SAFETY PRECAUTIONS

GENERAL GUIDELINES

1. Always use the manufacturer's replacement safety components. The critical safety components marked with ▽ on the schematics diagrams should not be by other substitutes. Other substitute may create the electrical shock , fire or other hazards. Take attention to replace the spacers with the originals. Furthermore where a short circuit has occurred , replace those components that indicate evidence of overheating.

2. After servicing , see that all the protective devices such as insulation barriers, insulation papers, shields and isolation R-C combinations are correctly installed.

3. When the receiver is not being used for a long time of period of time , unplug the power cord of the Adaptor from the AC outlet.

Color TFT LCD Module is very sensitive both electrically and physically.Users, therefore, are requested to follow the "Guidance of handling color TFT LCD Module"on the followings.

1 - Be careful not to make scratch on the polarizer.

Surface of polarizer is soft and can be physically damaged easily.
Please do not touch, push or rub polarizer surface with materials over HB hardness.

2 - Keep clean the surface.

Please wear rubber glove when touch the surface of LCD screen. Please use soft and anti-static material as cleaner.

3 - Keep out of water.

Water on/in the LCD may cause electrical short or corrosion. Please wipe out dry or water carefully.

4 - Prevent swift Temperature & Humidity change.

Instantaneous temperature and/or humidity change can make dew or ice which cause nonconformance such as malfunction.

5 High temperature & high humidity reduce the life-time.

LCD is not proper to be used at high temperature and high humidity. Please keep specified temperature and humidity condition.

6 - Keep out of Corrosive Gas.

Corrosive gas effect the polarizer and the circuit chemically and cause defects accordingly.

7 - Electrostatic discharge can make Damage

There are electro-static sensitive components such as CMOS in LCD Module. Please earth human body when handle the LCD.In addition, please do not touch the interface connector pin with bare.

8 - Do not operate for a long time under the same pattern

Operating LCD for a long time under the same pattern can cause image persistence and can damage it. Please follow following guidance.
1. Turn the power off when do not use.
2. Change the pattern periodically.

Operation Manual of DVP-L4 Firmware Download through RS-232 Interface

Rev. 0.4

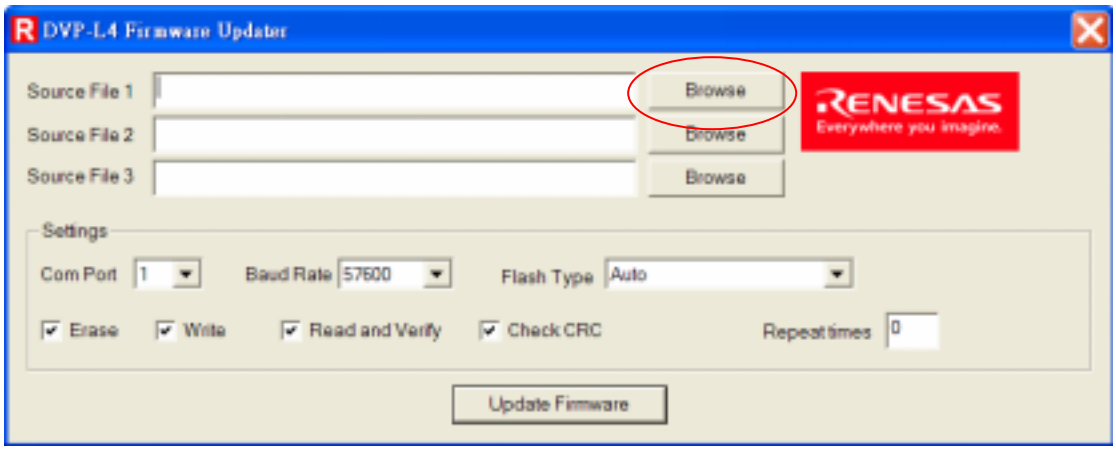
1. Purpose:

This Document explains the operation procedure of the Windows™

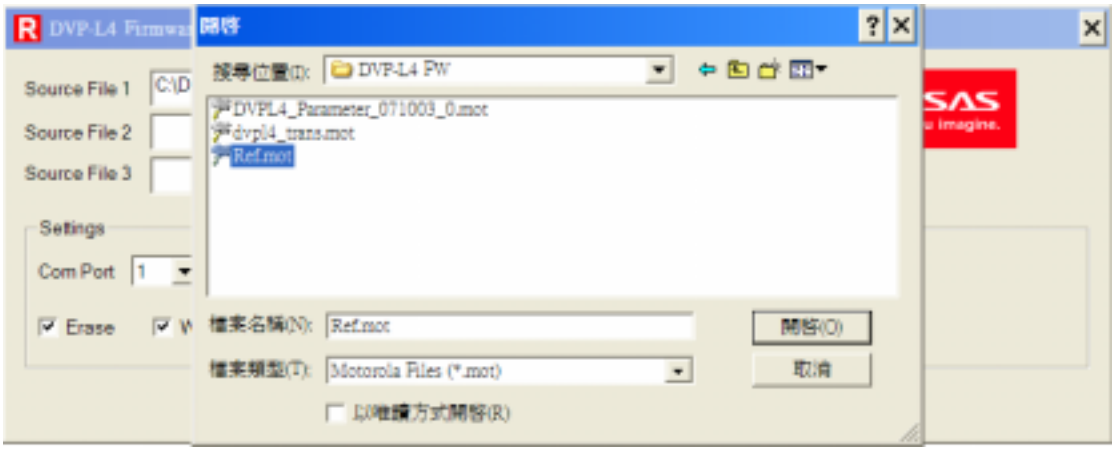
application program(AP) which downloads the DVP-L4 firmware to DVP-L4 system board through RS-232 interface. In addition, the command protocol between AP and DVP-L4 firmware is illustrated.

2. Operation Procedure of AP:

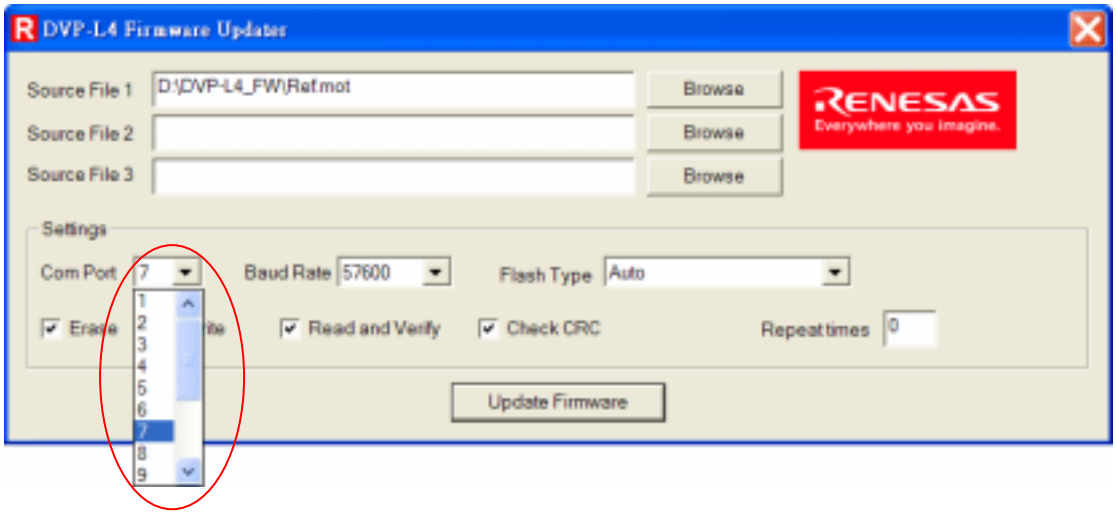
(1) Execute the file “DVP_L4_FW_DL.exe”. Then the following main dialog is shown.



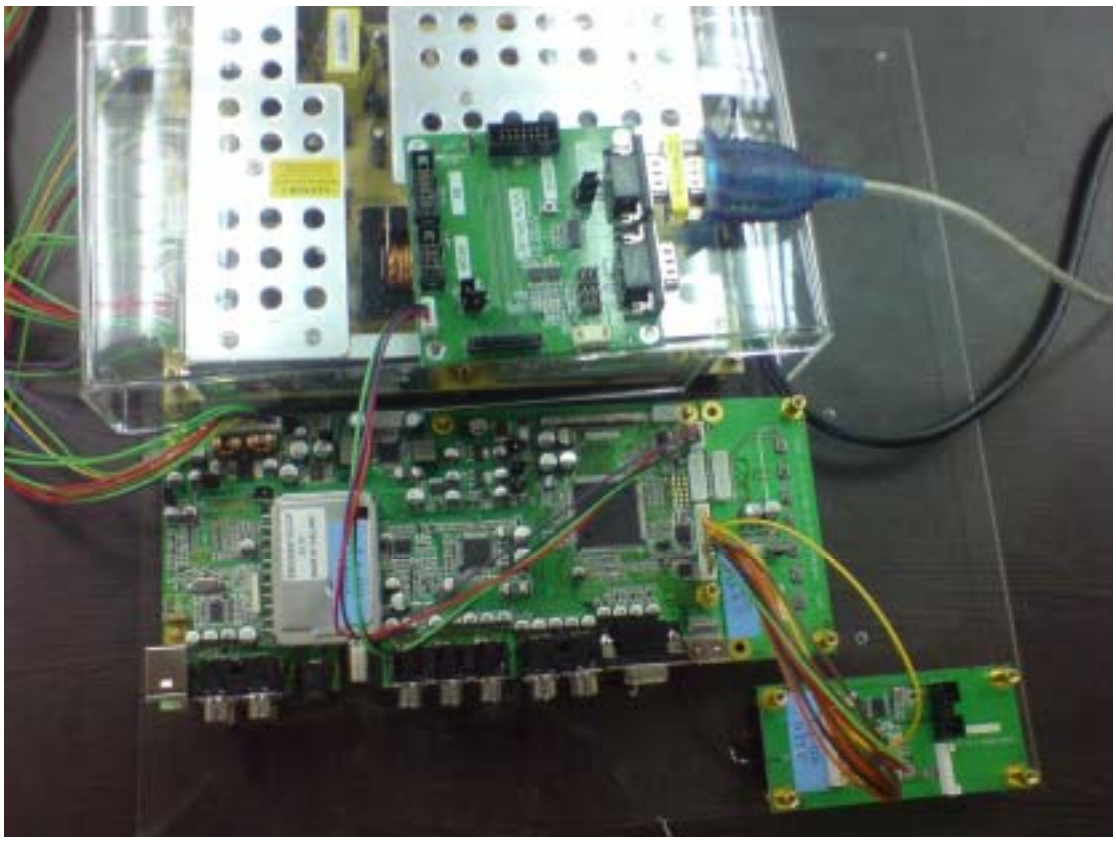
(2) Click the “Browse” button of Source File 1 to select the .mot file of DVP-L4 firmware. (e.g. the firmware filename is “Ref.mot”). Then double click the selected file or press the “Open” button.



(3) Choose the COM port as shown below:

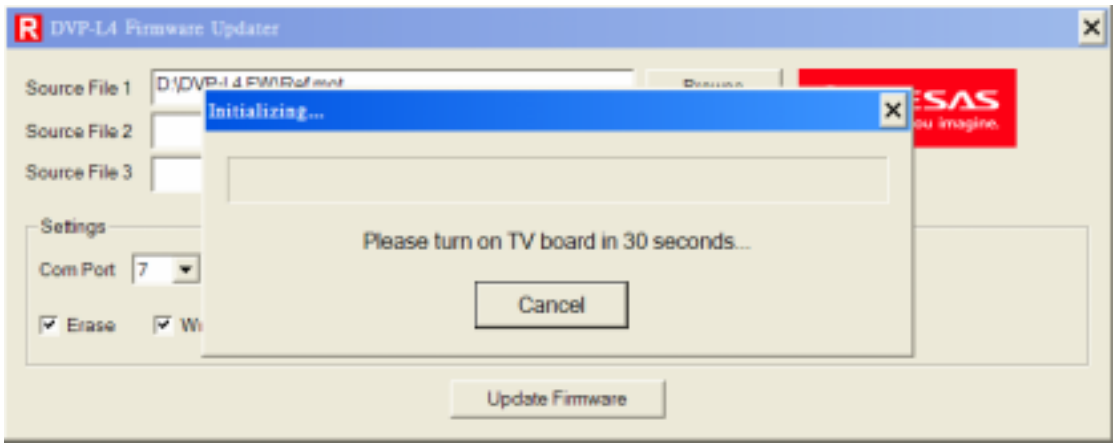


(4) Connect your selected COM port of PC to the terminal board via RS-232 cable as shown below.

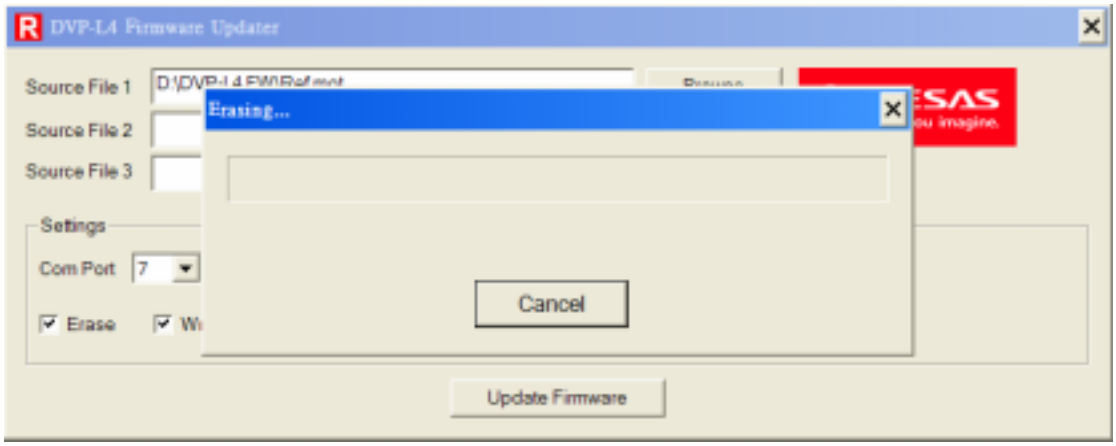


(5) Press the “Update Firmware” button and then a dialog will appear as

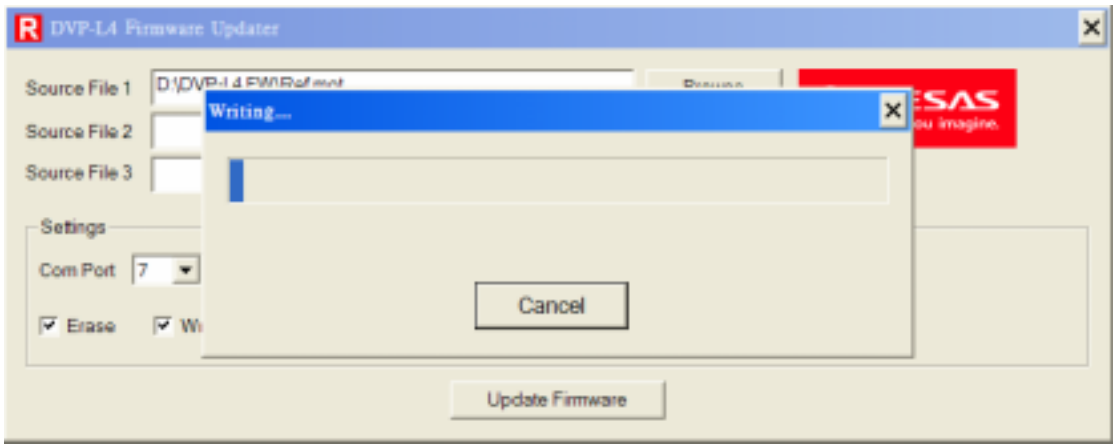
below. Please turn on the power of DVP-L4 system within 30 seconds.



(6) After power on, the title bar of the dialog will become “Erasing” soon.

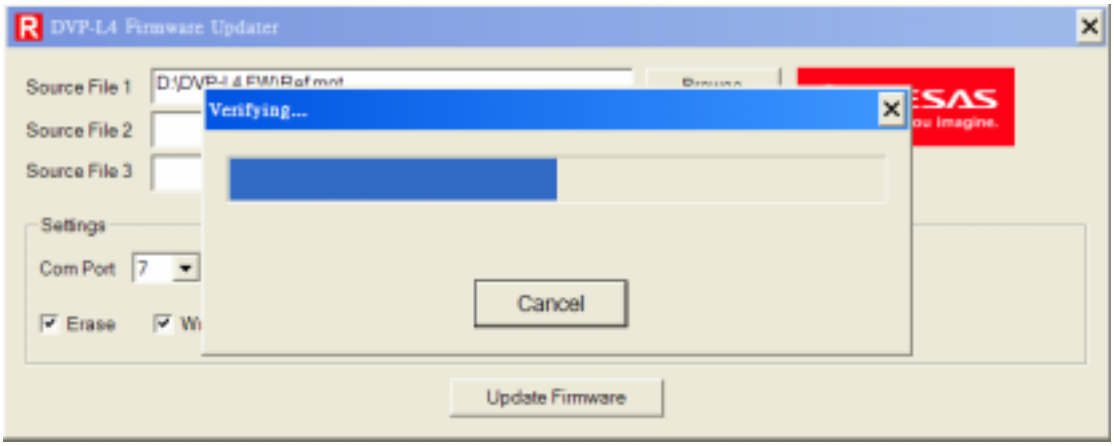


(7) After erasing is finished (about 5 second), the title bar of the dialog becomes “Writing” as below. The progress bar shows the percentage of progress.

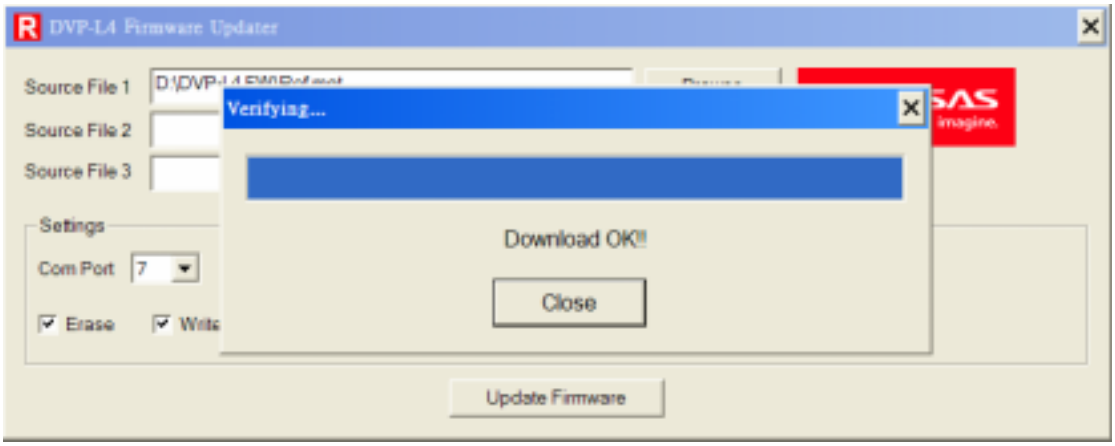


(8) After writing is finished, the title bar of the dialog becomes

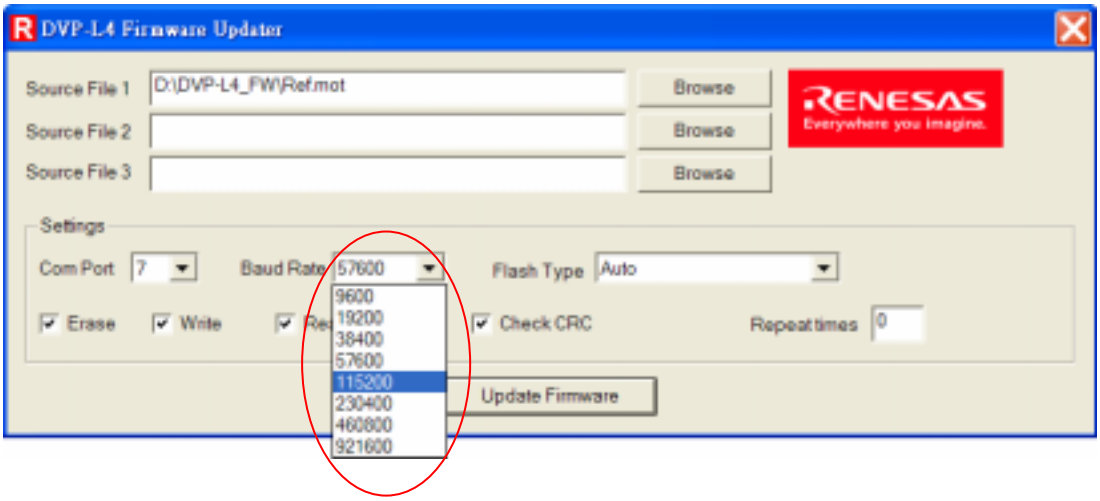
“Verifying” as below. The progress bar shows the percentage of progress.



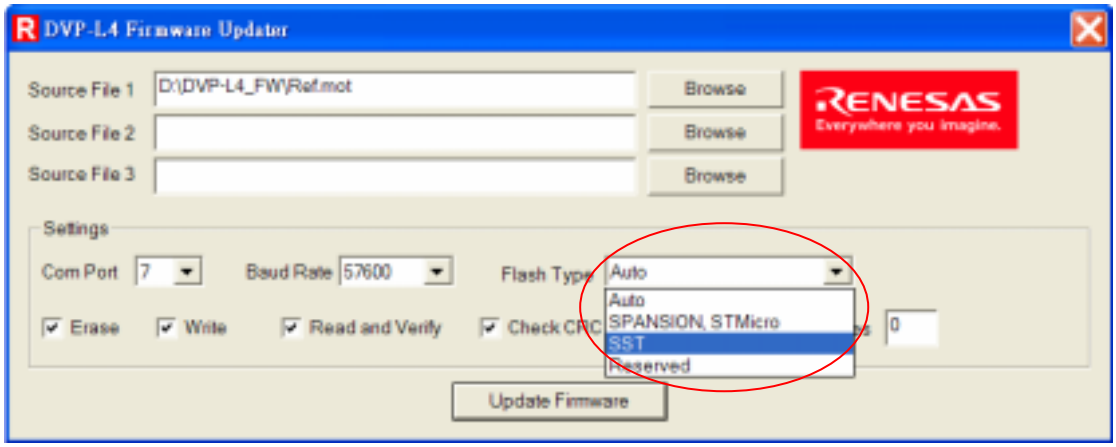
(9) After verifying is finished successfully, the dialog shows the message “Download OK!!” as below. Then press “Close” button to return to main dialog. And the download procedure is done.



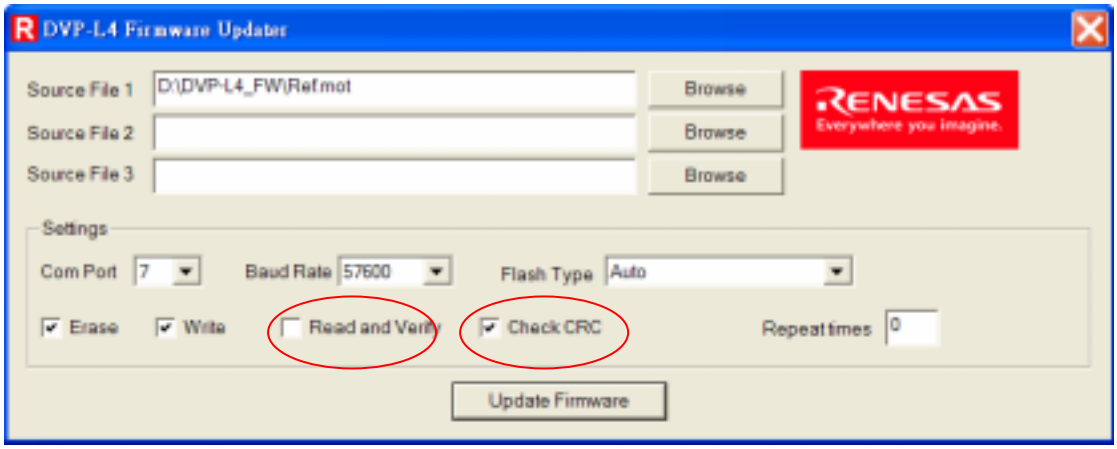
3. If your PC can support higher baud rate(115200bps~921600bps), or it cannot support default baud rate of 57600bps, change the baud rate as below. If you use USB-to-RS232 conversion cable, maybe you can select 230400bps to 921600bps. (It depends on the conversion cable)



4. Change flash ROM type:
Various flash ROM's can be selected automatically or manually.
SPANSION, STMicro and SST flash ROM are supported currently.
If auto detection fails, you may directly assign the flash ROM type. (e.g. SST)



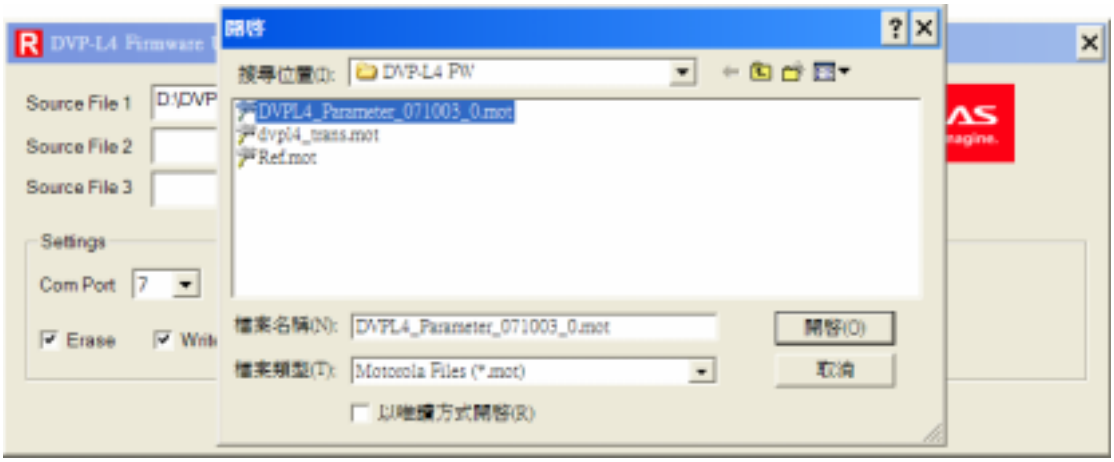
5. "Check CRC" vs. "Read an Verify":
If your platform is rather stable for firmware downloading, you may deselect the "Read and Verify" checkbox, but keep the "Check CRC" checkbox selected. If there is any error when writing data from AP to DVP-L4, the error message will pop up to inform the user.



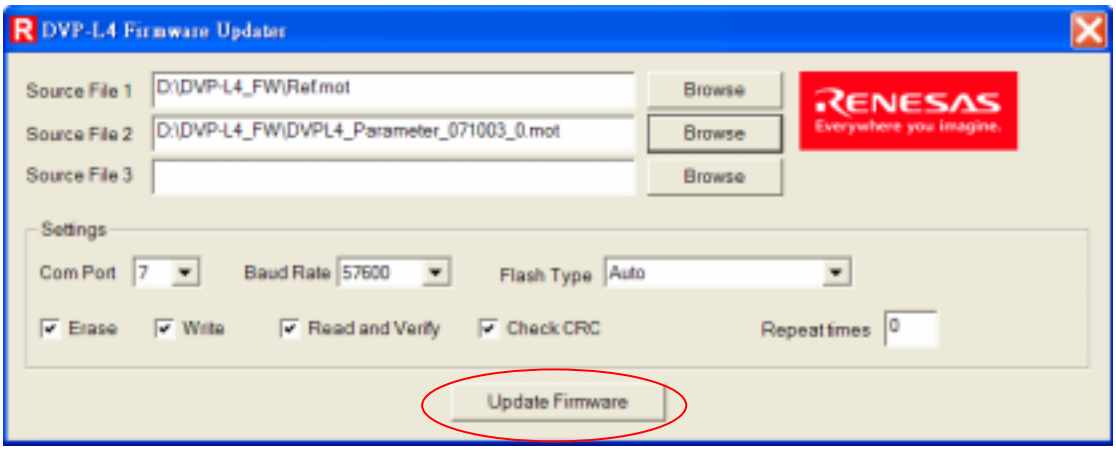
6. Parameter file download:

If the parameter file is also needed to be updated, please click the "Browse" button of Source File 2 to select the .mot file of DVP-L4 parameter. (e.g. the parameter filename is "DVPL4_Parameter_071003_0.mot").

Then double click the selected file or press the "Open" button.



Press the "Update Firmware" button and turn on the power of DVP-L4 system within 30 seconds.



7. Command Protocol:

(1) The following table is the command set sent from AP.

Command	Byte 0 (Cmd ID)	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5 ~ Byte X
Data Write	02h	N (note 1)	Address Byte 2	Address Byte 1	Address Byte 0	Data 0 ~ Data N-1
Write Continue	12h (note 2)	Data 0	Data 1	Data 2	Data 3	Data 4 ~ Data 255
Erase	D8h	00h	Address Byte 2	Address Byte 1	Address Byte 0	
Data Read	03h	N (note1)	Address Byte 2	Address Byte 1	Address Byte 0	
Get CRC	E1h	00h				
Init	E8h	00h				
End	E4h	00h				
Get ID	E2h	00h				
Set Flash Type	E3h	0~3 (note 3)				
Set Baud Rate	A0h	0 ~ 7 (note 4)				

Note 1: When N is 0, N denotes the length of data bytes is 256.

Note 2: “Write Continue” command will use the address of “Data Write” command plus 256.

Note 3: The flash ROM type is set according to the following table.

Flash Type	Auto	SPANSION,STMicro	SST	Reserved
Byte 1	0	1	2	3

Note 4: The baud rate(unit: bps) is set according to the following talbe.

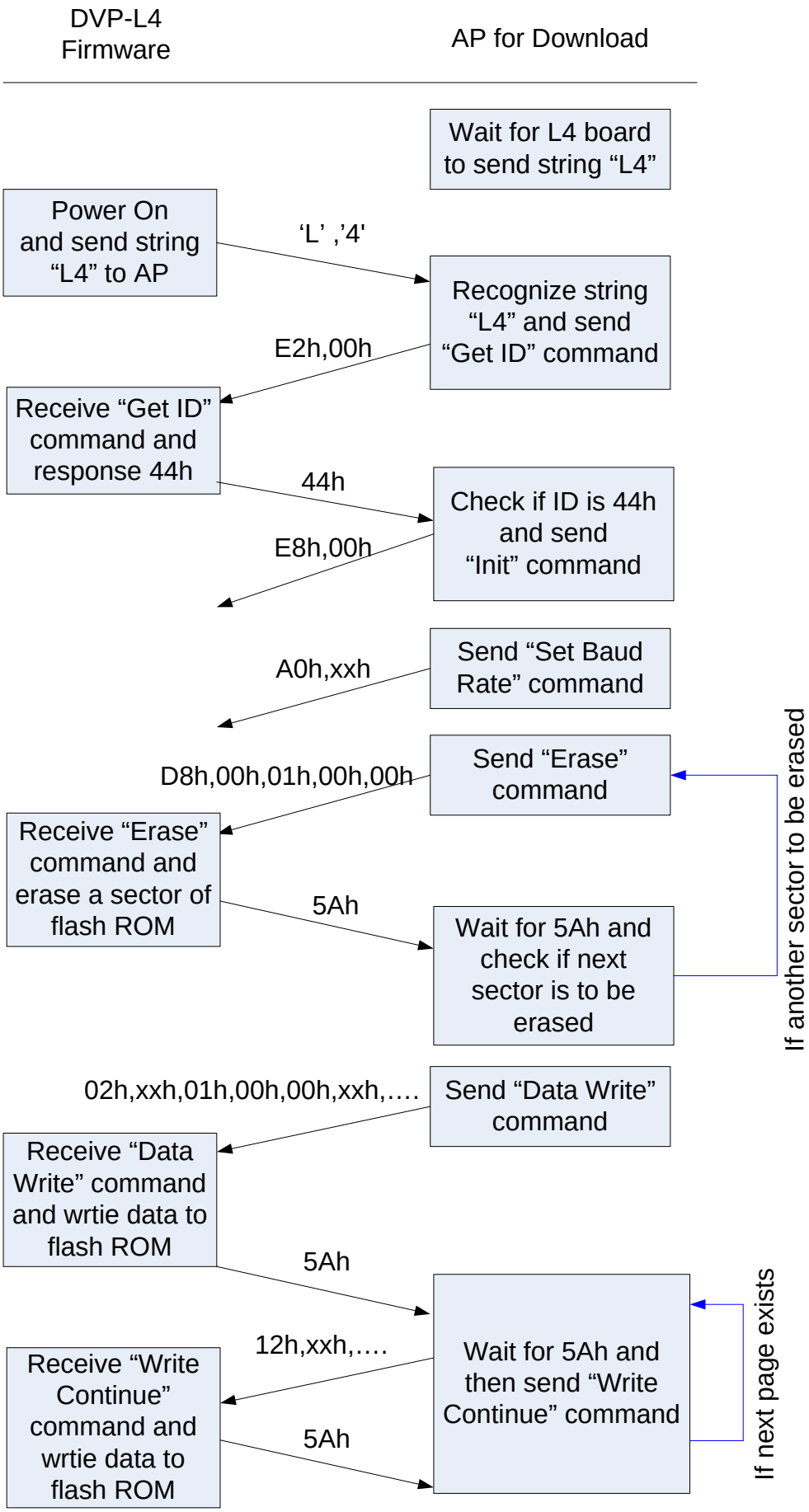
Baud Rate	9600	19200	38400	57600	115200	230400	460800	921600
Byte 1	0	1	2	3	4	5	6	7

(2) The following table shows the response data from DVP-L4 to AP.

Condition	Response Byte 0	Response Byte 1 ~ N-1
Power on	‘L’(4Ch)	‘4’(34h)
Data Write/Write Continue/ Erase Command	5Ah (note 5)	
Data Read Command	Data 0	Data 1 ~ N-1
Get CRC Command	High byte	Low byte
Get ID Command	44h	

Note 5: When 5Ah is replied by DVP-L4, it denotes that the writing or erasing operation is finished.

(3) The following flow diagram shows the hand-shaking operation between AP and DVP-L4 firmware.


DVP-L4
Firmware
AP for Download
Wait for L4 board to send string “L4”
Power On and send string “L4” to AP
‘L’ ,’4'
Recognize string “L4” and send “Get ID” command
E2h,00h
Receive “Get ID” command and response 44h
44h
Check if ID is 44h and send “Init” command
E8h,00h
Send “Set Baud Rate” command
A0h,xxh
Send “Erase” command
D8h,00h,01h,00h,00h
Receive “Erase” command and erase a sector of flash ROM
5Ah
Wait for 5Ah and check if next sector is to be erased
If another sector to be erased
Send “Data Write” command
02h,xxh,01h,00h,00h,xxh,….
Receive “Data Write” command and wrtie data to flash ROM
5Ah
Wait for 5Ah and then send “Write Continue” command
12h,xxh,….
Receive “Write Continue” command and wrtie data to flash ROM
5Ah
If next page exists

Chapter 1 Overview

1.1 Outline

DVP-L4 is a single-chip video signal processing LSI for Flat Panel Displays with digital and analog video inputs, and comprises A/D converter, HDMI receiver and video signal processing circuitry (with integrated frame buffer memory), as well as an M32C/80-based CPU core.

1.2 Features

DVP-L4 supports the following analog input formats: composite (CVBS), SCART (CVBS/R/G/B/FB), S-video (Y/C), component (YPbPr) and RGB (PC input). The following digital input formats are supported: HDMI and 16-bit digital.

The video signal processing unit offers the following features: adaptive 2D comb filtering (Y/C separation) for NTSC/PAL; NTSC/PAL/SECAM chroma decoding; motion-adaptive 3D noise reduction (for SD signals); motion-adaptive 3D de-interlacing (for SD signals); black stretch; luma gamma correction; contrast, brightness, color and offset adjustment; 2D LTI and CTI; 2D enhancer; histogram detection; and APL (Average Picture Level) detection.

DVP-L4 also integrates a VBI slicer compatible with Teletext (625i), CCD (525i/625i), EDS (525i), VPS (625i), WSS (625i), and Video ID (525i/525p).

The panel signal processing unit provides the following functions: VGA ~ full HD (1920×1080) resizer; universal color transform matrix; gamma correction; contrast and brightness adjustment; NCM (Natural Color Matrix); and character-based "color dot" OSD with support for 16-color characters. For interfacing with a flat panel DVP-L4 offers 8-bit single/dual LVDS output or 8/6-bit single RSDS output.

In addition DVP-L4 integrates 4 MB of SDRAM as frame buffer memory, as well as a 32/16-bit microcontroller. An external Flash Memory device (up to 1 MB) is required for program and data storage.

1.2.1 Block Diagram

The block diagram of DVP-L4 is shown in Figure 1.2.1.

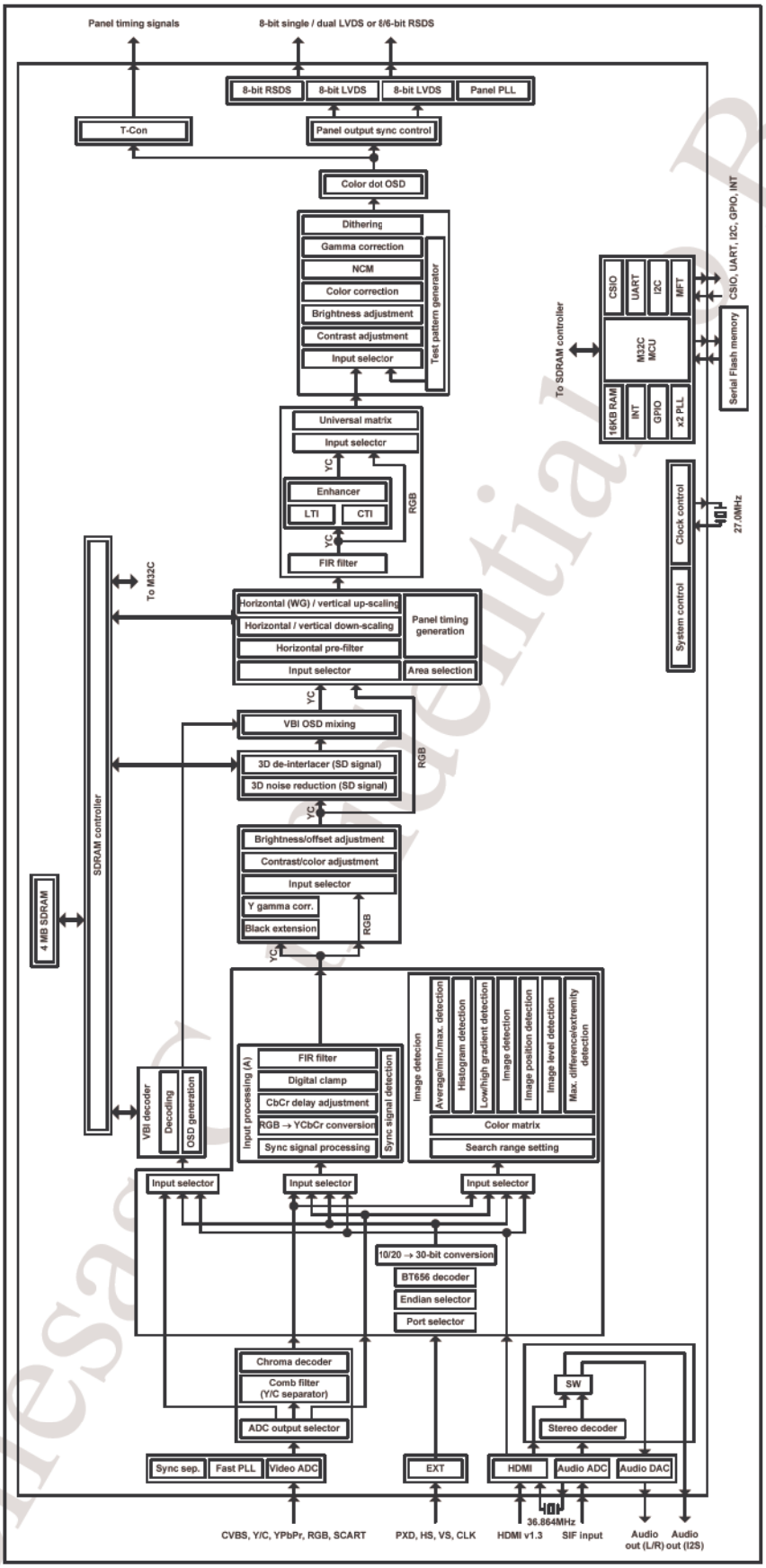


Figure 1.2.1 – DVP-L4 block diagram

1.2.2 Features overview

Table 1.2.1 to Table 1.2.5 provide an overview of the features of DVP-L4.

Table 1.2.1 – Features overview (1)

Block	Features
System	● Clock ・ 27 MHz ± 30 ppm, 36.864 MHz ± 30 ppm ● Supply voltages ・ 1.05 ± 0.05 [V], 1.8 ± 0.2 [V], 3.3 ± 0.3 [V] ● Package ・ 0.4 mm pitch 216-pin QFP (package size: 24 mm × 24 mm)
Video A/D converter	● 110 MHz 10-bit A/D converter, 3 channels ・ Analog gain amplifier, clamp, LPF Input terminals: A channel: 6 lines (SCART-G, SCART-CVBS, PC-G, COMP-Y, CVBS1, CVBS2 (RF)) B channel: 5 lines (SCART-B, SCART-FB, PC-B, COMP-Pb, S-Y) C channel: 4 lines (SCART-R, PC-R, COMP-Pr, S-C)
HDMI	● Version 1.3, 1 port ・ Supported video formats: 525i, 625i, 525p, 625p, 1125i, 1250i, 750p, 1125p VGA ~ UXGA (1600×1200@ up to 162MHz) YCbCr 16 bits, RGB 24 bits
Stereo decoder	● Stereo formats: ・ BTSC, EIAJ, NICAM, A2 (Zweiton) ● Features: ・ Analog audio IF (SIF) input support ・ SIF Automatic Gain Control (AGC) ・ Automatic System Detection (ASD) ・ Two-carrier multi-standard FM demodulation ・ Single-carrier high-deviation FM mono demodulation ・ FM pilot carrier presence detector ・ L-standard AM demodulation
Audio output	● Analog output ・ Integrated Automatic Volume Control (AVC) ・ Stereo line output ● Digital output ・ I^2S – 1 channel ・ S/PDIF (S/PDIF is pin-multiplexed with GPIO ports)
Frame buffer memory	● 4 MB of integrated SDRAM (bus width: 32 bits)

Table 1.2.2 – Features overview (2)

Block	Features
Integrated MCU	● 54 MHz 32/16-bit MCU (M32C core) ・ Integrated program RAM: 16 kB ・ Dedicated ports (with number of ports/buses): ➢ External interrupt: 3, UART: 4, CSIO: 3, I^2C: 2, MFT: 8 (of which 7 are I/O capable), 10-bit A/D converter: 5 ・ General-purpose ports: 26 (21 I/O ports, 5 input ports, pin-multiplexed with dedicated function pins)
VBI decoder and VBI overlay	● Decoder ・ Teletext (625i), CCD (525i), EDS (525i), VPS (625i), WSS (625i), Video ID (525i/525p/1125i/750p) ● Teletext overlay ・ Display size: 40 characters × 25 lines ・ Character size: 12 pixels × 10 lines ・ Character RAM: 1024 characters ・ Half tone and blinking control functions ・ Page RAM : 112 pages (special data: 12 pages, display data: 100 pages) ● CCD overlay ・ Display size: 32 characters × 16 lines ・ Character size: 16 pixels × 20 lines ・ Character RAM: 256 characters ・ Half tone and blinking control functions
Digital video input	● 16 bits, 1 channel (PXD[15:0], HSIN, VSIN, PXCLK) ・ 16-bit YCbCr ・ 8-bit YCbCr ・ 8-bit BT.656
Scaler	● Resizer ・ Source video area selection ・ Horizontal pre-filter ・ 2-tap horizontal/vertical scaling (linear or sample-and-hold) ・ Horizontal scaling with arbitrary scale factor ・ Vertical scaling with arbitrary scale factor ・ Horizontal Waterglass (non-linear) scaling ・ Line memory (up to 1920 pixels)
Panel timing generator	● Timing generation ・ Display timing signals: horizontal sync, vertical sync, horizontal enable, vertical enable ・ Video input data read timing signals: horizontal enable, vertical enable ● Sync control ・ External vertical sync, full free-run (during screen mute)

Table 1.2.3 – Features overview (3)

Block	Features
Video processing	● Video formats ・ SD signals: NTSC, PAL, SECAM, 525i, 625i, 525p, 625p ・ HD signals: 1125i, 1250i, 750p, 1125p (analog: up to 110 MHz sampling rate, digital: up to 162 MHz data rate) ・ PC input: VGA ~ UXGA (analog: up to 110 MHz sampling rate, digital: up to 162 MHz data rate) ● Comb filter (Y/C separation) ・ 2D: NTSC-3.58(M), NTSC-4.43, PAL-4.43, PAL-M, PAL-N ・ 1D: SECAM ● Chroma decoder and sync separation (SD signals) ・ NTSC-3.58(M), NTSC-4.43, PAL-N/M/B/H/I/G/D/60, SECAM ・ Color system detection ・ ACC (Auto Color Control), AGC (Auto Gain Control), peak limiter ・ Color killer, tint (hue) ・ Horizontal AFC, vertical countdown, 60/50 Hz support ・ Sync measurement and detection, digital clamp, DC offset adjustment ● Noise reduction (NR) ・ Horizontal NR (SD signals) ・ Adaptive 3D FIR (SD signals) ● De-interlacing ・ Adaptive 3D, 3:2 and 2:2 inverse pull-down (SD signals) ・ 2D (HD signals) ● Video and sync measurement ・ Horizontal period, horizontal sync pulse width, horizontal sync polarity ・ Vertical period, vertical sync pulse width, vertical sync polarity, line count, interlace detection ・ High gradient (white level), low gradient (black level) pixel count (adjustable area) ・ Average / maximum / minimum detection (division into 8 adjustable areas) ・ 8-step luma histogram detection (adjustable area) ・ Pixel level detection (adjustable position) ・ Maximum difference / extremity detection ・ Picture position detection

Table 1.2.4 – Features overview (4)

Block	Features
Video processing	● Picture quality improvement ・ Digital clamp ・ Contrast (unicolor), brightness, color and offset adjustment ・ Black stretch, luma (Y) gamma correction ・ Horizontal / vertical LTI (luma (Y) transient improvement) ・ Horizontal CTI (chroma transient improvement) ・ Horizontal / vertical sharpness (Y component) ・ Horizontal universal FIR filter (Y / C components, R / G / B components) ・ 9-axis universal color matrix ・ Saturation correction (R / G / B components) ・ NCM (Natural Color Matrix) ・ RGB gamma correction ・ Dithering
User OSD	● Character-based and “color dot” OSD ・ OSD format: mixed display of unicolor OSD and color dot OSD (CD OSD) with support for 16 colors ・ Display size: 120 characters × 54 lines ・ Character size: 16 pixels × 20 lines ・ Character RAM: ・384 characters (unicolor OSD only) ・96 characters (CD OSD only) ・256 characters (unicolor OSD) + 32 characters (CD OSD) ・128 characters (unicolor OSD) + 64 characters (CD OSD) ・ Character framing, character outlining (unicolor OSD only), per-line vertical stretch, per-line horizontal stretch ・ Display unit (pixels): ×1, ×2 (pixels) ・ Display unit (lines): ×1, ×2 (lines)
Test pattern generator	● Timing generation ・ Adjustable horizontal period, horizontal sync pulse width, vertical period, vertical sync pulse width, and active picture area ● Output format ・ Progressive RGB, 8 bits per channel ● Patterns ・ Horizontal luma ramp, vertical luma ramp, horizontal color ramp, vertical color ramp ・ Checkers, crosshatch, color bar ・ Active picture area frame, 2-way split-screen raster color
T-con	● Output signals ・ Horizontal timing signals: 6 (horizontal total: up to 4095 pixels) ・ Vertical timing signals: 1 (vertical total: up to 2047 lines)

Table 1.2.5 – Features overview (5)

Block	Features
Panel output	● Format ・ 8/6-bit single / dual LVDS output ・ 8/6-bit single RSDS output ・ RGB, QH, QV, QE ● Screen resolution ・ VGA (640×480) ~ full HD (1920×1080) ● Pixel clock frequency ・ 20.00 MHz ~ 150.00 MHz

1.2.3 Pin assignments (Top view)

Pin assignments (top view) are shown in Figure 1.2.2.

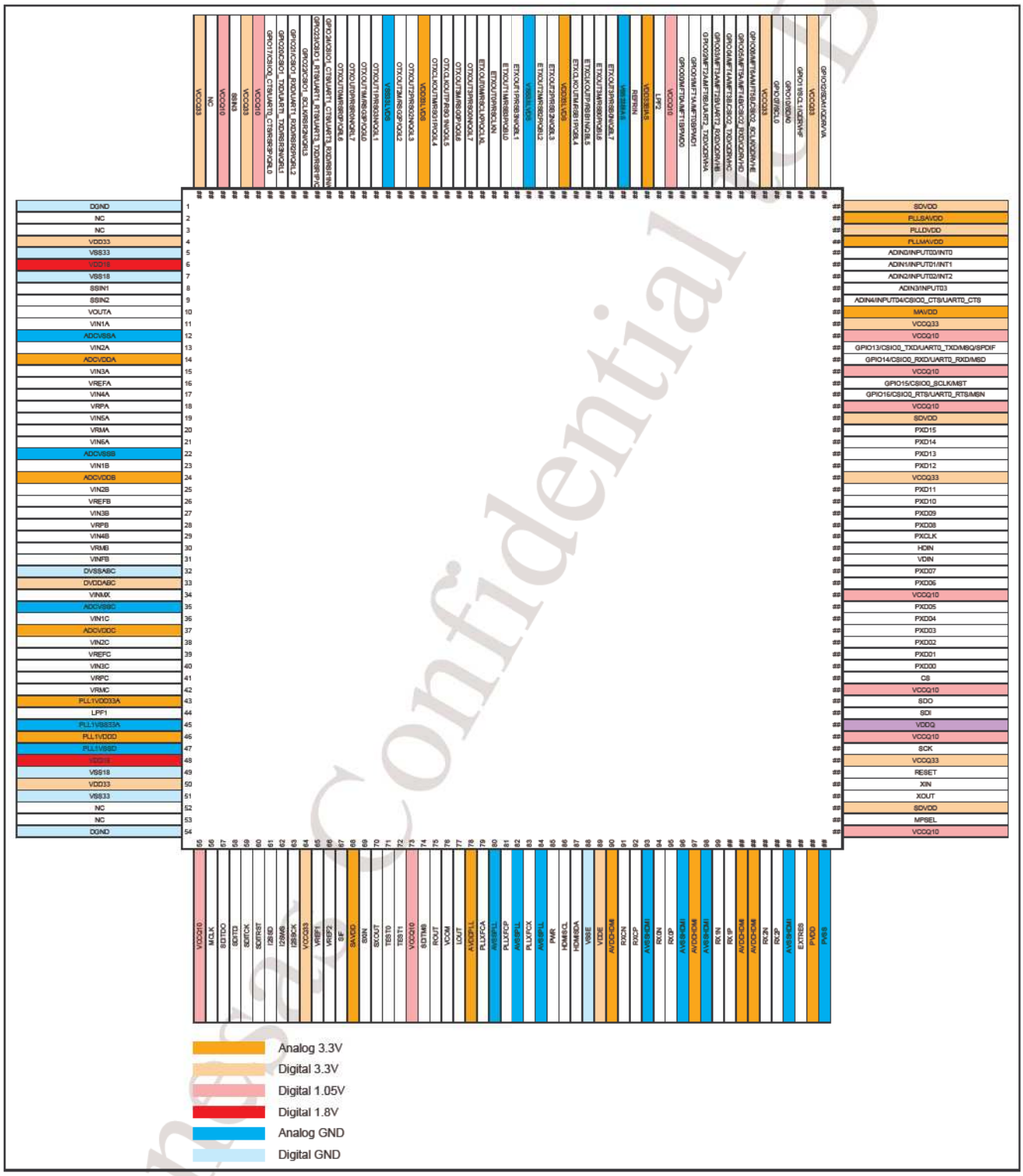
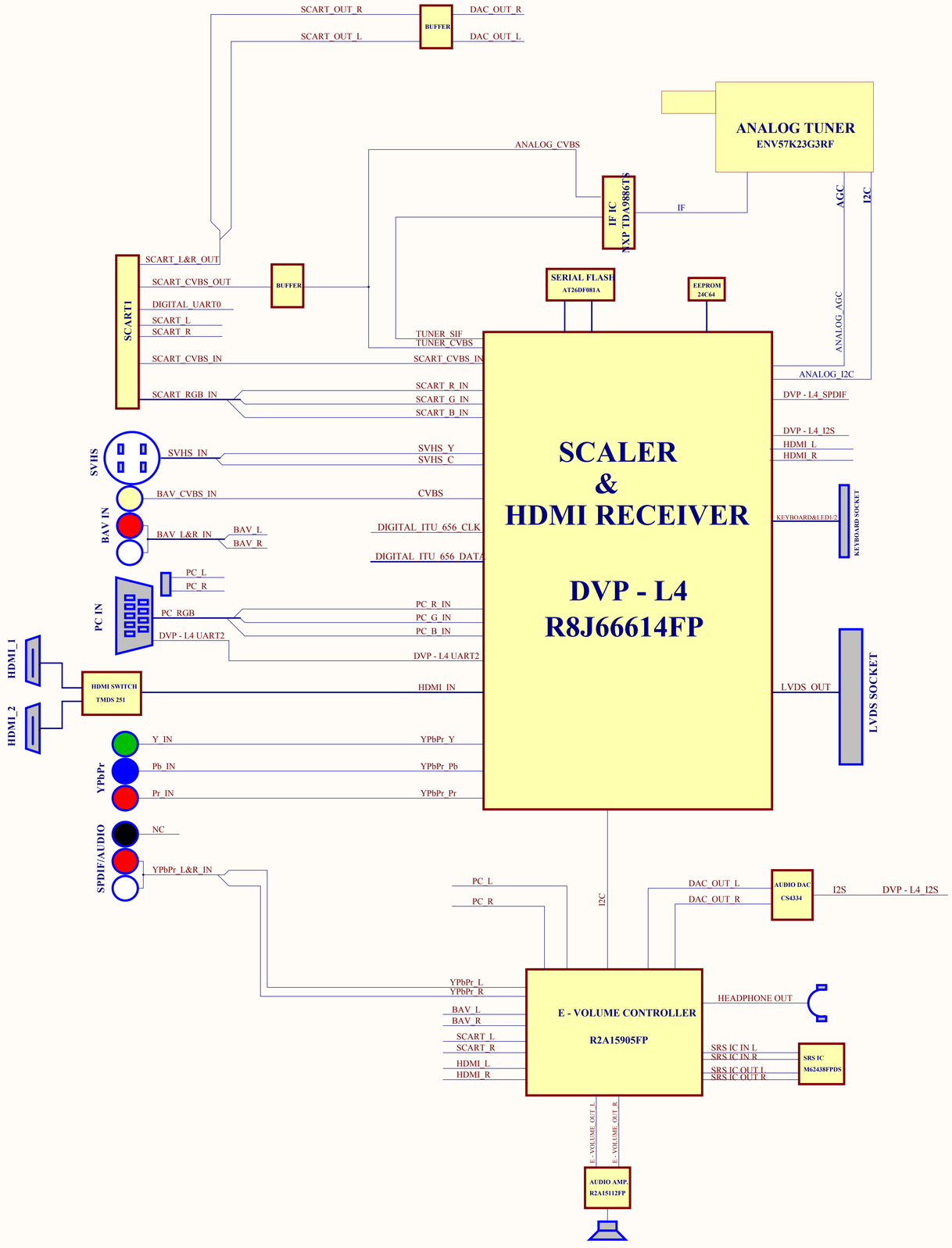


Figure 1.2.2 – Pin assignments (top view)



SC- SD ECO2 (RENESAS) BLOCK DIAGRAM

*** DVP - L4 UART 2 is connected to PC and used for L4 software upgrade**

Title		
Size: A0	Number	Revision
Date: 30.06.2008		Sheet of
File: D:\LCDTV\...\L4_Block_Diagram.SchDoc	Drawn By:	

CHASIS SC	ADJUSTMENT STEPS	DATE : 1 July 2008 VERSION NO : 1
BEKO PRODUCT	PROCESS SEQUENCE NO : 8	DEFINITON MAIN CHASIS PAGE : 1

SEQUENCE OF ADJUSTMENT AND CHECKING

Service Mode Options 1

OPTIONS 0

STBY RECALL ON: When Tv gets energy from network,it opens
OFF: When Tv doesn't grt energy from network,it doesn't open
Note:Unless the costumer demand, it is selected as OFF
MENU APPEAR: By selecting BEKO or GRUNDIG it can work using not only BEKO remote control but also GRUNDIG remote control.also you can use menu option
Note:You can use GRUNDIG only in GRUNDIG product,when using other products select BEKO
TEXT: Teletext type :FAST :Fastext ; TOP:Toptext; FAST_TOP :Fastext and Toptext ;NONE
NOTE: In default mode it select FAST
LANGUAGE: It uses for menu languages
A : İngilizce, Fransızca, Almanca, İtalyanca, İspanyolca, Portekizce, Hollandaca, Yunanca, Danimarkaca, İsveççe, Fince, Norveççe, Türkçe, İbranice, Rusça, Macarca, Slovakça, Çekçe, Lehçe, Arnavutça, Makedonca, Sırpça, Slovence, Rumence, Hırvatça, Bulgarca
B : İngilizce, Fransızca, Almanca, İtalyanca, Hollandaca, Yunanca, Danimarkaca, İsveççe, İspanyolca, Portekizce, Norveççe, Fince, Arnavutça, Makedonca, Türkçe, Rusça, Lehçe, Macarca, Hırvatça, Rumence, Bulgarca, Slovence, Çekçe, Slovakça, Arapça, Farsça
LOGO:Logo selecting of user menu OFF:ARCELİK,BEKO
It can be selected ARCELİK in ARCELIK products,It can be selected BEKO in BEKO products in other products it can be selected OFF
FACTORY MODE:T1 factory mode
NOTE:It can be selected as OFF after all the configuration and control.When it is in T1 mode by pressing menu button after then pressing red button,reach service menu as a shortcut
GAMMA: Don't any configuration in this option.it can leave as a software release
DCR:Dynamic Contrast:"ON":Dynamic Contrast active; "OFF":Dynamic Contrast inactive
NOTE: By selecting DCR ON in services menu,Dynamic Contrast options appear in main menu
By selecting Dynamic contrast ON,BACKLIGHT is getting inactive,and it can be automaticly config as contrast TV stage.By selecting dynamic contrast OFF,BACKLIGT can b config as a manual
Unless the costumer demand it can be selected as OFF
OPTIONS 1

BLUEBACK Blueback specification ON OFF
Not: Unless the costumer demand it can be selected as OFF
HOTEL Simple Otel TV specification ON ; OFF
Not: Unless the costumer demand it can be selected as OFF
HOTEL VOL For hotel TV maximum sound level is 20
Not: It can be selectes as costumer demand.

PRREPARED BY	CONTROLLED BY	APPRROVED BY	ISSUE DATE

CHASIS SC	ADJUSTMENT STEPS	DATE '1 July 2008
		VERSION NO : 1
BEKO PRODUCT	PROCESS	DEFINITION : Preset Value
	QUEUE NO : 9	PAGE : 1

Service Mode Specification 2

SERVICE MODE OPTIONS 2

ATS Auto Tunnig System:Channel order after automatic program scanning: ON:Active , OFF:inactive

Not: It can be selected as ON for all domestic market production and all Toshiba-Daewoo-Grundig production.For other production it is selected as OFF.

WSS Wide Screen Signaling:16:9,4:3 i.e.display formats is getting connection automatically ON:Acitve, OFF:inactive

Not: It can be selected ON for default.

TEST PATTERN It is used for test on the production steps. It can be leave out as coming from factory.

TEST PATTERNSE It is used for test on the production steps. It can be leave out as coming from factory

OPTIONS 2

TV ON ;OFF
DTV ON ;OFF
SCART1 ON ;OFF
AV ON ;OFF
S-Video ON ;OFF (For S_video input)
PC ON ;OFF (For PC input)
HDMI-1 ON ;OFF
HDMI-2 ON ;OFF
YPBPR ON ;OFF (For component input)

Not: Above input connection title is selected as a produc specifications.

SOUND OPTIONS

HEADPHONE Headphone specification ON: Specification available;OFF:Specification non-available

Not: ıt is selected as product specification.

SRS ON: SRS available; OFF: SRS non-available

Not: It is selected as costomer demand.

Not: Other titles is uses for design specification.It is leave out as coming from factory.

PREPARED BY	CONTROLLED BY	APPROVED BY	ISSUE DATE

CHASIS SC	ADJUSTMENT STEPS	DATE : 1 July 2008 VERSION NO : 1
BEKO PRODUCT	PROCESS SEQUENCE NO : 10	DEFINITON MAIN CHASIS PAGE : 1

SEQUENCE OF ADJUSTMENT AND CHECKING

Service Mode Options 3

IF SETTINGS

For SC which is used Panasonic XKU136RPS2 model tuner

AGC VHF -3 **AGC UHF** 0 **AGC LPRIME** -3

Not: It comes automatically configured and any configuration doesn't be done.

SECAM ON:Secam display system supports.OFF:Secam display system doesn't support.

Not: For EU products ON,for UK products OFF is choosen.Any configuration.

doesn't be done.It comes from factory configured.

GROUP DELAY ON:Specification open, OFF :Specification closed.

Not: It remains as OFF.

DIMMING

BACKLIGHT It can configure the screen light intensity.

Not: On services menu when DCR can be configured as "ON" ,in main menu dynamic contrast option appear "on-off".Any configuration doesn't be done.

ADJUSTMENTS

Any configuration or control doesn't be done.

EEPROM EDIT

Not: After all configuration and control "INITIAL ATS" ve "CUSTOMER DATA INIT" which are in this menu is performed by using their function and configuration order in these menu.

Not: For other titles any configuration doesn't be done.

PRREPARED BY	CONTROLLED BY	APPRROVED BY	ISSUE DATE

ECO KONSEPTİ TEKNİK ÖZELLİKLER		16”W, 19”W, 22”W	26”, 32”, 37”
Concept Properties			
Scaler IC		MStar Maria 5	Renesas L4
HD Ready		YES	YES
DeInterlacer		2D	3D
Comb Fitler		2D	2D (3D if no cost-up)
BACK CONNECTIONS			
Antenna (IEC 169-2, Female)		1 (no analog reception)	1 (analog reception optional for IDTV)
Scart		1 Full	1 Full
S-VHS In		-	-
Video In (RCA)		-	-
Audio In (2 RCA)		-	-
Audio Out (2 RCA)		-	-
Progressive YPbPr In (3 RCA)		1 through VGA	1
Progressive Audio In (2 RCA)		1 through PC Audio In	1
DVI		-	-
HDMI		1	1
PC Audio (L, R)		1	1
D-Sub 16 (VGA Connector)		1	1
SPDIF Coaxial		-	-
Headphone		1W, 8 Ω, 3.5mm, mono for Hotel TV only	1W, 8 Ω, 3.5mm, mono for Hotel TV only
RJ12 Port		for Hotel TV only	for Hotel TV only
Power Jack (12V, 1A)		for Hotel TV only	for Hotel TV only
FRONT\SIDE CONNECTIONS			
S-video In (DIN)		-	1
Video In (RCA)		1	1
Audio In (2 RCA)		1	1
Headphone		- (if not Hotel TV)	1 (if not Hotel TV)
VIDEO & GRAPHICS IN\OUT			
CVBS In		2 (1 via Scart, 1 via RCA)	2 (1 via Scart, 1 via RCA)
RF In		1 Opt.	1 Opt.
Y\C In		2 (1 via Scart, 1 via S-VHS)	2 (1 via Scart, 1 via S-VHS)
RGB+FB In-Video		1 through Scart 1	1 through Scart 1
RGB+HS, VS In -Graphics		1 through DSUB-16	1 through DSUB-16
YPbPr In (Progressive)		1 through DSUB-16	1
HDMI In		1	1 (2 opt.)
YUV In		1	1
CVBS Out		1 (via scart)	1 (via scart)
AUDIO IN\OUT			
Stereo L, R In		2 (1 via 2RCA, 1 via Scart)	1 (1 via Scarts)
Stereo L, R Out		2 (1 via scart, 1 via RCA output)	1 (1 via scart)
Subwoofer Out		NO	NO
S\PDIF In		-	-
S\PDIF Out		-	1
Audio Output Power (min)		16: 2 x 2W, 19: 2 x 2.5W 22: 2 x 3W	26": 2x5W, 32": 2 x 7W, 37": 2 x 10W
Number of speakers		2 (L+R)	2 (L+R)
ANALOG FRONT END			

Type		Hybrid Tuner or analog only	Hybrid Tuner or analog only
Multisystem		No (PAL/SECAM BG/DK/I, PAL/SECAM BG/L/L')	Yes
Receiving System		PAL/SECAM BG/DK/I/L/L' From Service Menu, NTSC 4.43, 3.58 via scart	PAL/SECAM BG/DK/I/L/L' From Service Menu, NTSC 4.43, 3.58 via scart
Input Freq. Range (MHz)		VHF (48,25-463,25MHz) UHF (471,25-855,25MHz)	VHF (48,25-463,25MHz) UHF (471,25-855,25MHz)
Tune down to 45,25MHz Tune up to 855,25MHz		YES	YES
Input Connector		IEC 169-2, Female	IEC 169-2, Female
Aerial Input Impedance		75 Ohm (unbalanced)	75 Ohm (unbalanced)
Tuning System		FST	FST
Tuning Control		PLL	PLL
Antenna Loop Through		NO	NO
RF Modulator		NO	NO
Channel Bandwidth		6\7\8 MHz Switchable	6\7\8 MHz Switchable
ATS (Automatic Tuning System)		Optional in Service Menu	Optional in Service Menu
Manual Search		YES	YES
AFT (Auto Fine Tuning)		YES	YES
VIDEO & GRAPHICS PROCESSING			
Comb Fitler		2D	2D (3D if no cost up)
DLTI, DCTI		YES	YES
Noise Reduction		YES	YES
Sync On Green (SOG) support on graphics		YES	YES
Gamma Correction		YES	YES
Main Picture	**De-interlacing**	3D Frame Based Motion Adaptive	3D Frame Based Motion Adaptive
	Noise Reduction	YES	YES
	Scaling	YES	YES
Chroma Decoding	**Analog/Digitized**	Digitized	Digitized
	Standard	PAL, SECAM, NTSC	PAL, SECAM, NTSC
Color Controls	**Brightness**	YES	YES
	Contrast	YES	YES
	Color\Saturation	YES	YES
	Color Temperature	YES	YES
	Tint	YES	YES
HDMI Receiver	**HDMI 1.x Compliant**	YES	YES
	Resolution	1080i @50Hz	1080i @50Hz
	HDCP Support	YES	YES
AV PIP		-	-
2 Tuner PIP		-	-
Txt Pages		8p	100p
Fastext		YES	YES
Toptext		OPT via service menu	OPT via service menu
VPS/PDC/CNI		YES	YES
WSS		YES	YES
AUDIO PROCESSING			
Standart (BG, DK, L\L', I, M, N, BTSC)		BG, DK, L\L', I from service menu	BG, DK, L\L', I from service menu

Stereo Decoding (German A2, Nicam, BTSC)		AV Stereo	YES
Dynamic Bass		NO	NO
Equalizer		Bas/Treble	YES
Dual I-II		Opt.	Opt.
Virtual Surround		-	Opt.
Effect\Spatial		YES	If possible without cost up
APPLICATIONS			
Menu System		Beko System = IX	Beko System, Grundig System
Remote Control		Beko RC = IX	Beko RC, Grundig RC, Daewoo RC
Supported Menu Languages		= LW	
Picture Formats (4:3, 16:9, 14:9, Panorama, LetterBox, Subtitle)	**4:3**	YES	YES
	16:9	YES	YES
	14:9	YES	If possible without cost up
	Panorama	If possible without cost up	If possible without cost up
	Letterbox	If possible without cost up	If possible without cost up
	Subtitle	If possible without cost up	If possible without cost up
	Auto	YES	YES
Number of Program Storage		100	100
No Ident Timer		YES	YES
Picture Freze		-	If possible without cost up
AVL (Automatic Volume Level)		YES	YES
Swap/Zapp		Swap	Optional in Service Menu
Child Lock / Panel Lock		-/+	If possible without cost up
Picture Format Switching Through Scart (Pin 8)		YES	YES
Auto RGB Detect Through Scart1 (Pin 16)		YES	YES
DDC Support		YES	YES
Timer		Sleep	On/Off
Picture Smart Modes		YES	YES
Sound Smart Modes		-	YES
Simple Hotel Mode		OPT.	OPT.
Software Update		YES (via Scart)	YES (via Scart)
Wake Up in PC	**Stby to On in PC Mode when last watched is PC**	YES with VGA option	YES
	Stby to On automatically when PC signal is available	NO	NO
SUPPORTED OUTPUTS FOR DISPLAYS			
Single TTL support	**24-bit**	YES	YES
Dual TTL support	**48-bit**	NO	NO
Single 10-bit TTL support	**30-bit**	NO	NO
Dual 10-bit TTL support	**60-bit**	NO	NO
Single LVDS support (8-bit)		YES	YES
Dual LVDS support (8-bit)		YES	YES
Single LVDS support (10-bit)		NO	NO
Dual LVDS support (10-bit)		NO	NO
Timing Control Support		NO	NO
POWER SUPPLY			
PSU Type		İnternal	Internal
Ratings	**16”W**		

	19”W		
	22”		
	26”		
	32”		
	37”		
Input Range		140V-265V, 50, 60Hz	140V-265V, 50, 60Hz
Groundless AC Plug		Depends on Tests	Depends on Tests
St-By Power Consumption		<1W (<1.5W for IDTV)	< 1W
REGULATIONS			
EMC		EN55020 EN55013 EN55022 (with PC)	EN55020 EN55013 EN55022 (with PC)
SAFETY		EN60065	EN60065
CABINET			
Keyboard	**On\Off (Tact switch)**	YES	YES
	Volume Up	NO	YES
	Volume Down	NO	YES
	Program Up	NO	YES
	Program Down	NO	YES
	Menu	NO	YES
	Source	NO	YES
LED	**Single color/Single Intensity**	NO	NO
	Single Color/Double Intensity	YES	YES
	Multi color	NO	NO
	On Timer Led	NO	NO