



G R O U N D P R O D U C T S

SAIC Ground Control System

USER MANUAL



Troll Systems Corporation

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PREFACE

This *User Manual* is intended for use with the ground-based receive site system designed and fabricated by Troll Systems Corporation. The sections and appendices that make up this manual are intended as a guide for installation and usage of this system.



NOTE: It is Troll Systems commitment to continually improve upon its products for greater functionality and ease of use. The images and references contained within this manual along with the accompanying specifications, drawings and supporting data received by the customer may differ from what is included herein.

This manual is based on the latest information available at the time of publication.

PACKAGING

Unpack the system components and all associated equipment with care. Verify that all equipment is included and free of any damage that may have occurred during shipping.

If you must return your product to Troll Systems Corporation for repair (and you no longer have your original box and packing materials), Troll will send you a packing box specifically designed to ship the product without damage.

If possible, notify the shipping carrier at the time of receipt that you are accepting any box (or boxes) as “damaged.” Most shipping carriers have time requirements for reporting damaged items.

Retain all boxes and packing materials should the need arise to return the controller to the factory for upgrades, repair, or configuration changes.

Re-use the original packaging material used for your system, if available and in good condition.

CONVENTIONS USED IN THIS DOCUMENT

Refer to the referential data in the final section of this manual for complete information in regard to the conventions and nomenclature used in this document.

SAFETY SUMMARY

General Safety Precautions

The following general safety precautions are not related to any specific procedures and therefore do not appear elsewhere in this publication. They are, however, precautions that personnel need to understand and apply when operating or repairing equipment. Installation, operation, and maintenance should be performed only by qualified personnel.

Hazard Advisory Placards/Signs

Read and heed all hazard advisory placards or signs affixed to the equipment or surrounding enclosures. They warn of potential hazards to personal safety and possible damage to equipment if correct maintenance practices are not followed. Ignoring hazard advisory placards (WARNINGS/CAUTIONS) places personnel at risk for serious injury or death.

Know and Comply with Local, State, and Federal Safety Requirements

You should be familiar with all local, state, and federal safety requirements applicable to the equipment, processes, and materials you use during maintenance. Before using any substances or materials marked toxic or hazardous, always refer to the Material Safety Data Sheets (MSDS) for that substance/material for any special protective equipment, handling, and/or disposal requirements.

Do Not Service or Adjust Alone

Do not start a maintenance or adjustment procedure if that procedure requires more than one technician to be safely performed. It is particularly important that such work not be performed in a remote area, away from other qualified personnel who may be needed to render assistance. When a maintenance task requires two or more personnel to be safely accomplished, delay the task until qualified personnel are available to assist you.

Electrical Power/Shock Hazards



WARNING: Potentially lethal voltage/current is present throughout many electrical installations. Maintenance personnel shall employ positive power lockout devices and post all required warning tags/signs when applicable to ensure that no unauthorized application of power can occur during maintenance. Failure to heed this warning could result in serious injury or death by electrocution.

Always verify that electrical power is disconnected and that applicable safety procedures have been followed before doing maintenance on any electrical/electronic equipment. High voltage electrical energy is stored in some electrical equipment (electrolytic capacitors, UPS batteries, etc.) even after the source of primary external power has been disconnected. Always remove external power, deactivate equipment, or discharge the potential to ground (when applicable) before working on the equipment.

If a high-potential insulation test is required, follow the procedures and precautions outlined in the appropriate National Electrical Manufacturing Association (NEMA) standards. Check with the area supervisor if unfamiliar with these standards, specific equipment, or procedures.

When electrical troubleshooting of a system must be accomplished with power applied, first verify that all personnel in the hazard area are advised, that the equipment is tagged, and/or that an assistant is posted at the point of power control.

Be Familiar With Resuscitation Techniques

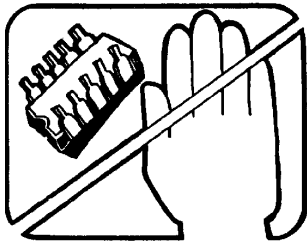
Personnel working with or near high voltages should be familiar with modern methods of resuscitation. It is beneficial to ensure that personnel are capable of performing Cardio-pulmonary resuscitation (CPR) should the need arise.

Electrostatic Discharge Sensitive (ESDS) Components

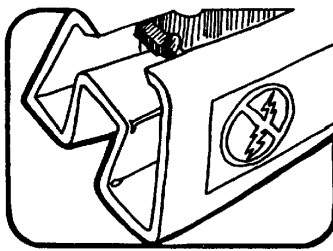


CAUTION: Beware of electrostatic buildup. Delicate solid-state Integrated Circuits (ICs) can be damaged by improper handling procedures. Use proper electrostatic safeguards when installing/removing circuit cards and handling ESD sensitive assemblies. As required, wear a grounded wrist strap, use antistatic floor and table mats, and minimize the handling of sensitive solid-state devices. Keep all ESD sensitive components in their original containers until ready for use. Always discharge personal static before handling ESD sensitive components and do not slide solid state devices over any surface. Handle plug-in card assemblies only by their non-conductive edges.

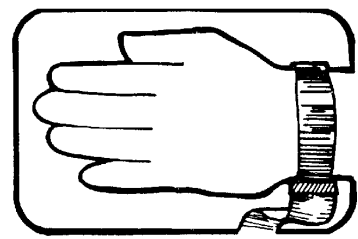
Computers, microprocessors, and other solid state components (circuit cards, I/O boards, etc.) which are not clearly marked with the ESDS symbol will be handled as ESD sensitive components until determined otherwise. Retain protective ESDS packing and shipping bags, containers, non-conductive foam pads, etc. for use in the return of repairable components.



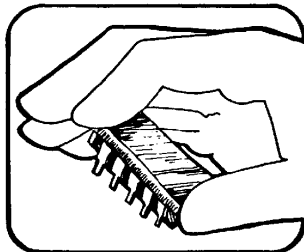
Minimize Handling



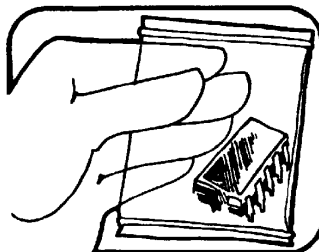
Keep parts in original containers until ready for use.



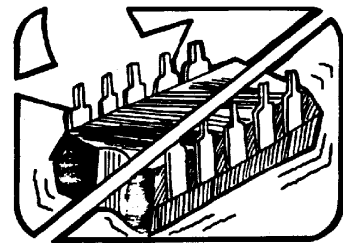
Discharge personal static before handling devices.



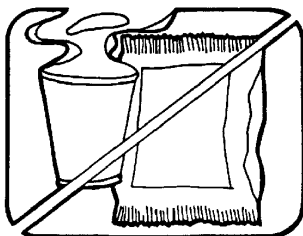
Handle each device by the devices' body, not the contacts



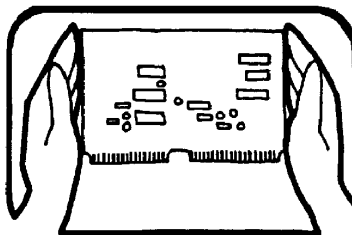
Use anti-static containers for handling and transport



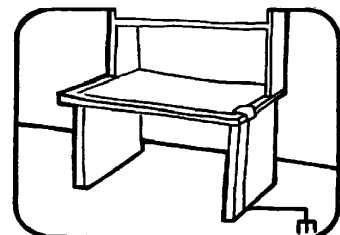
Do not slide devices over any surface



Avoid plastic, vinyl and styrofoam in work area



When removing plug-in assemblies, handle only by non-conductive edges and never touch open edge connector except at static-free work station. Placing shorting strips on edge connector usually provides complete protection to installed devices.



Handle devices only at a static-free work station.

Only anti-static type solder suckers should be used.

Only grounded tip soldering irons should be used.

CONTACT INFORMATION

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SAIC Ground RF Link System

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SECTION 1

SYSTEM OVERVIEW

1.1 INTRODUCTION

The Troll Systems A200 receive site system is comprised of the Troll Systems A200 Antenna, the Digital and Video IP Encapsulator (DAVIE), PC-based control software and the Troll Systems S750 site slave controller. These components provide precise microwave reception along with state-of-the-art control capability. The A200 antenna can be installed and adjusted to accommodate the user's reception requirements using the PC-based software as well as the S750 controller to adjust the antenna functions to perform to the users specific requirements.

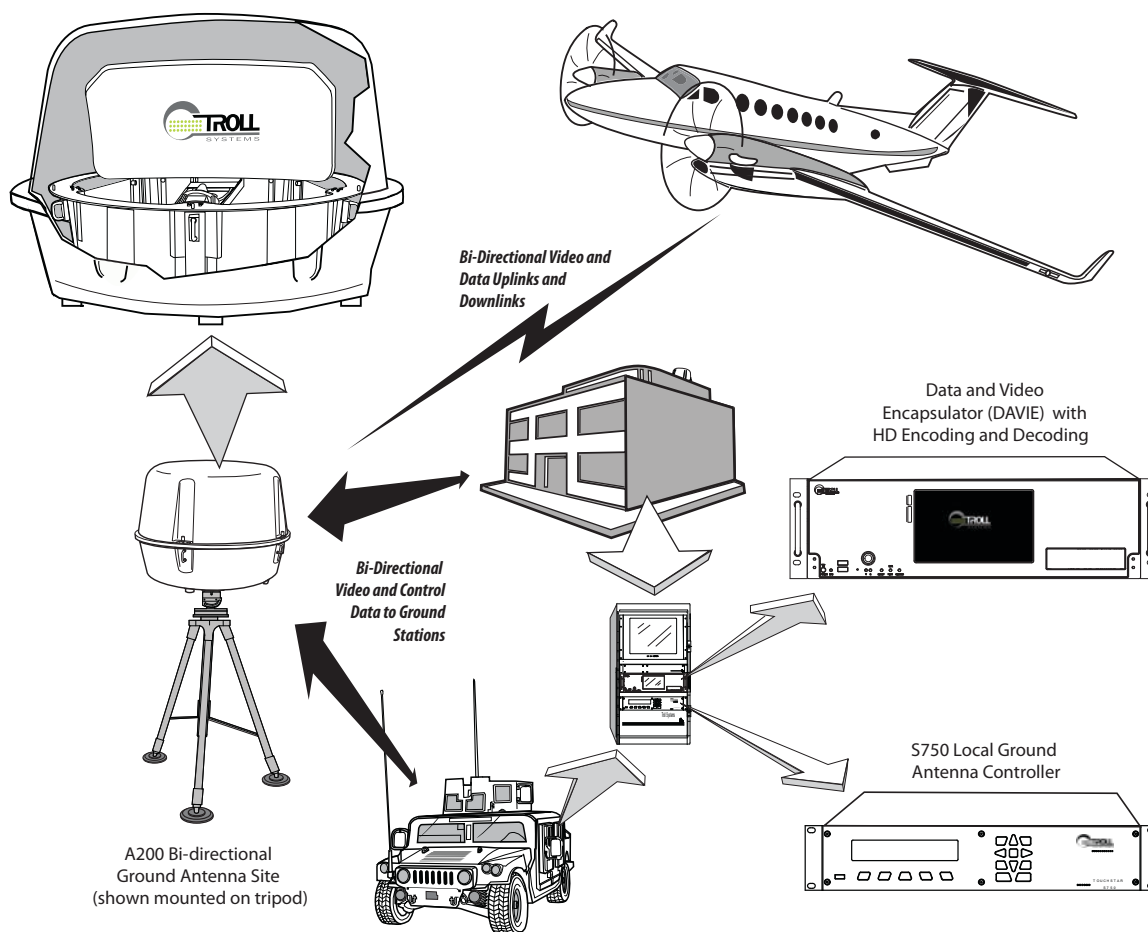


Figure 1–1. Troll Systems Receive Site A200 Antenna and S750 Controller

The ground system automatically tracks the aircraft (no user input required) from a, tower-mounted, fully enclosed antenna with built-in transceiver (no external RF components of cables). Along with the DAVIE unit, the system encrypts and decrypts of data prior to transmitting and receiving (AES256). Incoming and outgoing video and data are processed and routed to proper destinations based on predetermined priority. The received HD H.264 video is decoded and displayed. The video is available in multiple resolutions including HD (HD-SDI and HDMI) and SD (composite outputs).

1.2 SYSTEM QUICK START

Push in the ON / OFF switches on each component (usually located on the bottom left corner of the component's front panel). Upon system start-up, the DAVIE and the C100 controller will boot-up to the default screen, however, the system may be in standby operational mode. This allows the user to configure the system to the required settings prior to mission start. Refer to the following paragraphs for DAVIE and C100 overview.

1.2.1 S750 Controller Orientation and Set-up

Refer to the following for pertinent information regarding the set-up and use of the Troll Systems A200 antenna system.



NOTE: The information herein regarding the control and software screens for the system are intended as general reference towards the operation and use of the A200 antenna system. The graphical representation of this information may appear different than the final product configuration provided for the system.

1.2.1.1 Front Panel

The S750's front panel ([Figure 1-2](#)) includes five (5) key elements that are identified in the figure and discussed in the following subparagraphs. These items are summarized below.

- **Alphanumeric Display (4-Line/40-Character)**
- **Function Keys**
- **Keypad**
- **Status Indicators**
- **USB Port**

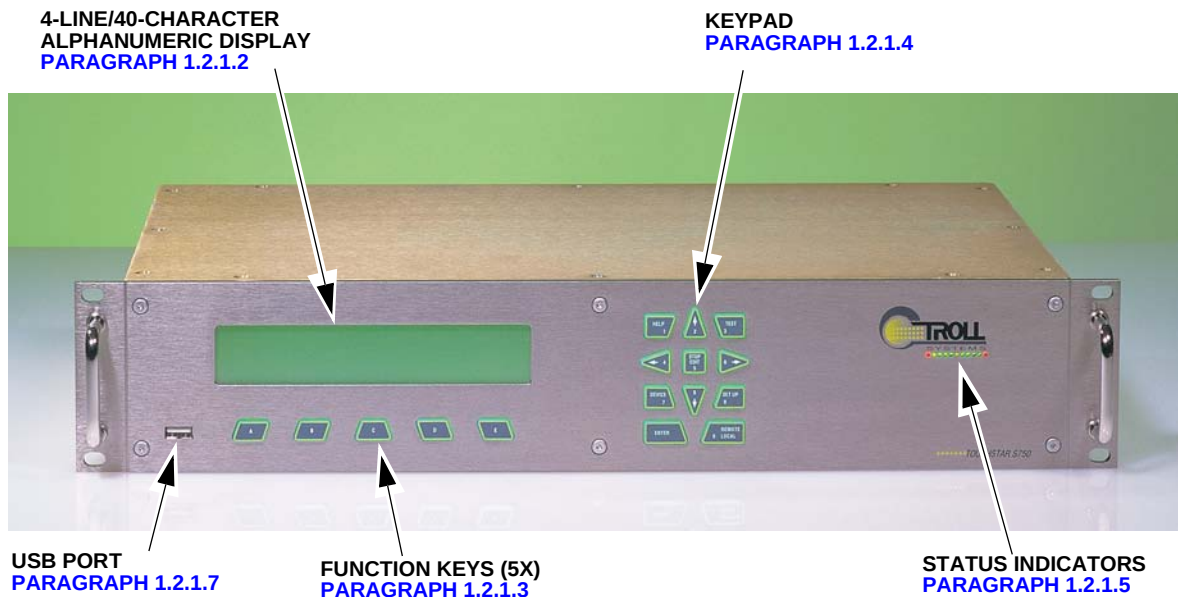


Figure 1-2. S750 Remote Site Controller – Front Panel Elements

1.2.1.2 Alphanumeric Display

The alphanumeric display (Figure 1-3) provides a 4x40 character (160 total characters) area that can be used (viewed) by an operator to locally monitor and control the S750 Remote Site Controller.

TOP LINE (LEFT) ALWAYS INCLUDES THE S750'S IDENTITY, i.e., *CUSTOMER / DEVICE / CONFIGURATION*

TOP LINE (RIGHT) USUALLY INDICATES THE S750'S CURRENT OPERATING MODE, i.e., *REMOTE (REM) OR LOCAL (LCL)*

```
Troll/S750_SAIC_A200#0000/FACT*    LCL
Troll Systems Corporation (C) 2010
COMM: CONNECTED
[ANT]  uWAVE  AUX
```

BOTTOM LINE ALWAYS INDICATES THE CURRENT SELECTIONS ASSOCIATED WITH THE FUNCTION KEYS

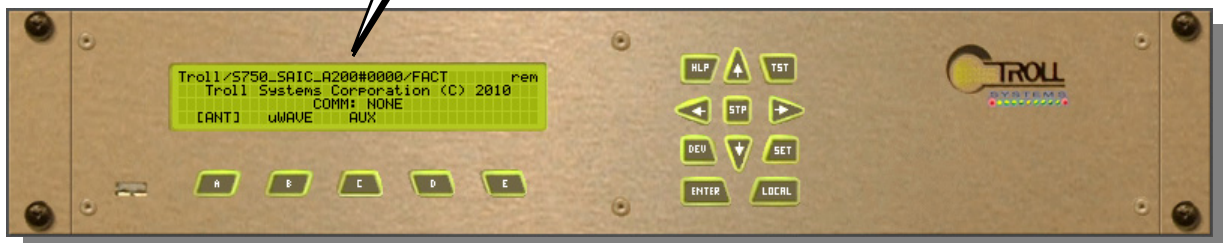


Figure 1-3. Alphanumeric Display – Main (Device) Screen

1.2.1.3 Function Keys

The front panel includes five (5) function keys (Figure 1–4) that act as *softkeys*. That is, the function of each of the buttons (A, B, C, D, and E) changes with respect to *function name* displayed directly above the given *function key* on the panel display.

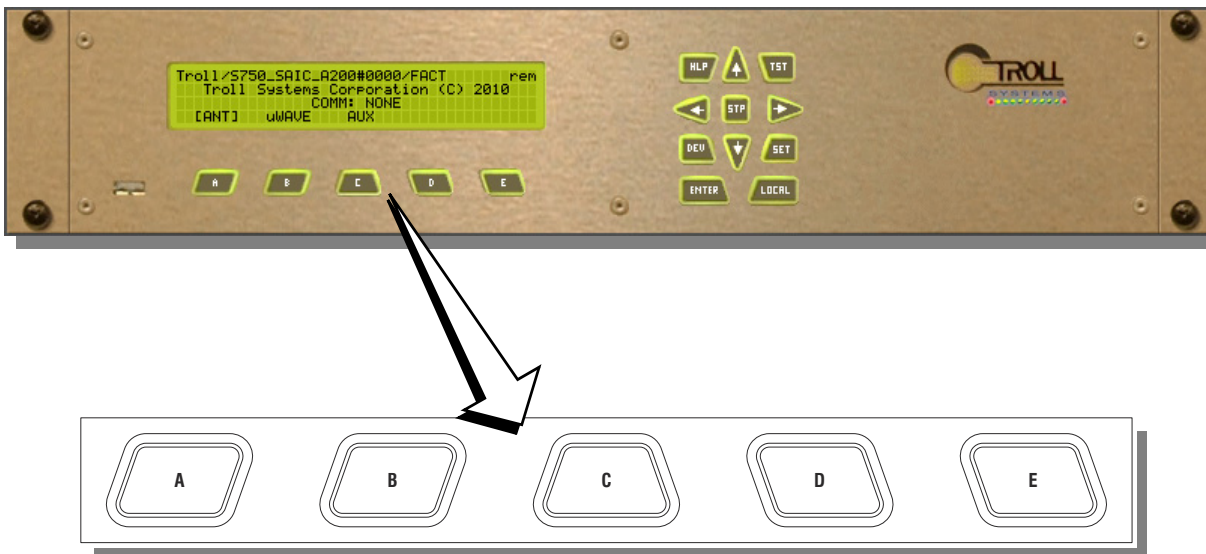


Figure 1–4. Front Panel Function Key

For example, in Figure 1–5, if function key “C” is pressed, the “C” key activates the “Presets” function, as shown directly above it.

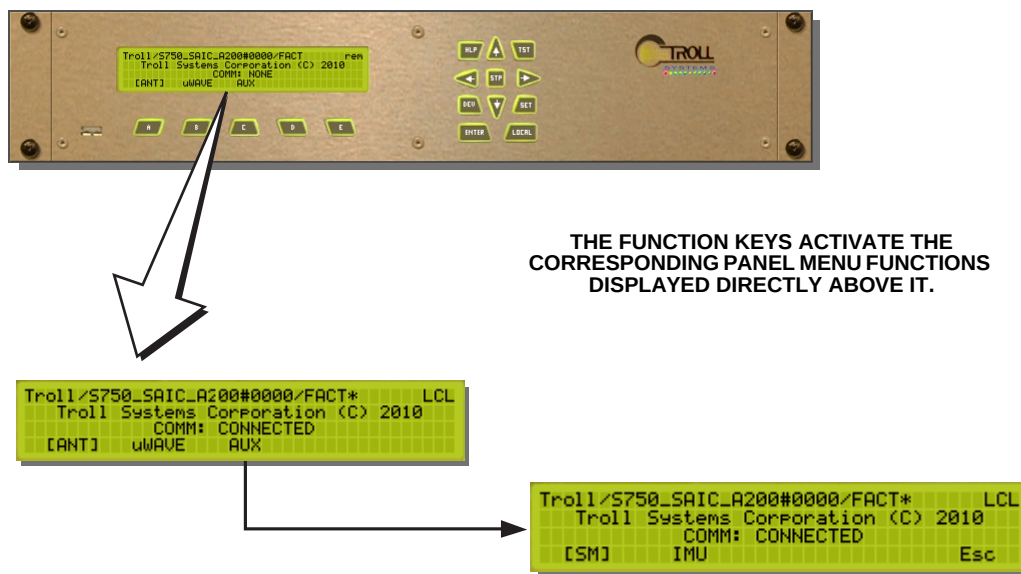


Figure 1–5. Function Key Usage

1.2.1.4 Using the Keypad

The keypad (Figure 1–6) provides dedicated function keys, a mode key, an ENTER key, and arrow keys. The dedicated function keys are HELP (1), TEST (3), STOP/EDIT (5), DEVICE (7), and SET UP (9). The mode key, REMOTE/LOCAL (0) allows the user to toggle the S750 between local (LCL) and remote (REM) operating modes. The ENTER key executes selections and operations that are shown with brackets in the display. The arrow keys provide a number of functions including: panning and tilting antennas and cameras, moving among function key selections, scrolling through configuration lists, etc. The left and right arrow keys also cycle through the selected function on the menu selections as shown with brackets on both sides of the menu selection. The ENTER key can then be used to activate that function.

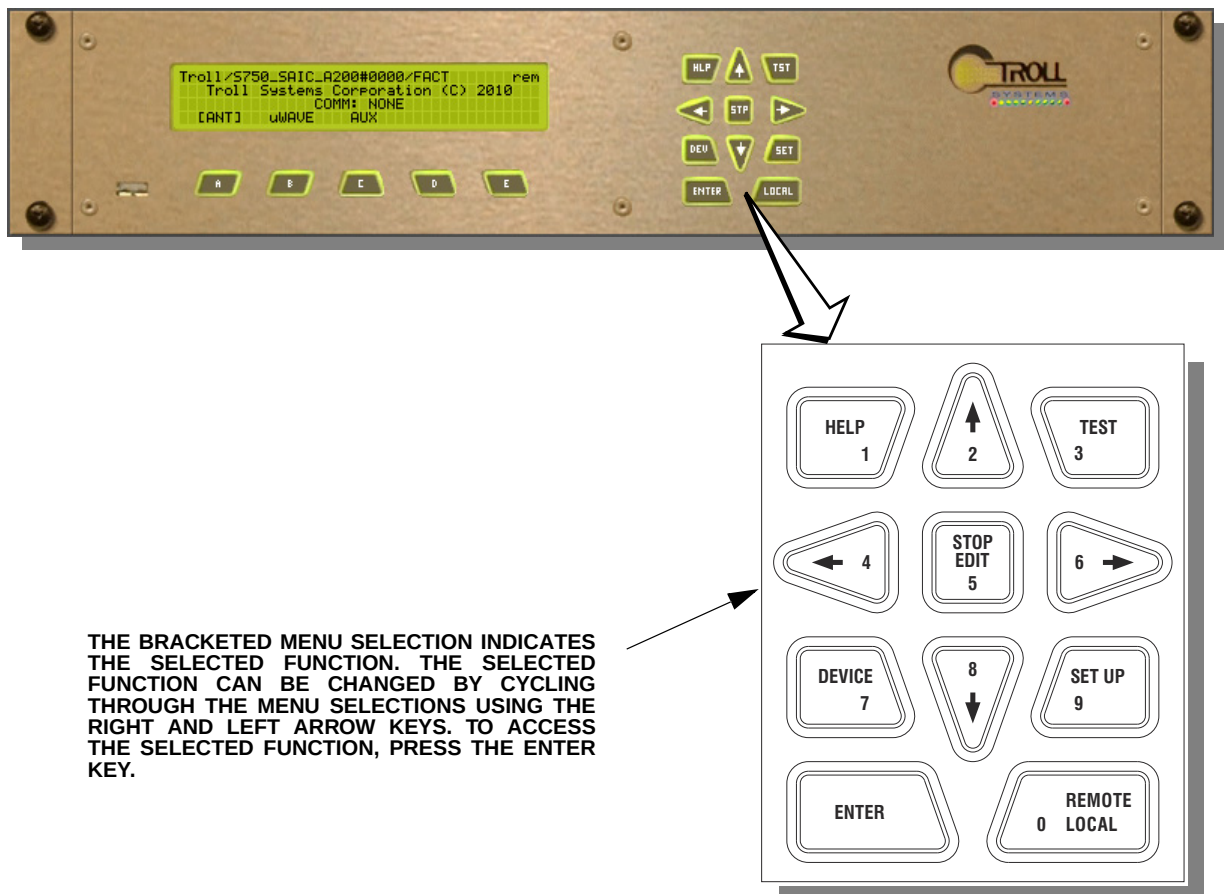


Figure 1–6. Front Panel Keypad



NOTE: Refer to Figure 1-6 of the S750 User manual for an illustrated view of the keypad and its related functions.

1.2.1.5 Status Indicators

A status indicator block (Figure 1–7) is provided on the front panel of the S750 to inform the user of the S750's current operating state. The indicator block is an LED array consisting of eleven (11) LEDs.

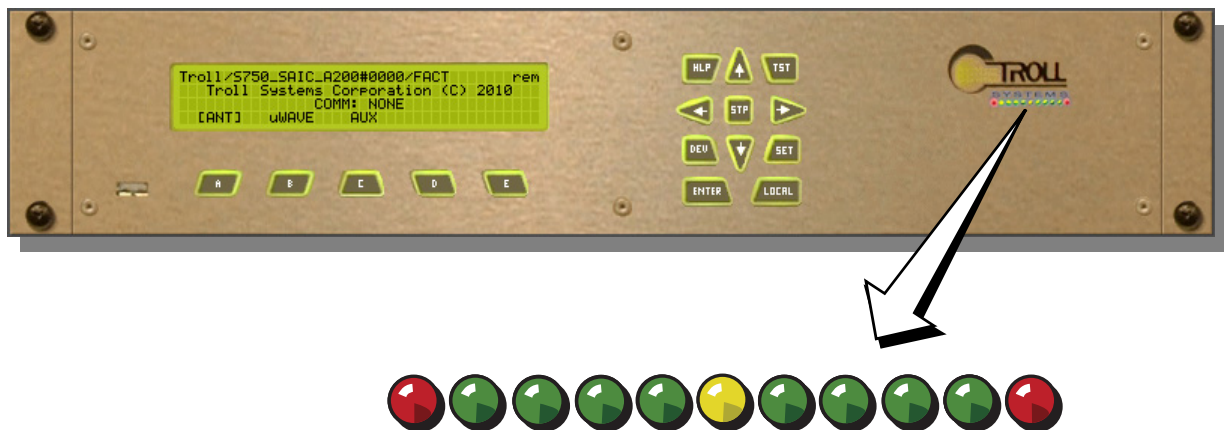


Figure 1–7. LED Status Indicators

1.2.1.6 Status Indicator Comms

The status indicator block operates in any one of three (3) states. These states include *program loading*, *program loaded/controller ready*, and *communicating with master*.

The status indicator block is used to alert the user of the S750's current operating state. The three states are detailed below.

- **Program Loading**

- The center (yellow) LED and the two (red) LEDs installed on the far right and left ends of the array flash alternatively while the S750's software loads. First the yellow LED flashes, then the two red flash in unison (Figure 1–8).

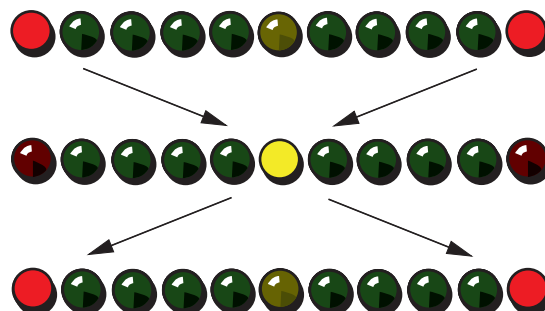


Figure 1–8. “Program Loading” Animation for LED Indicators

- **Program Loaded/Controller Ready**
 - The LEDs race from left-to-right and then right-to-left. Only one (1) LED is illuminated at a time. This state will continue until communication with the master controller is established (see [Figure 1–9](#)).

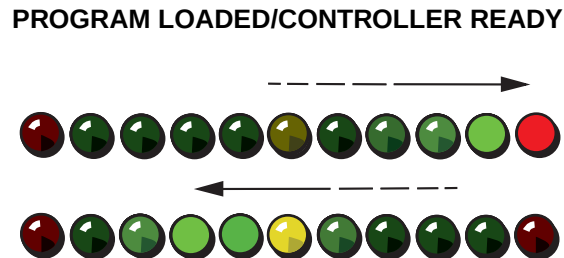


Figure 1–9. “Controller Ready” Animation for LED Indicators (after program is loaded)

- **Communicating with Master Controller**
 - LED array “accordions” from the center out to the left most and right-most LEDs. This operating state begins with center-most (yellow) LED illuminated ONLY and then illuminates the adjacent (green) LEDs (on either side) until all eleven LEDs including the (red) LEDs installed on the far right and left ends of the array are lit. This pattern continues as long as the S750 is communicating with a master controller (see [Figure 1–10](#)).

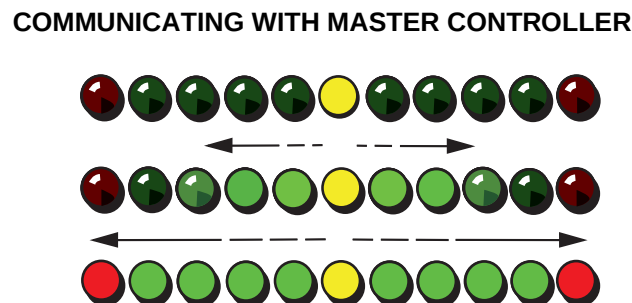


Figure 1–10. LED Indicators Master Controller Communications Animation

Each of these three (3) operating states aids the user to quickly determine the state of the S750 Remote Site Controller.

1.2.1.7 \USB Port

The USB port on the front panel is provided for the connection of an external USB flash drive. An external USB flash drive can be used to update the S750’s software without the need to physically change the internal Compact Flash (CF) card.

1.2.1.8 S750 Controller Screen Interface

Use the function keys as well as the keypad keys to navigate the control interface for the S750 controller. Refer to [Figure 1-11](#) for an example of selecting a menu item.

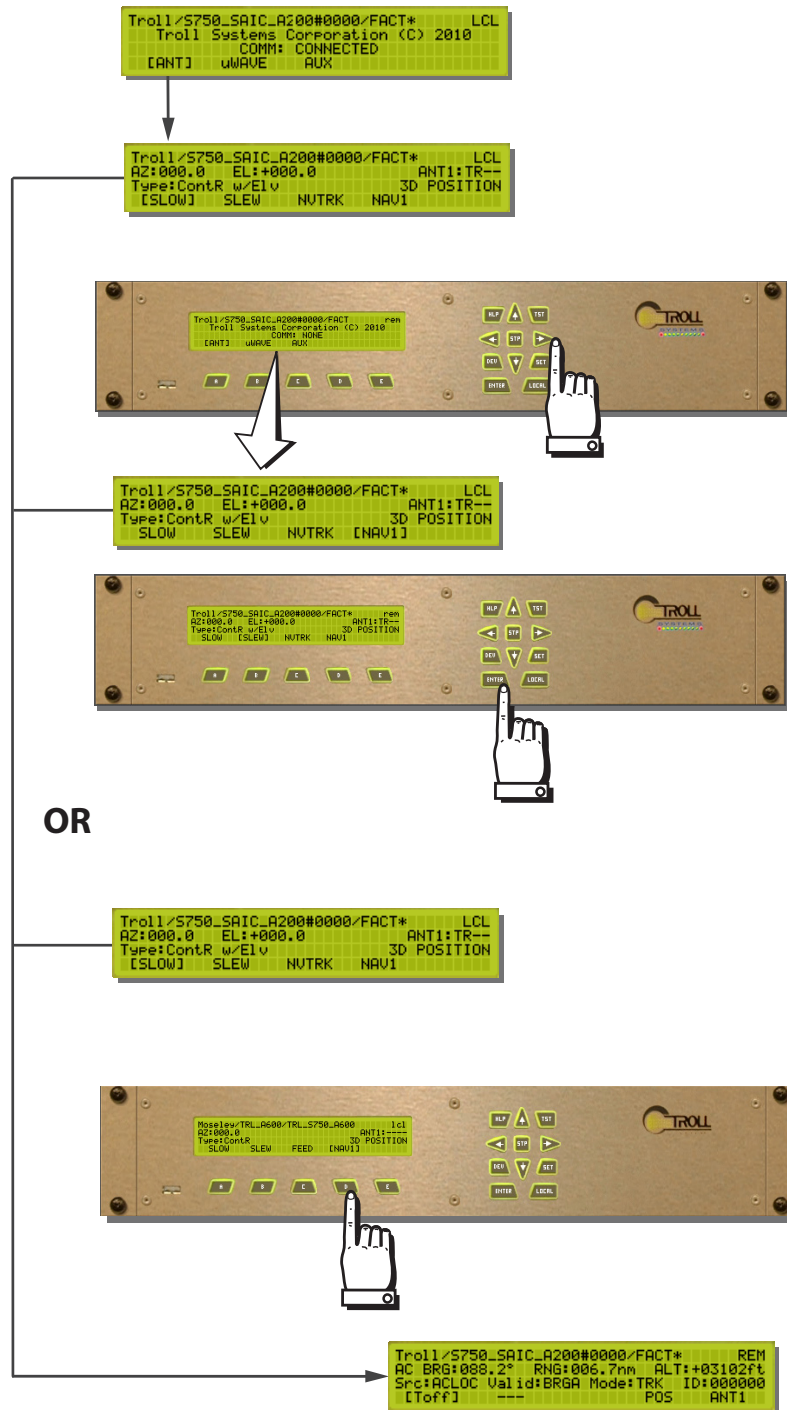


Figure 1-11. S750 Controller Control Navigation Interface

1.2.2 DAVIE: Data And Video IP Encapsulator

The onboard digital video and IP encapsulation unit utilizes a touchscreen with a graphical user interface (GUI) for all of the system controls and settings. The custom software created for this system utilizes and symbiotic operating protocol facilitated by the custom hardware utilizing high-performing subsystem components.

The software is designed to provide intuitive controls with easy access for efficient system operation and optimal performance of both the ground and airborne systems. The functions of the system are seamless and nearly instantaneous even when the RF and comms are encoded and decoded over long range transmission and reception.

Therefore the two DAVIE system components (airborne and ground) have nearly identical operational software interface. This section of the airborne manual details the GUI screens for the airborne DAVIE unit.



Figure 1–12. DAVIE (Data and Video IP Encapsulator)



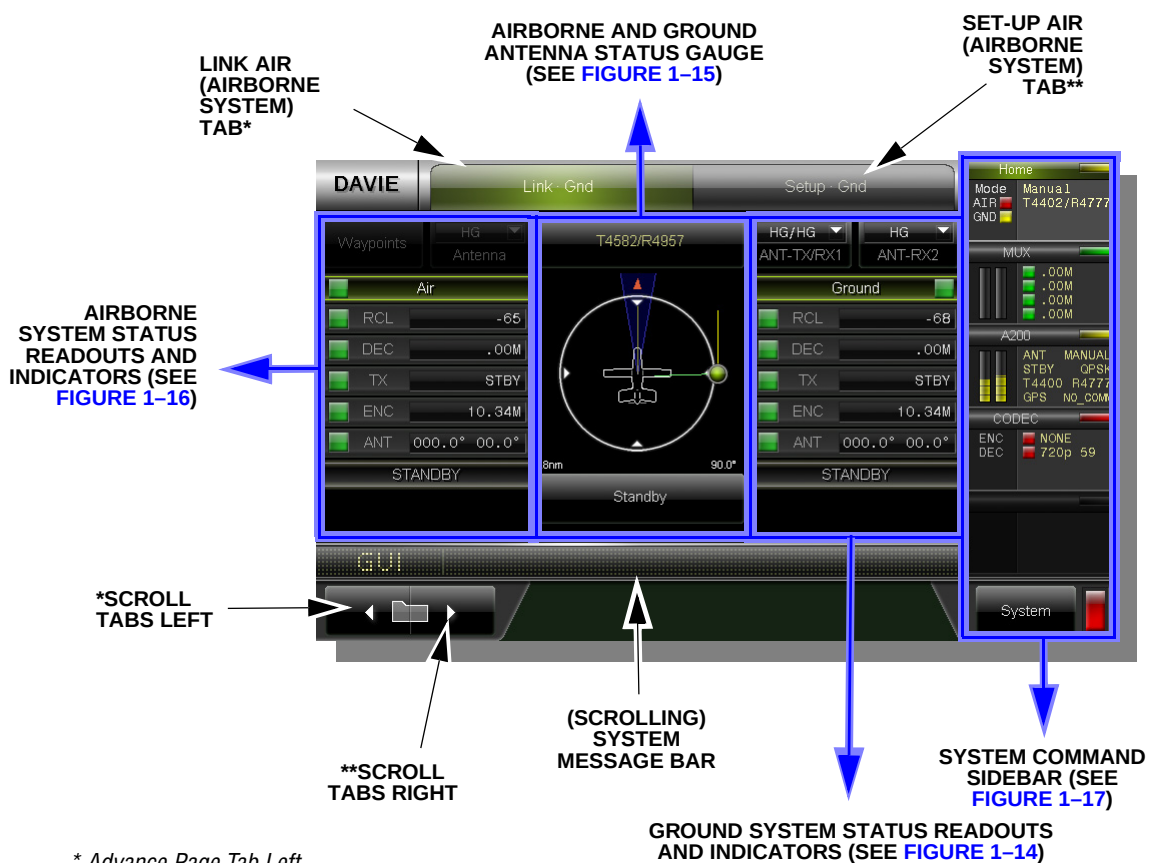
NOTE: The images herein may differ from those in the actual system. These images of the system GUI (and otherwise) are intended for reference only.

1.2.3 DAVIE: Data And Video GUI Software

The touchscreen GUI software of the ground systems command functions including system status, faults, settings and operation. The system's GUI default screen shows the status of the RF and comms link providing direct access to the other system settings and functions. [Figure 1-13](#) reveals the software visual orientation and basic interface navigation.

1.2.4 DAVIE Home (Default) Screen Detail

The DAVIE Home (or default) screen provides the status of all of the airborne system and ground system operational status. Additionally, several system operational settings are accessible from the default screen including waypoints, IMU, antenna configuration, RF comms link, decoder, encoder, transmitter, receiver and ethernet comms status.



* Advance Page Tab Left

** Advance Page Tab Right

Figure 1-13. DAVIE GUI Home (Default) Screen Orientation

1.2.4.1 Air Link - Ground System Status

The GUI Air-Link screen includes the ground system's comms indicators and read-out gauges providing at-a-glance status for the system's operation (see [Figure 1-14](#))

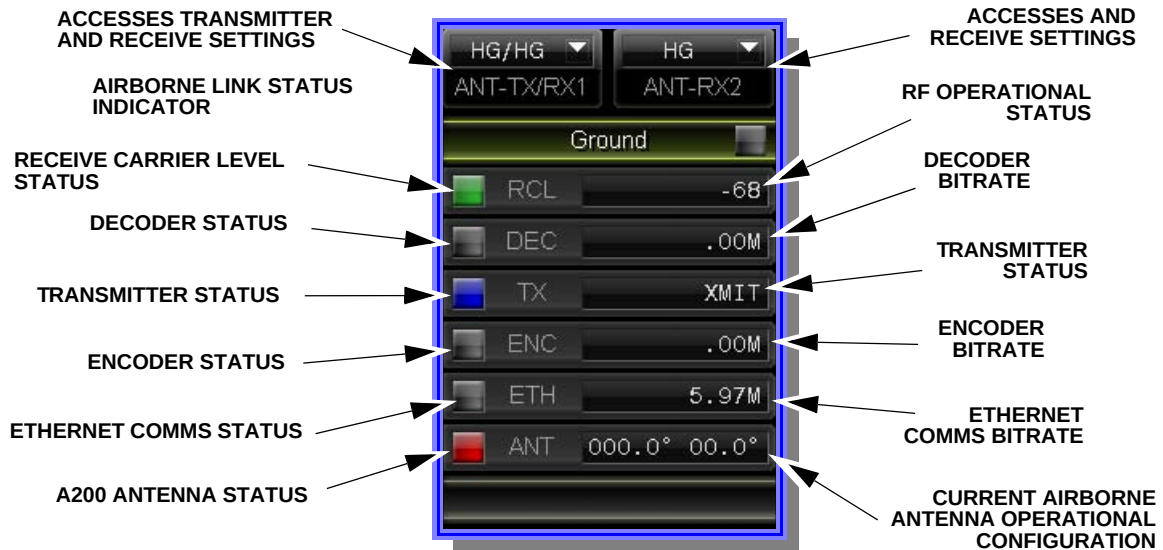


Figure 1-14. Ground System Link Data Indicators

1.2.4.2 Antenna Transmission / Reception Gauge

The antenna gauge provides the current operational configuration of the aircraft transmitting pods and the A200 receive site antenna relative to each other (see [Figure 1-15](#)).

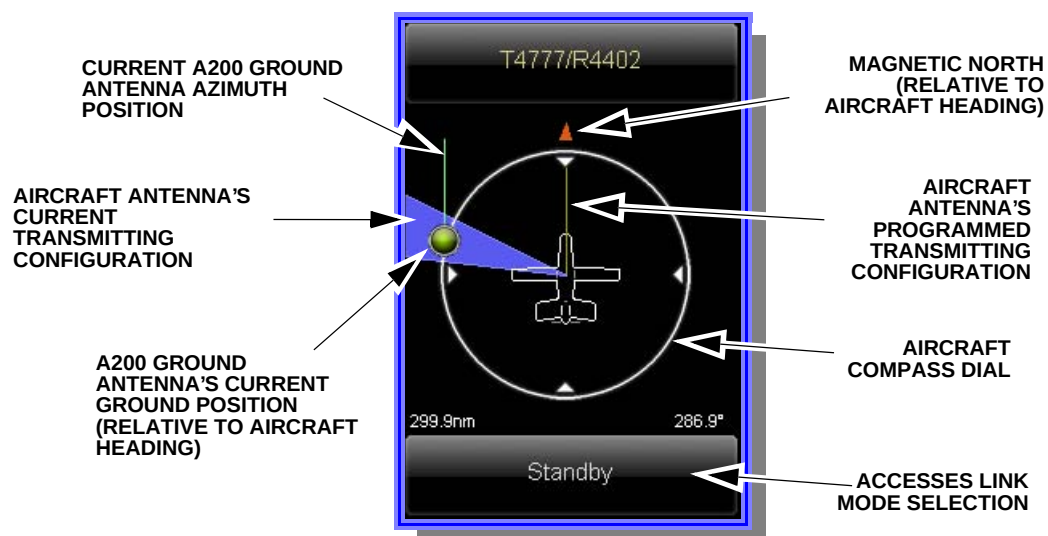


Figure 1-15. Transmitting and Reception Antenna Operation Gauge

1.2.4.3 Air Link - Airborne System Status

The GUI Air-Link screen includes the airborne system's comms indicators and read-out gauges providing at-a-glance status for the system's operation as well as touchscreen icon access to Waypoint settings and IMU configuration (see [Figure 1-16](#)).

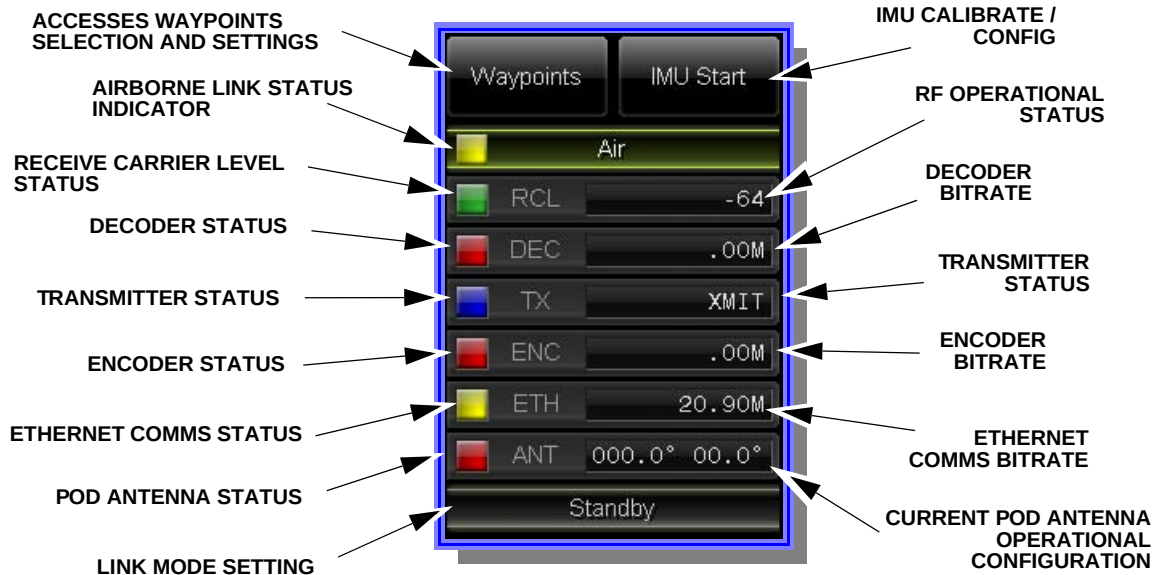


Figure 1-16. Airborne System Link Data Indicators

1.2.4.4 System Command Sidebar

The GUI sidebar has four box icons as well as a “System” GUI button. These icons provide access to multiplexing (MUX), the A200 (bi-directional antenna) and the airborne encoder/decoder settings (see [Figure 1-17](#)).

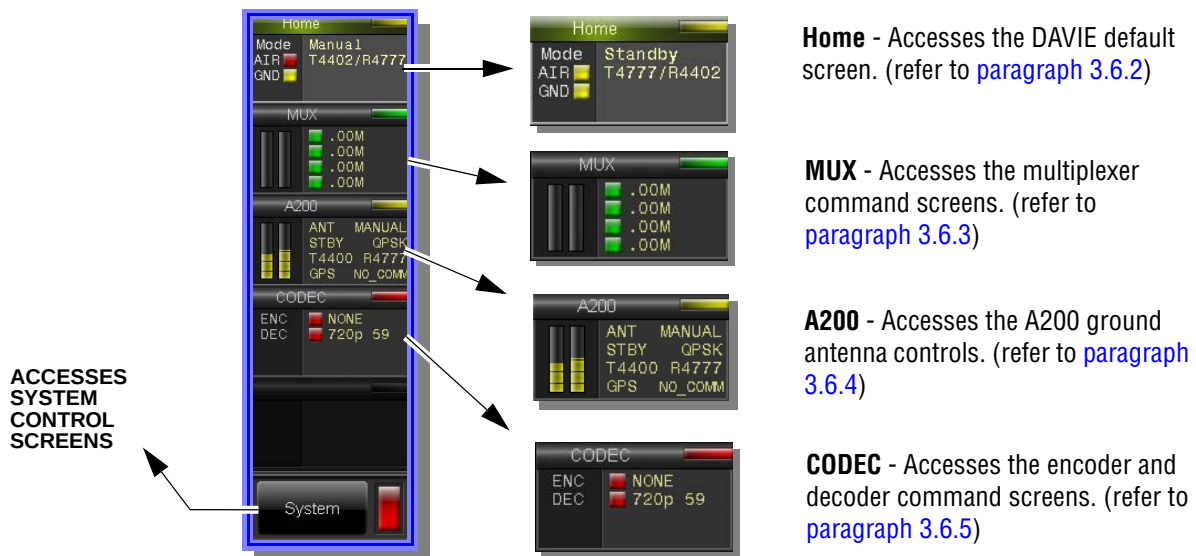


Figure 1-17. System Command Sidebar

1.3 GROUND SYSTEM COMPONENTS

1.3.1 A200 ENG Antenna

The A200 system is a receive site antenna that switches its reception configuration on command to receive Vertical Polarization. The antenna's parabolic dish and feed rotate to target and optimize azimuth reception. It is operated and manually calibrated and manually operated remotely using the master control software and/or locally using the S750 slave controller and the elevation angle can also be adjusted by approximately thirty-five degrees (+30, -5).



Figure 1–18. A200 Microwave Receiver Antenna (shown on Tripod Mount)

1.4 S750 CONTROLLER

The S750 controller interfaces with the A200 receive site antenna for set-up and manual control. It uses a real-time Operating System providing a compatible platform for PC based networks. Incorporating extensive built-in diagnostic and test features, it is also optionally capable control multiple antennas, receivers, routers, and other remote equipment, including the latest digital receivers and decoders.



Figure 1–19. S750 Diversity Receive Site Controller

1.4.1 Specifications

- Processor: AMD MIPS AU1500@400MHz
- Memory: 64MB RAM
- Storage: 256MB Compact Flash
- OS: Windows CE 5.0
- Serial Ports:
 - Two (2) Multimode RS-232/422/485
 - Three (3) RS-232
 - Expandable via ConTroll-PACs
- USB Ports: Five (5)
- ModemI: internal Dial-Up
- Ethernet: One (1) 10/100 Integrated NIC
- Control Modes: Remote Via Master Control System
- Local 4 x 40 Character LCD Display with Keypad
- Weight: 14 lbs.
- Vertical Rack Space: 2 EIA Rack Units
- Dimensions: (L x W x H) 19" x 3.5" x 12.25"
- Input Power: 100-240 VAC, 50-60Hz, Maximum 300 Watts
- Temperature Range: -20° to +50°C (-4° to 122°F)

1.4.2 DAVIE: Data And Video IP Encapsulator

The DAVIE is a digital video and IP encapsulation unit. The DAVIE encodes the video and data and uplinks the encoded data over an IP network from the A200 antenna to the Skylink mini pods on the airborne system. It also decodes the downlinked data from the airborne system for utilization by the ground system users.



Figure 1–20. DAVIE (Data and Video IP Encapsulator)

1.4.2.1 Ground System DAVIE provides the following critical functions:

Ground DAVIE provides the following critical functions:

- Data received from aircraft routed to user to video decoder
- Video decoding to HD and SD video outputs
- Prioritize and route IP traffic to and from the aircraft along with the video data.
- Provide system control
- Route data to and from GBLE for transmission and reception



SECTION 2

SYSTEM SET-UP AND CALIBRATION

2.1 INTRODUCTION

The A200 system is comprised of an A200 receive site antenna, an S750 slave controller for local antenna set-up and operation and Touchstar Master control software for remote system operation. This section addresses and illustrates the detailed physical configuration as well as the installation, set-up, required connectivity and operation configuration of this system, to insure proper operation and functionality. Once the system is installed on-site, all that is required is to connect it to its power and control sources as well as the video signal feed to the signal destination. Some minor adjustments and calibrations may also be required and then the system can be relied upon for self-sufficient operation.

2.2 SYSTEM INSTALLATION AND CONFIGURATION

The components for the Antenna System includes:

- A200 Receive Site Antenna
- S750 Remote Site Controllers
- Component power/control cable
- RF cable

2.2.1 System Installation

This section provides instructions for connecting the antenna and operating the Receive System remote site set-up. Refer to the information herein for handling, installation and connectivity of this system. For a diagram showing the complete system configuration refer to [Figure 2-3](#).

2.2.1.1 Antenna Handling

The five (5) chrome handles located on the exterior lower radome shell (refer to [Figure 2-1](#)) are mounted with 8-32 fasteners. These handles are sturdily mounted to the antenna frame but are intended for general light handling of the assembly. Use these handles for hand-carrying over short distances as well as for aligning and adjusting the antenna during mounting or servicing.



CAUTION: It is not recommended to use the antenna assembly handles for carrying it for over long distances or lifting it to heights beyond eight feet.

2.2.1.2 Antenna Mounting

The antenna assembly is mounted using eight (8) 3/8-16 fasteners that mount the bottom of the assembly to the receive site mount (refer to [Figure 2-1](#)).

Perform the following general mounting procedure:

1. Using the proper hoisting web, harness and/or equipment, lift the antenna assembly up to the site on which it is to be mounted.
2. Carefully place the antenna onto the mounting platform or surface and align the fastener holes.
3. Insert one of the eight (8) 3/8-16 fasteners through the platform mounting and turn it clockwise until the fastener threads catch.

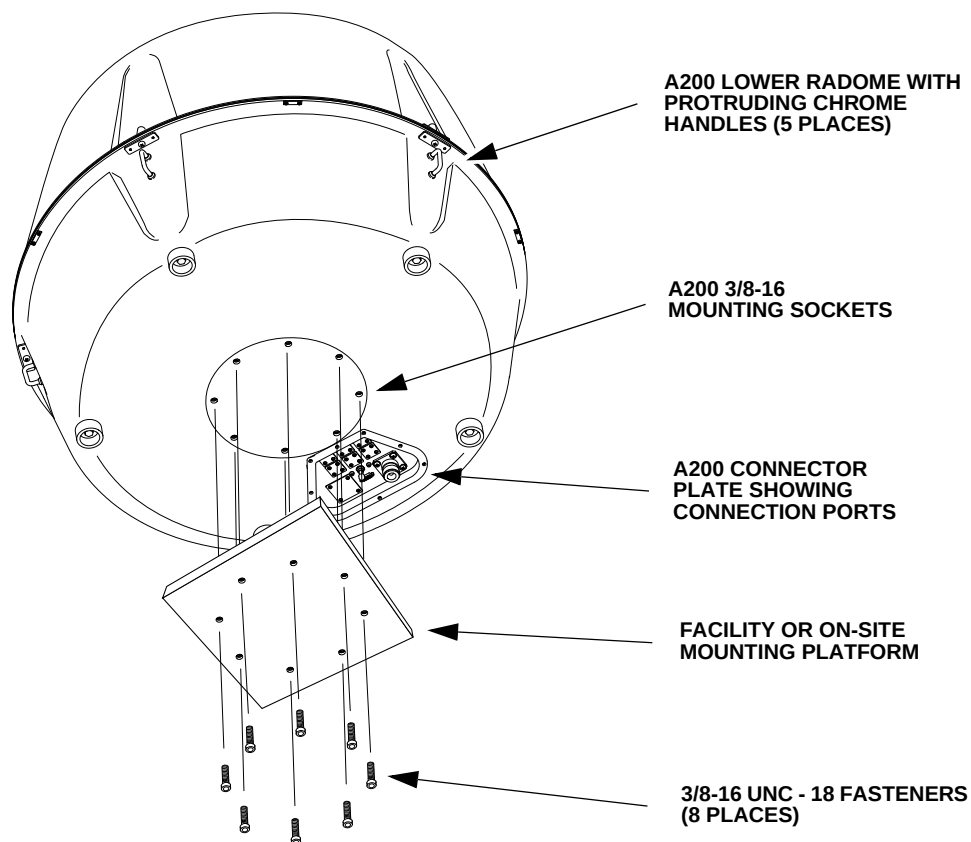


Figure 2-1. A200 Mounting Configuration

4. Insert a second mounting fastener into a mounting hole located to the opposite of the mounting hole array and turn it clockwise until the fastener threads catch.
5. Continue to insert the remaining fasteners into each mounting and turn each fastener until the threads catch.
6. Turn each fastener individually until they are all secure with the antenna proper level and secure.

2.2.2 System Connectivity

The connectivity requirements for the ground system varies per site. Typically the A200 antenna power and RF cable connect to the remote S750 Controller and the site receiver. Antenna Receive Site Connectivity

After the A200 Antenna and (refer to [paragraph 2.2.1.2](#)) and the S750 controller and receive site equipment has been installed, perform the following to connect the system.

- Connect the provided RF cable and the A200 to the processing and control components (refer to [Figure 2–3](#) for general reference).
- Connect the control cable to the A200 ports located on the under side of the antenna enclosure (see [Figure 2–2](#)).



Figure 2–2. A200 Video and Control Connections

7. Once the cables are connected to the A200, connect the other end of the control cable to the control port located on the rear panel of the S750 remote controller (refer to [Figure 2-3](#)).
8. Confirm that all cable connections are secure.

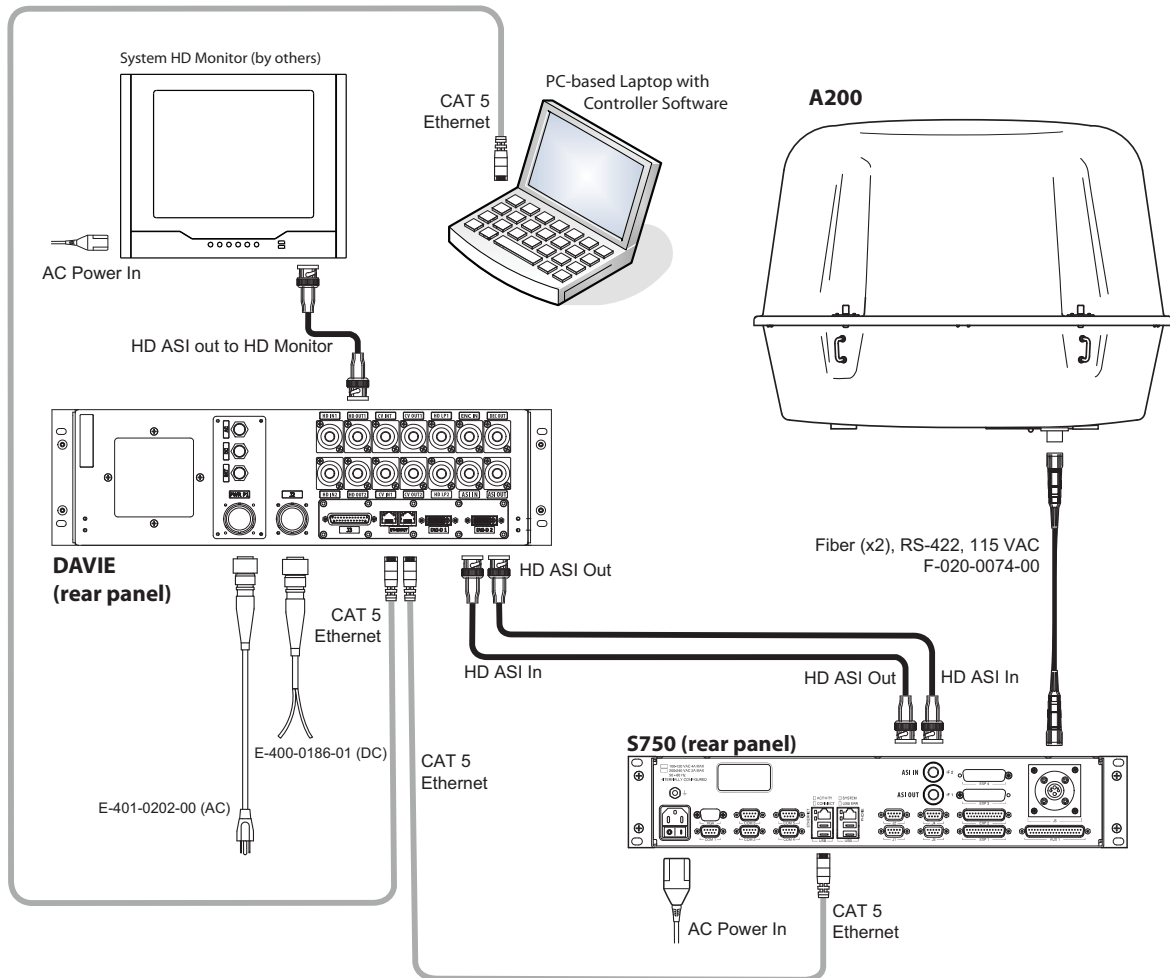


Figure 2-3. Ground System Connection Configuration

2.2.3 S750 Receive Site Controller

The S750 controller is a multi-faceted controller that enables the user to manually control and program the antenna for automated operation.

2.2.3.1 S750 Remote Controller Rear Panel

The rear panel (Figure 2-4) has several device connection options. Many of the key connections are summarized in the following list.

- Five (5) standard serial ports
 - Four (4) of the COM ports (COM2-COM5) are interchangeable regarding their assignment and use. Refer to system engineering data for information about the COM port assignments.
- Two (2) multi-purpose ports that can be used to connect serial devices
- External USB ports provide connection of up to three (3) X750 (or Troll Systems X350) expansion controllers
- Ethernet, phone line jacks and auxiliary ports
- A NavTrack (optional) and UMC-5 high speed modem interface
- Up to four (4) parallel ports

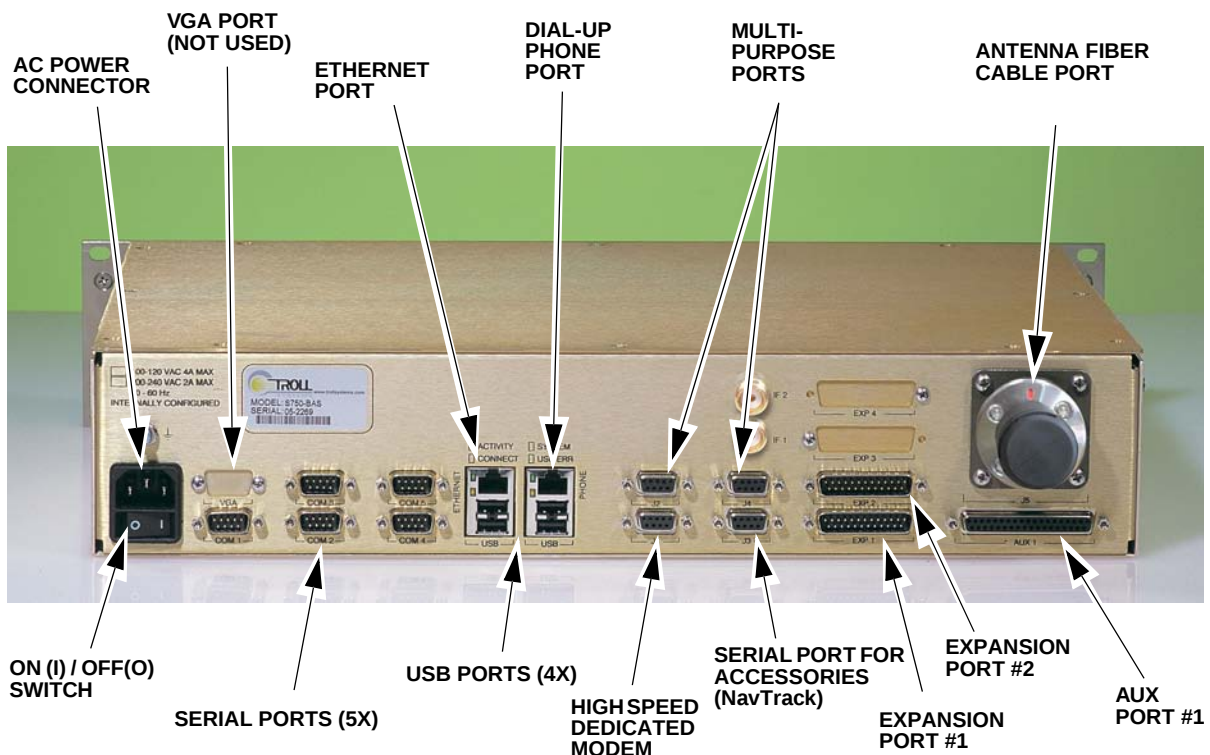


Figure 2-4. S750 Rear Panel Connector Configuration

2.2.4 Receive Site Calibration

Antenna calibration is performed using the S750 control functions to manually operate the A200 antenna (refer to [paragraph 3.5.5](#) and [paragraph 3.5.6](#) herein).

2.2.4.1 S750 Controller Set-up and Calibration

The S750 for this system does not require its own calibration. For detailed information regarding set-up and usage of the S750 controller refer to [paragraph 3.5.5](#).

2.3 GROUND SYSTEM ATP CHECKLIST

2.3.1 Connectivity Requirements

This system is comprised of the following components (see [Figure 2–3](#)):

- DAVIE Unit (PN: E-601-0020-00)
- S750 Local Controller (PN: E-601-0019-00)
- A200 Bi-directional Antenna (PN: E-601-0000-00)
- Laptop PC
- HD Monitor

The aforementioned components connectivity requires the following cables for proper functionality:

- S750 Controller to A200 Antenna (Cable PN: E-020-0074-00)
- DAVIE to Laptop PC using CAT 5e ethernet cable with RJ-45 connectors
- ASI HD Video Between DAVIE and S750 (BNC to BNC x2)
- ASI HD Video Between DAVIE to HD Monitor (BNC to BNC)
- AC power to DAVIE (Cable PN: E-401-0202-00)
 - DC power to DAVIE (Cable PN: E-401-0234-00)

2.3.2 Connectivity Instructional Checklist

Refer to [Table 2–1](#) and [Figure 2–3](#) for connectivity instructions.

Table 2–1. Ground System ATP Set-up Checklist

	Item	Set-up Procedure
	1.	Connect A200 antenna to the S750 controller using cable E-020-0074-00
	2.	Plug the S750 controller into an AC outlet using a standard three-prong AC cable
	3.	Plug the DAVIE into an AC outlet using E-401-0202-00 or into a DC power supply using cable E-401-0234-00
	4.	Connect the S750 controller ethernet port to the DAVIE ethernet port using CAT 5e ethernet cable with RJ-45 connectors
	5.	Connect the DAVIE ethernet port to the laptop PC ethernet port using CAT 5e ethernet cable with RJ-45 connectors
	6.	Connect the S750 controller ASI OUT to the DAVIE ASI IN using video cable with BNC connectors
	7.	Connect the DAVIE ASI OUT to the S750 controller ASI IN using video cable with BNC connectors
	8.	Connect DEC OUT of the DAVIE to and HD -SDI monitor using video cable with BNC connectors
	9.	Apply power to the DAVIE, S750 Controller, A200 Antenna, the laptop PC and HD monitor
	10.	Confirm network connectivity and comms



SECTION 3

SYSTEM OPERATION

3.1 INTRODUCTION

This section includes information relevant to the functionality of the A200 ENG Antenna System and S750 Controller as required for set-up, calibration and system operation.

3.2 A200 RECEIVE SITE ANTENNA

The A200 receive site antenna is a dynamic and versatile microwave downlink component that is preset to a specific bandwidth.

Once the A200 has been successfully installed, operational requirements for this component are minimal. Simply activate the unit by turning the ON/OFF switch to the ON position and the antenna is then ready to be set-up and calibrated using the Touchstar Control software or the S750 remote site antenna controller.

When performing service on the antenna system, turn the antenna power switch to the fail-safe position to prevent antenna rotation during service.

3.3 S750 REMOTE SITE CONTROLLER

The S750 is a state-of-the-art master control component that can be used as a direct-in hookup or over and IP network. In this application the S750 is connected directly to the antenna system for manual operation. The S750 utilized in this system serves as a critical component for setting-up the A200 antenna system.

The information included herein is specific to this application of the S750 controller. Refer to this information for system usage.

3.4 A200 ANTENNA THEORY OF OPERATION

The A200 antenna receives and transfers RF data to the S750 Antenna Master Controller and the S750 antenna controller provides several functions for the antenna as well as the overall system. These functions for the system includes set-up and calibration of the antenna's mechanical functions. But it is also capable of processing the RF data from the antenna (optional) and can be used to program the antenna system for automated operation (optional).

The site controller supplies 115 VAC electrical power to the A200 antenna. The antenna DC power converts it to 12 VDC and 24 VDC to provide VDC power to antenna subsystem functions. The converted DC power is then distributed as follows: The 12 VDC provides electrical power to the antenna low noise amplifier; the 24 VDC provides electrical power to the servo motor and the transfer switch.

The servo assembly sends control data through the slip rings to the servo expansion board to control dish rotation and polarization. The amplified RF then travels to the N-Type female connector and to its receive site destination. (refer to [Figure 3-1](#))

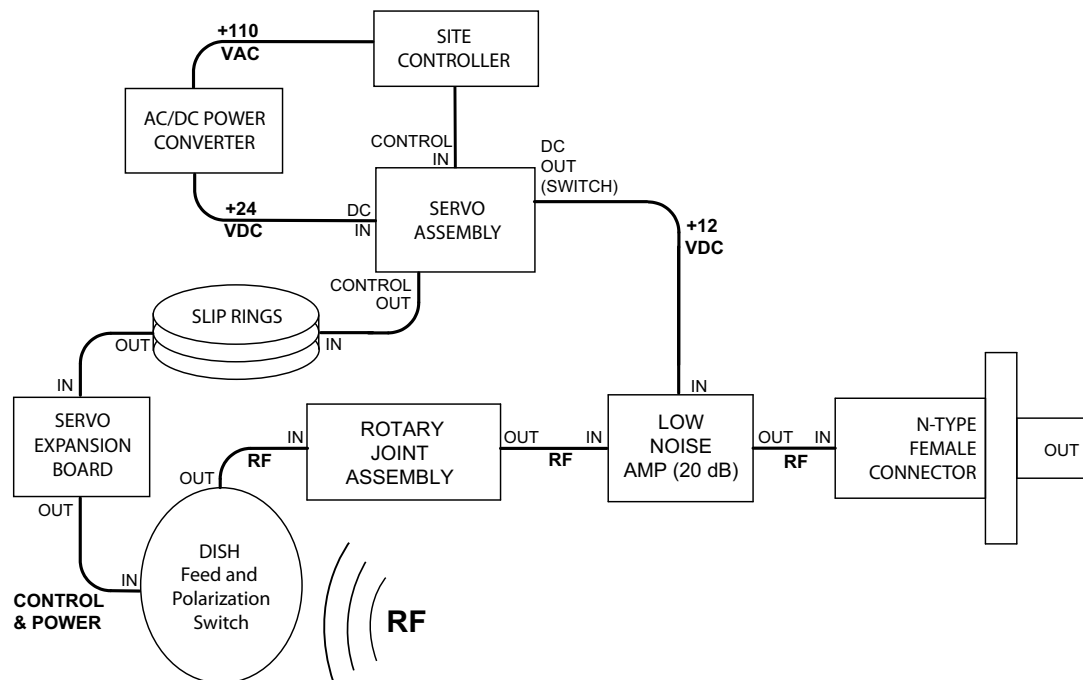


Figure 3-1. A200 System Functional Diagram

3.5 SYSTEM FUNCTIONALITY

The system utilizes both an MC17 master control system for remote system operation as well as a slave controller for local, or on-site, antenna operation and calibration. The information contained in this section of this manual includes detailed information for the set-up and operation of this system.

3.5.1 RF (MICROWAVE)

The antenna is configured to receive microwave signals in the 4.775 and 5.000 GHz range. The configuration includes quad-polarization, allowing the reception of vertical, horizontal, right-circular and left-circular polarization. The received signals are channel filtered (as required) and amplified by the antenna system before being relayed to the receive site for processing and distribution of the data.

3.5.2 MECHANICAL

The mechanical aspects of the antenna system are confined to the rotating parabola and feed assembly, as well as the mounting and handling of it.

3.5.2.1 Antenna Feed Assembly

The antenna feed assembly includes a parabolic dish and RF feed that is configured for continuous rotation. When in operation, the dish / feed assembly rotates for optimum RF capture. The dish / feed assembly is driven by a 24 VDC servo motor.



WARNING: During system set-up or maintenance procedures, the dish arm will rotate at full speed upon the application of system power, creating a risk of injury and damage to the system. Place the antenna system power switch to the fail-safe position prior to opening the radome or working on the antenna assembly and power-up

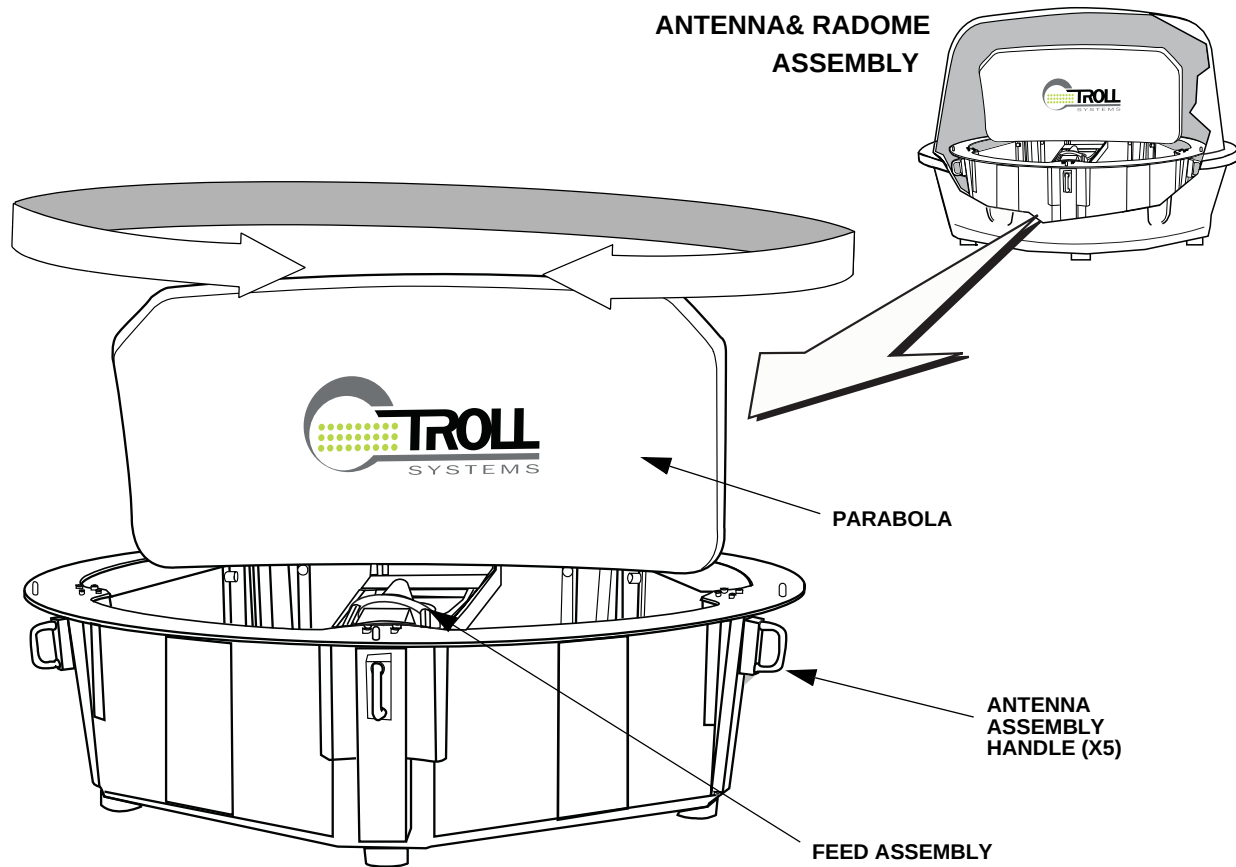


Figure 3–2. A200 Antenna Parabola / Feed Mechanical Functionality

3.5.2.2 Handling

The five (5) chrome handles protruding through the exterior of the lower radome shell is mounted with 8-32 fasteners. These handles are sturdily mounted to the antenna frame and are intended for general light handling of the assembly. Use these handles for hand-carrying the assembly over short distances as well as for aligning and adjusting the assembly during mounting or servicing.



CAUTION: The chrome antenna handles and the mounts securing them to the antenna assembly frame are not ruggedized and are intended for light handling only. Using these handles for carrying the antenna over long distances or hoisting it higher than eight feet is not recommended.

3.5.2.3 Mounting

The A200 antenna assembly is designed for simple and efficient mounting onto a standard fixed, portable or mobile mounting platforms including towers, heavy-duty tripods or even moving vehicles. The antenna assembly is mounted using eight (8) 3/18-16 fasteners that mount the bottom of the assembly to the receive site mount. For details regarding the A200 mounting configuration, refer to [Figure 2-1](#).

3.5.3 POWER

The A200 ENG antenna system operates using 110 VAC voltage. The system includes a power supply unit that provides lightning protection and converts the power to 12 VDC as well as 24 VDC to energize antenna components.

3.5.3.1 Power Requirements and Distribution

The system requires standard 110 volts of electrical alternating current (common household power) for functionality. The antenna system converts the 110 VAC to direct current at various voltages in accordance with the requirement of the particular antenna sub-system or component. Refer to [Figure 3-3](#) herein and for more information.

The 110 VAC, supplied by the S750 controller through the input connector to the power supply. The electrical energy passes through the lightning protection and to the AC the DC converter circuitry, where it is converted to 24 volts of electrical direct current. The 24 VDC is distributed to the servo for the transfer switch and a 28 VDC power switching component.

The 24 VDC is also distributed to a second DC power converter that step the voltage down to 12 VDC. The 28 VDC power switching component sends 28 VDC to the servo for the servo motor and to the user control, while the 12 VDC is sent to a second power switcher that supplies 12 VDC to the site controller. The site controller uses the 12 VDC to supply electrical power to the servo and the low noise amplifier.

3.5.3.2 Powering Up the System

The system power requirements originates from facility power. There are no power up procedures exclusive to the system. Once power is applied to the receive site controller, power is subsequently available for the antenna system. Before applying power to the system, ensure that the antenna and the antenna radome are secure. If the radome does not have the radome on it, replace the radome onto the antenna and secure it before applying power to the antenna.



WARNING: Once the antenna has power, the dish arm will rotate at full speed, creating a risk of injury and damage to the system. The antenna system power switch must be in the fail-safe position prior to opening the radome or operating the antenna assembly.

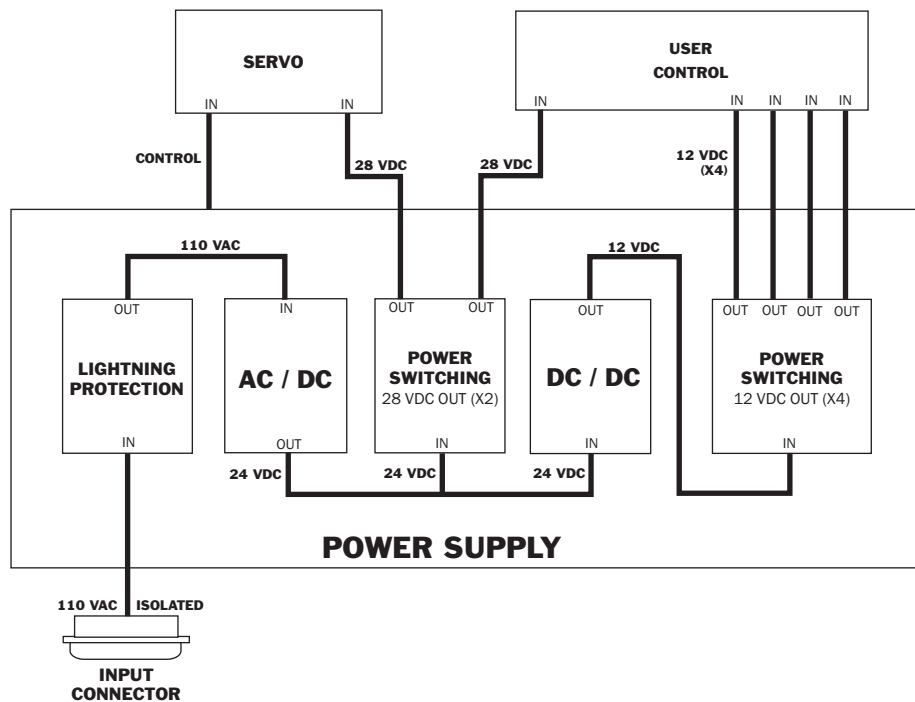


Figure 3-3. Power Distribution for A200 ENG System

Once system installation and hook-ups are complete, perform the following steps to power up the system:

1. Flip the power switch on the S750 controller (located on the back panel of the controller (refer to [Figure 2-4](#)). The | symbol on the controller power switch indicates ON while the O symbol indicates OFF.
2. Locate the antenna power switch on the bottom of the antenna radome.
3. Flip the antenna power switch to the ON position.

Once the system has powered-up check the controller and confirm the all system components are operative and functioning correctly.

3.5.4 CONTROL

3.5.4.1 Control Requirements

The system control requirements are applied through the S750 controller and the Touchstar software that is included with the system. The S750 controller provides the means to manually control the antenna as well as executing calibration functions of the system.

3.5.4.2 Control Functions

The user sends control and command functions to the antenna via the S750 controller. Control functions are executed through the controller keypad and numerical pad.

3.5.5 S750 Controller Orientation and Set-up

Refer to the following for pertinent information regarding the set-up and use of the Troll Systems A200 antenna system.



NOTE: The information herein regarding the control and software screens for the system are intended as general reference towards the operation and use of the A200 antenna system. The graphical representation of this information may appear different than the final product configuration provided for the system.

3.5.5.1 Front Panel

The S750's front panel ([Figure 3–4](#)) includes five (5) key elements that are identified in the figure and discussed in the following subparagraphs. These items are summarized below.

- Alphanumeric Display (4-Line/40-Character)
- Function Keys
- Keypad
- Status Indicators
- USB Port

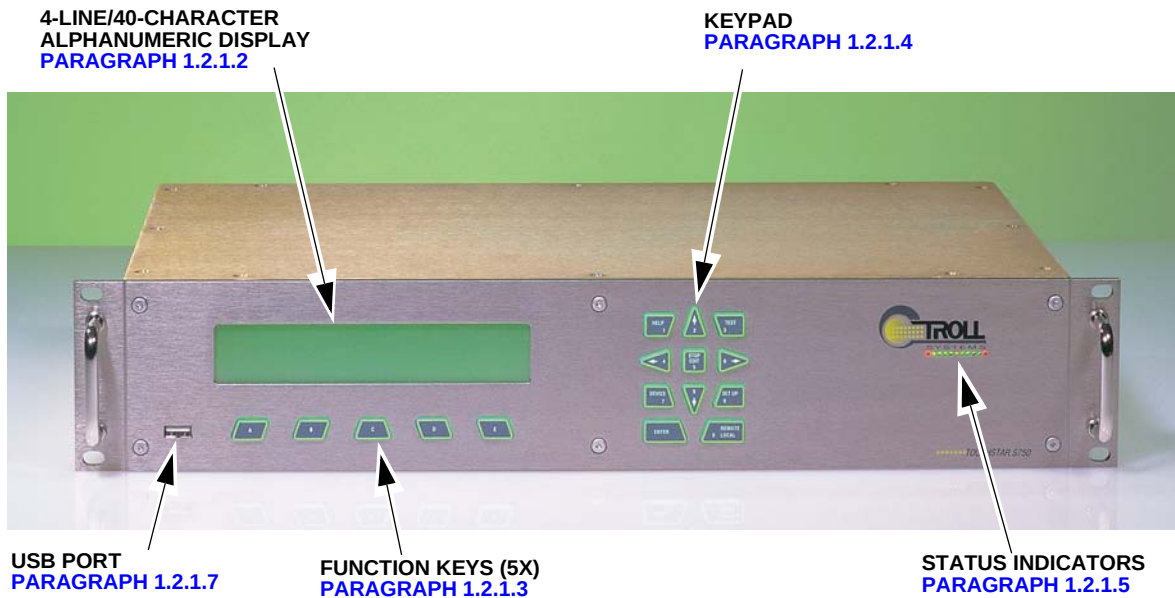


Figure 3–4. S750 Remote Site Controller – Front Panel Elements

3.5.6 S750 Operational Panels Navigation and Commands

3.5.6.1 Setup Screens

This section contains operational instructions for your S750 Remote Site Controller. The S750 is usually located at a remote receive site with an antenna and/or other components (e.g., antenna). Specific items discussed in this section include the following:

- **Operating Modes**
 - Remote and Local
- **Setup Screen Functions**
 - Volume Control, Network Settings, Software Updates, Customer and Device Configurations
- **Help Screen**
 - Software Version Information
- **Software Update Procedures**

The S750 will default to a main menu panel (see [Figure 1–3](#)). Pressing the SET key on the keypad (see [Figure 1–6](#)) accesses the system set-up functions (see [Figure 3–5](#)) with the “Network” function selected (as indicated by the brackets). Pressing ENTER accesses the Network menu panel and the available Network functions (see [Figure 3–17](#)). These selections can then be cycled through using the left and right arrow keys and selected by pressing ENTER.

3.5.6.2 Network Settings

The S750's internal network settings can be easily adjusted by qualified technicians. Perform the following procedures to modify the S750's network settings.



CAUTION: Changes to network addresses could adversely affect the operation of the entire network. These changes should only be made by qualified technicians.



NOTE: The S750's network settings can be modified in either local or remote mode.

1. Press the SET UP button on the S750 keypad. The display on the S750 should appear similar to the one shown in [Figure 3-5](#).

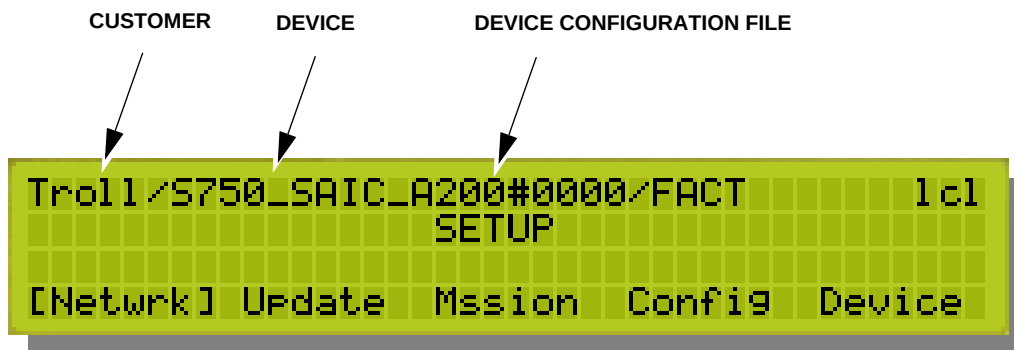


Figure 3-5. Setup Screen – Network Selected

2. Select “Network” [Netwrk]. The display on the S750 should appear similar to the one shown in [Figure 3-6](#).



Figure 3-6. Network Settings Screen

3. The available controls associated with the function keys are listed and described below:
 - a. IP – View/modify the internal IP address (refer to [paragraph 3.5.6.3](#))
 - b. SUBNET – View/modify the SUBNET address (refer to [paragraph 3.5.6.4](#))
 - c. GATEWA – View/modify the GATEWAY address (refer to [paragraph 3.5.6.5](#))
 - d. DNS – View/modify the DNS address (refer to [paragraph 3.5.6.6](#))
 - e. Esc – Returns to the previous screen (SETUP screen)

3.5.6.3 Viewing/Modifying the IP Addresses

The S750's Internet Protocol (IP) address is used as an identification number for access over the network. The S750 can be configured for either **DHCP** (Dynamic Host Configuration Protocol) or **Static** IP.

Setting the S750 to DHCP allows the DHCP server to automatically assign an IP address and DNS server information.

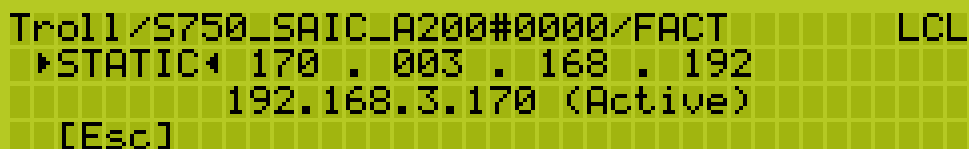
A Static IP is a specific address that is programmed into the S750. This setting will not change unless done so manually using the S750's front panel controls.



NOTE: Setting the IP address to static will cause all sub-addresses (SUBNET, GATEWAY, and DNS) to initially be set to 000.000.000.000. These addresses must be set manually if the IP is set to Static.

Perform the following procedure to change the IP address of the S750 Remote Site Controller.

1. Select [IP] to view and/or modify the IP address (DHCP or STATIC). The display on the S750 should appear similar to the one shown in [Figure 3–7](#).



```
Troll/S750_SAIC_A200#0000/FACT LCL
*STATIC* 170 . 003 . 168 . 192
192.168.3.170 (Active)
[Esc]
```

Figure 3–7. IP Address Screen

2. Use the up/down arrow buttons on the keypad to toggle between the DHCP address and the STATIC address.



NOTE: Numeric values cannot be modified if the IP is set to DHCP. When set to DHCP, the IP is set automatically and can only be changed (reverted) back to its factory default value).

3. The following steps detail how modify the IP address when set to STATIC.
4. If the IP address is set to STATIC, the left/right arrow buttons on the keypad can be used to move to specific portions of the address. Use the up/down arrow buttons on the keypad to increment and decrement the individual values. The displayed address will include the text (Mod*) to indicate that changes have been made (but have not yet been implemented).
5. Press [Take] when the desired address is displayed.
6. Press [Deflt] to return the S750's setting to its factory default value. If the IP is set to STATIC, it will be reset to DHCP (factory default). Press [Take] after pressing [Deflt] to set the address back to its default value.



NOTE: [Esc] can be pressed at any time to return to the Network Settings Screen.

7. Reset the S750 to apply all address changes.

3.5.6.4 Viewing/Modifying the SUBNET Address

1. Select [SUBNET] to view and/or modify the SUBNET address.
2. Use the left/right arrow buttons on the keypad to move to specific portions of the address. Use the up/down arrow buttons on the keypad to increment and decrement the individual values.
3. Press [Take] when the desired address is displayed.
4. Press [Deflt] to return the S750's setting to its factory default value.
5. Press [Esc] to return to the Network Settings Screen.



NOTE: The SUBNET address will be set to 000.000.000.000 any time that the IP address is switched from DHCP to STATIC.

6. Reset the S750 to apply all address changes.

3.5.6.5 Viewing/Modifying the Gateway Address

1. Select [GATEWA] to view and/or modify the Gateway address.
2. Use the left/right arrow buttons on the keypad to move to specific portions of the address. Use the up/down arrow buttons on the keypad to increment and decrement the individual values.
3. Press [Take] when the desired address is displayed.
4. Press [Deflt] to return the S750's setting to its factory default value.
5. Press [Esc] to return to the Network Settings Screen.
6. Reset the S750 to apply all address changes.

3.5.6.6 Viewing/Modifying the DNS Address

1. Select [DNS] to view and/or modify the DNS address.
2. Use the left/right arrow buttons on the keypad to move to specific portions of the address. Use the up/down arrow buttons on the keypad to increment and decrement the individual values.
3. Press [Take] when the desired address is displayed.
4. Press [Deflt] to return the S750's setting to its factory default value.
5. Press [Esc] to return to the Network Settings Screen.
6. Reset the S750 to apply all address changes.

3.5.6.7 Updating Software – Installing a New Compact Flash (CF) Card

Perform the following procedure to update the S750's software by removing the existing CF card and replacing it with a new CF card that includes updated software.

1. Turn the S750 Remote Site Controller OFF.
2. Disconnect all power and data cables.
3. Remove the S750 from the equipment rack.
4. Open the S750's top panel by removing the twelve (12) screws that secure it.
5. Remove the existing CF card from the Main Processor board.

3.5.6.8 Mission and Configuration Settings

The S750 Mission and Configuration (identity) can be changed by performing the following procedure.

1. Set the S750 to Local Mode.



NOTE: Go directly to [step 11](#) when the “mission” setting is to remain the same (unchanged) — but changes to the “configuration” are required.

2. Ensure that Local Mode (LCL/lcl) is indicated on the S750 display.
3. Press the SET UP button on the keypad. The display on the S750 should appear similar to the one shown in [Figure 3–5](#).
4. Select [Mssion] (Mission). The display on the S750 should appear similar to the one shown in [Figure 3–8](#).

```
Troll1/S750_SAIC_A200#0000/FACT*      LCL
MISSION*  Axsys/RIM
          ▾ ▸Axsys/MissionCtrl
[Select]  ---      Esc
```

Figure 3–8. Mission Screen

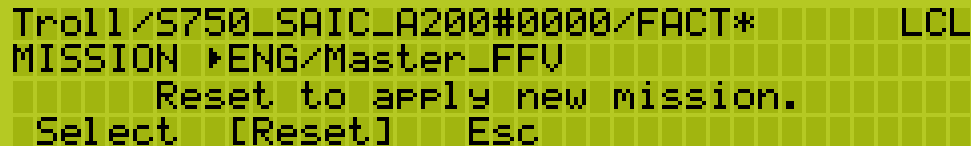
5. Use the UP and DOWN arrow keys to scroll the through the items until the required mission is on screen. The display on the S750 should appear similar to the one shown in [Figure 3–9](#) Select [Select].

```
Troll1/S750_SAIC_A200#0000/FACT*      LCL
MISSION ▸Axsys/MissionCtrl
          Reset to apply new mission.
[Select]  Reset      Esc
```

Figure 3–9. Controller Selection Screen

6. For example, if the arrow buttons on the keypad were used to select “ENG/Master_FFV” from the visible choices, the display on the S750 should appear similar to the one shown in [Figure 3–10](#). To apply a new mission select the “Reset” option.

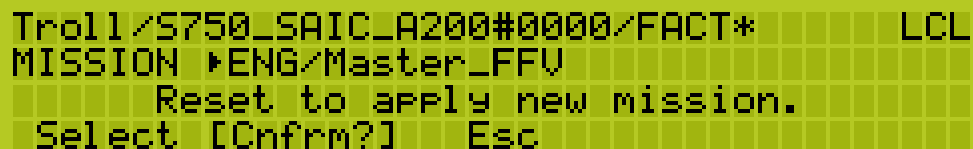
It is important to note that the new selection will not be set until the S750 controller has been reset.



```
Troll/S750_SAIC_A200#0000/FACT*      LCL
MISSION ▶ENG/Master_FFV
      Reset to apply new mission.
Select [Reset]  Esc
```

Figure 3–10. Mission Reset Screen

7. Press [Reset] when the indicator (small triangle) is aligned with the desired choice. The display on the S750 should appear similar to the one shown in [Figure 3–10](#).
8. Press [Cnfrm?] to confirm the selection, or scroll through the list of available devices associated with the current configuration (identity) and make that selection. The display on the S750 should appear similar to the one shown in [Figure 3–11](#).



```
Troll/S750_SAIC_A200#0000/FACT*      LCL
MISSION ▶ENG/Master_FFV
      Reset to apply new mission.
Select [Cnfrm?]  Esc
```

Figure 3–11. Reset Confirmation Screen

9. Press [Reset] to reset the S750 Remote Site Controller. The Reset screen will cease to be displayed after a few seconds. The main Device screen will then be displayed, indicating the new configuration. The display on the S750 should appear similar to the one shown in [Figure 3–11](#).
10. Following the reset, the individual configuration for the device can be set. Press the SET UP button on the keypad to access the SETUP screen again. The display on the S750 should appear similar to the one shown in [Figure 3–12](#).

11. Press [Config]. The display on the S750 should appear similar to the one shown in [Figure 3–12](#).



Troll1/S750_SAIC_A200#0000/FACT* LCL
SETUP
Netwrk Update Mssion [Config] Device

Figure 3–12. Setup Screen – Config Selected

12. Press [Select] to display a list of the configurations for the specified device. The display on the S750 should appear similar to the one shown in [Figure 3–13](#).



Troll1/S750_SAIC_A200#0000/FACT* LCL
SETUP
[Select] cfgrst Save Esc

Figure 3–13. Configuration Screen



Troll1/S750_SAIC_A200#0000/FACT* LCL
SETUP
Select [cfgrst] Save Esc

Figure 3–14. Configuration File Selection List

13. Use the UP and DOWN arrow buttons on the keypad to scroll through the available selections. For example, if the arrow buttons on the keypad were used to select “MESPNBas.Cfg” from the visible choices, the display on the S750 should appear similar to the one shown in the previous figure ([Figure 3–14](#)).

14. Press [Select] to choose the desired configuration. The display on the S750 should appear similar to the one shown in [Figure 3–15](#).

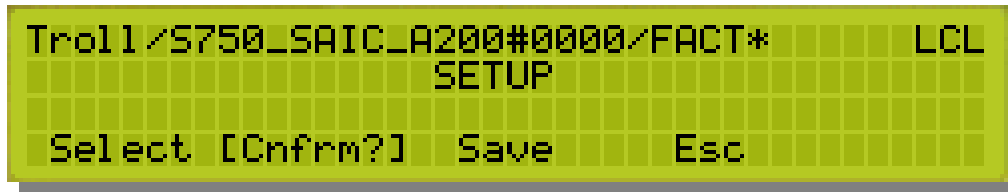


Figure 3–15. Configuration Confirmation Screen

15. Press [Save] after confirming that the “pending” configuration is correct. The display on the S750 should appear similar to the one shown in [Figure 3–16](#).



NOTE: The top right portion of the display will indicate that the loading process is taking place by displaying **CFG** (configuring) and **LCK** (S750 operations are currently locked/inhibited).

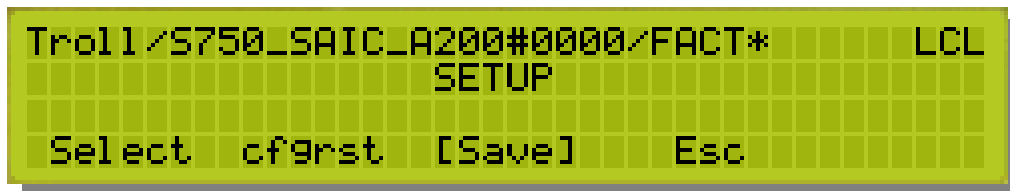


Figure 3–16. Saving Configuration

16. The S750 will reset itself after the loading process is completed. The display on the S750 should appear after successfully updating the configuration.

3.5.6.9 Main Screens

The S750 will default to a main menu panel (refer to [Figure 1–3](#)). Pressing the SET key accesses the system set-up functions with the “Network” function selected (as indicated by the brackets). Pressing ENTER accesses the Network menu panel and the available Network functions (see [Figure 3–17](#)). These selections can then be cycled through using the left and right arrow keys and selected by pressing ENTER.

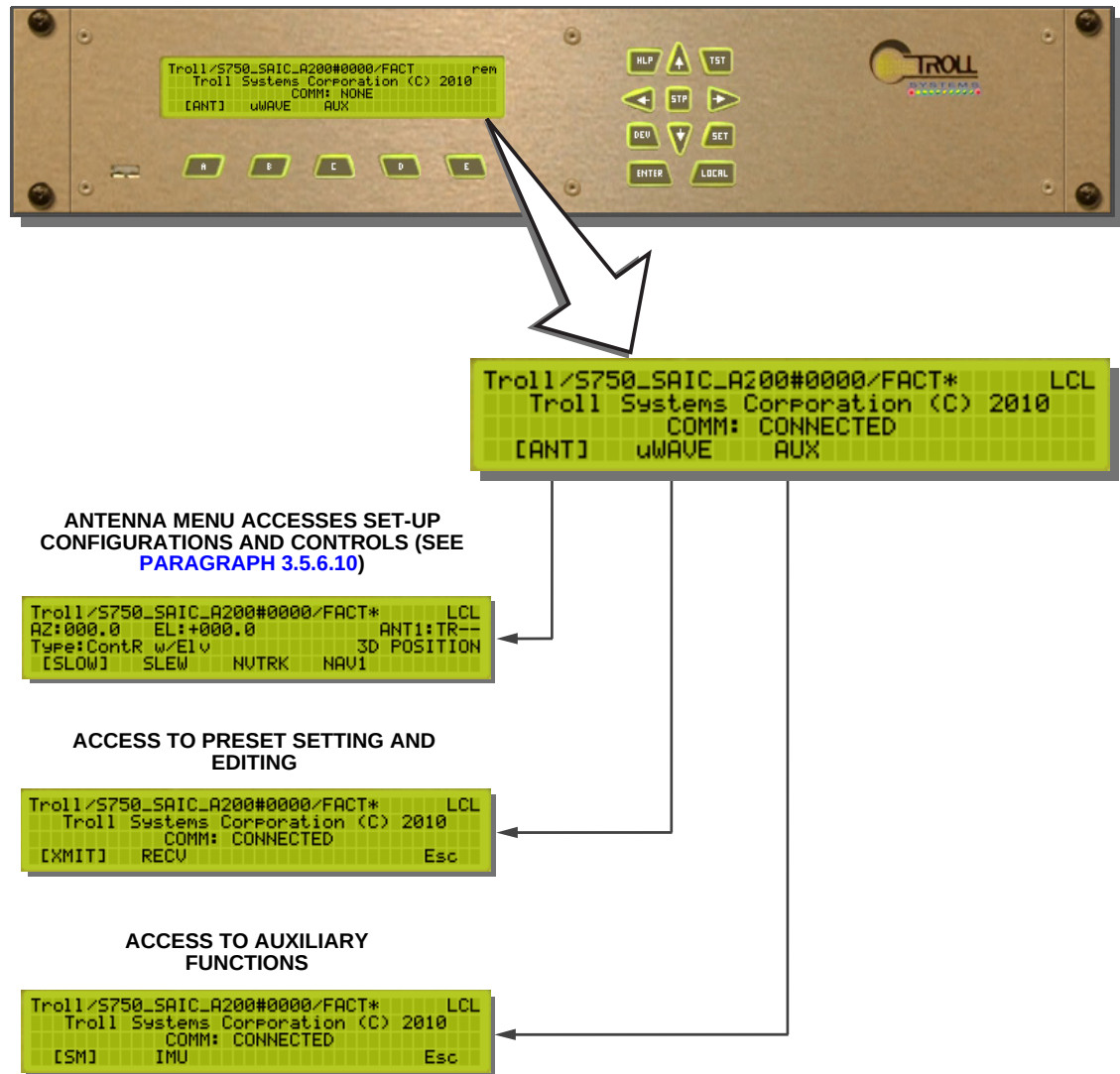


Figure 3–17. S750 Set-up Menu Panels

Once a sub-menu function is selected, then the function can be changed, edited or additional sub-menus of that function can be accessed and selected.

3.5.6.10 Antenna [ANT] Configuration and Controls

From the main panel screen, select antenna [ANT] to access the antenna configuration and control functions (see [Figure 3–18](#)). From the Antenna screen, the user can access different antenna related functions including antenna rotation speed, movement and navigational data. The Antenna menu selections include: SLOW, SLEW and NAV1.

Antenna movement (control) can be accomplished using the S750's front panel.

Perform the following procedures to move the antenna to a position that provides the best results for your communications system.



```
Troll/S750_SAIC_A200#0000/FACT*      LCL
AZ:000.0    EL:+000.0                  ANT1:TR--
Type:Contr w/Elv                      3D POSITION
[SLOW]      SLEW      NVTRK      NAV1
```

Figure 3–18. Antenna Control Panel

1. From the Antenna Control Screen, press the function key associated with the antenna's movement speed [FAST] or [SLOW].
 2. The user can then choose the speed that the antenna will move and the type of movement (slew or continuous). This is done by selecting the applicable function key and toggling from slow-to-fast movement and/or slew or continuous movement.
 3. The S750 display will indicate antenna movement (CW, CC, UP, DN) while in motion and will display "- -" when movement has ceased.
- **Perform the following procedure to slew the antenna:**
 1. Press the function key associated with the type of antenna movement [SLEW].
 2. The text above the function key will change from SLOW to FAST. The displayed text represents the current state (speed).
 3. Ensure that SLEW is displayed on the screen. If not press the associated function key to change to SLEW mode.
 4. Use the arrow keys on the S750's keypad to move the camera pedestal. The pedestal will move (slew) only for as long as the user continues to depress the given arrow key.

Perform the following procedure to manually control the antenna.

1. Select [ANT].
2. Select any of the available antennas: [ANT1], [ANT2], [ANT3], etc.

The second and third lines of the S750's display include the information in the following list:

- **RCL** – Receive Carrier Level (also referred to as signal strength). Optimal operating range is between -75 and -35 dBm
- **AZ** – Azimuth (or pan angle) measured in degrees from North. For example, a reading of 090.0 indicates that the antenna is pointing due east.
- **ANT1** – Indicates selected antenna (ANT1, ANT2, etc.) and uses the four characters to the right of the label to display real-time data regarding any movement of the antenna pedestal. Refer to [paragraph 3.5.6.11](#) for detailed information about moving the antenna.
 - The first two characters indicate horizontal (azimuth) movement. Clockwise (CW), Counter-Clockwise (CC), or no movement (--).
 - The second two characters indicate vertical (elevation) movement. Up (UP), down (DN), or no movement (--).
- **AntType** – Indicates the type of antenna selected and its calibration status (Cal'd or UnCal'd). Antenna types that can be configured for use with the S750 are listed below.
 - ContR – Continuous Rotation
 - Stops – Non-Continuous Rotation

3.5.6.11 Moving the Antenna

Most antenna installations feature horizontal (azimuth) movement of the antenna only. Other installations are pedestal-mounted allowing both horizontal (azimuth) and vertical (elevation) movement of the pedestal. Antenna movement (control) can be accomplished using the S750's front panel.

Perform the following procedures to move the antenna to a position that provides the best results for your communications system.

1. From the Antenna Control Screen press the function key associated with the pedestal [PED].
2. The user can then choose the speed that the antenna will move and the type of movement (slew or continuous). This is done by selecting the applicable function key and toggling from slow-to-fast movement and/or slew or continuous movement.
3. The S750 display will indicate antenna movement (CW, CC, UP, DN) while in motion and will display “- -” when movement has ceased.

3.5.6.12 NavTrack Antenna Control (Optional)

NavTrack is an optional feature that (when installed and activated) locks the antenna tracking onto the current video signal. It will appear on the Antenna Control Screen only when the optional NavTrack electronics card is installed in the S750 along with the associated software (Figure 3–19 and Figure 3–20).

THE NAV1 SCREEN CAN BE ACCESS BY CYCLING THROUGH THE MENU OPTIONS OR SELECTING THE CORRESPONDING FUNCTION KEY

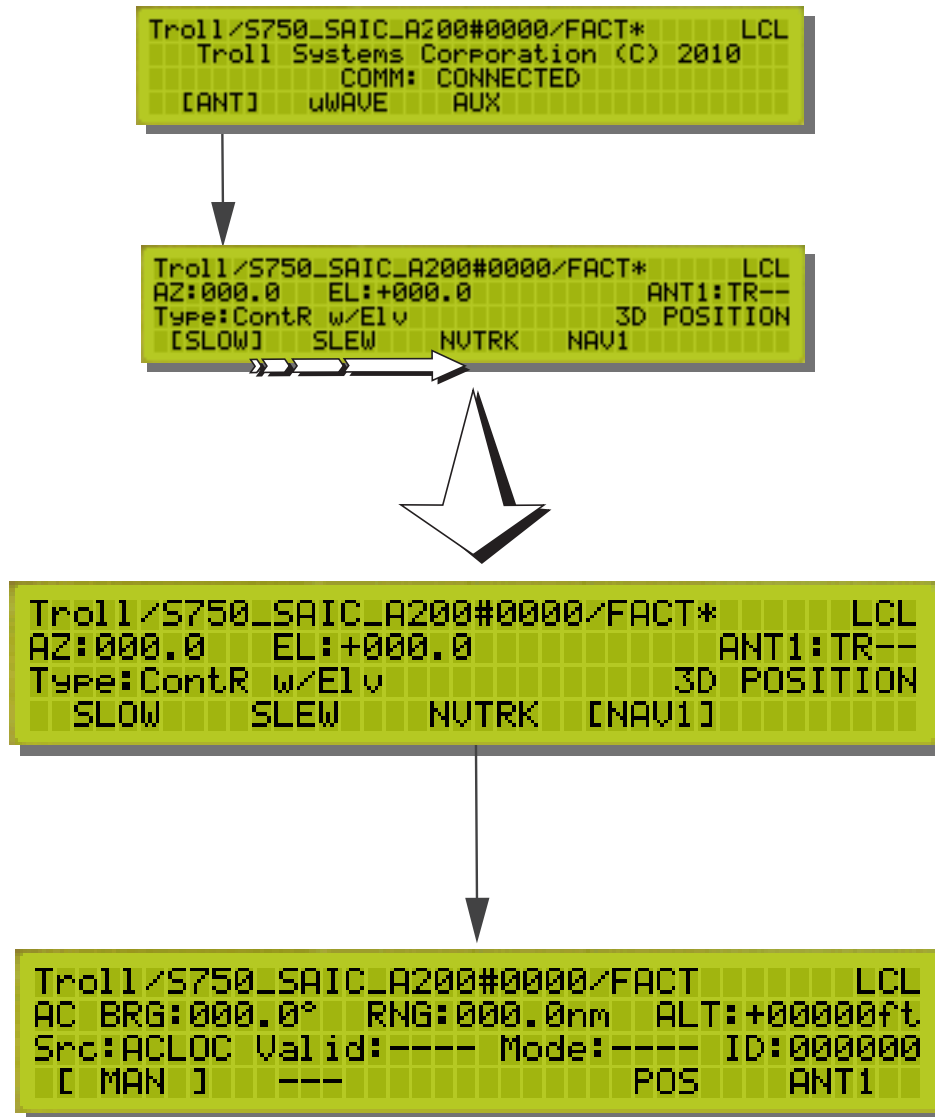


Figure 3–19. Antenna Configuration and Control Panel Screens

To properly utilize the NavTrack feature, the operator must first identify the direction of the NavTrack-equipped aircraft that is transmitting the video signal and then point the antenna toward that aircraft.

Activating (i.e., turning NavTrack ON) is easily accomplished by pressing the function key directly below [NAV1] (Figure 3–20). The S750's display indicates the current state of the NavTrack option (NTOFF) or (NTON).



Figure 3–20. Antenna Control Screen – NavTrack Selected

Perform the following procedure to operate NavTrack.

1. Ensure that the S750 is in Local (LCL) mode. Press the LOCAL/REMOTE key if necessary.
2. Press the DEVICE key (if the main Device screen is not currently displayed).
3. Rotate the antenna to a position that receives an optimal signal from the NavTrack-equipped aircraft.
4. Press [ANT] to display the Antenna Selection Screen. Select the applicable antenna (ANT1, ANT2, etc.) to display the Antenna Control Screen.
5. Select [NAV1] to display the NavTrack Screen.

The S750's display may include the information in the following list:

- **BRG** – Indicates the aircraft's *bearing* with respect to the receive antenna (measured in degrees from North).
- **RNG** – Indicates the aircraft's *range* from the receive antenna (measured in nautical miles (nm)).
- **ALT** – Indicates the aircraft's *altitude* (measured in feet above mean sea level).
- **NavTrk** – Indicates status of NavTrack feature. Displays TRACK when tracking an aircraft; display dashes (-----) when NOT tracking.
- **NO SIG/VALID** – Displays NO SIG when NavTrack feature is NOT receiving a signal to track. Displays VALID when NavTrack is decoding valid NavTrack data packets.
- **ID** – This value is a *checksum* that is generated by NavTrack and used to check the validity of NavTrack data packets. Displays 000000 when NOT tracking a signal.

6. Press [NTOFF] to turn the NavTrack feature ON. The screen will display NTON above the function key and immediately report live data from the aircraft (updated every few seconds).

7. Press [LAT] to display additional tracking data.

The second and third lines of the S750's display include the information in the following list:

- **GND** – Displays the latitude, longitude, and altitude of the receive site (ground) antenna.
- **AC** – Displays the latitude, longitude, and altitude of the aircraft.

8. Verify that valid tracking data is being received.

9. Press [Back] to return to the main NavTrack screen.

10. Press the function key below [NTON] to turn the NavTrack feature OFF when the video tracking session has been completed. Verify that NTOFF appears on the S750's display.

3.5.7 Auxiliary Equipment Control

The S750 Remote Site Controller provides basic site management control (ON/OFF) of auxiliary communications and/or control equipment within a given system (installation).

Auxiliary equipment control (site management) is accomplished by first accessing the Device Screen and then selecting [AUX] from the available choices. The display on the S750 should appear similar to the one shown in [Figure 3–21](#) when the Device Screen is displayed and [AUX] is selected.



```
Troll/S750_SAIC_A200#0000/FACT*      LCL
Troll Systems Corporation (C) 2010
COMM: CONNECTED
[ANT]  uWAVE  AUX
```

Figure 3–21. Auxiliary Equipment Control Screen – Auxiliary (AUX) Selected

The Auxiliary Equipment Control Screen ([Figure 3–22](#)) is used to provide basic site management control (ON/OFF) of other communications and/or control equipment within a given system (installation).

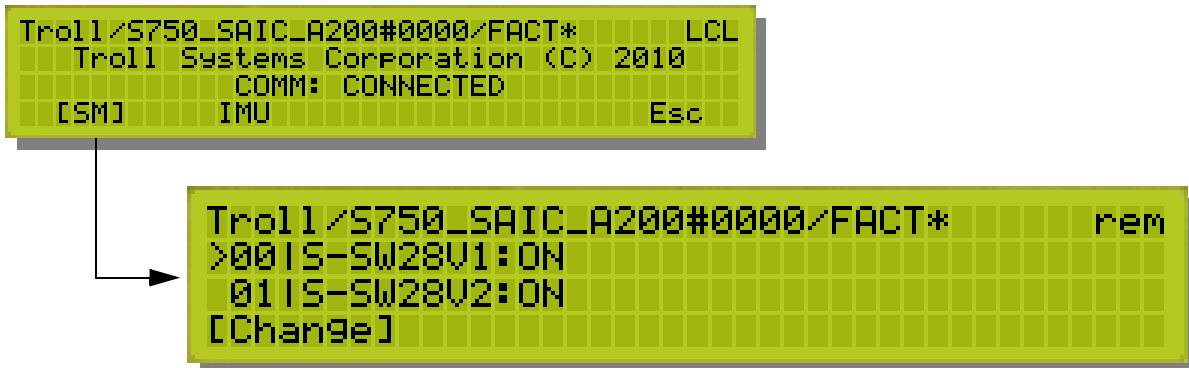


Figure 3-22. Auxiliary Equipment Control Screen

Perform the following procedure to toggle external equipment ON and OFF.

1. Use the UP and DOWN arrow buttons on the S750's keypad to select the device (auxiliary equipment) to be turned ON or OFF.
2. Observe current operating state (ON/OFF) of the selected item on the LCD display.
3. Select [Change] to switch the current state from ON to OFF (or OFF to ON).
4. Verify equipment status.
5. Select [Esc] when operation is completed.

3.5.7.1 Accessing the Help Screens

Information about the software installed within your S750 Remote Site Controller can be viewed on the S750 display by accessing the HELP screen. Perform the following procedure to display the HELP screen.

1. Press the HELP button on the S750 keypad (see [Figure 1-6](#)). The display on the S750 should appear similar to the one shown in [Figure 3-23](#).



Figure 3-23. HELP Screen

2. Press [About] to display information about the current software installed in the S750. The display on the S750 should appear similar to the one shown in [Figure 3–24](#).

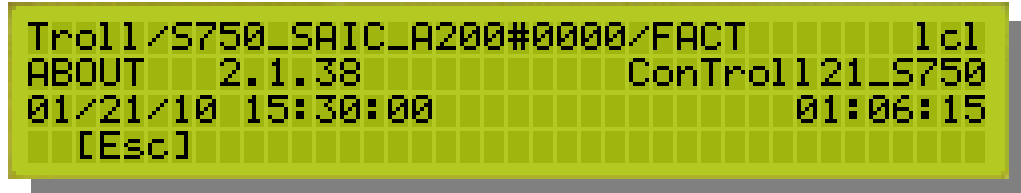


Figure 3–24. Software Information Screen

Through the Touchstar software, the calibration functions can also be performed.

3.6 DAVIE: DATA AND VIDEO GUI SOFTWARE

The touchscreen GUI software provides the user with access to all of the airborne systems command functions including system status, faults, settings and operation. The system's GUI default screen shows the status of the RF and comms link as well as direct access to the other system settings and functions. [Figure 1–13](#) and [Figure 3–25](#) reveals the software visual orientation and basic interface navigation.

3.6.1 DAVIE Controller Functionality

Included with this system is Troll Systems' DAVIE controller PC based software. Through the use of the Touchstar software, the user can execute the same set-up and control commands using a PC based graphical user interface. Once the software is launched, a widow will open revealing a main screen through which the command functions are accessed.

3.6.2 Home Screen

The Home screen is, in fact, the system default screen and will be accessible upon successful system start-up. Whenever one of the icons in the command sidebar is pressed, the GUI will immediately access the correlating screen (regardless of the currently selected screen or tabbed page). Pressing the “Home” icon on the command sidebar will immediately access the this screen.



Figure 3–25. DAVIE Software Home (Default) Screen

The Home screen is the core of the system’s operation and control. All of the key functions of the system can be monitored or changed from this screen (see [Figure 3–26](#)). Many of these items are detailed in [paragraph 1.2 of Section 1, “System Overview”](#). However, there are additional system functions accessible from the Home screen. These additional functions and settings include:

- Local / Remote configuration
- Link Channel Pair selection
- Link Mode Setting

The following paragraphs provides additional details regarding access and altering these system functions.

3.6.2.1 DAVIE - Home Link - Ground Page

The DAVIE Home ground link screen provides the user with direct access to the settings for the ground-based RF links to the airborne system (refer to [Figure 3-26](#)).

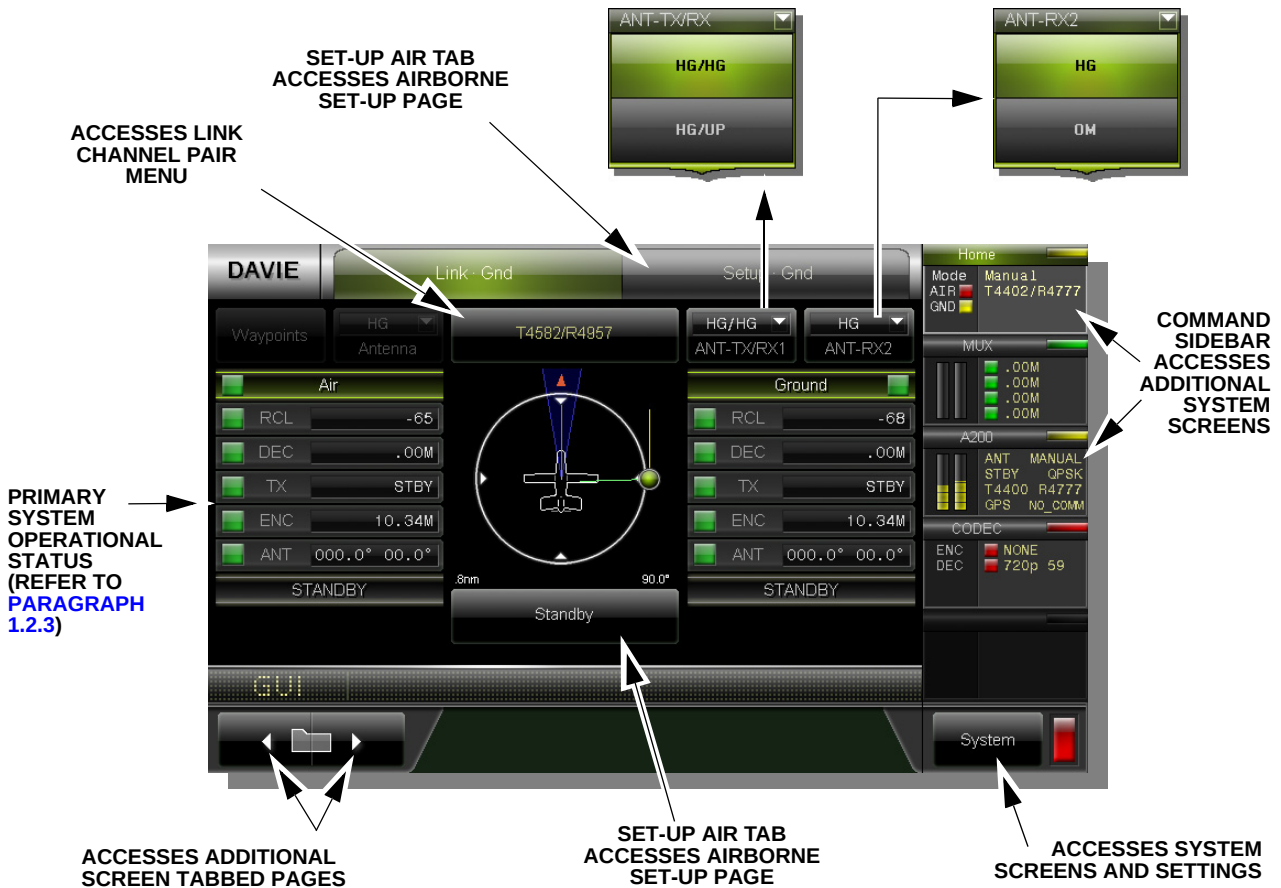


Figure 3-26. Home / Default Screen System Access Points

3.6.2.2 Link Channel Pair

Pressing the Link Channel Pair Icon accesses the Link Channel Pair menu page. It is this page that includes the menu that offers the user linked channel pair combinations from which to select (refer to [Figure 3-27](#)).

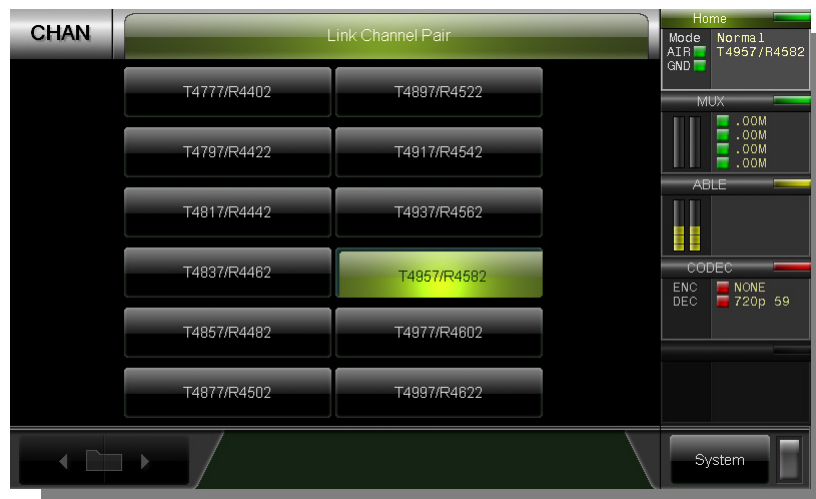


Figure 3-27. Link Channel Pair Menu Page

3.6.3 MUX - Multiplexing

The system's multiplexing functions can be accessed and monitored via the MUX pages. Pressing the MUX icon on the command sidebar of the GUI provides the user with this access (see [Figure 3–28](#)).

3.6.3.1 MUX- Channels Page

The MUX channels page provides status monitoring of the system's multiplexing functions for transmitter and receiver channels including:

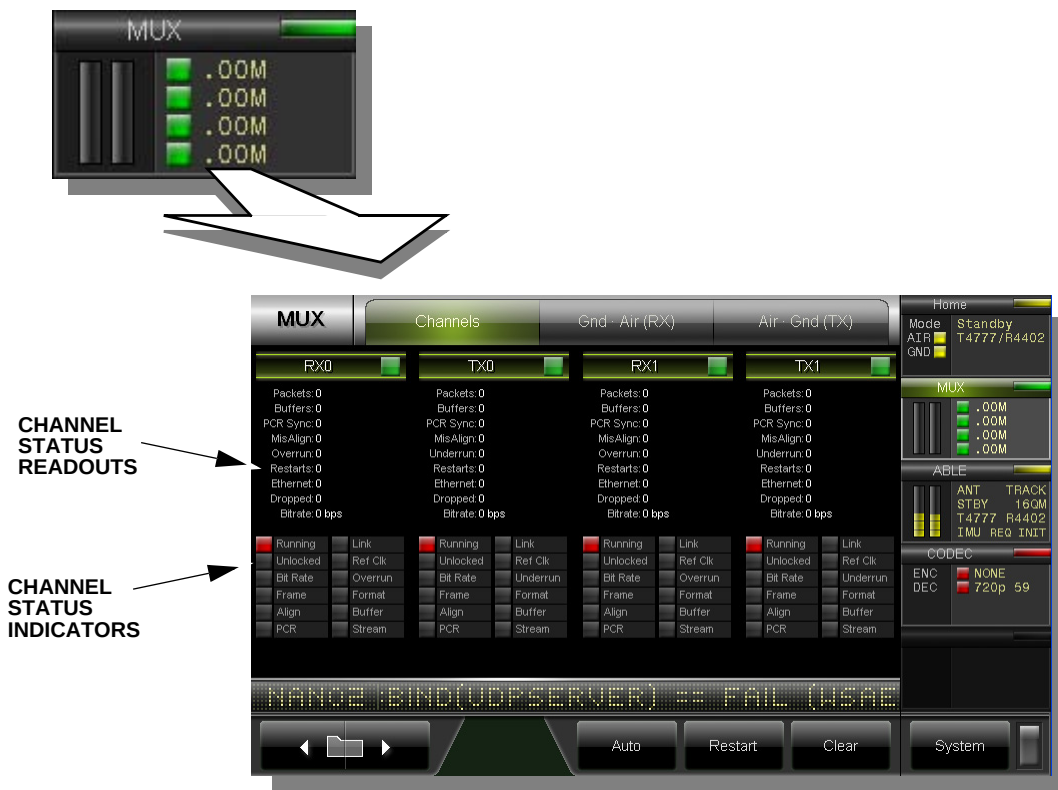


Figure 3–28. Mux Screen Channels Page

3.6.3.2 MUX - Ground to Airborne Page

The MUX Ground to Air page provides the status of the data transfer from the ground system to the airborne system including the status of the data transmitting and the data being received (see [Figure 3–29](#))

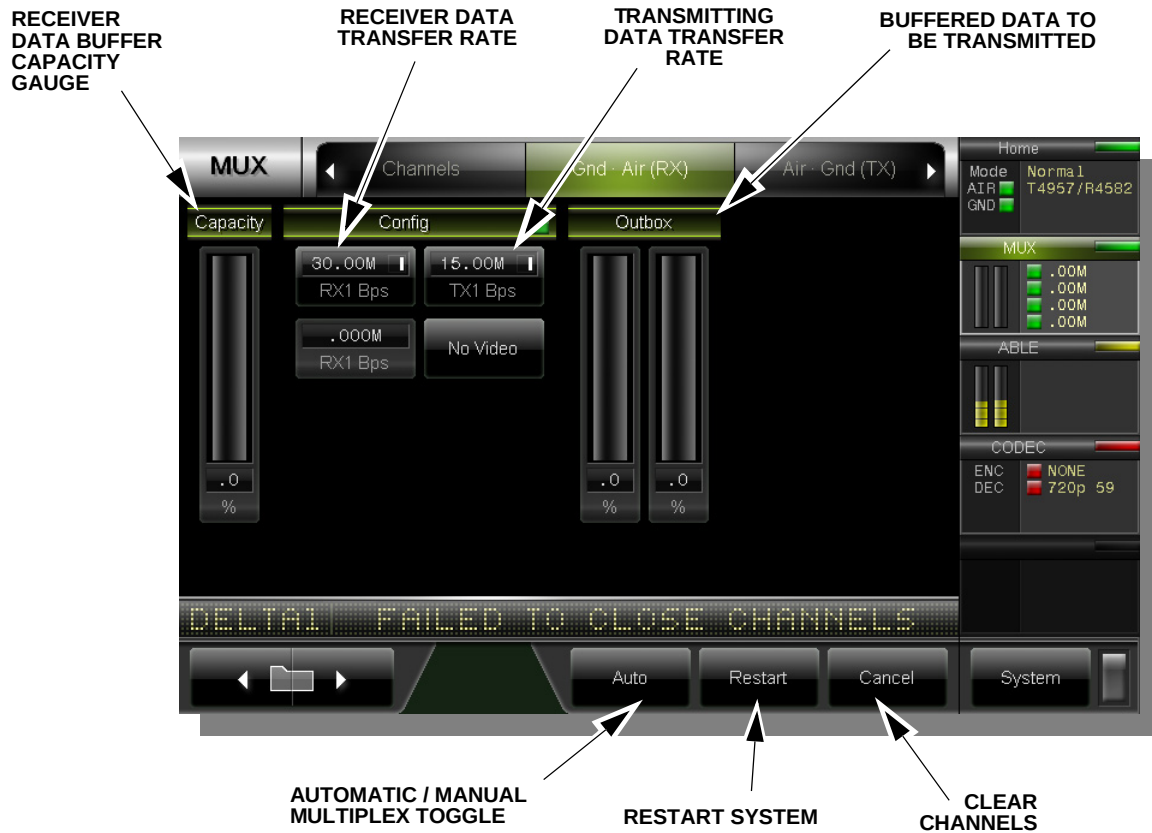


Figure 3–29. Multiplexing Ground to Air Status Page

3.6.3.3 MUX - Airborne to Ground Page

The MUX Air to Ground - page provides the status of the data transfer from the ground system to the airborne system including the status of the data transmitting and the data being received (see [Figure 3–29](#)).

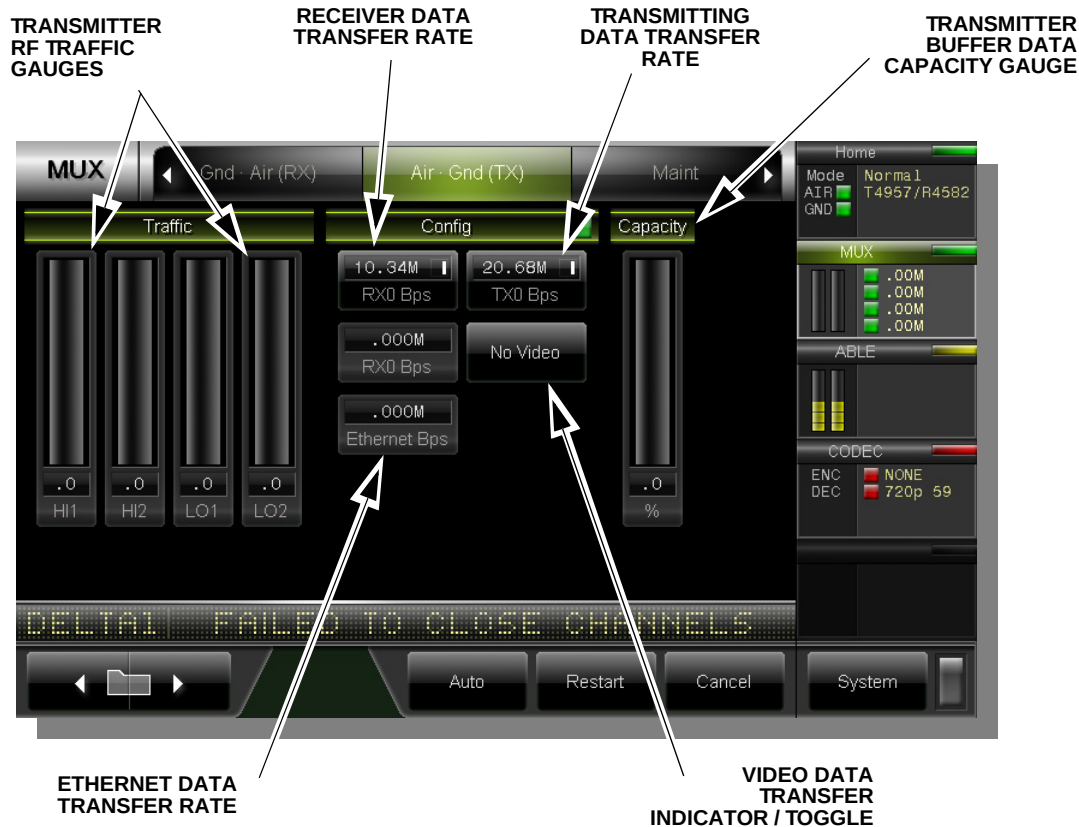


Figure 3–30. MUX Air to Ground Status Page

3.6.4 A200 (Ground Bi-Directional Link) GUI Screens

The A200 GUI pages provide the user with the means to monitor the status of the aircraft position as well as the airborne mini pod antennas as well as the ground system position and status. Additionally, the user can manually adjust the airborne antenna configuration (refer to [Figure 3-31](#)).

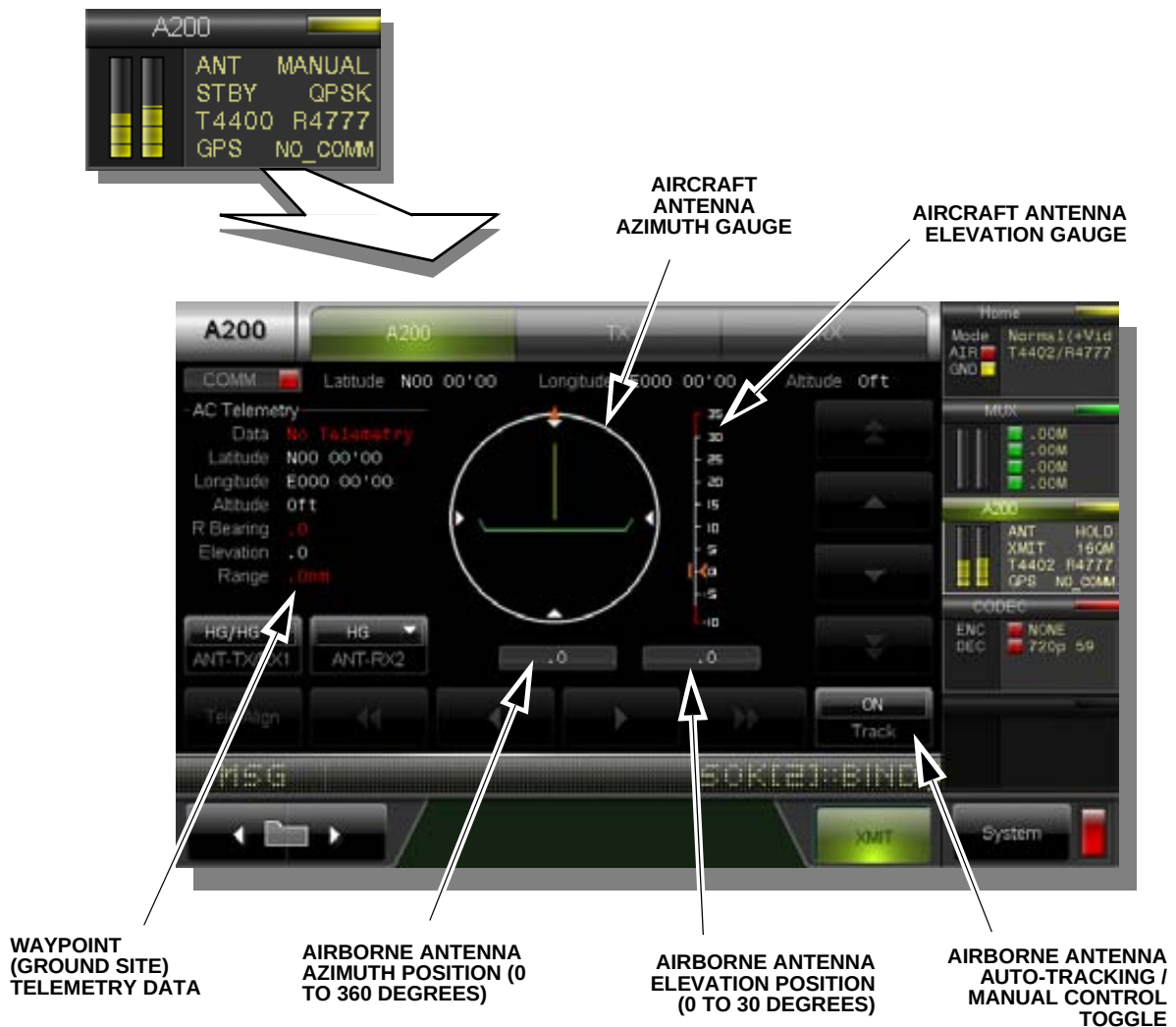


Figure 3-31. A200 Ground Antenna Status and Control Page

3.6.4.1 A200 - Antenna Page

The A200 antenna page offers the user complete access to the airborne system's antenna operational status and control functions. These include the waypoint (ground site) telemetry data, aircraft antenna status including azimuth position (relative to ground site as well as tracking data), antenna elevation position as well as access to manual control of the airborne antenna (refer to [Figure 3-32](#)).

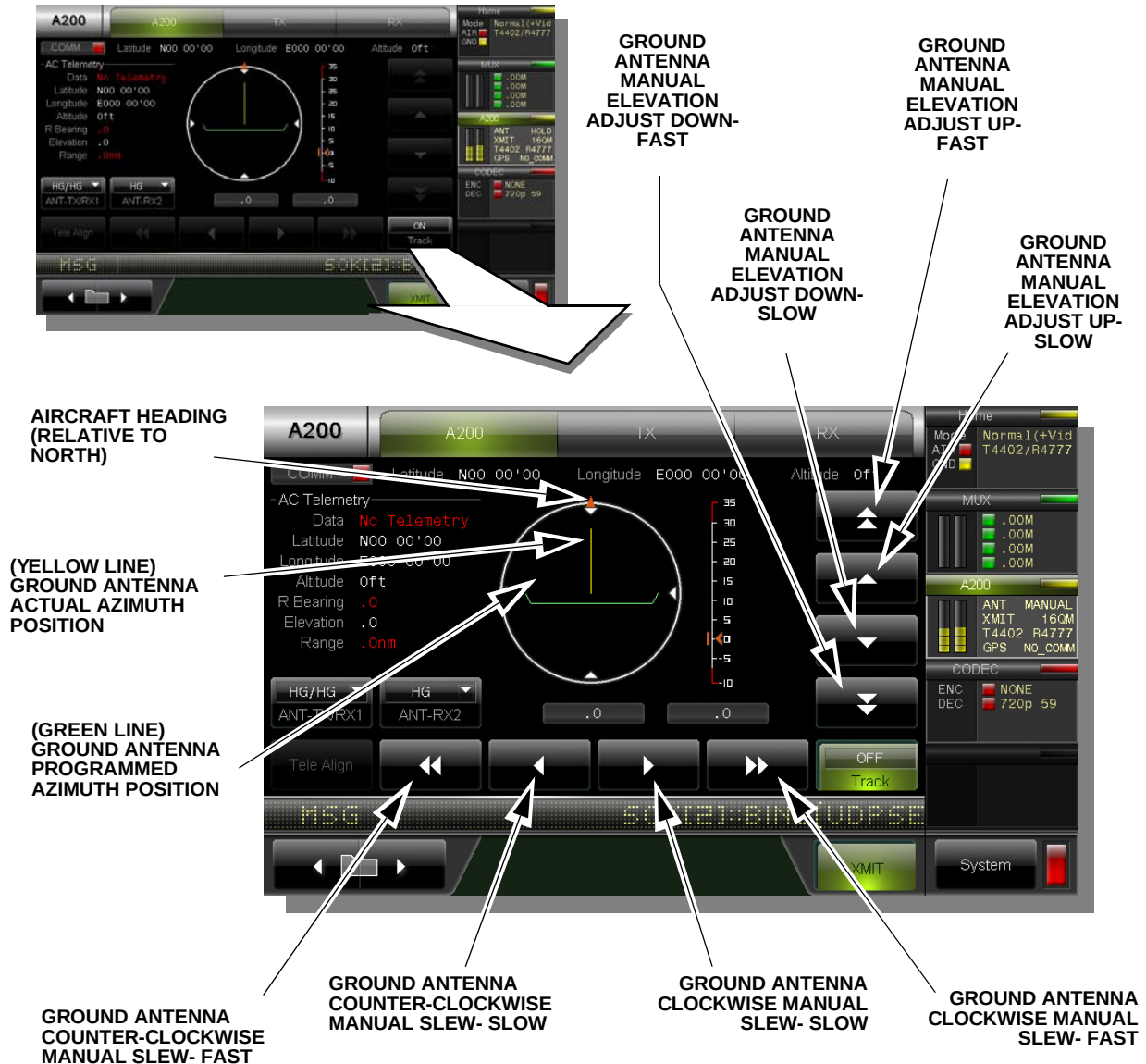


Figure 3-32. A200 Antenna Page Functional Detail

3.6.4.2 A200 - Transmitter Page

The A200 transmitter page provides access to transmitter encryption protocols (refer to [Figure 3-34](#) for encryption protocols) as well as several transmitter control settings including: Tx modulation, forward error correction, transmitter guard, Tx bandwidth, Transmission bitrate and transmitter power (see [Figure 3-33](#)).

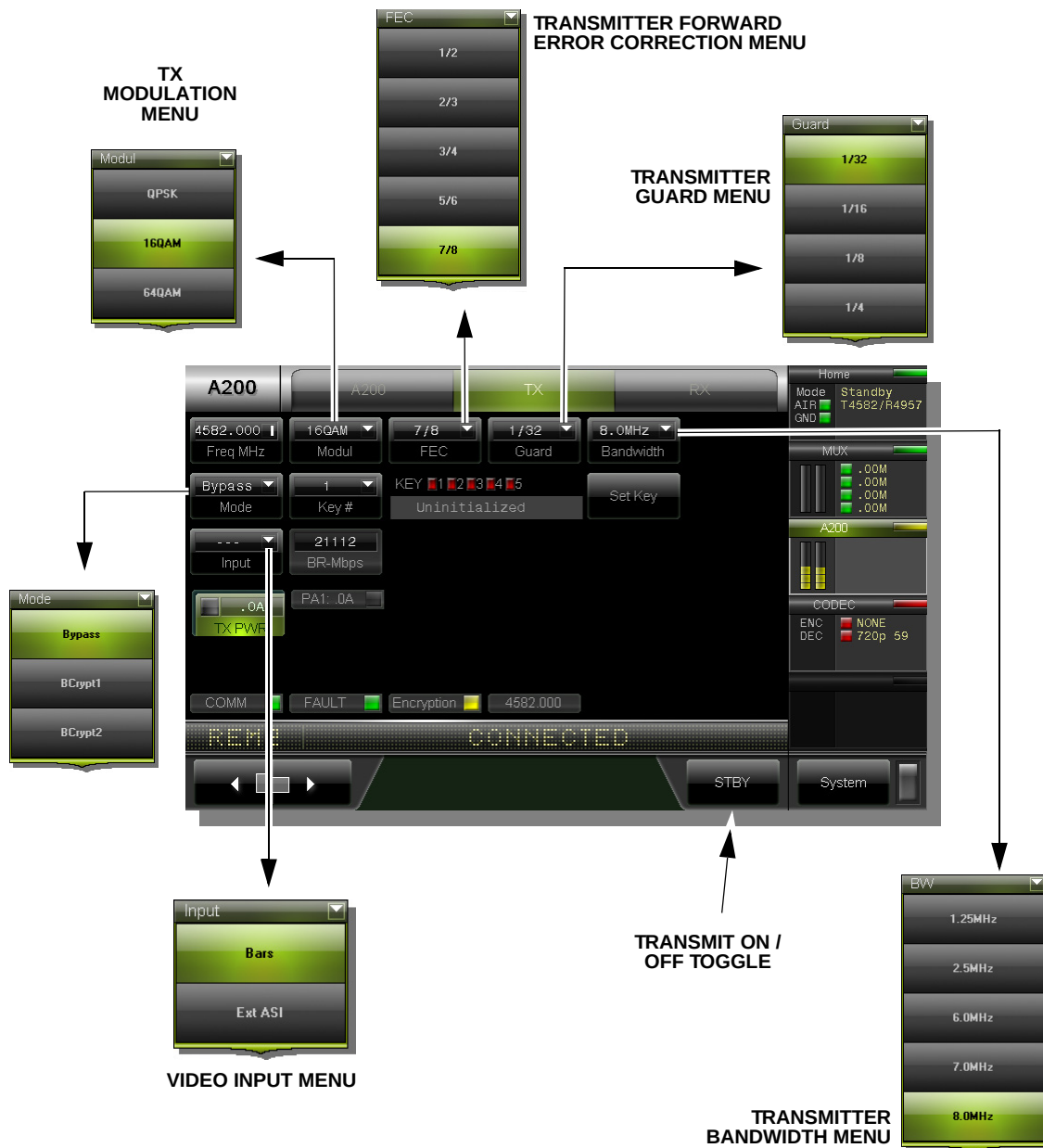


Figure 3-33. A200 Transmitter Settings Page

3.6.4.3 A200 - Receiver Page

The A200 receiver page provides access to several receiver control settings including: Rx modulation, forward error correction, receiver guard, Rx bandwidth, receiver bitrate and receiver power (refer to [Figure 3-34](#) for setting menus) as well as transmitter encryption protocols (see [Figure 3-33](#)).

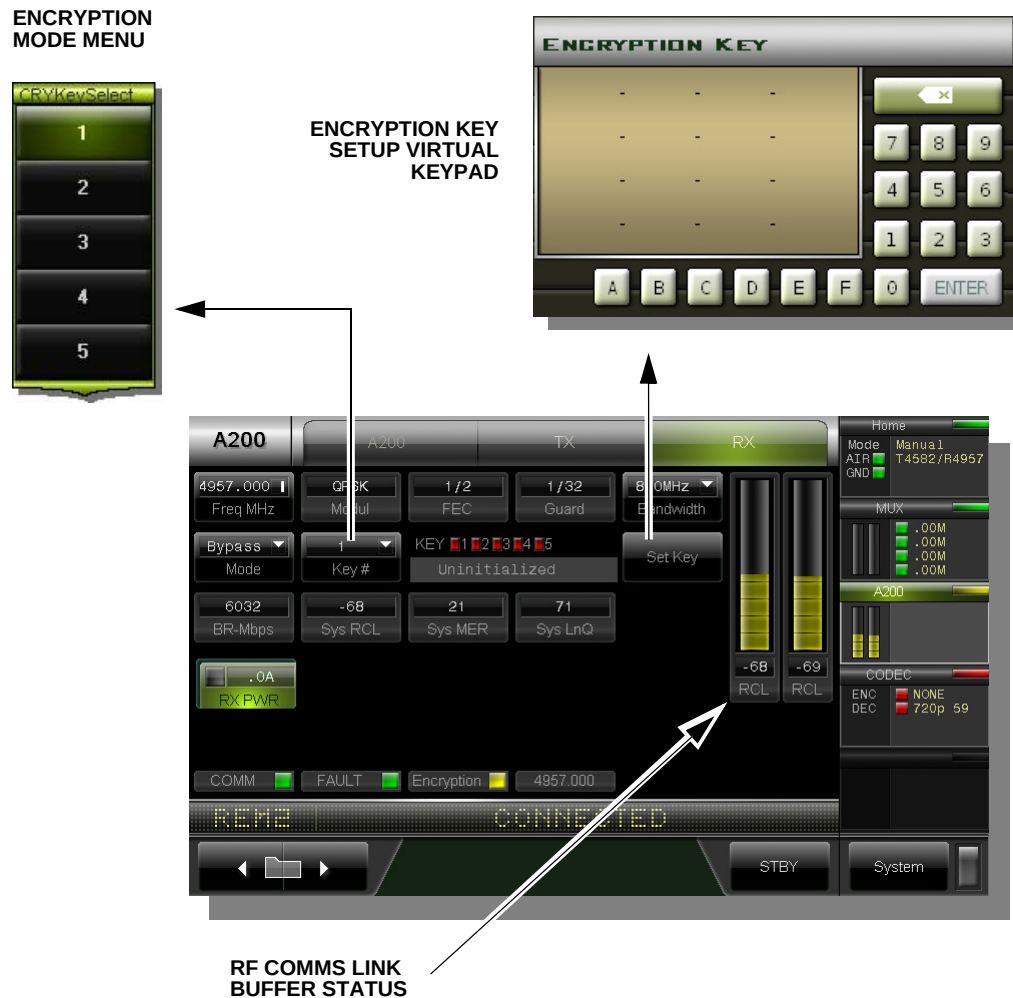


Figure 3-34. A200 Receiver Settings Page

The security protocol for the transmitter of this system requires an encryption key. The encryption key is the passcode required for transmission encryption.

3.6.4.4 Creating Encryption Keys

The encryption protocols for this system utilizes the Advanced Encryption Standard (AES) and Data Encryption Standard (DES), depending on the user's encryption requirements.

Do the following to set a new encryption key:

1. Access the security tab and press the Key # icon.
2. Press the Key number that requires new encryption (1 through 8).
3. Press the Encryption Mode icon.
4. Select the required encryption mode (see above - Bypass, AES128, AES192, AES256 or 3DES).
5. Press the Set Key icon to access the hexadecimal virtual keypad.
6. Key-in the encryption code per the requirements of the selected encryption mode (32 to 64 bit - see above).
7. Press the ENTER key to record the new encryption.

**AES128 AND 3DES
REQUIRE 32-BIT
ENCRYPTION KEYS**



**AES256 REQUIRES A 64-
BIT ENCRYPTION KEY**



Figure 3–35. Programming a New Encryption Key

3.6.5 CODEC - System Encoding and Decoding

The CODEC screens access the video and audio data encoding and decoding settings. It is from these pages that the user can access and alter the encoding of the data for RF transmission and decoding once the data is received.



Figure 3–36. DAVIE - CODEC GUI Pages

3.6.5.1 CODEC - Encoder Page

The CODEC encoder page provides access to the video and audio encoder settings including: video input format, input video scale, video data transmission bitrate, right and left channel audio transmission bitrate, transmitter bitrate, video test screen generator setting, frame, GOP and GOP mode and encoder power toggle.

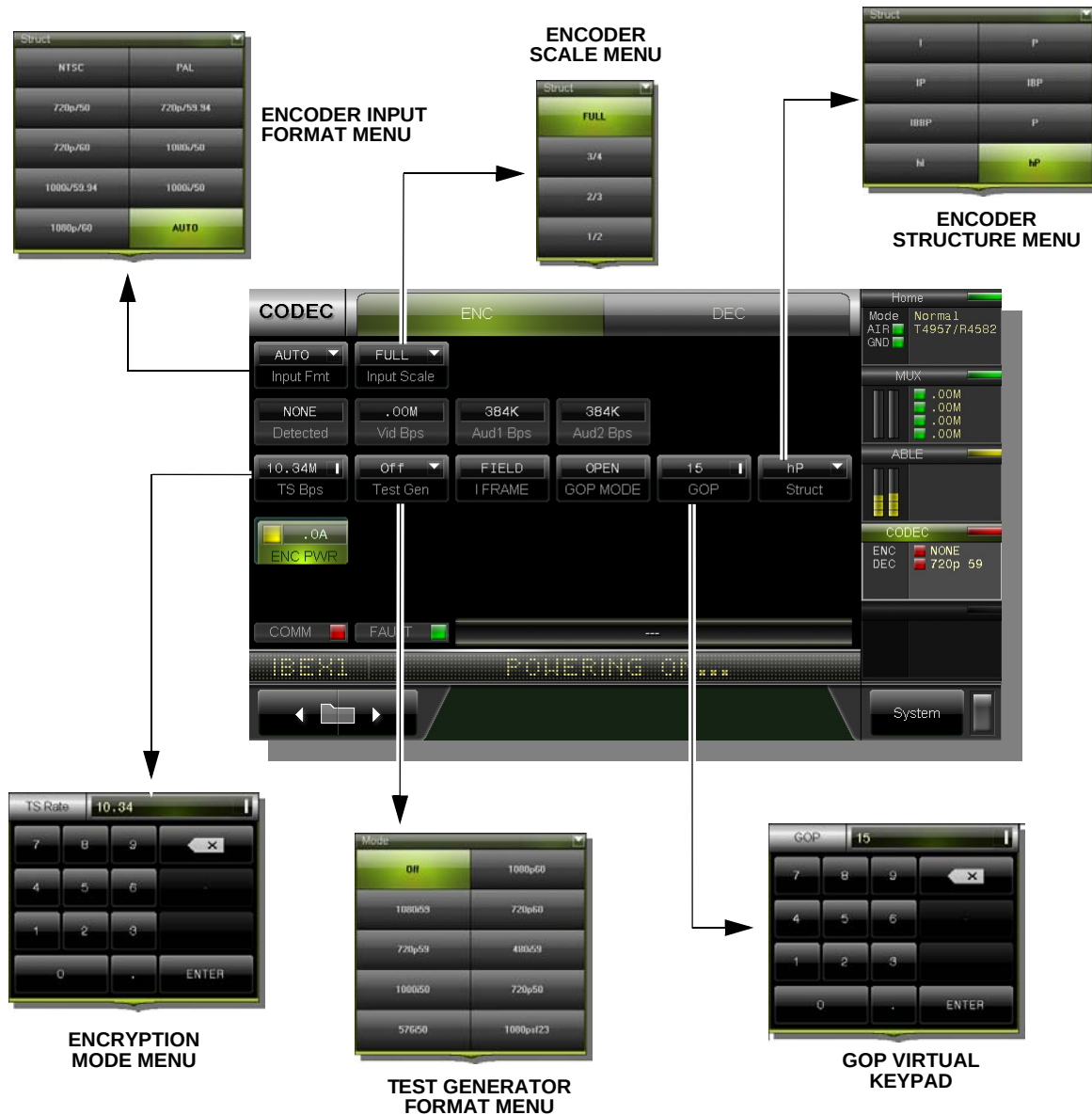


Figure 3–37. CODEC Encoder Page

3.6.5.2 CODEC - Decoder Page

The CODEC decoder page provides access to the video and audio encoder settings including: video resolution setting, video data transmission bitrate, right and left channel audio transmission bitrate, transmitter bitrate, and decoder power toggle (see [Figure 3–38](#)).

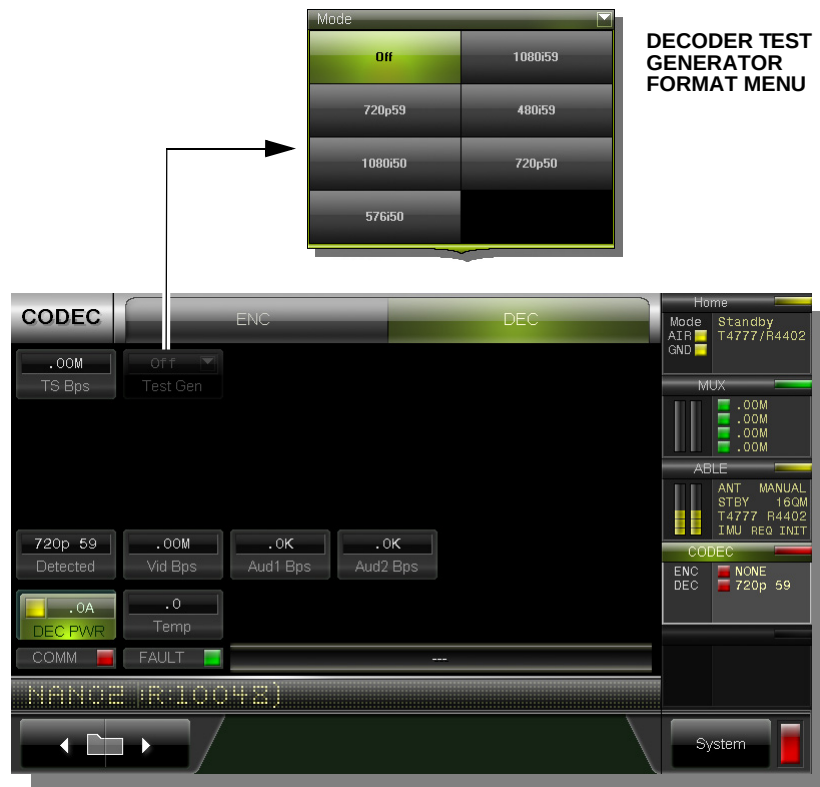


Figure 3–38. CODEC Decoder Page

3.6.6 System Screens

The system screens power settings for the airborne system as well as access the system status for the DAVIE and ABLE as well as the software referential data.

3.6.6.1 System - Power Page

The system power page provides the power status of various subsystems.



Figure 3–39. System Power Page

3.6.6.2 System - Software Page

The system software provides the user with the software version data and access to the software update utility.



Figure 3–40. System Software Page

3.6.6.3 System Remote 1 Software Page

The system remote software pages provide the user with the remote software version data and access to the software update utility.



Figure 3–41. System Remote 1 Software Page

3.6.6.4 System Remote 2 Software Page



Figure 3–42. System Remote 2 Software Page

3.6.6.5 System - CAL (Calibrate) - IMU Page

The system calibration pages access the status of the IMU and satellite tracking data



Figure 3–43. System Calibration IMU Page

3.6.6.6 System - CAL (Calibrate) - Satellites Page



Figure 3–44. System Calibration Satellite Page

3.6.6.7 System - CFG (Configuration) - Link Page

The system configuration pages provide the user with access system operational mode (user mode or maintenance mode), system clock settings, router data as well as access to link host settings (see [Figure 3-45](#))



Figure 3-45. System Configuration Link Page

3.6.6.8 System - CFG (Configuration) - Clock Page

The system configuration Clock page provides the user with the means to set the system clock (see [Figure 3-46](#)).

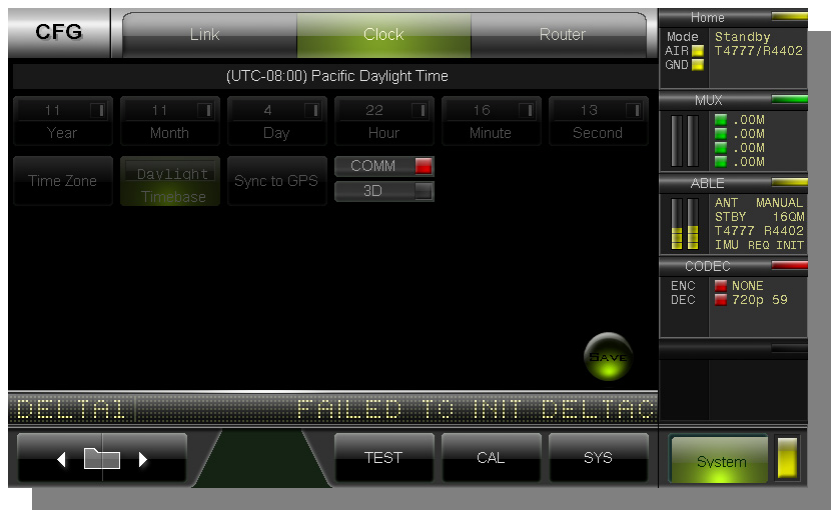


Figure 3-46. System Configuration Clock Page

3.6.6.9 System - CFG (Configuration) - Router Page

The system configuration Router page provides the user with the means to setup the system router (IP address, etc)(see [Figure 3-46](#)).



Figure 3-47. System Configuration Router Page



SECTION 4

TROUBLESHOOTING

4.1 INTRODUCTION

In the event of a malfunction, this section contains information and procedures for the maintenance and troubleshooting of issues that could occur that may effect the proper operation of the airborne microwave downlink system. Refer to the following sections herein to address these potential issues and the suggested procedures to correct them. In the event that the issue is not addressed in the Troubleshooting section, or the suggested action does not correct the problem, contact the manufacturer at the contact information listed within the manual herein.

4.2 MAINTENANCE

The A200 ENG Antenna system is a dynamic and high performance antenna that utilizes mechanical components and moving parts, increasing the possibility of eventual functional issues after a certain amount of system usage. In the event of a malfunction, refer to the troubleshooting sections herein or contact the manufacturer for the proper procedure to address, diagnose and correct the problem.

4.3 TROUBLESHOOTING

If a malfunction or operational anomaly occurs during usage of the airborne system, refer to the following Troubleshooting table to identify and possibly correct the problem.

Table 4–1. Troubleshooting the Ground-Based Microwave Downlink System

Problem	Possible Cause	Suggested Action
System inoperative	1. No power to system	1. Check system power switches • Check facility power supply connections
System has power but is inoperative	1. No power to S750 Controller and/or DAVIE 2. Controller software inoperative 3. Controller control connection(s) incorrect	1. Turn controller power on • Check controller connections 2. Check controller connections • Reboot system 3. Reconnect all cables • Check controller cable integrity
No RF reception	1. No video signal from antenna 2. No video signal from controller 3. No video signal from Controller 4. RF polarization conflict	1. Check antenna connections • Check antenna power 2. Check controller RF connection • Check controller power • Check software settings 3. Check controller RF connections • Check controller power • Check software settings 4. Change / Match polarization configuration
RF reception unclear	1. Local signal interference 2. RF Noise 3. RF reception weak 4. RF polarization conflict	1. Check system RF connections • Change antenna elevation • Clear from signal obstruction 2. Activate Low Noise Amplifier 3. Activate Low Noise Amplifier 4. Change / Match polarization configuration

SECTION 5

REFERENTIAL DATA

5.1 INTRODUCTION

The data included in this section provide referential information regarding the system or this document such as system specifications and cross reference to common specific nomenclature such as acronyms or abbreviations.

Additional documents that may follow this section, such as vendor component data may also be included such as:

- Component user manuals
- Data sheets
- White papers
- Operator instructions
- Specification sheets
- Engineering drawings
- Product listings

5.2 CONVENTIONS USED IN THIS DOCUMENT

Function Key Selections

Text appearing on the bottom line of the front panel display (just above the function keys) of the HD system assembly, the HD Interface or the HD Controller (i.e., commands associated with function keys A, B, C, D, and E) appear in the font, **Arial Rounded MT Bold**, used in the following example:

Emphasis

Text and terms that are emphasized to draw the reader's attention (due to their significance within the text) appear in *italics*. See the example below.

The camera system can be operated in *local* or *remote* modes.

5.3 WARNINGS, CAUTIONS, NOTES, AND HINTS

Warnings

Warnings are included to alert the user that possible hazards are associated with the processes/procedures described. These may cause death or injury in any form, if the instructions in the operational or procedural task are not followed precisely. Warnings describe the potential hazards and possible impact that could occur if the warnings are not observed.



WARNING: This format is used for general warnings.



WARNING: This format is used for electrical warnings.



WARNING: This format is used for mechanical warnings.



WARNING: This format is used for warnings which include the risk of fire.

Cautions

Cautions are included to alert the user that damage to the equipment (e.g., HD Controller) is possible if the instructions in the operational or procedural task are not followed precisely. Cautions describe the hazards and possible impact that could occur if the cautions are not observed.



CAUTION: This format is used for all cautions.

Notes

Notes are included to provide the user with supplemental information, which is helpful but does not necessarily belong in the core text. Many operational and procedural tasks are easier with the addition of notes.



NOTE: This format is used for all notes.

Hints

Hints are generally included to inform the user of special features and/or methods of performing various tasks. These are usually unique features/methods that provide streamlined use of the equipment and/or user interface.



Hint: This format is used for all hints.

5.3.1 Abbreviations, Acronyms, Terms

Abbreviations, acronyms, and terms used throughout this manual are defined in the following list.

Term	Definition
AC	Alternating Current
ALT	Altitude
ANT	Antenna
AUX	Auxiliary
Az	Azimuth
BAS	Broadcast Auxiliary Service
CAL	Calibrate
CAM	Camera
Ch	Channel
COMM	Communication
COTS	Commercial-Off-The-Shelf
CPU	Central Processing Unit
dB	Decibel
DC	Direct Current
DMM	Digital Multimeter
e.g.	Latin: exempli gratia, meaning “for example”
EMI	Electro-Magnetic Interference
ENG	Electronic News Gathering
ESD	Electro-Static Discharge
et al	Latin: et alia, meaning “and others”
FM	Frequency Modulation
GPS	Global Positioning System
GUI	Graphic User Interface
HD	High Definition
Hz	Hertz
H/W	Hardware

Term	Definition
I/O	Input/Output
i.e.	Latin: id est, meaning “that is”
LAT	Latitude
LCD	Liquid Crystal Display
LED	Light Emitting Diode
LNA	Low-Noise Amplifier
LNG	Longitude
MICROWV	Microwave
NEMA	National Electrical Manufacturing Association
NIC	Network Interface Card
nm (NM)	Nautical Mile (note: 1 nautical mile equals 1.150782 miles)
NTSC	National Television System Committee
NV	NavTrack
PC	Personal Computer
PED	Pedestal
POL	Polarization
PRSETS	Presets
RAM	Random Access Memory
RF	Radio Frequency
RFI	Radio Frequency Interference
ROM	Read Only Memory
RPC	Remote Procedure Call
RX	Receiver/Receive
S/W	Software
SDI	Serial Digital Interface
SV	System Variable
TX	Transmitter/Transmit
V	Volt
VAC	Volts Alternating Current
VDC	Volts Direct Current
W	Watt

5.4 WARRANTY

Troll warrants, to the original Customer only, that the product is free from defects in material and workmanship and conforms to the specification, if any. If no specification is listed, the items are warranted to conform to our currently published specification for the product. The warranty period is for a period of one year from the date of shipment. Troll will repair or replace (at its option) any such device which is returned to the Troll factory office, with transportation charges prepaid and within the warranty period. The liability of Troll shall be limited to the repair or replacement of the device and shall not include installation, or any other charge or expense incurred. This warranty shall not apply to any unit or part thereof which, in the opinion of Troll, has been installed or used improperly; damaged by accident, corrosion, misused, or negligence; or altered or repaired in such a manner as to impair performance. Troll must receive written notice of the defect within the warranty period. Customer must pay packing, crating and transportation costs to and from the factory. At the Customer's request, Troll will make reasonable efforts to provide warranty service at the Customer's premises, provided that Customer pays Troll's then current rates for field service and the associated travel and living expenses. If a fault has been caused by improper installation, maintenance or use, or by abnormal conditions of operation, those repairs will be billed at normal rates. Troll shall have the right of final determination as to the existence and cause of any such defect.

5.5 DO-160 TESTING

The SkyLink-Mini pod has passed DO-160 tests in both the mechanical and electrical categories.

5.5.1 DO-160 Mechanical Testing Categories

- Temperature and Altitude
- Temperature Variation
- Humidity
- Vibration
- Waterproofness
- Sand and Dust
- Salt Spray
- Lightning Direct Effects

5.5.2 DO-160 Electrical testing with EMI

- Magnetic Effects
- Power Input
- Voltage Spike
- Audio Frequency Conducted Susceptibility
- Induced Signal Susceptibility
- Radio Frequency Susceptibility
- Emission of Radio Frequency Energy
- Electrostatic Discharge

Table 5–1. RTCA DO-160E / DO160F Test Summary

Test Description	Section	Category
Temperature and Altitude	4	B3
Temperature Variation	5	B
Humidity	6	A
Operational Shocks and Crash Safety	7	B & D
Vibration	8	U2
Magnetic Effects	15	A or B
Power Input	16	Z
Voltage Spike	17	A
Audio Frequency Conducted Susceptibility	18	B
Induced Signal Susceptibility	19	CC
Radio Frequency Susceptibility	20	T
Emission of Radio Frequency Energy	21	M
Lightning Direct Effects	23	N.A.
Electrostatic Discharge	25	A

5.6 SYSTEM SPECIFICATIONS

The following data are the specification for the components of this system

5.6.1 A200 Antenna

5.6.1.1 General

- System Type: Offset Feed Parabola
- Main Antenna: Two (2) High Gain, Bi-directional, Parabolic Type

5.6.1.2 System Interface

- Connection:
 - (1) RF cable
 - (1) Control Cable
- Control: Troll Systems S750 Type Site Controller
- Power Input: 115 / 230 VAC
- Power Output: 12 VDC and 28 VDC (3 Amps)
- Antenna Control Device: Servo Motor Drive

5.6.1.3 Main Antenna

- Type: Parabolic
- RF Frequency Range: 2.0 - 2.5 GHz
- Gain: 20 dBi

5.6.1.4 Antenna Feed

- Configuration: 2 GHz Broadband
- Antenna Polarization:
 - Vertical
- Steering (Az): Continuous.
- LNA: 2.0 - 2.5 GHz

5.6.1.5 Rotator Assembly

- Rotation: Continuous
- Rotator Drive: 28 VDC Motor
- Rotation Speed: Max Speed 60 Degrees/Second

5.6.2 Antenna System Functional Components

The antenna system in an assembly that is comprised of the following components:

- Antenna dish / feed assembly
 - Polarization switching
- AC - DC power converter
 - Lightning protection
- Servo drive assembly
 - Servo drive expansion board (custom component)
 - Servo motor (28 VDC)
- Low noise amplifier (LNA)
- Channel filter with bypass option

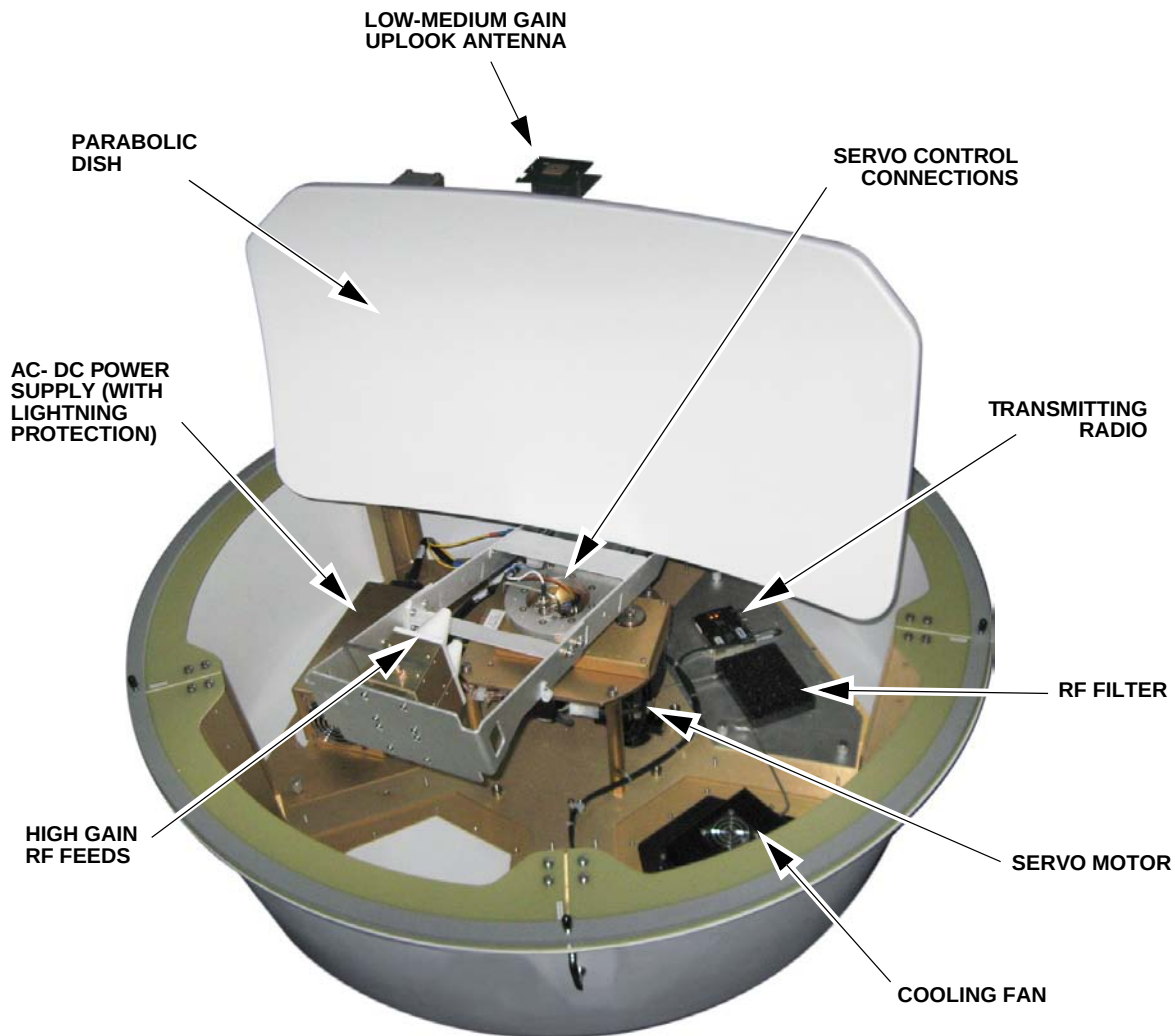


Figure 5–1. Antenna Assembly Interior Configuration

5.6.3 S750 Local Antenna Controller



Figure 5–2. S750 Diversity Receive Site Controller

5.6.4 Specifications

- Processor: AMD MIPS AU1500@400MHz
- Memory: 64MB RAM
- Storage: 256MB Compact Flash
- OS: Windows CE 5.0
- Serial Ports:
 - Two (2) Multimode RS-232/422/485
 - Three (3) RS-232
 - Expandable via ConTroll-PACs
- USB Ports: Five (5)
- Modem: internal Dial-Up
- Ethernet: One (1) 10/100 Integrated NIC
- Control Modes: Remote Via Master Control System
- Local 4 x 40 Character LCD Display with Keypad
- Weight: 14 lbs.
- Vertical Rack Space: 2 EIA Rack Units
- Dimensions: (L x W x H) 19" x 3.5" x 12.25"
- Input Power: 100-240 VAC, 50-60Hz, Maximum 300 Watts
- Temperature Range: -20° to +50°C (-4° to 122°F)

5.6.5 DAVIE: Data And Video IP Encapsulator



Figure 5–3. DAVIE (Data and Video IP Encapsulator)

The DAVIE provides the following features:

- 3U rack-mounted controller
- 115VAC power (DC optional)
- 100W (1amp nominal)
- HD-SDI/SDI video inputs (2)
- Composite video inputs (2)
- HD video outputs (2 HD-SDI, HDMI) at any resolution from 480i to 1080P/60 (full HD)
- Down converted outputs of above signals (2 composite)
- PIP (picture in picture) capability allowing two additional images to be composited on one screen
- Annotation overlay allowing text and graphics to be added to images
- Video Encoding using ultra-low latency H.264 compression (Mpeg4)
- Optional (not included) second Encoder to multiple simultaneous streams
- Video Decoding of H.264 video streams
- 10/100/1000 Ethernet inputs for transferring user data
- Mux video, control data and file data.
- Control of ABLE and GBLE microwave link equipment
- Front panel 7" touchscreen monitor for system control
- May also be controlled remotely with C100 and/or Cyclops software on computer
- Optional (not included) DVR capable of recording up to two streams and playback simultaneously. 100 hours of capacity per cartridge.



SECTION 6

ENGINEERING DRAWINGS

6.1 INTRODUCTION

This section contains top level engineering drawings, such as assembly drawings, schematics, and interconnect diagrams that define the configuration of the equipment used in this system.

6.2 DRAWING LIST

The drawings contained in this section are filed in alpha-numeric order. Digital versions of this document may not include the engineering drawings, but may be included as separate digital files for efficiency and accessibility.

