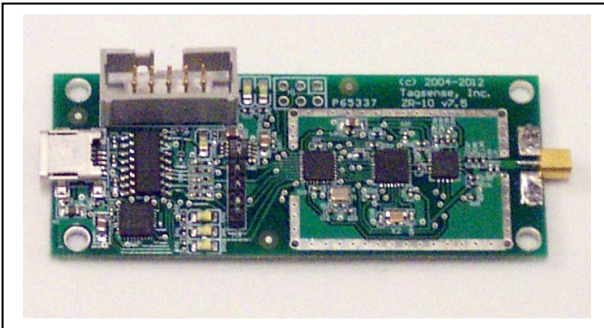




## ZR-100 Long-Range Active Tag Reader for Embedded Applications v1.0



### Features:

- Communication range over 1 mile (~1.6 km) in open air (at full power, w/5dBi omni antenna)
- Does not interfere with wireless computer networks (IEEE 802.11b/g)
- Bi-directional reader-tag communication – can send user commands and data to tags
- A single reader can support up to 50 tags at a time
- Supports dense reader mode using CSMA protocol
- Based on Industry standard IEEE 802.15.4
- TTL and RS-232 serial interface

### Applications:

- Asset tracking and monitoring
- Remote sensing and monitoring
- Sensor data logging
- Tagging of pallets, vehicles, animals, and shipping containers

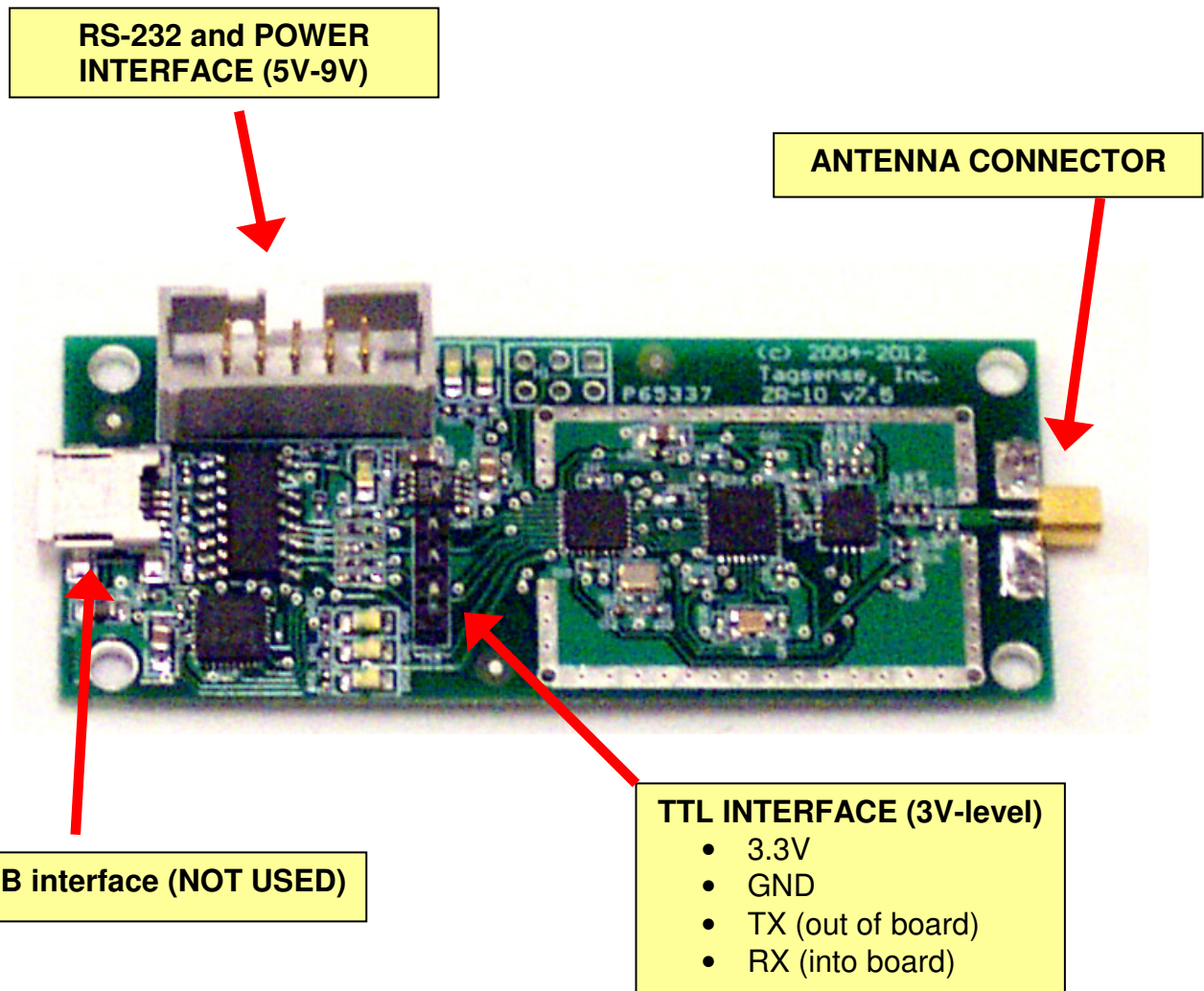
The ZR-100 is a versatile long-range active tag reader that communicates via the industry standard protocol IEEE 802.15.4. The operating frequency of 2.45 GHz enables this reader to have a long range (>1.5 kilometer) with shorter antennas.

The IEEE 802.15.4 physical layer protocol is widely used today and has bi-directional communication between the tag and the reader. This enables faster and more efficient communications when multiple tags and readers are present.

The ZR-100 is designed for embedded applications – to be plugged into another circuit board with an external antenna. The ZR-100 contains both a UART-compatible TTL-level data interface as well as a higher-voltage RS-232 serial interface for easy integration.



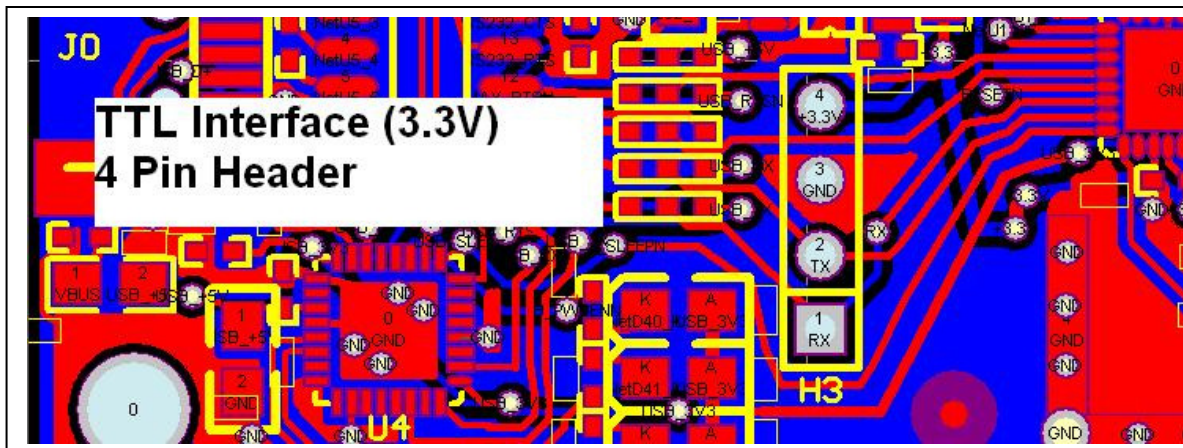
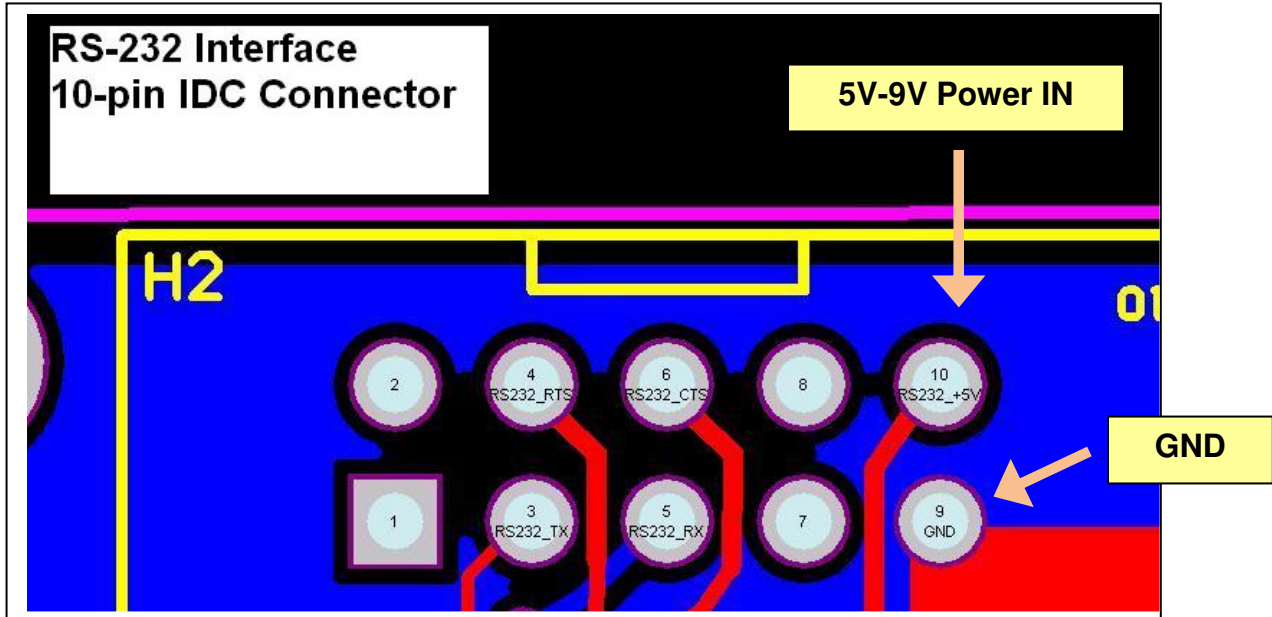
## ZR-100 Long-Range Embedded Active Tag Reader



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## ZR-100 Pin-outs





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## ZR-100 Long-Range Embedded Active Tag Reader

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### **Communications Overview:**

The ZR-100 Long-range Embedded Reader is designed to communicate with the TagSense ZT-50 and ZT-500 active RFID Tags. The ZR-100 reader communicates with the active tags using a variable packet length protocol which is designed to conserve power on the tag. This protocol is available to TagSense customers wishing to develop custom software using the active tags and reader. The Visual Basic source code for the Windows demonstration program is also provided for free with the purchase of any TagSense active RFID kit.

The TagSense air interface protocol layer is based on the underlying IEEE 802.15.4 industry standard, which is most well-known as the physical layer for Zigbee. However, the full Zigbee protocol is not well-suited for most RFID applications since it contains a great deal of overhead and requires a larger program memory on the tag to support routing tables and multi-hop/mesh capability.

In order to support general RFID applications, and conserve power, the TagSense active RFID tags use a star topology, where all tags communicate directly to the reader, and the reader sends control commands to the tags. The TagSense Active RFID tag protocol is also "tag-talks-first" or TTF, which works very well for ad-hoc networks, where tags are continuously entering or leaving the network. Since the reader needs to quickly process all the packets that are being received from multiple tags, the reader does a minimum amount of processing on the tag data and passes it on to the host.

For sending commands to the tags, TagSense implements a 2-byte CRC error check in addition to the embedded CRC used by IEEE802.15.4 in order to improve robustness and greatly reduce the probability of spurious commands generated by RF noise.

TagSense provides a wide range of commands that support sensor functions and i/o capability as well as the ability to control the frequency channel and transmit power, which makes the ZR-10 a very flexible and useful device.

### **OPERATING SPECIFICATIONS**

- **Frequency:**  
2.452-2.459 GHz MHz
- **Supply Voltage:** 5V-9V
- **Current consumption:**
  - <1mA when idle
  - Short bursts of pp to 200mA when transmitting depending on power setting)





## Summary of Reader Commands

The following is a summary of commands currently supported by the ZR-100 Reader. Details of the communication protocol can be found in the TagSense ZR-x communication protocol specification available from the TagSense web site.

| Command                  | Argument                          | Remarks  |
|--------------------------|-----------------------------------|--|
| Read Firmware Version    | <none>                            | Reader will return its firmware version. Older firmware versions of the ZR-x will return an error to this request.   |
| Read Queue Entries       | <none>                            | Reader will return the command handles for all queued tag commands   |
| Read Queue Length        | <none>                            | Reader will return the size of the queue (i.e. number of commands)   |
| Delete Queue Entry       | 1 byte command handle             | Reader will delete tag command with handle specified.  |
| Read Queue Entry Command | 1 byte command handle             | Reader will return the destination tag ID and payload for the handle specified.  |
| Set Reader ID            | 2 byte reader ID                  | Reader will set its ID to the argument of this command.  |
| Read Reader ID           | <none>                            | Reader will return its 2 byte ID.  |
| Flush Queue              | <none>                            | Reader will remove all tag commands from its queue   |
| Set Reader Time          | 4 byte UTC                        | Reader will synchronize its internal clock to the argument of this command   |
| Query Reader Time        | <none>                            | Reader will return its 4 byte UTC.   |
| Append Reader Time       | 1 Byte:<br><br>01= ON<br>00 = OFF | This controls whether or not the reader will append the value of its real-time clock (time stamp) to end of every tag packet that is received and forwarded to the host. |



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## Summary of Reader Commands (continued)

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| Command                         | Argument                          | Remarks  |
|---------------------------------|-----------------------------------|--|
| <b>Read Firmware Version</b>    | <none>                            | Reader will return its firmware version. Older firmware versions of the ZR-x will return an error to this request.   |
| <b>Read Queue Entries</b>       | <none>                            | Reader will return the command handles for all queued tag commands   |
| <b>Read Queue Length</b>        | <none>                            | Reader will return the size of the queue (i.e. number of commands)   |
| <b>Delete Queue Entry</b>       | 1 byte command handle             | Reader will delete tag command with handle specified.  |
| <b>Read Queue Entry Command</b> | 1 byte command handle             | Reader will return the destination tag ID and payload for the handle specified.  |
| <b>Set Reader ID</b>            | 2 byte reader ID                  | Reader will set its ID to the argument of this command.  |
| <b>Read Reader ID</b>           | <none>                            | Reader will return its 2 byte ID.  |
| <b>Flush Queue</b>              | <none>                            | Reader will remove all tag commands from its queue   |
| <b>Set Reader Time</b>          | 4 byte UTC                        | Reader will synchronize its internal clock to the argument of this command   |
| <b>Query Reader Time</b>        | <none>                            | Reader will return its 4 byte UTC.   |
| <b>Append Reader Time</b>       | 1 Byte:<br><br>01= ON<br>00 = OFF | This controls whether or not the reader will append the value of its real-time clock (time stamp) to end of every tag packet that is received and forwarded to the host. |



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## Summary of Reader Commands (continued)

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| Command                   | Argument       | Remarks  |
|---------------------------|----------------|--|
| SET_WATCHDOG_TIMEOUT      | 4-Byte timeout | Sets the watchdog timeout value. The timeout is in units of half-seconds. The reader will reset if no tag packets are received within the timeout interval.  |
| SET_CHANNEL               | 1-Byte (11-26) | Sets the frequency channel within the 2.4 GHz radio band.  |
| SET_TX_POWER              | 1-Byte (1-8)   | Sets reader transmit power level.  |
| SAVE_READER_CONFIGURATION | <none>         | Saves the following parameters of the current reader configuration: <ul style="list-style-type: none"><li>• TX power</li><li>• Radio channel</li><li>• Watchdog timeout</li><li>• Active/passive mode</li><li>• Append reader time</li><li>• Reader ID</li></ul> |