# SAA

# 1293A

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

This datasheet describes the features of SAA 1293A-03. The differences and additional features of the succeded 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 controler 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.

```
Pins    14      15      16      17      18      19      22      21
        |       |       |       |       |       |       |       |
        |       |       |       |       |       |       |       |
 36 ----o-------o-------o-------o-------o-------o-------o-------o
        |4      |8      |12     |17     |20     |24     |28     |32
        |       |       |       |       |       |       |       |
 37 ----o-------o-------o-------o-------o-------o-------o-------o
        |3      |7      |11     |15     |19     |23     |27     |31
        |       |       |       |       |       |       |       |
 38 ----o-------o-------o-------o-------o-------o-------o-------o
        |2      |6      |10     |14     |18     |22     |26     |30
        |       |       |       |       |       |       |       |
 39 ----o-------o-------o-------o-------o-------o-------o-------o
        |1      |5      |9      |13     |17     |21     |25     |29
```
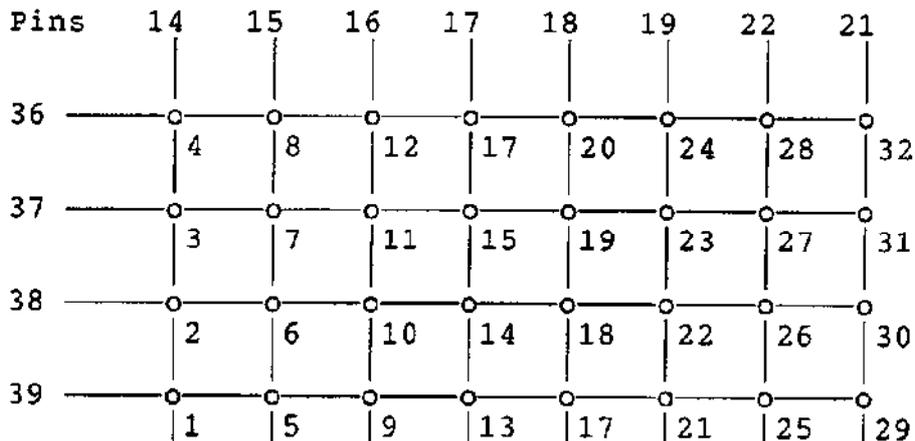
**Fig. 1: Diagram of the keyboard for direct input**

Keyboard and display  use common  lines. For scanning the  key-
board, 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  multi-
plex operation.

Normally the number of the station  selected will appear on the
display.  When the band is  changed and  during tuning, the cur-
rent 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 dep-
ends 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-con-
trol 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 re-
mote control decoder is the only part of the SAA 1293A which
is powered under standby conditions. This ensures that a se-
quence 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 stand-
by 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, aquired during the Memo
procedure (see section 12) and the options. The IM bus con-
sists 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 reqires 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 specifi-
cation in this data sheet relate to a crystal frequency of 4
MHz. With other crystal frequencies, there will be correspon-
ding 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 coresponding 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-recoder 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 allways 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 posibilities 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 automatc 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 allways 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, wheras 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 ouput 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 temorarily swiched 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 (activ HIGH / LOW ) depend on option 2.7. This output is needed for those TV sets which have to switch a time-contant 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 en-
sures 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 sta-
tion  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  uneffected. 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 'O' and then  pressing key  'O'
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  auto-
matically 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-out-
put to inactiv.  All station-parameters (tuning voltage,  band
and multi-standard)  and the display  of the station number re-
main  the same. The  decimal-point of  display's lefthand digit

is OFF. The tuner is completely uneffected. This is necessary
for those TV-sets prepared to work with descramblers connected
to the SCART- connector. If necessary, an extra LED, con-
trolled 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-Ouput**

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:

| Mode | Display | VCR-output | AV-output | |
|------|---------|------------|-----------|--|
| 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:

| Mode | Display | VCR-output | AV-output | |
|------|---------|------------|-----------|--|
| 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 there-after 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-trans-mission. Tuning aid is intented 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 modi-fied 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 multi-plier 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 | without tuning aid |
| 4 | > 3.6 | 560 | 224 | 112 | 112 | 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 dis-
play-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
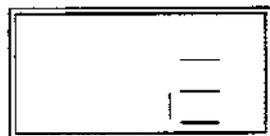


= tuning voltage is in high end of cable-band

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



= tuning voltage is in 3rd quarter of band VHF
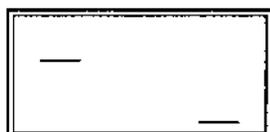
```
 _____
|  _____      |
| |_____|      |        = tuning voltage is in low end of band UHF
|        __    |
|       |__|   |
|_____|
```
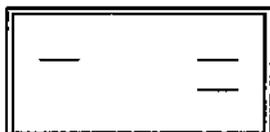
```
 _____
|  _____   ___|
| |_____|  |___|       = tuning voltage is in 4th quarter of band UHF
|        __    |
|       |__|   |
|_____|
```

```
  ^       ^
  |       |
  |       +----  level of tuning-voltage
  |
  +-------------  symbol for VHF and UHF
```
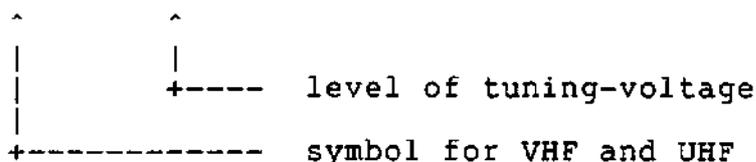
## 12.  MEMO Procedure

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-tele-
text-  decoder in such a way, that  the system allways 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-tele-
text 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,  deflec-
tion- 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 tele-
text controler  is needed,  because the  software for  teletext
control is allready on the chip. Besides the  standard features
of a  teletext system  (mix,hold,reveal,  cancel,double  height,
timed page>,  this chipset allways 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 sta-
tion 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 a n d 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 allways 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 allways 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. in 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  this 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 activ.
- 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 Tele-text (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 controlers 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 all vers. | + vers. C | TPU2732-teletext | TPU2735-teletext |
|---|---|---|---|---|
| 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 englisch 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-manufactorer 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 equip-
ped 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 contast of the teletext display.

TV-MODE

SE 0.5 s min.

SE = KEY

CH = DISPLAY

CHECK MODE — CH

SE

OPTION MODE — OP

SE

ITT-TEXT-DECODER NOT AVAILABLE

TELETEXT HOR. POSITION MODE — HP

Adjust with Keys TUN+, TUN-

SE

TELETEXT CONTRAST MODE — CO

Adjust with Keys TUN+, TUN-

SE

SE

TUN+

TUN-

1.8 — OPTION BYTE 1

Toggle Options with Keys 1..8

TUN+    TUN-

SE

2.8 — OPTION BYTE 2

Toggle Options with Keys 1..8

TUN+    TUN-

SE

3.8 — OPTION BYTE 3

Toggle Options with Keys 1..8

TUN+    TUN-

SE

4.8 — OPTION BYTE 4

Toggle Options with Keys 1..8

TUN+    TUN-

## 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:

```
1

      ____
  6|       |2
   |   8   |
      ____
  5|       |3
   |       |
      ____    x
    4       7
```
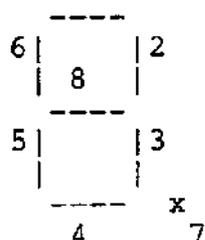
### MODIFICATION OF OPTIONS

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 diplay 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 diplay 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 sup-
ports. 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 'De-
cade --'.


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 gabs.

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:          --          Option not selected:
         |   |  |              No intelligent keys 'P+', 'P-'
                --
         |   |  |
          x        x


Display:          --          Option is selected:
         |   |  |              Intelligent keys 'P+', 'P-'
                --
         |   |  |
          x   --   x


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:          --         Option not selected:
          |   |  |           Philips-teletext not available
                 --
          |   |  |
          x   --
```

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

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

           |   |   |
           x  --  x


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


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
     simultaniously, 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:        --              Option not selected:
           |  |  |              'VOLUME' included in
           --     --            NORMALISATION
           |     |  |
           -- x  -- x
```

```
Display:        --    --        Option is selected:
           |  |  |              'VOLUME' not included in
           --     --            NORMALISATION
           |     |  |
           -- x  -- x
```

### 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:        --    --        Option not selected:
              |    |            analog-values are
           --     --            the normalisation-values
           |     |  |
           -- x  -- x
```

```
Display:        --    --        Option is selected:
           |  |  |              analog-values are the old
           --     --            values upon switch-off
           |     |  |
           -- x  -- x
```

## 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 activ 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:
```
        --
      |   |  |              Option not set:
        --                  Tuning remains in same band
      |   |  |
        -- x   -- x
```

Display:
```
        --     --
      |   |  |              Option is set:
        --                  Tuning continues in next band
      |   |  |
        -- x   -- x
```

### 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 apears as a 2-band
system VHF and UHF.

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

Display:
```
        --
      |                     Option not set:
        --                  No combined VHF-band
        |   |  |
        -- x   -- x
```

Display:
```
        --
      |   |                 Option is set:
        --                  Combined VHF-band
        |   |  |
        -- x   -- x
```

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 se-
lected: 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 unter any
station-no. isn't possible.

Display:

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

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

Display:

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

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

## 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:

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

Option not selected:
System with VHF-bands

Display:

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

Option is selected:
System without VHF-bands

## 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 activ 1 sec after tuning-key is released.

```
Display:        --     --        Option not selected:
             |      |           AFC remains off
               --
             |  |  |
               -- x  -- x
```

```
Display:        --     --        Option is selected:
             |   |  |            AFC returns after 1 sec
               --
             |  |  |
               -- x  -- x
```

## 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:        --     --        Option not selected:
             |   |  |            System without hyper-band
               --
             |  |  |
               -- x  --
```

```
Display:        --     --        Option is selected:
             |   |  |            System with hyper-band
               --
             |  |  |
               -- x  -- x
```

## 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:    | |
            --
               | |
            x

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

Display:       --
            | |
            --
               | |
            x

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

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

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

Display:       --
            | |
            --
               |
            x

Option not selected:
Support of SAA5041
for Teletext-commands

Display:       --
            | |
            --
               | |
            x

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

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

| Command | Teletext-decoder | | |
| | 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 an 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 intented 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 temparature 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 re-mote- control decoder. By means of this, it is possible to switch on the TV set by remote-control. Standby-mode is indi-cated 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 manu-factorer.


## 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 bc 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 Absloute Maximum Ratings

| | Symbol | Value | Unit |
|---|---|---|---|
| Supply Voltages | V1,V3 | 6 | V |
| | | | |
| **Output Voltages** | | | |
| Open-Drain Outp. Pins 10, 11 | Vo | -0.3 to +13.5 | V |
| Open-Drain Outp. Pins 28..35 | Vo | -0.3 to +13.5 | V |
| Open-Drain Outp. Pins 14..19 | Vo | -0.3 V to V40 | V |
| Open-Drain Outp. Pins 21, 22 | Vo | -0.3 V to V40 | – |
| TTL Output Pins 3, 5, 7..9 | Vo | -0.3 V to V40 | – |
| TTL Output Pins 13, 23..26 | Vo | -0.3 V to V40 | – |
| | | | |
| **Output Currents** | | | |
| Pins 10, 11, 33 , 34 | Io | 8 | mA |
| Pins 14..19, 21, 22 | Io | 25 | mA |
| Pins 28..32, 35 | Io | 5 | mA |
| Pins 3, 5, 7..9, 13, 23..26 | Io | 5 | mA |
| | -Io | 2 | mA |
| | | | |
| **Input Voltages** | | | |
| all Inp. except Pins 28..11 | ViH | V40 | – |
| | ViL | -0.3 | V |
| Pins 28..35 | ViH | 13.5 | V |
| | ViL | -0.3 | V |
| | | | |
| Ambient Operating Tempera- ture Range | Ta | 0 to +65 | oC |
| Storage Temperature Range | Ts | -40 to +125 | oC |

**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 |
| **Input Voltages** |  |  |  |  |  |
| 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. | fs | 3.5 | – | 4.6 | MHz |
| of Crystal at CL=20pF |  |  |  |  |  |
| Effect. Series Resist. | Rr | – | – | 60 | Ohm |
| of Crystal at CL=20pF |  |  |  |  |  |
| **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 | CL | – | – | 150 | pF |
| Pin 3 and 13 |  |  |  |  |  |

Table 8: Operating Conditions

## 16.3  Characteristics

|  | Symbol | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| **Current Cosumption** | | | | | |
| Pins 2 and 40 | I2+40 | – | 75 | 115 | mA |
| Pin 27 | I27 | – | 10 | 20 | mA |
| | | | | | |
| **Output Voltages** | | | | | |
| Pins 3, 13, 23..26 | | | | | |
| at −IoH=100μA | VoH | 2.7 | – | – | V |
| at IoL=1.6mA | VoL | – | – | 0.4 | V |
| Pin 5 | | | | | |
| at −IoH=100μA | VoH | V27−.4 | – | – | V |
| at IoL=1.0mA | VoL | – | – | 1.0 | V |
| Pins 7..9 | | | | | |
| at −IoH=200μA | VoH | 2.7 | – | – | V |
| at IoL=200μA | VoL | – | – | 0.4 | V |
| Pins 10, 11, 28..35 | | | | | |
| at IoL=4mA | VoL | – | – | 0.4 | V |
| Pins 14..19, 21, 22 | | | | | |
| at IoL=20mA | VoH | – | – | 0.5 | V |
| | | | | | |
| **Output Leakage Currents** | | | | | |
| Pins 10, 11, 28..35 | Ir | – | – | 20 | μA |
| at Vo=12V | | | | | |
| Pins 14..19, 21, 22 | Ir | – | – | 20 | μA |
| at Vo=5V | | | | | |
| | | | | | |
| Short-Circuit Out.curr. | −Ik | – | – | 2.8 | mA |
| Pins 36..38 at Vo=0 | | | | | |
| Input Capacitance | Ci | – | – | 5 | pF |
| Pins 12 and 13 | | | | | |
| | | | | | |
| Code of the Infrared | – | see Datasheet SAA 1250, | | | |
| Remote sign. at Pin12 | | 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 commds | 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 | IR-COMMAND [1..64] | | KEYBOARD | MATRIX-P. |
|---|---|---|---|---|
| | Vers. A | Vers. B | Vers. A | Vers. B |
| Option-Byte 4.1-> | = 1 | = 0 | = 1 | = 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 SAA 5040 | SAA 5041 | TPU2732- teletext | |
|---|---|---|---|---|
| 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 Dec. | Hex. | Description |
|---|---|---|
| 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)<br>    Bit 0..1:  00 = Band I     (VHF 1)<br>              01 = Band III   (VHF 3)<br>              10 = Band IV/V  (UHF)<br>              11 = Band Hyper (if availabel,<br>                              else UHF)<br>    Bit 2:     Multi-Standard<br>    Bit 3:     1 = Station memorized  (Opt. 1.4)<br>              1 = Station w. AV-mode (Opt. 1.8)<br>    Bit 4..7: Lower  4 bit of tuning-voltage |
| 133 | 85H | Station Parameters for P0 - (2. Byte)<br>    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 DIL | Pin PLCC | Function | Input | Output | Active |
|------|-----|------|----------|-------|--------|--------|
| 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**
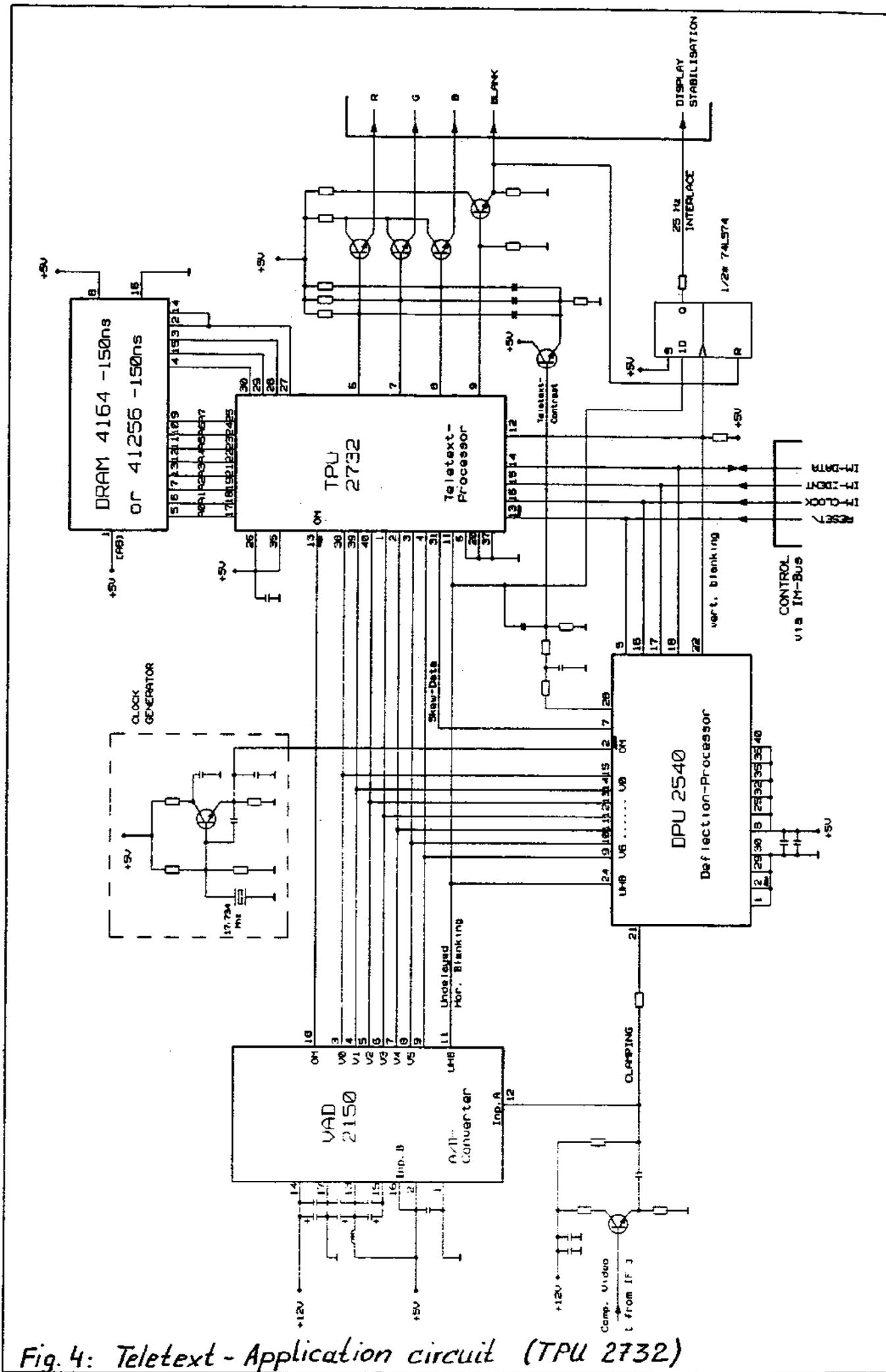
Fig. 4: Teletext - Application circuit (TPU 2732)

## 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 developement 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 eccepts 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 commds | 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<br>2 | \_ Reception of row<br>/ 26 (ECS-flag in<br>TPU 2735) | 00 = Program recognize TXT with extended character set by itself.<br>01 = Force ECS-flag (TPU2735) to 1. Extended characters are assumed by 16 sectors.<br>10 = Force ECS-flag (TPU2735) to 0. Extended characters are disabled by 28 sectors.<br>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<br>Option-Byte 4.1-> | IR-command [1..64]<br>Vers. A<br>= 1 | Vers. B<br>= 0 | Keyboard matrix-p.<br>Vers. A<br>= 1 | Vers. B<br>= 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    +<br>(Stop scanning) | 5 | 14 | 32 | 12 |
| 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 Dec. | Hex. | Description |
|---|---|---|
| 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)<br>    Bit 0..1: 00 = Band I      (VHF 1)<br>              01 = Band III    (VHF 3)<br>              10 = Band IV/V  (UHF)<br>              11 = Band Hyper (if availabel,<br>                              else UHF)<br>    Bit 2:     Multi-Standard<br>    Bit 3:     1 = Station memorized   (Opt. 1.4)<br>               1 = Station w. AV-mode (Opt. 1.8)<br>    Bit 4..7: Lower  4 bit of tuning-voltage |
| 133 | 85H | Station Parameters for P0 - (2. Byte)<br>    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 DIL | PLCC | Function | Input | Output | Active |
|------|---------|------|----------|-------|--------|--------|
| 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 simultaneosly 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 Vl 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 Vh 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
$$Vl < Vafc < Vh \ ,$$
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 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 (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<br>2 | \_ Reception of row<br>/ 26 (ECS-flag in<br>TPU 2735) | 00 = Program recognize TXT with<br>    extended character set by<br>    itself<br>01 = Force ECS flag to 1;<br>    16 sectors are available;<br>    extended character set is<br>    assumed<br>10 = Force ECS flag to 0;<br>    28 sectors are available;<br>    extended character set is<br>    disabled<br>11 = not allowed | |
| 3* | IR 60/ polish TXT<br>(only TVPO 2066-A23E) | IR 60is activ/<br>polish TXT is<br>assumed | IR 60not activ/<br>polish only if<br>Country Ident-<br>Bits transmited |
| 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<br><br>Option-Byte 4.1-> | IR-COMMAND [1..64]<br>Vers. A<br>= 1 | Vers. B<br>= 0 | KEYBOARD MATRIX-P.<br>Vers. A<br>= 1 | Vers. B<br>= 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<br>default values | 62 | 62 | – | – |
| OFF Standby | 2 | 2 | – | – |

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

continued...

| Function<br><br>Option-Byte 4.1-> | IR-command [1..64] | | | |
| | Vers. A<br>= 1 | Vers. B<br>= 0 | | |
|---|---|---|---|---|
| Program MDA with<br>  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<br>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)<br>　　Bit 0..1: 00 = Band I     (VHF 1)<br>　　　　　　 01 = Band III   (VHF 3)<br>　　　　　　 10 = Band IV/V  (UHF)<br>　　　　　　 11 = Band Hyper (if availabel,<br>　　　　　　　　　　　　　　　　else UHF)<br>　　Bit 2:    Multi-Standard<br>　　Bit 3:    1 = Station memorized  (Opt. 1.4)<br>　　　　　　 1 = Station w. AV-mode (Opt. 1.8)<br>　　Bit 4..7: Lower  4 bit of tuning-voltage |
| 54 | 36H | Station Parameters for P0 - (2. Byte)<br>　　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 DIL | Pin PLCC | Function | Input | Output | Active |
|------|------|------|----------|-------|--------|--------|
| 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



Fig. 6: Digital Audio Appl. circuit
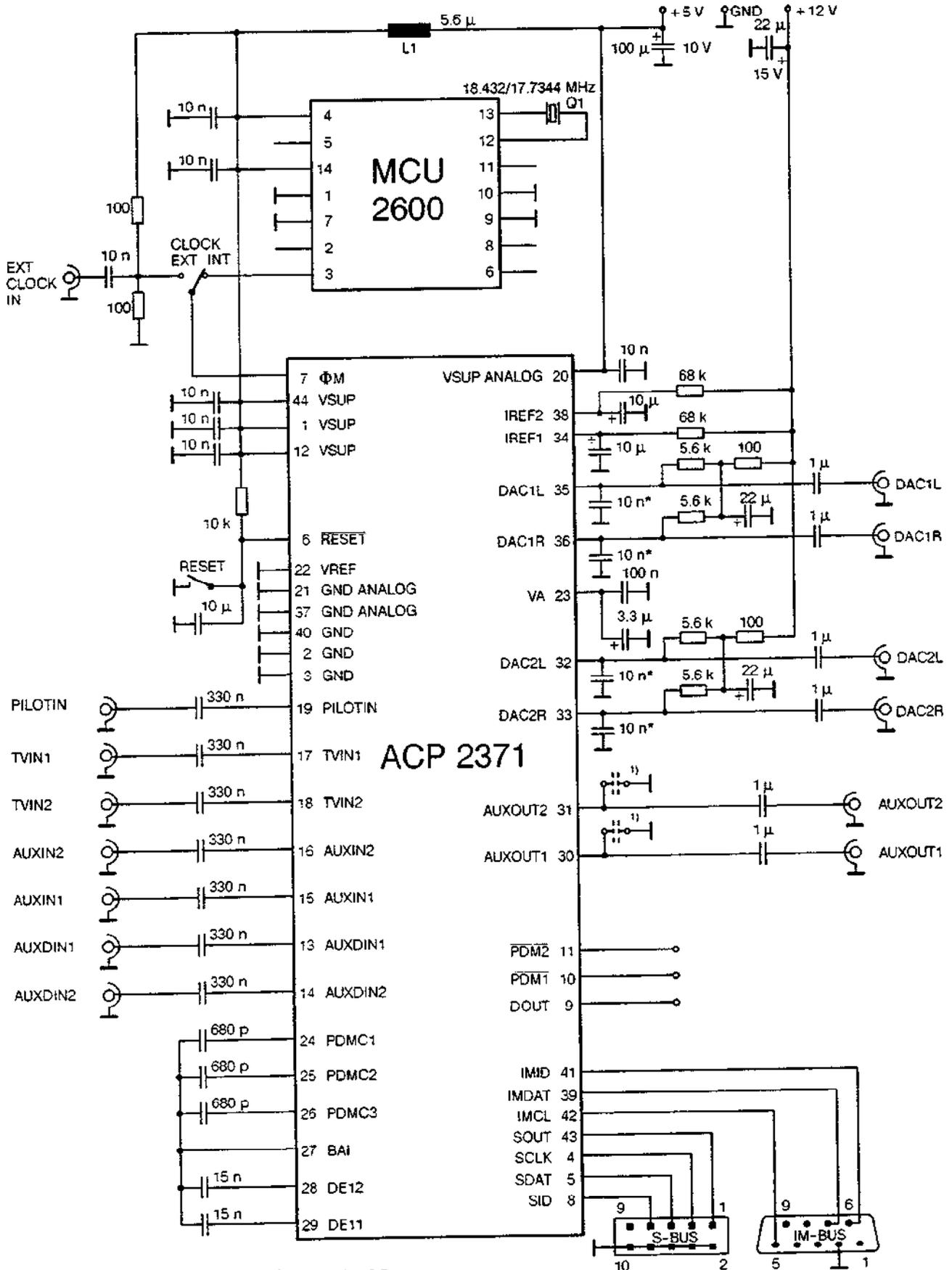
* Capacitors = 5%; all resistors = 1%; 1) see section 2.5.

Fig.8. Example circuit for Auto-Searching

V afc

C1
0.47u

R1
100k

Q1
BC549B

+12V

R2
100k

D1
1N4148

R3
10k

Q2
BC549B

Comparator
Output 1

R4
10k

+5V

Comp.
Outp.2

R5
100k

R6
10k

Q3
BC549B

R7
10k

R8
1k

R9
10k

Q4
BC549B

Comparator Outp.
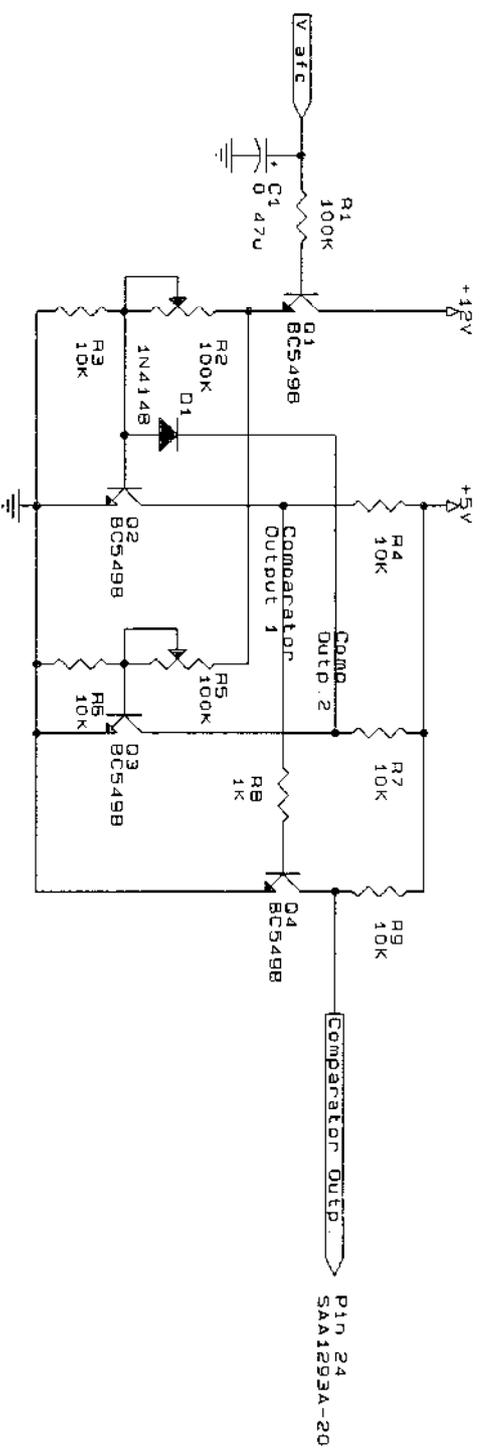
Pin 24
SAA1293A-20

| Comparator | Outp.1 | Outp.2 | Pin 24 |
|---|---|---|---|
| Vafc < Vl | 1 | 1 | 0 |
| Vh < Vafc < Vl | 0 | 1 | 1 |
| Vafc > Vh | 0 | 0 | 0 |

SAA 1293A-20

Title
Full-Auto-Search circuit

Size  Document Number
A                              1

Date:  June 12, 1991  Sheet  1 of 1

REV
1

VCC = 5V

5K1

5K1

VCC

JP1

(CUT!)

DPU2553

19

6

38

22

TPU2735

12

VIDEO OUT

(To Standalone
Teletext
Board)

14
15
4

X
Y
Z

X0
X1
Y0
Y1
Z0
Z1
INH
A
B
C

12
13
2
1
5
3
6
11
10
9

4053

1K

1K

BC5468

BC5468

10K

10K

VCC

VCC

10K

VIDEO IN

100

10K

1K

JP2

BC546B

1K

9K1

MUTE

14

SANDCASTLE

VERTICAL DRIVE

30

4

TDA4504B
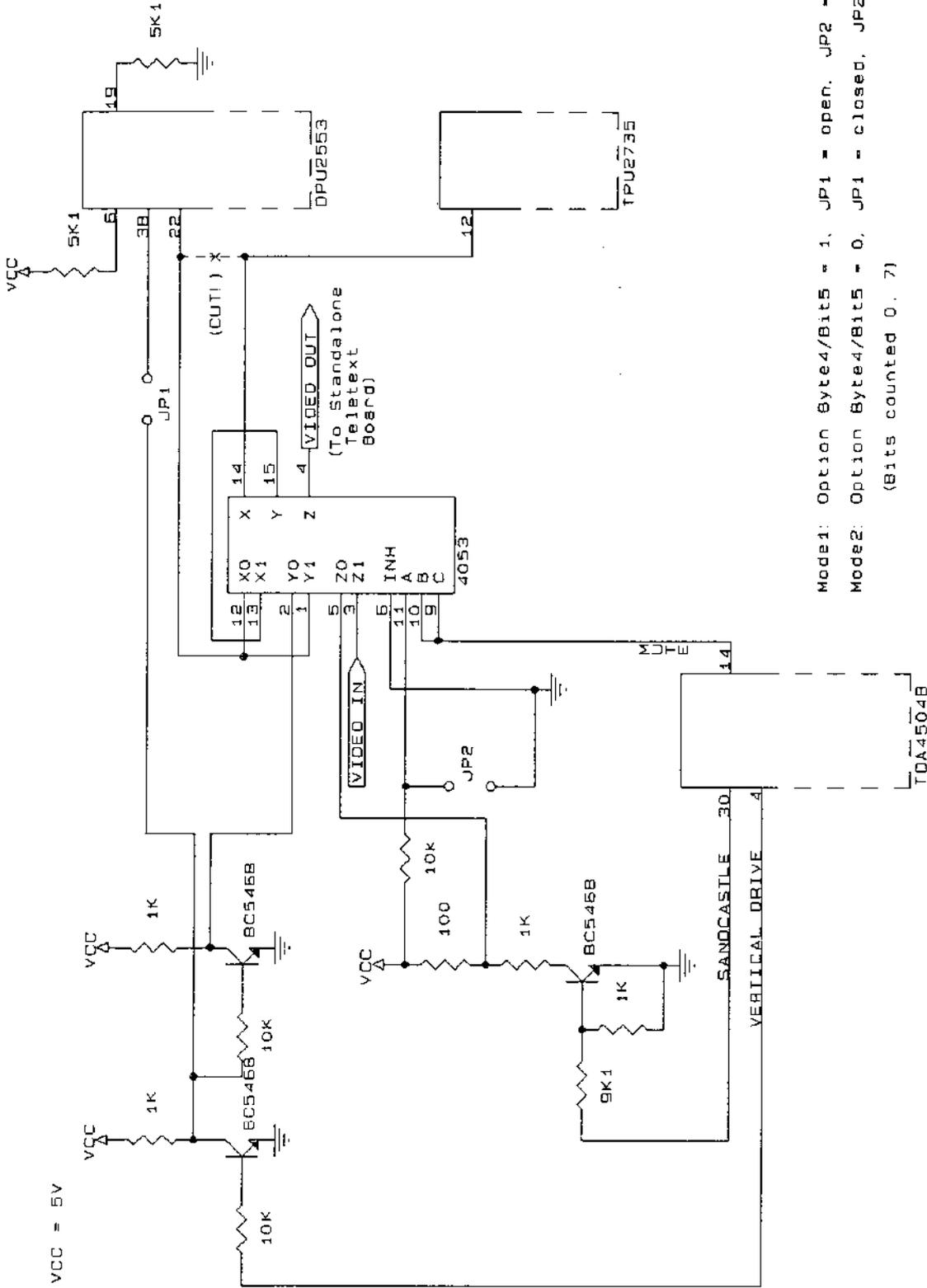
Mode1: Option Byte4/Bit5 = 1, JP1 = open, JP2 = open

Mode2: Option Byte4/Bit5 = 0, JP1 = closed, JP2 = closed

(Bits counted 0..7)

Title

Interface for Synchronisation

SAA 1293A-20

Size | Document Number | REV
A | 1 | 1

Date: April 29, 1991 | Sheet 1 of 1

| | SAA1293A-20 | SAA1293A-10 | SAA1293A-06 | SAA1293A-03 | SAA1293A-03 | SAA1293A-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 FLOF and extended char. Spanish, Turkish, Polish, Hungarian chars. Chipset: TPU2735, DPU 2553, VAD2150, DRAM41256 | Teletext ITT Chipset: TPU2732/35, DPU2540, VAD2150, DRAM 4164 | Teletext ITT Chipset: TPU2732/35, DPU2540, VAD2150, DRAM 4164 | - | - |
| | | No MI-Bus Teletext | Supports MI-Bus Teletext SAA5041, SAA5040/43 | Supports MI-Bus Teletext SAA5041 (add. commds.) 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. commds.) 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 selectable. | - | - |
| 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. | - |