008-0027-00

SENSOTEC, INC.
2080 Arlingate Lane
Columbus, Ohio 43228
Phone (614) 850-5000
Facsimile (614) 850-1111
Toll Free (800) 848-6564

INSTRUCTION MANUAL FOR ***THE SA-SD***

GENERAL DESCRIPTION

The SA-SD is a two-channel analog voltage sum or difference computer. The unit accepts input signals in the range of -5 to +5 volts any of its "A", "B", or “C" inputs and provides an output of 0 to 5 volts or 4-20 mA proportional to A+/-B. The SA-SD can be programmed for either sum or difference by an internal slide switch. The “C" input is available for cascading. The SA-SD is compatible with the SA system power supply and mother board power bus. All connections necessary for field installation are made through the connector strip on the rear of the instrument. All controls needed for set-up and calibration are available on the front panel.

SPECIFICATIONS

The relationship between output and inputs is:

$$V_{out} = G\left(\frac{A +/- B}{2} + C + Z\right)$$

where: V out = output voltage from -5 to +5 volts
A, B, C input voltages in the range of -5 to +5 volts
G = gain = 1 +/- 20% adjustable
Z = zero = 0 +/- 1 volt adjustable

The output voltage can overrange to +/- 10 volts before clamping. For 4-20 mA output a similar relationship holds:

$$I_{out} = G\left(\frac{A +/- B}{2} + C + Z\right)$$

where: I out = output current from 4-20 mA positive only
A, B, C = input voltages in the range of -5 to +5 volts
G = gain = $\frac{16\ mA}{5\ volts}$ +/- 20% adjustable
Z = zero = 4 mA +/- 3.2 mA adjustable

here are three accuracy components to the SA-SD:

1. zero shift accuracy
2. gain stability
3. sum or difference symmetry

The zero setting stability referred to the output is 30 µ v/ degrees F out of 5 volts (0.006%/ degrees F) maximum, typically it is one-fourth of this value. The gain setting stability is +/- 0.005%/ degrees F. Symmetry refers to the relative amount of "B" it takes to equal (sum) or nullify (difference) the effects of "A" at the output. If V out = G (A + nB) , n is 1.000 +/- the symmetry error.

The SA-SD is calibrated at the factory in either the sum or difference mode as specified by the customer's order to a symmetry of 0.0001 volt out of 5 volts which is 0.002%. If the mode is field changed, the internal symmetry pot must be readjusted to achieve this accuracy. The temperature stability of symmetry is +/- 5 ppm/F.

The inputs are single ended and referenced to 0 volts or input common. If voltage output is selected, the output common is also connect to 0 volts. If 4-20 mA current output is selected, the return (output common) is internally connected to OVC. OVC is made distinct from the 0 volts (input and voltage output commons). Since OVC is required to carry higher currents, this arrangement prevents interaction between channels.

The input resistances are as follows:

"A" is 60 K ohms,
"B" is 40 K ohms,
“C" is 40 K ohms,

In the difference mode inputs "A” and "B" may be used as unity gain differential amplifier with a differential input resistance of 80 K ohms. The voltage output is protected against indefinite short circuits or an impressed voltage of +/- 25 v or a +/- 50 v surge for 1/120 sec half sine wave non-repetitive. These conditions will not permanently damage the unit. Nevertheless, long term short circuits and

impressed voltages cause internal heating which causes drifts from which it may take several minutes to recover .

The output impedance is less than 1 ohm with a current drive capability of 2 mA (2.5 K ohms load) at 5 volts without loss of accuracy. Actual short circuit current may be 20 to 30 mA.

WIRING INSTRUCTIONS

Power should be OFF while wiring the unit. Refer to Drawing 0010039-00 for SA-SD rear connector wiring. This diagram shows the connections for standard wiring as well as for cascading two channels to sum four inputs. The input and output commons (ØV) are internally connected to circuit ground. The circuit ground is isolated from line or case ground. This prevents ground loops if the customer's scanner or readout input is grounded. If the customer's input is not grounded, the one of the output commons should be connected to line ground for best shielding and noise rejection.

FRONT PANEL CONTROLS

The "ZERO" adjusts the zero offset of the amplifier. The "GAIN" adjusts the slope of the input-to-output transfer function.

The four front panel buttons marked A1, B1, A2, and B2 for the "A" and "B" inputs to channel 1 and channel 2 respectively cause the OUTPUT to read the contribution of only the input selected. For example: if in the sum mode input "A" is 5 volts, input "B" is 3 volts, and input "C" is zero and ZERO and GAIN are adjusted so that the output is 0 volts at zero and 3.8 volts under these input conditions; then pressing "All yields an outpu of 2.375 volts and "B" yields 1.425 volts. Note that pressing these buttons reads the contribution to the OUTPUT of the input, not the value of the input itself. Also, the contribution of "B" in the difference mode is negative signal. This may sometimes present problems in 4-20 mA output systems which cannot give a negative output.

FIELD SET-UP

1. Allow unit to warm up about 10 minutes.

2. With "A” and "B" front panel buttons depressed, adjust zero control for zero output.

3. With ØV applied to “C" input and a calibrated full scale signal applied to the "A” and "B" input, adjust the GAIN control for 5 volts or 20 mA output.

4. Recheck zero.

CIRCUIT DESCRIPTION

Refer to schematic 013-0158-00. The signals from the "A", "B", an “C" inputs go directly to the A-1, B-1, A-2, B-2 switches on the front panel. The A switches ground "B" and “C" signals making B and C equal zero so that the output only reads the contribution of A. The B switches ground A and C similarly. The "A” and "B" signals from the switches to a resistor network and operational amplifier ØA1 which can be switched to sum or difference mode with the internal sum/difference switched. Potentiometer PAB adjusts the input symmetry. It must be readjusted if the unit is switch from sum to difference mode. The output of ØA1 is (A+/-B)/2. This output is summed to input “C" at the input of operational amplifier ØA2. Potentiometer PC adjusts the symmetry between A +/- B and C. It is fact set and should not need adjustment. ØA2 is set with a gain of 2 +/- 20 The zero adjustment pot is buffered by ØA3 and adjusted for either 5 or 10 volts excitation. The 250 ohm resistor and two 13 volt zeners on the outp of ØA2 protect it from surges of +/- 50 volts for 1/120 sec. half sine wave.

For 4-20 mA output, the 4-20 mA add-on board (Schematic 013-0130-001 is added to the circuit between ØA2 and the output pin.

All resistors in this circuit are metal film (RN55 or RN60) 1% tolerance except those in the summing networks which are .1% wirewound a the 250 ohm, 3 watt at the output for surge protection. All potentiometer are cermet multiturn.