



GS-S/ GS-L
S-Band/ L-Band Ground Station
for UAV/ UGV/ USV

User's Guide & Operating Manual

REV. X0 - 21 April 2007

<http://www.avalonrf.com/>

Avalon RF, Inc. • 344 Coogan Way • El Cajon, CA 92020
Phone: (619) 401-1967 • Fax: (619) 401-1971 • Email: sales@avalonrf.com

Table of Contents

1.	General.....	1
	Figure A – GS-S-20 Controls and Connectors	3
	Radio Reception	4
	Video Output.....	4
	Telemetry Downlink (optional).....	4
	Control Uplink (optional)	4
	Power	4
2.	Specifications.....	5
	Electrical Specifications	5
	Interconnecting	7
	Figure B – IO Connector pinout	7
	Mounting.....	8
	Mechanical Data	9
	Environmental Conditions	10
3.	Operating the GS-S.	11
	General Guidelines	11
4.	Error Conditions	12
5.	Ordering information	13
	Base models.....	13
	Options	13
	Recommended Accessories	14
6.	Connection Diagrams.....	15
	Appendix A: Interface Cable diagram.....	15

1. General

The Avalon RF GS series Ground Stations for Unmanned vehicles currently has 4 models-

GS-L-13	L-Band 13 dBi receive gain
GS-L-18	L-Band 18 dBi receive gain
GS-S-15	S-Band 15 dBi receive gain
GS-S-20	S-Band 20 dBi receive gain

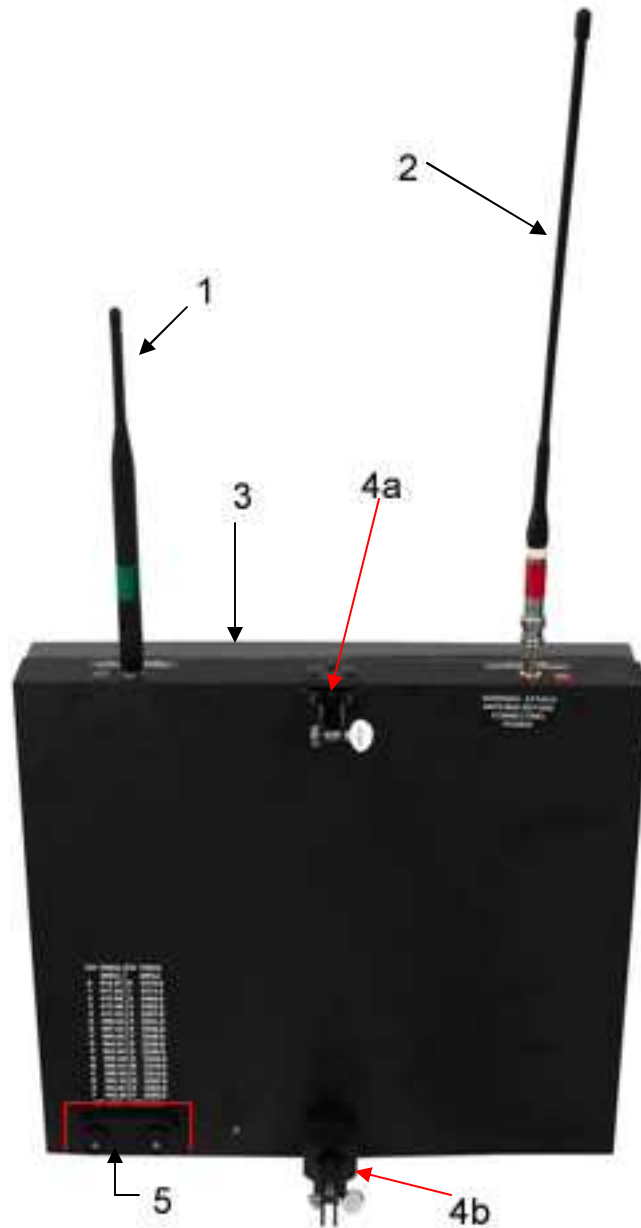
The GS is a complete radio Ground Station for use in military, homeland security, mobile security etc. for reception of wireless video from an airplane transmitter (e.g. a UAV/ Helicopter). It comprises of a video and telemetry downlink and a UHF control uplink. The unit is completely self-contained and requires no setup or connections of antennas, cables etc. All accessories have been supplied to setup a link within a few minutes.

The GS features a patented design that allows for excellent reception of wireless video with our unique diversity mechanism. With the GS-S-20 and the Avalon RF TX630 Video transmitter (higher power rf amplifier also available) a wireless video link of more than 17-18 miles is possible. The GS does not have any moving parts, which facilitates its usage in harsh weather including dusty/ saline/ icy environments. It is weatherproof and all I/O including power is made available through a robust 12-pin LEMO connector. The operating distance depends on a variety of factors such as transmit antenna gain, transmitter power etc.

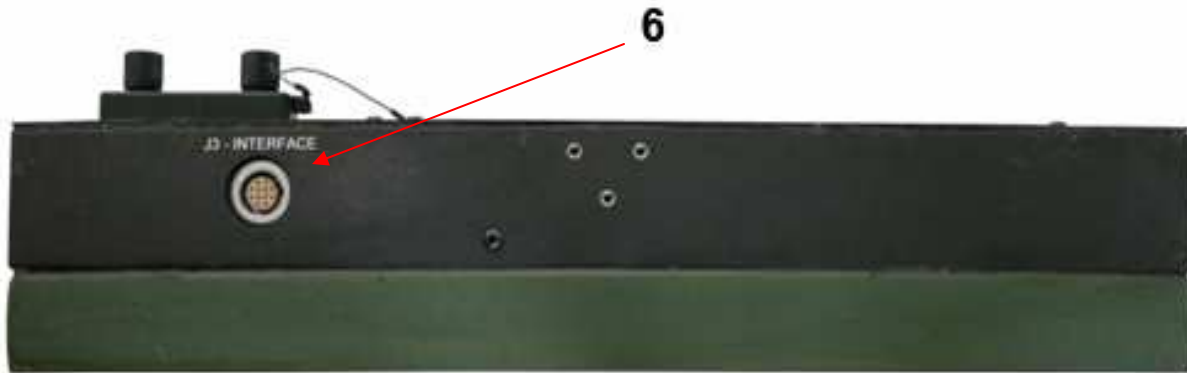
The GS-S looks like a picture frame with the front face actually a high gain directional flat panel antenna. The diversity mechanism works with this directional antenna and an omni directional antenna to give the best video signal reception. The control uplink is an independent UHF data link and has a separate antenna.

It has the following features:

- A single high quality video channel with no delay.
- Very easy setup with 16 channels for video downlink frequencies and 16 channels of UHF uplink frequencies
- RSSI signal outputs to set up a tracking system



Rear View	
1	Downlink Omni Antenna (Green Band)
2	Uplink Omni Antenna (Red Band)
3	High Gain Directional Flat Panel Antenna
4a	Top Mounting Clamp
4b	Bottom Mounting Clamp
5	Switch Cover



Bottom View	
6	Interface Connector – 12 Pin LEMO

Figure A – GS-S-20 Controls and Connectors

Any reference to the GS-S-20 in this manual is applicable to all the GS models except where explicitly stated.

1.1 RF Reception.

The GS-S-20 has a high gain 20 dBi flat panel antenna and a detachable omni antenna (via a SMA connector) that works with our advanced diversity electronics to yield excellent wireless video reception. The video receiver is allowed to determine the best video signal and the analog RSSI signals of both inputs are used to set up a tracking mechanism.

1.2 Video Output.

The intelligent electronics in the GS-S-20 performs diversity both on the rf signal and on the video signal. The final output is available dc restored to ground and continuously corrected for optimum level (1V p-p).

1.3 Telemetry Downlink.

With this feature, the audio sub-carrier on the rf signal is configured to receive digital data at 4.8Kb/s. This received digital information is then processed for timing recovery and made available at RS232 levels for direct connection to a serial port of a pc.

1.4 Control Uplink.

This data link is used as an uplink for camera control (typically PTZ) and works on UHF frequencies. A separate (detachable) omni directional antenna is installed on the GS-S-20 for communication with a companion receiver on the airplane. The input data is RS232 compatible at 4.8Kb/s and is transmitted wirelessly with error correction for accurate reception.

The combination of this uplink and the telemetry downlink gives a full duplex data communication with the bird (UAV/ Helicopter).

1.5 Power.

The GS-S-20 works off a standard 12V power source. The load is approx 1.2A or less. Please ensure that the power supply is capable of at least 4-5A current output to allow for the turn-on current surge.

2. Specifications

2.1 Electrical Specifications.

Frequency Range:

GS-S 2300 – 2500 MHz (standard)

GS-L 1700 – 1850 MHz (standard)

Tuning: 16 channels (determined by user defined frequencies) via rotary switch

RF Sensitivity: typ better than - 84 dBm

Bandwidth: 16 MHz

Antennas: 1 x 5 dBi omni antenna (detachable)

GS-S-20 1 x 20 dBi flat panel (HBW= 15; VBW= 16) on front face

GS-S-15 1 x 15 dBi flat panel (HBW= 20; VBW= 33) on front face

GS-L-18 1 x 18 dBi flat panel (HBW= 20; VBW= 20) on front face

GS-L-13 1 x 13 dBi flat panel (HBW= 30; VBW= 30) on front face

Video Output: NTSC or PAL (depending on system ordered)

Video level: 1 Vp-p into 75 ohm, Negative Sync Tip, dc restored to ground.

Telemetry Downlink (optional)

Telemetry output: RS232 compatible signal levels with 8 data bits, No Parity, 1 stop bit

Baud Rate: 4800 Baud

Control Uplink (optional)

Frequency Range: 392-420 MHz standard; any 40 MHz band in the frequency range 350 MHz – 800 MHz possible

No of Channels: 16 via rotary switch (user determined channel frequencies)

RF Impedance: 50 ohm

RF Output: 1W

Antenna: Half wave Omni directional (2.2 dBi gain), detachable

Data Input: RS232 compatible signal with 8 data bits, No Parity, 1 stop bit

Data Rate: 4800 Baud

Power: 12V unregulated DC nominal; 10 -17V DC input
Consumption: < 1.3A

2.2 Interconnecting.

All input/ output signal connections to the GS-S-20 are available through the 12-pin connector on the bottom of the unit.

The pin out of the 12-pin connector is as shown in figure B.

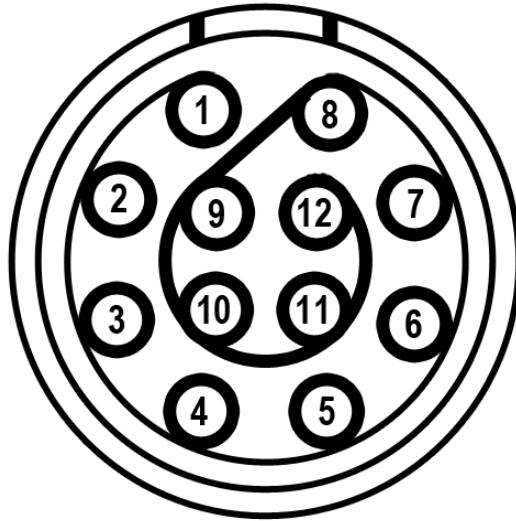


Figure B – IO Connector pinout

Pin #	Function
1	Power Input (10 Vdc to 17Vdc)
2	Power Return
3	Video Output
4	Video Return/ground
5	RSSI- Antenna 1
6	RSSI- Antenna 2
7	Program Tx (RS232)
8	Program Rx (RS232)
9	Signal ground
10	Uplink Enable
11	Downlink/ Telemetry data (RS232 level)
12	Control / Uplink data (RS232 level)

Avalon RF has supplied a 12-pin cable that breaks out into separate connections for power, video, telemetry and control uplink data. The RSSI signals and the programming RS232 signals are also brought out on this cable.

2.5 Mechanical

2.5.1 Mounting/ Installation.

The GS-S-20 is light enough to be carried in a backpack. The mounting brackets have been designed to tilt the antenna correctly for a target UAV at a distance of about 5miles or more and flying at an altitude of > 500 ft. It is designed to be mounted to a pole with a tripod mount. The user can use other mounting methods to suit their specific applications.

As a general rule, the GS-S-20 should be placed as high as is practically possible to maximize the operating range/ distance. The GS-S-20 should be mounted/ installed with the 2 detachable antennas upright. Also, ensure that there is a clear radio line-of-sight between the UAV/ transmitter and the GS-S-20 and that there are no high power transmitters in close proximity (even though they maybe known to be on other frequencies/ frequency bands).

As with any portable equipment, please exercise care and ensure safety of personnel. Do not place the unit at a location where if accidentally knocked over, it might jeopardize the safety of others.

2.5.2 Mechanical Data.

a) Size (see Figure G)	W (in/mm) x H (in/mm) x D (in/mm)
GS-S-20	13.5/ 343 x 12/ 305 x 3.5/ 89
GS-S-15	10.5/ 267 x 6.5/ 165 x 3/ 76
GS-L-18	15.5/ 394 x 16/ 406 x 3.5/ 89
GS-L-13	9.5/ 241 x 9.5/ 241 x 3/ 76
b) Weight	< 2.7 lbs (1.2 Kgs) without interface cable
c) Shipping weight	< 5.5 lbs (2.5 Kgs)

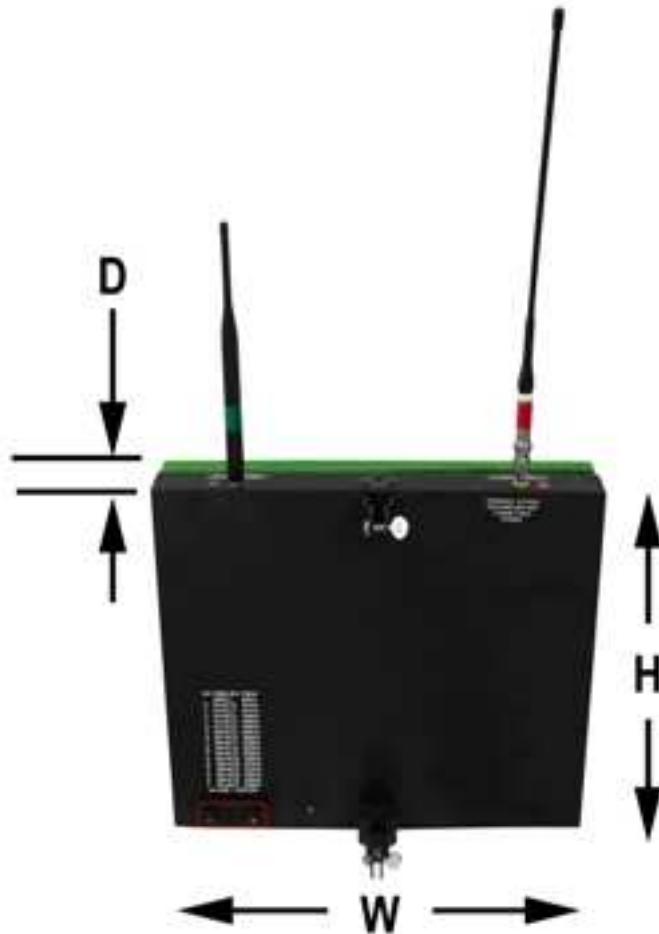


Figure G – GS Series Mechanical Outline

2.6 Environmental Conditions.

The TA-8 Series is designed to meet the following environmental conditions:

- 2.6.1 Operating temperature -4° to 122° F
-20° to 50° C
- 2.6.2 Storage temperature -13° to 150° F
-25° to 65° C
- 2.6.3 Humidity 5 to 95%, non-condensing
- 2.6.4 Inclination Any
- 2.6.5 Altitude -1500 feet to 15,000 feet
-450 meter to 4,500 meters

3. Operating the GS-S.

All required internal antenna connections have been made inside the GS-S. If installing any user equipment inside the enclosure, please do not disconnect any factory made antenna connections.

NOTE

The GS-S requires a radio line of sight (LOS) to work correctly. It may be used in other partially blocked LOS situations but the operating distance could be significantly reduced.

WARNING

The Uplink antenna MUST be connected before powering on the GS-S. Failure to do so might damage the Uplink power amplifier.

Operation of the GS-S is very simple. The user must first connect the 2 detachable omni antennas – the Uplink antenna and the downlink antenna. Mount the GS-S on a stable tripod or base.

Unscrew the frequency select switch cover (it is anchored by a wire to the frame) and let it hang loose. Do not remove the cover completely by cutting the holding wire or unscrewing its retainer. This cover has a water tight seal and is essential to protect the electronics inside from ingress of water. Select the downlink frequency of the signal of interest and the control Uplink frequency to match the UAV/ vehicle (the frequencies selection can also be done later).

Connect the interface cable connectors to the respective receptacles/ plugs and then plug into the GS-S.

3.1 General Guidelines

While the setup of the GS-S link is very simple, observing a few considerations will help get the optimum performance.

First, height of the equipment plays an important role in the distance over which the radio link works. The higher you place the GS-S, the longer the available link range. This is a direct result of the increased distance to horizon and clearing/ improving any Fresnel zone

obstacles. Please use proper judgment of safety when following this advice, especially for mobile applications.

For any rf signal, having metal objects near the receiving or transmitting antenna will severely affect the performance. With this in mind, avoid placement in any location that has large metal structures or objects that hinder a good LOS to the transmitter. The GS-S being a microwave receiver, trees and buildings are also an obstruction to signal reception.

The radio link must be configured correctly and the equipment chosen to meet the required range/ distance. Choice of transmitter amplifier, output power, type of antenna etc. is governed by considerations such as battery power on the UAV/ airplane, permissible antenna height on the UAV/airplane, cooling for transmitter etc. If you need assistance, please call Avalon RF Engineering at 619-401-1967.

4. Error Conditions

T.B.D.

5. Ordering information

5.1 Base models

GS-S-20	S-band 20 dBi Ground Station
GS-S-15	S-band 15 dBi Ground Station
GS-L-18	L-band 18 dBi Ground Station
GS-L-13	L-band 13 dBi Ground Station

All units come with the following standard accessories:

5.1.1 Universal input (100 – 240V, 50-60 Hz) AC power adaptor.

5.1.2 User guide & operating manual (this manual).

5.1.3 Interface cable for connection of data IO.

5.2 Options.

5.2.1 Option 00 – European version (PAL).

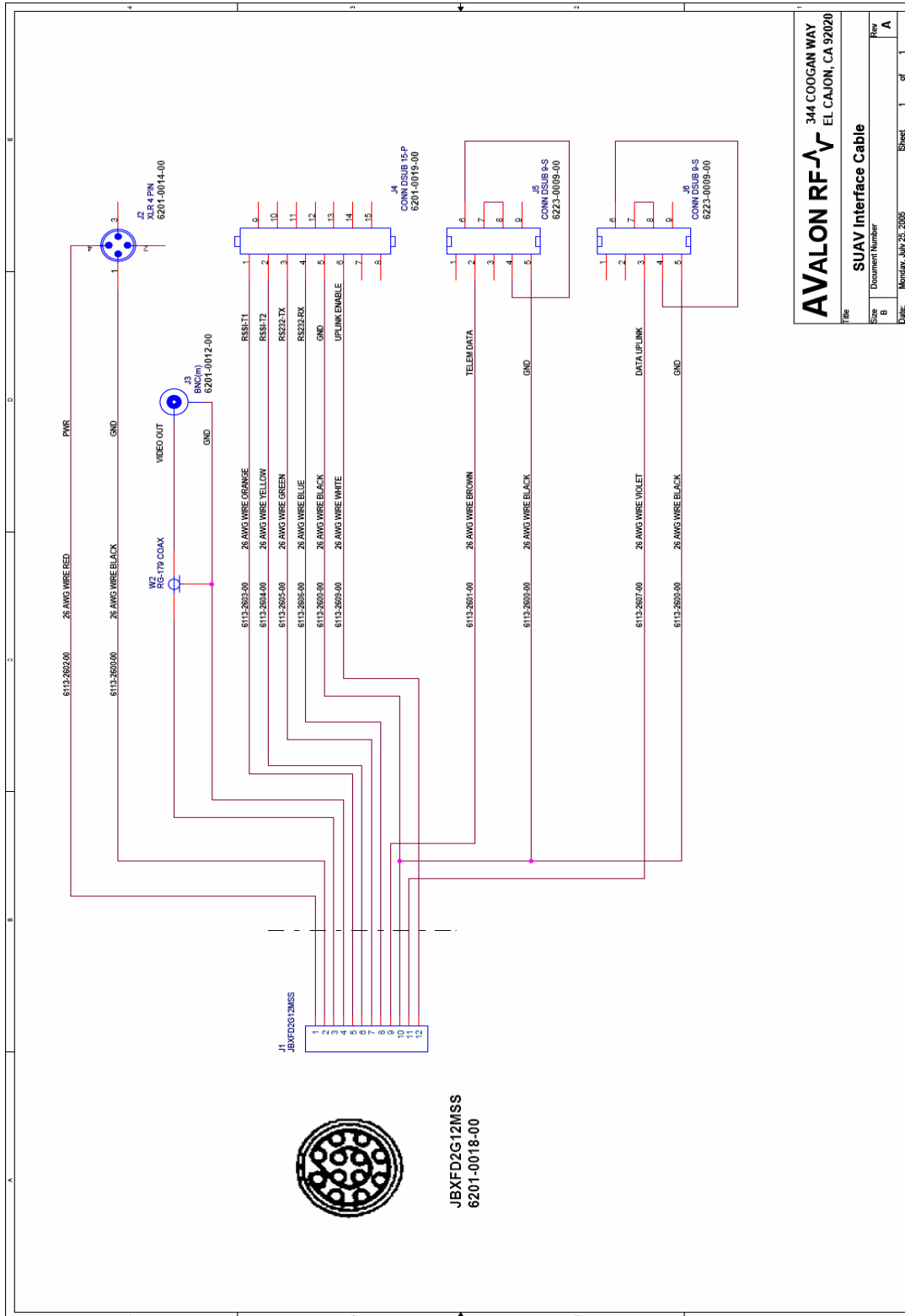
5.3 **Recommended accessories.**

5.3.1 Additional power (power/ data IO) cable for mobile applications

6. Connection Diagrams

Appendix A

Interface Cable Diagram



AVALON RF 344 COOGAN WAY
 EL CAJON, CA 92020

Title: SUAV Interface Cable
 Size: B
 Document Number: B
 Date: Monday, July 25, 2005
 Sheet: 1 of 1
 Rev: A