

**SAA 1293A**

**TUNING VOLTAGE PROCESSOR FOR ANALOG TV-SETS**

**VERSIONS:**

- SAA 1293A-03
- SAA 1293A-06
- SAA 1293A-10
- SAA 1293A-20

**June 12, 1991**

T A B L E O F C O N T E N T S

1.	General .....	4
2.	Direct Keyboard and Display .....	5
3.	Remote Control Decoder .....	5
4.	Mains Flip-Flop .....	6
5.	IM-Bus and Non-Volatile-Memory .....	6
6.	Clock Generator and Sequence Control .....	6
6.1	Switching On .....	7
6.2	Station Selection .....	7
6.2.1	Selection of Stations above P9 .....	7
6.2.2	Sequential Station Selection .....	8
7.	D/A Converters for the Analog Outputs .....	8
7.1	Fading Logic .....	9
7.2	NORMALISATION-key .....	9
7.3	'GRANNY'-key .....	9
8.	Control of Band, Multistandard and AFC .....	9
8.1	Band Outputs .....	9
8.2	Multistandard Output .....	10
8.3	AFC Output .....	10
9.	Control of switch for external Audio/Video-Signals ...	10
9.1	VCR Output .....	10
9.2	AV Output .....	10
10.	Auxiliary Output / Validate Input .....	13
11.	Tuning Voltage Generator .....	13
12.	MEMO Procedure .....	15
13.	Teletext Interface .....	16
13.1	TPU2732 Chipset .....	16
13.1.1	Features .....	16
13.2	TPU2735 Chipset (A10/A20 only) .....	18
13.2.1	FLOF .....	18
13.2.2	Initial Page .....	18
13.2.3	Linked Pages .....	19
13.2.4	Extended characters .....	19
13.2.5	Additional Teletext Features .....	19
13.3	SAA 5000 Chipset .....	20

<b>14.</b>	<b>Service Mode</b>	<b>21</b>
14.1	How to enter Service Mode	21
14.2	Submodes	22
14.2.1	Check Mode	24
14.2.2	Option Mode	24
14.2.3	Horizontal Position Mode	25
14.2.4	Text-Contrast Mode	25
14.3	How to leave Service Mode	25
14.4	Option Byte 1	26
14.5	Option Byte 2	32
14.6	Option Byte 3	36
14.7	Option Byte 4	40
<b>15.</b>	<b>Pin Connections</b>	<b>42</b>
15.1	Summary	42
15.2	Description of the Signals	43
<b>16.</b>	<b>Electrical Characteristics</b>	<b>46</b>
16.1	Absolute Maximum Ratings	46
16.2	Recommended Operating Conditions	47
16.3	Characteristics	48
<b>17.</b>	<b>Poly-Counter of DAC's</b>	<b>49</b>
<b>18.</b>	<b>SUMMARY</b>	<b>50</b>
18.1	Option Bytes	50
18.2	Command Codes for Infrared and Keyboard	52
18.3	Contents of Non-Volatile Memory	54
18.4	Ports	55
18.5	SAA 1293A - Microcontroller Application Circuit	56
18.6	TPU 2732 - Teletext Application Circuit	57
<b>APPENDIX</b>		
<b>A.</b>	<b>SAA 1293A-06</b>	<b>58</b>
<b>B.</b>	<b>SAA 1293A-10</b>	<b>59</b>
B.1	Option Bytes	60
B.2	Command Codes	62
B.3	Contents of Non-Volatile Memory	65
B.4	Ports	66
B.5	TPU 2735 - Teletext Application Circuit	67
<b>C.</b>	<b>SAA 1293A-20</b>	<b>68</b>
C.1	Option-Bytes	70
C.2	Command Codes	73
C.3	Contents of Non-Volatile Memory	76
C.4	Ports	77
C.5	ACP 2371 - Audio Application Circuit	78
C.6	OSD-Synchronisation Application Circuit	79
C.7	Example circuit for Auto-searching	80
<b>D.</b>	<b>Overview of all SAA1293 Versions</b>	<b>81</b>

## 1. General

This datasheet describes the features of SAA 1293A-03. The differences and additional features of the succeeded versions SAA 1293A-06, SAA 1293A-10 and SAA 1293A-20 are explained in the appendix.

The SAA 1293A is a single-chip microcomputer in n-channel MOS-technology. In a single 20B40 plastic package it contains, on one silicon chip, all the operating and tuning functions of a modern TV receiver. Thus, along with the MDA 2062 non-volatile memory, the SAA 1250 remote-control transmitter and the TBA 2800 preamplifier this offers a very economic solution for TV receivers with a low or average degree of operating comfort in which station selection is by voltage synthesis.

The most important features of the SAA 1293 are as follows:

- tuning voltage generation with rate multiplier allows the use of low-cost tuner and avoids problems with different channel-tables
- four analog outputs for volume, brightness etc.
- storage of up to 55 stations
- flexible processing due to options set by the equipment manufacturer. Thus a large product range of TV receiver can have the same SAA 1293A control microcomputer
- direct interfacing with ITT multipage teletext system without extra controller for teletext
- remote control of all functions, including tuning and teletext
- full two-digit station display
- keyboard with up to 32 keys for direct operation
- various intelligent tuning methods allow free selection of the station location during tuning
- standby mode with automatic mains-on when station is being selected
- multi-standard switch
- output switches for special audio-video modes
- flexible logic for fading in and out of sound and picture while a station is being changed
- bandswitch outputs for 4 bands maximum
- band indication on the display, no separate indication needed
- fine tuning or normal tuning at four tuning speeds using the remote-control
- service mode for easy setting up and servicing

## 2. Direct Keyboard and Display

A keyboard with 32 keys, each represented by a single normally open contact is provided for the direct operation of the TV receiver. Fig. 1 illustrates the layout of the 4\*8 keyboard matrix. No special demands are made on the keys being used. A debounce time of 40 ms is provided during keyboard operation. Table 15 shows the assignment of the commands to the keys and also to the infrared remote-control commands.

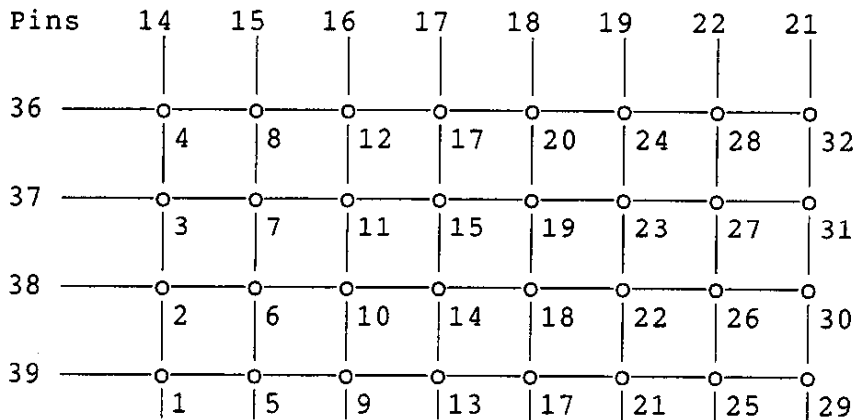


Fig. 1: Diagram of the keyboard for direct input

Keyboard and display use common lines. For scanning the keyboard, the display is therefore interrupted for a short time, invisible to the eye. Two switching transistors are needed for the two-digit display. The two digits are activated in multiplex operation.

Normally the number of the station selected will appear on the display. When the band is changed and during tuning, the current band is displayed (I, III, U, C), optionally together with a 3-step display of the tuning-voltage. The decimal-point of the lefthand digit is ON, when mode AV1 is active (Version A of mode AV1 only). The decimal-point of the righthand digit depends on option 2.8. When this option is set 0, the decimal-point is ON, when system is in teletext-mode. When this option is set 1, the decimal-point is ON, when the 2nd standard (multi-standard output pin31 = HIGH) has been selected.

The g-segment of one or both digits is used as the standby display. If only the g-segment of a single digit is to serve as the standby display, then additional wiring is required. (see Fig.3)

For the key/command assignments there are two versions A and B which are selected by option 4.1. (see table 15). The infrared commands 17 to 26 contain the mains-on command. Infrared commands 1,2,7,41 to 48 also operate in the teletext mode.

## 3. Remote-Control Decoder

The remote-control signal produced by the infrared remote-control transmitter IRT 1250/1260 (SAA 1250) is received by an infrared photo diode, is amplified by the preamplifier TDA

2800 and then fed to pin 12 of the SAA 1293A. A command word recognized as being valid is passed to the sequence control which then initiates further actions in accordance with table 15. Besides clock oscillator and reset circuit the remote control decoder is the only part of the SAA 1293A which is powered under standby conditions. This ensures that a sequence of infrared commands can be used to switch on the TV set.

#### 4. Mains Flip-Flop

The mains flip-flop is needed to enable the TV set to be switched on by the remote control. For this purpose the standby circuit of the TV receiver which consumes only very little power must be permanently switched on. In sets with standby mode a relay which switches the power supply of the TV set on and off - but not the standby supply - is actuated with the mains output (pin5) via an amplifier stage.

The TV set can be switched on from the standby mode by:

1. an active low level of at least 20 us duration at pin 5 (for this the mains switch of the TV receiver must have a so-called wiping contact).
2. by figure commands from the remote control.

The set can be switched into standby mode by means of a remote control command for 'TV set off'.

#### 5. IM-Bus and Non-Volatile-Memory

It is by means of this part of the circuit that the SAA 1293A communicates with the MDA 2062 non-volatile-memory which stores the tuning and analog data, acquired during the Memo procedure (see section 12) and the options. The IM bus consists of three lines IM-clock (pin9), IM-ident (pin8) and IM-data (pin7). IM-clock and IM-ident are unidirectional signals from the SAA 1293A to the memory, and IM-data is bidirectional for transferring the data in both directions. In addition, the MDA 2062 requires a memory clock signal which is issued from pin3 of the SAA 1293A (approx. 1kHz). All these signals on the IM bus have TTL level. The start of a telegram is initiated when IM-ident and IM-data go LOW. Data takeover occurs at the positive edge of IM-clock. For a detailed description of the IM bus protocol please refer to the data sheet of the MDA 2062.

#### 6. Clock Generator and Sequence Control

For the purpose of generating the clock signals required to operate the SAA 1293A the chip contains an oscillator which is designed for crystals in the frequency range from 3.5 to 4.5 MHz. The crystal is connected to pin1. All timing specification in this data sheet relate to a crystal frequency of 4 MHz. With other crystal frequencies, there will be corresponding variations. The reset input(pin4) is required in order to initialize the SAA 1293A during switching on. It then receives a reset signal which is delayed with respect to the supply

voltage by means of an external network. The SAA 1293A is enabled when the voltage at pin4 has reached 2V approximately. During operation there is a high level at pin4. Moreover the reset signal protects the contents of the MDA 2062 non-volatile-memory. An active reset blocks its programming voltage.

## 6.1 Switching On

The TV set can be switched on by the built-in mains switch. In this case it is tuned to station P1 and the analogs (volume, brightness etc.) have the values fixed by the user (MEMO ANALOGS). The set can also be switched on by remote control if it was previously in standby mode. This is done by pressing one of the figure keys 0 to 9 of the infrared remote-control transmitter. In this case the set is tuned to the corresponding station P0 to P9. The status of the analogs then depends on the option 2.2. Either they have the values fixed by the user or the values effective at the moment the TV set was switched off are recovered.

## 6.2 Station Selection

The SAA 1293A has a storage capacity for 55 (optionally 29) stations. When a new station is selected, information on tuning voltage, band and multistandard is read from MDA 2062 and the outputs are set appropriately.

The no. of available station locations is divided into 6 (or 3) decades. For making the selection, both the direct operating panel on the set itself and the remote-control have a decimal keypad. After the TV set is switched on, the system is in the decade '0'. However a '0' does not appear in the left-hand display position. Stations P0 to P9 now can be selected by pressing a single key. Station P0 is supplied for input of a video-recorder signal.

### 6.2.1 Selection of Stations above P9

To select a station with a no. greater than '9', the decade must first be selected. The decade is always indicated on the lefthand digit. The selection must be completed by pressing a figure key within 5 sec, otherwise the complete selection becomes null and void. There are 3 different possibilities to select the decade.

#### 6.2.1.1 Selection of decade with keys 'P1-' and 'P2-'

This version is available only for systems with max. 29 P-no's (Option 1.3=0). The system does not stick to the decade once selected. That means: If P15 was the selected station, you must press key '1' then the system switches to P1.

#### 6.2.1.2 Selection of decade with keys 'P10-' and 'P10+'

With this version, the decade of the P-no is selected sequentially. This version is available only for systems with

max. 55 P-no's (Option 1.3=1). The system sticks to the decade once selected until a new decade selection is made. That means: If P15 was the selected station, you must only press key '9' to switch to P19. But to come back to P0..P9, the zero-decade must be selected first. There is no '0' to display the zero-decade, but the lefthand digit is dark.

### 6.2.1.3 Selection of decade with key 'P--'

This key provides a 2-step selection for all P-no's P0..P55. This version is available for systems with max. 29 P-no's and with 55 P-no's as well. After pressing key 'P--', the figure entered first selects the decade 0..5 of the P-no. When the 2nd figure is entered, the selection of the P-no. is completed and the system is tuned to the station with the selected P-no. Only if option 1.3 is set to '1', the system sticks to the decade once selected.

### 6.2.2 Sequential Station Selection

In addition to the direct selection of stations the SAA 1293A has a facility for sequential station selection with keys 'P+' and 'P-'. This operates with automatic overflow from 29/55 to 0 and vice versa. Pressing these keys continuously initiates an automatic repeat function, i.e. the system switches to the next station every 0.7 sec. Option 1.4. determines whether all station locations are selected in sequence or only so-called 'activated station locations'. Activated stations were flagged during the procedure for MEMO TUNING (see 12.). This feature is called: 'Intelligent keys P+, P-'. Only P1 is always activated.

To reset an activated station, a special operation procedure is needed. The type of this procedure depends on the status of the option 3.3. (version of MEMO-procedure).

- Version A: \* Select station to be reset  
 \* Press MEMO key  
 \* Press one of the keys P+, P- within 5 sec
- Version B: \* Select station to be reset  
 \* Enter programming-mode by pressing 'Tune +' or 'Tune -'.  
 \* Press key NORMALISATION

## 7. D/A Converters for the Basic Settings

The SAA 1293A provides four analog outputs for adjustment of TV's basic settings (e.g. volume, brightness, contrast and colour-saturation). These control voltages are made available as pulse/pause modulated signals, where the ratio can be varied in 64 steps. The needed DC level signal is obtained by means of a simple RC lowpass filter.

For adjusting the four settings in both directions, two keys each are provided on the remote-control and on TV's keypad. Adjustment is in 64 steps at a rate of 6 steps/s for as long as the particular key is depressed. The outputs DAC1 to DAC3 are freely available, whereas DAC4 is reserved for volume, because of the mute function. When the mute key is depressed,



the sound is switched on and off togglewise. Any of the two keys 'Vol+' and 'Vol-' resets an active mute and recovers the original value for volume.

### 7.1 Fading Logic

Whenever station or band are being changed, the SAA 1293A ensures a smooth transition of sound and optionally of picture. The same happens, when an AV-mode is switched on or off. For this purpose DAC4 (Volume) is shut down for a few 100 ms. When option 2.5. is set DAC1 and DAC2 (e.g. for brightness and contrast) are included in this fading logic. Option 2.6. specifies the length of the fading period. (Option set = 600 ms period, else 200 ms period)

### 7.2 NORMALISATION-key

When this key is pressed, DAC1 to DAC4 are set to user's favorite values, stored in the non-volatile-memory. By means of option 2.1. it is possible to exclude DAC4 (Volume) from this procedure.

### 7.3 'GRANNY'-key

When this key is pressed, DAC1 to DAC4 are set to factory-set values, stored in the MDA 2062. They can only be set in service-mode and are not alterable by the user.

## 8. Control of Band, Multistandard and AFC

### 8.1 Band Outputs

The SAA 1293A provides on pins 29 and 30 two output lines which specify the selected band as coded information. Normally the system will support three bands (I,III,IV/V). When option 3.5. is enabled bands I and III are not supported (eg. for U.K. market) and when Option 3.7. is enabled, a separate hyperband for cable TV is supported. Decoding of a three-band system is by a simple circuitry with three diodes, whereas four bands need a full 2 to 4 decoder.

Pressing the band key switches to upper-next band and a symbol for the adjusted band is indicated on the display for 2 sec. As during station switching, sound and picture are faded and the AFC is disabled for 350 ms.

There are other two options which determine the performance of the system. When option 2.3. is selected, the band is not switched immediately the band key is pressed, but the band which is still active is displayed for 5 sec. The band key must be pressed again within this time if the band is to be switched. When option 3.2. is set to '1', band I and band III appear to the user as a single band VHF. In this case the band is indicated by lower dashes (for VHF) and higher dashes (for UHF).

Available bands	Option	3.2	3.5	3.7
I - III - U		0	0	0
I - III - U - H		0	0	1
U		0	1	0
U - H		0	1	1
V - U		1	0	0
V - U - H		1	0	1
H = Hyper-band (for cable-TV)				

Table 1: Available Bands selected with Option-Bytes

## 8.2 Multistandard Output

The SAA 1293A provides on pin 31 an open-drain output line for multi-standard, which will be normally used to select one of two TV-standards. The status of this output is specific for each station location and is stored with the user procedure MEMO TUNING. If the output is not needed for multi-standard purposes, it may be freely used for other purposes. Anyhow the corresponding key works as a toggle-function. When option 2.8. is set to display the status of the multi-standard output, the decimal point of the righthand display is ON, when the second standard is selected and level of pin 31 is HIGH.

## 8.3 AFC Output

Under normal conditions, the open-drain output for AFC at pin 35 has HIGH-level for 'AFC on'. Only during tuning, band switching and station switching it is temporarily switched to LOW-level, so that the change of the tuning-voltage is not effected by the AFC.

## 9. Outputs of external Audio/Video-Signals

### 9.1 VCR-output

The SAA 1293A provides on pin 32 an open-drain output for VCR-mode. The logical levels (active HIGH / LOW) depend on option 2.7. This output is needed for those TV sets which have to switch a time-constant in their deflection for video-recorder signals. To activate the VCR-output select station location '0'. The display will display '0' and the station parameters (tuning-voltage, band and multi-standard) for station location '0' of the non-volatile-memory will be activated (necessary if VCR is connected to TV's antenna).

### 9.2 AV-output

Besides the VCR-output the SAA 1293A supplies on pin 25 an extra output for 1 or 2 Audio-Video modes. Depending on the status of option 1.2. the system is equipped with a single AV-mode, called 'Mode AV1' in the description below or with 2 different AV-modes called 'Mode AV1' and 'Mode AV2'. A single AV-mode is good for a set with chinch-connectors, whereas two AV-modes are needed for a set equipped with a SCART-connector.

Whenever an AV-mode is switched on or off, a fading period ensures a smooth transition of sound and optionally of picture.

#### **Mode AV1:**

This mode is needed for a composite video and an audio signal feed to the TV via external video connector (not antenna!). If these signals come along with a switching-voltage, the TV set will use this voltage to power the external signals instead of those from the tuner to the signal processing unit. For those signal sources which do not supply this switching-voltage, the SAA 1293A provides MODE AV1. There are two versions to get into MODE AV1.

#### **Version A:**

For this version the remote-control and/or the keypad must be equipped with an AV-key. When the system was tuned to any station and this key is pressed once, the system will enter MODE AV1. It will set the AV-output and the VCR-output to activ. The decimal-point of the lefthand digit is ON. All station-parameters (tuning voltage, band and multi-standard) and the display of the station number remain the same. The tuner is completely unaffected. This version A is necessary for those TV sets prepared to work with descramblers connected to the SCART-connector.

#### **Version B:**

For this version the remote-control and/or the keypad need no AV-key. Now the procedure to get into MODE AV1 is to enter VCR-mode first by pressing key '0' and then pressing key '0' one more time. The display will now indicate 'AU' if option 1.2. is set to 1 AV-mode else it will indicate 'A1'. In opposite to version A the tuner will not stick to the original station.

#### **MODE AV2:**

This mode is needed for a RGB-video and an NF-audio signal feed to the TV via SCART-connector. If RGB signals come along with a so-called fast-blanking signal, the TV set will automatically use these signals as an input instead of those its signal processing unit. For those signal sources which do not provide this signal, the SAA 1293A provides MODE AV2. This mode is available only if option 1.2. is set. There are again two versions to get into MODE AV2.

#### **Version A:**

For this version the remote-control and/or the keypad must be equipped with an AV-key. When the system was tuned to any station and this key is pressed twice, the system will enter MODE AV2. It will set the AV-output to activ and the VCR-output to inactiv. All station-parameters (tuning voltage, band and multi-standard) and the display of the station number remain the same. The decimal-point of display's lefthand digit

is OFF. The tuner is completely unaffected. This is necessary for those TV-sets prepared to work with descramblers connected to the SCART- connector. If necessary, an extra LED, controlled by the two outputs VCR-mode and AV-mode is needed to indicate MODE AV2.

#### Version B:

For this version the remote-control and/or the keypad need no AV-key. Now the procedure to get into MODE AV2 is to enter VCR-mode first by pressing key '0' and then pressing key '0' two more times. The display will now indicate 'A2'. In opposite to version A the tuner will not stick to the original station. MODE AV2 will be left automatically with the next station selection.

Station	Use	VCR-output	AV-output
1..29/55	TV-Broadcast	inactiv	inactiv = HIGH
0	VCR via antenna	activ	inactiv = HIGH
AU (A1)	VCR via AV-con.	activ	activ = LOW
A2	RGB via SCART	inactiv	activ = LOW

Table 2: Logical level of VCR- and AV-Output

Any of the AV-modes are left again togglewise or by making a new P-no. selection.

#### Example for version A:

Mode	Display	VCR-output	AV-output	
TV	P 5	inactiv	inactiv	-> Key 'AV'
AV1	P.5	activ	activ	-> Key 'AV'

#### only if mode AV2 available:

AV2	P 5	inactiv	activ	-> Key 'AV'
TV	P 5	inactiv	inactiv	-> Key 'AV'
AV1	P.5	activ	activ	-> Key 'AV'
...	...	.....	.....	

#### Example for version B:

Mode	Display	VCR-output	AV-output	
TV	P 5	inactiv	inactiv	-> Key '0'
VCR	0	activ	inactiv	-> Key '0'
AV1	A 1	activ	activ	-> Key '0'

#### only if AV2 available:

AV2	A 2	inactiv	activ	-> Key '0'
VCR	0	activ	inactiv	-> Key '0'
AV1	A 1	activ	activ	-> Key '0'
...	...	.....	.....	

## 10. Auxiliary Output / Validate Input

The auxiliary output (pin28) is freely at the disposal of the equipment manufacturer. It is set active low temporarily by the appropriate operating keys but remains low for only as long as the key is depressed, automatically returning thereafter to the normal high state.

The same pin 28 may optionally (option 1.6) also used as so-called validate-input to provide the two features 'Automatic off-timer' and 'Tuning aid'. The off-timer will automatically switch off the system to standby 5 min. after end of TV-transmission. Tuning aid is intended to help the user while he is tuning through the bands by automatically reduce the tuning-speed to the slowest gear everytime a station is detected by the RF-part of the TV-set. To make use of these two features, a high signal (2.8..12V) must be provided at validate-input, if there is a broadcasting and a low signal (< 0.8V) else.

## 11. Tuning Voltage Generator

The tuning voltage for the capacitance diodes of the TV tuner is generated as a pulse/interval modulated signal by a modified rate multiplier. The range of variation of the pulse/interval ratio extends from 0 (no pulses) to infinity (continuous signal) with a resolution of 4032 steps. At a clock frequency of 4 MHz the basic period of the rate multiplier is 0.5 ms which results in tolerable filter expenditure (three RC networks, see Fig.3). During station search the tuning voltage is altered in positive or negative direction by means of the appropriate keys of the remote control or by the direct keys. The tuning speed increases with the duration of the key actuation. This also depends on the band since the number of channels per band varies considerably.

Option 3.1 specifies what happens when the end of a band is reached. The system may continue tuning in the neighbouring band or restart at the other end of the same band.

During the tuning process the sound is not switched off by the device, but the AFC is disconnected for the duration of tuning so that it does not effect the precise tuning-in of a station. Throughout the tuning operation the display indicates the band which is actually switched on and the tuning-voltage by means of a three step dash-display: LOW-MIDDLE-HIGH.

Gear	Period (sec)	I	Steps/s in band		
			III	IV/V	H
1	0....0.4	5	2	1	1
2	0.4..2.0	35	14	7	7
3	2.0..3.6	105	42	21	21
4	> 3.6	385	154	77	77
4	> 3.6	560	224	112	112

without tuning aid  
with tuning aid

**Table 3: Tuning-speed**

In the case of fine tuning by the remote control unit the tuning speed always remains at its low value. The display of

the station number does not change. Option 3.6. determines what happens with the AFC signal after the release of the keys for fine tuning.

### Display of Tuning-Voltage

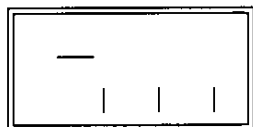
During the normal tuning-procedure (not fine-tuning), the 7-segment display not only shows a symbol for the actual band, but may also show a symbol for the relative level of the tuning-voltage. To activate that feature, option 1.5 must be set.

If option 3.2 is set '0', this display is a very simple 3-step indication with the two upper horizontal dashes of the 2 display-digits. For the first quarter of the band-range only the lefthand dash is ON, for the second quarter of the band-range both dashes are ON, and for the upper half only the righthand dash is ON.

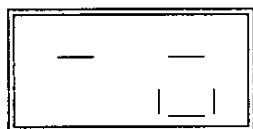
If option 3.2 is set '1', band I and III appear to the user as a single band VHF. Now lower dashes are for VHF and upper dashes are for UHF. The lefthand digit indicates band VHF with the lower dash and band UHF with the upper dash. The righthand digit does a 5-step indication with the 3 horizontal dashes. For the first fifth of the band-range only the lower dash is ON, for the second fifth its the lower and the middle dash, for the third fifth its the middle dash only, then comes middle and upper dash and for the last fifth only the upper dash is ON.

### Examples:

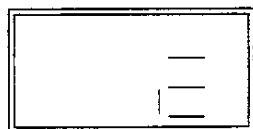
#### A. Option 3,2 set '0'



= tuning voltage is in low end of band III  
<-- symbol for band (I,III,U,C)

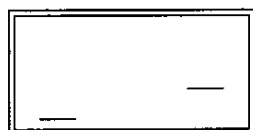


= tuning voltage is in center of band UHF

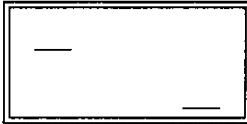


= tuning voltage is in high end of cable-band

#### B. Option 3,2 set '1'



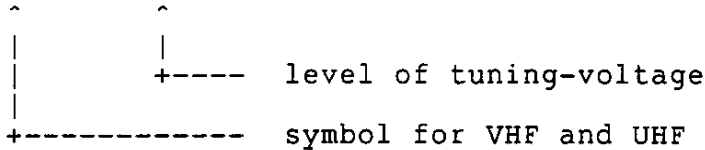
= tuning voltage is in 3rd quarter of band VHF



= tuning voltage is in low end of band UHF



= tuning voltage is in 4th quarter of band UHF



level of tuning-voltage

symbol for VHF and UHF

## 12. MEMO Procedure

Using the MEMO procedure the user can store both the tuning information acquired during tuning (tuning voltage, band and standard) as well as the values for the normalising of the analog outputs. Using option 3.3. the manufacturer can fix the mode of operation specifying version A or version B.

### Version A

Storage of tuning information:

- \* Select tuning voltage, band and standard
- \* Press MEMO key - display is flashing with '--'
- \* Select station location with direct - not with sequential method - display stops flashing

Storage of normalisation values:

- \* Set to agreeable values
- \* Press MEMO key - display is flashing with '--'
- \* Press 'Normalising' key or any key for the analog values

### Version B

Storage of tuning information:

- \* Select tuning voltage, band and standard - Display is flashing
- \* Select station location (direct or sequential method) - display stays flashing\* Press MEMO - display stops flashing

Storage of normalisation values:

- \* Set to agreeable values
- \* Press MEMO key

### 13. Teletext Interface

The SAA 1293A supports two completely different decoders for level 1 teletext. One decoder is an 8 page system consisting of 3 devices from the DIGIT2000-chipset of ITT. This chipset is IM-Bus controlled. The other decoder is a single page system consisting of 4 devices of the MULLARD-SAA50xx family. This chipset is MI-Bus controlled.

There is an automatic detection of the TPU of the ITT-teletext-decoder in such a way, that the system always supports this chipset by sending telegrams on the IM-bus, whenever the initialisation-routine of the software detects a TPU. When the TPU isn't detected, it's up to option 1.7 that MULLARD-teletext decoder is supported or not.

Because the AV-mode output is combined with the MI-Bus DATA-line, there is no use to send MI-Bus telegrams, if there is no decoder connected to it.

#### 13.1 TPU2732-Chipset

This chipset consists of teletext-processor TPU2732, deflection-processor DPU2543 and video analog to digital converter VAD 2150 and a 64K dynamic RAM. The interface for direct driving is via IM-bus at pins 7,8, and 9. No additional teletext controller is needed, because the software for teletext control is already on the chip. Besides the standard features of a teletext system (mix,hold,reveal, cancel,double height, timed page), this chipset always buffers extra seven teletext pages in the 64K RAM memory. This allows a fast access to the next and last pages in relation to the actual page, displayed on the screen. In addition, an inverse display of the colours of the teletext picture is available.

##### 13.1.1 Teletext-Features

###### TELETEXT ON

When system was in TV-mode, it enters TEXT-mode with default attributes (normal height, no MIX, no timed-page, no reveal). The page-no. is 100 when teletext mode is entered the first time after TV on or when the system is now switched to a station different from the station of last TELETEXT-session. Otherwise the system returns to the page, which was actually received, when the teletext-mode was left.

Pressing key TEXT in TEXT-mode resets HOLD, CANCEL, HEIGHT, MIX, REVEAL and TIMED PAGE.

###### MIX-MODE

This key toggles MIX on and off. There is no direct access to MIX-mode from TV-mode but only via TELETEXT-mode. MIX does not work in submode CANCEL.



**LAST PAGE**

Pressing this key in TELETEXT-mode the last selected and received page will be displayed again. To return to the actual page key NEXT PAGE must be pressed. A separate page must have been selected first, before a LAST PAGE is available. There is always only a single LAST PAGE in memory.

**NEXT PAGE**

Pressing this key in text-mode will normally select a page with a page-no. which is by 1 greater than the page, actually selected. Because the system always tries to catch the next 5 pages relative to the actual one, there is often a direct presentation of the next page, when the key NEXT PAGE is pressed. Selection of next page is not possible, if actual page is P899. The only exception is when LAST PAGE was pressed before. Then the system will return to the original page.

**TIMED PAGE**

This feature is combined with a separate feature called FAVORITE PAGE. Pressing this toggle-key, the system will again display the page, which was selected as TIMED PAGE in this or an earlier teletext-session. Because this page is buffered separately all the time, it's a kind of favorite page for the user. To select a new favorite page, just enter its 3-digit page-no. Selection of a real timed-page starts in the same way. First enter its page-no. The time-display in the right corner of the header starts flashing. Now you can enter the time or a subpage-code. Finally you have to press key DISPLAY CANCEL.

**REVEAL**

This is a toggle command. Setting it active the system will display the hidden part of the teletext-page, which is transmitted with the dedicated code for REVEAL (i.e. answer to a question). REVEAL is not possible in submode UPDATE.

**UPDATE**

This is a toggle command. Setting it active the display of the teletext-page will disappear immediately - except for the header-line which will disappear with 5 sec. delay. The system still remains in text-mode. When a selected page is received, the page-no. is indicated for 5 sec. in the upper-left corner. When a new figure-key is pressed in order to enter a new page-no, the whole header is switched on. Submode UPDATE is not possible in submode HOLD and it resets an active submode REVEAL and MIX.

**HOLD**

not possible in submodes UPDATE and TIMED PAGE - resets to upper half, when lower half

## HEIGHT

This is a 3-way toggle command. 'TOP-BOTTOM-NORMAL'

## INVERSE

This is a toggle-key, which allows an inverse display of all contents of the teletext-page (i.e. black gets white, red gets green etc.). Inverse is also possible together with the attributes MIX, DOUBLE HEIGHT, REVEAL etc.

### 13.2 TPU 2735-Chipset (A-10, A20 only)

The versions SAA 1293-A10 and SAA1293-A20 support decoder for FLOF (Full Level-One Features) Teletext, level 1.5 Spanish Teletext and Turkish, Polish and Hungarian Teletext instead of Spanish Teletext.

This chipset consists of teletext-processor TPU 2735, deflection-processor DPU 2543/53 and video analog to digital converter VAD 2150 and a 256K dynamic RAM. The interface for direct driving is via IM-bus at pins 18, 19 and 20. No additional teletext controller is needed, because the software for teletext control is already on the chip. Besides the standard features of a teletext system (mix, hold, reveal, cancel, double height), this chipset always buffers extra four teletext pages in the 256K RAM memory. This allows a fast access to the linked and last pages in relation to the actual page, displayed on the screen. In addition, an inverse display of the colours of the teletext picture is available.

#### 13.2.1 FLOF Teletext

FLOF provides user friendly access to Teletext pages. FLOF decoder uses three additional packets:

- packet 8/30 - initial page
- packet 27 - page linking
- packet 24 - prompts

The packet 24 contains words (prompts) indicating the nature of the information on the pages specified in the first four links of the packet 27. Each of these prompts is colour-coded (red, green, yellow, cyan), and remote controller contains four coloured keys. Index key is available too.

#### 13.2.2 The Initial Page

While entering the Teletext, in the course of one second, the reception of packet 8/30 is permitted. There are two possibilities:

- Packet 8/30 is received correctly. Data on the initial page are taken, and the request for it stated. FLOF mode is active.
- Packet 8/30 is either not received or page number not specified, or there is a transmission error. A request for page 100 is stated. FLOF mode is not active.

The initial page is displayed automatically only when Teletext is entered.

### 13.2.3 The Linked Pages

After the display of any of the pages the reception of packet 27 is checked. There are two possibilities:

- Packet 27 is received the Designation Code is 0000. Data on the linked pages are taken from packet 27. The transmitting of line 24 is checked. There are two possibilities:
  - Packet 24 is transmitted --> it is displayed.
  - Packet 24 is not transmitted --> it is not displayed.
- Packet 27 is not received or the Designation Code is not 0000. With regard to whether packet 8/30 is received or not (whether FLOF Teletext) there are two possibilities:
  - FLOF - Yes --> There is no linking, and packet 24 is not displayed.
  - FLOF - No --> The four pages following the displayed one are requested.

If there is an transmission error, or if page number is not specified this page is not linked. Because of request for the linked pages there is no updating during half minute.

### 13.2.4 Level 1.5 Spanish or Turkish/Hungarian/Polish Teletext (Extended Characters)

The Teletext decoder utilize packet 26 with the national set of characters. The decoding takes place immediately after the page of the Teletext has been received. It is possible to decode maximum 32 (for Spanish) or maximum 27 (for east europe) different characters. If packets 26 are received it is possible to store maximum 16 pages of the Teletext. If packets 26 are not received it is possible to store maximum 28 pages of Teletext.

### 13.2.5 Additional Teletext Features

#### **PAGE 100 / INDEX PAGE**

Display Index page and link 4 pages. In case there is no Index page Initial page is requested. In non FLOF mode Page 100 is requested. Executes a general SOFTWARE RESET. Terminates all special functions.

#### **LINK red/green/yellow/cyan**

Selection of pages with four coloured keys (s.chapter 13.2.3).

### 13.3 SAA5000-Chipset (only A-03/A-06)

The interface for direct driving of the SAA 5000 chipset is via the so-called MI-bus at pins 25 and 26. The teletext controllers supported are SAA 5040, SAA 5041, SAA 5042 and SAA 5043. Furthermore, the SAA1293A has three versions of the key assignment for teletext commands.

**Table 4: Key/Command-Assignments for teletext-commands**

Command	SAA5000-teletext		TPU2732- teletext	TPU2735- teletext
	all vers.	+ vers. C		
Mix *	31	55	31	31
Height *	28	51, 58	28	28
Small/Width	27	54	-	62
Hold *	29, 39	56	29	29
Reveal *	12	59	12	12
Update *	30	60, 62	30	30
Timed P *	38	53	38	38
Next P	-	-	8, 15	8, 15
Last P	-	-	5, 16	5, 16
Inverse *	-	-	27	27
Status	37	52	-	-
Page 100	-	-	-	32
Index	-	-	-	32
Set english character +	-	-	-	60
TT Reset	4	61	57, 61	57, 61
TT Off	3, 33	-	3	3
FLOF (red)	-	-	-	33
FLOF (green)	-	-	-	34
FLOF (yellow)	-	-	-	35
FLOF (blue)	-	-	-	36

\* = implemented as toggle-function

+ = only for polish teletext

## 14 Service Mode

### Introduction:

INTERMETALL's ICs of the SAA1293-family are TV-controller intended for voltage-synthesizer based tuning systems. They were designed to have some optional functions, so the TV-manufacturer can enable or disable features and he can select the functional performance of this IC.

This is implemented by his setting the so called 'option-flags' in non-volatile memory (EEPROM) MDA 2062. This is done in the so-called SERVICE-MODE. Some alignment of the teletext-picture can be made in the SERVICE-mode as well, if the system is equipped with a teletext-decoder of INTERMETALL. Because SERVICE-mode is implemented in the software of the device, no extra SERVICE-computer is necessary. Only a special remote-control is needed to activate SERVICE-mode. This remote-control for commissioning and test has to be supplied by the TV-manufacturer. He can prepare this remote-control, by adding only the key SERVICE (Infrared-command 1) to a normal remote-control. This special remote-control needs at least following keys:

IR-command	Meaning	
	normal mode	SERVICE-mode
1	SERVICE-mode ON	Next submode
4	Normalisation	MEMO for GRANDMA-key
39	MEMO	MEMO
17...24	'P1'...'P8'	Toggle Option-flag '1'...'8'
47	VOL +	Value + / Option-byte +
48	VOL -	Value - / Option-byte -

where command-codes are counted 1...64 not 0...63 !

Table 5: Service IR-commands

### 14.1 How to Enter Service Mode

You can enter SERVICE-mode out of any operation of the TV-set, from any mode (TV or TELETEXT). SERVICE-mode is entered, when key SERVICE (Infrared-command '1') is pressed for at least 500 ms. First submode CHECK is automatically entered then.

#### MEMO of values for GRANDMA-key

Pressing this key in normal TV-operation (not in SERVICE-mode) sets values of the 4 analog-functions to factory-set GRANDMA-values.

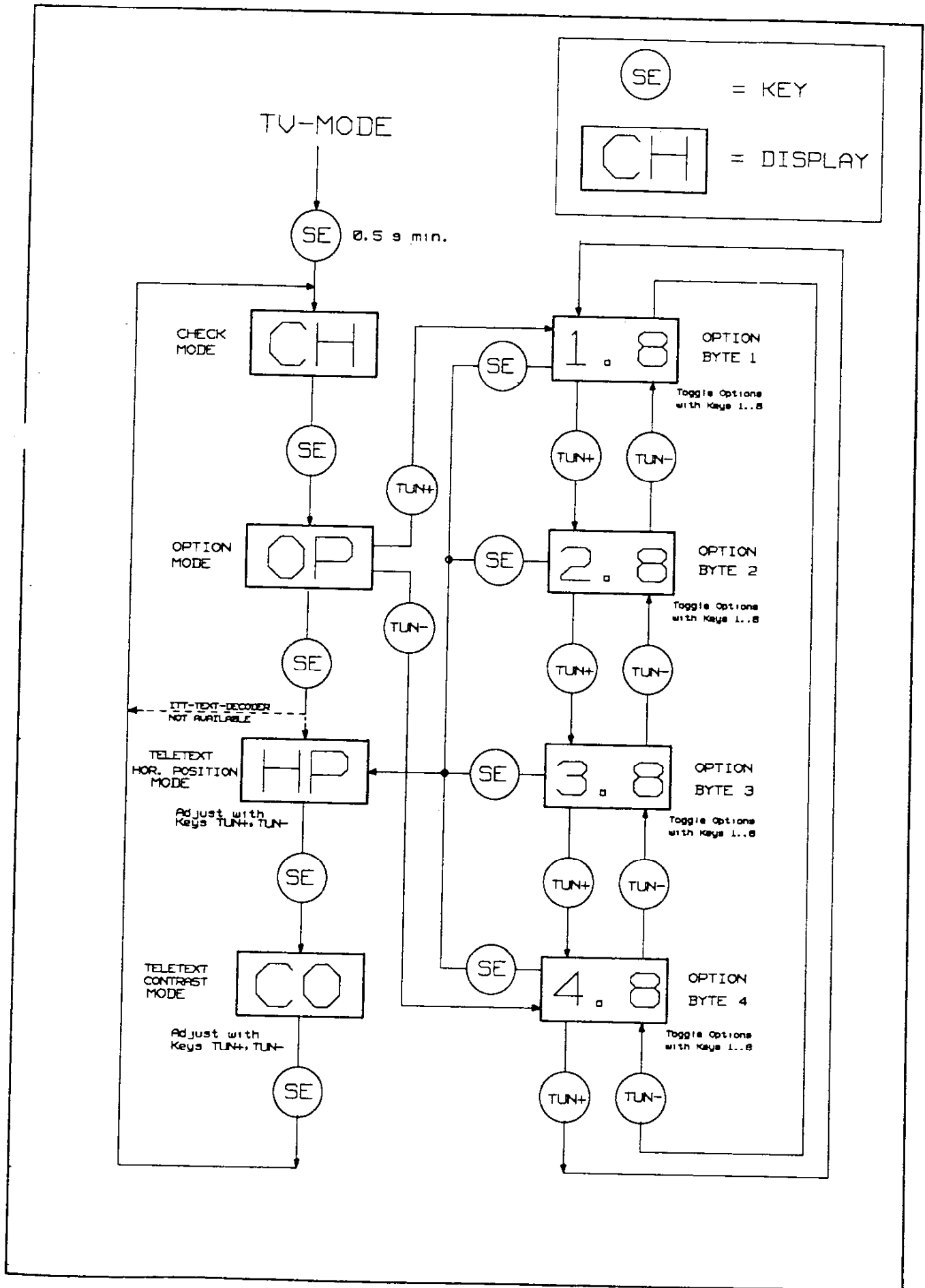
This factory-setting can be done in any submode of the SERVICE-mode using key NORMALISATION. The display indicates the memorisation by displaying 'gr'. The actual analog-values are copied into the non-volatile memory.

## 14.2 Submodes of Service Mode

The SERVICE-mode provides min 2 and max. 4 submodes. There are only 2 submodes CHECK and OPTIONS, if the system isn't equipped with an ITT-text-decoder, but there are 4 submodes, if there is this decoder in the system.

Anyhow the first submode is the CHECK-mode and the 2nd is the OPTIONS-mode. The display shows 'CH' when system is in CHECK-mode and it shows 'OP' when in OPTIONS-mode.

The 2 other submodes, available only in systems with ITT-text-decoder are HOR. POS. to adjust the horizontal position and TEXT CONTR. to adjust the contrast of the teletext display.



### 14.2.1 Submode CHECK

This submode allows normal TV-operation. The only difference is that auto-repeat-commands are accelerated, when they are given by direct keyboard of the TV-set. These auto-repeat-commands are:

1. Tuning +/-
2. Analog 1..4 +/-
3. Station P+/P-

This feature is very helpful for the factory-test.

### 14.2.2 Submode OPTIONS

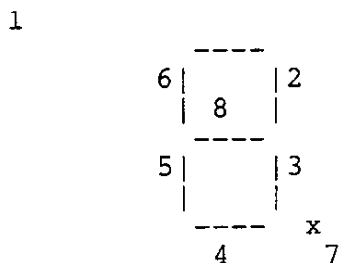
This submode allows handling of the options. This includes display, modification and MEMO of options-flags.

#### DISPLAY OF OPTIONS

There is a maximum of 32 options. Some of them are not used now, but may be used in further versions of SAA 1293. These 32 options are grouped together in 4 option-bytes with 8 options each. Only a single option-byte with 8 options may be displayed at the same time.

After having selected submode OPTIONS, each keypush of key VALUE+/- will display contents of next/last option-byte in an endless sequence with overrun 4 to 1/ underflow 1 to 4. Left display-digit shows the no. of the option-byte 1..4. Each segment of the right display-digit shows the actual status of a single option in EEPROM. Segment lit means 'Option is set'.

The segments are numbered:



#### MODIFICATION OF OPTIONS

Each option-flag may be set and reset with the corresponding key of the remote-control '1'...'8'. These keys work in toggle-mode: Set flag -> Clear flag -> Set flag and so on.

Press key MEMO to copy status of displayed option-byte into EEPROM. This handling is necessary for each option-byte, which has been modified.



#### 14.2.3 Submode HOR. POS.

This submode is available only, if system is equipped with an ITT text-decoder. The 7-segment display shows 'HP' and the TV-set goes into MIX-mode. Modification of the horizontal position is done with the VALUE+/- bottoms. Having found the centre position for the text-display, press MEMO to store the value.

#### 14.2.4 Submode TEXT CONTRAST

This submode is available only, if system is equipped with an ITT-text-decoder. The 7-segment display shows 'CO' and the TV-set goes into MIX-mode. Modification of the contrast of the text-picture is done with the VALUE+/- bottoms. When you have found the best contrast of the text-picture in relation to the contrast of the TV-picture, press MEMO to store the value.

#### 14.3 How to Leave Service Mode

SERVICE-mode is left by pressing key OFF TO STBY or releasing the mains-bottom. There is no possibility to directly return to the TV-mode. In contrast to older versions of the device no memorisation into EEPROM is done in the moment of switch-off.

In the next pages you will find a description of each available option of the system for SAA1293A-03. In the appendix you will find tables for all versions.

#### VERY IMPORTANT NOTE:

Option-flags not defined in this version have to be set definitely to '0' for reasons of upward-compatibility to further versions of the device.

#### 14.4 Option Byte 1 (FEATURES)

##### OPTION 1.1 - AV-modes

This option specifies if the system is equipped with 1 or 2 AV-modes or not. The exact no. of AV-modes is then specified with option 1.2. See description of AV-modes under option 1.2!

Display:

```

|   |   | No AV-mode at all
|   |   |
|   |   |
x   -- x
    
```

Display:

```

|   |   | 1 or 2 AV-mode(s)
|   |   |
|   |   |
x   -- x
    
```

##### OPTION 1.2 - Number of AV-modes

This option specifies the number of AV-modes, the system supports. Option 1.1 must be set '1' for any no. of AV-modes.

Display:

```

|   |   | 1 AV-mode
|   |   |
|   |   |
x   -- x
    
```

Display:

```

|   |   | 2 AV-modes
|   |   |
|   |   |
x   -- x
    
```

Mode	intended for	Station-no.	AV-outp. Pin 25	VCR-outp. Pin 32
TV	TV-broadcast	1..29/55	inactiv	inactiv
VCR	VCR via antenna	0	inactiv	activ
AV1	ext. comp. signal	AU / A1 +)	activ	activ
AV2	ext. RGB- signal	A2	activ	inactiv

+) Display is 'AU', if only 1 AV-mode available, else display is 'A1'

\* AV-output (pin25) is LOW for inactiv and HIGH for activ.  
 \* The logical status of VCR-output depends on option 2.7 !

**OPTION 1.3. - NO. OF STATION-LOCATIONS**

Option not selected:

System allows selection of 1 out of 29 stations. Selection of 10th and 20th-decade is done with keys '1-' and '2-'.

Option is selected:

System allows selection of 1 out of 55 stations. Selection of the decade is done with keys 'Decade +' and 'Decade -' or 'Decade --'.

Display:            --            Option not selected:  
          |    |    | 29 stations  
          |    |    |  
          |    |    |  
          x    -- x

Display:            --            Option is selected:  
          |    |    | 55 stations  
          |    |    |  
          |    |    |  
          x    -- x

**REMARKS:**

If this option is set '1', the system sticks to the decade once selected, until a new selection for the decade is made. This is not the case, if option 1.3 isn't set.

**Option 1.4. - INTELLIGENT KEYS 'P+' AND 'P-'**

Option not selected:

When the keys 'P+' and 'P-' are used for sequential station-selection, the system presents all P-numbers. These numbers will be incremented / decremented with each key-press, if a station-no. was memorized by the user or not.

Option is selected:

When the keys 'P+' and 'P-' are used for sequential station-selection, the system presents only those P-numbers, to which the user once memorized a station. In the sequence of P-numbers, the numbers may have gaps.

e.g. The user only memorized P-numbers 1,2,11,12,21 and 22

System then presents these P-numbers:

... <-> 21 <-> 22 <-> 1 <-> 2 <-> 11 <-> 12 <-> 21 <-> ...

Display:

```

      --
      | |
      | |
      | |
      x   x
  
```

Option not selected:

No intelligent keys 'P+', 'P-'

Display:

```

      --
      | |
      | |
      | |
      x  -- x
  
```

Option is selected:

Intelligent keys 'P+', 'P-'

**REMARK:**

If a station has been memorized to a P-no. by mistake, there must be a possibility to delete the flag, used to mark the P-no. again. The procedure needed for that depends on version of MEMO-procedure (option 3.3).

For version A: Press key 'P+' or 'P-' while you are in 5 sec-MEMO-phase. Then enter the no. of the station, which should be excluded.

For version B: Press key 'NORMALISATION', while you are in Programming-mode. Enter the no. of the station, which should be excluded; then press key 'MEMO'.

**Option 1.5 - DISPLAY OF TUNING VOLTAGE**

If this option is selected, the 7-segment display during the tuning does not only display a symbol for the band, it also displays an information, where the tuning-voltage actually is.

If option 3.2 is selected, the resolution of this display is 5 steps, else only 3 steps.

Display:            --            Option not selected:  
                   |    |            No display of tuning-voltage  
                   |    |            --  
                   |    |            |  
                   x    -- x

Display:            --            Option is selected:  
                   |    |            Display of tuning-voltage  
                   |    |            --  
                   |    |            |  
                   x    -- x

**Option 1.6 - AUTOMATIC OFF-TIMER AND TUNING AID**

If the IF-part of the TV-chassis provides a so-called VALIDATE or COINCIDENCE-signal (i.e. for AFC), the SAA1293A may supply 2 extra features:

OFF-TIMER switches the set to standby 5 min after end of TV-transmission.

TUNING-AID automatically reduces the tuning-speed to its lowest gear, so that the user can hardly miss a station while tuning the system in highest gear with max. speed.

These 2 features are not available separately, because they base on the same signal at pin 28, which must be in the range of 2.8..12V, when there is a signal and below 0.8V else.

Display:            --            Option not selected:  
                   |    |            Neither Off-timer nor  
                   |    |            Tuning-aid available  
                   |    |            --  
                   x    -- x

Display:            --            Option is selected:  
                   |    |            Off-timer and Tuning-aid  
                   |    |            available  
                   |    |            --  
                   x    -- x

**Option 1.7. - INTERFACE FOR PHILIPS-TELETEXT**

Option not selected:

System doesn't supply signals on MI-Bus-interface to control SAA50XX-circuitry for teletext and TELETEXT-mode may not be entered.

Option is selected:

System supplies signals on MI-Bus-Interface (pins 25+26) to control the SAA50XX-circuitry for teletext and TELETEXT-mode may be entered.

Display:	--         x --	Option not selected: Philips-teletext not available
----------	--------------------------	--

Display:	--         x -- x	Option is selected: Philips-teletext available
----------	----------------------------	---

**REMARKS:**

- \* If option 1.1 is selected to provide 1 or 2 AV-modes, the DATA-signal of the MI-Bus is multiplexed with the AV-signal. Special filter-hardware might be necessary to delete pulses of the DATA-signal on the AV-line.
- \* The ITT-teletext-decoder is automatically identified in the initialisation-part of the S/W. Don't set option 1.7 to support this decoder.

**Option 1.8. - AV-MODE SPECIFIC TO P-NO.**

Option not selected:

AV-mode is selected from any P-no. 1..29/55 with the AV-bottom (remote or local) or by togling the 'P0'-bottom, but after each P-no switch the set is in TV- (or VCR-) mode.

Option selected:

The TV-set has no AV-bottom. AV-mode is activ always with P0. The user may optionally select one, but just one additional P-no 1..29/55. This information is memorized in the non-volatile-memory.

Display:

```
  --  
  |  |  |  
  |  |  |  
  x  -- x
```

Option not selected:  
AV-mode not specific to P-no.

Display:

```
  --  
  |  |  |  
  |  |  |  
  x  -- x
```

Option is selected:  
AV-mode is specific to P-no.

**REMARKS:**

- \* If option 1.8 is selected, option 1.1 must be set '1' and option 1.2 must be set '0' to specify 1 AV-mode.
- \* Option 1.8 is available only, if option 1.4 isn't set simultaneously, because these 2 options use the same data in the non-volatile-memory.

### 14.5 Option Byte 2 (Performance)

These options of option-byte 2 enable/disable some features of the system in normal operation.

#### Option 2.1. - VOLUME AFTER NORMALISATION

Option not selected:

When key NORMALISATION is pushed, the values of all 4 analog outputs (incl. Volume) are reset to their normalisation-values, the user may set and modify in a MEMO-procedure (see below).

Option is selected:

Analog output no. 4 (for 'Volume') doesn't participate in this NORMALISATION-handling.

Display:            --            --  
                   |    |    |    |  
                   --    --    --    --  
                   |    |    |    |  
                   -- x   -- x

Option not selected:  
 'VOLUME' included in  
 NORMALISATION

Display:            --            --  
                   |    |    |    |  
                   --    --    --    --  
                   |    |    |    |  
                   -- x   -- x

Option is selected:  
 'VOLUME' not included in  
 NORMALISATION

#### OPTION 2.2. - ANALOG VALUES FOR SWITCHING ON FROM STANDBY

Option not selected:

The initial values of the 4 analog-outputs after start of system (from Power-on or from stand-by) are the normalisation-values from EEPROM, which the user may set and change by a MEMO-Procedure (see below).

Option is selected:

The initial values after start of system from stand-by are the old ones upon switch-off. (simulation of a potentiometer)

Display:            --            --  
                   |    |    |    |  
                   --    --    --    --  
                   |    |    |    |  
                   -- x   -- x

Option not selected:  
 analog-values are  
 the normalisation-values

Display:            --            --  
                   |    |    |    |  
                   --    --    --    --  
                   |    |    |    |  
                   -- x   -- x

Option is selected:  
 analog-values are the old  
 values upon switch-off



**OPTION 2.3. - BANDSWITCHING PROTECTION**

Option not selected:

Every time the key for bandswitch is pressed, the dedicated output-ports are instantly switched to next band. This band is then indicated for 5 sec.

Option is selected:

The first keypush of the bandswitch-key doesn't supply next band, but only triggers a 5 sec-period, where the actual band is displayed. The only way to switch to next band is to press the same bandswitch-key again within this 5sec-period.

Display:            --        --                    Option not selected:  
                   |    |    |                    Instant bandsw. with 1st keypush  
                   --    --                     
                   |    |    |  
                   -- x   -- x

Display:            --        --                    Option is selected:  
                   |    |    |                    Bandswitch with 2 keypushes  
                   --    --                    within 5 sec-period  
                   |    |    |  
                   -- x   -- x

**OPTION 2.4. - MUTING AT STATION CHANGING**

Option not selected:

If VOLUME has been muted - by MUTE-key - the active muting is reset by means of another keypush of this MUTE-key (toggle-key) or by changing the value for VOLUME by means of the 2 VOLUME-keys. A change of the station doesn't reset the active muting.

Option is selected:

Additionally to the 2 ways of resetting MUTE just described, MUTE will be reset, when station is changed.

Display:            --        --                    Option not selected:  
                   |    |    |                    station-ch. doesn't reset MUTE  
                   --    --                     
                   |    |    |  
                   -- x        x

Display:            --        --                    Option is selected:  
                   |    |    |                    station-change resets MUTE  
                   --    --                     
                   |    |    |  
                   -- x   -- x

**OPTION 2.5 - PICTURE FADING DURING STATION CHANGING**

By default only 'Volume' and 'AFC' are effected, when a station-switchover or a band-switchover occurs. Optionally 2 other analog outputs - out of 3 - participate in this skipping to allow a picture-fading.

Display:            --     --            Option not set:  
                  |     |                Only VOLUME is reduced  
                  --     --  
                  |     |  
                  -- x  -- x

Display:            --     --            Option is set:  
                  |     |                VOLUME and ANALOGS 1 and 2  
                  --     --                are reduced  
                  |     |  
                  -- x  -- x

**OPTION 2.6 - LENGTH OF FADING DURING STATION CHANGING**

You can select two different values for the duration of the fading, to allow optimum adaption to the TV-chassis.

Display:            --     --            Short fading-period  
                  |     |  
                  --     --  
                  |     |  
                  -- x  -- x

Display:            --     --            Long fading-period  
                  |     |  
                  |     |  
                  |     |  
                  |     |  
                  -- x  -- x

**OPTION 2.7. - STATUS OF VCR OUTPUT**

Option not selected:

The VCR-output (Pin 32) supplies HIGH-signal, when VCR is active.

Option is selected:

The VCR-output (Pin 32) supplies LOW-signal, when VCR is active.

Display:            --    --            Option not selected:  
                   |  |  |            VCR-output active HIGH  
                   --  --  
                   |  |  |  
                   -- x --

Display:            --    --            Option is selected:  
                   |  |  |            VCR-output active LOW  
                   --  --  
                   |  |  |  
                   -- x -- x

**OPTION 2.8. - DECIMAL POINT OF DISPLAY**

Option not selected:

The decimal-point of the right display is lit, when mode TELETEXT is active.

Option is selected:

The decimal-point of the right display is lit, when the 2nd standard has been selected.

Display:            --    --            Option not selected:  
                   |  |  |            Indication of TELETEXT-mode  
                   --  --  
                   |  |  |  
                   -- x -- x

Display:            --    --            Option is selected  
                   |  |  |            Indication of 2nd standard  
                   --  --  
                   |  |  |  
                   -- x -- x

## 14.6 Option Byte 3 (Tuning)

### Option 3.1 - Bandswitching during tuning

Option not set:

Actual band is never left, but tuning is continued at the other bandrange-limit.

Option is set:

Upper-/Lower-next band is enabled, when a bandlimit is reached during tuning.

Display:

```

--
|  |  |
--
|  |  |
-- x  -- x

```

Option not set:  
Tuning remains in same band

Display:

```

--
|  |  |  --
--
|  |  |
-- x  -- x

```

Option is set:  
Tuning continues in next band

### Option 3.2 - Combined VHF-band

Option not set:

Bands I and III appear as two completely different bands. The kind of switchover depends on option 3.1.

Option is set:

Band IV/V (UHF) is never left, but band I and band III (VHF) are tied together. For the user, the system appears as a 2-band system VHF and UHF.

```

+--> I <-----> III <--+  +--> IV/V <--+
      |               |               |
      +-----+-----+ +-----+

```

Display:

```

--
|
--
|  |  |  |
-- x  -- x

```

Option not set:  
No combined VHF-band

Display:

```

--
|  |
--
|  |  |  |
-- x  -- x

```

Option is set:  
Combined VHF-band

Remark:

The type of band-indication depends on this option 3.2. If option isn't set, the indication is with symbols 'I', 'III' and 'U'. If option is set, the indication is with symbols '-' for VHF and '-' for UHF.

**OPTION 3.3 - VERSION OF MEMO-PROCEDURE**

Option not selected:  
 Version A of MEMO-procedure  
 Option is selected:  
 Version B of MEMO-procedure

**Version A:**

Procedure to store station-parameters:

1. Select proper Standard
  2. = proper Band
  3. Tune to the wanted station (display shows band and is flashing) - AFC is off and remains off
  4. Key 'MEMO' triggers a 5 sec. period to select the station-no. (Display shows 2 dashes)
  5. Select station-no. within this period - AFC on again
- If a time-out happens, nothing is stored and the display starts indicating original progr.-no. again.

**Notes:**

1. The sequence of the first 4 items is not important !
2. The analog values are not stored !

Procedure to store the analog-values for NORMALISATION:

1. Set the 4 analog outputs to a convenient value
2. Push key 'MEMO' to trigger a 5 sec. period, where display shows two dashes.
3. Push any of the 8 analog-keys or key NORMALISATION within this period. If a time-out happens, nothing is stored and the display starts indicating original progr.-no. again.

**VERSION B:**

Procedure to store station-parameters:

1. Select proper Standard
2. = = Band
3. Tune to the wanted station (display shows band and is flashing) AFC is off while commands are given and up to 1 sec after key is released again.
4. Select station-no.
5. Key 'MEMO' triggers storing of all station-param. and analog values !!

**Notes:**

1. The sequence of the first 4 items is not important !!
2. There is no time-out
3. The analog values are also stored

Procedure to store the analog-values for NORMALISATION:

1. Set the 4 analog outputs to a convenient value
2. Key 'MEMO' triggers storing of the normalized values

Display:            --        --                    Option not selected:  
                   |     |     |                    Version A of MEMO-procedure  
                   --        --  
                   |     |     |  
                   -- x    -- x

Display:            --        --                    Option is selected:  
                   |     |     |                    Version B of MEMO-procedure  
                   --        --  
                   |     |     |  
                   -- x    -- x

**OPTION 3.4 - TUNING-COMMANDS OF REMOTE-CONTROL**

Option not selected:

Tuning-commands given by infrared remote-control have the same result as those directly given by front-panel. Option is selected: Tuning-commands given by infrared remote-control are only good for fine-tuning.

That means: 1. Tuning-speed isn't increased for long keypushes  
 2. Active band isn't indicated  
 3. When Version B of MEMO-procedure (Option 3.3.) is selected, programming-mode is not entered. Storing of station-parameters under any station-no. isn't possible.

Display:            --        --                    Option not selected:  
                   |    |    |                    IR-Tuning commands are for  
                   --        --                    regular tuning  
                   |    |    |  
                   -- x        x

Display:            --        --                    Option is selected:  
                   |    |    |                    IR-Tuning commands are only  
                   --        --                    for FINE-TUNING  
                   |    |    |  
                   -- x        --

**OPTION 3.5 - NO VHF-BANDS**

Option not selected:

System can be tuned to work in bands I and III too

Option is selected:

System may not be tuned to work in band I neither band III (i.e. for U.K.)

Display:            --        --                    Option not selected:  
                   |    |    |                    System with VHF-bands  
                   --        --  
                   |    |    |  
                   -- x        -- x

Display:            --        --                    Option is selected:  
                   |    |    |                    System without VHF-bands  
                   --        --  
                   |    |    |  
                   -- x        -- x

**OPTION 3.6 - AFC AFTER FIMETUNING**

Option not selected:  
 AFC remains off all the time till next station-selection is one.

Option is selected:  
 AFC returns active 1 sec after tuning-key is released.

Display:	<pre> --      --          --          -- x   -- x                 </pre>	Option not selected: AFC remains off
----------	--	---

Display:	<pre> --      --          --          -- x   -- x                 </pre>	Option is selected: AFC returns after 1 sec
----------	--	--

**OPTION 3.7 - HYPER-BAND**

Option not selected:  
 System doesn't support an extra band for cable-channels

Option is selected:  
 System supports an extra band for cable-channels

Display:	<pre> --      --          --          -- x   --                 </pre>	Option not selected: System without hyper-band
----------	--	---

Display:	<pre> --      --          --          -- x   -- x                 </pre>	Option is selected: System with hyper-band
----------	--	---

## 14.7 Option Byte 4 (Key/Command-Assignment)

## OPTION 4.1. - VERSION OF ASSIGNMENT FOR TV-COMMANDS

Option not selected: Version A of Assignments

Option is selected: Version B of Assignments

Function	IR-command		Matrix-point of keypad	
	Vers.A	Vers.B	Vers.A	Vers.B
.....	...	...	...	...

Display:  Option not selected:  
 -- Version A of Key-Assignments  
 for TV-commands  
 x

Display:  -- Option is selected:  
 -- Version B of Key-Assignments  
 for TV-commands  
 x

## Option 4.5 - VERSION OF ASSIGNMENT FOR TELETEXT-COMMANDS

This option selects the type of PHILIPS teletext-controller.  
 If option is set, the SAA 5040 or SAA 5043 is supported.  
 If option isn't set, the SAA 5041 is supported.

Display:  -- Option not selected:  
 -- Support of SAA5041  
 for Teletext-commands  
 x

Display:  -- Option is selected:  
 -- Support of SAA5040/43  
 for Teletext-commands  
 x

## Remark:

If the ITT-text-decoder is used, this option can be set to any position.



Command	T e l e t e x t - d e c o d e r		
	SAA5040(PHIL)	SAA 5041(PHIL)	TPU2732(ITT)
Height	28#, 51, 58	28#	28 #
Small	27 , 54	27	-
Hold	29#, 39# ,56#	29# , 39#	29 #
Reveal	12# , 59	12	12 #
Update	30#, 60#, 62	30#	30 #
Timed Page	38# , 53#	38#	38 #
Next Page	-	-	8, 15
Last Page	-	-	5, 16
Inverse Display	-	-	27 #
Status	37 , 52	37	-
PAGE 100	4 , 61	4	-
TXT Reset	57	61	57, 61
Combi-key +)	-	57	-
TXT Off	3 , 33	3 , 33	3

#) = implemented as toggle-function

+) = if MIX was ON, it is reset - else REVEAL is set ON

**SAA 5040:**

Command	resets:				
	HEIGHT	HOLD	REVEAL	UPDATE	TIMED P.
HEIGHT	-	no	yes	no	no
HOLD	yes+	-	yes	no	no
REVEAL	no	no	-	no	no
UPDATE	yes+	yes	yes	-	no
TIMED PAGE	yes+	yes	yes	no	-
PAGE 100	yes	yes	yes	yes	yes
TXT RESET	yes+	yes	yes	yes	no

**SAA 5041:**

Command	resets:				
	HEIGHT	HOLD	REVEAL	UPDATE	TIMED P.
HEIGHT	-	no	yes	no	no
HOLD	yes+	-	yes	no	no
REVEAL	no	no	-	no	no
UPDATE	yes+	yes	yes	-	no
TIMED PAGE	yes+	yes	yes	no	-
PAGE 100	yes	yes	yes	yes	yes
TXT RESET	yes+	yes	yes	yes	no

**TPU 2732/35:**

Command	resets:				
	HEIGHT	HOLD	REVEAL	UPDATE	TIMED P.
HEIGHT	-	no	no	no	no
HOLD	yes+	-	yes	no	refused
REVEAL	no	no	-	no	no
UPDATE	yes	refused	no	-	no
TIMED PAGE	yes+	refused	yes	no	-
TXT RESET	yes	yes	yes	yes	yes

+) = sets BOTTOM to TOP

## 15. Pin Connections

### 15.1 Summary Pin

1	XTAL - Oscillator Crystal
2	Test input - connect to Supply Voltage +5V
3	Memory Clock Output
4	RESET Input
5	MAINS Switch Input/Output
6	Test input - connect to ground
7	IM Bus DATA Input/Output
8	IM Bus IDENT Output
9	IM Bus CLOCK Output
10	DAC 1 Analog Output (for brightness control)
11	DAC 2 Analog Output (for contrast control)
12	Infrared Input
13	Tuning Voltage Output
14	Keyboard Column and Display Segment a Output
15	Keyboard Column and Display Segment b Output
16	Keyboard Column and Display Segment c Output
17	Keyboard Column and Display Segment d Output
18	Keyboard Column and Display Segment e Output
19	Keyboard Column and Display Segment f Output
20	Ground 0V
21	Keyboard Column and Display Segment h Output
22	Keyboard Column and Display Segment g Output
23	Display Left Digit Output
24	Display Right Digit Output
25	Combined AV-mode and MI Bus DATA Output
26	MI Bus DLIM Output
27	Standby Supply +5V
28	Combined Validate Input and Auxiliary Output
29	Bandswitch Output LOW
30	Bandswitch Output HIGH
31	Multistandard Output
32	VCR Output
33	DAC 3 Analog Output (for color-saturation control)
34	DAC 4 Analog Output (for volume-control)
35	AFC Output
36	Keyboard Row 1 Input
37	Keyboard Row 2 Input
38	Keyboard Row 3 Input
39	Keyboard Row 4 Input
40	Supply Voltage +5V

Table 6: Pinning

## 15.2 Description of the Signals

### Pin 1 - XTAL

To this pin must be connected the frequency-determinating crystal for generating the required clock frequency. The other connection of the crystal must be connected to ground.

### Pin 2 and 40 - Supply Voltage +5V

The device requires a +5V supply which must be connected to pin 2 and 40.

### Pin 3 - Memory Clock Output

This output port supplies the 1 kHz memory clock signal needed by the MDA 2062 non-volatile-memory. This clock signal is generated by internal dividing the 4 MHz clock signal by 4096.

### Pin 4 - RESET Input

The circuit connected to this pin is shown in the application-circuit. The function is explained in section 2.5.

### Pin 5 - Mains Switch

This port acts as an output and drives - via external switching amplifier, the mains relay. It is also used as an input for switching-on the TV-set by means of a wiping-contact of the main TV-on switch.

### Pin 6 and 20 - Ground

These pins must be connected to the negative of the supply.

### Pin 7 to 9 - IM Bus

These ports are the link of the SAA 1293A to the non-volatile-memory MDA 2062 and the TPU 2732 and DPU 2543 of the ITT teletext-decoder. IM-Bus IDENT and CLOCK act as an output only, whereas IM-Bus DATA is used as input and output.

### Pin 10, 11, 33 and 34 - DAC1 to DAC4 Analog Outputs

These open-drain output ports supply the pulse-width-modulated square-wave-signals described in section 2.6. These signals serve for actuating the basic settings. External RC-components are needed to generate the needed DC-signals. Pin 34 is intended for volume control.

### Pin 12 - Infrared Input

Via this pin, the device gets the infrared remote-control

signals which have been amplified in the TBA 2800 IR-amplifier IC. A small capacitor from pin 12 to ground may prove useful to suppress steep transients caused by noise.

#### **Pin 13 - Tuning Voltage Output**

This open-drain port supplies the tuning voltage for the capacitance diodes of the TV tuner in the shape of a pulse-width modulated signal. After amplification by an external HF-transistor, the tuning DC voltage is derived by multiple RC-filtering. A temperature compensated zener-diode must be provided for stabilizing the tuning voltage against variations of the supply voltage and ambient temperature.

#### **Pin 14 to 19, 21 and 22 - Keyboard Columns and Display Segments**

Via these outputs, the device controls directly - without needing an interface - a 2-digit LED-display and 8 columns of the direct keyboard.

#### **Pin 23 and 24 - Display-Digit Outputs**

These two TTL-level ports control - via external PNP transistors - the multiplexing of the anodes of the LED-display.

#### **Pin 25 and 26 - Combined AV-mode and MI Bus Outputs**

These two TTL-level ports provide the DLIM and the DATA-signal of the MI-Bus, required for the control of the SAA5000-teletext system. Pin 26 is HIGH during the quiescent state and leads only short LOW-pulses for bus-clock. Pin 25 is used as AV-output having HIGH-signal for TV and VCR-antenna and LOW-signal for external composite-video and RGB-signal. If the set runs with SAA5000-teletext very short data-pulses additionally appear on pin 25.

#### **Pin 27 - Standby Supply +5V**

This pin powers the clock oscillator, reset circuit and remote-control decoder. By means of this, it is possible to switch on the TV set by remote-control. Standby-mode is indicated by one segment of the LED-display.

#### **Pin 28 - Combined Validate Input and Auxiliary Output**

This open-drain port provides the device with the information, if broadcasting is active or not. This is needed as tuning-aid and automatic OFF-timer. (Active high level). Active low AUXILIARY output is designed for any application by the manufacturer.

#### **Pin 29 and 30 - Bandswitch Outputs**

It is via these open-drain ports that the tuner receives the

band information. In case of 3-band tuner, a simple diode matrix does the decoding. The external amplifier transistor of the selected band is conducting.

**Pin 31 - Multistandard Output**

This open-drain port may set the standard of a dual-standard system. The 2nd standard (level HIGH) may be displayed with the decimal-point of the right-hand digit.

**Pin 32 - VCR Switch Output**

This open-drain port serves for switching the deflection of the TV-set to VCR-operation or to switch the set to another signal-source other than the internal tuner. The active level of pin 32 is determined by option 2.7.

**Pin 35 - AFC Output**

This active-high open-drain port serves for AFC-control of the RF-part. AFC is disabled during station switch-over and during tuning.

**Pins 26 to 39 - Keyboard Row Inputs 1 to 4**

These four pins serve for connecting the rows of the direct keyboard.

## 16. Electrical Characteristics

All voltages are referred to pins 6 and 20.

### 16.1 Absolute Maximum Ratings

	Symbol	Value	Unit
Supply Voltages	V1, V3	6	V
<b>Output Voltages</b>			
Open-Drain Outp. Pins 10, 11	V <sub>o</sub>	-0.3 to +13.5	V
Open-Drain Outp. Pins 28..35	V <sub>o</sub>	-0.3 to +13.5	V
Open-Drain Outp. Pins 14..19	V <sub>o</sub>	-0.3 V to V40	V
Open-Drain Outp. Pins 21, 22	V <sub>o</sub>	-0.3 V to V40	-
TTL Output Pins 3, 5, 7..9	V <sub>o</sub>	-0.3 V to V40	-
TTL Output Pins 13, 23..26	V <sub>o</sub>	-0.3 V to V40	-
<b>Output Currents</b>			
Pins 10, 11, 33, 34	I <sub>o</sub>	8	mA
Pins 14..19, 21, 22	I <sub>o</sub>	25	mA
Pins 28..32, 35	I <sub>o</sub>	5	mA
Pins 3, 5, 7..9, 13, 23..26	I <sub>o</sub>	5	mA
	-I <sub>o</sub>	2	mA
<b>Input Voltages</b>			
all Inp. except Pins 28..11	V <sub>iH</sub>	V40	-
	V <sub>iL</sub>	-0.3	V
Pins 28..35	V <sub>iH</sub>	13.5	V
	V <sub>iL</sub>	-0.3	V
Ambient Operating Temperature Range	T <sub>a</sub>	0 to +65	°C
Storage Temperature Range	T <sub>s</sub>	-40 to +125	°C

Table 7: Maximum Ratings

## 16.2 Recommended Operating Conditions

	Symbol	Min.	Typ.	Max.	Unit
Supply Voltages	V2, V40	4.75	5.0	5.25	V
	V27	4.75	5.0	5.25	V
<b>Input Voltages</b>					
Pin 12, peak-to-peak	V12	400	-	-	mV
Pin 4 (active)	V4L	-	-	0.8	V
(inactive)	V4H	1.8	-	-	V
Pin 5 (active)	V5L	-	-	0.8	V
all other Inputs	ViH	2.4	-	-	V
	ViL	-	-	0.8	V
Clock Frequency (Pin1)	fcr	3.5	-	4.6	MHz
Series Resonance Freq. of Crystal at CL=20pF	fs	3.5	-	4.6	MHz
Effect. Series Resist. of Crystal at CL=20pF	Rr	-	-	60	Ohm
Equivalent Load Config. at Pin 1					
Load Capacitance	CL	-	-	3	pF
Series Load Capacitance	Cs	-	-	5	pF
Series Load Resistance	Rs	300	-	-	KOhm
Coupling Cap. to Pin 12	C12	-	10	-	nF
Load Capacitance at Pin 3 and 13	CL	-	-	150	pF

Table 8: Operating Conditions

## 16.3 Characteristics

	Symbol	Min.	Typ.	Max.	Unit
<b>Current Consumption</b>					
Pins 2 and 40	I <sub>2+40</sub>	-	75	115	mA
Pin 27	I <sub>27</sub>	-	10	20	mA
<b>Output Voltages</b>					
Pins 3, 13, 23..26					
at -I <sub>oH</sub> =100μA	VoH	2.7	-	-	V
at I <sub>oL</sub> =1.6mA	VoL	-	-	0.4	V
Pin 5					
at -I <sub>oH</sub> =100μA	VoH	V <sub>27</sub> -0.4	-	-	V
at I <sub>oL</sub> =1.0mA	VoL	-	-	1.0	V
Pins 7..9					
at -I <sub>oH</sub> =200μA	VoH	2.7	-	-	V
at I <sub>oL</sub> =200μA	VoL	-	-	0.4	V
Pins 10, 11, 28..35					
at I <sub>oL</sub> =4mA	VoL	-	-	0.4	V
Pins 14..19, 21, 22					
at I <sub>oL</sub> =20mA	VoH	-	-	0.5	V
<b>Output Leakage Currents</b>					
Pins 10, 11, 28..35	I <sub>r</sub>	-	-	20	μA
at V <sub>o</sub> =12V					
Pins 14..19, 21, 22	I <sub>r</sub>	-	-	20	μA
at V <sub>o</sub> =5V					
Short-Circuit Out.curr.	-I <sub>k</sub>	-	-	2.8	mA
Pins 36..38 at V <sub>o</sub> =0					
Input Capacitance	C <sub>i</sub>	-	-	5	pF
Pins 12 and 13					
Code of the Infrared Remote sign. at Pin12	-	see Datasheet SAA 1250, IRT 1250, IRT 1260			

Table 9: Characteristics



## 17. Code of Poly-counter of DAC's

Step	Code [bin]	Code [hex]	Step	Code [bin]	Code [hex]
1	00111111	3F	33	00110110	36
2	00011111	1F	34	00011011	1B
3	00101111	2F	35	00101101	2D
4	00110111	37	36	00010110	16
5	00111011	3B	37	00001011	0B
6	00111101	3D	38	00100101	25
7	00011110	1E	39	00010010	12
8	00001111	0F	40	00001001	09
9	00100111	27	41	00000100	04
10	00110011	33	42	00100010	22
11	00111001	39	43	00010001	11
12	00011100	1C	44	00001000	08
13	00101110	2E	45	00100100	24
14	00010111	17	46	00110010	32
15	00101011	2B	47	00011001	19
16	00110101	35	48	00001100	0C
17	00011010	1A	49	00100110	26
18	00001101	0D	50	00010011	13
19	00000110	06	51	00101001	29
20	00000011	03	52	00010100	14
21	00100001	21	53	00101010	2A
22	00010000	10	54	00010101	15
23	00101000	28	55	00001010	0A
24	00110100	34	56	00000101	05
25	00111010	3A	57	00000010	02
26	00011101	1D	58	00000001	01
27	00001110	0E	59	00000000	00
28	00000111	07	60	00100000	20
29	00100011	23	61	01100000	30
30	00110001	31	62	00111000	38
31	00011000	18	63	00111100	3C
32	00101100	2C	64	00111110	3E

Table 10: Code of Poly-Counter of DAC's

**18. Summary****18.1 Option Bytes****Option Byte 1 (Features) EAROM address = 251 = FBH**

Bit	meaning	'0'	'1'
1	AV modes	not available	available
2	Number of AV-modes	1	2
3	Number of stations	29	55
4	Intelligent Keys P+/-	not available	available
5	3-step-display (tune)	not available	available
6	Off-timer/tuning aid	not available	available
7	MULLARD-Teletext mode	not available	available
8	AV-mode specific	no specific.	to station loc.

**Option Byte 2 (Performance) EAROM address = 252 = FCH**

Bit	meaning	'0'	'1'
1	Volume aft. NORMALIZE	normalized	no action
2	Analog values for on from standby	normalized	values at time before standby
3	Bandswitching	immediate	during display
4	Muting at station changing	muting	no muting
5	Picture fading during station changing	only sound fad. no picture fad.	DAC1 + DAC2 reduced
6	Length of fading	short	long
7	Status of VCR-output	active high	active low
8	Dec. point of display	indic. teletext	indic. 2nd std.

**Option Byte 3 (Tuning) EAROM address = 253 = FDH**

Bit	meaning	'0'	'1'
1	Bandswitching during tuning	remains in same band	continues in neighb. band
2	Band I and III of VHF	combined band	single bands
3	MEMO procedure	Version A	Version B
4	Tuning command of remote control	as direct tuning commands	only fine tuning
5	VHF band	available	not available
6	AFC after fine tuning	remains off	on after 1 sec.
7	Hyper band (cable TV)	not available	available
8	- not used -	-	-

Option Byte 4 (Multistandard, OSD) EAROM addr.= 254= FEH

Bit	meaning	'0'	'1'
1	Version for TV comnds	Version A	Version B
2	- not used -	-	-
3	- not used -	-	-
4	- not used -	-	-
5	Version for TEXT com.	supports 5041	supports 5040
6	- not used -	-	-
7	- not used -	-	-
8	- not used -	-	-

Table 11-14: Option Bytes 1-4

## 18.2 COMMAND-CODES

All command-codes are based on IR-addresses '0' or '15'

IR- and Keyboard-commands for TV mode

FUNCTION Option-Byte 4.1->	IR-COMMAND [1..64]		KEYBOARD MATRIX-P.	
	Vers. A = 1	Vers. B = 0	Vers. A = 1	Vers. B = 0
Number 1	17	17	23	2
Number 2	18	18	19	3
Number 3	19	19	11	4
Number 4	20	20	7	5
Number 5	21	21	17	6
Number 6	22	22	16	7
Number 7	23	23	15	8
Number 8	24	24	14	9
Number 9	25	25	6	10
Number 0 / VCR	26	26	2	1
Program --	11	11	-	-
Pro10th/Pro10-	9	6	8	28
Pro20th/Pro10+	8	9	12	26
Program +	15	8	27	25
Program -	16	5	26	27
Tuning +	5	14	32	12
Tuning -	6	15	31	13
Analog 1+	41	41	9	14
Analog 1-	42	42	22	24
Analog 2+	43	43	5	17
Analog 2-	44	44	10	18
Analog 3+	45	45	21	19
Analog 3-	46	46	18	20
Analog 4+ (VOL)	47	47	3	21
Analog 4- (VOL)	48	48	1	22
Band switch	40	36	24	14
Multi-Standard	32	32	4	24
MEMO	39	39	20	23
NORMAL	4	4	29	29
Grandma-key	-	-	13	32
Mute	7	7	28	30
AV-switch	10	35	30	11
Auxiliary	63	63	25	31
Teletext ON *)	57,61	57,61	-	-
Time display *)	37,38,49	37,38,49	-	-
Service mode ON	1	1	-	-
OFF Standby	2	2	-	-

Table 15: IR- and Keyboard-commands for TV mode

## IR-commands for Teletext-mode

FUNCTION	SAA5000-teletext		TPU2732-teletext
	SAA 5040	SAA 5041	
Mix-mode *	31, 55	31	31
Height *	28, 51, 58	28	28
Small	27, 54	27	-
Hold *	29, 39, 56	29, 39	29
Reveal *	12, 59	12	12
Update *	30, 60, 62	30	30
Timed Page *	38, 53	38	38
Next Page	-	-	8, 15
Last Page	-	-	5, 16
Inverse D. *	-	-	27
Status	37, 52	37	-
Page 100	4, 61	4	-
TT Reset	57	61	57, 61
TT Off	3, 33	3, 33	3

Table 16: IR- and Keyboard-commands for Teletext mode

Rem.: \*) = Toggle keys  
 +) = only for Polish-Teletext

## IR- and Keyboard-commands for Service mode

Submodes of SERVICE-mode are:

1. CH = ChECK-mode (checks swing of tuning-voltage and analogs)
2. OP = OPTIONS-mode (shows and modifies OPTION-flags)
3. HO = HOR-POS-mode (set horizontal position of ITT-Txt.)
4. CO = CONTRAST-mode (set contrast-offset of ITT-Text)

Function	IR-command	Key-name in TV-mode
Next Submode	1	Service-mode ON
Toggle option bit 1	17	P1
Toggle option bit 2	18	P2
Toggle option bit 3	19	P3
Toggle option bit 4	20	P4
Toggle option bit 5	21	P5
Toggle option bit 6	22	P6
Toggle option bit 7	23	P7
Toggle option bit 8	24	P8
Data + / Option-byte +	47	VOL +
Data - / Option-byte -	48	VOL -
MEMO Data	39	MEMO
MEMO Grandma-key	4	NORMAL
OFF Standby	2	OFF Standby

Table 17: IR-commands for Service-mode

## 18.3 Contents of Non-Volatile Memory MDA 2061/62

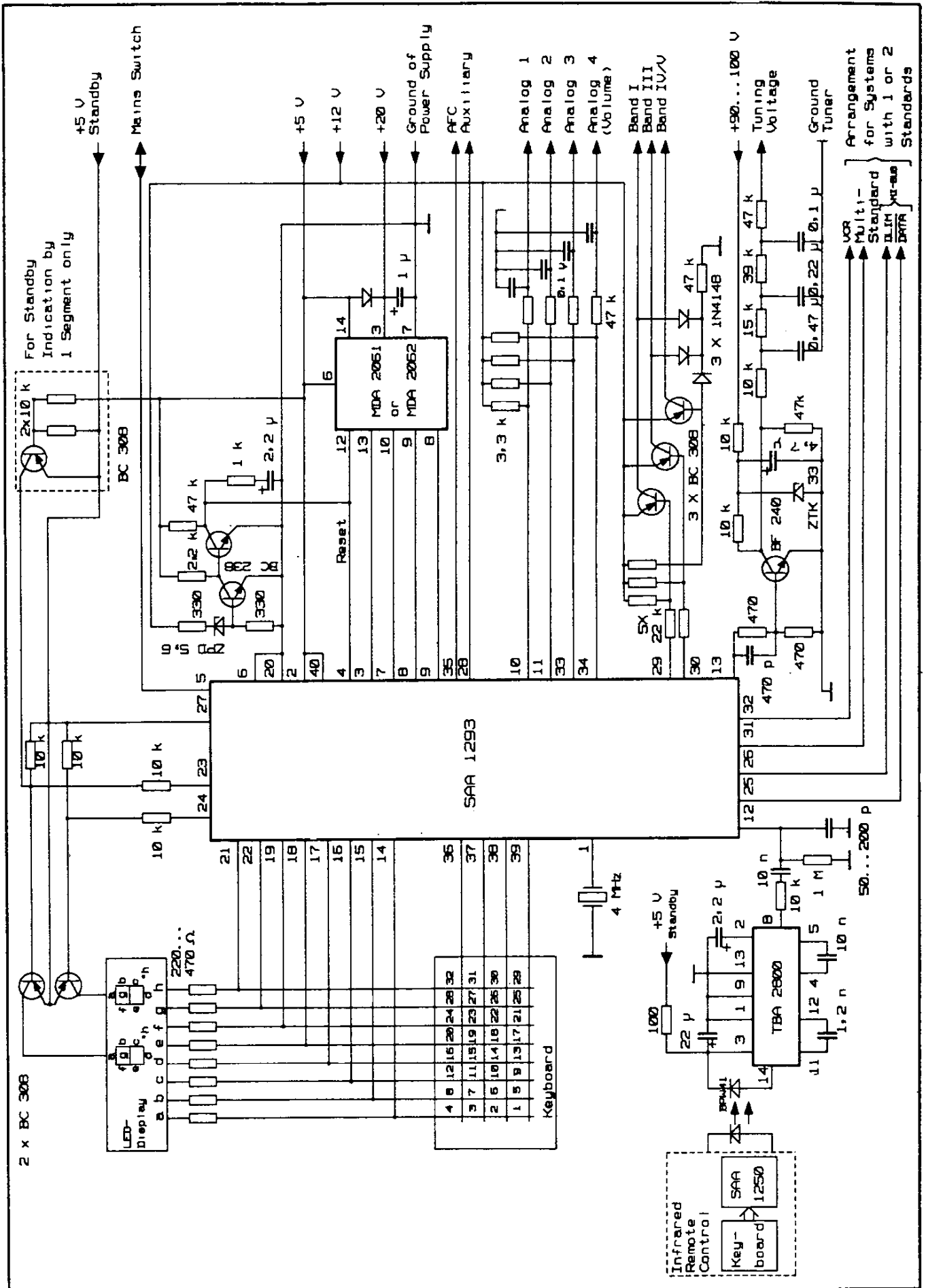
Address		Description
Dec.	Hex.	
128	80H	Analog value for NORMALIZATION-key DAC1
129	81H	" " " " DAC2
130	82H	" " " " DAC3
131	83H	" " " " DAC4 (VOL)
132	84H	Station Parameters for P0 - (1. Byte) Bit 0..1: 00 = Band I (VHF 1) 01 = Band III (VHF 3) 10 = Band IV/V (UHF) 11 = Band Hyper (if available, else UHF) Bit 2: Multi-Standard Bit 3: 1 = Station memorized (Opt. 1.4) 1 = Station w. AV-mode (Opt. 1.8) Bit 4..7: Lower 4 bit of tuning-voltage
133	85H	Station Parameters for P0 - (2. Byte) Bit 0..7: Higher 8 bit of tuning-voltage
134	86H	Station Parameters for P1 - (1. Byte)
135	87H	Station Parameters for P1 - (2. Byte)
:	:	:
158	9EH	Station Parameters for P13 - (1. Byte)
159	9FH	Station Parameters for P13 - (2. Byte)
160	A0H	- not usable -
161	A1H	Station Parameters for P14 - (1. Byte)
162	A2H	Station Parameters for P14 - (2. Byte)
:	:	:
191	BFH	Station Parameters for P29 - (1. Byte)
192	C0H	- not usable -
193	C1H	Station Parameters for P29 - (2. Byte)
194	C2H	Station Parameters for P30 - (1. Byte)
195	C3H	Station Parameters for P30 - (2. Byte)
:	:	:
244	F4H	Station Parameters for P55 - (1. Byte)
245	F5H	Station Parameters for P55 - (2. Byte)
246	F6H	Horizontal Adjust of Teletext-picture
247	F7H	Analog value for Grandma-key DAC1
248	F8H	" " " " DAC2
249	F9H	" " " " DAC3
250	FAH	" " " " DAC4 (VOL)
251	FBH	Option Flags of 1st Option-Byte
252	FCH	Option Flags of 2st Option-Byte
253	FDH	Option Flags of 3st Option-Byte
254	FEH	Option Flags of 4st Option-Byte
255	FFH	Contrast Offset of Teltext-picture

Table 18: Contents of MDA 2061/62

## 18.4 Ports

Port	Pin		Function	Input	Output	Active
	DIL	PLCC				
P10	28	-	Validate Inp./Aux.Out.	X	X	'0'
P11	29	-	Band 0 \ 01-V1 10-V3		X	'1'
P12	30	-	Band 1 / 11-UHF 00-HB		X	'1'
P13	31	-	Multistandard		X	'1'
P14	32	-	VCR Output		X	Option
P15	-	-	- not available -			
P16	-	-	- not available -			
P17	35	-	AFC Output		X	'1'
P20	23	-	Display Left Digit		X	'0'
P21	24	-	Display Right Digit		X	'0'
P22	25	-	AV / MI-Bus Data		X	'0'/'1'
P23	26	-	MI-Bus DLIM Output		X	'0'
P24	36	-	Keyboard row 0	X		'0'
P25	37	-	= = 1	X		'0'
P26	38	-	= = 2	X		'0'
P27	39	-	= = 3	X		'0'
P30	14	-	Keyb.Col 0 / Display a		X	'0'
P31	15	-	= 1 / = b		X	'0'
P32	16	-	= 2 / = c		X	'0'
P33	17	-	= 3 / = d		X	'0'
P34	18	-	= 4 / = e		X	'0'
P35	19	-	= 5 / = f		X	'0'
P36	22	-	= 6 / = g		X	'0'
P37	21	-	= 7 / = h		X	'0'

Table 19: Ports





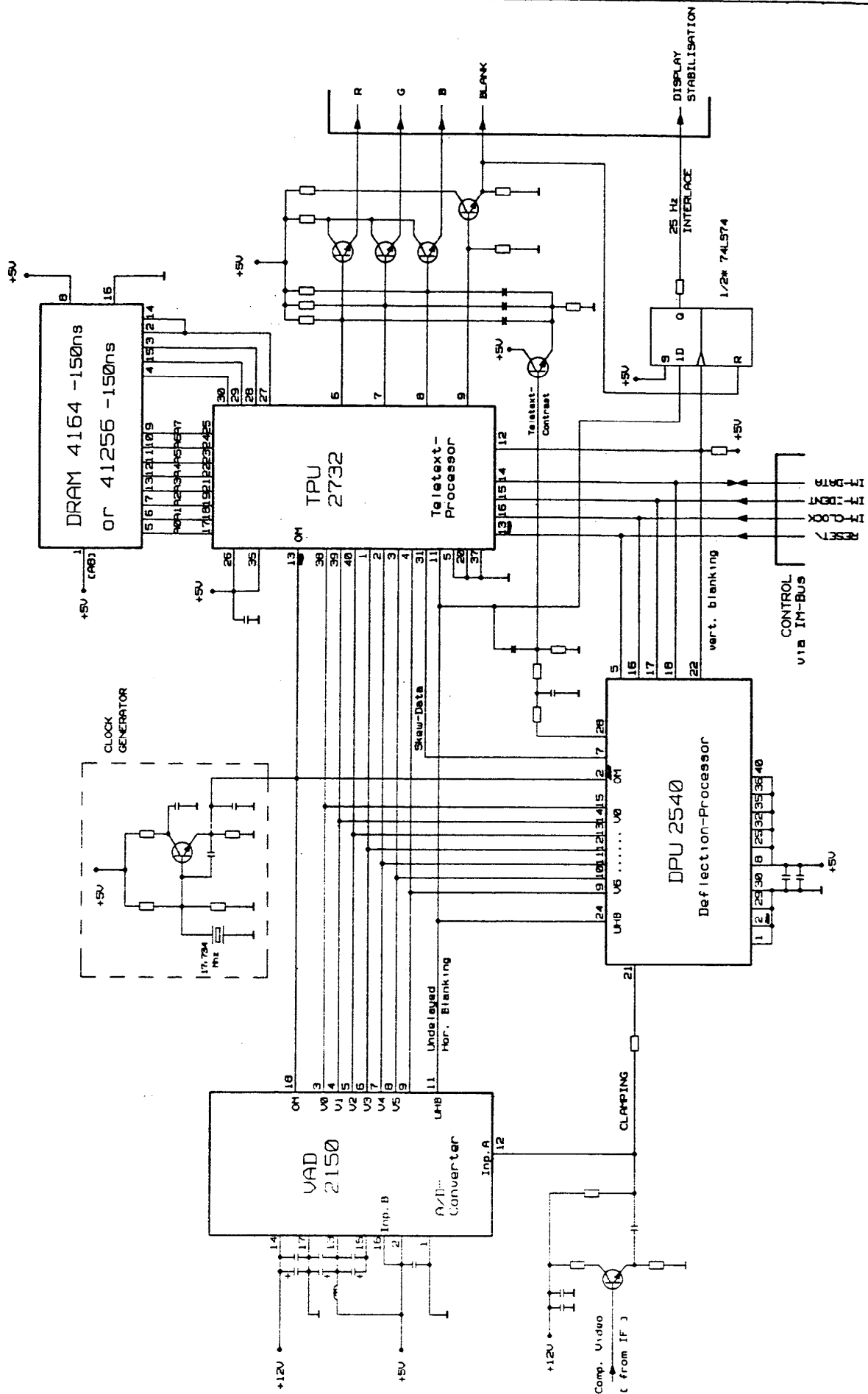


Fig. 4: Teletext - Application circuit (TPU 2732)

### A. SAA 1293A-06

The difference to the previous version SAA 1293A-03 is, that 2 additional IR-commands are added:

- **"SAA disable"**: The microcontroller is disabled in that way that no other IR-command is accepted but the "SAA enable"-command. The SAA1293A is not in Standby-mode (keeps running). This mode is usefull in development to controll the teletext stand-alone board with the PC and CLIMB-card via IM-Bus.
- **"SAA enable"**: The SAA1293A gets out of the disable-mode and accepts all IR-commands again.

**Note: only available with IR-address '8'!**

Function	IR-command [1..64]		Keyboard matrix-p.	
	Vers. A	Vers. B	Vers. A	Vers. B
SAA enable	11	11	-	-
SAA disable	12	12	-	-

**Table 20: IR- and Keyboard-commands for TV mode**

**B. SAA 1293A-10**

The SAA1293A-10 is based on the SAA1293A-06. It supports 29/55 Program-numbers, LED-display, MDA 2061/62 and is compatibel to the older version SAA1293A-06 except Mullard-Teletext (MI-Bus).

The modifications in SAA1293A-10 are:

- Support of TPU2735, FLOF and Spanish, Turkish, Polish and Hungarian Teletext.
- From this version the MI-Bus is not longer supported.
- New IR-Teletext-commands: 32, 60, 62.
- New Option-Bytes: 3.8, 4.3, 5.1, 5.2, 5.3, 5.4  
(Contrast for TXT picture is not stored in MDA2061)
- Error in SAA1293A-06 corrected in SAA1293A-10:  
If Option 1.8 is set (AC specific to P-no.) and press P+ or P-, TV stops when P-no = 0 is reached. Display shows 'A1' and it's not possible to leave this mode with key P+ or P-.

**B.1 Option Bytes****Option Byte 1 (Features) EAROM address = 251 = FBH**

Bit	meaning	'0'	'1'
1	AV modes	not available	available
2	Number of AV-modes	1	2
3	Number of stations	29	55
4	Intelligent Keys P+/-	not available	available
5	3-step-display (tune)	not available	available
6	Off-timer/tuning aid	not available	available
7	IR-address pair	0, 15	2, 13
8	AV-mode specific	no specific.	to station loc.

**Note Option-Bit 1.7:** MAINS-switch-on by IR is only possible with IR-address '15' and the IR-command of one of the number-keys.

**Option Byte 2 (Performance) EAROM address = 252 = FCH**

Bit	meaning	'0'	'1'
1	Volume aft. NORMALIZE	normalized	no action
2	Analog values for on from standby	normalized	values at time before standby
3	Bandswitching	immediate	during display
4	Muting at station changing	muting	no muting
5	Picture fading during station changing	only sound fad. no picture fad.	DAC1 + DAC2 reduced
6	Length of fading	short	long
7	Status of VCR-output	active high	active low
8	Dec. point of display	indic. teletext	indic. 2nd std.

**Option Byte 3 (Tuning) EAROM address = 253 = FDH**

Bit	meaning	'0'	'1'
1	Bandswitching during tuning	remains in same band	continues in neighb. band
2	Band I and III of VHF	combined band	single bands
3	MEMO procedure	Version A	Version B
4	Tuning command of remote control	as direct tuning commands	only fine tuning
5	VHF band	available	not available
6	AFC after fine tuning	remains off	on after 1 sec.
7	Hyper band (cable TV)	not available	available
8	TPU flag	TPU2735 (256KB)	TPU2732 (64 KB)

## Option Byte 4 (Multistandard, OSD) EAROM addr.= 254= FEH

Bit	meaning	'0'	'1'
1	Version for TV comnds	Version A	Version B
2	- not used -	-	-
3	Second Standard is	e.g. Secam	NTSC
4	- not used -	-	-
5	- not used -	-	-
6	- not used -	-	-
7	- not used -	-	-
8	- not used -	-	-

## Option Byte 5 (Extended Characters) EAROM addr.= 255= FFH

Bit	meaning	'0'	'1'
1 2	\ / Reception of row 26 (ECS-flag in TPU 2735)	00 = Program recognize TXT with extended character set by itself. 01 = Force ECS-flag (TPU2735) to 1. Extended characters are assumed by 16 sectors. 10 = Force ECS-flag (TPU2735) to 0. Extended characters are disabled by 28 sectors. 11 = not allowed	
3*	IR 60 / polish TXT	IR 60 is activ/ polish assumed	IR60 not activ/ polish only if Country Ident- Bits transmited
4	TPU 2735 - language	Polish, Turkish Hungarian	Spanish
5	-not used-		
6	-not used-		
7	-not used-		
8	-not used-		

Table 21-25: Option Bytes 1-5

\*) IR-command 60 sets the english character set.

## C.2 COMMAND-CODES

All command-codes are valid with IR-addresses '0' or '15'!

## IR- and Keyboard-commands for TV mode

Function Option-Byte 4.1->	IR-command [1..64]		Keyboard matrix-p.	
	Vers. A = 1	Vers. B = 0	Vers. A = 1	Vers. B = 0
Number 1	17	17	23	2
Number 2	18	18	19	3
Number 3	19	19	11	4
Number 4	20	20	7	5
Number 5	21	21	17	6
Number 6	22	22	16	7
Number 7	23	23	15	8
Number 8	24	24	14	9
Number 9	25	25	6	10
Number 0 / VCR	26	26	2	1
Program --	11	11	-	-
Pro10th/Pro10-	9	6	8	28
Pro20th/Pro10+	8	9	12	26
Program +	15	8	27	25
Program -	16	5	26	27
Scanning +	64	64	25	31
Scanning -	13	13	-	-
Tuning +	5	14	32	12
(Stop scanning)				
Tuning -	6	15	31	13
Analog 1+	41	41	9	15
Analog 1-	42	42	22	16
Analog 2+	43	43	5	17
Analog 2-	44	44	10	18
Analog 3+	45	45	21	19
Analog 3-	46	46	18	20
Analog 4+	47	47	3	21
Analog 4-	48	48	1	22
Band switch	40	36	24	14
Multi-Standard	32	32	4	24
MEMO	39	39	20	23
NORMAL	4	4	29	29
Grandma-key	-	-	13	32
Mute	7	7	28	30
AV-switch	10	35	30	11
Teletext ON *)	57,61	57,61	-	-
Time display *)	37,38,49	37,38,49	-	-
Service mode ON	1	1	-	-
OFF Standby	2	2	-	-

Table 39: IR- and Keyboard-commands for TV mode

Note: following table only be valid with IR-address '8'!

Function	IR-command [1..64]		Keyboard matrix-p.	
	Vers. A	Vers. B	Vers. A	Vers. B
SAA enable	11	11	-	-
SAA disable	12	12	-	-

Table 27: IR- and Keyboard-commands for TV mode

IR-commands for Teletext-mode

FUNCTION	SAA5000-teletext - c a n c e l e d -	TPU2732- teletext	TPU2735- teletext
Mix-mode *		31	31
Height *		28	28
Small		-	62
Hold *		29	29
Reveal *		12	12
Update *		30	30
Timed Page *		38	38
Next Page		8, 15	8, 15
Last Page		5, 16	5, 16
Inverse D. *		27	27
Status		-	-
Page 100		32	32
Index		-	32
Set english character +		-	60
TT Reset		57, 61	57, 61
TT Off		3	3
FLOF (red)		-	33
FLOF (green)		-	34
FLOF (yellow)		-	35
FLOF (blue)		-	36

Table 28: IR- and Keyboard-commands for Teletext mode

Rem.: \*) = Toggle keys  
+) = only for Polish-Teletext

**IR- and Keyboard-commands for Service mode**

Submodes of SERVICE-mode are:

1. CH = CHECK-mode (checks swing of tuning-voltage and analogs)
2. OP = OPTIONS-mode (shows and modifies OPTION-flags)
3. HO = HOR-POS-mode (set horizontal position of ITT-Txt.)
4. CO = CONTRAST-mode (set contrast-offset of ITT-Text)

Function	IR-command	Key-name in TV-mode
Next Submode	1	Service-mode ON
Toggle option bit 1	17	P1
Toggle option bit 2	18	P2
Toggle option bit 3	19	P3
Toggle option bit 4	20	P4
Toggle option bit 5	21	P5
Toggle option bit 6	22	P6
Toggle option bit 7	23	P7
Toggle option bit 8	24	P8
Data + / Option-byte +	47	VOL +
Data - / Option-byte -	48	VOL -
MEMO Data	39	MEMO
MEMO Grandma-key	4	NORMAL
Generate Reset	59	-
OFF Standby	2	OFF Standby

Table 29: IR-commands for Service-mode



## B.3 Contents of Non-Volatile Memory MDA 2061/62

Address		Description
Dec.	Hex.	
128	80H	Analog value for NORMALIZATION-key DAC1
129	81H	" " " " DAC2
130	82H	" " " " DAC3
131	83H	" " " " DAC4 (VOL)
132	84H	Station Parameters for P0 - (1. Byte) Bit 0..1: 00 = Band I (VHF 1) 01 = Band III (VHF 3) 10 = Band IV/V (UHF) 11 = Band Hyper (if available, else UHF) Bit 2: Multi-Standard Bit 3: 1 = Station memorized (Opt. 1.4) 1 = Station w. AV-mode (Opt. 1.8) Bit 4..7: Lower 4 bit of tuning-voltage
133	85H	Station Parameters for P0 - (2. Byte) Bit 0..7: Higher 8 bit of tuning-voltage
134	86H	Station Parameters for P1 - (1. Byte)
135	87H	Station Parameters for P1 - (2. Byte)
:	:	:
158	9EH	Station Parameters for P13 - (1. Byte)
159	9FH	Station Parameters for P13 - (2. Byte)
160	A0H	- not usable -
161	A1H	Station Parameters for P14 - (1. Byte)
162	A2H	Station Parameters for P14 - (2. Byte)
:	:	:
191	BFH	Station Parameters for P29 - (1. Byte)
192	C0H	- not usable -
193	C1H	Station Parameters for P29 - (2. Byte)
194	C2H	Station Parameters for P30 - (1. Byte)
195	C3H	Station Parameters for P30 - (2. Byte)
:	:	:
244	F4H	Station Parameters for P55 - (1. Byte)
245	F5H	Station Parameters for P55 - (2. Byte)
246	F6H	Horizontal Adjust of Teletext-picture
247	F7H	Analog value for Grandma-key DAC1
248	F8H	" " " " DAC2
249	F9H	" " " " DAC3
250	FAH	" " " " DAC4 (VOL)
251	FBH	Option Flags of 1st Option-Byte
252	FCH	Option Flags of 2st Option-Byte
253	FDH	Option Flags of 3st Option-Byte
254	FEH	Option Flags of 4st Option-Byte
255	FEH	Option Flags of 5st Option-Byte

Table 30: Contents of MDA 2061/62

## B.4 Ports

Port	Pin		Function	Input	Output	Active
	DIL	PLCC				
P10	28	-	Validate Inp./Aux.Out.	X	X	'0'
P11	29	-	Band 0 \ 01-V1 10-V3		X	'1'
P12	30	-	Band 1 / 11-UHF 00-HB		X	'1'
P13	31	-	Multistandard		X	'1'
P14	32	-	VCR Output		X	Option
P15	-	-	- not available -			
P16	-	-	- not available -			
P17	35	-	AFC Output		X	'1'
P20	23	-	Display Left Digit		X	'0'
P21	24	-	Display Right Digit		X	'0'
P22	25	-	AV - mode		X	'1'
P23	26	-	- not used -			-
P24	36	-	Keyboard row 0	X		'0'
P25	37	-	= = 1	X		'0'
P26	38	-	= = 2	X		'0'
P27	39	-	= = 3	X		'0'
P30	14	-	Keyb.Col 0 / Display a		X	'0'
P31	15	-	= 1 / = b		X	'0'
P32	16	-	= 2 / = c		X	'0'
P33	17	-	= 3 / = d		X	'0'
P34	18	-	= 4 / = e		X	'0'
P35	19	-	= 5 / = f		X	'0'
P36	22	-	= 6 / = g		X	'0'
P37	21	-	= 7 / = h		X	'0'

Table 31: Ports

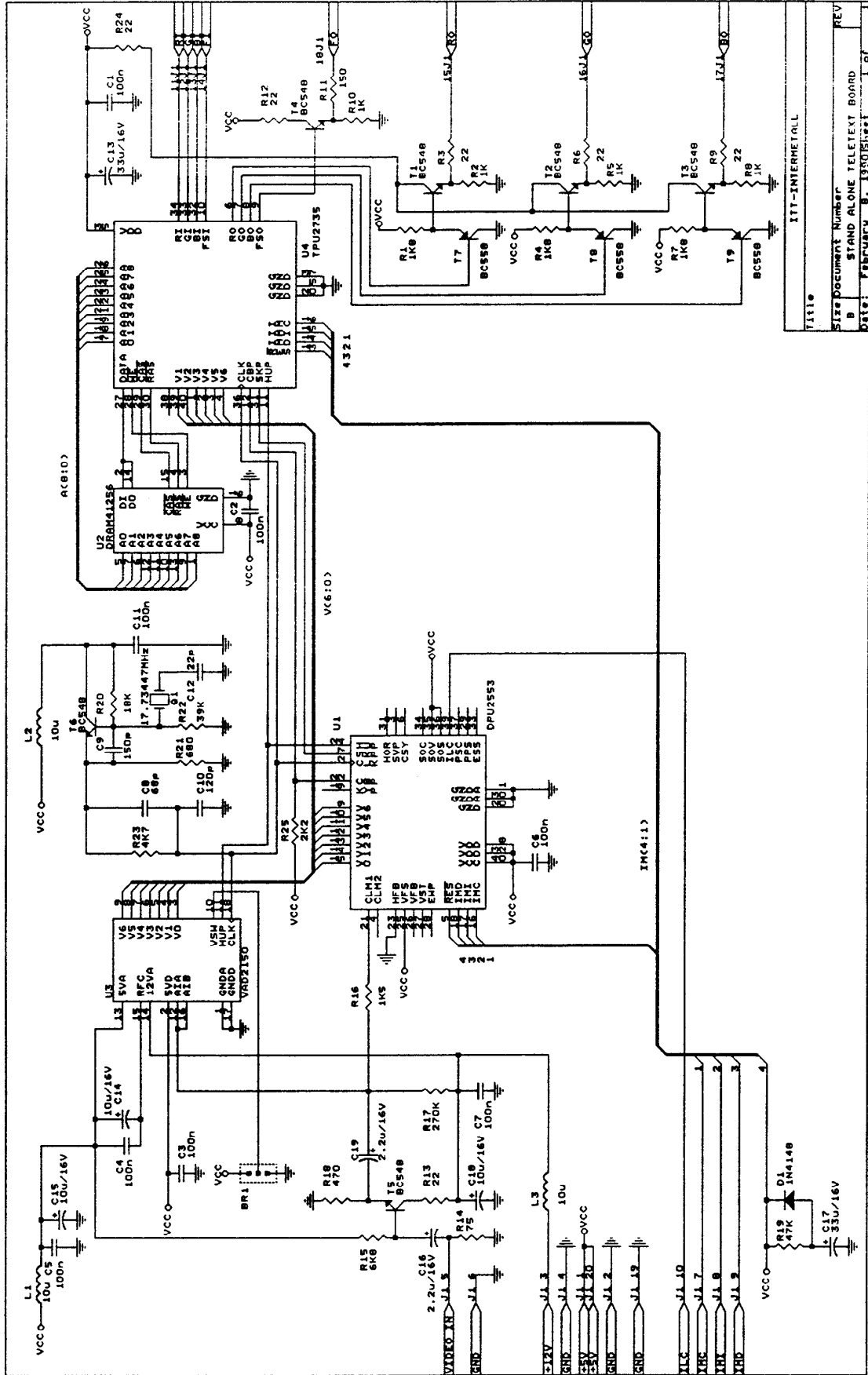


Fig. 5: TPU 2735 - Application circuit

### C. SAA 1293A-20

The SAA1293A-20 is based on the SAA1293A-03/10. The modifications are:

- **Digital Audio with ACP 2371** (Analog Audio by DAC still available by option-bit).  
(SAA1293A-03/10: Analog Audio with DAC)
- **supports 29/99 Program-numbers**  
(SAA1293A-03/10: 29/55 stations)
- **On-Screen Display with TPU 2735**, no LED display  
(SAA1293A-03/10: LED display)
- **Non-volatile memory NVM 3060** (4096 Bit)  
(SAA1293A-03/10: MDA 2062 (1024 Bit))
- **Level 1.5 Teletext with TPU 2735** (FLOF, and spec. Languages), no Mullard-Teletext (MI-Bus). Contrast for Teletext is not stored in NVM.  
(SAA1293A-03: Txt with TPU 2732, MI-Bus.)
- **Autosearch with a 'validate' signal or 'AFC'-comparator**
- **New IR-Teletext-commands and Option Bytes.**
- **Memorization of analog values for 'Grandma-key':**  
In version SAA1293 the factory setting can be done in Service-mode, submode Options with the key 'Normalisation'.  
In version SAA1293A there is no more special procedure for that feature. Memorization for the 'Grandma-key' happens simultaneously to the memorization of options or horizontal position every time the MEMO-key is pressed.

SAA1293A-20 supports digital audio with ACP2371 and On-Screen display (OSD) with the TPU2735. To get an OSD in case of no video-signal an additional small circuitry (Fig. 7) is needed. The circuit diagram shows the interface to teletext board and the handling of sync-signals. The interface needs the following signals from the Sync-Processor in the TV set: 'MUTE', 'Vertical drive' and 'Sandcastle' (Hor.flyback).

There are two different options for this interface. With Mode 2 you will get a more stable OSD for messages on your TV-screen in case of no video signal. The DPU of the teletext board in this case will lock to the vertical-sync of the TV-Sync processor. It depends on this Sync-processor (stability) if you can use this mode. The Mode 1 works in any case.

The SAA1293A-20 supports a semi-auto-searching as well as a full-auto-searching for the current available channels. The next available channel for the current band can be selected by pressing "Scan+" or "Scan-" and can be memorized with the "Memo" key. Break scanning with "tuning+" key.

With Option Byte 1, Bit 5 (s. chapter C.1) you can select semi- or full-auto-search. In semi-auto-search only a so-called "validate"-signal (e.g "Mute"-signal) at pin 26 is necessary to detect stations. The performance of this mode depends on the strength of the stations and on the performance of the AFC-circuit of the system.

The full-auto-search tune the station preciser than semi-auto-search because two signals are used for scanning: At the start of searching the "validate"-signal at pin 26 is used for a

high speed search through the band. If a station is found the AFC comparator output (s.Fig.8) at pin 24 is used for fine tuning of the station.

For the TV can be tuned exactly to TV station, the AFC comparator must be set as follow by the manufacturer (s.Fig.8):

- 1) The station must be set exactly by "Tune+" and "Tune-" keys. The comparator output 1 should be low level and comparator output 2 should be high level.
- 2) By hitting the "Tune+" key twice you get the lower treshold voltage  $V_l$  of the AFC-signal and the comparator output 1 must be changed to high level.
- 3) By hitting the "Tune-" key four or five times you get the higher treshold voltage  $V_h$  of the AFC-signal and the comparator output 1 and 2 must be changed to low level.
- 4) If the level of the AFC-signal is in the range  
 $V_l < V_{afc} < V_h$  ,  
the combined comparator output, which is connected to pin 24 of SAA1293A-20, should be high level.

## C.1 Option Bytes

Option Byte 1 (Features) EAROM address = 15 = 0FH

Bit	meaning	'0'	'1'
1	AV modes	not available	available
2	Number of AV-modes	1	2
3	Number of stations	29	99
4	Intelligent Keys P+/-	not available	available
5	Auto-search	Semi	Full
6	Off timer/Tuning aid	not available	available
7	Validate IR-address	0, 15	2, 13
8	AV-mode specific	toggle with IR	to station loc.

Note Option-Bit 1.7: MAINS-switch-on by IR is only possible with IR-address '15' and the IR-command of one of the number-keys.

Option Byte 2 (Performance) EAROM address = 16 = 10H

Bit	meaning	'0'	'1'
1	Volume aft. NORMALIZE	normalized	no action
2	Analog values for ON from standby	normalized	values at time before standby
3	Bandswitching	immediate	during display
4	Muting at station changing	muting	no muting
5	Picture fading during station changing	only sound fad. no picture fad.	DAC1 + DAC2 reduced
6	Length of fading	short	long
7	Status of VCR-output	active high	active low
8	Fast Blank polarity	TPU 2732 compat	TPU 2735

Option Byte 3 (Tuning) EAROM address = 17 = 11H

Bit	meaning	'0'	'1'
1	Bandswitching during tuning	remains in same band	continues in neighb. band
2	Band I and III of VHF	combined band	single bands
3	MEMO procedure	Version A	Version B
4	Tuning command of remote control	as direct	only fine tuning
5	VHF band	available	not available
6	AFC after fine tuning	remains off	on after 1 sec.
7	Hyper band (cable TV)	not available	available
8	TPU flag	TPU2735 (256Kb)	TPU2732 (64Kb)

## Option Byte 4 (Multistandard) EAROM addr.= 18 = 12H

Bit	meaning	'0'	'1'
1	IR-command set	Version A	Version B
2	Standard A (PAL)	not available	available
3	Standard B (NTSC)	not available	available
4	Standard C (SEC-L,w)	not available	available
5	Standard D (SEC-F,e)	not available	available
6	DPU2553/pin38	active	inactive
7	- not used -		
8	- not used -		

## Option Byte 5 (Extended Characters) EAROM addr.= 19 = 13H

Bit	meaning	'0'	'1'
1 2	Reception of row 26 (ECS-flag in TPU 2735)	00 = Program recognize TXT with extended character set by itself	
		01 = Force ECS flag to 1; 16 sectors are available; extended character set is assumed	
		10 = Force ECS flag to 0; 28 sectors are available; extended character set is disabled	
		11 = not allowed	
3*	IR 60/ polish TXT (only TVPO 2066-A23E)	IR 60 is activ/ polish TXT is assumed	IR 60 not activ/ polish only if Country Ident-Bits transmitted
4	TPU 2735 - Type for	Hung., Pol., Tur.	Spanish
5	-not used-		
6	-not used-		
7	-not used-		
8	-not used-		

Option Byte 6 (OSD) EAROM addr.= 20 = 14H

Bit	meaning	'0'	'1'
1	- not used -		
2	OSD-Mode	with Box	Mixed (TV back)
3	Time in bottom line	not available	available
4	Constant P-no. with	black backgrnd.	in mixed mode
5	Constant P-no. in	double size	normal size
6	Constant P-no. in	red	green
7	\ OSD -	00 = Name taken from NVM	
8	/ name select	01 = 'TVP 2075'	
		10 = 10 blanks	
		11 = ' TIME '	

Option Byte 7 (Audio, ACP) EAROM addr.= 21 = 15H

Bit	meaning	'0'	'1'
1	Physiological loudn.	OFF	ON
2	Billing. modes	1 + 2 + 3	2 + 3
3	OSD when muted	EAR., barg., m/s	MUTE
4	ADC xxxx	ADC 2300	ADC 2310
5	Volume control by	DAC4	ACP
6	- not used -		
7	- not used -		
8	- not used -		

Table 32-38: Option Bytes 1-7



## B.2 COMMAND-CODES

All command-codes are based on IR-addresses '0' or '15'

### IR- and Keyboard-commands for TV mode

FUNCTION Option-Byte 4.1->	IR-COMMAND [1..64]		KEYBOARD	MATRIX-P.
	Vers. A = 1	Vers. B = 0	Vers. A = 1	Vers. B = 0
Number 1	17	17	23	2
Number 2	18	18	19	3
Number 3	19	19	11	4
Number 4	20	20	7	5
Number 5	21	21	17	6
Number 6	22	22	16	7
Number 7	23	23	15	8
Number 8	24	24	14	9
Number 9	25	25	6	10
Number 0 / VCR	26	26	2	1
Program --	11	11	-	-
Pro10th/Pro10-	9	6	8	28
Pro20th/Pro10+	8	9	12	26
Program +	15	8	27	25
Program -	16	5	26	27
Tuning +	5	14	32	12
Tuning -	6	15	31	13
Analog 1+	41	41	9	14
Analog 1-	42	42	22	24
Analog 2+	43	43	5	17
Analog 2-	44	44	10	18
Analog 3+	45	45	21	19
Analog 3-	46	46	18	20
Analog 4+ (VOL)	47	47	3	21
Analog 4- (VOL)	48	48	1	22
Band switch	40	36	24	14
Multi-Standard	32	32	4	24
MEMO	39	39	20	23
NORMAL	4	4	29	29
Grandma-key	-	-	13	32
Mute	7	7	28	30
AV-switch	10	35	30	11
Auxiliary	63	63	25	31
Teletext ON *)	57,61	57,61	-	-
Time display *)	37,38,49	37,38,49	-	-
Service mode ON	1	1	-	-
Program MDA with default values	62	62	-	-
OFF Standby	2	2	-	-

Table 26: IR- and Keyboard-commands for TV mode

continued...

Function Option-Byte 4.1->	IR-command [1..64]			
	Vers. A = 1	Vers. B = 0		
Program MDA with default values	62	62		
Recall	3	3		
Auxiliary	63	63		
Balance (L)	50	50		
Balance (R)	58	58		
Stereo/Pseudo St.	51	51		
Mono/Stereo	56	56		
Treble +	52	52		
Treble -	53	53		
Bass +	54	54		
Bass -	55	55		
Biling.mode plus or toggle mono	59	59		

Table 39 (continued)

Note: following table only be valid with IR-address '8'!

Function	IR-command [1..64]		Keyboard matrix-p.	
	Vers. A	Vers. B	Vers. A	Vers. B
SAA enable	11	11	-	-
SAA disable	12	12	-	-

Table 40: IR- and Keyboard-commands for TV mode

## IR-commands for Teletext-mode

Function	T e l e t e x t - d e c o d e r	
	TPU2732	TPU 2735
MIX-mode	31	31 *)
Height	28	28 *)
Width	-	62 *)
Hold	29	29 *)
Reveal	12	12 *)
Update (Cancel)	30	30 *)
Timed Page	38	38 *)
Next Page	8,15	8,15
Last Page	5,16	5,16
Inverse Display	27	27 *)
Page 100 / INDEX	-	32
Set english char.	-	60 +)
TXT Reset	57,61	57,61
TXT OFF	3	3
FLOF (red)	-	33
FLOF (green)	-	34
FLOF (yellow)	-	35
FLOF (blue)	-	36

Table 41: IR-commands for TXT-mode

Rem.: \*) = Toggle keys  
 +) = only for Polish-Teletext

## IR- and Keyboard-commands for Service mode

Function	IR-command	Key-name in TV-mode
Next Submode	1	Service-mode ON
Toggle option bit 1	17	P1
Toggle option bit 2	18	P2
Toggle option bit 3	19	P3
Toggle option bit 4	20	P4
Toggle option bit 5	21	P5
Toggle option bit 6	22	P6
Toggle option bit 7	23	P7
Toggle option bit 8	24	P8
Data + / Option-byte +	47	VOL +
Data - / Option-byte -	48	VOL -
MEMO Data	39	MEMO
MEMO Grandma-key	4	NORMAL
Generate Reset	59	-
OFF Standby	2	OFF Standby

Table 44: IR-commands for Service-mode

## C.3 Contents of Non-Volatile Memory NVM 3060

Address		Description
Dec.	Hex.	
0	00H	Analog value for GRANDMA-key DAC1
1	01H	" " " " DAC2
2	02H	" " " " DAC3
3	03H	" " " " DAC4 (VOL)
4	04H	Analog value for NORMALIZATION-key DAC1
5	05H	" " " " DAC2
6	06H	" " " " DAC3
7	07H	" " " " DAC4 (VOL)
8	08H	Horizontal Adjust of Teletext-picture
9	09H	P-no. with mode 'AV1'
10	0AH	P-no. with mode 'AV2'
11	0BH	Bit 0..4 OSD horizontal position
12	0CH	Bit 0..5 OSD vertical position
13	0DH	Treshold for ACP
15	0FH	Option Flags of 1st Option-Byte
16	10H	Option Flags of 2st Option-Byte
17	11H	Option Flags of 3st Option-Byte
18	12H	Option Flags of 4st Option-Byte
19	13H	Option Flags of 5st Option-Byte
20	14H	Option Flags of 6st Option-Byte
21	15H	Option Flags of 7st Option-Byte
22	16H	Option Flags of 8st Option-Byte
23	17H	23..32, 10*2=20 colors for OSD messages
33	21H	Name in EAROM, 20 characters
53	35H	Station Parameters for P0 - (1. Byte) Bit 0..1: 00 = Band I (VHF 1) 01 = Band III (VHF 3) 10 = Band IV/V (UHF) 11 = Band Hyper (if availabel, else UHF) Bit 2: Multi-Standard Bit 3: 1 = Station memorized (Opt. 1.4) 1 = Station w. AV-mode (Opt. 1.8) Bit 4..7: Lower 4 bit of tuning-voltage
54	36H	Station Parameters for P0 - (2. Byte) Bit 0..7: Higher 8 bit of tuning-voltage
:	:	:
250	FAH	Station Parameters for P99 - (1. Byte)
251	FBH	Station Parameters for P99 - (2. Byte)
252	FCH	Balance
253	FDH	Volume
254	FEH	Treble
255	FFH	Bass

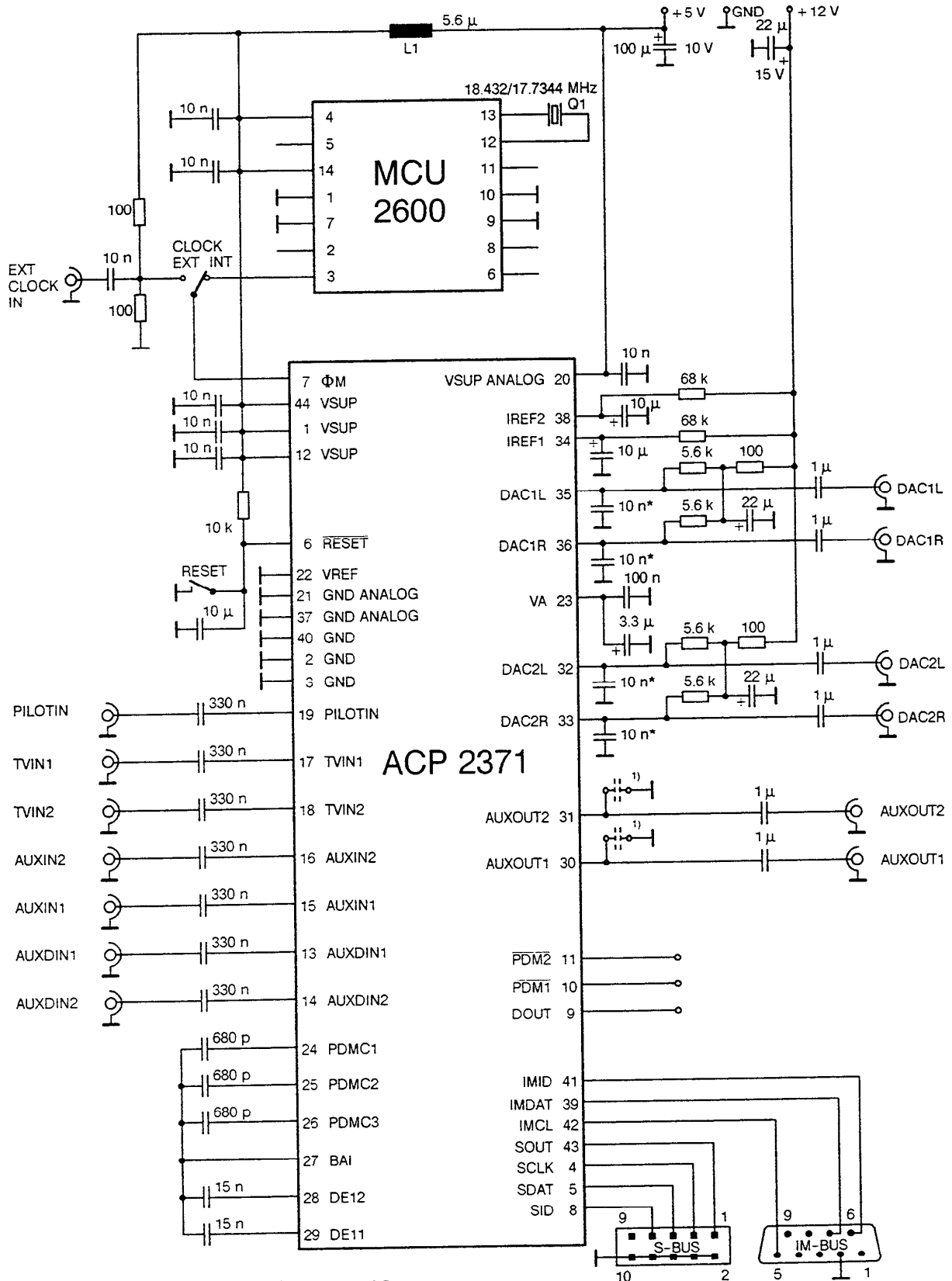
Table 45: Contents of NVM 3060

## C.4 Ports

Port	Pin		Function	Input	Output	Active
	DIL	PLCC				
P10	28	-	Auxiliary Output		X	'0'
P11	29	-	Band 0 \ 01-V1 10-V3		X	'1'
P12	30	-	Band 1 / 11-UHF 00-HB		X	'1'
P13	31	-	Multistandard		X	'1'
P14	32	-	VCR Output		X	Option
P15	-	-	- not available -			
P16	-	-	- not available -			
P17	35	-	AFC Output		X	'1'
P20	23	-	- not used -			
P21	24	-	Comparator Inp (Stat.)	X		'1'
P22	25	-	AV - Mode		X	'1'
P23	26	-	Validate Input	X		'1'
P24	36	-	Keyboard row 0	X		'0'
P25	37	-	= = 1	X		'0'
P26	38	-	= = 2	X		'0'
P27	39	-	= = 3	X		'0'
P30	14	-	Keyboard Column 0		X	'0'
P31	15	-	= = 1		X	'0'
P32	16	-	= = 2		X	'0'
P33	17	-	= = 3		X	'0'
P34	18	-	= = 4		X	'0'
P35	19	-	= = 5		X	'0'
P36	22	-	= = 6		X	'0'
P37	21	-	= = 7		X	'0'

Table 46: Ports

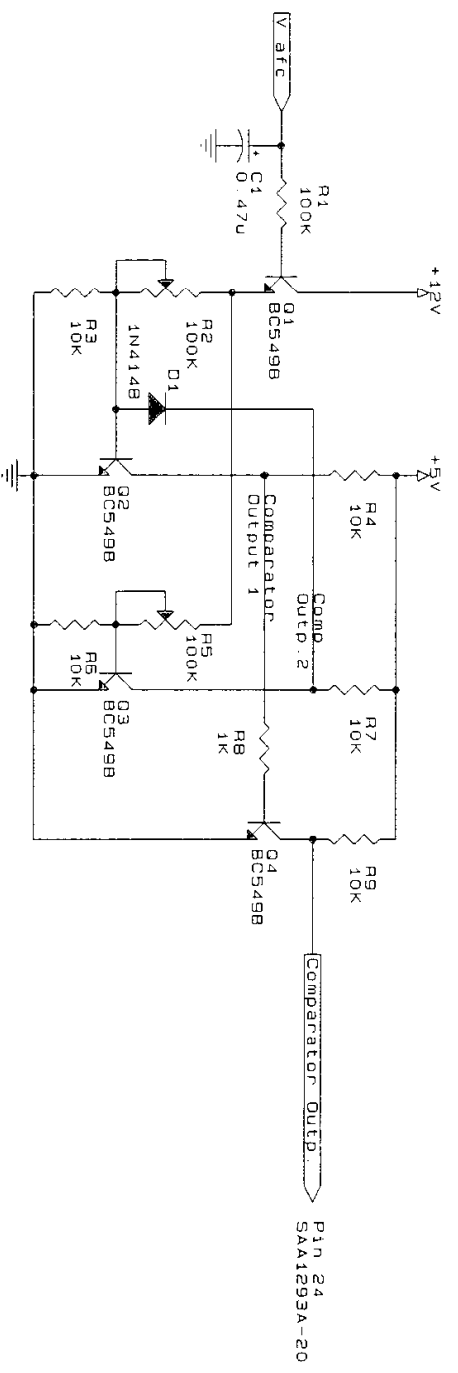
Application Circuit



\* Capacitors = 5%; all resistors = 1%; <sup>1)</sup> see section 2.5.

Fig. 6: Digital Audio Appl. circuit

Fig. 8: Example circuit for Auto-Searching



Comparator	Outp. 1	Outp. 2	Pin 24
Vafc < V1	1	1	0
Vh < Vafc < V1	0	1	1
Vafc > Vh	0	0	0

SAA 1293A-20	
Title Full-Auto-Search circuit	
Size Document Number	1
Date: June 12, 1991	Sheet 1 of 1
REV	1





SAA1293A-20	SAA1293A-10	SAA1293A-06	SAA1293A-03	SAA1293-03	SAA1293-02
16 KByte - ROM Chip	16 KByte - ROM Chip	6.5 KByte - ROM Chip	6.5 KByte - ROM Chip	6.5 KByte - ROM Chip	6.5 KByte - ROM Chip
Digital Audio (ACP2371) or Analog Audio (DAC4)	Analog Audio (DAC4)	Analog Audio (DAC4)	Analog Audio (DAC4)	Analog Audio (DAC4)	Analog Audio (DAC4)
On-Screen Display with TPU 2745, no LED	2-digit LED display	2-digit LED display	2-digit LED display	2-digit LED display	2-digit LED display
Non-volatile memory NVM 3060	Non-volatile memory MDA 2061/62	Non-volatile memory MDA 2061/62	Non-volatile memory MDA 2061/62	Non-volatile memory MDA 2061/62	Non-volatile memory MDA 2061/62
Autosearch with a 'validate' signal	-	-	-	-	-
Option-Bytes 1..7	Option-Bytes 1..5	Option-Bytes 1..4	Option-Bytes 1..4	Option-Bytes 1..4	Option-Bytes 1..4
	Teletext Level 1.5 FLOr and extended char. Spanish, Turkish, Polish, Hungarian chars. Chipset: TPU2735, DPU 2553, VAD2150, DRAM41256	Teletext ITR Chipset: TPU2732/35, DPU2540, VAD2150, DRAM 4164	Teletext ITR Chipset: TPU2732/35, DPU2540, VAD2150, DRAM 4164	-	-
	No MI-Bus Teletext	Supports MI-Bus Teletext SAA5041, SAA5040/43	Supports MI-Bus Teletext SAA5041 (add. comnds.) SAA5040/43	Supports MI-Bus Teletext SAA5041, SAA5042, SAA5040/43	Supports MI-Bus Teletext SAA5041, SAA5042
	No Contrast offset value for Telet. in MDA	Contrast offset value for Teletext in MDA	Contrast offset value for Teletext in MDA	Contrast offset value for Teletext in MDA	Contrast offset value for Teletext in MDA
	Max. Program-no. 29/99	Max. Program-no. 29/55	Max. Program-no. 29/55	Max. Program-no. 29/39	Max. Program-no. 29/39
	Supports IR-address pairs 0,15 and 2,13	IR-address pair 0,15	IR-address pair 0,15	IR-address pair 0,15	IR-address pair 0,15
		With 2 additional Infrared signals, SAA can be disabled or enabled (disable: SAA don't accept IR, only the enabling command)	-	-	-

**D. Overview of all Versions of "SAA 1293"**

The next two pages show in form of a table the differences of all SAA 1293 versions.

The SAA1293A-20 shows only the differences to the previous version SAA1293-A10. The added part in SAA1293-A10 shows only the differences to the previous version SAA1293-A06 and so on.

SAA1293A-03	SAA1293-03	SAA1293-02
6.5 Kbyte - ROM Chip	6.5 Kbyte - ROM Chip	6.5 Kbyte - ROM Chip
Analog Audio (DAC4)	Analog Audio (DAC4)	Analog Audio (DAC4)
2-digit LED display	2-digit LED display	2-digit LED display
Non-volatile memory MDA 2061/62	Non-volatile memory MDA 2061/62	Non-volatile memory MDA 2061/62
-	-	-
Option-Bytes 1..4	Option-Bytes 1..4	Option-Bytes 1..4
Teletext ITT Chipset: TPU2732/35, DPU2540, VAD2150, DRAM 4164	-	-
Supports MI-Bus Teletxt SAA5041 (add. comms.) SAA5040/43	Supports MI-Bus Teletxt SAA5041, SAA5042, SAA5040/43	Supports MI-Bus Teletxt SAA5041, SAA5042
Contrast offset value for Teletext in MDA	Contrast offset value for Teletext in MDA	Contrast offset value for Teletext in MDA
Max. Program-no. 29/55	Max. Program-no. 29/39	Max. Program-no. 29/39
IR-address pair 0,15	IR-address pair 0,15	IR-address pair 0,15
-	-	-
1 Output for 2 Multi- standards (pin 31)	2 Outputs for 4 Multi- standards (pin 31, or pin 25 and 26)	2 Outputs for 4 Multi- standards (pin 31, or pin 25 and 26)
2 Outputs for AV and VCR modes (pins 25, 32)	1 Output for VCR mode (pin 32)	1 Output for VCR mode (pin 32)
Sleep timer and tuning aid with a 'validate' signal.	-	-
2 Bytes for each Prog.-no. in MDA 2062	3 Bytes for each Prog.-no. in MDA 2062	3 Bytes for each Prog.-no. in MDA 2062
Picture fading during station change is sel- ectable.	-	-
Supports in addition SAA 5041-teletext controller.	-	-
Any IR-address (0 or 15) accepted for P-no.	-	-
	3-step-indication of actual tuning voltage on LED-display.	no information about tuning voltage. Only band is indicated.
	Supports in addition a 'hyper'-band for cable-TV's.	Only 3-band TV set.
	Other improvements: Indication of tuning- gear, Selection of AV-mode with P+/P- keys, Period of band-display reduced 5sec.->2.5 sec, better indication for MEMO-phase.	-