User's Manual

HDMI-CEC
Demonstration Board

CEC-78K0/KF2A

Tessera Technology Inc.
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V1.02

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CAUTION

- ·Do not give any physical damage to this equipment such as dropping
- ·Do not superimpose voltage to this equipment.
- ·Do not use this equipment with the temperature below 0℃ or over 40℃.
- ·Make sure the USB cables are properly connected.
- ·Do not bend or stretch the USB cables.
- ·Keep this equipment away from water.
- ·Take extra care to electric shock.
- ·This equipment should be handled like a CMOS semiconductor device. The user must take all precautions to avoid build-up of static electricity while working with this equipment.
- ·All test and measurement tool including the workbench must be grounded.
- ·The user/operator must be grounded using the wrist strap.
- ·The connectors and/or device pins should not be touched with bare hands.

INTRODUCTION

CEC-78K0/KF2A is designed for users who wish to evaluate HDMI-CEC features with 8-bit microcontroller 78K0/Kx2 series from Renesas Electronics.

It is assumed that the readers have been familiar with basics of HDMI and CEC. The overview and terms are available at "High-Definition Multimedia Interface Specification" in the following web site.
http://www.hdmi.org/manufacturer/specification.aspx

Please use the system with all necessary tests. Tessera Technology Inc. assumes no responsibility for any losses from the use of CEC-78K0/KF2A.

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1. CEC-78K0/KF2A

In this chapter, feathers and hardware specifications of CEC-78K0/KF2A, 8-bit microcontroller 78K0/Kx2 series from Renesas Electronics, are described.

1.1 Features

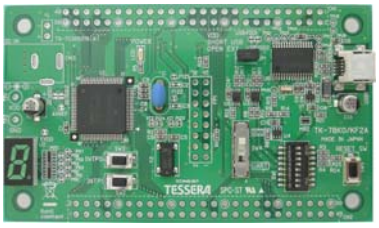
CEC-78K0/KF2A has following feathers.

- 2 HDMI channels
- 10 general purpose key inputs (AD input)
- Infrared remote control function
- MINICUBE2 connection (on-chip debug, writing on flash memory)
- USB connection with PC
- 1 7segLED
- 15x6 holes universal area

1.2 Hardware Structure

CEC-78K0/KF2A is a combined product of TK-78K0/KF2A and HDMI-CEC Demonstration Board.

TK-78K0/KF2A



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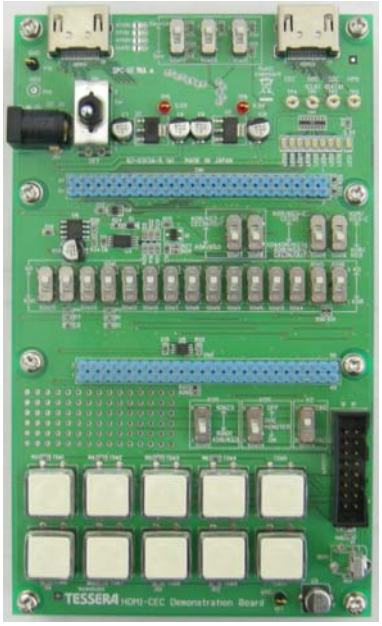
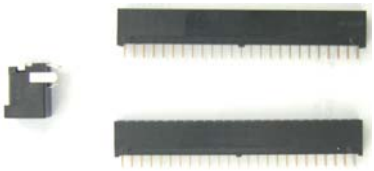
HDMI-CEC Demonstration Board



・The oscillator is exchanged from 20MHz to 10MHz.

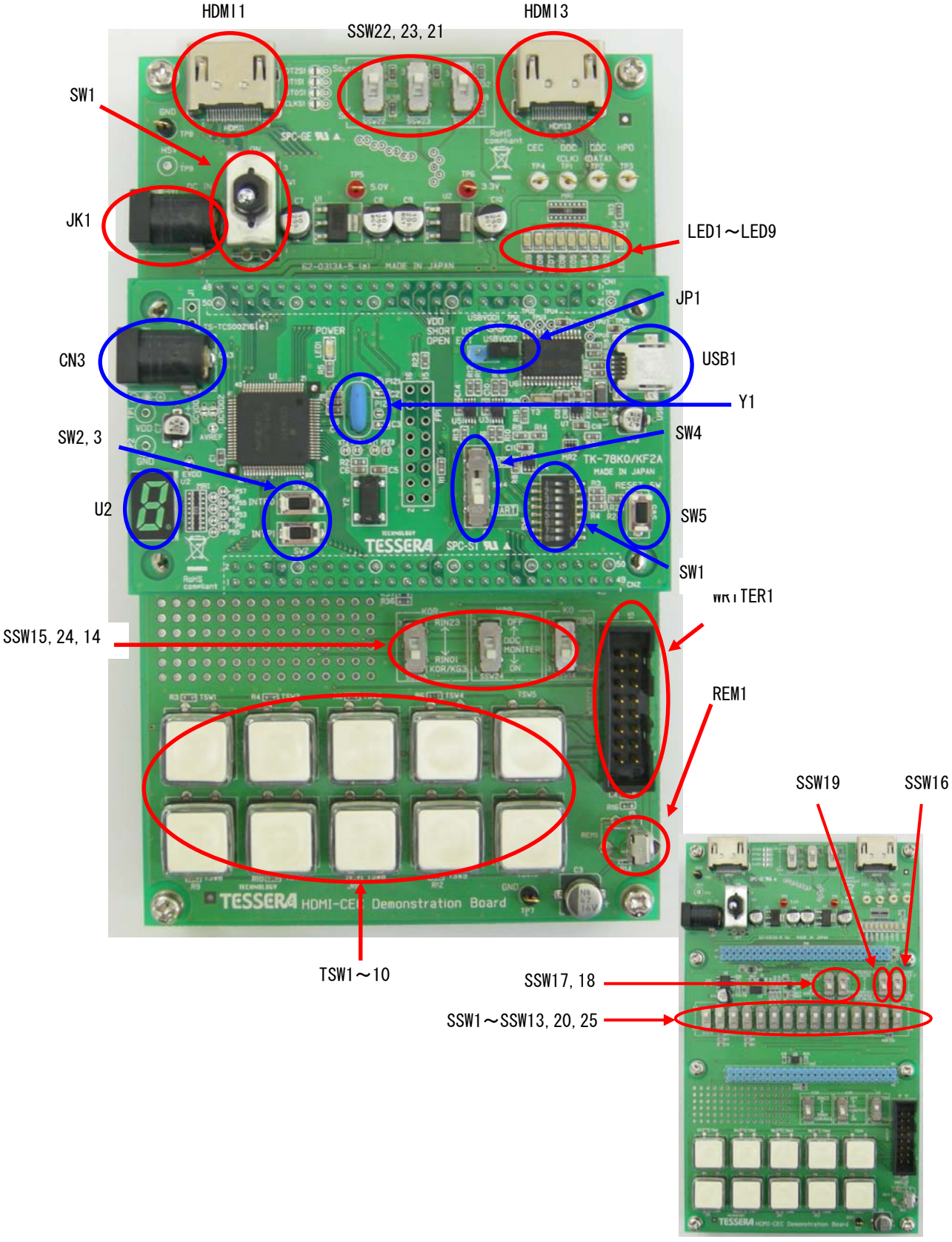
・Following connectors are mounted.



1.3 Hardware Specifications

CPU	uPD78F0547DA (78K0/KF2)
Clock	Main system clock: 10MHz, Sub system clock: 32.768KHz
Interface	HDMI connector 2ch MINICUBE2 connector (16pin) USB (mini B connector)
Operating Voltage	3.3V (DC 12V input)

1.4 Layout of Hardware Functions



1.5 Hardware Functions

1.5.1 HDMI-CEC Demonstration Board

- HDMI1, HDMI3
  They are HDMI connectors. All the pins of HDMI1 and HDMI3 are connected.

- JK1
  JK1 is a connector for AC adapter. Connect the bundled AC adapter here.

- SW1
  SW1 is the power switch. Power on when you shift it to ON and then LED1 is lighted.

- LED1
  LED1 is Power LED. It is lighted when the power is on.

- LED2-LED9
  These are LED that are connected to P7 of CPU. They are lighted when they output Low.

- SSW1-SSW13, 20, 25
  All those 15 switches must be set to "78K0" side. (default setting)

- SSW14
  Set this when you connect MINICUBE2 to WRITE1 connector.
  【DBG】 To start the debugger ID78K0-QB
  【PROG】 To start the flash programmer QB-Programmer
  This setting does not affect anything when you do not connect MINICUBE2.

- SSW15-SSW18, 24
  Not is use.

- SSW19
  This must be set to "K0&K0R/KG3&K0R/KG3-C CECIN/OUT" side. (default setting)

- SSW21-SSW23
  These are extended switched for HPD and DDC. Switch them with "Source" or "Sink".
  > Set it to "Source" when you use as Monitor mode.
  > Set it to "Sink" when you use as Pseudo TV mode.
  > Set it to "Source" when you use as Pseudo DVR mode.

- TSW1-TSW10

  These are use as inputs for general purpose switches. They are connected to A/D conversion ports.

  By pressing the switches, following voltages are input.

Switch	CPU Pin	CPU Input Voltage
TSW1	ANI2	0V
TSW2	ANI2	0.51V
TSW3	ANI2	0.96V
TSW4	ANI2	1.41V
TSW5	ANI2	1.88V

Switch	CPU Pin	CPU Input Voltage
TSW6	ANI3	0V
TSW7	ANI3	0.51V
TSW8	ANI3	0.96V
TSW9	ANI3	1.41V
TSW10	ANI3	1.88V

- WRITER1

  This is MINICUBE2 connector.

- REM1

  This is the light receiving element for infrared remote control function.

1.5.2 TK-78K0/KF2A Board

In this section, the hardware functions are briefly described. For details, refer to "TK-78K0/KF2A User's Manual".

- CN3

  This is a connector for AC adapter, but not in use. Use the JK1 AC adapter connector on HDMI-CEC Demonstration Board.

- SW2

  SW2 is a push-switch that is connected to P30. However, it cannot be used as it is connected to infrared remote control function. Do not touch when application is running.

- SW3

  SW3 is a push-switch that is connected to P120. However, it cannot be used as it is connected to infrared CEC control function. Do not touch when application is running.

- U2

  This is 7segLED. U2 is connected to P5.

- JP1

  JP1 sets the CPU power selection. Set this as open. (default setting)

- USB1

  This is a USB connector. Use bundled USB cable.

- SW1-1-SW1-5, SW4

  These are used as setting the operation mode.

Switch		MINICUBE2 is in Use		Bundled with TK-78K0/KF2A	
		ID78K0-QB is in Use CEC Viewer is in Use (default setting)	QB-Programmer is in Use	Flash Programmer WriteEZ5 is in Use	Debugger ID78K0-QB is in Use
SW1	1	OFF	OFF	ON	ON
	2	OFF	OFF	ON	ON
	3	OFF	OFF	ON	ON
	4	OFF	OFF	OFF	ON
	5	OFF	OFF	OFF	OFF
SW4		UART	Center	UART	OCD

※ To use the debugger ID78K0-QB(MINICUBE2)

- Set SSW14 to【DBG】
- Connect 78K0-OCD board that is bundled with MINICUBE2
- Set the switches for MINICUBE2 to "M2" and "T"

※ To use the flash programmer QB-Programmer

- Set SSW14 to【PROG】
- Disconnect 78K0-OCD board that is bundled with MINICUBE2
- Set the switches for MINICUBE2 to "M2" and "T"

- Set QB-Programmer settings as "Port：UART-Ext-OSC" and "Frequency：10.00"

- SW1-6 – SW1-8

  These are connected to P45, 46, 47 of CPU.

- SW5

  This is the CPU reset switch.

- Y1

  This is the CPU operation clock. Do not change this from default setting, 10MHz. The sample program will not work if it is changed.

1.6 Pin Function List

CN1	Pin Name	Used For
1	AVREF	
2	GND	
3	P33	
4	P16	Connect to Over Current(+5V)
5	VDD	
6	P130	
7	NC	
8	FLMD0	Connect to WRITE1 Connector(16Pin)
9	VDD	3.3V
10	(+12V)	
11	GND	GND
12	(+12V)	
13	VDD	3.3V
14	RESET	Connect to WRITE1 Connector(16Pin)
15	VDD	3.3V
16	(+12V)	
17	P124	
18	P30	Connect to Remote Control Module
19	P31	Connect to WRITE1 Connector(16Pin)
20	P32	Connect to WRITE1 Connector(16Pin)
21	P141	
22	P11	
23	P12	
24	P10	
25	P13	Connect to WRITE1 Connector(16Pin)
26	P14	Connect to WRITE1 Connector(16Pin)
27	P123	
28	P15	
29	P06	
30	P140	CEC-OUT Output
31	P60	DDC(CLK)
32	P61	DDC(DATA)
33	GND	GND
34	EVDD	
35	P62	HPD
36	P63	
37	P70	LED2
38	P71	LED3
39	P72	LED4
40	P73	LED5
41	P74	LED6
42	P75	LED7
43	P76	LED8
44	P77	LED9
45	P121	
46	P122	Connect to WRITE1 Connector(16Pin)
47	P142	
48	P143	
49	P144	
50	P145	

CN2	Pin Name	Used For
1	P00	
2	P01	
3	P02	
4	P03	
5	P04	
6	P05	
7	P17	
8	P120	CEC-IN input
9	P50	7segLED
10	P51	7segLED
11	P52	7segLED
12	P53	7segLED
13	P54	7segLED
14	P55	7segLED
15	P56	7segLED
16	P57	7segLED
17	NC	
18	NC	
19	GND	GND
20	EVDD	
21	P40	
22	P41	
23	P42	
24	P43	
25	P44	
26	P45	DipSW(SW1-6)
27	P46	DipSW(SW1-7)
28	P47	DipSW(SW1-8)
29	NC	
30	NC	
31	NC	
32	NC	
33	NC	
34	NC	
35	NC	
36	NC	
37	P64	
38	P65	
39	P66	
40	P67	
41	NC	
42	NC	
43	P27	
44	P26	
45	P25	
46	P24	
47	P23	KEY input(KEY6～10)
48	P22	KEY input(KEY1～5)
49	P21	
50	P20	

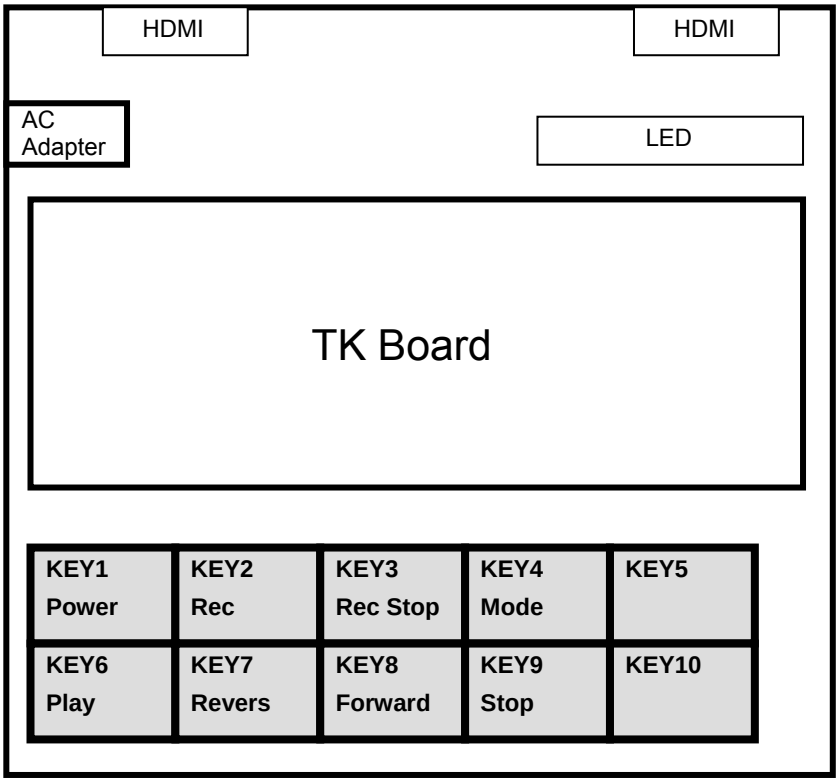
1.7 Circuit Diagram

Please refer to product version CD.

Please refer to product version CD.

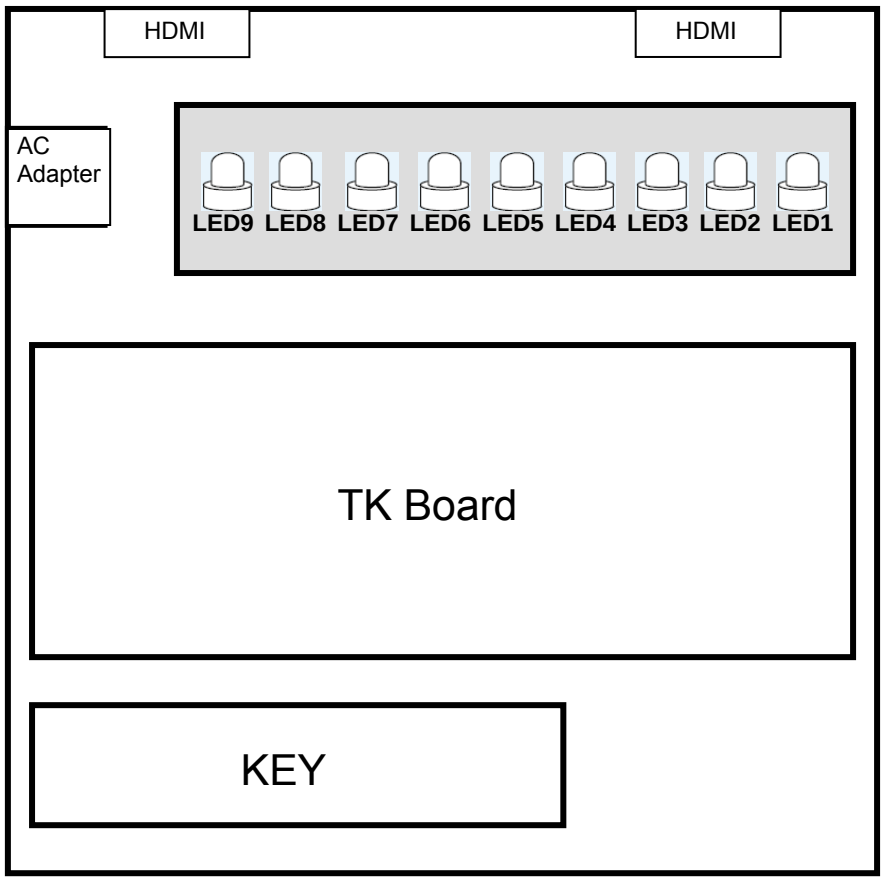
2. Settings for Sample Demonstration Program

2.1 KEY Settings



KEY	Used For
KEY1	Power
KEY2	Record
KEY3	Record Stop
KEY4	Mode Change (Monitor Mode at startup) Push to change the mode, "Pseudo TV"(LED9 light), "Pseudo DVR"(LED8 light), "Pseudo TV"(LED9 blinking), "Pseudo DVR"(LED8 blinking), "Monitor". Please evaluate it by the combination in blinking in lighting when evaluating it with the board.
KEY5	(Not in use)
KEY6	Play
KEY7	Rewind
KEY8	Fast-forward
KEY9	Stop
KEY10	Select Remote Controller Display（Remote Controller Code / Key Name）

2.2 LED Settings



LED	Used For
LED1(green)	Lighted when the board power is on.
LED2(red)	Pseudo device power
LED3(red)	Playing
LED4(red)	Fast-forwarding
LED5(red)	Reversing
LED6(red)	Recording
LED7(red)	
LED8(red)	Pseudo DVR mode
LED9(red)	Pseudo TV mode
LED Scroll	Monitor mode

3. GUI

In this chapter, GUI to control CEC of HDMI from PC (CEC Viewer) is described.

- The sample program (78K0_Kx2.hex) is pre-installed on the TK-78K0/KF2A.
  If you wrote other programs on the system, you can write the sample program (78K0_Kx2.hex) again by using following tools.
  - Flash memory programmer "WruteEZ5" that you can find in bundled CD-ROM.
  - Flash memory programmer for MINICUBE2 "QB-Programmer" or debugger "ID78K0-QB".
- This sample program works only if 10MHz oscillator is mounted on Y1 socket of TK-78K0/KF2A board.
- The remote control receiving function of this sample program (78K0_Kx2.hex) supports only NEC format.
- CEC Viewer works with Microsoft Excel. (operation check has been done on Excel 2000 and Excel 2003)

3.1 CEC Viewer Functions

CEC Viewer has following functions.

- Monitor sending/receiving CEC data
- Send specific commands from user input
- Pre-set command data, 20 KEY
- Output log data with Excel format
- Reproducing function by loading log data with Excel format

3.2 CEC Viewer Files

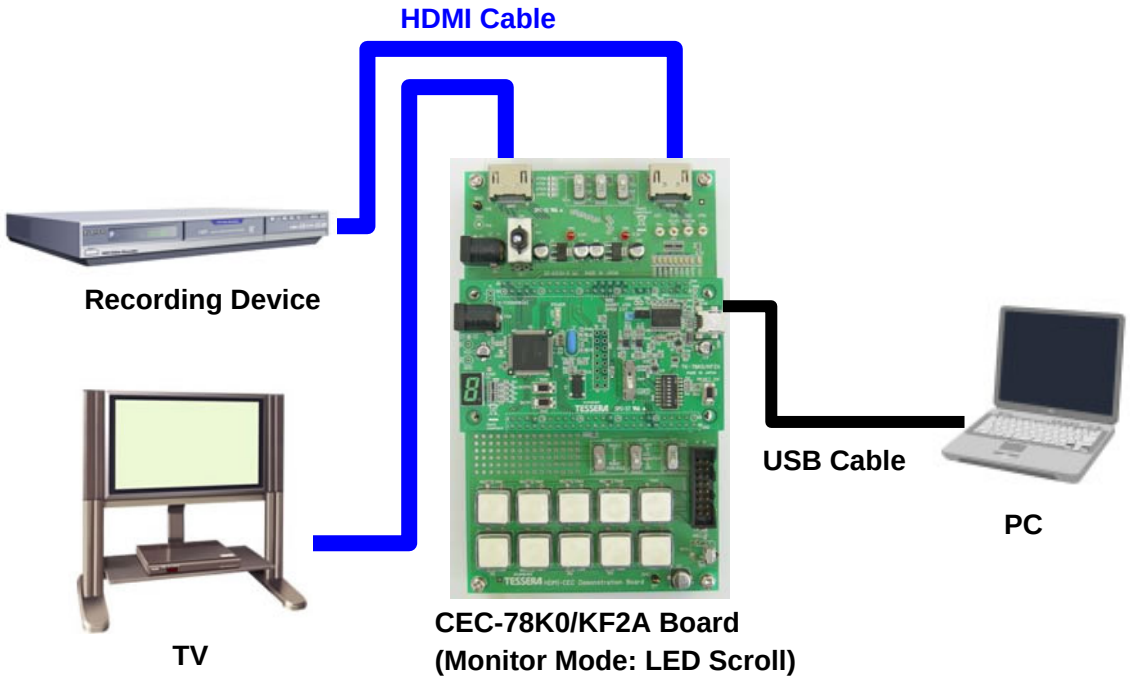
File	Description
CECViewer.exe	Start CEC Viewer by executing this file.
command.xls	CEC command (Opcode) data file. With using this file, you can add new Opcode. Since the program retrieves the command data from this file, do not close this file while CEC Viewer is running.
cecviewer.ini	Pre-set key data that is registered with GUI is stored in this file.

3.3 Connection Example

Connection examples of the board for using CEC Viewer are described.

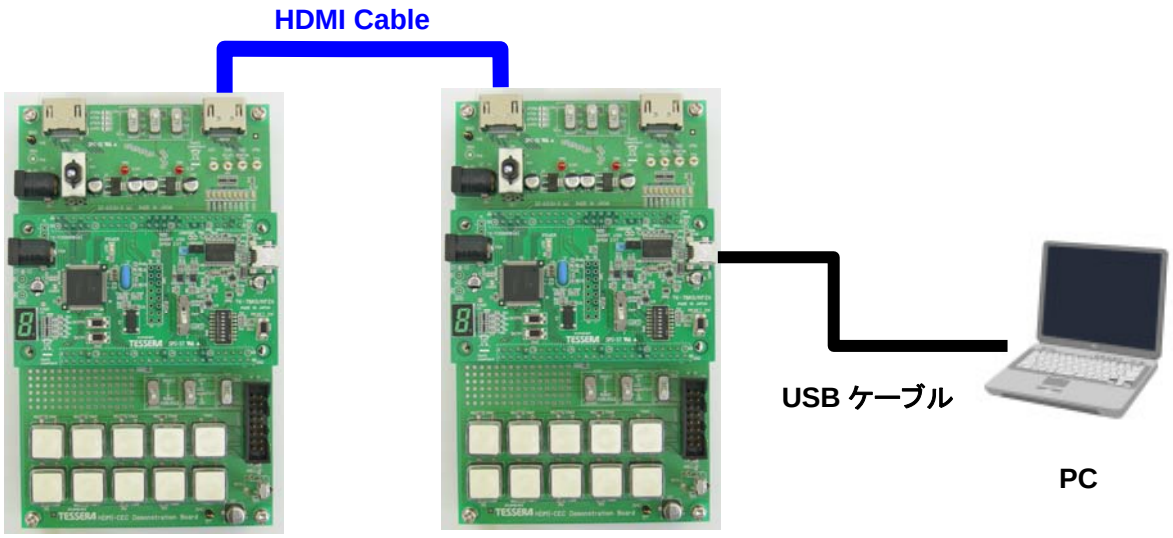
3.3.1 Example 1: Monitor Mode

You can monitor the data communication between devices by connecting the devices through the board. Following figure shows the connection example to monitor the communication between TV and recording device.



3.3.2 Example 2: Pseudo DVR Mode / Pseudo TV Mode

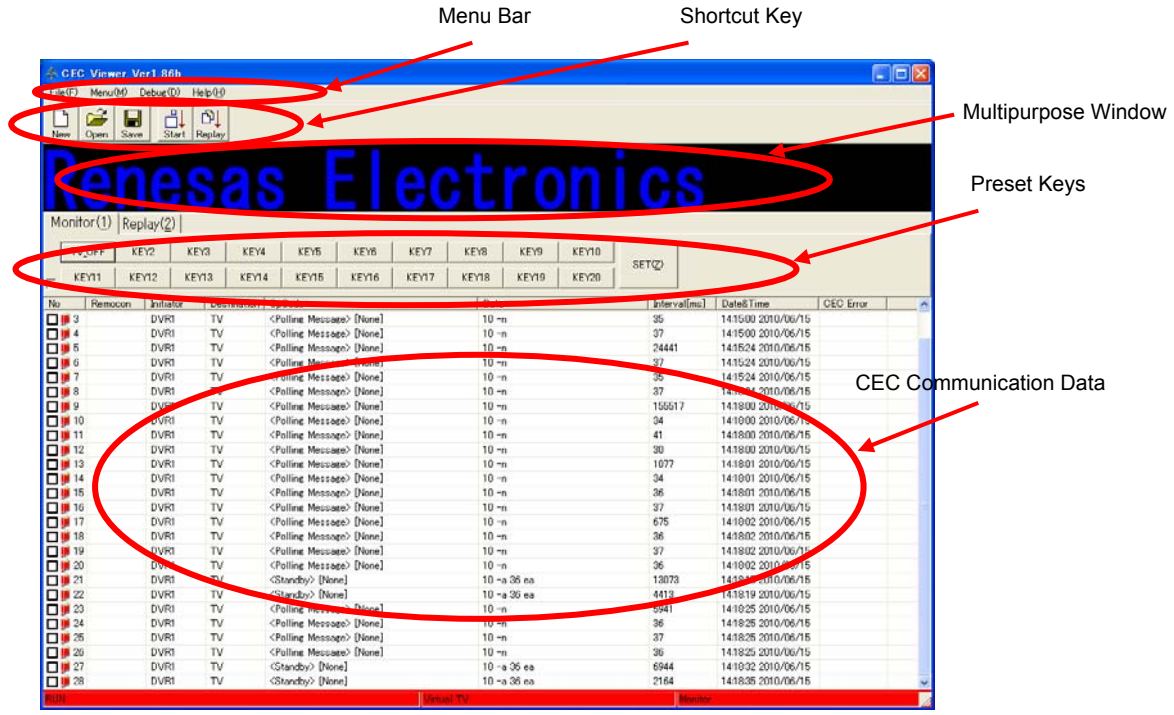
To operate the board as a pseudo DVR or TV, you need to connect the board to board together. You can reproduce functions, such as turning on the power of pseudo TV automatically by turning on the power of pseudo DVR, and turning off the power of pseudo DVR automatically by turning off the power of pseudo TV.



3.4 CEC Viewer Window

In this section, CEC Viewer window is explained.

3.4.1 Window Overview

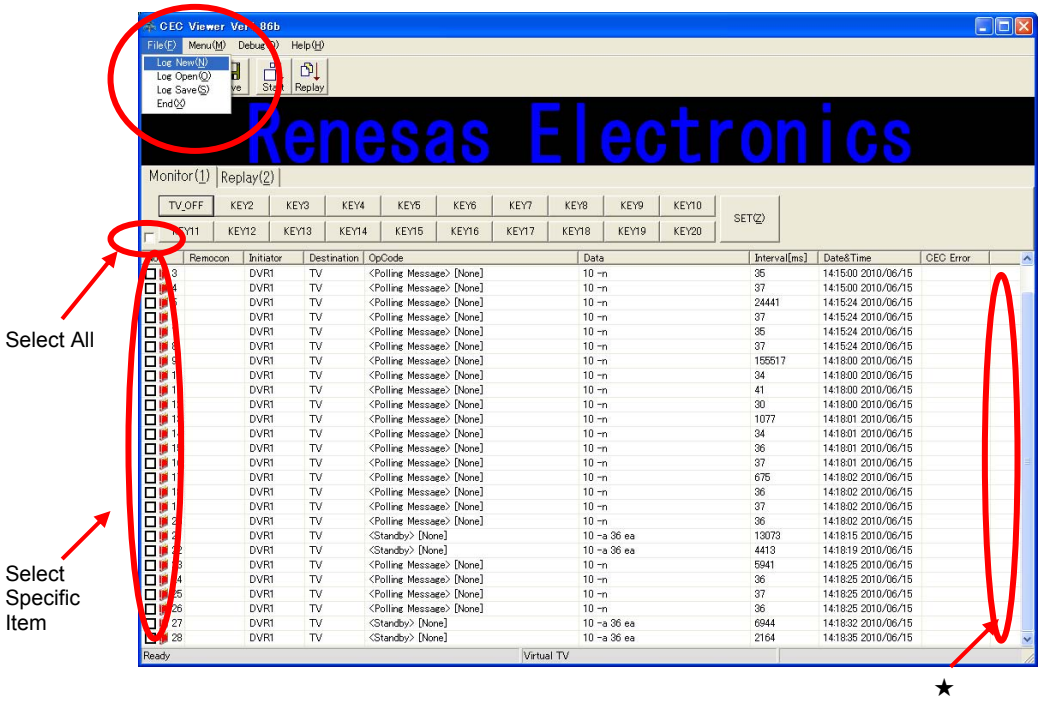


CEC Communication Data

No	Communication orders
Remocon	Remote controller code or remote controller code name
Initiator	Initiator Address name *
Destination	Destination Address name *
Opcode	Opcode name and its operand structure *
Data	Frame communication result It displays data on odd byte and EOM+ACK on even byte. It displays "e" when it has EOM, otherwise "-". It displays "a" when it has ACK, otherwise "n".
Interval[ms]	Interval time between CEC communication (or DDC communication offered as optional function)
Date & Time	Date and time when it gets the frame data

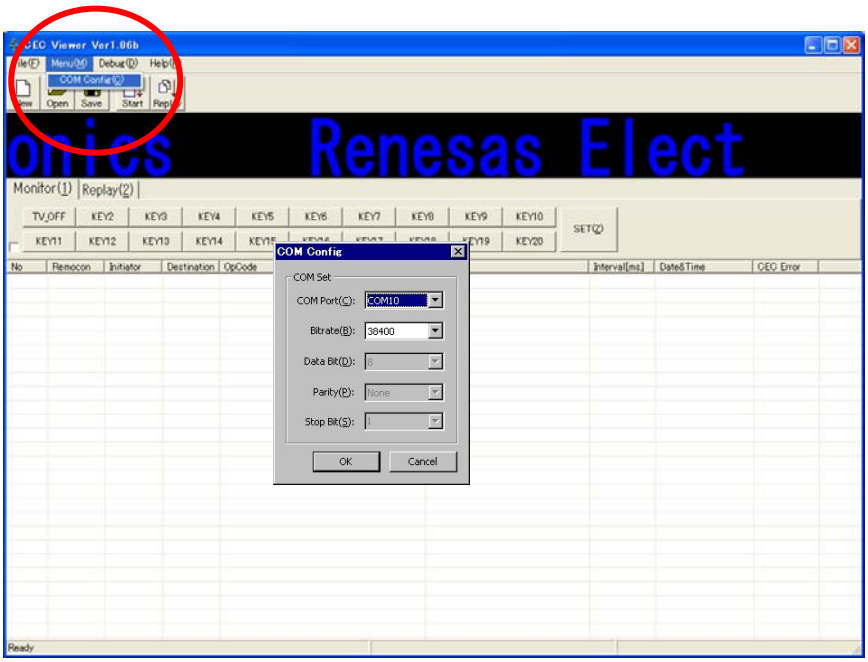
* It gets the information from "command.xls". If you close this file, it will not be able to display the logical address and Opcode.

3.4.2 "File" Menu



Log New	Clear log data displaying. It is the same as the shortcut key  .
Log Open	This does not work with current version of CEC Viewer. It is the same as the shortcut key  .
Log Save	Save the current log data with Excel format. It is the same as the shortcut key  . *You can select specific rows by checking the check box. *You can select all rows by checking the check box above "No". Please select * on the No row again after clicking the area of * once when all not selecting it.
End	Close CEC Viewer.

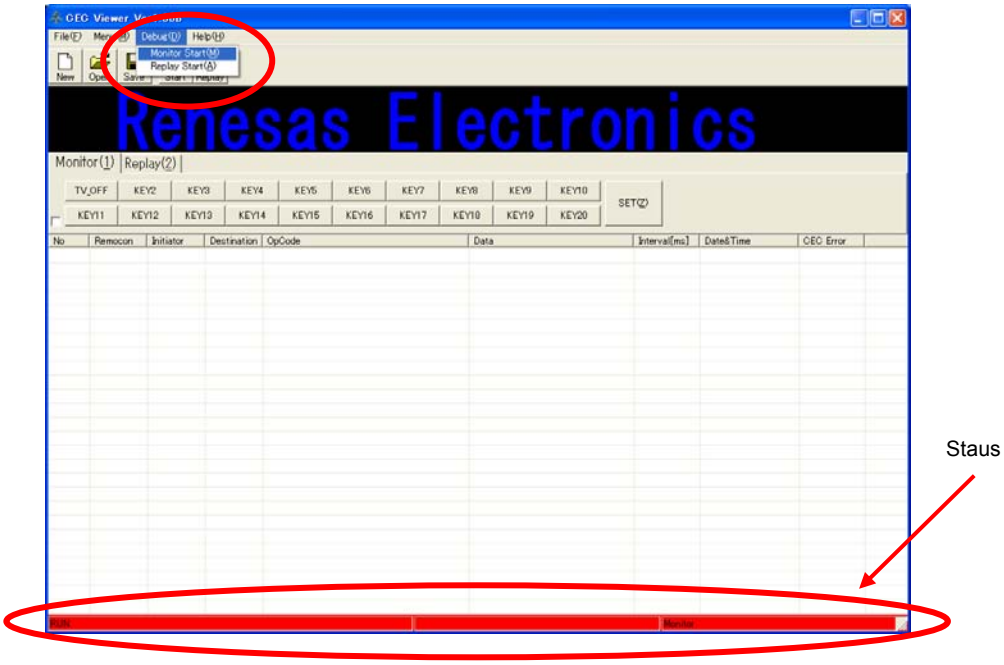
3.4.3 "Menu" Menu



COM Config (Settings for UART communication)

COM Port	Select the COM port that is assigned for TK-78K0/KF2A. (COM Port 1-19)
Bit rate	Select from 9600, 14400, 19200, 38400 (default), 57600, 115200, 128000. (Select the default setting, 38400)
Data Bit	Fixed with 8 bit.
Parity	Fixed with None.
Stop Bit	Fixed with 1 bit.

3.4.4 "Debug" Menu



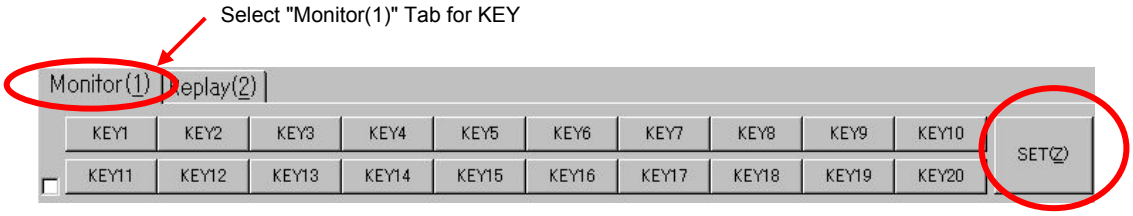
Monitor Start	Start monitoring CEC. When it starts monitoring, the bottom of the window becomes red color to show RUN status. Communication results are displayed only when the status bar shows RUN. Select this menu when you wish to monitor communication between devices or to send commands from CEC Viewer. To stop monitoring, select this menu again. It toggles like RUN, STOP, and RUN. It is the same as the shortcut key  .
Replay Start	Replay the CEC communication based on log data saved with Excel format. Set replay tag properly and execute. *For detail about replay function, refer to "3.6.4 Replay Function" It is the same as the shortcut key  .

3.5 Control From CEC Viewer

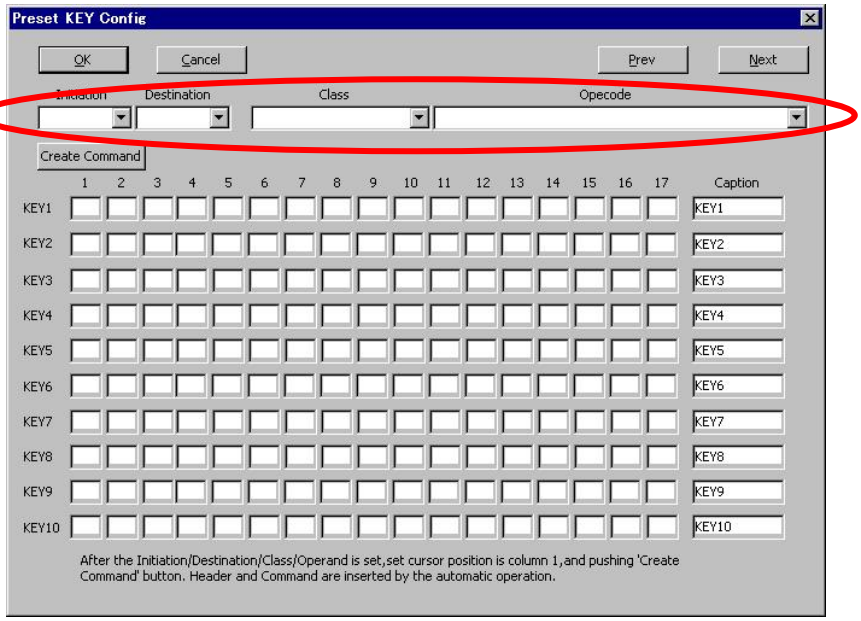
CEC data can be sent from CEC Viewer.

3.5.1 "Monitor" Tab

It sends user defined CEC data from preset keys.



Following "Preset KEY Config" screen is displayed by clicking "SET" key.

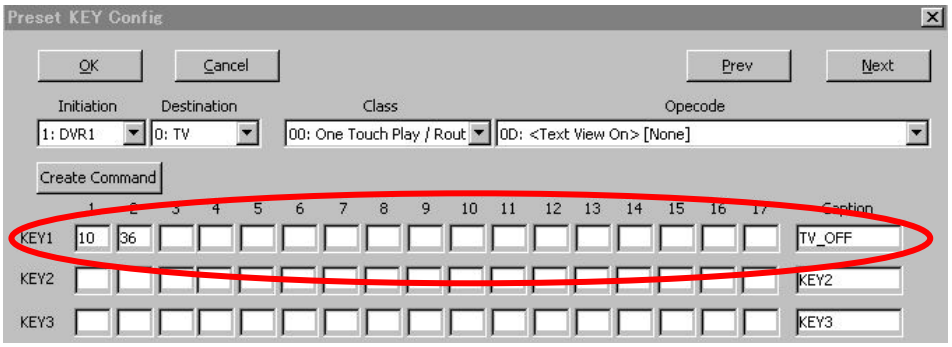


<KEY Setting>

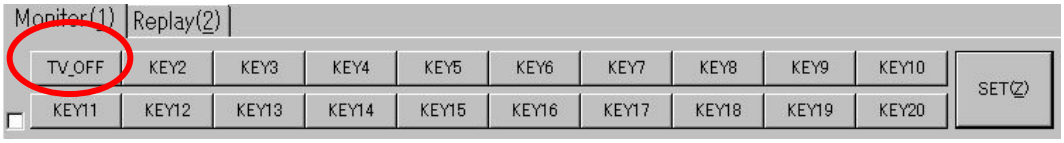
Select Header and Opcode for the sending CEC data at combo box shown above red area. (You can also enter it at the KEY input area directly.)

1. Select sender's initiator address at "Initiation".
2. Select receiver's destination address at "Destination".
3. Select the class of sending Opcode at "Class".
4. Select Opcode at "Opcode"
5. Move the cursor at the first byte of specific KEY, and click "Create Command" key. Header and Opcode will be automatically set.
6. Enter Operand for Opcode at the KEY input area directory as needed.

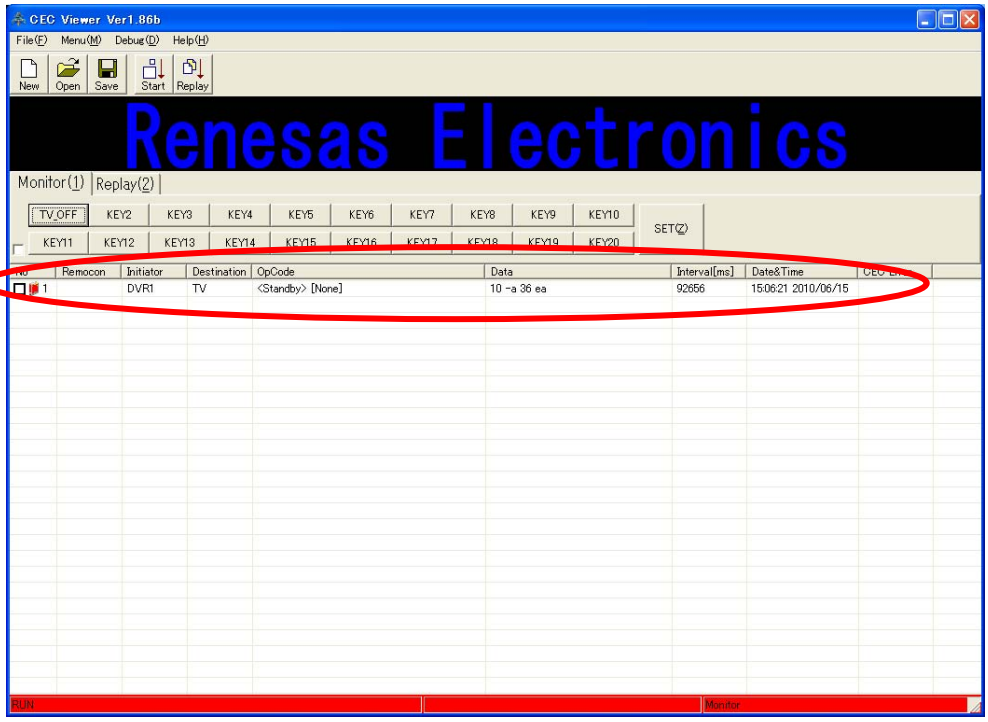
Also, captions of KEY on CEC Viewer can be changed.
Change the caption to "TV_OFF", then set the data [10] [36].



The caption of KEY1 is changed to "TV_OFF".



By clicking "TV_OFF" key, it outputs CEC data ([10][36]), then the log data is displayed.



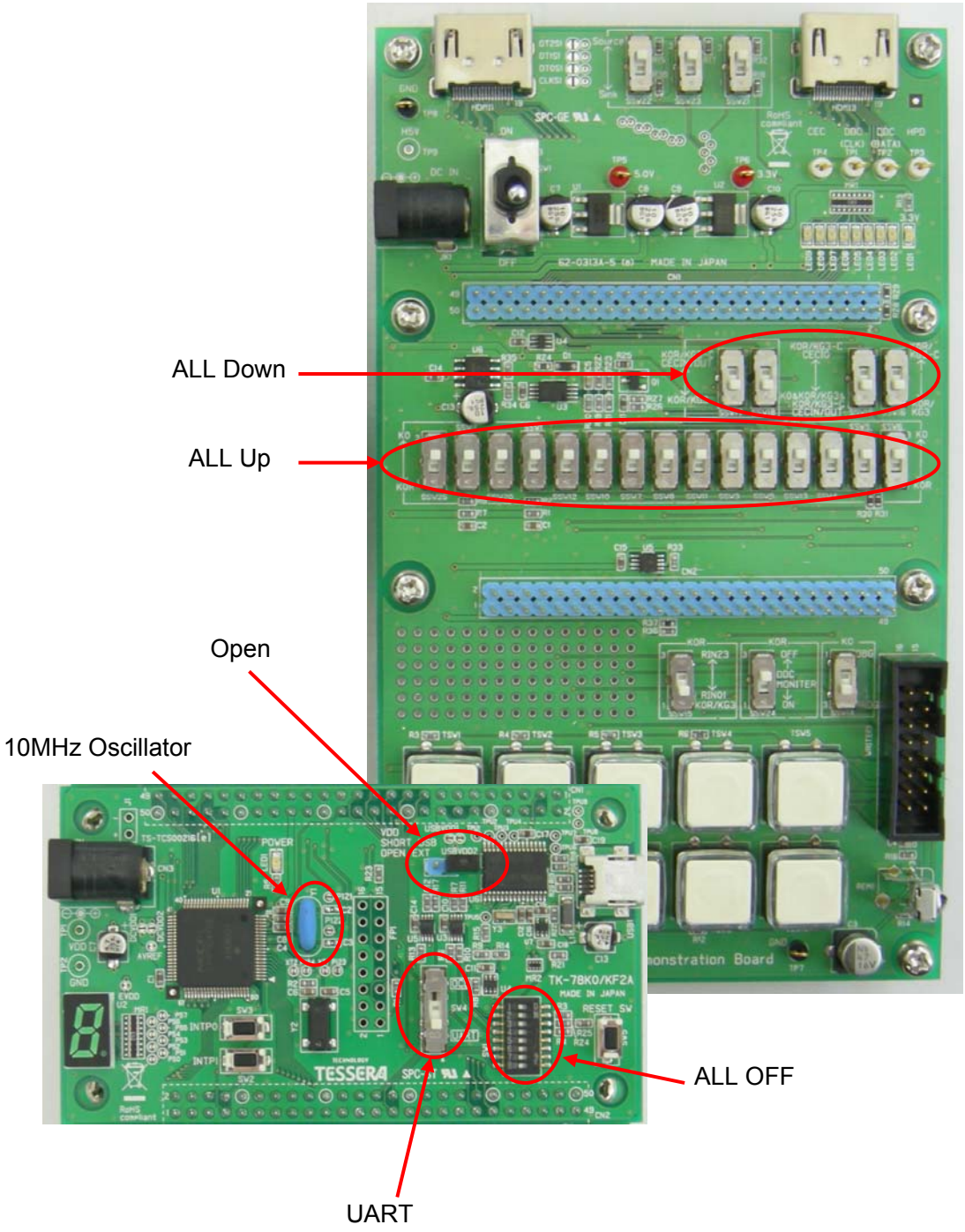
3.5.2 "Replay" Tab

It loads monitoring information, the board becomes a unit on the CEC, and then it replays the same CEC command communication.
For detail, refer to "3.6.4 Replay Function".

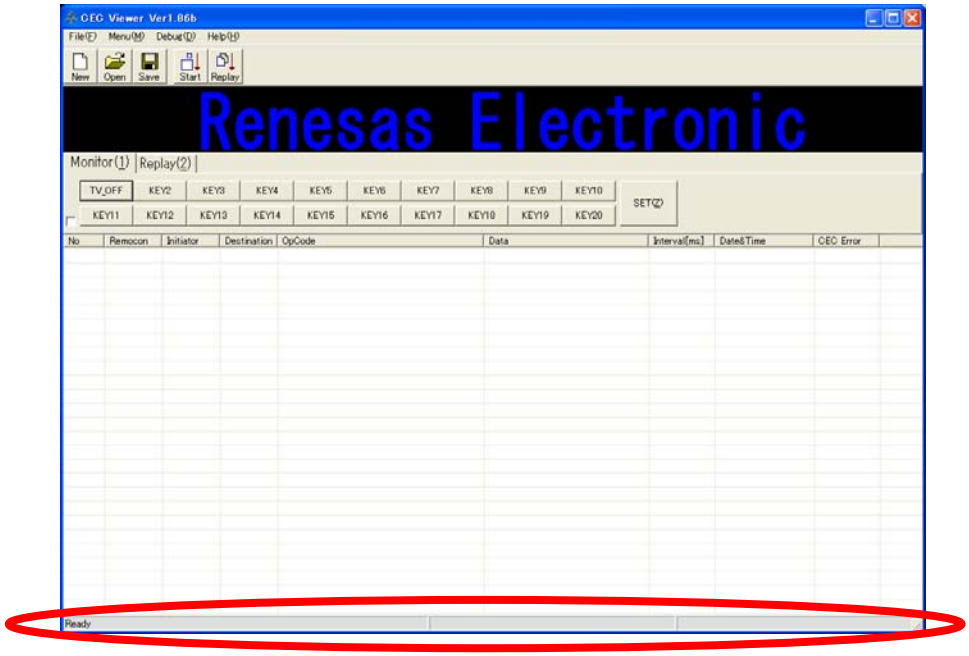
3.6 Specific Usages

3.6.1 Switch Settings

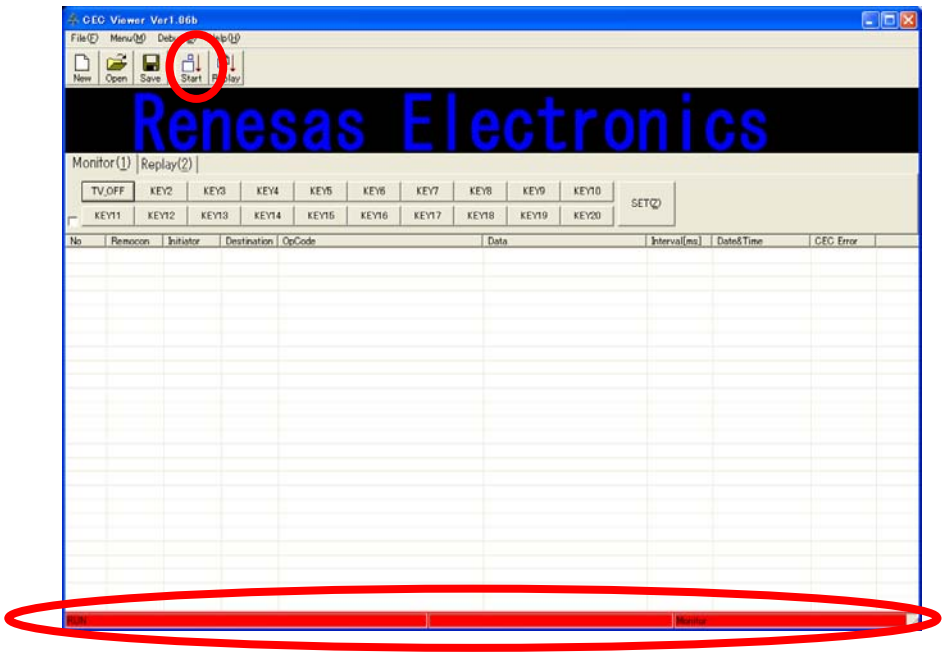
Set the switches as shown below.



3.6.2 Use As Monitor



When CEC Viewer is just started, the color of status bar is white to show "Ready". At this status, it does not display any CEC data.



Click "Start" button to start monitoring by CEC Viewer.
The status bar becomes red to show "Run" status.
With this status, CEC communication data between the boards will be displayed.
Click "Start" button again to stop monitoring ("Ready" status).

3.6.3 Pseudo Device Sample Program

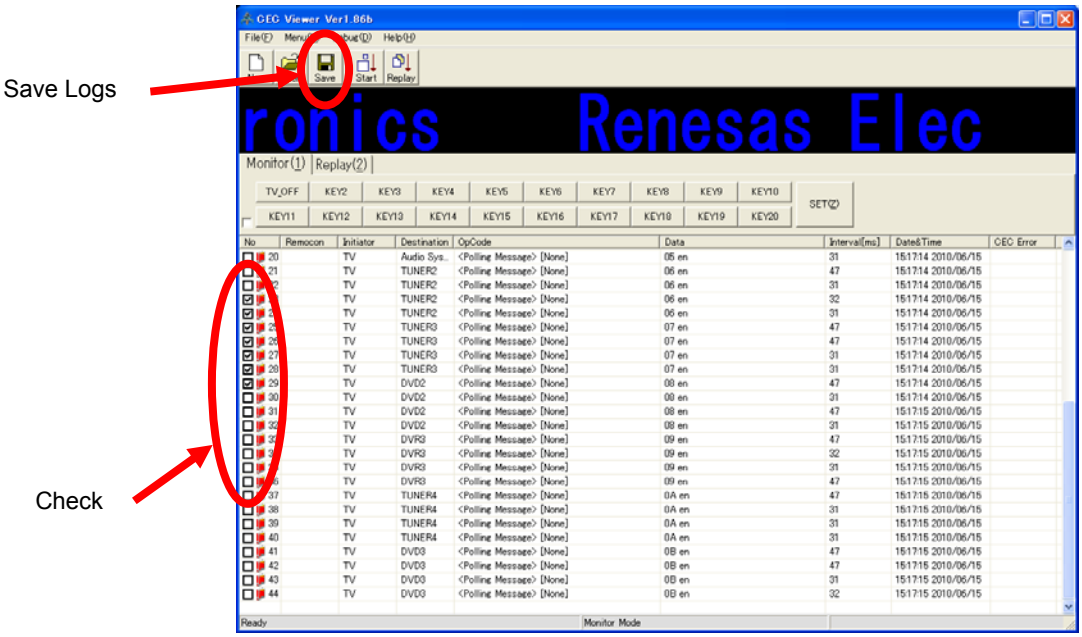
You just need to run CEC Viewer to use the Pseudo Device mode that is the same as Monitoring mode.
Click "TSW4(KEY4)" to select Pseudo Device (TV/DVR) mode. The multipurpose window displays the status of current pseudo device.

This is the example when you press power key with pseudo DVR mode.
The multipurpose window displays "Power ON" to show the pseudo DVR is turned up.

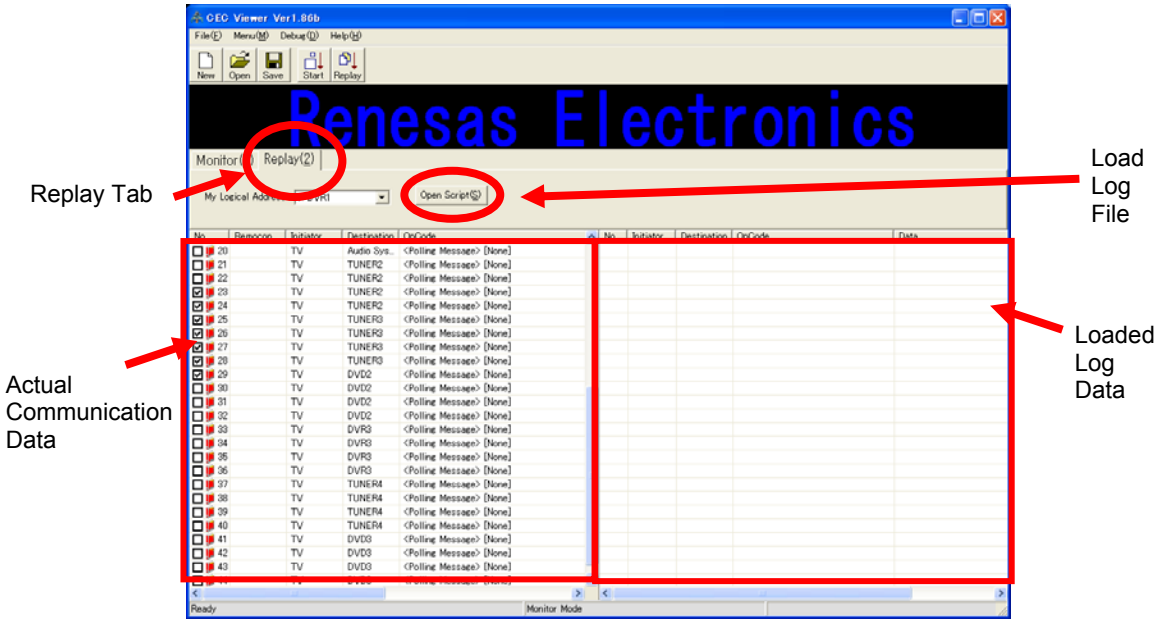
Mode	Multipurpose Window	Status
Pseudo TV Mode	Power ON	Power ON
	Power OFF	Power OFF
	HDMI Input Change	TV input is switched to HDMI input
Pseudo DVR Mode	Power ON	Power ON
	Power OFF	Power OFF
	PLAY	Playing
	STOP	Stopped
	FORWARD	Fast-forwarding
	REVERSE	Rewinding
	REC	Recording
	REC STOP	Recording Stop
	PLAY(Recording)	Playing While Recording
	STOP(Recording)	Stopped While Recording
	FORWARD(Recording)	Fast-forwarding While Recording
	REVERSE(Recording)	Rewinding While Recording

3.6.4 Replay Function

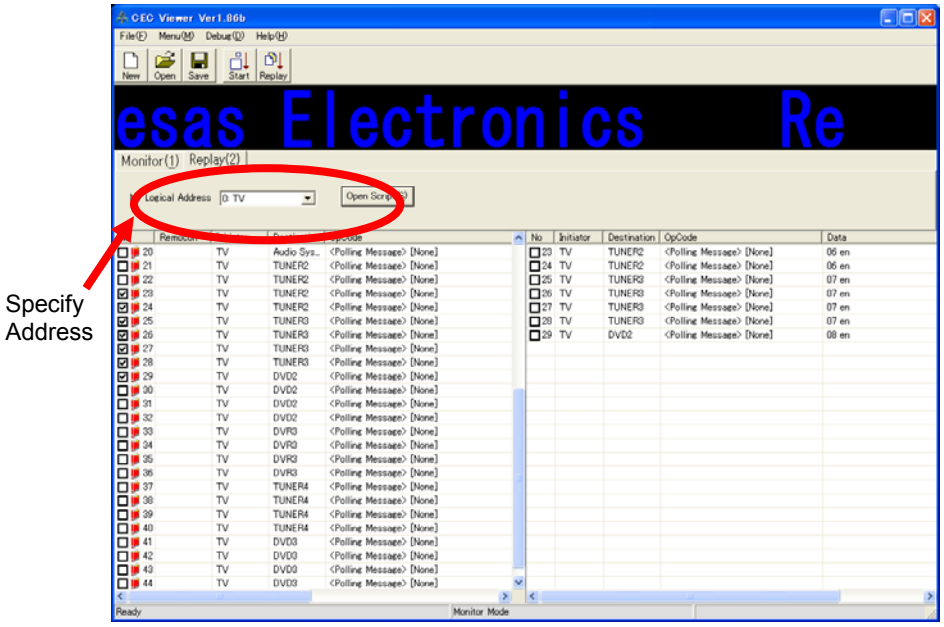
1. Monitor replaying communication. Operation mode should be monitor mode (LED is scroll status on the board).
2. Select the saving rows from monitoring CEC communication data and check the check boxes.
   Then, click "Save" button to save the data in a file。



3. Next, replay the saved CEC communication data. Click "Open Script" button on "Replay" tab and select the log file that you have just saved before.



4. Set the logical address to alternative address for the board. Specify the address at "My Logical Address".



5. The preparation for the replay process is completed. Now, you can start the replay by clicking "Replay" button.

   * The replay operation will be terminated when it received the data that is different from the log data. Use the replay function with the same environment as the one when you save the log data.

   <Example>

   When you replay the TV power operation, make sure the elapsed time after you turned off the TV power is the same as the time in the log file.