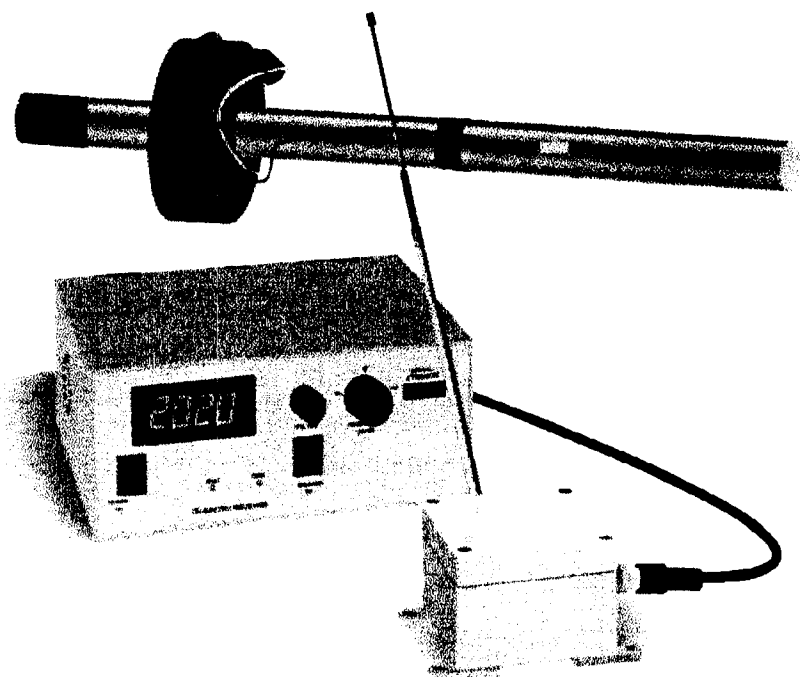




TX20B-i Series



Radio Telemetry System



Operator's Manual

Unpacking Instructions

Remove the Packing List and verify that you have received all equipment, including the following (quantities in parentheses):

LDTX20 Series Radio Telemetry System (1)

Operator's manual (1)

If you have any questions about the shipment, please call the OMEGA Customer Service Department.

When you receive the shipment, inspect the container and equipment for signs of damage. Note any evidence of rough handling in transit. Immediately report any damage to the shipping agent.

NOTE

The carrier will not honor damage claims unless all shipping material is saved for inspection. After examining and removing contents, save packing material and carton in the event reshipment is necessary.

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I. DESCRIPTION

The Model TX20B-i Series System is a non-contact data coupling system. The system consists of one or more TX20B-i Series Transmitters, Receiver, Model SL20 Induction Power Supply and the Model TX-BCA Collar Assembly. The Model RX20B-I-M is a single channel Receiver and the RX24B-BP and RX28B-BP Receiver Mainframes will accept up to four and eight Receiver Modules, respectively. Channel one is the left-most module when looking at the front of the Mainframe. All required accessories are included with the system.

The Model TX-BCA Collar Assembly houses the Transmitter and clamps to the shaft. The TX-BCA is custom fitted to a specific shaft size or for a range of shaft sizes. The Transmitter is connected directly to the rotating sensor and broadcasts the sensor signal for reception by the stationary Receiver.

Power is supplied to the Transmitter by the Induction Power Supply or by a 9 volt battery. The RX20B-I-M Receiver supplies DC power to the SL20 Induction Power Supply (IPS) via a multi-conductor cable. The SL20 has a loop antenna connected to it which transmits 500KHz power to the secondary loop antenna which rotates with the shaft. This pair of antennas also serves to transmit the signal back to the IPS. The signal is then fed from the IPS to the Receiver via the multi-conductor cable. The primary (stationary) loop antenna may be remotely mounted up to three feet from the IPS.

The following table correlates the various TX20B-i Series miniature Transmitters with the appropriate input type and range.

<u>Model</u>	<u>Input Type and Range</u>
TX20B-i-S1	Strain Gage, 0.3 mV/V
TX20B-i-S2	Strain Gage, 1.0 mV/V
TX20B-i-S3	Strain Gage, 2.0 mV/V
TX20B-i-S4	Strain Gage, 3.0 mV/V
TX20B-i-E1	DC Voltage, 0.1 Vdc
TX20B-i-E2	DC Voltage, 1.0 Vdc
TX20B-i-E3	DC Voltage, 5.0 Vdc
TX20B-i-E4	DC Voltage, 10.0 Vdc

<u>Model</u>	<u>Input Type and Range</u>
TX20B-i-J1	J Thermocouple, 0-200 F
TX20B-i-J2	J Thermocouple, 0-400 F
TX20B-i-J3	J Thermocouple, 0-800 F
TX20B-i-J4	J Thermocouple, 0-1000 F
TX20B-i-K1	K Thermocouple, 0-500 F
TX20B-i-K2	K Thermocouple, 0-1000 F
TX20B-i-K3	K Thermocouple, 0-1500 F
TX20B-i-K4	K Thermocouple, 0-2000 F

A regulated 5 volt excitation source is supplied with the models TX20B-i-S and TX20B-i-E. The sensor signal is conditioned and amplified and then connected to the input of a voltage controlled oscillator (VCO). This VCO converts the conditioned sensor signal to a variable frequency signal (Frequency Modulation) with a nominal center frequency of 4800 Hz. The 4800 Hz signal is referred to as the sub carrier.

The 4800 Hz signal then modulates the primary carrier in the 49 MHz band. The Transmitter incorporates a crystal oscillator which is tuned to a specific frequency. Transmitters can be ordered on several frequencies to permit the use of multiple transmitters in close proximity with no interference.

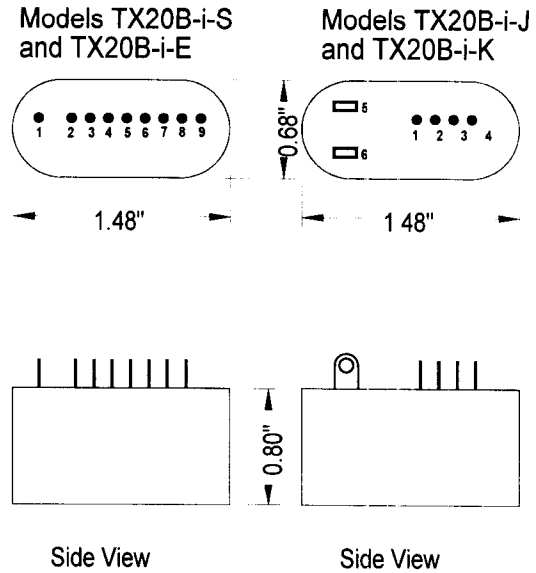
The Receiver or Receiver Module receives the transmitted sensor signal from any of the TX20B-i series transmitters and converts it to a ± 2 volt output.

II. CONNECTIONS

Model TX20B-i-S Strain Gage Transmitter:		Model TX20B-i-E Voltage Transmitter:	
<u>Pin</u>	<u>Description</u>	<u>Pin</u>	<u>Description</u>
1	antenna	1	antenna
2	gain terminal	2	gain terminal
3	gain terminal	3	gain terminal
4	+ excitation	4	+ excitation
5	+ signal	5	+signal
6	- signal	6	- signal
7	- excitation	7	-excitation
8	battery ground	8	battery ground
9	+ 9 volt power input	9	+ 9 volt power input

**Model TX20B-i-J, TX20B-i-K
Thermocouple Transmitter**

<u>Pin</u>	<u>Description</u>
1	calibration output (10 mV/Deg C).
2	battery -
3	battery +
4	antenna
5	- TC input
6	+ TC input



Model RX20B-I-M Receiver, RX22 and RX22-I Receiver Modules:
Connections are labeled on rear of unit.

When an RX24B-BP or RX28B-BP Mainframe is used, the IPS cable should be connected to the IPS connector labeled CH 1 + 2 for channels one or two and to the connector labeled CH 3 + 4 for channels three or four.

RX20B-I-M , RX24B-BP and RX28B-BP Rear Panel IPS and Power Connections:

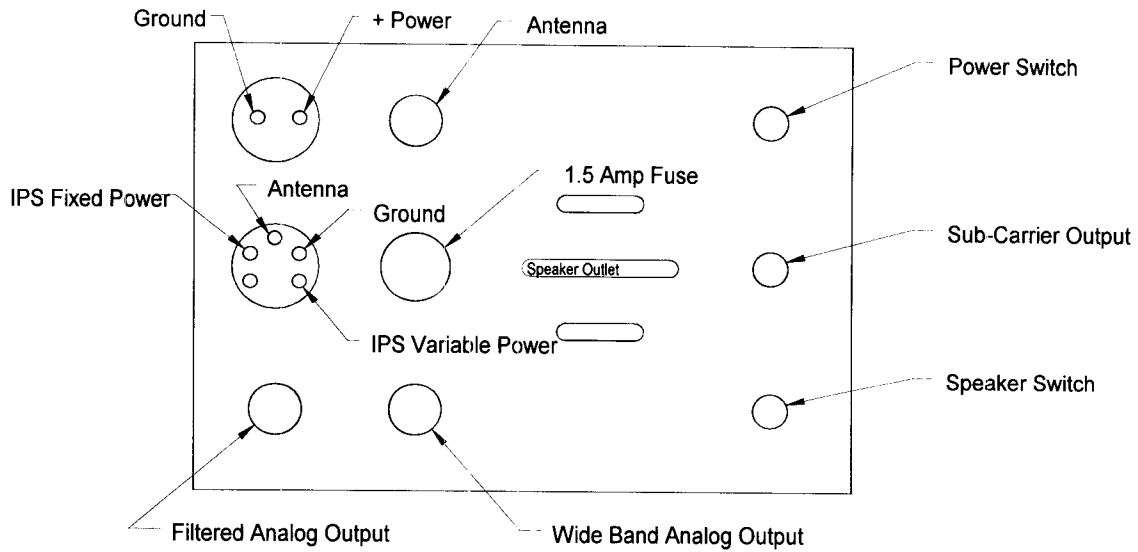
IPS Connector

<u>Pin</u>	<u>Description</u>
1	IPS variable power
2	Ground
3	Antenna
4	IPS fixed power
5	NC

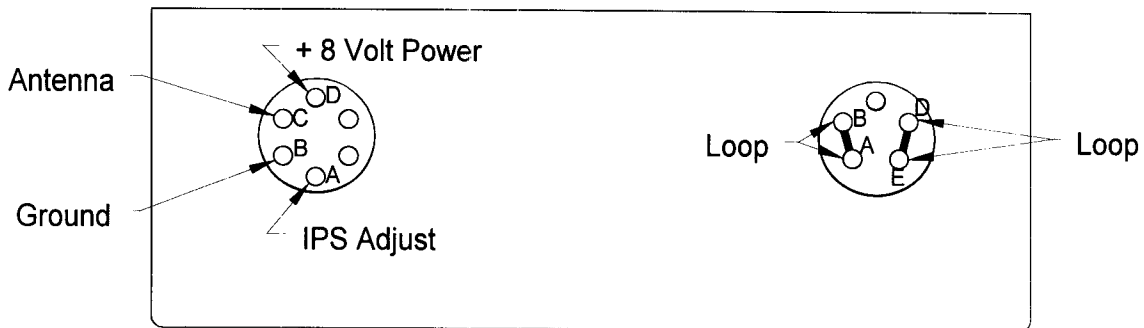
Power Connector

<u>Pin</u>	<u>Description</u>
1	+Power (11.5-16V)
2	Ground

Model RX20B-I-M Receiver Rear Panel



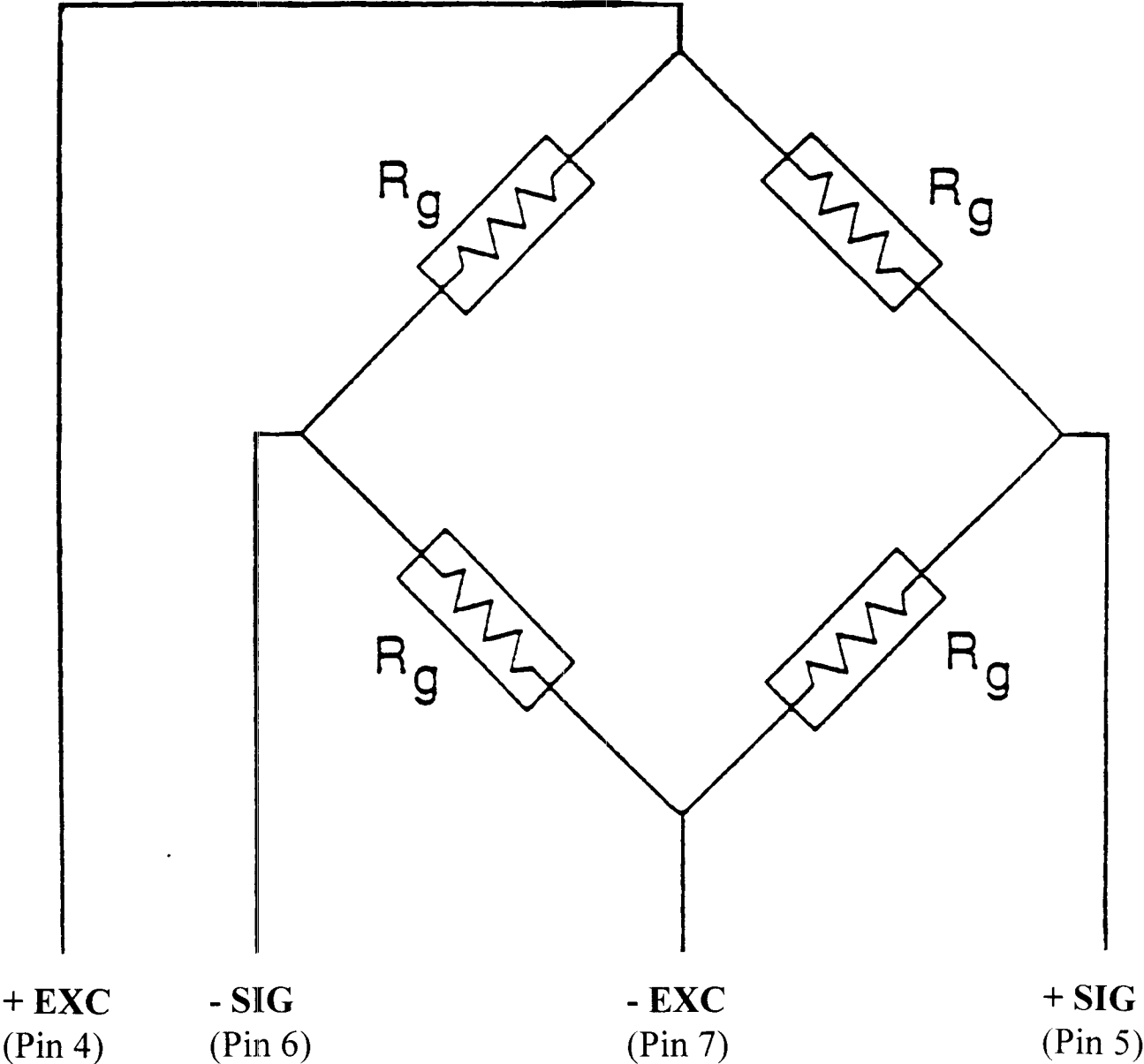
Model SL20 Induction Power Supply Connections



Model SL20

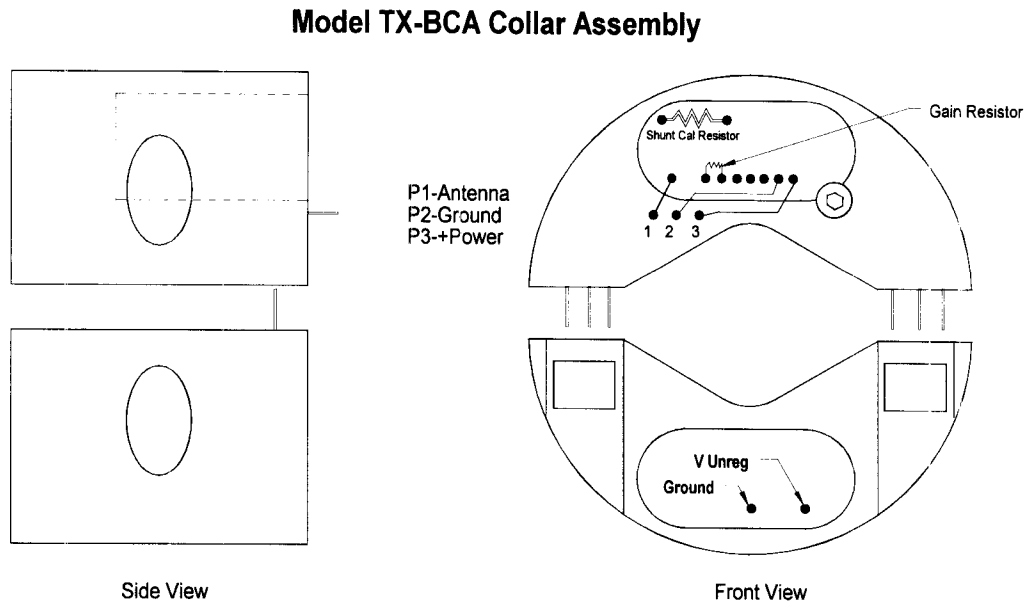
Connections to the TX-BCA Collar Assembly are labeled on the unit and shown on the following page.

Connecting Strain Gage Bridge to TX20B-i-S Strain Gage Transmitter:



III. SYSTEM SET-UP

A. Set-up with the Model TX-BCA Collar Assembly



1. Attach sensor or strain gages to the appropriate elements.
2. Install the Transmitter into the cavity in the side of the TX-BCA Collar and secure with the retaining screw. Connect the ground, power input, and antenna pins of the Transmitter to the appropriately marked pins on the Collar Assembly.
3. Solder the transducer lead wires to the Transmitter per the connections listed in the previous chapter.
4. Secure the Collar Assembly to the shaft near the sensor and tighten the bolts such that the gap between the two halves is the same on both sides.
5. Tape the sensor leads to the shaft with electrical tape. The tape should function as a strain relief between the Transmitter and sensor.

6. Mount the Model SL20 as close as possible to the Collar Assembly. The stationary loop should be parallel to, or surrounding, the face opposite to the embedded electrical connections. It is important that the stationary loop be within 1 or 2 inches of the secondary (rotating) loop. If the loops are in close proximity to metal surfaces, then it may be necessary to mount the loops closer together.
7. Secure the stationary loop into the mounting block on the top of the IPS with the cap screws.

Note: The stationary loop can be remotely mounted up to three feet from the IPS. If this is desired, then connect the stationary loop to the IPS with 16 gage, two conductor cable. Terminate the IPS end of the cable with tinned pig tails and secure with the socket head screws on the mounting blocks. The IPS unit is also available with a secondary connector in lieu of the terminal blocks. Solder the other end of the cable to the stationary loop making sure not to short the ends of the loop together.

8. Connect the IPS to the Receiver with the cable supplied. The connector on the rear of the Receiver is labeled "IPS".
9. Connect the included power supply to the jack on the rear of the Receiver labeled "DC+12V". For "in-vehicle" applications, the supplied 12 volt power cable can be used to run the Receiver on 12 volt vehicle power.

Note: Any excess Receiver power cord should be coiled and cable tied as close to the rear of the Receiver as possible. Do not coil excess antenna cable.

10. It is advisable to listen to the speaker output from the Receiver while the shaft is rotated 360 degrees to insure that there is a clean tone present throughout the rotation. The speaker can be turned on with the toggle switch on the back panel of the Receiver or on front of the Receiver Module.

B. Set-up without the Model 2010i Collar Assembly

(Utilizing Induction Power)

Note: An Induction Power Module is required to convert the 500KHz induction power to 9 VDC to power the Transmitter. This feature is integral to the TX-BCA Collar Assembly.

The Transmitter can be powered by a standard 9 volt battery, if desired. For this type of set-up, skip to the next section.

1. Attach sensor or strain gages to the appropriate elements. Refer Appendix for strain gage application.
2. Solder the transducer lead wires to the Transmitter per the connections listed in the previous chapter. The connections between the Model TX20B Transmitter and a typical strain gage are shown in the connections section.
3. Connect the power, ground and antenna leads of the Transmitter to the appropriate leads on the Induction Power Module.
4. Using putty, situate the Transmitter and Induction Power Module on the shaft (or element to be measured) 180 degrees apart. A thin strip of rubber wrapped around the shaft makes a good insulator between the shaft and Modules. Then, tape to the shaft with electrical tape. Strapping or fiberglass tape should be used for speeds in excess of 500 rpm. For speeds in excess of 1000 rpm, wrap another strip of rubber around the Transmitter and battery and secure with a metal band clamp.
5. A rotating antenna loop must be fabricated to extend around the shaft. ¼” thin walled copper tubing functions well for lower speed applications. For shaft speeds greater than 500 rpm, use the following method:

Wrap a one inch wide piece of neoprene foam rubber or non-metallic insulating material around the shaft next to the Transmitter and secure with tape. Then wrap the antenna wire around the foam rubber and twist the wire around itself to secure. Wrap electrical tape around the wire. For shaft sizes of two inches and smaller, wrap two turns. The antenna wire should be spaced at least one inch from the shaft
6. Connect each end of the rotating antenna wire to one of the secondary (rotating) loop connections on the Induction Power Module. Secure to the shaft with electrical tape.

7. Mount the Model SL20 as close as possible to the rotating antenna loop. The stationary loop should be parallel to, or surrounding, the rotating loop. It is important that the stationary loop be within 1 or 2 inches of the rotating loop. If the loops are in close proximity to metal surfaces, then it may be necessary to mount the loops closer together.
8. Secure the stationary loop into the mounting block on the top of the IPS with the cap screws and align with the rotating loop.

Note: The stationary loop can be remotely mounted up to three feet from the IPS. If this is desired, then connect the stationary loop to the IPS with 16 gage, two conductor cable. Terminate the IPS end of the cable with tinned pig tails and secure with the socket head screws on the mounting blocks. The IPS unit is also available with a secondary connector in lieu of the terminal blocks. Solder the other end of the cable to the stationary loop making sure not to short the ends of the loop together.

9. Connect the IPS to the Receiver with the cable supplied. The connector on the rear of the Receiver is labeled "IPS".
10. Connect the included power supply to the jack on the rear of the Receiver labeled "DC+12V". For "in-vehicle" applications, the supplied 12 volt power cable can be used to run the Receiver on 12 volt vehicle power.

Note: Any excess Receiver power cord should be coiled and cable tied as close to the rear of the Receiver as possible. Do not coil excess antenna cable.

B. Set-up without the Model TX-BCA Collar Assembly (Utilizing Battery Power)

1. Attach sensor or strain gages to the appropriate elements. Refer to manufacturer's instructions for strain gage application.
2. Solder the transducer lead wires to the Transmitter per the connections listed in the previous chapter. The connections between the Model TX20B-S Transmitter and a typical strain gage are shown in Section II: Connections.
3. Solder a piece of wire to the Transmitter's antenna pin. The wire should be long enough to reach around the shaft or at least 18 inches, whichever is longer.

4. Solder the battery clip wires to the power and ground pins on the transmitter and attach to the battery.
5. Using putty, situate the transmitter and 9 volt battery on the shaft (or element to be measured) 180 degrees apart. A thin strip of rubber wrapped around the shaft makes a good insulator between the shaft and Transmitter and battery. Then, tape to the shaft with electrical tape. Strapping or fiberglass tape should be used for speeds in excess of 500 rpm. For speeds in excess of 1000 rpm, wrap another strip of rubber around the Transmitter and battery and secure with a metal band clamp.
6. Wrap the antenna lead around the shaft and secure with electrical tape.
7. Tape the sensor and battery leads to the shaft with electrical tape. The tape should function as a strain relief between the Transmitter and sensor.
8. Mount the receiving antenna assembly supplied with the system as close as possible to the Transmitter. Connect the antenna to the BNC jack on the rear of the Receiver with the coaxial cable.

Note: Any excess Receiver power cord should be coiled and cable tied as close to the rear of the Receiver as possible. Do not coil excess antenna cable.

9. It is advisable to listen to the speaker output from the Receiver while the shaft is rotated 360 degrees to insure that there is a clear tone present throughout the rotation. The speaker can be turned on with the toggle switch on the back panel of the Receiver or on the front panel of the Receiver Module.

IV. IPS TUNING

The IPS may require tuning depending on the amount of magnetic alloys near the loop or if the IPS loop antenna diameter is changed. To tune the IPS, proceed as follows:

1. Connect an oscilloscope across the primary loop antenna at the base (where the loop exits the IPS).

2. Turn the IPS power adjustment on the Receiver fully counterclockwise.
3. With the Receiver connected to the IPS, turn on the Receiver power.
4. Set the oscilloscope to a range covering 500KHz and adjust the gain until a sinusoidal waveform is detected. It may be necessary to turn the IPS power adjustment a few turns clockwise to detect the signal.
5. Remove the cover on the IPS by backing out the four retaining screws.
6. The IPS is tuned by adjusting the dip switches located inside the IPS until the peak to peak voltage across the primary loop is maximized. Start by switching in the lowest value of capacitor which is not already switched on. The capacitance values associated with the dip switch settings increase with increases in the dip switch number.
7. The IPS is tuned when the sinusoidal waveform is at maximum obtainable magnitude by adding or subtracting capacitance. The distance between the primary and secondary loops will also affect the magnitude. The capacitors are switched in parallel (additive). Once the peak magnitude has been reached by adjusting the dip switches, add an additional minimal amount of capacitance by switching in one more capacitor. The waveform should now be about 90 % of its peak magnitude.

Note: In general, the closer the loop is to surrounding magnetic materials, the higher the value of capacitance required to tune the loop. Also, more capacitance is required to tune the loop as the secondary loop is placed closer to the primary loop.

8. Once the IPS is tuned, replace the cover and remove the oscilloscope leads.

V. IPS Power Adjustment

1. The IPS must be tuned as described in section IV before the power level can be set.
2. Turn the Induction Power Level setting all the way counterclockwise.

3. Connect a voltmeter across the ground and unregulated output pins of the TX-BCA Collar Assembly. With the secondary IPS loop mounted in parallel to, and within 1 or 2 inches of the primary loop, adjust the IPS power level adjustment on the front of the Receiver clockwise until 12 volts is obtained on the voltmeter. If the Collar Assembly or IPS units are to be heated during operation, then adjust the unregulated voltage to 15 volts at ambient temperature.
4. If 12 volts is not obtainable, then either the IPS is not tuned properly or the secondary loop is not close enough to the primary loop. It is important to mount the secondary loop as close as possible to the primary loop.
5. If possible, slowly rotate the shaft to insure that 12 volts is maintained throughout rotation.
6. If the pins of the Transmitter are not accessible, then turn on the speaker and listen for the sub-carrier tone while adjusting the IPS power level adjustment clockwise.
7. Continue to adjust $\frac{1}{2}$ turn clockwise after the tone is first heard.
8. Once the IPS power level is set and the transducer is connected, it is advisable to listen to the speaker output from the Receiver while the shaft is rotated 360 degrees to insure that there is a clean tone present throughout the rotation. The speaker can be turned on with the rotary switch on the front panel of the Receiver.

VI. CALIBRATION

1. The system should be allowed to warm up for 20 minutes prior to calibration.
2. Connect a voltmeter or recorder to the output terminals on the Receiver's rear panel. The digital display can be referenced instead of an external voltmeter.
3. With zero torque applied to the shaft, or with the sensor at its zero point, adjust the zero potentiometer so that zero volts out is obtained.

4. Apply a known input to the sensor. For strain gage applications, short a calibration resistor across the - excitation and - signal pins of the Transmitter, pins 7 and 6. The connection of this resistor to the bridge simulates a known (torque) value. Most strain gage manufacturers supply precision resistors which simulate a known strain value for a given type of bridge. This strain value can be correlated to an actual load (foot-pounds). This type of calibration is referred to as shunt calibration.
5. Adjust the span potentiometer so that the meter indicates the desired output. The output should be scaled so that the full scale of the sensor equals 2 volts output.
6. The gain of the transmitter can be changed if the desired output from the receiver cannot be obtained. To do so, solder a metal film resistor across pins 2 and 3 of the transmitter. With no resistor, the transmitter will accept 0 to .3 MV/V (Full Scale). The following table correlates the gain resistor required for the corresponding full scale output from the bridge.

<u>Full Scale Output</u>	<u>Gain Resistor</u>
.3 mV/V	NONE
.45 mV/V	1.00M Ohm
.60 mV/V	475K Ohm
1.0 mV/V	221K Ohm
1.2 mV/V	182K Ohm
1.6 mV/V	121K Ohm
2.0 mV/V	82.5K Ohm
3.0 mV/V	56.2K Ohm
5.0 mV/V	33K Ohm
7.0 mV/V	22K Ohm
10.0 mV/V	15K Ohm
20.0 mV/V	7.8K Ohm
30.0 mV/V	4.7K Ohm

Note: Dead-weight calibration may be employed in lieu of shunt calibration.

VII. SPECIFICATIONS

Model TX20B-i Series Transmitters (all):

RF Frequency	49.830 MHz
Modulation Type	FM-FM
Power Source	Standard 9 volt battery
Dimensions	.8"H x 1.45"W x .7"L
Operating Temperature Range	-40 to 130° C

Model TX20B-i-S Strain Gage Transmitter:

Input	4 arm Wheatstone Bridge
Excitation	5 volts DC

Model TX20B-i-E Voltage Transmitter:

Input	± 50 mV to 10 volts full scale
Excitation	5 volts DC

Model TX20B-i-J Thermocouple Transmitter:

Input	Type J Thermocouple
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Model TX20B-i-K Thermocouple Transmitter:

Input	Type K Thermocouple
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Model RX20B-I-M Receiver, RX22 and RX22-i Receiver Modules:

Output	± 2 Volts or 0 to 5 Volts
Power	115 VAC or 12VDC
Signal coupling	via antennas
Output Ripple	< 5 mV (Filtered) < 15 mV (Wide Band)
Display	RX20B-M: 3 ½ Digit Backlit LCD RX22: 3 ½ Digit Miniature LCD
Size	RX20B-M: 5.5"L x 4.19"W x 2.5"H 3024: 12.0"L x 9.375"W x 5.25"H 3025: 12.0"L x 18.5"W x 5.25"H

System Specifications:

Frequency Response	Wide Band output - DC to 1100 Hz Filtered output - DC to 4 Hz
Integral Non-linearity	± .10% of full scale
Repeatability	± .05% of full scale
Overall accuracy	Better than ± .25% of full scale



WARRANTY/DISCLAIMER

OMEGA warrants this unit to be free of defects in materials and workmanship and to give satisfactory service for a period of **13 months** from date of purchase. OMEGA Warranty adds an additional one (1) month grace period to the normal **one (1) year product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product. If the unit should malfunction, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective it will be repaired or replaced at no charge. However, this WARRANTY is VOID, if the unit shows evidence of having been tampered with or shows evidence of being damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components which wear or which are damaged by misuse are not warranted. These include contact points, fuses, and triacs.

OMEGA is pleased to offer suggestions on the use of its various products. Nevertheless, OMEGA only warrants that the parts manufactured by it will be as specified and free of defects.

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CONDITIONS: Equipment sold by OMEGA is not intended to be used, nor shall it be used: (1) as a "Basic Component" under 10 CFR 21 (NRC), used in or with any nuclear installation or activity; or (2) in medical applications or used on humans. Should any Product(s) be used in or with any nuclear installation or activity, medical application, used on humans, or misused in any way, OMEGA assumes no responsibility as set forth in our basic WARRANTY / DISCLAIMER language, and additionally, purchaser will indemnify OMEGA and hold OMEGA harmless from any liability or damage whatsoever arising out of the use of the Product(s) in such a manner.

RETURN REQUESTS / INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA ENGINEERING Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting OMEGA:

1. P.O. number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR **NON-WARRANTY** REPAIRS OR **CALIBRATION**, consult OMEGA for current repair/calibration charges. Have the following information available BEFORE contacting OMEGA:

1. P.O. number to cover the COST of the repair/calibration,
2. Model and serial number of the product, and
3. Repair instructions and/or specific problems relative to the product.

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