## Add/Subtract Function Board Part Locations

Zero Adjustment Potentiometer
A Gain Adjustment
B Gain Adjustment
C Gain Adjustment
D Gain Adjustment
Span Adjustment



Solder Jumpers

ADDER/
SUBTRACTOR
INPUT BD

Solder Jumpers

Solder Jumpers

Solder Jumpers

Solder Jumpers

Solder Jumpers

P5

Solder Jumpers

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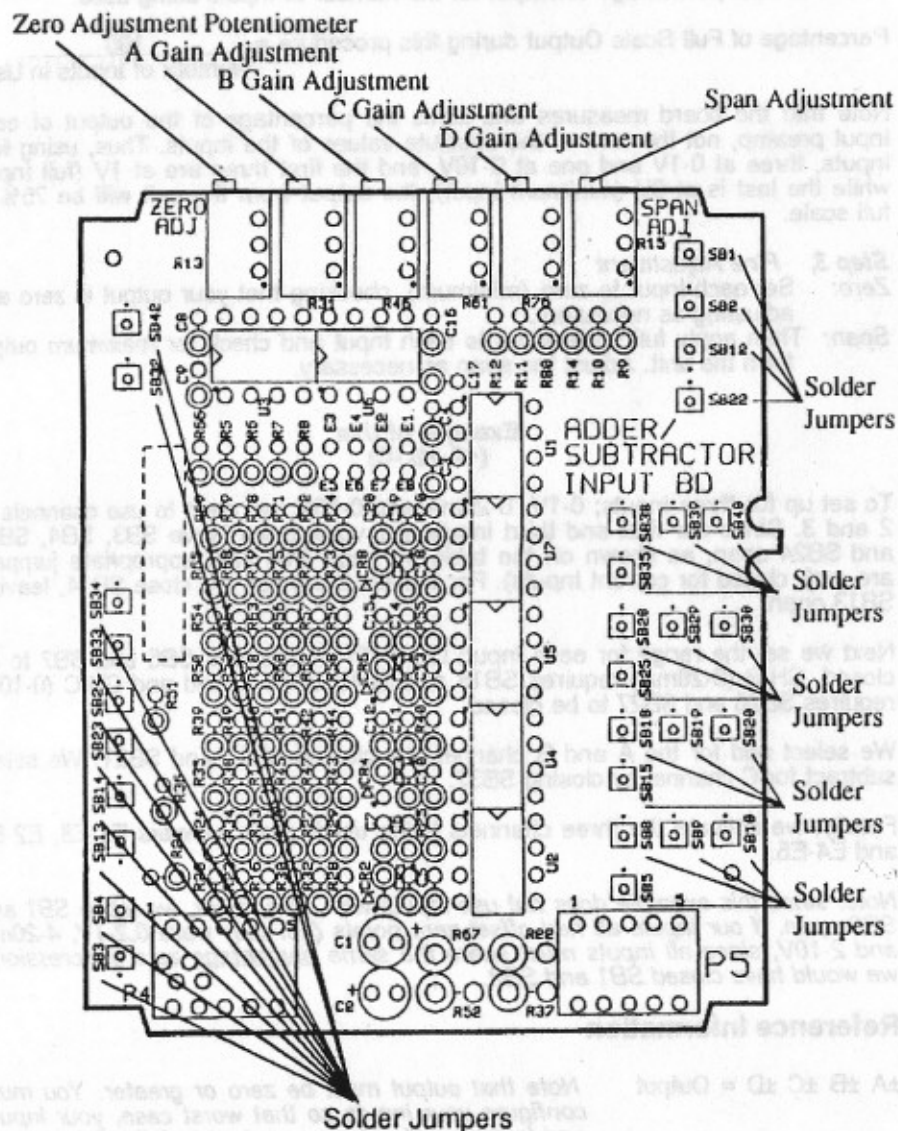
## Specifications

**Accuracy:** 0.3% *(includes linearity, zero & span drift and offsets)*
**Input Overload Protection:** DCV ranges: 250VAC or VDC
                   Current: 10Ω: 150mA; 100Ω: 50mA

**Stability:** 0.03% *(of span/°C)*
**Repeatability:** ±0.10% FS
**Response Time:** 150mS
**Input Impedance:** > 1MΩ *(voltage)* 10Ω or 100Ω *(current)*
**Span Adjustment:** ±10%
**Zero Adjustment:** ±10%
**Input Ranges:** 0.1-10V, *no bipolar inputs;* 1-100mA

*For general Series 8000 specifications, see the base manual, which provides general information for the entire series.*

## Setup Procedure

Prior to reconfiguring, check that all solder jumpers are open and that pin jumpers E1 through E4 are open. This will help ensure that only the needed connections are made when you complete configuration.

I. Disassemble the Series 8000 unit as described on page 6 of the main manual.
II. Remove the Add/Subtract Input board.
III. Set up board for your purposes:
     1. Select zero offset, if needed. *All inputs must have no zero offset or have the same percentage offset (4-20mA, 1-5v and 20-100v are all 20%).*
     2. Determine which channels you will be using (up to four).
     3. Select and setup each channel for current or voltage.
     4. Determine the appropriate range settings for each channel.
     5. Select and enable add or subtract mode for each input.
IV. Calibrate as described on page 14-3.
V. Reassemble the unit as described in the main manual, pages 4 to 6.

## Setup Instructions

### Zero Offset Signals

If your inputs use zero offset, close solder jumpers SB1 and SB2, for 25% offset.
The zero adjustment offers ±10, allowing a maximum offset of 35%. They should be open if you are not using zero offset.

### VDC or mA Inputs

Determine voltage or current for each input. For current, one solder jumper must be closed.

*Closed Jumpers (current only) All other Jumpers are Open*

| Current (mA) Span | CH A | CH B | CH C | CH D | SHUNT Ω |
|---|---|---|---|---|---|
| 0-1 | SB3 | SB13 | SB23 | SB33 | 100 |
| 0-2 | SB3 | SB13 | SB23 | SB33 | 100 |
| 0-5 | SB3 | SB13 | SB23 | SB33 | 100 |
| 0-10 | SB3 | SB13 | SB23 | SB33 | 100 |
| 0-20 | SB4 | SB14 | SB24 | SB34 | 10 |
| 0-50 | SB4 | SB14 | SB24 | SB34 | 10 |
| 0-100 | SB4 | SB14 | SB24 | SB34 | 10 |

*For Voltage Inputs,* none of the solder jumpers above should be closed.

Having selected the channels you will be using and configured the channels for voltage and/or current (you may use voltage into some channels and current into others so long as you correctly configure each input preamplifier for its input), you must determine the range settings required. This is shown in the table below.

### Input Range Table

#### Close indicated solder Jumper (all others should be open)

| Volts DC | Current (mA) | CH A | CH B | CH C | CH D |
|---|---|---|---|---|---|
| 0-0.1 | 0-1 | SB5/SB10 | SB15/SB20 | SB25/SB30 | SB35/SB40 |
| 0-0.2 | 0-2 | SB5/SB9 | SB15/SB19 | SB25/SB29 | SB35/SB/39 |
| 0-0.5 | 0-5 | SB5/SB8 | SB15/SB18 | SB25/SB28 | SB35/SB38 |
| 0-1.0 | 0-10 | SB5/SB7 | SB15/SB17 | SB25/SB27 | SB35/SB37 |
| 0-2.0 | - | SB6/SB9 | SB16/SB19 | SB26/SB29 | SB36/SB39 |
| 0-5.0 | - | SB6/SB8 | SB16/SB18 | SB26/SB28 | SB36/SB38 |
| 0-10.0 | - | SB6/SB7 | SB16/SB17 | SB26/SB27 | SB36/SB37 |
| - | 0-20 | SB5/SB9 | SB15/SB19 | SB25/SB29 | SB35/SB39 |
| - | 0-50 | SB5/SB8 | SB15/SB18 | SB25/SB28 | SB35/SB38 |
| - | 0-100 | SB5/SB7 | SB15/SB17 | SB25/SB27 | SB35/SB37 |

### Add/Subtract Selection (by channel)

Set each input for add or subtract by closing the appropriate solder jumper. Note that the sum of all inputs must always be positive as a negative sum would require a negative output, an invalid condition:

| | CH A | CH B | CH C | CH D |
|---|---|---|---|---|
| To Add, close | SB11 | SB21 | SB31 | SB41 |
| To Subtract, close | SB12 | SB22 | SB32 | SB42 |

### Channel Activation

Finally, activate the channels which you are using. To do this, close the indicated pin jumpers (see page 14-4 for locations):

| CH A | CH B | CH C | CH D |
|---|---|---|---|
| E1-E8 | E2-E7 | E4-E6 | E3-E5 |

## Calibration

Calibration consists of three steps:
1. Rough calibration, setting the zero output.
2. Preamp adjustment, setting full preamp output levels by adjusting each preamp gain adjust potentiometer.
3. Fine adjustment, completed by repeating step 1.

### Step 1, Rough Calibration
Set each input to zero input (minimum input if using offset zero inputs). Set the zero adjust potentiometer to provide zero (or minimum) output from your output board. Apply maximum input on all channels and adjust the span potentiometer for maximum output from the unit.

### Step 2, Preamp Adjustment
1. Apply full input to Channel A and Zero (minimum) input to all other inputs.
2. Adjust the preamp gain adjustment potentiometer. The value you should get for this adjustment depends on the number of inputs you are using. See the formula below.

3. Perform this step for each input in use, setting all but the input being adjusted to zero and the input being adjusted to full output, which will be indicated by the correct percentage of output for the number of inputs being used.

$$\text{Percentage of Full Scale Output during this procedure} = \frac{100}{\text{Number of Inputs in Use}}$$

Note that the board measures and sums the percentage of the output of each input preamp, not the sum of the absolute values of the inputs. Thus, using four inputs, three at 0-1V and one at 0-10V, and the first three are at 1V (full input) while the last is at 0V (minimum input), the output from the unit will be 75% of full scale.

### Step 3, Fine Adjustment
Zero: Set each input to zero (minimum), checking that your output is zero and adjusting as necessary.
Span: Then apply full scale input to each input and check for maximum output form the unit. Adjust the span as necessary.

### Example of Use
### (+A +B -C)

To set up for three inputs; 0-1V, 0-20mA and 0-10V, we elect to use channels 1, 2 and 3. Since our first and third inputs are voltage we leave SB3, SB4, SB23 and SB24 open, as shown on the table on page 14-1 (the appropriate jumpers are *only* closed for current inputs). For the second input, we close SB14, leaving SB13 open.

Next we set the range for each input: CH-A (0-1V) requires SB5 and SB7 to be closed, CH-B (0-20mA) requires SB15 and SB19 to be closed and CH-C (0-10V) requires SB26 and SB27 to be closed.

We select add for the A and B channels by closing SB11 and SB21. We select subtract for C channel by closing SB32.

Finally, we activate the three channels being used: close jumpers E1-E8, E2-E7 and E4-E6.

Note: since this example does not use inputs with zero offset, we leave SB1 and SB2 open. If our inputs all had offset zero points (i.e. they were 0.2-1V, 4-20mA and 2-10V, since all inputs must share the same *percentage* zero suppression), we would have closed SB1 and SB2.

## Reference Information

±A ±B ±C ±D = Output      Note that output must be zero or greater. You must configure your inputs so that worst case, your inputs and formula will not cause output to fall below zero.