

Cyber Hardened Intelligent Block Upconverter

IBUC 2, IBUC 2e, IBUC 2G, IBUC R and IBUC G

Operations Manual

24-Hour Technical Support: +1 669.258.9740

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© October 2020 Terrasat Communications, Inc.

315 Digital Drive
Morgan Hill, CA 95037

Phone: +1 408.782.5911
FAX: +1 408.782.5912

www.terrasatinc.com

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REVISION HISTORY

Revision	Date	Description
A	08/06/2020	Initial Public Release
B	10/09/2020	Added Appendix B, Embedded Web Pages Updated Appendix C, ASCII Command Response Structure Added Appendix E, Firmware Upgrade
C	TBD	Updated Appendix B, Embedded Web Pages



This manual provides information about the Terrasat Communications, Inc. line of cyber hardened intelligent block upconverters.

Conventions and References

Before you start using this manual, it is important to understand the typographical conventions and terms used in the documentation.

[Table P.1](#) describes typographical conventions used in Terrasat Communications, Inc. documentation. For definitions of specialized terms used in the documentation, see [Appendix F, Glossary](#).

Table P.1 Typographical Conventions

Convention	Description/Example
Emphasis	Used to emphasize the importance of a point. The IP Address <i>must</i> be a unique number.
Internal cross-references	References to a section in the same document are marked in blue and are hyperlinked. See Warranty Information on page 1-5 .
Product and feature names	Named Terrasat products and features are identified on first use. ...line of intelligent block upconverters (IBUCs).
Technical Publication References	References to other Terrasat publications. If the reference is hyperlinked, it is also underscored. For detailed information, see the Terrasat Communications, Inc. IBUC Operations Manual .
User-entered values	A special font marks text that you type. At the password prompt, type <code>MyPassword</code> .

Cautions and Warnings



CAUTION

CAUTION indicates a hazardous situation that, if not avoided, could result in minor or moderate injury. CAUTION might also be used to indicate other unsafe practices or risks of property damage.



HIGH-VOLTAGE



HIGH VOLTAGE indicates the presence of a high-voltage hazard.



WARNING

WARNING indicates a potentially hazardous situation that, if not avoided, could result in death or serious injury.

Trademarks

Terrasat Communications Inc. is a registered trademark. Also, other product names mentioned in this manual may be trademarks or registered trademarks of their respective companies and are hereby acknowledged.

Electrical Safety Notice

This equipment has been designed to minimize exposure of personnel to hazards. All operators and technicians must:

- Know how to work around, with, and on high-voltage equipment.
- Exercise every precaution to ensure safety of personnel.
- Exercise extreme care when working near high voltages.
- Be familiar with the warnings in this manual.

INTRODUCTION

This manual is intended for users of Terrasat Communications, Inc. block upconverter systems including the Cyber Hardened IBUC **2**, IBUC **2e**, IBUC **2G**, IBUC **R** and IBUC **G**. It contains information about

- Installation, operation, and maintenance of Cyber Hardened IBUC **2**, IBUC **2e**, IBUC **2G**, IBUC **R** and IBUC **G** systems.
- Use of user interface protocols for remote monitor and control capabilities

Block Upconverters

The term “intelligent” block upconverter (IBUC) refers to the advanced features and monitor and control capabilities of the entire line of Terrasat IBUC models. Each IBUC model includes automatic gain control (AGC) and automatic level control (ALC) features as well as internal diagnostics. Terrasat IBUCs also provide extensive monitoring and control through software commands and alarms providing access to the numerous operating parameters and features available in the unit. Access to features and monitor and control (M&C) functions is provided via several methods including RS232, SSHv2, UDP (SNMPv3) and TCP/IP (HTTPS). Each IBUC model is also fitted with a multifunction LED for visual status indications.

Reference Documents

Use the satellite operation standards listed in [Table 1.1](#) as reference documents.

Table 1.1 Satellite Operation Standards

Earth Station Standards	
Intelsat IESS 308/309	Performance Characteristics for Intermediate Data Rate Digital Carriers Using Convolutional Encoding and QPSK Modulation
Eutelsat EESS 502	Minimum Technical and Operational Requirements for Earth Stations Transmitting to a Eutelsat Transponder for Non-Standard Structured Types of SMS Transmissions. Standard M.
2014/53/EU	Radio (and Telecommunications Terminal) Equipment Directive (RED/RTTE)
ETSI EN 301 443 v2.1.1 (2016-05)	Satellite Earth Stations and Systems (SES); Harmonised Standard for Very Small Aperture Terminal (VSAT); Transmit-only, transmit-and-receive, receive-only satellite earth stations operating in the 4 GHz and 6 GHz frequency bands covering the essential requirements of article 3.2 of the Directive 2014/53/EU
ETSI EN 301 430 V2.1.1 (2016-05)	Satellite Earth Stations and Systems (SES); Harmonised Standard for Satellite News Gathering Transportable Earth Stations (SNG TES) operating in the 11 GHz to 12 GHz/13 GHz to 14 GHz frequency bands covering the essential requirements of article 3.2 of the Directive 2014/53/EU
ETSI EN 301 428 V2.1.2 (2017-05)	Satellite Earth Stations and Systems (SES); Harmonised Standard for Very Small Aperture Terminal (VSAT); Transmit-only, transmit/receive or receive-only satellite earth stations operating in the 11/12/14 GHz frequency bands covering the essential requirements of article 3.2 of the Directive 2014/53/EU
ETSI EN 301 360 V2.1.1 (2016-06)	Satellite Earth Stations and Systems (SES); Harmonised Standard for Satellite Interactive Terminals (SIT) and Satellite User Terminals (SUT) transmitting towards satellites in geostationary orbit, operating in the 27,5 GHz to 29,5 GHz frequency bands covering the essential requirements of article 3.2 of the Directive 2014/53/EU
ETSI EN 301 459 V2.1.1 (2016-05)	Satellite Earth Stations and Systems (SES); Harmonised Standard for Satellite Interactive Terminals (SIT) and Satellite User Terminals (SUT) transmitting towards satellites in geostationary orbit, operating in the 29,5 GHz to 30,0 GHz frequency bands covering the essential requirements of article 3.2 of the Directive 2014/53/EU
MIL-STD-188-164C	Interoperability of Super High Frequency (SHF) Satellite Communications Terminals.
ANSI/TIA/EIA 568	Commercial Building Telecommunications Cabling Standard
Environmental Standards	
ETS 300 019-1-1	Equipment Engineering (EE): Environmental Conditions and Environmental Tests for Telecommunications Equipment. Part 1-1: Classification of environmental conditions. Storage.
ETS 300 019-1-2	Equipment Engineering (EE): Environmental Conditions and Environmental Tests for Telecommunications Equipment. Part 1-2: Classification of environmental conditions. Transportation.

Table 1.1 Satellite Operation Standards (Continued)

ETS 300 019-1-4	Equipment Engineering (EE): Environmental Conditions and Environmental Tests for Telecommunications Equipment. Part 1-4: Classification of environmental conditions. Stationary use at non-weather protected locations.
ETS 300 019-2-1	Equipment Engineering (EE): Environmental Conditions and Environmental Tests for Telecommunications Equipment. Part 2-1: Specification of environmental tests; Storage
ETS 300 019-2-2	Equipment Engineering (EE): Environmental Conditions and Environmental Tests for Telecommunications Equipment. Part 2.2: Specification of environmental tests; Transportation
ETS 300 019-2-3	Environmental Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Part 2-3: Specification of environmental tests; Stationary use at weather protected locations
ETS 300 019-2-4	Equipment Engineering (EE): Environmental Conditions and Environmental Tests for Telecommunications Equipment. Part 2-4: Specification of environmental tests; Stationary use at non-weather protected locations
MIL-STD-810G	Environmental Engineering Considerations and Laboratory Tests.
2011/65/EU	Restriction of the use of certain hazardous substances (RoHS)
EN IEC 63000:2008	Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances
2015/863	Amending Annex II to Directive 2011/65/EU of the European Parliament and of the Council as regards the list of restricted substances
EMC/EMI Standards	
2014/30/EU	Electromagnetic Compatibility (EMC)
EN 55032:2015/AC:2016-07	Electromagnetic compatibility of multimedia equipment - Emission requirements
EN 55024:2010/A1:2015	Information technology equipment - Immunity characteristics - Limits and methods of measurement
EN 61000-3-2:2014	Electromagnetic compatibility (EMC) - Part 3-2: Limits - Limits for harmonic current emissions (equipment input current ≤ 16 A per phase)
EN 61000-3-3:2013	Electromagnetic compatibility (EMC) - Part 3-3: Limits - Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current ≤ 16 A per phase and not subject to conditional connection
EN 61000-3-11:2000	Electromagnetic compatibility (EMC) - Part 3-11: Limits - Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems - Equipment with rated current ≤ 75 A and subject to conditional connection
EN 61000-3-12:2011	Electromagnetic compatibility (EMC) - Part 3-12: Limits - Limits for harmonic currents produced by equipment connected to public low-voltage systems with input current > 16 A and ≤ 75 A per phase
EN 61000-4-2:2009	Electromagnetic compatibility (EMC) - Part 4-2: Testing and measurement techniques - Electrostatic discharge immunity test

Table 1.1 Satellite Operation Standards (Continued)

EN 61000-4-3:2006/A2:2010	Electromagnetic compatibility (EMC) - Part 4-3: Testing and measurement techniques - Radiated, radio-frequency, electromagnetic field immunity test
EN 61000-4-4:2012	Electromagnetic compatibility (EMC) - Part 4-4: Testing and measurement techniques - Electrical fast transient/burst immunity test
EN 61000-4-5:2014/A1:2017	Electromagnetic compatibility (EMC) - Part 4-5: Testing and measurement techniques - Surge immunity test
EN 61000-4-6:2014/AC:2015	Electromagnetic compatibility (EMC) - Part 4-6: Testing and measurement techniques - Immunity to conducted disturbances, induced by radio-frequency fields
EN 61000-4-11:2004/A1:2017	Electromagnetic compatibility (EMC) - Part 4-11: Testing and measurement techniques - Voltage dips, short interruptions and voltage variations immunity tests
EN 61000-4-34:2007/A1:2009	Electromagnetic compatibility (EMC) - Part 4-34: Testing and measurement techniques - Voltage dips, short interruptions and voltage variations immunity tests for equipment with mains current more than 16 A per phase
ETSI EN 301 489-1 V1.9.2 (2011-09)	Electromagnetic compatibility and Radio spectrum Matters (ERM); Electromagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements
ETSI EN 301 489-12 V3.1.1 (2019-04)	Electromagnetic compatibility and Radio spectrum Matters (ERM); Electromagnetic Compatibility (EMC) standard for radio equipment and services; Part 12: Specific conditions for Very Small Aperture Terminal, Satellite Interactive Earth Stations operated in the frequency ranges between 4 GHz and 30 GHz in the Fixed Satellite Service (FSS)
MIL-STD-461G	Requirements for the Control of Electromagnetic Interference Characteristics of Subsystems and Equipment
Safety Standards	
2014/35/EU	Low voltage (LVD)
EN 62368-1:2014/AC:2017-03	Audio/video, information and communication technology equipment - Part 1: Safety requirements (IEC 62368-1:2014, modified)
EN 60950-22:2017	Information technology equipment - Safety - Part 22: Equipment installed outdoors
EN 60529:1991/A2:2013/AC:2019-02	Degrees of protection provided by enclosures (IP Code)
Cyber Security Best Practices	
FIPS 140-2	Security Requirements for Cryptographic Modules
Application Security and Development STIG	
Web Server SRG	
Network Other Devices STIG	
General Purpose OS STIG	

Warranty Information

Determination of warranty status of equipment shall be in accordance with the following Terrasat Communications, Inc. Warranty Policy.

(A) This warranty is for equipment of Terrasat Communications, Inc. The term “Terrasat” as used throughout this warranty shall mean Terrasat Communications, Inc., if the equipment was manufactured by Terrasat Communications, Inc.

(B) Terrasat warrants that its equipment shall be free from defects in material or workmanship at the time of shipment and that it will conform to applicable specifications.

For all Satcom products, the buyer shall exercise any and all warranty claims within a period of thirty-six (36) months.

(1) The warranty does not apply to any part of a product if it has been altered, repaired, or misused in any way that, in the opinion of Terrasat, affects the reliability of, or detracts from the performance of, any part of the product; or it is damaged as a result of the use of such part in or in connection with equipment not previously approved by Terrasat.

(2) The warranty does not apply to any product or parts thereof if its serial number or the serial number of any of its parts has been altered, defaced, or removed.

(3) The warranty does not cover damages or losses incurred in transport.

(4) The warranty does not cover replacement or repair necessitated by loss or damage resulting from cases beyond the control of Terrasat.

(5) The warranty does not include the furnishing of any labor involved or connected with the removal and/or reinstallation of warranted equipment or parts on site, or any labor required to diagnose the necessity for replacement or repair.

(6) In no event shall Terrasat be liable to buyer for any indirect, special, or consequential damages or lost profits arising from the use of the equipment or products, even if Terrasat has been advised of the possibility thereof, or for any inability to use them either separated from or in combination with any other equipment or products.

(C) Terrasat’s warranty, as stated herein, is in lieu of all other warranties, expressed, implied or statutory, including those of merchantability and fitness for a particular purpose, and Terrasat neither assumes nor authorizes any person to assume for it any other obligation or liability to any person in connection with the sale or use of Terrasat’s products. The buyer shall pass on to any purchaser, lessee, or other user of Terrasat’s products, the aforementioned warranty and shall indemnify and hold upon allegations that the buyer, its agents, or employees have made additional warranties or representations as to product preference or use.

(D) A fixed charge established for each product will be imposed for all equipment returned for warranty repair and where the cause of failure cannot be identified by Terrasat.

Note: Warranty seals are designed to break upon internal access. Access to the internal electronic components without prior written approval will void the warranty.

For more information about returning a product for repair, see [Repair Policy](#) on [page 6-8](#)

FUNCTIONAL DESCRIPTION

The Terrasat outdoor unit (ODU) consists of an intelligent block upconverter (Cyber Hardened IBUC **2**, IBUC **2e**, IBUC **2G**, IBUC **R** or IBUC **G**), power supply unit (PSUI), and low-noise block converter (LNB) for use in satellite earth stations. The outdoor equipment is designed to interface directly with an L-band satellite modem.

Introduction

This chapter contains detailed information about the various system components of the following Cyber Hardened IBUC models:

- IBUC **2**: All of the original features of the IBUC but in a smaller, more cost-effective package that is ideal for applications where compact size, light weight, and low thermal dissipation are critical factors.
- IBUC **2e**: The low energy consumption model of the IBUC **2**, intended for use with modems with limited capacity power supplies and where DC power is supplied only via coaxial cable.
- IBUC **2G**: The compact physical size of the IBUC **2** powered by gallium nitride (GaN) technology. GaN devices like the IBUC **2G** can operate at much higher temperatures and work at much higher voltages than GaAs devices.
- IBUC **R**: All of the original features of the larger IBUC package with an RJ45 Ethernet connector.
- IBUC **G**: Higher power IBUC in large enclosure powered by gallium nitride (GaN) technology.

System Components

The interfacility link (IFL) between the ODU and the L-band modem uses 950 MHz to 2.0 GHz (L-band) as the interface frequency. This approach enables transmission and reception over the entire satellite band as opposed to a single transponder. The L-band IFL can also carry associated signals such as 10 MHz and DC voltage which simplify installation and reduce costs. Terrasat IBUC systems can be used for single channel per carrier/multiple channels per carrier (SCPC/MCPC), point-to-point, or point-to-multiple point network applications (such as voice, data, video, or IP services). The integrated RJ45 connector enables both SNMPv3 and the Embedded Web Pages for monitor and control purposes. Its smaller form factor and lighter weight make the Cyber Hardened IBUC **2**, IBUC **2e**, and IBUC **2G** ideal for situations where mobility is key. These smaller models can be carried in a backpack/case or mounted on antennas that can be quickly assembled and disassembled. See [Figure 2.9](#) on [page 2-25](#) through [Figure 2.11](#) on [page 2-27](#) for typical equipment configurations.

The Cyber Hardened IBUC **2**, IBUC **2e**, IBUC **2G**, IBUC **R** and IBUC **G** are available in a variety of frequency bands as listed in [Table 2.1](#) through [Table 2.5](#). The IBUC houses the IF interface (demux), the upconverter, the monitor and control (M&C) card, a DC-to-DC converter (if DC powered) and associated circuitry, an AC-to-DC converter (if AC powered), and a solid state power amplifier (SSPA) assembly. The IBUC can also house an optional internal 10 MHz reference signal module. Higher-power IBUCs also have an external cooling fan assembly. The input interface to the IBUC connects to a 50 Ω or an optional 75 Ω coaxial cable that carries the L-Band transmit signal. This IFL (interfacility link cable) interface can also carry an external 10 MHz reference for the oscillator signal band and DC power.

Table 2.1 IBUC **2** Transmit Frequency Plans

Signal	Standard C-band	Palapa C-band	Insat C-band	Extended C-band	Full C-band
L-band (Inverting)	950 MHz to 1525 MHz	975 MHz to 1275 MHz	1150 MHz to 1450 MHz	950 MHz to 1750 MHz	975 MHz to 1850 MHz
LO frequency (Inverting)	7.375 GHz	7.700 GHz	8.175 GHz	7.600 GHz	7.700 GHz
L-band (Non-Inverting)	950 MHz to 1525 MHz	1125 MHz to 1425 MHz	965 MHz to 1265 MHz	950 MHz to 1750 MHz	950 to 1825 MHz
LO frequency (Non-Inverting)	4900 MHz	5300 MHz	5760 MHz	4900 MHz	4900 MHz
RF frequency	5.850 GHz to 6.425 GHz	6.425 GHz to 6.725 GHz	6.725 GHz to 7.025 GHz	5.850 GHz to 6.650 GHz	5.850 GHz to 6.725 GHz
Output Power	5, 10, 15, 20, 25, 30, 40, 50, 60, 80 watts	5, 10, 15, 20, 25, 30, 40, 50, 60, 80 watts	5, 10, 15, 20, 25, 30, 40, 50, 60, 80 watts	5, 10, 15, 20, 25, 30, 40, 50, 60, 80 watts	5, 10, 15, 20, 25, 30, 40, 50, 60, 80 watts

Signal	X-band	Standard Ku-band (Band 1)	Full Ku-band (Band 2)	Low Ku-band (Band 3)
L-band	950 MHz to 1450 MHz	950 MHz to 1450 MHz	950 MHz to 1700 MHz	950 MHz to 1450 MHz
LO frequency (Inverting)	—	—	—	—
LO frequency (Non-Inverting)	6.950 GHz	13.050 GHz	12.800 GHz	11.800 GHz
RF frequency	7.900 GHz to 8.400 GHz	14.000 GHz to 14.500 GHz	13.750 GHz to 14.500 GHz	12.750 GHz to 13.250 GHz
Output Power	5, 10, 20, 25, 40, 50, 60 watts	4, 8, 12, 16, 20, 25, 30, 40, 50 watts	4, 8, 12, 16, 20, 25, 30, 40, 50 watts	4, 8, 12, 16, 20, 25, 30, 40, 50 watts

Table 2.2 IBUC **2e** Transmit Frequency Plans

Signal	Standard C-band	Palapa C-band	Insat C-band	Extended C-band	Full C-band
L-band (Inverting)	950 MHz to 1525 MHz	975 MHz to 1275 MHz	1150 MHz to 1450 MHz	950 MHz to 1750 MHz	975 MHz to 1850 MHz
LO frequency (Inverting)	7.375 GHz	7.700 GHz	8.175 GHz	7.600 GHz	7.700 GHz
L-band (Non-Inverting)	950 MHz to 1525 MHz	1125 MHz to 1425 MHz	965 MHz to 1265 MHz	950 MHz to 1750 MHz	950 MHz to 1825 MHz
LO frequency (Non-Inverting)	4900 MHz	5300 MHz	5760 MHz	4900 MHz	4900 MHz
RF frequency	5.850 GHz to 6.425 GHz	6.425 GHz to 6.725 GHz	6.725 GHz to 7.025 GHz	5.850 GHz to 6.650 GHz	5.850 GHz to 6.725 GHz
Output Power	5, 10, 20 watts	5, 10, 15, 20 watts	5, 10, 15, 20 watts	5, 10, 15, 20 watts	5, 10, 15, 20 watts

Signal	Standard Ku-band (Band 1)	Full Ku-band (Band 2)	Low Ku-band (Band 3)
L-band	950 MHz to 1450 MHz	950 MHz to 1700 MHz	950 MHz to 1450 MHz
LO frequency (Inverting)	—	—	—
LO frequency (Non-Inverting)	13.050 GHz	12.800 GHz	11.800 GHz
RF frequency	14.000 GHz to 14.500 GHz	13.750 GHz to 14.500 GHz	12.750 GHz to 13.250 GHz
Output Power	4, 8, 12, 16 watts	4, 8, 12, 16 watts	4, 8, 12, 16 watts

Table 2.3 IBUC **2G** Transmit Frequency Plans

Signal	Standard C-band	Palapa C-band	Insat C-band	Extended C-band	Full C-band
L-band (Inverting)	950 MHz to 1525 MHz	975 MHz to 1275 MHz	1150 MHz to 1450 MHz	950 MHz to 1750 MHz	975 MHz to 1850 MHz
LO frequency (Inverting)	7.375 GHz	7.700 GHz	8.175 GHz	7.600 GHz	7.700 GHz
L-band (Non-inverting)	950 MHz to 1525 MHz	1125 MHz to 1425 MHz	965 MHz to 1265 MHz	950 MHz to 1750 MHz	950 MHz to 1825 MHz
LO frequency (Non-Inverting)	4900 MHz	5300 MHz	5760 MHz	4900 MHz	4900 MHz
RF frequency	5.850 GHz to 6.425 GHz	6.425 GHz to 6.725 GHz	6.725 GHz to 7.025 GHz	5.850 GHz to 6.650 GHz	5.850 GHz to 6.725 GHz
Output Power	100, 125 watts	100, 125 watts	100, 125 watts	100, 125 watts	100, 125 watts

Signal	Standard Ku-band (Band 1)	Full Ku-band (Band 2)	Low Ku-band (Band 3)	X-band	Ka-band
L-band	950 MHz to 1450 MHz	950 MHz to 1700 MHz	950 MHz to 1450 MHz	950 MHz to 1450 MHz	1000 MHz to 2000 MHz
LO frequency (Inverting)	—	—	—	—	—
LO frequency (Non-Inverting)	13.050 GHz	12.800 GHz	11.800 GHz	6.950 GHz	28.000 GHz
RF frequency	14.000 GHz to 14.500 GHz	13.750 GHz to 14.500 GHz	12.750 GHz to 13.250 GHz	7.900 GHz to 8.400 GHz	29.000 GHz to 30.000 GHz
Output Power	50, 80 watts	50, 80 watts	80 watts	100 watts	5, 10, 16, 20, 25, 40 watts

Signal	Ka-band	Ka-band
L-band	1000 MHz to 1500 MHz	1000 MHz to 2000 MHz
LO frequency (Inverting)	—	—
LO frequency (Non-Inverting)	28.500 GHz	29.000 GHz
RF frequency	29.500 GHz to 30.000 GHz	30.000 GHz to 31.000 GHz
Output Power	5, 10, 16, 20, 25, 40 watts	5, 10, 16, 20, 25, 40 watts

Table 2.4 IBUC **R** Transmit Frequency Plans

Signal	Standard C-band	Palapa C-band	Insat C-band	Extended C-band	Full C-band
L-band (Inverting)	950 MHz to 1525 MHz	975 MHz to 1275 MHz	1150 MHz to 1450 MHz	950 MHz to 1750 MHz	975 MHz to 1850 MHz
LO frequency (Inverting)	7.375 GHz	7.700 GHz	8.175 GHz	7.600 GHz	7.700 GHz
L-band (Non-Inverting)	950 MHz to 1525 MHz	1125 MHz to 1425 MHz	965 MHz to 1265 MHz	950 MHz to 1750 MHz	950 MHz to 1825 MHz
LO frequency (Non-Inverting)	4900 MHz	5300 MHz	5760 MHz	4900 MHz	4900 MHz
RF frequency	5.850 GHz to 6.425 GHz	6.425 GHz to 6.725 GHz	6.725 GHz to 7.025 GHz	5.850 GHz to 6.650 GHz	5.850 GHz to 6.725 GHz
Output Power	100, 125, 150, 175, 200, 400 watts	100, 125, 150, 175, 200 watts	100, 125, 150, 175, 200 watts	100, 125, 150, 175, 200 watts	100, 125, 150, 175, 200 watts

Signal	X-band	Standard Ku-band (Band 1)	Full Ku-band (Band 2)	Low Ku-band (Band 3)
L-band	950 MHz to 1450 MHz	950 MHz to 1450 MHz	950 MHz to 1700 MHz	950 MHz to 1450 MHz
LO frequency (Inverting)	—	—	—	—
LO frequency (Non-Inverting)	6.950 GHz	13.050 GHz	12.800 GHz	11.800 GHz
RF frequency	7.900 GHz to 8.400 GHz	14.000 GHz to 14.500 GHz	13.750 GHz to 14.500 GHz	12.750 GHz to 13.250 GHz
Output Power	80, 100, 125, 150, 175 watts	60, 80, 100, 200 watts	60, 80, 100, 200 watts	60, 80, 100, 125, 200 watts

Table 2.5 IBUC  Transmit Frequency Plans

Signal	Standard C-band	Palapa C-band	Insat C-band	Extended C-band	Full C-band
L-band (Inverting)	950 MHz to 1525 MHz	975 MHz to 1275 MHz	1150 MHz to 1450 MHz	950 MHz to 1750 MHz	975 MHz to 1850 MHz
LO frequency (Inverting)	7.375 GHz	7.700 GHz	8.175 GHz	7.600 GHz	7.700 GHz
L-band (Non-Inverting)	950 MHz to 1525 MHz	1125 MHz to 1425 MHz	965 MHz to 1265 MHz	950 MHz to 1750 MHz	950 MHz to 1825 MHz
LO frequency (Non-Inverting)	4900 MHz	5300 MHz	5760 MHz	4900 MHz	4900 MHz
Output Power	400 watts	400 watts	400 watts	400 watts	400 watts

Signal	X-band	Standard Ku-band (Band 1)	Full Ku-band (Band 2)	Low Ku-band (Band 3)	Ka-band
L-band	950 MHz to 1450 MHz	950 MHz to 1450 MHz	950 MHz to 1700 MHz	950 MHz to 1450 MHz	1000 MHz to 2000 MHz
LO frequency (Inverting)	—	—	—	—	—
LO frequency (Non-Inverting)	6.950 GHz	13.050 GHz	12.800 GHz	11.800 GHz	28.000 GHz
RF frequency	7.900 GHz to 8.400 GHz	14.000 GHz to 14.500 GHz	13.750 GHz to 14.500 GHz	12.750 GHz to 13.250 GHz	29.000 GHz to 30.000 GHz
Output Power	400 watts	150, 200, 300, 400 watts	150, 200, 300, 400 watts	200, 300, 400 watts	5, 10, 16, 20, 25, 40 watts

Signal	Ka-band	Ka-band
L-band	1000 MHz to 1500 MHz	1000 MHz to 2000 MHz
LO frequency (Inverting)	—	—
LO frequency (Non-Inverting)	28.500 GHz	29.000 GHz
RF frequency	29.500 GHz to 30.000 GHz	30.000 GHz to 31.000 GHz
Output Power	80 watts	80 watts

DC Supply

DC power can be supplied through the N-connector or F-connector of the L-band input (labeled J1) or through the external power connector (labeled J3). For the high-power units, DC power is supplied through the six-pin circular connector (labeled J3) of the DC input. Higher-power units (such as Ku-band 20 watts and higher, C-band 30 watts and higher, X-band 25 watts and higher, or Ka-band 16 watts and higher) cannot accept DC input through the L-band input connector due to the higher current draw.

Terrasat IBUCs have several supply voltage options. The standard configuration is 48 VDC. However, a 24 VDC option is available for lower power units. Refer to the datasheets in [Appendix D](#) for more information. This choice of 24 VDC or 48 VDC is available only when the IBUC is ordered and configured at the factory. The operating voltage range for the 24 VDC option is 20 VDC to 28 VDC. The operating voltage range for lower-power units with 48 VDC is 37 VDC to 60 VDC. The operating voltage range for higher power units is 42 VDC to 60 VDC. DC-powered units are configured at the factory to have floating input.

Terrasat offers the low power, low energy consumption IBUC **2e**. These units are DC powered only via coaxial cable. While lower power versions of the IBUC **2e** can support voltage swings from 18 VDC to 75 VDC, higher power versions can only support swings from 37 VDC to 60 VDC. More information about the operating voltage range maximum power consumption for these units can be found in the datasheet in [Appendix D](#).

AC Supply

Some IBUCs are available with optional AC power, delivered through connector J3, as seen in [Figure 2.3](#). [Table 2.6](#) lists the voltage ranges for different bands and power levels.

Table 2.6 AC Supply Operating Voltage Ranges

Voltage	Band	Watts
100 VAC to 240 VAC	C-band	5 watts to 125 watts
200 VAC to 240 VAC	C-band	150 watts to 400 watts
100 VAC to 240 VAC	X-band	5 watts to 125 watts
200 VAC to 240 VAC	X-band	150 watts to 400 watts
100 VAC to 240 VAC	Ku-band	4 watts to 125 watts
200 VAC to 240 VAC	Ku-band	150 watts to 400 watts
100 VAC to 240 VAC	Ka-band	5 watts to 80 watts

Note: The IBUC **2e** pictured in [Figure 2.1](#) has a plate covering the connector at J3. This is because the low energy consumption IBUC **2e** is powered only via coaxial cable through connector J1.

Note: For more information about connector types, breather valve system and mounting options, refer to sections: [System Cabling Requirements](#) on [page 3-13](#), [System Pressurization](#) on [page 3-12](#) and [Antenna Mounting](#) on [page 3-8](#) respectively.

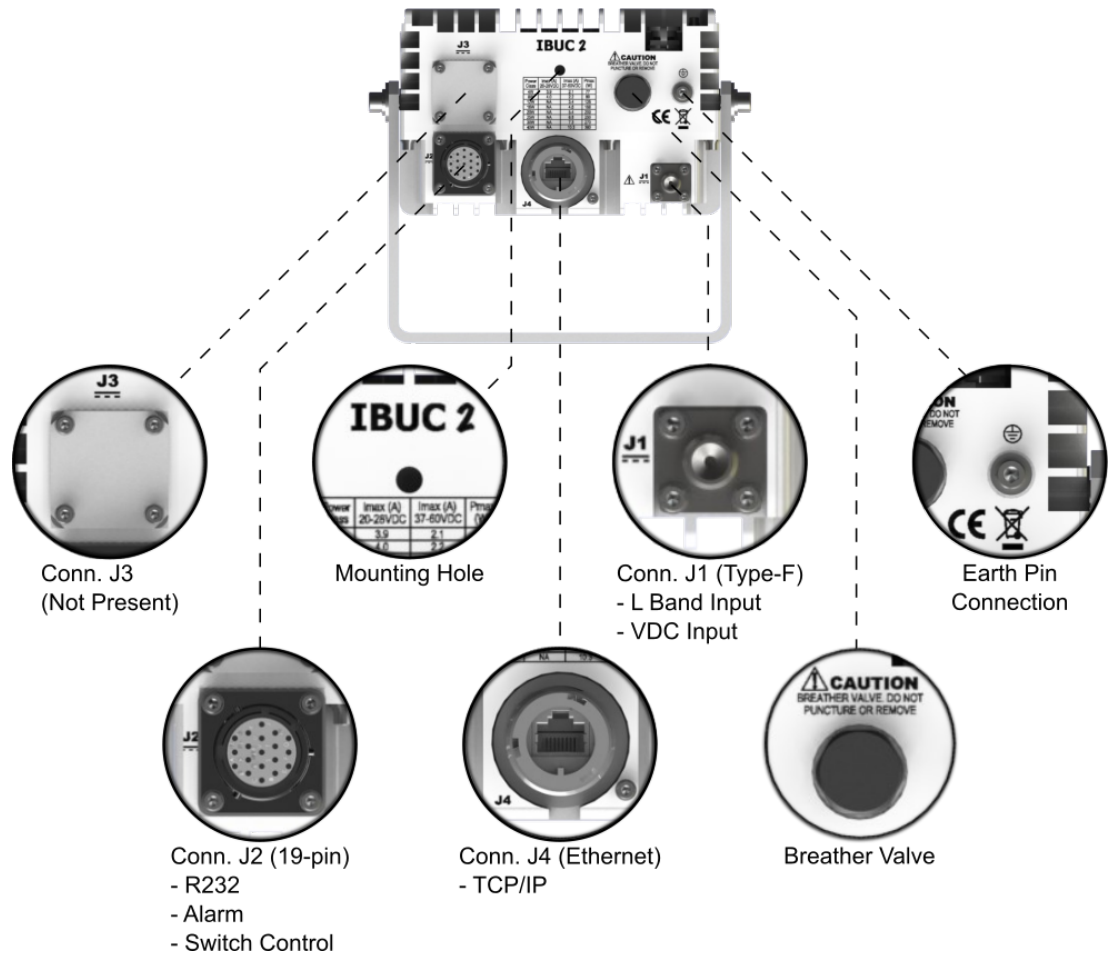


Figure 2.1 Front Panel of a Low Energy Consumption IBUC **2e**

Note: The IBUC **2** pictured in [Figure 2.2](#) has a N-Type connection at connector J1.

Note: For more information about connector types, breather valve system and mounting options, refer to sections: [System Cabling Requirements](#) on [page 3-13](#), [System Pressurization](#) on [page 3-12](#) and [Antenna Mounting](#) on [page 3-8](#) respectively.

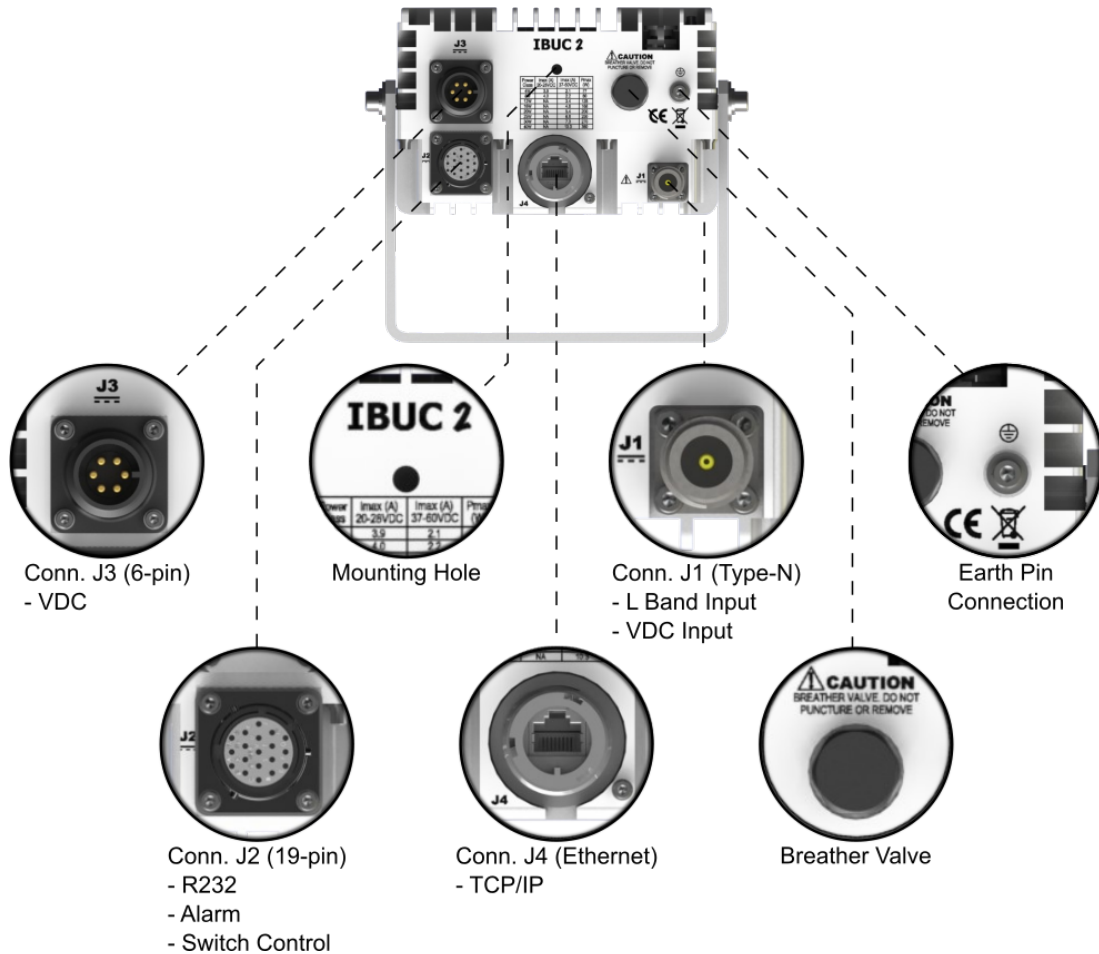


Figure 2.2 Front Panel of a DC-powered IBUC **2**

Note: The IBUC **2G** pictured in [Figure 2.3](#) has an N-type connector at J1.

Note: For more information about connector types, breather valve system and mounting options, refer to sections: [System Cabling Requirements](#) on [page 3-13](#), [System Pressurization](#) on [page 3-12](#) and [Antenna Mounting](#) on [page 3-8](#) respectively.

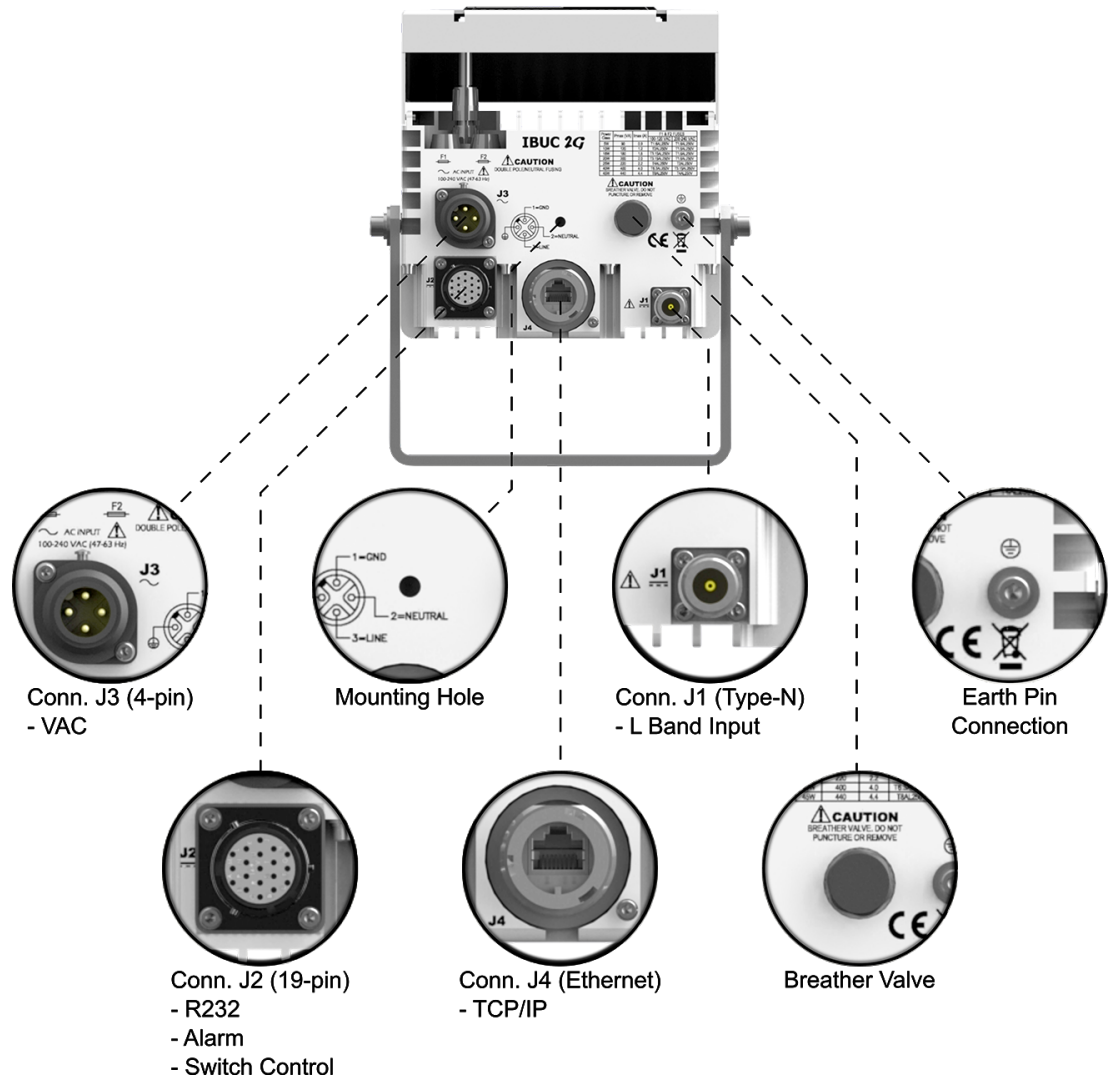


Figure 2.3 Front Panel of an AC-powered IBUC **2G**

Note: The IBUC **G** pictured in [Figure 2.4](#) has an MilSpec Hirose connector at J3.

Note: For more information about connector types, breather valve system and mounting options, refer to sections: [System Cabling Requirements](#) on [page 3-13](#), [System Pressurization](#) on [page 3-12](#) and [Antenna Mounting](#) on [page 3-8](#) respectively.

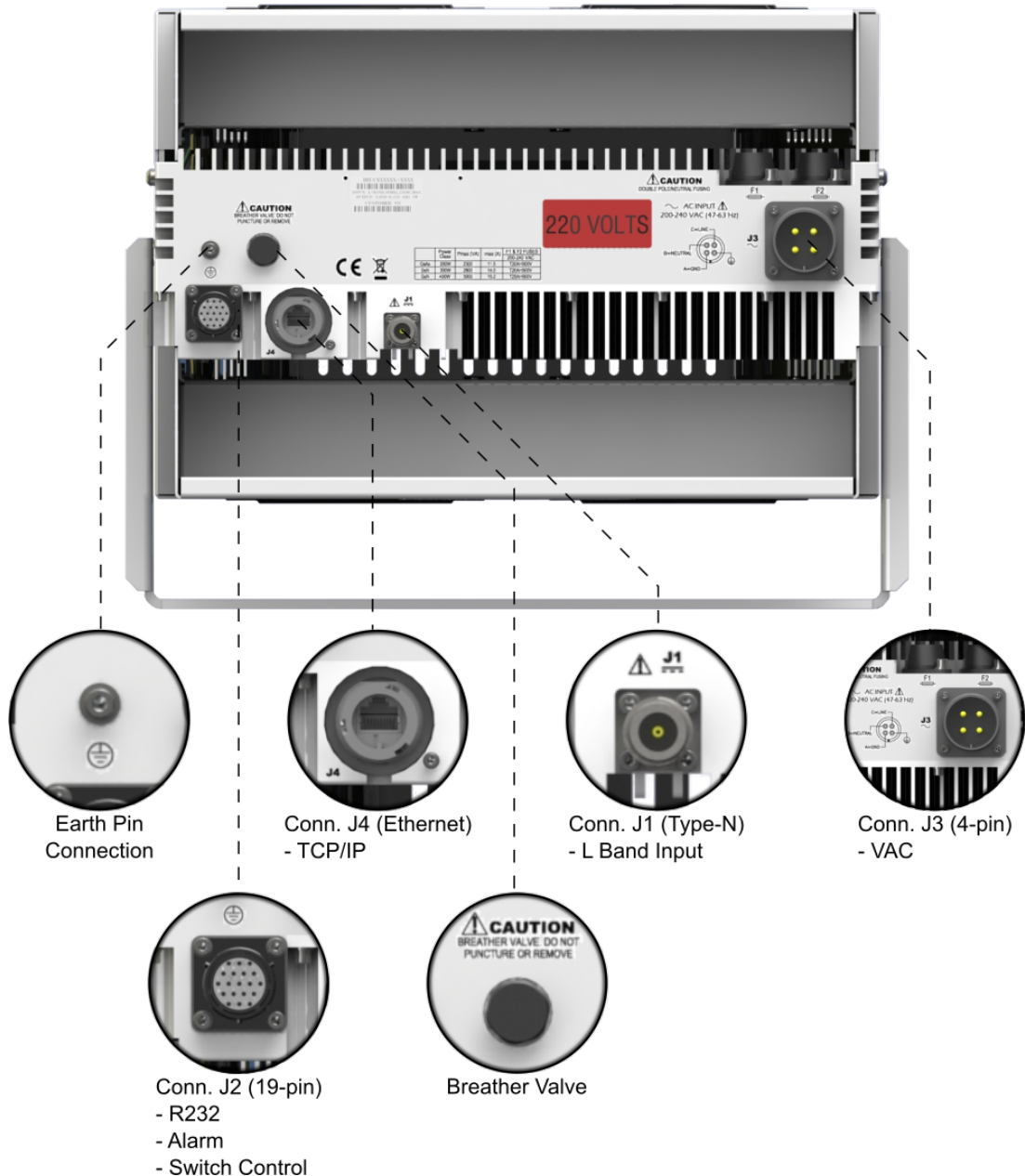


Figure 2.4 Front Panel of an AC-powered IBUC **G** using MilSpec connector

Fuses

Table 2.7 lists the fuse markings of the fuses required by different AC-powered IBUC models. Figure 2.5 on page 2-15 defines the international marking schema.

Table 2.7 Fuse Markings

Signal	Power Level	Fuse Markings	
		115 VAC	230 VAC
C-band	5 W	T1.6AL250V	T1.6AL250V
	10 W	T2AL250V	T1.6AL250V
	15 W	T2.5AL250V	T1.6AL250V
	20 W	T3.15AL250V	T1.6AL250V
	25 W	T4AL250V	T2AL250V
	30 W		
	40 W	T5AL250V	T2.5AL250V
	50 W		
	60 W	T6.3AL250V	T3.15AL250V
	80 W	T10AL250V	T5AL250V
	100 W	T12.5AL250V	T6.3AL250V
	125 W		
	150 W	N/A	T10AL250V
	175 W		
	200 W		
X-band	250 W	N/A	T12.5AL250V
	300 W	N/A	T15AH500V
	400 W	N/A	T20AH500V
	400 W(G)	N/A	T16AL250V
	5 W	T1.6AL250V	T1.6AL250V
	10 W	T2AL250V	T1.6AL250V
	20 W	T3.15AL250V	T1.6AL250V
	25 W	T4AL250V	T2AL250V
	40 W	T6.3AL250V	T3.15AL250V
	50 W		
	60 W	T8AL250V	T4AL250V
	80 W	T10AL250V	T5AL250V
	100 W	T12.5AL250V	T6.3AL250V
	100 W(G)	T8AL250V	T4AL250V
	125 W	T12.5AL250V	T6.3AL250V
	150 W	N/A	T10AL250V
	175 W		
	400 W(G)	N/A	T12.5AL250V

Table 2.7 Fuse Markings (Continued)

Signal	Power Level	Fuse Markings	
		115 VAC	230 VAC
Ku-band	4 W	T1.6AL250V	T1.6AL250V
	8 W	T2.5AL250V	T1.6AL250V
	12 W	T2.5AL250V	T1.6AL250V
	16 W	T3.15AL250V	T1.6AL250V
	20 W	T4AL250V	T2AL250V
	25 W	T5AL250V	T2.5AL250V
	30 W	T8AL250V	T4AL250V
	40 W	T8AL250V	T4AL250V
	50 W	T10AL250V	T5AL250V
	50 W(G)	T6.3AL250V	T3.15AL250V
	60 W	T12.5AL250V	T6.3AL250V
	80 W	T12.5AL250V	T6.3AL250V
	80 W(G)	T10AL250V	T5AL250V
	100 W 125 W	T16AL250V	T8AL250V
	150 W(G)	N/A	T10AL250V
	200 W	N/A	T20AH500V
	200 W(G)	N/A	T10AL250V
	300 W(G) 400 W(G)	N/A	T20AH500V
Ka-band	5 W(G)	T1.6AL250V	T1.6AL250V
	10 W(G)	T2AL250V	T1.6AL250V
	16 W(G) 20 W(G)	T3.15AL250V	T1.6AL250V
	25 W(G)	T4AL250V	T2AL250V
	40 W(G)	T6.3AL250V	T3.15AL250V
	45 W(G)	T8AL250V	T4AL250V
	80 W(G)	T10AL250V	T5AL250V

Note: (G) marker stands for IBUC models that use GaN technology for power amplification and required different fuses than regular GaAs amplifiers

Note: For IBUCs that require fuses up to 6.3 A, Terrasat recommends time lag fuse with a high I^2t value. For IBUCs that require fuses greater than 6.3 A, Terrasat recommends time-delay fuses.

For reference, IBUCs are delivered with one of the following Littelfuse Series fuse:

- [Littelfuse 213 Series](#). (5x20mm time-lag surge withstand glass body cartridge for medium current ratings)
- [Littelfuse 218 Series](#). (5x20mm time-lag glass body cartridge for high current ratings)
- [Littelfuse FLQ Series](#). (10x38mm time-delay midget fuse for high voltage, high current ratings)
- [Littelfuse 326 Series](#). (6.3x32mm Slo-Blo® Fuse with ceramic body construction for high interrupting and voltage ratings)
- [Littelfuse 332 Series](#). (6.3x32mm Very Fast-Acting fuse for solid-state device protection)

Figure 2.5 explains the fuse marking schema.

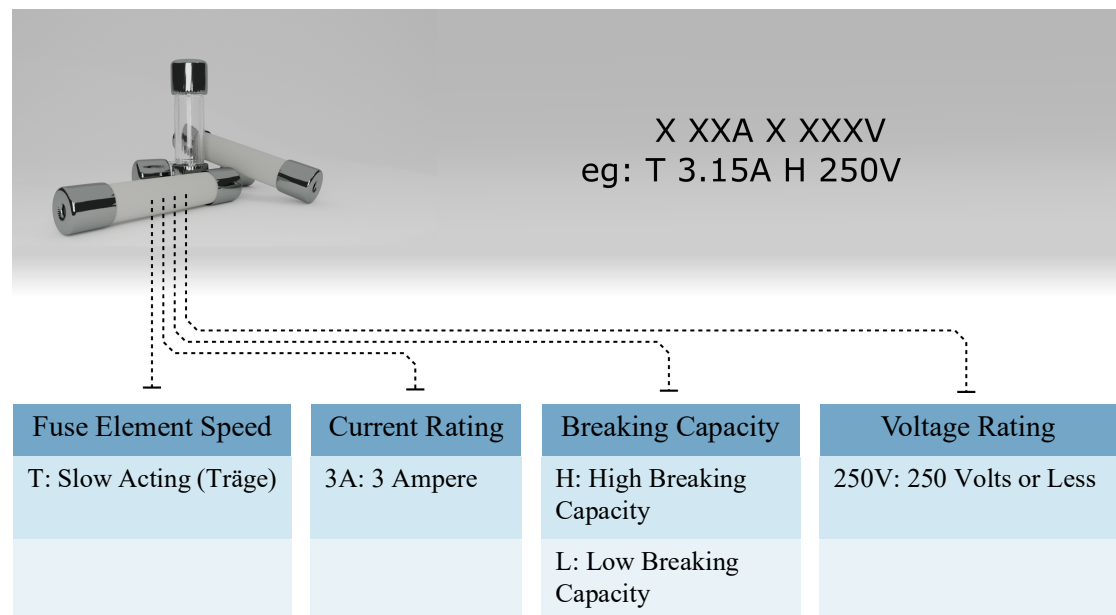


Figure 2.5 [IEC 127](#) Compliant Fuse Marking

Monitor and Control

Each IBUC is equipped with extensive monitor and control (M&C) capabilities. Use any of the following methods to access those capabilities:

- Via the J2 connector using RS232. This method requires that a separate cable must be run and connected to J2.

[Figure D.1](#) on [page D-2](#) contains a drawing for fabricating your own cable.

- Via the J4 connector using TCP/IP. This method requires a separate Ethernet cable.

[Figure D.2](#) on [page D-3](#) contains a drawing for fabricating your own cable.

RF Signal Flow

L-band input to the IBUC is through the input N-connector or the F-connector (labeled J1). Required inputs include an L-band signal at -20 dBm or less and a 10 MHz sine wave reference signal between +5 dBm and -12 dBm (for those units that do not have the optional internal 10 MHz reference signal).

The US National Institute of Standards and Technology defines single sideband (SSB) phase noise as the ratio of the spectral power density measured at an offset frequency from the carrier to the total power of the carrier signal. The most generally used phase noise unit of measure has been the single sideband power within a one hertz bandwidth at a frequency f away from the carrier referenced to the carrier frequency power. This unit of measure is represented as $\mathcal{L}(f)$ in units of dBc/Hz. An internal phase-locked Local Oscillator provides excellent phase noise when locked to an external 10 MHz reference. Single sideband phase noise using an external reference signal is listed in [Table 2.8](#).

Table 2.8 External 10 MHz Reference Signal Parameters

Condition	External Reference
10 Hz	-115 dBc/Hz
100 Hz	-140 dBc/Hz
1 kHz	-150 dBc/Hz
10 kHz	-155 dBc/Hz
100 kHz	n/a
1 MHz	n/a

The internal 10 MHz reference signal meets the minimum phase noise requirements listed in [Table 2.9](#).

Note: If an external 10 MHz reference signal is applied to a unit with the optional internal 10 MHz reference signal, the external signal has priority. When the external signal is removed from such units, the system automatically reverts to the internal 10 MHz signal, requiring no additional user input.

Table 2.9 Internal 10 MHz Reference Signal Parameters

	Minimum	Maximum	Condition
Phase Noise		-125 dBc/Hz	10 Hz
		-145 dBc/Hz	100 Hz
		-160 dBc/Hz	1 kHz
		-165 dBc/Hz	10 kHz

Table 2.9 Internal 10 MHz Reference Signal Parameters

	Minimum	Maximum	Condition
Frequency Stability vs. Operating Temperature Range (referenced to frequency at +25 °C)	-30 ppb	+30 ppb	-40 °C to +85 °C
Tuning Range (referenced to nominal frequency)	±1 ppm	±1 ppm	
Tuning Slope	Positive		

Input to the IBUC also includes AC or DC voltage (via the J3 connector) and DC voltage for low-power units. The input (L-band, 10 MHz, and DC via coaxial cable) is routed to the demultiplexer circuitry where the various signals are split off and routed to the appropriate circuits within the IBUC. (Only IBUCs with direct DC or AC via the J3 connector feed the power supply directly.) The input voltage from the demultiplexer circuitry is routed to the power supply and the FSK signal is routed to the M&C card.

The external 10 MHz reference signal is routed to the multiplier circuitry where its level is first detected and an alarm issued if the signal is low. However, if the signal level is low and the system is equipped with the optional internal 10 MHz signal, the system will automatically switch to the internal 10 MHz signal. The 10 MHz signal is then multiplied to the frequency used for phase-locking purposes. The output of the multiplier is routed to the phase detector circuitry where it is compared with the phase of the DRO (dielectric resonator oscillator) signal sample and consequently generates a voltage that is applied as a control voltage to the DRO to adjust its frequency. The DRO has been optimized for phase noise at a single frequency based on the frequency band of that particular IBUC. The output of the DRO is amplified and routed to the mixer.

The L-band signal that is split off in the demultiplexer circuitry is first filtered and a sample of it detected for input power detection and control purposes. The signal is then amplified, and goes through a variable attenuator. The attenuation is used to provide an attenuation adjustment of 30 dB in 0.1 dB steps and to provide automatic level control (ALC) or automatic gain control (AGC).

After additional amplification and filtering, the signal is routed to the mixer. The L-band signal is then mixed with the DRO signal to “upconvert” to the appropriate RF signal based on the frequency band of the IBUC. The RF signal is filtered, amplified, and then routed to the temperature compensation circuitry. The temperature compensation circuitry has been calibrated so that the IBUC gain does not vary more than 3 dB at any given frequency.

Note: Some units can vary up to 4 dB at any given frequency.

The signal is then routed through an isolator to the solid-state power amplifier (SSPA). Some models have an additional mechanical filter between the isolator and the SSPA. The SSPA amplifies the signal which is then routed to the output through an isolator for reverse power protection. The RF output is detected for M&C purposes. The IBUC gain has been calibrated so that at minimum attenuation, a -30 dBm input results in rated power of at least P1dB at the output at any frequency or temperature, for GaAs units. For GaN units the IBUC gain has been calibrated so that at minimum attenuation, the small signal gain is, at a minimum, $(P_{SAT}+31)$ dB.

To operate at lower power levels, reduce the input to the IBUC or reduce the IBUC gain by using the variable attenuator, accessible using any of the M&C interfaces. The output of a C-band IBUC is a CPR137G waveguide or an N-type connector, the output of an X-band is a CPR112G waveguide, the output of a Ku-band IBUC is a WR75 cover with groove waveguide, and the output of a Ka-band IBUC is a WR28 UG cover with groove waveguide.

[Figure 2.6](#) depicts the signal flow for units that are DC powered, [Figure 2.7](#) depicts the signal flow for units that are AC powered, and [Figure 2.8](#) depicts the signal flow for DC-powered low energy-consumption units.

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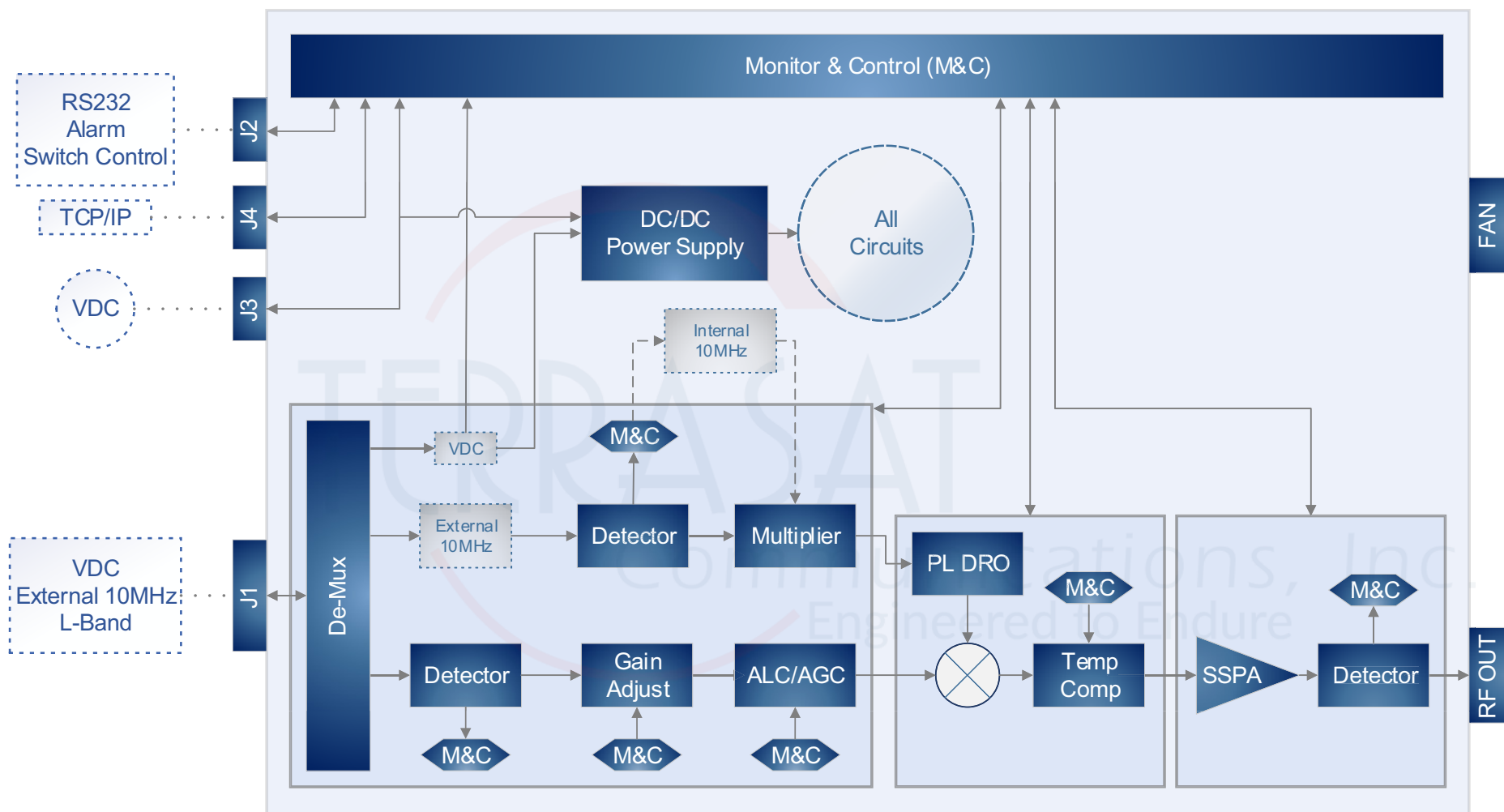


Figure 2.7 DC-powered Cyber Hardened IBUC Block Diagram

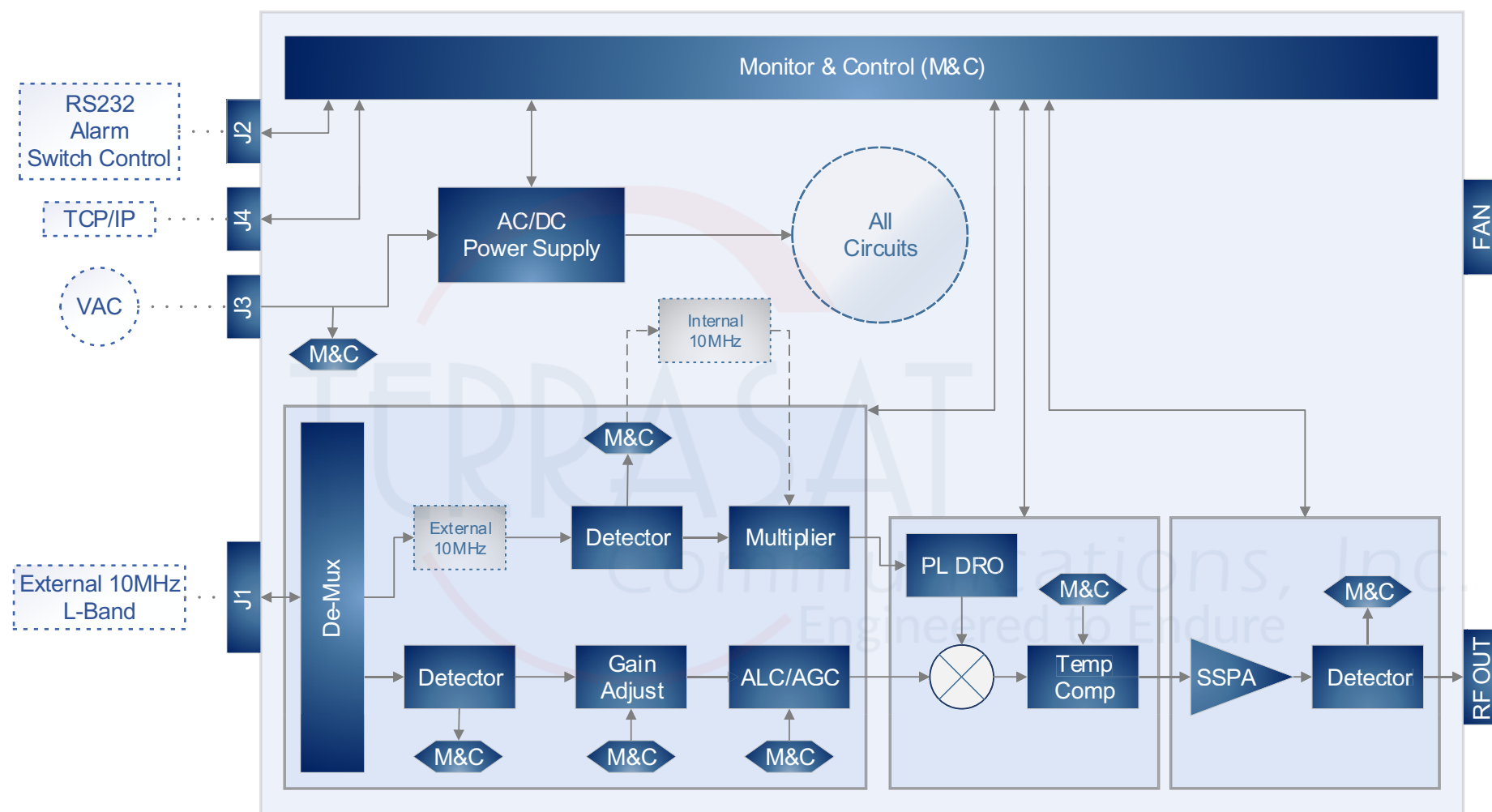


Figure 2.8 AC-powered Cyber Hardened IBUC Block Diagram

Software

The Cyber Hardened IBUC **2**, IBUC **2e**, IBUC **2G**, IBUC **R** or IBUC **G** monitors and controls numerous parameters and has features which simplify installation and use and enhance system performance.

Some of these key features include:

- Monitor and Control

The IBUC can be monitored and controlled through a couple of interfaces including RS232 and Ethernet port. See [Chapter 5, Monitor and Control Features](#), for a full description of these functions.

- Tx Attenuation

The gain of the unit can be set over a 30 dB range in 0.1 dB steps.

- Automatic Gain Control (AGC)

The IBUC continuously monitors input and output levels. When AGC is enabled, the gain of the system is maintained at a constant level by an internal algorithm. Gain is the difference between output power and input power.

- Automatic Level Control (ALC)

Similar to the AGC system, when ALC is enabled, the gain is adjusted to maintain a constant output level.

- Input Power Overdrive Protection

Based on internal selectable stable references, transistor overdrive will be measured and automatically assessed. Terrasat's Inc. algorithm allows the input overdrive point to be up to 6dB higher than the selected reference point. If such condition is not met, internal attenuators will be activated to limit power delivery.

- Embedded Web Pages (HTTPS)

- Simple Network Management Protocol (SNMPv3)

Provides integration of IP M&C in existing network management systems.

- Burst Operation

Enables operation in burst mode. The IBUC reports peak output power of valid bursts (above a burst threshold) when in burst mode.

- Event History (with time stamps)

A log of events that occur is maintained. This can simplify troubleshooting of the system (especially when an intermittent problem occurs).

- Sensors

A series of internal sensors enable you to verify performance and to troubleshoot the system. Sensors include internal temperature, 10 MHz input detector, supply

voltage, current consumption, phase-locked dielectric resonator oscillator (PLDRO) lock voltage, input level and output level.

- Statistic History

A log of system core statistics is automatically gathered and maintained. This resource can simplify troubleshooting of the system. For a complete list of which variables are gathered, refer to command [SHL](#) on [page C-27](#).

System Configurations

[Figure 2.9](#) to [Figure 2.11](#) show typical earth station installations using Terrasat block upconverters. In normal operation, the IBUC and the low-noise block downconverter (LNB) are mounted outdoors. Depending on the model of the IBUC, the PSUI can be mounted indoors or outdoors. The IBUC and the LNB can interface directly with a satellite modem, a 70 MHz to L-band rack converter or modem combiner network. [Table 2.10](#) lists the requirements for proper operation.

Table 2.10 Basic System Requirements

IBUC	LNB
DC supply	DC supply
~ from the modem	~ from the modem
~ from the outdoor PSUI	10 MHz reference signal
~ from the indoor PSUI	~ internally referenced
~ from the telecom station	~ externally referenced
AC supply	~ free running
~ AC mains	RF input
10 MHz reference signal	~ from the antenna
~ internally referenced	
~ externally referenced	
L-band signal	

Certain considerations must be made when selecting the IFL because appropriate shielding and signal levels are required for normal system operation. The IBUC is designed to operate with a -30 dBm Tx L-band input signal to achieve rated power at maximum gain/minimum attenuation. The Cyber Hardened IBUC **2**, IBUC **2e**, IBUC **2G**, IBUC **R** or IBUC **G** provides a variable attenuator that is accessible through the various M&C interfaces that enables the gain of the unit to be reduced by up to 30 dB in 0.1 dB steps. The attenuator can be used to prevent overdrive to the IBUC in configurations with a short cable run (or IFL), thus preserving the dynamic range of the modem. In addition, the externally referenced IBUC and the externally referenced LNB must have a 10 MHz input signal at +5 dBm to -12 dBm for the IBUC, and 0 dB to -10 dBm for the LNB. The maximum voltage drop for a 24 VDC IBUC is 4 volts and the maximum drop for a 48 VDC IBUC is 11 volts.

For AC-powered IBUCs, the range is 100 VAC to 240 VAC. For higher power units operate from 200 VAC to 240VAC.

Note: The system configurations in [Figure 2.9](#) to [Figure 2.11](#) depict an external 10 MHz reference signal; however, an optional internal 10 MHz reference signal is available.

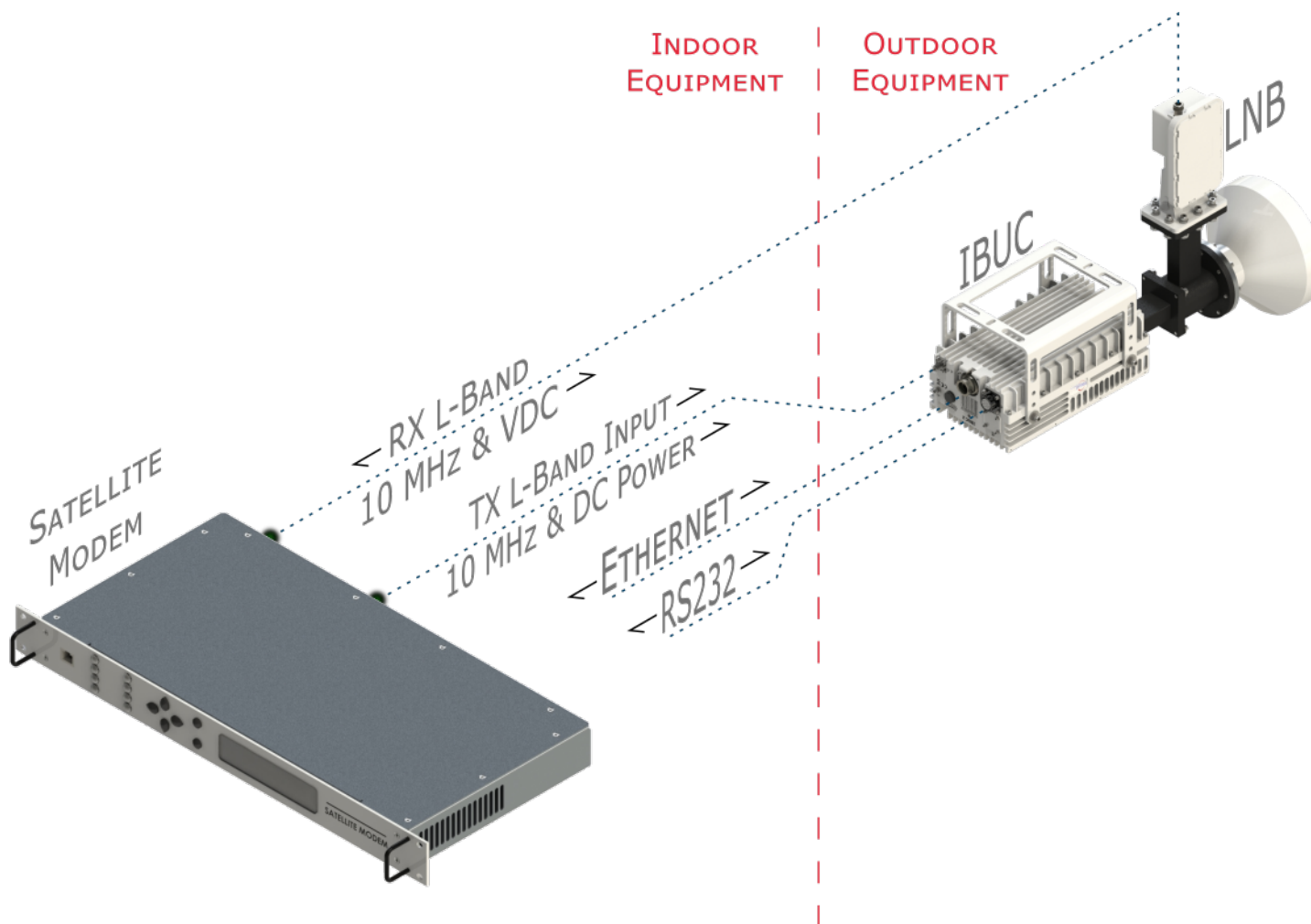


Figure 2.9 DC Low Power IBUC System Configuration

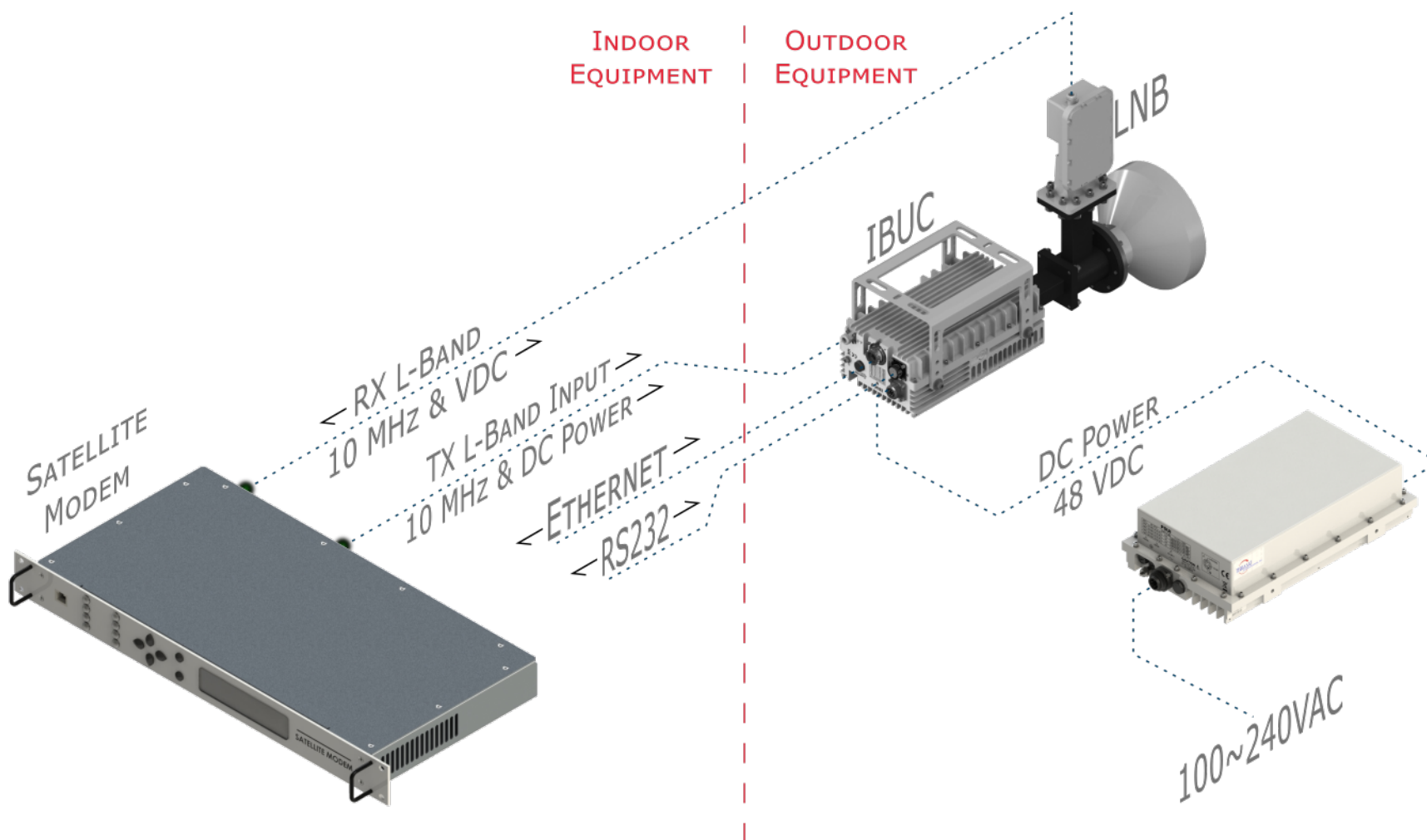


Figure 2.10 DC Power IBUC System Configuration

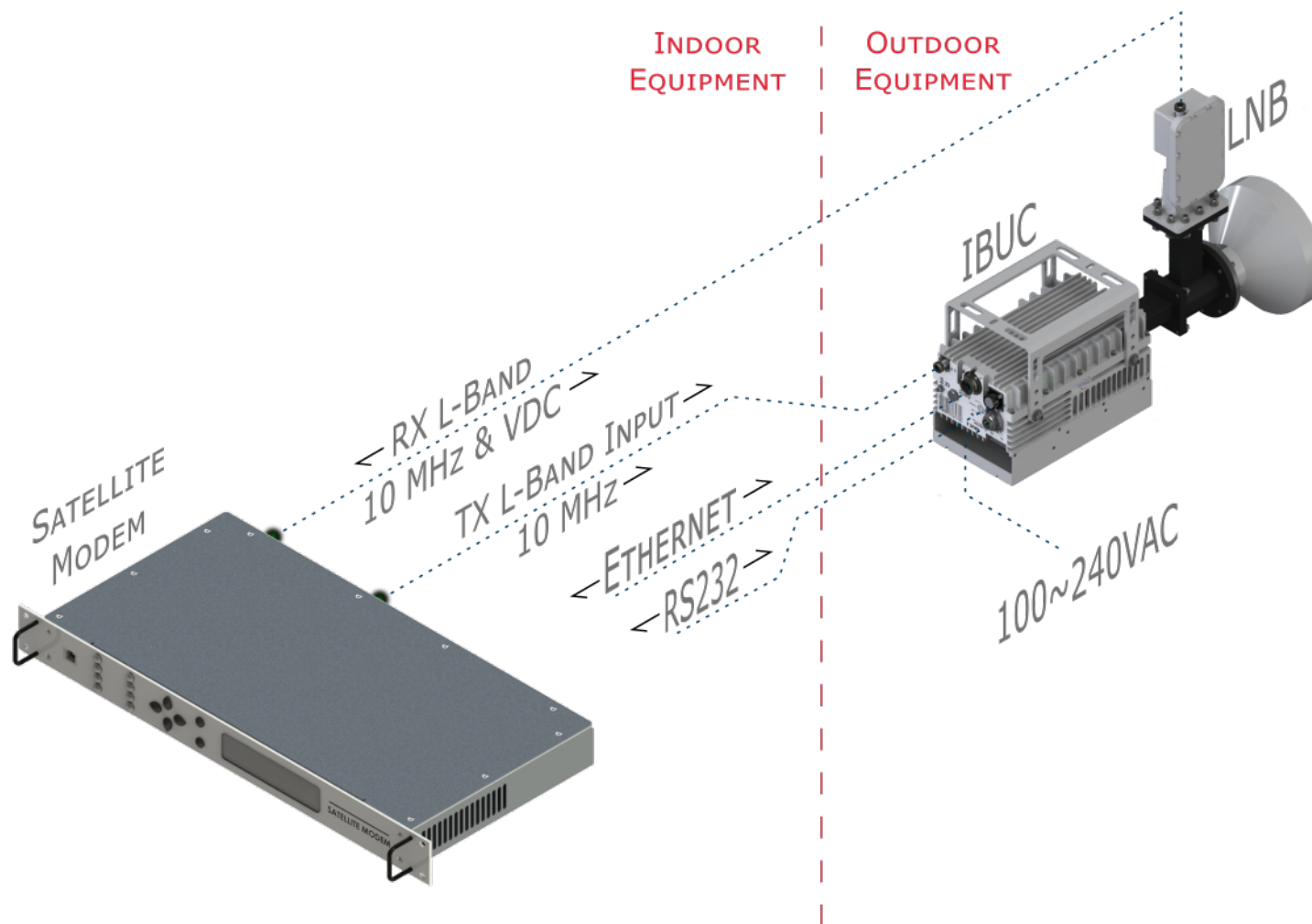


Figure 2.11 AC Power IBUC System Configuration

Storage Information

There are no storage limitations on the Cyber Hardened IBUC **2**, IBUC **2e**, IBUC **2G**, IBUC **R** or IBUC **G** other than avoiding excessive exposure beyond the -45 °C to +65 °C external ambient temperature.

INSTALLATION

This chapter contains the general requirements for installing the Terrasat outdoor unit (ODU).

Introduction

The ODU consists of an intelligent block upconverter (IBUC) and a low-noise block converter (LNB). An power supply (PSUI) can also be part of the configuration.

General Requirements



WARNING

For protection of personnel and equipment, use care when installing the antenna and whenever working on or around the system.

Follow standard safety precautions with hand or power tools.

Use care when working with high AC voltages and microwave emissions.

Unpacking

Check to make sure that the ODU has not been damaged in shipment. If there is any damage, contact the shipper before proceeding. If you need to declare any equipment as damaged during transit, save the original shipping cartons to ease inspection reporting.

Terrasat recommends retaining and re-using all shipping cartons and foam forms if the equipment will be stored or reshipped. The cartons should be clearly marked to indicate that they contain fragile electronic equipment.

Compare the contents of the shipping container with the packing list to ensure that all items have been received. If any item is missing, contact Terrasat.

Furnished Items

The following list describes items that are furnished with Terrasat Communications, Inc. Cyber Hardened IBUC's. Refer to [Figure 3.1](#) for visual representation of such items.

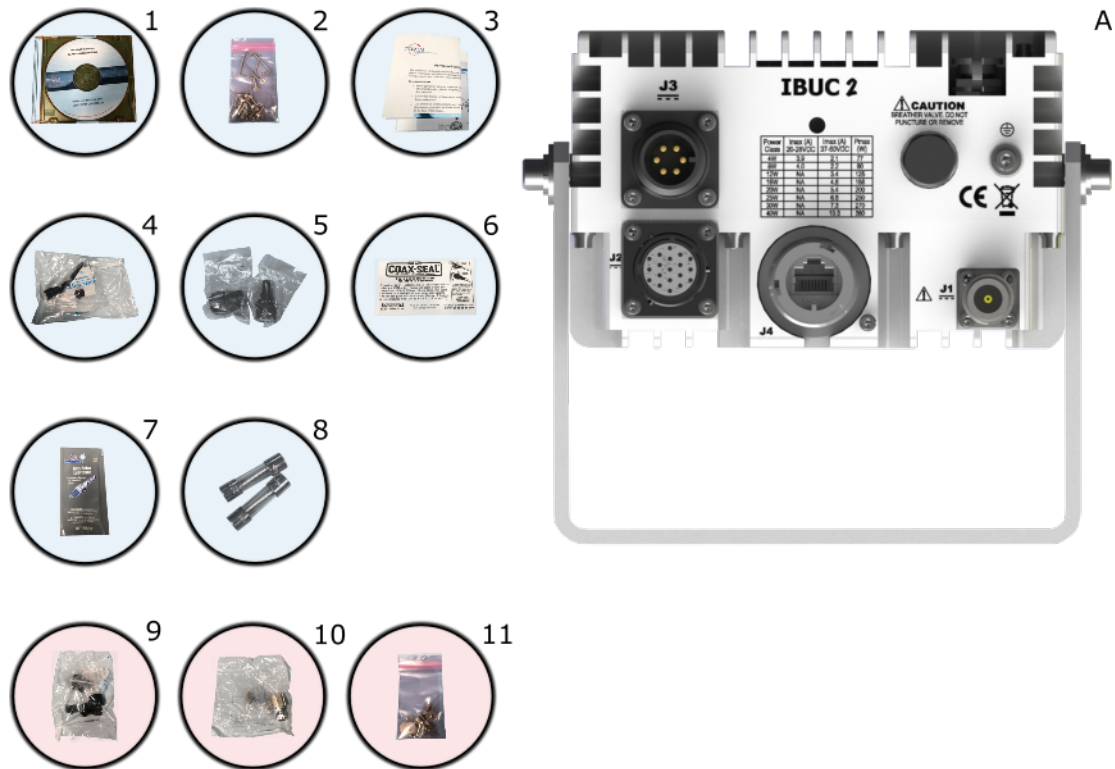


Figure 3.1 Furnished items with Cyber Hardened IBUC **2**

A. An Cyber Hardened IBUC **2**, IBUC **2e**, IBUC **2G**, IBUC **R** or IBUC **G** with an integrated solid state power amplifier (SSPA)

1. Product documentation on CD
2. Waveguide gaskets and hardware (waveguide units only)
3. Test datasheet
4. DC supply mating connector (for units with DC supply)

[Figure D.4](#) on [page D-5](#) contains information about fabricating your own DC supply cable.

5. AC supply mating connector (for units with AC supply)

[Figure D.4](#) on [page D-5](#) contains information about fabricating your own AC supply cable.

6. Sealing tape for Type-N connector

7. 5 g pouch of Permatex anti-seize lubricant

The anti-seize lubricant is a heavy duty high-temperature lubricant that prevents galling (friction between metal parts that can weld the nut and bolt together and prevent removal), seizing, and corrosion of fasteners during assembly and aids the disassembly of parts exposed to heat or corrosive environments.

8. Fuses

The fuses are intended for 220 VAC operation and are only supplied with units that operate over the range of 100 VAC to 240 VAC.

9. [Optional] 19-pin monitor and control (M&C) mating connector

10. [Optional] IP67 industrial RJ45 mating connector

11. [Optional] Mounting brackets and bolts. See [Figure 3.6](#) on [page 3-12](#).

Accessories

The following are optional accessories:

- A waveguide Rx reject filter
- A four-way combiner/divider module
- A TCP/IP test cable
- Waveguide pieces
- IFL cables (for example, LMR-400)
- Installation kits

Note: Exact contents of the shipping carton vary according to the model and type of IBUC.

Installing the ODU

Consider the following when preparing to install the ODU.

Tools

Have available a standard electrician's toolkit and any tools listed in the antenna manufacturer's installation instructions.

Test Equipment

Terrasat recommends the equipment or its equivalent listed in [Table 3.1](#) for installation and system alignment.

Table 3.1 Recommended Test Equipment

Equipment	Type
Spectrum Analyzer	Agilent HP8563E
Digital Voltmeter	Fluke 8050
Waveguide-to-coaxial Adapter	C-band or Ku-band
RF cables	With calibrated insertion loss up to 15 GHz
40 dB attenuator	High power to match HPA output
Assortment of cables, connectors and adapters (calibrated up to 15 GHz)	

Site Considerations

The ODU is designed to be mounted on or near the antenna. Locate and install the antenna according to instructions supplied by the antenna manufacturer. Choose an area that is free of interference from motors or other electrical equipment and that has a clear line of sight from the antenna to the satellite. Use size 3/0 or 4/0 AWG (American Wire Gauge) stranded copper wire to ground the Cyber Hardened IBUC **2**, IBUC **2e**, IBUC **2G**, IBUC **R** or IBUC **G** to the antenna frame and to the lightning protection ground rod. For higher power units with an external power supply, Terrasat recommends using an isolation filter to reduce power line interference.

Mounting Considerations

Optional mounting brackets are available to aid mounting on most antennas. The ODU must be mounted such that:

- The IBUC has sufficient support to minimize the effects of antenna sway in strong winds.
- The fan intake and exhausts are free from any obstructions.
- The heat fins have air movement across them.

Throughout installation and during any polarization, azimuth or elevation adjustment, ensure that cables and waveguide are not crimped or pinched. Ensure that there is adequate slack in the cable.

Power Requirements



WARNING

Installation and connection to the line power supply must be made in compliance with applicable wiring codes and regulations.

For DC-powered IBUC models with a rated power level of 25 watts or below for C-band, 20 watts and below for X-band, 16 watts and below for Ku-band and 10 watts and below for Ka-band, the power for the IBUC can come either from the IFL supplied from the Terrasat indoor unit (IDU) equipped with a 200 watts power supply or from a satellite modem equipped with a suitable power supply. DC power for these lower power IBUCs can also be supplied directly through the external power connector (J3) by using the Terrasat 250 watts external power supply. Refer to the part number label (shown in [Figure A.1](#) on [page A-1](#)) to determine voltage requirements. Ensure that 24 VDC input voltage is from 20 VDC to 28 VDC and that the 48 VDC input is from 37 VDC to 60 VDC.

Note: Power for the IBUC **2e** comes only via coaxial cable. Refer to the datasheet in [Appendix D, Component Specifications and Reference Drawings](#) for power requirements.

Outdoor Power Supply

Terrasat offers four models of outdoor power supplies. DC-powered IBUCs with a rated power level higher than 25 watts C-band, 25 watts X-band or 16 watts Ku-band require a separate power supply. Units that get their power from the earth (or telecom) station do not require an external power supply. [Table 3.2](#) lists the four outdoor power supply models and applications for each. Power supplies have an autoranging AC front end that works with both 115 VAC and 230 VAC.

Note: The IBUC is configured at the factory to be floating. Ensure that the correct polarity is applied to any unit.

Table 3.2 Terrasat Outdoor Power Supplies

Model	Output Power	Application
PSUI-948-0250S-4	250 W	<ul style="list-style-type: none"> • C-band up to 25 W • X-band up to 25 W • Ku-band up to 16 W • Ka-band up to 16 W
PSUI-948-600-4	600 W	<ul style="list-style-type: none"> • C-band up to 80 W • X-band up to 80 W • Ku-band up to 50 W • Ka-band up to 40 W
PSUI-948-1000-4	1000 W	<ul style="list-style-type: none"> • C-band 100 W to 125 W • X-band 100 W to 125 W • Ku-band 60 W to 80 W
PSUI-948-600-4	1200 W	<ul style="list-style-type: none"> • C-band 150 W to 200 W • X-band 150 W to 175 W

All IBUCs that are AC-powered and all Terrasat outdoor PSUI's are furnished with a detachable AC power connector that is used to connect and disconnect power. When connecting the AC connector to the AC power source, the wiring must include a 15 A or 20 A circuit breaker. A disconnect device (such as a circuit breaker or mains supply plug on the power supply cord) that is readily accessible must also be provided. Any outdoor AC connections should be made using suitable connectors or boxes with an IEC protection class of at least IP65.



WARNING

Ensure AC power is off when connecting or disconnecting the power supply unit's power cord. To turn off AC power to the unit, use the installed circuit breaker or a similar disconnecting device.

If a circuit breaker is not easily accessible as a disconnecting device, the input connector will be the disconnecting device. In this case, the socket-outlet must be installed near the equipment and must be easily accessible for pluggable equipment.

All AC-powered IBUCs and the Terrasat outdoor PSUI are furnished with mating connectors for the AC mains power cable. To remain compliant with European Low Voltage Directive (EN 60950-1), use a power cable that meets IEC 60227 requirements such as HAR Cable Designation H03VV-F or H03VVH2-F and/or

others with water resistance for outdoor applications. Power cable plugs must also comply with all applicable local and federal standards and regulations.

Indoor Power Supply

Terrasat offers a 1000 watts indoor power supply unit (PSUI) which provides 48 VDC power. The 1000 watts PSUI can power C-band and X-band units through 125 watts, Ku-band units through 80 watts, and Ka-band units through 40 watts. Each indoor PSUI is packaged in a rack-mountable chassis which occupies one rack unit (1.75 in.) of space. The indoor PSUI is shipped with a mating connector for DC power and a power cord for AC mains.

Note: AC transients and surges can cause data transmission errors and loss of synchronization in the modem and/or the ODU. Take proper precautions to ensure uninterrupted service.

Grounding

Terrasat recommends the following grounding and lightning protection:

- Cable Shielding

Shield currents can be eliminated with proper techniques. A grounding strap at the end of the coaxial and data cables should be connected to the ground lug at the antenna base with #4 gauge copper wire. This provides a path of least resistance prior to entering the equipment.

- AC

The best way to protect the equipment is to have two protectors. The first is the power mains protector that is mounted directly across the mains in the breaker box. The second should be mounted or grounded directly at the base or hub of the antenna or at the 19-in. rack.

- Data and Control Lines

The I/O lines can deliver surge current to the equipment and should also be protected.

- Electrical Grounding

Grounding of the IBUC **2**, IBUC **2e**, IBUC **2G**, IBUC **R** or IBUC **G** and PSUI units is recommended to prevent possible damage from lightning or other induced electrical surges. Terrasat recommends using 3/0 or 4/0 AWG stranded copper wire for bonding the IBUC and the PSUI to the earth ground (or grounding rod), using the most direct or shortest route.

Antenna Recommendations

Most antenna masts are encased in concrete. Typically, the mast pipe is submerged in a 4 ft to 5 ft (1.22 m to 1.53 m) deep augered hole. This provides a good Ufer ground. A Ufer ground encases grounding connectors in concrete. Concrete absorbs moisture

quickly and loses that moisture slowly—as much 15 to 30 days after rain or snow melt). The mineral properties of concrete and their natural pH mean that concrete has a supply of ions to conduct current. The soil around concrete becomes “doped” by the concrete and, as a result, the pH of the soil rises. The moisture in the concrete in combination with the “doped” soil make a good connector of electrical energy. The concrete’s large volume and area of contact with the surrounding soil allow a good transfer to the ground. In the concrete base, a Ufer ground can be established by running #4 gauge solid wire or rebar and connecting to the base of the pedestal with pigtails.

The Ufer ground is only one step in proper grounding. The Ufer ground should be augmented with coupled pairs of 10 ft (3.05 m) ground rods placed 20 ft (6.1 m) into the ground, spaced 20 ft (6.1 m) apart. The first rod should be placed close to the antenna. The second rod should be placed towards the equipment enclosure. A #2 gauge wire should connect the rods and antenna mount. A ground rod should be placed at the equipment enclosure, as well. If it is virtually impossible to install the ground rods, then radials are needed. This can be accomplished by laying 10 or more lengths of 1½-in. (3.81 cm) copper strap at least 50 ft (15.24 m) long in a radial fashion around the antenna base. The straps should be buried, if possible. The hub must be interconnected to the utility ground.

The ground configuration can vary from one location to another. It is best to measure soil conductivity and design a 5 Ω or less ground system. To protect the system from a direct strike, a lightning rod placed 2 ft (61 cm) higher than the highest point of the dish should be interconnected to the Ufer ground with #2 gauge copper wire.

Antenna Mounting

The IBUC has a variety of mounting options: on the focal point, the boom arm, the antenna back structure, or in the hub (depending on the antenna type).

Note: [Figure 3.2](#) and [Figure 3.3](#) are photographs of actual installations.



Figure 3.2 IBUC **2** Field Installation



Figure 3.3 IBUC 2 Installation

The Cyber Hardened IBUC **2**, IBUC **2e**, IBUC **2G**, IBUC **R** or IBUC **G** have mounting holes on both sides of the unit that can be used to attach the IBUC to the antenna. For the location of these mounting holes, see [Figure 3.4](#).

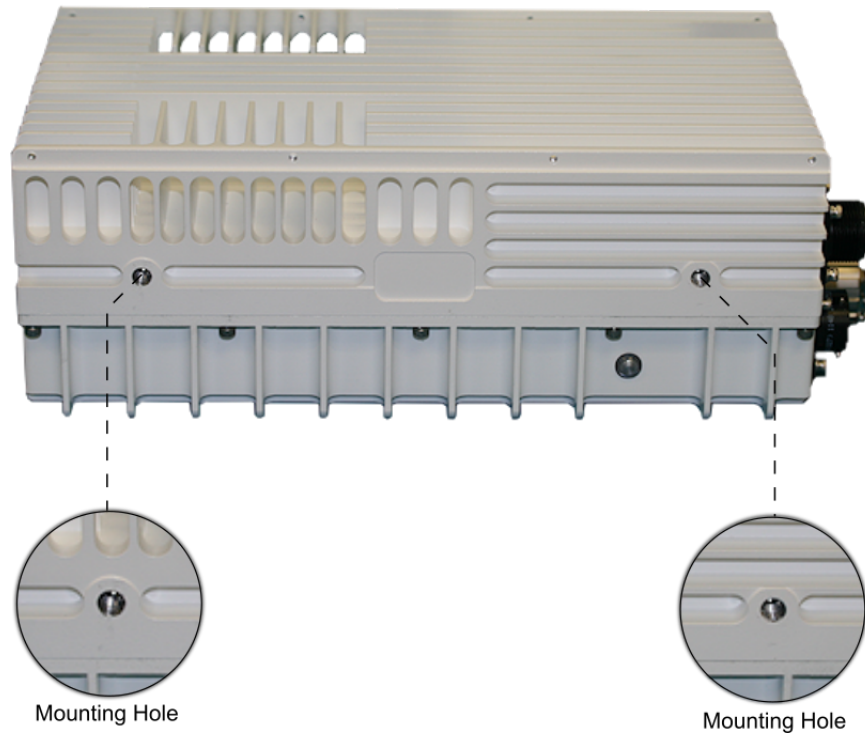


Figure 3.4 Location of Mounting Holes

There is also a single mounting hole located on the front of the IBUC that is identified in [Figure 2.1](#) to [Figure 2.3](#) on [page 2-11](#). This mounting hole is on the same axis as the center of the waveguide of the unit (that is, it is in line with the center of the waveguide). This single mounting hole enables the unit to be rotated when mounted on the focal point of an antenna.

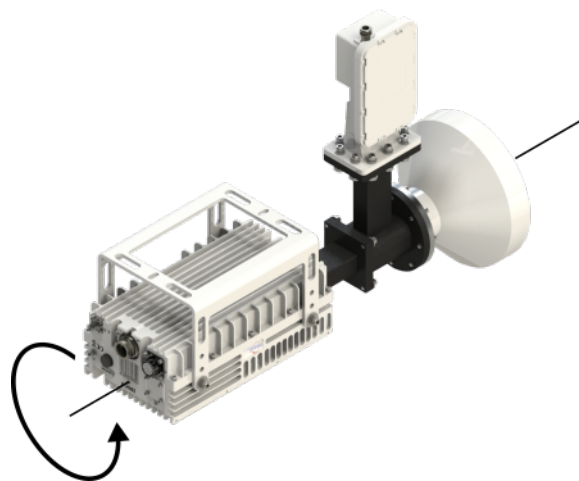


Figure 3.5 IBUC In Line Mounting Configuration

Optional mounting brackets are available that aid in attachment to antennas. The mounting slots identified in [Figure 3.6](#) on [page 3-12](#) give you additional flexibility when attaching the IBUC to the antenna.

Note: Ensure that the threads of the bolts used for mounting the IBUC have been dipped in the included Permatex anti-seize lubricant. This prevents galling, seizing, and corrosion of fasteners during assembly and will aid in future disassembly. For more information about applying the Permatex lubricant, see [page 3-18](#).

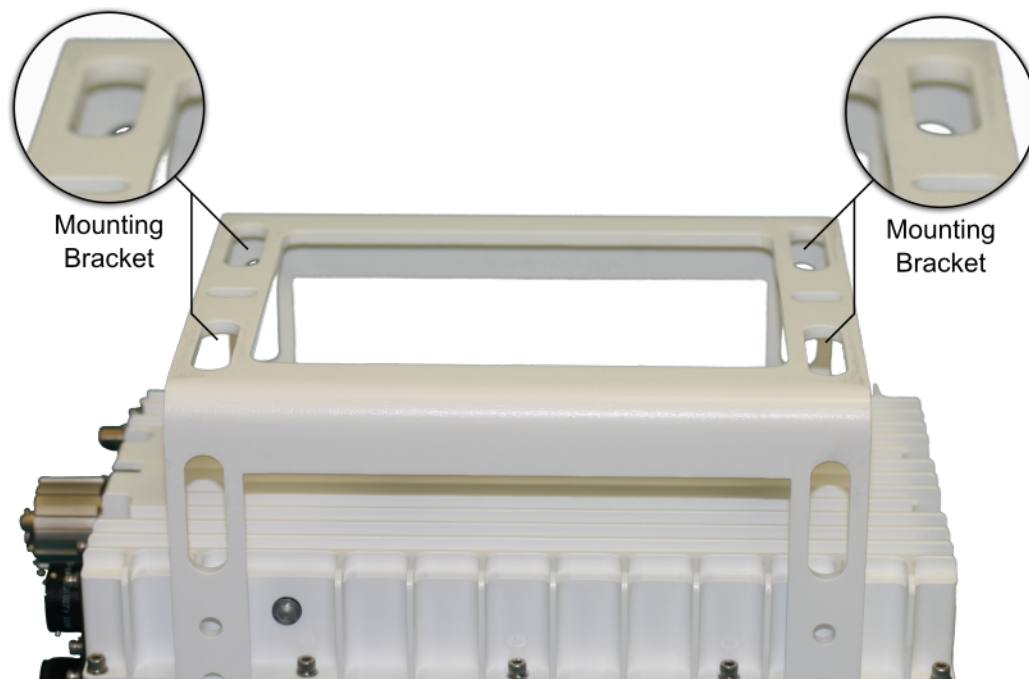


Figure 3.6 Location of Adjustment Slots on Optional Mounting Bracket

System Pressurization

The IBUC chassis contains a breather valve (the location is identified in [Figure 2.1](#) to [Figure 2.3](#) on [page 2-11](#)) that is designed to equalize pressure inside and outside of the unit while allowing the passage of air or water vapor but not environmental contaminants such as liquids, debris, or dust. If you intend to pressurize the waveguide, you must install a pressure window at the output of the IBUC; otherwise the breather valve will not permit pressurization of the system.

Note: IBUC units designed for Ka-band operation have pressure window already installed at the output of the IBUC and are able to operate with pressurized waveguide configurations.

System Cabling Requirements

Cables and Connectors

Interface connectors for the Cyber Hardened IBUC **2**, IBUC **2e**, IBUC **2G**, IBUC **R** or IBUC **G** and their mates are listed in [Table 3.3](#). Additional mating connectors and/or cables can be ordered from Terrasat at optional items.

Table 3.3 Interface Connector Schedule

Reference Designator	Function	Interface Connector	Interface Connector Mate
J1	Tx Input	TYPE-N SOCKET (TYPE-F SOCKET optional)	TYPE-N PLUG (TYPE-F PLUG optional)
J2	M&C Interface	AMPHENOL CIRCULAR, BOX MOUNTING SOCKET, 19S (PT02E-14-19S (027))	AMPHENOL CIRCULAR, STRAIGHT PLUG, 19P (PT06E-14-19P (475))
J3	DC Power	AMPHENOL CIRCULAR, BOX MOUNTING SOCKET (ACS02E14S-6P (553))	AMPHENOL CIRCULAR STRAIGHT PLUG (ACS06E14S-6S(553))
J3 ¹	AC Power	CONNECTOR, MALE RECEPTACLE, 3P (AMPHENOL C016 20C003 100 12)	CONNECTOR, FEMALE PLUG, 3P (AMPHENOL C016 20D003 110 12)
J3 ²	AC Power	CONNECTOR, MALE RECEPTACLE, 4P (HIROSE H/MS3102A22-22P-D-T(73))	CONNECTOR, FEMALE PLUG, 4P (HIROSE H/MS3106A22-22S-D-T(73))
J4 ³	Ethernet	RJ45-IP67 SHIELDED INLINE CONNECTOR WITH CAP	RJ45-IP67 PLUG
RF Output	C-band	CPR137, CPRG WAVEGUIDE OR TYPE-N SOCKET	CPR137, CPRF WAVEGUIDE OR TYPE-N PLUG
RF Output	X-band	CPR112, CPRG WAVEGUIDE	CPR112, CPRF WAVEGUIDE
RF Output	Ku-band	WR75 COVER FLANGE WITH GROOVE	WR75 COVER FLANGE
RF Output	Ka-band	WR28 COVER FLANGE WITH GROOVE	WR28 COVER FLANGE

1. Three-pin J3 connector is only used in AC powered units.
2. Connector used for High Power units
3. Ethernet port does **not** support PoE

J1 – Transmit In The Tx Input connector is a Type-N socket (Type-F socket, optional) connector used to connect the IF at L-band from the modem to the IBUC. Use 50 Ω cables (75 Ω for Type-F connectors) to connect to J1. Certain considerations must be taken when selecting the IFL because appropriate shielding and signal levels are required for normal system operation. The IBUC is designed to operate at rated power with a –30 dBm Tx L-band signal, with the variable attenuator set to minimum attenuation. The variable attenuator is accessible through the M&C interfaces for system gain adjustment. In addition, the IBUC must have a 10 MHz input signal from +5 dBm to –12 dBm (only for those IBUC models with an external 10 MHz reference signal). For IBUC models with both the optional internal reference signal and an external 10 MHz signal, the external signal will automatically receive priority without any user interaction.

For lower wattage IBUCs that are DC powered, the coaxial cable should be selected for its current carrying capacity. A lower wattage IBUC can draw up to 6.0 amps. The maximum voltage drop for a 24 VDC IBUC is 4 volts and the maximum voltage drop for a 48 VDC IBUC is 11 volts. The cable should also have good shielding effectiveness in order to prevent outside interference.

Note: The caution symbol, shown in [Figure 3.7](#), is printed on the chassis next to the J1 connector indicates that VDC may be present. In general, lower power IBUCs allow DC power via coaxial cable. However, AC-powered IBUCs cannot be supplied via coaxial cable.

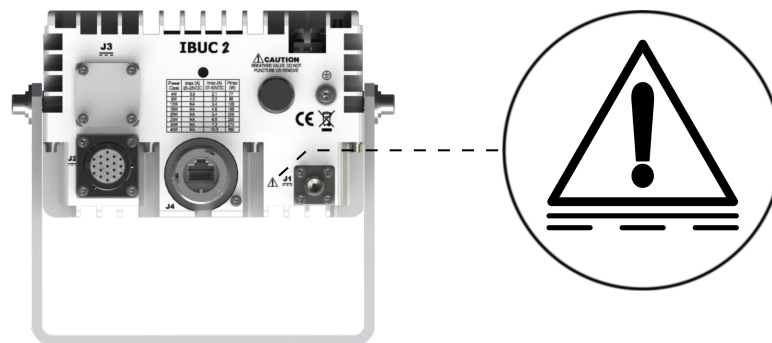


Figure 3.7 Connector J1 Caution Symbol

Note: Fire codes may require that cables in occupied building be installed in steel conduit. Local government agencies may waive this requirement with the use of Plenum cables which are standard cables encased in solid Teflon. Check codes for your area.

Note: Equipment outages due to faulty installation are not covered by the Terrasat warranty. Terrasat recommends following OEM procedures when making cables and connectors.

J2 – M&C Interface The M&C interface is a 19-pin circular socket connector used to enable remote monitoring and control of IBUC operating parameters. Pin assignments are shown in [Table 3.4](#). If the M&C port of the IBUC is going to be used, the cable should be a shielded multi-conductor cable. For more information about fabricating your own cable, see the IP cable drawing in [Appendix D](#). An optional pre-assembled IP test cable is available from Terrasat.

Table 3.4 Pin Assignments for M&C Interface Connector J2

Pin	Function
A	RESERVED
B	RESERVED
C	+5V
D	RS232 RXD
E	RS232 TxD
F	GROUND
G	RESERVED
H	RESERVED
J	Factory Reset
K	RESERVED
L	IBUC Alarm Output Normally Open
M	IBUC Alarm Output Common
N	Mute
P	IBUC Alarm Output Normally Closed
R	RESERVED
S	RESERVED
T	RESERVED
U	RESERVED
V	RESERVED

Note: Pin F is the return to close the circuit for RS232.

J3 – DC Power DC Power can be supplied to the IBUC through a 6-pin circular socket connector. Pin assignments are listed in [Table 3.5](#)

Table 3.5 Pin Assignments for DC Power Connector J3

Pin	Function
A	VDC –
B	VDC –
C	VDC –
D	VDC +
E	VDC +
F	VDC +

Note: The IBUC is factory configured for floating supply. J3 is internally connected and has no VDC connection to Common.

Note: The operating voltage is integrated into the model number of each IBUC. For more information about the model number of your particular model IBUC, see [Appendix A](#).



CAUTION

For some countries $220V_{rms}$ is provided via Line-Line bus. If this is your setup, connect one of the Line leads to the Line Pin of the IBUC connector, and the other Line lead to the Neutral Pin of the connector. In the case that $110V_{rms}$ is needed, or $220V_{rms}$ is provided via Line-Neutral bus connect power leads to their matching connector pins.

J3 – AC Power AC Power is supplied to the through a 3-pin plus ground connector. The connector is configured as described in [Table 3.6](#).

Table 3.6 Pin Assignments for AC Power Connector J3

Pin	Function
1	N/C
2	Neutral
3	Line
4	Ground

Note: For high-power IBUC models such as IBUC G shown in [Figure 2.4](#) on [page 2-12](#), military grade Hirose connector is used.

J3 – AC Power AC Power for high power units is supplied via specialized 4 pin Milspec connector. The connector is configured as described in

Table 3.7 Pin Assignments for Milspec High-Power AC Connector J3

Pin	Function
A	Ground
B	Neutral
C	Line
D	Ground

J4 – Industrial Ethernet Connector The industrial Ethernet connector is an IP67-rated RJ45 Cat. 5e interface with a locking protective cover. The connector is configured as described in [Table 3.8](#).

Table 3.8 Pin Assignments for Ethernet Connector J4

Pin	Function
1	TCP/IP Tx(+)
2	TCP/IP Tx(–)
3	TCP/IP Rx(+)
4	Not Used
5	Not Used
6	TCP/IP Rx(–)
7	Not Used
8	Not Used



WARNING

The IBUC Ethernet circuit does not support Power Over Ethernet (PoE) functionality. Routing PoE connection to port J4 might irreversibly damage IBUC unit.

RF Output The types of waveguide used for various bands of the IBUC are listed in [Table 3.3](#) on [page 3-13](#).

Cable and Waveguide Connections



WARNING

Ensure that all power is disconnected prior to making any connections.

When installing the cable and waveguide assemblies, ensure that all connections are weather tight. If an Rx reject filter is being used, attach it to the IBUC waveguide output. Use proper gasketing methods to prevent the entry of water.

Water-Resistant Wrap

Terrasat recommends applying water-resistant wrap (such as mastic tape) to all outdoor connectors to prevent the entry of water and subsequent water damage. Mastic tapes are designed to flow and self-heal if cut or punctured. When applied spirally with the proper tension, mastic tapes form a tight continuous coating that permits little or no moisture absorption or penetration. Terrasat provides water-resistant sealing tape for Type-F and Type-N connectors.

Apply the mastic tape, as follows:

1. Ensure that all connectors are firmly tightened, dry, and free from all grease, dust, and dirt.
2. Cut the mastic tape to the desired size. The tape should be long enough to cover the connector completely.
3. Center the tape on the connector to be sealed and wrap the tape in a tight spiral around the connector using a 50% overlap. Squeeze the tape tightly and ensure that both ends of the tape have formed around the connector and the cable with any gaps.

Apply the tape to all connectors that may be exposed to moisture.

Applying the Anti-Seize Lubricant

Terrasat recommends applying anti-seize lubricant to screws and bolts that could be exposed to weathering or corrosive environments. The lubricant prevents galling, seizing, and corrosion during assembly and aids in future disassembly. A 5 g pouch of Permatex anti-seize lubricant is included with the installation kit for this purpose.

To apply the anti-seize lubricant,

1. Wear appropriate person protection equipment to avoid contact with skin and eyes. This includes safety glasses, neoprene or nitrile gloves, and clothing sufficient to limit skin exposure.
2. Ensure that mating surfaces (screw holes) are clean, dry and free of dirt, debris, or loose surface rust.
3. Use a brush or lint-free cloth to apply a think coat of anti-seize to the screws and bolts that require protection, as shown in [Figure 3.8](#). The anti-seize should be applied right down to the base of the threads.



Figure 3.8 Applying the Anti-Seize Lubricant

4. Spread the lubricant to a thin film without any lumps.
5. Reassemble the parts using normal torque values.
6. Wipe off any excess material with a disposable towel.

Waveguide Connections

If necessary, connect a section of flexible waveguide between the orthogonal mode transducer (OMT) transmit port and the IBUC Tx RF output (or optional Rx reject filter). The waveguide should be attached to the antenna feed according to the manufacturer's instructions. Use proper gasketing methods to prevent water entry and subsequent damage.

Note: During installation, be sure to remove the sticker shown in [Figure 3.9](#) that covers the waveguide flange. The sticker itself does not create a pressure window and will allow moisture to enter the waveguide. Also be sure to install the waveguide gasket into the channel identified in [Figure 3.9](#) to ensure a good seal between surfaces. Do not re-use old gaskets.



Figure 3.9 Waveguide Label and Channel for Gasket



WARNING

The output of the IBUC is microwave power. Never look into the waveguide or put your head into the path of the beam that goes to the satellite.

Basic System Alignment

The following sections outline the procedure for setup and alignment of an earth station. Before you align the ODU, the antenna should be set to the desired azimuth and elevation settings per the manufacturer's instructions.

Ensure that the IBUC Tx output power is disabled to prevent accidental transmission interference with adjacent satellite or transponders before attempting to align or perform any other operation involving the ODU. Before attempting any signal changes, carefully evaluate the possible effects of the transmitted signal.



CAUTION

The IBUC must not transmit until alignment and any necessary adjustments are complete.

Setting the Tx and Rx Frequencies

All transmit and receive frequencies are set in the modem.

If using a direct connection to an L-band modem, follow the manufacturer's instructions for setting the transmit and receive frequencies.

Receive L-band Output Measurements

To check the receiver,

1. Ensure that 15 VDC to 24 VDC (LNB Bias) is present at the modem input.
2. Use a spectrum analyzer to ensure that the 10 MHz reference signal is present at the modem.



WARNING

DC power will be present on the cable. Terrasat recommends the use of a DC block when using a spectrum analyzer.

3. Connect the LNB to the demodulator's Rx input by attaching the coaxial cables from the Rx L-band output on the LNB to the demodulator's Rx L-band input port.

Transmit Power Alignment

Transmit L-band Input Adjustment with Modem or Converter



WARNING

DC power might be present on the cable. Terrasat recommends the use of a DC block when using a spectrum analyzer.

To set the power level of the modulator output,

1. Use a spectrum analyzer to measure the power level of the L-band signal at the output of the coaxial cable that connects to the IBUC at the Tx L-band connector J1.

2. Use the level adjust mechanism of the modem or converter to increase or decrease the power level. Adjust to reach a level of -30 dBm. (All IBUC units are designed to reach rated power at P1dB over frequency and temperature with -30 dBm at the input when the attenuator is set to minimum attenuation.) For some modems and shorter cable runs, it is not possible to reach -30 dBm. In this case, the attenuator in the IBUC may be used instead.
3. Check that the 10 MHz reference signal is present and within the range of $+5$ dBm though -12 dBm.

Note: The Cyber Hardened IBUC **2**, IBUC **2e**, IBUC **2G**, IBUC **R** and IBUC **G** require a 10 MHz reference signal to operate. Check the model number of your IBUC to determine whether an external 10 MHz signal is required.

4. Disconnect the spectrum analyzer from the coaxial cable.

Transmit RF Output Adjustment with Modem or Converter (70 MHz to L-band)

To adjust the power level of the IBUC transmitter output,

1. Connect a waveguide-to-coaxial adapter and a 40 dB high-power attenuator to the IBUC waveguide output.
2. Ensure that DC power to the IBUC is applied in the proper voltage range. (Depending on your setup, this could be through the coaxial cable or through the J3 connector.)
3. Connect the Tx L-band input signal to the Tx L-band connector J1 on the IBUC.
4. Enable the Tx signals in the modem or converter and the IBUC.
5. Measure the RF output with a power meter connected to the attenuator attached at the waveguide output. For accuracy, measure pure carrier (that is, continuous wave or CW) and the frequency allotted to you by the satellite network operations center (NOC).
6. If the modem still has available range, use the level adjust mechanism to reach the designated power level. If there is no available range, use the attenuation setting on the IBUC instead.

Note: To set attenuation on IBUC, you first need to establish communication with the IBUC. For more information about the various M&C interfaces you can use to establish communication, see [Chapter 5, Monitor and Control Features](#).

7. If using a satellite modem, adjust the RF output to the designated power level (provided by the satellite network operations center or its engineering staff) with the L-band output (modem) level adjust mechanism.
8. Disable the Tx signal in the modem or converter.
9. Disconnect the Tx L-band input signal.
10. Remove the waveguide-to-coaxial adapter and install the transmit waveguide section to the antenna transmit feed.

11. Once the transmit input and output power levels have been set, begin transmitting by connecting the Tx L-band input signal to the J1 connector on the IBUC and enabling the Tx in the modem or converter.
12. Under the guidance of NOC staff, fine-adjust the transmit power for the desired down link margin at the receiving station by adjusting the Tx L-band output level adjust (modem or converter output) or by adjusting the gain of the IBUC by setting the Tx attenuator.

Final Checks

To ensure reliable operation, inspect the system for crimped or pinched cabling. Make sure that all connections are secure and sealed. Once the system has been aligned and is operating satisfactorily, the IBUC will require infrequent maintenance.

OPERATIONS

This chapter describes general operation of the Cyber Hardened IBUC **2**, IBUC **2e**, IBUC **2G**, IBUC **R** and IBUC **G**.

Introduction

After the Cyber Hardened IBUC has been mounted and connections verified, the antenna must be aimed towards the appropriate satellite. Follow the antenna manufacturer's instructions, using the coordinates (azimuth, elevation, and polarity) provided by the satellite operator. Do not transmit until you have received authorization—including a transmit power level—from the satellite network operations center (NOC) staff.

Start-up Checklist

The IBUC leaves the factory preconfigured for operation; however, you can fine-tune its settings for your particular needs.

Prior to start up, verify the following:

- Transmit/Receive frequencies

All transmit and receive frequencies are set using the modem. Follow the modem manufacturer's instruction.

- Cable connections

Ensure that all of the external cables between the IBUC and other equipment are seated correctly and that there are no breaks or cracks, no sharp bends, pinch points nor flattened sections in the cables.

- Power

Ensure that the IBUC is receiving power, Power can come via the modem, an external power supply, or from AC mains.

If power is supplied by the modem, ensure that the modem provides the correct DC voltage and the DC power has been enabled.

- 10 MHz reference signal

Verify that the 10 MHz reference signal is present. Some IBUC models have an internal 10 MHz reference signal. If this option is not available, a 10 MHz reference signal supplied on the IF cable from the modem is required.

Turning On the IBUC

To turn on the Cyber Hardened IBUC **2**, IBUC **2e**, IBUC **2G**, IBUC **R** or IBUC **G**,

1. Connect the L-band input cable (J1), the M&C cable (J4), and the power cable (J3)
2. Apply power to the IBUC.
3. The Power LED on the side of the unit next to the J4 connector lights up.

A flashing green light indicates that the IBUC is operating normally.

A red light indicates only that a fault (or alarm) has occurred. (A flashing red light indicates a minor alarm and a solid red light indicates a major alarm.)

4. Allow the unit to warm up for approximately 15 minutes before operating the transmitter module. This will assure stable gain and power.

Setting Operating Parameters

To set operating parameters, the IBUC must be connected to a terminal (for example, a terminal emulator such as Putty, or the Embedded Web Pages via a PC). Connect the IBUC to the Ethernet port of a PC by using a TCP/IP cable assembly (such as the one depicted in [Figure D.2](#) on [page D-3](#)).

Most of the procedures below can be accomplished by using the steps provided in [Appendix B, Embedded Web Pages](#). For **user creation and deletion** only [RS232](#) or [SSHv2](#) interfaces are available.

1. Establish a connection with the Cyber Hardened IBUC **2**, IBUC **2e**, IBUC **2G**, IBUC **R** or IBUC **G** by using either [RS232](#) or [SSHv2](#), described in [Chapter 5, Monitor and Control Features](#) or by the steps provided in [Appendix B, Embedded Web Pages](#).
2. Set the Tx Output current state via [TST](#) command. See [page C-44](#) for further description. Output can assume one of the following values,
 - Tx Disabled
 - Tx Enabled, Not Muted
 - Tx Enabled, Muted

When the Tx Output is set to Disabled, the Tx Output level displayed from command **TPO** reads -99.0 dBm. This is not the actual reading. See [page C-41](#) for further description.

When conditions cause the automatic shut-off of the Tx Output signal, the Tx Output is muted and the Tx Output level displayed from command **TPO** reads -96.0 dBm. This is not the actual reading.

3. Configure the Power Monitor Frequency to set at which frequency you are operating. Use the **TFR** command described on [page C-38](#). The factory default values in [Table C.6](#) on [page C-39](#) are listed according to the model number of the IBUC.

Note: To ensure accurate readings, you must set the actual operating frequency.

Example: If, according to your Satellite NOC, your allocated frequency is 6400 MHz, set the Power Monitor Frequency to 6400 MHz. Do not use the factory default value unless that is your actual operating frequency.

Note: It is critical to the operation of the IBUC that **TFR** be set correctly. The configured frequency increases the accuracy of input and output power readings. The attenuator requires the **TFR** frequency to ensure accurate values are applied when using the **TPT** command. See [page C-42](#) for detailed operation of **TPT** command.

4. Set the Power Read Mode via **TPM** command. Options include:

- Burst
- Continuous Wave

See [page C-41](#) for further description.

5. Set the Gain Mode via **TGC** on [page C-39](#). Options include:

- Open
Open is the gain obtained when there is no feedback in the measuring loop.
- AGC (Automatic Gain Control)
The IBUC continuously monitors input and output levels. When AGC is enabled, the gain of the system is maintained at a constant level by an internal algorithm. Gain is the difference between output power and input power.
- ALC (Automatic Level Control)
Similar to the AGC system, when ALC is enabled the gain is adjusted when changes are detected in order to maintain a constant output level.

Note: The IBUC has an internal temperature compensation feature that minimizes gain variations due to changes in temperature. This feature is configured at the factory and requires no user input. For specific information about your particular model IBUC, see the datasheets in [Appendix D, Component Specifications and Reference Drawings](#).

Setting the Tx Frequency (L-band)

Changing the L-band frequency will cause a change to the RF frequency. To set the L-band frequency,

1. Establish a connection with the Cyber Hardened IBUC **2**, IBUC **2e**, IBUC **2G**, IBUC **R** or IBUC **G** by using either [RS232](#) or [SSHv2](#), described in [Chapter 5, Monitor and Control Features](#) or by the steps provided in [Appendix B, Embedded Web Pages](#).
2. Verify the data in the Band Inversion via [TFI](#) command. See [TFI](#) for further information.
3. Calculate the IF frequency by using the following formulas:

$$\text{IF} = \text{RF} - \text{LO} \quad \text{Non-inverted/Low side}$$

$$\text{IF} = \text{LO} - \text{RF} \quad \text{Inverted/High side}$$

Note: RF and LO frequencies for various bands are provided from [Table 2.1](#) on [page 2-3](#) through [Table 2.5](#) on [page 2-7](#).

Setting Alarm Thresholds

Although the IBUC will function using the factory-configured settings, by setting high and low level thresholds for the Tx Input/Output you can access more information about events such as power fluctuations that might trigger an alarm. Alarms will be generated when the input and output amplitudes fall outside of the threshold ranges. For this reason, Terrasat recommends that once the user has reached the proper input and output settings for their budget, to narrow the threshold ranges for alarms. To display or set alarm thresholds,

1. Establish a connection with the Cyber Hardened IBUC **2**, IBUC **2e**, IBUC **2G**, IBUC **R** or IBUC **G** by using either [RS232](#) or [SSHv2](#), described in [Chapter 5, Monitor and Control Features](#) or by the steps provided in [Appendix B, Embedded Web Pages](#).
2. Set the Tx Input High/Low thresholds via [TBH](#) and [TBL](#) commands. See [page C-34](#) and [page C-35](#) for further description.

The IBUC leaves the factory with a default range of -15 dBm to -60 dBm.

Example: After observing the unit, you determine that the IBUC operates consistently at -37 dBm. Although the threshold range is 45 dB, that range is too wide for everyday use. Instead consider setting the input thresholds at ± 3 dB; this would make the high level threshold -34 dBm and the low level threshold -40 dBm.

3. Tx Output High/Low thresholds are set via [TAH](#) and [TAL](#) commands. See [page C-32](#) and [page C-33](#) for further description.

When you set up your system and the Tx Output reaches its budgeted level, Terrasat recommends that, instead of the (P1dB - 20 dB) to (P1dB + 1 dB) threshold range that is the default, you narrow the range between the high and low thresholds to ± 3 dB.

Example: After observing the unit, you determine that the output level operates consistently at 32 dBm. Although the threshold range is 21 dB, that range is too wide for everyday use. Instead consider setting the output thresholds at ± 3 dB; this would make the high level threshold 35 dBm and the low level threshold 29 dBm.

If the IBUC unit is configured for burst power monitoring, command **TBT** will set the burst threshold value. See [page C-35](#) for further information.

4. Verify your settings.

Configuring Alarm States

The IBUC offers flexibility with the levels of alarms produced when user-specified thresholds are exceeded.

1. Consider which alarms to configure. [Table 5.1](#) on [page 5-3](#) contains the default alarm configuration. Each alarm that is user configurable can be set as a major event, a minor event, or be disabled.
2. Establish a connection with the Cyber Hardened IBUC **2**, IBUC **2e**, IBUC **2G**, IBUC **R** or IBUC **G** by using either [RS232](#) or [SSHv2](#), described in [Chapter 5, Monitor and Control Features](#).
3. Display or configure alarms to be major events or minor events by using commands [CM2](#) and [CM1](#) respectively. See [page C-13](#) and [page C-14](#) for further description.
4. Display or set suppressed alarms via [CMS](#) and [TAZ](#) commands. Use [CMS](#) command to display or configure suppression mask and command [TAZ](#) to enable or disable suppression. See [page C-15](#) and [page C-34](#) for further description.

Configuring ALC/AGC

The Cyber Hardened IBUC **2**, IBUC **2e**, IBUC **2G**, IBUC **R** and IBUC **G** offer two methods of ensuring consistent signal levels: automatic level control (ALC) and automatic gain control (AGC).

ALC

When enabled, the Automatic Level Control (ALC) circuitry in the IBUC monitors output levels and adjusts the gain to maintain a consistent output for input signal variations. If a signal level is consistently below the predetermined target level, the ALC will cause the gain to be increased until the target level is reached. If a signal level exceeds the target level, the ALC will decrease the gain.

To enable ALC,

1. Establish a connection with the Cyber Hardened IBUC **2**, IBUC **2e**, IBUC **2G**, IBUC **R** or IBUC **G** by using either [RS232](#) or [SSHv2](#), described in [Chapter 5, Monitor and Control Features](#) or by the steps provided in [Appendix B, Embedded Web Pages](#).
2. Set Gain Mode to “Open” via [TGC](#) command. See [page C-39](#) for further description.
3. Set Tx Input and Tx Output Thresholds in order to determine a baseline setting. See [Setting Alarm Thresholds](#) on [page 4-4](#).
4. Change IBUC Tx Output level and monitor it via [TPO](#) command, see [page C-41](#), until it reaches the desired level.

Note: IBUC Tx Output Level can be adjusted by two methods. The user must either change the modem output level, or change the IBUC’s internal attenuation level. In the latter case, use the [TPT](#) command, described on [page C-42](#).

5. When the Tx Output Level reading is equal to the level that you want to maintain, enable ALC via [TGC](#) command.

The IBUC will now continuously self-monitor, increasing or decreasing the gain in order to maintain a constant signal at the level you defined.

Note: The Tx Output Level is “captured” when ALC is enabled.

AGC

When enabled via [TGC](#) command, the Automatic Gain Control (AGC) circuitry in the IBUC maintains the gain constant and equal to the target gain that was established when AGC was enabled.

Gain control settings can drift with time or temperature changes. You can reset the Gain Control function (when reset, the Gain Control returns to mid-range or 0.0).

Terrasat units enable you to offset the target by using the attenuation control without having to first disable the ALC or AGC.

Example: Set the output power level to 40 dBm and enable ALC. From this point forward, the ALC algorithm will maintain the output level at 40 dBm.

If you want to change the output level to 41 dBm, reduce the attenuation by 1 dB. The target level will be updated automatically.

Configuring the External Mute

Pin N of the M&C interface connector has dual functionality: it functions as an alarm input or an external mute.

External Mute

When the IBUC operates as a single thread IBUC, Pin N of the M&C interface connector functions as an external mute. If it is not connected (left open), then transmission is not muted. When Pin N is connected to Pin F (chassis ground), transmission is muted.

To re-enable transmission, remove the Pin N connection to Pin F. Transmission will now resume. For more information about the M&C interface connector, see [System Cabling Requirements](#) on [page 3-13](#).

Common Errors

LED is Red

A red LED indicates only that a fault (or alarm) has occurred and does not necessarily indicate that transmission has stopped. A flashing red light indicates a minor alarm and a solid red light indicates a major alarm. You can communicate with the IBUC to determine what is causing the fault, and then clear the fault condition.

1. Establish a connection with the Cyber Hardened IBUC **2**, IBUC **2e**, IBUC **2G**, IBUC **R** or IBUC **G** by using either [RS232](#) or [SSHv2](#), described in [Chapter 5, Monitor and Control Features](#) or by the steps provided in [Appendix B, Embedded Web Pages](#).
2. To determine current alarm status, the user should query the IBUC via [CAS](#) command, described on [page C-5](#).

When the fault is cleared, the LED should be flashing green.

No Power to the Cyber Hardened IBUC **2**, IBUC **2e**, IBUC **2G**, IBUC **R** or IBUC **G**

If the Power LED is off or not turning on at all, the IBUC is probably not receiving power.

Restore power to the IBUC by

- If the IBUC is powered by the modem, verifying that the modem is working properly.
- Checking that the modem is receiving power (that is, the modem power cord is plugged in) and that DC power to the IBUC is enabled.
- Checking that all cable connections are solid.
- Checking that the power supply is functioning or that AC mains has the proper voltage.

- Checking the disconnect devices such as the circuit breaker.
- Checking the fuses.
 - For DC-powered IBUCs, the fuses are in the power supply.
 - For AC-powered IBUCs, the fuses are in the IBUC.

Fuses are 5x20 mm time-lag glass body cartridge type.



WARNING

Before applying power to the unit, ensure that the waveguide output is properly terminated. Failure to do so could lead to serious personal injury, excessive RF radiation levels, and equipment damage.

Time Stamp Data is Incorrect

Note: This only applies if the customer is not using NTP.

The time stamp on the alarm log may be incorrect after the IBUC has lost power for an extended period. In such cases you can set the system date and time by using the provided CLI commands. To correct Time Stamp Data,

1. Open Terminal session using either [RS232](#) or [SSHv2](#), described in [Chapter 5, Monitor and Control Features](#) and login or by the steps provided in [Appendix B, Embedded Web Pages](#).
2. Check whether the IBUC time zone is correctly configured via command [TZO](#) on [page C-46](#).
3. Configure IBUC Real Time Clock via command [CTM](#) on [page C-20](#).

Satellite Network Operations Center Doesn't Recognize Signal

The Cyber Hardened IBUC **2**, IBUC **2e**, IBUC **2G**, IBUC **2R** or IBUC **2G** appears to be transmitting a signal, but the satellite network operations center (NOC) cannot identify your carrier.

To determine whether your settings are correct,

1. Verify that your frequency is within the bandwidth slot that was allocated to you.
2. Determine whether the IBUC operates with the LO on the low side or the high side of the frequency that was allocated to you.
3. Check the signal mix. Remember that low-side is non-inverting and high-side is inverting.

4. Use the following formulas to calculate IF frequency

low side $IF = RF - LO$ Non-inverting

high side $IF = LO - RF$ Inverting

The LO for each IBUC band is found in [Table 2.1](#) through [Table 2.4](#).

5. Check the Tx output state via [TST](#) command on [page C-44](#), and Tx output level via [TPO](#) command on [page C-41](#).

When Tx output power is disabled, the Tx output level will read -99.0 dBm. This is not an actual power reading; rather it indicates the loss of power.

When conditions cause the automatic shut-off of the Tx output signal, the Tx output level will read -96.0 dBm. This is not an actual power reading; rather it indicates the automatic shut-off of power.

Transmit Power in Saturation

The IBUC, at minimum attenuation, makes rated power at -30 dBm input. Operating the IBUC at higher levels will result in spectral distortion and high intermodulation levels. Terrasat recommends operating with power back-off levels sufficient to meet the spectral density mask.

To avoid signal saturation,

1. Reduce input power from the modem.
2. Open Terminal session using either [RS232](#) or [SSHv2](#) and issue the command [TPT](#) on [page C-42](#) to modify the internal attenuation.

Tx Input/Output Level Verification

To verify the Tx IF Input level,

1. Open Terminal session using either [RS232](#) or [SSHv2](#), described in [Chapter 5, Monitor and Control Features](#) and login or by the steps provided in [Appendix B, Embedded Web Pages](#).
2. Query the IBUC unit via [TDT](#) command, on [page C-36](#).

To verify the Tx RF Output level,

1. Open Terminal session using either [RS232](#) or [SSHv2](#), described in [Chapter 5, Monitor and Control Features](#) and login or by the steps provided in [Appendix B, Embedded Web Pages](#).
2. Query the IBUC unit via [TPO](#) command, on [page C-41](#).

If your reading does not match your expected level, first verify that the Cyber Hardened IBUC **2**, IBUC **2e**, IBUC **2G**, IBUC **R** or IBUC **G** is receiving the proper input level.

3. If the input is at the correct level, use the command [TPT](#) on [page C-42](#) to modify the attenuation to set the output to the expected level.
4. If, after setting the output to your expected level, you are still having transmission problems, check the flexible waveguide and antenna feed for obstructions. Also check the alignment of the antenna.

MONITOR AND CONTROL FEATURES

This chapter describes the various monitor and control (M&C) features and functions that the Cyber Hardened IBUC **2**, IBUC **2e**, IBUC **2G**, IBUC **R** and IBUC **G** offer.

Introduction

You must first establish a communication link with the IBUC to be able access any of the M&C interfaces.

M&C Interfaces

The Cyber Hardened IBUC **2**, IBUC **2e**, IBUC **2G**, IBUC **R** and IBUC **G** offer the following M&C interfaces:

- RS232
- Multifunction LED
- Ethernet

RS232

No additional configuration of the IBUC is required for proper RS232 operation. The RS232 port uses ASCII protocol at a fixed baud rate of 115200, 8 stop bits, no parity, no flow control, and one stop bit for communication. To initiate an RS232 session,

1. Connect a 19-pin to DB9F cable between the computer and the IBUC.
[Figure D.1](#) on [page D-2](#) contains a drawing for fabricating a cable.
2. Activate a terminal emulation program such as PuTTY
3. Configure Serial RS232 Session with matching baud rate, stop bits, parity, flow control and stop bit, as given above and connect to the IBUC unit.

4. At the “IBUC Login” prompt enter the username. A default banner will be displayed followed by the “Password” prompt.
5. Enter the previously defined password. After this step, the user should see the “IBUC>” prompt.

At this point, one may enter commands from [Appendix C, ASCII Command/Response Structure](#).

Note: The Default administrator username/password for a new system is admin/admin. Upon logging in, the administrator should create a new username/password via command [ADU](#), described on [page C-3](#). After a successful creation of the new user, the system administrator should logout from the Terrasat default username, login to the newly created user and delete the Terrasat username via command [DLU](#) on [page C-22](#).



CAUTION

Do not delete the default username before creating your new personalized username.

Do not delete an IBUC user while logged into it.

Note: One might change the current username password via [CPS](#) command, described in detail on [page C-18](#).

Multifunction LED

The multifunction LED is mounted on the Cyber Hardened IBUC **2**, IBUC **2e**, IBUC **2G**, IBUC **R** and IBUC **G** housing and provide visual indications of IBUC status. LED colors and modes are as follows:

- Flashing Green - No alarms
- Flashing Red - Minor alarm being reported
- Steady Red - Major alarm being reported

Certain alarms are configurable meaning that you define them as major or minor alarms when thresholds you set are exceeded. Major alarms will cause relay closure (Form-C). The alarms shown in [Table 5.1](#) are the factory default configuration.

Thresholds for alarms that are user configurable can be set by using any of the M&C interfaces described in this chapter.

Table 5.1 Default Alarm Configuration

		Alarm State		
		Major	Minor	None
Tx Alarms	User Configurable	Solid RED	Flashing Red	Log Only
DRO out of lock	No	X		
Tx Output Level High	Yes	X		
Tx Output Level Low	Yes	X		
Tx Input Level High	Yes		X	
Tx Input Level Low	Yes		X	
High Temperature Alarm	Yes		X	
Tx Simulated Fault	No	X		
10 MHz Reference Fault	No		X	
Input Voltage Out of Range	No		X	
Switch Fault	No	X		
Input Current Out of Range	No			X
AGC/ALC Target Out of Range	No			X
AGC/ALC Out of Range	No			X
Overdrive Alarm	No		X	
Tx Muted Alarm	No	X		

To disable the multifunction LED use the ASCII command [CLE](#) on [page C-12](#).

Ethernet

Using Ethernet, you can communicate with the IBUC **2**, IBUC **2e**, IBUC **2G**, IBUC **R** or IBUC **G** through SSHv2, SNMPv3 or through the onboard Web Server (HTTPS). The IBUC uses a static IP addressing structure and does not support DHCP (Dynamic Host Control Protocol).

The IBUC is configured at the factory, as follows:

IP Address	192.168.1.21
IP Gateway	192.168.1.1
Subnet Mask	255.255.255.0

Note: Your computer should have a static IP address on the same subnet as the IBUC. Using a suitable cable, connect the computer to the J2 connector on the IBUC.

Determining the IP Address of Your IBUC

Due to the lack of support of DHCP, the IBUC IP address will not change after configuration. In the event that such IP address is not known by the user, it is recommended the usage of Wireshark® network packet analyzer for IP discovery.

SSHv2

SSHv2 enables you to connect to another computer by using a SSHv2 client from the host PC. The default port for SSHv2 is 22. Characters are echoed back to the user. The response is terminated with ‘IBUC>’. To initiate a session,

1. Activate a SSHv2 client program from the host computer such as PuTTY.
2. Configure SSHv2 Session with SSH port and IP address. Connect to the IBUC unit.
3. At the “IBUC Login” prompt enter the username. A default banner will be displayed followed by the “Password” prompt.
4. Enter the previously defined password. After this step, the user should see the “IBUC>” prompt.

You can now use the ASCII commands to configure and monitor the IBUC. For more information, see [Appendix C, ASCII Command/Response Structure](#).

Note: The Default administrator username/password for a new system is admin/admin. Upon logging in, the administrator should create a new username/password via command [ADU](#), described on [page C-3](#). After a successful creation of the new user, the system administrator should logout from the Terrasat default username, login to the newly created user and delete the Terrasat username via command [DLU](#) on [page C-22](#).



CAUTION

Do not delete the default username before creating your new personalized username.

Do not delete an IBUC user while logged into it.

Note: One might change the current username password via [CPS](#) command, described in detail on [page C-18](#).

SNMPv3

The IBUC supports SNMP version 3.0 protocol. The SNMPv3 agent listens on Port 161 for SNMP messages and uses Port 162 for transmitting Trap information. SNMPv3 can be configured from the RS232 and SSHv2.

The following commands configure SNMPv3 operation on the IBUC:

1. Establish a connection with the Cyber Hardened IBUC **2**, IBUC **2e**, IBUC **2G**, IBUC **R** or IBUC **G** by using either [RS232](#) or [SSHv2](#).
2. Make sure that both SNMPv3 interface and SNMPv3 Trap functionality are disabled. To disable SNMPv3 interface use the [CIS](#) command described on [page C-11](#). To disable SNMPv3 Trap functionality use the command [CIT](#), described on [page C-11](#).

Note: Terrasat, Inc. Cyber Hardened IBUC's come with two preconfigured SNMPv3 users. The first is "auth_no_priv", which is destined for read-only access levels. The second user is "auth_priv", which is used for read-write operations. Both users configurations are further described below:

"auth_no_priv"

- Username: auth_no_priv
- Authentication: MD5
- Auth. Password: 12345678 (default)

"auth_priv"

- Username: auth_priv
- Authentication: MD5
- Auth. Password: 12345678 (default)
- Encryption: DES
- Priv. Password: 12345678 (default)

3. (Optional) If SNMPv3 Trap functionality is required configure Trap Target IP Address by using command [CIH](#) on [page C-10](#).



CAUTION

If Trap functionality is required, **do not delete** “auth_priv” user as mentioned on Item 4.

Note: Trap service is configured to use “auth_priv” as default SNMPv3 user, hence, it will use the same configurations as “auth_priv”.

- Engine ID: 0x10203040
- Trap Username: auth_priv
- Authentication: (same as user)
- Auth. Password: (same as user)
- Encryption: (same as user)
- Priv. Password: (same as user)

4. Although both preconfigured SNMPv3 users might provide all of the expected functionality, the user is encouraged to create new SNMPv3 users with non-publicly shared Authentication and Private passwords. Use command [SNMP User Configuration](#) page to manage SNMPv3 users.

Note: It is recommended that a new SNMPv3 user is created before deletion of the default users.

5. (Optional) If the default SNMPv3 Views and Groups do not provide all of the expected functionality, the user may create new Views and Groups by usage of [SNMP Groups](#).
6. Enable SNMPv3 interface via [CIS](#) command on [page C-11](#) (and SNMPv3 Trap functionality via [CIT](#) command on [page C-11](#)).

MIBs

Management Information Bases (MIBs) are hierarchical virtual databases used to manage the devices in a communications network. The following MIBs are provided for the SNMPv3 management station:

- SNMPv2-MIB
- HOST-RESOURCES-MIB
- TERRASAT-MIB

- TERRASAT-SMI-MIB
- SNMP-FRAMEWORK-MIB
- SNMP-MPD-MIB
- SNMP-USER-BASED-SM-MIB
- SNMP-VIEW-BASED-ACM-MIB
- SNMP-TARGET-MIB
- SNMP-NOTIFICATION-MIB

Embedded Web Pages

Current IBUC configuration and status information also can be accessed via the Embedded Web Pages. Although this method does not provide all of the administrative privileges, such as user creation and deletion, it is the most intuitive for overall IBUC management.

To access to Embedded Web Pages, open any Web browser and type the IP address of the IBUC. A login page then appears. After login, the user will have a choice of eight Web pages with IBUC status, control, alarm information and live charts. Individual pages are displayed from the selection of the three main drop-down menus.

For more information about the options available on each Web page, see [Appendix B, Embedded Web Pages](#).

Power Measurement

The Cyber Hardened IBUC **2**, IBUC **2e**, IBUC **2G**, IBUC **R** and IBUC **G** are capable of accurately reading the input and output power for a single carrier in either continuous signal mode (CSM) or in burst mode. The dynamic range for input power is from -55 dBm to -20 dBm and for output power the dynamic range is from rated power to 20 dB below rated power. Each unit is loaded with a detector calibration lookup table that compensates for detector variations in frequency, power level, and temperature. The reported power level is then based on the user-requested frequency and the internally monitored temperature and power level. If multiple carriers are present, the composite transmit power level is read but accuracy is dependent upon the actual carrier frequencies, levels, and modulation being used.

The power measurement occurs in the following two ways:

1. Burst Mode

In burst power measurement mode it is assumed that, in normal operation, a transmit carrier may or not be present due to the nature of burst mode operation. Since the transmit burst pulse has a rise time and a fall time and the envelope level varies during symbol transitions when the signal is modulated, the power must be

reported as a peak value. To maintain detected accuracy of the burst pulse, 128 consecutive measurements of the pulse are taken. Once the initial reading exceeds the burst threshold, 128 consecutive readings are taken (regardless of level). The highest value of the 128 is displayed. The IBUC reports the most recent valid reading above the burst threshold.

Burst Time: 500 μ s to 1 s

Measurement accuracy: ± 2 dB absolute, 1.5 dB p-p relative. Accuracy is improved as the burst threshold setting is raised closer to the carrier peak.

The detector accuracy is based on a pulsed unmodulated signal with a pulse width of 500 μ s.

2. Continuous Signal Mode (CSM)

In CSM power measurement mode, it is assumed that, in normal operation, a transmit carrier is always present. Therefore, reported power is the peak power over 128 consecutive readings.

Measurement accuracy: ± 1 dB absolute, 1 dB p-p relative*

The detector accuracy is based on a CW unmodulated carrier.

* Relative measurement accuracy defines the error between any two power readings at any particular frequency over the dynamic range.

Notes: To make the given accuracy achievable, the operating transmit frequency information must be provided via M&C in order to use the information in the detector's internal calibration look-up table.

By default, the unit will be set to perform CSM measurements.

Input Power Overdrive Protection

To ensure that output stage transistors achieve saturation, and thus, maximum performance, the Cyber Hardened IBUC **2**, IBUC **2e**, IBUC **2G**, IBUC **R** and IBUC **G** allow for input overdrive. Input overdrive point allows for 6 dB overdrive at 0 dB attenuation above the expected saturation point. As excessive saturation could damage Gallium Nitride FET (GaN) based units due to unsustainable heat levels within the device, a input overdrive protection algorithm is employed to protect power amplifiers.

Such algorithm takes advantage of the IBUC's input and output power readings to drive internal attenuators, changing input drive level to achieve protection. This feature ensures input overdrive protection without adverse effects to operations outside the BUC. Input overdrive protection depends on the selected operation mode. The three possible operations modes are: Open Loop, AGC, ALC.

1. Open Loop Operation

In Open Loop Operation, input overdrive point changes based on the user input attenuation. Once the input overdrive condition occurs, every 1 dB increase of the input level causes a 1 dB increase in attenuation. If the input level exceeds -15 dBm the algorithm increases the attenuation to maximum.

2. AGC Operation

In AGC Operation, input overdrive point changes based on both user input attenuation and any attenuation applied by the AGC loop. Once the input overdrive condition occurs, every 1 dB increase of the input level causes a 1 dB increase in attenuation. If the input level exceeds -15 dBm the algorithm increases the attenuation to maximum.

3. ALC Operation

ALC Operation uses no input protection. The output level is automatically controlled by the attenuators. As the input level increases, ALC attenuates to maintain the same level.

TROUBLESHOOTING

This chapter discusses basic troubleshooting procedures for the Terrasat Communications, Inc. line of intelligent block upconverters (Cyber Hardened IBUC **2**, IBUC **2e**, IBUC **2G**, IBUC **R** and IBUC **G**) and outdoor units (ODUs).

Maintenance

In general, Terrasat power supply units (PSUIs) and ODUs are self-contained and require little maintenance. However, for optimum performance, Terrasat recommends that users inspect the mechanics of the system quarterly and perform the following:

- Clean the antenna feeds to keep them clear of obstructions.
- Check cables and connectors for signs of wear, damage, or loose connections.
- Check all fan intakes and exhausts to ensure that they are clear of debris. The user can use a water hose for this purpose **while the unit is off**.

Transceiver Fault Isolation

Use the information in this section to assist in determining whether a Terrasat unit is faulty. The intent is to determine a “Go” or “No Go” situation based on alarms indicated through the M&C ports, as well as by measuring certain signals using test equipment.

AC Power Problems/Conditioning

In today’s electrical environment, there are many types of power-related problems that can prevent proper operation of sensitive electronic equipment. These problems or disturbances can be caused by things such as voltage induced by lightning, switching high-power electrical equipment On/Off, or utility company actions such as power factor correction. Serious problems can arise with the occurrence of transients and spikes which can cause random errors or even failure of the circuitry.

Whatever the origin of the transients, they can be classified into two simple categories:

- Common Mode

Noise voltage that appears equally and in phase from each signal conductor to ground. (The term “common” refers to the fact that identical noise appears on both the active and neutral wires.) Common-mode noise poses a threat because the noise attempts to dissipate its energy from neutral to ground or from active to ground.

- Normal Mode

Noise potential between the power line conductors. It adds to and subtracts from the power line sinusoidal voltage wave and is sometimes referred to as differential-mode noise or transverse-mode noise. Normal-mode noise attempts to dissipate its energy along any path from line to neutral. If the normal-mode noise has sufficient voltage (or energy), damage can occur.

Category A

At the wall outlets (and more than 30 ft. [9 m] from a distribution panel), the typical noise is a 0.5 μ s rise time up to 6 kV peak open circuit voltage, 100 kHz ring wave with 200 ampere short circuit current capability.

Category B

At the distribution panel, one can experience the 100 kHz ring wave listed previously but with 500 ampere current capability and a unidirectional impulse up to 6 kV potential rising in 1.2 μ s and decaying to half voltage in 50 μ s. Accompanying this can be a short circuit current up to 3000 amperes rising to peak in 8 μ s and decaying to half value in 20 μ s.

To ensure uninterrupted service, Terrasat recommends using a line conditioner or uninterruptible power supply (UPS) based on the expected AC power at the site.

Site-Related Problems

VSAT antennas are often fitted at the top of buildings. Avoid close proximity to elevator motors, and such. Ensure that the satellite signal path is free and clear of obstructions.

M&C Checks

When troubleshooting the IBUC, the first level of troubleshooting should be to check the status through the M&C port. Events and an event history log are available with the IBUC M&C. For specific information about using the RS232 or Ethernet ports, see [Chapter 5, Monitor and Control Features](#).

Power Supply Checks

Before beginning RF troubleshooting of DC-powered IBUCs, first verify that the proper voltages are being supplied to the IBUC. Input DC voltage and IBUC current consumption data are available from the IBUC M&C. Verify that the values are within limits. If an M&C interface is not available, use a multimeter to verify that the appropriate voltages (24 VDC or floating 48 VDC) are present at the IBUC. Check the part number label on the IBUC to determine the required voltage. The IBUC DC supply can be through either the J1 or J3 connector.

Transmit Power Setting

There have been several cases reported to Terrasat Technical Support where the transmit power has been turned up to or near saturation while transmitting a digital carrier. This most likely will result in spectral distortion, re-growth, and intermodulation products for multi-carrier operation. To reduce saturation, reduce the input level or increase the attenuation.

Note: When transmitting digital carriers, it is customary to operate the power amplifier system with an output back off (OBO) sufficient to meet the spectral density mask requirements and interference requirements of multi-carrier operation.

Transmit Intermediate Frequency Input Level Verification

If low or no Tx output power is detected, begin troubleshooting by checking the input to the IBUC.



WARNING

DC power might be present on the cable. Terrasat recommends the use of a DC block.

1. Check the Tx Input Level displayed in M&C or disconnect the cable at the IBUC J1 connector (Tx L-band) and use a spectrum analyzer to measure the power level of the L-band signal at the output of the coaxial cable that connects to the IBUC at J1 (Tx L-band). The L-band signal level should be within the range of -20 dBm through -55 dBm. If it is not, check the cable and modem output.
2. If the L-band signal is within range, check that the 10 MHz reference signal is within the range of +5 dBm through -12 dBm and is distortion free. If it is not, check the cable and modem output.
3. For DC-powered IBUCs, if the L-band and 10 MHz signals are good check that the DC voltage level is within range. The DC voltage may be on the L-band IFL or

from a separate power supply for 16 watts Ku-band, 25 watts C-band, or 20 watts X-band and lower power units. For higher power units, the DC voltage will be on the DC cable that is connected to the IBUC DC Input (J3 connector). If it is not, check the PSUI or modem power supply outputs and cables.

4. For DC-powered IBUCs, if the L-band, 10 MHz and DC voltage signals are within range, continue with the IBUC Tx Output verification procedure that follows.
5. Disconnect the spectrum analyzer from the coaxial cable.

Cyber Hardened IBUC 2 Transmit Output Verification

This check assumes that the L-band, 10 MHz, and DC inputs (for DC-powered IBUCs) are at the correct levels.

1. Tx Output level is monitored and displayed in the IBUC M&C. Alternatively, you can connect a waveguide-to-coaxial adapter and a 40 dB high-power attenuator to the IBUC Tx waveguide output.
2. Measure the Tx RF output with the spectrum analyzer connected at the waveguide output. Ensure that the cable loss of the cable being used for the measurement has been taken into account.
3. RF power should be between rated power and no lower than 25 dB below rated power. If it is not, the IBUC is defective and should be returned to the factory for repair. Instructions for returning a unit for repair are on [page 6-8](#).
4. IF the IBUC Tx RF output measures within specification, ensure that the waveguide, feedhorn, and antenna are properly aligned.

Receive L-band Output Verification

If low or no RF output power is detected, begin troubleshooting by checking the output of the LNB.

1. Ensure that 15 VDC to 24 VDC (LNB Bias) is present at the modem Rx Input using a digital voltmeter (DVM). If it is not present, check the cable and modem.
2. Use a spectrum analyzer to ensure that the 10 MHz signal is present at the modem Rx Input. If it is not, check the cable and modem.



WARNING

DC power might be present on the cable. Terrasat recommends the use of a DC block.

3. Connect the LNB to the demodulator by attaching the coaxial cables from the Rx L-band Out on the LNB to the demodulator Rx L-band input port. If the Rx level is low, check the cable, the feedhorn, and the antenna for proper operation.

Common Problems

The following problems or occurrences have been noted during normal troubleshooting.

Tx Output is Disabled

When the Tx Output is set to Disabled, the Tx Output level shown on the [Sensors](#) on [page B-23](#) reads -99.00 dBm. This is not an actual reading.

However, when conditions cause the automatic shut-off of the Tx Output signal, the Tx Output is muted and the Tx Output level on the [Sensors](#) on [page B-23](#) reads -96.00 dBm.

Incorrect Frequency Settings

If the Satellite Network Operations Center (NOC) does not recognize your signal, see [page 4-8](#) for additional information.

Damaged Cables

RF coaxial cable damaged due to improper handling (such as contact damage due to improper mating; cable insulation that is damaged, crushed, cut, or charred; cables were not discharged prior to connecting them; or conductors that are nicked, gouged, damaged, or severed) may impair system performance and reliability. Do not attempt to repair broken or damaged coaxial cables unless absolutely necessary. Replace the entire cable whenever possible.

Damaged cabling and incorrectly tightened connectors can leak RF energy, which may lead to excessive levels in their immediate vicinity.



CAUTION

Never disconnect RF cables or connectors associated with a transmitter in operation since this may result in an RF burn through direct contact with RF conductors.

10 MHz Reference Signal is at the Wrong Level or Missing

A 10 MHz input is used to provide a stable reference frequency to which the phase-locked local oscillator (or PLDRO) synchronizes. The 10 MHz reference signal level should be between -12 dBm to +5 dBm.

When the IBUC senses that the phase-locked local oscillator has gone out of lock, a PLDRO Lock alarm is triggered. This alarm then initiates a series of routines that leads to the muting of the power amplifier (that is, the IBUC is automatically shut-off). [Table 6.1](#) lists four possible scenarios caused by changes in the 10 MHz reference signal or whether the PLDRO is locked.

Table 6.1 Possible Scenarios for IBUCs with an External 10 MHz Reference Signal

10 MHz Reference Signal Level	Phase-Locked Local Oscillator	Results
Low	Locked	Causes a minor alarm (10 MHz Detector). Unit is still transmitting. Check the 10 MHz signal level. Resultant phase noise may be degraded.
Low	Out-of-Lock	Causes a major alarm (PLDRO Out of Lock). Power amplifier is muted and the IBUC is automatically shut-off. Check the 10 MHz reference signal level and whether the 10 MHz reference signal is enabled at the modem.
Within Specifications	Locked	Unit is operating normally. No alarms are present.
Within Specifications	Out-of-Lock	Causes a major alarm (PLDRO Out of Lock). Power amplifier is muted and the IBUC is automatically shut-off. PLDRO may be faulty and the IBUC might need to be returned for repair.

Antenna is Pointed Toward Wrong Satellite or is Misaligned

Transmission to the wrong satellite or on the wrong polarization or channel can cause interference with other satellite users and may result in fines from the satellite operator.

To ensure that your antenna is aligned with the correct satellite,

1. Follow the antenna manufacturer's instructions to verify the azimuth, elevation, and polarization settings.
2. Follow the antenna manufacturer's instructions to move the antenna into a position that provides maximum signal strength.
3. Establish a communications link with the satellite network operations center (NOC).

4. Peak the signal on the satellite, and then adjust polarization per guidance from NOC staff.

Moisture Migrated Into the Cyber Hardened IBUC

Moisture can enter and damage the IBUC if waveguide gaskets are missing, there is a hole in the feed window, or there is a break in the coaxial connectors.

To prevent moisture from entering the IBUC,

- Ensure that the paper label is removed from the waveguide prior to installation and operation.
- Ensure that the rubber waveguide gasket is intact and fully seated in the grooved channel before making the connection.
- Use water-resistant wrap (or mastic tape) on all outdoor connectors to ensure a water-tight seal. Mastic tapes are designed to flow and self-heal if cut or punctured. For more information about applying water-resistant wrap, see [page 3-18](#).
- Avoid using damaged connectors (for example, scratched mating surfaces, eccentric or bent center conductors, and so on.).
- Seal all coaxial cable fittings with putty.

Bad Orthogonal Mode Transducer and/or Antenna

If the antenna feedhorn and orthogonal mode transducer (OMT) are not positioned correctly, the IBUC will not operate properly.

To position the feedhorn and OMT,

- Refer to the antenna manufacturer's assembly instructions to verify that the feedhorn and OMT were mounted correctly on the antenna.
- Establish a communications link with the satellite network operations center (NOC).
- Guided by NOC staff, slowly rotate the outdoor equipment to the appropriate position.
- If rotation is impossible, it is likely that there is a problem with OMT and it will need to be returned to the antenna manufacturer.

LED is Red

A red LED indicates only that a fault (or alarm) has occurred and does not necessarily indicate that transmission has stopped. A flashing red light indicates a minor alarm and a solid red light indicates a major alarm. You can communicate with the IBUC to determine what is causing the fault, and then clear the fault condition.

1. Establish a connection with the IBUC by using any of the M&C interfaces.
2. View the Alarm Status Tab (shown on [page B-8](#)) to determine the current alarm.
3. View the Sensor Tab (shown on [page B-23](#)) to determine which sensor reading caused the alarm.
4. Compare your readings to the thresholds.
5. Adjust the threshold level(s) to bring the reading(s) within specifications and thus clear the fault

When the fault is cleared, the LED should be flashing green.

Repair Policy

The Terrasat Cyber Hardened IBUC **2**, IBUC **2e**, IBUC **2G**, IBUC **2R**, IBUC **G** and PSUI are not field repairable.

In the event that a failure has been detected, it might be necessary to return the defective unit to the factory or a factory-authorized service center. The following section contains instructions for returning a defective unit to the factory for repair.

Returned Material Authorization (RMA)

If any equipment is determined to be defective:

- Have the following information available:
 - Unit serial number
 - Unit part number and description
 - Complete description of the failure
 - Designated contact name and phone number
 - Billing information
 - Shipping information
- Contact Terrasat Customer Service to request an RMA number.
 - Telephone: +1 408.782.5911
 - E-mail: techsupport@terrasatinc.com
- Properly package the defective equipment in its original container (if available and undamaged), and mark the RMA number on the outside of the shipping container.

Note: Do not return any equipment without an RMA number.

- Ship the equipment to the following address:
Terrasat Communications, Inc.
315 Digital Drive
Morgan Hill, CA 95037
U.S.A.
- After the unit is received at Terrasat, an initial evaluation will be performed.
 - If the unit is found to be in-warranty, the unit will be repaired and returned at no charge.
 - If the unit is found to be out-of-warranty, Terrasat Customer Service will contact the designated contact for authorization to proceed with the repair.
- Authorization in the form of a purchase order will be required.
- Once authorization is received, the unit will be repaired and returned.



PART NUMBERING SCHEMA

The charts in this appendix illustrate the part numbering schema used for Terrasat Communications, Inc. Products.

Identifying the Part and Serial Numbers

Figure A.1 illustrates the difference between the unit's part number and serial number.



Figure A.1 Identifying the Part and Serial Numbers

Decoding the Part Number

Use the charts on the following pages to help determine the information contained in the part number about your specific unit.

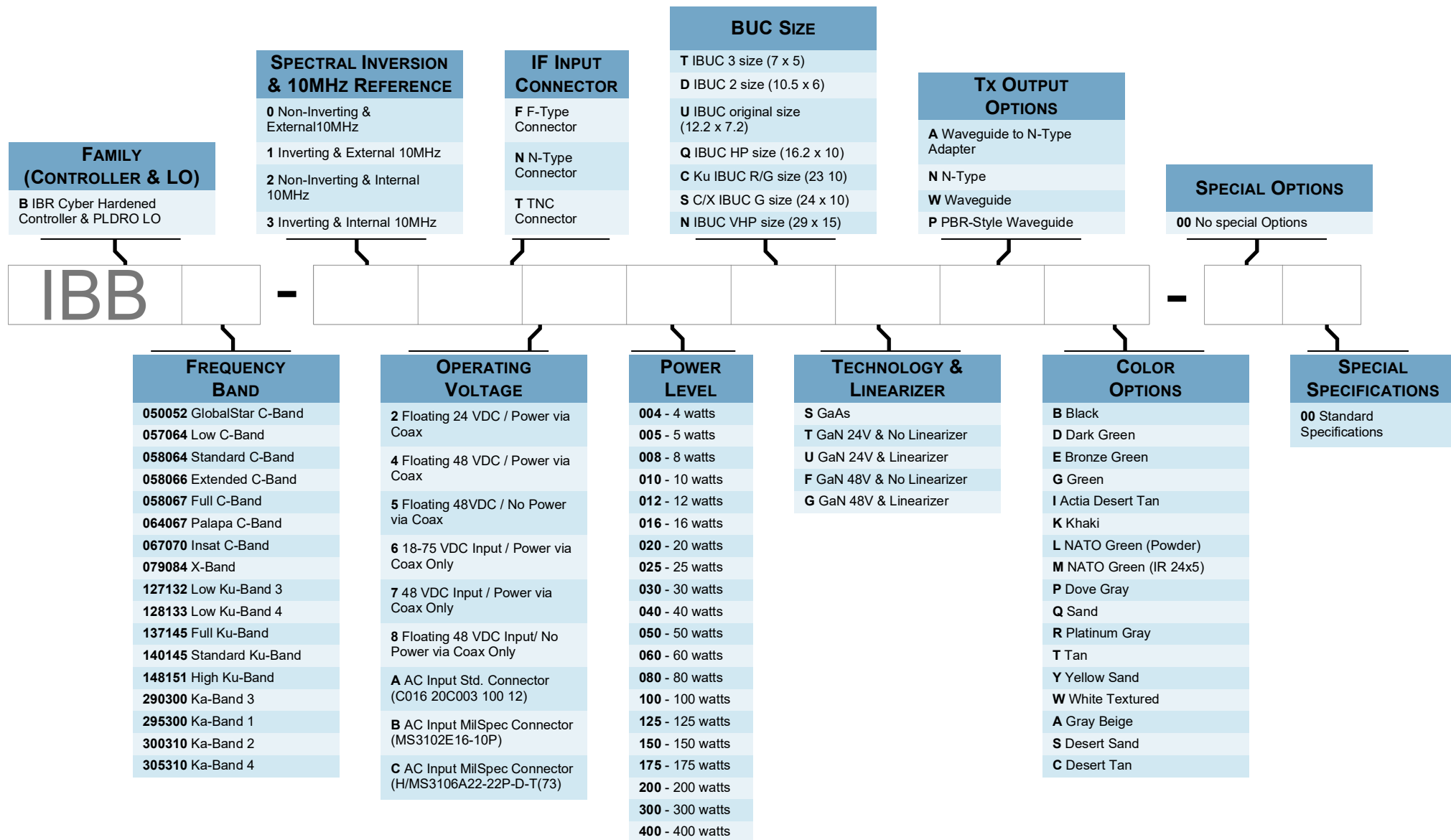


Figure A.2 Part Numbering Schema for Cyber Hardened IBUC

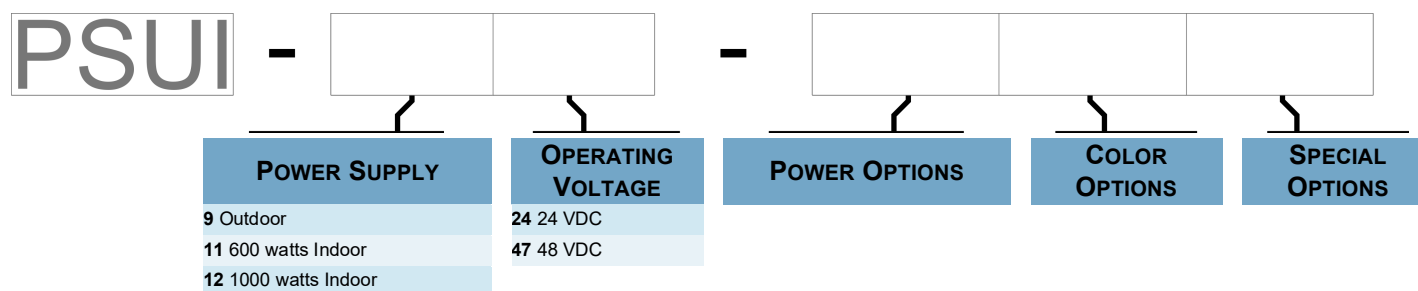


Figure A.3 Part Numbering Schema for Cyber Hardened IBUC with PSUI Systems

EMBEDDED WEB PAGES

The embedded Web pages shown in this appendix are a user-friendly way to access the various monitor and control (M&C) features offered by the Cyber Hardened IBUC **2**, IBUC **2e**, IBUC **2G**, IBUC **R** and IBUC **G**.

Some of the screen shots from the Web interface shown in this appendix are under development and may appear slightly different from the actual ones.

Introduction

To access the embedded Web pages,

1. Connect the host computer's Ethernet cable to the Cyber Hardened IBUC **2**, IBUC **2e**, IBUC **2G**, IBUC **R** or IBUC **G** J4 pin header.

Note: Steps 2 through 8 will guide the user on how to setup the host PC for the first access to the Cyber Hardened IBUC embedded web pages. Despite this process being shown on a Windows machine, the process can be achieved on other Operating Systems.

2. On Windows Operating Systems, open the Start Menu by pressing the Windows icon and then search for "Control Panel" in the search bar.
3. Navigate to "Network Connections > Network and Sharing Center > Change Adapter Settings".
4. Right Click on Ethernet Connection Icon and select "Properties"

The Local Area Connection Status window shown in [Figure B.1](#) appears.

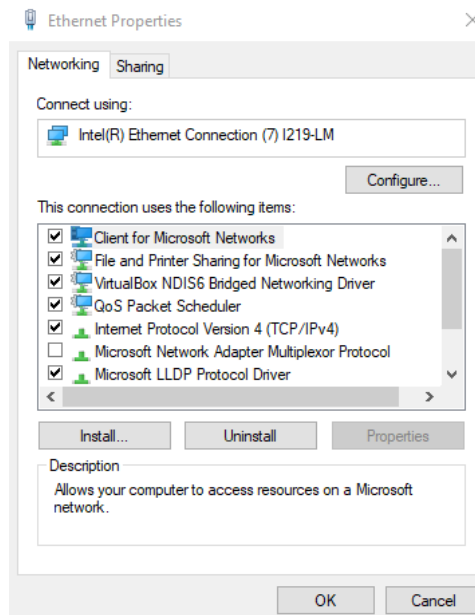


Figure B.1 Ethernet Properties Window

5. In the dialog window, scroll down until “Internet Protocol Version 4 (TCP/IPv4)” becomes visible select it.
6. Click Properties.

The window shown in [Figure B.2](#) appears

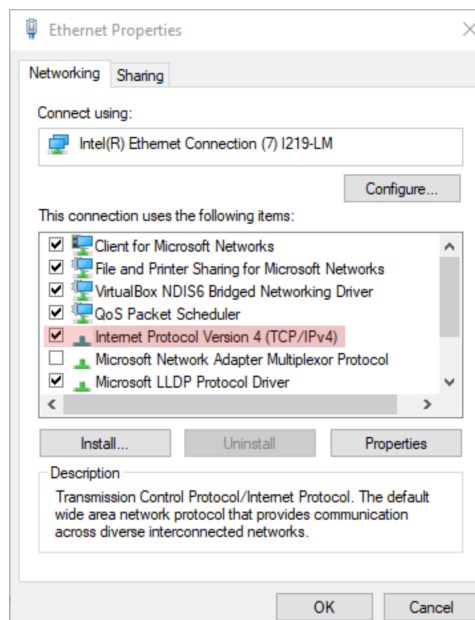


Figure B.2 Choosing the Internet Protocol (TCP/IP) Properties

7. Select “Use the following IP address,” and set the IP Address to 192.168.1.100 and an appropriate gateway.

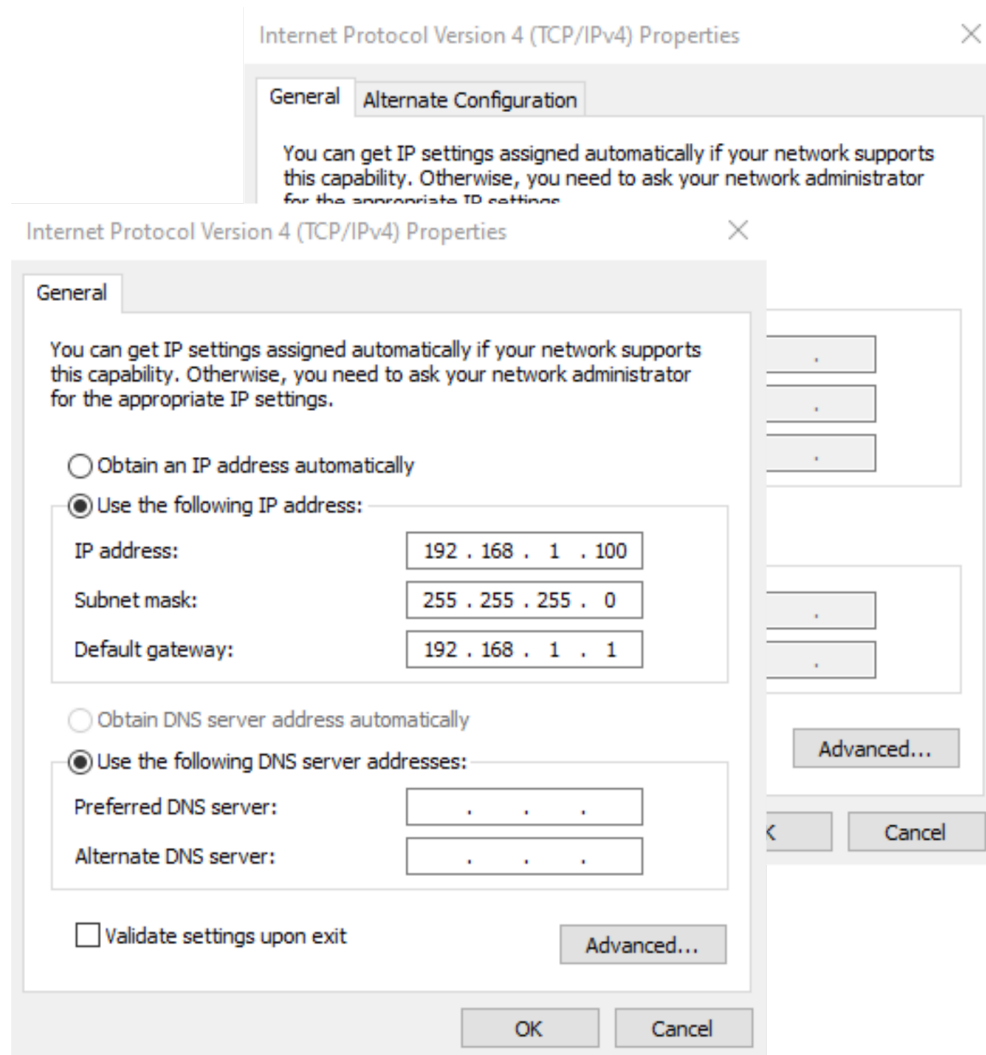


Figure B.3 Host IP Address Configuration

8. Click OK.
9. Using the host computer, activate a Web browser window.
10. To open the Embedded Web Pages, access <https://192.168.1.21>
11. Within a few seconds, the Login page shown in [Figure B.4](#) on [page B-4](#) will appear.

Note: Since the embedded web pages are served using a self signed certificate, a warning will be issued saying that the web pages are not digitally signed. Terrasat Inc. is working with third parties to get the certificates signed and this message will go away in future. Click the option to proceed to the website.

Web Pages Menu Tree

Log In

Once connected via Web Browser to a Cyber Hardened IBUC unit, the Login web page should appear. Type your password in the dialog box, and then click **Login**. The default username/password is `admin/admin`. If the login password that you entered is accepted, the Information page will appear, else a message to re-enter the username and password will appear.

IBUC

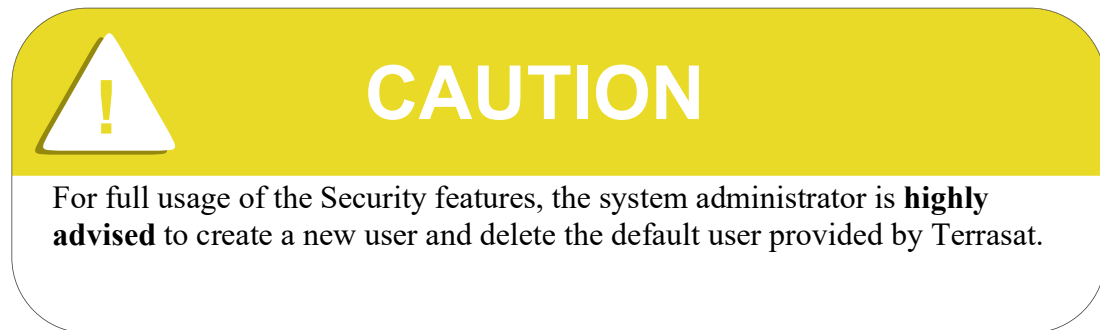
Welcome to IBUC

User ID

Password

Submit

Figure B.4 Login Tab



Responsive Design

If remote access to the IBUC is needed, the Embedded Web Pages can be viewed in a mobile device or tablet. Due to it's responsive design, the web pages will adjust automatically to the screen resolution of the device, allowing for easy navigation and control.

The image displays a mobile-optimized web interface for configuring a device. The top navigation bar is dark grey with white text for 'Configuration', 'Status', 'Charts', and a 'Log Out' button. The main content area is light grey and contains two columns of settings. The left column includes fields for Time, NTP Server Address, NTP Timezone, Enable External LED, Reboot Firmware, and Enable AC 50Hz Correction, each with a corresponding input field or checkbox. A blue 'Submit' button is at the bottom of this column. The right column displays various system parameters with their current values in input fields: Model Number, Serial Number, F/W Version, H/W Version, Tx Rated Power, Frequency Band, RF Frequency Range, IF Frequency Range, LO Frequency, Spectral Inversion, and Total System Hours.

Setting	Value
Time (mm/dd/yyyy hh:mm:ss)	10/01/2023 10:00:00
NTP Server Address	0.pool.ntp.org
NTP Timezone Offset(+/-HH:MM)	-07:00
Enable External LED	Enabled
Reboot Firmware	Select
Enable AC 50Hz Correction	Disabled
Model Number	IBB058067-3NA125D
Serial Number	TE8117680,
F/W Version	FW IBB v0.31, Sep 29
H/W Version	0002
Tx Rated Power (Watts)	125
Frequency Band	C-Band Full
RF Frequency Range (MHz)	5850 to 6725
IF Frequency Range (MHz)	1850 to 975
LO Frequency (MHz)	7700
Spectral Inversion	Inverted
Total System Hours	22

Figure B.5 Mobile view of the Embedded Web Pages

Configuration Menu

Information

Use this page to view read-only data such as the model number, serial number, revisions, and frequencies for the Cyber Hardened IBUC **2**, IBUC **2e**, IBUC **2G**, IBUC **R** or IBUC **G**.

Configuration ▾ Status ▾ Charts ▾ Log Out	
Model Number	IBB058064-1NA125DGWW-0000
Serial Number	TE8117680
F/W Version	FW IB8 v0.37, Oct 8 2020 09:55:08
H/W Version	0002
Tx Rated Power (Watts)	125
Frequency Band	C-Band Standard
RF Frequency Range (MHz)	5850 to 6425
IF Frequency Range (MHz)	1525 to 950
LO Frequency (MHz)	7375
Spectral Inversion	Inverted
Total System Hours	1170

Figure B.6 Information Page

From this page, you can view the following parameters:

- **Model Number**
Displays the model number of the IBUC. More information about the data contained within the part number is found in [Appendix A](#).
- **Serial Number**
Displays the unique serial number of the IBUC.
- **Firmware Version**
Displays the version number. The firmware version number of the IBUC is used mainly by Terrasat Technical Support personnel.
- **Hardware Version**
Displays the version number of the hardware.

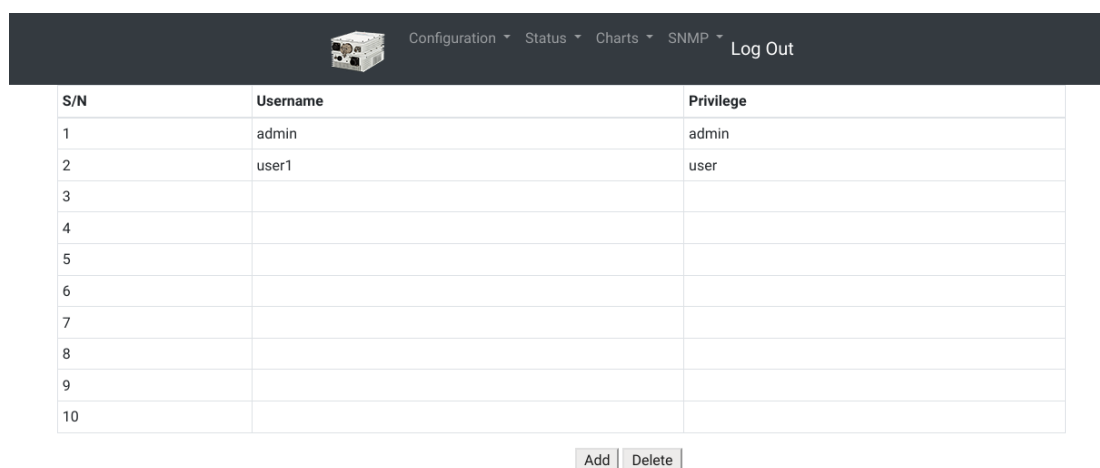
Note: The hardware version can be updated only when the IBUC is returned to the factory.

- **Tx Rated Power**
Displays transmitter output power at 1 dB compression. Tx rated power information is contained within the part number. More information about locating the power level of the IBUC is found in [Appendix A](#).
- **Frequency Band**
Displays the standard name of the band.
- **RF Frequency Range**
Displays the valid RF frequencies for the IBUC. The RF Frequency range for each of the various IBUC bands is listed in [Table 2.1](#) on [page 2-3](#) through [Table 2.5](#) on [page 2-7](#).
- **IF Frequency Range**
Displays the valid IF frequencies for the IBUC. The L-band IF Frequency range for each of the various IBUC bands is listed in [Table 2.1](#) on [page 2-3](#) through [Table 2.5](#) on [page 2-7](#).
- **LO Frequency**
Displays the valid LO frequencies for the IBUC. The LO Frequency for each of the various IBUC bands is listed in [Table 2.1](#) on [page 2-3](#) through [Table 2.5](#) on [page 2-7](#).
- **Spectral Inversion**
Options include:
 - Non-Inverted
 - Inverted
When inverted, the relationship between the RF and IF frequencies is inverse; that is, if the modem frequency lowers, the RF frequency increases and vice-versa.
- **Total System Hours**
Displays the total number of hours that the system has been operating, that is, the total number of hours that the system has been powered on. This accumulates after cycles (imagine it like a odometer of a car).
- **Total Tx Enabled Hours**
Displays the total number of hours that the transmitter has been enabled (that is, with transmit = On and mute = Off).
- **Internal 10 MHz**
Indicates whether the IBUC has the internal 10 MHz optional installed or not.
- **Supply Voltage**
Displays the power supply voltage range for which the IBUC was designed. The Supply Voltage Range is based on the configuration of your IBUC.

User Configuration

Here the operator can view all current users registered by the system (see [Figure B.7](#)), add more users ([Figure B.8](#)) or delete existing users ([Figure B.9](#)). A registered user is composed of three main informations:

- Username: String of characters indicating the name that identifies the User. This field can contain up to 32 characters.
- Privilege: Defines the access the user has. Can assume one of two values: ‘admin’ or ‘user’
- Password: String of characters indicating the password this User requires to access the unit. This field can contain up to 32 characters.



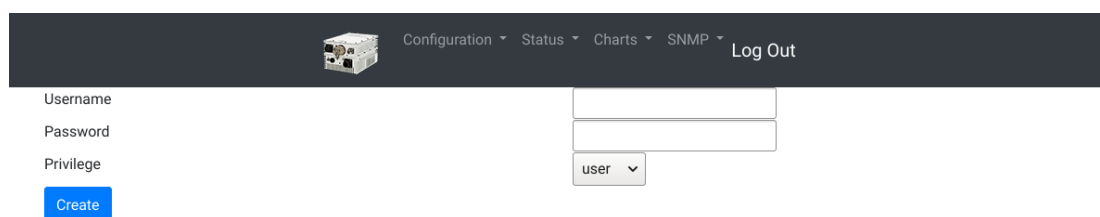
The screenshot shows the 'User Configuration' page. At the top, there is a navigation bar with a device icon and tabs for 'Configuration', 'Status', 'Charts', 'SNMP', and 'Log Out'. Below the navigation bar is a table with three columns: 'S/N', 'Username', and 'Privilege'. The table contains two rows of data: S/N 1 with Username 'admin' and Privilege 'admin', and S/N 2 with Username 'user1' and Privilege 'user'. Below the table are 'Add' and 'Delete' buttons.

S/N	Username	Privilege
1	admin	admin
2	user1	user
3		
4		
5		
6		
7		
8		
9		
10		

Add Delete

Figure B.7 Cyber Hardened IBUC Users

From the main User Tab, the operator is able to add more users by pressing on the “Add” button or delete existing users by pressing the “Delete” button.



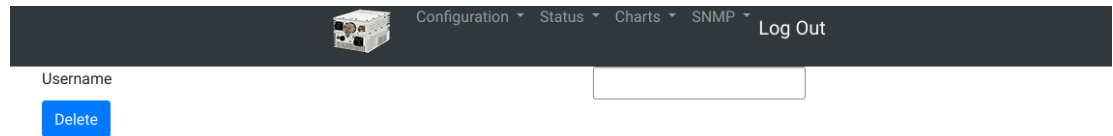
The screenshot shows the 'Add User' form. It has a navigation bar with a device icon and tabs for 'Configuration', 'Status', 'Charts', 'SNMP', and 'Log Out'. Below the navigation bar, there are three input fields: 'Username', 'Password', and 'Privilege'. The 'Privilege' field is a dropdown menu with 'user' selected. Below the input fields is a blue 'Create' button.

Figure B.8 Add Cyber Hardened IBUC User

The operator is not able to directly change user passwords via the Embedded Web Pages. This goal can be achieved by one of two methods:

- Using the provided ASCII command [ADU](#) on [page C-3](#), or [CPS](#) on [page C-18](#).

- Deleting and re-creating a user with a different password using the Embedded Web Pages.



Configuration ▾ Status ▾ Charts ▾ SNMP ▾ Log Out

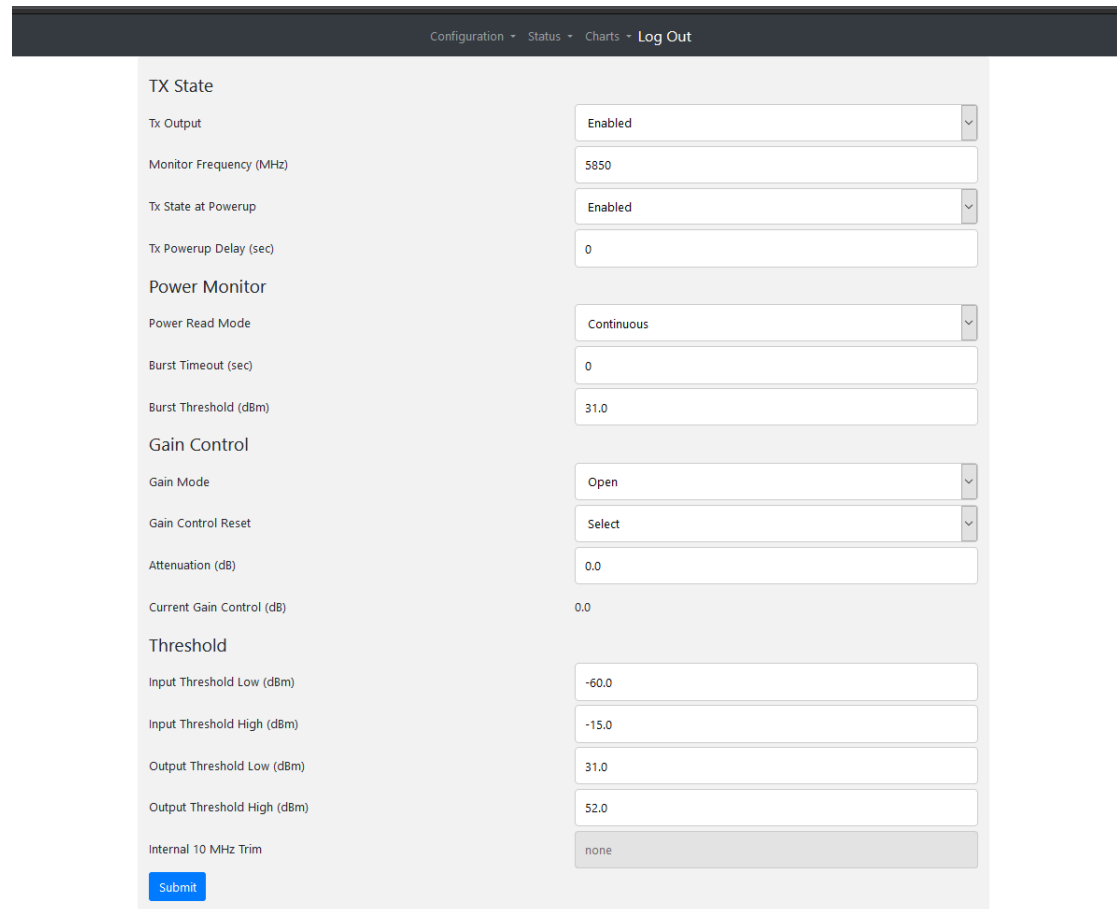
Username

Delete

Figure B.9 Delete Cyber Hardened IBUC User

Transmit Configuration

Use this page to configure transmission operating parameters for the Cyber Hardened IBUC **2**, IBUC **2e**, IBUC **2G**, IBUC **R** and IBUC **G**. Click **Submit** when you have completed entering data to ensure that your changes are saved and then implemented.



Configuration ▾ Status ▾ Charts ▾ Log Out

TX State

Tx Output

Monitor Frequency (MHz)

Tx State at Powerup

Tx Powerup Delay (sec)

Power Monitor

Power Read Mode

Burst Timeout (sec)

Burst Threshold (dBm)

Gain Control

Gain Mode

Gain Control Reset

Attenuation (dB)

Current Gain Control (dB)

Threshold

Input Threshold Low (dBm)

Input Threshold High (dBm)

Output Threshold Low (dBm)

Output Threshold High (dBm)

Internal 10 MHz Trim

Submit

Figure B.10 Tx Configuration Tab

From this page you can configure the following parameters:

- Tx Output

Select whether the unit is actively transmitting. Options include:

- Enabled
- Disabled

- Power Monitor Frequency

Sets the Power Monitor Frequency which is the actual frequency at which you are operating. To ensure accurate readings, you must set your operating frequency which might be different from the factory default values listed in [Table B.1](#).

Example: If the frequency allocated to you by the satellite carrier is 6400 MHz, set the Power Monitor Frequency to 6400 MHz.

The factory default values in [Table B.1](#) are listed according to the model number of the IBUC. For more information about identifying the model number of the IBUC, see [Appendix A, Part Numbering Schema](#).

Table B.1 Default Values for Power Monitor Frequency

Model Number	Default Value	Model Number	Default Value
050052	5100	128133	13050
057064	6075	137142	14000
058064	6137	137145	14125
058066	6250	140145	14250
058067	6287	173181	17700
064067	6575	181184	18250
067070	6875	290300	29500
079084	8150	295300	29750
127132	13000	300310	30500

- Tx State at Power-Up

Sets whether the unit is transmitting upon power-up. Options include:

- Enable
- Disable

- Tx Power-Up Delay

Sets the transmit power output delay of the IBUC in seconds. When configured, the Tx Output will be muted for the period specified before beginning to transmit.

- **Power Read Mode**

Sets the mode in which power is read. Options include:

- **Burst**

In burst mode, the input signal is active only a small percentage of the time because packets of data are sent in bursts.

- **Continuous**

In continuous mode, the input signal continues without interruption.

- **Burst Timeout**

Sets the longest allowable time between valid data bursts before the IBUC reports an alarm. This command applies when the IBUC is set to burst power monitoring.

The set value must be between 0 and 300 seconds. 0 is the default value (No Timeout).

- **Burst Threshold**

Sets the burst threshold for the IBUC. This value determines the level at which a burst is considered valid. The threshold is for the output power level; the threshold for input power is configured internally.

The value must be between rated power and no less than 2 dB below rated power. Default values are listed in [Table B.2](#).

Table B.2 Default Values for Burst Threshold

Power Level	Default Value	Power Level	Default Value
004	16.0	050	27.0
005	17.0	060	28.0
008	19.0	080	29.0
010	20.0	100	30.0
012	21.0	125	31.0
016	22.0	150	32.0
020	23.0	175	32.4
025	24.0	200	33.0
030	25.0	300	35.0
040	26.0	400	36.0

- Gain Mode

Options include:

- Open: no feedback in the measuring loop.
Keep in mind the open-loop gain is affected by temperature and frequency; however, the temperature compensation feature is still active when the unit operates with open-loop gain. Open is the default setting.
- Automatic Gain Control (AGC)
- Automatic Level Control (ALC)

Note: The user should **not switch directly** from AGC/ALC to ALC/ACG. This action may cause errors. Instead the user should first change from AGC/ALC to Open Loop gain and then change to ALC/AGC. After Switch from the ALC/AGC Gain Mode to Open Loop Mode, the user **must reset the Gain Control**.



CAUTION

Resetting the ALC/ACG attenuation control **might cause abrupt changes of the Tx Output level**. For reduced interference on nearby channels, **Terrasat recommends:** attenuating the input signal (via IBUCs internal control), resetting the gain control, re-adjusting the input signal attenuation until output power reaches the desired level and finally enabling the desired Gain mode.

- Gain Control Reset

Over time, gain control levels can fluctuate. When the Gain Control Reset option is enabled, the gain control resets to 0.0 Options include:

- Select (default)
- Reset

Note: You must choose “Reset” and then click **Submit** in order to reset the gain control.

- Attenuation

Type a value within the range of 0.0 dB to 30.0 dB in 0.1 dB steps. After you click **Submit**, the gain of the unit will be reduced by that value.

The default setting is 0.0 dB

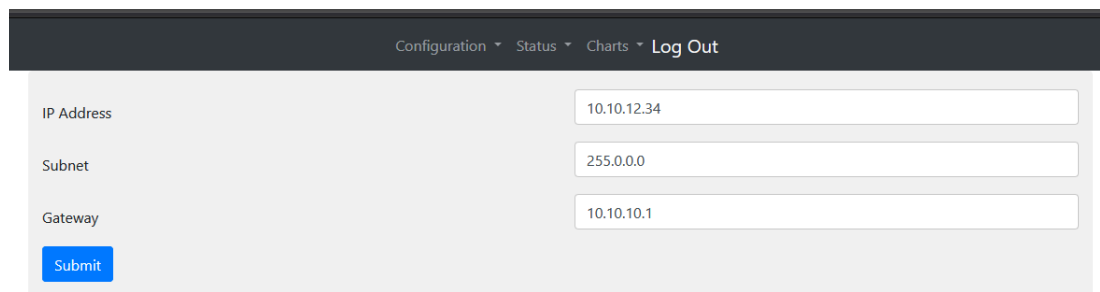
- Current Gain Control

Indicates the current gain of the AGC/ALC voltage variable attenuator (VVA) circuitry. The Gain Control range is 0 dB to 30.0 dB. When the Gain Control Reset option is selected, this value will reset to 0.0.

- **Input Threshold Low**
Sets the lowest permitted transmit input value down to -60 dBm. You will receive an error message if you try to exceed the threshold range. Click **OK** to return to the Tx Config page to enter a valid value.
 - **Input Threshold High**
Sets the highest permitted transmit input value up to -15 dBm. You will receive an error message if you try to exceed the threshold range. Click **OK** to return to the Tx Config page to enter a valid value.
 - **Output Threshold Low**
Sets the lowest permitted transmit input value down to (rated P1dB - 20 dB). You will receive an error message if you try to exceed the threshold range. Click **OK** to return to the Tx Config page to enter a valid value.
 - **Output Threshold High**
Sets the highest permitted transmit input value up to (rated P1dB+ 1 dB). You will receive an error message if you try to exceed the threshold range. Click **OK** to return to the Tx Config page to enter a valid value.
 - **Internal 10 MHz Trim**
You can specify a frequency trimming value for IBUCs equipped with optional internal 10 MHz reference signal.
Valid values: 0-4095
- Note: When the IBUC is operating using an external 10 MHz reference signal, this field is grayed-out and unavailable for user input.

Interface Configuration

Use this page to configure the TCP/IP interface for the Cyber Hardened IBUC **2**, IBUC **2e**, IBUC **2G**, IBUC **R** and IBUC **G**. Click **Submit** when you have completed entering data to ensure that your changes are saved and implemented.



The screenshot shows a web interface for configuring the TCP/IP interface. At the top, there is a dark navigation bar with links: Configuration, Status, Charts, and Log Out. Below this, the main content area has a light gray background. It contains three input fields for configuration: IP Address (with the value 10.10.12.34), Subnet (with the value 255.0.0.0), and Gateway (with the value 10.10.10.1). Each input field is a white box with a light gray border. Below the input fields is a blue button labeled 'Submit'.

Figure B.11 Interface Configuration Tab

From this page you can configure the following parameters:

- **IP Address**
Valid values range from (but do not include) 1.0.0.0 through 224.0.0.0. When the netmask is applied, 0 and 225 in the last byte are excluded.
- **IP Subnet Mask**
Sets the IP netmask.
 - Valid values range from 8 through 30 representing the number of ones in the netmask. This corresponds to 22.0.0.0 to 255.255.255.252.
- **Gateway Address**
Sets the IP Gateway Address which is the address that the IBUC will send to if the requested IP address does not reside on the local LAN segment.

Note: This address cannot be the same as the IP address of the unit.

System Configuration

Use this page to set the system time or NTP Server configurations; and other setting like the External LED. Click **Submit** when you have completed entering data to ensure that your changes are saved and then implemented.

Figure B.12 System Configuration Tab

From this page you can configure the following parameters:

- **Time**
Sets the system time of the IBUC in a mm/dd/yyyy hh:mm:ss format.

Note: If “Manual” option is enabled, the user can use the “Time” entry to manually configure the time settings. If disabled, the IBUC will attempt to connect to a NTP Server to automatically configure the time and date settings.

- **NTP Server Address**
Sets the address for the NTP server used to update time and date settings. The address can be filled out with either the server domain (such as 0.pool.ntp.org) or its IP address (such as 68.233.45.146).
- **NTP Timezone Offset**
Sets the timezone offset used to update time and date settings. Only values between -12:00 and 12:00 are considered valid entries.
- **External LED**
Sets the state of the multifunction LED indicator. Options include
 - Disabled (LED is off)
 - Enabled (LED is on)Enabled is the default setting.
- **Reboot Firmware**
When selected, this causes a momentary muting of the transmitter and should be used with caution. A dialog box appears and you are asked to confirm your selection.
- **Enable AC 50 Hz Correction**
When enabled, applies a 50 Hz correction factor to AC-powered IBUCs. Options include:
 - Disabled
 - EnabledDisabled is the default setting.

Alarm Configuration

Use this page to configure alarms as Minor, Major, or None. You can also configure the alarms as suppressible. Suppressible alarms will be suppressed only when the “Suppress Faults” option is enabled. Click **Submit** when you have completed entering data to ensure that your changes are saved and then implemented.

Configuration ▾
Status ▾
Charts ▾
Log Out

Temperature	Minor ▾
Input Threshold Low	Minor ▾
Input Threshold High	Minor ▾
Output Threshold Low	Major ▾
Output Threshold High	Major ▾
Temperature Suppressible	Disable ▾
Input Threshold Low Suppressible	Enable ▾
Input Threshold High Suppressible	Enable ▾
Output Threshold Low Suppressible	Enable ▾
Output Threshold High Suppressible	Enable ▾
High Temperature Shutdown	Enable ▾
Simulate Fault	Disable ▾
Suppress Faults	Disable ▾

Submit

Figure B.13 Alarm Configuration Tab

From this page you can configure the following alarms:

- **Temperature**
Sets the type of alarm produced when the temperature threshold has been exceeded. Options include:
 - Disable
 - Minor
 - Major

- **Input Threshold Low**
Sets the type of alarm produced when the lower Tx Input Threshold has been exceeded. Options include:
 - Disable
 - Minor
 - Major
- **Input Threshold High**
Sets the type of alarm produced when the higher Tx Input Threshold has been exceeded. Options include:
 - Disable
 - Minor
 - Major
- **Output Threshold Low**
Sets the type of alarm produced when the lower Tx Output Threshold has been exceeded. The default lower threshold is equal to rated P1dB - 20. Options include:
 - Disable
 - Minor
 - Major
- **Output Threshold High**
Sets the type of alarm produced when the higher Tx Output Threshold has been exceeded. The default higher threshold is equal to rated P1dB+ 1. Options include:
 - Disable
 - Minor
 - Major
- **Temperature Suppressible**
Sets whether the temperature alarm is suppressible. When suppressed (enabled), a temperature alarm will not appear as an event in the Event Log. Options include:
 - Disable
 - Enable
- **Input Threshold Low Suppressible**
Sets whether the lower input threshold is suppressible. Options include:
 - Disable
 - Enable

- **Output Threshold Low Suppressible**
Sets whether the lower output threshold is suppressible. Options include:
 - Disable
 - Enable
- **Output Threshold High Suppressible**
Sets whether the higher output threshold is suppressible. Options include:
 - Disable
 - Enable
- **High Temperature Shutdown**
Sets whether to shutdown the IBUC when the internal temperature threshold of 85° C has been exceeded. The unit must cool down by 20° C before resuming transmission. Transmission will resume automatically once the unit has cooled by 20° C. Options include:
 - Disable
 - Enable (default)
- **Suppress faults**
Sets whether the unit will suppress all alarms that are configured as suppressible. Options include:
 - Disable
 - Enable
- **Simulate faults**
When enabled, a simulated alarm is issued that does not affect transmission status or traffic. Options include:
 - Disable
 - Enable

Use this alarm to determine whether your alarm settings are functional.

Configuration File

Use this page to download current Cyber Hardened IBUC **2**, IBUC **2e**, IBUC **2G**, IBUC **R** or IBUC **G** Configuration File or to upload it from your computer. Configuration Files contains information about all of the selections within the Configuration Menu and SNMP Menu, aiding the user in several manners:

- Automation: By using a Configuration File from a configured unit, the user is able to replicate it's configurations to several identical units.

Note: Using configuration files from different Cyber Hardened IBUC models is **not recommended**. The usage of such files should be restrained only for identical models.

- Recovery: In case the user is not sure if the modification of one or more configurations might cause problems to the units performance, it is advised to download the Configuration File as a safe recovery point. This way it is always possible to revert back to known operation conditions by uploading such file.
- Technical Support: In some cases of technical difficulties, the user might be prompted to download the Configuration File and send it to Terrasat Inc. Technical Support team for further analysis.

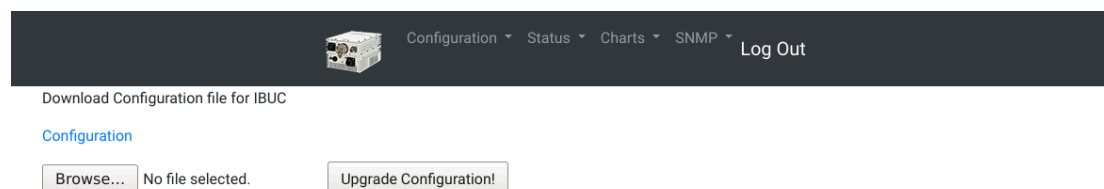


Figure B.14 Configuration File page

Note: The usage of the Configuration File is a feature **exclusive** to the Embedded Web Pages and is **not available to use via ASCII Commands**.

Status Menu

Alarms

Use this tab to verify the alarm status of the unit. Alarm status is indicated with color:

- **Green:** indicates that the parameter is operating within specifications and no faults have occurred.
- **Yellow:** indicates a minor fault.
- **Red:** indicates a major fault.
- **Grayed-Out:** indicates that particular parameter is not available for monitoring. [Table B.1](#) on [page B-10](#) contains the default configuration and lists which alarms are available for user configuration.

For information about how to configure these alarms, see the [Alarm Configuration](#) on [page B-16](#).

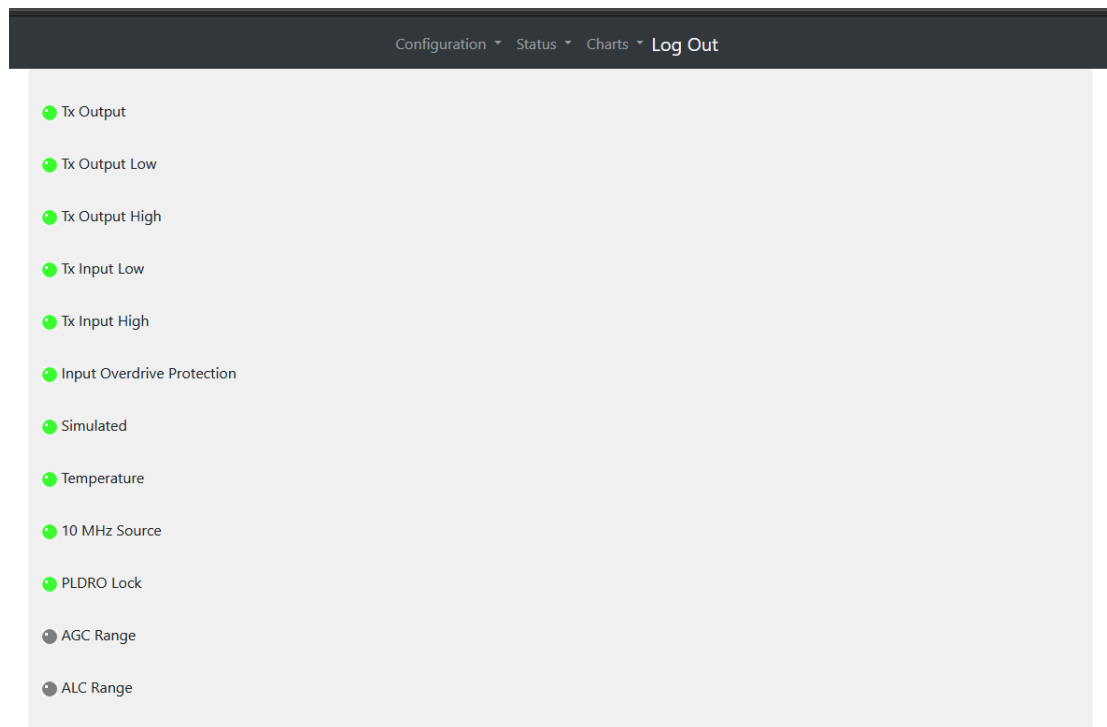


Figure B.15 Alarm Status Tab

From this page, you can view the following parameters:

- Tx Output

Indicates whether the Cyber Hardened IBUC **2**, IBUC **2e**, IBUC **2G**, IBUC **R** or IBUC **G** is currently transmitting. Options include:

- On
- Disabled
- Muted (Alarm)

- Tx Output Low

Indicates whether the Tx Output level is operating below a minimum threshold. Options include:

- OK
- Major
- Minor

- Tx Output High

Indicates whether the Tx Output level is operating above a maximum threshold. Options include:

- OK
- Major
- Minor

- Tx Input Low

Indicates whether the Tx Input level is operating below a minimum threshold. Options include:

- OK
- Major
- Minor

- Tx Input High

Indicates whether the Tx Input level is operating above a maximum threshold. Options include:

- OK
- Major
- Minor

- **Input Overdrive Protection**

Indicates whether the internal Power Amplifiers are operating with overdrive. Options include:

- OK
- Major

- **Simulated Alarm**

Indicates whether a simulated alarm has been issued. A simulated alarm is mainly used for testing. Options include:

- OK
- Major

- **Temperature (Internal)**

Indicates that the internal temperature of the IBUC exceeds 85° C.

Note: If the High Temperature Shutdown alarm has been enabled and the internal temperature of the IBUC exceeds 85° C, the IBUC will shut down automatically

- **10 MHz Source**

Indicates whether the source of the 10 MHz reference signal is internal or external.

Note: For IBUCs operating with only an external 10 MHz reference signal, this field is labelled “10 MHz Detector” and the options include:

- OK (indicates that the 10 MHz signal is functioning properly)
- Low (indicates that the 10 MHz signal is low or missing)

- **PLDRO Lock**

Indicates whether the phase-locked dielectric resonator oscillator (PLDRO) frequency is locked (or stable). When the PLDRO is out-of-lock, this alarm causes the muting of the amplifier and automatically shuts down the IBUC. Options include:

- OK (indicates that the PLDRO is locked and functioning properly)
- Major

Note: This alarm is always a major alarm and is not available for user configuration.

- **AGC Range**

Indicates that the automatic gain control function is unable to maintain the gain level. Options include:

- OK
- Major
This alarm occurs whenever the internal AGC gain is out of range and can no longer maintain the desired Tx Output level
- N/A

- **ALC Range**

Indicates that the Tx Output level is being kept constant by the automatic level control (ALC) function. Options include:

- **OK**
- **Major**
This alarm occurs whenever the internal ALC gain is out of range and can no longer maintain the desired Tx Output level
- **N/A**

Note: Both ALC Range and ACG Range alarms are always a major and are not available for user configuration.

Sensors

Use this tab to view real-time voltage, current, and power levels for the Cyber Hardened IBUC **2**, IBUC **2e**, IBUC **2G**, IBUC **R** and IBUC **G**.

Configuration ▾ Status ▾ Charts ▾ Log Out	
Supply Voltage(VAC)	216
Supply Current (A)	1.14
Supply Power(VA)	246.24
Tx Input Level (dBm)	-47.72
Tx Output Level (dBm)	34.38
Internal Temperature (°C)	39
DRO Tuning Voltage (VDC)	3.82

Figure B.16 Sensor Tab

From this page, you can view the following parameters:

- **Supply Voltage**
Displays the supply voltage readings (V for DC-powered IBUCs; VAC for AC-powered IBUCs). Valid values depend on the IBUC model. The readings on this page should fall within the range listed on the [Information](#) on [page B-6](#).
- **Supply Current**
Displays the current draw at the input of the IBUC in amps.
- **Supply Power**
Displays the power consumption of the IBUC (watts for DC-powered IBUCs; VA for AC-powered IBUCs).

- **Tx Input Level**
Displays the Tx Input level in dBm.
- **Tx Output Level**
Displays the Tx Output level in dBm.
- **Internal Temperature**
Displays the real-time internal temperature of the IBUC in ° C.

Note: If the High Temperature Shutdown alarm has been enabled and the internal temperature of the IBUC exceeds 85° C, the IBUC will shut down automatically.

- **DRO Tuning Voltage**
Displays the tuning voltage for the DRO in volts. This voltage is not static and is continually monitored. The valid range is 1 to 9 volts; ideally, the DRO tuning voltage should fall within the range of 2 to 8 volts when the DRO is locked.

If your readings consistently fall within the range of 1 to 2 volts or 8 to 9 volts, contact Terrasat Technical Support.

Event Log

For extended monitoring and troubleshooting capabilities, the user is able to see all events that occur within the Cyber Hardened unit by using the Event Log page. Each Log page is able to show up to 25 event entries. The user is able to go to the next page by pressing the **Next** button. The **Clear** button clears the entire event log.

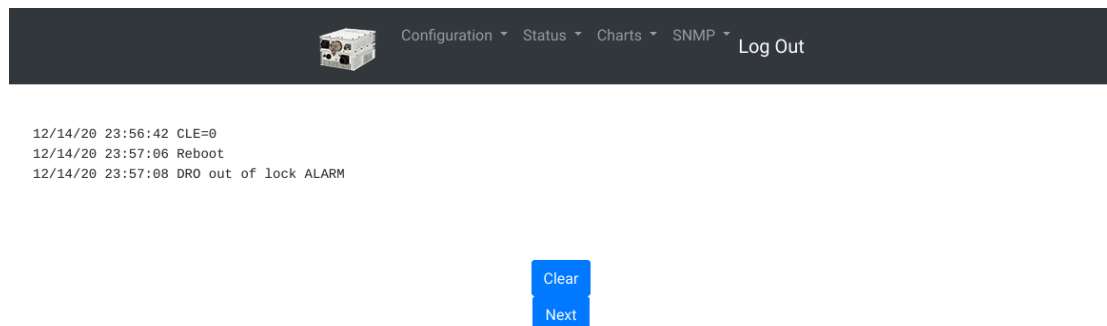


Figure B.17 Event Log

Charts Menu

For extended monitoring periods, the user is able to view: Supply Current, Supply Voltage, Input Power, Output Power and DRO Voltage Charts.

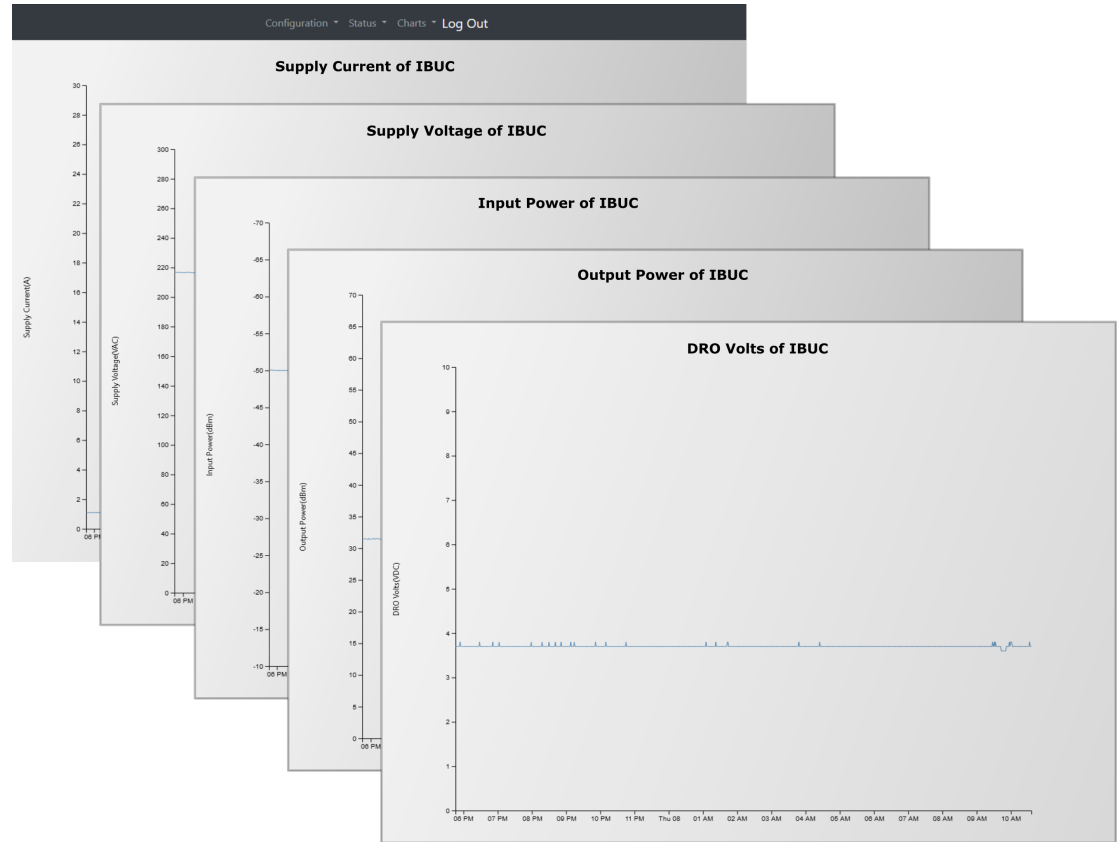


Figure B.18 Statistics Charts

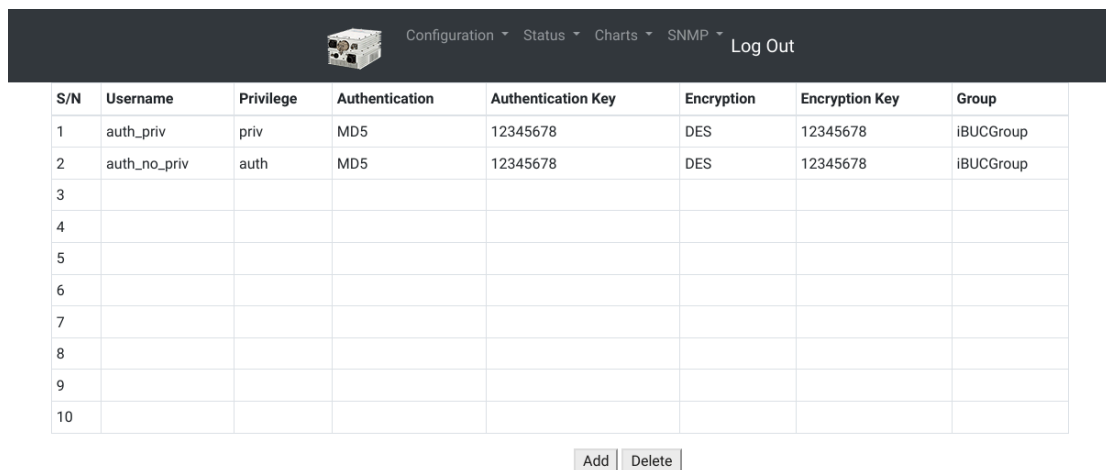
SNMP Menu

Within the SNMP drop-down menu, the operator is able to access various SNMP Tabs used to configure SNMP operation.

SNMP User Configuration

In this page, the operator is able to view existing SNMPv3 USM registered users (see [Figure B.19](#)), add new SNMP users ([Figure B.20](#)) or delete existing users ([Figure B.21](#)). A SNMPv3 user is composed of several fields:

- **Username:** String characters indicating the name that identifies the SNMP User. This field can contain up to 32 characters.
- **Privilege:** Defines the security level that this user has access to. This field can assume one of two values:
 - auth (Read-Only Access)
 - priv (Read-Write Access)
- **Authentication Type:** Can assume one of two values, 'MD5' or 'SHA'.
- **Authentication Key:** String of alphanumeric characters indicating the pass phrase used by the selected authentication method. This field can contain up to 32 characters.
- **Encryption Type:** Can assume one of two values, 'DES' or 'AES'.
- **Encryption Key:** String of alphanumeric characters indicating the pass phrase used by the selected encryption method. This field can contain up to 32 characters.
- **Group:** String characters indicating the SNMP Group this user is mapped to. This field can contain up to 32 characters.

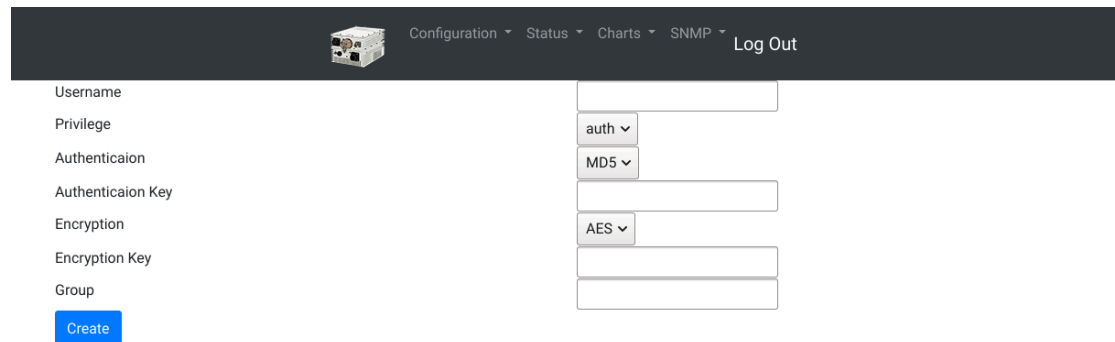


The image shows a web interface for configuring SNMP users. At the top, there is a navigation bar with a router icon and tabs for Configuration, Status, Charts, SNMP, and Log Out. Below the navigation bar is a table with 8 columns: S/N, Username, Privilege, Authentication, Authentication Key, Encryption, Encryption Key, and Group. The table contains two rows of data. Below the table are two buttons: Add and Delete.

S/N	Username	Privilege	Authentication	Authentication Key	Encryption	Encryption Key	Group
1	auth_priv	priv	MD5	12345678	DES	12345678	iBUCGroup
2	auth_no_priv	auth	MD5	12345678	DES	12345678	iBUCGroup
3							
4							
5							
6							
7							
8							
9							
10							

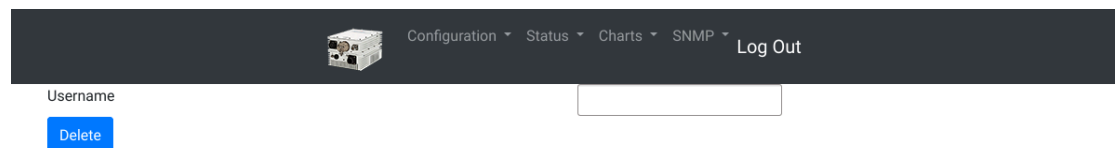
Add Delete

Figure B.19 SNMP Users



The figure shows a web interface for adding a new SNMP user. At the top, there is a dark navigation bar with a router icon, a menu (Configuration ▾ Status ▾ Charts ▾ SNMP ▾), and a Log Out link. Below the navigation bar, the form is organized into two columns. The left column contains labels for the form fields: Username, Privilege, Authenticaion (sic), Authenticaion Key (sic), Encryption, Encryption Key, and Group. The right column contains the corresponding input fields: a text box for Username, a dropdown menu for Privilege (currently showing 'auth'), a dropdown menu for Authenticaion (currently showing 'MD5'), a text box for Authenticaion Key, a dropdown menu for Encryption (currently showing 'AES'), a text box for Encryption Key, and a text box for Group. At the bottom left of the form is a blue 'Create' button.

Figure B.20 SNMP User Add



The figure shows a web interface for deleting an existing SNMP user. It features the same dark navigation bar as Figure B.20. Below the navigation bar, the form is simpler, with a single text box for the Username and a blue 'Delete' button positioned below it.

Figure B.21 SMP User Delete

SNMP Views

In this page, the operator is able to view existing SNMPv3 views (see [Figure B.22](#)), add new SNMP views ([Figure B.23](#)) or delete existing views ([Figure B.24](#)). A SNMPv3 view is composed of several fields:

- **Name:** String characters indicating the name that identifies the MIB View. This field can contain up to 32 characters.
- **Flag:** Indicates whether the object described by the OID is included or excluded from this view. Can assume one of two values, 'included' or 'excluded'.
- **OID Subtree:** Object identifier string.
- **Mask:** Family mask used to define a family of view subtrees. It is composed of two hexadecimal characters in length.


 Configuration ▾ Status ▾ Charts ▾ SNMP ▾ Log Out				
S/N	Name	Flag	Subtree	Mask(hex/none)
1	all	excluded	.1	none
2	systemview	excluded	.1	none
3	systemview	included	.1.3.6.1.2.1.1	none
4	systemview	included	.1.3.6.1.6.3	none
5	systemview	included	.1.3.6.1.4.1.21369	none
6				
7				
8				
9				
10				

Figure B.22 SNMP Views


 Configuration ▾ Status ▾ Charts ▾ SNMP ▾ Log Out	
Name	<input type="text"/>
Flag	<input type="button" value="included ▾"/>
Subtree	<input type="text"/>
Mask(hex/none)	<input type="text"/>
<input type="button" value="Create"/>	

Figure B.23 SNMP Views Add


 Configuration ▾ Status ▾ Charts ▾ SNMP ▾ Log Out	
View name	<input type="text"/>
Subtree	<input type="text"/>
<input type="button" value="Delete"/>	

Figure B.24 SNMP Views Delete

SNMP Traps

In this page, the operator is able to manage and configure Trap communication. Trap messaging requires several fields to be configured:

- Profile: String of up to 32 characters indicating the Notification Filter Profile Name that will be used by Trap messages.
- Username: String of characters indicating the username of this Trap message. This field can contain up to 32 characters.

- **Privilege:** Defines the security level that this Trap message has access to. This field can assume one of two values:
 - auth
 - priv
- **Authentication Type:** Can assume one of two values, ‘MD5’ or ‘SHA’
- **Authentication Key:** String of alphanumeric characters indicating the pass phrase used by the selected authentication method. This field can contain up to 32 characters.
- **Encryption Type:** Can assume one of two values, ‘DES’ or ‘AES’
- **Encryption Key:** String of alphanumeric characters indicating the pass phrase used by the selected encryption method. This field can contain up to 32 characters.
- **Trap Destination IP Address:** IP address indicating the destination IP of this Trap message.


 Configuration ▾ Status ▾ Charts ▾ SNMP ▾ Log Out								
S/N	Profile	Username	Privilege	Authentication	Authentication Password	Encryption	Encryption Password	Destination IP
1	no_coldstart	auth_no_priv	auth	MD5	12345678	DES	12345678	10.10.19.68
2								
3								
4								
5								
6								
7								
8								
9								
10								

Figure B.25 SNMP Trap Sessions


 Configuration ▾ Status ▾ Charts ▾ SNMP ▾ Log Out	
Profile	<input type="text"/>
Username	<input type="text"/>
Privilege	auth ▾
Authentication	MD5 ▾
Authentication Password	<input type="text"/>
Encryption	DES ▾
Encryption Password	<input type="text"/>
Trap Destination IP Address	<input type="text"/>
<input type="button" value="Create"/>	

Figure B.26 SNMP Trap Session Add


SNMP Trap Notifications Filters

In this page, the operator is able to manage and configure Trap Notification Filters used by the unit. The notification filter enables the Cyber Hardened unit to choose which type of SNMP notifications are sent to the management station based on the OID of the notification to be sent.

- **Profile:** String of characters indicating the name that identifies the Filter profile. This field can contain up to 32 characters.

Note: This field will be used when configuring SNMP Traps

- **OID Subtree:** Object identifier string.
- **Flag:** Indicates whether the object described by the OID is included or excluded from this filter. Can assume one of two values, 'included' or 'excluded'.
- **Mask:** Family mask used to define a family of view subtrees. It is composed of two hexadecimal characters in length.

 Configuration ▾ Status ▾ Charts ▾ SNMP ▾ Log Out				
S/N	Profile	Subtree	Flag	Mask
1	no_coldstart	.1.3.6.1.4.1.21367	included	0x00
2				
3				
4				
5				
6				
7				
8				
9				
10				

Add Delete

Figure B.27 SNMP Notifications & Filter


 Configuration ▾ Status ▾ Charts ▾ SNMP ▾ Log Out	
Profile	<input type="text"/>
Subtree	<input type="text"/>
Flag	Included ▾
mask	<input type="text"/>
<input type="button" value="Create"/>	

Figure B.28 Adding Notifications & Filters

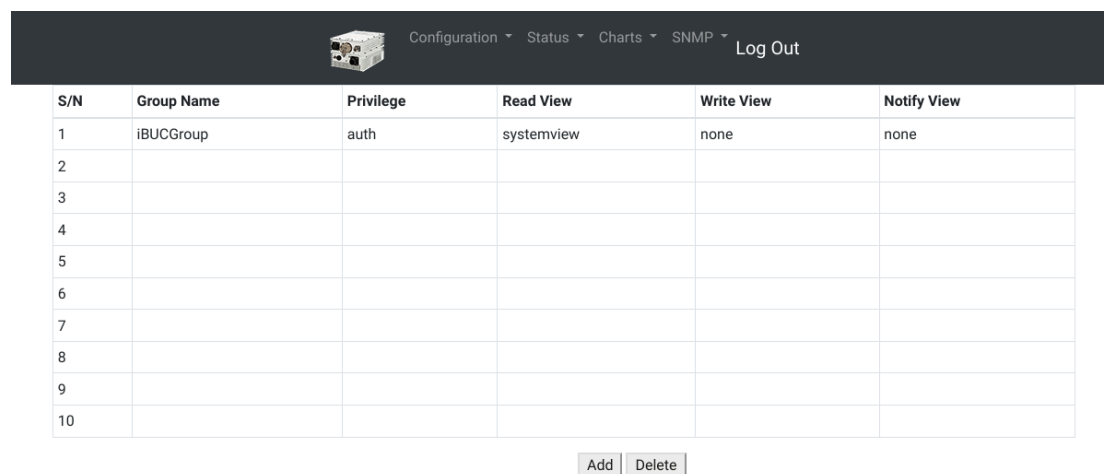
SNMP Groups

In SNMP Group page, the user is able to view existing groups (Figure B.29), add new groups (Figure B.30) and delete existing groups (Figure B.31) from the unit.

- **Group Name:** String of characters indicating the name that identifies the SNMP Group. This field can contain up to 32 characters.
- **Privilege:** Defines the security level that this group has. This field can assume one of three values:
 - auth
 - priv
- **Read View:** String of up to 32 characters indicating the read access to management objects for the group.
- **Write View:** String of up to 32 characters indicating the write access to management objects for the group.
- **Notify View:** String of up to 32 characters indicating the read access to management objects for the group.

Note: All three Read, Write and Notify Views can contain key values, such as **none** or **all**, indicating that the group has access to none of the management objects or all of them. In addition, the user is also able to input a specific view that the group will have.

Note: A couple of default groups are available to the operator. Auth Group

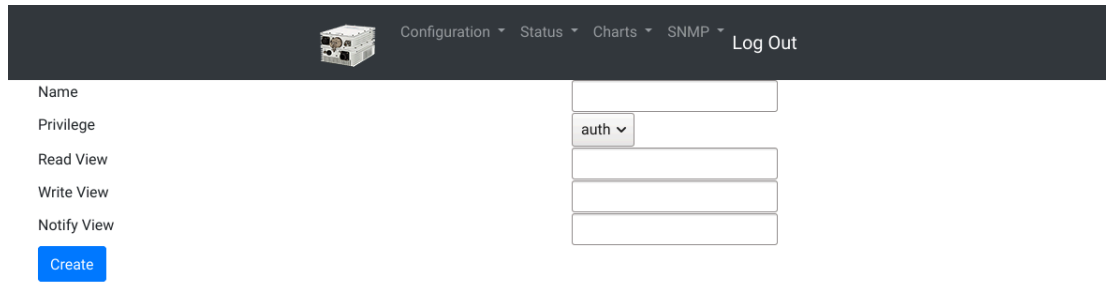


The screenshot shows a web interface for managing SNMP groups. At the top, there is a navigation bar with a router icon and menu items: Configuration, Status, Charts, SNMP, and Log Out. Below the navigation bar is a table with 6 columns: S/N, Group Name, Privilege, Read View, Write View, and Notify View. The table contains 10 rows. The first row (S/N 1) has the following values: Group Name: iBUCGroup, Privilege: auth, Read View: systemview, Write View: none, and Notify View: none. The remaining 9 rows (S/N 2 to 10) are empty. Below the table, there are two buttons: Add and Delete.

S/N	Group Name	Privilege	Read View	Write View	Notify View
1	iBUCGroup	auth	systemview	none	none
2					
3					
4					
5					
6					
7					
8					
9					
10					

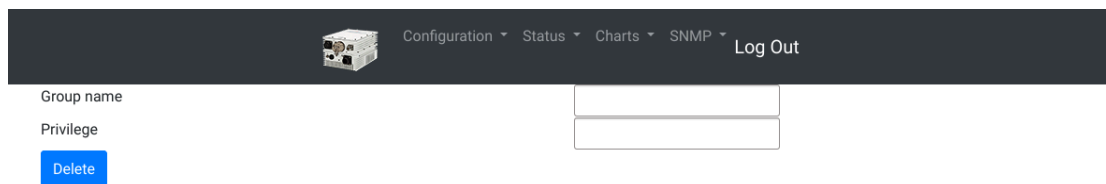
Add Delete

Figure B.29 SNMP Groups



The screenshot shows the 'Add SNMP Groups' web page. At the top is a dark navigation bar with a device icon, menu items 'Configuration', 'Status', 'Charts', and 'SNMP', and a 'Log Out' link. Below the navigation bar, the form is organized into two columns. The left column contains labels for 'Name', 'Privilege', 'Read View', 'Write View', and 'Notify View', followed by a blue 'Create' button. The right column contains a text input field for the name, a dropdown menu for privilege (currently showing 'auth'), and three stacked text input fields for the views.

Figure B.30 Add SNMP Groups



The screenshot shows the 'Delete SNMP Groups' web page. It features the same dark navigation bar as Figure B.30. The form below has two columns. The left column contains labels for 'Group name' and 'Privilege', followed by a blue 'Delete' button. The right column contains a text input field for the group name and a single text input field for the privilege.

Figure B.31 Delete SNMP Groups



ASCII COMMAND/RESPONSE STRUCTURE

Cyber Hardened IBUC Console and SSHv2 Command Set

This command set is used with RS232 and SSHv2 interfaces.

- Parameters are delimited by “< >” for clarity and are not part of the actual query or command. Single quotes delimit an exact string used for a parameter.
- It is expected that both commands and responses are terminated by using <LF><CR>, where

<LF> = 0x0A. (Line Feed)

<CR>= 0x0D. (Carriage Return)

Be sure to configure the SSHv2 or RS232 client accordingly.

In some cases users may type queries/commands with structures that differ from what is expected. In this case one should receive an “Error Response” from the IBUC unit. In such cases, refer to [Table C.1](#) for a more detailed explanation about such errors.

Table C.1 Error Response Table

Code	Error Message	Description
1	error = invalid value	This is not a valid value for this command.
2	error = bad command	This command is not in the command set.
3	error = func not yet done	This command has not been implemented.
4	error = bad format in command	One of the parameters is formatted incorrectly.
5	error = error accessing config storage	Unable to access EEPROM.
6	error = ODU fault	Cannot switch, target unit has a major fault.
7	error = Please enter valid password	Incorrect password has been entered.
8	error = Switch Fault	The waveguide switch is faulted.
9	error = ODU Comm Fault	Legacy Binary packet checksum is invalid.

Table C.1 Error Response Table (Continued)

Code	Error Message	Description
10	error = Timeout waiting for packet	UDP has timed out waiting for response packet.
11	error = Not master	The slave cannot perform the requested command.
12	error = Turn on Tx first	Cannot engage AGC/ALC because Tx Output is muted.
13	error = Tx Alarms present	Cannot engage AGC/ALC because DRO is out of lock.
14	error = Burst Not Detected	AGC/ALC time out waiting for a valid burst (15 seconds).
15	error = AGC/ALC Targets OOR	The ALC target power is outside the valid power range of the unit. The AGC target gain is outside the range of the unit.
16	error = Gain Control OOR	When engaging AGC/ALC mode, the gain control is outside preset limits.
17	error = Redund not enabled	This unit is not part of a redundant pair.
18	error = Invalid IP for subnet	The IP subnet selected is invalid for the configured IP address.
19	SET is not valid with <command>	You can only query this parameter.
20	GET is not valid with <command>	You can only change this parameter.

ADU

Description: Display or add IBUC users. The type ‘user’ is meant for read only access. Such users can read values but not set them. The type ‘admin’ can set values to passwords and add new users.

Q

Query: ADU

Response Values: <Username>, <User Type>

C

Command: ADU = <Username>, <Password>, <User Type>

Response: chpasswd: password for ‘<Username>’ changed

Parameters:

<Username>

string of displayable ASCII characters [up to 32 characters]

<Password>

string of displayable ASCII characters [up to 32 characters]

<User Type>

‘admin’ or ‘user’

ATL

Description: Display the minimum and maximum internal temperatures in degrees C recorded since leaving the factory.

Q Query: ATL
Response Values: <±aaa>, <±bbb>, <nnnnn>

Parameters:

<±aaa>

Minimum temperature in degrees C. This parameter can assume positive or negative values

<±bbb>

Maximum temperature in degrees C. This parameter can assume positive or negative values

<nnnnn>

Number of writes to temp. log

C10

Description: Display the current state of the external 10 MHz source. When no external 10 MHz source is configured the <State> parameter will always be read as '1=10MHz within Range'.

Q Query: C10
Response: <State>

Parameters:

<State>

1 = 10MHz within Range / 0 = 10MHz out of range

CAS

Description: Displays the current active alarms. Use the CAS command to display hexadecimal values that represent the Transmit and Miscellaneous alarms. For the meaning of the individual alarms or to use CAS=1 to display the alarm strings, see [Table C.2](#).

Q

Query: CAS

Response: CAS=T0xhhhh,M0xhhhh

Q

Query: CAS=1

Response:

Verbose alarm report

Tx alarms: 0xhhhh

<Tx alarm strings>

Misc alarms: 0xhhhh

<misc alarm strings>

Parameter:

<Tx alarm strings>

verbose strings of each alarm that is active.

<misc alarm strings>

verbose strings of each alarm that is active.

Table C.2 Alarm Mask

Transmit Alarm Mask		Transmit Alarm Mask	
0x0001	AGC/ALC Out of Range Alarm	0x0100	Tx Simulated Alarm
0x0002	Tx Muted Alarm	0x0200	10 MHz Reference Alarm
0x0004	DRO Loss of Lock Alarm	0x0400	Not Used
0x0008	Tx Output Threshold High Alarm *	0x0800	Not Used
0x0010	Tx Output Threshold Low Alarm *	0x1000	Input Overdrive Alarm
0x0020	Tx Input Threshold High Alarm *	0x2000	Not Used
0x0040	Tx Input Threshold Low Alarm *	0x4000	AGC/ALC Target Out of Range Alarm
0x0080	High Temperature Alarm *	0x8000	Not Used

CCF

Description: Display the power offset between the RF output and the sample port. CCF is not available unless the IBUC has a sample port. This query returns the offset for the frequency configured with TFR.

Q

Query: CCF

Response: CCF=<Offset>

Parameter:

<Offset>

Offset between the RF output and the sample port [decimal number in dB]

CBT

Description: Display or configure the longest allowable time between valid data bursts before the IBUC reports an alarm. This command applies when the IBUC is set to burst power monitoring.

Q

Query: CBT

Response: CBT=<Timeout>

C

Command: CBT=<Timeout>

Response: CBT=<Timeout>

Parameters:

<Timeout>

timeout value in seconds [0 to 300]. A value of 0 means no timeout

CCM

Description: Displays the model number and serial number of the Cyber Hardened IBUC **2**, IBUC **2e**, IBUC **2G**, IBUC **R** or IBUC **G**.

Q

Query: CCM

Response Values: CCM=<Model Number>,<Serial Number>

Parameters:

<Model number>

Model number variable string [up to 20 characters]

<Serial Number>

Serial number variable string [up to 10 characters]

CCS

Description: Displays the M&C firmware version level. This is a read-only command.

Q

Query: CCS

Response: CCS=FW IBB v<mm>.<nn>, <date> <time>

Parameters:

<mm>

Major revision number [0 to 99]

<nn>

Minor revision number [0 to 99]

CIA

Description: Displays or sets the IP address of the unit. Valid values range from (but do not include) 1.0.0.0 through 223.255.255.254..

Q

Query: CIA

Response: CIA=<IP Address>

C

Command: CIA=<IP Address>

Response: CIA=<IP Address>

Parameters:

<IP Address>

IP address of the unit [1.0.0.0 to 223.255.255.254]

Note: Typical usage of this command to set up network is,

IBUC>CIA=192.168.1.200

IBUC>CIM=255.255.255.0

IBUC>CIG=192.168.1.1

For CIM and CIG commands descriptions, see [CIM](#) on [page C-10](#) and [CIG](#) on [page C-9](#).

CID

Description: Displays the current consumption by the IBUC.

Q Query: CID
Response:
AC Current=<Value> Amps
or
DC Current=<Value> Amps

Parameter:

<Value>
Current consumption [decimal number]

CIG

Description: Displays or configures the IBUC network gateway address. This address will be sent to if the requested IP address does not reside on the local LAN segment.

Q Query: CIG
Response: CIG=<Gateway IP>

C Command: CIG=<Gateway IP>
Response: CIG=<Gateway IP>

Parameter:

<Gateway IP>
Network Gateway Address [1.0.0.0 to 223.255.255.254]

CIM

Description: Displays or sets the Network Mask..

Q

Query: CIM

Response: CIM=<Netmask>

C

Command: CIM=<Netmask>

Response: CIM=<Netmask>

Parameter:

<Netmask>

Network Mask [255.0.0.0 to 255.255.255.252]

CIS

Description: Displays, enables or disables SNMPv3.

Q

Query: CIS

Response: CIS=<State>

C

Command: CIS=<State>

Response: CIS=<State>

Parameters:

<State>

0 - Disable / 1 - Enable

CIT

Description: Displays, enables or disables SNMPv3 Trap service.

Q

Query: CIT

Response: CIT=<State>

C

Command: CIT=<State>

Response: CIT=<State>

Parameter:

<State>

0 - Disable / 1 - Enable

CLE

Description: Displays or sets the state of the external LED indicator. If disabled, the external LED indicator will remain off.

Q

Query: CLE

Response: CLE=<State>

C

Command: CLE=<State>

Response: CLE=<State>

Parameters:

<State>

0 - Off / 1 - On

CM1

Description: Displays or sets the minor alarm mask of the unit. This is a hexadecimal value. See [Table C.3](#) for available hexadecimal values..

Q

Query: CM1

Response: CM1=<Hex Mask>

C

Command: CM1=<Hex Mask>

Example: CM1=0x0008 will set the Tx Output Threshold High Alarm to minor.

Response: CM1=<Hex Mask>

Parameter:

<Hex Mask>

Minor alarm mask [Hexadecimal value.

[Table C.3](#) below refers to configurable alarm mask values. Only the alarms shown in the table are maskable out of all alarms available.

Table C.3 Configurable Alarm Mask

Transmit Alarm Mask	
0x0008	Tx Output Threshold High Alarm
0x0010	Tx Output Threshold Low Alarm
0x0020	Tx Input Threshold High Alarm
0x0040	Tx Input Threshold Low Alarm
0x0080	High Temperature Alarm

CM2

Description: Displays or sets the major alarm mask of the unit. This is a hexadecimal value.

Q

Query: CM2

Response: CM2=<Hex Mask>

C

Command: CM2=<Hex Mask>

Example: CM2=0x0008 will set the Tx Output Threshold High Alarm to major.

Response: CM1=<Hex Mask>

Parameter:

<Hex Mask>

Major alarm mask [Hexadecimal value]

See [Table C.3](#) on [page C-12](#) for available hexadecimal values.

CMS

Description: Display or configure the alarm suppression mask. This command does not suppress alarms. You must set TAZ=1 to enable suppression..

Q

Query: CMS

Response: CMS=<Hex Mask>

C

Command: CMS=<Hex Mask>

Example: CMS=0x0008 will set the Tx Output Threshold High Alarm to suppressible.

Response: CMS=<Hex Mask>

Parameter:

<Hex Mask>

Alarm suppression mask [Hexadecimal value]

See [Table C.3](#) on [page C-12](#) for available hexadecimal values.

Note: To suppress alarms,

IBUC> CMS=<Hex Mask>

IBUC> TAZ=1

COI

Description: Displays general information about the IBUC. This is a read-only command.

Q

Query: COI

Response:

COI=Undefined
Model Undefined,
SN TE8100000,
FW IBB v1.0, Jun 24 2020 10:10:17,
P=0(0 W)
LOid=3:CS, (5850 to 6425 MHz)

Q

Query: COI=1

Response:

COI=ODUPwr(CSM)=30.0 dBm, TxOn/Off=0
Band=CS
PwrClass=0(0 W)
PLDRO ool=1, Temp. Out of Range=0
FW IBR v1.0, Jun 24 2020 10:10:17
BucSn=TE8100000, HwAssyRev=Undefined
HousingTemp=-12, HighTempSdEn=1

COX

Description: Displays the current internal temperature of the unit..

Q

Query: COX

Response: COX=<Internal Temperature>

Q

Query: COX=1

Response: COX=<External Temperature>

Parameter:

<Internal Temperature>

Current internal temperature of the unit [degrees C]. Parameter can assume negative or positive values

<External Temperature>

Current external temperature of the unit [degrees C]. Parameter can assume negative or positive values

CPL

Description: Displays the private label string of the unit..

Q

Query: CPL

Response: <Manufacturer>

Parameter:

<Manufacturer>

String representing the manufacturer of the IBUC [String]

CPS

Description: Sets the password for the user who is logged in. To change password for other users use “ADU” command on [page C-3](#). The password does not take effect until the next login. You cannot query this item.

C

Command: CPS=<New Password>

Response: TBD

Parameter:

<New Password>

New password for current user [String]

CRT

Description: Display or configure the internal 10 MHz source frequency. When the IBUC is equipped with an internal 10 MHz source, the user can trim the frequency output of the IBUC. Depending upon the frequency band, the incremental frequency movement at the output of the IBUC will vary..

Q

Query: CRT

Response: CRT=<Value>

C

Command: CRT=<Value>

Response: CRT=<Value>

Parameters:

<Value>

Internal 10 MHz source trim value [0 to 4095]

CSF

Description: Display or configure the IBUC for an input AC frequency of 50/60 Hz. This command only applies to AC powered IBUCs..

Q Query: CSF
Response: CSF=<AC Frequency>

C Command: CSF=<AC Frequency>
Response: CSF=<AC Frequency>

Parameters:

<AC Frequency>
0 = 60 Hz / 1 = 50 Hz

CTI

Description: Display internal 10 MHz source installed..

Q Query: CTI
Response: CTI=<Value>

Parameters:

<Value>
0 = Not Installed / 1 = Installed

CTM

Description: Display or configure the IBUC real time clock. If NTP is not used this provides a way of manually setting the system clock. The IBUC will maintain time up to a week during power losses. It is preferable to use NTP to avoid having to reset the system time..

Q

Query: CTM

Response: CTM=<Date> <Time>

C

Command: CTM=<Date> <Time>

Response: CTM=<Date> <Time>

Parameters:

<Date>

Date used by IBUC unit [mm/dd/yyyy] (e.g.: 07/02/2020)

<Time>

Time used by IBUC unit [hh:mm:ss] (e.g.: 15:40:27)

CTV

Description: Displays the DRO tuning voltage. This is a read-only command..

Q

Query: CTV

Response: DRO Voltage=<Tuning Voltage> Volts

Parameters:

<Tuning Voltage>

DRO tuning voltage [decimal number from 0 to 10.00]

CVD

Description: This command displays the current input AC/DC power..

Q

Query: CVD

Responses:

AC Voltage=<AC Reading> Volts

or

DC Voltage=<DC Reading> Volts

Parameters:

<AC Reading>

Current AC input voltage [decimal number with one decimal place]

<DC Reading>

Current DC input voltage [decimal number with one decimal place]

CZZ

Description: Reboots the IBUC and/or resets all parameters to their default values. .

C

Command: CZZ

Response: None

C

Command: CZZ=1

Response: None

Note: Issuing the command CZZ=1 will prompt the IBUC to reset all internal parameters to their default and then reboot the IBUC. Both commands will cause a momentary mute of the transmitter, and should be used with caution.

DLU

Description: This command allows an administrator to delete another user from the system..

C

Command: DLU=<Username>

Response:

Parameter:

<Username>

User that will be deleted [String]

DRO

Description: Get min/max DRO tuning volts. This command displays the maximum and minimum DRO tuning voltage recorded by the IBUC..

Q

Query: DRO

Response: DRO: min=<Min Value>, max=<Max Value>, origin<Original Value>

Parameters:

<Min Value>

Minimum voltage recorded by th IBUC [0 to 10.0 volts]

<Max Value>

Maximum voltage recorded by th IBUC [0 to 10.0 volts]

<Origin Value>

DRO voltage when the IBUC left the factory [0 to 10.0 volts]

DTM

Description: Disable internal 10 MHz. This command allows the user to disable the internal 10 MHz source for troubleshooting purposes. This command does not persist through a reboot of the IBUC

Q

Query: DTM

Response: DTM=<State>

C

Command: DTM=<State>

Response: DTM=<State>

Parameters:

<State>

0 = normal operation / 1 = disable internal 10 MHz source

EHl

Description: Display up to 25 IBUC event history entries. Each subsequent call displays up to 25 more entries. Once the history end is reached the 'No New Events' string will appear. Issuing the command EHI=0 will reset the index of the event log, allowing the user to see the log from beginning.

Q

Query: EHI

Response: <Date> <Time> <Event String>

C

Command: EHI=0

Response: <Date> <Time> <Event String>

Parameters:

<Date>

Date in which the event was issued [mm/dd/yyyy]

<Time>

Time in which the event was issued [hh:mm:ss]

<Event String>

String that corresponds to the issued command [String]

EHZ

Description: Clear the event history of the IBUC.

C

Command: EHZ

Response: event log cleared

Parameters:

HLP

Description: Display the available list of commands.

Q

Query: HLP

Response:

Parameters:

NTP

Description: Display or configure the NTP Server IP address.

Q

Query: NTP

Response:

<IP/Hostname>

C

Command: NTP=
<IP/Hostname>

Response:

<IP/Hostname>

Parameters:

<IP/Hostname>

NTP Server IP address or Hostname

SGA

Description: Display or configure the security to group mapping of SNMPv3.

Q Query: SGA

Response:
<Group Name>,<Level>,<Readview>,<Writeview>,<Notifyview>

C Command: SGA=
<Group Name>,<Level>,<Readview>,<Writeview>,<Notifyview>

Response:
<Group Name>,<Level>,<Readview>,<Writeview>,<Notifyview>

Parameters:

<Group Name>
SNMPv3 group name [up to 32 alpha numeric characters]

<Level>
SNMPv3 group matching security level [up to 32 alphanumeric characters]

<Readview>
SNMPv3 group read view [up to 32 alphanumeric characters]

<Writeview>
SNMPv3 group write view [up to 32 alphanumeric characters]

<Notifyview>
SNMPv3 group notify view [up to 32 alphanumeric characters]

SGD

Description: Delete an existing SNMPv3 group.

C Command: SGD=<Group Name>,<Level>

Response:

Parameters:

<Group Name>
SNMPv3 group name that should be deleted [alphanumeric string]

<Level>
SNMPv3 group matching level [up to 32 alphanumeric characters]

SHL

Description: Display up to 25 IBUC statistic history entries. Each subsequent call displays up to 25 more entries. Once history end is reached the ‘No New Stats’ string will appear. Issuing the command SHL=0 will reset the statistics log index to the beginning.

Q Query: SHL

Response: <Date> <Time> <POut> <PIn> <Temp> <DRO> <Volt>
<Amp>

C Command: SHL=0

Response: <Date> <Time> <POut> <PIn> <Temp> <DRO> <Volt>
<Amp>

Parameters:

<Date>
Date of the statistic entry [mm/dd/yyyy]

<Time>
Time that the statistic entry was issued [hh:mm:ss]

<POut>
IBUC output RF power [decimal number]

<PIn>
IBUC input IF power [decimal number]

<Temp>
Internal temperature of the IBUC in degrees C [integer]

<DRO>
DRO tuning voltage [decimal number]

<Volt>
DC/AC power input voltage [decimal number]

<Amp>
DC/AC power input current [decimal number]

SHP

Description: Display or configure the data collection period for statistics.

Q

Query: SHP

Response: SHP=<Period>

C

Command: SHP=<Period>

Response: SHP=<Period>

Parameters:

<Period>

Period of data collection [1 to 1440 minutes] If Period is selected to be 0 statistic collection will be disabled.

SHZ

Description: Clear the statistics history of the IBUC.

C

Command: SHZ

Response: stat log cleared

Parameters:

SNA

Description: Display existing SNMPv3 Trap Notification Filter or add a new one. One or more of the parameters below should be used for user configuration.

Q Query: SNA
Response: <Profile>,<Subtree>,<Mask>

C Command: SNA= <Profile>,<Subtree>,<Mask>
Response: <Profile>,<Subtree>,<Mask>

Parameters:

- <Profile>
String of up to 32 characters indicating the Notification Filter Profile Name that will be used by Trap messages
- <Subtree>
OID tree to filter.
- <Mask>
Family mask used to define a family of view subtrees. It is composed of two hexadecimal characters in length

SND

Description: Delete an existing SNMPv3 Trap Notification Filter.

C Command: SND= <Profile>,<Subtree>
Response: <Profile>,<Subtree>

Parameters:

- <Profile>
String of up to 32 characters indicating the Notification Filter Profile Name that will be used by Trap messages
- <Subtree>
OID tree to filter.

STA

Description: Display existing SNMPv3 Trap sessions or add new SNMPv3 Traps. One or more of the parameters below should be used for user configuration.

Q

Query: STA

Response: <Profile>,<Username>,<Privilege>,<Authentication>,<Auth. Password>,<Encryption>,<Priv. Password>,<Target IP>

C

Command: STA= <Profile>,<Username>,<Privilege>,<Authentication>,<Auth. Password>,<Encryption>,<Priv. Password>,<Target IP>

Response: <Profile>,<Username>,<Privilege>,<Authentication>,<Auth. Password>,<Encryption>,<Priv. Password>,<Target IP>

Parameters:

<Profile>

String of up to 32 characters indicating the Notification Filter Profile Name that will be used by Trap messages

<Name>

String of characters indicating the username of this Trap message. This field can contain up to 32 characters.

<Privilege>

Defines the security level that this Trap message has access to. This field can assume one of two values:

- auth
- priv

<Authentication>

Can assume one of two values, 'MD5' or 'SHA'

<Authentication Password>

String of alphanumeric characters indicating the pass phrase used by the selected authentication method. This field can contain up to 32 characters.

<Encryption>

Can assume one of two values, 'DES' or 'AES'

<Encryption Password>

String of alphanumeric characters indicating the pass phrase used by the selected encryption method. This field can contain up to 32 characters.

<Target IP>

IP address indicating the destination IP of this Trap message.

STD

Description: Delete an SNMPv3 Trap session. One or more of the parameters below should be used for user configuration.

C

Command: STD= <Profile>,<Name>,<Target IP>

Response: <Profile>,<Name>,<Target IP>

Parameters:

<Profile>

String of up to 32 characters indicating the Notification Filter Profile Name that will be used by Trap messages

<Name>

String of characters indicating the username of this Trap message. This field can contain up to 32 characters.

<Target IP>

IP address indicating the destination IP of this Trap message.

SUA

Description: Display or configure an SNMPv3 user. One or more of the parameters below should be used for user configuration.

Q

Query: SUA

Response: <Name>,<Privilege>,<Authentication>,<Auth. Password>,<Encryption>,<Priv. Password>,<Group>

C

Command: SUA= <Name>,<Privilege>,<Authentication>,<Auth. Password>,<Encryption>,<Priv. Password>,<Group>

Response:<Name>,<Privilege>,<Authentication>,<Auth. Password>,<Encryption>,<Priv. Password>,<Group>

Parameters:

<Name>

Username [up to 32 alphanumeric characters]

<Privilege>

User privilege ['rouser' or 'rwuser']

<Authentication>

Authentication method ['MD5', 'SHA']

<Password>

User authentication password [min of 8; max of 32 alphanumeric characters]

<Encryption>

Encryption method ['DES' or 'AES']

<Priv. Password>

Encryption password [min of 8; max of 32 alphanumeric characters]

<Group>

Group name configured with SGA.

Note: Two users, 'auth_no_priv' and 'auth_priv' are preconfigured for read-only and read-write access. The following MIB are available by default:

- SNMPv2-MIB
- HOST-RESOURCES-MIB
- TERRASAT-MIB
- TERRASAT-SMI-MIB
- SNMP-FRAMEWORK-MIB
- SNMP-MPD-MIB
- SNMP-USER-BASED-SM-MIB
- SNMP-VIEW-BASED-ACM-MIB
- SNMP-TARGET-MIB
- SNMP-NOTIFICATION-MIB

SUD

Description: Delete SNMPv3 user

C

Command: SUD=<User>

Response: User successfully deleted

Parameter:

<User>

Username of a previously configured user that should be deleted [String]

SVA

Description: Display or configure an SNMPv3 view.

Q

Query: SVA

Response: <Name>,<Flag>,<OID Tree>,<Mask>

C

Command: SVA=<Name>,<Flag>,<OID>,<Mask>

Response:<Name>,<Flag>,<OID>,<Mask>

Parameters:

<Name>

SNMPv3 view name [up to 32 alphanumeric characters]

<Flag>

SNMPv3 flag ['included' or 'excluded']

<OID>

SNMPv3 OID

<Mask>

Mask indicating which OIDs must match to be part of the view [Hex value]

SVD

Description: Delete a view from SNMPv3.

C

Command: SVD=<View Name>,<OID Tree>

Response: View <View Name> deleted

Parameter:

<View Name>

SNMPv3 view representing name [up to 32 alphanumeric characters]

<OID Tree>

SNMPv3 view matching OID [integer]

TAH

Description: Displays or sets the output high power threshold based upon the Cyber Hardened IBUC **2**, IBUC **2e**, IBUC **2G**, IBUC **R** or IBUC **G** Rated Power Level (RPL). See [Table C.4](#) on [page C-35](#). This item must be greater than the TAL setting.

Q

Query: TAH

Response: TAH=<Value>

C

Command: TAH=<Value>

Response: TAH=<Value>

Parameters:

<Value>

Output high power threshold [RPL – 20 dB to RPL + 1 dB]

TAL

Description: Displays or sets the output low power threshold based upon the Cyber Hardened IBUC **2**, IBUC **2e**, IBUC **2G**, IBUC **R** or IBUC **G** Rated Power Level (RPL). See [Table C.4](#) on [page C-35](#). This setting must be less than the TAH setting.

Q

Query: TAL

Response: TAL=<Value>

C

Command: TAL=<Value>

Response: TAL=<Value>

Parameters:

<Value>

Output low power threshold [RPL – 20 dB to RPL + 1 dB]

TAS

Description: Displays or sets the Tx simulated alarm setting.

Q

Query: TAS

Response: TAS=<Setting>

C

Command: TAS=<Setting>

Response: TAS=<Setting>

Parameter:

<Setting>

0 = no alarm, 1 = alarm

TAZ

Description: Enables the suppression of any alarms configured as suppressible.

Q

Query: TAZ

Response: TAZ=<Setting>

C

Command: TAZ=<Setting>

Response: TAZ=<Setting>

Parameter:

<Setting>

0 = no suppression / 1 = suppress configured alarms

TBH

Description: Display or configure the input power high alarm threshold. This setting must be greater than the TBL setting.

Q

Query: TBH

Response: TBH=<Value>

C

Command: TBH=<Value>

Response: TBH=<Value>

Parameters:

<Value>

Input power high alarm threshold [-60 dBm to -15 dBm]

TBL

Description: Display or configure the input power low alarm threshold. This setting must be less than the TBH setting.

Q

Query: TBL

Response: TBL=<Value>

C

Command: TBL=<Value>

Response: TBL=<Value>

Parameters:

<Value>

Input power low alarm threshold [-60 dBm to -15 dBm]

TBT

Description: Displays or sets the burst threshold based upon the Cyber Hardened IBUC **2**, IBUC **2e**, IBUC **2G**, IBUC **R** or IBUC **G** Rated Power Level (RPL). See [Table C.4](#). This command only applies if the IBUC is configured for burst power monitoring.

Q

Query: TBT

Response: TBT=<dBm>

C

Command: TBT=<dBm>

Response: TBT=<dBm>

Parameters:

<dBm>

Burst threshold [RPL – 20 dB to RPL + 1 dB]

Table C.4 Default Values for the TAH, TAL, and TBT Commands

Power Level		TAH	TAL	TBT
Watts	dBm	Default Value	Default Value	Default Value
002	33.0	34.0	13.0	13.0
004	36.0	37.0	16.0	16.0
005	37.0	38.0	17.0	17.0
008	39.0	40.0	19.0	19.0
010	40.0	41.0	20.0	20.0
012	40.8	41.8	21.0	21.0
016	42.0	43.0	22.0	22.0
020	43.0	44.0	23.0	23.0
025	44.0	45.0	24.0	24.0
030	44.8	45.8	25.0	25.0
040	46.0	47.0	26.0	26.0
050	47.0	48.0	27.0	27.0
060	47.8	48.8	28.0	28.0
080	49.0	50.0	29.0	29.0
100	50.0	51.0	30.0	30.0
125	51.0	52.0	31.0	31.0
150	51.8	52.8	32.0	32.0
175	52.4	53.4	32.4	32.4
200	53.0	54.0	33.0	33.0
400	56.0	57.0	36.0	36.0

TDT

Description: Display the input L-band power level.

Q Query: TDT
Response: Tx Input Power=<Level> dBm

Parameter:

<Level>
L-Band input power level [decimal number]

TFB

Description: Displays the RF frequency band of this Cyber Hardened IBUC **2**, IBUC **2e**, IBUC **2G**, IBUC **R** or IBUC **G**. See [Table C.5](#) for more information about band numbers and corresponding frequency range.

Q

Query: TFB

Response: TFB=<Band Number> dBm

Parameter:

<Band Number>

Corresponding band numbering [Integer]

Table C.5 Band Numbering

Band Number	Band Name	Frequency	
03	Standard C-band	05850 - 06425	MHz
04	Insat C-band	06725 - 07025	MHz
05	Extended Ku-band	13750 - 14250	MHz
06	Standard Ku-band	14000 - 14500	MHz
07	X-band	07900 - 08400	MHz
08	Full Ku-band	13750 - 14500	MHz
09	Extended C-band	05850 - 06650	MHz
10	Full C-band	05850 - 06725	MHz
11	Low Ku-band	12750 - 13250	MHz
12	Palapa C-band	06425 - 06725	MHz
14	DBS-band 1	17300 - 18100	MHz
15	DBS-band 2	18100 - 18400	MHz
16	Ka-band 1	29500 - 30000	MHz
17	Ka-band 2	30000 - 31000	MHz
18	Ku-band 4	12800 - 13300	MHz
19	C-band 6	05725 - 06425	MHz
20	Ka-band 3	29000 - 30000	MHz
21	Ka-band 4	30500 - 31000	MHz
22	GlobalStar C-band	05000 - 05200	MHz

TFI

Description: Displays the spectral inversion for this Cyber Hardened IBUC **2**, IBUC **2e**, IBUC **2G**, IBUC **R** or IBUC **G**. This is a read-only command.

Q Query: TFI
Response: TFI=<Value>

Parameters:

<Value>
0 = Non-inverted (low side LO) / 1 = Inverted (high side LO)

TFR

Description: Displays or sets the output power monitor frequency of the Cyber Hardened IBUC **2**, IBUC **2e**, IBUC **2G**, IBUC **R** or IBUC **G**. The default values in [Table C.6](#) on [page C-38](#) are listed according to the model number of the Cyber Hardened IBUC. The command only increases the accuracy of the displayed power levels.

Q Query: TFR
Response: TFR=<Frequency>

C Command: TFR=<Frequency>
Response: TFR=<Frequency>

Parameter:

<Frequency>
Which IF or RF frequency (in MHz) to monitor is based upon the frequency band of the IBUC. IF will be automatically converted to RF.

Table C.6 Default Values for the TFR Command

Model Number	Default Value (MHz)	Model Number	Default Value (MHz)
057064	6075	137142	14000
058064	6137	137145	14125
058066	6250	140145	14250
058067	6287	173181	17700
064067	6575	181184	18250
067070	6875	290300	29500
079084	8150	295300	29750
127132	13000	300310	30500
128133	13050	305310	30750

TGC

Description: Displays or sets the operating mode of the Cyber Hardened IBUC **2**, IBUC **2e**, IBUC **2G**, IBUC **R** or IBUC **G**. When using AGC or ALC, the IBUC power levels must be set prior to closing the loop.

Q

Query: TGC

Response: TGC=<Control Type>

C

Command: TGC=<Control Type>

Response: TGC=<Control Type>

Parameter:

<control type>

0 – Open loop

1 – Automatic Level Control (ALC)

2 – Automatic Gain Control (AGC)

TGL

Description: Displays the gain and level targets for AGC or ALC. This is a read-only command.

Q Query: TGL
Response: gain_target = <xx.xx>, level_target = <yy.yy>

Parameter:

<xx.xx>
AGC gain target in dB [decimal number]
<yy.yy>
ALC level target in dBm [decimal number]

TGR

Description: Displays or resets the gain control of the Cyber Hardened IBUC **2**, IBUC **2e**, IBUC **2G**, IBUC **R** or IBUC **G**.

Q Query: TGR
Response: TGR=<xx.x>

C Command: TGR=0
Response: Gain Control Reset

Parameter:

<xx.x>
Delta (in dB) from the attenuator setting when AGC/ALC was activated [decimal number]

TPM

Description: Displays or configures the power monitoring mode of the Cyber Hardened IBUC **2**, IBUC **2e**, IBUC **2G**, IBUC **R** or IBUC **G**. When configured for burst, TBT must also be set. Default values for the TBT command are given in [Table C.4](#) on [page C-35](#). If CW is selected power is read continuously. If burst is selected the power reading only changes when a valid burst is detected.

Q

Query: TPM

Response: TPM=<Value>

C

Command: TPM=<Value>

Response: TPM=<Value>

Parameter:

<Value>

0 = CW / 1 = Burst

TPO

Description: Displays the current output power of the Cyber Hardened IBUC **2**, IBUC **2e**, IBUC **2G**, IBUC **R** or IBUC **G**. If TPM is set to burst, this will be the last valid burst sample of the output power. Use the TFR command to configure the desired frequency to be monitored. This is a read-only command.

Q

Query: TPO

Response: Tx Output Power=<xx.xx> dBm

Parameter:

<xx.xx>

Current output power [decimal number]

TPT

Description: Displays or sets the attenuator of the Cyber Hardened IBUC **2**, IBUC **2e**, IBUC **2G**, IBUC **R** or IBUC **G**. .

Q

Query: TPT

Response: TPT=<xx.x>

C

Command: TPT=<xx.x>

Response: TPT=<xx.x>

Parameter:

<xx.x>

IBUC attenuation [0 to 30 dB].

TSD

Description: Displays or sets the transmit power output delay before the transmitter is enabled. When configured, the Tx output will be muted for the time period configured.

Q

Query: TSD

Response: TSD=<value>

C

Command: TSD=<value>

Response: TSD=<value>

Parameter:

<Value>

Power up delay before transmitter is enabled [0–500 seconds]

TSP

Description: Displays or sets the state of the Tx output at power up.

Q

Query: TSP

Response: TSP=<State>

C

Command: TSP=<State>

Response: TSP=<State>

Parameter:

<State>

0 – Tx output OFF / 1 – Tx output ON

TST

Description: Displays or sets the state of the Tx output. This command can be overridden by alarms.

Q

Query: TST

Response: TST=<Response Value>, <String>

C

Command: TST=<Set Value>

Response: TST=<Response Value>, <String>

Parameters:

<set value>

0 = disable / 1 = enable

<response value>

0 = disabled / 1 = enabled / 2 = enabled but muted

<string>

0 = 'Tx Disabled' / 1 = 'Tx Enabled, Not Muted' / 2 = 'Tx Enabled, Muted'

TTS

Description: Displays or sets the high-temperature shutdown alarm. If the Cyber Hardened IBUC internal temperature exceeds maximum operating temperature, enabling this will disable the transmitter until the internal temperature cools by 20° C, then will enable the transmitter. Disabling this could cause damage to the IBUC, therefore caution should be exercised.

Q

Query: TTS

Response: TTS=<State>

C

Command: TTS=<State>

Response: TTS=<State>

Parameter:

<State>

0 = Disable Shutdown / 1 = Enable Shutdown.

TTT

Description: Displays the number of total hours that the transmitter has been enabled (that is, with the transmit signal ON and the mute OFF) since leaving factory.

Q

Query: TTT

Response: TTT=<Hours>

Parameters:

<Hours>

Number of hours transmitter has been ready to transmit or transmitting [Integer]

TZO

Description: Displays or configures the NTP Server Timezone Offset. TZO can be set from -12 to 14 hours.

Q

Query: TZO

Response: TZO=<±hh:mm>

C

Command: TZO=<±hh:mm>

Response: TZO=<±hh:mm>

Parameter:

<±hh:mm>

Time zone offset [hh = hours, mm = minutes]. This parameter can assume positive or negative values.

A P P E N D I X

D

COMPONENT SPECIFICATIONS AND REFERENCE DRAWINGS

This chapter contains component specifications and outline drawings for the Terrasat Communications, Inc. line of C-band, X-band, Ku-band and Ka-band intelligent block upconverters (IBUC **2**, IBUC **2e**, IBUC **2G**, IBUC **R** and IBUC **G**), power supply units (PSUIs), low-noise block converters (LNBs), associated interface units and accessories supplied with IBUC **2**, IBUC **2e**, IBUC **2G**, IBUC **R** and IBUC **G** systems.

Reference Drawings

Outline drawings are subject to change without notice. To ensure that the latest information is available, contact Terrasat.

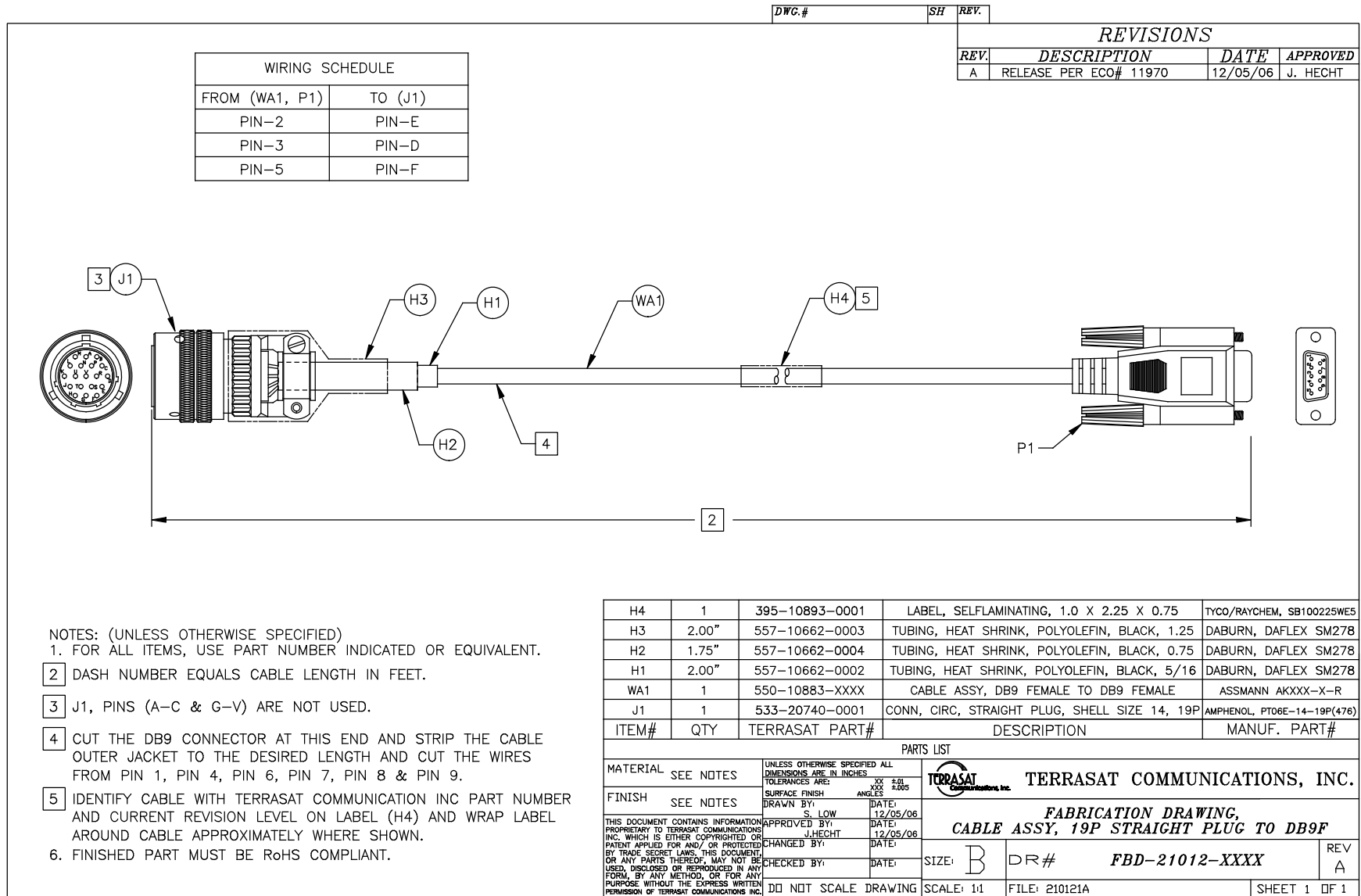


Figure D.1 Fabrication Drawing, FBD-21012-XXXX, Rev A

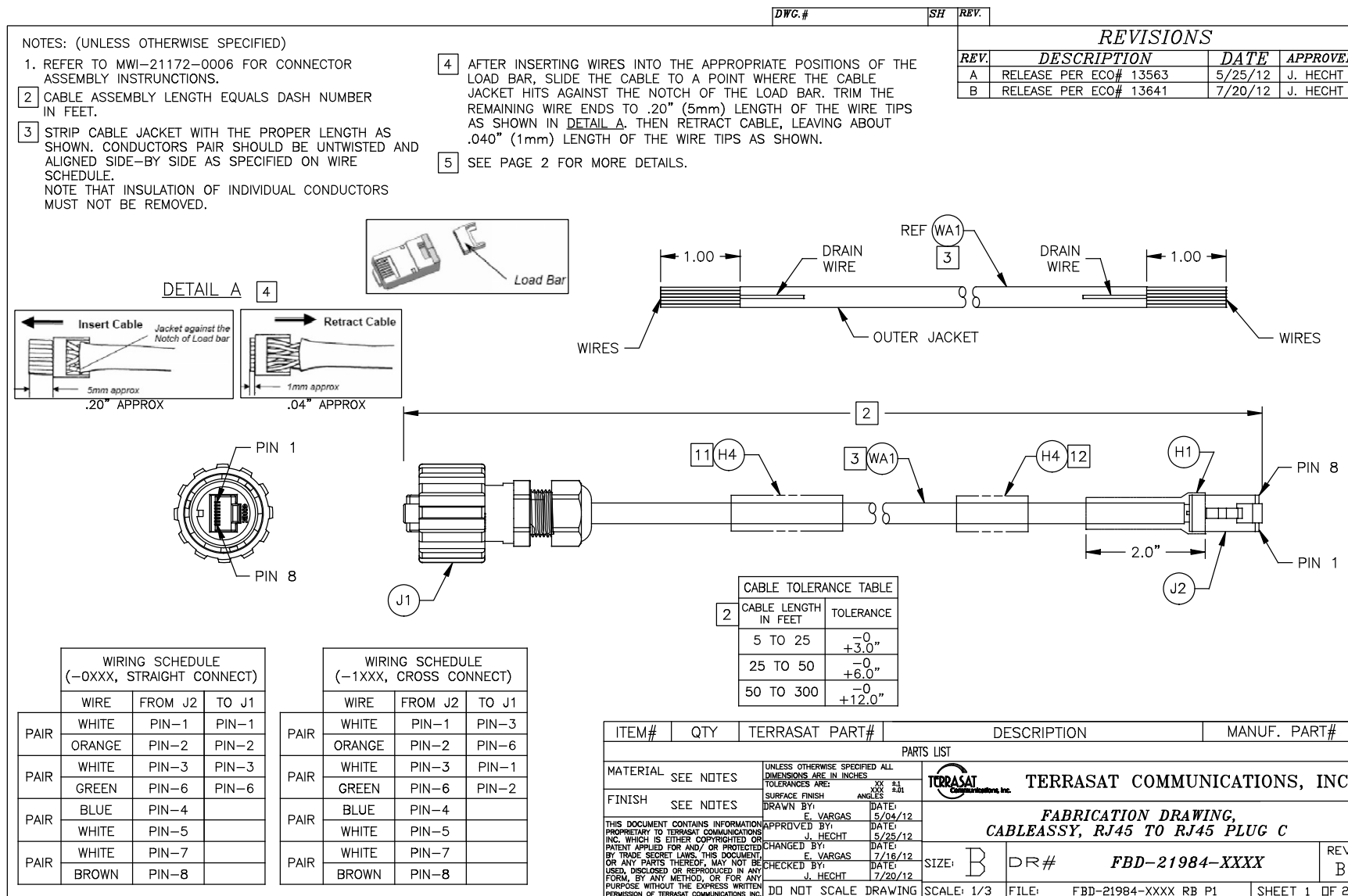


Figure D.2 Fabrication Drawing, FBD-21984-XXXX, Rev B, page 1 of 2

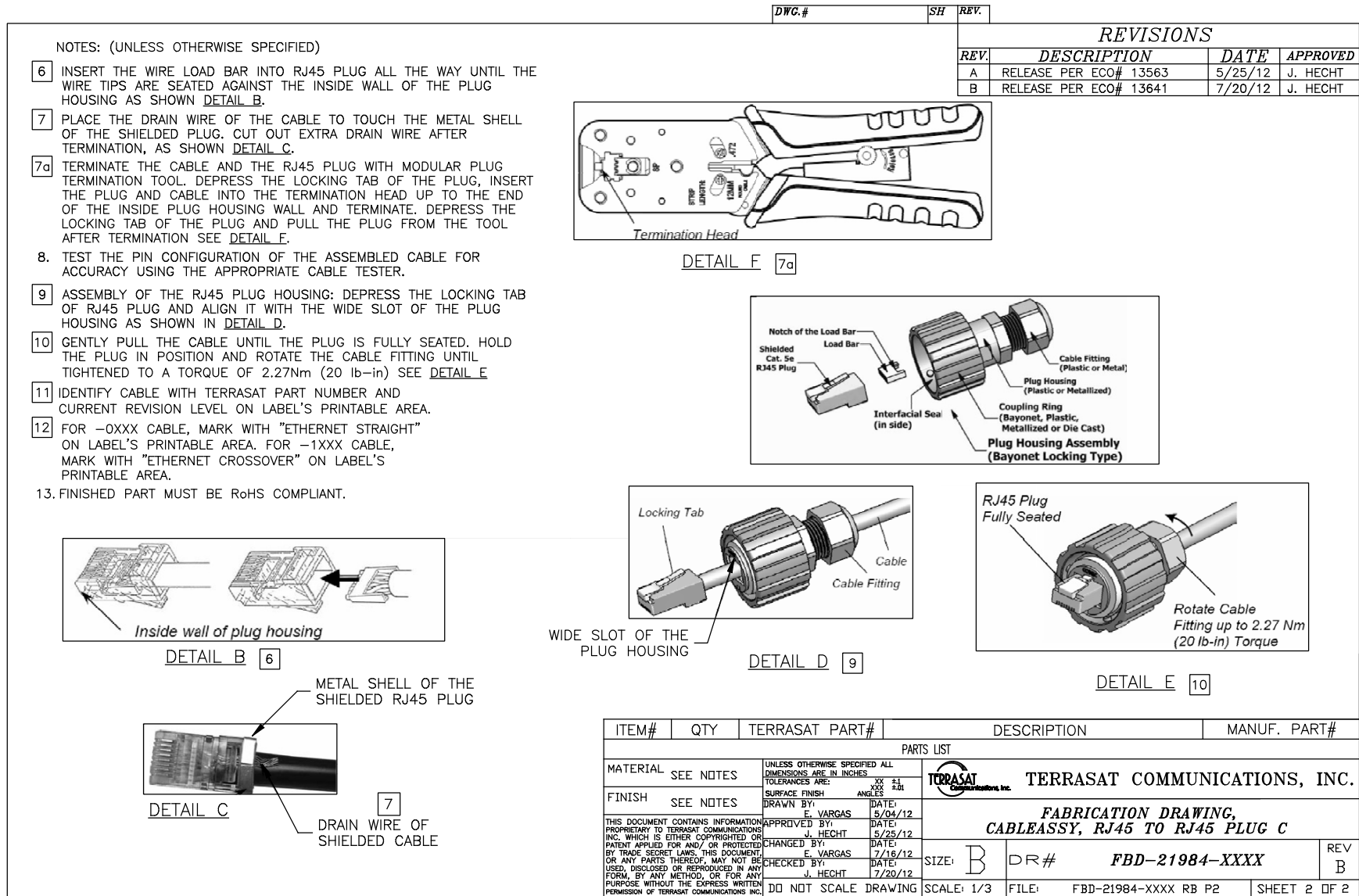


Figure D.3 Fabrication Drawing, FBD-21984-XXXX, Rev B, page 2of 2

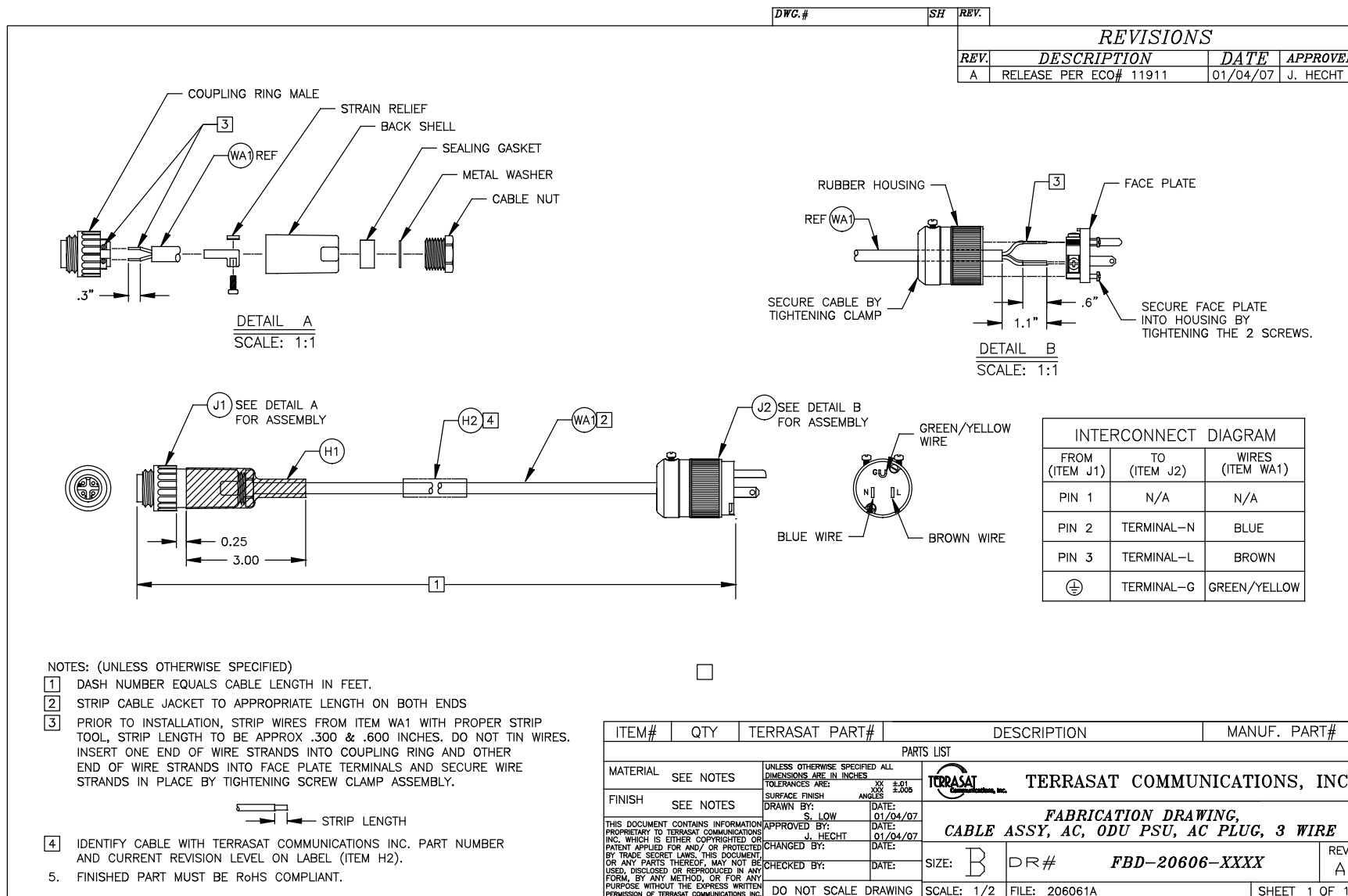


Figure D.4 Fabrication Drawing, FBD-20606-XXXX, Rev A

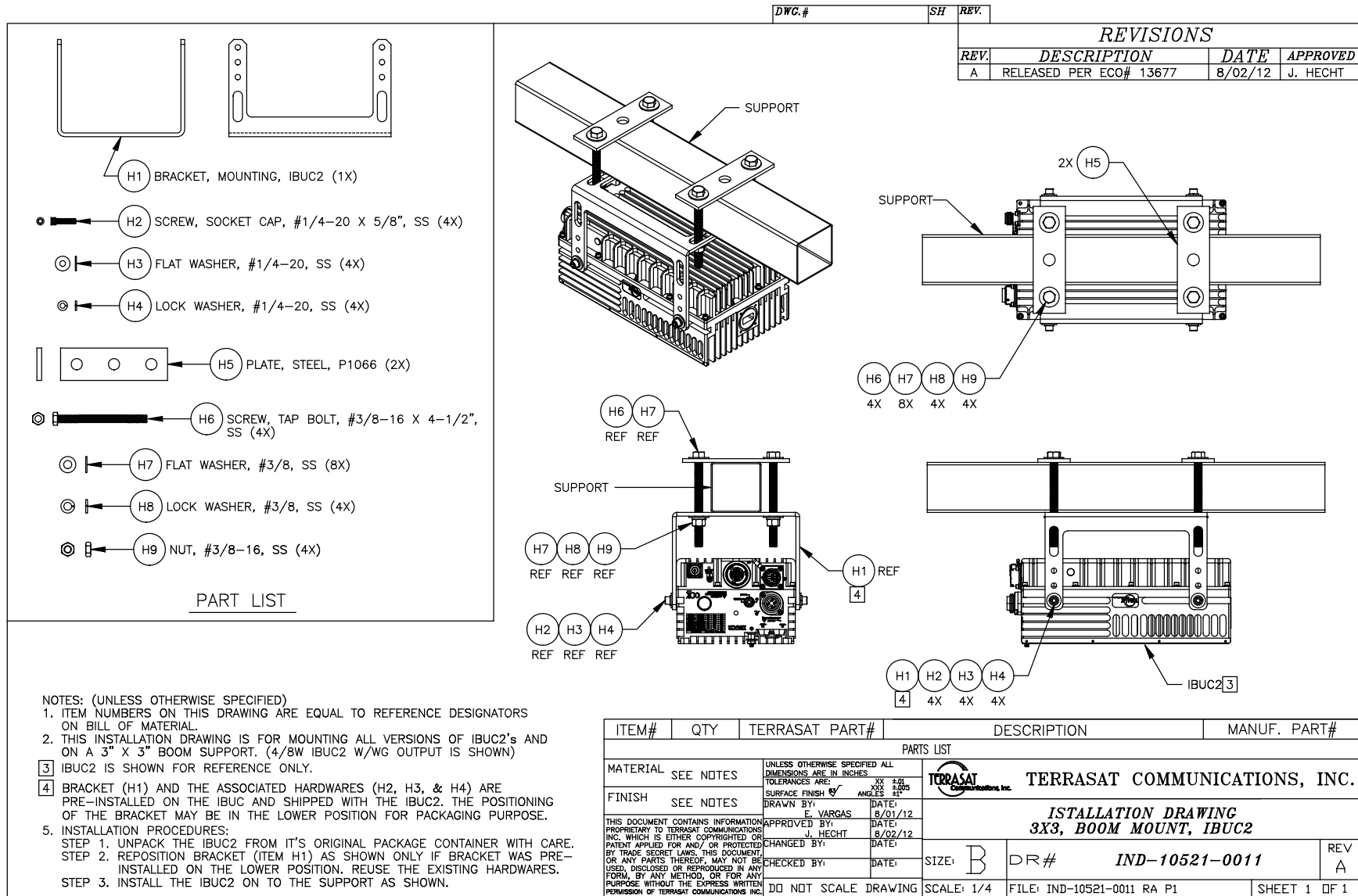


Figure D.5 Example Installation Drawing, IND-10521-0011, Rev A

Data Sheets

Refer to the datasheets in Terrasat, Inc. web site: www.terrasatinc.com.

Product specifications are subject to change without notice. To ensure that the latest information is available, contact Terrasat.

FIRMWARE UPGRADE

As development is made, new features or bug fixes might occur, improving functionality offered by the Cyber Hardened IBUC **2**, IBUC **2e**, IBUC **2G**, IBUC **R** or IBUC **G**. Hence, the user is encouraged to always maintain the IBUCs firmware up to date.

The steps shown in this appendix provide the user with a guide on how to perform such updates to the IBUCs firmware.

Note: The steps provided below are valid only for firmware revisions v0.39 and above. If your IBUC does not meet these requirements, please contact Terrasat Inc. Technical Support. For more info, see [Repair Policy](#) on [page 6-8](#).

Update Procedure

Firmware updates to the Cyber Hardened IBUC **2**, IBUC **2e**, IBUC **2G**, IBUC **R** or IBUC **G** are done through the web, thus, ensure that you have TCP/IP connection to the device. Check how to connect to your IBUC unit on [pages page B-1 through page B-3](#). Once stable connection to the unit is ensured, follow the steps below.

1. Download the latest firmware version on Terrasat Inc. website (<https://terrasatinc.com/resources/firmware-updates/>). Once downloaded, the user should have a compressed zip file. It should look like ibb_vX_YY.zip, where X and YY refers to the major and minor update numbers. Extract all contents from the file and verify that the file named ibb_vX_YY.swu is present. See [Figure E.1](#) for reference.

Example: If the firmware version downloaded is version 0.39, one should download ibb_v0_39.zip file, which should contain ibb_v0_39.swu file.

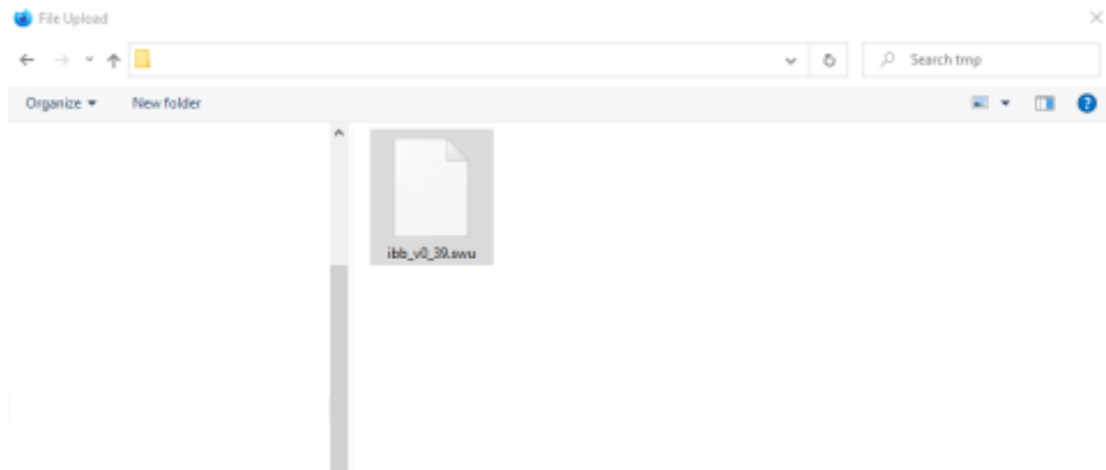


Figure E.1 Firmware Upgrade File

2. Open any web browser and access port 8080 of the IBUC. This can be accomplished by appending “:8080” after the IBUCs IP address.

Example: If the units IP address in the local network is 192.168.1.21, to access port 8080, the user should type <http://192.168.1.21:8080>.

Once accessed, the web browser should show a page as the one on [Figure E.2](#).

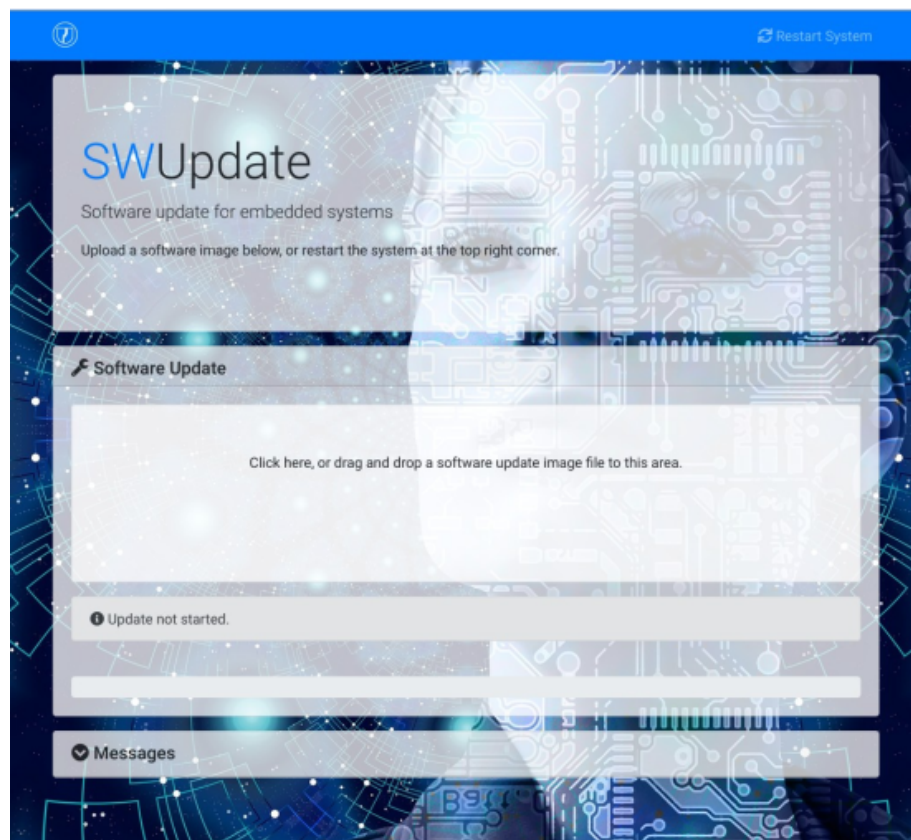


Figure E.2 Software Update Web Page

3. Once opened, drag and drop the swu file to the software update area, or, click the software update area and select the swu file from the File Upload menu.

Once done correctly, the file should automatically start being uploaded to the unit. Refer to [Figure E.3](#).

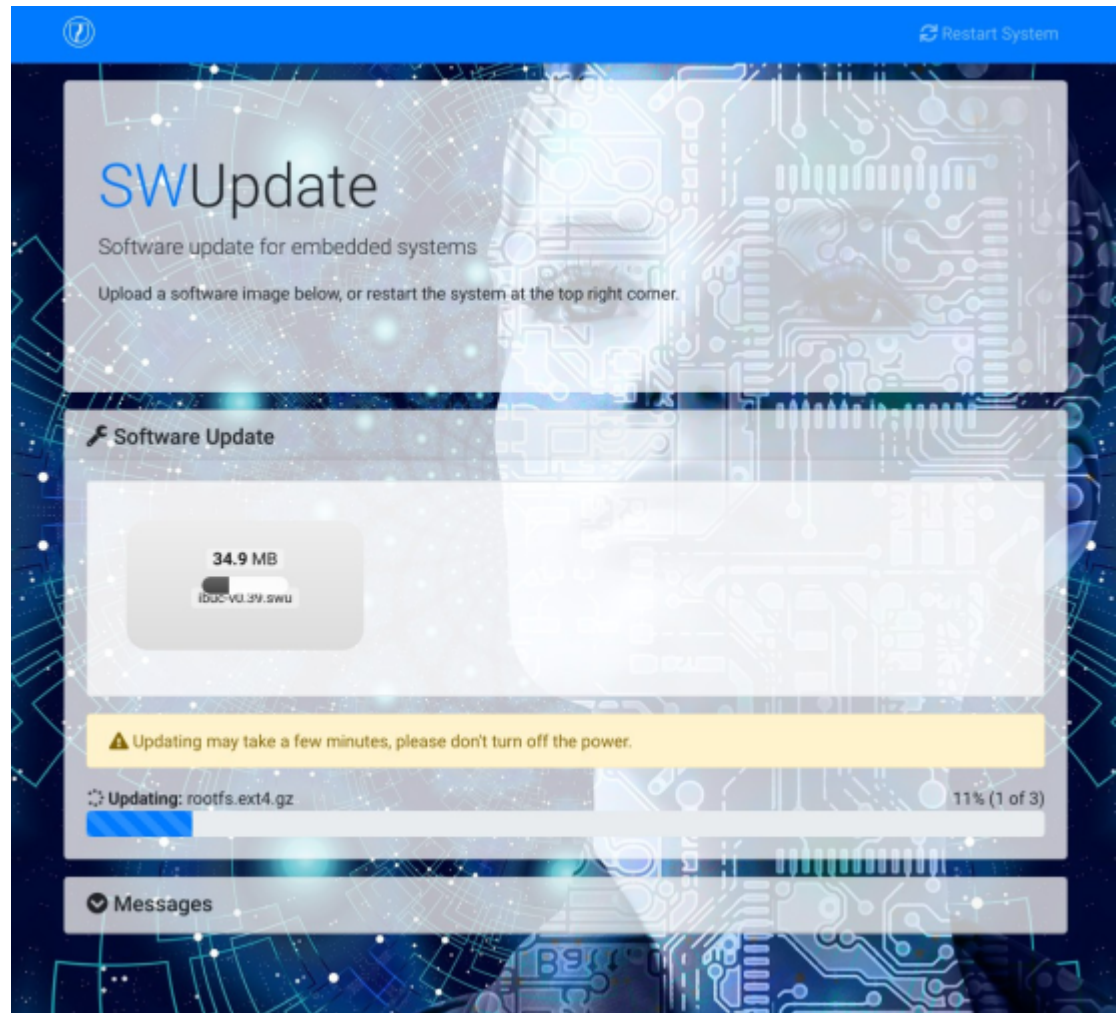


Figure E.3 Software Update progress

4. Once the upload process has been finished successfully the system will automatically reboot.

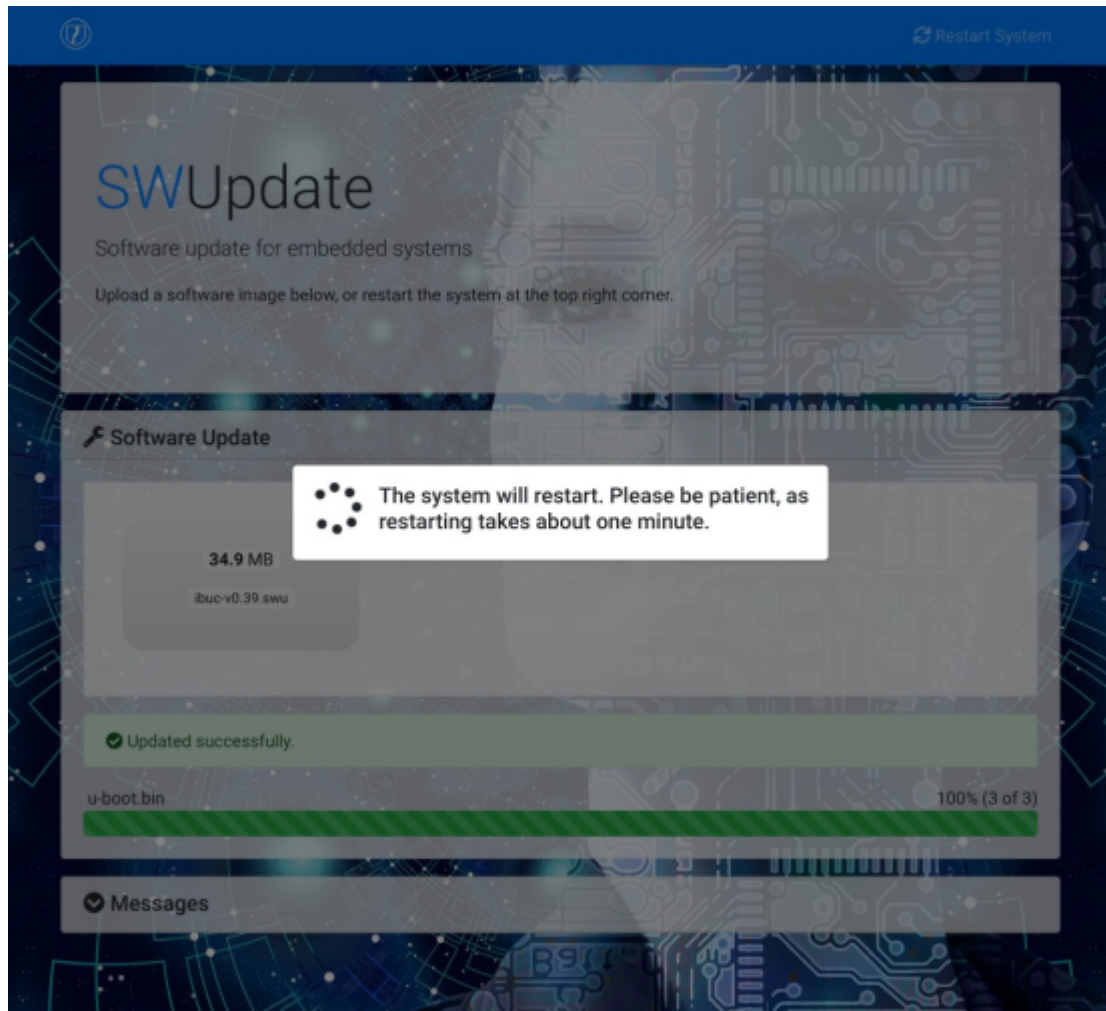


Figure E.4 Software Update Wait for Reboot

5. Upon complete reboot & system upgrade, the software update page will come back to its original state, asking for firmware upgrades. The unit is now updated and can be used.

Note: If the user is not sure if the firmware upgrade has been successful, access the [Information](#) of the Embedded Web Pages (see [Information](#) on [page B-6](#)) or through the CCS ASCII command (see [CCS](#) on [page C-7](#)).



GLOSSARY

Glossary of Terms

The following acronyms are used in Terrasat Communications, Inc. documentation:

° C	Degrees Celsius
° K	Degrees Kelvin
1RU	One Rack Unit (1.75 in.)
μs	Microsecond
AC	Alternating Current
AGC	Automatic Gain Control
ALC	Automatic Level Control
AWG	American Wire Gauge
ATE	Automated Test Equipment
ATP	Acceptance Test Procedure
BER	Bit Error Rate
BUC	Block Upconverter
CSM	Continuous Signal Mode
CW	Continuous Wave
DAB	Digital Audio Broadcasting
dB	Decibel
dB/oct	Decibel per Octave
dBc	Decibel Below Carrier
dBm	Decibel referenced to 1 milliwatt
DC	Direct Current

DCE	Data Communication Equipment
DRO	Dielectric Resonator Oscillator
DTE	Data Terminal Equipment
DVM	Digital voltmeter
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
ERM	<u>E</u> lectromagnetic Compatibility and <u>R</u> adio Spectrum <u>M</u> atters
fr	Frequency
FSK	Frequency Shift Keying
FSS	Fixed Satellite Services
F/W	Firmware
g	Gravity
GHz	Gigahertz
GUI	Graphical User Interface
HHT	Hand-held Terminal
HPA	High-Power Amplifier
HPC	High-Power Converter
HTTP	Hypertext Transfer Protocol
Hz	Hertz
I/O	Input/Output
IBUC	Intelligent Block Upconverter
IDU	Indoor Unit
IF	Intermediate Frequency
IFL	Interfacility Link
IP	Internet Protocol
kg	Kilogram
LNB	Low Noise Block Converter
LO	Local Oscillator
M&C	Monitor and Control
max	Maximum
MCPC	Multiple Carrier Per Channel
MHz	Megahertz
MIB	Management Information Base

min	Minimum
ms	Millisecond
MTBF	Mean Time Between Failure
MUC	Microwave Upconverter
ns	Nanosecond
OCXO	Oven-controlled Quartz Oscillator
ODU	Outdoor Unit
OMT	Orthogonal Mode Transducer
p-p	Peak to Peak
P1dB	Power at the 1dB Compression Point
PFC	Power Factor Corrected
PLDRO	Phase-Locked Dielectric Resonator Oscillator
PLL	Phase-Locked Loop
PLLNBC	Phase-Locked Low-Noise Block Converter
PLO	Phase Locked Oscillator
ppb	Parts Per Billion
ppm	Parts Per Million
PSUI	Power Supply Unit
Pwr	Power
QTP	Qualification Test Procedure
QPSK	Quadrature Phase Shift Keying
RF	Radio Frequency
RFT	Radio Frequency Transceiver
RH	Relative Humidity
RMS	Root Mean Square
RTC	Real Time Clock
RTS/CTS	Request to Send/Clear to Send
Rx	Receive
s	Second
SCPC	Single Carrier Per Channel
SNG	Satellite News Gathering
SNMP	Simple Network Management Protocol
SSB	Single Side Band

SSPA	Solid-State Power Amplifier
TCP/IP	Transfer Control Protocol/Internet Protocol
TRF	Transmit Reject Filter
Tx	Transmit
UDP	User Datagram Protocol
UPC	Upconverter
UPS	Uninterruptible Power Supply
VAC	Volts Alternating Current
VDC	Volts Direct Current
VSAT	Very Small Aperture Terminal
VSWR	Voltage Standing Wave Ratio
VVA	Variable Voltage Attenuator
W	watts
WG	Waveguide

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