PD ELECTRONICS MANUAL
7-11-86

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---- CONTROL INPUT VARIATIONS

CONTROL INPUTS:
The PD electronics is designed for rack mount instalation with either onboard control input panel or remote input panel. If it is on board then it is listed below. If it is remote then the connectors are the same as described below except that there is no buffered output, the male connectors are daisy chained to the females and therefore are interchangable. It is also possible that the control connections are wired to a terminial strip for permanet installations.

-PDD Digital Input.
The PDD input panel will accept RS-422 signals in either "LMI Designer","LMI Micro II", LMI Fast Patch, "ETC", or Colortran protocall. The control panel has two connectors. The male connector is the input and the female connector is an output to chain to the next pack. They are not interchangable !!!

-PDA Analog Input.
The PDA input panel will take DC analog control levels. 0 to +10 Volts is normal but it can be modified by the factory for almost any voltage range. This panel has a 10 pin male Cinch Jones type connector for each 6 control inputs.

-PDS Multiplex Analog Input.
The PDS input panel will accept Strand-Century multiplex analog signals. The panel has two connectors, one marked "INPUT" and one marked "OUTPUT". They are not interchangable.

-PDX Blank Panel.
The PDX panel is used when the input connections are remotely connected.

NOTE: Other connectors and interfaces are available on request. Consult the factory for details.

SPECIFICATIONS:

ELECTRICAL SPECIFICATIONS

Control Input:

Dimmer Pack shall be capable of receiving data in any of the following formats:

a) Analog 0 to 40 Volts DC (0 to 10 normal).
b) Analog Pulse Width Modulated; 40 to 1000 Hz.
c) Digital RS-422 Asyncronous or Syncronous at speeds up to 307K baud.
d) Analog Multiplexed.
e) RS-232 at speeds up to 19.2K baud.

Control Response:

Response of dimmer to a control change shall not exceed 64 milliseconds. A filter mode shall be provided to slow the response and smooth the reaction of the dimmer to a noisy control.

Curve:

Each dimmer output shall follow the standard IES square law curve but may be modified at special request.

Line Regulation:

Each dimmer output for a constant control setting shall not vary more than 3/4 VAC RMS for incoming lines of 90 to 140 VAC providing the incoming line is a least 3 VAC above the required output voltage.

Tracking:

Two or more dimmers with identical loads, set to the same control setting shall have matching outputs through the entire curve within +/- 1 VAC RMS regardless of their phase.

Performance:

Each dimmer shall be capable of operating indefinitely at its rated load and be capable of withstanding hot patching cold incandescent loads up to its rated capacity.

Lamp Warming:

The dimmer pack shall be capable of providing a lamp warming voltage of 8 VAC RMS to each dimmer if desired. This circuit shall have a blackout feature that allows dimmer to goto 0 VAC RMS during a blackout for 5 seconds before returning to the warming voltage.

SPECIFICATIONS:(Cont)

Operating Voltage:

Each dimmer shall operate satisfactorily from 90 to 140 VAC, 60 Hz. Supply to the pack shall either be 120/208 3 phase or 120/240 1 phase. A 1 phase/3 phase select block shall be provided to ease field changing. The control electronics shall not need to be changed and shall automaticaly sense the correct phasing.

Operating Temperature:

Each dimmer shall operate in ambient air temperature of 0 to 40°C.(32-104°F). The pack shall have an optional thermal shutdown at 60°C (140°F). Internal fans shall operate if there is valid data or temperature exceeds 38°C (100°F).

Control Electronics:

The control electronics shall be controlled by two 68B09 microprocessors. The electronics shall be cabable of performing internal system check as well as user diagnostics. The control electronics shall have the following incicators:

AC Line indications (Neon) for each phase.
Phase sense LED indicators for each phase.
Over Temperature LED indicator.
Over Voltage LED indicator.
Valid Data LED indicator.

Thumbwheels shall be provided to change the dimmer addressing. Skipping of dimmer numbers shall not be necessary for any pack size. A reset switch shall be provided to establish new addressing and reset the microprocessor.

----- CONNECTIONS -----

CONTROL CONNECTIONS:

Connect the appropriate mating connector for your system to the control input panel. Below is a list of standard pin assignments for some connectors.

ANALOG:

Connector:Cinch Jones 10 Pin (PDA)
LMI (0 to +10 Volts)

1	control input 1
2	control input 2
3	control input 3
4	control input 4
5	control input 5
6	control input 6
7	no connection
8	common (isolated from earth ground)
* 9	+15 output for LMI control head only.
10	no connection

Higher number control inputs are on consecutive connectors.

Connector:Cinch Jones 8 Pin
EDI (0 to +10 Volts)

1	control input 1
2	control input 2
3	control input 3
4	control input 4
5	control input 5
6	control input 6
7	no connection
8	common (isolated from earth ground)

Higher number control inputs are on consecutive connectors.

* Wired to but not connected to connector.

CONTROL CONNECTIONS: cont.

DIGITAL:

Connector Switchcraft D4F,D4M (PDD)
LMI, ETC or Colortran protocol

1 data +
2 data -
3 clock + (if required)
4 clock - (if required)

The male connector (D4M) is the input.
The female connector (D4F) is an output for connection to next rack.

ANALOG MULTIPLEX:

Connector Switchcraft: TA4F (PDS)
Strand-Century protocol

1 clock +
2 common
3 clock -
4 analog multiplex signal

The connector marked "IN" on the left is for data in and the connector marked "OUT" on the right, is for connecting to the next dimmer rack.

CHANGING YOUR CONTROL PANEL

Disconect power before attempting any modifications.

Remove the two screws on each side of the pack that secure the electronics tray.

Slide the tray out about six inches.

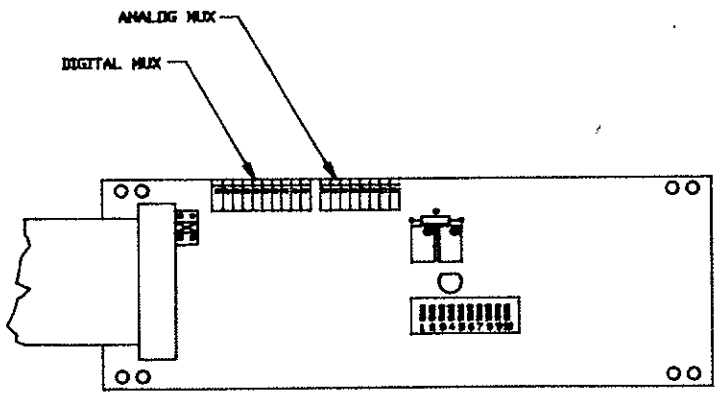
Remove the four screws securing the control Input Panel.

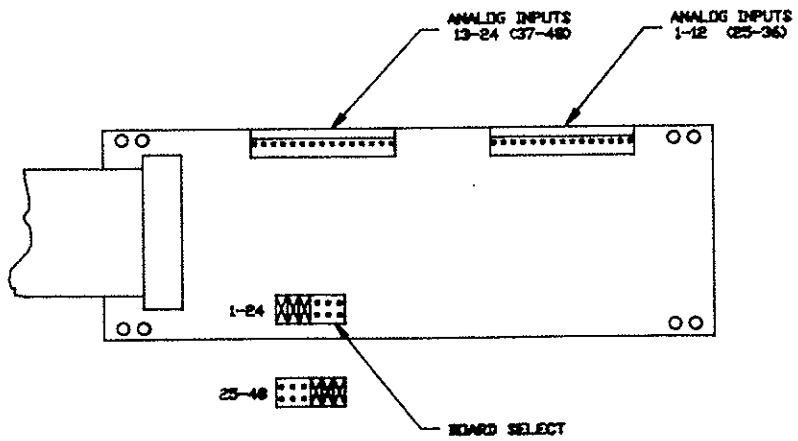
Disconect the connector from the Input PCB.

Remove the Input Panel.

Reinstall in reverse order.

Be sure to connect the connector from the new Input Panel to the proper connector on the Input PCB and is installed correctly.





---- START UP ----

Fuses: These fuses are for the electronics (replace with type 3AG-2).

Line Indicators: The indicators show the presence of voltage on the output of the fuses.

Status Indicators: 5 LED's for monitoring the electronics as follows:

Data - Indicates the presence of valid data.

BLINKS	No digital or analog multiplex data.
BLINKS	No analog levels are above 60 mV.
ON	Good data.

Over Temp - Indicates temperature problems.

OFF	Internal temp. is less then 100 deg. F.
BLINKS	Internal temp. is between 100 and 140 deg. F.
ON	Internal temp. exceeds 140 deg. F.

Phase A,B.C - Indicates presence of phases.

OFF	Voltage is less than 90 Volts.
ON	Voltage is greater than 90 Volts.

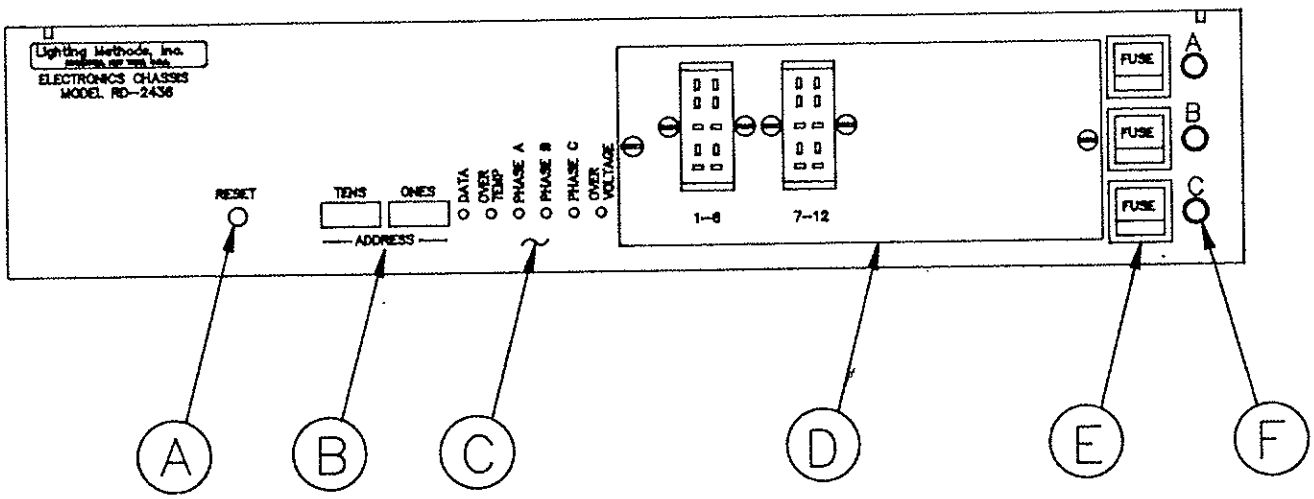
Over Voltage - Indicates over voltage problems.

OFF	Voltage on all phases is less than 140 Volts.
ON	Voltage on any phase is greater than 140 Volts.

NOTE: These indicators will mean other things during startup selftest and diagnostics. See Diagnostic Section.

Thumbwheels: Sets the dimmer numbering assignments for the pack.

Reset Switch: Resets the control electronics.



A-RESET SWITCH
B-THUMBWHEELS
C-STATUS INDICATORS
D-INPUT PANEL
E-FUSES
F-LINE INDICATORS

SETTING THE THUMBWHEELS

Thumbwheels: The thumbwheels select the dimmer assignments in groups of six. A 24 dimmer rack uses four groups of six.(The group size is changeable through the configuration switches inside.) The tens thumbwheel sets the tens digit. The ones thumbwheel sets the ones digit.

SETTING	START DIMMER NUMBER
0 0	1
0 1	7
0 2	13
0 3	19
.	.
.	.
.	.
1 0	61
1 1	67
.	.
.	.

NOTE: The thumbwheels should be set to 0 0 for analog mode.

---- START UP ----

POWERING UP

Turn on the AC power to the rack. At power up the following should happen:

1) Electronics run a selftest. All 5 Status indicators and the fans will come on. This signifies the start of selftest. The test takes about one second to complete.

2) If selftest passes, the Over Temperature and Over Voltage LED's will go out. The Phase LED's that do not have power to them will go out and the Data LED will either be on or blinking. The blinking indicates that there is no data or less than 60 mV on all analog inputs.

If there are any errors, the Status indicators will display the error. See Trouble Shooting section.

RUNNING

During normal operation all Status indicators should remain the same after startup. If the status indicators change refer to the Trouble Shooting Section.

When data is lost for more than three minutes the dimmers will fade to zero. After six minutes the fans will turn off if temperature inside the rack is less than 100 deg. F. The fans will turn back on as soon as data is reestablished or the temperature exceeds 100 deg. F.

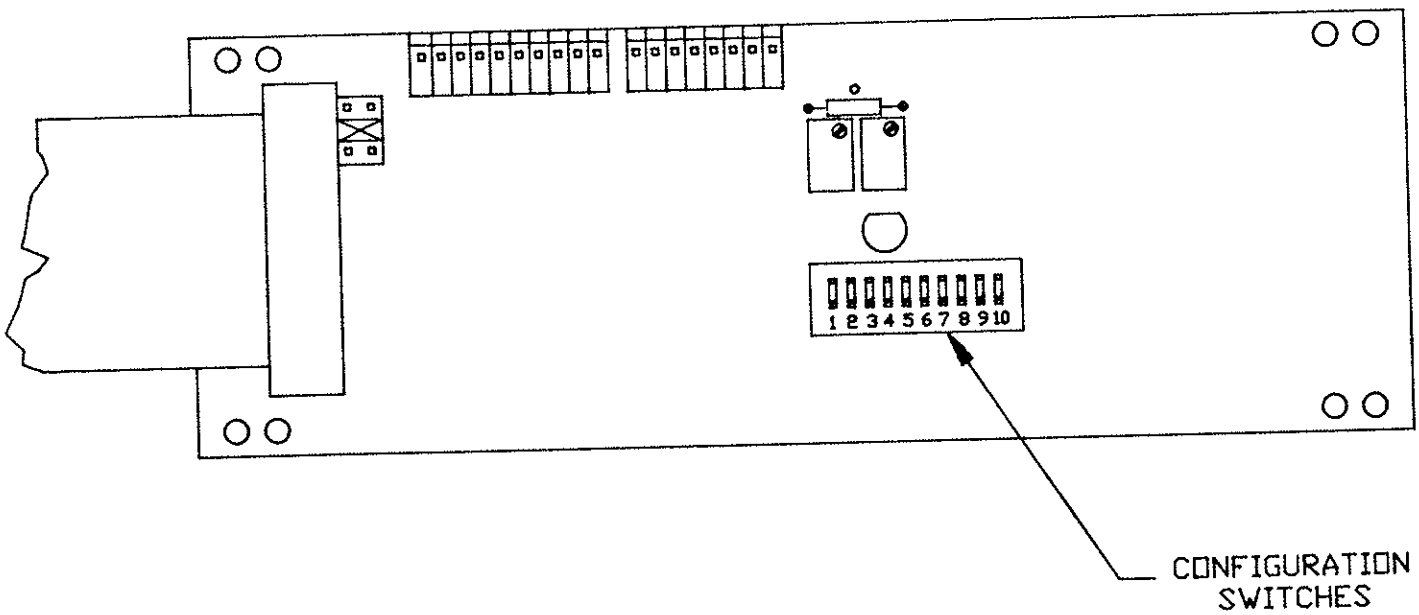
----CONFIGURATION----

GENERAL INFORMATION

Inside the PD electronics are up to four printed circuit boards(PCB). One is mounted on the floor of the control tray. It is the main PCB of the electronics. No potentiometer adjustments should normally be necessary on the main PCB. If a problem occurs, the tuning proceedures are in the Diagnostic section. There is however a select jumper for selecting Baud rates for LMI MicroII or Colortran protocals.

The other PCB's are located on the back of the of the front panel of the control tray. One, which will always be there is for multiplex input and system configuration. On this board is a dip switch for configuration, a potentiometer for adjusting the temperature sensor and a potentiometer for adjusting the analog multiplex input. Adjustment of the potentiometers is described in the Diagnostic Section. The others boards, which are optional, are for analog input. On these boards there are no adjustments, only a series of jumpers for board addressing.

Most of the setting in the electronics are set at the factory and should not require any changing.


1 2 3 4 5 6 7 8 9 10
CONFIGURATION
SWITCHES

SETTING THE RACK SIZE:

These switches select how many dimmers are in the pack. They should be set to match the number of dimmers in the rack. The first 4 are normal for a PD pack.

(*) = closed ( ) = open

S10 S7 S6 S5	# OF DIMMERS	PHASING
( )( )( )( )	3	1 2 3
( )( )( )(*)	6	11 22 33
( )( )(*)( )	12	1111 2222 3333
( )( )(*)(*)	24	11111111 22222222 33333333
( )(*)( )( )	48	11111111 22222222 33333333 11111111 22222222 33333333
( )(*)( )(*)	SPARE 1	CUSTOM
( )(*)(*)( )	SPARE 2	CUSTOM
( )(*)(*)(*)	SPARE 3	CUSTOM
(*)( )( )( )	3	123
(*)( )( )(*)	6	123123
(*)( )(*)( )	12	123123123123
(*)( )(*)(*)	24	123123123123123123123123
(*)(*)( )( )	48	123123123123123123123123 123123123123123123123123
(*)(*)( )(*)	24	112233112233112233112233
(*)(*)(*)( )	48	112233112233112233112233 112233112233112233112233
(*)(*)(*)(*)	48	111122223333111122223333 111122223333111122223333

NOTE: In custom equipment these settings may have been changed to match the equipment.

SETTING THE THUMB WHEEL OFFSET:

These switches select the number of dimmers that each count of the thumbwheels will be worth. They are ignored in analog mode.

(*) = closed ( ) = open

S8 S9	NUMBER OF DIMMERS PER COUNT	
(*)( )	3	
( )( )	6	(Normal)
( )(*)	12	
(*)(*)	24	

FILTER ENABLE SWITCH:

This switch enables the input filter. Enabling this filter causes a smooth dimmer response to an input that is not steady (flickers) or one that changes in large steps. Disabling this filter causes the dimmers to respond exactly to the input without any delay or filtering.

(*) = closed ( ) = open

S2	FILTER
( )	Enabled (Normal)
(*)	Disabled

PREHEAT ENABLE SWITCH:

This switch enables the preheat mode. Enabling this mode causes the dimmers to have an output voltage of about 8 Volts (RMS) at zero control. This mode has an instant black out feature. When a control level drops to zero, the dimmer output will go to 0 Volts for 5 seconds before returning to the preheat voltage.

(*) = closed ( ) = open

S3	PREHEAT
(*)	Enabled
( )	Disabled (Normal)

ANALOG vs. MULTIPLEX SWITCH:

This switch select either analog (0-10v) control signals, if equipped, or multiplexed control signals.

(*) = closed ( ) = open

S1	CONTROL
( )	Multiplexed
(*)	Analog

If Multiplex is selected then the electronics will for most cases will sort out what kind of data is being sent. Exceptions are listed below.

PROTOCAL	Changes
Analog Multiplex	PDS input panel connected to analog mux input connector on configuation PCB.
All Digital Multiplex	PDD Normal input panel with 4 pin XLR connected to digital input connector on configuration PCB.
Colortran	Move jumper on main PCB to two pins closest to the thre transformers.
LMI MicroII	Move jumper on main PCB to two pins farthest from the three transformers.

FAST MODE SWITCH

In some cases it may be desired to disable the line regulation electronics. This switch disables it.

(*) = closed ( ) = open

S1	FAST MODE
( )	Off (Normal)
(*)	On

GENERAL INFORMATION

Upon power up, the main PCB conducts some simple selftests to make sure the unit is wired correctly and all components are working. There are also a series of diagnostic tests that can be run by the user. These tests allow checking of the dimmer outputs without control, tuning of the line monitoring circuits, and a more thorough testing of the internal circuits.

---- DIAGNOSTICS ----

START UP SELF TEST:

On startup all Status Indicators will turn on. If no errors are found, then the proper Phase LED's will stay on, the Over Temp LED will go off, the Data LED will either blink or be on, and the Over Voltage LED will go off. The Status Indicators will start to operate as described in section 4. If an error occurs during selftest, all LED's will either remain on or blink. The blinking LED's indicate the error number. Below is a listing of errors. All these errors are fatal and will not let the dimmer operate until the problem is corrected. Contact the factory for instruction on correcting the problem.

LED Blinking	Error #	Problem
Over Voltage	1	Passes all tests but data type is undetermined or not connected.
Phase 3	2	Bad slave processor EROM.
Phase 2	3	Bad master processor EROM.
Phase 1	4	Bad master processor RAM.
Over Temp	5	Slave processor not running.
Data	6	Bad slave processor RAM.
Over Voltage & Any Phase	7	Phase with blinking LED is above 140 Volts.
All Phases	8	Phase A is not above 100 Volts.

USER DIAGNOSTICS STARTUP

The user diagnostics are initiated by setting the thumbwheels to the desired number and pressing the Reset switch. Certain tests require an additional changing of the thumbwheels without pressing the Reset switch. Follow the directions carefully. At the begining of each major test all Status Indicators will flash three times to indicate a diagnostic operation is going to occur.

90 MANUAL TESTS

Set the Thumbwheels (TW) to 90. Press the Reset switch.

Resetting the TW to any of the following settings will cause the function to occur.

Setting	Description
00	Turns fans off.
01	Turns fans on.
02	Displays master EPROM MSB revision on LED's.
03	Displays master EPROM LSB revision on LED's.
04	Displays master EPROM Month on LED's.
05	Displays master EPROM day on LED's.
06	Displays master EPROM year on LED's.
*07	Reads slave processor RAM page 1 over and over.
*08	Writes and reads slave processor RAM @ $0000
*09	Reads slave processor address
*10	Slave processor ram test. (55 W/R then AA W/R. All ram.) Flashes LED's when running. Stops and blinks data LED if error occurs.
11	Displays slave EPROM MSB revision on LED's.
12	Displays slave EPROM LSB revision on LED's.
12	Displays slave EPROM Month on LED's.
14	Displays slave EPROM day on LED's.
15	Displays slave EPROM year on LED's.

* Test 7,8,9, and 10 are for factory testing only.

All number displays are in binary using Data and Over Temperature for the tens digit and Phase 1, Phase 2, Phase 3 and Over Voltage for the ones digit.

Binary code: ( )= off (*)=on

0	( )( )( )( )
1	( )( )( )(*)
2	( )( )(*)( )
3	( )( )(*)(*)
4	( )(*)( )( )
5	( )(*)( )(*)
6	( )(*)(*)( )
7	( )(*)(*)(*)
8	(*)( )( )( )
9	(*)( )( )(*)

Example: Day=26

	D	OT	P1	P2	P3	OV
Display	(*)	( )	( )	(*)	(*)	( )

91 THUMBWHEEL TEST

Set the Thumbwheels (TW) to 91. Press the Reset switch.

Resetting the TW to any of the following settings will cause the LED's to display the thumbwheel setting. The display will switch back and forth between ones and tens. When the Data LED is on the LED's will display the tens TW. When the Over Temperature LED is lit the LED's will display the one's TW.

TW setting	LED's lit P1 P2 P3 OV
0	( )( )( )( )
1	( )( )( )(*)
2	( )( )(*)( )
3	( )( )(*)(*)
4	( )(*)( )( )
5	( )(*)( )(*)
6	( )(*)(*)( )
7	( )(*)(*)(*)
8	(*)( )( )( )
9	(*)( )( )(*)

Any other LED combinations are not valid

92 CHASE TEST

Set the Thumbwheels (TW) to 92. Press the Reset switch

This test causes the outputs starting with dimmer 1 to turn on to full one at a time. When all outputs are on the dimmers will turn off one at a time starting with dimmer 1. This process will continue until reset. Changing the Ones's TW will change the speed of the chase. 0-will stop it, 9-slowest, 1-fastest.

93 FADE ALL TEST

Set the Thumbwheels (TW) to 93. Press the Reset switch

This test will fade all dimmers to full and then back to zero. This process will continue until reset. Changing the Ones's TW will change the speed of the chase. 0-will stop it, 9-slowest, 1-fastest.

94 FADE ONE TEST

Set the Thumbwheels (TW) to 94. Press the Reset switch.

This test will fade each dimmer to full and then back to zero one at a time starting with dimmer 1. This process will continue until reset. Changing the Ones's TW will change the speed of the chase. (0-will stop it, 9-slowest, 1-fastest.)

95 DIMMER CHECK TEST

Set the Thumbwheels (TW) to 95. Press the Reset switch.

This test will turn on a selected dimmer to full. Set TW to the dimmer number that you want to turn on. The dimmer will come on.

96 MULTIPLEX ANALOG TUNING

Set the Thumbwheels (TW) to 96. Press the Reset switch.

This test will allow you to tune the Analog multiplex adjustment pot for differnt consoles. The console should be connected with all channels at zero except channel one. Channel one should be set at 50%.

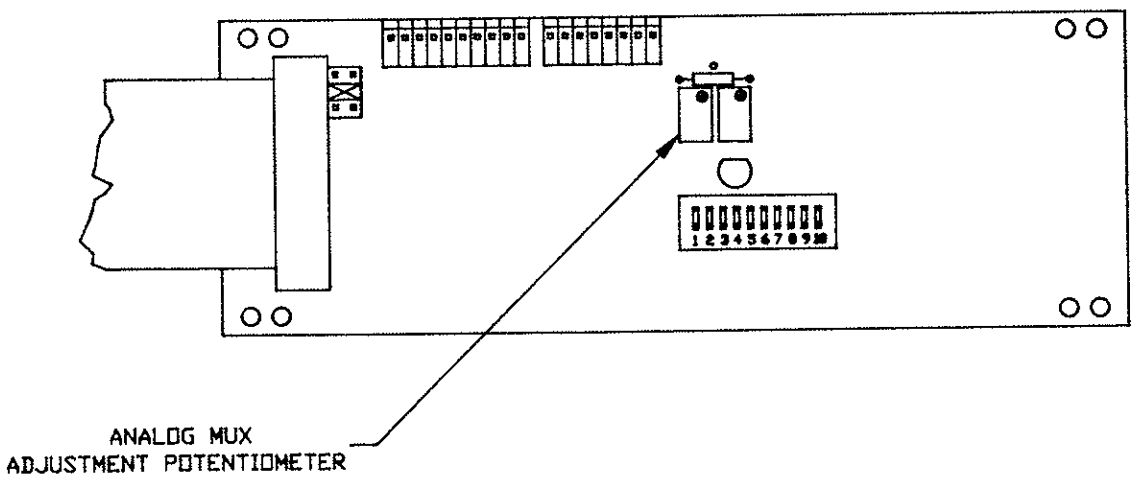
Be sure the A-D reference voltage is adjusted correctly before making this adjustment. (See Tuning the A-D Reference Voltage)

All LED's will go out.

Over voltage will blink if there is bad or no data.

Tune multiplex adjustment potentiometer using the Data LED as indicator.

Data LED	OFF	More gain required
	ON	Less gain reqiired
	BLINK	Set correctly



97 LINE MONITORING POT ADJUSTMENTS

Set the Thumbwheels (TW) to 97. Press the Reset switch.

This test will allow you to adjust the line monitoring analog to digital converters. You will need a calibrated AC voltmeter to make the following adjustments. Line voltage must be between 90 and 140 volts.

Be sure the A-D reference voltage is adjusted correctly before making this adjustment. (See Tuning the A-D Reference Voltage)

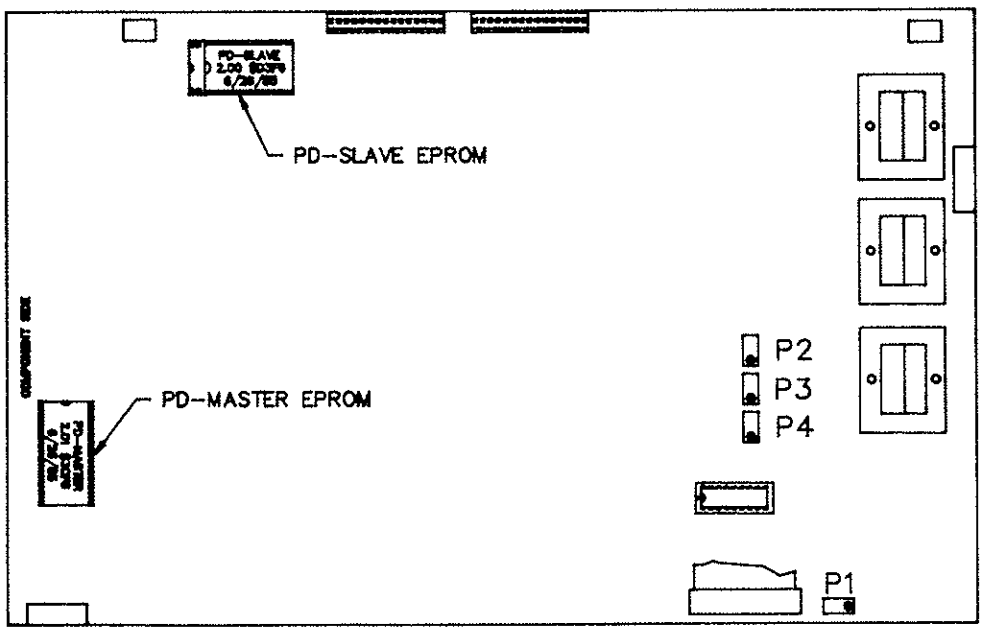
Using the meter measure the line voltage on Phase 1.

Reset the TW's the equal the second and third digit of the line voltage.
ie. 113 Volts: Use a 1,3 setting.

Adjust P2 slowly until the Phase 1 LED stays on. If it starts to blink turn back until it stops and stays on.

Use the same procedure for Phase 2 using P3 and the Phase 2 LED

Use the same procedure for Phase 3 using P4 and the Phase 3 LED



98 MASTER PROCESSOR SHORT RAM TEST

Set the Thumbwheels (TW) to 98. Press the Reset switch.

This test will do a short memory test on the Master processors memory.

All the Status indicators will randomly go on and off during this test. The test will run continuously unless an error is found. One pass on all memory takes about ten seconds. If an error is found, all Status Indicators will freeze except one which will blink.

Error conditions:Blinking LED

Data LED	Bit stuck low.
Over Temp. LED	Address crosstalk.
Data and Over Temp.	Bit stuck high.

If error occurs call the factory for further instructions.

99 MASTER PROCESSOR LONG RAM TEST

Set the Thumbwheels (TW) to 99. Press the Reset switch.

This test will do a long memory test on the Master processors memory.

All the Status indicators will randomly go on and off during this test. The test will run continuously unless an error is found. One pass on all memory takes about ten minutes. If an error is found, all Status Indicators will freeze except one which will blink.

Error conditions:Blinking LED

Data LED	Address crosstalk above test cell.
Over Temp. LED	Error at test cell.
Data and Over Temp.	Address crosstalk below test cell.

If error occurs call the factory for further instructions.

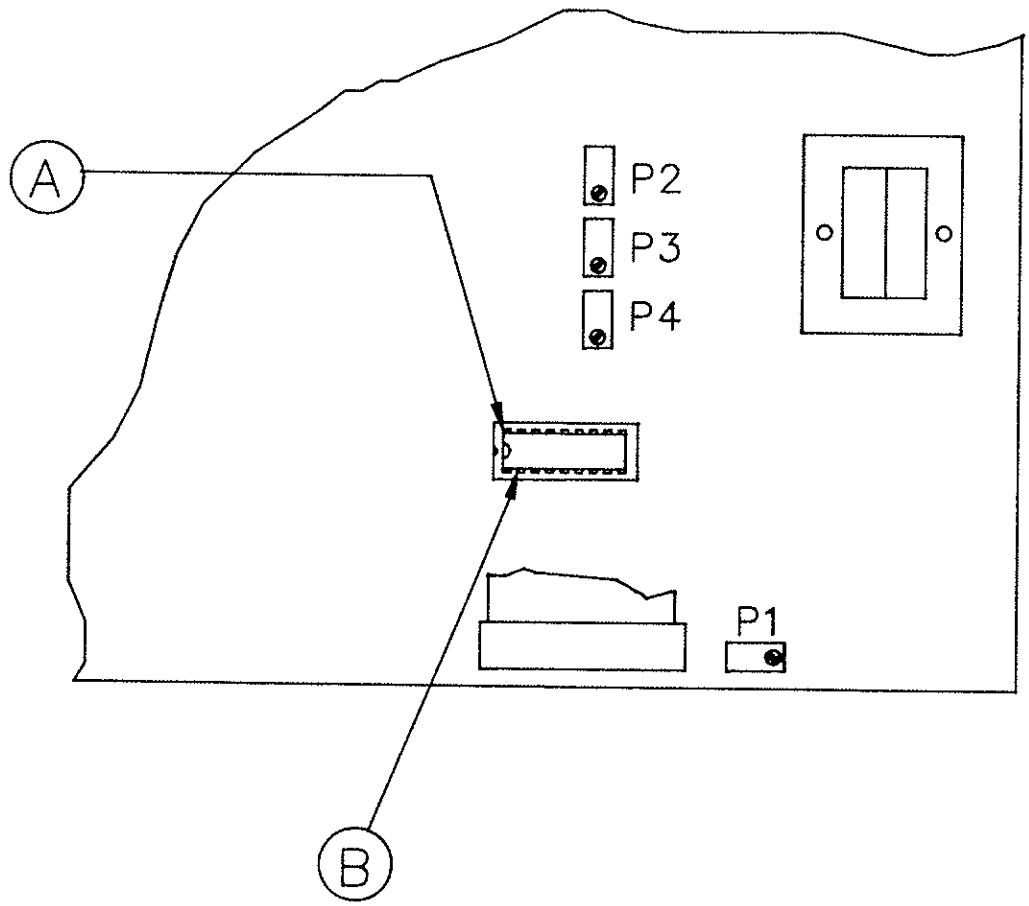
TUNING THE A-D REFERENCE VOLTAGE

To tune the A-D reference voltage you will need a calibrated digital DC voltmeter.

Place the (-) probe on pin 18 of the A-D.

Place the (+) probe on pin 2 of the A-D.

Adjust P1 slowly until the meter reads -5.00 Volts



A—NEGATIVE PROBE (PIN—18)
B—POSITIVE PROBE (PIN—2)

TUNING THE TEMPERATURE SENSOR

This procedure will instruct you on tuning the temperature sensor potentiometer. This pot is located in the component side of the Input PCB next to the sensor. You will need a calibrated digital DC voltmeter and a way of accurately measuring the room temperature in Celsius. Adjust pot as follows:

Measure the voltage between the ends of the pot. Be sure to put both probes right at the pot to get the best reading. (figure 9)

Adjust the voltage to the following formula:

$$Vtp = \frac{\text{room temp (deg. C)} + 273}{100}$$

This would be 2.98 Volts for a room temperature of 25 deg. C

Be sure not to touch the sensor while adjusting

Be sure to allow enough time for the pack and room to reach the same temperature.

An improperly tuned sensor will have no harmful effects except the Temperature LED may act incorrectly and the fans may not turn off after cool down.

Be sure to reinstall the ribbon cable correctly if you removed it. Damage will result if plugged in backwards !!!.