

RS232C Control of UT Monitor

Summary

Hitachi's Ultra Thin LCD Monitor can be controlled by connecting the external controller as PC to RS-232C terminal on the monitor. In addition, the external controller can get information of the monitor by requesting control data from the external control device. Detail of communication is shown in "[3. Communication Protocol](#)".

1. RS-232C Serial Interface

The electrical conditions of connecting the monitor and the external controller conform RS-232C standard. And physical conditions are shown below.

◆ 1.1 Connection Terminal

RS-232C terminal was changed from previous model, from D-SUB 9Pin at behind of TV to miniDIN 8Pin at bottom of monitor. Pin position and allocation are shown below.

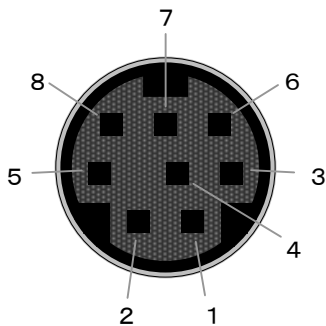


Figure1.1-1 Pin Position (miniDIN 8Pin female)

Pin#	Mark	Direction	Means
1	NC	-	
2	NC	-	
3	TxD	O	Send Data (Monitor ⇒ PC)
4	GND	G	Ground
5	RxD	I	Receive Data (PC ⇒ Monitor)
6	NC	-	
7	NC	-	
8	NC	-	

Table1.1 Pin allocation

【 Reference 】

RS-232C connection of PC side is D-SUB 9Pin male.
Figure 1.1-2 shows pin position.

Figure1.1-2 Pin Position (D-SUB 9Pin male)

3. Communication Protocol

◆ 3.1 Terminal Mode(Monitor – External Control Device serial Communication)ON/OFF Switching

After the monitor received the terminal mode ON/OFF request from the external controller, the monitor replays ACK when mode can change or NAK when mode cannot change.(Character Code is shown Table3.1.1).

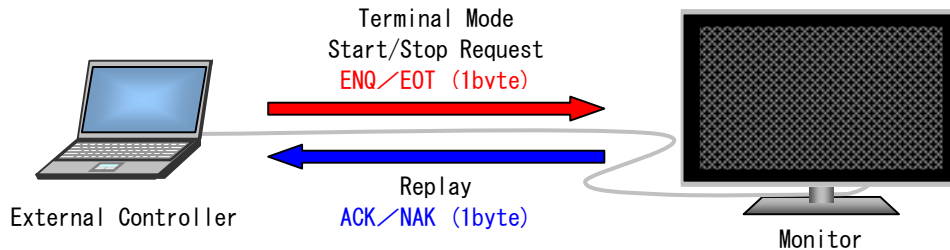


Figure3.1.1 Terminal Mode ON/OFF Switching

Mode		Terminal Mode ON	Terminal Mode OFF
Items			
Receive	Communication Contents	Start Request	Stop Request
	Character	ENQ	EOT
	Character Code (HEX)	05	04
Send	Communication Contents	ACK/NAK Replay	ACK/NAK Replay
	Character	ACK/NAK	ACK/NAK
	Character Code (HEX)	06 / 15	06 / 15

Table3.1.1 Terminal Mode ON/OFF Switching Character Code

- When the terminal mode is “ON”, the command data can send and receive. Detail of command data sending and receiving are shown “3.2 Command Data Send and Receive ”
- The initial setting of the terminal mode is “OFF”.
- When the terminal mode is “ON”, main switch and remote signal are ignored. Only main power switch is allowed.
- When the terminal mode is “ON”, if main power OFF→ON, or A/C cable remove→insert, terminal mode is set to initial setting (OFF).
- When the following states, terminal mode cannot be allowed “ON”;
 - Adjustment Mode
 - Sequence is on execution
 - Auto Adjustment ※1
 - Amplitude Adjustment ※1
- Using the monitor for TV(The monitor doesn't send NAK also.)
 - ※1 After the Auto Adjustment or the Amplitude Adjustment is to timing in which terminal mode ON request is received, terminal mode “ON” might be allowed.
- Each data (ENQ, EOT, ACK, NAK) size is 1byte.

◆ 3.2 Command Data Send and Receive

◇ 3.2.1 Command Mode Type

The terminal mode fall into 3 type (a)~(c) depend on received commands from external controller . The Command Data format is shown in “[3.2.2 Receive Data Format](#)” and “[3.2.3 Send Data Format](#)”. And the available commands of each mode are shown in [Table3.2.5-1](#) and [Table3.2.5-2](#).

(a) Normal Command•Write Mode

If the monitor receives available writing command from the external controller like the PC, the monitor executes the command and replays the ACK. If received command is not available, the monitor replays the NAK.

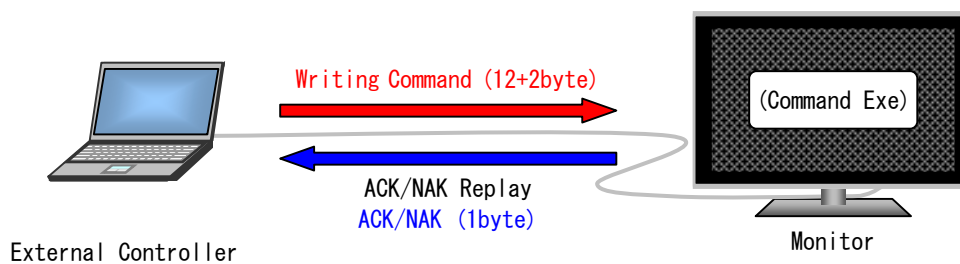


Figure3.2.1-1 Writing Command Receive

- The command that require to take time control completion like Power take time to the ACK reply.
- When the timeout period of ACK/NAK is set by the external control device side, it set long. After ACK/NAK is received or timeout, the monitor executes the next command.
- When power is ON, the timeout period is set about 8 seconds. Otherwise, the timeout period is set about 4 seconds. It confirms the operation with a real machine.

(b) Normal Command•Read Mode

If the monitor receives available reading command from the external controller like the PC, the monitor sends required data. If received command is not available, the monitor replays the NAK.

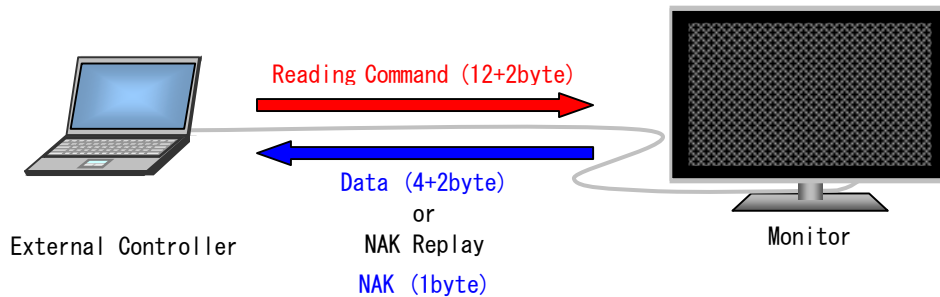


Figure3. 2. 1-2 Reading Command Receive

(c) Wired Remote Command Mode

If the monitor receives available remote code through the serial communication from the external controller like the STB in hotel, the monitor executes the code and replays the ACK. If received code is not available, the monitor replays the NAK.

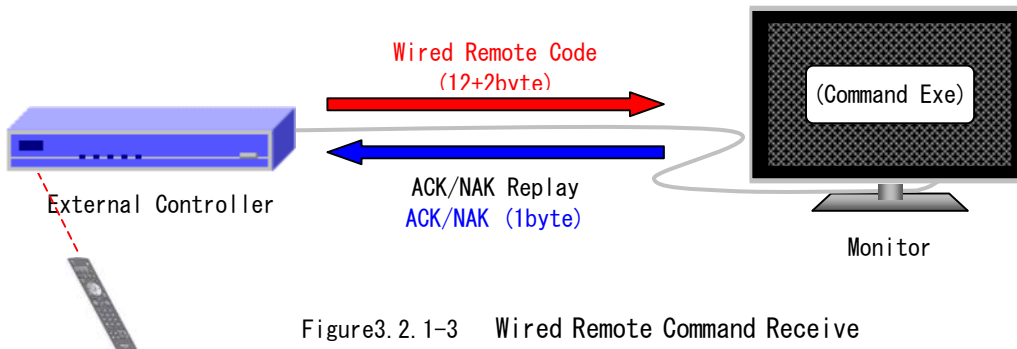


Figure3. 2. 1-3 Wired Remote Command Receive

- The command(key) that require to take time control completion like Power also replay ACK without waiting the control completion. And it takes time to the ACK reply.
- After ACK send, received command is not available until the control is completed.
- The wired remote command supports only writing mode, reading mode is not supported.
- The function and the acceptance condition are basically the same as the case of the infrared rays remote.

◇ 3.2.2 Receive Data Format

- The command length is fixed 12 bytes. And Transmission Start/Stop code (One byte respectively) is added before and behind it.
- The 1st~6th Command show HEX(1byte) numerical value by character(ASCII 2 bytes).

ex. 0x01 (1byte) ⇒ '0'(1byte), '1'(1byte)

Data Byte	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Command #		1st		2nd		3rd		4th		5th		6th		
Receive Contents	Start Code	Func1		R/W		Func3		Func4		High byte Data		Lower byte Data		Stop Code
Character	STX	0~F	0~F	0~F	0~F	0~F	0~F	0~F	0~F	0~F	0~F	0~F	0~F	ETX
Code (HEX)	02	※1	※1	※1	※1	※1	※1	※1	※1	※1	※1	※1	※1	03

※1 When character is '0' ~ '9', set 30~39. When character is 'A' ~ 'F' set 41~46. When the character is written by HEX, the character of higher 4bit (code) is received in first.

Table3.2.2-1 Receive Data Format

- Following R/W mode that is set by 2nd command, the command style is used as Table3.2.2-2.
- The data that is set "Dummy" is ignored by system microcomputer.
- Detail of each command and writing data are shown in "[Table3.2.5-1](#)" and "[Table3.2.5-2](#)".

Style	内容	Command Data					
		1st	2nd	3rd	4th	5th	6th
A	Read Normal Command Data	Command	Process Mode (R)	Command	Command	Dummy	Dummy
		(**)	(01)	(**)	(**)	(00)	(00)
B	Write Normal Command Data or Wired Remote Code Mode	Command	Process Mode (W)	Command	Command	Writing Data	Writing Data
		(**)	(00)	(**)	(**)	(**)	(**)

※ In the inside (), the character is expressed. ** is depend on the command.

Table3.2.2-2 Receive Command Style

◇ 3.2.3 Send Data Format

- If the monitor receive the reading mode data from the external controller, the monitor send reading data when it able to end processing normally. The command length is fixed 4 bytes. And Transmission Start/Stop code (One byte respectively) is added before and behind it.
- The sent data show HEX(1byte) numerical value by character(ASCII 2byte).

		Data byte					
		1	2	3	4	5	6
Read Data Format	Contents	Start Code	High byte Data	Lower byte Data	Stop Code		
	Character	STX	0~F	0~F	0~F	0~F	ETX
	Code (HEX)	02	※1	※1	※1	※1	03
Acknowledge ※2	Contents	ACK					
	Character	ACK					
	Code (HEX)	06					
Negative Acknowledge	Contents	NAK					
	Character	NAK					
	Code (HEX)	15					

- ※1 When character is '0' ~ '9', set 30~39. When character is 'A' ~ 'F' set 41~46.
When the character is written by HEX, the character of higher 4bit (code) is received in first.
- ※2 It doesn't send in Normal Command•Read Mode.

Table3.2.3-1 Send Data Format

◇ 3.2.4 Command Setting Example

It explains how to set the command data on the external controller side enumerating the concrete illustration as follows.

ex. The Volume is set to 20 ... ①

Command #	1st	2nd	3rd	4th	5th	6th
Command Contents	Func1	R/W	Func3	Func4	High byte Data	Lower byte Data
Setting Contents	0x27	W (0x00)	0		20 (0x0014)	

The

content that should be set to each command is as shown in Table3.2.4-1.(See [Table3.2.5-1](#)).

Table3. 2. 4-1 Command Data Setting

It is necessary to convert the content of the Table3.2.4-1 as follows, and to add transmission start/stop code because the setting data is showing of the numerical value of HEX by the character.

Command #		1st		2nd		3rd		4th		5th		6th		
Command	Start Code	Func1		R/W		Func3		Func4		High byte Data		Lower byte Data		Stop Code
Data Byte	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Character	STX	2	7	0	0	0	0	0	0	0	0	1	4	ETX
Code (HEX)	02	32	37	30	30	30	30	30	30	30	30	31	34	03

Table3. 2. 4-2 Command Data Setting (Example①)

◇ 3.2.5 Command

(a) Normal Command

No.	Command	Receive byte→ Item→	Receive Command Data					14 (ETX)	※4	※5	Memo
			1 (STX)	2, 3 Func1	4, 5 R/W	6, 7, 8, 9 Func3, 4	10, 11, 12, 13 Data		Memory	OSD	
1	Power		02h	6Eh	1:R / 0:W	0	0:OFF, 1:ON	03h	Y	Y	
2	Inputs		02h	6Fh	1:R / 0:W	0	0:RGB, 12:HDMI	03h	Y	Y	※1
3	Volume		02h	27h	1:R / 0:W	0	0~60	03h			
4	Mute		02h	29h	1:R / 0:W	0	0:OFF, 1:ON	03h			
5	Balance		02h	28h	1:R / 0:W	0	0~20 (10:Center)	03h			
6	Bass		02h	2Ah	1:R / 0:W	0	0~30 (15:Center)	03h			
7	Treble		02h	2Bh	1:R / 0:W	0	0~30 (15:Center)	03h			
8	Brightness		02h	59h	1:R / 0:W	0	0~62 (31:Center)	03h			
9	Black Enhancement		02h	1Fh	1:R / 0:W	0	0~62 (31:Center)	03h			
10	Color Density		02h	10h	1:R / 0:W	0	0~62 (31:Center)	03h			
11	Tint		02h	13h	1:R / 0:W	0	0~62 (31:Center)	03h			
12	Picture Quality (Only Non-RGB Input)		02h	14h	1:R / 0:W	0	0~30 (15:Center)	03h			
13	Color Temperature		02h	60h	1:R / 0:W	0	0:Cool, 1:Normal, 2:Warm	03h			
14	Back Light (Only LCD)		02h	6Dh	1:R / 0:W	0	0~40 (20:Center)	03h			
15	Video Mode (Only Non-RGB Input)		02h	A4h	1:R / 0:W	3	0:Dynamic, 1:Natural, 2:Cinema	03h			
16	Wide Mode		02h	40h	1:R / 0:W	0	0:4:3, 1:Full/Full 1 (RGB 0:Normal,1:Full)	03h			※2
17	Color System (for Video Input)		02h	A1h	1:R / 0:W	0	0:Auto~7:PAL-N	03h			※3
18	Read RS232C Version		02h	B0h	1:R	0	Read Value: 0220h~ (Ver 2.20~)	03h			

※1 When D-SUB Composite input, Reading data set 0:RGB (Do not individuate by Setup Menu/RGB Input setting)

※2 WRITE Value: SD signal:4:3, Full HD signal:Full 1 RGB:Normal, Full Read Value: 2:Other

※3 Data: 0:Auto, 1:PAL, 2:SECAM, 3:NTSC4.43, 4:NTSC3.58, 5:PAL60, 6:PAL-M, 7:PAL-N

When D-SUB Composite input only (Setup Menu/RGB Input set to Composite and select RGB monitor).

※4 Memory: Y: When Power OFF⇒ON, keep status before Power OFF (Last Memory) No Mark: Non-Last Memory

※5 OSD: Y: Show OSD No Mark: Non-OSD

Table3. 2. 5-1 Normal Command

(b) Wired Remote Command

No.	Command	Receive byte→ Items→	Receive Command Data					14 (ETX)	Memory	OSD	Memo
			1 (STX)	2, 3 Func1	4, 5 R/W	6, 7, 8, 9 Func3, 4	10, 11, 12, 13 Data				
1	Power ON/OFF		02h	F9h	0:W	0	5017h	03h	Y	Y	
2	Power ON		02h	F9h	0:W	0	503Eh	03h	Y	Y	
3	Power OFF		02h	F9h	0:W	0	503Fh	03h	Y	Y	
4	Inputs		02h	F9h	0:W	0	5009h	03h	Y	Y	
5	Mute ON/OFF		02h	F9h	0:W	0	500Bh	03h		Y	
6	Volume Up		02h	F9h	0:W	0	5012h	03h	Y	Y	
7	Volume Down		02h	F9h	0:W	0	5015h	03h	Y	Y	
8	Non-Display ON/OFF		02h	F9h	0:W	0	5054h	03h			
9	Video Mode		02h	F9h	0:W	0	505Eh	03h	Y	Y	
10	Wide Mode		02h	F9h	0:W	0	506Fh	03h	Y	Y	
11	Auto Adjustment (RGB Input)		02h	F9h	0:W	0	50ADh	03h	Y	Y	

※ Data(10~13 byte)set remote code.

Table3.2.5-2 Wired Remote Command