MOON

by SIMAUDIO

Neo 240i Integrated Amplifier

RS-232 and Infrared Communication Protocols

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Revision History

Document Revisions

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Protocol Revisions

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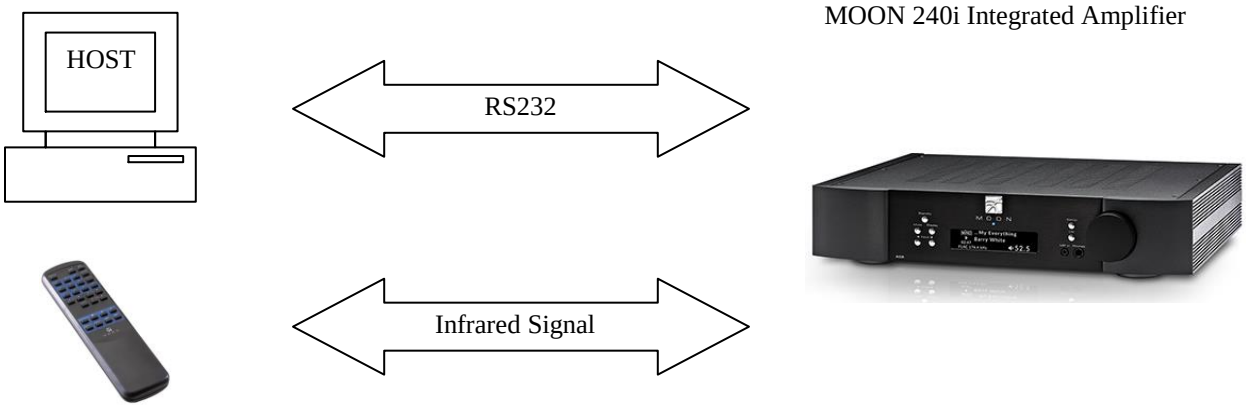
1 Introduction

The 240i Integrated Amplifier (UNIT) has a RS232 control port to allow bidirectional communication between the UNIT and an external HOST such as a personal computer (PC), touch screen panel, custom installation controller, etc. The HOST can send commands and status requests to the UNIT. If the user accesses the UNIT's front panel interface, a configurable unsolicited feedback message is sent to the HOST to keep synchronization. Please note that when the UNIT is integrated in a complete custom automation system, it is advised not to use the SimLink connection to avoid possible control conflicts.

The UNIT also has an infrared receiver for infrared remote control (handset remote control, infrared blaster or repeater, etc.). The infrared protocol used is Philips RC5 system-command frames. Please contact NXP (formerly Philips Semiconductor) for RC5 frame definition.



1.1 Abbreviations and definitions

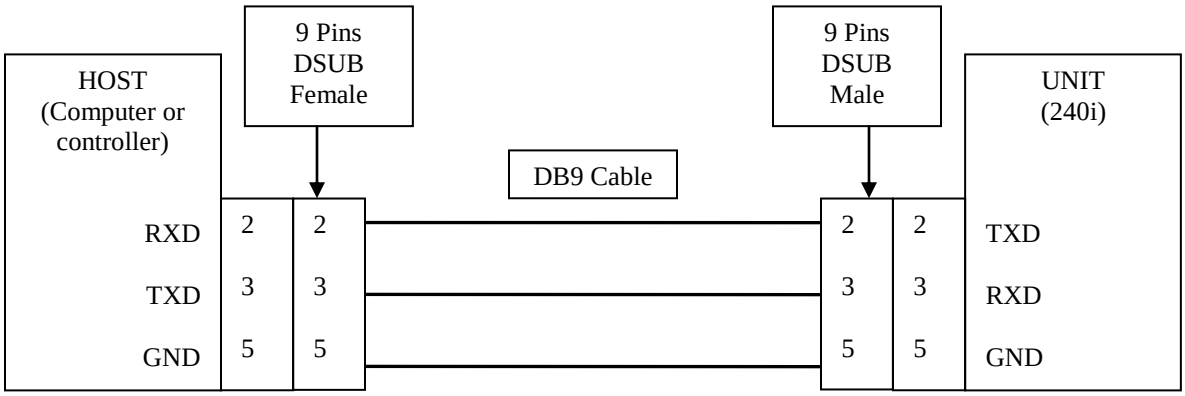
Here is a list of definitions and abbreviations used in this document:

- Byte: 8 bit length number.
- Nibble: 4 bit length number.
- HOST: Remote device used to control the 240i unit via RS232 control port.
- UNIT: Device controlled by the HOST. In this case, it is the 240i Integrated Amplifier.
- 0xnn: Prefix used to represent hexadecimal number where nn is a hexadecimal number. For example, 0xff is equivalent to 255 in decimal and 0x80 is equivalent to 128.
- <CR>: Carriage Return ASCII control character (0x0d).
- <LF>: Line Feed ASCII control character (0x0a).

2 RS232 Physical interface

2.1 Connection cable

The UNIT is connected to the HOST using a standard 9 pins DSUB male to female straight through connector. The following picture shows the physical connection pinout.



2.2 Communication port setup

The communication port must be set to the following:

- Baud Rate: 9600 baud (default)
- Data length: 8 bits (1 byte)
- Stop length: 1 bit
- Parity: None
- Flow Control: None

2.3 Error detection

The UNIT detects framing, noise and data overrun errors. If any physical layer error occurs, the UNIT will reject the complete packet and will wait for a new header as defined in RS232 Protocol definition.

2.4 Receive buffer

The UNIT receive buffer is sized to receive commands on a one-to-one basis. The HOST cannot queue multiple commands and then wait for multiple responses form the UNIT. When the HOST sends a command, it must wait for the UNIT's response before sending a new command. Please refer to the RS232 Protocol definition section. Since the UNIT response is very fast, there will be no lag experienced on the user side.

3 RS232 Protocol definition

3.1 General description

The communication protocol uses printable ASCII characters to ease debugging and custom software design. The protocol uses a defined packet structure for HOST to UNIT and UNIT to HOST data exchange. Every command sent to the UNIT will return a response. The response code and length is command dependent and described in

RS232 UNIT responses.

3.2 Message packet format

The data type used in a packet is defined by the following table:

Data Type	Description	ASCII character	Hex Value
HEX	Hexadecimal value	0 to 9 A to F a to f (2 characters)	0x30-0x39 0x41-0x46 0x61-0x7a
BOOLEAN	Boolean value (0 means FALSE or OFF and 1 means TRUE or ON)	0 or 1	0x30 or 0x31
ASCII	Single ASCII printable character	Printable ASCII	many
ASCII CTL	Single ASCII control character	Control ASCII	many
ASCII STR	Null Terminated ASCII character string	Printable ASCII	many

For the HEX data type, a two byte ASCII value is used. For example, to send a value 0x1f (one byte), we need to send the ASCII character 1 (0x31) followed by the ASCII character F (0x46). Note that **uppercase** and **lowercase** characters are considered valid. For the BOOLEAN data type, a single byte is sent and has an ASCII value of 0 or 1 (0x30 or 0x31 value).

The message packet begins with a header delimiter followed by the packet number of bytes field (HEX data type). Following the number of bytes field is a command/response field (HEX data type), a parameter field (command/response dependent) and an end of packet delimiter. The number of bytes field is data type independent and excludes the header and the end of packet delimiter as well as itself. This number represents the total number of ASCII characters that will be transmitted in this packet. For debugging purpose, the backspace character can be used to cancel the last transmitted byte (unless the last byte was an end of packet).

The following table shows the message packet format:

Byte Number	Field	Description	ASCII Character	Hex Value
1	HEADER	Header delimiter	#	0x23
2	NUMBER OF BYTES	High nibble of packet number of bytes field (HEX data type)	0 to 9 A to F a to f	0x30-0x39 0x41-0x46 0x61-0x7a
3		Low nibble of packet number of bytes field (HEX data type)	0 to 9 A to F a to f	0x30-0x39 0x41-0x46 0x61-0x7a
4	COMMAND or RESPONSE CODE	High nibble of code (HEX data type)	0 to 9 A to F a to f	0x30-0x39 0x41-0x46 0x61-0x7a
5		Low nibble of code (HEX data type)	0 to 9 A to F a to f	0x30-0x39 0x41-0x46 0x61-0x7a
…	PARAMETERS	Parameters (number of parameters is command dependent and parameters are HEX, BOOLEAN, ASCII or ASCII STR data type)	Printable ASCII	Many
N	END OF PACKET	End of packet delimiter	<CR>	0x0d

3.3 Packet examples

Here are some valid packets examples (these are dummy examples; don't use them to test your connections):

- #021F<CR> = Send command 0x1f
- #041801<CR> = Send command 0x18 with parameter value of 0x01 (assuming a HEX data type for this parameter; every parameter is command dependent and data type may vary).
- #064B1101<CR> = send command 0x4b with 4 BOOLEAN parameters value of 1,1,0,1.

3.4 Commands and responses categories

The commands and responses are split in 4 different categories, each having a specified range:

Command type	Value range
Setup commands	0x20 to 0x5f
Status commands	0x01 to 0x1f
User commands	0x60 to 0x9f
UNIT responses	0xa0 to 0xfe

4 RS232 Setup commands

This section defines the setup commands that can be sent to the UNIT. Setup commands modify the unit behavior regarding specific environment changes. For example, setting the unsolicited feedback ON will enable the UNIT to send unsolicited message to HOST when the user executes functions on the front panel or remote control. The setup commands code range is from 0x20 to 0x5f.

4.1 Set communication parameters

This command sets the communication parameters as well as the unsolicited feedback and display activities. The following table shows the command packet.

Field	Field Value	Description	Data Type
HEADER	#	Header delimiter	ASCII
NUMBER OF BYTES	06	Number of bytes in this packet	HEX
COMMAND CODE	20	Set communication parameters	HEX
PARAMETER 1: Baud rate selection	01 to 06	01= Set Baud Rate at 38400 baud 02= Set Baud Rate at 19200 baud 03= Set Baud Rate at 9600 baud (**default**) 04= Set Baud Rate at 4800 baud 05= Set Baud Rate at 2400 baud 06= Set Baud Rate at 1200 baud	HEX
PARAMETER 2: Unsolicited feedback setup	0 or 1	0 = Set unsolicited feedback OFF. 1= Set unsolicited feedback ON (**default**).	BOOLEAN
PARAMETER 3: Unsolicited display feedback setup	0 or 1	0 = Set unsolicited display feedback OFF (**default**). 1= Set unsolicited display feedback ON.	BOOLEAN
END OF PACKET	<CR>	End of packet delimiter	ASCII CTL

4.1.1 Valid example

- #06200311<CR> = Set communication parameters to 9600 baud, activate unsolicited feedback and unsolicited display feedback.

4.1.2 Response from UNIT

The UNIT will send the Communication setup response defined in

RS232 UNIT responses.
NOTE: The baud rate will change after the UNIT's response so the response will be sent using the previous baud rate.

4.2 Reset UNIT

This command resets the UNIT as if the mains rocker switch was toggled OFF then back ON. The following table shows the command packet.

Field	Field Value	Description	Data Type
HEADER	#	Header delimiter	ASCII
NUMBER OF BYTES	02	Number of bytes in this packet	HEX
COMMAND CODE	21	Reset UNIT	HEX
END OF PACKET	<CR>	End of packet delimiter	ASCII CTL

4.2.1 Valid example

- #0221<CR> = Reset UNIT.

4.2.2 Response from UNIT

The UNIT will send the UNIT status response and the
Unit Wake-up response defined in

RS232 UNIT responses.
NOTE: The communication baud rate will reset to the default value of 9600 baud, the unsolicited feedback will reset to ON.

4.3 Set factory defaults

This command sets the factory default values in the UNIT setup menu. The following table shows the command packet.

Field	Field Value	Description	Data Type
HEADER	#	Header delimiter	ASCII
NUMBER OF BYTES	02	Number of bytes in this packet	HEX
COMMAND CODE	22	Set factory defaults	HEX
END OF PACKET	<CR>	End of packet delimiter	ASCII CTL

4.3.1 Valid example

- #0222<CR> = Set factory defaults.

4.3.2 Response from UNIT

The UNIT will send the

Factory defaults response defined in

RS232 UNIT responses.

NOTE: This command does not affect the RS232 communication parameters. Baud rate and unsolicited feedback will not change.

4.4 Set input label

This command sets the label of the specified input ID to the desired value. The values set by this command are stored in non-volatile memory and kept even if mains power is removed. The following table shows the command packet.

Field	Field Value	Description	Data Type
HEADER	#	Header delimiter	ASCII
NUMBER OF BYTES	0F	Number of bytes in this packet	HEX
COMMAND CODE	23	Set input label	HEX
PARAMETER 1: Input ID	00 to 06	00=Invalid 01=Set OPTICAL1 input label 02=Set OPTICAL2input label 03=Set SPDIF1 input label 04=Set SPDIF2input label 05=Set USB input label 06=Set A1 input label 07=Set A2 input label 08=Set PHONO input label 09=Set MP input label	HEX
PARAMETER 2: Label	13 byte string	NULL terminated label string (12 characters + NULL)	ASCII STR
END OF PACKET	<CR>	End of packet delimiter	ASCII CTL

4.4.1 Valid example

- #0D2302ANDRMEDA<NULL><CR> = Set OPTICAL2 input label to ANDRMEDA.

4.4.2 Response from UNIT

The UNIT will send the **Error! Reference source not found.** with the set input ID defined in

RS232 UNIT responses.

4.5 Enable/disable input

This command enables or disables the specified input ID. The values set by this command are stored in non volatile memory and kept even if mains power is removed. The following table shows the command packet.

Field	Field Value	Description	Data Type
HEADER	#	Header delimiter	ASCII
NUMBER OF BYTES	05	Number of bytes in this packet	HEX
COMMAND CODE	24	Enable/disable input	HEX
PARAMETER 1: Input ID	00 to 06	00=Invalid 01=Enable/disable OPTICAL1input 02=Enable/disable OPTICAL2input 03=Enable/disable SPDIF1input 04=Enable/disable SPDIF2input 05=Enable/disable USB input 09= Enable/disable A1 input 07=Enable/disable A2 input 08=Enable/disable PHONO input 09=Enable/disable MP input	HEX
PARAMETER 2: Enable/disable	0 or 1	0=input disabled 1=input enabled (**default**)	BOOLEAN
END OF PACKET	<CR>	End of packet delimiter	ASCII CTL

4.5.1 Valid example

- #0524040<CR> = Disable SPDIF2 input.

4.5.2 Response from UNIT

The UNIT will send the **Error! Reference source not found.** with the set input ID defined in

RS232 UNIT responses.

4.6 Set MiND

This command sets the input connected to a MiND. If the UNIT is connected to the SimLink bus, the chosen input of the Set MiND command will be automatically selected when the user plays a track on the MiND. The values set by this command are stored in non-volatile memory and kept even if mains power is removed. The following table shows the command packet.

Field	Field Value	Description	Data Type
HEADER	#	Header delimiter	ASCII
NUMBER OF BYTES	04	Number of bytes in this packet	HEX
COMMAND CODE	2B	Set MiND function	HEX
PARAMETER 1: Input ID	01 to 07	00= Invalid 01= Set OPTICAL1 as MiND input 02= Set OPTICAL1 as MiND input 03= Set SPDIF1 as MiND input 04= Set SPDIF2 as MiND input (**default**) 05= Invalid 06= Set ANALOG1 as MiND input 07= Set ANALOG2 as MiND input 08= Invalid 09= Invalid	HEX
END OF PACKET	<CR>	End of packet delimiter	ASCII CTL

4.6.1 Valid example

- #042C04<CR> = Set SPDIF2 as MiND input.

4.6.2 Response from UNIT

The UNIT will send the MiND setup response
defined *in*

RS232 UNIT ***responses***.

4.7 Set CD

This command sets the input connected to a CD player. If the UNIT is connected to the SimLink bus, the chosen input of the Set CD command will be automatically selected when the user plays a track on the CD player. The values set by this command are stored in non-volatile memory and kept even if mains power is removed. The following table shows the command packet.

Field	Field Value	Description	Data Type
HEADER	#	Header delimiter	ASCII
NUMBER OF BYTES	04	Number of bytes in this packet	HEX
COMMAND CODE	2C	Set CD function	HEX
PARAMETER 1: Input ID	01 to 07	00= Invalid 01= Invalid 02= Invalid 03= Set SPDIF1 as CD input 04= Set SPDIF2 as CD input 05= Invalid 06= Set ANALOG1 as CD input 07= Set ANALOG2 as CD input 08= Invalid 09= Invalid	HEX
END OF PACKET	<CR>	End of packet delimiter	ASCII CTL

4.7.1 Valid example

- #042C04<CR> = Set SPDIF2 as CD input.

4.7.2 Response from UNIT

The UNIT will send the CD setup response defined in

RS232 UNIT responses.

5 RS232 Status commands

This section defines the status commands that can be sent to the UNIT. Status commands are used to poll different parameters that define the current UNIT status. For example, at power up, the HOST may want to know the UNIT status that it is controlling. The status commands code range is from 0x01 to 0x1f.

5.1 Get UNIT status

This command asks for the current general UNIT status. The following table shows the command packet.

Field	Field Value	Description	Data Type
HEADER	#	Header delimiter	ASCII
NUMBER OF BYTES	02	Number of bytes in this packet	HEX
COMMAND CODE	01	Get UNIT status	HEX
END OF PACKET	<CR>	End of packet delimiter	ASCII CTL

5.1.1 Valid example

- #0201<CR> = Get UNIT status.

5.1.2 Response from UNIT

The UNIT will send the UNIT status response defined in

RS232 UNIT responses.

5.2 Get product information

This command asks for the product information. Available information is: product identification number, product software revision, product boot code revision and communication software revision. The following table shows the command packet.

Field	Field Value	Description	Data Type
HEADER	#	Header delimiter	ASCII
NUMBER OF BYTES	02	Number of bytes in this packet	HEX
COMMAND CODE	02	Get product information	HEX
END OF PACKET	<CR>	End of packet delimiter	ASCII CTL

5.2.1 Valid example

- #0202<CR> = Get product information.

5.2.2 Response from UNIT

The UNIT will send the Product information response defined in

RS232 UNIT responses.

5.3 Get communication setup

This command asks for the UNIT's communication setup. The following table shows the command packet.

Field	Field Value	Description	Data Type
HEADER	#	Header delimiter	ASCII
NUMBER OF BYTES	02	Number of bytes in this packet	HEX
COMMAND CODE	03	Get communication setup	HEX
END OF PACKET	<CR>	End of packet delimiter	ASCII CTL

5.3.1 Valid example

- #0203<CR> = Get communication setup.

5.3.2 Response from UNIT

The UNIT will send the Communication setup response defined in

RS232 UNIT responses.

5.4 Get MiND

This command gets the input designed for MiND playing. The following table shows the command packet.

Field	Field Value	Description	Data Type
HEADER	#	Header delimiter	ASCII
NUMBER OF BYTES	02	Number of bytes in this packet	HEX
COMMAND CODE	08	Get MiND function	HEX
END OF PACKET	<CR>	End of packet delimiter	ASCII CTL

5.4.1 Valid example

- #0208<CR> = Get MiND input.

5.4.2 Response from UNIT

The UNIT will send the MiND setup response in defined

*RS232 UNIT **responses**.*

5.5 Get CD

This command gets the input designed for CD playing. The following table shows the command packet.

Field	Field Value	Description	Data Type
HEADER	#	Header delimiter	ASCII
NUMBER OF BYTES	02	Number of bytes in this packet	HEX
COMMAND CODE	0A	Get CD function	HEX
END OF PACKET	<CR>	End of packet delimiter	ASCII CTL

5.5.1 Valid example

- #020A<CR> = Get CD input.

5.5.2 Response from UNIT

The UNIT will send the CD setup response defined in

RS232 UNIT responses.

5.6 Get expanded product information

This command asks for the expanded product information for the specified subsystem ID. The main system is at ID number 00. The following table shows the command packet.

Field	Field Value	Description	Data Type
HEADER	#	Header delimiter	ASCII
NUMBER OF BYTES	04	Number of bytes in this packet	HEX
COMMAND CODE	1F	Get expanded product information command	HEX
PARAMETER 1: Desired sub-system	00 to FE	00= Main system 01 to FE= Sub-system ID	HEX
END OF PACKET	<CR>	End of packet delimiter	ASCII CTL

5.6.1 Valid example

- #041F00<CR> = Get expanded product information for the UNIT main system.

5.6.2 Response from UNIT

The UNIT will send the

Expanded product information response defined in

RS232 UNIT responses.

6 RS232 User commands

This section defines the user commands that can be sent to the UNIT. User commands are similar to these available on a remote control or the UNIT's front panel interface. For example, the user can switch the power ON or OFF using the front panel buttons or the remote control. The HOST may want to do the same action using a custom interface that runs on a PC or custom controller. It is strongly recommended to read the user's manual to get familiar with the UNIT operation and special conditions. The user commands code range is from 0x60 to 0x9f.

6.1 Set power state

This command sets the UNIT's power to the specified parameter value. Note that this command does not control the UNIT's back panel mains switch but only the internal standby control. There are 2 different ways to control the UNIT's power. The first one is power toggling as when using the UNIT front panel switch. The second one is forcing UNIT power either ON or OFF. The following table shows the command packet.

Field	Field Value	Description	Data Type
HEADER	#	Header delimiter	ASCII
NUMBER OF BYTES	04	Number of bytes in this packet	HEX
COMMAND CODE	60	Set power state	HEX
PARAMETER 1: Desired Power state	01 to 03	01= Toggle power state (same as pressing the front panel's pushbutton). 02= Set power ON. 03= Set power OFF.	HEX
END OF PACKET	<CR>	End of packet delimiter	ASCII CTL

6.1.1 Valid example

- #046001<CR> = Toggle power state.

6.1.2 Response from UNIT

The UNIT will send the UNIT status response defined in

RS232 UNIT responses.

6.2 Set display state

This command sets the UNIT's display state to the specified parameter value. There are 3 different ways to control the UNIT's display state. The first one is display state toggling as when using the UNIT front panel switch. The second and third ones are respectively setting the display ON or OFF. The following table shows the command packet.

Field	Field Value	Description	Data Type
HEADER	#	Header delimiter	ASCII
NUMBER OF BYTES	04	Number of bytes in this packet	HEX
COMMAND CODE	61	Set display state	HEX
PARAMETER 1: Desired Display state	01 to 03	01=Toggle display state (same as pressing the front panel's pushbutton). 02=Set display ON. 03=Set display OFF.	HEX
END OF PACKET	<CR>	End of packet delimiter	ASCII CTL

6.2.1 Valid example

- #046101<CR> = Toggle display state.

6.2.2 Response from UNIT

The UNIT will send the UNIT status response defined in

RS232 UNIT responses.

6.3 Set display intensity

This command sets the UNIT display intensity to the specified parameter value. The following table shows the command packet.

Field	Field Value	Description	Data Type
HEADER	#	Header delimiter	ASCII
NUMBER OF BYTES	04	Number of bytes in this packet	HEX
COMMAND CODE	62	Set display intensity	HEX
PARAMETER 1: Desired display intensity	01 to 04	01=Scroll to next display intensity (low, medium, high, etc) 02=Set display intensity to low. 03=Set display intensity to medium (**default**). 04=Set display intensity to high.	HEX
END OF PACKET	<CR>	End of packet delimiter	ASCII CTL

6.3.1 Valid example

- #046202<CR> = Set display intensity to low.

6.3.2 Response from UNIT

The UNIT will send the UNIT status response defined in

RS232 UNIT responses.

6.4 Set input selection

This command selects the specified input. The following table shows the command packet.

Field	Field Value	Description	Data Type
HEADER	#	Header delimiter	ASCII
NUMBER OF BYTES	04	Number of bytes in this packet	HEX
COMMAND CODE	63	Set input selection	HEX
PARAMETER 1: Input ID	00 to 0A	00= Invalid 01= Select OPT1 input 02= Select OPT2 input 03= Select SPDIF1 input 04= Select SPDIF2 input 05= Select USB input 06= Select A1 input 07= Select A2 input 08= Select PHONO input 09= Select MP input 80= Go to previous input 81= Go to next input	HEX
END OF PACKET	<CR>	End of packet delimiter	ASCII CTL

6.4.1 Valid example

- #046305<CR> = Select USB input.

6.4.2 Response from UNIT

The UNIT will send the UNIT status response defined in

RS232 UNIT responses or the Error response defined in

RS232 UNIT responses if the selected input is not available.

6.5 Set master volume

This command sets the master volume to the specified value, increments or decrements the volume with 3 different step sizes. The allowed value range for direct specified value is from 000 to 800 which correspond to 0.0 to 80.0 on the UNIT display. Note that values between 0.0 and 30.0 have minimum increment values of 10 and values between 30.0 and 80.0 have minimum increment values of 1. If an increment value of 1 is sent and the master volume is below 30.0, the UNIT will treat it as an increment of 10. If MUTE is activated, sending a new master volume will deactivate the MUTE state. The following table shows the command packet.

Field	Field Value	Description	Data Type
HEADER	#	Header delimiter	ASCII
NUMBER OF BYTES	08	Number of bytes in this packet	HEX
COMMAND CODE	64	Set master volume	HEX
PARAMETER 1: Action type	01 to 07	01=Decrement master volume with small step (1) 02=Decrement master volume with medium step (10) 03=Decrement master volume with large step (20) 04=Increment master volume with small step (1) 05=Increment master volume with medium step (10) 06=Increment master volume with large step (20) 07=Set the master volume to the specified value	HEX
PARAMETER 2: Value MSB	00 to 03	Value MSB (used in specified value only)	HEX
PARAMETER 3: Value LSB	00 to FF	Value LSB (used in specified value only)	HEX
END OF PACKET	<CR>	End of packet delimiter	ASCII CTL

6.5.1 Valid examples

- #0864030000<CR>= Decrement master volume with a large step. If volume was 40.0, new volume is 38.0.
- #0864070320<CR>= Set master volume to 80.0 (800).

6.5.2 Response from UNIT

The UNIT will send the **Error! Reference source not found.** defined in

RS232 UNIT responses.

6.6 Set mute

This command sets the mute state. There are 3 different ways to control the UNIT's mute state. The first one is mute state toggling as when using the UNIT front panel switch. The second and third ones are respectively setting the mute state ON or OFF. The following table shows the command packet.

Field	Field Value	Description	Data Type
HEADER	#	Header delimiter	ASCII
NUMBER OF BYTES	04	Number of bytes in this packet	HEX
COMMAND CODE	65	Set mute	HEX
PARAMETER 1: Desired mute state	01 to 03	01=Toggle mute state (same as pressing the front panel's pushbutton). 02=Set mute ON. 03=Set mute OFF.	HEX
END OF PACKET	<CR>	End of packet delimiter	ASCII CTL

6.6.1 Valid example

- #046501<CR> = Toggle mute state.

6.6.2 Response from UNIT

The UNIT will send the UNIT status response defined in

RS232 UNIT responses.

6.1 Set balance value

This command sets the balance value to the specified one (percentage of attenuation on the opposite channel). The allowed value range is from 0 to 200 which means from 100% left to 100% right. A balance value of 100 corresponds to center. The following table shows the command packet.

Field	Field Value	Description	Data Type
HEADER	#	Header delimiter	ASCII
NUMBER OF BYTES	06	Number of bytes in this packet	HEX
COMMAND CODE	66	Set balance value	HEX
PARAMETER 1: Action type	01 to 03	01=Decrement balance with 1% step (go left) 02=Increment balance with 1% step (go right) 03=Set the balance to the specified value	HEX
PARAMETER 2: Value	00 to C8	Value (used in specified value only)	HEX
END OF PACKET	<CR>	End of packet delimiter	ASCII CTL

6.1.1 Valid examples

- #06660100<CR>= Decrement balance value with 1% (go left).

6.1.2 Response from UNIT

The UNIT will send the

UNIT status response defined in

RS232 UNIT responses.

7 RS232 UNIT responses

This section defines the UNIT's responses sent to the HOST. The responses are sent after valid RS232 command execution or after user action (front panel or remote control) if unsolicited feedback is active. For example, if the HOST sends a Set power state command, the UNIT will send the UNIT status response after the command is executed. Also, if the unsolicited feedback is active, the UNIT will send the UNIT status response when the user presses the UNIT's standby switch on the front panel. The UNIT responses code range is from 0xa0 to 0xfe.

7.1 Acknowledge response

This response is used to tell the HOST that the command has been received and that it has been processed. The acknowledge response is sent only for commands that do not have specific responses. Most commands have specific response so the acknowledge response is not sent very often. Please see each command description to know the response it is associated to. The following table shows the response packet.

Field	Field Value	Description	Data Type
HEADER	#	Header delimiter	ASCII
NUMBER OF BYTES	04	Number of bytes in this packet	HEX
RESPONSE CODE	A0	Acknowledge response	HEX
PARAMETER 1: Command code	01 to 9F	Command that is acknowledged.	HEX
END OF PACKET	<CR>	End of packet delimiter	ASCII CTL

7.1.1 Valid example

- #04A001<CR> = Acknowledge command number 0x01.

7.1.2 Response from HOST

The UNIT does not require any response form the HOST.

7.2 Error response

This response is used to tell the HOST that an error occurred in the command field, the parameter field or in the command execution. The possible errors are defined in the following table.

Field	Field Value	Description	Data Type
HEADER	#	Header delimiter	ASCII
NUMBER OF BYTES	06	Number of bytes in this packet	HEX
RESPONSE CODE	A1	Error response	HEX
PARAMETER 1: Command code	Many	Command that was sent. This field will be 00 if a hardware error occurred or a corrupted packet has been received.	HEX
PARAMETER 2: Error code	Many	01= Unknown command. 02= Hardware interface error. 03= Invalid parameter. 04= Invalid or corrupted packet. 05= Cannot process command, UNIT in standby. 06= Cannot process command, UNIT in mute. 07= Cannot process command, option not installed.	HEX
END OF PACKET	<CR>	End of packet delimiter	ASCII CTL

7.2.1 Valid example

- #06A17501<CR> = Unknown command error message (command 0x75 is unknown).

7.2.2 Response from HOST

The UNIT does not require any response form the HOST.

7.3 Communication setup response

This response returns the UNIT's communication setup to the HOST. The following table shows the response packet.

Field	Field Value	Description	Data Type
HEADER	#	Header delimiter	ASCII
NUMBER OF BYTES	06	Number of bytes in this packet	HEX
RESPONSE CODE	A2	Communication setup response	HEX
PARAMETER 1: Baud rate selected	01 to 06	01= Baud Rate is 38400 baud 02= Baud Rate is 19200 baud 03= Baud Rate is 9600 baud (**default**) 04= Baud Rate is 4800 baud 05= Baud Rate is 2400 baud 06= Baud Rate is 1200 baud	HEX
PARAMETER 2: Unsolicited Feedback status	0 or 1	0 = unsolicited feedback is OFF. 1= unsolicited feedback is ON (**default**).	BOOLEAN
PARAMETER 3: Unsolicited Display Feedback status	0 or 1	0 = unsolicited display feedback OFF (**default**). 1= unsolicited display feedback ON.	BOOLEAN
END OF PACKET	<CR>	End of packet delimiter	ASCII CTL

7.3.1 Valid example

- #06A20301<CR> = Baud rate is 9600 baud, unsolicited feedback is OFF and unsolicited display feedback is ON.

7.3.2 Response from HOST

The UNIT does not require any response form the HOST.

7.4 UNIT status response

This response returns the UNIT state to the HOST. The following table shows the response packet.

Field	Field Value	Description	Data Type
HEADER	#	Header delimiter	ASCII
NUMBER OF BYTES	10	Number of bytes in this packet	HEX
RESPONSE CODE	A3	UNIT status response	HEX
PARAMETER 1: Actual master volume MSB	00 to 03	Master volume MSB	HEX
PARAMETER 2: Actual master volume LSB	00 to FF	Master volume LSB	HEX
PARAMETER 3: Balance value	00 to FF	Balance value 00=Balance 100% left 64=Balance in center C8=Balance 100% right	HEX
PARAMETER 4: Selected input ID	00 to 08	01= OPT1 input selected 02= OPT2 input selected 03= SPDIF1 input selected 04= SPDIF2 input selected 05= USB input selected 06= A1 input selected 07= A2 input selected 08= PHONO input selected 09= MP input selected	HEX
PARAMETER 5: Active Sample Rate	00 to 0A	00= No stream playing 01= 44.1kHz stream playing 02= 48kHz stream playing 03= 88.2kHz stream playing 04= 96kHz stream playing 05= 176.4kHz stream playing 06= 192kHz stream playing 07= 352.8kHz stream playing 08= 384kHz stream playing 09= DSD64 stream playing 0A= DSD128 stream playing 0B= DSD256 stream playing	HEX
PARAMETER 6: UNIT state byte #1	00 to FF	BIT0= UNIT is ON when 1 BIT1= Mute active when 1 BIT2= Dac is locked when 1 BIT3= Display is OFF when 1 BIT4= Power Supply fault when 1 BIT5= DC Detected when 1 BIT6= Not used BIT7= Not used	HEX
PARAMETER 7: UNIT state byte #1	00 to FF	BIT0= Not used BIT1= Not used BIT2= Not used BIT3= Not used BIT4= Not used BIT5= Not used BIT6= Not used BIT7= Not used	HEX
END OF PACKET	<CR>	End of packet delimiter	ASCII CTL

7.4.1 Valid example

- #08A3000001<CR> = OPTICAL1 input selected, unit is ON, display is ON, mute inactive and no valid stream detected.

7.4.2 Response from HOST

The UNIT does not require any response form the HOST.

7.5 Product information response

This response returns the UNIT information. Available information is: product identification number, product software revision, RS232 communication software revision and product boot code revision. The following table shows the response packet.

Field	Field Value	Description	Data Type
HEADER	#	Header delimiter	ASCII
NUMBER OF BYTES	08	Number of bytes in this packet	HEX
RESPONSE CODE	A4	Product information response	HEX
PARAMETER 1: Product identification number	6B	6B=Moon 240i Integrated Amplifier	HEX
PARAMETER 2: Software revision number	01 to FF	Software revision number.	HEX
PARAMETER 3: Communication software revision number	01 to FF	RS232 communication software revision number.	HEX
END OF PACKET	<CR>	End of packet delimiter	ASCII CTL

7.5.1 Valid example

- #08A46B0102<CR> = Product ID is 0x6B (240i), software revision 1, RS232 communication software revision 2.
- #08A4FFFFFF<CR> = Get Expanded Product Information command must be used.

7.5.2 Response from HOST

The UNIT does not require any response form the HOST.

7.6 Input setup response

This response returns the requested input ID setup information. The following table shows the response packet.

Field	Field Value	Description	Data Type
HEADER	#	Header delimiter	ASCII
NUMBER OF BYTES	14	Number of bytes in this packet	HEX
RESPONSE CODE	A7	Input setup response	HEX
PARAMETER 1: Requested input ID	00 to 06	00=Invalid 01=OPTICAL1 input setup 02= OPTICAL2 input setup 03=SPDIF1 input setup 04=SPDIF2 input setup 05=USB input setup 06=ANALOG1 input setup 07=ANALOG2 input setup 08=PHONO input setup 09=MP input setup	HEX
PARAMETER 2: Label	9 byte string	NULL terminated label string (12 characters + NULL)	ASCII STR
PARAMETER 3: Offset value	00 to C8	00=Offset is -10.0 … 64=Offset is 0.0 … C8=Offset is +10.0	HEX
PARAMETER 4: Bypass	0 or 1	0=Bypass is inactive 1=Bypass is active	BOOLEAN
PARAMETER 5: Enable/Disable	0 or 1	0=Input is disabled 1=Input is enabled	BOOLEAN
END OF PACKET	<CR>	End of packet delimiter	ASCII CTL

7.6.1 Valid example

#15A701OPTICAL1 <NULL>01<CR>=OPTICAL1 input setup is: label is “OPTICAL1 “, input OPTICAL1is enabled.

7.6.2 Response from HOST

The UNIT does not require any response form the HOST.

7.7 Factory defaults response

This response is returned when factory defaults have been loaded in the UNIT. The following table shows the response packet.

Field	Field Value	Description	Data Type
HEADER	#	Header delimiter	ASCII
NUMBER OF BYTES	02	Number of bytes in this packet	HEX
RESPONSE CODE	A9	Factory defaults response	HEX
END OF PACKET	<CR>	End of packet delimiter	ASCII CTL

7.7.1 Valid example

- #02A9<CR> =Factory defaults have been loaded in the UNIT.

7.7.2 Response from HOST

The UNIT does not require any response form the HOST.

7.8 Unit Wake-up response

This response is used to tell the HOST that the UNIT rocker switch has been turned on to ease synchronization between HOST and UNIT. This response is sent once and will also be sent after every Reset UNIT command. The following table shows the response packet.

Field	Field Value	Description	Data Type
HEADER	#	Header delimiter	ASCII
NUMBER OF BYTES	02	Number of bytes in this packet	HEX
RESPONSE CODE	AA	Wake-up response	HEX
END OF PACKET	<CR>	End of packet delimiter	ASCII CTL

7.8.1 Valid example

- #02AA<CR> = UNIT's rocker switch was turned on.

7.8.2 Response from HOST

The UNIT does not require any response form the HOST.

7.9 MiND setup response

This response returns the CD input ID setup information. The following table shows the response packet.

Field	Field Value	Description	Data Type
HEADER	#	Header delimiter	ASCII
NUMBER OF BYTES	04	Number of bytes in this packet	HEX
RESPONSE CODE	AC	MiND setup response	HEX
PARAMETER 1: Input ID	01 to 04	01= OPTICAL1 set as MiND input 02= OPTICAL2 set as MiND input 03= SPDIF1 set as MiND input 04= SPDIF2 set as MiND input 06=ANALOG1 set as MiND input 07=ANALOG1 set as MiND input	HEX
END OF PACKET	<CR>	End of packet delimiter	ASCII CTL

7.9.1 Valid example

- #04AC04<CR> = SPDIF2 is set as MiND input.

7.9.2 Response from HOST

The UNIT does not require any response form the HOST.

7.10 CD setup response

This response returns the CD input ID setup information. The following table shows the response packet.

Field	Field Value	Description	Data Type
HEADER	#	Header delimiter	ASCII
NUMBER OF BYTES	04	Number of bytes in this packet	HEX
RESPONSE CODE	AD	CD setup response	HEX
PARAMETER 1: Input ID	01 to 07	01= SPDIF1 set as CD input 02= SPDIF2 set as CD input 06=ANALOG1 set as MiND input 07=ANALOG1 set as MiND input	HEX
END OF PACKET	<CR>	End of packet delimiter	ASCII CTL

7.10.1 Valid example

- #04AD08<CR> = AES/EBU is set as CD input.

7.10.2 Response from HOST

The UNIT does not require any response form the HOST.

7.11 Expanded product information response

This response returns expanded product information for the main system and the different sub-systems included in the product. All the devices should return at least the main system information. In this main system information, the device also indicates how many subsystems it also supports.

Main System information:

Field	Field Value	Description	Data Type
HEADER	#	Header delimiter	ASCII
NUMBER OF BYTES	24	Number of bytes in this packet	HEX
RESPONSE CODE	FE	Expanded product information response.	HEX
PARAMETER 1: Sub-system ID	00	00= main system information.	ASCII HEX
PARAMETER 2: Serial number	aaabbbbccccc	aaa= Date code (ASCII) bbbb= product number (HEX) ccccc= serial number (HEX) **Note**: leading zeroes or spaces character are used when needed. **Note**: a date code of 000 means unknown serial number.	ASCII HEX
PARAMETER 3: Quantity of sub-systems	00 to FF	xx= Quantity of sub-systems	HEX
PARAMETER 4: Product identification number	0000 to FFFF	xxxx= UNIT product code.	HEX
PARAMETER 5: Main hardware revision number	01 to FF	xx= Main hardware revision number	HEX
PARAMETER 6: Main firmware revision number	xxyyzzzz	xx= Major revision number yy= Minor revision number zzzz= Build number	HEX
PARAMETER 7: Communication software revision number	01 to FF	RS232 communication software revision number.	HEX
PARAMETER 8: Boot code revision number	01 to FF	Boot code revision number.	HEX
END OF PACKET	<CR>	End of packet delimiter	ASCII CTL

7.11.1 Valid example

- #24FE0000J00710123401007101010112340202<CR> = Main system information field. UNIT is product number 6Z, date code is J, serial number is 01234, 1 sub-system is present, main hardware revision is 1, main firmware revision is 01.01 build number 1234, communication software revision is 02 and boot code revision number is 02.

7.11.2 Response from HOST

The UNIT does not require any response form the HOST.

8 RS232 Unsolicited feedback

This section lists the responses that will be sent when the unsolicited feedback or the unsolicited display feedback is active. The following table resumes the unsolicited feedback responses.

Response Code	Description
A3	UNIT status response. Sent when UNIT state changes.
A9	Factory defaults response. Sent when factory defaults have been loaded.
AA	Unit Wake-Up

Note: regardless of the unsolicited feedback setup, the UNIT will send the UNIT status response and Unit Wake-up response at initial startup.

9 Infrared remote control

This section lists the RC5 infrared commands that are accepted by the UNIT. Please note that the UNIT will respond only to RC5 system number **16**. Also note that the UNIT uses some commands that are in the extended range of the RC5 protocol. The following table resumes the RC5 commands.

RC5 Command Code	Description
00	Select OPT1 input
01	Select OPT2 input
02	Select SPDIF1 input
03	Select SPDIF2 input
04	Select USB input
05	Select A1 input
06	Select A2 input
07	Select Phono input
08	Select MP input
12	Toggle UNIT's power state
13	Toggle mute state
15	Display intensity scroll
61	Toggles UNIT's power state (broadcasted on the SimLink bus)
62	Select previous input
63	Select next input
88	Set mute ON
89	Set mute OFF
123	Set UNIT ON
124	Set UNIT OFF

Appendix A: 240i RS232 Command and Response Codes Summary

Setup command code	Number of bytes	Parameters	Description
20	06	01= Set Baud Rate at 38400 baud 02= Set Baud Rate at 19200 baud 03= Set Baud Rate at 9600 baud (**default**) 04= Set Baud Rate at 4800 baud 05= Set Baud Rate at 2400 baud 06= Set Baud Rate at 1200 baud	Set communication parameters
		0 = Set unsolicited feedback OFF. 1= Set unsolicited feedback ON (**default**).	
		0 = Set unsolicited display feedback OFF (**default**). 1= Set unsolicited display feedback ON.	
21	02	None	Reset UNIT
22	02	None	Set Factory Defaults
23	0D	00=Invalid 01=Set OPTICAL1 input label 02=Set OPTICAL2 input label 03=Set SPDIF1 input label 04=Set SPDIF2input label 05=Set USB input label 06=Set A1 input label 07=Set A2 input label 08=Set PHONO input label 09=Set MP input label	Set input label
		NULL terminated label string (12 characters + NULL)	
24	05	00=Invalid 01=Enable/disable OPTICAL1 input 02=Enable/disable OPTICAL2input 03=Enable/disable SPDIF1 input 04=Enable/disable SPDIF2input input 05=Enable/disable USB input 06= Enable/disable A1 input 07=Enable/disable A2 input 08=Enable/disable PHONO input 09=Enable/disable MP input	Enable/disable input
		0=input disabled 1=input enabled (**default**)	

Status command code	Number of bytes	Parameters	Description
01	02	None.	Get UNIT status
02	02	None.	Get product information
03	02	None.	Get communication setup
04	02	None.	Get UNIT display string
07	02	None.	Get IR
08	02	None.	Get MiND Input
0A	02	None.	Get CD Input
1F	04	00= Main system 01 to FE= Sub-system ID	Get expanded product information command

User command code	Number of bytes	Parameters	Description
60	04	01=Toggle power state (same as pressing the front panel's pushbutton). 02=Set power ON. 03=Set power OFF.	Set power state
61	04	01=Toggle display state (same as pressing and holding the front panel pushbutton). 02=Set display ON. 03=Set display OFF.	Set display state
62	04	01=Scroll to next display intensity (low, medium, high, etc) 02=Set display intensity to low. 03=Set display intensity to medium (**default**). 04=Set display intensity to high.	Set display intensity
63	04	00= Invalid 01= Select OPT1 input 02= Select OPT2 input 03= Select SPDIF1 input 04= Select SPDIF2 input 05= Select USB input 06= Select A1 input 07= Select A2 input 08= Select PHONO input 09= Select MP input 80= Go to previous input 81= Go to next input	Set input selection
65	04	01=Toggle mute state (same as pressing the front panel's pushbutton). 02=Set mute ON. 03=Set mute OFF.	Set mute
66	04	01=Decrement balance with 1% step (go left) 02=Increment balance with 1% step (go right) 03=Set the balance to the specified value	Set Balance

UNIT response code	Number of bytes	Parameters	Description
A0	04	Command that is acknowledged (01 to 9F).	Acknowledge response
A1	06	Command that was sent. This field will be 00 if a hardware error occurred or a corrupted packet has been received. 01= Unknown command. 02= Hardware interface error. 03= Invalid parameter. 04= Invalid or corrupted packet. 05= Cannot process command, UNIT in standby. 06= Cannot process command, UNIT in mute. 07= Cannot process command, option not installed.	Error response
A2	06	01= Baud Rate is 38400 baud 02= Baud Rate is 19200 baud 03= Baud Rate is 9600 baud (**default**) 04= Baud Rate is 4800 baud 05= Baud Rate is 2400 baud 06= Baud Rate is 1200 baud 00= unsolicited feedback is OFF. 01= unsolicited feedback is ON (**default**). 00= unsolicited display feedback is OFF(**default**). 01= unsolicited display feedback is ON.	Communication setup response

A3	08	01= OPT1 input selected 02= OPT2 input selected 03= SPDIF1 input selected 04= SPDIF2 input selected 05= USB input selected 06= A1 input selected 07= A2 input selected 08= PHONO input selected 09= MP input selected	UNIT status response
		00= No stream playing 01= 44.1kHz stream playing 02= 48kHz stream playing 03= 88.2kHz stream playing 04= 96kHz stream playing 05= 176.4kHz stream playing 06= 192kHz stream playing 07= 352.8kHz stream playing 08= 384kHz stream playing 09= DSD64 stream playing 0A= DSD128 stream playing 0B= DSD256 stream playing	
		BIT0= UNIT is ON when 1 BIT1= Mute active when 1 BIT2= Valid stream (locked) when 1 BIT3= Not used BIT4= Not used BIT5= Not used BIT6= Not used BIT7= Not used	
		BIT0= Not used BIT1= Not used BIT2= Not used BIT3= Not used BIT4= Not used BIT5= Not used BIT6= Not used BIT7= Not used	
A4	08	6B=Moon 240i Integrated Amplifier.	Product information response
		Software revision number.	
		RS232 communication software revision number	

A7	14	00=Invalid 01=OPTICAL1 input setup 02= OPTICAL1input setup 03=SPDIF1 input setup 04= SPDIF1input setup 05=USB input setup 06=A1 input setup 07=A2 input setup 08= PHONO input setup 09=MP input setup	Input setup response
		NULL terminated label string (8 characters + NULL)	
		0=Input is disabled 1=Input is enabled	
A9	02	None.	Factory defaults response
AA	02	None.	Wake-up response
AC	04	01= OPTICAL1 set as MiND input 02= OPTICAL2 set as MiND input 03= SPDIF1 set as MiND input 04= SPDIF2 set as MiND input	MiND setup response
AD	04	01= SPDIF1 set as CD input 02= SPDIF2 set as CD input	CD setup response