Lebow® Products Inc.

MODEL 7542

OPERATION MANUAL

1728 Maplelawn Road
Troy, Michigan 48084
Phone: 248-643-0220
Fax: 248-643-8142
www.lebow.com

Version: 20050321

Table of Contents

1 Introduction

1.A General Description and Specifications 1.1
1.B Mounting of the Model 7542 .... 1.3

2 Connections

2.A Introduction 2.1
2.B Transducer / 7542 Interconnections 2.2
2.C Wiring for ±5 V-DC Outputs 2.3
2.D Wiring for Current Output 2.3
2.E Wiring for Remote Shunt Calibration 2.4

3 Configuration and Calibration

3.A Setting Model 7542 Zero and Gain 3.1
3.B Setting Current Output Frequency and Polarity 3.4
3.C Setting Torque Polarity 3.4

Illustrations

Fig. 1 Simplified Block Diagram of the Model 7542 .... 1.2
Fig. 2 Model 7542 Physical Layout 1.3
Fig. 3 Model 7542 / Transducer Interconnections 2.2
Fig. 4 Model 7542 Signal Wiring
- **Fig. 4.a** Wiring for ±5 V-DC Outputs 2.3
- **Fig. 4.b** Wiring for Current Output 2.3
- **Fig. 4.c** Wiring for Remote Shunt CAlibration 2.3

Fig. 5 Model 7542 Internal Programming Jumpers
- **Fig. 5.a** Jumpers for Gain and Zero Settings 3.1
- **Fig. 5.b** Jumpers for Current and Torque Settings 3.4

Tables

Table 1 Model 7542 Terminal Pads 2.1

1. Introduction

1.A General Description and Specifications

With the **Model 7542 Embedded AC Strain Gage Conditioner**, the manufacturer of AC-excited rotary transformer torque sensors can offer *high-accuracy, high-stability analog signal conditioning* as a valuable transducer feature. As shown in Fig. 2, the 7542 product consist of two joined 2” x 2” circuit boards to be mechanically mounted within the torque transducer itself. The 7542’s “real-world” I/O connections are made available to the transducer end-user through a CUSTOM CONNECTOR *provided by the transducer manufacturer.*

This single-channel conditioner module is of *phase-sensitive carrier-amplifier* design, and is intended primarily for sensors that employ transformer-coupling to the transducer bridge (as shown in Fig. 3).

By means of the basic wiring configuration and special jumper settings, the 7542 can be set to produce either
(1) **Two independent ±5 V-DC analog outputs**, with respective low-pass corner frequencies of 2 Hz and 600 Hz; or
(2) **one analog current output** of either unipolar (4 to 20 mA) or bipolar (4 to 12 to 20 mA) form, and derived from either the 2-Hz (“slow”) or the 600-Hz (“fast”) voltage signal.*

Either shaft-torque direction (clockwise or counter-clockwise) can be designed for “positive” output.

As shown in Fig. 3 , the 7542 permits the end-user to deliver a **“CAL”** logic input to the CUSTOM CONNECTOR, thereby activating the transducer manufacturer’s proprietary CALIBRATION NETWORK for either positive or negative shunt calibration.

Conformal coated for high-temperature operation (up to 185° F (85° C)), the 7542 is designed for high sensitivity within an electrical noisy and mechanically dynamic environment. Multistage gain amplification maintains the unit’s extraordinary signal accuracy and stability, once the initial gain-setting procedure (explained in detail in Section 3) has been properly performed.

Fig. 1 is a simplified block diagram showing the Model 7542’s major operational components.

With regard to the following SPECIFICATIONS, please note that they pertain only to the 7542 module itself, and are not intended to reflect the performance of the module/transducer system as a whole.

* It is of course up to the transducer manufacturer whether to dedicate a 7542 exclusively to one of the two input modes or to design the module into the transducer in such a way as to permit the end-user to convert from one mode to the other as required by the application.

Model 7542 Specifications

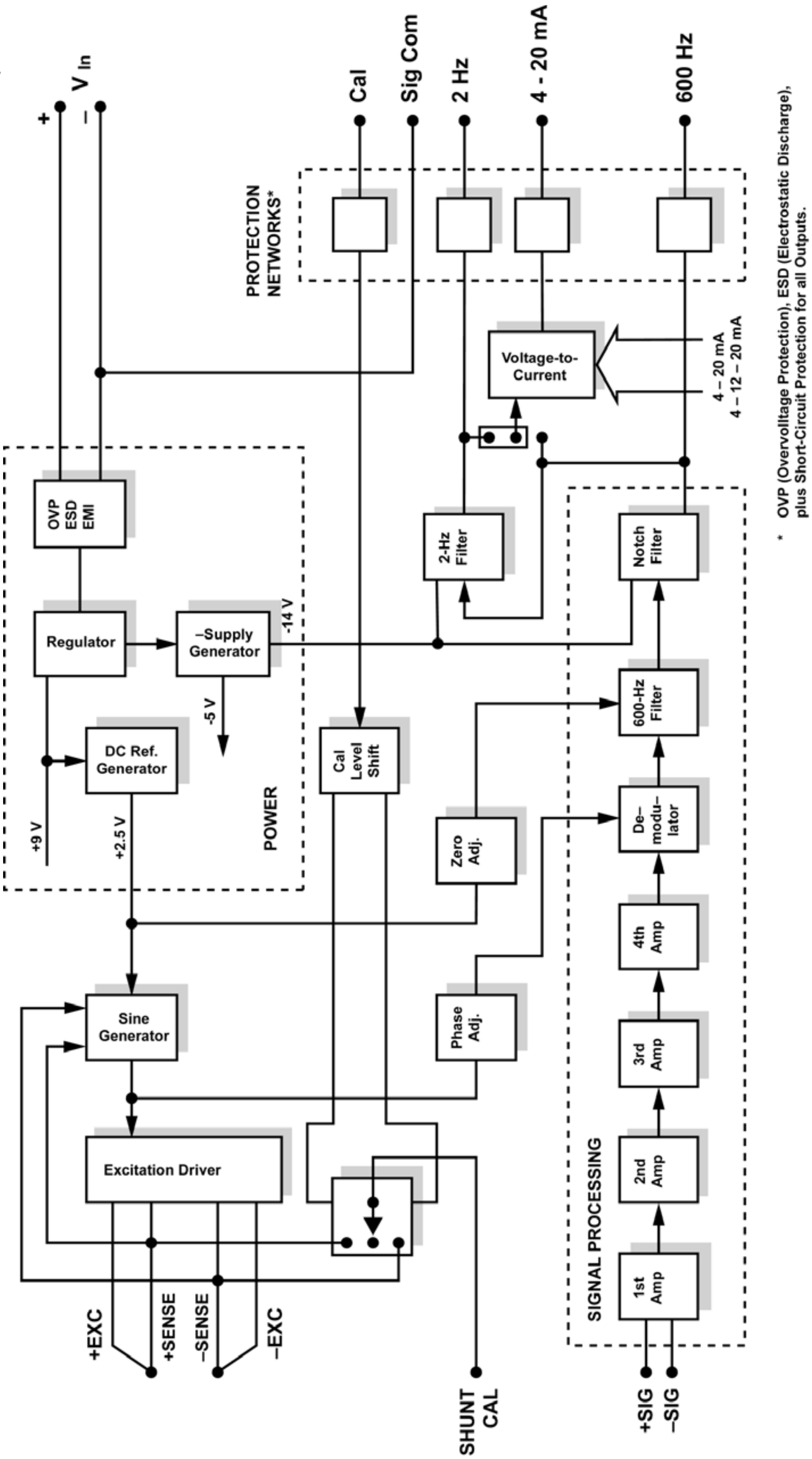
Size (HWD): 1” x 2” x 2”; the entire 2” x 2” to surface of the top board must be accessible for module setup
Required Power: 12 to 24 V-DC at 80 mA, nominal; the power input is protected against reversal of polarity
Operating Temperature Range: -25° F to 185° F (-32° C to 85° C)
Sensor Input:
- **Type:** Transformer-coupled resistive bridge
- **Bridge Impedance:** 300 to 400 Ω, nominal
- **Input Impedance:** Greater than 10MΩ
- **Excitation Frequency:** 5 kHz
- **Full-Scale Range:** 0.75 to 4 mV/V
- **Excitation Supplied:** Nominal 2.8 V-AC (rms) at 5 kHz, balanced

Analog Outputs: Selectable by wiring for either
- (1) **Two voltage outputs**, ±5 V-DC full scale, with low-pass corner frequencies of 2 Hz and 600 Hz respectively; or
- (2) **One current output**, selectable by internal jumpers for either unipolar (4 to 20 mA) or bipolar (“zero-center” 4 to 12 to 20 mA) form and for a low-pass corner frequency of either 2 Hz or 600 Hz

Output Ripple and Noise: 0.02% of full scale (rms) max. for 2-Hz output; 0.03% of full scale (rms) max. for 600-Hz output
Accuracy:
- **Linearity:** 0.02% of full scale**
- **Stability (Zero and Span):** ±25 ppm/°C for an operating temperature between 0° C and 50° C; otherwise ±50 ppm/°C
- **Span/Symmetry and Zero Adjustments:** Coarse control via internal pin interconnections; fine control via potentiometers to balance ±1.5% of full scale initial unbalance
- **Phase Adjustment:** Via potentiometer to ±25°**
- **Shunt Calibration Control:** positive or negative selectable via nominal ±2.5-V “CAL” logic input (see Fig. 3)

** With respect to a resistive bridge.

Fig.1
Simplified Block Diagram of the Model 7542

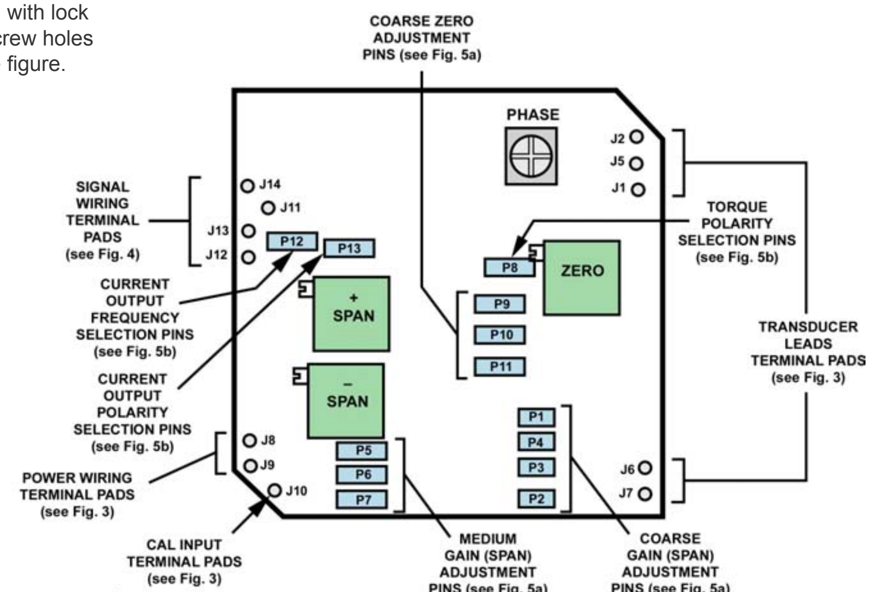


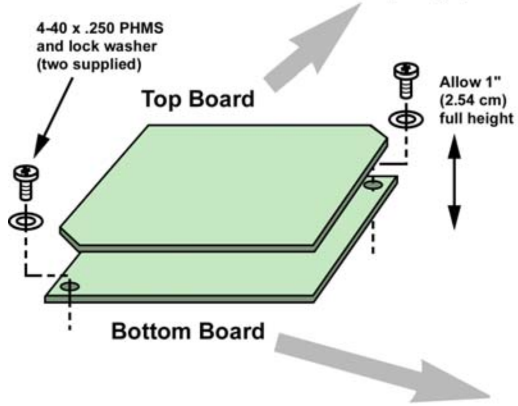
1.B MOUNTING OF THE MODEL 7542

As shown in fig. 2, the bottom 7542 board is to be mounted directly to a flat surface within the torque transducer by means of two machine screws (two 4-40 x .250 pan-head screws are supplied with the module, along with lock washers). Size and placement of screw holes in the bottom board are given in the figure.

IMPORTANT

An unmounted 7542 may be safely operated (for setup and diagnostics purposes) only with a power supply of 15 V-DC or less. When the power supply is greater than 15 V-DC, the 7542 must be mounted to a metallic surface (which serves as a heat sink).





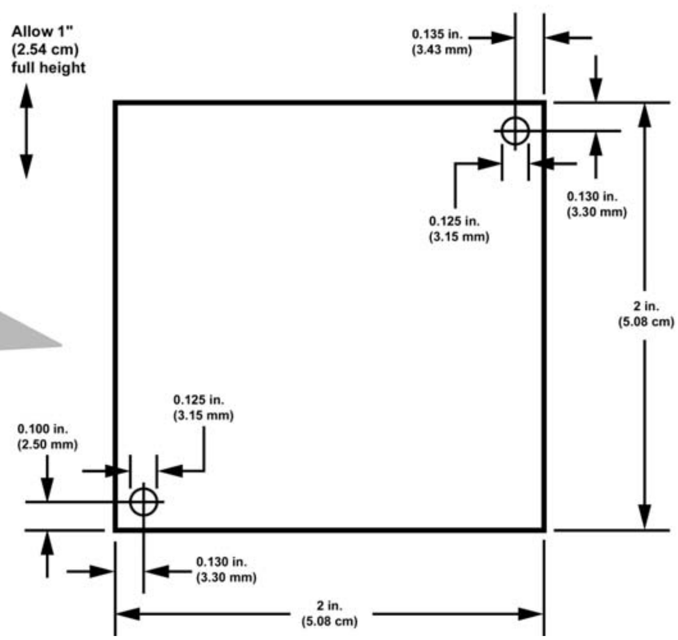


Fig. 2
Model 7542 Physical Layout

2.A INTRODUCTIONS

All interconnections between the 7542 module and the torque transducer—and between the 7542 and the CUSTOM CONNECTOR furnished by the transducer manufacturer—are to be accomplished by lead wires soldered directly to the numbered “J” TERMINAL PADS on the 7542’s upper board (shown in Fig. 2 and listed in Table , below).

IMPORTANT:
Extreme care should be taken when attaching lead wires to the 7542’s top board. *The soldered end of any wire must not protrude more than 1/16 of an inch form the underside of the top board*. Otherwisse, wire contact with board components **could cause severe instrument damage**.

Table 1
Model 7542 Terminal Pads

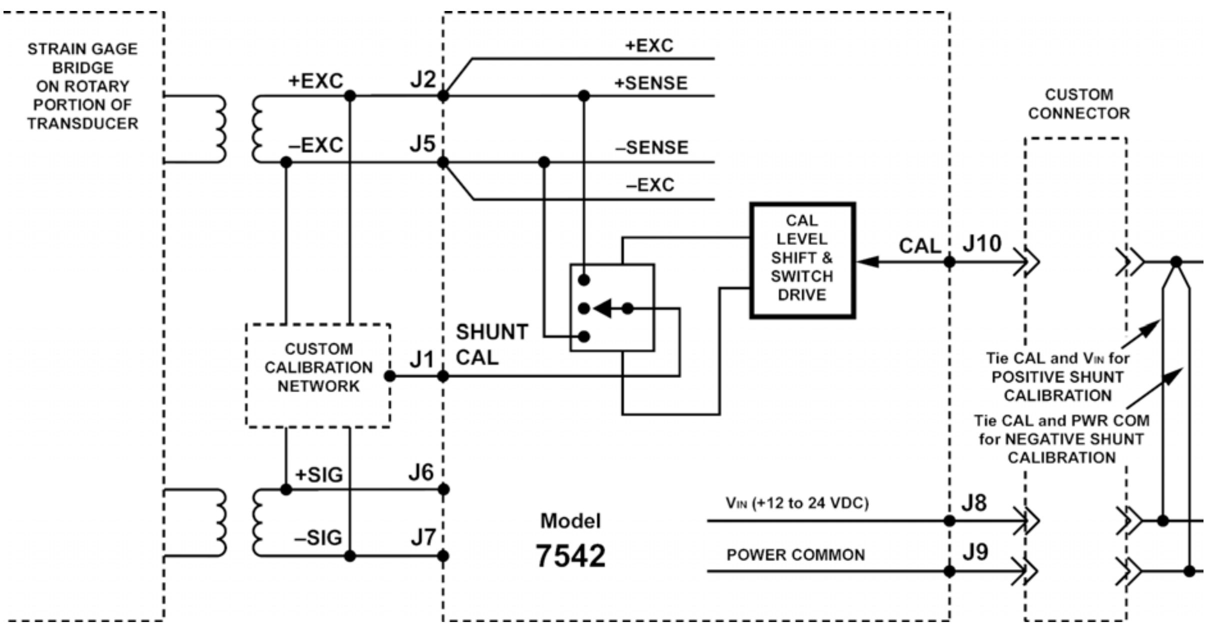
Pad Number	Line Function
J1	SHUNT CAL
J2	+ EXCITATION
J5	– EXCITATION
J6	+ SIGNAL
J7	– SIGNAL
J8	V_{in} (+12 TO 24 V-DC)
J9	POWER COMMON
J10	CAL
J11	2-Hz VOLTAGE OUTPUT
J12	600-Hz VOLTAGE OUTPUT
J13	CURRENT OUTPUT (4-20 OR 4-12-20 mA)
J14	SIGNAL COMMON

2.B TRANSDUCER / 7542 INTERCONNECTIONS

Fig. 3 shows how Terminal Pads J1, J2, J5, J6, and J7 are to be connected to transformer-coupled strain gage bridge signals and to the transducer manufacturer's proprietary CALIBRATION NETWORK.

The transducer end-user can specify either POSITIVE or NEGATIVE shunt calibration by typing the "CAL" input line to the "Vin" power line or to POWER COMMON, respectively, at the CUSTOM CONNECTOR.

Fig. 3
Model 7542 / Transducer Interconnections

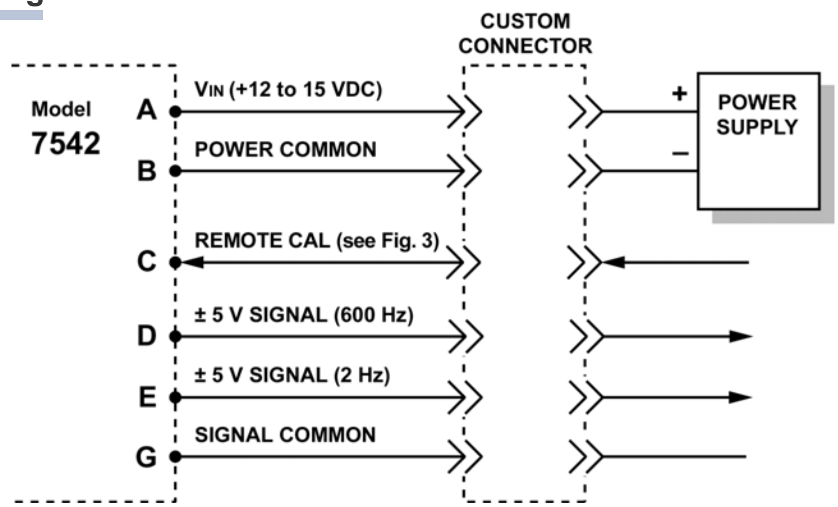


2.C WIRING FOR ±5 V-DC OUTPUTS

Terminal-pad connections for the 7542's power-supply lines and two ± 0-5 V-DC analog outputs (along with the SIGNAL COMMON return line) are shown in Fig. 4.a. As explained in Section 3.c, the "positive" direction of both outputs may be set to represent either shaft-torque direction (clockwise or counterclockwise).

Fig. 4
Model 7542 Signal Wiring

Fig. 4a
Wiring for ±5 V-DC Outputs

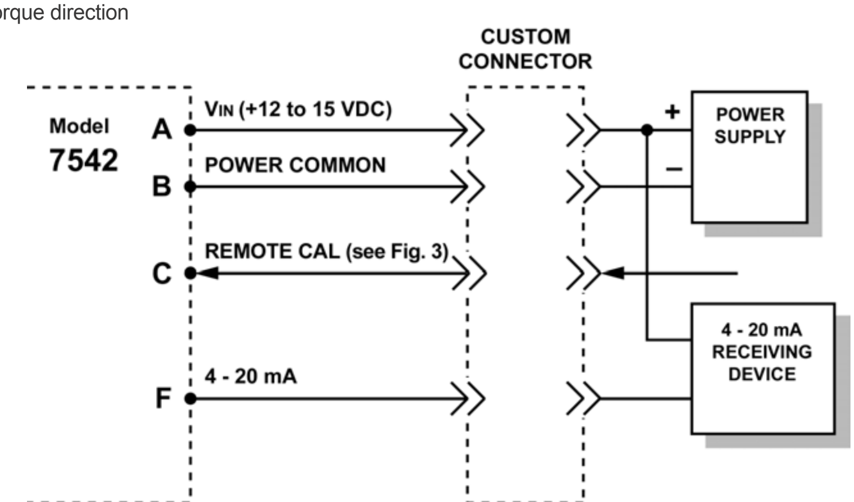


- Power requirements: 12 to 15 VDC @ 80 mA minimum
- A pre-wired cable assembly is available (**Lebow part number: 7202-51-xx**).

2.D WIRING FOR CURRENT OUTPUT

Terminal-pad connections for the 7542's power-supply lines and single analog current output are shown in Fig. 4.b. As explained in Section 3.c, the "positive" direction of the output may be set to represent either shaft-torque direction (clockwise or counterclockwise). See Section 3.b for setting the current output to either 2 Hz or 600 Hz, and to either unipolar (4 to 20 mA) or bipolar ("zero-center" 4 to 12 to 20 mA) form.

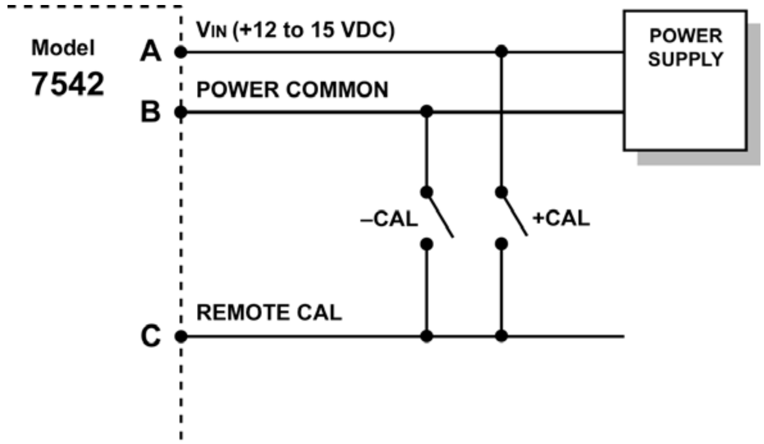
Fig. 4b
Wiring for Current Output



- Power requirements: 12 to 15 VDC @ 80 mA minimum
- A pre-wired cable assembly is available (**Lebow part number: 7202-51-xx**).

2.E WIRING FOR REMOTE SHUNT CALIBRATION

Fig. 4c
Wiring for Remote Shunt Calibration



- Tie REMOTE CAL and VIN to activate REMOTE POSITIVE SHUNT CALIBRATION.
- Tie REMOTE CAL and POWER COMMON to activate REMOTE NEGATIVE SHUNT CALIBRATION.
- Deactivate remote shunt calibration function before operating Torque Transducer.

3. Configuration and Calibration

PLEASE NOTE: For all internal pin connections mentioned in this section, it is recommended that the minijumpers supplied with the 7542 be used only in the initial configuration of the module (which, as regards determination of precise zero and gain settings, may involve a fairly extensive trial and error session, as explained in Section 3.a). After the initial configuration has been thoroughly tested and verified, the minijumpers should be replaced by actual hard-wire connections, to ensure optimum instrument stability.

3.a Setting Model 7542 Zero and Gain

Performing the "successive approximation" technique described in this section is necessary to achieve exact calibration off the 7542 module with reference to the torque transducer in which it is embedded. The procedure includes all required phase and symmetry adjustments.

Following an initial zero adjustment, increasingly "finer" full-scale span adjustments will be made, periodically re-zeroing as necessary, until a full-scale transducer reading of exactly 5.000 V is obtained.

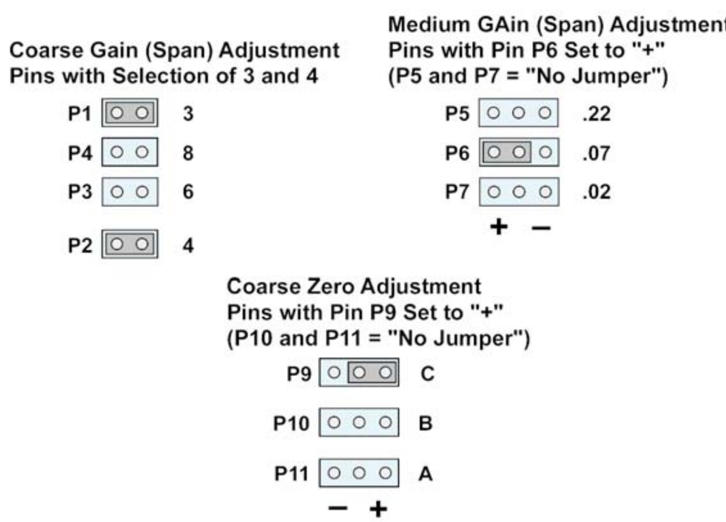
Fig. 2 shows the locations of the 7542 top board of the COARSE ZERO ADJUSTMENT PINS ("P9", "P10", and "P11"); the COARSE GAIN (SPAN) ADJUSTMENT PINS ("P1", "P4", "P3", and "P2"); and the MEDIUM GAIN (SPAN) ADJUSTMENT PINS ("P5", "P6", and "P7"). Locations of the ZERO, +SPAN, -SPAN, and PHASE fine-adjustment potentiometers ("pots") are also shown in Fig. 2.

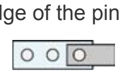
1. Connect a voltmeter with at least 1 mV resolution to the 2-Hz voltage output (see Fig. 4.a).
2. Set the 7542's current output to 600 Hz and to a "4 to 12 to 20 mA" reading by setting **P12** and **P13**, respectively, as explained in Section 3.b, below.
3. Chose the desired torque direction for a positive output and set **P8** accordingly, as explained in section 3.c, below.
4. Remove all minijumpers from **P1** through **P7** and from **P9** through **P11**.
5. Use a small screwdriver to mechanically center the ZERO POT, as follows:
   a. Turn the pot screw fully counterclockwise until a click is heard (or until high turning resistance is encountered).
   b. Carefully turn the pot screw clockwise 9 (nine) full turns.
6. Use the same procedure to mechanically center the +SPAN and –SPAN POTS.

(cont'd)

Fig. 5
Model 7542 Internal Programming Jumpers

Fig. 5a
Jumpers for Gain and Zero Settings



PLEASE NOTE: "+" and "–" jumper positions for P5-P7 are opposite to those for P9-P11. Also note that when *no jumper interconnection* is required for a given pin set, the supplied minijumper may be placed over a single pin, with one end overhanging the edge of the pin block, like this: 

7. Load the torque transducer to its full-scale positive value and adjust the PHASE POT to obtain a maximum reading on the voltmeter.

8. Remove all load from the transducer. If the meter reading is now greater than or equal to 70 mV, go to Step 11.

   Otherwise, if the reading is less than 70 mV, adjust the ZERO POT until an exact zero reading (0.000 V) is obtained.

   If a zero reading (0.000 V) can be achieved, go to Step 11. Otherwise, if a zero reading (0.000 V) cannot be achieved, go to Step 9.

9. **COARSE ZERO ADJUSTMENT**

   a. Mechanically center the ZERO POT (as in Step 5), and observe the voltmeter reading.

   b. If the meter reading is greater than 1.5000 or less than -1.5000, it means that the transducer offset is too high, and YOU CANNOT PROCEED WITH THE 7542 CALIBRATION.

   c. Otherwise, select the range within which the meter reading lies from the following table, and set the **P9** jumper accordingly (see Fig. 5.a):

P9:

Range	Jumper Setting
Between 1.5000 and 0.5000	–
Between 0.5000 and –0.5000	[no jumper]
Between –0.5000 and –1.5000	+

   d. If the meter reading is now greater than 0.5000 or less than –0.5000, check the **P9** jumper, if present, to be sure that the contacts are good.

   e. Otherwise, select the range within which the meter reading lies from the following table, and set the **P10** jumper accordingly (see Fig. 5.a):

P10:

Range	Jumper Setting
Between 0.5000 and 0.1670	–
Between 0.1667 and –0.1667	[no jumper]
Between –0.1667 and –0.5000	+

   f. If the meter reading is now greater than 0.1667 or less than –0.1667, check the **P10** jumper, if present, to be sure that the contacts are good.

   g. Otherwise, select the range within which the meter reading lies from the following table, and set the **P11** jumper accordingly (see Fig. 5.a):

P11:

Range	Jumper Setting
Between 0.1667 and 0.0555	–
Between 0.0555 and –0.0555	[no jumper]
Between –0.0555 and –0.1667	+

10. **FINE ZERO ADJUSTMENT**

    Adjust the ZERO POT until an exact reading (0.000 V) is obtained.

11. **COARSE GAIN (SPAN) ADJUSTMENT**

    a. Load the torque transducer to its full-scale positive value, and observe the voltmeter reading.

    b. If the reading is greater than 6.3684 or less than 0.9818, it means that the transducer output is too high or too low, respectively, and YOU CANNOT PROCEED WITH THE 7542 CALIBRATION.

    c. Otherwise, select the range within which the meter reading lies from the following table, and set the **P1-P4** jumpers accordingly (see Fig. 5.a):

P11-P4:

Range	Jumper Setting(s)
Between 6.3684 and 4.0825	[no jumper]
Between 4.0825 and 2.8868	select 3 only
Between 2.8868 and 2.0412	select 3 and 4
Between 2.0412 and 1.4434	select 3, 4, and 6
Between 1.4434 and 0.9818	select 3, 4, 6, and 8

12. If you installed NO JUMPERS for **P1-P4** in Step 11, you may proceed to Step 16.

    Otherwise, readjust the PHASE POT to obtain a maximum reading on the voltmeter, and proceed as follows.

13. Remove all load from the transducer. If the meter reading is now less than 70 mV, adjust the ZERO POT until an exact zero reading (0.000 V) is obtained.

14. If the meter reading was greater than or equal to 70 mV in Step 13, it means that a zero reading (0.000 V) cannot be achieved by means of the ZERO POT alone. Mechanically center the ZERO POT (as in Step 5), and proceed as follows.

15. Remove any jumpers for **P9**, **P10**, and **P11**, and repeat Steps 9.b through 10, above.

16. **MEDIUM GAIN (SPAN) ADJUSTMENT**

    a. Load the torque transducer to its full-scale positive value, and observe the voltmeter reading.

(cont'd)

b. If the meter reading is greater than 6.3684 or lessthan 3.9271, check the P1-P4 jumper(s), if present, to be sure that the contacts are good.

c. Otherwise, select the range within which the meter reading lies from the following table, and set the **P5** jumper accordingly (see Fig. 5.a):

P5:

Range	Jumper Setting
Between 6.3684 and 5.4198	–
Between 5.4198 and 4.6156	[no jumper]
Between 4.6156 and 3.9271	+

d. If you installed NO JUMPER for **P5** in Step c, you may proceed to Step i, below.

Otherwise, remove all load from the transducer. If the meter reading is now less than 70 mV, adjust the ZERO POT until an exact zero reading (0.000 V) is obtained.

e. If the meter reading was greater than or equal to 70 mV in Step d, it means that a zero reading (0.000 V) cannot be achieved by means of the ZERO POT alone. Mechanically center the ZERO POT (as is Step 5), and proceed as follows.

f. Remove any jumpers for **P9**, **P10**, and **P11**, and repeat Steps 9.b through 10, above.

g. Load the torque transducer to its full-scale positive value, and observe the voltmeter reading.

h. If the meter reading is greater than 5.4201 or less than 4.6084, check the **P5** jumper, if present, to be sure that the contacts are good. Otherwise, proceed as follows.

i. Select the range within which the meter reading lies from the following table, and set the **P6** jumper accordingly (see Fig. 5.a):

P6:

Range	Jumper Setting
Between 5.4201 and 5.1354	–
Between 5.1354 and 4.8657	[no jumper]
Between 4.8657 and 4.6084	+

j. If you installed NO JUMPER for **P6** in Step I, you may proceed to Step o, below.

Otherwise, remove all load from the transducer. If the meter reading is now less than 70 mV, adjust the ZERO POT until an exact zero reading (0.000 V) is obtained.

k. If the meter reading was greater than or equal to 70 mV in Step j, it means that a zero reading (0.000 V) cannot be achieved by means of the ZERO POT alone. Mechanically center the ZERO POT (as in Step 5), and proceed as follows.

l. Remove any jumpers for **P9**, **P10**, and **P11**, and repeat Steps 9.b through 10, above.

m. Load the torque transducer to its full-scale positive value, and observe the voltmeter reading.

n. If the meter reading is greater than 5.1354 or less than 4.8657, check the **P6** jumper, if present, to be sure that the contacts are good. Otherwise, proceed as follows.

o. Select the range within which the meter reading lies from the following table, and set the **P7** jumper accordingly (see Fig. 5.a):

P7:

Range	Jumper Setting
Between 5.1354 and 5.0452	–
Between 5.0452 and 4.9549	[no jumper]
Between 4.9549 and 4.8657	+

p. If you installed NO JUMPER for **P7** in Step o, you may proceed to Step 17, below.

Otherwise, remove all load from the transducer. If the meter reading is now less than 70 mV, adjust the ZERO POT until an exact zero reading (0.000 V) is obtained.

q. If the meter reading was greater than or equal to 70 mV in Step p, it means that a zero reading (0.000 V) cannot be achieved by means of the ZERO POT alone. Mechanically center the ZERO POT (as is Step 5), and proceed as follows.

r. Remove any jumpers for **P9**, **P10**, and **P11**, and repeat Steps 9.b through 10, above.

17. **FINE GAIN (SPAN) ADJUSTMENT**

a. With a positive full-scale load still applied to the transducer, adjust the +SPAN POT until the meter reads exactly 5.000 V.

b. Load the torque transducer to its NEGATIVE full-scale value.

c. Adjust the –SPAN POT until the meter reads exactly –5.000 V.

18. Remove all load from the transducer and adjust the ZERO POT until an exact zero reading (0.000 V) is obtained.

19. Repeat Steps 17 and 18 as required.

3.B SETTING CURRENT OUTPUT FREQUENCY AND POLARITY

The 7542's single current output may be derived from either of the two analog voltage outputs: "slow" (2 Hz) or "fast" (600 Hz). Fig. 2 shows the location of the CURRENT OUTPUT FREQUENCY SELECTION PINS ("P12") on the 7542 top board. As shown in Fig. 5.b, below, the two leftmost pins of P12 should be connected? by minijumper or wire (see the NOTE at the top of p. 3.1)? to select a current frequency of 2 Hz; the two rightmost pins should be connected to select a current frequency of 600 Hz.

The current output may also be set to either unipolar form (4 to 20 mA) or bipolar ("zero-center" 4 to 12 to 20 mA) form. Fig. 2 shows the location of the CURRENT OUTPUT POLARITY SELECTION PINS ("P13") on the 7542 top board. As shown in Fig. 5.b, the two leftmost pins of P13 should be connected? by minijumper or wire (see the NOTE at the top of p. 3.1)? to select a 4-20 mA current output; the two rightmost pins should be connected to select 4-12-20 mA.

3.C SETTING TORQUE POLARITY

The positive direction of the 7542's analog voltage and current outputs can be set to represent either CLOCKWISE or COUNTERCLOCKWISE torque. Fig. 2 shows the location of the TORQUE POLARITY SELECTION PINS ("P8") on the 7542 top board. As shown in Fig. 5.b, below the two leftmost pins of P8 should be connected? by minijumper or wire (see the NOTE at the top of p. 3.1)? to produce positive output for a counterclockwise shaft torque; the two rightmost pins should be connected to produce positive output for a clockwise shaft torque.

Fig. 5b
Jumpers for Current and Torque Settings