

# *SX 165/250 Multipoint Recorder*

## *Calibration Procedures*

### 4. ADJUSTMENTS

#### 4.1 Calibration:

##### 4.1.1 Calibration Procedure. EMF and TC Ranges. See Fig. 4-1, A and B.

##### A. General Calibration

- (1) Rotate the servo shaft to the "0" end mechanical stop (recorder de-energized). The pointer scribe line should be at least 1/64" below the subzero line on the paper. If it is not or if the print carriage hits the lifting mechanism before the end stop is reached, loosen the carriage screw, position the carriage properly, and retighten.
- (2) Energize the recorder. Apply a large negative signal, at least equal to the span, to the input. Set the low-end stop to the subzero line on the paper.
- (3) Align the scale with the paper at the "0" end.
- (4) Apply a positive input signal, equal to at least twice the span, to the input. Set the high-end stop to the dot on the scale.

##### B. High Level Preamp Adjustments, 055872

- (1) Span Jumpers — The two blue plastic span jumpers W1 and W2 are in the location shown in Fig. 4-1F. To remove, pull straight away from the printed circuit card. A small screwdriver inserted between the printed circuit card and the jumper will facilitate the jumper's removal.

To install the jumpers, just push them onto the two pins indicated for each jumper in Table 4-1 for the span desired.

- (2) Zero — Apply an input signal equal to the low end of the span and adjust the zero potentiometer until the pointer registers on the first calibration line at the low end of scale.
- (3) Span Trim — Apply an input signal equal to 100% of the span and adjust the span trim potentiometer until the pointer registers at the high end calibration line on the scale.
- (4) Zero and Span Trim — Repeat Steps (2) and (3) if necessary.
- (5) Final Adjustment — After low and high ends of scale have been calibrated, check entire scale at 20% increments. If errors are not evenly split, readjust low or high end, or both to split errors.

##### C. Preamp and Range Card Calibration

*NOTE: On the range-card connector, short P1-1 to P1-2 to disable Option 001 open-input check. Skip steps 1, 2, and 3 if instrument has bleeder current type failsafe.*

- (1) Place a 10 K ohm calibration resistor (see recorder accessories kit, Section 8) in series with the input source.
- (2) Apply an input to balance the recorder at approximately midscale.
- (3) Adjust the CURRENT OFFSET potentiometer so that no pointer shift is observed when the source resistance is switched from 10 K ohm to zero.
- (4) **Thermocouple Instruments Only.** With a mercury thermometer, measure the ambient temperature in the immediate vicinity of the range card. Measure the millivoltage between TP3 and TP4 on the range card. From Table 4-2 determine the proper value of this millivoltage for the temperature and type of TC used. Adjust the RJ CURRENT potentiometer to the proper value.

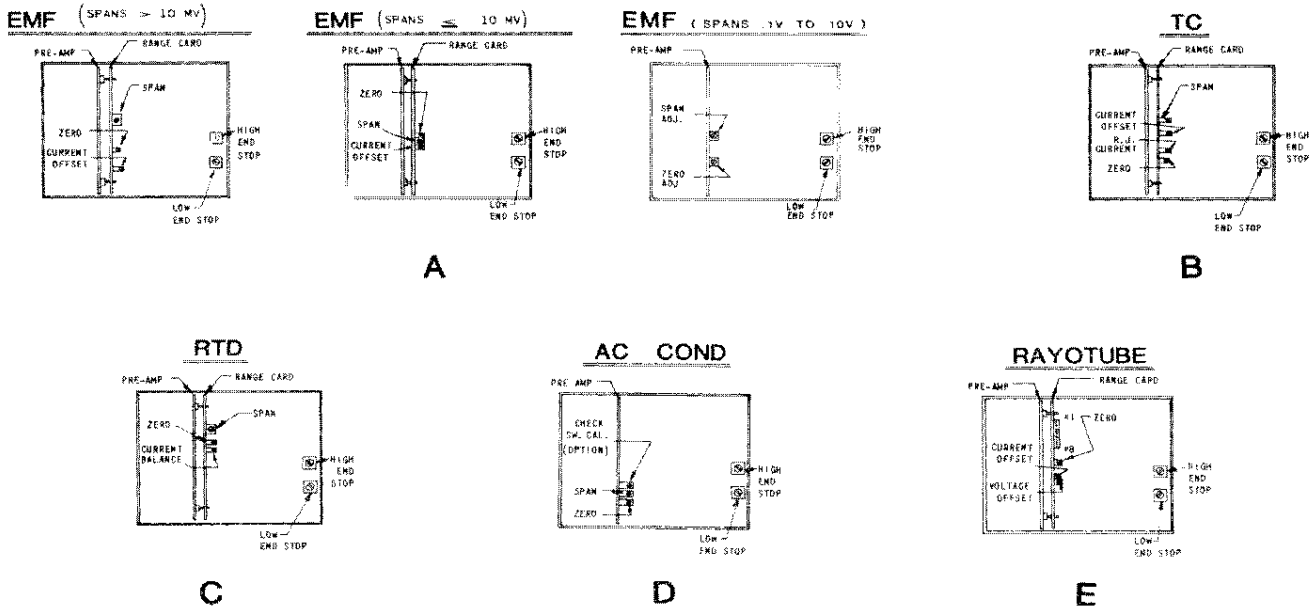
TABLE 4-1

SPAN	JUMPER PLUG W1	JUMPER PLUG W2
3V to 5V	C to 4	C to 3
1V to 3V	C to 3	C to 2
.1V to 1V	C to 2	C to 1
6V to 10V	C to 1	C to 3
5V to 6V	C to 1	C to 2

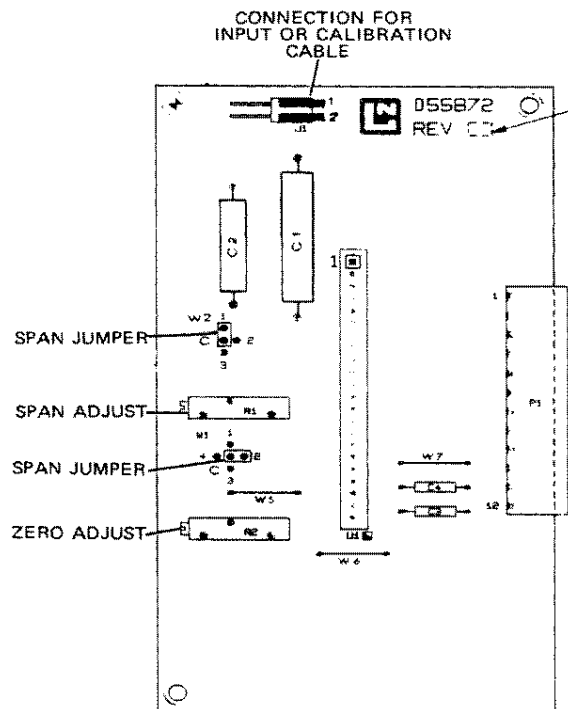
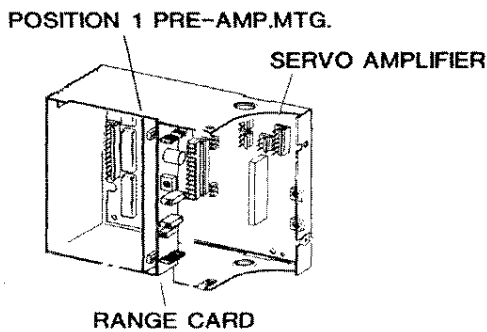
TABLE 4-2 — RJ CURRENT ADJUSTMENT  
VALUES

THERMOCOUPLE TYPE	MILLIVOLTAGE @ 25° C	CORRECTION COEFFICIENT
J	13.70 mV	+0.053 mV/° C
T	11.05 mV	+0.043 mV/° C
K	10.91 mV	+0.042 mV/° C
E	16.30 mV	+0.063 mV/° C
R,S	1.56 mV	+0.006 mV/° C
W	0.57 mV	+0.002 mV/° C
W5	3.64 mV	+0.014 mV/° C
N	7.01 mV	+0.027 mV/° C

# SX 165/250 Multipoint Recorder Calibration Procedures



Calibration setups for emf (A), TC (B), RTD (C), electrolytic conductivity (D) and Rayotube (E) as observed from left side of recorder.



F Preamplifier adjustment location

# *SX 165/250 Multipoint Recorder*

## *Calibration Procedures*

- (5) Use an ice bath or ice point reference to connect TC wires to copper wires from the calibrating source.

If an ice point reference is not available, the temperature of the junction between the TC wires from the recorder and the copper wires from the calibrating source must be measured with a mercury thermometer. The voltage corresponding to this temperature for the type TC being used must be subtracted from the low and high ends of the scale millivoltage. The new millivoltages are to be used in Steps 6 and 7.

- (6) Apply the low-end input signal. Adjust the ZERO potentiometer to set the pointer to the low end of the scale.
- (7) Apply the full-scale input signal and adjust the SPAN potentiometer to set the pointer to the high end of the scale.
- (8) Repeat Steps 6 and 7 if necessary.

### **4.1.2 Calibration Procedure, RTD Ranges.** See Fig. 4-1(C)

#### **A. General Calibration**

Proceed as in Section 4.1.1(A).

#### **B. Range Card Calibration**

- (1) Connect equal precision resistors  $\leq 5$  ohms (L&N Part No. 011706, 5 ohms, 0.1%) in series with the A- and B- leads of a test resistor and the input to the recorder. Connect the C- lead directly to the input. The A- and B- leads of the test resistor must be of equal length. Set the test resistor to zero ohms for this test.
- (2) Connect a portable potentiometer (Cat. 8690 or equivalent), between the A- and B- leads of the test resistor, at the recorder.
- (3) Adjust the current balance potentiometer to obtain zero volts  $\pm 5$   $\mu$ V on the meter.
- (4) Remove the potentiometer and 5 ohm resistors from the input.
- (5) Connect a test resistor, equal to the low end of the span, to the recorder input.
- (6) Adjust the ZERO potentiometer to set the recorder to zero.
- (7) Connect a test resistor, equal to the high end of the span, directly to the input.
- (8) Adjust the SPAN potentiometer to set the recorder to 100% of span.

- (9) Repeat Steps 5 through 8 until proper calibration is obtained.

#### **C. Ac Specific Conductance Ranges.** See Fig. 4-1(D).

The conductivity circuit employs a combination preamplifier/range card mounted in the preamplifier card location.

- (1) For recorder with automatic compensators, connect a resistor, equal to the 25°C value of the compensating resistor of the cell being used, to the A and B terminals of the recorder. Refer to the cell assembly to find this value. For fixed and manual compensators, this value (resistor) is not needed.

For concentration ranges, the reference temperature may be other than 25°C. In this case connect a resistor equal to the compensator's value at the correct reference temperature. See also note following Step 6.

- (2) Connect a resistor, equal to the low end of the span, to the A and C terminals.
- (3) Adjust the ZERO potentiometer until the pointer is at the low end of the scale.
- (4) Connect a resistor, equal to the high end of the span, to the A and C terminals.
- (5) Adjust the SPAN potentiometer until the pointer is set at the high end of the scale.
- (6) Repeat Steps 2 through 5 as necessary until no further adjusting is needed.

*NOTE: For concentration ranges, the SPAN and ZERO controls are not located on the preamp/range card but are instead located on the chassis side hanger bracket on the same side as the preamp. Use these controls the same as the regular potentiometer and proceed normally with the calibration.*

#### **4.1.3 Rayotube Ranges—See Fig. 4-1**

A Rayotube range card and a Rayotube module, which mount on the side of the recorder chassis, are required to measure and record the output of radiation detectors. The module contains a span adjust (emissivity compensator) potentiometer and a span select switch that provides a continuously adjustable span from 1 to 25 millivolts in two steps: 1 to 5 mV and 5 to 25 mV. The zero adjust potentiometer, located on the range card, provides 10% zero adjust for low-end suppression.

There are three checks required to assure accurate recorder operations. Proceed as follows:

#### *Current Offset*

- (1) Place a 10 k ohm resistance in series with the input source. This calibration resistor (approx 10 k) is

# *SX 165/250 Multipoint Recorder Calibration Procedures*

included in the recorder accessories kit, Section 8.  
(It is L&N Part No. 011156, 10 k ohms, 1/2 W, 10%.)

- (2) Apply an input to balance the recorder at approximately midscale.
- (3) Adjust the Current Offset potentiometer (R5) so that no pen shift is observed when the source resistance is switched from 10 k ohms to zero.

## *Voltage Offset*

- (1) Short the input (0 mV input), turn the Span Pot fully counterclockwise, set the span switch in the X1 position.
- (2) Adjust the Zero Pot until the recorder balances anywhere on the scale.
- (3) Adjust the Voltage Offset until there is minimum pointer shift when the span switch is toggled between X1 and X5.

## *Emissivity Compensator*

With the zero set to true zero the span should be adjustable as follows:

- (1) With the span switch in the X1 position, and the span pot in the extreme CCW position, the span should be 0.9 mV or less.
- (2) With the span switch in the X1 position, and the span pot in the extreme CW position, the span should be 5.5 mV or greater.
- (3) With the span switch in the X5 position, and the span pot in the extreme CCW position, the span should be 4.5 mV or less.
- (4) With the span switch in the X5 position, and the span pot in the extreme CW position, the span should be 25.5 mV or greater.
- (5) Final zero pot and span compensator setting to be such that the recorder calibrates per the range data supplied in the Rayotube Directions Book 277122 or Temperature—EMF Book 277161.