



**KERN & Sohn GmbH**

D-72322 Balingen-Frommern

Postbox 4052

E-Mail: [info@kern-sohn.de](mailto:info@kern-sohn.de)

Tel: 0049-[0]7433- 9933-0

Fax: 0049-[0]7433-9933-149

Internet: [www.kern-sohn.de](http://www.kern-sohn.de)

---

E

**Service Manual  
Electronic Precision Balances**

Page 2

---

---

# KERN HUM

Version 1.0

---

---



# KERN HUM

Version 1.0

## Service Manual

## Electronic Precision Balances

---

---

### Table of Content

<b>1. INTRODUCTION</b>	3
<b>2. SPECIFICATION</b>	4
2.1 System Block Diagram	4
2.2 Physical Layout of Electrical Connection	5
2.3 General Specification	6
2.3.1 Overall View	6
2.3.2 Dimensions	7
2.3.3 Model Specification	7
2.3.4 Operating Conditions	7
2.3.5 Main Components	8
2.3.6 Analog Specification	8
2.3.7 Capacity & Division	8
<b>3. INITIAL SETUP</b>	9
3.1 Internal Functions and Alternate Division	9
3.2 Auto and Dealer Calibration	10
3.3 Disable Calibration with Dip Switch (S1)	10
3.4 Offset and Span Value Data	11
3.5 Flow Chart	12
3.5.1 Auto Calibration (for end-user)	12
3.5.2 Function Test (for technicians only)	13
<b>4. TROUBLE SHOOTING</b>	17
4.1 Trouble Shooting Loop	17
4.2 Parts and Components Trouble Shooting	18
4.2.1 Power Supply Check	18
4.2.1.1 Relevant Parts	18
4.2.1.2 Input Voltage: 5.5V or higher	19
4.2.1.3 Output Voltage of Regulation: 5V +/- 10%	19
4.2.2 Load Receptor Check	19
4.2.3 LCD Display Check	19
4.2.4 CPU Check	19
4.2.5 A/D Unit Checking	20
<b>5. ELECTRICAL CIRCUITRY</b>	21
5.1 Schematics	21
5.2 PCB Layout	26

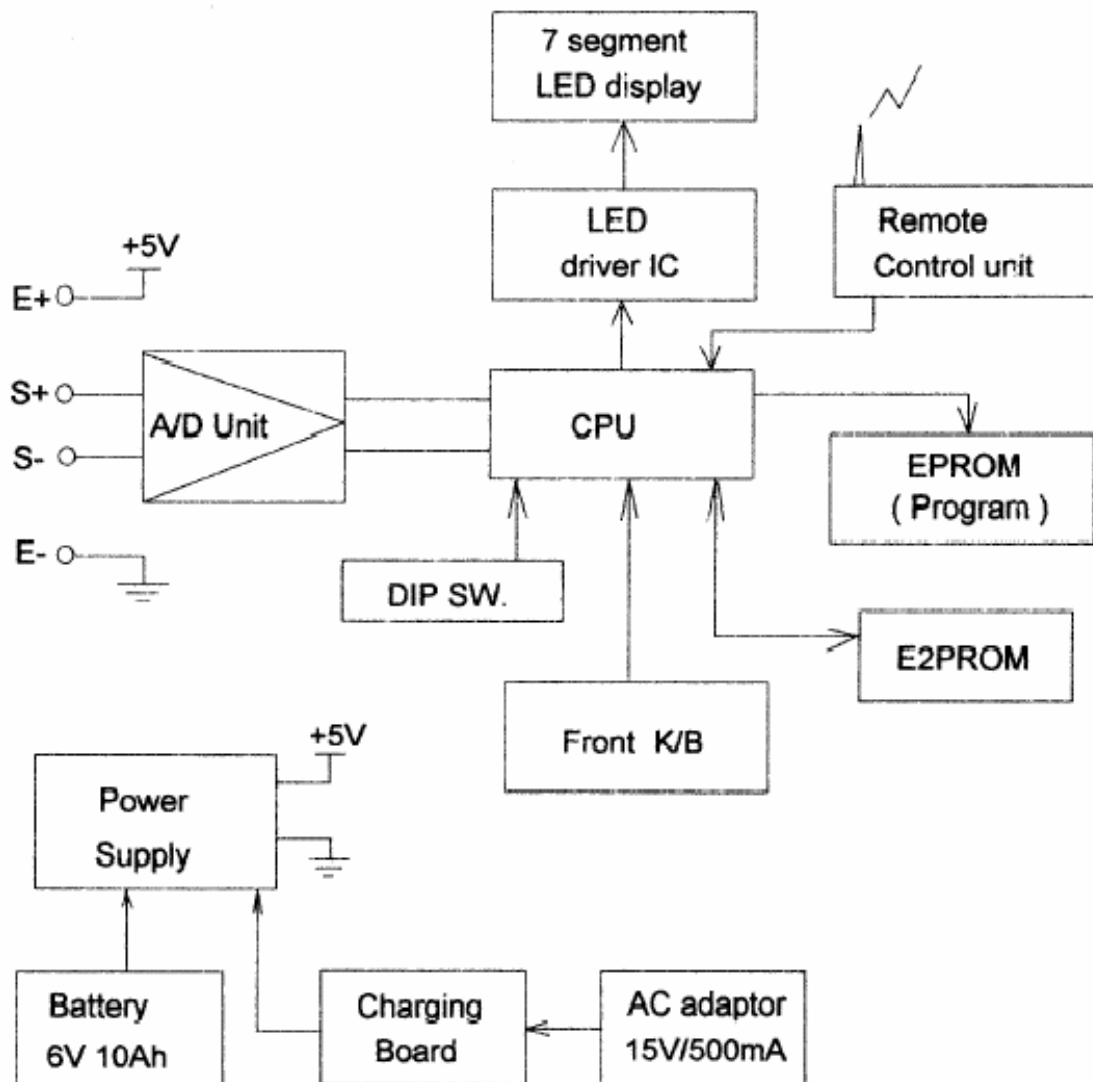
## 1. INTRODUCTION

Features of the KERN HUM series:

- Full Tare
- Tare indicator
- Zero indicator
- Negative value indicator
- Special hold function
- 2 types of calibration
- Dip switch to prevent end-user calibration
- Built-in rechargeable battery operated
- Operating time after fully charged: 80 hrs.
- Low-battery signal
- AC adaptor included
- LED display – Easy to read
- Optional Wireless Remote Controller
- Capacity: 1ton, 3ton, 5ton, 7.5ton

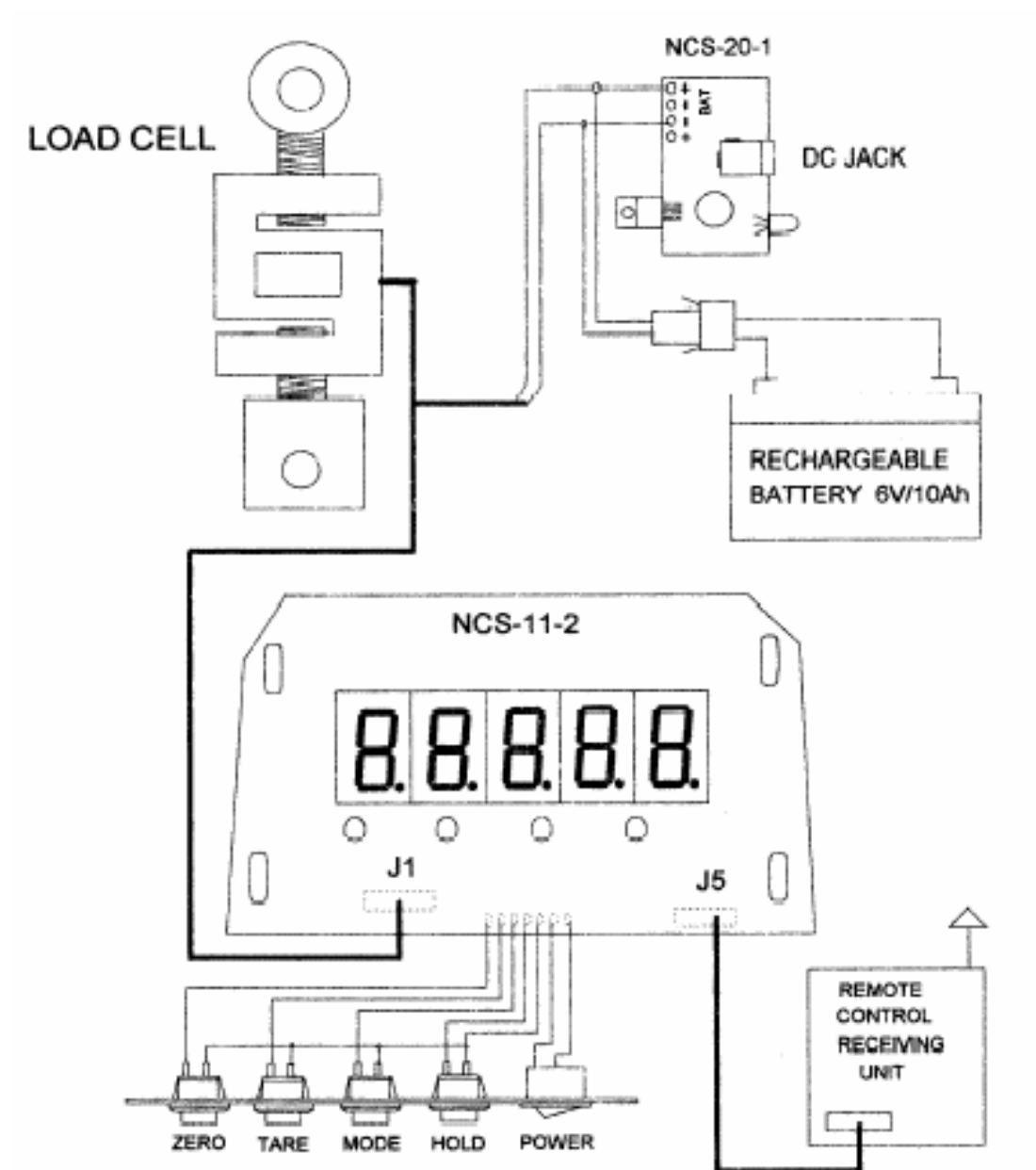
## 2. SPECIFICATION

### 1. SYSTEM BLOCK DIAGRAM



**Description:** When a load is applied to the loadcell, the resistance to the excitation current in the strain gauge changes and the analog output signal varies. It is amplified and digitalized continuously by the A/D converter into a digital signal. Subsequently, the resulting count is processed and managed by the CPU. The CPU refers to the instructions from the keyboard and then conveys the output data to the LCD driver which formats the data into a readout for the display.

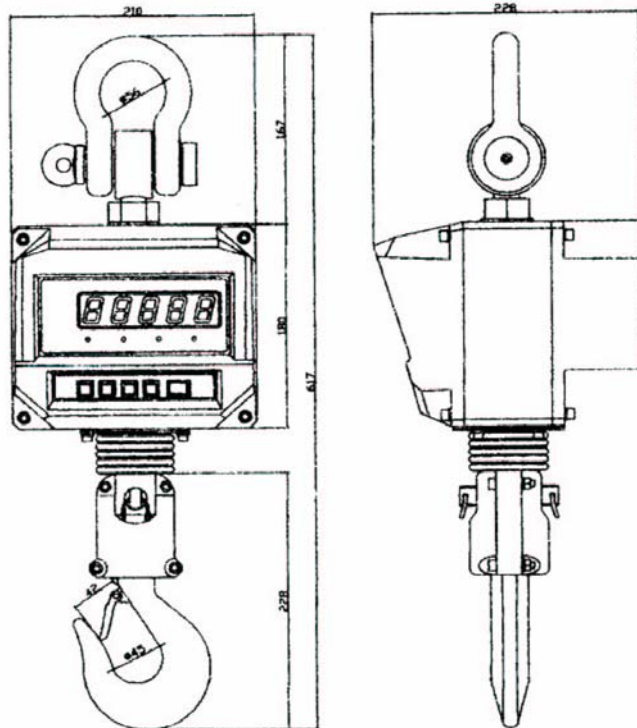
## 2. PHYSICAL LAYOUT OF ELECTRICAL CONNECTION



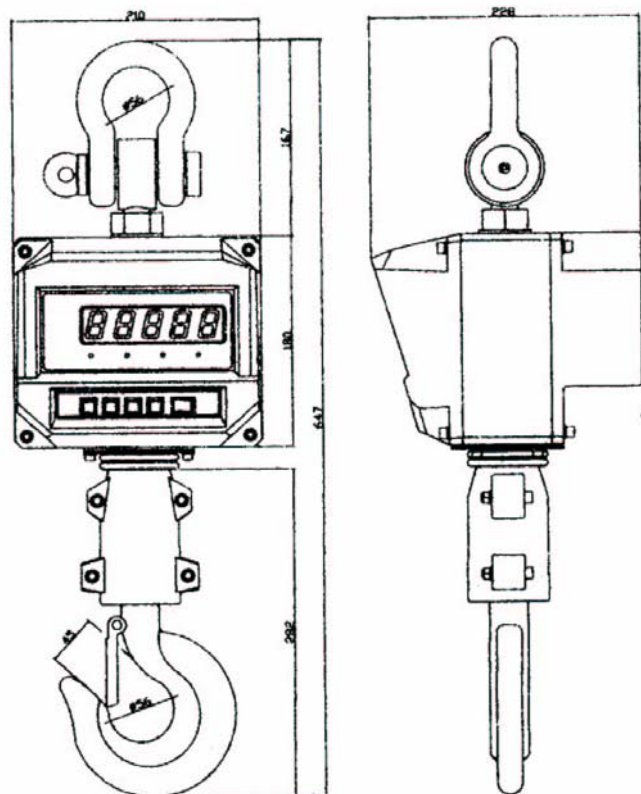
### 3. GENERAL SPECIFICATION

#### 3.1 Overall View

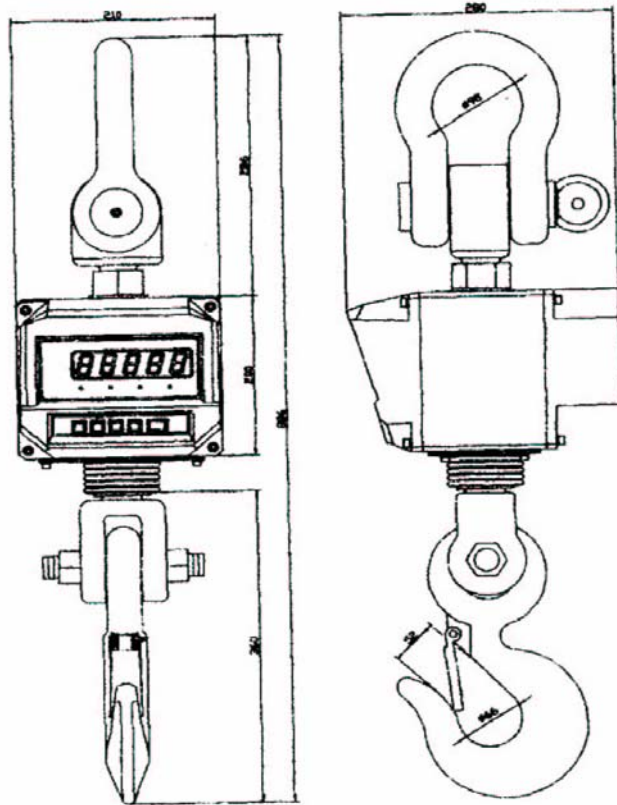
500kg~2ton



3ton



**5ton, 7.5ton**



### **3.2 Dimension**

\*Overall Size: 228(D) x 210 (W) x 575(H)mm -----500kg~2ton capacities  
228(D) x 210 (W) x 609(H)mm -----3ton capacity  
228(D) x 210 (W) x 880(H)mm -----5ton, 7.5ton capacities

### **3.3 Model Specification**

Display resolution : 1/2000(1ton)  
1/2500(5ton, 7.5ton)  
1/3000(3ton)

Internal resolution: 1/30000  
Display: Single-sided  
Weight display → 5 digits

### **3.4 Operation condition**

- \* Power source: Rechargeable battery (6V 10 Ah) or AC adapter (DC 15V, 500mA)
- \* Operating Temperature: 0°C ~ 40°C
- \* Operating Humidity : 15 ~ 85% RH
- \* Power Consumption: 1W/0.1W  
5W When charge

### 3.5 Main Components used

- \* Micro Processor : 89C51/80C31
- \* Crystal Oscillator : 6 MHz/7.3728MHz
- \* Display Device : 7 Segments LED display/Liquid Crystal Display(LCD)
- \* Loadcell : 350 resistance loadcell

### 3.6 Analog Specification

- \* INPUT SENSIVITY : 2mV/V
- \* ZERO ADJUST RANGE : 2% R.O.
- \* ZERO BALANCE RANGE : +/-5% R.O.
- \* L/C APPLIED VOLTAGE : DC 5V
- \* SPEED OF A/D CONVERSION : 4 times/sec
- \* INTERNAL RESOLUTION : 30000

### 3.7 Capacity & division

MODEL NO.	CAPACITY	EXTERNAL DIVISION
HUM1000K500	1000kg	0.5kg
HUM3000K1000	3000kg	1kg
HUM5000K2000	5000kg	2kg
HUM7500K5000	7500kg	5kg

### 3. INITIAL SETUP

#### 1. INTERNAL FUNCTIONS AND ALTERNATE DIVISION

INTERNAL FUNCTION TABLE

Function	Symbol	Description
1	F.1	Span value reading and dealer calibration
2	F.2	Full display segment and max. capacity check
3	F.3	Check offset value and scale configuration
4	F.4	Auto power off setting

#### HOW TO ENTER THE REQUIRED FUNCTION MODE

- Turn scale off.
- Press and hold TARE, then turn scale on. Scale display F.1
- Press TARE until the required function number appears.
- Press MODE
- Press MODE until the required setting appears.
- Press TARE to confirm.
- Repeat step c to f for other function setting, or
- Press ZERO to save settings and return to normal operation.

#### F.1 Span Value Reading and Dealer Calibration

Simply enter F.1, then put on the designated mass to check Span Value or keep going to do Dealer Calibration.

#### F.2 Display Segment and Rated Capacity & Division Check

When function is entered, scales will first display the rated capacity and division, then display all segment. Check and make sure that no segment are missed.

#### F.3 Check Offset Value is within acceptable range and Scale Configuration

- Enter F.3, scale displays the Offset value.
- Hold MODE (for about 2 seconds)
- Scale displays capacity and division configuration.
- Press MODE until the required configuration obtained.  
Note: In some countries, only the metric weight unit is available.
- Press ZERO to save setting and back to normal operation status.

#### F.4 Auto Power Off Setting

Two modes are available: (Default = 4\_OFF)

0\_OFF = Auto Power Off function is disabled.

4\_OFF = Scale will automatically turned off after 4 minutes unused.

## 2. AUTO AND DEALER CALIBRATION

### ACCEPTABLE FOR AUTO AND DEALER CONFIGURATION

Model Number	External Division	Acceptable Auto and Dealer Calibration Load	
HUM1000K500	1/2000	500kg	1000kg
HUM3000K1000	1/3000	1000kg	2000kg
HUM5000K2000	1/2500	2000kg	5000kg
HUM7500K5000	1/2500	2000kg	5000kg

#### Dealer Calibration Procedure

1. Turn scale off.
2. Press and hold TARE, then turn scale on.
3. Scale displays F.1
4. Press MODE
5. Scale displays offset value
6. Press ZERO to zero offset value
7. Press TARE
8. Press ZERO
9. Press TARE
10. Press ZERO, the LED bellows ZERO indicator will be lighted.  
It means the scale is ready for dealer calibration.
11. Make sure that the figure being displayed is =0 or 1, if not, press ZERO again.
12. Load calibration either load as listed on above table.
13. When value display is stable, press MODE.
14. Wait until the scale start count down.
15. Calibration completed and scale is ready for operation.

#### Auto Calibration Procedure

1. Turn scale off
2. Press and hold MODE, then turn scale on.
3. Scale displays CAL?
4. Press MODE
5. Scale displays LOAD XXXX or XXXX
6. Load calibration load according to above table.
7. Wait until the scale display DONE and start count down.
8. Calibration completed and scale is ready for operation.

## 3. DISABLE CALIBRATION WITH DIP SW.(S1)

The DIP SW.#1 is used to control calibration. Push this switch to ON position to disable calibration.

#### 4. OFFSET AND SPAN VALUE DATA

OFFSET AND SPAN VALUE DATA TABLE

Model Number	External Division	Offset Value (Thousand)	Span Value (Thousand) at Various Load Applied	Offset Control	Span Control(Ohm) R1A R1B	
HUM1000K500	1/2000	4~7	10-16 at 500kg, 25~40 at 1000 kg	VR1 Trimmer	40k	x
HUM3000K1000	1/3000	4~7	10~15 at 1000kg, 20~30 at 2000kg	VR1 Trimmer	43.2K	x
HUM5000K2000	1/2500	4~7	10~16 at 2000kg, 25~40 at 5000kg	VR1 Trimmer	25K	x
HUM7500K5000	1/2500	4~7	8~16 at 2000kg, 20~30 at 5000kg, 30~45 at 7500kg	VR1 Trimmer	18K	x

##### READING OFFSET VALUE

1. Turn scale off
2. Remove all load from platter
3. Enter F.3 and read the offset value

##### READING SPAN VALUE

1. Turn scale off
2. Remove all load from platter
3. Enter F.1
4. Press ZERO
5. Apply load to platter. Span value according to load applied will be displayed.

##### HOW TO ADJUST OFFSET VALUE

In case the offset value is out of range, adjust the trimmer located at VR1(TR2) on the mainboard to obtain correct offset value.

##### HOW TO ADJUST SPAN VALUE

The span value is controlled by resistor located on R1A and R1B Standard resistor value of R1A and R1B is listed on the above table.

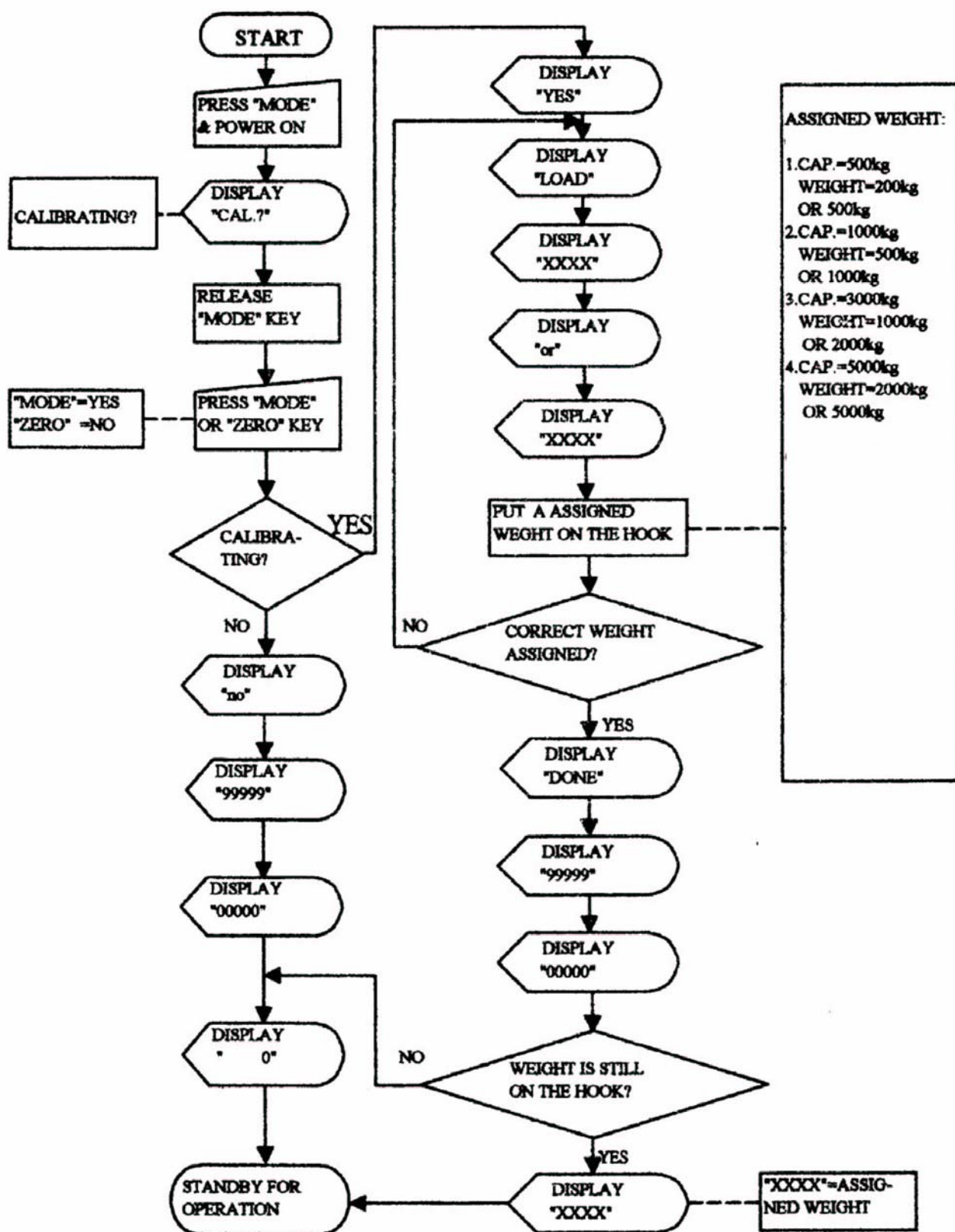
If the required span value is not attained, then change R1A and/or R1B resistor according to either case below:

Span value too low : Increase the resistance of R1A and/or R1B.

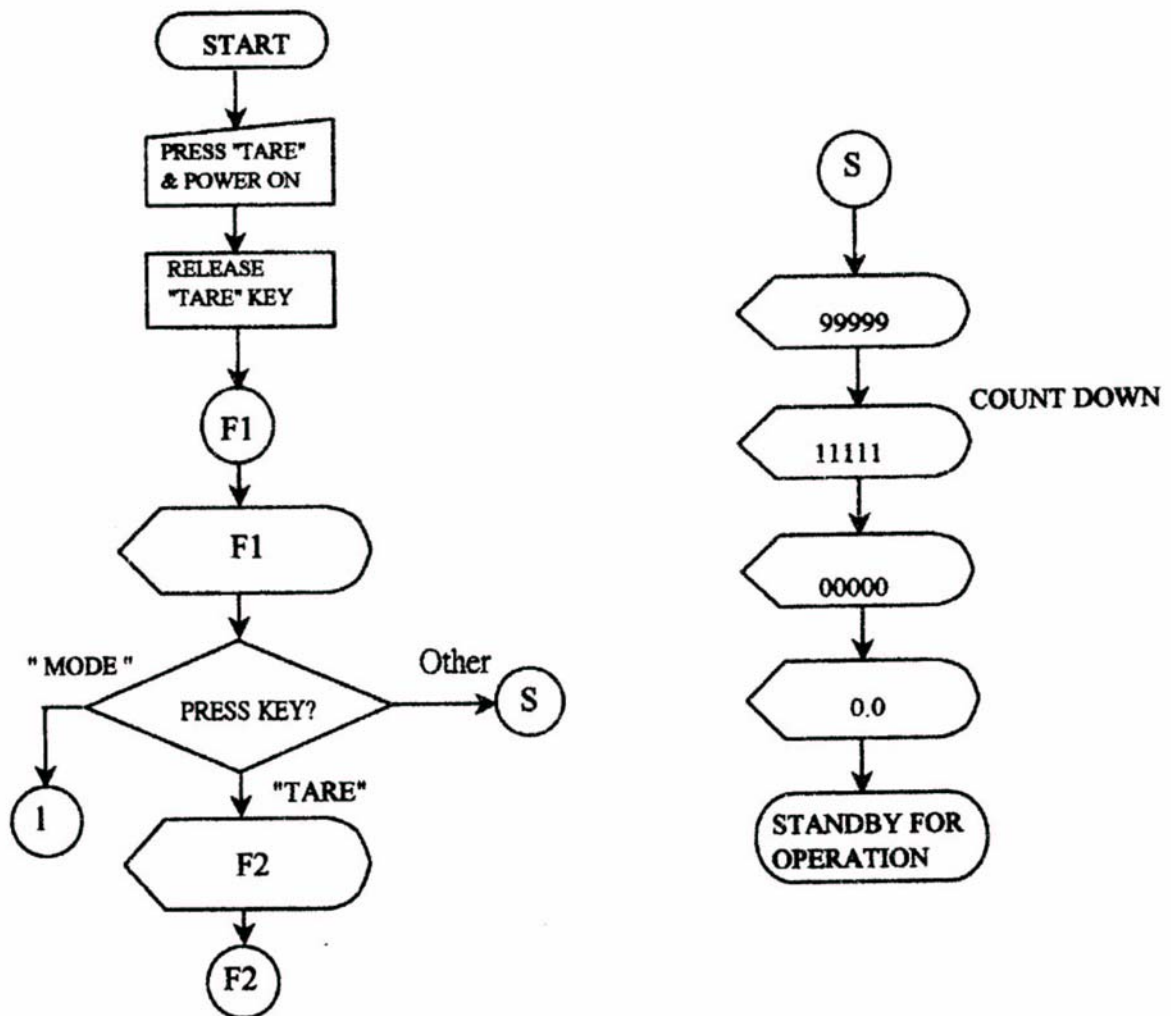
Span value too high : Decrease the resistance of R1A and/or R1B.

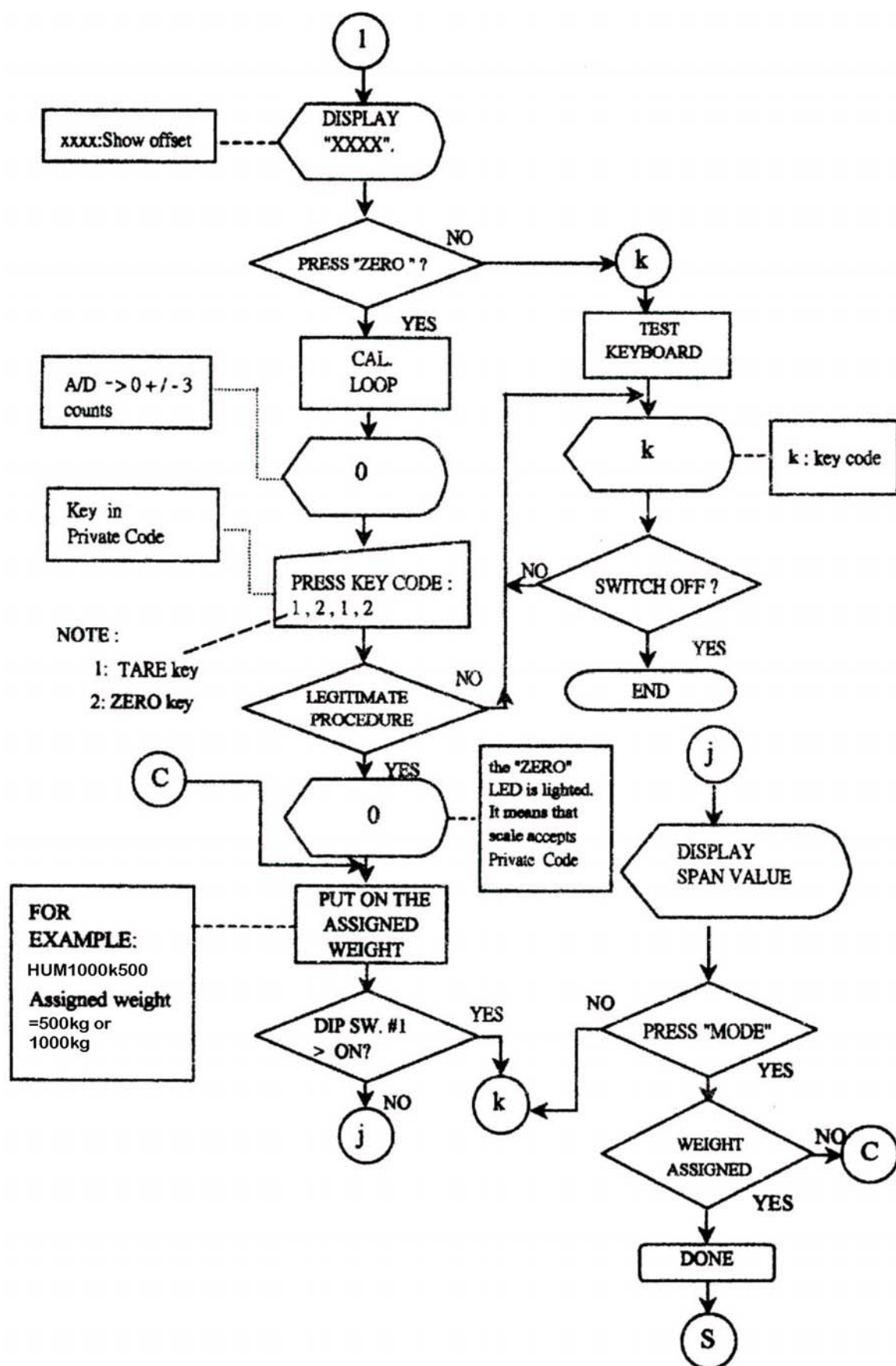
## 5. FLOW CHART

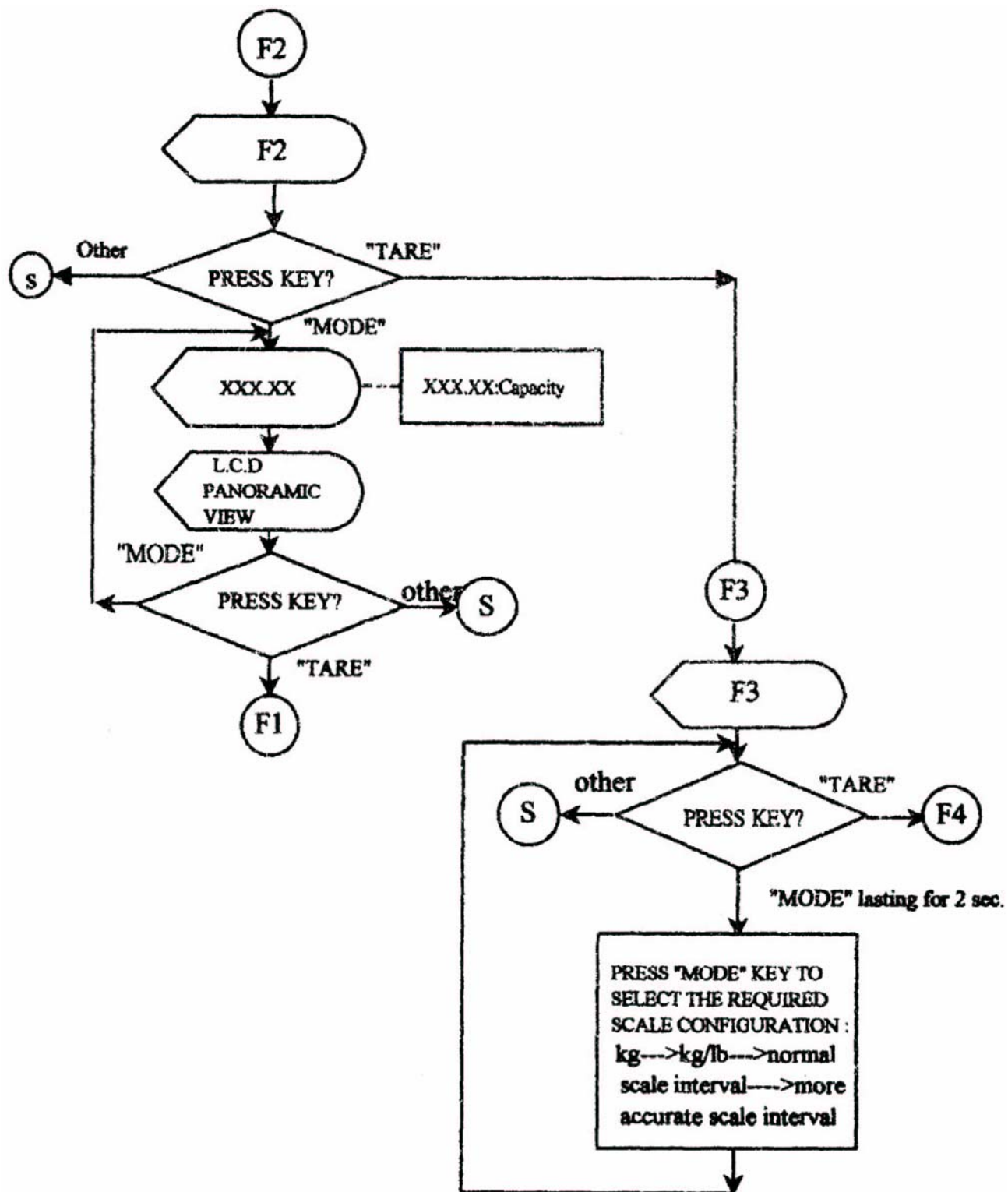
### 5.1 Auto Calibration (for end-user)

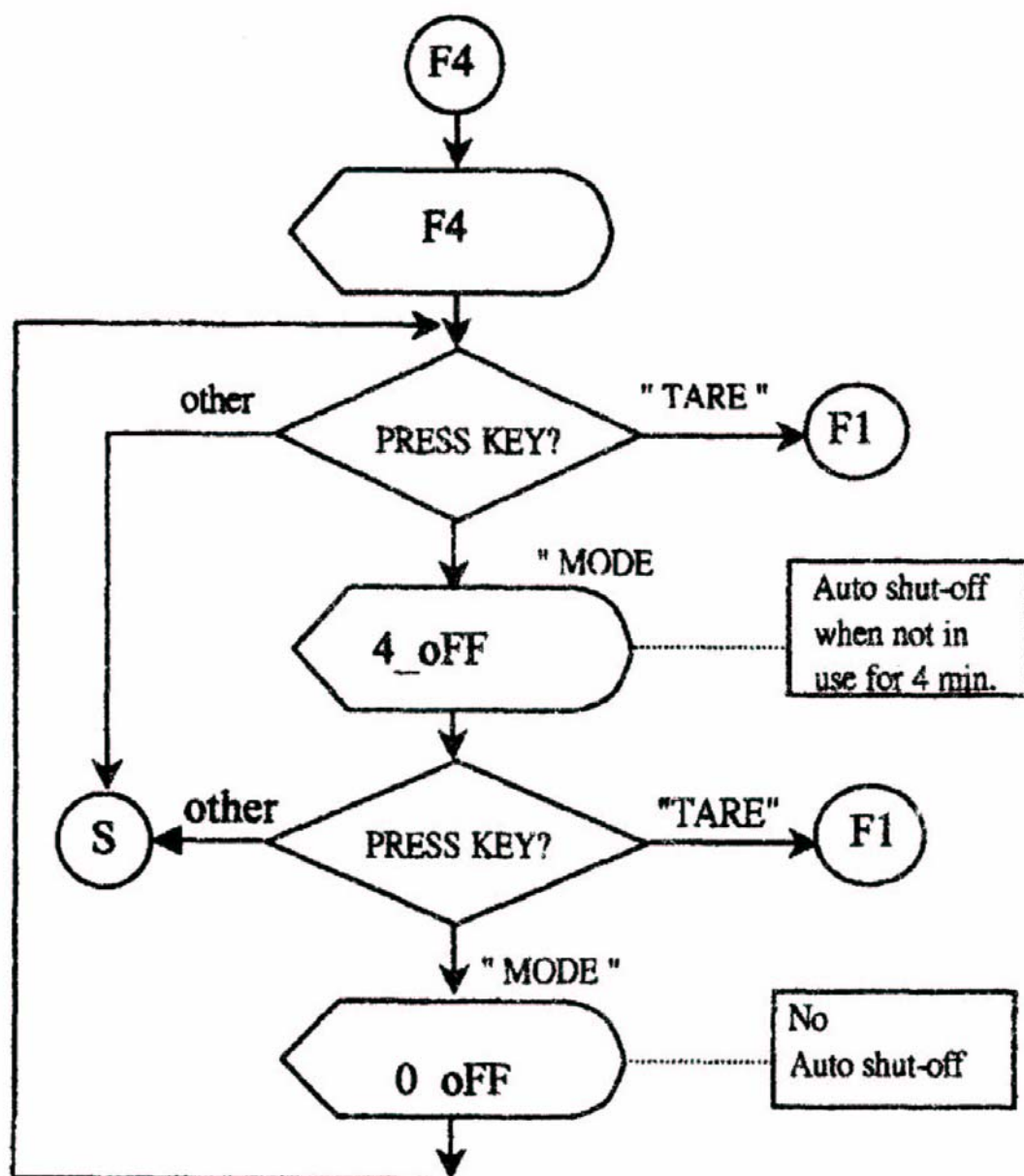


## 5.2 Function Test (for technicians only)



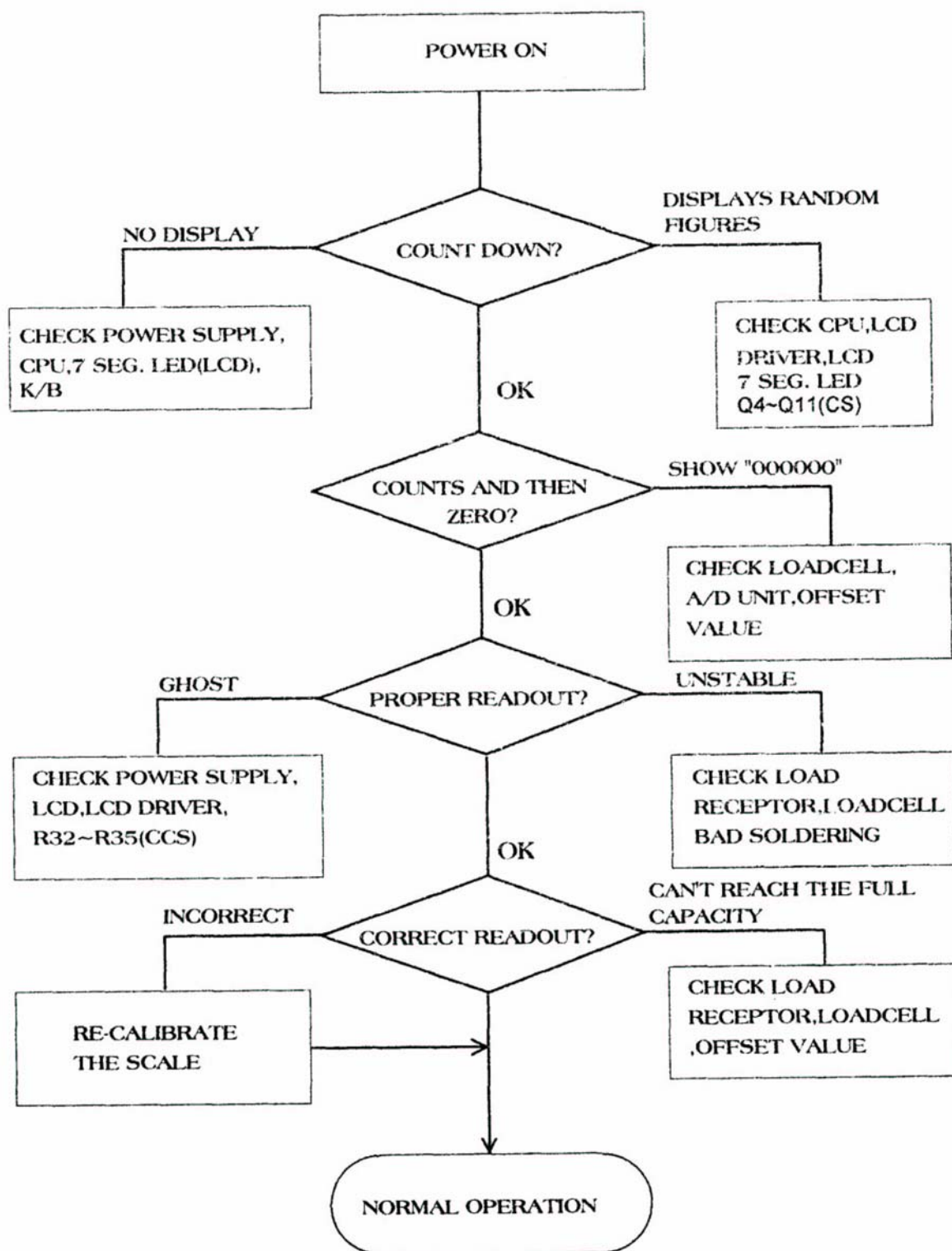






## 4. TROUBLE SHOOTING

### 1. TROUBLE SHOOTING LOOP



## 2. PARTS AND COMPONENTS TROUBLE SHOOTING

### 2.1 Power Supply Checking

#### 2.1.1 Relevant parts:

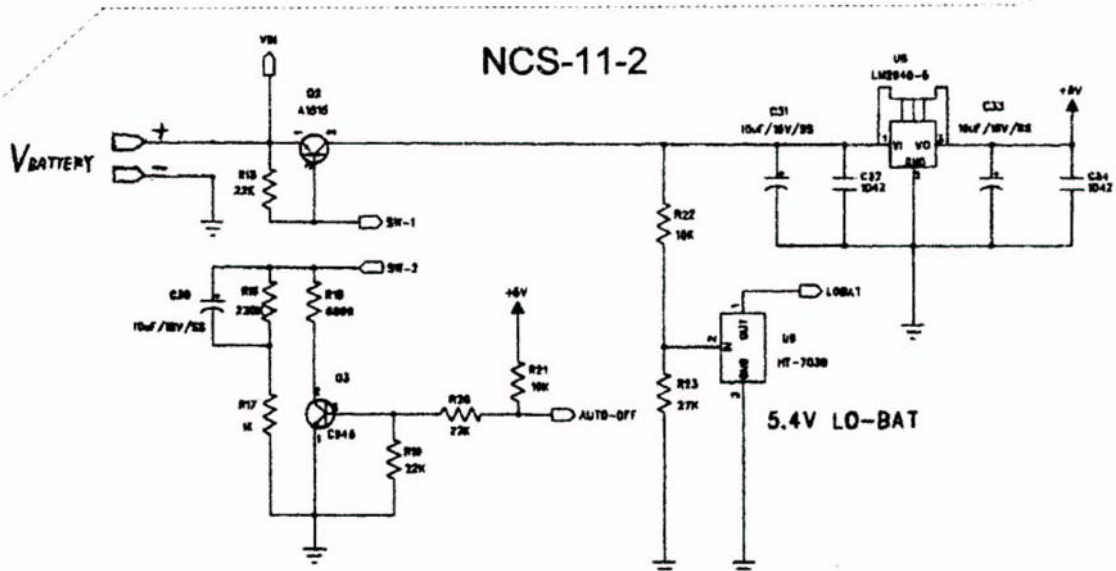
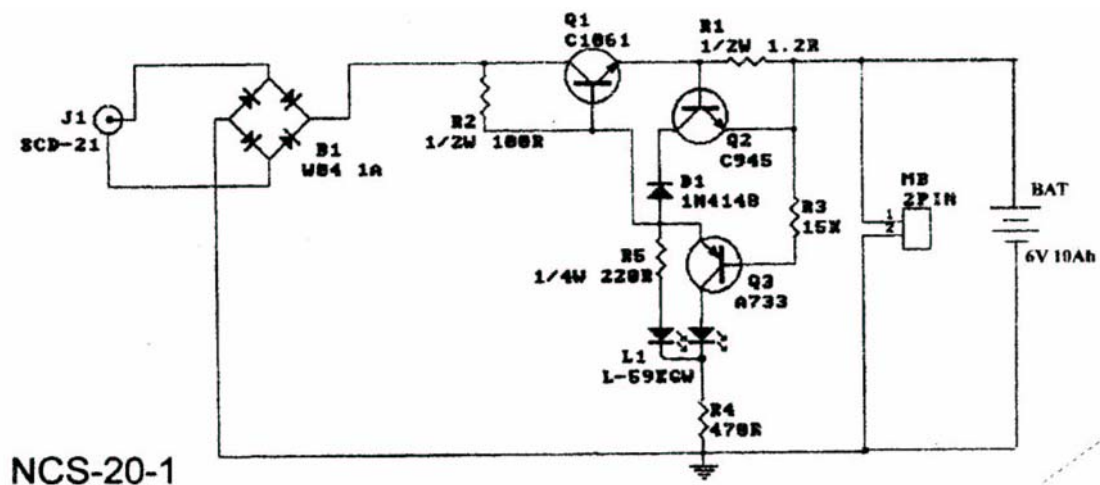
##### HUM SERIES

##### Power Board(NCS-20-1)

Q1(C1061)  
R1 (1.2 ohm, 1/2W)  
Q2 (C945)  
DC-JACK (SCD-21)  
B1 (W041A)

##### Main Board(NCS-11-2)

U8 (LM2930-5)  
Q2 (A1515)  
C30 (EC 10uF/16V)  
Q3 (C945)  
U9 (HT-7039)  
ROCK SW. (R19-00)



## Description:

- 1) AC Adaptor: This AC adaptor provides about (15V) dc power.
- 2) Battery: Built-in Rechargeable Battery (6V 10 Ah).
- 3) How Battery is charged completely?  
The charging voltage is regulated by Q1(C1061) and ZD1(7.5V) for about 7volts.  
The charging current will go down automatically If battery's voltage reached.  
Q2(C945) and R1(1.2R,1/2W) provide Over-Current protection.
- 4) Charging status indications:  
LED turns RED(or ORANGE) colour → In charged  
LED turns GREEN colour → Full charged
- 5) Auto-off:  
If the scale is set on 4\_Off or even under LO-BAT situation, after some minutes the CPU will release a negative pulse to cut off Q4 transistor, then Q1 will be cut off too, therefore the scale is shut down immediately.
- 6) Low Power Detection:  
The U9(HT-7039) is designed to detect the power level. Whenever the power less than 5.4 V, it will release a low potential signal to CPU, and then CPU will instruct display to show LO-BAT symbol.

### 2.1.2 Input voltage: 5.5V or higher

Check and recharge battery if voltage less than 5.5V.

Check and replace DC-Jack or AC adaptor if been defective.

### 2.1.3 Output voltage of regulation: 5V +/- 10%

Check that the output voltage is within 5V +/- 10%

- a) less than 2.7V, the CPU may not work properly.
- b) more than 6V, ghost will appear on LCD.

## 2.2 Load receptor Checking

The load receptor device shall not touch anything around itself during operation.

Check that the load receptor is not contacted with the upper (no load) and/or lower (with load) stopper.

## 2.3 LCD Display Checking

2.3.1 Check that it is soldered and connected properly between LCD and driver IC(uPD/7225) and CPU.

2.3.2 Check whether LCD is broken.

## 2.4 CPU Checking

2.4.1 Check that all pins are seated properly into the socket.

2.4.2 Check that the Crystal Oscillator works.

2.4.3 Check the RESET is normally low.

## 2.5 A/D Unit Checking

2.5.1 Check that the +5V power is correctly fed to the A/D unit.

2.5.2 Check that the signal output of loadcell is normal.

2.5.3 Check OP.Amplifier & A/D Converter(AD7715).

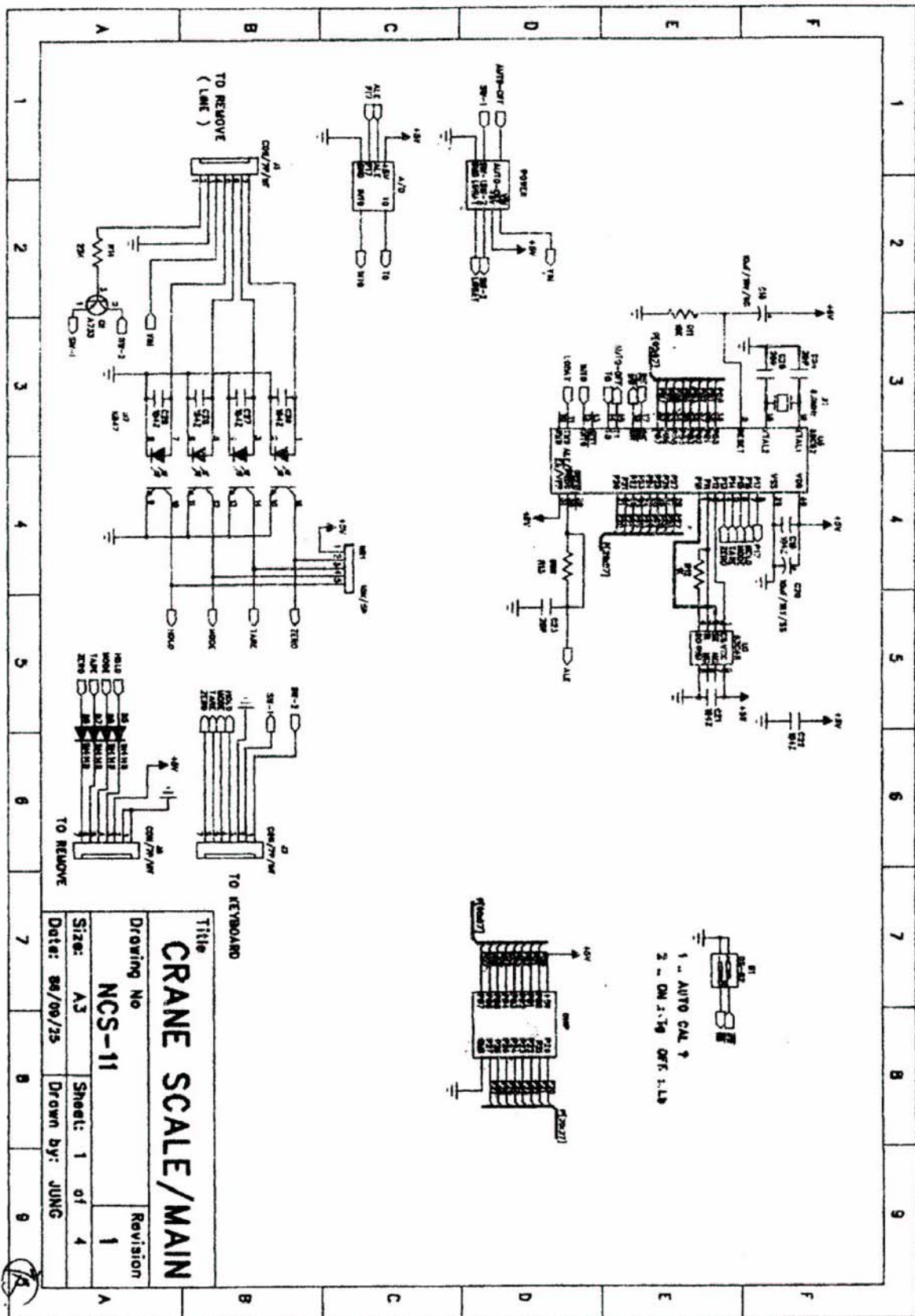
When no error is found with the above checking procedures, the trouble can be caused on the loadcell or the PCB itself. Replace a new one could be better to identify the defective.

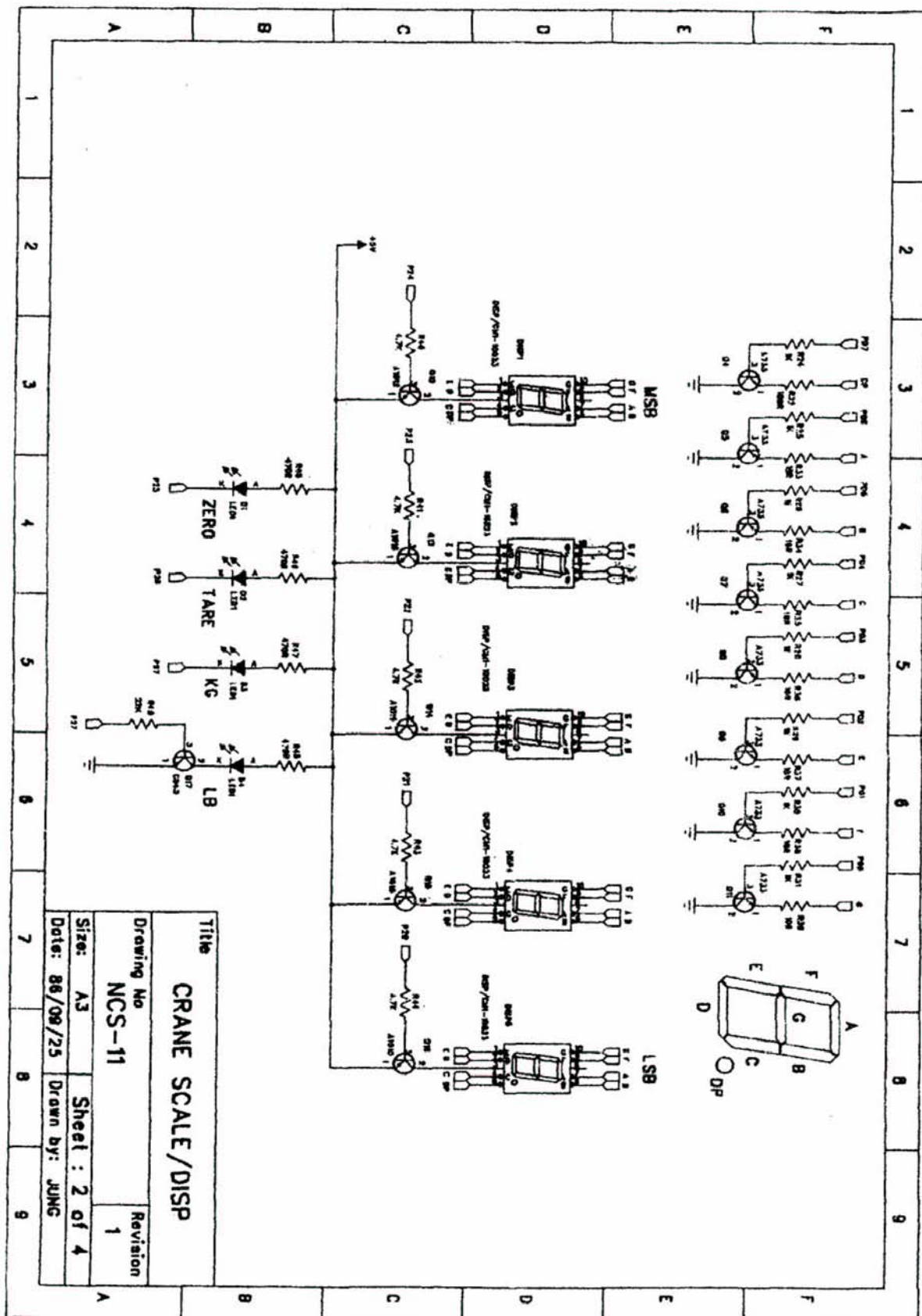
In this way, the readout of weight would be varied because of the output voltage of loadcell and different span value, so recalibration is required after this replacement.

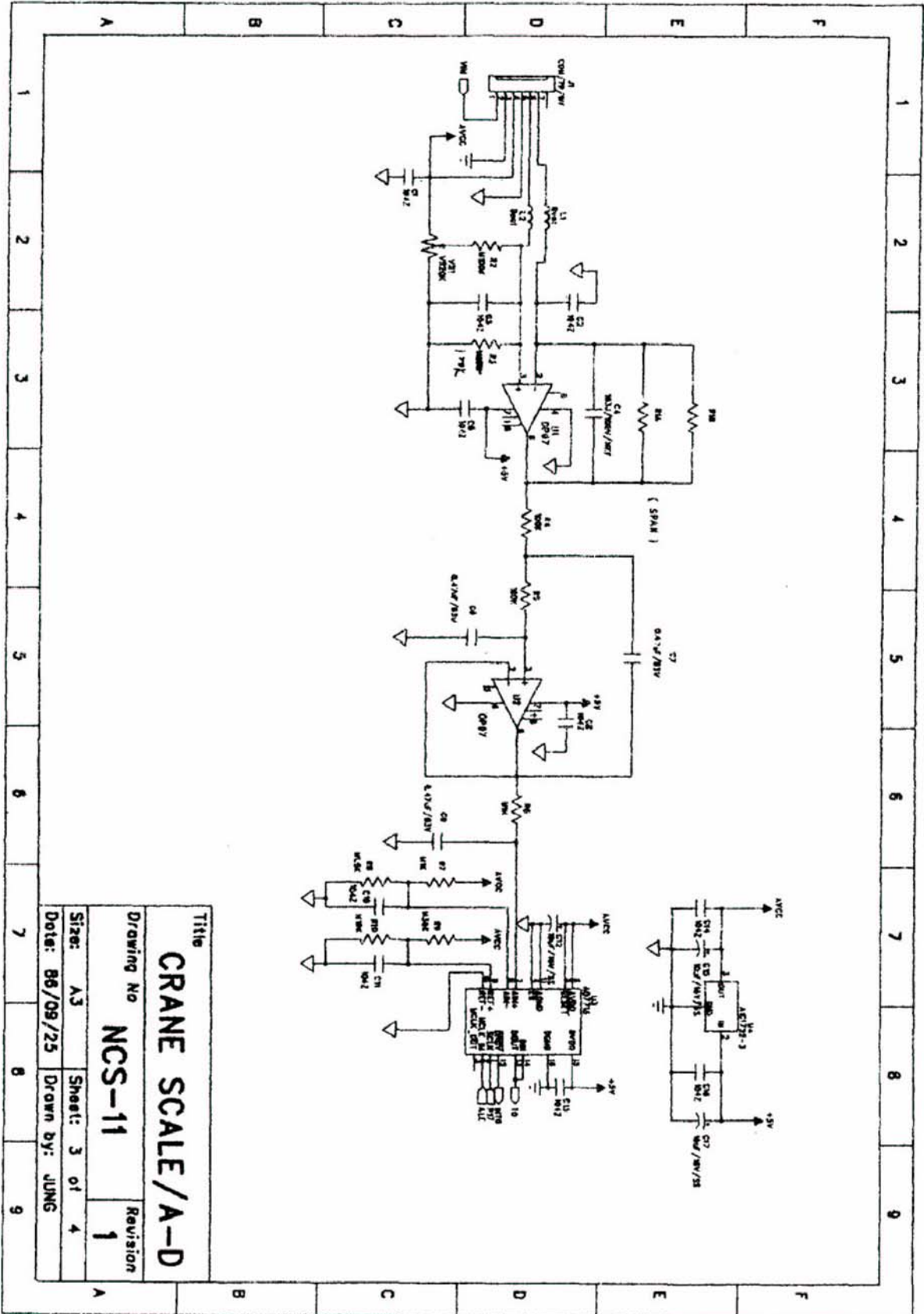
## 5. ELECTRICAL CIRCUITRY

### 1. SCHEMATICS

HUM series



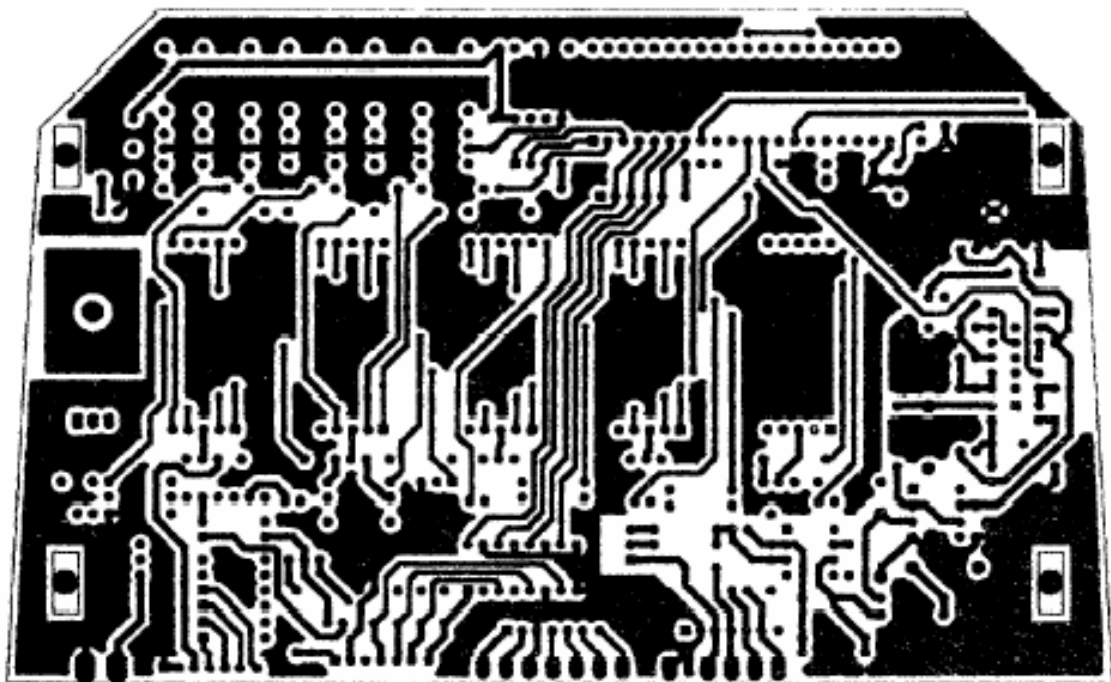




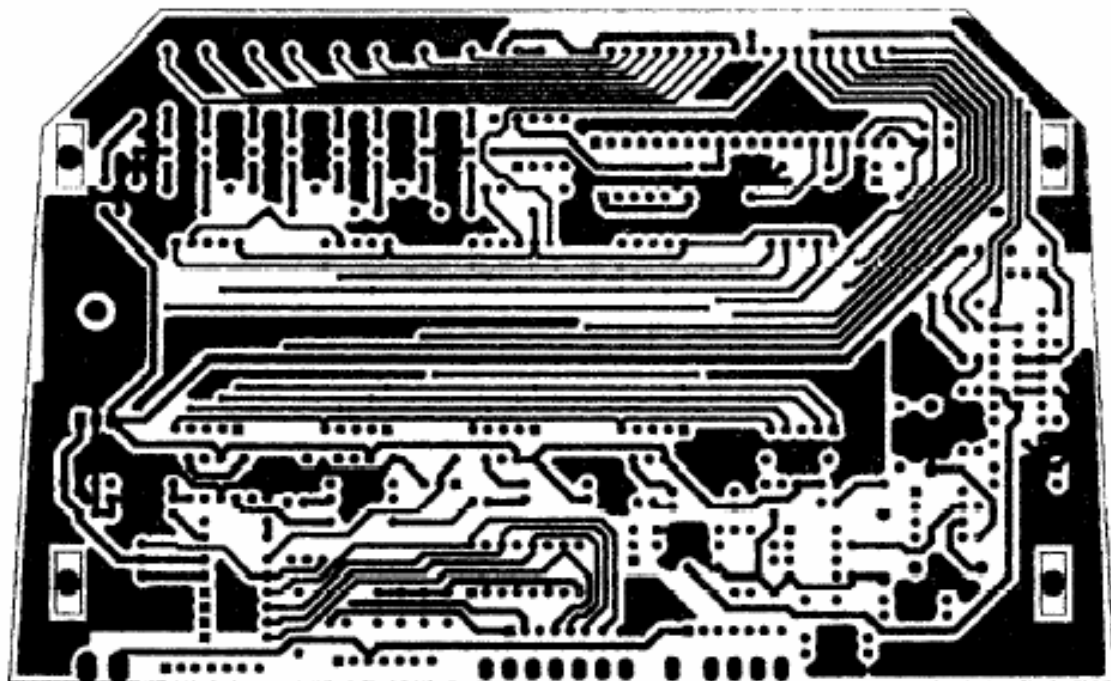




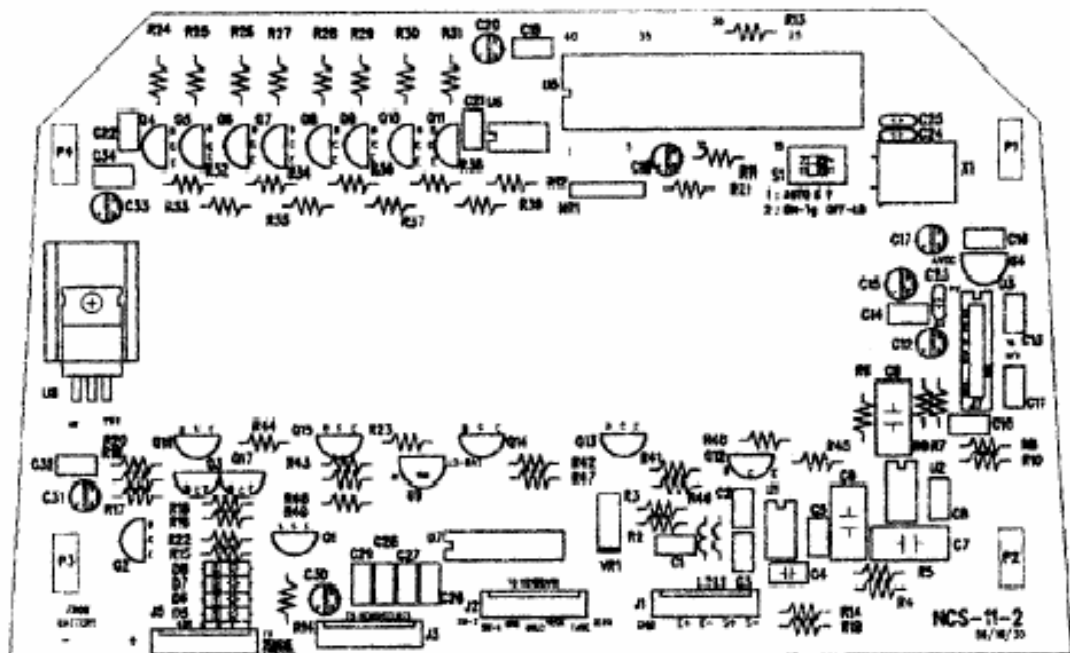
## 2. PCB LAYOUT



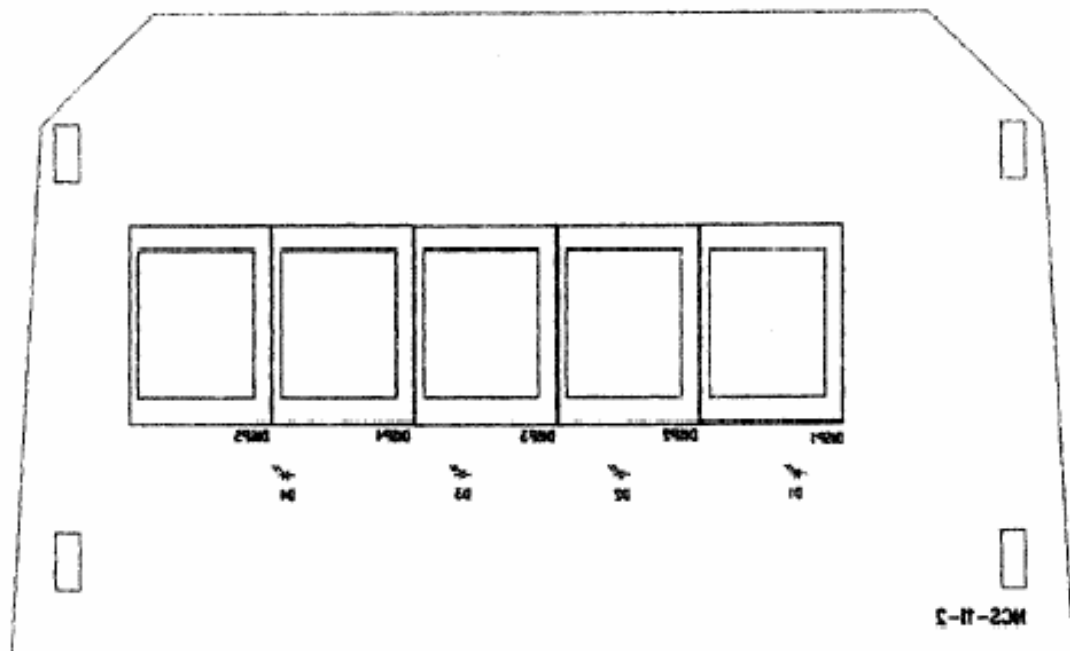
**NCS-11-2 TOP LAYER**



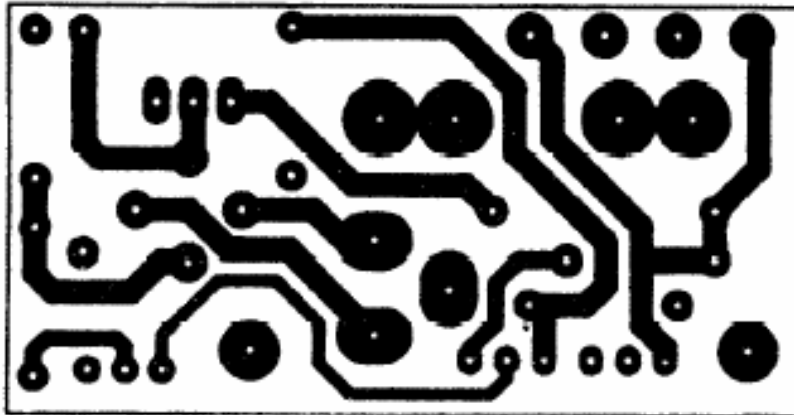
**NCS-11-2 BOTTOM LAYER**



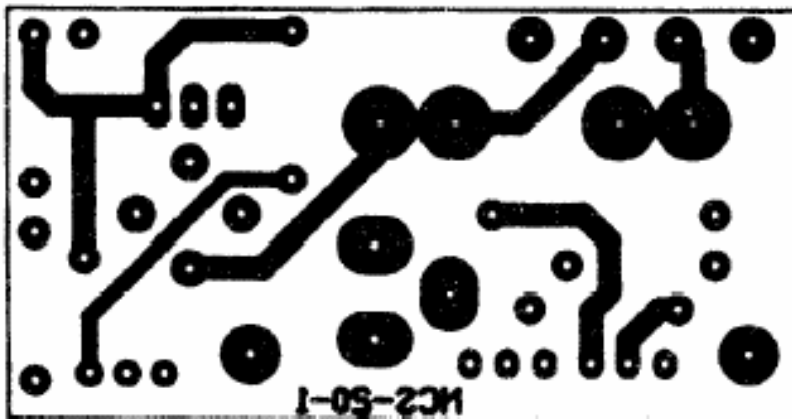
**NCS-11-2 TOP OVERLAY**



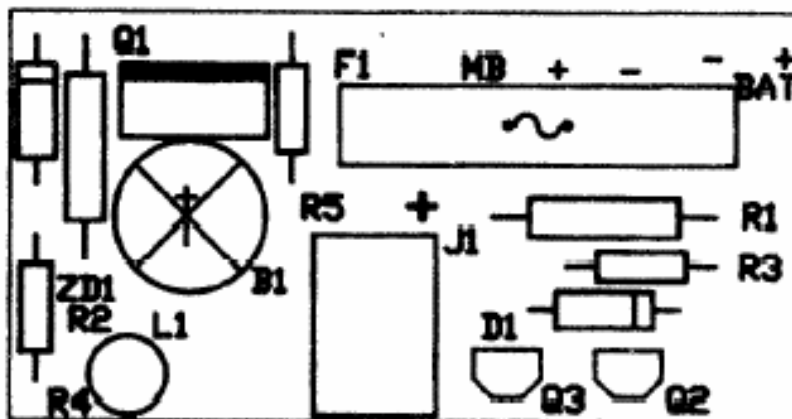
**NCS-11-2 BOTTOM OVERLAY**



NCS-20-1  
TOP LAYER



NCS-20-1  
BOTTOM LAYER



NCS-20-1  
TOP OVERLAY