
# OPERATION MANUAL

## 70 MHz TO L-BAND
## INDOOR UP-CONVERTER
## ARUN-70L

**PM 170-705000-201, Rev. 2n**

# WARRANTY

This Advantech Wireless product is warranted against defects in material and workmanship for a period of 2 years from date of shipment. During the warranty period, Advantech Wireless will, at its option, either repair or replace the product, which proves to be defective.

To return a product for warranty or repair service, first request a Return Material Authorization (RMA) number by contacting Advantech Wireless at:

Phone: (514) 420-0045 or Fax: (514) 420-0073
Website: www.advantechwireless.com or e-mail: support@advantechwireless.com

The product should be shipped to the following address, in the original shipping container (box), with the prepaid shipping charges.

Advantech Wireless
657 Orly Avenue
Dorval, Quebec
H9P 1G1
CANADA

Please indicate the RMA number on all shipping documentation.

Units shipped without a prior issued RMA, or not shipped in the original container, may be rejected and returned at sender's expense.

## LIMITATIONS OF WARRANTY

Advantech Wireless warrants this product to be free of defects in materials and workmanship.

The foregoing warranty shall not apply to defects resulting from improper handling or abuse by the purchaser, unauthorized modification, operating outside of the product's environmental specifications, improper installation or maintenance.

*Advantech Wireless shall not be liable for any direct, indirect, special, incidental or consequential damages.*

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# 1. INTRODUCTION

The Advantech Wireless ARUN-70L is an indoor 70 MHz to L-Band Up-Converter designed to interface between 70 MHz modems and L-Band transmitters. With the addition of a Block Up-Converter (BUC) and an amplifier, a complete transmitting satellite system can be implemented with minimum effort.

# 2. PRODUCT DESCRIPTION

The 70 MHz to L-Band indoor Up-Converter consists of a single 19" wide, 1 RU shelf assembly that contains an up-converter from 70 MHz to L-Band. The ARUN-70L also contains a power supply, a reference oscillator, and monitoring and control to manage the Up-Converter unit.

The major features of the ARUN-70L are:

- Up-converts 70 MHz ± 18 MHz to L-Band (950 – 1525 MHz)
- Phase-locked local oscillator to 10 MHz internal/external reference source
- Front Panel display of status and control functions
- Remote Monitoring and Control via serial interface
- Compact rack-mount package

The ARUN-70L is equipped with an internal 10 MHz reference source. The switch allows the operation of the up-converter using either an internal or an external 10 MHz reference signal. The switching operation depends upon the power level of the externally applied signal.

The externally applied 10 MHz reference power level should be between –3 dBm and +3 dBm and a frequency of 10 MHz ± 2 Hz.

When the externally applied 10 MHz reference power level is less than –10 dBm, the 10 MHz reference will automatically switch to the internal reference. When switching to the internal reference occurs, the up-converter will go OUT OF LOCK for a few seconds due to the instability caused by the transition. The internal reference oscillator reaches its nominal stability 15 minutes after switching to the internal reference. When the 10 MHz input power level is greater than –10 dBm, the system switches to the external reference.

A product outline of the ARUN-70L is given in **Figure 1** and **Figure 2**. A block diagram of the Up-Converter is given in **Figure 3**.

| **TABLE 1:** CONNECTORS | | | |
|---|---|---|---|
| **Connector** | **Function** | **Description** | **Mating Connector** |
| IF | 70 MHz INPUT | BNC-Type (F) 50 Ω | BNC-Type (M) 50 Ω |
| RF | L-Band OUTPUT | N-Type (F) 50 Ω | N-Type (M) 50 Ω |
| RELAY | Discrete Interface | DB-9 (F) | DB-9 (M) |
| RS485 | RS-485 Serial Interface | DB-9 (F) | DB-9 (M) |
| RS232 | RS-485 Serial Interface | DB-9 (F) | DB-9 (M) |
| AC | AC Line | IEC 60320-C14 | IEC 60320-C13 |

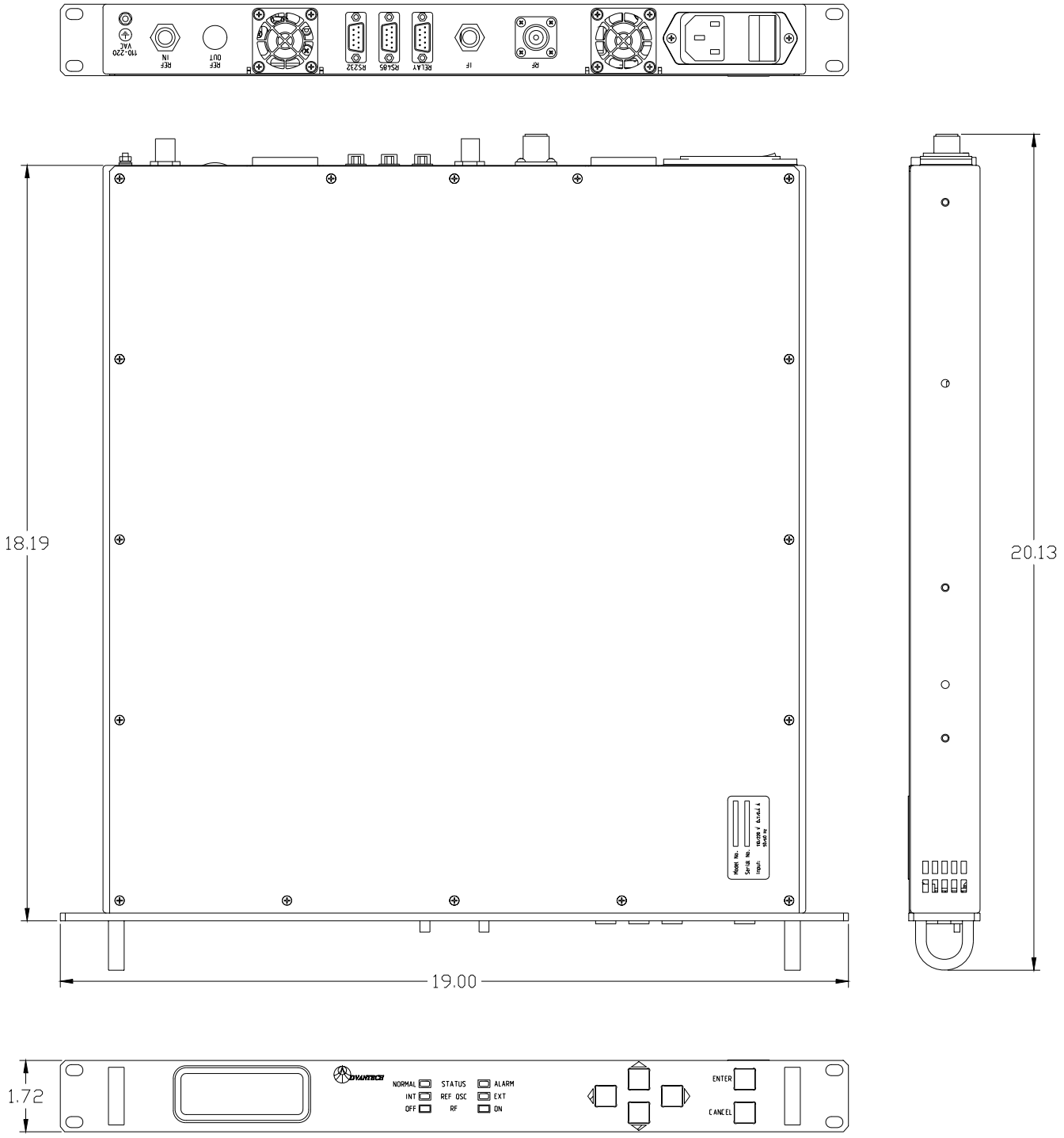



**Figure 1**: Outline Drawing

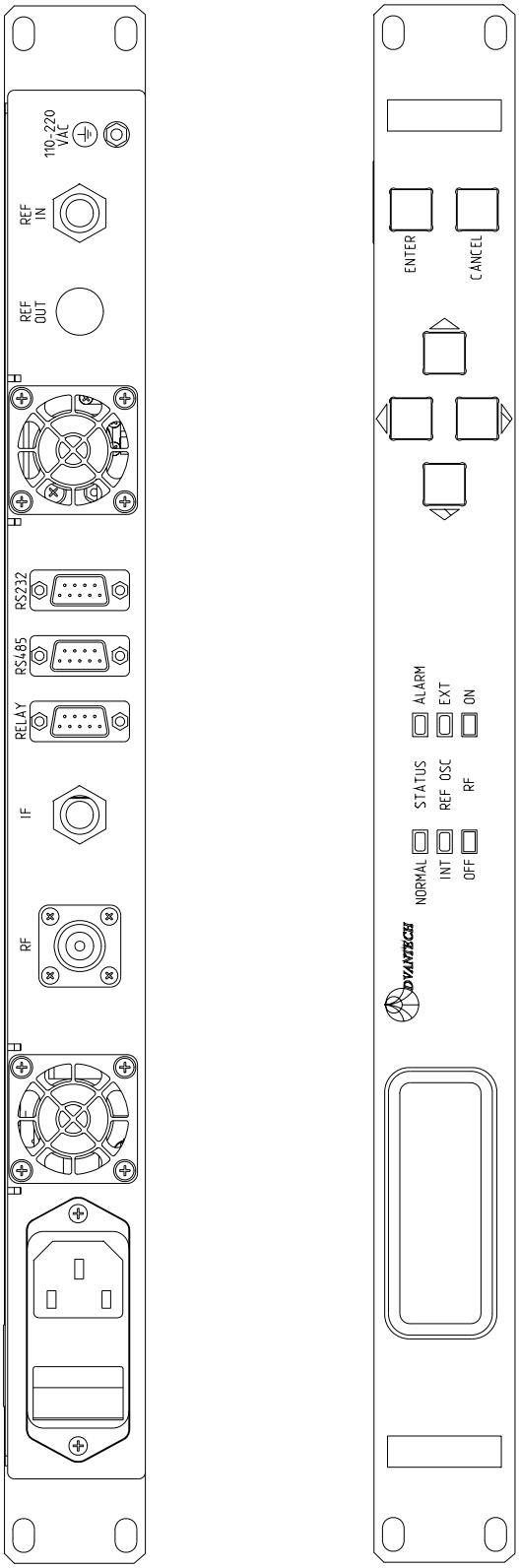



**Figure 2**: Front and Back Panels

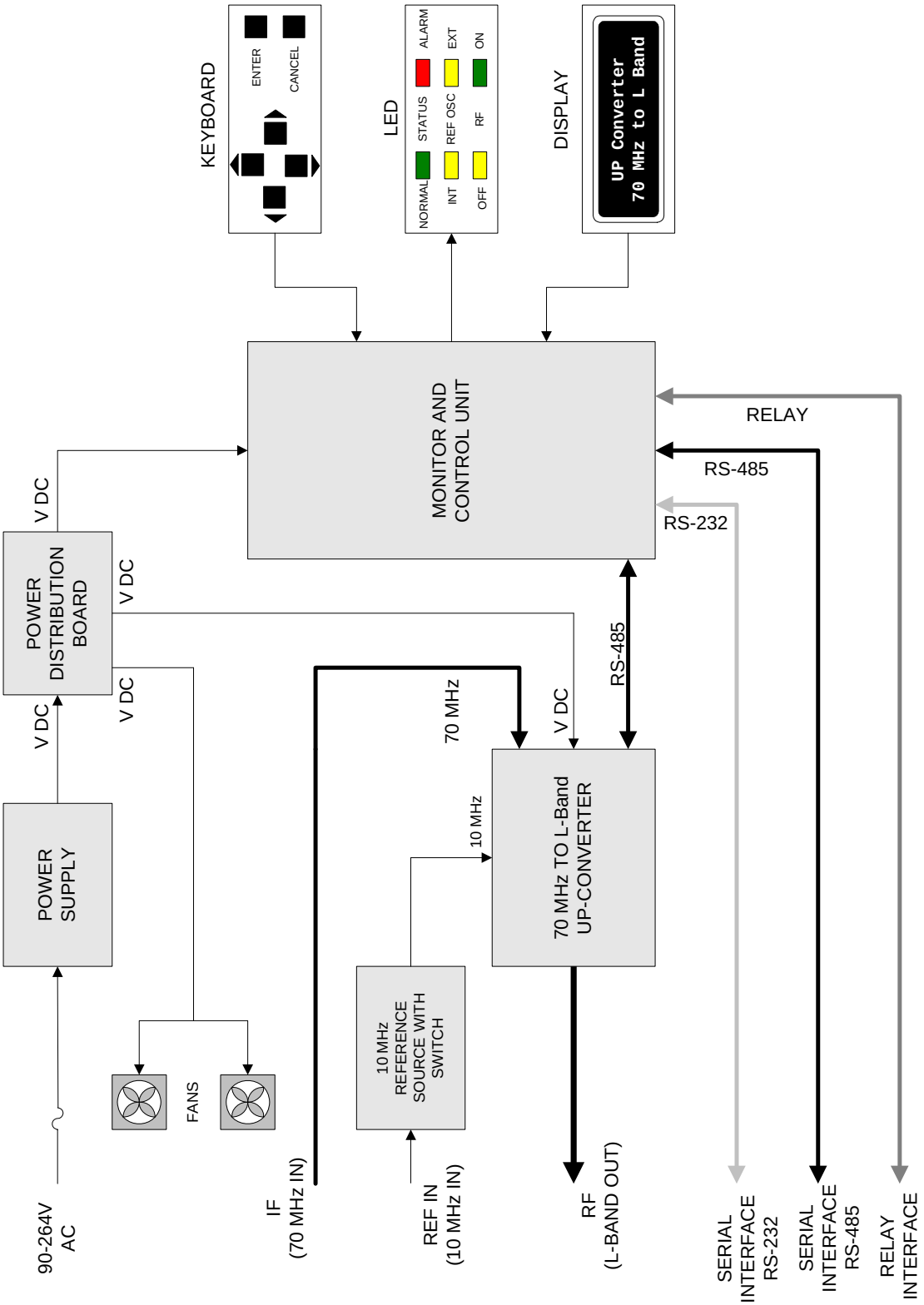



**Figure 3**: Block Diagram

# 3. MONITORING AND CONTROL BY THE FRONT PANEL

Local monitoring and control can be done using the keypad, LEDs and the fluorescent display located on the front panel.

## 3.1 KEYPAD AND FLUORESCENT DISPLAY

Keypad is used to navigate through the various menus provided by the fluorescent display. Here are the basic rules to move between menus.

From main menu, the **[↑]** key is used to go to the shelf menus or the **[↓]** key to go to the up-converter menus.

- The **[↑]** and **[↓]** keys are used to move between parameters.
- The **[←]** and **[→]** keys are used to move between modules.
- The **[Enter]** key is used to edit a parameter.
- The **[↑]**, **[↓]**, **[←]** and **[→]** keys are used to change value of the selected parameter.
- The **[Enter]** key is used to save changes.
- The **[Cancel]** key is used to discard changes.

**Figure 4:** Monitor and Control Menu, **Figure 5:** Shelf Menu and **Figure 6:** Help Menu provide a flow chart of the menus.

## 3.2 GAIN ADJUSTMENT

The up-converter 70 MHz to L-Band has a conversion gain of 20 dB. This gain may be adjusted in 0.1 dB steps between 0 dB and 20 dB (20 dB range).

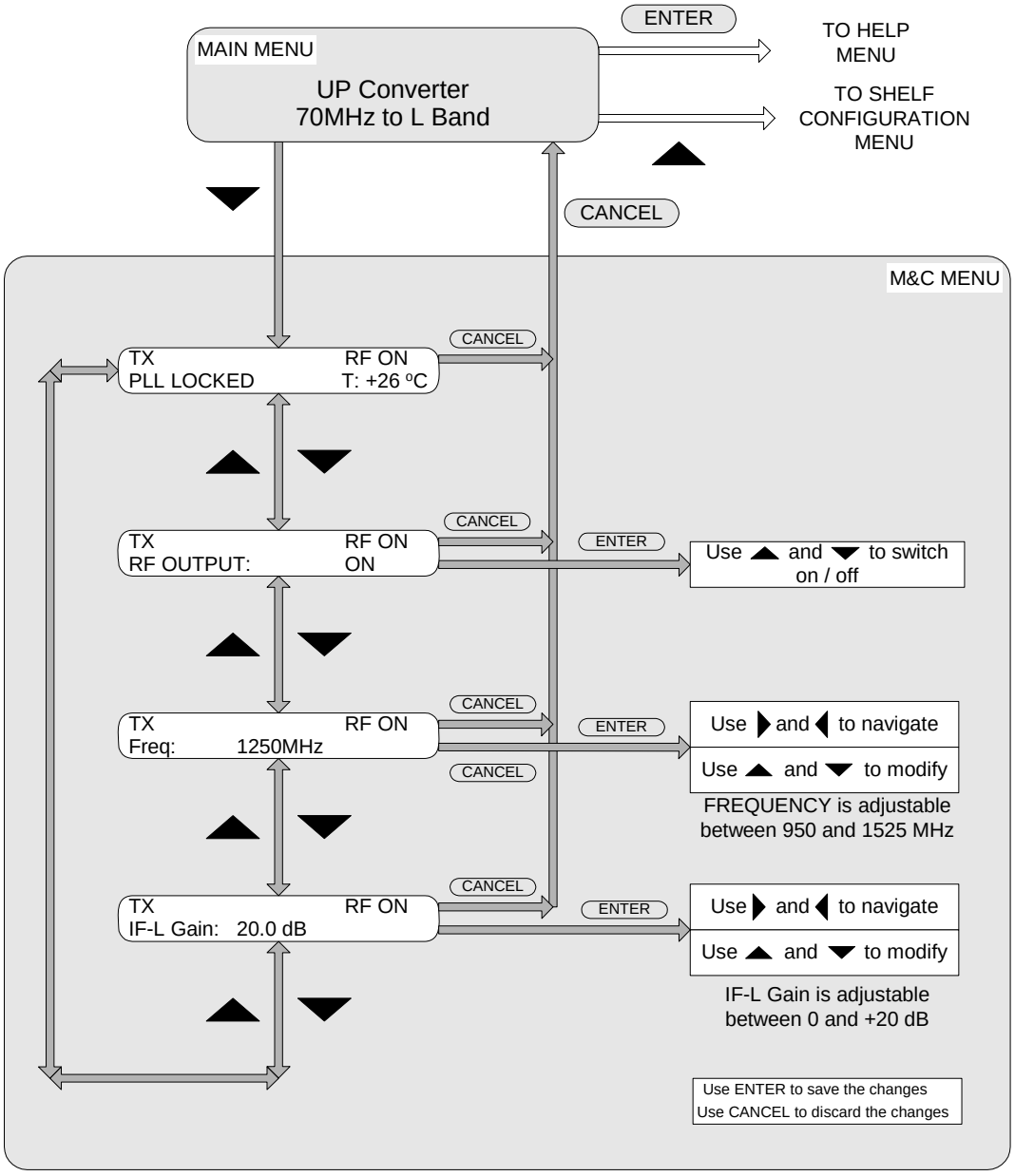



**Figure 4**: Monitor and Control Menu

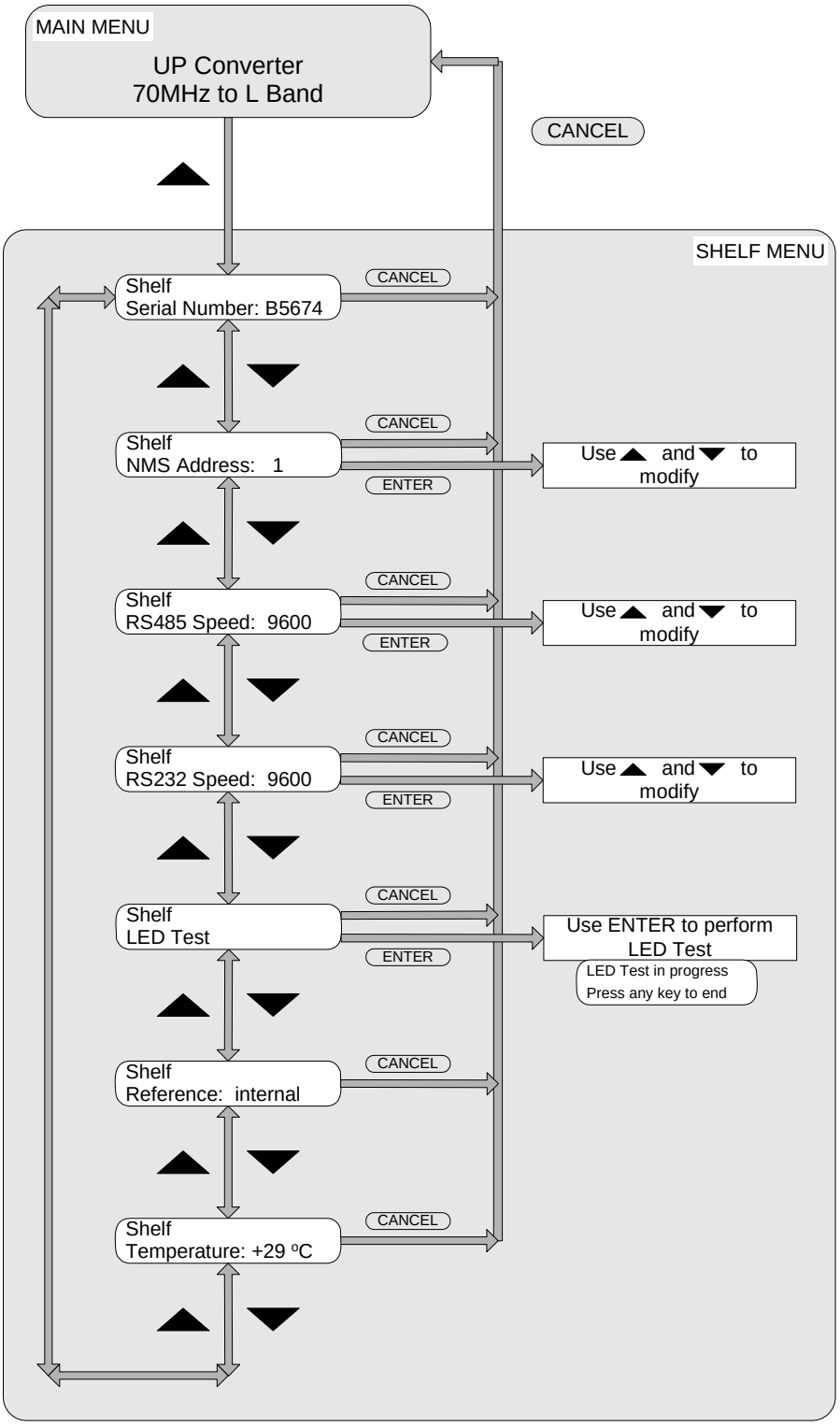



**Figure 5**: Shelf Menu

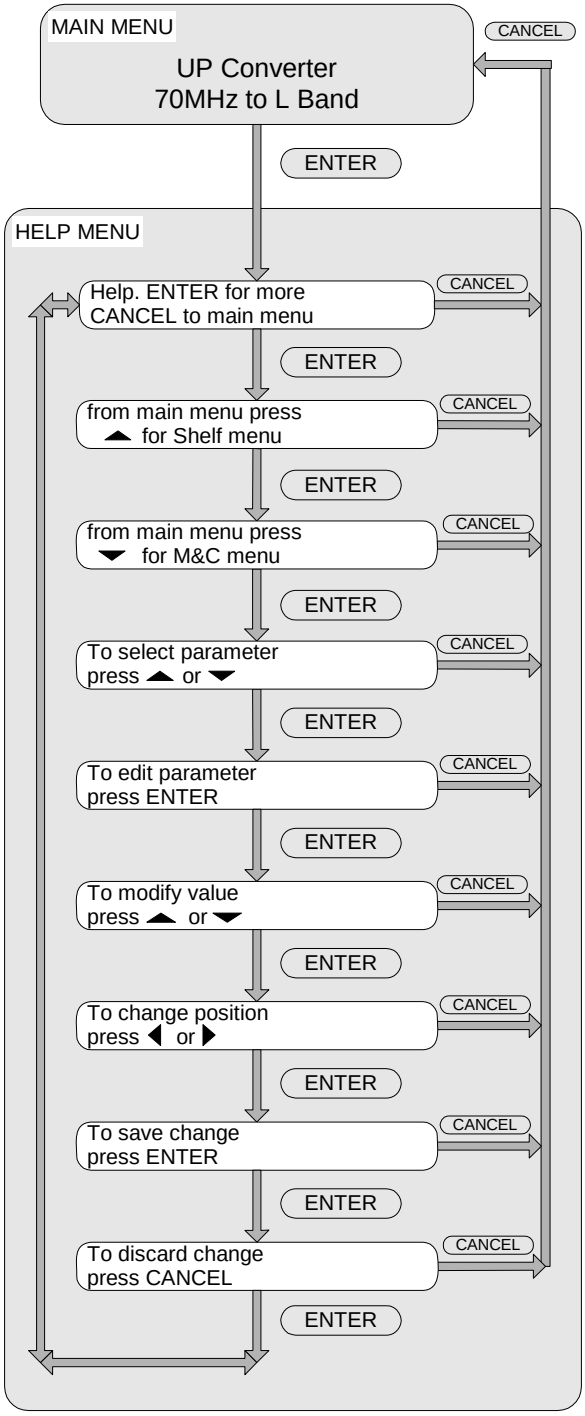



**Figure 6**: Help Menu

### 3.3 LEDs

Six LEDs on the front panel provide the status of the Up-Converter. **TABLE 2** gives a description of each LED.

**TABLE 2:** LED INDICATORS

| LED | Color | Description |
|---|---|---|
| STATUS NORMAL | green | Indicates that the Up-Converter is supplied with DC power and it is in good functioning condition |
| STATUS ALARM | red | An alarm condition has been detected in the Up-Converter. |
| REF OSC INT | yellow | Indicates that the Up-Converter is locked by the internal reference signal |
| REF OSC EXT | yellow | Indicates that the Up-Converter is locked by the external reference signal |
| RF OFF | yellow | The Up-Converter is in MUTE state (no output) |
| RF ON | green | The Up-Converter is in RF ON state |

# 4. MONITORING AND CONTROL BY THE DISCRETE INTERFACE

This interface offers the essential monitoring and control of the Up-Converter by discrete signals. The discrete interface is located on the rear panel (connector labeled “RELAY”).

Pin 2 and pin 4 together with pin 3 (common) are Form-C relay outputs that provide alarm indication for the Up-Converter.

When the unit is in ALARM condition, pin 2 is closed to pin 3 TX ALARM COMMON, and pin 4 is open relative to pin 3. When the unit is in good functioning condition (NO ALARM), pin 2 is open relative to pin 3, and pin 4 is closed to pin 3.

Pins 1 and 5 allow the operator to mute or un-mute the RF of the Up-Converter. When Pin 1 is connected to pin 5 (MUTE COMMON), the up-converter is un-muted. When Pin 1 is not connected to pin 5, the up-converter is muted.

**TABLE 3:** DISCRETE INTERFACE – PIN ASSIGNMENT

| Pin Number | Description |
|---|---|
| 1 | TX Mute (pin 1 should be connected to pin 5 MUTE COMMON in order to enable the unit) |
| 2 | TX Alarm NC (when pin 2 is closed to pin 3 TX ALARM COMMON, the unit is in ALARM condition; when pin 2 is open relative to pin 3, the unit is in good functioning condition) |
| 3 | TX ALARM COMMON |
| 4 | TX Alarm NO (when pin 4 is open relative to pin 3 TX ALARM COMMON, the unit is in ALARM condition; when pin 4 is closed to pin 3, the unit is in good functioning condition) |
| 5 | MUTE COMMON |
| 6 | RX Alarm NC (not available for this application) |
| 7 | RX Alarm Common (not available for this application) |
| 8 | RX Alarm NO (not available for this application) |
| 9 | RX Mute (not available for this application) |

# 5. MONITORING AND CONTROL BY THE RS-232 INTERFACE

The RS-232 serial interface is a terminal mode interface which allows the operator to monitor and control important parameters of the Up-Converter such as PLL lock status, temperature, conversion gain in each up-converter module, and L-Band frequency of the frequency converter.

## 5.1 ELECTRICAL CONNECTION

The RS-232 port of the Up-Converter can be directly connected to a COM port of computer. The RS-232 port uses a DB9 female connector with pin assignment described in EIA232 standard. See **TABLE 4** for pin assignment. To connect the RS-232 port of the Up-Converter to a PC, use a standard RS-232 cable for computer.

**TABLE 4:** RS-232 INTERFACE – PIN ASSIGNMENT

| Pin Number | Description |
|---|---|
| 1 | Not Connected |
| 2 | TX |
| 3 | RX |
| 4 | Not Connected |
| 5 | Ground |
| 6 to 9 | Not Connected |

## 5.2 PORT SETTINGS

For proper operation, use the following settings:

**TABLE 5:** RS-232 PORT SETTINGS

| Parameter | Setting |
|---|---|
| Baud Rate | 9600 |
| Data Bits | 8 |
| Stop Bit | 1 |
| Parity | None |

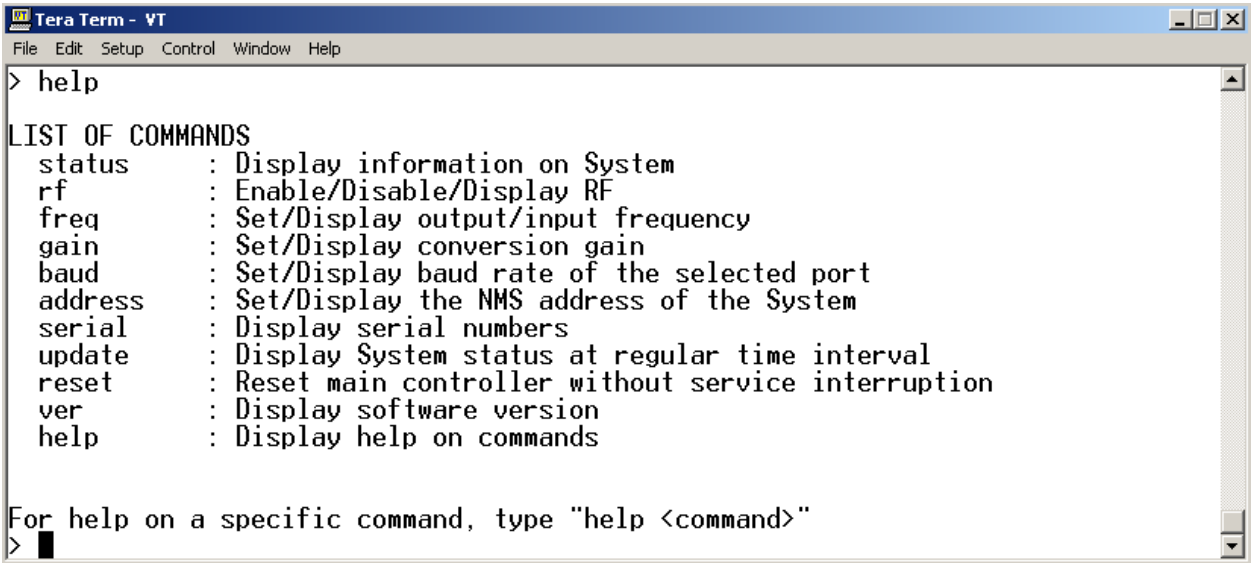
## 5.3 COMMAND DESCRIPTION

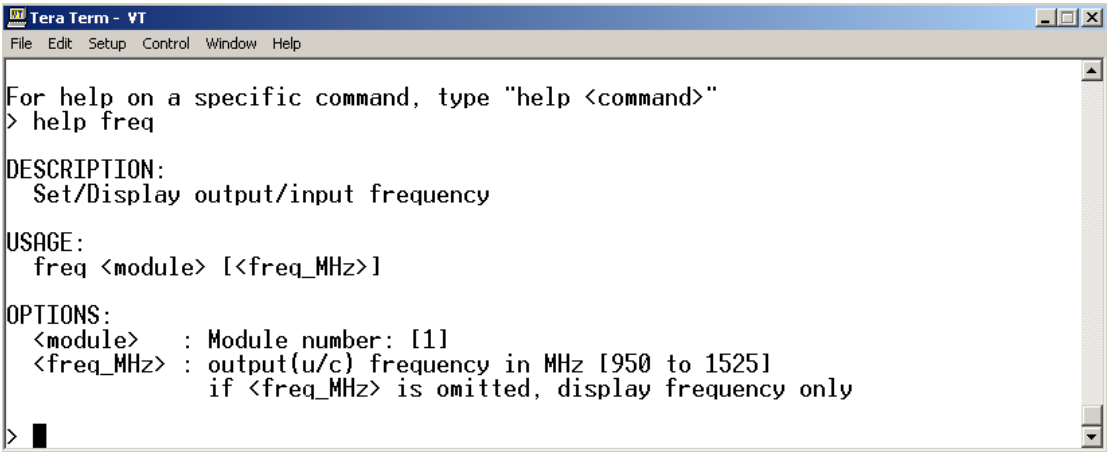
To monitor and control an Up-Converter via the RS-232 interface, start a terminal emulation program and use the commands listed in **TABLE 6** and **TABLE 7**.

**TABLE 6:** RS-232 MONITORING COMMANDS

| Command | Command Description | Option | Option Range |
|---|---|---|---|
| **status** | Display important information on the Up-Converter. | none | N/A |
| **rf** | Display the RF output status (ON or OFF) of the up-converter | none | N/A |
| **freq** | Display the output frequency in L-Band of the up-converter. | none | N/A |
| **gain** | Display conversion gain of the up-converter | none | N/A |
| **baud** *port* | Display baud rate of the selected port | port | rs232, rs485 |
| **address** | Display the NMS address of the Up-Converter | none | N/A |
| **serial** | Display the serial number of the Up-Converter | none | N/A |
| **update** *interval* | Repeatedly display status of Up-Converter at the selected time interval in secs. | interval | off,[1:3600] |
| **reset** | Reset the main controller without service interruption | none | N/A |
| **ver** | Display software version | none | N/A |
| **help** [*command*] | Display usage information on the selected command. If *command* is omitted, a brief description of all commands is given. | command | status, update, rf, freq, gain, baud, address, ver or help |

| **TABLE 7:** RS-232 CONTROL COMMANDS | | | |
|---|---|---|---|
| **Command** | **Command Description** | **Option** | **Option Range** |
| **rf** *module onoff* | Turn ON or OFF the RF output of the selected module | module | rx, tx, buc |
| | | onoff | on or off |
| **freq** *module freq* | Set the input/output frequency in L-Band of the selected module. | module | rx, tx |
| | | freq | model dependant |
| **gain** *module gain* | Set conversion gain of the selected module | module | rx, tx, buc |
| | | gain | model dependant |
| **baud** *port speed* | Set baud rate of the selected port. | port | rs232, rs485 |
| | | speed | 1200, 2400, 4800, 9600, 19200, 28800, 38400, 57600 |
| **address** *addr* | Set the NMS address of the shelf. | addr | [1:15] |
| **reset** | Resets the main control unit without service interruption. | none | N/A |



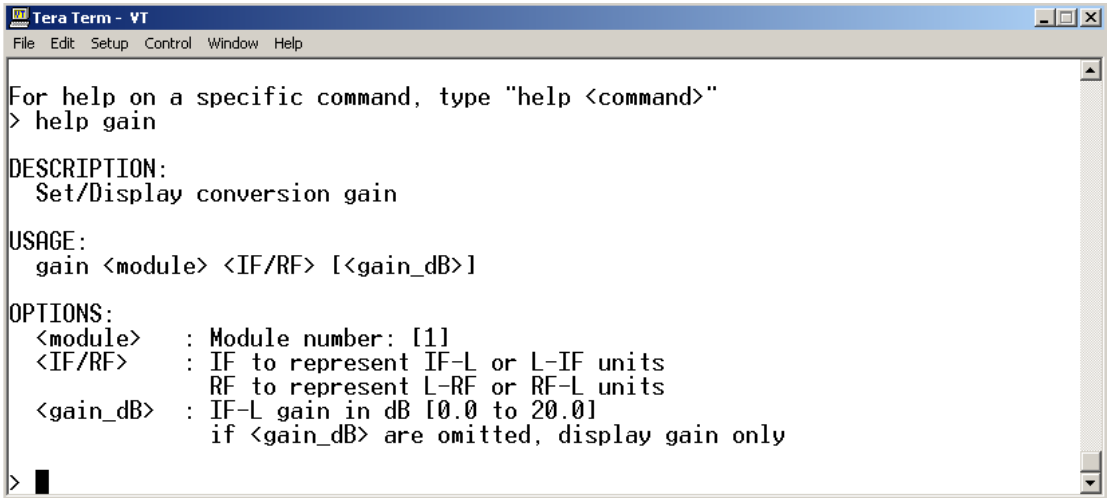




**Figure 7**: RS232 Help Menus

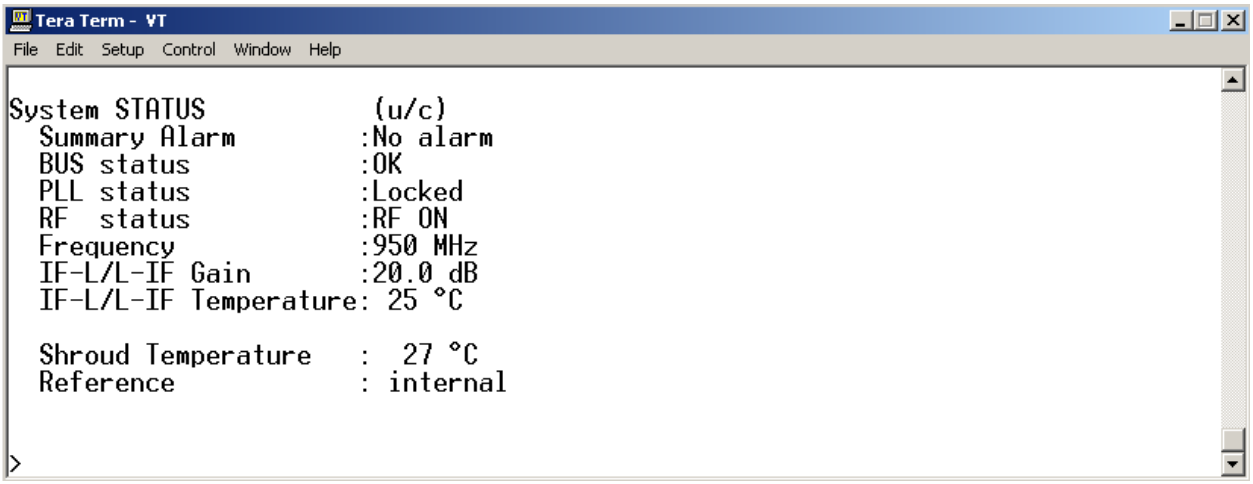



**Figure 8**: RS232 STATUS Command and Response

# 6. MONITORING AND CONTROL BY THE RS-485 INTERFACE

The Advantech Wireless RS-485 interface provides the operator with serial communication between a computer (or a network controller) and a Converter using the RS-485 4-wire standard. It allows the operator to monitor and control important parameters of the system such as alarms, internal temperature and gain. As opposed to the RS-232 interface, the RS-485 serial interface follows a packet-like structure. A detailed description of the protocol is given in **Sections 6.4** and **6.5**.

## 6.1 ELECTRICAL CONNECTION

The RS-485 port of the Converter can be connected to a COM port of a computer using an RS-232/RS-485 4-wire adapter. The RS-485 port uses a DB9 female connector with pin assignment described in **TABLE 8**.

**TABLE 8:** RS-485 INTERFACE – PIN ASSIGNMENT

| Pin Number | Description |
|---|---|
| 1,2,7,8 | Not Connected |
| 3 | RX- |
| 4 | TX- |
| 5 | Ground |
| 6 | TX+ |
| 9 | RX+ |

## 6.2 PORT SETTING

For proper operation, use the following settings:

**TABLE 9:** RS-485 PORT SETTINGS

| Parameter | Setting |
|---|---|
| Baud Rate | 9600 |
| Data Bits | 8 |
| Stop Bit | 1 |
| Parity | None |

## 6.3 PROTOCOL OVERVIEW

The RS-485 interface follows a packet structure. Each packet consists of 7 bytes of information. The packets can be either a command or a response message. The command messages are sent from a personal computer (or from a network controller) to the Converter and the response messages are sent from the Converter to the computer. The computer cannot initiate more than one command every 40 ms.

The Converter will accept a command only if the first byte contains the appropriate address. If the address of the packet does not match the address of the Converter, the command is ignored. The valid address range is from 0x01 to 0x0F. In the response message, the address is shifted left by 4.

The last byte of the packet is a checksum, which is calculated as the sum of byte 1 to 6. If the checksum is incorrect (packet is corrupted), the command is not executed and no response message is sent. If the command number or the command data is invalid, the command is not executed, and no response message is sent. Unused bytes are set to 0xAA.

The following tables show the general structure of the command message and the response message.

| **TABLE 10:** COMMAND MESSAGE FORMAT | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
| Byte 1 | 0x0 | | | | Address | | | |
| Byte 2 | Command Number | | | | | | | |
| Byte 3 | Command Data | | | | | | | |
| Byte 4 | | | | | | | | |
| Byte 5 | | | | | | | | |
| Byte 6 | | | | | | | | |
| Byte 7 | Checksum | | | | | | | |

| **TABLE 11:** RESPONSE MESSAGE FORMAT | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
| Byte 1 | Address | | | | 0x0 | | | |
| Byte 2 | Response Data | | | | | | | |
| Byte 3 | | | | | | | | |
| Byte 4 | | | | | | | | |
| Byte 5 | | | | | | | | |
| Byte 6 | | | | | | | | |
| Byte 7 | Checksum | | | | | | | |

## 6.4 COMMAND MESSAGES

The following table provides a list of the supported commands. All other command numbers are reserved.

**TABLE 12:** LIST OF COMMANDS

| Command | Command Number | Command Format | Expected Response | Response Format |
|---|---|---|---|---|
| Request Status | 0x01 or 0x2A | See **TABLE 13** | Status Message | See **TABLE 35** |
| Set Mute/Unmute | 0x02 | See **TABLE 15** | None | N/A |
| Set Frequency | 0x04 | See **TABLE 17** | None | N/A |
| Set Gain | 0x05 | See **TABLE 19** | None | N/A |
| Read Identification | 0x07 | See **TABLE 21** | Identification Message | See **TABLE 37** |
| Read Serial Number | 0x08 | See **TABLE 23** | Serial Number Message | See **TABLE 39** |
| Read Frequency Range | 0x09 | See **TABLE 25** | Frequency Range Message | See **TABLE 41** |
| Read Gain | 0x0A | See **TABLE 27** | Gain Message | See **TABLE 43** |
| Read Gain Range | 0x0D | See **TABLE 29** | Gain Range Message | See **TABLE 45** |
| Read Frequency | 0x0F | See **TABLE 31** | Frequency Message | See **TABLE 47** |
| Read Temperature | 0x12 | See **TABLE 33** | Temperature Message | See **TABLE 49** |

**NOTE:** To store the frequency, gain, address, and mute/unmute control, the redundant system uses a programmable EEPROM with the endurance limited to 100,000 write/erase cycles. Going beyond this limit may affect the operation of the system. Make sure the "Set" commands (0x02, 0x04, 0x05) are used only when needed.

### 6.4.1 RESQUEST STATUS (0X01 OR 0X2A)

The request status command is used to retrieve the status of the Converter.

| TABLE 13: REQUEST STATUS – MESSAGE FORMAT | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
| Byte 1 | 0x0 | | | | Address | | | |
| Byte 2 | 0x01 | | | | | | | |
| Byte 3 | 0xAA | | | | | | | |
| Byte 4 | 0xAA | | | | | | | |
| Byte 5 | 0xAA | | | | | | | |
| Byte 6 | 0xAA | | | | | | | |
| Byte 7 | Checksum | | | | | | | |

| TABLE 14: REQUEST STATUS – PARAMETER DESCRIPTION | | |
|---|---|---|
| **Parameter** | **Description** | **Value** |
| Address | Address of the Converter | 0x1 to 0xF |
| Checksum | Sum of byte 1 to byte 6 | 0x00 to 0xFF |

### 6.4.2 SET MUTE/UN-MUTE (0X02)

This command is used to mute or un-mute the Converter

| TABLE 15: SET MUTE/UNMUTE – MESSAGE FORMAT | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
| Byte 1 | 0x0 | | | | Address | | | |
| Byte 2 | 0x02 | | | | | | | |
| Byte 3 | RF Output Ctrl | | | | | | | |
| Byte 4 | 0xAA | | | | | | | |
| Byte 5 | 0xAA | | | | | | | |
| Byte 6 | 0xAA | | | | | | | |
| Byte 7 | Checksum | | | | | | | |

| TABLE 16: SET MUTE/UNMUTE – PARAMETER DESCRIPTION | | |
|---|---|---|
| **Parameter** | **Description** | **Value** |
| Address | Address of the Converter | 0x1 to 0xF |
| RF Output Ctrl | Mute or Unmute the RF Output | 0x5A: Mute TX<br>0xA5: Unmute TX<br>0x0F: Mute RX<br>0xF0: Unmute RX |
| Checksum | Sum of byte 1 to byte 6 | 0x00 to 0xFF |

### 6.4.3 SET FREQUENCY (0X04)

This command is used to set the L-Band frequency of the Converter.

| **TABLE 17:** SET FREQUENCY – MESSAGE FORMAT | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
| Byte 1 | 0x0 | | | | Address | | | |
| Byte 2 | 0x04 | | | | | | | |
| Byte 3 | Direction | | | | | | | |
| Byte 4 | Frequency, integer part MSB | | | | | | | |
| Byte 5 | Frequency, integer part LSB | | | | | | | |
| Byte 6 | Frequency, decimal part | | | | | | | |
| Byte 7 | Checksum | | | | | | | |

| **TABLE 18:** SET FREQUENCY – PARAMETER DESCRIPTION | | |
|---|---|---|
| **Parameter** | **Description** | **Value** |
| Address | Address of the Converter | 0x1 to 0xF |
| Direction | RF path direction | 0x5A: TX<br>0xA5: RX |
| Frequency, integer part | Integer part of the L-Band frequency in MHz | Unsigned integer<br>0x0001 to 0xFFFF |
| Frequency, decimal part | Decimal part of the L-Band frequency (in MHz) divided by 0.125 | 0x00 to 0x07 |
| Checksum | Sum of byte 1 to byte 6 | 0x00 to 0xFF |

### 6.4.4 SET GAIN (0X05)

This command is used to set the conversion gain of the Converter.

| **TABLE 19:** SET GAIN – MESSAGE FORMAT | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
| Byte 1 | 0x0 | | | | Address | | | |
| Byte 2 | 0x05 | | | | | | | |
| Byte 3 | Module | | | | | | | |
| Byte 4 | Gain, MSB | | | | | | | |
| Byte 5 | Gain, LSB | | | | | | | |
| Byte 6 | 0xAA | | | | | | | |
| Byte 7 | Checksum | | | | | | | |

| **TABLE 20:** SET GAIN – PARAMETER DESCRIPTION | | |
|---|---|---|
| **Parameter** | **Description** | **Value** |
| Address | Address of the Converter | 0x1 to 0xF |
| Module | Converter Module | 0x01: IF-L Up-Converter<br>0x02: L-IF Down-Converter<br>0x03: L-RF Up-Converter<br>0x04: RF-L Down-Converter |
| Gain | Conversion Gain in 0.1 step | Signed integer<br>0x0000 to 0xFFFF |
| Checksum | Sum of byte 1 to byte 6 | 0x00 to 0xFF |

### 6.4.5 READ IDENTIFICATION (0X07)

This command is used to request the unit type and software version of the Converter.

| **TABLE 21:** READ IDENTIFICATION – MESSAGE FORMAT | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
| Byte 1 | 0x0 | | | | Address | | | |
| Byte 2 | 0x07 | | | | | | | |
| Byte 3 | 0xAA | | | | | | | |
| Byte 4 | 0xAA | | | | | | | |
| Byte 5 | 0xAA | | | | | | | |
| Byte 6 | 0xAA | | | | | | | |
| Byte 7 | Checksum | | | | | | | |

| **TABLE 22:** READ IDENTIFICATION – PARAMETER DESCRIPTION | | |
|---|---|---|
| **Parameter** | **Description** | **Value** |
| Address | Address of the Converter | 0x1 to 0xF |
| Checksum | Sum of byte 1 to byte 6 | 0x00 to 0xFF |

### 6.4.6 READ SERIAL NUMBER (0X08)

This command is used to request the serial number of the Converter.

| **TABLE 23:** READ SERIAL NUMBER – MESSAGE FORMAT | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
| Byte 1 | 0x0 | | | | Address | | | |
| Byte 2 | 0x08 | | | | | | | |
| Byte 3 | 0xAA | | | | | | | |
| Byte 4 | 0xAA | | | | | | | |
| Byte 5 | 0xAA | | | | | | | |
| Byte 6 | 0xAA | | | | | | | |
| Byte 7 | Checksum | | | | | | | |

| **TABLE 24:** READ SERIAL NUMBER – PARAMETER DESCRIPTION | | |
|---|---|---|
| **Parameter** | **Description** | **Value** |
| Address | Address of the Converter | 0x1 to 0xF |
| Checksum | Sum of byte 1 to byte 6 | 0x00 to 0xFF |

### 6.4.7 READ FREQUENCY RANGE (0X09)

This command is used to request the L-Band frequency range of the Converter.

| TABLE 25: READ FREQUENCY RANGE – MESSAGE FORMAT | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
| Byte 1 | 0x0 | | | | Address | | | |
| Byte 2 | 0x09 | | | | | | | |
| Byte 3 | Direction | | | | | | | |
| Byte 4 | 0xAA | | | | | | | |
| Byte 5 | 0xAA | | | | | | | |
| Byte 6 | 0xAA | | | | | | | |
| Byte 7 | Checksum | | | | | | | |

| TABLE 26: READ FREQUENCY RANGE – PARAMETER DESCRIPTION | | |
|---|---|---|
| **Parameter** | **Description** | **Value** |
| Address | Address of the Converter | 0x1 to 0xF |
| Direction | RF path direction | 0x5A: TX<br>0xA5: RX |
| Checksum | Sum of byte 1 to byte 6 | 0x00 to 0xFF |

### 6.4.8 READ GAIN (0X0A)

This command is used to request the conversion gain of the Converter.

| TABLE 27: READ GAIN – MESSAGE FORMAT | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
| Byte 1 | 0x0 | | | | Address | | | |
| Byte 2 | 0x0A | | | | | | | |
| Byte 3 | Module | | | | | | | |
| Byte 4 | 0xAA | | | | | | | |
| Byte 5 | 0xAA | | | | | | | |
| Byte 6 | 0xAA | | | | | | | |
| Byte 7 | Checksum | | | | | | | |

| TABLE 28: READ GAIN – PARAMETER DESCRIPTION | | |
|---|---|---|
| **Parameter** | **Description** | **Value** |
| Address | Address of the Converter | 0x1 to 0xF |
| Module | Converter Module | 0x01: IF-L Up-Converter<br>0x02: L-IF Down-Converter<br>0x03: L-RF Up-Converter<br>0x04: RF-L Down-Converter |
| Checksum | Sum of byte 1 to byte 6 | 0x00 to 0xFF |

### 6.4.9 READ GAIN RANGE (0X0D)

This command is used to request the gain range of the Converter.

| TABLE 29: READ GAIN RANGE – MESSAGE FORMAT | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
| Byte 1 | 0x0 | | | | Address | | | |
| Byte 2 | 0x0D | | | | | | | |
| Byte 3 | Module | | | | | | | |
| Byte 4 | 0xAA | | | | | | | |
| Byte 5 | 0xAA | | | | | | | |
| Byte 6 | 0xAA | | | | | | | |
| Byte 7 | Checksum | | | | | | | |

| TABLE 30: READ GAIN RANGE – PARAMETER DESCRIPTION | | |
|---|---|---|
| **Parameter** | **Description** | **Value** |
| Address | Address of the Converter | 0x1 to 0xF |
| Module | Converter Module | 0x01: IF-L Up-Converter<br>0x02: L-IF Down-Converter<br>0x03: L-RF Up-Converter<br>0x04: RF-L Down-Converter |
| Checksum | Sum of byte 1 to byte 6 | 0x00 to 0xFF |

### 6.4.10 READ FREQUENCY (0X0F)

This command is used to request the L-Band frequency of the Converter.

| **TABLE 31:** READ FREQUENCY – MESSAGE FORMAT | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
| Byte 1 | 0x0 | | | | Address | | | |
| Byte 2 | 0x0F | | | | | | | |
| Byte 3 | Direction | | | | | | | |
| Byte 4 | 0xAA | | | | | | | |
| Byte 5 | 0xAA | | | | | | | |
| Byte 6 | 0xAA | | | | | | | |
| Byte 7 | Checksum | | | | | | | |

| **TABLE 32:** READ FREQUENCY – PARAMETER DESCRIPTION | | |
|---|---|---|
| **Parameter** | **Description** | **Value** |
| Address | Address of the Converter | 0x1 to 0xF |
| Direction | RF path direction | 0x5A: TX<br>0xA5: RX |
| Checksum | Sum of byte 1 to byte 6 | 0x00 to 0xFF |

### 6.4.11 READ TEMPERATURE (0X12)

This command is used to request the hot spot temperature of the Converter.

| **TABLE 33:** READ TEMPERATURE – MESSAGE FORMAT | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
| Byte 1 | 0x0 | | | | Address | | | |
| Byte 2 | 0x12 | | | | | | | |
| Byte 3 | 0xAA | | | | | | | |
| Byte 4 | 0xAA | | | | | | | |
| Byte 5 | 0xAA | | | | | | | |
| Byte 6 | 0xAA | | | | | | | |
| Byte 7 | Checksum | | | | | | | |

| **TABLE 34:** READ TEMPERATURE – PARAMETER DESCRIPTION | | |
|---|---|---|
| **Parameter** | **Description** | **Value** |
| Address | Address of the Converter | 0x1 to 0xF |
| Checksum | Sum of byte 1 to byte 6 | 0x00 to 0xFF |

## 6.5 RESPONSE MESSAGES

### 6.5.1 STATUS MESSAGE

The Status Message is sent after reception of the “Request Status” command (0x01 or 0x2A).

**TABLE 35:** STATUS MESSAGE – MESSAGE FORMAT

| | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
|---|---|---|---|---|---|---|---|---|
| Byte 1 | Address | | | | 0x0 | | | |
| Byte 2 | Reserved | | | | | | | |
| Byte 3 | Reserved | | | | | | | |
| Byte 4 | 0x1 | 0x1 | DCCOM | 0x1 | 0x1 | UCCOM | 0x1 | 0x1 |
| Byte 5 | Power Class | | | | | CKSM | TXPLL | TXST |
| Byte 6 | 0x0 | | | | SAL | UCMD | RXPLL | RXST |
| Byte 7 | Checksum | | | | | | | |

| **TABLE 36:** STATUS MESSAGE – PARAMETER DESCRIPTION | | |
|---|---|---|
| **Parameter** | **Description** | **Value** |
| Address | Address of the Converter | 0x1 to 0xF |
| UCCOM (not applicable) | Internal Communication with Converter | 0: Communication OK<br>1: No communication |
| DCCOM | Internal Communication with Converter | 0: Communication OK<br>1: No communication |
| Power Class | Rated Power in dBm starting from 30dBm. For rated power less than 30 dBm, Power Class is 0. | 0x00 to 0x1F |
| CKSM | Checksum Error in Command | 0: No error<br>1: Error in checksum |
| TXPLL | TX PLL Alarm | 0: PLL Locked<br>1: PLL out-of-lock |
| TXST | TX RF Output Status | 0: RF OFF (muted)<br>1: RF ON (unmuted) |
| SAL | Summary Alarm | 0: No alarm<br>1: Alarm |
| UCMD | Unknown Command | 0: No error<br>1: Unknown Command |
| RXPLL | RX PLL Alarm | 0: PLL Locked<br>1: PLL out-of-lock |
| RXST | RX RF Output Status | 0: RF OFF (muted)<br>1: RF ON (unmuted) |
| Checksum | Sum of byte 1 to byte 6 | 0x00 to 0xFF |

### 6.5.2 IDENTIFICATION MESSAGE

The Identification Message is sent after reception of a "Read Identification" command (0x07).

| **TABLE 37:** IDENTIFICATION MESSAGE – MESSAGE FORMAT | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
| Byte 1 | Address | | | | 0x0 | | | |
| Byte 2 | 0x0 | | | | Reserved | Reserved | DC | UC |
| Byte 3 | 0x0 | | | | Reserved | Reserved | Reserved | SPECTR |
| Byte 4 | Unit Type | | | | | | | |
| Byte 5 | 0xA | | | | 0x0 | Reserved | Reserved | Reserved |
| Byte 6 | Software Version | | | | | | | |
| Byte 7 | Checksum | | | | | | | |

| **TABLE 38:** IDENTIFICATION MESSAGE – PARAMETER DESCRIPTION | | |
|---|---|---|
| **Parameter** | **Description** | **Value** |
| Address | Address of the Converter | 0x1 to 0xF |
| DC | Unit is a Down-Converter | 0: No<br>1: Yes |
| UC | Unit is an Up-Converter | 0: No<br>1: Yes |
| SPECTR | RX spectrum inversion | 0: RX spectrum not inverted<br>1: RX spectrum inverted |
| Unit Type | Type of Frequency Conversion | 0x00: N/A<br>0x01: 70 MHz to L-Band<br>0x02: 70 MHz to C-Band<br>0x03: 70 MHz to Ku-Band<br>0x04: 140 MHz to L-Band<br>0x05: 140 MHz to C-Band<br>0x06: 140 MHz to Ku-Band<br>0x07: L-Band to C-Band<br>0x08: L-Band to Ku-Band |
| Software Version | Software Version of the Converter | 0x01 to 0xFF |
| Checksum | Sum of byte 1 to byte 6 | 0x00 to 0xFF |

### 6.5.3 SERIAL NUMBER MESSAGE

The Serial Number Message is sent after reception of the "Read Serial Number" command (0x08).

| **TABLE 39:** SERIAL NUMBER MESSAGE – MESSAGE FORMAT | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
| Byte 1 | Address | | | | 0x0 | | | |
| Byte 2 | Character 1 | | | | | | | |
| Byte 3 | Character 2 | | | | | | | |
| Byte 4 | Character 3 | | | | | | | |
| Byte 5 | Character 4 | | | | | | | |
| Byte 6 | Character 5 | | | | | | | |
| Byte 7 | Checksum | | | | | | | |

| **TABLE 40:** SERIAL NUMBER MESSAGE – PARAMETER DESCRIPTION | | |
|---|---|---|
| **Parameter** | **Description** | **Value** |
| Address | Address of the Converter | 0x1 to 0xF |
| Character 1 to 5 | ASCII Code of Character 1 to 5 | 0x00 to 0x7F |
| Checksum | Sum of byte 1 to byte 6 | 0x00 to 0xFF |

### 6.5.4 FREQUENCY RANGE MESSAGE

The Frequency Range Message is sent after reception of the "Read Frequency Range" command (0x09).

| **TABLE 41:** FREQUENCY RANGE MESSAGE – MESSAGE FORMAT | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
| Byte 1 | Address | | | | 0x0 | | | |
| Byte 2 | Lowest Frequency, MSB | | | | | | | |
| Byte 3 | Lowest Frequency, LSB | | | | | | | |
| Byte 4 | Direction | | | | | | | |
| Byte 5 | Highest Frequency, MSB | | | | | | | |
| Byte 6 | Highest Frequency, LSB | | | | | | | |
| Byte 7 | Checksum | | | | | | | |

| **TABLE 42:** FREQUENCY RANGE MESSAGE – PARAMETER DESCRIPTION | | |
|---|---|---|
| **Parameter** | **Description** | **Value** |
| Address | Address of the Converter | 0x1 to 0xF |
| Lowest Frequency | Lowest L-Band Frequency in MHz | Unsigned integer<br>0x0000 to 0xFFFF |
| Highest Frequency | Highest L-Band Frequency in MHz | Unsigned integer<br>0x0000 to 0xFFFF |
| Direction | RF Path direction | 0x5A: TX<br>0xA5: RX |
| Checksum | Sum of byte 1 to byte 6 | 0x00 to 0xFF |

### 6.5.5 GAIN MESSAGE

The Gain Message is sent after reception of the "Read Gain" command (0x0A).

| **TABLE 43:** GAIN MESSAGE – MESSAGE FORMAT | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
| Byte 1 | Address | | | | 0x0 | | | |
| Byte 2 | Gain, MSB | | | | | | | |
| Byte 3 | Gain, LSB | | | | | | | |
| Byte 4 | 0xAA | | | | | | | |
| Byte 5 | 0xAA | | | | | | | |
| Byte 6 | 0xAA | | | | | | | |
| Byte 7 | Checksum | | | | | | | |

| **TABLE 44:** GAIN MESSAGE – PARAMETER DESCRIPTION | | |
|---|---|---|
| **Parameter** | **Description** | **Value** |
| Address | Address of the Converter | 0x1 to 0xF |
| Gain | Conversion Gain in 0.1 dB step | Signed integer<br>0x0000 to 0xFFFF |
| Checksum | Sum of byte 1 to byte 6 | 0x00 to 0xFF |

### 6.5.6 GAIN RANGE MESSAGE

The Gain Range Message is sent after reception of the "Read Gain Range" command (0x0D).

| **TABLE 45:** GAIN RANGE MESSAGE – MESSAGE FORMAT | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
| Byte 1 | Address | | | | 0x0 | | | |
| Byte 2 | Lowest Gain, MSB | | | | | | | |
| Byte 3 | Lowest Gain, LSB | | | | | | | |
| Byte 4 | Module | | | | | | | |
| Byte 5 | Highest Gain, MSB | | | | | | | |
| Byte 6 | Highest Gain, LSB | | | | | | | |
| Byte 7 | Checksum | | | | | | | |

| **TABLE 46:** GAIN RANGE MESSAGE – PARAMETER DESCRIPTION | | |
|---|---|---|
| **Parameter** | **Description** | **Value** |
| Address | Address of the Converter | 0x1 to 0xF |
| Lowest Gain | Lowest conversion gain in 0.1 dB step | Signed integer<br>0x0000 to 0xFFFF |
| Highest Gain | Highest conversion gain in 0.1 dB step | Signed integer<br>0x0000 to 0xFFFF |
| Module | Converter Module | 0x01: IF-L Up-Converter<br>0x02: L-IF Down-Converter<br>0x03: L-RF Up-Converter<br>0x04: RF-L Down-Converter |
| Checksum | Sum of byte 1 to byte 6 | 0x00 to 0xFF |

### 6.5.7 FREQUENCY MESSAGE

The Frequency Message is sent after reception of the "Read Frequency" command (0x0F).

| **TABLE 47:** FREQUENCY MESSAGE – MESSAGE FORMAT | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
| Byte 1 | Address | | | | 0x0 | | | |
| Byte 2 | Frequency, integer part MSB | | | | | | | |
| Byte 3 | Frequency, integer part LSB | | | | | | | |
| Byte 4 | Direction | | | | | | | |
| Byte 5 | Frequency, decimal part | | | | | | | |
| Byte 6 | 0xAA | | | | | | | |
| Byte 7 | Checksum | | | | | | | |

| **TABLE 48:** FREQUENCY MESSAGE – PARAMETER DESCRIPTION | | |
|---|---|---|
| **Parameter** | **Description** | **Value** |
| Address | Address of the Converter | 0x1 to 0xF |
| Frequency, integer part | Integer part of the L-Band frequency in MHz | Unsigned integer<br>0x0001 to 0xFFFF |
| Frequency, decimal part | Decimal part of the L-Band frequency (in MHz) divided by 0.125 | 0x00 to 0x07 |
| Direction | RF Path direction | 0x5A: TX<br>0xA5: RX |
| Checksum | Sum of byte 1 to byte 6 | 0x00 to 0xFF |

### 6.5.8 TEMPERATURE MESSAGE

The Temperature Message is sent after reception of the "Read Temperature" command (0x12).

| **TABLE 49:** TEMPERATURE MESSAGE – MESSAGE FORMAT | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
| Byte 1 | Address | | | | 0x0 | | | |
| Byte 2 | Temperature, MSB | | | | | | | |
| Byte 3 | Temperature, LSB | | | | | | | |
| Byte 4 | 0xAA | | | | | | | |
| Byte 5 | 0xAA | | | | | | | |
| Byte 6 | 0xAA | | | | | | | |
| Byte 7 | Checksum | | | | | | | |

| **TABLE 50:** TEMPERATURE MESSAGE – PARAMETER DESCRIPTION | | |
|---|---|---|
| **Parameter** | **Description** | **Value** |
| Address | Address of the Converter | 0x1 to 0xF |
| Temperature | Temperature in $0.1^{o}$ Celsius | Signed integer<br>0x0000 to 0xFFFF |
| Checksum | Sum of byte 1 to byte 6 | 0x00 to 0xFF |

# 7. PRODUCT SPECIFICATIONS

The following specifications characterize the performance of the Advantech Wireless Up-Converter, P/N 170-705000-201.

**TABLE 51:** PRODUCT SPECIFICATIONS

| | |
|---|---|
| Input Frequency | 70 ± 18 MHz |
| Output Frequency | 950 – 1525 MHz (1 MHz step) no spectrum inversion |
| Frequency Adjustment Step | 1 MHz |
| Conversion Gain | 20 ± 1 dB @ +23 °C and 1350 MHz |
| Gain Adjustment Range | 20 dB (from 0.0 dB to +20.0 dB) |
| Gain Adjustment Step | 0.1 dB |
| Frequency Response Flatness | 2.0 dB p-p, max (over 36 MHz) |
| Input Return Loss | 16 dB, min |
| Output Return Loss | 16 dB, min |
| Input Power Level | -40 to -10 dBm |
| Output Power ($P_{1dB}$) | +5 dBm, min |
| In band Spurious | -55 dBm @ $P_{out}$ = 0 dBm, G = 20 dB |
| Third Order Intermodulation (two equal tones 5 MHz apart) | - 40 dBc, max @ SCL 13 dB back-off ($P_{out\ total}$ = -5 dBm) |
| Phase Noise @ offset 100 Hz<br>1 kHz<br>10 kHz<br>100 kHz | -63 dBc/Hz<br>-73 dBc/Hz<br>-83 dBc/Hz<br>-93 dBc/Hz |
| Internal Reference Frequency | 10 MHz |
| External 10 MHz Reference (optional) | 10 MHz sine wave, -3 dBm to +3 dBm |
| IF Input Port | BNC (f) 50 Ω |
| RF Output Port | N-type (f) 50 Ω |
| RS-232 Interface | D-sub 9 (f) |
| RS-485 Interface | D-sub 9 (f) |
| Relay Interface | D-sub 9 (f) |
| Power Connector | IEC 60320 10 amp |
| Power Consumption | 40 Watt typical |
| Panel Height | 1 RU of 19” rack |

# 8. PACKING LIST

| **TABLE 52:** PACKING LIST (SHIPPING KIT P/N 195-705000-201) | | | |
|---|---|---|---|
| **Item** | **Quantity** | **Description** | **Part #** |
| **1.** | 1 | Installation and Operating Manual | PM 170-705000-201 Rev. 2n |
| **2.** | 1 | Up-Converter 70 MHz ± 18 MHz to L-Band model ARUN-70L | 170-705000-201 |
| **3.** | 3 | Connector D-Sub 9 Sold Cup Plug | 631-871380-003 |
| **4.** | 3 | Connector D-Sub 9 Backshell Plastic with Thumb Screws | 631-925380-001 |
| **5.** | 1 | 3-Cond IEC 320 M/F Power Cord 10A 250V, 2.5-3 m long | 670-315008-001 |
| **6.** | 1 | Slide Non-pivoting 124 C-300-SRC Solid Bearing (optional, delivered if ordered separately) | 815-300124-002 |

# 9. APPENDIX A: SAFETY AND EMC COMPLIANCE

Advantech Wireless products are compliant with following standards:

**SAFETY:** IEC 60950-1 second edition 2005

**EMC:** EN301489-1 2004 (EMC for radio equipment and services, common technical requirements):

EN 55022: 1998 / A1: 2000 - Class A
EN61000-4-4 Transient/burst 0.5kV Signal Lines, 1 kV Power Lines
EN61000-4-2 Electrostatic discharge 4kV CD, 8 kV AD
EN61000-4-5 Surge 1kV, 0.5 kV
EN61000-4-11 AC port dips 70%, 40%, 0%
EN 61000-4-3 Radiated Immunity 80-1000 MHz @ 3 V/m

**SUPPLEMENTARY INFORMATION:**

The products herewith comply with the requirements of the Low Voltage Directive 73/23/EEC and of the EMC Directive 89/336/EEC and may carry the CE-marking accordingly.