

A501009

SERVICE MANUAL
FOR THE
TM-300 TRACTION MACHINE

ITO CO., LTD.

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SECTION 1 TROUBLESHOOTING

1-1 Troubleshooting Introduction

The following chart contains certain problems that could occur during operation of TM-300. Probable causes and recommended remedies are included.

1-2 Troubleshooting chart

Trouble Shooting Chart

SYMPTOM	PROBABLE CAUSE	REMEDY
1. Unit power "on", LCD screen remains blacked out.	<ol style="list-style-type: none"> 1. No electrical power 2. Power cord not plugged into power source. 3. Unit fuse blown. 4. LCD inverter connector disconnected. 5. Ribbon cable connector disconnected, or damaged. 6. Defective IC1 on I/F Board. 	<ol style="list-style-type: none"> 1. Have building power circuits checked. 2. Plug unit power cord into AC electrical outlet. 3. Replace fuse, see Minor Repair (Section 2) 4. Connect the connector. 5. Check the Ribbon cable & connector. 6. Replace IC1, or I/F Board.
2. LCD screen is blurred or bluish.	<ol style="list-style-type: none"> 1. LCD backlight not adjusted. 	<ol style="list-style-type: none"> 1. Adjust the brightness by turning the LCD control knob on the rear panel.
3. "E1 error" legend appears.	<ol style="list-style-type: none"> 1. Error in traction force. 	<ol style="list-style-type: none"> 1. Perform easy calibration. See Minor Repair (section 2) Contact dealer. 2. Perform regular calibration. See Repair (section 3) Check back-up circuit.
4. "E2 error" legend appears.	<ol style="list-style-type: none"> 2. Unit is running on ROM data (back-up data) due to defective calibration data, or back-up circuit. 	<ol style="list-style-type: none"> 1. Connect safety switch to the unit. 2. Advise patient not to push safety switch when starting the unit. 3. Replace safety switch ass'y. 4. Check wiring and connector CN3 on I/F Board.
5. "E3 error" legend appears just after initial system check.	<ol style="list-style-type: none"> 1. Safety switch not connected. 2. Safety switch operated when "START" key pressed. 3. Safety switch or its cord defective. 4. Switch-related internal wiring defective. 	<ol style="list-style-type: none"> 1. Replace operating panel. 2. Check sensor-related wiring and connector CN2 on I/F Board. 3. Replace CPU board, and perform regular calibration.

(Continued)

SYMPTOM	PROBABLE CAUSE	REMEDY
6. No traction force is generated and "E3 error" legend appears after 30 second motor running.	1. Defective wave washer on gear head output shaft. 2. Hexagon socket screw loosed. 3. Motor won't run.	1. Replace defective wave washer. 2. Scenw the hexagon socket screw. 3. Check motor wiring, or replace I/F Board.
7. No traction force is generated and "set parameters" menu display appears after ten second motor running.	1. Error in sensor output adjustment.	1. Perform easy calibration. 2. Perform sensor output adjustment.
8. When force increasing or reached 100%, "E3 error" and buzzer sound occur.	1. Limit switch is wrongly positioned. 2. Limit switch defective.	1. Locate limit switch correctly. Contact dealer. 2. Contact dealer.
9. No force is generated after elapse of rest time, and the unit stops with "E3 error" and buzzer sound.	1. Gear-train clutch defective. 2. DC solenoid wire rope tension lowered.	1. Stop using the unit. Contact dealer. 2. Stop using the unit. Contact dealer.
10. Wire rope won't come out of unit, or go into unit smoothly.	1. Wire rope nylon coating has a crack.	1. Replace wire rope.
11. Unit power "off", or standby, wire rope can not be pulled out of the unit.	1. Idle gear mating with wheel gear.	1. Turn power switch "ON", and input less than 5kg for traction force. Run the unit and stop the unit by pressing stop key to release mating.

SECTION 2 MINOR REPAIR

2-1 Replacement of Fuse

Tools Required : Screwdriver

Parts Required : Fuse (F, midget type)

for 110,120 volt operation 2 Amp, 125 Volt

for 220,230,240 volt operation 2 Amp, 250 Volt

Fuse holders are located on the rear panel of the unit.

Warning : Turn the unit "off" and remove AC electrical line cord from the electrical outlet.

2-2 Easy Calibration

(1) General information

TM-300 is provided with a software for easy calibration, which can be field performed if only 5 kg-spring balance is available, and never needs to be returned to the factory for re-calibration.

In case that there is non-negligible difference between set value and measured force, or "El error" legend appears on LCD screen, perform easy calibration following the below-mentioned procedures.

Notes : (a) Even if "El error" legend appears, the unit can start running only by pressing "START" Key as TM-300 is basically designed to run on the back-up data common to all units.

(b) If easy calibration fails to remove "El error" legend display, perform regular calibration (factory calibration) and/or mechanical adjustment. See Section 3 for regular calibration.

(2) Easy Calibration Procedures

Hang a 5 kg-spring balance at a firm structure and connect the wire rope hook to the balance.

Step 1. Turn the unit on.

Step 2. In "Set Parameters" menu display, press "STOP" key, and press "1", "4", "7" in order in five seconds to produce "Calibration" menu display in LCD screen.

Step 3. Keep on pressing "8" key to produce a force of 5 kg, while "2" key to reduce a force down from more than 5 kg. Press "5" key to end calibration when force is just 5 kg.

Step 4. Check if no "El error" legend appears by turning the unit off and on.

SECTION 3 REPAIR

3-1 Preparations for Repair

Warning : Always turn power "off" and unplug unit when working inside the unit.

Step 1. Removal of pulley

- (a) Turn the pulley to the right side of the unit. (See Fig.1)
- (b) Extract the pulley from the unit.

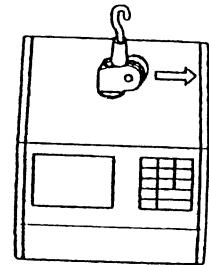


Figure 1

Step 2. Removal of four screws on rear panel.

Tools Required : Screwdriver

- (a) Remove the four screws and washers on rear panel.
(See Fig.2)

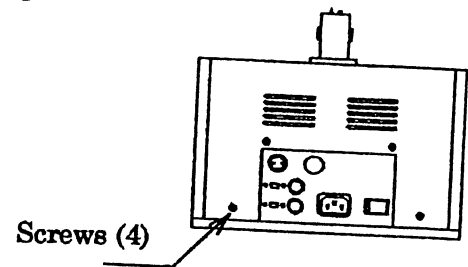


Figure 2

Step 3. Removal of bottom plate

Tools Required : Screwdriver

- (a) Lay the unit on its side.
- (b) Remove two screws and washers. (See Fig.3)

Step 4. Removal of cover screws

Tools Required : Hexagon socket screw key

- (a) Remove four hexagon socket head cap screws (M5) from the bottom plate. (See Fig.3)

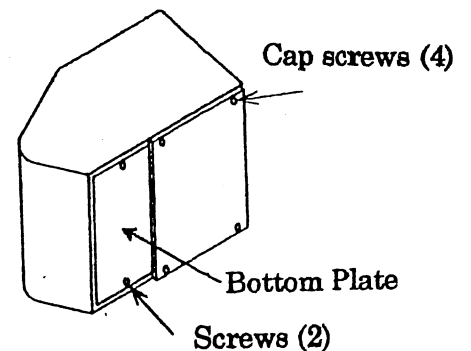


Figure 3

Step 5. Place the unit horizontally.

Step 6. Pull up the cover gently together with pulley until they come off the mechanism. (See Fig.4)

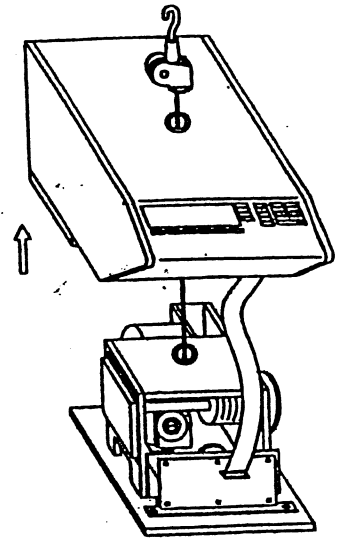


Figure 4

Step 7. Lay the cover on its side by the mechanism. (See Fig.5)

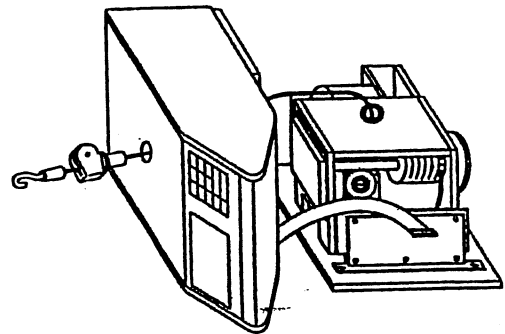


Figure 5

Step 8. Disengage the ribbon cable connector on the I/F board. (See Fig.6)

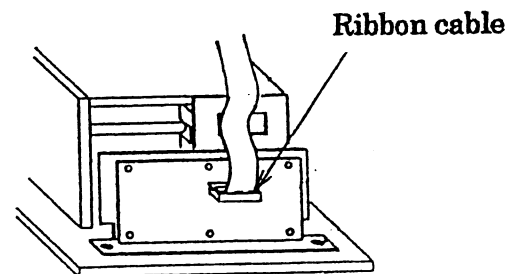


Figure 6

3-2 Replacement of Parts

(1) Replacement of I/F Board

Tools Required : Screwdriver

- (a) Unplug all the connectors on the I/F Board.
- (b) Remove two screws securing I/F Board stand. (See Fig.7)
- (c) Install a new I/F Board on I/F Board stand.

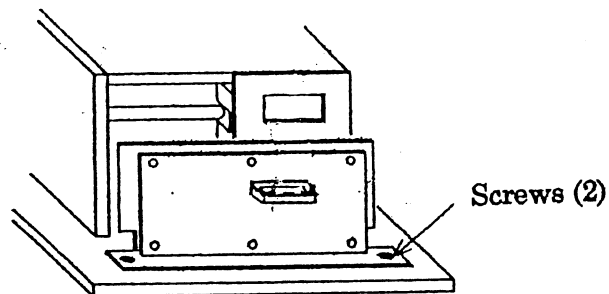


Figure 7

(2) Replacement of CPU Board

Tools Required : Box screwdriver

- (a) Disengage four connectors (switch board cable, inverter harness, flexicable, CPU ribbon cable) and a ground tape on CPU Board. (See Fig.8)
- (b) Remove seven nuts on CPU Board.
- (c) Remove old CPU Board and install a new one.

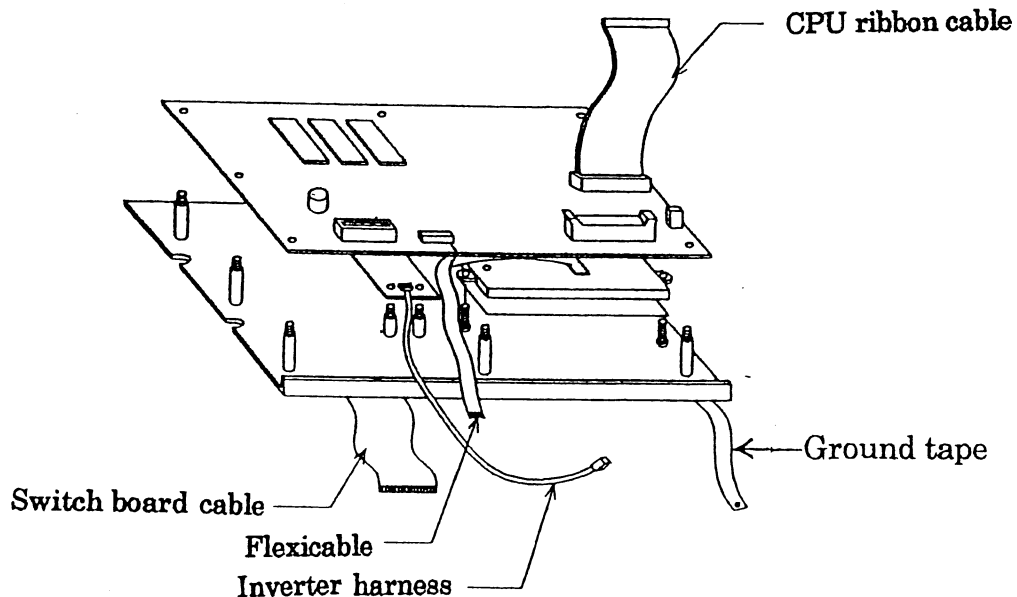


Figure 8

Caution : Early manufactured CPU board is provided with a sub-board on which a memory back up cell is mounted. Therefore, replace the CPU board together with sub-board. take caution not to permit the cell to be short-circuited. (See Fig.9)

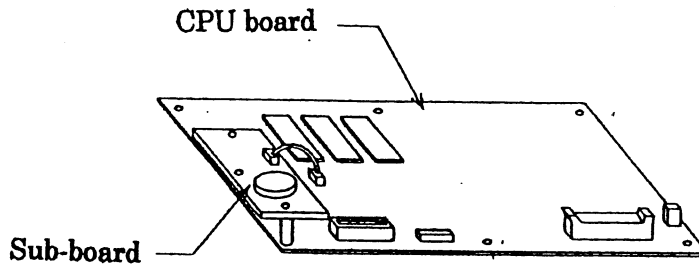


Figure 9

(3) Replacement of LCD Module

Tools required : Box screwdriver

- (a) Remove CPU Board.
- (b) Remove four nuts securing LCD Module. (See Fig.10)
- (c) Remove the old LCD Module.
- (d) Install a new LCD Module with a shield mesh put between the LCD Module and the cover.

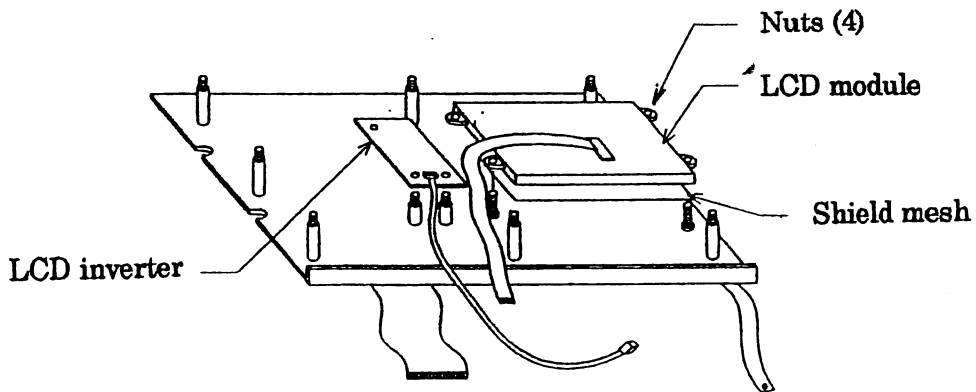


Figure 10

(4) Replacement of LCD Inverter (See Fig.10)

Tools required : Box screwdriver

(a) Remove CPU Board.

(b) Remove three nuts securing LCD Inverter.

(c) Remove the old LCD Inverter

(d) Install a new LCD Inverter with the shield tubes applied on the harness.

(5) Replacement of Wire Rope

Tools required : Screwdriver, Tweezers

Hexagon wrench key (1.5mm)

Removal of Wire Rope

(a) Remove I/F Board and its stand. (See Fig.7)

(b) Remove four screws securing the rope holder. (See Fig.11)

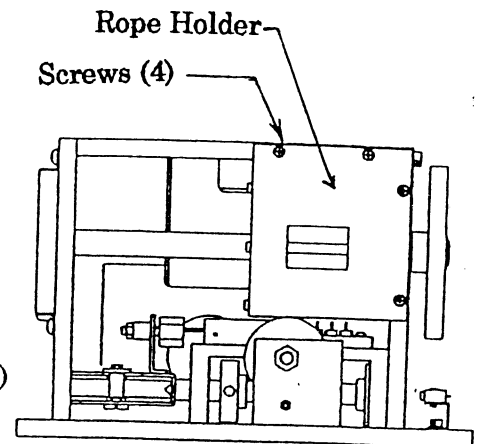


Figure 11

(c) Grasping the wire rope close to pulley socket, pull out most of wire rope which is wound around the drum.

(d) Rotate the drum to the position where two socket screws on the drum can be visible and engaged with a hexagon wrench key, and place a I-shaped tool between idle gear and wheel gear to prevent the rotation of the drum until wire rope replacement is completed. (See Fig.12)

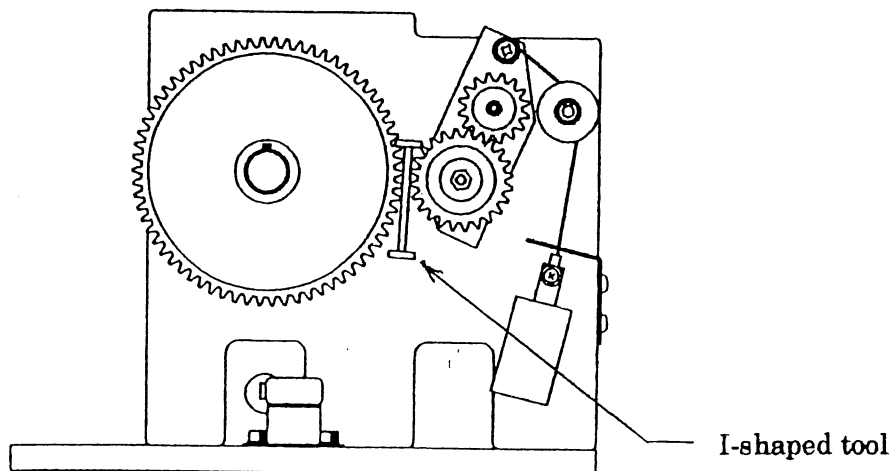


Figure 12

- (e) Unscrew the two hexagon socket screws by two turns with a hexagon wrench key. (See Fig.13)

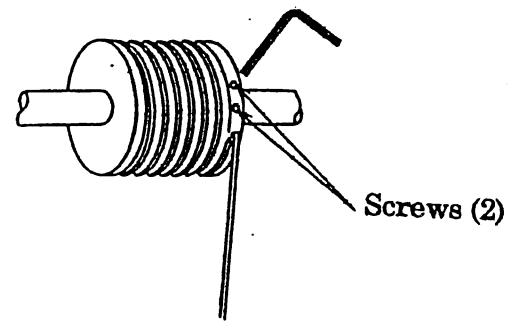
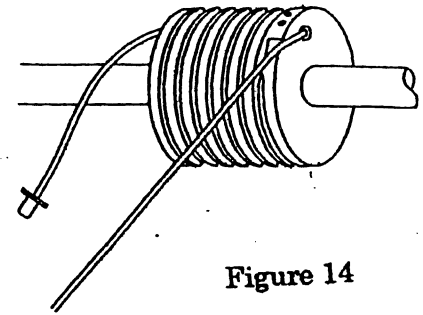


Figure 13

- (f) Force the rope tail into the drum until the rope tail comes out of the opposite side of the drum. (See Fig.14)



- (g) Cut off the rope tail with a nipper, and pull out all the wire rope from the mechanism. (See Fig.15)

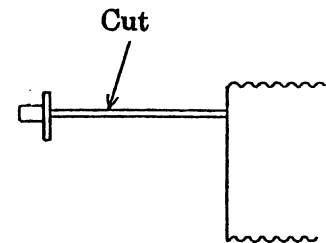


Figure 15

Installation of Wire Rope

- (a) Check if the following parts are all available in a wire rope kit. (See Fig. 16)

Wire rope with a hook	1 pc
Stop ring	2 pcs
I-shaped tool	1 pc
Hexagon wrench key (1.5mm)	1 pc

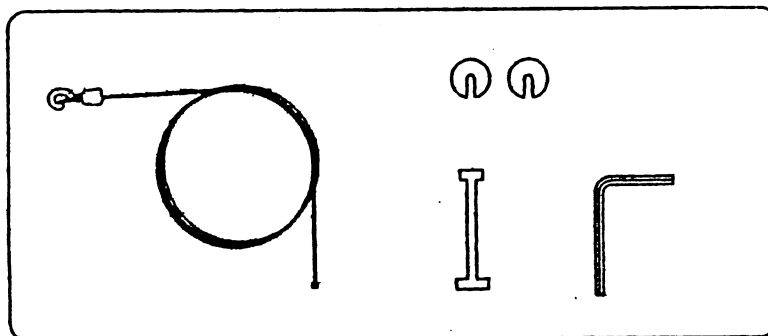


Figure 16

(b) Run the wire rope through the following mechanical parts in order. (See Fig.17.)

- a. Pulley
- b. Cover
- c. Pulley socket
- d. First roller
- e. Sensor roller*
- f. Second roller
- g. Rope holder

* Use a pair of tweezers to make the wire rope run through sensor roller.

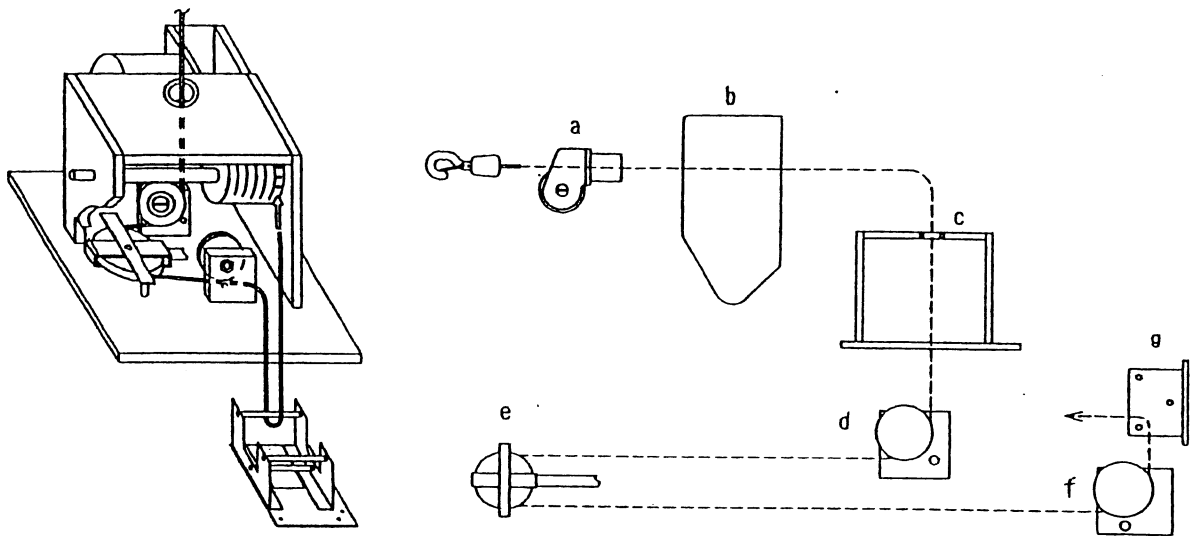


Figure 17

(c) Before inserting the rope end into the drum, bend the rope tail in the direction of natural curl at the point of 35mm from the rope end. (See Fig.18)



Figure 18

- (d) Insert the wire rope tail into the drum tunnel entrance and let it run through the tunnel. (See Fig.19)

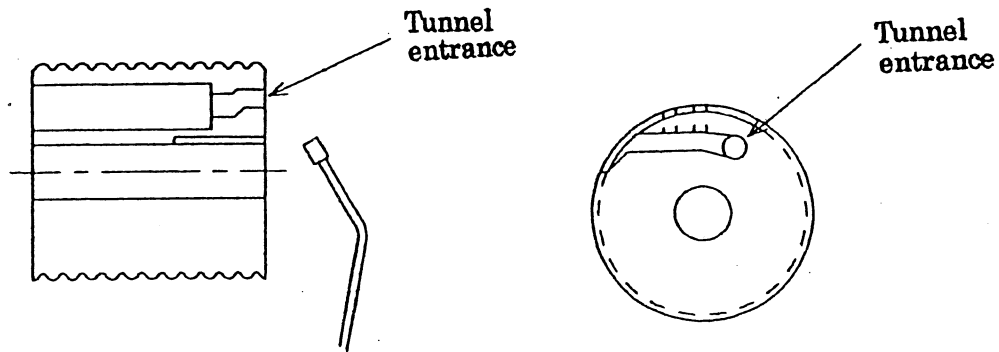


Figure 19

- (e) Attach a stop ring at the foot of rope ring and reduce its slit with a radio pliers. (See Fig.20)

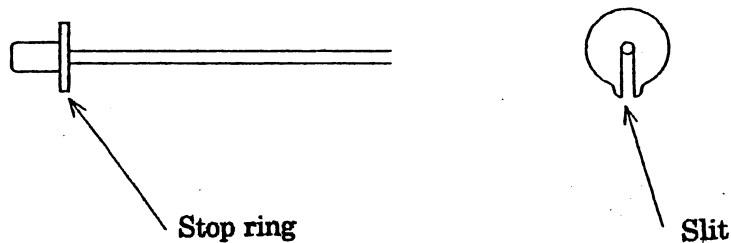


Figure 20

- (f) Pull the rope firmly into the drum.
 (g) Turn the two hexagon socket screws with the rope just below the screws in the drum groove. (See Fig.21)

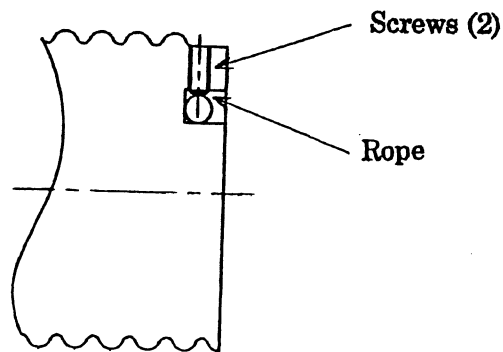


Figure 21

- (h) Remove I-shaped tool between gears and let the wire rope wind on the drum.
 (i) Install the rope holder on the mechanism with four screws.

(6) Replacement of Wave Washer

Tools required : Hexagon wrench key

Parts required : Wave Washer

(a) Unscrew the hexagon socket head screw on the gear head output axis using a hexagonal wrench key. (See Fig.22)

(b) Remove pinion stopper, oiles washer, pinion, pinion key, and old wave washers.

Note : Early manufactured unit is provided with a pair of black wave washers.

Discard all the old washers.

(c) Install a new stainless wave washer.

(d) Reassemble pinion, pinion key, oiles washer, pinion stopper, and hexagon socket head screw in order.

Check if the wave washer is set without eccentricity.

(e) Supply sufficient volume of grease onto wave washer and pinion.

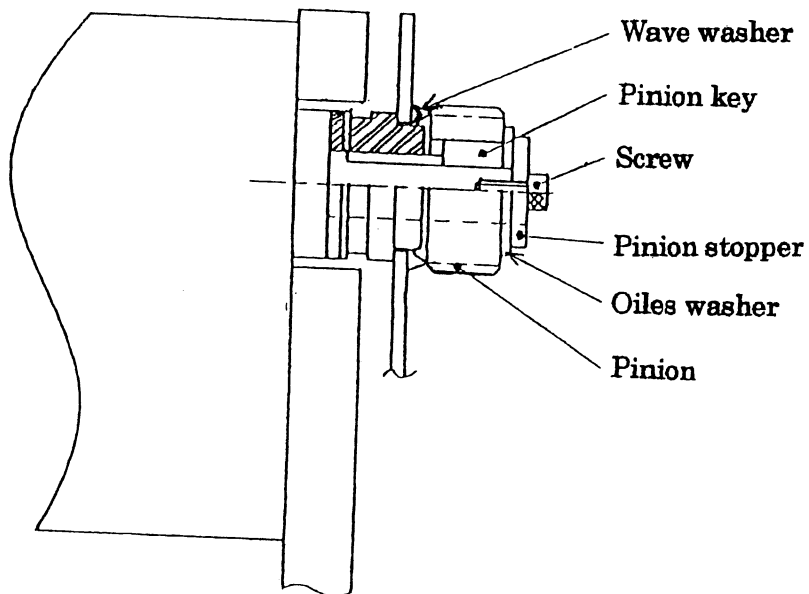


Figure 22

3-3 Regular Calibration

(1) General information

Regular calibration is same as factory calibration and should be performed when easy calibration fails to eliminate the appearance of "El error" legend display.

Regular calibration requires a spring balance of a capacity of more than 90 kg., and a set of firm metal frame, on which TM-300 and a balance are to be mounted.

Caution : Regular calibration must be done with caution. Use a strongly built metal frame to avoid injury to the operator.

(2) Preparations

- 1° Secure the unit on a metal frame with four bolts (5/16 – 18 UNC).
- 2° Connect a spring balance head to the metal frame, and connect the spring balance hook to the wire rope. (See Fig.23)
- 3° Turn the unit on.

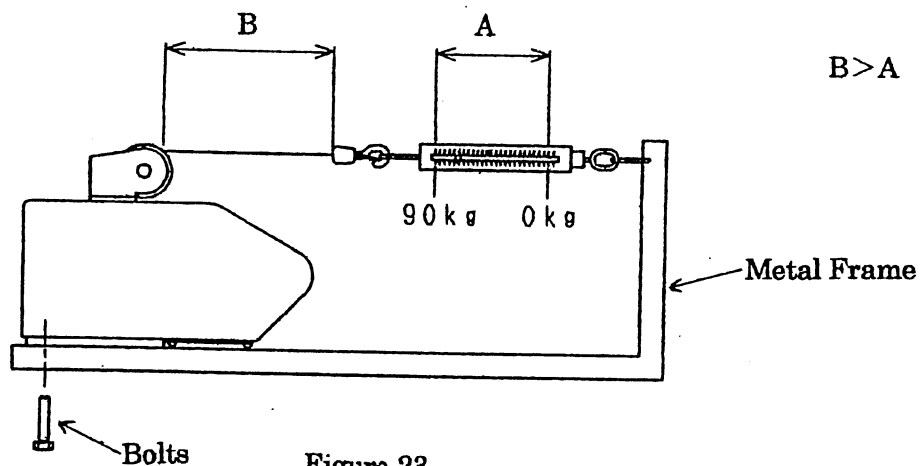


Figure 23

(3) Calibration Procedures

- Step 1. If "El error" legend display appears on the LCD screen, press "START" key to display "Set parameters" menu.
- Step 2. Press "STOP" key, and each of "3", "6", "9" key in order in five seconds, and "Calibration" menu display will appear in LCD screen.
- Step 3. Keep on pressing "8" key to increase traction force up to 5kg, while "2" key to reduce the force down from more than 5kg. Press "5" key when force is just 5kg.
- Step 4. Keep on pressing "8" key to increase the force up to 50kg. Press "5" key when force is just 50kg.

Step 5. Keep on pressing "8" key to increase the force up to 90kg.

Press "5" key to terminate the calibration when force is just 90kg. "Set parameters" menu display automatically appears after completion of calibration.

Step 6. Check if the unit is calibrated according to the following procedures.

Procedure : Turn the unit off and on.

"E1 error" legend should not be displayed if calibrated.

- Notes: 1. Calibration could be performed repeatedly. If "E1 error" legend appears after calibration, repeat calibration again.
2. If "E1 error" legend display can not be eliminated, please contact dealer.

SECTION 4 REPLACEMENT PARTS

No.	Item
101	Oiles washer 83W-10,80W-10
102	Wave washer 1410201-41020
103	Arm
104	Pinion spacer
105	Pinion
106	Pinion key
107	Oiles washer 70W-1000
108	Pinion stopper
109	Hexagon socket head cap screw (M3X8)
201	Arm (same with 103)
202	Pinion (same with 105)
203	Idle gear
204	U-nut (M4)
205	Wire pulley
206	Wire pulley axis
207	Hexagon socket head cap screw (M5)
208	Wire assembly
209	DC solenoid (MD-262-2)
210	Plunger support
211	Truss small screw
212	Wheel gear
213	Micro-switch stand
214	Micro-switch
215	Hexagon socket head cap screw (M5x25)
216	I/F board
217	I/F board stand
218	I/F board spacer (C307)
219	Hexagon nut with flange
220	Small pan head screw (M5x10)

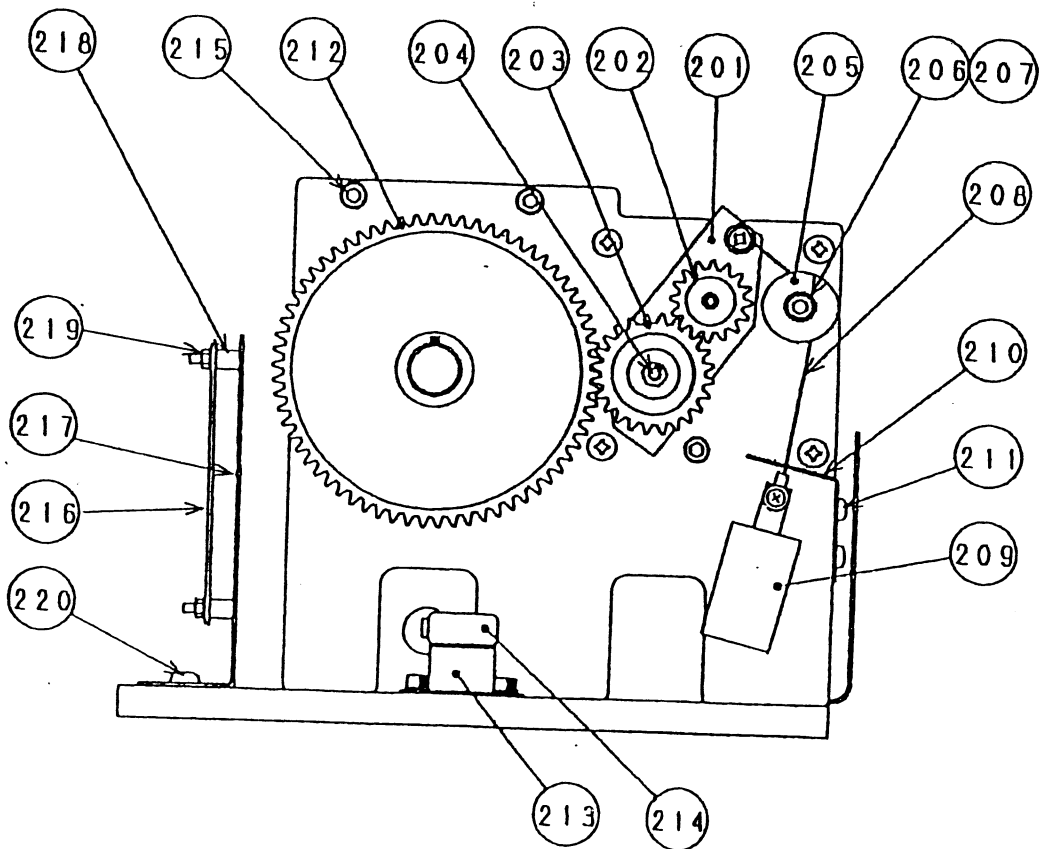
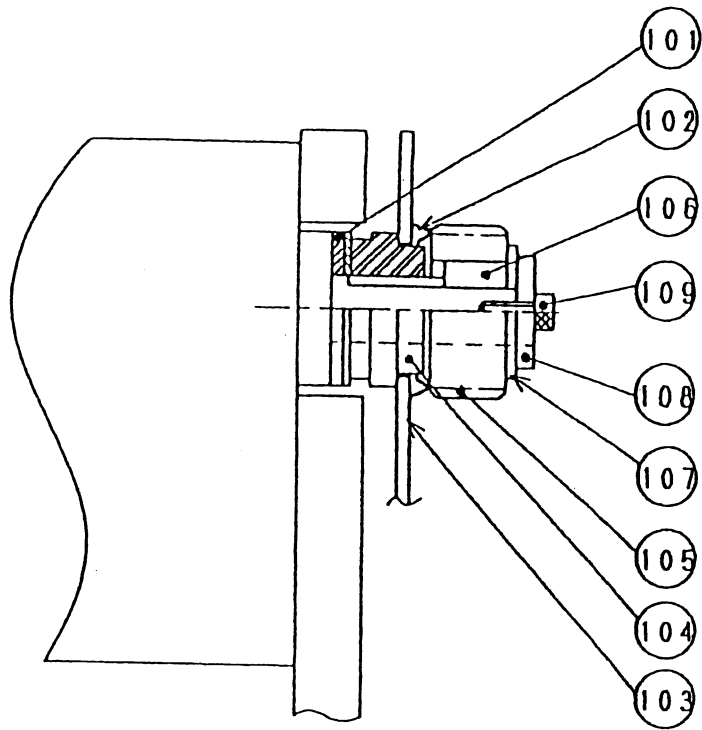
- 301 Oiles bush (80B-2220)
- 302 Drum axis
- 303 Drum
- 304 Drum key
- 305 C ring (STW-15)
- 306 Wheel gear (same with 212)
- 307 C ring (STW-15)
- 308 Wheel spacer
- 309 Micro-switch AVM3225P (same with 214)
- 310 micro-switch stand (same with 213)
- 311 Sensor (S8FLP10A, 1Kohm)
- 312 Adjuster
- 313 Sensor axis
- 314 Spiral spring Assembly
- 315 C ring (STW-12)

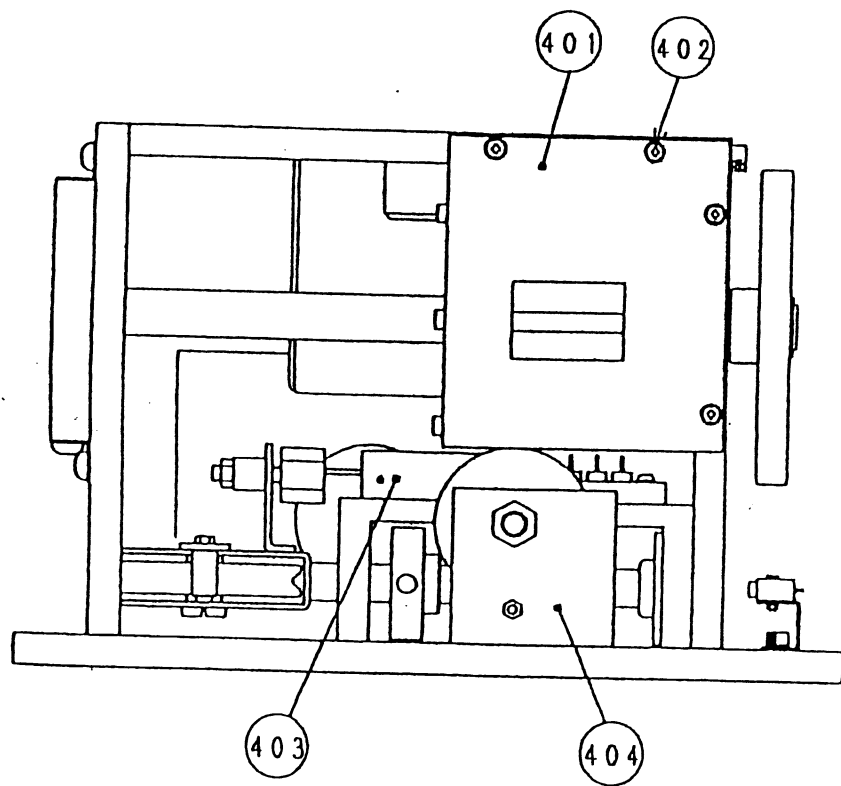
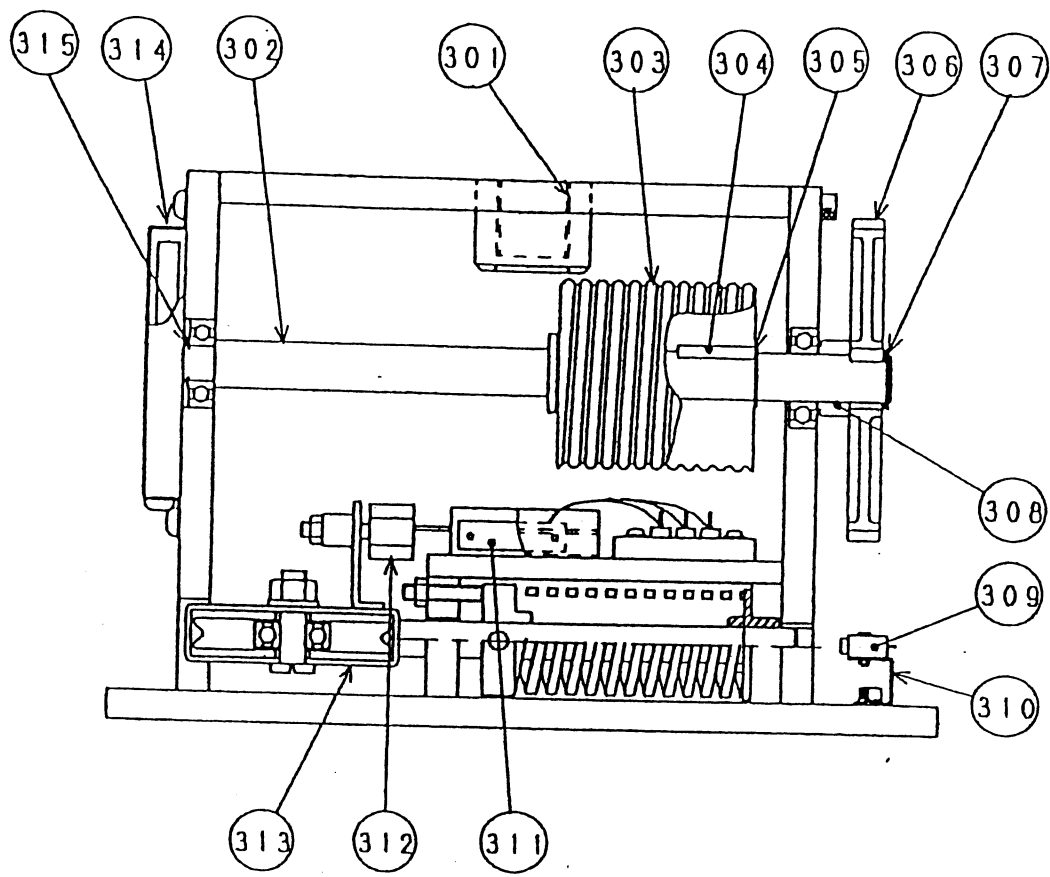
- 401 Rope holder assembly
- 402 Screw (M3)
- 403 Guide roller 1
- 404 Guide roller 2

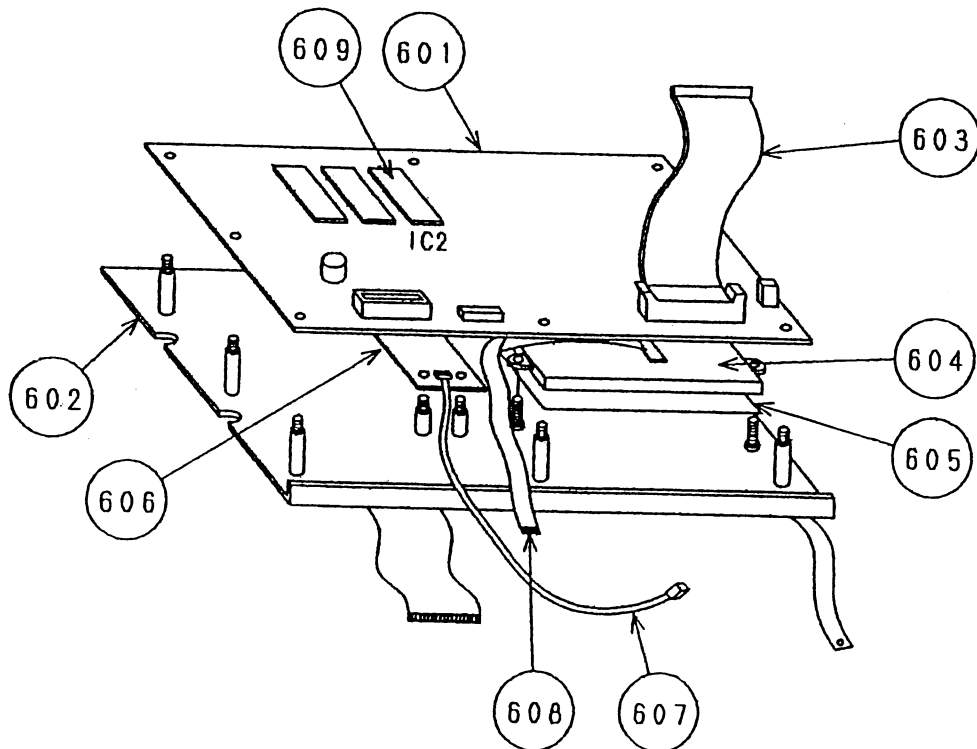
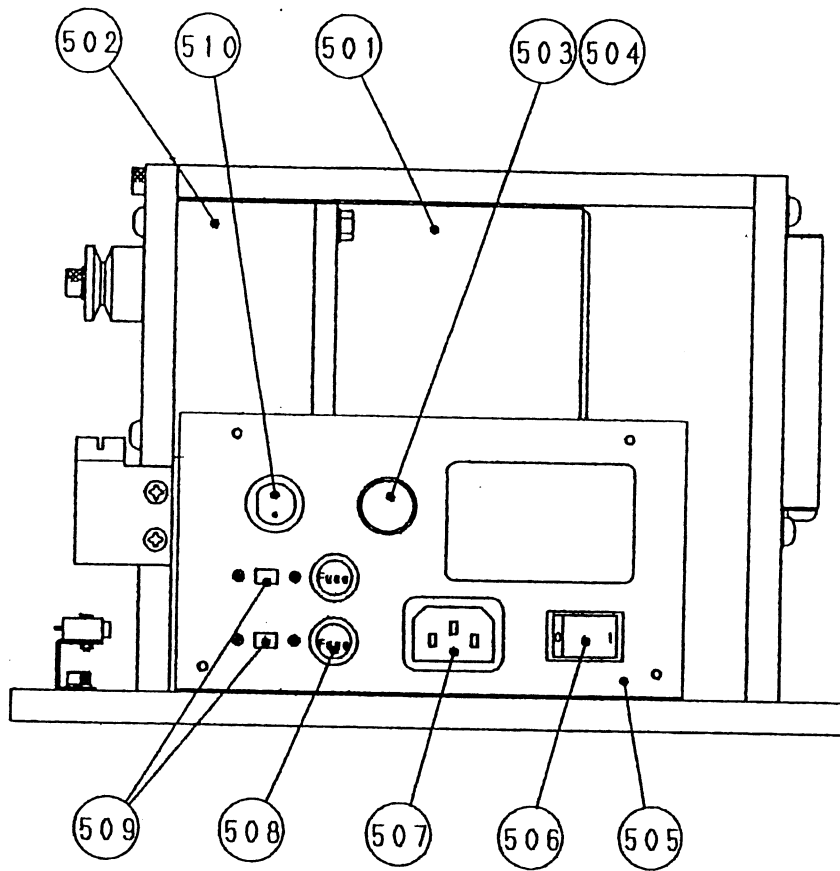
- 501 Motor
- 502 Gear head
- 503 LCD control knob
- 504 Volume control (RK11K114)
- 505 Rear panel
- 506 Power switch (JW-M21RAA)
- 507 Inlet with filter (GL-2030E)
- 508 Fuse 2A
- 509 Slide switch (MS-12AAS1)
- 510 Connector (CN-45,2P)

- 601 CPU board
- 602 Panel switch board
- 603 Flat ribbon cable
- 604 LCD module
- 605 Shield mesh
- 606 LCD inverter
- 607 Inverter harness
- 608 Flexi cable
- 609 System ROM (IC2)

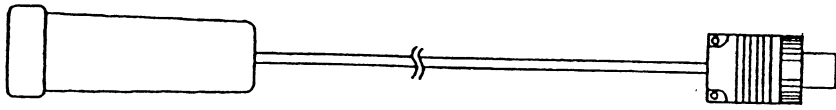
- 701 Safety switch assembly
- 702 Wire rope assembly



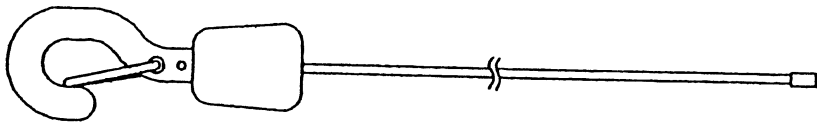




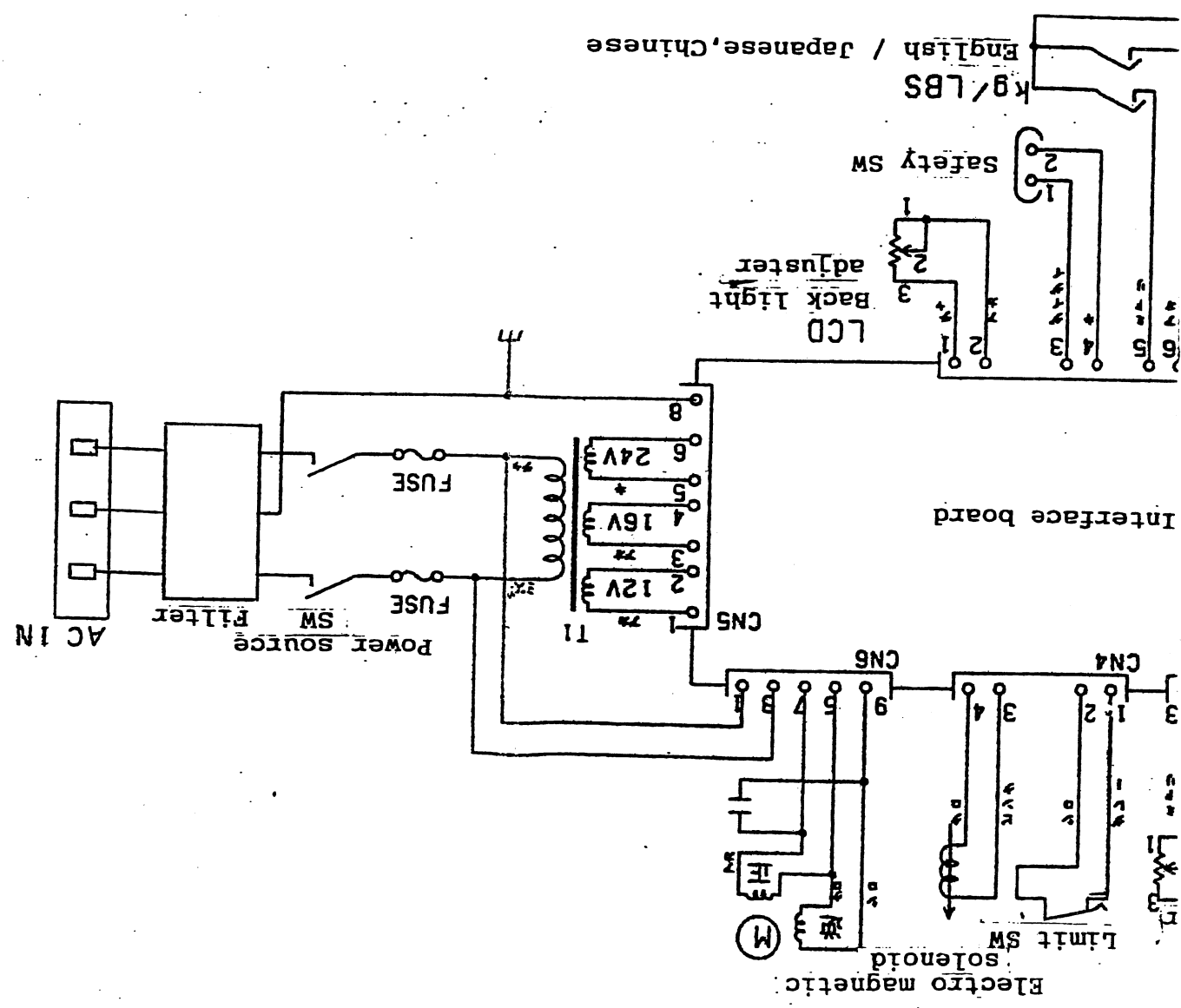
701



702

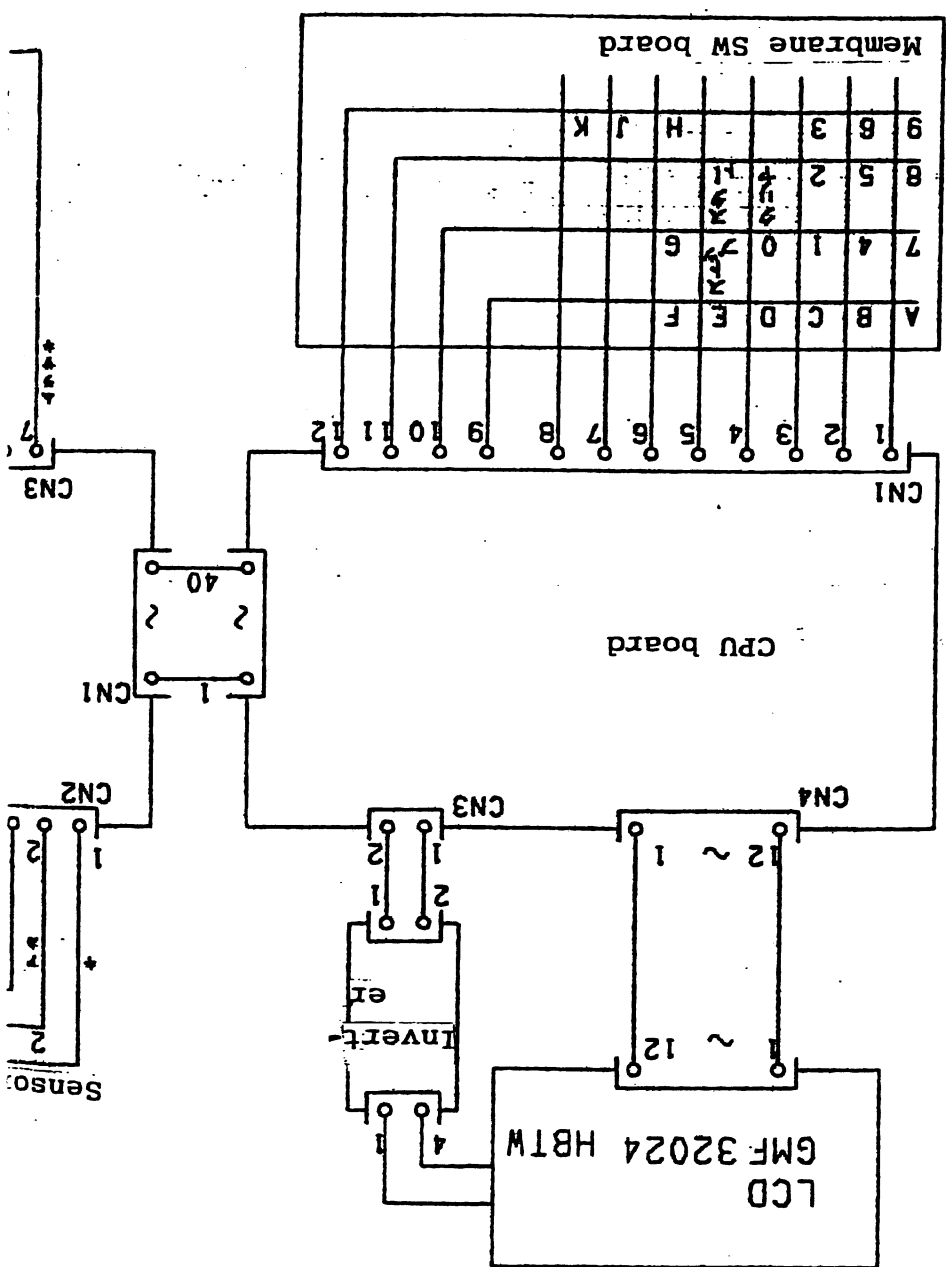


63kg以下	±0.2	±0.3	±	第三角法	承認	照査機	機因	設計	製因	名	TM-300 General	Circuit diagram
	±	±	±	單位	作成	ID.10.19	工業番号	ZX9723	/			
No	名	因	書	材	貨	個數	地	理	記(規格)本			



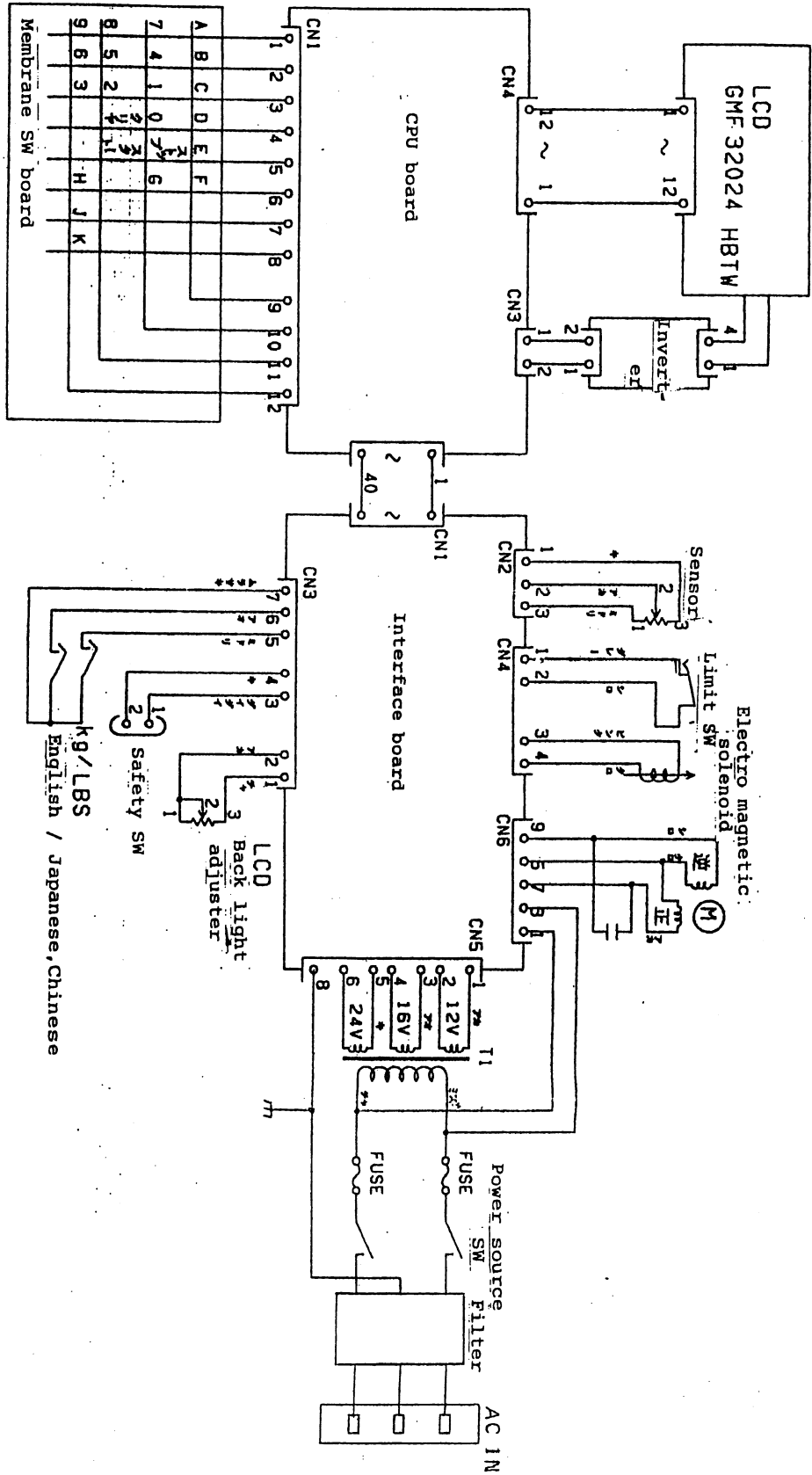
注記：(7) 図面は、実測しない事。(1) 図面中記載文は、よく読む事。(機中)

			▽
			▽
			▽



注記：(ウ) 指定なき寸法許容差欄のA・B・S記号の内、記号に○を付けた許容差を使用する事。





No.	名 称	单 位	数 量	材 质	作 业	工 事 号	检 查 团	設 計	製 造 团	名 称
△	63号之尺 200以下	±0.2	±0.3	±	第三角法	D.10.19	2X9723	△	△	TM-300 General circuit diagram
△	16号之尺 63以下	±0.1	±0.2	±	尺 度	10.10.21		△	△	
△	16以下	±0.05	±0.1	±		10.10.21		△	△	

符号	变更事项	实施日期	担当者

图 号	43-0144
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