MBT-4000

Multi-Band Transceiver System
Installation and Operation Manual

IMPORTANT NOTE: The information contained in this document supersedes all previously published information regarding this product. Product specifications are subject to change without prior notice.

Part Number MN/MBT4000.IOM - Revision 3

Errata A

Comtech EF Data Documentation Update

Subject:	Appendix A. Remote Control Operation
Date:	December 9, 2005
Document:	MBT-4000 Multi-Band Transceiver System, Installation and Operation Manual, Revision 3, dated January 3, 2005,
Part Number:	MN/MBT4000.EA3
Collating Instructions:	Attach this page to page A-16

Comments:

Change FRE commands to read:

Change Specifics:

Operating RF Frequency	FRE=xxxxx.xxx	BDC BUC	9 bytes, numeric	Command or Query Valid Operating RF frequency, in MHz. **For Ku BDCs:** **FRE values: 10950-11700 MHz an LO of 10000 MHz is activated** **FRE values: 11701-12250 MHz an LO of 10700 MHz is activated** **FRE values: 12251-12750 MHz an LO of 11300 MHz is activated** Example: FRE=11300.000	FRE=(message ok) FRE? (received ok, but invalid arguments found) FRE* (message ok, but not permitted in current mode) FRE! (command not accepted by MBT-4000 base unit. It must be addressed to BUC or BDC sub-units)	FRE?	FRE=xxxxx.xxx (see description of arguments)

Errata B

Comtech EF Data Documentation Update

Subject: Chapter 2. Installation

Date: March 9, 2006
Document: MBT-4000 Multi-Band Transceiver System, Installation and Operation Manual, Revision 3, dated January 3, 2005,
Part Number: MN/MBT4000.EB3
Collating Instructions: Attach this page to page 2-1

Comments:

Change Table 2-1, ITT Cannon connector from “KPT06B-12-35” to “KPT06B-12-3S”.

Change Specifics:

2.1.1 PWR IN (J1) Pin Connections

Table 2-1. PWR IN (J1) Pin Connections

Pin	PWR IN (J1)
A	LINE
B	NEUTRAL
C	GND
	Mating Connectors: ITT Cannon KPT06B-12-3S CEFD PN CN/MS-STPG03F02

Errata C

Comtech EF Data Documentation Update

Subject: Chapter 3. System Operation

Date: December 21, 2006
Document: MBT-4000 Multi-Band Transceiver System, Installation and Operation Manual, Revision 3, dated January 3, 2005,
Part Number: MN/MBT4000.EC3
Collating Instructions: Attach this page to page 3-1

Comments:

Change Table in section 3.1.1: Add new C-Band BDC option

Change Specifics:

3.1.1 Block Down Converter (BDC-4000)

The BDC-4000 translates a band-specific input frequency block (C-, X-, or Ku- or Ka-), from the LNA, down to L-Band (950 to 2000 MHz).

BDC-4000 C, X, Ku, Ka

Band	Frequency	LO Frequency	Inverting
C-Band	3400 – 4200 MHz	5150 MHz	Yes
C-Band(opt)	3625 – 4200 MHz	2300 MHz	No
X-Band	7250 – 7750 MHz	6300 MHz	No
Ku-Band-W	10.95 – 12.75 GHz 11.7 – 12.20 GHz 12.250 – 12.275 GHz	10.00 GHz 10.75 GHz 11.30 GHz	No
Ka-Band	20.20 – 21.20 GHz		

Notes: **1**. No spectral inversion, selectable inversion for inverted Block Down Converter

2. 10 dB gain adjustment.

Errata D

Comtech EF Data Documentation Update

Subject: Revised Ku-Band -W

Date: January 23, 2007
Document: MBT-4000 Multi-Band Transceiver System, Installation and Operation Manual, Revision 3, dated January 3, 2005,
Part Number: MN/MBT4000.ED3
Collating Instructions: Attach this page to page 3-1

Comments:

Change Ku-Band specified under Band in Table :

Change Specifics:

3.1.1 Block Down Converter (BDC-4000)

The BDC-4000 translates a band-specific input frequency block (C-, X-, or Ku- or Ka-), from the LNA, down to L-Band (950 to 2000 MHz).

BDC-4000 C, X, Ku, Ka

Band	Frequency	LO Frequency	Inverting
C-Band	3400 – 4200 MHz	5150 MHz	Yes
C-Band(opt)	3625 – 4200 MHz	2300 MHz	No
X-Band	7250 – 7750 MHz	6300 MHz	No
Ku-Band-W **(Single module containing three LOs)**	10.95 – **11.70** GHz 11.7 – 12.20 GHz 12.250 – 12.**75** GHz	10.00 GHz 10.75 GHz 11.30 GHz	No
Ka-Band	20.20 – 21.20 GHz		

Notes: **1**. No spectral inversion, selectable inversion for inverted Block Down Converter

2. 10 dB gain adjustment.

Errata E

Comtech EF Data Documentation Update

Subject: Revised Remote Commands

Date: January 30, 2007
Document: MBT-4000 Multi-Band Transceiver System, Installation and Operation Manual, Revision 3, dated January 3, 2005,
Part Number: MN/MBT4000.EE3
Collating Instructions: Attach this page to page A-1

Comments:

Revise various Remote Commands to read:

Change Specifics:

Page No.	Command		Description of Change
A-12	Concise Configuration Status	(CCS)	Changed codes “e, ff, and g” to: e = X (reserved for future use) ff = X (reserved for future use) g = X (reserved for future use)
A-13	Calibrate LNA Current	(CLC)	Deleted BDC from Valid column.
A-14	Concise Maintenance Status	(CMS)	Changed code fff.f to: fff.f = XXX.X (reserved for future use)
A-16	Monitor LNA Current	(LCM)	Deleted BDC from Valid column
A-16	LNA Current Source	(LCS)	Deleted BDC from Valid column
A-17	LNA Current Window	(LCW)	Deleted BDC from Valid column
A-17	LNA Fault Logic	(LFL)	Deleted BDC from Valid column
A-19	Online Status	(ONL)	Changed Valid column to MBT only. Deleted examples for BDC and BUC under Description of Argurements column

Errata F

Comtech EF Data Documentation Update

Subject: Revised Table B-2 Summary Faults

Date: February 1, 2007
Document: MBT-4000 Multi-Band Transceiver System, Installation and Operation Manual, Revision 3, dated January 3, 2005,
Part Number: MN/MBT4000.EF3
Collating Instructions: Attach this page to page B-2

Comments:

Revise various Mnemonic column to read:

Change Specifics:

Mnemonic	Type	Mute	Description
LNAI1	Summary Fault – Configurable	Slot 1	The IO1A/FAULT input (AUX COMM 1) indicates a fault. Monitoring for this fault is enabled using the EAM-1X command.
LNAI2	Summary Fault – Configurable	Slot 2	The IO2A/FAULT input (AUX COMM 2) indicates a fault. Monitoring for this fault is enabled using the EAM-2X command.

Errata G

Comtech EF Data Documentation Update

Subject:	Revised Section 4-2, Single Base Redundancy
Date:	November 5, 2008
Document:	MBT-4000 Multi-Band Transceiver System, Installation and Operation Manual, Revision 3, dated January 3, 2005,
Part Number:	ER-MBT4000EG3
CO Number:	CO5819
Collating Instructions:	Attach this page to page 4-2

Comments:

Revise Section 4.2 to remove all description of support for single-base redundancy operation.

Change Specifics:

4.2 Single-Base Redundancy Operation

Single-base redundancy operation is not supported in the MBT-4000.

MBT-4000

Multi-Band Transceiver System
Installation and Operation Manual

Part Number MN/MBT4000.IOM
Revision 3
June 3, 2005

Comtech EF Data is an ISO 9001
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Comtech EF Data, 2114 West 7th Street, Tempe, Arizona 85281 USA, 480 333 2200, FAX 480 333 2161.

CUSTOMER SUPPORT

Contact the Comtech EF Data Customer Support Department for:

- Product support or training
- Information on upgrading or returning a product
- Reporting comments or suggestions concerning manuals

A Customer Support representative may be reached at:

Comtech EF Data
Attention: Customer Support Department
2114 West 7th Street
Tempe, Arizona 85281 USA

480 333 2200 (Main Comtech EF Data Number)
480 333 4357 (Customer Support Desk)
480 333 2161 FAX

or, E-Mail can be sent to the Customer Support Department at:

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Contact us via the web at www.comtechefdata.com.

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1. Request a Return Material Authorization (RMA) number from the Comtech EF Data Customer Support Department.

2. Be prepared to supply the Customer Support representative with the model number, serial number, and a description of the problem.

3. To ensure that the product is not damaged during shipping, pack the product in its original shipping carton/packaging.

4. Ship the product back to Comtech EF Data. (Shipping charges should be prepaid.)

For more information regarding the warranty policies, see Warranty Policy, p. viii.

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Figures

Tables

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ABOUT THIS MANUAL

This manual provides installation and operation information for the Comtech EF Data MBT-4000, Multi-Band Transceiver System. This is a technical document intended for earth station engineers, technicians, and operators responsible for the operation and maintenance of the MBT-4000, Multi-Band Transceiver System.

CONVENTIONS AND REFERENCES

CAUTIONS AND WARNINGS

Indicates information critical for proper equipment function.

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

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

METRIC CONVERSION

Metric conversion information is located on the inside back cover of this manual. This information is provided to assist the operator in cross-referencing non-Metric to Metric conversions.

TRADEMARKS

All product names mentioned in this manual may be trademarks or registered trademarks of their respective companies and are hereby acknowledged.

RECOMMENDED STANDARD DESIGNATIONS

Recommended Standard (RS) Designations are equivalent to the designation of the Electronic Industries Association (EIA). Reference to only one designator is used in the document

REPORTING COMMENTS OR SUGGESTIONS CONCERNING THIS MANUAL

Comments and suggestions regarding the content and design of this manual will be appreciated. To submit comments, please contact the Comtech EF Data Customer Support Department.

EMC COMPLIANCE

This is a Class A product. In a domestic environment, it may cause radio interference that requires the user to take adequate protection measures.

EN55022 COMPLIANCE

This equipment meets the radio disturbance characteristic specifications for information technology equipment as defined in EN55022.

EN50082-1 COMPLIANCE

This equipment meets the electromagnetic compatibility/generic immunity standard as defined in EN50082-1.

FEDERAL COMMUNICATIONS COMMISSION (FCC)

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment.

This equipment generates, uses, and can radiate radio frequency energy. If not installed and used in accordance with the instruction manual, it may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference; in which case, users are required to correct the interference at their own expense.

Note: To ensure compliance, properly shielded cables for DATA I/O shall be used. More specifically, these cables shall be shielded from end to end, ensuring a continuous shield.

NEW IN THIS RELEASE

- Revised Appendix A
- Revised Appendix B.

SAFETY COMPLIANCE

EN 60950

Applicable testing is routinely performed as a condition of manufacturing on all units to ensure compliance with safety requirements of EN60950.

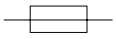
This equipment meets the Safety of Information Technology Equipment specification as defined in EN60950.

LOW VOLTAGE DIRECTIVE (LVD)

The following information is applicable for the European Low Voltage Directive (EN60950):

<HAR>	Type of power cord required for use in the European Community.
	CAUTION: Double-pole/Neutral Fusing. ACHTUNG: Zweipolige bzw. Neutralleiter-Sicherung.

International Symbols:

Symbol	Definition
	Alternating Current.
	Fuse.

Symbol	Definition
	Protective Earth.
	Chassis Ground.

Note: For additional symbols, refer to “Cautions” listed earlier in this preface.

WARRANTY POLICY

This Comtech EF Data product is warranted against defects in material and workmanship for a period of two years from the date of shipment. During the warranty period, Comtech EF Data will, at its option, repair or replace products that prove to be defective.

For equipment under warranty, the customer is responsible for freight to Comtech EF Data and all related custom, taxes, tariffs, insurance, etc. Comtech EF Data is responsible for the freight charges **only** for return of the equipment from the factory to the customer. Comtech EF Data will return the equipment by the same method (i.e., Air, Express, Surface) as the equipment was sent to Comtech EF Data.

LIMITATIONS OF WARRANTY

The foregoing warranty shall not apply to defects resulting from improper installation or maintenance, abuse, unauthorized modification, or operation outside of environmental specifications for the product, or, for damages that occur due to improper repackaging of equipment for return to Comtech EF Data.

No other warranty is expressed or implied. Comtech EF Data specifically disclaims the implied warranties of merchantability and fitness for particular purpose.

EXCLUSIVE REMEDIES

The remedies provided herein are the buyer's sole and exclusive remedies. Comtech EF Data shall not be liable for any direct, indirect, special, incidental, or consequential damages, whether based on contract, tort, or any other legal theory.

DISCLAIMER

Comtech EF Data has reviewed this manual thoroughly to provide an easy-to-use guide to your equipment. All statements, technical information, and recommendations in this manual and in any guides or related documents are believed reliable, but the accuracy and completeness thereof are not guaranteed or warranted, and they are not intended to be, nor should they be understood to be, representations or warranties concerning the products described. Further, Comtech EF Data reserves the right to make changes in the specifications of the products described in this manual at any time without notice and without obligation to notify any person of such changes.

If you have any questions regarding the equipment or the information in this manual, please contact the Comtech EF Data Technical Publications Department at: tpubs@comtechefdata.com

Chapter 1. Introduction

Figure 1-1. MBT-4000 Outdoor Multi-Band RF Transceiver

1.1 OVERVIEW

This manual provides instructions on the installation, operation and maintenance of the MBT-4000, Multi-Band Transceiver System (MBT-4000), manufactured by Comtech EF Data (CEFD). Specifications for this model are included in this section.

1.2 FUNCTIONAL DESCRIPTION

The MBT-4000 is designed to perform the following functions:

- C-, X-, or Ku- RF to L-Band down conversion
- L-Band to C-, X-, or Ku- RF up conversion
- RF Band switching in minimal time without requiring tools
- Easy expansion for providing a redundant system or other frequency bands
- Automatic band identification for the BUC, BDC, and antenna feed (if the feeds provide an identifying connector)
- System status verification via LEDs located behind a removable cover
- Flexible configuration: 2 Ups, 2 Downs, or an Up and a Down

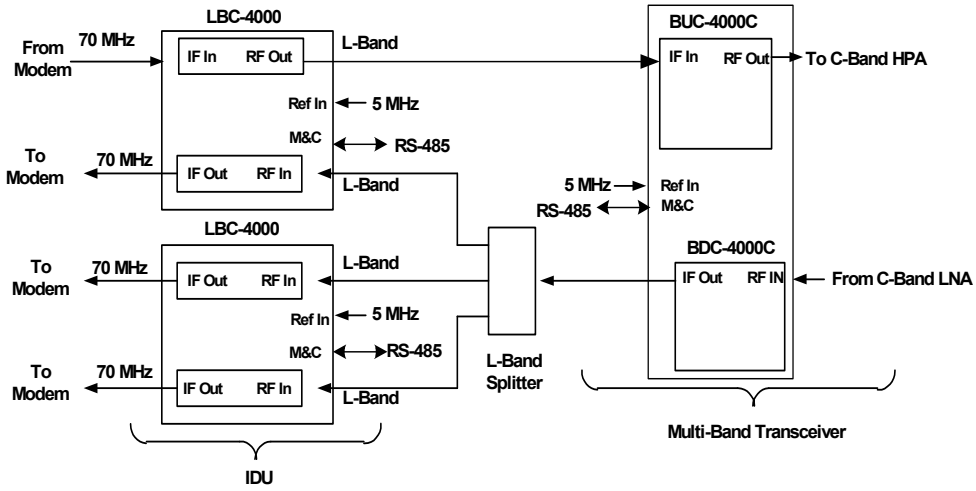


Figure 1-2. MBT-4000 Typical Application

1.3 SPECIFICATIONS

Table 1-1. MBT-4000 Specifications

BUC-4000 ODU Characteristic	Specifications	BDC-4000 ODU Characteristic	Specifications
Input Frequency Range	950-2000 MHz, 125 kHz steps (1 kHz optional)	Output Frequency Range	950 – 2000 MHz
Output Freq By Model: BUC-4000C BUC-4000X BUC-4000Ku BUC-4000Ka	 5850 – 6650 MHz 7900 – 8400 MHz 13.75 – 14.50 GHz 30.00 – 31.00 GHz 27.50 – 28.50 GHz (opt) 28.50 – 29.50 GHz (opt) 29.50 – 30.10 GHz (opt)	Input Freq by Model: BDC-4000C BDC-4000X BDC-4000KW BDC-4000Ka	 3400 – 4200 MHz 7250 – 7750 MHz 10.95 – 12.75 GHz 20.20 – 21.20 GHz 17.70 – 18.70 GHz (opt) 18.70 – 19.20 GHz (opt) 19.20 – 20.20 GHz (opt)
Input/Output Impedance	50Ω	Input/Output Impedance	50Ω
Input Return Loss	15 dB minimum	Input Return Loss	18 dB minimum
Output Return Loss	18 dB minimum	Output Return Loss	15 dB minimum
Input Connector	Type – N, Female	Input Connector	N, Female (C, X, and Ku)
Output Connector	N, Female (C, X, and Ku)	Output Connector	Type – N, Female
Gain	15 dB nominal at minimum attenuation	Gain	15 dB nominal at minimum attenuation
User Attenuation Range	0 to 10 dB	User Attenuation Range	0 to 10 dB, in 0.25 dB steps (0.1 dB opt)
Output Power, P1dB	+10 dBm minimum	Output Power, P1dB	+10 dBm minimum
Third Order Intercept	+20 dBm minimum	Third Order Intercept	+20 dBm minimum
Carrier Spurious	-60 dBc	Carrier Spurious	-60 dBc
Non-Carrier Spurious	-60 dBm		
External Reference	Input, either 5 or 10 MHz ±5 dBm optional		

BUC-4000 ODU Characteristic	Specifications	BDC-4000 ODU Characteristic	Specifications
UCS-4000 Combined Transfer Characteristics		**DCS-4000 Combined Transfer Characteristics**	
Gain	40 dB nom at minimum attenuation	Gain	50 dB nom at minimum attenuation
Gain Adjustment	50 dB, 0.25 dB steps (0.1 dB optional)	Gain Adjustment	50 dB, 0.25 dB steps (0.1 dB optional)
Gain Adjustment Accuracy	1.0 dB over 50 dB range	Gain Adjustment Accuracy	1.0 dB over 30 dB range
Gain Stability	±0.25 dB/day at constant temperature ±1.0 dB over temperature	Gain Stability	±0.25 dB/day at constant temperature ±1.0 dB over temperature
Noise Figure	20 dB at minimum attenuation	Transmit Phase Noise	Exceeds requirements of MIL-STD 188-164A
AM/PM Conversion	0.1 deg/dB, max, to –15 dBm output	Noise Figure	15 dB max, at minimum attenuation
Group Delay: Linear Parabolic Ripple	 ±0.05 nS/MHz ± 0.01 nS/MHz^2 1 nS p-p	Image Rejection	60 dB minimum
Third Order Intercept	+20 dBm	AM/PM Conversion	0.1 deg/dB, max, to –15 dBm output
Amplitude Response	±0.50 dB over any 36/72 MHz ±1.1 dB over full band	Group Delay: Linear Parabolic Ripple	 ±0.05 nS/MHz ±0.01 nS MHz^2 1 nS p-p
Environmental Operating Temperature ODU: BUC-4000 IDU: LBC-4000 Operating Altitude Operating Humidity Non-Operating Temperature	 -40° to +50°C (-40° to 122°F) -10° to +50°C (-14° to 122°F) 10,000 Feet above sea level 5 to 95% non-condensing -50° to +71°C (58° to 160°F)	Third Order Intercept Amplitude Response	+20 dBm minimum ±0.50 dB over any 36/72 MHz ±1.1 dB over full band
Physical ODU: MBT-4000 Prime Power Size	 90 to 260 VAC, 47 to 63 Hz See drawing, Figure 3		

Note: Contact factory with specific concerns.

1.3.1 COMMON FEATURES

MBT-4000 meets or exceeds MIL-STD-188-164A. The system operates with low phase noise, auto-band sensing capability, and functions in 1 MHz step size (1 kHz option).

1.3.2 DIMENSIONAL ENVELOPE

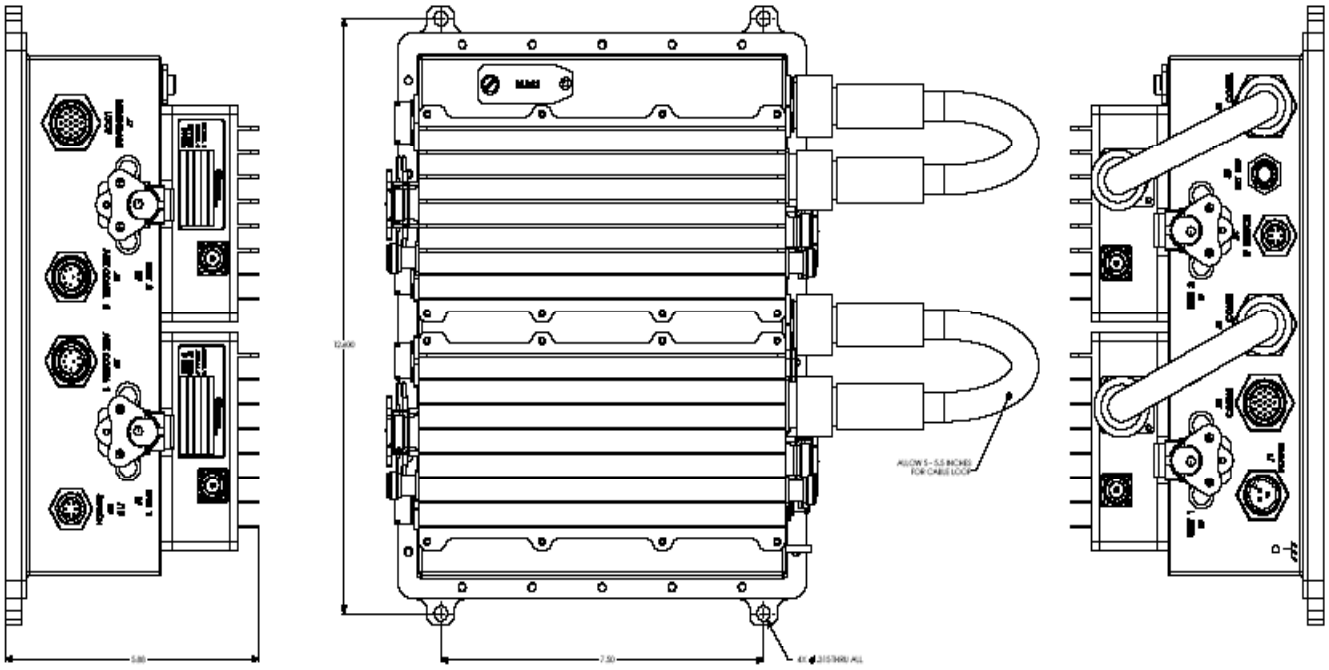


Figure 1-3. MBT-4000 Dimensional Envelope

1.4 SYSTEM OVERVIEW

The transceiver is constructed in a modular configuration. Common to the configuration for any frequency band of operation is a base module which provides the M&C, Power Supply, and Reference function. Band-specific BUC and BDC modules can be mounted to the base module with clip-type fasteners. BUC and BDC modules for other bands and spares for all modules are stored in a transit case until needed.

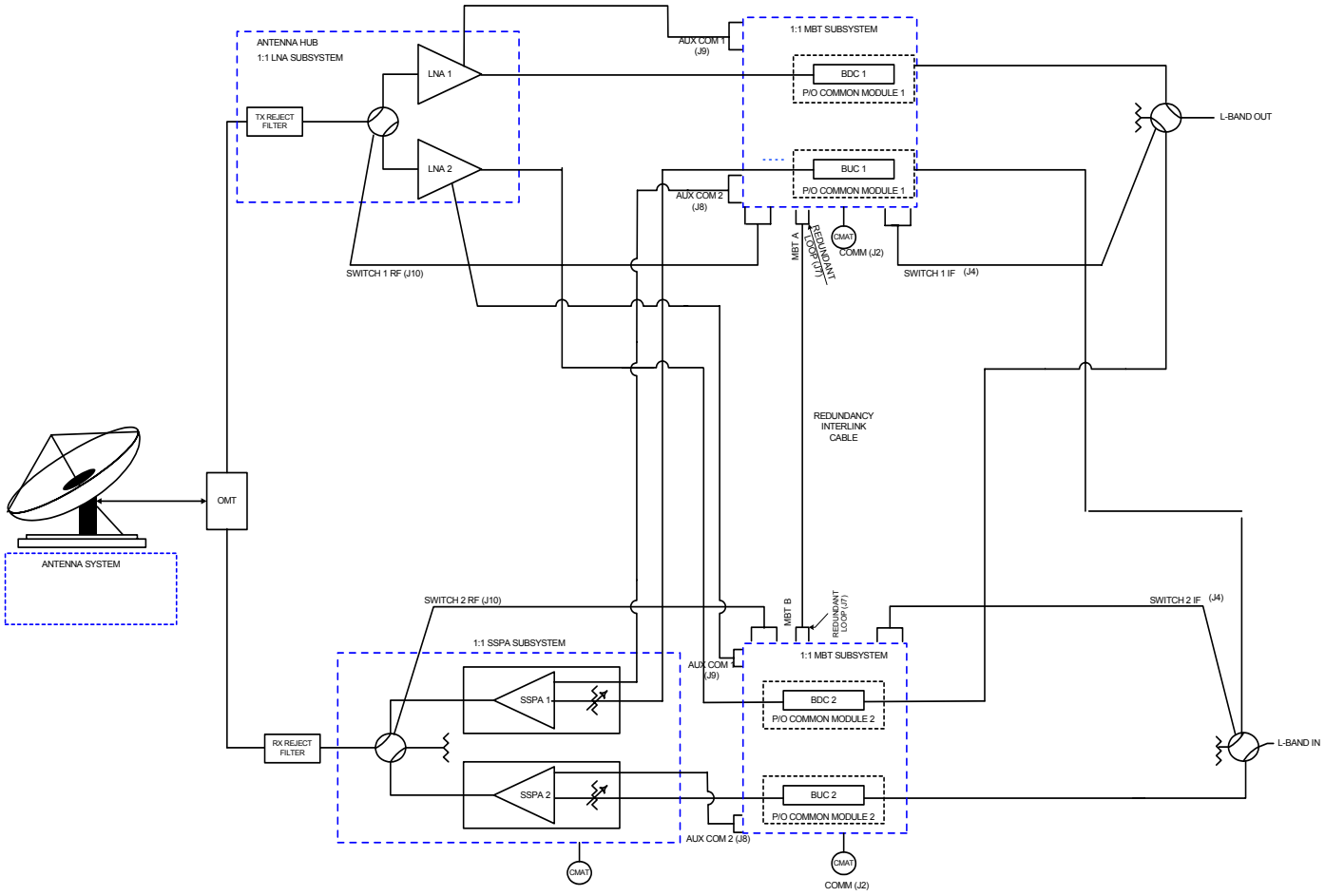


Figure 1-4. Typical, Chain Switched, Redundant Diagram

NOTES:

Chapter 2. Installation

2.1 Unpacking and Inspection

Inspect shipping container for damage. If shipping containers are damaged, keep them until contents of shipment have been carefully inspected and checked for normal operation.

Remove the packing list from the outside of the shipping carton. Open the carton and remove the contents, checking the contents against the packing list. Verify completeness of the shipment and that the unit functions correctly. If damage is evident, contact the carrier and Comtech EF Data immediately and submit a damage report. If the unit needs to be returned to Comtech EF Data, use the original shipping container.

2.2 Installation and Operation

The Common Module of the MBT-4000 may be located near or on the antenna. The band-specific BUC and BDC is latched into place on top of the Common Module (M&C, Power Supply, Reference). Cables to the antenna and IDU complete the installation. To change the band of operation, cables to the BUC and BDC are removed and clips released, allowing removal and replacement of the BUC/BDC with appropriate band-specific modules.

2.2.1 PWR IN (J1) Pin Connections

Table 2-1. PWR IN (J1) Pin Connections

Pin	PWR IN (J1)
A	LINE
B	NEUTRAL
C	GND
	Mating Connectors: ITT Cannon KPT06B-12-35 CEFD PN CN/MS-STPG03F02

2.2.2 COMM (J2) PIN CONNECTIONS

Table 2-2. COMM (J2) Pin Connections

Pin	COMM (J2)
A	RS 485 Rx+
B	RS 485 Rx-
C	RS 485 Tx+
D	RS 485 Tx-
E	RS 232 RD
F	NC
G	RS 232 TD
H	NC
J	NC
K	SUM FLT COMM
L	SUM FLT NO
M	SUM FLT NC
N	NC
P	NC
R	NC
S	NC
T	GND
U	GND
V	NC
	Mating Connectors: Cannon MS3116J14-19P CEFD CN/MS3116J14-19P

2.2.3 IF SWITCH (J4) PIN CONNECTIONS

Table 2-3. IF Switch (J4) Pin Connections

Pin	IF Switch (J4)
A	POS 1 IF
B	GND
C	POS 2 IF
D	POS 1 IND IF
E	GND
F	POS 2 IND IF
	Mating Connectors: Cannon MS3116J10-6P CEFD CN/MS3116J10-6P

2.2.4 REDUNDANT LOOP (J7) PIN CONNECTIONS

Table 2-4. Redundant Loop (J7) Pin Connections

Pin	Redundant Loop (J7)
A	SW POS 2 DRIVE OUT
B	GND
C	SW POS 2 DRIVE OUT
D	RF SW IND OUT
E	IF SW IND OUT
F	SW POS 1 DRIVE IN
G	SW POS 2 DRIVE IN
H	RF SW IND IN
J	IF SW IND IN
K	MBT A IND
L	MBT B IND
M	NC
N	BXC 1 FLT OUT
P	BXC 2 FLT OUT
R	BXC 1 FLT IN
S	BXC 2 FLT IN
T	NC
U	TX
V	RX
	Mating Connectors: CEFD CA/WR11224 Redundant Loop Cable

2.2.5 AUX COMM 1 (J9) PIN CONNECTIONS

Table 2-5. Aux Comm 1 (J9) Pin Connections

Pin	AUX COMM1 (J9)
A	AUX Rx + A
B	AUX Rx – A
C	AUX Tx + A
D	AUX Tx – A
E	+12.6V LNA A
F	IO1 A/Fault
G	IO1 B
H	GND
	Mating Connectors: Cannon MS3116J12-8P CN/MS3116J12-8P

2.2.6 AUX COMM 2 (J8) PIN CONNECTIONS

Table 2-6. Aux Comm 2 (J8) Pin Connections

Pin	AUX COMM 2 (J8)
A	AUX Rx + B
B	AUX Rx – B
C	AUX Tx + B
D	AUX Tx – B
E	+12.6V LNA B
F	I02 A/Fault
G	I02 B
H	GND
	Mating Connectors: Cannon MS3116J12-8P CN/MS3116J12-8P

2.2.7 RF SWITCH (J10) PIN CONNECTIONS

Table 2-7. RF Switch (J10) Pin Connections

Pin	RF SWITCH (J10)
A	POS 1 RF
B	GND
C	POS 2 RF
D	POS 1 IND RF
E	GND
F	POS 2 IND RF
	Mating Connectors: MS3116J10-6P CN/MS3116J10-6P

NOTES:

Chapter 3. System Operation

3.1 OPERATION

This chapter contains instructions for operating the MBT-4000.

3.1.1 BLOCK DOWN CONVERTER (BDC-4000)

The BDC-4000 translates a band-specific input frequency block (C-, X-, or Ku- or Ka-), from the LNA, down to L-Band (950 to 2000 MHz).

BDC-4000 C, X, Ku, Ka

Band	Frequency	LO Frequency	Inverting
C-Band	3400 – 4200 MHz	5150 MHz	Yes
X-Band	7250 – 7750 MHz	6300 MHz	No
Ku-Band-W	10.95 – 12.75 GHz 11.7 – 12.20 GHz 12.250 – 12.275 GHz	10.00 GHz 10.75 GHz 11.30 GHz	No
Ka-Band	20.20 – 21.20 GHz		

Notes: **1.** No spectral inversion, selectable inversion for inverted Block Down Converter

2. 10 dB gain adjustment.

3.1.2 BLOCK UP CONVERTER (BUC-4000)

The BUC-4000 translates the LBC-4000 L-Band output carrier to the desired output frequency (C, X-, or Ku- or Ka-), with an output level capable of driving an HPA.

BUC-4000 C, X, Ku, Ka

Band	Frequency	LO Frequency	Inverting
C-Band	5850 – 6650 MHz	4900 MHz	No
X-Band	7900 – 8400 MHz	6950 MHz	No
Ku-Band-W	13.75 – 14.50 GHz	12.800 GHz	No
Ka-Band	30.00 – 31.00 GHz		

Notes:

1. No spectral inversion

2. 10dB gain adjustment

Chapter 4. Redundant Configuration

4.1 General

The MBT-4000 is designed to operate in both stand-alone and redundant configurations. Every MBT-4000 base contains the circuitry and logic necessary to perform all the functions of a backup controller in either a single base and dual base configuration. The BDC-4000 is capable of supplying LNA power over the center conductor of the coaxial cable. This power supply features current monitoring with programmable failure limits. Overcurrent and undercurrent failures can participate in overall fault indication and redundant switchover criteria.

Each MBT-4000 base includes two "AUX COMM" connectors. Each of these connectors includes a logic input intended to be connected to contact closure fault indications of external equipment. Thus, external equipment failure may participate in overall fault indication and redundant switchover operation.

Each AUX COMM connector also is capable of supplying power to external LNAs (or other devices). This power supply features current monitoring with programmable failure limits. Overcurrent and undercurrent failures can participate in overall fault indication and redundant switchover criteria.

Each MBT-4000 base includes two "switch drive" connectors. Each of these connectors is intended for driving and monitoring a 28V latching switch. In most installations, one switch drive connector will drive an RF waveguide switch, while the second switch drive connector will drive an IF(L-Band) co-axial switch.

4.2 Single-Base Redundancy Operation

Refer to Figure 4-1 showing a typical single-base redundancy configuration.

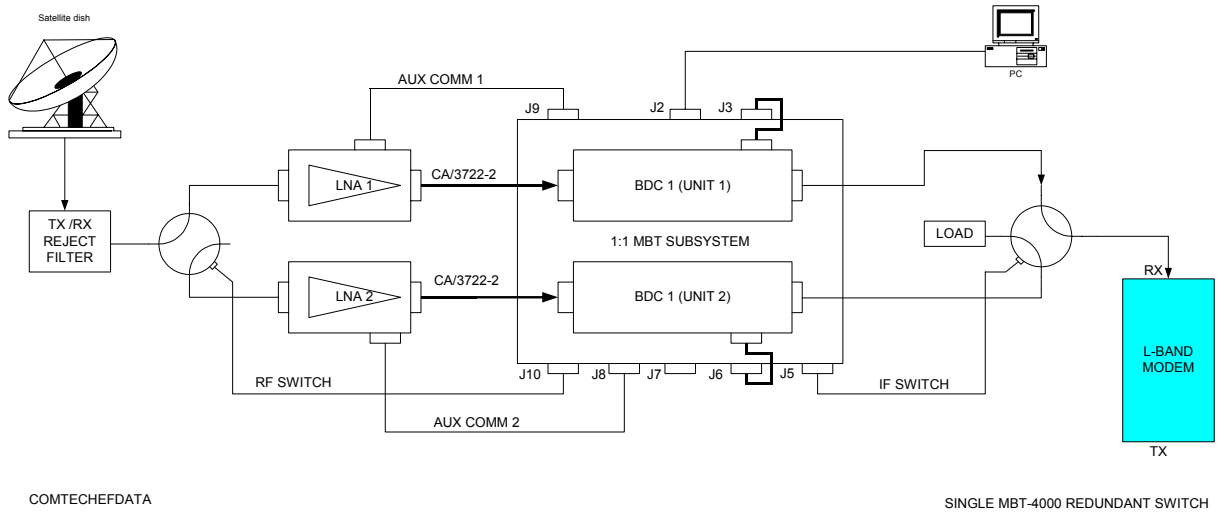


Figure 4-1. Single-Base Redundancy Operation

The MBT-4000 base unit monitors health of the two BDCs or two BUCs installed. In case of a fault on the on-line BxC, the MBT-4000 base will automatically switch over to the standby BxC according to the following rules:

1. The standby BxC must be of the same type as the on-line BxC.
2. The MBT-4000 must be set to redundancy mode 1, the RED=1 command must have been received by the base.
3. Both BxCs must be set to automatic mode, the commands RAM=11 and RAM=21 must have been received by the base.
4. The standby BxC must not be in faulted state.
5. When BxC UNIT 1 is on-line, both the RF and IF switches will be switched to position A. When BxC UNIT 2 is on-line, the switches will be switched to position B.

4.3 Dual Base (Chain) Redundancy Operation

Refer to Figure 4-2 of typical Dual Base (Chain) Redundancy configuration.

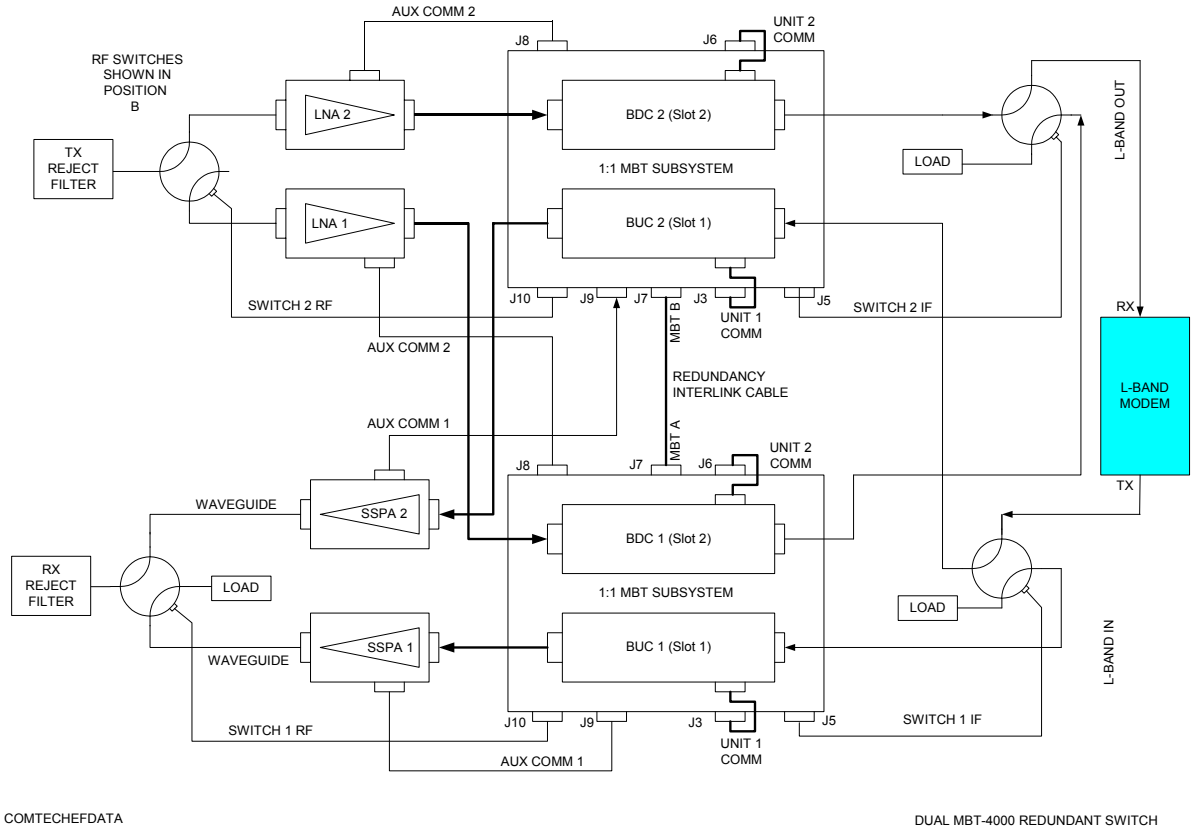


Figure 4-2. Dual Base (Chain) Redundancy Operation

The two MBT-4000 base units cooperate in monitoring the health of the four BxCs (and each other). In case of a fault on an on-line BxC the MBT-4000 base containing the corresponding standby BxC, will automatically switch over to the standby BxC according to the following rules:

1. In dual base (chain) redundancy operation, the redundancy is 'slot' based. The corresponding pairs reside in the same 'slot' of the opposite MBT-4000 base, the pair of BxCs connected to J3 UNIT 1 COMM (slot 1) on each base form a redundant pair. The BxCs connected to J6 UNIT 2 COMM (slot 2) on each base form the other redundant pair. Typically one pair is used for up conversion and the other for down.
2. The corresponding BxCs in a pair must be of the same type.
3. The redundancy interlink cable (p/n:CA/WR11224-1 or equivalent), must be installed.
4. Base unit identification(MBT A or MBT B) is driven by the redundancy interlink cable. Hard wired connections within the cable designate one MBT-4000 base as MBT-A and the other as MBT-B. The cable is labeled accordingly.

5. The RF and IF switches connected to MBT-A correspond to the redundant pair of BxCs installed on J3 UNIT 1 COMM (slot 1).
6. The RF and IF switches connected to MBT-B correspond to the redundant pair of BxCs installed on J6 UNIT 2 COMM (slot 2).
7. When a BxC attached to MBT-A is on-line, the corresponding RF and IF switches will be switched to position A. When a BxC attached to MBT-B is on-line, the corresponding switches will be switched to position B.

For a switchover to occur:

- Both MBT-4000 base units must be set to redundancy mode 2, the RED=2 command must have been received by each base.

- Both BxCs must be set to automatic mode. For example, if the redundant pair is on slot 2 of the bases, the command RAM=21 must have been received by each base.

- The corresponding standby BxC must not be in faulted state.

4.4 External Fault Monitoring

Each MBT-4000 base includes two logic inputs, one per AUX COMM connector, that may be connected to contact closure fault indications of external equipment (usually an SSPA or LNA). Thus, external equipment failure may participate in overall fault indication and redundant switchover operation according to the following rules:

1. An open connection (or 2.7 V min) indicates a fault condition exists.
2. A closed connection (or 0.7 V max) indicates no fault condition exists.
3. Maximum voltage range on fault logic inputs is –12V to +12V.
4. The fault inputs correspond to a slot, the fault input of AUX COM 2 corresponds to the BxC installed as UNIT 2. The fault input of AUX COM 1 corresponds to the BxC installed as UNIT 1.
5. To enable fault input checking the EFI=nm command is usedwnput parameter ‘n’ can equal 1for AUX COM 1 input, or 2 for AUX COMM 2 input. The mode parameter ‘m’ can equal 0 for disabled, or 1 for enabled. Each input must be enabled individually.

4.5 LNA Power Supply Current Monitoring

The MBT-4000 base and BDC-4000 are capable of supplying power to external LNAs.

The MBT-4000 base supplies the power from a pin in the AUX COMM connectors. The BDC-4000 supplies the power over the center conductor of the coaxial cable.

These power supplies feature current monitoring with programmable failure limits. Over-current and under-current failures can participate in overall fault indication and redundant switchover criteria.

The following commands and rules configure operation of this feature.

1. The power supplies are +12.6V with a 350 mA current limit.
2. No more than two of the four possible supplies should be enabled simultaneously.
3. An individual supply is enabled by issuing the 'LCS=sm' command as follows:

    a. 's' is the source. Valid values are 1 or 2 where: 1=AUX COMM 1 supply and 2=AUX COMM 2 supply. The BDC-4000 only has a single current source, so 's' must be set to 1 on a BDC-4000.
    b. 'm' is the mode. Valid values are 0=OFF or 1=ON.

4. In case of excessive current (more than 350 mA), the supply will be disabled and a fault will be posted. The 'LCS=sm' command must be sent again to re-enable the supply.
5. To enable programmable current monitoring, the following steps are taken:

    a. The desired output is enabled as outlined above.
    b. The nominal current is calibrated using the CLC=s command, where 's' is the source as described previously.
    c. The programmable current window is specified using the LCW=sxx command. Where 's' is the source as described previously and 'xx' is the allowable percentage of variance from nominal (set by the CLC command). Acceptable values for 'xx' are 20 to 50 in increments of 1%. In addition, a value of '99' for 'xx' disables the alarm function.
    d. If a current is detected outside this window, a LNA current fault will be posted, but the supply will not be disabled.

4.6 Gain Equalization of Redundant Units

Gain equalization in an MBT-4000 system is accomplished by issuing individual attenuation settings to the specific BxCs.

4.7 Operational Configuration Commands

In automatic redundancy mode, configuration commands (with the exception of attenuation and LNA power supply configuration) sent to the on-line unit will be mirrored in the off-line unit. In auto mode, commands sent to the off-line unit will be rejected.

In manual mode, configuration commands are not mirrored. However, upon reverting to "auto" mode, online unit configuration will transfer to the off-line unit, again with the exception of attenuation and LNA power supply configuration.

4.8 LED Status Indicators

The two LED indicators reflect the staus of the MBT-4000 as follows:

For the Online status:

GREEN	No faults present and the unit is unmated.
YELLOW	No faults present and the unit is muted.
RED	The unit is faulted.

For the Offline status:

GREEN	No faults present, the unit is unmated, and LED indicator light is blinking.
YELLOW	No faults present, the unit is muted, and LED indicator light is blinking.
RED	The unit is faulted and LED indicator light is blinking.

Appendix A. Remote Control

This section describes the protocol and message command set for remote monitor and control of the BUC/BDC-4000 product.

The electrical interface is either an RS-485 multi-drop bus (for the control of many devices) or an RS-232 connection (for the control of a single device), and data is transmitted in asynchronous serial form, using ASCII characters. Control and status information is transmitted in packets, of variable length, in accordance with the structure and protocol defined in later sections.

A.1 RS-485

For applications where multiple devices are to be monitored and controlled, a full-duplex (or 4-wire) RS-485 is preferred. Half-duplex (2-wire) RS-485 is possible, but is not preferred.

In full-duplex RS-485 communication there are two separate, isolated, independent, differential-mode twisted pairs, each handling serial data in different directions. It is assumed that there is a 'controller' device (a PC or dumb terminal), which transmits data, in a broadcast mode, via one of the pairs. Many 'target' devices are connected to this pair, which all simultaneously receive data from the controller. The controller is the only device with a line-driver connected to this pair - the target devices only have line-receivers connected.

In the other direction, on the other pair, each target has a tri-stateable line driver connected, and the controller has a line-receiver connected. All the line drivers are held in high-impedance mode until one target transmits back to the controller.

Each target has a unique address, and each time the controller transmits, in a framed 'packet' of data, the address of the intended recipient target is included. All of the targets receive the packet, but only the intended one will reply. The target enables its output line driver, and transmits its return data packet back to the controller, in the other direction, on the physically separate pair.

RS-485 (full duplex) summary:

Two differential pairs	one pair for controller to target one pair for target to controller
Controller-to-target pair	one line driver (controller) and all targets have line-receivers.
Target-to-controller pair	one line receiver (controller) and all targets have tri-state drivers.

A.2 RS-232

This is a much simpler configuration in which the controller device is connected directly to the target via a two-wire-plus-ground connection. Controller-to-target data is carried, via RS-232 electrical levels, on one conductor, and target-to-controller data is carried in the other direction on the other conductor.

A.3 BASIC PROTOCOL

Whether in RS-232 or RS-485 mode, all data is transmitted as asynchronous serial characters, suitable for transmission and reception by a UART. The asynchronous character format is fixed at 8 data bits, no parity, and 1 stop bit. Only two (2) baud rates are supported: 9600 baud and 19200 baud.

All data is transmitted in framed packets. The host controller is assumed to be a PC or ASCII dumb terminal, which is in-charge of the process of monitor and control. The controller is the only device that is permitted to initiate, at will, the transmission of data. Targets are only permitted to transmit when they have been specifically instructed to do so by the controller.

All bytes within a packet are printable ASCII characters, less than ASCII code 127. In this context, the Carriage Return and Line Feed characters are considered printable.

All messages from controller to target require a response (with one exception). This will be either to return data that has been requested by the controller, or to acknowledge reception of an instruction to change the configuration of the target. The exception to this is when the controller broadcasts a message (such as Set time/date) using Address 0, when the target is set to RS-485 mode.

A.4 PACKET STRUCTURE

Controller-to-Target:

Start of Packet	Target Address	Address De-limiter	Instruction Code	Code Qualifier	Optional Arguments	End of Packet
< ASCII code 60 (1 character)	(4 or 6 characters)	/ ASCII code 47 (1 character)	(3 characters)	= or ? ASCII code 61 or 63 (1 character)	(n characters)	Carriage Return ASCII code 13 (1 character)

Example: <0412/MUT=1{CR}

Target-to-Controller:

Start of Packet	Target Address	Address De-limiter	Instruction Code	Code Qualifier	Optional Arguments	End of Packet
> ASCII code 62 (1 character)	(4 or 6 characters)	/ ASCII code 47 (1 character)	(3 characters)	=, ?, !, or * ASCII code 61, 63, 33 or 42 (1 character)	(From 0 to n characters)	Carriage Return, Line Feed ASCII code 13,10 (2 characters)

Example: >0412/MUT={CR}{LF}

Each of the components of the packet is now explained.

A.4.1 START OF PACKET

Controller to Target: This is the character '<' (ASCII code 60)

Target to Controller: This is the character '>' (ASCII code 62)
Because this is used to provide a reliable indication of the start of packet, these two characters may not appear anywhere else within the body of the message.

A.4.2 ADDRESS

Up to 9999 devices can be uniquely addressed. In both RS-232 and RS-485 applications, the permissible range of values is 1 to 9999. It is programmed into a target unit using the remote control port.

The BDC and BUC sub-devices may also be addressed by appending the corresponding sub-device address. The sub-device address is 'A1' for the BUC and 'A2' for the BDC.

For example, a mute command addressed to a BUC attached to an MBT-4000 at address 0412 will be:

<0412A1/MUT=1{CR}

The format of the response will be:

>0412A1/MUT={CR}{LF}

Sub-device addresses cannot be changed.

The controller sends a packet with the address of a target - the destination of the packet. When the target responds, the address used is the same address, to indicate to the controller the source of the packet. The controller does not have its own address.

A.4.3 INSTRUCTION CODE

This is a three-character alphabetic sequence that identifies the subject of the message. Wherever possible, the instruction codes have been chosen to have some significance. This aids in the readability of the message, should it be displayed in its raw ASCII form. Upper case and lower case alphabetic characters may be used (A-Z, and a-z).

A.4.4 INSTRUCTION CODE QUALIFIER

This single character further qualifies the preceding instruction code.

Code Qualifiers obey the following rules:

1. From Controller-to-Target, the only permitted values are:
   = (ASCII code 61)
   ? (ASCII code 63)

   They have these meanings:

   The '=' code (controller to target) is used as the assignment operator, and is used to indicate that the parameter defined by the preceding byte should be set to the value of the argument(s) which follow it.

   For example, in a message from controller to target, MUT=1 would mean 'enable the mute function'.

   The '?' code (controller to target) is used as the query operator, and is used to indicate that the target should return the current value of the parameter defined by the preceding byte.

   For example, in a message from controller to target, MUT? would mean 'return the current state of the mute function'

2. From Target-to-Controller, the only permitted values are:
= (ASCII code 61)
? (ASCII code 63)
! (ASCII code 33)
* (ASCII code 42)
# (ASCII code 35)

They have these meanings:

The '=' code (target to controller) is used in two ways:
First, if the controller has sent a query code to a target (for example MUT?, meaning 'is mute enable or disable?'), then the target would respond with MUT=x, where x represents the state in question, 1 being 'enable' and 0 being disable.
Second, if the controller sends an instruction to set a parameter to a particular value, and providing the value sent in the argument is valid, then the target will acknowledge the message by replying with MUT= (with no message arguments).

The '?' code (target to controller) is only used as follows:
If the controller sends an instruction to set a parameter to a particular value, and if the value sent in the argument is not valid, then the target will acknowledge the message by replying (for example) with MUT? (with no message arguments). This indicates that there was an error in the message sent by the controller.

The '' code (target to controller) is only used as follows:*
If the controller sends an instruction to set a parameter to a particular value, and if the value sent in the argument is valid, however, the target is in the wrong mode (e.g., standby mode in redundancy configuration) that it will not permit that particular parameter to be changed at that time, then the target will acknowledge the message by replying (for example) with MUT* (with no message arguments).

The '!' code (target to controller) is only used as follows:
If the controller sends an instruction code which the target does not recognize, then the target will acknowledge the message by echoing the invalid instruction, followed by the ! character. Example: XYZ!

The '#' code (target to controller) is only used as follows:
If the controller sends an instruction code which the target cannot currently perform because of hardware resource issues, then the target will acknowledge the message by echoing the invalid instruction, followed by the # character.

A.4.5 MESSAGE ARGUMENTS

Arguments are not required for all messages. Arguments are ASCII codes for the characters 0 to 9 (ASCII 48 to 57), period (ASCII 46) and comma (ASCII 44).

A.4.6 END OF PACKET

Controller to Target: This is the 'Carriage Return' character (ASCII code 13).

Target to Controller: This is the two-character sequence 'Carriage Return', 'Line Feed'. (ASCII code 13, and code 10.)

Both indicate the valid termination of a packet.

A.5 REMOTE COMMANDS

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Parameter Type	Command (Instruction Code and qualifier)	Valid on MBT, BDC, or BUC	Arguments for Command or Response to Query	Description of arguments (Note that all arguments are ASCII numeric codes, that is, ASCII codes between 48 and 57)	Response to Command (target to controller)	Query (Instruction Code and qualifier)	Response to query (target to controller)
Automatic Fault Recovery State	AFR=x	All	1 byte, value of 0, 1	Command or Query. Enable Automatic Fault Recovery on a BXC as follows: 0=Disabled 1=Enabled Example: AFR=1	AFR=(message ok) AFR? (received ok, but invalid arguments found) AFR*(message ok, but not permitted in current mode)	AFR?	AFR=x (same format as command arguments)
Attenuation	ATT=xx.xx	BDC BUC	5 bytes, numeric	Command or Query Valid attenuation level, in dB, at 0.25dB step size as factory default. Example: ATT=08.25	ATT=(message ok) ATT? (received ok, but invalid arguments found) ATT*(message ok, but not permitted in current mode) ATT! (Command not accepted by MBT-4000 base unit. It must be addressed to BUC or BDC sub-units)		
Clear All Stored Alarms	CAA=	All	None	Command only. Instructs the slave to clear all Stored Events. This command takes no arguments.	CAA=(message ok)	N/A	N/A

Parameter Type	Command (Instruction Code and Qualifier)	Valid on MBT, BDC, or BUC	Arguments for Command or Response to Query	Description of arguments (Note that all arguments are ASCII numeric codes, that is, ASCII codes between 48 and 57)	Response to Command (Target to controller)	Query (Instruction Code and qualifier)	Response to query (Target to controller)
Concise AUX COMM I/O	N/A	MBT	n=Slot 1=AUX COMM 1 2=AUX COMM 2	Query only. Used to Query the Concise AUX COMM I/O of the MBT-4000 base unit, where n=1 or 2 Where: n=1(AUX COMM 1) n=2(AUX COMM 2) Example: <0001/CAI?n{cr} >0001?CAI=nabcd{cr}{lf} Where: n=1 or 2 (AUX COMM) a=12V (0=Off, 1=On) b=IOA (O=logic low [voltage input < 0.5], 1=logic high [voltage input > 2.7 vdc) c=IOB (O=logic low [voltage input < 0.5], 1=logic high [voltage input >2.7 vdc] d=Reserved (Always zero)	CAI=(message ok) CAI? (received ok, but invalid arguments found) CAI*(message ok, but not permitted in current mode)	CAI?n	CAI=nabcd (see description for details of arguments)

Parameter Type	Command (Instruction Code and qualifier)	Valid on MBT, BDC, or BUC	Arguments for Command or Response to Query	Description of arguments (Note that all arguments are ASCII numeric codes, that is, ASCII codes between 48 and 57)	Response to Command (target to controller)	Query (Instruction Code and qualifier)	Response to query (target to controller)
Concise Alarm Status	N/A	All	20 bytes, numeric	Query only. Used to query the alarm status of the unit. Example: <0001/CAS?{cr} >0001/CAS=abcdefghijkl{cr}{lf} where: a through l = 0 or 1, 0=OK, 1=FLT All: a=+15V Power Supply b=+7.5V Power Supply c=+5.0V Power Supply MBT-4000: d=+28V Power Supply e=Ref Oscillator Lock Detect f=Intermodule Communications g=Max current on LNA power supply AUX COMM1 h=Max current on LNA power supply AUX COMM2 i=Current window LNA power supply AUX COMM1 j=Current window LNA power supply AUX COMM2 k=Fault input AUX COMM1 (Pin F, J9) l=Fault input AUX COMM2 (Pin F, J8) BDC/BUC: d=X (reserved for future use) e=Synthesizer Lock Detect f=Heat-sink Temperature g=LNA current (BDC only, reserved on BUC) h=Reserved, always zero i-l=Not sent.	N/A	CAS?	CAS=x…X (see description for details of arguments)

Parameter Type	Command (Instruction Code and qualifier)	Valid on MBT, BDC, or BUC	Arguments for Command or Response to Query	Description of arguments (Note that all arguments are ASCII numeric codes, that is, ASCII codes between 48 and 57)	Response to Command (target to controller)	Query (Instruction Code and qualifier)	Response to query (target to controller)
Concise Configuration Status	N/A	All	48 bytes (BDC) 41 bytes (BUC) 32 bytes (MBT) alphanumeric	Query only. Returns the summarized version of RCS. **Example for MBT-04000 base unit:** <0001/CCS?{cr} >0001/CCS=aa,bb,cc,dd,e,ff,g,h{cr}{lf} Where: aa=Frequency band for Unit 1 BXC ('C", 'X", 'Ka', 'Ku', or 'NA') bb=Frequency band for Unit 2 BXC ('C', 'X', 'Ka', 'KU', OR 'NA') cc=Direction for Unit 1 BXC ('DN'=BDC, 'UP'=BUC, 'NA'=None) dd=Direction for Unit 2 BXC ('DN'=BDC, 'UP'=BUC, 'NA'=None) e=Redundancy mode (0, 1, or 2) ff=Automatic mode g=Redundancy loop cable address N=No Cable A=MBT-A B=MBT-B h=External reference lock (1=locked, 0=Not locked) **Example BDC or BUC:** <0001A1/CCS?{cr}{lf} >0001A1/CCS=aaaaa,bb.bb,c,d.d,e,ff,g,hhhh,i,j,{CR}{lf} Where: aaaaa=Frequency in MHz bb.bb=Attenuation in dB c=mute state, 0=unmated, 1=muted d.d=slope adjust e=LNA current source (BDC only, BUC=X) ff=LNA current window (BDC only, BUC=XX) g=LNA fault logic (BDC only, BUC=X) hhhh=XXXX (reserved for future use) i=X (reserved for future use) j=Fault recovery, 0=Manual, 1=Auto	N/A	CCS?	CCS=x….x (see description for details of arguments)

Parameter Type	Command (Instruction Code and qualifier)	Valid on MBT, BDC, or BUC	Arguments for Command or Response to Query	Description of arguments (Note that all arguments are ASCII numeric codes, that is, ASCII codes between 48 and 57)	Response to Command (target to controller)	Query (Instruction Code and qualifier)	Response to query (target to controller)
Circuit Identification	CID=	All	24 bytes, alphanumeric	Command or Query. Used to identify or name the unit or station. First line is limited to 24 characters. Example: CID={cr} -Earth Station 1-- ---Converter #1---	CID=(message ok) CID?(received ok, but invalid arguments found)	CID?	CID=x…x (see description for details of arguments)
Calibrate LNA Current	CLC=s	MBT BDC	S=1 byte Value of 1 , 2 1=LNA A 2= LNA 2	Command only. This command is used to set the calibration point for the LNA current alarm feature. Source 1=LNA A (AUX COMM1) 2=LNA B(AUX COMM2) Example: CLC=1	CLC=(message ok) CLC?(received ok, but invalid arguments found) CLC*(message ok, but not permitted in current mode) CLC!(command not accepted by BUC or BDC sub-units.)	N/A	N/A

Parameter Type	Command (Instruction Code and qualifier)	Valid on MBT, BDC, or BUC	Arguments for Command or Response to Query	Description of arguments (Note that all arguments are ASCII numeric codes, that is, ASCII codes between 48 and 57)	Response to Command (target to controller)	Query (Instruction Code and qualifier)	Response to query (target to controller)
Concise Maintenance Status	N/A	All	40 bytes alphanumeric	Query only. Used to query the maintenance status of the unit in concise format. Response is comma delimited as follows: Example: <0001/CMS?{cr} >0001/CMS=aaa.a,bbb.b,ccc.c,ddd.d,eee.e,fff.f,ggg.g,h,I,j,k{cr} {lf} **All:** aaa.a=+15V power supply bbb.b=+7.5V power supply ccc.=+5V power supply **MBT-4000 Base Unit:** ddd.d=+28V power supply eee.e=Ref oscillator tuning voltage fff.f=LNA current in mA for LNA A (AUX COMM1) ggg.g= LNA current in mA for LNA B (AUX COMM2) h=local RF switch position (A, B, or N) i=Local IF switch position (A, B, or N) j=Remote RF switch position (A or B) k=Remote IF switch position (A or B) Note: 1. It is not possible to detect the absence of a remote switch. 2. N= Not present. **BDC:** ddd.d=XXX.X (reserved for future use) eee.e=Synthesizer tuning voltage fff.f=LNA current in mA. ggg.g= Unit temperature in °C. h – k= Not present **BUC:** ddd.d=XXX.X (reserved for future use) eee.e=Synthesizer tuning voltage fff.f=RF output power in dBm (reserved) ggg.g=Unit temperature in °C h – k= Not present	N/A	CMS?	CMS=… (see description for details of arguments)

Parameter Type	Command (Instruction Code and qualifier)	Valid on MBT, BDC, or BUC	Arguments for Command or Response to Query	Description of arguments (Note that all arguments are ASCII numeric codes, that is, ASCII codes between 48 and 57)	Response to Command (target to controller)	Query (Instruction Code and qualifier)	Response to query (target to controller)
Concise Utility Status	N/A	MBT	21 bytes alphanumeric	Query only. Used to query the utility status of the MBT-400 Base Unit, response is comma delimited. Where: aaaa=Physical Address bbbb=Remote Baud Rate Example: <0001/CUS? >0001/CUS=aaaa,bbbb{cr}{lf}	N/A	CUS?	CUS=x…x (see description for details of arguments)
Set RTC (Real-Time-Clock) Date	DAT=mmddyy	All	6 bytes, numeric	Command or Query. A command in the form mmddyy where; dd = day of the month, between 01 and 31 mm = month of the year, between 01 and 12 yy = year, between 00 and 96 (2000 to 2096) Example: DAT=042503 would be April 24, 2003.	DAT= (message ok) DAT? (received ok, but invalid arguments found) DAT* (message ok, but not permitted in current mode)	DAT?	DAT=mmddyy (same format as command arguments)
Enable Aux Com Fault Input Monitoring	EAM=nm	MBT	n=1 AUX COMM1 2=AUX COMM2 m=0 (disabled), 1 (monitoring enabled)	Command or Query. EAM controls monitoring of external fault logic inputs to Aux Comm connectors (J8/J9 pin F). If enabled and external fault input is at Logic 1 (> 2.6 vdc) a fault will be reported. Note: The inputs may be driven by a contact closure relay. They have an internal pull-up resistor (4.7k) to +5 vdc. Example: EAM=21	EAM=(message ok) EAM?(received ok, but invalid arguments found)	EAM?n	EAM=nm (same format as command arguments)

Parameter Type	Command (Instruction Code and qualifier)	Valid on MBT, BDC, or BUC	Arguments for Command or Response to Query	Description of arguments (Note that all arguments are ASCII numeric codes, that is, ASCII codes between 48 and 57)	Response to Command (target to controller)	Query (Instruction Code and qualifier)	Response to query (target to controller)
Operating RF Frequency	FRE=xxxxx.xxx	BDC BUC	9 bytes, numeric	Command or Query Valid Operating RF frequency, in MHz. Example: FRE=11300.000	FRE=(message ok) FRE? (received ok, but invalid arguments found) FRE* (message ok, but not permitted in current mode) FRE! (command not accepted by MBT-4000 base unit. It must be addressed to BUC or BDC sub-units)	FRE?	FRE=xxxxx.xxx (see description of arguments)
Retreive Firmware Number	N/A	ALL		Query only Gets the Firmware Number of the unit. Example: FRW=FW12001'cr''lf'	N/A	FRW?	FRW=FWxxxx
Monitor LNA Current	N/A	MBT BDC	s_xxx.x, s=1 byte, value of 1, 2 1=LNA A 2=LNA B xxx.x=5 bytes, numeric	Query only. Returns LNA Current Source Level in mA. Example: <0001/LCM?2 >0001/LCM=2_045.3{cr}{lf}	LCM= (message ok) LCM? (received ok, but invalid arguments found) LCM! (command not accepted by BUC or BDC sub-units)	LCM?s s=1 byte, value of 1, 2	LCM=s_xxx.x
LNA Current Source	LCS=sx	MBT BDC	s=1 byte, value of 1, 2 1=LNA A 2=LNA B x=1 byte, value of 0, 1 0 = Disable 1 = Enable	Command or Query. LNA Current Source Enable, where: Source: 1=LNA A (Aux Comm 1), 2=LNB B (Aux Comm 2) Enable: 0 = Disabled2=LNA B, 1 = Enabled Example: LCS=10	LCS= (message ok) LCS? (received ok, but invalid arguments found) LCS* (message ok, but not permitted in current mode) LCS! (command not accepted by BUC or BDC sub-units)	LCS?s s=1 byte, value of 1, 2	LCS=sx (same format as command arguments)

Parameter Type	Command (Instruction Code and qualifier)	Valid on MBT, BDC, or BUC	Arguments for Command or Response to Query	Description of arguments (Note that all arguments are ASCII numeric codes, that is, ASCII codes between 48 and 57)	Response to Command (target to controller)	Query (Instruction Code and qualifier)	Response to query (target to controller)
LNA Current Window	LCW=sxx	MBT BDC	s=1 byte, value of 1, 2 1=LNA A 2=LNA B xx=2 bytes, numeric	Command or Query. This command allows the user to set the alarm window in ± % of the calibrated LNA Current. Valid inputs are 20 to 50 in increments of 1%. In addition, setting the value to 99 disables the alarm function. Default is disabled. Example: LCW=130, set alarm window for LNA A (Aux Comm 1) to ± 30%.	LCW= (message ok) LCW? (received ok, but invalid arguments found) LCW* (message ok, but not permitted in current mode) LCW! (command not accepted by BUC or BDC sub-units)	LCW?s	LCW=sxx (same format as command arguments)
LNA Fault Logic	LFL=sx	MBT BDC	s=1 byte, value of 1, 2 1=LNA A 2=LNA B x=1 byte, Value of 0, 1 0 = Disable 1 = Enable	Command or Query. Allows LNA Fault Logic to contribute to the summary fault relay as follows: Source — Enable 1=LNA A (Aux Comm 1) — 0 = Disabled 2=LNA B (Aux Comm 2) — 1 = Enabled Example: LFL=11	LFL= (message ok) LFL? (received ok, but invalid arguments found) LCS* (message ok, but not permitted in current mode) LFL! (command not accepted by BUC or BDC sub-units)	LFL?s s=1 byte, Value of 1, 2	LFL=sx (same format as command arguments)

Parameter Type	Command (Instruction Code and qualifier)	Valid on MBT, BDC, or BUC	Arguments for Command or Response to Query	Description of arguments (Note that all arguments are ASCII numeric codes, that is, ASCII codes between 48 and 57)	Response to Command (target to controller)	Query (Instruction Code and qualifier)	Response to query (target to controller)
Retrieve next 5 unread Stored Alarms	N/A	All	145 bytes	Query only The unit returns the oldest 5 Stored Events which have not yet been read over the remote control. Reply format: Sub-body{CR}Sub-body{CR}Sub-body{CR}Sub-body{CR}Sub-body, where Sub-body= YYYYYYYYYY ZZ hhmmss mmddyy Where: YYYYYYYYYY=being the fault description. ZZ= being the alarm type. FT = Fault OK = Clear IF = Information If there are no new events, the unit will reply with LNA* Note: See Appendix B for a description of possible Alarm/Events that may be found in the Alarm queue.	N/A	LNA?	LNA=YY..ss (see description for details of arguments)
Mute State	MUT=x	BDC BUC	1 byte, value of 0,1	Command or Query. Mute the unit, where: 0 = Disabled, 1 = Enabled Example: MUT=1	MUT= (message ok) MUT? (received ok, but invalid arguments found) MUT* (message ok, but not permitted in current mode) MUT! (command not accepted by MBT-4000 base unit. It must be addressed to BUC or BDC sub-units)	MUT?	MUT=x (same format as command arguments)

Parameter Type	Command (Instruction Code and qualifier)	Valid on MBT, BDC, or BUC	Arguments for Command or Response to Query	Description of arguments (Note that all arguments are ASCII numeric codes, that is, ASCII codes between 48 and 57)	Response to Command (target to controller)	Query (Instruction Code and qualifier)	Response to query (target to controller)
Online Status	N/A	All	N/A	Query only. Used to query the online status of the unit (useful in redundant configurations). Return position of corresponding RF switch. **Example for MBT-4000 base unit:** <0001/ONL?{cr} >0001/ONL={cr}{lf} ON1=ON ,{cr} ON2=ON , {cr}{lf} **Example for BDC:** <0001A1/ONL?{cr} >0001A1/ONL=1{cr}{lf} **Example for BUC:** <0001A2/ONL?{cr} >0001A2/ONL=1{cr}{lf}	ONL= (message ok) ONL? (received ok, but invalid arguments found)	ONL?	ONL=x

Parameter Type	Command (Instruction Code and qualifier)	Valid on MBT, BDC, or BUC	Arguments for Command or Response to Query	Description of arguments (Note that all arguments are ASCII numeric codes, that is, ASCII codes between 48 and 57)	Response to Command (target to controller)	Query (Instruction Code and qualifier)	Response to query (target to controller)
Retrieve AUX COMM I/O	N/A	MBT	1 byte, value of n=1 or 2 1=Aux Comm1 2=Aux Comm2	Query only. Used to Retrieve AUX COMM I/O of the MBT-4000 base unit., where n=1 or 2 where: n=1 (Aux Comm 1) n=2 (Aux Comm 2) Example: <0001/RAI?1 Returns: >0001/RAI= 12V1=On IO1A=0 IO1B=1 RSVD=0 Note: 0 = Logic low or input voltage < 0.5 vdc. 1 = Logic level 1 or input voltage > 2.7 vdc.	RAI = (message ok) RAI? (received ok, but invalid arguments found) RAI* (message ok, but not permitted in current mode)	RAI?n	RAI=x….x (see description for details of arguments)
Redundancy Mode	RAM=um	MBT	u=1 byte, value of 1, 2 1=Unit 1 2=Unit 2 m=1 byte, Value of 0, 1 0 = Manual 1 = Automatic	Command or Query. Sets redundancy mode as follows: Unit: 1=Unit 1, 2=Unit 2 Mode: 0 = Manual, 1 = Automatic Example: RAM=11	RAM= (message ok) RAM? (received ok, but invalid arguments found) RAM* (message ok, but not permitted in current mode)	RAM?u u=1 byte, Value of 1, 2	RAM=um (same format as command arguments)

Parameter Type	Command (Instruction Code and qualifier)	Valid on MBT, BDC, or BUC	Arguments for Command or Response to Query	Description of arguments (Note that all arguments are ASCII numeric codes, that is, ASCII codes between 48 and 57)	Response to Command (target to controller)	Query (Instruction Code and qualifier)	Response to query (target to controller)
Retrieve Alarm Status	N/A	All	92 bytes MBT-4000 64 bytes (BUC), 74 bytes (BDC), alphanumeric	Query only. Used to Query the Alarm status of the unit **Example for MBT-4000 base:** <0001/RAS?{cr} >0001/RAS={cr} 15VT1=OK{cr} 7V5T1=OK{cr} 5VLT1=OK{cr} 28VT1=OK{cr} REFLD=OK{cr} IICST=OK{cr} LNAC1=OK{cr} LNAC2=OK{cr} LNAW1=OK{cr} LNAW2=OK{cr} LNAI1=OK{cr} LNAI2=OK{cr}{lf} **Example for BDC or BUC:** <0001A1/RAS?{cr} >0001A1/RAS={cr} 15VLT=OK{cr} 7V5LT=OK{cr} 5VOLT=OK{cr} REFLD=XX {cr} (reserved for future use) SYNLD=OK{cr} HSTMP=OK{cr} LNACR=OK{cr}{lf} Note: LNACR will only appear for BDC.	N/A	RAS?	RAS=x….x (see description for details of arguments)

Parameter Type	Command (Instruction Code and qualifier)	Valid on MBT, BDC, or BUC	Arguments for Command or Response to Query	Description of arguments (Note that all arguments are ASCII numeric codes, that is, ASCII codes between 48 and 57)	Response to Command (target to controller)	Query (Instruction Code and qualifier)	Response to query (target to controller)
Retrieve Configuration Status	N/A	All	65 bytes (MBT-4000) 98 bytes (BDC), 76 bytes (BUC) alphanumeric	Query only. Used to Query the configuration status of the unit **Example for MBT-4000 base:** <0001/RCS?{cr} >0001/RCS={cr} BF1=X {cr} BF2=X {cr} BT1=DN{cr} BT2=UP{cr} RED=0{cr} RAM=00{cr} MBT=N, A, or B EXT=0{cr}{lf} **Example for BDC or BUC:** <0001A1/RCS?{cr} >0001A1/RCS={cr} FLO=06300{cr} ATT=01.00{cr} MUT=1{cr} SLP=0.3{cr} LCS=0{cr} LCW=99{cr} LFL=1{cr} REF=XXXX{cr} (reserved for future use) XRE=X{cr} (reserved for future use) AFR=0{cr}{lf} Note: for BUC, LCS, LCW, & LFL will not be shown.	N/A	RCS?	RCS=x….x (see description for details of arguments)

Parameter Type	Command (Instruction Code and qualifier)	Valid on MBT, BDC, or BUC	Arguments for Command or Response to Query	Description of arguments (Note that all arguments are ASCII numeric codes, that is, ASCII codes between 48 and 57)	Response to Command (target to controller)	Query (Instruction Code and qualifier)	Response to query (target to controller)
Redundancy State	RED=x	MBT	1 byte, value of 0,1, or 2	Command or Query. Controls redundancy state. 0=Off 1=Enables redundancy using single base unit 2=Enables redundancy using dual base units Example: RED=1	RED= (message ok) RED? (received ok, but invalid arguments found) RED* (message ok, but not permitted in current mode)	RED?	RED=x (same format as command arguments)
Reference Oscillator Adjust	REF=xxxx	MBT	4 bytes, numeric	Command or Query. Ref Osc Adjust, between 0000 and 0255. Resolution 0001. Example: REF=0197 Note: REF cannot be adjusted when the unit is locked to an external reference source.	REF= (message ok) REF? (received ok, but invalid arguments found) REF* (message ok, but not permitted in current mode)	REF?	REF=xxxx (same format as command arguments)
Retrieve Equipment Type	N/A	All	22 bytes, alphanumeric	Query only. The unit returns a string indicated the Model Number and the software version installed Example: RET=BUC-4000 VER:1.0.3	N/A	RET?	RET=x….x (see description for details of arguments)

Parameter Type	Command (Instruction Code and qualifier)	Valid on MBT, BDC, or BUC	Arguments for Command or Response to Query	Description of arguments (Note that all arguments are ASCII numeric codes, that is, ASCII codes between 48 and 57)	Response to Command (target to controller)	Query (Instruction Code and qualifier)	Response to query (target to controller)
Retrieve Maintenance Status	N/A	All	MBT-4000 - 103 bytes, alphanumeric BDC – 98 bytes, alphanumeric BUC – 98 bytes, alphanumeric	Query only. Used to Query the maintenance status of the unit. **Example for MBT-4000 base: <0001/RMS?{cr}** >0001/RMS={cr}{lf} 15VT1=015.1{cr} 7V5T1=007.7{cr} 5VLT1=005.0{cr} 28VT1=027.2{cr} REFVT=001.3{cr} LNA_1=000.0{cr} LNA_2=000.0{cr} RFSWP=B{cr} IFSWP=N{cr} RRFSW=B{cr} RIFSW=B{cr}{lf} **Example for BUC: <0001A2/RMS={cr}** >0001A2/RMS={cr}{lf} 15VT=015.1{cr} 7V5T=007.6{cr} 5VLT=005.2{cr} REFV=XXX.X{cr} (reserved for future use) SYNT=007.2{cr} POUT=XXX.X{cr} (reserved for future use) TEMP=+25.0{cr}{lf} **Example for BDC: <0001A1/RMS={cr}** >0001A1/RMS={cr}{lf} 15VT=015.1{cr} 7V5T=007.6{cr} 5VLT=005.2{cr} REFV=XXX.X{cr} (reserved for future use) SYNT=007.2{cr} LNAC=255.0{cr} TEMP=+25.0{cr}{lf} Note: “REFV” will show tuning voltage of reference OSC for standalone. Otherwise REFV=xxx.x which means Not Applicable.	N/A	RMS?	RMS=x….x (see description for details of arguments)

Parameter Type	Command (Instruction Code and qualifier)	Valid on MBT, BDC, or BUC	Arguments for Command or Response to Query	Description of arguments (Note that all arguments are ASCII numeric codes, that is, ASCII codes between 48 and 57)	Response to Command (target to controller)	Query (Instruction Code and qualifier)	Response to query (target to controller)
Serial Number	N/A	All	9 bytes, numeric 000000000 to 999999999	Query only. Used to Query the units 9 digit serial number. Slave returns its S/N, in the form xxxxxxxxx. Example: RSN=000000165	N/A	RSN?	RSN=xxxxxxxxx (see description for details of arguments)
Retrieve Utility Status	N/A	MBT	24 bytes alphanumeric	Query only. Used to Query the utility status of the MBT-4000 base unit.. **Example:** <0001/RUS={cr} >0001/RUS={cr}{lf} ADR=0001{cr} BDR=9600{cr}{lf}	N/A	RUS?	RUS=x….x (see description for details of arguments)
Remote Baud Rate	SBR=xxxx	MBT	4 bytes,	Command or Query. Set remote baud rate as follows: 9600 = 9600 baud 19K2 = 19200 baud	SBR= (message ok) SBR? (received ok, but invalid arguments found) SBR! (Command not accepted by BUC and BDC sub-units.)	SBR?	SBR=xxxx (same format as command arguments)
Summary Fault Status	N/A	All	N/A	Query only. Used to Query the status of the Summary Fault Relay. Where: 0=OK 1=FT Example: SFS?	N/A	SFS?	SFS=**x** (see description for details of arguments)
Remote Address	SPA=xxxx	MBT	4 byte, numeric	Command or Query. Set Physical Address-between 0001 to 9999. Resolution 0001 Example: SPA=0412	SPA= (message ok) SPA? (received ok, but invalid arguments found) SPA! (Command not accepted by BUC and BDC sub-units.)	SPA?	SPA=xxxx (same format as command arguments)

Parameter Type	Command (Instruction Code and qualifier)	Valid on MBT, BDC, or BUC	Arguments for Command or Response to Query	Description of arguments (Note that all arguments are ASCII numeric codes, that is, ASCII codes between 48 and 57)	Response to Command (target to controller)	Query (Instruction Code and qualifier)	Response to query (target to controller)
Slope Adjust	SSA=x.x	BDC BUC	3 bytes, numeric	Command or Query. Slope adjust level, valid from 0.0 to 1.0 with 0.1 resolution. Example: SSA=0.3	SSA= (message ok) SSA? (received ok, but invalid arguments found) SSA* (message ok, but not permitted in current mode) SSA! (command not accepted by MBT-4000 base unit. It must be addressed to BUC or BDC sub-units)	SSA?	SSA=x.x (same format as command arguments)
Set Redundancy Switch	SSW=xy	MBT	2 bytes	Command only. SSW control the switches dedicated to Slot1 or 2, and sets them to either Port A or Port B. Syntax: SSW=xy Where: X = 1 or 2 depicting Slot 1 or 2 Y = A or B depicting the switch direction. Direction A Switched to Converter on MBT_A B Switched to Converter on MBT_B	SSW=(message ok) SSW=xy	N/A	N/A
Set RTC Time	TIM=hhmmss	All	6 bytes, numeric	Command or Query. A command in the form hhmmss, indicating the time from midnight, Where: hh = hours, between 00 and 23 mm = minutes, between 00 and 59 ss = seconds, between 00 and 59 Example: TIM=231259 would be 23 hours, 12 minutes and 59 seconds from midnight.	TIM = (message ok) TIM? (received ok, but invalid arguments found) TIM * (message ok, but not permitted in current mode)	TIM?	TIM=hhmmss (same format as command arguments)

Parameter Type	Command (Instruction Code and qualifier)	Valid on MBT, BDC, or BUC	Arguments for Command or Response to Query	Description of arguments (Note that all arguments are ASCII numeric codes, that is, ASCII codes between 48 and 57)	Response to Command (target to controller)	Query (Instruction Code and qualifier)	Response to query (target to controller)
Retrieve Number of unread Stored Alarms	N/A	All	2 bytes, numeric	Query only. Returns the number of Stored Events which remain unread, in the form xx. Example reply: TNA=18	N/A	TNA?	TNA=**xx** (see description for details of arguments)
Terminal Status change	N/A	All	1 byte, value of 0,1	Query only. Used to Query the status of the Terminal Status. Where: 0=no change in status 1=change in status Example: TSC=0	N/A	TSC?	TSC=x (see description for details of arguments)
External Reference Fault Logic	XRF=x	MBT	1 byte, value of 0,1	Command or Query. XRF controls whether or not the Software monitors the external reference source. If enabled and no source is present, a fault will be reported. 0=Ext Reference not monitored 1=Ext Reference is monitored and the lock state reported Example: XRF=1	XRF=(message ok) XRF?(received ok, but invalid arguments found)	XRF?	XRF=x (see description for details of arguments)

NOTES:

Appendix B. Faults/Events

There are three types of Faults/Events that may occur and be recorded in the event log of an MBT-4000, BDC-400 or BUC-4000. These are:

- Summary Faults
- Configurable Summary Faults
- Informational Events

Summary Faults indicate improper operation. When a Summary Fault condition occurs: The Summary Fault Relay will be de-energized. If a Summary Fault occurs on a converter, it will mute. If a Summary Fault occurs on the base unit, the applicable converters (one or both) will be muted according to the specific error. If a Summary Fault occurs on the on-line unit of a redundant pair, the off-line unit will detect the fault and assume on-line state. In all cases, a corresponding event message will be added to the event log.

Configurable Summary Faults operate the same as Summary Faults, except Configurable Summary Faults may be enabled/disabled via remote commands.

Informational Events are operation conditions which may be important, but are not considered improper operation and will not cause a converter to mute.

Tables B1through B8 list possible Fault/Event messages.

Table B-1. MBT-4000 Summary Faults

Mnemonic	Type	Mute	Description
15V PS1	Summary Fault	All	The 15 volt power supply is out of tolerance.
28V PS1	Summary Fault	All	The 28 volt power supply is out of tolerance.
5VT PS1	Summary Fault	All	The 5 volt power supply is out of tolerance.
7V5 PS1	Summary Fault	All	The 7.5 volt power supply is out of tolerance.
IIC BUS	Summary Fault	All	Unable to communication via the internal high speed communication bus

Table B-2. MBT-4000 Configurable Summary Faults

Mnemonic	Type	Mute	Description
AUXCOM1	Summary Fault – Configurable	Slot 1	The IO1A/FAULT input (AUX COMM 1) indicates a fault. Monitoring for this fault is enabled using the EAM command.
AUXCOM2	Summary Fault – Configurable	Slot 2	The IO2A/FAULT input (AUX COMM 2) indicates a fault. The converter attached to UNIT 2 COMM (J6) has been muted.
LNACUR1	Summary Fault - Configurable	Slot 1	The +12.6 V LNA A (AUX COMM 1) power supply current has exceeded the maximum limit of 350 mA and has been disabled. The converter attached to UNIT 1 COMM (J3) has been muted. The LNA power supply—and thus this fault—is enabled using the LCS command. This fault is cleared by a LCS command or power cycle.
LNACUR2	Summary Fault - Configurable	Slot 2	The +12.6 V LNA B (AUX COMM 2) power supply current has exceeded the maximum limit of 350 mA and has been disabled. The converter attached to UNIT 2 COMM (J6) has been muted. The LNA power supply—and thus this fault—is enabled using the LCS command. This fault is cleared by a LCS command or power cycle.
LNAWIN1	Summary Fault - Configurable	Slot 1	The +12.6 V LNA A (AUX COMM 1) power supply current is outside the programmed window. (The power supply is not disabled in response to this fault.) The converter attached to UNIT 1 COMM (J3) has been muted. LNA current window monitoring is configured and enabled using the LCS, CLC and LCW commands. This fault is cleared by a LCS command, CLC command, LCW command or power cycle.
LNAWIN2	Summary Fault – Configurable	Slot 2	The +12.6 V LNA B (AUX COMM 2) power supply current is outside the programmed window. (The power supply is not disabled in response to this fault.) The converter attached to UNIT 2 COMM (J6) has been muted. LNA current window monitoring is configured and enabled using the LCS, CLC and LCW commands. This fault is cleared by a LCS command, CLC command, LCW command or power cycle.

Mnemonic	Type	Mute	Description
REF LD	Summary Fault – Configurable	All	The External Reference Monitor has lost lock with the external reference signal. All attached converters (UNIT 1 and UNIT 2) have been muted. Monitoring for this fault is enabled using the XRF command. This fault is cleared when lock has been regained.

Table B-3. MBT-4000 Informational Events

Mnemonic	Type	Mute	Description
BXCTYP1	Informational Event	None	In redundancy mode, the BxC corresponding to slot 1 is not of the same type. Redundancy mode switched to manual (RAM=10).
BXCTYP2	Informational Event	None	In redundancy mode, the BxC corresponding to slot 2 is not of the same type. Redundancy mode switched to manual (RAM=20).
LOG CLR	Informational Event	None	The Event LOG Queue was cleared in response to receipt of a CAA command.
PWR OFF	Informational Event	None	Power off was detected.
PWR ON	Informational Event	None	Power on was detected.

Table B-4. BDC-4000 Summary Faults

Mnemonic	Type	Description
15V SUP	Summary Fault	The 15 volt power supply is out of tolerance.
5VT SUP	Summary Fault	The 5 volt power supply is out of tolerance.
7V5 SUP	Summary Fault	The 7.5 volt power supply is out of tolerance.
OVR TMP	Summary Fault	The maximum operating temperature has been exceeded.
PLL LD	Summary Fault	The PLL has lost lock.

Table B-5. BDC-4000 Configurable Summary Faults

Mnemonic	Type	Description
LNA CUR	Summary Fault - Configurable	The +12.6 V LNA power supply current (via center conductor of coax connector) has exceeded the maximum limit of 350 mA and has been disabled. The LNA power supply—and thus this fault—is enabled using the LCS command.
LNA WIN	Summary Fault - Configurable	The +12.6 V LNA A power supply current (via center conductor of coax connector) is outside the programmed window. (The power supply is not disabled in response to this fault.) LNA current window monitoring is configured and enabled using the LCS, CLC and LCW commands.

Table B-6. BDC-4000 Informational Events

Mnemonic	Type	Description
LOG CLR	Informational Event	The Event LOG Queue was cleared in response to receipt of a CAA command.
PWR OFF	Informational Event	Power off was detected.
PWR ON	Informational Event	Power on was detected.

Table B-7. BUC-4000 Summary Faults

Mnemonic	Type	Description
15V SUP	Summary Fault	The 15 volt power supply is out of tolerance.
5VT SUP	Summary Fault	The 5 volt power supply is out of tolerance.
7V5 SUP	Summary Fault	The 7.5 volt power supply is out of tolerance.
OVR TMP	Summary Fault	The maximum operating temperature has been exceeded.
PLL LD	Summary Fault	The PLL has lost lock.

Table B-8. BUC-4000 Informational Events

Mnemonic	Type	Description
LOG CLR	Informational Event	The Event LOG Queue was cleared in response to receipt of a CAA command.
PWR OFF	Informational Event	Power off was detected.
PWR ON	Informational Event	Power on was detected.

METRIC CONVERSIONS

Units of Length

Unit	Centimeter	Inch	Foot	Yard	Mile	Meter	Kilometer	Millimeter
1 centimeter	—	0.3937	0.03281	0.01094	6.214×10^{-6}	0.01	—	—
1 inch	2.540	—	0.08333	0.2778	1.578×10^{-5}	0.254	—	25.4
1 foot	30.480	12.0	—	0.3333	1.893×10^{-4}	0.3048	—	—
1 yard	91.44	36.0	3.0	—	5.679×10^{-4}	0.9144	—	—
1 meter	100.0	39.37	3.281	1.094	6.214×10^{-4}	—	—	—
1 mile	1.609×10^{5}	6.336×10^{4}	5.280×10^{3}	1.760×10^{3}	—	1.609×10^{3}	1.609	—
1 mm	—	0.03937	—	—	—	—	—	—
1 kilometer	—	—	—	—	0.621	—	—	—

Temperature Conversions

Unit	° Fahrenheit	° Centigrade
32° Fahrenheit	—	0 (water freezes)
212° Fahrenheit	—	100 (water boils)
-459.6° Fahrenheit	—	273.1 (absolute 0)

Formulas
C = (F - 32) * 0.555
F = (C * 1.8) + 32

Units of Weight

Unit	Gram	Ounce Avoirdupois	Ounce Troy	Pound Avoir.	Pound Troy	Kilogram
1 gram	—	0.03527	0.03215	0.002205	0.002679	0.001
1 oz. avoir.	28.35	—	0.9115	0.0625	0.07595	0.02835
1 oz. troy	31.10	1.097	—	0.06857	0.08333	0.03110
1 lb. avoir.	453.6	16.0	14.58	—	1.215	0.4536
1 lb. Troy	373.2	13.17	12.0	0.8229	—	0.3732
1 kilogram	1.0×10^{3}	35.27	32.15	2.205	2.679	—

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