

# SB104A

## Rotary Position Sensor

BLN-95-8971-4

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### DESCRIPTION

The SB104A Rotary Position/Steering Sensor detects changes in the orientation of construction machinery. Grade changes are detected through a horizontal wand, skate or ski attachment that follows a stringline or hard surface reference. Steering changes are detected through a vertical wand. Deviations from the pre-set null move the sensor and rotate the rotor of a non-contacting microsyn sensor. As the rotor turns, ac voltages are created in the secondary coils and are compared in an external amplifying stage to activate the machine's hydraulic servovalves.

In a typical application, the output of the SB104A is used as an input for the R7232A Proportional Indicating Controller. The output of the controller drives a MCV103/113 Servovalve to reposition the mobile equipment as deviations occur.



### FEATURES

- Infinite resolution microsyn contactless transducer
- Easy to install
- Two hubs for attaching grid or ski to either side of sensor
- Multiple attachment angles
- Adjustable spring bias on the hub varies the grid to stringline tension
- Rugged aluminum housing
- Resists corrosion, moisture and other damaging environmental effects.

### ORDERING INFORMATION

#### SPECIFY

1. Model Number SB104A
2. Controller, if needed; R7232A
3. Cable; KW01009 Sensor Cable.  
(Must be used with the R7232A, Indicating Controller. Mates with Bendix-type MS3102A-14S-6P (K04183) connector. Has an MS3106A-14S-6S (K04185) connector on both ends.)

#### ACCESSORIES

Order the necessary parts from the list below.

1. Part Number KG07002, Steering Follower Wand
2. Part Number KG04003, Right Angle Grade Follower
3. Part Number K09274, Grid Arm
4. Part Number KG02001, Ski Runner (must be used with the K09274 Grid Arm)
5. Part Number KG06001, Skate Runner (must be used with the K09274, Grid Arm and KG02001 Ski Runner)

## TECHNICAL DATA

### ELECTRICAL

#### MAXIMUM INPUT VOLTAGE

1. 0.7 V-ac RMS, typical, with a 440 Hz square wave input from the R7232A Proportional Indicating Controller
2. 2.5 V-ac RMS maximum with a 60 Hz input.

#### OUTPUT VOLTAGE

With a 0.7 V-ac, 440 Hz primary input, each secondary coil voltage varies from 1.1 V-ac at one travel limit to 2.3 V-ac at the other and 1.7 V-ac at null.

#### GAIN

1. 0.6 millivolts dc per 0.001 inch vertical deflection per 0.7 V-ac excitation from a typical controller diode demodulation bridge, such as the in the R7232A.
2. 0.45 millivolts ac per 0.001 inch vertical deflection per V-ac excitation with the secondary coils wired in series opposing with a 10 K resistance.
3. 0.30 millivolts ac per 0.001 inch vertical deflection per V-ac excitation with the secondary coils as half a bridge circuit and two 10 K resistors as the other half.

### MECHANICAL

#### SHAFT TORQUE TO ROTATE HUB

24 gram-centimeters maximum within 5° of null

#### NULL

Electrical null is located with the hub roll pins equal distance from the case stop pin.

#### TRAVEL

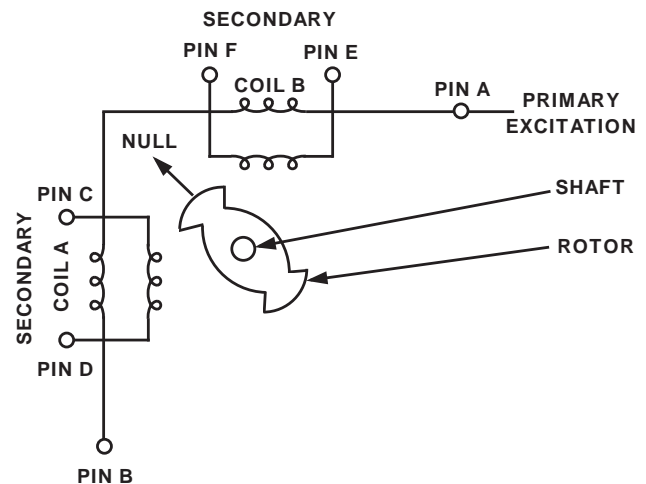
$\pm 20^\circ$  minimum from null

### THEORY OF OPERATION

An excitation of up to 0.7 V-ac (440 Hz square wave) is supplied, usually by the R7232A Panel Mount Amplifier across Pins A and B of the SB104A's MS connector. See the Connection Diagram. As the command signal from the stringline or reference surface moves up/down (grade) or in/out (steering), the SB104A's follower is moved, resulting in rotation of its hub. As the non-contact, stainless steel rotor connected to the hub moves toward one secondary and away from the other, the voltage induced in the coil toward the rotor is increased, the opposite being true of the secondary. At the full 20° of travel, the voltage across the secondary proximate to the rotor is 2.3 V-ac, while the other voltage is 1.7 V-ac.

The signals from the secondaries are sent to two bridge rectifiers in the R7232A, where each is converted to dc. At null the voltage across both capacitors is equal to the voltage of the reference potentiometer. When a changed signal from the secondaries is introduced, the voltages across the capacitors are offset, inducing a differential between the reference and lead between the capacitors. This differential serves as the positive or negative correction signal that is amplified and then supplied to the machine servovalves to close the control loop. Control action drives the machine to a position such that the sensor error signal to the R7232A is at null.

### BLOCK DIAGRAM

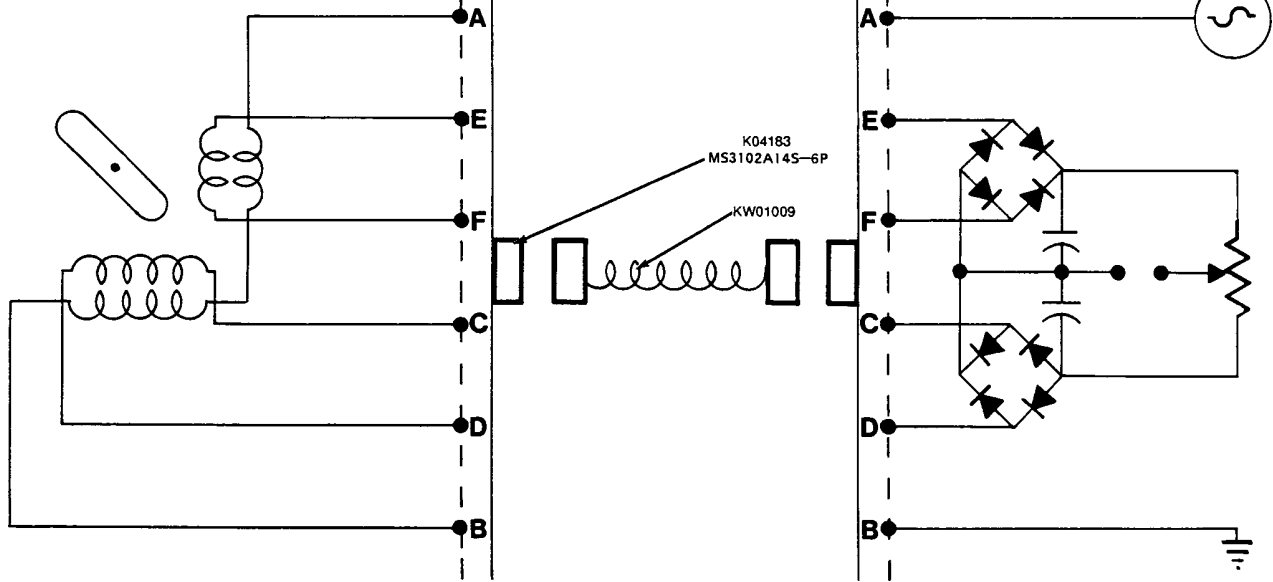


921A

# CONNECTION DIAGRAM

SB104A

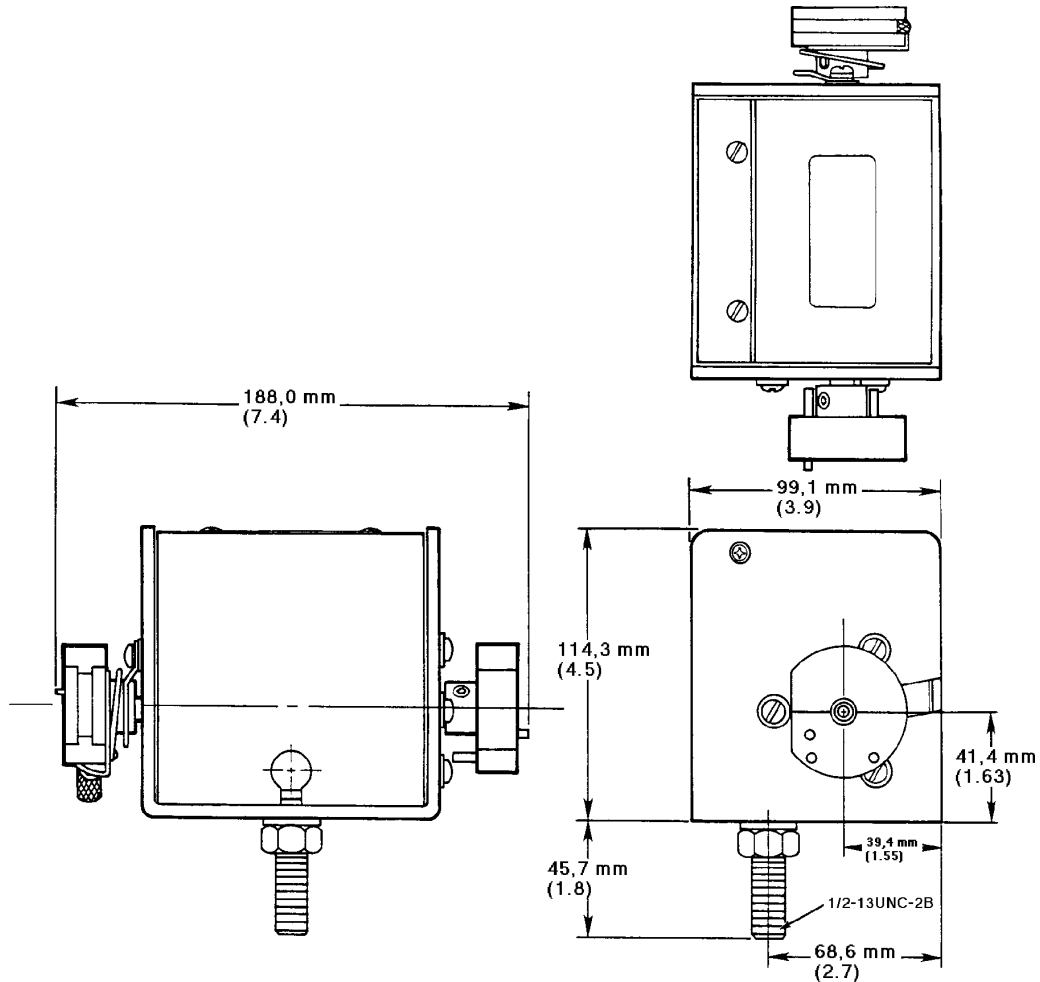
R7232A



1161A

Wiring Schematic of the SB104A and R7232A.

# DIMENSIONS



Dimensions of the SB104A in Millimeters (Inches).

1160

## ENVIRONMENTAL

### SHOCK

50 g's for 11 milliseconds. Three shocks in both directions of the three mutually perpendicular axes for a total of 18 shocks.

### VIBRATION

Withstands a vibration test designed for mobile equipment controls consisting of two parts:

1. Cycling from 5 to 2000 Hz in each of the three axes.
2. Resonance dwell for one million cycles for each resonance point in each of the three axes.

Run from 1 to 46 g's. Acceleration level varies with frequency.

### HUMIDITY

After being placed in a controlled atmosphere of 95% humidity at 49° C (120° F) for 10 days, the sensor will perform within specification limits.

### TEMPERATURE RANGE

0° to 77° C (32° to 170° F) operating  
-40° to 77° C (-40° to 170° F) storage

### DUST

After being placed in a controlled atmosphere of dust simulating outdoor conditions for 24 hours, the SB104A will perform within specification limits.

### DIMENSIONS

See Figure 1.

## INSTALLATION

### MOUNTING

The SB104A can be mounted on either side of the machine in any orientation, depending upon the location of the grade or steering reference. With the SB104A at null and a follower equivalent to a six-inch radius arm attached to the sensor at a 45° angle down as referenced to the top surface of the sensor, the null touch point of the follower will be approximately 5.5 inches below the centerline of the mounting bolt. Figure 3 illustrates the dimension. When the arm is at 45° angle up, the touch point is approximately 3.25 inches above the mounting stud. The follower may also be attached so that it is parallel to the top surface of the SB104A.

Once the mounting location is determined, drill a 14 mm (9/16 inch) clearance hole for the mounting bolt. Remove the nut and lockwasher from the mounting bolt. Slip the mounting bolt through the clearance hole. Replace the lockwasher and nut and tighten the nut firmly.

The follower may be attached to either hub of the SB104A. The KG04003 right angle grade follower adapts to almost any grade application. The attachment can follow a stringline at a 45° angle above or below the SB104A, or it can follow the stringline horizontally. Figures 4, 5, 6 and 7 exhibit the possible ways of attaching the right angle grade follower. Note the direction of travel for each.

Guide holes on the KG07002 Steering Follower are identified in Figure 8. This follower may be attached to either hub of the SB104A. Unlike the right angle grade follower, it is mounted vertically for steering applications. See Figure 9.

Other followers include a ski and skate that attach to the K09274 grid arm. Figure 10 shows the ski and skate assembly. These followers are used to follow hard reference surfaces for grade applications. See Ordering Information for Part Numbers.

After the follower has been installed, adjust the spring bias adjustment on the hub so that the follower exerts a slight

tension on the stringline at null. Note that when the hub roll pins are centered around the case stop pin, the SB104A is at null.

### WIRING

All wiring connections are made through a Bendix MS-type connector located under the top cover. Figure 11 shows the SB104A with the cover removed. A fully assembled cable with mating connectors is available to make all necessary wiring between the SB104A and the R7232A Panel Mount Amplifier. See Ordering Information for Part Numbers.

After mounting the SB104A and R7232A, attach the cable to each unit. Replace the cover with the cord through the notch. A strain relief is included with the SB104A. Place it on the cable and insert it into the notch to protect the cable from pulling loose. Be sure the cable extends through the notch in the cover and is not captured behind the edge.

If the SB104A is used with an amplifier other than the R7232A, use Figure 2 to determine the input and output pins of the Bendix connector. The voltage between Pins C and D of the unit will equal the voltage between Pins E and F at the center of travel (i.e., with the stop hub centered).

When connected to the R7232A and with the follower at null, counterclockwise rotation of the left hub will result in a larger secondary voltage between Pins C and D than the voltage between Pins E and F. Counterclockwise rotation will also result in counterclockwise deflection of the R7232A deviation meter, and Pin C of the amplifier output connector will be positive with respect to Pin D.

If the SB104A is used in a system with an R7232A, follow the startup procedure in Bulletin 95-8982 supplied with the R7232A. No further adjustments to the sensor are necessary.

## TROUBLESHOOTING

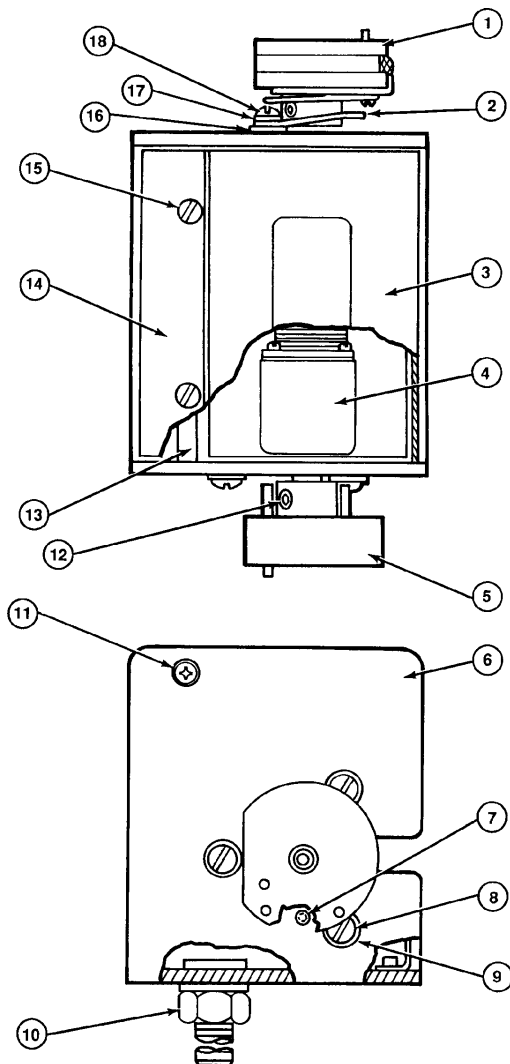
Should a system malfunction develop, the first step must be to isolate the problem component of the system. Preliminary checks should include examination of the cables and leads. Look for damaged or broken wires. Examine areas where shorting may occur. Check the system power supply voltage, making sure it is greater than 11 Vdc if using and R7232A.

Check all other components within the system. If all of the components operate satisfactorily, replace the entire SB104A. If it is used with the R7232A, use the Troubleshooting Section of the R7232A Bulletin 95-8982 to check the system.

If VOM is available, several resistance checks can be made on the SB104A. Disconnect the cable and refer to Figure 2.

1. Circuit should be complete between connector pins:  
A and B  
D and C  
E and F
2. Circuit should be open between connector pins:  
A and F  
A and D  
D and F

## SPARE PARTS



ITEM NUMBER	PART NUMBER	DESCRIPTION
1	K04232	Left Hub Assembly
2	K03368	Hanger Assembly
3	K04233	Cover
4	K04224	Replacement Rotary Pos. Sensor
5	K04228	Rt Hub Assy With Stop Pin
6	K02920	Case Assembly
7	K00409	Set Screw, 10-32 X 1/2, Oval End
8	K06293	Screw, 10-32 X 1/2
9	K00411	Flat Washer
10	K04758	Bag Assembly
11	K06269	Round Head Screw, 8-32
12	K04446	Set Screw, 1/4-28, 0.25, ST
13	K04193	Cross Bracket
14	K04364	Cover
15	K06258	Screw
16	K00411	Flat Washer
17	K00391	Flat Washer
18	K06291	Screw, 10-32 X 3/8

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## **CUSTOMER SERVICE**

### **NORTH AMERICA**

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#### **DEVICE REPAIR**

For devices in need of repair or evaluation, include a description of the problem and what work you believe needs to be done, along with your name, address and telephone number.

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