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INTRODUCTION

This manual describes the function, theory of operation, and operating procedures for the System 6 Dual Pressure Module.

Section 1 briefly describes the function of the Dual Pressure Module and its specifications. This section also describes and cross-references each control, indicator, or connector, to a number keyed to the panel illustrations.

Section 2 discusses basic theory, a discussion of transducers and provides a brief description of how the Dual Pressure Module works.

Section 3 provides information about additional equipment necessary to operate the Dual Pressure Module. This section also describes how to connect the transducer and chart recorder, how to calibrate the system, and how to perform an end-to-end test to ensure the system is ready for data collection.



1. DUAL PRESSURE MODULE

1.1 FUNCTION

The Dual Pressure Module is a precision two channel transducer amplifier configured to signal condition outputs of commonly used strain gage full or half bridge pressure transducers. The two channels are separate and independent of one another-sharing only a common Bridge Excitation and Calibration Circuit. The amplifiers incorporate active filters to set the signal bandwidth from 0 to 100 Hz. In addition each channel has an active averaging post filter whose output is available simultaneously with the prime signal.

Front panel controls for each channel provide the ability to set the GAIN, OFFSET and BALANCE necessary to interface the low level transducer signal to a high level output signal necessary for driving recording, display, and data acquisition devices.

1.2 SPECIFICATIONS

DC Bridge Excitation Voltage 5.000 V \pm 5 mV
DC Bridge Excitation Current 40 mA max

Pressure Amplifier

GAIN 182 - 2000 (adjustable)
Input Impedance 200K ohms
Output Voltage 12V @ $R_L \geq 10K$; \pm 10V @ $R_L \geq 2K$
Active Low Pass Filter $f_c = 100$ Hz (-3db @ 90 Hz)
Active Averaging Filter -3db @ 0.2 Hz
(MEAN Pressure Output)
OFFSET Range \pm 5.2 V (referenced to Output)
Input BALANCE Range \pm 15 μ A (summed to transducer output)
CALIB Reference Signal 2.50 mV
Output Polarity Switchable (+Run, -Run)
Input Receptacle HIROSE P/N HR10-7R-6S
Mating Input Plug HIROSE P/N HR10-7P-6P



1.3 FRONT PANEL CONTROLS

NOTE: The number preceding each item corresponds to its location in Figures 1 & 2Error! Bookmark not defined..

56, 61 FUNCTION SWITCH

The FUNCTION SWITCH is used to select one of four possible inputs to the signal conditioning amplifier:

CALIB - The precision 2.50 mV is connected.

ZERO - The input is shorted.

-RUN - A positive going input signal will be negative going at the output (inverting).

+RUN - A positive going input signal will be positive going at the output (non-inverting).

53, 58 BALANCE

The BALANCE control is a 10 turn potentiometer used to inject a balancing current into one output node of the transducer bridge allowing transducer offsets to be balanced. The range of balance current is $\pm 15\mu\text{A}$ which corresponds to $\pm 2.6\text{mV}$ using a 350 ohm bridge.

55, 60 GAIN

The GAIN control is a 10 turn potentiometer connected in the amplifier chain that allows the overall gain from input to output to be adjusted over the range of 182 to 2000.

57, 62 OFFSET

The OFFSET control is a ten-turn potentiometer used to DC offset the amplifier output over the range of $\pm 5.2\text{V}$.

54, 59 TRANSDUCER INPUT CONNECTOR

The connector is a miniature, keyed, 6 position, quick disconnect interface to the transducer cable. Figure 1 shows the input connector with pin and key locations.



Figure 1 Dual Pressure Module Front Panel



1.4 REAR PANEL FOR DUAL PRESSURE MODULES

39 PRESSURE "A" OUTPUT (PHONE)

The high level output signal of channel A.

40 MEAN PRESSURE "A" OUTPUT (PHONE)

The high level output signal of channel A after post filtering to provide a "mean" signal.

50 PRESSURE "B" OUTPUT (PHONE)

The high level output signal of channel B.

51 MEAN PRESSURE "B" OUTPUT (PHONE)

The high level output signal of channel B after post filtering to provide a "mean" signal.



DUAL PRESSURE MODULE

Figure 2 Dual Pressure Rear Panel



2. THEORY OF OPERATION

2.1 OVERVIEW

Pressure transducers based on the well established Wheatstone Bridge principal using resistive elements for the bridge legs are typically a low level device. Full scale output signals range can range from less than 1 mV to over 10 mV. These low level signals must be signal conditioned by amplification, filtering and offsetting in order to be usable by display, recording and data acquisition devices.

In a typical application the transducer will be selected that is best fitted for a particular pressure measuring task. Considerations will include: the pressure range to be measured, the ease of attachment of the transducers to the pressure source and frequency response. The sensitivity or gage factor will dictate the gain required to amplify the full scale transducer signal to the full scale display or recording signal. Initial unbalance of the transducer bridge can be compensated with the BALANCE control. Control of output offset and polarity are provided to accomodate output options.

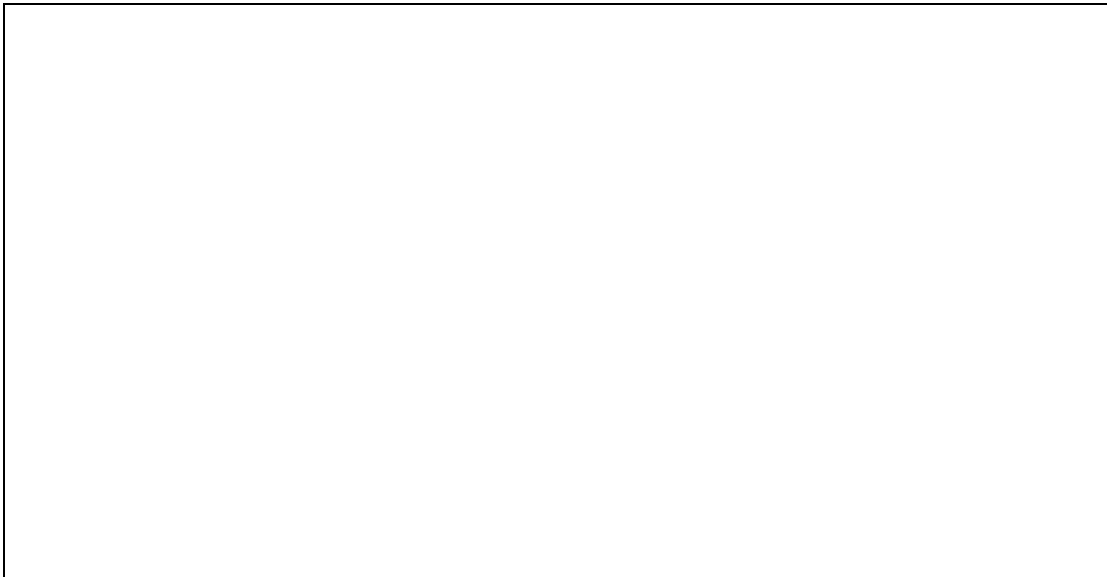


Figure 3 Simplified Block Diagram

AMPLIFIER (see Fig 3)

Block A is the common 5 volt excitation supply whose output is centered around system ground (+2.5V to -2.5V). The supply is regulated by a precision 2.5V reference. The regulator is capable of supplying 40 mA bridge excitation currents.

Block B is a two stage balanced differential to single ended DC instrumentation amplifier. This block has a fixed gain of 100. Offset and gain control are implemented in block C which has an additional gain of 5.23. Block D is a four pole active filter having a gain of 3.84 cornering at 100Hz. Block E a two pole averaging filter having a gain of 1 cornering at .2Hz. GAIN control has a range of .091 to 1 so the overall gain is:

$$(100) (.091 \text{ to } 1) (5.23) (3.84) = 183 \text{ to } 2008$$



DUAL PRESSURE MODULE

The OFFSET control is used to DC offset the operating point of amplifier C over the range ± 1.36 volts. This offset range, referred to the module output, is ± 5.23 volts.

The BALANCE control is used to initially balance the transducer at a reference pressure (ie., 0 mm Hg). The network is proportioned to sum ± 15 uA into the output node of the transducer bridge. Using the standard sensitivity of 50 uV/V/CmHg and a bridge impedance of 350 ohms, the balance control would have the capability of balancing a bridge offset of ± 100 mm Hg.



3. FIRST-TIME START UP AND OPERATION

3.1 EQUIPMENT REQUIRED

1. Chart Recorder or Digital Voltmeter.
2. Mercury Manometer or other accurate pressure gauge calibrated in mmHg.
3. Pressure source (a 20cc or 30cc syringe can be used).
4. Pressure transducer.
5. Transducer cable terminated with HIROSE HRIO-7J-6P (See Appendix)
6. Interconnecting signal cable between DUAL PRESSURE output and Chart Recorder input.
7. PVC or surgical tubing for connecting the source manometer and transducer.
8. "T" fitting for tubing.

3.2 PROCEDURE

1. Connect the manometer to the pressure tube using the "T" fitting so that the manometer is measuring the pressure applied to the transducer, and connect the input cable to Transducer A.

2. Electrically connect DUAL PRESSURE output (see REAR PANEL OUTPUTS FOR DUAL PRESSURE MODULES) to the Chart Recorder or Digital Voltmeter input.

3. Preset the DUAL PRESSURE controls as follows:

SWITCH	ZERO
GAIN	CW
OFFSET	CENTERED (5 turns from either end)
BALANCE	CENTERED

4. Set up the Chart Recorder so that the pen is in the center of the chart with 0 volts applied. Set the gain on the recorder so a +10 volt signal will run the pen to the top of the chart and a -10 volt signal will run the pen to the bottom.

5. Note the position of the recorder pen with 0 volts applied. Then turn the System Six power on. Carefully set the OFFSET control so that the pen is in the same position as with 0 volts applied.

6. Move the switch to the CALIB position - the pen should move to approximately half way between mid-scale (0 volts) and full scale (± 10 volts).

7. Advance the switch to the + RUN position. With 0 mmHg pressure applied carefully adjust the BALANCE control until the pen is in the center (0 volts) position.

8. Using the pressure source apply a pressure to the transducer - the pen should move up or toward the +10 volt position. (If the pen moves down the signal from the transducer is inverted and can be corrected by reversing the signal Leads and repeating steps 5-7.

9. With 0 mmHg applied re-adjust the recorder position control until the pen is at the bottom of the chart.

10. Apply a full scale pressure to the transducer and adjust the pen position to the top of the scale using either the recorder gain control or the DUAL PRESSURE GAIN control. Re-check the 0 position (step 9) and full scale.



DUAL PRESSURE MODULE

The recorder position will track the manometer within the linearity tolerance of the transducer and the accuracy and readability of the chart.

Note: Using a digital voltmeter as the output device will allow more precise setting of the controls



4. APPENDIX

APPENDIX A: TRANSDUCER CABLE

The DUAL PRESSURE module requires two transducer cables having one end terminated with the mating connector for the TRANSDUCER A and TRANSDUCER B inputs. The following diagram shows the wire color coding and typical connection to a transducer. This cable is available from TRITON and is PN 200-1930.

Connector - HIROSE P/N HR10-7J-6P
Cable - COONER NMEF 4/26-1938SJ

Table with 2 columns: Terminal Label and Description. Rows include + EX (Positive bridge excitation voltage), - EX (Negative bridge excitation voltage), + SIG (Positive bridge output), and - SIG (Negative bridge output).

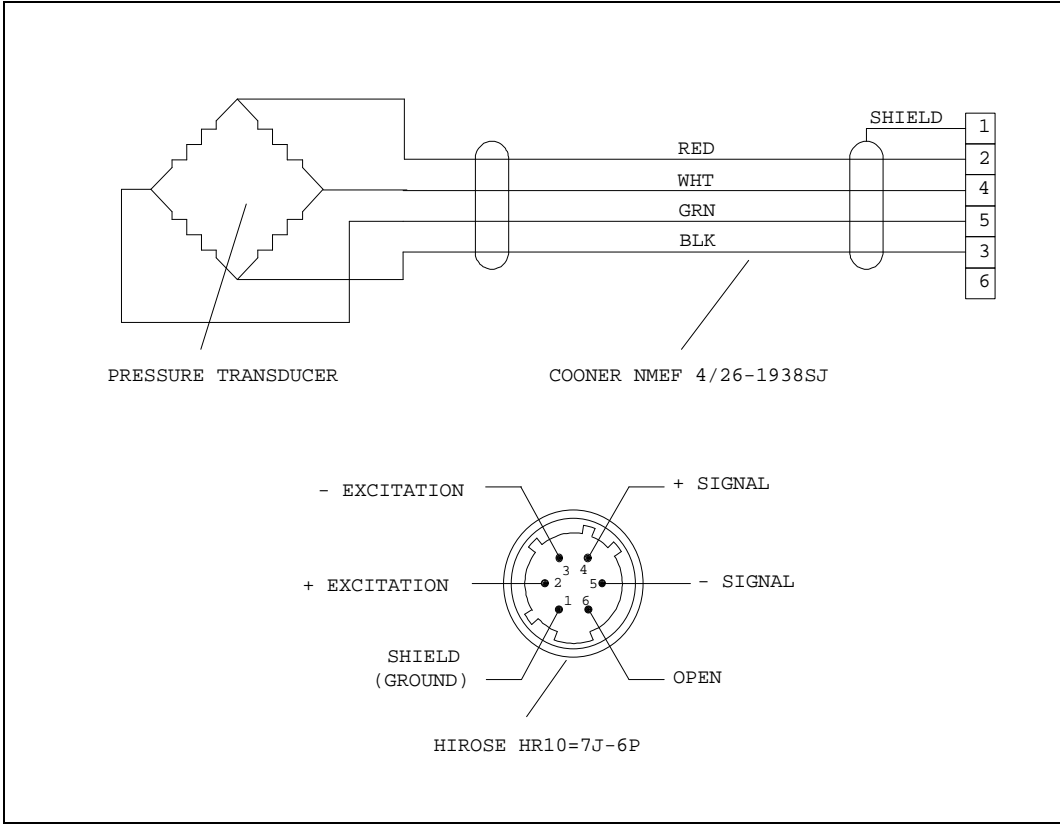


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