RS232/485 Serial Communication Control

for MDT521S

1. Application

This document defines the communication protocols for serial control of the MDT521S.

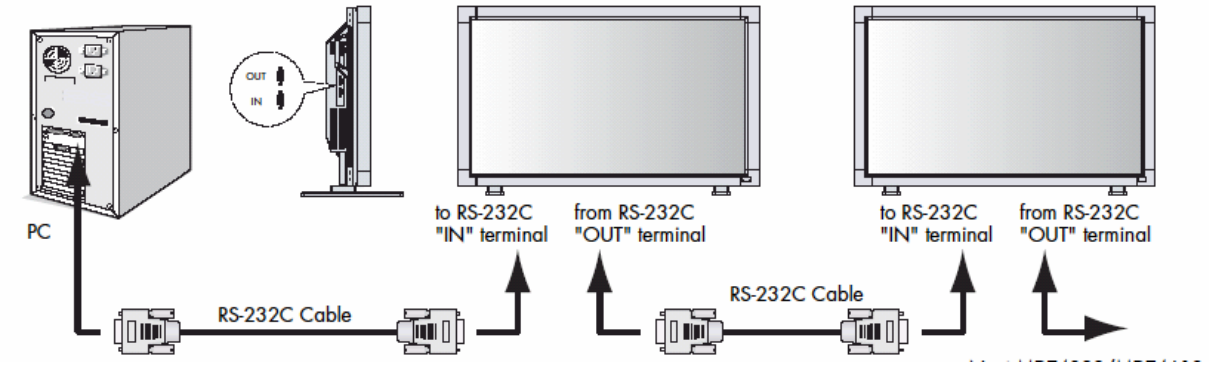
-----Revision History-----

Release: Jun. 11th 2009. H.Tanizoe,K.Kawashima

2. Connectors and wiring

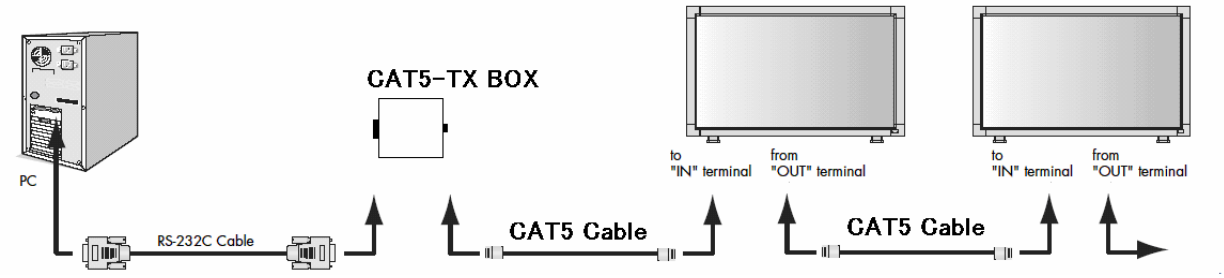
A:RS232C connection

Connector: D-Sub 9-pin
Cable: Cross (reversed) cable or null modem cable



B:CAT5 RS485 connection

Connector: D-SUB 9pin or USB(Either one can be used for communication between PC and CAT5 Tx-BOX. In order to use the USB, you need USB driver with your PC installed. Please check User's manual for details.)
Cable: (D-SUB 9pin:Cross (reversed) cable or null modem cable, USB:Standard USB cable)



3. Communication Parameter

(1) Communication system	Asynchronous, half-duplex(RS485), Full-duplex(RS232)
(2) Interface	RS232C /USB or RS232C (DB9) between HOST and CAT5 Tx-BOX
(3) Baud rate	9600bps
(4) Data length	8bits
(5) Parity	None
(6) Stop bit	1 bit
(7) Communication code	ASCII

3.1 Communication timing

The controller should wait for a packet interval before next command is sent.
The packet interval needs to be longer than 600msec for the MDT521S.

[Important Information]
HOST system shall send next command after receiving a reply command from Monitor, if it is sequential commands communication. If Host do not wait for monitor's reply, communication error may happen.

Communication disabled period after power on: After Monitor Power on, either by AC switch, Remote Controller or Serial communication command, Monitor goes initialize mode of controller and can not handle the remote control commands correctly during the mode. So do NOT send any command at least 7 sec. after monitor power on. If you make the code which send any command after Power ON command, please put a wait at least 7 sec. after sending the command.

4. Communication Format

4-1.Basic command

This command set supports only the basic control of monitor and does NOT support multi monitor control by daisy chained connection. This command set will be written in the user's manual of MDT521S.

1) Control command diagram

The command is structured by the address code, function code, data code and end code. The length of the command is different for each function.

	Address code	Function code	Data code	End code
HEX	30h 30h	Function	Data	0Dh
ASCII	'0' '0'	Function	Data	↵

[Address code] 30h 30h (In ASCII code, '0' '0') fixed.
[Function code] A code of each fixed control move.
[Data code] A code of each fixed control data (number) and not always indicated.
[End code] 0Dh (In ASCII code, '↵') fixed.

2) Control sequence

(1) The command from a computer to the LCD monitor will be sent in 600ms.

(2) The LCD monitor will send a return command 600ms* after it has received and encoded. If the command isn't received correctly, the LCD monitor will not send the return command.

(3) The personal computer checks the command and confirms if the command, which has been sent, has been executed or not.

(4) This LCD monitor sends various codes other than return code. When having a control sequence by RS-232C, reject other codes from personal computers side.

*: The sending time of return command may delay depending on the condition (during changing of the input signal, etc.).

Example: Turn the power ON (' ' is for ASCII code)

Sending commands from the PC	Status code from LCD monitor	Meaning
30 30 21 0D '0' '0' '!' '↵'		Command for POWER ON
	30 30 21 0D '0' '0' '!' '↵'	Command received (Command echoed back)

3) Operation commands

The operation commands execute the basic operation setting of this LCD monitor.

It may not operate when changing the signal:

Operation	ASCII	HEX
POWER ON	!	21h
POWER OFF	"	22h
INPUT HDMI	_r1	5Fh 72h 31h
INPUT DVI-D	_r2	5Fh 72h 32h
INPUT D-SUB	_r3	5Fh 72h 33h
INPUT BNC	_r4	5Fh 72h 34h
INPUT CAT5	_r5	5Fh 72h 35h
Reserved	_r6	5Fh 72h 36h
INPUT VIDEO	_v1	5Fh 76h 31h
INPUT YPbPr	_v2	5Fh 76h 32h
INPUT S-VIDEO*	_v3	5Fh 76h 33h

• POWER OFF command should be operated over 1 minute after the power is turned on.

• POWER ON command should be operated over 1 minute after the power is turned off.

* S-VIDEO is SEPARATE only

4) Read command

Host computer sends the command without Data-code to monitor.

After receiving this command, the monitor returns the command with Data-code of current status to host computer.

< ex. > When Host computer ask Power status of monitor, the status of monitor is powered-on.

Command from computer	Command from Monitor	Detail of command
30 30 76 50 0D 0"0'v"P'[enter]		Ask about the power status of monitor.
	30 30 76 50 31 0D '0"0"v"P"1'[enter]	Monitor is powered-on.

Structure of the Read-command

			ASCII		HEX	
			Function	Data (Receive)	Function	Data (Receive)
POWER	ON		vP	1	76 50	31
	OFF(stand by)		vP	0	76 50	30
Input	HDMI		vI	r1	76 49	72 31
	DVI-D		vI	r2	76 49	72 32
	D-SUB		vI	r3	76 49	72 33
	BNC		vI	r4	76 49	72 34
	CAT5		vI	r5	76 49	72 35
	Reserved		vI	r6	76 49	72 36
	Video		vI	v1	76 49	76 31
	YP b Pr		vI	v2	76 49	76 32
	S-VIDEO		vI	v3	76 49	76 33
Picture mode	HIGHBRIGHT		vM	p1	76 4D	70 31
	STANDARD		vM	p2	76 4D	70 32
Temperature of Internal monitor	Around Main board	resolution 1˚C	tc1	(ex.) +25	74 63 31	2B 20 32 35
	Around Power PCB	resolution 1˚C	tc2	(ex.) +31	74 63 32	2B 20 33 31

4-2.Extended command

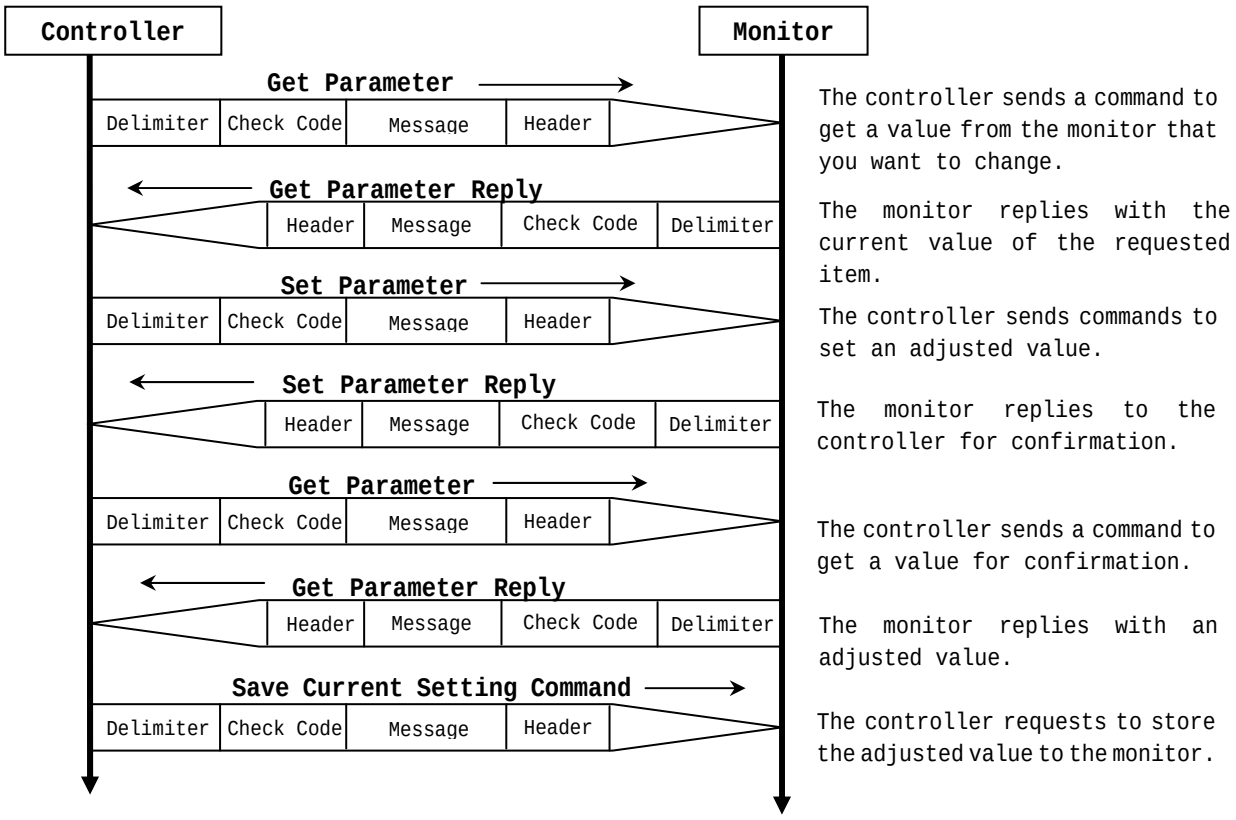
his command set supports multi monitor control by daisy chained connection. This command set will NOT be written in the user's manual of MDT521S.

The command packet consists of four parts, Header, Message, Check code and Delimiter.

Header	Message	Check Code	Delimiter

Sequence of a typical procedure to control a monitor is as follows,

[A controller and a monitor, two-way communication composition figure]



The controller sends a command to get a value from the monitor that you want to change.

The monitor replies with the current value of the requested item.

The controller sends commands to set an adjusted value.

The monitor replies to the controller for confirmation.

The controller sends a command to get a value for confirmation.

The monitor replies with an adjusted value.

The controller requests to store the adjusted value to the monitor.

4.1 Header block format (fixed length)

Header	Message	Check code	Delimiter

SOH	Reserved '0'	Destination 'A'	Source	Message Type	Message Length
1st	2nd	3rd	4th	5th	6th -7th

1st byte) SOH: Start of Header
ASCII SOH (01h)

2nd byte) Reserved: Reserved for future extensions.

MDT521S must be ASCII '0'(30h)

3rd byte) Destination: Destination equipment ID. (Receiver)

Specify a command's receiver's address.

If the command should be sent to certain monitor only, the either of character 'A'(41h) to 'Z'(5Ah) which is corresponding to monitor ID from No1 to No.26 should be set to this portion. If it is a broad cast command(only "set command" is available), then the '*'(2Ah)should be applied.

4th byte) Source: Source equipment ID. (Sender)

Specify a sender address.

The controller must be '0'(30h).

5th byte) Message Type: (Case sensitive.)

Refer to section 4.2 "Message block format" for more details.

ASCII 'A' (41h): Command

ASCII 'B' (42h): Command reply.

ASCII 'C' (43h): Get current parameter from a monitor.

ASCII 'D' (44h): "Get parameter" reply.

ASCII 'E' (45h): Set parameter.

ASCII 'F' (46h): "Set parameter" reply.

6th -7th bytes) Message Length:

Specify the length of the message (that follows the header) from STX to ETX.

This length includes STX and ETX.

The byte data must be encoded to ASCII characters.

Ex.) The byte data 3Ah must be encoded to ASCII characters '3' and 'A' (33h and 41h).

The byte data 0Bh must be encoded to ASCII characters '0' and 'B' (30h and 42h).

4.2 Message block format

Header	**Message**	Check code	Delimiter

"Message block format" is allied to the "Message Type" in the "Header".

Refer to the section 6 "Message format" for more detail.

1) Get current parameter

The controller sends this message when you want to get the status of the monitor.

For the status that you want to get, specify the "OP code page" and "OP code", refer to "Appendix A. Operation code table".

"Message format" of the "Get current parameter" is as follows;

STX	OP code page		OP code		ETX
	Hi	Lo	Hi	Lo	

➢ Refer to section 5.1 "Get current parameter from a monitor." for more details.

2) Get Parameter reply

The monitor will reply with the status of the requested item specified by the controller in the "Get parameter message".

"Message format" of the "Get parameter reply" is as follows;

STX	Result		OP code page		OP code		Type		Max value				Current Value				ETX
	Hi	Lo	Hi	Lo	Hi	Lo	Hi	Lo	MSB			LSB	MSB			LSB	

➢ Refer to section 5.2 "Get parameter reply" for more details.

3) Set parameter

The controller sends this message to change a setting of the monitor.

Message format of the "Set parameter" is as follows;

STX	OP code page		OP code		Set Value				ETX
	Hi	Lo	Hi	Lo	MSB			LSB	

➢ Refer to section 5.3 "Set parameter" for more details.

4) Set Parameter reply

The monitor replies with this message for a confirmation of the "Set parameter message".

Message format of the "Set parameter reply" is as follows;

STX	Result		OP code page		OP code		Type		Max value				Requested setting Value				ETX
	Hi	Lo	Hi	Lo	Hi	Lo	Hi	Lo	MSB			LSB	MSB			LSB	

➢ Refer to section 5.4 "Set parameter reply" for more details.

5) Command

"Command message" format depends on each command.

Usually, this "command message" is used for some non-slider controls and some special operations, such as "Save current settings", "Get timing report", "power control", "Schedule", etc. Refer to section 5.5 "Commands message" for more details.

6) Command reply

The monitor replies to a query from the controller.

“Command reply message” format depends on each command.

Refer to section 5.5 “Commands message” for more details.

Header	Message	**Check code**	Delimiter

4.5 Check code

Check code is the Block Check Code (BCC) between the Header and the End of Message except SOH.

		2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
SOH	D_0								
Reserved	D_1								
Destination	D_2								
Source	D_3								
Type	D_4								
Length	D_5								
STX	D_6								
Data	D_7								
|	|								
|	|								
ETX	D_n								
Check code	D_{n+1}	P	P	P	P	P	P	P	P

$D_{n+1} = D_1$ XOR D_2 XOR D_3 XOR ,,, D_n

XOR: Exclusive OR

Following is an example of a Check code (BCC) calculation.

Header							Message										Check code (BCC)	Delimiter
SOH	Reserved	Destination Address	Source Address	Message type	Message length		STX	OP code page		OP code		Set Value				ETX		
01	30	41	30	45	30	41	02	30	30	31	30	30	30	36	34	03	77	0D
D_0	D_1	D_2	D_3	D_4	D_5	D_6	D_7	D_8	D_9	D_{10}	D_{11}	D_{12}	D_{13}	D_{14}	D_{15}	D_{16}	D_{17}	D_{18}

Check code (BCC) $D_{17} = D_1$ xor D_2 xor D_3 xor … xor D_{14} xor D_{15} xor D_{16}

= 30h xor 41h xor 30h xor 45h xor 30h xor 41h

xor 02h xor 30h xor 30h xor 31h xor 30h xor 30h

xor 30h xor 36h xor 34h xor 03h

= 77h

4.6 Delimiter

Header	Message	Check code	**Delimiter**

Packet delimiter code; ASCII CR(0Dh).

5. Message type

5.1 Get current Parameter from a monitor.

STX	OP code page		OP code		ETX
	Hi	Lo	Hi	Lo	
1st	2nd-3rd		4th–5th		6th

Send this message when you want to get the status of a monitor.

For the status that you want to get, specify the “OP code page” the “OP code”, refer to “Appendix A. Operation code table”.

1st byte) STX: Start of Message

ASCII STX (02h)

2nd-3rd bytes) OP code page: Operation code page.

Specify the “OP code page” for the control which you want to get the status.

Refer to “Appendix A Operation code table” for each item.

OP code page data must be encoded to ASCII characters.

Ex.) The byte data 02h must be encoded to ASCII characters '0' and '2' (30h and 32h).

OP code page 02h -> OP code page (Hi) = ASCII '0' (30h)

OP code page (Lo) = ASCII '2' (32h)

Refer to Operation code table. (Appendix A)

4th–5th bytes) OP code: Operation code

Refer to “Appendix A Operation code table” for each item.

OP code data must be encoded to ASCII characters.

Ex.) The byte data 3Ah must be encoded to ASCII characters '3' and 'A' (33h and 41h).

OP code 3Ah -> OP code (Hi) = ASCII '3' (33h)

OP code (Lo) = ASCII 'A' (41h)

Refer to Operation code table.

6th byte) ETX: End of Message

ASCII ETX (03h)

5.2 "Get parameter" reply

STX	Result		OP code page		OP code		Type		Max value				Current Value				ETX
	Hi	Lo	Hi	Lo	Hi	Lo	Hi	Lo	MSB			LSB	MSB			LSB	
1st	2nd-3rd		4th–5th		6th –7th		8th -9th		10th -13th				14th -17th				18th

MDT521S replies with a current value and the status of the requested item (operation code).

1st byte) STX: Start of Message

ASCII STX (02h)

2nd-3rd bytes) Result code.

These bytes indicate a result of the requested commands as follows,

00h: No Error.

01h: Unsupported operation with this monitor or unsupported operation under current condition.

This result code from the monitor is encoded to ASCII characters.

Ex.) The byte data 01h is encoded to ASCII character '0' and '1' (30h and 31h).

4th–5thbytes) OP code page: Operation code page.

These bytes indicate a replying item's OP code page.

This returned value from the monitor is encoded to ASCII characters.

Ex.) The byte data 02h is encoded to ASCII character '0' and '2' (30h and 32h).

Refer to the operation codes table.

6th –7thbytes) OP code: Operation code

These bytes indicate a replying item's OP code.

This returned value from the monitor is encoded to ASCII characters.

Refer to the operation code table.

Ex.) The byte data 1Ah is encoded to ASCII character '1' and 'A' (31h and 41h).

8th -9thbytes) Type: Operation type code

This returned value from the monitor is encoded to ASCII characters.

Ex.) The byte data 01h is encoded to ASCII character '0' and '1' (30h and 31h).

00h: Set parameter

01h: Momentary

Like the AutoSetup function which automatically changes the parameter.

10th-13thbytes) Max. value: Maximum value which monitor can accept. (16bits)

This returned value from the monitor is encoded to ASCII characters.

Ex.) '0','1','2' and '3' means 0123h (291)

14th -17thbytes) Current Value: (16bits)

This returned value from the monitor is encoded to ASCII characters.

Ex.) '0','1','2' and '3' means 0123h (291)

18thbyte) ETX: End of Message

ASCII ETX (03h)

5.3 Set parameter

STX	OP code page		OP code		Set Value				ETX
	Hi	Lo	Hi	Lo	MSB			LSB	
1st	2nd-3rd		4th-5th		6th-9th				10th

Send this message to change monitor’s adjustment and so on.

The controller requests a monitor to change value.

1stbyte) STX: Start of Message

ASCII STX (02h)

2nd-3rdbytes) OP code page: Operation code page

This OP code page data must be encoded to ASCII characters.

Ex) The byte data 02h must be encoded to ASCII '0' and '2' (30h and 32h).

Refer to the Operation code table.

4th-5thbytes) OP code: Operation code

This OP code data must be encoded to ASCII characters.

OP code 1Ah -> OP code (Hi) = ASCII '1' (31h)

OP code (Lo) = ASCII 'A' (41h)

Refer to the Operation code table.

6th-9thbytes) Set value:(16bit)

This data must be encoded to ASCII characters.

Ex.) 0123h -> 1st(MSB) = ASCII '0' (30h)

2nd = ASCII '1' (31h)

3rd = ASCII '2' (32h)

4th(LSB) = ASCII '3' (33h)

10thbyte) ETX: End of Message

ASCII ETX (03h)

5.4 "Set parameter" reply

STX	Result		OP code page		OP code		Type		Max value				Requested setting Value				ETX
	Hi	Lo	Hi	Lo	Hi	Lo	Hi	Lo	MSB			LSB	MSB			LSB	
1st	2nd-3rd		4th-5th		6th-7th		8th-9th		10th-13th				14th -17th				18th

The Monitor echoes back the parameter and status of the requested operation code.

(If command is sent as “Broadcast” then no reply should be sent back.)

1stbyte) STX: Start of Message

ASCII STX (02h)

2nd-3rdbytes) Result code

ASCII '0''0' (30h, 30h): No Error

ASCII '0''1' (30h, 31h): Unsupported operation with this monitor or unsupported operation under current condition.

4th-5thbytes) OP code page: Echoes back the Operation code page for confirmation.

Reply data from the monitor is encoded to ASCII characters.

Ex.) OP code page 02h -> OP code page = ASCII '0' and '2' (30h and 32h)

Refer to Operation code table.

6th-7thbytes) OP code: Echoes back the Operation code for confirmation.

Reply data from the monitor is encoded to ASCII characters.

Ex.) OP code 1Ah -> OP code (Hi) = ASCII '1' (31h)

OP code (Lo) = ASCII 'A' (41h)

Refer to Operation code table

8th-9thbytes) Type: Operation type code

ASCII '0''0' (30h, 30h): Set parameter

ASCII '0''1' (30h, 31h): Momentary

Like Auto Setup function, that automatically changes the parameter.

10th-13thbytes) Max. value: Maximum value that monitor can accept. (16bits)

Reply data from the monitor is encoded to ASCII characters.

Ex.) '0''1''2''3' means 0123h (291)

14th -17thbytes) Requested setting Value: Echoes back the parameter for confirmation. (16bits)

Reply data from the monitor is encoded to ASCII characters.

Ex.) '0''1''2''3' means 0123h (291)

18thbyte) ETX: End of Message

ASCII ETX (03h)

5.5 Commands

"Command message format" depends on each command. Some commands are shown with usage. Refer to section 7 to 10.

5.5.1 Save Current Settings.

The controller requests for the monitor to store the adjusted value.

STX	Command code		ETX
	'0'	'C'	

- Send "OC"(30h, 43h) as Save current settings command.
- Complete "Save Current setting" command packet as follows;

  (The destination “A” (monitor ID of 1) is only an example. It should be changed according to the target monitor ID)

ASCII: 01h-30h-41h-30h-41h-30h-34h-02h-30h-43h-03h-CHK-0Dh

SOH-'0'-'A'-'0'-'A'-'0'-'4'-STX-'0'-'C'-ETX-CHK- CR

The monitor replies the packet for confirmation as follows;

SOH-'0'-'0'-'A'-'B'-'0'-'6'-STX-'0'-'0'-'0'-'C'-ETX-CHK- CR

5.5.2 Get Timing Report and Timing reply.

The controller requests the monitor to report the displayed image timing.

STX	Command code		ETX
	'0'	'7'	

- Send "07"(30h, 37h) as Get Timing Report command.
- Complete "Get Timing Report" command packet as follows;

  (The destination “A” (monitor ID of 1) is only an example. It should be changed according to the target monitor ID)

ASCII: 01h-30h-41h-30h-41h-30h-34h-02h-30h-37h-03h-CHK-0Dh

SOH-'0'-'A'-'0'-'A'-'0'-'4'-STX-'0'-'7'-ETX-CHK- CR

The monitor replies status as the following format;

STX	Command		SS		H Freq.				V Freq.				ETX
	'4'	'E'	Hi	Lo	MSB			LSB	MSB			LSB	

- SS: Timing status byte

  Bit 7 = 1: Sync Frequency is out of range.
  Bit 6 = 1: Unstable count
  Bit 5-2 Reserved (Don't care)
  Bit 1 1:Positive Horizontal sync polarity.
  0:Negative Horizontal sync polarity.
  Bit 0 1:Positive Vertical sync polarity.
  0:Negative Vertical sync polarity.

- H Freq: Horizontal Frequency in unit 0.01kHz

- V Freq: Vertical Frequency in unit 0.01Hz

  Ex.) When H Freq is '1''2''A''9' (31h, 32h, 41h, 39h), it means 47.77kHz.

5.5.3 NULL Message

STX	Command code		ETX
	'B'	'E'	

The NULL message returned from the monitor is used in the following cases;

- A timeout error has occurred. (The default timeout is 10sec.)
- The monitor receives an unsupported message type.
- The monitor detects a packet BCC (Block Check Code) error.
- To tell the controller that the monitor does not have any answer to give to the host (not ready or not expected)
- Complete "NULL Message" command packet as follows;

  (The destination “A” (monitor ID of 1) is only an example. It should be changed according to the target monitor ID)

  01h-30h-30h-41h-41h-30h-34h—02h-42h-45h-03h-CHK-0Dh

  SOH-'0'-'0'-'A'-'A'-'0'-'4'-STX-'B'-'E'-ETX-CHK- CR

6. Typical procedure example

The following is a sample of procedures to control the monitor, these are examples of "Get parameter", "Set parameter" and "Save current settings".

6.1. How to change the “Brightness” setting.

Step 1. The controller requests the Monitor to reply with the current brightness setting and capability to support this operation. (Get parameter)

Header	Message	Check code	Delimiter
SOH-'0'-'A'-'0'-'C'-'0'-'6'	STX-'0'-'0'-'1'-'0'-ETX	BCC	CR

Header
SOH (01h): Start Of Header
'0' (30h): Reserved
'A' (41h): Monitor ID
If the command should be sent to certain monitor only, the either of character ‘A’(41h) to ‘Z’(5Ah) which is corresponding to monitor ID from No1 to No.26 should be set to this portion. If it is a broad cast command(only “set command” is available), then the ’*’(2Ah)should be applied.

'0' (30h): Message sender is the controller
'C' (43h): Message is "Get parameter command"
'0'-'6' (30h, 36h): Message length is 6 bytes

Message
STX (02h): Start of Message
'0'-'0' (30h, 30h): Operation code page number is 0
'1'-'0' (31h, 30h): Operation code is 10h (in the OP code page 0)
ETX (03h): End of Message

Check code
BCC: Block Check Code
Refer to the section 4.5 “Check code” for a BCC calculation.

Delimiter
CR (0Dh): End of packet

Step 2. The monitor replies with current Brightness setting and capability to support this operation.
(If command is sent as “Broadcast” then no reply should be sent back.)

Header	Message	Check code	Delimiter
SOH-'0'-'0'-'A'-'D'-'1'-'2'	STX-'0'-'0'-'0'-'0'-'1'-'0'-'0'-'0' -'0'-'0'-'6'-'4'-'0'-'0'-'3'-'2'-ETX	BCC	CR

Header
SOH (01h): Start Of Header
'0' (30h): Reserved
'0' (30h): Message receiver is the controller
'A' (41h): Monitor ID
This portion should depend on the monitor ID of Monitor.(’A’(41h)-‘Z’(5Ah))
'D' (44h): Message Type is "Get parameter reply"
'1'-'2' (31h, 32h): Message length is 18 bytes

Message
STX (02h): Start of Message
'0'-'0' (30h, 30h): Result code. No error
'0'-'0' (30h, 30h): Operation code page number is 0
'1'-'0' (31h, 30h): Operation code is 10h (in the page 0)
'0'-'0' (30h, 30h): This operation is "Set parameter" type
'0'-'0'-'6'-'4' (30h, 30h, 36h, 34h): Brightness max value is 100(0064h)
'0'-'0'-'3'-'2' (30h, 30h, 33h, 32h): Current Brightness setting is 50(0032h) as 50%
ETX (03h): End of Message

Check code
BCC: Block Check Code
Refer to the section 4.5 “Check code” for a BCC calculation.

Delimiter
CR (0Dh): End of packet

Step 3. The controller request the monitor to change the Brightness setting

Header	Message	Check code	Delimiter
SOH-'0'-'A'-'0'-'E'-'0'-'A'	STX-'0'-'0'-'1'-'0'-'0'-'0'-'5'-'0'-ETX	BCC	CR

Header
SOH (01h): Start Of Header
'0' (30h): Reserved
'A' (41h): Monitor ID
If the command should be sent to certain monitor only, the either of character ‘A’(41h) to ‘Z’(5Ah) which is corresponding to monitor ID from No1 to No.26 should be set to this portion. If it is a broad cast command(only “set command” is available), then the ’*’(2Ah)should be applied.
'0' (30h): Message sender is the controller
'E' (45h): Message Type is "Set parameter command"
'0'-'A' (30h, 41h): Message length is 10 bytes

Message
STX (02h): Start of Message

'0'-'0' (30h, 30h): Operation code page number is 0
'1'-'0' (31h, 30h): Operation code is 10h (in the page 0)
'0'-'0'-'5'-'0' (30h, 30h, 35h, 30h): Set Brightness setting 80(0050h) as 80%
ETX (03h): End of Message

Check code
BCC: Block Check Code
Refer to the section 4.5 “Check code” for a BCC calculation.

Delimiter
CR (0Dh): End of packet

Step 4. The monitor replies with a message for confirmation.
(If command is sent as “Broadcast” then no reply should be sent back.)

Header	Message	Check code	Delimiter
SOH-'0'-'0'- 'A' -'F'-'1'-'2'	STX-'0'-'0'-'0'-'0'-'1'-'0'—'0'-'0'-'0' -'0'-'6'-'4'-'0'-'0'-'5'-'0'-ETX	BCC	CR

Header
SOH (01h): Start Of Header
'0' (30h): Reserved
'0' (30h): Message receiver is the controller
'A' (41h): Monitor ID
This portion should depend on the monitor ID of Monitor.(’A’(41h)-‘Z’(5Ah))
'F' (46h): Message Type is "Set parameter reply"
'1'-'2' (31h, 32h): Message length is 18 bytes

Message
STX (02h): Start of Message
'0'-'0' (30h, 30h): Result code. No error
'0'-'0' (30h, 30h): Operation code page number is 0
'1'-'0' (31h, 30h): Operation code is 10h (in the page 0)
'0'-'0' (30h, 30h): This operation is "Set parameter" type
'0'-'0'-'6'-'4' (30h, 30h, 36h, 34h): Brightness max value is 100(0064h)
'0'-'0'-'5'-'0' (30h, 30h, 35h, 30h): Received a Brightness setting was 80(0050h) as 80%
ETX (03h): End of Message

Check code
BCC: Block Check Code
Refer to the section 4.5 “Check code” for a BCC calculation.

Delimiter
CR (0Dh): End of packet

- Repeat Step 1 and Step 2, if you need to check the Brightness setting. (Recommended)

Step 5. Request the monitor to store the Brightness setting. (Save Current Settings Command)

Header	Message	Check code	Delimiter
SOH-'0'-'A'-'0'-'A'-'0'-'4'	STX-'0-'C'-ETX	BCC	CR

Header
SOH (01h): Start Of Header
'0' (30h): Reserved
'A' (41h): Monitor ID
If the command should be sent to certain monitor only, the either of character ‘A’(41h) to ‘Z’(5Ah) which is corresponding to monitor ID from No1 to No.26 should be set to this portion. If it is a broad cast command(only “set command” is available), then the ’*’(2Ah)should be applied.
'0' (30h): Message sender is the controller
'A' (41h): Message type is "Command"
'0'-'4' (30h, 34h): Message length is 4 bytes

Message
STX (02h): Start of Message

'0'-'C' (30h, 43h): Command code is 0Ch as "Save current settings"
ETX (03h): End of Message

Check code
BCC: Block Check Code
Refer to the section 4.5 “Check code” for a BCC calculation.

Delimiter
CR (0Dh): End of packet

6.2 How to read the measurement value of the built-in temperature sensors.

MDT521S has two built-in temperature sensors.
The controller can monitor inside temperatures by using those sensors through RS-232C.

The following shows the procedure for reading the temperatures from the sensors.

Step 1. Select a temperature sensor which you want to read.

Header	Message	Check code	Delimiter
SOH-'0'-'A'-'0'-'E'-'0'-'A'	STX-'0'-'2'-'7'-'8'-'0'-'0'-'0'-'1'-ETX	BCC	CR

Header
SOH (01h): Start of Header
'0' (30h): Reserved
'A' (41h): Monitor ID
If the command should be sent to certain monitor only, the either of character ‘A’(41h) to ‘Z’(5Ah) which is corresponding to monitor ID from No1 to No.26 should be set to this portion.

'0' (30h): Message sender is the controller
'E' (45h): Message Type is "Set parameter command"
'0'-'A' (30h, 41h): Message length is 10 bytes

Message
STX (02h): Start of Message
'0'-'2' (30h, 32h): Operation code page number is 02h
'7'-'8' (37h, 38h): Operation code is 78h (on page 2)
'0'-'0'-'0'-'1' (30h, 30h, 30h, 31h): Select the temperature sensor #1 (01h).
00h: No meaning
01h: Sensor #1
02h: Sensor #2
ETX (03h): End of Message

Check code
BCC: Block Check Code
Refer to the section 4.5 “Check code” for a BCC calculation.

Delimiter
CR (0Dh): End of packet

Step 2. The monitor replies for confirmation.

Header	Message	Check code	Delimiter
SOH-'0'-'0'-'A'-'F'-'1'-'2'	STX-'0'-'0'-'0'-'2'-'7'-'8'-'0'-'0'-'0'-'0'-'0'-'2'-'0'-'0'-'0'-'1'-ETX	BCC	CR

Header
SOH (01h): Start of Header
'0' (30h): Reserved
'0' (30h): Message receiver is the controller
'A' (41h): Monitor ID
This portion should depend on the monitor ID of Monitor.(’A’(41h)-‘Z’(5Ah))

'F' (46h): Message Type is "Set parameter reply"
'1'-'2' (30h, 32h): Message length is 18 bytes

Message
  STX (02h): Start of Message
  '0'-'0' (30h, 30h): Result code. No error
  '0'-'2' (30h, 32h): Operation code page number is 02h
  '7'-'8' (37h, 38h): Operation code is 78h (in the page 2)
  '0'-'0' (30h, 30h): This operation is "Set parameter" type
  '0'-'0'-'0'-'2' (30h, 30h, 30h, 32h): Number of temperature sensors 2 (0002h).
  '0'-'0'-'0'-'1' (30h, 30h, 30h, 31h): temperature sensor is #1.
  ETX (03h): End of Message

Check code
  BCC: Block Check Code
     Refer to the section 4.5 “Check code” for a BCC calculation.

Delimiter
  CR (0Dh): End of packet

Step 3
The controller requests the monitor to send the temperature from the selected sensor.

Header	Message	Check code	Delimiter
SOH-'0'-'A'-'0'-'C'-'0'-'6'	STX-'0'-'2'-'7'-'9'-ETX	BCC	CR

Header
  SOH (01h): Start of Header
  '0' (30h): Reserved

  'A' (41h): Monitor ID
  If the command should be sent to certain monitor only, the either of character ‘A’(41h) to ‘Z’(5Ah) which is corresponding to monitor ID from No1 to No.26 should be set to this portion.

  '0' (30h): Message sender is the controller
  'C' (43h): Message Type is "Get parameter "
  '0'-'6' (30h, 36h): Message length is 6 bytes

Message
  STX (02h): Start of Message
  '0'-'2' (30h, 32h): Operation code page number is 02h.
  '7'-'9' (37h, 39h): Operation code is 79h (in the page 2)
  ETX (03h): End of Message

Check code
  BCC: Block Check Code
       Refer to the section 4.5 “Check code” for a BCC calculation.

Delimiter
  CR (0Dh): End of packet

Step 4. The monitor replies a temperature of selected sensor.

Header	Message	Check code	Delimiter
SOH-'0'-'0'-'A'-'D'-'1'-'2'	STX-'0'-'0'-'0'-'2'-'7'-'9'-'0'-'0' -'0'-'0'-'F'-'F'-'0'-'0'-'3'-'2'-ETX	BCC	CR

Header
  SOH (01h): Start of Header
  '0' (30h): Reserved
  '0' (30h): Message receiver is the controller
  'A' (41h): Monitor ID
  This portion should depend on the monitor ID of Monitor.(’A’(41h)-‘Z’(5Ah))
  'D' (44h): Message Type is "Get parameter reply"
  '1'-'2' (31h, 32h): Message length is 18 bytes

Message

STX (02h): Start of Message
'0'-'0' (30h, 30h): Result code. No error
'0'-'2' (30h, 32h): Operation code page number is 2
'7'-'9' (37h, 39h): Operation code is 79h (in the page 2)
'0'-'0' (30h, 30h): This operation is "Set parameter" type
'0'-'0'-'F'-'F' (30h, 30h, 46h, 46h): Maximum value.
'0'-'0'-'3'-'2' (30h, 30h, 33h, 32h): The temperature is **50** degrees Celsius.

Readout value is 2's complement.

Temperature [Celsius]	Readout value	
	Binary	Hexadecimal
+125.0	0000 0000 0111 1101	007Dh
+ 25.0	0000 0000 0001 1001	0019h
+ 1.0	0000 0000 0000 0001	0001h
0	0000 0000 0000 0000	0000h
- 1.0	1111 1111 1111 1111	FFFFh
- 25.0	1111 1111 1110 0111	FFE7h
- 55.0	1111 1111 1100 1001	FFC9h

ETX (03h): End of Message

Check code
BCC: Block Check Code
Refer to the section 4.5 “Check code” for a BCC calculation.

Delimiter
CR (0Dh): End of packet

7. Power control procedure

7.1 Power status read

1) The controller requests the monitor to reply a current power status.

Header	Message	Check code	Delimiter
SOH-'0'-'A'-'0'-'A'-'0'-'6'	STX-'0'-'1'-'D'-'6'-ETX	BCC	CR

Header
SOH (01h): Start Of Header
'0' (30h): Reserved
'A' (41h): Monitor ID

If the command should be sent to certain monitor only, the either of character ‘A’(41h) to ‘Z’(5Ah) which is corresponding to monitor ID from No1 to No.26 should be set to this portion.

'0' (30h): Message sender is the controller
'A' (41h): Message Type is "Command"
'0'-'6' (30h, 36h): Message length is 6 bytes

Message
STX (02h): Start of Message
'0'-'1'-'D'-'6': Get power status command
ETX (03h): End of Message

Check code
BCC: Block Check Code
Refer to the section 4.5 “Check code” for a BCC calculation.

Delimiter
CR (0Dh): End of packet.

2) The monitor returns with the current power status.

Header	Message	Check code	Delimiter
SOH-'0'-'0'-'A'-'B'-'1'-'2'	STX-'0'-'2'-'0'-'0'-'D'-'6'-'0'-'0'-'0' -'0'-'0'-'4'-'0'-'0'-'0'-'1'-ETX	BCC	CR

Header
SOH (01h): Start Of Header

'0' (30h): Reserved
'0' (30h): Message receiver is the controller
'A' (41h): Monitor ID
This portion should depend on the monitor ID of Monitor.('A'(41h)-'Z'(5Ah))

'B' (42h): Message Type is "Command reply"
'1'-'2' (31h, 32h): Message length is 18 bytes

Message
STX(02h):Start of Message
'0'-'2' (30h, 32h): Reserved data
'0'-'0' (30h, 30h): Result code
00: No Error
01: Unsupported
'D'-'6'(44h, 36h): Display power mode code
'0'-'0' (30h, 30h): Parameter type code is "Set parameter"
'0'-'0'-'0'-'4' (30h, 30h, 30h, 34h): Power mode is 4 types
'0'-'0'-'0'-'1' (30h, 30h, 30h, 31h): Current power mode
<Status>
0001: ON
~~0002: Stand-by (power save)~~
~~0003: Suspend (power save)~~
0004: Stand-by (power save),OFF (same as IR power off)
ETX (03h): End of Message

Check code
BCC: Block Check Code
Refer to the section 4.5 "Check code" for a BCC calculation.

Delimiter
CR (0Dh): End of packet

7.2 Power control

1) The controller requests the monitor to control monitor power.

Header	Message	Check code	Delimiter
SOH-'0'-'A'-'0'-'A'-'0'-'C'	STX-'C'-'2'-'0'-'3'-'D'-'6'-'0'-'0'-'0'-'1'-ETX	BCC	CR

Header
SOH (01h): Start Of Header
'0' (30h): Reserved
'A' (41h): Monitor ID
If the command should be sent to certain monitor only, the either of character 'A'(41h) to 'Z'(5Ah) which is corresponding to monitor ID from No1 to No.26 should be set to this portion. If it is a broad cast command(only "set command" is available), then the '*'(2Ah)should be applied.

'0' (30h): Message sender is the controller
'A' (41h): Message type is "Command"
'0'-'C (30h, 43h): Message length is 12 bytes

Message
STX (02h): Start of Message
'C'-'2','0'-'3'-'D'-'6' (43h, 32h, 30h, 33h, 44h, 36h): power control command
'0'-'0'-'0'-'1' (30h, 30h, 30h, 31h): Power mode
0001: ON
0002, 0003: Do not set.
0004: OFF (same as the power off by IR)
ETX (03h): End of Message

Check code
BCC: Block Check Code
Refer to the section 4.5 "Check code" for a BCC calculation.

Delimiter
CR (0Dh): End of packet.

2) The monitor replies a data for confirmation.(If command is sent as “Broadcast” then no reply should be sent back.).

Header	Message	Check code	Delimiter
SOH-'0'-'0'-'A'-'B'-'0'-'E'	STX-'0'-'0'-'C'-'2'-'0'-'3'-'D'-'6'-'0'-'0'-'0'-'1'-ETX	BCC	CR

Header
SOH (01h): Start Of Header
'0' (30h): Reserved
'0' (30h): Message sender is the controller
'A' (41h): Monitor ID
This portion should depend on the monitor ID of Monitor.(’A’(41h)-‘Z’(5Ah)).
'B' (42h): Message type is "Command reply"
'N'-'N': Message length.
Note.) The maximum data length that can be written to the monitor at a time is 32bytes.
Ex.) The byte data 20h is encoded as ASCII characters '2' and '0' (32h and 30h).

Message
STX (02h): Start of Message
'0'-'0' (30h, 30h): Result code. No error
'C'-'2’,'0'-'3'-'D'-'6' (43h, 32h, 30h, 33h, 44h, 36h): power control reply command
- The monitor replies same as power control command to the controller.

'0'-'0'-'0'-'1' (30h, 30h, 30h, 31h): Power mode
0001: ON
0002, 0003: Do not set.
0004: OFF (same as the power off by IR)
ETX (03h): End of Message

Check code
BCC: Block Check Code
Refer to the section 4.5 “Check code” for a BCC calculation.

Delimiter
CR (0Dh): End of packet.

8. Asset Data read and write

8.1 Asset Data Read Request and reply

This command is used in order to read Asset Data.

1) The controller requests the monitor to reply with Asset data.

Header	Message	Check code	Delimiter
SOH-'0'-'A'-'0'-'A'-'0'-'A'	STX-'C'-'0'-'0'-'B'-'0'-'0'-'2'-'0'-ETX	BCC	CR

Header
  SOH (01h): Start Of Header
  '0' (30h): Reserved
  'A' (41h): Monitor ID

  If the command should be sent to certain monitor only, the either of character ‘A’(41h) to ‘Z’(5Ah) which is corresponding to monitor ID from No1 to No.26 should be set to this portion.

  '0' (30h): Message sender is the controller
  'A' (41h): Message type is "Command"
  '0'-'A' (30h, 41h): Message length is 10 bytes

Message
  STX (02h): Start of Message
  'C'-'0'-'0'-'B' (43h, 30h, 30, 42h): Asset read request command
  '0'-'0' (30h, 30h): Offset data from top of the Asset data.
   At first set 00h: Read data from the top of Asset data area.

  '2'-'0' (32h, 30h): Read out data length is 32bytes.
                      Maximum readout length is 32bytes at a time.
  ETX (03h): End of Message

Check code
  BCC: Block Check Code
       Refer to the section 4.5 “Check code” for a BCC calculation.

Delimiter
  CR (0Dh): End of packet

2) The monitor replies Asset data to the controller.

Header	Message	Check code	Delimiter
SOH-'0'-'0'-'A'-'B'-N-N	STX-'C'-'1'-'0'-'B'- Data(0)-Data(1)---Data(N)-ETX	BCC	CR

Header
  SOH (01h): Start of Header
  '0' (30h): Reserved
  '0' (30h): Message receiver is the controller
  'A' (41h): Monitor ID
  This portion should depend on the monitor ID of Monitor.(’A’(41h)-‘Z’(5Ah)).
  'B' (42h): Message type is "Command reply"
  N-N: Message length
              Ex.) The byte data 20h is encoded to ASCII characters '2' and '0' (32h and 30h).
              Note.) This length is includes STX and ETX.

Message
  STX (02h): Start of Message
  'C'-'1'-'0'-'B' (43h, 31h, 30, 42h): Asset read reply command
  Data(0) – Data(N): Retuned Asset data.
  ETX (03h): End of Message

Check code
  BCC: Block Check Code
       Refer to the section 4.5 “Check code” for a BCC calculation.

Delimiter

CR (0Dh): End of packet

8.2 Asset Data write

This command is used in order to write Asset Data.

1) The controller requests the monitor to write Asset data.

Header	Message	Check code	Delimiter
SOH-'0'-'A'-'0'-'A'-N-N	STX-'C'-'0'-'0'-'E'-'0'-'0'- Data(0)-Data(1)---Data(N)-ETX	BCC	CR

Header
SOH (01h): Start Of Header
'0' (30h): Reserved
'A' (41h): Monitor ID
If the command should be sent to certain monitor only, the either of character 'A'(41h) to 'Z'(5Ah) which is corresponding to monitor ID from No1 to No.26 should be set to this portion. If it is a broad cast command(only "set command" is available), then the '*'(2Ah)should be applied.

'0' (30h): Message sender is the controller
'A' (41h): Message type is "Command"
N-N: Message length.
Note.) The maximum data length that can be written to the monitor at a time is 32bytes.
Ex.) The byte data 20h is encoded as ASCII characters '2' and '0' (32h and 30h).

Message
STX (02h): Start of Message
'C'-'0'-'0'-'E' (43h, 30h, 30, 45h): Asset Data writes command
'0'-'0': Offset address from top of Asset data.
00h : Write data from top of the Asset data area.

Data0 - DataN: Asset data. The data must be ASCII characters strings.
ETX (03h): End of Message

Check code
BCC: Block Check Code
Refer to the section 4.5 "Check code" for a BCC calculation.

Delimiter
CR (0Dh): End of packet

2) The monitor replies a data for confirmation.(If command is sent as "Broadcast" then no reply should be sent back.).

Header	Message	Check code	Delimiter
SOH-'0'-'0'-'A'-'B'-N-N	STX-'0'-'0'-'C'-'0'-'0'-'E'-'0'-'0'- Data(0)-Data(1)---Data(N)-ETX	BCC	CR

Header
SOH (01h): Start Of Header
'0' (30h): Reserved
'0' (30h): Message receiver is the controller
'A' (41h): Monitor ID
This portion should depend on the monitor ID of Monitor.('A'(41h)-'Z'(5Ah)).
'B' (42h): Message type is "Command reply"
N-N: Message length.
Note.) The maximum data length that can be written to the monitor at a time is 32bytes.
Ex.) The byte data 20h is encoded as ASCII characters '2' and '0' (34h and 30h).

Message
STX (02h): Start of Message
'0'-'0': Result code. No error
'C'-'0'-'0'-'E' (43h, 30h, 30, 45h): Asset Data write command
'0'-'0': Offset address from top of Asset data.
00h : Write data into from top of the Asset data area.

Data(0) –- Data(N): Asset data. The data must be ASCII characters strings.

ETX (03h): End of Message

Check code
BCC: Block Check Code
Refer to the section 4.5 “Check code” for a BCC calculation.

Delimiter
CR (0Dh): End of packet

9. Date & Time read and write

9.1 Date & Time Read

This command is used in order to read the setting of Date & Time.

1) The controller requests the monitor to reply with the Date & Time.

Header	Message	Check code	Delimiter
SOH-'0'-'A'-'0'-'A'-'0'-'6'	STX-'C'-'2'-'1'-'1'-ETX	BCC	CR

Header
SOH (01h): Start Of Header
'0' (30h): Reserved
'A' (41h): Monitor ID
If the command should be sent to certain monitor only, the either of character ‘A’(41h) to ‘Z’(5Ah) which is corresponding to monitor ID from No1 to No.26 should be set to this portion.

'0' (30h): Message sender is the controller
'A' (41h): Message type is "Command"
'0'-'6'(30h, 36h): length.

Message
STX (02h): Start of Message
'C'-'2'-'1'-'1' (43h, 32h, 31h, 31h): Date & time read request command
ETX (03h): End of Message

Check code
BCC: Block Check Code
Refer to the section 4.5 “Check code” for a BCC calculation.

Delimiter
CR (0Dh): End of packet

2) The monitor replies Date & Time to the controller.

Header	Message	Check code	Delimiter
SOH-'0'-'0'-'A'-'B'-'1'-'4'	STX-'C'-'3'-'1'-'1'-YY-MM-DD-WW-HH-MM-DS-ETX	BCC	CR

Header
SOH (01h): Start of Header
'0' (30h): Reserved
'0' (30h): Message receiver is the controller
'A' (41h): Monitor ID
This portion should depend on the monitor ID of Monitor.(’A’(41h)-‘Z’(5Ah)).
'B' (42h): Message type is "Command reply"
'1'-'4'(31h, 34h): Message length

Message
STX (02h): Start of Message
'C'-'3'-'1'-'1' (43h, 33h, 31h, 31h): Date & Time read reply command
'YY'-'MM'-'DD'-'WW'-'HH'-'MN'-'DS': Date & Time data
YY: Year (offset 2000)
'0'-'0'(30h, 30h): 2000
|
'6'-'3'(36h, 33h): 2099 (99 = 63h)

MM: Month

'0'-'1'(30h, 31h): January
|
'0'-'C'(30h, 43h): December

DD: Day
'0'-'1'(30h, 31h): 1
|
'1'-'E'(31h, 45h): 30(=1Eh)
'1'-'F'(31h, 46h): 31(=1Fh)

WW: weekdays
'0'-'0'(30h, 30h): Sunday
'0'-'1'(30h, 31h): Monday
'0'-'2'(30h, 32h): Tuesday
'0'-'3'(30h, 33h): Wednesday
'0'-'4'(30h, 34h): Thursday
'0'-'5'(30h, 35h): Friday
'0'-'6'(30h, 36h): Saturday

HH: Hours
'0'-'0'(30h, 30h): 0
|
'1'-'7'(31h, 37h): 23 (=17h)

MN: Minutes
'0'-'0'(30h, 30h): 0
|
'3'-'B' (33h, 42h): 59 (=3Bh)

DS: Daylight saving (Summer time)
'0'-'0'(30h, 30h): NO
'0'-'1'(30hm 31h): YES

ETX (03h): End of Message

Check code
BCC: Block Check Code
Refer to the section 4.5 “Check code” for a BCC calculation.

Delimiter
CR (0Dh): End of packet

9.2 Date & Time Write

This command is used in order to write the setting of the Date & Time.

1) The controller requests the monitor to write Date & Time.

Header	Message	Check code	Delimiter
SOH-'0'-'A'-'0'-'A'-'1'-'4'	STX-'C'-'2'-'1'-'2'-YY-MM-DD-WW-HH-MN-DS-ETX	BCC	CR

Header
SOH (01h): Start Of Header
'0' (30h): Reserved
'A' (41h): Monitor ID
If the command should be sent to certain monitor only, the either of character ‘A’(41h) to ‘Z’(5Ah) which is corresponding to monitor ID from No1 to No.26 should be set to this portion. If it is a broad cast command(only “set command” is available), then the ’*’(2Ah)should be applied.

'0' (30h): Message sender is the controller
'A' (41h): Message type is "Command"
'1'-'4'(31h, 34h): Message length.

Message
STX (02h): Start of Message
'C'-'2'-'1'-'2' (43h, 32h, 31h, 32h): Date & Time write command

'YY'-'MM'-'DD'-'WW'-'HH'-'MN'-'DS': Date & Time data
YY: Year (offset 2000)
'0'-'0'(30h, 30h): 2000
|
'6'-'3'(36h, 33h): 2099 (99 = 63h)

MM: Month
'0'-'1'(30h, 31h): January
|
'0'-'C'(30h, 43h): December

DD: Day
'0'-'1'(30h, 31h): 1
|
'1'-'E'(31h, 45h): 30(=1Eh)

WW: weekdays
This parameter if no use, since the week is automatically calculated by Monitor based on the date data.

HH: Hours
'0'-'0'(30h, 30h): 0
|
'1'-'7'(31h, 37h): 23 (=17h)

MN: Minutes
'0'-'0'(30h, 30h): 0
|
'3'-'B' (33h, 42h): 59 (=3Bh)

DS: Daylight saving (Summer time)
'0'-'0'(30h, 30h): NO
'0'-'1'(30h, 30h): YES

ETX (03h): End of Message

Check code
BCC: Block Check Code
Refer to the section 4.5 “Check code” for a BCC calculation.

Delimiter
CR (0Dh): End of packet

2) The monitor replies a data for confirmation.(If command is sent as “Broadcast” then no reply should be sent back.).

Header	Message	Check code	Delimiter
SOH-'0'-'0'-'A'-'B'-'1'-'6'	STX-'C'-'3'-'1'-'2'-ST-YY-MM-DD-WW-HH-MN-DS-ETX	BCC	CR

Header
SOH (01h): Start Of Header
'0' (30h): Reserved
'0' (30h): Message receiver is the controller
'A' (41h): Monitor ID
This portion should depend on the monitor ID of Monitor.(’A’(41h)-‘Z’(5Ah)).

'B' (42h): Message type is "Command reply"
'1'-'6'(31h, 36h): Message length.

Message
STX (02h): Start of Message
'C'-'3'-'1'-'2' (43h, 33h, 31h, 32h): Date & Time write reply command
ST: Date & Time Status command
'0'-'0'(30h, 30h):No error
'0'-'1'(30h, 31h):Error
'YY'-'MM'-'DD'-'WW'-'HH'-'MN'-'DS': Date & Time data
YY: Year (offset 2000)
'0'-'0'(30h, 30h): 2000
|

'6'-'3'(36h, 33h): 2099 (99 = 63h)

MM: Month
'0'-'1'(30h, 31h): January
|
'0'-'C'(30h, 43h): December

DD: Day
'0'-'1'(30h, 31h): 1
|
'1'-'E'(31h, 45h): 30(=1Eh)
'1'-'F'(31h, 46h): 31(=1Fh)

WW: weekdays
This parameter if no use, since the week is automatically calculated by Monitor based on the date data.

HH: Hours
'0'-'0'(30h, 30h): 0
|
'1'-'7'(31h, 37h): 23 (=17h)

MN: Minutes
'0'-'0'(30h, 30h): 0
|
'3'-'B' (33h, 42h): 59 (=3Bh)

DS: Daylight saving (Summer time)
'0'-'0'(30h, 30h): NO
'0'-'1'(30h, 31h): YES

ETX (03h): End of Message

Check code
BCC: Block Check Code
Refer to the section 4.5 “Check code” for a BCC calculation.

Delimiter
CR (0Dh): End of packet

10.Schedule read and write

10.1 Schedule Read

This command is used in order to read the setting of the Schedule.

1) The controller requests the monitor to read Schedule

Header	Message	Check code	Delimiter
SOH-'0'-'A'-'0'-'A'-'0'-'8'	STX-'C'-'2'-'1'-'3'-PG-ETX	BCC	CR

Header
  SOH (01h): Start Of Header
  '0' (30h): Reserved
  'A' (41h): Monitor ID
  If the command should be sent to certain monitor only, the either of character 'A'(41h) to 'Z'(5Ah) which is corresponding to monitor ID from No1 to No.26 should be set to this portion.

  '0' (30h): Message sender is the controller
  'A' (41h): Message type is "Command"
  '0'-'8'(30h, 38h): Message length.

Message
  STX (02h): Start of Message
  'C'-'2'-'1'-'3' (43h, 32h, 31h, 33h): Schedule read request command
      PG: Program No.
      - The data must be ASCII characters strings.
  ETX (03h): End of Message

Check code
  BCC: Block Check Code
      Refer to the section 4.5 "Check code" for a BCC calculation.

Delimiter
  CR (0Dh): End of packet

2) The monitor replies Schedule to the controller.

Header	Message	Check code	Delimiter
SOH-'0'-'0'-'A'-'B'-'1'-'6'	STX-'C'-'3'-'1'-'3'-PG-ON HOURS-ON MIN-OFF HOURS-OFF Min-INPUT-WD-FL-ETX	BCC	CR

Header
  SOH (01h): Start of Header
  '0' (30h): Reserved
  '0' (30h): Message receiver is the controller
  'A' (41h): Monitor ID
      This portion should depend on the monitor ID of Monitor.('A'(41h)-'Z'(5Ah)).

  'B' (42h): Message type is "Command reply"
  '1'-'6'(31h, 36h): Message length

Message
  STX (02h): Start of Message
  'C'-'3'-'1'-'3' (43h, 33h, 31h, 33h): Schedule read reply command
  PG-ON HOURS-ON MIN-OFF HOURS-OFF MIN-INPUT-WD-FL: Schedule data
      PG: Program No.
          '0'-'0'(30h, 30h): Program No.1
            |
          '0'-'6'(30h, 36h): Program No.7

      ON_HOUR: Turn on time (hour)
          '0'-'0'(30h, 30h): 00
            |
          '1'-'7'(31h, 37h): 23 (=17h)
          '1'-'8'(31h, 38h): ON timer isn't set.

      ON_MIN: Turn on time (minute)
          '0'-'0'(30h, 30h): 0
            |

'3'-'B'(33h, 42h): 59
'3'-'C'(33h, 43h): On timer isn't set.

OFF_HOUR: Turn off time (hour)
'0'-'0'(30h, 30h): 00
|
'1'-'7'(31h, 37h): 23 (=17h)
'1'-'8'(31h, 38h): Off timer isn't set.

OFF_MIN: Turn off time (minute)
'0'-'0'(30h, 30h): 0
|
'3'-'B'(33h, 42h): 59 (=3Bh)
'3'-'C'(33h, 43h): Off timer isn't set.

INPUT: Timer input
'0'-'0'(30h, 30h): RGB1(HDMI)
'0'-'1'(30h, 31h): RGB2(DVI-D)
'0'-'2'(30h, 32h): RGB3(D-SUB)
'0'-'3'(30h, 33h): RGB4(BNC)
'0'-'4'(30h, 34h): DVD/HD
'0'-'5'(30h, 35h): VIDEO
'0'-'6'(30h, 36h): VIDEO(S)
'0'-'7'(30h, 37h): It is operates by last memory input
'0'-'8'(30h, 38h): RGB5(CAT5)

WD: Week setting
bit 0: Monday
bit 1: Tuesday
bit 2: Wednesday
bit 3: Thursday
bit 4: Friday
bit 5: Saturday
bit 6: Sunday

EX.
'0'-'1'(30h, 31h): Monday
'0'-'4'(30h, 34h): Wednesday
'0'-'F'(30h, 46h): Monday, Tuesday, Wednesday and Thursday
'7'-'F'(37h, 46h): Monday to Sunday

FL: Option
bit 0: Everyday
bit 1: Every week
bit 2: Schedule Disable/Enable
* When bit0 and bit1 are '1', it behaves as Everyday.

EX.

FL setting	Schedule	Everyweek	Everyday	Schedule behavior
'0'-'0'(30h, 30h)				Schedule Disable
'0'-'1'(30h, 31h)			O	Schedule Disable
'0'-'2'(30h, 32h)		O		Schedule Disable
'0'-'3'(30h, 33h)		O	O	Schedule Disable
'0'-'4'(30h, 34h)	O			Once *Follow WD (Week setting)
'0'-'5'(30h, 35h)	O		O	Everyday
'0'-'6'(30h, 36h)	O	O		Everyweek *Follow WD (Week setting)
'0'-'7'(30h, 37h)	O	O	O	Everyday

ETX (03h): End of Message

Check code
BCC: Block Check Code
Refer to the section 4.5 “Check code” for a BCC calculation.

Delimiter
CR (0Dh): End of packet

10.2 Schedule Write

This command is used in order to write the setting of the Schedule.

1) The controller requests the monitor to write Schedule.

Header	Message	Check code	Delimiter
SOH-'0'-'A'-'0'-'A'-'1'-'6'	STX-'C'-'2'-'1'-'4'-PG-ON HOURS-ON MIN-OFF HOURS-OFF Min-INPUT-WD-FL-ETX	BCC	CR

Header
SOH (01h): Start Of Header
'0' (30h): Reserved
'A' (41h): Monitor ID
If the command should be sent to certain monitor only, the either of character 'A'(41h) to 'Z'(5Ah) which is corresponding to monitor ID from No1 to No.26 should be set to this portion. If it is a broad cast command(only "set command" is available), then the '*'(2Ah)should be applied.

'0' (30h): Message sender is the controller
'A' (41h): Message type is "Command"
'1'-'6'(31h, 36h): Message length.

Message
STX (02h): Start of Message
'C'-'2'-'1'-'4' (43h, 32h, 31h, 34h): Schedule writes command
PG-ON HOURS-ON MIN-OFF HOURS-OFF Min-INPUT-WD-FL: Schedule data
PG: Program No.
'0'-'0'(30h, 30h): Program No.1
|
'0'-'6'(30h, 36h): Program No.7

ON_HOUR: Turn on time (hour)
'0'-'0'(30h, 30h): 00
|
'1'-'7'(31h, 37h): 23 (=17h)
'1'-'8'(31h, 38h): ON timer isn't set.

ON_MIN: Turn on time (minute)
'0'-'0'(30h, 30h): 0
|
'3'-'B'(33h, 42h): 59
'3'-'C'(33h, 43h): On timer isn't set.

OFF_HOUR: Turn off time (hour)
'0'-'0'(30h, 30h): 00
|
'1'-'7'(31h, 37h): 23 (=17h)
'1'-'8'(31h, 38h): Off timer isn't set.

OFF_MIN: Turn off time (minute)
'0'-'0'(30h, 30h):0min
|
'3'-'B'(33h, 42h):59 (=3Bh)
'3'-'C'(33h, 43h): Off timer isn't set.

INPUT: Timer input
'0'-'0'(30h, 30h): RGB1(HDMI)
'0'-'1'(30h, 31h): RGB2(DVI-D)
'0'-'2'(30h, 32h): RGB3(D-SUB)
'0'-'3'(30h, 33h): RGB4(BNC)
'0'-'4'(30h, 34h): DVD/HD
'0'-'5'(30h, 35h): VIDEO
'0'-'6'(30h, 36h): VIDEO(S)
'0'-'7'(30h, 37h): It is operates by last memory input
'0'-'8'(30h, 38h): RGB5(CAT5)

WD: Week setting
bit 0: Monday
bit 1: Tuesday
bit 2: Wednesday

bit 3: Thursday
bit 4: Friday
bit 5: Saturday
bit 6: Sunday

EX.
'0'-'1'(30h, 31h): Monday
'0'-'4'(30h, 34h): Wednesday
'0'-'F'(30h, 46h): Monday, Tuesday, Wednesday and Thursday
'7'-'F'(37h, 46h): Monday to Sunday

FL: Option
bit 0: Everyday
bit 1: Every week
bit 2: Schedule Disable/Enable
* When bit0 and bit1 are '1', it behaves as Everyday.

EX.

FL setting	Schedule	Everyweek	Everyday	Schedule behavior
'0'-'0'(30h, 30h)				Schedule Disable
'0'-'1'(30h, 31h)			O	Schedule Disable
'0'-'2'(30h, 32h)		O		Schedule Disable
'0'-'3'(30h, 33h)		O	O	Schedule Disable
'0'-'4'(30h, 34h)	O			Once *Follow WD (Week setting)
'0'-'5'(30h, 35h)	O		O	Everyday
'0'-'6'(30h, 36h)	O	O		Everyweek *Follow WD (Week setting)
'0'-'7'(30h, 37h)	O	O	O	Everyday

ETX (03h): End of Message

Check code
BCC: Block Check Code
Refer to the section 4.5 “Check code” for a BCC calculation.

Delimiter
CR (0Dh): End of packet

2) The monitor replies a data for confirmation.(If command is sent as “Broadcast” then no reply should be sent back.).

Header	Message	Check code	Delimiter
SOH-'0'-'0'-'A'-'B'-'1'-'8'	STX-'C'-'3'-'1'-'4'-ST-PG-ON HOURS-ON MIN-OFF HOURS-OFF Min-NPUT-WD-FL-ETX	BCC	CR

Header
SOH (01h): Start Of Header
'0' (30h): Reserved
'0' (30h): Message receiver is the controller
'A' (41h): Monitor ID
This portion should depend on the monitor ID of Monitor.(’A’(41h)-‘Z’(5Ah)).

'B' (42h): Message type is "Command reply"
'1'-'8'(31h, 38h): Message length.

Message
STX (02h): Start of Message
'C'-'3'-'1'-'4' (43h, 33h, 31h, 34h): Schedule writes reply command
ST: Schedule Status command
0(30h):No error
1(31h):Error

PG-ON HOURS-ON MIN-OFF HOURS-OFF Min-NPUT-WD-FL: Schedule data
PG: Program No.
'0'-'0'(30h, 30h): Program No.1
|
'0'-'6'(30h, 36h): Program No.7

ON_HOUR: Turn on time (hour)
'0'-'0'(30h, 30h): 00
|
'1'-'7'(31h, 37h): 23 (=17h)
'1'-'8'(31h, 38h): ON timer isn't set.

ON_MIN: Turn on time (minute)
'0'-'0'(30h, 30h): 0
|
'3'-'B'(33h, 42h): 59
'3'-'C'(33h, 43h): On timer isn’t set.

OFF_HOUR: Turn off time (hour)
'0'-'0'(30h, 30h): 00
|
'1'-'7'(31h, 37h): 23 (=17h)
'1'-'8'(31h, 38h): Off timer isn't set.

OFF_MIN: Turn off time (minute)
'0'-'0'(30h, 30h): 0
|
'3'-'B'(33h, 42h): 59 (=3Bh)
'3'-'C'(33h, 43h): Off timer isn’t set.

INPUT: Timer input
'0'-'0'(30h, 30h): RGB1(HDMI)
'0'-'1'(30h, 31h): RGB2(DVI-D)
'0'-'2'(30h, 32h): RGB3(D-SUB)
'0'-'3'(30h, 33h): RGB4(BNC)
'0'-'4'(30h, 34h): DVD/HD
'0'-'5'(30h, 35h): VIDEO
'0'-'6'(30h, 36h): VIDEO(S)
'0'-'7'(30h, 37h): It is operates by last memory input
'0'-'8'(30h, 38h): RGB5(CAT5)

WD: Week setting
bit 0: Monday
bit 1: Tuesday
bit 2: Wednesday
bit 3: Thursday
bit 4: Friday
bit 5: Saturday
bit 6: Sunday

EX.
'0'-'1'(30h, 31h): Monday
'0'-'4'(30h, 34h): Wednesday
'0'-'F'(30h, 46h): Monday, Tuesday, Wednesday and Thursday
'7'-'F'(37h, 46h): Monday to Sunday

FL: Option
bit 0: Everyday
bit 1: Every week
bit 2: Schedule Disable/Enable
* When bit0 and bit1 are '1', it behaves as Everyday.

EX.

FL setting	Schedule	Everyweek	Everyday	Schedule behavior
'0'-'0'(30h, 30h)				Schedule Disable
'0'-'1'(30h, 31h)			O	Schedule Disable
'0'-'2'(30h, 32h)		O		Schedule Disable
'0'-'3'(30h, 33h)		O	O	Schedule Disable
'0'-'4'(30h, 34h)	O			Once *Follow WD (Week setting)
'0'-'5'(30h, 35h)	O		O	Everyday
'0'-'6'(30h, 36h)	O	O		Everyweek *Follow WD (Week setting)
'0'-'7'(30h, 37h)	O	O	O	Everyday

ETX (03h): End of Message

Check code
BCC: Block Check Code
Refer to the section 4.5 “Check code” for a BCC calculation.

Delimiter
CR (0Dh): End of packet

11. Self diagnosis

11.1 Self-diagnosis status read

This command is used in order to read the Self-diagnosis status.

1) The controller requests the monitor to read Self-diagnosis status.

Header	Message	Check code	Delimiter
SOH-'0'-'A'-'0'-'A'-'0'-'4'	STX-'B'-'1'-ETX	BCC	CR

Header
SOH (01h): Start of Header
'0' (30h): Reserved
'A' (41h): Monitor ID
If the command should be sent to certain monitor only, the either of character ‘A’(41h) to ‘Z’(5Ah) which is corresponding to monitor ID from No1 to No.26 should be set to this portion.

'0' (30h): Message sender is the controller
'A' (41h): Message type is "Command"
'0'-'4'(30h, 34h): Message length.

Message
STX (02h): Start of Message
'B'-'1' (42h, 31h): Self-diagnosis command
ETX (03h): End of Message

Check code
BCC: Block Check Code
Refer to the section 4.5 “Check code” for a BCC calculation.

Delimiter
CR (0Dh): End of packet

2) The monitor replies a result of the self-diagnosis.

Header	Message	Check code	Delimiter
SOH-'0'-'0'-'A'-'B'-N-N	STX-'A'-'1'- ST(0)-ST(1) --------ST(n)-ETX	BCC	CR

Header
SOH (01h): Start Of Header
'0' (30h): Reserved
'0' (30h): Message receiver is the controller
'A' (41h): Monitor ID
This portion should depend on the monitor ID of Monitor.(’A’(41h)-‘Z’(5Ah)).

'B' (42h): Message type is "Command reply "
N-N: Message length.
Note.) The maximum data length that can be written to the monitor at a time is 32bytes.
Ex.) The byte data 20h is encoded as ASCII characters '2' and '0' (34h and 30h).

Message
STX (02h): Start of Message
'A'-'1' (41h, 31h): Application Test Report reply command
ST: Result of self-tests
00:Normal

70:Analog 3.3V abnormality
71:Analog 12V abnormality
72:Analog 5V abnormality
73:Audio amplifier +12V abnormality
78:Panel 12V abnormality
80:Cooling fan-1 abnormality
81:Cooling fan-2 abnormality

- The byte data 70 is encoded as ASCII characters '7' and '0' (37h and 30h).

ETX (03h): End of Message

Check code

BCC: Block Check Code
Refer to the section 4.5 “Check code” for a BCC calculation.

Delimiter

CR (0Dh): End of packet

12. Serial No. & Model Name Read

12.1 Serial No. Read

This command is used in order to read a serial No.

1) The controller requests the monitor to read a serial No.

Header	Message	Check code	Delimiter
SOH-'0'-'A'-'0'-'A'-'0'-'6'	STX-'C'-'2'-'1'-'6'-ETX	BCC	CR

Header
SOH (01h): Start Of Header
'0' (30h): Reserved
'A' (41h): Monit or ID
If the command should be sent to certain monitor only, the either of character 'A'(41h) to 'Z'(5Ah) which is corresponding to monitor ID from No1 to No.26 should be set to this portion.

'0' (30h): Message sender is the controller
'A' (41h): Message type is "Command"
'0'-'6'(30h, 36h): Message length.

Message
STX (02h): Start of Message
'C'-'2'-'1'-'6' (43h, 32h, 31h, 36h): Serial No. command
ETX (03h): End of Message

Check code
BCC: Block Check Code
Refer to the section 4.5 "Check code" for a BCC calculation.

Delimiter
CR (0Dh): End of packet

2) The monitor replies a data for confirmation.(If command is sent as "Broadcast" then no reply should be sent back.).

Header	Message	Check code	Delimiter
SOH-'0'-'0'-'A'-'B'-N-N	STX-'C'-'3'-'1'-'6'- Data(0)-Data(1)---Data(n)-ETX	BCC	CR

Header
SOH (01h): Start Of Header
'0' (30h): Reserved
'0' (30h): Message receiver is the controller
'A' (41h): Monitor ID
This portion should depend on the monitor ID of Monitor.('A'(41h)-'Z'(5Ah)).
'B' (42h): Message type is "Command reply "
N-N: Message length.
Note.) The maximum data length that can be written to the monitor at a time is 32bytes.
Ex.) The byte data 20h is encoded as ASCII characters '2' and '0' (32h and 30h).

Message
STX (02h): Start of Message
'C'-'3'-'1'-'6' (41h, 33h, 31h, 36h): Serial No. reply command
Data(0)-Data(1)----Data(n):Serial Number
- The data must be ASCII characters strings.

ETX (03h): End of Message

Check code
BCC: Block Check Code
Refer to the section 4.5 "Check code" for a BCC calculation.

Delimiter
CR (0Dh): End of packet

12.2 Model Name Read

This command is used in order to read the Model Name.

1) The controller requests the monitor to read Model Name.

Header	Message	Check code	Delimiter
SOH-'0'-'A'-'0'-'A'-'0'-'6'	STX-'C'-'2'-'1'-'7'-ETX	BCC	CR

Header
SOH (01h): Start Of Header
'0' (30h): Reserved
'A' (41h): Monitor ID
If the command should be sent to certain monitor only, the either of character 'A'(41h) to 'Z'(5Ah) which is corresponding to monitor ID from No1 to No.26 should be set to this portion.

'0' (30h): Message sender is the controller
'A' (41h): Message type is "Command"
'0'-'6'(30h, 36h): Message length.

Message
STX (02h): Start of Message
'C'-'2'-'1'-'7' (43h, 32h,31h,37h): Model Name command
ETX (03h): End of Message

Check code
BCC: Block Check Code
Refer to the section 4.5 "Check code" for a BCC calculation.

Delimiter
CR (0Dh): End of packet

2) The monitor replies a data for confirmation.(If command is sent as "Broadcast" then no reply should be sent back.)

Header	Message	Check code	Delimiter
SOH-'0'-'0'-'A'-'B'-N-N	STX-'C'-'3'-'1'-'7'-Data(0) -Data(1)—--- -Data(n)-ETX	BCC	CR

Header
SOH (01h): Start Of Header
'0' (30h): Reserved
'0' (30h): Message receiver is the controller
'A' (41h): Monitor ID
This portion should depend on the monitor ID of Monitor.('A'(41h)-'Z'(5Ah)).

'B' (42h): Message type is "Command reply "
N-N: Message length.
Note.) The maximum data length that can be written to the monitor at a time is 32bytes.
Ex.) The byte data 20h is encoded as ASCII characters '2' and '0' (32h and 30h).

Message
STX (02h): Start of Message
'C'-'3'-'1'-'7' (41h, 33h, 31h, 37h): Model Name reply Command
Data(0) -Data(1)----Data(n):Model name
- The data must be ASCII characters strings.

ETX (03h): End of Message

Check code
BCC: Block Check Code
Refer to the section 4.5 "Check code" for a BCC calculation.

Delimiter
CR (0Dh): End of packet

13. Control Commands for Auto Brightness function

MDT521S supports the Auto Brightness function via RS232c control in order to share a sensor detected result in a monitor with multiple monitors.

We have 2 modes of control.

Stand alone mode: A monitor can control the others as Master(Primary).

Remote control mode: All of monitors are controlled by Host PC as slave(Secondary).

13.1 Auto Brightness Parameter Read

Read parameters about AUTO BRIGHTNESS from A monitor to Host PC.

1) **Read Request from PC to Monitor.**

Header	Message	Check code	Delimiter
SOH-'0'-'A'-'0'-'A'-'0'-'6'	STX-'C'-'2'-'2'-'1'-ETX	BCC	CR

Header
SOH (01h): Start Of Header
'0' (30h): Reserved
'A' (41h): Monitor ID
If the command should be sent to certain monitor only, the either of character 'A'(41h) to 'Z'(5Ah) which is corresponding to monitor ID from No1 to No.26 should be set to this portion.
'0' (30h): Message sender is the controller
'A' (41h): Message type is "Command"
'0'-'6'(30h, 36h): Message length.

Message
STX (02h): Start of Message
'C' -'2' -'2' -'1' (43h,32h,32h,31h): Auto Brightness Parameter Read command
ETX (03h): End of Message

Check code
BCC: Block Check Code
Refer to the section 4.5 "Check code" for a BCC calculation.

Delimiter
CR (0Dh): End of packet

2) **Reply from Monitor to PC.**

The monitor replies the packet for confirmation as follows;

Header	Message	Check code	Delimiter
SOH-'0'-'0'-'A'-'B'-'0' -'A'	STX-'C'-'3'-'2'-'1'-[RES]-[RES]-[VAL_H] -[VAL_L]-ETX	BCC	CR

Header
SOH (01h): Start Of Header
'0' (30h): Reserved
'0' (30h): Message receiver is the controller
'A' (41h): Monitor ID
'B' (42h): Message type is "Command reply "
'0' -'A' (30h, 41h): Message length.
Message
STX (02h): Start of Message
'C'-'3'-'2' -'1' (41h, 33h, 32h,31h): Auto Brightness Parameter Read reply Command
RES: Result code('0'(30h)-'0'(30h):Normal, 、'0'(30h)-'1'(31h):Abnormal)
VAL: Auto Brightness setting parameter

bit0: LIGHT FROM BACK (1:Yes,0:No)

bit1: BACK WALL (1:Near,0:Far)

bit2: FRONT SENSOR (1:On,0:Off)

bit3: BACK SENSOR (1:On,0:Off)

bit4:Saturation(1:On,0:Off)

bit5:Video Detect(1:On,0:Off)

bit6-7:Not used

VAL_H: ASCII code of bit4-7of data

VAL_L: ASCII code of bit0-3 of data

Example) If Bit0 and 1 =1 and the other bits =0, (00000011)

VAL_H='0'(0x30) VAL_L='3'(0x33)

ETX (03h): End of Message

Check code

BCC: Block Check Code

Refer to the section 4.5 “Check code” for a BCC calculation.

Delimiter

CR (0Dh): End of packet

13.2 Auto Brightness Parameter Write

Send AutoBrightness Parameters from Host(PC or Primary Monitor) to Slave (Secondary) Monitors.

1) **Write Parameters from PC to Monitor.**

Header	Message	Check code	Delimiter
SOH-'0'-'*'-'0'-'A'-'0'-'8'	STX-'C'-'2'-'2'-'2'-[VAL_H]-[VAL_L]-ETX	BCC	CR

Header
SOH (01h): Start Of Header
'0' (30h): Reserved
'*' (2Ah): Monitor ID (Use '*' as "ALL" for Broadcasting of parameter)
'0' (30h): Message sender is the controller
'A' (41h): Message type is "Command"
'0'-'8'(30h, 38h): Message length.

Message
STX (02h): Start of Message
'C' -'2' -'2' -'2' (43h,32h,32h,32h): Auto Brightness Parameter Write command
VAL: AutoBrightness setting parameter
bit0: LIGHT FROM BACK (1:Yes,0:No)
bit1: BACK WALL (1:Near,0:Far)
bit2: FRONT SENSOR (1:On,0:Off)
bit3: BACK SENSOR (1:On,0:Off)
bit4:Saturation(1:On,0:Off)
bit5:Video Detect(1:On,0:Off)
bit6-7:Not used
VAL_H: ASCII code of bit4-7of data
VAL_L: ASCII code of bit0-3 of data
Example) If Bit0 and 1 =1 and the other bits =0, (00000011)
VAL_H='0'(0x30) VAL_L='3'(0x33)
ETX (03h): End of Message

Check code
BCC: Block Check Code
Refer to the section 4.5 "Check code" for a BCC calculation.

Delimiter
CR (0Dh): End of packet

2) **Reply from Monitor to PC.**

Basically, No need reply because it is broadcasting request.

[only for reference if the write command is done with certain destination ID]

Header	Message	Check code	Delimiter
SOH-'0'-'0'-'A'-'B'-'0' -'A'	STX-'C'-'3'-'2'-'2'-[RES]-[RES]-[VAL_H]-[VAL_L]-ETX	BCC	CR

Header
SOH (01h): Start Of Header
'0' (30h): Reserved
'0' (30h): Message receiver is the controller
'A' (41h): Monitor ID
'B' (42h): Message type is "Command reply "
'0' -'A' (30h, 41h): Message length.

Message
STX (02h): Start of Message
'C'-'3'-'2' -'2' (41h, 33h, 32h,32h): Auto Brightness Parameter Write reply Command
RES: Result code('0'(30h)-'0'(30h):Normal, 、'0'(30h)-'1'(31h):Abnormal)
VAL_H-VAL_L: AutoBrightness setting parameter
ETX (03h): End of Message

Check code
BCC: Block Check Code
Refer to the section 4.5 "Check code" for a BCC calculation.

Delimiter
  CR (0Dh): End of packet

13.3 Auto Brightness Sensor Read

Read light sensor detected data from Monitor to Host PC.

1) **Read Request from PC to Monitor.**

Header	Message	Check code	Delimiter
SOH-'0'-'A'-'0'-'A'-'0'-'6'	STX-'C'-'2'-'2'-'3'–ETX	BCC	CR

Header
SOH (01h): Start Of Header
'0' (30h): Reserved
'A' (41h): Monitor ID
If the command should be sent to certain monitor only, the either of character 'A'(41h) to 'Z'(5Ah) which is corresponding to monitor ID from No1 to No.26 should be set to this portion.
'0' (30h): Message sender is the controller
'A' (41h): Message type is "Command"
'0'-'6'(30h, 36h): Message length.

Message
STX (02h): Start of Message
'C' -'2' -'2' -'3' (43h,32h,32h,33h): Auto Brightness Sensor Read command
ETX (03h): End of Message

Check code
BCC: Block Check Code
Refer to the section 4.5 "Check code" for a BCC calculation.

Delimiter
CR (0Dh): End of packet

2) Reply from Monitor to PC.

The monitor replies sensed data of light sensor as follows;

Note: If AutoBrightness=Off then retun Null Message.

Header	Message	Check code	Delimiter
SOH-'0'-'0'-'A'-'B'-'1' -'4'	STX-'C' -'3' -'2' -'3' -[RES] -[RES] -[FVAL_HH] -[FVAL_HL] -[FVAL_LH] -[FVAL_LL] -[BVAL_HH] -[BVAL_HL] -[BVAL_LH] -[BVAL_LL] -[APL_HH] -[APL_HL] -[APL_LH] -[APL_LL] –ETX	BCC	CR

Header
SOH (01h): Start Of Header
'0' (30h): Reserved
'0' (30h): Message receiver is the controller
'A' (41h): Monitor ID
'B' (42h): Message type is "Command reply "
'1' -'4' (31h, 34h): Message length.

Message
STX (02h): Start of Message
'C'-'3'-'2' -'3' (41h, 33h, 32h,33h): Auto Brightness Sensor Read Reply Command
RES: Result code('0'(30h)-'0'(30h):Normal, 、'0'(30h)-'1'(31h):Abnormal)
FVAL_HH:Front Sensor Detected Data(High High byte)(Maximum='F'(0x46))
FVAL_HL:Front Sensor Detected Data(High Low byte) (Maximum='F'(0x46))
FVAL_LH:Front Sensor Detected Data(Low High byte) (Maximum='F'(0x46))
FVAL_LL:Front Sensor Detected Data(Low Low byte) (Maximum='F'(0x46))
BVAL_HH:Back Sensor Detected Data(High High byte) (Maximum='F'(0x46))
BVAL_HL:Back Sensor Detected Data(High Low byte) (Maximum='F'(0x46))
BVAL_LH:Back Sensor Detected Data(Low High byte) (Maximum='F'(0x46))
BVAL_LL:Back Sensor Detected Data(Low Low byte) (Maximum='F'(0x46))
APL_HH:APL data(High High byte) (Maximum='F'(0x46))
APL_HL:APL data(High Low byte) (Maximum='F'(0x46))
APL_LH:APL data(LowHigh byte) (Maximum='F'(0x46))
APL_LL:APL data(Low Low byte) (Maximum='F'(0x46))
ETX (03h): End of Message

Check code

BCC: Block Check Code
Refer to the section 4.5 “Check code” for a BCC calculation.

13.4 Auto Brightness Sensor Write

Broadcast light sensor data from Host(PC or Primary Monitor) to Secondary Monitors.

1) **Write Parameters from PC to Monitors.**

Header	Message	Check code	Delimiter
SOH-'0'-'*'-'0'-'A'-'1'-'2'	STX-'C'-'2'-'2'-'4'–[FVAL_HH] -[FVAL_HL]- [FVAL_LH] -[FVAL_LL] - [BVAL_HH] -[BVAL_HL] -[BVAL_LH] -[BVAL_LL] -[APL_HH] -[APL_HL] -[APL_LH] -[APL_LL] –ETX	BCC	CR

Header
SOH (01h): Start Of Header
'0' (30h): Reserved
'*' (2Ah): Monitor ID (Use '*' as "ALL" for Broadcasting of parameter)
'0' (30h): Message sender is the controller
'A' (41h): Message type is "Command"
'1'-'2'(31h, 32h): Message length.

Message
STX (02h): Start of Message
'C' -'2' -'2' -'4' (43h,32h,32h,34h): Auto Brightness Sensor Write command
FVAL_HH:Front Sensor Detected Data(High High byte)
FVAL_HL:Front Sensor Detected Data(High Low byte)
FVAL_LH:Front Sensor Detected Data(Low High byte)
FVAL_LL:Front Sensor Detected Data(Low Low byte)
BVAL_HH:Back Sensor Detected Data(High High byte)
BVAL_HL:Back Sensor Detected Data(High Low byte)
BVAL_LH:Back Sensor Detected Data(Low High byte)
BVAL_LL:Back Sensor Detected Data(Low Low byte)
APL_HH:APL data(High High byte)
APL_HL:APL data(High Low byte)
APL_LH:APL data(LowHigh byte)
APL_LL:APL data(Low Low byte)
ETX (03h): End of Message

Check code
BCC: Block Check Code
Refer to the section 4.5 "Check code" for a BCC calculation.

Delimiter
CR (0Dh): End of packet

2) **Reply from Monitor to Host.**

Basically, No need reply because it is broadcasting request.

[only for reference if the write command is done with certain destination ID]

Note: If AutoBrightness is not "Remote" then return Null Message.

Header	Message	Check code	Delimiter
SOH-'0'-'0'-'A'-'B'-'1' -'4'	STX-'C'-'3'-'2'-'4'-[RES]-[RES]-[FVAL_HH]-[FVAL_HL]- [FVAL_LH]-[FVAL_LL]-[BVAL_HH]-[BVAL_HL]-[BVAL_LH]-[BVAL_LL]-[APL_HH]-[APL_HL]-[APL_LH]-[APL_LL]-ETX	BCC	CR

Header
SOH (01h): Start Of Header
'0' (30h): Reserved
'0' (30h): Message receiver is the controller
'A' (41h): Monitor ID
'B' (42h): Message type is "Command reply "
'1' -'4' (31h, 34h): Message length.

Message
STX (02h): Start of Message
'C'-'3'-'2' -'4' (41h, 33h, 32h,34h): Auto Brightness Sensor Write reply Command
RES: Result code('0'(30h)-'0'(30h):Normal, 、'0'(30h)-'1'(31h):Abnormal)

FVAL_HH:Front Sensor Detected Data(High High byte)
FVAL_HL:Front Sensor Detected Data(High Low byte)
FVAL_LH:Front Sensor Detected Data(Low High byte)
FVAL_LL:Front Sensor Detected Data(Low Low byte)
BVAL_HH:Back Sensor Detected Data(High High byte)
BVAL_HL:Back Sensor Detected Data(High Low byte)
BVAL_LH:Back Sensor Detected Data(Low High byte)
BVAL_LL:Back Sensor Detected Data(Low Low byte)
APL_HH:APL data(High High byte)
APL_HL:APL data(High Low byte)
APL_LH:APL data(LowHigh byte)
APL_LL:APL data(Low Low byte)
ETX (03h): End of Message

Check code
BCC: Block Check Code
Refer to the section 4.5 “Check code” for a BCC calculation.

Delimiter
CR (0Dh): End of packet

14. Control Commands for Automatic ID Assignment function

You can set sequential Monitor ID automatically for daisy chained monitors.
This function is executed by following 2 steps.

NOTE: This function is only applicable for RS232C based daisy chained connection, but not applicable CAT5(RS485) based daisy chained connection.

Step1: Change the communication mode to “ID assignment mode” by Mode change command.
Step2: Apply Monitor ID by Automatic ID assignment Command.

14.1 Mode Change Command

Change the RS232C communication mode to “ID assignment Mode”.
NOTE: This command is only applicable for RS232C based daisy chained connection, but not applicable CAT5(RS485) based daisy chained connection. If you send this command to Monitor with RS485 connection, communication control problem will be occurred.

1) **Write Parameters from PC to Monitors.**

Header	Message	Check code	Delimiter
SOH-'0'-'*'-'0'-'A'-'0'-'4'	STX-'0'-'E'–ETX	BCC	CR

Header
SOH (01h): Start Of Header
'0' (30h): Reserved
'*' (2Ah): Monitor ID (Use ‘*’ as “ALL” for Broadcasting of parameter)
'0' (30h): Message sender is the controller
'A' (41h): Message type is "Command"
'0'-'4'(30h, 34h): Message length is 4 bytes.

Message
STX (02h): Start of Message
'0' -'E' (30h,45h): Command code is 0Eh as "Force Mode Change"
ETX (03h): End of Message

Check code
BCC: Block Check Code
Refer to the section 4.5 “Check code” for a BCC calculation.

Delimiter
CR (0Dh): End of packet

2) **Reply from Monitor to Host.**

Basically, No need reply because it is broadcasting request.

[only for reference if the write command is done with certain destination ID]

Header	Message	Check code	Delimiter
SOH-'0'-'0'-SRC-'B'-'0' -'6'	STX- [RES]-[RES]- '0'-'E'-ETX	BCC	CR

Header
SOH (01h): Start Of Header
'0' (30h): Reserved
'0' (30h): Message receiver is the controller
SRC: Monitor ID
This portion should depend on the monitor ID of Monitor.(’A’(41h)-‘Z’(5Ah))
'B' (42h): Message type is "Command reply "
'0' -'6' (30h, 36h): Message length is 6 bytes.

Message
STX (02h): Start of Message
RES: Result code('0'(30h)-'0'(30h):Normal, 、'0'(30h)-'1'(31h):Abnormal)
'0'-'E' (30h, 45h): Force Change Mode reply command
ETX (03h): End of Message

Check code
BCC: Block Check Code
Refer to the section 4.5 “Check code” for a BCC calculation.

Delimiter
CR (0Dh): End of packet

14.2 Automatic ID Assignment

This command executes the Automatic ID assignment operation by Monitor itself. Only start ID should be suggested by Host to 1st connected Monitor and daisy chained monitor can assign own Monitor ID one by one sequentially.

NOTE: This function is only applicable for RS232C based daisy chained connection, but not applicable CAT5(RS485) based daisy chained connection. If you send this command to Monitor with RS485 connection, communication control problem will be occurred.

1) Write Parameters from PC to Monitors.

Header	Message	Check code	Delimiter
SOH-'0'-'*'-'0'-'A'-'0'-'8'	STX-'C'-'2'-'2'-'0'-[VAL]-[VAL] –ETX	BCC	CR

Header
- SOH (01h): Start Of Header
- '0' (30h): Reserved
- '*' (2Ah): Monitor ID (Use '*' as "ALL" for Broadcasting of parameter)
- '0' (30h): Message sender is the controller
- 'A' (41h): Message type is "Command"
- '0'-'8'(30h, 38h): Message length is 8 bytes.

Message
- STX (02h): Start of Message
- 'C'-'2'-'2'-'0' (41h, 32h, 32h,30h):"Exec ID Assignment"
- VAL:Value(Start Monitor ID No. (1-26))
  (Ex.)
  1 --- '0'(30h),'1'(31h)
  26 --- '1'(31h),'A'(41h)
- ETX (03h): End of Message

Check code
- BCC: Block Check Code
  Refer to the section 4.5 "Check code" for a BCC calculation.

Delimiter
- CR (0Dh): End of packet

2) **Reply from Monitor to PC.**

Basically, No need reply because it is broadcasting request.

[This is only for reference if the write command is done with certain destination ID]

Header	Message	Check code	Delimiter
SOH-'0'-'0'-SRC-'B'-'0' -'A'	STX-[RES]-[RES] -'C'-'2'-'2'-'0'-[VAL] -[VAL]–ETX	BCC	CR

Header
- SOH (01h): Start Of Header
- '0' (30h): Reserved
- '0' (30h): Message receiver is the controller
- SRC: Monitor ID
  This portion depends on the monitor ID of Monitor.('A'(41h)-'Z'(5Ah))
- 'B' (42h): Message type is "Command reply "
- '0' -'A' (30h, 41h): Message length.

Message
- STX (02h): Start of Message
- RES: Result code('0'(30h)-'0'(30h):Normal, 、'0'(30h)-'1'(31h):Abnormal)
- 'C'-'2'-'2' -'0' (41h, 32h, 32h,30h): Exec ID Assignment reply command
- VAL: ID No. suggested from Host
- ETX (03h): End of Message

Check code
- BCC: Block Check Code
  Refer to the section 4.5 "Check code" for a BCC calculation.

Delimiter
- CR (0Dh): End of packet

Appendix

A. Operation Code (OP code) Table

	Item	OP code page	OP code	Parameter	Remarks
PICTURE	Brightness	00h	10h	0: dark | MAX.: bright	
	Contrast	00h	12h	0: low | MAX.: high	
	Sharpness	00h	8Ch	0: dull | MAX.:sharp	
	Tint	00h	90h	0: | MAX.:	
	Color	02h	1Fh	0: pale | MAX.: deep	
	Black Level	00h	92h	0: dark | MAX.: bright	
	Noise Reduction	02h	20h	0: Off | MAX.	
	Color control	00h	Red: 16h Green: 18h Blue: 1Ah	0: | MAX.:	
	Reserved	00h	14h		
	Color Temperature(2)	00h	0ch	0:2600K | 74:10000K	100K/step
	Picture reset	00h	08h	1: Reset	Momentary
SCREEN	H Position	00h	20h	0: Left side | Max.: Right side	Depends on a display timing
	V Position	00h	30h	0: Down side | Max.: Up side	Depends on a display timing
	Clock	00h	0Eh	0: | Max.	
	Clock phase	00h	3Eh	0: | Max.	
	H Resolution	02h	50h	0: | Max.	
	V Resolution	02h	51h	0: | Max.:	
	Zoom Mode	02h	CEh	1:REAL 2:custom 5:Dynamic 6:Normal 7:FULL	
	Zoom H-Expansion	02h	6Ch	0:100% | 100:300%	
	Zoom V- Expansion	02h	6Dh	0:100% | 100:300%	

	Item		OP code page	OP code	Parameter	Remarks
	Zoom H-Position		02h	CCh	0: Left side | Max.: Right side	
	Zoom V-Position		02h	CDh	0: Down side | Max.: Up side	
	Screen reset		00h	06h	1: Reset	Momentary
AUDIO	Balance		00h	93h	O: Left | 50:(Center) | 100: Right	
	Treble		00h	8Fh	O: Min. | 50:(Center) | 100: Max.	
	Bass		00h	91h	0: Min. | 50:(Center) | 100: Max.	
	Audio reset		02h	31h	1: Reset	Momentary
PIP	PIP Size		02h	71h	1: Small 2: Middle 3: Large	
	PIP Audio				N/A	
	PIP Reset				N/A	Momentary
Configuration 1	Auto Setup		00h	1Eh	1: Execute	Momentary
	Auto Adjust				N/A	
	Power Save		00h	E1h	0: OFF 1: ON	
	Language		00h	68h	1:English 2:German 3:French 4:Spanish 5:Japanese 6:Italian 7:Swedish 8:Chinese	OSD Language
	Screen Saver	Gamma	02h	DBh	1:normal 2:screen saving gamma	
		Brightness	02h	DCh	1:normal 2:decrease brightness	
		Cooling Fan	02h	7Dh	1:Auto 2:Forced ON	
		Motion	02h	DDh	0: 0s(Off) | 90: 900s	10s/step
	Color System		02h	21h	1: NTSC 2: PAL 3: SECAM 4: Auto 5: 4.43NTSC 6: PAL-60	
	Side Border Color		02h	DFh	0:Black 1: Middle 2: White	
	Factory Reset		00h	04h	1: Reset	Momentary
	Configuration Reset				N/A	

	Item		OP code page	OP code	Parameter	Remarks
Configuration 2	OSD Turn Off		00h	FCh	0-4:Do not set. 5:5sec | 120:120sec	
	Information OSD		02h	3Dh	0:disable information OSD 3-10: OSD timer [seconds]	
	Off Timer		02h	2Bh	0: OFF 1: 1 hour | 24: 24 hours	1 hour/step
	OSD Position	H Position	02h	38h	0: | MAX.:	
		V Position	02h	39h	0: | MAX.:	
Advanced Option						
	Input Resolution		02h	DAh	1: Auto 2: 1024x768 3: 1280x768 4: 1360x768	
	Black Level Expansion		02h	22h	1: OFF 2: MIDDLE 3: HIGHT	
	Gamma Selection		02h	68h	Gamma Table Selection 1: Native Gamma 4: Gamma=2.2 8: Gamma=2.4 7: S Gamma 5: **Option(Dicom simulate)**	
	Scan Mode		02h	E3h	1: OVER SCAN 2: UNDERSCAN	
	Scan Conversion		02h	25h	1: OFF(INTERLACE) 2: Enable (IP ON/PROGRESSIVE)	
	Film Mode		02h	23h	1: OFF 2: AUTO	
	Monitor ID		02h	3Eh	1-26:ID	
	IR Control		02h	3Fh	1: Lock (Off) 3:Primary 2: Normal 4:Secondary	
	Tiling	H monitor	02h	D0h	1 | 5	Number of H-division
		V monitor	02h	D1h	1 | 5	Number of V-division
		Position	02h	D2h	1: Upper left | MAX.: Lower right	
		Mode	02h	D3h	1: Disable (OFF) 2: Enable (ON)	
		Frame comp.	02h	D5h	1: Disable (OFF) 2: Enable (ON)	
	Power On Delay		02h	D8h	0: OFF (0sec) 2,4,6,8,10,20,30,40, 50:50sec	
	Advanced Option Reset		02h	E4h	1:RESET	Momentary

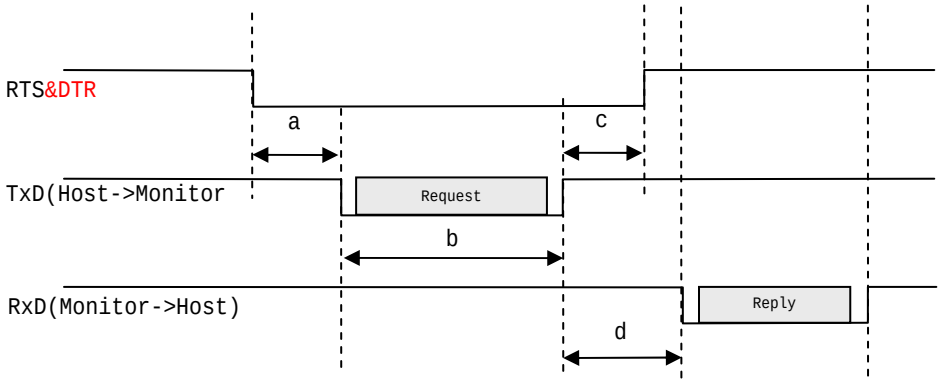
	Item	OP code page	OP code	Parameter	Remarks
	Input	00h	60h	1: RGB3 (D-SUB) 2: RGB4 (BNC) 3: RGB1 (HDMI) 4: RGB2 (DVI-D) 12: DVD/HD 5: VIDEO (Composite) 7: S-VIDEO 8: CAT5 9 Reserved	
	Picture Mode	02h	1Ah	1: sRGB 3: Hi-Bright 4: Standard 5: Cinema	SRGB: PC mode only Cinema: A/V mode only
	PIP ON/OFF Still ON/OFF	02h	72h	1: OFF 2: PIP 4: Still	
	PIP Input	02h	73h	0: No mean 1: RGB-3(D-SUB) 2: RGB-4(BNC) 3: RGB-1(HDMI) 4: RGB-2 (DVI-D) 12:DVD/HD 5: VIDEO (Composite) 7: S-VIDEO 8: CAT5 9 Reserved	This operation has limitation of selection. Please refer to the monitor instruction manual.
	Still Capture	02h	76h	0: Off 1: Capture	Momentary
	Audio Input	02h	2Eh	1: Audio 1(PC) 4:HDMI 2: Audio 2 3: Audio 3	
	Mute	00h	8Dh	0,2: UNMUTE 1: MUTE	
	Volume UP/Down	00h	62h	0: whisper | 100: loud	
	PIP H Position	02h	74h	0: left side | MAX.: right side	
	PIP V Position	02h	75h	0: UP side | Max.: Down side	
Temperature sensor	Select Temperature sensor	02h	78h	1: Sensor #1 2: Sensor #2	
	Readout a temperature	02h	79h	Returned value is 2's complement. Refer to section 6.2	Read only
Auto Brightness	AutoBrightness On/Off	02h	2dh	0:Off 1:Local 2:Remote	
	AutoBrightness Control	02h	E7h	0:Secondary 1:Primary	

B. Application Note for RS485 based communication using CAT5 Tx BOX.

1) RS-485 is half-duplex communication. So data flow control in HOST side is required.
2) Data flow control is done by following procedure.

HOST send data to Monitor while both of RTS and DTR signal is “LOW” (Clear) status.
HOST receive data from Monitor while RTS signal is “HIGH”(Set) status.

3) Following chart shows more detailed timing of data flow control by RTS.



a: setup time of TxD by HOST: up to programming
b: Data transmission time of TxD by HOST: up to data length
c: Margin time of TxD period by HOST: up to programming
d: Reply preparation time by Monitor =approx.140msec(min)

HOST PC should keep RTS signal “LOW” while above (b) period at least. (a) and (c) is required in order to make reliable communication between HOST and Monitor.

4) Example of programming.

System:

Case1:OS:Windows XP Professional SP2, CPU:Centrino Duo 1.66GHz

Case2:OS:Windows XP Home SP1, CPU: Pentium4 2.8GHz

Case3:OS:Windows XP Professional SP2, CPU:Pentium3 933MHz

Procedure:

```
///
/// Send Data ///
....
EscapeCommFunction(hFile,CLRRTS)    ; CLEAR RTS & DTR
SLEEP(20)                           ; put 20msec delay for above “a: setup time of TxD by HOST”.
WriteFile()                         ; Data transmission of TxD
SLEEP(70)                           ; put 70msec delay for above “c: Margin time of TxD period by HOST”.
EscapeCommFunction(hFile,SETRTS)    ; SET RTS& DTR
....
/// Receive Data (Ex. by Polling timer at 100msec interval)///
....
ReadFile()                          ; Data Receive of RxD
....
///
```

---------- end of document----------

All data are subject to change without notice.