TITAN

Quick Start Guide

Product Name: RFID READER

Brand: TITAN

Model:HRD22000

Manufacture: Star Systems International Limited

Your Success is Our Vision

Attention

The Titan RFID reader described in this Quick Start Guide is a commercial product and must be installed by professional installer.

FCC Radiation Exposure Statement
The antennas used for this transmitter must be installed to provide a minimum separation distance of at least 1 meter from any person and must not be co-located with any other transmitter.

Site License Disclaimer
Users of the Titan RFID reader acknowledge that a site license is required when the device is configured for FCC Part 90 regulations. It is the user's responsibility to file for the site license and submit the appropriate fees and payments to the regulating authority. United States filings require submission of FCC Form 601 with Schedule D and H. Canadian filings require submission of Industry Canada forms IC2365BB and IC2430BB.

Licence d'Etat-client Avertissement
Client (utilisateur final) reconnaît que le site d'une licence est requise pour chaque lecteur emplacement du système. Il incombe au client de déposer pour la licence d'exploitation et soumettre le paiement du dépôt approprié. Unis dépôts États exigent l'achèvement et la soumission du formulaire FCC 601 à l'annexe D et H. dépôts canadiennes exigent l'achèvement et la soumission de Industrie Canada Formulaires IC2365BB et IC2430BB.

Changes or Modifications
Changes or modifications to the Titan RFID reader not expressly approved by Star Systems International Ltd. could void the user's authority to operate the Titan RFID reader.

WARNING
This equipment complies with FCC Part 90 and Industry Canada.RSS-137 rules. This device complies with FCC Part 15 and Industry Canada license exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Cet appareil est conforme à FCC Partie15 de Industrie Canada RSS standard exempts de licence (s). Son tilisation est soumise à Les deux conditions suivantes: (1) cet appareil ne peut pas provoquer 'interférences et (2) cet appareil doit accepter Toute interférence, y compris les interférences qui peuvent causer un mauvais fonctionnement du dispositif.

WARNING: Class B devices
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 commercial environment. This equipment generates, uses, and can radiate radio-frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case users will be required to correct the interference at their own expense.

Antennas
This radio transmitter (Titan RFID reader **<insert certification number>**) has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Table for Filed Antenna

Ant	Brand	Model Name	Antenna Type	Connector	Gain (dBi)	NOTE
1	TITAN	HRD22000	Avior	N/A	15	Antenna
2	TITAN	HRD22000	Cheetah	N/A	12	Antenna
3	TITAN	HRD22000	Hydra	N/A	12	Antenna
4	TITAN	HRD22000	Bobcat	N/A	9	Antenna

Professional Installation

The Titan RFID reader requires professional installation to correctly set the transmitter power for the RF cable and antenna selected, to ensure that the radiated power complies with regulatory limits for the region where the reader is installed. See the section "Information on Regulatory Regions" for more details.

The information below could either be added to the "Installation & Wiring" section or could be added as a new section:

Information on Regulatory Regions

The Titan RFID reader is designed to operate in various regulatory regions. The regulatory region is locked by the manufacturer such that the reader may only operate on authorized frequencies for that regulatory region. The regulatory region is not configurable by end users or professional installers.

Professional Installation

Because the Titan RFID reader is capable of up to +33dBm conducted power at its RF ports, professional installation is required to ensure compliance with radiated power limits for the regulatory region where it is operated.

FCC Part 90

This information applies to Titan RFID readers that have been configured by the manufacturer for the FCC Part 90 regulatory region.

Pursuant to FCC Part 90.205, the Titan RFID reader's radiated power is limited to +44.8dBm (30 Watts) ERP (Effective Radiated Power). The professional installer must enter the cable loss and antenna gain at the time of installation. Using this information, the Titan RFID reader will automatically calculate and limit the maximum conducted output power that is allowed, based on the following equation:

Maximum conducted power (dBm) = 44.8 (ERP in dBm) – Antenna Gain (in dBd) + Cable Loss (in dB)

Note that Part 90 specifies the radiated power limit in terms of ERP and the Antenna Gain is specified in dBd, which is gain relative to an ideal half-wave dipole antenna.

FCC Part 15.247

This information applies to Titan RFID readers that have been configured by the manufacturer for the FCC Part 15 regulatory region.

Pursuant to FCC Part 15.204, the Titan RFID reader may only be operated with antennas approved by Star Systems International.

Pursuant to FCC Part 15.247, the Titan RFID reader's radiated power is limited to +36dBm EIRP (Equivalent Isotropically Radiated Power). The Titan RFID reader's conducted power may be increased above +30dBm to compensate for cable loss, so long as the +36dBm EIRP limit is still met. The professional installer must enter the cable loss and antenna gain at the time of installation. Using this information, the Titan RFID reader will automatically calculate and limit the maximum conducted output power that is allowed, based on the following equation:

Maximum conducted power (dBm) = 36 (EIRP in dBm) – Antenna Gain (in dBi) + Cable Loss (in dB)

Note that Part 15.247 specifies the radiated power limit in terms of EIRP and the Antenna Gain is specified in dBi, which is gain relative to an ideal (theoretical) isotropic antenna.

Contents
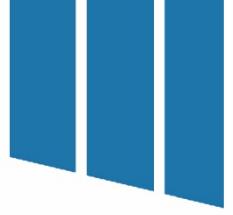
Version 0.46

November 9, 2017

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This product is not designed, intended, authorized or warranted to be suitable for life support applications or any other life critical applications which could involve potential risk of death, personal injury, property damage, or environmental damage.

Users of the Titan RFID reader acknowledge that a site license is required when the device is configured for FCC Part 90 regulations. It is the user's responsibility to file for the site license and submit the appropriate fees and payments to the regulating authority. United States filings require submission of FCC Form 601 with Schedule D and H. Canadian filings require submission of Industry Canada forms IC2365BB and IC2430BB.

This document is intended as an initial reference and the User Guide is recommended in addition to this Quick Start Guide.

Your safety is extremely important. Read and follow all warnings and cautions in this document before handling and operating RFID equipment. You can be seriously injured, and equipment and data can be damaged if you do not follow the safety warnings and cautions.

A caution alerts you to an operating procedure, practice, condition, or statement that must be strictly observed to prevent equipment damage or destruction, or corruption or loss of data.

Note: Notes either provide extra information about a topic or contain special instructions for handling a condition or set of circumstances.

I. TITAN

Getting Started

The Star Systems International (SSI) Titan Quick Start Guide is intended to allow users to quickly install, configure and operate the multi-protocol Titan UHF RFID reader.

This document provides instructions for basic installation and operation. In addition to this document, users should refer to the more detailed User Guide document for additional details.

What is Titan

The Titan (RAIN) RFID reader is a high performance Multi-Protocol UHF reader specifically designed for high speed tolling applications utilizing state of the art Doppler technology. It also incorporates the Low-Level Reader Protocol (LLRP) ratified by EPC Global for complete flexibility and integration. It can even be used as a direct replacement for current tolling products on the market. When deployed in conjunction with a wide variety antenna system it achieves unsurpassed air interface performance with all the features expected from a software based architecture. Titan supports up to 4 antennas simultaneously and multiple protocols concurrently.

Unpacking Titan

It is our recommendation that after unpacking the Titan to save the packing material and box. There is one RFID reader included in each box along with regional documentation package. Included in the documentation package is the Quick Start Guide and appropriate compliance documentation.

What you will need

The reader is shipped without cables included. Depending on your configuration, the cables needed may include the Power field cable, Serial field cable, CAN field cable and RF cables. These cables can be purchased from SSI. Since each application has different cabling requirements and/or lengths, it is recommended to contact your SSI sales representative to purchase the approved cables for your application.

2. Installation & Wiring

Before proceeding with the installation of the reader, it is recommended to have a proper site plan. For licensed frequency installations, the frequencies to be used are also needed. A site plan will dictate which cables are needed for your application.

1   Connections

The connector faceplate diagram is shown in **_FIGURE 1_**. A schematic of the possible interconnections is shown in **_FIGURE 2_**.

A. DC Power

The Power connector is used in applications where the Power Over Ethernet (POE+) is not being utilized. The input range for the Power ranges from 12 – 48 VDC at the reader. It is recommended to measure the actual voltage at the reader to make certain it is within specification.

B. Network (LAN) and PoE+

The LAN connector is used for all the Ethernet connections that are routed to the reader. This includes any PoE+ connections. Refer to the diagram below for the proper routing of connections.

(* All features of the Titan are supported by either DC power or PoE+. It is also permissible for the User to connect both DC power and PoE+ to the reader simultaneously.)

C. Controller Area Network (CAN)

The CAN connector may be used where a dense reader population is prevalent when using specific protocols. Please refer to the User Guide for additional information regarding the CAN functionality.

D. GPIO / Serial

The GPIO/Serial connector is used for serial communications and various I/O. The Titan reader supports up to 2 optically isolated inputs as well as 2 open collector outputs. Please refer to the User Guide for more information regarding the serial port and I/O capabilities.

E. RF Ports

The Titan supports up to 4 antennas connections simultaneously with various protocols. Please refer to the User Guide for specifics.

*FIGURE 1 - Connector Faceplate Arrangement*
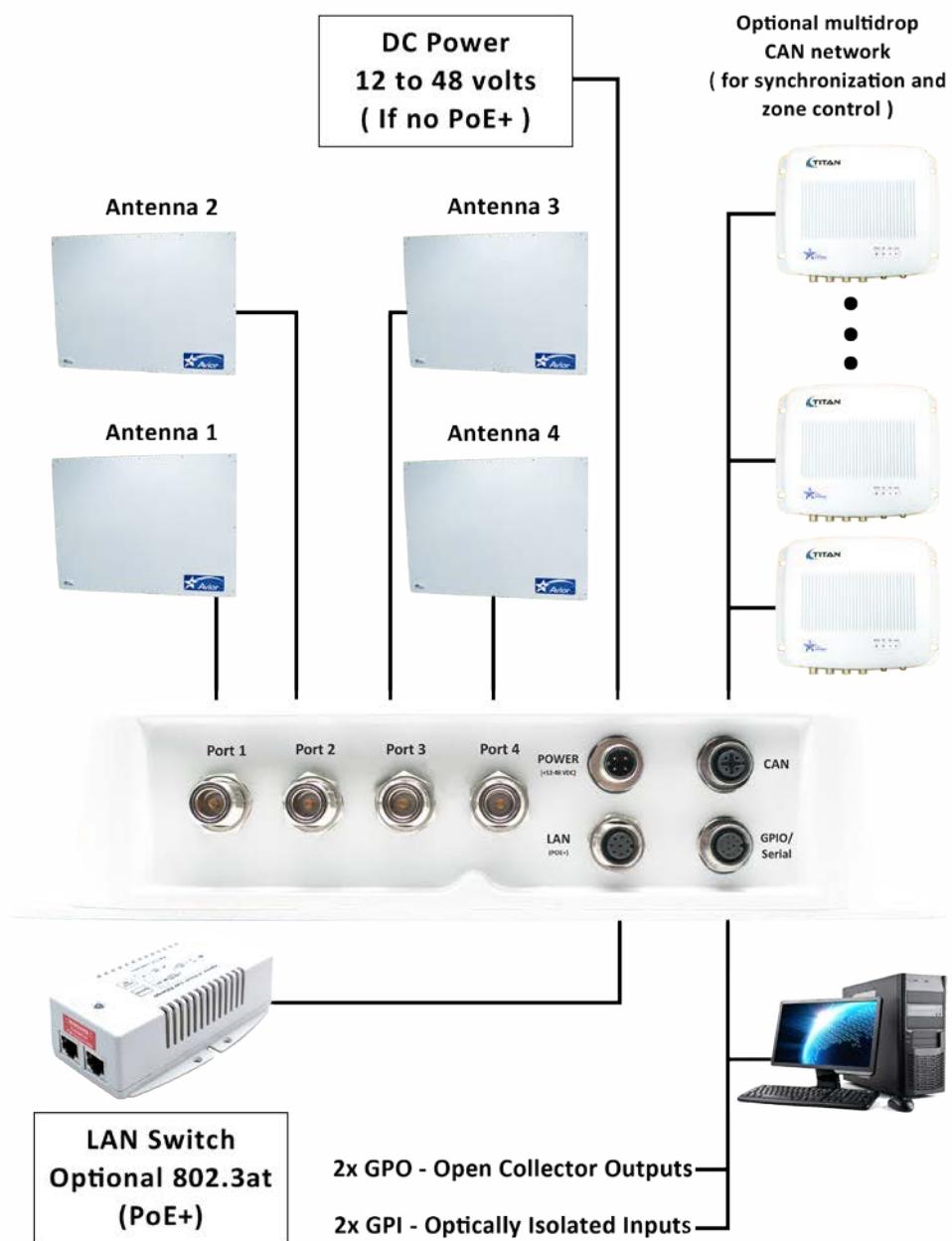
*FIGURE 2 – Titan Connection Diagram*

Connector pin out details

The following diagram provides specific details regarding each connector type:
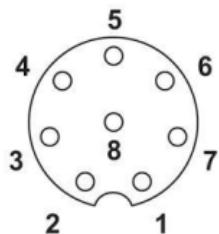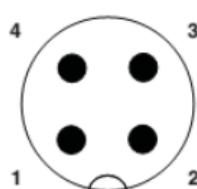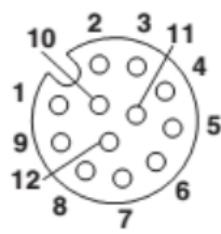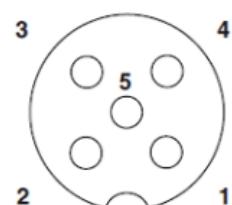
DC Power:

Pin	Signal	Description
1	+V	Voltage (12-48v)
2	GND	Ground

LAN(PoE+):

Pin	Mode A	Mode B	Description
1	Rx+, DC+	Rx+	LAN Rx+, DC+ for Mode A POE Spec
2	Rx-, DC+	Rx-	LAN Rx-, DC+ for Mode A POE Spec
3	Tx+, DC-	Tx+	LAN Tx+, DC- for Mode A POE Spec
4	Unused	DC+	DC+ for Mode B POE Spec
5	Unused	DC+	DC+ for Mode B POE Spec
6	Tx-, DC-	Tx-	LAN Tx-, DC- for Mode A POE Spec
7	Unused	DC-	DC- for Mode B POE Spec
8	Unused	DC-	DC- for Mode B POE Spec

CAN:

Pin	Signal	Description
1	CANH	Dominant High
2	CANL	Dominant Low
3		
4		
5	GND	Ground

Ports 1-4:

Pin	Signal	Description
1	RF	Center Pin RF output
2	GND	Ground

GPIO/Serial:

Pin	Signal	Description
1	GND	Ground
2	GPO_1	Open Collector General Purpose Output #1
3	GPO_2	Open Collector General Purpose Output #2
4	GND	Ground
5	GPI_1	Optically Isolated Input #1
6	GPI_2	Optically Isolated Input #2
7	GND	Ground
8	Tx	RS-232 Transmit
9	RTS	RS-232 RTS (Hardware Flow Control)
10	Rx	RS-232 Receive
11	GND	Ground
12	CTS	RS-232 CTS (Hardware Flow Control)
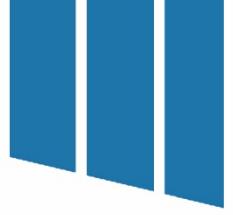
Reader Placement

Things to consider when developing a proper site plan includes mounting, site layout, reader/tag alignment, traffic flow lanes, local electrical codes and LAN requirements. It is recommended to contact your local SSI sales representative to aid in the proper planning of your application.

Electrical Considerations

Cable lengths are an important factor when developing a site plan and there may be power losses to consider. As a rule, it is always good practice to keep the cable lengths as short as possible. The actual voltage measured at the reader requires a minimum of 12VDC to function properly.

2   Visual Indicators

FIGURE 3 below illustrates the visual indicators on the top panel. There are four LEDs:

· **Power** is a dual color LED

- o **Yellow** indicates power is on and there are no system faults

- o **Red** indicates reader status is ERROR

· **LAN** is a single color **green** LED which blinks to indicate LAN connectivity

· **Transmitter** is a dual color LED

- o **Yellow** indicates the radio transmitter is active

- o **Red** indicates the transmitter should be active be is blocked by a Listen-Before-Talk (LBT)

  event

· **Receiver** is a dual color LED

- o **Yellow** indicates tag signals are being decoded

- o **Red** indicates the receiver is being blocked by strong interference
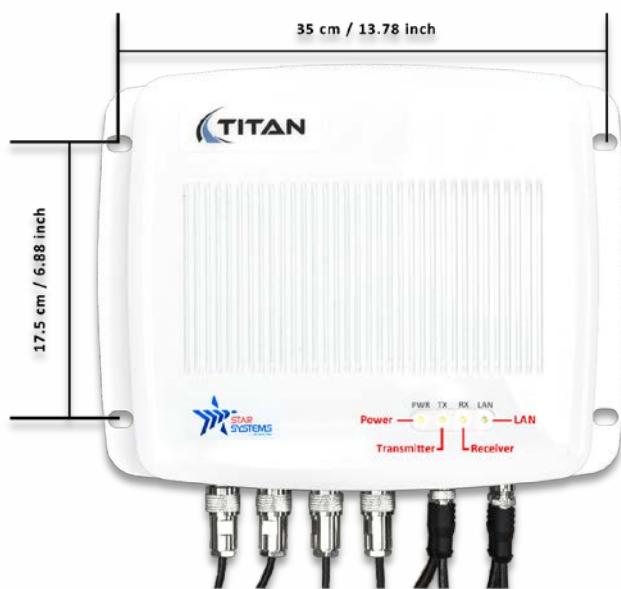
FIGURE 3 - Mounting holes and Top Panel Visual Indicators

3   Mounting

The mounting pattern is shown in *FIGURE 3*. It is recommended that the reader be mounted on a vertical, flat surface such that the connectors are facing down toward the ground.

4   General Purpose Inputs & Outputs

a. Open Collector Outputs

The two open collector outputs available on the GPIO/Serial connector can be used like relays. See FIGURE 4. An external supply is used tied across a load. The load could be a lamp, a relay coil, or pullup resistor.

When the software control holds the NPN transistor base at zero volts (ground potential), the NPN transistor is "off" and no current flows. Thus, the collector terminal is at the supply voltage, VDC as shown in the figure. This is useful in PLC applications where the load is a pullup resistor, and the collector terminal is used as a logic control to a PLC input. When the software sets the NPN transistor base terminal to 3.3 volts, the transistor turns "on" and the collector terminal becomes a low impedance path to ground. Thus, current flows through the load. While this is useful for signaling to a PLC controller, other uses can be when the load is a relay coil, with the collector current energizing the coil, or if the load is a lamp indicator.

The DC supply voltage should be limited to 30 volts.

The collector current should be limited to 250 milliamps.
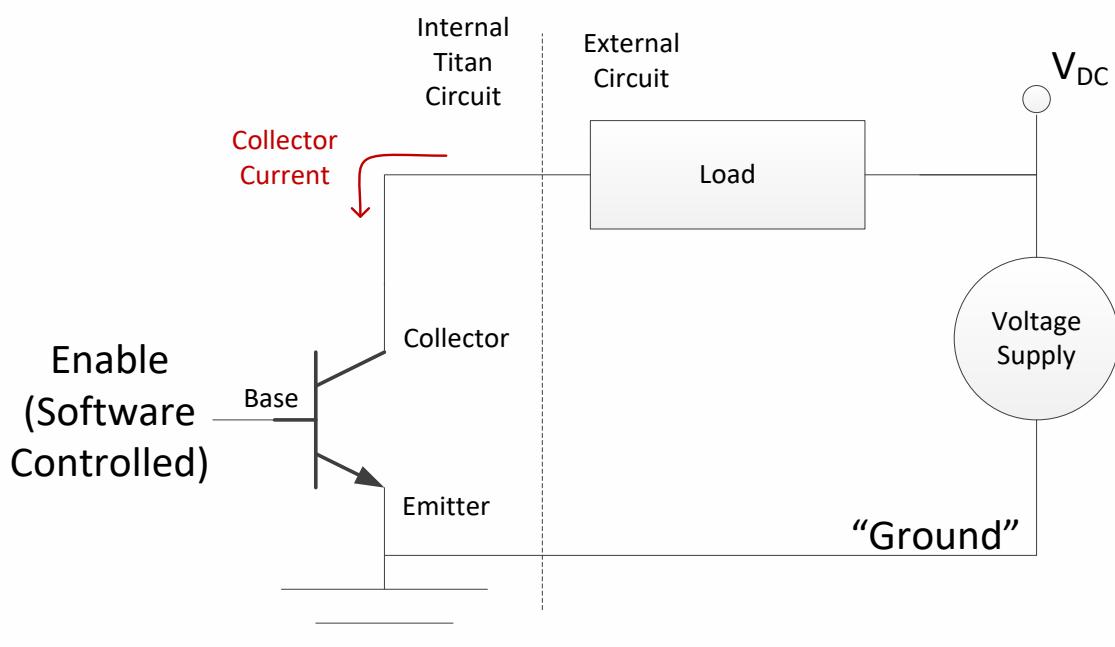

FIGURE 4 – Open Collector Circuit

b. Optically Isolated Inputs

The two isolated inputs available on the GPIO/Serial connector can be used to signal events or status to the Titan processor, normally used to trigger RFID read cycles or to stop RFID read cycles. See **_FIGURE 5_**. An external "PLC level" input signal is attached across the GPI / GPI return wires on the GPIO/serial cable. The logic high level should typically be from 12 to 30 volts, which is governed by the fixed 4.7K ohm internal bias resistor.

When the external controller holds the GPI input high, current flows through the LED, which in turn enables the NPN transistor, which results in the internal GPI signal to the Titan processor being pulled low.

The external PLC supply voltage should be limited from 12 to 30 volts.

Under no circumstances should the LED current exceed 20 milliamps.
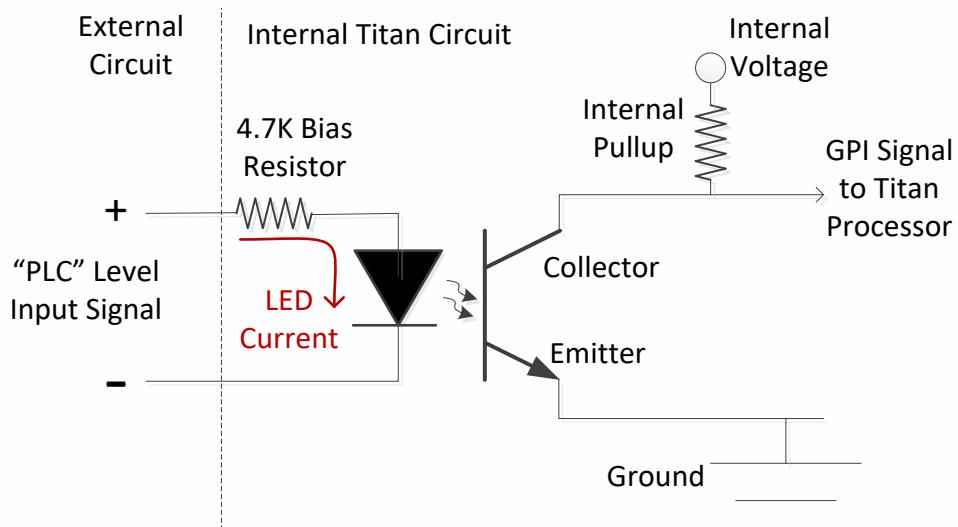
FIGURE 5 – Isolated General-Purpose Input Circuit

5   Serial Connection

The default serial connection configuration is as follows:

- 115.2 Kbps
- bits
- 1 start bit
- 1 stop bit
- No parity

These settings are configurable once a connection is made to the reader.

6   CAN

The Controller Area Network (CAN) is an optional multidrop network used for synchronization and zone control. Please refer to the User Manual for configuration and programming information.

There are two types of connections for the CAN port:

- Series Drop – wherein the Titan being connected is in the middle and there are additional readers before and after
- End Node – wherein the Titan being connected is on the end of the network

These two configurations are shown in *FIGURE 6*.

Star Systems International stocks M12 CAN connectors for "tee" series drop and terminated end note configurations. If only two readers are connected, both are terminated. As other readers are added, they are connected using the tee connectors.
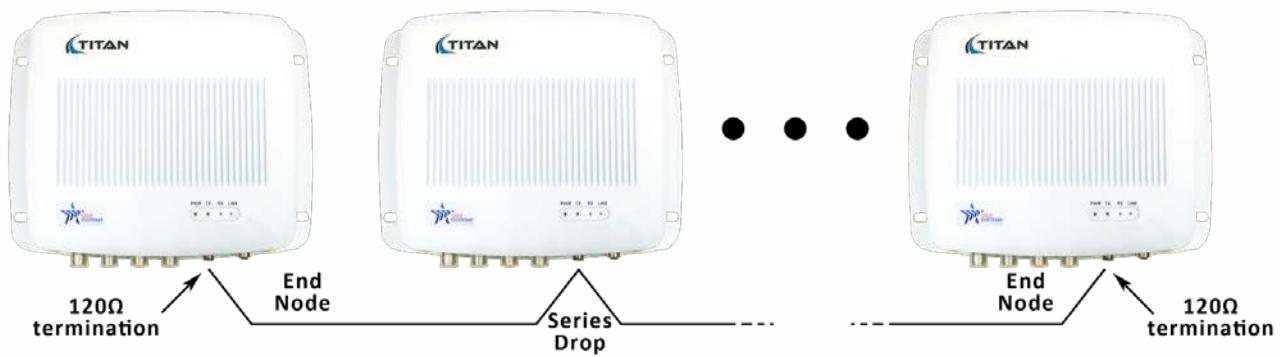
FIGURE 6 - CAN Network Installation

3. Configuration

The Titan reader can be configured using a command line interface or a web server. To enable specific protocols and antenna ports please refer to the user manual on specifics for your application.

Text Stream Interface (TSI)

The Text Stream Interface (TSI) is an ASCII text based communications protocol that allows users to interact with the Titan reader. This interface has various levels of permission and allows the users to configure, test and operate the reader. A TSI connection is established by opening a TCP/IP socket connection to port 50007.

Logging In

There are two logins available to the user which will be discussed below. The initial login level will be determined by the "TSI" variable called "setup.default_login_level". This level will default to "guest" and can be changed to "admin" if it is desired to give all those who connect to the reader "admin" level access.

Guest

The "guest" login default password is "guest". There are very limited sets of commands available to the "guest" that will give this level of login access to version type of information and the ability to login at a higher level with the correct password.

Administrator

The "admin" login default password is "admin". This login level can be accessed via the login command:

"reader.login(admin, admin)"

With this access level, the fully functioning of the reader can be obtained. If the login password has been changed, it can be reset to factory defaults using the methods described in user guide.

Command Line

The Titan reader supports the Text Stream Interface (TSI). This interface has various levels of permission and allows the users to configure, test and operate the reader. Please refer to the user manual for more information.

Web Server

The Titan also supports an embedded web server which can be used in addition to the TSI. This web server can also be utilized for configuration, test and proper operation of the reader. Please refer to the user manual for more information.

4. Troubleshooting

1 No LED Indicators Turn On

1. Verify the auxiliary DC input is from 12 to 50 volts *at the Titan input*.
   a. It is important to account for voltage drops in the cable.
   b. The Titan reader will draw approximately 12 watts in its power up sequence. The Titan reader will draw approximately 18 watts at full power operation at 25 degrees C.
      i. The current draw will depend on the voltage at the reader input terminals
      ii. The voltage drop across the supply cable will depend on the wire gauge and the length of cable
2. If using a PoE switch, try using an auxiliary DC input
3. If using a PoE switch, ensure the switch is 802.3at compliant (PoE+)
   a. Ensure your Ethernet connection cable has all four pairs of cable – required for PoE+

If using PoE, … aux

Check the voltage at the connector end

Voltage drop due to current

2 No LAN Connectivity

1. Connect a serial cable – the Titan processor reports a rich set of status and events during startup, including events related to LAN network connectivity
2. Use the serial cable to reset the LAN connection to DHCP (default)
   a. Ensure there is a DHCP server on the network
3. Alternatively, set the Titan reader to a static IP address accessible on the network

a. Transmitter Will Not Turn On

Check the "Return Loss" to each antenna(s) configured

Check the valid protocols

Valid protocols not configured

b. Antenna Detection Problems

Disconnect the antenna cable and attach a known good termination, such as Minicircuits part number **KARN-50CN+** or similar.

- If this does not detect, contact Star Systems International.
- If the known good termination does connect, examine the cable and antenna for connection problems.

c. Tag Detection Problems

Be sure to use a known good tag for tests. In addition, perform the following:

1. Confirm the antennas detected list is as expected
2. Check the transmitter power
3. Perform an RF survey diagnostic command. This command performs the following system level tests:
    a. Scans the environment with the transmitter off
        i. Looks for interference signals
        ii. Measures the noise floor
    b. Scans the environment with the transmitter on
        i. Looks for interference signals
        ii. Measures the noise floor

The RF survey will report the noise floor and any potential interference signals. The RF survey may report other readers in the vicinity. As a rule, when using Part-90 or ETSI fixed frequencies, ensure that the following channelization is enforced:

- For ISOC, ISOB, or ISO-10374 (ATA) type protocols, assign the operating frequency 2MHz or more from adjacent readers.
    - It is acceptable to use a "cellular" frequency reuse strategy – reusing frequencies within the same installation, so long as two readers next to one another ("adjacent") are separated by 2MHz or more.
- For Title-21 assign the operating frequency 4MHz or more from adjacent readers.
- For PS111 there are only two valid frequency assignments. Alternate the frequency assignment between adjacent readers.

Warranty

WARRANTY

All Hardware Products sold by Star Systems International Limited (SSI) are warranted against defects in material and workmanship under normal use and service for one (1) year from the original date of purchase (the "Warranty"). Any Extended Warranties must be documented on the original invoice as a separate line item. For defects covered by this Warranty, SSI will repair the defect or replace the product, at its sole option and return the product to you.

EXCLUSIONS

If the defect was caused by any of the following, the Warranty shall not apply and an estimate for repair or replacement will be submitted for your approval prior to work being performed: abuse, mishandling, acts of God, vandalism, accident, electrostatic discharge damage, failure to follow installation or operating instructions, failure to provide a suitable environment, unauthorized modification of the product modification of the printed circuit board by parties other than SSI, and damage that is caused during shipping for warranty service and any product that is returned with the security seal broken.

RMA PROCEDURE

For Warranty service, the Customer must comply with Star Systems International Return Materials Authorization ("RMA") policy, which is published on the Star Systems International website at www.star-int.net, and may be updated from time to time. Prior to shipping a product to Star Systems International for warranty inspection, replacement or repair, an RMA number must be obtained from Star Systems International's RMA department at +852 3691 9925 or by email at support@star-int.net. RMA forms can be downloaded from the Star Systems International website or the Customer can receive the form by email by contacting the RMA department. One RMA form must be used for each RMA submission and the product should be shipped to the address below. For products covered by this Warranty, the Customers are responsible for payment of shipping costs to the Star Systems International repair center and Star Systems International will be responsible for the cost of returning the item. The standard return shipment is "Speed Post". Any other desired "expedited" or overnight shipping costs for warranty repairs will be the customer's responsibility.

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About Us

Star Systems International is a market leader in providing passive ISO 18000-6C/63 UHF RFID transponders, readers, solutions and consulting services for vehicle identification systems. STAR Systems leverages technical implementation expertise, training and support to ensure customer success. Our focus on "Making RFID Work" for ETC, EVR, Fleet Management, Parking and Access Control applications allows our customers to deliver high-performance and reliable integrated solutions.

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Visit the SSI website at www.star-int.net **Download** page to download our documents.
Visit the Star Systems University at www.star-int.net and click **Tech Support > Star Systems University** to review technical information or to request technical support for your RFID product.

IC Warning

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions:

(1) This device may not cause interference, and

(2) This device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:

(1) l'appareil ne doit pas produire de brouillage, et

(2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement

The distance between user and products should be more than 100cm

La distance entre l'utilisateur et des produits devraient être plus de 100 cm