

TorqueTrak 50
Shaft Power Meter
(TT50 SPM)
Installation and Operation Manual
(System No: 866-800)



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1 SYSTEM OVERVIEW

The TT50 SPM Shaft Power Meter is a rugged precision instrument designed for applications where ongoing measurement of torque and/or power on a rotating shaft is required.

System features include:

- Two independent strain sensor channels
- RPM measurement via integrated gyro or integrated Hall Effect sensor or optional external Hall sensor
- One-year battery life for transmitter (dependent on sample rate)
- Simple, robust mounting system for on-shaft components (transmitter)
- Digital design inherently immune to electrical noise
- Non-contact data transfer eliminates wear surfaces for long life without signal degradation
- Installation does not require shaft modification or machine disassembly
- Built-in shunt system calibration
- Fully encapsulated on-shaft electronics for high reliability
- Eight user-selectable input ranges from 0.125 to 16 mV/V (62.5 to 8000 microstrain at gage factor of 2.0)
- Multiple options for long distance error-free data transmission to monitoring and display equipment including:
 - Wired RS-485 Modbus
 - Wired Ethernet Modbus TCP
- Transmits two 16-bit signed strain values, one 16-bit signed RPM value, and 32 bits of status information
- LED indicators on transmitter and receiver highlight system status in addition to detailed status information contained in the RS-485 Modbus serial communications data

The TT50 SPM Shaft Power Meter consists of the following primary components:

TX50 Transmitter Collar

The TX50 Transmitter collar is a set of links that are secured around the shaft to be measured. It is composed of a transmitter link, a set of four battery links (batteries not included) and, depending on the size of the shaft, additional expansion links.

The strain gage sensor(s), which are installed on the shaft, are connected to the transmitter link. The transmitter is powered by the batteries and can transmit data from one or two strain sensors.

The TX50 measures the strain signal from the strain gages(s) then amplifies and transmits the data via BlueTooth to the RX50 Receiver.

Note: Although not explicitly part of the TT50 SPM system, strain gage sensors are required for use with the system. A full-bridge pattern, e.g for torque, thrust or bending, is required. The TT50 SPM will work with welded gages or bonded (glued) gages.

RX50 Receiver

The RX50 Receiver, which is installed in the vicinity of the TX50 Transmitter, acquires the data from the transmitter, then communicates the data to a connected host device through a Modbus interface.

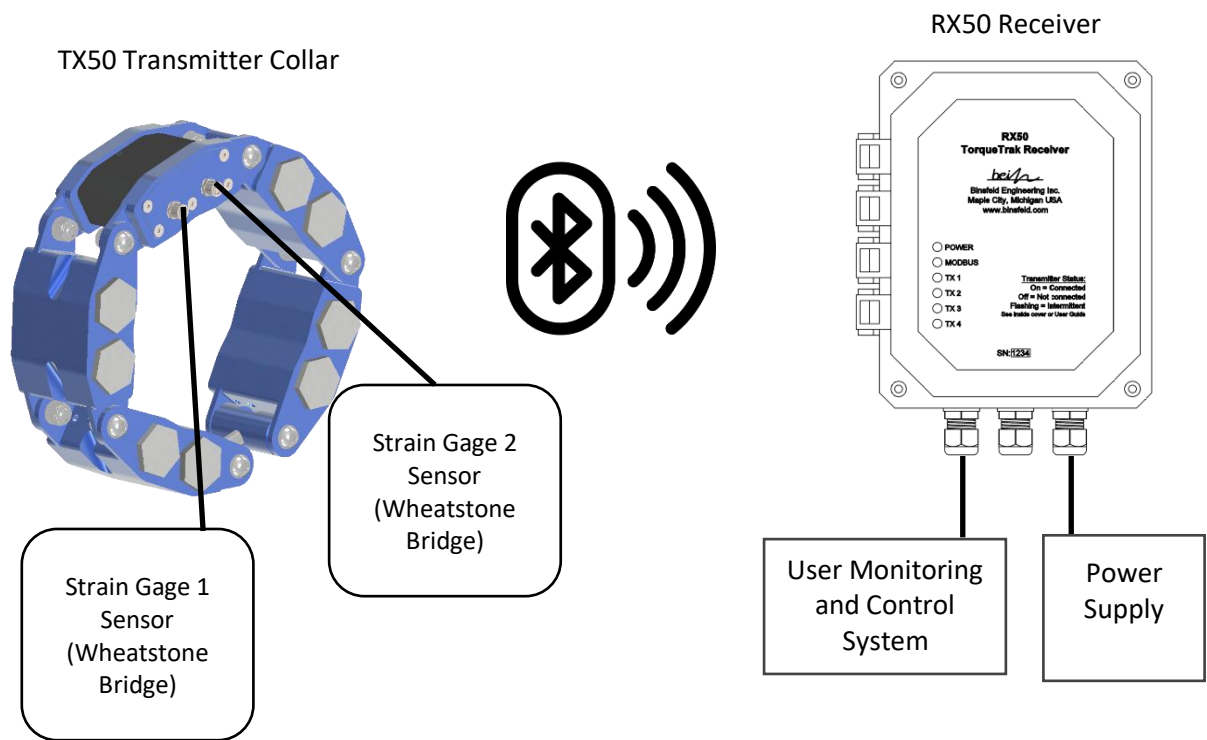


Figure 1: System Components and Standard Configuration

2 FEATURES AND CONTROLS

2.1 TX50 TRANSMITTER

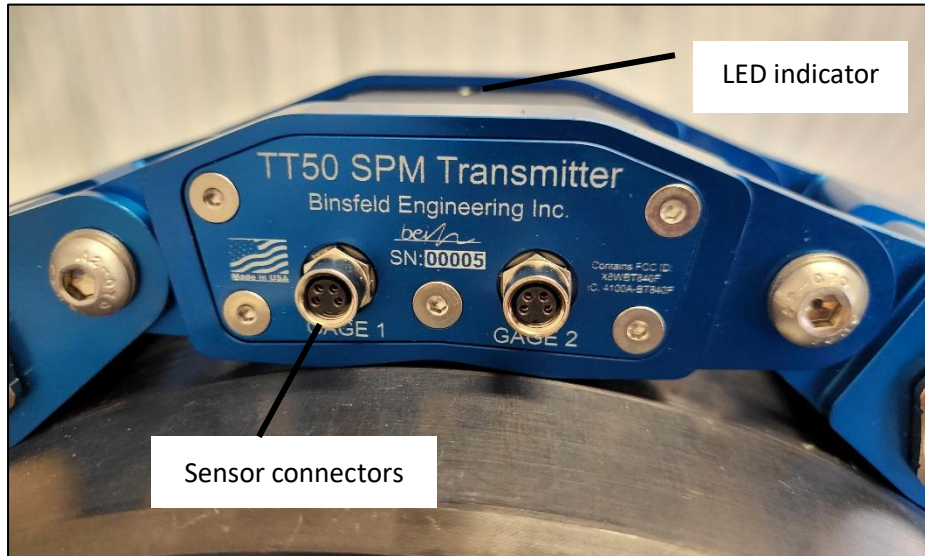


Figure 2: TX50 Transmitter Connections

The Transmitter link includes two M8 connectors for connection to the strain gage sensor(s).
An LED on the Transmitter link indicates the transmitter status.

Transmitter LED Indication

The Transmitter LED will light in four basic patterns to indicate transmitter status:

Transmitter LED is solid green when the transmitter is connected to the receiver and is idle (not capturing and transmitting).

Transmitter LED blinks green when the transmitter is connected to the receiver and is capturing and transmitting data (normal condition).

- LED blinking rate slows to one blink every two seconds after the first 60 seconds of transmission.

Transmitter LED blinks green two times each second when the transmitter is disconnected from the receiver.

The diagram below shows these scenarios graphically.

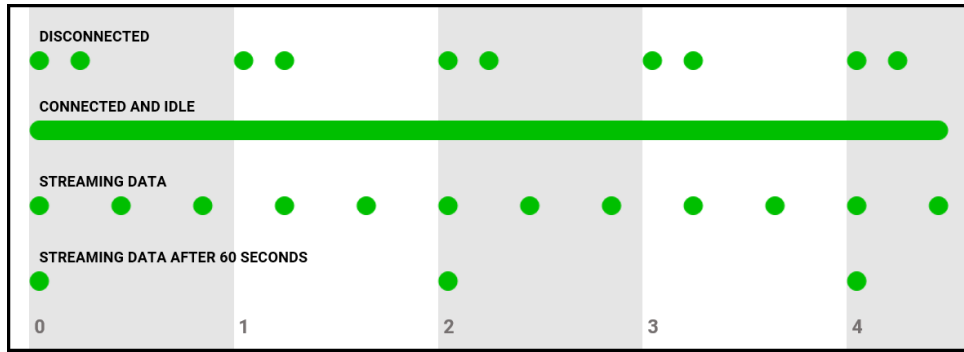


Figure 3: Transmitter LED Indication Patterns

Detailed instructions for installing the TX50 Transmitter collar, connecting the sensors, and installing or replacing batteries are included elsewhere in this manual.

2.2 RX50 RECEIVER

The RX50 Receiver is contained in a durable water-resistant enclosure with mounting flanges for installation near the TX50 Transmitter. Grommets allow for insertion of power and communication cables.

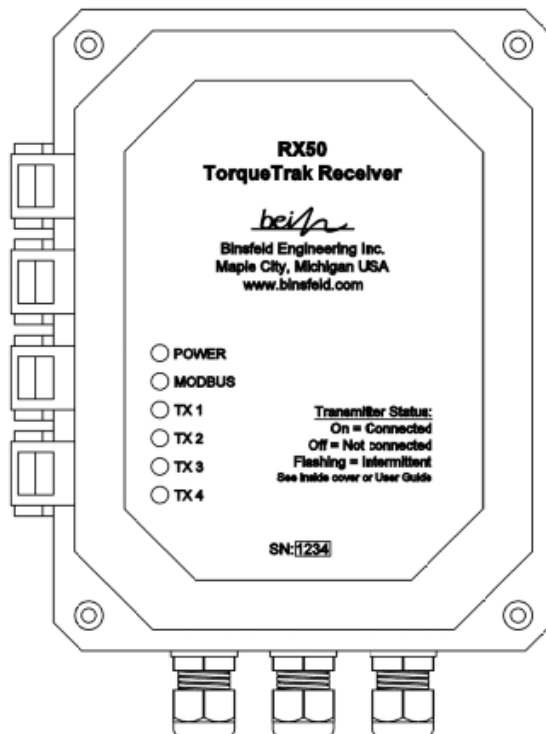


Figure 4: RX50 Receiver

The receiver features six LEDs on the front panel that indicate the following:

POWER:

- On solid green when power is applied and within specification
- Off when power is below minimal functioning threshold

MODBUS:

- Flashing green when Modbus signal is active
- Off when no Modbus activity

TX 1:

- On solid green when TX50 Transmitter is connected to the receiver and communicating normally
- Flashing when TX50 Transmitter operation is abnormal
- Off when TX50 Transmitter is not connected. Possible causes include:
 - Signal out of range
 - Low TX battery power
 - Internal warning or abnormal operation

Inside the RX50 enclosure are terminals for connecting power and RS485 communication.

Detailed instructions for installing and connecting the receiver are included elsewhere in this manual.

3 CONFIGURATION TOOL

The TT50 Modbus Configuration Tool is a LabVIEW-based program used to configure and to read output data from the TT50 Shaft Power Meter system.

For complete details see the TT50 Modbus Configuration Tool Manual.

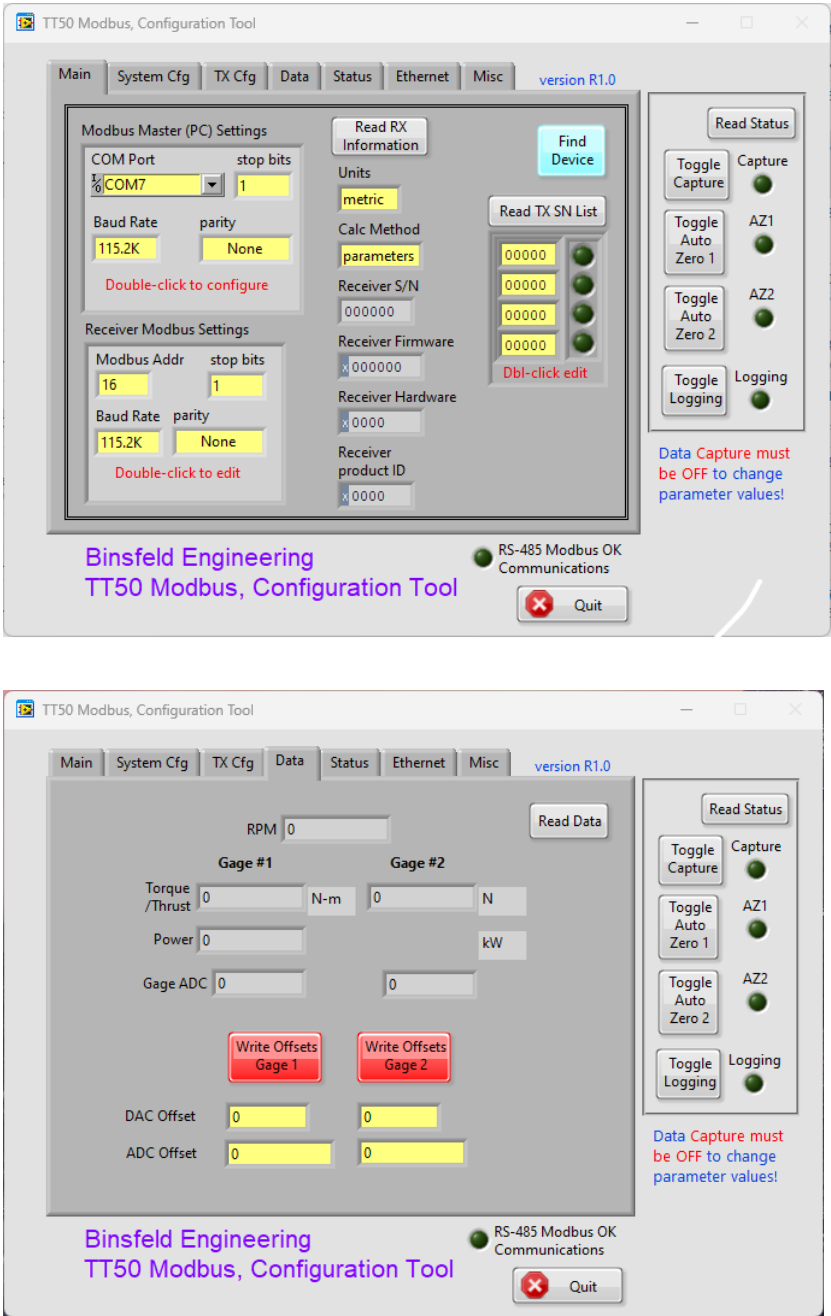


Figure 5: Configuration Tool Sample Screens

4 COMMUNICATIONS INTERFACE

Bi-directional RS-485 Modbus RTU communications are supported with a Modbus master device but are not required. The TT50 does not require any data to be received from a master device so no communications errors are declared if there is nothing connected to the RS-485 connector. A Modbus master is required to configure parameters such as gain, baud rate and sample rate. The Modbus ASCII transmission mode is not supported.

Generally, communication configuration should be required only once during installation. If the default parameters don't need to be changed then configuration during installation may not be required. The default parameter settings are:

Table 1: Default configuration parameters

Modbus slave address	16
Baud rate	115.2K
Parity	none
Stop bits	1

5 INSTALLATION

WARNING!

PERSONAL INJURY

DO NOT USE this product as a safety or emergency stop device or in any application where failure of the product could result in personal injury.

Failure to comply with these instructions could result in death or serious injury.

The end user is responsible for the proper installation and operation of this device. Improper installation or operation could result in damage, injury or death.

Certain environments could cause damage or degradation to the components of the system resulting in mechanical failure.

Mechanical failure could cause parts to detach from the shaft and fly off at high speeds. These flying parts could cause equipment damage, bodily injury and possibly death. Keep equipment and personnel away from areas where parts flung from the shaft could injure.

A shield or guard is recommended in applications where something or someone could come in contact with the rotating parts of the system.

Make sure there is sufficient spacing between the system installed on the shaft and nearby stationary elements before rotating the shaft.

Keep clear of the machinery while the shaft is rotating.



5.1 TX50 TRANSMITTER COLLAR INSTALLATION

Before installing the transmitter collar it is important to consider the entire layout on the shaft including the strain gage sensor(s). The strain gages should be adjacent to the collar to minimize interconnecting wires.

For convenience, install the batteries in the battery links before moving to the shaft for installation.

Once the sensor(s) and transmitter arrangement have been determined, installation can proceed as follows:

1. Install the strain gage(s) as directed by the manufacturer, including waterproofing.
 - a. Lead wires should be at least 6" long from where they exit the gage protection.
 - b. For easiest transmitter installation, locate the gage at the top of the shaft.
2. Hang the collar over the shaft adjacent to the strain gage(s) with the loose collar ends hanging down and the transmitter link connectors directed toward the strain gage(s).
3. Apply anti-seize lubricant to the threads of the tension bolt provided. NOTE: It is essential to use the anti-seize lubricant on the tension bolt threads.
4. Bring the loose ends of the collar together with the tension bolt and tighten until the collar has a slip-fit on the shaft.
5. Position the collar so the transmitter link is adjacent to the strain gage(s) or close enough to connect the gage wires.

6. Once the collar is in final position, tighten each of the M8 pivot bolts (that join the links) to 8 Nm (71 in-lbs).
7. After the pivot bolts are tightened, tighten the tension bolt to 12 Nm (106 in-lbs).
8. Connect the strain gage(s) to the transmitter link.
9. Verify that the TX50 is operating properly by observing the indicators on the RX50 Receiver.

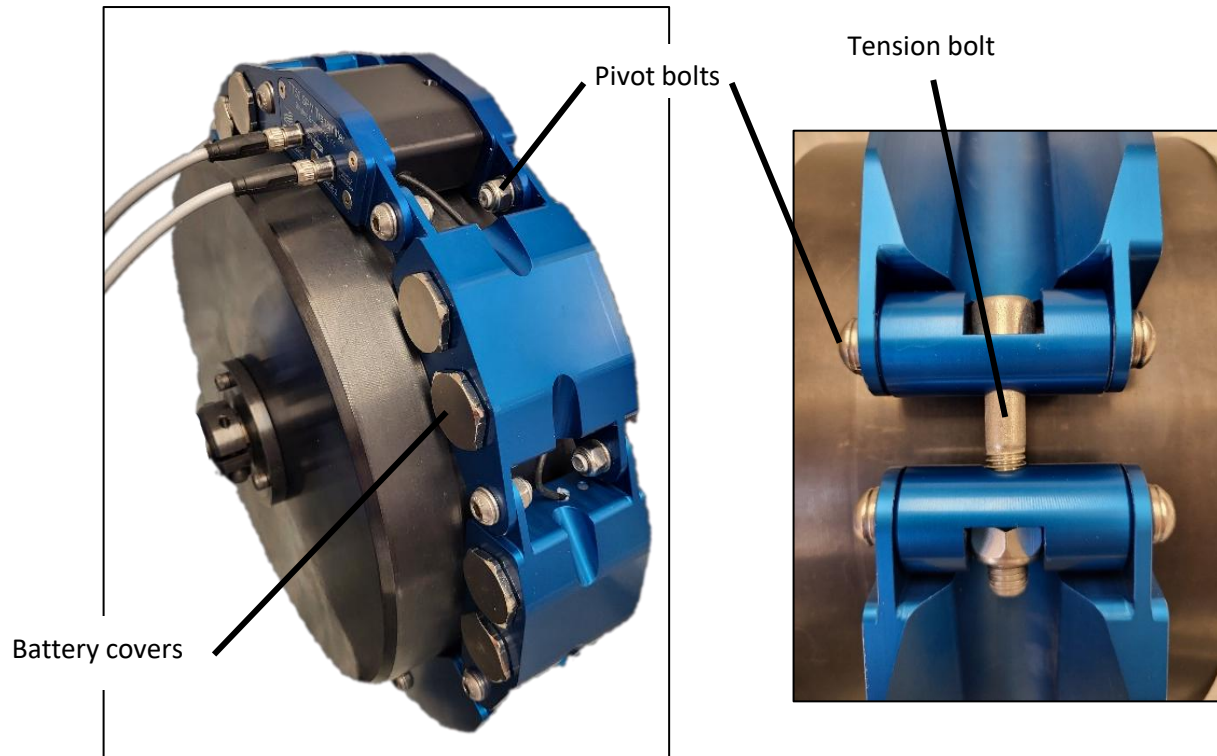


Figure 6: TX50 Transmitter Collar

5.2 RX50 RECEIVER INSTALLATION

5.2.1 Receiver Mounting

The RX50 Receiver should be installed in the closest reasonable location to the TX50 Transmitter, typically within several meters.

The RX50 Receiver can be installed in any orientation. However, it is generally a good idea to mount the unit with the cable connections pointing down to minimize the opportunity for fluids to enter the device.

Note: The RX50 enclosure is only sealed (e.g. from liquids, dust) when the mating connectors/cables are attached or seal plugs are installed in the wire glands.

Refer to Appendix B for enclosure dimensions including the mounting flanges.

5.2.2 Receiver Connections

Open the RX50 by removing the four corner screws and opening the cover latch.

Power Connection

Insert the power cable (9-36VDC) through one of the grommets and connect to the screw terminals as shown.

NOTE: A CE-rated power supply must be used to maintain compliance.

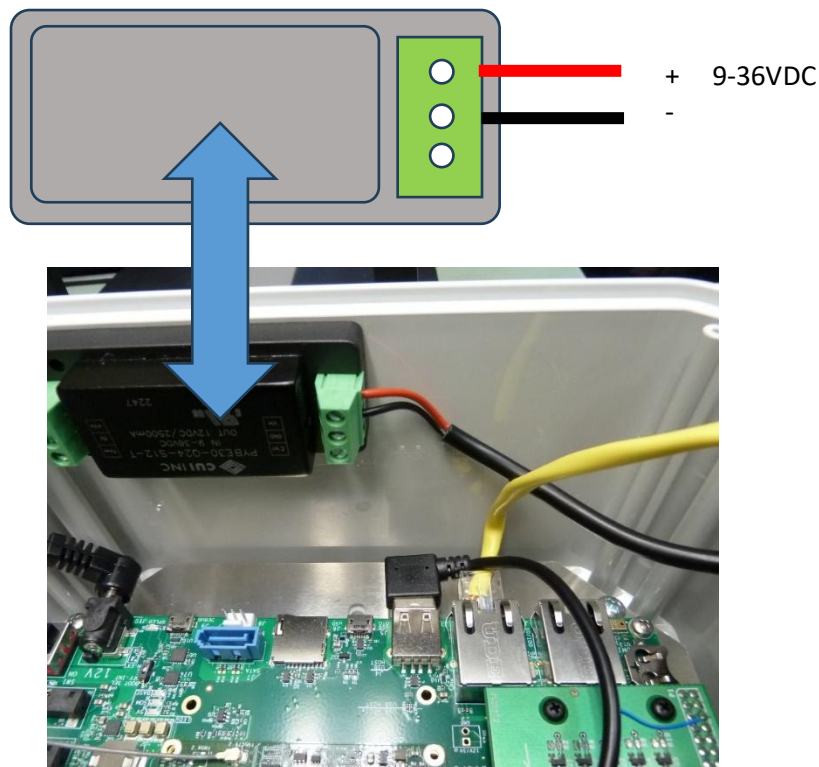


Figure 7: RX50 Receiver Power Connection

RS485 Connection

Insert the Modbus cable through the other grommet and connect to the screw terminals as shown.

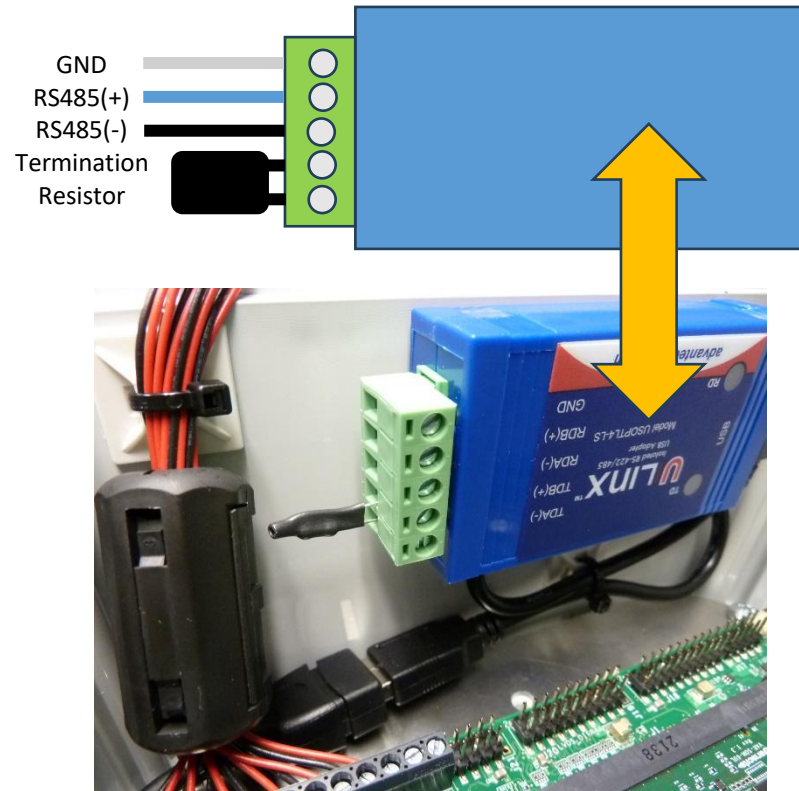


Figure 8: RX50 Receiver Modbus Connection

6 REPLACING BATTERIES

Note: For maximum battery life, replace all eight batteries at the same time. Mixing partially depleted batteries with new batteries will reduce the battery life of the entire set of batteries.

The TT50 SPM is powered by eight 3.6V LiSOCL2 batteries, for example, Tadiran model TL-5920 C-size cells

To install new batteries:

1. Remove all of the battery caps using a 30mm socket (provided).
2. Remove the eight batteries and dispose of properly.
3. Install new batteries with the positive end into the link first.
4. Reinstall all battery caps and tighten to 8 Nm (71in-lbs).
5. Verify that the TX50 is operating properly by viewing the indicators on the RX50 Receiver.

7 APPENDIX A: SPECIFICATIONS

TX50 (Strain) Transmitter (Module)

Number of strain channels	2
Power Supply Voltage	3.2 to 5.5 VDC
Power Supply Current (low-power mode)	4 mA
Power Supply Current (hi-speed mode)	40 mA
Battery: (8) Tadiran TL-5920	3.6V, 8.5Ah (nom)

Transmit Distance line-of-sight	5 m
Transmit Distance on rotating shaft	2 m typical

RF link	BLE (Bluetooth Low Energy) pre-certified transceiver module
Antenna	Internal
Strain bridge input range	8 user-selectable: ± 0.125 to ± 16 mV/V

Input Range	Full Scale Input (mV/V)	Strain Input Range (Torque or Bending; Full Bridge, 4 Active Arms) (microstrain)
1	± 16	8000
2	± 8	4000
3	± 4	2000
4	± 2	1000
5	± 1	500
6	± 0.5	250
7	± 0.25	125
8	± 0.125	62.5

Strain signal ADC resolution 24 bits. 1/16,777,200

Accuracy (max error)

Input Range	0.125	0.25	0.5	1	2	4	8	16	$\pm$ mV/V
Strain Zero error	1.0	0.50	0.25	0.13	0.10	0.10	0.10	0.10	%FS
Strain Scale error	0.4	0.4	0.4	0.4	0.45	0.50	0.60	0.80	%FS

Transmission sample rate (aggregate)	1 to 2400sps
Excitation Voltage	3.0 VDC
Strain Bridge Balance	Automatic, user initiated Auto-Balance
Bridge Balance Range	± 0.5 mV/V(max)
Strain Bridge Shunt References	5 user-selectable: 125, 250, 500, 1000 or 1924 μ V/V with 350 Ω bridge
Bridge Resistance	350 Ω
Shaft speed measurement	Integrated gyro
Max speed measurement	Gyro: 666 RPM
Speed Scale error (Gyro)	$\pm 2\%$ (max)
Speed Zero error (Gyro)	± 0.5 RPM (max) (± 3 deg/sec)

Speed Scale TC (Gyro)	±150ppm/°C (max)
Speed Zero TC (Gyro)	±0.0025 RPM/°C (±30.015 deg/sec/°C)
Indicator	Single Red/Green LED
Housing material	Cast nylon with aluminum frame
G-force	300 G's
Ingress	IP66
Operating Temperature Range	-40 to 85 °C (-40 to 185 °F)

Sensor connections: M8-4F circular, threaded

Description	Pin number	Connector Cable Color
Sen + (Positive sense or voltage input)	1	Brown
Sen - (Negative sense or voltage input)	2	White
Exc + (Positive excitation voltage output)	3	Blue
Exc - (Negative excitation voltage output)	4	Black

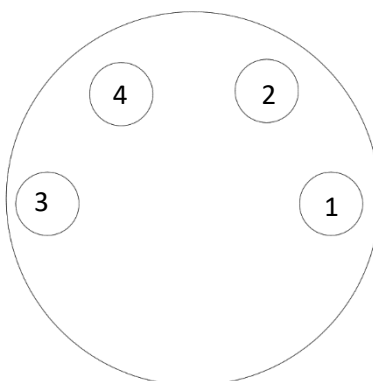


Figure A1 – Strain Gage Connector as Viewed on Transmitter

RX50 Receiver

Power supply input	9 to 36 VDC, 4W max, 2.5W typical
Receiver RF link	BLE (Bluetooth Low Energy)
External Indicators	LED light for Power, Modbus, Transmitter 1, 2, 3, 4
Network connectivity	Modbus (RTU + TCP/IP)
Ingress	IP66
Operating Temperature Range	-25 to 60°C (-13 to 140°F)

TT50 System

Standard Warranty	1 year
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8 APPENDIX B: DIMENSIONS

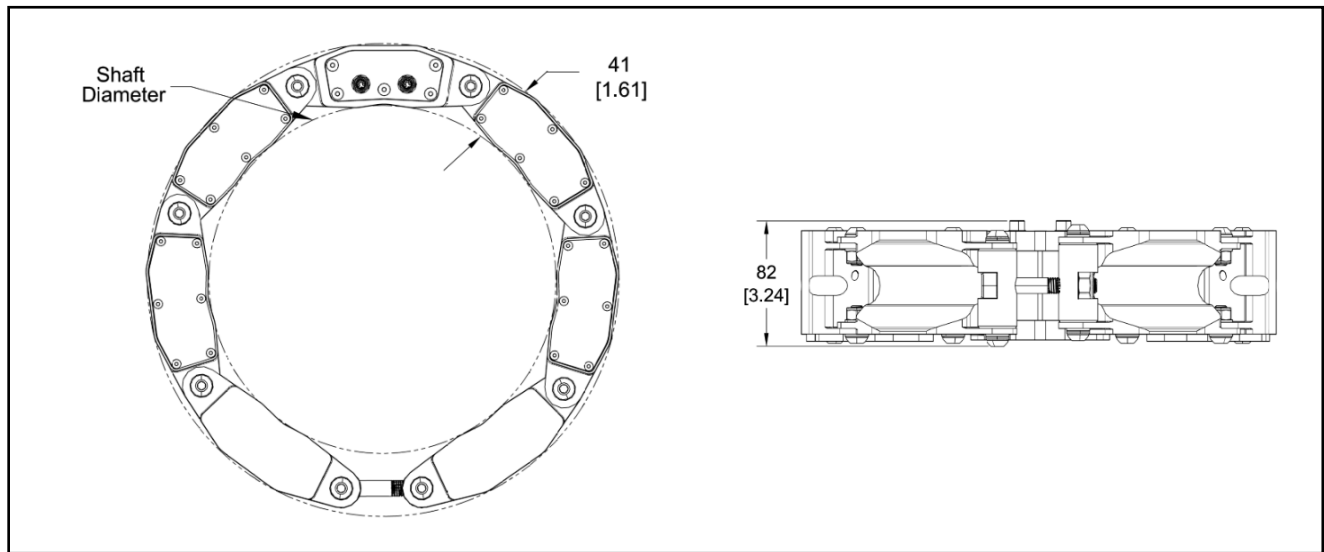


Figure B1: TX50 Transmitter Collar Dimensions

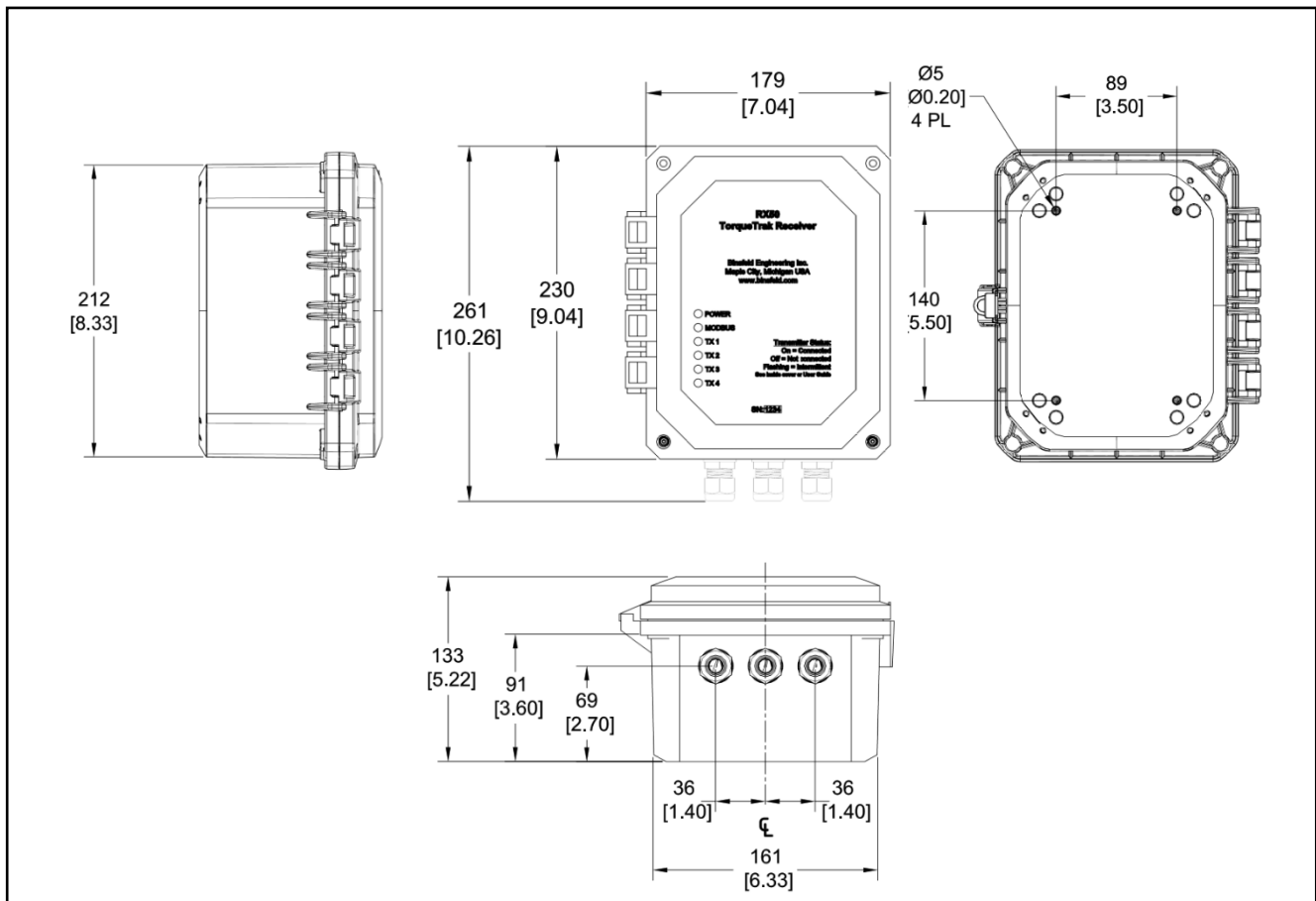


Figure B2: RX50 Receiver Dimensions (mm [inch])

USA and Canada:

47 CFR § 2.1077 Compliance Information

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10 WARRANTY AND SERVICE INFORMATION

ONE YEAR LIMITED WARRANTY

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Binsfeld Engineering Inc.'s sole obligation under this warranty is, upon evaluation by Binsfeld Engineering Inc., and at Binsfeld Engineering Inc.'s option, to repair or correct any defect or to replace or exchange the Product with a copy of the original invoice to Binsfeld Engineering Inc. at its own cost. Any repaired, corrected, replaced or exchanged Products shall be subject to the warranty and limitations set forth. If Binsfeld Engineering Inc. has received notification from Customer, and no defects of the Product could be found, Customer shall bear the costs that Binsfeld Engineering Inc. incurred as a result of notice.

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