HARRIS
assuredcommunications®

Product Manual
MM-018623-001
Rev. D, Mar/15

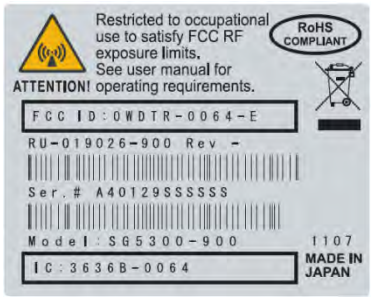
OpenSky2

SG5300 Data Modem

800 MHz and 900 MHz

MANUAL REVISION HISTORY

REV	DATE	REASON FOR CHANGE
-	Jul/11	Initial release.
A	Oct/11	Revised DNP3 information and AT command list in Table 7-1.
B	May/12	Revised firmware installation and configuration instructions. Updated Warranty statement.
C	Sep/13	Updated to include non-incendive rating information.
D	Mar/15	Added serial tunneling information.



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1 REGULATORY AND SAFETY INFORMATION

1.1 REGULATORY APPROVALS

1.1.1 Transmitter

The transmitting devices listed below have been tested and meet the following regulatory requirements:

MODEL	DESCRIPTION	FCC ID (PART 90)	INDUSTRY CANADA (RSS-119)
SG5300-800	RU-019026-800 Radio Unit	OWDTR-0063-E	3636B-0063
SG5300-900	RU-019026-900 Radio Unit	OWDTR-0064-E	3636B-0064

1.1.2 Receiver

This receiver associated with this transmitting device has been tested and declared to meet the regulatory requirements defined in the following sub-sections. Associated FCC labelling may be found on page 2.

1.1.3 FCC Compliance

This device 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.

1.1.4 Industry Canada

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 installer of this SG5300 must ensure that the antenna is located or pointed such that it does not emit RF field in excess of Health Canada limits for the general population; consult Safety Code 6, obtainable from Heath Canada's website www.hc-sc.gc.ca/rpb.

1.2 SAFETY SYMBOL CONVENTIONS

The following conventions may be used in this manual to alert the user to general safety precautions that must be observed during all phases of operation, service, and repair of this product. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the product. Harris assumes no liability for the customer's failure to comply with these standards.

The WARNING symbol calls attention to a procedure, practice, or the like, which, if not correctly performed or adhered to, could result in personal injury. Do not proceed beyond a WARNING symbol until the conditions identified are fully understood or met.

The **CAUTION** symbol calls attention to an operating procedure, practice, or the like, which, if not performed correctly or adhered to, could result in a risk of danger, damage to the equipment, or severely degrade the equipment performance.

The **NOTE** symbol calls attention to supplemental information, which may improve system performance or clarify a process or procedure.

The **ESD** symbol calls attention to procedures, practices, or the like, which could expose equipment to the effects of **E**lectro-**S**tatic **D**ischarge. Proper precautions must be taken to prevent ESD when handling circuit modules.

The electrical hazard symbol is a WARNING indicating there may be an electrical shock hazard present.

This symbol indicates the presence of a potential RF hazard.

1.3 RF ENERGY EXPOSURE INFORMATION

To ensure that exposure to RF electromagnetic energy is within the FCC allowable limits for occupational use, always adhere to the following guidelines:

DO NOT operate the SG5300 without a proper antenna attached, as this may damage the SG5300 and may also cause the FCC RF exposure limits to be exceeded. A proper antenna is the antenna supplied with this SG5300 by Harris Corporation or an antenna specifically authorized by Harris for use with this SG5300.

DO NOT transmit for more than 50% of total RADIO use time ("50% duty cycle"). Transmitting more than 50% of the time can cause FCC RF exposure compliance requirements to be exceeded. The SG5300 is transmitting when the "TX" indicator light is on.

Always transmit using low power when possible.

1.3.1 Safety Training Information

YOUR HARRIS SG5300 GENERATES RF ELECTRO-MAGNETIC ENERGY DURING TRANSMIT MODE. THIS SG5300 IS DESIGNED FOR AND CLASSIFIED AS "OCCUPATIONAL USE ONLY," MEANING IT MUST BE USED ONLY IN THE COURSE OF EMPLOYMENT BY INDIVIDUALS AWARE OF THE HAZARDOUS RF ENERGY AND THE WAYS TO MINIMIZE EXPOSURE. THIS STATION IS NOT INTENDED FOR USE BY THE "GENERAL POPULATION" IN AN UNCONTROLLED ENVIRONMENT. IT IS THE RESPONSIBILITY OF THE LICENSEE TO ENSURE THAT THE MAXIMUM PERMISSIBLE EXPOSURE LIMITS ARE OBSERVED AT ALL TIMES DURING TRANSMISSION. THE STATION LICENSEE IS TO ENSURE THAT NO BYSTANDERS COME WITHIN THE RADIUS OF THE LIMITS.

When licensed by the FCC, this device complies with the FCC RF exposure limits when persons are beyond the MPE radius of the antenna (see Table 1-1). In addition, your Harris SG5300 installation complies with the following Standards and Guidelines with regard to RF energy and electromagnetic energy levels and evaluation of such levels for exposure to humans:

FCC OET Bulletin 65 Edition 97-01 Supplement C, Evaluating Compliance with FCC Guidelines for Human Exposure to RADIO Frequency Electromagnetic Fields.

American National Standards Institute (C95.1 – 1992), IEEE Standard for Safety Levels with Respect to Human Exposure to RADIO Frequency Electromagnetic Fields, 3 kHz to 300 GHz.

American National Standards Institute (C95.3 – 1992), IEEE Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields – RF and Microwave.

Table 1-1: MPE Table

	Antenna	Minimum Safe Distance (cm)	
		Controlled Environment	Uncontrolled Environment
800 MHz	AN-225001-001 3 dBd (5.15 dBi) dual band roof mount antenna	20	20
	AN-225001-002 3 dBd (5.15 dBi) dual band elevated feed point antenna	20	20
	AN-225001-003 3 dBd (5.15 dBi) dual band elevated feed point antenna	20	20
	AN-225001-004 2 dBd (4.15 dBi) low profile antenna	20	25
	AN-225001-005 5 dBd (7.15 dBi) dual band roof mount antenna	20	20
900 MHz	AN-225005-001 3 dBd (5.15 dBi) roof mount antenna	20	20
	AN-225005-002 3 dBd (5.15 dBi) elevated feed roof mount antenna	20	20
	AN-225005-003 3 dBd (5.15 dBi) elevated feed roof mount antenna	20	20
	AN-225005-004 2 dBd (4.15 dBi) low profile antenna	20	25

To ensure that your exposure to RF electromagnetic energy is within the FCC allowable limits for occupational use, do not operate the station in a manner that would create an MPE distance in excess of that allowable by the FCC.

Changes or modifications not expressly approved by Harris could void the user's authority to operate the equipment.

1.3.2 Contact Information

For additional information on exposure requirements or other information, contact Harris at 1-800-528-7711 or at http://www.pspc.harris.com.

1.3.3 Occupational Safety Guidelines and Safety Training Information

To ensure bodily exposure to RF electromagnetic energy is within the FCC allowable limits for occupational use. Always adhere to the following basic guidelines:

- The SG5300 should only be used for necessary work-related communications.
- The SG5300 should only be used by authorized and trained personnel.
- Do not attempt any unauthorized modification to the SG5300. Changes or modifications to the SG5300 may cause harmful interference and/or cause it to exceed FCC RF exposure limits. Only qualified personnel should service the SG5300.
- Always use Harris authorized accessories (antennas, control heads, speakers/mics, etc.). Use of unauthorized accessories can cause the FCC RF exposure compliance requirements to be exceeded.

The information listed above provides the user with information needed to make him or her aware of a RF exposure, and what to do to assure that this SG5300 operates within the FCC exposure limits of this radio.

1.4 DIVISION 2 NON-INCENDIVE PROTECTION

Division 2 Non-Incendive Protection is available as an option when ordering the SG5300-900, 900 MHz unit. When ordered with this option, this apparatus is suitable for use in hazardous locations as defined by the National Electrical Code (NEC) as Class I, Division 2, groups A, B, C, and D applications. Specific torque values for antenna and cable connections (further discussed in the installation section of this manual) are required to conform to this rating. When no serial cable connection is present, a protective cover (supplied with the option) is required.

When installing electrical equipment in hazardous areas, it is important to be familiar with the National Electrical Code rules, the National Fire Protection Agency regulations, all local codes, and the specifications of your underwriter for hazardous areas. Ensure those who are responsible for installing the equipment are properly qualified for the work and are informed of all necessary information and specifications.

WARNING: EXPLOSION HAZARD.

DO NOT DISCONNECT WHILE THE CIRCUIT IS LIVE OR UNLESS THE AREA IS KNOWN TO BE FREE OF IGNITIBLE CONCENTRATIONS.

Always follow all NEC, NFPA, and local codes when installing this equipment in hazardous areas. Knowledgeable personnel, who are familiar with national and local codes, must supervise hazardous area equipment installations.

Harris is not responsible for the installation of your hazardous area equipment. YOU MUST ENSURE THAT THE INSTALLATION OF THIS EQUIPMENT CONFORMS TO ALL APPLICABLE REGULATIONS AND CODES, INCLUDING, BUT NOT LIMITED TO, THOSE OF THE NATIONAL FIRE PROTECTION ASSOCIATION, THE NATIONAL ELECTRICAL CODE, AND ANY APPLICABLE LOCAL CODES. Important information regarding installation of the SG5300 is included in this manual; however, should not be regarded as the complete set of information required to safely install electrical equipment in hazardous areas. Always use qualified technicians and knowledgable personnel who are familiar with national and local codes to install such equipment in hazardous areas.

This apparatus is suitable for use in Class I, Division 2 groups A, B, C, and D.

2 INTRODUCTION

2.1 ABOUT THIS MANUAL

This manual is written for the communications professional responsible for installing and maintaining the SG5300 Data Modem.

Some features found in this manual require the SG5300 operating software version to be **R21A** or later.

2.2 GLOSSARY OF TERMS

The following table is a list of terms used in this manual.

Table 2-1: Glossary of Terms

TERM	DEFINITION
AWG	American Wire Gauge
DNP3	Distributed Network Protocol
ICMP	Internet Control Message Protocol
IEEE	Institute of Electrical & Electronics Engineers
LED	Light Emitting Diode
LCL	Licensed Channel List
MES	Mobile End System
NEC	National Electrical Code
NEMA	National Electrical Manufactures Association
NFPA	National Fire Protection Association
PPP	Point to Point Protocol
SDO	Site Deployment Order
SLIP	Serial Line Internet Protocol
SNMP	Simple Network Management Protocol
TAC	Technical Assistance Center
TFTP	Trivial File Transfer Protocol
TRU	Remote Terminal Unit
UDP	User Datagram Protocol
VIDA	Voice, Interoperability, Data, and Access
WAN	Wide Area Network

3 DESCRIPTION

The SG5300 Data Modem is part of the OpenSky® suite of products which delivers very high capacity, end-to-end digital data communication. The small and lightweight unit is housed in a plastic case suitable for mounting indoors or in a National Electrical Manufactures Association (NEMA) approved enclosure. It is designed to provide reliable, secure, and cost effective data communications to and from remote locations.

Options are available which make the SG5300-900 an apparatus suitable for use in hazardous locations. When ordered with these options, the SG5300-900 meets the requirements defined by the *National Electrical Code* (NEC) for use in Class I, Division 2, groups A, B, C, and D applications.

Figure 3-1: SG5300 Data Modem

3.1 MULTIPLE APPLICATIONS

The SG5300 is suitable for a wide range of applications. The substantial coverage of an OpenSky private wireless network means that the SG5300 can be useful to collect or distribute data messages in locations where other wireless technologies are either not available or unreliable. Utilities will find it an excellent means of communication with line reclosers, capacitor banks, and other devices on the grid. Transportation applications include automated signs, bus stop kiosks, and connection with remote traffic flow and weather sensors. Public safety agencies may use it to send alarms for public notification of severe weather, emergencies, or for a host of other applications.

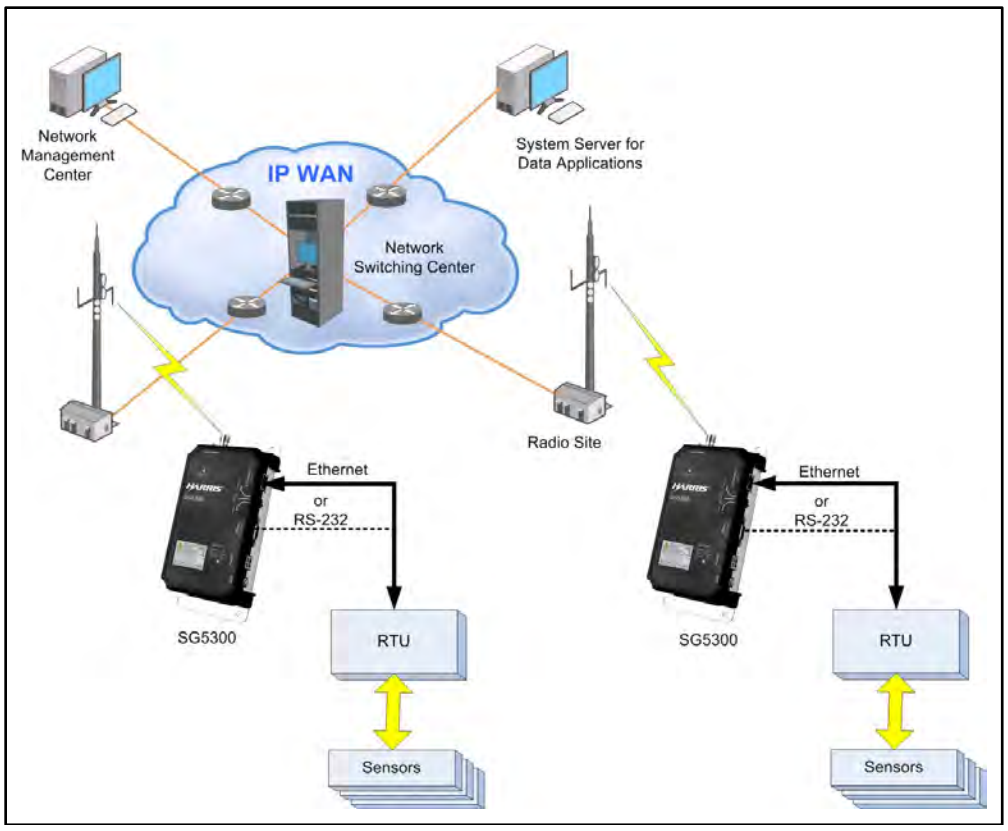


Figure 3-2: SG5300 System Application

The SG5300 provides a choice of Ethernet (RJ45) or Serial (DB9) interface to remote terminals. Its 3-Watt RF output makes it a compact and cost-effective wireless link that can easily fit alongside Remote Terminal Units (RTUs) and other devices.

The SG5300 is capable of interfacing to RTUs via an Ethernet 10/100Base-T interface port or TIA/EIA-232 Serial interface port. The Ethernet port is capable of operating as a data interface between the SG5300 and external devices with MTU size of 1400 bytes or less.

The Serial port is capable of operating as the data interface using Serial Line Internet Protocol (SLIP), Point to Point Protocol (PPP), Packetized Distributed Network Protocol (DNP3), or Serial Tunneling between the SG5300 and external devices (RTUs). The SG5300 is configured so that the data interface communicates with either the Ethernet port or the Serial port, but not both simultaneously. For additional information, refer to Section 9 for DNP3 or Section 10 for Serial Tunneling.

The Serial port is also used as a maintenance port to configure the RF radio, software loading, and configuration of the Ethernet port. However, the Serial port is not available for maintenance use while external devices are connected to the Ethernet port.

3.2 OVER-THE-AIR PROGRAMMING

As an OpenSky radio, the SG5300 benefits from a flexible, software-based design. Features, profiles, and system updates are software-defined and can be reprogrammed over the air.

3.3 VERSATILE MOUNTING

The SG5300 is designed to be mounted indoors or in a NEMA enclosure.

4 OPERATION

In-service operation of the SG5300 is completely automatic. Once the unit is properly installed and configured, local unit operation can be observed by viewing the Status LEDs for proper operation.

After properly installing the unit, operational control and monitoring can be made from the Network Management Center and the Centralized System Server.

4.1 STARTING THE SG5300

Start the radio operation by following these steps:

1. When installed in hazardous locations, observe all safety requirements for operating such apparatus.
2. Apply DC power to the transceiver.
3. Observe the Status LEDs for the proper indications as defined in Table 4-1.

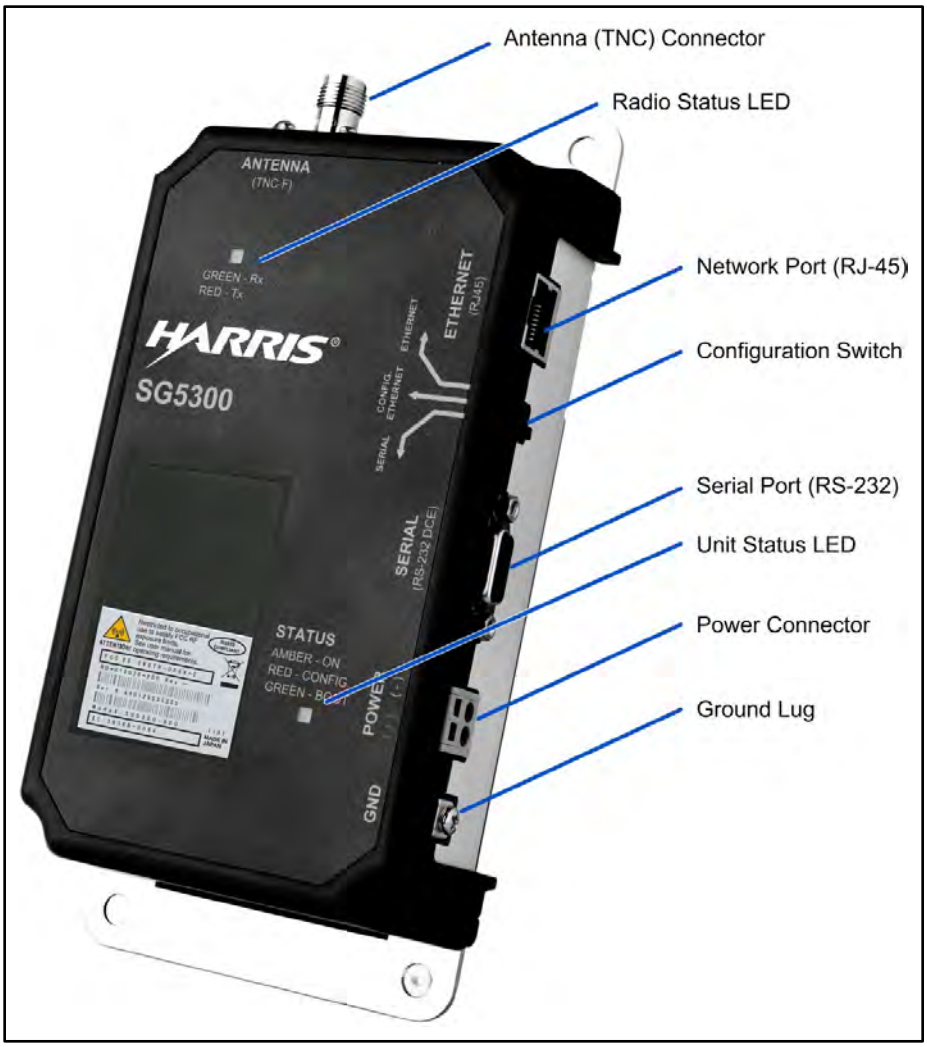


Figure 4-1: SG5300 Controls and Indicators

4.2 INDICATORS

The SG5300 RF Radio unit has two tri-color LEDs which indicate its operating status. The Unit Status LED, located near the power connector, indicates Power On or Normal Operation (amber or orange). It also indicates when the unit is in the Configure Ethernet mode (red) or is booting up (green).

The Radio Status LED, located near the antenna connector, indicates the operational status of the radio section. This LED indicates whether data is being transmitted (red), received (green) or other support functions (orange).

Table 4-1: Indicators and Controls

INDICATOR	INDICATOR COLOR	DESCRIPTION
Radio Status LED	OFF	No Status
	Blinking GREEN	Receiving RF Signal
	Blinking RED	Transmitting RF Signal
	Blinking AMBER	Data Registration Failure and/or Loss of Sync
	Solid AMBER	Offline
Unit Status LED	OFF	No Power Applied
	AMBER	Normal Operation
	GREEN	Booting Up
	RED	Configure Ethernet
CONTROL	**POSITION**	**DESCRIPTION**
Configuration Switch (Config)	Ethernet	Selects Ethernet Port for data interface.
	Config Ethernet	Allows you to configure the Ethernet port settings using an RS-232 terminal.
	Serial	Selects Serial Port for data interface.

5 UNPACKING AND CHECKING EQUIPMENT

Before unpacking, installing, or operating the SG5300, read this section of the manual thoroughly. It contains detailed unpacking and handling instructions, and safety precautions to protect users and equipment.

5.1 UNPACKING EQUIPMENT

The SG5300 may be shipped in separate transit packages. The associated cabling and accessories for each unit, if any, may also be shipped in separate containers.

When unpacking the equipment, check the contents against the packing list. Contact your Harris representative and the carrier if any discrepancies are noted.

Save the shipping cartons and packing materials in case the equipment needs to be shipped back to the Harris for service.

5.2 INSPECTING AND INVENTORYING EQUIPMENT

Carefully unpack the equipment and examine each item. If there is any damage to the equipment, contact the carrier immediately and have their representative verify the damage. If you fail to report the shipping damages immediately, you may forfeit any claim against the carrier.

After removal from the carton, examine the SG5300 for broken, damaged, loose, or missing parts. Examine the RF connector(s), power connector, and ground lug for cracks, bent or damaged threads, or damage to any paint or seals. If any are noted, contact the Harris Customer Care center immediately. Any unauthorized attempts to repair or modify this equipment will void the warranty and could create a safety hazard.

5.3 ITEMS INCLUDED

The following items are included in the SG5300 package:

- RU-019026-800 Radio Unit (800 MHz)

  or

- RU-019026-900 Radio Unit (900 MHz)

  and

- SG5300 Data Modem Quick Guide (14221-6100-1000)
- Serial Port Protective Cover (Non-Incendive rated models)

5.4 OPTIONS AND ACCESSORIES

MODEL/OPTION NUMBER	DESCRIPTION
Transceivers	
SG5300-800	SG5300, Data Only, 800 MHz
SG5300-900	SG5300, Data Only, 900 MHz
Options	
	Adds Non-Incendive Rated option to the SG5300-800 or SG5300-900 transceiver (available only at the time of original sale of equipment)
	Serial Port Protective Cover (required to meet Non-Incendive rating)
Antennas	
AN-225001-001	764-870 MHz, Dual band 3 dB gain roof mount antenna
AN-225001-002	764-870 MHz, Dual band 3 dB gain elevated feed point antenna
AN-225001-003	764-870 MHz, Dual band 3 dB gain elevated feed point antenna
AN-225001-004	764-870 MHz, Dual band 2 dB gain low profile antenna
AN-225001-005	764-870 MHz, Dual band 5 dB gain roof mount antenna
AN-225005-001	900 MHz, 3 dB gain roof mount antenna
AN-225005-002	900 MHz, 3 dB gain elevated feed roof mount antenna
AN-225005-003	900 MHz, 3 dB gain elevated feed roof mount antenna
AN-225005-004	900 MHz, 2 dB gain low profile antenna

6 INSTALLATION

6.1 GENERAL PLANNING

Careful planning and preparation of any installation will always benefit the end result.

1. Always read and follow all installation instructions, local and national building and electrical codes, and general safety rules.

2. Before beginning the installation, collect information from the Site Deployment Order (SDO) specific to the site access such as:

   - Permission to access the site.
   - Important contact names and telephone numbers.
   - Location of and directions to the site.
   - Keys and/or lock combinations to access the site and equipment shelter (if any), or points of contact to obtain them.
   - Site entry alarm system pass-codes and/or disable keys.
   - Information about work practices needed to work safely at the site including, where applicable, additional work practices required for working in non-incendive areas.

3. Other important information that may or may not be included on the SDO includes:

   - Type of mounting—NEMA case, interior wall, etc.
   - Drawing or description of each site showing how and where the equipment is being installed.
   - Applicable inspections completed (electrical, local build code, etc.).
   - Installer must be aware of other transmitters and receivers on site that could cause interference to, or be interfered with, by the equipment. Strong signals from, or to, co-located equipment may inflict permanent damage to either device.

4. We recommend pre-staging the equipment to become familiar with the specific hardware and cabling, tooling, and supplies that are needed to complete the installation.

6.2 SITE GROUNDING

Installers should review the recommended grounding procedures in the *Site Grounding and Lightning Protection Guidelines Manual, AE/LZT 123 4618/1* and ensure a suitable ground is installed between the SG5300's ground lug and earth ground. Grounding must also be in compliance with any local and national electrical codes.

6.3 EQUIPMENT INSTALLATION

Below are the basic steps for installing the SG5300. In most cases, these steps alone are sufficient to complete the installation. However, when installed in hazardous locations as defined by the NEC as Class I, Division 2 groups A, B, C, or D, the SG5300 product must include the factory label specifying it meets the standard and requires additional installation procedures. Read, understand, and follow all instructions,

Notes, Cautions, and Warnings which appear in this and other sections of this manual before beginning attempting installation.

The 900 MHz unit, SG5300-900, when installed in hazardous locations as defined by the NEC as Class I, Division 2 groups A, B, C, or D, require additional installation procedures. Read, understand, and follow all instructions, Notes, Cautions, and Warnings which appear in this and other sections of this manual before beginning installation.

Always follow all NEC, NFPA, and local codes when installing this equipment in hazardous areas. Knowledgeable personnel, who are familiar with national and local codes, must supervise hazardous area equipment installations. Refer to Section 1.4 for additional information.

WARNING: EXPLOSION HAZARD.
DO NOT DISCONNECT WHILE THE CIRCUIT IS LIVE OR UNLESS THE AREA IS KNOWN TO BE FREE OF IGNITIBLE CONCENTRATIONS.

1. Mount the SG5300 to a stable surface. Refer to Section 6.4 for dimensions.
2. Connect the RTU equipment to the appropriate data interface connector.

   (See Section 6.6.4 for Ethernet interface or 6.6.5 for a serial interface.)

Only one data interface connection can be used at a time.

3. Select the interface using the Configuration switch.
4. Connect the SG5300 to a suitable power source (see Section 6.5) which meets the following requirements:
   a. A readily accessible disconnect device shall be incorporated external to the equipment.
   b. A 1-Amp over-current protection device shall be provided external to the equipment.
5. Install and orient the antenna as required (see Section 6.6.3).
6. Configure the SG5300 as required. Refer to Section 7 for instructions.

The operating frequencies are not set at the factory. Determine the transmitter and receiver frequencies to be used, and follow the programming instructions in Section 7.

6.4 MOUNTING THE SG5300

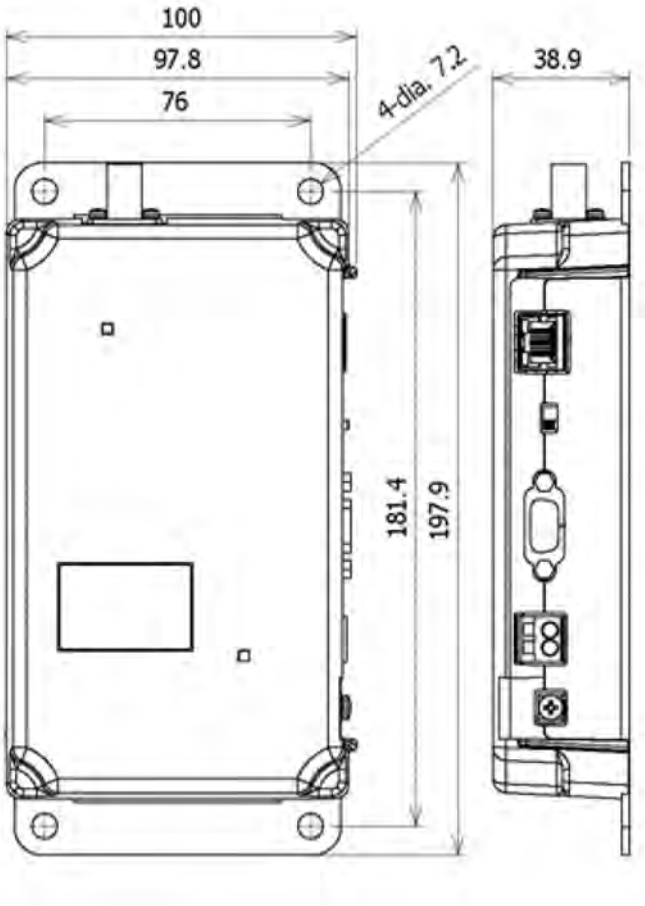
The SG5300 is typically installed in an outdoor enclosure that protects the unit from weather and where temperature is not typically controlled. The unit may also be mounted indoors in equipment closets.

Outdoors, the SG5300 should be mounted in a customer-supplied NEMA type enclosure that can supply the required voltage as well as the appropriate environmental conditions. See Specifications in Section 13.1 for environmental requirements.

Indoors, the SG5300 can be mounted using the mounting holes on the housing in areas of appropriate environmental conditions. Figure 6-1 shows the SG5300 mounting dimensions.

NOTE

The SG5300 should be mounted at least three (3) feet from human traffic.



Unit: mm (not to scale)

Figure 6-1: SG5300 Physical Dimensions

6.5 SURGE PROTECTION

When installing an SG5300, always install external surge protectors to protect the unit from lightning or transient damage. Table 6-1 lists surge protectors that have been tested and are available from Harris.

Table 6-1: Surge Protection Options

PART NUMBER	DESCRIPTION
PT-016508-002	RF Surge Protector, Coax, TNC.
PT-016508-003	Cat5e, RJ-45, Data Port Surge Protector.
PT-016508-005	Surge Protector, DC, Wire, 54 Vdc.

6.6 CONNECTIONS

Table 6-2: SG5300 Connections

CONNECTION	DESCRIPTION
Input Power:	WAGO, 2-pin connector for DC Power (+9 to 57 VDC)
Ethernet Interface:	Ethernet connector (RJ-45)
Serial Interface:	Serial RS-232 connector (DB-9F)
Antenna:	RF connector (TNC-F)

6.6.1 Power Connections

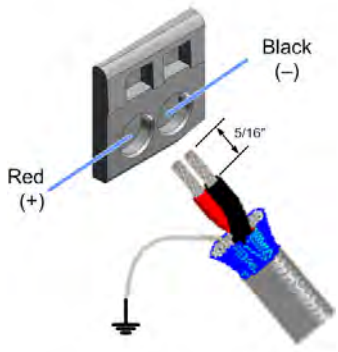
The SG5300 is compatible with any well-filtered +9.0 to +57 VDC power source.

Exceeding the maximum input voltage of +57 Volts may cause permanent damage to the equipment.

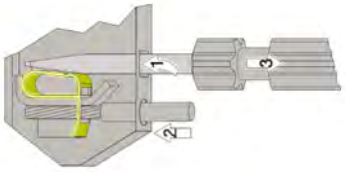
The power interface meets the following requirements:

- Connector Type: WAGO, 2-pin
- Connector Part Number: 231-602/017-000-2
- Mating Wire: AWG 12-18 (red and black)
- Maximum Power: 20 Watts
- Input Voltage Range: +9 to +57 VDC

Use the following procedure to connect the power cable wires to the SG5300. The red wire (12-18 AWG) on the power cable is the positive lead; the black wire (12-18 AWG) is negative.



1. Route the power cable between the SG5300 and the power source.
2. At the SG5300, strip off 5/16-inch (8-9 mm) of insulation from each wire.
3. Using a small flat-head screwdriver, insert the screwdriver blade ① into the power connector release port to open the spring clamp.



4. Insert the stripped wire end ② into the power connector wire opening.
5. Remove the screwdriver ③ and the spring clamp will secure the wire. This can be verified by gently tugging in the wire.
6. Repeat the process for the other wire.
7. Connect shield directly to ground or the grounding lug.

NOTE

Remember to connect the shield wire to ground.

8. Connect the other end of the power cable to the power source as required. A readily accessible disconnect device shall be incorporated external to the equipment. A 1-Amp over-current protection device shall be provided external to the equipment.

6.6.2 Safety/Earth Ground

To minimize the chances of damage to the SG5300 and RTU equipment, a good safety ground is recommended which bonds the antenna system, the SG5300, power source, and connected data equipment to a single-point ground. For safety purposes, earth ground and lightning protection connections should be made as required by local ordinances and the *Site Grounding and Lightning Protection Guidelines Manual, AE/LZT 123 4618/1*.

NOTE

To prevent equipment damage, ensure all equipment is connected to a single-point ground system and keep all grounds leads as short as possible.

Normally, adequate ground is provided if the SG5300 is mounted to a grounded metal surface. If the SG5300 is not mounted to a grounded surface, connect a safety ground to the SG5300 using the grounding lug or one of the four mounting screws.

6.6.3 Antenna Installation

NOTE

FOR DIVISION 2 NON-INCENDIVE APPLICATIONS:

Any connection to the RF antenna connector shall be torqued from 15 to 17 in-lbs.

1. Connect an antenna or antenna feedline cable onto the antenna connector on the top of the SG5300 by turning it clockwise into the TNC female connector.
2. Torque the antenna cable connection from 15 to 17 in-lbs.
3. Install surge protectors as required.

6.6.4 Ethernet Data Interface Connection

The SG5300 Ethernet interface is used for connecting to an RTU. The unit's Ethernet Interface meets the following requirements:

- Connector Type: RJ-45 Receptacle
- Electrical Protocol: 10/100Base-T
- Data Rate: 10/100 Mbps
- Data Format: Ethernet IEEE 802.3

Table 6-3: Ethernet Interface Signals

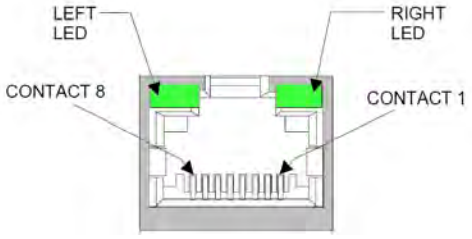
	Signal Name	Dir	Pin	Primary Function
	TX+	Out	1	Transmit Data +
	TX-	Out	2	Transmit Data –
	RX+	In	3	Receive Data +
	RX-	In	6	Receive Data –
	Not Used		4	Terminated
	Not Used		5	Terminated
	Not Used		7	Terminated
	Not Used		8	Terminated
	SHIELD			Chassis Ground

Table 6-4: Ethernet LEDs

Link LED (Left Side)		Activity LED (Right Side)	
Color	**Meaning**	**Color**	**Meaning**
Off	No Link	Off	No Activity
Amber	10 Mbps	Amber	Half-Duplex
Green	100 Mbps	Green	Full-Duplex

6.6.5 Serial Data Interface Connection

The SG5300 serial interface is used for Serial Line Internet Protocol (SLIP), Point to Point Protocol (PPP), or DNP3 data as well as for unit configuration and maintenance support. The serial interface can be configured to operate as a full duplex DCE EIA/TIA-232 port and meets the following requirements:

- Connector Type: DB-9F Receptacle
- Mating Part Number: DEMM9 Plug
- Electrical Protocol: EIA/TIA-232 Full Duplex
- Data Rate: 9.6 kbps for 900 MHz, 19.2 kbps for 800 MHz
- Data Format: 8 bits/character, No Parity, 1 stop bit

To meet Division 2 Non-Incendive applications, the serial connection must have installed either a serial cable or a protective cover (refer to Figure 6-2). The mounting screws of the cable or protective cover shall be torqued to a minimum of 3 in-lbs.

FOR DIVISION 2 NON-INCENDIVE APPLICATIONS:

If the serial port connection is not used, a serial port cover (refer to Figure 6-2) shall be installed on the serial port.

FOR DIVISION 2 NON-INCENDIVE APPLICATIONS:

The serial cable or protective cover mounting screws shall be torqued to a minimum of 3 in-lbs.

Table 6-5: Serial Interface Signals

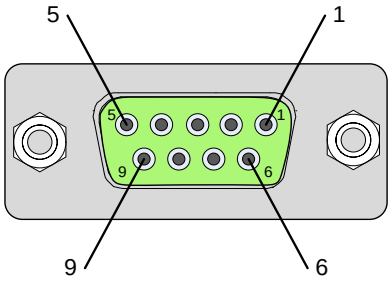
	Pin Number	Signal Name
	1	Not Connected (NC)
	2	Receive Data (RD)
	3	Transmit Data (TD)
	4	Not Connected (NC)
	5	Signal Ground (GND)
	6	Not Connected (NC)
	7	Request-To-Send (RTS)
	8	Clear-To-Send (CTS)
	9	Not Connected (NC)

Figure 6-2: Serial Port Protective Cover for Division 2 Non-Incendive Applications

7 CONFIGURATION

Configuration of the SG5300 is performed with an external computer attached to the DB9 serial port. Your Network Administrator should configure the SG5300. Changes to the configuration, if required, can also be made over-the-air if this option has been purchased.

There are three primary considerations when setting up an SG5300. These include configuration and software loading of either the RF Radio or the Ethernet port.

WARNING: EXPLOSION HAZARD.
DO NOT DISCONNECT WHILE THE CIRCUIT IS LIVE OR UNLESS THE AREA IS KNOWN TO BE FREE OF IGNITIBLE CONCENTRATIONS

7.1 EQUIPMENT REQUIRED

Service PC

7.2 CONFIGURING THE RF RADIO

To configure the SG5300 RF Radio unit through a serial connection between a console terminal or PC and the SG5300's Serial port:

1. Connect a console terminal or PC running a terminal emulation program (i.e., HyperTerminal) to your unit's serial port. The default serial port settings are **19200 baud, 8 bits, no parity, 1-stop bit, no flow control**.

2. Toggle the SG5300's Configuration Switch from and back to the **Serial** position. This will reset and re-boot the RF-Radio which results in a software version banner being sent to the terminal display using serial tunneling break-in.

If the banner is not output, it may be necessary to enter the off-line escape commands into the terminal (i.e., **+++** or *******).

3. Enter the user/system specific configuration setting commands into the SG5300. The following is an example of an SG5300 configuration file:

If commands are entered individually, the SG5300 RF Radio responds with an **OK** message after each accepted command entry.

at@r*	Removes all channels from the radio's Licensed Channel List (LCL)
at@c7,75,0,5	DLS109A 900 MHZ – Adds an RF channel to the radio's Licensed Channel List (LCL)
at@g7,75,0,5	Go to licensed channel
at\s 10.248.15.84	Set the radios IP address
at\b 10.248.15.254	Set the radios broadcast IP address

at***36**	Set the RF output power to 4 watts
atchanscan6	Enable channel scanning with automatic client attachment
at@toxff	Set tuning mode to normal
at@aoato	After the radio reboots/power-up, it will go on-line, and data and voice register.
at@ar1	Enable auto registration at power on
at@spni<>	Where "<>" is replaced with service provider network ID (ex.: at@spni11)
at@q0	Disable shutdown timer
at@ser_flowctl0	Disable serial flow control
at@h2	Sets the radio's home site ID to a specific site ID number
atz	Save and reboot

NOTE

Table 7-1 provides a sample of useful AT commands. A complete list of AT commands can be found in the *OpenSky Mobile-End System (MES) AT Command Reference Manual, MM-016649-001*.

4. Enter the **atz** command to reboot the SG5300 RF radio.

   After a few moments, the software version banner appears along with the RF radio's network registration and connection information, as shown in Figure 7-1: Rebooting Example.

NOTE

Configuration and wireless network connectivity is verified from the output registration and connection information.

```
atz
reboot...
** Logging Currently Disabled


MPU Processor V OTP R18.05 Sep 13 2011 18:40:40
Modem Escape Char: *
Feature Encryption Decode Error


DSP Processor V OTP R18.05 Sep 13 2011 18:34:21
Transceiver Type: 7  Version: -  Xcvr Ctrlr:
WARNING Type B Band Rev: OTP/Flash 16/15 Size: OTP/Flash 684/680
No Saved Misc Cal Parameters.
deviation: 4500 (0x1194)
Connecting to Last Channel.
CONNECT
```

Figure 7-1: Rebooting Example

5. Toggle the SG5300's Configuration Switch into either the Serial or Ethernet position, as required for normal operation.

Table 7-1: Useful SG5300 AT Commands

COMMANDS	DESCRIPTION
at\s yyy.yyy.yyy.yyy	Sets the radio's IP Address (yyy.yyy.yyy.yyy).
at\b zzz.zzz.zzz.zzz	Sets the radio's Broadcast IP Address (zzz.zzz.zzz.zzz).
at@c x,x,x,x	Loads Band, Chan#1, Chan#2, RF Protocol. Where: Band = 7 (900 MHz) or 8 (800 MHz) Chan#1 = 0 to 830 (at@c? lists channels) Chan#2 = 0 (N/A) RF Protocol = 3 (OTP, 2-slot) or 4 (OTP 4-slot)
at@h <Site Id>	Selects a home site for the MES to give preference to while channel scanning. Range: 0 to 65565
at@mdp_type#	Sets the data type for the serial connection to SLIP (Serial Line Internet Protocol), PPP (Point-to-Point Protocol), or Distributed Network Protocol (DNP3 static/dynamic), when the radio is on-line in non-text mode (ATO). 0 Sets the data type to Serial Line Internet Protocol (SLIP). This option must be selected when using the Ethernet port. 1 Sets the data type to PPP. Radio will look for PPP packets from the host. 2 Sets the data type to DNP3 Static (refer to Section 9). 3 Sets the data type to DNP3 Dynamic (refer to Section 9). 4 Static Serial Tunneling (refer to Section 10). 5 Network originated Serial Tunneling (refer to Section 10). 6 Client plus Network initiated Serial Tunneling (refer to Section 10. (For example: **`at@mdp_type2`** for DNP3 static)

7.3 CONFIGURING THE ETHERNET PORT

To configure the SG5300 Ethernet port through a serial connection between a console terminal or PC and the SG5300's Serial port:

1. Connect a console terminal or PC running a terminal emulation program (i.e., HyperTerminal) to your unit's serial port. The default serial port settings are **9600 baud, 8 bits, no parity, 1-stop bit, no-flow control.**

2. Toggle the SG5300's Configuration Switch from and to the Config-Ethernet position. Within three (3) seconds of setting the switch, enter three lowercase x characters (**`xxx`**).

The easiest way to enter Setup Mode is to hold down the **x** key at the terminal (or emulation) while switching the unit into Config-Ethernet. **You must do this within three seconds of setting the SG5300's Configuration Switch into the Config-Ethernet position.**

The terminal should display a firmware version banner similar to the following example:

```
*** SLIP Server ***
MAC address xxxxxxxxxxx
Software version V6.7SLIP.3.SLIP   (120116) CPK6702_XPTEX
Press Enter for Setup Mode
```

3. Within 5 seconds, press the **Enter** key to enter the Ethernet Setup Mode.

   The terminal should display the current configuration settings followed by the Change Setup menu:

```
Change Setup:
  0  Server configuration
  1  Channel 1 configuration
  5  Expert
  6  Security
  7  factory defaults
  8  exit without save
  9  save and exit                 Your choice ?
```

4. From the Change Setup menu, enter **0** for Server configuration after the "**Your choice ?"** and press the **Enter** key.

5. Set the entry fields (as shown on the next page) where the IP Address ***xxx.xxx.xxx.xxx*** is replaced with the desired IP Address for the SG5300 Ethernet port.

After every entry field, a respective default or previously set value will be displayed within the parenthesis. If the displayed value is correct, simply press the **Enter** key.

```
IP Address : (0) xxx.(0) xxx.(0) xxx.(0) xxx
Set Gateway IP Address (N) ?
Netmask: Number of Bits for Host Part (0=default) (8)
Change telnet config password (N) ?
```

6. From the Change Setup menu, enter **1** for Channel 1 configuration after "**Your choice ?"** and press the **Enter** key.

7. Set the entry fields as shown below where the Local Serial IP address ***xxx.xxx.xxx.xxx*** is replaced with the previously set SG5300 Ethernet port IP address and the Peer Serial IP address ***yyy.yyy.yyy.yyy*** is replaced with the previously set SG5300 RF Radio IP address.

After every entry field, a respective default or previously set value will be displayed within the parenthesis. If the displayed value is correct, press the **Enter** key.

```
Baudrate (19200)
I/F Mode (4C) ?
Flow (00) ?
Enable passive mode (N) ?
Enable bridge mode (N) ?
Local Serial IP address: (255) xxx.(255) xxx.(255) xxx.(255) xxx
```

```
Peer Serial IP address: (255) yyy.(255) yyy.(255) yyy.(255) yyy
NAT IP address: (000) .(000) .(000) .(000)
NAT IP address offset:  (16) ?
DNS Server IP address: (000) .(000) .(000) .(000)
Allow broadcasts in (Y) ?
Monitor Connection Control (N) ?
SLIP Client Mode (N) ?
```

8. From the Change Setup menu, enter **9** for Save and exit after "**Your choice ?"** and press the **Enter** key.

9. After all values are stored into nonvolatile memory, the terminal should display the "Parameters stored ..." message.

10. Toggle the SG5300's Configuration Switch into either the Serial or the Ethernet position for the desired normal operation of the SG5300.

8 ETHERNET FIRMWARE INSTALLATION AND CONFIGURATION

This section provides instructions for installing firmware in the SG5300.

8.1 UPDATE ETHERNET DEVICE FIRMWARE

8.1.1 Set Server IP Address

WARNING: EXPLOSION HAZARD.

DO NOT DISCONNECT WHILE THE CIRCUIT IS LIVE OR UNLESS THE AREA IS KNOWN TO BE FREE OF IGNITIBLE CONCENTRATIONS

1. Connect the SG5300 to the PC serial port.

   If working with a DTE device a null modem cable or adapter will be required.

2. Place SG5300 serial interface selector switch in the **Config Ethernet** position.

3. Connect power to the device being configured while depressing the “x” key (must be lower case).

4. The following message should appear:

```
*** SLIP Server ***
MAC address xxxxxxxxxxx
Software version V6.7SLIP.3.SLIP   (120116) CPK6702_XPTEX
Press Enter for Setup Mode
```

5. Within five (5) seconds, press the **Enter** key to enter Setup Mode.

   The following message should appear:

```
Change Setup:
  0  Server configuration
  1  Channel 1 configuration
  5  Expert
  6  Security
  7  factory defaults
  8  exit without save
  9  save and exit                 Your choice ?
```

6. Proceed to next section to install software.

8.1.2 Install Software

1. If this is a new install and the device has yet to be configured, enter “**7**” to load factory defaults.

2. Enter “0” to configure server.

3. When prompted for an IP Address, enter the desired IP address (i.e., 192.168.1.254).

4. When asked to set Gateway IP Address (N): Press the **Enter** key.

5. When prompted for a Netmask, enter: **8**

6. Change telnet config password (N): Press the **Enter** key.

7. When the following menu appears:

```
Change Setup:
  0  Server configuration
  1  Channel 1 configuration
  5  Expert
  6  Security
  7  factory defaults
  8  exit without save
  9  save and exit                Your choice ?
```

8. Enter "9" to exit configuration mode and start normal operation.

9. Connect the Ethernet port of the slip converter to the Ethernet port of the PC containing the FTP server and code for the device being configured.

10. Set the TFTP PC's IP address to 192.168.1.5.

11. Place the code to be downloaded in the directory C:\Code.

12. Place the serial selector switch in the "**Ethernet**" position.

13. Open a DOS command prompt window.

14. Enter the following command:

    tftp –i (IP Address of SG5300) PUT c:\code\xpteslps6.7.SLIP.3.rom X5

    (i.e. tftp –i 192.168.1.254 PUT c:\code\ xpteslps6.7.SLIP.3.rom X5)

15. Wait for the transfer to complete (about 8-10 seconds) and then set the needed IP addresses for the serial ports and the translation tables.

8.2 CONFIGURATION

8.2.1 Load Factory Defaults

1. Connect the SG5300 to the serial port of the PC and place the serial interface selector switch in the **Config Ethernet** position.

2. Connect power to the device being configured while depressing the "x" key (must be lower case).

3. The following message should appear:

```
*** SLIP Server ***
MAC address xxxxxxxxxxx
Software version V6.7SLIP.3.SLIP   (120116) CPK6702_XPTEX
Press Enter for Setup Mode
```

4. Within five (5) seconds, press the **Enter** key to enter Setup Mode.

   The following message should appear:

```
Change Setup:
  0  Server configuration
  1  Channel 1 configuration
  5  Expert
  6  Security
  7  factory defaults
  8  exit without save
  9  save and exit                 Your choice ?
```

5. Enter "**7**" followed by the **Enter** key.

6. After selecting factory defaults, select menu item "**9**" followed by the **Enter** key to exit and save changes.

8.2.2 Set Server IP Address

1. Connect the SG5300 to the serial port of the PC and place the serial interface selector switch in the **Config Ethernet** position.

2. Connect power to the device being configured while depressing the "x" key (must be lower case) When the following message appears :

   *** SLIP Server ***
   MAC address xxxxxxxxxxx
   Software version V6.7SLIP.3.SLIP   (120116) CPK6702_XPTEX
   Press Enter for Setup Mode

3. Press the **Enter** key to enter Setup Mode.

The following message appears:

```
Change Setup:
  0  Server configuration
  1  Channel 1 configuration
  5  Expert
  6  Security
  7  factory defaults
  8  exit without save
  9  save and exit                 Your choice ?
```

4. Enter "0" followed by the enter key.

5. When prompted for an IP Address: enter the desired IP address of the Ethernet server port (i.e., 192.168.1.254), placing a period between the octets or press the **Enter** key to move to the next octet.

6. When asked to set Gateway IP Address (N): Press then **Enter** key.

7. When prompted for a Netmask, enter the number of bits for Host Part (0): **8**

8. When prompted to change the telnet config password (N) ?: Press the **Enter** key.

9. When the following menu appears:

```
Change Setup:
  0  Server configuration
  1  Channel 1 configuration
  5  Expert
  6  Security
  7  factory defaults
  8  exit without save
  9  save and exit                 Your choice ?
```

10. If this was the last item to configure then enter "9" followed by the **Enter** key.

8.2.3 Serial Channel and Network Configuration

Both the serial converter and the SG5300 have the capability to perform PAT/NAT translations. Before starting a configuration, the user should have a good understanding of what device(s) are going to be connected to the Ethernet port. The mapping contained in the static table is a very important piece of the configuration.

1. From the main menu, enter "**1**" followed by the **Enter** key.

2. When prompted for the "Baudrate (19200)": Enter **19200** or press the **Enter** key.

3. When prompted for the "I/F Mode (4C) ?": Press the **Enter** key.

4. When prompted for the "Flow (00) ?": Press the **Enter** key.

5. When prompted for to "Enable passive mode (N) ?": Press the **Enter** key.

6. When prompted for the “Enable bridge mode (N) ?”: Press the **Enter** key.

7. When prompted for the “Local Serial IP address”: Enter the desired IP address of the local serial port (i.e., 10.248.15.85), placing a period between the octets or press the **Enter** key to move to the next octet.

8. When prompted for the “Peer Serial IP address”: Enter the IP address assigned to the radio serial port (i.e., 10.248.15.86), placing a period between the octets or press the **Enter** key to move to the next octet.

9. When prompted for the “NAT IP address (000.000.000.000)”: Leave set to 000.000.000.000 placing a period between the octets or press the **Enter** key to move to the next octet.

10. When prompted for the “NAT IP address offset: (16) ?”: Press the **Enter** key.

11. When prompted for the “DNS Server IP address: address (000.000.000.000)”: Leave set to 000.000.000.000, placing a period between the octets or press the **Enter** key to move to the next octet.

12. When prompted for the “Allow broadcasts in (N) ?”: Press the **Enter** key.

13. When prompted for the “Monitor Connection Control (N) ?”: Press the **Enter** key.

14. When prompted for the “SLIP Client Mode (N) ?”: Press the **Enter** key.

```
Static Map Table
   PROTO    [Cloud Socket]          [Ethernet Socket]
01: ICM 010.000.000.001:00000 <-> 192.168.001.001:00000
02: UDP 010.000.000.001:00000 <-> 192.168.001.001:00000
03:     --- 000.000.000.000:00000 <-> 000.000.000.000:00000
04:     --- 000.000.000.000:00000 <-> 000.000.000.000:00000
05:     --- 000.000.000.000:00000 <-> 000.000.000.000:00000
06:     --- 000.000.000.000:00000 <-> 000.000.000.000:00000
07:     --- 000.000.000.000:00000 <-> 000.000.000.000:00000
08:     --- 000.000.000.000:00000 <-> 000.000.000.000:00000
09:     --- 000.000.000.000:00000 <-> 000.000.000.000:00000
10:     --- 000.000.000.000:00000 <-> 000.000.000.000:00000
11:     --- 000.000.000.000:00000 <-> 000.000.000.000:00000
12:     --- 000.000.000.000:00000 <-> 000.000.000.000:00000
13:     --- 000.000.000.000:00000 <-> 000.000.000.000:00000
14:     --- 000.000.000.000:00000 <-> 000.000.000.000:00000
```

15. When prompted to “Change Map Table? (N) ?”: Enter **Y** and press the **Enter** key.

16. When prompted to “Clear Map Table? (N) ?”: Press the **Enter** key.

17. When prompted to “Edit entry # (0 to exit): (0) ?: Enter **1**

18. When prompted for the “Map Cloud TCP, UDP or ICMP to Ethernet IP & Port” and “A(LL) or T(CP) or U(DP) or (I)CMP:” Enter:
    - **A** for ALL traffic

      The ALL filter selection allows all traffic from the radio (cloud socket) to flow to the Ethernet socket. IP address and port translation can be accomplished if required.

- **T** for TCP traffic

  The TCP filter selection enables TCP traffic from the radio (cloud socket) to flow to the Ethernet socket. IP address and port translation can be accomplished if required.

- **U** for UDP traffic

  The UDP filter selection enables UDP traffic from the radio (cloud socket) to flow to the Ethernet socket. IP address and port translation can be accomplished if required.

- **I** for ICMP traffic

  The ICMP filter selection enables ICMP traffic from the radio (cloud socket) to flow to the Ethernet socket. Only IP address translation can be accomplished, if required. ICMP does not use port numbers.

19. When prompted for the "Cloud Port #: (0) ?": Enter the port number that was assigned at the source of the message (i.e., telnet port 23, HTTP port 80).

20. When prompted for the "To Port #: (0) ?": Enter the port number that the destination application will want to see.

    If it is the same number assigned at the source of the message (i.e., telnet port 23, HTTP port 80), enter 0 for the cloud port and to port numbers. When both the cloud and two port numbers are set to zero, no port translation takes place.

21. When prompted for the "At IP address": Enter the destination IP address, (where you want the data sent to on the Ethernet port network), placing a period between the octets or press the **Enter** key to move to the next octet.

22. When prompted for the "Edit entry # (0 to exit): (1) ?": Enter 0 if all entries have been completed or the next table position to be configured.

23. If 0 was entered, you will be given the current static map table and asked if you wish to make changes. Review the entries, if correct enter "**N**;" otherwise, enter "**Y**" and make any needed corrections.

```
Static Map Table
   PROTO    [Cloud Socket]          [Ethernet Socket]
01: ICM 010.000.000.001:00000 <-> 192.168.001.001:00000
02: UDP 010.000.000.001:00000 <-> 192.168.001.001:00000
03:     --- 000.000.000.000:00000 <-> 000.000.000.000:00000
04:     --- 000.000.000.000:00000 <-> 000.000.000.000:00000
05:     --- 000.000.000.000:00000 <-> 000.000.000.000:00000
06:     --- 000.000.000.000:00000 <-> 000.000.000.000:00000
07:     --- 000.000.000.000:00000 <-> 000.000.000.000:00000
08:     --- 000.000.000.000:00000 <-> 000.000.000.000:00000
09:     --- 000.000.000.000:00000 <-> 000.000.000.000:00000
10:     --- 000.000.000.000:00000 <-> 000.000.000.000:00000
11:     --- 000.000.000.000:00000 <-> 000.000.000.000:00000
12:     --- 000.000.000.000:00000 <-> 000.000.000.000:00000
13:     --- 000.000.000.000:00000 <-> 000.000.000.000:00000
14:     --- 000.000.000.000:00000 <-> 000.000.000.000:00000

Change Map Table? (N) ?
```

24. When the following information is displayed, select menu item "**9**" followed by the **Enter** key to save changes and exit.

```
*** basic parameters
Hardware: Ethernet TPI
IP addr 192.168.1.254, no gateway set,netmask 255.255.255.0
*** Security
SNMP is              enabled
SNMP Community Name: public
Telnet Setup is      enabled
TFTP Download is     enabled
Port 77FEh is        enabled
Web Server is        enabled
Web Setup is         enabled
ECHO is              disabled
Enhanced Password is disabled


***************** Channel 1 *****************
Baudrate 19200, I/F Mode 4C, Flow 00
CPU performance  : Standard
Local Serial IP address 10.0.0.2
Peer Serial IP address 10.0.0.1
NAT IP address 0.0.0.0
NAT IP address offset 16
DNS Server IP address 0.0.0.0
Passive Mode: disabled
Bridge Mode: disabled
Allow broadcasts: disabled
Monitor Connection Control: disabled
SLIP Client Mode: disabled

Static Map Table
   PROTO    [Cloud Socket]          [Ethernet Socket]
01: ICM 010.000.000.001:00000 <-> 192.168.001.001:00000
02: UDP 010.000.000.001:00000 <-> 192.168.001.001:00000
03:     --- 000.000.000.000:00000 <-> 000.000.000.000:00000
04:     --- 000.000.000.000:00000 <-> 000.000.000.000:00000
05:     --- 000.000.000.000:00000 <-> 000.000.000.000:00000
06:     --- 000.000.000.000:00000 <-> 000.000.000.000:00000
07:     --- 000.000.000.000:00000 <-> 000.000.000.000:00000
08:     --- 000.000.000.000:00000 <-> 000.000.000.000:00000
09:     --- 000.000.000.000:00000 <-> 000.000.000.000:00000
10:     --- 000.000.000.000:00000 <-> 000.000.000.000:00000
11:     --- 000.000.000.000:00000 <-> 000.000.000.000:00000
12:     --- 000.000.000.000:00000 <-> 000.000.000.000:00000
13:     --- 000.000.000.000:00000 <-> 000.000.000.000:00000
14:     --- 000.000.000.000:00000 <-> 000.000.000.000:00000

*** Expert

CPU performance: Regular
Monitor Mode @ bootup : enabled
MTU Size: 1400
Alternate MAC: disabled
Ethernet connection type: auto-negotiate
```

```
Change Setup:
  0 Server configuration
  1 Channel 1 configuration
  5 Expert
  6 Security
  7 factory defaults
  8 exit without save
  9 save and exit                 Your choice ?
```

8.3 IMPLEMENTATION

Once the new slip code is loaded, you will receive a message similar to the following when you connect to the SG5300:

```
*** SLIP Server ***
MAC address 00204ADFCAF7
Software version V6.7.SLIP.3 (120116) CPK6702_XPTEX
Press Enter for Setup Mode


*** basic parameters
Hardware: Ethernet TPI
IP addr 10.248.15.109, no gateway set,netmask 255.255.255.0
*** Security
SNMP is               enabled
SNMP Community Name: public
Telnet Setup is       enabled
TFTP Download is      enabled
Port 77FEh is         enabled
Web Server is         enabled
Web Setup is          enabled
ECHO is               disabled
Enhanced Password is disabled


***************** Channel 1 *****************
Baudrate 9600, I/F Mode 4C, Flow 00
CPU performance  : Standard
Local Serial IP address 255.255.255.255
Peer Serial IP address 255.255.255.255
NAT IP address 255.255.255.255
DNS Server IP address 255.255.255.255
Passive Mode: enabled
Bridge Mode: enabled
Allow broadcasts: enabled
Monitor Connection Control: enabled
SLIP Client Mode: enabled

Static Map Table
   PROTO    [Cloud Socket]          [Ethernet Socket]
01: --- 000.000.000.000:00000 <-> 000.000.000.000:00000
02: --- 000.000.000.000:00000 <-> 000.000.000.000:00000
03: --- 000.000.000.000:00000 <-> 000.000.000.000:00000
04: --- 000.000.000.000:00000 <-> 000.000.000.000:00000
05: --- 000.000.000.000:00000 <-> 000.000.000.000:00000
06: --- 000.000.000.000:00000 <-> 000.000.000.000:00000
```

```
07: --- 000.000.000.000:00000 <-> 000.000.000.000:00000
08: --- 000.000.000.000:00000 <-> 000.000.000.000:00000
09: --- 000.000.000.000:00000 <-> 000.000.000.000:00000
10: --- 000.000.000.000:00000 <-> 000.000.000.000:00000
11: --- 000.000.000.000:00000 <-> 000.000.000.000:00000
12: --- 000.000.000.000:00000 <-> 000.000.000.000:00000
13: --- 000.000.000.000:00000 <-> 000.000.000.000:00000
14: --- 000.000.000.000:00000 <-> 000.000.000.000:00000


*** Expert

CPU performance: Regular
Monitor Mode @ bootup : enabled
MTU Size: 1400
Alternate MAC: disabled
Ethernet connection type: auto-negotiate

Change Setup:
  0 Server configuration
  1 Channel 1 configuration
  5 Expert
  6 Security
  7 factory defaults
  8 exit without save
  9 save and exit                Your choice ?
```

8.4 IMPLEMENTATION EXAMPLES

8.4.1 Sample Implementation, SG5300 and One Logical Network

This is a sample implementation for a single device and one (1) logical network.

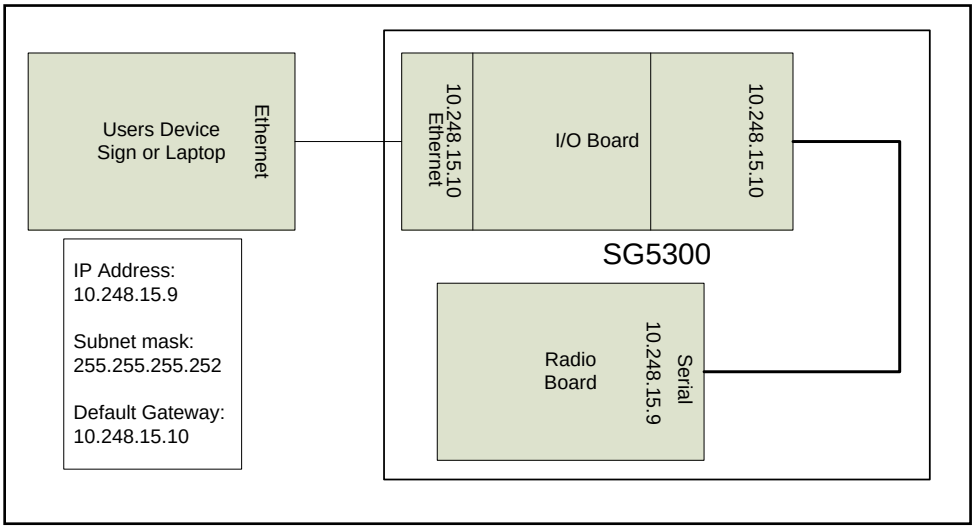


Figure 8-1: SG5300 and One logical network

For this example you would enter the following configuration:

1. Assign a Server IP Address and net mask (Menu Selection 0).

2. Assign a Serial IP Address (Menu Selection 1).

3. Assign a Peer Serial IP Address (Menu Selection 1).

4. Assign static entries into the translation table to allow UDP and ICMP traffic (Menu Selection 1 table entry).

When you have completed your configuration entries, your configuration will look like the following:

```
*** basic parameters
Hardware: Ethernet TPI
IP addr 10.248.15.10, no gateway set,netmask 255.255.255.0
*** Security
SNMP is              enabled
SNMP Community Name: public
Telnet Setup is      enabled
TFTP Download is     enabled
Port 77FEh is        enabled
Web Server is        enabled
Web Setup is         enabled
ECHO is              disabled
Enhanced Password is disabled

***************** Channel 1 *****************
Baudrate 19200, I/F Mode 4C, Flow 00
CPU performance  : Standard
Local Serial IP address 10.248.15.10
Peer Serial IP address 10.248.15.9
NAT IP address 0.0.0.0
NAT IP address offset 16
DNS Server IP address 0.0.0.0
Passive Mode: disabled
Bridge Mode: disabled
Allow broadcasts: disabled
Monitor Connection Control: disabled
SLIP Client Mode: disabled

Static Map Table
   PROTO    [Cloud Socket]          [Ethernet Socket]
01: ICM 010.248.015.009:00000 <-> 010.248.015.009:00000 (Sends all ICMP
traffic from the peer serial port to 010.248.015.009 at the Ethernet
port)

02: UDP 010.248.015.009:00000 <-> 010.248.015.009:00000 (Sends all UDP
traffic from the peer serial port to 010.248.015.009 at the Ethernet
port)

03: --- 000.000.000.000:00000 <-> 000.000.000.000:00000
04: --- 000.000.000.000:00000 <-> 000.000.000.000:00000
05: --- 000.000.000.000:00000 <-> 000.000.000.000:00000
06: --- 000.000.000.000:00000 <-> 000.000.000.000:00000
07: --- 000.000.000.000:00000 <-> 000.000.000.000:00000
```

```
08: --- 000.000.000.000:00000 <-> 000.000.000.000:00000
09: --- 000.000.000.000:00000 <-> 000.000.000.000:00000
10: --- 000.000.000.000:00000 <-> 000.000.000.000:00000
11: --- 000.000.000.000:00000 <-> 000.000.000.000:00000
12: --- 000.000.000.000:00000 <-> 000.000.000.000:00000
13: --- 000.000.000.000:00000 <-> 000.000.000.000:00000
14: --- 000.000.000.000:00000 <-> 000.000.000.000:00000


An Alternate map that could be used is:

Static Map Table
   PROTO    [Cloud Socket]          [Ethernet Socket]
01:  ALL  010.248.015.009:00000  <->  010.248.015.009:00000  (Sends  all
traffic from the  cloud to 010.248.015.009 at the Ethernet port)

02: --- 000.000.000.000:00000 <-> 000.000.000.000:00000
03: --- 000.000.000.000:00000 <-> 000.000.000.000:00000
04: --- 000.000.000.000:00000 <-> 000.000.000.000:00000
05: --- 000.000.000.000:00000 <-> 000.000.000.000:00000
06: --- 000.000.000.000:00000 <-> 000.000.000.000:00000
07: --- 000.000.000.000:00000 <-> 000.000.000.000:00000
08: --- 000.000.000.000:00000 <-> 000.000.000.000:00000
09: --- 000.000.000.000:00000 <-> 000.000.000.000:00000
10: --- 000.000.000.000:00000 <-> 000.000.000.000:00000
11: --- 000.000.000.000:00000 <-> 000.000.000.000:00000
12: --- 000.000.000.000:00000 <-> 000.000.000.000:00000
13: --- 000.000.000.000:00000 <-> 000.000.000.000:00000
14: --- 000.000.000.000:00000 <-> 000.000.000.000:00000



*** Expert

CPU performance: Regular
Monitor Mode @ bootup : enabled
MTU Size: 1400
Alternate MAC: disabled
Ethernet connection type: auto-negotiate
```

5. Select menu item “9” to save your configuration and exit.

8.4.2 Sample Implementation, SG5300 and Two Logical Networks

This is a sample implementation for a single device and two (2) logical networks.

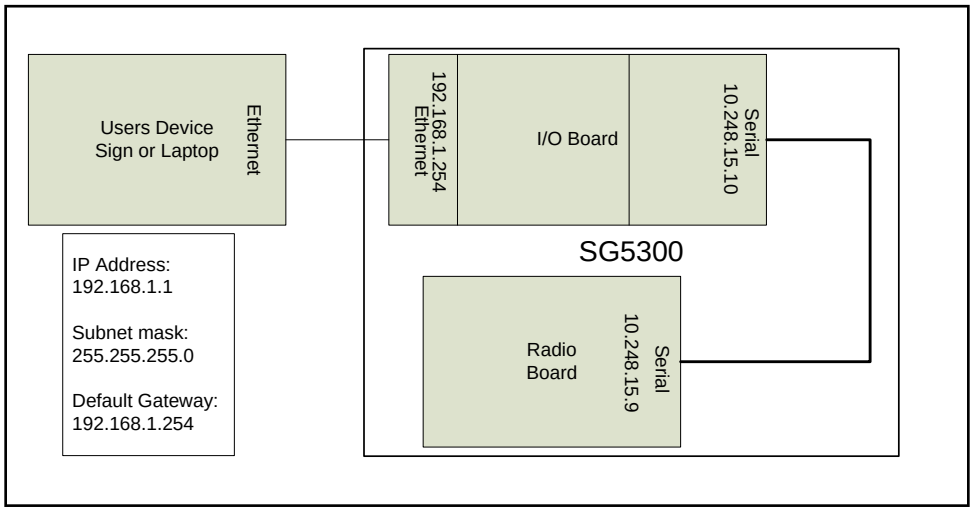


Figure 8-2: SG5300 and Two Logical Networks

For this example you would enter the following configuration:

1. Assign a Server IP Address and net mask (Menu Selection 0).

2. Assign a Serial IP Address (Menu Selection 1).

3. Assign a Peer Serial IP Address (Menu Selection 1).

4. Assign static entries into the translation table to allow UDP and ICMP traffic (Menu Selection 1 table entry).

5. When you have completed your configuration entries, your configuration will look like the following:

```
*** basic parameters
Hardware: Ethernet TPI
IP addr 192.168.1.254, no gateway set,netmask 255.255.255.0
*** Security
SNMP is              enabled
SNMP Community Name: public
Telnet Setup is      enabled
TFTP Download is     enabled
Port 77FEh is        enabled
Web Server is        enabled
Web Setup is         enabled
ECHO is              disabled
Enhanced Password is disabled


***************** Channel 1 *****************
Baudrate 19200, I/F Mode 4C, Flow 00
CPU performance  : Standard
Local Serial IP address 10.248.15.10
```

```
Peer Serial IP address 10.248.15.9
NAT IP address 0.0.0.0
NAT IP address offset 16
DNS Server IP address 0.0.0.0
Passive Mode: disabled
Bridge Mode: disabled
Allow broadcasts: disabled
Monitor Connection Control: disabled
SLIP Client Mode: disabled

Static Map Table
   PROTO    [Cloud Socket]          [Ethernet Socket]
01: ICM 010.248.015.009:00000 <-> 192.168.001.001:00000 (Sends all ICMP
traffic to 192.168.001.001 )
02: UDP 010.248.015.009:00000 <-> 192.168.001.001:00000 (Sends all UDP
traffic to 192.168.001.001 )

03: --- 000.000.000.000:00000 <-> 000.000.000.000:00000
04: --- 000.000.000.000:00000 <-> 000.000.000.000:00000
05: --- 000.000.000.000:00000 <-> 000.000.000.000:00000
06: --- 000.000.000.000:00000 <-> 000.000.000.000:00000
07: --- 000.000.000.000:00000 <-> 000.000.000.000:00000
08: --- 000.000.000.000:00000 <-> 000.000.000.000:00000
09: --- 000.000.000.000:00000 <-> 000.000.000.000:00000
10: --- 000.000.000.000:00000 <-> 000.000.000.000:00000
11: --- 000.000.000.000:00000 <-> 000.000.000.000:00000
12: --- 000.000.000.000:00000 <-> 000.000.000.000:00000
13: --- 000.000.000.000:00000 <-> 000.000.000.000:00000
14: --- 000.000.000.000:00000 <-> 000.000.000.000:00000


*** Expert

CPU performance: Regular
Monitor Mode @ bootup : enabled
MTU Size: 1400
Alternate MAC: disabled
Ethernet connection type: auto-negotiate
```

6. Select menu item “9” to save your configuration and exit.

8.4.3 Sample Implementation, SG5300, 2 Logical Networks, and Multiple Devices

This is a sample implementation for multiple devices and two (2) logical networks.

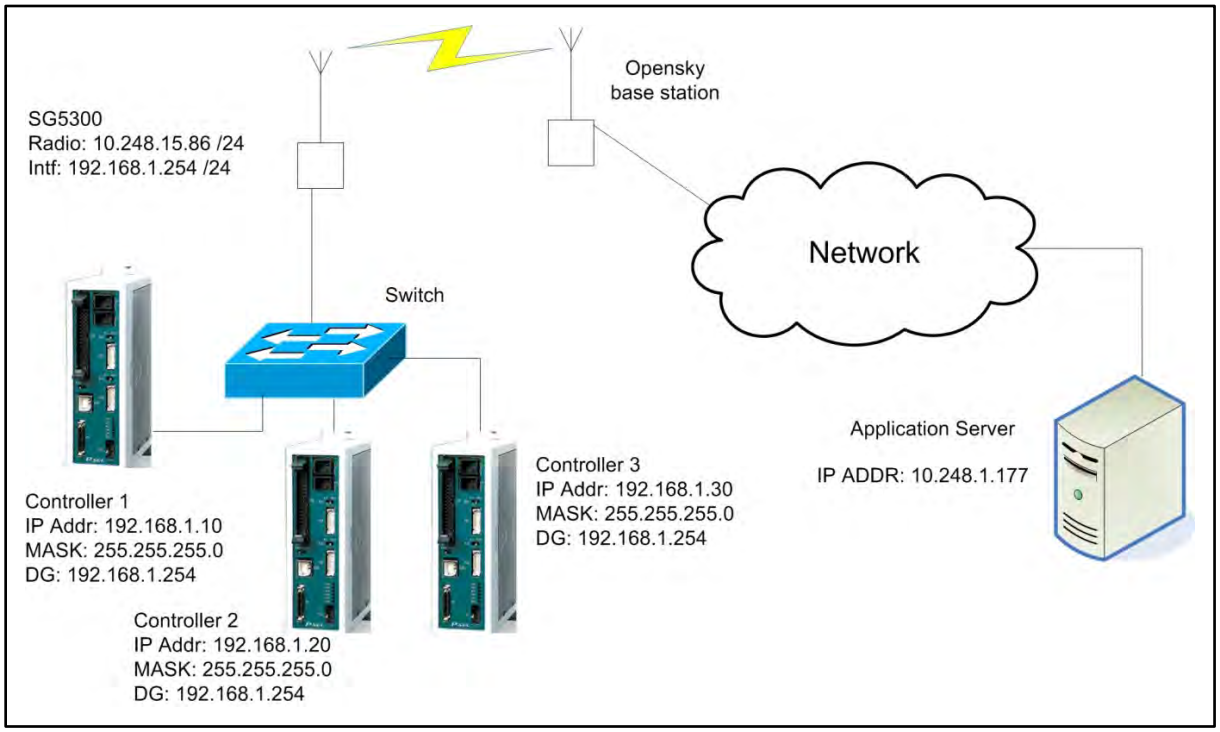


Figure 8-3: SG5300, Two Logical Networks, and Multiple Devices

In this example, the application server will need to maintain a static table that it associates the 192.x.x.x network address to a port number. Also assume the ports and IP addresses have been associated in the following manner:

- 192.168.10 = 10.248.15.86 port 5010
- 192.168.20 = 10.248.15.86 port 5020
- 192.168.30 = 10.248.15.86 port 5030

For this example you would enter the following configuration:

1. Assign a Server IP Address and net mask (Menu Selection 0).
2. Assign a Serial IP Address (Menu Selection 1).
3. Assign a Peer Serial IP Address (Menu Selection 1).
4. Assign static entries into the translation table to allow UDP and ICMP traffic (Menu Selection 1 table entry).
5. When you have completed your configuration entries, you configuration will look like the following data:

*** basic parameters
Hardware: Ethernet TPI
IP addr 192.168.1.254, no gateway set,netmask 255.255.255.0
*** Security
SNMP is enabled
SNMP Community Name: public
Telnet Setup is enabled
TFTP Download is enabled
Port 77FEh is enabled
Web Server is enabled
Web Setup is enabled
ECHO is disabled
Enhanced Password is disabled

********** Channel 1 **********
Baudrate 19200, I/F Mode 4C, Flow 00
CPU performance : Standard
Local Serial IP address 10.248.15.85
Peer Serial IP address 10.248.15.86
NAT IP address 0.0.0.0
NAT IP address offset 16
DNS Server IP address 0.0.0.0
Passive Mode: disabled
Bridge Mode: disabled
Allow broadcasts: disabled
Monitor Connection Control: disabled
SLIP Client Mode: disabled

Static Map Table
PROTO [Cloud Socket] [Ethernet Socket]

01: ICM 010.248.015.086:00000 <-> 192.168.001.010:00000 (Sends all ICMP traffic to 192.168.001.010)

02: UDP 010.248.015.086:05010 <-> 192.168.001.010:00000 (Sends all UDP port 5010 traffic to 192.168.001.010)

03: UDP 010.248.015.086:05020 <-> 192.168.001.020:00000 (Sends all UDP port 5020 traffic to 192.168.001.020)

04: UDP 010.248.015.086:05030 <-> 192.168.001.030:00000 (Sends all UDP port 5010 traffic to 192.168.001.030)

05: --- 000.000.000.000:00000 <-> 000.000.000.000:00000
06: --- 000.000.000.000:00000 <-> 000.000.000.000:00000
07: --- 000.000.000.000:00000 <-> 000.000.000.000:00000
08: --- 000.000.000.000:00000 <-> 000.000.000.000:00000
09: --- 000.000.000.000:00000 <-> 000.000.000.000:00000
10: --- 000.000.000.000:00000 <-> 000.000.000.000:00000
11: --- 000.000.000.000:00000 <-> 000.000.000.000:00000

12: --- 000.000.000.000:00000 <-> 000.000.000.000:00000
13: --- 000.000.000.000:00000 <-> 000.000.000.000:00000
14: --- 000.000.000.000:00000 <-> 000.000.000.000:00000

*** Expert

CPU performance: Regular
Monitor Mode @ bootup : enabled
MTU Size: 1400
Alternate MAC: disabled
Ethernet connection type: auto-negotiate

6. Select menu item “9” to save your configuration and exit.

9 DISTRIBUTED NETWORK PROTOCOL (DNP3)

A common protocol used is the Distributed Network Protocol (DNP3). DNP3 is an open, standards-based, interoperability protocol typically used by the electric utility industry to establish communication between substation, outstations, and master stations. It is a more general protocol than IEC 60870-5-104. In addition to the electric utilities, it can also be used in the water infrastructure, oil and gas, waste water, and security industries.

The SG5300 is designed to support the DNP3 protocol (via its serial port) to support various Outstation configurations (refer to Figure 9-1). DNP3 is also supported via the Ethernet port, but IP based Outstations and the DNP3 Master Station must perform their own encapsulation of DNP3 frames. A radio configured to support DNP3 will not be able to provide IP services to connected devices. For more information about DNP3 protocol, please refer to the Distributed Network Protocol Organization at www.dnp.org.

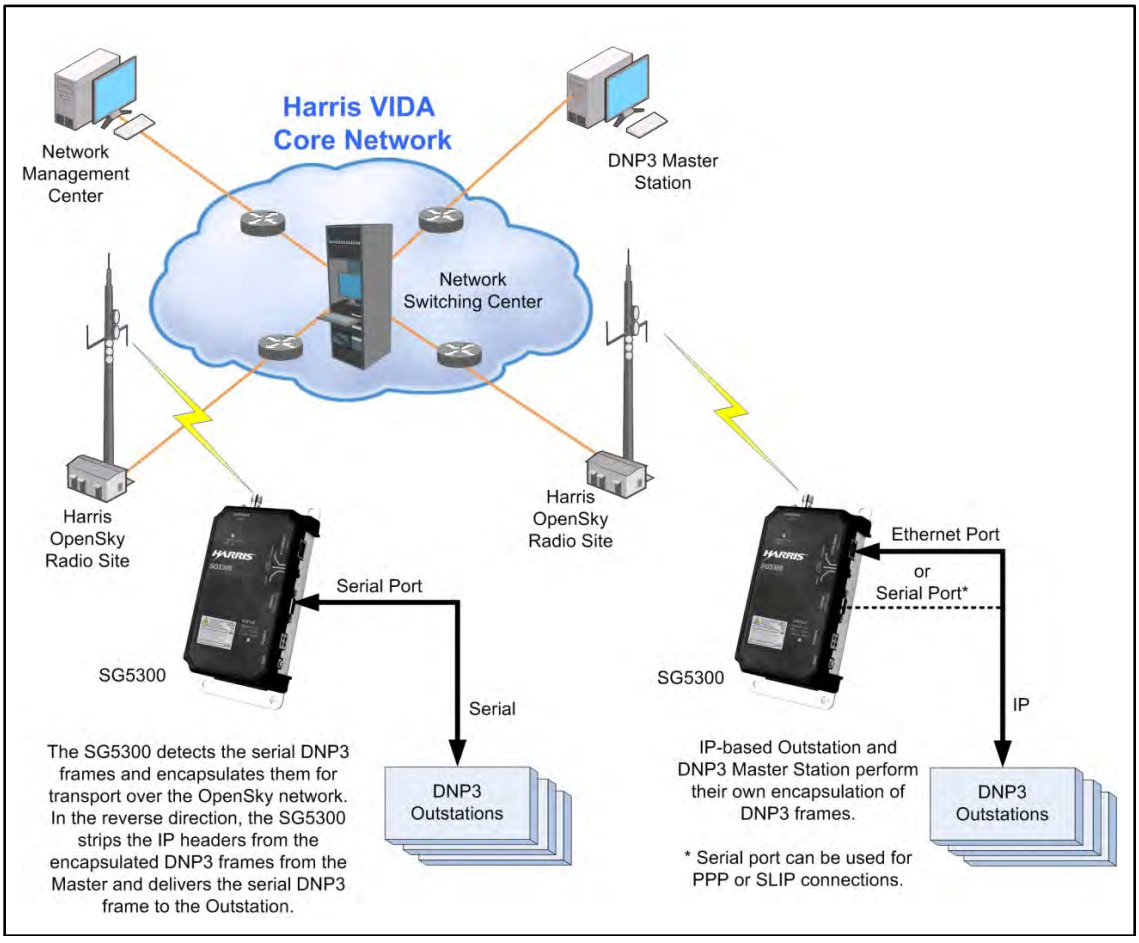


Figure 9-1: DNP3 Protocol Example

9.1 DNP3 COMMANDS

Table 9-1: Commands Associated to DNP3

<table>
<tr><th>COMMANDS</th><th>DESCRIPTION</th></tr>
<tr><td>at@mdp_type</td><td>Sets the data type for the serial connection to Distributed Network Protocol DNP3 static/dynamic.
2 Sets the data type to DNP3 Static
3 Sets the data type to DNP3 Dynamic
Example: at@mdp_type2</td></tr>
<tr><td>at@dnp3_addroute</td><td>Adds a route to the Distributed Network Protocol (DNP3) routing table. The network DNP3 address cannot be the same as the host DNP3 address. The host DNP3 port cannot be the same as the radio's service port. Up to 64 routes may be added to the table.
<table>
<tr><th>OPERAND</th><th>RANGE</th></tr>
<tr><td>Network DNP3 Address</td><td>0 to 65535</td></tr>
<tr><td>Host DNP3 Address</td><td>0 to 65535</td></tr>
<tr><td>Network DNP3 Port</td><td>0 to 65519, Except 20000</td></tr>
<tr><td>Host DNP3 Port</td><td>0 to 65519, Except 20000</td></tr>
<tr><td>Network IP Address</td><td>xxx.xxx.xxx.xxx</td></tr>
</table></td></tr>
<tr><td>at@dnp3_removeroute</td><td>Removes a route or all routes from the Distributed Network Protocol (DNP3) routing table.
Examples:
at@dnp3_removeroute101,102 removes the DNP3 route with the network DNP3address 101 and host DNP3 address 102.
at@dnp3_removeroute* removes all DNP3 routes.</td></tr>
</table>

9.2 ESTABLISHING SERIAL COMMUNICATIONS

1. Connect your PC's COM to the **SERIAL RS-232** port on the SG5300.
2. Set the **CONFIG** switch on the SG5300 to **SERIAL**.
3. Connect using a terminal program such as Reflections or Tera Term. Use connection settings that match the configuration of SG5300. (Default settings: 19200, N, 8, 1, NONE)
4. Apply power to the SG5300 and do the following:
   a. Observe the startup information displayed on the terminal program.
   b. Verify the software versions reported are at least R21A or later.

   The device is ready to configure when it reports "Connecting to Licensed Channel."

9.3 DNP3/IP ADDRESSING

A radio configured to provide DNP3 connectivity to an external device needs to be configured with its locally supported DNP3 addresses, local UDP port, and the DNP3 address and IP/UDP port pair for each Master it must communicate with. Communication between a single Outstation and a number of Masters may be may be required for some redundant schemes or if there are multiple users of the outstation data.

The radio may learn these addresses initially through a static configuration and may optionally learn addresses dynamically. Dynamic address updates simplify the address configuration of devices and simplifies updates to addressing in the field. Addressing may be limited to only static configuration to provide a higher level of security in the system. The radio is configured to operate in Static or Dynamic Addressing mode through local configuration (AT command).

9.3.1 DNP3/IP Routing Table

The SG5300 maintains a DNP3/IP Routing Table. AT command "*at@dnp3_addroute*" is used to build the table. The table provides the information required to route DNP3 frames based on destination DNP3 Address and IP address and UDP port. The table may only contain one instance of any particular source/destination DNP3 address pair. An example DNP3/IP Routing Table is shown in Table 9-2. From the radio's perspective, Network components are used to identify remote DNP3 Masters. The Host Port is used to identify the UDP port to be used for IP communications to or from a DNP3 Master. The Host DNP3 address is used to identify locally connected DNP3 devices. The Host DNP3 and Network DNP3 address cannot be the same in any individual route in the DNP3/IP Routing Table.

UDP port 6425 is reserved, since it is the radio's service port number and cannot be entered in the DNP3/IP Routing Table as a Host Port. UDP port 20000 is defined as the default port number in the DNP3 specifications.

Table 9-2: DNP3/IP Routing Table

NETWORK DNP3 ADDRESS	HOST DNP3 ADDRESS	NETWORK DNP3 PORT	HOST DNP3 PORT	NETWORK IP ADDRESS
4001	2001	4001	2001	10.248.11.37

For example: `at@dnp3_addroute4001,2001,4001,2001,10.248.11.37` adds a DNP3 route with network DNP3 address 4001, host DNP3 address 2001, network DNP3 port 4001, host DNP3 port 2001, and network IP address 10.248.11.37. The radio's DNP3/IP Routing Table can contain a maximum of 64 entries.

9.3.2 Static Addressing

In this configuration, the radio is locally configured with all required DNP3 and IP address and port pairs. Messages received from the network are discarded if they meet the following:

- Are destined to a different DNP3 address than locally configured DNP3 addresses.
- Arrive from a network addresses/port that is not in the table.

Local messages are discarded if they meet the following:

- They are from a host address the radio does not recognize.
- The network address is not known.

Example:

1. Using a terminal emulator, establish a communication link to the Outstation SG5300, as shown in Figure 9-3: Adding a DNP3 Static Routing Table.

2. Remove a route or all routes from the Distributed Network Protocol (DNP3) Routing Table as required, for example:

   `at@dnp3_removeroute*` removes all DNP3 routes

3. Add a route to the Distributed Network Protocol (DNP3) Routing Table, for example:

   `at@dnp3_addroute4001,2001,4001,2001,10.248.11.37`

4. Press **Enter**; the SG5300 responds with **OK** if the route is accepted.

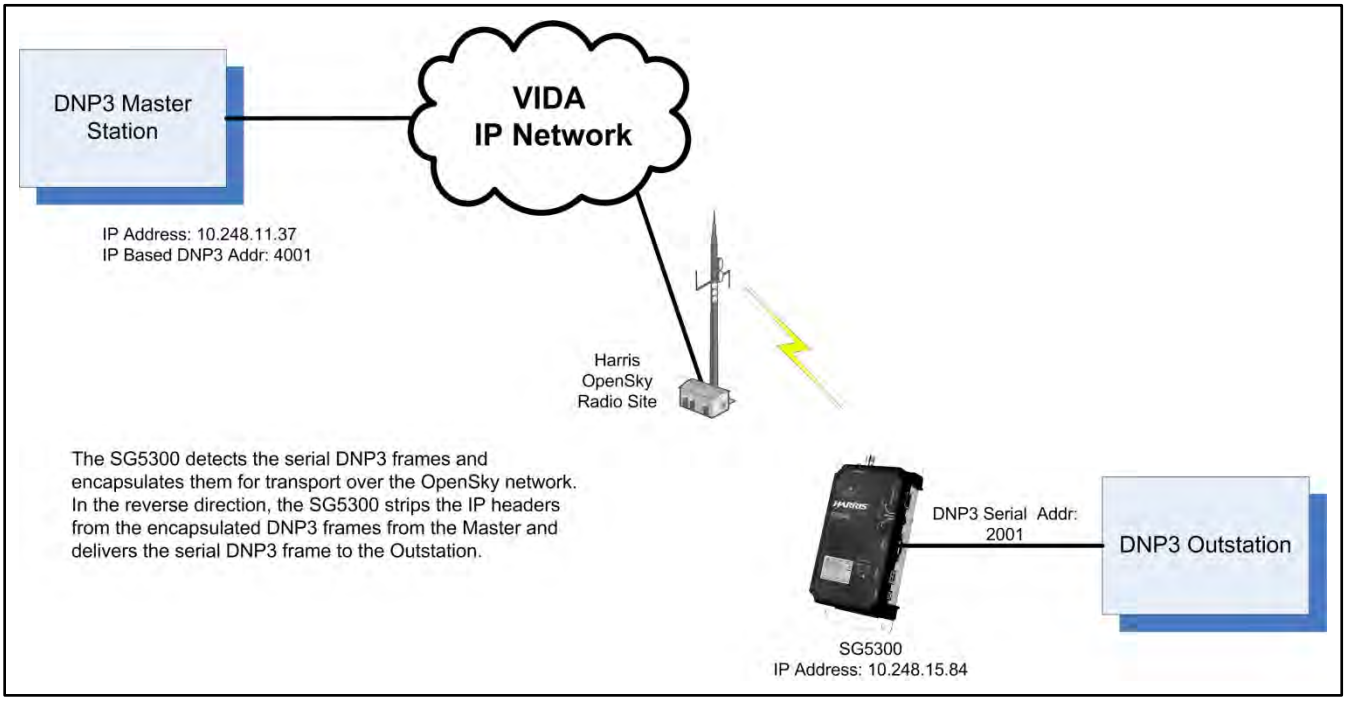


Figure 9-2: DNP3 Static Addressing Example

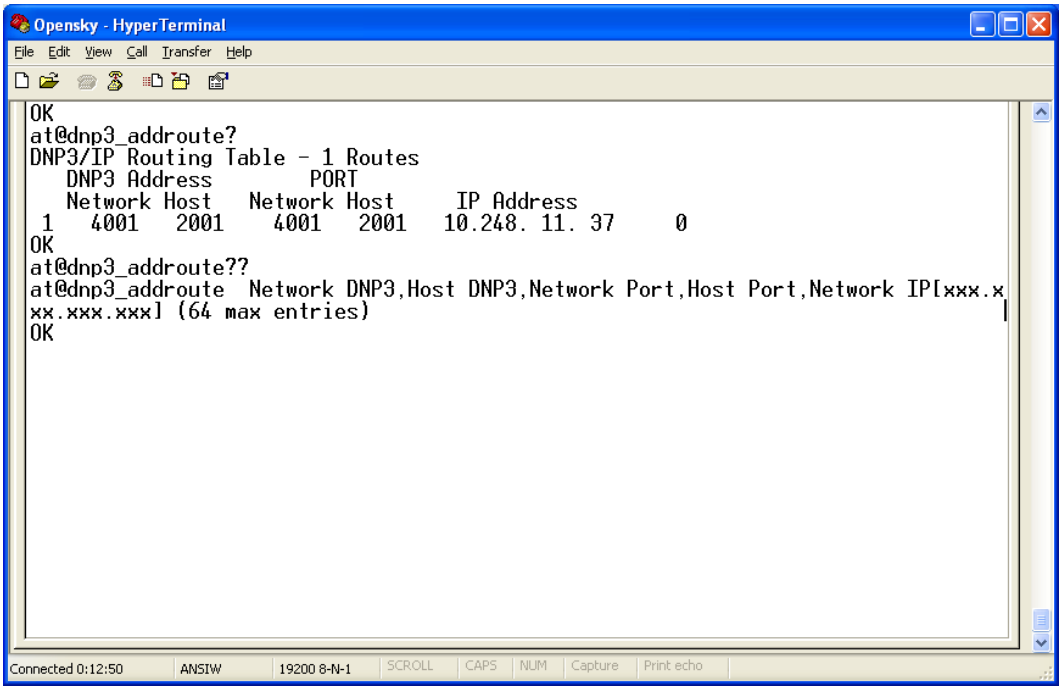


Figure 9-3: Adding a DNP3 Static Routing Table

9.3.3 Dynamic Addressing

In this configuration, the radio may be locally configured with entries in the DNP3/IP Routing Table as described in Section 9.3.1.

With Dynamic Addressing enabled, if the radio receives a DNP3 frame from the network, it will check to see if the addressing is already in the table. If not, the radio will update the table accordingly.

If a DNP3 frame is received from the locally connected device, it will check to see if the addressing is already in the table. If not, the radio will drop the DNP3 frame since the destination routing is unknown.

The radio learns about DNP3/IP routes based on messages from the network. When messages are received over the network with a different destination address than the previously configured DNP3 address, the radio updates the table to add the new entry. The radio also updates the table if it receives a DNP3 frame locally for a local DNP3 address that was previously unknown. If a DNP3/IP address pair received over the network conflicts with a pair in the table, the old pair is overwritten with the newly discovered pair.

9.3.4 Broadcast Address

Broadcast messages are also supported through the use of a network-defined VIDA broadcast IP address and one of the three available DNP3 broadcast addresses. When a DNP3 frame with a broadcast address (65533-65535) is to be transmitted by a DNP3 Master, the DMS will use the configured broadcast address and UDP port for the subscribers.

10 SERIAL TUNNELING

Serial tunneling is a method of routing serial packet data between a client (RTU) and a server(s) located on the fixed IP network. The transport of the serial packets is transparent to the client and the server.

Several methods (modes) of serial tunneling are supported, each with unique routing behaviors. The supported methods include the following:

- Static tunneling (refer to Section 10.2.1).
- Network initiated tunneling (refer to Section 10.2.2).
- Client initiated tunneling (refer to Section 10.2.3).

There are two (2) functions associated with each method of serial tunneling: client to server packet framing and packet routing between a client and a server. In general, a client sends serial data to the SG5300's serial port. The SG5300 encapsulates the serial data within an IP/UDP packet and sends it to a Server on the network, based on the SG5300's configuration. When the SG5300 receives an IP/UDP packet from a server on the network, it strips the IP/UDP header from the packet and sends the resulting serial data to the client via the serial port.

NOTE

The following sub-sections are written from the SG5300 perspective and is based on these terms and the definitions:

Destination:	Refers to the server to which the SG5300 sends packets
Source:	Refers to the SG5300 transceiver
Client:	Refers to the device connected to the SG5300's serial port

10.1 SERIAL TUNNELING COMMANDS

The following commands are used to configure Serial Tunneling.

NOTE

SG5300 OTP Software Release R21A or later is required to support Serial Tunneling. For more information (and software installation procedures), refer to the Software Release Notes Manual 14221-1100-8120: *SG5300 OpenSky Trunked Protocol*.

Additional information about OTP commands may be found in Reference Manual MM-016649-001: *OpenSky Mobile End System AT Commands.*

Table 10-1: Commands Associated to Serial Tunneling

COMMAND	DESCRIPTION
at@mdp_type<x>	Configures the SG5300 for Serial Tunneling operating mode (protocol). 4 Static tunneling 5 Network initiated 6 Client initiated plus Network initiated tunneling Example: at@mdp_type4
at@ping_config<x>	Configures the SG5300 to accept ICMP commands (Ping) from the network. 0 ICMP disabled 1 ICMP enabled

COMMAND	DESCRIPTION
at@stpktsz<bytes>	Used for all Serial Tunneling modes; configures the maximum number of bytes stored by the SG5300's serial tunneling buffer. Range: 1 to 1472 (default is 1472 bytes) Example: at@stpktsz100 When the buffered data reaches its maximum limit, it is encapsulated and sent to the destination server as an IP/UDP packet. Similar to command at@stpkttime; when either of these commands is met, the buffered data is encapsulated by the SG5300 and sent to the destination server as an IP/UDP packet.
at@stpkttime<ms>	Used for all Serial Tunneling modes; configures the maximum time (in milliseconds) which the SG5300 will wait for bytes (characters) from the Client before a packet is formed and sent. Range: 1 to 1000 (ms) (default is 500 ms) Example: at@stpkttime500 Once a byte is received from the Client, the SG5300 counts the elapsed time after the last byte received until this value is met. Similar to command at@stpktsz; when either of these commands is met, the buffered data is encapsulated by the SG5300 and sent to the destination server as an IP/UDP packet.
at@stdestaddr<IP address>	Used for Static Serial Tunneling modes; configures the SG5300's Network IP address. Example: at@stdestaddr148.174.255.255
at@stsrcport<UDP port>	Used during Static Serial Tunneling; configures the UDP port of the SG5300. Range: 0 to 32767 (default is 0) Example: at@stsrcport5100
at@stdestport<UDP port>	Used during Static Serial Tunneling; configures the destination (server's) UDP port to which the SG5300 sends packets. Range: 0 to 32767 Example: at@stsrcport5200
at@stnetport<UDP port>	Used during Network Initiated Tunneling; configures the network filter UDP port. Range: 0 (No filtering) 1 to 65536 Example: at@stnetport5300 When the SG5300 is IDLE and receives a packet from the network, if the destination UDP port in the network IP packet does not match this Network Filter UDP Port, the packet is discarded. Otherwise, the packet is passed to the attached client. The client UDP filter port cannot be the same as the radio service port (AT\P).
at@stclientport<UDP port>	Used during Client Initiated Serial Tunneling; configures the source UDP port in the IP/UDP packet sent from the client to the network. Range: 0 to 65535 Example: at@stsrcport5400

COMMAND	DESCRIPTION
at@stdiscime<seconds>	Used during Client Initiated Serial Tunneling; configures time within which a client can receive a packet from a server when establishing a communication link. Range: 1 to 300 Example: at@stdiscime5
at@staddnet<table entry>,<IP address>,<network port>	Used during Client Initiated Serial Tunneling; configures a route to the Network Address Table. Table Entry Range: 1 to 64 UDP Port Range: 0 to 65535 For example: at@addnet10,111.112.113.114,56789
at@stwaitime<seconds>	Used during Client or Network Initiated Serial Tunneling; used during Network initiated tunneling; configures the wait time within which the client or network can send packets without returning to the IDLE state.
at@stremovenet<table entry>	Used during Client Initiated Serial Tunneling; used to remove a route (table entry) from the Network Address Table. * removes all entries. For example: at@stremovenet1 (removes table entry #1) at@stremovenet* (clears the entire table)
atz	Save and Reboot

10.2 ESTABLISHING SERIAL COMMUNICATIONS

1. Connect your PC's COM to the **SERIAL RS-232** port on the SG5300.
2. Set the **CONFIG** switch on the SG5300 to **SERIAL**.
3. Connect using a terminal program such as Reflections or Tera Term. Use connection settings that match the configuration of SG5300. (Default settings: 19200, N, 8, 1, NONE)
4. Apply power to the SG5300 and do the following:
   a. Observe the startup information displayed on the terminal program.
   b. Verify the software versions reported are at least R21A or later.

   The device is ready to configure when it reports "Connecting to Licensed Channel."
5. Proceed to Section 10.2.1, 10.2.2, or 10.2.3 and configure serial tunneling.

10.2.1 Static Tunneling

Static tunneling supports packet routing between a client and one (1) server. In this mode, a packet session may be initiated at any time by the client or the server.

Send the following commands to configure an SG5300 for Static Tunneling:

at@stpktsz<bytes> Where <bytes> is a value from 1 to 1472 representing the maximum Serial Tunneling IP/UDP packet size in bytes.

at@stpkttime<ms>	Where <ms> is a value from 1 to 1000 representing the Serial Tunneling Character Wait Time in milliseconds.
at@ping_config1	Configures the SG5300 to accept ping requests.
at@mdp_type4	Configures the unit for Serial Tunneling Static protocol.
at@stdestaddr<IP address>	Where <Ip Address> is the destination (server's) IP address.
at@stsrcport<UDP port>	Configures the SG5300's UDP port.
at@stdestport<UDP port>	Configures the destination (server's) UDP port in the client packet.
atz	Save and Reboot.

10.2.2 Network Initiated Serial Tunneling

In this mode, a Client cannot send a serial tunneling packet to the network until an IP/UDP packet has been received from a Server. The destination UDP port of the Server IP/UDP packet matches the Radio Network Filter Port configured in the radio (at@stnetport). Server-originated packets with a destination UDP port other than the configured filter port are discarded.

When the radio receives a valid IP/UDP packet from a Server, it initiates a communications session between the Server and the Client. The radio starts a configured wait timer (at@stwaittime).

During the communications session, the Client and the Server may send messages to each other. All packets received from the network from an IP address other than the Server involved in the communications session are discarded. The Radio Network Filter UDP Port is used as the source UDP port for all messages from the Client to the Server. Whenever the radio receives a message from the Client or the Server, a configured wait timer is set/reset. Once the wait time has expired, the communications session has ended and the radio returns to an idle state.

Send the following commands to configure an SG5300 for Network Initiated Serial Tunneling:

at@stpktsz<bytes>	Where <bytes> is a value from 1 to 1472 representing the maximum Serial Tunneling IP/UDP packet size in bytes.
at@stpkttime<ms>	Where <ms> is a value from 1 to 1000 representing the Serial Tunneling Character Wait Time in milliseconds.
at@ping_config1	Configures the SG5300 to accept ping requests.
at@mdp_type5	Configures the unit for Network Initiated Serial Tunneling.
at@stnetport<UDP port>	Where <UDP Port> is the destination port in the network packet.
atz	Save and Reboot.

10.2.3 Client Initiated Serial Tunneling

In this mode, The Client or server may initiate a communications session. For Server initiated sessions, the behavior is similar to that described in Section 10.2.2 for Network Initiated Serial Tunneling. For Client initiated sessions, the Client sends data to the SG5300 where it is encapsulated into an IP/UDP packet using the destination IP address and destination UDP port for the first entry in the pre-stored table. The SG5300 sends the packet, starts the discovery timer (at@stdisctime), and enters the discover state. While the SG5300 is in the discover state, any additional serial tunneling data from the Client to the SG5300 will be discarded.

When the SG5300 receives a reply IP/UDP packet from a Server, it checks to determine if it is a valid response to the query. If the network IP/UDP packet is not a valid response, the packet will be discarded.

If the SG5300 does not receive a valid response from the current Server within the discover time, the SG5300 resends the serial tunneling packet to the next IP address/UDP port entry in the Network Address Table and resets the discover timer. This continues until the SG5300 receives a network IP/UDP packet from the currently queried Server or the Network Address Table is exhausted. If the Network Address Table is exhausted, the SG5300 reverts back to an IDLE state.

If the SG5300 receives a valid packet from the Server it is currently querying, the SG5300 establishes a communications session between the Server and the Client. Once a communication session has been established, the SG5300 maintains the session as described in Section 10.2.2, with the following exceptions:

- Packets from the network must have a destination UDP port equal to the configured SG5300 Source UDP Port (at@stclientport) rather than the SG5300 Network Filter UDP Port (at@stnetport), and;
- The destination UDP port of client-originated packets will be set to the source UDP port from the last received network packet.

Client-originated packets will continue to use the configured SG5300 Source UDP Port as the source UDP port.

Send the following commands to configure an SG5300 for Network Initiated Serial Tunneling:

at@stpktsz<bytes>	Where <bytes> is a value from 1 to 1472 representing the maximum Serial Tunneling IP/UDP packet size in bytes.
at@stpkttime<ms>	Where <ms> is a value from 1 to 1000 representing the Serial Tunneling Character Wait Time in milliseconds.
at@ping_config1	Configures the SG5300 to accept ping requests.
at@mdp_type6	Configures the unit for Client plus Network Initiated Serial Tunneling.
at@stclientport<UDP port>	Configures the source UDP port in the IP/UDP packet sent from the client to the network.
at@stdiscime<seconds>	Configures time within which a client can receive a packet from a server when establishing a communication link.
at@stwaitime<seconds>	Configures the wait time within which the client or network can send packet without returning to the IDLE state.
at@staddnet<table entry>,<IP address>,<network port>	Adds a server entry to the Network Address Table, where <table entry> is an index identifier, followed by the IP address, and UDP port for the server.

Repeat the ***at@staddnet*** command for each additional server to list in the Network Address Table. Us the ***at@stremovenet<table entry>*** to remove an entry from the Network Address Table.

atz	Save and Reboot.

11 TROUBLESHOOTING AND SERVICING

WARNING: EXPLOSION HAZARD.
DO NOT DISCONNECT WHILE THE CIRCUIT IS LIVE OR UNLESS THE AREA IS KNOWN TO BE FREE OF IGNITIBLE CONCENTRATIONS

There are no user serviceable components within the SG5300 assembly. This assembly contains ESD sensitive components and should only be serviced by Harris qualified personnel.

11.1 TROUBLESHOOTING

If a unit is suspected to be faulty or need service and repair, perform the following checks:

- Visually inspect the installation for obvious defects such as worn, weathered, or frayed cabling.
- Verify that the unit is receiving sufficient voltage and current to the power input connector.
- Replace any defective antenna or power source components as required, and return any inoperable SG5300s to Harris for repairs.

11.2 SERVICING

The SG5300 is not a field repairable unit. If a unit is suspected to need servicing or re-alignment, then the unit should be removed from service and returned to Harris for repairs. Periodic checks of frequency and modulation bandwidth should be performed during routine preventative maintenance checks.

Troubleshooting the SG5300 is not difficult, but it requires a logical approach.

It is good practice to start by checking the simple things. For proper operation, the SG5300 must meet the following basic requirements:

- Proper and stable primary power. Remove power to reset the unit.
- Ensure all connections (RF, data, and power) are secure and torque to specification, where indicated (refer to Section 6.6.5).
- Ensure the antenna system (antenna and lightning protection) are properly connected, torqued to specification (refer to Section 6.6.3), and in working order.
- Ensure the SG5300 is properly configured.
- Ensure you are using the correct interface between the SG5300 and the connected data equipment (correct cable wiring, proper data format, timing, etc.).
- The LED status indicators are an important troubleshooting tool and should be checked whenever a problem is suspected. Table 4-1 describes the function of each status LED.

There are no field repairable components in the SG5300 RF Radio unit. If you suspect the SG5300 is defective, replace it with a known good unit and return the defective assembly to Harris for repair.

If troubleshooting assistance is required, contact a qualified service technician or Harris Technical Assistance Center (see Section 12).

12 CUSTOMER SERVICE

12.1 TECHNICAL ASSISTANCE

The Technical Assistance Center's (TAC) resources are available to help with overall system operation, maintenance, upgrades, and product support. TAC is the point of contact when answers are needed to technical questions.

Product specialists, with detailed knowledge of product operation, maintenance, and repair provide technical support via a toll-free (in North America) telephone number. Support is also available through mail, fax, and e-mail.

For more information about technical assistance services, contact your sales representative, or contact the Technical Assistance Center directly at:

North America:	1-800-528-7711
International:	1-434-385-2400
Fax:	1-434-455-6712
E-mail:	PSPC_tac@harris.com

12.2 CUSTOMER CARE

If any part of the system equipment is damaged on arrival, contact the shipper to conduct an inspection and prepare a damage report. Save the shipping container and all packing materials until the inspection and the damage report are completed. In addition, contact the Customer Care center to make arrangements for replacement equipment. Do not return any part of the shipment until you receive detailed instructions from a Harris representative.

Contact the Customer Care center at http://www.pspc.harris.com/CustomerService or:

North America:

Phone Number:	1-800-368-3277
Fax Number:	1-321-409-4393
E-mail:	PSPC_CustomerFocus@harris.com

International:

Phone Number:	1-434-455-6403
Fax Number:	1-321-409-4394
E-mail:	PSPC_InternationalCustomerFocus@harris.com

13 SPECIFICATIONS

13.1 GENERAL SPECIFICATIONS

Model Number:

SG5300-800 (RU-019026-800)
SG5300-900 (RU-019026-900)

Physical Characteristics:

Electrical Power:	+9 to +57 Vdc
Power Consumption:	9.6 Watt Transmit 2.5 Watt Receive <3 Watt Average Power at 95/5
Size (H x W x D):	1.5 × 3.9 × 7.8 in (3.9 × 10.0 × 19.8 cm)
Weight:	1.6 lbs (0.7 kg) (less mounting hardware)

Environmental Specifications:

Operating Temperature:	-22 to +140°F (-30 to +60°C)
Relative Humidity:	95% @ 122°F (+50°C)
Altitude:	15000 ft (4572 m)
Color (case)	Black & Metallic
Non-incendive Rating (Optional):	Class I, Division 2 groups A, B, C, and D (available on the SG5300-900, Revision A, 900 MHz units)

System Interfaces (Ethernet or Serial):

Ethernet - The SG5300 Ethernet interface is used for connecting to an RTU.

- Connector Type: RJ45
- Electrical Protocol: 10/100 BaseT
- Data Format: Ethernet IEEE 802.3

Serial - The SG5300 serial interface is used for data (SLIP/PPP) as well as for maintenance support. The serial interface is configurable to operate as a full duplex DCE EIA/TIA-232 port.

- Connector Type: 9-pin D Receptacle
- Electrical Protocol: EIA/TIA-232 Full Duplex
- Data Format: 8 bits/character, 1 start bit, 1 stop bit

13.2 TRANSMITTER SPECIFICATIONS

TYPICAL PERFORMANCE SPECIFICATIONS	800 MHZ	900 MHZ
Frequency Range (MHz):	806-809 / 809-824	896-901 / 935-940
Rated RF Power Trunked (W):	0.5-3	0.5-3
Frequency Stability (-30 to +60°C; +25°C Ref) (ppm):	±1.5 / ±2.5	±1.5
Modulation Deviation (kHz):	±3.75 / ±4.0	±1.8

13.3 RECEIVER SPECIFICATIONS

TYPICAL PERFORMANCE SPECIFICATIONS	800 MHZ	900 MHZ
Frequency Range (MHz):	851-870	935-940
Frequency Separation (MHz):	Full bandwidth	Full bandwidth
Channel Spacing (kHz):	25/NPSPAC	12.5
Frequency Stability (-30 to +60°C; +25 Ref) (ppm):	±1.5	±1.5

13.4 DIGITAL OPERATION

Data Rate (kbps):	19.2 for 800 MHz, 9.6 for 900 MHz
Modulation:	4-Level GFSK; M4FM

14 WARRANTY REGISTRATION

Please register this product within 10 days of purchase. Registration validates the warranty coverage, and enables Harris to contact you in case of any safety notifications issued for this product.

Registration can be made on-line at the Customer Care center webpage:

http://www.pspc.harris.com/Service/Customerservice.aspx.

While on the webpage, please review the applicable battery and/or product warranty literature.

Public Safety and Professional Communications | www.pspc.harris.com
221 Jefferson Ridge Parkway | Lynchburg, VA USA 24501 | 1-800-528-7711