OPERATIONS AND REPAIR MANUAL

MODEL 1030
ION CHAMBER SURVEY METER

June 2006

hpi

health physics instruments

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GENERAL DESCRIPTION

The Model 1030 Survey Meter consists of an ion chamber, an electrometer with a metering circuit, and the necessary power supplies. It has the following ratemeter ranges: 0-100 rad/h, 0-10 rad/h, 0-1 rad/h, O-.1 rad/h, and O-.01 rad/h, It also has 0-10 mrad, 0-1 mrad, and 0-0.1 mrad integrating dose ranges. The survey meter will measure the absorbed dose from any penetrating radiation including x-rays, gamma rays, neutrons, and high energy particles.

The gas-filled ion chamber is a cylindrical tissue equivalent plastic shell, 2" in diameter with interleaved collector and HV plates. The chamber is operated at about 90 volts and the pressure of tissue equivalent filling gas is 30 psi. The electrometer circuit measures the total charge collected by the central loop. High Voltage is always connected to the chamber and is approximately 9OVDC.

USE

The instrument is designed to measure pulsed penetrating radiation. Measurements of absorbed dose in non-controlled areas in the vicinity of radiation sources may be performed quickly.

When switching to the 0.01 rad/h rate meter range, the meter will normally be driven off scale. By momentarily switching to the reset position, RST, and back to the .01 rad/h range, the time constant capacitor will be discharged and the meter will come on-scale, Rapid switching of the range switch does not harm the meter.

The instrument is independent of battery voltage until the voltage is insufficient to operate the power supply oscillators, The battery check switch position, BAT, consists of a 6 volt voltmeter operated with the load on the batteries. Replace the batteries if the pointer is below the line on the scale in the BAT check position. The instrument will operate properly at 4.5 volts.

The three absorbed dose ranges employ the same charging capacitor. Switching from one range to the next does not destroy the measurement, The capacitor is discharged and the meter returned to zero by switching to the reset position, RST, or by pushing the reset push button.

The reset button will usually cause some meter deflection on release. This is particularly evident on the most sensitive rate and integrate ranges. Often just a quick tap on the button will reset the instrument more effectively than a long push. This will not, of course, reset the timer.

The instrument has some geotropism. If it moved from a horizontal position to a vertical position or vice-versa, the meter will momentarily move upscale or downscale on the most sensitive rate range. On the most sensitive integrate range, the same action will cause the meter to move upscale or downscale and remain there. Both actions are normal and are due to the small deflection of the parallel plates in the detector. When using the most sensitive integrate range, keep the instrument in the same orientation.

HUMIDITY

The 1030 is sensitive to humidity. At high humidity levels it will often read downscale on the most sensitive rate range and not integrate properly on the most sensitive integrate range. We recommend keeping the instrument in a plastic bag with desiccant if the humidity effects the readings. If the instrument is reading low it may help to remove the back and blow warm

air from a hair dryer into the top compartment with the meter and switch. Replace the back and check for a downscale reading on the most sensitive rate range.

DIGITAL TIMER

The 1030E-T3 incorporates a digital timer which is visible above the meter scale. If this 3 digit display is not on, push the reset button down for approximately 1/2 seconds. When the button is released the display will turn on and the timer will begin counting up in 1 second increments from 0. When the reset button is released the display will turn on and begin counting from 0. The instrument will always reset the radiation measuring section when the reset button is depressed, even if it is momentarily. When the display reads 999 + 1 the display will turn off conserving power.

GENERAL CIRCUIT

The Model 1030 Survey Meter consists of a detector, a low voltage DC to DC converter, a high voltage power supply, an electrometer and metering circuit, and a selector switch assembly. The power supply is mounted on the printed circuit board. Three high impedance circuit feedback elements are used.

The electrometer is a varactor bridge type. Zero adjustment is available to cancel the offset voltage, The DC to DC converter supplies +/-15 v to the electrometer from the 6 v batteries. All adjustments, except the high voltage calibrate, are located in the battery compartment,

DISASSEMBLY

The following order is recommended to disassemble the instrument:

1. Remove the end plate by removing the 4 rubber feet to replace batteries or make calibration adjustments.

2, Remove back plate by removing 4 rubber feet and 2 screws. Range switch, electrometer, circuit board and meter are available.

3. Remove 2 screws on the edges of circuit board. The circuit board may now swing up so that components are available. Board may be unplugged. High voltage batteries are mounted on this board.

4. Remove knob and selector switch nut and withdraw signal lead from detector. Selector switch can swing out of the chassis without disconnecting leads to circuit board.

5, Remove electrometer by removing 2 4-40 screws available under circuit board.

6. Remove the 2 hex slotted spacer/nuts holding the front panel to the instrument case. These nuts are located in the corners of the meter compartment beside the meter. This will permit the meter and front panel to be removed as a unit.

7. Remove detector by removing the 2 connectors from the chamber and removing the 4 mounting nuts.

CALIBRATION

To properly calibrate the instrument in mrads with known exposure rates from Co-60 or Cs-137, a factor of 0.96 must be used to obtain tissue rads from exposure in R (NCRP quotes 0.957). If the exposure rate at some location is known to be 10 mR/h, the instrument should read 9.6 mrad/h.

All adjustments are in the battery compartment. The procedure is to check the accuracy of all ranges. If one is off or incorrect, the appropriate sensitivity adjustment should be changed.

1. Check zero by setting range switch on RST.

2. Check battery condition and replace batteries if necessary (front panel switch to BAT),

3. Check H.V. batteries by turning instrument off and moving slide switch to HV Test. Reading on the meter should be within the BAT section. Return slide switch to operate position.

4. Observe accuracy of all ranges and adjust the proper calibration control.

MAINTENANCE

CAUTION: HIGH VOLTAGE EXISTS AT THE CHAMBER AND ON THE CIRCUIT BOARD.

The only routine service required in the replacement of batteries and the calibration. Any type of 1,3 to 1.5 volt batteries of the D size may be used, such as carbon dry cells, or alkaline cells. The HV batteries are WRDA type 221 (Eveready #505).

REPAIR

CAUTION: After removing the bottom panel, the high megohm resistors are exposed. They are mounted on the switch section nearest the back panel. Because of their small size, they may be overlooked. Do not handle these resistors with your fingers, as they will change resistance and alter the calibration.

The location of all parts is shown in the drawings or in the parts diagram.

If difficulties are experienced, determine whether the circuit or the chamber is faulty. Disconnect the chamber by withdrawing the jack from the center of the chamber and note the reading when the instrument is turned on. The meter should approach zero and possibly dip slowly below on the x.01 rate meter range.

If the chamber is at fault, it can be tested if an electrometer such as a General Radio or Keithley is available. With the high voltage from the instrument applied, the current should be about 1.5 x 10E-13 amps/mR/h from gamma rays. The chamber is sealed and no repairs can be made in the field.

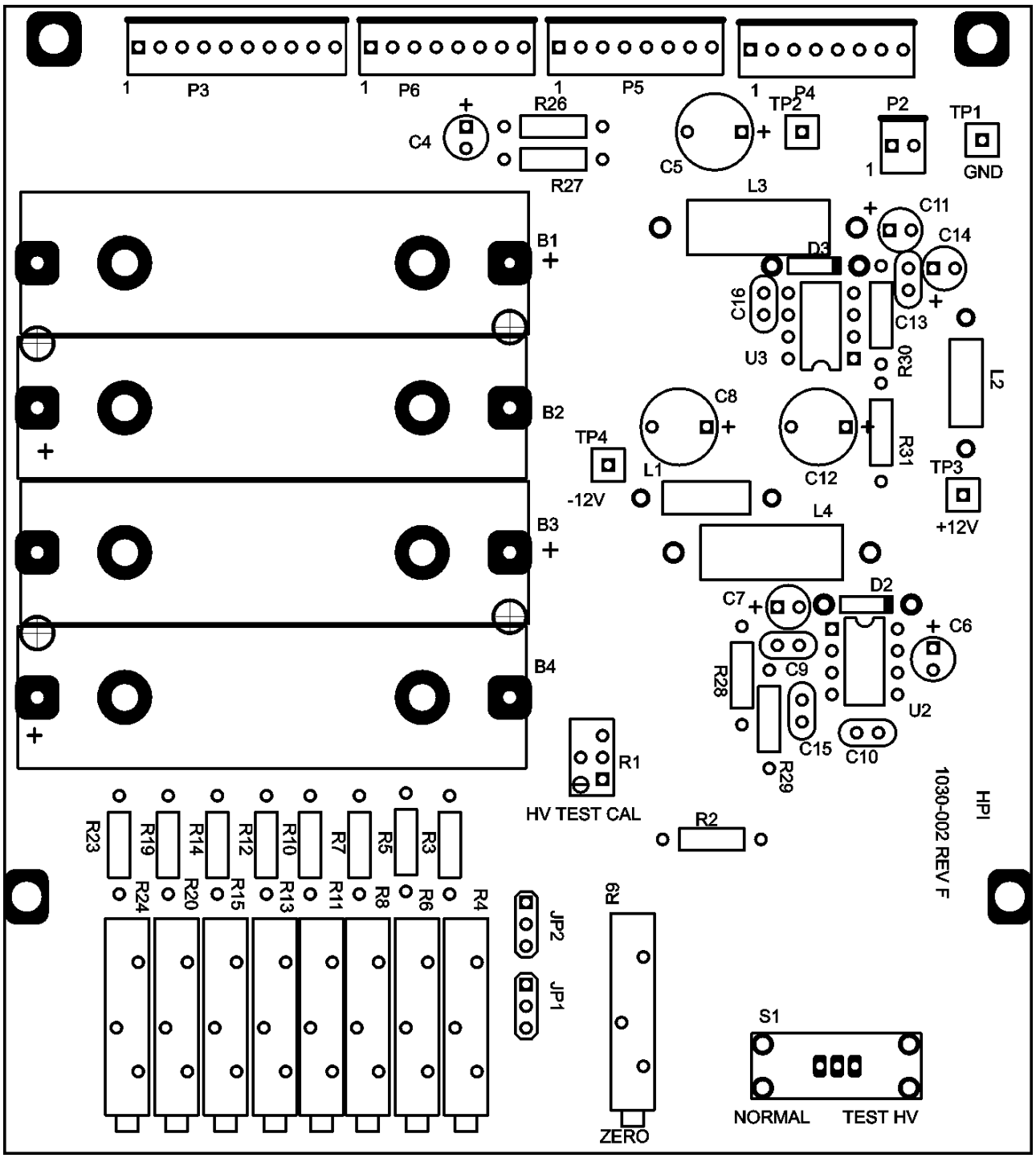
The high voltage test cal adjustment for the HV check is adjusted for full scale on the meter when new HV batteries are installed.

PARTS

Designation	Quan	Value	Description

B1,B2,B3,B4	4	22.5V #505	Battery
B5	4	D cells	Battery
C1	0	0.1uF	Capacitor
C10,C13,C9,C15,C16	3	0.1uF	Capacitor
C11,C6	2	120uF	Capacitor, Tantalum
C12,C8	2	330uF	Capacitor, Electro
C14,C7	2	33uF	Capacitor, Tantalum
C17	1	100pF	Capacitor
C2	1	470pF	Capacitor, polystyrene
C3	1	20pF	Capacitor, polystyrene
C4	1	33uF	Capacitor, Tantalum
C5	1	330uF	Capacitor, Electro
D1	1	1N5817	Diode
D2,D3	2	1N5817	Diode
G1	1	HPI1030DET	Detector Ion Chamber
J1	1	1 pin	To Chamber
J2	1	2 pins	To Batteries
J3	1	9 Pins	To Switch
J4	1	8 pins	To Switch
J5	1	8 pins	To Electrometer
J6	1	8 pins	To Meter
JP1,JP2	2		Jumperspdtb
K1	1	HPI	Reed Relay Modified
L1, L2	1	22 uH	Inductor
M1	1	7035, API	Meter
P1	1	1 pin	
P2	1	2 pins	Molex SIP
P3	1	9 Pins	Molex SIP
P4	1	8 pins	Molex SIP
P5	1	8 pins	Molex SIP
P6	1	8 pins	Molex SIP
R1	1	1M	Potentiometer 3/8 Top adj
R5,R19	1	4.7K	Res, 5% cf
R3, R7,R10,R12,R14,R23	1	100	Res, 5% cf
R27	1	0	Res, 5% cf
R11,R20,R24,R4, R13,R15,R6,R8	8	10K	Potentiometer, 87PR Type
R16	1	1.00K	Res 1% mf
R17	1	13	Res, 5% cf
R18	1	1x10E11	Res, 5% cf
R2	1	1.2M	Res, 5% cf
R21	1	1KM	Res, 5% cf
R22	1	10M	Res, 5% cf
R25	1	110K	Res, 5% cf
R26	1	100	Res, 5% cf
R28	1	1M	Res, 1%
R29	2	100K	Res, 1%
R30	1	909K	Res 1%
R31	1	100.0K	Res 1%
R9	1	100K	Potentiometer, 89PR type
S1	1		Switchspdt
S2	1	CK8121	Pushbutton
SW1A,SW1B,SW1C,SW1D,SW1E	4	12pos	Rotary Switch Ceramic,Electro
U2	1	Max765	Switching Regulator
U3	1	Max761	Switching Regulator
U5	1	310J	Electrometer
uHL3	2	22uH	Ind
uHL3	2	47uH	Ind

PARTS PLACEMENT DIAGRAM



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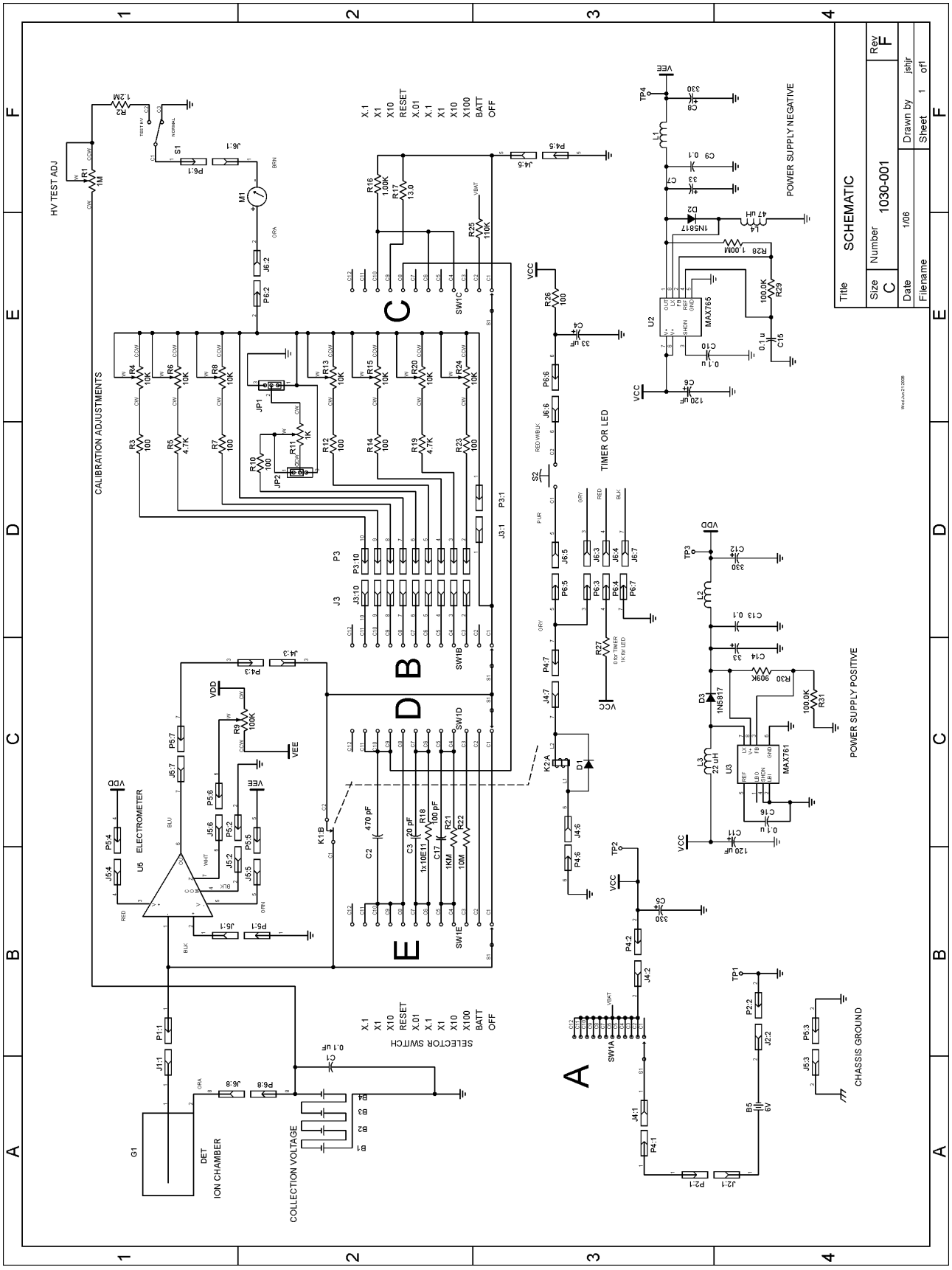
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POWER SUPPLY POSITIVE
TIMER OR LED
ELECTROMETER
SELECTOR SWITCH
X.1 X1 X10 RESET X.01 X.1 X1 X10 X100 BATT OFF
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DET
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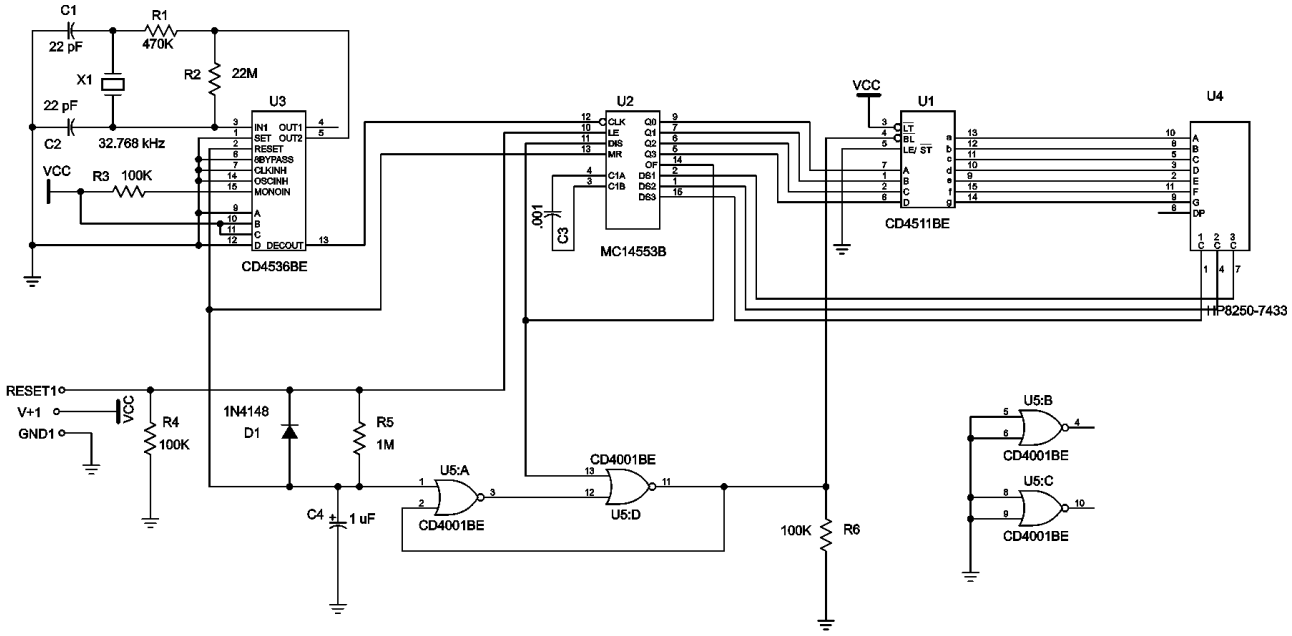
CHASSIS GROUND
MAX765
MAX761
1N5817
47 UH
22 uH
6V

TIMER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U2
MC14553B
.001
C3
VCC
U1
CD4511BE
U4
HP8250-7433
RESET1
V+1
GND1
VCC
R4
100K
1N4148
D1
R5
1M
C4
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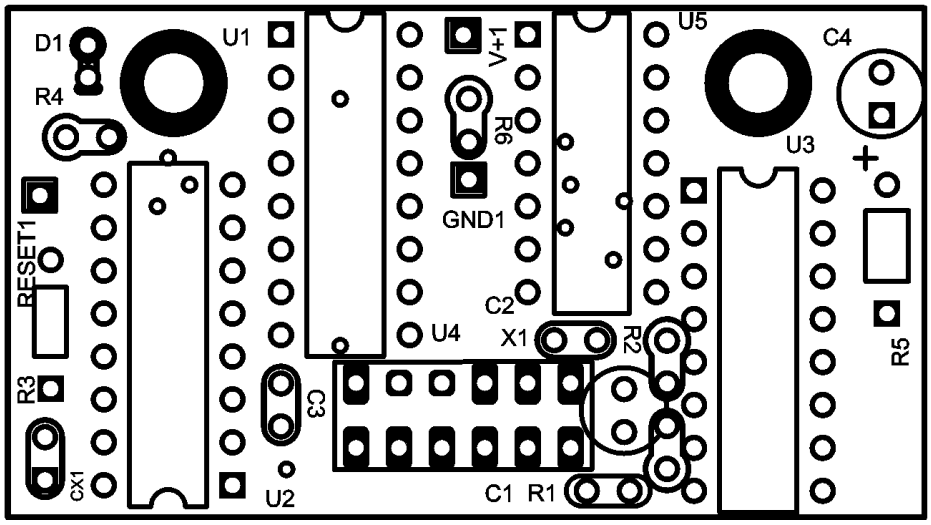
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V+1
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RESET1
C2
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U4
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R5
R3
C3
CX1
U2
C1
R1