



Operator's Manual

SERIES 8000

SIGNAL CONDITIONERS



4561-F Mission Gorge Place
San Diego, CA 92120
P: 619-521-2161
F: 619-521-2169
www.nonlinearsystems.com

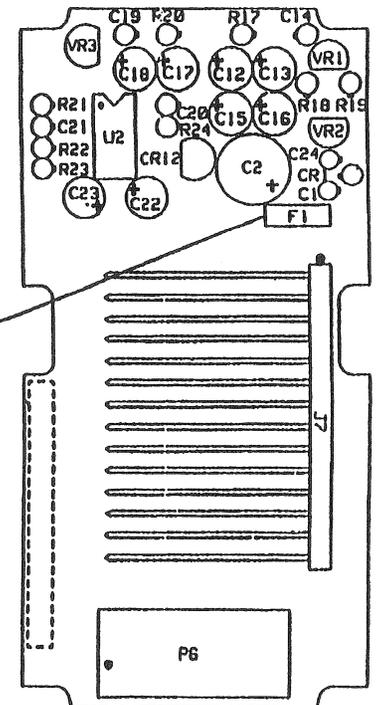
Specifications

- Input: 9 to 30Vdc
- Isolation: 1500Vdc or Vac peak
input board supply/output board supply all outputs to main Vdc input
- Regulation: High Line to Low Line < 1%
- Temperature Drift: < 1% per 1000 hours
- Power: 2.5 Watts typical
- Fuse: 3 Amp

Setup Procedure

This board requires no setup. Perform setup for the other boards as described in applicable manuals, refer to pages 4 through 6 of this main manual if required

Fuse (NLS p/n 4227)

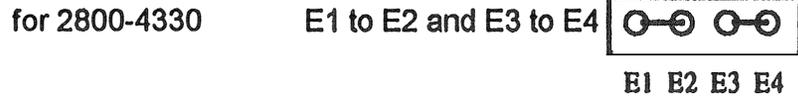


Instructions for:
2800-5006, 5007, & 5008

Setup Instructions

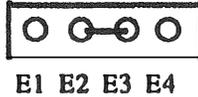
120Vac Setup

The following jumper wires must be set for 120Vac:

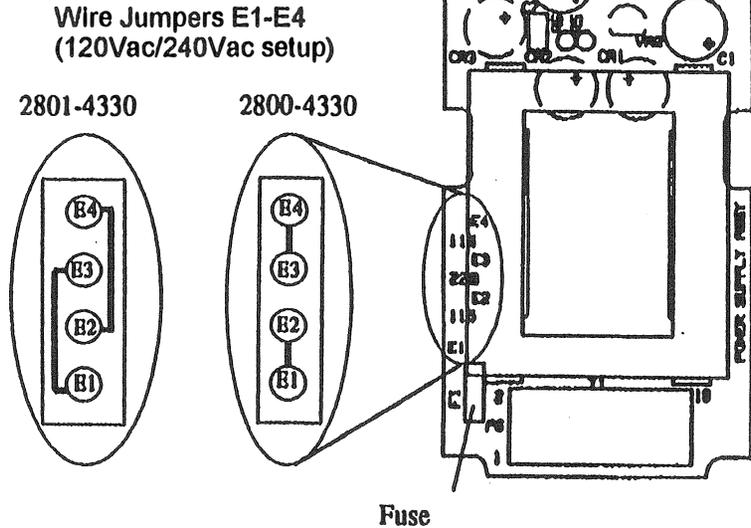


240Vac Setup

The following jumper wire must be set for 120Vac input:
E2 to E3. The jumper wire must be set in the following configuration for either assembly.



AC Power Supply Board Part Locations



Operator's Manual

SERIES 8000

SIGNAL CONDITIONERS

© NON-LINEAR SYSTEMS 1995

This document contains information proprietary to Non-Linear Systems (NLS®) and is provided solely for instrument operation and maintenance. The information in this document may not be duplicated in any manner without the prior approval in writing from Non-Linear Systems (NLS®).



SAN DIEGO, CA
P: 619-521-2161
sales@nonlinearsystems.com

This is a  recognized component.

Three Year Limited Warranty

Model 8000 Signal Conditioners are warranted in their entirety against any defects of parts, materials and workmanship within a period of three (3) years following the date of purchase of the unit by the original buyer. This warranty is extended by Non-Linear Systems (NLS®) only to the original buyer or original user, who must present proof of purchase at the time that warranty service is sought.

In the United States, any Model 8000 unit claimed to be defective during the warranty period should be returned with proof of purchase to:

Non-Linear Systems - Signal Conditioner Repair
4174 Sorrento Valley Blvd
San Diego, California 92121

Outside of the United States, contact your local Non-Linear Systems distributor where your signal conditioning unit was purchased.

Any implied warranties arising out of the sale of a Model 8000 Signal Conditioner, including but not limited to implied warranties of merchantability and fitness for a stated purpose, are limited in duration to the above stated three (3) year period.

Manufacturer shall not be liable for loss of use of the signal conditioner or other incidental or consequential damages, expenses or economic loss.

Some states do not allow limitations on how long implied warranties last or the exclusion of incidental or consequential damages, so the above limitations or exclusions may not apply to you. This warranty gives you specific legal rights, and you may have other rights which vary from state to state.

Series 8000

AC Power Supply

Warning

Series 8000 units operate on dangerous line voltages.

- *Never operate your unit with the protective case removed.*
- *Always disconnect your series 8000 signal conditioner from line power before you open the case for any purpose.*

Specifications

Line Frequency:	50 to 400Hz
Input:	120Vac \pm 10% or 240Vac \pm 10%
Isolation:	1500Vdc or Vac peak input board supply/output board supply/line power
Regulation:	High Line to Low Line < 1%
Temperature Drift:	< 1% per 1000 hours
Power:	2.5 Watts typical
Fuse:	1/4 Amp, slow-blow

Setup Procedure

- I. Disassemble the unit as described on page 6 of this manual.
- II. Remove the AC Power Supply Board.
- III. The standard configuration is 120Vac. If 240Vac is required, follow the setup instructions on page AC-2.
- IV. Reassemble the unit as described in this manual, pages 4 to 6.

Section VII

General Specifications

The following are Series 8000 general specifications only, board-specific specifications are in the instructions for the individual boards.

Isolation: input/output/power—1500VDC or VAC peak

Dielectric—2kV for 1 minute (input to case)

Operating Temperature: 0° to 60°C (32° to 140°F)

Power: 120VAC/220VAC (48Hz to 400Hz) at 2.5W ± 10%

9VDC to 28VDC at 2.5W

Common Mode Rejection: >120dB at DC
>80dB at 60Hz

Common Mode Voltage: 600VDC or AC peak (input to ground)

Zero Offset Adjustment: ±50% of each selected range

Span Adjustment: ±15% (non-interactive)

Zero Adjustment: ±15% (non-interactive)

Range Settings: switch selectable

Overvoltage Protection: 250VAC on input (except current, RTD, T/C, mV inputs;
see the individual board manuals for these specifications)

Short Circuit Protection: outputs (voltage and current)

RFI Suppression: at <10V/m at 146mHz: <2% error F.S.

Shock and Vibration: meets MIL-T-28800 Type II Class 5

Humidity: 90% RH non-condensing

Case: polycarbonate, meets UL 94 V-0 flame retardant standard

Weight: 1.3 lb (0.59 kg)

Table of Contents

Introduction	1
Theory of Operation	3
Block Diagram	3
Functional Capabilities	3
Basic Assembly	5
Safety Warnings and Cautions	5
Procedure	5
Disassembly	7
General Calibration	11
Preparations	11
Setting Solder Jumpers	11
Input Calibration	11
Output Calibration	11
Special Function Board Calibration	12
Mounting	13
Mounting Location	13
Mounting Hardware	13
Wiring	13
Hookup	13
Label and Overlay Examples and Explanation	14
Socket Wiring	19
General Specifications	23

Setup, calibration, and specification information for your Series 8000 unit will be found in the board-specific manuals in the pocket at the back of this manual. This base manual provides general information required to use any Series 8000 unit.



Safety Warnings and Cautions

Series 8000 units use and operate on dangerous line voltages.

- *Never operate your unit with the protective case removed.*
- *Always disconnect your Series 8000 signal conditioner from line power before you open the case for any purpose.*

Printed in USA

Instruction for Non-Warranty Repair & Calibration

A unit returned for non-warranty calibration or repair should be shipped with the following information:

- Company Name (if Applicable).
- Your name, telephone and Fax number so we may contact you for calibration or out-of-warranty repair charges.
- Address that you want the unit shipped back to.
- A description of the problem encountered or service required.
- A \$10.00 inspection/handling charge in the form of a check, money order or purchase order payable to Non-Linear Systems.

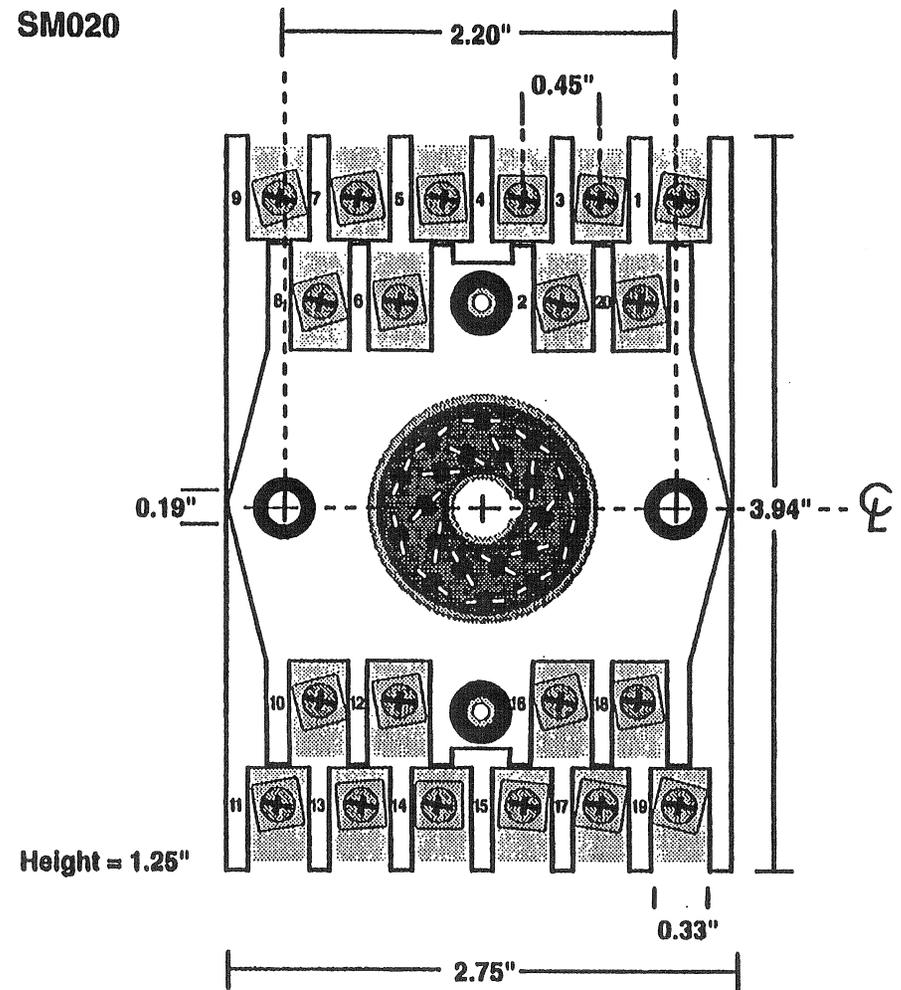
Ship the signal conditioner in a sturdy box, with shipping charges prepaid, to:

Non-Linear Systems -- Signal Conditioner Repair
4174 Sorrento Valley Blvd
San Diego, California 92121

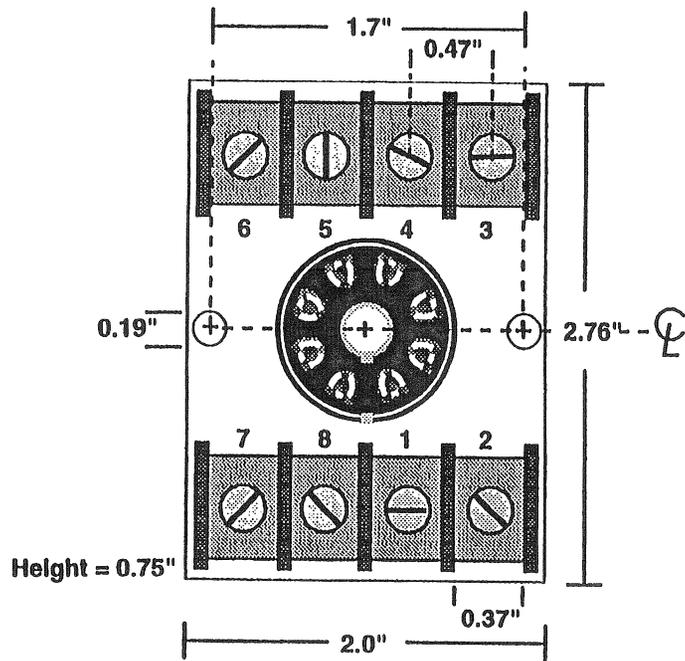
You will be contacted by Non-Linear Systems (NLS®) with repair/calibration charges. Return ground shipping in Continental U.S. will be paid by Non-Linear Systems (NLS®).

For questions in North America, contact our Signal Conditioner Repair Department at (619) 535-2161. Outside the North America, contact your local Non-Linear Systems dealer or distributor where you purchased your Series 8000 unit.

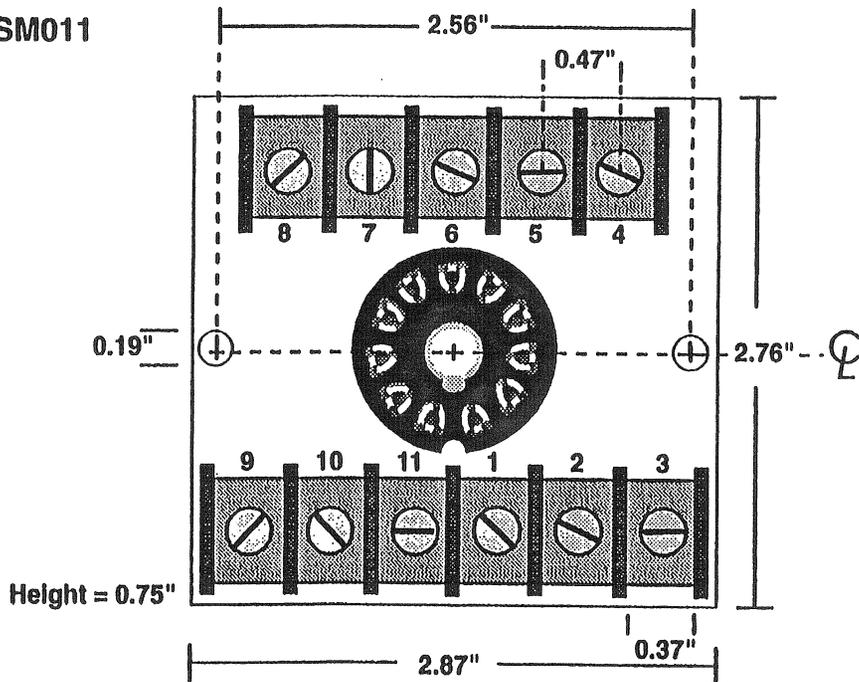
SM020



SM008



SM011



Section I

Introduction

The Series 8000

The Series 8000 is a new family of modular signal conditioners which offers maximum flexibility, providing a selection of wide-ranging, user-adjustable inputs and outputs and switch selectable functions. The entire system has been designed for industrial applications.

Series Features

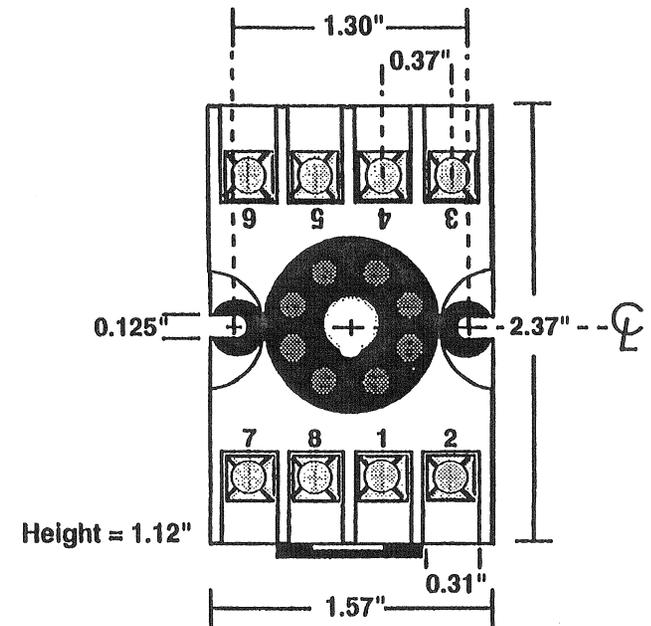
- Switch selectable I/O ranges
- Input/output overvoltage protection
- Built-in RFI/EMI suppression
- Isolation from input and output to power up to 1500V_{Peak}
- Switchable power supply voltages
 - 120VAC/240VAC
 - 12VDC/24VDC
- All alarm boards have transmitter outputs for process and set point
- Alarms are fully user configurable for all limit alarm configurations (i.e., failsafe, deadband, latching, high sense, low sense, etc.)
- All alarm boards are capable of remote DC set point programming for 1-5V, 4-20mA, 0-1V, and 0-10V (proper pin base required for access to these features).
- Many input boards are configurable, containing different input types which are jumper selectable on the board (e.g. T/C, RTD, mVDC).

User Benefits

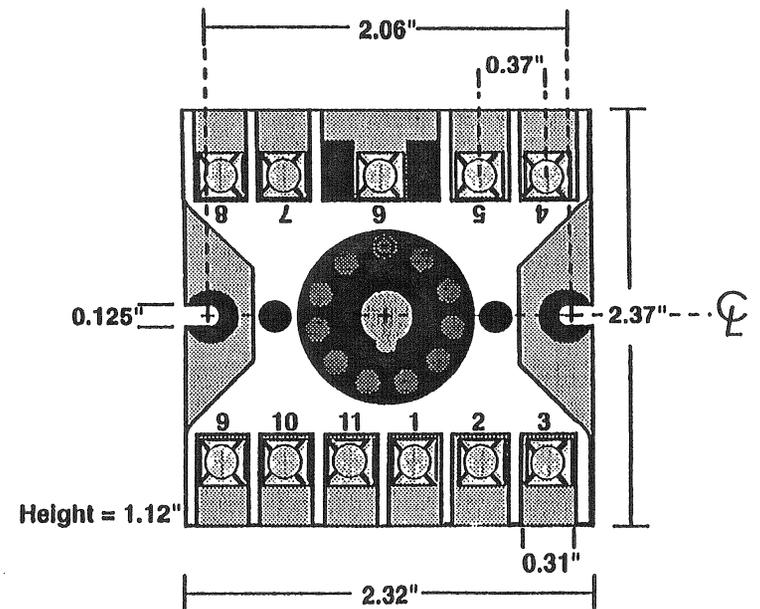
- All models are *immediately available* through local distributors even for *traditionally nonstandard ranges and "special" configurations*
- No special range/product charges
- Unique combinations (reduces system costs)
- Convenient plug-in design
 - easy installation
 - easy replacement
 - easy troubleshooting
- Compact
- Rugged electronic design
- Low cost
- Flexible

These socket wiring diagrams are supplied to allow you to provide adequate space for sockets and pre-wire sockets for the Series 8000.

DR018



DR011



Function Type Code No.
 Peak/Sample Hold 46
Label 2 is for code numbers 60 and 70.
Label 3 is for code numbers 71 and 72

P/N 2800-2800-01

PIN#	OUTPUT
6	Peak
7	Hold COM
9	- Out
10	+ Out
11	Hold

11PPH-1

11-pin

PIN#	OUTPUT
4	Peak
5	Hold
14	- Out
15	+ Out
17	Hold COM

20PPH-1

20-pin (label 2)

PIN#	OUTPUT
4	Peak
5	Hold
14	-(N.O.)
15	+(COM)
16	24V (N.C.)
17	Hold COM

20PPHF-1

20-pin (label 3)

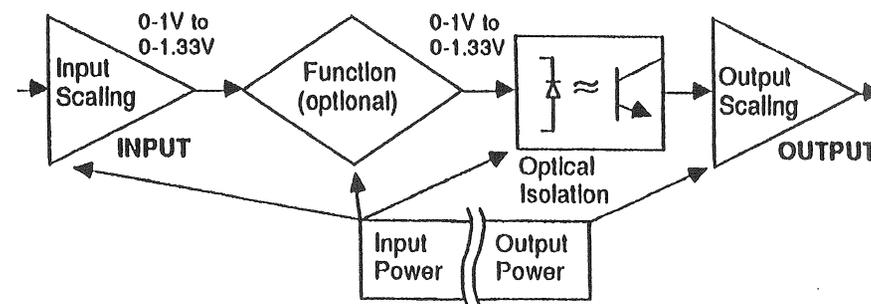
Section II

Theory of Operation

Each input board conditions the supplied input signal to a voltage (0-1V to 0-1.33V) common to the group of cards in the unit. This signal is then passed to the next board, either a function board or the output board. The function board, if one is present, performs its function within the confines of the standard signal, passing the resultant signal to the output board. Finally, the output board conditions the signal it transmits, proportionately scaling the output signal within the defined output range.

Note that the boards and base unit connectors for the Series 8000 units are designed to allow changing any board type without interfering with the function or calibration of the other boards.

Block Diagram



Functional Capabilities

Input

AC
 DC
 Potentiometer
 Thermocouple
 RTD
 Millivolt DC
 LVDT
 High/Low Select
 Multiply/Divide
 Frequency
 Programmable Ramp/Soak
 Add/Subtract
 Frequency Scaler
 Strain Gage

Function

Square Root
 Power Term ($A^{N^{th}}$)
 N^{th} Root
 Rate of Change
 Linearization
 Ramp Buffer
 Peak/Sample Hold
 Rate of Change

Output

DC
 Valve Positioner
 Adjustable Power Supply
 Frequency
 Alarm Relays (single or dual)

See Figure 1 for selection information.

With Sample/Hold Function Board		Limit Alarm		Frequency Output		DC Output		Limit Alarm with Process Xmitr, Remote SP and Valve Positioner		Frequency Output	
DC Output	Top Mount SP or Valve Positioner	With Remote SP, Xmitr, latch	With 5V	With 5V, 24V or Relay	DC Output	Limit Alarm with Process Xmitr, Remote SP and Valve Positioner	DC Output	Limit Alarm with Process Xmitr, Remote SP and Valve Positioner	DC Output	Limit Alarm with Process Xmitr, Remote SP and Valve Positioner	Frequency Output
DC	11-pin*	20-pin	8-pin*	11-pin	11-pin	20-pin	11-pin	20-pin	11-pin	20-pin	20-pin
AC	11-pin*	20-pin	8-pin	11-pin	11-pin	20-pin	11-pin	20-pin	11-pin	20-pin	20-pin
Potentiometer	20-pin	20-pin	8-pin	8-pin	20-pin	20-pin	20-pin	20-pin	20-pin	20-pin	20-pin
mV DC Thermocouple	11-pin*	20-pin	8-pin	8-pin	20-pin	20-pin	11-pin	20-pin	20-pin	20-pin	20-pin
RTD	11-pin*	20-pin	8-pin	8-pin	20-pin	20-pin	11-pin	20-pin	20-pin	20-pin	20-pin
Frequency	20-pin	20-pin	8-pin	8-pin	20-pin	20-pin	11-pin	20-pin	20-pin	20-pin	20-pin
Strain Gage	20-pin†	20-pin†	11-pin	11-pin	20-pin	20-pin	—	—	—	—	—
LVDT†	20-pin†	20-pin†	11-pin	11-pin	20-pin	20-pin	—	—	—	—	—
Multiplier/Divider	20-pin	20-pin	8-pin	8-pin	20-pin	20-pin	20-pin	20-pin	20-pin	20-pin	20-pin
Add/Subtract	20-pin†	20-pin†	20-pin	20-pin	20-pin	20-pin	—	—	—	—	—
High/Low Select	20-pin†	20-pin†	20-pin	20-pin	20-pin	20-pin	—	—	—	—	—
Programmable Ramp/Soak†	20-pin	—	—	—	20-pin	—	—	—	—	—	—

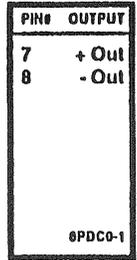
* = industry standard pinouts † = cannot be used with function board

The Frequency Scaler and Adjustable Power Supply are individual units using the 8-pin base and cannot be used with any other board

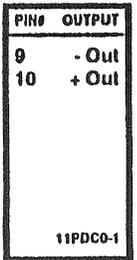
Figure 1. Base Type Selection Chart

Output Type Code No.
DC 60
Adjustable Power Supply 65

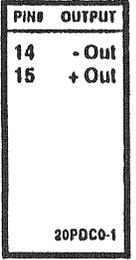
P/N 2800-2780-00



8-pin



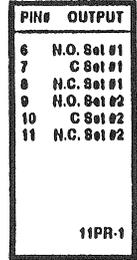
11-pin



20-pin

Output Type Code No.
All Alarms 80 through 97

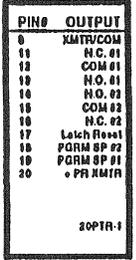
P/N 2800-2710-01



11-pin



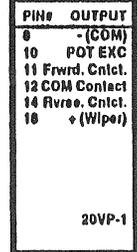
20-pin



20-pin

Output Type Code No.
Valve Positioner 73

P/N 2800-2850-00



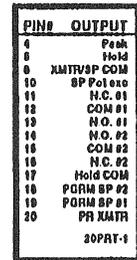
20-pin

FUNCTION CONNECTION LABELS

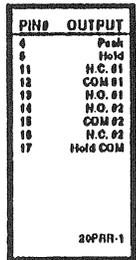
(These are for Peak/Sample Hold function board only - others Do Not require labels)

Function Type Code No.
Peak/Sample Hold 46
Label 1 is for use with code numbers 81-84 and 87.
Label 2 is for code numbers 80, 85, 86, 90, 95 and 96.

P/N 2800-2790-01



20-pin (label 1)



20-pin (label 2)

Input Type Code No.
LVDT 08

PIN#	INPUT
1	Line (+)
2	Ground
3	Line (-)
4	+ In
5	- In
6	+ Exc
7	+ Exc
11	- Exc

11-pin

PIN#	INPUT
1	Line (+)
2	Ground
3	Line (-)
4	+ Exc
5	- Exc
6	ZAX
7	- In
9	+ In
17	+ Exc

20-pin

P/N 2800-2751-00

Input Type Code No.
Strain Gage 09

PIN#	INPUT
1	Line (+)
2	Ground
3	Line (-)
4	+ In
5	- In
7	+ Exc
8	- Exc

11-pin

PIN#	INPUT
1	Line (+)
2	Ground
3	Line (-)
4	+ Exc
5	- Exc
7	- In
9	+ In

20-pin

P/N 2800-2750-00

Input Type Code No.
Frequency Scaler 07

PIN#	OUTPUT
1	Line (+)
2	Ground
3	Line (-)
5	+ In
6	Slg-Com
7	+ (Com)
8	- (N.O.)

8-pin

PIN#	OUTPUT
1	Line (+)
2	Ground
3	Line (-)
4	+ In
5	Slg-Com
9	RELAY
10	- (N.O.)
11	+ (COM)
11	24V (N.C.) Pulse

11-pin

PIN#	OUTPUT
1	Line (+)
2	Ground
3	Line (-)
5	+ In
7	Slg-Com
14	RELAY
15	- (N.O.)
16	+ (COM)
16	24V (N.C.)

20-pin

P/N 2800-2840-01

OUTPUT CONNECTION LABELS

Output Type Code No.
Frequency 70
Frequency 71
Frequency 72

PIN#	OUTPUT
7	+ (Com)
8	- (N.O.)

8-pin

PIN#	OUTPUT
9	RELAY
10	- (N.O.)
10	+ (COM)
11	24V (N.C.) Pulse

11-pin

PIN#	OUTPUT
14	RELAY
15	- (N.O.)
16	+ (COM)
16	24V (N.C.)

20-pin

P/N 2800-2720-00

Section III

Basic Assembly

Your Series 8000 unit consists of four P.C. boards (five if your unit includes a function board) and a high-impact, polycarbonate case. The P.C. boards are: a base board, a power supply (120/220VAC or 12/24VDC), an input board, a function board (if needed) and an output board.

Safety Warnings and Cautions

Series 8000 units use and operate on dangerous line voltages (see warnings on underside of case).



- Never operate your unit with the protective case removed.
- Always disconnect your Series 8000 signal conditioner from line power before you open the case for any purpose.

Procedure

All installation directions refer to the installation of the various boards and the case to the base board (whichever of the 8-, 11-, or 20-pin bases is appropriate).

- Note that the appropriate location for input, output, power supply and function boards is printed in the base board (boards cannot be plugged into the incorrect connectors due to unique pin/connector layouts).
- Boards should be installed with the component side facing in.

Step 1. Configuration

Check the specific board instructions in the back pocket of this manual and determine the pin jumper, solder jumper and DIP switch settings (see Figure 3 for examples) needed for the desired input type and range. Set these, as needed, prior to installing the boards.

Step 2. Input Board

The input board attaches to the base board on the lower left side, as shown in Figure 3a. This card's connectors will only fit into the sockets on this one side of the base board. Install the board, checking that the connectors are fully seated in the base sockets.

Step 3. Output Board

The output board will only fit on the other long side of the base board (see Figure 3a). Install the card, checking that the connectors are fully seated.

Step 4. Power Supply

The Series 8000 offers two power boards. One is an AC power supply, jumper selectable between 120VAC and 220V. The other is a DC power supply, operating selectable between 12VDC and 24VDC. Both power supplies are slow fused for 1/8 amp and operate at 2.5 watts.

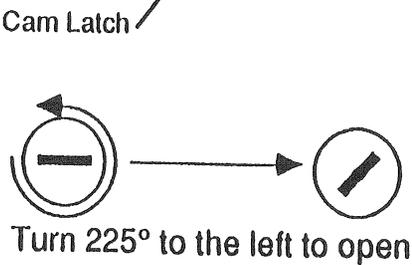
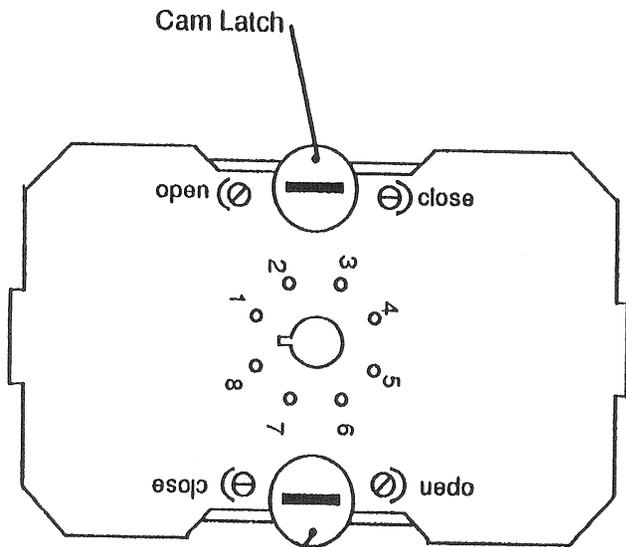
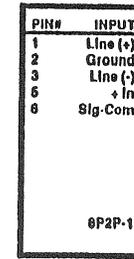


Figure 2. Cam Latch Location and Operation

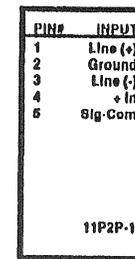
INPUT CONNECTION LABELS

Input Type	Code No.
DC	01
AC	03
Thermocouple	04
Millivolt	06
Frequency	10

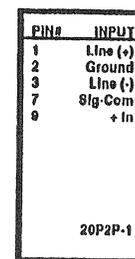
P/N 2800-2730-00



8-pin



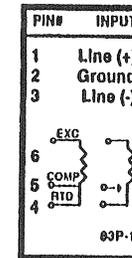
11-pin



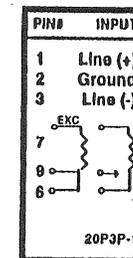
20-pin

Input Type	Code No.
RTD input	05
Potentiometer	02

P/N 2800-2760-00



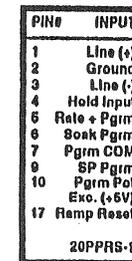
8-pin



20-pin

Input Type	Code No.
Programmable Ramp/Soak	11

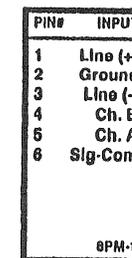
P/N 2800-2770-00



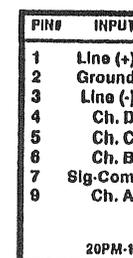
20-pin

Input Type	Code No.
Multiplier	15
Divider	16
Add/Subtract	14
High Select	12
Low Select	14

P/N 2800-2740-00



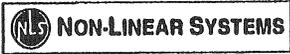
8-pin



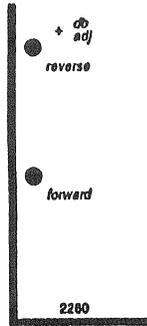
20-pin

Label and Overlay Examples and Explanation

Logo Overlay



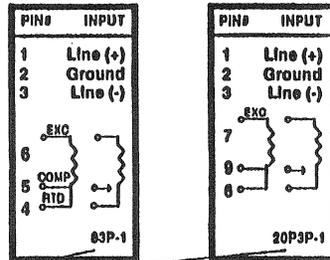
Output Overlay



Input Overlay



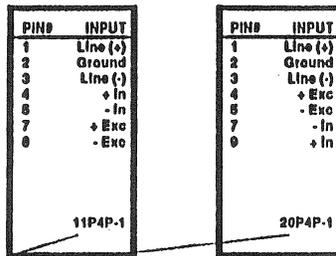
Input Connection Labels



Indicates number of pins on base unit

Part number (different for each card) — P/N 2800-2760-00

Output Connection Labels



Indicates number of pins on base unit
(should be the same on the input label)

Part number (different for each card) — P/N 2800-2750-00

Step 4. Power Supply

The power supply will only plug in on the correct side of the base board. Firmly insert the connectors on the power supply board onto the pins on the base board, making certain that the board seats fully.

Check that the alignment tabs on the input and output boards fit properly into the notches in the power supply board (see Figure 3a, 3c and 3d).

Step 5. Function Board

If used, the function board fits in the remaining short side of the base board. **NOTE:** If not used, the pin jumper on the base board *must* be installed (see Figure 3b)

Install the function board, checking that the board is fully seated.

Step 6. Case

Designed for the Series 8000, this housing protects your unit.

- Vibration protection—The case acts as a final retaining device, securing the boards in their sockets, minimizing the effects of vibration and high "g" loads. Electronics packaged in the case withstand standard three foot drop test.
- Exposure Protection—The case is high impact polycarbonate, providing a package resistant to common industrial chemicals. Since the case fits to the base with a lap fit, the case-base seal is splash resistant.

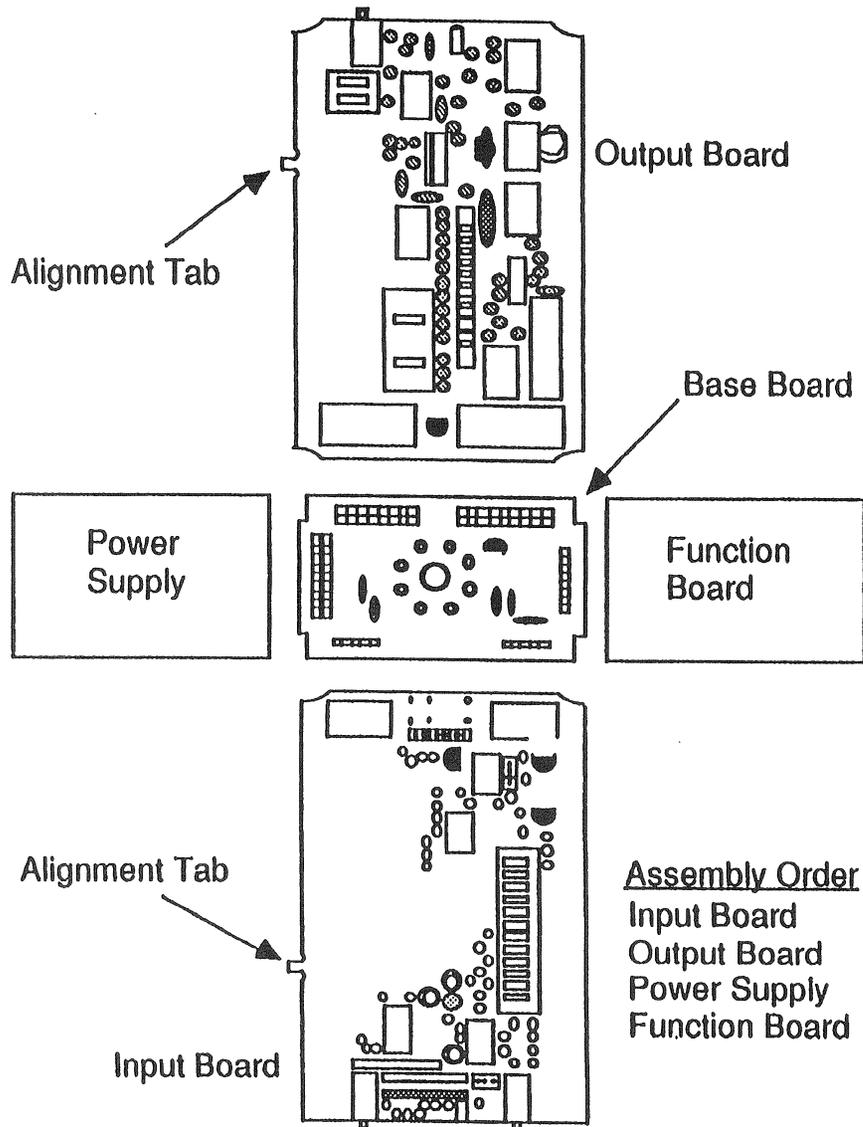
Firmly slide the case down over the electronics and onto the base. Make sure that cam latches are in the closed position (see Figure 2). The case will not go on with the latches in the open position. This completes assembly.

Disassembly

The case is held closed by two cam latches located on the bottom of the case base (see Figure 2). To open these, turn them 225 degrees (5/8 of a turn) counterclockwise, using a coin or similar object. This exerts pressure on the sides of the case, allowing you to pull the case free from the base.

The boards which plug into the long sides of the base are the input and output boards. Along the short sides of the base are the power supply board and the function board. You should remove the boards in the following order:

- Function board
- Power supply
- Output and Input boards (in either order)



Note: illustration is not to scale

Figure 3a. Exploded View of Series 8000 Components

Mounting Location

We recommend installation of Series 8000 units in a vertical (upright) position. Side mounting is acceptable. For other mounting positions and in areas of high vibration we recommend the use of a retaining spring (model number SM800).

Examples of common mounting locations are:

- Behind panels
- Remote field locations (in appropriate enclosures)
- Bulkhead surfaces

Mounting Hardware

Mounting hardware available for the Series 8000 includes:

- Plastic channel track (four foot lengths, 2.9 inches wide)
- Barrier terminal socket (includes base board, mounting socket, terminal blocks, screws and washers)
- DIN rail (3 feet long)
- DIN rail/flush mount sockets

Wiring

For all Series 8000 units, input power terminals are:

	<u>DC</u>	<u>AC</u>
Pin 1	DC+	Hot
Pin 2	———Ground (electrostatic shield)———	
Pin 3	DC-	Neutral

Hookup

Note the pin connections called out on the label affixed to the side of your unit. Wire the socket as indicated by the label. We recommend that signal lines should be wired with twisted, shielded pair. Shields should be grounded at the Series 8000 end only. Route signal lines as far as possible from power lines.

The table beginning on page 15 shows all labels for the Series 8000 and is intended for use in determining the appropriate wiring connection prior to receiving a Series 8000 unit and for the information of system designers as assistance in system documentation.

Special Function Board Calibration

Step 5.

Turn the unit off.

Step 6.

Remove the pin jumper from the base board's function board pins.

Step 7.

Verify that any needed function board configuration has been completed, per the specific instructions at the back of this manual. Install the function board (see the Basic Assembly section).

Note: Major zero and span adjustments should not be required when installing and calibrating a function board (they are minimally affected by the installation of a function board).

Step 8.

Turn the unit on.

Step 9.

Input the zero input to the input board. If required, adjust the zero adjustment to fine tune your unit. Repeat the process, if needed, for span.

Step 10.

Refer to your function board's specific instructions at the back of this manual for specific calibration information and procedures.

Step 11.

Having completed the specific calibration instructions, your Series 8000 unit is calibrated and will now perform the required functions.

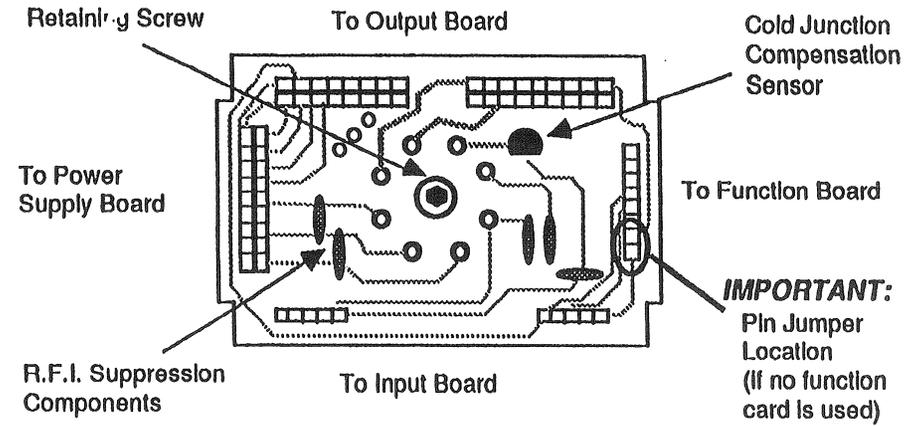
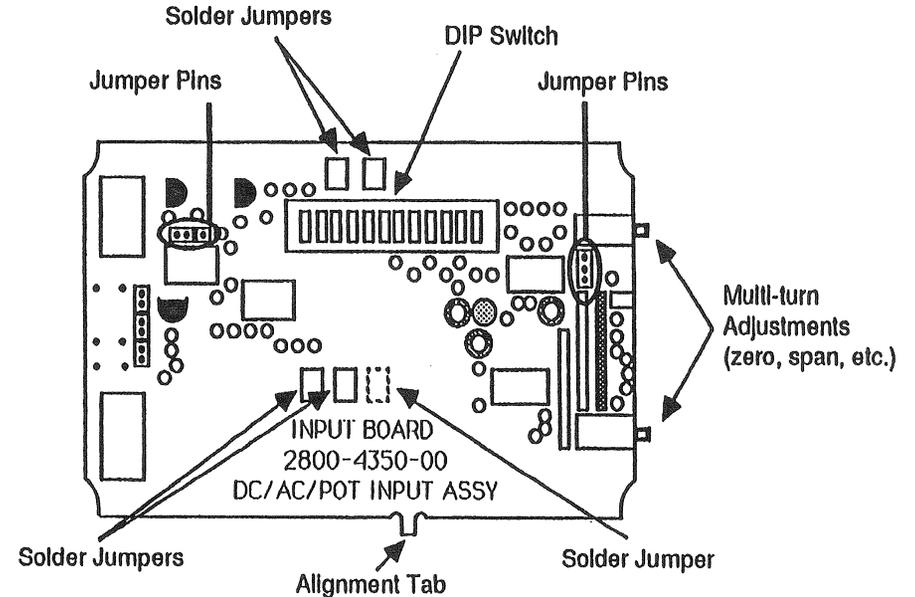
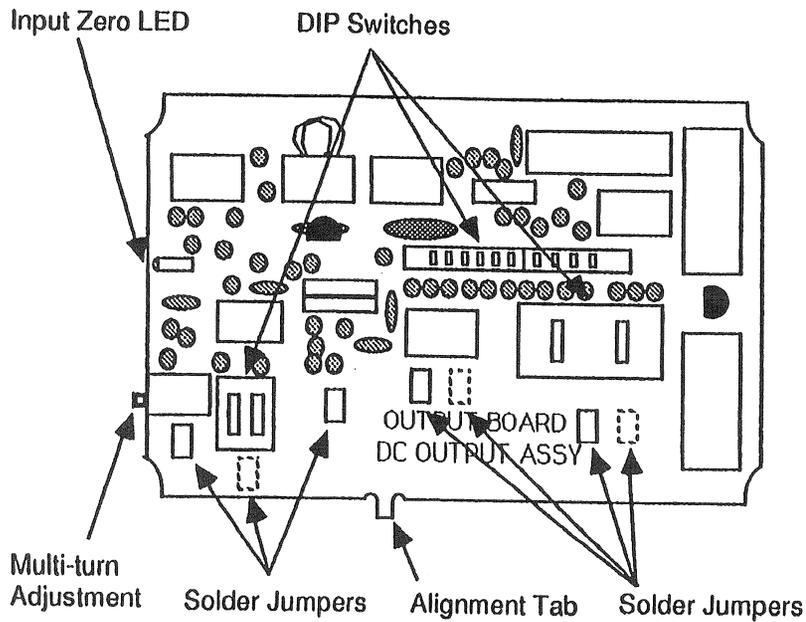


Figure 3b. Base Board



Note: Solder Jumpers surrounded by a solid lined box are on the component side of the board. Solder Jumpers surrounded by a broken line are on the opposite side of the board.

Figure 3c. Input Board



Note: Solder jumpers surrounded by a solid line are on the component side of the board. Solder jumpers surrounded by a broken line are on the other side of the board.

Figure 3d. Output Board

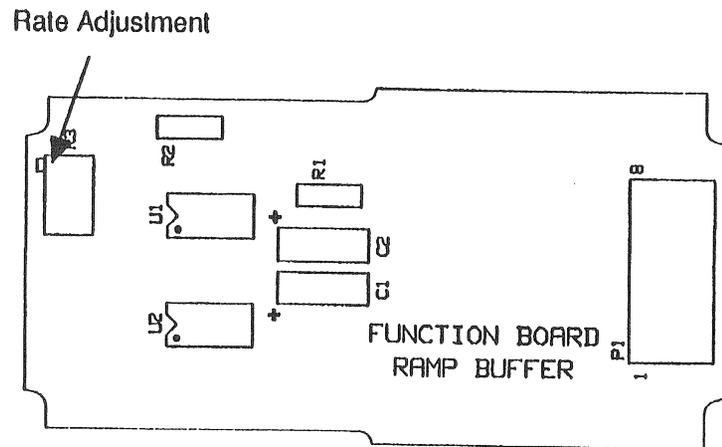


Figure 3e. Function Board

Preparations

Step 1.

Make certain that your boards are correctly configured for your requirements (see the specific instructions for your boards at the end of this manual), checking that all DIP switches, pin jumpers and solder jumpers are correctly installed (see Figure 3b, 3c and 3d for examples of DIP switch, pin jumper and solder jumper locations). Verify that you have the required equipment listed in the specific calibration instructions for the calibration of your boards.

Setting Solder Jumpers

Setting a solder jumper is a simple task, requiring only that you carefully add a bead of solder to that solder jumper (if closing the jumper) or removing the solder bead (if opening the jumper). We suggest using a desoldering tool or desoldering braid for opening a solder jumper. We strongly recommend cleaning any flux remaining on the board to avoid future contamination problems.

Input Calibration

Step 2.

Using the appropriate calibration device, input the zero setting to the input board. Adjust the zero offset control on the input board until the LED on the output board lights. This performs a coarse adjustment.

Note: If you have a function board, complete input/output calibration before installing.

Note: If you have an alarm output board, DO NOT follow steps 3 and 4. Instead, see your board's specific instructions for calibration.

Step 3.

Adjust the zero trim control on the output board for the required zero output.

Output Calibration

Step 4.

With full scale input, adjust the span control until the output is at the desired full scale output. Calibration is now complete.

If you do not have a function board, calibration is complete. If your unit has a function board, complete the following steps: