MAINTENANCE MANUAL

EK-A SERIES

MODELS: EK-120A
EK-1200A
EK-12KA

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CHAPTER 1. OUTLINE

The EK series comprises load cell-type personal-use balances with 1/12,000 resolution. The available models are listed below, together with their maximum readings, increments, and weighing pan types.

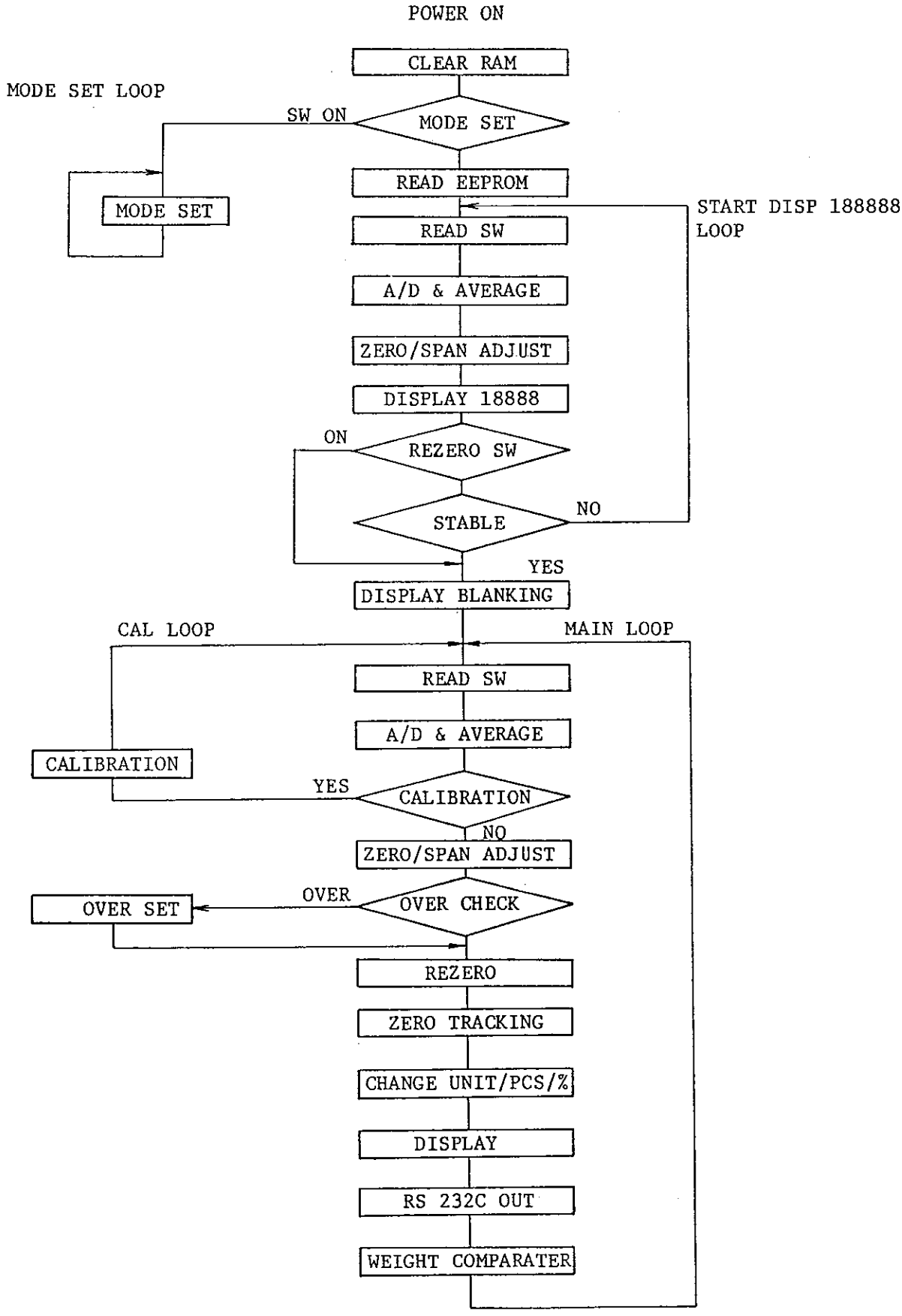
- EK 120A: 120 g/0.01 g, with round pan
- EK 1200A: 1,200 g/0.1 g, with small rectangular pan
- EK 12KA: 12,000 g/1 g, with rectangular pan

The EK 120A is similar to the EK 1200A but different from the EK 12KA in housing shape. Accurate measurement is made possible by additionally employing a level and by adjusting balance legs. Besides weighing objects, each model can count pieces and give indications in percentage points. The models designed for use outside Japan permit the change of units from grains to pounds, ounces, pennyweights, ounces (troy) or taels (Hong Kong) and grains with a switch.
Below are the options available.

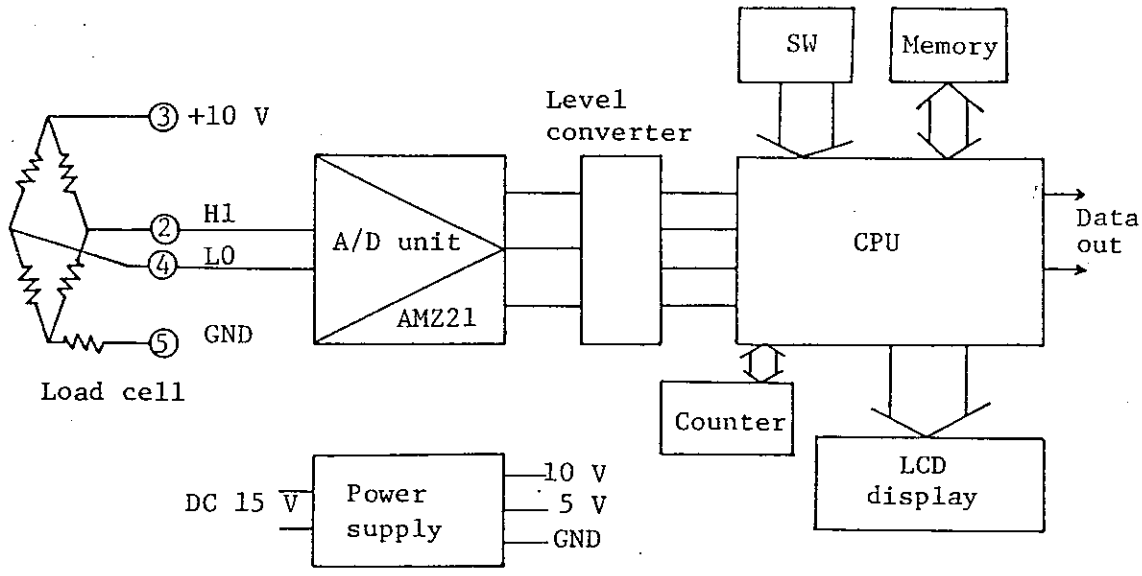
- EK-02: RS-232C board for the EK 12K
- EK-03: RS-232C board for the EK 120/1200
- EK-04: Battery board for the EK 120/1200
- EK-05: Battery board for the EK 12K
- EK-06: Weight comparator board for the EK series
- EK-07: Underhook weighing fixture for the EK 12K

The RS-232C boards and the battery boards are essentially the same as those for the EW series but differ in the length of board connecting cables and in fixture sizes due to different housing shapes and mounting procedures. It is necessary to select boards applicable to each model.
The accuracy of measurement is ensured by measures taken to counter such sources of external disturbance as noise propagation over the power line and radio wave emissions.

Flow chart


POWER ON
CLEAR RAM
MODE SET LOOP
SW ON
MODE SET
READ EEPROM
MODE SET
START DISP 188888
LOOP
READ SW
A/D & AVERAGE
ZERO/SPAN ADJUST
DISPLAY 18888
ON
REZERO SW
NO
STABLE
YES
DISPLAY BLANKING
CAL LOOP
MAIN LOOP
READ SW
A/D & AVERAGE
CALIBRATION
YES
CALIBRATION
NO
ZERO/SPAN ADJUST
OVER
OVER SET
OVER CHECK
REZERO
ZERO TRACKING
CHANGE UNIT/PCS/%
DISPLAY
RS 232C OUT
WEIGHT COMPARATER

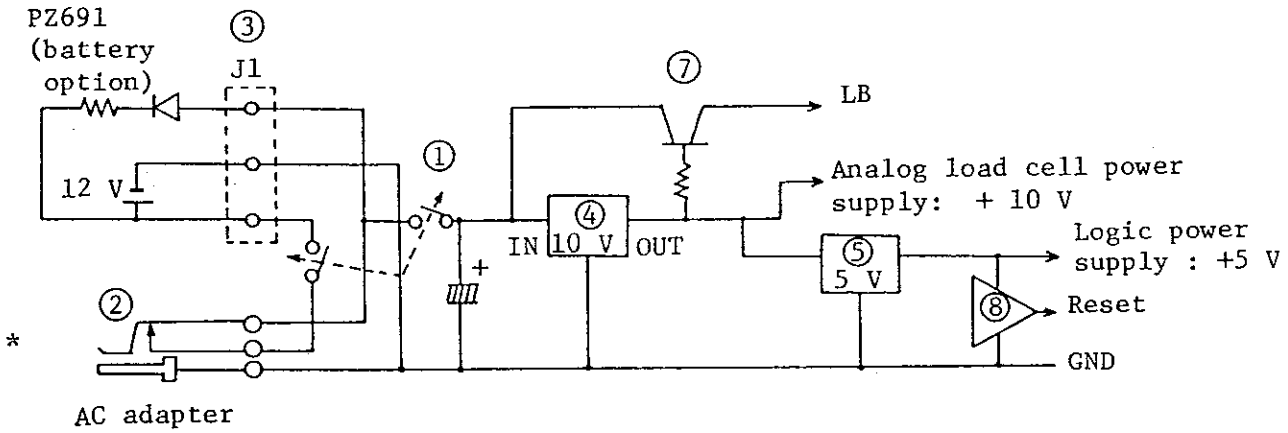
EK Block Diagram



Operating principles

The weight of an object is detected as an output potential difference of load cell ①. The analog output is then converted to digital format by the AMZ21. After A/D conversion, the data is processed with calibration data and output for display, DATA OUT, etc. A digital calibration feature allows zero and span adjustments to be readily performed through the use of the CAL slide switch and FRONT key switch. The calibration data is stored in memory (EEPROM) along with the unit and other related information.

Power Supply Section



① Power switch: Operating this switch turns off power to all circuits except for the battery charging circuit.

② AC adapter: This AC adapter provides about 15 V to 20 V of power (full-wave rectification with power switch off). The voltage drops when the battery option or the RS-232C board is connected.

③ J1: The battery option, if installed, is charged by connecting the AC adapter and by turning off the power switch. The battery is fully charged by setting the charge switch to FULL for about 15 hours, then setting the charge switch to TRICKLE. This permits flow of a just enough charging current to replenish the self-discharge of the battery.

④ 10 V regulator: This regulator supplies a regulated voltage of 10 V ± 10% to the load cell and analog section.

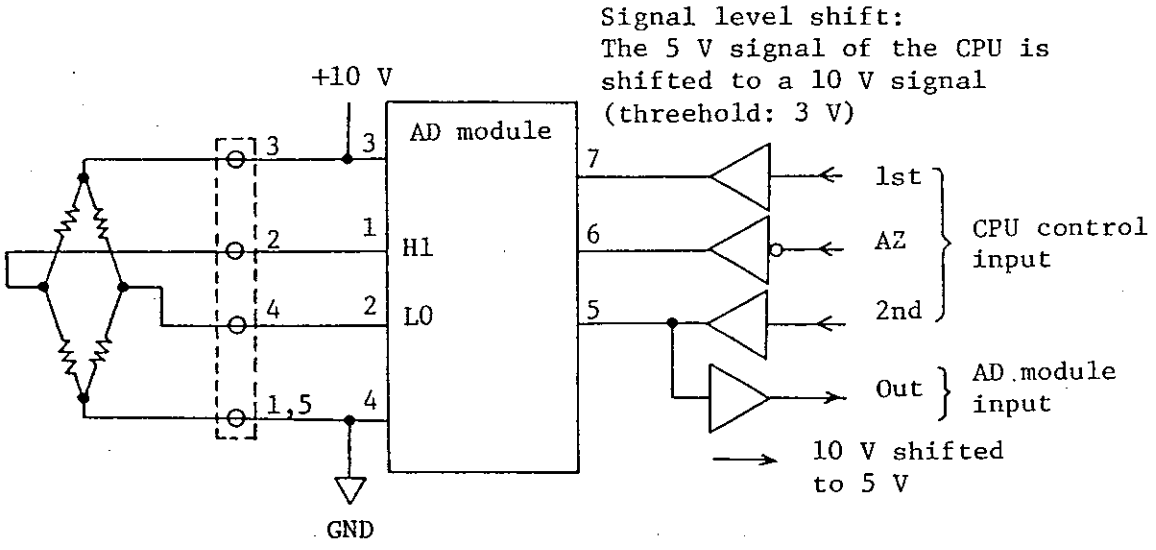
⑤ 5 V regulator: This regulator supplies a regulated voltage of 5 V ± 10% to the logic section.

⑦ Low battery detection circuit:
If the potential difference between input and output of the 10 V regulator becomes about 0.7 V or less, this circuit detects a low level and causes an "Lb" indication to appear.

⑧ Reset: If the supply voltage to the logic section becomes 3.5-4.6 V or less, a low level is detected and the CPU is reset.

* If the AC adapter jack is short-circuited while the battery is in use, a large current flows, destroying the battery.

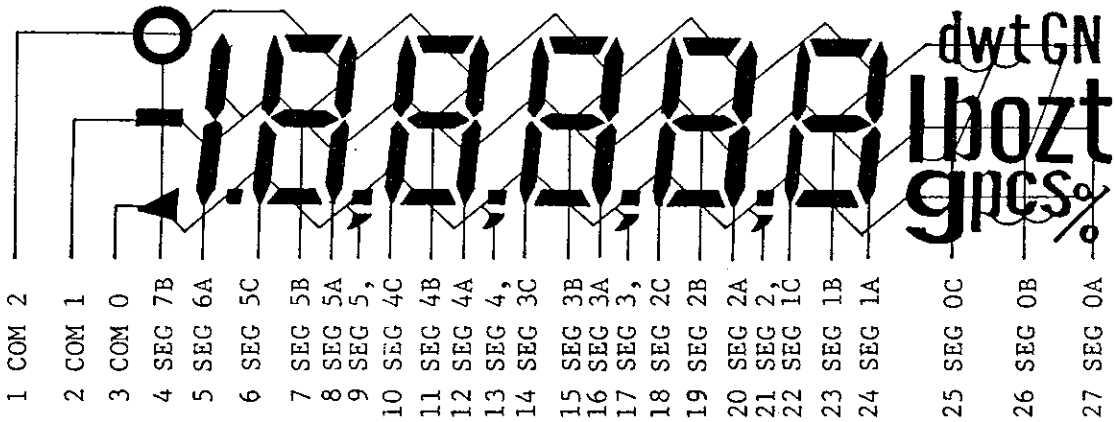
Analog Section and Load Cell

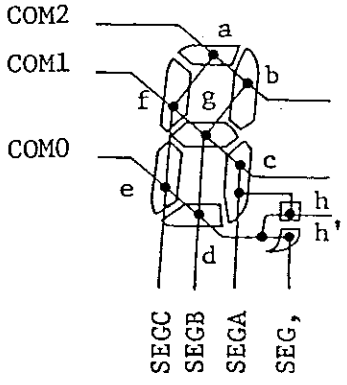


- Load cell and AD module power supply: +10 V
- Load cell output voltage
  - Between Hl and LO: Zero = about 2.5 mV
    Full-scale = about 12 mV (EK 1200/12K)
    about 7 mV (EK 120)
  - Between Hl and GND, between LO and GND: about 5.5 V

The AD module receives the control signal from the CPU, and A/D converts the load cell output voltage to issue an OUT signal.

Display

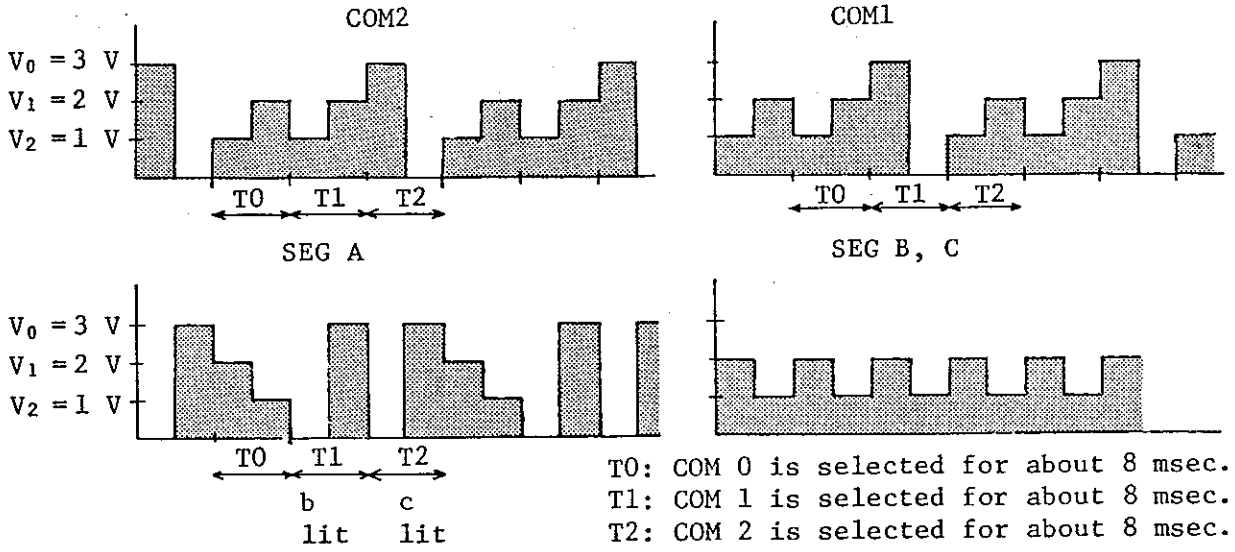




	SEG C	SEG B	SEG A
COM 2	a	b	
COM 1	f	g	c
COM 0	e	d	h

No.	COM2	COM1	COM0	No.	COM2	COM1	COM0	No.	COM2	COM1	COM0
4	○ 7B	— 7g	△ 7d	12		4c	4h	20		2c	2h
5		6c	6h	13			4h'	21			2h'
6	5a	5f	5c	14	3a	3f	3e	22	1a	1f	1e
7	5b	5g	5d	15	3b	3g	3d	23	1b	1g	1d
8		5c	5h	16		3c	3h	24		1c	
9			5h'	17			3h'	25	dwt 0a	lb 0f	g 0e
10	4a	4f	4e	18	2a	2f	2c	26	GN 0b	OZ 0g	PCS 0d
11	4b	4g	4d	19	2b	2g	2d	27		t 0c	% 0h

The LCD consists of a matrix made up of three common lines, with three segment lines provided for each digit.



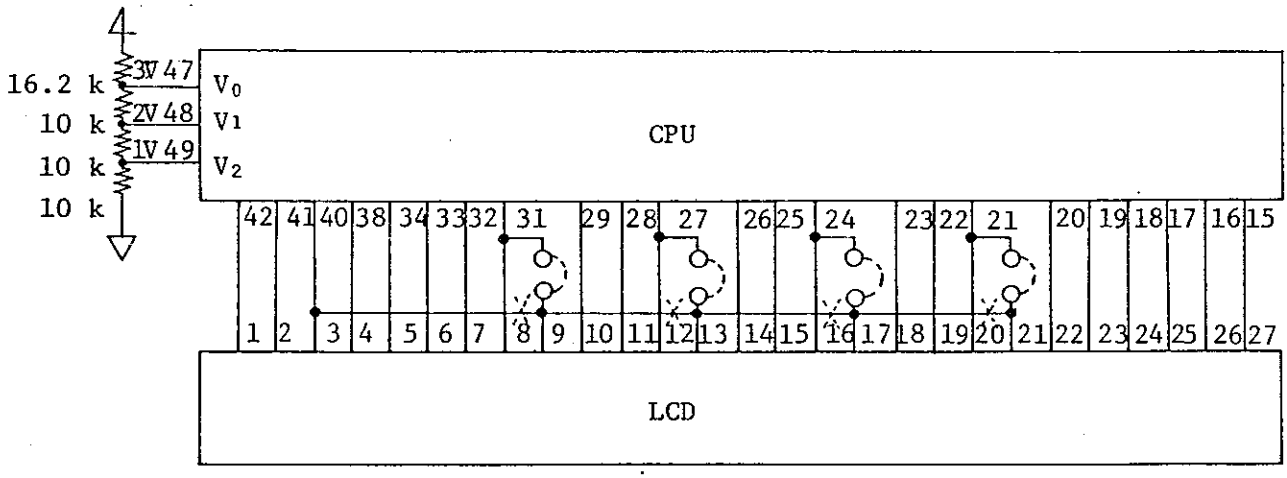
T0: COM 0 is selected for about 8 msec.
T1: COM 1 is selected for about 8 msec.
T2: COM 2 is selected for about 8 msec.

Example: Waveforms of COM 1, COM 2 and SEG A given when '1' is displayed.

The common lines output stair step waveforms with a period of about 24 msec., one-third out of phase from each other. Each segment line also outputs a stair step waveform with a period of 24 msec. When lit up, the segment produces a waveform of large amplitude in opposite phase to the common; when turned off, the segment produces a waveform of small amplitude.

'SEG,' is used to change the shape of the decimal point from '■' to ','. Normally, 'SEG,' is short-circuited to COM 0 and turned off. Short-circuiting 'SEG,' to SEG A of each digit lights ',' as well as '■'. (Cut the pattern indicated by crosses (X) and attach jumpers (⌒).)

LCD reference voltage



Diode settings

- D33, D34: Decimal point setting
  - D33 attached, D34 attached = no decimal point (0)
  - D33 detached, D34 attached = 1 decimal place (0.0)
  - D33 attached, D34 detached = 2 decimal places (0.00)
  - D33 detached, D34 detached = 3 decimal places (0.000)

- D35, D36: Scale factor
  - D35 attached, D36 attached = 3,000 (max. reading), 1 (increment)
  - D35 detached, D36 attached = 6,000 (max. reading), 2 (increment)
  - D35 attached, D36 detached = 15,000 (max. reading). 5 (increment)
  - D35 detached, D36 detached = internal 4x magnification mode (1/12,000)

- D37: Span check diode
  - With D37 attached and power turned on, the check mode is entered.

- With D37 detached and power turned on, the ordinary 1/3,000 scale display appears.
- After check mode start, either pressing the [ZERO] and [TARE] switches simultaneously or attaching D37 while the ordinary 1/3,000 scale is in use causes an internal 1/60,000 scale mode to be entered. This mode allows an AD converter value and a zero set value to be displayed for span setting.

The CPU performs zero and span calculations as follows:

{(AD counter value) - (zero set value in decimal)}
× (span set value in decimal) ÷ 1,048,576 = 12,000

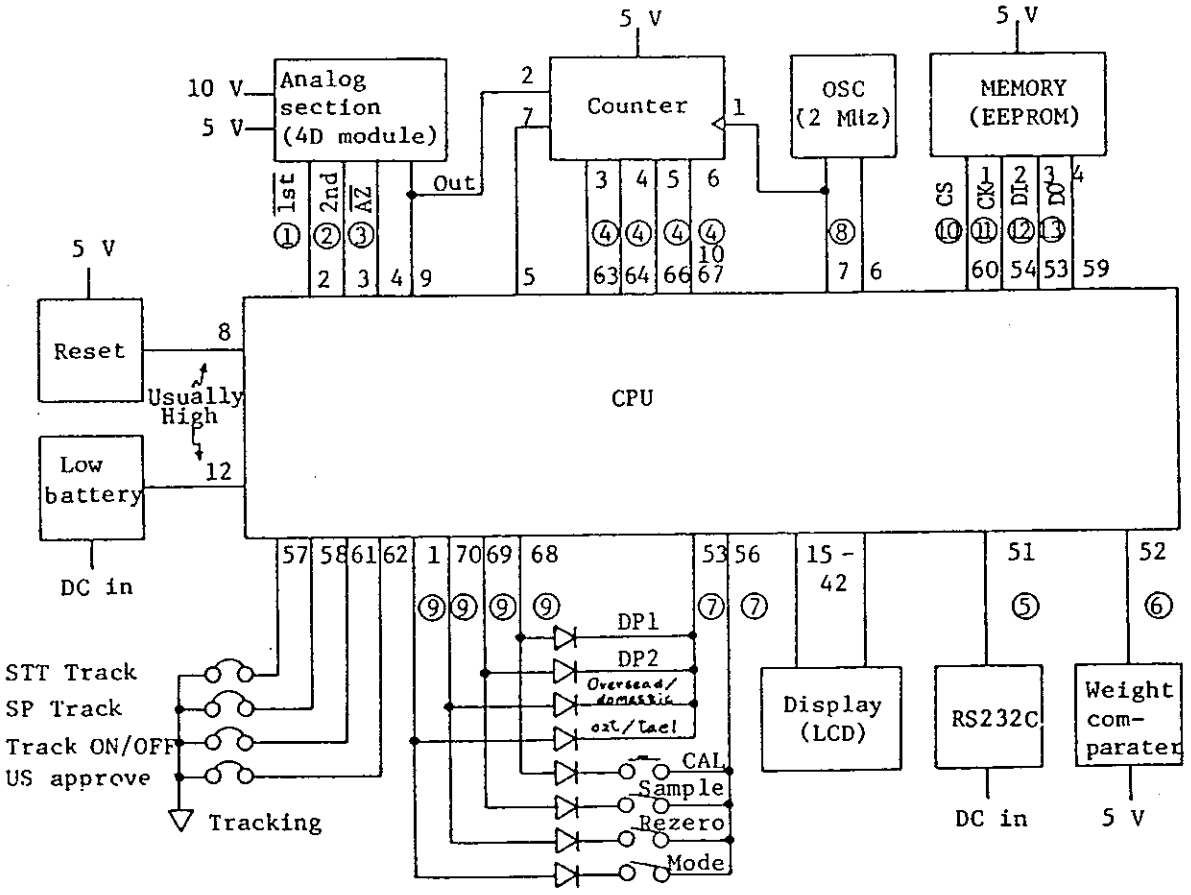
1,200 ÷ 4 = 3,000 = 1/3,000 display

The zero set value for 10 through FFFO in hexadecimal is set to '1' by detaching D1 through D12, or to '0' by attaching the same diodes. The span set value for 10 through FFFFO in hexadecimal is set to '1' by detaching D13 through D28, or to '0' by attaching the same diodes.

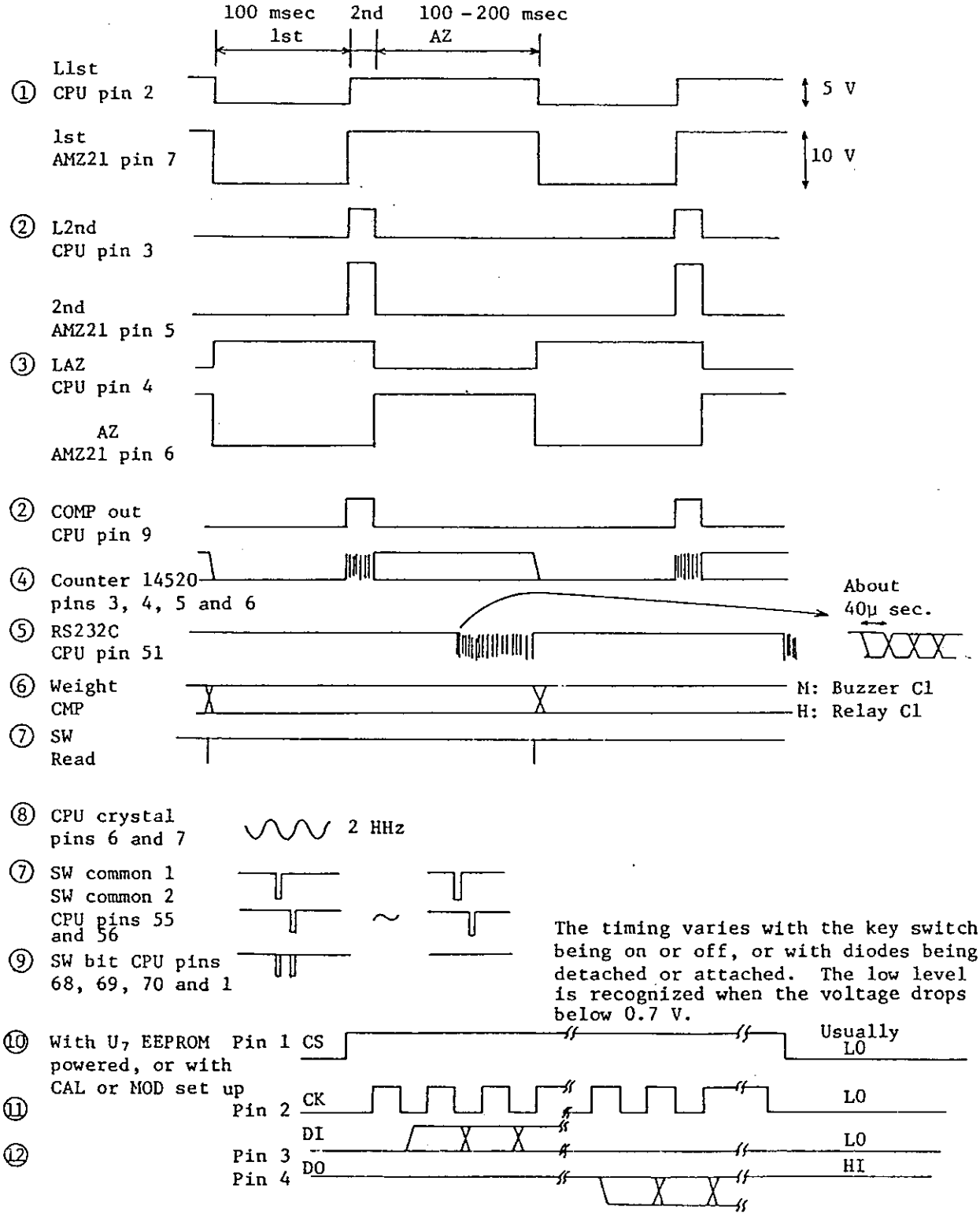
- C1 through C5: Power supply capacitors
- C7: Capacitor for AZ
- C8: Integrating capacitor
- C9, C10: Filter capacitor
- C11, C12, C13: By-pass capacitor
- J1: Diode for the battery board
- J2: Diode for the RS-232C board
- J3: Diode for the AC adapter
- J4: Diode for the load cell
- J5: Diode for the key switch
- D1 through D4: 16^1 digit DIP switch for zero setting
- D5 through D8: 16^2 digit DIP switch for zero setting
- D9 through D12: 16^3 digit jumpers for zero setting
- D13 through D16: 16^1 digit jumpers for span setting
- D17 through D20: 16^2 digit jumpers for span setting
- D21 through D24: 16^3 digit jumpers for span setting

- D25 through D28: 16^4 digit jumpers for span setting
- D29: Provides 1/3,000 scale display when short-circuited, and 1/6,000 scale display when open.
- D30: Changes units between gram and ounce when attached, and provides gram display alone when detached.
- D31: Tare subtraction
- D32: Zero

The numbers correspond to
those in the timing chart.



Timing Chart



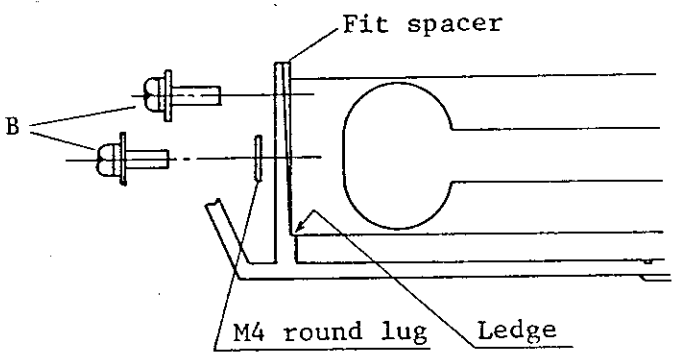
CHAPTER 2. LOAD CELL REPLACEMENT PROCEDURES

EK-120A Load Cell Replacement Procedure

1. Remove the faulty load cell, upper stopper, load angle, etc.

CAUTION: Do not touch or bump the strain gauge portions located on the upper and lower faces of the new load cell.

2. Set the load cell and the fit spacer as shown below. Then fix them using screws B (torque: 10 kg/cm). Fit an M4 round lug to screws B on the lower side.



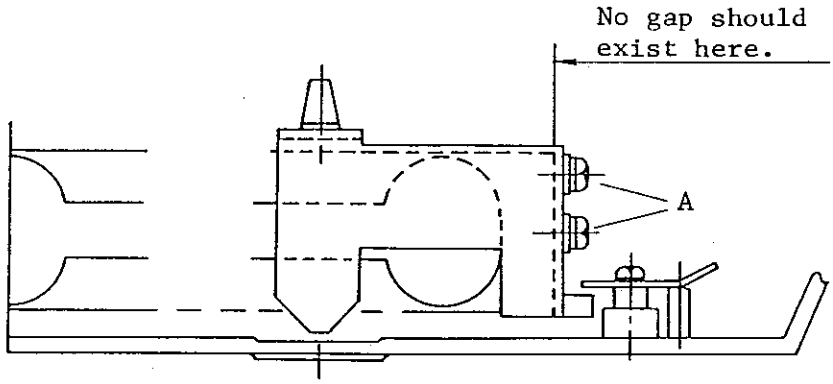
CAUTION: The load cell should not stick-out over the ledge. It should be mounted squarely.

3. Mounting the load angle

   ① Set the load angle in parallel with the load cell, as shown below.

   ② Provide a clearance of about 0.75 mm between the stopper and the lower case.

   ③ Fix the load angle using screws A in such a manner that no gap is left between the load cell and the load angle.



View B: Mounting the Load Angle

4. Adjusting the stopper

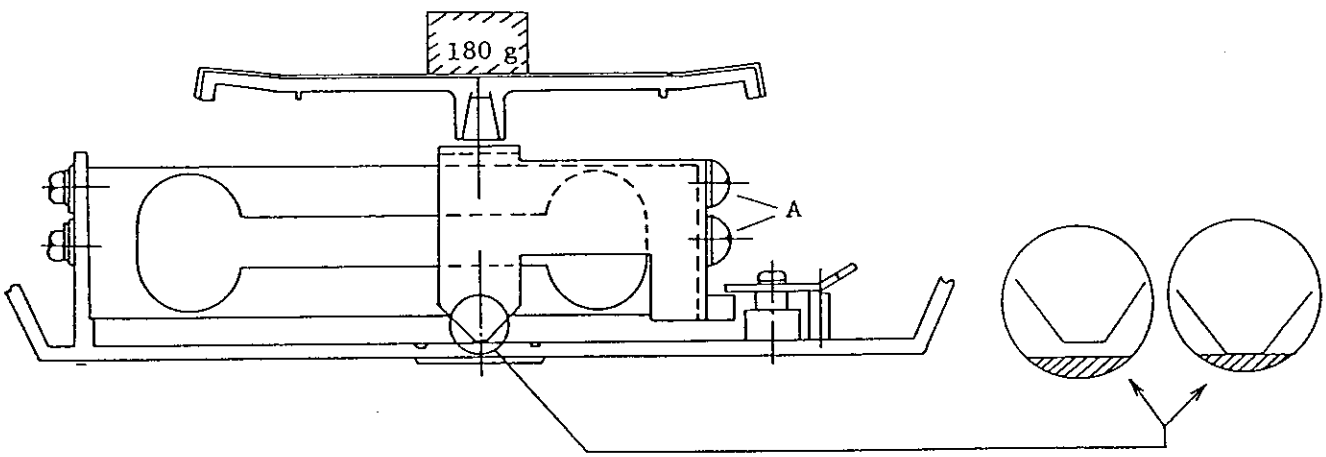
① Place a weight of 180 g on the pan.

② Press the pan with your hand to make sure that the stopper has not yet reached the lower case.

③ Replace the 180 g weight with a weight of 300 g.

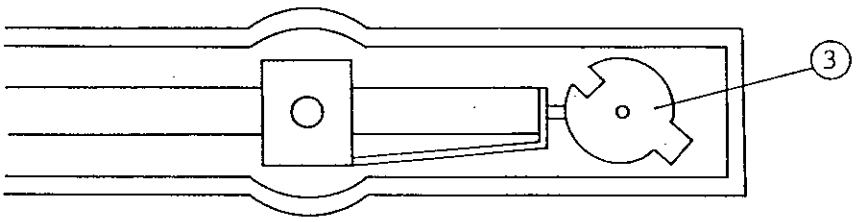
④ Press the pan with your hand to make sure that the stopper has completely reached the lower case.

⑤ Adjust the position of the load angle by using screws A so that conditions ② and ④ above are satisfied.



5. Mounting the upper stopper

   Set claw ③ of the upper stopper as shown below. Fix it with a screw.



6. Connect the load cell connector to the board.

7. Mount the upper case and the pan.

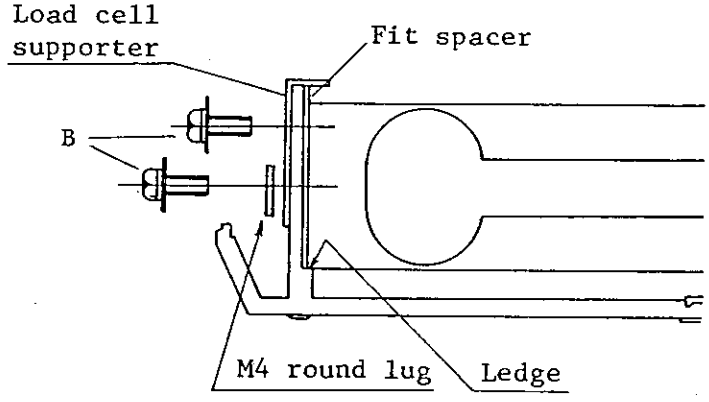
8. Adjust the zero point and the span. Check linearity and the four corner adjustment. Replacement has been completed.

EK-1200A Load Cell Replacement Procedure

1. Remove the faulty load cell, upper stopper, load angle, etc.

CAUTION: Do not touch or bump the gauge portions located on the upper and lower faces of the new load cell.

2. Set the load cell, the load cell supporter, and the fit spacer as shown below. The fix them using screws B (torque: 10 kg/cm). Fit an M4 round lug to screws B on the lower side.



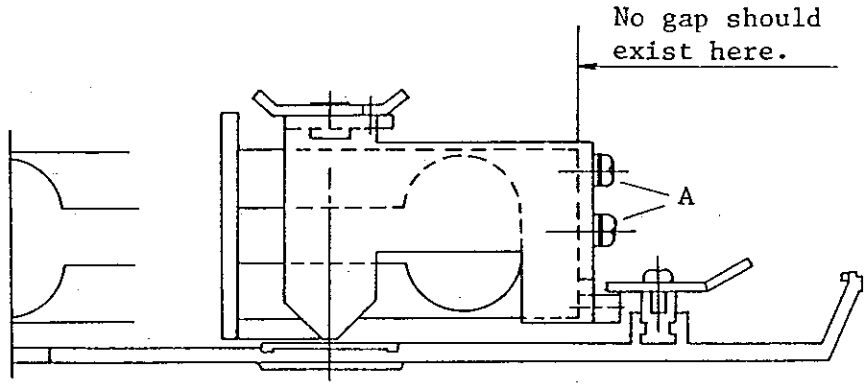
CAUTION: The load cell should not stick-out over the ledge. It should be mounted squarely.

3. Mounting load angle

   ① Set the load angle in parallel with the load cell, as shown below.

   ② Provide a clearance of about 0.8 mm between the stopper and the lower case.

   ③ Fix the load angle using screws A in such a manner that no gap is left between the load cell and the load angle.



View B: Mounting the Load Angle

4. Adjusting the stopper

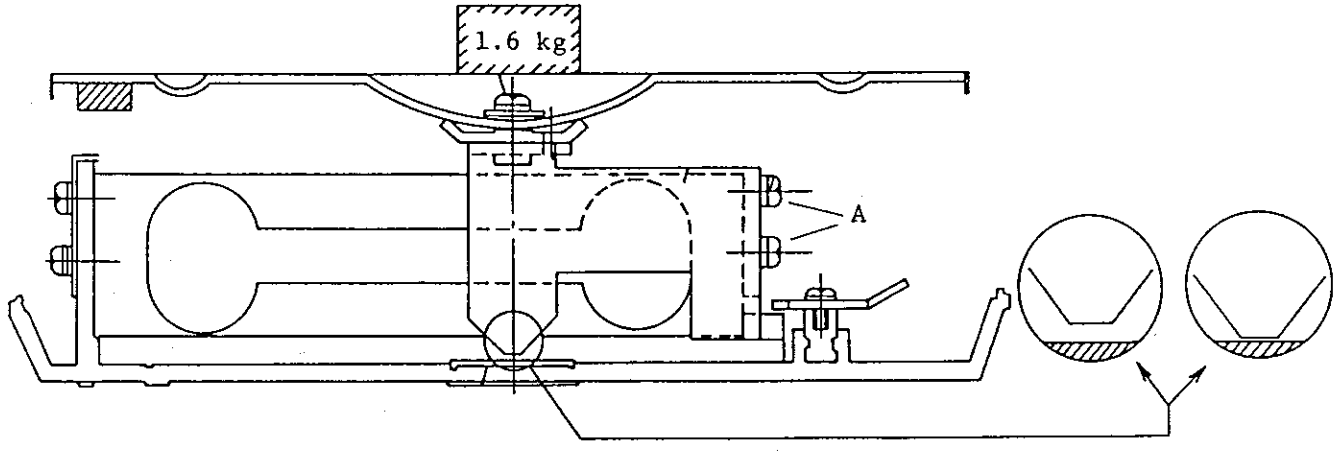
① Place a weight of 1.6 kg on the pan.

② Press the pan with your hand to make sure that the stopper has not yet reached the lower case.

③ Replace the 1.6 kg weight with a weight of 2.7 kg.

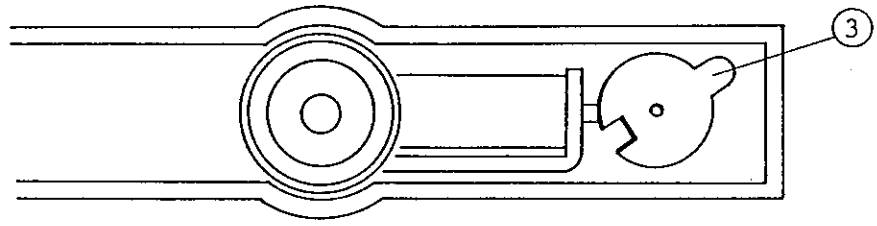
④ Press the pan with your hand to make sure that the stopper has completely reached the lower case.

⑤ Adjust the position of the load angle by using screws A so that conditions ② and ④ above are satisfied.



5. Mounting the upper stopper

   Set with claw ③ of the upper stopper as shown below. Fix it with a screw.



6. Connect the load cell connector to the board.

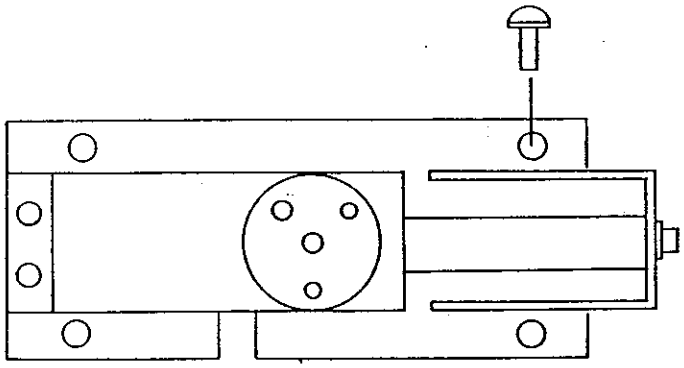
7. Mount the upper case and the pan.

8. Adjust the zero point and the span. Check linearity and the four corners. Replacement has been completed.

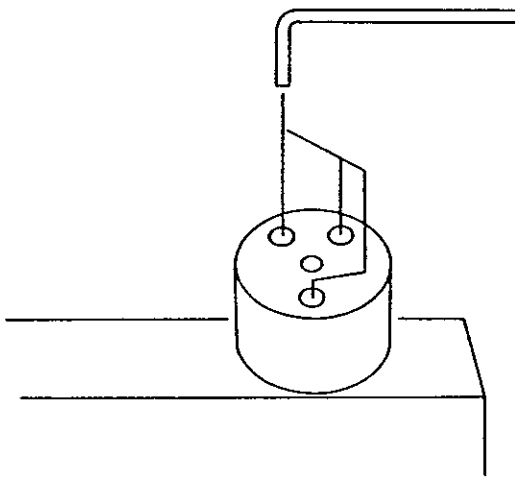
EK-12A Load Cell Replacement Procedure

1. Remove the faulty load cell unit.

2. Mount a new load cell.

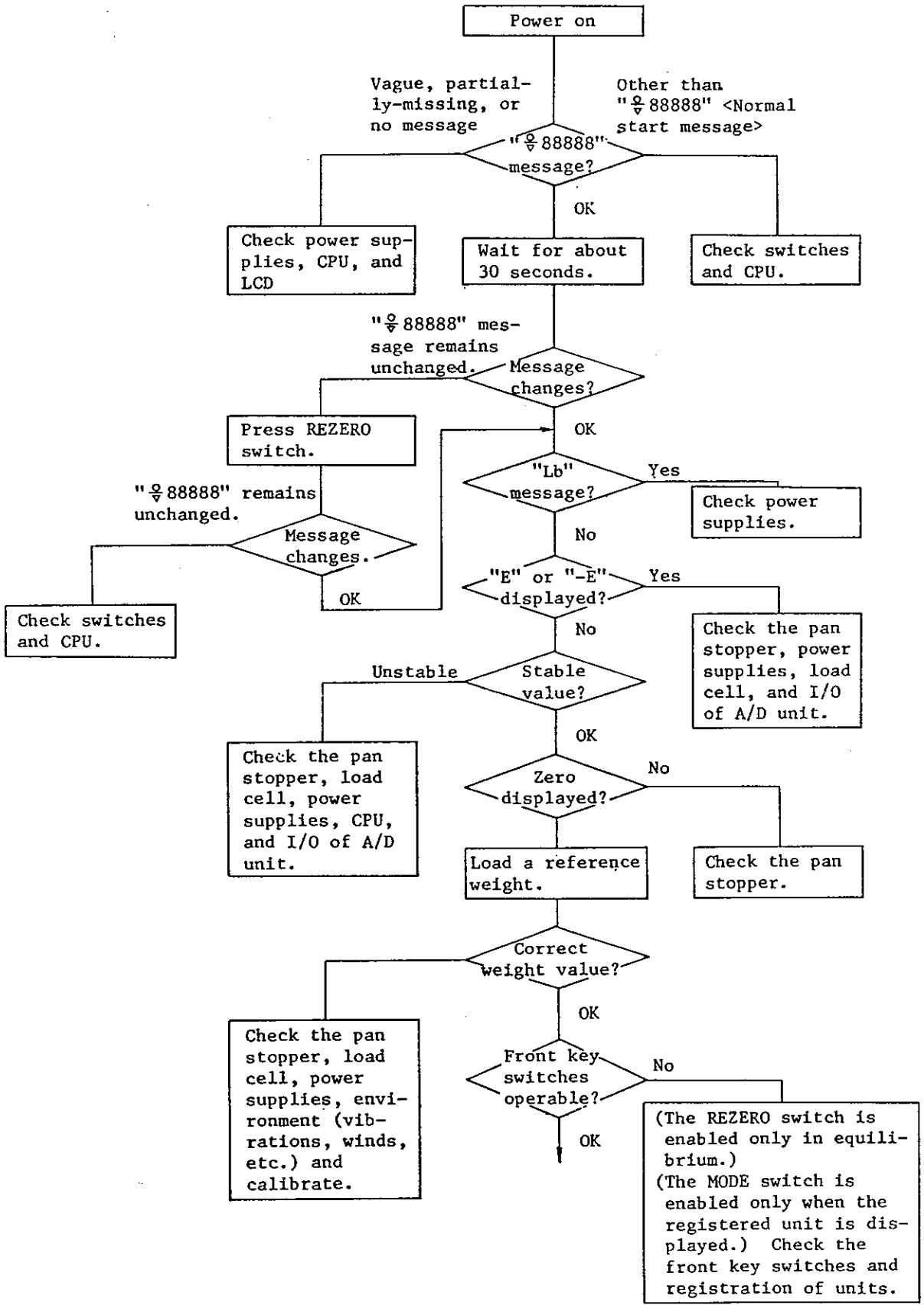


3. Place the pan support. Then adjust the clearance and level the pan support by turning the three hex screws in the mounting block.



4. Adjust the zero point and the span. Check linearity and the four corners. Replacement has been completed.

TROUBLESHOOTING



o Power supply check:

10-V regulator

Input: Output voltage + 0.7 V or higher (when the input voltage is under the above voltage, "Lb" message is displayed.)

Output: 10 V ± 10%

5-V regulator

Input: 10 V ± 10%

Output: 5 V ± 5%

When the output voltage is under the above value, a CPU reset occurs.

o Pan stopper check:

Check that the pan is positioned in place.

Check that the pan does not touch anything around it, at any time.

Check that the load cell stopper is not in contact with the upper (without load) or lower (with load) stopper.

o Load cell check:

Load cell excitation:	10 V ± 10%		
Load cell output voltage:	HI - LO voltage		Approx. 2.5 mV (zero)
			7 to 12 mV (Full range)
	HI/LO - GND voltage		Approx. 5.5 V
	Connector J6	pins 1 and 5	GND
		pin 2	Output HI
		pin 3	10 V
		pin 4	Output LO

o CPU check:

Clock 2 MHz
Reset Normally high
Check waveforms of switches, counter (14520), EEPROM (59306), level converter (339), and LCD outputs.
Check the soldering state of CPU pins and check for no solder bridges (by patting the chip).

o Switch check:

Check the operation of the front key switches, CAL switch, and POWER switch.

o LCD check:

Check that the liquid crystal display is not cracked or broken.
Check the wiring between the LCD and the CPU.
Check the waveform of the LCD signals.

o AD unit check:

Check that the 5-V signal of the CPU is correctly converted into a 10-V signal and that the 10-V signal is correctly fed to the control input of the AD unit.
Check that the 10 V signal is valid.
Check that the output voltage of the load cell is normal.

When no error is found in the power supply, load stopper, AD unit control signal checks though the value displayed is changing or "E" or "-E" is displayed, the trouble can be caused on the load cell or a board. Replace the load cell or the board by a new one to identify the defective.
In this case, though correct weight data is not obtained because of different output voltages of the load cell and different span values, this replacement is helpful to check measuring stability and location of troubles.

PARTS LIST

EK－120／1200A
MAIN BOARD－1／2

CIRCUIT SYMBOL OR DRWG. NO.	PARTS NAME	DESCRIPTION	Q'TY
	7PZ:855	MAIN BOARD FUULLY ASSEMBLED	1
	PC:855	PRINTED CIRCUIT BOARD	1
C 8,9,12～15	CC:0.022U	CAPACITOR 0.022μF 50V	6
C 2,3,5,6	CC:0.1U25V	CAPACITOR 0.1μF 25V	4
C 10,11	CC:47P	CAPACITOR 47pF 50V	2
C 4	CK:SM25VB100	CAPACITOR 100μF 25V	1
C 1	CK:SM35VB470	CAPACITOR 470μF 35V	1
C 7	CK:SM50VB10	CAPACITOR 10μF 50V	1
D 1～9	DI:1S2473	DIODE	9
	ED:LT5093-35P3	DISPLAY PANEL	1
J 4	EJ:0470-01-230	CONNECTOR	1
	FH:85PN0819	FUSE HOLDER	2
	FS:EAWK-200MA	FUSE	1
J 5,6	JD:230-05-30	CONNECTOR	2
J 1,2,3	JT:171825-3	CONNECTOR	3
	MF:AMZ21	HYBRID	1
Q 1	QT:A1015Y	TRANSISTOR	1
R 6～10	RC:10K	RESISTOR 10KΩ,1/4W	5
R 3,5,11	RC:15K	RESISTOR 15KΩ,1/4W	3
R 4	RC:2.2K	RESISTOR 2.2KΩ,1/4W	1
R 2	RC:3.3K	RESISTOR 3.3KΩ,1/4W	1
R 1	RC:5.6R	RESISTOR 5.6Ω,1/4W	1
R 13～15	RM:10KF	RESISTOR 10KΩ,1/4W ±100ppM/℃	3
R 16	RM:16.2KF	RESISTOR 16.2KΩ,1/4W ±100ppM/℃	1
R 12	RN:IHR-4-223MA	RESISTOR NETWORK	1
SW 1	SP:PSF0P-A2K	SWITCH	1
	SS:SSG1X2NB5X7	SWITCH	1
U 3	UA:C339C	VOLTAGE COMPARATOR	1
U 5	UA:S-8054ALR	VOLTAGE COMPARATOR	1
U 8	UC:MB88541-155M	CPU	1
U 6	UC:14520B	CMOS IC	1
U 7	UN:NCR59306	EEPROM	1
U 1	UR:TA78DL10P	VOLTAGE REGULATOR	1
U 2	UR:TA78L005AP	VOLTAGE REGULATOR	1

EK－１２０／１２００A
MAIN BOARD－２／２

CIRCUIT SYMBOL OR DRWG. NO.	PARTS NAME	DESCRIPTION	Q'TY
X 1	XT:HC18/U2MHZ	XTAL	1
	07:A44234	DISPLAY PANEL HOLDER	1
	10:LWS-1.5S	CABLE CLAMPER	1

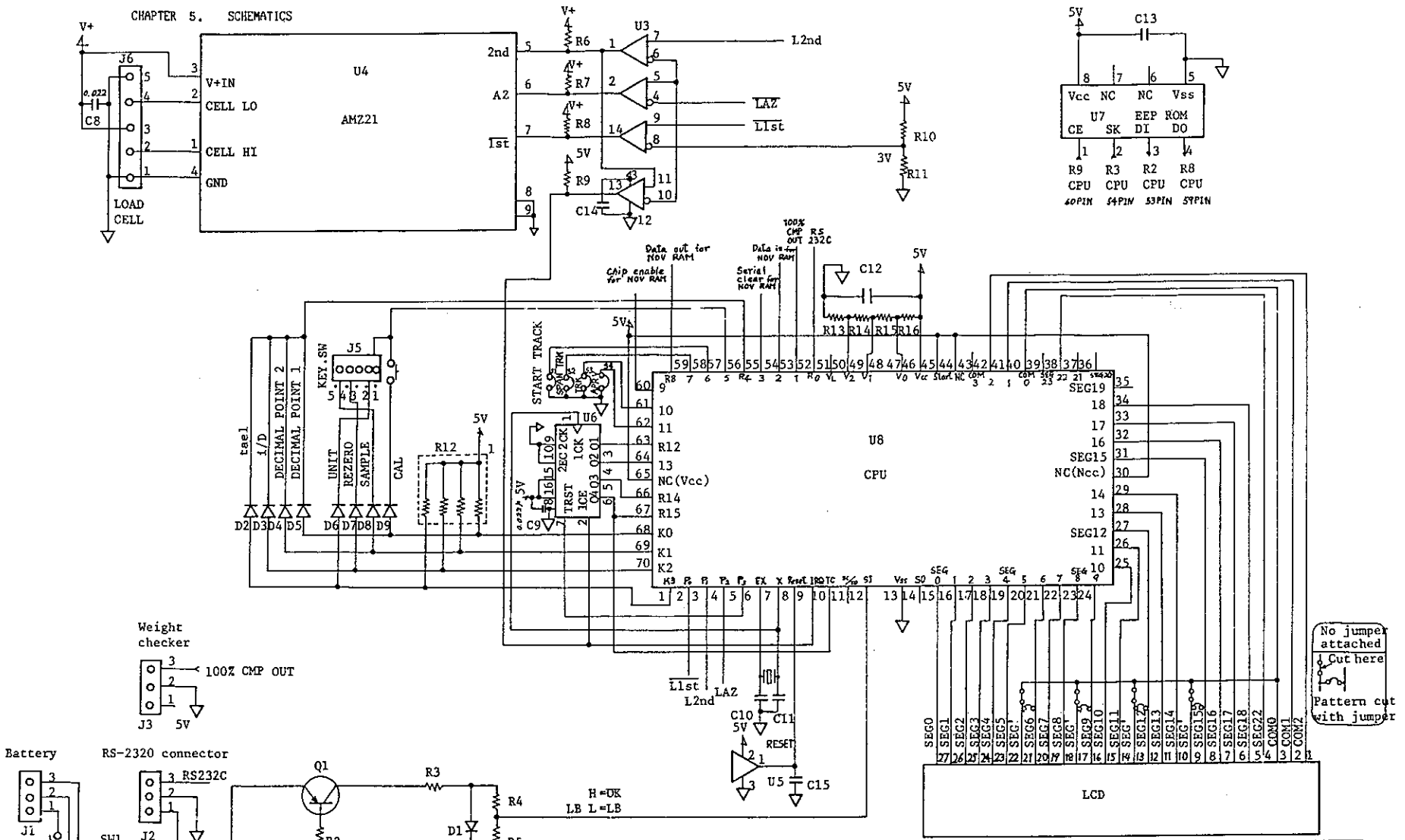
PARTS LIST

EK－12KA
MAIN BOARD－1／2

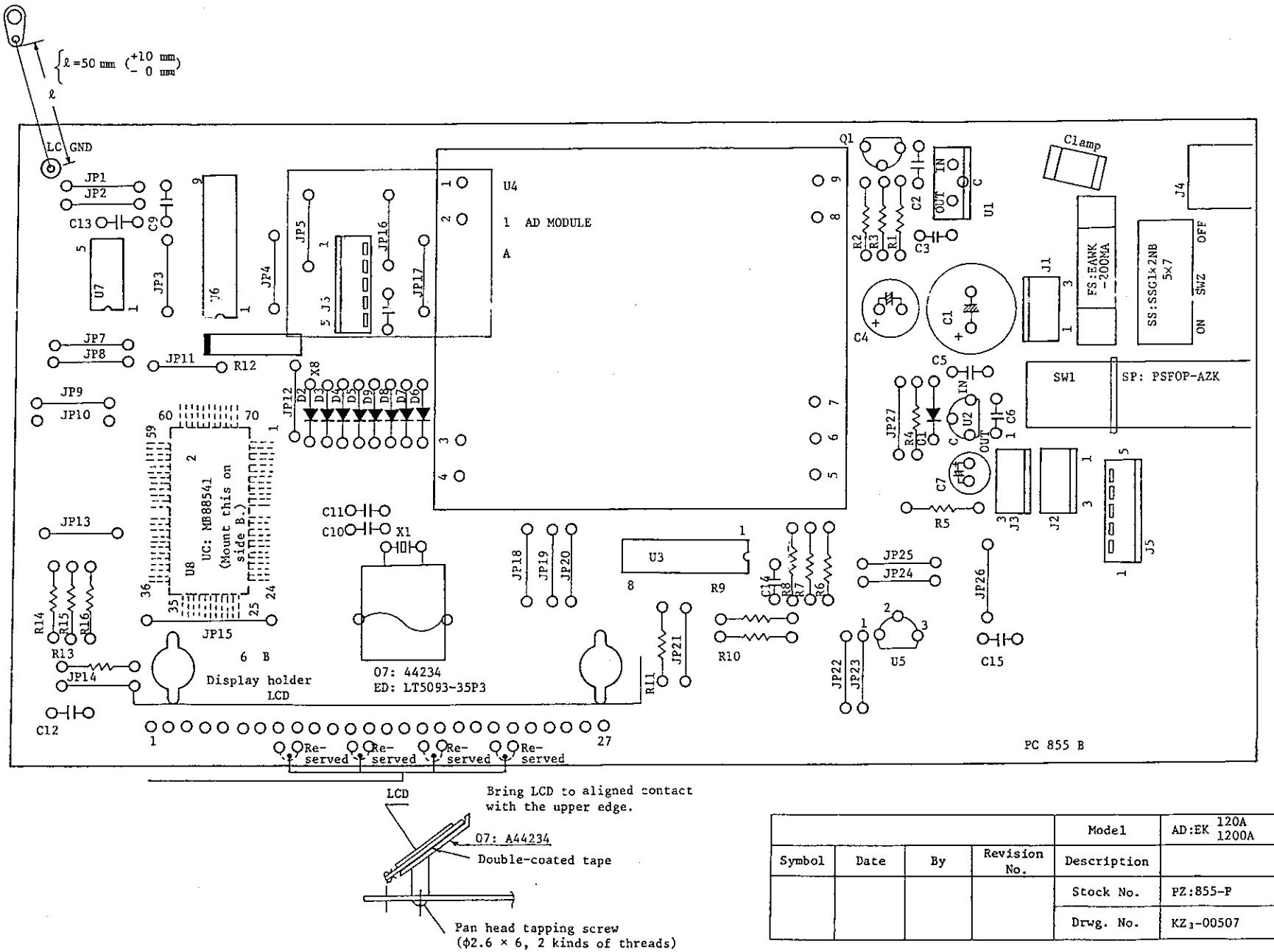
CIRCUIT SYMBOL OR DRWG. NO.	PARTS NAME	DESCRIPTION	Q'TY
	7PZ:856	MAIN BOARD FUULLY ASSEMBLED	1
	PC:856	PRINTED CIRCUIT BOARD	1
C 8～10,13～15	CC:0.022U	CAPACITOR 0.022μF 50V	6
C 2,3,5,6	CC:0.1U25V	CAPACITOR 0.1μF 25V	4
C 11,12	CC:47P	CAPACITOR 47pF 50V	2
C 4	CK:SM25VB100	CAPACITOR 100μF 25V	1
C 1	CK:SM35VB470	CAPACITOR 470μF 35V	1
C 7	CK:SM50VB10	CAPACITOR 10μF 50V	1
D 1～9	DI:1S2473	DIODE	9
	ED:LT5093-35P3	DISPLAY PANEL	1
J 4	EJ:0470-01-230	CONNECTOR	1
	FH:85PN0819	FUSE HOLDER	2
	FS:EAWK-200MA	FUSE	1
J 5,6	JD:230-05-30	CONNECTOR	2
J 1,2,3	JT:171825-3	CONNECTOR	3
	MF:AMZ21	HYBRID	
Q 1	QT:A1015Y	TRANSISTOR	1
R 6～10	RC:10K	RESISTOR 10KΩ,1/4W	5
R 3,5,11	RC:15K	RESISTOR 15KΩ,1/4W	3
R 4	RC:2.2K	RESISTOR 2.2KΩ,1/4W	1
R 2	RC:3.3K	RESISTOR 3.3KΩ,1/4W	1
R 1	RC:5.6R	RESISTOR 5.6Ω,1/4W	1
R 13～15	RM:10KF	RESISTOR 10KΩ,1/4W ±100ppM/℃	3
R 16	RM:16.2KF	RESISTOR 16.2KΩ,1/4W ±100ppM/℃	1
R 12	RN:IHR-4-223MA	RESISTOR NETWORK	1
SW 1	SP:PSFOP-A2K	SWITCH	1
CAL	SW:DLA	SWITCH	1
U 3	UA:C339C	VOLTAGE COMPARATOR	
U 5	UA:S-8054ALR	VOLTAGE COMPARATOR	1
U 8	UC:MB88541-155M	CPU	1
U 6	UC:14520B	CMOS IC	1
U 7	UN:NCR59306	EEPROM	1
U 1	UR:TA78DL10P	VOLTAGE REGULATOR	1
U 2	UR:TA78L005AP	VOLTAGE REGULATOR	1

EK－12KA
MAIN BOARD－2／2

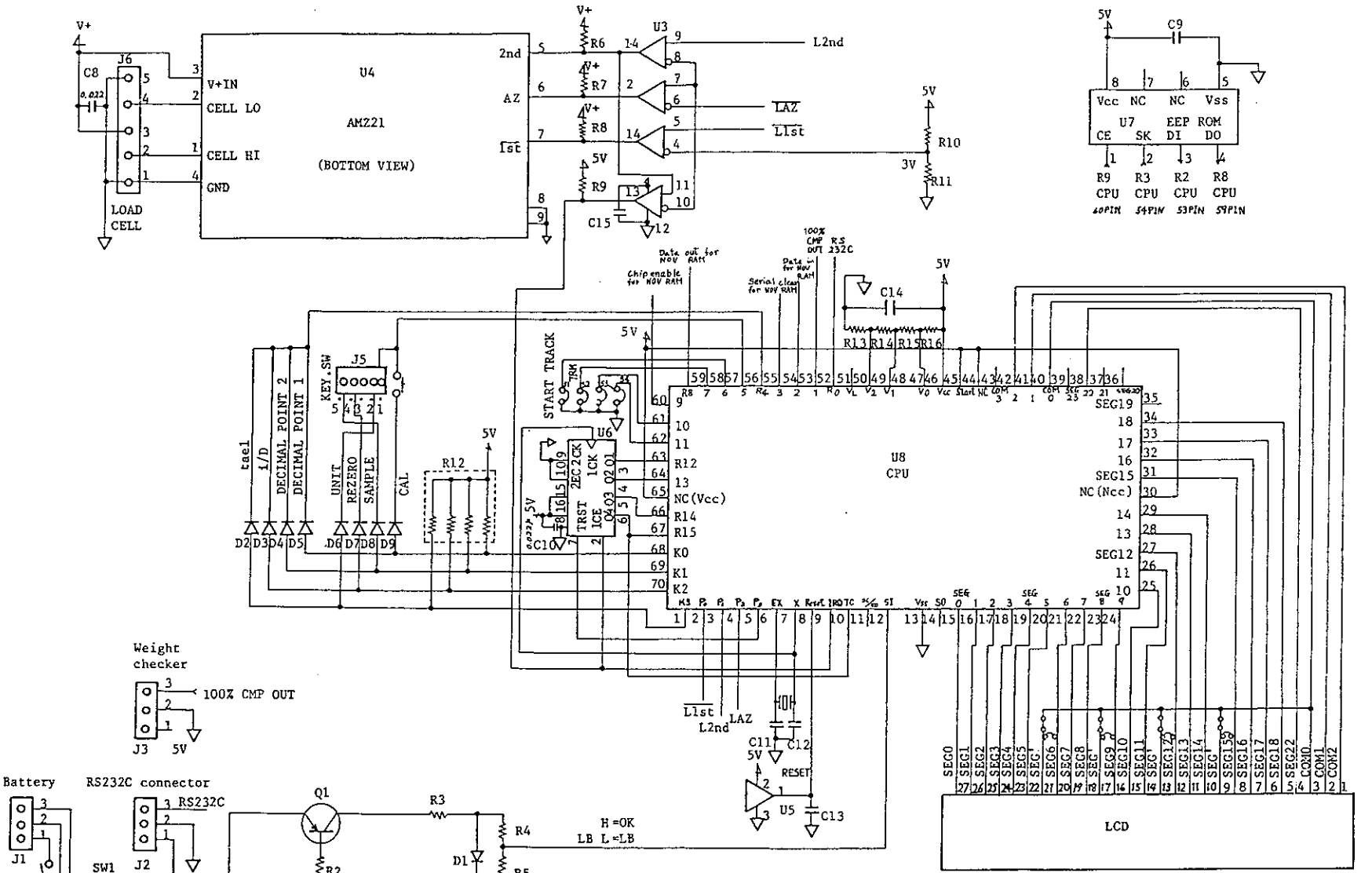
CIRCUIT SYMBOL OR DRWG. NO.	PARTS NAME	DESCRIPTION	Q'TY
X 1	XT:HC18/U2MHZ	XTAL	1
	07:A44234	DISPLAY PANEL HOLDER	1
	07:A46264A	SPACER	2



				Model	AD:EK 120A 1200A
Symbol	Date	By	Revision No.	Description	Main Board
				Stock No.	PZ:855
				Drwg. No.	EC3-00865

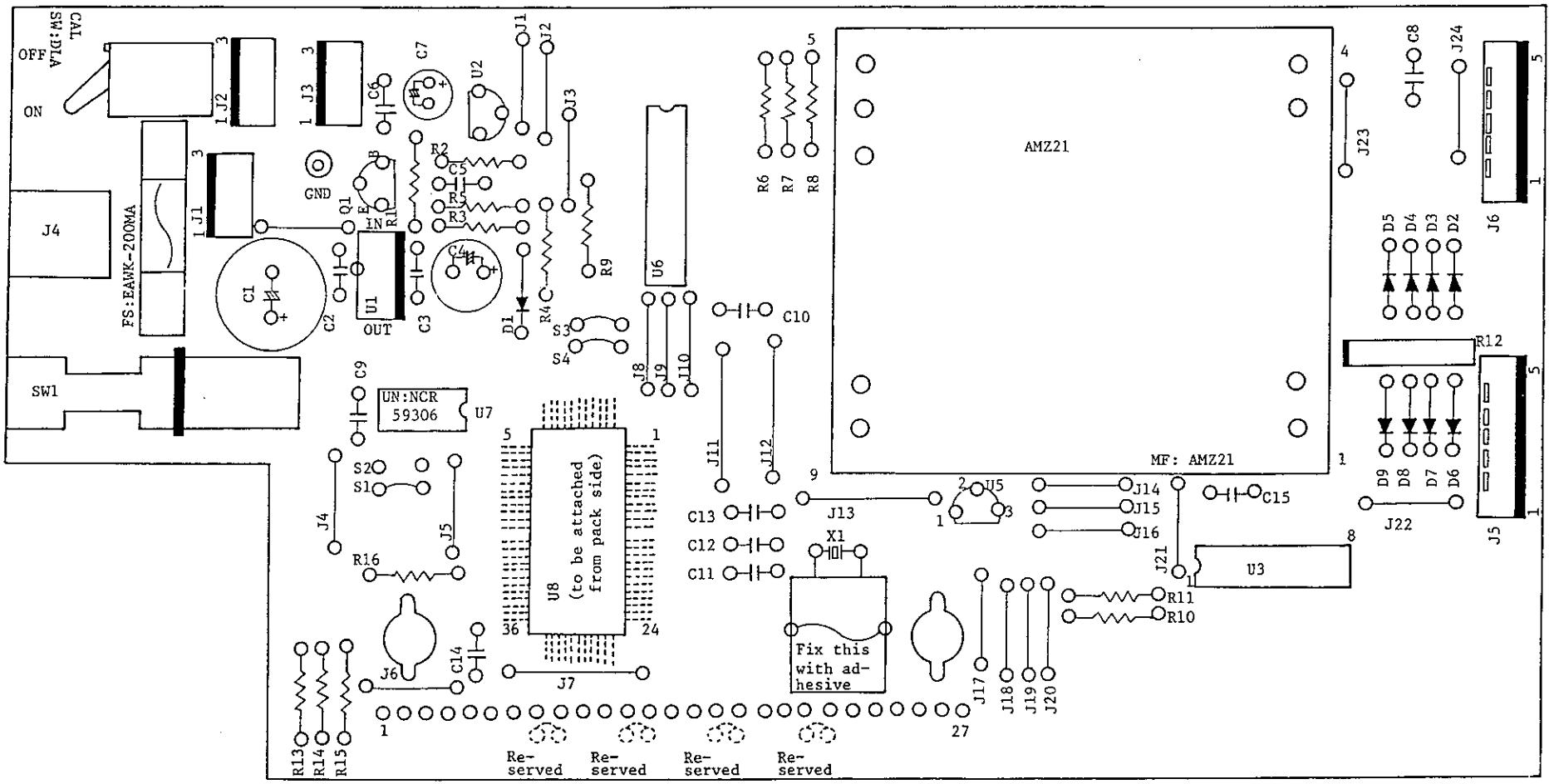


				Model	AD:EK 120A 1200A
Symbol	Date	By	Revision No.	Description	
				Stock No.	PZ:855-P
				Drwg. No.	KZ3-00507

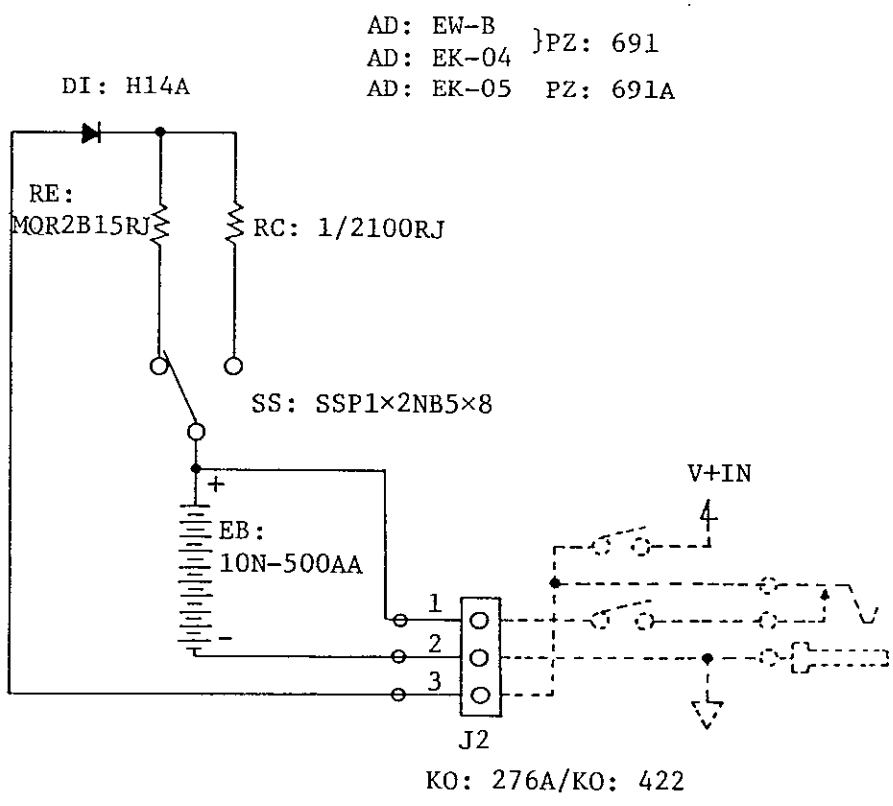


				Model	AD:EK 12KA
Symbol	Date	By	Revision No.	Description	Main Board
				Stock No.	PZ:856
				Drwg. No.	EC_3-00865

PZ:856 (EK 12K) Component Layout



				Model	AD:EK12KA
Symbol	Date	By	Revision No.	Description	PC856A
				Stock No.	
				Drwg. No.	EP$_4$-02626

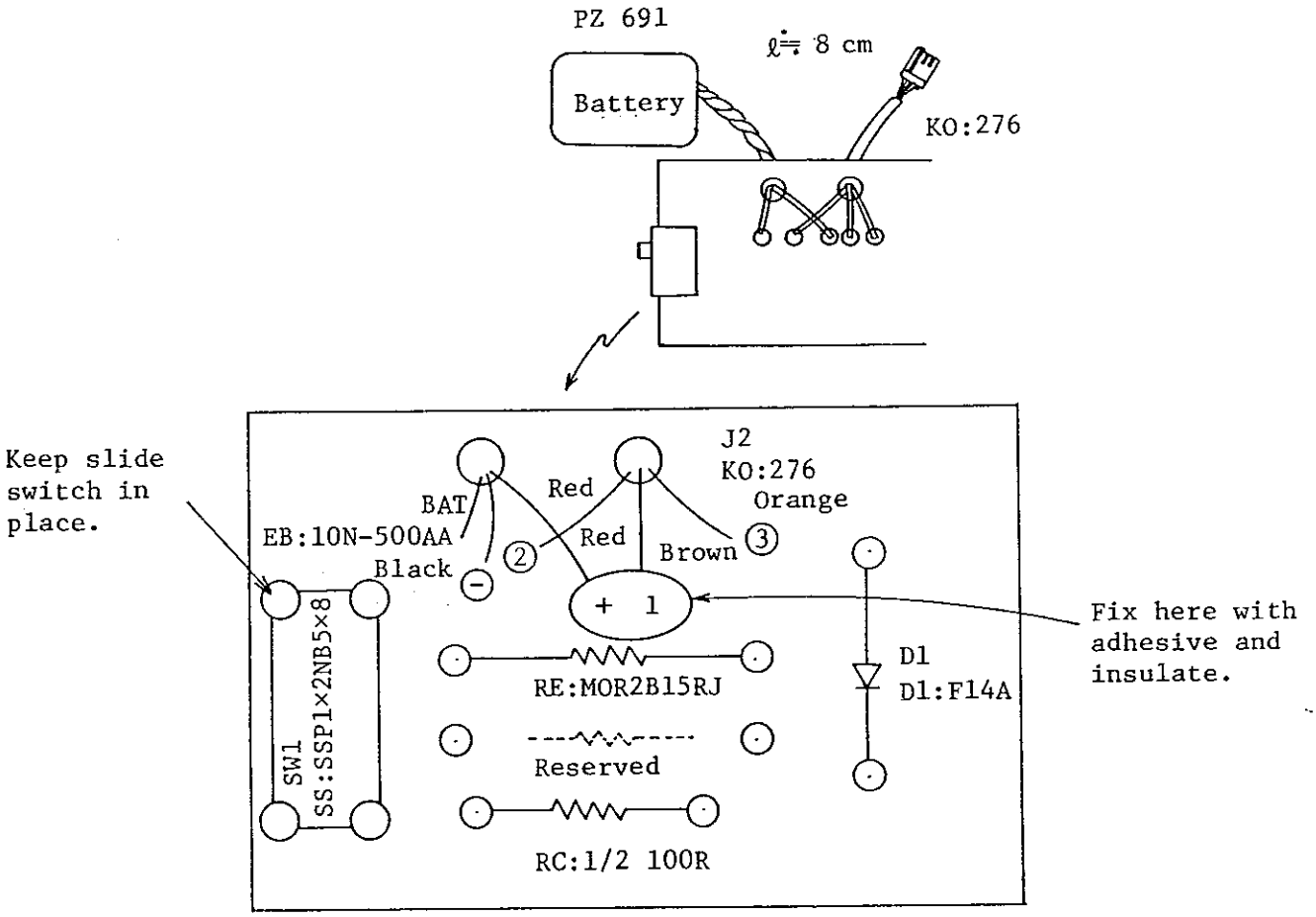


EW-B All B type model	PZ:691	KO:276A cable (about 15 cm long)
EK-04 EK 120/1200	PZ:691	KO:276A cable (about 15 cm long)
EK-05 EK12K	PZ:691A	KO:422 cable (about 18 cm long) Fittings {04:A46257 A 04:A46261 A 06:A46266 04:A46301 A M3 × 8 pan head screw M4 × 8 pan head screw

				Model	AD:EW-B/EK-04/05
Symbol	Date	By	Revision No.	Description	Battery Board
				Stock No.	PZ:691
				Drwg. No.	EC4-00118

Battery for the EW-B
and EK 120/1200

(AD:EWxxxxB
AD:EK-04)

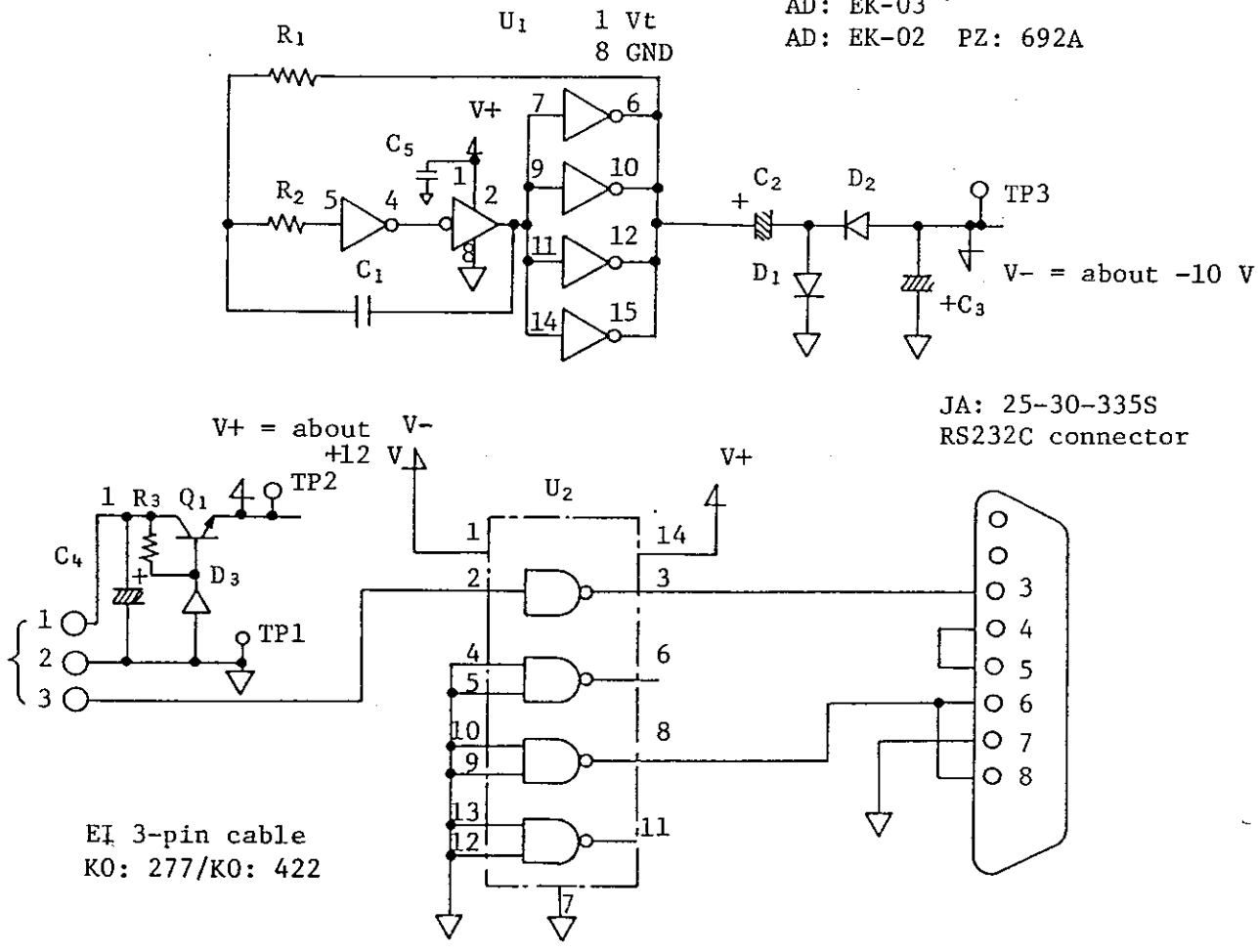


KO:276 18 cm → 14 cm → 16 cm (changed)

				Model	AD: EW-B EK-04
Symbol	Date	By	Revision No.	Description	Battery Board
				Stock No.	PZ:691
				Drwg. No.	KZ4-00259

RS232 BOARD

AD: EW-03
AD: EK-03 } PZ: 692
AD: EK-02 PZ: 692A

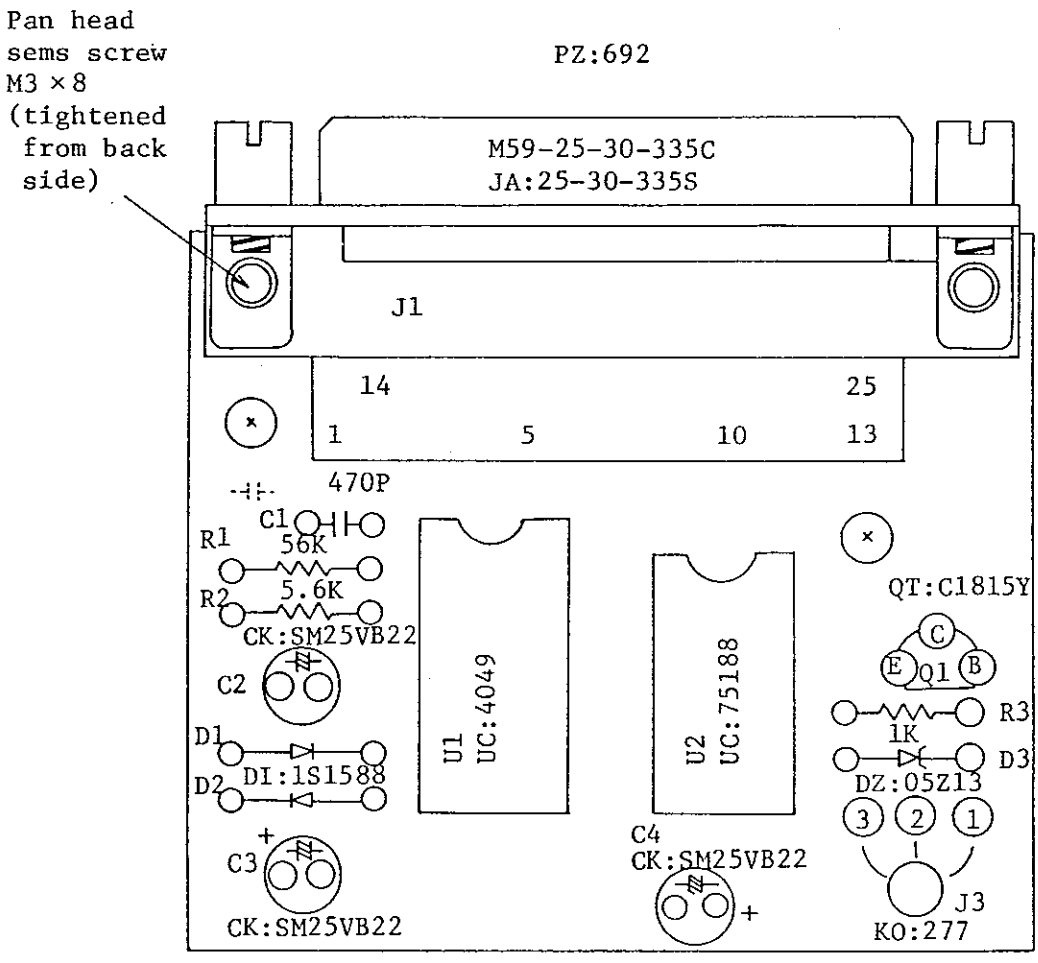


EW-03 All EW models	PZ:692	KO:277 cable (about 12 cm long) fixed with pan head tapping screw
EK-03 EK 120/1200	PZ:692	KO:277 cable (about 12 cm long) fixed with pan head tapping screw
EK-02 EK 12K	PZ:692A	KO:422 cable (about 18 cm long) fixed with M3 pan head screw

				Model	AD:EW-03/EK-$^{03}_{02}$
Symbol	Date	By	Revision No.	Description	EW/EK RS232C Board
				Stock No.	PZ:692/692A
				Drwg. No.	EC$_4$-00119

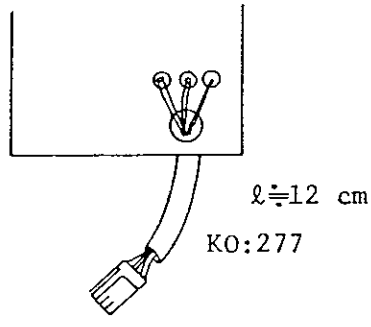
RS-232C Option for All EW Models
and the EK 120/1200

AD:EW-03
AD:EK-03



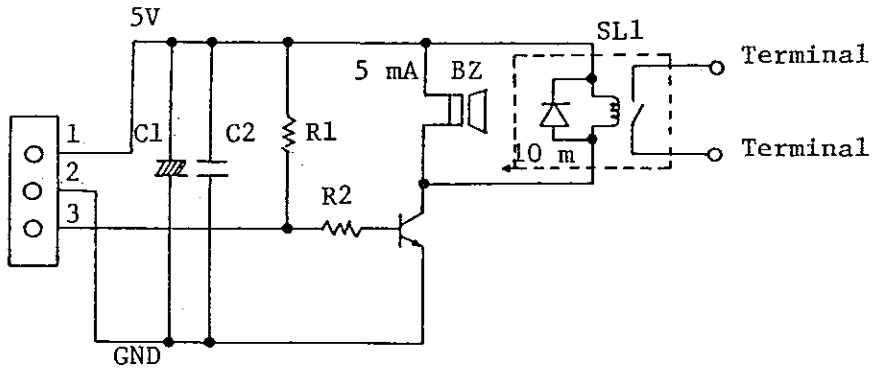
KO:277
ℓ = 13 cm

* TP is not needed.



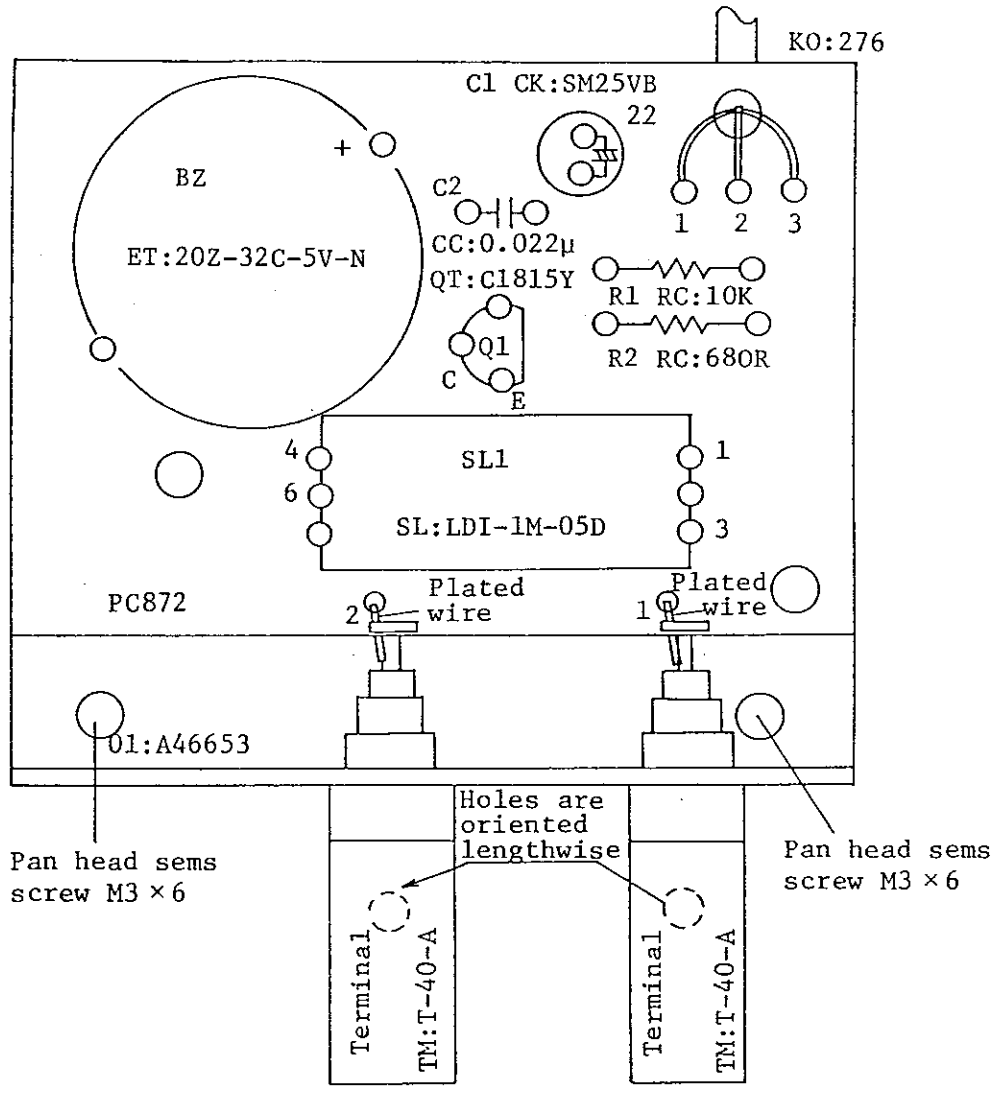
				Model	AD: EW-03 EK-03
Symbol	Date	By	Revision No.	Description	OP-03 RS232C Board
				Stock No.	PZ:692
				Drwg. No.	KZ4-00260

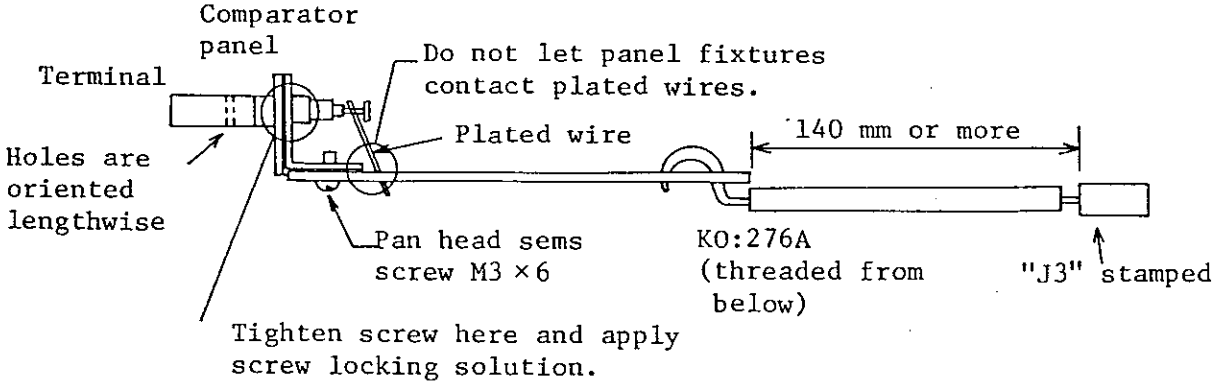
BUZZER BOARD PZ:872



KO:276A cable
(16 cm long)

				Model	AD:EK-06
Symbol	Date	By	Revision No.	Description	Buzzer Board
				Stock No.	PZ:872
				Drwg. No.	EC_4-00137





				Model	AD:EK-06
Symbol	Date	By	Revision No.	Description	PC872 Component Layout
				Stock No.	
				Drwg. No.	KZ4-00312