

SIM2 BV INTERNATIONAL SRL

NERO4

IR and RS-232 Control

Rev. 1.0 (18 November 2016)



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Revision History

Rev.	Date	Software Version	Description of Change
1.0	18 November 2014		Initial version.

1. Introduction

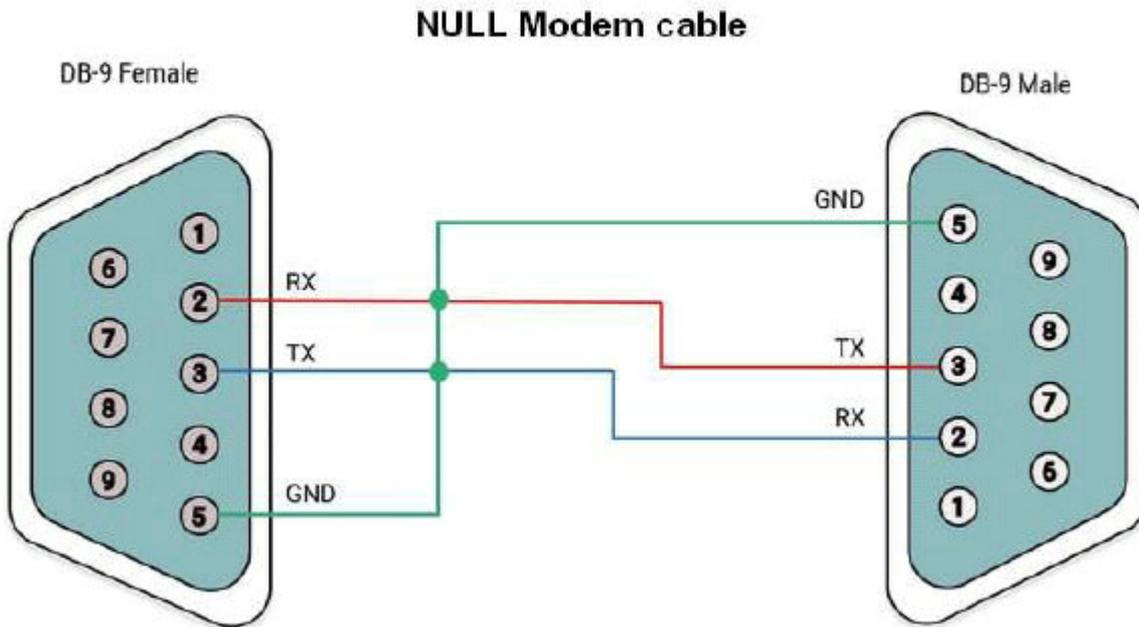
This document describes how to interface the N ERO4 projector with a Home Theatre control system (or a PC) over a direct serial connection or IR communication.

1.1 Setting up the RS-232 Serial connection

Follow these steps to configure the control system (or the PC) serial port.

>Switch off the control system (or the PC) and the projector.

>Use a NULL Modem serial cable with 9 pin male to the control system (or the PC) and 9 pin female to the Projector:



>Make sure the distances between equipment do not exceed the specifications of the interface (15 m or 50 feet).

>Switch on the control system (or the PC) and, after start up, switch on the projector.

>Set the Serial Port Parameters as shown below:

Communication Parameters

Communication Parameters

Parameter	Value
Transfer Rate	19200 bps
Data Bits	8
Parity Bit	None
Stop Bit	1
Flow Control	None

>Set the control system (or the PC program) Communication Mode to Binary (or Hex). ASCII mode is not supported.

> Set the control system interface (or the PC communication program) Display Mode to Hex.

1.2 Execution of the command

Command execution time may vary from 0.1 to 2.0 seconds, depending on the operation that have been requested. If the projector is busy when a command is sent, the unit may not accept the command. When several commands are to be sent one after the other, sufficient time between them should be allowed. When the unit is switched on from Standby wait 15 seconds before sending commands or reading messages sent by the projector.

In this section, serial commands (and respective responses) are listed. Commands (and responses) are series of bytes (numbers holding values from 0 to 255).

In the following, bytes are represented by couples of hexadecimal digits, shown in monospace (fixed-width) type (for example: EF¹). Spaces between bytes (for example: E4 48) have been inserted just to make the command more readable and are not part of the command itself.

Commands do not require any termination character: do not add <LF>, <CR>, <EOT> or the like at the end of the given series of bytes.

1.3 Communication Protocol

The communication protocol is packet oriented. Packets consists of Header and Payload.

The packet header size is fixed (7 bytes), while the packet payload type and content varies based on the type of packet.

The entire packet size is variable, being the sum of the fixed-size packet header and variable-sized packet payload. Event packet size is 13 bytes.

Header

All Packets use the same Packet Header format.

The Packet Header size is fixed at seven bytes.

0	1	2	3	4	5	6
BE	EF	Packet Type	Packet Payload Size		Packet Checksum (CRC)	

0xEFBE is a fixed value that is used to insure packet alignment if there are partial packets received or byte lost. The least-significant byte of the word (BE) is sent first, then the most-significant-byte (EF).

The **Packet Type** is a number (a byte in length) that defines the type of data in the packet.

The **Packet Payload Size** is a number (two bytes) that defines the size of the payload portion of the packet. For a given Packet Type, Packet Size is fixed.

The **Packet Checksum** (two bytes) is the CRC value for the entire packet (Header and Payload).

2. Commands

2.1 Remote Control Keys Codes

The following serial commands are meant to emulate button presses on the SUPERLUMIS IR Remote Control. Like remote button presses they interact with the OSD of the projector.

Key	Command	Response	
		Pass	Fail
Power On	BE EF 02 06 00 6B E6 52 01 00 00 00 00	06	15
Power Off	BE EF 02 06 00 51 E4 48 01 00 00 00 00	06	15
Function button (F1)	BE EF 02 06 00 F7 EA 0E 01 00 00 00 00	06	15
Function button (F2)	BE EF 02 06 00 26 EB 0F 01 00 00 00 00	06	15
Function button (F3)	BE EF 02 06 00 49 E9 10 01 00 00 00 00	06	15
Mode	BE EF 02 06 00 98 E8 11 01 00 00 00 00	06	15
Up	BE EF 02 06 00 DC E7 55 01 00 00 00 00	06	15
Down	BE EF 02 06 00 C1 E6 58 01 00 00 00 00	06	15
Left	BE EF 02 06 00 EF E7 56 01 00 00 00 00	06	15
Right	BE EF 02 06 00 3E E6 57 01 00 00 00 00	06	15
Enter	BE EF 02 06 00 BA E7 53 01 00 00 00 00	06	15
Source	BE EF 02 06 00 AB E8 12 01 00 00 00 00	06	15
Re-sync	BE EF 02 06 00 0D E6 54 01 00 00 00 00	06	15
Menu	BE EF 02 06 00 23 E7 5A 01 00 00 00 00	06	15
Freeze	BE EF 02 06 00 7A E9 13 01 00 00 00 00	06	15
Format (Aspect Ratio)	BE EF 02 06 00 CD E8 14 01 00 00 00 00	06	15
Information	BE EF 02 06 00 1C E9 15 01 00 00 00 00	06	15
AV Mute	BE EF 02 06 00 2F E9 16 01 00 00 00 00	06	15
D (Digital) Zoom	BE EF 02 06 00 FE E8 17 01 00 00 00 00	06	15
VGA	BE EF 02 06 00 01 E8 18 01 00 00 00 00	06	15
HDMI2	BE EF 02 06 00 D0 E9 19 01 00 00 00 00	06	15
HDMI1	BE EF 02 06 00 E3 E9 1A 01 00 00 00 00	06	15
HDMI3	BE EF 02 06 00 32 E8 1B 01 00 00 00 00	06	15
DisplayPort	BE EF 02 06 00 85 E9 1C 01 00 00 00 00	06	15
1	BE EF 02 06 00 67 E8 1E 01 00 00 00 00	06	15
2	BE EF 02 06 00 B6 E9 1F 01 00 00 00 00	06	15
3	BE EF 02 06 00 B9 EC 20 01 00 00 00 00	06	15
4	BE EF 02 06 00 68 ED 21 01 00 00 00 00	06	15
5	BE EF 02 06 00 5B ED 22 01 00 00 00 00	06	15
6	BE EF 02 06 00 8A EC 23 01 00 00 00 00	06	15
7	BE EF 02 06 00 3D ED 24 01 00 00 00 00	06	15
8	BE EF 02 06 00 EC EC 25 01 00 00 00 00	06	15
9	BE EF 02 06 00 DF EC 26 01 00 00 00 00	06	15
0	BE EF 02 06 00 0E ED 27 01 00 00 00 00	06	15

¹A variety of alternative conventions are used for representing hexadecimal digits, the most common being: Hex EF, EF₁₆, EFh, 0xEF.

2.2 Operation Commands

2.2.1 Response

There are two possible response type from the projector: Pass and "Fail". The "Fail" type as a fix return response byte equal to value "15".

When the projector successfully execute the command sent, it return a "Pass" packet. This one could be a fix byte, value "06", if the command require only an acknowledge response, or three bytes if the command perform an action to "Set", "Get", "Increment" or "Decrement" to a value of a specific parameter or function.

The "Pass" packet, when the response has three bytes, starting with a fix byte "20" and follow two bytes that are the parameter or function value, as a word of 16 bits. In this "word" bits the least-significant byte is sent first, then the most-significant-byte.

Examples

1) Brightness is at value 1.

Get Brightness: BE EF 1A 0C 00 BE 82 1C 00 01 00 00 00 00 00 00 00 00
Response: 20 01 00 value is 00 01

2) Brightness is at value 1. Send an increment command.

Get Brightness: BE EF 1A 0C 00 5E A3 00 00 02 00 00 00 00 00 00 00
Response: 20 02 00 value is 00 02

3) Brightness is at decimal value -3.

Get Brightness: BE EF 1A 0C 00 BE 82 1C 00 01 00 00 00 00 00 00 00 00
Response: 20 FD FF value is FF FD (-3 in decimal notation)

4) Auto Power Off is at decimal value 120.

Get Auto Power Off: BE EF 1A 0C 00 31 33 28 00 01 00 00 00 00 00 00 00 00
Response: 20 78 00 value is 00 78 (120 in decimal notation)

5) Sleep Time is at decimal value 360.

Get Sleep Time: BE EF 1A 0C 00 76 4A 4A 00 01 00 00 00 00 00 00 00 00
Response: 20 68 01 value is 01 68 (360 in decimal notation)

2.2.2 Set action

The "Set" action is a command where is it necessary to write the parameter or function value. In the commands list below, is indicated with the label "Data" the value to send.

For this type of commands it is necessary to calculate the Packet Checksum (CRC): value for the entire packet, made of two bytes.

See the CRC Packet Checksum appendix, for more details.

Examples

1) Brightness is at value 1. Set its value at decimal value 20 (14 in hexadecimal).

Command: BE EF 1A 0C 00 crc crc 00 00 00 00 Data 00 00 00 00 00 00

Data = 14

CRC = 6B 02

Set Brightness: BE EF 1A 0C 00 6B 02 00 00 00 00 14 00 00 00 00 00 00
Response: 20 14 00 value is 00 14 (20 in decimal notation)

2) Brightness is at value 1. Set its value at decimal value -3 (FD in hexadecimal).

Command: BE EF 1A 0C 00 crc crc 00 00 00 00 Data 00 00 00 00 00 00

Data = FD

CRC = 49 CC

Set Brightness: BE EF 1A 0C 00 6B 02 00 00 00 00 14 00 00 00 00 00 00
Response: 20 FD 00 value is FD (-3 in decimal notation)

2.2.3 List of commands

Power

Function	Range	Action	Command	Response	
				Pass	Fail
ON		Set	BE EF 02 06 00 80 E5 49 01 00 00 00 00	06	15
OFF		Set	BE EF 02 06 00 B3 E5 4A 01 00 00 00 00	06	15

Direct Source Commands

Function	Range	Action	Command	Response	
				Pass	Fail
HDMI1		Set	BE EF 02 06 00 D5 E5 4C 01 00 00 00 00	06	15
HDMI2		Set	BE EF 02 06 00 04 E4 4D 01 00 00 00 00	06	15
HDMI3		Set	BE EF 02 06 00 08 EA 01 01 00 00 00 00	06	15
VGA		Set	BE EF 02 06 00 62 E4 4B 01 00 00 00 00	06	15
DisplayPort		Set	BE EF 02 06 00 3B EA 02 01 00 00 00 00	06	15

Display Menu – Display Mode

Function	Range	Action	Command	Response	
				Pass	Fail
Dynamic		Set	BE EF 02 06 00 EA EB 03 01 00 00 00 00	06	15
Bright		Set	BE EF 02 06 00 9B F2 A2 01 00 00 00 00	06	15
Cinema		Set	BE EF 02 06 00 A8 F2 A1 01 00 00 00 00	06	15
Sport		Set	BE EF 02 06 00 5D EA 04 01 00 00 00 00	06	15
Natural		Set	BE EF 02 06 00 8C EB 05 01 00 00 00 00	06	15
User1		Set	BE EF 02 06 00 BF EB 06 01 00 00 00 00	06	15
User2		Set	BE EF 02 06 00 4A F3 A3 01 00 00 00 00	06	15
User3		Set	BE EF 02 06 00 FD F2 A4 01 00 00 00 00	06	15

Display Menu – Noise Reduction

Function	Range	Action	Command	Response	
				Pass	Fail
	0 .. 3	Increment	BE EF 1A 0C 00 B1 72 1C 00 02 00 00 00 00 00 00 00 00 00	20 XX XX	15
	0 .. 3	Decrement	BE EF 1A 0C 00 74 23 1C 00 03 00 00 00 00 00 00 00 00 00	20 XX XX	15
	0 .. 3	Get	BE EF 1A 0C 00 BE 82 1C 00 01 00 00 00 00 00 00 00 00 00	20 XX XX	15

Display Menu – Brightness

Function	Range	Action	Command	Response	
				Pass	Fail
	-50 .. 50	Increment	BE EF 1A 0C 00 5E A3 00 00 02 00 00 00 00 00 00 00 00	20 XX XX	15
	-50 .. 50	Decrement	BE EF 1A 0C 00 9B F2 00 00 03 00 00 00 00 00 00 00 00 00	20 XX XX	15
	-50 .. 50	Set	BE EF 1A 0C 00 crc crc 00 00 00 00 Data 00 00 00 00 00 00 00	20 XX XX	15
	-50 .. 50	Get	BE EF 1A 0C 00 51 53 00 00 01 00 00 00 00 00 00 00 00 00	20 XX XX	15

Display Menu – Contrast

Function	Range	Action	Command	Response	
				Pass	Fail
	-50 .. 50	Increment	BE EF 1A 0C 00 9D 5E 01 00 02 00 00 00 00 00 00 00 00	20 XX XX	15
	-50 .. 50	Decrement	BE EF 1A 0C 00 58 0F 01 00 03 00 00 00 00 00 00 00 00	20 XX XX	15
	-50 .. 50	Set	BE EF 1A 0C 00 crc crc 01 00 00 00 Data 00 00 00 00 00 00 00	20 XX XX	15
	-50 .. 50	Get	BE EF 1A 0C 00 92 AE 01 00 01 00 00 00 00 00 00 00 00 00	20 XX XX	15

Display Menu – Sharpness

Function	Range	Action	Command	Response	
				Pass	Fail
	1 .. 15	Increment	BE EF 1A 0C 00 91 52 04 00 02 00 00 00 00 00 00 00 00 00	20 XX XX	15
	1 .. 15	Decrement	BE EF 1A 0C 00 54 03 04 00 03 00 00 00 00 00 00 00 00 00	20 XX XX	15
	1 .. 15	Get	BE EF 1A 0C 00 9E A2 04 00 01 00 00 00 00 00 00 00 00 00	20 XX XX	15

Display Menu – Color

Function	Range	Action	Command	Response	
				Pass	Fail
	-50 .. 50	Increment	BE EF 1A 0C 00 5A A7 03 00 02 00 00 00 00 00 00 00 00 00	20 XX XX	15
	-50 .. 50	Decrement	BE EF 1A 0C 00 9F F6 03 00 03 00 00 00 00 00 00 00 00 00	20 XX XX	15
	-50 .. 50	Get	BE EF 1A 0C 00 55 57 03 00 01 00 00 00 00 00 00 00 00 00	20 XX XX	15

Display Menu – Tint

Function	Range	Action	Command	Response	
				Pass	Fail
	-50 .. 50	Increment	BE EF 1A 0C 00 99 5A 02 00 02 00 00 00 00 00 00 00 00 00	20 XX XX	15
	-50 .. 50	Decrement	BE EF 1A 0C 00 5C 0B 02 00 03 00 00 00 00 00 00 00 00 00	20 XX XX	15
	-50 .. 50	Get	BE EF 1A 0C 00 96 AA 02 00 01 00 00 00 00 00 00 00 00 00	20 XX XX	15

Display Menu – Gamma

Function	Range	Action	Command	Response	
				Pass	Fail
Film	1	Set	BE EF 1A 0C 00 4F E7 0B 00 00 00 00 00 00 00 00 00 00 00	20 XX XX	15
Video (2.6)	2	Set	BE EF 1A 0C 00 83 26 0B 00 00 00 01 00 00 00 00 00 00 00 00	20 XX XX	15
Graphics	3	Set	BE EF 1A 0C 00 96 66 0B 00 00 00 02 00 00 00 00 00 00 00 00	20 XX XX	15
Standard(2.2)	4	Set	BE EF 1A 0C 00 A9 A6 0B 00 00 00 07 00 00 00 00 00 00 00 00	20 XX XX	15
1,8	5	Set	BE EF 1A 0C 00 5A A7 0B 00 00 00 03 00 00 00 00 00 00 00 00	20 XX XX	15
2.0	6	Set	BE EF 1A 0C 00 70 27 0B 00 00 00 05 00 00 00 00 00 00 00 00	20 XX XX	15
2,4	7	Set	BE EF 1A 0C 00 25 27 0B 00 00 00 09 00 00 00 00 00 00 00 00	20 XX XX	15

Display Menu – Brilliant Color

Function	Range	Action	Command	Response	
				Pass	Fail
	1 .. 10	Increment	BE EF 1A 0C 00 A5 66 13 00 02 00 00 00 00 00 00 00 00	20 XX XX	15
	1 .. 10	Decrement	BE EF 1A 0C 00 60 37 13 00 03 00 00 00 00 00 00 00 00	20 XX XX	15
	1 .. 10	Get	BE EF 1A 0C 00 AA 96 13 00 01 00 00 00 00 00 00 00 00 00	20 XX XX	15

Display Menu – Color Temperature

Function	Range	Action	Command	Response	
				Pass	Fail
D55	1	Set	BE EF 1A 0C 00 11 DF 39 00 00 00 02 00 00 00 00 00 00 00	20 XX XX	15
D65	2	Set	BE EF 1A 0C 00 7B 1F 39 00 00 00 0B 00 00 00 00 00 00 00	20 XX XX	15
D75	3	Set	BE EF 1A 0C 00 44 DF 39 00 00 00 0E 00 00 00 00 00 00 00	20 XX XX	15
D83	4	Set	BE EF 1A 0C 00 04 9F 39 00 00 00 01 00 00 00 00 00 00 00	20 XX XX	15
D93	5	Set	BE EF 1A 0C 00 C8 5E 39 00 00 00 00 00 00 00 00 00 00 00	20 XX XX	15
Native	6	Set	BE EF 1A 0C 00 DD 1E 39 00 00 00 03 00 00 00 00 00 00 00	20 XX XX	15

Display Menu – Color Gamut

Function	Range	Action	Command	Response	
				Pass	Fail
Native	1	Set	BE EF 1A 0C 00 68 FE 41 00 00 00 00 00 00 00 00 00 00 00	20 XX XX	15
HDTV	2	Set	BE EF 1A 0C 00 A4 3F 41 00 00 00 01 00 00 00 00 00 00 00	20 XX XX	15
User	3	Set	BE EF 1A 0C 00 CE FF 41 00 00 00 08 00 00 00 00 00 00 00	20 XX XX	15
Cinema	4	Set	BE EF 1A 0C 00 02 3E 41 00 00 00 09 00 00 00 00 00 00 00	20 XX XX	15
LCC	5	Set	BE EF 1A 0C 00 17 7E 41 00 00 00 0A 00 00 00 00 00 00 00	20 XX XX	15

Display Menu – Color Space

Function	Range	Action	Command	Response	
				Pass	Fail
Auto		Set	BE EF 02 06 00 E9 E0 70 01 00 00 00 00	06	15
RGB (0-255)		Set	BE EF 02 06 00 38 E1 71 01 00 00 00 00	06	15
RGB(16 - 235)		Set	BE EF 02 06 00 0B E1 72 01 00 00 00 00	06	15
YUV		Set	BE EF 02 06 00 DA E0 73 01 00 00 00 00	06	15

Display Menu – CMS

Function	Range	Action	Command	Response	
				Pass	Fail
Select Red		Set	BE EF 1A 0C 00 1F B7 37 00 00 00 00 00 00 00 00 00 00 00	20 XX XX	15
Sel. Green		Set	BE EF 1A 0C 00 D3 76 37 00 00 00 00 01 00 00 00 00 00 00 00	20 XX XX	15
Select Blue		Set	BE EF 1A 0C 00 C6 36 37 00 00 00 00 02 00 00 00 00 00 00 00	20 XX XX	15
Select Cyan		Set	BE EF 1A 0C 00 0A F7 37 00 00 00 00 03 00 00 00 00 00 00 00	20 XX XX	15
Sel. Yellow		Set	BE EF 1A 0C 00 EC B6 37 00 00 00 00 04 00 00 00 00 00 00 00	20 XX XX	15
Sel. Magenta		Set	BE EF 1A 0C 00 20 77 37 00 00 00 00 05 00 00 00 00 00 00 00	20 XX XX	15
Sel. White		Set	BE EF 1A 0C 00 35 37 37 00 00 00 00 06 00 00 00 00 00 00 00	20 XX XX	15
x Offset	-50..50	Inc	BE EF 1A 0C 00 06 FB 3A 00 02 00 00 00 00 00 00 00 00 00 00	20 XX XX	15
x Offset	-50..50	Dec	BE EF 1A 0C 00 C3 AA 3A 00 03 00 00 00 00 00 00 00 00 00 00	20 XX XX	15
x Offset	-50..50	Get	BE EF 1A 0C 00 09 0B 3A 00 01 00 00 00 00 00 00 00 00 00 00	20 XX XX	15
x Offset	-50..50	Set	BE EF 1A 0C 00 CRC CRC 3A 00 00 00 XX XX 00 00 00 00 00 00 00	20 XX XX	15
y Offset	-50..50	Inc	BE EF 1A 0C 00 C5 06 3B 00 02 00 00 00 00 00 00 00 00 00 00	20 XX XX	15
y Offset	-50..50	Dec	BE EF 1A 0C 00 00 57 3B 00 03 00 00 00 00 00 00 00 00 00 00	20 XX XX	15
y Offset	-50..50	Get	BE EF 1A 0C 00 CA F6 3B 00 01 00 00 00 00 00 00 00 00 00 00	20 XX XX	15
y Offset	-50..50	Set	BE EF 1A 0C 00 CRC CRC 3B 00 00 00 XX XX 00 00 00 00 00 00 00	20 XX XX	15
Brightness	-50..50	Inc	BE EF 1A 0C 00 0E F3 3C 00 02 00 00 00 00 00 00 00 00 00 00	20 XX XX	15
Brightness	-50..50	Dec	BE EF 1A 0C 00 CB A2 3C 00 03 00 00 00 00 00 00 00 00 00 00	20 XX XX	15
Brightness	-50..50	Get	BE EF 1A 0C 00 01 03 3C 00 01 00 00 00 00 00 00 00 00 00 00	20 XX XX	15
Brightness	-50..50	Set	BE EF 1A 0C 00 CRC CRC 3C 00 00 00 XX XX 00 00 00 00 00 00 00	20 XX XX	15
Reset		Set	BE EF 02 06 00 A8 E3 61 01 00 00 00 00	06	15

Display Menu – Lens Iris

Function	Range	Action	Command	Response	
				Pass	Fail
	1 .. 12	Increment	BE EF 1A 0C 00 1A E7 33 00 02 00 00 00 00 00 00 00 00 00 00	20 XX XX	15
	1 .. 12	Decrement	BE EF 1A 0C 00 DF B6 33 00 03 00 00 00 00 00 00 00 00 00 00	20 XX XX	15
	1 .. 12	Get	BE EF 1A 0C 00 15 17 33 00 01 00 00 00 00 00 00 00 00 00 00	20 XX XX	15

Display Menu – Dynamic Contrast

Function	Range	Action	Command	Response	
				Pass	Fail
On		Set	BE EF 1A 0C 00 AB 0E 15 00 00 00 00 01 00 00 00 00 00 00 00 00	20 XX XX	15
Off		Set	BE EF 1A 0C 00 67 CF 15 00 00 00 00 00 00 00 00 00 00 00 00 00	20 XX XX	15

Display Menu – Brightness Mode

Function	Range	Action	Command	Response	
				Pass	Fail
Bright		Set	BE EF 1A 0C 00 6C FA 42 00 00 00 00 00 00 00 00 00 00 00 00	20 XX XX	15
Eco		Set	BE EF 1A 0C 00 A0 3B 42 00 00 00 00 01 00 00 00 00 00 00 00 00	20 XX XX	15

Display Menu – RGB Gain/Bias

Function	Range	Action	Command	Response	
				Pass	Fail
Red Gain	-50..50	Set	BE EF 1A 0C 00 52 AF 05 00 02 00 00 00 00 00 00 00 00	20 XX XX	15
Red Gain	-50..50	Set	BE EF 1A 0C 00 97 FE 05 00 03 00 00 00 00 00 00 00 00	20 XX XX	15
Red Gain	-50..50	Set	BE EF 1A 0C 00 5D 5F 05 00 01 00 00 00 00 00 00 00 00	20 XX XX	15
Green Gain	-50..50	Set	BE EF 1A 0C 00 56 AB 06 00 02 00 00 00 00 00 00 00 00	20 XX XX	15
Green Gain	-50..50	Set	BE EF 1A 0C 00 93 FA 06 00 03 00 00 00 00 00 00 00 00	20 XX XX	15
Green Gain	-50..50	Set	BE EF 1A 0C 00 59 5B 06 00 01 00 00 00 00 00 00 00 00	20 XX XX	15
Blue Gain	-50..50	Set	BE EF 1A 0C 00 95 56 07 00 02 00 00 00 00 00 00 00 00	20 XX XX	15
Blue Gain	-50..50	Inc	BE EF 1A 0C 00 50 07 07 00 03 00 00 00 00 00 00 00 00	20 XX XX	15
Blue Gain	-50..50	Dec	BE EF 1A 0C 00 9A A6 07 00 01 00 00 00 00 00 00 00 00	20 XX XX	15
Red Bias	0..100	Get	BE EF 1A 0C 00 81 42 08 00 02 00 00 00 00 00 00 00 00	20 XX XX	15
Red Bias	0..100	Set	BE EF 1A 0C 00 44 13 08 00 03 00 00 00 00 00 00 00 00	20 XX XX	15
Red Bias	0..100	Inc	BE EF 1A 0C 00 8E B2 08 00 01 00 00 00 00 00 00 00 00	20 XX XX	15
Green Bias	0..100	Dec	BE EF 1A 0C 00 42 BF 09 00 02 00 00 00 00 00 00 00 00	20 XX XX	15
Green Bias	0..100	Get	BE EF 1A 0C 00 87 EE 09 00 03 00 00 00 00 00 00 00 00	20 XX XX	15
Green Bias	0..100	Set	BE EF 1A 0C 00 4D 4F 09 00 01 00 00 00 00 00 00 00 00	20 XX XX	15
Blue Bias	0..100	Inc	BE EF 1A 0C 00 46 BB 0A 00 02 00 00 00 00 00 00 00 00	20 XX XX	15
Blue Bias	0..100	Dec	BE EF 1A 0C 00 83 EA 0A 00 03 00 00 00 00 00 00 00 00	20 XX XX	15
Blue Bias	0..100	Get	BE EF 1A 0C 00 49 4B 0A 00 01 00 00 00 00 00 00 00 00	20 XX XX	15
Reset		Set	BE EF 02 06 00 79 E2 60 01 00 00 00 00	06	15

Display Menu – Signal

Function	Range	Action	Command	Response	
				Pass	Fail
Automatic		Off	BE EF 1A 0C 00 37 9F 29 00 00 00 00 00 00 00 00 00 00	20 XX XX	15
Automatic		On	BE EF 1A 0C 00 FB 5E 29 00 00 00 01 00 00 00 00 00 00 00	20 XX XX	15
Frequency	-50..50	Increment	BE EF 1A 0C 00 F9 3A 2A 00 02 00 00 00 00 00 00 00 00	20 XX XX	15
Frequency	-50..50	Decrement	BE EF 1A 0C 00 3C 6B 2A 00 03 00 00 00 00 00 00 00 00	20 XX XX	15
Frequency	-50..50	Get	BE EF 1A 0C 00 F6 CA 2A 00 01 00 00 00 00 00 00 00 00	20 XX XX	15
Phase	0..31	Increment	BE EF 1A 0C 00 3A C7 2B 00 02 00 00 00 00 00 00 00 00	20 XX XX	15
Phase	0..31	Decrement	BE EF 1A 0C 00 FF 96 2B 00 03 00 00 00 00 00 00 00 00	20 XX XX	15
Phase	0..31	Get	BE EF 1A 0C 00 35 37 2B 00 01 00 00 00 00 00 00 00 00	20 XX XX	15
H. Position	-50..50	Increment	BE EF 1A 0C 00 F1 32 2C 00 02 00 00 00 00 00 00 00 00	20 XX XX	15
H. Position	-50..50	Decrement	BE EF 1A 0C 00 34 63 2C 00 03 00 00 00 00 00 00 00 00	20 XX XX	15
H. Position	-50..50	Get	BE EF 1A 0C 00 FE C2 2C 00 01 00 00 00 00 00 00 00 00	20 XX XX	15
V. Position	-50..50	Increment	BE EF 1A 0C 00 32 CF 2D 00 02 00 00 00 00 00 00 00 00	20 XX XX	15
V. Position	-50..50	Decrement	BE EF 1A 0C 00 F7 9E 2D 00 03 00 00 00 00 00 00 00 00	20 XX XX	15
V. Position	-50..50	Get	BE EF 1A 0C 00 3D 3F 2D 00 01 00 00 00 00 00 00 00 00	20 XX XX	15

Range for Signal parameter depends on signal

Display Menu – Pure Engine

Function	Range	Action	Command	Response	
				Pass	Fail
Ultra detail	OFF	Set	BE EF 1A 0C 00 97 3F 51 00 00 00 00 00 00 00 00 00 00	20 XX XX	15
Ultra detail	1	Set	BE EF 1A 0C 00 5B FE 51 00 00 00 01 00 00 00 00 00 00	20 XX XX	15
Ultra detail	2	Set	BE EF 1A 0C 00 4E BE 51 00 00 00 02 00 00 00 00 00 00	20 XX XX	15
Ultra detail	3	Set	BE EF 1A 0C 00 82 7F 51 00 00 00 03 00 00 00 00 00 00	20 XX XX	15
Pure Color	OFF	Set	BE EF 1A 0C 00 93 3B 52 00 00 00 00 00 00 00 00 00 00	20 XX XX	15
Pure Color	1	Set	BE EF 1A 0C 00 5F FA 52 00 00 00 01 00 00 00 00 00 00	20 XX XX	15
Pure Color	2	Set	BE EF 1A 0C 00 4A BA 52 00 00 00 02 00 00 00 00 00 00	20 XX XX	15
Pure Color	3	Set	BE EF 1A 0C 00 86 7B 52 00 00 00 03 00 00 00 00 00 00	20 XX XX	15
Pure Color	4	Set	BE EF 1A 0C 00 60 3A 52 00 00 00 04 00 00 00 00 00 00	20 XX XX	15
Pure Color	5	Set	BE EF 1A 0C 00 AC FB 52 00 00 00 05 00 00 00 00 00 00	20 XX XX	15
Pure Motion	OFF	Set	BE EF 1A 0C 00 83 2B 5E 00 00 00 00 00 00 00 00 00 00	20 XX XX	15
Pure Motion	1	Set	BE EF 1A 0C 00 4F EA 5E 00 00 00 01 00 00 00 00 00 00	20 XX XX	15
Pure Motion	2	Set	BE EF 1A 0C 00 5A AA 5E 00 00 00 02 00 00 00 00 00 00	20 XX XX	15
Pure Motion	3	Set	BE EF 1A 0C 00 96 6B 5E 00 00 00 03 00 00 00 00 00 00	20 XX XX	15
Reset		Set			

Display Menu – Aspect Ratio

Function	Range	Action	Command	Response	
				Pass	Fail
4:3		Set	BE EF 02 06 00 2A F4 83 01 00 00 00 00	06	15
16:9		Set	BE EF 02 06 00 7F F4 86 01 00 00 00 00	06	15
LBX		Set	BE EF 02 06 00 4C F4 85 01 00 00 00 00	06	15
SuperWide		Set	BE EF 02 06 00 9D E4 44 01 00 00 00 00	06	15
Native		Set	BE EF 02 06 00 AE F5 87 01 00 00 00 00	06	15
Auto		Set	BE EF 02 06 00 4C E5 45 01 00 00 00 00	06	15

Display Menu – Edge Mask

Function	Range	Action	Command	Response	
				Pass	Fail
	0 .. 10	Increment	BE EF 1A 0C 00 66 9B 12 00 02 00 00 00 00 00 00 00 00	20 XX XX	15
	0 .. 10	Decrement	BE EF 1A 0C 00 A3 CA 12 00 03 00 00 00 00 00 00 00 00	20 XX XX	15
	0 .. 10	Get	BE EF 1A 0C 00 69 6B 12 00 01 00 00 00 00 00 00 00 00	20 XX XX	15

Display Menu – Digital Zoom

Function	Range	Action	Command	Response	
				Pass	Fail
	-5 .. 25	Increment	BE EF 1A 0C 00 62 9F 11 00 02 00 00 00 00 00 00 00 00	20 XX XX	15
	-5 .. 25	Decrement	BE EF 1A 0C 00 A7 CE 11 00 03 00 00 00 00 00 00 00 00	20 XX XX	15
	-5 .. 25	Get	BE EF 1A 0C 00 6D 6F 11 00 01 00 00 00 00 00 00 00 00	20 XX XX	15

Display Menu – H Image Shift

Function	Range	Action	Command	Response	
				Pass	Fail
	-100 .. 100	Increment	BE EF 1A 0C 00 A9 6A 16 00 02 00 00 00 00 00 00 00 00	20 XX XX	15
	-100 .. 100	Decrement	BE EF 1A 0C 00 6C 3B 16 00 03 00 00 00 00 00 00 00 00	20 XX XX	15
	-100 .. 100	Get	BE EF 1A 0C 00 A6 9A 16 00 01 00 00 00 00 00 00 00 00	20 XX XX	15

Display Menu – V Image Shift

Function	Range	Action	Command	Response	
				Pass	Fail
	-100 .. 100	Increment	BE EF 1A 0C 00 6A 97 17 00 02 00 00 00 00 00 00 00 00	20 XX XX	15
	-100 .. 100	Decrement	BE EF 1A 0C 00 AF C6 17 00 03 00 00 00 00 00 00 00 00	20 XX XX	15
	-100 .. 100	Get	BE EF 1A 0C 00 65 67 17 00 01 00 00 00 00 00 00 00 00	20 XX XX	15

Setup Menu – Projection

Function	Range	Action	Command	Response	
				Pass	Fail
Front-Desktop	1	Set	BE EF 1A 0C 00 01 CF 35 00 00 00 02 00 00 00 00 00 00 00	20 xx xx	15
Rear-Desktop	2	Set	BE EF 1A 0C 00 D8 4E 35 00 00 00 00 00 00 00 00 00 00 00	20 xx xx	15
Front-Ceiling	3	Set	BE EF 1A 0C 00 14 8F 35 00 00 00 01 00 00 00 00 00 00 00	20 xx xx	15
Rear-Ceiling	4	Set	BE EF 1A 0C 00 CD 0E 35 00 00 00 03 00 00 00 00 00 00 00	20 xx xx	15

Setup Menu – Lamp Settings

Function	Range	Action	Command	Response	
				Pass	Fail
Lamp Reminder	on	Set	BE EF 1A 0C 00 6F CA 46 00 00 00 01 00 00 00 00 00 00 00	20 xx xx	15
Lamp Reminder	off	Set	BE EF 1A 0C 00 A3 0B 46 00 00 00 00 00 00 00 00 00 00 00	20 xx xx	15
Reset		Set	BE EF 1A 0C 00 7A 8A 46 00 00 00 02 00 00 00 00 00 00 00	20 xx xx	15

Setup Menu – Lens Settings

Function	Range	Action	Command	Response	
				Pass	Fail
Zoom / Focus	Lock	Set	BE EF 1A 0C 00 6F CA 46 00 00 00 01 00 00 00 00 00 00 00	20 xx xx	15
Zoom / Focus	Unlock	Set	BE EF 1A 0C 00 A3 0B 46 00 00 00 00 00 00 00 00 00 00 00	20 xx xx	15

Setup Menu – Power Settings

Function	Range	Action	Command	Response	
				Pass	Fail
Direct Power On	On	Set	BE EF 1A 0C 00 7B DE 49 00 00 00 01 00 00 00 00 00 00	20 XX XX	15
Direct Power On	Off	Set	BE EF 1A 0C 00 B7 1F 49 00 00 00 00 00 00 00 00 00 00	20 XX XX	15
Auto Power Off	0..180	Increment	BE EF 1A 0C 00 3E C3 28 00 02 00 00 00 00 00 00 00 00	20 XX XX	15
Auto Power Off	0..180	Decrement	BE EF 1A 0C 00 FB 92 28 00 03 00 00 00 00 00 00 00 00	20 XX XX	15
Auto Power Off	0..180	Get	BE EF 1A 0C 00 31 33 28 00 01 00 00 00 00 00 00 00 00	20 XX XX	15
Sleep Timer	0..990	Increment	BE EF 1A 0C 00 79 BA 4A 00 02 00 00 00 00 00 00 00 00	20 XX XX	15
Sleep Timer	0..990	Decrement	BE EF 1A 0C 00 BC EB 4A 00 03 00 00 00 00 00 00 00 00	20 XX XX	15
Sleep Timer	0..990	Get	BE EF 1A 0C 00 76 4A 4A 00 01 00 00 00 00 00 00 00 00	20 XX XX	15
Power Mode	Active	Set	BE EF 1A 0C 00 70 E6 4B 00 00 00 00 00 00 00 00 00 00	20 XX XX	15
Power Mode	Eco	Set	BE EF 1A 0C 00 BC 27 4B 00 00 00 01 00 00 00 00 00 00	20 XX XX	15

Auto Power Off step = 5 minutes

Sleep Timer step = 30 minutes

Setup Menu – Security

Function	Range	Action	Command	Response	
				Pass	Fail
Security Timer	(°)	Set	BE EF 1A 0C 00 crc crc 4C 00 00 00 mm dd hh 00 00 00 00 00	20 XX XX	15
Security	On	Set	BE EF 1A 0C 00 E5 3C 81 00 00 00 01 00 00 00 00 00 00	20 XX XX	15
Security	Off	Set	BE EF 1A 0C 00 29 FD 81 00 00 00 00 00 00 00 00 00 00	20 XX XX	15

Security Timer range:

Month mm = 00 .. 12

Day dd = 00 .. 30

Hour hh = 00 .. 24

Setup Menu – Test Pattern

Function	Range	Action	Command	Response	
				Pass	Fail
Off	1	Set	BE EF 1A 0C 00 78 EE 4D 00 00 00 00 00 00 00 00 00 00	20 xx xx	15
Grid(Green)	2	Set	BE EF 1A 0C 00 B4 2F 4D 00 00 00 01 00 00 00 00 00 00	20 xx xx	15
Grid (Magenta)	3	Set	BE EF 1A 0C 00 A1 6F 4D 00 00 00 02 00 00 00 00 00 00	20 xx xx	15
Grid(White)	4	Set	BE EF 1A 0C 00 6D AE 4D 00 00 00 03 00 00 00 00 00 00	20 xx xx	15
White	5	Set	BE EF 1A 0C 00 8B EF 4D 00 00 00 04 00 00 00 00 00 00	20 xx xx	15

Setup Menu – 12V Trigger

Function	Range	Action	Command	Response	
				Pass	Fail
12V Trigger A	Off	Set	BE EF 1A 0C 00 54 C2 50 00 00 00 00 00 00 00 00 00 00	20 xx xx	15
12V Trigger A	On	Set	BE EF 1A 0C 00 98 03 50 00 00 00 01 00 00 00 00 00 00	20 xx xx	15
12V Trigger B	Off	Set	BE EF 1A 0C 00 04 92 6C 00 00 00 00 00 00 00 00 00 00	20 xx xx	15
12V Trigger B	On	Set	BE EF 1A 0C 00 C8 53 6C 00 00 00 01 00 00 00 00 00 00	20 xx xx	15

Setup Menu – Auto Source

Function	Range	Action	Command	Response	
				Pass	Fail
	Off	Set	BE EF 1A 0C 00 00 96 6F 00 00 00 00 00 00 00 00 00	20 xx xx	15
	On	Set	BE EF 1A 0C 00 CC 57 6F 00 00 00 01 00 00 00 00 00 00	20 xx xx	15

Setup Menu – High Altitude

Function	Range	Action	Command	Response	
				Pass	Fail
	Off	Set	BE EF 1A 0C 00 23 8B 26 00 00 00 00 00 00 00 00 00	20 xx xx	15
	On	Set	BE EF 1A 0C 00 EF 4A 26 00 00 00 01 00 00 00 00 00 00	20 xx xx	15

Setup Menu – Display Mode Lock

Function	Range	Action	Command	Response	
				Pass	Fail
	Off	Set	BE EF 1A 0C 00 24 B2 74 00 00 00 00 00 00 00 00 00	20 xx xx	15
	On	Set	BE EF 1A 0C 00 E8 73 74 00 00 00 01 00 00 00 00 00 00	20 xx xx	15

Setup Menu – Keypad Lock

Function	Range	Action	Command	Response	
				Pass	Fail
	Off	Set	BE EF 1A 0C 00 E7 4F 75 00 00 00 00 00 00 00 00 00	20 xx xx	15
	On	Set	BE EF 1A 0C 00 2B 8E 75 00 00 00 01 00 00 00 00 00 00	20 xx xx	15

Setup Menu – Information Hide

Function	Range	Action	Command	Response	
				Pass	Fail
	Off	Set	BE EF 1A 0C 00 E0 76 27 00 00 00 00 00 00 00 00 00	20 xx xx	15
	On	Set	BE EF 1A 0C 00 2C B7 27 00 00 00 01 00 00 00 00 00 00	20 xx xx	15

Setup Menu – HDMI2 Settings

Function	Range	Action	Command	Response	
				Pass	Fail
	Edid 1	Set	BE EF 1A 0C 00 20 B6 77 00 00 00 00 00 00 00 00 00	20 xx xx	15
	Edid 2	Set	BE EF 1A 0C 00 EC 77 77 00 00 00 01 00 00 00 00 00 00	20 xx xx	15

Setup Menu – Reset

Function	Range	Action	Command	Response	
				Pass	Fail
	OSD	Set	BE EF 02 06 00 1F E2 66 01 00 00 00 00	06	15
	Factory	Set	BE EF 02 06 00 A1 E1 78 01 00 00 00 00	06	15

2.3 Status Commands

Status Commands may be used to get the current value of the main projector parameters.

Sections below describe the responses when the unit is On. It is not possible to receive a significant response when the unit is in Standby state.

Status Commands

Parameter	Command
Projector	BE EF 10 0A 00 34 B7 01 01 00 01 01 15 01 00 00 02
Status	
Signal Status	BE EF 10 0A 00 33 37 01 01 00 01 01 15 01 00 00 08
Lamp Status	BE EF 10 0A 00 A9 36 01 01 00 01 01 15 01 00 01 10

Projector Status

When in Standby State, the projector does not respond to this command.

If the unit is On, the returned packet (27 byte long) is described in the following table:

1E	BE	EF	10	13	00	..	..	01	01	00	01	01	15	01	00	00	02	00	00	00	SS	..	..	..	..	..
0	1																17	18			20	21				

where bytes marked with .. are not relevant.

The response may be separated into 4 parts:

- 1 bytes (byte 0) that initiates the packet (1E)
- 17 bytes (bytes 1-17) that duplicate the sent command (apart from 2 of them for the CRC)
- 3 Error bytes (bytes 18-20) that signal errors in the processing of the command
- 1 Data byte (bytes 21) that contain the requested data

If the 3 Error bytes (bytes 18-20) are 00 00 00 then requested data are valid.

Byte 21 (labeled SS in the table above) contains Projector Status: On = 01

Signal Status

When then unit is On, the returned packet (25 byte long) is described in the following table:

1E	BE	EF	10	11	00	..	..	01	01	00	01	01	15	01	00	00	08	00	00	00	SS	..	..	II	..
0	1																17	18			20	21			24

where bytes marked with .. are not relevant.

The response may be separated into 4 parts:

- 1 bytes (byte 0) that initiates the packet (1E)
- 17 bytes (bytes 1-17) that duplicate the sent command (apart from 2 of them | the CRC)
- 3 Error bytes (bytes 18-20) that signal errors in the processing of the command
- 2 Data bytes (bytes 21, 24) that contain the requested data

If the 3 Error bytes (bytes 18-20) are 00 00 00 then requested data are valid.

When in Standby State, the projector does not respond to this command.

The tables below explain the meaning of returned data.

- Byte 21 (labelled SS in the table above) contains current Input Status:

OK	00
No Signal	01

- Byte 24 (labelled II in the table above) contains Current Input:

VGA	05
HDMI 1	12
HDMI 2	13
HDMI 3	14
Display Port	15

Lamp Status

When the unit is On, the returned packet (27 byte long) is described in the following table:

1E	BE	EF	10	13	00	..	..	01	01	15	01	00	01	10	00	00	00	UU	UU	UU	SS	LL	LL	LL
0	1													17	18			21	22	23	24	25	26	27

where bytes marked with .. are not relevant.

The response may be separated into 4 parts:

- 1 bytes (byte 0) that initiates the packet (1E)
- 17 bytes (bytes 1-17) that duplicate the sent command (apart from 2 of them for the CRC)
- 3 Error bytes (bytes 18-20) that signal errors in the processing of the command
- 6 Data bytes (bytes 21-27) that contain the requested data

If the 3 Error Bytes (bytes 18-20) are 00 00 00 then requested data are valid.

The tables below explain the meaning of returned data.

- Bytes 21, 22 and 23 (labelled UU UU UU in the table above) contain **Unit Working Hours**. UU UU UU is the hex representation of the number of working hours. Therefore, if, for instance, UU UU UU= 09 D8 00 then Unit Working Hours is 2520.

- Byte 25 (labelled SS in the table above) contains the **Lamp Status**:

Off	00
On	02

- Bytes 25, 26 and 27 (labelled LL LL LL in the table above) contain **Lamp Working Hours**. LL LL LL is the hex representation of the number of working hours. Therefore, if, for instance, LL LL LL = 01 B6 00 then Unit Working Hours is 438.

2.4 Appendix - Checksum CRC

Modbus CRC16 method

Calculation of the checksum is performed by the C code shown below.

SIM2 have a application for PC windows, to calculate the CRC, from an inserted hexadecimal string.

The application name is "CRC Calculator" ver. 1.3 or greater.

To perform the calculation correctly, first set to zero those fields (2 bytes) that contain the checksum.

```
// Using two 256 byte lookup tables, quickly calculate a 16-bit CRC on
```

```
// a block of data.
```

```
// Params:
```

```
// pcData : Pointer to data to calculate CRC on.
```

```
// nCount : Number of data bytes.
```

```
// Return: 16-bit CRC value.
```

```
WORD CalculateCRC16(BYTE *pcData, int nCount) {
    BYTE cCRCHi = 0xFF;          // high byte of CRC initialised
    BYTE cCRCLo = 0xFF;          // low byte of CRC initialised
    BYTE cIndex;                  // will index into CRC lookup table
    while (nCount-->0) {         // step through each byte of data
        cIndex = cCRCHi ^ *pcData++; //calculate the CRC
        cCRCHi = cCRCLo ^ cCRCHiArray[cIndex];
        cCRCLo = cCRCLoArray[cIndex];
    }
    return (cCRCHi << 8) + cCRCLo;
}
```

```
// Lookup table used for high-byte of CRC
```

```
static const BYTE cCRCHiArray[] = {
0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0,
0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41,
0x00, 0xC1, 0x81, 0x40, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0,
0x80, 0x41, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40,
0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1,
0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0, 0x80, 0x41,
0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1,
0x81, 0x40, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41,
0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0,
0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x00, 0xC1, 0x81, 0x40,
0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1,
0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40,
0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0,
0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41,
0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0,
0x80, 0x41, 0x00, 0xC1, 0x81, 0x40
};
```

```
// Lookup table used for low-byte of CRC
static const BYTE cCRCLoArray[] = {
0x00, 0xC0, 0xC1, 0x01, 0xC3, 0x03, 0x02, 0xC2, 0xC6, 0x06,
0x07, 0xC7, 0x05, 0xC5, 0xC4, 0x04, 0xCC, 0x0C, 0x0D, 0xCD,
0x0F, 0xCF, 0xCE, 0x0E, 0x0A, 0xCA, 0xCB, 0x0B, 0xC9, 0x09,
0x08, 0xC8, 0xD8, 0x18, 0x19, 0xD9, 0x1B, 0xDB, 0xDA, 0x1A,
0x1E, 0xDE, 0xDF, 0x1F, 0xDD, 0x1D, 0x1C, 0xDC, 0x14, 0xD4,
0xD5, 0x15, 0xD7, 0x17, 0x16, 0xD6, 0xD2, 0x12, 0x13, 0xD3,
0x11, 0xD1, 0xD0, 0x10, 0xF0, 0x30, 0x31, 0xF1, 0x33, 0xF3,
0xF2, 0x32, 0x36, 0xF6, 0xF7, 0x37, 0xF5, 0x35, 0x34, 0xF4,
0x3C, 0xFC, 0xFD, 0x3D, 0xFF, 0x3F, 0x3E, 0xFE, 0xFA, 0x3A,
0x3B, 0xFB, 0x39, 0xF9, 0xF8, 0x38, 0x28, 0xE8, 0xE9, 0x29,
0xEB, 0x2B, 0x2A, 0xEA, 0xEE, 0x2E, 0x2F, 0xEF, 0x2D, 0xED,
0xEC, 0x2C, 0xE4, 0x24, 0x25, 0xE5, 0x27, 0xE7, 0xE6, 0x26,
0x22, 0xE2, 0xE3, 0x23, 0xE1, 0x21, 0x20, 0xE0, 0xA0, 0x60,
0x61, 0xA1, 0x63, 0xA3, 0xA2, 0x62, 0x66, 0xA6, 0xA7, 0x67,
0xA5, 0x65, 0x64, 0xA4, 0x6C, 0xAC, 0xAD, 0x6D, 0xAF, 0x6F,
0x6E, 0xAE, 0xAA, 0x6A, 0x6B, 0xAB, 0x69, 0xA9, 0xA8, 0x68,
0x78, 0xB8, 0xB9, 0x79, 0xBB, 0x7B, 0x7A, 0xBA, 0xBE, 0x7E,
0x7F, 0xBF, 0x7D, 0xBD, 0xBC, 0x7C, 0xB4, 0x74, 0x75, 0xB5,
0x77, 0xB7, 0xB6, 0x76, 0x72, 0xB2, 0xB3, 0x73, 0xB1, 0x71,
0x70, 0xB0, 0x50, 0x90, 0x91, 0x51, 0x93, 0x53, 0x52, 0x92,
0x96, 0x56, 0x57, 0x97, 0x55, 0x95, 0x94, 0x54, 0x9C, 0x5C,
0x5D, 0x9D, 0x5F, 0x9F, 0x9E, 0x5E, 0x5A, 0x9A, 0x9B, 0x5B,
0x99, 0x59, 0x58, 0x98, 0x88, 0x48, 0x49, 0x89, 0x4B, 0x8B,
0x8A, 0x4A, 0x4E, 0x8E, 0x8F, 0x4F, 0x8D, 0x4D, 0x4C, 0x8C,
0x44, 0x84, 0x85, 0x45, 0x87, 0x47, 0x46, 0x86, 0x82, 0x42,
0x43, 0x83, 0x41, 0x81, 0x80, 0x40
};
```

Example

Set the brightness value to +20.

Command is BE EF 1A 0C 00 crc crc 00 00 00 00 Data 00 00 00 00 00 00 00

+20 in hexadecimal value is 0x14

The init string to send is BE EF 1A 0C 00 crc crc 00 00 00 00 14 00 00 00 00 00 00 00

To calculate the CRC, set the initial CRC values to zero:

BE EF 1A 0C 00 00 00 00 00 00 00 14 00 00 00 00 00 00 00

Buffer = [0xBE, 0xEF, 0x1A, 0x0C, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x14, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00]

CRC = CalculateCRC16(Buffer, 19)

the CalculateCRC16 return the value 0x026B

The string to send is BE EF 1A 0C 00 6B 02 00 00 00 00 14 00 00 00 00 00 00 00

Tx BE EF 1A 0C 00 6B 02 00 00 00 00 14 00 00 00 00 00 00 00

Rx 20 14 00

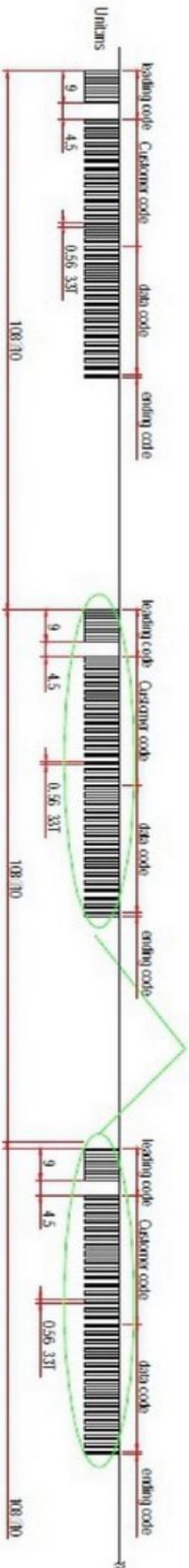
3. IR communication



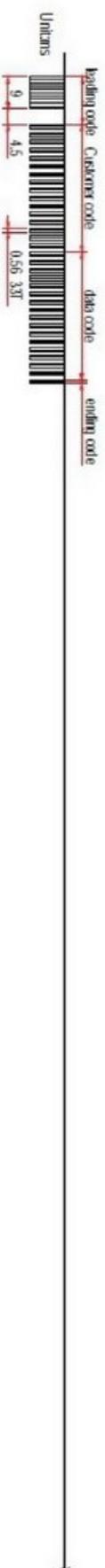
IR format timing chart



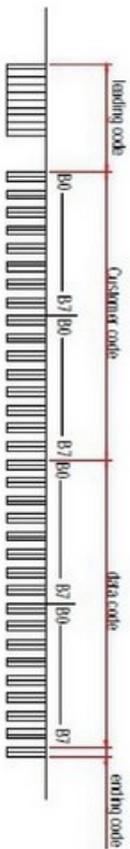
After a button be pressed And holding



Format2: NEC standard IR format with repeat



Format4 : NEC standard IR format without repeat



Not note tolerance: ($\pm 3\%$)

The IR formatting timing chart is conforming the 38KHz NEC coding standard

Key Position	printing-key definition	Key code				Repeat
		BYTE1	BYTE2	BYTE3	BYTE4	
		customer 0	customer 1	data 0	data 1	
1	Power Off	32	CD	2E	#BYTE3	F1
2	Power On	32	CD	02	#BYTE3	F1
3	Brightness	32	CD	41	#BYTE3	F1
4	Gamma	32	CD	43	#BYTE3	F1
5	Contrast	32	CD	42	#BYTE3	F1
6	Lens	32	CD	D1	#BYTE3	F1
7	Color Settings	32	CD	D2	#BYTE3	F1
8	Iris	32	CD	D3	#BYTE3	F1
9	F1	32	CD	26	#BYTE3	F1
10	F2	32	CD	27	#BYTE3	F1
11	F3	32	CD	66	#BYTE3	F1
12	Aspect	32	CD	D4	#BYTE3	F1
13	Pure Engine/Pure	32	CD	4A	#BYTE3	F1
14	Arrow Up	32	CD	C6	#BYTE3	F1
15	Disp.Mode/Mode	32	CD	95	#BYTE3	F1
16	Arrow Left	32	CD	C8	#BYTE3	F1
17	ENTER	32	CD	C5	#BYTE3	F1
18	Arrow Right	32	CD	C9	#BYTE3	F1
19	Menu	32	CD	88	#BYTE3	F1
20	Arrow Down	32	CD	C7	#BYTE3	F1
21	Info	32	CD	25	#BYTE3	F1
22	Light	NA	NA	NA	NA	NA
23	Re-Sync	32	CD	04	#BYTE3	F1
24	HDMI1	32	CD	16	#BYTE3	F1
25	HDMI2	32	CD	9B	#BYTE3	F1
26	HDMI3	32	CD	98	#BYTE3	F1
27	DP	32	CD	9F	#BYTE3	F1
28	VGA/YPbPr	32	CD	8E	#BYTE3	F1

Light button for turn on backlight of IR remote. The backlight of IR remote will be turn off automatically after 60 seconds while no button pressed.

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