

LCD Monitor

Interface Manual for Programmers

LMD-1750W
LMD-2050W
LMD-2450W

Table of Contents

RS-232C

Communication Format	3
Command Block Format	4
Communication Protocol	4
Connections	5
Features of the Command Protocol	5
Command Table	6
Command Description	7
Input Config (21H)	7
Input Select (22H)	7
Control Data (23H)	7
Display Data (24H)	8
Picture Delay Min (27H)	9
Selected Offset (28H)	9
On Switch Function (29H)	9
Off Switch Function (2AH)	9
Select Display (2BH)	9
Select Menu (2CH)	10
Scan Aspect (2DH)	10
Select Config Data (2FH)	10
Multi Display (31H)	10
Marker (32H)	11
Closed Caption (33H)	11
Audio Select (34H)	12
White Balance Data (40H)	12
White Balance Data Copy (42H)	13
Status Sense (60H)	13
White Balance Sense (61H)	13
Status Remote (6EH)	13
Status Reply (70H)	13
White Balance Reply (71H)	14
Status Remote Reply (7EH)	14
ACK Reply (04H)	14
NAK Reply (05H)	14

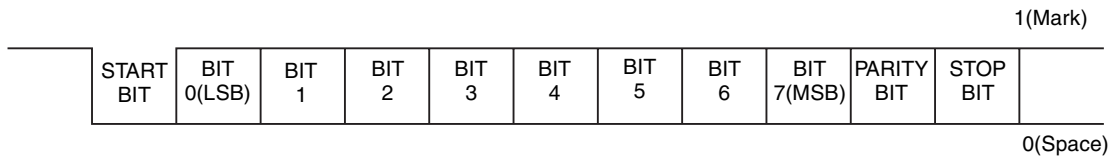
Ethernet

Overview	15
Connections	15
Communication Protocol	16
SDAP	16
SDCP	16
Command Block Format	17
SDAP Packets	17
SDCP Packets	18
VMC Command Description	20
Format of VMC Packets	20
Details of VMC Commands	21

Communication Format

Asynchronous, bit serial signal

- Based on RS-232C
- Data signaling rate: 38400 bit/sec
- Start bit: 1 bit
- Data bit: 8 bits
- Parity: Even
- Stop bit: 1 bit



Command Block Format

Data communication between the remote controller and the monitor is performed in accordance with the following format.

STX	Byte Count	Destination Address	Source Address	Command Block	Checksum
1 byte	1 byte	1 byte	1 byte	n bytes	1 byte

- **STX:** start of text code value equals 02H.
- **Byte Count**
This indicates the number of data bytes (maximum 255 bytes) which have been inserted between this byte and the Checksum byte. Values 00H, 01H, 02H are illegal values.
- **Destination address:**
One byte address value which defines who receives the message. The value 01H should be specified.
- **Source address:**
One byte address value which defines who transmits the message. The destination to which the reply should be sent is shown with this value. A value from 41H to 7FH should be specified.
- **Command Block**
This designates a particular command. Refer to “Command Description” (on page 7) for the details.
- **Checksum**
This value is set so that the bottom eight bits of the sum of all bytes from the byte count to the checksum inclusive are zero.

Communication Protocol

The remote controller should take the initiative in communication between the remote controller and the monitors.

The monitor will carry out one of the following actions when receiving the message.

- When the received message is an undefined message, a communication error occurs or the automatic adjustment of APA or AUTO CHROMA/PHASE is working, a NAK (05H) is issued.
- When the received command is a question, the specific replay and data are issued.
- When the received command is anything else, an ACK is issued.

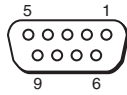
The next message can be received as soon as a NAK is issued from the monitor to the remote controller.

Notes

- If there are not enough or too many data bytes of data values then a NAK is issued and no values are specified.
- Bits which are not specified here are undefined bits and their values are always ignored.

Connections

Pin assignment for the RS-232C connector is as follows.



Pin number	Signal
1	NC
2	RX
3	TX
4	NC
5	GND
6	NC
7	RTS
8	CTS
9	NC

Features of the Command Protocol

This protocol provides the following features when individual monitors are controlled.

- Switch functions can be changed.
- The ability to remotely make settings and adjustments normally made with the monitor's menu.

Command Table

Using this protocol, the following commands can be executed by the monitors.

All values in the following table are hexadecimal.

Command from Remote Controller			Return from Monitor		
Specific Command	Name	Data Bytes	Specific Command	Name	Data Bytes
21	Input Config	2	04	ACK	0
22	Input Select	1	04	ACK	0
23	Control Data	×	04	ACK	0
24	Display Data	×	04	ACK	0
27	Picture Delay Min	1	04	ACK	0
28	Selected Offset	1	04	ACK	0
29	On Switch Function	1	04	ACK	0
2A	Off Switch Function	1	04	ACK	0
2B	Select Display	1	04	ACK	0
2C	Select Menu	1	04	ACK	0
2D	Scan Aspect	1	04	ACK	0
2F	Select Config Data	2	04	ACK	0
31	Multi Display	3	04	ACK	0
32	Marker	2	04	ACK	0
33	Closed Caption	1	04	ACK	0
34	Audio Select	2	04	ACK	0
40	White Balance Data	×	04	ACK	0
42	White Balance Data Copy	1	04	ACK	0
60	Status Sense	1	70	Status Reply	×
61	White Balance Sense	1	71	White Balance Reply	7
6E	Status Remote	0	7E	Status Remote Reply	1

× : varies depending on the number of data items.

Command Description

Input Config (21H)

Used to control the current video signal being displayed on the monitor.

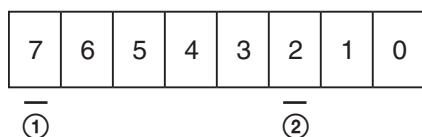
The switches effectively being controlled are Input Connector and Preset White Balance.

The command has two sections.

1. Information being changed
2. Values to be applied

1. Information being changed

The values are specified as follows:



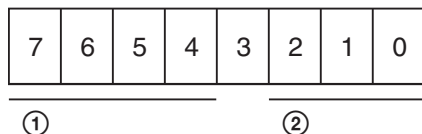
① Input connector information

② Preset white balance information

When 1 is set in the bit position, information for the bit is applied. When 0 is set, information for the bit is ignored. When 1 is set in the ① and ② bit positions, information on both items is applied.

2. Values to be applied

The values are specified as follows:



① Input connector

- COMPOSITE = 0000
- Y/C = 0010
- RGB = 0100
- COMPONENT = 0101
- DVI = 1000
- HD15 = 1001
- OPTION A-1 = 0110
- OPTION A-2 = 0111
- OPTION B-1 = 1010
- OPTION B-2 = 1011

The values which are specified here are applied to the current monitor state if the input setting is set to ON. If the input setting is set to OFF, the values are ignored.

② Preset white balance information

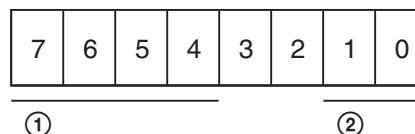
- D93 = 000
- D65 = 011
- USER = 010

The values specified here are applied to the current monitor state.

Input Select (22H)

Used to control ON/OFF of each input connector.

The values are specified as follows:



① Input connector

- COMPOSITE = 0000
- Y/C = 0010
- RGB = 0100
- COMPONENT = 0101
- DVI = 1000
- HD15 = 1001
- OPTION A-1 = 0110
- OPTION A-2 = 0111
- OPTION B-1 = 1010
- OPTION B-2 = 1011

② Input connector offset

- OFF = 01
- ON = 10
- ALL RESET = 11

The values are applied to the current monitor state.

If the input setting is set to OFF, the values are advanced.

If only one input setting is set to ON, the value is ignored and an ACK is issued.

Control Data (23H)

Defines the keys on the front panel and data in the USER CONTROL menu.

The command has two sections.

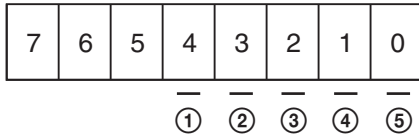
1. The element of CONTROL data being sent
2. CONTROL data value

1. The element of CONTROL data being sent

The element of CONTROL data being sent is the first byte of data contained within the command block of the message.

Several items of CONTROL data can be specified in one message stream. When the bit of an item is set to 1, the data value is changed, and it is set to 0, the data value is not changed. When the byte value is 0, no data are changed and a NAK is issued.

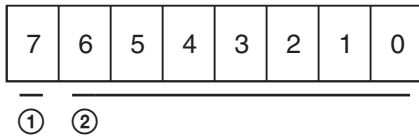
The values are specified as follows:



- ① CONTRAST
- ② APERTURE
- ③ BRIGHTNESS
- ④ PHASE
- ⑤ CHROMA

2. CONTROL data value

Each value is one byte of data. PHASE is specified as -50 to +50 and others are 0 to 100 (8 bit data, MSB is a mark data. If the value is a negative number, it is represented as a complement of 2). The data is defined from the lower bit item to the higher one. For example, if the PHASE and CONTRAST data are defined, the PHASE data is specified in the first byte and the CONTRAST data is specified in the next byte. The values are specified as follows:



- ① Mark data
 - + = 0
 - = 1

② Numerical value data

The values of the CONTROL data which is defined by this command are applied to the current monitor state.

Display Data (24H)

Defines PITCH, DOT PHASE, SIZE H, SIZE V, SHIFT H and SHIFT V data in the USER CONFIG menu. The command has two sections.

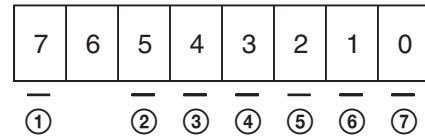
1. The element of USER CONFIG data being sent
2. USER CONFIG data value

1. The element of USER CONFIG data being sent

The element of USER CONFIG data being sent is the first byte of the command block of the message. Several items of USER CONFIG data can be specified in one message stream. If 1 is indicated in the bit position, the data is changed and 0 is indicated, no data is changed.

If the byte value is 0, no data are changed and a NAK is issued. If the RESET value is set to 1, all items are specified to the default setting.

The values are specified as follows:



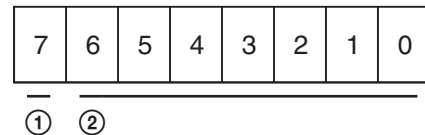
- ① RESET
- ② PITCH
- ③ DOT PHASE
- ④ SIZE H
- ⑤ SIZE V
- ⑥ SHIFT H
- ⑦ SHIFT V

2. USER CONFIG data value

Each adjustment value is one byte of data (8 bit data, MSB is a mark data. If the value is a negative number, it is represented as a complement of 2). The data are defined from the subordinate bit element to the superordinate bit element in the data bytes. For example, if the data to be adjusted are SIZE H and SHIFT H, then the first byte of data bytes is for SHIFT H and the next byte is for SIZE H.

Adjustment Item	Max.	Min.
PITCH	-100	+100
DOT PHASE	0	+31
SIZE H	-100	+100
SIZE V	-100	+100
SHIFT H	-30	+30
SHIFT V	-30	+30

The values are specified as follows:



- ① Mark data
 - + = 0
 - = 1

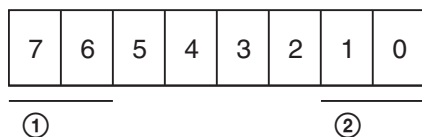
② Numerical value data

This is not the data to increase or decrease the setting. Enter the adjustment value.

The standard value (center value) of the PITCH data is not always 0 (zero). It differs depending on the input signals. The maximum and minimum values mentioned above are variable values to each standard value.

Picture Delay Min (27H)

Controls the MODE select of Pic Delay Min.
The values are specified as follows:



① ② Mode select

01 00 Mode 0

01 01 Mode 1

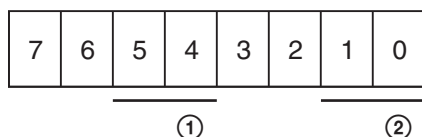
01 10 Mode 2

The values are applied to the current monitor state.

Selected Offset (28H)

Defines the offset to be applied to COMPONENT or NTSC signal which is selected to be displayed on the monitor.

The values are specified as follows:



① COMPONENT signal offset

SMPTE = 01

BETA 0 = 10

BETA 7.5 = 11

② NTSC signal offset

NTSC 0 = 01

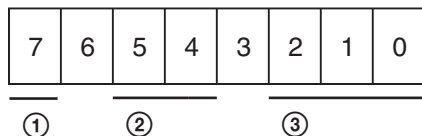
NTSC 7.5 = 10

The values are applied to the current monitor state.

On Switch Function (29H)

This command is used to set the offset value of the REMOTE setting, ETHERNET, APA, POWER SAVING, KEY INHIBIT, Tally Lamp (green), TALLY Lamp (red), H/V DELAY, BLUE ONLY and MONO to ON.

The values are specified as follows:



① ② ③ Action taken

11 000 REMOTE applied

11 011 ETHERNET applied

11 001 APA applied

11 010 POWER SAVING applied

11 100 KEY INHIBIT applied

11 101 Tally Lamp (green) applied

1 11 001 Tally Lamp (red) applied

1 11 010 H/V DELAY applied

1 11 011 BLUE ONLY applied

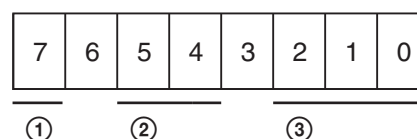
1 11 100 MONO applied

For “11000” definition, this command is accepted whenever the RMT (remote) is set to ON and OFF.

Off Switch Function (2AH)

This command is used to set the offset value of the REMOTE setting, ETHERNET, APA, POWER SAVING, KEY INHIBIT, Tally Lamp (green), Tally Lamp (red), H/V DELAY, BLUE ONLY and MONO to OFF.

The values are specified as follows:



① ② ③ Action taken

11 000 REMOTE removed

11 011 ETHERNET removed

11 001 APA removed

11 010 POWER SAVING removed

11 100 KEY INHIBIT removed

11 101 Tally Lamp (green) removed

1 11 001 Tally Lamp (red) removed

1 11 010 H/V DELAY removed

1 11 011 BLUE ONLY removed

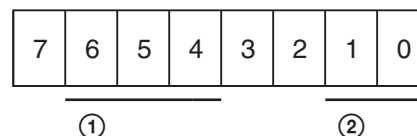
1 11 100 MONO removed

For “11000” definition, this command is accepted whenever the RMT (remote) is set to ON and OFF.

Select Display (2BH)

Defines the offset values of LANGUAGE and FORMAT DISP in the menu.

The values are specified as follows:



① LANGUAGE

ENGLISH = 001

GERMAN = 010

FRENCH = 011

ITALIAN = 100

SPANISH = 101
 JAPANESE = 110
 CHINESE = 111

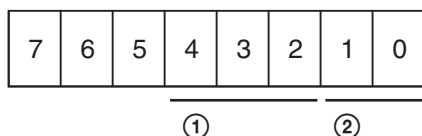
② FORMAT DISP

AUTO = 01
 ON = 10
 OFF = 11

Select Menu (2CH)

Defines the offset value of COLOR SPACE and CHROMA in the menu.

The values are specified as follows:



① COLOR SPACE offset

OFF = 001
 EBU = 011
 SMPTE-C = 101
 ITU-709 = 111

② CHROMA offset

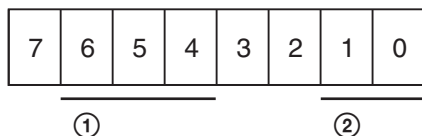
OFF = 01
 ON = 10
 AUTO ADJUST= 11

The values are applied to the current monitor state.
 If a correct signal is not input or the adjustment is in failure, an error message is issued for AUTO ADJUST definition.

Scan Aspect (2DH)

Defines SCAN and ASPECT in the menu.

The values are specified as follows:



① SCAN

NORMAL = 000
 OVER = 001
 FULL = 011
 NATIVE = 101

② ASPECT

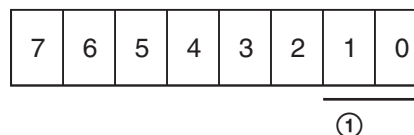
4:3 = 00
 16:9 = 01

The values are applied to the current monitor state.

Select Config Data (2FH)

Defines SYNC in the menu.

The values are specified as follows:



① SYNC

The sync signal is the internal one = 01

The sync signal is the external one = 10

The values are applied to the current monitor state.

SYNC data is applied when the COMPONENT or RGB signal is input.

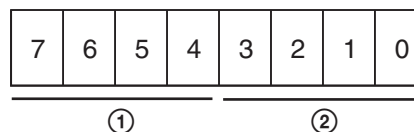
If the correct value is specified, an ACK is issued.

Multi Display (31H)

This command is used to set the multi display.

The values are specified as follows.

Sub Input Select



① Input signal

COMPOSITE = 0000

Y/C = 0010

RGB = 0100

COMPONENT = 0101

OPTION A-1 = 0110

OPTION A-2 = 0111

OPTION B-1 = 1010

OPTION B-2 = 1011

WAVE FORM = 1100

AUDIO LEVEL¹⁾ = 1101

OFF = 1110

1) Not available for LMD-1750W

② Multi Display

OFF = 0001

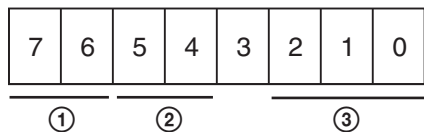
PIP/POP = 0010

SIDE BY SIDE = 0011

MULTI DISPLAY ENABLE OFF = 0111

MULTI DISPLAY ENABLE ON = 1111

Position



① 4 : 3 display

- 1 = 01
- 2 = 10
- 3 = 11

② Frame

- FRAME RIGHT = 01
- FRAME LEFT = 10

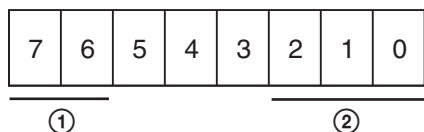
③ 16 : 9 display

- POSITION 1 = 001
- POSITION 2 = 010
- POSITION 3 = 011
- POSITION 4 = 100

Wave Form Select

Note

This item is not available for LMD-1750W.



① Period

- H PERIOD = 01
- V PERIOD = 10

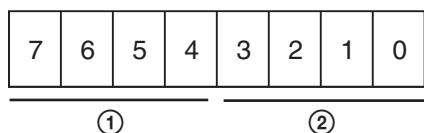
② Signal level

- Y LEVEL = 001
- R LEVEL = 010
- G LEVEL = 011
- B LEVEL = 100

Marker (32H)

This command is used to set the marker.
The values are specified as follows.

Marker and Safe Area



① SAFE AREA

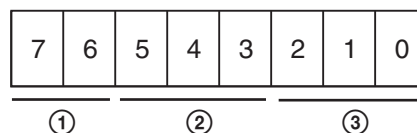
- OFF = 0001
- 80% = 0010
- 85% = 0011
- 88% = 0100
- 90% = 0101
- 93% = 0110

② Marker Select

- OFF = 0001
- 4:3 = 0010
- 16:9 = 0011
- 15:9 = 0100
- 14:9 = 0101
- 13:9 = 0110
- 1.85:1 = 0111
- 2.35:1 = 1000
- 1.85&4:3 = 1001

- MARKER ENABLE OFF = 1010
- MARKER ENABLE ON = 1011

Marker display



① CENTER MARKER

- ON = 10
- OFF = 11

② MARKER LEVEL

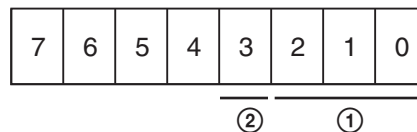
- 1 = 001
- 2 = 010
- 3 = 011

③ MARKER MAT

- OFF = 001
- HALF = 010
- BLACK = 011

Closed Caption (33H)

This command is used to set the closed caption.
The values are specified as follows.



① Closed caption selection

- CC1 = 001
- CC2 = 010

CC3 = 100
 CC4 = 101
 TEXT 1 = 110
 TEXT 2 = 111

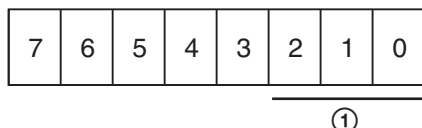
② Closed caption display

CLOSED CAPTION ENABLE ON = 1
 CLOSED CAPTION ENABLE OFF = 0

Audio Select (34H)

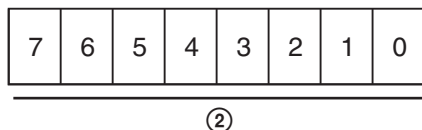
This command is used to set the closed caption.
 The values are specified as follows.

① Input Select



ALL = 001
 COMPOSITE = 010
 Y/C = 011
 COMPONENT = 100
 RGB = 101
 HD15 = 110
 DVI = 111

② Option Audio Setting



OFF = 10000000
 CH1 = 10000001
 CH2 = 10000010
 CH3 = 10000011
 CH4 = 10000100
 CH5 = 10000101
 CH6 = 10000110
 CH7 = 10000111
 CH8 = 10001000
 CH9 = 10001001
 CH10 = 10001010
 CH11 = 10001011
 CH12 = 10001100
 CH13 = 10001101
 CH14 = 10001110
 CH15 = 10001111
 CH16 = 10010000
 CH1+CH2 = 10010001
 CH3+CH4 = 10010010
 CH5+CH6 = 10010011
 CH7+CH8 = 10010100
 CH9+CH10 = 10010101

CH11+CH12 = 10010110
 CH13+CH14 = 10010111
 CH15+CH16 = 10011000

White Balance Data (40H)

This command is used to save the values for USER of the white balance data into the NVM of the monitor from the remote controller. The preset white balance data are not changed by this command.

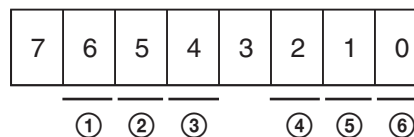
The command has two sections:

1. The elements of white balance data being sent
2. The white balance values to be saved

1. The elements of white balance data being sent

The element of white balance data being sent is judged by the first byte of the command block of the message. Several elements of white balance data can be specified in one message stream. When the bit of an item is set to 1, the data value is changed, and it is set to 0, the data value is not changed.

The values are specified as follows:



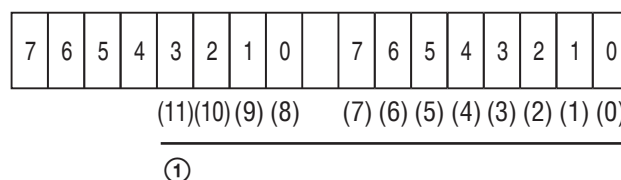
- ① B Bias
- ② G Bias
- ③ R Bias
- ④ B Gain
- ⑤ G Gain
- ⑥ R Gain

2. The white balance values to be saved

The elements of white balance data mentioned above contained in the bit are accepted in the order from the lower to upper bit elements. For example, when the bits specified as B Bias and R Gain are set to 1, R Gain data value is changed first, then B Bias value. The adjustment values, which consist of two bytes, are sent in the order from lower to upper byte elements.

Gain data consist of 12 bits and the setting values are in the range between 0 and 4095.

The values are specified as follows:



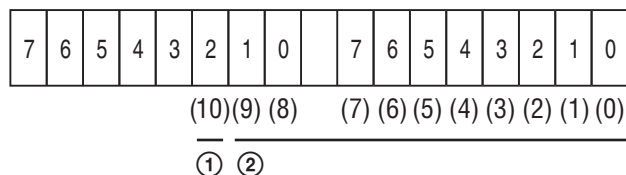
① Numerical value data

This is not the data to increase or decrease the current setting value.

Enter the adjustment value.

Bias data consist of 11-bit. MSB is a Mark data and is represented as a complement of 2. The setting values are in the range between -1024 and 1023 .

The values are specified as follows:



① Mark data

- + = 0
- = 1

② Numerical value data

This is not the data to increase or decrease the current setting value.

Enter the adjustment value.

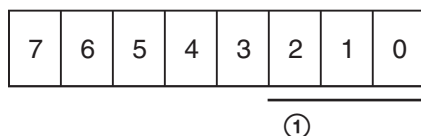
If the subcommand is not defined, NAK and an undefined message error are issued. If the subcommand is properly defined, ACK is issued.

White Balance Data Copy (42H)

This command is used to copy the values for USER of the white balance data from the color temperature data and save them into the NVM of the monitor. The values are applied to the current monitor state.

The color temperature values of the source data are specified at the first byte.

The values are specified as follows:



Bits which are not specified here are undefined bits.

① Preset white balance

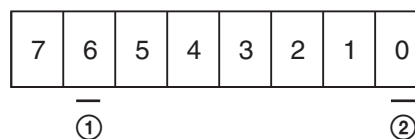
- D93 = 000
- D65 = 011

Status Sense (60H)

This command is used to sense the status of the monitor's current operation. The remote controller can

specify which items of data should be replied. Specify them in one data byte.

The values are specified as follows:



The bit to request the reply must be set to 1.

① Selected offset

② Current Input Configuration

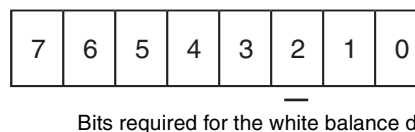
If there is no reply, a NAK is issued.

The monitor will send Status Reply (70H) to the remote controller.

White Balance Sense (61H)

This command is used to obtain the values for USER of the white balance data stored in the NVM of the monitor. The preset white balance data are not changed by this command.

The values are specified as follows:



The bit to request the white balance data must be set to 1. If there is no reply, a NAK is issued.

The monitor will send White Balance Reply (71H) to the remote controller.

Status Remote (6EH)

This command is used to obtain the current remote control status for the monitor.

The monitor will reply with the Status Remote Reply (7EH).

Status Reply (70H)

This command is used to send back the required status data to the remote controller.

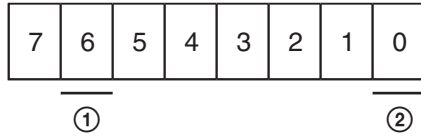
The [0x70] command data is specified as the first data byte of the command block.

The reply consists of two sections.

- 1 Element of reply data
- 2 Reply data

1. Element of reply data

The values are specified as follows:



The bit for the reply data must be set to 1.

① Selected offset

② Input Configuration data

2. Reply data

The Reply data consists of several bytes. The Reply data starts at the LSB of the specified data byte.

Each section of the data reply requires the following details.

Input Configuration data: Two bytes. The byte order is the same as that specified in “2. Values to be applied” of “Input Config (21H)” on page 7.

Selected offset: One byte. The byte order is the same as that specified in “Selected Offset (28H)” on page 9.

White Balance Reply (71H)

This command is used to send the white balance data to the remote controller.

The [0x71] command data is specified as the first data byte of the command block.

The [0x04] command data is sent back as the second data byte in one data byte.

The two-byte data of the following adjustment values are sent back in the order of the lower to upper bytes as the third data byte.

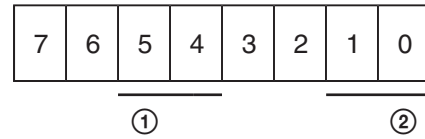
- R gain
- G gain
- B gain
- R bias
- G bias
- B bias

Status Remote Reply (7EH)

This reply informs the remote controller of the current remote status of the monitor. The monitor always reply to questions in REMOTE ON and REMOTE OFF mode. The [0x7E] command data is specified as the first data byte of this command.

The status of the remote control is sent as the second data byte in one data byte.

The values are specified as follows:



① Control applied

REMOTE ON = 01

REMOTE OFF = 10

② Type of remote control ready to apply

This value should always be 10.

ACK Reply (04H)

The monitor sends this command when all the commands were correctly received and executed.

NAK Reply (05H)

The monitor sends this command when an error has occurred after reception of the command.

The [0x05] command data is specified as the first data byte of the command block.

An error which is found in the serial communication port is sent in one data byte as the second byte data.

The errors are as follows:

Error Code	Error Type	Explanation
0x04	Checksum error	The received command data is not recognized as the data is different from the checksum.
0x01	Command error	The received message is an undefined message. A communication error occurs. The automatic adjustment such as APA, AUTO CHROMA/ PHASE is working or the automatic adjustment failed.

Overview

This unit can control the monitor using the commands described in this manual via the network (Ethernet). For example, the Input Select, Power On/Off, etc. can control from the external controller such as the PC.

On notation

This document uses the following notations:

- A hexadecimal number is indicated by an **h** after the number (10h = 0x10 = 16.) Otherwise, the number is a decimal.
- Character strings are enclosed by quotation marks (“ ”).

Connections

When you connect the unit to the network that uses the Ethernet, use the straight cable. When using a hub for network connection, use a hub with automatic cable type (straight or cross) detection feature (AUTO MDIX).

Network ports used by the monitor (the FTP data port is not shown)

Service	Port number	Factory setting	Change	
			Service usage	Port number
SDAP	53862	Auto start	No	No
SDCP	53484	Auto start	No	No
FTP	21	Auto start	No	No

Communication Protocol

You can control the monitor using the Simple Display Control Protocol (SDCP) and the Simple Display Advertisement Protocol (SDAP), which define the packet conventions and communication procedures for the commands.

SDCP is used to exchange monitor commands and statuses. You can obtain video settings and information, modify system settings including networking settings and obtain information using Video Monitor Control (VMC) packets superimposed on the SDCP protocol. The SDAP protocol periodically broadcasts the status of devices using UDP to check the connections.

For more information on the SDCP protocol, refer to section SDAP on page 16.

SDAP

The monitor provides the Status Advertisement Service. This service allows for the development of host applications that automatically find devices on the network. Monitors and controllers periodically broadcast device information over the network.

Function

The following table shows the device information that is periodically (at regular intervals) sent out to the network as broadcast packets:

Advertised information

Information	Description
Category	Category of the device (0Bh)
Device name	Name of the device
Serial number	Serial number of the device
Location	Location of the device
Community	Community name of the device
Power status	Power on/off status of the device

Protocol definition

The following table defines the SDAP protocol used to implement this advertisement service:

Definition of the SDAP protocol

Category	Description
Protocol name	SDAP (Simple Display Advertisement Protocol)
Transport type	UDP
Port number	53862
Broadcast interval	Monitor: 15 seconds Controller: 30 seconds

SDCP

This protocol provides a service for remotely controlling the monitor.

Function

This service responds to the control commands and requests for status and information sent from the host controller.

The unit provides four connection modes: Single connection, Peer to Peer connection, Group connection, and All connection. The Single connection and Peer to Peer connection modes send SDCP packets using TCP to identify a single monitor. The Group connection and All connection modes send SDCP packets using UDP broadcast function within the area network to identify more than one monitor. The controller can obtain status information from the monitor only if they are connected via TCP. Do not perform status sensing when connecting via UDP.

Protocol definition

The following table defines the SDCP protocol used to implement this service:

Definition of the SDCP protocol

Category	Description
Protocol name	SDCP (Simple Display Control Protocol)
Transport type	TCP and UDP
Port number	53484
TCP connection timeout	30 seconds

Considerations on communication

- Do not issue the next command from the controller until you receive the return data for the previous command from the monitor. Otherwise, the monitor cannot receive the next command and thus cannot respond to the controller nor issue an error code. Refer to “Wait time for return data” (on page 17) for information on the wait time between the controller issuing a command and the monitor responding with the return data.

- When a communication error occurs, the monitor discards the data it has received up to that point and waits for a new command.
- When an SDCP packet has a problem:
Monitors are response-oriented. Sending return data after the communication takes place inside the monitor results in an error that delays the response. Therefore, the monitor returns an SDCP packet indicating that the command was successfully processed as soon as it receives a command, even if the data area of the SDCP packet has a problem. If the SDCP packet has a problem in areas other than the data area, an appropriate SDCP packet is returned. For status sensing, normal operations are also implemented as response-oriented operations. Therefore, the monitor returns some data even if non-existent data are status-sensed.

- When broadcasting cursor or knob operations are performed from the menu using UDP, make sure to have an interval of 50 milliseconds between each command (BKM-15R issues a command every 100 milliseconds.) Time-consuming operations such as the white balance adjustment require longer intervals. Commands received before the previous process finishes are placed in a queue, but subsequent commands are discarded once the queued commands reach a certain number.

Wait time for return data

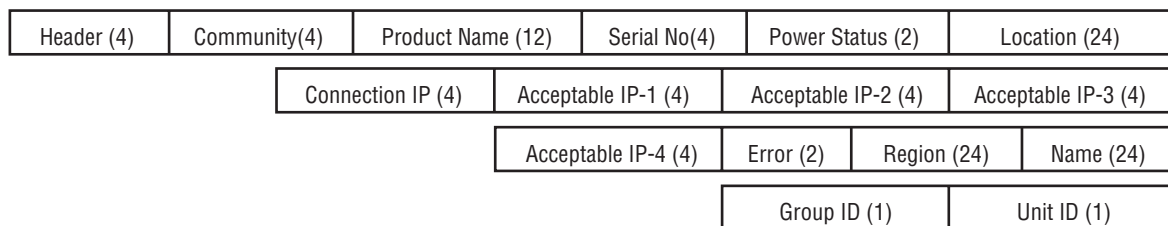
The wait time for the host to receive return data from the monitor after it issued an SDCP packet is in the range of 4 to 8 milliseconds when using a 10base-T connection, assuming that no communication failure occurs.

Command Block Format

SDAP Packets

This section describes the structure of SDAP packets. As shown in the following diagram, various information is bundled into a packet starting from the header. Each field is described in the subsequent paragraphs.

Structure of an SDAP packet



Format

SDAP packet version 4 includes all of the fields comprising version 3, which is used for the SONY SRX projector, plus Group ID and Unit ID.

Header

The Header uses four bytes: two bytes for the 16-bit ID and a byte each for the 8-bit Version and Category.

Structure of the SDAP header

Byte 0, 1	Byte 2	Byte 3
ID (2 bytes)	Version (1 byte)	Category (1 byte)
“DA”	04h	0Bh / 0Ch

ID: Fixed to “DA”.

Version: Indicates the version number of the protocol.

It is fixed to 04h (version 4.)

Category: Indicates the category number of the display device. For a monitor, it is fixed to 0Bh. For a monitor controller, it is fixed to 0Ch.

Community

Contains a 4-byte string indicating the community name specified for the device. It is set to “SONY”.

Device information

Product Name : Name of the device (up to 12 characters.)

If the name is shorter than 12 characters, 00h is inserted to fill in the space.

Serial No.: Serial number of the device (hexadecimal value.)

Location: Location information for the device (up to 24 characters.)

If it is shorter than 24 characters, 00h is inserted to fill in the space.

Connection IP (SDAP Ver2.00): Indicates the IP address of the host to which the device is currently connected and from which the menu is operated (hexadecimal value). A value of 00h indicates that the device is not connected to any host.

Acceptable IP (SDAP Ver2.00): Contains the registered information for the host IP address that accepts a connection via SDCP (hexadecimal value). Information for four hosts is sent in a packet. A value of 00h indicates that no host is specified.

Error (SDAP Ver3.00): Indicates whether an error occurred: 0 if no error occurred, 1 if an error occurred.

Region (SDAP Ver3.00): Contains regional information. If it is shorter than 24 characters, 00h is inserted to fill in the space.

Name (SDAP Ver3.00): Indicates the name of the projector. If it is shorter than 24 characters, 00h is inserted to fill in the space.

Group ID (SDAP Ver4.00): Indicates the group ID assigned to the monitor (1-byte hexadecimal value.)

Unit ID (SDAP Ver4.00): Indicates the unit ID assigned to the monitor (1-byte hexadecimal value.)

SDCP Packets

This section describes the structure of version 3 SDCP packets about only the fields used by the unit.

Structure of an SDCP packet

Header (2)	Community (4)	Group ID (1)	Unit ID (1)	Command (5)	Data (n)
------------	---------------	--------------	-------------	-------------	----------

Format

Version 3 includes all of the fields comprising version 2, which is used for SONY SRX projector, plus Group ID and Unit ID, with the Data length field changed to two bytes.

Header

The Header uses two bytes: a byte each for the 8-bit Version and Category.

Structure of the SDCP header

Byte 0	Byte 1
Version	Category
03h	0Bh

Version: Indicates the version number of the protocol. It is fixed to 03h (version 3.)

Category: Contains the category number for the monitor (0Bh). The unit checks the category number

and ignore the request if it is set to a number other than 0Bh.

Community

Contains a 4-byte case-sensitive alpha-numerical string indicating the community name. For the unit, it is set to "SONY". Community name must be four characters long. You can not specify a name shorter than four characters. Requests are processed only when this field matches the community name specified for the display device.

Group ID

Indicates the ID of the group with which the unit is registered. It is set to 0 for Single and Peer to Peer network connections and to 0xFF for All connections. If a number other than 0x00 or 0xFF is specified as the Group ID, the monitor with the specified Group ID accepts the command (the range of values for the Group ID is 1 to 99 depending on 7SEG for BKM-15R). The ID is a 1-byte hexadecimal value. When a Group ID is specified, broadcast communication with UDP is used. In this case, monitors do not return any response to the command.

Unit ID

Indicates a device-specific ID that is registered with the unit. It is set to 0 for Peer to Peer Network and Group connections and to 0xFF for All connections.

The ID is a 1-byte hexadecimal value. When a monitor receives an SDCP packet via TCP, it accepts the command only if the Unit ID specified in the packet (if specified) matches its Unit ID.

The Unit IDs for the monitors in the same subnet should be unique. The behavior of the monitors that have the same Unit ID depends on the configuration of the controller.

ID settings for various connection modes

Mode	Group ID	Unit ID
Peer to Peer	0	0
Single	0	1 to 99
Group	1 to 99	0
All	0xFF	0xFF

Command

The following table shows the format of request and response commands:

Format of the SDCP Command field

Byte 6	Byte 7, 8	Byte 9, 10
Request/response	Item No.	Data Length

Request

Specifies the command request from the host to the monitor.

SDCP request

Request	Description
SET (00h)	Specifies the command request. Status requests are also considered as commands.

Response

Returns the result to the request sent from the host.

SDCP response

Response	Description
NG (00h)	Indicates that the request was invalid or could not be completed.
OK (01h)	Indicates that the request was successfully completed.

Item no.

Defines the format of the information included in the Data field.

Item no.

Value	Description
B000h	Indicates a monitor command.
B001h	Indicates a monitor command for monitors with built-in controllers.

Data length

Specifies the length (n) of the subsequent Data field (a 2-byte hexadecimal value).

The maximum value that can be specified is 499 (01F3h).

Example of normal communication

Request	Item No.	Data Length	Data
00h	Item No.	n	Set Data (n byte)

Example of response

SDCP SET

OK (01h)	Item No.	n	Get Data (n byte)
----------	----------	---	-------------------

Example of error communication

If there is an error in the request, or if the request results in an error, "NG" is returned as the response.

In this case, the Item no. field contains the item number of the original request packet and the Error Code field contains a 1-byte category and a 1-byte error code.

Refer to "SDCP error codes" (page 19) for the list of categories and error codes.

Error response

NG (00h)	Item No.	2	Error Code (16)
----------	----------	---	-----------------

Support for broadcast communication

The broadcast communication via UDP is supported for controlling more than one monitor from a single controller. In this configuration, monitors do not return any response to commands.

SDCP error codes

The following table lists the SDCP error codes (not all of the error codes are implemented.) For description of the errors, refer to the subsequent paragraphs.

SDCP error codes

Category	Error	Error Code
Communication Error (F0**h)	Check Sum Error	10h
	Other Communication Error	50h

Communication Error

This type of error indicates a communication error between the controller and the main control microcomputer of the display.

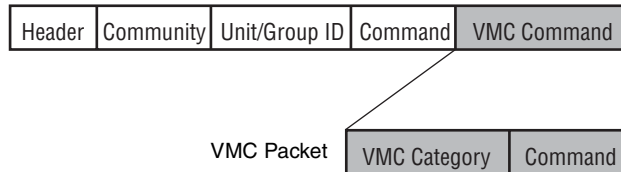
Check Sum Error: A check sum error occurred at the main control microcomputer.

Other Communication Error: Another type of communication error occurred.

VMC Command Description

You can control the monitor settings using VMC packets superimposed on SDCP. A VMC packet is applied to the Data field of an SDCP packet to send commands to the monitor and receive its status.

SDCP



Format of VMC Packets

A VMC packet is comprised of combinations of strings. The Category field specifies the category of the command and the Command field contains the command string and its parameters. Both fields have variable length. A space is used as the separator between them:

“Category Command Parameter1 Parameter2”

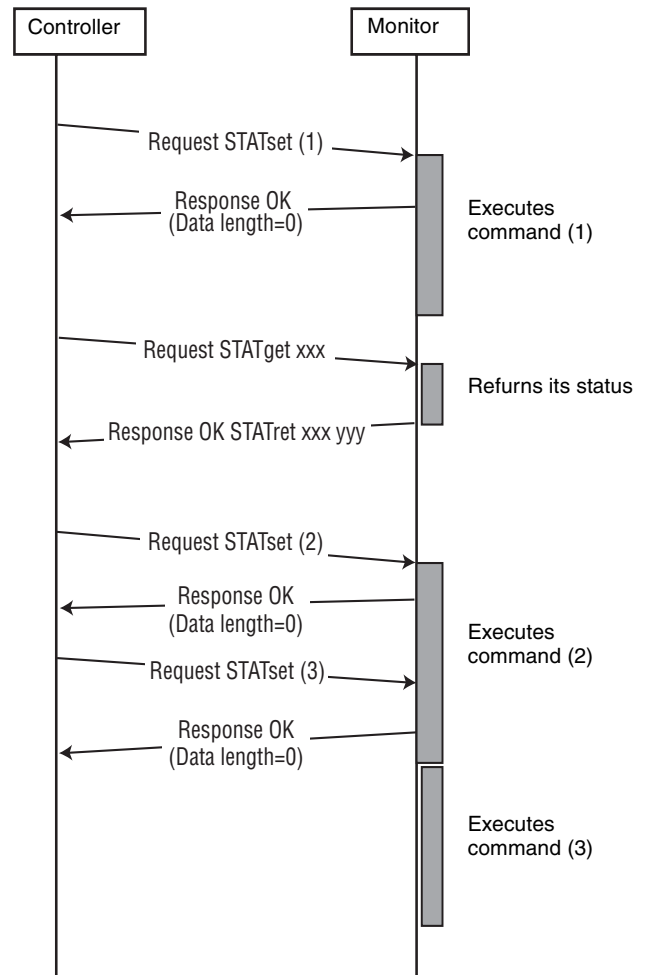
The termination code (0x00) for the strings is not sent. The command may not be correctly interpreted if a space is appended after a string. (You must configure the receiving device to accept strings with termination codes or spaces.)

Communication sequence for the VMC packets

SDCP (TCP) communication sequence

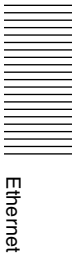
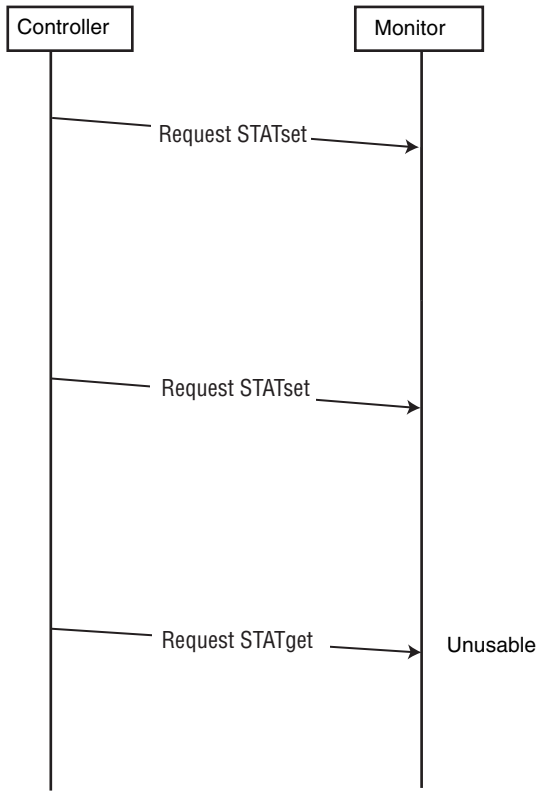
The following diagram shows the SDCP (TCP) communication sequence.

The monitor returns the response to a command upon its reception. For a command that takes time to process, the execution continues even after the response is sent out. If the monitor receives the next command while executing the previous command, it places the next command in the queue. For a status request, the monitor returns the response only after the command result becomes ready to be sent and the status value is set.



SDCP (UDP) communication sequence

The following diagram shows the communication sequence for ALL and Group-mode SDCP (UDP) communication:



Details of VMC Commands

VMC category

The following table lists the VMC command categories:

List of command categories

Category	Communication direction	Description
“STATset”	Controller to monitor	Sets the status of the monitor.
“STATget”	Controller to monitor	Requests the monitor to send its status back to the controller.
“STATret”	Monitor to controller	Response to “STATget”.
“INFOknob”	Controller to monitor	Notifies the monitor the status of the rotary switch.
“INFObutton”	Controller to monitor	Transmits inputs from multipurpose buttons such as the numeric keypad and the cursor to the monitor.

Command

Enter the setting value in [Value] (do not enter []).

Function	Command Name	Command	Send (Ethernet → Monitor)
SDCP (Ethernet Command) V0.2	Button CONTROL (20H)	INFObutton MENU	Displays the menu.
		INFObutton MENUUP	Moves the menu item upward.
		INFObutton MENUDOWN	Moves the menu item downward.
		INFObutton MENUENT	Confirms the menu item.
	Input Config (21H)	STATset INPUTSEL CVBS	Selects the composite input.
		STATset INPUTSEL YC	Selects the Y/C input.
		STATset INPUTSEL RGB	Selects the RGB input.
		STATset INPUTSEL COMP	Selects the component input.
		STATset INPUTSEL DVI	Selects the DVI input.
		STATset INPUTSEL HD15	Selects the HD15 input.
		STATset INPUTSEL OPA1	Selects the option A-1 input.
		STATset INPUTSEL OPA2	Selects the option A-2 input.
		STATset INPUTSEL OPB1	Selects the option B-1 input.
		STATset INPUTSEL OPB2	Selects the option B-2 input.
		STATset WBSSEL LOW	Selects COLOR TEMP D65.
		STATset WBSSEL HIGH	Selects COLOR TEMP D93.
		STATset WBSSEL USER	Selects COLOR TEMP USER.
		Control Data (23H)	STATset CONTRAST [Value]
	STATset APERTURE [Value]		Sets the aperture level. Adjustable range is 0 to 6.
	STATset BRIGHTNESS [Value]		Sets the brightness level. Adjustable range is 0 to 100.
	STATset PHASE [Value]		Sets the phase level. Adjustable range is 0 to 100.
	STATset CHROMA [Value]		Sets the chroma level. Adjustable range is 0 to 100.
	Display Data (24H)	STATset RESET	Resets the setting to the factory setting.
		STATset PITCH [value]	Sets the pitch. Adjustable range is +30 to -30.
		STATset DOTPHASE [value]	Sets the dot phase. Adjustable range is +30 to -30.
		STATset SIZEH [value]	Sets the H size. Adjustable range is +30 to -30.
		STATset SIZEV [value]	Sets the V size. Adjustable range is +30 to -30.
		STATset SHIFTH [value]	Sets the H shift. Adjustable range is +30 to -30.
		STATset SHIFTV [value]	Sets the V shift. Adjustable range is +30 to -30.
	Picture Delay Min (27H)	STATset MODE0	Sets PICTURE DELAY MIN to 0.
		STATset MODE1	Sets PICTURE DELAY MIN to 1.
		STATset MODE2	Sets PICTURE DELAY MIN to 2.
	Select Offset (28H)	STATset SMPTE	Sets COMPONENT LEVEL to SMPTE.
		STATset BETA0	Sets COMPONENT LEVEL to BETA 0.
		STATset BETA75	Sets COMPONENT LEVEL to BETA 7.5.
		STATset NTSC0	Sets the NTSC setup level to 0.
		STATset NTSC75	Sets the NTSC setup level to 7.5.
	On Switch Function (29H)	STATset REMOTE ON	Sets the remote to ON.
		STATset APA ON	Sets APA to ON.
		STATset POWERSAVING ON	Sets POWER SAVING to ON.
		STATset KEYINHIBIT ON	Sets KEY INHIBIT to ON.

Function	Command Name	Command	Send (Ethernet → Monitor)
		STATset TALLYGREEN ON	Sets the tally green to ON.
		STATset TALLYRED ON	Sets the tally red to ON.
		STATset HVDELAY ON	Sets the H/V delay function to ON.
		STATset BLUEONLY ON	Sets BLUE ONLY to ON.
		STATset MONOCHR ON	Sets MONO to ON.
	Off Switch Function (2AH)	STATset REMOTE OFF	Sets the remote to OFF.
		STATset APA OFF	Sets APA to OFF.
		STATset POWERSAVING OFF	Sets POWER SAVING to OFF.
		STATset KEYINHIBIT OFF	Sets KEY INHIBIT to OFF.
		STATset TALLYGREEN OFF	Sets the tally green to OFF.
		STATset TALLYRED OFF	Sets the tally red to OFF.
		STATset HVDELAY OFF	Sets the H/V delay function to OFF.
		STATset BLUEONLY OFF	Sets BLUE ONLY to OFF.
	Select Display (2BH)	STATset MONOCHR OFF	Sets MONO to OFF.
		STATset ENGLISH	Sets the menu language to English.
		STATset GERMAN	Sets the menu language to German.
		STATset FRENCH	Sets the menu language to French.
		STATset ITALIAN	Sets the menu language to Italian.
		STATset SPANISH	Sets the menu language to Spanish.
STATset JAPANESE		Sets the menu language to Japanese.	
STATset CHINESE		Sets the menu language to Chinese.	
STATset FMTDISPAUTO		Sets FORMAT DISPLAY to Auto.	
STATset FMTDISPON		Sets FORMAT DISPLAY to ON.	
Select Menu (2CH)	STATset FMTDISPOFF	Sets FORMAT DISPLAY to OFF.	
	STATset CSCOFF	Sets COLOR SPACE (ChromaTru) to OFF.	
	STATset CSCEBU	Sets COLOR SPACE (ChromaTru) to EBU.	
	STATset CSCSMPTE	Sets COLOR SPACE (ChromaTru) to ITU-709.	
	STATset CSCITU	Sets COLOR SPACE (ChromaTru) to SMPTE-C.	
	STATset AUTOCHOFF	Sets AUTO CHROMA/PHASE to OFF.	
	STATset AUTOCHON	Sets AUTO CHROMA/PHASE to ON.	
Scan Aspect (2DH)	STATset AUTOADJ	Starts the auto adjustment of AUTO CHROMA/PHASE.	
	STATset SCANMODE NORMAL	Sets the SCAN size to NORMAL.	
	STATset SCANMODE OVER	Sets the SCAN size to OVER.	
	STATset SCANMODE FULL	Sets the SCAN size to FULL.	
	STATset SCANMODE NATIVE	Sets the SCAN size to NATIVE.	
	STATset ASPECT 4BY3	Sets the aspect ratio to 4:3.	
Select Config Data (2FH)	STATset ASPECT 16BY9	Sets the aspect ratio to 16:9.	
	STATset EXTSYNC OFF	Sets the external sync to OFF.	
Multi Display (31H)	STATset EXTSYNC ON	Set the external sync to ON.	
	STATset MULTIDISP DISABLE	Sets the multi display to OFF.	
	STATset MULTIDISP ENABLE	Sets the multi display to ON.	
	STATset MULTIDISP PIP	Sets to PIP/POP mode.	
	STATset MULTIDISP SBS	Sets to SIDE BY SIDE mode.	
	STATset MULTIDISP CVBS	Sets SUB INPUT DISPLAY to COMPOSITE.	
	STATset MULTIDISP YC	Sets SUB INPUT DISPLAY to Y/C.	
	STATset MULTIDISP RGB	Sets SUB INPUT DISPLAY to RGB.	
STATset MULTIDISP COMP	Sets SUB INPUT DISPLAY to COMPONENT.		

Function	Command Name	Command	Send (Ethernet → Monitor)
		STATset MULTIDISP OPA1	Sets SUB INPUT DISPLAY to OPTION A-1.
		STATset MULTIDISP OPA2	Sets SUB INPUT DISPLAY to OPTION A-2.
		STATset MULTIDISP OPB1	Sets SUB INPUT DISPLAY to OPTION B-1.
		STATset MULTIDISP OPB2	Sets SUB INPUT DISPLAY to OPTION B-2.
		STATset MULTIDISP VIDEO_WAVE	Sets SUB INPUT DISPLAY to VIDEO WAVE.
		STATset MULTIDISP AUDIO_WAVE	Sets SUB INPUT DISPLAY to AUDIO LEVEL ^{a)} .
		STATset MULTIDISP POSITION1	Sets the position of the sub display to 1.
		STATset MULTIDISP POSITION2	Sets the position of the sub display to 2.
		STATset MULTIDISP POSITION3	Sets the position of the sub display to 3.
		STATset MULTIDISP POSITION4	Sets the position of the sub display to 4.
		STATset MULTIDISP RIGHT	Sets the position of the frame to RIGHT.
		STATset MULTIDISP LEFT	Sets the position of the frame to LEFT.
		STATset MULTIDISP SIZE1	Sets SUB PICTURE SIZE to 1.
		STATset MULTIDISP SIZE2	Sets SUB PICTURE SIZE to 2.
		STATset MULTIDISP SIZE3	Sets SUB PICTURE SIZE to 3.
		STATset MULTIDISP YLEVEL	Sets WAVE FORM to Y ^{a)} .
		STATset MULTIDISP RLEVEL	Sets WAVE FORM to R ^{a)} .
		STATset MULTIDISP GLEVEL	Sets WAVE FORM to G ^{a)} .
		STATset MULTIDISP BLEVEL	Sets WAVE FORM to B ^{a)} .
		STATset MULTIDISP HPERIOD	Sets WAVE FORM to H PERIOD ^{a)} .
		STATset MULTIDISP VPERIOD	Sets WAVE FORM to V PERIOD ^{a)} .
	Marker (32H)	STATset MARKER OFF	Sets the marker to OFF.
		STATset MARKER ON	Sets the marker to ON.
		STATset MARKERSEL OFF	Sets the ASPECT marker to OFF.
		STATset MARKERSEL 4B3	Sets the 4:3 marker.
		STATset MARKERSEL 16B9	Sets the 16:9 marker.
		STATset MARKERSEL 15B9	Sets the 15:9 marker.
		STATset MARKERSEL 14B9	Sets the 14:9 marker.
		STATset MARKERSEL 13B9	Sets the 13:9 marker.
		STATset MARKERSEL 185B1	Sets the 1.85:1 marker.
		STATset MARKERSEL 235B1	Sets the 2.35:1 marker.
		STATset MARKERSEL 185A4B3	Sets the 1.85:1&4:3 marker.
		STATset SAFEAREA OFF	Sets the safe area marker to OFF.
		STATset SAFEAREA 80	Sets the safe area marker to 80 %.
		STATset SAFEAREA 85	Sets the safe area marker to 85 %.
		STATset SAFEAREA 88	Sets the safe area marker to 88 %.
		STATset SAFEAREA 90	Sets the safe area marker to 90 %.
		STATset SAFEAREA 93	Sets the safe area marker to 93 %.
		STATset MARKERMAT OFF	Sets MARKER MAT to OFF.
		STATset MARKERMAT HALF	Sets MARKER MAT to HALF.
		STATset MARKERMAT BLACK	Sets MARKER MAT to BLACK.
		STATset MARKERLEVEL 1	Sets MARKER LEVEL to 1.
		STATset MARKERLEVEL 2	Sets MARKER LEVEL to 2.
		STATset MARKERLEVEL 3	Sets MARKER LEVEL to 3.
		STATset CENTMARKER OFF	Sets CENTER MARKER to OFF.
		STATset CENTMARKER ON	Sets CENTER MARKER to ON.

Function	Command Name	Command	Send (Ethernet → Monitor)
	Closed Caption (33H)	STATset CC DISABLE	Sets CLOSED CAPTION to OFF.
		STATset CC ENABLE	Sets CLOSED CAPTION to ON.
		STATset CC CC1	Sets CLOSED CAPTION to CC1.
		STATset CC CC2	Sets CLOSED CAPTION to CC2.
		STATset CC CC3	Sets CLOSED CAPTION to CC3.
		STATset CC CC4	Sets CLOSED CAPTION to CC4.
		STATset CC TEXT1	Sets CLOSED CAPTION to TEXT1.
		STATset CC TEXT2	Sets CLOSED CAPTION to TEXT2.
	Audio Select (34H)	STATset BKMAUDIOSEL OFF	Sets BKM AUDIO SETTING to OFF.
		STATset BKMAUDIOSEL CH1	Sets BKM AUDIO SETTING to CH1.
		STATset BKMAUDIOSEL CH2	Sets BKM AUDIO SETTING to CH2.
		STATset BKMAUDIOSEL CH3	Sets BKM AUDIO SETTING to CH3.
		STATset BKMAUDIOSEL CH4	Sets BKM AUDIO SETTING to CH4.
		STATset BKMAUDIOSEL CH5	Sets BKM AUDIO SETTING to CH5.
		STATset BKMAUDIOSEL CH6	Sets BKM AUDIO SETTING to CH6.
		STATset BKMAUDIOSEL CH7	Sets BKM AUDIO SETTING to CH7.
		STATset BKMAUDIOSEL CH8	Sets BKM AUDIO SETTING to CH8.
		STATset BKMAUDIOSEL CH9	Sets BKM AUDIO SETTING to CH9.
		STATset BKMAUDIOSEL CH10	Sets BKM AUDIO SETTING to CH10.
		STATset BKMAUDIOSEL CH11	Sets BKM AUDIO SETTING to CH11.
		STATset BKMAUDIOSEL CH12	Sets BKM AUDIO SETTING to CH12.
		STATset BKMAUDIOSEL CH13	Sets BKM AUDIO SETTING to CH13.
		STATset BKMAUDIOSEL CH14	Sets BKM AUDIO SETTING to CH14.
		STATset BKMAUDIOSEL CH15	Sets BKM AUDIO SETTING to CH15.
		STATset BKMAUDIOSEL CH16	Sets BKM AUDIO SETTING to CH16.
		STATset BKMAUDIOSEL CH1CH2	Sets BKM AUDIO SETTING to CH1+CH2.
		STATset BKMAUDIOSEL CH3CH4	Sets BKM AUDIO SETTING to CH3+CH4.
		STATset BKMAUDIOSEL CH5CH6	Sets BKM AUDIO SETTING to CH5+CH6.
		STATset BKMAUDIOSEL CH7CH8	Sets BKM AUDIO SETTING to CH7+CH8.
		STATset BKMAUDIOSEL CH9CH10	Sets BKM AUDIO SETTING to CH9+CH10.
		STATset BKMAUDIOSEL CH11CH12	Sets BKM AUDIO SETTING to CH11+CH12.
		STATset BKMAUDIOSEL CH13CH14	Sets BKM AUDIO SETTING to CH13+CH14.
		STATset BKMAUDIOSEL CH15CH16	Sets BKM AUDIO SETTING to CH15+CH16.
STATset INPUTAUDIOSEL ALL	Sets INPUT SELECT to ALL.		
STATset INPUTAUDIOSEL COMPOSITE	Sets INPUT SELECT to COMPOSITE.		
STATset INPUTAUDIOSEL YC	Sets INPUT SELECT to Y/C.		
STATset INPUTAUDIOSEL COMPONENT	Sets INPUT SELECT to COMPONENT.		
STATset INPUTAUDIOSEL RGB	Sets INPUT SELECT to RGB.		
STATset INPUTAUDIOSEL HD15	Sets INPUT SELECT to HD15.		
STATset INPUTAUDIOSEL DVI	Sets INPUT SELECT to DVI.		

a) Not available for LMD-1750W

