User’s Guide

RT 400

Battery Low
Link Failure
Charging

RT400 Telemetry System
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WARNING: These products are not designed for use in, and should not be used for, patient-connected applications.
DESCRIPTION

TELEMETRY SYSTEM Wireless Telemetry from... presents a real alternative to costly cables or wires. TELEMETRY SYSTEM enables remote data acquisition from sensors without hard-wiring.

The TELEMETRY SYSTEM transmitter conveniently interfaces with any resistor or strain gauge based sensor and converts the sampled analogue measurements to digital code. This code is sent to the receiver unit by radio, where the original analogue signal is reconstructed and a scaled output signal is produced.

The in-built UHF radio transmitter and receiver circuits operate on 915 MHz and are approved to FCC part 15, allowing LICENCE FREE use in the USA. A fixed compact 1/4 wave helical antenna is provided on both transmitter and receiver units as standard, enabling line of sight operating ranges of over 200 metres to be achieved.

The compact design incorporates a miniature microprocessor base circuit, which provides 16 bit analogue to digital conversion and digital encoding for the radio transmission. Using highly reliable radio designs, and by including data error detection techniques, data transmission is safe and free from errors caused by interference.

Both TELEMETRY SYSTEM units are powered by a rechargeable battery. Battery life is extended to 600 hours by utilising duty-cycle power saving. Both the transmitter and receiver units are light, compact yet rugged, and are housed in a tough ABS enclosures, environmentally protected against water ingress or dust to IP65.

Typical applications include remote monitoring of strain gauge outputs for stress analysis, weighing systems, load cells and transducers.

INSTALLATION

Surface mounting

The RT400T and RT400R are intended for surface mount installation using the 4 brackets supplied. For best results do not mount these units directly onto a conductive/metal surface, use a spacer of wood or plastic to provide a minimum separation gap of 25mm. Ensure that NO metal objects are within 50mm of the free (hot) end of the antenna.

To attach the unit to the intended surface(See figure 2):-

1) Remove the the plastic blanking plugs in each corner of the rear housing to reveal the retaining screws.
2) Unscrew and remove the 4 retaining screws. Remove the rear housing for electrical installation access.
3) Insert each plastic mounting bracket into the square recesses in each corner of the rear housing and fix into place by fastening the original retaining screws through the bracket screw holes.
4) Tighten down the retaining screws to re-seal the housing.
5) Aline the enclosure in the desired position on the mounting surface.
6) Fasten the unit to the surface using M4 screws through the 4mm slots in the mounting brackets.
ELECTRICAL INSTALLATION

Access to the enclosure for electrical installation is achieved by removing the rear housing as described above.

Power connection

As standard both the RT400T and RT400R units operate from an internal 3.6V rechargeable battery. When the TELEMETRY SYSTEM units are supplied new, this battery will be fully charged. To prevent draining the battery before installation, the Power ON/OFF switch will be factory set to the OFF position. To begin operation, slide the power switch into the ON position.

A 12Vdc/500mA power pack is required to recharge the internal battery when drained. The units can be left on float charge continuously without any harm. Otherwise, recharge the battery when indicated by the LED status light on the front panel of the units. The red 'Charging' LED is illuminated when the external power pack is connected and switched on.

Battery life

RT400T: The battery life when fully charged will depend on two factors; the Duty Cycle time setting, and the input impedance of the interfaced sensor. Typically, when using a Wheatstone bridge type sensor with input impedance of 1000ohms, and a Duty Cycle time of 10seconds, a continuous operation battery life of 500hours can be expected, before recharging is required.

A variant of the standard unit, includes a non-rechargeable Lithium battery pack, which will increase the battery life to typically 10000 hours continuous use before replacing.

RT400R: When fitted, the internal battery life will typically be 8 hours before recharging. This unit would therefore normally be powered by the 12V power pack, with the battery on float charge. The battery acts only as a power backup.

Signal connections

A 4 way screw terminal block enables external signal connections to be made to the TELEMETRY SYSTEM units. The signal cable should be passed through the cable gland at the base of the units, which will accept cable diameters of 3 - 6.5mm. 4 way, screened instrument cable should be used for these connections. The screw terminal block will accept conductor sizes from 0.5 to 1.5mm².

Address code

An 8 way DIP switch is used to select the required transmitter and receiver address codes. The 8 bit address code must be set the same to allow the RT400T to communicate with RT400R. The address code prevent interference from adjacent sets, and 256 codes available.
RT400T TRANSMITTER

Input signal

The RT400T will interface directly with a wheatstone bridge sensor. A sensor excitation voltage of 3.3Vdc is provided to power the sensor, which is turned ON for 60mS before sampling the output takes place, then switch OFF to preserve battery power. See figure 5 for connection details.

Input range

The input sensitive range is selectable on 2 DIP switches (See figure 3). The sensitivity range should be selected to best match the interfaced sensor, as this will achieve the highest resolution of measurement. The selectable ranges are:

<table>
<thead>
<tr>
<th>Range Switches</th>
<th>Input full-scale sensitivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>On  On</td>
<td>+/-5mV</td>
</tr>
<tr>
<td>On  Off</td>
<td>+/-25mV</td>
</tr>
<tr>
<td>Off On</td>
<td>+/-500mV</td>
</tr>
<tr>
<td>Off Off</td>
<td>+/-1000mV</td>
</tr>
</tbody>
</table>

Transmission duty-cycle

Once powered, the transmitter unit will continue to sample the input signal and transmit the coded measurement. The time interval between each successive transmission is controllable and can be set to the required value between 500mS and 10seconds, by adjusting the duty cycle trimming potentiometer (see figure 3). During each transmission, the ‘Transmit’ green LED will illuminate briefly.
RT400R RECEIVER

Voltage signal

The input signal from the transmitter units is reconstructed in the receiver, and a scaled output signal of 0 to +/-2.5Vdc is generated, representing zero to full-scale. For example:

Conditions
Input range: 2mV/V selected.
Sensor type: Load cell, with measured full-scale sensitivity of 1.800mV/V.
Applied load: +30%FS.

Then receiver output = \((50/100) \times (1.8/2) \times 2.5\, \text{V} = 1.125\, \text{V}\)

Communication link failure alarm

The green LED switches ON (illuminated) to indicate that the communications link between the transmitter and receiver units has failed. This maybe due to a week or nonexistent radio signal, or miss-matched address codes. When this LED is switched OFF a communications link is present.

This indication is also available as an open drain switch (see figure 4). The drain connection switches to 0V when the communication link is made, and switches to high impedance when communications are lost.

Time-out alarm delay

The time period that the receiver unit waits to receive a valid data frame before activating the communication link failure alarm, can be adjusted to suit the duty-cycle of the transmitter unit. The time-out period can be adjusted from 1 second to 9 hours by selecting the appropriate delay on the MODE switches (see selection table below).

<table>
<thead>
<tr>
<th>Mode switches</th>
<th>Time-out delay (seconds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 3 2 1 0 0</td>
<td>1</td>
</tr>
<tr>
<td>4 3 2 1 0 1</td>
<td>2</td>
</tr>
<tr>
<td>4 3 2 1 0 1 0</td>
<td>4</td>
</tr>
<tr>
<td>4 3 2 1 0 1 1</td>
<td>8</td>
</tr>
<tr>
<td>4 3 2 1 0 1 0 0</td>
<td>16</td>
</tr>
<tr>
<td>4 3 2 1 0 1 0 1</td>
<td>32</td>
</tr>
<tr>
<td>4 3 2 1 0 1 1 0</td>
<td>64</td>
</tr>
<tr>
<td>4 3 2 1 0 1 1 1</td>
<td>128</td>
</tr>
<tr>
<td>4 3 2 1 0 1 0 0 0</td>
<td>256</td>
</tr>
<tr>
<td>4 3 2 1 0 1 0 1 0</td>
<td>512</td>
</tr>
<tr>
<td>4 3 2 1 0 1 0 1 1</td>
<td>1024</td>
</tr>
<tr>
<td>4 3 2 1 0 1 0 1 0 0</td>
<td>2048</td>
</tr>
<tr>
<td>4 3 2 1 0 1 0 1 0 1</td>
<td>4096</td>
</tr>
<tr>
<td>4 3 2 1 0 1 0 1 1 0</td>
<td>8192</td>
</tr>
<tr>
<td>4 3 2 1 0 1 0 1 1 1</td>
<td>16384</td>
</tr>
<tr>
<td>4 3 2 1 0 1 1 1</td>
<td>32768</td>
</tr>
</tbody>
</table>

Note: '0' represents OFF, '1' represents ON
**RT400T SINGLE CHANNEL RADIO TRANSMITTER**

**Technical Specification**

**FREQUENCY RANGE:** 915MHz  
**TRANSMITTER POWER:** 0.25mW  
**TYPE APPROVAL:** FCC part 15  
**TRANSMISSION INTERVAL IDENTIFICATION ADDRESS:** 500 μs, 10 & (adjustable), 0-255 (switch selectable)

**USER SELECTABLE RANGES:**
1) +/-2mV/V  5) +/-5mV  
2) +/-10mV/V  6) +/-25mV  
3) +/-200mV/V  7) +/-500mV  
4) +/-400mV/V  8) +/-1000mV

**RESOLUTION:** Better than 0.02% (13 bit)  
**SENSOR EXCITATION:** 3.3 Vdc (9Vdc available as option)  
**POWER REQUIREMENTS:** Internal 3.6V@120mAhr rechargeable battery  
**STAND-BY CURRENT:** 150μA  
**BATTERY LIFE:** 600 hours typically when fully charged  
**BATTERY CHARGING:** 12Vdc@10mA for 14 hours or continuous trickle charge  
**HOUSING:** High impact resistance ABS, rated to IP65  
**DIMENSIONS:** 55 x 90 x 40 mm  
**WEIGHT:** 120 g (approximately)  
**OPERATING TEMPERATURE:** -10 degC to +55 degC  
**STORAGE TEMPERATURE:** -40 degC to +85 degC  
**ANTENNA:** 42mm, 1/4 wave helical in plastic moulding  
**SENSOR CONNECTION:** 4 screw terminals for 0.5 to 1.5mm² wire  
**CABLE GLAND:** Accepts cable diameter 3.0 - 6.5mm diameter
RT400R SINGLE CHANNEL RADIO RECEIVER

Technical Specification

FREQUENCY RANGE: 915MHz
RECEIVER SENSITIVITY: 113 dBm
TYPE APPROVAL: FCC part 15
COMMUNICATION FAIL URF: Adjustable time delay
ALARM: Open drain output, maximum current 100mA. Switches to low impedance during communication failure.

ANALOGUE OUTPUTS: +/-2.5Vdc full-scale (0-5 Vdc option available)
RESOLUTION: Better than 0.02% (13 bit)
POWER REQUIREMENTS: 12Vdc from power pack
INTERNAL BATTERY 3.6V@120mAhhr rechargeable (When fitted)
STAND-BY CURRENT: 14mA
BATTERY LIFE: 8 hours typically when fully charged
BATTERY CHARGING: 12Vdc@20mA for 7 hours or continuous float charge
HOUSING: High impact resistance ABS, rated to IP65
DIMENSIONS: 55 x 90 x 40 mm
WEIGHT: 120 g (approximately)
OPERATING TEMPERATURE: -10 degC to +55 degC
STORAGE TEMPERATURE: -40 degC to +85 degC
ANTENNA: 42mm, 1/4 wave helical in plastic moulding
CABLE CONNECTION: 4 screw terminals for 0.5 to 1.5mm² wire
CABLE GLAND: Accepts cable diameter 3.0 - 6.5mm diameter
DIMENSIONS IN M.M.

Figure 1. DIMENSIONAL DRAWING

DIMENSIONS IN M.M.

Figure 2. RECOMMENDED WALL MOUNTING DETAIL
Figure 3. RT400T INTERNAL LAYOUT
Figure 4. RT400R INTERNAL LAYOUT
Figure 5. RT400T CONNECTION DETAILS

Figure 6. RT400R CONNECTION DETAILS
WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of 13 months from date of purchase. OMEGA's 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 malfunctions, 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. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of having been 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, are not warranted, including but not limited to contact points, fuses, and triacs.

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RETURN REQUESTS / INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA 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.

The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR WARRANTY RETURNS, please have the following information available before contacting OMEGA:
1. Purchase Order 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, consult OMEGA for current repair charges. Have the following information available before contacting OMEGA:
1. Purchase Order number to cover the cost of the repair,
2. Model and serial number of the product, and
3. Repair instructions and/or specific problems relative to the product.

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