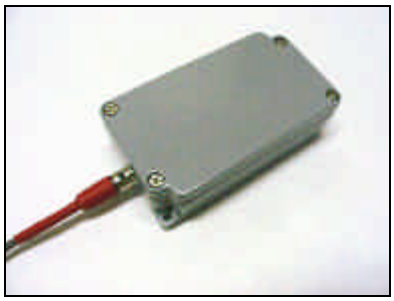
OPERATION MANUAL

Model 2070
Gamma Detector Module

August 2002



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GENERAL INFORMATION

This instrument is manufactured in the United States of America by:

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Health Physics Instruments is a division of Far West Technology, Inc. Billing is through Far West Technology, Inc.

Both Health Physics Instruments and Far West Technology have been manufacturing radiation measuring devices since 1972.

REPAIR SERVICE

Although we design and manufacture our instruments to a high standard, we realize that repairs are sometimes necessary. If you believe service is needed on this instrument please call our service department before shipping the instrument to us for repair; often we can help you with simple problems. If you do decide to return it to us for repair then please include:

1. Contact person's name
2. Organization or Company name
3. Address
4. Phone number of contact person
5. Description of the problem
6. Anything else you may think important

We will inform you of the repair charges and wait for your authorization before we repair your instrument.

TABLE OF CONTENTS

I. GENERAL DESCRIPTION

The Model 2060 is a solid state gamma measurement module. It has a very wide dynamic range of 0.001 mR/h through 10 R/h. The output is through a serial port.

II. MOUNTING AND SETUP

The Model 2060 is mounted using the screw holes on the corner of the case. It may also be mounted using the double stick foam tape that will give some shock isolation.

The 2070 is somewhat shock sensitive. Banging it with your hand will not be a problem, but if you bang it with a screwdriver it will show a few uR. Consequently don't mount the 2070 on a rack, doorframe, table, or anything that may be subject to banging doors, equipment, or people. The best orientation of the 2070 would be with the top parallel to the ground.

Plug the miniature XLR connector into the socket on the end of the case. The wire is terminated in lugs for power and a DB9F connector for the RS232 output. Remove the lugs and/or DB9 connector if you do not want to use them.

The shield can be connected to chassis ground or to system ground. Inside the module, there is a 10 ohm resistor between chassis ground (shield) and the external ground connection (pin 2) that eliminates excessive ground currents if they are not at the same potential.

The wire has 4 conductors and a shield. The connections are:

Min. XLR Connector Pin #	**Wire Color**	**Power Supply Connection**	**RS232 Connection**
1	Red	Power supply, + 7 to +12 VDC at 30 mA.	
2	Black	Power supply, ground	
3	Green		RS232 Output (TXD) Pin 2 on DB9F
4	White		RS232 Return (Ground) Pin 5 on DB9F
Outside shield	Shield	System Chassis Ground or System Ground	

III. RS232 OUTPUT

The settings of the RS232 output are: 9600 baud, 8 bits, 1 stop bit, and no parity. There is no flow control.

The radiation level is transmitted every second. The data packet consists of two groups, both in hex format that are sent every second. The first is 4 hex bytes of an averaged radiation level and is in uR/h. The second is 2 hex bytes of the radiation dose (uR) for the last second. Following the data is a carriage return and line feed.

An example would be:

00001C50 001A

The first group, 00001C50 represents a radiation level of 7,248 uR/h and is updated every 7.5 minutes. The second group, 001A represents a dose of 26 uR in 1 second and is updated every second.

When the module updates the dose rate (4 byte second group) there is a decimal point preceding the two groups. Thus a reading of several seconds would look like:

00000050 0001

00000050 0001

.00000051 0001

00000051 0001

00000051 0001

00000051 0001

00000051 0001

Note that the third reading from the top has the decimal point in front of it indicating that the level has been updated. All following readings in the first 4 byte group are the same as the one with the decimal point.

At turn on the 2070 will output a sign-on message showing HPI and the version of the software followed by a data packet.

IV. OPERATION

The module operates on a 7.5 minute cycle. It will update the output level every 7.5 minutes. During a radiation level change, if the radiation level is above 8.2 mR/h the output will be correct when it updates at the 7.5 minute interval. If it is below 8.2 mR/h it will take eight 7.5 minutes updates (60 minutes) to be correct. Thus background levels that are low radiation levels will take longer to be correct, but they are not hazardous. Higher levels that are more hazardous will update quicker.

There is an 8 level rotating stack that operates first in, first out. The detector counts are counted for 7.5 minutes and that value is placed on the next available position on the stack. The contents of the stack are added up every 7.5 minutes and the sum is the radiation level in uR. The counts from the detector are calibrated to be 1 uR/count. If the level is above 1024 counts in 7.5 minutes (8.192 mR/h), then those counts are put in all of the locations in the stack.

Background radiation will vary depending on location but is generally between 5 and 15 uR/h. The 2070 may, because of statistics, report zero radiation for periods of up to an hour. If the radiation level is zero for a period of 3 hours then assume that the detector has malfunctioned.

V. SETTINGS AND INDICATORS

Inside the module is a small dipswitch and pushbutton switch (See Figure 1).

Reset Pushbutton Switch

This will reset the program and all previous data and average information will be lost. This has the same effect as turning the power off then on. The 2070 will output the sign-on message and then show the data packets every second.

The 4 Position Dipswitch

For normal operation turn all positions to off.

Position 1: When turned on, the 2070 will output a radiation level of 00002710 0003 every second. Internally the 2070 will continue to measure the radiation level. When position 1 is turned off the radiation level will

continue as though the switch had never been turned on. Position 3 or 4 will not work when this position is turned on.

Position 2: Not used in this version of software.

Position 3: When turned on, the 2070 will only output the data packet whenever it updates, i.e. every 7.5 minutes.

Position 4: When turned on, the 2070 will add the cumulative counts from the detector to the serial data packets. The counts are preceded by a + sign to show that this is activated. The counts are 3 bytes in hex. An example would be:

00000000 0000+000014

This example shows that there are 20 (14 hex) counts since reset.

The counts are reset at turn on or after the reset button is pressed. The value will wrap around to 000000. This position is useful for calibration or for monitoring the actual total counts.

Interior LED

The interior LED is located on the circuit board. During normal operation it flashes on one second and off one second. It also shows the position of some of the programming switches.

LED	Status
Slow Flashing: On one second, off one second	Normal operation
On but winks off	Dipswitch 1 turned on
Off but winks on	Dipswitch 4 turned on
Rapid flashing	For a couple of seconds at turn on

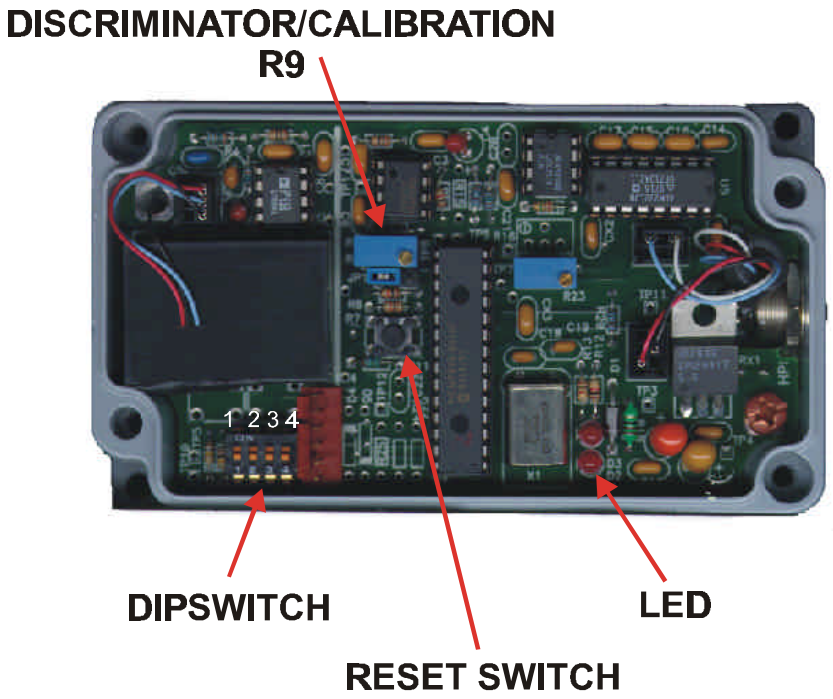


Figure 1 Interior view of module

VI. CALIBRATION

There are two trimmers on the circuit board. Trimmer marked R23 is used to adjust the analog output that is not used in this version. Trimmer R9 is the discriminator and it is adjusted until one count from the detector is equal to 1 uR.

Detector Calibration

1 Connect the 2070 cable to an external power supply (+12V) and to an external RS232 terminal or a computer with a terminal emulator program. The connections and serial setup are shown in the setup section.

2 With the external power supply turned on, the 2070 should show the sing-on message and begin to send out the serial data. Turn dipswitch #4 on. The serial data should now show the counts after the + sign.

3 Hit the reset pushbutton to reset the counts.

4 Expose the detector to 1000 mR/h for 1 minute. See figure 2 for location of detector.

5 Note the counts on the terminal (right hand value after the + sign). 1000 mR/h for 1 minute is 16.666 mR or 16,666 uR or 411A (hex). The display should show a value within +/- 10% of 411A (hex).

6 Adjust the trimmer R9 clockwise to increase the reading.

5. Turn dipswitch #4 to off when the adjustment is correct and to return to normal operation.

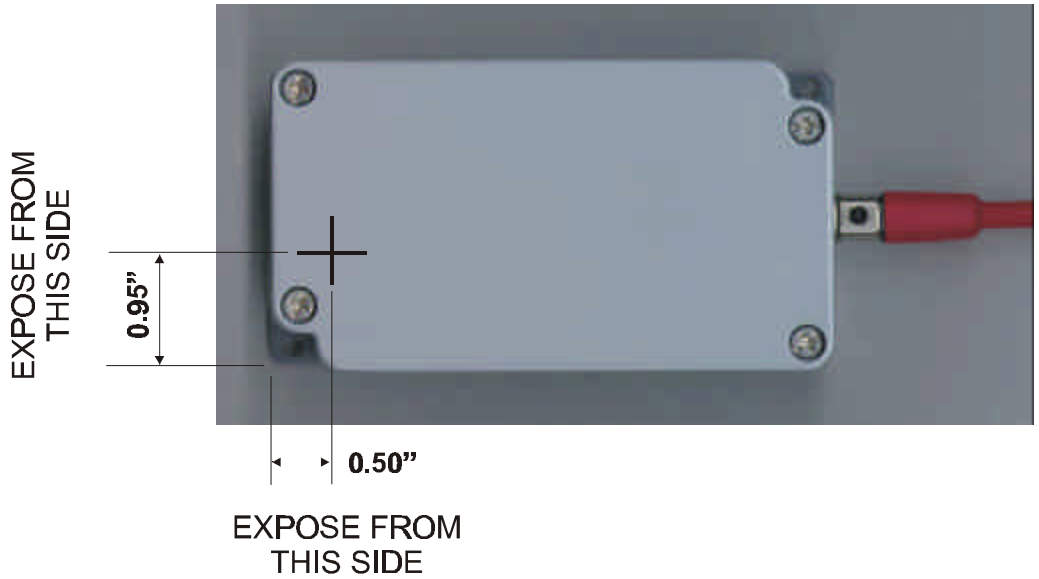


Figure 2 Detector location

VII. SPECIFICATIONS

All specifications are preliminary and subject to change.

Radiation

Sensitivity: 1 count/uR

Range: Background to 30 R/h

Detector: Pin Diode

Calibration: With Cs137

Response Time: 1 hr below 8.192 mR/h, 7.5 min above 8.192 mR/h

Mechanical

Size: 4.5 x 2.5 x 1.4

Weight: 10 oz

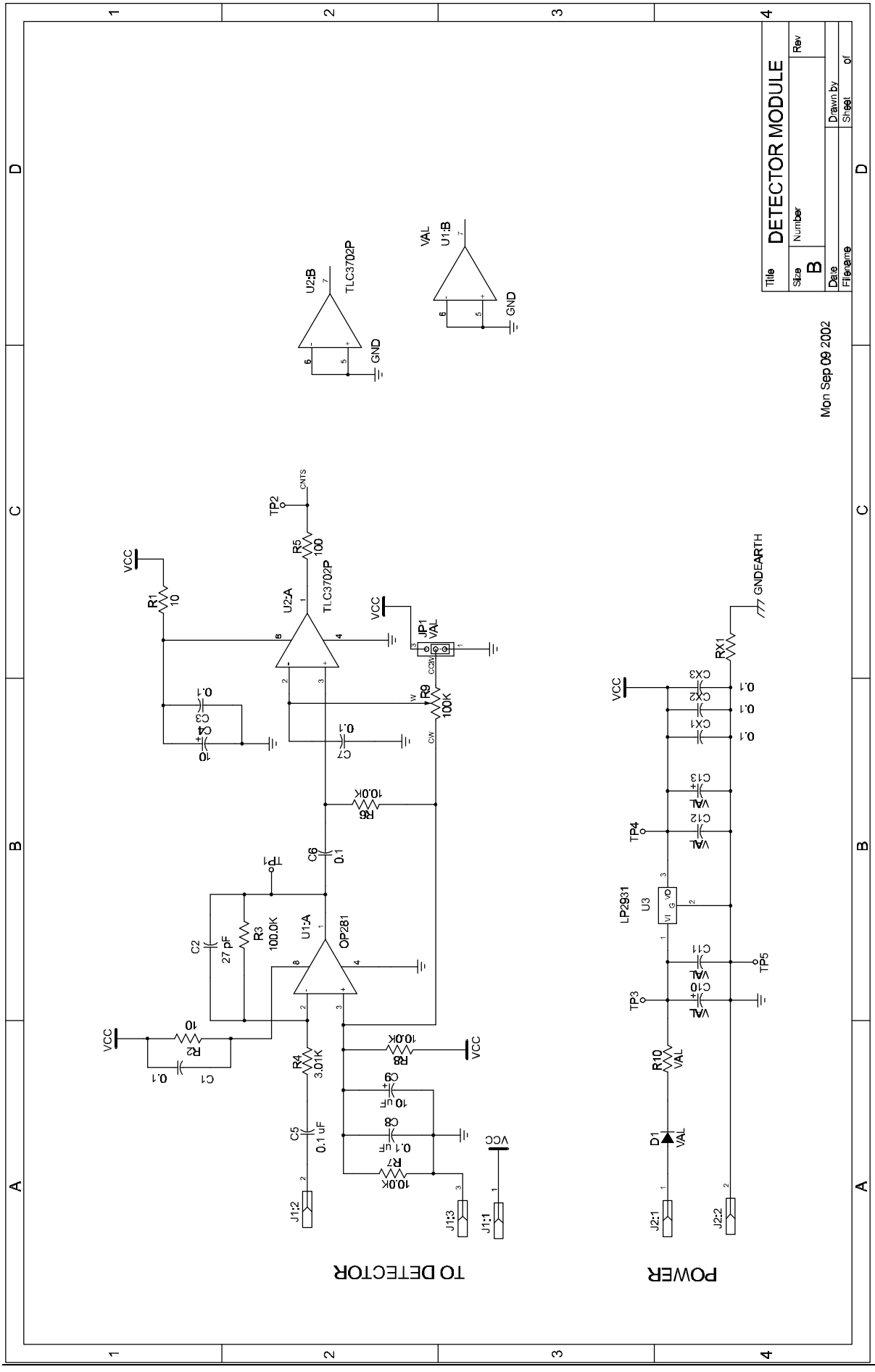
Material: Aluminum case with mounting holes

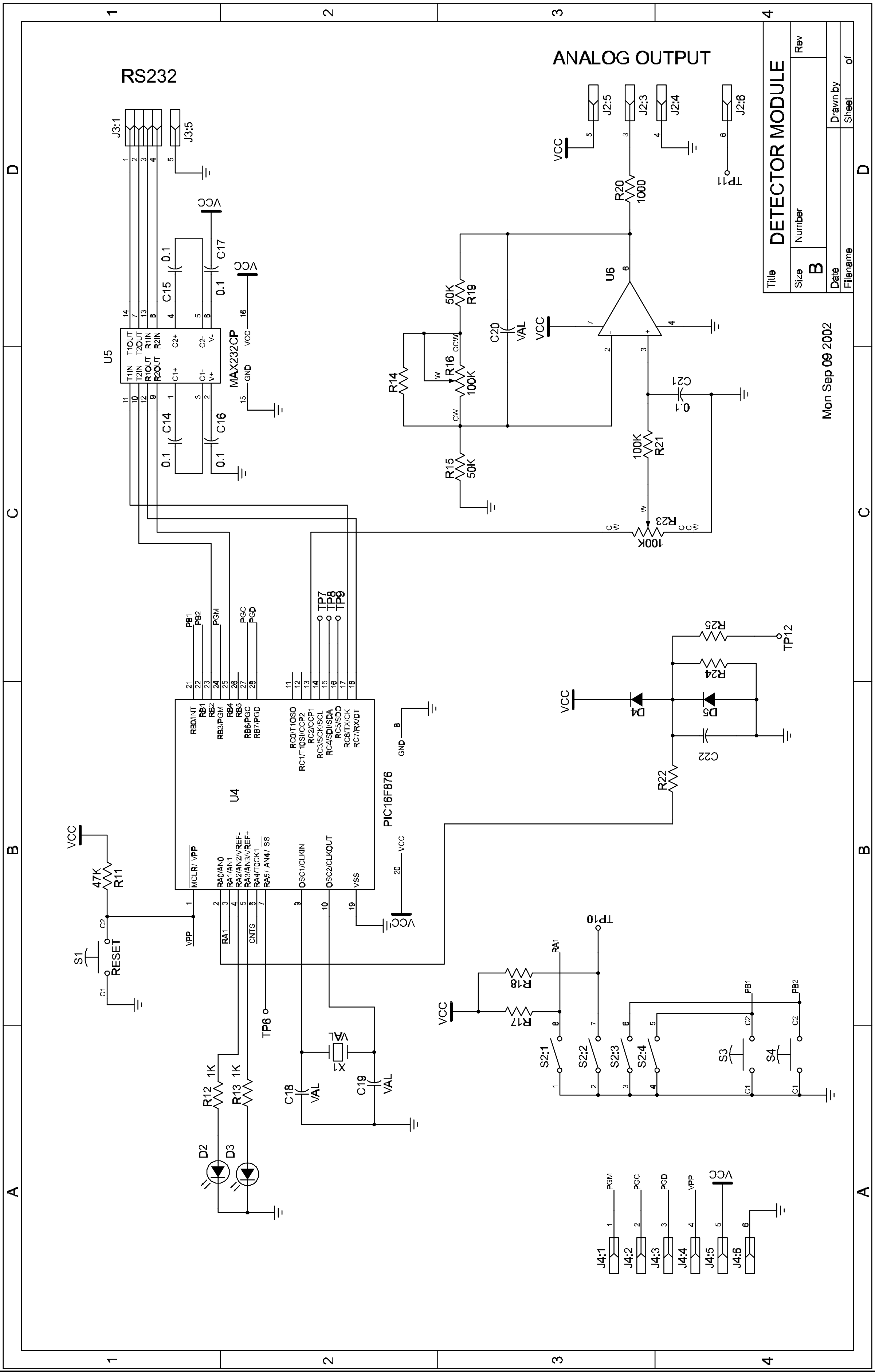
Electrical

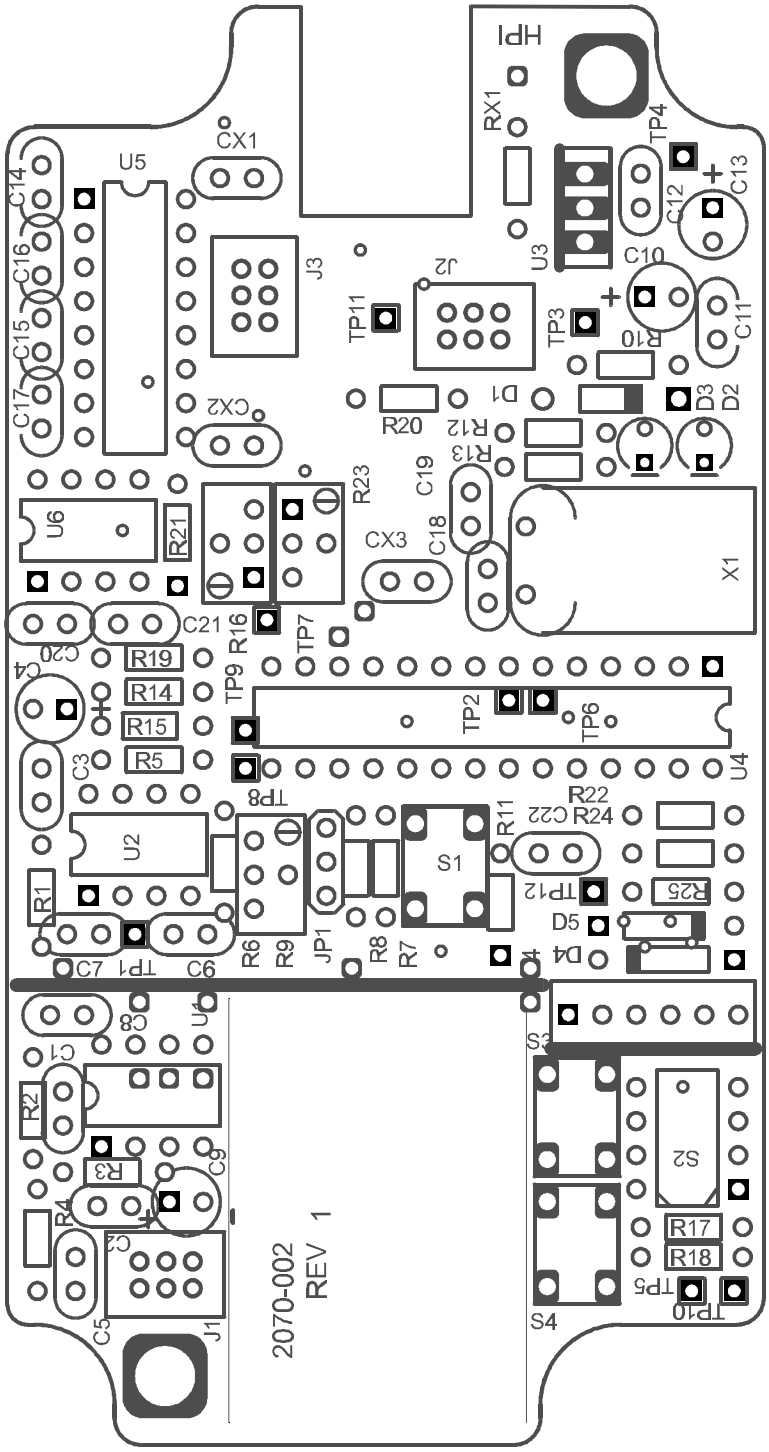
Power requirements: 8 to 12 VDC, 20 to 40 mA

Connector: 4 pin connector with ground, power, and RS232 TXD

Output: Serial RS232


DETECTOR MODULE
Title
Size
B
Number
Rev
Date
Drawn by
Filename
Sheet
of
Mon Sep 09 2002
U2:B
TLC3702P
GND
VAL
U1:B
GND
TP2
CNTS
R5
100
U2:A
TLC3702P
VCC
R1
10
JP1
VAL
R9
100K
C3
0.1
C4
10
C7
0.1
R6
10.0K
C6
0.1
TP1
U1:A
OP281
C2
27 pF
R3
100.0K
VCC
R2
10
C1
0.1
R4
3.01K
R8
10.0K
VCC
C9
10 uF
C8
0.1 uF
C5
0.1 uF
R7
10.0K
VCC
J1:2
J1:3
J1:1
TO DETECTOR
GNDEARTH
RX1
VCC
CX3
CX2
CX1
0.1
0.1
0.1
C13
VAL
C12
VAL
TP4
LP2931
U3
C11
VAL
TP5
C10
VAL
TP3
R10
VAL
D1
VAL
J2:1
J2:2
POWER


RS232
ANALOG OUTPUT
DETECTOR MODULE
Mon Sep 09 2002
MAX232CP
PIC16F876
RESET


HP1
RX1
TP4
CX1
U5
C14
C16
C15
C17
J3
J2
U3
C12
C13
C10
C11
TP11
TP3
R10
D1
D3
D2
CX2
R20
R12
R13
C19
R23
U6
R21
CX3
C18
X1
C21
C20
R16
TP7
R19
TP9
R14
TP2
TP6
R15
R5
C3
U4
TP8
R22
C22
R24
U2
R11
S1
TP12
R25
R1
D5
D4
C7
TP1
C6
R6
R9
JP1
R8
R7
C8
U1
S3
C1
R2
R3
C9
R4
C2
S2
R17
R18
TP5
TP10
C5
J1
2070-002
REV 1
S4