INSTRUCTION MANUAL
MODEL 2792B
9 CHANNEL ISOTRON™ SIGNAL CONDITIONER

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SECTION 1

GENERAL DESCRIPTION

1.1 INTRODUCTION

The Endevco model 2792B 9 Channel ISOTRON™ Signal Conditioner is designed for use with Endevco ISOTRON™ accelerometers or any other integral electronics piezoelectric transducer which will operate with a selectable constant current power supply of 4 or 10mA with a compliance voltage of +20V.

The 2792B will accept an input voltage of up to +20V which is the sum of the quiescent transducer voltage (bias voltage typically +10 volts d.c.) and the transducer output signal voltage (typically 5 volts peak). It has a flat frequency response from 1Hz to 30kHz (±5%) and provides a decoupled output signal of ±5V pk into output loads of 2000 ohms or greater. The output voltage of the amplifier is proportional to the transducer signal output. The available output current is ±2mA minimum.

Normalisation of the accelerometer's sensitivity is achieved by the 4-decade push-up/push-down (S1-S4) switches. (These switches also can be used to apply additional gain or attenuation to the vibration signal being measured, see Section 3.

The gain of the amplifier is set by a two position switch (S5) with gains of x1 and x10.

The 2792B is designed for stand alone operation or it can be mounted in a 19" instrument rack.

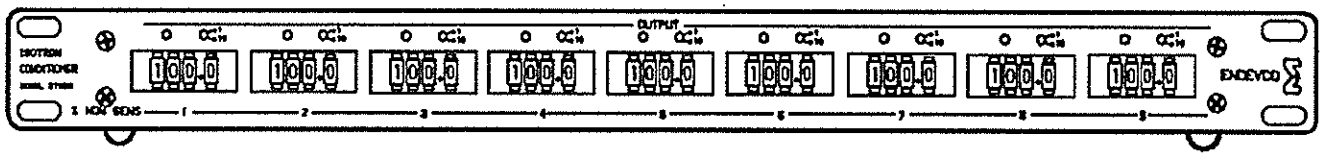

Figure 1

1.2 INPUT POWER REQUIREMENTS

The 2792B signal conditioner operates from a.c. mains voltage with a rear panel selector for 110 to 125V or 200 to 250V ac 50 to 60Hz. It will also operate from 200V 400Hz aircraft supplies.

1.3 INPUT AND OUTPUT CONNECTORS

The input and output connectors are electrically isolated BNC type with one side connected to circuit common.

SECTION 2

INSPECTION AND INSTALLATION

2.1 INSPECTION

The signal conditioner is packed in a protective bag and in a primary cardboard carton. This carton will be packed in a larger padded carton to prevent in–transit damage. However, upon receipt of the unit, the customer should inspect the signal conditioner to be certain that no damage has occurred during shipment. Obvious damage should be reported immediately to the carrier.

Inspect the contents of the shipping carton and verify that the mains power cable and four self–adhesive rubber feet have been packed with the signal conditioner.

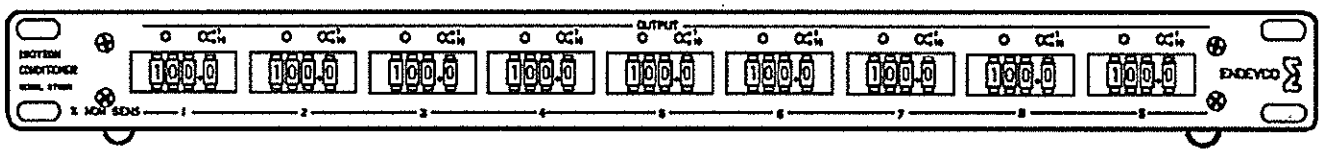

Figure 2

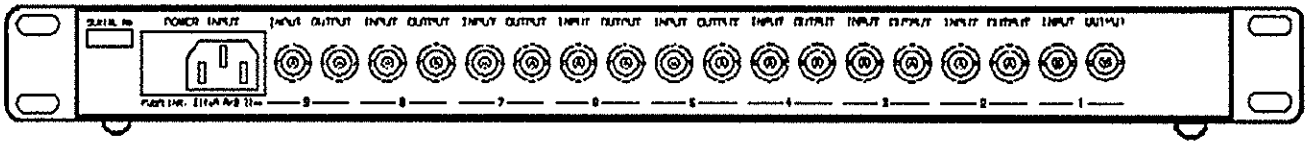

Figure 3

2.2 INSTALLATION

The signal conditioner is supplied in a 1U 19" rack mounting case. For bench use we recommend that the four adhesive rubber feet be attached to the lower panel of the box.

(a) Check that the power supply selector is set for the correct input voltage.

(b) Connect the transducer cable to the input connector (BNC) on the rear panel of the signal conditioner.

(c) Connect the monitoring device to the output connector (BNC) on the rear panel.

(d) Set the gain switch (S5) to x1, and the % of nominal sensitivity switches (S1–S4) to read 100.0%, as shown below on figure 4 channel 1.

(e) The signal conditioner is now ready for operation. When the power is switched on, the Power–On" green LED will light and the channel bi–colour "Status" LEDs should indicate green.

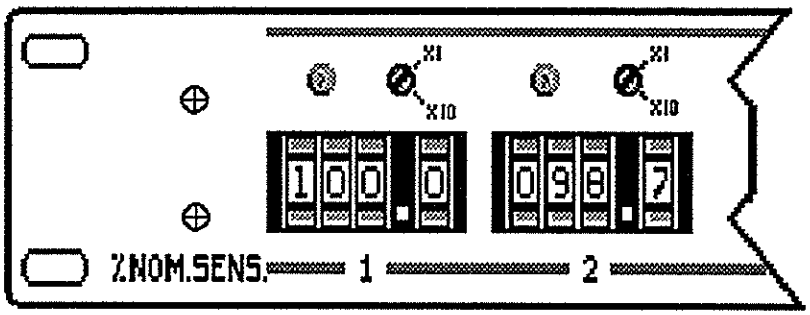

Figure 4

SECTION 3

OPERATION

GENERAL

This section describes the functions of the controls and connectors and provides instructions for using the signal conditioner.

3.1 CONTROLS AND CONNECTORS

All the operating controls for the signal conditioner are located on the front panel. Connectors for the mains input, transducer input and signal output are to be found on the rear panel. Figures 2, 3 & 4 show the controls and connectors.

3.2 OPERATING INSTRUCTIONS

Connect the ISOTRON accelerometer to the input socket (J1) of channel 1. Connect the readout instrument via a coaxial cable to the output socket (J2) of channel 1.

The 2792B is supplied with the constant current source set to 4 mA (Internal Link LK1 position 1–2). If 10 mA is reqired, set link LK1 to position 2–3.

Switch on the mains and allow 15 minutes for the 2792B to stabilise at operating temperature.

Normalise the system (ISOTRON accelerometer and signal conditioner) by performing the following steps:–

Note the voltage sensitivity expressed in mV/g on the calibration certificate supplied with the accelerometer. Assume, for the purpose of this example, that the voltage sensitivity is 9.87mV/g.

On the four decade push button switch assembly adjust the first switch (left hand) to read 0. The second switch to read 9. The third switch to read 8. The fourth switch which is the right hand side of the decimal point, to read 7.

This switch setting indicates that the accelerometer we are using has a

sensitivity of 98.7% of its nominal sensitivity of 10 mV/g.

Check that the gain adjustment switch (S5) is in the "x1" position. The signal conditioner will now be providing an output of 10 mV/g on channel 1. Figure 4 channel 2 shows this set-up arrangement.

3.3 GAIN ADJUSTMENT

The 2792B is normally operated with an overall gain of x1 or x10, selected by the gain switches on the front panel.

However, it is possible to set the amplifier to have a broader range of gain settings by using a combination of the gain switch and the "% of nominal sensitivity" switches.

Assume that the gain switch (GS) is set to x1. When the "% of nominal senstivity" switches (%NSS) are set to 100.0% the gain of the amplifier is unity.
When the %NSS are set to 050.0%, the gain is x2. When the %NSS are set to 200.0%, the gain is x0.5.
Thus the gain increases as the %NSS reading reduces, and vici-versa.

The gain of the amplifier can be set as follows:-

$$= \frac{100 \times \text{GS setting (either 1 or 10)}}{\%\text{ of nominal sensitivity setting}}$$

3.4 NORMALISATION AND GAIN

If you want to normalise the amplifier gain for your particular accelerometer and also adjust the gain, the setting of the %NSS should be as follows:-

To add gain of "A", the setting of the %NSS should

$$\frac{\text{actual sensitivity}}{\text{nominal senstivity}} \times 100 \times \frac{1}{A} \times \text{GS (1 or 10)}$$

3.5 NOTES ON NORMALISATION

Normalisation is the adjustment of the gain of the amplifier to compensate for the difference in the transducer's sensitivity from its nominal value.

The 2792B uses the 4-digit push-up/push-down switches to make this adjustment. The following examples, on page 9, show the settings that have to be made on the "% of nominal sensitivity" switches, for different transducer sensitivities and the resulting output from the amplifier.

For Isotron™ accelerometers having other nominal sensitivities than 10 mV/g, the "% of nominal sensitivity" setting can be calculated as follows:-

$$\%\ \text{of nominal sensitivity} = \frac{\text{actual sensitivity}}{\text{nominal sensitivity}} \times 100$$

The table on page 9 gives examples of settings for Isotron™ accelerometers having different nominal sensitivities.

Column 1 gives 3 sensitivity figures, a lower than nominal, the nominal and a higher than nominal sensitivity.

Column 2 shows the setting of the "% of nominal sensitivity" switches for correct normalisation of that accelerometer.

Column 3 shows the output of the amplifier in mv/g.

3.6 USE WITH PIEZOELECTRIC ACCELEROMETERS

Piezoelectric accelerometers can be used with the 2792B in conjunction with an Endevco Model 2771A-XX Remote Charge Convertor (RCC). The 2771A's are constant current powered and are therefore compatible with the 2792B. The 2771A's are available with gains of x0.1 (2771A-01), x1 (2771A-1) and x10 (2771A-10).

Isotron™ Accelerometer Sensitivity in mV/g	2792B Signal Conditioner " % of nominal sensitivity"	Output mV/g
0.045	90.0	0.050
0.050	100.0	0.050
0.056	112.0	0.050
0.096	96.0	0.10
0.100	100.0	0.10
0.109	109.0	0.10
0.233	93.3	0.25
0.250	100.0	0.25
0.272	108.0	0.25
0.965	96.5	1.0
1.000	100.0	1.0
1.034	103.4	1.0
1.96	98.0	2.0
2.00	100.0	2.0
2.03	101.5	2.0
4.97	99.4	5.0
5.00	100.0	5.0
5.03	100.6	5.0
9.56	95.6	10.0
10.00	100.0	10.0
10.32	103.2	10.0
98.5	98.5	100
100.0	100.0	100
103.6	103.6	100
485.7	97.1	500
500.0	100.0	500
509.3	101.9	500
995	99.5	1000
1000	100.0	1000
1078	107.8	1000

SECTION 4

THEORY OF OPERATION

4.1 GENERAL DESCRIPTION

The circuit diagram Y8-22/6 Sht 1 shows the power supply and Y8-22/6 sheet 2 one of the nine identical signal channels.

Each signal channel provides a constant current source to power the transducer followed by a variable gain amplifier set by the 4-decade push-up/push-down switches (S1-4) and a further gain of x1 or x10 set by the gain switch (S5).

The output from each channel exceeds 5V peak into 2 Kohm load.

A bi-colour LED on each channel indicates correct connection or open or short circuit in the transducer or its connecting cable.

The mains power supply provides d.c. power to all channels with a green LED indicating "Power-On". A mains voltage selector panel allows operation from 220/240V or 100/120V at 50/60Hz, and 200V 400Hz aircraft supplies.

4.2 INPUT CIRCUIT

The transducer is connected via socket J1 between Pin 5 of IC1b and OV. The input circuit consisting of a quad op-amp IC1b together with R7,R8,R41 & R42 provides the constant current drive required by the transducers. It also buffers the transducers a.c. output signal and couples this to C4 from a low source impedance.

4.3 LED "STATUS" INDICATORS

LD1 is a green/red bi-colour LED which indicates green if the input socket is connected to a good Isotron transducer; indicates red if the transducer/cable is short circuit; is turned off if no transducer is connected or if the transducer/cable is open circuit.

A normal transducer will produce a voltage drop of 8V to 12V when connected to J1. IC1a pins 1,2 & 3 will therefore sit between 9.5 and 13.5V, IC1a pins 1 & 7 are at -3.5V, Q2 is off, hence the "status" green LED is lit via R43

With a short-circuit input connection, pin 3 of IC1a sits approximately 1.5V above signal ground. Pins 2 and 3 of IC1a, are at 1.5V. The LED detection circuit will monitor J1 input which is now near 0V, IC1a pin 1 will be at -1.2V, pin 7 will be at 20V thus turning on Q2 and turning on the "status" red LED.

With an open circuit input condition, IC1d pin 7 is at -3.5V, IC1a pin 1 will sit at between 20.5 and 25.5V, turning on Q2 and thus extinguishing the "status" LED.

4.4 ADJUSTABLE SENSITIVITY STAGE

The low impedance signal from C4 is amplified by IC3, a standard op-amp inverter stage in which the feedback resistors are selected by four front panel digital switches S1 to S4. The front panel read-out from the digital switches is presented in decade fashion in terms of "% of transducer nominal sensitivity".

Trimming resistor RV2 enables tolerances in the signal circuits to be taken out using a simple calibration procedure.

4.5 OUTPUT STAGE

The output from IC3 is a.c. coupled to the output amplifier IC2 which has a gain of x1 or x10 selected by panel gain switch S5, the output being connected to socket J2. Maximum output exceeds 10V peak.

4.6 REGULATORS

To ensure negligible crosstalk between channels, each channel has its own IC-regulated +25V line.

The -5V line is common to all channels since crosstalk via this route is insignificant owing to the rejection characteristics of the op-amps.

4.7 POWER SUPPLY

This is conventional, using a split primary shielded toroidal mains transformer followed by diode bridges and electrolytic smoothing capacitors. Unregulated +34V and IC-regulated -5V are fed to all channels.

SECTION 5

IN-SERVICE RECALIBRATION PROCEDURE

1. With nominal power input:-

   Check that the outputs of individual power supplies (Reg 3) are approximately +25 volts and the common supply (Reg 2) output is approximately -5 volts.

   After establishing that the supplies are functioning proceed as follows:-

2. Check operation on each channel the "Status" LED by observing it is extinguished with no connection of J1 (Rear Panel); red with a short circuit at J1; for "normal operation with a good transducer the LED will be green.

3. Connect a suitable instrument to measure d.c. mA across J1 and it should read 4 mA (with Link LK1 in position 1-2).

4. Connect the input test circuit, see figure 5. Set the "% of nominal sensitivity" switches to 100.0, and the gain switch S5 to x1. Adjust the signal generator to provide an input of 1.000V RMS at 1kHz. Check that the output of that channel, is 1.000V RMS ±1%, if not re-adjust/repair as per paragraph 6

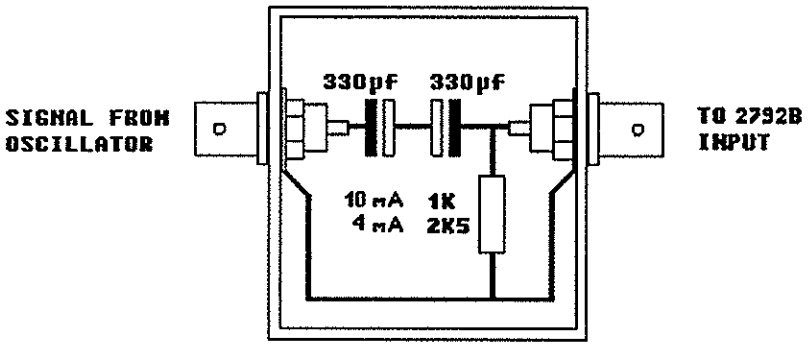

Figure 5

5. Change the input to 5.000V RMS at 1kHz and check the output is 5.000V RMS ±1%, if not re-adjust/repair as per paragraph 6. If satisfactory proceed to paragraph 7.

6. Re-adjustment procedure: Apply an input of 1.000V RMS at 1kHz (using the input circuit shown) and check that the signal at IC1b Pin 7 is 1.182V, using RV2, adjust the output signal at J2 to 1.000V RMS ±5mV. Then repeat the test in paragraph 5.

7. Reduce the input signal to 100mV RMS, with the gain switch S5 set to x 10. Check that the output at the rear panel is 1.000V RMS ±1%.

8. "% of Nominal Sensitivity" Switches Check: Set the gain switch S5 to x1. Apply an input signal at 1kHz, and adjust to give an output of 1.000V RMS with "% of nominal sensitivity" switches set to 100.0.

   Change the "% of nominal sensitivity" switches to 50.0% and the output signal should be 2.00V ±1%.

   Change the "% of nominal sensitivity" switches to 110.0% and the output signal should be .909V ±1%.

9. Noise:
   With the input terminated with a screened 100 ohm resistance, set the gain switch to x1. First set the "% of nominal sensitivity" switches to 50.0% to set the gain of the amplifier to x2. Measure and record the RMS value of the residual noise, it should be less than 0.4mV. Increase the gain to 20 by switching the gain switch to x10, and re-measure. The noise should be less than 2mV.

10. Frequency Response:
    With the "% of nominal sensitivity" switches set to 100.0% and the gain switch set to x1, adjust the input at 1kHz to give an output of 1.000V RMS. Maintain the input level, change the frequency and check that the output at 1Hz and 30kHz is within ±5% of 1V RMS.

WARRANTY

ELECTRONIC EQUIPMENT

ENDEVCO warrants each new electronic instrument to be free from defects in material and workmanship for one year from date of shipment to the original purchaser. This warranty does not extend to units that have been misused or used in violation of ENDEVCO recommendations, or to units that have been altered or repaired outside ENDEVCO's factory. Defects covered by this warranty will be remedied at no charge, provided the instrument is delivered to the factory with all transportation charges prepaid. If, upon examination, it is found that the defect is not within the scope of this warranty, a statement of repair charges and a request for authorization to proceed with the repair will be submitted.

The above warranty period does not extend to new cable assemblies, mounting accessories, connectors and other non-serialised products which are only warranted to meet applicable ENDEVCO specifications when shipped from our factory.

The liability of ENDEVCO under this warranty is limited to repair or replacement of any defective instrument within the sole discretion of ENDEVCO. The foregoing warranty is exclusive and in lieu of all other warranties express or implied.