



## ***Scorpion I Reader User's Guide***

***RF Code, Inc. Publication: 03801674-01***

<i>Issue Date</i>	<i>Comment</i>	<i>Revision</i>
November 8, 2001	Initial Release	00
January 23, 2002	Added P/N's of added equipment	01
February 6, 2002	Added FCC Disclaimer and Motion tag P/N detail	02



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## FCC Certification

**Information to User:** - Changes or modifications to this equipment, not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

**Note:** This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However there is no guarantee that interference to radio or television reception, which may be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- ✓ Reorient or relocate the receiving antenna.
- ✓ Increase the separation between the equipment and receiver.
- ✓ Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- ✓ Consult the dealer or an experienced radio/TV technician for help.

Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

The Scorpion I's two major components are independently certified and comply with Federal Communications Commission (FCC) rules, part 15.

1. This Scorpion I Reader complies with part 15 of the FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.
2. The system operates by using Scorpion I tags that have been certified or are in the certification process. These devices comply with part 15 of the FCC rules. Operation is subject to the following two conditions: (1) these devices may not cause harmful interference, and (2) these devices must accept any interference received, including interference that may cause undesired operation.
  - a. FCC ID: N3S2001B01 for:
    - i. Standard 7 second Spider Tag P/N: 05101297-06.

- b. FCC ID: N3S2001B02 for:
  - i. 13 second Spider Tag P/N: 05101297-07
  - ii. 25 second Spider Tag P/N: 05101297-20
  - iii. 50 second Spider Tag P/N: 05101297-21.
  
- c. FCC ID: P6F2001B03 for:
  - i. 2 second Scorpion I Tag P/N: 05101297-26
  - ii. 5 second Scorpion I Tag P/N: 05101297-27
  - iii. 10 second Scorpion I Tag P/N: 05101297-28
  - iv. 15 second Scorpion I Tag P/N: 05101297-29.
  
- d. FCC IDs: P6F2001C04 for:
  - i. Scorpion I Tags with motion sensor P/N 05101677-01 (containing PCB level P/N 02021663-01)
  - ii. Scorpion I Tags W/O motion sensor P/N 05101677-11 (containing PCB level P/N 02021663-11)

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## 1 Introduction

The RF Code Scorpion I System is an RFID monitoring system designed to report tags within defined reader operating ranges. The system utilizes “beacon” tags that periodically report their presence with an encoded radio transmission. The Scorpion I Reader is a dual channel radio receiver tuned to the Scorpion I Tag transmission frequency.

The Scorpion I includes a Client Bridge as the interface between the Scorpion I Reader and an Ethernet network. The reader receives the message and decodes the tag’s identity each time the tag transmits. The reader sends the tag identity information through the Client Bridge to the RF Code Concentrator LI software application for processing. The Client Bridge can be configured to operate as a wired connection to the Ethernet 10/100 network, using an RJ-45 connector, or using an IEEE 802.11b wireless connection to the host computer.

## 2 Purpose

This manual provides instructions for the Scorpion I Reader setup and operation. The Scorpion I Reader has different modes of operation and optional functions that are user-selected, depending on the system’s operational requirements.

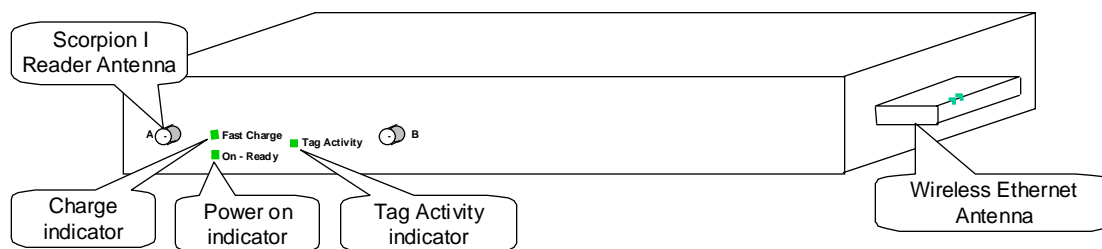
## 3 Scope

The instructions in this manual show how to configure the Scorpion I Reader for physical options contained within the device itself. Operational Instructions for the Scorpion I System using RF Code’s Concentrator LI software are found in the Concentrator LI User’s Guide; RF Code publication ***IS1007***

## 4 Scorpion I Reader

The Scorpion I Reader contains the internal components of an RF Code Scorpion I Reader and an Ethernet Client Bridge and is housed in a 12" x 8.5" x 2" painted, aluminum chassis with screw-on cover. The reader works with Scorpion I Tags that periodically transmit an encoded radio signal identity. The reader decodes each tag's signal and sends that information to the host processor, using the Ethernet Client Bridge as a communication interface to the local area network (LAN).

### 4.1 Scorpion I Reader Physical I/O



**Figure 1 Scorpion I Reader (Front View)**

Each Scorpion I Reader **Antenna Post** (A & B) supplies an RF signal to the two parallel radio receivers in the Scorpion I Reader. Reference Paragraph 4.3, Page 7 for antenna positioning for optimum performance. The antenna input impedance is 50 ohms nominal.

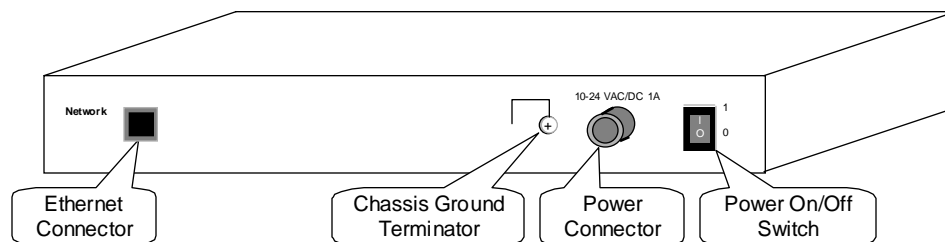
**Charge Indicator** is on while the reader is in operation. The light may or may not be on while the power is applied, even when the reader's power switch is off.

**On- Ready Indicator** light, when illuminated, indicates the Scorpion I Reader has power applied through the external power connector and the power switch is on.

**Tag Activity Indicator** light is used for two purposes: to show the status of the reader while in standby mode and to show tag detections while in active mode.

1. While in active mode, the light flashes at random indicating the reader has read one or more tags each time it flashes. Because the reader can decode tags faster than the light can be turned on and off, a single flash may indicate more than one tag being decoded. When the Scorpion I Reader is using the auto-registration mode, the activity light flashes may indicate auto-registration activity prior to reporting tag IDs to the network.
2. While in standby mode, the reader's Tag Activity light turns on and off at a distinctively cyclic rate that indicates the reader is in standby mode.

The **Wireless Ethernet Antenna** is positioned on the outside of the Scorpion I chassis while being plugged into the Client Bridge inside the chassis. The antenna is on the end of a PCMCIA card that is plugged into the Client Bridge through a cutout in the Scorpion I enclosure.



**Figure 2 Scorpion I (Rear View)**

**Ethernet Connector** is an RJ-45 Ethernet jack to be used as the termination point when this reader is part of a wired Ethernet LAN network. This reader can be connected to a standard 10 Mbps network or a 10/100 Mbps network that can switch speeds down to 10 Mbps.

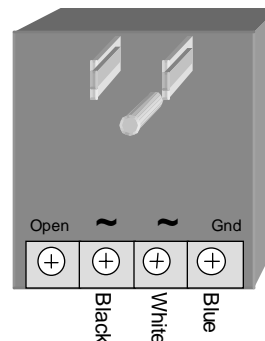
**Chassis Ground Terminator** is a screw terminal that can be used to electrically ground the Scorpion I chassis. Normally this termination is not used because the reader is grounded through the third wire ground lead in the power connector. The only time this Chassis Ground terminator should be used is if the ground through the power connection is not connected.

**Caution:** *Do not install this reader with both grounds connected. If both grounds are connected, severe damage to the reader may result during a near proximity lightning strike.*

## Scorpion I IIIAR Reader

**Power On/Off Switch** supplies power to the reader. The switch is on when it is in the 1 position.

**Power Transformer** has a three-pin keyed connector used to supply power from the power source to the reader. The power transformer supplied with the Scorpion I provides the reader with 18 volts AC. The power transformer plugs into a standard 110 – 125 VAC wall outlet. The cable's active leads are labeled ~ and ~, the Gnd lead is connected to the wall outlet ground. The "Open" terminal is not used in this application. The factory-supplied cable is connected to the transformer using wire colors shown below the termination blocks. The factory-supplied cable terminates in a circular 97 Series screw connector at the Scorpion I Reader.



If the reader is being supplied with DC power, the DC power is supplied through the black and white wires (either polarity) with the blue wire connected to earth ground.

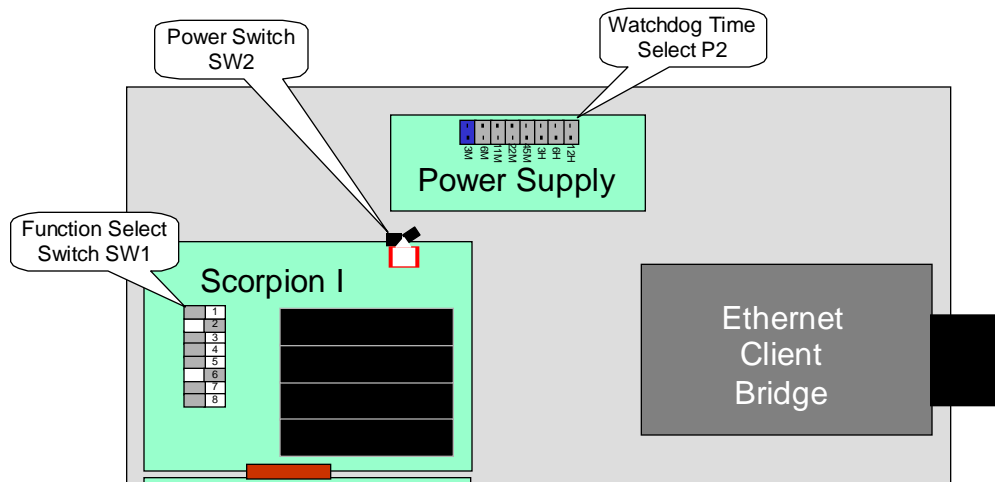


## 4.2 Scorpion I Reader Internal Settings

The Scorpion I Reader has three major components inside the enclosure:

- Scorpion I Reader printed circuit board (PCB);
- Power Supply PCB; and,
- Ethernet Client Bridge.

All three components have physical configuration capabilities that affect how the reader works.



**Figure 3 Scorpion I Internal Configuration Points**

There are two **Scorpion I Reader printed circuit boards** that comprise the Scorpion I Reader. The PCB on the side of the enclosure extends the two antenna posts through the side of the enclosure. The main PCB is the processor and data interface to the outside world. These two boards operate as one Scorpion I Reader through a right angle connector.

The main PCB has a power switch (SW2) that must remain in the **On** position, all the time. The main PCB also has an eight-position Dipswitch (SW1) that permits the selection of specific functions and baud rates used by the reader. The SW1 Dipswitch factory setting is switches two and six on and all other switches off as shown in Figure 3. Each time the reader is turned on, it is restored to the default settings which is determined by this switch. Most of the reader's configuration controls are implemented by serial download

commands to the embedded Scorpion I Reader in the chassis. Instructions for the Scorpion I Reader's operation using RF Code's Concentrator LI are found in the Concentrator LI user's guide; RF Code publication number 03801400-11.

To implement a feature required in the Scorpion I's operation, the reader is supplied with an empty battery holder. Batteries are not used in the Scorpion I application. *Do not install batteries in the battery holder.*

**Caution:** *By installing batteries, the reader will lose a functional feature and could possibly create a physical hazard to the user.*

The **Power Supply printed circuit board** provides power to the Scorpion I Reader and the Client Bridge inside the enclosure. The power supply PCB receives its power from the external power connector and will operate with 10 to 18 volts, either AC or DC input.

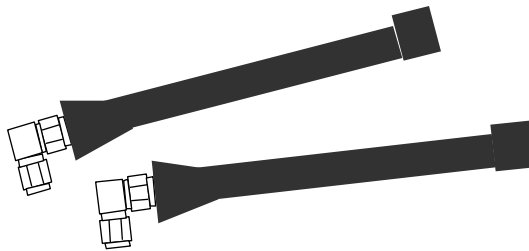
The power supply PCB also provides a communication watchdog between the Scorpion I Reader and the Client Bridge. The watchdog monitors the communication handshake lines between the two devices. If there is no communications activity from either the Client Bridge or the Scorpion I Reader for the period of time selected by the P2 jumper, the watchdog power cycles (momentarily turns off the power) to both devices at the same time. Power cycling restarts both units in their default startup configuration, which permits them to resume normal communications.

The inactivity watch time is set with a Jumper on P2 termination strip. The inactivity watch time can be set as short as three minutes (3M), and as long as twelve hours (12H), with six intermediate steps between these extremes. The watchdog times are approximate and not intended for exact timing. The factory setting is three minutes and can be changed by removing the selection jumper from the three-minute (3M) P2 terminals and placing it on the desired P2 terminals. Note: do not operate the reader with the jumper removed; the watchdog requires a valid jumper position to operate correctly.

The **Ethernet Client Bridge** can be operated using the wireless 802.11b Ethernet link or the wired RJ-45 connection. If wired Ethernet is to be used, remove the wireless PCMCIA card from the Client Bridge while the unit's power is turned off. Connect the Ethernet access RJ-45 cable into the reader.

If wireless Ethernet is used, plug the wireless PCMCIA card into the Client Bridge while the unit's power is turned off. Do not attempt to use the wired RJ-45 connection at the same time the wireless PCMCIA card is plugged in.

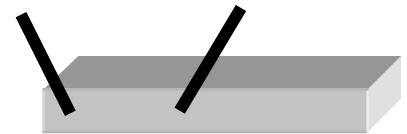
### 4.3 Scorpion I Reader Antennas



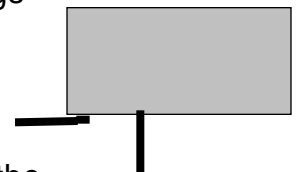
The type of antennas used and the reader's range setting determine the effective read range. The normal reader range features are defined using  $\frac{1}{4}$  wave helical antennas. These antennas are appropriate for most reader applications. Optional antennas

that offer diverse receiving properties are available for the Scorpion I Reader. Contact your Scorpion I Reader distributor for more information.

The Scorpion I Reader has two receiver channels that can operate independently, or jointly, to provide tag signal diversity reception. The reader can operate with one antenna on either antenna post; the benefit of receiver diversity reception is obtained with both antennas attached.



To achieve the best receiver diversity, it is desirable to have the antennas positioned at different angles from the reader. Because the tags may be located at various places and orientations around the reader, the signal path to the reader may vary for each tag. Because the signal path is different for each tag, one antenna may see the signal while the other may not. Keep the antennas separated; having the antennas overlapped cancels the effectiveness of each antenna. It may be necessary to experiment with antenna positions to achieve optimum coverage.



#### 4.4 Scorpion I Reader Environmental Limits

Operating Temperature	-20 + 60° C
Storage Temperature	-40 + 75° C
Operating humidity	<95% Non-condensing at 50° C
Storage humidity	<98% Non-condensing at 50° C

The Scorpion I Reader enclosure is designed to meet the requirements of NEMA 12 indoor installation standards.

#### 4.5 Scorpion I Reader Mounting

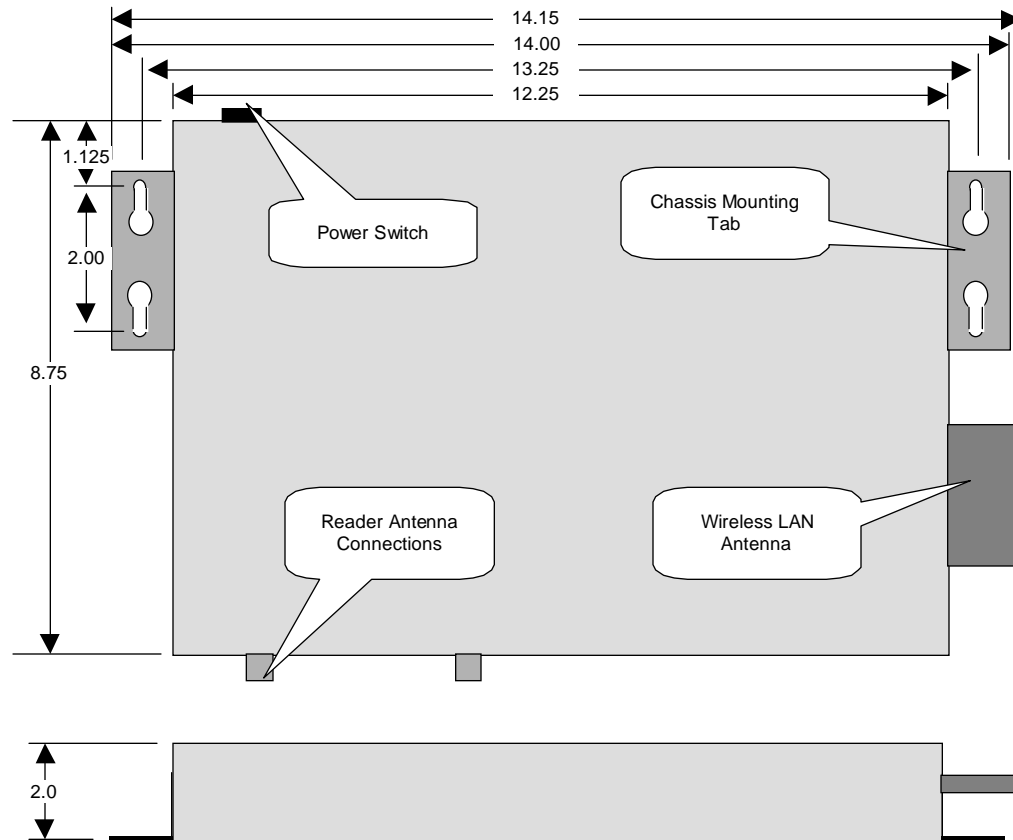
This reader mounting discussion defines the reader antenna's mounting locations. If the antennas are mounted on the reader, then these installation instructions apply to the reader with the antennas installed on the reader.

As a general rule, the higher the antenna is positioned above the ground or floor, the better the reader's detection range. Detached antennas with low loss SMA coaxial extension cables connected to the reader may be used to separate the reader from the antennas.

To minimize RF interference, maintain a four to six foot separation between the Scorpion I Reader antennas and potential RF radiators such as computers, monitors, printers and electronic office equipment. The local radio environment can limit the reader's effective range. Grounded and reflective metallic structures around the reader's antennas and/or tags affects the system's performance.

As a general rule, the reader's antennas should be mounted as high as reasonably possible. However, mounting the antennas on the ceiling that is also the floor of the story above may be detrimental because the antennas are located near a "grounded floor". The difference is, the floor is now above the reader instead of below the reader. It may be necessary to experiment to find the optimum position for placing the reader's antennas.

Figure 4 shows the chassis mounting tabs on the Scorpion I Reader. The dimensions are in inches.



**Figure 4 Scorpion I Physical Mounting Dimensions**

## 4.6 Scorpion Tags



This reader operates in conjunction with Scorpion tags that periodically transmit a radio frequency encoded identity. This transmission is intended to be received the reader, decoded, and passed on to the system database for processing.

### Problem Analysis

This is a brief list of potential problems, with possible solutions, that may be encountered while using the Scorpion I Reader. If the problem cannot be resolved using this remedy chart, please call the distributor from which you obtained the Scorpion I System for help in resolving the problem.

Condition	Symptom	Remedy
There are no tags being read at the reader	✓ The reader power light is off	<ul style="list-style-type: none"> <li>✓ Plug in the reader power pack</li> <li>✓ Turn on the reader power switch</li> </ul>
There are no tags being read at the reader.	<ul style="list-style-type: none"> <li>✓ The reader power light is on</li> <li>✓ The reader detect light is flashing on and off at a regular interval</li> </ul>	✓ The reader is in standby mode and needs to be configured and enabled for operation.
There are no tags being read at the reader.	✓ The reader has power but is unresponsive to system communications or remote restart commands.	✓ Verify the LAN is connected and the Client Bridge can be "Pinged"
There are no tags being read at the reader. The reader has been configured and enabled.	<ul style="list-style-type: none"> <li>✓ The reader power light is on</li> <li>✓ The reader detect light is not flashing</li> <li>✓ The system is receiving the "status" message from the reader.</li> </ul>	<ul style="list-style-type: none"> <li>✓ Verify the antennas are attached to the reader and / or move the tags closer to the reader.</li> <li>✓ Change the range setting on the reader to a longer range to see the available tags.</li> <li>✓ Verify the communication medium between the reader and the computer is operational.</li> <li>✓ Verify that the configured group code is the same as the tags being read.</li> <li>✓ Verify the computer program is setup correctly to receive tag IDs.</li> </ul>
Tag IDs do not drop off the computer display when the tags are moved away from the reader	✓ The ¼ wave helical antenna(s) are installed on the reader	<ul style="list-style-type: none"> <li>✓ Change the reader's range setting to a shorter range.</li> <li>✓ Verify that the data path from the reader to the computer is functional</li> </ul>
The Scorpion I Reader reports erratic tag movement in Exception mode.	✓ Reports normal tag information while in Continuous mode.	✓ Verify that the tag timeout time is configured 25% larger than the transmission interval from the tag.

*Notes:* \_\_\_\_\_

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