MT13x9 hardware interface to front panel

Gridd

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Disclaimer

This is rather research paper since it discusses facts not clearly known.
Therefore, it would be honest to warn any individual about use this information on its own risk.

1. Proper use of this information suppose some experience in low-level programming and hardware (basics of the digital electronics at least).
2. Author of this memo cannot be responsible for any consequences that may arise from application of information, contained herein. Doing wrong may cause severe damage of your DVD player (or even electric shock for unqualified person).
3. Author of this memo believes this information is correct as much as possible, but recognizes that our knowledge is not full and may sufficiently change.

You can reach author of this memo at gg2004@yandex.ru, or post at Yahoo MT13x9 group or Amstrad forum. Please inform me of any bugs in this memo, misinterpretation or incompleteness.

The goal of this memo is attempt to build a system from pieces of known facts in plain form for everyone who would like to understand this subject better. The qualified ones probably would not find anything new in this paper, but for beginners it should be quite helpful.

Everyone's been a newbie, everyone's needed kickstart.

How it works. In general

VFD stands for Vacuum Fluorescent Display. This is most common indicator for status representation in different DVD players and home electronics appliances, because of its cheapness and reliability. The LCD is second one.

NEC sometimes refers VFD as Front Interface Panel in their datasheets, so don't stuck if you meet FIP™ in NEC's docs or somewhere else. For the eye of engineer in electronics VFD and LCD are quite different – LCD consumes lower power, and, basically, needs other chips (drivers). In practice this mean you cannot throw away VFD and set up LCD on the same place without sufficient redesign of scheme. From the programmer's point of view there is no difference. That sounds good and we should keep it for future reference. And while you would not read explicit notice, you have to void difference for VFD and LCD.

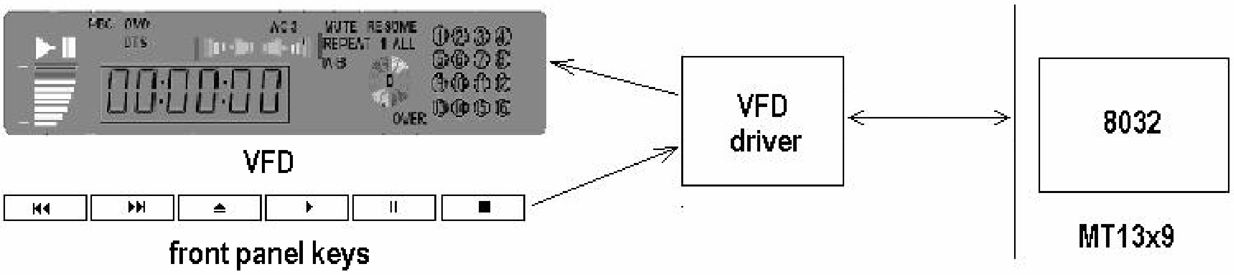


Fig.1 VFD interface components

The general VFD interface is shown at Fig.1 User reads device status on display and tries to change the sequence of operation by pressing front panel keys. A chip responsible for displaying out information on VFD and reading buttons named as VFD driver. It is controlled by 8032 processor core integrated in MT13x9. For MT1389-based boards this IC is usually NEC ìPD 16312 or compatible (for successful datasheet search by google you have to type **uPD** or even **mPD** at search bar). MT1369-based boards use NEC ìPD 16311. MT1379 boards can use both types.

Original NEC chips are not frequent guests on printed circuit boards. There is a number of VFD drivers available on market and most of them are made by Asian manufacturers not widely known. (Princeton Technologies (PT), HolTek (HT), SamHop MicroElectronics (SM), Topro (TP), AnaChip (AD)) But last two digits in chip model number may give some info when docs are lacking. If there are '12' or '11' there is a chance that chip would be compatible with NEC. To ensure this, try to retrieve datasheet from the Net. You may require Chinese Acrobat Reader (or full Acrobat) for successful reading (even if these datasheets were written in English they may use numbers and some symbols from Chinese fonts ☺).

Variety of designs

If DVD manufacturer can spend some additional resources to improve hardware design or just to create something different and, for its opinion, customer attractable, then VFD board schematics may became quite different of reference Mediatek design.

There are some VFD boards distinctive from that reference – BBK 965S, LG 7831, Pioneer DV-470-S, Philips DVD LX-8300.

BBK965S uses LCD driver PT6554LQ by Princeton Technologies. As mentioned above, from the programmer's point of view there is no difference between LCD and VFD, but PT6554LQ also differs from NEC uPD 16312 – it has more pins and consequently more inner registers. It looks like extended version of 16312 and uses other command set (but similar – none carefully checked that). Further exploration is needed to determine distinct features. Unfortunately, there is no complete datasheet available on the Net (the currently available one has pinout and examples of typical applications but it lacks of programming guide).

LG 7831 uses Hynix GMS81C2012. This is programmable 8-bit MCU (microcontroller unit) and has independent program wired in the internal ROM. And, again, further exploration is needed. Probably MCU may be responsible for generation characters on chip side and therefore 8032 code of LG may be simpler to understand, since there would not be character tables inside 8032 code. But this is not a fact, just a proposition…

Pioneer DV-470-S, Philips DVD LX-8300 use different VFD drivers – PE5374B and Toshiba TMP87CH74 respectively. When reversing code you have to have these datasheets at hand.

Links to some datasheets

NEC uPD 16312 (you can find here uPD 16311 also)
http://www.alldatasheet.com/datasheet-pdf/view/NEC/UPD16312.html

PT6554
http://www.princeton.com.tw/english/product/getProductFile.asp?Product_no=PT6554

Hynix GMS81C2020
http://www.hynix.com/eng/products/ system_ic/sp/down/GMS81C2020.pdf

PE5374B
Unknown chip by unknown manufacturer. No datasheet . Let author know if you find something about.

Toshiba TMP87CH74
http://pdf.toshiba.com/taec/components/Datasheet/TMP87CH74_M74.pdf

VFD in itself

VFD is fragile vacuum-contained tube with luminescent anode segments and cathode grids inside. There is a huge variety of VFDs on market since manufacturers pay enough attention to exterior view of production. A lot of VFD manufactures are not known to wide public. The well-known names are Samsung and Futaba and more or less known are ZEC and Noritake.

A good FAQ on VFD technology resides on Noritake site.
http://www.noritake-elec.com/vfd_technology.htm

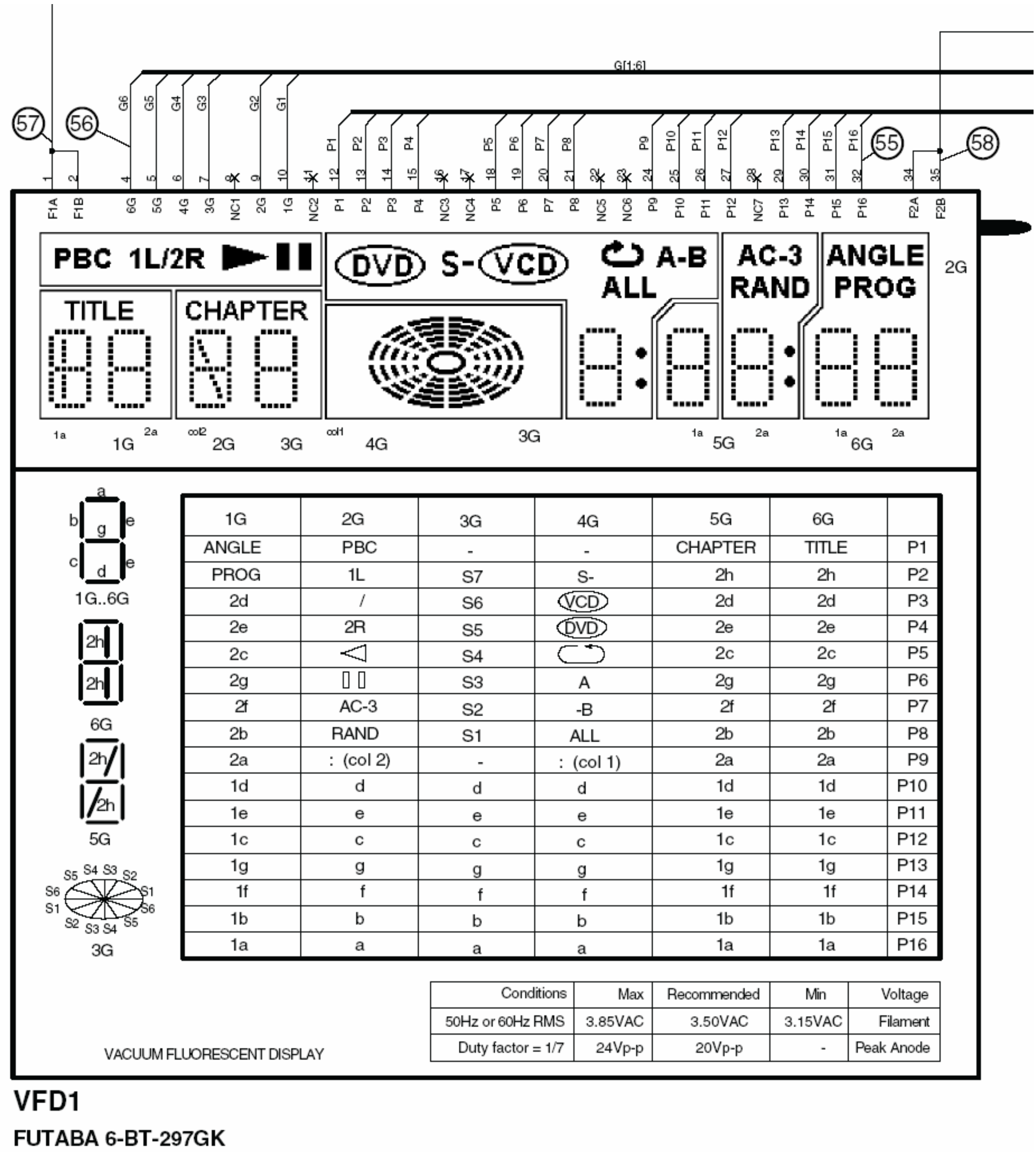
This is a good introduction in hardware matter. You can learn that is 'duty factor', 'bias' and lot of other stuff, but this is extra reading. If you miss it, you lose almost nothing.

Samsung VFD and recommended VFD drivers for their production is at
http://www.samsungsdi.co.kr/contents/en/product/vfd/vfd.html
Find «VFD catalog», Click «View e-book»

I don't know who was that smart boy in Samsung who put PDFs in flash player. Instead of whole thing downloading you have to sit and click for every page in VFD catalogue. That's boring and embarrassing even on 256K link. Really!

MAXIM site also has web pages of VFD tube manufacturers (some links are dead)
http://www.maxim-ic.com/appnotes.cfm/appnote_number/1154

Service Manuals often miss the VFD manufacturer's name and sometimes even does not contain model number. Therefore, understanding which information displayed at specific program point is not simple. There is a perfect page from Grundig Xenaro GDP 5100-6150 service manual. This is extremely rare case when manufacturer puts VFD layout in manual. Grundig player does not use MT1389, but has similar VFD controller board. Fig.2 included just for reference to better understand the connections of VFD to driver chip and how it displays information.



1G	2G	3G	4G	5G	6G	
ANGLE	PBC	-	-	CHAPTER	TITLE	P1
PROG	1L	S7	S-	2h	2h	P2
2d	/	S6	VCD	2d	2d	P3
2e	2R	S5	DVD	2e	2e	P4
2c	◁	S4		2c	2c	P5
2g	▯▯	S3	A	2g	2g	P6
2f	AC-3	S2	-B	2f	2f	P7
2b	RAND	S1	ALL	2b	2b	P8
2a	: (col 2)	-	: (col 1)	2a	2a	P9
1d	d	d	d	1d	1d	P10
1e	e	e	e	1e	1e	P11
1c	c	c	c	1c	1c	P12
1g	g	g	g	1g	1g	P13
1f	f	f	f	1f	1f	P14
1b	b	b	b	1b	1b	P15
1a	a	a	a	1a	1a	P16

Conditions	Max	Recommended	Min	Voltage
50Hz or 60Hz RMS	3.85VAC	3.50VAC	3.15VAC	Filament
Duty factor = 1/7	24Vp-p	20Vp-p	-	Peak Anode

VFD1

FUTABA 6-BT-297GK

Fig 2. Futaba VFD example. Model 6-BT-297GK.
(from Grundig Xenaro GDP 5100-6150 service manual)

This VFD has six grids (1G-6G) and 16 segments (P1-P16) connected internally to different symbols and common 7-segment indicators. Other models usually have different sets. To highlight specific symbol or digital element you have to select respective grids and segments, i.e current should be driven to these pins by VFD driver chip.

Another good example is from Philips manual. DVD players manufactured by Philips often use indicators capable to show any alphanumeric symbol. (15-segment) versus traditional 7-segment.

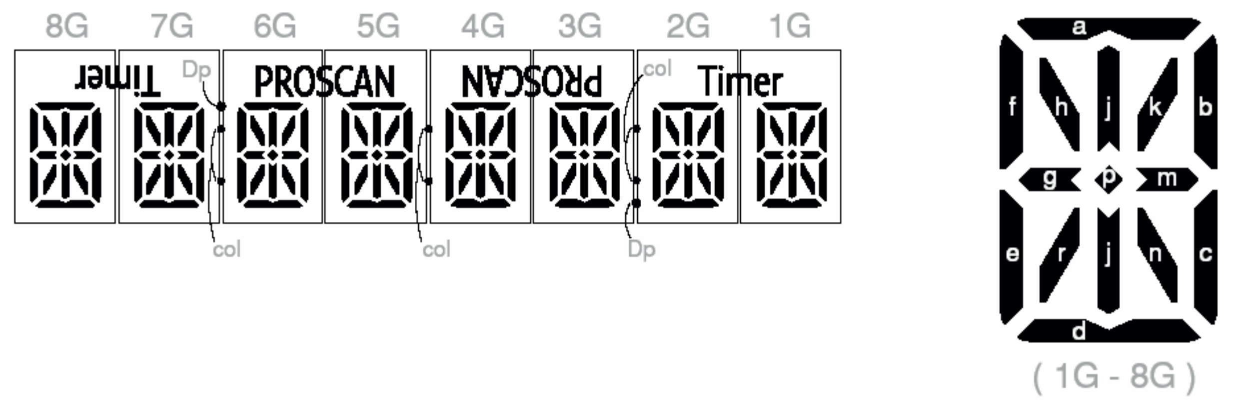


Fig 3. Overall view of HUV-08SS57T or 20U26115TAN , with detailed view of single 15-segment element (from Philips LX-3900-SA service manual)

Table 2. Relation between grids and segments for Philips indicator

	8G	7G	6G	5G	4G	3G	2G	1G
P1	a	a	a	a	a	a	a	a
P2	j	j	j	j	j	j	j	j
P3	h	h	h	h	h	h	h	h
P4	k	k	k	k	k	k	k	k
P5	b	b	b	b	b	b	b	b
P6	f	f	f	f	f	f	f	f
P7	m	m	m	m	m	m	m	m
P8	g	g	g	g	g	g	g	g
P9	c	c	c	c	c	c	c	c
P10	e	e	e	e	e	e	e	e
P11	r	r	r	r	r	r	r	r
P12	n	n	n	n	n	n	n	n
P13	d	d	d	d	d	d	d	d
P14	-	col		col		col		-
P15	p	p	p	p	p	p	p	p
P16	Timer		PROSCAN		PROSCAN		Timer	
P17	-	Dp		-	-	Dp		-

and we should not miss excellent *camomille's* drawings in Excel. It may be very useful for VFDs consisting of 7-segment elements. (Characteres.xls 34816 bytes in size)

Character Number	Character Code	Disp		g	f	e	d	c	b	a
00	3F		0	0	1	1	1	1	1	1
01	06		0	0	0	0	0	1	1	0
02	5B		0	1	0	1	1	0	1	1
03	4F		0	1	0	0	1	1	1	1
04	66		0	1	1	0	0	1	1	0
05	6D		0	1	1	0	1	1	0	1
06	7D		0	1	1	1	1	1	0	1
07	07		0	0	0	0	0	1	1	1
08	7F		0	1	1	1	1	1	1	1
09	6F		0	1	1	0	1	1	1	1
0A	00		0	0	0	0	0	0	0	0
0B	77		0	1	1	1	0	1	1	1
0C	7C		0	1	1	1	1	1	0	0
0D	39		0	0	1	1	1	0	0	1
0E	58		0	1	0	1	1	0	0	0
0F	5E		0	1	0	1	1	1	1	0
10	79		0	1	1	1	1	0	0	1
11	71		0	1	1	1	0	0	0	1
12	6F		0	1	1	0	1	1	1	1
13	76		0	1	1	1	0	1	1	0
14	30		0	0	1	1	0	0	0	0
15	1F		0	0	0	1	1	1	1	1
16	38		0	0	1	1	1	0	0	0
17	37		0	0	1	1	0	1	1	1
18	3F		0	0	1	1	1	1	1	1
19	73		0	1	1	1	0	0	1	1
1A	67		0	1	1	0	0	1	1	1
1B	50		0	1	0	1	0	0	0	0
1C	6D		0	1	1	0	1	1	0	1
1D	78		0	1	1	1	1	0	0	0
1E	3E		0	0	1	1	1	1	1	0
1F	66		0	1	1	0	0	1	1	0
20	6E		0	1	1	0	1	1	1	0
21	08		0	0	0	0	1	0	0	0
22	B6		1	0	1	1	0	1	1	0
23	86		1	0	0	0	0	1	1	0
24	00		0	0	0	0	0	0	0	0
25	00		0	0	0	0	0	0	0	0
26	5C		0	1	0	1	1	1	0	0

Address of 1st Character	Message at VFD	A0	A1	A2	A3	A4	A5	A6
129F4	STOP			1C	1D	18	19	
129F9	HOLD			13	18	16	0F	
129FE	PAUSE			19	0B	1E	1C	10
12A04	PLAY			19	16	0B	20	
12A09	SEARCH		1C	10	0B	1B	0D	13
12A10	SEARCH		1C	10	0B	1B	0D	13
12A17	ROOT			1B	26	26	1D	
12A1C	TITLE			1D	14	1D	16	10
12A22	NO DISC	17	26	0A	0F	14	1C	0D
12A2A	UN DISC	1E	17	0A	0F	14	1C	0D
12A32	OPEN			18	19	10	17	
12A37	CLOSE			0D	16	18	1C	10
12A3D	UCD			1E	0D	0F		
12A41	SUCD			1C	1E	0D	0F	
12A46	LOAD			16	18	0B	0F	
12A4B	OFF				18	11	11	
12A4F	HELLO			13	10	16	16	18
12A55	JPEG			15	19	10	12	
12A5A	P CD			19	0A	0D	0F	
12A5F	ERR			10	1B	1B		
12A63	UPGRADE	1E	19	12	1B	0B	0F	10
12A6B	DIGEST		0F	14	12	10	1C	1D
12A72	PBC			19	0C	0E		
12A76		0A	0A	0A	0A	0A	0A	0A
12A7E	PS ON	19	1C	0A	0A	0A	18	17
12A86	PS OFF	19	1C	0A	0A	18	11	11
12A8E	FILES			11	14	16	10	1C
12A94	EJECT			10	15	10	0D	1D
12A9A	READ			1B	10	0B	0F	

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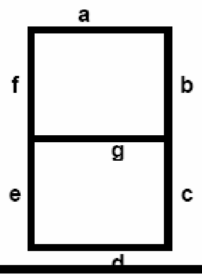


VFD driver

Let’s look to VFD chip closer with connected VFD Futaba 6-BT-297GK (not shown here, see fig.2)

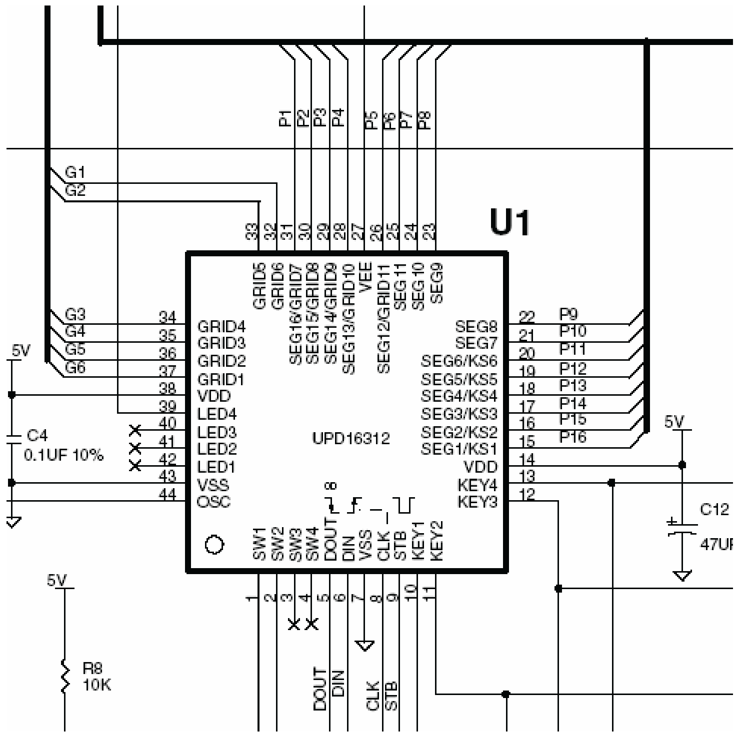


Fig 3. VFD driver example. (NEC ìPD16312)
(from Grundig Xenaro GDP 5100-6150 service manual)

Short pins description: (more detailed – in ìPD16312 datasheet)
Pin OSC is an external oscillator pin required for chip synchronizing and has no interest for programming. Pins VSS, VDD are the supply power for IC and has no interest for programming also.

Understanding of other pins is essential.

VFD Futaba 6-BT-297GK has grids G1-G6 connected to 32-37 pins of VFD driver IC (GRID6-GRID1). Such signal wiring is illogical only at first glance and may be easily justified by PCB layout. This is done often to improve signal throughput, reduce noise and cross-talks between neighbor wires. Don’t forget – there are hard- and soft- wares. The PCB redesign requires much more efforts, time and money in comparison of changing bits order while programming.

Segments of Futaba VFD connected to 15-31 pins (P16-P1 respectively). This is a set of pins (SEG1/KS1-KS6, SEG7-SEG11 and SEG12/GRID11-SEG16/GRID7). Some pins may have different assignment, depending on selected VFD driver configuration.

LED1-LED4 – each of these pins can directly connect to LED. Status of bits can be programmed independently. Oftenly one LED used to show STANDBY status. BBK 965S uses more LED pins for LCD backlight of regulated intensity.

KEY1 – KEY4 – key matrix for front panel buttons (PAUSE, STOP, REWIND, etc.). Front keys also wired to SW1-SW2 (not shown on Fig.3) but Grundig front panel is not suitable for educational purposes (engineers drawn jog dial and buttons which were not seen at front). So we should look for some primitive circuit to learn basics. Here is it.

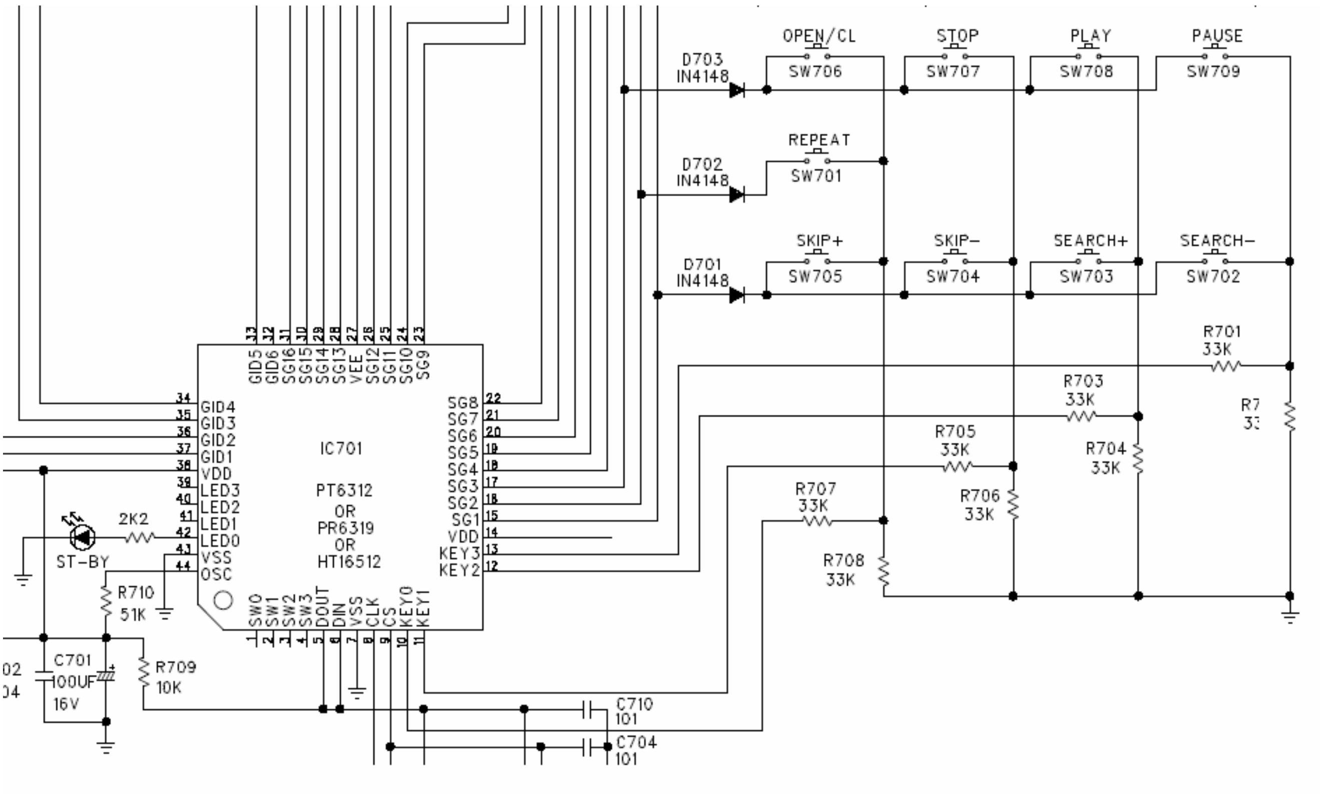


Fig.4. Keyscan Matrix example
(from Memorex MD2028 Service Manual (MT1379))

Some wirings were removed to clean the picture (pin 14, for example). Note the STANDBY LED on LED0 (pin 42). There is a plain set of front panel buttons, connected to KEY0-KEY3 (rows) and SG1-SG3 (columns). To read the status of pressed button, you should select respective column by setting one of SG1-SG3 to ‘1’. Current began to flow and if button pressed it goes to respective KEY0-KEY3 input. VFD driver reads status and stores bits for each pressed button in internal RAM register.

And, again, this is a just an example. In most cases of real life, circuit diagrams of specific players will be different.

To customize VFD driver chip for handling miscellaneous numbers of grids and segments, the chip should be programmed appropriately. Basically driver chip configuration (number of supported SEGs and GRIDs) programmed only once during initial setup. It may use default settings also.

VFD interface to host. 4-wire vs. 3

There is a detailed description of the internal VFD driver registers in datasheets, consequently there is no need to copy manual pages here. You can always download and read original.

Nevertheless, some attention to programming of chips should be paid. Usually this topic is not covered extensively and datasheets are full of technical details useful for engineers in electronics but have little interest for programmers.

VFD driver gets commands and puts data to host by DIN / DOUT / CLK / STB serial interface (Sometime it refers as NEC interface). Let’s look closely at VFD driver from previous figure 4.

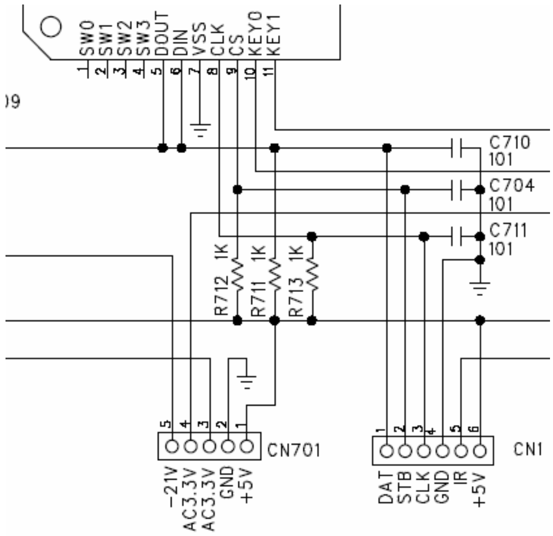


Fig.5 A closer view to host interface.
(from Memorex MD2028 Service Manual (MT1379))

Table1. NEC interface pins

Name on chip	Name on connector	Name on MT1389	Purpose
DIN	DAT	VDATA	VFD driver data input
DOUT			VFD driver data output
CLK	CLK	VCLK	VFD driver tx/rx data clock
CS (STB)	STB	VSTB	Chip select (strobe)

Flat cable, connected to CN1 at fig.5 leads to MPEG board where these signals connect to MT1389 (8032 host) pins. Signal may change its name when traveling between sheets of drawings and complicate understanding for the first time. That happens very frequently because OEM service manuals created by copying and pasting pages from different sources and none carefully scrutinizes every sheet.

Originally NEC proposed 4-wire interface. Basically, there is no simultaneous read/write operations from/to VFD driver at the same time. To reduce number of wires, pins DIN and DOUT are usually soldered together. Chip inside has some protective logics preventing registers data from mutual influence. Thus, 4 wires became 3.

To see which pins of MT1389 used for VFD interface, look at the summary table at the end of this memo. Note the ‘shifting up and wrapping around’ of VFD interface bits in MT1369 devices, and no difference between MT1379 and MT1389.

As we can see, DVD manufacturer for some purpose may change assignment of 8032 bits to control VFD driver. This is one of the reasons why firmwares may be incompatible between OEMs and may not work if flashed directly without adaptation.

Adaptation requires careful studying of all available info. The best source is service manual for specific model, but obtaining it is not simple, and frequently is not possible.

And even you have pdf on hand, be careful. For example, schematics of BBK965S probably may have errata. Circuit Diagram of VFD board shows separated DIN and DOUT wires, but MPEG board get only one – VSDA. For proper functioning it should be somewhere connected together, but this is not shown.

The known exclusions of VFD design are LG 7831, Pioneer DV-470-S, Philips LX-3900. They use different chips as VFD drivers. (Philips and LG use MCU, Pioneer uses unknown chip)

Serial Communication Format for NEC 16311/16312 and compatibles

Nevertheless, number of players (especially non-brands) has NEC-compatible chips.

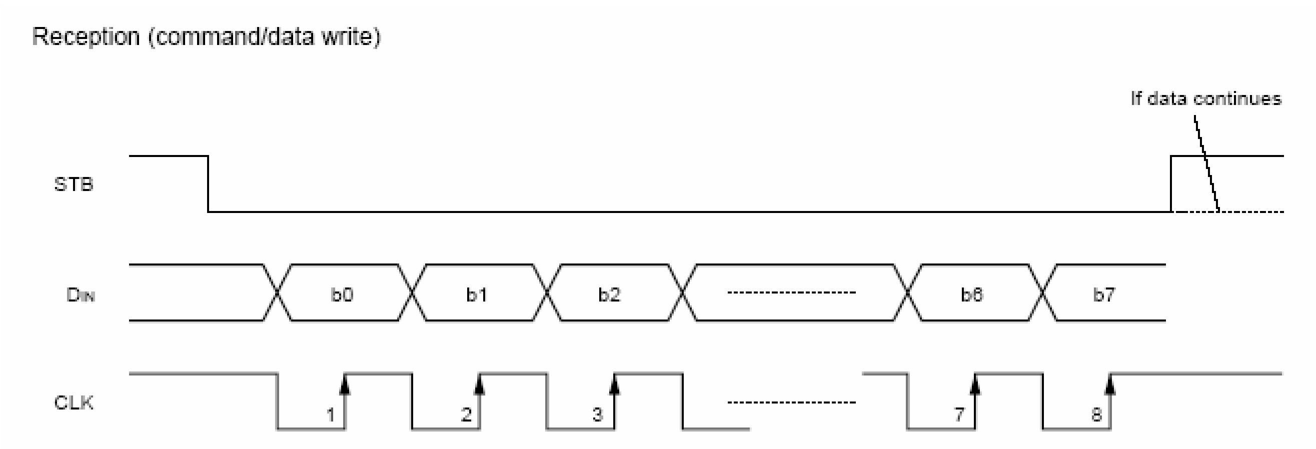


Fig.6 Data reception over NEC interface.
(snatched from NEC mPD 16312 datasheet)

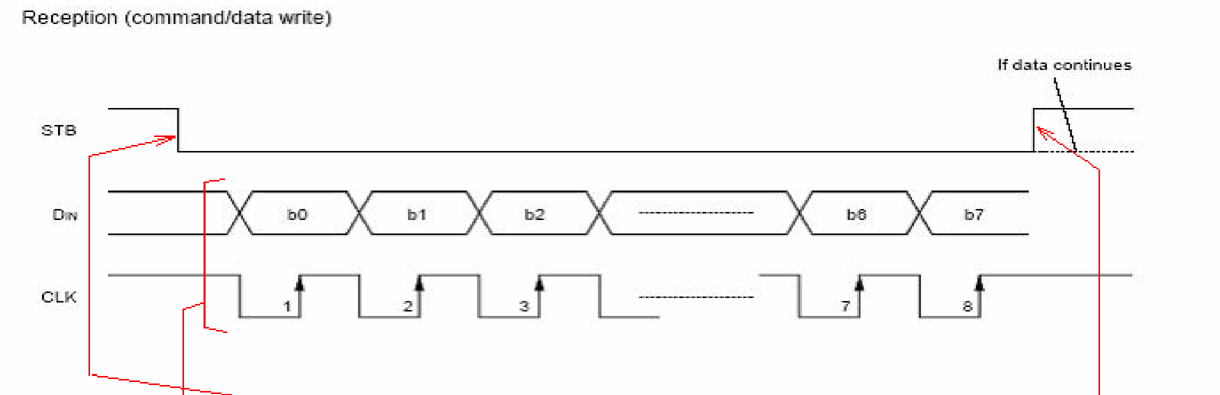
Reception is for VFD driver side, for 8032 side it would be transmission. To write data we should:

1. Set STB pin low.
2.Put data on DIN,
3.Accompany each bit with toggling CLK.
….. < if command requires additional data,
serialize bytes to bits
and send them across the wire>
4. set STB pin high.

VFD interface pin arrangement for BBK965S

P13 – VSCK (CLK)
P14 – VSDA (DIN/DOUT)
P15 – VSTB (STB)

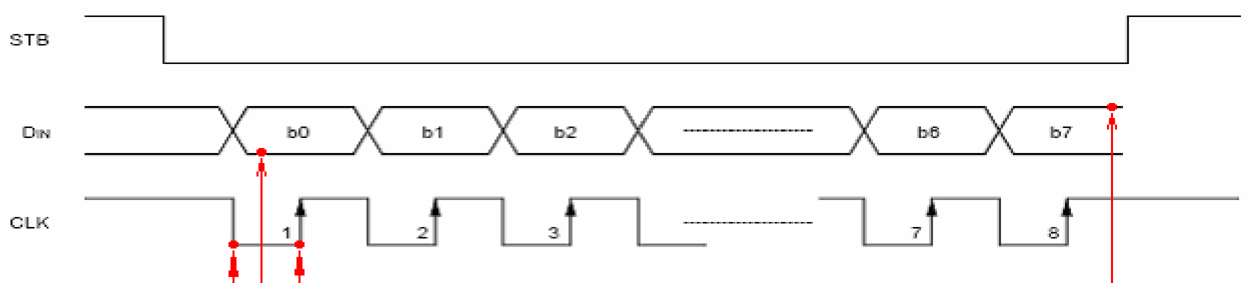
The following code (CODE4:A373 – CODE4:A37D) from BBK965S firmware bank4, an example of sending command to VFD interface. The '???' shows that 0x43 is doubt to be 'SCAN KEYS' ☺, but in this case, it does not matter.




```
CODE4:A373              clr     P15                     ; VSTB (STB) set low - initialize
                                                        ; serial interface
CODE4:A375              nop
CODE4:A376              mov     R7, #0x43 ; 'C'   ; scan keys???
CODE4:A378              lcall   transmit_byte_to_VFD_D4A1
CODE4:A37B              setb    P15                    ; VSTB (STB) set high - close interface
CODE4:A37D              nop
```

Fig.7 Example code for complete interface cycle to VFD from 8032 (BBK 965S)

To see what happened in detail we should look **transmit_byte_to_VFD** subroutine listing:




```
CODE4:D4A1 ; --------------- S U B R O U T I N E ---------------------------------------
CODE4:D4A1
CODE4:D4A1 ; R7 - byte to write,
CODE4:D4A1 ; uses A,R6
CODE4:D4A1
CODE4:D4A1 transmit_byte_to_VFD_D4A1:                 ; CODE XREF: CODE4_A349+2F□p
CODE4:D4A1                                            ; CODE4_A349+6C□p ...
CODE4:D4A1              clr     A
CODE4:D4A2              mov     R6, A                 ; R6 works as counter, R6=0;
CODE4:D4A3
CODE4:D4A3 while_byte_not_completed:         ;
CODE4:D4A3              clr     P13                   ; VSCLK low (CLK)
CODE4:D4A5              nop
CODE4:D4A6              mov     A, R7                 ; rotate byte over C
CODE4:D4A7              rrc     A
CODE4:D4A8              mov     P14, C                ; send bit over VSDA (DIN)
CODE4:D4A8                                            ; (VFD serial data)
CODE4:D4AA              mov     A, R7
CODE4:D4AB              clr     C
CODE4:D4AC              rrc     A
CODE4:D4AD              mov     R7, A
CODE4:D4AE              setb    P13                   ; VSCLK up (CLK)
CODE4:D4B0              nop
CODE4:D4B1              inc     R6                    ; counter++
CODE4:D4B2              mov     A, R6
CODE4:D4B3              cjne    A, #8, while_byte_not_completed; VSCLK on (VFD serial
clock)
CODE4:D4B6              setb    P14                   ; VSDA up
CODE4:D4B8              nop
CODE4:D4B9              ret
CODE4:D4B9 ; End of function transmit_byte_to_VFD_D4A1
CODE4:D4B9
```

Fig.8 Example code for byte transmission to VFD from 8032 (BBK 965S) and its relation to signal timings

VSTB(STB) stay low all the time while data transmission is in progress. VFD reads VSDA(DIN) on the rising edge VSCLK(CLK) (transition from low to high – 'setb P13'). The order of bits in transmission is from LSB to MSB (serialization and output done by 'rrc A / mov P14,C' commands).

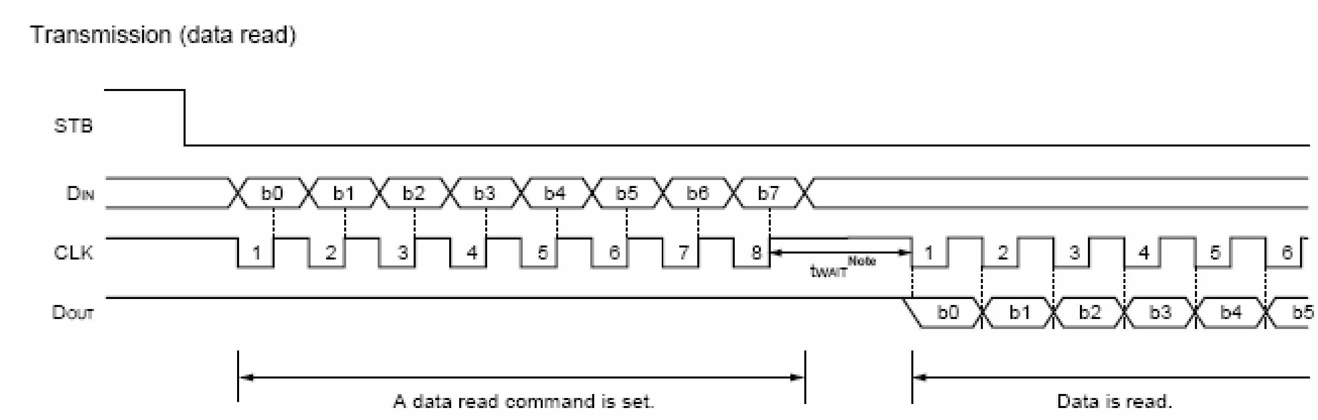


Fig. 9. Data transmission over NEC interface
(snatched from NEC mPD 16312 datasheet)

And again transmission is for VFD driver side, for 8032 it would be reception.
To read data we should:

1. set STB low and keep it while reading is not completed.
2. toggle CLK from high to low (falling edge)
3. read data from DIN/DOUT,
4. set STB high when reading has to be completed to close serial interface.

LSB goes first when 8032 reads VFD driver. Between sequential write and read there should be delay of $_{twait}$ to ensure write operation has been completed and there would not be unwanted influence of previous operation. Datasheet says that 1 microsec of delay would be enough. Usually you see the six or seven **nop**s in code.

After this discussion understanding of display memory updating by incrementing address would be quite obvious. Note the behaviour of STB signal. It toggles every new command and stays low while command data (DIN) are transmitting. You cannot transmit more than 22 bytes between STB toggles. This is NEC 16312 chip restriction.

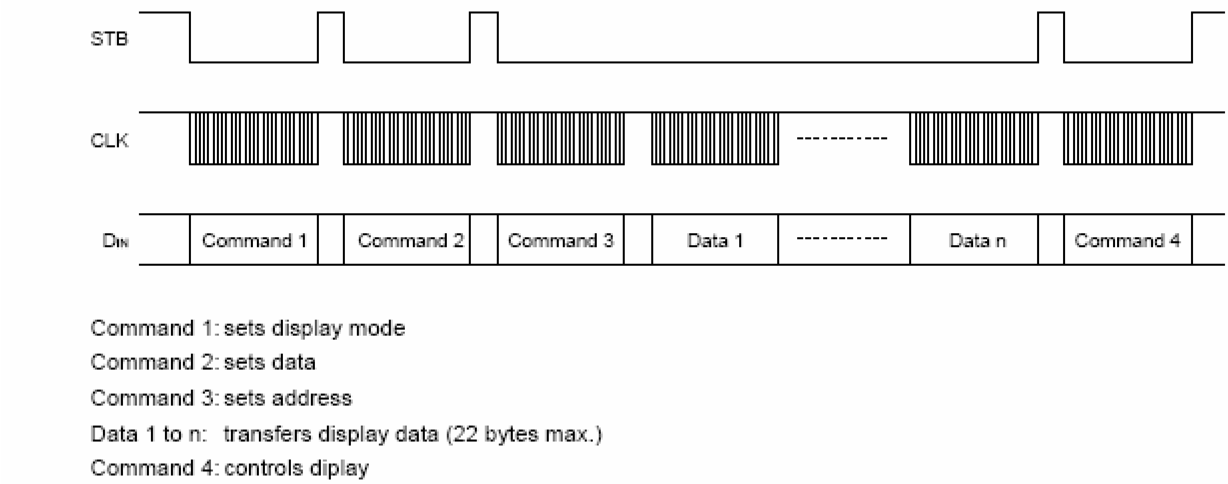


Fig.10 Updating display memory by incrementing address.
(snatched from NEC mPD 16312 datasheet)

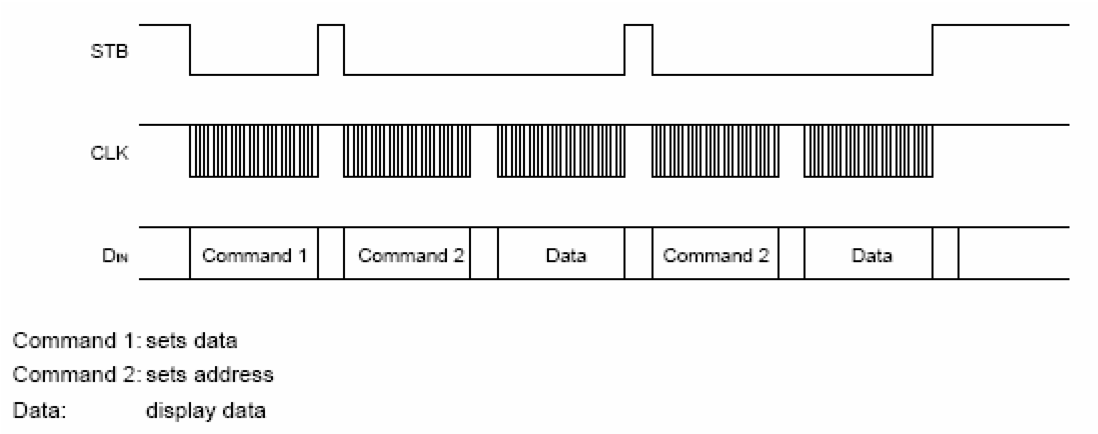


Fig. 11. updating specific adress.
(snatched from NEC mPD 16312 datasheet)

Happy reversing!

Gridd, 19.10.2004

Table 2. Summary Table (from unpublished paper)

	Daewoo DVG-8500N (Hitachi HOP 1120/1200)	Memorex MVD2029 (Sony KHM-234)	Philips DVD625 (submods /001 /021 /051), Philips DVD728/729/731	Sanyo SF-HD60AV (Memorex MVD2028 / 2030)	Memorex MVD2022 , POLAR DV10xx, (Sony KHM-280)	BBK965S	MTK Ref design board	Philips LX3900SA (mod. 01/05/69/75/93)	Philips DVD LX-8300 (mod.	Pioneer DV-470-S/K	LG DV8731	
Processor	MT1369AE	MT1369E	MT1379E	MT1379E	MT137E 'C'	MT1389	MT1389	MT1389E	MT1389E	MT1389EE	MT1389	Processor
P1.0	?	?	?	?	?	?	?	?	?		?	P1.0
P1.1	?	?	?	?	?	?	?	?	?		?	P1.1
P1.2	VSTB	VSTB	STBY_DECT	No conn	No conn	no conn	no conn	No conn	No conn	FP_SO	no conn	P1.2
P1.3	VSCK	VSCK	VSCK	VSCK	VSCK	VSCK	VSCK	VSCK	VSCK	FP_SCK	No conn	P1.3
P1.4	VSDA	VSDA	VSDA	VSDA	VSDA	VSDA	VSDA	VSDA	VSDA	FP_ACK	VFD_SCK	P1.4
P1.5	STANDBY	ASTB	VSTB	VSTB	VSTB	VSTB	VSTB	VSTB	Selection HDMI/DAC	FP_SI	VFD_TXD	P1.5
P1.6	SCL (I_2C)	SCL	SCL	SCL	SCL	SCL	SCL	SCL	SCL_HDMI (SCL_DAC)	SCL	SCL	P1.6
P1.7	SDA (I_2C)	SDA	SDA	SDA	SDA	SDA	SDA	SDA	SDA_HDMI (SDA_DAC)	SDA	SDA	P1.7
P3.0	MICMUTE	P3.0[1]	ASTB	TV1	P3.0 ASTB	No conn	No conn	STB_SW	FP_IRQ	LIMIT	No conn	P3.0
P3.1	MUTE	P3.1	P3.1	TV2	P-S-SELECT	No conn	No conn	AV_MUTE	AV_MUTE	UP3_1	VFD_RXD	P3.1
P3.2	?	?	?	?	?	?	?	?	?	?	?	P3.2
P3.3	?	?	?	?	?	?	?	?	?	?	?	P3.3
P3.4	RXD	RXD	RXD	RXD	RXD	RXD	RXD	RXD	RXD	RXD	RXD	P3.4
P3.5	TXD	TXD	TXD	TXD	TXD	TXD	TXD	TXD	TXD	TXD	TXD	P3.5
Front panel controller	NEC uPD 16311	NEC uPD 16311	NW 6312 (625), PT6312 (728-731)	PT6312 or HR6319 or HT16512	Unknown (Missing pages)	PT6554LQ	NW6312	NW6312 PT3611 uPD16311[2]	TMP87CH74	PE5374B	Hynix GMS81C2012	Front panel controller
Parental password	3308					7890						Parental password
Design name	Not specified	MTK_1369_HD6_E2T4[3]	625 - CL 36532022_015 (19/03/03) 728-729-731 – (27/03/03)	MTK_1369_HD6 Revisions: E1T2 - MVD2028 E1T3 - MVD2030	MT1379 SERVO SONY MEGA	Not specified	CONF_V2	SD6.1	SD6.3	WYXCN, WYxCN/FG	DV8000'S SR14811B	Design name

? – Not known from schematics
No conn – No connection

[1] This is not a mistyping, all the names are from circuit diagram
[2] A bit confusing – NW6312 and mPD16311 written together on schematics, at block diagram PT3611 specified (typo?)
[3] Looks like design for Sanyo