SPEX INDUSTRIES, INC. 3880 PARK AVE. EDISON, N.J. 08820 · 201-549-7144 TELEX: 078341

MODEL 1870 INSTRUCTIONS January 1974

1. GENERAL INFORMATION

1.1 Unpacking

CAUTION! Do not use the slit housings or other protrusions for lifting.

If any shipping damage is noticed at delivery, the carrier should note such evidence on the delivery receipt and sign all copies.

Place the instrument, including the shipping base, on a sturdy table in a room where temperature variations are not excessive. Inspect for previously hidden damages and notify the carrier immediately if any are found.

Position the instrument so the front, then the rear end overhangs the table by several inches. Remove the shipping base and replace shipping bolts by leveling legs and pads. Level the spectrometer.

1.2 Inspection for Damage

After removing the instrument from the shipping container, inspect it for visible evidence of any damage. Check that all readily visible mechanical and electrical components are in their proper position and intact. If damage is evident, do not operate the instrument but notify Spex Industries, Inc. and follow these instructions:

Notify the carrier at once.

Many public carriers do not recognize claims for concealed damage if reported later than 15 days after delivery. In case of a shipping-damage claim the carrier agent's inspection is required. For this reason, the original packing should be retained as evidence of mishandling or abuse. While Spex Industries, Inc. is not liable for damage in transit, the company will extend every effort to aid and advise.

1.3 Removing Transport Clamp

Remove the instrument's bottom plate; it is secured by six screws. The transport clamp is fastened by a red-headed screw - loosen the screw and remove the clamp. Replace the bottom plate. (see Unpacking Instructions attached to shipping crate)

CAUTION! Driving the 1870 before removing the transport clamp will damage the mechanism.

2. OPTICAL ALIGNMENT CHECK

2.1 Mirrors

Remove screws from the top cover of the spectrometer. Standing on the control panel side of the instrument, swing the cover slightly up and lift it off. There are two aperture masks on the flat 45° mirror, and one cover/target and two aperture masks on the collimating and camera mirror holders. The grating is protected with a plastic cover. While supporting the masks with one hand, remove the four socket head screws from the collimating mirror and camera mirror holders.

2.2 Grating

In order to protect the grating surface from fingerprints it is highly recommended that lint free gloves be worn.

Note the way the grating in its kinematic mount is attached to the backing plate. (See Fig. 1) Hand scan the grating to about 10,000 A. While holding the grating mount with your right hand, turn the thumb screw counterclockwise with your left hand until the grating mount is disengaged.

Place the grating with its mount face up. Carefully remove the tape from one side, then lift the plastic cover up and away from the grating. Don't let the tape or the plastic cover brush against the grating surface.

When installing the grating, make sure that the three ball nose screws of the grating mount are properly mated with the cone, flat and slot of the backing plate. (See Fig. 1)

Save the plastic cover for future. Any time you have removed a grating from the spectrometer, install the plastic cover over it.

2.3 Slits

Remove the protective plastic cover from the entrance slit.

The 1871 Exit Slit Assembly mounts on the front plate of the instrument. Note two guide pins on the rear of the 1871. Engage these pins in the corresponding holes of the front plate and secure the assembly in place using four socket head screws provided. Remove plastic cover from the slit.

2.4 No. 1874 Camera Adapter

The 1874 Camera Adapter mounts on the front plate of the instrument. Note two guide pins on the rear of the adapter as well as the four position rotatable stop in front. Engage the guide pins in the corresponding holes of the front plate and secure the assembly in place using four socket head screws provided. Make sure that the rotatable stop is on the bottom end of camera adapter.

2.5 Useful tools

Short optical bar with riders
Small He-Ne laser, low power (.5 mW)
Quartz Hg lamp (Spex #1634)
Power supply for Hg lamp (Spex #1635)
Eye piece (Spex #1529)
1P28 Photomultiplier tube
Photomultiplier base (Spex 1424B)
Photomultiplier Housing (Spex #1424)
Power Supply for PM tube
Recorder or photometer

2.6 Optical Testing in the Field

Before attempting to realign the instrument, you should check to make sure that the instrument is in focus, and that the wavelength accuracy is within specifications (see 2.6.1 and 2.6.3). Moderate misalignments can be corrected with adjustments of the grating mount. Changing the position of the mirrors is likely to affect other aspects of the instrument's performance.

2.6.1 Focus Check with the 1871 Exit Slit Assembly

Mount a Hg pencil lamp as close as possible to the entrance slit. Make sure the lamp is positioned properly so that the collimating mirror and grating are fully illuminated.

Close the entrance slit to 10 microns wide by 2 mm high and the exit slit to 100 microns wide. Use an eyepiece or a microscope to focus on the slit jaws. Using the hand scan knob, move the grating so that the 5461A line of Hg is visible. The focal plane of the green line should be at the exit slit jaws.

For photoelectric testing, close the exit slit to 10 microns wide. Set the wavelength counter as indicated on the trace shown in the test report. If the 2nd order of the 3131A doublet of Hg was used, then the counter should be set to 6262A and a U.V. sensitive phototube should be used. Scan by hand or, alternatively, by motor using the 1873 Minidrive, and compare with the trace in the test report.

2.6.2 Focus Check with the 1874 Camera Adapter

Install the 1874 Camera Adapter and a photographic film or plate holder. Refer to the photograph accompanying the instrument and using the same wavelength counter setting as indicated on the envelope, take a series of spectra and compare them with the enclosed photograph.

2.6.3 Wavelength Accuracy

Refer to the wavelength table in the test report. If you are equipped with the 1871 Exit Slit Assembly, set the entrance and exit slit settings to 10 microns. Using a phototube or an eyepiece scan the instrument until a peak intensity is noticed for a particular line.

If the wavelength is different from the counter setting by less than 5A, a small adjustment of the grating mount screw B (Fig. 1) will bring the wavelength accuracy within specifications.

If you do not have the 1871 Exit Slit Assembly, insert the lucite target supplied with the instrument into the exit port of the instrument. Set the wavelength counter to a known visible line such as a He-Ne 6328A line. This should intersect the crosshairs on the lucite target. If not, then adjust screw B on the grating mount to bring the light over to the crosshairs.

2.7 Complete Alignment Procedure

2.7.1 Alignment of Laser Source

Remove the top cover of the instrument. Open the entrance slit to 2 mm width by 2 mm height. Place the spherical mirror target mask on the collimating mirror, and place the L shaped bracket in position near the 45° mirror (See Fig. 2)

Turn on the laser, and aim the laser beam so that it passes through: a) the entrance slit, b) the L shaped bracket alignment hole, and c) the hole in the spherical mirror target mask.

2.7.2 Alignment of Optics

Remove the spherical mirror target mask. Set the wavelength counter to 0A. Position the L shaped bracket near the grating. By means of the adjusting screws A and B on the spherical mirror holder (See Fig. 3), bring the laser beam to the correct optical height (using L bracket as a target) and to the center of the grating. The laser beam should be centered over the grating shaft. Do not touch the hex nut with the copper springs, as no motion is imparted to the mirror.

At this time set the wavelength counter to 6328A. Place the sector mirror target mask in position and adjust the height of the laser beam to the center of the target. Place the L shaped bracket near the exit port of the spectrometer, and adjust the height of the laser beam by means of the top socket head screw behind the sector mirror mount. Do not adjust 2 lower socket head screws as this will change the alignment of the sector mirror.

If you are equipped with the 1871 Exit Slit Assembly, adjust the grating screw B to bring the laser beam through the exit slit.

If you are not equipped with the 1871 Exit Slit Assembly, then place the lucite target supplied with the instrument in the exit port. Set the counter to 6328A and adjust the grating so that the laser beam falls on the cross hairs.

2.7.3 Rocking the Grating

This procedure should be followed when installing a grating that was not shipped with the instrument. Remove the original grating and install the new grating (See Sect. 2.2)

Open the entrance slit to 1 mm wide by 2 mm high. Scan the wavelength counter to 0A and using a laser or another source, adjust screw A to bring the light beam to the center of the exit slit, or the center of the lucite target.

Then scan to some other visible wavelength, (6328A for a He-Ne laser). Adjust cam C to raise or lower the image to the center of the exit slit or the lucite target.

Repeat the above until you are satisfied that the spectrum is centered at high and low wavelengths.

2.7.4 Paralleling Slits

Adjust the entrance and exit slit to 15 microns, and set the shutter height to 10 mm. Using a Hg pencil lamp slowly scan past the 5461A line in both directions, observing the manner in which the illuminated area will move up or down as you scan across the line. If the slit is properly paralleled, then scanning in the direction of increasing wavelength, the central portion of the slit will be illuminated first, with light spreading to both ends uniformly. The line will first disappear at the center, then evenly towards both ends. If necessary, loosen the Allen head screws around the exit slit, turn the slit until it is properly paralleled, and retighten. Do not loosen the screws which mount the adapter plate to the spectrometer, as this plate cannot rotate. (See Sect. 2.3)

2.7.5 Refocusing the Instrument as a Spectrometer

This procedure should be followed only if the instrument has been proven to be out of focus after it has been thoroughly aligned.

Readjust the entrance and exit slit to 10 microns wide. Set the entrance slit to 2 mm height. Set up the instrument for photoelectric readout with a strip chart recorder. Set the wavelength so that the 2nd order of the 3131A doublet of Hg emerges from the exit slit(counter should read 6262A). Slowly scan the Hg doublet. Observe the intensity of the lines, the depth of the valley between the lines, and the half-width. Loosen the Allen head screws which lock the spherical mirror holder to the baseplate. Adjust the focus slightly by turning the focusing screw through hole C behind the mirror and then rescan.

Continue to focus and scan until the valley is deepest relative to the line intensities and the half width is a minimum. When you are satisfied that the instrument is in best focus, tighten the Allen head screws. At this time it is advisable to recheck the wavelength accuracy alignment and slit parallelism. (Sect. 2.6.3, 2.7.2 and 2.7.4)

2.7.6 Refocusing the Instrument as a Spectrograph

Mount a Hg pencil lamp and some kind of timing shutter. Mount a polaroid film or plate in the film holder. Scan to the 2nd order of the 3131A doublet. Make a series of time exposures to determine the best exposure. Focus the spherical mirror as in 2.7.5 and take a picture after each exposure. By setting the wavelength counter to 6900A, the doublet will be positioned 2 inches to the right of center. By setting the wavelength counter to 5500, the doublet will be positioned 2 inches to left of center.

By examining the pictures you will be able to determine which position of the mirror gives the best focal position. Reposition the mirror to this position and tighten down the Allen head screws. As before, recheck the wavelength accuracy, alignment, and slit parallelism.

3. MAINTENANCE

3.1 Mechanical

The instrument should be handled as any precision device would be. In particular, the hand scanning knob should not be rotated too rapidly. This may cause the counter to break.

Every year or so, the leadscrew and guide can be cleaned of accumulated dirt, using a soft brush or lint free cloth. A few drops of light machine oil should be placed on the leadscrew and slide bar.

Do not attempt to scan past the limits of the machine as this will cause gears to slip and thus the wavelength will read incorrectly.

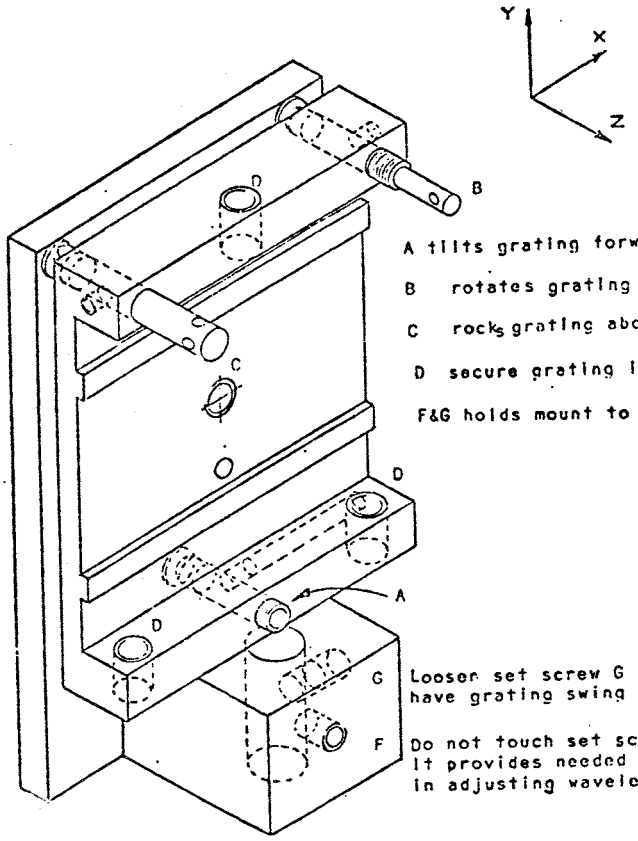
3.2 Optical

Before becoming too concerned about a small blemish visible on a grating, remember that it can affect performance only in proportion to its size. Even the best gratings rarely look cosmetically perfect.

Dust may be removed from gratings and mirrors by using an air bulb to blow away the particles. For stubborn dust particles a stream of methanol or acetone should be directed at the optic and allowed to air dry. Use only the Spectrochemical grade reagent grade, when cleaning the optics.

Fingerprints may be removed from the mirrors if action is taken immediately after such an accident. Body acids will attack the aluminum. Touch the fingerprint lightly with a piece of pressure sensitive tape and "roll" it off in the direction towards the edge of the optic.

Remember, mirrors can be recoated, gratings cannot.



A tilts grating forward or backward around X-axis

B rotates grating around Y-axis

C rocks grating about Z-axis, with the center of rotation through screw A

D secure grating in its mount

F&G holds mount to grating shaft

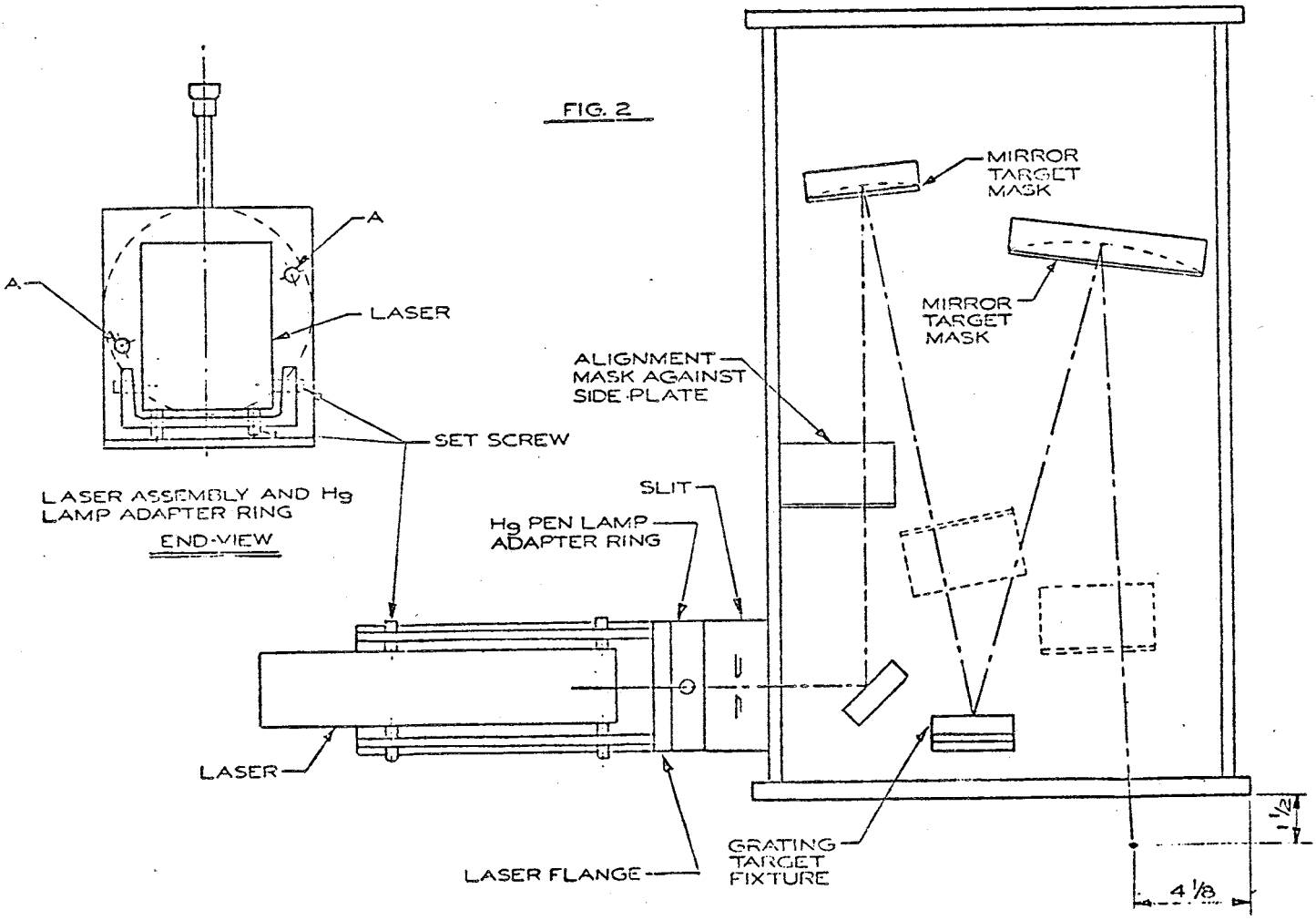
Looser set screw G to have grating swing freely.

Do not touch set screw F. It provides needed friction in adjusting wavelength.

Fig. 1

Kinematic mount & Backing Plate Assembly

FIG. 2



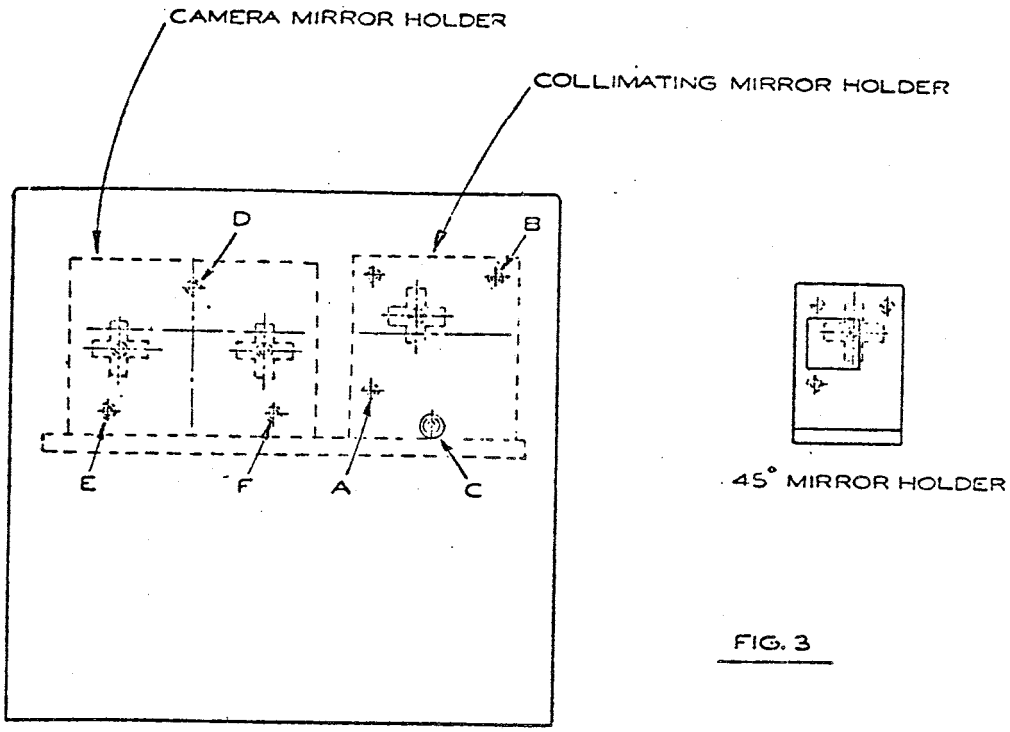
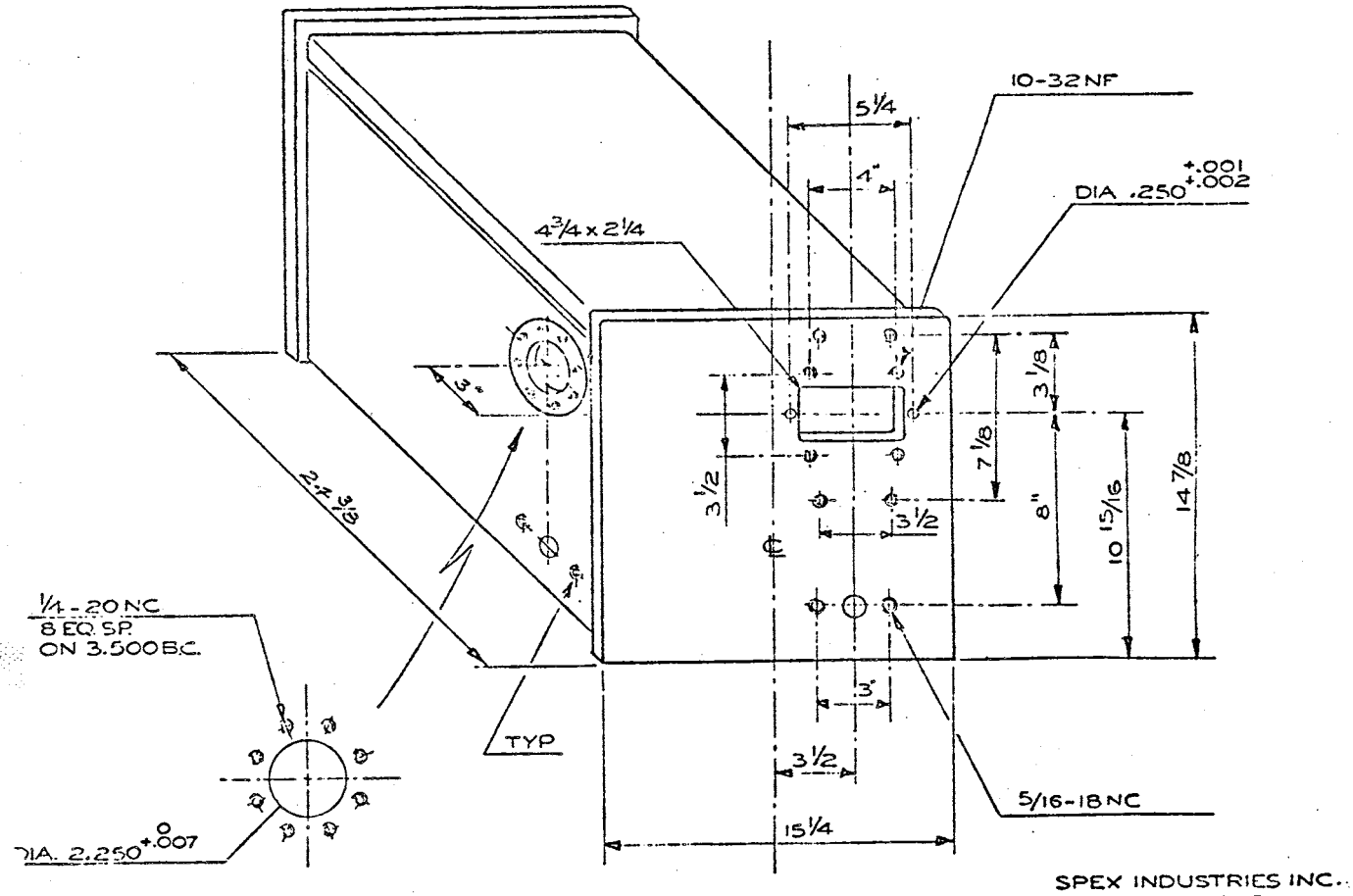


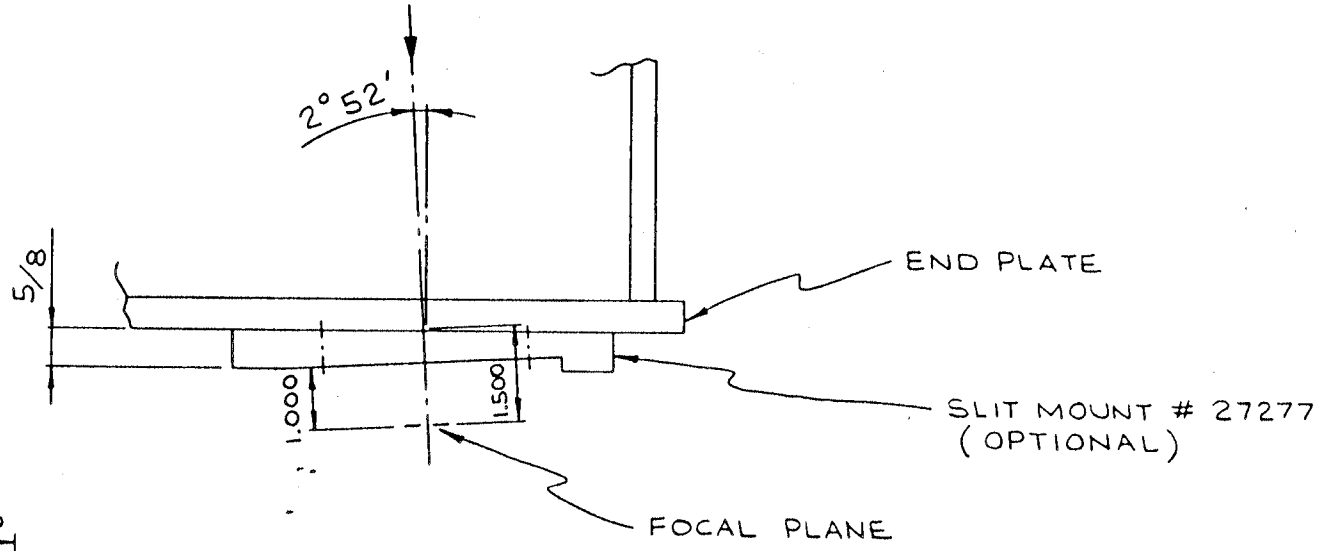
FIG. 3

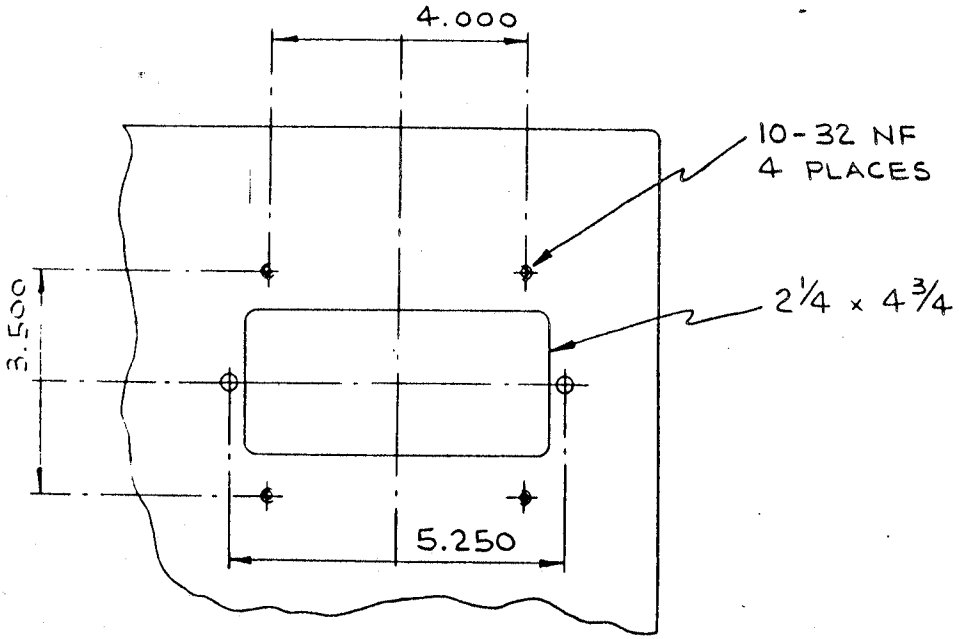


SPEX INDUSTRIES INC.
1870 MULTIMATE
OVERALL DIMENSIONS

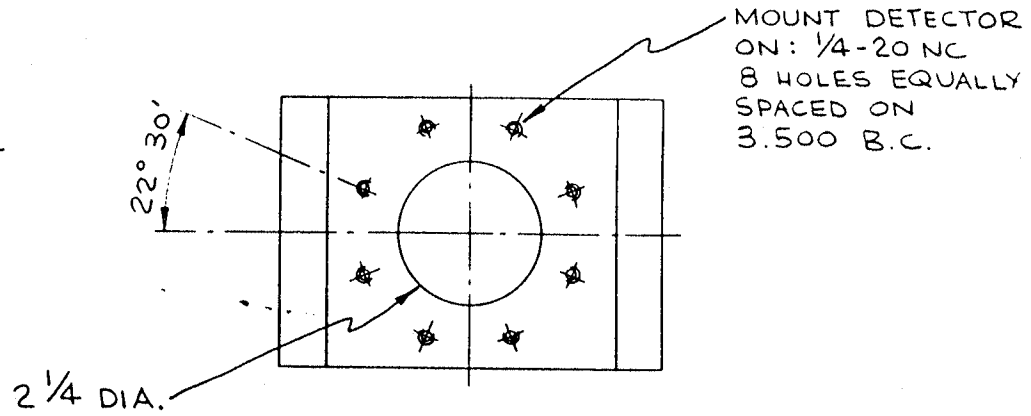
FIG. 4

1870 EXIT END FOCAL PLANE



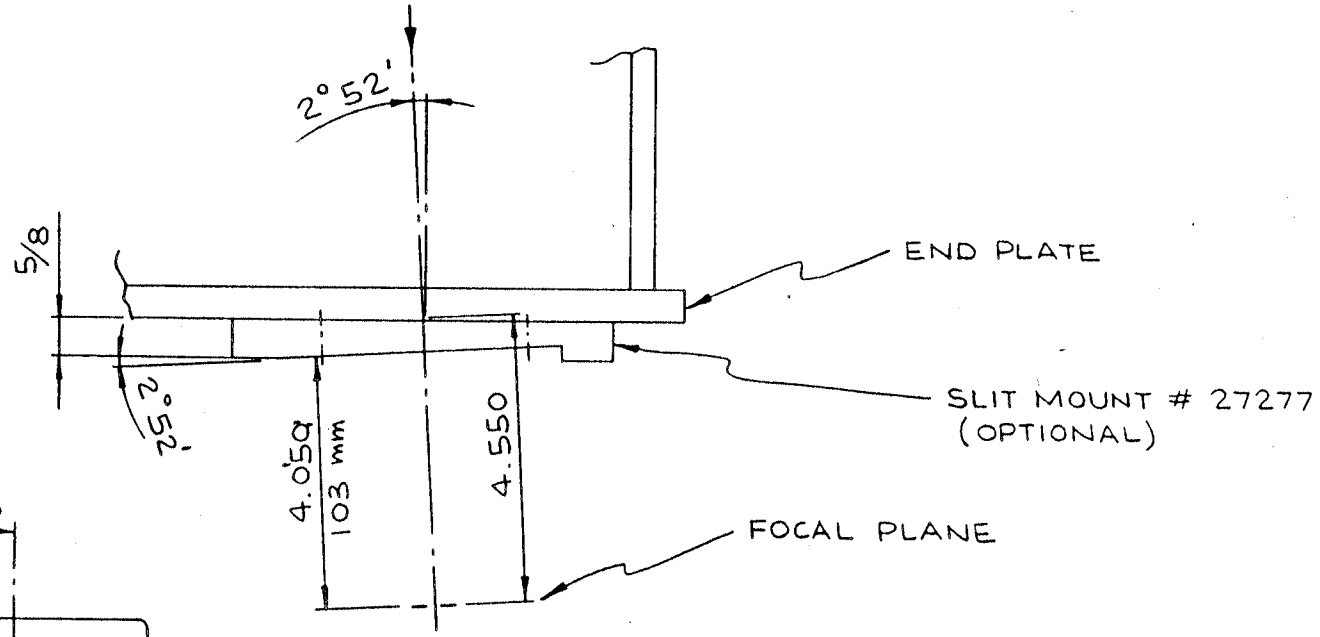


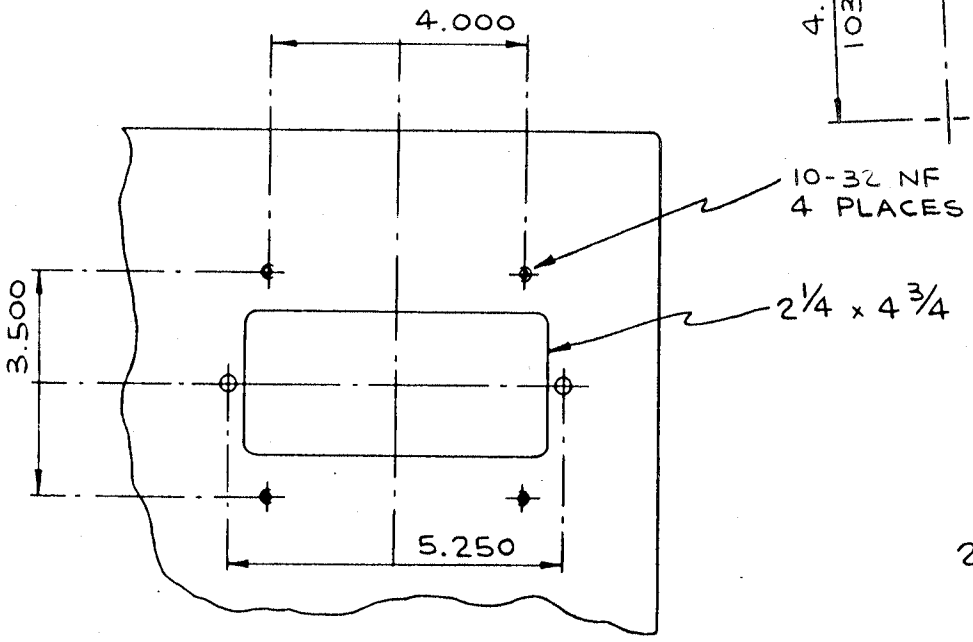
END PLATE



SLIT MOUNT # 27277
(OPTIONAL)

1870 DETECTOR MOUNTING DETAIL
FOCAL PLANE (WITH EXTENDED MIRROR # 31064)





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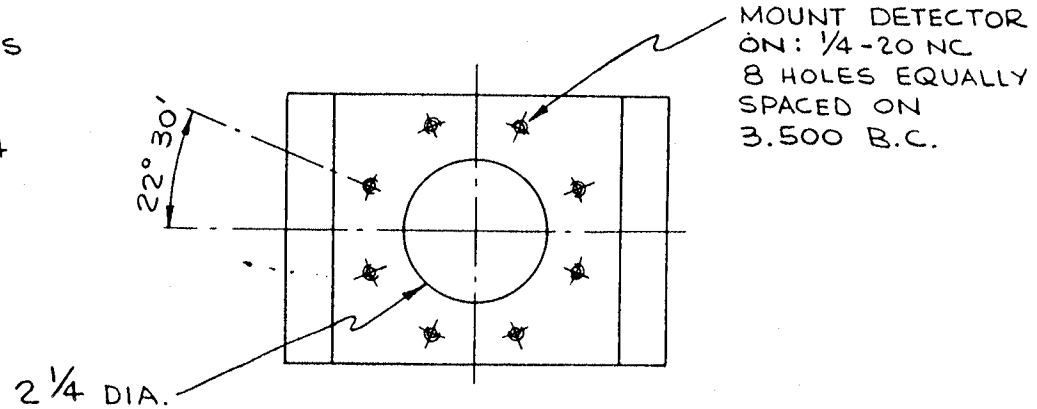
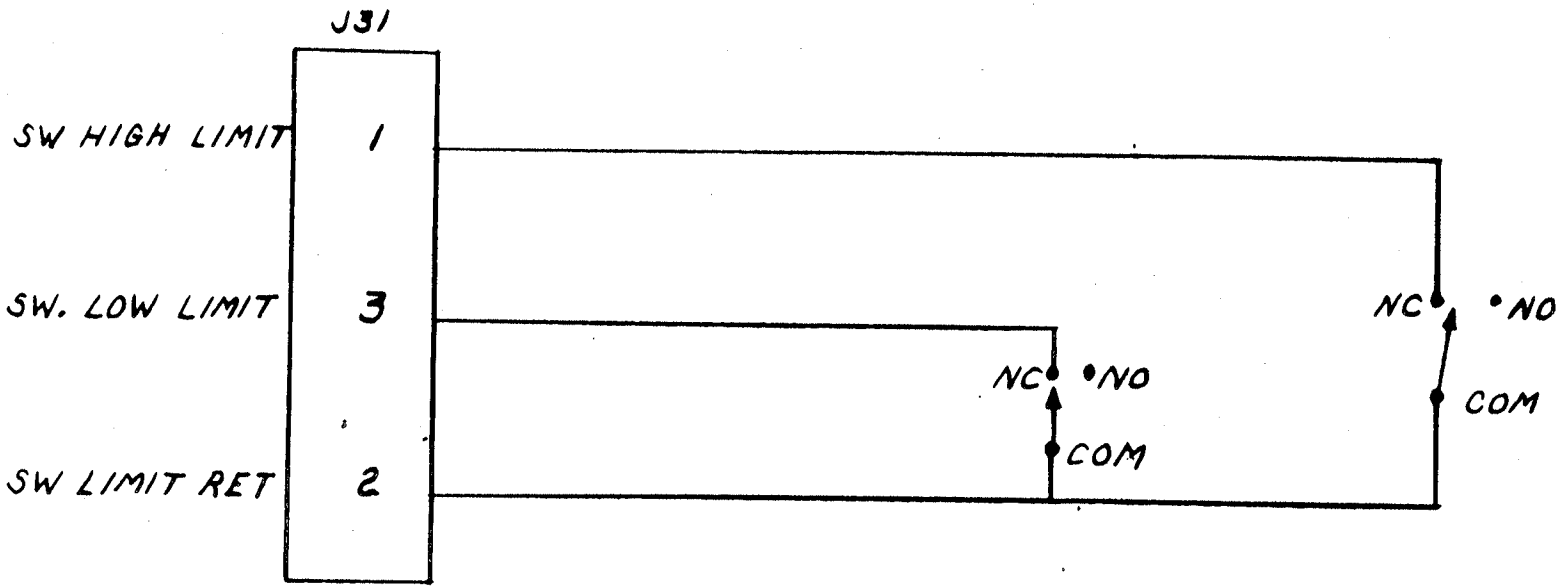


SLIT MOUNT # 27277
(OPTIONAL)

31573

DATE	SYM	REVISION RECORD	AUTH.	DR.	CK.



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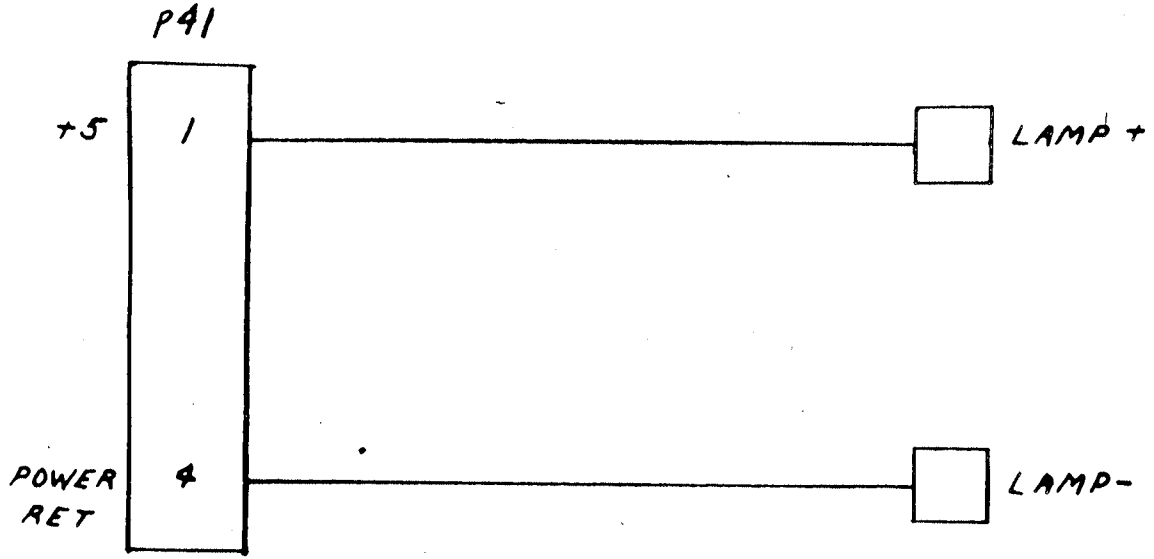
			APPROVED BY DAK
	FRACTIONAL ±	TITLE LIMIT SWITCH HARNESS SCHEMATIC	
	ANGULAR ±	DATE 6-7-82	DRAWING NUMBER 31573

31575

DATE	BY/M	REVISION RECORD	AUTH.	DR.	CK.



ASSEMBLY B31574

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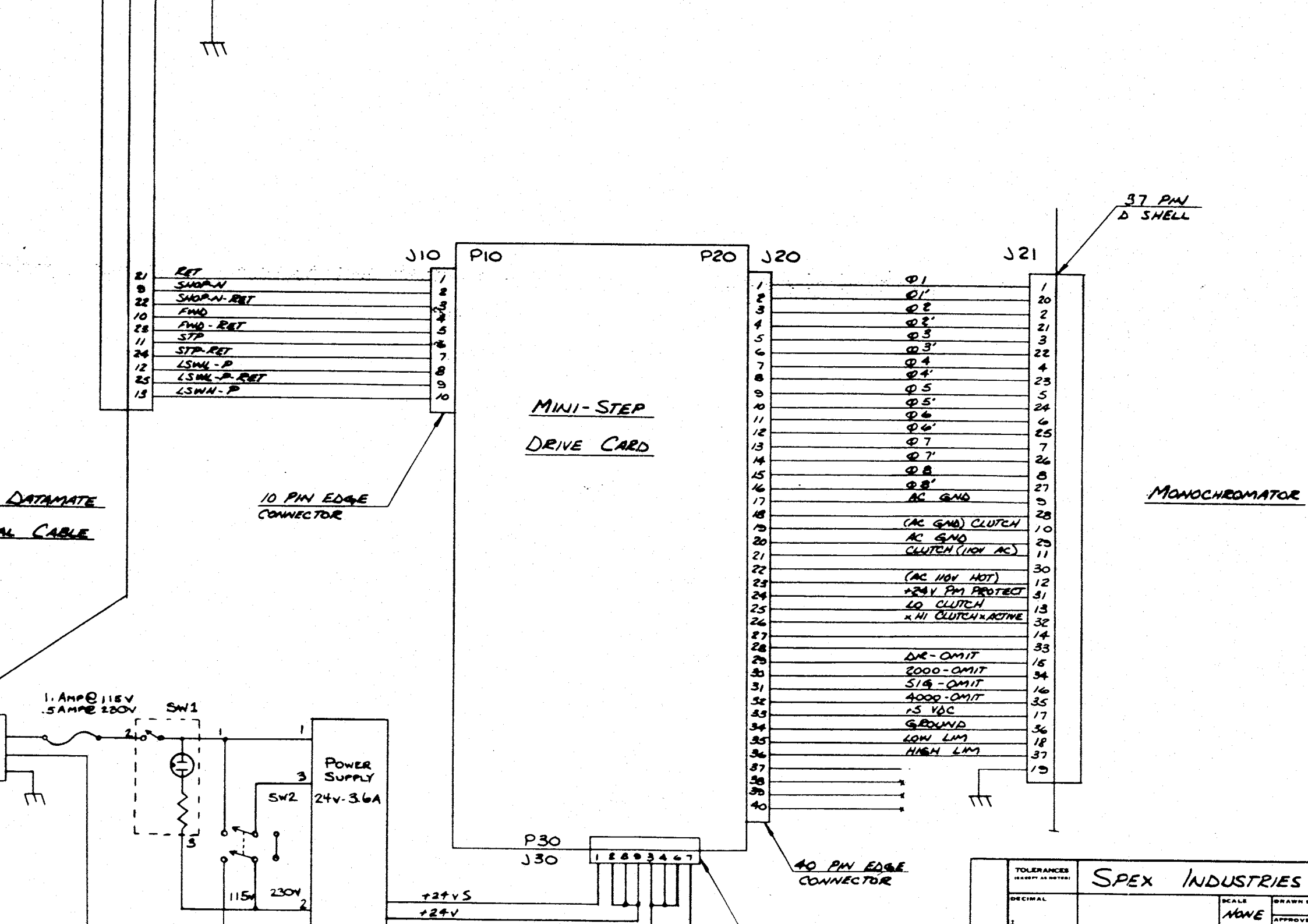
J10
P10
P20
J20
J21
37 PIN
D SHELL
MINI-STEP
DRIVE CARD
10 PIN EDGE
CONNECTOR
40 PIN EDGE
CONNECTOR
P30
J30
DATAMATE
CABLE
MONOCHROMATOR
1. AMP @ 115V
.5 AMP @ 230V
SW1
SW2
115V
230V
POWER
SUPPLY
24V-3.6A
+24VS
+24V
RET
SHOP-N
SHOP-N-RET
FWD
FWD-RET
STP
STP-RET
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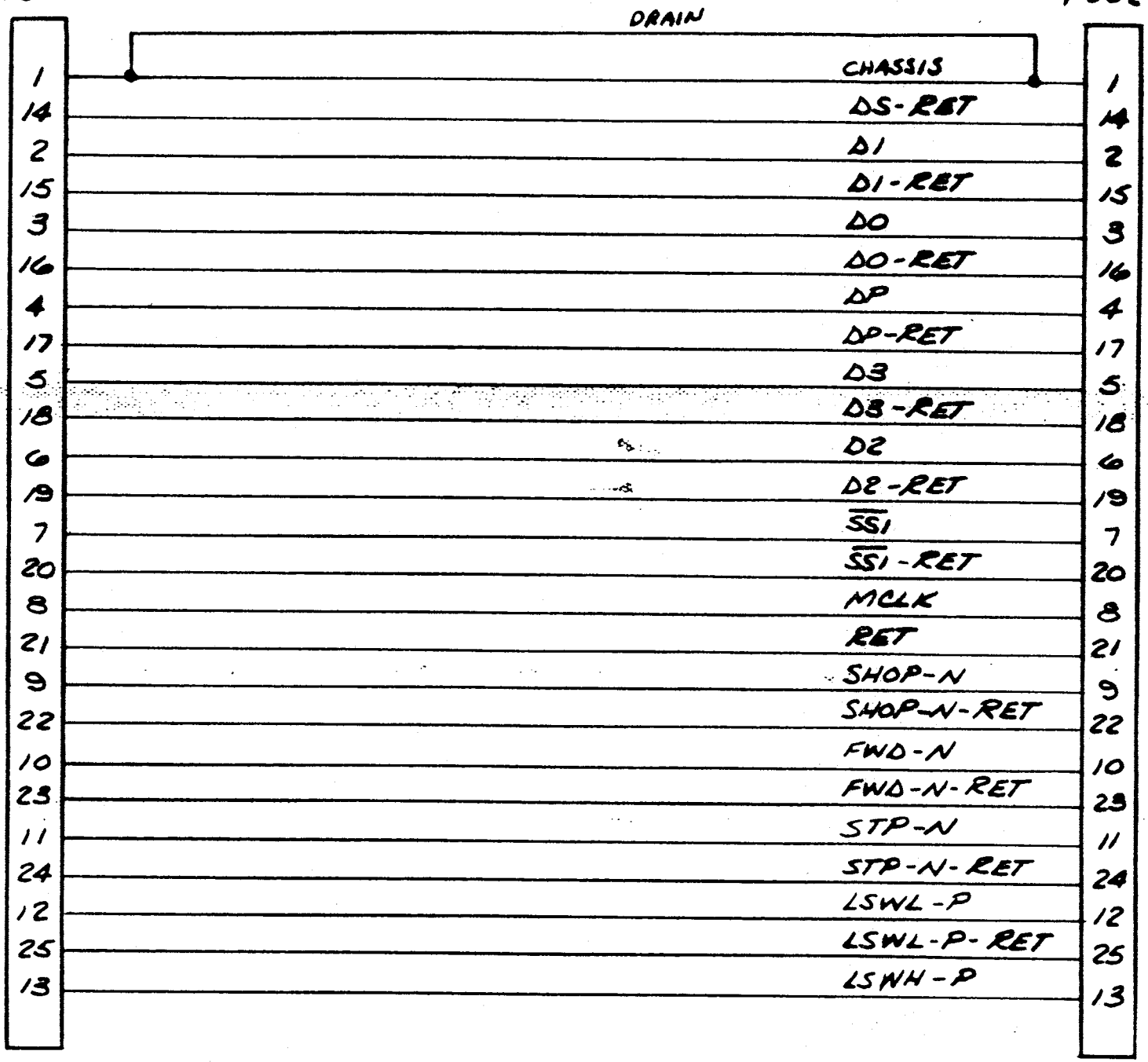
AC GND
(AC GND) CLUTCH
AC GND
CLUTCH (110V AC)
(AC 110V HOT)
+24V PWR PROTECT
LO CLUTCH
HI CLUTCH ACTIVE
DIR-OMIT
2000-OMIT
SIG-OMIT
4000-OMIT
+5 VDC
GROUND
LOW LIM
HIGH LIM
TOLERANCES
DECIMAL
SCALE
NONE
SPEX INDUSTRIES



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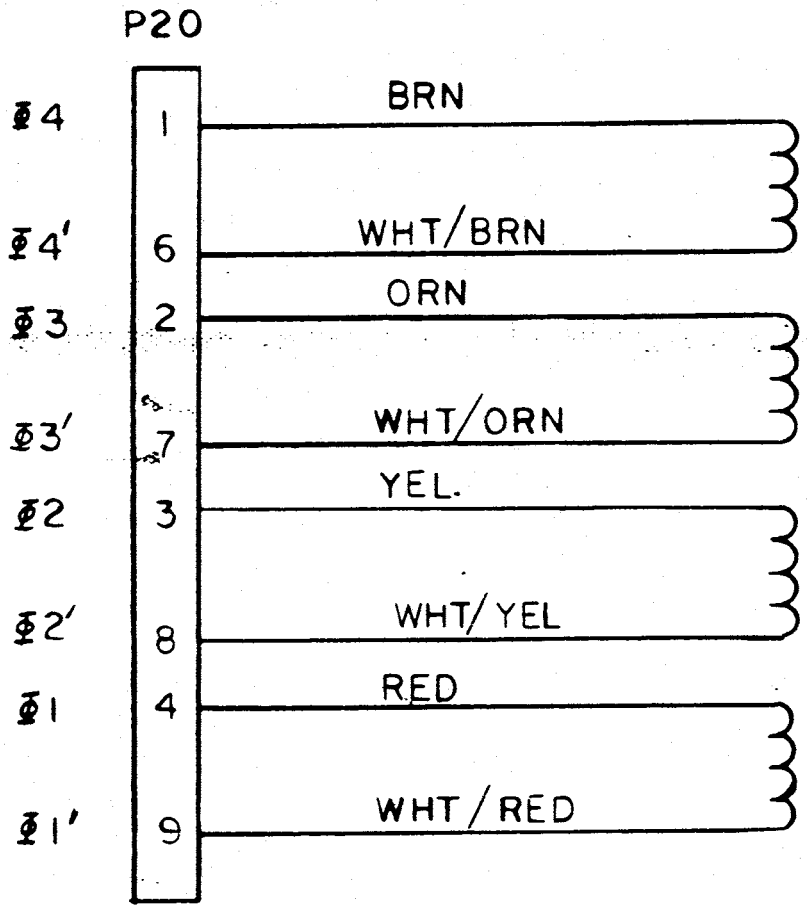

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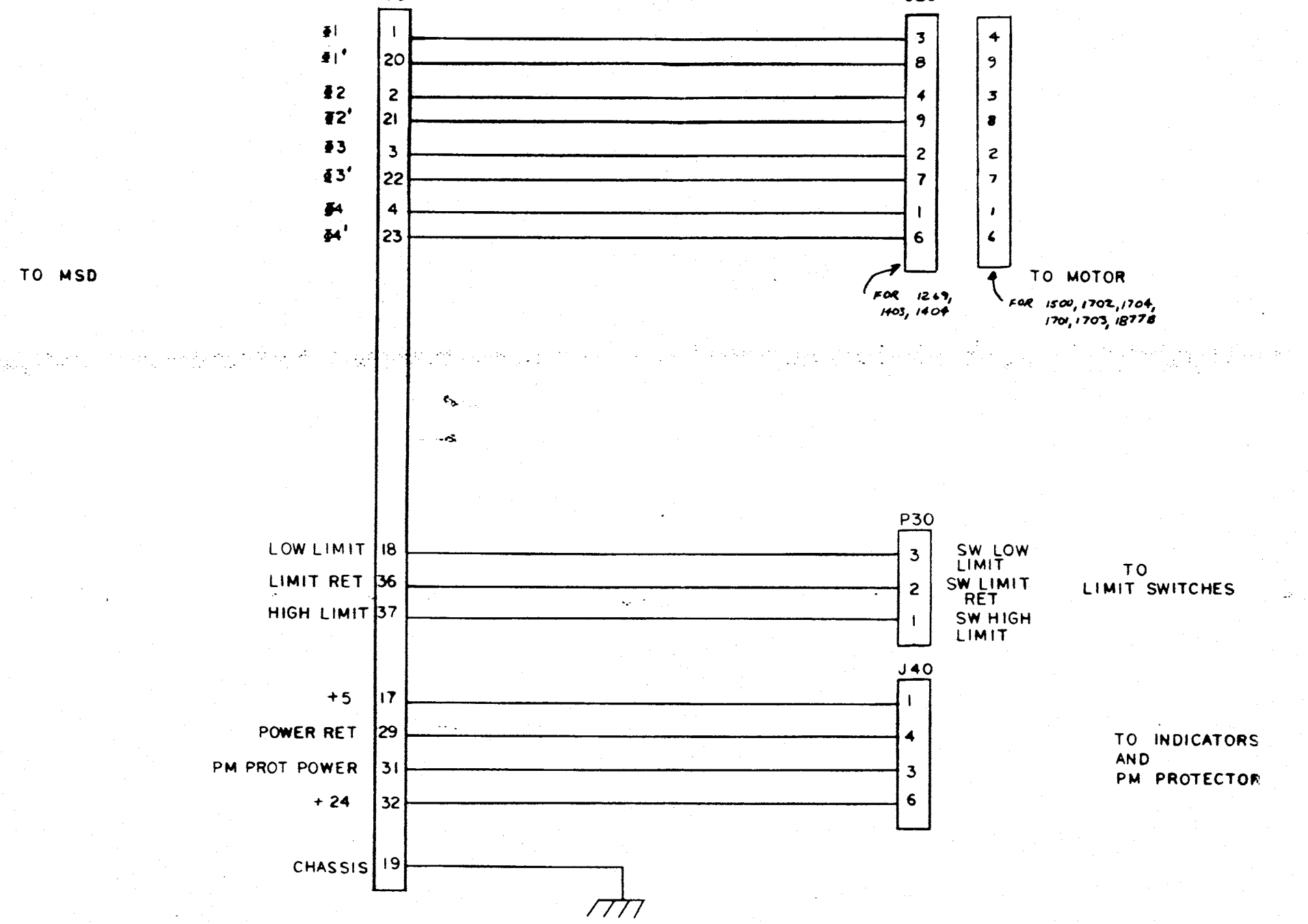
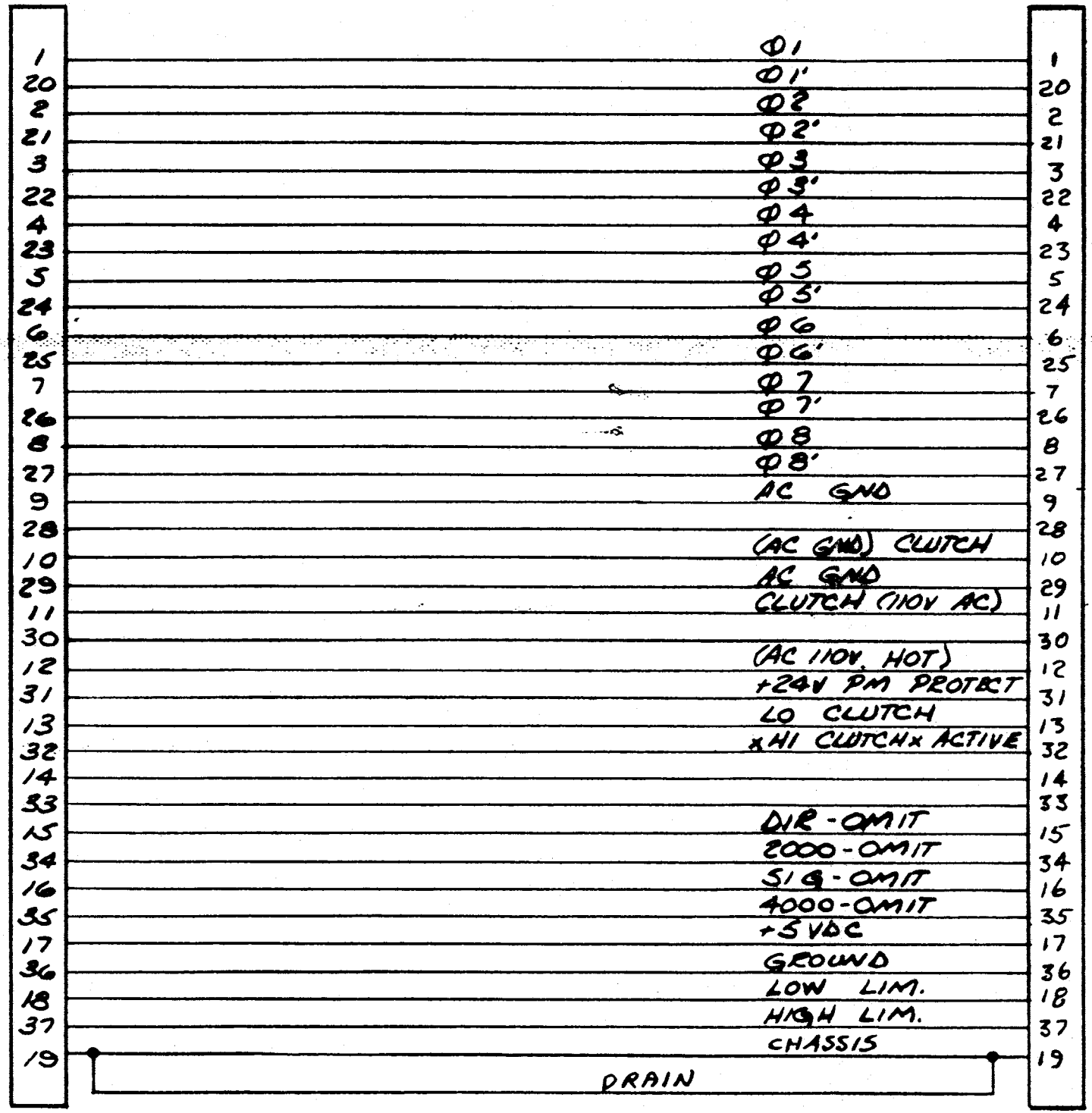


TOLERANCES

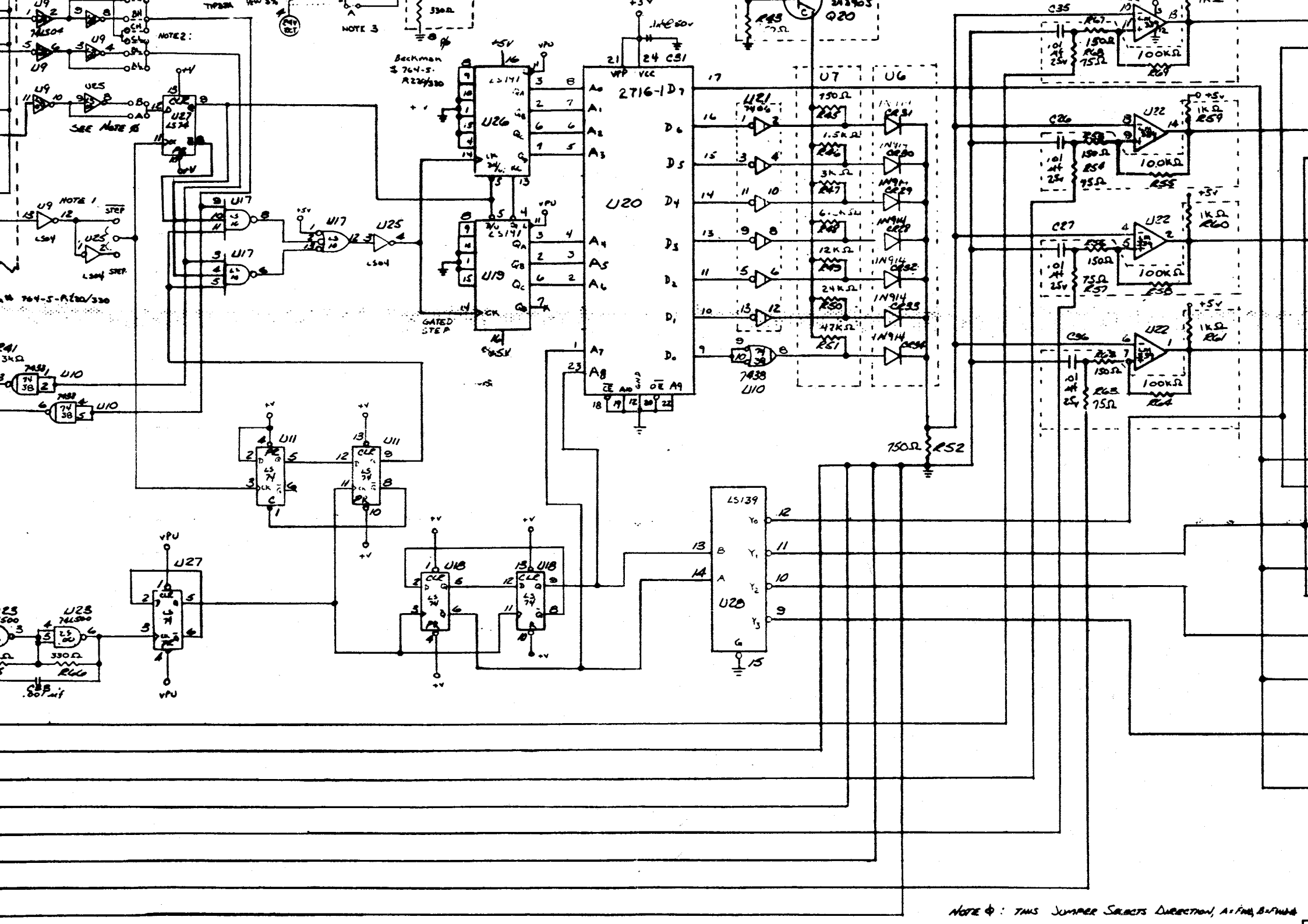
SPEX INDUSTRIES,



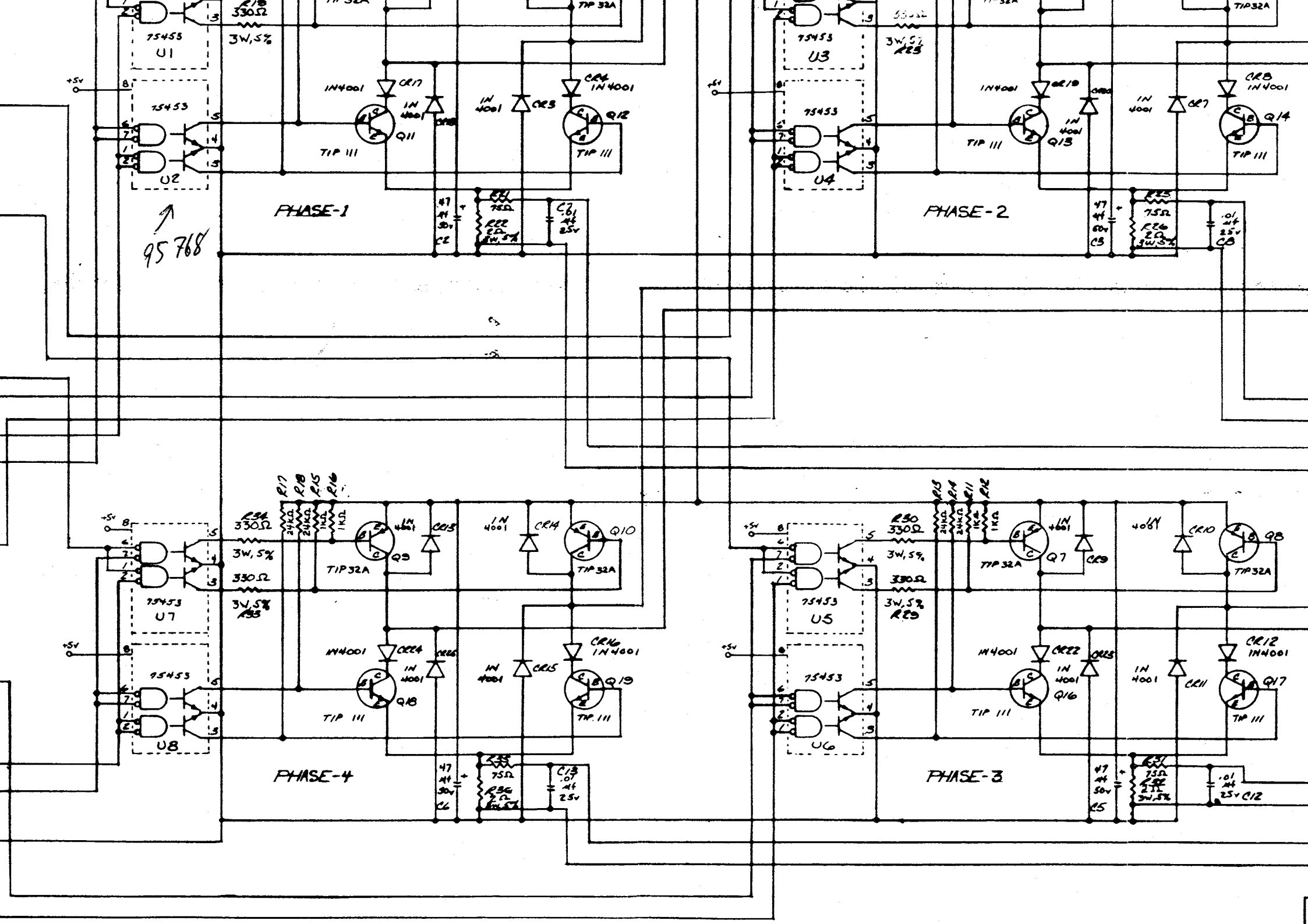
TOLERANCES (EXCEPT AS NOTED)

DECIMAL

SPEX IND



NOTE ϕ : THIS JUMPER SELECTS DIRECTION, A: FWD, B: REVERSE


PHASE-1
PHASE-2
PHASE-3
PHASE-4
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U1
U2
U3
U4
U5
U6
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+5V
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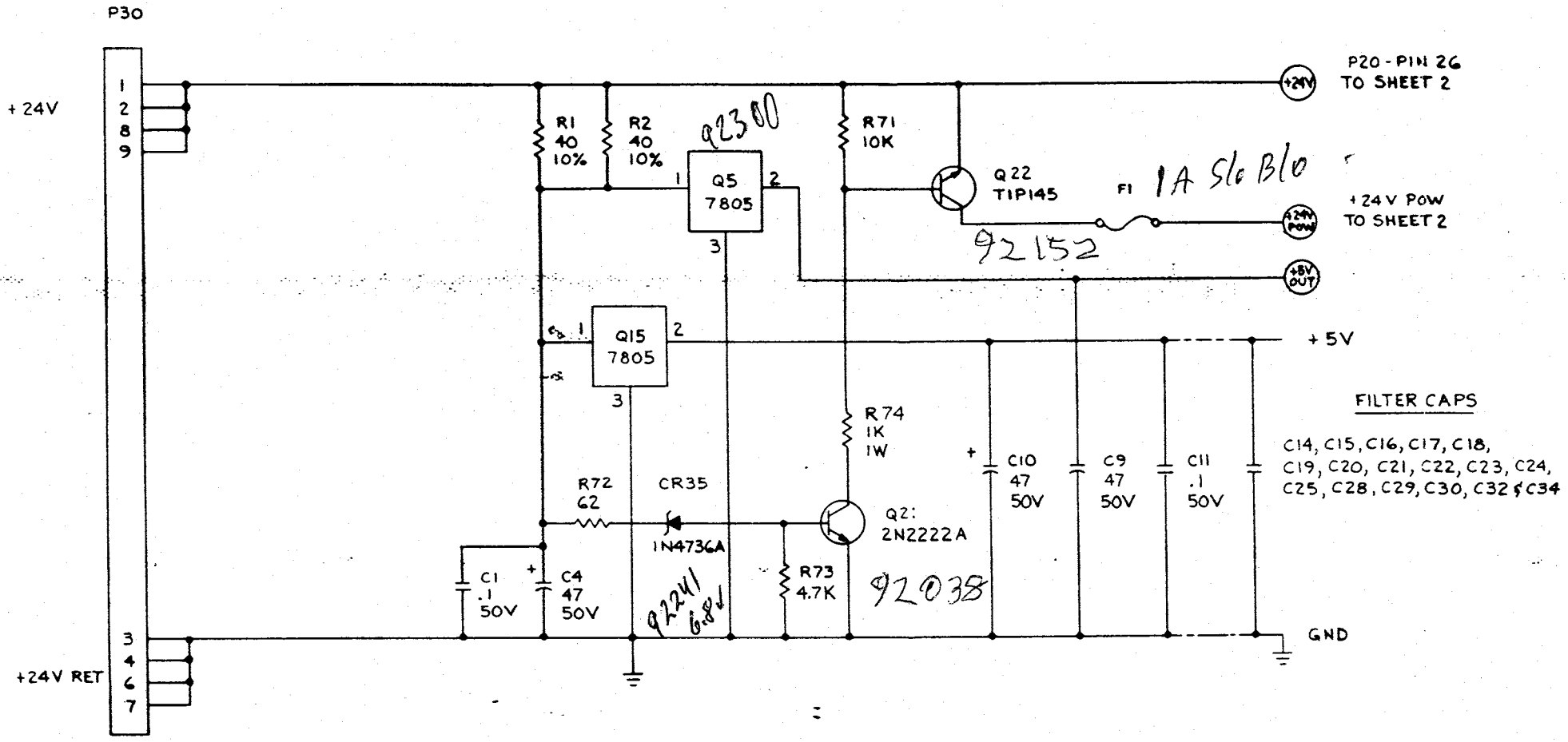
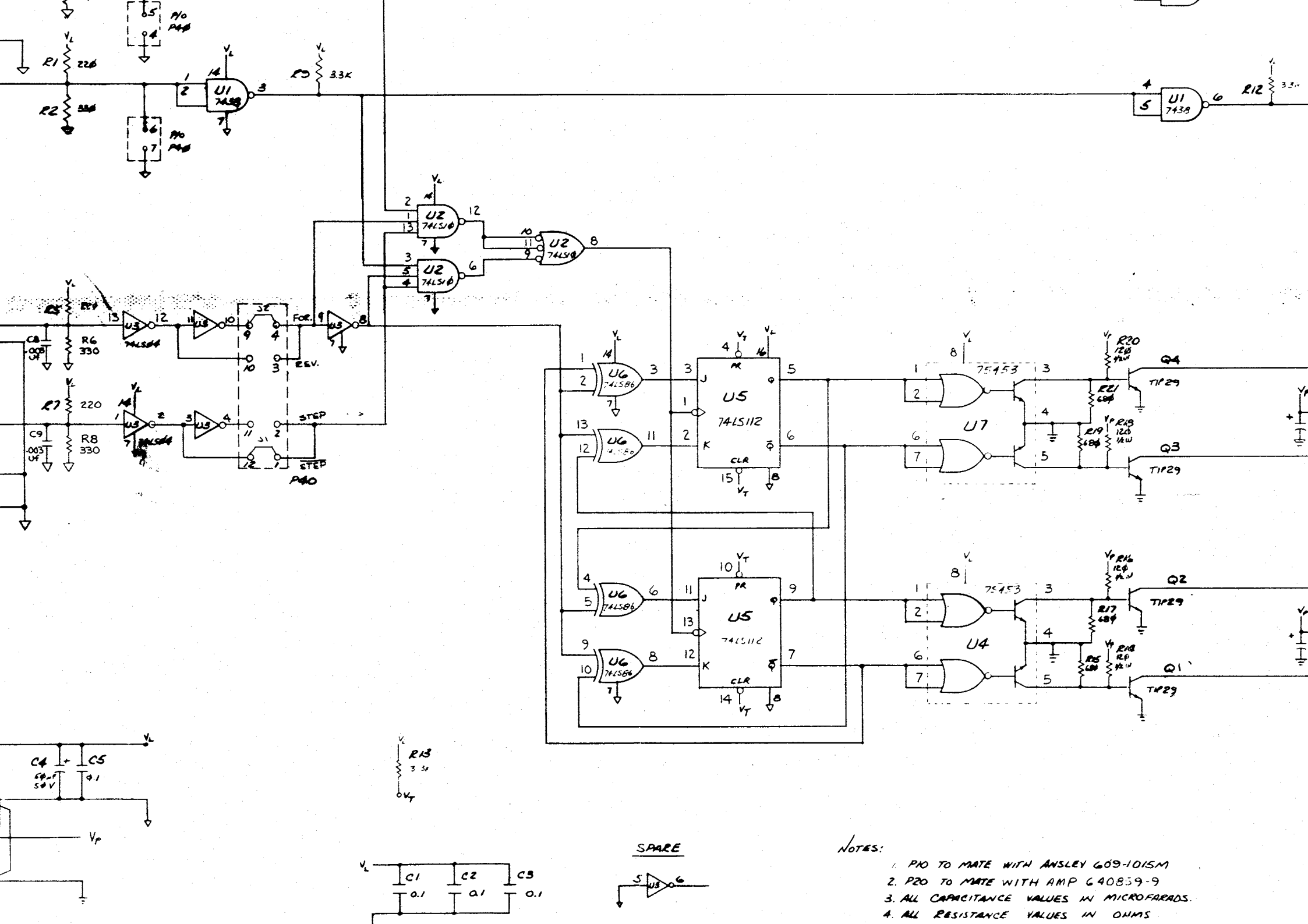
3W, 5%



WHEN USED WITH A 4 PHASE MOTOR, DELETE LISTED ITEMS FROM PC BOARD.

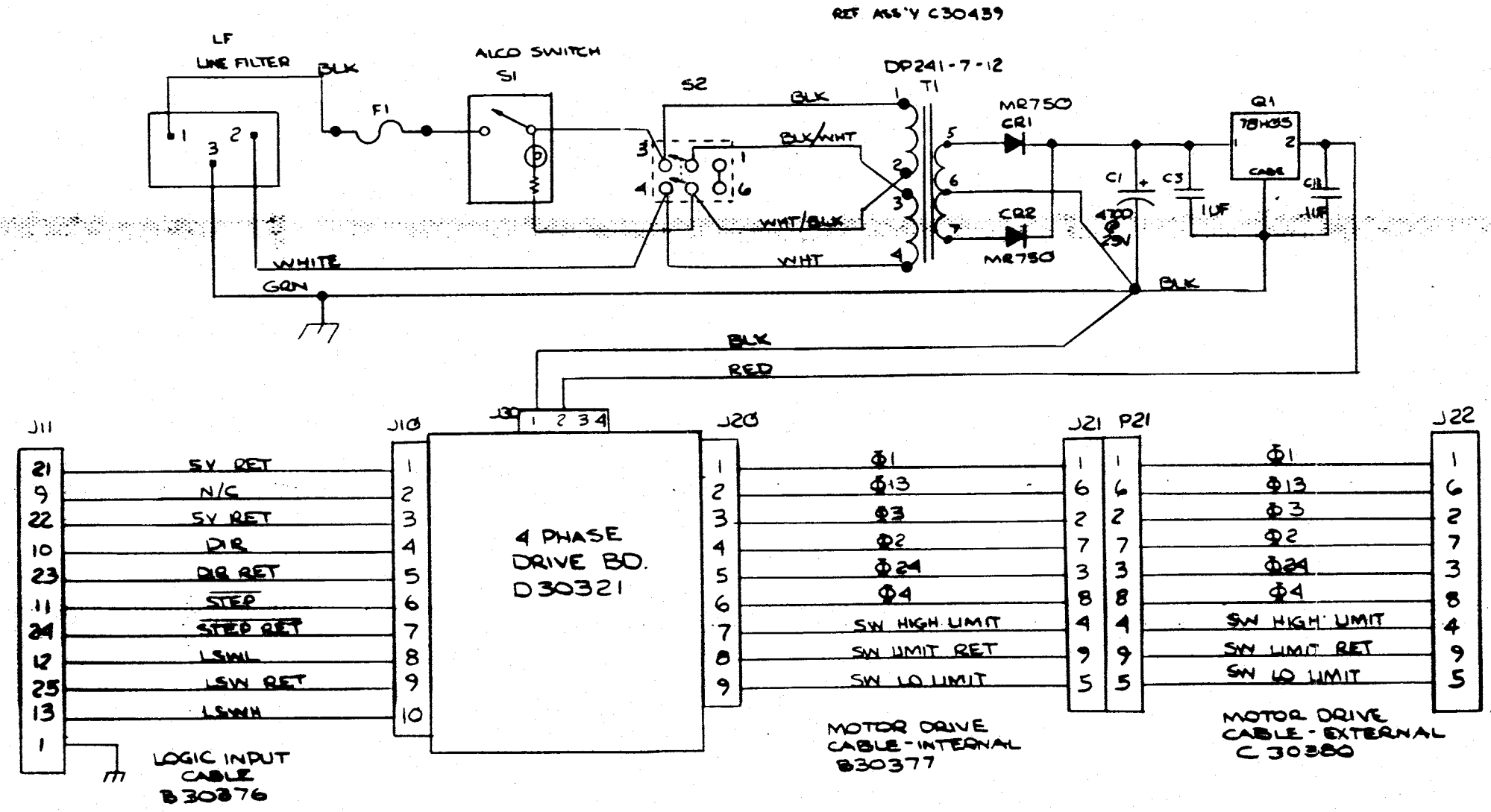
ITEM	DISCRIP.	SPEC NO.
R56, R62	150Ω	90204
R11, R12, R15, R16, R60, R61.	1KΩ	90319
R31, R35, R57, R63	75Ω	90176
R13, R14, R17, R18.	24KΩ	90180
R58, R64.	100KΩ	90359
R29, R30, R33, R34.	330Ω	90834
R32, R36.	2Ω	90833
C12, C13, C27, C36.	.01uF	91070
C8, C9, C20, C21, C25.	0.1uF	91168
C5, C6.	47uF	91298
Q9, Q10, Q7, Q8.	TIP32	92149
Q16, Q17, Q18, Q19	TIP111	92150
CR11, CR12, CR13, CR14, CR15, CR16, CR9, CR10, CR22, CR23, CR24, CR25	IN4001	92227

REPLACE R42 500Ω WITH BOURNS 3339P-1-102 POT. SET TO ~700Ω.
REPLACE R1 & R2 40Ω, 10W WITH 50Ω 10W.



NOTES:

1. P10 TO MATE WITH ANSLEY 609-1015M
2. P20 TO MATE WITH AMP 640859-9
3. ALL CAPACITANCE VALUES IN MICROFARADS.
4. ALL RESISTANCE VALUES IN OHMS



30372

4		SPEX INDUSTRIES