AGILE MMDS UPCONVERTER MA4061

POWER AMPLIFIER MA4070B

INSTALLATION AND OPERATION GUIDE
FOR SYSTEM OPERATORS

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WaveCom's Corporate Mandate

is to be a leading worldwide designer and manufacturer of state-of-the-art communications equipment and components. Through the remarkable success of our customers and business partners, WaveCom innovations are achieving this goal.

SAFETY PRECAUTIONS

1. Before installing and operating this equipment, read all Safety, Installation and Operating sections. Retain this manual for future reference.

2. Follow all instructions — Failure to do so may result in damage to the unit or severe personal injury.

3. Servicing should not be attempted by the user. There are no user serviceable parts inside. Refer all servicing to factory qualified personnel.

4. Shock Hazard — An electrical shock hazard exists when the chassis cover is removed as is required to set internal controls. Always disconnect power from the unit before removing the cover.

5. Cleaning — Do not use liquid or aerosol cleaners. Use a damp cloth for cleaning.

Warning Do not work on the system or connect or disconnect cables during periods of lightning activity.

LES PRÉCAUTIONS DE SÉCURITÉ

1. Avant d'installer ou d'opérer cet équipement, lisez, toutes les sections de sécurités, d'installations et d'opérations. Gardez ce manuel comme source de référence.

2. Suivez toutes instructions - si non, vous risquez d'endommager la machine ou de vous blesser sérieusement.

3. N'essayez, pas de réparer cet équipement vous même. Référez toutes revisions nécessaire au personnel qualifié de la manufacture.

4. Risque de choc - Il y a un risque de décharge électrique qui existe quand la couverture du châssis est enlevée, comme est nécessaire pour ajuster les contrôlcs internes. Il faut toujours couper l'électricité avant d'enlever le couvercle pour faire aucun ajustage.

5. Le nettoyage - n'utilisez pas de nettoyeurs aérosols ou liquides. Utilisez un tissu humide pour nettoyer.

Attention Ne pas travailler sur le système ni brancher ou débrancher les câbles pendant un orage du foudre.

☛ Important Installation Instructions

☛ Caution: To comply with FCC RF exposure requirements in section 1.1307, any antenna which is connected to an MA4061/MA4070 requires a minimum distance of 1.5 meters between it and all persons.

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1.0 GENERAL INFORMATION

1.1 System Overview

The **MA4061B** is a fully agile commercial quality IF upconverter for MMDS and LMDS applications. Advanced design permits full frequency agility over the 2500 to 2686 MHz frequency band while still maintaining a phase noise specification which exceeds the requirement of 64 QAM. The MA4061B is a modular circuit card designed for use with the WaveCom MA4000 Series. The **MA4070B** is a solid state, fixed gain power amplifier for MMDS applications. Each MA4000 card chassis with common MA4010 power supply can contain up to 2 MA4061B independent frequency agile upconverters, and complementing MA4070B Power Amps in a 4U rack mount configuration. Up to 10 MA4061B's can also be configured in a MA4000 chassis. This advanced cost effective upconverter offers high performance, flexibility and space efficiency.

1.2 MA4061B Module Features

- Front panel selectable output frequency from 2500 to 2686 in 62.5 kHz steps
- RF output muted when changing output configuration or phase lock alarm
- High reliability, state of the art design using microstrip MMIC and surface mount technology; conservative component derating and 100% burn in help ensure reliable operation
- Low power consumption
- Input IF AGC ensures very stable output level, even if input varies

1.3 MA4070B Module Features

- FCC emission mask approved for 31.5 dBm RF output
- 1.41W linear transmit power for 64 QAM modulation
- May be operated with video
- High reliability, state of the art design using microstrip MMIC and surface mount technology; conservative component derating and 100% burn in help ensure reliable operation
- Low power consumption

1.4 System Features

- Local control via LCD and 4 soft touch push buttons
- Remote frequency and level agile via RS232/RS485
- Fully phase locked synthesized oscillators referenced to a TCXO for exceptional frequency stability
- Durable design is reflected in the stainless steel chassis and lexan labels
- International internal switching power supply (100 to 240 VAC)
- Front panel displays IF/RF power

1.5 Specifications

IF INPUT - MA4061B

IF Frequency (center of the band)	44.00 MHz
Channel Pass Band	6 MHz (custom BW possible)
IF Input Level	25 to 35 dBmV (total power)
Impedance	75 ohm
IF AGC	enable/disable

RF OUTPUT - MA4061B

Output Frequency Range	2500 to 2686 MHz
Frequency Step Size	62.5 kHz
Output Level	-15 dBm to 3 dBm (adjustable)
Frequency Response (Over any 5 MHz band)	±0.5 dB
Spurious Products (2500 to 2686 MHz)	-60 dBc
Frequency Stability (10 to 40°C)	±3 kHz (MA4010 TCXO 1 ppm)
C/N In Band	-60 dBc (4 MHz BW)
Phase Noise	-94 dBc/Hz at 10 kHz offset
Output Return Loss (2500 to 2686 MHz)	-20 dB

MA4070B

Output Frequency	2500 to 2600 MHz
	(any 100 MHz band available from 2500 to 2700 MHz)
Output Power	FCC emission mask approved for 31.5 dBm
Gain	34 dB ±2 dB, fixed
Gain Stability	±0.5dB (10 to 40° C)
Gain Flatness	±0.3 dB over 6 MHz
Mute Level	-60 dBc
Spurious	
Inband	-55 dBc
Out of Band	-55 dBc
Sync Pulse Compression	2 IRE max (analog video, 7 W)
Spectral Sideband Regrowth	-35 dBc max (64 QAM, 2 W)
Input Impedance	50 ohm
Output connector	N female
Front Panel Indicators	DC Power, RF High, RF Low, High Reverse Power

MISCELLANEOUS

Remote Control Interface	RS232/RS485
Remote Control Connector	RJ45 (in and out)
Operating Temperature	10 to 40°C (50 to 104°F)
IF Input Connector	F female (75 ohm)
RF Output Connector	SMA female (50 ohm)
MA4010 Power Supply	100 to 240 VAC; 50/60 Hz
Shipping Weight	
MA4000 chassis with MA4010 PS	18 lbs. (8.2 kg)
MA4061 Modulator Card (each)	1.2 lbs. (0.6 kg)
MA4070B Power Amplifier Module (each)	6.2 lbs. (2.8 kg)
Dimensions (MA4000 chassis)	19" (w) x 13.7" (d) x 7" (h) (48.3 x 34.8 x 17.8 cm)
Mounting (MA4000 chassis)	Standard 19" rack - 4U (7.0")

OTHER FEATURES

Local and Remote Control
RF Output Muting with Visual Indicator

OPTIONS

MA4070B	Power/Control Module (MA4011D and/or MA4012D)
FP1 - Frequency Plan 2.5 GHz to 2.6 GHz	2R1 - Additional PS4011D (100 to 240 VAC) Power Supply Module
FP2 - Frequency Plan 2.6 GHz to 2.7 GHz	2R2 - Additional PS4012D (-48 VDC) Power Supply Module

Chassis
8F1 - Front Intake - Fan Tray

Specifications subject to change without notice.

2.0 INSTALLATION

2.1 Unpacking the Unit

Carefully remove the equipment from its packing material and set it on a solid surface, such as a table or desk. If it appears damaged in any way, notify the carrier, and keep all packing materials for inspection by the carrier's agent.

2.2 Operating Environment

The MA4001B chassis includes an active cooling fan tray which forces cooling air from the bottom through to the top of the chassis. (See options (p 8) for selection of front air intake – rear air intake is factory default). For adequate ventilation, a space of 1U (1.75") should be left in the rack, directly above the MA4001B chassis for warm air exhaust. It is designed to operate at temperatures ranging from 10 to 40°C (50 to 104°F). As with all electrical equipment, operation at excessive temperature accelerates the deterioration of components. For this reason, measures should be taken to prevent the build up of excessive heat in the rack.

2.2.2 Antenna Requirements

The MA4070B is used with a user-supplied antenna. Please consult table 2.2A for further information. Mount the antenna according to the manufacturer's instructions.

TABLE 2.2A: ANTENNA LIST

Transceiver Power		Antenna Type	Antenna Gain	Safe Distance
(Watts)	(dBm)		(dBi)	(meters)
1.41	31.5	Omni	10	0.3353
1.41	31.5	Omni	15	0.5962
1.41	31.5	Cardioid Horizontal	20	1.0602
1.41	31.5	Cardioid Vertical	20	1.0602

A self-adhesive RF exposure label is supplied with each MA4070B unit for the user to affix to their antenna. To operate the MA4070B in compliance with FCC regulations, you must apply the included label on to the antenna. Peel off the protective backing from the label and affix it to the front of the antenna such that the label is readable from a distance of 3 feet.

☛ **Caution:** To comply with FCC RF exposure regulations in section 1.1307, a minimum separation distance of 1.5 meters is required between this antenna and all persons.

2.3 Power Requirements

The equipment has an international auto-ranging internal power supply which allows it to be powered from any 100 to 240 VAC; 50 to 60 Hz source.

Check the total current consumption of all equipment on the same line before applying power to the MA4000B system. Avoid sharing an AC source that feeds heavy motors or other equipment, which require large current drains.

2.4 Rack Mounting

The MA4000 system is designed for standard rack mounting in a 19" equipment rack. It requires 4U (7.00") of vertical rack space. It should be installed in a rack allowing access to the back of the unit. The upconverter should be isolated from strong RF radiation emanating from local equipment in the rack. Power line transients that may cause damage to the unit should be avoided.

2.5 Module Installation/Replacement

1. Power off the chassis using the rear panel AC switch

2. Disconnect the RF cables from the rear of the corresponding module

3. Using a screwdriver, loosen the corresponding front panel captive screws until the module is free to pull forward

4. Insert the replacement module and retighten the front panel captive screws

5. Turn on the AC power switch

6. Configure the output frequency and configure IF/RF levels

7. Reconnect the rear panel RF cables

3.0 OPERATION

3.1 Front Panel Description

<u>DIAGRAM 3.1A : FRONT PANEL – MA4200 SYSTEM</u>
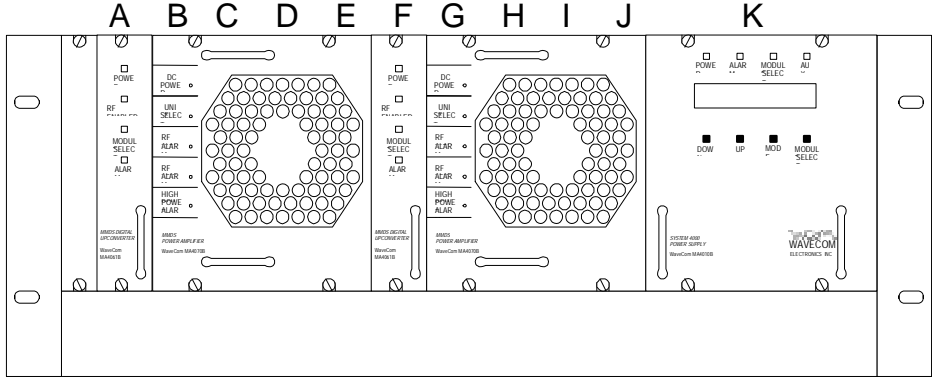
As shown in Diagram 3.1A, the power/control module front panel has an LCD display, four soft touch push buttons, and 4 indicator LEDs. All other modules have 4 indicator LEDs. Modules are configured using push buttons on the power supply module, or via the remote interface. If no configuration adjustments are being made via the front panel controls, the display back light will shut off after a five minute time out. Pressing any of the front panel buttons will re-enable the back light.

3.1.1 MA4010B Power/Control Module

<u>DIAGRAM 3.1B : FRONT PANEL – MA4010B</u>
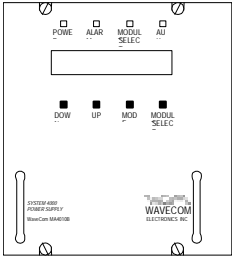
<u>DISPLAY</u>

<u>The first line on the display</u> is the Mode Information Line. It shows the settings for the currently selected module. The possible operating modes depend upon the currently selected module (See Section 3.2, Front Panel Operating Modes (pp 15 to 17) for a detailed description of the available modes).

<u>The second line on the display</u> is the Status Information Line. The Status Line is divided as follows:

The two leftmost characters are "mX" where X is replaced by the currently selected module address. The module addresses are assigned starting with module A in the leftmost slot in the chassis and module K in the Power Supply. The modules in between are lettered B through J. When used with the MA4070B Power Amp Modules, the MA4061B Upconverter Modules can only be installed in slots A and F. The MA4070B Power Amp Modules can only be installed in slots B thru E and slots G thru J (as shown in Diagram 3.1A).

The next two characters are "sXX" where "XX" indicate the status code for the currently selected module. Refer to Section 5.0, Status Codes (pp 23 to 25) for a list of current status codes.

The next two characters are "eXX" where "XX" indicates the error code for the currently selected module. (This code is only displayed when it is non-zero). Refer to Section 6.0, Error Codes (pp 27 to 29) for the list of current error codes.

The final three characters indicate if local front panel control of the MA4001B chassis is enabled ("L/R") or disabled ("_R_"). Remote control of the chassis is always available.

MODULE SELECT BUTTON
The MODULE SELECT button allows the user to select the module to display and/or control (the MODULE SELECT LED will be lit on the selected module, and the LCD display will indicate the module address in the status line).

MODE BUTTON
The MODE button allows the user to cycle through each of the various modes for the selected module.

UP/DOWN BUTTONS
The UP/DOWN arrow buttons adjust the settings for the currently selected mode of the selected module.

POWER ON LED
When the green POWER ON indicator is illuminated, the module has been correctly installed and powered on.

ALARM LED
A constant Alarm LED on the MA4010B indicates a critical alarm condition. Detailed alarm information is available by selecting the module from the front panel and observing the status and error codes on the LCD display.

MODULE SELECT LED
When the green MODULE SELECT indicator is illuminated, it indicates that the corresponding module has been selected from the front panel or via the remote control interface.

AUX LED
This LED is reserved for future use.

3.1.2 MA4061B – Upconverter Card

DIAGRAM 3.1C : FRONT PANEL – MA4061B
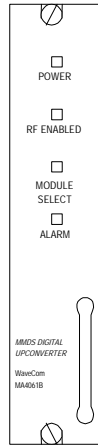
POWER

RF ENABLED

MODULE
SELECT

ALARM

MMDS DIGITAL
UPCONVERTER

WaveCom
MA4061B

POWER ON LED

When the green POWER ON indicator is illuminated, the module has been correctly installed and powered on.

RF ENABLED LED

When the green RF ENABLED indicator is illuminated, the internal output circuitry is enabled to provide an RF output. The RF ENABLED indicator does not necessarily indicate the presence of an output, it only reflects that the module is capable of an RF output if an IF input is applied and the levels configured.

MODULE SELECT LED

When the green MODULE SELECT indicator is illuminated, it indicates that the corresponding module has been selected from the front panel or via the remote control interface.

ALARM LED

The red MA4061 ALARM indicator has two modes. A flashing Alarm LED indicates a non-critical alarm condition (i.e. soft alarm). A constant Alarm LED indicates a critical alarm condition (i.e. hard alarm). Detailed alarm information is available by selecting the corresponding module from the front panel and observing the status and error codes on the LCD display.

3.1.3 MA4070B – Power Amplifier

<u>DIAGRAM 3.1D : FRONT PANEL – MA4070B</u>
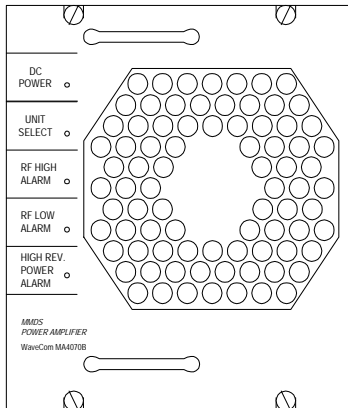
<u>DC POWER LED</u>

When the green DC POWER indicator is illuminated, the module has been correctly installed and powered on.

<u>UNIT SELECT LED</u>

When the green UNIT SELECT indicator is illuminated, the corresponding module has been selected from the front panel or via the remote control interface.

<u>RF HIGH ALARM LED</u>

When the RF HIGH ALARM LED is illuminated, detected power levels have exceeded acceptable limits. Limits will depend on whether default or custom thresholds are set.

<u>RF LOW ALARM LED</u>

When the RF LOW ALARM LED is illuminated, detected power levels have exceeded acceptable limits. Limits will depend on whether default or custom thresholds are set.

<u>HIGH REV POWER ALARM LED</u>

When the HIGH REV POWER ALARM LED is illuminated, detected power levels have exceeded acceptable limits. Limits will depend on whether default or custom thresholds are set.

3.2 Front Panel Operating Modes

3.2.1 MA4061 Upconverter Modes

FREQUENCY

When this mode is selected, the display will read: **Frq XXXX.XXXX MHz**

The displayed frequency is the current configured Output Frequency. To adjust the output frequency, use the UP/DOWN arrow buttons. Single stepping will allow 62.5 kHz adjustment, while holding the buttons depressed will change the frequency more quickly.

☞   The displayed frequency represents the center of the band.

☞   During frequency change, the output is muted and the RF ENABLED indicator is turned off for 5 seconds to avoid undesirable interference.

AUTO IF

When this mode is selected, the display will read: **IF AGC Enabled**

                                                            or

                                                            IF AGC Disabled

Pressing the Up or Down buttons will toggle the display between Enabled and Disabled. When enabled, the MA4061 will automatically optimize the IF level and ensure it is within a pre-set threshold range (default ±0.5 dB). When disabled, the IF level can be manually adjusted as described in the next section.

☞   The Auto IF mode should only be used for continuous IF inputs (non-bursty).

☞   If the IF level is not within ±4.0 dB of the optimum level during Auto IF mode, the output will be muted to avoid undesirable interference, and the Alarm LED will be on.

☞   At the time of shipping, the AUTO IF is enabled.

IF LEVEL ADJUST

When this mode is selected, the display will read: **IFPwr ±XX.X dB**

The display indicates the approximate IF power level measured at the internal IF power detector. To adjust the IF level, use the UP/DOWN arrow buttons. To configure the MA4061 Upconverter for optimum performance, the IF level should be adjusted to read approximately 0.0 dB (-0.5 to +0.5). An IF level less than 0 dB will degrade noise performance and a level above 0 dB will promote intermodulation products.

☞   The IF level can only be adjusted if the Auto IF mode is disabled.

RF OUTPUT LEVEL ADJUST

When this mode is selected, the display will read: **RFPwr ±XX.X dBm**

The display indicates the approximate RF output power level measured by the internal RF power detector. To adjust the RF level, use the UP/DOWN arrow buttons. The RF output level may be set within the range of -15 dBm to +3 dBm.

☞   Ensure that the IF level is correctly set before adjusting the RF level.

OUTPUT ENABLE/DISABLE

When this mode is selected, the display will read: **Output Enabled**

or

Output Disabled

Pressing the Up or Down buttons will toggle the display between Enabled and Disabled. When enabled, the RF output from the MA4061 Upconverter is enabled. When disabled, the RF output from the MA4061 Upconverter is disabled.

☞ An RF output is only present when there is a valid IF input configured as described in the previous sections. This means that at the time of shipping, the output is disabled until a valid input is applied.

IF AND RF ALARM THRESHOLD SETTING

The IF and RF alarm threshold can be configured by the user via remote control.

Default settings are as follows: **IF +4, -4 dB, alarm function enabled**

RF -15, +4 dBm, alarm function enabled

The IF and RF alarms can be independently enabled or disabled via remote control. Refer to Section 7.5, Detailed Command Descriptions and System Responses (pp 34 to 40) for instructions on how to adjust these settings.

DEFAULT SETTINGS

At the time of shipping from factory, the default settings of the MA4061 are:

AUTO IF AGC enabled

IF & RF Thresholds enabled

Output is disabled (until a vaild input is supplied)

The default status code at the time of shipping is s0E. Once a valid input is applied, this status will change.

3.2.2 MA4070 Upconverter Modes

FORWARD POWER ADJUST

When this mode is selected, the display will read: **Fwd Pwr XX.X dB**

The display indicates the approximate RF power level measured before the output. To adjust the RF level, use the UP/DOWN arrow buttons. The RF output level may be set within the range of +20 dBm to +40 dBm.

☞ The RFlevel can only be adjusted if a MA4061 is in the preceding slot

REVERSE POWER

When this mode is selected, the display will read: **Rev Pwr XX.X dBm**

The display indicates the approximate RF power level returned to the card from mismatched connections, etc. The detector measures from +20dBm to +40dBm

OUTPUT ENABLE/DISABLE

When this mode is selected, the display will read: **Output Enabled**

or

Output Disabled

Pressing the Up or Down buttons will toggle the display between Enabled and Disabled. When enabled, the RF output from the MA4070 Power Amplifier is enabled. When disabled, the RF output from the MA4070 Power Amplifier is disabled.

☞ An RF output is only present when there is a valid IF input configured as described in the previous sections. This means that at the time of shipping, the output is disabled until a valid input is applied.

FORWARD AND REVERSE ALARM THRESHOLD SETTING

The IF and RF alarm threshold can be configured by the user via remote control.

Default settings are as follows:	**ForwardHigh**	**+41 dB, alarm function enabled**
	ForwardLow	**+20 dB, alarm function enabled**
	ReverseHigh	**+40 dBm, alarm function enabled**

The alarms can be independently enabled or disabled via remote control. Refer to Section 7.5, Detailed Command Descriptions and System Responses (pp 34 to 40) for instructions on how to adjust these settings.

3.2.3 MA4010B Power/Control Module Modes

ADDRESS

When this mode is selected, the display will read: **Address XXX**

☞ The displayed address is the currently selected MA4001B chassis Address. A different address can be selected by pressing the Up or Down buttons. The MA4001B chassis has an address from 001 - 999. The address is only used for remote control and monitoring purposes. The factory default address is 999.

RS232/RS485 SELECT

When this mode is selected, the display will read: **RS232 Selected**
or
RS485 Selected

Pressing the Up or Down buttons will toggle the display between RS232 and RS485.

☞ The Remote Interface Connector Pinout will change depending upon the Interface Type selected. Please refer to Section 4.1, Power/Control Module Rear Panel Connection (pp 19, 20) for details.

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MA4061/MA4070 Manual; MAN1L2301 Rev03 (Mar 2002)
Approved: R. L.

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3.3 Remote Control Operating Instructions

The MA4000 system may be controlled via the RS232/RS485 Remote Interface connector. (Refer to Section 4.1, Power/Control Module Rear Panel Connections (pp 19, 20) for the connector pin-out).

The input data rate can be 9600, 14400, or 28800 baud. The MA4000 System Controller will automatically determine which data rate is in use and adjust accordingly. There are no user settings relating to baud rate selection.

For additional information refer to Section 7.0, Detailed Remote Control (pp 31 to 41).

4.0 REAR PANEL CONNECTIONS
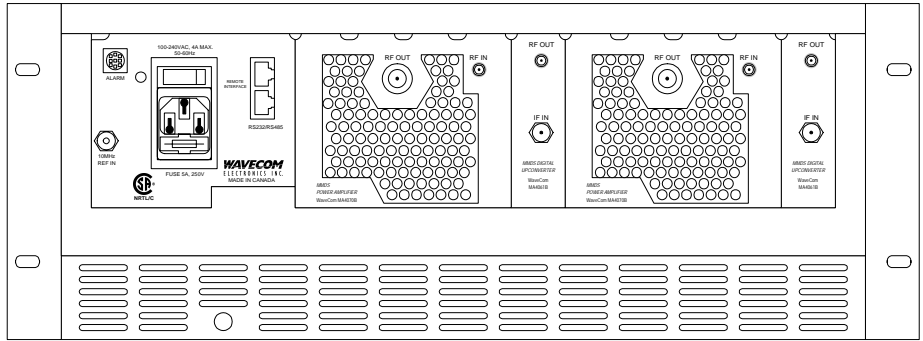
4.1 MA4010B - Power/Control Module

DIAGRAM 4.1A : REAR PANEL – MA4010B
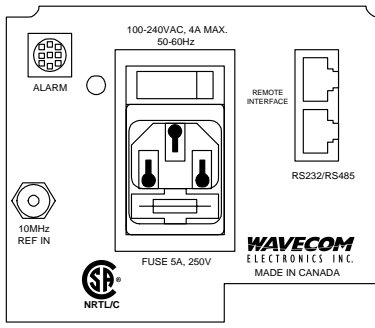
AC INPUT

The AC input accepts input voltages from 100 to 240 VAC. The fuse is internal to the IEC holder. If the fuse requires replacement, ensure the voltage and current rating is correct. The AC power switch may be used for turning the power on and off to the entire chassis.

10 MHZ REF IN

If this option is installed, it will allow the user to use an external 10 MHz reference. When a signal of the specified level is present, it will override the internal reference and automatically use the external reference.

ALARM

This connector is reserved for future use.

REMOTE INTERFACE

The Remote Interface connector is a dual RJ45. Both sockets in the connector are identical. The pin-out for the matching RJ45 plug is shown in the following table and diagram:

DIAGRAM 4.1B : RJ45 PLUG CONNECTIONS
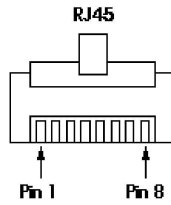
TABLE 4.1A : RS232 PIN-OUT

Terminal				Upconverter
RJ45 Pin	**Signal**	**Direction**	**Signal**	**RJ45 Pin**
1	CTS	←	CTS	1
2	DSR	←	DSR	2
3	RXD	←	TXD	3
4	RXD/GND	—	RXD/GND	4
5	TXD/GND	—	TXD/GND	5
6	TXD	→	RXD	6
7	DTR	→	DTR	7
8	RTS	→	RTS	8

☛ **Note:** The above pin-out allows a straight through RJ45 cable to be used for connection between the terminal and the MA4001B chassis. It is also possible to use an RJ45 - DB25 adapter to connect to a PC or similar RS232 standard serial port.

TABLE 4.1B: RS485 PIN-OUT

Terminal				Upconverter
RJ45 Pin	**Signal**	**Direction**	**Signal**	**RJ45 Pin**
1	NC		NC	1
2	NC		NC	2
3	A	↔	A	3
4	GND	—	GND	4
5	GND	—	GND	5
6	B	↔	B	6
7	NC		NC	7
8	NC		NC	8

☛ **Note:** The above pin-out allows connection to an RS485 communications bus. If desired, an RS485 - RS232 converter and an RJ45 - DB25 adapter can be used to connect to a PC or similar RS232 serial port.

4.2 MA4061B - MMDS Upconverter Card
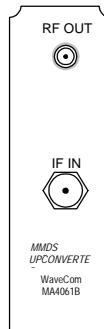
RF OUT

The RF out SMA connector provides the RF output signal from 2500 to 2686 MHz with a level of -15 to 4 dBm. The impedance is 50 ohm.

IF IN

The IF Input F connector accepts an input signal at 44 MHz with up to a 6 MHz bandwidth from a 75 ohm source. The level should be from +25 to +35 dBmV.

4.3 MA4070B - Power Amplifier
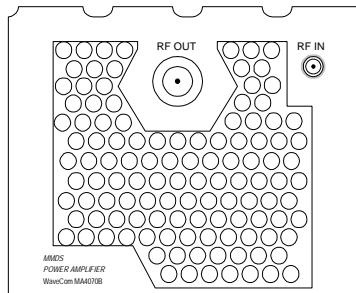
RF OUT

The RF output N connector provides the RF output signal from 2500 to 2600 MHz or 2600 to 2686 MHz. The impedance is 50 ohm.

RF IN

The RF Input SMA connector accepts an input signal at 2500 to 2686 MHz with up to a 6 MHz bandwidth from a 50 ohm source.

5.0 STATUS CODES

5.1 MA4061B Status Codes

The status code is displayed on line 2 of the LCD display. It consists of an 's' character followed by a 2 digit hexadecimal number. The following tables can be used to interpret the meaning of the digits.

TABLE 5.1A: MOST SIGNIFICANT DIGIT DESCRIPTION

Digit	Description	Digit	Description
0	None	8	Reserved
1	Backup Relay Enabled	9	Reserved
2	Reserved	A	Reserved
3	Reserved	B	Reserved
4	Reserved	C	Reserved
5	Reserved	D	Reserved
6	Reserved	E	Reserved
7	Reserved	F	Reserved

TABLE 5.1B: LEAST SIGNIFICANT DIGIT DESCRIPTION

Digit	Description
0	None
1	Output is disabled
2	IF AGC is enabled
3	IF AGC is enabled, Output is disabled
4	IF Threshold Detection is enabled
5	IF Threshold Detection is enabled, Output is disabled
6	IF Threshold Detection is enabled, IF AGC is enabled
7	IF Threshold Detection is enabled, IF AGC is enabled, Output is disabled
8	RF Threshold Detection is enabled
9	RF Threshold Detection is enabled, Output is disabled
A	RF Threshold Detection is enabled, IF AGC is enabled
B	RF Threshold Detection is enabled, IF AGC is enabled, Output is disabled
C	RF Threshold Detection is enabled, IF Threshold Detection is enabled
D	RF Threshold Detection is enabled, IF Threshold Detection is enabled, Output is disabled
E	RF Threshold Detection is enabled, IF Threshold Detection is enabled, IF AGC is enabled
F	RF Threshold Detection is enabled, IF Threshold Detection is enabled, IF AGC is enabled, Output is disabled

5.2 MA4070B Status Codes

The status code is displayed on line 2 of the LCD display. It consists of an 's' character followed by a 2 digit hexadecimal number. The following tables can be used to interpret the meaning of the digits.

TABLE 5.2A: MOST SIGNIFICANT DIGIT DESCRIPTION

Digit	Description	Digit	Description
0	None	8	Reserved
1	Reserved	9	Reserved
2	Reserved	A	Reserved
3	Reserved	B	Reserved
4	Reserved	C	Reserved
5	Reserved	D	Reserved
6	Reserved	E	Reserved
7	Reserved	F	Reserved

TABLE 5.2B: LEAST SIGNIFICANT DIGIT DESCRIPTION

Digit	Description
0	None
1	Output is disabled
2	Forward Power High Threshold Detection is enabled
3	Forward Power High Threshold Detection is enabled, Output is disabled
4	Forward Power Low Threshold Detection is enabled
5	Forward Power Low Threshold Detection is enabled, Output is disabled
6	Forward Power Low Threshold Detection is enabled, Forward Power High Threshold Detection is enabled
7	Forward Power Low Threshold Detection is enabled, Forward Power High Threshold Detection is enabled, Output is disabled
8	RF Threshold Detection is enabled
9	RF Threshold Detection is enabled, Output is disabled
A	RF Threshold Detection is enabled, Forward Power High Threshold Detection is enabled
B	RF Threshold Detection is enabled, Forward Power High Threshold Detection is enabled, Output is disabled
C	RF Threshold Detection is enabled, Forward Power Low Threshold Detection is enabled
D	RF Threshold Detection is enabled, Forward Power Low Threshold Detection is enabled, Output is disabled
E	RF Threshold Detection is enabled, Forward Power Low Threshold Detection is enabled, Forward Power High Threshold Detection is enabled
F	RF Threshold Detection is enabled, Forward Power Low Threshold Detection is enabled, Forward Power High Threshold Detection is enabled, Output is disabled

5.3 MA4010B Power/Control Module Status Codes

The status code is displayed on line 2 of the LCD display. It consists of an 's' character followed by a 2 digit hexadecimal number. The following tables can be used to interpret the meaning of the digits.

TABLE 5.3A: MOST SIGNIFICANT DIGIT DESCRIPTION

Digit	Description	Digit	Description
0	None	8	Reserved
1	Reserved	9	Reserved
2	Reserved	A	Reserved
3	Reserved	B	Reserved
4	Reserved	C	Reserved
5	Reserved	D	Reserved
6	Reserved	E	Reserved
7	Reserved	F	Reserved

TABLE 5.3B: LEAST SIGNIFICANT DIGIT DESCRIPTION

Digit	Description	Digit	Description
0	None	8	Reserved
1	Local Control Locked Out	9	Reserved
2	Reserved	A	Reserved
3	Reserved	B	Reserved
4	Reserved	C	Reserved
5	Reserved	D	Reserved
6	Reserved	E	Reserved
7	Reserved	F	Reserved

6.0 ERROR CODES

6.1 MA4061B Error Codes

When the error code is non-zero, it is displayed on line 2 of the LCD display. It consists of an 'e' character followed by a 2 digit hexadecimal number. The following table can be used to interpret the meaning of the digits.

TABLE 6.1A: MOST SIGNIFICANT DIGIT DESCRIPTION

Digit	Description
0	None
1	Fixed LO Error
2	IF AGC Error
3	IF AGC Error, Fixed LO Error
4	IF Threshold Error
5	IF Threshold Error, Fixed LO Error
6	IF Threshold Error, IF AGC Error
7	IF Threshold Error, Fixed LO Error
8	RF Threshold Error
9	RF Threshold Error, Fixed LO Error
A	RF Threshold Error, IF AGC Error
B	RF Threshold Error, IF AGC Error, Fixed LO Error
C	RF Threshold Error, IF Threshold Error
D	RF Threshold Error, IF Threshold Error, Fixed LO Error
E	RF Threshold Error, IF Threshold Error, IF AGC Error
F	RF Threshold Error, IF Threshold Error, IF AGC Error, Fixed LO Error

TABLE 6.1B: LEAST SIGNIFICANT DIGIT DESCRIPTION

Digit	Description
0	None
1	Output is Muted
2	Hard Alarm condition
3	Hard Alarm condition, Output is Muted
4	Soft Alarm condition
5	Soft Alarm condition, Output is Muted
6	Soft Alarm condition, Hard Alarm condition
7	Soft Alarm condition, Hard Alarm condition, Output is Muted
8	Variable LO Error
9	Variable LO Error, Output is Muted
A	Variable LO Error, Hard Alarm condition
B	Variable LO error, Hard Alarm condition, Output is Muted
C	Variable LO Error, Soft Alarm condition
D	Variable LO Error, Soft Alarm condition, Output is Muted
E	Variable LO Error, Soft Alarm condition, Hard Alarm condition
F	Variable LO Error, Soft Alarm condition, Hard Alarm condition, Output is Muted

6.2 MA4070B Error Codes

TABLE 6.2A: MOST SIGNIFICANT DIGIT DESCRIPTION

Digit	Description
0	None
1	Reverse Power Threshold Error
2	Reserved
3	Reverse Power Threshold Error, Reserved
4	Reserved
5	Reverse Power Threshold Error, Reserved
6	Reserved
7	Reverse Power Threshold Error, Reserved
8	Reserved
9	Reverse Power Threshold Error, Reserved
A	Reserved
B	Reverse Power Threshold Error, Reserved
C	Reserved
D	Reverse Power Threshold Error, Reserved
E	Reserved
F	Reverse Power Threshold Error, Reserved

TABLE 6.2B: LEAST SIGNIFICANT DIGIT DESCRIPTION

Digit	Description
0	None
1	Hard Alarm condition
2	Soft Alarm condition
3	Soft Alarm condition, Hard Alarm condition
4	Forward Power High Threshold Error
5	Forward Power High Threshold Error, Hard Alarm condition
6	Forward Power High Threshold Error, Soft Alarm condition
7	Forward Power High Threshold Error, Soft Alarm condition, Hard Alarm condition
8	Forward Power Low Threshold Error
9	Forward Power Low Threshold Error, Hard Alarm condition
A	Forward Power Low Threshold Error, Soft Alarm condition
B	Forward Power Low Threshold Error, Soft Alarm condition, Hard Alarm condition
C	Forward Power Low Threshold Error, Forward Power High Threshold Error
D	Forward Power Low Threshold Error, Forward Power High Threshold Error, Hard Alarm condition
E	Forward Power Low Threshold Error, Forward Power High Threshold Error, Soft Alarm condition
F	Forward Power Low Threshold Error, Forward Power High Threshold Error, Soft Alarm condition, Hard Alarm condition

6.3 MA4010B Power/Control Module Error Codes

When the error code is non-zero, it is displayed on line 2 of the LCD display. It consists of an 'e' character followed by a 2 digit hexadecimal number. The following table can be used to interpret the meaning of the digits.

TABLE 6.3A: MOST SIGNIFICANT DIGIT DESCRIPTION

Digit	Description	Digit	Description
0	None	8	Reserved
1	5 Volt Supply Under voltage	9	Reserved
2	Reserved	A	Reserved
3	Reserved	B	Reserved
4	Reserved	C	Reserved
5	Reserved	D	Reserved
6	Reserved	E	Reserved
7	Reserved	F	Reserved

TABLE 6.3B: LEAST SIGNIFICANT DIGIT DESCRIPTION

Digit	Description
0	None
1	Hard Alarm condition
2	Reserved
3	Reserved
4	Reserved
5	24 Volt Supply Under voltage, Hard Alarm
6	Reserved
7	Reserved
8	Reserved
9	10 Volt Supply Under voltage, Hard Alarm
A	Reserved
B	Reserved
C	Reserved
D	10 Volt Supply Under voltage, 24 Volt Supply Under voltage, Hard Alarm
E	Reserved
F	Reserved

7.0 DETAILED REMOTE CONTROL

7.1 Operation

The MA4001B chassis may be controlled via the RS232/RS485 Remote Interface connector. (See Section 4.1, Power/Control Module Rear Panel Connections (pp 19, 20) for the connector pin-out).

The input data rate can be 9600, 14400, or 28800 baud. The MA4000 System Controller will automatically determine which data rate is in use and adjust accordingly. There are no user settings relating to baud rate selection.

7.2 Message Format

All messages to the MA4000 system controller consist of a sequence of ASCII characters. Messages must meet the following guidelines in order to be correctly interpreted by the controller.

- There can be no more than 75 ms between consecutive message bytes.
- After receiving the entire message, the MA4000 System Controller will require approximately 200 ms to process and respond to the message.
- Only one message can be processed at a time, consequently the user must wait for a reply before sending a new message.
- Commands sent to an invalid chassis address will be discarded without a response.

7.3 Command Structure

The command structure consists of a sequence of ASCII characters terminated by a carriage return. All ASCII characters are case-insensitive unless otherwise indicated. Commands are to be in one of the following two general formats:

<start>ADD<sp>MOD<sp>CC<sp>CRC<cr>

or

<start>ADD<sp>MOD<sp>CC<sp>PARM<sp>CRC<cr>

<start>   ASCII Asterisk character

<sp>   ASCII Space character

<cr>   ASCII Carriage Return character

ADD = Address (3 ASCII characters)

      Addresses are 3 digit numbers. Three digits (including leading zeros) are required to correctly define an address.

MOD = Module (1 ASCII character)

      A = Module A (Leftmost module)

      B = Module B

      .

      .

      J = Module J (Next to Power Control Module)

CC = Command Code (2 or 3 ASCII characters)

MA4061B Command Codes

FL = Load Frequency

AI = Set IF Attenuation

AR = Set RF Attenuation

OE = Enable Output

OD = Disable Output

ITS = Set IF Threshold

ITD = Disable IF Threshold

ITE = Enable IF Threshold

IAS = Set IF AGC Threshold

IAE = Enable IF AGC Threshold

IAD = Disable IF AGC Threshold

RTS = Set RF Threshold

RTD = Disable RF Threshold

RTE = Enable RF Threshold

SU = Unit Status Request

LE = Enable Local Control

LD = Disable Local Control

MA4070B Command Codes

OE = Enable Output

OD = Disable Output

SU = Unit Status Request

SC = Configuration Status Request

LE = Enable Local Control

LD = Disable Local Control

FPHS = Forward Power High Set

FPHE = Forward Power Hi Enable

FPHD = Forward Power High Disable

FPLS = Forward Power Low Set

FPLE = Forward Power Low Enable

FPLD = Forward Power Low Disable

RPS = Reverse Power Threshold Set

RPE = Reverse Power Threshold Enable

RPE = Reverse Power Threshold Disable

CRC = CRC-16 checksum (3 characters)

The checksum is preferred, but not required. If the checksum is used, the first character is an ASCII "V" followed by the low and high bytes respectively of the computed CRC 16 checksum (the checksum characters are not necessarily ASCII). The checksum is to be computed on all characters after the initial <start> character up to, and including, the first "V" character in the CRC section. If the checksum is not used, the 3 characters should be ASCII "NNN" (they must be uppercase).

PARM is one or more characters, and is command specific.

7.4 Response Structure

The response structure will consist of a sequence of ASCII characters, terminated by a carriage return. Responses will be in one of the two following general formats:

<start>ADD<sp>R<sp>RC<sp>CRC<cr>

or

<start>ADD<sp>R<sp>RC<sp>PARM<sp>CRC<cr>

There will be one response returned for all commands.

<start>   ASCII Asterisk character

<sp>   ASCII Space character

<cr>   ASCII Carriage Return character

ADD = Address (3 characters)

        The address of the unit that is responding to the command.

R = ASCII "R" character (1 character)

        Indicates that this is a response to a previous message.

RC = Response Code (3 characters)

        OK = Command Accepted

        MOD = Command Denied because the addressed module is invalid

        ERR = Command Denied because of Syntax Error

        CRC = Command Denied because of CRC-16 error

CRC = CRC-16 checksum (3 characters)

        The response checksum is always valid. The first character will be an ASCII "V" followed by the low and high bytes respectively of the computed CRC 16 checksum (the checksum characters are not necessarily ASCII). The checksum will be computed on all characters after the initial <start> character up to, and including, the first "V" character in the CRC section.

PARM is one or more characters, and is command specific.

7.5 Detailed Command Descriptions and System Responses

7.5.1 MA4061B Upconverter Detailed Command Descriptions and System Responses

This section defines each of the command codes and the associated parameters for the MA4061B Upconverter module.

FL - Load Frequency

Description: Loads the frequency for the specified module.

Parameters: Desired frequency in MHz, in the form XXXX.XXXX. Leading zeros are optional, but not required. The decimal point and four trailing characters are required. Valid input frequencies are between 2500.0000 MHz and 2686.0000 MHz. Valid trailing characters are multiples of 0.0625 MHz, all others will be denied.

Example: *999<sp>A<sp>FL<sp>2500.0625<sp>CRC<cr>

Response: OK or MOD or ERR or CRC

AI - Set IF Attenuation

Description: Sets the IF attenuation for the specified module.

Parameters: Desired IF attenuation in dB, in the form XX.XX. Leading zeros are optional, but not required. The decimal point and two trailing characters are required. Valid attenuation values are between 0 dB and 25 dB in 0.25 dB steps. Valid trailing characters are 00, 25, 50 or 75.

Example: *999<sp>A<sp>AI<sp>10.50<sp>CRC<cr>

Response: OK or MOD or ERR or CRC

AR - Set RF Attenuation

Description: Sets the RF attenuation for the specified module.

Parameters: Desired RF output attenuation in dB, in the form XX.XX. Leading zeros are optional, but not required. The decimal point and two trailing characters are required. Valid attenuation values are between 0 dB and 39.75 dB in 0.25 dB steps. Valid trailing characters are 00, 25, 50 or 75.

Example: *999<sp>A<sp>AR<sp>4.25<sp>CRC<cr>

Response: OK or MOD or ERR or CRC

ITS - Set IF Threshold

Description: Sets the IF thresholds for the specified module.

Parameters: Desired IF thresholds in dB, in the form X.X<sp>-X.X. Leading zeros are optional, but not required. The decimal point and trailing character is required. The first parameter is the positive threshold and can range between 4.0 and 0.0 dB. The second parameter is the negative threshold and can range between 0.0 and -4.0 dB. The trailing character can range between 0.0 and 0.9.

Example: *999<sp>A<sp>ITS<sp>1.5<sp>-1.5<sp>CRC<cr>

Response: OK or MOD or ERR or CRC

ITE - Enable IF Threshold

Description: Enables IF Threshold detection for the specified module.

Parameters: None

Example: *999<sp>A<sp>ITE<sp>CRC<cr>

Response: OK or MOD or ERR or CRC

ITD - Disable IF Threshold

> **Description:** Disables IF Threshold detection for the specified module.
>
> **Parameters:** None
>
> **Example:**   *999<sp>A<sp>ITD<sp>CRC<cr>
>
> **Response:** OK or MOD or ERR or CRC

IAS - Set Auto IF Threshold

> **Description:** Sets the Auto IF Thresholds for the specified module.
>
> **Parameters:** Desired IF thresholds in dB, in the form X.X<sp>-X.X. Leading zeros are optional, but not required. The decimal point and trailing character is required. The first parameter is the positive threshold and can range between 4.0 and 0.0 dB. The second parameter is the negative threshold and can range between 0.0 and -4.0 dB. The trailing character can range between 0.0 and 0.9.
>
> **Example:**   *999<sp>A<sp>IAS<sp>1.5<sp>-1.5<sp>CRC<cr>
>
> **Response:** OK or MOD or ERR or CRC

IAE - Enable Auto IF

> **Description:** Enables Auto IF Mode for the specified module.
>
> **Parameters:** None
>
> **Example:**   *999<sp>A<sp>IAE<sp>CRC<cr>
>
> **Response:** OK or MOD or ERR or CRC

IAD - Disable Auto IF

> **Description:** Disables Auto IF Mode for the specified module.
>
> **Parameters:** None
>
> **Example:**   *999<sp>A<sp>IAD<sp>CRC<cr>
>
> **Response:** OK or MOD or ERR or CRC

RTS - Set RF Threshold

> **Description:** Sets the RF Thresholds for the specified module.
>
> **Parameters:** Desired RF thresholds in dBm, in the form XX.X<sp>XX.X. Leading zeros are optional, but not required. The decimal point and trailing character is required. The first parameter indicates the high threshold, and the second indicates the low threshold. The trailing character can range between 0.0 and 0.9.
>
> **Example:**   *999<sp>A<sp>RTS<sp>60.0<sp>50.0<sp>CRC<cr>
>
> **Response:** OK or MOD or ERR or CRC

RTE - Enable RF Threshold

> **Description:** Enables RF Threshold detection for the specified module.
>
> **Parameters:** None
>
> **Example:**   *999<sp>A<sp>RTE<sp>CRC<cr>
>
> **Response:** OK or MOD or ERR or CRC

RTD - Disable RF Threshold

> **Description:** Disables RF Threshold detection for the specified module.
>
> **Parameters:** None
>
> **Example:**   *999<sp>A<sp>RTD<sp>CRC<cr>
>
> **Response:** OK or MOD or ERR or CRC

OE - Enable Output

    Description: Turns on the Output from the specified module.

    Parameters: None

    Example: *999<sp>A<sp>OE<sp>CRC<cr>

    Response: OK or MOD or ERR or CRC

OD - Disable Output

    Description: Turns off the Output from the specified module.

    Parameters: None

    Example: *999<sp>A<sp>OD<sp>CRC<cr>

    Response: OK or MOD or ERR or CRC

LE - Enable Local Control

    Description: Enables local control of the MA4001B chassis. The module address must indicate a valid module even though the command does not change any module settings.

    Parameters: None

    Example: *999<sp>A<sp>LE<sp>CRC<cr>

    Response: OK or MOD or ERR or CRC

LD - Disable Local Control

    Description: Disables local control of the MA4001B chassis. The module address must indicate a valid module even though the command does not change any module settings.

    Parameters: None

    Example: *999<sp>A<sp>LD<sp>CRC<cr>

    Response: OK or MOD or ERR or CRC

SU - Status Unit Request

    Description: The Status Unit Request command returns the factory model and revision history for the specified module. The detailed contents of the reply are shown in the response section.

    Parameters: None

    Example: *999<sp>A<sp>SU<sp>CRC<cr>

    Response: OK or MOD or ERR or CRC

If the response is OK, then the following parameters will also be returned in the order shown below. (Note: X may be replaced by any valid character. All other characters will be as shown).

TABLE 7.5.1A : RESPONSE PARAMETERS FOR STATUS UNITS REQUEST

Parameter (Units)	Format	Example
Model	XXXXXXXXXXX	Upconverter
Module SN	XXXXXXX	0123456
Hardware Revision	XXX	010 (i.e. Rev 1.0)
Microcontroller Revision	XXX	010 (i.e. Rev 1.0)
PLD Revision	XXX	010 (i.e. Rev 1.0)
Miscellaneous	16 chars	

7.5.2 MA4070B Upconverter Detailed Command Descriptions and System Responses

This section defines each of the command codes and the associated parameters for the MA4070B Power Amplifier module.

OE - Enable Output

    Description: Turns on the Output from the specified module.

    Parameters: None

    Example: *999<sp>A<sp>OE<sp>CRC<cr>

    Response: OK or MOD or ERR or CRC

OD - Disable Output

    Description: Turns off the Output from the specified module.

    Parameters: None

    Example: *999<sp>A<sp>OD<sp>CRC<cr>

    Response: OK or MOD or ERR or CRC

LE - Enable Local Control

    Description: Enables local control of the MA4001B chassis. The module address must indicate a valid module even though the command does not change any module settings.

    Parameters: None

    Example: *999<sp>A<sp>LE<sp>CRC<cr>

    Response: OK or MOD or ERR or CRC

LD - Disable Local Control

Description: Disables local control of the MA4001B chassis. The module address must indicate a valid module even though the command does not change any module settings.

Parameters: None

Example: *999<sp>A<sp>LD<sp>CRC<cr>

Response: OK or MOD or ERR or CRC

SU - Status Unit Request

Description: The Status Unit Request command returns the factory model and revision history for the specified module. The detailed contents of the reply are shown in the response section.

Parameters: None

Example: *999<sp>A<sp>SU<sp>CRC<cr>

Response: OK or MOD or ERR or CRC

If the response is OK, then the following parameters will also be returned in the order shown below. (Note: X may be replaced by any valid character. All other characters will be as shown).

TABLE 7.5.2A : RESPONSE PARAMETERS FOR STATUS UNITS REQUEST

Parameter (Units)	Format	Example
Model	XXXXXXXXXXX	MA4070
Module SN	XXXXXXX	0123456
Hardware Revision	XXX	010 (i.e. Rev 1.0)
Microcontroller Revision	XXX	010 (i.e. Rev 1.0)
Miscellaneous	16 chars	

SC - Status Configuration Request

Description: The Status Configuration Request command returns the active configuration, including error codes and alarm status for the addressed module. It also returns the current status of the power supply module. The detailed contents of the reply are shown in the response section.

Parameters: None

Example: *999<sp>A<sp>SC<sp>CRC<cr>

Response: OK or ERR or CRC or MOD

If the response is OK, then the following parameters will also be returned in space delimited format in the order shown below. (Note: X may be replaced by any valid character. All other characters will be as shown). Error codes are the last two digits reported on the status code line. Refer to Section 6.0, Error Codes (pp 27 to 29) for more details.

TABLE7.5.2B : RESPONSE PARAMETERS FOR STATUS CONFIGURATION REQUEST

Parameter (Units)	Format	Example
MA4070 Status Code	XXXX	0101
MA4070 RF Power (dBm)	XXX.X	31.5
MA4070 RF Reverse Power (dBm)	XX.X	< 20

FPHS – Forward Power High Set

Description: Sets the Forward Power High for the specified module. When the Forward Power High is enabled, and the RF Power is above the threshold limit, a non-critical alarm will be triggered.

Parameters: Desired RF Thresholds in dBm, in the form XX.X. The decimal point and trailing characters are required. The trailing character can range between 0.0 and 0.9

Example: *999<sp>B<sp>FPHS<sp>38.0<sp>CRC<cr>

Response: OK or MOD or ERR or CRC

FPHE – Enable Forward Power High

Description: Enables the Forward Power High for the specified module. When the Forward Power High is enabled, and the RF Power is above the threshold limit, a non-critical alarm will be triggered.

Parameters: None

Example: *999<sp>B<sp>FPHE<sp>CRC<cr>

Response: OK or MOD or ERR or CRC

FPHD – Disable Forward Power High

Description: Disables the Forward Power High for the specified module.

Parameters: None

Example: *999<sp>B<sp>FPHD<sp>CRC<cr>

Response: OK or MOD or ERR or CRC

FPLS – Set Forward Power Low

> **Description:** Sets the Forward Power Low for the specified module. When the Forward Power Low is enabled, and the RF Power is below the threshold limit, a non-critical alarm will be triggered.

> **Parameters:** Desired RF Thresholds in dBm, in the form XX.X. The decimal point and trailing characters are required. The trailing character can range between 0.0 and 0.9

> **Example:**   *999<sp>B<sp>FPLS<sp>34.0<sp>CRC<cr>

> **Response:** OK or MOD or ERR or CRC

FPLE – Enable Forward Power Low

> **Description:** Enables the Forward Power Low for the specified module. When the Forward Power Low is enabled, and the RF Power is below the threshold limit, a non-critical alarm will be triggered.

> **Parameters:** None

> **Example:**   *999<sp>B<sp>FLPE<sp>CRC<cr>

> **Response:** OK or MOD or ERR or CRC

FPLD – Disable Forward Power Low

> **Description:** Disables the Forward Power Low for the specified module.

> **Parameters:** None

> **Example:**   *999<sp>B<sp>FPLD<sp>CRC<cr>

> **Response:** OK or MOD or ERR or CRC

RPS – Set Reverse Power Threshold

> **Description:** Sets the Reverse Power Threshold for the specified module. When the Reverse Power Threshold is enabled, and the RF Power is above the threshold limit, a non-critical alarm will be triggered.

> **Parameters:** Desired RF Thresholds in dBm, in the form XX.X. The decimal point and trailing characters are required. The trailing character can range between 0.0 and 0.9

> **Example:**   *999<sp>B<sp>RPS<sp>25.0<sp>CRC<cr>

> **Response:** OK or MOD or ERR or CRC

RPE – Enable Reverse Power Threshold

> **Description:** Sets the Reverse Power Threshold for the specified module. When the Reverse Power Threshold is enabled, and the RF Power is above the threshold limit, a non-critical alarm will be triggered.

> **Parameters:** None

> **Example:**   *999<sp>B<sp>RPE<sp>CRC<cr>

> **Response:** OK or MOD or ERR or CRC

RPD – Disable Reverse Power Threshold

> **Description:** Disables the Reverse Power Threshold for the specified module.

> **Parameters:** None

> **Example:**   *999<sp>B<sp>RPD<sp>CRC<cr>

> **Response:** OK or MOD or ERR or CRC

7.6 CRC Calculation

The CRC calculations are performed using a table driven approach. The polynomial used is **X^16+X^15+X^2+1**.

Only the basic algorithm and lookup table will be described here. Sample code is available on request. For further information, this approach is described in detail in the following paper:

Perez, Aram; Byte-wise CRC Calculations, IEEE Micro, June 1983, pp. 40 - 50

The algorithm for the CRC calculation is as follows:

Exclusive-OR the input byte with the low-order byte of the CRC register to get X.

Shift the CRC register 8 bits to the right.

Exclusive-OR the CRC register with the contents of the table, using X as an index.

Repeat steps 1 - 3 for all message bytes.

☞　　**Note:** The CRC register is 16 bits long, and should be cleared to 0 before beginning the calculations.

For the transmit message: After all the message bytes have been processed, the CRC is tagged on to the end of the message with the least significant byte first.

For the received message: After all the received message bytes have been processed, the resulting CRC should be zero. If it is not zero, at least one bit error has occurred. If it is zero, it is assumed that no errors have occurred.

8.0 WARRANTY AND SERVICE POLICIES

8.1 Warranty Statement

WaveCom warrants its products to be free from defects in workmanship or materials for a period of two years. The warranty begins on the date of the original shipment from WaveCom to its customer. No claim may be allowed for expenses incurred in installation or use. No other expressed or implied warranties shall apply to the goods sold. WaveCom is not responsible for delayed shipments, other loss beyond WaveCom's control, or consequential damages of any kind arising in connection with the use of its products. This warranty is a return-to-factory warranty only. During the warranty period WaveCom will at its option, replace, repair or refund the price paid for any item which is returned for service. This warranty does not apply to physically or environmentally abused units.

8.2 Service Policies: How to Return an Item for Service

Before returning any item for service, an R.M.A. (Returned Material Authorization) number must be assigned by WaveCom. A unique R.M.A. number will be assigned for each item being returned. When requesting an R.M.A. number, please be prepared to provide the model, WaveCom serial number, original invoice number, your purchase order number and an adequate fault description. R.M.A. service is available Monday to Friday from 8:30 a.m. to 4:30 p.m. CST (statutory holidays excepted).

To obtain an R.M.A. number you may: Call: (306) 955-7075, press '0' for Operator or '2' for Service Dept

Or Fax: (306) 384-0086 — Attention: R.M.A. Request

Once an R.M.A. number has been assigned, please refer to it in all correspondence and make certain that all applicable R.M.A. numbers are clearly marked on the outside of each package being returned. You must also ensure that each product is shipped to WaveCom in its original shipping container (or equivalent) via Prepaid carrier, with appropriate insurance and customs documentation (where required). WaveCom will not accept collect shipments, damaged shipments or shipments unaccompanied by an R.M.A. number.

Items will be returned from WaveCom to the customer via prepaid ground carrier. Any alternate means of shipment must be requested by the customer and will be subject to additional charges.

Please ship authorized returning items to: Repair Center
WaveCom Electronics Inc.
202 Cardinal Crescent
Saskatoon, SK Canada S7L 6H8

8.3 Repair Charges and Warranty Exemptions

Items returned beyond the warranty period or items that do not qualify for warranty service are subject to additional out-of-warranty repair charges. Descriptions of these charges and warranty exemptions are below:

1) Repair turnaround time is typically 5-10 working days after receipt of the item at WaveCom. A Flat Rate Repair Charge will apply to all out-of-warranty items. Flat Rate Repair Charges are subject to change without notice.

2) Any faults due to customer error (ie - incorrect set-up or configuration settings) are subject to the current Test Fee and will be exempt from warranty.

3) Items returned with inadequate fault descriptions are subject to the current Test Fee and are exempt from warranty.

4) In the event that no fault is found, the item is subject to the current Test Fee and will be exempt from warranty.

5) Any product exhibiting external damage (either from shipping, improper handling or use) will be subject to inspection. If said damages are determined to be the cause of failure, the item will be exempt from warranty. All repairs to correct the external damage are subject to Time & Materials Charges (parts and labor at current rates).

6) Items with damage caused by unauthorized repairs or by external devices are subject to current out-of-warranty Flat Rate Repair Charges and are exempt from warranty.

7) All products returned for Factory Optioning are subject to the applicable current Option Charge plus Test Fee. Factory-optioned products carry the balance of the original warranty or a 90 day warranty, whichever is greater.

All out-of-warranty repairs must be approved by the customer in writing. No repairs will be made until the customer's Purchase Order or Out-Of-Warranty Repair Authorization is received.

APPENDIX A – CRC – 16 CALCULATIONS TABLE

All values in the table are in Hex format.

X Term	Entry	X Term	Entry	X Term	Entry
0	0	33	1540	67	EA41
1	C0C1	34	D701	68	EE01
2	C181	35	17C0	69	2EC0
3	140	36	1680	6A	2F80
4	C301	37	D641	6B	EF41
5	3C0	38	D201	6C	2D00
6	280	39	12C0	6D	EDC1
7	C241	3A	1380	6E	EC81
8	C601	3B	D341	6F	2C40
9	6C0	3C	1100	70	E401
A	780	3D	D1C1	71	24C0
B	C741	3E	D081	72	2580
C	500	3F	1040	73	E541
D	C5C1	40	F001	74	2700
E	C481	41	30C0	75	E7C1
F	440	42	3180	76	E681
10	CC01	43	F141	77	2640
11	CC0	44	3300	78	2200
12	D80	45	F3C1	79	E2C1
13	CD41	46	F281	7A	E381
14	F00	47	3240	7B	2340
15	CFC1	48	3600	7C	E101
16	CE81	49	F6C1	7D	21C0
17	E40	4A	F781	7E	2080
18	A00	4B	3740	7F	E041
19	CAC1	4C	F501	80	A001
1A	CB81	4D	35C0	81	60C0
1B	B40	4E	3480	82	6180
1C	C901	4F	F4441	83	A141
1D	9C0	50	3C00	84	6300
1E	880	51	FCC1	85	A3C1
1F	C841	52	FD81	86	A281
20	D801	53	3D40	87	6240
21	18C0	54	FF01	88	6600
22	1980	55	3FC0	89	A6C1
23	D941	56	3E80	8A	A781
24	1B00	57	FE41	8B	6740
25	DBC1	58	FA01	8C	A501
26	DA81	59	3AC0	8D	65C0
27	1A40	5A	3B80	8E	6480
28	1E00	5B	FB41	8F	A441
29	DEC1	5C	3900	90	6C00
2A	DF81	5D	F9C1	91	ACC1
2B	1F40	5E	F881	92	AD81
2C	DD01	5F	3840	93	6D40
2D	1DC0	60	2800	94	AF01
2E	1C80	61	E8C1	95	6FC0
2F	DC41	62	E981	96	6E80
30	1400	63	2940	97	AE41
31	D4C1	64	EB01	98	AA01
32	D581	65	2BC0	X Term	Entry
X Term	Entry	66	2A80	99	6AC0
		X Term	Entry	9A	6B80

X TERM	ENTRY		X TERM	ENTRY
9B	AB41		D4	5F00
9C	6900		D5	9FC1
9D	A9C1		D6	9E81
9E	A881		D7	5E40
9F	6840		D8	5A00
A0	7800		D9	9AC1
A1	B8C1		DA	9B81
A2	B981		DB	5B40
A3	7940		DC	9901
A4	BB01		DD	59C0
A5	7BC0		DE	5880
A6	7A80		DF	9841
A7	BA41		E0	8801
A8	BE01		E1	48C0
A9	7EC0		E2	4980
AA	7F80		E3	8941
AB	BF41		E4	4B00
AC	7D00		E5	8BC1
AD	BDC1		E6	8A81
AE	BC81		E7	4A40
AF	7C40		E8	4E00
B0	B401		E9	8EC1
B1	74C0		EA	8F81
B2	7580		EB	4F40
B3	B541		EC	8D01
B4	7700		ED	4DC0
B5	B7C1		EE	4C80
B6	B681		EF	8C41
B7	7640		F0	4400
B8	7200		F1	84C1
B9	B2C1		F2	8581
BA	B381		F3	4540
BB	7340		F4	8701
BC	B101		F5	47C0
BD	71C0		F6	4680
BE	7080		F7	8641
BF	B041		F8	8201
C0	5000		F9	42C0
C1	90C1		FA	4380
C2	9181		FB	8341
C3	5140		FC	4100
C4	9301		FD	81C1
C5	53C0		FE	8081
C6	5280		FF	4040
C7	9241			
C8	9601			
C9	56C0			
CA	5780			
CB	9741			
CC	5500			
CD	95C1			
CE	9481			
CF	5440			
D0	9C01			
X TERM	**ENTRY**			
D1	5CC0			
D2	5D80			
D3	9D41			

WAVECOM

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