GROUNDCONTROL

TOUGHSAT
Users Manual

**Important warning regarding your
Ground Control Toughsat System**

ALL POWER to ALL system electronics MUST be disconnected if connecting the control cable from the Toughsat dish to the Toughsat ACU (Controller) and the iDirect modem.

Permanent damage will occur to the unit causing it to cease functionality until the unit is returned to Ground Control's facility for repairs. This damage is NOT covered under the unit's warranty.

If you have any questions regarding connecting or operating your Ground Control Toughsat system, stop and please contact our Technical Support Team immediately for assistance to prevent damaging your equipment. You can contact our 24/7 Support Team at the following:

<div align="center">

GROUND CONTROL SUPPORT
USA Toll Free: 1-800-931-5559
International: 00-1-805-783-4633
Email: support@groundcontrol.com

</div>

TOUGHSAT Owner Information

Please fill out the information on this page with the account information supplied to you from Ground Control and keep the manual in the rack-mount electronics case. It will be helpful both for on-site setup as well as required information if you need to contact Ground Control for support.

Ground Control Account Number: GC_____

iDirect or CPE Serial Number: _____

Modem Static IP Address: _____

System Type (Roof Mounted / Flyaway)   _____

Mobile System IP Address: _____

Router IP Address: _____

Contacting Ground Control Technical Support

Ground Control technical support representatives are available 24 hours per day for your convenience. Please note that our standard hours of operation are Monday – Friday, 8AM to 5PM Pacific Standard Time. If you call outside of these hours, support response may be delayed and certain resources may not be available to the support agent.

For Technical Support, please call **1-800-931-5559** from the U.S. or **+1-805-783-4633** from abroad. You may also email **support@groundcontrol.com** from a computer connected to working Internet connection.

Table of Contents

Toughsat Features

- Manufactured by Ground Control at our plant in California. Supported by us 24x7.
- Complete Ready-To-Go System pricing. No other equipment needed to purchase for operation.
- Bundled with our **High-Performance iDirect Service** providing up to 20Mbps x 5Mbps Internet speeds.
- We offer special service pricing for **Public Safety Organizations**.
- One-Button operation. The Toughsat may be deployed and operated by anyone with little or no training.
- Establishes a self-contained local area wireless "G" network (100' radius) automatically.
- Complete system pricing includes **Toughsat TS2 ACU (Antenna Control Unit)** & **iDirect Evolution X7 Router**.
- Black anodized billet aluminum construction, UV resistant plastics, sealed all-weather electronics.
- System is ideal for our **VoIP phone service**. Connect 1 or 10 phones that work like any phone.
- Typical seek time to find and lock on satellite and establish broadband connectivity is 3.5 minutes.
- Computer control is not required. There is no software to install on any computer.
- Both .98 & 1.2 systems have low stow heights below 12 inches. Excellent for vehicle clearance issues.
- No external equipment (including iDirect router) is required to find and peak on any Ku-Band satellite.
- No certification or licensing required for use. System may be operated by anyone.
- Dish peaking accuracy is within 0.1° with near zero play using dish braking technology.
- Impervious to magnetic interference. Search routines do not use a compass to acquire satellite.
- The XP is SNG rated to stream live video at guaranteed 4 x 4 Mbps with our **Streaming Services**.
- Autostow Feature - Dish will automatically stow if rig is moved or dish goes off signal.
- Optional UPS. A backup battery for stowing the dish if power is shut off or disconnected. **($299)**
- 6 watt transmitter is standard... required for 20 x 5 Mbps plans or video streaming. (8 watt available).
- The Toughsat is capable of locking on any liner polarized Ku-band satellite in orbit.
- Modular design - components easily replaced in field, normally within one hour.
- Onboard sensors allow quick-search for up to 10° of vehicle/rig tilt (longer times for tilting of > 10°)
- No-backlash locking mechanisms for Azimuth and Elevation to stabilize signal in high-wind operation.
- Dish arm stabilizing pneumatics maintain radio position in high-wind operation.
- The .98m XP is operational in Cat 1 hurricane force winds of up to 75 mph (the 1.2m XP is operational 50 mph).
- The XP is operational in temperatures of -20° to 140°F (-29° to 60° C) at 100% humidity.
- The XP operates in extreme weather with an **IP-66** ingress rated with **IP-67** components.
- The .98m XP weighs less than 125 lbs (56.7 kg). The 1.2m XP is 133 lbs.
- Powered by 100-240 VAC 50-60 Hz with US, UK, EU, AU and Brazil plug types available.
- Optional antenna booster extends wireless connectivity up to half a mile. **($299)**
- One button stowing in less than one minute from fully deployed.
- Operates globally in northern or southern hemispheres.
- **Standard Warranty** - 1 year parts and on-site labor.
- Extended 12 and 24 month warranties and Lifetime Radio Electronics warranties available. **more**
- Hundreds of Ground Control certified field technicians in the U.S. and Canada for on-site installations.
- Free 24-7 U.S. based technical support from Ground Control.

Toughsat TS2 Controller Features

▶ One-Button "Deploy" and One-Button "Stow" commands. Requires little or no training to operate.
▶ **Dual-Matrix** Sat 1 & Sat 2 buttons enable powerful redundant technologies for maintaining 100% uptime.
▶ Backlit display on 1RU ACU panel for real time system status.
▶ A 1RU ACU 19"w x 12"d x 1.75"h x with integrated full feature Wi-Fi router and 4 port LAN.
▶ Integrated full feature 4 port router to network up to 256 connected devices.
▶ Wireless 802.11 "G" access point rated at 54Mbps, with 4 port full-duplex 10/100 Ethernet Switch.
▶ Automatically establishes a 100' wireless access point and wiring to computers is optional.
▶ Integrated router is easily bypassed for supporting alternative router.
▶ Integrated high capacity MicroSD card for user manuals and other documents.
▶ Integrated DVB-S2 tuner reduces acquisition time and provides for satellite modem independence.
▶ Designed for communication with all iDirect iNFINITI, Evolution, and Tachyon routers.
▶ Wireless Security TKIP (WPA) and AES (WPA2) security with 128-bit encryption.
▶ SPI Firewall, VPN passthrough, MAC address filtering, NAT, DMZ, Port Forwarding, Port Triggers.
▶ DHCP Server, DHCP Client, QOS, Tos/DiffSerf, UPnP, MAC Address clone, RIP v1, RIP v2.
▶ No internal fan - ACU operates silent.
▶ Multiple Auto-Stow routines, loss of signal, vehicle movement, power loss. to prevent accidental collisions.
▶ Custom TS2 panel and web interface branding available for qualified resellers.
▶ Compatible with all Toughsat mobile systems.

Web Accessible Interface Screen

▶ ACU may be accessed by any connected computer/smartphone with browser. No software to install.
▶ Detailed intuitive screens allow for preference settings and powerful overrides of many system parameters.
▶ Controls to locate any visible satellite using satellite longitude only.
▶ Override GPS with any Lat/Long.
▶ One-button upgrading, with optional auto-update.
▶ System Status - dish location, GPS coordinates, signal strength and connectivity state.
▶ Full control over integrated router via interface screens.

Powerful Diagnostics & Auto Firmware Updating

▶ FREE Lifetime firmware upgrades with one-button simplicity.
▶ ACU automatically checks for firmware updates when connected to the Internet.
▶ System provides accurate technical diagnostics without dispatching a technician to remote site.
▶ Generates detailed running history log files that are kept on SD card and used for diagnostics.

Toughsat Standard Included Equipment

● The Toughsat XP or SP Mobile Satellite System.

● Toughsat TS2 ACU (Antenna Control Unit) with integrated 4 port wireless router.

● Evolution X7 Satellite Gateway (or other purchased VSAT gateway).

● 50 feet of cable run between dish and Controller

Using The Toughsat

Find A Level Area

If the Toughsat is within three degrees of level, it will normally find satellite within 3.5 minutes, otherwise the time to find satellite may be a few minutes longer.

A bullseye level in the driving cab will help. Also make sure to park in an open sky area where line-of-sight to the orbiting satellite is possible. (High in the Southern Sky in the USA). Avoid parking next to trees or tall structures & carry a compass to help park a rig.

Power Off During Generator Startups

STEP 2 – POWER OFF - Check to see that power to the electronics is turned off before starting the generator. This is a good practice to avoid any power spikes or low voltage issues.

STEP 3 – START THE GENERATOR, or connect to any power source you may be using.

X7 Front Panel

Power On   Press Deploy

STEP 4 – TURN POWER ON for the electronics (using power bar switch) and **wait 2 minutes** for the iDirect gateway to boot up and GPS to be found. The iDirect will front display will show solid amber RX (receive) and NET (Network) lights when ready.

STEP 5 – PRESS "Deploy" button to deploy the dish. It will take about 3.5 minutes for the system to automatically find satellite and create a wireless network. There is no other interaction required.

When The Toughsat Is Online

Gateway Online
RX TX NET and POWER lights are solid green

Toughsat TS2 Status Display

The system is online when the gateway lights (on the iDirect Evolution X7) show solid RX, TX, NET and Power lights are solid green. Also the Toughsat display will display the current system status. If you do not see this light pattern, it could be due to bad or incorrect cable connections. Please contact Ground Control support for help. Note that the iDirect does not have a power switch and turns on when power is present.

PRESS STOP TO STOP ALL DISH MOVEMENT of the Toughsat for any reason. You may press "Deploy" or "Stow" after pressing the "Stop" button.

Connecting To The Internet

The Toughsat is pre-configured, so connecting to the Internet is as easy as connecting to the LAN via Ethernet or the wireless access point. The default SSID for the Wi-Fi "**Toughsat <serial number>".** There are 4 Ethernet ports on the back of the ACU that access the LAN. Up to 256 LAN connections can be made. The router default configuration uses DHCP to manage the IP addresses, so all devices should be set to receive DHCP.
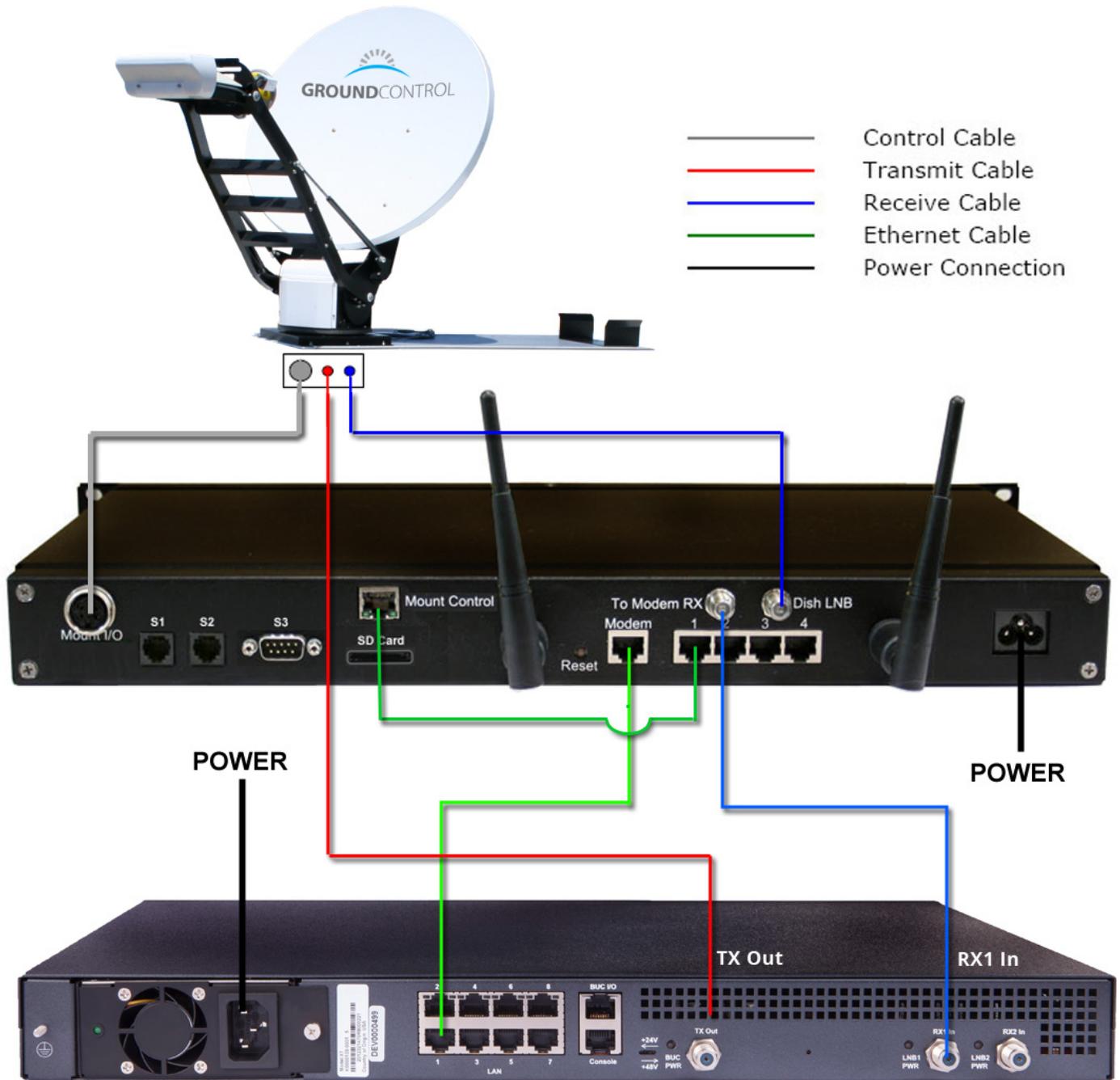

Ethernet or Wireless Connection
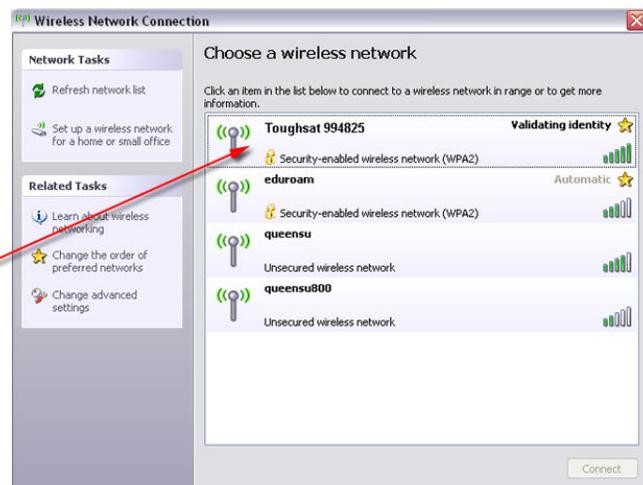
Once the computer is connected to the network, you may simply open any browser and navigate to any web page.

Areas To Physically Avoid

DANGER ZONE

The transmission strength is strongest between the radio and the reflector. Do not place any body part in this zone.

Toughsat Wiring Diagram

Above is the standard wiring between the Toughsat, the TS2 controller, and the iDirect X7 satellite router.

Input voltage is between 100/240 Volts AC. We strongly recommend using a UPS (Universal Power Supply) in situations where power is inconsistent, such as fuel powered generators, solar panels, and DC inverters.

NOTE - Commercial grade routers will work with our equipment, however support is limited from Ground Control for routing issues with unknown equipment.

WARNING – DO NOT PLUG IN CONTROL CABLE IF CONTROLLER IS POWERED ON. Doing so will damage electronics, which is not covered by the warranty.

Accessing The Wireless Router

You can reconfigure the wireless settings, add encryption or security, or even disable the wireless completely from the router interface at **http://192.168.1.1** Leave the username blank and the password is "**admin**". Do not change the static IP settings inside the router unless instructed by Ground Control.

Accessing The Toughsat Web Interface

You can view the Toughsat web interface, type in **192.168.1.2** on a connected browser.
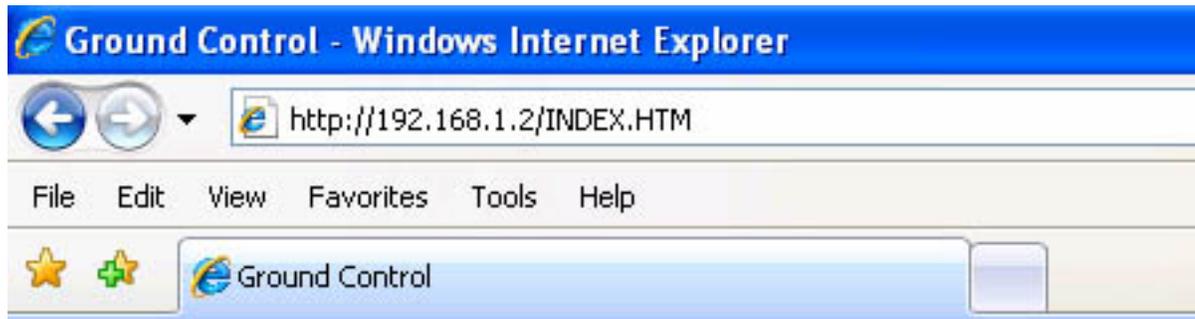
There are no logins or passwords for this page, and it contains a large amount of information about your system. Some menus will even allow you to change configuration settings for your dish. Leave these alone unless instructed or you know what you are doing. Many of these settings will prevent your dish from working correctly if changed. Contact Ground Control Technical Support if you have questions about the items on these pages.

First, look to the lower left quadrant of the screen, to the "Input Data" Section: Confirm that it displays "GPS Signal OK" and has GPS coordinates. Without this information, or if the Toughsat does not display "GPS Signal OK", it will not deploy. Once you have confirmed this, look for "Reference Satellite" and make sure it is the same thing as "Target Satellite".

When all of these things are true, click on "Find Satellite". This dish should lock on satellite and create an Internet connection automatically.

Now look at the "Signal Quality" section, here: and you will see what the Toughsat is doing at this moment, in the "Status" line. The Toughsat will search for signal, and when it's ready, it will display "Passed Test, System Online". You are online. Confirm it by connecting to any web page on the Internet with your browser.

Stowing The Dish

Stowing the dish on the Flyaway can either be done by pressing "Stow" on the Toughsat TS2 panel, or by accessing the controller's web page at http://192.168.1.2 and pressing on the "Stow Dish" button.

PRESS STOP – TO STOP ALL MOVEMENT OF THE DISH for any reason. Press "Find Satellite" or "Stow Dish" to resume movement.

NOTE - The Toughsat must be stowed before moving of the vehicle can take place. Failure to stow the system before moving the vehicle may cause damage to your dish and will void your warranty. When the TOUGHSAT is commanded to stow, the unit begins its stowing process automatically, and will not stop until it is stowed, or encounters heavy resistance.

Resistance sufficient to stop the TOUGHSAT from stowing may damage your dish. Make sure that when you are stowing the TOUGHSAT, the area where it must lower is clear of obstructions.

Location and Line-of-Sight to Satellite

When choosing a place to set up your satellite equipment, please keep the following things in mind. First, all satellite systems require constant line of sight access to the satellite in the sky, which means that you must choose your location with care. Small obstructions may sometimes be ignored, but that is never guaranteed. Large obstructions – such as trees, buildings, power poles, etc – must be avoided. The MSS requires a clear view of the southern hemisphere sky for operation in the continental US. Second, there are other things that can obstruct your signal through radio-spectrum interference. High voltage power lines may cause interference with the satellite signal, reducing performance or preventing access altogether. Radar emitters, such as those found at airports, in police vehicles, and in certain areas as part of speed-enforcement measures, will also prevent the satellite system from obtaining a signal lock. Further, radar installations can shut off an already established satellite link by causing harmful interference.

Vehicle Level Considerations

The tilt tensors on the Toughsat can register and compensate for up to 10 degrees of tilt in any direction. However, all satellite internet radio signals are highly polarized to prevent interference. IF you are more than 3 degrees out of level, your search times will be longer and your dish may not ever get online. Make sure that your vehicle is less than 3 degrees from level in both directions and attempt your search again.

If your Toughsat GPS is not able to attain GPS coordinates, your GPS receiver or antenna may be malfunctioning or temporarily unable to obtain a position fix. Click on the "Override" link.

Input your current GPS location, as obtained from an outside GPS receiver or known coordinates. Then click "Calculate"

If your target or reference satellite is incorrect, click on "Satellite Settings"

From the drop down menus, select the correct satellite for your system (123W for iDirect). Click "Calculate" You should be able to search again and lock on. If you still cannot lock on, please contact Technical Support.

Advanced Operation

Gateway Agnostic Setup

The Toughsat is capable of finding the satellite and locking on without the presence of a modem. While this will not allow you to get online or access any web services, it can be convenient for certain classes of users. The procedure for deploying the Toughsat is the same in this case as in the basic operation mode, with only a few differences. The Toughsat Controller is turned on first, and in this case some care must be taken to avoid pressing the One Step buttons before the controller is fully online. Doing so may cause the Controller to enter a special installation mode, and will not operate normally. Allow 90 seconds for the Controller to come fully online.

When the Controller is online, the same process is used to deploy the dish. When using the Controller web interface, instead of saying "Passed Test, System Online" it will display "System Pointed" on the status line. When using the Remote Keypad, the LED's will still indicate "On Signal", but not "Tx Enabled".

Web Interface Password Protection

Customers who forward the interface, often like to enable password protection on the interface. This prevents those who are unauthorized from doing stuff to the system (both locally and remotely). To enable this, go to http://192.168.1.2/password.htm - username is admin and leave the password field blank. From here, you can set an admin, user and limited password. The page explains the different levels of access to the interface - various levels of access can be given to the appropriate people who have access to the system. If you do not want to have a password on a certain access level, then just leave the password field blank, but they'll still have to enter the appropriate user name to access the interface (so if you only wanted to have admin access to have a password, then put an admin password in and leave the others alone, but they would still need to enter user as the username when they go to the main interface page before they could see anything).

Configuring Your Toughsat for Remote Control

Under certain circumstances, you may wish to allow your Toughsat to be controlled remotely. Doing so is possible, but requires a little bit of set up.

NOTICE: The following instructions are provided for use only with the default hardware configuration. If you are using a 3rd party router, gateway, firewall, or any other 3rd party device these steps may not work for you. Ground Control recommends that you use your Toughsat with the factory hardware.

First, you'll need to make sure that Remote Management is enabled on the built-in linksys wireless router. To do so, log in to the Linksys router at 192.168.1.1; Username field should be left blank, and the default password is "admin". Click on the Administration button, and make sure that "Remote Management" is enabled. The default port is set to 8080; if you are using the default Linksys password, you should use a different port (and be sure to write it down). Click on the save settings button, and then the continue button when prompted.

While still logged into the router, go to the Applications and Gaming tab. Create a new entry with "Toughsat" in the application line. The Start and End ports should both be 80, and the IP address should be 2. Check the Enable box, then click on save settings, and continue when prompted.

If you wish to allow remote control of the Toughsat, you may want to increase the refresh rate of the control page. Since the control page uses Javascript and AJAX elements, they will change their information too fast for a remotely-connected user to see. To fix this, go to 192.168.1.2/setflash.htm. The user name is "admin" and the password is "skynet2029".

WARNING: It is very important that you do not change any of the settings on this screen without either confirming them with Ground Control support or following the direct instructions of this manual. Permanent damage to your system may result.

Scroll down to the bottom of the page and look for the "Javascript Refresh Rate (ms)" option. It should be set to 500 by default; change it to 2000 and click on Update. This will reboot your Toughsat and take you back to the main control

page. NOTE: from this point forward, your control page will always take 2 full seconds for information to display, change, or update - even when connected locally. If you decide that the delay is not worth the ability to manually control the Toughsat, follow the above steps and set the refresh rate back to 500.

Please note that anything that takes the antenna offline will also compromise your ability to control it. If you tell it to stow while remotely connected, it will remain offline and stowed until someone locally commands it to search. If you hit "Find Satellite" you will lose communication until it again acquires the network. You may also wish to set a _password_ on the system to control access.

Updating the Toughsat FLASH file

You will receive a file from Ground Control containing a file with the same name as your Toughsat serial number. Make sure that the file name matches your serial number, then unzip the attachment. Connect a laptop to your system and bring up an FTP client. Connect to 192.168.1.2., username is "admin" and the password is "boomerang58".

Make sure the dish is stopped. It doesn't need to be stowed, but it cannot be moving at this time. Upload the file to the root directory of the FTP server. Turn the controller off, wait 10 seconds and turn it back on. Navigate to 192.168.1.2 and check to see if the serial number has updated to 10940. If it has, wait 30 seconds for the unit to finish flashing the memory then try to stow the dish - the dish should stow fully.

If you had any custom satellite settings, you will need to reconfigure them, as well as any custom IP's that had been set.

How To Adjust The Reference Satellite

1. Power on the unit

2. Connect to the GC Controller

3. Bring up the dish control page at 192.168.1.2

4. In the top center, there will be a blue button that says "Satellite Settings". Click on it.
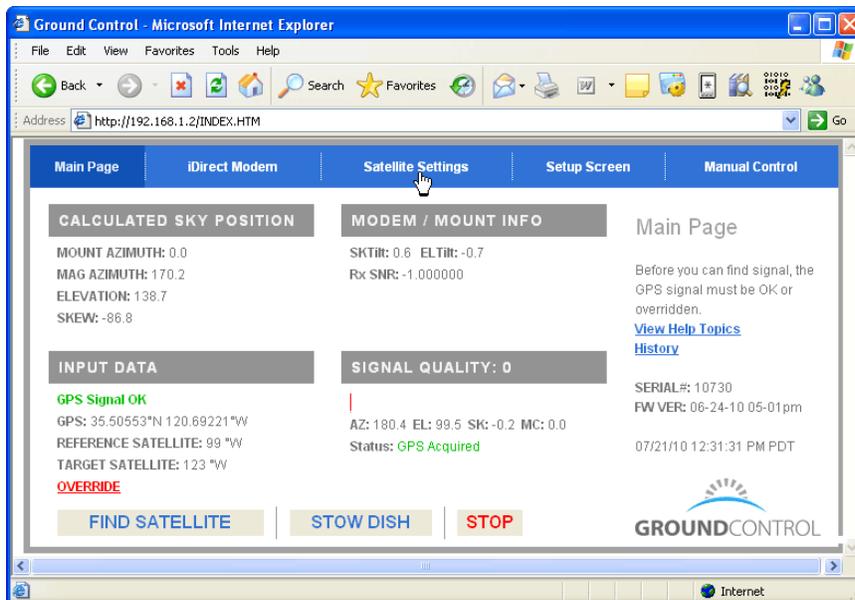
5. There will be two drop-down menus. One says "Target Satellite" and should be set to G18 123w. The second says "Reference Satellite" and should be set to G16 99w. Click on "Submit" at the bottom, which will return you to the main page.
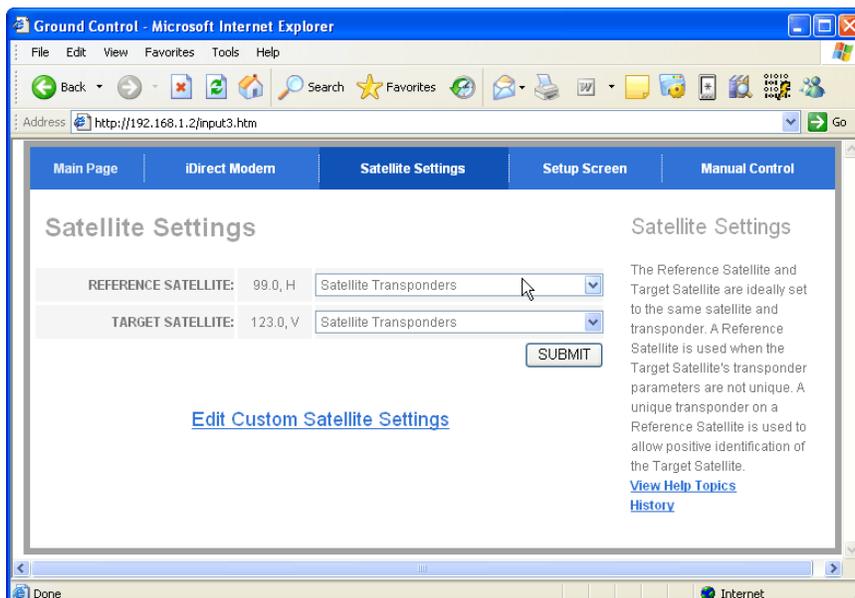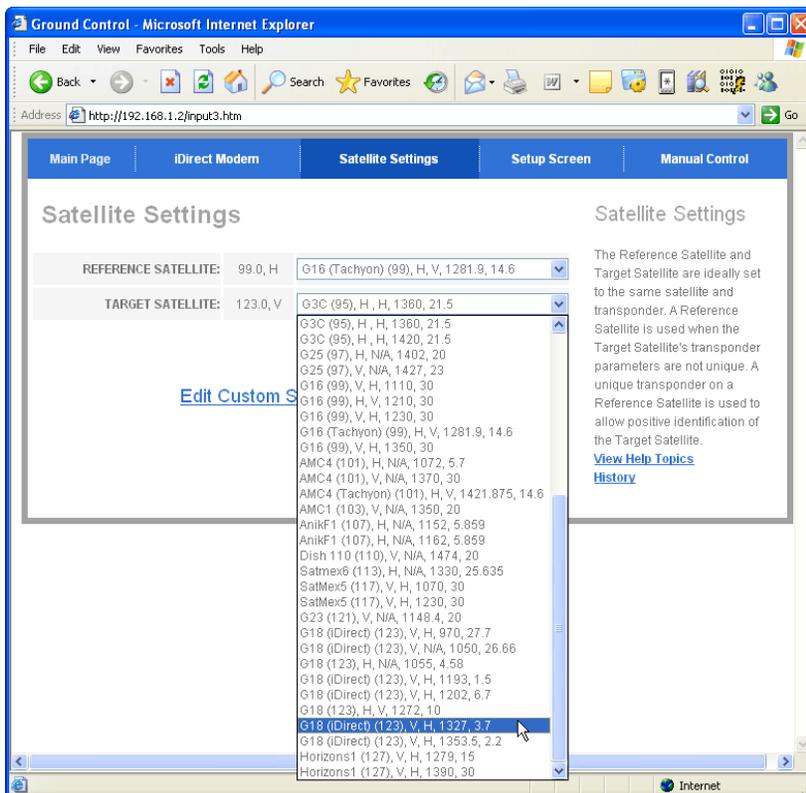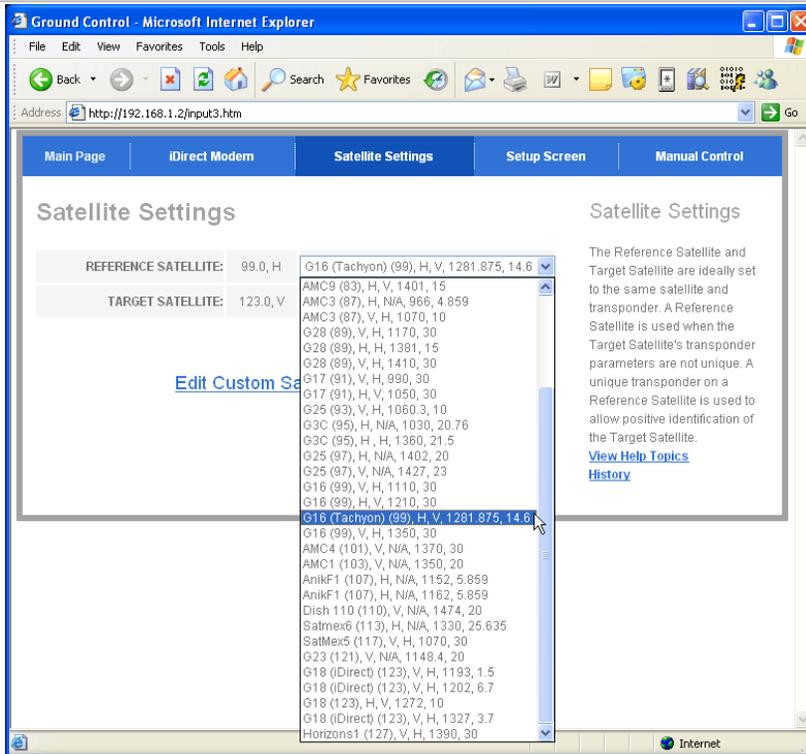
6. After the dish finishes saving flash memory, you can press "Find Satellite". The dish should then deploy and begin its search procedure.
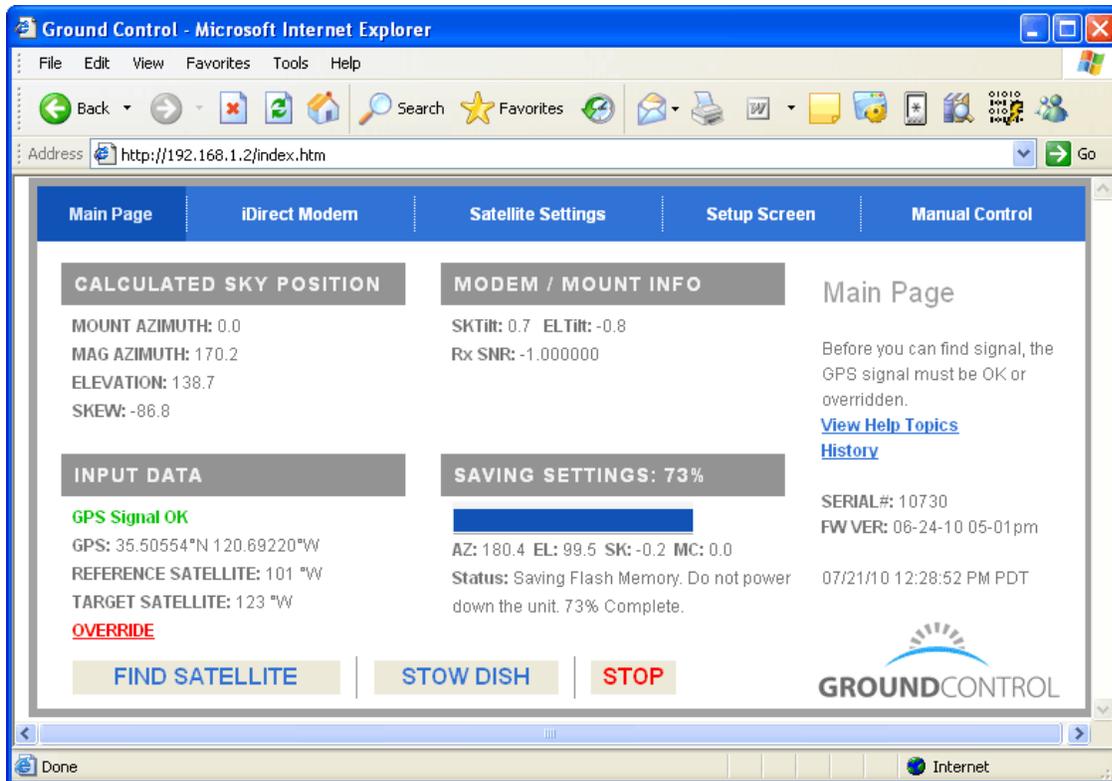
Manual Motor Control Of The Toughsat System

Manually adjusting the antenna is not normally recommended, but may be a useful troubleshooting step. It is important to note that because the manual control page is still using the antenna software, these controls are still subject to motor current limits and other software controls.

To start, go to the Dish Control Page by navigating to 192.168.1.2 in your computers web browser.
(You are not required to type in http://)
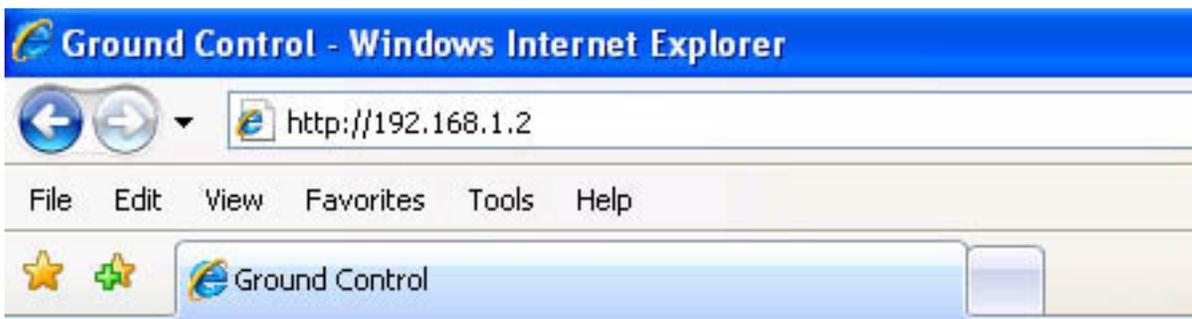
Locate the "Manual Control" button in the upper right corner and click it. You should see Toughsat Main menu. Click on the Manual tab on the top right of the menu.

The buttons that you see control all three axes of motion for the antenna. The left and right buttons adjust the azimuth (side to side movement), the up and down buttons control the elevation (up and down movement) and the diagonal arrows adjust the skew / polarity of the antenna clockwise or counter-clockwise. You should also note the "Step size" boxes: these control the amount of adjustment that each click of the arrows makes. The default is 0.5 degrees, which is a very small motion. For large motions of the dish, you should set the step size for the motors you're going to adjust - a good size is 15 degrees. Once you have input the new step size(s), click on the "apply" button to save your choices. Then, you may begin adjusting the antenna using the manual control buttons.

Using The Manual Control Buttons On The Upper Control Board

Accessing the Upper Control Board (UCB) is not normally done, but may be required under certain circumstances. To start, you will need to make sure that you have a #2 Phillips head screwdriver and a 5/32" hex wrench, and the power to the antenna turned off.
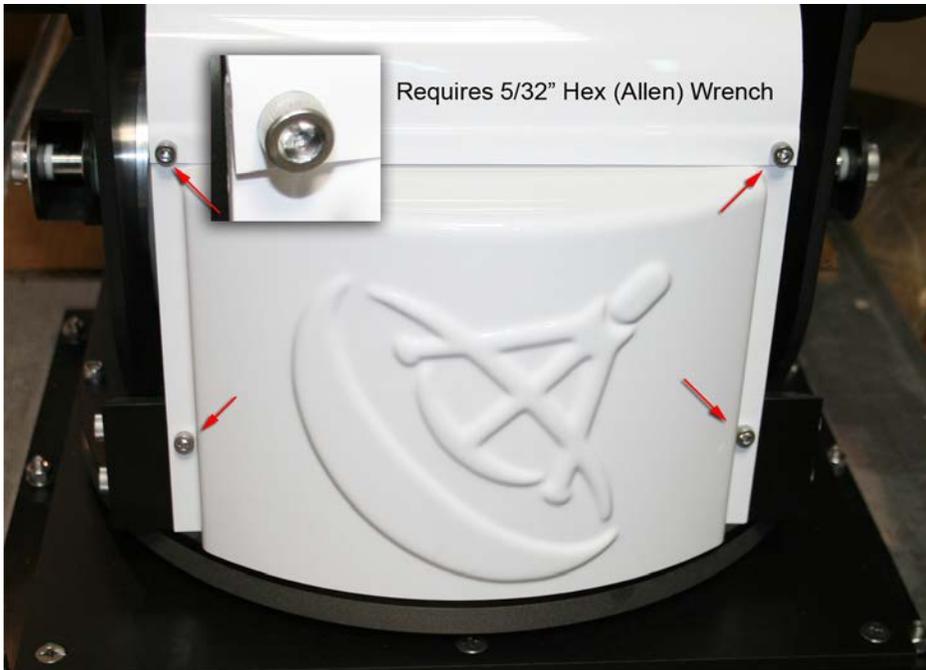
The Toughsat internal parts and electronics are protected by three plastic covers. The front and back covers are held together by the top cover, which must be removed first. After that, the back cover may be removed, exposing the UCB (Upper Control Board) housing (shown below).

Remove the 4 screws that hold the UCB cover in place.

The Upper Control Board (UCB) - Opened
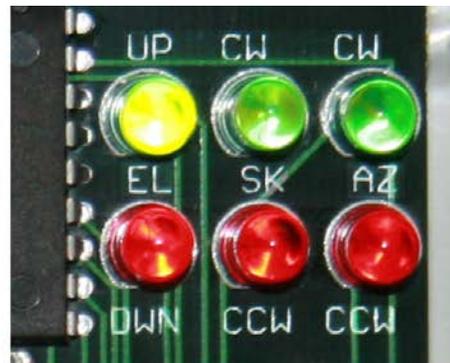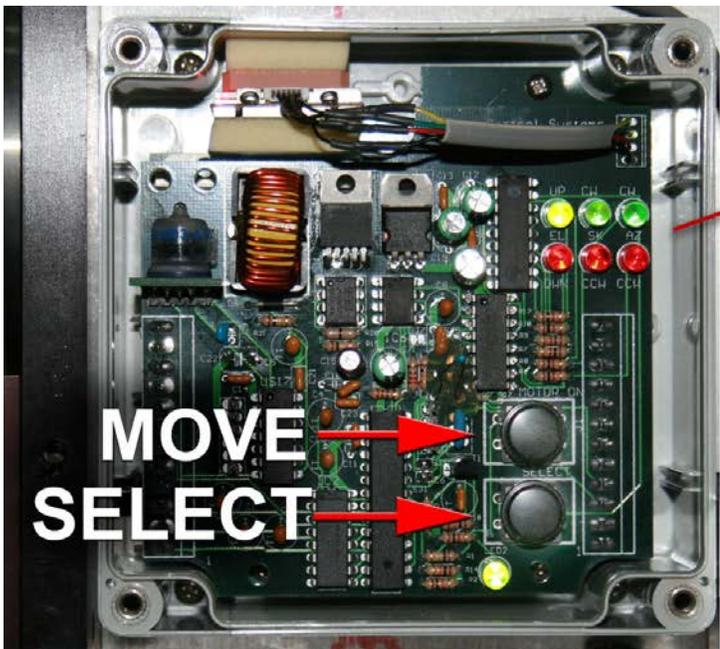
Select one of 6 directions to move
Use the **Select** button to choose Axis
Elevation Up (top left LED light)
Elevation Down (bottom left LED light)
Skew Clockwise CW (top middle LED)
Skew Counter Clockwise CCW (bottom middle LED)
Azimuth Rotation Clockwise CW (top right LED)
Azimuth Rotation Counter Clockwise CCW (bottom right LED)
Press the **Move** button to move that axis

The Upper Control Board is capable of moving all motors and axis of the dish.

To do this, locate the two black buttons on the face of the board and press the SELECT button to cycle through which axis motor to move. The LED lights on the board show which motor is selected.

The circuit panel LED lights that show motor control are labeled:
EL = Elevation of the Dish. Elevation can move "UP" and DWN".
SK = Skew of the transmitter. Skew can move CW (Clockwise) and CCW (Counter Clockwise)
AZ = Azimuth, or the rotation of the dish. Azimuth can move "CW (Clockwise) and CCW (Counter Clockwise)

Pressing the SELECT button cycles through the LED's to indicate which motor will be selected, and in which direction. The MOVE button activates the indicated motor / direction for as long as it is held down.

EXAMPLE – To stow the dish from a raised position (such as during an emergency for instance), press "SELECT" to cycle to the AZ - CW or AZ - CCW LED light. Next, press and HOLD the MOVE button until the antenna rotates into a desired location for stowing. Next, press the SELECT button cycle to the EL-DWN LED light and then press the MOVE button to stow the dish.

When you have finished adjusting the antenna, close up the UCB by replacing its cover and all 4 screws. Then, reinstall the base plastics, remembering to install the back plastic cover first, and then the top cover.

Final Walk-Around Checklist

Get in the habit of walking around the rig before driving away after using the system.

☐ **DISH IS FULLY STOWED**

☐ **POWER BAR FOR ELECTRONIC IS TURNED OFF**

☐ **GENERATOR IS OFF**

☐ **LEVELING JACKS LEGS ARE RETRACTED** (if used)

Toughsat Facts

Required Coax Cable
Please note that if any coax cables are damaged, they must be replaced with special Belden 1694A cables that may be purchased from Ground Control. Use of any other brand or specification of cable will cause your Toughsat to fail during satellite search.

Weather
First and foremost, weather can and will prevent you from getting online. Water is very good at absorbing the radio-waves that are used to make a satellite internet connection. Most satellite systems will not operating during storms, periods of rain, or thick cloud conditions. While the Toughsat has a larger transmitter, which may allow it to perform in some of these conditions, successful operation of this system is not guaranteed. Further, operation of this equipment during any of these conditions may pose a special hazard.

CAUTION: Operation of any electronic or radio device under conditions of storm (including lightning, thunder, heavy rain, or related conditions) can damage the equipment permanently. Further, by operating metal containing equipment during these conditions, you may make yourself a target for lightning strike. Always follow proper safety precautions during periods of inclement weather.

The TOUGHSAT is also resistant to loss of service due to heavy clouds. Heavy clouds contain excess amounts of moisture, which can and will absorb the radio signal used to make a satellite internet connection. Because of its larger transmitter, the Toughsat may be resistant to loss of service due to heavy clouds, though operation of the system during periods of heavy-cloud weather is not guaranteed.

The iDirect Modem LED Indicators

The iDirect modem has the following front panel lights: Power, Status, Transmit (Tx), Net, and Receive (Rx). The explanations below are for Ground Control service with iDirect platform version 6.0.9.6 (standard continental US settings).

The POWER light:
→ GREEN: AC Power has been applied to the unit.

The STATUS light:
→ GREEN: The option file is correct, the POST has completed successfully
→ Flashing: The POST is in progress
→ RED: The option file is not correct, or there is a serious fault in hardware / software.

The FAN light:
→ GREEN: All fans inside of the modem are operating correctly.
→ RED: One or more fans inside the modem have failed.

The TEMP light:
→ GREEN: The modem is operating within temperature specifications.
→ RED: The modem is operating outside of the specified temperature range and may behave incorrectly.

The Transmit (Tx) light:
→ GREEN: The transmitter is enabled and active.
→ AMBER: The transmitter is not enabled. If this light has a slow flash, the transmitter is attempting to communicate to the network, but has not yet locked. If this light does not come on, check your _Networking_ settings and your _GPS_ settings.

The Net light:
→ GREEN: The modem has successfully locked into the network.
→ Flashing: The modem is in the process of acquiring the network, and will be online soon.
→ AMBER: The modem has "heard" the network, but has not yet been able to talk back.
→ Flashing: The modem has not yet "heard" the network, and is still waiting for it's signal.

The Receive (Rx) light:
→ GREEN: The modem has successfully identified the satellite signal, and the Rx is locked.
→ Amber: The modem has not yet identified the satellite signal. This typically indicates either a severe radio-frequency interference issue, a loss of signal due to line-of-sight disruptions, or that the antenna is not correctly pointed.

The modem also has the following rear panel lights: BUC Pwr, Input Pwr, Ethernet Link / Activity light, and Console Link / Activity light.

BUC Pwr:
→ OFF: The BUC (Transmitter) is not receiving power from the modem. This normally indicates a serious configuration issue, unless your system has a transmitter that is externally powered via a secondary power source.
→ GREEN: The BUC is being powered by the modem. This should be the typical state.
→ RED: The BUC is shorting out, or there is damage to the coaxial cable to it.

INPUT Pwr:
→ OFF: The modem is not being supplied with power. Check to make sure that the power cord and transformer connections are tight and correct.
→ GREEN: The modem is being powered. This should be the typical state.

Troubleshooting Indicators
Some of the more common trouble indicators are listed below, for reference.

Tx light does not come on: This means that your modem is not even attempting to transmit. This is typically caused by a mobile modem not receiving GPS from the controller, or a fix modem that has the wrong GPS coordinates. Double-check the _networking_ configuration of the system, and contact technical support.

Status light turns red, modem reboots: This means that the option file (the modem configuration) has become corrupt. The option file will need to be replaced, and the modem will need to be _recovered_.

PWR lights are red: If the "PWR" lights on the back of the modem are red, this indicates that there is a problem with the coaxial cables that go to the radio equipment. This is typically a break or bend in the cables, a build up of corrosion on the connectors, or a loose and faulting connector.

Basic System Troubleshooting

The first step before going into more detailed troubleshooting is to make sure that all cables are connected properly and then perform a power reset on all equipment. Always try this first before doing more in depth troubleshooting.

Troubleshooting Search Issues

Under acceptable conditions, a Toughsat should be able to complete its search procedure and establish a full signal lock on its designated satellite in as little as 5 minutes, and never more than 30. Average search times are around 6-7 minutes. In the event that your dish has been searching for 20+ minutes, it's highly unlikely that it is going to be able to establish signal lock.

There are several factors which effect a Toughsat's ability to locate signal, but the majority of them come down to location. This is due to the fact that all satellite communication units require an unobstructed line of site to the satellite in the sky. All of our target satellites are geosynchronous, meaning their orbit speed matches the rotation of the earth, keeping them in a fixed, constant position in the sky, directly over the equator. In our case, our target satellite for all iDirect systems is located at 123 west longitude, meaning for North America, your dish will always be looking south to southwest.

If your dish is searching for long periods without finding a signal lock, you'll first want to eliminate any possible environmental factors.

Line of Sight – Your dish needs a completely clear, unobstructed view of the south to southwest sky. This includes even small items such as hanging power lines that you might not suspect can cause a problem. If there's anything you even suspect might be too close, move your system and try again. The Toughsat actually will locate and identify 2 satellites during it's search; the first at 99west (this is a reference satellite that speeds up the search process), and then the target satellite of 123west. As these satellites are several degrees apart, the dish needs a wider field of view than if it were just looking for a single target.

Flat Ground – Because the satellite signals are polarized, the dish has to align itself not only up and down, but also with a clockwise/counterclockwise twist known as skew in order to establish a signal lock. Because of this, the dish platform (and thus whatever it may be mounted on) have to be within 5 degrees of perfectly level in order for the signals to still align properly. The dish will actually give you an error message if it is more than 5 degrees off, which eliminates some of the guesswork, but it's good to get it as level as possible prior to searching.

Possible Sources of Interference – This is an issue that is rarely encountered, but still a legitimate concern. Satellite shares operating frequencies with a handful of other technologies, the most prominent of which is radar, though any source of strong radio signals can potentially be an issue if in close proximity (large radio antennae, cell phone towers, etc.). Airports tend to be the biggest source of radar related interference cases, though we have also seen cases of police with hand-held radar guns actually causing issues as well. Unfortunately in any situation where a large stationary device is the source of the interference, the only option is to move the Toughsat further away.

In the event that you're confident none of the above is preventing your unit from seeing signal and yet it still cannot establish a lock, the problem most likely lies with the hardware itself (or its corresponding software). This is mostly seen on units which have

The dish is online, but I can't browse the Internet

If your dish is on-signal (showing a green Signal Quality bar on the Main Page: 192.168.1.2) but you cannot browse, check the status line. It should read "passed test, system online". If it instead says "Passed test, system pointed" then your dish connected to the satellite without the modem. Power cycle the modem and the dish, then try again.

Also, check the status lights on your modem. If you are fully online, and not stuck in cross-pol or another status.

If you are still unable to browse, check the Ethernet connections between your computer, your modem, and your GC Controller. You should see link lights active on all of them:

Then, check the settings in your router. Go to 192.168.1.1   …The default username and password are both "admin". You should see the main router page:

If you do have link lights, but still can't browse, check IP settings (next section).

If you do not have link lights, try replacing the Ethernet cables and power cycling. If this does not solve the problem, please contact Technical Support.

On Signal But TX Light Not Blinking

If you're on signal and the tx light on your modem isn't blinking.
1. The modem isn't getting GPS.
2. The modem or dish is seeing no signal or the signal is too low to enable the transmitter.
3. The transmitter is disabled in the modem settings
4. The site isn't enabled to the network.

Issue 1 - The modem isn't getting GPS

For this issue first check the MSS Main Page for the proper GPS, it should have this info listed on the bottom left hand side of the page under "Input Data" if it has GPS it should say "GPS Signal OK" and under list the current Lat. And Long. If this is says "Waiting For GPS" then you will need to wait till it gets a GPS signal before getting online usually this will only take a few minutes but sometimes can take up to 20 minutes depending on the situation.

If it has been a significant amount of time and you still have no GPS signal you try the following:
• Resetting your dish, by unplugging it for 10 seconds and plugging it back in.
• Stowing the dish completely and waiting for it to get GPS.*

*In some situations with the arms fully deployed the reflector can block the line of sight to the GPS satellite and make the wait to get GPS longer.

Issue 2 - The Modem or Dish is seeing little to no signal.

iDirect modem's need a minimum Rx SNR of 5 in order for the transmitter to be enabled to check your current SNR you will need to open up the Dish's Main Page and under Modem Mount Info you should see a value listed next to Rx SNR, usually when the modem has a "good" receive signal that value is 13 or better. If it's under 5 you will need to repeak your dish again. If repeaking doesn't fix this you could be looking at line of sight issues, check your view of the southern sky(provided you are in the western hemisphere) if there is anything blocking your view of the sky(buildings, trees, power lines, etc.) then you will need to move to an area with a clear view.

Another possibility is radio interference which can come in several forms, but you should watch that you don't try and deploy the dish near cell phone towers or near any equipment that uses radar as these will cause the dish to see little to no signal.

Issue 3 - Your Transmitter is Disabled in the Modem

Also your transmitter might have gotten disabled in which case you should enable it via telnet. To do this on a windows (xp or older):

1. Select start and then "run" in the run box type in "cmd" and then hit "enter" on your keyboard.

2. In the command prompt window type in "telnet", space and then the IP for your modem which you can find on your customer information sheet provided in your manual.

3. Once you have successfully telnet'd into the modem type "tx enable" and it will tell you the current transmitter status, either on or off.

4. If it says off then: type in "tx enable on" and check to see that your modem's tx light starts blinking, if it does and provided all satellite equipment is in good working condition your modem should get online shortly.

If you have windows Vista or 7 there is no run function located on the start menu instead you would use the search option and type in "cmd" into the search and the results will appear at the top of the

If you get stuck or any of this information doesn't match what you're modem is doing or telling you then STOP and contact technical support for assistance.

*If you have another internet service provider other than ground control it would be best to stop and contact them for further troubleshooting on this issue.

Issue 4 - The Modem isn't enabled in the network

If you think the modem isn't enabled in the network than you can call Technical Support and verify this, if it is in fact disabled you can contact Ground Control to verify, if it is in fact disabled enabling a mobile site is a very quick process.

Unable To Access Network – Check IP Settings

If your network settings of the router (which is integrated into the controller) have been accidentally changed, the dish will not be able to communicate with the router.

Check the modem IP and default gateway. The Modem IP should match what is listed at the beginning of this document, or on your CUSTOMER INFORMATION SHEET which has your IP settings for your system. The default gateway should be 192.168.1.1, with a default DNS of 192.168.1.1.

If the IP settings were wrong, change them. Then click on "Save Settings"

Check the Default Gateway Address; it should be the same as the modem IP at the beginning of this document.

The Internet IP address will normally be one digit up from the gateway IP address.

Correct these settings, and click "save settings at the bottom"

Attempt to browse again. If you cannot get online, please call technical support.

Basis Networking Issues

Even before you connect any external computers to your Toughsat system, the system itself makes up a small, basic network. The components of this network are the modem (iDirect), the Toughsat controller which houses an internal router, and the Toughsat dish itself. It's important that all 3 of these components are always present and connected properly, as the system will not function if they are not properly connected, and properly configured. This is partly because the modem needs to receive periodic GPS updates from the dish to maintain it's connection to the network.

Physical Configuration

The Toughsat controller (and it's internal router) are the central communications hub for the entire system, everything else in the network talks to each other through this unit. On the back of the controller you will find 6 Ethernet cable ports, as well as connectors for the systems coax lines, control cables, and power. The Ethernet cable ports are labeled:

Mount Control
Modem
1
2
3
4

There should already be a short jumper cable connected from "Mount Control" to port 1. This is the dish's communications cable. There should then be a cable connected from the modem (in the port marked "LAN A") to the port marked "Modem". Finally, if any of your own computers are connected via cable instead of wirelessly, they should be connected to any of the 3 remaining open ports, marked 2, 3, and 4. Check all of these connections to make sure they are present, and connected tightly. Any cables with broken connectors or tears in the cable shielding should be replaced.

When powered on and all proper cable connections are present, the status lights on the front of the Toughsat control unit should be lit in conjunction with any ports that have cables connected to them. This means that at the very least INTERNET and port 1 should be lit, as well as any of the remaining 3 that have a computer connected to them. WLAN will also be lit if the wireless connection is enabled (which it is by default). If any of these are not lit, first double check that all devices are actually powered on. If still not lit, it indicates the router is not recognizing any connection on that port, and is likely a faulty port on one of the devices. If one of the numbered (1,2,3,4) ports fails, any of the remaining numbered ports may be used as an alternate for a short term fix. The failure of any other ports will necessitate the replacement of the corresponding device.

Software Configuration

Along with the proper physical connections, all of the devices in the network will also require the proper IP configuration in order to communicate. In the case of iDirect modems, their IP configuration is hard coded as part of their internal option file, and will not need to be adjusted. This leaves the router (the Toughsat control unit) and the Toughsat dish itself.

A list of the required IP settings can be found on the customer information sheet, which should be left at the site at the time of installation. It is also on record at Ground Control, should your customer information sheet be unavailable, you can get the information from our Technical Support department.

You'll want to verify the settings in the router first. Using a pc that's connected to it vi either an Ethernet cable or wirelessly, open your preferred web browser and input 192.168.1.1 into the address field. You should be immediately prompted for a username and password. if the page fails to load, either your computer is unable to communicate with the router, or the router's address was changed. Verify your pc is connected properly, and that it's own IP address is properly configured. By default it should be set to obtain an address from the router automatically. If you are sure that everything is connected and configured correctly and you still can't access the router at this address, it's likely the router's address has been changed, and the router will need to be hard reset.

When prompted for a username and password by the router, leave the username field empty, and enter "admin" in the password field. Use lower case. Hit "OK" and you should be taken to the router's configuration screen. The default start screen happens to be the main configuration screen, so no extra navigation is required. The very first options presented are the IP configuration options. They should be set to "static IP", and then the appropriate IP addresses, taken from the customer info sheet, entered into their corresponding fields. These will be:

Internet IP address
Subnet Mask
Default Gateway
DNS 1
DNS 2

DNS 3 can be left blank. Once all addresses have been input, hit the "save" button at the bottom of the screen.

After the router has been configured, you should have no problem accessing the dish control page at 192.168.1.2 using your web browser. Along the top of the dish control page are several options, first click "setup screen". From the setup screen, click "IP configuration". On the IP configuration screen the only option we are concerned with (and indeed, the only one you should ever have to change) is the "Modem IP" field. Make sure it matches the modem's IP address from the customer info sheet (this will be the same address listed as the "default gateway" from the router settings). Again, save these settings before leaving the page.

Once all settings have been set and saved, it's a good idea to physically power cycle the entire system once to be sure the new settings are in use. At this point you should be able to access all of your various systems pages, and your unit should be ready to search for satellite. If for any reason you find you're still having connectivity issues after this, contact the Technical Support department for further assistance.

Satellite Dish Won't Search Or Is Stuck

First Steps: First make sure that all equipment is powered on. To do this, look for the indicator lights on the front of the equipment:

If you found equipment that wasn't powered on, try power it on and try your search again.

If all equipment was on, try power cycling. Find the power cables to the Controller, your iDirect gateway, and pull them out. Count slowly to ten, then plug the modem, then the controller. You should see the power lights come on, and shortly afterward, you should see the link lights on your modem come up to indicate that they are communicating with the controller:

You should also see a link lights on the TS2 controller:

When all of these are active, your equipment is up and ready to search. Connect to the dish control page at 192.168.1.2, then check the input data.

First check to make sure the basic parameters are ok:
- Under "Input Data" you should have a green "GPS Signal OK"
- Under "Modem/Mount Info" there will be SK and EL tilt readings, as well as an RX readout.

If the GPS is "not acquired", it most likely just needs more time. It's common for the GPS to take several minutes to acquire. If it still hasn't acquired after 10 minutes or more, you may need to call technical support.

If Under Modem/Mount Info it says "No Modem Found", it means the dish failed to establish communications with the modem. Power cycle the entire system once. If this does not clear the problem, check IP settings.

BUC Power LED Is Red

This light will show red when the modem reads a short in the transmit path.

The first thing you'd want to try is to just reset your modem, by unplugging it for 10 seconds and then plugging it back in, if the light stays red after the reboot you need to bypass any of the transmit cable runs on the dish till you get a green light on there.

The Most common cables to go bad are the cables connected at the end of the arm running to the BUC and LNB these go bad after time mostly due to the higher amount of stress the dish puts them under when it adjusts skew.

Here are some images showing how this would work.

First you'd disconnect the red receive coax from the end of the arm. See the image below with the cable in question circled.
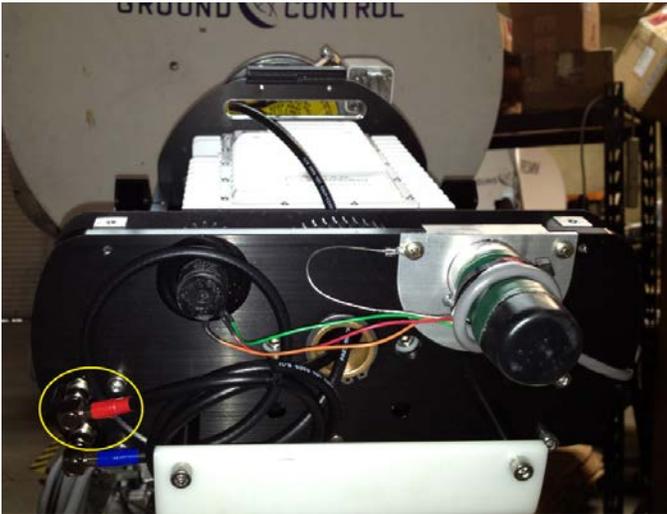
Now you will want to remove the other end of the same cable where it connects to the transmitter, below is an image showing this.

Now connect a new or spare coax cable in place of the one you just removed and power up the unit, after the modem boots up completely(this takes a couple of minutes generally) if this was the bad cable the BUC Power light would illuminate green and your modem would be ready to transmit again.

The example above is just the most common piece to go bad there are several other places where the coax could be broken. Below is a photo showing all the cable runs on a Toughsat.

Testing / Bypassing / Rolling Coaxial Cables

Your Toughsat system uses high-grade Belden 1694-A Shielded coaxial cables to connect the modem to the radio equipment at the end of the support arms. These cables run from the modem to the base of the Toughsat, then internally along the arms. Typically, the most likely place for cables to have damage is inside the unit itself. To that end, we can test coaxial cables in a number of ways.

During these tests, you will be connecting and disconnecting cables. It is important that you do not connect or disconnect any coaxial cables until the power to the modem and controller are off. This is to avoid doing damage to the equipment via surge or spark.

Voltmeter Testing:
With a voltmeter or a multimeter, it is possible to test the cables for continuity. First, determine the modem output voltage by disconnecting the cables from the back of the modem and controller, one at a time. Place one probe on the threaded shield of the coaxial connector, and the other probe inside it. If you do not have probes narrow enough to reach inside the connector, you may use a paperclip or other thin metal object for this purpose. Power the modem on, read the voltage, then reconnect the coaxial cables.

Next, disconnect the cables from the base of the antenna. This time, the testing will be done with one probe touching the center conductor and the other touching the inside of the threaded nut on the cable. Measure and record the voltage, then replace the cables.

Finally, locate the cable connections on the radio equipment. These may be sealed with a layer of electrical tape, and an inner layer of rubber tape. These are to protect the connectors from the damage of inclement weather, and should be replaced as soon as the system is determined to be operational. Again, place one probe on the center conductor and the other on the inside of the threaded nut. Measure and record the voltage, then reconnect the cables.

Ideally, the voltage from the modem should stay within 0.1vDC. If the total drop from the modem to either of the two cable terminations is greater than 0.5vDC, this could indicate a problem with the cable(s) which might require them to be replaced.

Bypassing Cables
To bypass a coaxial cable, you will need enough spare Belden 1694-A cable to go directly from your modem to the radio equipment. This is typically done when one or more cables has been determined to be "bad" and the system must be used immediately, or before they can be replaced.

Bypassing the installed coaxial cables is as simple as disconnecting the cables (one at a time) from the modem and controller. Then run fresh, "known-good" cable directly to the radio equipment, disconnecting the installed cables there. Once the replacement cable is in place, test the system again. You will want to watch carefully to make sure that the movement of the antenna does not damage your cable, or catch on anything.

To stow a system that has one or more bypass cables installed, first stop the dish and return it to the "stow" position. This can be done by manually adjusting the antenna using either the UCB buttons or the Manual Control Page buttons, or by pressing the "stow" button on your controller or web interface and then stopping the antenna before it begins to lower itself. Once the antenna is in position, disconnect the bypass cable(s) and make sure that the installed cables are out of the way of any points of motion as well as out of the stow path of the antenna.

Rolling Cables
To "roll the cables" is to switch one for the other. In this way, a possible problem with one of the cables can be tested without the use of a voltmeter. For instance, if your antenna was pointed and had receive lock, but you did not have transmit lock, you could switch the receive and transmit cables. If doing so replaced your transmit problem with a receive problem, then your receive cable is more than likely the source of the issue.

Rolling cables on a Toughsat requires that you first disconnect and switch the coaxial cables at the back of the modem and the controller. Remember that the receive cable goes into the controller, not the modem; make sure that as you switch them, the small "jumper" coaxial cable connecting the modem and the controller should not be adjusted.

Next, you will need to switch the cables at the base of the antenna, where it mounts to the roof. Doing so will require 2 small 9/16" box-end wrenches. After these cables have been switched, you may continue to the radio equipment. Carefully disconnect the cables from the transmitter and receiver, and switch them.

After the cables have been replaced, test your system again. If the problem has "switched sides" from transmit to receive, or vice versa, then the problem is with the cables.

Toughsat Specifications

BANDWIDTH & NETWORK (iDirect Services- Galaxy 18)
Download (with 6 Watt BUC).. Up to 20,000 Kbps with iDirect X7
Upload (with 6 Watt BUC) .... Up to 5,000 Kbps with iDirect X7
Public IP Address... Included
DHCP... Yes. Wireless or 4 port Ethernet
Wireless Security...WPA (TKIP) WPA2 (AES) + WEP 64 and 128bit
NAT... Supported by included router
Firewall... Supported by included router
Port Mapping & Port Triggers... Supported by included router
QoS, ToS, MAC Address Clone, RIP v1 RIP v2.............. Supported by included router
Networkable clients machines.. Unlimited
Wi-Fi.. Cisco Linksys wireless router "G"

SATELLITE DISH
Reflector Type   ……………………………………………… 0.98 square meter effective area
Mount Geometry……………………………………………. 3 Axis motor drive (elevation, azimuth & skew)
Deployment Sensors …………………………………….…..GPS & Tilt Sensor +- 1°

MAXIMUM MOUNT ROTATION
Azimuth……………………………………………………..410°
Elevation……………………………………………………165°
Polarization…………………………………………………+-80°

RF INTERFACE
Transmit Power……………………………………………….6 watts for XP (Upgradable to 8 Watt)
Receive Frequency…………………………………………..Range 950-1450 mhz

DIMENSIONS OF DISH
Dish Stowing Extended Dimensions ………………………59" L x 39" W x 12" H (150 x 74 x 30.5 cm)
Mounting Plate……………………………………………….22" x 57" (56 x 145 cm)
Base Plate (attached to mounting plate)…………………..14" x 16" (35.6 x 40.7 cm)
Deployed Height…………………………………………….52" max height (132 cm)
Weight………………………………………………………125 lbs (56.7 kg)
Boom Sweep…………………………………………………53" from center (Clearance is 15" for most locations)

ENVIRONMENT
Wind Deployed………………………………………………75 mph (120 kph)
Wind Stowed…………………………………………………140 mph (225 kph)
Max Operational Temperature (at 100% humidity)……….Operational -20° F to 140° F (-28° C to 60° C)
Max Survival Temperature (at 100% humidity)……………-60° F to 160° F (-51° C to 71° C)

Power Requirements
Dish Controller & Dish Motors (Via 120 VAC).................. 15 watts average (can be turned off after pointing)
iDirect Modem (via AC120V to DC 24V @ 5 Amp).......... 75 watts average

Contacting Ground Control Support

Ground Control technical support representatives are available 24 hours per day for your convenience. Please note that our standard hours of operation are Monday – Friday, 8AM to 5PM Pacific Standard Time. If you call outside of these hours, support response may be delayed and certain resources may not be available to the support agent.

For Technical Support, please call **1-800-931-5559** from the U.S. or **+1-805-783-4633** from abroad. You may also email **support@groundcontrol.com** from a computer connected to working Internet connection.

GROUNDCONTROL
www.groundcontrol.com