Communications Protocol

For the Mirage Audio System

Data acquisition and control of Autonomic equipment is performed by home automation systems or personal computers using a special protocol developed by Autonomic. This document explains the protocol itself and the low level transport.

1. Transport

1.1 RS-232

The cable must be a straight wired, **Only RX, TX & 0V (pin 5) are used.** Baud Rate = **9600.**

Each byte in the command is encoded into two ASCII encoded hexadecimal characters. A line feed signals the end of the command. The carriage return that is typically used in combination with the line feed is optional and is ignored. XON and XOFF (characters 11h and 13h) are used for flow control where the XOFF state times out after approximately 1.5 seconds in order to prevent an inadvertent system lock up.

If the device that is receiving a command is capable of transmission, it should transmit the command back to the originator. This is required because of connection issues with RS-232. For example a PC's TX is connected to an amplifier's RX and the amplifier's TX is connected to a keypad and the PC's RX. For the PC to communicate successfully with the keypad, everything that arrives on the amplifier's RX must be sent back out of its TX. To avoid possible endless cycles, the device originally sending a command must ignore the command if it is received again.

1.2 USB

Previously the CDC class (abstract control model) was employed to emulate RS-232, enabling software to interact with devices supporting USB theoretically without need of change. However from the Mirage M-800 Amplifier onwards a proprietary protocol is in use.

1.3 Mirage Amplifier Bus

The Mirage bus is based on the I²C bus and allows multiple devices to be attached to a common bus. All transmissions are performed using multi-master mode and take the following form:

<start bit><address byte><command data><stop bit>

The address byte is a requirement of the I²C bus. 7 bit address mode is used and the R/W bit is always 0 (always writing). Address 30h is used for the Mirage Amplifier protocol (02h was used by older devices until this address was declared as being reserved). Other addresses are used such as 3Ah (for Ethernet packets) and 20h (for transmission preambles to ensure collision free access to the bus). Other devices using different protocols can be connected to the Mirage Amplifier bus if they use different addresses and support multi-master mode.

1.4 Infrared

The infrared interface allows Mirage Amplifier devices to be controlled using the Mirage Amplifier Communications Protocol. It is not suitable for two-way communications unless combined with RS232 or the Mirage Amplifier bus.

The modulation frequency is 44.1 kHz and all bursts of IR are 1ms in length. The length of the pauses between the IR bursts is what contains the data. The first pause is 3ms and represents the start bit. All following pauses are either 1ms or 2ms, which represent logic 0 and logic 1 respectively. Each IR stream takes the following form:

\<start bit\>\<product ID\>\<command data\>\<checksum\>\<stop bit\>

The product ID is a three bit code and is 001 for Mirage Amplifiers.
The checksum is built using the command data: the sum of each byte in the command plus the checksum must equal zero. The stop bit is represented by a 15ms pause before there is any further IR activity. A receiver can however decide as soon as 4ms after IR activity has ceased that the packet is complete.

1.5 Ethernet

On Ethernet equiped devices, commands can also be sent via Ethernet in the same format as RS232 commands to TCP port 17037. However unlike RS232, commands sent to the device are not echoed back. A telnet session can be used for experimentation purposes.

2. Command Protocol

Command structure: **\<command\>\<zone\>[\<data\>[\<data\>[...]]]**
Command:
The command byte can have the following values:

Command (Hex Value)	Description
00	No Operation
01	Standby
02	Mute
03	Source Selection
04	Volume
05	Bass
06	Treble
07	Balance
08	Request Protocol Version
09	Send All Parameters
0C	Amplifier special features
0D	Maximum Volume Limit
10	Unsupported IR command received
11	Volume Up
12	Volume Down
13	Amp Source - Keypad Bank Assignment
14	Request Device information
1B	Preset Parameters
1C	Zone Name
1D	Preamplifier Volume Mode
1E	Preset Selection / Status
1F	Report Key press in preset
21	Request amp source - Keypad Bank Assignments

22	Request device log entry
27	Set time zone, date and time
29	Source Name
2A	Preset Name
2B	Request preset name
2C	Source Up
2D	Source Down
2E	Zone assignment
2F	Request zone assignments
30	Link zones
31	Audio delay
32	Source Gain
33	Page Preset 2 Selection
34	Clipping notification
35	IR routing assignments
36	Party mode select/deselect
37	Party mode configuration
38	Zone name request
39	Request extended device information
3A	Network settings
3C	List sources
40	Report message
41	Request time
42	Settings management
43	PCM stream management
44	Zone gain
46	Source specific metadata
47	Source specific metadata request
60 – 6F	Reserved (undocumented commands)
70 – 7F	User defined commands
80 + command value	Command Response

The commands are also used as notifications. If an amplifier is switched on by pressing the standby button on the amplifier's front panel, it will notify the other devices by sending the standby command. Any other amplifiers on the same zone will take the notification as a command and also switch on. This can be used for synchronising two amplifiers.

Zone:

This byte is used for checking if the command is applicable to the device receiving the command. If the command is applicable, it will be used for optionally selecting a "sub-device", e.g. a bank or part of a device.

The lower 5 bits of the zone byte equal **00 – 1F** for zones 0 to 31. The upper 3 bits can represent a sub-zone or extended zones. FF is used for addressing all zones and can be used for turning all amplifiers on.

Bits 7 is set for extended zones 32..95. Bit 5..7 represent three zone ranges:

000 common zone range (0..31)
100 extended zones 32..63
110 extended zones 64..95

Data:

Some commands use a unique 16 bit device ID, which is assigned to the device during manufacturing. The number of data bytes is dependent on the command. The maximum number of data bytes should be restricted to 20. If a multi-byte parameter containing large numbers (e.g. the device ID) then the left most bytes in the string (the ones received first) are the most significant (big-endian format).
If fewer than the expected number of data bytes are received, the Mirage M-800 Amplifier and later devices treat the command as a request and will return the requested data.

Command	Data field length	Content (Hex value)
Standby **(01)**	1 byte	**00** Standby A off **01** Standby A on **04** Toggle standby A
Mute (**02**)	1 byte	**00** mute **01** unmute **02** toggle mute
Source Selection (**03**)	1 byte	**00** select S5 (CD) **01** select S6 (Tape) **02** select S7 (Tuner) **03** select S4 (Aux) **04** select S8 (Utility) **05** select S1 (SAT) **06** select S2 (DVD) **07** select S3 (Video) **08 .. 0F** select S9..S16 **10** Reserved **11** Reserved **12** Media Player **13** Reserved Bit 5 is reserved and should be set to 0. Bit 6 is set if Video source is not to be switched, i.e. **40** select S5 (CD) audio only **41** select S6 (Tape) audio only **42** select S7 (Tuner) audio only **43** select S4 (Aux) audio only **44** select S8 (Utility) audio only **45** select S1 (SAT) audio only **46** select S2 (DVD) audio only **47** select S3 (Video) audio only **48 .. 4F** select S9..S16 audio only Bit 7 is set to turn the zone on.
Volume (**04**)	1 byte	**00 – A0** (0 – 160) Decimal value is only in increments of 4.

Bass (**05**)	1 byte	**F4 – 0C** (-12 – 12)
Treble (**06**)	1 byte	**F4 – 0C** (-12 – 12)
Balance (**07**)	1 byte	**EC – 14** (-20 – 20)
Request Protocol Version (**08**)	0 bytes in command, 1 byte in response	**01** in response for the current version.
Send All Parameters (**09**)	0 bytes	Do not send to all zones because this will generate an unreasonable amount of traffic, particularly on large amplifier stacks. This command is deprecated – try to use requests for specific parameters if possible.
Amplifier special features (**0C**)	1 byte	Bit 0 = loudness enable Bits 1..3 = not used Bit 4 = Preamplifier controls Ampon signal when set, otherwise the amplifier controls Ampon. Bit 5 = Ampon control supported when set. Bit 6 = Sound played back on page preset. Obsolete, use the flag in the Preset Parameters command. Bit 7 = Sound playback enable supported when set (deprecated).
Maximum volume (**0D**)	1 byte	**00 – A0** (0 – 160)
Unsupported IR command received (**10**)	1 byte	The command received. This can be used for controlling other devices using the amplifier as an IR receiver.
Volume Up (**11**)	0 bytes	**00** (value ignored)
Volume Down (**12**)	0 bytes	**00** (value ignored)
Amp Source - Keypad Bank Assignment (**13**)	3 bytes	First two bytes are the device ID followed by one byte where the upper 4 bits is the amplifier source and the lower 4 bits are the keypad bank. If the upper 4 bits are all set (**F**), the assignment is deleted for the bank.

Request Device information (**14**)	0 or 1 bytes in command, 5+ bytes in response	Request: if a data byte exists, bit 0 is set if devices should not reply on the Mirage Amplifier bus. This enables information retrieval of devices directly connected to a serial port, usb, etc. If bit 1 is set devices should only reply on the port that received that command. This prevents flooding the stack with responses. If bit 2 is set all zones on the unit responding are listed after the data. Response: First byte is the device type. Second byte is the firmware version. Third byte is device specific information. Fourth & firth bytes are a unique ID for the device (MSD first). If more than 5 bytes are returned, the remaining data are specific to the type of device. Zones are added to the response if bit 2 is set in the options byte in the request.
Preset Parameters (**1B**)	12 - 24 bytes	Like the preset select command, this command should be sent to all zones. The first byte is the preset to set up using the same constants as the preset select command, where preset 1 = 2. 10h can be used for specifying settings for the preset used by the second page contact. Three bytes for the auto activation schedule in local time: • Hour (0..23) • Minute (0..59) • Weekdays (bit 0 = Sun, bit 1 = Mon, .., bit 6 = Sat). Bit 7 is set to deactivate auto activation. 8 bytes for the zone selection: lower 32 bits (last 4 bytes) represent the 32 zones for the amp rooms, upper 32 bits represent the 32 zones for the Preamp rooms. Optionally 3 more bytes for DND (do not disturb). First two bytes are the time window (time from, time to) where bits 2..6 represent the hour and bits 0..1 represent the minute in quarter hour resolution (minute in {00, 15, 30, 45}). The third byte represents the preset to substitute when inside the time window (where preset 1 = 2). Set to 0 when DND is unused. DND is only supported for page presets. Optionally 1 byte for flags: • Bits 0..1 preset sound selection (4 sounds) • Bit 2 enables sound playback on preset activation by contact closure (page presets). • Bit 3 enables sound playback on preset activation by Preset Selection command. • Bit 4 enables sound looping. • Bit 5 disables preset macro transmission. Optionally 8 bytes for zone 32..95 selection.
Zone name (**1C**)	Unlimited	Data field contains the string. Character encoding is UTF-8.
Preamp volume mode (**1D**)	1 byte	A signed number in the same units as the volume command. –128 (**80h**) represents independent mode, otherwise tracking mode is specified and the offset is equal to Preamp – Amp volume.

Preset Selection / Status (**1E**)	1 or 2 bytes	Supports up to 15 presets (including page preset) and is intended to always be transmitted to all zones (zone byte should be **FF**). 1st byte commands the preset selection: **00** = default (page preset input selects between standard and page preset modes) **01** = force page preset mode **02** = select preset 1 **03** = select preset 2 ... **0F** = select preset 15 **10** = select preset assigned to the second page contact Bit 7 selects the preset load function, which loads the preset settings but stays in non-preset mode. Bit 6 selects sound playback. Bit 5 locks all settings when set. Prevents inadvertent changes to the preset via front panel, IR or otherwise. 2nd optional byte specifies the current preset status: **00** = standard mode **01** = page preset selected **02** = preset 1 selected **03** = preset 2 selected … **FF** = unspecified
Report key press in preset (**1F**)	1 byte	Same as the "Emulate key press on Keypad" command except that this is only used for reporting the keys in a preset macro for information only.
Request amp source to keypad bank assignments (**21**)	2 bytes	Device ID. The keypad then sends all its assignments.

Request device log entry (**22**)	3 - 5 bytes in request, 11 or more bytes in response when entry exists, 4 bytes when not.	Request contains: • Device ID (2 bytes) • Log entry ID low byte • Log entry ID high byte (optional) • Number of entries to return (optional) Responses are returned with: • Device ID (2 bytes) • Log entry ID low byte (1 byte) • Log entry type (1 byte), FFh for no entry • Hour (0..23) • Minute (0..59) • Second (0..59) • Weekday (0 = Sun, 1 = Mon, .., 6 = Sat). Lower 3 bits only. • Day (1..31) • Month (1..12) • Year (0..255, where 0 = 2000) Further bytes may be sent as parameters. The number and format depend on the log entry type. Multiple responses are returned if the request asks for more than 1 log entry.
Set time zone, date and time (**27**)	19 bytes	• Standard time offset in minutes (2 bytes) • Daylight saving time (DST) offset in minutes (2 bytes) • DST to standard time changeover month (1..12) • DST to standard time changeover week (1 = first week in month, 2 = second week, 5 = last week in month) • DST to standard time changeover weekday (0 = Sun, 1 = Mon, .., 6 = Sat) • DST to standard time changeover hour (0..23) • Standard time to DST changeover month • Standard time to DST changeover week • Standard time to DST changeover weekday • Standard time to DST changeover hour • Hour (0..23). Bit 7 set if in DST, bit 6 set if standard time. If neither bit is set, time is local time (either DST or standard time). • Minute (0..59) • Second (0..59) • Weekday (0 = Sun, 1 = Mon, .., 6 = Sat). Lower 3 bits only. • Day (1..31) • Month (1..12) • Year (0..255, where 0 = 2000) The offset values are 16 bit signed values in minutes (high byte first). The following rule applies: local time = UTC + offset If no daylight saving applies, all changeover parameters are 0. Changeover times are in the standard local time.

Source Name (**29**)	Min 4 bytes	First byte is the source ID (00 – 0B). Bytes 2 – 4 represent a short name of up to three characters. If the name is shorter than three characters, the remaining bytes are set to 00. After the short name an optional long name can be specified. Character encoding is UTF-8.
Preset Name (**2A**)	Min 1 byte	The first byte is the preset to set up using the same constants as the preset select command, where preset 1 = 2. Following bytes is the preset name. Character encoding is UTF-8.
Request preset name (**2B**)	1 byte	The preset to set up using the same constants as the preset select command, where preset 1 = 2. The response is the "Preset Name" command.
Source Up (**2C**)	1 byte	**00** audio source up with video source sync **01** audio source up **02** video source up
Source Down (**2D**)	1 byte	**00** audio source down with video source sync **01** audio source down **02** video source down
Zone assignment (**2E**)	2+ bytes	Device ID followed by a list of zone numbers
Request zone assignments (**2F**)	0 or 2 bytes in request, *n* bytes in response	Request: device ID of device to request the zones from. If no device ID is specified, the device receiving the command will answer and the command will not be relayed to another interface. Response: device ID followed by a list of zone numbers.
Link zones (**30**)	2+ bytes	Replaces the "link zone pair" command (0F) and can link any number of zones into a group. This command should be sent to all zones (zone byte = FF). The first byte specifies the options for the zone link group: • Bit 0 is set for source linking • Bit 1 is set for volume linking • Bit 2 is set for standby (power on/off) linking • Bit 7 is set if the list of zones is preceded by a 4 byte group identifier. Group identifiers are not enabled in all amplifier firmwares. • Bit 6 is reserved for internal purposes. • Bit 5 can be set in requests for suppressing responses for ungrouped zones. Sending 30FF20 will request only the grouped zones. The remaining bytes list the zones in the group and are in {0..95}. Zones can be removed from the group by defining new groups which exclude the zone or by defining groups which contain only the zone to exclude. Similarly if a group contains {A, B, C, D} and a new group is defined containing {A, C} then {B, D} will remain in the original group. A zone cannot belong to more than one group. Zone groupings are not affected by presets.
Audio delay (**31**)	1 byte	Output delay of audio stream in 5ms steps. 00 = no delay.

Source Gain (**32**)	2 bytes	First byte is the source ID (00 – 0B). Second byte is analogue input gain **00 – 12** (0dB – +18dB).
Page Preset 2 Selection (**33**)	1 byte	The preset to be selected when the second page contact is closed. Sent to all zones.
Clipping notification (**34**)	2 bytes	First byte is type of clipping event. The second byte is information pertaining to the event. The following events are currently defined: • 01 – analogue input clipped. The following byte represents the source that is clipped. • 02 – analogue input unclipped.
IR routing assignments (**35**)	6+ bytes 3 bytes in request	First two bytes is the unit ID. Third byte is the IR source (keypads, bus run, expansion bus, etc) where the first keypad is 0. The bus run is 4 on the Mirage M-400 Amp and 8 on the Mirage M-800 Amp. The expansion bus is 5 and 9 on the M-400 and M-800 Amplifiers. Fourth byte is the zone to monitor for source selection in {0..95}. Then for each source starting from S1, two bytes which represent a bitmap of IR output enables. IR output 1 is at bit 0, IR sum output follows bit for last output, expansion bus follows bit for IR sum output. If the IR source is the expansion port or bus run, the zone is ignored and only two bytes for the IR output enables is used. Sent to all zones.
Party mode select / deselect (**36**)	1 byte	**00** = deselect party mode (selects standard mode) **01** = select party mode The party mode selection is stored in presets so that presets can activate or deactivate this mode. Sent to all zones.
Party mode configuration (**37**)	3 bytes	First two bytes is the unit ID of the party master. Third byte is the source selected for its party mode output. Sent to all zones.
Zone name request (**38**)	0 bytes	Requests the zone name.

Request extended device information (**39**)	2 bytes in command, response length is device specific	Command: two bytes for the unit ID. Response for Mirage M-800 Amplifier: • 4 bytes for 32 bit unit ID where bytes 3-4 match the standard 16 bit unit ID. • 3 bytes for firmware version: major, minor and beta version (0 for release versions). • 1 byte current temperature (signed). • 1 byte peak temperature (signed). • 4 bytes for IP address. • 6 bytes for MAC address. • 3 bytes manufacture date: year (0..255 = 2000..2255), month (1..12), day (1..31) • 1 byte flags (bit 0 set when settings are locked)
Network settings (**3A**)	Minimum 3 bytes	Two bytes for the unit ID, followed by setting ID which is followed by the setting. Setting IDs: • 01h = Network name • 02h = Time server name • 03h = 1 byte flags where bit 0: 0 = DHCP, 1 = Static, bit 1: 0 = Time server disabled, 1 = Time server enabled, bit 2: reserved. 16 bytes IP addresses (4 bytes per address): IP address, subnet mask, DNS server, default router. • 81h = Request network name • 82h = Request time server name • 83h = Request IP addresses and flags Sent to all zones.
List sources (**3C**)	0 bytes to query sources.	Lists the available sources on the zone. Notifications are sent if the available sources change.
Report message (**40**)	2+ bytes	First byte is message type: • **00** = Information • **01** = Error • **02** = Success Followed by UTF-8 string. Sent to whichever zones and interfaces are relevant.
Request time (**41**)	1 byte in request, 7 bytes in response	Requests the time. 00 = Immediately, 01 = the next time it changes. The response contains the time in UTC if available: • Hours (0..23 decimal) • Minutes (0..59 decimal) • Seconds (0..59 decimal) • Weekday (0 = Sun, 1 = Mon, .., 6 = Sat). Lower 3 bits only. Bit 4 is set for UTC and clear for local time. • Day (1..31) • Month (1..12) • Year (0..255, where 0 = 2000)

Settings management (**42**)	3+ bytes	Two bytes for the unit ID, followed by instruction: • **00** = Query settings lock state. • **01** = Lock settings. • **02** = Unlock settings. If a command, this must be followed by 4 bytes for the password. If status is being reported only the instruction byte is sent. • **03** = Restore default settings. Must be followed by two bytes 55h and AAh. Sent to all zones.
Zone gain (**44**)	1 byte	**F4 – 0C** (-12 dB – +12dB)
User accounts (**45**)	3+ bytes	Two bytes for the unit ID, one byte for list entry index, followed by strings for user name and password. Each string is null terminated. 1 byte follows the strings which specifies the resource being protected. Currently only 01 is defined for the web application which uses the following further parameters. • 12 bytes for zone enable (zones 0..95). Bit 0 of the 12th byte corresponds to zone 0 and bit 7 of the 1st byte corresponds to zone 95. • 3 bytes for source enable (S1..S16, Media player). Bit 0 of the 3rd byte corresponds to S1 and bit 7 of the 2nd byte corresponds to S16. Bit 2 of the 1st byte is the media player, bits 0 and 1 are reserved. • 2 bytes for preset enable (presets 1..14). Bit 0 of the 2nd byte corresponds to preset 1. • 1 byte for other enable where bit 0 enables the Settings button. No parameters follow the list entry index for the last entry in the list. The list entry index begins at 0 and is FFh to request the list. Entries must be sent in ascending order.
Source specific meta-data (**46**)	2+ bytes	First byte is source ID. Second byte is metadata entry index beginning at 0. Remaining bytes is the metadata in UTF-8 format. Support for this command and the number of supported metadata entries is device specific.
Source specific meta-data request (**47**)	2 bytes	First byte is source ID. Second byte is metadata entry index beginning at 0. Support for this command and the number of supported metadata entries is device specific.

Notes:

- 'Standby On' commands imply that the amplifier is not muted if the amplifier was previously off. A mute command must follow the standby command if it should be muted.
- The Volume Up and Volume down commands increment or decrement the amplifiers volume at each command string reception. Therefore to achieve a volume ramp, the commands must be sent continuously for the duration of the ramp.

    * Zone Grouping

    The "link zones" command tells all the zones in the command to be linked into one group. Commands sent to any of the zones in the group will cause all the zones in the group to implicitly track the change. Devices therefore need to know about all the zones in the group, even if they are otherwise not used by the device. In addition, devices reporting their linked zones using this command must be able to list zones in the group that are not used by the device.

- The first byte of the response to the "request device information" has the following values:
    * 00 = amplifier
    * 01 = keypad
    * 02 = remote control

- The third byte of the response to the "request device information" has the following meanings for the amplifier when bit 7 is 1:
    * 87h = M400
    * 88h = M800

- The "send all parameters" command applies to amp/preamp groups and not to individual rooms.
  The preamp bit of the zone byte is ignored.