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Service manual
Compact balances

KERN FCB

Version 1.1
4/2009
GB

FCB-SH-e-0911

GB

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Version 1.1 4/2009

Service manual

Compact balances

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1 Basic Information

Grundlegende Hinweise

The device must be repaired only by trained specialist staff or personnel with professional formation (such as a repair-specialist accredited by law concerning verification).

The service manual is obligatory for repair work.

After repair, original conditions of the device have to be restored.

Only original spare parts should be used.

Das Gerät darf nur von geschultem oder beruflich ausgebildetem Fachpersonal (z. B. eichrechtlich anerkannter Instandsetzer) repariert werden.

Die Serviceanleitung ist bindend für Reparaturen.

Das Gerät muss nach erfolgter Reparatur wieder in den Originalzustand zurückversetzt werden.

Es dürfen nur Originalersatzteile verwendet werden.

2 Introduction

2.1 Features

- Full Tare
- Memory function with indicator
- Stable indicator
- Negative value indication
- Two types of Digital Auto Calibration
- Solder pads to prevent end-user internal calibration
- RS232 interface, printing function
- Custom scale by going through SET manual
  - Multiple serial interface modes
  - Different communication baud rates selectable
  - Auto off enable / disable
  - Zero tracking enable / disable
  - Multiple calibration weight selectable
  - Backlight selectable
- Pre-Tare function
- Animal weighing mode
- Low battery indicator
- Auto off function (battery mode only)
- AC adaptable
- Display segment test function
- Overload protection
- Optional rechargeable battery

2.2 Digital Auto Calibration Procedure

1. Turn balance on and allow the unit to acclimatize and stabilize for 30 minutes.
2. Select the calibration weight through the manual with [Print], [Mode/Cal] and [Set/M] keys.
3. Press and hold the [Mode/Cal] key until the display shows a flashing weight reading. The flashing weight reading indicates the correct weight that must be placed on the weighing pan.
4. Gently place the correct calibration weight on the center on the weighing pan. With the display still flashing, press the [Set/M] key.
5. The display will now show [Cal F] and then return to normal operating mode. The calibration is complete when the display correctly shows the weight that is placed on the weighing pan while the display has stabilized.
6. Remove the calibration weight and press the [TARE] key to reset the zero point.

In case [CAL E] is displayed instead of [CAL F], this indicates a calibration procedure error. Turn the scale off and then on and repeat the procedure.

2.3 Internal Calibration Procedure

1. Remove the top housing of the scale.
2. Connect **J3** on the main board by soldering the pads together.
   (**J4** for FCB 8K0.1, FCB 16K0.2 and FCB 30K0.5)
3. Place scale on a hard level surface. With weighing pan installed, turn balance on. Display shall show the internal counts.
4. The internal counts shall fall in the range from **60 000** to **85 000**
   (**70 000** to **300 000** for FCB 8K0.1, FCB 16K0.2 and FCB 30K0.5).
   In case out of this range, connect **J10** left side or right side (**J6** for FCB 8K0.1, FCB 16K0.2 and FCB 30K0.5) to increase or reduce the reading.
   Connecting or disconnecting pads on **J7**, **J8** or **J9** (**J2**, **J3**, **J4** or **J5** for FCB 8K0.1, FCB 16K0.2 and FCB 30K0.5) can fine tune the reading.
5. Press [Set/M] key once. Display will show [CAL 0] and then the required calibration weight. Place the corresponding calibration weight on the center of the weighing plate. Press [Set/M] again while the weight placed on the weighing pan is stable.
6. Display will now show [CAL 1] and then the next calibration weight. Place the corresponding calibration weight on the weighing plate. Repeat this step until display shows [CAL F]. Remove all weights from weighing pan. Display shall return to zero.
7. Reset the zero point and check the accuracy at different weight.
8. Disconnect J3 (**J4** for FCB 8K0.1, FCB 16K0.2 and FCB 30K0.5).
9. Install the top housing of scale.

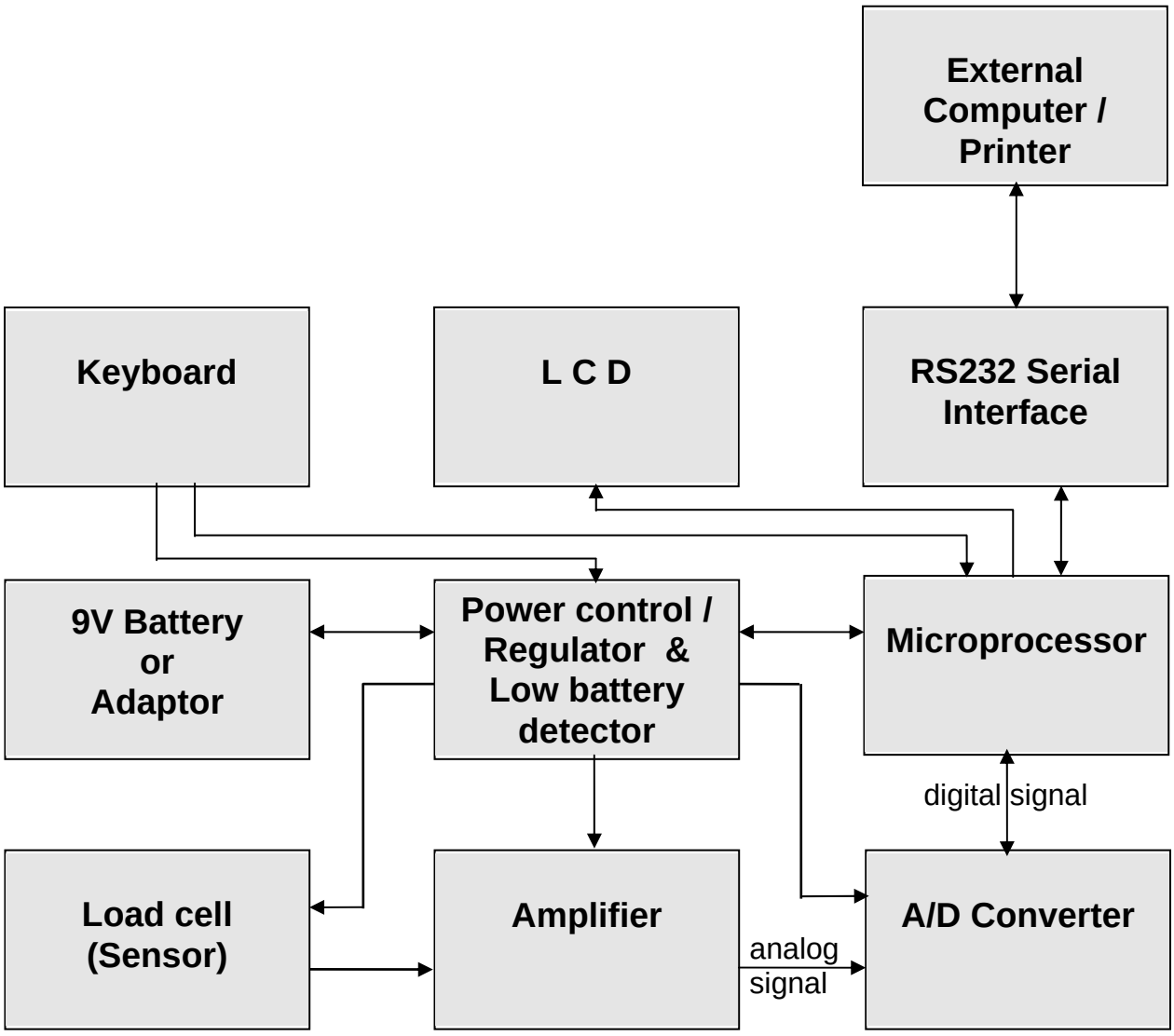
In case [CAL E] is display instead of [CAL F], this indicates a calibration procedure error, or wrong weight applied for calibration.
Turn the scale off and then on and repeat the procedure.

2.4 Display Segment Test

Whenever the scale is power on, all segments of the LCD will be turn on for 4 seconds. Check for any missing segment.

3 Functional Block Diagram / Description

3.1 Functional Block Diagram



3.2 Function Description

1. ***Load cell***
   This is the heart of the whole system. The load cell itself is arranged as a bridge. The resistance change of the bridge elements is proportional to the load applied on the load cell. Therefore, the output of the load cell is an analog signal, which is proportional to the load applied on the scale.

2. ***Amplifier***
   The analog signal from the load cell is very small, of the order of micro-volt. Hence, a linear and stable amplifier is applied to amplify the analog signal to an appropriate level.

3. ***A/D Converter***
   In order for the analog signal can be input to the microprocessor, this part converts the analog signal to its digital equivalent. The operation of the analog to digital converter is using a SIGMA DELTA technique and under the control of the microprocessor.

4. ***Microprocessor***
   The microprocessor control all the functions of the scale, such as auto zero, A/D conversion, timings, weight calculation, unit convertion, and display, parts counting, percentage weight, RS232 interface, overload indication, low battery indication, tare / memory function, etc….

5. ***Display***
   This is the part where the weight is shown out on the LCD display in digital form. The whole display is driven by the microprocessor.

6. ***Power Regulator and Low Battery Detector***
   This part contains the ON/OFF power control. In order for the external power can be used by other parts of the scale, a regulator is used to regulate the supply. A low battery detector is employed to make sure that the power supply is strong enough for normal operation of the scale. If rechargeable battery is installed, it can be charged up by the charging circuit.

7. ***Keyboard***
   The keyboard provides on user interface. [On/Off], [Mode/Cal], [Set/M], [Print] and [Tare] keys are employed to operate the scale.

8. ***RS232 Interface***
   The RS232 serial interface provides the communication to the external computer or printer.

4 Trouble Shooting

Power on

↓

Full Segments?

If no display, check battery /adaptor; connection between keyboard—main board, battery/adaptor—main board.
If missing segments, check fixing of LCD frame, zebra connector under LCD.

↓

Display Zero?

If display [LO], check battery>7.5v, adaptor>9v.
If display [E] , check internal count.

↓

Proper readout?

If unstable reading, check weighing plate, overload stopper, load cell and wires, environmental conditions and stable table.

↓

Correct reading?

If not accurate, perform internal calibration.
If cannot reach full capacity, check weighing plate, overload stopper, load cell and internal zero point.
If always zero, check internal zero point. Internal calibration if necessary.

↓

Proper Data to External Device?

If external device not response, check correct RS232 cable and connection, application software running correctly, wires connecting D-sub connector and main PCB.

↓

Normal operation.

5 To Replace PCB

1. Disassemble top housing of scale.
2. Disconnect PL1, PL2, PL3 and JP2 from the PCB.
   Disassemble the ground wire screw.
   Replace a new PCB. Connect PL1, PL2, PL3 and JP2 again.
   Assemble the ground wire with screw.
3. Assemble the top housing.
4. Perform internal calibration as described in section 2.
5. Check accuracy of scale at different weight.

FCB6K1		**FCB12K1**		**FCB15K5**		**FCB24K1**		**FCB24K2**	
weight (g)	tol. (g)	weight (g)	tol. (g)	weight (g)	tol. (g)	weight (g)	tol. (g)	weight (g)	tol. (g)
1000	3	2000	3	1000	15	5000	3	5000	6
2000	3	4000	3	5000	15	10000	3	10000	6
4000	3	8000	3	10000	15	15000	3	15000	6
6000	3	12000	3	15000	15	20000	3	20000	6
						24000	3	24000	6

FCB24K10		**FCB3K0.1**		**FCB6K0.5N**		**FCB30K1**		**FCB8K0.1**	
weight (g)	tol. (g)	weight (g)	tol. (g)	weight (g)	tol. (g)	weight (g)	tol. (g)	weight (g)	tol. (g)
5000	30	1000	0.2	1000	1	5000	2	1000	0.2
10000	30	2000	0.3	2000	1.5	10000	3	3000	0.3
15000	30	3000	0.3	4000	1.5	15000	3	5000	0.3
20000	30			5000	1.5	20000	3	7000	0.3
24000	30			6000	1.5	30000	4	8000	0.3

FCB16K0.2		**FCB30K0.5**	
weight (g)	tol. (g)	weight (g)	tol. (g)
1000	0.4	5000	1
5000	0.6	10000	1.5
10000	0.6	15000	1.5
15000	0.6	20000	1.5
16000	0.6	30000	2

6. Check other functions, such as Tare, Memory, Print, Mode, and Auto-Off.

6 To Replace Load Cell Assembly

1. Disassemble top housing of scale.
2. Disconnect PL2 (SENSOR for FCB 8K0.1, FCB 16K0.2 and FCB 30K0.5) from main PCB. Remove the four screws fixing the bottom plate of the load cell assembly. Replace the load cell with a new one.
   Connect PL2 (SENSOR for FCB 8K0.1, FCB 16K0.2 and FCB 30K0.5) and fix the four screws.
3. Put 110% full capacity loading onto weight stand of scale. Adjust the overload screws on the weight stand until they just not touch the bottom plate.
4. Assemble the top housing.
5. Perform internal calibration as described in section 2.
6. Check accuracy of scale at different weight.

FCB6K1		**FCB12K1**		**FCB15K5**		**FCB24K1**		**FCB24K2**	
weight (g)	tol. (g)	weight (g)	tol. (g)	weight (g)	tol. (g)	weight (g)	tol. (g)	weight (g)	tol. (g)
1000	3	2000	3	1000	15	5000	3	5000	6
2000	3	4000	3	5000	15	10000	3	10000	6
4000	3	8000	3	10000	15	15000	3	15000	6
6000	3	12000	3	15000	15	20000	3	20000	6
						24000	3	24000	6

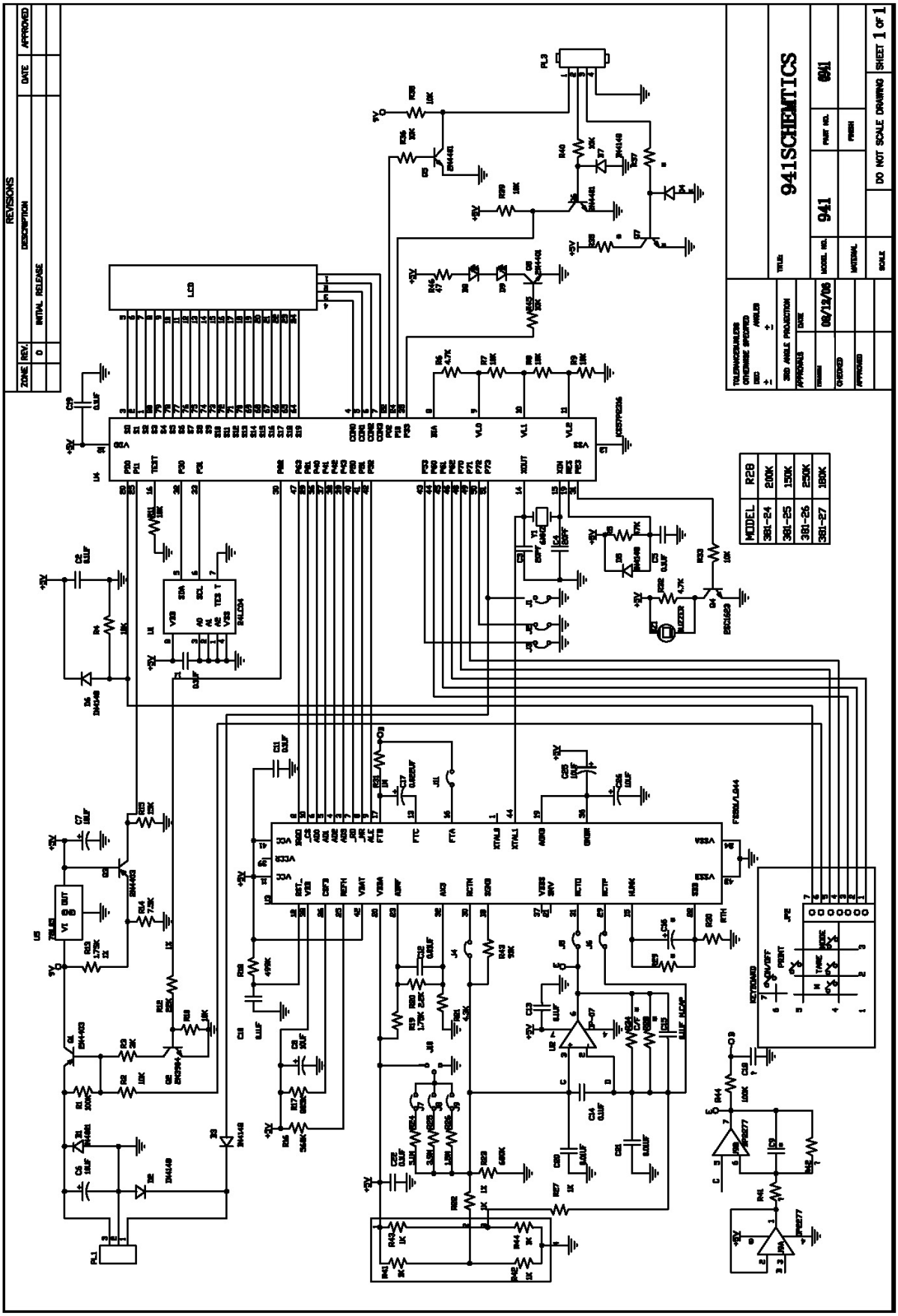
FCB24K10		**FCB3K0.1**		**FCB6K0.5N**		**FCB30K1**		**FCB8K0.1**	
weight (g)	tol. (g)	weight (g)	tol. (g)	weight (g)	tol. (g)	weight (g)	tol. (g)	weight (g)	tol. (g)
5000	30	1000	0.2	1000	1	5000	2	1000	0.2
10000	30	2000	0.3	2000	1.5	10000	3	3000	0.3
15000	30	3000	0.3	4000	1.5	15000	3	5000	0.3
20000	30			5000	1.5	20000	3	7000	0.3
24000	30			6000	1.5	30000	4	8000	0.3

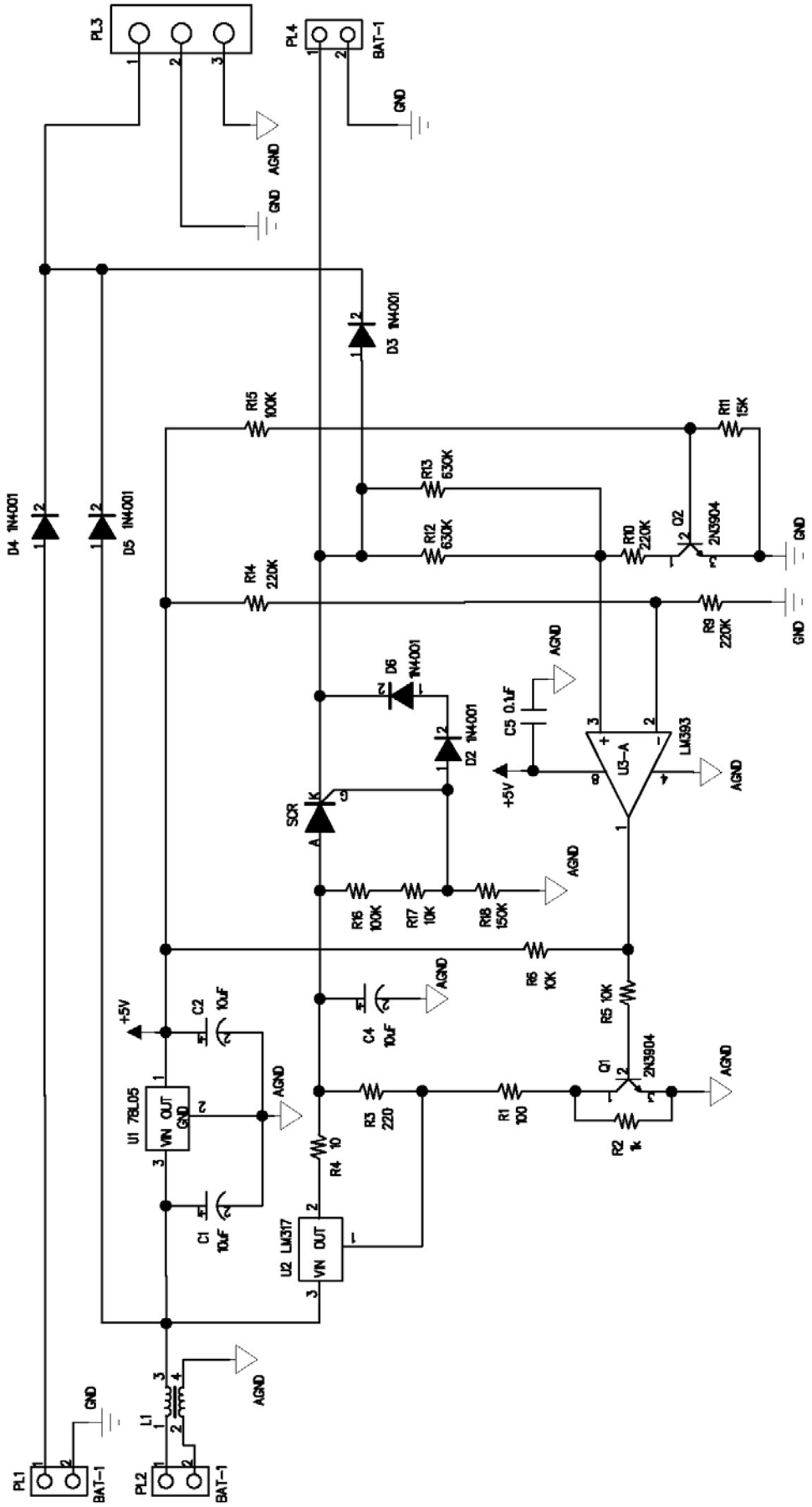
FCB16K0.2		**FCB30K0.5**	
weight (g)	tol. (g)	weight (g)	tol. (g)
1000	0.4	5000	1
5000	0.6	10000	1.5
10000	0.6	15000	1.5
15000	0.6	20000	1.5
16000	0.6	30000	2

7. Check other functions, such as Tare, Memory, Print, Mode, and Auto-Off.

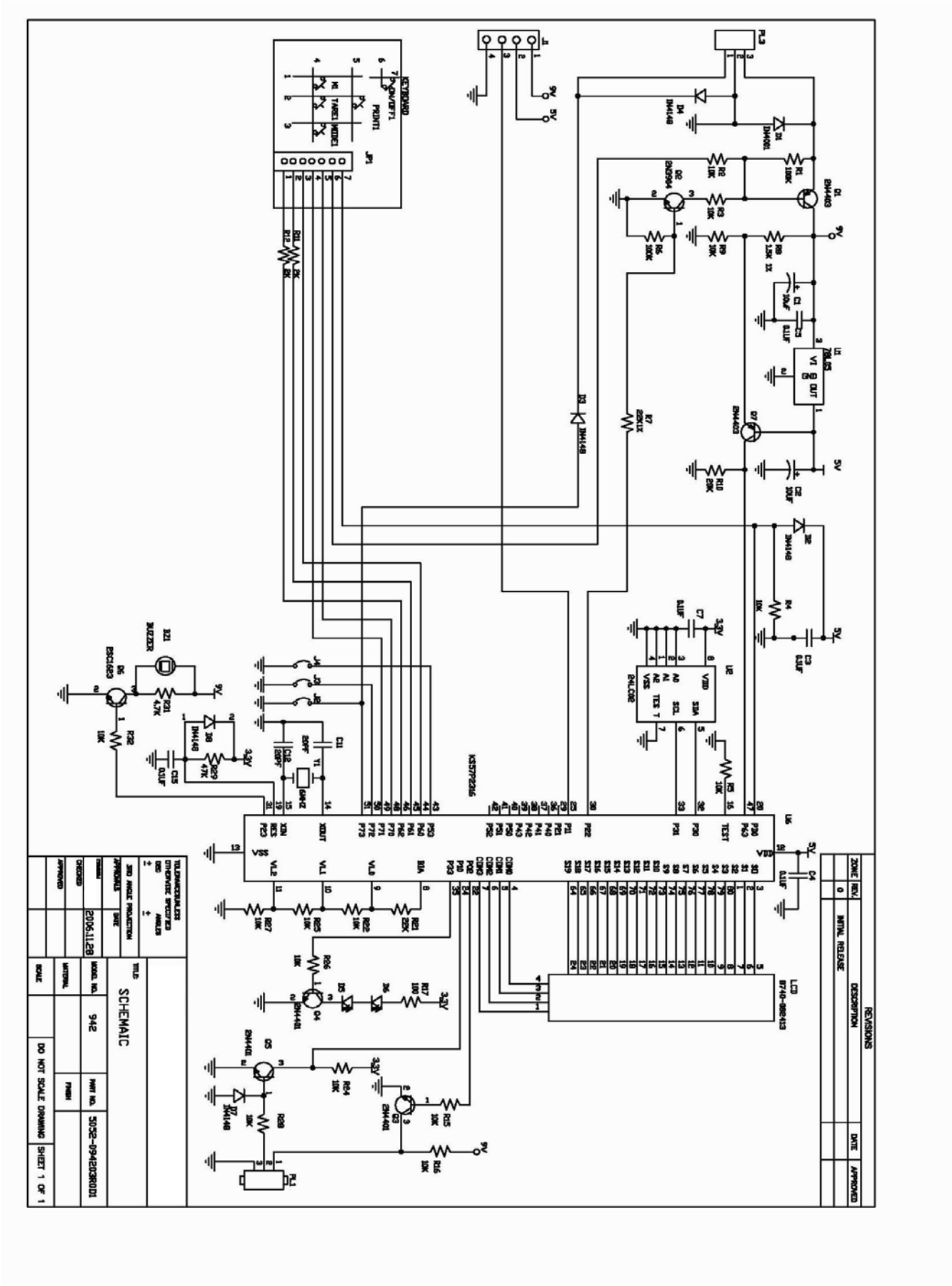
7 Schematics

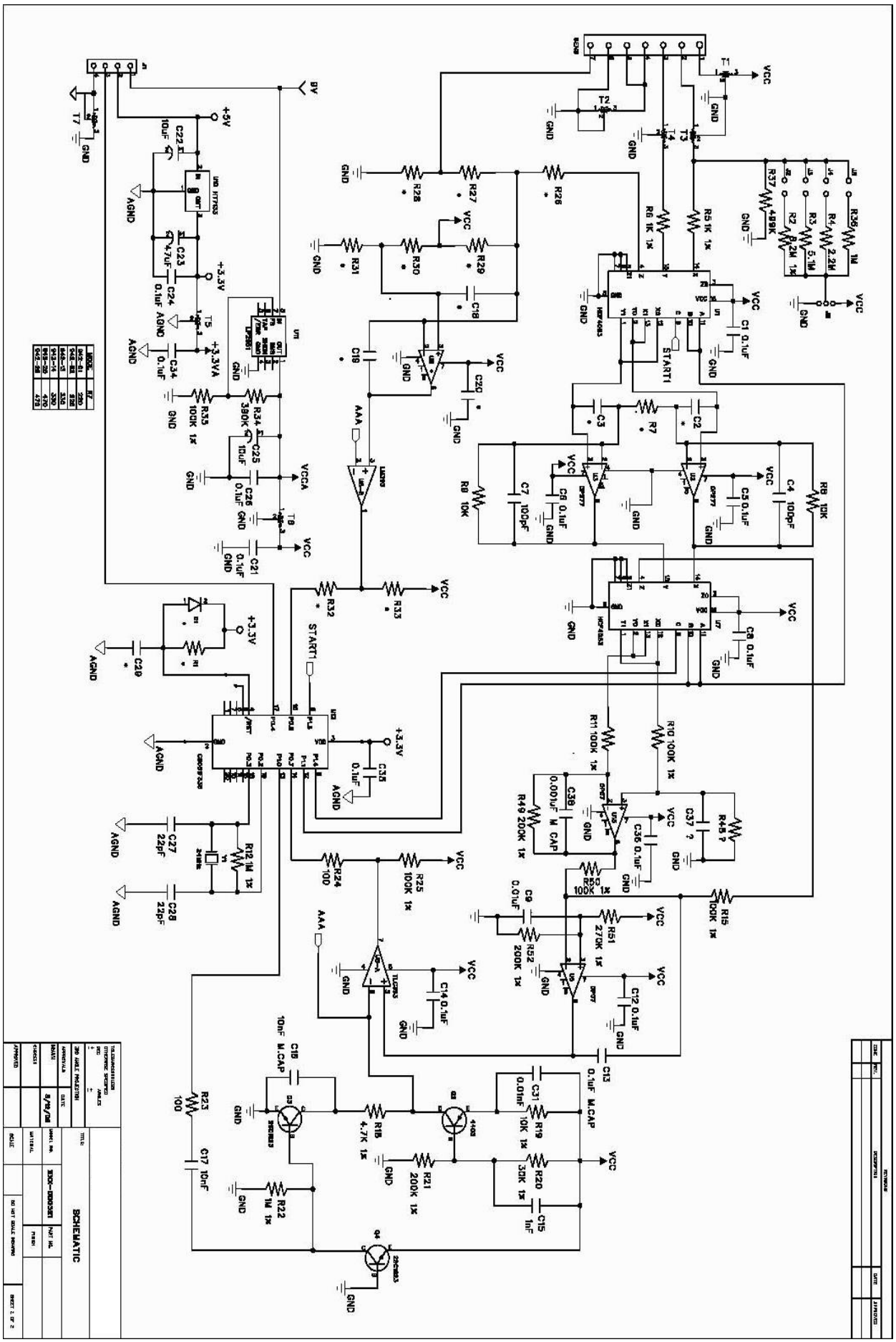
FCB 6K1, FCB 12K1, FCB 15K5, FCB 24K1, FCB 24K2, FCB 24K10, FCB 3K0.1, FCB 6K0.5, FCB 30K1




PL3
PL4
BAT-1
GND
AGND
D3 1N4001
D4 1N4001
D5 1N4001
D6 1N4001
D2 1N4001
R15 100K
R11 15K
R13 630K
R12 630K
R10 220K
Q2 2N3904
R14 220K
R9 220K
C5 0.1uF
+5V
U3-A
LM393
SCR
R16 100K
R17 10K
R18 150K
R6 10K
C4 10uF
C2 10uF
U1 78L05
VIN OUT GND
R3 220
R1 100
R5 10K
Q1 2N3904
R2 1k
R4 10
C1 10uF
U2 LM317
VIN OUT
L1
PL1
PL2

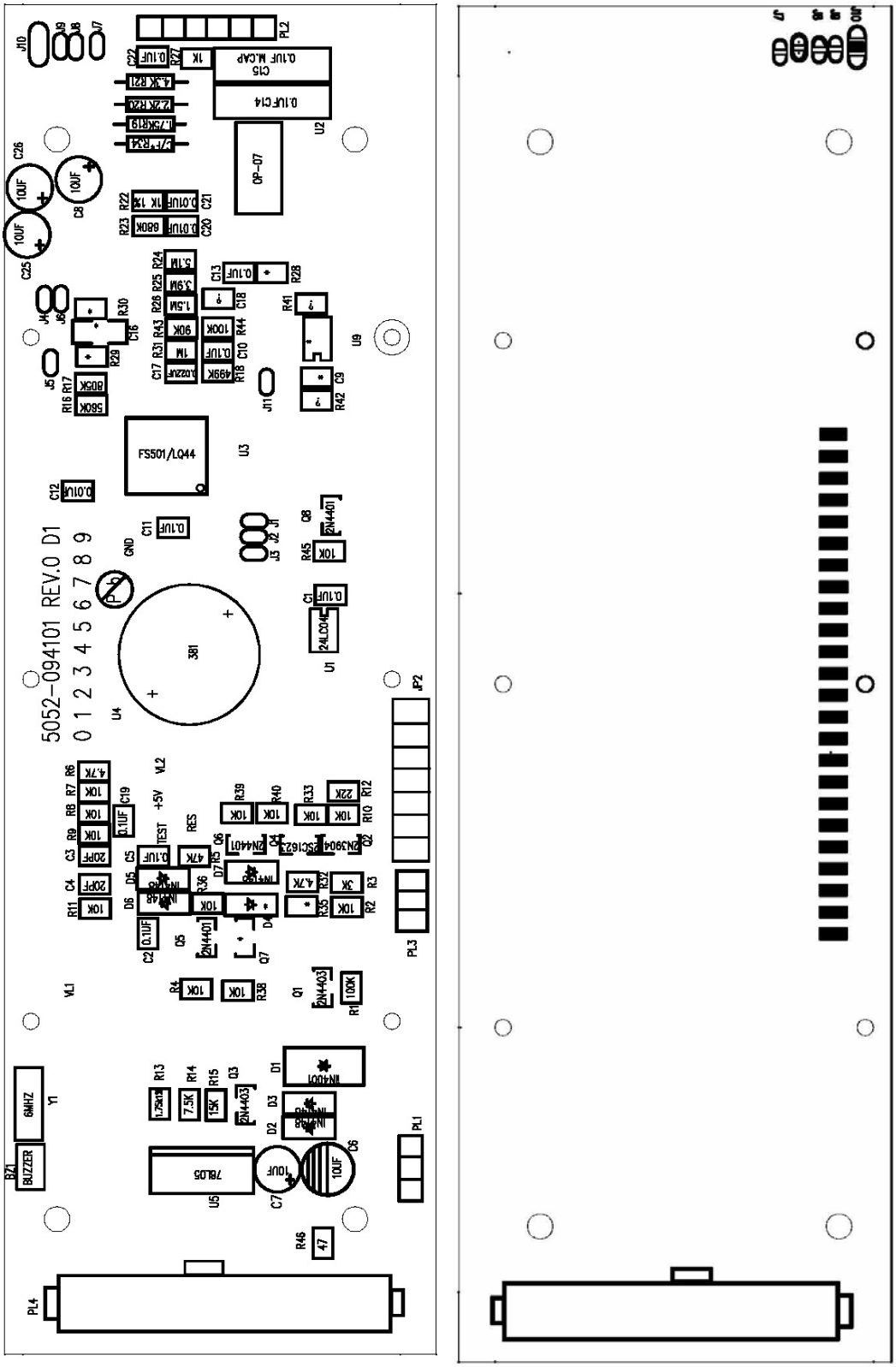
FCB 8K0.1, FCB 16K0.2, FCB 30K0.5

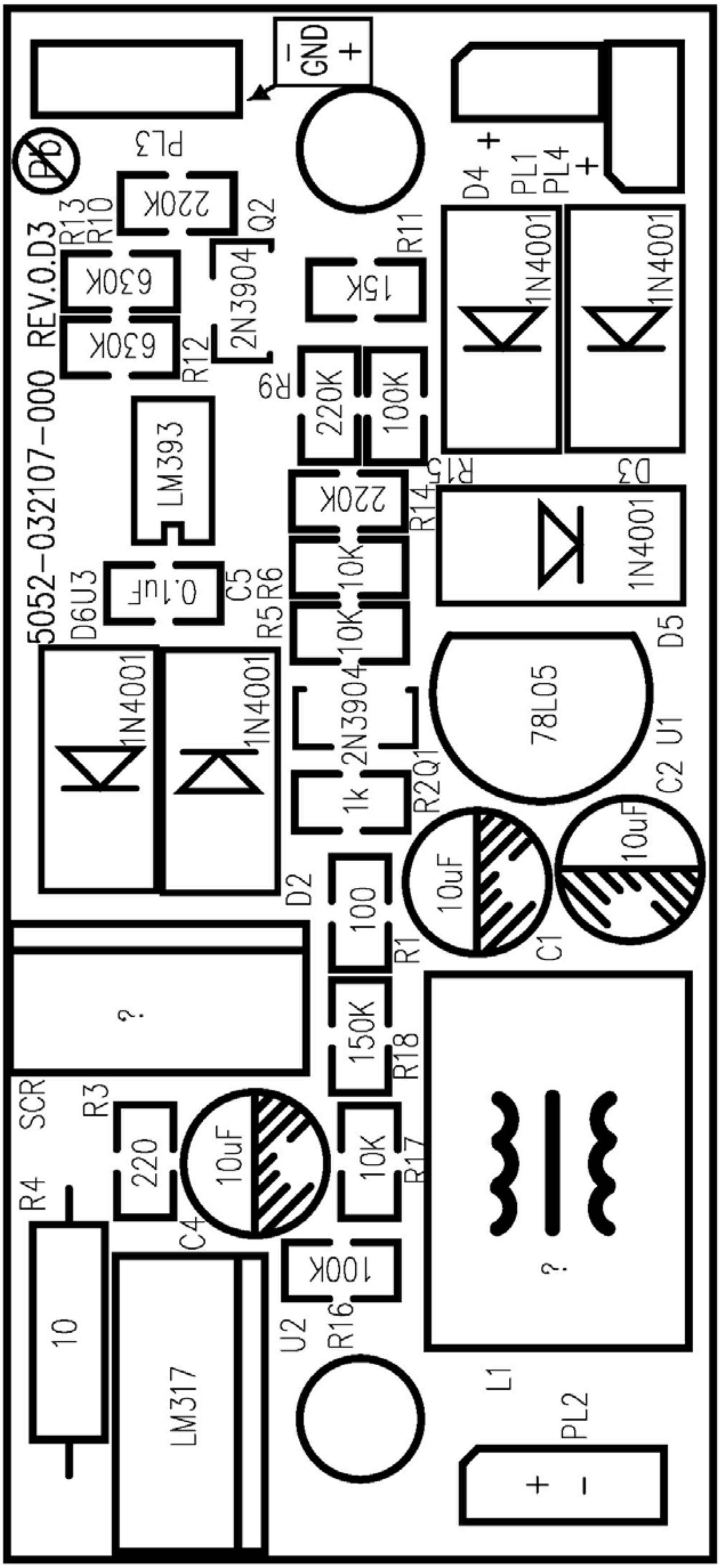



SCHEMATIC
VCC
GND
AGND
START1
AAA
+5V
+3.3V
+3.3VA
VCCA
BY
R1 100K 1%
R2 2.2M 1%
R3 5.1M
R4 2.2M
R5 1K 1%
R6 1K 1%
R7
R8 10K
R9 10K
R10 100K 1%
R11 100K 1%
R12 1M 1%
R13 100K 1%
R15 100K 1%
R16 4.7K 1%
R17 100K 1%
R18 100K 1%
R19 10K 1%
R20 30K 1%
R21 200K 1%
R22 1M 1%
R23 100
R24 100
R25 100K 1%
R26
R27
R28
R29
R30
R31
R32
R33
R34 390K 1%
R35 100K 1%
R36 1M
R37 499K
R48 ?
R49 200K 1%
R51 270K 1%
R52 200K 1%
C1 0.1uF
C2
C3
C4 100pF
C5 0.1uF
C6 0.1uF
C7 100pF
C8 0.1uF
C9 0.01uF
C10 0.1uF
C12 0.1uF
C13 0.1uF M.CAP
C14 0.1uF
C15 1nF
C16
C17 10nF
C18
C19
C20
C21 0.1uF
C22 10uF
C23 4.7uF
C24 0.1uF
C25 10uF
C26 0.1uF
C27 22pF
C28 22pF
C31 0.01nF
C34 0.1uF
C35 0.1uF
C36 0.1uF
C37 ?
C38 0.001uF M CAP
C39 10nF M.CAP
Q3
Q4
Y1

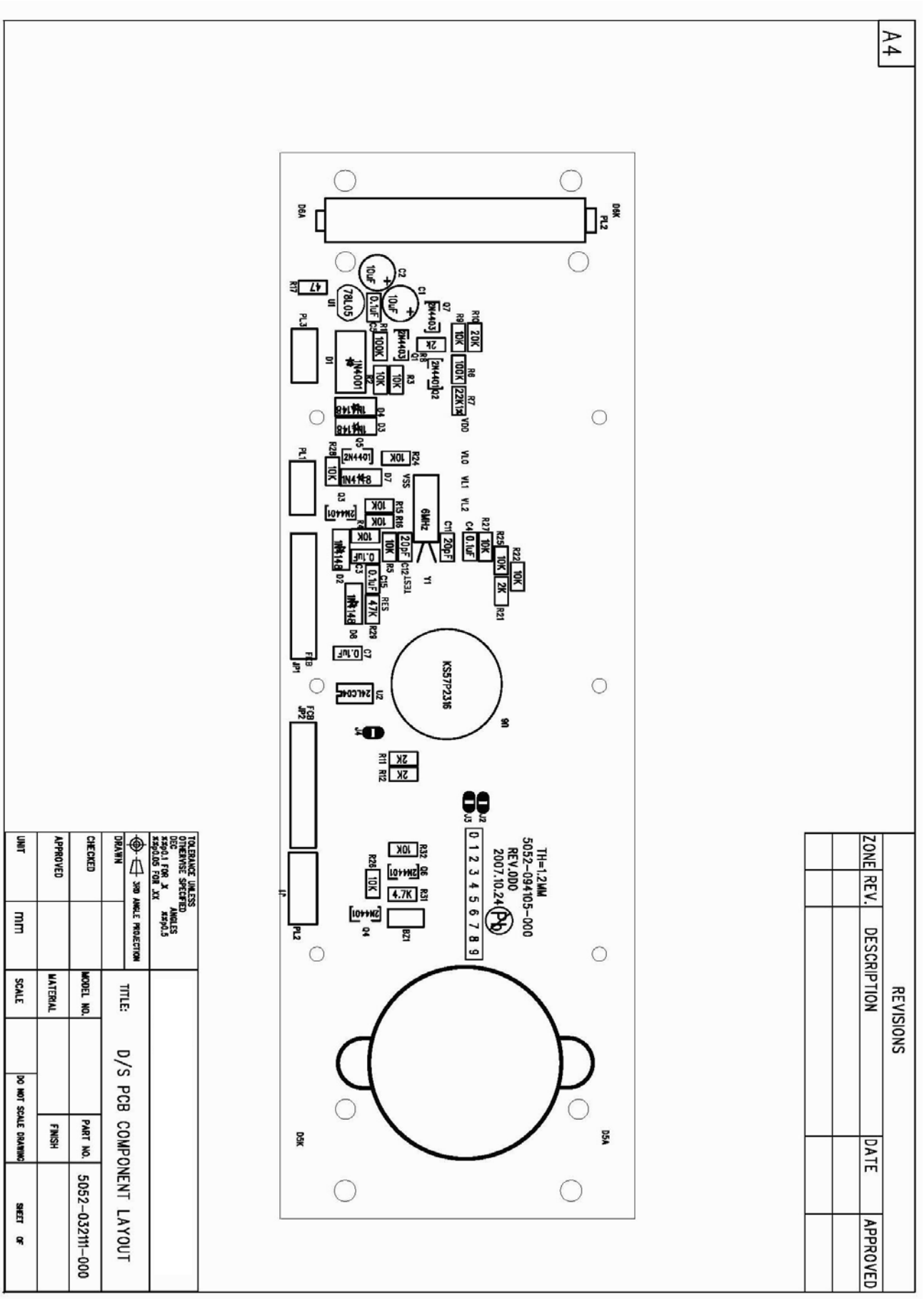
8 Components Layout

FCB 6K1, FCB 12K1, FCB 15K5, FCB 24K1, FCB 24K2, FCB 24K10, FCB 3K0.1, FCB 6K0.5, FCB 30K1



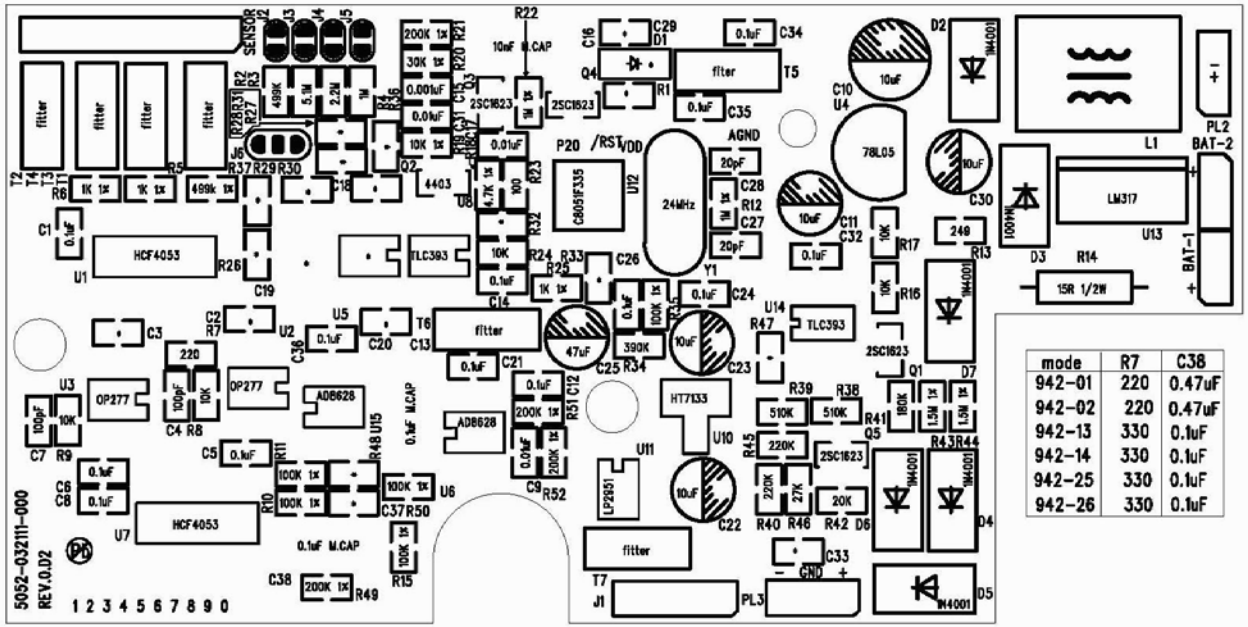

5052-032107-000 REV.0.D3
GND
PL1
PL2
PL3
PL4
LM393
LM317
78L05
2N3904
1N4001
10uF
0.1uF
220K
630K
15K
100K
10K
1k
100
150K
220
10
SCR
D2
D3
D4
D5
D6
U1
U2
U3
Q1
Q2
C1
C2
C4
C5
L1
R1
R2
R3
R4
R5
R6
R9
R10
R11
R12
R13
R14
R15
R16
R17
R18

FCB 8K0.1, FCB 16K0.2, FCB 30K0.5



A4

REVISIONS				
ZONE	REV.	DESCRIPTION	DATE	APPROVED



mode	R7	C38
942-01	220	0.47uF
942-02	220	0.47uF
942-13	330	0.1uF
942-14	330	0.1uF
942-25	330	0.1uF
942-26	330	0.1uF

TOLERANCE UNLESS OTHERWISE SPECIFIED DEC ANGLES ±±p0.1 FOR .X ±±p0.5 ±±p0.05 FOR .XX					
3RD ANGLE PROJECTION		TITLE:	D/S PCB COMPONENT LAYOUT		
DRAWN					
CHECKED		MODEL NO.		PART NO.	5052-032111-000
APPROVED		MATERIAL		FINISH	
UNIT	mm	SCALE	DO NOT SCALE DRAWING		SHEET OF