

Redundant IBUC System

An Innovative Approach to Redundancy

Terrasat Communications Inc

Our Ground-breaking IBUCs bring advanced features & performance to C-Band, X-Band, Ka-Band, Ku-Band earth terminals & VSATs worldwide.

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Why RF Redundancy?

For low-revenue, non-critical links, some level of service outage is acceptable. The investment in redundancy is not justified by the returns. In this paper we address those more critical links where, for example, service interruption triggers SLA penalties or lost revenue. Non-monetary examples are critical government/military links or Air Traffic Control networks, where consequences of failure can impact lives.

As a satellite terminal equipment manufacturer, Terrasat has invested heavily in building reliability into our products. We built our reputation on IBUCs endurance in the field. Nonetheless, the reality is that, eventually, everything is subject to failure for a variety of reasons.

IBUC Redundant System Overview

The basic function of the redundancy system is to automate switching to a secondary IBUC in the event of a failure in the primary unit. At the outset of product design, Terrasat determined to take an innovative approach that would:

- Strengthen protection for the customer – no single point of failure
- Decrease complexity – simplify the installation
- Reduce cost
- Provide rich, full-featured management, monitoring, and control

Earlier technology RF Transceiver and BUC redundancy systems often relied on an external logic controller. This is typically a device that is mounted in a rack inside the equipment shelter. It accepts major alarm contact closures from the Outdoor Units (ODUs) and makes the switching decision. The drawbacks are:

1. Limited information upon which to base the switching decision – normally selected by the manufacturer - with no ability given to the customer to modify alarms for local conditions
2. The added cost of the logic controller unit
3. High cost and complexity of running cables between the controller, the ODUs, & the waveguide switch

Terrasat took an entirely new approach in developing a complete 1:1 protection system that does not rely upon a third party logic controller unit. Since the IBUC is an intelligent device with sensors, microprocessor and software, it was a matter of incorporating the decision-making

function into the Block Upconverter itself. This eliminates the rack-mounted logic controller with its expense & additional cabling. All signal routing is managed through a small interface junction box mounted on a plate along with the two IBUCs. Since the IBUC is an integrated package design (BUC and SSPA in a single enclosure) it is possible to monitor multiple functions in both the BUC & SSPA sections to give true, robust redundancy. Pictures and diagrams will probably communicate more than a thousand words & are a lot faster. So let us dive in.

Below you will see a front view of redundant IBUCs mounted on the supplied plate assembly:

All interconnecting cables are included to connect the IBUCs to the junction box.



Front view

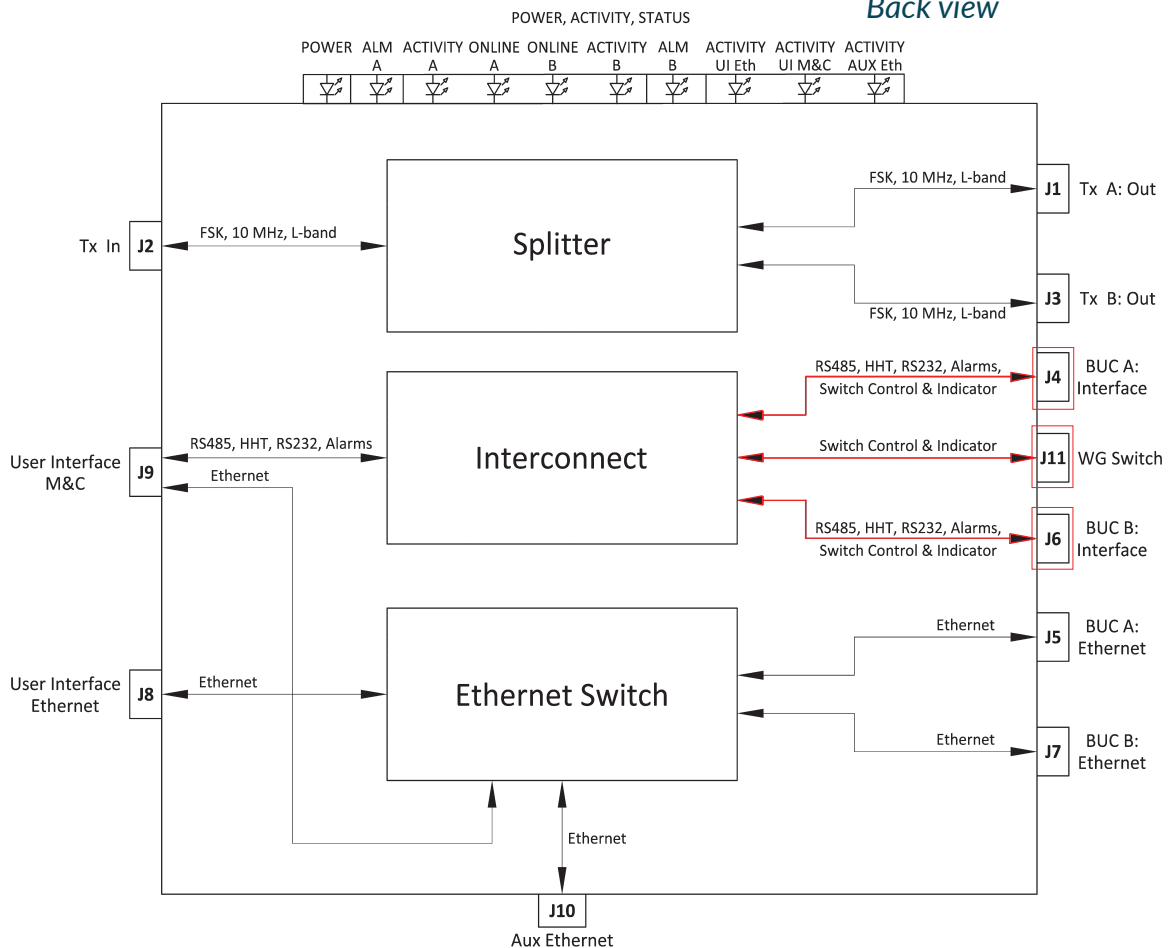
The back view shows the plumbing through a waveguide switch. It is a complete system requiring no third party devices. Everything pictured is provided.

immediately commands the switch to change positions. Other things are going on, such as LED indication and alarm reporting. But that is the basic switching function.

Please see the diagram of the junction box below. The junction box supports cable interconnections and includes an Ethernet switch and LED indicators. See the red arrow indicating the circuit that routes the alarm information from BUC A to BUC B. The red boxes are the connectors cabled to the M&C ports of the two BUCs. In brief, the alarm output from BUC A is the alarm input to BUC B. If BUC A goes into an alarm condition, a normally closed contact opens, breaking the circuit. BUC B receives the indication and



Back view



There are other interesting things on this drawing. The junction box includes the L-band splitter to the two BUCs. There is local access via handheld controller or web browser and remote NMS connection through TCP/IP, RS232 or RS485. All IBUC products are SNMP-compliant for easy interface with any NMS. Power for the junction box is derived from redundant IBUC power supplies. This close-up photograph below of the junction box may help to put it into perspective. The junction box routes information between the IBUCs and provides the user interface. LEDs provide a quick visual indication of the operating condition.

When the assembly is completed and thoroughly tested, we ship the system fully assembled for easy installation. The installer only has to attach the mounting plate according to the local conditions and re-attach the provided cables.

The photo to the right shows units installed in the field. There are many ways to mount the plate assembly.



Field installation of Redundant IBUCs



Junction box routes information to the IBUCs & user interface

Managing the System

The power of an intelligent BUC design starts to come into focus when you look at how the system is managed. Basically, it can be set up as a local, standalone protected system – or it can be integrated into a managed network. Here we take a brief look at the setup & management functions using the IP interface web pages included with every IBUC. But keep in mind that there is a local handheld option and RS485 & RS232 interfaces for your NMS.

Once installed, the system can be turned on using the factory default settings. This provides a quick “plug-and-play” operation.

But you are not limited to the factory settings. The operator has choices in determining alarms upon which he would like the system to switch.

Below is a table below showing the alarms that are user-configurable as major or minor. This shows them in the context of the LED bank. The system will switch on major alarms only.

Within these categories, you also have the ability to set thresholds and ranges. The easiest way is via a web browser. The web pages are served by the IBUC itself.

TX Alarm	User Configurable	Alarm State		
		Major Solid Red	Minor Flashing Red	None Log Only
DRO Out of Lock	N	X		
TX Output Level High	Y	X		
TX Output Level Low	Y	X		
TX Input Level High	Y		X	
TX Input Level Low	Y		X	
Temperature Alarm	Y		X	
TX Simulated Fault	N	X		
10 MHz Reference Fault	N		X	
Input Voltage Out of Range	N		X	
Switch Fault	N	X		
Fan Alarm	Y		X	
Input Current Out of Range	N			X
AGC/ALC Target Out of Range	N			X
AGC/ALC Out of Range	N			X
AGC/ALC Not Settled	N			X

Example 1 is screen shot of the web page where you can set alarms as major or minor. For redundant systems, BUC A & BUC B appear side-by-side:

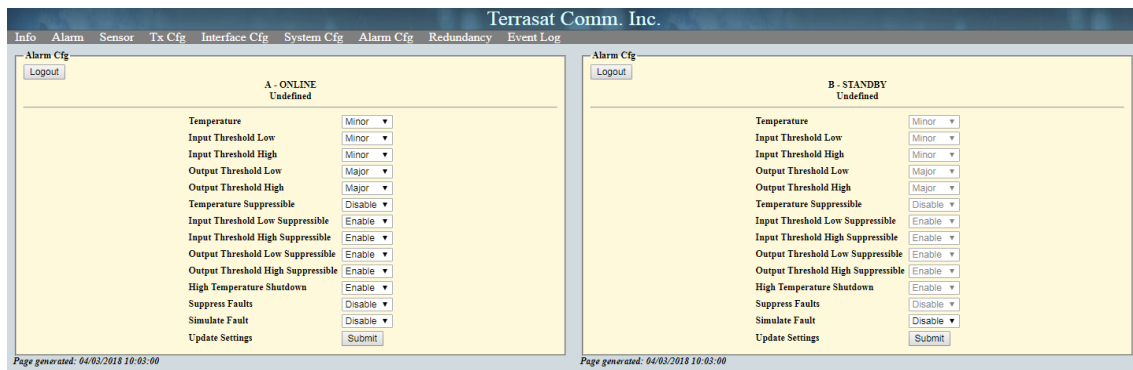
The user merely makes an Ethernet connection with a web browser. He is then presented with a login page, enters the password, & the IBUC web server provides the pages of information.

In total there are nine logically designed web pages providing management and control of about 70 functions, plus a time/date stamped event log. Example 2 is a screenshot of the main alarm page. From the alarm page the operator can immediately see the health status of the system.

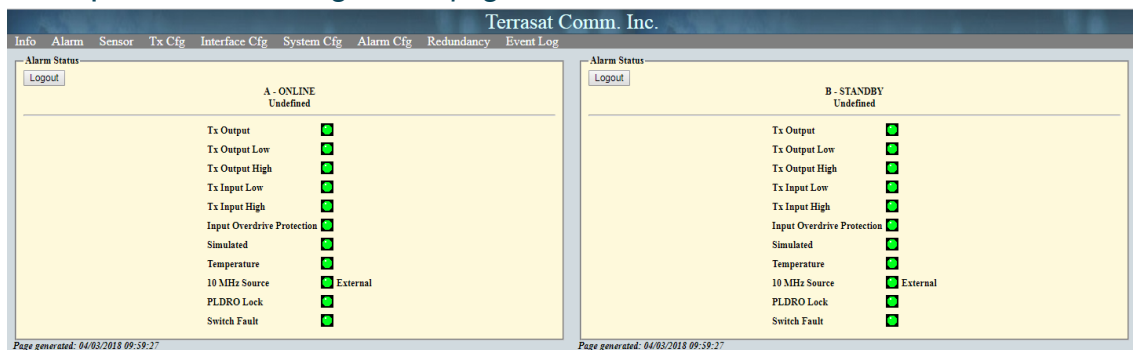
The sensor page on Example 3 on the next page enables the operator to drill down to finer detail.



Field installation of IBUC G model



Example 1: Alarm Configuration page



Example 2: Alarm Status page



Example 3: Sensors page

Eco-Mode Operation

Another innovation that is included in every IBUC redundancy system is “Eco-Mode” warm standby functionality. In a 1:1 system, both IBUCs are running “hot”. With higher power systems, the AC power consumption can be a significant cost factor in both sizing of the UPS and paying the ongoing energy bill. By turning on Eco-Mode with a software command, the operator puts the standby unit into a “warm” state where the BUC intelligence is still present to make the switch in case the primary IBUC goes into alarm. Meanwhile, the SSPA is offline. In a switching event the SSPA comes up immediately since it is a solid-state device.

LNB Redundancy

Some networks require redundancy on the receive function as well as transmit. Terrasat provides an LNB redundancy system that is entirely independent from the transmit system. Independent switching eliminates a single point of failure & is more robust than chain switching where the failure of an LNB takes the active, healthy BUC out of service while

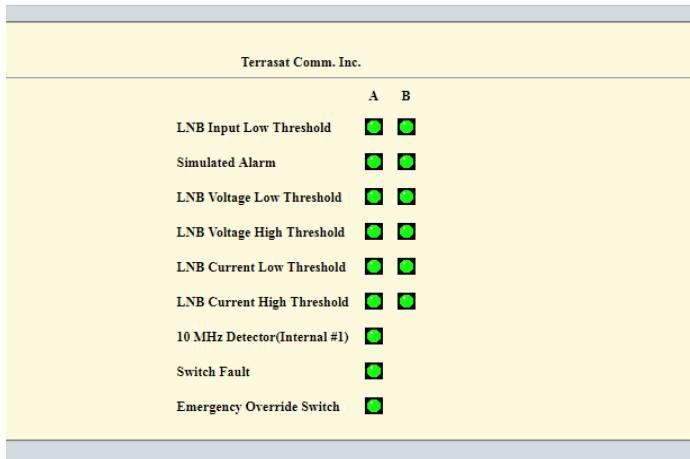
the whole chain is switched over.

LNBs are not smart devices. So there is little information for switching. What Terrasat has done is developed an LNB redundancy interface unit that monitors current, voltage, plus composite signal level of each of the two LNBs. This provides an added layer of switching accuracy. The redundancy interface unit presents the information on a range of protocols:

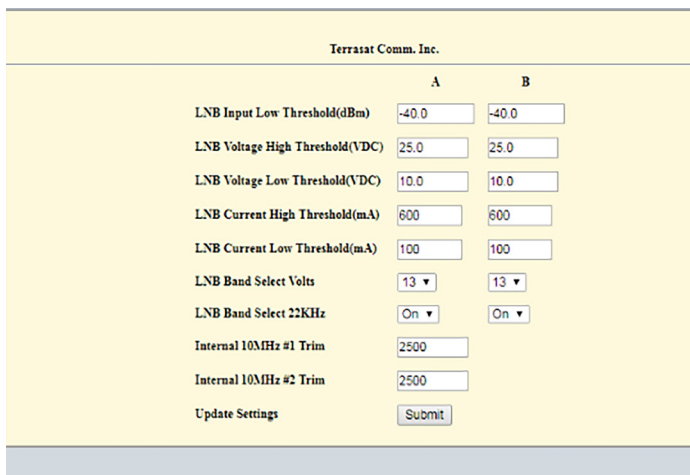
- TCP/IP with embedded web pages
- SNMP
- HTTP
- Telnet
- RS232
- RS485
- Handheld controller
- LED indicators

The outdoor interface unit is mounted near the feed. The waveguide switch & cables are included in the assembly. A bank of LEDs give a quick visual indication of the levels & switch position.

As with the IBUCs, the RX redundancy unit presents information simply to a web browser. Here is the alarm page:



The user can customize thresholds to local conditions on the RX configuration page:



Final Words

When high link reliability is critical, redundant IBUCs can be part of the equation. As an innovative solution, IBUCs bring several advantages:

- 1:1 simplicity using IBUC Intelligence
- Simplified installation
- Multi-protocol management including embedded web interface and SNMP compatibility
- User-configurable alarms
- Eco-mode AC mains power cost reduction
- Independent LNB redundancy



RX Redundancy front



RX Redundancy back

Updated 11/20/2019