GENESYS™ 20 SPECTROPHOTOMETER

Thermo Spectronic

SERVICE
MANUAL

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NOTE

This service manual contains information, instructions, and specifications for the GENESYS™ 20 spectrophotometer that were believed accurate at the time this manual was written. However, as part of Thermo Spectronic's on-going program of product development, the specifications and operating instructions may be changed from time to time. Thermo Spectronic reserves the right to change such operating instructions and specifications. Under no circumstances shall Thermo Spectronic be obligated to notify purchasers of any future changes in either this or any other instructions or specifications relating to Thermo Spectronic products, nor shall Thermo Spectronic be liable in any way for its failure to notify purchasers of such changes.

FCC COMPLIANCE STATEMENT FOR U.S.A. USERS

This equipment generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with the reference guide, may cause interference to radio communications. It has been tested and found to comply with the limits in effect at the time of manufacture for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

NEW PRODUCT WARRANTY

Thermo Spectronic instrumentation and related accessories are warranted against defects in material and workmanship for a period of three (3) years from the date of delivery.

This warranty covers all parts and labor, and applies only to equipment which has been installed and operated in accordance with the operator's instruction manual and which has been serviced only by authorized Thermo Spectronic dealers or service personnel. This warranty does not apply to equipment and accessories that have been modified or tampered with in any way, misused, or damaged by accident, neglect, or conditions beyond Thermo Spectronic's control.

Thermo Spectronic is not responsible under this warranty for loss in operating performance due to environmental conditions.

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UPDATE POLICY

Thermo Spectronic may, from time to time, revise the performance of its products, and in doing so incur no obligation to furnish any such revisions to any Thermo Spectronic customer.

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Section 1
Description

The GENESYS™ 20 spectrophotometer is a bench-mount instrument that performs Absorbance, % Transmittance, and Concentration measurements within the wavelength range of 325 to 1100 nanometers. Its features include:

- Two-line, 20-character LCD display
- Tactile keyboard that clicks to indicate a key was pressed
- Optional cell holders available for a wide range of cuvettes, test tubes and longpath cells
- Optional internal printer
- Built-in RS232 interface
- Built-in Centronics Printer Port

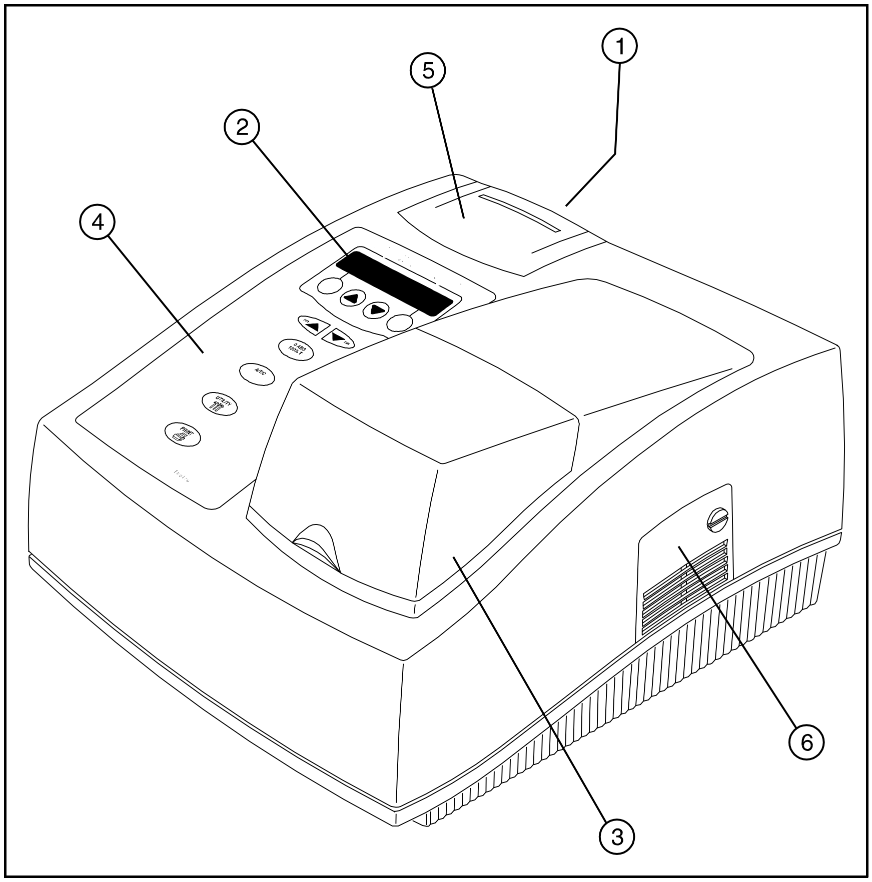


Figure 4-1 - GENESYS 20 Components

Figure 1.1 shows the main components of the instrument (indicated by the numerical call outs). These are as follows:

1. On/Off switch (on back)
2. LCD display
3. Sample compartment door
4. Keyboard
5. Optional built-in printer
6. Lamp compartment door

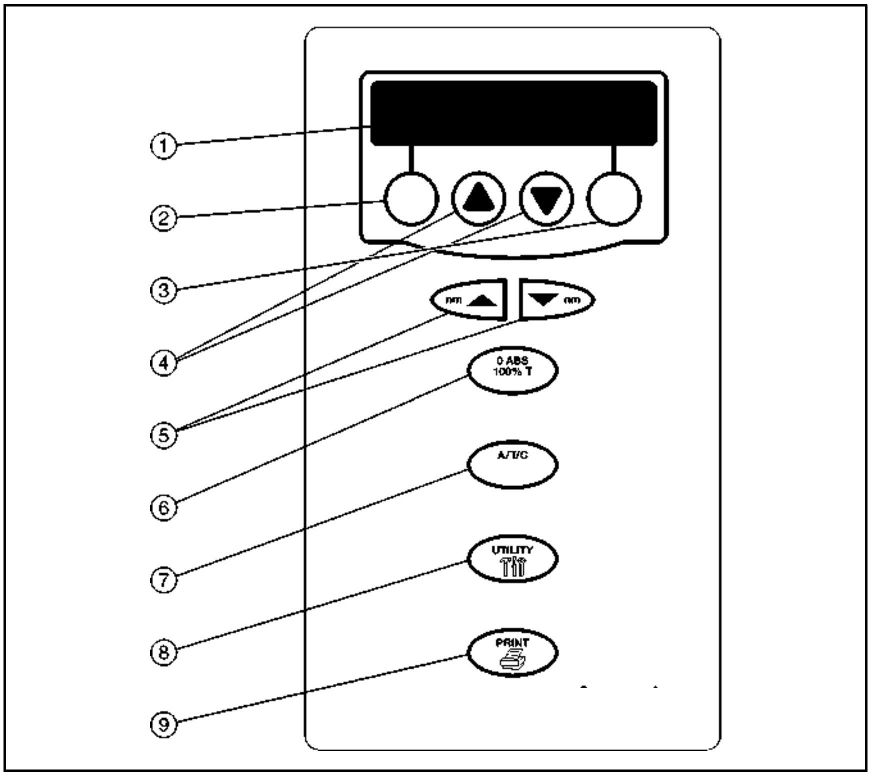


Figure 4-2 - Keyboard Layout

The main keyboard functions are shown in Figure 1.2 (indicated by the numerical call-outs). These are as follows:

1. Display - 20-character, 2-line LCD

2. Soft key 1 - Function varies depending on screen; generally Escape, Back Up, or Clear

3. Soft key 2 - Function varies depending on screen; generally Enter, Accept, or Continue

4. Scroll keys - Used to scroll through menus and enter numeric values

5. Wavelength controls - Increase and decrease the wavelength settings

6. 0 Abs/100%T - Automatically sets the instrument to zero absorbance (100%T)

7. A/T/C - Switches between absorbance, %transmittance, and concentration modes

8. Utility - Accesses instrument set-up, diagnostics, and other functions

9. Print - Sends currently displayed data to selected printer

Section 2
Specifications

Wavelength range	325 to 1100nm
Bandpass	≤8 mm
Stability	≤3 mA/hour drift
Stray light	≤0.1%T, when measured at 340 and 400nm
Wavelength repeatability	±0.5nm
Wavelength accuracy	±2.0nm
Noise (@ 500nm)	≤1 mA at 0A and 4 mA at 2A, peak-to-peak (15 seconds)
Photometric accuracy	
0.0 to 0.3 A	± 0.003 A
0.301 to 2.5 A	± 1.0%
Photometric range	0-125%T, -0.1-2.5A, 0-1999C
Light source lifetime	Visible: ~1000 hours
Grating	1200 lines/mm
Data output	• Two-line, 20-character LCD display • RS232C port • Centronics port
Dimensions	12 in. W x 13 in. D x 7 in. H [30 cm W x 33 cm D x 19 cm H]
Power requirements	Selected automatically; 100 to 240 Volts, 50 to 60 Hz

The GENESYS 20 spectrophotometer has been designed to operate under the environmental and electrical requirements listed below.

Line voltages	100 - 240V ± 10% 50 - 60 Hz ± 10%

Operating environment

The instrument meets the previous specifications when operated under the following conditions, after a 30-minute warm-up period.

Ambient temperature	Relative humidity
50°F to 75°F (15°C to 24°C)	20% to 80%
76°F to 85°F (25°C to 29°C)	20% to 70%
86°F to 95°F (30°C to 35°C)	20% to 60%
96°F to 105°F (36°C to 40°C)	20% to 50%

Storage environment	-40°F to 140°F [-40°C to 60°C] Relative humidity not to exceed 60%. Allow instrument to adjust to room temperature for 24 hours after taking it out of storage. Temperature should be maintained at ±4°F [±2°C]. Relative humidity should be maintained to ±5%.
Altitude	From below sea level to 6562 feet [2000 meters].

For indoor use only

Installation Category II

Pollution Degree 2

Section 3
Installation and Performance Checks

The following performance checklist can be copied, completed, and a copy left with the end-user. The checklist should be used anytime an instrument is tested, or repaired.

Thermo Spectronic
Field Inspection / Performance Checklist
GENESYS 20

Customer________________________ Contact_________________________
Phone #_________________________ S/N_____________________________
Cat #_____________ Man #_______ Date_______
SPECTRONIC Standards Kit, Certified Kit # ________________

I Initial inspection -

1 Appearance . . . . Good___ Fair___ Poor___
2 Line voltage . . . . _____VAC
3 Ground Continuity (< 1 ohm) . . . . _____ OK
4 Revision Level (Firmware) . . . . ________
5 CURRENT REVISION . . . . ________

II Subsystem and Voltage checks -

1 Power up sequence . . . . Pass___ Fail ___
2 Voltages: +5v ___ ± 0.1v +12v ____ ± 0.6v -12v ____ ± 0.6v
3 Lamp Voltage 5.7v to 6.1v ________ v
4 Light centered on entrance slit . . . . _____ OK
5 Check Image at Detector . . . . _____ OK
6 SPECTRONIC Wavelength std (+/- 5.0nm) . . . . _____ OK
7 Photometric Accuracy (10% T & 50% T) ....
   a 10% T filter value ± 2.0% T . . . . _____ OK
   b 50% T filter value ± 2.0% T . . . . _____ OK
8 SRE
   a 340nm (≤ 0.4% T) ..... _____ OK
   b 400nm (≤ 0.4% T) . . . . _____ OK
9 Keyboard Tests . . . . _____ OK
10 Display Tests . . . . _____ OK
11 Beeper Volume . . . . _____ OK

III Comments -

____

____

____

FSE signature ____________________________________ Date__/__/__

Section 4
Troubleshooting

This section is designed to guide the service technician through basic procedures to be used in determining the cause of various machine errors. Diagnostic techniques do not take the technician beyond board-level analysis. If an error exists on a particular circuit board, replace the entire board.

4.1 Error Messages

A number of error messages are generated by the spectrophotometer to indicate improper operations. These are displayed for the operator (and explained in the *GENESYS 20 Operator's Manual*) and can normally be resolved without further troubleshooting. They are included here for the convenience of the Service Technician.

The instrument generates two types of errors. With the first type, a warning signal is generated and the error message displays briefly, but the instrument is still functional. With the second type of error, the error message remains and the instrument is not functional until the condition is resolved.

Flashing Data Display Indicates the sample has an absorbance or transmittance value below or above the photometric range of the instrument. The display flashes until the condition is resolved.

Lamp Failure Indicates the lamp has failed. The message remains on the display until the lamp is replaced.

Sample too dark Indicates the instrument has been asked to zero a sample with a high absorbance at a low energy point. The instrument beeps three times to announce the message, the message remains on the display for two seconds, then the normal display returns.

Sample too bright Indicates the instrument has been asked to zero a sample while the door of the sample compartment is open. The instrument beeps three times to announce the message, the message remains on the display for two seconds, then the normal display returns.

Key not active

Indicates a non-functional key was pressed. For example, this message would appear if **[A/T/C]** is pressed when viewing the Utility menu. The instrument beeps three times to announce the message, the message remains on the display for two seconds, then the normal display returns.

4.2 General Troubleshooting Items

1. Nothing Works (No lights, no fan)

Check:

a. Instrument is plugged in and there is power to the outlet.

b. Line cord is good.

c. Open fuse. This unit has two fuses. Both fuses must be good.

d. Check for a defective power switch.

e. Check primary power connection from switch to power supply.

f. Disconnect power supply from main board and check voltages (Ground is P3-4,5): +5V at P3-2,3; +12V at P3-1; -12V at P3-6. Turn off power and reconnect to main board. Determine if main board is loading the power supply.

g. Check fuse on power supply PC board. There is a single fuse on the PC board. Test the fuse for continuity. This fuse is an F2A, 250v. In case of failure the power supply must be returned to a Power-One Authorized Service Center.

2. Main board.

Check:

a. All cables assemblies connected.

b. +5v at J9-2, or C21+ (Ground is J9-5, 6 or C21-)

c. +12v at J9-1, or C22+

d. -12v at J9-7, or C24-

e. +8v at U30-1, or C27+

f. -8v at U29-2, or C26-

g. +5vA (Analog) at U28-1, or C23+

3. Detector board.

Check:

a. +5vA at J1-1, or C7+ (Ground at J1-7 or C7-)

b. at J1-2

c. Check output signal at J1-3. Should be -8v with room light on detector; 0v with detector dark.

4. Mono Drive board.

Check:

a. +5v at J3-3, or C6+ (Ground at J3-5)

b. +12v at J3-6 (Ground at J3-7)

c. -12v at J3-8 (Ground at J3-7)

d. +VMot at J3-1 (Ground at J3-2) (+VMot equals +5v)

5. Normal power up sequence:

a. Instrument beeps once. Display shows **"SPEC 20 Genesys"** on the top line; and **"Soft Rev. = x.xx"** on the second line.

b. The lamp turns on dimly (low voltage setting). The monochromator begins to move to the limit switch.

c. The limit switch closes. The mono drive reverses to open the switch again.

d. The lamp turns on to the normal power level (6.0 volts). The monochromator moves to a position approximately half way between the hard stops. A good way to view this is to look at the sector gear on the bottom of the instrument.

e. The second line of the display changes to **"Filter Wheel Init"**. The filter wheel starts moving. The filter wheel first finds the large opening (O54 filter). It then scans to find the dark edge of that filter position.

f. The second line of the display changes to **"Monochromator Init"**. The monochromator begins to scan for the zero order peak.

g. After the monochromator initializes, the unit goes to 546nm (or the user-designated power-on wavelength).

h. An auto zero is performed at the current wavelength.

6. Service Tools:

a. H-152378 - Cuvette target

b. H-152619 - Grating target

c. H-152621 - Detector target

The following tools are used on the production line and should **NOT** be used in the field:

d. H-152620 - Turning mirror target tool

e. H-152622 - Grating hold down fixture

f. H-152623 - Grating zero order alignment tool

g. H-152625 - Grating mount tool

h. H-152626 - Filter motor pinion spacer

i. H-152627 - Grating motor pinion spacer

j. H-152630 - Optical stop alignment tool

k. H-152632 - Wavelength calibration tool

l. H-152634 - Main mirror cementing tool

7. Common Problems and Probable Cause

The following is a list of problems which may be encountered in servicing the GENESYS 20. The symptom is described in the left hand column. A suggested action is listed in the right hand column. Items in quotes "" are actual display texts.

Symptom:	Possible Cause:
No Display	1. Display cable is not connected to Main Board.
	2. Contrast adjustment pot is not turned fully counter clockwise.
	3. Display cable offset on header. (Pin 1 not aligned with pin 1 of the header.)
	4. Display is defective. Replace.
Limit switch error	1. Wires connecting limit switch to main board are not connected (check both ends of wire assembly).
	2. Sector gear is not moving, therefore not closing limit switch.
	3. Limit switch is defective. Check continuity of switch with an ohm meter.
A/D Error	1. Hardware failure. Replace main board.
Continuous Beep	This can occur when lines on the microprocessor data bus are held either high or low.
	1. Unplug Mono drive board data cable (J16). Power up main board with J16 not connected. If beeping stops, there is a short in the mono drive board, or the data cable (J16).

	2.	Check keyboard and display cables. Make sure they are properly plugged on (not offset by 1 pin).
	3.	Hardware failure. Replace main board.
Light not green at 550nm	This is a gross wavelength error. The light beam in the sample compartment should be green at 550nm, red at 600nm, and blue at 450nm.	
	1.	Try reloading the wavelength calibration file into the EEPROM (U4). Use the wavelength table transfer program. If problem persists, replace the EEPROM (U4), and use the wavelength table transfer program to download the calibration table.
"Bad Utility Checksum"	1.	The sum check for the utility area was invalid. This problem is self correcting. The default values are written to this area immediately after this error occurs.
	2.	EEPROM socket failure. The EEPROM may not be contacting the socket properly. Either replace the EEPROM, socket or the entire main board.
	3.	Hardware failure. Replace main board.
"Filter Whl Init Fail"	Filter wheel initialization error. The second display line may read **"Dark Edge Not Found"**, or **"Insufficient Energy"**, or **"O54 Not Found"**. This error can occur whenever the signal is prevented from getting through the filter wheel and to the detector.	

	1.	Check lamp alignment. The lamp may not be aligned to the entrance slit. Turn the lamp adjustment cam 1/8 of a turn and power up again. Repeat this until lamp cam has been rotated for one full turn.
	2.	Filter wheel, or detector board, or mono motor cable not connected to main board.
	3.	A sample was left in the sample compartment and is blocking the light beam. Remove sample and restart.
	4.	Filter wheel motor is defective. Replace filter wheel assembly.
	5.	Detector assembly is defective. Replace.
	6.	Make sure filter and mono motor wires do not interfere with the filter wheel.
"Gain Oscillating"	1.	This occurs when the instrument is unable to set the proper gain during an auto zero. The most probable cause is a resistor error on the detector board. Replace the detector board.
"Hardware Failure 13"	1.	Same as **"Sample too bright"**.
	2.	Also may be caused by excessive dark offset due to detector board contamination. Replace detector board assembly.
"Hardware Failure 15"	1.	Same as **"Sample too bright"**.

"Invalid Wv Table"

1. The stored wavelength calibration table has been lost. Replace it by using the wavelength table transfer program. The wavelength calibration information is available from the Rochester, NY facility. The table is identified by the instrument serial number. See section 8 below.

2. EEPROM socket failure. The EEPROM may not be contacting the socket properly. Either replace the socket, or the entire main board.

3. Hardware failure. Replace main board.

"Invalid uStep Table"

1. The stored micro step table has been lost. Replace it by using the wavelength table transfer program.

2. EEPROM socket failure. The EEPROM may not be contacting the socket properly. Either replace the socket of the entire main board.

3. Hardware failure. Replace main board.

"Lamp Failure"

1. The tungsten lamp has burned out. Replace it.

2. Hardware failure. Replace main board.

3. Make sure that the lamp is plugged into the main board at connector J8.

"Mono Init Failure"

This occurs when there is not enough energy at the detector to detect a zero order peak.

1. Detector, or mono motor cable not connected to main board.

2. Detector assembly is defective. Replace.

	3.	The mono motor is defective. Do not replace mono motor. Replace instrument.
"RAM Failure"	1.	The RAM is internal to the microprocessor. Therefore, either replace the 80C251 chip or the entire main board. Please note the second line of the display and return the chip to the factory.
"ROM Failure"	1.	Improper EPROM (U3) installed. Replace EPROM.
	2.	Hardware failure. Replace main board.
"Sample too bright"	1.	Check if sample compartment door is open or ajar.
	2.	Hardware failure. Check main board, detector board, and monochromator position (green light at 550nm). (See **Update Information** section of manual)
"Sample too dark"	1.	Check if sample path is blocked.
	2.	Hardware failure. Check main board, detector board, and monochromator position (green light at 550nm).

8. Detailed Instructions for Loading Wavelength Table

PROBLEM: Default Wavelength (WL) Calibration Table is being used instead of calibration specific to the instrument.
During manufacture, a wavelength (WL) calibration is performed on the 20 GENESYS. A WL calibration table, specific to the particular instrument is then stored into memory. If this customized WL calibration table is lost, then the system uses a default WL calibration table stored in ROM memory. This default table is fairly accurate for the majority of 20 GENESYS instruments, however, it is not the specific WL calibration table for the instrument and may result in a wavelength accuracy error outside the stated +/- 2 nm tolerance.

SYMPTOM/CAUSE:

At instrument turn-on, the following message appears on the display:

INVALID WL TABLE
"LOADING DEFAULT WL TABLE"

In a normal operating unit, the display will show:

SPEC 20 GENESYS

Followed by the firmware revision level, filter wheel init, mono init etc.

Loss of memory on the internal EEPROM may have been caused by a loose EEPROM chip.

SOLUTION:

I. Before loading the Wavelength Calibration Tables into the GENESYS 20 instrument, please perform the following steps, which in some cases may remedy the problem:

- Ensure that the power is shut off and the ac power cord is disconnected from the rear of the GENESYS 20 instrument.

- Lift the small cover (rear of the display) to gain access to the EEPROM (U3); some instruments have the printer installed in this location.

- The EEPROM is located in the middle of the opening when looking down onto the main circuit board; U3 socket location. If the EEPROM socket has a small lever, pull it up to release locking tension on the EEPROM pins. Reseat the EEPROM by lightly pushing down on it. Once it is seated, push the socket lever back down to lock the EEPROM in place. If the EEPROM socket does not have the lever, lightly push down on the EEPROM.

- Put the cover or printer assembly back in place, plug in the ac power cord and power on the instrument to see if the problem has been resolved. If the problem still exists, power off the instrument and continue with the following detailed procedure.

II. OBTAIN THE WL CALIBRATION FILE FOR THE INSTRUMENT

The WL calibration files are maintained in the manufacturing facility in Rochester, NY, USA. Contact the Technical Support Department using the Phone, FAX, or e-mail addresses which appear elsewhere within this manual. The file can be sent on 3.5 " floppy disc or through e-mail.

A PC with a serial port and data cable available from which the data can be downloaded to the GENESYS 20 is required. The GENESYS 20 uses a 9-pin DCE protocol communications port. This means that a "straight through" cable is required to communicate with most computers.

Technical Support will need the following information:

A Contact person's name
Catalog number AND **Serial number** of the defective instrument
Phone / FAX number

AND

Shipping Address
OR
e-mail address

III. LOADING THE GENESYS 20 WAVELENGTH CALIBRATION TABLE

1. Install the interface cable between the male 9 pin connector on the GENESYS 20 and the computer's Com 1 port using a female 9 pin to female 9 pin straight cable (336042) or a female 9 to female 25 pin cable (336041).

2. Power on the GENESYS 20 and the computer.

3. Ensure the RS232 setup on the GENESYS 20 is set up correctly by following these steps:

   a. Press the Utility key.
   b. Use the down arrow key until you see the RS232 Setup option on the display. To change any of the settings of the RS232 setup, press CHANGE, then use the up or down arrow keys until you get the correct setting and then press ACCEPT.
   c. Set Baud Rate for 9600
   d. Set Data Bits for 8
   e. Set Parity for None
   f. Set Stop Bits for 1
   g. Set Handshake for CTS/RTS
   h. Set Terminator for CR+LF
   I. Press the ESC key to go back to the normal menu

4. On the computer, go to the DOS prompt.

5. If you were mailed the floppy diskette with the MONOTAB.EXE file and your serial number file, insert the floppy diskette into the A drive and change the directory to the A drive by pressing A: and press the ENTER key. Type the command DIR to read the files on the floppy diskette. You should see the two files that you need, MONOTAB.EXE and your serial number file (e.g. 3SG91010.20W) If you were E-Mailed the files or received the files over the Internet, save the files to your hard drive (Normally the C drive) and run the files from there.

6. Type the following: MONOTAB 1

7. You should then see the following menu on the computer:

0. Quit	
1. Load all monochromator tables	(Loads the table from the floppy or hard drive to the GENESYS 20)
2. Load micro step table only	(Loads only the micro step table to the GENESYS 20)
3. Load wavelength table only	(Loads only the wavelength table to the GENESYS 20)
4. Query monochromator table	(Reads all of the monochromator tables and creates a file on the floppy or hard drive, depending on where you are running the MONOTAB.EXE file from.)

8. Press 1, then ENTER to 'load all monochromator tables' to the GENESYS 20.

9. If there are no communication problems, you will be prompted to enter the filename (serial number file of the instrument; i.e. 3SG91010.20W). Then press the ENTER key on the computer keyboard. The file will be loaded into the GENESYS 20 at this time.

10. If you did not get the prompt to enter the serial number file, then there are communication problems. Check the following:

    a. The RS232 cable is securely fastened to the GENESYS 20 and the computer.
    b. The RS232 cable is connected to the Com 1 port on the computer.
    c. The RS232 setup on the GENESYS 20 is set up as detailed in step 3 above.

11. If the file was loaded correctly, turn the instrument off and back on again. The wavelength tables should be loaded properly and the instrument should operate normally.

Section 5
Routine Maintenance

NOTE

To clean the instrument, gently wipe the outside of the instrument with a soft cloth to remove any dust or spills. Water, isopropyl alcohol and other common laboratory cleaning agents may be used if necessary.

⚠ WARNING

HIGH VOLTAGES EXIST INSIDE THE CABINET ANY TIME THE POWER CORD IS PLUGGED INTO A LIVE RECEPTACLE, AND THE POWER SWITCH IS TURNED ON. ALWAYS TURN OFF THE POWER SWITCH AND UNPLUG THE LINE CORD FROM THE RECEPTACLE BEFORE ACCESSING THE INTERIOR OF THE SPECTROPHOTOMETER. FAILURE TO OBSERVE THIS WARNING MAY RESULT IN SERIOUS BURNS, INTERRUPTION OF HEART RHYTHM, DISRUPTION OF THE NERVOUS SYSTEM, OR DEATH.

5.1 Lamp Replacement

⚠ WARNING

THE LAMP GETS VERY HOT DURING OPERATION. BEFORE REMOVING THE LAMP, TURN OFF THE INSTRUMENT AND ALLOW THE LAMP TO COOL DOWN FOR 10 MINUTES. FAILURE TO HEED THIS WARNING MAY RESULT IN BURNS.

1. Turn off and unplug the instrument.

2. Allow the lamp to cool for at least 10 minutes.

CAUTION

WHEN REMOVING THE LAMP BRACKET AND LAMP ASSEMBLY TO CHANGE THE LAMP, THE LAMP CABLE REMAINS CONNECTED TO THE MAIN CIRCUIT BOARD INSIDE THE INSTRUMENT. USE CARE NOT TO PULL TOO HARD ON THE ASSEMBLY OR THE CABLE MAY BE DAMAGED.

3. Use a coin or large screwdriver to loosen the quarter-turn fastener on the door of the lamp compartment. Pull up on the door and lift to remove it.

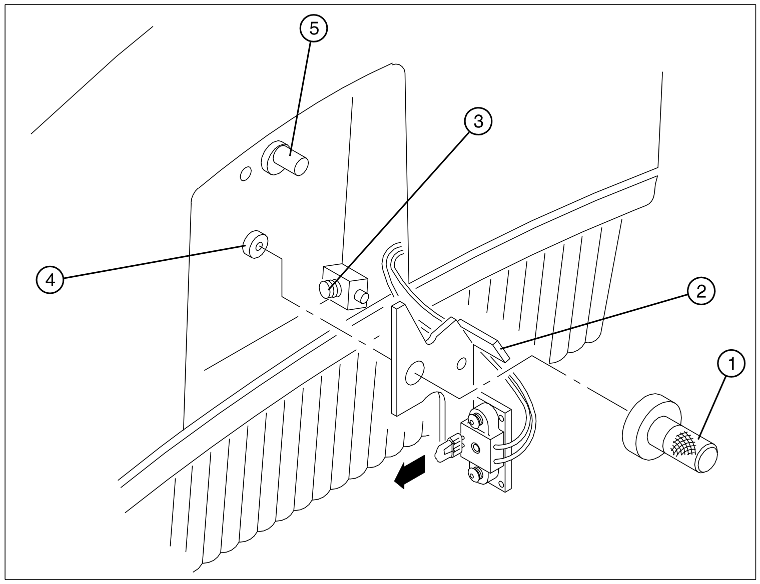


Figure 5.1 - Lamp Compartment

4. Loosen and remove the thumbscrew (refer to Figure 5.1, [Item #1]).

5. Carefully pull the tab at the top of the lamp holder assembly [Item #2] to lift the assembly out of the instrument.

6. Pull the lamp straight out to remove it from its socket as shown by the arrow Figure 5.1.

7. Use a soft, lint-free cloth to hold the new lamp. DO NOT TOUCH THE LAMP WITH YOUR FINGERS!

8. Align the two legs protruding from the clean, new lamp with the two holes in the socket and press the lamp securely into the socket (the legs should fit snugly in the holes).

9. Position the lamp holder assembly, pressing the spring (Item #3) on the right and aligning the pin (Item #4) with the hole in the assembly.

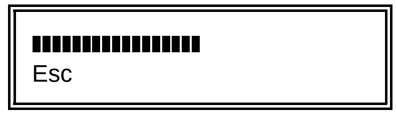
10. Gently slide the assembly into place and replace the thumbscrew.

11. Plug the instrument into an appropriate wall outlet and turn on the power.

12. Press **[Utility]** to access the utility functions, after initialization.

13. Press **[▼]** until **Lamp Alignment** appears on the display.

14. Press **[Align]** to display an energy graph as shown below.



15. Use a slotted screwdriver to adjust the alignment screw [Item #5] until the graph displays its maximum value.

16. Press **[Esc]** twice to return to the standard display.

17. If desired, reset the hours of lamp operation to zero (refer to the *GENESYS 20 Operator's Manual*).

18. Replace the door of the lamp compartment and allow the lamp to warm up for at least 30 minutes.

5.2 Replace Fuse

NOTE

The instrument fuse must be replaced with the same type and rating fuse. Use IEC standard 5x20mm, Type F fuse, 2.5A, 250VAC, 1500A interrupt rating [Littlefuse #216025].

NOTE

The fuse is located in the power entry module on the back of the instrument.

CAUTION

IF THE FUSE FAILS REPEATEDLY, IT MAY INDICATE A SERIOUS PROBLEM WITH THE INSTRUMENT.

1. Turn off and unplug the instrument.
2. Position the instrument to access the power entry module on the back of the instrument.
3. Remove the power cord.
4. Insert a very small flat-blade screwdriver into the notch on the fuse cover and pry off the cover as shown in Figure 5.2.

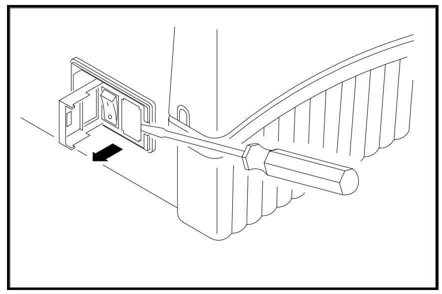


Figure 5.2
Removing Fuse Cover

5. Use the screwdriver to remove the fuse holder to access the fuses as shown in Figure 5.3.

6. Unsnap both fuses to remove them (refer to Figure 5.3, [Item #1]).

7. Insert the new fuses, pushing them in so they snap into place.

8. Replace the fuse cover.

9. Replace the power cord.

10. Plug the instrument back into the appropriate wall outlet and turn on the power.

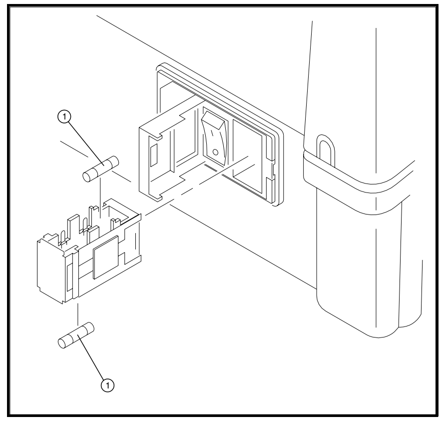


Figure 5.3
Remove and Replace Fuses

Section 6
Optical Description

The monochrometer configuration in the GENESYS 20 uses a modified single mirror Czerny-Turner mounting technique. A schematic of the monochromator layout is shown in Figure 6.1.

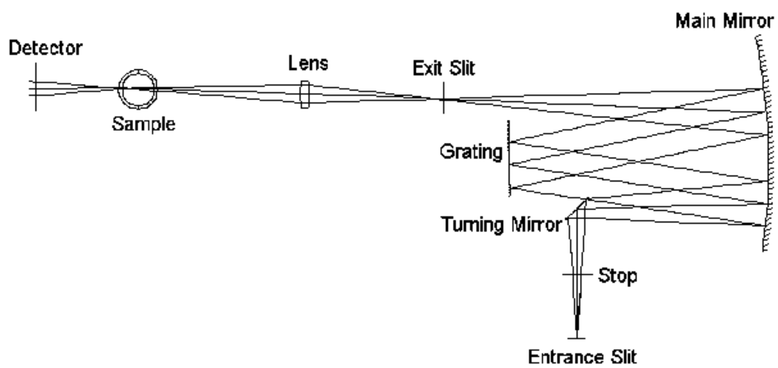


Figure 6.1 - Optical Path

Lamp:	The Tungsten-Halogen lamp provides continuous energy output. There is no illumination optics between the lamp and the entrance slit. Instead, the lamp is mounted very close to the entrance slit.
Stop:	An optical stop reduces the amount of stray light in the instrument.
Turning Mirror:	The turning mirror directs the diverging beam to the main mirror.
Main Mirror:	The main mirror converts the diverging beam to parallel light and directs it to the grating.
Grating:	The planar grating, whose orientation is controlled by a micro-stepping motor, sends a horizontally dispersed spectrum of collimated light back to the main mirror.
Main Mirror:	The beam hits the main mirror a second time and is focused onto the exit slit.

Lens:	The lens brings the beam leaving the exit slit to a focus at the center of the sample location.
Detector:	The light is transmitted through the sample and lands on the detector. The detector is angled to prevent light reflection back into the sample compartment area.

Section 7
Optical Alignment

WARNING

HIGH VOLTAGES EXIST INSIDE THE CABINET ANY TIME THE POWER CORD IS PLUGGED INTO A LIVE RECEPTACLE, AND THE POWER SWITCH IS TURNED ON. THE POWER SWITCH SHOULD ALWAYS BE TURNED OFF AND THE LINE CORD UNPLUGGED FROM THE RECEPTACLE BEFORE ACCESSING THE INTERIOR OF THE SPECTROPHOTOMETER. HOWEVER, THE FILTER WHEEL ALIGNMENT PROCEDURE REQUIRES THE OPERATOR TO HAVE POWER TURNED ON WHILE ACCESSING THE INTERIOR OF THE CABINET. THEREFORE, IT IS VERY IMPORTANT THAT ONLY TRAINED TECHNICIANS, AWARE OF THE DANGERS AND PROPER SAFETY PRECAUTIONS, PERFORM THIS ALIGNMENT PROCEDURE. ALWAYS EXERCISE EXTREME CARE AND BE AWARE THAT LIVE POWER EXISTS AT VARIOUS POINTS ON THE INTERNAL COMPONENTS. FAILURE TO OBSERVE THIS WARNING MAY RESULT IN SERIOUS BURNS, INTERRUPTION OF HEART RHYTHM, DISRUPTION OF THE NERVOUS SYSTEM, OR DEATH.

WARNING

WHEN IN OPERATION, CERTAIN INTERNAL COMPONENTS, SUCH AS THE LAMP AND THE HEAT SINK ON THE MAIN CIRCUIT BOARD, BECOME HOT. AVOID TOUCHING THESE AREAS. FAILURE TO OBSERVE THIS WARNING MAY RESULT IN BURNS.

CAUTION

CIRCUIT BOARDS AND OTHER ELECTRONIC COMPONENTS ARE SUBJECT TO DAMAGE FROM ELECTROSTATIC DISCHARGE. TO PREVENT SUCH DAMAGE, USE A WRIST OR HEEL GROUNDING STRAP. GROUND TOOLS THROUGH A CONDUCTIVE MAT BEFORE TOUCHING ANY POTENTIALLY STATIC-SENSITIVE ASSEMBLIES OR DEVICES. WHEN HANDLING PRINTED CIRCUIT BOARDS OR OTHER ELECTRONIC ASSEMBLIES, HOLD THE BOARD BY ITS EDGES TO AVOID TOUCHING CIRCUIT TRACES OR DEVICES WITH BARE HANDS OR FINGERS.

CAUTION

MOST ASSEMBLIES ARE MOUNTED TO THE PLASTIC HOUSING WITH THREAD-FORMING SCREWS. ALWAYS BE CAREFUL TO NOT OVER TIGHTEN THESE SCREWS OR THEY WILL STRIP OUT THE HOLE. THIS WILL IMPAIR THE ABILITY OF THE SCREW TO PROPERLY SECURE THE ASSEMBLY.

7.1 Filter And Lens Assembly Alignment

Most of the optical components of the GENESYS 20 Spectrophotometer are fixed at the factory and are not field adjustable. The filter and lens assembly is the one component which may require field alignment. This alignment should be checked each time the unit is serviced. It must be aligned if found to be improper. It must also be aligned if the filter wheel assembly is replaced. (Refer to "Section 9 - Disassembly and Replacement" for instructions on replacing the filter and lens assembly.)

7.1.1 Alignment Tool

Alignment of the filter and lens assembly requires an alignment tool. Spectronic instruments has a commercially available alignment tool (part number H-152378). However, an alignment tool can also be easily fabricated for use in the alignment procedure. To fabricate the alignment tool:

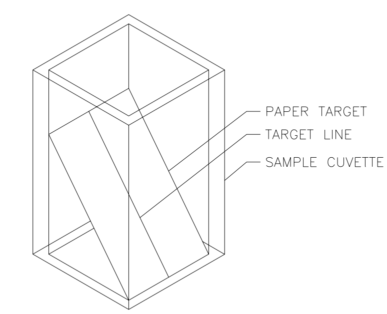


Figure 7.1
Fabricated Alignment Tool

1. Cut out a piece of paper 10 mm wide by approximately 20mm long.

2. Draw a thin, dark line exactly down the center of the paper.

3. Place the paper into a sample cuvette so it slants diagonally from front to back across the cuvette.

7.1.2 Alignment Check

1. Remove the power cord from the instrument.

2. Remove the cover assembly (refer to "Section 9 - Disassembly and Replacement").

3. Disconnect the filter wheel motor cable from the main circuit board.

4. Replace the cover assembly (refer to "Section 9 - Disassembly and Replacement").

5. Open the sample cover door and leave open through the procedure.

6. Place the alignment tool in the sample holder so the vertical alignment line is facing the filter and lens assembly.

7. Insert the power cord and turn on power to the assembly.

8. Look straight down into the sample cuvette and observe the position of the visible red dot relative to the vertical center line. If the red dot is centered on the line, the filter and lens assembly alignment is correct. If the red dot is not centered, proceed with the alignment procedure.

7.1.3 Alignment Procedure

1. Remove the power cord from the instrument.

2. Remove the cover assembly, rear panel, main circuit board, and monochromator cover (refer to "Section 9 - Disassembly and Replacement").

3. Slightly loosen the screw securing the filter and lens assembly. The assembly must not be loose enough to rock, or loose position but it must be moveable.

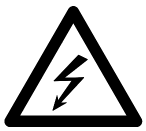
4. Connect the cables for the power supply, limit switch, monochromator motor, and lamp to the main circuit board. Do not connect the cable for the filter wheel motor. (The detector cable can be connected but it is not necessary.)

5. Without putting the monochromator cover back on, set the main circuit board in position on top of the lugs. Make sure the filter and lens assembly is not covered and that there is access to the attachment screw.

CAUTION

MAKE SURE THE MAIN CIRCUIT BOARD DOES NOT TOUCH ANY METAL WHICH MIGHT SHORT CIRCUIT SOMETHING ON THE BOTTOM OF THE BOARD. FAILURE TO OBSERVE THIS CAUTION MAY RESULT IN DAMAGE TO THE MAIN CIRCUIT BOARD.

6. Place the alignment tool in the sample holder so the vertical alignment line is facing the filter and lens assembly.



WARNING

THE FILTER WHEEL ALIGNMENT PROCEDURE REQUIRES THE OPERATOR TO HAVE POWER TURNED ON WHILE ACCESSING THE INTERIOR OF THE CABINET. THEREFORE, IT IS VERY IMPORTANT THAT ONLY TRAINED TECHNICIANS, AWARE OF THE DANGERS AND PROPER SAFETY PRECAUTIONS, PERFORM THIS ALIGNMENT PROCEDURE. ALWAYS EXERCISE EXTREME CARE AND BE AWARE THAT LIVE POWER EXISTS AT VARIOUS POINTS ON THE INTERNAL COMPONENTS. CERTAIN PARTS ON THE POWER SUPPLY AND MAIN CIRCUIT BOARD SUCH AS THE LAMP CIRCUIT BREAKER HEAT SINK ARE ALSO HOT WHEN THE INSTRUMENT IS OPERATING. FAILURE TO OBSERVE THIS WARNING MAY RESULT IN SERIOUS BURNS, INTERRUPTION OF HEART RHYTHM, DISRUPTION OF THE NERVOUS SYSTEM, OR DEATH.

7. Insert the power cord and turn on power to the assembly.

8. Turn the filter wheel so the light passes through a blank position.

9. Look straight down into the sample cuvette and observe the position of the visible red dot relative to the vertical center line. Move the filter and lens assembly until the red dot is centered on the line.

10. When the filter and lens assembly is properly aligned, tighten the mounting screw.

11. Double check the alignment after the screw is tightened to make sure it is still proper.

12. Turn off power to the instrument and remove the power cord.

13. Remove the alignment tool.

14. Reassemble the instrument (refer to "Section 9 - Disassembly and Replacement").

Section 8
Electrical Circuit Description and Adjustment

> **NOTE**
>
> **Refer to "Section 12 - Drawings and Schematics" for the layout and schematic drawings of all boards referenced in this section.**

8.1 Primary Wiring 4001-600, Revision B

AC power is provided through a detachable power cable to a dual-fused power entry module (4001-652) which contains a single-throw double-pole power switch. AC voltages of 100-240 volts ±10% and line frequencies of 50-60 Hertz ±10% are suitable for input to the universal-input AC/DC switching power supply (4001-653). High frequency noise disturbances on the Ground and Mains are filtered by torroidal ferrites and additional circuitry on the AC/DC switching power supply board.

The AC/DC switching supply (4001-653) powers the instrument through a cable to the Main Board (4001-6044). All other electrical peripherals and boards are connected to the Main Board. This includes a 10-key keypad, 2 line by 20 character display, tungsten lamp, Detector Board, internal printer, Centronics port, RS232 connection, 12 volt DC cooling fan, filter wheel motor, grating motor limit switch, and the Monochromator Drive Board.

8.2 Universal Input AC/DC Switching Power Supply Board (Purchased) 4001-653

The AC/DC power supply provides fixed +5 volt and -12 volt supplies and a quasi-regulated +12 volt supply. Heavy loading on the +5 volt supply will cause the +12 volt supply to decrease in magnitude by as much as 2 volts. Short circuit, overload, and over temperature protection is built-in. All outputs will be disabled when any one output has a fault, for as long as the fault exists. A replaceable AC line fuse is also located on the board. Specifications for the current model:

Mfg/Model:	Power-One MAP40-3000
AC input voltage range:	90-264 Volts AC
AC input frequency range:	50-60 Hertz
Minimum Output Power:	40 Watts
Output Voltages/Currents:	+5 Volts, 3.0 Amps/5.0 Amps peak +12 Volts, 2.0 Amps/3.5 Amps peak -12 Volts, 0.3 Amps/0.5 Amps peak
Internal Fuse:	2A/250Volt normal blow 5mmx20mm
Power Factor:	0.67 typical

8.3 Main Board 4001-6044, Revision B

8.3.1 Digital Circuitry

The Microcontroller

An Intel 80C251 8-Bit Microcontroller is used to control all instrument functions and to process data into the appropriate units. The 80C251 contains a central processing unit, a clock generator using an external 11.0592 MHz crystal, a power-on reset circuit (with U12 providing the control signal), a serial port, timers for control of the A/D converter and miscellaneous functions, and I/O (input/output) lines for control of the peripheral electronics. Please refer to the 8X251S_ Embedded Microcontroller User's Manual and the 8XC251SB data sheets for further information.

Memory

The spectrophotometer software resides in the 64Kx8 bit U3 EPROM which could be expanded to 128Kx8 bits. All chips are bottom loaded into the ZIF socket. An option for an additional 32Kx8 bit static RAM (U3) and 64Kx8 bit EPROM (U2) are not exercised.

A 2Kx8 bit EEPROM (U4) is used to store utility parameters and the monochromator motor step-to-wavelength lookup table. Other sizes up to 32Kx8 bit are supported by the hardware.

Address Latch, Chip Selects, and I/O Decoding

The 80C251 uses a 16-bit address bus whose upper byte is multiplexed with an 8-bit data bus by storing the address on the U5 latch with the ALE control line. The microprocessor operates in page mode to shorten the average bus cycle time by only updating the upper address byte when the value changes. Two additional address lines are created using direct I/O lines from the microprocessor, thus extending the address bus to 18 bits.

U24 is a dual 2-to-4 decoder wired in tandem to decode Address lines 14-17 and generate the Chip Select control signals.

Reading data from and writing data to I/O devices is controlled by the U14 and U25 decode chips. These I/O devices include the keyboard, display, printers, A/D converter, offset correction D/A converter, analog gain control, grating motor drive, filter wheel drive, and the tungsten lamp power supply control.

Direct I/O Signals

A number of direct I/O signals, located on the Microcontroller ports 1 and 3, are used for timing-critical controls. Devices controlled include the serial port, display, printer, write control, address bits, and the grating motor limit switch.

8.3.2 Analog Circuitry

Gain-Controlled Amplifier

The photometric signal arrives on the board at J10 pin 3 already amplified by the preamplifier on the Detector Board (4001-6034). The typical voltage range is 0 to -4 volts, but voltages as low as -8 volts can occur when the detector is saturated with light. GAIN0, GAIN1, and GAIN2 signals control the preamplifier gain and allow 8 different gain steps. The GAIN3 control signal to the U43 bilateral switch allows for an additional 9th amplification step if necessary. The signal is then added to the output of the 8-bit D/A converter (U44). Op-amp U40 adds the two signals, low-pass filters the sum (R17, C28), and reverses the polarity so a positive voltage is presented to the logarithmic A/D converter.

Dark Correction D/A Converter

The output of U44, an 8-bit D/A converter, sinks 2mA full scale and creates a voltage range of +5.00 to -5.00 volts at R33. This voltage divided down by the U40, R32, R23 amplifier to provide a ± 16.6 mV offset adjustment to the photometric signal. The voltage adjustment is chosen so zero volts is presented to the A/D converter within ½ lsb (65 μvolts) when no light passes through the sample compartment. This provides a true dark or 0%T reading by correcting for leakage currents and op-amp offset voltages and bias currents. Any dark voltage outside this range cannot be zeroed out and will cause an instrument failure (hardware error #13 or 14).

A/D Converter

The A/D converter multiplexes its inputs through U31 and operates on a logarithmic principle with an equivalent resolution of roughly 22 bits. A capacitor (C37) is charged to a precision 5.00 Volt reference supplied by U42. The capacitor is then discharged through a fixed resistor (R26) to ground until its voltage is equal to the input signal being measured. At this point, a comparator (U41) trips and sends a signal through the S-R latch (U32) to the microprocessor. The latch is reset and the capacitor recharged by switching U43 with the MEASURE control signal set LOW. The U41 comparator then has feedback (R25, R28) switched in by U43 with the /ZERO signal set LOW. With U41 now in a linear operation, the input signal is changed to ground by the multiplexer. In this “zero” mode, C35 stores the offset voltage of U41. The voltage on C35 will be added to the signal being measured next to cancel the op-amp offset voltage. The comparator function is returned to U41 by setting /ZERO HIGH and the next signal to be measured is selected. The MEASURE signal is then set HIGH to start the capacitor discharge and enable the output latch.

The time from setting MEASURE to HIGH to begin the measurement until a falling edge occurs at the output latch is precisely measured by a microcontroller timer. Measurements are made directly in terms of absorbance as a result of the exponential decay. All other conversions to transmittance, concentration, or voltage are carried out by the microprocessor.

Voltage Sources

U28, U29, and U30 provide +5, +8, and -8 volt references for use by the analog electronics. Double regulation is used to provide a level of isolation from the noisy digital electronics.

The Display

The display is a 2 line by 20 character liquid crystal type with a back light. A contrast potentiometer (R1) is accessible by the customer. U18 latches the data for the display. All drivers are located on the display itself.

The Keyboard

The ten keyboard keys are arranged in a matrix of rows and columns. A key press electrically connects the row and column of that key. U20 sends a test pattern with one LOW bit to the columns and U19 is used to read back data from the rows. A LOW bit received back indicates a key pressed at the intersection of the column where the LOW signal was sent and the row where the LOW signal was read from.

Tungsten Lamp Power Supply

The Tungsten lamp supply is a buck-mode (step-down) switching regulator controlled by U26 and operating at a frequency of 72 kHz. The lamp is run in constant-current mode and operates at a voltage near 6.0 volts. A pulse-width modulated (PWM) signal from the microprocessor is filtered by D3, R9, R10, and C16 to establish a bias voltage which U27 maintains across the lamp current sense resistor R12 through feedback with C20 and R14. Increasing the duty cycle of the PWM signal increases the bias voltage and thus the current through the lamp. Q1 turns the lamp on and off. Ferrite bead L1 keeps the 72 kHz frequency and its harmonics from feeding back to other circuits or into the mains.

Filter Wheel Drive

The filter wheel stepper motor is driven by open-collector transistors in U37. When moving the 12 volt unipolar stepper motor, Q2 is turned on to drive the motor with 12 volts. Once the motor is at rest, Q2 is turned off and the motor is held by 4.3 volts through D18 to reduce power consumption. The filter wheel position is initialized by scanning for the odd-shaped orange filter position and locating the edge of the aperture.

Monochromator Grating Limit Switch

A closure of the limit switch attached to J11 signals a coarse initialization of the monochromator during instrument power-up.

Cooling Fan

A cooling fan is powered by +12V through J14.

Serial Port (RS232 or Serial Printer)

An RS232C format serial port is available at the DE-9 connector J3. U8 provides voltage level translation from +5 volts and ground to ± 12 volts. Direct I/O control lines are used for all signals because of the timing critical nature of the communications protocol. Two data lines (TXD/RXD) are used and two control lines (RTS/CTS) are available for hardware handshaking if enabled by the software. Baud rates are software selectable over the range of 300-19200 Baud. A serial printer can also be operated from this port. For further information refer to the Operator's Manual.

Parallel Port (Centronics Printer Interface)

U6, U7, U9, U10, U11, and U13 provide the logic and latches to control either an internal or external parallel Centronics printer. The active port is software selectable by the user. Direct I/O lines are also necessary to control the printers. The printer controls are accessed through the keyboard. The external parallel printer attaches to the DB-25 connector J2.

Pump and Thermoelectric Flowcell Accessories

There is no support for these accessories at this time.

8.4 Mono Drive Board 4001-6054, Revision B

Low-pass filtering has been applied to the ±12 volt power supplies. A 5.00 volt precision voltage reference (U6) is used for the D/A converters. The monochromator wavelength is controlled with a unipolar stepper motor. Microstepping is employed with 16 microsteps per whole step resolution to achieve roughly 0.3nm per motor step resolution. The drive current to each coil is controlled by a pair of latched 8-bit D/A converters (U3, U4) which will allow motor coils to be partially energized. The complementary current outputs of these D/A converters sink a total of 500μAmps and use the 20.0K ohm resistors to supply 250 μAmps each.

When more than 250 μAmps is required by an output, the balance of the current is sunk from the virtual ground summing junction of U5. The output power transistors and the U5 op-amps form a current amplifier for each motor coil. When current is sunk from the virtual ground node, the same voltage drop occurs across the 1.50K ohm resistor and the 0.47 ohm resistor, thus causing a current amplification of 1500/0.47 = 3191. The current supplied to the summing junction and the amplified current both flow through the motor coil, turning it on. The complementary output of the D/A in this case will require less than 250 μAmps and will cause the extra current from the 20.0K ohm resistors to be forced into the summing junction, causing a negative voltage across the 0.47 ohm resistor. This turns off that coil.

The maximum output current of the D/A converter is 250 μAmps, yielding a maximum possible motor coil current of 0.8 amps which also flows through the 0.47 ohm resistors. Software can limit this to a lower value to match a motor's rated current limit. A 0.1μF integrating capacitor is used to avoid high frequency oscillations in the current amplifier by slowing down the amplifier response time. Diodes D1, D3, D5, D7 keep each current amplifier in a linear region and prevent reverse biasing the power transistor bases when a channel is turned off. Diodes D2, D4, D6, and D8 protect the transistors from inductive voltage spikes when the motor coils are turned off.

8.5
Detector Board
4001-6034,
Revision A

CAUTION

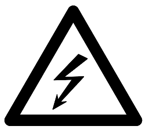
THE DETECTOR BOARD IS EXTREMELY SENSITIVE TO SURFACE CONTAMINATION AND SHOULD ONLY BE HANDLED BY THE EDGES.

The Detector Board contains a transimpedance (I to v) preamplifier with a “T-gain” stage that allows for 8 gain steps by adjusting the “T-gain” resistor value with an 8-channel multiplexer (U2). Multiple gain steps allow the output voltage to be presented to the A/D converter in a usable range of roughly 1.5 to 3.5 volts for 100%T. The gain values ranges from 2e+6 to 1.6e+9 including the 9th gain step on the Main Board. It is possible to set 100%T with less than 1nA of photocurrent or as much as 1.75μA.

The photodiode is operated in the photovoltaic or zero-bias mode which produces a linear relationship between the incident light power and the generated photocurrent. The op-amp used is chopper stabilized which reduces its own offset voltage to a few μvolts by storing the actual op-amp offset voltage on capacitors (C5 and C6) during one cycle and using the caps to cancel the offset voltage during the next cycle. This chopping action occurs at a rate of roughly 450 Hz. The op-amp employs a JFET input stage to provide low input bias currents in the picoamp range. Filtering caps C3 and C4 are used to stabilize the circuit and filter out electronic noise. Strapping the diode across the op-amp inputs takes advantage of the common mode noise rejection of the op-amp to reduce pickup of electrostatic fields.

Photodiode

A single silicon blue-enhanced photodiode with a 13mmx15mm active area is used for the entire 325-1100nm wavelength range. The photodiode is cemented with conductive epoxy to a FR-4 printed circuit board. Two gold-plated pins protruding from the board are inserted through a light shield into pin sockets on the Detector Board. One pin is soldered to maintain contact during product shipment.



⚠ WARNING

HIGH VOLTAGES EXIST INSIDE THE CABINET ANY TIME THE POWER CORD IS PLUGGED INTO A LIVE RECEPTACLE, AND THE POWER SWITCH IS TURNED ON. ALWAYS TURN OFF THE POWER SWITCH AND UNPLUG THE LINE CORD FROM THE RECEPTACLE BEFORE ACCESSING THE INTERIOR OF THE SPECTROPHOTOMETER. FAILURE TO OBSERVE THIS WARNING MAY RESULT IN SERIOUS BURNS, INTERRUPTION OF HEART RHYTHM, DISRUPTION OF THE NERVOUS SYSTEM, OR DEATH.

⚠ WARNING

WHEN IN OPERATION, CERTAIN INTERNAL COMPONENTS, SUCH AS THE LAMP AND THE HEAT SINK ON THE MAIN CIRCUIT BOARD, BECOME HOT AND MAY STILL BE HOT WHEN THE UNIT IS OPENED FOR SERVICING. AVOID TOUCHING THESE AREAS. FAILURE TO OBSERVE THIS WARNING MAY RESULT IN BURNS.

CAUTION

CIRCUIT BOARDS AND OTHER ELECTRONIC COMPONENTS ARE SUBJECT TO DAMAGE FROM ELECTROSTATIC DISCHARGE. TO PREVENT SUCH DAMAGE, USE A WRIST OR HEEL GROUNDING STRAP. GROUND TOOLS THROUGH A CONDUCTIVE MAT BEFORE TOUCHING ANY POTENTIALLY STATIC-SENSITIVE ASSEMBLIES OR DEVICES. WHEN HANDLING PRINTED CIRCUIT BOARDS OR OTHER ELECTRONIC ASSEMBLIES, HOLD THE BOARD BY ITS EDGES TO AVOID TOUCHING CIRCUIT TRACES OR DEVICES WITH BARE HANDS OR FINGERS.

CAUTION

MOST ASSEMBLIES ARE MOUNTED TO THE PLASTIC HOUSING WITH THREAD-FORMING SCREWS. ALWAYS BE CAREFUL TO NOT OVER TIGHTEN THESE SCREWS OR THEY WILL STRIP OUT THE HOLE. THIS WILL DESTROY THE ABILITY OF THE SCREW TO PROPERLY SECURE THE ASSEMBLY.

9.1 External Covers

1. Turn off power to the GENESYS 20 using the ON/OFF switch at the back of the unit.

2. Unplug the power cord from the receptacle and remove the power cord from its connector at the back of the main housing cover.

9.1.1 Lamp Door Assembly

The lamp cover door is located at the right side of the cover assembly (refer to Figure 9.1). It can be removed separately to gain access to the light, but it will not stay attached when the main cover is removed.

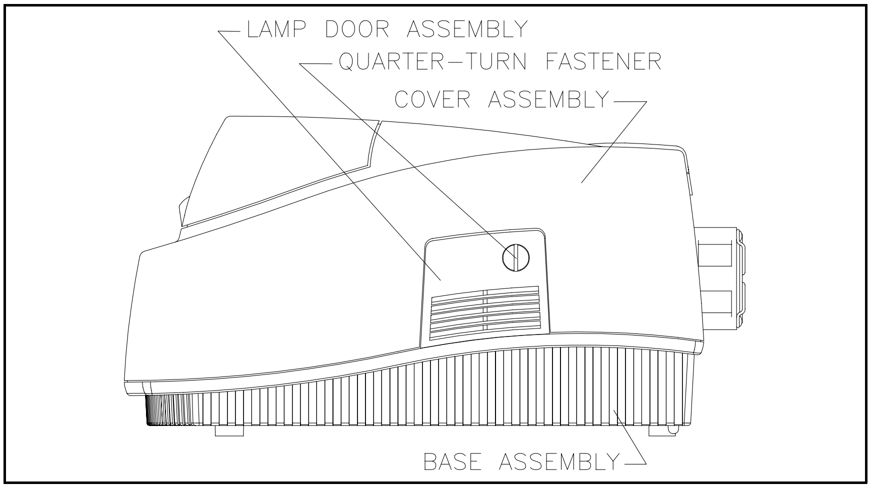


Figure 9.1 - Cover Assembly: Side View

<u>REMOVAL</u>

1. Using a coin or large-blade screwdriver, turn the quarter-turn fastener counterclockwise to release the cover.

2. Pull out on the fastener to free the top of the lamp door assembly and remove the door from the cutout in the cover assembly.

<u>REPLACEMENT</u>

3. Carefully set the bottom of the lamp door assembly into the bottom of the cutout in the cover assembly.

4. Make sure the quarter-turn fastener is rotated to the horizontal position and carefully push the top of the lamp door assembly into the cutout.

5. Turn the quarter-turn fastener clockwise to latch the door.

9.1.2 Printer Cover

The printer cover is located at the back left corner on the top of the cover assembly. This may be a blank cover or may include an integral printer (optional). It can be removed separately to gain access to the printer or EPROMs on the main circuit board or can be left in place and removed as part of the cover assembly.

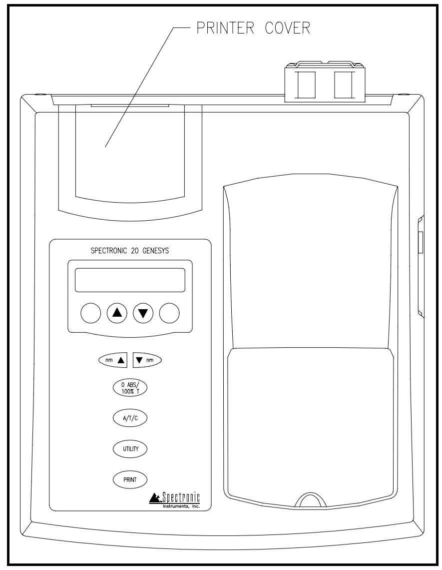


Figure 9.2
Cover Assembly: Top View

<u>REMOVAL</u>

1. If the printer cover includes the optional printer, remove the printer tape roll and pull the paper out of the printer.

2. Grasp the lower back edge of the printer cover and pull up to remove the printer cover.

<u>REPLACEMENT</u>

3. Insert the front of the printer cover into the front of the cutout in the cover assembly.

4. Carefully push the printer cover into position. Press firmly until it snaps into the cutout.

5. Replace paper.

9.1.3 Cover Assembly

<u>REMOVAL</u>

1. Remove any sample holders which may be installed in the unit.

2. If the optional printer is installed, remove the printer tape roll, pull the paper out of the printer, and remove the printer from the instrument.

3. Loosen the two screws at the back of the unit which secure the cover assembly to the base assembly. It is not necessary to completely remove these screws.

4. Reach under the front of the unit and press the two clips toward the sides of the unit and up. Figure 9.3 shows a bottom view of the base assembly indicating the location of the two clips.

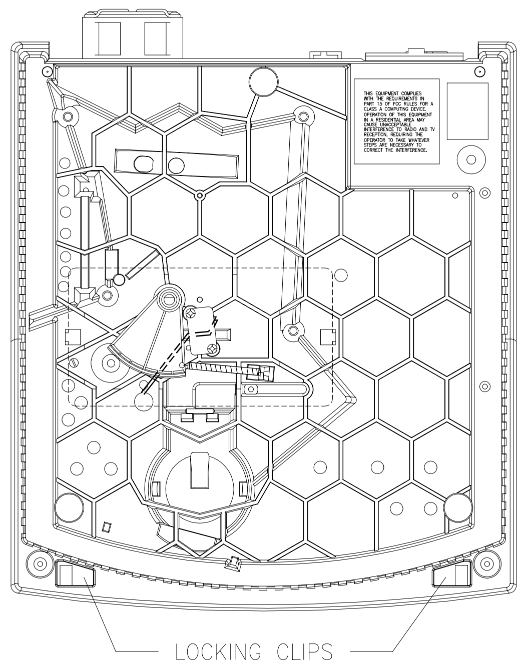


Figure 9.3 - Base Assembly: Bottom View

CAUTION

WHEN LIFTING THE COVER ASSEMBLY, TAKE CARE NOT TO PULL ON THE WIRES CONNECTING THE KEYPAD AND DISPLAY TO THE MAIN CIRCUIT BOARD. FAILURE TO OBSERVE THIS CAUTION MAY RESULT IN DAMAGE TO THE WIRING HARNESS.

5. Carefully lift the front of the cover assembly so the upper rear portion of the cover moves away from the connectors on the edge of the main circuit board.

6. Carefully lift the cover assembly to free the back of the assembly from the two screws located at the back of the base assembly.

7. Continue to lift the cover to free the back panel which fits in a track in the cover assembly.

CAUTION

WHEN REMOVING CONNECTORS FROM THE CIRCUIT BOARD RECEPTACLES, ALWAYS GRASP THE BODY OF THE CONNECTOR — NEVER PULL ON THE WIRE HARNESS. FAILURE TO OBSERVE THIS CAUTION MAY RESULT IN DAMAGE TO THE WIRING HARNESS.

8. Set the cover assembly on its side and carefully disconnect the key pad and display cables from the main circuit board (refer to Figure 9.4, 9.7).

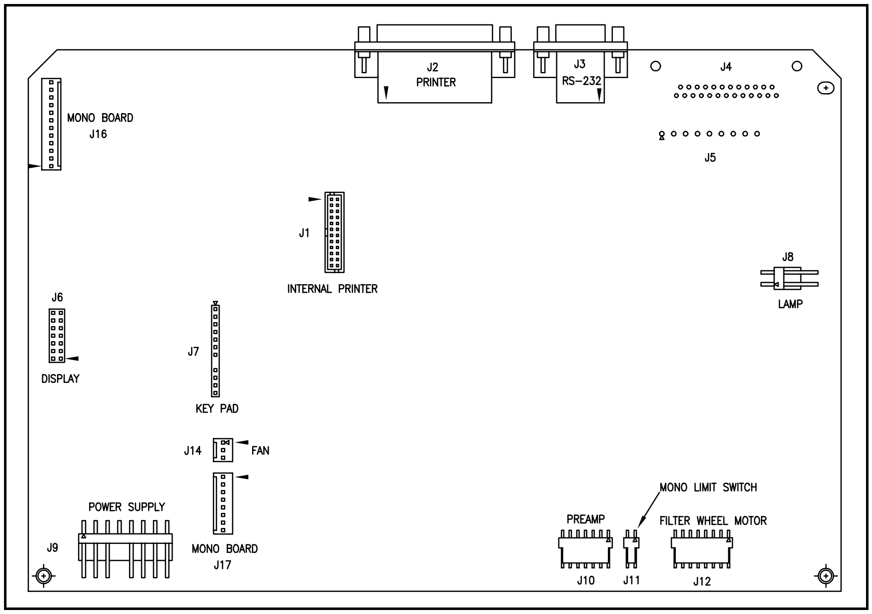


Figure 9.4 - Connections to Main Board

<u>REPLACEMENT</u>

9. Attach the cable for the display to the connector on the main board. Make sure Pin 1 of the cable is lined up with Pin 1 of the connector. Pin 1 of the cable is indicated by the red stripe on the edge of the cable. Pin 1 of the connector is indicated by an arrow in Figure 9.4, 9.7.

10. Attach the cable for the key pad to the connector on the main board. The connector is keyed so it can only be attached in one orientation.

11. Align the back panel with the slots in the sides of the cover assembly and slide the cover assembly down into position on the base assembly.

While lowering the cover, make sure the cover assembly slots are behind the attachment screws on the back of the base assembly.

12. Rotate the cover assembly and rear panel forward until the connectors on the main board are in their proper positions. Make sure no wires are caught between the cover assembly and base assembly.

13. When everything is aligned properly, press the front of the cover assembly down until the locking clips snap into place.

14. Tighten the two screws on the back of the base assembly.

15. If the optional printer is present, install the printer, and thread the paper into the printer.

16. Plug the power cord into the connector on the back of the unit.

9.1.4 Sample Compartment Cover Assembly

NOTE

If the sample compartment cover is to be separated from the hinge without the hinge being replaced, it is not necessary to remove the main cover assembly. Follow only those instructions which apply to separating the sample compartment cover from the hinge.

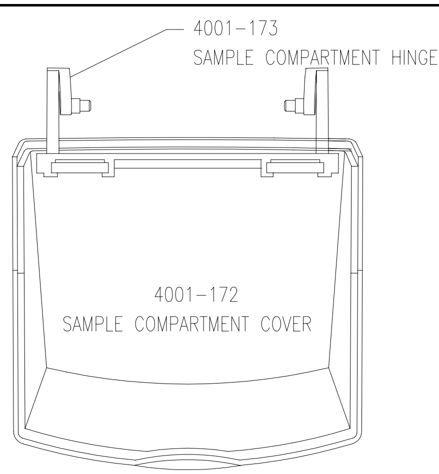


Figure 9.5 - Sample Compartment Cover Assembly

1. Remove the main cover assembly (refer to "Section 9.1.3 - Cover Assembly").

2. Remove the sample compartment cover from the sample compartment hinge.

   a. Using a very small screwdriver, gently pry up on the center of each hinge tab while gently pulling the cover slightly away from the hinge.

   b. Slide the cover off the hinge tabs.

3. Remove the hinge assembly from the main cover assembly.

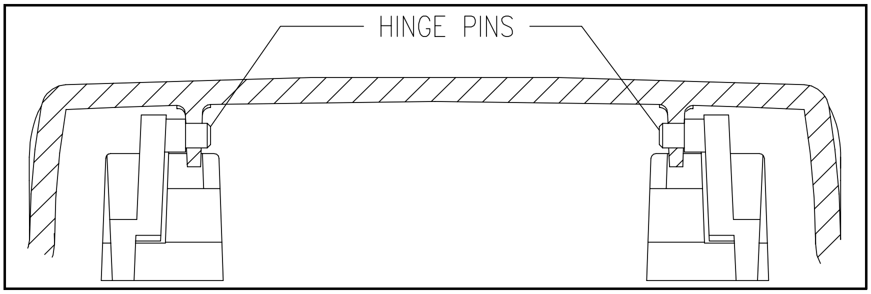


Figure 9.6 - Sample Compartment Cover Hinge Mounting

   a. One at a time, press each hinge pin out of its mounting hole so it catches on the outside of the plastic and does not return to the hole.

   b. Slide the hinge away from the main cover assembly.

<u>REPLACEMENT</u>

4. Carefully slide the hinge into position on the cover assembly until the hinge pins lock into their locating holes.

5. Carefully slide the sample compartment cover onto the hinge until the tabs snap into position.

6. Replace the main cover assembly (refer to "Section 9.1.3 - Cover Assembly").

9.1.5 Rear Panel

REMOVAL

1. Remove the main cover assembly (refer to "Section 9.1.3 - Cover Assembly").

2. Completely remove the two screws at the back of the base assembly previously loosened to remove the cover assembly.

3. Move the top of the panel away from the main circuit board until the board is out of its mounting slot and the panel is clear of the connectors on the back edge of the board.

4. Lift up on the rear panel to remove it from the base assembly.

REPLACEMENT

5. Set the rear panel into position in the base assembly. Make sure it is oriented so the paper holder slots are located beneath the printer assembly and on the outside of the unit.

6. Insert the two screws through the base assembly outer casing and the rear panel and partially thread the screws into their respective nuts. **DO NOT TIGHTEN AT THIS TIME!**

7. Replace the main cover assembly (refer to "Section 9.1.3 - Cover Assembly").

9.2 Front Panel Assemblies

The key pad or display each have a wire harness connected to the main circuit board. Therefore, the cover assembly must be removed including disconnecting these cables before either the key pad or display can be changed.

9.2.1 Display

REMOVAL

1. Remove the main cover assembly (refer to "Section 9.1.3 - Cover Assembly").

2. Lay the cover assembly upside down on the work surface.

3. Remove the four thread-forming screws holding the display to the cover assembly.

4. Pull the display away from the cover assembly. It may be necessary to pull hard on the display and possibly pry it away as it tends to be held in place by the adhesive of the key pad.

REPLACEMENT

5. Make sure the cover screen is clean of all dust and finger prints.

6. Locate the UP arrow on the back of the display and align it toward the back (top) of the cover assembly. The cable harness will be on the side of the display closest to the side of the cover.

7. Replace the four thread-forming screws. **DO NOT OVER TIGHTEN!**

8. Replace the main cover assembly (refer to "Section 9.1.3 - Cover Assembly").

9.2.2 Key Pad

1. Remove the main cover assembly (refer to "Section 9.1.3 - Cover Assembly").

2. Peel off the old key pad and pull the wire harness through the slot in the cover assembly.

3. Clean off all old adhesive from the cover assembly with isopropyl alcohol.

4. Make sure the display is clean of all dust and finger prints. Also check the back side of the display cover screen in the key pad to make sure it is clean.

5. Orient the key pad and start the wire harness through the hole in the cover assembly. Make sure the wire harness is straight with no twists.

CAUTION

DO NOT TOUCH THE KEY PAD TO THE COVER ASSEMBLY UNTIL IT IS PROPERLY POSITIONED. IF THE ADHESIVE TOUCHES THE COVER ASSEMBLY, IT WILL STICK IN THAT POSITION AND CANNOT BE EASILY REPOSITIONED WITHOUT CAUSING THE KEYPAD TO BE DAMAGED OR NOT ADHERE PROPERLY.

6. Carefully strip the cover paper off the adhesive on the back of the key pad.

7. Carefully align the key pad to the depression in the cover assembly without actually touching the key pad to the cover. Make sure the wire harness is fully pushed through the hole in the cover.

8. Touch one edge to the cover and press the key pad down all across the pad working toward the opposite edge to prevent trapping air under the key pad.

9. Make sure the top of the cover screen is clean and free of dust and finger prints.

10. Replace the main cover assembly (refer to "Section 9.1.3 - Cover Assembly").

9.3 INTERNAL ASSEMBLIES

9.3.1 Main Circuit Board

> **NOTE**
>
> **The EPROM and EEPROM can be accessed by removing only the printer cover. However, it may be easier to replace these with the cover assembly removed so there is full access to the circuit board.**

1. Remove the main cover assembly (refer to "Section 9.1.3 - Cover Assembly").

> **CAUTION**
>
> **WHEN REMOVING CONNECTORS FROM THE CIRCUIT BOARD RECEPTACLES, ALWAYS GRASP THE BODY OF THE CONNECTOR — NEVER PULL ON THE WIRE HARNESS. FAILURE TO OBSERVE THIS CAUTION MAY RESULT IN DAMAGE TO THE WIRING HARNESS.**

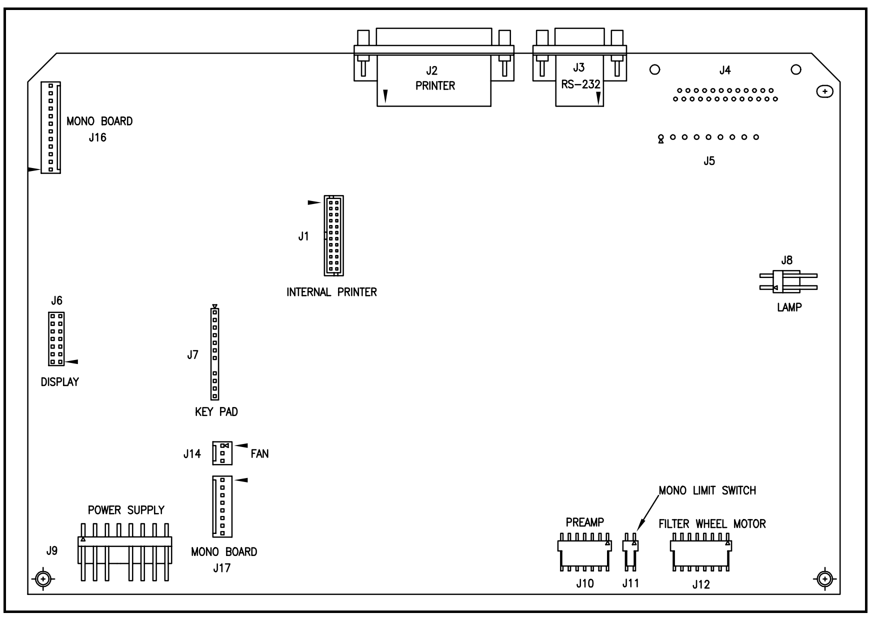


Figure 9.7 - Connections to Main Board

2. Carefully remove the connectors for all cable assemblies attached to the main circuit board.

3. Remove the two screws at the front of the circuit board securing the circuit board to the base assembly.

> **NOTE**
>
> **The screws securing the circuit board also secure the monochromator cover.**

4. Carefully lift the circuit board off the base assembly.

REPLACEMENT

5. The EEPROM contains the calibration constants for the monochromator and other instrument parameters. This information is specific to a specific instrument and must be maintained with the instrument. If the circuit board is being replaced with a new board, the EEPROM must be transferred to the new circuit board.

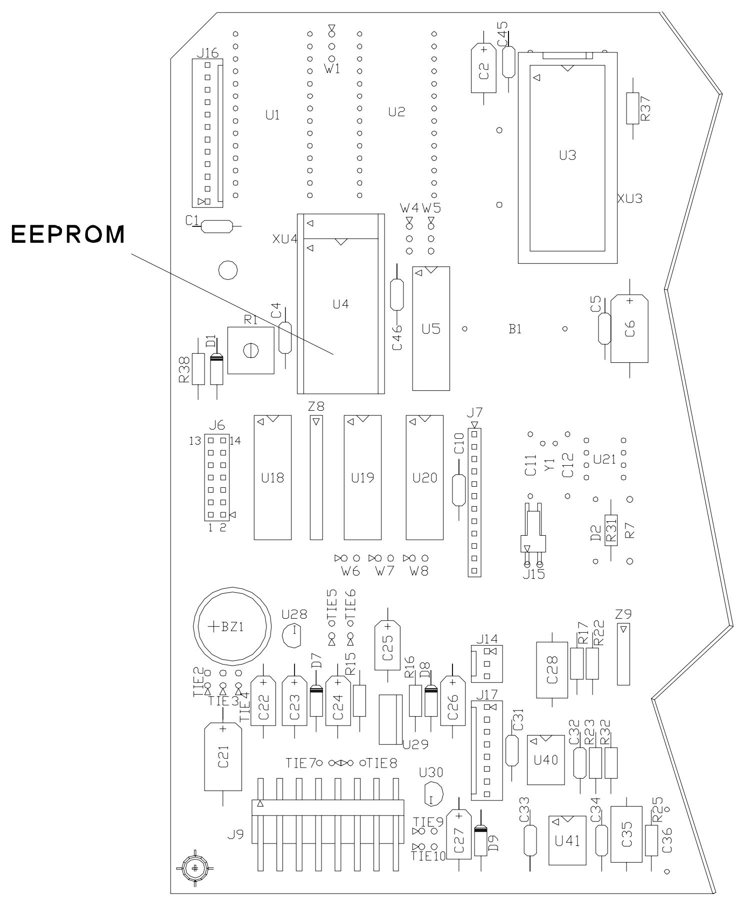


Figure 9.8 - Main Circuit Board

a. Note the location of Pin 1. Using a ROM puller, remove the EEPROM from the board. Pull up equally to prevent bending any of the pins.

NOTE

When replacing the EEPROM in the new circuit board, note that the socket has four more holes than the EEPROM has pins. Bottom load the EEPROM. That is, make sure the bottom pins (opposite the top-indicating notch) are inserted into the bottom holes of the socket so the four empty pin holes are located above the top of the EEPROM.

b. Carefully insert the EEPROM into the socket making sure it is properly located. Make sure all pins are lined up with a socket hole. Make sure none of the pins are bent when the EEPROM is pressed into the socket.

6. Make sure screw holes in the monochromator cover are lined up with the nuts in the lugs.

7. Carefully place the circuit board on top of the monochromator cover. Slide it into the slots on the rear panel aligning the back connectors with the slots in the rear panel.

8. Move the board and rear panel so the front holes in the circuit board line up with the nuts in the lugs.

9. Insert the two screws through the circuit board and monochromator cover and carefully tighten.

10. Attach the wire harnesses to the connectors on the main circuit board. Each wire harness only attaches to one connector on the board. Match the harnesses to the connector

11. Replace the main cover assembly (refer to "Section 9.1.3 - Cover Assembly").

9.3.2 Power Entry Module

REMOVAL

1. Remove the main cover assembly (refer to "Section 9.1.3 - Cover Assembly").

2. Remove the main circuit board (refer to "Section 9.3.1 - Main Circuit Board").

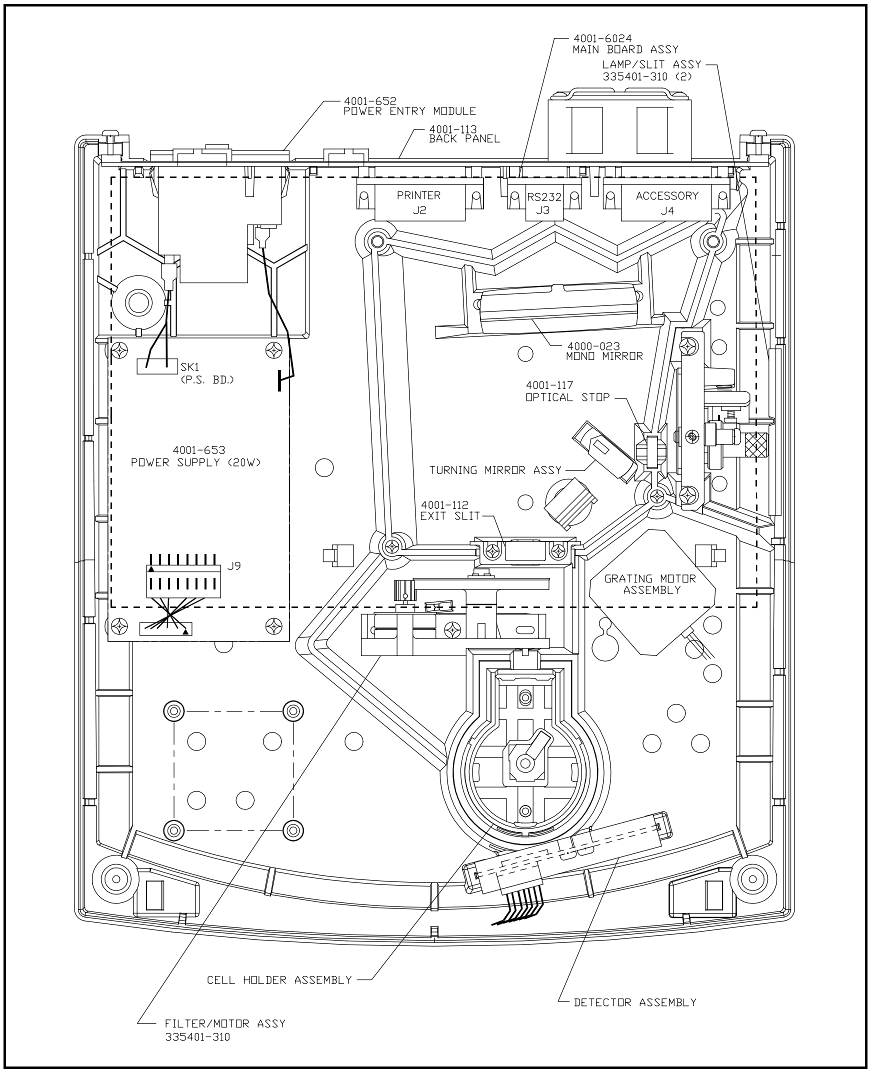


Figure 9.9 - Interior Layout

3. Remove the rear panel (refer to "Section 9.1.5 - Rear Panel").

> **NOTE**
>
> **It is sometimes easier to lift the module out of its cutout (Step 6) before the wires are removed to make it easier to grasp the connectors with pliers. Take care not to jerk the module too hard when removing each wire or the remaining connected wires may be damaged.**

4. Remove the ground connector (green and yellow wire) from the upper right terminal of the power entry module (as viewed from the rear).

5. Remove the two power connector wires (white wires) from the upper and lower terminals on the right side (as viewed from the rear).

6. Lift the power entry module out of its cutout in the base assembly.

REPLACEMENT

NOTE

If desired, the wires can be attached to the terminals on the new power module before the module is to be replaced.

7. Push the new power entry module into the cutout on the base assembly.

8. Connect the ground connector (green and yellow wire) to the upper right terminal on the power entry module (as viewed from the rear).

9. Connect the two power connector wires (white wires) to the upper and lower terminals on the right side of the power entry module (as viewed from the rear). The two wires are interchangeable. Either wire can be connected to either of the two terminals. (The two middle terminals are not used.)

10. Replace the rear panel (refer to "Section 9.1.5 - Rear Panel").

11. Replace the main circuit board (refer to "Section 9.3.1 - Main Circuit Board").

12. Replace the main cover assembly (refer to "Section 9.1.3 - Cover Assembly").

9.3.3 Power Supply

REMOVAL

1. Remove the main cover assembly (refer to "Section 9.1.3 - Cover Assembly").

2. Remove the mono board assembly.

3. Remove the main circuit board (refer to "Section 9.3.1 - Main Circuit Board").

4. Disconnect the connector for the wire harness to the power entry module from the socket on the power supply (refer to Figure 9.9).

5. Disconnect the ground wire connector (green and yellow wire) from the power supply.

6. Remove the four thread-forming screws which secure the power supply to the base assembly. Note how one lead of the power supply cable assembly (which connects to the main circuit board) is attached between the power supply and the base assembly. This wire provides instrument grounding and must be in place when the power supply is replaced.

REPLACEMENT

7. If the power supply is being replaced with a new one, transfer the power supply cable assembly from the old power supply to the new power supply. Maintain the same wire harness polarity.

8. Place the power supply in position over the four mounting lugs. Locate the grounding wire of the power supply cable assembly between the power supply and the right front lug.

9. Insert and tighten the four screws to secure the power supply to the base assembly starting with the screw through the ground wire. **DO NOT OVER TIGHTEN!**

10. Connect the ground wire from the power entry module.

11. Connect the wire harness from the power entry module.

12. Replace the mono board assembly.

13. Replace the main circuit board (refer to "Section 9.3.1 - Main Circuit Board").

14. Replace the main cover assembly (refer to "Section 9.1.3 - Cover Assembly").

9.3.4 Detector Assembly

REMOVAL

1. Remove the Foil Shield.

2. Remove the main cover assembly (refer to "Section 9.1.3 - Cover Assembly").

CAUTION

DO NOT TOUCH THE DETECTOR. HOLD THE DETECTOR ASSEMBLY AT THE SIDES OR TOP AND BOTTOM ONLY. DO NOT REACH BEHIND THE ASSEMBLY. FAILURE TO OBSERVE THIS CAUTION MAY RESULT IN LOSS OF ACCURACY AND PERFORMANCE.

3. Disconnect the preamp cable connector from the detector assembly.

4. Remove the top two screws which attach the assembly to the base assembly. Do not remove the lower screw or the board will fall out of the assembly.

REPLACEMENT

5. Align the detector assembly with the mounting holes and replace the screws. **DO NOT OVER TIGHTEN!**

6. Replace the foil shield.

7. Replace the main cover assembly (refer to "Section 9.1.3 - Cover Assembly").

9.3.5 Entrance Slit/ Illumination Assembly

REMOVAL

1. Remove the main cover assembly (refer to "Section 9.1.3 - Cover Assembly").

2. Remove the main circuit board (refer to "Section 9.3.1 - Main Circuit Board").

3. Move the Mono Motor wires out of the way.

4. Lift off the monochromator cover.

5. Move the wires for the filter wheel motor out of the way.

6. Remove the two screws on the top of the assembly and lift up on the assembly to remove it from the base assembly.

REPLACEMENT

7. Slide the entrance slit/illumination assembly into position.

8. Replace the two screws on top of the assembly. **DO NOT OVER TIGHTEN!**

9. Replace the monochromator cover making sure the filter wheel motor cable is properly positioned.

10. Replace the main circuit board (refer to "Section 9.3.1 - Main Circuit Board").

11. Replace the main cover assembly (refer to "Section 9.1.3 - Cover Assembly").

9.3.5.1 Lamp Socket

> **NOTE**
> **The lamp socket can be removed from the entrance slit/illumination assembly after the assembly is removed from the base assembly. However, it can also be removed without removing the entire assembly.**

REMOVAL

1. Remove the main cover assembly (refer to "Section 9.1.3 - Cover Assembly").

2. Disconnect the lamp cable from the main circuit board.

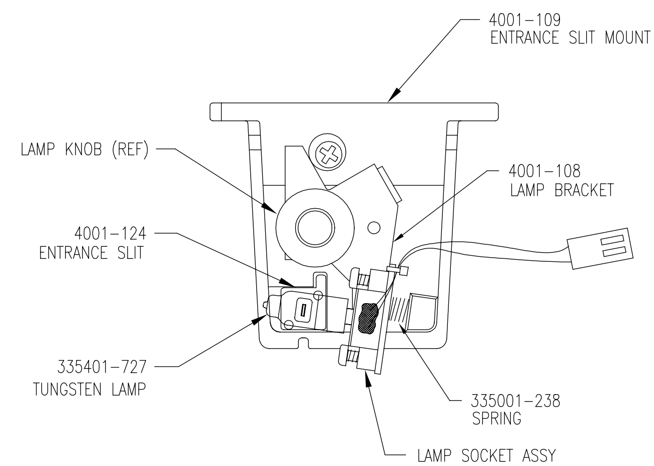


Figure 9.10 - Entrance Slit/Illumination Assembly

3. Unscrew the lamp holding knob (turn counterclockwise).

4. Remove the socket from the assembly.

REPLACEMENT

5. Position the socket on the entrance slit/illumination assembly mounting screw. Make sure the screw is properly positioned and not bent or squeezed.

6. Screw the lamp holding knob onto the mounting screw (turn clockwise).

7. Connect the lamp cable to the main circuit board.

8. Replace the main cover assembly (refer to "Section 9.1.3 - Cover Assembly").

9.3.5.2 Spring

REMOVAL

1. Remove the main cover assembly (refer to "Section 9.1.3 - Cover Assembly").

2. Disconnect the lamp cable from the main circuit board.

3. Remove the lamp socket (refer to "Section 9.3.5.1 - Lamp Socket").

4. Pull the spring out of its mounting hole. This may require some force.

5. Clean out as much of the old RTV adhesive as possible.

REPLACEMENT

6. Apply RTV adhesive to the end of the spring and press it into its mounting hole.

7. Replace the lamp socket (refer to "Section 9.3.5.1 - Lamp Socket").

8. Connect the lamp cable to the main circuit board.

9. Replace the main cover assembly (refer to "Section 9.1.3 - Cover Assembly").

9.3.6 Filter and Lens Assembly

REMOVAL

1. Remove the main cover assembly (refer to "Section 9.1.3 - Cover Assembly").

2. Remove the main circuit board (refer to "Section 9.3.1 - Main Circuit Board").

3. Lift off the monochromator cover.

CAUTION

DO NOT TOUCH THE LENS ON THE BACK SIDE OF THE FILTER WHEEL ASSEMBLY OR ANY OF THE FILTER ELEMENTS. FAILURE TO OBSERVE THIS CAUTION MAY LEAD TO INACCURACY AND LOSS OF PERFORMANCE.

4. Remove the single center screw holding the filter wheel assembly in position and raise the assembly.

REPLACEMENT

5. Set the filter wheel assembly in position on the two pins.

6. Insert the holding screw and tighten until the assembly cannot rock but can still be moved from end to end of the slots.

7. Align the filter wheel as described in "Section 7 - Optical Alignment."

8. When the filter wheel is properly aligned, tighten the holding screw. **DO NOT OVER TIGHTEN!**

9.3.6.1 Filter Wheel

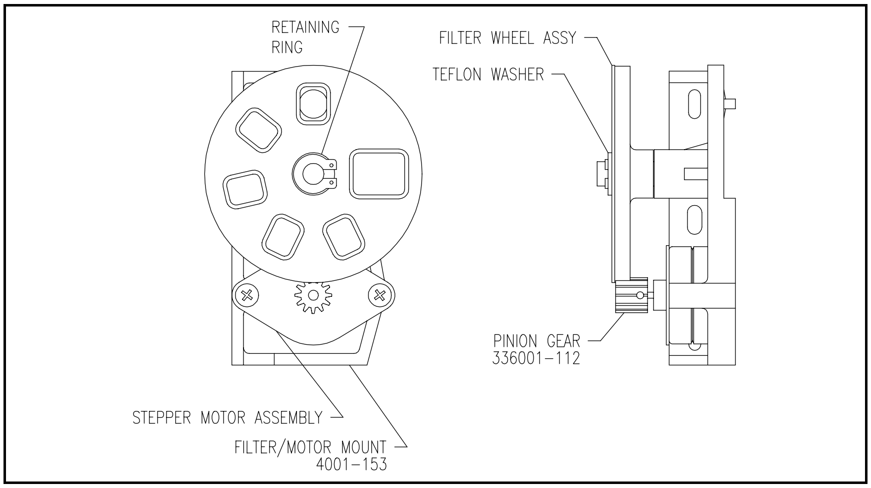


Figure 9.11 - Filter and Lens Assembly

<u>REMOVAL</u>

1. Remove the filter and lens assembly from the base assembly (refer to "Section 9.3.6 - Filter Wheel Assembly").

2. Remove the retaining ring securing the filter wheel and <u>discard</u>. This retaining ring will not be reused.

3. Remove the Teflon washer and filter wheel, and clean the Teflon washer.

<u>REPLACEMENT</u>

4. Replace the filter wheel on its mounting pin with the hub down making sure the gear teeth of the filter wheel mesh properly with the gear teeth of the motor pinion. (The filter wheel can only be positioned one way on the lug.)

5. Place the Teflon washer on the mounting pin above the filter washer.

CAUTION

NEVER REUSE A RETAINING RING ONCE IT HAS BEEN REMOVED. EVEN THOUGH IT MAY APPEAR GOOD, THE STRETCHING OF THE RING REQUIRED TO REMOVE THE RING INTRODUCES STRESSES WHICH WILL CAUSE THE RING TO FAIL.

6. Clamp the Teflon washer and filter wheel in position using a new retaining ring.

7. Replace the filter and lens assembly in the base assembly (refer to "Section 9.3.6 - Filter and Lens Assembly").

9.3.6.2 Filter Wheel Motor

REMOVAL

1. Remove the filter and lens assembly from the base assembly (refer to "Section 9.3.6 - Filter Wheel Assembly").

2. Remove the filter wheel (refer to "Section 9.3.6.1 - Filter Wheel").

3. Remove the two screws securing the filter wheel motor.

REPLACEMENT

4. Position the filter wheel motor so the wires are on the side toward the filter wheel.

5. Mount the motor with the two thread-forming screws. **DO NOT OVER TIGHTEN!**

6. Replace the filter wheel (refer to "Section 9.3.6.1 - Filter Wheel").

7. Check the filter wheel and motor alignment.

    a. Hold the pinion and attempt to move the filter wheel.

    b. If there is any play, loosen either mounting screw for the motor and move the motor closer to the filter wheel.

    c. Recheck for play.

8. Replace the filter and lens assembly in the base assembly (refer to "Section 9.3.6 - Filter and Lens Assembly").

9.4 Limit Switch

The limit switch is located on the bottom of the instrument.

REMOVAL

1. Remove the power cord from the back of the instrument.

2. Turn the instrument over and lay it on its top.

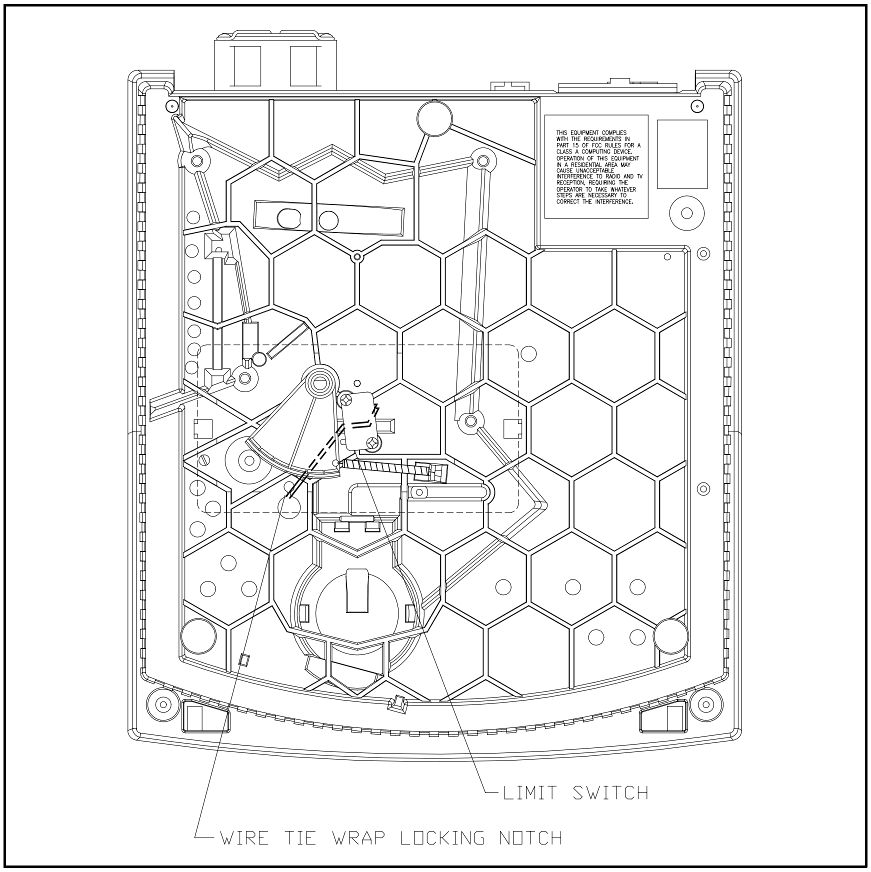


Figure 9.12 - Genesys 20: Bottom View

3. Remove the Sector gear and Limit Switch Cover.

4. Remove the two screws which secure the limit switch.

5. Remove the two wires attached to the limit switch terminals.

REPLACEMENT

6. Attach the two wires to the limit switch.

7. Locate the limit switch in position. Make sure the wires are routed under the switch and spring. The tie wrap on the wires must be trapped under the locking notch as indicated in Figure 9.12 after the wire is fed through the hole in the base assembly.

8. Replace the two screws.

9. Replace the two screws which secure the limit switch.

10. Turn the unit back over to its upright position.

Section 10
Accessories

Part #	Description
4010	Single Cell Holder - holds one 10mm square cuvette, 10mm round test tube or ½” test tube up to 100mm tall (standard with instrument)
4011	Cylindrical Longpath Cell Holder - holds one cylindrical longpath cell up to 50mm long and 22-25mm in diameter
4012	Rectangular Longpath Cell Holder - holds one rectangular longpath cell up to 50mm long and 12.5mm wide
4014	COD Vial Cell Holder - holds one COD vial up to 104mm tall and 18mm in diameter
4015	1" Test Tube Holder - holds one 1" pathlength test tube, up to 104 mm tall
4028	Filter Holder - holds one filter/lens up to 8mm thick, with dimensions up to 44mm W x 104mm H
4088	20-Column Internal Printer (user-installable); includes 5 rolls of paper
333150	SPECTRONIC Standards
336041	Interface cable to connect GENESYS 20 Series to IBM PC/XT computer
335942	Interface cable to connect GENESYS 20 Series to IBM/AT computer
336043	Interface cable to connect GENESYS 20 Series to non-IBM equipment

Section 11
Spare Parts and Special Tools

Spare Parts:

335423	Tungsten-halogen lamps package of 2
4062	Fuses, package of 4
4054	Paper for 4088 internal printer, package of 5 rolls 5 year legibility
336041	Interface Cable - IBM PC/XT
335942	Interface Cable - IBM PC/AT
336043	Interface Cable - Non-IBM
4001-250	Lamp Socket Assembly
4001-260	Filter Motor Assembly
4001-252	Fan Assembly
4001-263	Filter Wheel
4001-264	Filter Wheel with Lens and Motor
4001-1611	Wire Assembly, Limit Switch (SPS)
4001-1612	Wire Assembly, Power Entry (SPS)
4001-1613	Wire Assembly, Mono Motor Power (SPS)
4001-1614	Wire Assembly, Mono Motor Control (SPS)
4001-1615	Wire Assembly, Detector (SPS)
4001-1616	Wire Assembly, Power Supply (SPS)
4001-250	Holder, GENESYS 20 Lamp (SPS)
4001-251	Motor, GENESYS 20 Grating (SPS)
4001-252	Fan, GENESYS 20 (SPS)
4001-253	Cable, GENESYS 20 Mono Motor Power (SPS)
4001-254	Cable, GENESYS 20 Mono Motor Control (SPS)
4001-255	Cable, GENESYS 20 Detector (SPS)
4001-256	Cable, GENESYS 20 Power Supply (SPS)
4001-260	Motor, GENESYS 20 Filter (SPS)
4001-261	Cable, GENESYS 20 Limit Switch (SPS)
4001-262	Power Entry Cable Assembly (SPS)
4001-263	Filter Wheel, GENESYS 20 (SPS)
4001-264	Filter Wheel, GENESYS 20 with Lens and Motor
4001-265	Turning Mirror Assembly (SPS)
4001-266	Grating Assembly (SPS)
4001-267	Knob ASM, GENESYS 20 Lamp (SPS)
4001-268	Entrance Slit / Illumination Assembly
4001-269	Display Assembly (SPS)
4001-270	Detector, GENESYS 20 (SPS)
4001-271	Cover, GENESYS 20 Main (SPS)
4001-272	Door, GENESYS 20 Lamp (SPS)
4001-6056	PC Board, GENESYS 20 Mono (SPS)
4001-6146	PC Board, GENESYS 20 Main (SPS)
4001-990S	Packing Kit, GENESYS 20 (SPS)

Service Tools

H152378 - Cuvette target
H152619 - Grating target
H152621 - Detector target
H152626 - Filter motor pinion spacer

The following tools are used on the production line and should not be used in the field *(list provided as reference only)*:

H152620 - Turning mirror target tool
H152622 - Grating hold down fixture
H152623 - Grating zero order alignment tool
H152625 - Grating mount tool
H152627 - Grating motor pinion spacer
H152630 - Optical stop alignment tool
H152632 - Wavelength calibration tool
H152634 - Main mirror cementing tool

This section provides interconnect, assembly, schematic drawings and parts lists for the mechanical, electrical, and cable assemblies of the GENESYS 20 Spectrophotometer.

12.1 Mechanical Assemblies

NOTE

All the mechanical assemblies are on different sheets of Thermo Spectronic Drawing Number 4001-200 — "Main Assembly." (Refer to the Sht# Column below)

FIG.	ASSEMBLY DESCRIPTION	PART NO.	REV.	SHT#
12-1	Lamp Socket Assembly	4001-250	E	3
12-2	Filter Motor Assembly	3360014-671	E	3
12-3	Grating Motor Assembly	4001-251	E	3
12-4	Fan Assembly	4001-252	E	3
12-5	Mono Motor Power Cable Assembly	4001-253	E	3
12-6	Mono Motor Control Cable Assembly	4001-254	E	3
12-7	Detector Cable Assembly	4001-255	E	3
12-8	Power Supply Cable Assembly	4001-256	E	3
12-9	Limit Switch Cable Assembly	4001-261	E	3
12-10	Power Entry Cable Assembly	4001-262	E	3
12-11	Filter Assembly	4001-263	E	4
12-12	Filter and Lens Assembly	4001-264	E	4
12-13	Turning Mirror Assembly	4001-265	E	4
12-14	Grating and Mount Assembly	4001-266	E	4
12-15	Cuvette Adapter Assembly	4010-000	E	5
12-16	Lamp Knob Assembly	4001-267	E	5
12-17	Entrance Slit/Illumination Assembly	4001-268	E	5
12-18	Display Assembly	4001-269	E	5
12-19	Detector Assembly	4001-270	E	5
12-20	Main Cover Assembly	4001-271	D	6
12-21	Lamp Door Assembly	4001-272	D	6
12-22	Main Board	4001-6046	K	7
12-23	Mono Motor Board	4001-6056	K	7
12-24	Base Assembly	4001-200	C	7
12-25	Main Assembly	4001-200	C	8
12-26	Interface Cable - IBM PC/XT	336041-000	A	1

FIG.	ASSEMBLY DESCRIPTION	PART NO.	REV.	SHTS.
12-27	Interface Cable - IBM PC/AT	336042-000	A	1
12-28	Interface Cable - Non-IBM	226043-000	A	1

BOARDS AND SCHEMATICS (See Section 12-2):

FIG.	ASSEMBLY DESCRIPTION	PART NO.	REV.	SHTS.
12-29	Main Board Assembly	4001-6024	A	1
12-30	Detector Board Assembly	4001-6034	K	1
12-31	Main Board Assembly	4001-6044	K	1
12-32	Mono Driver Board Assembly	4001-6054	A	1
12-33	Primary Wiring	4001-600	A	1
12-34	Detector (Preamp) Board	4001-6031	B	1
12-35	Mono Drive Board	4001-605-1		1
12-36	Mono Drive Board	4001-605-1		2
12-37	Processor	4001-6021	A	1
12-38	Memory 1 - I/O Decode	4001-6021	A	2
12-39	Memory 2 - Oem/Optional	4001-6021	A	3
12-40	Keyboard & Display Control	4001-6021	A	4
12-41	Mono Drive & Analog Gain Reg.	4001-6021	A	5
12-42	Filter Wheel & T-O-Y/Lamp Cntrl.	4001-6021	A	6
12-43	Analog Processing	4001-6021	A	7
12-44	A / D	4001-6021	A	8
12-45	Lamp Power Supply	4001-6021	A	9
12-46	Internal Printer Interface	4001-6021	A	10
12-47	External Printer Interface	4001-6021	A	11
12-48	RS-232 Interface	4001-6021	A	12
12-49	Accessory Module Interface	4001-6021	A	13
12-50	Board Power Supply	4001-6021	A	14
12-51	Processor	4001-6041	B	1
12-52	Memory 1 - I/O Decode	4001-6041	B	2
12-53	Memory 2 - Oem/Optional	4001-6041	B	3
12-54	Keyboard & Display Control	4001-6041	B	4
12-55	Mono Drive & Analog Gain Reg.	4001-6041	B	5
12-56	Filter Wheel & T-O-Y/Lamp Cntrl.	4001-6041	B	6
12-57	Analog Processing	4001-6041	B	7
12-58	A / D	4001-6041	B	8
12-59	Lamp Power Supply	4001-6041	B	9
12-60	Internal Printer Interface	4001-6041	B	10
12-61	External Printer Interface	4001-6041	B	11
12-62	RS232 Interface	4001-6041	B	12
12-63	Accessory Module Interface	4001-6041	B	13
12-64	Power Supply Board	4001-6041	B	14

FIG.	ASSEMBLY DESCRIPTION	PART NO.	REV.	SHTS.
ACCESSORIES				
12-65	Printer/Relay Cable	4001-1601	B	1
12-66	Printer Cable	4001-1604	B	1
12-67	Printer Assembly	4001-200	A	1

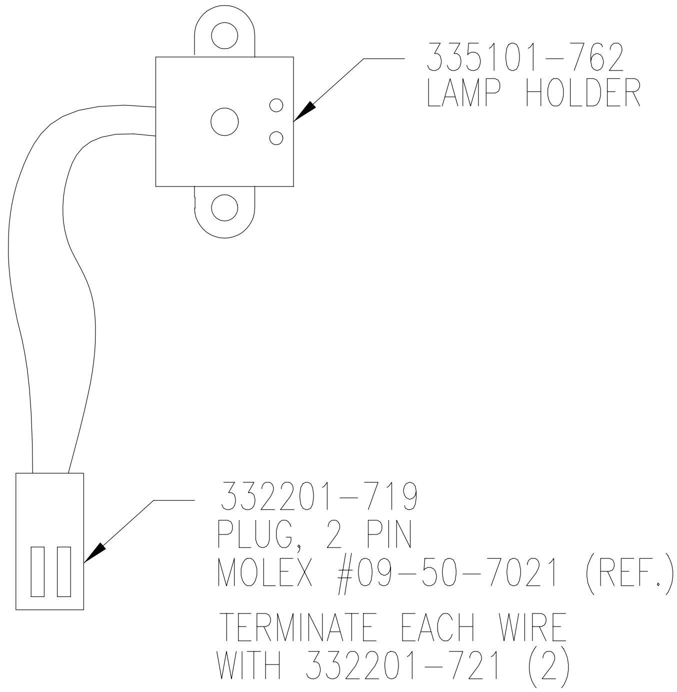
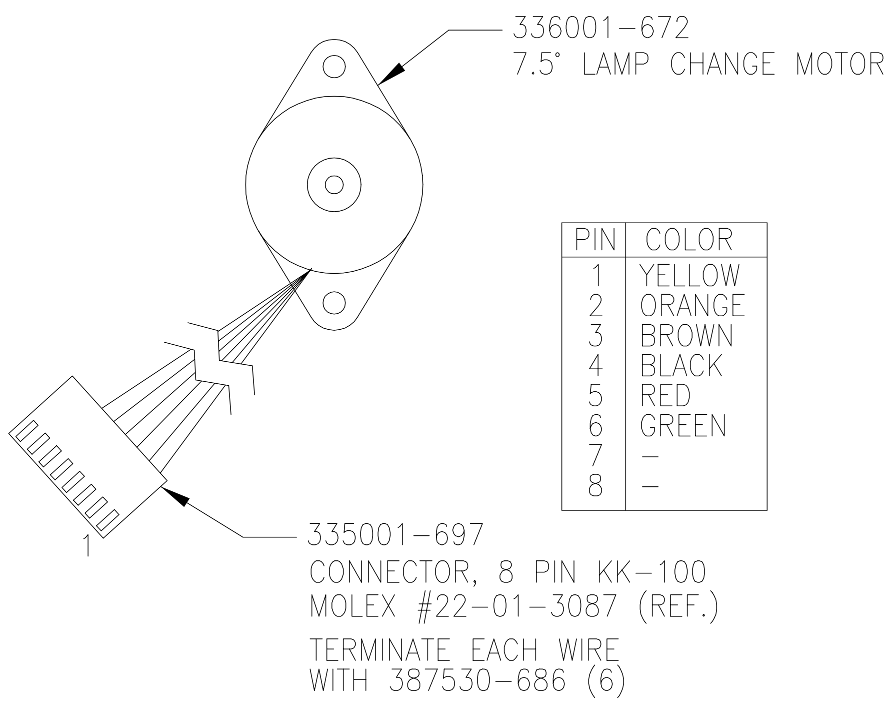
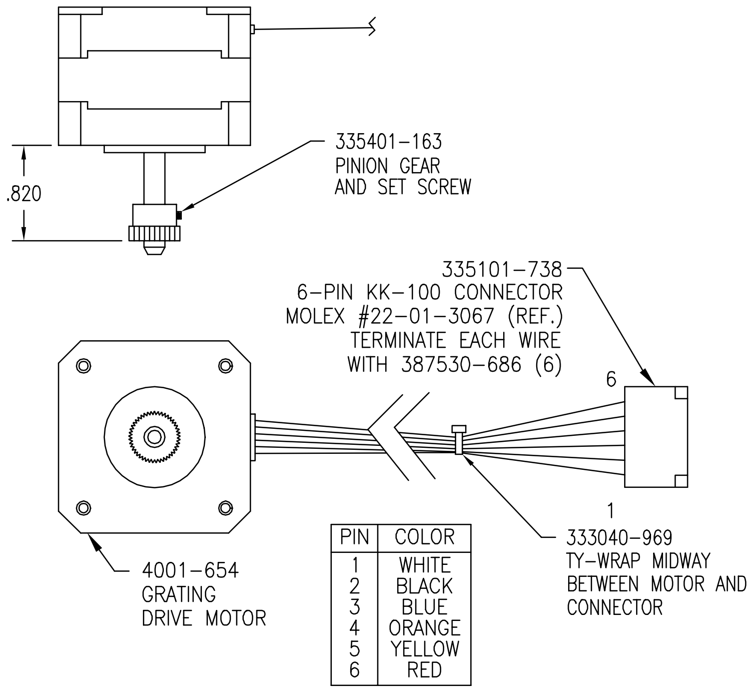


Figure 12.1 -Lamp Socket Assembly [4001-250, Rev. E]



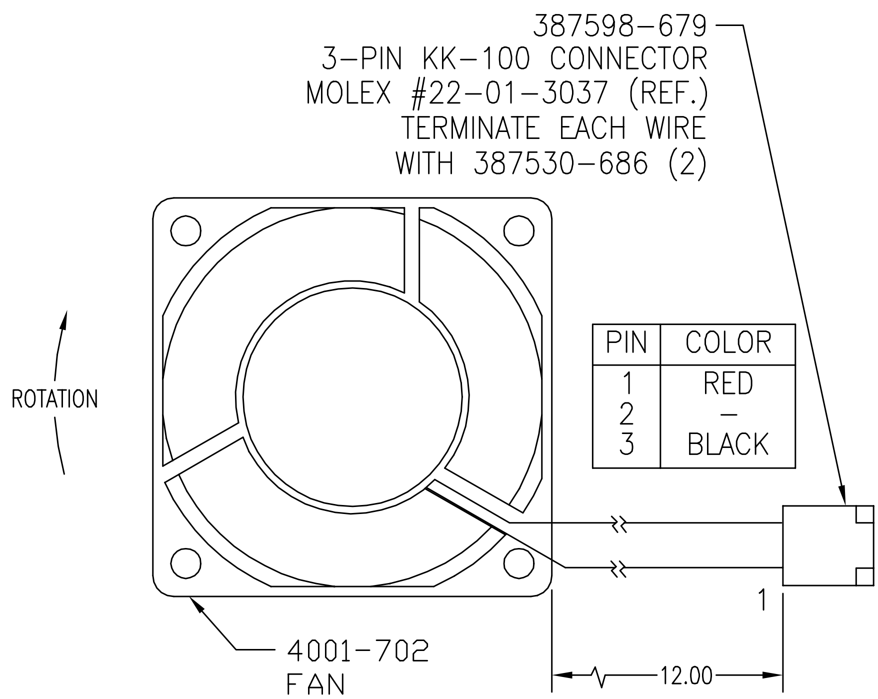
PIN	COLOR
1	YELLOW
2	ORANGE
3	BROWN
4	BLACK
5	RED
6	GREEN
7	–
8	–

Figure 12.2 - Filter Motor Assembly [336001-671, Rev. E]



PIN	COLOR
1	WHITE
2	BLACK
3	BLUE
4	ORANGE
5	YELLOW
6	RED

Figure 12.3 - Grating Motor Assembly [4001-251, Rev. E]



PIN	COLOR
1	RED
2	–
3	BLACK

Figure 12.4 - Fan Assembly [4001-252, Rev. C]
(See **Update Information** section of manual)

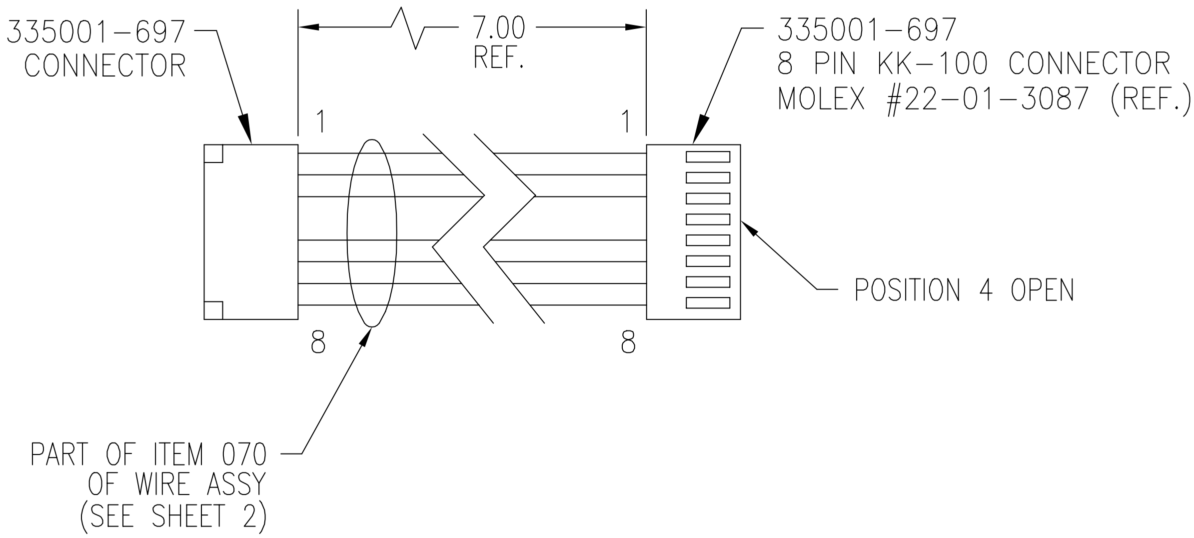


Figure 12.5 - Mono Motor Power Cable Assembly [4001-253, Rev. E]

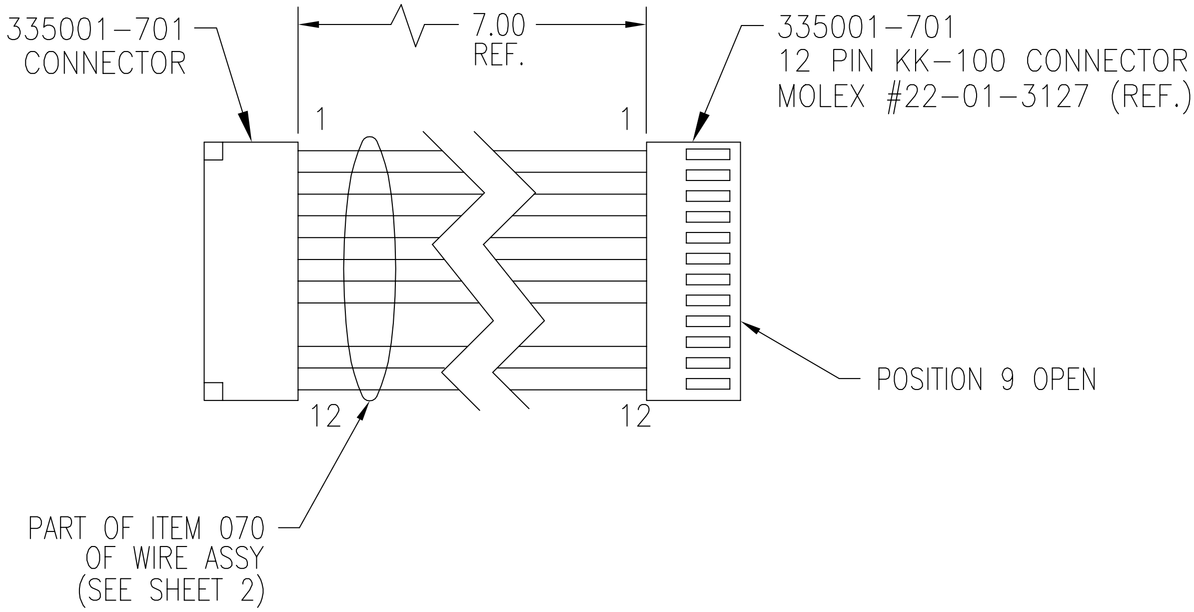


Figure 12.6 - Mono Motor Control Cable Assembly [4001-254, Rev. E]

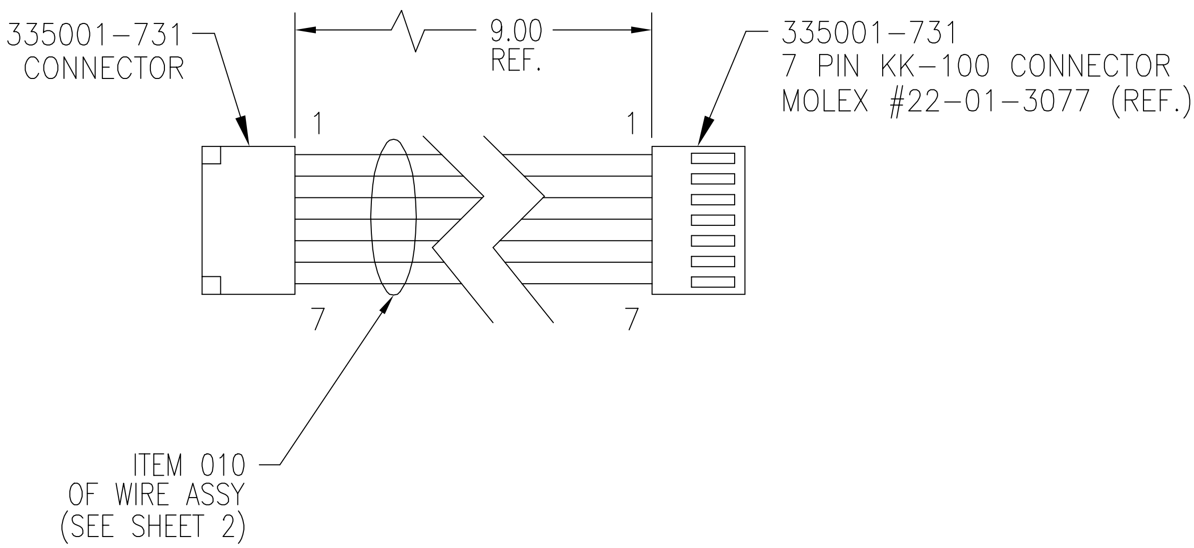


Figure 12.7 - Detector Cable Assembly [4001-255, Rev. E]

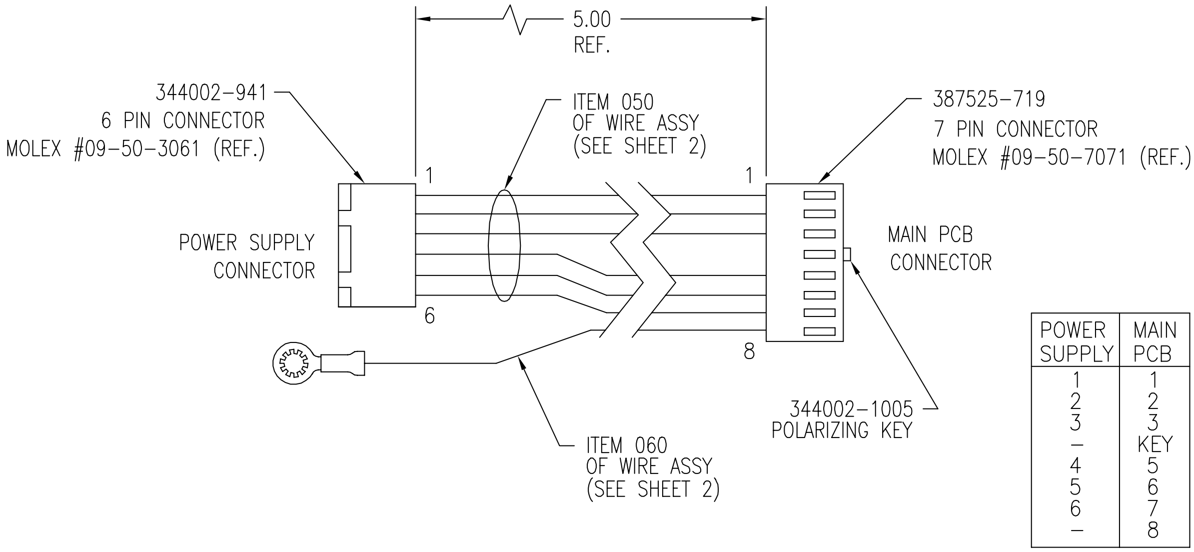


Figure 12.8 - Power Supply Cable Assembly [4001-256, Rev. E]

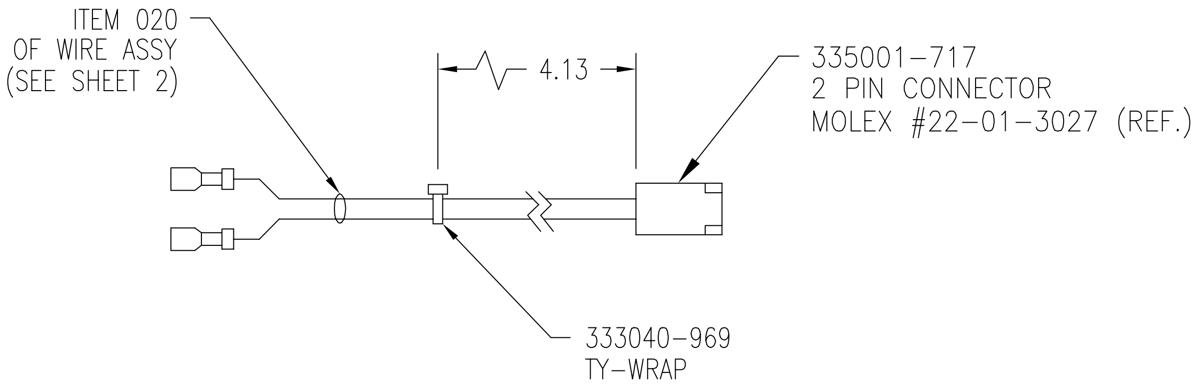


Figure 12.9 - Limit Switch Cable Assembly [4001-261, Rev. E]

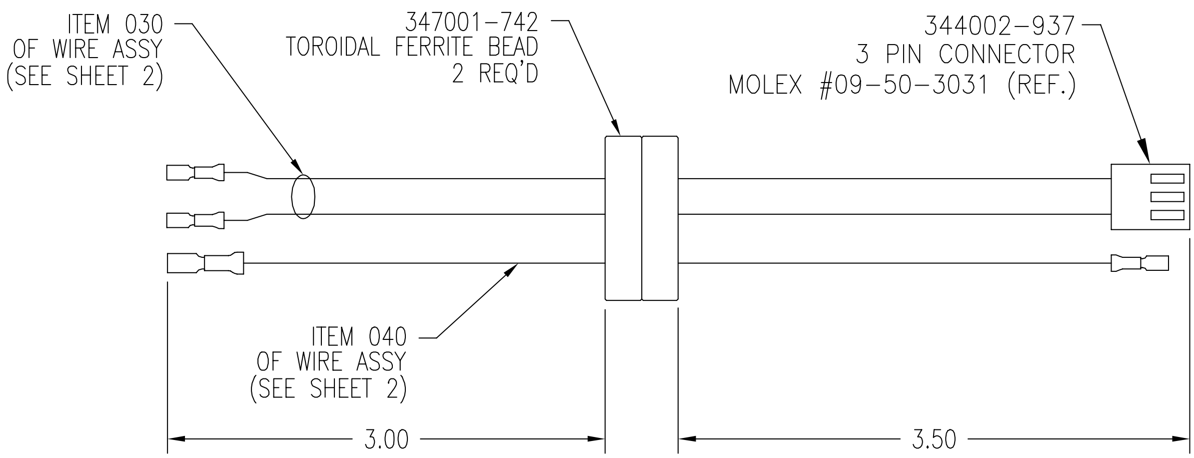


Figure 12.10 - Power Entry Cable Assembly [4001-262, Rev. E]

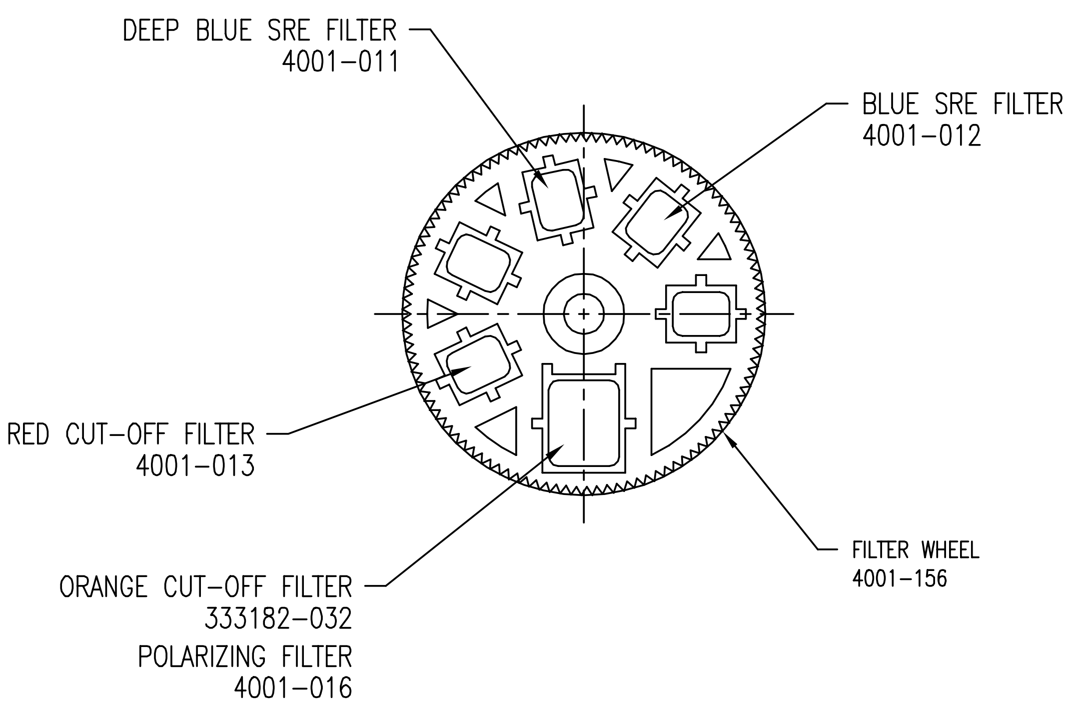


Figure 12.11 - Filter Assembly [4001-263, Rev. E]

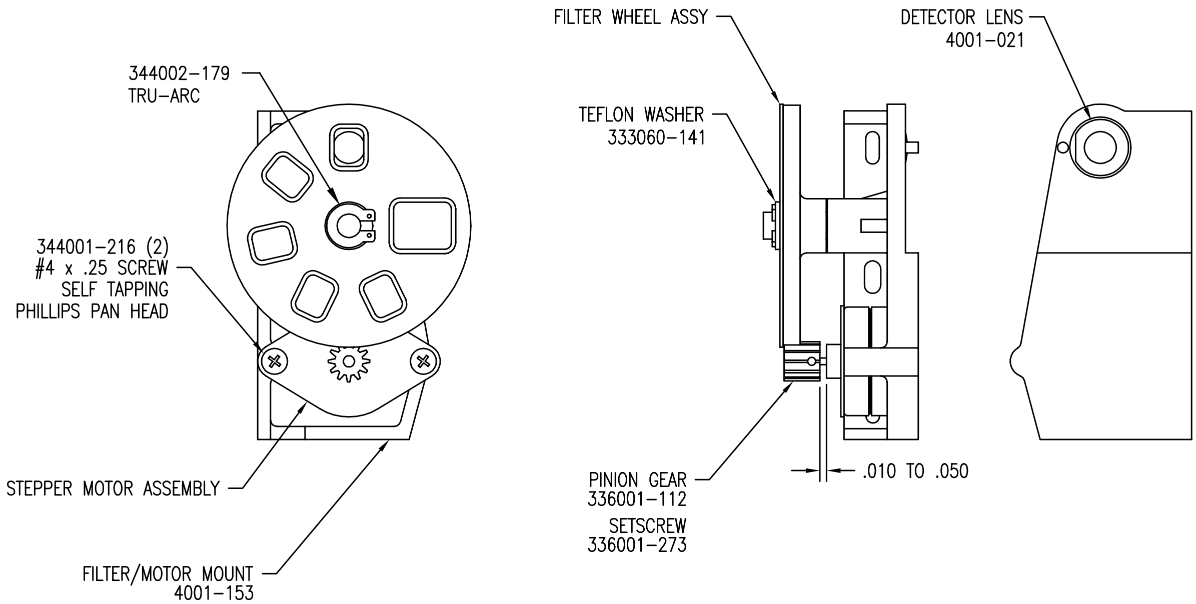


Figure 12.12 - Filter & Lens Assembly [4001-264, Rev. G]

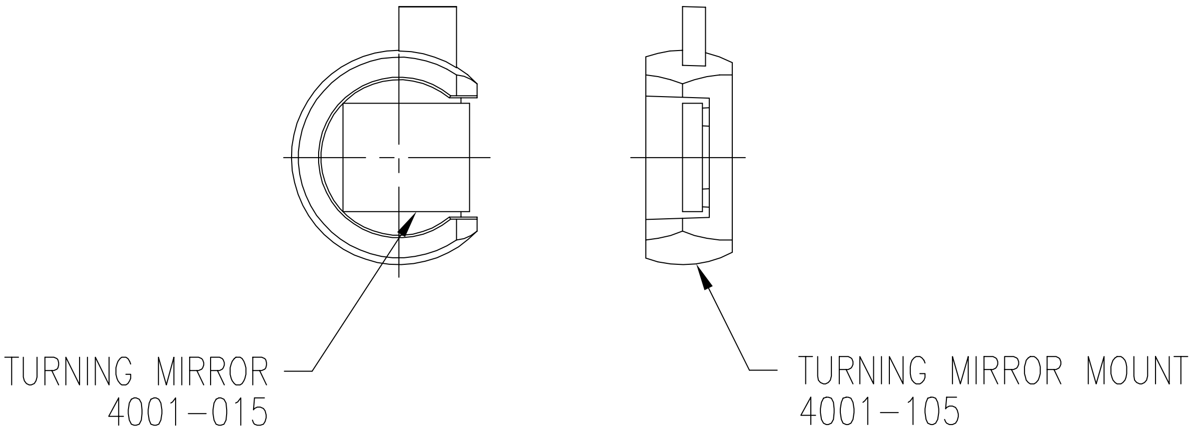


Figure 12.13 - Turning Mirror Assembly [4001-265, Rev. E]

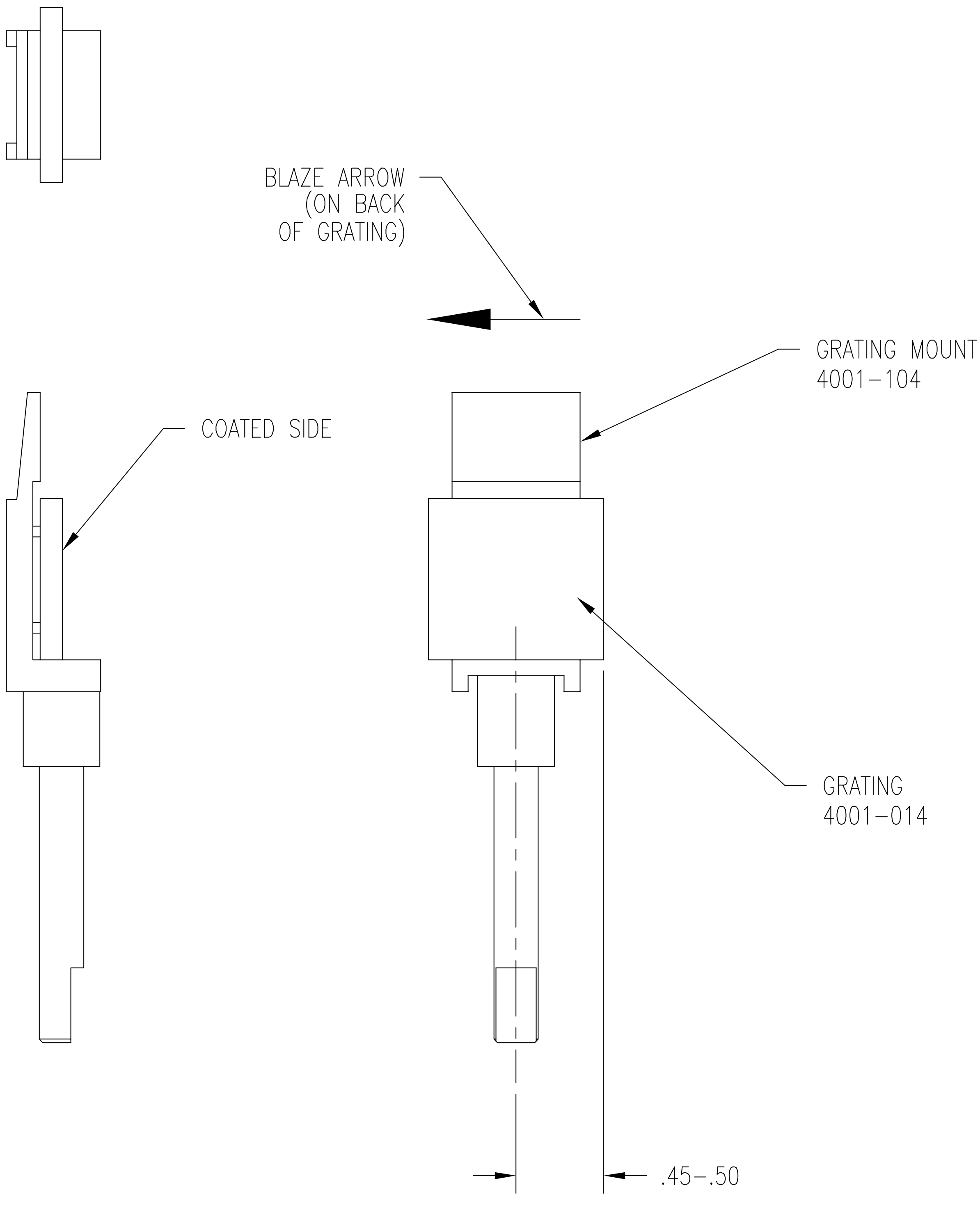


Figure 12.14 - Grating & Mount Assembly [4001-266, Rev. E]

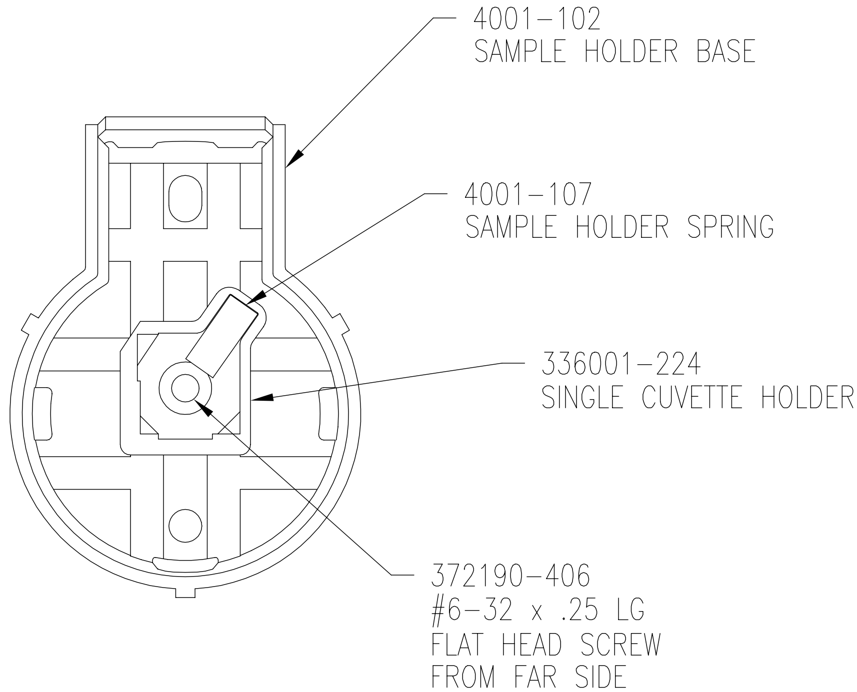


Figure 12.15 - Cuvette Adapter Assembly [4010-000, Rev. E]

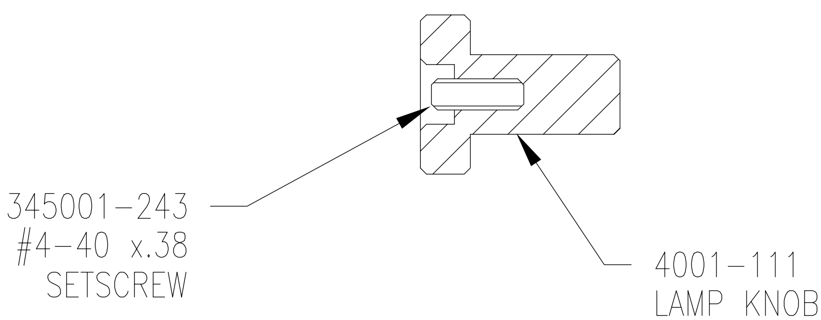


Figure 12.16 - Lamp Knob Assembly [4001-267, Rev. E]

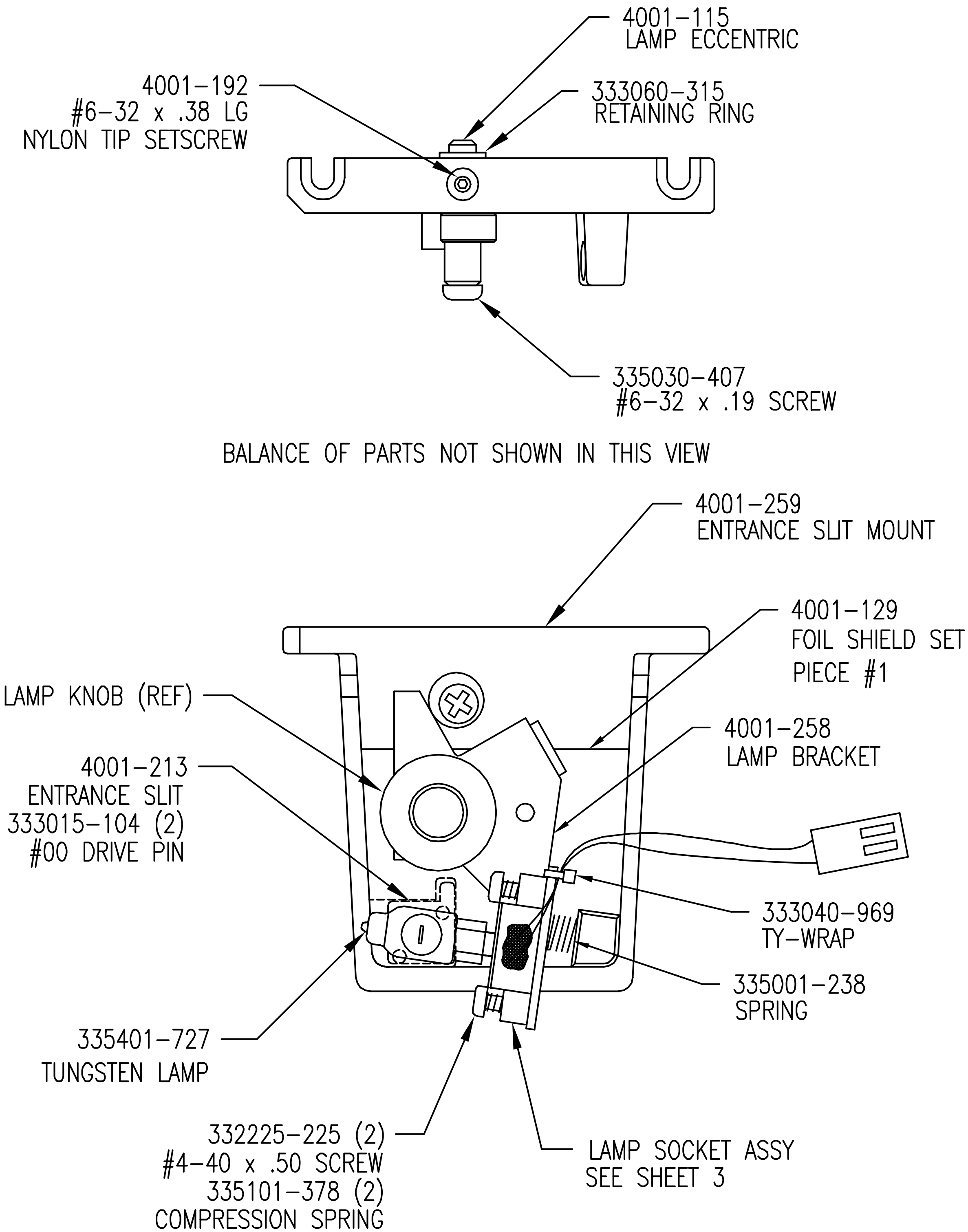


Figure 12.17 - Entrance Slit / Illumination Assembly [4001-268, Rev. E]

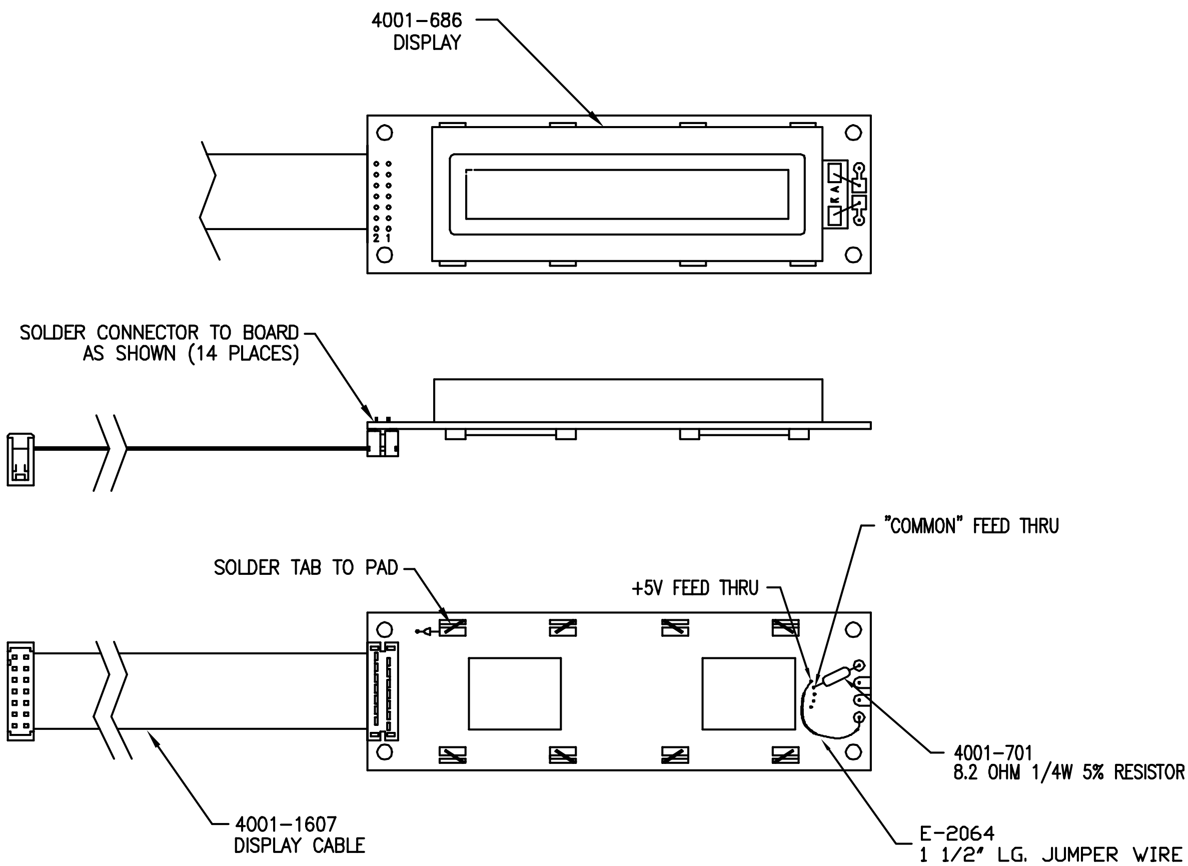


Figure 12.18 - Display Assembly [4001-269, Rev. E]

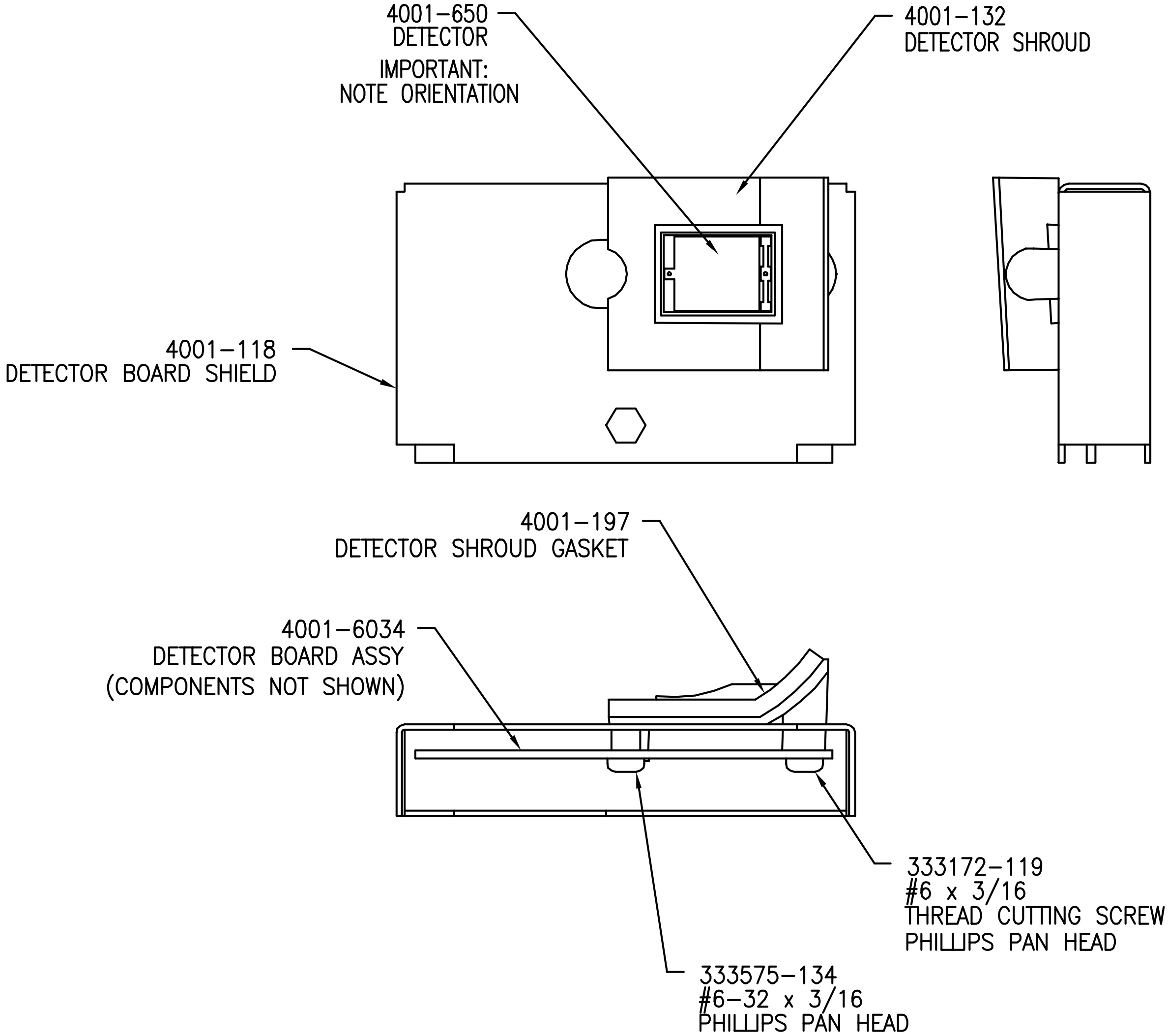


Figure 12.19 - Detector Assembly [4001-270, Rev. E]

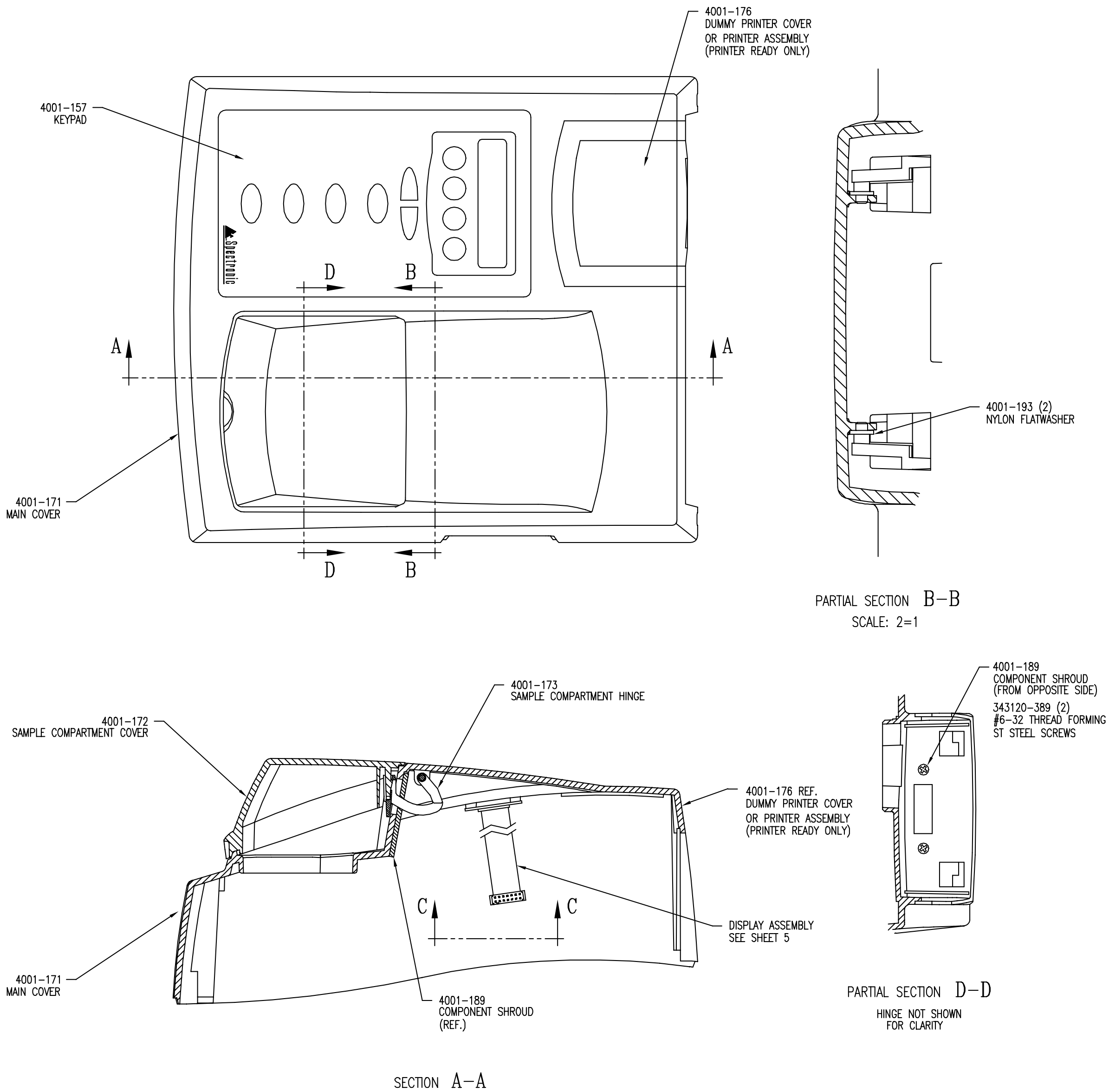


Figure 12.20 - Main Cover Assembly [4001-271, Rev. D]

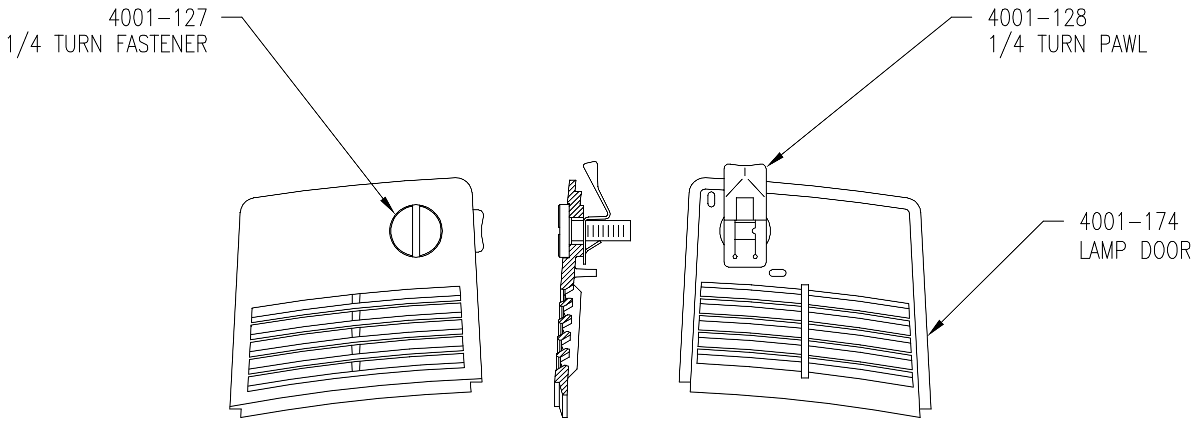


Figure 12.21 - Lamp Door Assembly [4001-272, Rev. D]

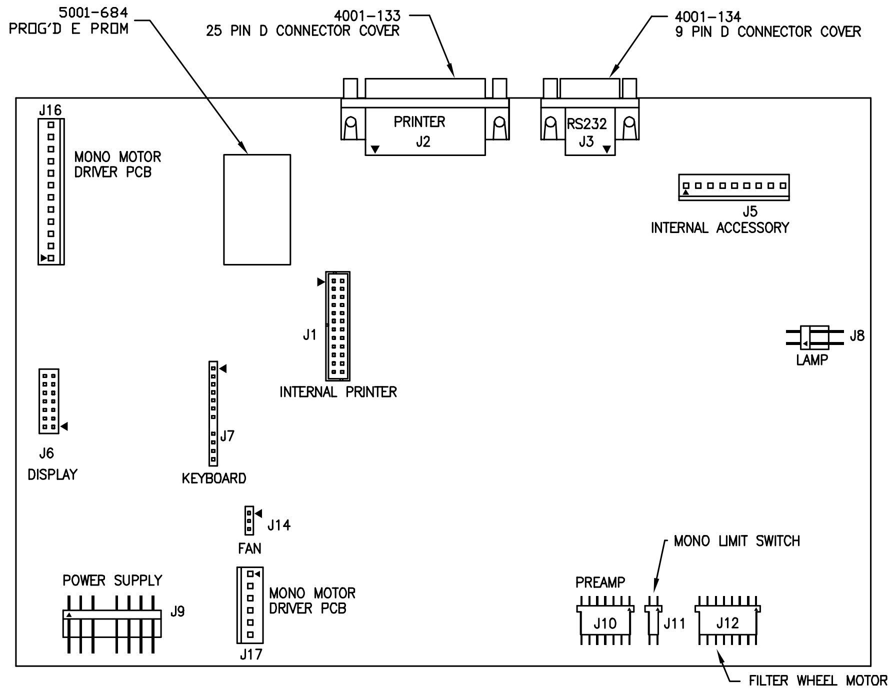


Figure 12.22 - Main Board [4001-6046, Rev. K]

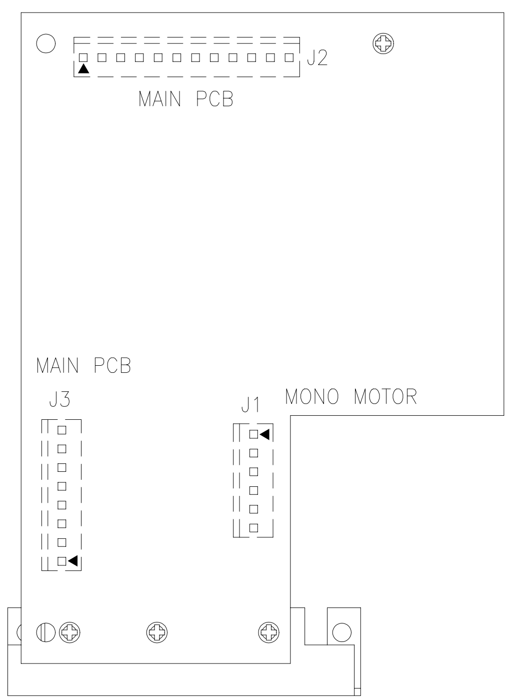
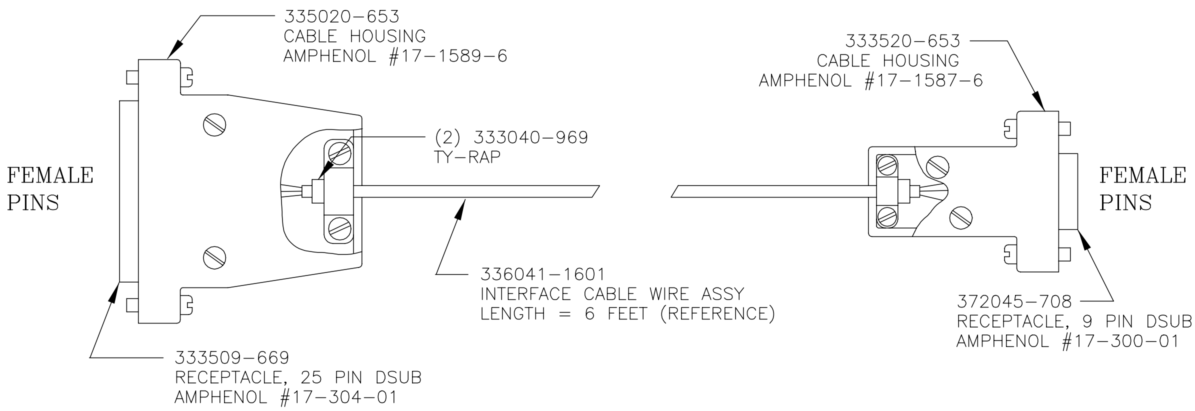
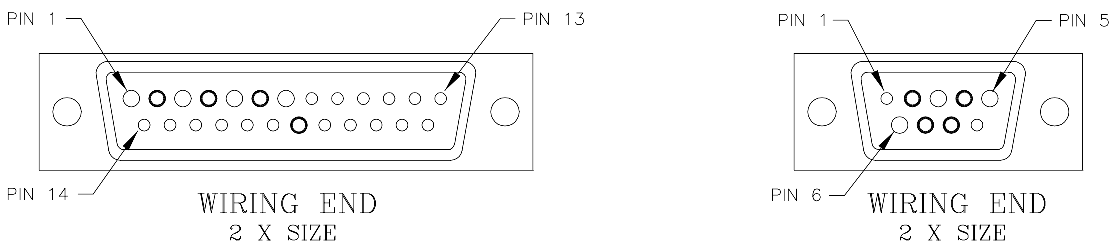


Figure 12.23 - Mono Motor Board [4001-6056, Rev. K]

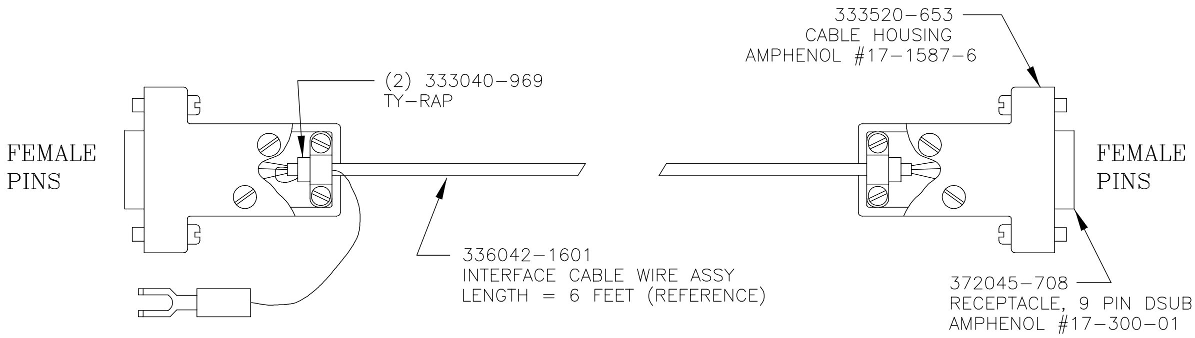


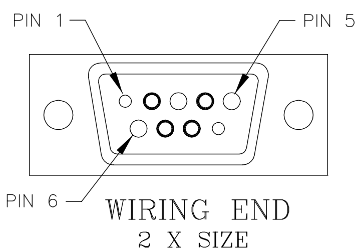


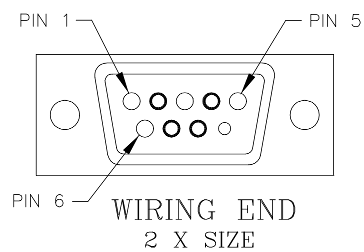
PIN	COLOR	SIGNAL
1	DRAIN	CHASSIS GND
2	BROWN	TXD
3	BLACK	RXD
4	GREEN	RTS
5	BLUE	CTS
6	YELLOW	DSR
7	ORANGE	SIG GND
20	RED	DTR

PIN	COLOR	SIGNAL
1	–	DCD
2	BLACK	RXD
3	BROWN	TXD
4	RED	DTR
5	ORANGE	SIG GND
6	YELLOW	DSR
7	GREEN	RTS
8	BLUE	CTS
9	–	RI

Figure 12.26 - Interface Cable - IBM PC/XT [336041-1602, Sht. 1,Rev. A]



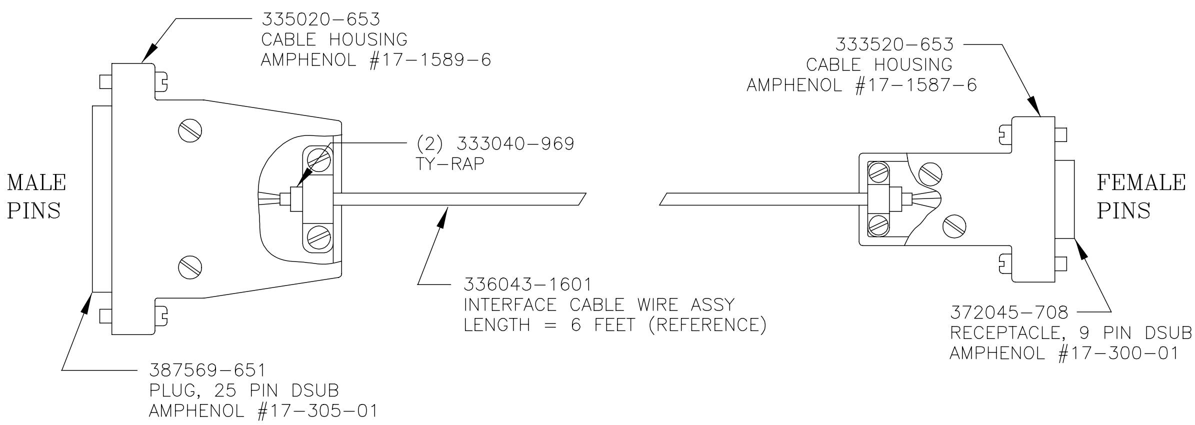


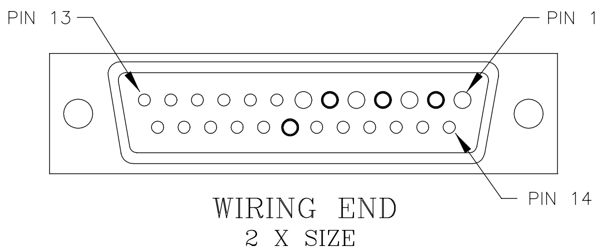


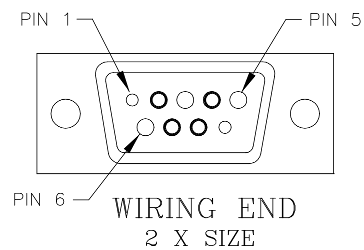
PIN	COLOR	SIGNAL
1	–	DCD
2	BLACK	RXD
3	BROWN	TXD
4	RED	DTR
5	ORANGE	SIG GND
6	YELLOW	DSR
7	GREEN	RTS
8	BLUE	CTS
9	–	RI

PIN	COLOR	SIGNAL
1	–	DCD
2	BLACK	RXD
3	BROWN	TXD
4	RED	DTR
5	ORANGE	SIG GND
6	YELLOW	DSR
7	GREEN	RTS
8	BLUE	CTS
9	–	RI

Figure 12.27 - Interface Cable - IBM PC/AT [335942-000, Sht. 1, Rev. A]







PIN	COLOR	SIGNAL
1	DRAIN	CHASSIS GND
2	BROWN	TXD
3	BLACK	RXD
4	GREEN	RTS
5	BLUE	CTS
6	YELLOW	DSR
7	ORANGE	SIG GND
20	RED	DTR

PIN	COLOR	SIGNAL
1	–	DCD
2	BLACK	RXD
3	BROWN	TXD
4	RED	DTR
5	ORANGE	SIG GND
6	YELLOW	DSR
7	GREEN	RTS
8	BLUE	CTS
9	–	RI

Figure 12.28 - Interface Cable - Non-IBM [336043-000, Sht. 1, Rev. A]

12.2 Boards and Schematics

Main Board Assembly [4001-6024, Rev. A]

Ref. Des.	Description
1	Main Board
2	Heatsink, Thermalloy #6043PB
B1	Not Presently Used
BZ1	Beeper
C1	Capacitor Cerm., .1 Mfd 50V
C2	Capacitor Tant., 4.7 Mfd 10V
C3	Capacitor Tant., 10 Mfd 20V
C4	S/A C1 .1 Mfd 50V Cerm.
C5	S/A C1. 1 Mfd 50V Cerm.
C6	Capacitor Elect., 47 Mfd 10V
C7	S/A C1 .1 Mfd 50V Cerm.
C8	S/A C1 .1 Mfd 50V Cerm.
C9	S/A C1 .1 Mfd 50V Cerm.
C10	S/A C1 .1 Mfd 50V Cerm.
C11	Not Presently Used
C12	Not Presently Used
C13	Capacitor Cerm., 27 Pf 27V
C14	S/A C13 27 Pf 27V Cerm.
C15	S/A C1 .1 Mfd 50V Cerm.
C16	Capacitor Tant., 1 Mfd 20V
C17	Capacitor Elect., 470 Mfd 35V
C18	S/A C17 470 Mfd 35V Tant.
C19	S/A C1 .1 Mfd 50V Cerm.
C20	Capacitor Cerm., .22 Mfd 50V
C21	S/A C6 47 Mfd 20V Tant.
C22	S/A C3 10 Mfd 20V Tant.
C23	S/A C2 4.7 Mfd 10V Tant.
C24	S/A C3 10 Mfd 20V Tant.
C25	S/A C3 10 Mfd 20V Tant.
C26	S/A C2 4.7 Mfd 10V Tant.
C27	S/A C2 4.7 Mfd 10V Tant.
C28	Capacitor Polycarb., .068 Mfd 50V
C29	Capacitor Film., .001 Mfd 200V
C30	S/A C1 .1 Mfd 50V Cerm.

Ref. Des.	Description
C31	S/A C1 .1 Mfd 50V Cerm.
C32	S/A C1 .1 Mfd 50V Cerm.
C33	S/A C1 .1 Mfd 50V Cerm.
C34	S/A C1 .1 Mfd 50V Cerm.
C35	Capacitor Polycarb., .1 Mfd 100V
C36	Capacitor Cerm., .022 Mfd 50V
C37	Capacitor Polyprop., .1 Mfd 100V
C38	S/A C1 .1 Mfd 50V Cerm.
C39	S/A C1 .1 Mfd 50V Cerm.
C40	S/A C1 .1 Mfd 50V Cerm.
C41	S/A C3 10 Mfd 20V Tant.
D1	Diode, 1N914
D2	Not Presently Used
D3	S/A D1 1N914
D4	S/A D1 1N914
D5	Zener Diode, 1N4693A
D6	Schottky Diode, 1N5822
D7	Diode, 1N4001
D8	S/A D7 1N4001
D9	S/A D7 1N4001
D10	Not Presently Used
D11	S/A D1 1N914
D12	S/A D7 1N4001
D13	S/A D7 1N4001
D14	S/A D7 1N4001
D15	S/A D7 1N4001
D16	S/A D1 1N914
D17	S/A D1 1N914
D18	S/A D7 1N4001
J1	Wafer, Metric Polarized, Dual Row 24 Pin, Molex #87331-2420
J2	Connector, 25 Pin Female D-Sub Holmberg #H2R25RA29BS
J3	Connector, 9 Pin Male D-Sub Holmberg #H2M09RA29BS
J4	Connector, 25 Pin Male D-Sub Holmberg #H2M25RA29BS
J5	Wafer, Polarized 9 Pin KK156, Molex #26-51-0093
J6	Wafer, Non-Polarized Dual Row 14 Pin . 100 Centers, Ansley #609-64 82D-2

Ref. Des.	Description
J7	Wafer, Non-Polarized 12 Pin
	KK100, Molex #22-03-2121
J8	Wafer, Right Angle Polarized 2 Pin
	KK156, Molex #26-48-1024
J9	Wafer, Right Angle Polarized 8 Pin
	KK156, Molex #26-48-1084
J10	Wafer, Right Angle Polarized 7 Pin
	KK100, Molex #22-05-3071
J11	Wafer, Right Angle Polarized 2 Pin
	KK100, Molex #22-05-3021
J12	Wafer, Right Angle Polarized 8 Pin
	KK100, Molex #22-05-3081
J13	Wafer, Right Angle Polarized 6 Pin
	KK100, Molex #22-05-3061
L1	Ferrite Bead, 68 Ohm
L2	Inductor, 100 uH
Q1	Transistor, 2N3904
Q2	Transistor, MPSA64
R1	Potentiometer, 20 K
	Bourns #3386P series
R2	Resistor CF, 47 K 5% 1/4W
R3	Resistor CF, 470 Ohm 5% 1/4W
R4	Resistor CF, 10 K 5% 1/4W
R5	S/A R3 470 Ohm 5% 1/4W CF
R6	S/A R3 470 Ohm 5% 1/4W CF
R7	Not Presently Used
R8	Resistor MF, 1.10 K 1% 1/4W
R9	Resistor MF, 18.2 K 1% 1/4W
R10	Resistor MF, 15.4 K 1% 1/4W
R11	S/A R4 10 K 5% 1/4W CF
R12	Resistor CC, 0.27 Ohm 5% 1W
R13	Resistor CF, 68 K 5% 1/4W
R14	S/A R13 68 K 5% 1/4W CF
R15	S/A R8 1.10 K 1% 1/4W MF
R16	Resistor MF, 205 Ohm 1% 1/4W
R17	Resistor MF, 634.0 K 1% 1/4W
R18	Resistor MF, 10.0 K 1% 1/4W
R19	Resistor MF, 4.99 K 1% 1/4W
R20	S/A R2 47 K 5% 1/4W CF
R21	S/A R4 10 K 5% 1/4W CF

Ref. Des.	Description
R22	S/A R17 634.0 K 1% 1/4W MF
R23	S/A R19 4.99 K 1% 1/4W MF
R24	S/A R18 10.0 K 1% 1/4W MF
R25	Resistor MF, 1.00 K 1% 1/4W
R26	Resistor MF, 49.9 K 1% 1/4W
R27	S/A R4 10 K 5% 1/4W CF
R28	S/A R25 1.00 K 1% 1/4W MF
R29	Resistor MF, 2.49 K 1% 1/4W
R30	S/A R17 634.0 K 1% 1/4W MF
R31	S/A R3 470 Ohm 5% 1/4W CF
R32	Resistor MF, 1.50 M 1% 1/4W
R33	S/A R19 4.99 K 1% 1/4W MF
R34	S/A R19 4.99 K 1% 1/4W MF
R35	S/A R29 2.49 K 1% 1/4W MF
R36	S/A R2 47 K 5% 1/4W CF
R37	S/A R4 10 K 5% 1/4W CF
U1	Not Presently Used
U2	Not Presently Used
U3	Programmed AM27C512
U4	IC X28C16
U5	IC 74HC373
U6	IC 74HC244
U7	IC 74HC00
U8	IC MC145406
U9	IC 74HC374
U10	S/A U9 74HC374
U11	IC 74HC257
U12	IC DS1233D-10
U13	IC 74HC08
U14	IC 74HC138
U15	IC 74HC240
U16	S/A U9 74HC374
U17	IC 74HC273
U18	S/A U17 74HC273
U19	S/A U15 74HC240
U20	S/A U17 74HC273
U21	Not Presently Used
U22	IC 80C251
U23	IC 74HC04
U24	IC 74HC139
U25	IC 74HC154
U26	IC MC34166T

Ref. Des.	Description
U27	IC TL071CP
U28	IC LM78L05
U29	IC LM337T
U30	IC LM78L08
U31	IC CD4051
U32	IC 74HC132
U33	S/A U17 74HC273
U34	S/A U17 74HC273
U35	S/A U17 74HC273
U36	S/A U17 74HC273
U37	IC ULN2803
U38	S/A U13 74HC08
U39	S/A U37 ULN2803
U40	IC TLC2272CP
U41	IC TL072P
U42	IC MC1404U5 (REF 02)
U43	IC CD4053 (MC14053)
U44	IC DAC08
W1	Copper Connection on Board
W2	Copper Connection on Board
W3	Copper Connection on Board
W4	Copper Connection on Board
W5	Copper Connection on Board
W6	Not Presently Used
W7	Not Presently Used
W8	Not Presently Used
W9	Copper Connection on Board
XBT1	Not Presently Used
XU1	Not Presently Used
XU2	Not Presently Used
XU3	IC Socket, 28 Pin ZIF
XU4	IC Socket, 28 Pin
XU22	IC Socket, 44 Pin PLCC
Y1	Not Presently Used
Y2	Crystal, 11.0592 MHz
Z1	Not Presently Used
Z2	Resistor Netwk, Iso., 470 Ohm DIP (8)
Z3	S/A Z2 470 Ohm DIP Netwk

Ref. Des.	Description
Z4	Resistor Netwk, Com., 10 K SIP (9)
Z5	S/A Z4 10 K SIP Netwk
Z6	S/A Z2 470 Ohm DIP Netwk
Z7	S/A Z2 470 Ohm DIP Netwk
Z8	S/A Z4 10 K SIP Netwk
Z9	Resistor Netwk, Precision, 1.0K/9.0K

Main Board Assembly [4001-6044, Rev. B]

Ref. Des.	Description
1	Main Board
2	Heatsink, Thermalloy #6043PB
B1	Not Presently Used
BZ1	Beeper
C1	Capacitor Cerm., .1 Mfd 50V
C2	Capacitor Tant., 4.7 Mfd 10V
C3	Not Presently Used
C4	S/A C1 .1 Mfd 50V Cerm.
C5	S/A C1 .1 Mfd 50V Cerm.
C6	Capacitor Elect., 47 Mfd 10V
C7	S/A C1 .1 Mfd 50V Cerm.
C8	S/A C1 .1 Mfd 50V Cerm.
C9	S/A C1 .1 Mfd 50V Cerm.
C10	S/A C1 .1 Mfd 50V Cerm.
C11	Not Presently Used
C12	Not Presently Used
C13	Capacitor Cerm., 27 Pf 27V
C14	S/A C13 27 Pf 27V Cerm.
C15	S/A C1 .1 Mfd 50V Cerm.
C16	Capacitor Tant., 1 Mfd 20V
C17	Capacitor Elect., 470 Mfd 35V
C18	S/A C17 470 Mfd 35V Tant.
C19	S/A C1 .1 Mfd 50V Cerm.
C20	Capacitor Cerm., .22 Mfd 50V
C21	S/A C6 47 Mfd 20V Tant.
C22	Capacitor Tant., 10 Mfd 20V
C23	S/A C2 4.7 Mfd 10V Tant.
C24	S/A C22 10 Mfd 20V Tant.
C25	S/A C22 10 Mfd 20V Tant.
C26	S/A C2 4.7 Mfd 10V Tant.
C27	S/A C2 4.7 Mfd 10V Tant.
C28	Capacitor Polycarb., .1 Mfd 50V
C29	Capacitor Film., .001 Mfd 200V
C30	S/A C1 .1 Mfd 50V Cerm.
C31	S/A C1 .1 Mfd 50V Cerm.
C32	S/A C1 .1 Mfd 50V Cerm.
C33	S/A C1 .1 Mfd 50V Cerm.
C34	S/A C1 .1 Mfd 50V Cerm.

Ref. Des.	Description
C35	Capacitor Polycarb, .1 Mfd 100V
C36	Not Presently Used
C37	Capacitor Polyprop., .1 Mfd 100V
C38	S/A C1 .1 Mfd 50V Cerm.
C39	S/A C1 .1 Mfd 50V Cerm.
C42	S/A C1 .1 Mfd 50V Cerm.
C43	S/A C1 .1 Mfd 50V Cerm.
C44	S/A C22 10 Mfd 20V Tant.
C45	S/A C1 .1 Mfd 50V Cerm.
C46	S/A C1 .1 Mfd 50V Cerm.
C47	S/A C1 .1 Mfd 50V Cerm.
C48	S/A C1 .1 Mfd 50V Cerm.
C49	S/A C1 .1 Mfd 50V Cerm.
D1	Diode, 1N914
D2	Not Presently Used
D3	Diode, LM336Z-2.5V
D5	Zener Diode, 1N4693A
D6	Schottky Diode, 1N5822
D7	Diode, 1N4001
D8	S/A D7 1N4001
D9	S/A D7 1N4001
D11	S/A D1 1N914
D16	S/A D1 1N914
D17	S/A D1 1N914
D18	S/A D7 1N4001
J1	Wafer, Metric Polarized, Dual Row
	24 Pin, Molex #87331-2420
J2	Connector, 25 Pin Female D-Sub
	Holmberg #H2R25RA29BS
J3	Connector, 9 Pin Male D-Sub
	Holmberg #H2M09RA29BS
J4	Not Presently Used
J5	Wafer, Polarized 9 Pin
	KK156, Molex #26-51-0093
J6	Wafer, Non-Polarized Dual Row 14 Pin
	.100 Centers, Ansley #609-64 82D-2
J7	Wafer, Non-Polarized 12 Pin
	KK100, Molex #22-03-2121
J8	Wafer, Right Angle Polarized 2 Pin
	KK156, Molex #26-48-1024

Ref. Des.	Description
J9	Wafer, Right Angle Polarized 8 Pin
	KK156, Molex #26-48-1084
J10	Wafer, Right Angle Polarized 7 Pin
	KK100, Molex #22-05-3071
J11	Wafer, Right Angle Polarized 2 Pin
	KK100, Molex #22-05-3021
J12	Wafer, Right Angle Polarized 8 Pin
	KK100, Molex #22-05-3081
J14	Wafer, Polarized 3 Pin
	KK100, Molex #22-23-2031
J15	Not Presently Used
J16	Wafer, Polarized 12 Pin
	KK100, Molex #22-23-2121
J17	Wafer, Polarized 8 Pin
	KK100, Molex #22-23-2081
L1	Ferrite Bead, 68 Ohm
L2	Inductor, 100 uH
Q1	Transistor, 2N3904
Q2	Transistor, MPSA64
R1	Potentiometer, 20 K
	Bourns #3386P series
R2	Resistor CF, 47 K 5% 1/4W
R3	Resistor CF, 470 Ohm 5% 1/4W
R4	Resistor CF, 10 K 5% 1/4W
R5	S/A R3 470 Ohm 5% 1/4W CF
R6	S/A R3 470 Ohm 5% 1/4W CF
R7	Not Presently Used
R8	Resistor MF, 1.10 K 1% 1/4W
R9	Resistor MF, 18.2 K 1% 1/4W
R10	Resistor MF, 49.9 K 1% 1/4W
R11	S/A R4 10 K 5% 1/4W CF
R12	Resistor CC, 0.27 Ohm 5% 1W
R13	Resistor CF, 68 K 5% 1/4W
R14	S/A R13 68 K 5% 1/4W CF
R15	S/A R8 1.10 K 1% 1/4W MF
R16	Resistor MF, 205 Ohm 1% 1/4W
R17	Resistor MF, 634.0 K 1% 1/4W
R18	Resistor MF, 10.0 K 1% 1/4W
R19	Resistor MF, 4.99 K 1% 1/4W
R20	S/A R2 47 K 5% 1/4W CF

Ref. Des.	Description
R21	S/A R4 10 K 5% 1/4W CF
R22	S/A R17 634.0 K 1% 1/4W MF
R23	S/A R19 4.99 K 1% 1/4W MF
R24	S/A R18 10.0 K 1% 1/4W MF
R25	Resistor MF, 1.00 K 1% 1/4W
R26	S/A R10 49.9 K 1% 1/4W MF
R27	S/A R4 10 K 5% 1/4W CF
R28	S/A R25 1.00 K 1% 1/4W MF
R29	Resistor MF, 2.49 K 1% 1/4W
R30	S/A R17 634.0 K 1% 1/4W MF
R31	S/A R3 470 Ohm 5% 1/4W CF
R32	Resistor MF, 1.50 M 1% 1/4W
R33	S/A R19 4.99 K 1% 1/4W MF
R34	S/A R19 4.99 K 1% 1/4W MF
R35	S/A R29 2.49 K 1% 1/4W MF
R36	S/A R2 47 K 5% 1/4W CF
R37	S/A R4 10 K 5% 1/4W CF
R38	Not Presently Used
R39	S/A R25 1.00 K 1% 1/4W MF
R40	Resistor MF, 274.0 K 1% 1/4W
U1	Not Presently Used
U2	Not Presently Used
U3	Programmed TMS 27C512
U4	IC X28C16
U5	IC 74HC373
U6	IC 74HC244
U7	IC 74HC00
U8	IC MC145406
U9	IC 74HC374
U10	S/A U9 74HC374
U11	IC 74HC257
U12	IC DS1233D-10
U13	IC 74HC08
U14	IC 74HC138
U15	IC 74HC240
U16	S/A U9 74HC374
U17	IC 74HC273
U18	S/A U17 74HC273
U19	S/A U15 74HC240
U20	S/A U17 74HC273
U21	Not Presently Used
U22	IC 80C251

Ref. Des.	Description
U23	IC 74HC04
U24	IC 74HC139
U25	IC 74HC154N
U26	IC MC34166T
U27	IC TL071CP
U28	IC LM78L05
U29	IC LM337T
U30	IC LM78L08
U31	IC CD4051
U32	IC 74HC132
U33	S/A U17 74HC273
U34	S/A U17 74HC273
U35	S/A U17 74HC273
U36	S/A U17 74HC273
U37	IC ULN2803
U40	IC TLC2272ACP
U41	IC TL072P
U42	IC MC1404U5 (REF 02)
U43	IC CD4053(MC14053)
U44	IC DAC08
W1	Copper Connection on Board
W3	Copper Connection on Board
W4	Copper Connection on Board
W5	Copper Connection on Board
W6	Not Presently Used
W7	Not Presently Used
W8	Not Presently Used
W9	Copper Connection on Board
XBT1	Not Presently Used
XU1	Not Presently Used
XU2	Not Presently Used
XU3	IC Socket, 28 Pin ZIF
XU4	IC Socket, 28 Pin
XU22	IC Socket, 44 Pin PLCC
Y1	Not Presently Used
Y2	Crystal, 11.0592 MHz
Z1	Not Presently Used
Z2	Resistor Netwk, Iso., 470 Ohm DIP (8)

Ref. Des.	Description
Z3	S/A Z2 470 Ohm DIP Netwk
Z4	Resistor Netwk, Com., 10 K SIP (9)
Z5	S/A Z4 10 K SIP Netwk
Z6	S/A Z2 470 Ohm DIP Netwk
Z7	S/A Z2 470 Ohm DIP Netwk
Z8	S/A Z4 10 K SIP Netwk
Z9	Resistor Netwk, Precision, 1.0K/9.0K

Mono Driver Board Assembly [4001-6054, Rev. A]

Ref. Des.	Description
1	Mono Driver Board
2	Heatsink, Thermalloy #6099B
3	Insulator
4	Shoulder Washer
5	Screw, 4-40T x .50 Long Pan Head
6	Keps Nut, #4-40T
C1	Capacitor Cerm, .1 MFD 50V
C2	Capacitor Cerm, .01 MFD 80V
C3	S/A C1 .1 Mfd 50V Cerm.
C4	S/A C2 .01 Mfd 80V Cerm.
C5	S/A C1 .1 Mfd 50V Cerm.
C6	Capacitor Tant., 10 Mfd 20V
C7	S/A C1 .1 Mfd 50V Cerm.
C8	S/A C6 10 Mfd 20V Tant.
C9	S/A C6 10 Mfd 20V Tant.
C10	S/A C1 .1 Mfd 50V Cerm.
C11	S/A C1 .1 Mfd 50V Cerm.
C12	S/A C1 .1 Mfd 50V Cerm.
C13	S/A C1 .1 Mfd 50V Cerm.
C14	S/A C1 .1 Mfd 50V Cerm.
C15	S/A C1 .1 Mfd 50V Cerm.
D1	Diode, 1N914
D2	Diode, 1N4001
D3	S/A D1 1N914
D4	S/A D2 1N4001
D5	S/A D1 1N914
D6	S/A D2 1N4001
D7	S/A D1 1N914
D8	S/A D2 1N4001
J1	Connector, 6 Pin Polarized KK100, Molex #22-23-2061
J2	Connector, 12 Pin Polarized KK100, Molex #22-23-2121
J3	Connector, 8 Pin Polarized KK100, Molex #22-23-2081
Q1	Transistor, MTP3055E
Q2	S/A Q1 MTP3055E

Ref. Des.	Description
Q3	S/A Q1 MTP3055E
Q4	S/A Q1 MTP3055E
R1	Resistor MF, 10.0 K 1% 1/4W
R2	S/A R1 10.0 K 1% 1/4W MF
R3	Resistor MF, 20.0 K 1% 1/4W
R4	S/A R3 20.0 K 1% 1/4W MF
R5	Resistor CF, 1 K 5% 1/4W
R6	Resistor MF, 1.50 K 1% 1/4W
R7	Resistor Power, 0.47 Ohm 5% 1/2W
R8	S/A R5 1K 5% 1/4W CF
R9	S/A R6 1.50 K 1% 1/4W MF
R10	S/A R7 0.47 Ohm 5% 1/2W Power
R11	S/A R1 10.0 K 1% 1/4W MF
R12	S/A R1 10.0 K 1% 1/4W MF
R13	S/A R3 20.0 K 1% 1/4W MF
R14	S/A R3 20.0 K 1% 1/4W MF
R15	S/A R5 1K 5% 1/4W CF
R16	S/A R6 1.50 K 1% 1/4W MF
R17	S/A R7 0.47 Ohm 5% 1/2W Power
R18	S/A R5 1K 5% 1/4W CF
R19	S/A R6 1.50 K 1% 1/4W MF
R20	S/A R7 0.47 Ohm 5% 1/2W Power
R21	Resistor CF, 100 Ohm 5% 1/4W
R22	S/A R21 100 Ohm 5% 1/4W CF
U1	IC 74HC273
U2	S/A U1 74HC273
U3	IC DAC0800
U4	S/A U3 DAC0800
U5	IC LM324N
U6	IC REF-02

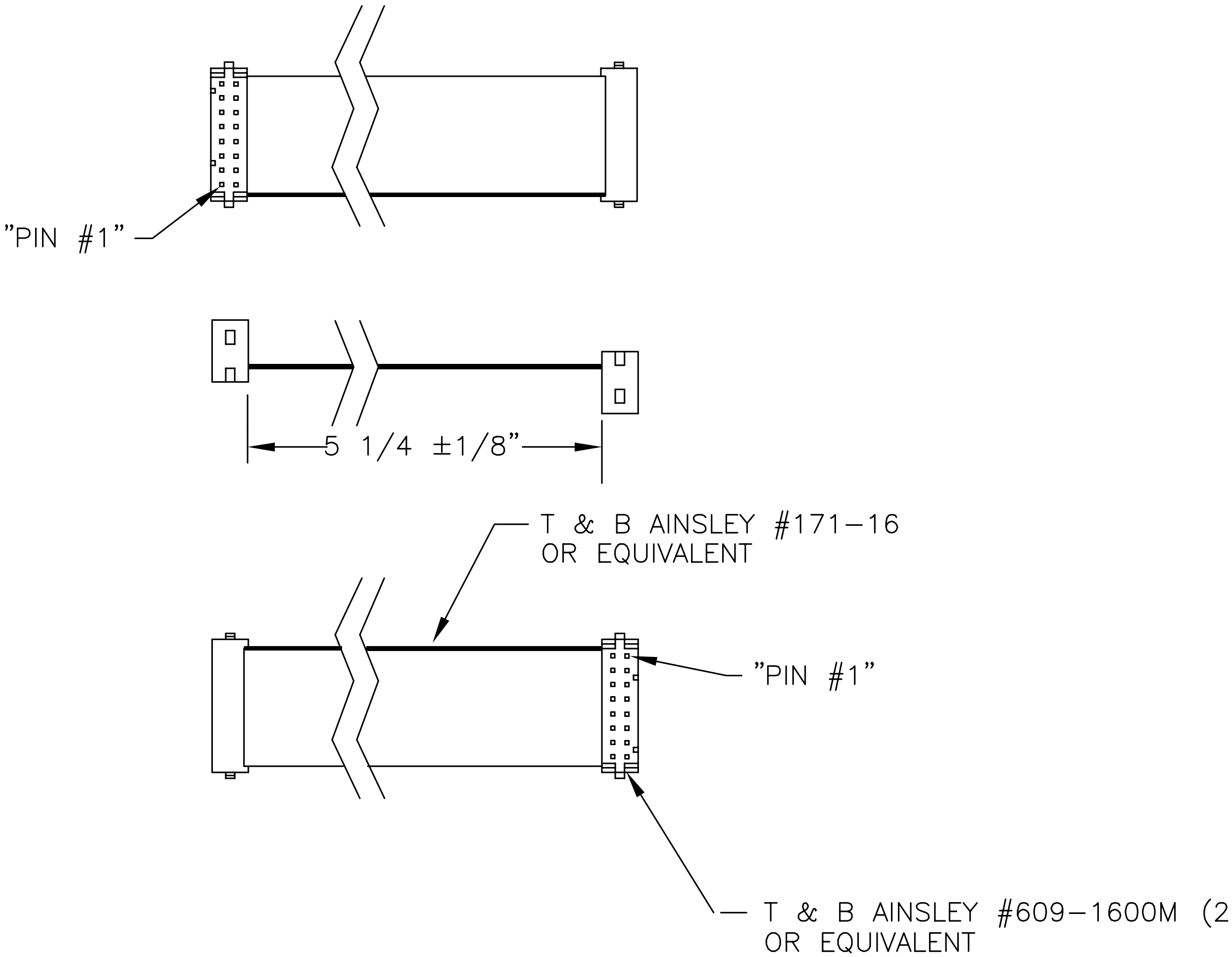


Figure 12.29 Printer/Relay Cable

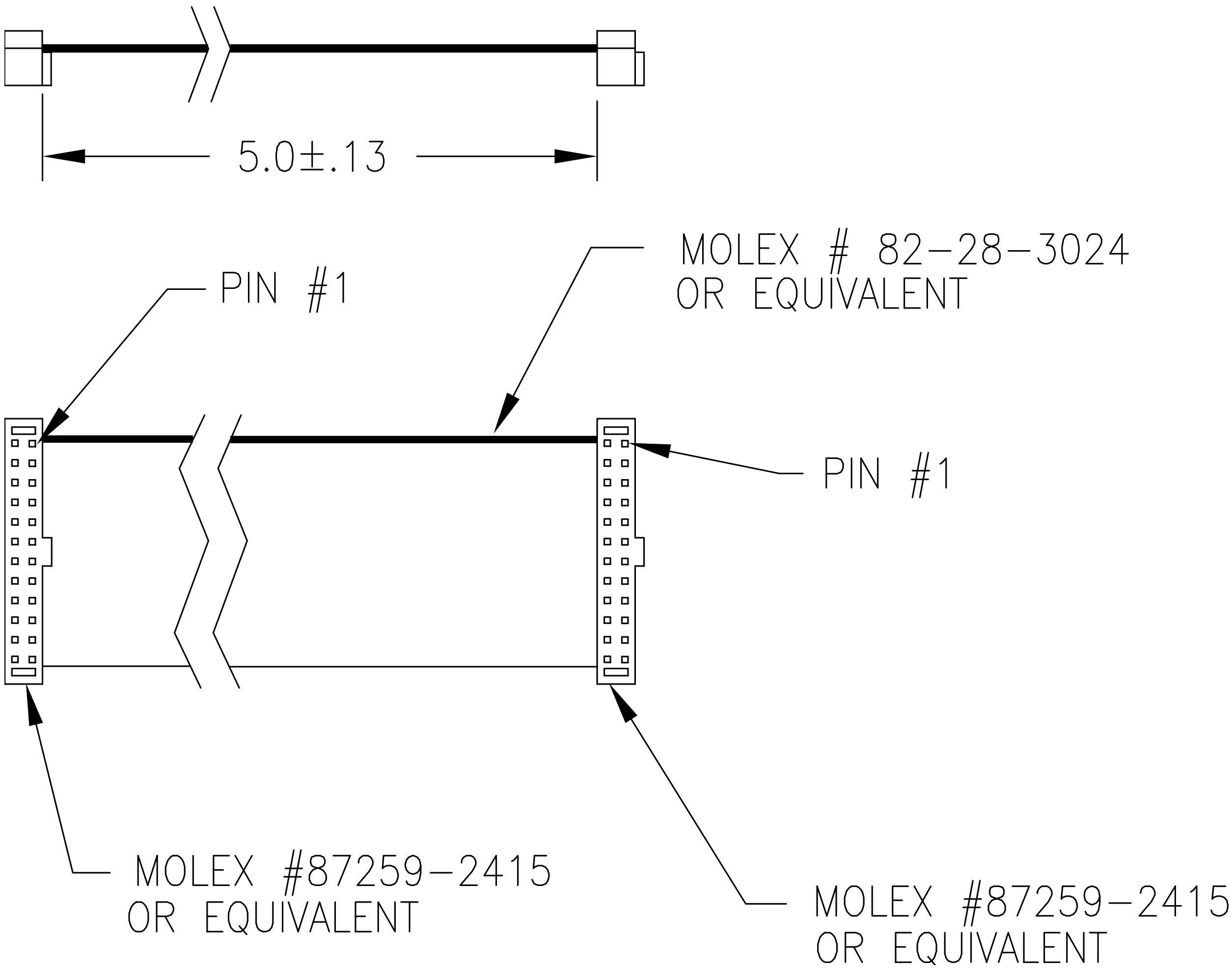
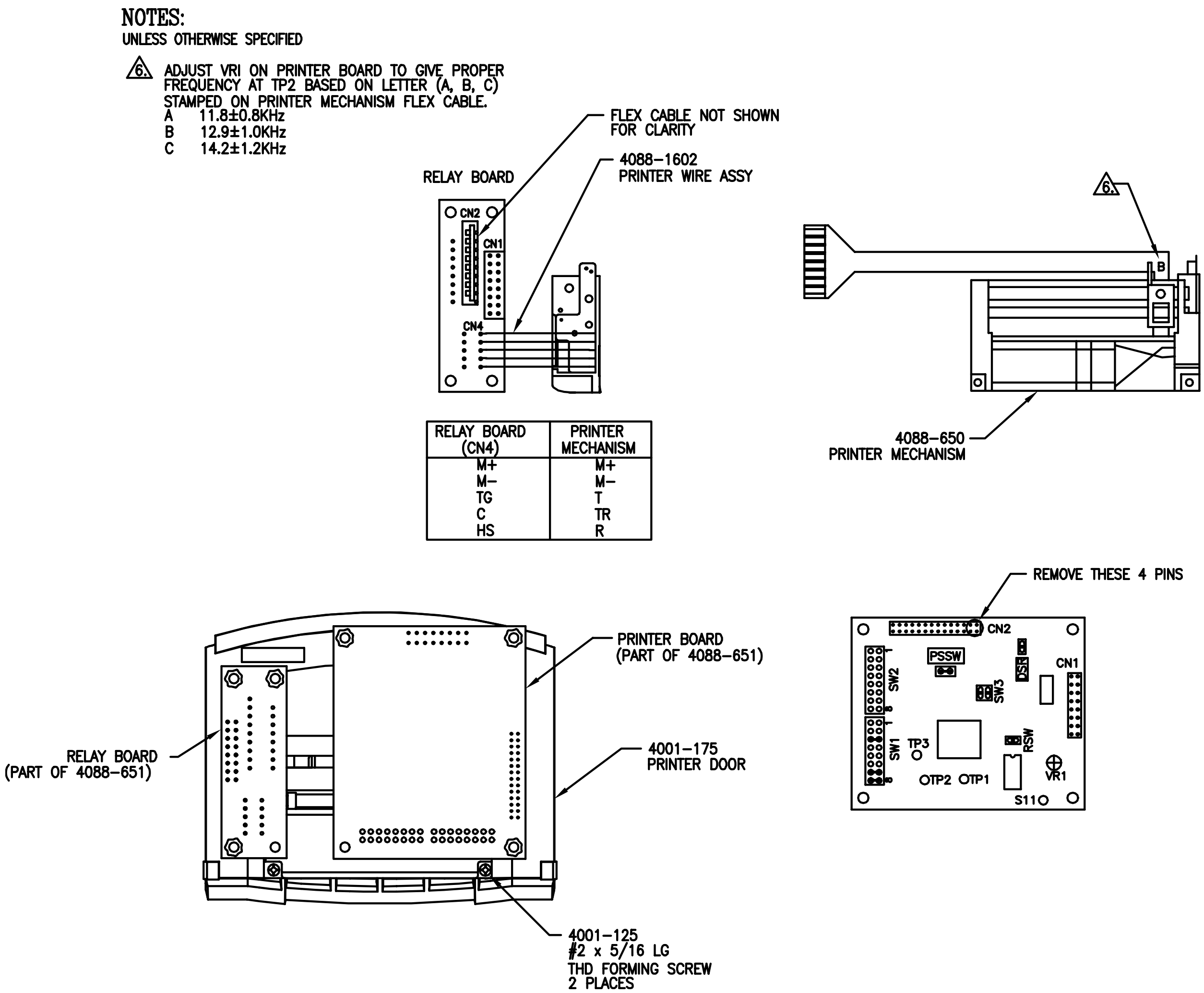


Figure 12.30 Printer Cable



RELAY BOARD (CN4)	PRINTER MECHANISM
M+	M+
M-	M-
TG	T
C	TR
HS	R

Figure 12.31 Printer Assembly

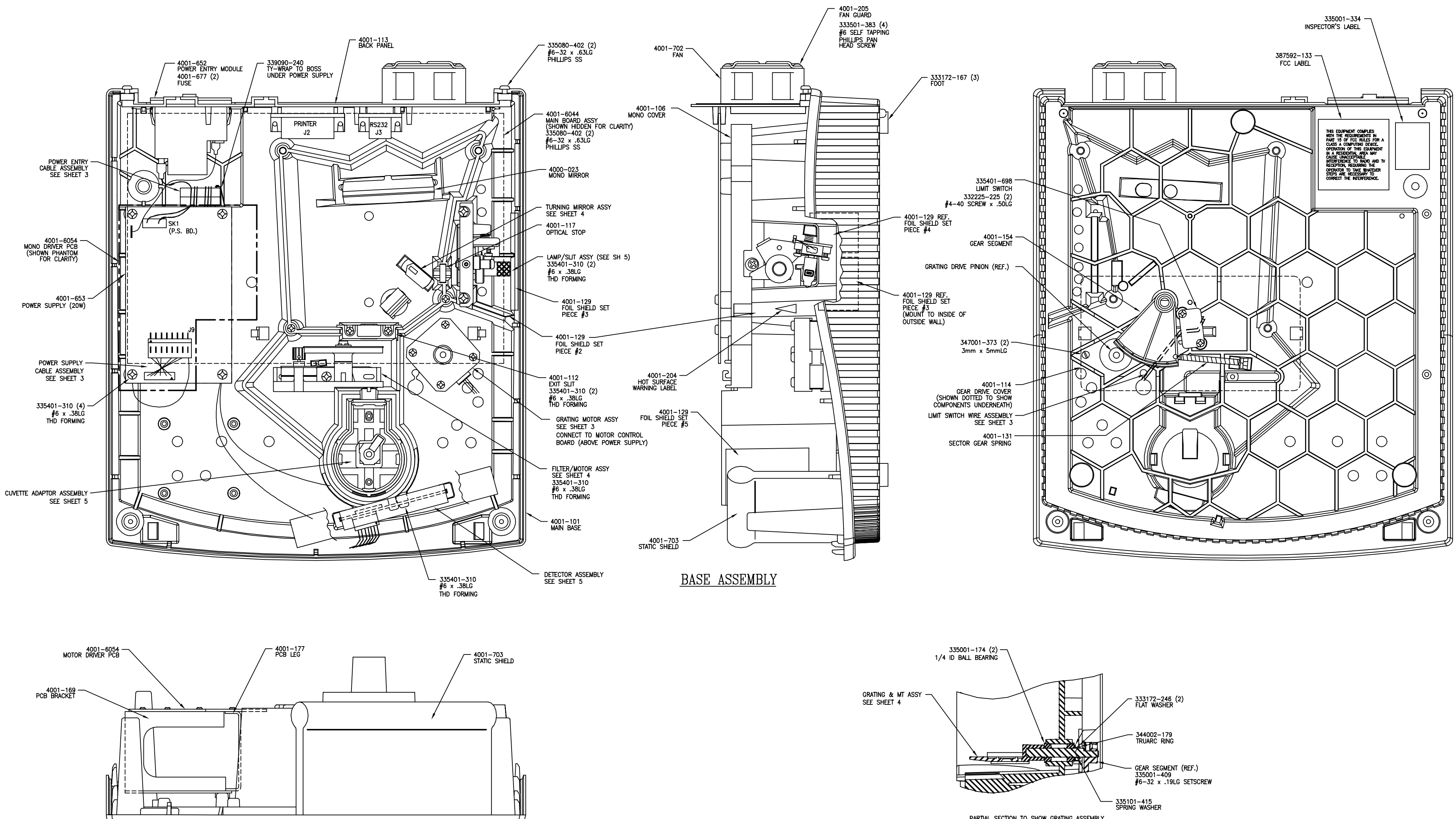


Figure 12.24 Base Assembly
[4001-200, Sht. 7, Rev. C]

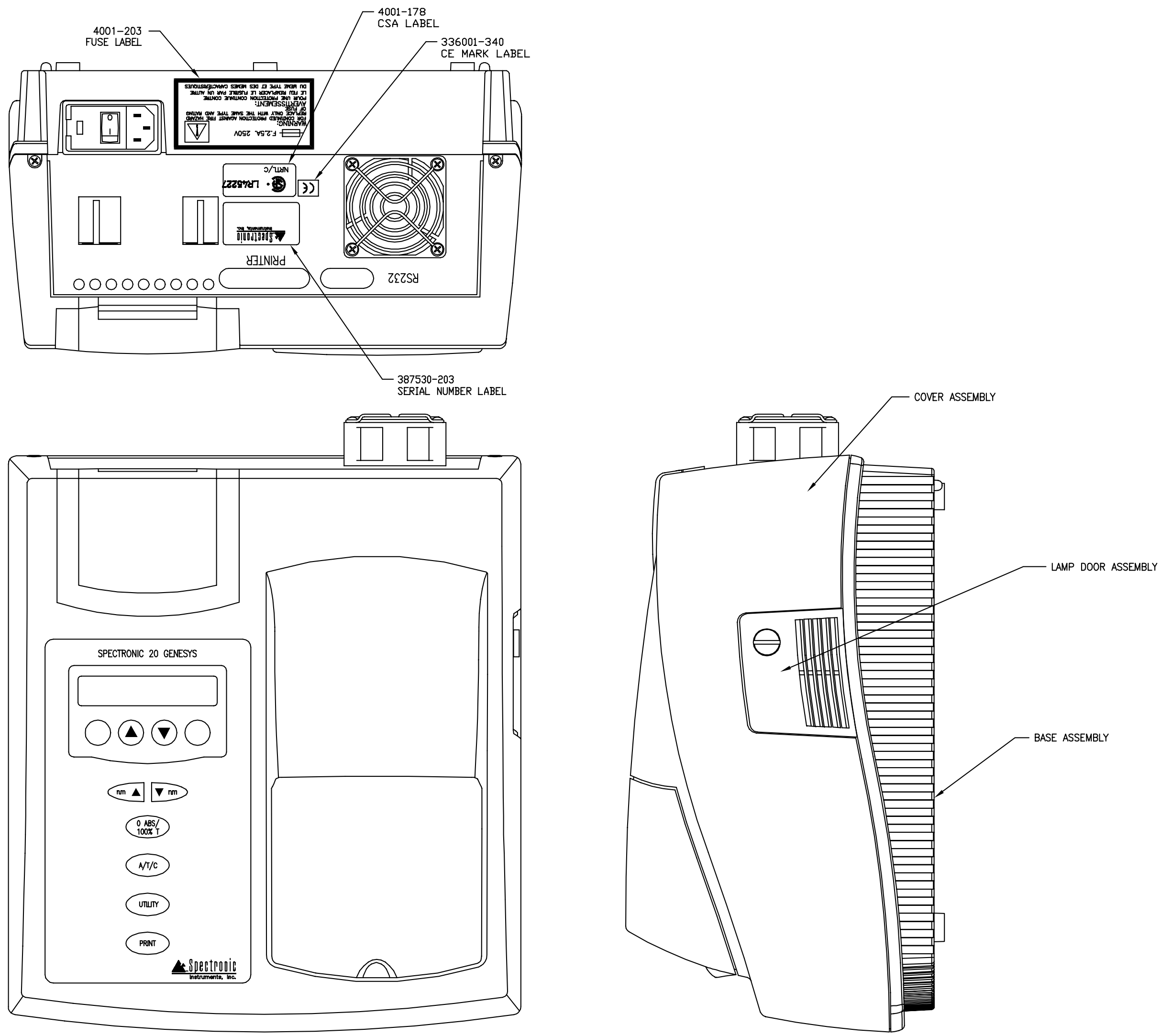


Figure 12.25
Main Assembly
[4001-200, Sht. 8, Rev. C]

NOTES:

1. TRIANGLE SHOWN ON THE PARTS DENOTES PIN 1 LOCATION ON ALL PARTS EXCEPT J6. ON J6 THE TRIANGLE DENOTES THE DESIGNATED FEATURE OF ITS MATING PART.

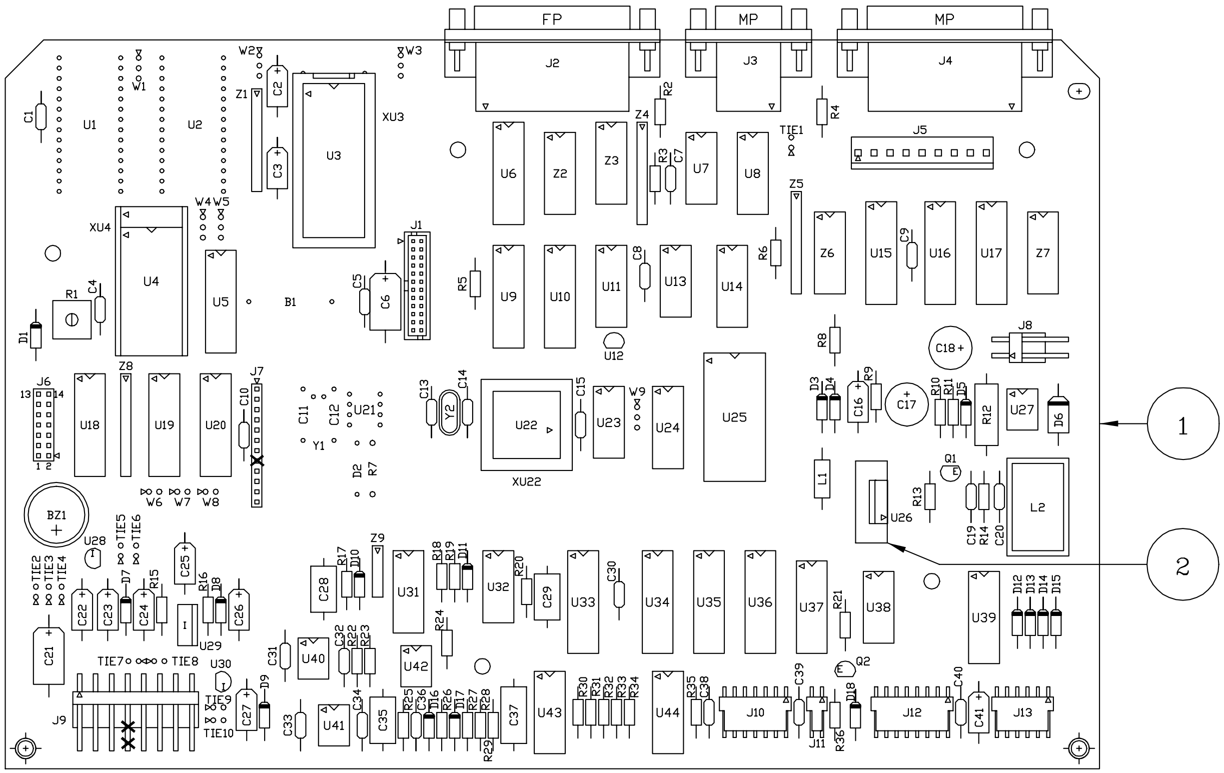


Figure 12.29
Main Board Assembly
[4001-6024, Rev. A]

Detector Board Assembly [4001-6034, Rev. B]

Ref. Des.	Description
1	Detector Board
2	Pin Socket
C1	Capacitor Cerm., .1 Mfd 50V
C2	S/A C1 .1 Mfd 50V Cerm.
C3	Capacitor Polycarb., 2200 Pf 50V
C4	S/A C3 2200 Pf 50V Polycarb.
C5	S/A C1 .1 Mfd 50V Cerm.
C6	S/A C1 .1 Mfd 50V Cerm.
C7	Capacitor Tant., 10 Mfd 20V
D1	To be Mounted at a Later Assembly Operation
J1	Connector, Polarized 7 Pin KK100, Molex #22-23-2071
R1	Resistor MF, 1.00 M 1% 1/4W
R2	S/A R1 1.00 M 1% 1/4W MF
R3	Resistor MF, 60.4 Ohm 1% 1/4W
R4	Resistor MF, 78.7 Ohm 1% 1/4W
R5	Resistor MF, 182 Ohm 1% 1/4W
R6	Resistor MF, 412 Ohm 1% 1/4W
R7	Resistor MF, 1.00 K 1% 1/4W
R8	Resistor MF, 953 Ohm 1% 1/4W
R9	Resistor MF, 2.21 K 1% 1/4W
R10	Resistor MF, 10.7 K 1% 1/4W
R11	Resistor MF, 5.11 K 1% 1/4W
U1	IC TLC2652CP
U2	IC CD4051

NOTES:
UNLESS OTHERWISE SPECIFIED

1. TRIANGLE SHOWN ON THE PARTS DENOTES PIN 1 LOCATION.

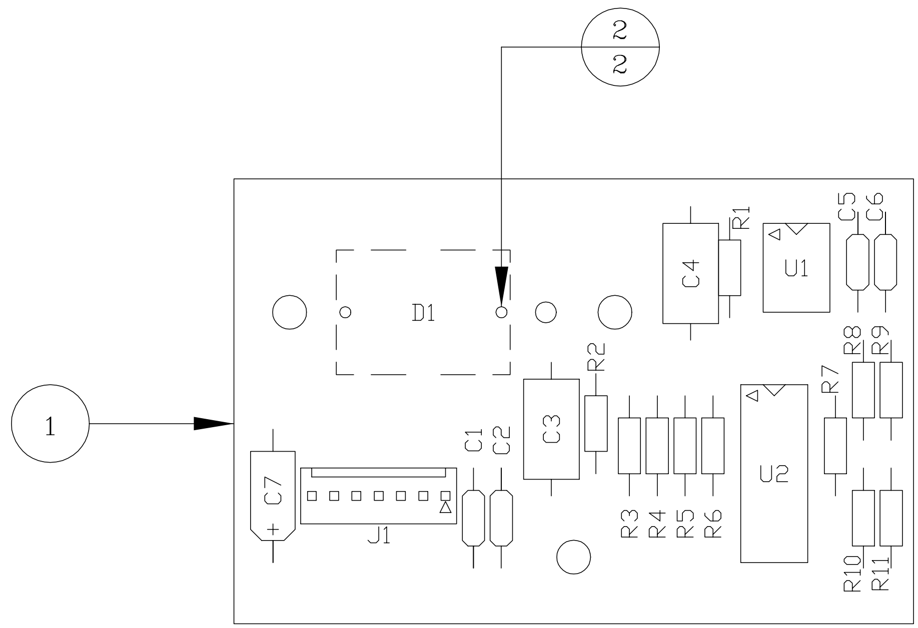


Figure 12.30
Detector Board Assembly
[4001-6034, Rev. B]

NOTES:
UNLESS OTHERWISE SPECIFIED

1. TRIANGLE SHOWN ON THE PARTS DENOTES PIN 1 LOCATION ON ALL PARTS EXCEPT J6. ON J6 THE TRIANGLE DENOTES THE DESIGNATED FEATURE OF ITS MATING PART.

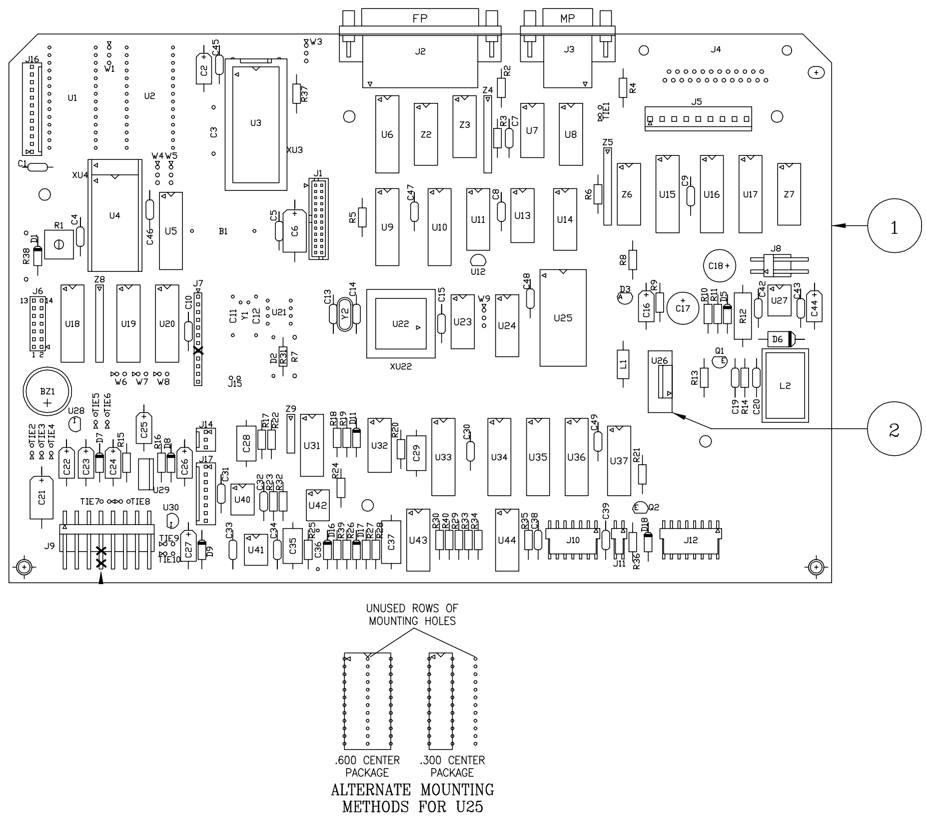
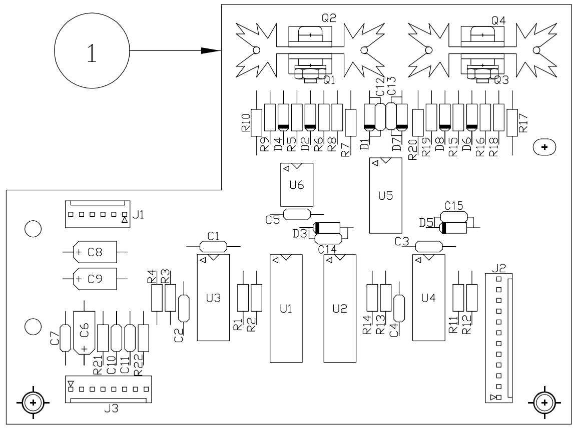
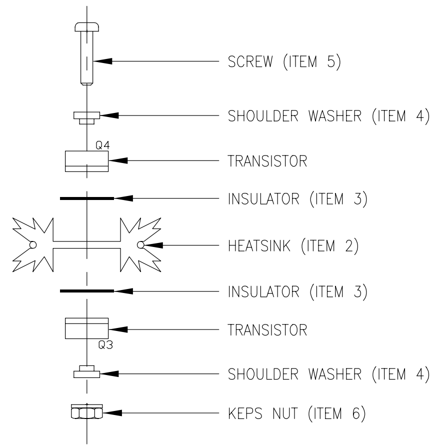


Figure 12.31
Main Board Assembly
[4001-6044, Rev. B]

NOTES:
UNLESS OTHERWISE SPECIFIED

1. TRIANGLE SHOWN ON THE PARTS DENOTES PIN 1 LOCATION.





TYPICAL TRANSISTOR MOUNTING
(Q1–Q2 AND Q3–Q4)

Figure 12.32
Mono Driver Board Assembly
[4001-6054, Rev. A]

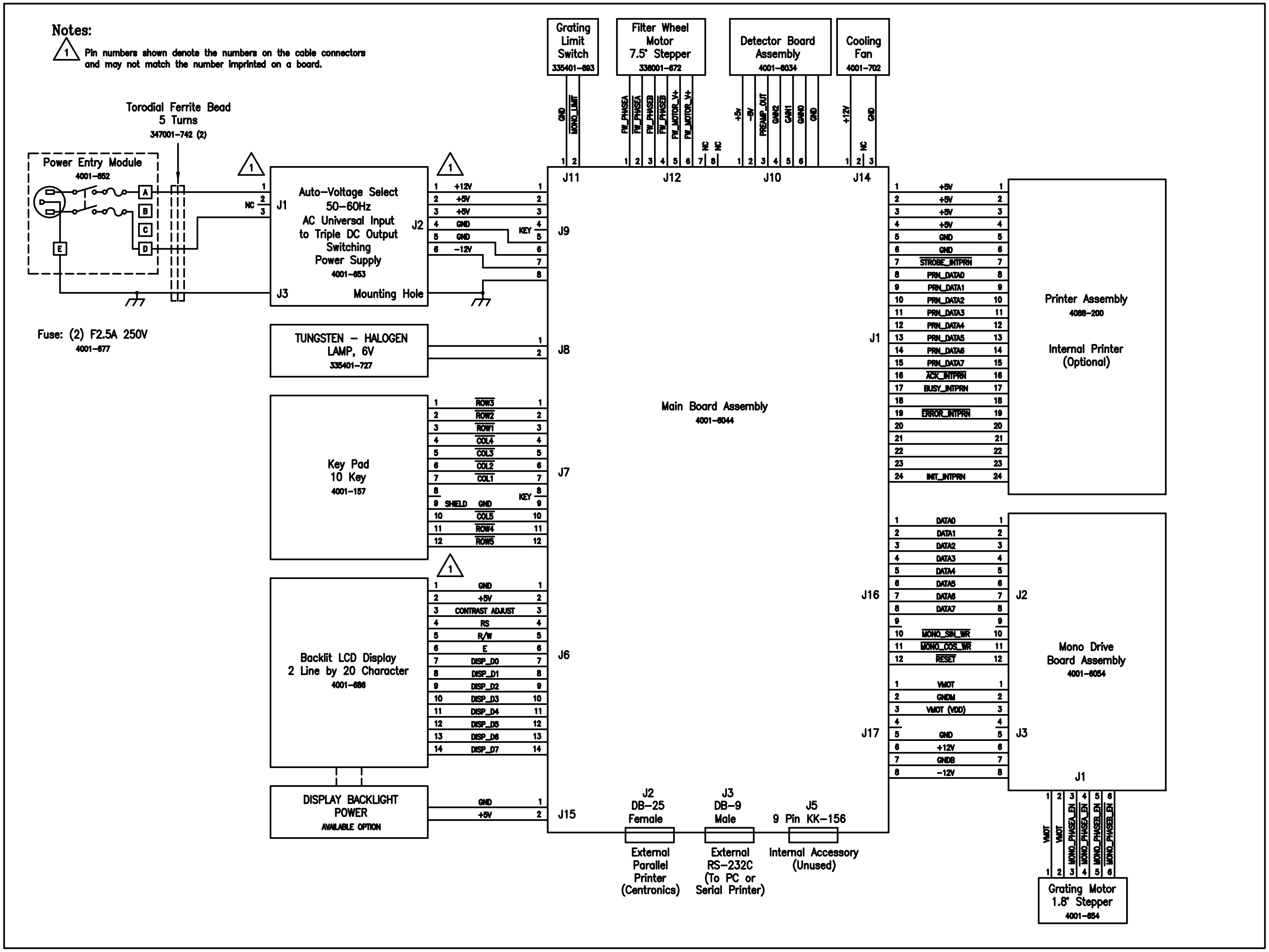


Figure 12.33 Primary Wiring Schematic [4001-600, Rev. B]

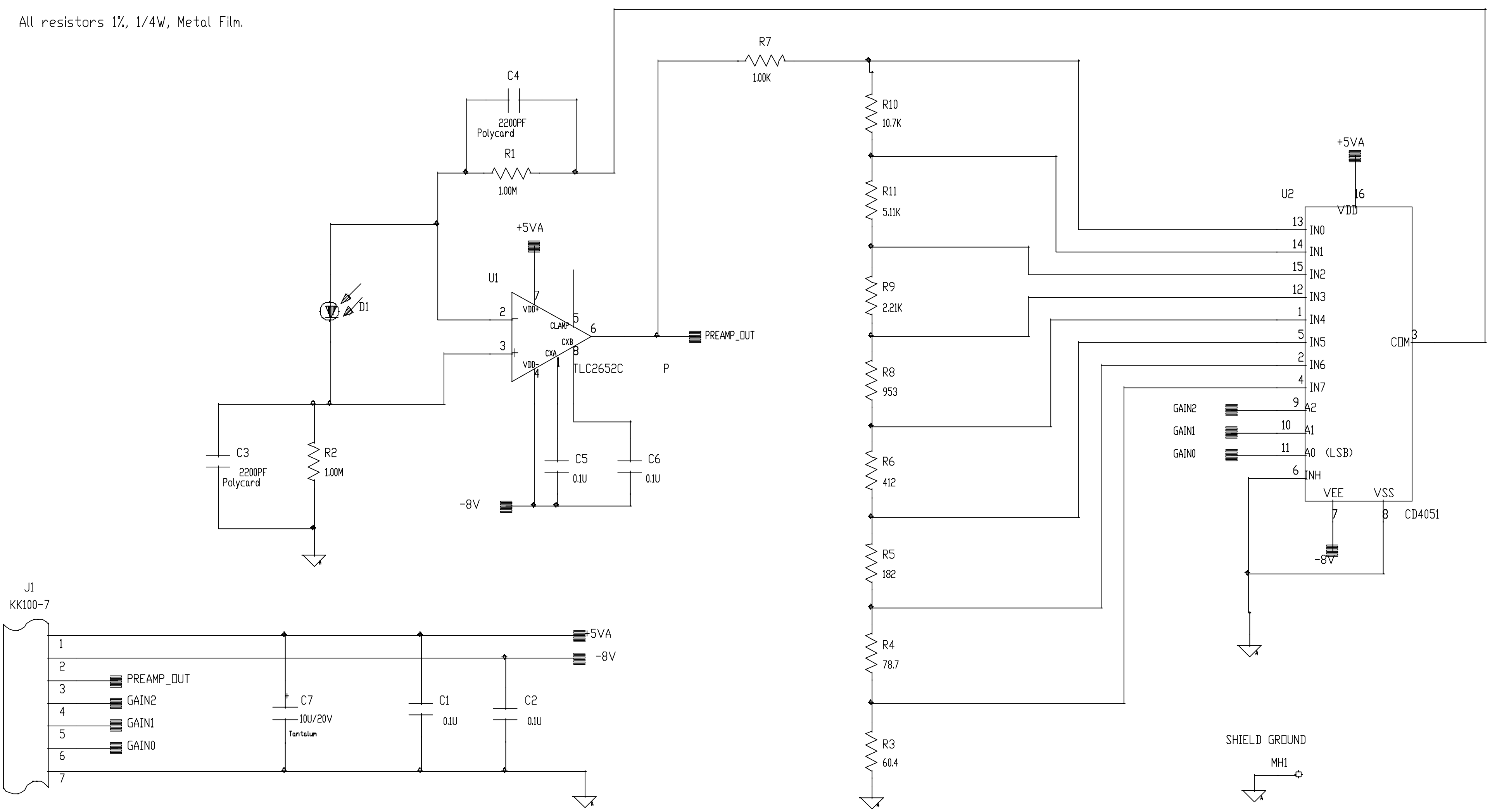


Figure 12.34
Detector (Preamp) Board Schematic
[4001-6031, Rev. B]

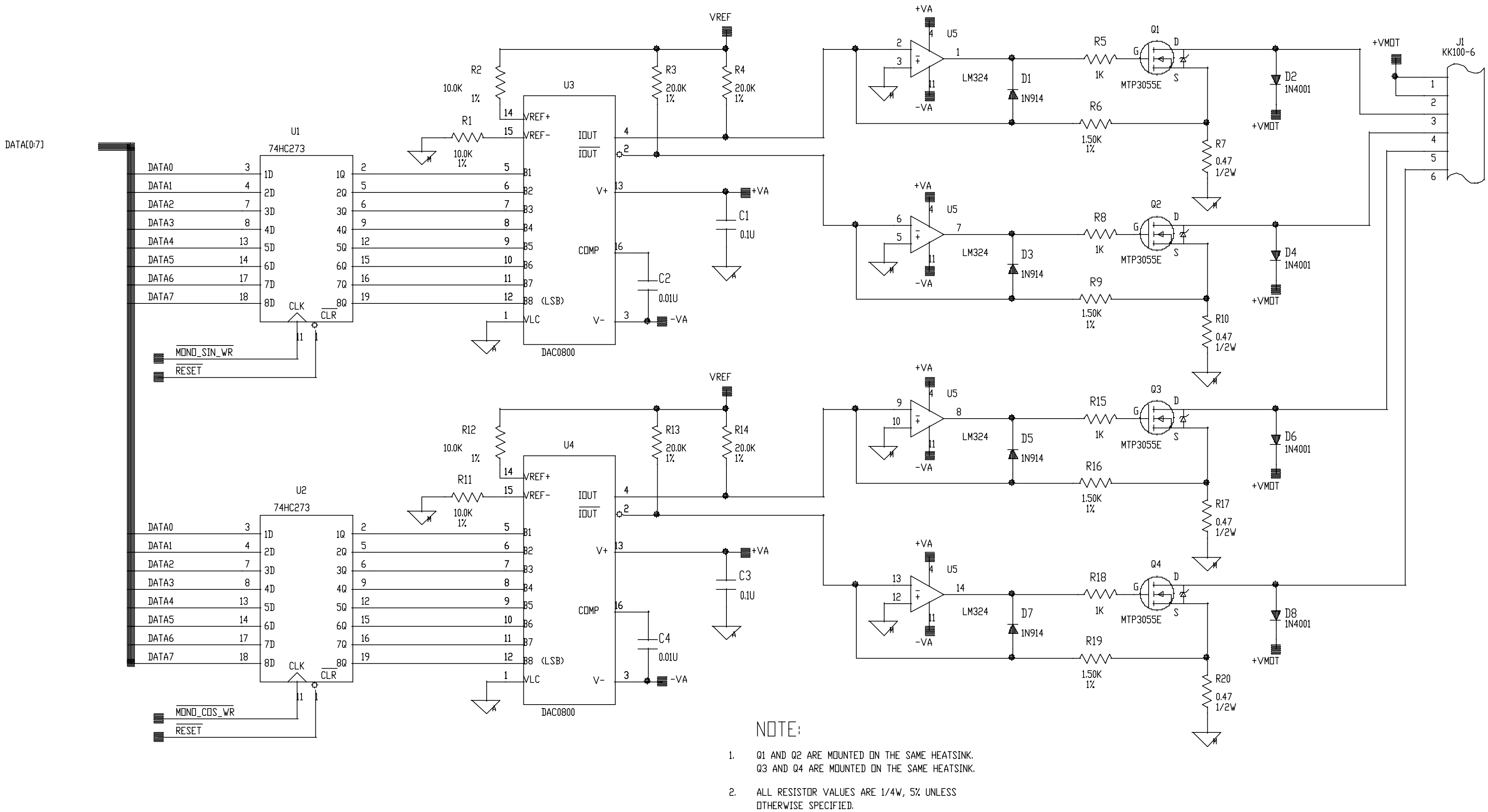
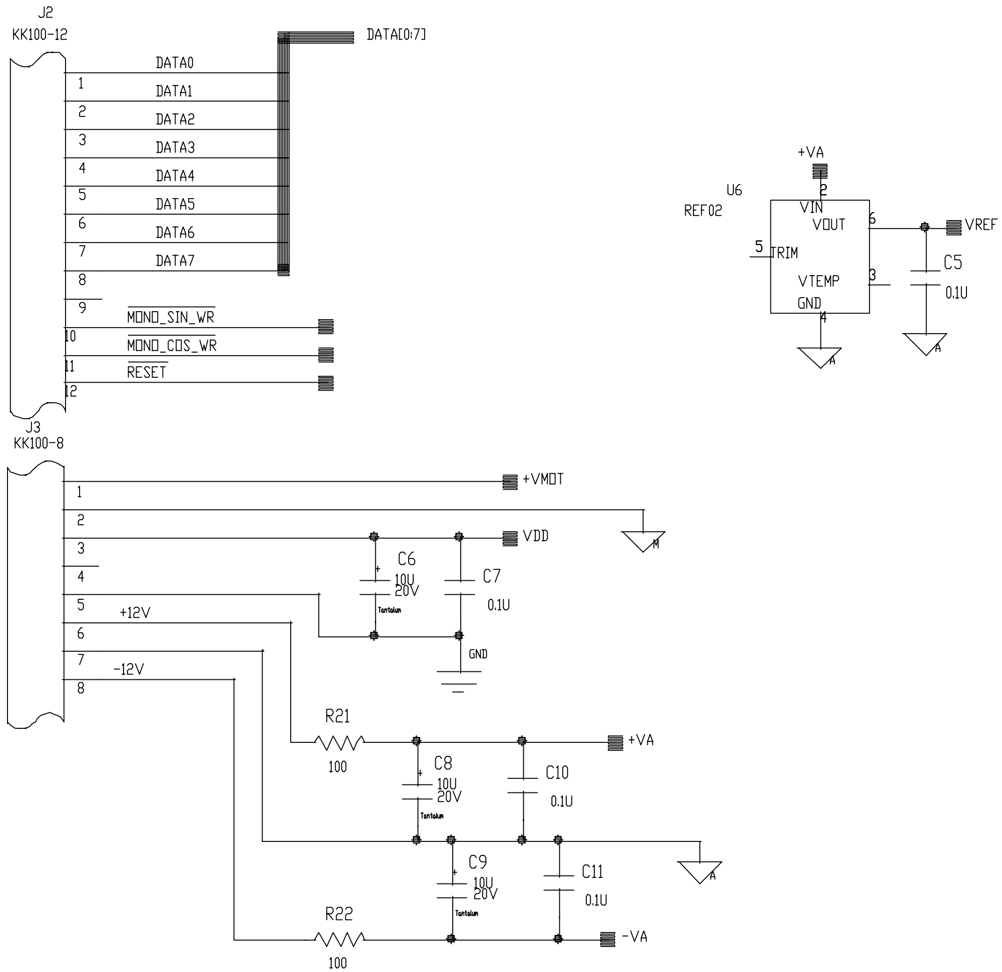


Figure 12.35
Mono Drive Board Schematic
[4001-605-1, Sht. 1]



REF. DES.	VDD	DIGITAL GROUND	+VA	ANALOG GROUND	-VA	MOTOR GROUND
U1	20	10				
U2	20	10				
U3			13	1	3	
U4			13	1	3	
U5			4		11	3, 5, 10, 12
U6			2	4		

Figure 12.36
Mono Drive Board Schematic
[4001-605-1, Sht. 2]

Figure 12.37
Processor Schematic
[4001-6021, Sht. 1, Rev. A]

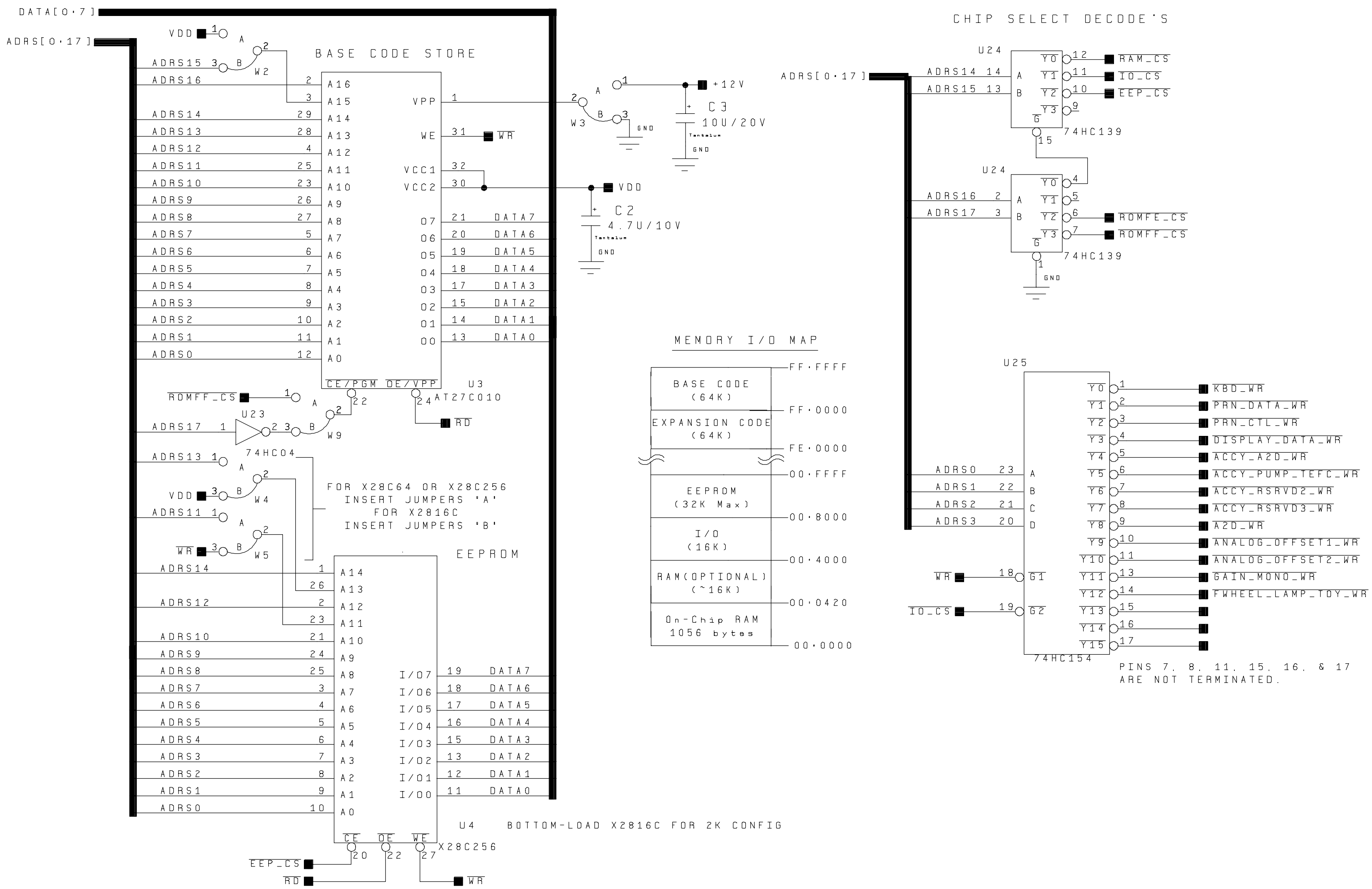


Figure 12.38
Memory 1 /I /O Decode Schematic
[4001-6021, Sht. 2, Rev. A]

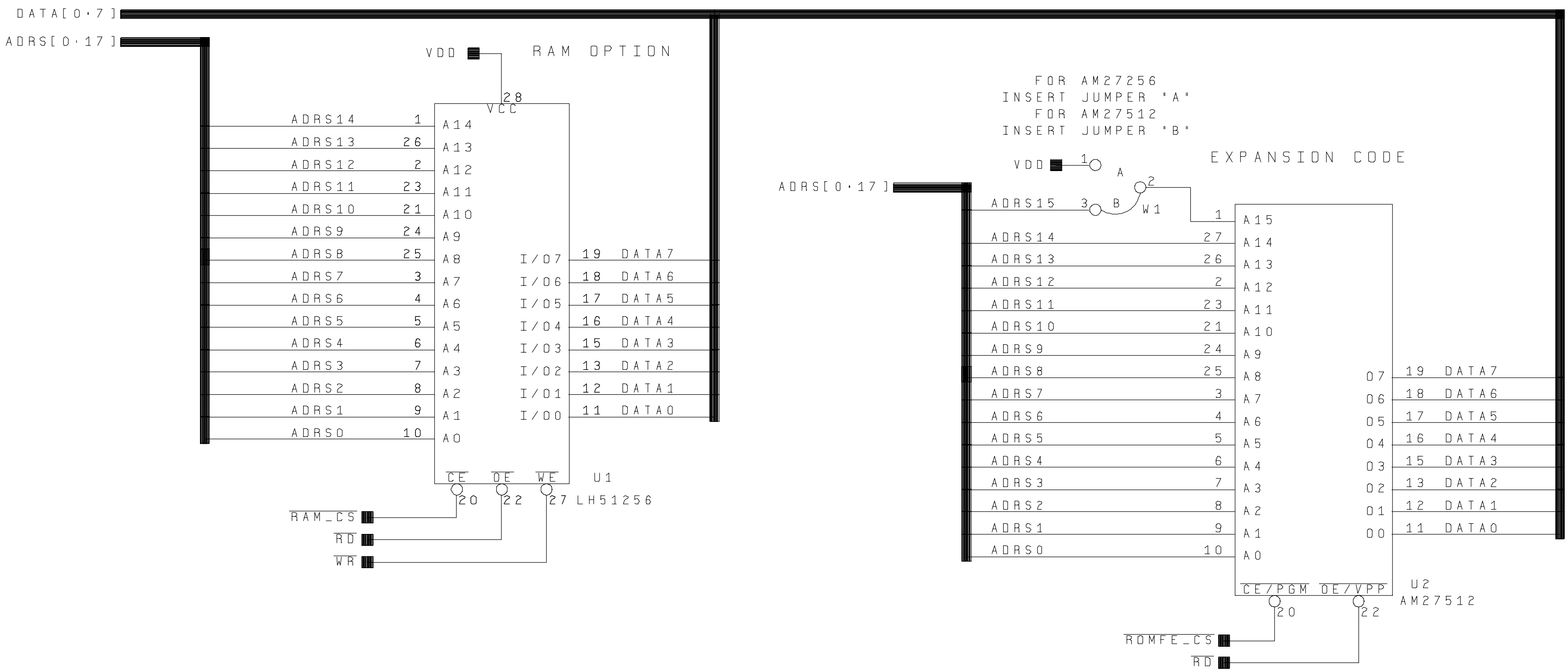


Figure 12.39
Memory 2 - Oem / Optional Schematic
[4001-6021, Sht. 3, Rev. A]

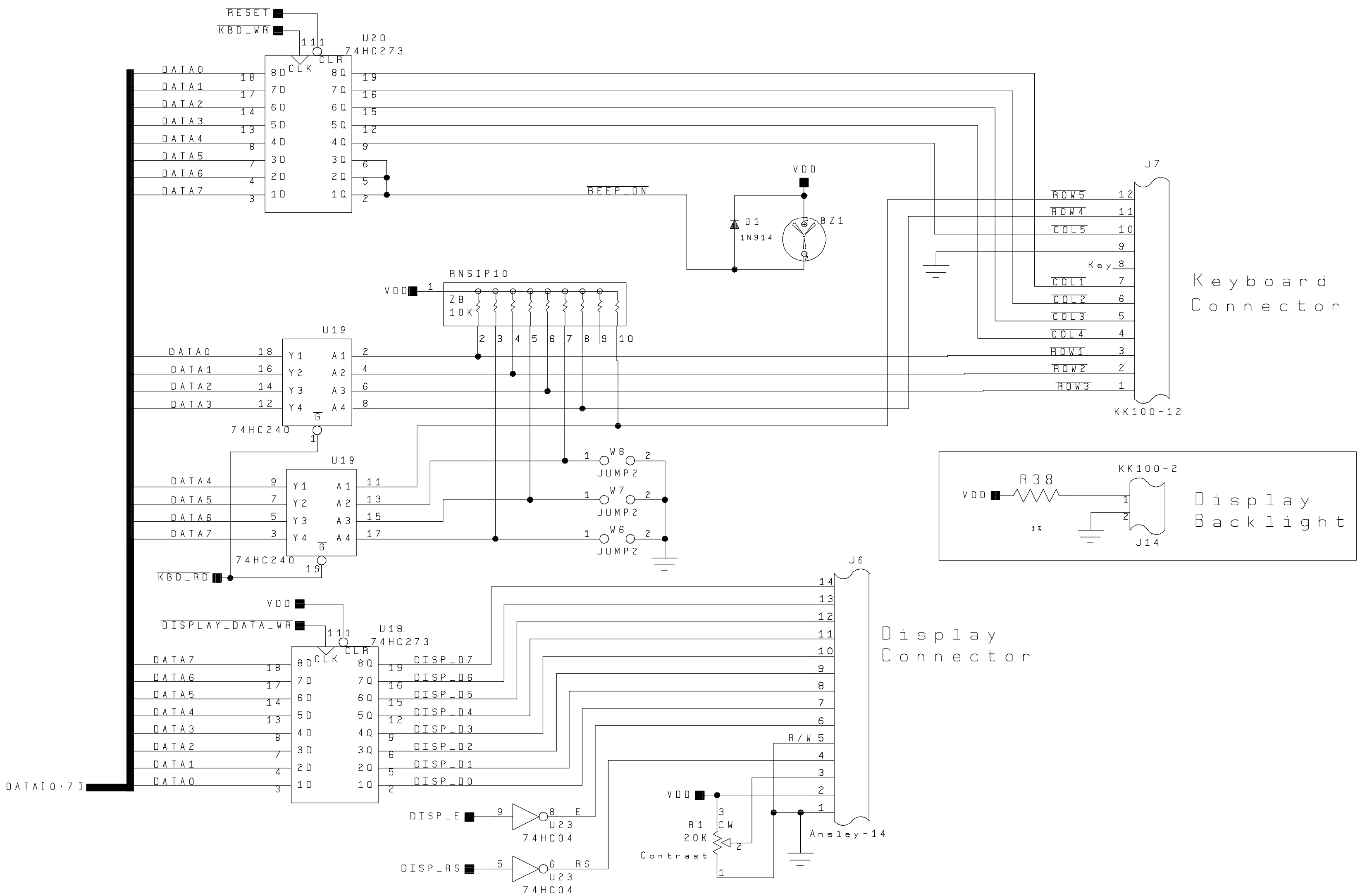
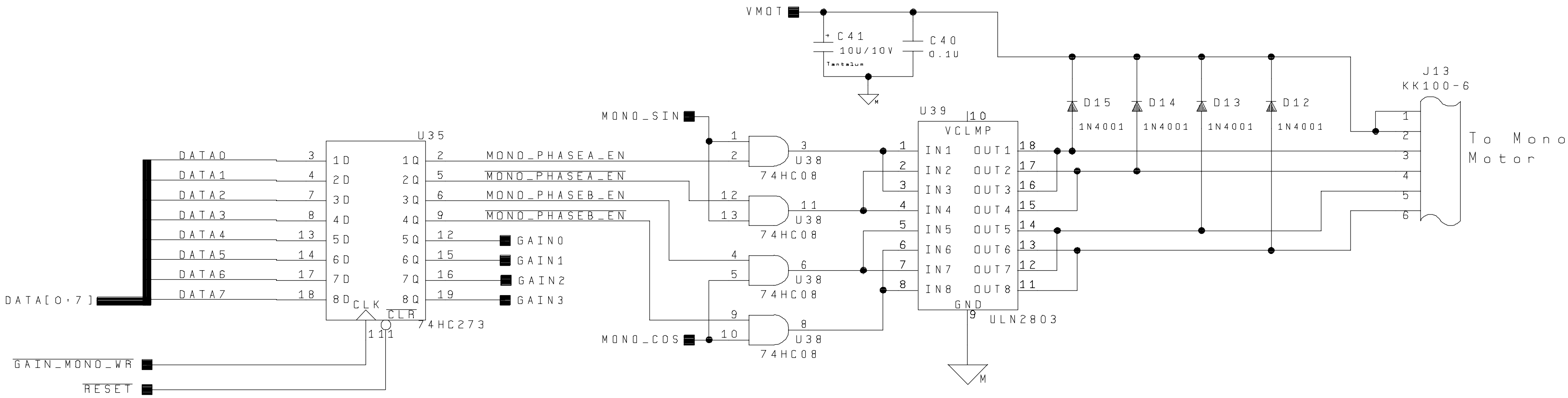


Figure 12.40
Keyboard & Display Control Schematic
[4001-6021, Sht. 4, Rev. A]



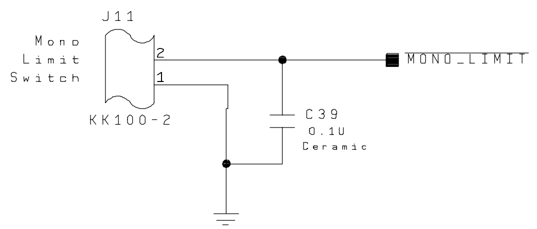


Figure 12.41
Mono Drive & Analog Gain Reg. Schematic
[4001-6021, Sht. 5, Rev. A]

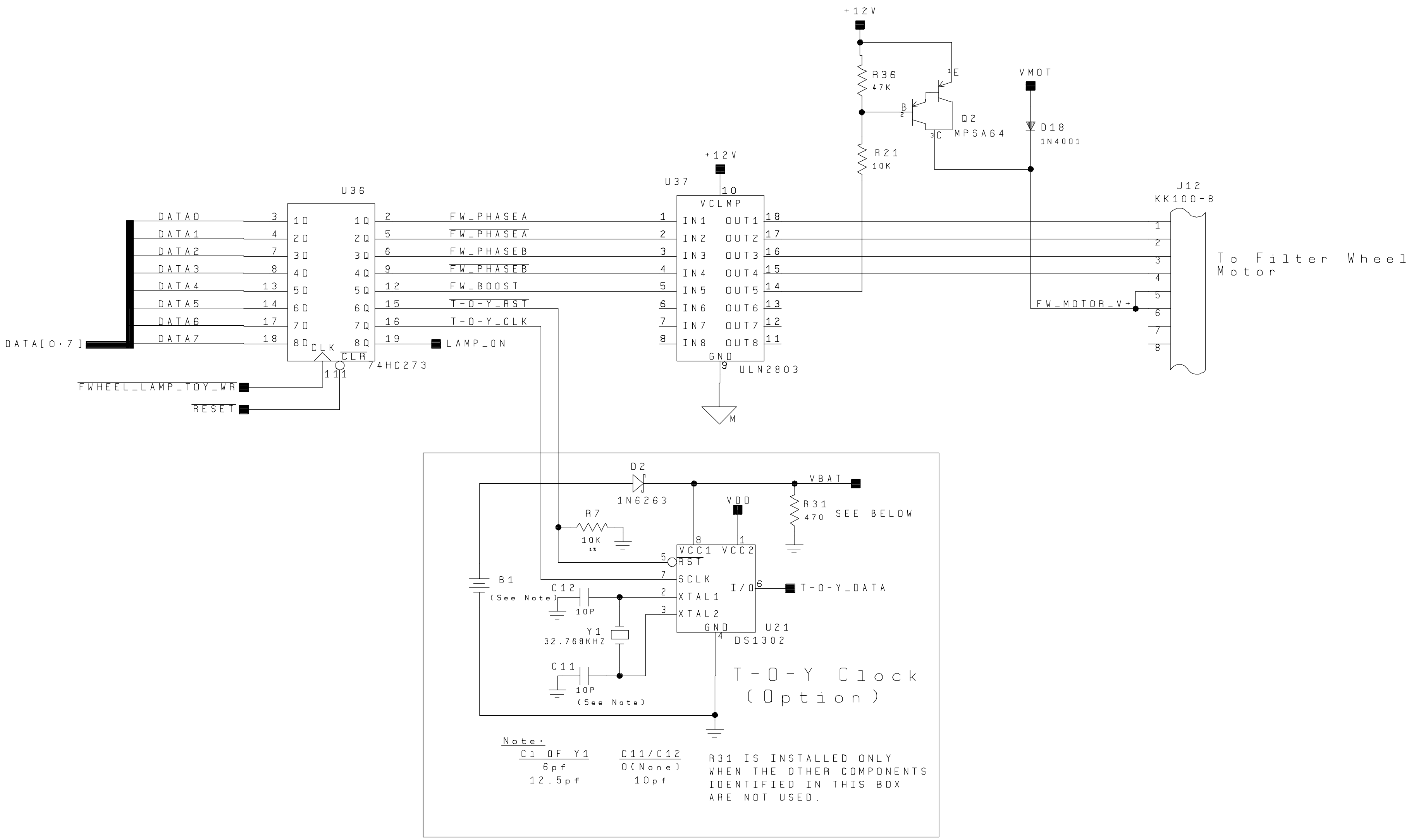


Figure 12.42
Filter Wheel and T-O-Y / Lamp Control Schematic
[4001-6021, Sht. 6, Rev. A]

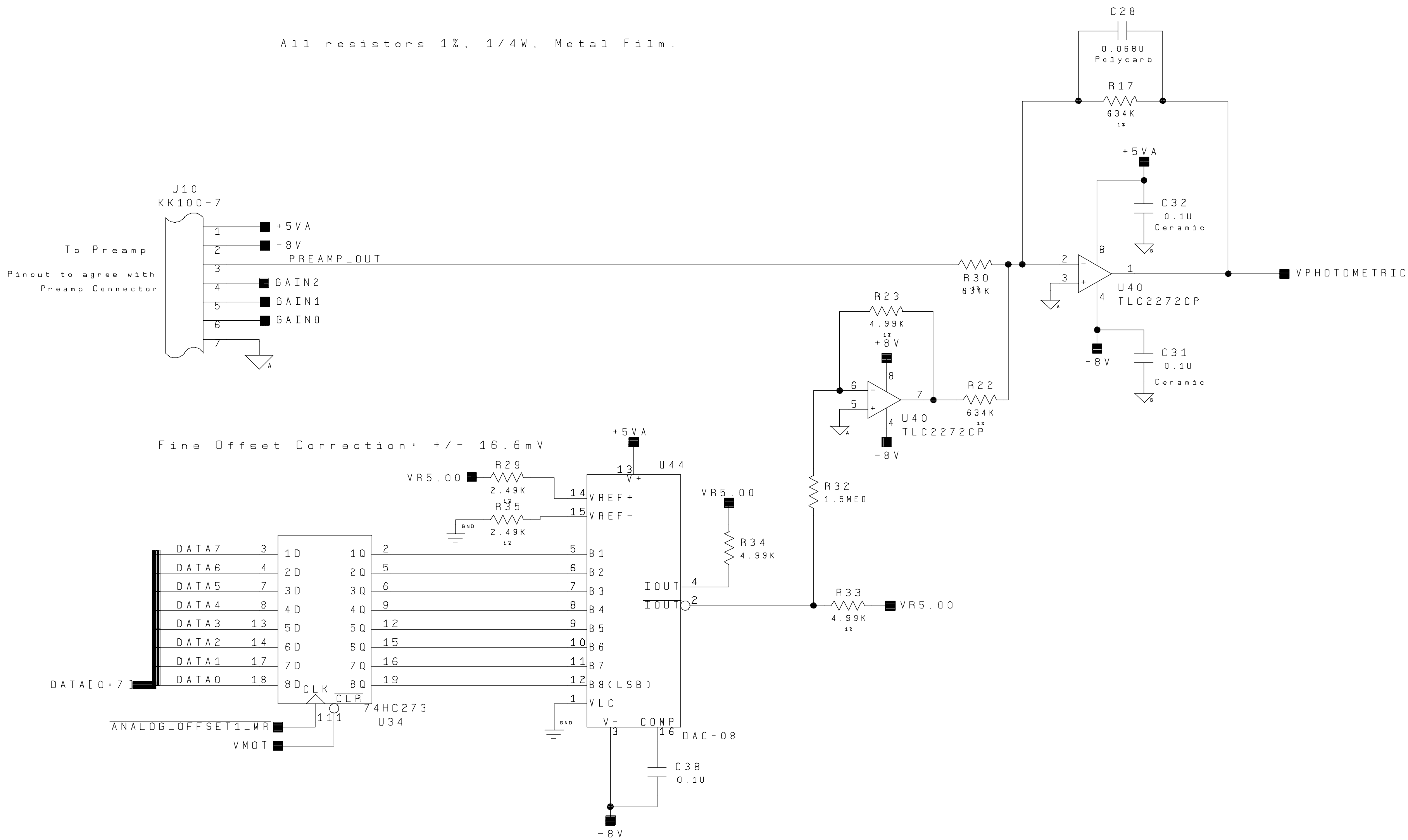


Figure 12.43
Analog Processing Schematic
[4001-6021, Sht. 7, Rev. A]

All resistors 1%, 1/4W, Metal Film.

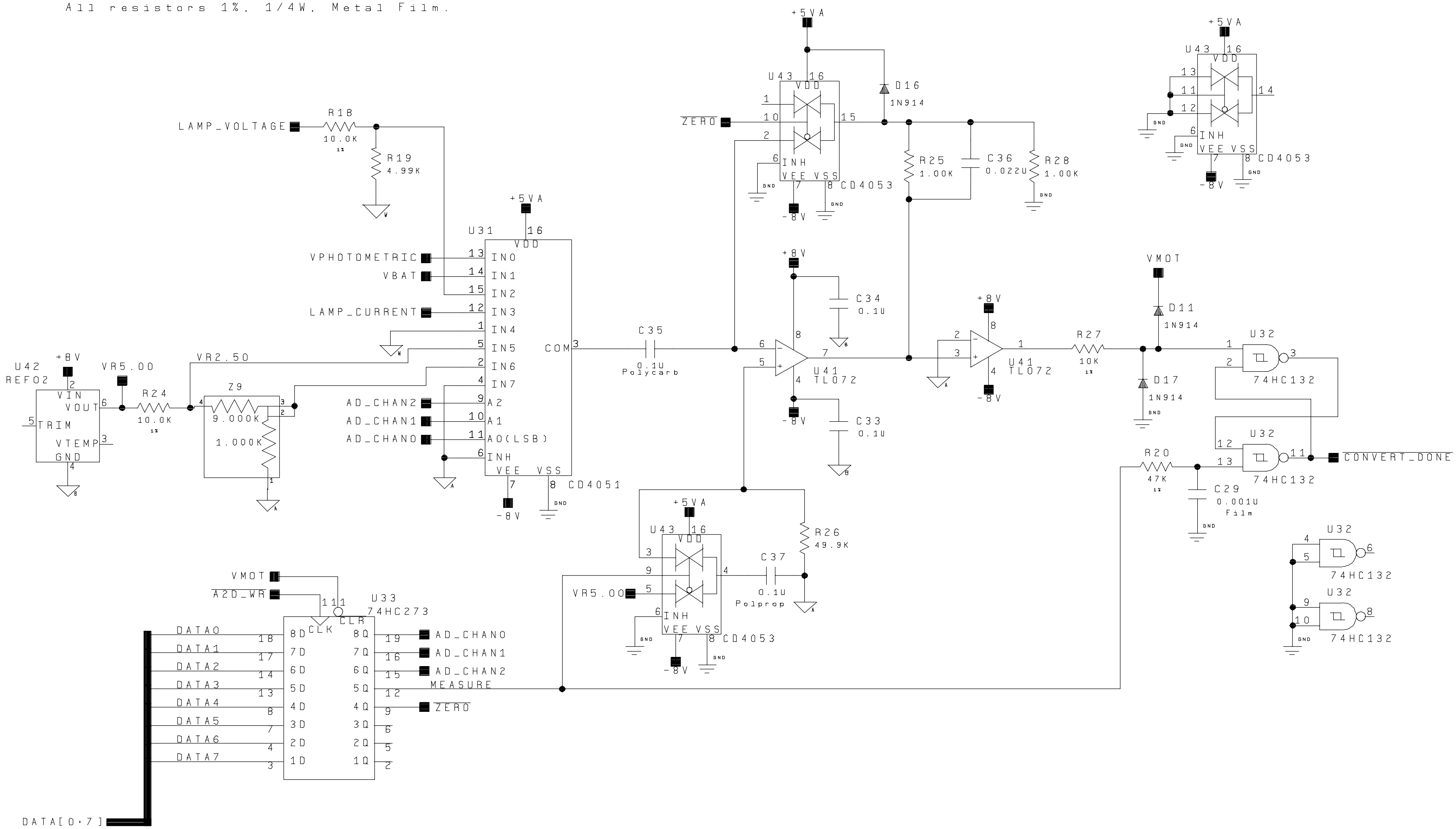


Figure 12.44
A / D Schematic
[4001-6021, Sht. 8, Rev. A]

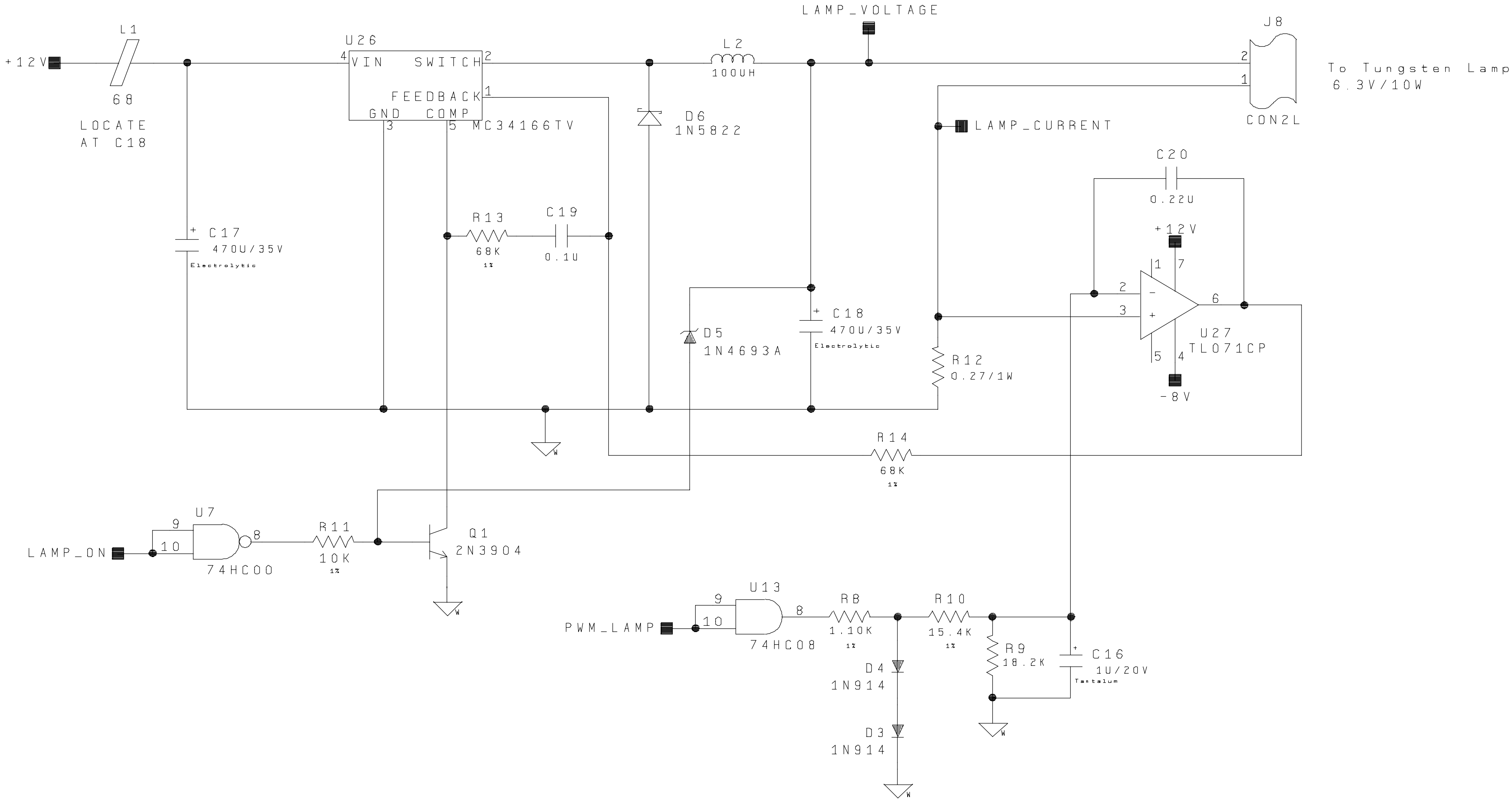


Figure 12.45
Lamp Power Supply Schematic
[4001-6021, Sht. 9, Rev. A]

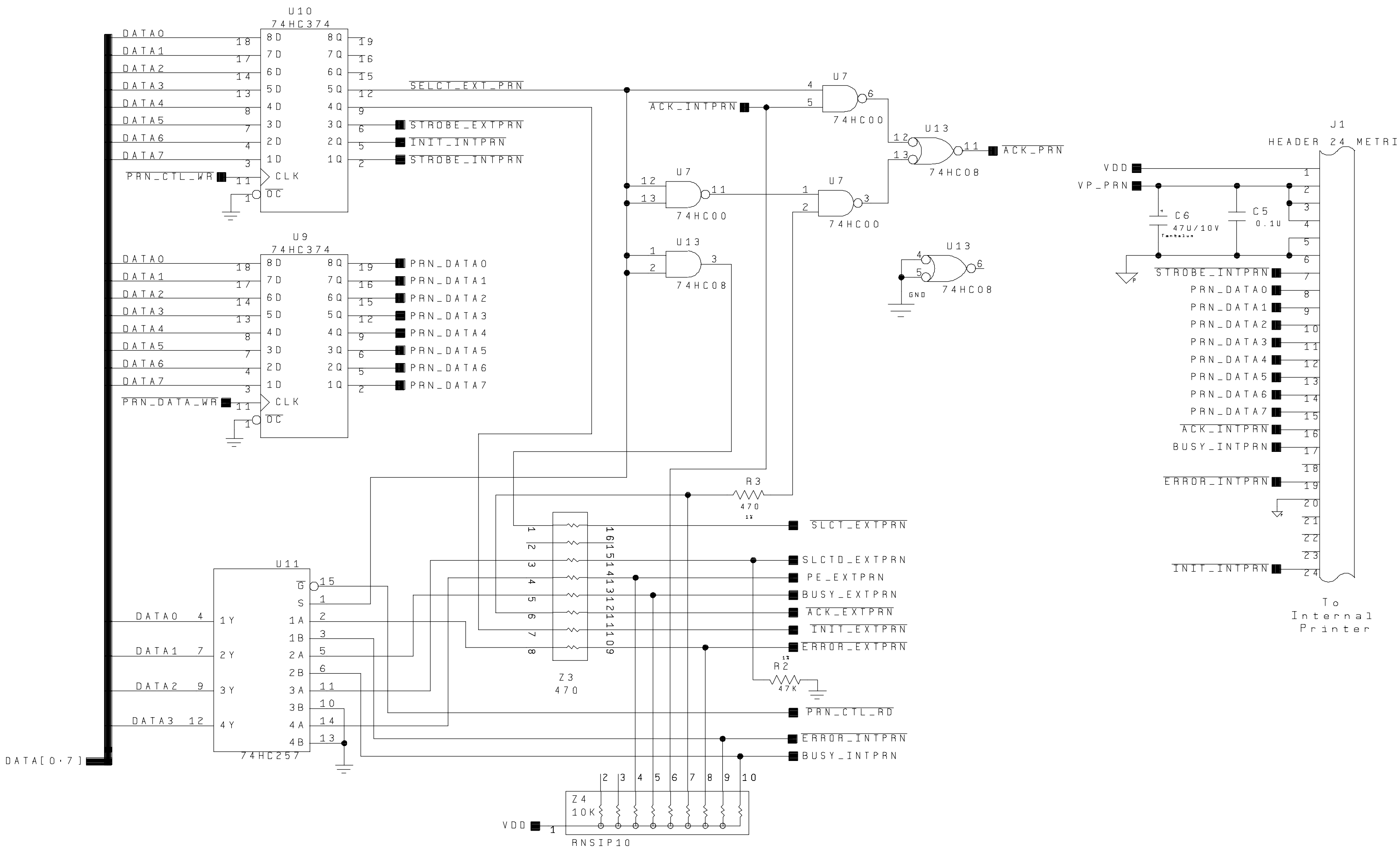


Figure 12.46
Internal Printer Interface Schematic
[4001-6021, Sht. 10, Rev. A]

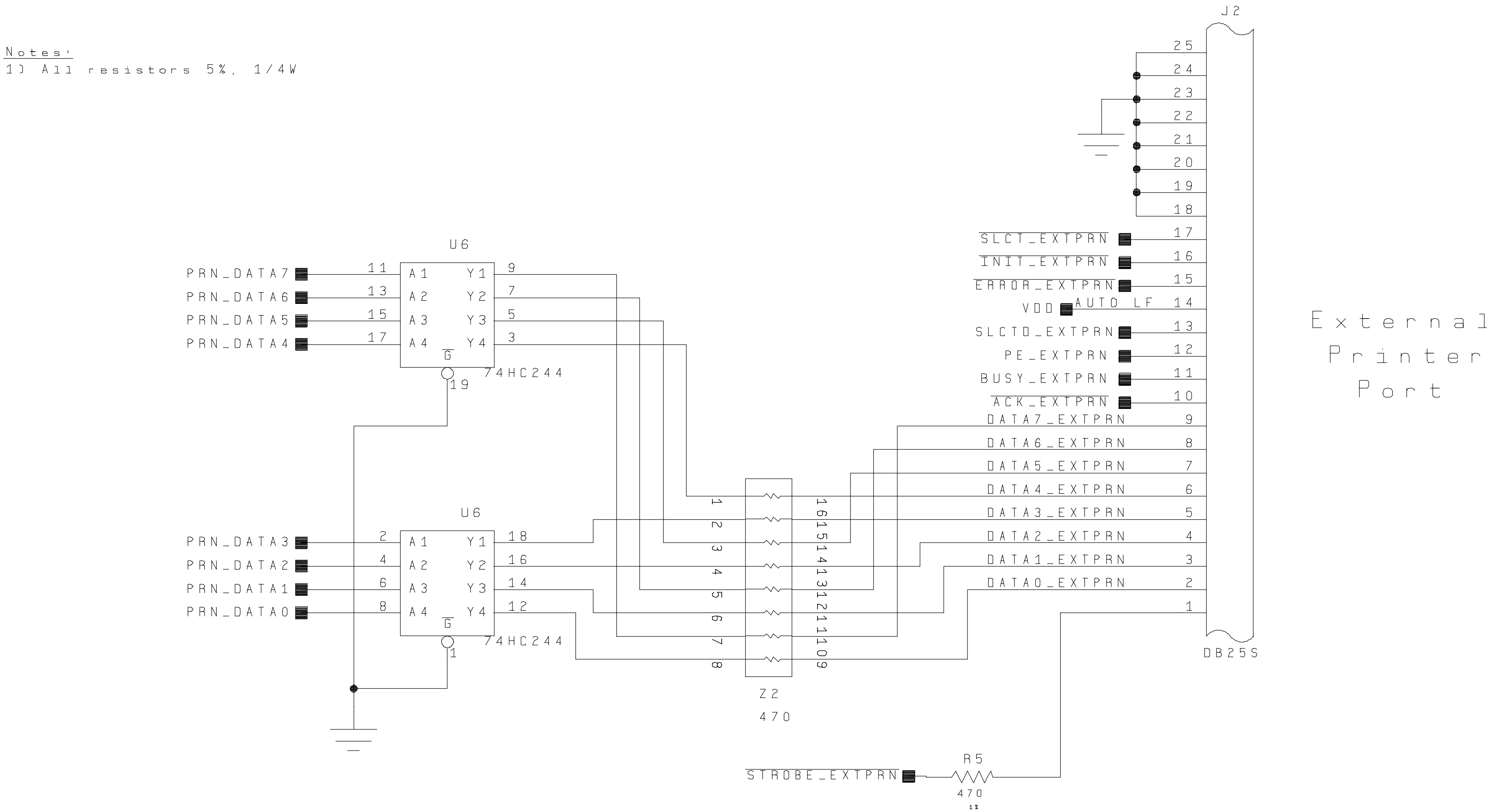


Figure 12.47
External Printer Interface Schematic
[4001-6021, Sht. 11, Rev. A]

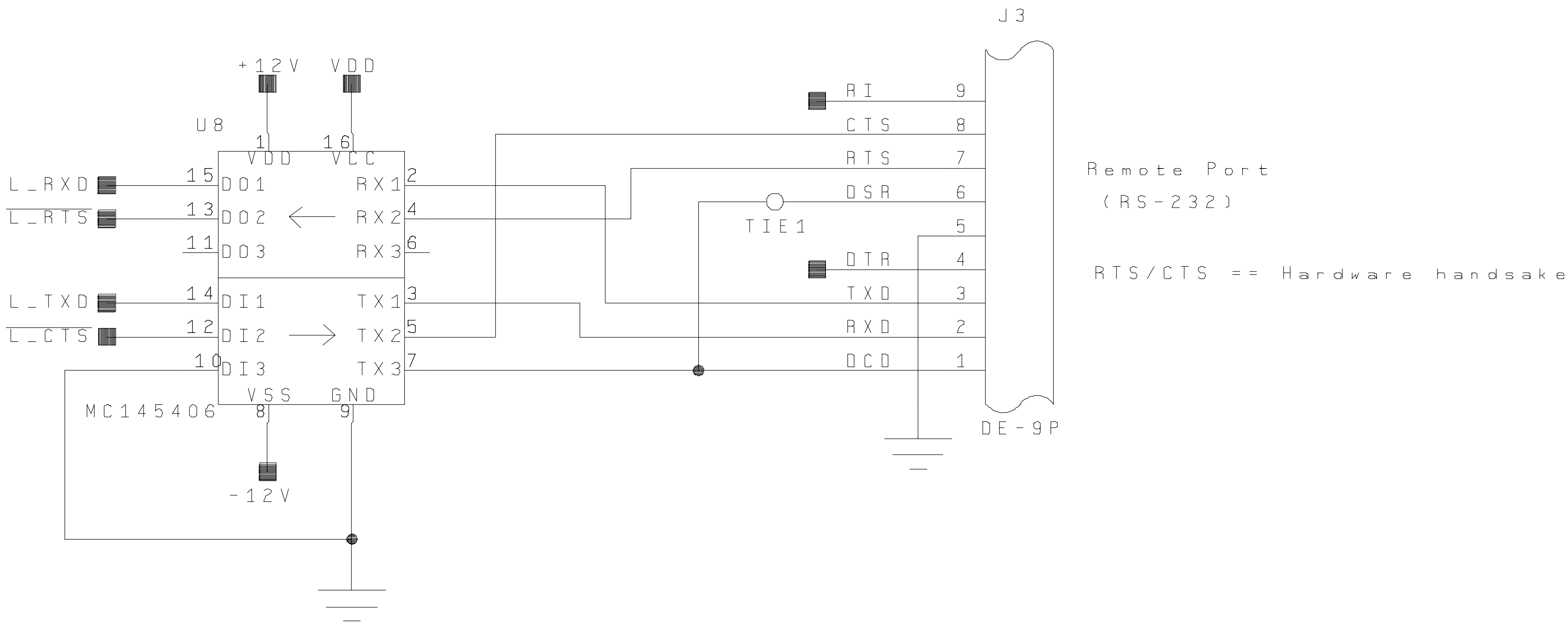


Figure 12.48
RS-232 Interface Schematic
[4001-6021, Sht. 12, Rev. A]

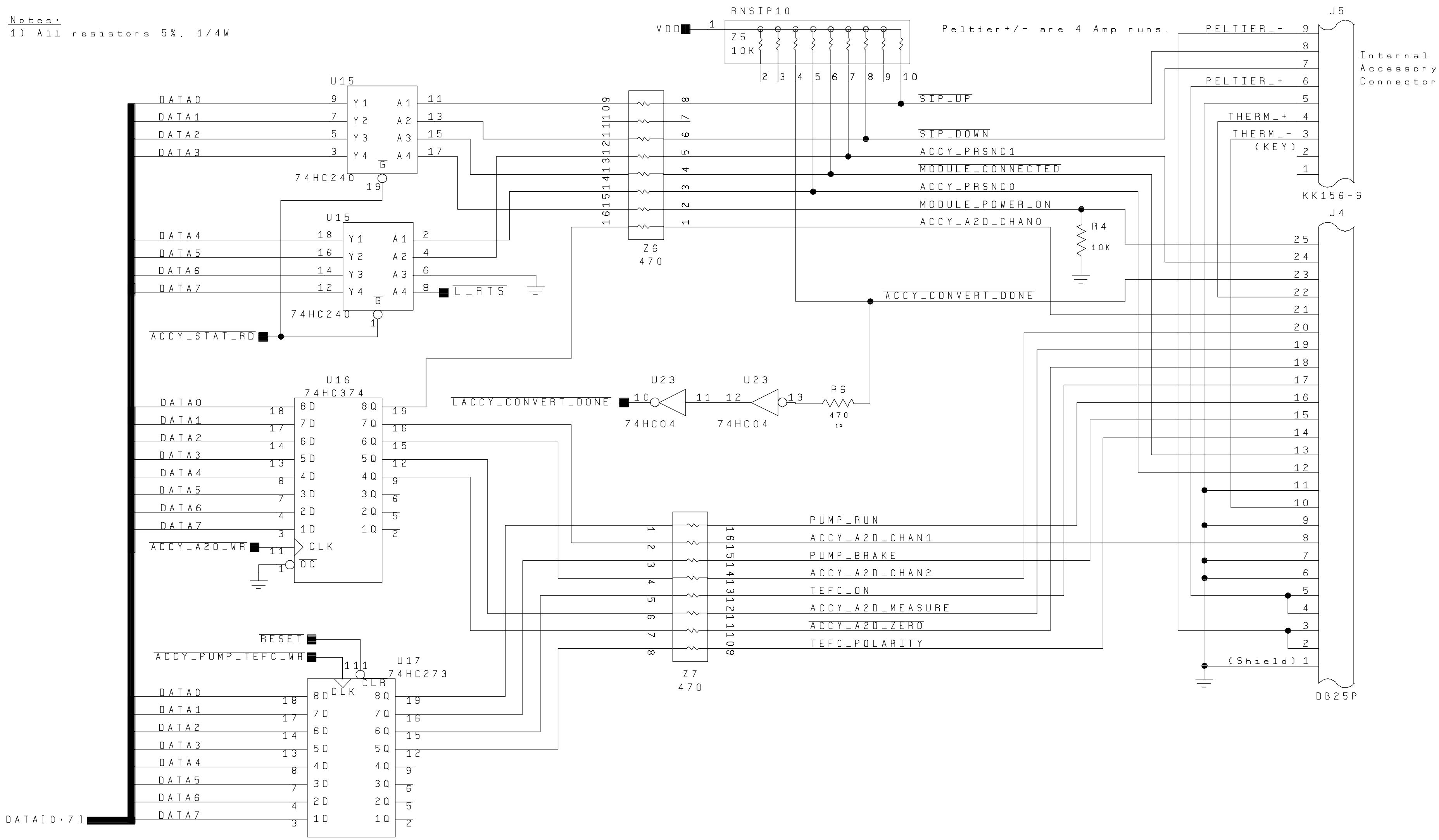


Figure 12.49
Accessory Module Interface Schematic
[4001-6021, Sht. 13, Rev. A]

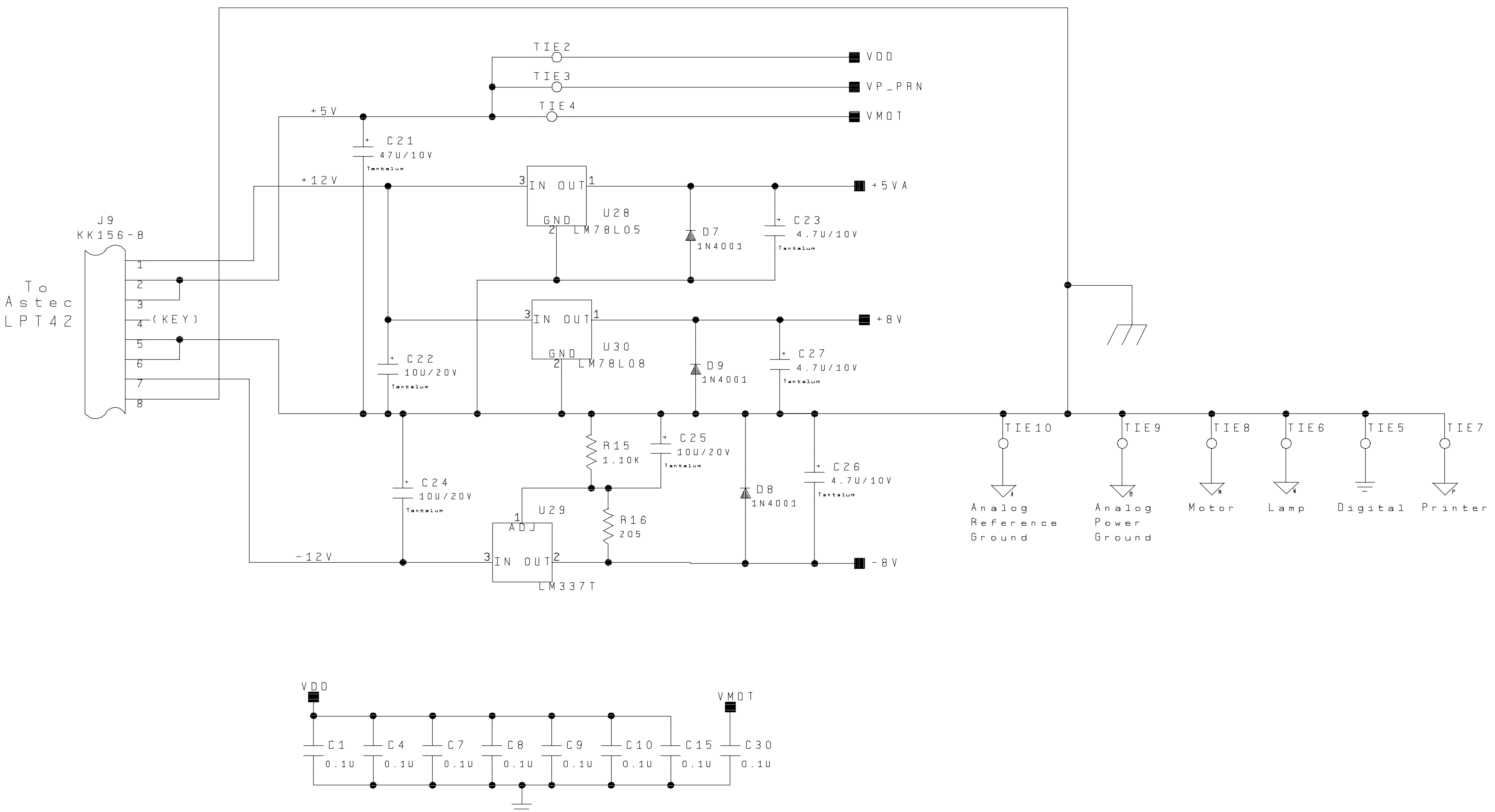
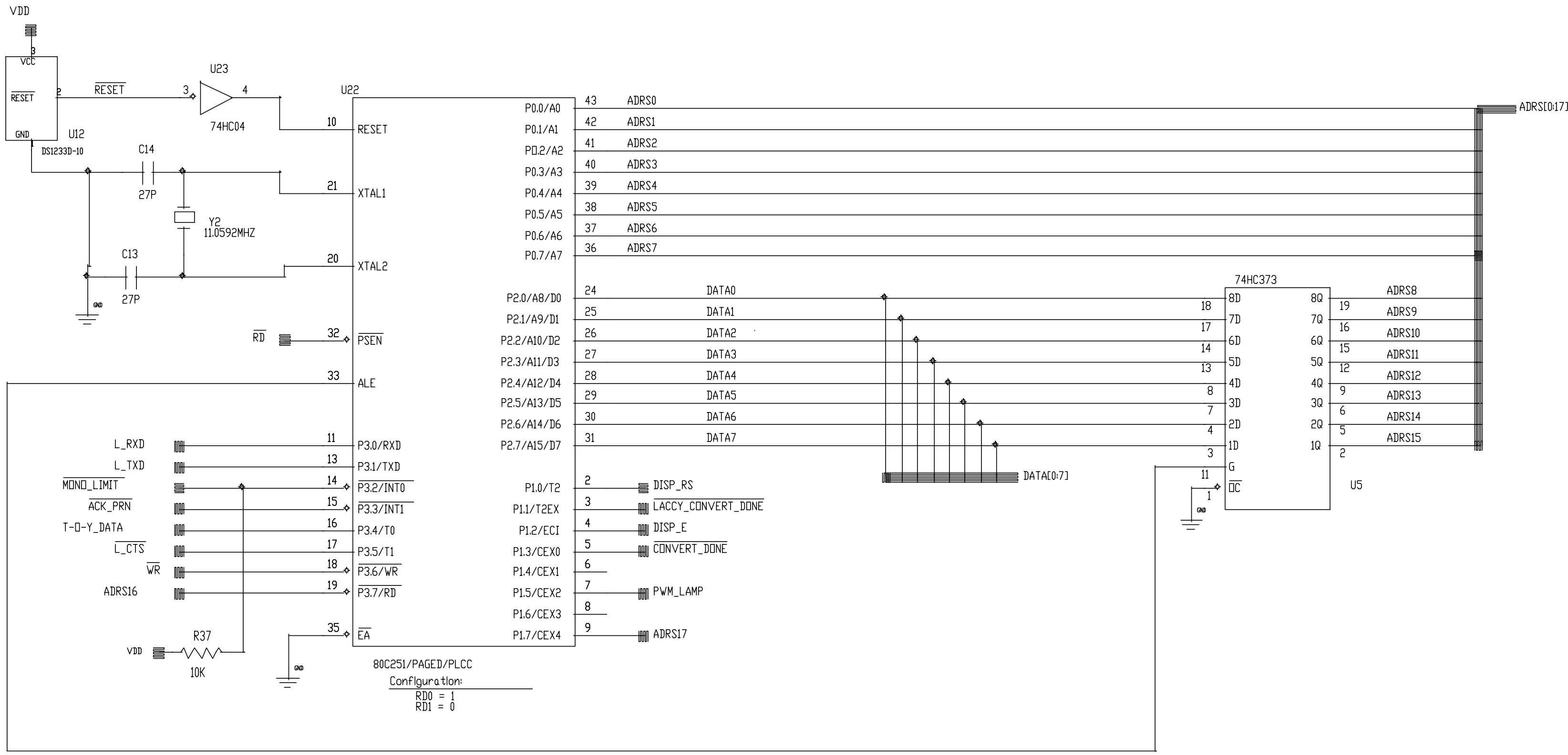


Figure 12.50
Board Power Supply Schematic
[4001-6021, Sht. 14, Rev. A]



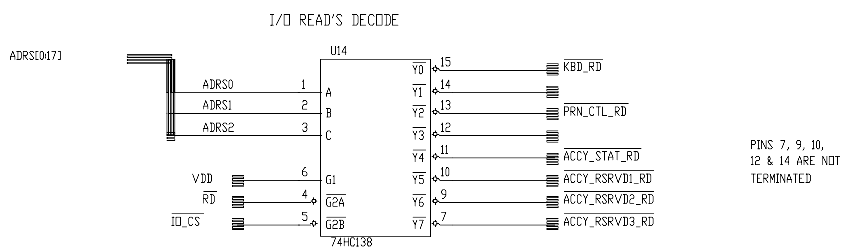


Figure 12.51
Processor Schematic
[4001-6041, Sht. 1, Rev. D]

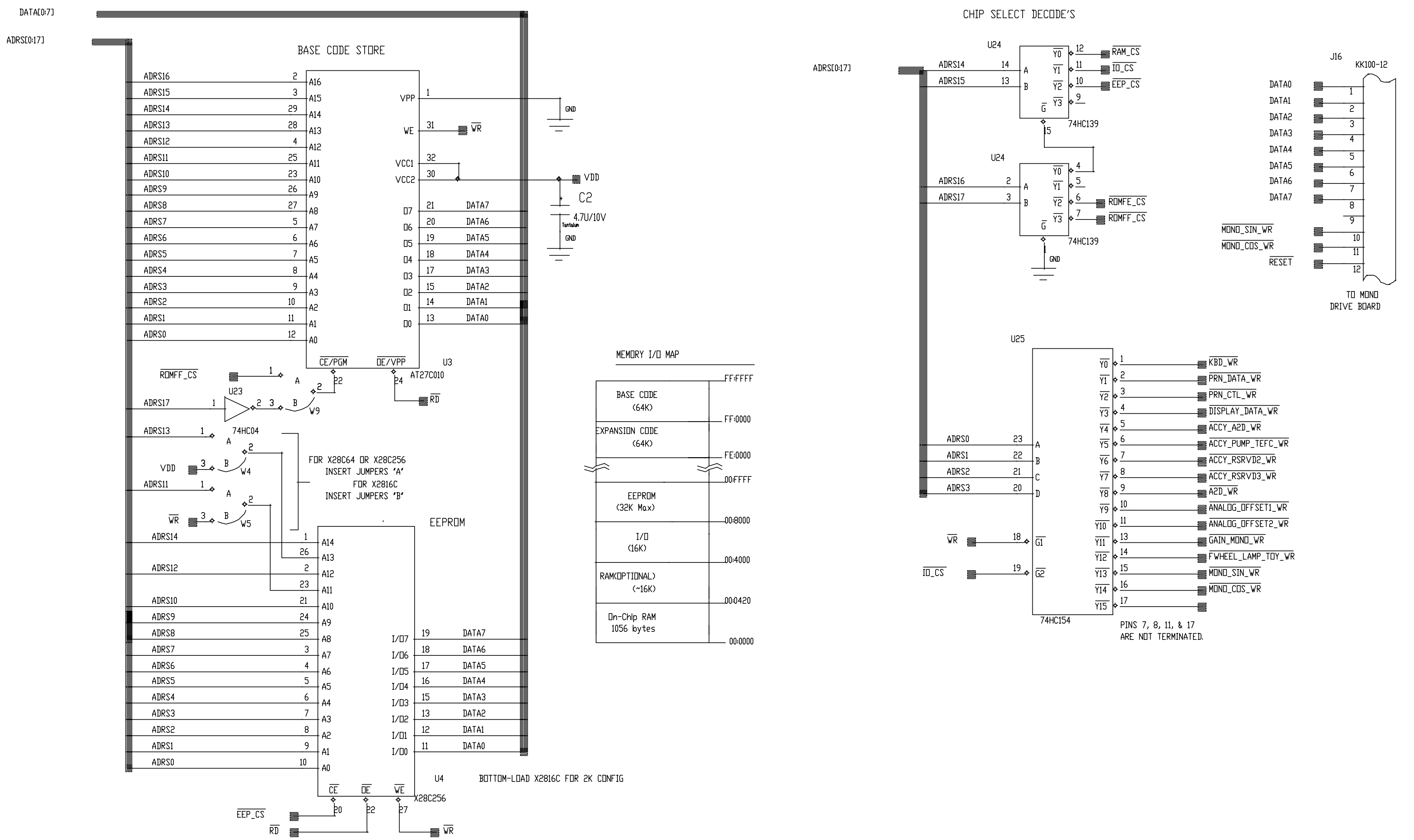


Figure 12.52
Memory 1 / I / O Decode Schematic
[4001-6041, Sht. 2, Rev. D]

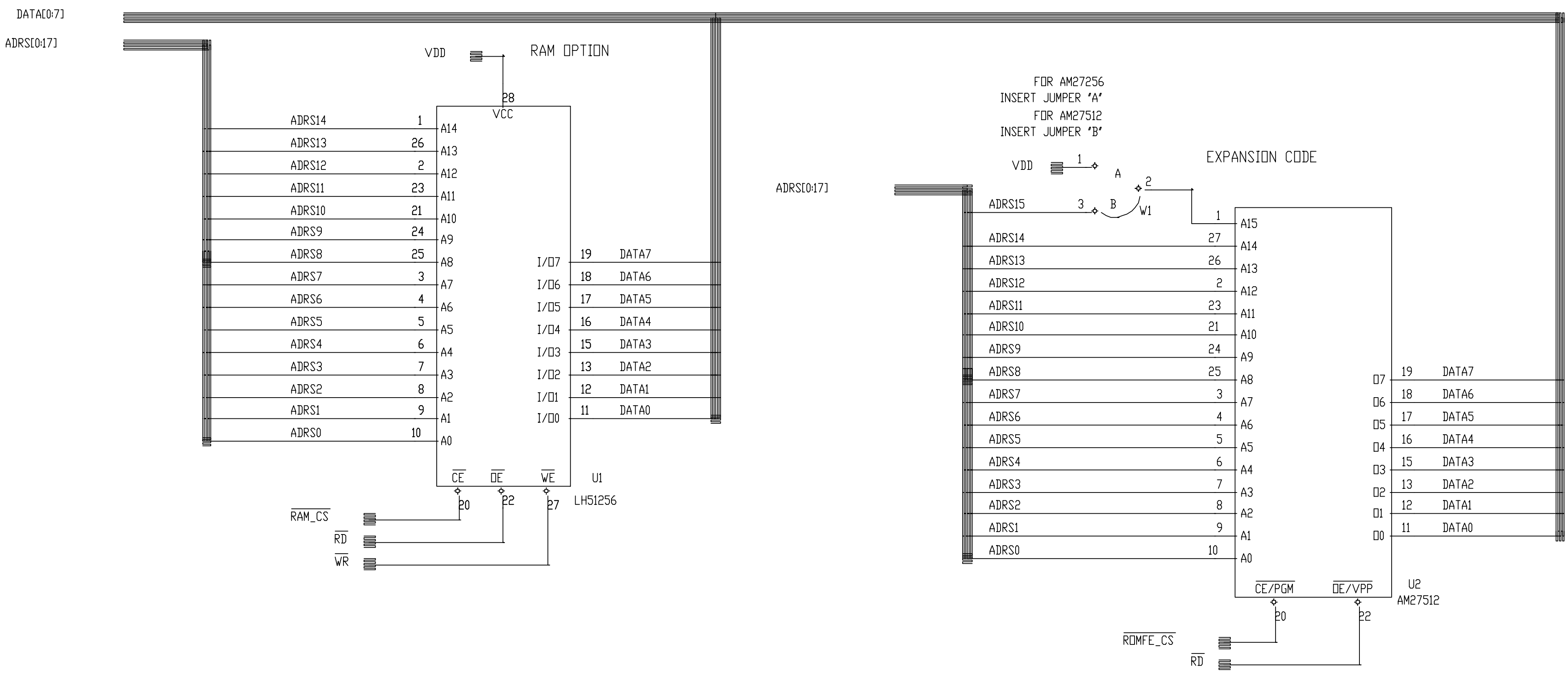


Figure 12.53
Memory 2 - Oem / Optional Schematic
[4001-6041, Sht. 3, Rev. D]

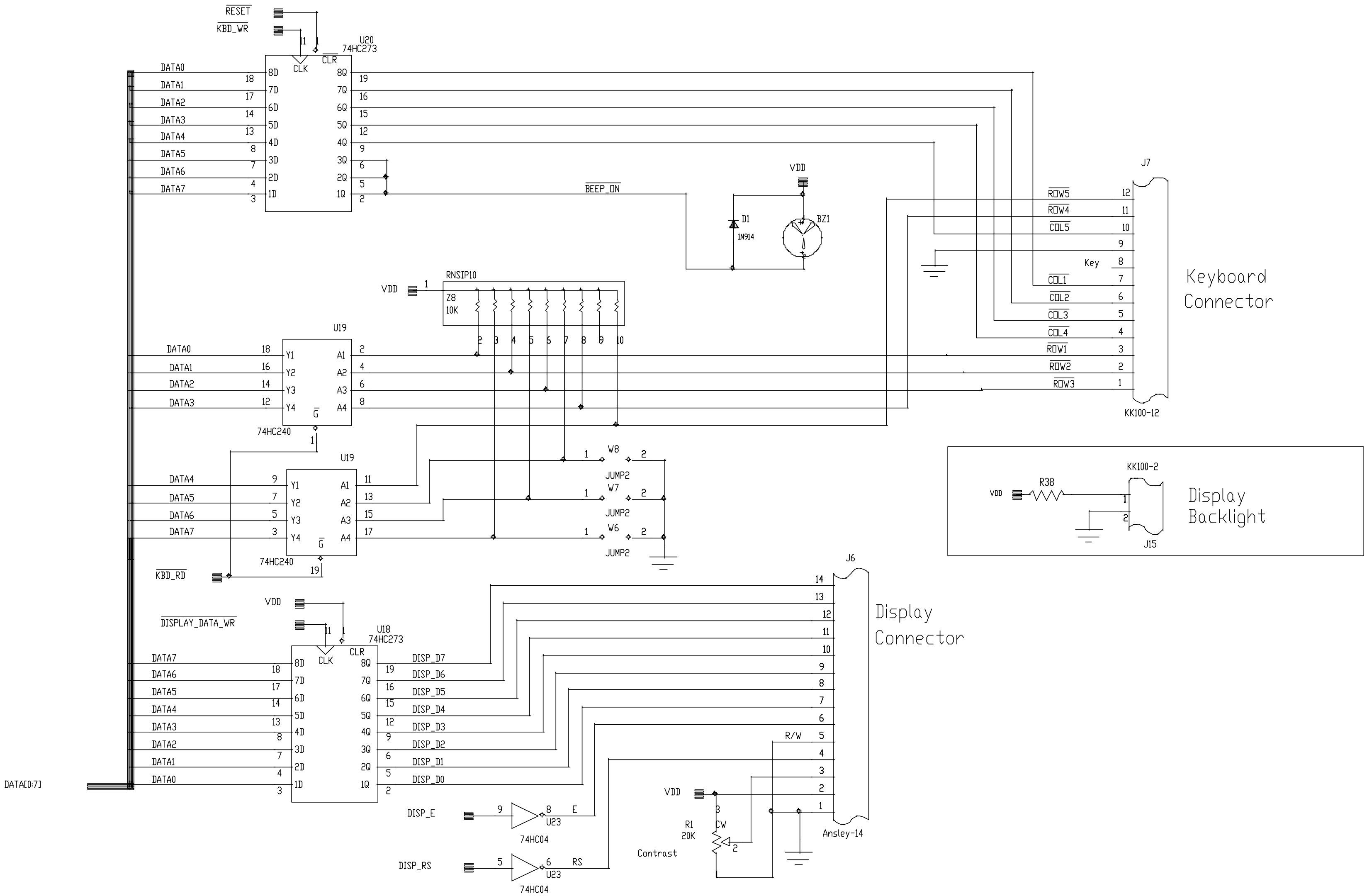
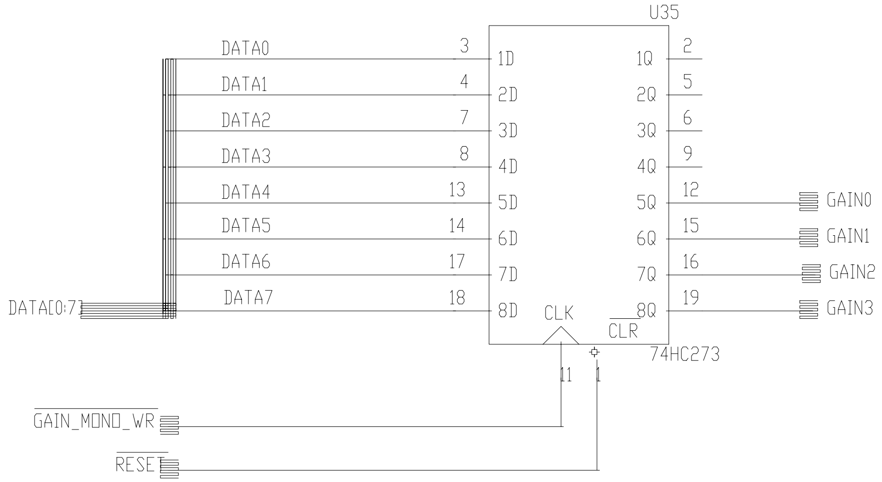


Figure 12.54
Keyboard & Display Control Schematic
[4001-6041, Sht. 4, Rev. D]



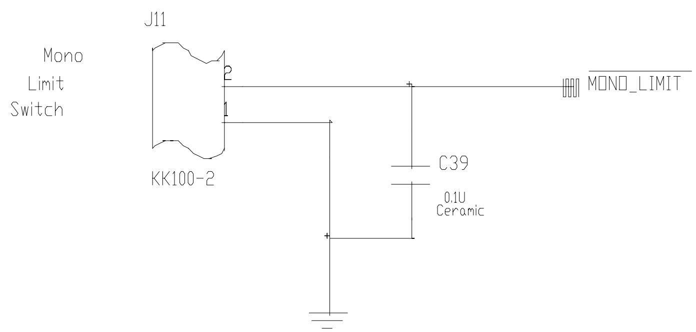


Figure 12.55
Mono Drive & Analog Gain Reg. Schematic
[4001-6041, Sht. 5, Rev. D]

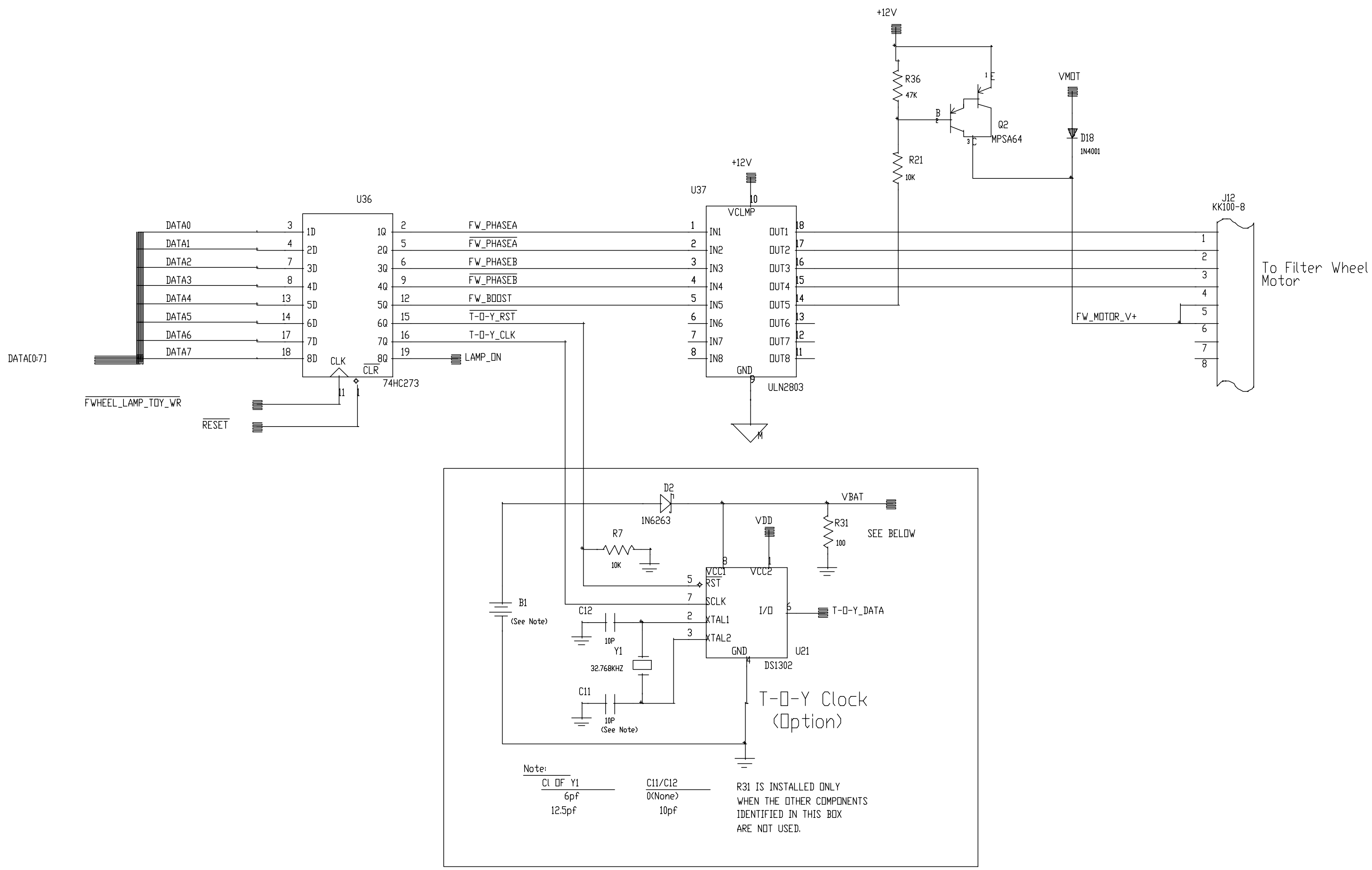


Figure 12.56
Filter Wheel and T-O-Y / Lamp Control Schematic
[4001-6041, Sht. 6, Rev. D]

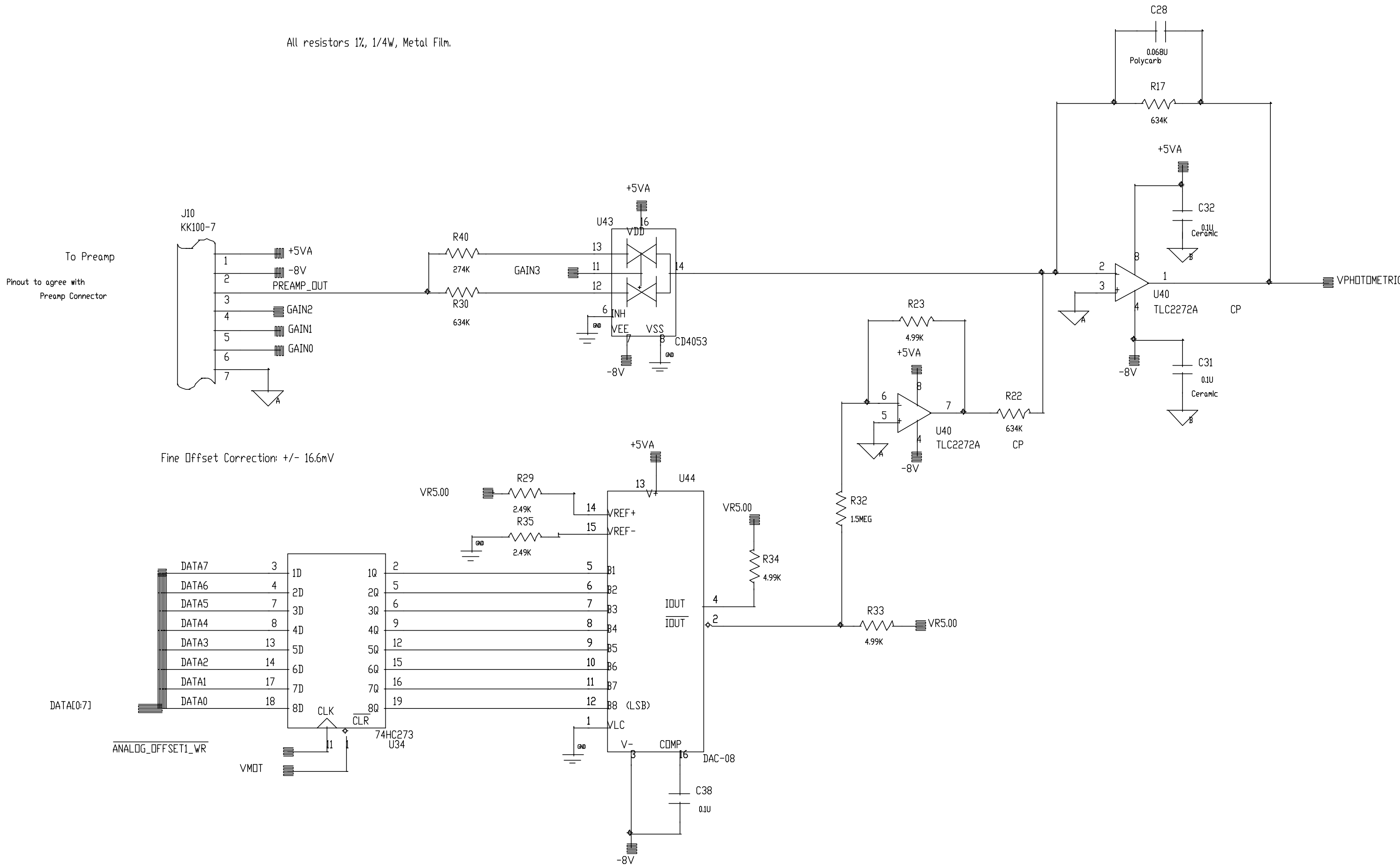


Figure 12.57
Analog Processing Schematic
[4001-6041, Sht. 7, Rev. D]

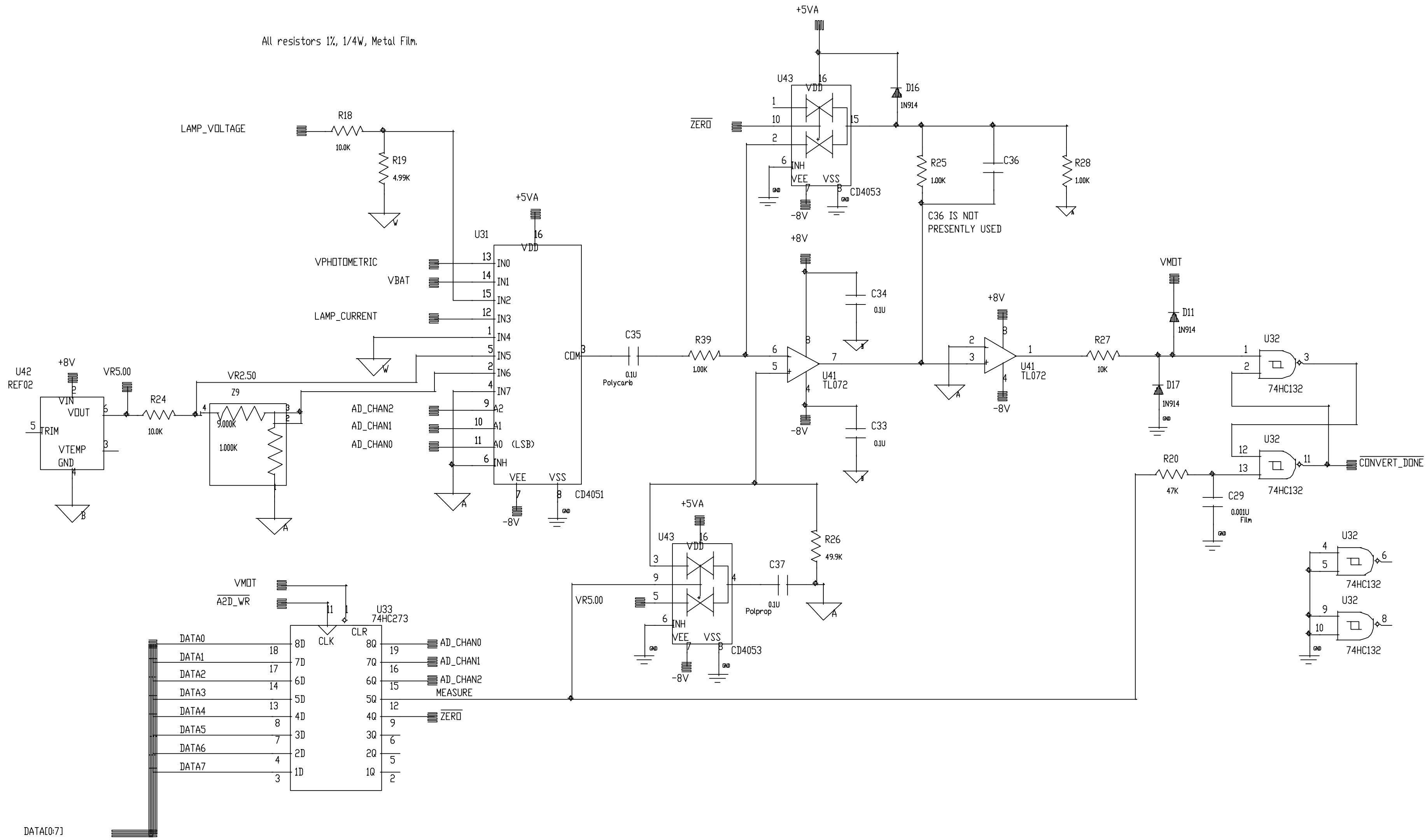


Figure 12.58
A / D Schematic
[4001-6041, Sht. 8, Rev. D]

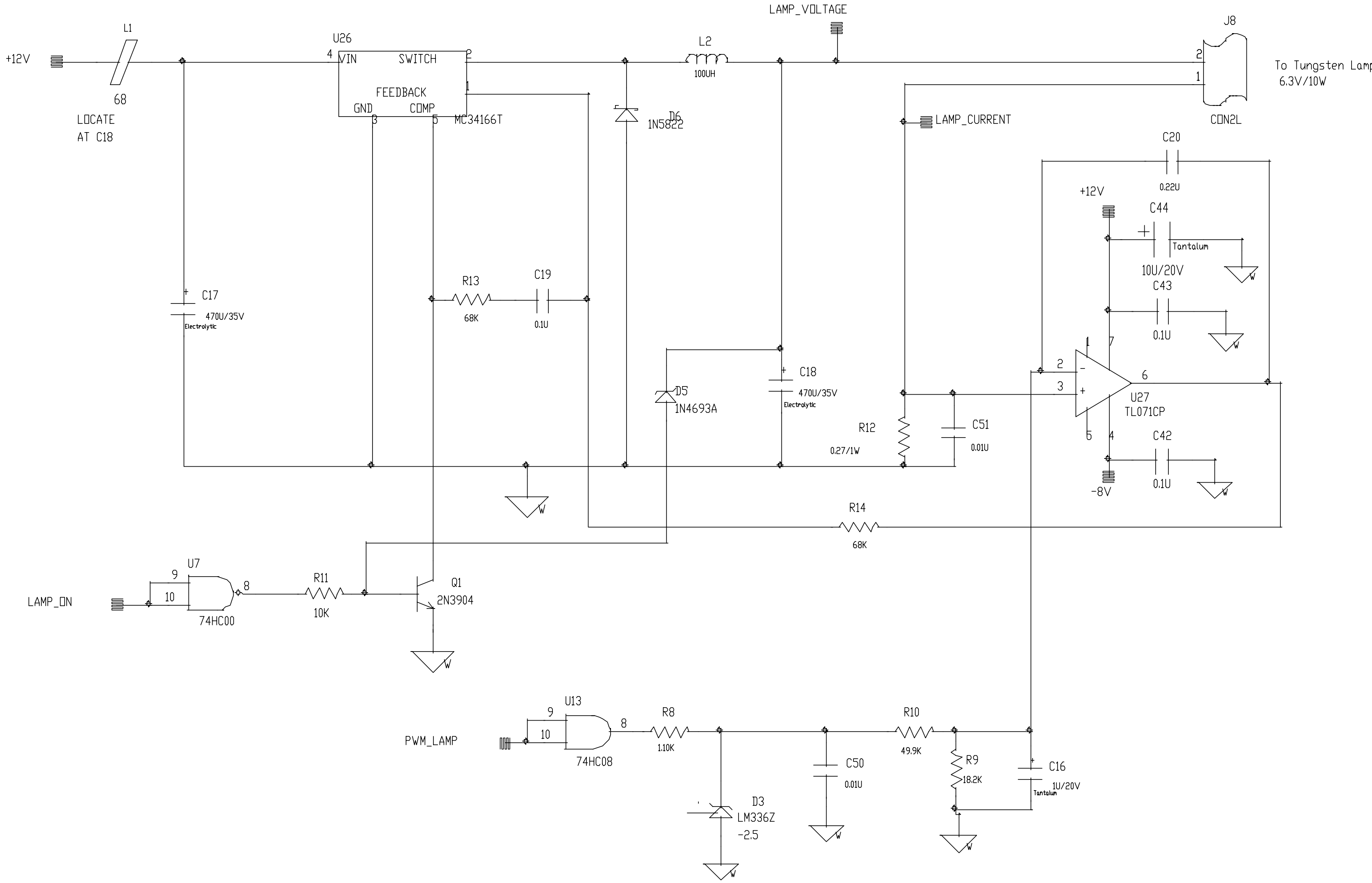


Figure 12.59
Lamp Power Supply Schematic
[4001-6041, Sht. 9, Rev. D]

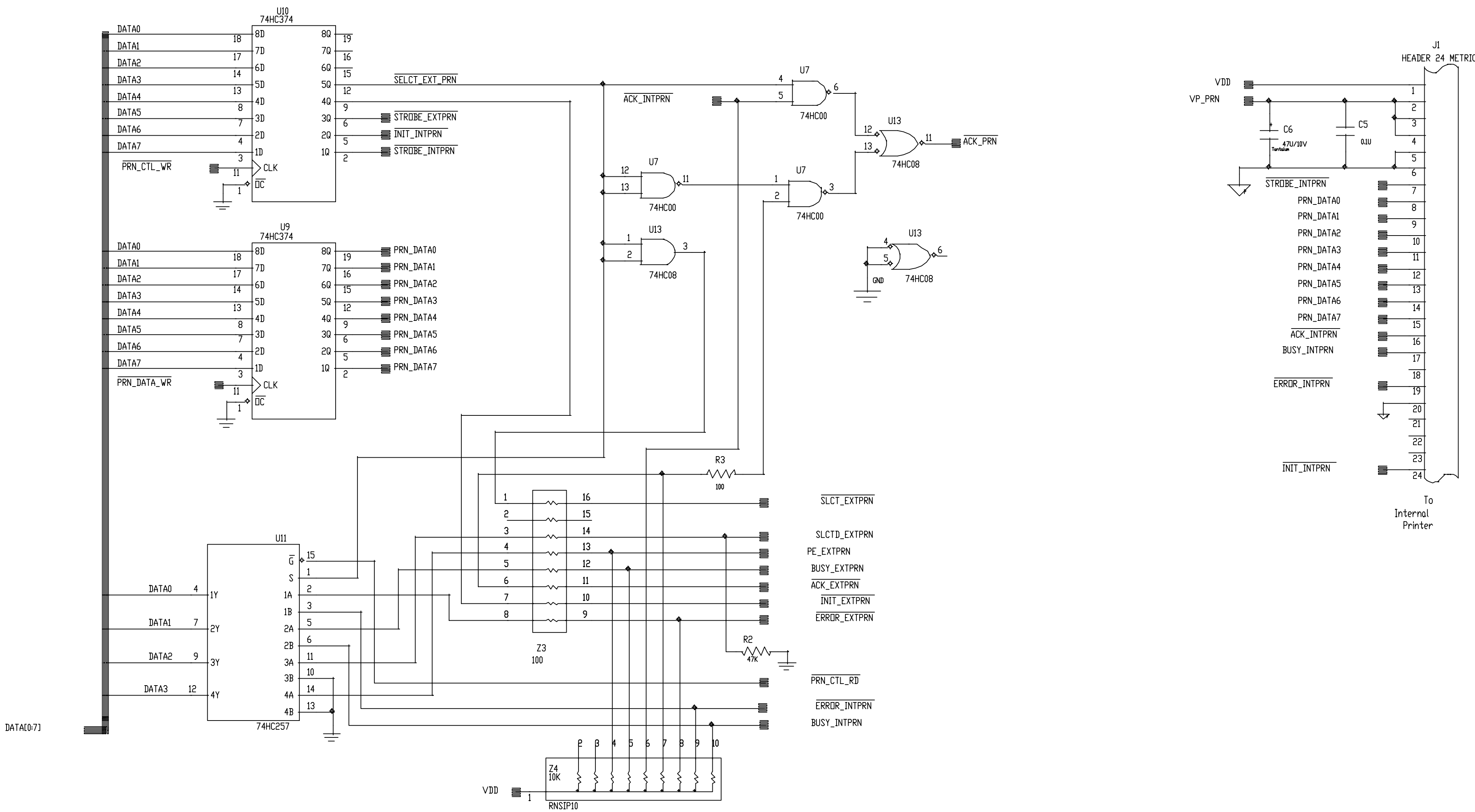


Figure 12.60
Internal Printer Interface
[4001-6041, Sht. 10, Rev. D]

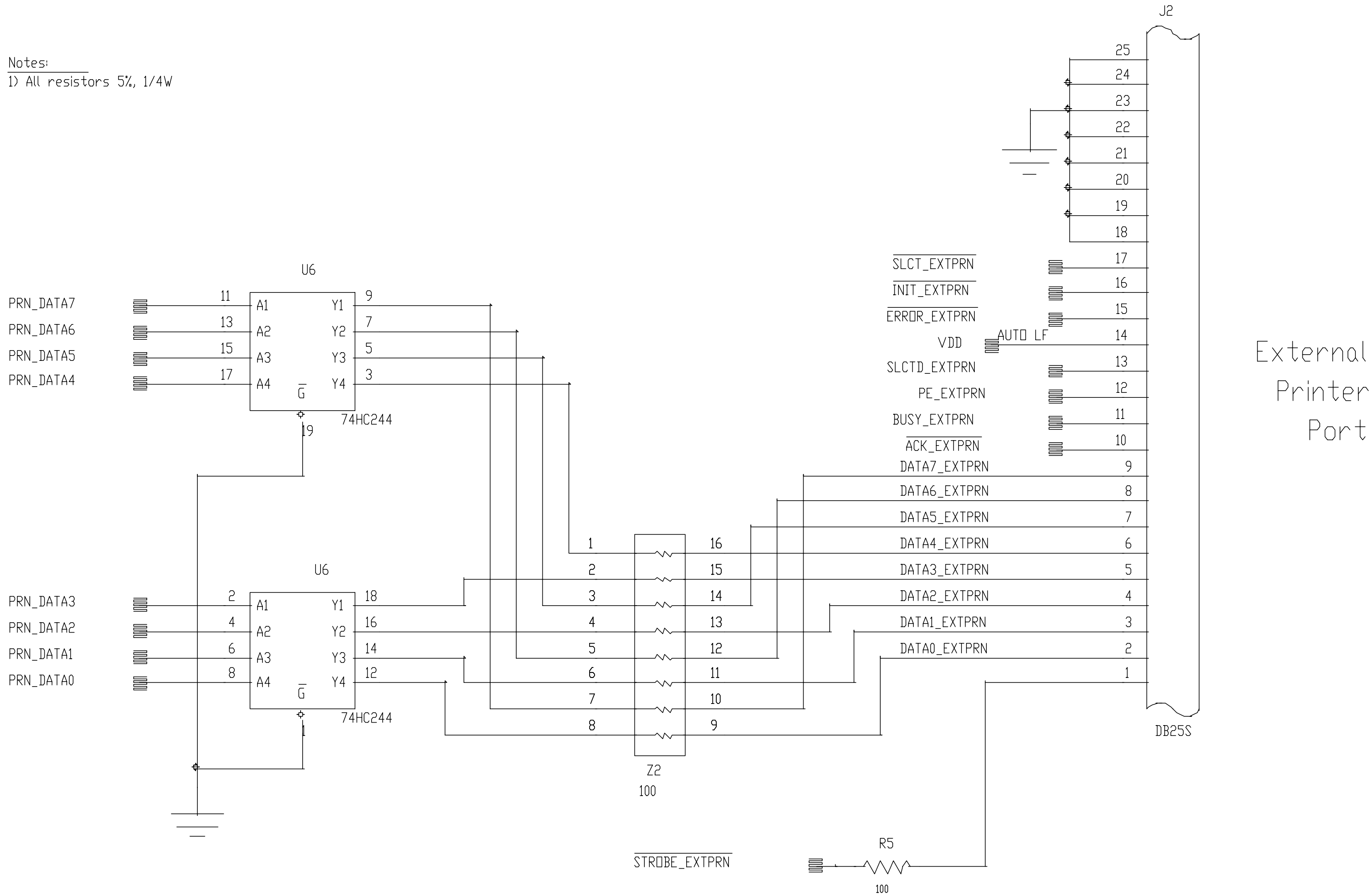


Figure 12.61
External Printer Interface
[4001-6041, Sht. 11, Rev. D]

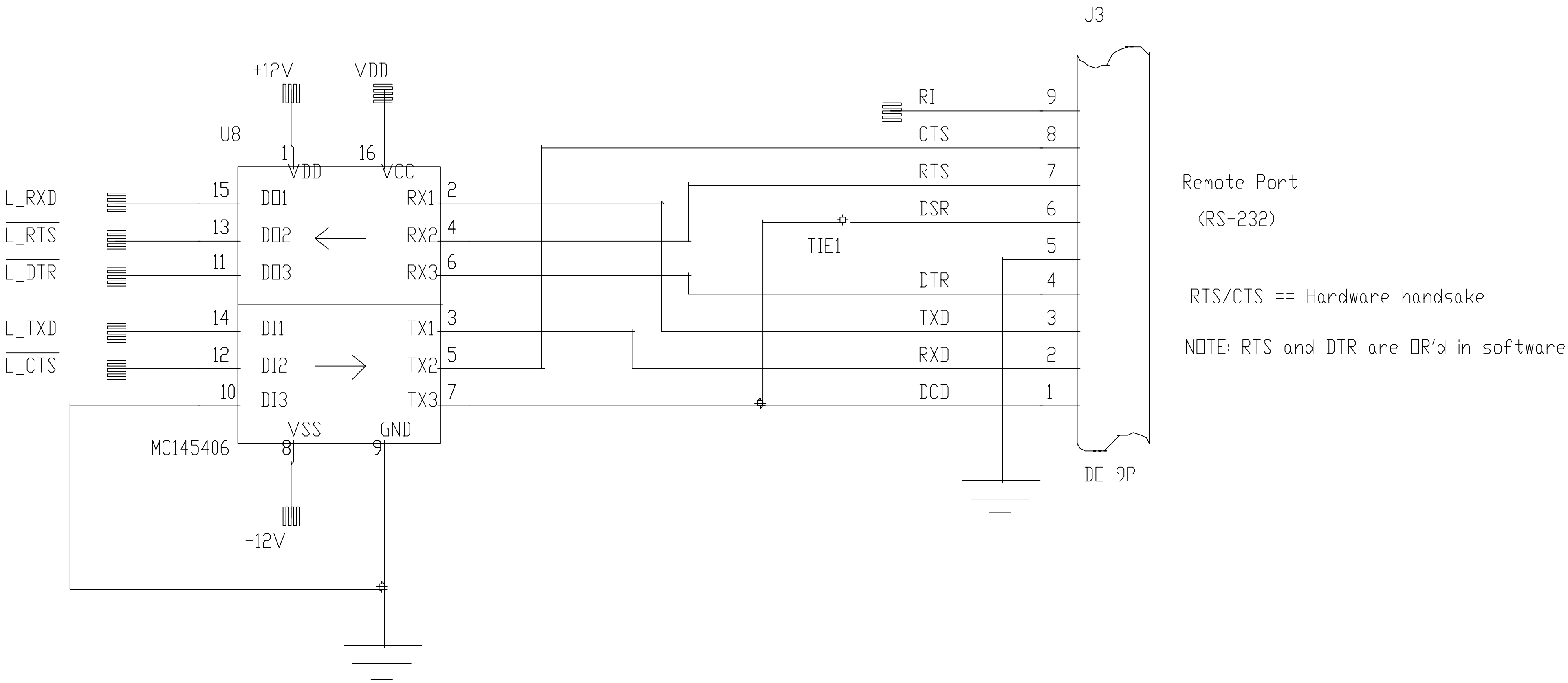


Figure 12.62
RS-232 Interface Schematic
[4001-6041, Sht. 12, Rev. D]

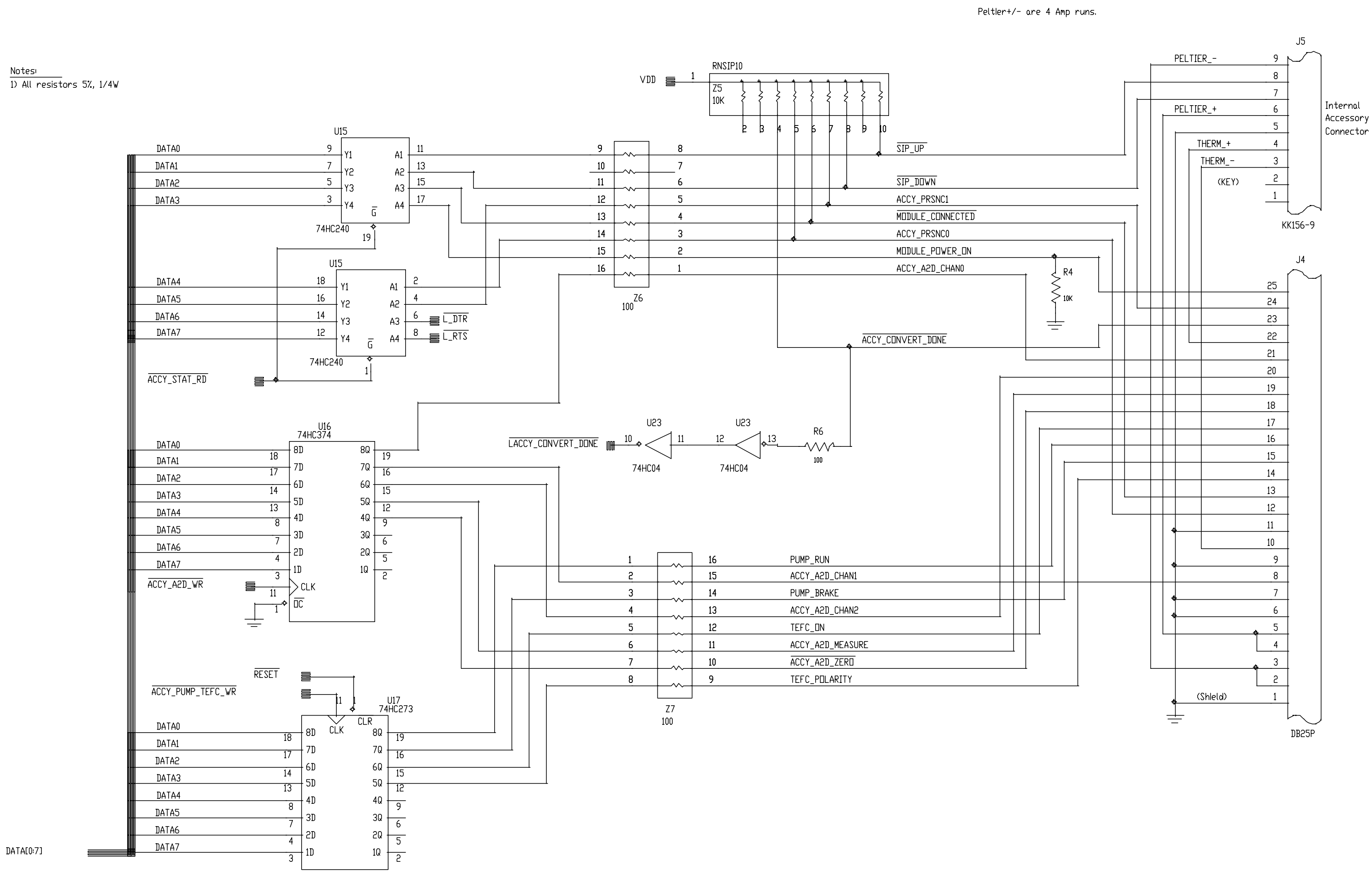


Figure 12.63
Accessory Module Interface Schematic
[4001-6041, Sht. 13, Rev. D]

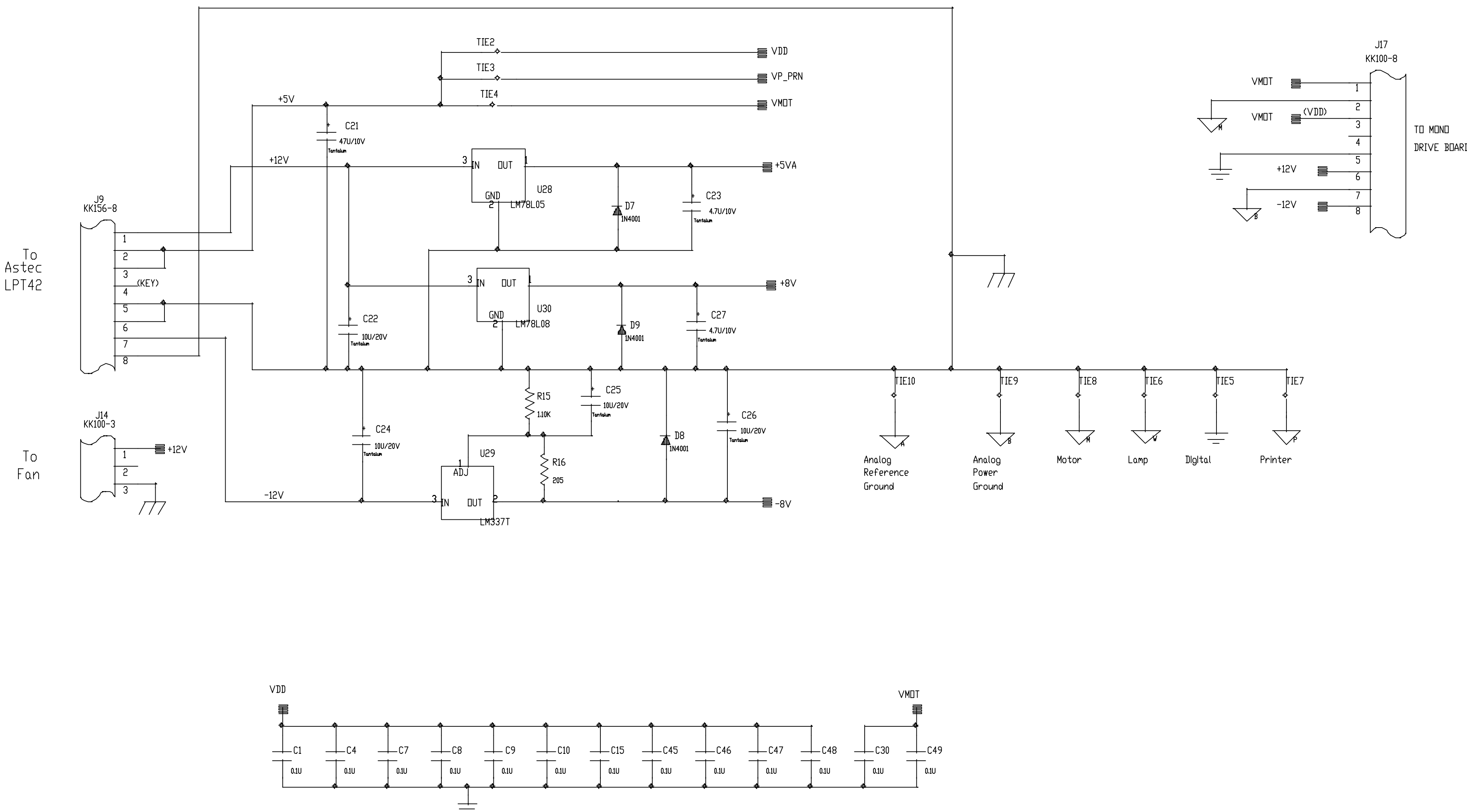


Figure 12.64
Power Supply Board Schematic
[4001-6041, Sht. 14, Rev. D]

Section 13
Update Information

Fan and Fan Guard Part Change

Problem:

Fails Electronic Discharge (ESD) Test. This test is required as part of CE approval.

Note - The instrument properly meets photometric performance specifications with the original fan motor/fan guard.

Symptom/Cause:

System lockups during ESD performance testing. **An external ESD is generated and aimed at the instrument. The system can fail when ESD, at CE test voltage level, contacts the metal guard over the fan area.**

Solution:

1. Some changes were made to the Operator's Manual regarding ESD precautions whenever inside the printer compartment.

2. The FAN guard was changed to non-conductive plastic.

3. Because of the plastic fan guard, the Fan motor has to be changed to one with higher cubic foot per minute airflow rating. This is required to ensure sufficient airflow through the new plastic fan guard.

   Note - If replacing the fan motor in a unit with a plastic Fan Guard, the appropriate motor listed below must be used to ensure proper instrument airflow.

Replacement parts:

	OLD NUMBER	NEW NUMBER
FAN MOTOR	4001-702	4001-27
FAN GUARD	4001-205 (metal)	4001-217 (plastic)
MOUNTING SCREWS	336001-324 (# 6 1.25 inch)	336001-324 (# 6 1.25 inch)

"Sample Too Bright" Error Message

Problem: At turn on or during operation the error message "Sample too bright" appears on the screen. At this point, the system locks up.

Symptom/Cause: Can be caused by the instrument operator by opening the sample compartment door during a measurement. Or, if the door is opened during initialization of the instrument.

Excessive D/C offsets in the Main Board's Analog electronics. This problem may be enhanced by environments with high concentration of corrosive fumes or by environments with high humidity.

Solution: Replace the Main Board (4001-7044)
or
Change components as indicated below.

The specific component level changes are as follows:

COMPONENT #	CHANGED FROM	CHANGED TO
R17, R22, R30	634 K, +/- 1%	63.4 K, +/-1%
R40	274 K, +/- 1%	27.4 k, +/1 1%
C28*	0.1 uF	1.0 uF

**Note - C28 may have been incorrectly labeled on the schematic as a 0.068 uF instead of the original value of 0.10 uF.*

Changing the Main PCB

Problem:	Instrument loses its Wavelength Table when the Main PCB is replaced.
Symptom/Cause:	Information is stored on the 335110-661 EEPROM (U4)
Solution:	When replacing the 4001-6046 Main PCB, remove the EEPROM from the old board and install it into the new board. The current (since 01 Feb 1999) 4001-6046 boards are shipped without a 335110-661 EEPROM.
Produce Affected:	All GENESYS 20 models

Change in Lamp Eccentric

The 4001-115 Lamp Eccentric (also called the ‘alignment screw’) is used to align the lamp in the GENESYS 20 spectrophotometer. This item has been changed as follows:

- The lamp eccentric used to be adjusted by using a Phillips-head screwdriver to maximize the lamp energy throughput. The core of the eccentric had a tapped hole for a Phillips-head screw.

- The tapped hole in the eccentric core has been removed; a Phillips-head screw is no longer used for the adjustment. A slot has been machined in the head of the eccentric core so that a slotted scredriver can be used to rotate the eccentric and align the lamp.

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