(9) Power Supply Box Section

[1] Control Board (Appendix "Exploded View/Parts List," Fig. 8-11)

Tools to use: Phillips screw driver (ISO No.2)
Spanner (nominal: 5.5)

Refer to Fig. 8 of Appendix "Exploded View/Parts List."

a. Disassembly

1) Remove the outer casing (2). Refer to 3-4 (1) [1] .

2) Remove the box cover (1)(Figure 8, No.6).
   - Remove seven cross-recessed pan head screws (Sems A)/ M4 × 8

3) Remove the connectors on the control board.
   - CN1 (LCD Brightness Adjustment Unit)
   - CN2 (12V (input/output) power supply cable)
   - CN3 (LCD unit)
   - CN4 (Dryer Temperature Sensor)
   - CN5 (Battery unit)
   - CN6 Axis X sensor relay cable)
   - CN7 (RSA-232C connector cable)
   - CN8 (Operating panel relay board)
   - CN9 (Dryer unit terminal block)
   - CN10 (Cover open/close detection sensor unit)
   - CN12 (Door open/close detection sensor unit)
   - CN13 (Washing/water supply solenoid valve unit)
   - CN15 (Dryer unit terminal block)
   - CN16 (Dryer)
   - CN17 (Axis X stepping motor unit)
   - CN18 (Exhaust fan unit)
   - CN19 (Axis Z stepping motor unit)
   - CN20 (DC-DC inverter input cable)
   - CN21 (12V (motor) power supply cable)

4) Remove the control board.
   - Remove six cross-recessed pan head screws (Sems B)/ M3 × 6.

b. Assembly

Follow the steps for disassembly in a reversed order.

[2] Power Supply Board (Appendix "Exploded View/Parts List," Fig. 8-2)

Tools to use: Phillips screw driver (ISO No.2)

Refer to Figure 8 of Appendix "Exploded View/Parts List."

a. Disassembly

1) Remove the outer casing (2). Refer to 3-4 (1) [1] .

2) Remove the box cover (1).
   - Remove seven cross-recessed pan head screws (Sems A)/ M4 × 8.

3) Remove the connectors on the control board.

4) Remove the control board together with the installation block.
   - Remove four cross-recessed pan head screws (Sems A)/ M4 × 8.

5) Remove the wiring on the DC power supply terminal block.
   • C-6 (DC-DC converter input cable)
6) Remove the power supply board.
   • Remove four cross-recessed pan head screws (Sems B)/ M3 × 6.

b. Assembly

Follow the steps for disassembly in a reversed order.

[3] LCD Inverter Board (Appendix "Exploded View/Parts List," Fig. 8-18)

Tools to use: Phillips screw driver (ISO No.2)

Refer to Fig. 8 of Appendix "Exploded View/Parts List."

a. Disassembly

1) Remove the outer casing (2) and (1). Refer to 3-4 (1) [1] , [2].
2) Remove the box cover (1).
   • Remove seven cross-recessed pan head screws (Sems A)/ M4 × 8.
3) Remove the connectors on the control board.
4) Remove the control board together with the installation block.
   • Remove four cross-recessed pan head screws (Sems A)/ M4 × 8.
5) Remove the connectors on the LCD inverter board.
6) Remove the LCD inverter board.
   • Remove four cross-recessed pan head screws (Sems B)/ M3 × 6.

b. Assembly

Follow the steps for disassembly in a reversed order.

[4] Switching regulator (Appendix "Exploded View/Parts List," Fig. 8-20)

Tools to use: Phillips screw driver (ISO No.2)

Refer to Fig. 8 of Appendix "Exploded View/Parts List."

a. Disassembly

1) Remove the outer casing (2) and (1). Refer to 3-4 (1) [1] , [2].
2) Remove the box cover (1).
   • Remove seven cross-recessed pan head screws (Sems A)/ M4 × 8.
3) Remove the connectors on the control board.
4) Remove the control board together with the installation block.
   • Remove four cross-recessed pan head screws (Sems A)/ M4 × 8.
5) Remove the wiring on the parts installation board.
6) Remove the parts installation board.
   • Remove four cross-recessed pan head screws (Sems B)/ M4 × 8.
7) Remove the switching regulator from the parts installation board.
   • Remove two cross-recessed pan head screws (Sems A)/ M3 × 6.

b. Assembly

Follow the steps for disassembly in a reversed order.

[5] Battery Unit (Appendix "Exploded View/Parts List," Fig. 8-13)

Tools to use: Phillips screw driver (ISO No.2)

Refer to Fig. 8 of Appendix "Exploded View/Parts List."

Caution:
- *Make sure to turn off the machine power supply before replacing the battery unit. Replace the battery unit quickly as data in the RAM will be lost in about 16 seconds when the battery unit is removed while the power supply is off.*
- *Even if the LCD screen displays "Error No.4 battery Low: Main Board," the data will be protected for a while.*
- *Make sure to use Toshiba ER4V battery.*

a. Disassembly

1) Remove the outer casing (2). Refer to 3-4 (1) [1].
2) Remove the box cover (1)(Fig.8-6).
   - Remove seven cross-recessed pan head screws (Sems A)/ M4 × 8.
3) Remove the battery from the clamp.
4) Remove the connector on the control board.
   - CN5.
5) Remove the battery unit.

b. Assembly

Follow the steps for disassembly in a reversed order.

[6] Board Cooling Fan Unit (Appendix "Exploded View/Parts List," Fig. 8-17)

Tools to use: Phillips screw driver (ISO No.2)

Refer to Fig. 8 of Appendix "Exploded View/Parts List."

a. Disassembly

1) Remove the outer casing (2) and (1). Refer to 3-4 (1) [1] , [2].
2) Remove the box cover (2)(Figure 8-7).
   - Remove four cross-recessed pan head screws (Sems A)/ M4 × 8.
3) Remove the fan input cable (DC power supply terminal block).
4) Remove the board cooling fan.
   - Remove four cross-recessed pan head screws/M4 × 30.

b. Assembly

Follow the steps for disassembly in a reversed order.

[7] External Signal Terminal Unit (Appendix "Exploded View/Parts List," Fig. 8-15)

Tools to use: Phillips screw driver (ISO No.2)

Refer to Fig. 8 of Appendix "Exploded View/Parts List."

a. Disassembly

1) Remove the outer casing (2). Refer to 3-4 (1) [1].
2) Remove the box cover (1)(Fig. 8-6).
   - Remove seven cross-recessed pan head screws (Sems A)/ M4 × 8.
3) Remove the connectors on the control board.

- CN9
- CN15

4) Remove the external signal terminal block.
   - Remove two cross-recessed pan head screws (Sems A)/ M3 × 15.

b. Assembly

Follow the steps for disassembly in a reversed order.

[8] RS-232C Connector Unit (Appendix "Exploded View/Parts List," Fig. 8-16)

Tools to use: Phillips screw driver (ISO No.2)
Spanner (nominal: 5)

Refer to Fig. 8 of Appendix "Exploded View/Parts List."

a. Disassembly

1) Remove the outer casing (2). Refer to 3-4 (1) [1] .

2) Remove the box cover (1)(Fig. 8-16).
   - Remove seven cross-recessed pan head small screws (Sems A)/ M4 × 8.

3) Remove the connector on the control board.
   - CN7 (RS-232C unit)

4) Remove the RS-232C connector unit.
   - Remove the fixing metal (XM2Z-0022).

b. Assembly

Follow the steps for disassembly in a reversed order.

[9]. Replacement of Control Program (ROM)

Parts No: A-AK23-0900

Tools to use: IC pulling-out tool (or minus driver nominal: 4.5 × 50)

a. Disassembly

1) Remove the outer casing (2) Refer to 3-4 (1) [1] .

2) Remove the box cover (1)(Fig. 8-16).
   - Remove seven cross-recessed pan head small screws (Sems A)/ M4 × 8.

3) Remove the ROM from the control board using the IC pulling-out tool.

Caution: • *When using a minus driver, take care not to bend pins on the ROM and not to damage the printed IC board.*

b. Assembly

Follow the steps for disassembly in a reversed order.

Caution: • *For installing the ROM onto the control board, bring the ROM and the recessed part of the IC socket together, and bring the ROM pins to meet the socket.*

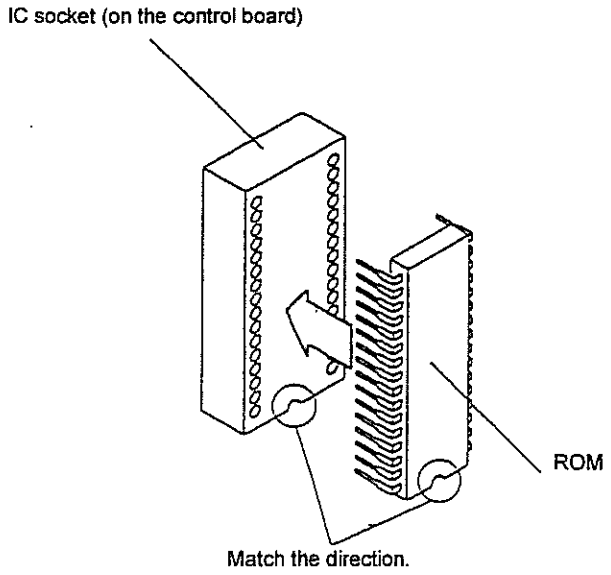


Figure 3-38 Replacement of Control Program (ROM)

[10] Exhaust Unit (Appendix "Exploded View/Parts List," Fig. 9-8)

Tools to use: Phillips screw driver (ISO No.2)
Socket driver (for M4)

Refer to Fig. 9 of Appendix "Exploded View/Parts List."

a. Disassembly

1) Remove the outer casing (2) and the rear panel. Refer to 3-4 (1) [1] , [3].
2) Remove the box cover (1).
   • Remove seven cross-recessed pan head small screws (Sems A)/ M4 × 8.
3) Remove the connector on the control board.
   • CN18 (exhaust fan unit)
4) Remove the exhaust unit.
   • Remove four cross-recessed pan head small screws (Sems B)/ M4 × 8.
5) Remove the front exhaust cover (Fig. 9-2).
   • Remove eight cross-recessed pan head small screws (Sems B)/ M4 × 6.
6) Remove the exhaust fan.
   • Remove two cross-recessed pan head small screws/M4 × 15, and a cross-recessed pan head small screw/M4 × 18.

b. Assembly

Follow the steps for disassembly in a reversed order.

[11] Dryer (optional at the factory)

(1) Dryer Unit

Tools to use: Phillips screw driver (ISO No.2)
Spanner (nominal: 8)

Refer to Figure 11 of Appendix "Exploded View/Parts List."

a. Disassembly

1) Remove the outer casings (2) and (1). Refer to 3-4 (1) [1] , [2].

2) Remove the connector on the control board.
   - CN16

3) Remove the dryer top cover from the dryer (Fig. 11-1).
   - Remove eight cross-recessed pan head screws (Sems B)/ M4 × 8.

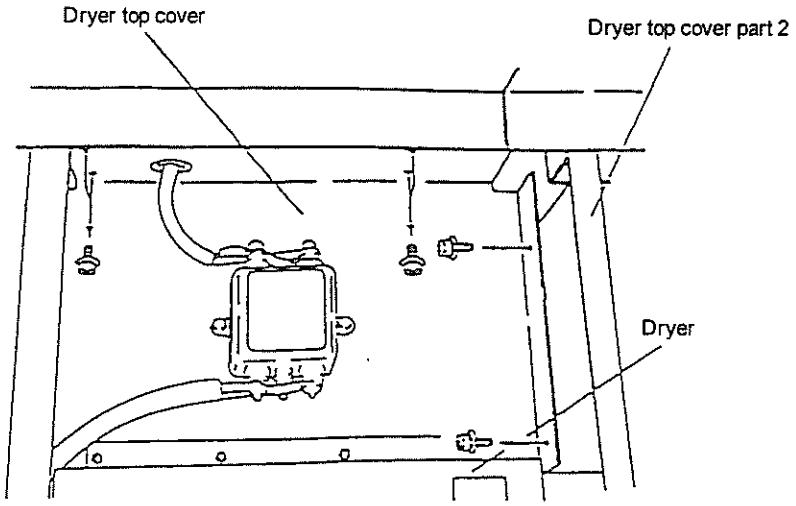


Figure 3-39 Removal of the Dryer Top Cover

4) Remove the dryer top cover part 2 (Fig. 11-13).
   • Remove two cross-recessed pan head small screws (Sems B)/ M4 × 8.

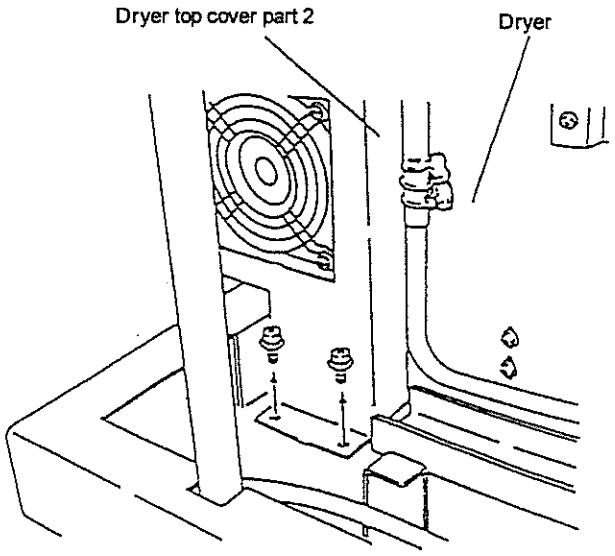


Figure 3-40 Removal of the Dryer Cover Part 2

5) Remove the dryer unit.
   • Remove three upset hex bolts SW, with a washer, M5 × 10.

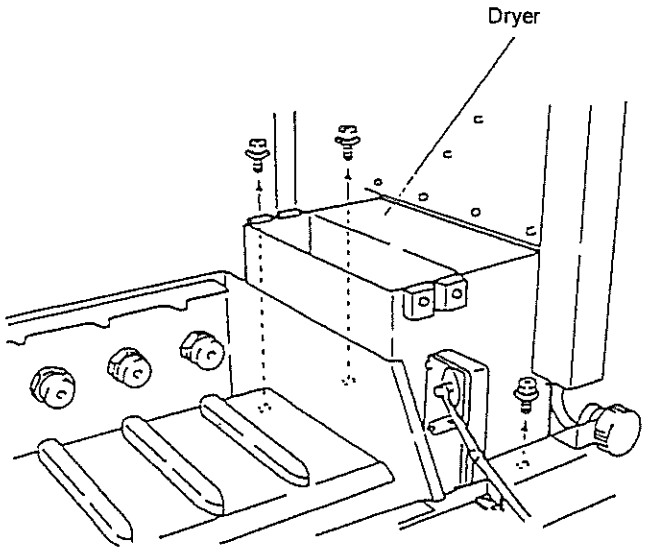


Figure 3-41 Removal of the Dryer

b. Assembly

Follow the steps for disassembly in a reversed order.

Caution: when fixing the dryer unit to the base bottom, press the dryer to the right side of the lower tray to fix it.

[2] Dryer Temperature Sensor (Fig. 11-15)

Tools to use: Phillips screw driver (ISO No.29)
Spanner (nominal: 8)

Refer to Fig. 11 of Appendix "Exploded View/Parts List."

a. Disassembly

1) Remove the dryer unit. Refer to 3-4 (11) [1] .

2) Remove the fan installation plate (Fig. 11-10).

- Remove the wiring from the dryer terminal block and from the dryer relay unit, and remove seven cross-recessed pan head small screws/M3 × 6.

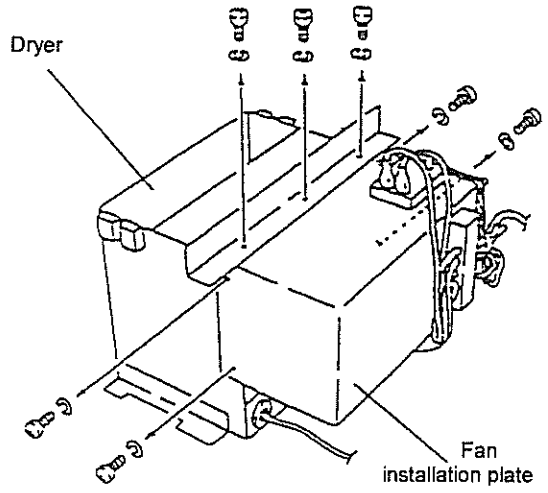


Figure 3-42 Removal of the Fan Installation Plate

3) Remove the drying heater unit.

- Remove four cross-recessed pan head small screws/M3 × 6.

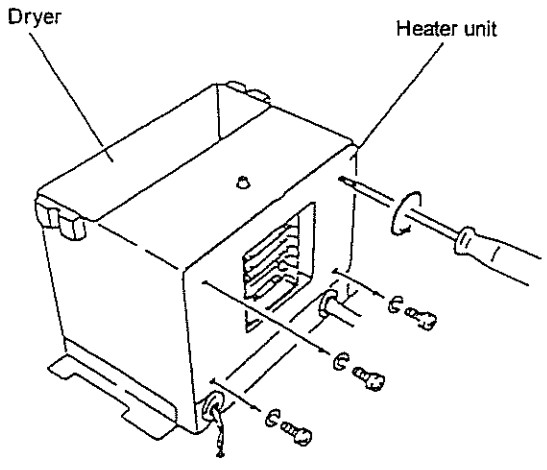


Figure 3-43 Removal of the Heater Unit

4) Remove the temperature sensor.
   • Remove four cross-recessed pan head small screws/M3 × 6.

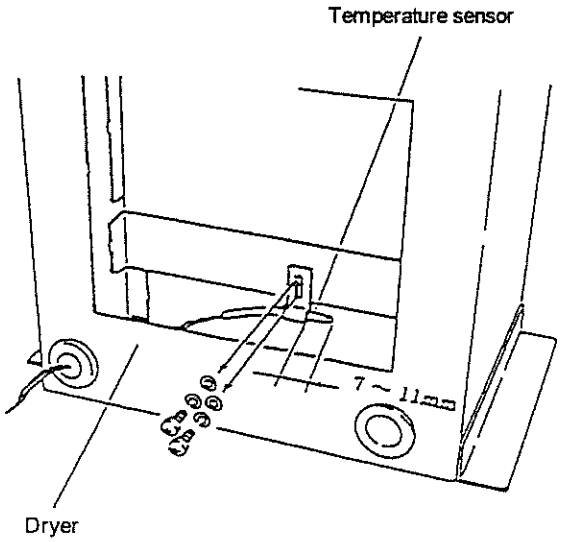


Figure 3-44 Removal of the Temperature Sensor

b. Assembly

Follow the steps for disassembly in a reversed order.

[3] OTP Unit (Fig. 11-18)

Tools to use: Phillips screw driver (ISO No.2)
Spanner (nominal: 8)
Parts: Silicon grease

Refer to Fig. 11 of Appendix "Exploded View/Parts List."

a. Disassembly

1) Remove the dryer unit. Refer to 3-4 (11) [1] .
2) Remove the fan installation plate. Refer to 3-4 (11) [2].
3) Remove the drying heater unit. Refer to 3-4 (11) [2].
4) Remove the OTP unit from the heater unit.
   • Remove two cross-recessed pan head small screws/M3 × 5.

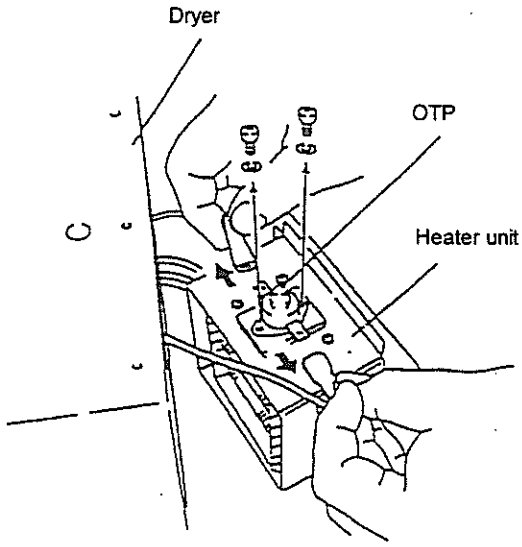


Figure 3-45 Removal of the OTP

b. Assembly

Follow the steps for disassembly in a reversed order.

Caution: Apply silicon grease onto the back of the OTP.

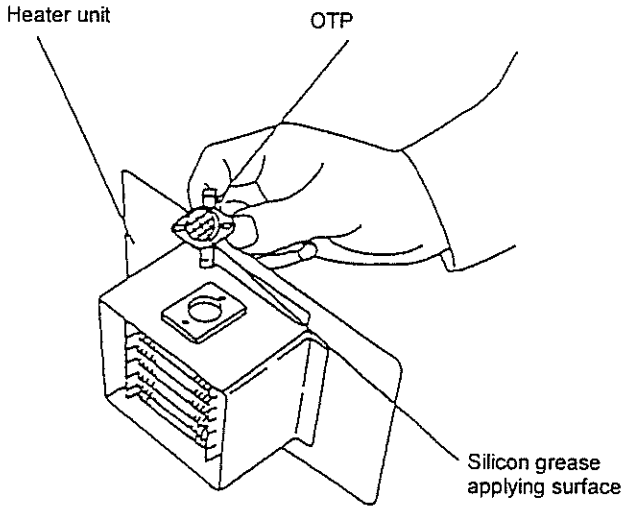


Figure 3-46 Silicon Grease Applying Surface

[4] Drying Heater (Appendix "Exploded View/Parts List," Fig. 11-6)

Tools to use: Phillips screw driver (ISO No.2)
Spanner (nominal: 8)

Refer to Fig. 11 of Appendix "Exploded View/Parts List."

a. Disassembly

1) Remove the dryer unit. Refer to 3-4 (11) [1] .
2) Remove the fan installation plate. Refer to 3-4 (11) [2].
3) Remove the drying heater unit. Refer to 3-4 (11) [2].
4) Remove the drying heater from the heater unit.
   • Remove eight cross-recessed pan head small screws/M3 × 6.

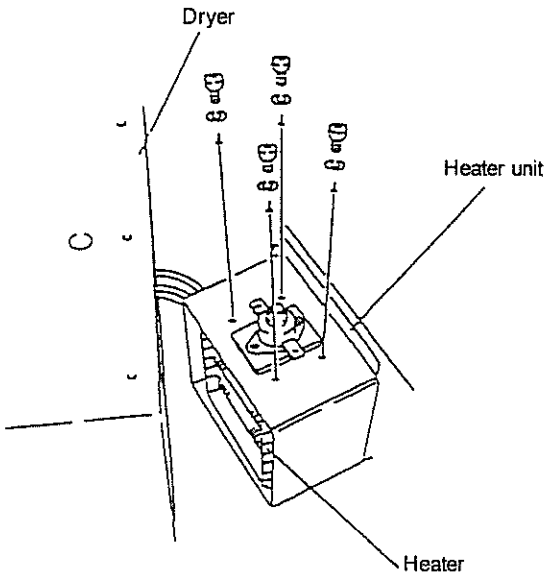


Figure 3-47 Removal of the Drying Heater

b. Assembly

Follow the steps for disassembly in a reversed order.

[5] Drying Heater Relay Unit (Appendix "Exploded View/Parts List," Fig. 11-17)

Tools to use: Phillips screw driver (ISO No.2)
Spanner (nominal: 8)

Refer to Fig. 8 and 11 of Appendix "Exploded View/Parts List."

a. Disassembly

1) Remove the outer casing (2). Refer to 3-4 (1) [1] .
2) Remove the box cover (1)(Fig. 8-6).
   • Remove seven cross-recessed pan head small screws/M4 × 8.
3) Remove the connector on the control board.
   • CN16
4) Remove the relay unit.
   • Remove two cross-recessed pan head small screws (Sems A)/M3 × 10.

b. Assembly

Follow the steps for disassembly in a reversed order.

[6] Dryer Fan Unit (Appendix "Exploded View/Parts List," Fig. 11-16)

Tools to use: Phillips screw driver (ISO No.2)
Stably phillips screw driver (ISO No.2)
Soldering iron

Refer to Fig. 11 of Appendix "Exploded View/Parts List."

a. Disassembly

1) Remove the outer casing (2). Refer to 3-4 (1) [1] .
2) Remove the connector on the control board.
   • CN16
3) Remove the wiring on the drying heater relay unit.
4) Remove the dryer cover part 2 (Fig. 11-13).
   • Remove four cross-recessed pan head small screws (Sems B)/M4 × 8.
5) Remove the dryer fan unit.
   • Remove four cross-recessed pan head small screws /M4 x35.

b. Assembly

Follow the steps for disassembly in a reversed order.

Chapter 4 Product Inspection Programs

4-1 Inspection Items of Product Inspection Programs

(1) TEST 1

1. PROPERTY
   - Set up of product default values
2. KEY SWITCHES
   - Operation panel switches
3. DISPLAY
   - LCD contrast
   - Screens
4. SENSORS
   - Cover open/close detection sensor
   - Door open/close detection sensor
   - Battery voltage detection mechanism
   - Fume fan rotation detection sensor
5. REMOTE & POWER
   - Remote alarm output
   - Power failure signal detection mechanism
6. TEMPERATURE
   - Drying station temperature control
   - Drying fan operation detection sensor
7. COMMUNICATION
   - Communication functions

(2) TEST 2

1. CARRIER
   - Automatic offset
   - Block offset
   - Manual offset
   - Offset clear
   - Carrier station transfer
   - X/Z axis stop position sensor
   - Wire continuous extension
2. MAXIMUM CURRENT
   - Measurement of maximum consumption current
3. COPY TEST PROGRAM
   - Copying test program

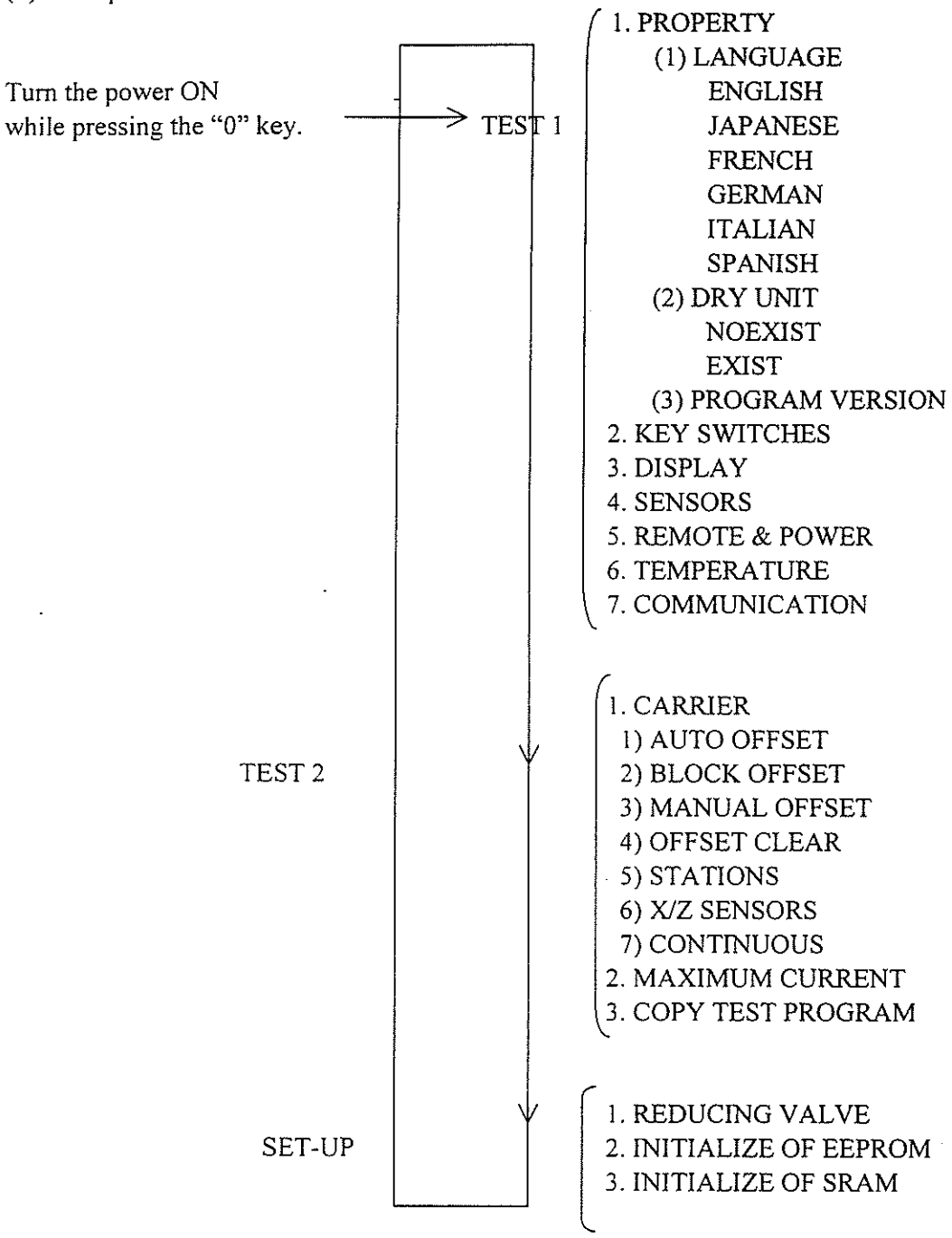
(3) SET UP

1. REDUCING VALVE
   - Up counter
   - Down counter

2. INITIALIZE OF EEPROM
   - EEPROM initialization
3. INITIALIZE OF SRAM
   - SRAM initialization
   -

4-2 Composition of Product Inspection Program:

(1) Composition:



(2) The main functions of the function keys are as follows:

* "F1" key : "SELECT" (Selection / Determination)
  "START" (Execution)
  "MEMORY" (Execution)
  "YES" (Execution)
* "F2" key : "STOP" (Stop)
* "F5" key : "NEXT" (Next screen)
  "EXIT" (Previous screen)
  "NO" (Stop)

(3) Buzzer Sound:

1. Click sound:

When any key is pressed, the sound "Pi" is generated. However, when any unacceptable key is pressed, the sound "Pi, Pi" is generated to inform the operator of the fault key entry.

2. Alarm Sound:

When the inspection was completed with some abnormalities, the alarm sound like "PiPi, PiPi, PiPi" is given for approximately 10 seconds to inform the operator of the abnormalities.

4-3 Starting Procedures of Product Inspection Program:

(1) Starting method of Product Inspection Menu Screen:

1. Turn the power switch ON while pressing the "0" key. Press on the "0" key until it sounds "Pi."
2. The menu screen for the "PRODUCT TEST 1" appears.

PRODUCT TEST 1 1. PROPERTY 5. REMOTE & POWER 2. KEY SWITCHES 6. TEMPERATURE 3. DISPLAY 7. COMMUNICATION 4. SENSORS MESSAGE: SELECT MENU (1-7)				
SELECT				NEXT

3. By pressing the "F5" key, the screen can move to the menu screen for the "PRODUCT TEST 2".

PRODUCT TEST 2 1. CARRIER 2. MAXIMUM CURRENT 3. COPY TEST PROGRAM MESSAGE: SELECT MENU (1-3)				
SELECT				NEXT

4. By pressing the "F5" key, the screen can move to the menu screen for the "PRODUCT SET-UP".

PRODUCT SET-UP 1. REDUCING VALVE 2. INITIALIZE OF EEPROM 3. INITIALIZE OF SRAM MESSAGE: SELECT MENU (1-7)				
SELECT				NEXT

5. By pressing the "F5" key, the screen returns to the menu screen for the "PRODUCT TEST 1".

6. The Product Inspection Program ends by turning the power OFF.

* Each inspection item can be selected by pressing the "F1" key after the cursor was moved by the arrow key or by directly keying a numerical key.

4-4 Details of Product Inspection Program

4-4-1 TEST 1

(1) PROPERTY

* Set up of product defaults (language and optional drying station).
* Verification of the ROM version loaded on the instrument.

1. Test content
   a. Set up of language
   b. Set up for presence of drying station
   c. Verification of the ROM version loaded on the instrument.
2. Program
   a. Set up the language to be used and write it into the EEPROM.
   b. Set up the presence or absence of the drying station and write it into the EEPROM
   c. The ROM version loaded on the instrument is displayed.

3-1. Procedure for setting up the language

(1) By selecting "1. PROPERTY", the display moves to the following sub menu screen.

PRODUCT TEST 1 - PROPERTY -				
1. LANGUAGE				
2. DRY UNIT				
3. PROGRAM VERSION				
MESSAGE: SELECT MENU (1-3)				
SELECT				EXIT

(2) Select "1. LANGUAGE" to move the display to the next one. Select an appropriate language to be used on the instrument by using the up and down arrow key. The order of language is ENGLISH JAPANESE GERMAN FRENCH SPANISH ITALIAN ENGLISH (return to the first).

PRODUCT TEST 1 < LANGUAGE >				
ENGLISH				
MESSAGE: SELECT COMMAND				
MEMORY				EXIT

(3) Write the selected language into the EEPROM by pressing the "F1" key.

PRODUCT TEST 1 < LANGUAGE > ENGLISH MESSAGE: WRITING				

After the writing is properly completed, the following screen appears.

PRODUCT TEST 1 < LANGUAGE > ENGLISH COMPLETE MESSAGE: SELECT COMMAND				
				EXIT

If the writing is abnormally completed, the following screen will appear.

PRODUCT TEST 1 < LANGUAGE > ENGLISH ERROR MESSAGE: SELECT COMMAND				
				EXIT

(4) Press the "F5" key twice to return to the menu screen of "PRODUCT TEST 1."

3-2. Procedure for setting up presence or absence of the drying station

(1) By selecting "1. PROPERTY", the display moves to the following sub menu screen.

PRODUCT TEST 1 - PROPERTY - 1. LANGUAGE 2. DRY UNIT 3. PROGRAM VERSION MESSAGE: SELECT MENU (1-3)				
SELECT				EXIT

(2) Select "2. DRY UNIT" to start the inspection.. Select either "EXIST" or "NOEXIST" to mate the drying station with the product specification by using the right and left arrow key. The order of item is EXIST NOEXIST EXIST (return to the first).

PRODUCT TEST 1 <DRY UNIT>				
NOEXIST EXIST				
MESSAGE: SELECT COMMAND				
MEMORY				EXIT

(3) After selected, write it into the EEPROM by pressing the "F1" key.

PRODUCT TEST 1 <DRY UNIT>				
NOEXIST EXIST				
MESSAGE: WRITING				

After the writing is properly completed, the following screen appears.

PRODUCT TEST 1 <DRY UNIT>				
NOEXIST EXIST				
COMPLETE				
MESSAGE: SELECT COMMAND				
				EXIT

If the writing is abnormally completed, the following screen will appear.

PRODUCT TEST 1 <DRY UNIT>				
NOEXIST EXIST				
ERROR				
MESSAGE: SELECT COMMAND				
				EXIT

(4) Press the "F5" key twice to return to the menu screen of "PRODUCT TEST 1."

3-3. Procedure for verifying the ROM version

(1) By selecting "1. PROPERTY", the display moves to the following sub menu screen.

PRODUCT TEST 1 - PROPERTY - 1. LANGUAGE 2. DRY UNIT 3. PROGRAM VERSION MESSAGE: SELECT MENU (1-3)				
SELECT				EXIT

(2) Select the desired item by using the numeral keys or the arrow key and press the "F1" key. The inspection will start. When the "3. PROGRAM VERSION" is selected, the screen moves to the following screen.

PRODUCT TEST 1 < PROGRAM VERSION > A-AK23-0900-00-A MESSAGE: SELECT COMMAND				
				EXIT

(3) Press the "F5" key to return the sub menu screen of "1. PROPERTY."

(2) KEY SWITCHES

* Inspection of the operation panel key switches

1. Test content

   a. Check for correct functionality of operation panel key switches.

2. Program

When a key switch is pressed, the following message will appear to indicate the functionality assigned to each key.

[F1] key : "F1 KEY SWITCH OK"
[F2] key : "F2 KEY SWITCH OK"
[F3] key : "F3 KEY SWITCH OK"
[F4] key : "F4 KEY SWITCH OK"
[F5] key : "F5 KEY SWITCH OK"
[1] key : " 1 KEY SWITCH OK"
[2] key : " 2 KEY SWITCH OK"
[3] key : " 3 KEY SWITCH OK"
[4] key : " 4 KEY SWITCH OK"
[5] key : " 5 KEY SWITCH OK"
[6] key : " 6 KEY SWITCH OK"
[7] key : " 7 KEY SWITCH OK"
[8] key : " 8 KEY SWITCH OK"
[9] key : " 9 KEY SWITCH OK"
[0] key : " 0 KEY SWITCH OK"
[ ] key : " KEY SWITCH OK"
[ ] key : " KEY SWITCH OK"
[ ] key : " KEY SWITCH OK"
[ ] key : " KEY SWITCH OK"

After all the key switches have been pressed, the following message appears.

" ALL KEY SWITCHES OK"

3. Procedure

(1) Select the "2. KEY SWITCHES" in the "PRODUCT TEST 1" menu screen to move the next test screen.

PRODUCT TEST 1 - KEY SWITCHES -				
MESSAGE: SELECT COMMAND				
START				EXIT

(2) Press the "F1" key to start the functional testing. When the testing on the F1 key is completed, the following message will appear.

PRODUCT TEST 1 - KEY SWITCHES -				
F1 KEY SWITCH OK				
MESSAGE: PUSH NEXT KEY				

(3) Press the "F2" key twice to stop the procedure. The following display will appear.

(4) If the last keypress is [0] and all key testing results well, the instrument will show the following display.

PRODUCT TEST 1 - KEY SWITCHES -				
0 KEY SWITCH OK				
ALL KEY SWITCHES OK				
MESSAGE: SELECT COMMAND				
				EXIT

(5) Press the "F5" key to return to the menu screen of "PRODUCT TEST 1."

(3) DISPLAY

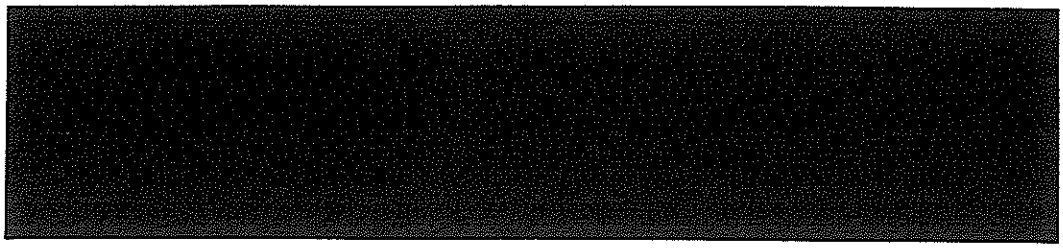
* LCD contrast
* Screens

1. Test content
   a. Check for proper LCD bright adjustment through the contrast adjustment verification screen..
   b. Check for correct functionality of the LCD by turning the screen to all white or all black.
2. Program
   a. Display a screen calling for the bright adjustment.
   b. Turn the screen to all white or all black to determine the LCD functions well.
3. Procedure

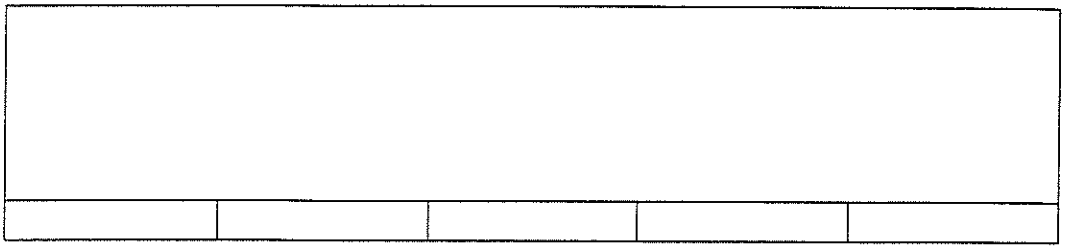
(1) Select the "3. DISPLAY" in the menu screen of "PRODUCT TEST 1" to move the next test screen.

PRODUCT TEST 1 - DISPLAY -				
FIRST : MAKE SURE CONTRAST IS GOOD.				
SECOND: PUSH F1 KEY.				
MESSAGE: SELECT COMMAND				
START				EXIT

(2) Press the F1 key to start the testing for the LCD. At this moment, the LCD will turn to all black.

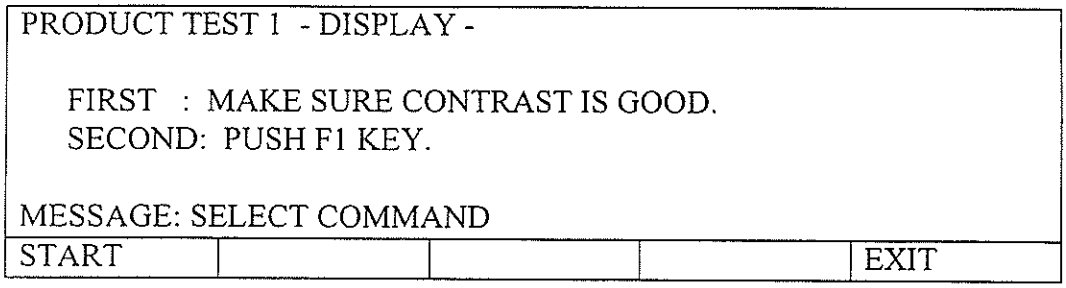


(3) Then, press the F1 key again, and the LCD will change to all white.



(4) If the LCD testing needs to be repeated, press the F1 key. (The screen will change to/from all black/all white.)

(5) If the LCD testing needs to stop halfway, press the F2 key. The following screen will appear.



(6) Press the "F5" key to return to the "PRODUCT TEST 1" menu screen.

(4) SENSORS

* Cover open/close detection sensor
* Door open/close detection sensor
* Battery voltage detection mechanism
* Fume fan rotation detection sensor

1. Test content
   a. Check for proper functionality of the cover open/close detection sensor.
   b. Check for correct functionality of the door open/close detection sensor
   c. Check for proper functionality of the battery voltage detection mechanism.
   d. Check for proper functionality of the fume fan rotation detection sensor assembled to the fume fan.
2. Program
   a. By monitoring the cover open/close detection sensor, the message is displayed in the LCD screen according to the input signal. (However, other messages are also indicated in the LCD screen besides the following messages.)

CPU input signal	Message
Low	HOOD: OPEN
High	HOOD: CLOSE

   b. By monitoring the door open/close detection sensor, the message is displayed in the LCD screen according to the input signal. (However, other messages are also indicated in the LCD screen besides the following messages.)

CPU input signal	Message
Low	DOOR: OPEN
High	DOOR: CLOSE

   c. The message is displayed in the LCD screen according to the output signal from the battery detection circuit. (However, other messages are also indicated in the LCD screen besides the following messages.)

CPU input signal	Message
Low	BATTERY: OFF
High	BATTERY: ON

   d. The message is displayed in the LCD screen according to the output signal from the fume fan rotation detection sensor. (However, other messages are also indicated in the LCD screen besides the following messages.)

Sensor	Message
Fan operates	FUME FAN: ON
Fan stops.	FUME FAN: OFF

3. Procedure

(1) Select the "4. SENSORS" in the menu screen of PRODUCT TEST 1 to move the next test screen. The following screen appears.

PRODUCT TEST 1 - SENSORS -				
HOOD : CLOSE FUME FAN : ON DOOR : CLOSE BATTERY : ON				
MESSAGE: SELECT COMMAND				
				EXIT

(2) At this time, depending on the output signal from each sensor, different messages are displayed.

If the cover is open, the following screen will appear.

PRODUCT TEST 1 - SENSORS -				
HOOD : OPEN FUME FAN : ON DOOR : CLOSE BATTERY : ON				
MESSAGE: SELECT COMMAND				
				EXIT

If the cover is closed, the following screen will appear.

PRODUCT TEST 1 - SENSORS -				
HOOD : CLOSE FUME FAN : ON DOOR : CLOSE BATTERY : ON				
MESSAGE: SELECT COMMAND				
				EXIT

If the door is open, the following screen will appear.

PRODUCT TEST 1 - SENSORS -				
HOOD : CLOSE FUME FAN : ON DOOR : OPEN BATTERY : ON				
MESSAGE: SELECT COMMAND				
				EXIT

If the door is closed, the following screen will appear.

PRODUCT TEST 1 - SENSORS -				
HOOD : CLOSE FUME FAN : ON DOOR : CLOSE BATTERY : ON				
MESSAGE: SELECT COMMAND				
				EXIT

If the remaining battery voltage is 3.0V or more, the following screen will appear.

PRODUCT TEST 1 - SENSORS -				
HOOD : CLOSE FUME FAN : ON DOOR : CLOSE BATTERY : ON				
MESSAGE: SELECT COMMAND				
				EXIT

If the remaining battery voltage is 2.9V or less, the following screen will appear.

PRODUCT TEST 1 - SENSORS -				
HOOD : CLOSE FUME FAN : ON DOOR : CLOSE BATTERY : OFF				
MESSAGE: SELECT COMMAND				
				EXIT

If the fume fan rotation detection sensor receives an operation signal, the following screen will appear.

PRODUCT TEST 1 - SENSORS -				
HOOD : CLOSE FUME FAN : ON DOOR : CLOSE BATTERY : ON				
MESSAGE: SELECT COMMAND				
				EXIT

If the fume fan rotation detection sensor receives a stop signal, the following screen will appear.

PRODUCT TEST 1 - SENSORS -				
HOOD : CLOSE FUME FAN : OFF DOOR : CLOSE BATTERY : ON				
MESSAGE: SELECT COMMAND				
				EXIT

(3) By pressing the F5 key, the screen returns to the menu screen of PROTUCT TEST 1.

(5) REMOTE & POWER

* Remote alarm output
* Power failure detection mechanism

1. Test content
   a. Check to verify if a remote alarm signal can be properly outputted between the terminal No. 3 and the terminal No. 4 and also between the terminal No. 3 and the terminal No. 5 (external alarm ports) in the External Signal Terminal Block Unit.
   b. Check to verify if a signal inputted to between the terminal No. 1 and the terminal No. 2 (power failure detecting ports) can be properly detected.
2. Program
   a. Corresponding to the key operation, the instrument controls the circuit between the terminal No. 3 and the terminal No. 4 or between the terminal No. 3 and the terminal No. 5 in the External Signal Terminal Block Unit.

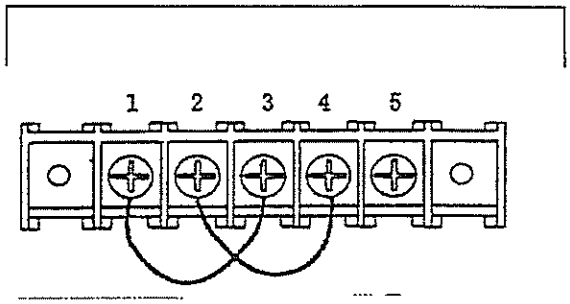
      By the keypress on the F1 key, the circuit between the terminal No. 3 and the terminal No. 4 is open (OPEN) and between the terminal No. 3 and the terminal No. 5 is short-circuited (CLOSE).
      By the keypress on the F2 key, the circuit between the terminal No. 3 and the terminal No. 4 is short-circuited (CLOSE) and between the terminal No. 3 and the terminal No. 5 is open (OPEN).

   b. By monitoring the input signal to the power failure detecting terminals, the instrument displays the message in the LCD screen according to the input signal.

Between No1 terminal and No. 2 terminal	CPU input signal	Message
Short circuit	Low	POWER ON
Open	High	POWER FAILURE

3. Procedure

In order for the above two test items to be checked at the same time, connect the terminals in the External Signal Terminal Block Unit by using two wires as shown on the right hand.



(1) Select "5. REMOTE & POWER" in the menu screen of PRODUCT TEST 1 to move to the next test screen.

PRODUCT TEST 1 - REMOTE & POWER -				
TER. 3 - 4 : CLOSE POWER : POWER ON TER. 3 - 5 : OPEN				
MESSAGE: SELECT COMMAND FOR TER. 3 – 4.				
OPEN	CLOSE			EXIT

(2) By pressing the "F1" key, check for the following indications displayed.

Terminal 3 ~ 4 --- "TER. 3 ~ 4 : OPEN"
Terminal 3 ~ 5 --- "TER. 3 ~ 5 : CLOSE"
Terminal 1 ~ 2 --- "POWER: POWER FAILURE"

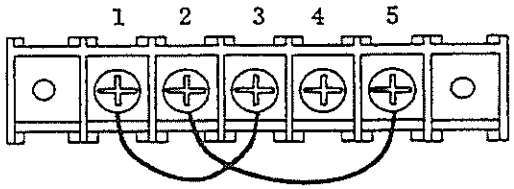
PRODUCT TEST 1 - REMOTE & POWER-				
TER. 3 - 4 : OPEN POWER : POWER FAILURE TER. 3 - 5 : CLOSE				
MESSAGE: SELECT COMMAND FOR TER. 3 – 4.				
OPEN	CLOSE			EXIT

(3) By pressing the "F2" key, check for the following indications displayed.

Terminal 3 ~ 4 --- "TER. 3 ~ 4 : CLOSE"
Terminal 3 ~ 5 --- "TER. 3 ~ 5 : OPEN"
Terminal 1 ~ 2 --- "POWER: POWER ON"

PRODUCT TEST 1 - REMOTE & POWER-				
TER. 3 - 4 : CLOSE POWER : POWER ON TER. 3 - 5 : OPEN				
MESSAGE: SELECT COMMAND FOR TER. 3 – 4.				
OPEN	CLOSE			EXIT

(4) If the above testing needs to be repeated, press the "F1" key or "F2" key.



(5) By pressing the "F5" key, the screen will return to the menu screen of PRODUCT TEST 1.

* If the terminals in the External Signal Terminal Block Unit is routed as shown on right, the indications for the "POWER" will be reversed.

(6) TEMPERATURE

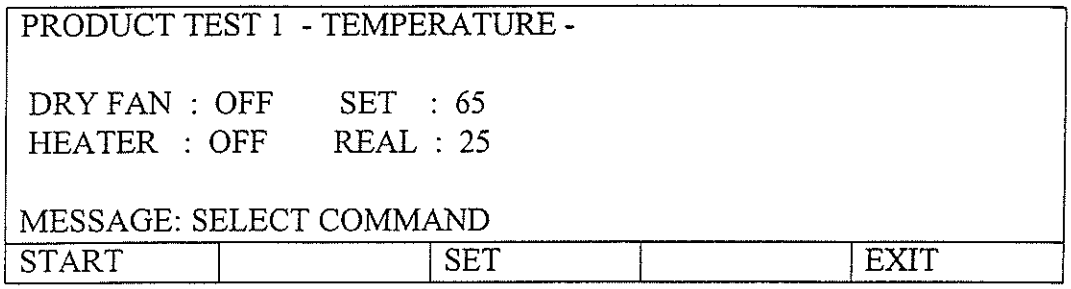
* Drying station temperature control
* Drying fan operation detection sensor

1. Test content
   a. Check for correct temperature control for the drying station.
   b. Check to verify if the drying fan and its operation detection sensor function properly.
2. Program
   a. The drying station will be controlled at the set temperature.
   b. The operation status of the drying fan and its detection sensor are displayed. (However, other messages are also indicated in the LCD screen besides the following messages.)
      The drying fan is in operation: ON
      The drying fan has been stopped: OFF
      The sensor detects the fan operating: ON
      The sensor detects the fan stopping: OFF

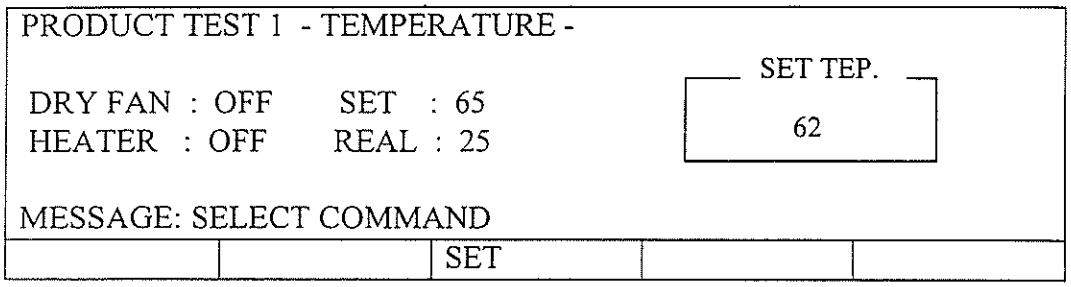
CPU input signal	Message
Low	DRY FAN : ON
High	DRY FAN : OFF

3. Procedure

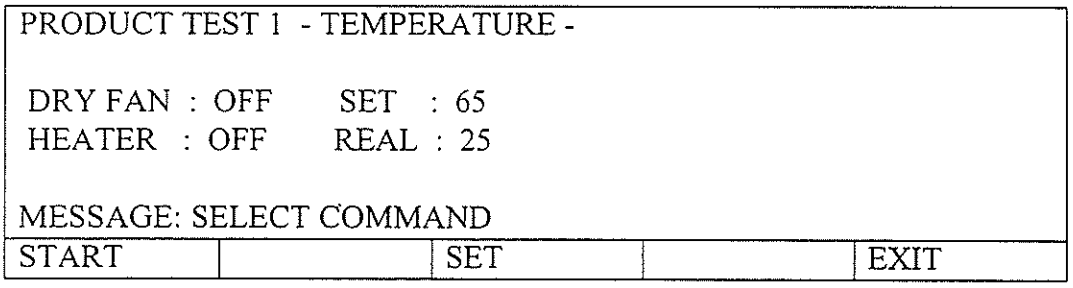
(1) Select "6. TEMPERATURE" in the PRODUCT TEST 1 menu screen to move to the next text screen.



(2) To change the set temperature, press the "F3" key. Then, key in a desired temperature by using the numeral keys.



(3) After the temperature has been keyed in, press the "F3" key to store it into memory.



(4) Press the "F1" key to activate the temperature control and the drying fan on the drying station and then to start the inspection. The status of the fan and the heater, the preset temperature and the actual temperature of the drying station are indicated on the screen.

PRODUCT TEST 1 - TEMPERATURE -				
DRY FAN : ON SET : 65 HEATER : ON REAL : 25				
MESSAGE: TESTING				
	STOP			

If any problem is found in the operation of the sensor and/or the temperature control, the following message will be displayed.

SENSOR SHORT : The sensor connector is short-circuited.
SENSOR OPEN : The sensor is not connected.
HIGH TEMP. : The measured temperature exceeds 75 .
LOW TEMP. : The drying station temperature cannot reach the preset temperature within 30 minutes.

PRODUCT TEST 1 - TEMPERATURE -				
DRY FAN : ON SET : 65 HEATER : ON REAL : 25				
MESSAGE: SENSOR SHORT				
				EXIT

(5) The inspection can be terminated by pressing the "F2" key .

PRODUCT TEST 1 - TEMPERATURE -				
DRY FAN : ON SET : 65 HEATER : ON REAL : 25				
MESSAGE: SELECT COMMAND				
START		SET		EXIT

(6) Press the "F5" key to return to the PRODUCT TEST 1 menu screen.

(7) COMMUNICATION

* Communication functions

1. Test content
   a. Check to see if the instrument can properly communicate with the optional printer box.
2. Program
   a. The data are communicated to the optional printer box. Then, the printer box returns the data to the instrument. The CPU verifies if the same date have been returned to the instrument.

Verification result	Message	Alarm
Correct	COMPLETE	---
Abnormal	ERROR	The buzzer sounds.

3. Procedure

(1) Select "7. COMMUNICATION" in the PRODUCT TEST 1 menu screen to display the following screen.

PRODUCT TEST 1 - COMMUNICATION -				
MESSAGE: SELECT COMMAND				
START				EXIT

(2) Press the "F1" key to start the testing.
At this moment, the "F2" key will stop the testing.

PRODUCT TEST 1 - COMMUNICATION -				
MESSAGE: TESTING				
	STOP			

(3) When the testing has been correctly completed, the following display will appear.

PRODUCT TEST 1 - COMMUNICATION -				
COMPLETE				
MESSAGE: SELECT COMMAND				
				EXIT

(4) If any abnormality is detected, the alarm will sound and the following display will appear.

PRODUCT TEST 1 - COMMUNICATION -				
ERROR				
MESSAGE: SELECT COMMAND				
START				EXIT

(5) By pressing the "F5" key, the screen will return to the PRODUCT TEST 1 menu screen.

4-4-2 TEST 2

(1) CARRIER
* Automatic Offset
* Block Offset
* Manual Offset
* Offset Clear
* Carrier Station Transfer
* X/Z Axis Stop Position Sensor
* Wire Continuous Extension

1 Test Contents:

a. Automatic Offset

The following rectifications are automatically performed to correctly transfer the carrier:
* Pitch between the 1st floor and the 2nd floor
* Z axis stroke (Stroke between the lower sensor on the 1st floor and the upper sensor on the 2nd floor)
* X axis pitch (Pitches of slits at the X axis stop position at each station)

b. Block Offset

The standard positions on the X/Z directions are set by block to rectify the scattering of the stations at the product assembly. - CHECKS ALIGNMENT FOR EACH QUADRANT STA 4 - 11 - 21 - BAYOR NEVER OFFSET > 2MM OR FAILURE ERROR WILL OCCUR.

c. Manual Offset

If any defects on the carrier transfer should occur after the Block Offset was set, the standard positions on the X/Z directions for all stations within the block can be rectified manually.

d. Offset Clear

The set offset contents are returned to the default values.

e. Carrier Station Transfer

It is verified if the carrier correctly stops at each station position and if the baskets can smoothly transfer without hitting solution reservoirs/wash reservoirs during the operations of picking and placing the baskets.

f. X/Z Axis Stop Position Sensor

It is verified if the X/Z axis stop position sensor correctly functions. It is verified if the LCD display shows "Sensor : ON" at each slit stop position.

g. Wire Continuous Extension

The carrier is continuously moved to remove the loosing of the wire.

2 Program

a. Automatic Offset

The following items are automatically measured and the measurements are written into the EEPROM. Also, all measurements are checked if these values are within the acceptable range. Then, the results appear in the screen.

Measuring items by the Automatic Offset:

Items	Set Contents
Pitch between the 1st floor and the 2nd floor	Measuring value *1
Stroke of the upper sensor and the lower sensor on the 1st floor	Measuring value *1
Stroke of the upper sensor and the lower sensor on the 2nd floor	Measuring value *1
1st station : pitch of the slit at the X axis stop position	Measuring value *1
28th station : pitch of the slit at the X axis stop position	Measuring value *1

*1 : Depends on the assembling accuracy.

Message and buzzer relations:

Result	Message	Buzzer
Pass	"COMPLETE"	-
Fail	"ERROR"	Alarm sound

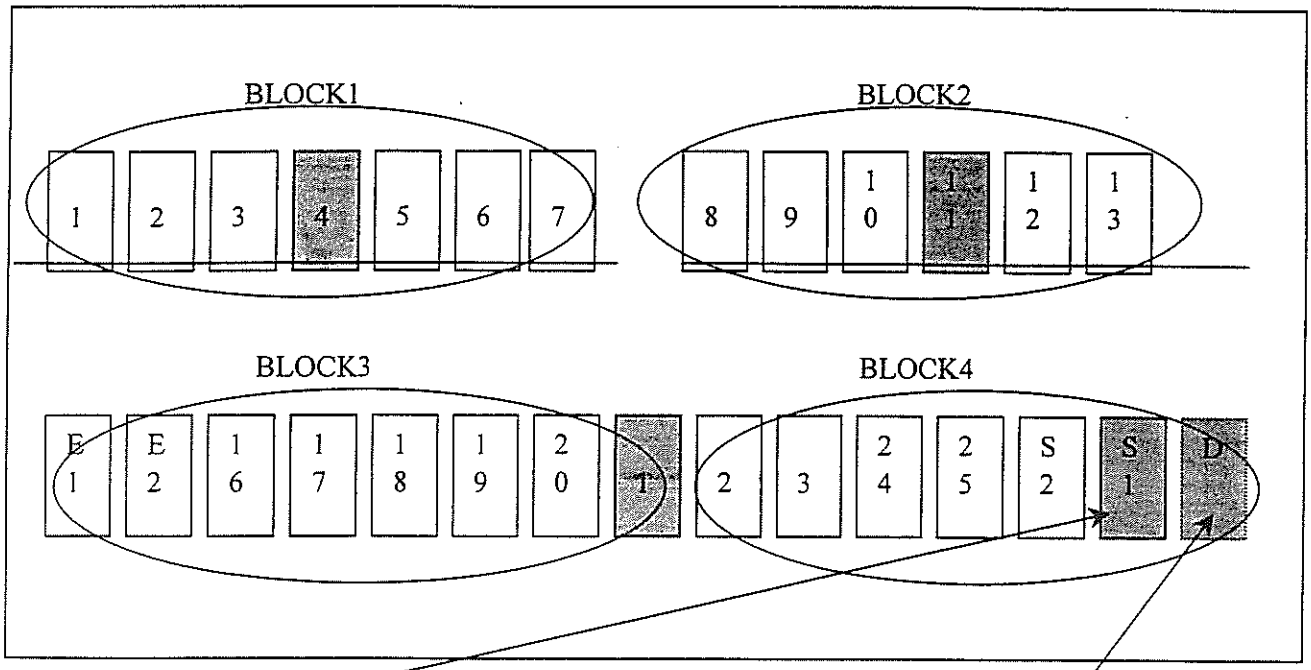
b. Block Offset:

Inside the instrument is 4 blocks as shown below and is automatically measured. The offset value of the X/Z direction measured at the specified station within the block is written in the EEPROM. The value is reflected to all stations within the block.

Also, it is verified if the values are within the acceptable range on all items as well as the automatic offset and the results appear in the screen.

The block offset needs to be done if any problem occurs in the automatic offset.

Block description inside instrument



Measuring items of Block Offset:

Item	Set Content
Block 1 : X directional standard position	Measuring value *1
Block 4 : X directional standard position	Measuring value *1
Block 1 : Z directional standard position	Measuring value *1
Block 4 : Z directional standard position	Measuring value *1

*1 : Depending on the assembling accuracy

c. Manual Offset:

The standard position of the X/Z directions at each station can be manually adjusted. The inspection items shown below are all manually measured and the values are written into the EERPOM.

The manual offset needs to be done if any problem occurs in the automatic offset and the block offset.

Measuring items of Manual Offset:

Item	Set Content
The upper position on the 2nd floor	Measuring value *1
The upper position on the 1st floor	Measuring value *1
1st station : X axis offset	Measuring value *1
28th station : X axis offset	Measuring value *1
1st station : Z axis offset	Measuring value *1
28th station : Z axis offset	Measuring value *1

*1 : Depending on the assembling accuracy

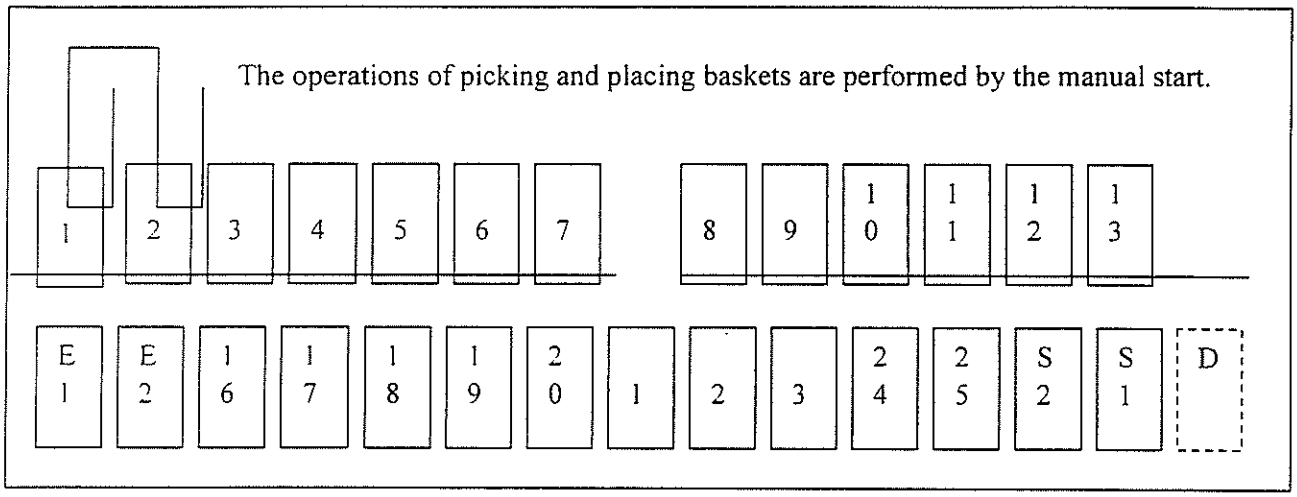
d. Offset Clear

The set offset values are returned to the default values.

e. Carrier Station Transfer

It is verified if the carrier correctly stops at each station position and if the baskets can smoothly transfer without hitting solution reservoirs/wash reservoirs during the operations of picking and placing the baskets.

Transfer Pattern:



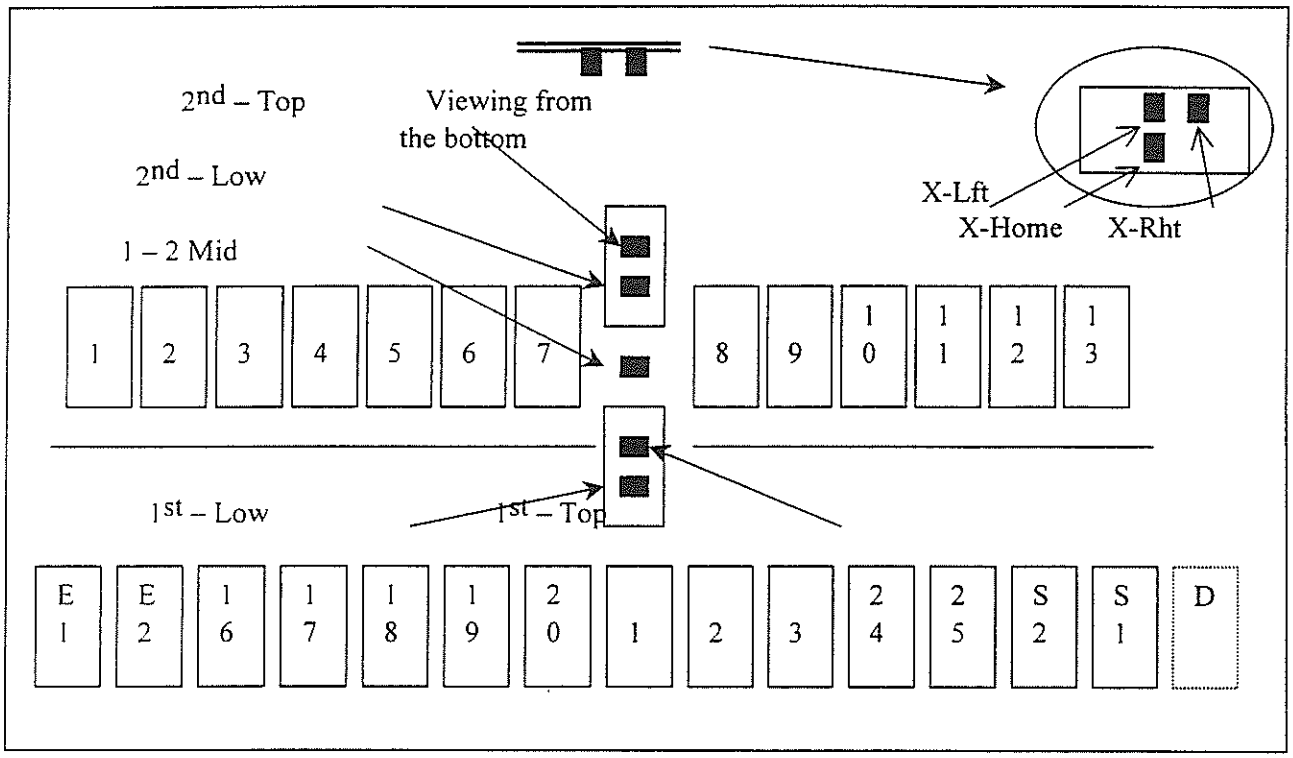
f. X/Z Axis Stop Position Sensor

The operations of the sensors which detect the stop position on the X axis or the Z axis appear on the screen. When the indication on the screen is ON (when the instrument see the fixed position), the buzzer is given. While the arrow key is being pressed, the carrier is moving to the arrow key direction.

Description	CPU Port	Low	High
X-Home	P80	ON *1	OFF
X-Lft	P84	ON *1	OFF
X-Rht	P51	ON *1	OFF
2nd-Top	P81	OFF	ON *2
2nd-Low	P52	OFF	ON *2
1st-Top	P87	OFF	ON *2
1st-Low	P53	OFF	ON *2
1-2Mid	P70	OFF	ON *2

*1 : The indication "ON" appear when the sensor transmits a light.
*2 : The indication "ON" appear when the sensor shields a light.

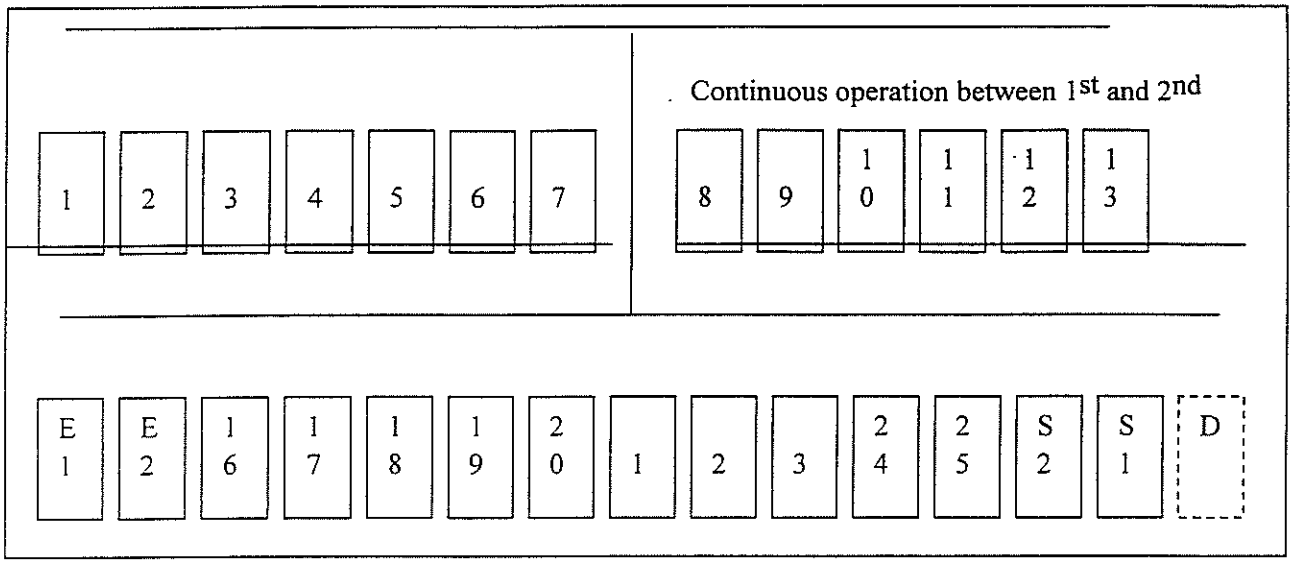
Descriptions of the X/Z axis sensors:



g. Wire Continuous Extension

The X/Z axis motor continuously operates. Also, the operated time in this test appears.

Movement pattern of wire extension operation



-1 Details of Automatic Offset

(1) When the number 1 "Carrier" is selected in the menu screen of the PRODUCT TEST 2, the following sub screen appears:

PRODUCT TEST 2 - CARRIER -				
(1) AUTO OFFSET 5. STATIONS				
(2) BLOCK OFFSET 6. X/Y STOP SENSORS				
(3) MANUAL OFFSET 7. CONTINUOUS				
(4) OFFSET CLEAR				
MESSAGE: SELECT MENU (1-7)				
SELECT				EXIT

(2) When the number 1 "AUTO" is selected, the following screen appears:

PRODUCT TEST 2 AUTO OFFSET				
MESSAGE: SELECT COMMAND				
SELECT				EXIT

(3) When the "F1" key is pressed, the inspection item "Pitch between the 1st floor and the 2nd floor" starts to measure and the value appears in the screen. The inspection can be stopped by pressing the "F2" key.

PRODUCT TEST 2 AUTO OFFSET 1. STAIR ADJUST STANDARD = 294.8256 mm (004176 p) MEASURE = 294.8962 mm (004177 p) MESSAGE: MEASURING

	STOP			

(4) Upon completion of the measurement, the next inspection item "Z axis stroke" starts to measure and the value appears in the screen. The inspection can be stopped by pressing the "F2" key.

PRODUCT TEST 2 AUTO OFFSET 2. Z STROKE STANDARD = 133.9282 mm (001897 p) MEASURE (2) = 134.1400 mm (001900 p) MEASURE (1) = 127.0800 mm (001800 p) MESSAGE: MEASURING

	STOP			

(5) Upon completion of the measurement, the next inspection item "X axis stroke" starts to measure and the value appears in the screen. The inspection can be stopped by pressing the "F2" key.

PRODUCT TEST 2 AUTO OFFSET 3. X PITCH STANDARD (27) = 059.9394 mm (00849 p) MEASURE (27) = 060.0100 mm (00850 p) MESSAGE: MEASURING

	STOP			

(6) Upon completion of the above inspections and if the measurements are all fallen into the acceptable ranges, the following screen appears:

PRODUCT TEST 2 AUTO OFFSET				
MEASURE STROKE IS COMPLETE				
MESSAGE: SELECT COMMAND				
				EXIT

If the measurements are not fallen into the acceptable range, the following screen appears:

PRODUCT TEST 2 AUTO OFFSET				
MOTION ERROR NO. 10				
MESSAGE: SELECT COMMAND				
START				EXIT

(7) When the "F5" key is pressed, it returns to the sub menu screen.

-2 Details of Block Offset:

(1) When the number 1 "Carrier" is selected in the menu screen of the PRODUCT TEST 2, the following sub screen appears:

PRODUCT TEST 2 - CARRIER -				
1. AUTO OFFSET 5. STATIONS				
2. BLOCK OFFSET 6. MANUAL OPERATE				
3. MANUAL OFFSET 7. X/Z STOP SENSORS				
4. OFFSET CLEAR 8. CONTINUOUS				
MESSAGE: SELECT MENU (1-8)				
SELECT				EXIT

* "F1" key means the determination of the menu item.
* "F5" key means to return to the previous screen.
* "Arrow" key means to move the menu items.

(2) When the number 2 is selected, the following screen appears:

When the drying station is not provided.

PRODUCT TEST 2 BLOCK OFFSET				
BLOCK1 [Sta. 04] BLOCK3 [Sta. 21] BLOCK2 [Sta. 11] BLOCK4 [Sta. 27]				
MESSAGE: SELECT COMMAND				
SELECT	HOME			EXIT

When the drying station is provided.

PRODUCT TEST 2 BLOCK OFFSET				
BLOCK1 [Sta. 04] BLOCK3 [Sta. 21] BLOCK2 [Sta. 11] BLOCK4 [Sta. 28]				
MESSAGE: SELECT COMMAND				
SELECT	HOME			EXIT

* "F1" key means the determination of the block.
* "F2" key means to transfer the carrier to the HOME POSITION.
* "F5" key means to return to the previous screen.
* "Arrow" key means to move the items.

(3) The block to be set is selected by the Arrow key and the "F1" key is pressed. (In the above example, the "Block 1" is selected. The carrier transfers to the station selected.

(4) Fine adjustments of the X/Z directions to the carrier standard position is made by the Arrow key.

PRODUCT TEST 2 BLOCK OFFSET				
X_OFFSET [04] = 001p / +0.0706 mm Z_OFFSET [04] = 002p / +0.1412 mm				
MESSAGE: SELECT COMMAND				
X/Z	CLEAR	CHECK	SAVE	EXIT

* "F1" key means to switch the X Offset to Z Offset or vise versa.
* "F2" key means that the offset value is set to the default value.
* "F3" key means up & down movements of the arm (when it is verified by moving the carrier up & down).
* "F4" means to write the set value to EEPROM.
*"F5" key means to return to the block selection screen.
* "Arrow" key means to move the carrier.

(5) The above procedures 2-4 are repeated for the other block settings.

(6) When the "F5" is selected, it returns to the sub menu screen.

-3 Details of Manual Offset

(1) When the number 1 "Carrier" is selected in the menu screen of the PRODUCT TEST 2, the following sub screen appears:

PRODUCT TEST 2 - CARRIER -				
1. AUTO BLOCK OFFSET 5. STATIONS				
2. BLOCK OFFSET 6. X/Z STOP SENSORS				
3. MANUAL OFFSET 7. CONTINUOUS				
4. OFFSET CLEAR				
MESSAGE: SELECT MENU (1-7)				
SELECT				EXIT

* "F1" key means the determination of the menu item.
* "F5" key means to return to the previous screen.
* "Arrow" key means to move the menu items.

(2) When the "3. MANUAL OFFSET" is selected, the following screen appears:

PRODUCT TEST 2 MANUAL OFFSET				
PRESENT STA. = 1				
X AXIS POS. = CENTER				
Z AXIS POS. = TOP				
SENSOR COUNT = 000p				
MESSAGE: SELECT COMMAND				
SELECT	HOME			EXIT

* "F1" key means the determination of the station to be offsetted.
* "F2" key means to move to the HOME POSITION.
* "F5" key means to return to the previous screen.
* " " key means to move the carrier to the 2nd floor if the carrier is located in the 1st floor.
* " " key means to move the carrier to the 1st floor if the carrier is located in the 2nd floor.
* " " key means to move the carrier to the left station.
* " " key means to move the carrier to the right station.

However, if the " " key is pressed when the carrier is located to the HOME POSITION on the 2nd floor, the carrier moves to the 1st station.

(3) The carrier is moved to the station to be set by the "Arrow" key.

(4) When the "F1" key is pressed, the station position is determined. The screen moves to the next screen.

When the station 21 is selected:

PRODUCT TEST 2 MANUAL OFFSET				
X_OFFSET [21] = 001p / +0.0706 mm Z_BASE [21] = 002p / +0.1412 mm				
MESSAGE: SELECT COMMAND				
X/Z	CLEAR	CHECK	SAVE	EXIT

*"F1" key means to switch the X Offset to Z Base or vise versa.
* "F2" key means that the offset value is set to the default value.
* "F3" key means up & down movements of the arm (when it is verified by moving the carrier up & down).
* "F4" means to write the set value to EEPROM.
*"F5" key means to return to the previous screen.
* "Arrow" key means to move the carrier to the arrow direction.

(5) The above procedures 3-4 are repeated for setting the MANUAL OFFSET of the other stations.

(6) When the "F5" key is pressed, it returns to the sub menu screen.

-4 Details of OFFSET CLEAR:

(1) When the number 1 "Carrier" is selected in the menu screen of the PRODUCT TEST 2, the following sub screen appears:

PRODUCT TEST 2 - CARRIER -				
1. AUTO OFFSET 5. STATIONS 2. BLOCK OFFSET 6. X/Z STOP SENSORS 3. MANUAL OFFSET 7. CONTINUOUS 4. OFFSET CLEAR				
MESSAGE: SELECT MENU (1-7)				
SELECT				EXIT

* "F1" key means the determination of the menu item.
* "F5" key means to return to the previous screen.
* "Arrow" key means to move the menu items.

(2) When the "4. OFFSET CLEAR" is selected, the following screen appears:

PRODUCT TEST 2 OFFSET CLEAR				
Z_STROKE & X_PITCH X_OFFSET & Z_BASE				
MESSAGE: ARE YOU SURE ?				
YES				NO

(3) The items to be returned to the default values are selected by the "Arrow" key (,).

Automatic offset : Z_STROKE & X_PITCH
Block, Manual offset : X_OFFSET & Z_BASE

(4) Pressing the "F1" key moves to the next reconfirmation screen.

PRODUCT TEST 2 OFFSET CLEAR				
Z_STROKE & X_PITCH X_OFFSET & Z_BASE				
MESSAGE: SELECT COMMAND				
CLEAR				EXIT

(5) Pressing the "F1" key returns the selected values to the default values.

(6) When the "F5" key is pressed, it returns to the menu screen of the "CARRIER".

-5 Details of Carrier Station Transfer:

(1) When the number 1 "Carrier" is selected in the menu screen of the PRODUCT TEST 2, the following sub screen appears:

PRODUCT TEST 2 - CARRIER -				
1. AUTO OFFSET 5. STATIONS				
2. BLOCK OFFSET 6. X/Z STOP SENSORS				
3. MANUAL OFFSET 7. CONTINUOUS				
4. OFFSET CLEAR				
MESSAGE: SELECT MENU (1-7)				
SELECT				EXIT

(2) When the "5. STATIONS" is selected, the following screen appears:

If the carrier is positioned in the 2nd floor, the carrier moves to the HOME POSITION in the 2nd floor. If the carrier is located in the 1st floor, the carrier moves to the HOME POSITION in the 1st floor.

When the carrier is positioned to the station 21.

PRODUCT TEST 2 STATIONS				
CURRENT STA = 21				
MESSAGE: TESTING				
	STOP			

(3) The carrier moves in accordance with the Arrow key.

: When the carrier is located on the 1st floor, it moves to the HOME POSITION on the 2nd floor.
: When the carrier is located on the 2nd floor, it moves to the HOME POSITION on the 1st floor.
: The carrier picks up baskets from the station where it stays and places into the next station on the left hand. Then, it moves to the top position.
: The carrier picks up baskets from the station where it stays and places into the next station on the right hand. Then, it moves to the top position.
However, if the " " key is pressed when the carrier is positioned at the HOME POSITION on the 2nd floor, the carrier moves to the 1st station first. Then, it picks up baskets from 1st station and places them into the next station on the right hand before going up to the top position.

(4) The visual inspection is made at all stations (28 stations when the drying station is provided and 27 stations when the drying station is not provided) on the stop positions and baskets not being hit to the solution/wash reservoirs during picking up or placing operations.

When the " " key is pressed at the procedure 2 and the baskets are picked up at the station 21 and are placed to the station 22:

PRODUCT TEST 2 STATIONS				
CURRENT STA = 22				
MESSAGE: TESTING				
	STOP			

If any error is detected during the carrier in motion, the following screen appears:

PRODUCT TEST 2 STATIONS				
MOTION ERROR No 10				
MESSAGE: SELECT COMMAND				
	STOP			

*MOTION ERROR NO 10 : Error Number

[Actions to be taken when any error occurs]
* Actions for the error numbers are taken. (Refer to the Table below)
* The "Manual Offset" inspections are performed.

Error #	Descriptions	Actions
10	Sensor detection error	Verify the connector connection between the sensor PC board *1 and the Controller PC board.
11	Timeout error	Verify the connector connection between the sensor PC board *1 and the Controller PC board.
12	X axis HOME POSITION detection error	Verify the connector connection between the sensor PC board *1 and the Controller PC board.
13	Z axis HOME POSITION detection error	Verify the connector connection between the sensor PC board *1 and the Controller PC board.
14	X axis in motion error	Verify the connector (CN17) on the Controller PC board.
15	Z axis in motion error	Verify the connector (CN17) on the Controller PC board.

* The sensor PC board means the X axis sensor board, the Z axis upper floor sensor board or the Z axis lower floor sensor board

(5) When the "F2" key is pressed, it returns to the menu screen of the "Carrier".

PRODUCT TEST 2 - CARRIER -				
1. AUTO OFFSET 5. STATIONS				
2. BLOCK OFFSET 6. X/Z STOP SENSORS				
3. MANUAL OFFSET 7. CONTINUOUS				
4. OFFSET CLEAR				
MESSAGE: SELECT MENU (1-7)				
SELECT				EXIT

(6) After it is verified that no abnormalities has occurred during operations, the power switch is turned off to complete the inspections.

-6 Details of the X/Z Axis Stop Position Sensor

(1) When the number 1 "Carrier" is selected in the menu screen of the PRODUCT TEST 2, the following sub screen appears:

PRODUCT TEST 2 - CARRIER -				
1. AUTO OFFSET 5. STATIONS				
2. BLOCK OFFSET 6. X/Z STOP SENSORS				
3. MANUAL OFFSET 7. CONTINUOUS				
4. OFFSET CLEAR				
MESSAGE: SELECT MENU (1-7)				
SELECT				EXIT

(2) When the "6. X/Z STOP SESOR" is selected, the inspections automatically starts. When the stop position of the X/Z Axis is detected, the buzzer sound is given and the indications on each sensor appear in the screen.

PRODUCT TEST 2 X/Z STOP SENSORS				
X-Home : OFF	2^{ND} - Top : OFF	1^{ST} – Low : OFF		
X-Lft : OFF	2^{ND}- _ Low : OFF	1- 2 Mid : OFF		
X-Rht : OFF	1^{st} _ Top : OFF			
MESSAGE: SELECT COMMAND				
GO HOME				EXIT

* "F1" key means to move to the HOME POSITION.
* "Arrow " key means to move the carrier to the arrow direction.

The inspections should be performed verifying that there is no abnormalities on the carrier operations and the indications.

- When using the up and down arrow keys, be sure to move the carrier to the HOME POSITION first. If not, the arm will hit on the right or left tray.

(3) When the "F5" key is pressed, the following screen appears:

PRODUCT TEST 2 X/Z STOP SENSORS				
MESSAGE: POWER OFF				

(4) After it is verified that there is no abnormalities occurred during the operations, the power switch is turned off to complete the inspections.

-7 Wire Extension

(1) When the number 1 "Carrier" is selected in the menu screen of the PRODUCT TEST 2, the following sub screen appears:

PRODUCT TEST 2 - CARRIER -				
1. AUTO OFFSET 5. STATIONS				
2. BLOCK OFFSET 6. X/Z STOP SENSORS				
3. MANUAL OFFSET 7. CONTINUOUS				
4. OFFSET CLEAR				
MESSAGE: SELECT MENU (1-7)				
SELECT				EXIT

(2) When the number "7" is selected, the following screen appears:

PRODUCT TEST 2 CONTINUOUS				
CONTINUOUS TIME = 00:00				
MESSAGE: SELECT COMMAND				
START				EXIT

(3) When the "F1" key is pressed, the carrier continuously operates.
The time is measured during this continuous operations.

PRODUCT TEST 2 CONTINUOUS				
CONTINUOUS TIME = 00:00				
MESSAGE: SELECT COMMAND				
	STOP			

The test should last more than 15 hours to remove the initial wire extension.

(4) After it is verified that the carrier is continuously operating, the "F2" key is pressed to complete the test.
The carrier will move and place baskets in the 1st station, or the 13th station, or the 14th station, or the 27th station (or the drying station). Then, it will stop after going up to the top position at either of these stations or returning to the HOME POSITION.

PRODUCT TEST 2 - CARRIER -				
1. AUTO OFFSET 5. STATIONS				
2. BLOCK OFFSET 6. X/Z STOP SENSORS				
3. MANUAL OFFSET 7. CONTINUOUS				
4. OFFSET CLEAR				
MESSAGE: SELECT MENU (1-7)				
SELECT				EXIT

(2) MAXIMUM CURRENT

The maximum consumption current is measured.

Test Content
The maximum consumption current of the tested instrument is inspected to see if it is fallen into the regulated value.
* This mode is not used except for the factory inspection prior to the shipment.

(3) COPY TEST PROGRAM

The test program is copied.

l Inspection:
The sample staining program for testing is operated with the instruments and the carrier movements are verified at the factory prior to the shipment.
* This mode is not used except for the factory inspection prior to the shipment.

4-4-3 SET-UP

(1) REDUCING VALVE
* Up counter
* Down counter

1. Test content
   a. Up counter : The solenoid valve is controlled to inspect the flow rate of water for the wash stations.
   b. Down counter: The solenoid valve is kept open for a preset length of time to inspect the flow rate of water coming from the facility side
2. Program
   a. The screen displays the duration of time from when the solenoid valve turns open to when it is closed.
   b. After a preset length of time passes, the open solenoid valve is closed.

3-1. Details of Up Counter

(1) By selecting "1. REDUCING VALVE" in the PRODUCT SET-UP menu screen, the display moves to the following screen.

PRODUCT SET-UP - REDUCING VALVE -				
UP COUNT : 00				
MESSAGE: SELECT COMMAND				
START		UP/DOWN		EXIT

(2) When the "F1" key is pressed, the solenoid valve turns open and the up counter starts working.

PRODUCT SET-UP - REDUCING VALVE -				
UP COUNT : 01				
MESSAGE: TESTING				
	STOP			

(3) The up counter will stop and the solenoid valve will be closed by pressing the "F2" key.

PRODUCT SET-UP - REDUCING VALVE -				
UP COUNT : 15				
MESSAGE: SELECT COMMAND				
				EXIT

(4) When the "F5" key is pressed, the display will return to the first screen of REDUCING VALVE.

3-2. Details of Down Counter

(1) By selecting "1. REDUCING VALVE" in the PRODUCT SET-UP menu screen, the display moves to the following screen.

PRODUCT SET-UP - REDUCING VALVE -				
UP COUNT : 00				
MESSAGE: SELECT COMMAND				
START		UP/DOWN		EXIT

(2) The display will change to the down counter screen by pressing the "F3" key. The time of "30" seconds has been preset as a default value.

PRODUCT SET-UP - REDUCING VALVE -				
DOWN COUNT : 30				
MESSAGE: SELECT COMMAND				
START		UP/DOWN		EXIT

(3) The counting period of time is variable from 5 seconds to 60 seconds by 5 second increment and can be changed by using the arrow keys..

PRODUCT SET-UP - REDUCING VALVE -				
DOWN COUNT : 30				
MESSAGE: SELECT COMMAND				
START		UP/DOWN		EXIT

(4) When the "F1" key is pressed, the solenoid valve turns open and the down counter starts working.

PRODUCT SET-UP - REDUCING VALVE -				
DOWN COUNT : 29				
MESSAGE: TESTING				
	STOP			

(5) The key press of the "F5" key can stop the testing.

PRODUCT SET-UP - REDUCING VALVE -				
DOWN COUNT : 08				
MESSAGE: SELECT COMMAND				
				EXIT

(6) When the down counter reaches "00", the solenoid valve is closed.

PRODUCT SET-UP - REDUCING VALVE -				
DOWN COUNT : 00				
MESSAGE: SELECT COMMAND				
				EXIT

(7) When the "F5" key is pressed, the screen will return to the first screen of REDUCING VALVE.

(2) INITIALIZE OF EEPROM

* Initialization of EEPROM

1. Test content
   a. All data stored in the EEPROM are forcedly cleared.
      If this inspection is done, all of the offset values will be erased. Then, the setting procedure for the offset values described in the 4-4-2 (1) CARRIER has to be done again.
2. Program
   a. The value of "0" is written into the memory.
      - When correctly completed, the prompt of COMPLETE is displayed.
      - When abnormally completed, the prompt of ERROR is displayed with an alarm buzzer.
3. Details

(1) By selecting "2" in the PRODUCT SET-UP menu screen, the display moves to the following screen.

PRODUCT SET-UP - INITIALIZE OF EEPROM -				
MESSAGE: ARE YOU SURE?				
YES				NO

(2) When the "F1" key is pressed, the following screen appears to make sure again to execute the inspection. Pressing the "F5" key can terminate the inspection.

PRODUCT SET-UP - INITIALIZE OF EEPROM -				
MESSAGE: SELECT COMMAND				
START				EXIT

(3) By pressing the "F1" key, the inspection starts.

(4) When the inspection is correctly completed, the following screen will appear.

PRODUCT SET-UP - INITIALIZE OF EEPROM -				
COMPLETE				
MESSAGE:				
				EXIT

When abnormally completed, the following message will be displayed and an alarm buzzer will sound.

PRODUCT SET-UP - INITIALIZE OF EEPROM -				
ERROR				
MESSAGE: SELECT COMMAND				
START				EXIT

(5) By pressing the "F5" key, the display returns to the menu screen.

(3) INITIALIZE OF SRAM

* Initialization of SRAM

1. Test content
   a. The SRAM is initialized.
      If this inspection is done, all of the data that the operator has created such as user programs and solution data will be erased. Enough attention should be given to do this inspection.
2. Program
   a. The value of "0" is written into the SRAM. Then, the programs are reread out for comparison.
      - When normally completed, the prompt of COMPLETE is displayed.
      - When abnormally completed, the prompt of ERROR is displayed with an alarm buzzer.
3. Details

(1) By selecting "3" in the PRODUCT SET-UP menu screen, the display moves to the following screen.

PRODUCT SET-UP - INITIALIZE OF SRAM -				
MESSAGE: ARE YOU SURE?				
YES				NO

(2) When the "F1" key is pressed, the following screen appears to make sure again to execute the inspection. Pressing the "F5" key can terminate the inspection.

PRODUCT SET-UP - INITIALIZE OF SRAM -				
MESSAGE: SELECT COMMAND				
START				EXIT

(3) By pressing the "F1" key, the inspection starts.

(4) When the inspection is normally completed, the following screen will appear.

PRODUCT SET-UP - INITIALIZE OF SRAM -				
COMPLETE				
MESSAGE:				
				EXIT

When abnormally completed, the following message will be displayed and an alarm buzzer will sound.

PRODUCT SET-UP - INITIALIZE OF SRAM -				
ERROR				
MESSAGE: SELECT COMMAND				
START				EXIT

(5) By pressing the "F5" key, the display returns to the menu screen.

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Chapter 5 Troubleshooting

5-1 List of Troubles

(1) Troubles with an Error Number

- ERROR NO 1 SYSTEM ERROR
- ERROR NO 2 POWER FAILURE
- ERROR NO 3 MEMORY ERROR
- ERROR NO 4 BATTERY LOW: MAIN BOARD
- ERROR NO 5 EEPROM READ ERROR
- ERROR NO 6 EEPROM WRITE ERROR
- ERROR NO 10 HOOD OPEN ERROR
- ERROR NO 11 MOTOR TIME OUT
- ERROR NO 12 GO HOME X POS
- ERROR NO 13 GO HOME Z POS
- ERROR NO 14 ARM X ERROR
- ERROR NO 15 ARM Z ERROR
- ERROR NO 20 PAUSE
- ERR 30 SENSOR OPEN
- ERR 31 SENSOR SHORT
- ERR 32 TEMPERATURE LOW
- ERR 33 TEMPERATURE HIGH
- ERR 34 DRY FAN STOP
- ERR 40 PRINT TIME OUT
- ERR 41 PRINT ERROR
- ERR 42 PRINT COMM
- ERR 43 PRINTBOX BATTERY LOW
- ERR 44 RTC READ ERROR
- ERR 45 RTC WRITE ERROR
- ERR 50 FUME FAN STOP

(2) Troubles with no Error Number

- Power Supply cannot be turned on
- Stain process cannot be started
- During stain process, the process suddenly returned to the standby state
- "Error No.4 battery Low: Main Board" is not indicated, but the memory has been lost
- No key input is accepted
- The buzzer does not work
- The LCD does not light
- Water leaks from the water supply circuit
- Excessive water supply
- Insufficient water supply
- Water does not accumulate in the washing reservoir
- Water supply into the washing reservoir does not stop
- Water does not drain from the washing reservoir
- Water does not drain from the tray (right, left, bottom)
- The hood was closed, but the system does not recognize that the hood has been closed.
- The door was closed, but the system does not recognize that the door has been closed.
- Abnormal noise during arm transfer or hold
- The arm hits the solution/washing reservoir.
- The arm hits the side of the system or the solution/washing reservoir.
- The reservoir cannot be taken out from the tray. The reservoir cannot be placed to the specified position.
- Abnormal noise from the fan (exhaust, board cooling, dryer)
- No remote alarm is outputted

5-2 Troubles with an Error Number

(1) Error No.1 System Error

• Abnormality in the management of operating data was detected.

1) Probable causes

a. Noise has caused abnormality in the data in RAM1.

b. Defect in the controlling program has caused data abnormality.

c. Abnormality in RAM1 has caused abnormality in the data.
* Check RAM1 only when turning on the power supply.

2) Main tools to use in checking

• Tester

• Tools for disassembly and assembly

3) Checking of causes, and countermeasures

When any one of abnormalities mentioned above has occurred, it may be difficult for servicemen to deal with it in some cases. In such cases, please contact the manufacturer.

Provided that if abnormality is due to the probable cause a. above, it may be probable to return the system to normal operation by modifying the user registered reagent data and program data.

(2) Error No.2 Power Failure

- Power failure was detected during stain process.
- During stain process, "Power Out Failure" from UPS continued for more than five minutes.
  * When not using UPS, "Power Failure" error will immediately occur.
  * This abnormality does not occur while the system is in a standby state. If the state mentioned above occurs while some other abnormality is being occurring during a standby state, this abnormality occurs.

1) Probable causes

a. Abnormality in the facility power supply has caused power failure.

b. Abnormality in UPS has caused power failure.

c. A power failure signal "Power Out Signal" continued to reach the Nos. 1 and 2 pins (terminals to receive power failure signals from UPS) on the external signal terminal block TB-B for more than five minutes. If the system is set for "UPS is provided," CPU1 judges that the power has failed when the connection between the terminals is open, and that the power is on when the connection between them is closed.

d. The power supply was turned off during stain process.

2) Main tools to use in checking

- Tester
- Tools for disassembly and assembly

3) Checking of causes, and countermeasures

- Check the probable cause a.

  Other equipment being used in the area should also be experiencing power failure. Check them. In this case, ask for investigation of the facility power supply.

- Check the probable cause b.

  Check the condition of UPS.

  If some abnormality is observed, inspect UPS.

- Check the probable cause c.

  Check if the system is correctly set (existence of UPS).

  If not correct, execute setting again.

  If correct and UPS is provided, check the cables connected to the Nos. 1 and 2 pins on TB-B on the rear of the system (for disconnection, loose connection, etc.). If it is abnormal, repair or change the cable.

- Check the probable cause d.

  The system has no trouble. In that case, explain the correct operation of the system to the operator.

(3) Error No. 3 Memory Error

- Abnormality in RAM1 was detected during RAM checking when the power supply was turned on.

1) Probable causes

- Troubles in CPU1 and/or the memory RAM1 on the control board.

2) Main tools to use in checking

- Tools for disassembly and assembly

3) Checking of causes, and countermeasures

Turn on the power supply again. If "Memory Error" occurs again, replace the control board.

Upon turning on of the power supply, if "Memory Error" does not occur again, noise may be a probable cause for the error. Continue operation and observe the conditions of the system.

(4) Error No.4 Battery Low: Main Board

- The battery monitoring circuit in the resetting section on the control board has generated low voltage signals.

* If the power supply is turned off while this error is existing, the data set by the user will be lost.

1) Probable causes

a. The battery unit has a limited life left and its voltage to be supplied to the battery monitoring circuit has gone down to below 3V.

b. Abnormality in the battery monitoring circuit on the control board generated low voltage signals.

c. Judged as battery low voltage due to abnormality in CPU1 on the control board.

2) Main tools to use in checking

- Lead for short-circuiting terminals.
- Tools for disassembly and assembly

3) Checking of causes, and countermeasures

Replace the battery unit. If Error No.4 is cancelled, the trouble was due to the probable cause a. In this case, replace the battery unit.

If Error No.4 is not cancelled, the trouble was due to the probable cause b. or c. In this case, replace the control board.

(5) Error No.5 EEPROM Read Error

It has been tried to read data from EEPROM, but no response.

(6) Error No.6 EEPROM Write Error

It has been tried to write data into EEPROM, but no response.

1) Probable causes

a. Abnormality in EEPROM in the memory on the control board is responsible for the error.

b. Abnormality in the control board is responsible for the error.

2) Main tools to use in checking

- Tools for disassembly and assembly

3) Checking of causes, and countermeasures

Replace EEPROM, and execute "Initialize of EEPROM" in "Set Up" of the product inspection program (refer to Chapter 4-4-3 (1)). If the same error (Error No. 5 or 6) still occurs, the error was due to the probable cause a. Set data again in EEPROM replaced in the production inspection program.

If the error still occurs, the error was due to the probable cause b. Replace the control board. In this case, EEPROM on the control board in which the error has occurred may be usable, and thus check it. When replacing EEPROM, too, set data again in EEPROM.

(7) Error No. 10 Hood Open Error

- During stain process or motor driving, "Hood Open" was detected.

  * During stain process, the cover open/close detection switch unit is constantly being monitored. This error occurs if the system detects that the cover is open even if the motor is not driving. When not in stain process, this error occurs only during returning to the home position.

1) Probable causes

a. The cover opened as the operator made an erroneous operation.

b. Dislocation of the cover sensor plate caused not to press the switch unit, and it has been judged as the cover having been opened.

c. Abnormality in the cover open/close detection switch unit has caused the erroneous judgement.

d. Abnormality in CPU1 on the control board has caused the erroneous judgement

e. Abnormality in the sensor input section on the control board prevented correct transmission of cover open/close signals to CPU1.

2) Main tools to use in checking

- Tester
- Leads for short-circuiting terminals.
- Tools for disassembly and assembly

3) Checking of causes, and countermeasures

- Check the probable cause a.

  In this case, the system has no trouble. Just close the cover. Explain the operation of the system again to the operator.

- Check the probable cause b.

  With "Error No.10" being displayed, turn on/off the cover open/close switch unit using a driver.

  If "Error No.10" is cancelled when the switch is turned on, the error was due to the probable cause b. With reference to Chapter 3 3-3 (1) Adjustment of Cover Open/Close Detection Switch, adjust the position of the cover sensor plate.

- Check the probable causes c, d and e

  If "Error No.10" is cancelled when the Nos. 1 and 2 pins of CN 10 on the control are board short-circuited, and if "Error No. 10" occurs when they are open, there are no troubles in the control board.

  If so, the error was due to the probable cause c. In this case, replace the cover open/close switch unit.

  In not, the error was due to the probable cause d. or e. In this case, replace the control board.

(8) Error No. 11 Motor Time Out

- The motor was driven to return to the home position, but the sensor was not able to detect within a specified time.

* Refer to Chapter 2 Procedures to Return to the Home Position.

1) Probable causes

a. Due to motor malfunction caused by obstacles, damages in the mechanism or mal-adjustment, the home position was not detected within a specified time.

b. Due to abnormality in the sensor board or in the connection, the sensor did not respond to the slit or light screen.

c. Due to abnormality in the CPU1 on the control board, a correct judgement was not made.

d. Due to abnormality in the sensor input section on the control board, sensor board signals were not transmitted correctly.

e. Abnormality in the motor (including the cables) caused nondetection of the home position.

f. Due to abnormality in the motor control IC on the control board, the motor was not correctly controlled.

2) Main tools to use in checking

- Tester
- Tools for disassembly and assembly

3) Checking of causes, and countermeasures

- Check the probable cause a.

  Check the shaft, slide guide, LM guide, axis routes for troubles (obstacles, damages, wire dislocation, etc.) If no troubles are found, turn off the power supply, hold the basket arm base with hands, and move it over the entire range to check if it is probable to move it over the entire range easily.

  If there are troubles here, the error was due to the probable cause a. In that case, replace parts with reference to Chapter 3 3-3 (3) Carrier Unit Axis Z Position Adjustment, (4) Axis X Driving Wire Tensile Adjustment, (5) Axis Z Driving Wire Tensile Adjustment, (6) Axis Z Middle Sensor (12) Sensing Rail or 3-4 Replacement of Parts (6) Driving Section.

- Check the probable cause b.,c. or d.

  In accordance with the procedures of the product inspection program in Chapter 4, activate "Test 2 [1] Carrier Axis X/Y Stop Position Sensor."

  If the LCD display and LED display are in the state of "Sensor Transmission" when Nos. 1 and 2 pins (axis Z middle), Nos. 3 and 4 pins (axis Z lower floor lower limit), Nos.5 and 6 pins (axis Z lower floor origin), Nos. 13 and 14 pins (axis Z upper floor lower limit), Nos. 9 and 10 pins (axis Z upper floor origin), Nos. 11 and 12 pins (axis X stop position detection 2), Nos. 13 and 14 pins (axis X stop position detection 1) and Nos. 15 and 16 pins (axis X origin nearby) of CN6 on the control board are short-circuited, and if the state of "Sensor Light Screened" is displayed when they are open, there are no troubles.

  If there are no troubles, the error was due to the probable cause b. Check the connection of the sensor board, and if there are no troubles found, replace the sensor board.

If troubles are found at any point, the error was due to the probable cause c or d. Replace the control board.

LCD Display of Each Sensor and State of LED (LCD display of "ON" indicates to be at the specified point.)

Name of sensor	Sensor transmitted		Sensor light screened	
	LCD display	LD which is On	LCD display	LD which is off
Axis X origin nearby	X – Home On	LD1	X - Home Off	LD1
Axis X stop position detection 1	X-Lft On	LD2	X - Lft Off	LD2
Axis X stop position detection 2	X – Rht On	LD3	X - Rht Off	LD3
Axis Z upper floor origin	2nd - Top Off	LD4	2nd - Top On	LD4
Axis Z upper floor lower limit	2nd - Low Off	LD5	2nd - Low On	LD5
Axis Z lower floor origin	1st - Top Off	LD6	1st - Top On	LD6
Axis Z lower floor lower limit	1st - Low Off	LD7	1st - Low On	LD7
Axis Z middle	1st - 2Mid Off	LD8	1 - 2Mid On	LD8

- Check the probable cause e.

  Remove CN 17 and CN 19 from the control board, and measure the resistance between the pins of each connector.

  If the resistances of respective pins are almost of the same value (1.7 for axis X, 4.3 for axis Z, these values may change when the motor is replaced), there are no troubles. If there are troubles, the error was due to the probable cause e. In that case, replace the motor.

  No.1 pin (white) and No.3 pin (orange)

  No.1 pin (white) and No.4 pin (blue)

  No.2 pin (black) and No.5 pin (red)

  No.2 pin (black) and No.6 pin (yellow)

- Check the probable cause f.

  If no troubles are found in checking the probable cause a through e, the error may be due to the probable cause f. In that case, replace the control board, and operate the system.

(9) Error No.12 Go Home X POS

- The carrier was moved to detect the home position and stopped after detection of home position. The position on the axis X was checked immediately after the carrier stopped, and it was judged that a dislocation of position has occurred.

(10) Error No. 13 Go Home Z POS

- The carrier was moved to detect the home position and stopped after detection of home position. The position on the axis Z was checked immediately after the carrier stopped, and it was judged that a dislocation of position has occurred.

1) A dislocation of position has occurred following the stop due to maladjustment. Tools to use in checking

2) Main tools to use in confirmation

   Tools for disassembly and assembly

3) Checking of causes, and countermeasures

   Perform adjustment in accordance with Chapter 3 3-3 (3) Carrier Unit Axis Z Position Adjustment, (4) Axis X Driving Wire Tensile Adjustment, (5) Axis Z Driving Wire Tensile Adjustment, (6) Axis Z Middle Sensor and (12) Sensing Rail or 3-4 Replacement of Parts. If some troubles are found in parts, replace them in accordance with Chapter 3 3-4 (6) Driving Section. When the adjustment is performed as above, it is necessary to set the offset again. Following Chapter 4 Procedures of the Product Inspection Program, activate "Test 2 [1] Carrier" and set again the offset by automatic offset and manual offset.

(11) Error No. 14 Arm X Error

- Upon the completion or the staring of transfer along the X axis directions, the instrument judged that the carrier was not positioned to the correct position.

(12) Error No.15 Arm Z Error

- Upon the completion or the staring of transfer along the Z axis directions, the instrument judged that the carrier was not positioned to the correct position.

1) Probable causes

a. Due to a mal-adjustment of the motor caused by an overload by abnormalities of the mechanism such as damage, transformation, etc. or obstacles (regarded as an obstacle if baskets are not taken out), the carrier did not stop at the correct position.

b. A dislocation of position has occurred due to mal-adjustment.
   - Wire route and tension
   - Solution reservoir position
   - Sensor positions
   - Offset value

c. Due to motor troubles, the carrier did not stop at the correct position.

d. Due to troubles in the motor control IC on the control board, the motor was not controlled correctly.

2) Tools to use in checking

- Tester
- Tools for disassembly and assembly

3) Checking of causes, and countermeasures

- Check the probable cause a.

  Check the shaft, slide guide, LM guide, wire routes for troubles (damages, deformation, etc.) and/or obstacles. To check deformation, etc., turn off the power supply, hold the base of the basket arm, and move the carrier over the entire range of movement to check if it moves over the entire range. If it moves smoothly, it may be judged that there are no troubles. If there are troubles here, adjust the system in accordance with Chapter 3 3-3 (3) Carrier Unit X Axis Position Adjustment, (4) X Axis Driving Wire Tensile Adjustment, (5) Z Axis Driving Wire Tensile Adjustment, (6) Z Axis Middle Sensor or (12) Sensing Rail or replace parts in accordance with Chapter 3 3-4 (6) Driving Section. If any obstacles are found, remove them.

- Check the probable cause b.

  Check the position of each part if they are within the criteria values Chapter 3 3-3 (3) Carrier Unit X Axis Position Adjustment, (4) X Axis Driving Wire Tensile Adjustment, (5) Z Axis Driving Wire Tensile Adjustment, (6) Z Axis Middle Sensor or (12) Sensing Rail. If not at the correct position, the error was due to the probable cause b. Perform adjustments in accordance with Chapter 3 3-3 (3) Carrier Unit X Axis Position Adjustment, (4) X Axis Driving Wire Tensile Adjustment, (5) Z Axis Driving Wire Tensile Adjustment, (6) Z Axis Middle Sensor or (12) Sensing Rail.

  When adjustment is performed, make sure to activate "Test 2 [1]Carrier" in accordance with Chapter 4 Procedures of the Product Inspection Program, and set the offset again by means of automatic offset or manual offset.

- Check the probable cause c.

  Remove the motor from CN 17 and CN 19 on the control board, and measure the resistance between the pins of each connector.

If the resistance of respective pins are almost the equal values, there is no trouble. If there are troubles, the error was due to the probable cause e. In that case, replace the motor.

No.1 pin (white) and No.3 pin (orange)

No.1 pin (white) and No.4 pin (blue)

No.2 pin (black) and No.5 pin (red)

No.2 pin (black) and No.6 pin (yellow)

* The resistance of the motor may change when the model of motor is changed.

  X Axis motor 1.7 Ω

  Z Axis motor 4.3 Ω

- Check the probable cause d.

When no cause has been found in checking the probable causes a through c above, the error may have been due to the probable cause d. In that case, replace the control board, and operate the system.

(13) Error No. 20 Pause

* The system stopped temporarily during stain process.

1) Probable causes

a. During stain process, the operator temporarily stopped the system.

b. The operator opened the door during stain process.

c. Due to the dislocation of the door SW lever, the switch unit was not pressed and it was judged that the door was in an open position.

d. Due to abnormality in the door open/close detection switch unit, it was judged erroneously during stain process that the door was opened.

e. Due to abnormality in CPU1 on the control board, it was judged erroneously during stain process that the door was opened.

f. Due to abnormality in the sensor input section on the control board, it was judged erroneously during stain process that the door was opened.

2) Main tools to use in checking

- Tester
- Leads for short-circuiting terminals
- Tools for disassembly and assembly

3) Checking of causes, and countermeasures

- Check the probable cause a. or b.

  In this case, there are no troubles in the system. Just close the door.

  Explain the operator the operation of the system again.

- Check the probable cause c.

  With "Error No.20" displayed, turn on/off the door open/close detection switch unit using a driver.

  If "Error No.20" is cancelled when the switch is turned on, the error was due to the probable cause b. Adjust the door switch lever position in accordance with Chapter 3-3 (2) Adjustment of Door Open/Close Detection Switch.

- Check the probable cause d, e, or f.

  If "Error No.20" is cancelled when the Nos. 1 and 2 pins of CN12 on the control are board short-circuited, and if "Error No. 20" occurs when they are open, there are no troubles in the control board.

  If so, the error was due to the probable cause d. Replace the door open/close switch unit.

  If not, the error was due to the probable cause e. or f. In that case, replace the board.

(14) Error 30 Sensor Open

- Abnormality on the dryer temperature sensor (disconnection).

1) Probable causes

a. The option setting is for "A dryer is provided," even though no dryer is provided.

b. Due to a disconnection of the dryer temperature sensor, an abnormal value was inputted into the signal amplifier on the control board.

c. Due to abnormality in the signal amplifier on the control board, CPU1 judged that the sensor was disconnected.

d. Due to abnormality in CPU1 on the control board, it was not possible to make a correct judgement.

2) Tools to use in checking

- Leads for short-circuiting terminals
- Tools for disassembly and assembly

3) Checking of causes, and countermeasures

- Check the probable cause a.

  Activate "Test 1 [1] Property 2. Dry Unit" in accordance with Chapter 4 Procedures of the Product Inspection Program, and check the setting. If the setting is not correct, perform the setting again.

- Check the probable cause b., c. or d.

  Short-circuit the Nos. 1 and 3 pins of CN 4 on the control board. With the pins short-circuited, turn on the power supply, and check if "Error 31 Sensor Short" occurs. If "Error 31 Sensor Short" is displayed, the error was due to the probable cause b. In that case, replace the dryer temperature sensor.

  If "Error 31 Sensor Short" is not displayed, the error was due to the probable cause c. or d. In that case, replace the control board.

(15) Error 31 Sensor Short

- Abnormality in the dryer temperature sensor (short circuit)

1) Probable causes

a. Due to a disconnection of the dryer temperature sensor, an abnormal value was inputted into the signal amplifier on the control board.

b. Due to abnormality in the signal amplifier on the control board, CPU1 judged that the sensor was disconnected.

c. Due to abnormality in CPU1 on the control board, it was not possible to make a correct judgement.

2) Tools to use in checking

- Leads for short-circuiting terminals
- Tools for disassembly and assembly

3) Checking of causes, and countermeasures

Short-circuit the Nos. 1 and 3 pins of CN 4 on the control board. With the pins short-circuited, turn on the power supply, and check if "Error 31 Sensor Short" occurs. If "Error 31 Sensor Short" is displayed, the error was due to the probable cause a. In that case, replace the dryer temperature sensor.

If "Error 31 Sensor Short" is not displayed, the error was due to the probable cause b. or c. In that case, replace the control board

(16) Error 32 Temperature Low

- The dryer was heated, but the temperature was not reached even after 30 minutes.
  - Depending on the ambient temperature, the temperature may not be reached. If the temperature is set at higher than 55°C, the error does not occur when the temperature measured is higher than 55°C even if the temperature does not reach the temperature set.

1) Probable causes

a. As the optional OTP unit on the dryer was activated, it was not possible to supply power to the heater.

b. Due to abnormality in the OTP unit, it was not possible to supply power to the heater.

c. Due to the disconnection or poor connection of the dryer heater, it was not possible to supply power to the heater.

d. Due to the poor connection of the dryer option, it was not possible to supply power to the heater.

e. Due to abnormality in the driver section on the control board, it was not possible to control (turn on) the dryer heater relay unit.

f. Due to abnormality in CPU1 on the control board, it was not possible to control (turn on) the dryer heater relay unit.

g. Due to abnormality in the dryer heater relay unit, it was not possible to control (turn on) the dryer heater relay unit.

h. Due to abnormality in CPU1 on the control board, it was judged that the error was a low temperature trouble.

2) Main tools to use in checking

- Tester
- Leads for short-circuiting terminals
- Tools for disassembly and assembly

3) Checking of causes, and countermeasures

- Check the probable cause a.

  Check if the OTP unit has been activated.

  If it has been activated, the error was due to the probable cause a. In that case, reset the OTP unit, and operate the system again.

  If "Error 33 Temperature High" is displayed or if the OTP unit is activated after starting the system again, it seems that the OTP unit has been activated as the power supply to the heater was not turned off. Check the system in accordance with "Error 33 Temperature High."

- Check the probable cause b.

  With the power supply to the system off, measure the resistance at both ends of the OTP unit. If the ends are short-circuited when the OTP unit is not operating, there are no troubles. If there are troubles, the error was due to the probable cause under b. In that case, replace the OTP unit.

- Check the probable cause c.

  With the power supply to the system off, remove the dryer terminal block short-circuit cable (JP), and measure the resistances between the Nos. 2 and 4 pins, and Nos. 3 and 5 pins.

If not disconnected (approximately same values should be indicated), there are no troubles. If there are troubles, the error was due to the probable cause c. In that case, replace the dryer heater.

- Check the probable cause d.

  Turn on the power supply to the system and check the voltage between the Nos. 1 and 5 pins on the dryer terminal block unit. If the voltage is of the same value as that of the power supply, there are no troubles. If not, the error was due to the probable cause d. Check the connection.

- Check the probable cause e., f. or g.

  In accordance with Chapter 4 Procedures of the Product Inspection Program, activate "Test 1 [6] Temperature • Dryer Temperature Control," and start and stop temperature control.

  When starting temperature control, measure the voltage on the Nos. 4 and 5 pins of CN 16 on the control board, and if it is about 11 V, there are no troubles.

  If there are troubles, the error was due to the probable cause e or f. In that case, replace the control board. If checking discovers no troubles, and if the voltage on the Nos. 2 and 5 pins of the dryer terminal block unit is approximately of the same level as that of the power supply, there are no troubles in the dryer heater relay unit.

  If there are troubles, the error was due to the probable cause g. In that case, replace the dryer heater relay unit.

- Check the probable cause h.

  Open and short-circuit the Nos. 1 and 3 pins of CN 4 on the control board. If "Error 30 Sensor Open" is displayed when open, and if "Error 31 Sensor Short" is displayed when short-circuited, the error was due to the probable cause h. Replace the dryer temperature sensor. Otherwise, the error was due to the probable cause i. Replace the control board.

(17) Error 33 Temperature High

- The dryer temperature exceeded 75°C.

1) Probable causes

a. Due to the incorrect wiring of the dryer unit, the heater always remains on.

b. Due to abnormality in CPU1 on the control board, the heater cannot be turned off.

c. Due to abnormality in the driver unit on the control board, the heater cannot be turned off.

d. Due to abnormality in the dryer heater relay unit, the heater always remains on.

e. Due to abnormality in the dryer temperature sensor, it was judged that the error was a high temperature trouble.

f. Due to abnormality in CPU1 on the control board, it was judged that the error was a high temperature trouble.

2) Main tools to use in checking

- Tester
- Leads for short-circuiting terminals
- Tools for disassembly and assembly

3) Checking of causes, and countermeasures

- Check the probable cause a.

  Check if the wiring of the dryer unit is as in the circuit diagram.

  If there are any mistakes, correct the wiring as specified.

- Check the probable cause b., c. or d.

  In accordance with Chapter 4 Procedures of the Product Inspection Program, activate "Test 1 [6] Temperature • Dryer Temperature Control," and start and stop temperature control.

  When stopped, measure the voltage on the Nos. 4 and 5 pins of CN 16 on the control board, and there are no troubles if it is 0V.

  When there are troubles, the error was due to the probable cause b. or c. In that case, replace the control board.

  If there are no troubles found in this checking, and if the voltage on the Nos. 2 and 5 pins on the dryer terminal block unit is 0V, there are no troubles in the dryer heater relay unit.

  When there are troubles, the error was due to the probable cause d. Replace the dryer heater relay unit.

- Check the probable cause e. or f.

  Open/short-circuit the Nos. 1 and 3 pins of CN4 on the control board. If "Error 30 Sensor Open" is displayed when open, and if "Error 31 Sensor Short" is displayed when short-circuited, the error was due to the probable cause e. Replace the dryer temperature sensor. Otherwise, the error was due to the probable cause f. Replace the control board.

(18) Error 34 Dry Fan Stop

* While outputting On signals to the dryer heater, a dryer fan stop was detected.

1) Probable causes

a Due to abnormality in the dryer fan, outputting of fan operation signals stopped.

b. Due to abnormality in CPU1 on the control board, it was erroneously judged that the dryer fan stopped.

c. Due to abnormality in the sensor input on the control board, operating signals were not transmitted.

d. Due to abnormality in CPU1 on the control board, the dryer fan was not activated.

e. Due to abnormality in the driver section on the control board, the dryer fan was not activated.

f. Due to abnormality in the dryer fan, the fan stopped.

2) Main tools to use in checking

- Tester
- Leads for short-circuiting terminals
- Tools for disassembly and assembly

3) Checking of causes, and countermeasures

In accordance with Chapter 4 Procedures of the Product Inspection Program, activate "Test 1 [6] Temperature • Dryer Temperature Control," and start the dryer fan.

If the dryer fan starts as instructed, the error was due to the probable cause a., b. or c. Remove CN 16 from the board, and if the LCD displays "Dry Fan: ON" when the Nos. 2 and 3 pins were short-circuited on the board, there are no troubles on the control board. When there are no troubles, the error was due to the probable cause a. Replace the dryer fan. When there are troubles, the error was due to the probable cause b or c. Replace the control board.

When the dryer fan does not operate as instructed, measure the voltage on the Nos. 1 and 2 of CN 16 on the control board. If the voltage is about 11V when the dryer fan is started, there are no troubles. When there are troubles, the error was due to the probable cause d. or e. In that case, replace the control board.

When there are no troubles, and if the fan does not operate, the error was due to the probable cause under f. Replace the dryer fan.

(19) Error 40 Print Time Out

- The system does not become a standby state even after a certain time has passed following the sending out of characters.

1) Probable causes
   No printer is connected.

2) Main tools to use in checking
   - None

3) Checking of causes, and countermeasures
   Check the printer connection.

(20) Error 41 Print Error

- The option setting indicates "a printer is provided," but the printer error signal line remains in an error state.

1) Probable causes
   The printer is not ready.

2) Main tools to use in checking
   - None

3) Checking of causes, and countermeasures
   Check the printer connection.

(21) Error 42 Print Comm

- Transmission to and reception from the printer was abnormal three times consecutively.

1) Probable causes
   a. The printer is not ready.
   b. The serial cable to the printer box is not the one specified.
   c. Abnormal connection to the printer or to the printer box caused the error.
   d. Due to abnormality in the printer box, it was not possible to control transmission and reception.
   e. Due to abnormality in the control board, it was not possible to control transmission and reception.

2) Main tools to use in checking
   - None

3) Checking of causes, and countermeasures
   Check the printer and connections. When there are no troubles, replace the printer box. After replacement, if there are no troubles any more, the error was due to the probable cause c. If the trouble remains existed, the error was due to the probable cause d. In that case, replace the control board.
   - Make sure to connect the printer box only after turning off the power supply to the system.

(22) Error 43 Printbox Battery Low

- The voltage of the battery in the optional printer box got low.

1) Probable causes
   Due to the longevity of the battery unit in the printer box, the voltage got to less than 3V.

2) Main tools to use in checking
   - None

3) Checking of causes, and countermeasures
   Replace the battery in the printer box.

(23) Error 44 RTC Read Error

- It was tried to read time data from the optional printer box, but troubles occurred.

(24) Error 45 RTC Write Error

- It was tried to write time data into the optional printer box, but troubles occurred.

1) Probable causes
   There are troubles in the printer box.

2) Main tools to use in checking
   - None

3) Checking of causes, and countermeasures
   Check the printer box.
   * Make sure to turn off the power supply to the system before connecting the printer box.

(25) Error 50 Fume Fan Stop

- The fume fan stop was detected.

1) Probable causes

a. Due to abnormality in CPU1 on the control box, it was erroneously judged that the fume fan stopped.

b. Due to abnormality in the sensor input on the control box, operating signals were not transmitted.

c. Due to abnormality in the fume fan, the fan stopped.

d. Due to abnormality in the fume fan, the output of fan operating signals stopped.

2) Main tools to use in checking

- Leads for short-circuiting terminals
- Tools for disassembly and assembly

3) Checking of causes, and countermeasures

Connect a new fume fan unit to CN 18 on the control board, and operate it.
Here, if "Error 50" occurs, the error was due to the probable cause a. or b. Replace the control board.
If the fan operates normally, the error was due to the probable cause c. or d. Replace the fume fan unit.

* Make sure to turn off the power supply to the system before connecting the fume fan unit.

5-3 Troubles with no Error Number

(1) Power Supply cannot be turned on

- The power supply indicator does not light.

1) Probable cause

a. Troubles in the facility power supply.

b. Troubles in the power supply cord.

c. The power supply fuses (F1-1, 2) melted.

d. Troubles in the power supply input section.

e. Troubles in the control power supply switching power supply (PW1).

2) Main tools to use in checking

- Tester
- Tools for disassembly and assembly

3) Checking of causes, and countermeasures

- Check the probable cause a.

  Check if the facility power supply is as specified in the system specifications.

  When there are troubles here, the error was due to the probable cause a. Ask for a facility power supply inspection.

- Check the probable cause b.

  Check if there are troubles (disconnection, poor connection, etc.) in the power supply cord set. In case of poor connection, firmly connect it. If using a grounding adapter, the power supply cord set is subject to poor connection. Pay attention.

  When there are no troubles with the connection, remove the power supply cord set from the facility socket and from the system, and check it for disconnection.

  When disconnection is found, replace the power supply cord set.

- Check the probable cause c.

  Remove the fuse from the power supply fuse holder, and check it for melting. If it is molten-disconnected, the error was due to the probable cause c. When replacing the fuse, check, using a tester, that the wiring (up to the F1 to PW1 input side, and the dryer option section in Chapter 2 Wiring Diagram) is not short-circuited. If not short-circuited, replace the fuse. If short-circuited, remove the cause, and then replace the fuse. When replacing the fuse, make sure to use a fuse specified.

  The fuse may be molten-disconnected not only due to over current, but also due to shock or fatigue.

- Check the probable cause d.

  Check if the voltage on the power supply input section is as specified. When there are troubles, the error was due to the probable cause d. Check for disconnection and poor connection. If there are no troubles, replace those parts in question. When replacing the fuse, make sure to use a fuse specified.

- Check the probable cause e.

  Check if there are troubles in the output voltage on the control power supply switching power supply (PW1). When there are troubles, the error was due to the probable cause e. Replace the switching power supply (PW1). When replacing the part, make sure to use the part specified.

(2) Stain process cannot be started

- Stain process does not start, though no error or warning is displayed.

1) Probable causes
   Troubles occurred in the control program.

2) Main tools to use in checking
   None

3) Checking of causes, and countermeasures
   Notify the manufacturer details of troubles and the program version.
   * To check the program version, activate "Test 1 [1]Property 3. program Version" in accordance with Chapter 4 Procedures of the Product Inspection Program, and check it.

(3) During stain process, the process suddenly returned to the standby state

1) Probable causes

a. Due to abnormality in the control power supply PW1, +12V went down, and the output voltage from PW2 went down. As a result, the +5V power supply got down to less than 4.6V, and the +5V monitoring and runaway detection circuit on the control board operated to generate resetting signals.

b. Due to abnormality in the control power supply PW2, the +5V power supply got down to less than 4.6V, and the +5V monitoring and runaway detection circuit on the control board operated to generate resetting signals.

c. With mal-function due to noise, resetting signals were generated.

d. Due to abnormality in the +5V monitoring and runaway detection circuit on the control board, resetting signals were generated.

2) Main tools to use in checking

None.

3) Checking of causes, and countermeasures

- Check the probable cause a. or b.

Check if the output of PW1 and PW2 in the control power supply section are as specified in the block diagram. When there are troubles, replace those parts in question.

- Troubles in the cable connected may have caused troubles in the output voltage. When checking voltage, therefore, check voltage not only on the output terminal of each power supply, but also on each connecting point.

- Check the probable cause c. or d.

When there are no troubles found in checking the probable cause a. or b., the error may have been due to the probable cause c. or d. First, to minimize the influence of noise, take the measures as below;

- Fix all the wires inside the system so that none of them comes into contact with the control board. In so doing, make sure to fix the power supply line, motor cable, and signal line separately.
- Allow some distance between the system and other equipment which may cause noise.
- Do not connect other equipment to the same socket to which the system is connected.

If the error still occurs frequently even after the countermeasures as above have been taken, the error may have been due to the probable cause d. In that case, replace the control board.

(4) "Error No.4 battery Low: Main Board" is not indicated, but the memory has been lost

1) Probable causes

a. Due to abnormality in the battery voltage monitoring circuit on the control board, the voltage on the battery unit went down, but it was not detected.

b. Due to abnormality in the RAM1 power supply switching and resetting circuit, it was not possible to supply data backup power to RAM1 during resetting operation or white the power supply was off.

c. Due to the troubles in the control program, the data in the RAM1 has been destroyed.

2) Main tools to use in checking

- Tester
- Leads for short-circuiting terminals
- Tools for disassembly and assembly

3) Checking of causes, and countermeasures

- Check the probable cause a. or b.

  Remove the battery unit from the control board, and measure voltage on the battery unit. When it is less than 3V, the error was due to the probable cause a. Replace he control board and battery unit.

  When it is over 3V, the error was due to the probable cause b. Replace the control board.

- Check the probable cause c.

  When none of the probable causes a or b are applicable, the error may have been due to the probable cause c.

  Notify the manufacturer details of troubles and the program version.

  * To check the program version, activate "Test 1 [1]Property 3. program Version" in accordance with Chapter 4 Procedures of the Product Inspection Program, and check it.

(5) No key input is accepted

- No key input is accepted al all.
- Input by some keys is not accepted.

1) Probable causes

a. Some other key was depressed by miss operation.

b. The error occurred due to the poor connection of the operating panel key board or the operating panel relay board.

c. The error occurred due to troubles in the operating panel.

d. Due to troubles in the control board, key inputs were not recognized.

2) Main tools to use in checking

- Tester
- Tools for disassembly and assembly

3) Checking of causes, and countermeasures

Activate "Test 1 [2] Key Switches" in accordance with Chapter 4 Procedures of the Product Inspection Program, and check if key input is normal.

When all key inputs are accepted, the error is considered due to the probable cause a. Refer to Operating Manual again.

Confirm if there are no troubles in the connections and cables. As there is a possibility of cables having been disconnected, confirm their conductivity with a tester.

When no troubles are found in the confirmation above, replace the operating panel keyboard and confirm key input. When there are still troubles after replacing the operating panel keyboard, replace the control board.

(6) The buzzer does not work

1) Probable causes

- The error occurred due to the poor connection to the operating panel relay board.
- The error occurred due to troubles in the operating panel relay board.

2) Main tools to use in checking

- Tester
- Tools for disassembly and assembly

3) Checking of causes, and countermeasures

Check the connecting points and cables. Using a tester, check the cables for disconnection.

When there are no troubles in the connecting points and cables, replace the operating panel relay board, and operate the system. If there are still troubles after replacing the operating panel relay board, replace the control board.

(7) The LCD does not light

* The power supply indicator is on, but the LCD is not on.

1) Probable causes

a. Troubles in the initial setting of the LCD

b. Troubles in the LCD unit

c. Troubles in the back light

d. Poor adjustment of the LCD brightness

e. Troubles in the LCD brightness adjustment unit

f. Troubles in the power supply board (-12V power supply)

g. Troubles in the control board

2) Main tools to use in checking

- Tester
- Tools for disassembly and assembly

3) Checking of causes, and countermeasures

- Check the probable cause a. or b.

  Check the LCD unit for connection, and turn on the power supply again. If the system operates normally after the power supply is turned on again, the error was due to the probable cause a. Continue operation. When there are still troubles, the error was due to the probable cause b. In that case, replace the LCD unit.

- Check the probable cause c.

  In that case, the LCD display is very dark, but normal. (The display can be checked.) Replace the LCD inverter unit.

- Check the probable cause d.

  Rotate left and right the knob on the brightness adjustment unit on the system front right bottom. If the LCD display is seen then, the error was due to the probable cause d. In that case, there are no troubles in the system itself.

- Check the probable cause e.

  Remove the brightness adjustment unit from CN 1 on the control board, rotate the knob left and right, and check any change in the resistance value.

  When the value changes in the range of 0 to 1kΩ, there are no troubles. When there are troubles, the error was due to the probable cause d. Replace the brightness adjustment unit.

- Check the possible cause under f.

  Remove the brightness adjustment unit from CN 1 on the control board, and measure the voltage on the Nos. 1 and 2 pins of CN 1.

  When the voltage is -12V, there are no troubles. When there are troubles, replace the power supply board (PW2).

- Check the possible cause under g.

  When none of the above probable causes is applicable, the error may have been due to the control board. Replace the control board.

(8) Water leaks from the water supply circuit

1) Probable causes

a. Parts in the water supply section have been damaged. (Water supply hose, etc.)

b. Parts are not firmly connected.

2) Main tools to use in checking

- Tools for disassembly and assembly

3) Checking of causes, and countermeasures
With reference to Chapter 3 3-4 (8) Wash/Water Supply Section, replace damaged parts or adjust the water supply circuit.

(9) Excessive water supply

1) Probable causes

a. Troubles in the constant flow valve.

b. High pressure in the facility water supply

2) Main tools to use in checking

- Tools for disassembly and assembly

3) Checking of causes, and countermeasures
Check if the facility requirements under Chapter 1 General are met.
If the facility is as specified, the error was due to the probable cause a. With reference to the adjustment under Chapter 3, replace the constant flow valve.
If not as specified, adjust the facility water supply pressure.

(10) Insufficient water supply

1) Possible causes

a. The water supply valve is closed.

b. The water supply facility does not meet the facility requirements.

c. The strainer on the water supply circuit (including the nozzle) or the reducing valve is blocked.

d. Due to troubles in the wash/water supply solenoid valve unit, the wash/water supply solenoid valve unit does not open.

e. Troubles in the reducing valve and/or constant flow valve.

2) Main tools to use in checking

- Tools for disassembly and assembly.

3) Checking of causes, and countermeasures

- Check the probable cause a.

  Check if the water supply valve is not closed. When it is closed, the error was due to the probable cause a. In that case, open the water supply valve.

- Check the probable cause b.

  Check if the facility requirements under Chapter 1 General are met.

  If not satisfied, request for modification so that the facility requirements will be met.

- Check the probable cause c.

  With reference to the adjustment method under Chapter 3, clean the strainer on the water supply circuit (including the nozzle) and the reducing valve.

  - Clean the strainer periodically.

- Check the probable cause d. or e.

  When none of the probable causes above is applicable, the error may have been due to the probable cause c. or d. With reference to the adjustment method under Chapter 3, replace the wash/water supply solenoid valve unit or reducing valve and constant flow valve.

  - It is not possible to locate defective parts except for replacing parts, and check their operation at customer sites.

(11) Water does not accumulate in the washing reservoir

- Water is injected through the nozzle, but it leaks.
- No water can be injected through the nozzle.

1) Probable causes

a. The washing reservoir is damaged.

b. The washing reservoir is dislocated.

c. There is a gap between the nozzle and grommet, through which water leaks.

d. Poor connection to the facility water supply line.

e. Troubles in the facility water supply line, and water is not supplied.

f. The strainer on the water supply circuit (including the nozzle) or on the reducing valve is blocked, and thus water is not supplied.

g. Due to troubles in the control board, the washing/water supply solenoid valve unit does not open.

h. Due to troubles in the washing/water supply solenoid valve unit, the washing/water supply solenoid valve does not open.

i. Due to troubles in the reducing valve or in the constant flow valve, water is not supplied.

2) Main tools to use in checking

- Tester
- Leads for short-circuiting wires
- Tools for disassembly and assembly

3) Checking of causes, and countermeasures

- Check the probable cause a., b., c. or d.

  Visually check for the possible causes.

  When there are troubles, repair or replace parts in question.

- Check the probable cause e.

  Check the facility water supply line for troubles (water pressure, flow).

  When there are troubles, request for inspection of the facility water supply line.

- Check the probable cause f.

  Check if the strainer or the water supply circuit is not blocked. When blocked, clean the water supply circuit and strainer. When the strainer is excessively blocked, water quality may be a problem. Request for inspection of water quality.

- Check the probable cause g. or h.

  Activate "Set Up [1]Reducing Valve-Up Counter" in accordance with Chapter 4 Procedures of the Product Inspection Program.

  Here, open the solenoid valve, and measure the voltage on the Nos. 1 and 2 pins of CN 13 on the control board. If the voltage is about 11V when it is open, and if it is 0V when it is closed, there should be no troubles. When there are troubles, the error was due to the probable cause g. Replace the control board.

  Upon confirming that there are no troubles in the control board, similarly open and close the solenoid valve, and judge from the operating sound or vibration (keeping a hand on the solenoid valve, open

and close it) if the solenoid valve operates normally. If not, the error was due to the probable cause h. In that case, replace the solenoid valve.

- Check the probable cause i.

  When none of the above mentioned probable causes is applicable, the error may have been due to the probable cause i. Replace the reducing valve and constant flow valve.

(12) Water supply into the washing reservoir does not stop

1) Probable causes

a. Due to abnormality in the control board, the washing/water supply solenoid valve does not close.

b. Due to abnormality in the washing/water supply valve unit, the valve does not close.

2) Main tools to use in checking

- Tools for disassembly and assembly

3) Checking of causes, and countermeasures

Turn off the power supply to the system, and check if the water supply to the washing reservoir stops. If water supply stops with the power supply off, the error was due to the probable cause a. Replace the control board. If water supply does not stop even if the power supply is turned off, the error was due to the probable cause b. In that case, replace the washing/water supply valve unit.

(13) Water does not drain from the washing reservoir

1) Probable causes

The drain hole on the washing reservoir is blocked.

2) Main tools to use in checking

- None.

3) Checking of causes, and countermeasures

If this hole is blocked, water cannot be drained from the washing reservoir.

(14) Water does not drain from the trays (right, left, bottom)

1) Probable causes

a. The system employs an indirect draining. The excessively high back pressure in the facility draining line prevents draining.

b. The drain hose to the drain outlet is not horizontal or inclined downward in relation to the system drain outlet.

c. The system is not installed on a level.

d. The facility draining capacity is not sufficient.

e. The system draining piping is blocked to prevent efficient draining.

2) Main tools to use in checking

- Tools for disassembly and assembly

3) Checking of causes, and countermeasures

- Check the probable cause a., b. , c. or d.

Check if the system is installed as specified in the installation manual.

- Check the probable cause e.

  When none of the above possible causes is applicable, the error may have been due to the probable cause e.

  Check the drain piping.

(15) Abnormal noise during arm transfer or hold

1) Probable causes

a. It was due to troubles in the motor unit.

b. It was due to loose screws.

c. It was due to troubles in the control board.

2) Main tools to use in checking

- Tester
- Tools for disassembly and assembly

3) Checking of causes, and countermeasures

- Check the probable cause a.

  Visually and with a tester, check the motor unit for troubles (disconnection, short-circuit). When there are troubles, the error was due to the probable cause a. In that case, replace the motor unit. If the motor unit is short-circuited, it appears that there are troubles in the control board. Simultaneously replace the control board.

- Check the probable cause b.

  Check the screws on the driving section for loosening.

  When loosened, the error seems due to the probable cause b. In that case, additionally fasten the screws.

- Check the probable cause c.

  When none of the above possible causes is applicable, the error may have been due to the probable cause c. In that case, replace the control board.

(16) The arm strikes against the reservoirs

1) Probable causes

a. The reservoir is not set correctly.

b. The reservoir is deformed.

2) Main tools to use in checking

- Tools for disassembly and assembly

3) Checking of causes, and countermeasures

- Check the possible cause under a.

  Visually check the reservoir for position.

  When not set correctly, set the reservoir again.

- Check the probable cause b.

  Visually check the reservoir for deformation.

  When there are troubles found, replace the reservoir.

(17) The arm strikes against the side of the device or reservoir

1) Probable causes

a. The arm is deformed.

b. The axis X sensor, slit and arm are dislocated from each other.

c. The system itself is deformed.

2) Main tools to use in checking

- Tools for disassembly and assembly

3) Checking of causes, and countermeasures

- Check the probable cause a.

  Visually check the arm for deformation.

  When the arm is deformed, replace parts in question.

- Check the probable cause b.

  Make readjustment with reference to the adjustment method under Chapter 3.

  When adjusted, the offset value changes. Thus, adjust the offset value, too.

- Check the probable cause c.

  When there are still troubles even after replacement of parts and re-adjustment, the error may have been due to the probable cause c. In that case, contact the manufacturer.

(18) The basket cannot be taken out of the reservoir. The basket cannot be placed on the specified part of the reservoir.

1) Probable causes

a. The reservoir is not in a correct position.

b. The adapter is deformed.

2) Main tools to use in checking

- Tools for disassembly and assembly

3) Checking of causes, and countermeasures

- Check the probable cause a.

  Visually check the reservoir for position.

When mispositioned, make adjustment with reference to the adjustment method under Chapter 3.

- Check the probable cause b.

  Visually check the adapter for deformation.

  When there are troubles, replace the adapter.

(19) Abnormal noise from the fan (fume, board cooling, dryer)

1) Probable causes

a. Mixing of foreign substances.

b. Troubles in the fan (appearance).

c. Loosened fan fixing screws.

d. Troubles in the fan.

2) Main tools to use in checking

- Tools for disassembly and assembly

3) Checking of causes, and countermeasures

- Check the probable cause a. or b.

  Visually check fixing of foreign substances or the appearance for troubles (damages to blades, their deformation, etc.)

  When there are foreign substances mixed, the error was due to the probable cause a, and remove them. When there are troubles in the appearance, the error was due to the probable cause b. Replace parts in question.

- Check the probable cause c.

  Confirm if the fan installing screws are not loose.

  If loose, the suspected cause (c) could be the cause of trouble. Fasten the screws.

- Check the probable cause d.

  If none of the above suspected causes is applicable, the suspected cause (d) could be the cause of trouble. Replace the fan.

(20) No remote alarm is outputted

1) Probable causes

a. It was due to troubles in the control board.

b. Signals were not transmitted due to troubles in the external wiring.

2) Main tools to use in checking

- Tester
- Tools for disassembly and assembly

3) Checking of causes, and countermeasures

Activate "Test 1 [5] Remote & Power-Remote Alarm Output," and open and close the external terminal in accordance with Chapter 4 Procedures of the Product Inspection Program.

Then measure the resistance on the external signal terminal block on the rear of the system. There are no troubles if the Nos. 3 and 4 pins are open and if the Nos. 3 and 5 pins are short-circuited when the external terminal is open, and if the Nos. 3 and 4 pins are short-circuited and if the Nos. 3 and 5 pins are open when it is short-circuited, there are no troubles. When there are troubles, the error was due to the probable cause a. In that case, replace the control board. When there are no troubles, the error seems due to the probable cause b. In that case, check the external wiring.

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Chapter 6 Setup Mode

This set up mode is provided to allow easy settings, such as the selection of language, program setting by routine processing, washing reservoir setting, start/end reservoir setting, etc. at the time of product installation.

In the set up mode, the display is only in English.

When any trouble occurs during setting, refer to Chapter 5 Trouble Shooting.

6-1 Items to Be Set with Setup Mode

(1) Environment Mode

1) Switching of display language

- English
- Japanese
- French
- German
- Italian
- Spanish

2) Setting of washing reservoir

- The top washing reservoir
- Number of washing reservoirs

3) Setting of starting and ending reservoirs

- Setting of the starting reservoir (S1, S2)
- Setting of the ending reservoir (E1, E2)

4) Changing of set points

- Mix amplitude: Setting of basket upward and downward agitation distance. Initially set for 25 mm.
  Options: 10, 15, 20, 25, 30 mm
- Mix frequency: Setting of basket upward and downward agitation frequency. Initially set for three times.
  Options: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 times
- Mix speed: Setting of the number of basket upward and downward movement speed in five steps. Initially set for 3.
  Options: Levels 1, 2, 3, 4, 5
- Dryer temperature set: Setting of drying temperature (only when a dryer is provided). Initially set for 65 degrees.
  Possible range of temperature setting: 30 to 65°C
- Water wash cycle time: In a washing step, water continues to flow to replace water after the specimens move to the other reservoir from the washing reservoir. Setting of this continuous water flow time. Initially set for one minute.
  Possible range of setting: 30 to 1 min 30 seconds.
- Washout frequency: Setting of the number of basket upward and downward movements in the enhanced wash. Initially set for three times.

Options: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 times

- Washout speed: Setting of the speed of basket upward and downward movements in the enhanced wash in five levels. Initially set for Level 3.
  Levels 1, 2, 3, 4, 5
- Ups connect: Setting whether to connect the system to the backup power supply (UPS). Initially set for not connecting.
  Options: Yes - With UPS No - Without UPS
- Key sound: Setting whether to generate a sound when the key switch is depressed on the operating panel. Initially set for Yes.
  Options: Yes - A sound to be generated when the key switch is depressed.
  No - A sound not to be generated when the key switch is depressed.
- Printer box connect: Setting whether to connect the optional printer box. In order to make this change valid, it is necessary to turn on the power supply again after the completion of changing operation. Initially set for No.
  Options: Yes - With a printer box No - Without a printer box
- Printer setup: Setting of line change information in the printer. Initially set for CR.
  Options: CR- To be selected when the CR function of the printer is only in return.
  CR + LF - To be selected when the CR function of the printer is in return and in line change.
- Printer error: Setting of handling of error signals which are received from the printer. Initially set for Ignore.
  Options: Acknowledge - The system displays an error message when it receives error signals. Ignore -The system does not respond even if it receives error signals.
- Printer timing: Setting whether to automatically print process report upon the completion of stain process. Initially set for Automatic.
  Options: Automatic - Automatically print. Manual - Not automatically print.

(2) Water Rinse Mode

1) To turn on the washing valve.

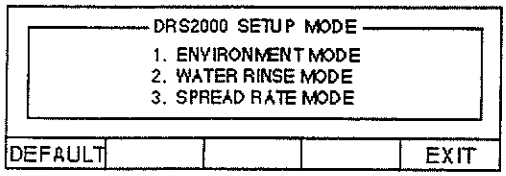
2) To turn off the washing valve.

(3) Spread Rate Mode

1) To change the allowance when the stain time set in the program is finitely extended.

6-2 Commencement and Termination of Setup Mode

a. Depressing Key "1," turn on the power supply. The main menu will be displayed. Then, continue to depress Key "1" until the buzzer generates a sound "Pee."



* If Key "1" is kept depressed after the sound, the system interprets that "1" has been selected.

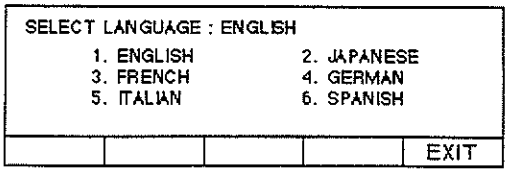
b. Select an item for setting via the ten keys.

c. The setup mode ends when the power supply is turned off.

6-3 Details of Setting of and Procedures for Setup Mode

(1) Environment Mode

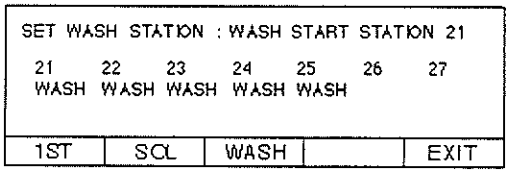
a. While the main menu is displayed, depress Key "1" and the language selection menu will be displayed.



b. When switching the language, depress the number (1 through 6 on the ten key).
When the number is depressed, the language thus selected will be displayed at the top.

c. When Key "Exit" is depressed, the following items will be automatically set and the menu will change to the washing reservoir setting menu in accordance with the specifications of the language selected.
   A. Setting of a recommended program.
   B. Setting of a washing reservoir.
   C Setting of the starting and ending reservoirs.
   D. Setting of a reservoir layout list.
   E. Setting of a solution name list.
   F. Setting of a stain method list.
   G. Setting of solution names in enhanced wash.

d. When Key "Exit" is depressed in the language selection menu, the display will change to the washing reservoir setting menu. The initial display is one set in language selection.



Key "1ST"

Depress the cursor key to move the cursor to 21, 22 or 23, and depress the key. Then, five consecutive reservoirs starting there will be set as washing reservoirs.

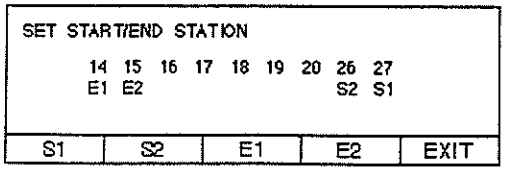
Key "SOL"

When it is desired to change any of the five washing reservoirs to solution reservoir (s), move the cursor to the washing reservoir to change to the solution reservoir, and depress the key. The display will change to SOL from Wash, and the reservoirs can be used as a solution reservoir(s). Provided that only up to three reservoirs may be changed to solution reservoirs.

Key "Wash"

When using a reservoir changed to a solution reservoir as a washing reservoir, depress the key. Then, the display will change to Wash from Sol, and the reservoir can be used as a washing reservoir.

e. Depress Key "Exit". The display will change to the starting and ending reservoir setting menu.



f. The initial display is as set in language selection.

Key "S1"

Move the cursor to the reservoir number of the starting reservoir to set, and depress the key, Then, the S1 display will move.

Key "S2"

Move the cursor to the reservoir number of the starting reservoir to set, depress the key, Then, the S2 display will move. To stop setting of "S2," move the cursor to the reservoir number of the position where S2 is displayed, and depress the key. The S2 display will disappear.

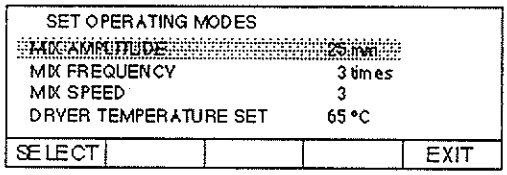
Key "E1"

Move the cursor to the reservoir number of the ending reservoir to set, and depress the key, Then, the E1 display will move.

Key "E2"

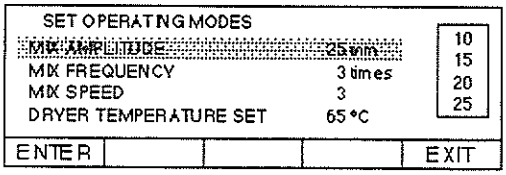
Move the cursor to the reservoir number of the starting reservoir to set, and depress the key, Then, the E2 display will move. To stop setting of E2, move the cursor to the reservoir number of the position where E2 is displayed, and depress the key. The E2 display will disappear.

g. Depress Key "Exit" and the display will change to the set valve changing menu.



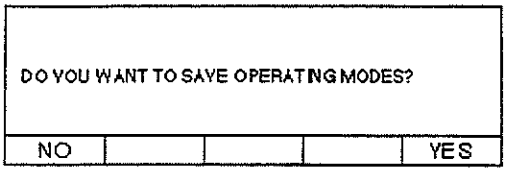
This is the same as the Chapter 4 [8] other operations (5) Set the system operating environment in the operating manual. However, the washing reservoir start number cannot be changed in this Set Up Mode.

h. Scroll the screen with Keys "▲"and "▼" to move the cursor to the item to change, and select with Key "Select."



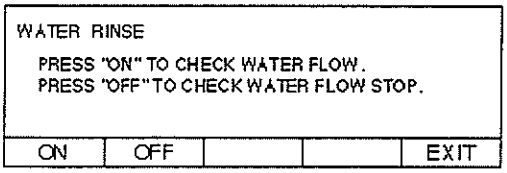
i. Scroll the screen with Keys "▲"and "▼" to move the cursor to the item to set, and select with Key "Enter." (Use the number keys for drying temperature and washing refreshing time.)

j. Upon the completion of changing of all set valves, depress Key "Exit."



k. Depress Key "Yes" and then the display will change to the main menu for setup mode after the changes are stored. Depress Key "No" to stop changing. The display will change to the main menu.

(2) Water Rinse Mode



a. Depress "2" in the main menu, and this screen will be displayed.

Key "On"

Depress this key. The washing solenoid valve will open. Water flow can be confirmed.

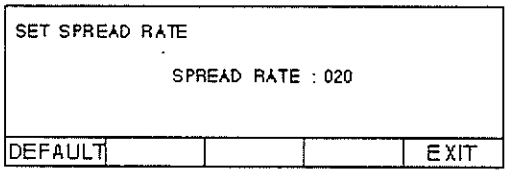
Key "Off"

Depress this key. The washing solenoid valve will close. Water flow will stop.

Key "Exit"

Depress this key to move to the main menu.

(3) Spread Rate Mode



a. When "3" is selected in the main menu, this screen will be displayed.

b. When the stain time set in the program is finitely extended, the allowance may be changed.

Ten keys

Possible to set in the range from 0 to 999.

Key "Default"

Depress this key, and then 20 will be set.

Tissue-Tek® DRS-2000™

Automatic Slide Stainer

Parts List

Revised
03/99

TIYODA MFG. U.S.A., INC.

EXPLODED VIEW OF ILLUSTRATION
WITH PARTS LIST (DRS-2000)

REFERENCE

CLASS		Replacement Frequency
	A	Will need to be replaced in a relatively short time period (consumables or equivalents).
	B	Will need to be replaced or serviced after a longer time of period than Class A.
	C	Can be used for a relatively longer time, but will need to be replaced or serviced.
	(None)	These parts ate more durable than the ones classified in C.
INDEX		Callout numbers for the parts shown in each illustration.
PART CODE		Code numbers for illustrated parts. These numbers will be needed when the parts are inquired or ordered.
PARTS DESCRIPTION/MODEL		Part names and models. Screws and relative parts show materials and dimensions as well.
QTY.		Quantity of parts used in each instrument.
REMARKS		In the column, the supplemental explanation on screws and parts and the relation to each instrument are indicated.
		Combination of screws and washers
	Sems A	Pan head screw + spring washer
	Sems B	Pan head screw + spring washer + plain washer
	Sems C	Pan head screw + external tooth lockwasher
CHANGE		In case the parts are changed, affected IECN # are shown.

CONTENTS

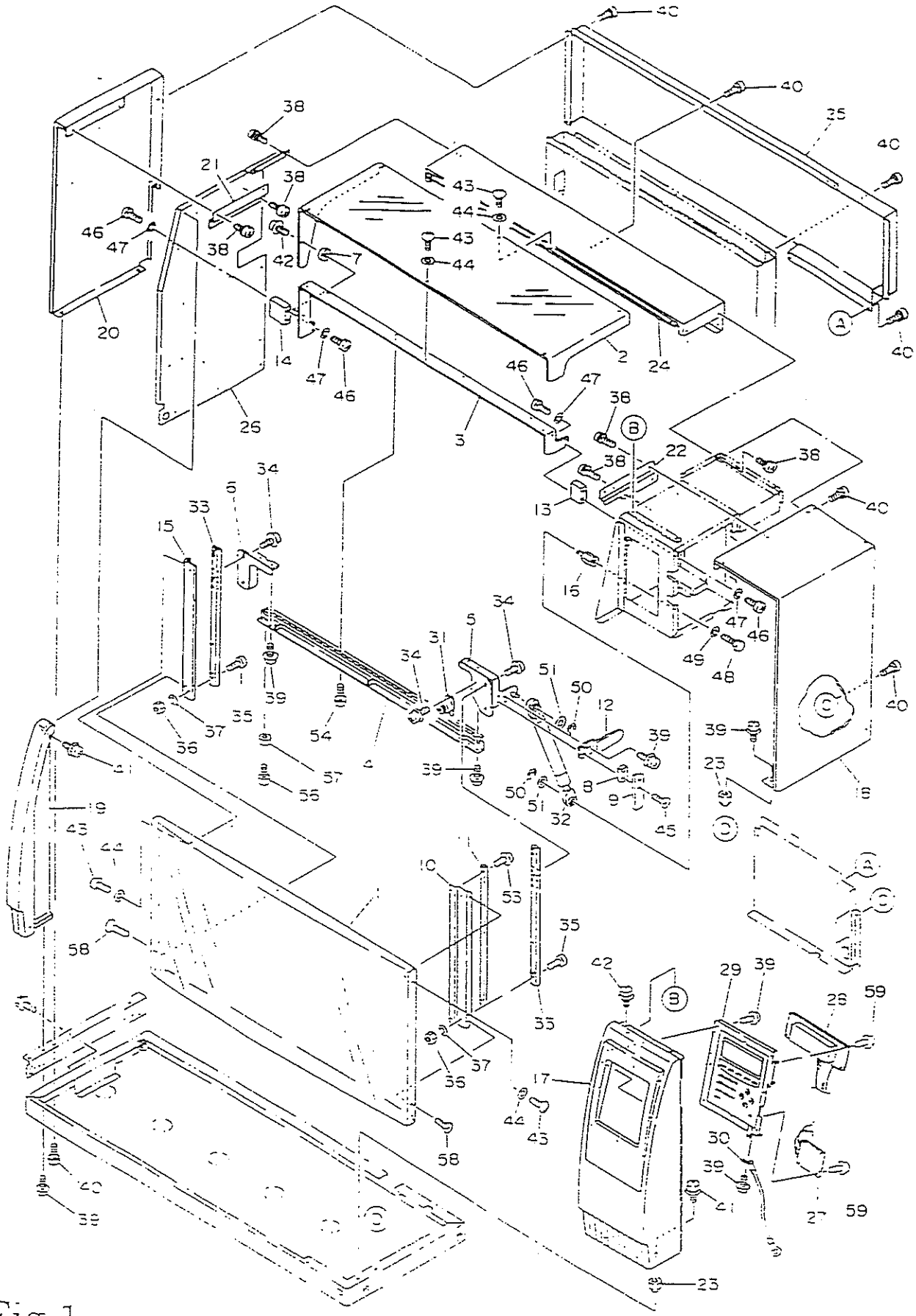


Fig.1

1. CASING AND COVER

CLASS	INDEX	PART CODE	PART DESCRIPTION/MODEL	QTY.	REMARKS	CHANGE
C	1	A-AK23-0200-02	Cover, Front	1		
C	2	A-AK23-0201-02	Cover, Top	1		9324
	3	A-AK23-0202-02	Support, Top Cover	1		9324
	4	A-AK23-0203-03	Lever Brace	1		8976
	5	A-AK23-0207-02	Lever, Front Cover, Right Hand	1		8976
	6	A-AK23-0208-01	Lever, Front Cover, Left Hand	1		
	7	A-AK23-0216-02	Collar, Top Cover	1		9324
	8	A-AK23-0217-01	Collar, Cover Piece	1		
	9	A-AK23-0218-01	Cover Piece, Front Cover	1		
	10	A-AK23-0219-01	Bracket, Slide Rail, Right Hand	1		
	11	A-AK23-0220-01	Rack, Slide Rail	1		
	12	A-AK23-0225-01	Sensor Plate, Front Cover	1		
	13	A-AK23-0227-01	Collar (1), Top Cover Support	1		9324
	14	A-AK23-0228-01	Collar (2), Top Cover Support	1		9324
	15	A-AK23-0229-01	Bracket, Slide Rail, Left Hand	1		
	16	A-AK23-0240-00	Damper Shaft	1		
	17	A-AK23-0301-03	Outer Casing (1), Right Front	1		8976, 9099
	18	A-AK23-0302-01	Outer Casing (2), Right Side	1		
	19	A-AK23-0303-02	Outer Casing (3), Left Front	1		
	20	A-AK23-0304-02	Outer Casing (4), Left Side	1		8976
	21	A-AK23-0305-01	Bracket, Left Side Casing	1		9324
	22	A-AK23-0306-01	Bracket, Right Side Casing	1		9324
	23	A-AK23-0307-00	Guide Pin, Outer Casing	3		
	24	A-AK23-0308-01	Top Panel	1		
	25	A-AK23-0311-01	Rear Panel	1		
	26	A-AK23-0312-03	Inner Plate, Left Side	1		8976
C	27	F51-070-00	Operation Panel Relay Board E:NDRS-06	1		
C	28	F51-072-00	LCD Unit E:NDRS-09	1		
C	29	F51-069-00	Operation Panel Key Board Unit E:NDRS-05	1		
	30	A4-10-0502	Grounding Cable, FGM-200-M4	1		
B	31	D9-28-0284	Rotary Damper, FRN-C2R201GI	1		
C	32	D9-28-0282	Gas Damper, B-461-2	1		
	33	D9-17-0008	Slide Rail, TM-231-3	2		
	34	B6-29-1107	Screw, Cross-Recessed Pan Head, M3x6, Bs	6	Sems B	
	35	B6-13-1109	Screw, Cross-Recessed Pan Head, M3x8, Bs	4		
	36	B6-41-1102	Hex Nut, M3, Bs	4		
	37	B6-53-5101	Spring Washer, diameter 3, PB	4		
	38	B6-28-1105	Screw, Cross-Recessed Pan Head, M4x8, Bs	12	Sems A	
	39	B6-29-1106	Screw, Cross-Recessed Pan Head, M4x8, Bs	18	Sems B	
	40	B6-29-2002	Screw, Cross-Recessed Pan Head, M4x8, Bs	17	Sems C	
	41	B6-29-1108	Screw, Cross-Recessed Pan Head, M4x12, Bs	3	Sems B	
	42	B6-29-1102	Screw, Cross-Recessed Pan Head, M4x15, Bs	5	Sems B	
	43	B6-25-1101	Screw, Cross-Recessed Truss Head, M4x10, Bs	8		
	44	B6-52-7001	Nylon Washer, 4mm	2		9324
	44	B6-52-7011	Nylon Washer, 6mm	6		9324
	45	B6-14-1106	Screw, Cross-Recessed Flat Head, M3x15, Bs	2		
	46	B6-13-2001	Screw, Cross-Recessed Pan Head, M4x8, SUS	8		
	47	B6-53-2001	Spring Washer, diameter 4, SUS	8		
	48	B6-11-2002	Hex Bolt, M6x10, SUS	1		

1. CASING AND COVER

CLASS	INDEX	PART CODE	PART DESCRIPTION/MODEL	QTY.	REMARKS	CHANGE
	49	B6-53-2002	Spring Washer, diameter 6, SUS	1		
	50	B6-72-2007	E Ring, diameter 4, SUS	2		
	51	B6-52-2002	Plain Washer, diameter 6, SUS	2		
	52					
	53	B6-29-1111	Screw, Cross-Recessed Pan Head, M3x12, Bs	2	Sems B	
	54	B6-28-1116	Screw, Cross-Recessed Pan Head, M4x6, Bs	4	Sems A	
	55					
	56	B6-12-2023	Hex Socket Head Bolt, M4x20, SUS	1		
	57	B6-41-2001	Hex Nut, M4, SUS	1		
	58	B6-14-1208	Flat Head Screw, M4x10, Bs-Cr	2		
	59	B6-28-1101	Pan Head Screw, M3x6, Bs-Ni	8	Sems A	
	60					
	61					
	61					
	63					
	64					
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	67					
	68					
	69					
	70					
	71					
	72					
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	82					
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		A-AK23-0492-01	Top Cover Cushion (F)	1	Not shown in Fig.	9324
		A-AK23-0493-01	Top Cover Cushion (R)	1	Not shown in Fig.	9324
		A-AK23-0497-000	Collar (3), Top Cover Support	2	Not shown in Fig.	9324
		A-AK23-0498-00	Top Cover Side Stay	1	Not shown in Fig.	9324

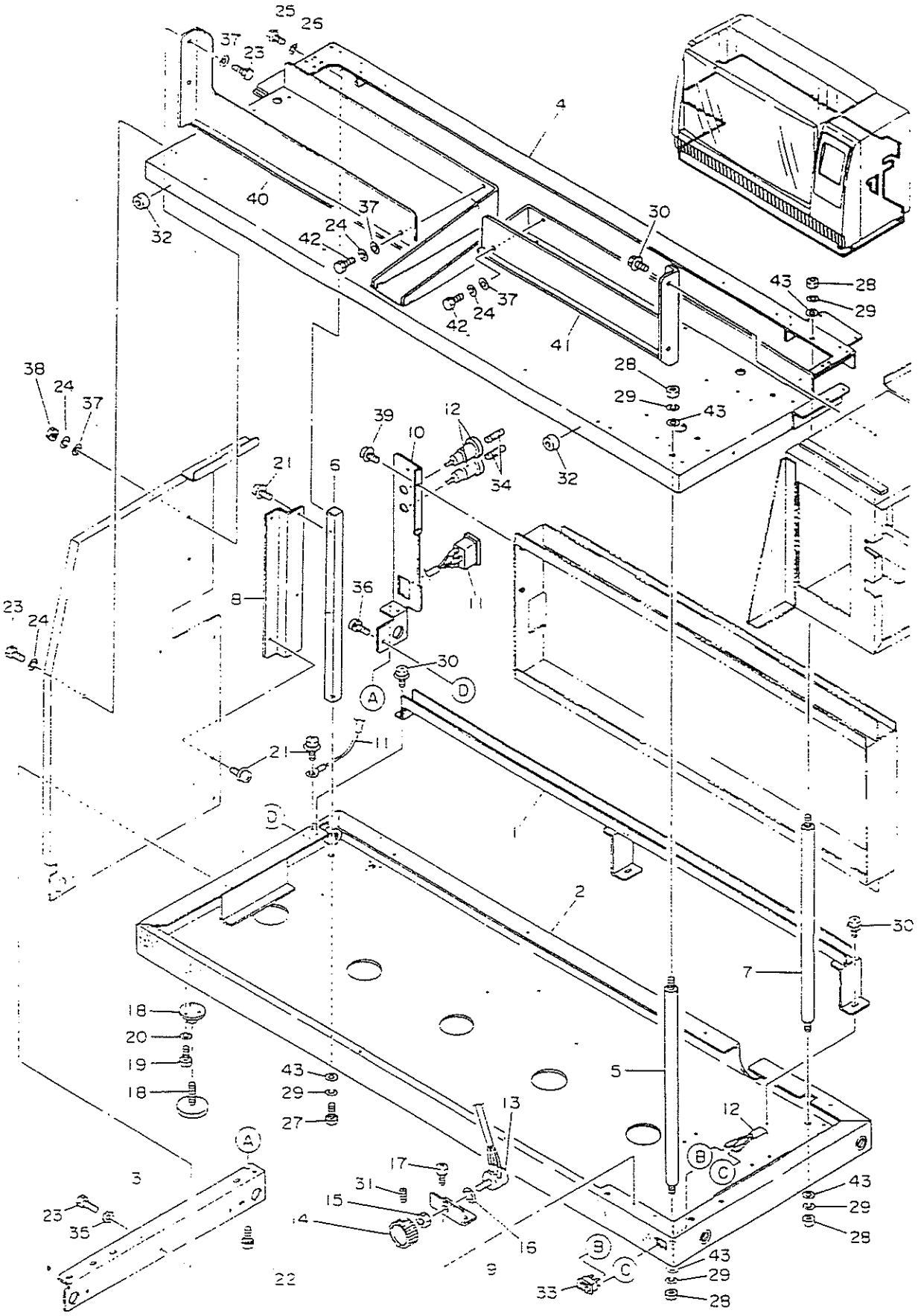
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Fig.2

2. BASE

CLASS	INDEX	PART CODE	PART DESCRIPTION/MODEL	QTY.	REMARKS	CHANGE
	1	A-AK23-0133-01	Slide Guide	1		
	2	A-AK23-0370-05	Base, Lower	1		8976
	3	A-AK23-0372-01	Bracket, Left Side Casing	1		
	4	A-AK23-0377-05	Base, Upper	1		8976
	5	A-AK23-0389-01	Column, Front	1		
	6	A-AK23-0390-01	Column, Sub	1		
C	7	A-AK23-0391-01	Column, Rear	1		
C	8	A-AK23-0392-02	Cover, Power Inlet	1		
	9	A-AK23-0518-01	Bracket, Water Flow Adjustment Knob	1		
C	10	A-AK23-0519-01	Panel, Power Inlet	1		
	11	F51-061-00	Power Inlet Connector Unit E:NDRS-24	1		
	12	F51-062-00	Fuse Holder Unit (1) E:NDRS-23	1	for 100V line	
	12	F51-063-00	Fuse Holder Unit (2) E:NDRS-25	1	for 200V line	
C	13	F51-077-00	LCD Brightness Adjustment Unit E:NDRS-13	1		
C	14	B5-10-0271	Knob, W-3BS	1		
	15		Hex Nut, M8, P0.75, t2.0, Bs	1	accessory to Item 14	
	16		Lockwasher, Internal Tooth, M8 Fe	1	accessory to Item 14	
	17	B6-29-1105	Screw, Cross-Recessed Pan Head, M4x8, Bs-Ni	2	Sems A	
C	18	D9-03-0134	Adjuster Foot, C-27-3	4		
	19	B6-13-2016	Screw, Cross-Recessed Pan Head, M3x8, SUS	12		
	20	B6-53-2007	Spring Washer, diameter 3, SUS	12		
	21	B6-29-1106	Screw, Cross-Recessed Pan Head, M4x8, Bs-Ni	5	Sems B	
	22	B6-29-2002	Screw, Cross-Recessed Pan Head, M4x8, SUS	2	Sems C	
	23	B6-11-2018	Hex Bolt, M5x10, SUS	7		
	24	B6-53-2006	Spring Washer, diameter 5, SUS	4		
	25	B6-11-2003	Hex Bolt, M6x15, SUS	1		
	26	B6-53-2002	Spring Washer, diameter 6, SUS	1		
	27	B6-11-2014	Hex Bolt, M8x20, SUS	1		
	28	B6-41-2003	Hex Nut, M8, SUS	4		
	29	B6-53-2003	Spring Washer, diameter 8, SUS	5		
	30	B6-38-1200	Hex Bolt + Spring Washer + Washer, M5x10, Fe-Ni	5		
	31	B6-34-2003	Set Screw, Hex Socket Headless, M4x8, SUS	1		
	32	D9-03-0172	Rubber Foot, TM-166-9, Black	2		
C	33	A3-00-1260	Power Switch, A8CA-207-2A	1		
A	34	A3-40-0463	Fuse, GGL8	2	for 100V line	
A	34	A3-40-0364	Fuse, ES3-5000	2	for 200V line	
	35	B6-56-2004	Tooth Washer, diameter 5, Fe	3		
	36	B6-28-1104	Screw, Cross-Recessed Pan Head, M5x8, Bs-Ni	1	Sems A	
	37	B6-52-2006	Plain Washer, diameter 5 (5x10xt0.8), SUS	2		
	38	B6-41-2007	Hex Nut, M5, SUS	2		
	39	B6-29-1110	Screw, Cross-Recessed Pan Head, M4x6, Bs	2	Sems B	
	40	A-AK23-0394-00	Reinforcement (9), Base, Upper	1		
	41	A-AK23-0395-00	Reinforcement (10), Base, Upper	1		
	42	B6-11-2017	Hex Bolt, M5x8, SUS	2		
	43	B6-52-2003	Plain Washer, M8, SUS	5		
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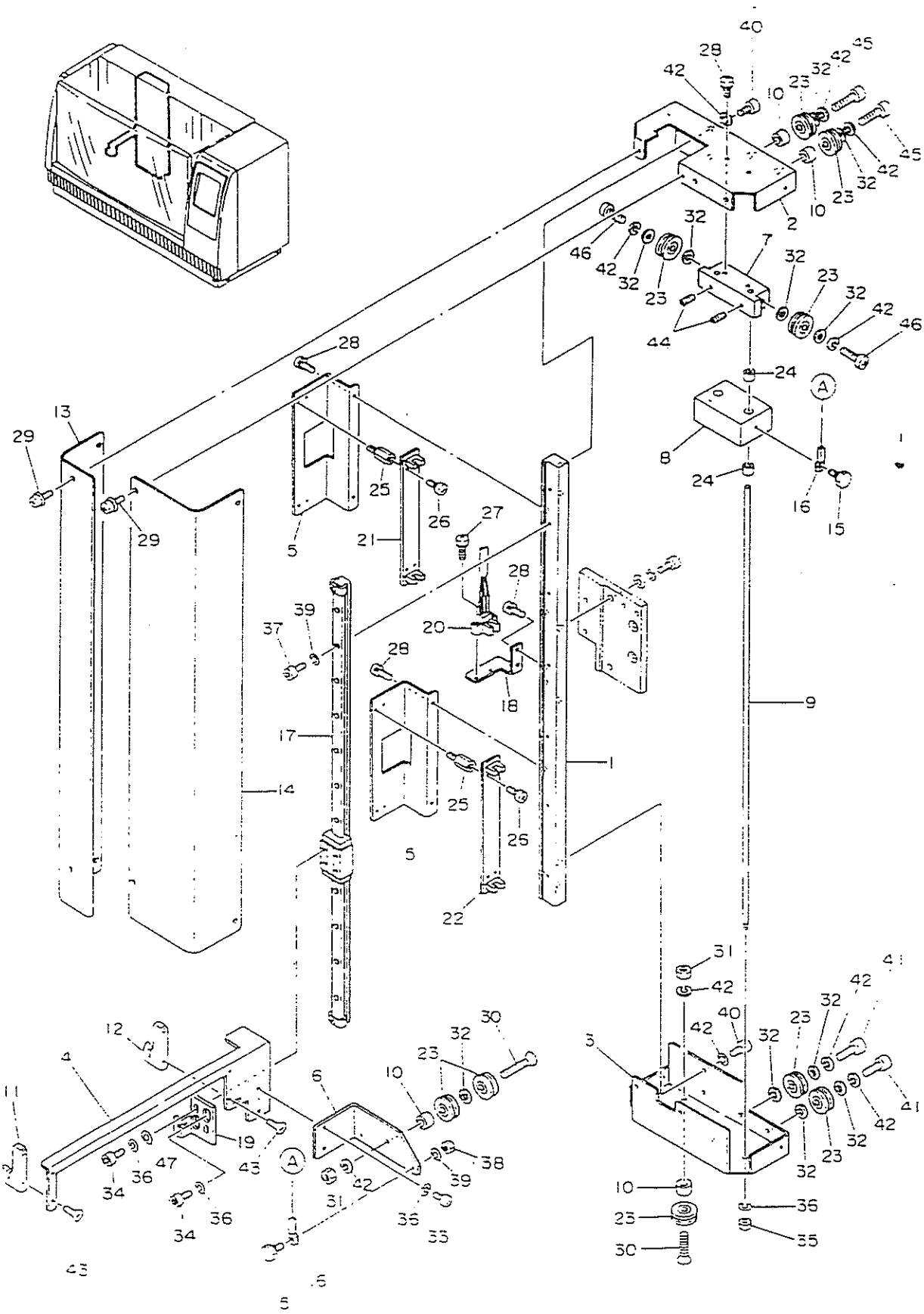

Fig.3

3. DRIVE UNIT (1)

CLASS	INDEX	PART CODE	PART DESCRIPTION/MODEL	QTY.	REMARKS	CHANGE
	1	A-AK23-0103-00	Support Bar, Linear Guide	1		
	2	A-AK23-0104-00	Frame, Z Axis Pulley, Upper	1		
	3	A-AK23-0109-00	Frame, Z Axis Pulley, Lower	1		
	4	A-AK23-0110-00	Robotic Arm	1		
	5	A-AK23-0111-00	Bracket, Z Axis Sensor	2		
	6	A-AK23-0112-02	Mounting Plate, Arm Pulley	1		8976, 9099
	7	A-AK23-0113-00	Base, Weight Guide Bar	1		
	8	A-AK23-0114-01	Balance Weight	1		8976
	9	A-AK23-0115-00	Guide Bar, Balance Weight	2		
	10	A-AK23-0116-00	Spacer, Pulley	4		
C	11	A-AK23-0117-02	Holder, Adapter, Front — OLD STYLE 9mm Deep 6 Recess	1		8918, 9211
C	12	A-AK23-0118-02	Holder, Adapter, Rear — 14mm Deep 6 Recess NEW	1		8918, 9211
	13	A-AK23-0119-00	Cover (1), Z Axis	1		
	14	A-AK23-0120-01	Cover (2), Z Axis	1		
	15	A-AK23-0136-00	Shaft, Driving Wire End	4		
C	16	A-AK23-0141-00	Weight, Driving Wire	2		
C	17	A-AK23-0142-00	LM Guide	1		
	18	A-AK23-0148-00	Support, Middle Sensor, Z Axis	1		
	19	A-AK23-0149-02	Light Screen, Z Axis	1		8918, 8976
C	20	F51-068-00	Z Axis Middle Sensor Unit E:NDRS-26	1		
C	21	F51-066-00	Upper Floor Sensor Board E:NDRS-03	1		
C	22	F51-067-00	Lower Floor Sensor Board E:NDRS-04	1		
C	23	B0-01-3012	Pulley, DV-19-H	9		
C	24	B0-03-8390	Bearing, R-AR0608	4		
	25	A4-07-0042	Spacer, BS-310	8		
	26	B6-28-1101	Screw, Cross-Recessed Pan Head, M3x6, Bs-Ni	8	Sems A	
	27	B6-28-1106	Screw, Cross-Recessed Pan Head, M3x10, Bs-Ni	2	Sems A	
	28	B6-28-1105	Screw, Cross-Recessed Pan Head, M4x8, Bs-Ni	8	Sems A	
	29	B6-29-1106	Screw, Cross-Recessed Pan Head, M4x8, Bs-Ni	8	Sems B	
	30	B6-14-2017	Screw, Cross-Recessed Flat Head, M5x30, SUS	2		
	31	B6-41-2007	Hex Nut, M5, SUS	2		
	32	B6-52-2012	Plain Washer, diameter 5, 5x10xt1.0, SUS	11		
	33	B6-13-2001	Screw, Cross-Recessed Pan Head, M4x8, SUS	2		
	34	B6-12-2004	Bolt, Hex Socket Head, M4x8, SUS	4		
	35	B6-41-2001	Hex Nut, M4, SUS	2		
	36	B6-53-2001	Spring Washer, diameter 4, SUS	8		
	37	B6-12-2028	Bolt, Hex Socket Head, M3x12, SUS	7		
	38	B6-41-2008	Hex Nut, M3, SUS	2		
	39	B6-53-2007	Spring Washer, diameter 3, SUS	9		
	40	B6-12-2021	Bolt, Hex Socket Head, M5x10, SUS	4		
	41	B6-12-2005	Bolt, Hex Socket Head, M5x15, SUS	2		
	42	B6-53-2006	Spring Washer, diameter 5, SUS	12		
	43	B6-14-2011	Screw, Cross-Recessed Flat Head, M3x8, SUS	4		
	44	B6-34-2002	Set Screw, Hex Socket Headless, M4x6, SUS	2		
	45	B6-12-2009	Bolt, Hex Socket Head, M5x20, SUS	2		
	46	B6-13-1142	Screw, Cross-Recessed Pan Head, M5x15, Bs-Ni	2		
	47	B6-52-2000	Plain Washer, M4, SUS	2		
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4. DRIVE UNIT (2)

	INDEX	PART CODE	PART DESCRIPTION/MODEL	QTY.	REMARKS	CHANGE
	1	A-AK23-0101-00	Slide Shaft	1		
	2	A-AK23-0102-02	Mounting Plate, Z Axis Slide Unit	1		
	3	A-AK23-0105-00	Mounting Plate, Z Axis Pulley	1		
	4	A-AK23-0106-01	Bracket, X Axis Sensor	1		8976
	5	A-AK23-0107-01	Bracket, X Axis Driving Wire	1		
	6	A-AK23-0108-00	Spacer, Mounting Plate, Z Axis Pulley	1		
	7	A-AK23-0116-00	Spacer, Pulley	2		
	8	A-AK23-0121-00	Bracket, Z Axis Motor	1		
	9	A-AK23-0122-00	Support (1), Relay Pulley, Z Axis	1		
	10	A-AK23-0123-00	Support (2), Relay Pulley, Z Axis	1		
	11	A-AK23-0124-00	Bracket, X Axis Motor	1		
	12	A-AK23-0125-01	Base, Driving Wire	1		
	13	A-AK23-0128-00	Spacer, Driving Wire Base	3		
	14	A-AK23-0129-00	Wire Tensioner	1		
	15	A-AK23-0130-01	Drum, Driving Wire	2		
	16	A-AK23-0131-01	Rail, Sensor Cable	1		
	17	A-AK23-0132-00	Column, Sensor Cable Rail	2		
	18	A-AK23-0136-00	Shaft, Driving Wire End	4		
C	19	A-AK23-0137-00	Driving Wire, Left, X Axis	1		
C	20	A-AK23-0138-00	Driving Wire, Right, X Axis	1		
C	21	A-AK23-0139-00	Driving Wire, Upper, X Axis	1		
C	22	A-AK23-0140-00	Driving Wire, Lower, X Axis	1		
	23	A-AK23-0144-00	Shaft, X Axis Pulley	1		
	24	A-AK23-0145-00	Cable Clamp (1)	1		
	25	A-AK23-0146-00	Cable Clamp (2)	1		
C	26	F51-065-00	X Axis Sensor Board E:NDRS-02	1		
C	27	F51-078-00	X Axis Stepping Motor Unit E:NDRS-14	1		
C	28	F51-079-00	Z Axis Stepping Motor Unit E:NDRS-15	1		
C	29	B0-03-8751	Slide Unit, SMA16W	1		
	30	B0-03-8794	Shaft Support, SH16A	2		
C	31	B0-01-3012	Pulley, DV-19-H	7		
	32	A4-07-0042	Spacer, BS-310	4		
	33	A4-07-0119	Spacer, AR-430	3		
C	34	B3-12-2010	Soft Tape, 10x15x4m		30 mm x 3 pcs.	
	35	B6-28-1101	Screw, Cross-Recessed Pan Head, M3x6, Bs-Ni	4	Sems A	
	36	B6-28-1116	Screw, Cross-Recessed Pan Head, M4x6, Bs-Ni	2	Sems A	
	37	B6-28-1105	Screw, Cross-Recessed Pan Head, M4x8, Bs-Ni	11	Sems A	
	38	B6-29-1106	Screw, Cross-Recessed Pan Head, M4x8, Bs-Ni	20	Sems B	
	39	B6-13-1128	Screw, Cross-Recessed Pan Head, M4x30, Bs-Ni	2		
	40	B6-41-1103	Hex Nut, M4, Bs-Ni	2		
	41	B6-53-5102	Spring Washer, diameter 4, Pb	2		
	42	B6-14-1107	Screw, Cross-Recessed Pan Head, M4x8, Bs-Ni	3		
	43	B6-12-2011	Bolt, Hex Socket Head, M3x20, SUS	2		
	44	B6-12-2008	Bolt, Hex Socket Head, M4x6, SUS	2		
	45	B6-11-2030	Bolt, Hex Socket Head, M4x10, SUS	1		
	46	B6-53-2001	Spring Washer, diameter 4, SUS	3		
	47	B6-52-2001	Plain Washer, diameter 4, SUS	1		
	48	B6-41-2008	Hex Nut, M3, SUS	2		
	49	B6-53-2007	Spring Washer, diameter 3, SUS	2		

4. DRIVE UNIT (2)

CLASS	INDEX	PART CODE	PART DESCRIPTION/MODEL	QTY.	REMARKS	CHANGE
	50					
	51	B6-12-2009	Bolt, Hex Socket Head, M5x20, SUS	6		
	52	B6-12-2030	Bolt, Hex Socket Head, M5x25, SUS	2		
	53	B6-12-2031	Bolt, Hex Socket Head, M5x30, SUS	1		
	54	B6-41-2007	Hex Nut, M5, SUS	1		
	55	B6-53-2006	Spring Washer, diameter 5, SUS	10		
	56	B6-52-2012	Plain Washer, diameter 5, 5x10xt1.0, SUS	8		
	57	B6-12-2002	Bolt, Hex Socket Head, M6x15, SUS	2		
	58	B6-53-2002	Spring Washer, diameter 6, SUS	2		
	59	B6-52-2002	Plain Washer, diameter 6, SUS	2		
	60	B6-14-1113	Screw, Cross-Recessed Flat Head, M5x20, Bs-Ni	2		
	61	B6-34-2003	Set Screw, Hex Socket Headless, M4x8, SUS	4		
B	62	F51-104-00	Laminated Cable E:NDRS-44	1		
B	63	A4-10-0111	Relay Cable, X Axis Sensor	1		
B	64	A4-08-0503	Fixing Base, TMS-20	1		
	65	B6-14-1102	Screw, Cross-Recessed Flat Head, M3x5, Bs-Ni	1		
B	66	A-AK23-0150-00	Gasket, X Motor Base	1		
B	67	A-AK23-0151-00	Gasket (1), Z Motor Base	1		
B	68	A-AK23-0152-00	Gasket (2), Z Motor Base	1		
	69	B6-38-1511	Hex Bolt with Spring Washer + Washer, M5x25, Fe-Ni	4		
	70	B6-29-1101	Screw, Cross-Recessed Pan Head, M4x10, Bs-Ni	2	Sems B	
	71	A4-03-0093	Clamp, LFC-30N-0	1		
	72	A-AK23-0153-00	Bracket, Shaft Support	2		
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KIT TO CHANGE METAL TO PLASTIC DOOR CATCH - K60-574-00

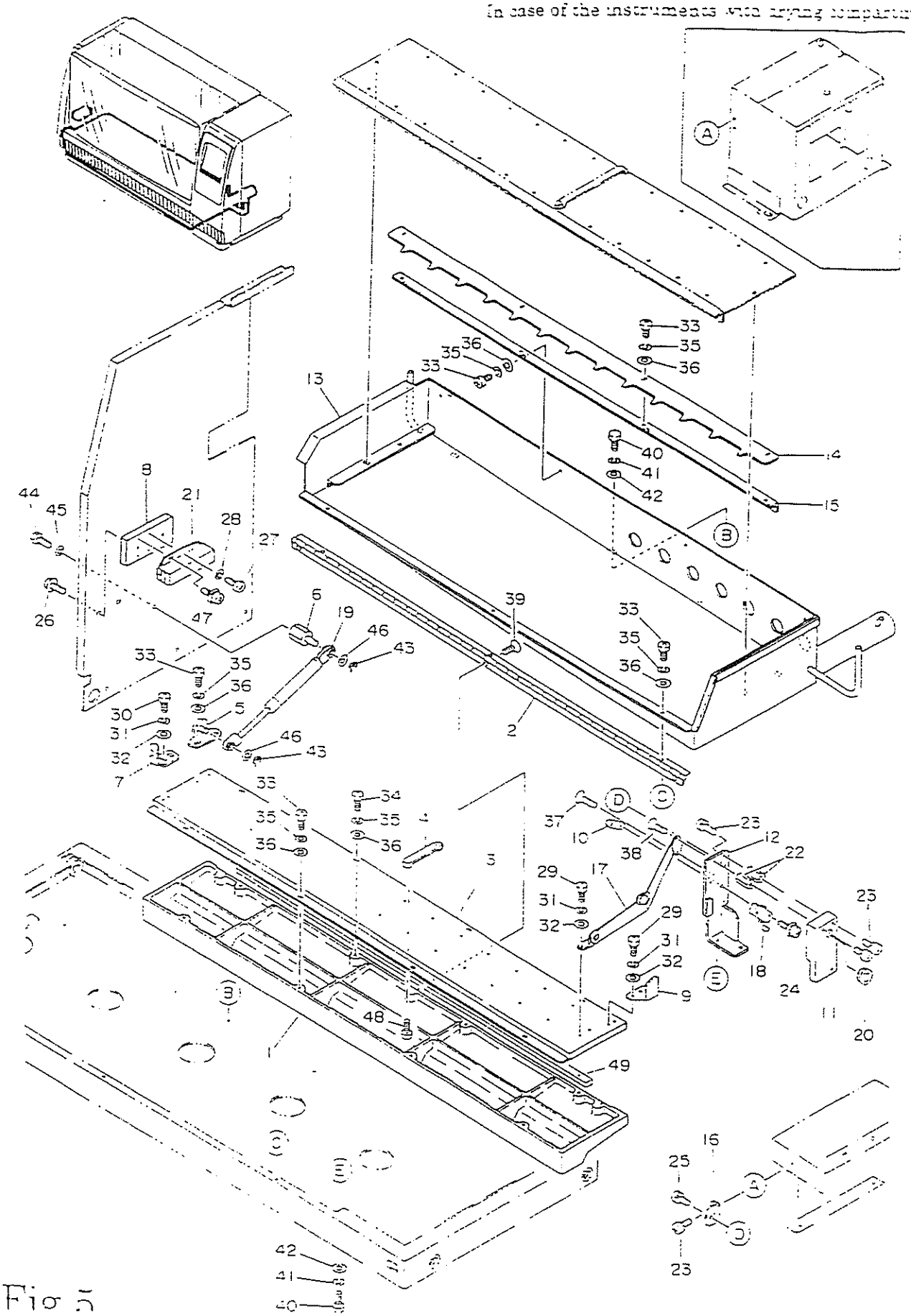

Fig 5

5. DOOR AND LOWER TRAY

CLASS	INDEX	PART CODE	PART DESCRIPTION/MODEL	QTY.	REMARKS	CHANGE
	1	A-AK23-0230-01	Door	1		
	2	A-AK23-0232-01	Door Hinge	1		
	3	A-AK23-0235-01	Inner Panel, Door	1		
C	4	A-AK23-0236-00	Reservoir Guide, Door	7		
	5	A-AK23-0237-01	Stay, Oil Damper, Door	1		
	6	A-AK23-0240-00	Damper Shaft	1		
	7	A-AK23-0241-01	Catch Receiver, Door	1		
	8	A-AK23-0242-02	Catch Base, Door	1		
	9	A-AK23-0243-01	Lever, Door Switch	1		
	10	A-AK23-0244-00	Bracket, Door Switch	1		
	11	A-AK23-0245-01	Cover, Door Switch	1		
	12	A-AK23-0246-02	Bracket, Door Stay	1		8976
	13	A-AK23-0250-03	Lower Tray	1		8976, 9099
	14	A-AK23-0265-01	Reservoir Stopper, Lower Tray	1		
	15	A-AK23-0266-00	Base, Reservoir Stopper, Lower Tray	1		
	16	A-AK23-0494-00	Support, Door Stay	1		
	17	A-AK23-0495-00	Door Stay	1		
C	18	F51-076-00	Door Switch Unit E:NDRS-12	1		
C	19	D9-28-0283	Oil Damper, B-466-3	1		
	20	A4-07-0345	Grommet, C-30-BW-8-1	1		8976
B	21	D9-04-0206	Door Catch, B-OCL	1		
	22	A4-07-0055	Spacer, ASB-315	3		
	23	B6-28-1101	Screw, Cross-Recessed Pan Head, M3x6, Bs-Ni	7	Sems A	
	24	B6-29-1117	Screw, Cross-Recessed Pan Head, M3x18, Bs-Ni	2	Sems B	
	25	B6-28-1105	Screw, Cross-Recessed Pan Head, M4x8, Bs-Ni	1	Sems A	
	26	B6-29-1106	Screw, Cross-Recessed Pan Head, M4x8, Bs-Ni	2	Sems B	
	27	B6-13-1102	Screw, Cross-Recessed Pan Head, M2x5, Bs-Ni	2		
	28	B6-53-5105	Spring Washer, diameter 2, Pb	2		
	29	B6-13-2017	Screw, Cross-Recessed Pan Head, M3x6, SUS	4		
	30	B6-13-2016	Screw, Cross-Recessed Pan Head, M3x8, SUS	2		
	31	B6-53-2007	Spring Washer, diameter 3, SUS	6		
	32	B6-52-2008	Plain Washer, diameter 3, SUS	6		
	33	B6-13-2001	Screw, Cross-Recessed Pan Head, M4x8, SUS	17		
	34	B6-13-2007	Screw, Cross-Recessed Pan Head, M4x15, SUS	4		
	35	B6-53-2001	Spring Washer, diameter 4, SUS	21		
	36	B6-52-2001	Plain Washer, diameter 4, SUS	21		
	37	B6-14-1102	Screw, Cross-Recessed Flat Head, M3x5, Bs-Ni	1		
	38	B6-14-1103	Screw, Cross-Recessed Flat Head, M3x8, Bs-Ni	1		
	39	B6-14-2010	Screw, Cross-Recessed Flat Head, M4x10, SUS	3		
	40	B6-11-2018	Hex Bolt, M5x10, SUS	5		
	41	B6-53-2006	Spring Washer, diameter 5, SUS	5		
	42	B6-52-2006	Plain Washer, diameter 5, SUS	5		
	43	B6-72-2007	E Ring, diameter 4, SUS	2		
	44	B6-11-2002	Hex Bolt, M6x10, SUS	1		
	45	B6-53-2002	Spring Washer, diameter 6, SUS	1		
	46	B6-52-2002	Plain Washer, diameter 6, SUS	2		
	47	B6-29-1107	Screw, Cross-Recessed Pan Head, M3x6, Bs-Ni	2	Sems B	
	48	B6-22-0101	Tapping Screw, M3x6, SUS	14		9171
	49	A-AK23-0496-00	Reinforcement, Inner Panel, Door	1		

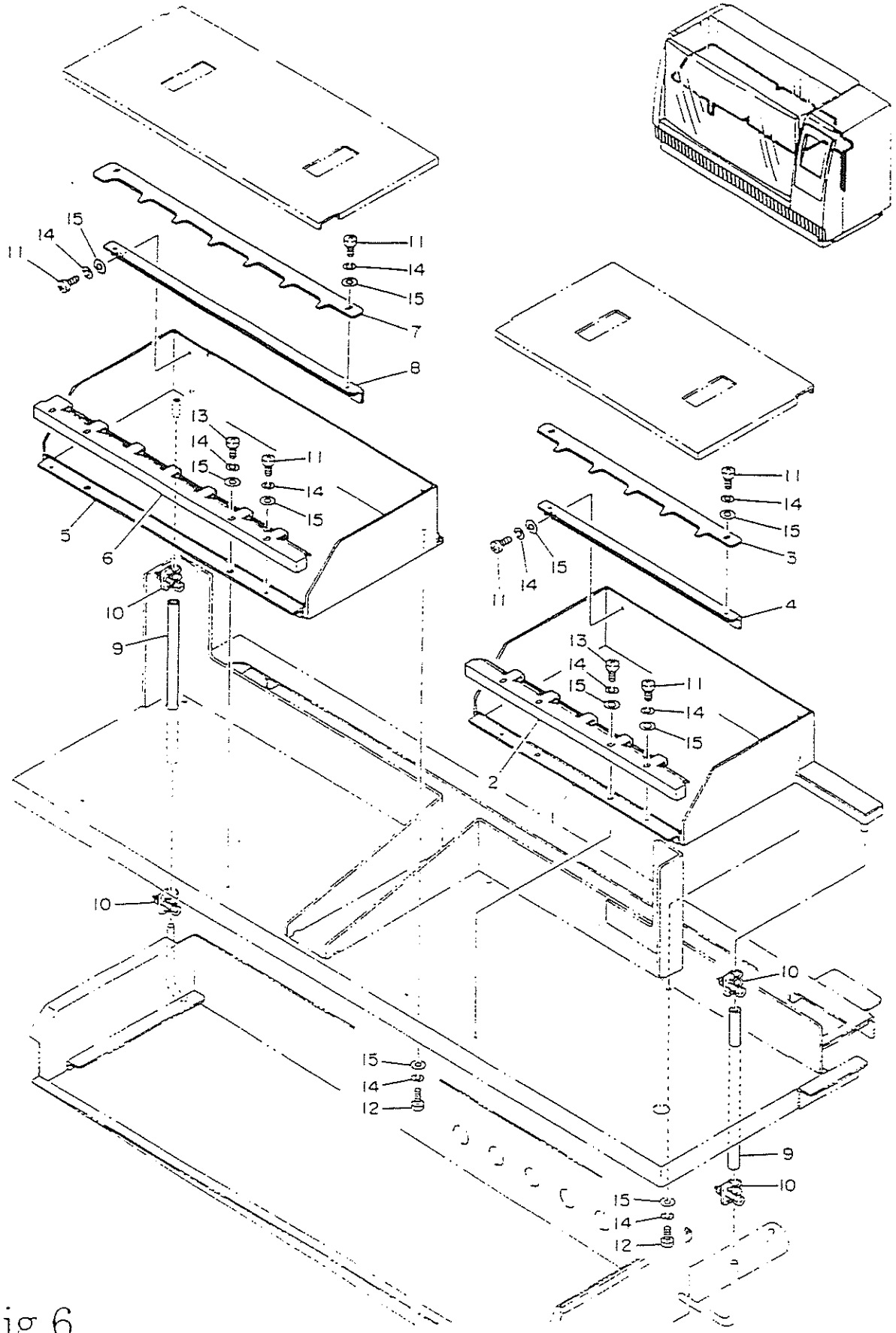
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Fig.6

6. UPPER TRAY

CLASS	INDEX	PART CODE	PART DESCRIPTION/MODEL	QTY.	REMARKS	CHANGE
	1	A-AK23-0267-03	Upper Tray, Right Hand	1		8976
	2	A-AK23-0273-01	Reservoir, Guide, Upper Tray, Right Hand	1		
	3	A-AK23-0274-01	Reservoir Stopper, Upper Tray, Right Hand	1		
	4	A-AK23-0275-00	Base, Reservoir Stopper, Upper Tray, Right Hand	1		
	5	A-AK23-0277-02	Upper Tray, Left Hand	1		8976
	6	A-AK23-0283-01	Reservoir Guide, Upper Tray, Left Hand	1		
	7	A-AK23-0284-01	Reservoir Stopper, Upper Tray, Left Hand	1		
	8	A-AK23-0285-00	Base, Reservoir Stopper, Upper Tray, Left Hand	1		
B	9	A-AK23-0287-00	Drain Tube, Upper Tray	2		
	10	D9-00-0103	Clamp, Drain Tube, diameter 10	4		8976
	11	B6-13-2001	Screw, Cross-Recessed Pan Head, M4x8 , SUS	12		
	12	B6-13-2003	Screw, Cross-Recessed Pan Head, M4x12 , SUS	4		
	13	B6-13-2008	Screw, Cross-Recessed Pan Head, M4x20 , SUS	4		
	14	B6-53-2001	Spring Washer, diameter 4, SUS	20		
	15	B6-52-2001	Plain Washer, diameter 4, SUS	20		
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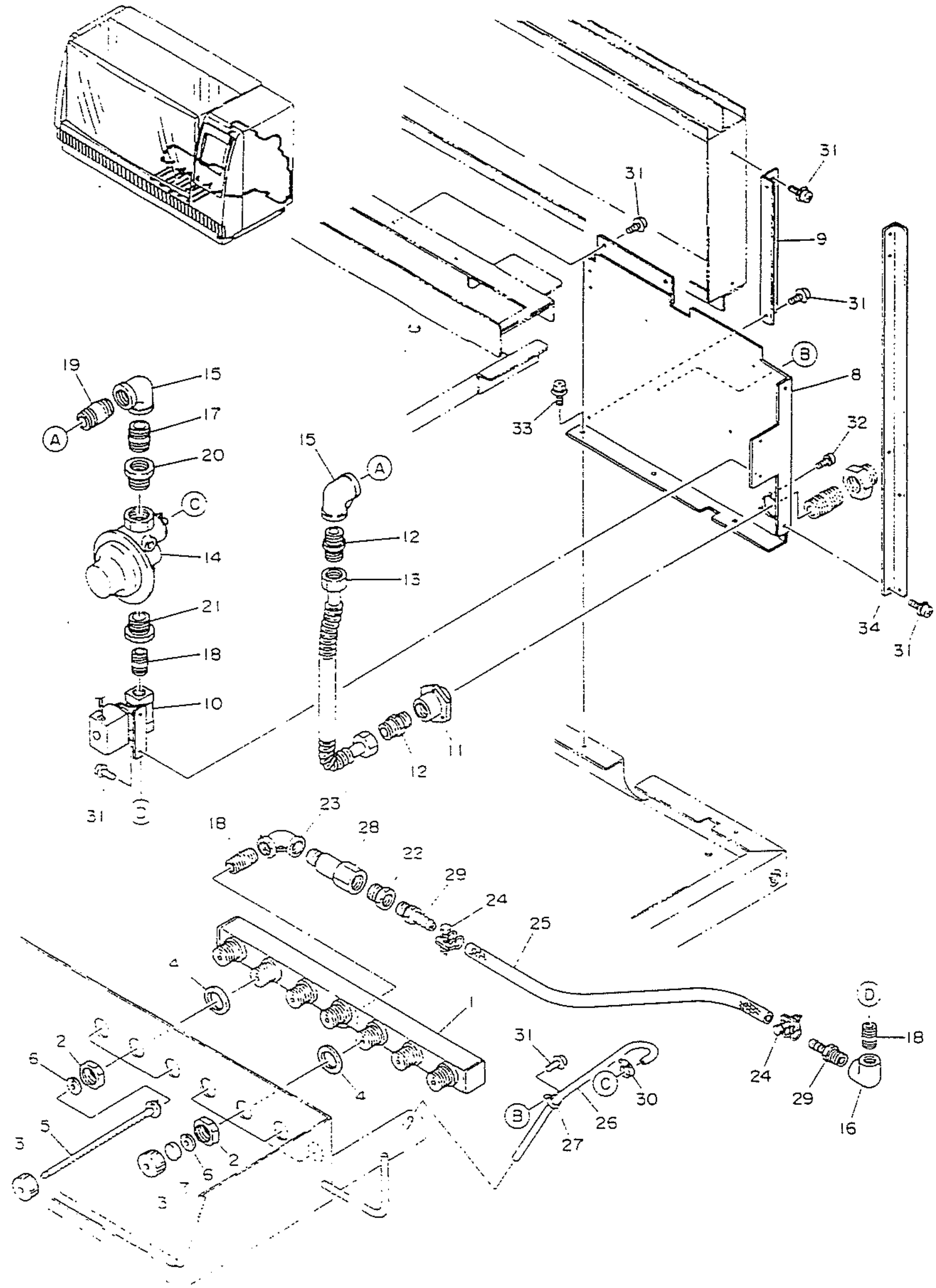
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Fig.7

7. WATER SUPPLY AND WASH STATION

CLASS	INDEX	PART CODE	PART DESCRIPTION/MODEL	QTY.	REMARKS	CHANGE
	1	A-AK23-0420-02	Manifold	1		8976
	2	A-AK23-0424-02	Fixing Nut, Manifold	7		9171
	3	A-AK23-0425-02	Fixing Nut, Nozzle	7		9171
C	4	A-AK23-0427-00	Gasket, Manifold	7		
	5	A-AK23-0428-00	Nozzle	3		
B	6	A-AK23-0433-00	Gasket, Nozzle	7		
	7	A-AK23-0434-00	Blind Collar	4		
	8	A-AK23-0435-04	Rear Plate, Water Supply Section	1		8976, 9275
	9	A-AK23-0439-00	Blind Plate, Water Supply Section	1		
C	10	F51-080-00	Solenoid Valve Unit E:NDRS-16	1		
	11	A4-02-0490	Panel Socket, TTH04	1		
	12	A6-20-3010	Nipple Joint, Ni Plating, Bs 1/2	2		
	13	A6-38-3000	Flex Tube, S 1/2 300L	1		
C	14	A8-20-8100	Reducing Valve, RW35-S, Preset 0.85 Kgf/cm2	1		
	15	A6-31-0040	Elbow Joint, SUS 1/2	2		
	16	A6-31-0030	Elbow Joint, SUS 3/8	1		
	17	A6-30-0040	Nipple Joint, SUS 1/2	2		
	18	A6-30-0030	Nipple Joint, SUS, 3/8	3		
	19	A6-30-1054	Nipple Joint, Long, SUS 1/2x40L	1		
	20	A6-34-5160	Bushing, SUS 3/4x1/2	1		
	21	A6-34-5120	Bushing, SUS 3/4x3/8	1		
	22	A6-34-5110	Bushing, SUS 1/2x3/8	1		
	23	A6-31-1000	Special Elbow Joint, SUS 1/2 x 3/8	1		
	24	D9-00-0121	Clamp, Water Supply Hose, diameter 17	2		
B	25	B7-19-0040	Teflon Hose, Water Supply, 10x16	0.3m		
B	26	B7-00-0060	Vinyl Tube, 6x8	0.5m		
	27	A4-03-0005	Nylon Clamp, NK-6N	2		8976
C	28	A8-50-0250	Constant Flow Valve, HCT-15A-11L	1		
	29	A6-28-1041	Hose Mouth (Male), BsBM 3/8PTx3/8	2		
	30	D9-00-0148	Hose Band, SNP-1.5	1		
	31	B6-29-1106	Screw, Cross-Recessed Pan Head, M4x8, Bs-Ni	12	Sems B	
	32	B6-28-1114	Screw, Cross-Recessed Pan Head, M5x10, Bs-Ni	3	Sems A	
	33	B6-38-1200	Hex Bolt with Spring Washer + Washer, M5x10, Fe	3		
	34	A-AK23-0437-05	Rear Plate (2), Water Supply Section	1		9111, 9192
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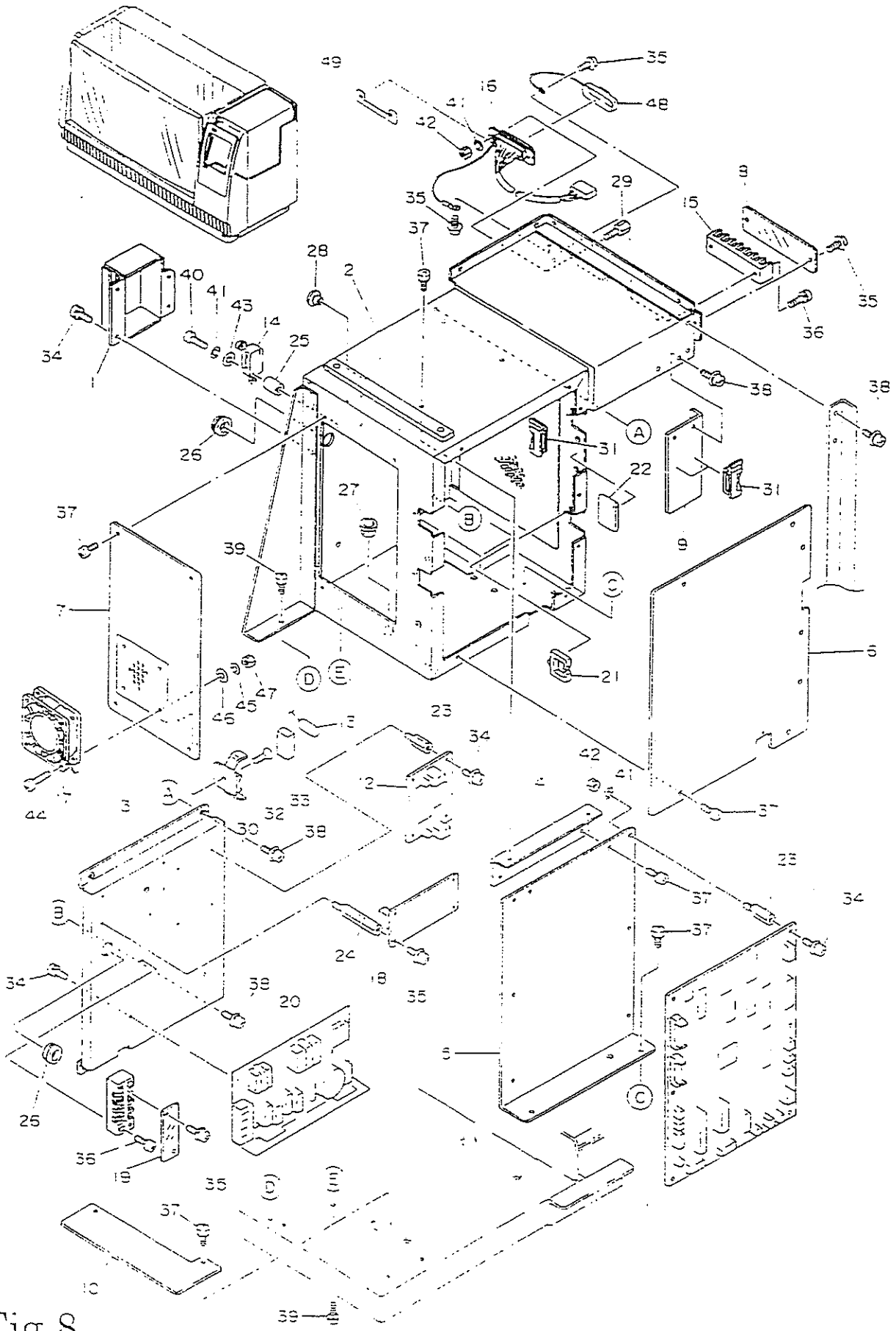

Fig.8

8. POWER SUPPLY SECTION BOX

CLASS	INDEX	PART CODE	PART DESCRIPTION/MODEL	QTY.	REMARKS	CHANGE
	1	A-AK23-0226-01	Cover, Front Cover Sensor	1		
	2	A-AK23-0500-08	Power Supply Box	1		8976, 9099, 9275
	3	A-AK23-0506-04	Board, Parts Fixing	1		8976, 9099
	4	A-AK23-0507-00	Bracket	1		
	5	A-AK23-0508-01	Board, PCB Fitting	1		9099
	6	A-AK23-0509-00	Box Cover (1)	1		
	7	A-AK23-0510-02	Box Cover (2)	1		9099
	8	A-AK23-0521-00	Cover, Terminal Block	1		
	9	A-AK23-0522-01	Cable Guide	1		
	10	A-AK23-0527-01	Heat Insulation Plate	1		8976
C	11	F51-064-00	Controller Board E:NDRS-01	1		
C	12	F51-071-00	Power Supply Board E:NDRS-07	1		
A	13	F51-074-00	Battery Unit E:NDRS-10	1	Toshiba ER4V	
C	14	F51-075-00	Front Cover Sensor Unit E:NDRS-11	1		
	15	F51-086-00	External Signal Terminal Block Unit E:NDRS-21	1		
	16	F51-087-00	RS-232C Connector Unit E:NDRS-22	1		
C	17	F51-088-00	Cooling Fan Unit E:NDRS-27	1		
C	18	F51-073-00	LCD Inverter Board E:NDRS-28	1		
	19	A4-05-0630	Terminal Block, UF1003-20A-4P	1		
C	20	A3-16-1263	Switching Regulator, PAA50F-12	1		
	21	A4-03-0092	Clamp, EDS-1717U	5		
	22	A3-90-4090	Ferrite Core, SSC-33.5-20	1		
	23	A4-07-0042	Spacer, BS-310	10		
	24	A4-07-0072	Spacer, BS-330	4		
	25	A4-07-0064	Duracon Spacer, C-309	2		
	26	A4-07-0341	Grommet, C-30-NG-79-G	2		8976
	27	A4-07-0118	One Touch Bush, TB-0813	1		
	28	D9-03-0510	Plug Cushion Rubber, TM-96-14	1		
	29	A3-90-2020	Fixing Screw, XM2Z-0022 (Supplied to Item 16)	2		
	30	A4-03-0091	Clamp, ARC.68-S-14	1		
	31	A4-03-0093	Clamp, LFC-30N-0	3		
	32	B6-41-1115	Screw, Cross-Recessed Flat Head, M3x6, Bs-Ni	1		
	33	B3-12-2010	Soft Tape, 10x15x4m	1	50mm x 1 pc.	
	34	B6-28-1101	Screw, Cross-Recessed Pan Head, M3x6, Bs-Ni	1	Sems A	
	35	B6-29-1107	Screw, Cross-Recessed Pan Head, M3x6, Bs-Ni	10	Sems B	
	36	B6-28-1108	Screw, Cross-Recessed Pan Head, M3x15, Bs-Ni	4	Sems A	
	37	B6-28-1105	Screw, Cross-Recessed Pan Head, M4x8, Bs-Ni	19	Sems A	
	38	B6-28-1106	Screw, Cross-Recessed Pan Head, M4x8, Bs-Ni	8	Sems B	
	39	B6-28-1104	Screw, Cross-Recessed Pan Head, M5x8, Bs-Ni	5	Sems A	
	40	B6-13-1105	Screw, Cross-Recessed Pan Head, M3x25, Bs-Ni	2		
	41	B6-53-5101	Spring Washer, diameter 3, Pb	10		
	42	B6-41-1102	Hex Nut, M3, Bs-Ni	8		
	43	B6-52-1102	Plain Washer, diameter 3, Bs-Ni	2		
	44	B6-13-1128	Screw, Cross-Recessed Pan Head, M4x30, Bs-Ni	4		
	45	B6-53-5102	Spring Washer, diameter 4, Pb	4		
	46	B6-52-1103	Plain Washer, diameter 4, Bs-Ni	4		
	47	B6-41-1103	Hex Nut, M4, Bs-Ni	4		
	48	A4-06-0914	Cover, RS-232C Connector, XM2T-2501	1		
	49	A-AK23-0528-00	Plate Connector	1		9099

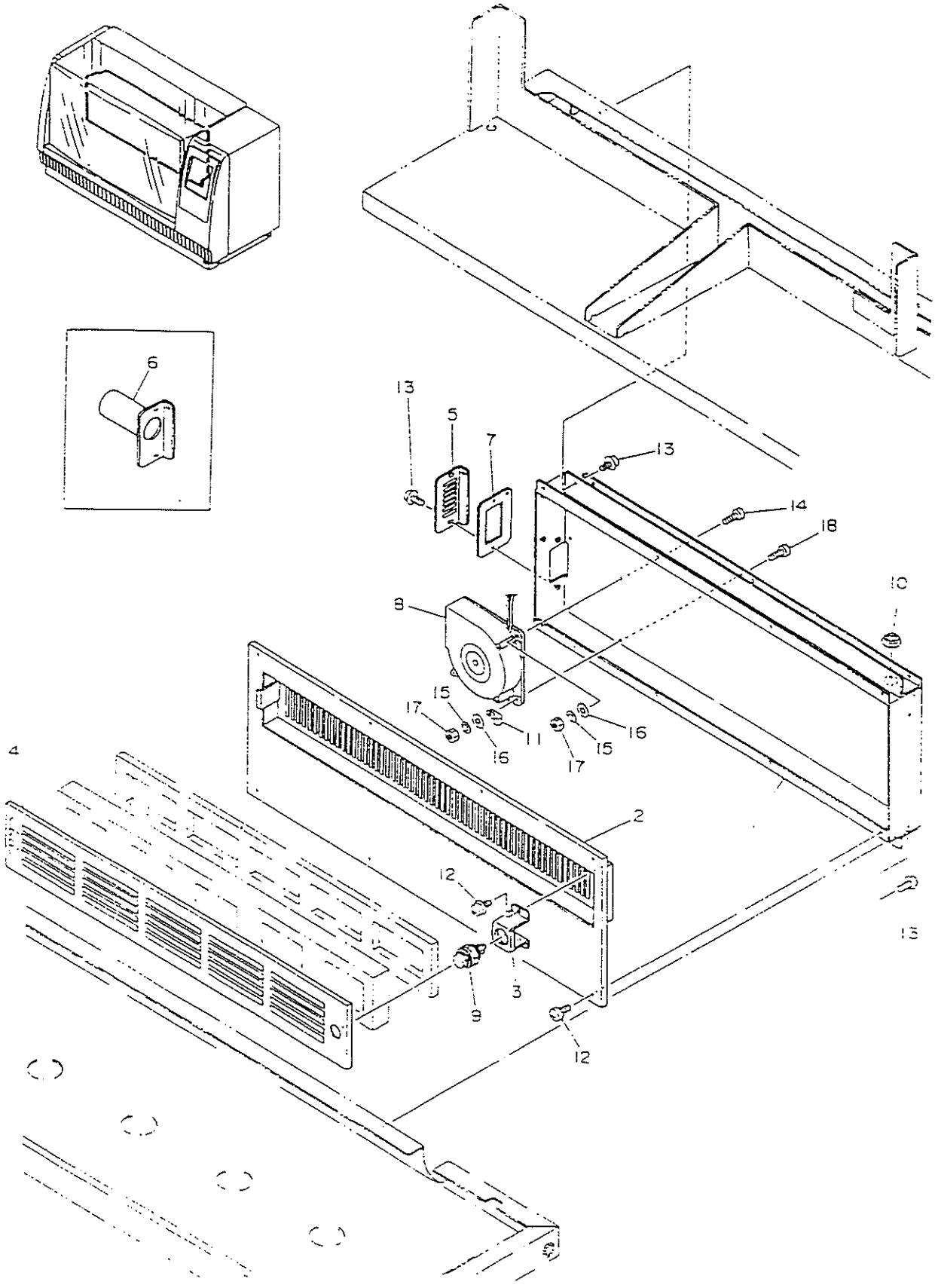

Fig.9

9. FUME VENTILATION SECTION

CLASS	INDEX	PART CODE	PART DESCRIPTION/MODEL	QTY.	REMARKS	CHANGE
	1	A-AK23-0450-01	Frame, Fume Ventilation	1		
	2	A-AK23-0455-03	Front Cover, Fume Ventilation	1		8976
	3	A-AK23-0460-01	Bracket, Cover Button	1		9099
	4	A-AK23-0461-01	Filter Cover	1		
	5	A-AK23-0465-01	Grill, Fume Ventilation	1		
	6	A-AK23-0631-01	Duct Connection Adapter	1	Option	
C	7	A-AK23-0466-01	Gasket, Fume Ventilation Grill	1		
C	8	F51-081-00	Ventilator Fan Unit E:NDRS-17	1		
	9	D9-04-0208	Filter Cover Button, Y-251F-03-3	1		
	10	A4-07-0303	Grommet, C-30-SG-20A	1		8976
	11	A4-03-0003	Nylon Clamp, NK-4N	1		
	12	B6-29-1106	Screw, Cross-Recessed Pan Head, M4x8, Bs-Ni	10	Sems B	
	13	B6-29-1106	Screw, Cross-Recessed Pan Head, M4x8, Bs-Ni	6	Sems B	
	14	B6-13-1124	Screw, Cross-Recessed Pan Head, M4x15, Bs-Ni	2		
	15	B6-53-5102	Spring Washer, diameter 4, Pb	3		
	16	B6-52-1103	Plain Washer, diameter 4, Bs-Ni	3		
	17	B6-41-1103	Hex Nut, M4, Bs-Ni	5		
	18	B6-13-1126	Screw, Cross-Recessed Pan Head, M4x20, Bs-Ni	1		
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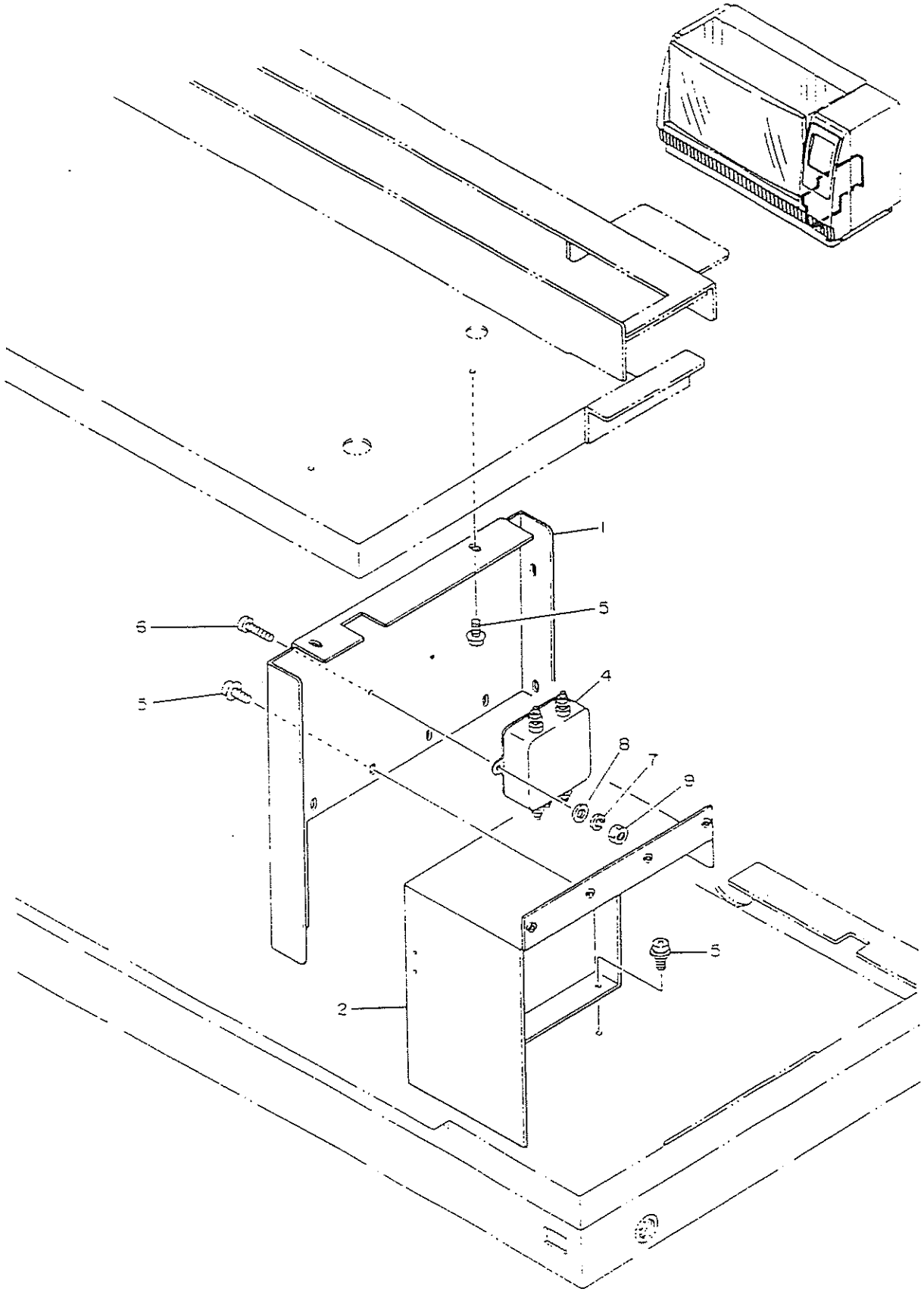

Fig.10

10. COVER FOR DRYER (WITHOUT DRYING COMPARTMENT)

CLASS	INDEX	PART CODE	PART DESCRIPTION/MODEL	QTY.	REMARKS	CHANGE
	1	A-AK23-0490-02	Top Cover, Dryer	1		
	2	A-AK23-0491-02	Cover (without Drying Compartment)	1		
	3					
	4	A3-60-8105	Noise Filter, GT-205U	1		
	5	B6-29-1106	Screw, Cross-Recessed Pan Head, M4x8, Bs-Ni	11	Sems B	
	6	B6-13-1121	Screw, Cross-Recessed Pan Head, M4x10, Bs-Ni	2		
	7	B6-53-5102	Spring Washer, diameter 4, Pb	2		
	8	B6-52-1103	Plain Washer, diameter 4, Bs-Ni	2		
	9	B6-41-1103	Hex Nut, M4, Bs	2		
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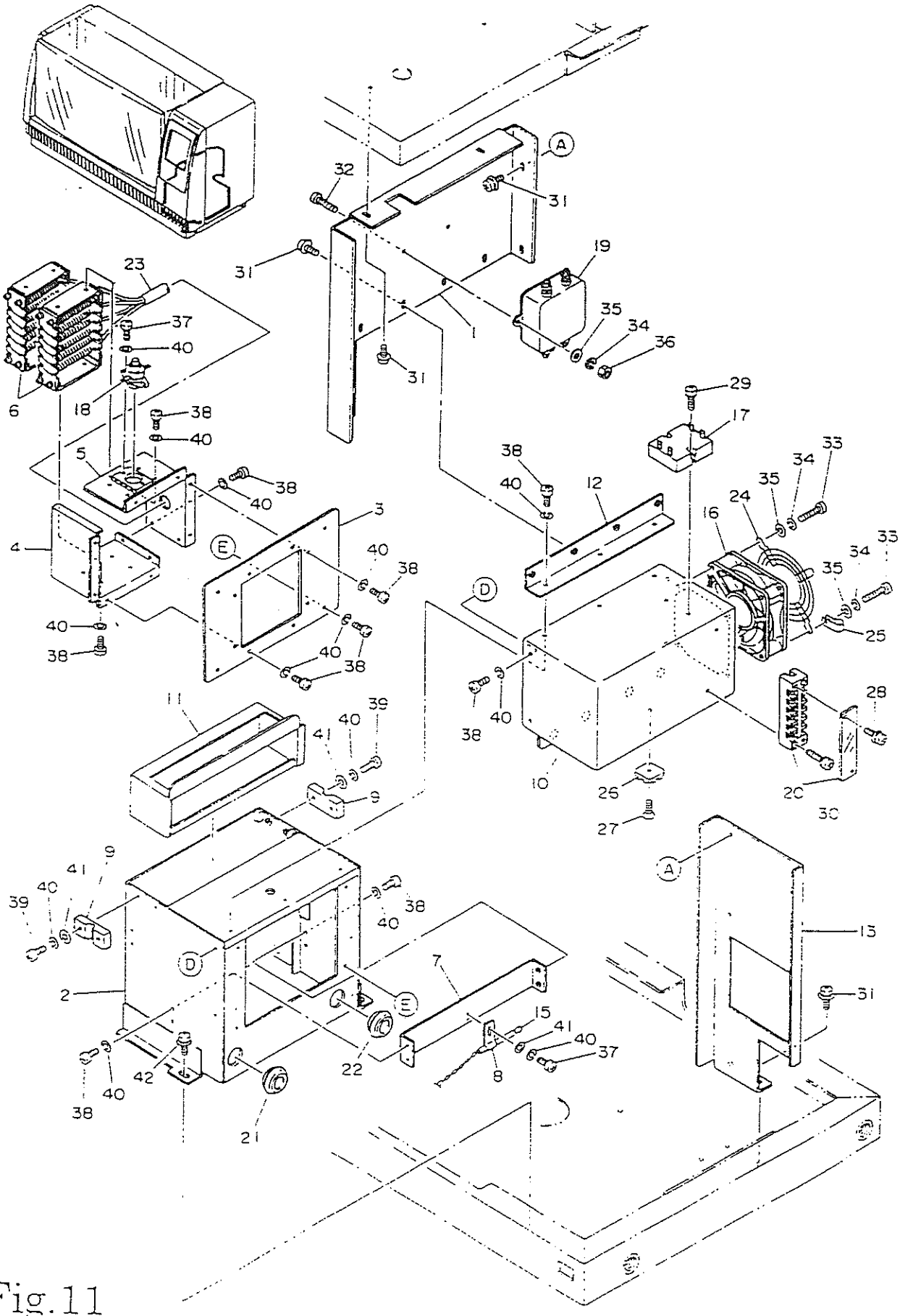
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Fig.11

11. COVER FOR DRYER (OPTION)

CLASS	INDEX	PART CODE	PART DESCRIPTION/MODEL	QTY.	REMARKS	CHANGE
	1	A-AK23-0490-02	Top Cover, Dryer	1		8976
	2	A-AK23-0600-01	Dryer Body	1		
	3	A-AK23-0606-00	Frame Heater Unit	1		
	4	A-AK23-0607-00	Bracket (Bottom), Heater Unit	1		
	5	A-AK23-0608-00	Bracket (Top), Heater Unit	1		
C	6	A-AK23-0611-00	Heater Unit, Dryer	2		
	7	A-AK23-0612-00	Air Baffle	1		
	8	A-AK23-0613-00	Bracket, Temperature Sensor	1		
	9	A-AK23-0614-01	Basket Support	2		
	10	A-AK23-0615-02	Frame, Dryer Fan	1		
	11	A-AK23-0616-01	Paraffin Receiver	1		
	12	A-AK23-0617-00	Bracket (1), Cover, Dryer	1		
	13	A-AK23-0618-00	Bracket (2), Cover, Dryer	1		
	14					
	15	F51-085-00	Dryer Temperature Sensor E:NDRS-08	1		
C	16	F51-082-00	Dryer Fan Unit E:NDRS-18	1		
C	17	F51-083-00	Heater Relay Unit E:NDRS-19	1		
C	18	F51-084-00	OTP Unit E:DRS-20	1		
C	19	A3-60-8105	Noise Filter, GT-205U	1		
	20	A4-05-0650	Terminal Block, UF1003-20A-6P	1		
	21	A4-07-0307	Grommet, C-30-SG-16A	1		9171
	22	A4-07-0303	Grommet, C-30-SG-20A	1		8976
	23	A4-09-0607	Insulation Tube, S-693 F-2, diameter 10	0.2m		
	24	D9-02-0120	Fan Guard, 109-049C	1		
	25	A4-03-0004	Nylon Clamp, NK-5N	1		
	26	A4-08-0503	Fixing Base, TMS-20	1		
	27	B6-14-1102	Screw, Cross-Recessed Flat Head, M3x5, Bs-Ni	1		
	28	B6-29-1107	Screw, Cross-Recessed Pan Head, M3x6, Bs-Ni	2	Sems B	
	29	B6-28-1106	Screw, Cross-Recessed Pan Head, M3x10, Bs-Ni	2	Sems A	
	30	B6-28-1108	Screw, Cross-Recessed Pan Head, M3x15, Bs-Ni	2	Sems A	
	31	B6-29-1106	Screw, Cross-Recessed Pan Head, M4x8, Bs-Ni	11	Sems B	
	32	B6-13-1121	Screw, Cross-Recessed Pan Head, M4x10, Bs-Ni	2		
	33	B6-13-1129	Screw, Cross-Recessed Pan Head, M4x35, Bs-Ni	4		
	34	B6-53-5102	Spring Washer, diameter 4, Pb	6		
	35	B6-52-1103	Plain Washer, diameter 4, Bs-Ni	6		
	36	B6-41-1103	Hex Nut, M4, Bs-Ni	2		
	37	B6-13-2014	Screw, Cross-Recessed Pan Head, M3x5, SUS	4		
	38	B6-13-2017	Screw, Cross-Recessed Pan Head, M3x6, SUS	36		
	39	B6-13-2020	Screw, Cross-Recessed Pan Head, M3x12, SUS	4		
	40	B6-53-2007	Spring Washer, diameter 3, SUS	44		
	41	B6-52-2008	Plain Washer, diameter 3, SUS	6		
	42	B6-38-1200	Hex Bolt with Spring Washer + Washer, M5x10, Fe	3		
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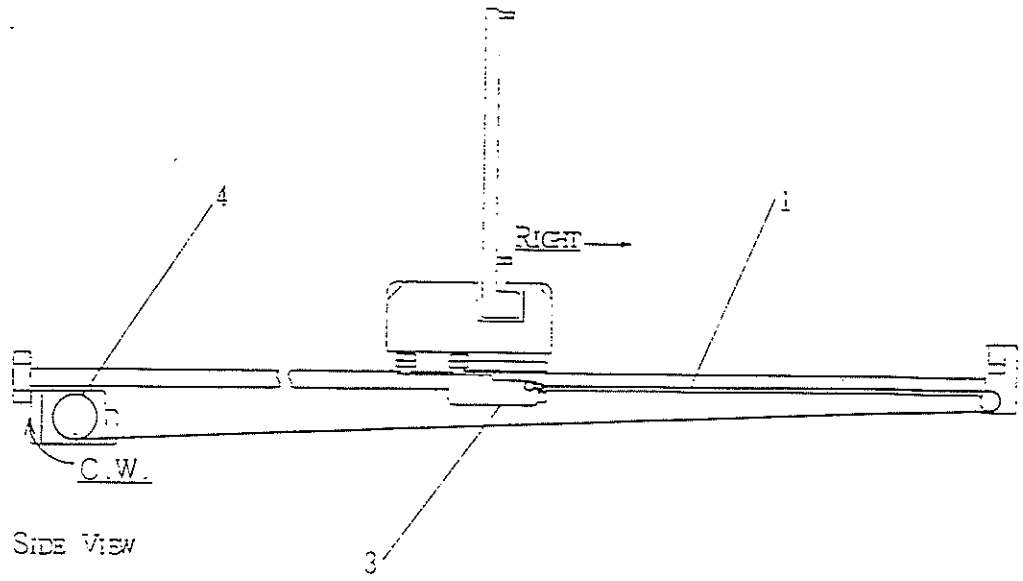
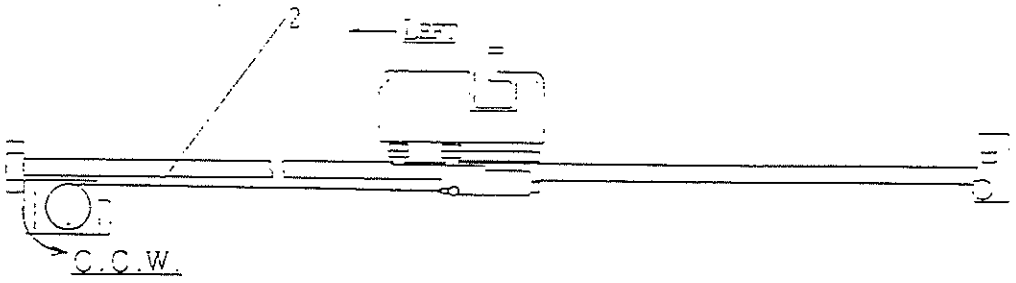


SIDE VIEW



SIDE VIEW

Fig.12

12. DRIVING WIRE ROUTE (X AXIS)

CLASS	INDEX	PART CODE	PART DESCRIPTION/MODEL	QTY.	REMARKS	CHANGE
C	1	A-AK23-0137-00	Driving Wire, Left, X Axis	1		
C	2	A-AK23-0138-00	Driving Wire, Right, X Axis	1		
	3	A-AK23-0107-01	Bracket, X Axis Driving Wire	1		
	4	A-AK23-0130-01	Drum, Driving Wire	1		
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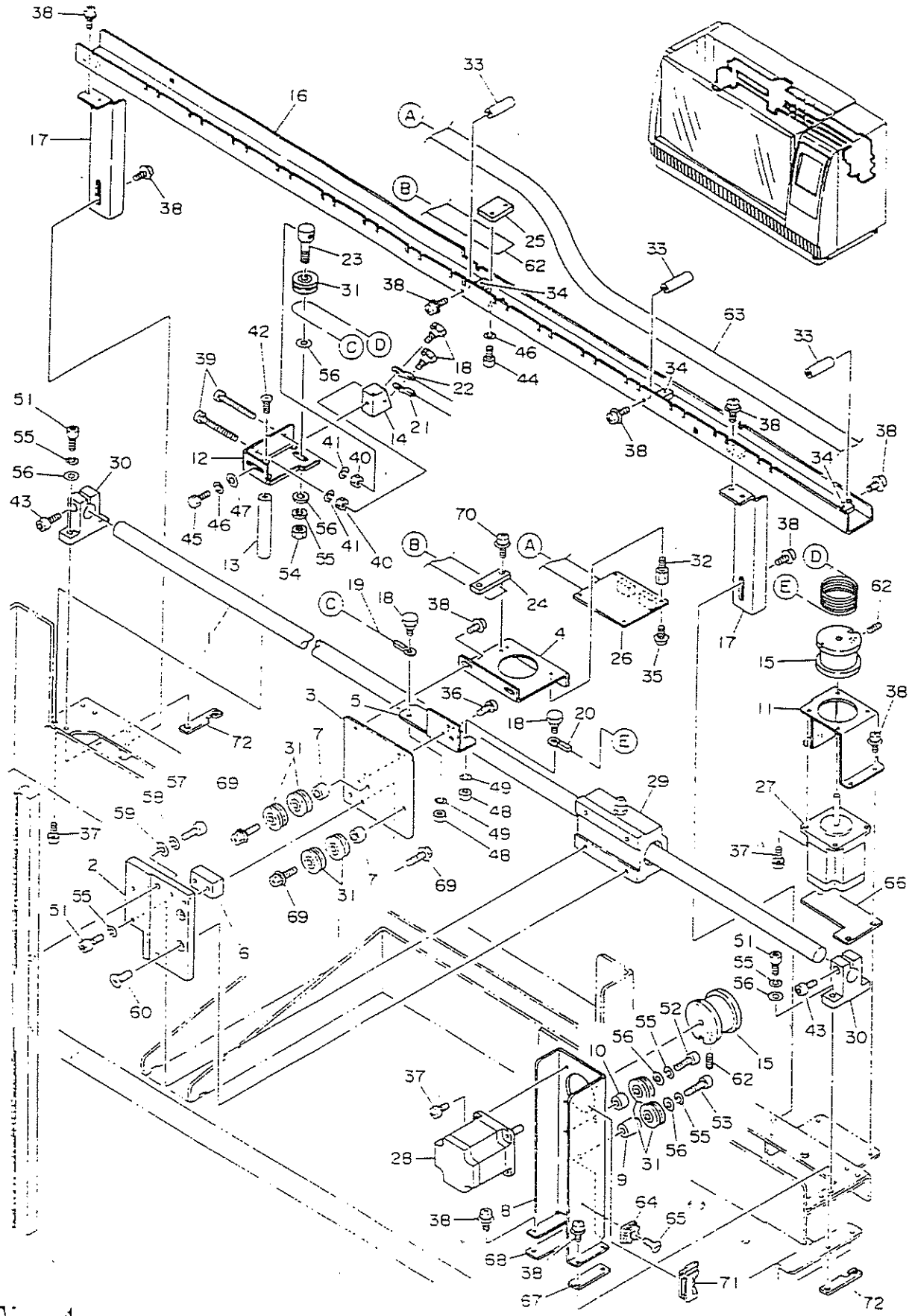

Fig.4

13. DRIVING WIRE ROUTE (Z AXIS)

CLASS	INDEX	PART CODE	PART DESCRIPTION/MODEL	QTY.	REMARKS	CHANGE
C	1	A-AK23-0139-00	Driving Wire, Upper, Z Axis	1		
C	2	A-AK23-0140-00	Driving Wire, Lower, Z Axis	1		
	3	A-AK23-0112-02	Mounting Plate, Arm Pulley	1		
	4	A-AK23-0130-01	Drum, Driving Wire	1		
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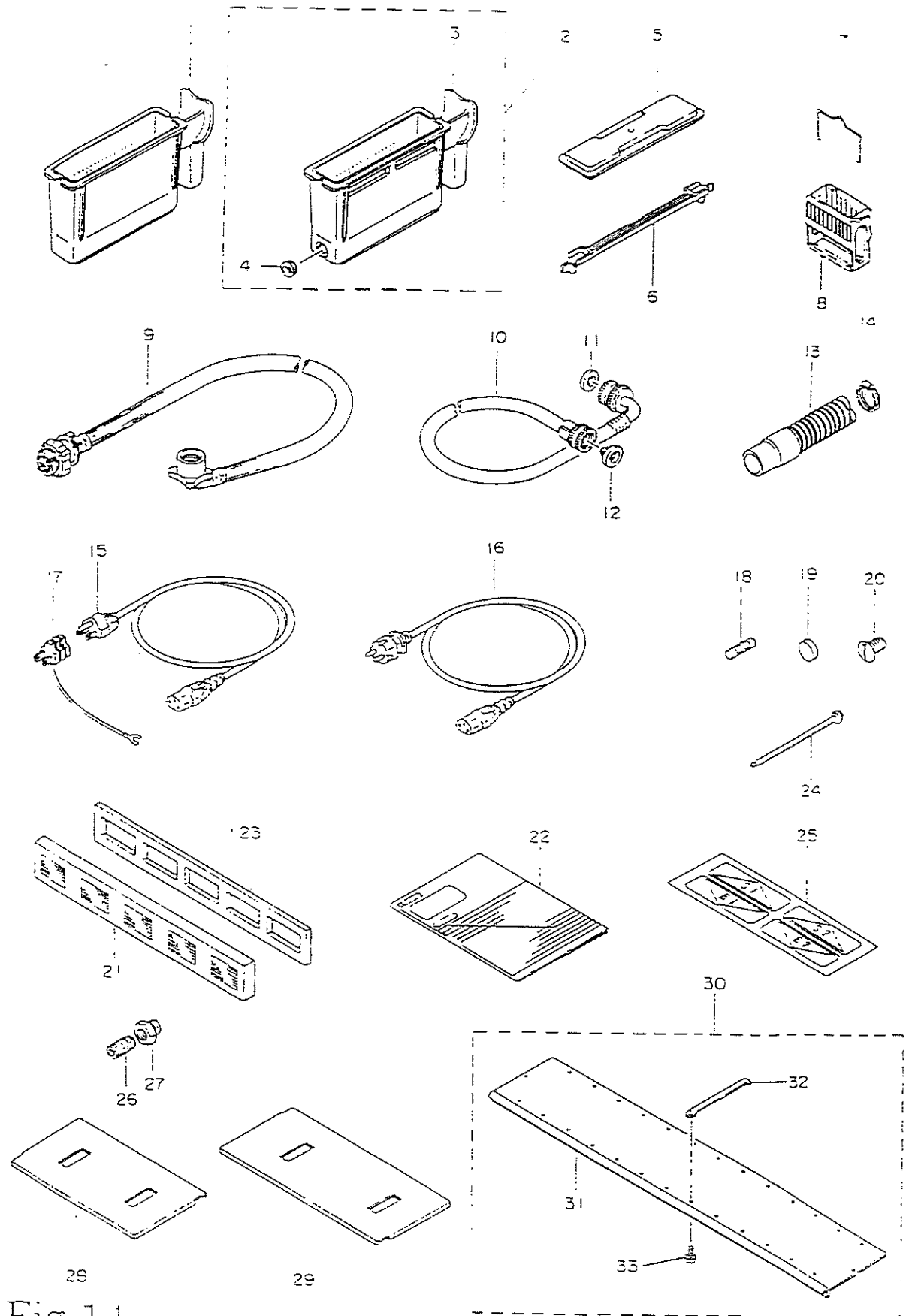
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Fig.14

14. ACCESSORIES

CLASS	INDEX	PART CODE	PART DESCRIPTION/MODEL	QTY.	REMARKS	CHANGE
A	1	A-AK23-0401-01	Reagent Reservoir	26		
A	3	A-AK23-0402-01	Wash Reservoir	5		
A	5	A-AK23-0405-00	Reservoir Lid	26		
A	6	A-AK23-0410-02	Basket Adapter	* 5	*3 for SFA	9211
A	7	A-AK23-0403-00	Basket Hook	* 10	*6 for SFA	
A	8	K16-500-05	Basket	* 10	*6 for SFA	
B	9	B7-44-0030	Water Supply Hose, T-4, Joint 2 m	1	except for SFA	
B	10	D9-90-0010	Hose Assembly, 3806FE	1	Only for SFA	
B	11	D9-90-0020	Hose Washer, GSW300	1	Only for SFA	
B	12	D9-90-0030	Filter Screen, 66FCW	1	Only for SFA	
	14	D9-00-0146	Hose Band, SY38	1		
	15	A4-10-0086	Power Cord Set, US-351-J02	1	for 100V line	
	16	A4-10-0108	Power Cord Set, EC-882-E04	1	for 200V line	
	17	A4-02-0413	Grounding Adapter, KFD-3	1	for 100V	
A	18	A3-40-0463	Fuse, GGL8	2	for 100V line	
A	18	A3-40-0364	Fuse, ES3-5000	2	for 200V line	
	19	A-AK23-0434-00	Blind Collar	1		
A	4	A4-07-0342	Rubber Bush, C-30-B6-6-2	10		8976
	20	A4-07-0511	Bush, CP-30-BC-16	4		
A	21	A-AK23-0470-00	Activated Carbon Filter, K15-815-A0 MONTHLY OR <	1		8976
	22	A-AK23-0930-00	Operating Manual, A-AK23-0930-00	1		
C	23	A-AK23-0467-00	Filter Sponge	1		
	24	A-AK23-0428-00	Nozzle	2		
	25	A-AK23-0555-00	Label, Start/End Station	1		
	26	A6-30-0040	Nipple Joint, SUS 1/2	1		
	27	A6-34-5160	Bushing, SUS 3/4 x 1/2	1		
	27	A-AK23-0440-00	Adapter, Water Supply (for SFA)	1	SFA only	
	28	A-AK23-0276-02	Reservoir Base, Upper Tray, Right Hand	1		8976
	29	A-AK23-0286-02	Reservoir Base, upper Tray, Left Hand	1		8976
	30	A-AK23-0097-00	Lower Tray Shelf Unit	1		
	31	A-AK23-0259-02	Shelf, Lower Tray	1		8976
C	32	A-AK23-0264-00	Reservoir Guide, Lower Tray	13		
	33	B6-22-0101	Tapping Screw, M3x6, SUS	26		
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A	2	A-AK23-0095-00	Wash Reservoir Unit	5		
B	13	A-AK23-0096-00	Drain Hose Unit	1		
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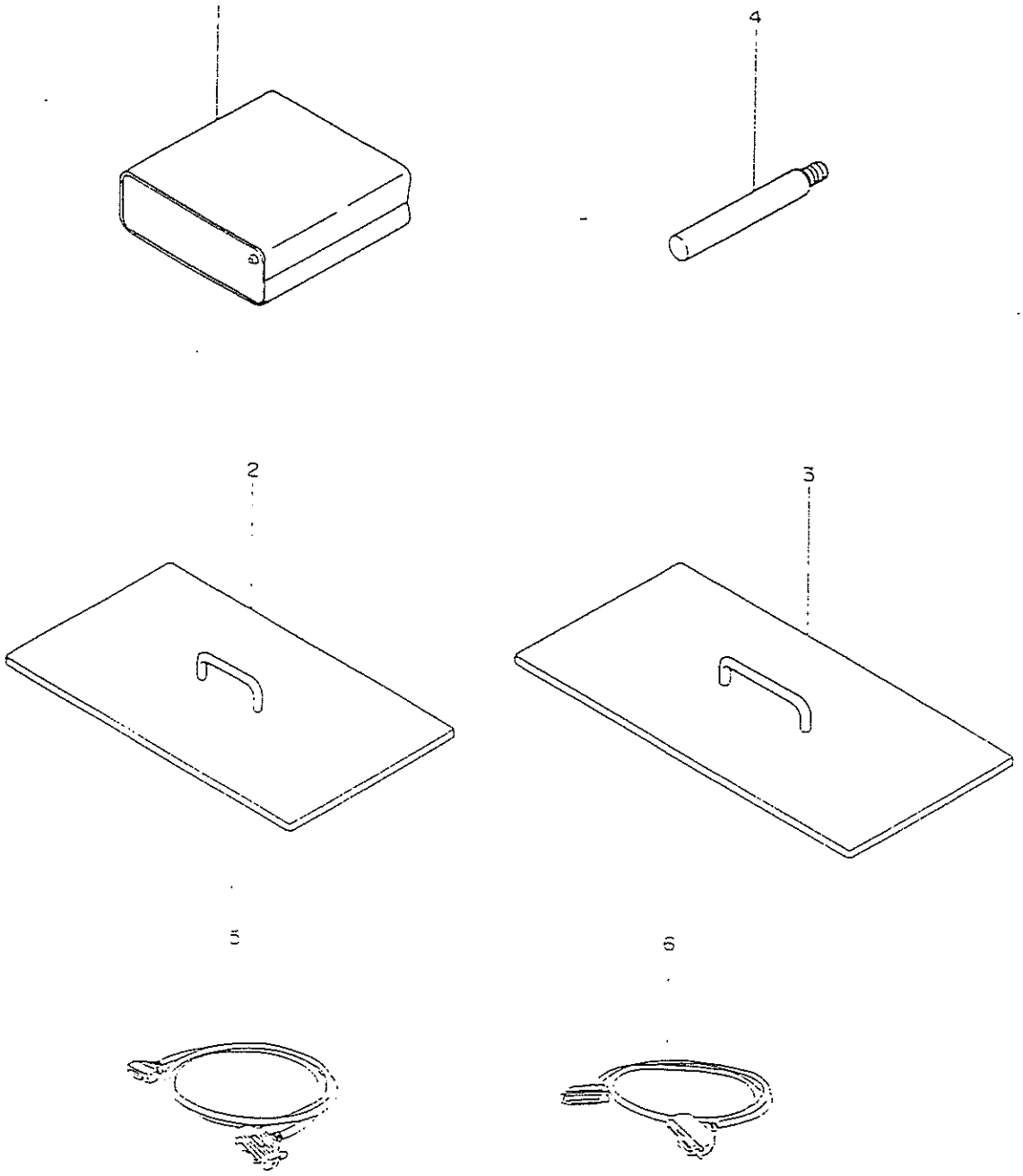

Fig.15

15. OPTION

CLASS	INDEX	PART CODE	PART DESCRIPTION/MODEL	QTY.	REMARKS	CHANGE
	1	2014830	DRS2000 Print Box, DRS-PRB	1		
	2	A-AK23-0406-00	Large Solution Reservoir Lid (for 6 reservoirs)	1		
	3	A-AK23-0408-00	Large Solution Reservoir Lid (for 7 reservoirs)	1		
	4	B5-20-0701	Carrying Handle	1		
	5	A4-10-9900	Serial Cable	4		
	6	A4-10-0104	Parallel Cable	1		
	7			1		
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	14					
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	16					
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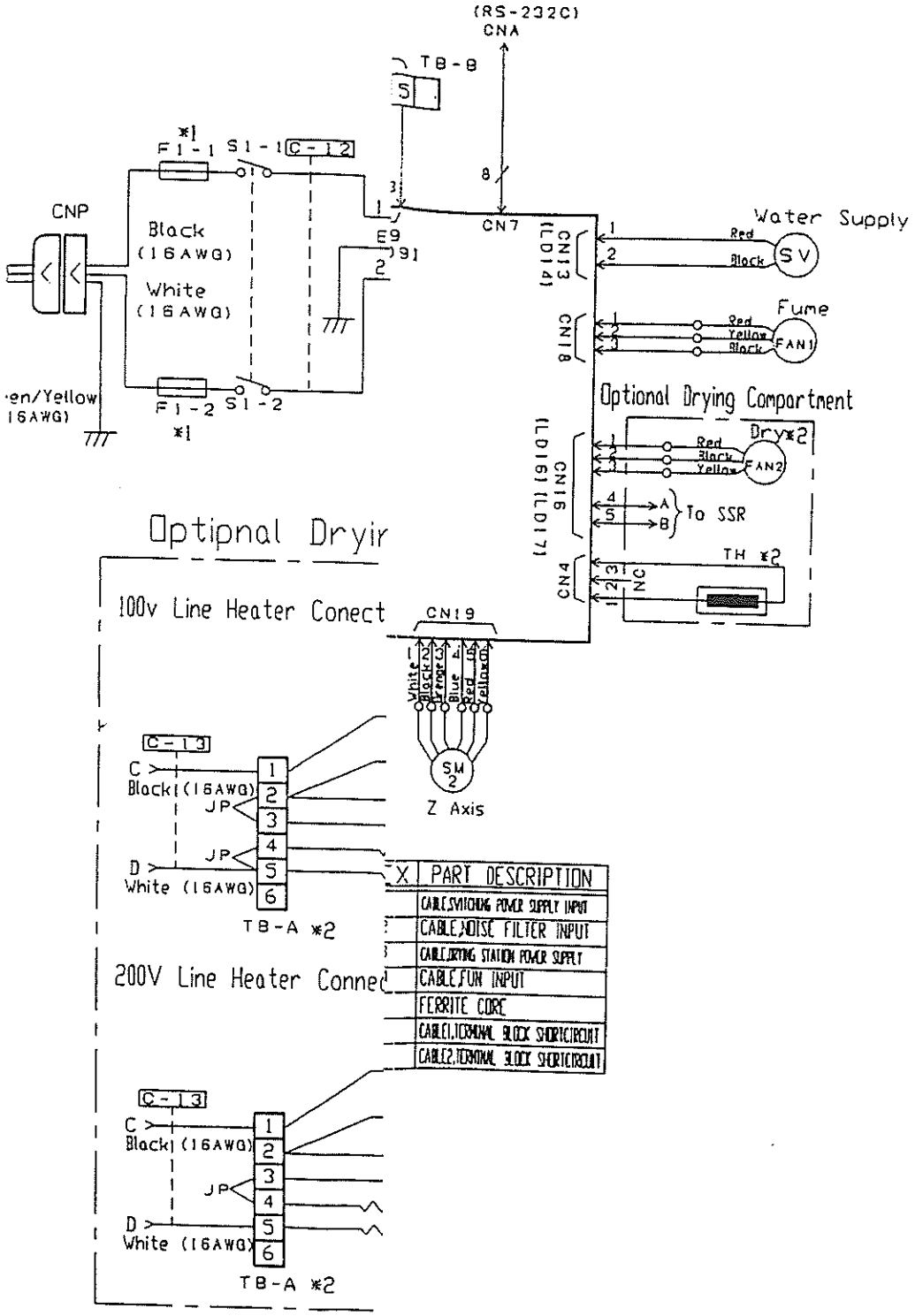
(RS-232C)
CNA
TB-8
*1
F1-1
S1-1
C-12
CNP
Black
(16AWG)
White
(16AWG)
E9
CN7
Water Supply
Red
Black
SV
CN13
(LD14)
Fume
Red
Yellow
Black
FAN1
CN18
Optional Drying Compartment
F1-2
S1-2
*1
Dry*2
Red
Black
Yellow
FAN2
CN16
(LD15) (LD17)
To SSR
TH *2
CN4
NC
Optipnal Dryir
100v Line Heater Conect
CN19
White
Black
Orange
Blue
Red
Yellow
SW 2
Z Axis
C-13
C
Black (16AWG)
JP
D
White (16AWG)
TB-A *2
200V Line Heater Connec
C-13
C
Black (16AWG)
JP
D
White (16AWG)
TB-A *2
X
PART DESCRIPTION
CABLE,SWITCHING POWER SUPPLY INPUT
CABLE,NOISE FILTER INPUT
CABLE,DRYING STATION POWER SUPPLY
CABLE,FUN INPUT
FERRITE CORE
CABLE1,TERMINAL BLOCK SHORTCIRCUIT
CABLE2,TERMINAL BLOCK SHORTCIRCUIT
*1 We use diffrent parts be
*2 This will be required when the
*3 This will be also required when
the connection system is diffe

Fig. 16

16. ELECTRICAL COMPONENTS

CLASS	INDEX	PART CODE	PART DESCRIPTION/MODEL	QTY.	REMARKS	CHANGE
	CORD	A4-10-0086	Power Cord Set, UC-351-J02	1	For 100V	
	CORD	A4-10-0108	Power Cord Set, EC-882-E04	1	For 200V	
	CNP	F51-061-00	Power Inlet Connector Unit E:NDRS-24	1		
	F1	A3-40-0463	Fuse, GGL8	2	For 100V	
	F1	A3-40-0364	Fuse, ES3-5000	2	For 200V	
		F51-062-00	Fuse Holder Unit (1) E:NDRS-23	1	For 100V	
		F51-063-00	Fuse Holder Unit (2) E:NDRS-25	1	For 200V	
	S1	A3-00-1260	Power Switch, A8CA-207-2A	1		
	NF1	A3-60-8105	Noise Filter, GT-205U	1		
	PW1	A3-16-1263	Switching Regulator, PAA50F-12	1	Auto Volt Switch	
	PW2	F51-071-00	Power Supply Board E:NDRS-07	1		
	MB	F1-064-00	Controller Board E:NDRS-01	1		
	XB	F51-065-00	X Axis Sensor Board E:NDRS-02	1		
	ZB1	F51-066-00	Upper Floor Sensor Board E:NDRS-03	1		
	ZB2	F51-067-00	Lower Floor Sensor Board E:NDRS-04	1		
	PB1	F51-069-00	Operation Panel Key Board Unit E:NDRS-05	1		
	PB2	F51-070-00	Operation Panel Relay Board Unit E:NDRS-06	1		
	LCD	F51-072-00	LCD Unit E:NDRS-09	1		
	INV	F51-073-00	LCD Inverter Board E:NDRS-28	1		
	BAT	F51-074-00	Battery Unit E:NDR-10	1		
	RS1	F51-075-00	Front Cover Sensor Unit E:NDRS-11	1		
	RS2	F51-076-00	Door Switch Unit E:NDRS-12	1		
	VR	F51-077-00	LCD Brightness Adjustment Unit E:NDRS-13	1		
	SM1	F51-078-00	X Axis Stepping Motor Unit E:NDRS-14	1		
	SM2	F51-079-00	Z Axis Stepping Motor Unit E:NDRS-15	1		
	SV	F51-080-00	Solenoid Valve Unit E:NDRS-16	1		
	FAN1	F51-081-00	Ventilator Fan Unit E:NDRS-17	1		
	FAN3	F51-088-00	Cooling Fan Unit E:NDRS-27	1		
	TB-B	F51-086-00	External Signal Terminal Block Unit E:NDRS-21	1		
	TB-C	A4-05-0630	Terminal Block, UF1003-20A-4P	1		
	CAN	F51-087-00	RS-232C Connector Unit E:NDRS-22	1		
	C-1	F51-089-00	Relay Cable, Z Axis Upper Floor Sensor E:NDRS-31	1		
	C-2	F51-090-00	Relay Cable, Z Axis Lower Floor Sensor E:NDRS-32	1		
	C-3	A4-10-0111	Relay Cable, X Axis Sensor with Sheet LFR 18-1.25-0.8X0.1TA-1701.45	1		
	C-4	F51-091-00	Cable, 12V Power Supply (I/O) E:NDRS-33	1		
	C-5	F51-092-00	Cable, 12V Power Supply (Motor) E:NDRS-34	1		
	C-6	F51-093-00	Cable, DC-DC Converter Input E:NDRS-35	1		
	C-7	F51-094-00	Cable, Inverter Input E:NDRS-36	1		
	C-8	F51-095-00	Cable, DC-DC Converter Output E:NDRS-37	1		
	C-9	F51-096-00	Cable, Inverter Output E:NDRS-38	1		
	C-10	F51-097-00	Cable, Switching Power Supply Output E:NDRS-39	1		
	C-11	F51-098-00	Cable, Switching Power Supply Input E:NDRS-40	1		
	C-12	F51-099-00	Cable, Noise Filter Input E:NDRS-41	1		
	C-14	F51-103-00	Cable, Fan Input E:NDRS-46	1		
	COR1	A3-90-4090	Ferrite Core, SSC-33.5-20	1		
	JP	F51-101-00	Cable 1, Terminal Block Short-Circuit E:NDRS-43 (4 pc. set) 2 pcs. only when no Drying Station is provided	1	For 100V	

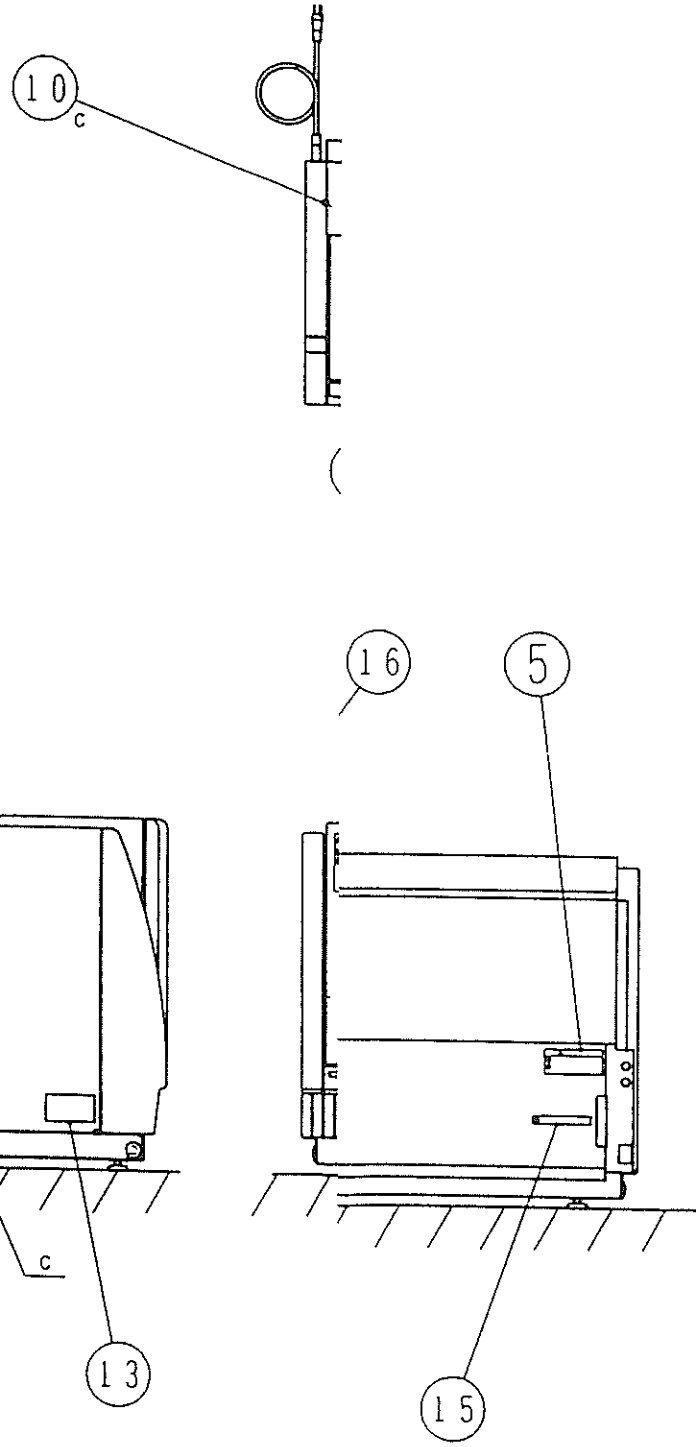

Fig.17

LABELS (FOR INTERNATIONAL)

CLASS	INDEX	PART CODE	PART DESCRIPTION/MODEL	QTY.	REMARKS	CHANGE
	1	A-AK23-0556-01	Label, C1-023-S0	1		
	2	A-AK23-0558-01	Label, C1-021-S0	1		
	3	A-AK23-0560-01	Sticker Label, External Signal Terminal	1		
	4	A-AK23-0567-01	Sticker Label, Hood (English and French)	1		8941
	5	A-AK23-0570-01	Label, W1-019-S0	1		
	6	A-AK23-0571-02	Label, C1-012-S0	1		
	7	A-AK23-0559-00	Sticker Label, Contrast	1		8941
	8	A-AK23-0573-02	Label, W1-020-S0	1		
	9	B5-03-6630	Sticker Label, Grounding	1		
	10	A-AK23-0556-00	Sticker Label, Door Open.Close	1		
	11	A-AK23-0557-00	Sticker Label, Station Positions	1		
	12		S/N Plate	1		