**ROHDE & SCHWARZ**

Instruments
Division

Operating Manual

# TV GENERATOR PAL

# SGPF

**2016.4049.02**
**2016.4003.XX**

*DESCRIPTION OF OPTIONS FOLLOWS FIRST COLOURED DIVIDER*

# Certified Quality System

# ISO 9001

## DQS REG. NO 1954-04

## Qualitätszertifikat

Sehr geehrter Kunde,

Sie haben sich für den Kauf eines Rohde & Schwarz-Produktes entschieden. Hiermit erhalten Sie ein nach modernsten Fertigungsmethoden hergestelltes Produkt. Es wurde nach den Regeln unseres Qualitätsmanagementsystems entwickelt, gefertigt und geprüft. Das Rohde & Schwarz-Qualitätsmanagementsystem ist nach ISO 9001 zertifiziert.

## Certificate of quality

Dear Customer,

You have decided to buy a Rohde & Schwarz product. You are thus assured of receiving a product that is manufactured using the most modern methods available. This product was developed, manufactured and tested in compliance with our quality management system standards.

The Rohde & Schwarz quality management system is certified according to ISO 9001.

## Certificat de qualité

Cher client,

Vous avez choisi d'acheter un produit Rohde & Schwarz. Vous disposez donc d'un produit fabriqué d'après les méthodes les plus avancées. Le développement, la fabrication et les tests respectent nos normes de gestion qualité.

Le système de gestion qualité de Rohde & Schwarz a été homologué conformément à la norme ISO 9001.

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# ROHDE&SCHWARZ

# EC Certificate of Conformity
(to EMC Directive 89/336/EEC)

# CE

This is to certify that

| TV Generator PAL |
| --- |
| SGPF |
| 2016.4049.02 |

(equipment, type, designation)

complies with the provisions of the Directive of the Council of the European Communities on the approximation of the laws of the Member States relating to electromagnetic compatibility (EMC Directive 89/336/EEC).

This declaration of conformity of the European Communities is the result of an examination carried out by the Quality Assurance Department of **ROHDE & SCHWARZ** in accordance with European Standards EN 50081-1 and EN 50082-1, as laid down in Article 10 of the Directive.

**ROHDE & SCHWARZ**
GmbH & Co. KG

# SGPF   Contents

# SGPF Contents

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## Supplement to SKDF, SGPF, SAF and SFF Manual

### Pulse shapes of 2T pulses

All 2T pulses produced by the Video Generators SKDF, SGPF, SAF and SFF feature minimal preshoots and postshoots so that the pulse base is increased to 420 ns (nominal 400 ns) at the nominal half-amplitude duration of 200 ns.

The 2T pulse is therefore wider at the base and narrower at the top.

The 2T K-factor is determined by the base width and is approximately 0.5 %.

This pulse shape is of advantage for performing evaluations on an oscilloscope. Since there are no pre- and postshoots, any distortion displayed on the oscilloscope has been caused by the device under test. Reading off the result is thus simplified since no differential evaluations have to be made.

If the 2T pulse is $\cos^2$-shaped, it has significant spectral components up to and above 8 MHz. Since according to CCIR Rep. 624 the bandwidth of the system to B/G standard is 5 MHz, or pursuant to CCIR Rec. 601 a sampling rate of 13.5 MHz is used - yielding a maximum bandwidth up to 6 MHz - symmetrical pre- and postshoots of up to 1.3 % will result according to the standard.

If nevertheless the $\cos^2$-shape is required, it can be generated at any time by SAF and SFF with the aid of the SIGNAL EDIT menu:

After calling up SIGNAL EDIT, select the signal element MOD. PULSE.

This element can be modified

|       | LOCATION | 22.000 μs | (desired location in n x 37.037-ns raster) |
|-------|----------|-----------|--------------------------------------------|
|       | WIDTH    | 200 ns    |                                            |
|       | LEVEL Y  | 700 mV    | (desired amplitude)                        |
|       | LEVEL CB | 0.0 mV    |                                            |
|       | LEVEL CR | 0.0 mV    |                                            |
| (or   | LEVEL SC | 0.0 mV)   |                                            |

and contains the $\cos^2$-pulse at the 6 MHz bandwidth of the SAF or SFF.

Care should be taken that the pulse peak falls within the 37.037-ns raster. If this condition is not adhered to, the pre- and postshoots will be asymmetrical, since the 13.5-MHz samples produced by the generator are then not symmetrical about the pulse center.

It is recommended to adjust for symmetrical pre- and postshoots with the aid of an oscilloscope.

# 1    Characteristics

## 1.1    Description

The SGPF is divided into the following functional groups (see Fig. 1-2):

▶ clock generator
▶ video signal generator with
   signal memory
   modulator
   colour subcarrier coupler
▶ D/A converter with lowpass filter
▶ external input
▶ processor control with front panel and IEC-625/ IEEE-488 bus
▶ genlock with test signal insertion (option)

### 1.1.1    Clock Generator

A 15-MHz temperature-stabilized crystal oscillator is used to produce the control signals and the sampling clock for the signals.

### 1.1.2    Digital Video Signal Generator

Video signal generation is purely digital. The three components Y (luminance), R-Y and B-Y (chrominance) with a resolution of 10 bits are read out from a ROM. These three components are applied to the gate array TVMUL where the two chrominance components are modulated with the colour subcarrier, ie the B-Y component with the colour subcarrier sine, the R-Y component with the colour subcarrier cosine. The phase of the cosine signal is reversed from line to line, as prescribed by the PAL standard.

Modulation is performed by digital multiplication. The modulated components are added and then combined with the luminance. Thus the CCV signal digitally coded with a resolution of 12 bits is available at the output of the TVMUL gate array. The sine and cosine values for the multiplication are supplied by RAMs to the TVMUL gate array. The RAMs are addressed by a second gate array TVDIV. This gate array calculates the colour subcarrier phase for each sample. The result is supplied to the TVMUL array with a resolution of 10 bits. A reset pulse with a period of 8 fields ensures that TVDIV generates the colour subcarrier with the correct colour- subcarrier / syncpulse phase (SC/H) of 0°.

Sync and burst being stored separately from the video signal and from the test pattern circle, only about 500 Kbytes of memory capacity are required per component. Pattern configuration is determined by a ROM. The data from this memory determine the signal to be read out in any particular line. The different video signals can be set on the generator from the processor.
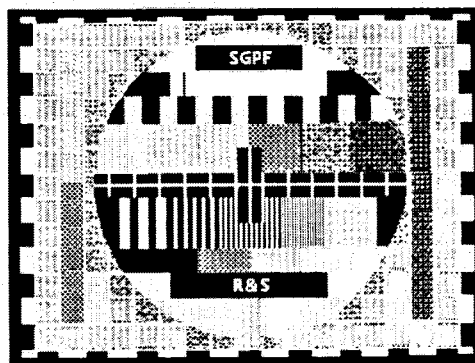


Fig. 1-1    Universal test pattern

## 1.1.3   Test Line Coding

In the test line region, the memory which holds the pattern configuration switches over to an EEPROM where test line coding is stored. The EEPROM also contains information as to which lines are inserted into the generator signal from a signal applied to the EXT VITS input or into a program signal from the generator signal (the latter being possible only with the genlock option fitted).

The coding is programmed with the aid of DIL switches inside the instrument (3.2.8). The eight coding blocks can be selected by the processor.

## 1.1.4   D/A Converter with Lowpass Filter

The 12-bit coded samples from the digital video generator are applied to a D/A converter at the rate of 15 MHz.

The amplitude of the output signal is adjusted by varying the reference voltage of the D/A converter.

The output signal of the D/A converter passes through a sin x/x equalizer, a steep-edged Cauer lowpass filter and an allpass chain for group delay correction. The signals for the front-panel and the rear-panel outputs are routed via separate output stages so that excellent output isolation is obtained.
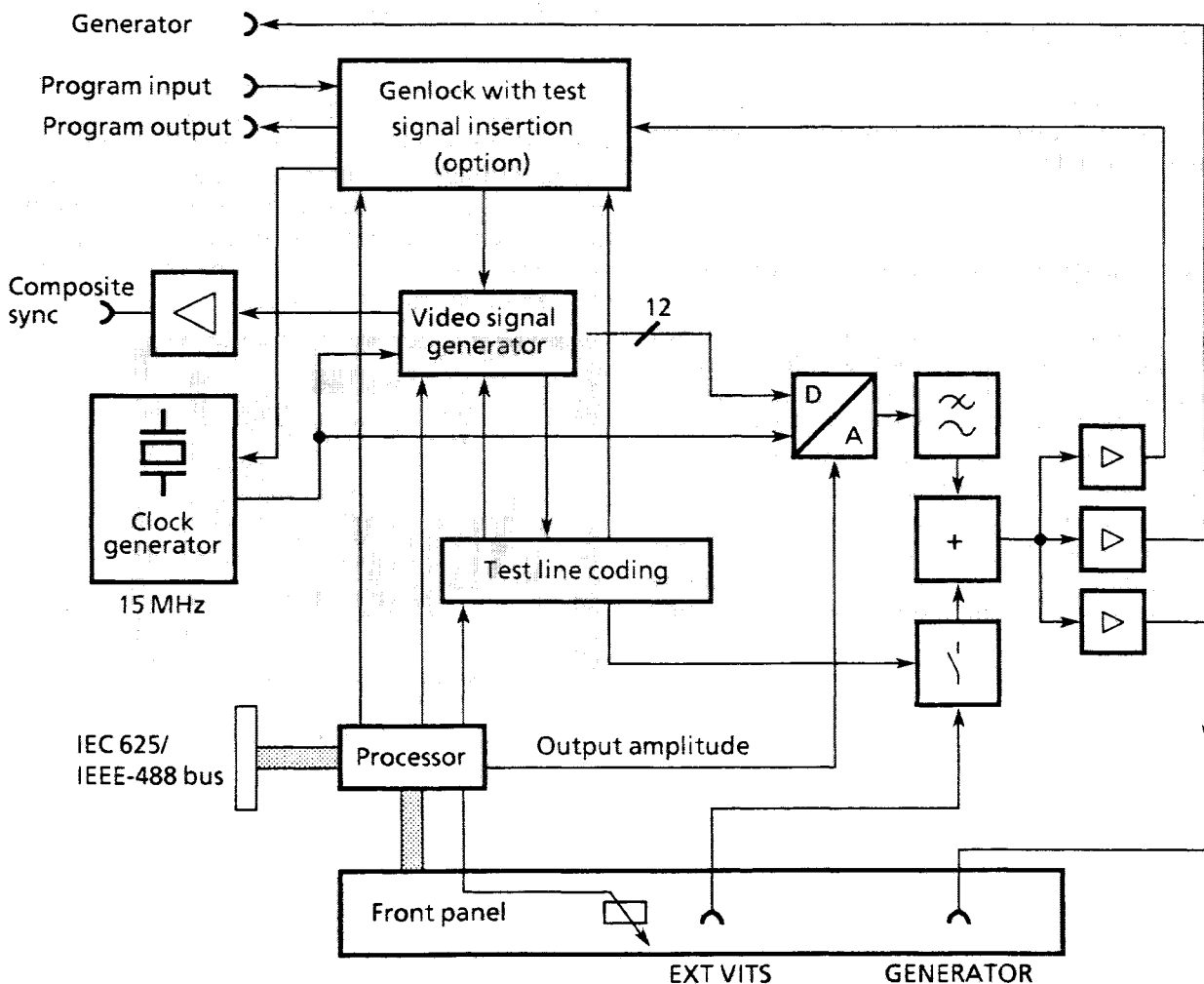


**Fig. 1-2   Block diagram**

## 1.1.5    External Input EXT VITS

The signal applied to the EXT VITS input is clamped to the level of the back porch. A FET switch is used to insert the desired line of the external signal into the generator signal in accordance with the test line coding.

This input furthermore allows to superimpose eg sweep signals on the 50% grey pedestal (or on all other video signals) in the active picture area. Insertion into the test line area is disabled in this case.

## 1.1.6    Processor

Operation of the SGPF is controlled by a processor system. Thanks to battery backup of the RAM, the SGPF stores the last setting so that the last setup is restored after power failure, for instance.

The processor also executes the commands of the IEC-625/IEEE-488-bus interface implementing the IEEE-488.2 standard version.

The processor furthermore handles switchover of the output amplitude from the calibrated mode CAL to the value determined by the front-panel potentiometer in the VAR mode. To adjust the output amplitude via the IEC-625/IEEE-488 bus, the processor has a D/A converter permitting amplitude variation in 4-mV steps.

## 1.1.7    Genlock with Test Signal Insertion (Option)

As the manual for genlock with test signal insertion is supplied with this option, no detailed description is given here.
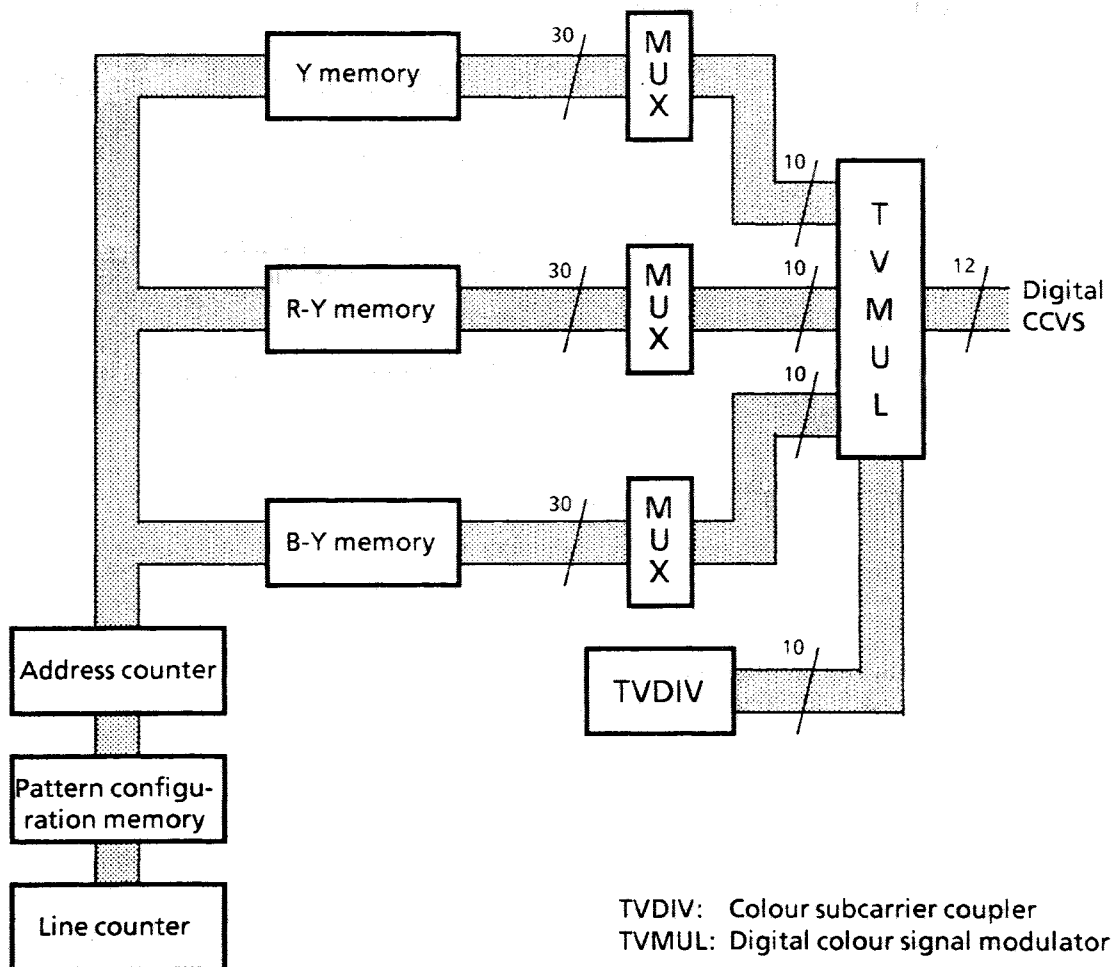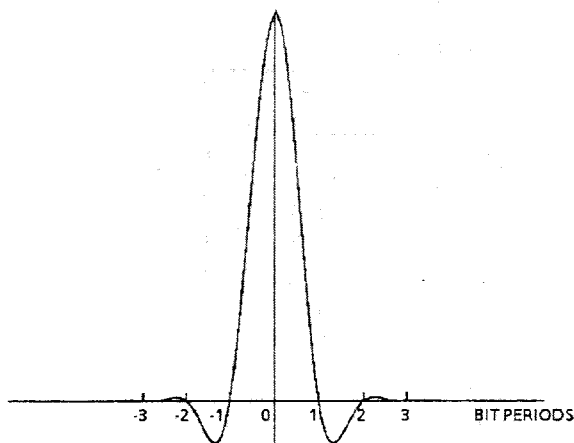
Fig. 1-3    Block diagram

TVDIV:    Colour subcarrier coupler
TVMUL:    Digital colour signal modulator

## 1.1.8    Teletext (Option)

### 1.1.8.1   Teletext Features

With the Teletext Option fitted, the SGPF generates a teletext signal in the field-blanking interval in accordance with the Broadcast Teletext Specification of BBC. Many countries using the PAL standard have introduced this type of teletext.
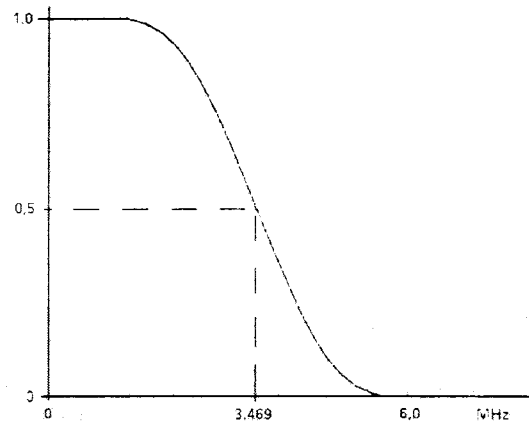
**Data-line waveform**

Each teletext line consists of 45 bytes ( = 360 bits) which are transmitted at the rate of 6.9375 Mbit/s (444 x 15625). The first two bytes comprise the clock run-in sequence. The timing is such that the last but one bit of the run-in occurs 12 µs after the H sync leading edge. The individual bits are transmitted in the NRZ (non-return-to-zero) code, the level of a 1 being 426 mV and that of a 0 corresponding to 0 mV. The basic waveform of a '1' bit of the SGPF teletext has the following shape:



Spectrum of a bit from teletext signal

### 1.1.8.2   Contents of Teletext Signal

| Page | Contents |
| --- | --- |
| 100 | Index |
| 101 | Character set |
| 150 | Subtitles |
| 199 | Clock cracker |

The teletext signal is repeated after four frames.



Basic waveform of a '1' bit of SGPF teletext

For detailed information on the coding of the teletext contents see the Broadcast Teletext Specification of the BBC.

### 1.1.8.3   Generation of Teletext Lines

The SGPF generates the teletext in the same way as the test lines, i.e. the teletext signal is stored in memory line by line like a normal video signal. With 64 teletext lines, 64 different video signal lines are stored in the EPROMs.

The SGPF offers the possibility of storing a four-frame sequence in the test lines. This function is used for the teletext mode. 8 teletext lines are produced in each of the 8 consecutive field-blanking intervals. Section 1.1.8.4 lists these lines. Internally these lines are addressed in the 4 frames by the test line number 60 to 63.

*Note:*

When the Teletext Option is fitted in the SGPF, the jumper X373 must be in the position 1-2 (four-frame sequence).

The lines which are reserved for teletext in the test line region must not be used for test signal insertion since otherwise lines will be missing in the teletext signal. This would entail missing lines in the teletext pages. Moreover, the teletext may only be programmed in the lines reserved for teletext.

If the teletext has been overwritten inadvertently in the test line coding memory, reprogram the lines as follows:

| Frame | Line | Test line signal |
|-------|------|------------------|
| 0 | n | 60 |
| 1 | n | 61 |
| 2 | n | 62 |
| 3 | n | 63 |

n being the line in which the teletext has been erased by mistake.

(See Section 3.2.8 for test line coding).

### 1.1.8.4   Lines Reserved for Teletext

**German version**

Software version 11 (control bits C12 to 14 = 001)

Lines   9,    11,   12,   13,   14,   15,   20,   21

322, 324, 325, 326, 327, 328, 333, 334

**Italian version**

Software version 12 (control bits C12 to 14 = 011)

Lines   6,    7,    8,    9,    10,   11,   12,   13

319, 320, 321, 322, 323, 324, 325, 326

The following SGPF model includes the Teletext Option:
2016.4003.54

The following SGPF model includes the Test Signal Insertion and Teletext Options:
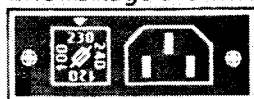2016.4003.55

# 2   Preparation for Use

## 2.1   Putting into Operation

### 2.1.1   Environmental Conditions

The instrument operates at ambient temperatures between + 5 °C and + 45°C.

### 2.1.2   Setting to AC Supply

The instrument is factory-set to 230 V and can thus be operated in an AC supply voltage range from 198 to 253 V. Set the voltage selector to the line voltage available.



For the AC supply voltage range 108 to 138 V, for example, the voltage selector must be set to 120 V and the power fuse on the rear panel be exchanged. To do so, remove the cap from the voltage selector, replace the fuse by one specified on the rear panel and set the selector so that the arrow is pointing to the required voltage.

### 2.1.3   Operation with External Ground

A removable safety earth link is fitted at the rear of the SGPF. This link enables safety earth and chassis to be separated and may only be taken off after the power cable has been unplugged.

> To isolate the chassis from safety earth, unscrew the nuts and remove the metal link.

The chassis and bolt X2 must now be taken to external ground. Otherwise, VDE regulations would be violated and the user would run the risk of contacting line voltage.

Caution:   With the link removed, the chassis is not connected to the earthing wire of the power cable.

In the case of large test systems, the chassis may be taken to the system ground. The safety earth link must be refitted without fail if this system ground connection is removed.

## 2.1.4   Compliance with Radio Protection Mark

To comply with the specifications of the radio protection mark, shielded lines must be used for connecting the parallel data interface. The shielding has to be taken to safety earth or to chassis. For detailed pin assignment see drawing in section 3.3.

## 2.1.5   Switching On SGPF



To connect the SGPF to the AC supply, use the power cable supplied with the instrument and connector X1 on the rear panel. The SGPF is ready for operation immediately after switch-on. The guaranteed performance data are reached after approx. 10 minutes. The switched-on status is indicated by a green front panel LED (see Fig. 3-1). The primary fuse is provided on the rear panel. Current limiters have been substituted for secondary fuses.

### 2.1.5.1   Buffer Memory

The SGPF has a RAM backed up by a lithium battery for storing the current setting. If this battery is fully discharged, the instrument is set to the default state:

▶ video signal 1
▶ VITS block 1
▶ output level CAL
▶ line-repetitive mode OFF
▶ EXT OFF
▶ SC/H phase 0°
▶ Bypass OFF [1]
▶ bounce time 2 s (duration of bounce signal)
▶ initial setting of IEC-625/IEEE-488 bus parameters (see 3.3.10)

If this setting is also desired in the battery backup mode, the CAL/VAR key must be kept pressed while the instrument is being switched on. For instructions on replacing the lithium battery see section 4.1.4.

---

[1]   Only of interest with genlock and bypass options fitted

## 2.1.5.2   LED Test

After the SGPF has been switched on, all LEDs with the exception of the red fuse-blown indicator are switched on for approx. 0.5 s.

## 2.1.6   Operation using Junction Panel with Bypass Circuit

(Order No. 2016.1679.02)
The voltage for driving the relay in the bypass option is available from socket X7 on the SGPF. Under normal operating conditions this connector provides the sync signal. The DC voltage required for driving the bypass relay is available when link X170 on the generator PCB is in position 2-3. In this case the bypass circuit can be switched on and off using remote-control commands BYPASS ON and BYPASS OFF (see description "Junction panel" following coloured divider).

Table 2-1   Test programs

| | |
|---|---|
| 0 | NOP |
| 1 | Read RAM D107<br>Address range: A000H to BFFFH |
| 2 | Read EPROM D108<br>Address range: 0000H to 7FFFH |
| 3 | Write pattern control register D115<br>Test pattern: 00H to FFH |
| 4 | Write analog switch control register D114<br>Test pattern: 00H to FFH |
| 5 | Write front panel register<br>Test pattern: 55H/AAH alternating<br>Upper and lower LEDs lighting alternately |
| 6 | Write front panel register<br>Test pattern: 33H/CCH alternating |
| 7 | Write front panel register<br>Test pattern: 00H/FFH alternating |
| 8 | Read front panel register<br>Polling of front panel keys |
| 9 | Test of analog switch: calibrated |
| 10 | Test of analog switch: variable |
| 11 | Test of D/A converter, full range<br>Test pattern: 00H to FFH |
| 12 | Test of D/A converter, normal operating range<br>Test pattern: 02H to E9H |
| 13 | Test of D/A converter        0 dB<br>Test pattern: 80H |
| 14 | Test of D/A converter        + 3 dB<br>Test pattern: E8H |

## 2.2   Codings

To ensure proper functioning of the instrument, the coding links on the processor and generator PCBs must be inserted as described below. Coding should be checked if problems occur. In most cases, only the indicated position is meaningful as in the other position the signal would be either interrupted for test purposes or taken to ground.

Processor board (2016.1785)

| X101 | X102 | Function |
|---|---|---|
| 1-2 | 1-2 | Normal operation |
| 2-3 | 2-3 | Test of processor |

*Processor test programs:*
The programs are selected using the address switch of the IEC/IEEE bus after links X101 and X102 have been set to position 2-3.

| | |
|---|---|
| 15 | Test of D/A converter        -6 dB<br>Test pattern: 03H |
| 16 | RAM test<br>The RAM is tested by writing and reading a specific pattern.<br>No error: no LED lights up<br>Faulty: all LEDs light up |
| 17 | Test of CMOS RAM backup<br>Checking battery backup of CMOS RAM<br>RAM is checked as to the presence of the RAM test pattern.<br>Test meaningful only if the instrument was switched off after the RAM test.<br>No error: no LED lights up<br>Faulty: all LEDs light up |
| 18 | Enable V interrupt<br>The V interrupt is counted and read out in binary form with the aid of LEDs on the front panel. |
| 19 | Disable V interrupt<br>The V interrupt is disabled. |
| 20 | Write and read IEC/IEEE data register<br>Test pattern: 00H to FFH |
| 21 | Write IEC/IEEE register<br>Test pattern: 55H/AAH alternating |
| 22 | Read IEC/IEEE register |
| 23 | Test of IEC/IEEE-bus IC by writing and reading the status byte<br>No error: no LED lights up<br>Faulty: all LEDs light up |
| 24 | Write to TVDIV registers (D601) |

## Generator board (2016.4755)

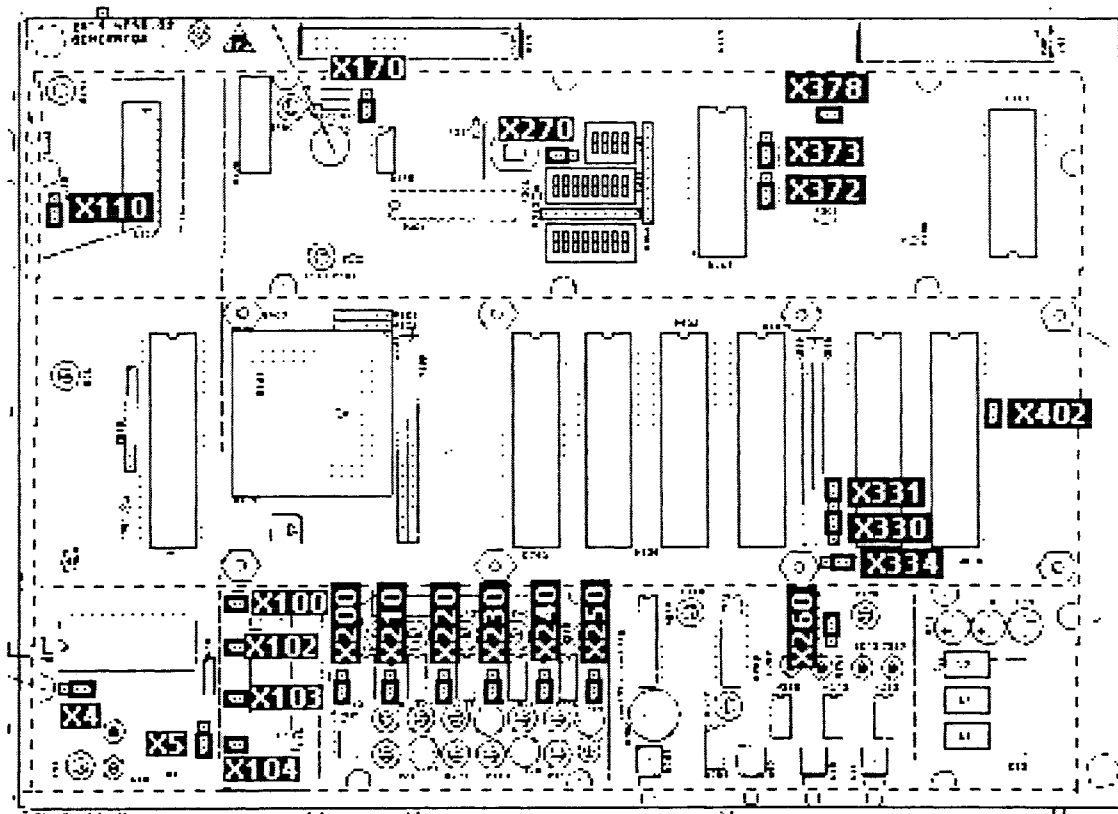| Link | Position | Link | Position |
|------|----------|------|----------|
| X110 | 1-2 | X230 | 1-2 |
| X4 | 1-2 | X240 | 1-2 |
| X5 | 1-2 | X250 | 1-2 |
| X15 | 1-2 | X260 | 1-2 |
| X100 | 1-2 | X270 | 1-2 |
| X101 | 1-2 | X330 | 1-2 |
| X102 | 1-2 | X331 | 2-3 |
| X103 | 1-2 | X334 | 1-2 |
| X104 | 1-2 | X372 | 1-2 |
| X200 | 1-2 | X373 | 1-2 |
| X210 | 1-2 | X378 | none |
| X220 | 1-2 | X402 | 1-2 |
| X170 | 1-2  with X7 =    sync output:<br><br>2-3  with X7 =    output for bypass relay switching voltage | | |



Fig. 2-1    Coding of generator 2016.4755

# 3   Operating Instructions

## 3.1   Operating Controls

### 3.1.1   Front Panel

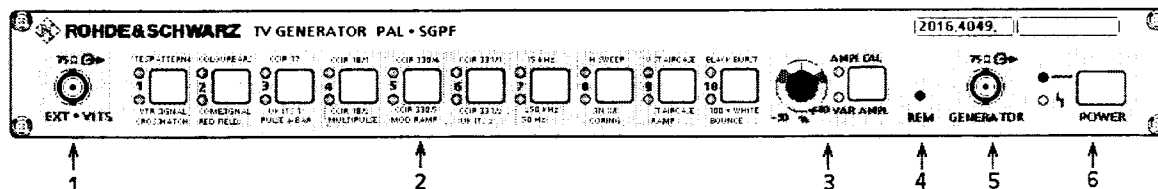All controls and indicators are arranged in groups according to their function:



**Fig. 3-1**   Front panel

| Ref. No. | Labelling | Function |
|---|---|---|
| 1 |  | EXT VITS input $Z_{in} = 75\ \Omega$ |
| 2 |  | Video signal selection Key assignment see table 3-1 |
| 3 |  | Output level setting SHIFT function Reset function |
| 4 |  | Remote-control indicator LED (yellow) lights up for remote control |
| 5 |  | Signal output 75 Ω |
| 6 |  | Power-on key with fuse-blown indicator (red) and power-on indicator (green) |

**Table 3-1** Key assignment for signal selection



**Direct signal selection:**

| Text top (a)<br>LED top (a) | Text centre (b)<br>LED bottom (b) | Text bottom (c)<br>both LEDs |
|---|---|---|
| 1a = TEST PATTERN | 1b = VTR SIGNAL | 1c = CROSSHATCH |
| 2a = COLOUR BARS | 2b = COMB SIGNAL | 2c = RED FIELD |
| 3a = CCIR 17 | 3b = UK ITS 1 | 3c = PULSE + BAR |
| 4a = CCIR 18/1 | 4b = CCIR 18/2 | 4c = MULTIPULSE |
| 5a = CCIR 330/4 | 5b = CCIR 330/5 | 5c = MOD RAMP |
| 6a = CCIR 331/1 | 6b = CCIR 331/2 | 6c = UK ITS 2 |
| 7a = 15 kHz | 7b = 250 kHz | 7c = 50 Hz |
| 8a = H SWEEP | 8b = SIN X/X | 8c = CORING |
| 9a = V STAIRCASE | 9b = STAIRCASE | 9c = RAMP |
| 10a = BLACK BURST | 10b = 100 % WHITE | 10c = BOUNCE |

0 = 50% grey pedestal indicated by upper LEDs 8 and 10
(Selectable by pressing the keys CAL / VAR and 10 together)

**Signal selection with CAL I VAR key being pressed simultaneously (SHIFT function):**
(see also section 3.2.3)

| LED top (a) | LED bottom (b) |
|---|---|
| 1 = Test line block VITS 1 | |
| 2 = Test line block VITS 2 | |
| 3 = Test line block VITS 3 | |
| 4 = Test line block VITS 4 | |
| 5 = Test line block VITS 5 | |
| 6 = Test line block VITS 6 | |
| 7 = Test line block VITS 7 | |
| 8 = Test line block VITS 8 | |
| 9 = Field-repetitive mode | 9 = Line-repetitive mode |
| 10 = EXTERNAL OFF | 10 = EXTERNAL ON (selects signal #0 = 50 % grey) |

## 3.1.2    Rear Panel
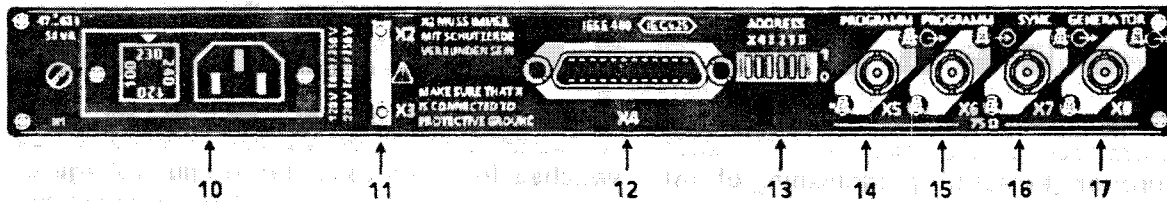


Fig. 3-2    Rear panel

| Ref. No. | Labelling | Function |
|---|---|---|
| 10 |  | AC supply connector with voltage selector and fuse |
| 11 | X2  X3 | Link for safety earth/chassis. Observe instructions under 2.1.3 |
| 12 |  | IEC-625/IEEE-488-bus connector (see section 3.3) |
| 13 | ADDRESS X43210  1  0 | IEC-625/IEEE-488-bus address switch (see section 3.3) |
| 14 | X 5 | Program output (option) 75 Ω |
| 15 | X 6 | Program input (option) $Z_{in} = 75\,\Omega$ |
| 16 | X 7 | Composite sync output 2 V into 75 Ω when used with junction panel: switching voltage for bypass relay |
| 17 | X 8 | Signal output 75 Ω |

## 3.2 Manual Operation
(See Figs 3-1 and 3-2)

A key is provided on the front panel for each setting function (except for programming of test line coding). LEDs assigned to the keys indicate the function selected in the normal or in the SHIFT mode. The functions of the keys and LEDs grouped in sections are described below. Some special functions can only be used via IEC/IEEE-bus commands.

### 3.2.1 EXT · VITS Input

The front-panel BNC connector labelled "EXT·VITS" is provided for application of a composite colour video signal (CCVS). In accordance with the programmed test line coding, individual lines of this signal can be inserted into the generator signal. To ensure correct insertion, the external signal has to meet the following conditions:
It must be genlocked and have the standard level of 0 dB. The amplitude control must be set to CAL. In the EXT mode it is also possible to superimpose a sweep signal on the active picture region. The signal amplitude must not exceed $1 V_{pp}$. In the EXT·VITS mode test signal insertion via this socket is inhibited. The EXT·VITS input impedance is 75 Ω.

### 3.2.2 SIGNAL Keypad
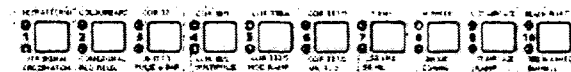
The front-panel keypad comprising keys 1 to 10 is for selecting a total of 30 full-field signals. By pressing one of these keys, the signal specified at the top is selected and the associated upper LED lights up. When the key is pressed again, the signal indicated below the key is selected and the lower LED lights up. To select the lowermost signal, the key is pressed again, both LEDs lighting up simultaneously. The new signal selected starts with the beginning of the next full field.

For the SHIFT functions of the SIGNAL keypad see section 3.2.7.

### 3.2.3 AMPLITUDE Section

The AMPL key allows the output signal to be switched from the calibrated output voltage of $1 V_{pp}$ to a variable value adjustable with the potentiometer. Thus it is possible to vary the level of the output signal from -6 to +3 dB (0.5 to 1.4 $V_{pp}$) using the potentiometer. The selected setting is indicated by the two LEDs CAL and VAR. If this key is pressed when the SGPF is switched on, the generator default status is restored.

If the AMPL key is pressed together with one of keys 1 to 10, the corresponding SHIFT function is activated. If the CAL/VAR key is held down longer than 2 s, the LEDs indicate the SHIFT functions such as VITS block 1 to 8, field- or line-repetitive mode, EXT ON/ OFF (see 3.2.7).

Switchover between CAL and VAR occurs only if the key has not been pressed longer than 2 s and if none of keys 1 to 10 was operated while the CAL/VAR key was being pressed.

## 3.2.4 REM Indicator

The REM LED lights up if the SGPF is in the remote-control mode.

## 3.2.5 GENERATOR Output

The generator signal is brought out at this 75-$\Omega$ socket.

## 3.2.6 POWER Key

The POWER key is for switching the instrument on. Prior to switching the SGPF on, observe the instructions of section 2.1. The green LED lights up to indicate that the instrument is on. In the case of secondary-voltage failure, the red LED lights up.

## 3.2.7 SHIFT Function

To set the SHIFT function, the CAL/VAR key must be pressed and held down. After 2 s, the LEDs indicate the additional functions set. These settings can be varied by keeping the CAL/VAR key down and then pressing the key associated with the desired function.

## 3.2.7.1 Switchover of Test Line Blocks
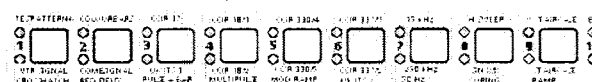
Keys 1 to 8 are associated with the coding blocks VITS 1 to VITS 8. Block switchover is possible by pressing one of the eight keys with the CAL/VAR key being pressed simultaneously. The selected VITS block is indicated by the corresponding LED in the upper row.

**Table 3-2** SHIFT functions

| CAL/VAR key | Signal | VITS | Field-/line-repetitive | EXT | Indication |
|---|---|---|---|---|---|
| Not pressed<br>Not pressed | x<br>x | * 1)<br>* | Field-repetitive<br>Line-repetitive | No<br>No | LED x lights<br>LED x blinks |
| Not pressed<br>Not pressed | x<br>x | *<br>* | Field-repetitive<br>Line-repetitive | Yes<br>Yes | LED x lights<br>LED x blinks |
| Pressed 2) | * | x | * | * | LED x top = VITS x |
| Pressed 2)<br>Pressed 2) | *<br>* | *<br>* | Field-repetitive<br>Line-repetitive | *<br>* | LED 9 top<br>LED 9 bottom |
| Pressed 2)<br>Pressed 2) | *<br>0 3) | *<br>* | *<br>* | No<br>Yes | LED 10 top<br>LED 10 bottom |

1) Meaning of *: not affected by this setting
2) Keep CAL / VAR key down (>2 s)
3) Signal 0 is set via EXT.VITS.
   In normal mode, indicated by upper LEDs 8 and 10.
   Every other signal can be set in normal mode.

## 3.2.7.2 Line-repetitive Mode

Key 9 is used to select field-repetitive or line-repetitive operation. In the SHIFT mode, the upper LED lights up to indicate field-repetitive operation whereas the lower LED indicates the line-repetitive mode. If the SHIFT key is not pressed, the LED associated with the selected signal blinks to indicate the line-repetitive mode. Due to the line-repetitive function implemented in the instrument, video signal configurations different from the field-repetitive mode are assigned to some test signals.

With signals containing field-repetitive components such as TEST PATTERN, VTR SIGNAL, CROSSHATCH, COMB SIGNAL, 50 Hz, H SWEEP, V STAIRCASE, lines representing the corresponding signal are repeated every 80 lines in the line-repetitive mode.

## 3.2.7.3 External Sweep Signal

Switchover to EXT is performed with key 10 in the SHIFT mode. First the processor switches to a 50 % grey pedestal (Signal #0). A signal applied to the EXT VITS input is superimposed on the generator signal over the entire active picture area. In order not to overdrive the generator output stage, the amplitude of the external signal must not exceed 1 $V_{pp}$. With the SHIFT key pressed (>2 s), the upper LED 10 indicates EXT OFF and the lower LED 10 EXT ON. In the normal mode, only the selected signal is indicated.

### 3.2.8    Programming of Test Line Coding

For programming the individual VITS blocks, open the instrument (see also section 4.1.3):

▶ Switch the instrument off and unplug the power connector.

▶ Remove all other cables connected.

▶ Unscrew the two feet on the rear panel (2 screws each) and remove them.

▶ To remove the upper cover, insert a small screwdriver into the holes on the two sides of the cover at the height of the feet and take the cover towards the rear.

▶ Unscrew the shielding cover of the generator (front PCB).

▶ Switch the instrument on again for programming.

On the rear side of the generator PCB only the 4-bit and the two 8-bit DIL switches are located (Fig. 3-3). The upper two switches (S350/S351) are for setting the line number which is the decimal equivalent of bits Z0 to Z9. To simplify programming, the numbers of the test lines are given in binary format in Table 3-3. Remember that a switch is set to 1 if the side labelled "open" is pressed down. The test lines in 4 consecutive full fields can be coded differently. It is, for instance, possible to insert an eight-field sequence identification pulse in line 7 of the first field. To activate this mode, link X373 must be changed over to position 1-2.
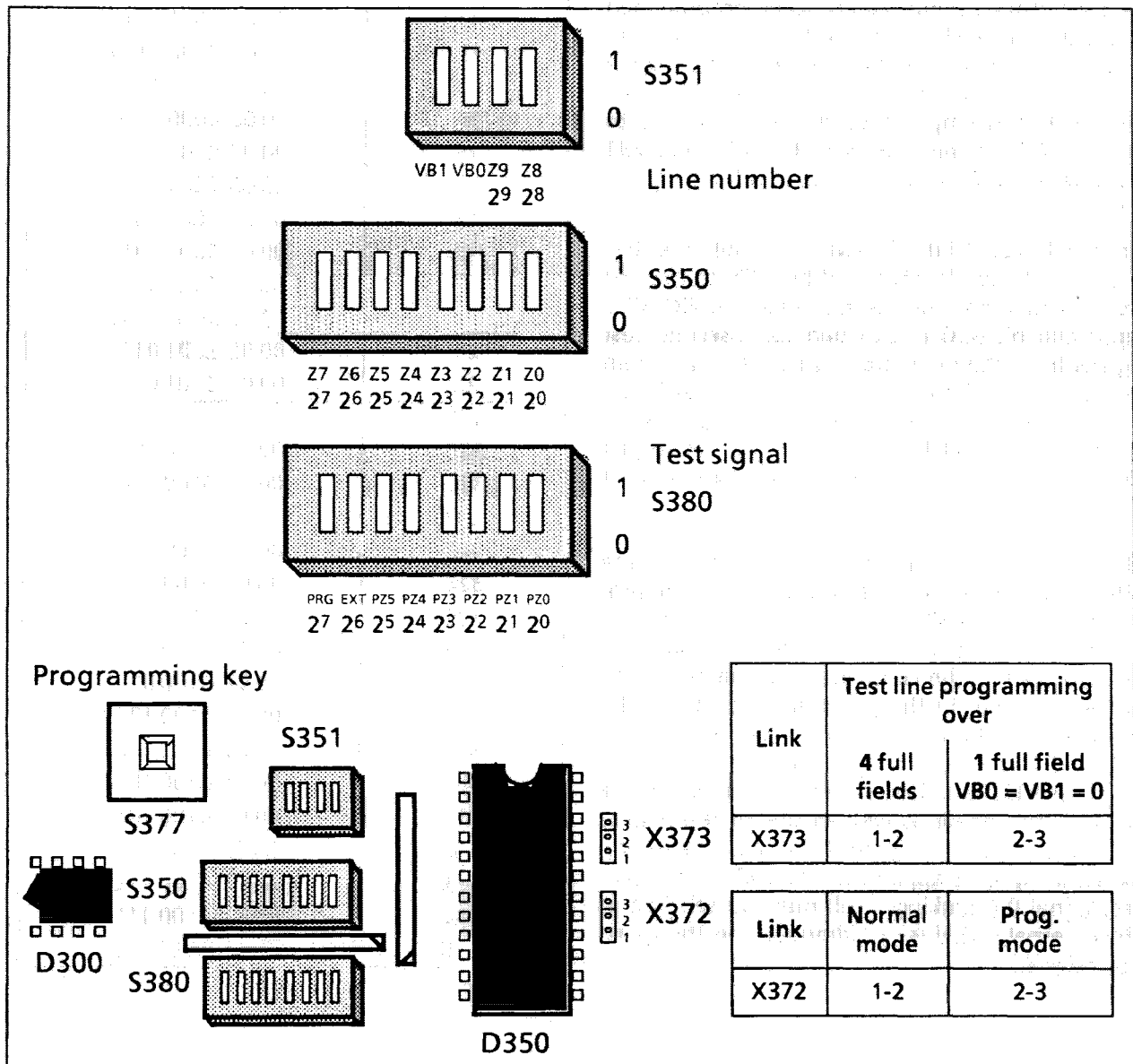


| Link | Test line programming over | |
|---|---|---|
| | 4 full fields | 1 full field VB0 = VB1 = 0 |
| X373 | 1-2 | 2-3 |

| Link | Normal mode | Prog. mode |
|---|---|---|
| X372 | 1-2 | 2-3 |

Fig. 3-3    DIL switches and links for test line coding

The switches VB0 and VB1 enable selection of the memory locations for the test lines of the different full fields.

| VB1 | VB0 | Full field (B) | Fields |
|-----|-----|----------------|--------|
| 0 | 0 | 0 | 1 and 2 |
| 0 | 1 | 1 | 3 and 4 |
| 1 | 0 | 2 | 5 and 6 |
| 1 | 1 | 3 | 7 and 8 |

Field 1 is defined as the field where the burst phase in line 1 equals 135° and where the colour subcarrier has the sine 0° position when the sync in line 1 is 50%.

As a consequence, the eight-field sequence identification pulse has to be inserted in full field 0 (VB0 = VB1). The test lines that are not intended to have a full-field sequence are to be programmed identically in each of the 4 full fields. As this might be somewhat cumbersome when no change of test lines is required, the full-field sequence can be switched off by changing link X373 over to position 2-3. In this case, switches VB0 and VB1 must be set to 0 in normal mode and in program mode.

On the lower 8-bit DIL switch (S380), the test signal is selected by means of bits PZ0 to PZ5. Bit EXT controls the insertion pulse for the EXT VITS input and bit PRG is provided for inserting test signals from the generator signal into a program signal (only if the genlock option is fitted). The two bits EXT and PRG for the insertion pulses are active low, i.e. bit EXT must be 0 for test signal insertion into an external signal, the switch must be closed.

The VITS block to be programmed is set using the SHIFT function or via the IEC/IEEE bus. For programming, link X372 must be set to position 2-3. The test signal set with bits PZ0 to PZ5 (S380) can be displayed in the complete test line region on an oscilloscope. In the programming mode, the full field signal is also controlled by the switches. Table 3-4 shows the available test signals. Switches S350 and S351 set the line in which the signal is to appear as well as the corresponding full field when coding the 4 full-field sequence. When a signal is applied to the EXT VITS input, test signal 0 (blanking level) must be selected as the external signal is superimposed on the generator signal.

After having completed all settings, press key S377 to store this setup in the EEPROM. After removing link X372, programming can be checked on the oscilloscope. Prior to closing the cover of the instrument, link X372 must be placed in the initial position, so that the generator will return to the normal operating mode.

Table 3-3    Decimal-to-binary conversion of test line numbers

| Decimal line number | Use S350/S351 to set binary line number |
|---------------------|------------------------------------------|
| 6 | 00 00 0000 0110 |
| 7 | 00 00 0000 0111 |
| 8 | 00 00 0000 1000 |
| 9 | 00 00 0000 1001 |
| 10 | 00 00 0000 1010 |
| 11 | 00 00 0000 1011 |
| 12 | 00 00 0000 1100 |
| 13 | 00 00 0000 1101 |
| 14 | 00 00 0000 1110 |
| 15 | 00 00 0000 1111 |
| 16 | 00 00 0001 0000 |
| 17 | 00 00 0001 0001 |
| 18 | 00 00 0001 0010 |
| 19 | 00 00 0001 0011 |
| 20 | 00 00 0 001 0100 |
| 21 | 00 00 0001 0101 |
| 22 | 00 00 0001 0110 |
| 319 | 00 01 0011 1111 |
| 320 | 00 01 0100 0000 |
| 321 | 00 01 0100 0001 |
| 322 | 00 01 0100 0010 |
| 323 | 00 01 0 100 0011 |
| 324 | 00 01 0100 0100 |
| 325 | 00 01 0100 0101 |
| 326 | 00 01 0100 0110 |
| 327 | 00 01 0100 0111 |
| 328 | 00 01 0100 1000 |
| 329 | 00 01 0100 1001 |
| 330 | 00 01 0100 1010 |
| 331 | 00 01 0100 1011 |
| 332 | 00 01 0100 1100 |
| 333 | 00 01 0100 1101 |
| 334 | 00 01 0100 1110 |
| 335 | 00 01 0100 1111 |

| Function | Use S350/S351 to set binary line number bits Z9 to Z0 | Use S380.7 to set bit PRG | Use S380.6 to set bit EXT | Use S380.5 - 0 to set binary signal number bits PZ5 to PZ0 |
|---|---|---|---|---|
| Test line into generator signal | XX XXXX XXXX | 1 | 1 | X XXXX |
| External signal into generator signal | XX XXXX XXXX | 1 | 0 | 00 0000 |
| Test line into program signal | XX XXXX XXXX | 0 | 1 | X XXXX |
| External signal into program signal | XX XXXX XXXX | 0 | 0 | 00 0000 |

**Tabelle 3-4**   Insertion test signals, to be set with S380

| Decimal | Binary | Signal |
|---|---|---|
| 0 | 000000 | Blanking level |
| 1 | 000001 | 50% Grey |
| 2 | 000010 | Colour Bars |
| 3 | 000011 | CCIR 17 |
| 4 | 000100 | CCIR 18/1 |
| 5 | 000101 | CCIR 330/4 |
| 6 | 000110 | CCIR 331/1 |
| 7 | 000111 | 15 kHz |
| 8 | 001000 | H- Sweep 1 |
| 9 | 001001 | H- Sweep 2 |
| 10 | 001010 | Black burst |
| 11 | 001011 | 80% Grey |
| 12 | 001100 | Pulse + Pluge |
| 13 | 001101 | UK ITS 1 |
| 14 | 001110 | CCIR 18/2 |
| 15 | 001111 | CCIR 330/5 |
| 16 | 010000 | CCIR 331/2 |
| 17 | 010001 | 250 kHz |
| 18 | 010010 | SIN X/X |
| 19 | 010011 | Staircase |
| 20 | 010100 | 100% White |

| Decimal | Binary | Signal |
|---|---|---|
| 21 | 010101 | Crosshatch |
| 22 | 010110 | Red Field |
| 23 | 010111 | Pulse + Bar |
| 24 | 011000 | Multipulse |
| 25 | 011001 | Mod Ramp |
| 26 | 011010 | UK ITS 2 |
| 27 | 011011 | 2 T pulse |
| 28 | 011100 | Coring |
| 29 | 011101 | Ramp |
| 30 | 011110 | 10% Grey |
| 31 | 011111 | 90% Grey |
| 32 | 100000 | Noise 1 |
| 33 | 100001 | Noise 2 |
| 34 | 100010 | Noise 3 |
| 35 | 100011 | Noise 4 |
| 36 | 100100 | Eye Odd |
| 37 | 100101 | Eye Even |
| 38 | 100110 | IBA - Test Line |
| 39 | 100111 | BT - Comp. Waveform |
| 40 | 101000 | BBC - Test Line |
| 41 | 101001 | H- Sweep 3 |
| 42 | 101010 | H- Sweep 4 |

**Programming examples** (see Fig. 3-3)

Link X372 in position 2-3
Link X373 in position 2-3

**Example 1**
The CCIR 330/5 test signal is to be inserted into line 330 of the generator signal:

CCIR 330/5    = test signal 15
              = binary 001111

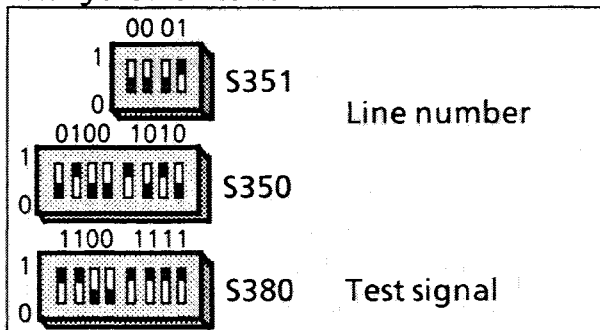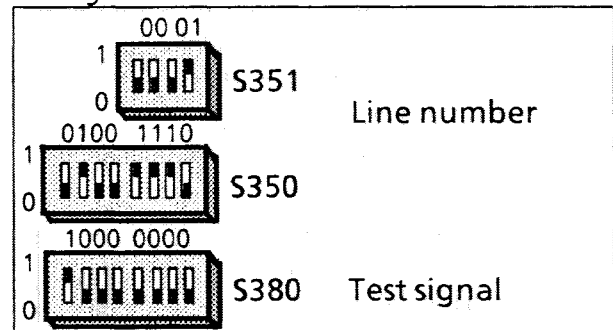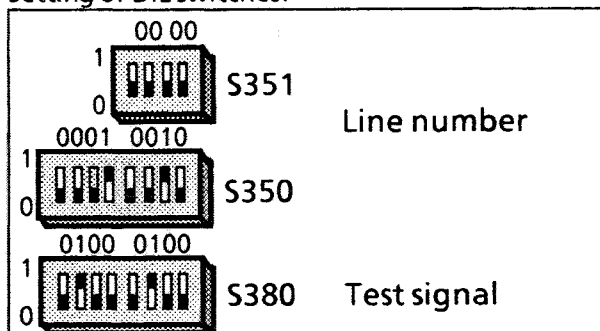PRG           = no insertion
              = logic level 1

EXT           = no insertion
              = logic level 1

Line 330      = binary 01 0100 1010
Bit VB0/VB1   = 0

Setting of DIL switches:



**Example 2** (only with genlock option)
The CCIR 18/1 test signal is to be inserted into line 18 of the program signal:

CCIR 18       = test signal 4
              = binary 000100

PRG           = insertion
              = logic level 0

EXT           = no insertion
              = logic level 1

Line 18       = binary 00 0001 0010
Bit VB0/VB1   = 0

Setting of DIL switches:



**Example 3**
Line 334 of an external signal is to be inserted into the generator signal:

Blanking level = test signal 0
               = binary 000000

PRG            = no insertion
               = logic level 1

EXT            = insertion
               = logic level 0

Line 334       = binary 01 0100 1110
Bit VB0/VB1    = 0

Setting of DIL switches:



**Example 4** (only with genlock option)
An external signal is to be inserted into line 14 of a program signal:

Blanking level = test signal 0
               = binary 000000

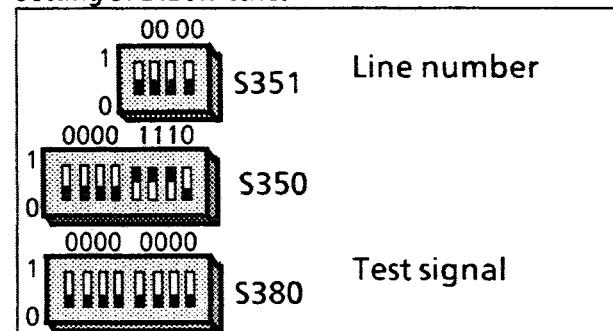PRG            = insertion
               = logic level 0

EXT            = insertion
               = logic level 0

Line 14        = binary 00 0000 1110
Bit VB0/VB1    = 0

Setting of DIL switches:

## 3.3    Remote Control

A controller (eg PCA2 or PCA5) can be connected to the SGPF via the IEC-625/ IEEE-488 bus to make it fully system-compatible.

### IEC/IEEE Bus

As standard, the SGPF is fitted with a 24-contact IEC-625/IEEE-488 connector on the rear. The inter-face complies with IEC standard 625-1 as well as with IEEE standards 488.1 and 488.2 which will also be taken over by IEC. IEEE 488.2 specifies, for instance, data transmission formats and common commands.
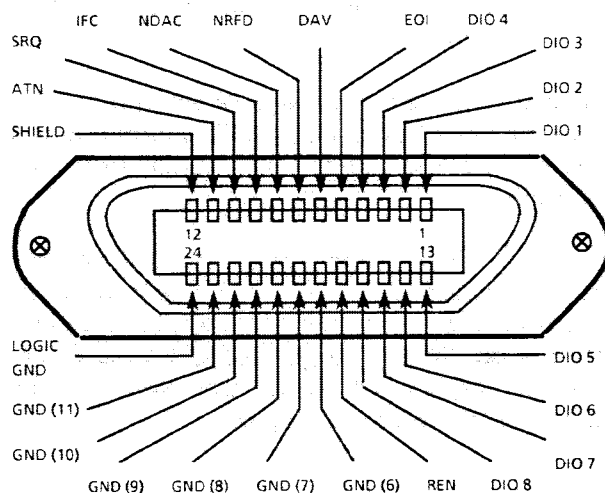


**Fig. 3-4**    Contact assignment of IEC-625/ IEEE-488-bus connector

The **standardized interface** includes three groups of bus lines:

1.  **Data bus with 8 lines DIO 1 to DIO 8**
    Data transmission is bit parallel and byte serial, the characters being transmitted in the ISO 7-bit code (ASCII code).

    DIO 1 represents the least significant and DIO 8 the most significant bit.

2.  **Control bus with 5 lines**
    The control bus is used to manage the information flow:

    **ATN** (attention)
    becomes active low during transmission of addresses, common or addressed commands to the devices on the bus.

    **REN** (remote enable)
    for switching the device to the remote state.

    **SRQ** (service request)
    asserting SRQ enables a device to send a service request to the controller.

    **IFC** (interface clear)
    is activated by the controller to place the IEC/IEEE-bus interfaces of the devices into a defined initial state.

    **EOI** (end or identify)
    identifies the end of data transmission and is used in parallel poll.

3.  **Handshake bus with 3 lines**
    This bus controls data transmission timing.

    **NRFD** (not ready for data)
    in the active low state signals to the talker/controller that one of the devices on the bus is not ready to accept data.

    **DAV** (data valid)
    is activated by the talker/controller shortly after a new data byte has been put on the data bus.

    **NDAC** (not data accepted)
    is kept active low by the bus device until the device has accepted the data on the bus.

For further information, eg data transmission timing, see IEC standard 625-1.

According to IEC 625-1, devices which can be remote-controlled via the IEC/IEEE bus may be provided with different interface functions. See Table 3-5 for SGPF interface functions.

**Table 3-5**     Interface functions

| Identi-fication | Interface function |
|---|---|
| SH1 | Source handshake, complete capability |
| AH1 | Acceptor handshake, complete capability |
| L4 | Listener, complete capability, unaddress if MTA |
| T6 | Talker, complete capability, capability to answer serial poll, unaddress if MLA |
| SR1 | Service request, complete capability |
| PP0 | Parallel poll, no capability |
| DT0 | Device trigger, no capability |
| RL1 | Remote/local function, complete capability |
| DC1 | Device clear, complete capability |
| C0 | Controller, no capability |

### 3.3.1   Setting the Device Address

The device address is set to "08" in the factory, but it can be changed with the aid of the rear address switch. On power up, the address is read into a non-volatile memory.



$$\begin{array}{cccccc} X & A4 & A3 & A2 & A1 & A0 \\ & 2^4 & 2^3 & 2^2 & 2^1 & 2^0 \end{array}$$

(factory setting)
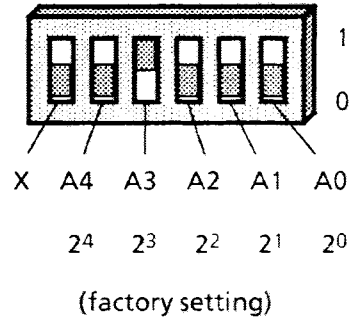
**Note:**   *In the upper position, the switch is set for logic 1.*

The address is the decimal equivalent of bits A0 to A4 of the talk or listen address. This format is also used in the IEC/IEEE-bus commands from the controller.

If switch X is in position 1 and if link X101 on the processor board is in position 2-3, the front-panel controls are disabled and the signal amplitude is set to 0 dB. When the genlock option is fitted, only test signals with 0-dB level will thus be inserted into the program signal.

## 3.3.2 Local-to-Remote State Transition

After switching on, the device is in the local state (manual control).

If the SGPF is addressed by the controller as a listener (in R&S controllers with BASIC commands IECOUT or IECLAD), it changes to the remote state (remote control) and also remains in this state after data transmission.

> The front-panel LED REM lights up to
> **REM** indicate this state.

There are two ways to return to the local state:
▶ The controller sends the addressed command GTL (go to local).
▶ Press any front-panel key. The controller can disable manual return to the local state by sending the universal command LLO (local lockout).

Remote-to-local or local-to-remote state transition will not affect the other settings on the device.

## 3.3.3 Interface Messages

Interface messages (as specified in IEC 625-1/ IEEE 488) are sent to the SGPF via the data lines, the ATN line being active (low).

### Universal Commands

Universal commands are encoded in the range 10 through 1F hex, 16 through 31 decimal (see Table 3-8). They affect all devices on the bus without any addressing being required.

Table 3-6   Universal commands for SGPF

| Com-mand | BASIC command in R&S controllers | Function |
|---|---|---|
| DCL (Device Clear) | IECDCL | Sets the command processing software to a defined initial state. No change of device setup. |
| LLO (Local Lockout) | IECLLO | Front-panel controls disabled |
| SPE (Serial Poll Enable) | IECSPE * | Ready for serial poll |
| SPD (Serial Poll Disable) | IECSPD * | End of serial poll |

\* The BASIC command "IECSPL address, status", which includes the commands "IECSPE" and "IECSPD", also reads the status of the addressed device and stores it in the integer variable "status".

### Addressed Commands

The addressed commands are encoded in the range 00 through 0F hex, 0 through 15 decimal (see Table 3-8). They only affect devices addressed as a listener (using the BASIC command "IECLAD address").

Table 3-7   Addressed commands for SGPF

| Com-mand | BASIC command in R&S controllers | Function |
|---|---|---|
| SDC (Selected Device Clear) | IECSDC | Interrupts processing of received commands and sets the command processing software to a defined initial status. No change of device setup. |
| GTL (Go To Local) | IECGTL | Activates the local state (manual control). |

**Table 3-8** ASCII / ISO and IEC code chart

| Control characters | | | | | | Numbers and symbols | | | | Upper case | | | | Lower case | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | NUL | | 16 | DLE | | 32 | SP | 48 | 0 | 64 | @ | 80 | P | 96 | ` | 112 | p |
| 1 | SOH | GTL | 17 | DC1 | LLO | 33 | ! | 49 | 1 | 65 | A | 81 | Q | 97 | a | 113 | q |
| 2 | STX | | 18 | DC2 | | 34 | " | 50 | 2 | 66 | B | 82 | R | 98 | b | 114 | r |
| 3 | ETX | | 19 | DC3 | | 35 | # | 51 | 3 | 67 | C | 83 | S | 99 | c | 115 | s |
| 4 | EOT | SDC | 20 | DC4 | DCL | 36 | $ | 52 | 4 | 68 | D | 84 | T | 100 | d | 116 | t |
| 5 | ENQ | PPC | 21 | NAK | PPU | 37 | % | 53 | 5 | 69 | E | 85 | U | 101 | e | 117 | u |
| 6 | ACK | | 22 | SYN | | 38 | & | 54 | 6 | 70 | F | 86 | V | 102 | f | 118 | v |
| 7 | BEL | | 23 | ETB | | 39 | ' | 55 | 7 | 71 | G | 87 | W | 103 | g | 119 | w |
| 8 | BS | GET | 24 | CAN | SPE | 40 | ( | 56 | 8 | 72 | H | 88 | X | 104 | h | 120 | x |
| 9 | HT | TCT | 25 | EM | SPD | 41 | ) | 57 | 9 | 73 | I | 89 | Y | 105 | i | 121 | y |
| 10 | LF | | 26 | SUB | | 42 | * | 58 | : | 74 | J | 90 | Z | 106 | j | 122 | z |
| 11 | VT | | 27 | ESC | | 43 | + | 59 | ; | 75 | K | 91 | [ | 107 | k | 123 | { |
| 12 | FF | | 28 | FS | | 44 | , | 60 | ⟨ | 76 | L | 92 | \ | 108 | l | 124 | ¦ |
| 13 | CR | | 29 | GS | | 45 | - | 61 | = | 77 | M | 93 | ] | 109 | m | 125 | } |
| 14 | SO | | 30 | RS | | 46 | . | 62 | ⟩ | 78 | N | 94 | ^ | 110 | n | 126 | ˜ |
| 15 | SI | | 31 | US | | 47 | / | 63 | ? / UNL | 79 | O | 95 | - | 111 | o | 127 | DEL |
| Addressed commands | | | Universal commands | | | Listen addresses | | | | Talk addresses | | | | Secondary addresses and commands | | | |



| 8 | BS | GET |
|---|---|---|

Interface message

ASCII character

Decimal
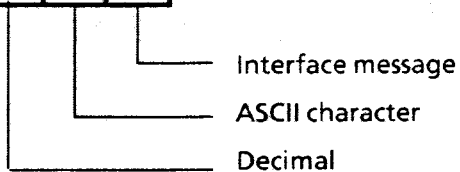
Code for control characters
(addressed / universal commands)

## 3.3.4  Device-dependent Messages

Device-dependent messages (in accordance with IEC 625-1) are transmitted on the data lines, with the ATN line being high, ie not active. The ASCII code (ISO 7-bit code) is used for transmission (see Table 3-8).

As can be seen from Table 3-9, device-dependent messages may be classified under two different aspects:

**Table 3-9**   Classification of device-dependent messages

| Type of message | Direction of transmission | |
|---|---|---|
| | to SGPF | from SGPF |
| Common commands (in line with IEEE 488.2) | see Table 3-10 | see Table 3-11 |
| Device-specific commands (depending on device characteristics) | see Table 3-12 | see Table 3-13 |

In the following text, device messages received by the SGPF are referred to as "commands".

## 3.3.4.1  Common Commands and Queries

The commands and queries are listed in Tables 3-10 and 3-11 and concern:

▸ commands referring to the service request function and the relevant status and enable registers,
▸ commands for device identification,
▸ commands for internal device setups,
▸ commands for polling internal device settings.

The headers of these commands consist of "*" followed by three letters.

*Examples:*

8 is assumed to be the device address (IEC-625/IEEE-488 bus) = factory setting.

1.  Basic setting
    IECOUT 8, "*RST"

2.  Clearing the event status register
    IECOUT 8, "*CLS"

3.  Switchover to message without header
    IECOUT 8, "*HDR 0"

**Table 3-10**    Common commands received by the SGPF

| Command | Numerical value, range | Description |
|---|---|---|
| *RST | --- | **Reset**<br>▶ Places the device in the default state: SIGNAL 1; VITS 1; HFREQUENT off; AMPL CAL; bounce time 2 s; EXT off; SC/H phase 0°; bypass off<br>▶ Switches to messages with header (same as command *HDR1)<br>▶ Clears the operation complete function<br><br>This command does not change the IEC/IEEE interface status, the selected IEC/IEEE-bus address nor the registers of the service request function. |
| *PSC | 0 or 1 | **Power On Status Clear**<br><br>If 1: The service request enable register (SRE) and the event status enable register (ESE) are cleared on power-on.<br>If 0: The contents of the above registers are retained even if the device is switched on and off. This allows the SGPF to assert a service request on power-on. |
| *HDR | 0 or 1 | **Header**<br><br>If 1: All device-dependent messages from the SGPF to the controller are sent with header (not the replies to common commands).<br>If 0: Device-dependent messages are sent without header.<br><br>Set to 1 also with command *RST. |
| *OPC | --- | **Operation Complete**<br><br>Sets bit 0 (operation complete) in the event status register if all preceding commands have been processed and executed (see section 3.3.8). |
| *CLS | --- | **Clear Status**<br><br>Clears the event status register (ESR). The enable registers of the service request function (ESE and SRE) remain unchanged. |
| *ESE | 0 to 255 | **Event Status Enable**<br><br>The event status enable register is set to the defined value which is interpreted as a decimal number (see section 3.3.7). |
| *SRE | 0 to 255 | **Service Request Enable**<br><br>The service request enable register is set to the defined value which is interpreted as a decimal number (see section 3.3.7). |
| *WAI | --- | **Wait To Continue**<br><br>Interrupts command processing until all previous commands have been executed (see section 3.3.8). |

## 3.3.4.2   Common Queries

Table 3-11     Common queries

| Query | Output message, data value | | Description |
|---|---|---|---|
| | Digits | Range | |
| *IDN? | 25 | alpha-numeric | **Identification Query** <br><br> The following identification text is sent in reply to the *IDN? query via the IEC/IEEE bus: <br> "ROHDE & SCHWARZ,SGPF,0,1.00" <br> ROHDE & SCHWARZ = manufacturer <br> SGPF    = model <br> 0            = reserved for serial number (not used with SGPF) <br> 1.00    = firmware level (for example) |
| *OPT? | 1 | alpha-numeric | **Option Identification Query** <br><br> Sends information on built-in options via the IEC/IEEE bus. <br> 0: No option built in. |
| *PSC? | 1 | 0 or 1 | **Power-On Status Clear Query** <br><br> For readout of the device's power-on-status-clear flag; see *PSC in Table 3-10. |
| *HDR? | 1 | 0 or 1 | **Header Query** <br><br> For readout of header flag status; see *HDR in Table 3-10. |
| *OPC? | 1 | 1 | **Operation Complete Query** <br><br> The ASCII character 1 is placed into the output buffer and bit 4 (MAV) in the status byte is set if all previous commands have been processed and executed (see section 3.3.8). |
| *ESR? | 1 to 3 | 0 to 255 | **Event Status Register Query** <br><br> The contents of the event status register are output in decimal form, the register being cleared afterwards. |
| *ESE? | 1 to 3 | 0 to 255 | **Event Status Enable Query** <br><br> The contents of the event status enable register are output in decimal form. |
| *STB? | 1 to 3 | 0 to 255 | **Read Status Byte Query** <br><br> The contents of the status byte are output in decimal form. |
| *SRE? | 1 to 3 | 0 to 255 | **Service Request Enable Query** <br><br> The contents of the service request enable register are output in decimal form. |

| Query | Output message, data value | | Description |
|-------|--------|-------|-------------|
| | Digits | Range | |
| *TST? | 1 | 0 to 7 decimal | **SELF TEST QUERY**<br>A hardware test of 3 parameters (ROM error, buffer RAM check, V-pulse check) is carried out in the device. The decimal equivalent of the 3-bit test register is sent as follows: |

| Decimal-equivalent | Register bit number | | | Error number | Error found |
|----|----|----|----|----|-------------|
| | 2 | 1 | 0 | | |
| 0 | 0 | 0 | 0 | | No error |
| 1 | 0 | 0 | 1 | 1 | Error of clock generator (V interrupt missing) |
| 2 | 0 | 1 | 0 | 2 | ROM error |
| 4 | 1 | 0 | 0 | 3 | Upon power up, no valid setting could be found in the buffer RAM, e.g. if the lithium battery is flat (for exchange see 4.2.1) |
| 3 | 0 | 1 | 1 | | Errors 1 and 2 |
| 5 | 1 | 0 | 1 | | Errors 1 and 3 |
| 6 | 1 | 1 | 0 | | Errors 2 and 3 |
| 7 | 1 | 1 | 1 | | Errors 1, 2 and 3 |

Note that a result is obtained only after completion of the test which takes about 3 s. Set timeout of IEC/IEEE-bus controller accordingly.

| Query | Output message, data value | | Description |
|-------|--------|-------|-------------|
| *LRN? | max. 68 | alpha-numeric | **LEARN QUERY**<br><br>The SGPF sends a string consisting of the individual setting commands with parameters which represent the current device status. If this string is buffered and returned to the SGPF unchanged after several operations have been carried out on the device, the SGPF is placed in the state prior to the query (except for flags and common command registers).<br><br>The *LRN? query should always be sent as a single query message; otherwise, the response messages cannot be separated. |

## 3.3.4.3 Device-specific Setting Commands

All SGPF functions that can be selected using the front-panel controls can also be set via the IEC/IEEE bus. Setting commands and front-panel entries have the same effect.

Table 3-12 shows the setting commands and Table 3-13 the queries with the corresponding messages sent by the SGPF.

The headers are identical or similar to the corresponding key label so that easy-to-read (self-documenting) programs are obtained.

The headers may be truncated by omitting characters at the end (eg SI instead of SIGNAL). The shortest form possible is printed in **bold** in the tables.

Table 3-12    Device-specific setting commands

| Header | Parameter | Per-missible units | DEFAULT units | Meaning |
|---|---|---|---|---|
| **S**IGNAL **<**n**>** | n: 0 to 30 | --- | --- | Front-panel signals (see section 3.1)<br>    0   50% grey pedestal<br>  1 to 10   signals top<br>11 to 20   signals centre<br>21 to 30   signals bottom |
| **<**n**> <**unit**>** | n: 1 to 10 | **A, B, C** | --- | Direct selection of front-panel signals, eg: SIGNAL 3B = signal 13 (A = top, B = centre, C = bottom) |
| **V**ITS **<**n**>** | n: 1 to 8 | --- | --- | Selection of the 8 different test line blocks, eg.<br>VITS 3 = test line block 3 |
| **A**MPLITUDE **C**ALIBRATED | --- | --- | --- | Example:<br>AMPLITUDE C = position CAL |
| **A**MPLITUDE **V**ARIABLE | --- | --- | --- | Example:<br>AMPLITUDE V = position VAR Setting via front-panel potentiometer |
| **A**MPLITUDE<br>      **<**n**> <**unit**>** | 0.496 to 1.416<br>496 to 1416<br>-6.09 to 3.02<br>49.6 to 141.6 | **V**<br>**m**V<br>**d**B<br>**P**CT | V | Setting by internal D/A converter. Indication by CAL and VAR LEDs. Setting in 4-mV steps, eg:<br>AMPLITUDE 52 PCT<br>    = 52% amplitude |
| **B**OUNCETIME | 0.08 to 16.000<br>80 to 16000 | **S**<br>**m**S | S | Changing the bounce signal period; setting in steps of 80 ms |
| **SC**_**H**_**PHASE** | -360 to + 360<br>-6.283 to<br>+ 6.283 | **D**EG<br>**R**AD | | SC/H phase shift;<br>setting in steps of 0.088° |
| **B**YPASS [1] | 0 to 1<br>**ON**<br>**OF**F | | | 0: device not bypassed<br>1: device bypassed |

[1]   The command is only applicable if the Genlock Option SG.F-Z2 (order no. 2016.6964.02) and the Junction Panel with bypass SG.F-Z (order no. 2016.1679.02) are fitted.

| Header | Parameter | Per-missible units | DEFAULT units | Meaning |
|---|---|---|---|---|
| HFREQUENT | 0 to 1 **ON** **OF**F | | | Switching line-repetitive mode on and off. The associated LED blinks to indicate this mode. |
| EXTERNAL | 0 to 1 **ON** **OF**F | | | Switching on and off of sweep signal applied to the EXT VITS input for superposition on a 50% grey pedestal ( = Signal # 0). |

*Examples:*

(The IEC/IEEE-bus address of SGPF is assumed to be 8).

```
IECOUT 8, "SIG 4; AM 780 mV"
IECOUT 8, "SIG 5C; AMPL VAR"
IECOUT 8, "AMPL 1.345" or IECOUT 8, "AM 1.345V" or IECOUT 8, "AM 1345 mV"
IECOUT 8, "BOU 4.04" or IECOUT 8, "Bounce 4040 ms"
IECOUT 8, "HFREQU 0" or IECOUT 8, "HFREQU OFF
```

## 3.3.4.4 Device-specific Queries

The shortest form possible is printed in **bold** in the table.

Table 3-13  Device-specific queries

| Query | Message sent by SGPF in talk mode | |
|---|---|---|
| | Header | Parameter or number format in default units |
| **S**IGNAL? | SIGNAL | 0 to 30 |
| **V**ITS? | VITS | 1 to 8 |
| **A**MPLITUDE? | AMPLITUDE | CALIBRATED VARIABLE 0.496 to 1.416 |
| **B**OUNCETIME? | BOUNCETIME | 0.08 to 16.00 |
| **H**FREQUENT? | HFREQUENT | 0 to 1 |
| **SC**_H_PHASE? | SC_H_PHASE | -179.92 to 180.00 |
| **BY**PASS? | BYPASS | 0 to 1 |
| **E**XTERNAL? | EXTERNAL | 0 to 1 |

*Examples:*

```
10  IECTERM 10 (talker delimiter "LF")
20  IECOUT 8, "*HDR 1; Sig?; Ampl?"
30  IECIN 8, A$
40  PRINT A$ yields the following output (example): SIGNAL 25; AMPLITUDE CALIBRATED
```

### 3.3.5  Syntax of Setting Commands and Queries (Controller-to-Device Messages)

Fig. 3-5 shows the syntax of a command line (program message). Each message must be terminated by one of the following delimiters:

- New line = NL (ASCII code 10 decimal)
- End (EOI line active) together with
  - the last character of the command line or
  - the semicolon (;) or
  - an ASCII character with the code 0 through 32 decimal

Since a carriage return (ASCII code 13 decimal) is permissible as a filler without effect in front of the delimiter, the combination CR + NL can be used as well.

All Rohde & Schwarz IEC/IEEE-bus controllers send a standard delimiter accepted by the device.

A command line may also take up more than one line on the screen of the controller as it is only terminated by the delimiter. Most IEC/IEEE-bus controllers automatically add the delimiter to the useful text.

A command line may contain several commands (program message units) that must be separated from each other by a semicolon (;).
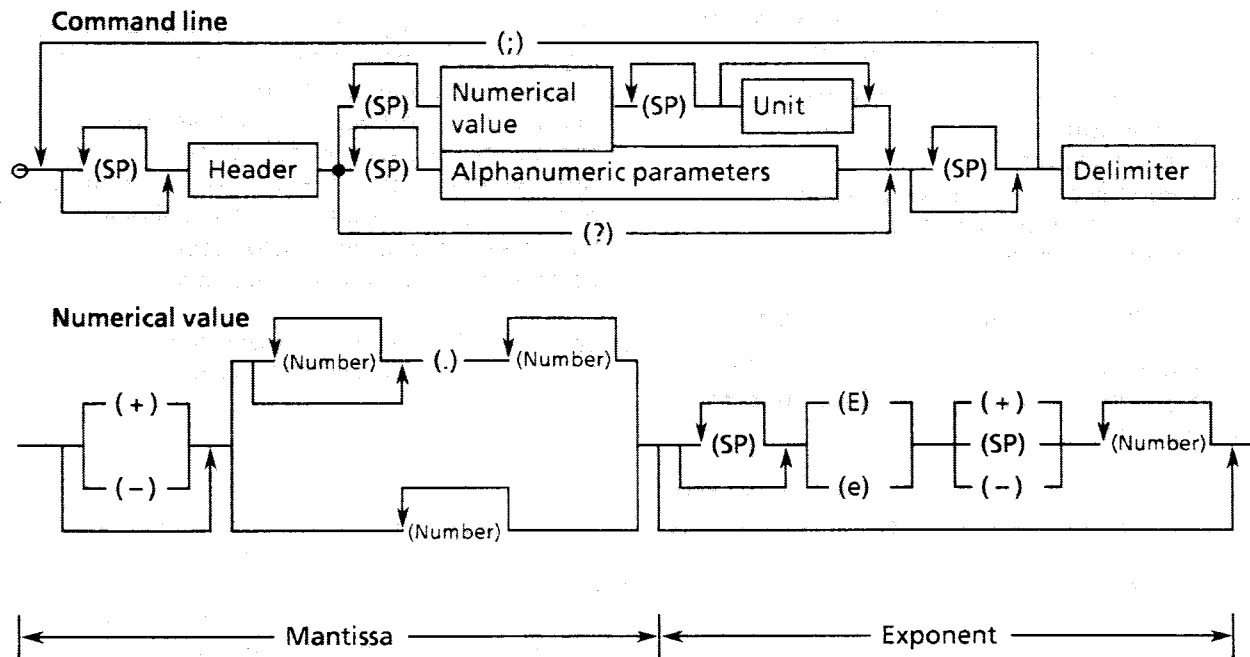


SP: Any character with the ASCII code 0 through 9 and 11 through 32 decimal, in particular the space character.

Fig. 3-5    Syntax diagram of a command line



*RST; SIGNAL 26; AMPL 0.65 V <CR><LF>

Line feed

Carriage return

SIG?; AMPL? <LF>

A command may consist of the following elements:
● Header and question mark
  e.g.    SIGNAL?

  When receiving such a combination, the SGPF makes the requested data available in an output buffer to enable their transmission via the IEC/IEEE bus as soon as the SGPF has been addressed as the talker.
  Note:    *The question mark is placed directly after the header.*

● Header and numerical value
  e.g.    AMPL 61.3E-2

  Header and numerical value(s) must be separated by at least one space (ASCII code 32 decimal). In the case of device-specific commands, the numerical value may be followed by a unit.

Lower case and upper case are both permissible as they are equivalent. Units can thus be written in their usual form (e.g. dB) instead of in upper case (e.g. DB) which is also permissible.

Additional spaces may be inserted at the following positions:
▶ before the header,
▶ between header and numerical value,
▶ before and after the semicolon (;),
▶ before the delimiter.

## Headers of device-specific commands

The headers are identical or similar to the key labelling. This yields easy-to-read (self-documenting) programs.

By omitting certain characters, the headers may be truncated (e.g.: S or SI instead of signal). The shortest form possible is given in bold in Tables 3-12 to 3-13.

## Numerical values

Only decimal numbers and the following notations are permissible:
● With or without sign
  e.g.    5, +5, -5

● With or without decimal point, the position of the decimal point being freely selectable
  e.g.    1.234, -100.5, .327

● With or without exponent to the base of 10, "E" or "e" defining the exponent
  e.g.    .451, 451E-3, +4.51e-2

● The exponent may be used with or without sign, a space being permitted instead of the sign
  e.g.    1.5E+3, 1.5E-3, 1.5E3

● Mantissa and exponent may be preceded by zeros
  e.g.    +0001.5, -01.5E-03

● The mantissa may consist of a maximum of 40 digits without leading zeros. The length of the exponent is limited to 2 digits. If this length is exceeded in the case of ne.g.ative exponents, the number is rounded off to zero; with positive exponents overflow occurs. If the length of the mantissa is exceeded, decimal places are truncated whereas too many places before the decimal point result in an overflow.

Note:    *The exponent alone (e.g. E-3) must not be used; the correct format is 1E-3.*

## Unit

In the case of device-dependent setting commands, a unit may be appended directly to the numerical value (e.g. 1.38, also permissible 1.38E3MV). The permissible units are listed in Table 3-12. The units may also be abbreviated and written in lower-case or upper-case letters. If no unit is specified, the default unit will apply.

### 3.3.6   Syntax of Messages sent by SGPF in Talk Mode (Device-to-Controller Messages)

The SGPF sends messages via the IEC/IEEE bus if:

1. it has been requested by one or more queries (messages followed by a question mark) within a single command line to make data available in the output buffer,

2. setting bit 4 (MAV = message available) in the status byte indicates that the requested data are available in the output buffer (see also section 3.3.7), and if

3. it has been addressed as a talker (BASIC command "IECIN address, string variable").

It should be noted that the command line with the queries is sent immediately before the talk address. If another command line is sent in between, the output buffer is cleared.

If the SGPF is addressed as a talker immediately after a query without due consideration of point 2) above, the bus handshake will be inhibited until the requested data are available (eg with query *TST? approx. 3 s).

The syntax of the messages sent by the SGPF is shown in Fig. 3-6. It is similar to that of the commands the SGPF receives.

- NL (ASCII code 10 decimal) together with End (EOI line active) is used as the delimiter.
- Using the command "*HDR0" or "*HDR1", it is possible to select whether only numerical values (*HDR0) or the header plus numerical values (*HDR1) are to be sent.

The setting "header plus numerical values" is also selected by
▸ the command *RST (reset).

The transmission of headers plus numerical values allows messages sent by the SGPF to be returned unchanged as commands. Any setting entered via the keyboard can thus be read out, stored in the controller and repeated later on via the IEC/IEEE bus.

- If the SGPF receives several queries, it also returns several messages in a single line; these messages are separated from each other by a semicolon.

- Header and numerical values are always separated by a space.
- Headers only consist of upper case letters and the character *.

- Fig. 3-6 shows the syntax of the numerical values. Only decimal numbers are sent. As regards the exact format of the numerical values for each specific message, see Tables 3-11 and 3-13.

- The messages sent by the SGPF do not include any units. In the case of physical quantities, the numerical values are referred to the default units listed in Table 3-12.

# SGPF Remote Control

**Program examples:**

(For the IEC/IEEE-bus controller PCA5, 8 being assumed as the IEC/IEEE-bus address of SGPF)

**Example 1: Self-test**

```
5   IECTIME 5000    ......................    Timeout = 5 s; test takes about 3 s
10  IECTERM 10      ........................  Input delimiter: NL
20  IECOUT 8, "*TST?"   ..................    Triggering of test function
30  IECIN 8,ST$     ......................    Talker addressing and data reading
40  PRINT "Selbsttest SGPF: ";ST$
```

**Example 2:** Identification; data available signalled by service request

```
10  IECTERM 10      ........................  Input delimiter: NL
20  ON SRQ GOSUB 100    ..................    Upon service request go to line 100
30  IECOUT 8, "*SRE 16; *IDN?"  ..........    SRQ by MAV bit and identification query
.
.
.
100 REM   SERVICE REQUEST ROUTINE
110 IECSPL 8,S%     ......................    Serial poll
120 IF (S% AND 16) = 0 THEN GOTO 150   .....  Service request from SGPF?
130 IECIN 8,ID$     ......................    If so, talker addressing
140 PRINT "Identifikation:"; ID$
150 ON SRQ GOSUB 100
160 RETURN
```

**Output queue**
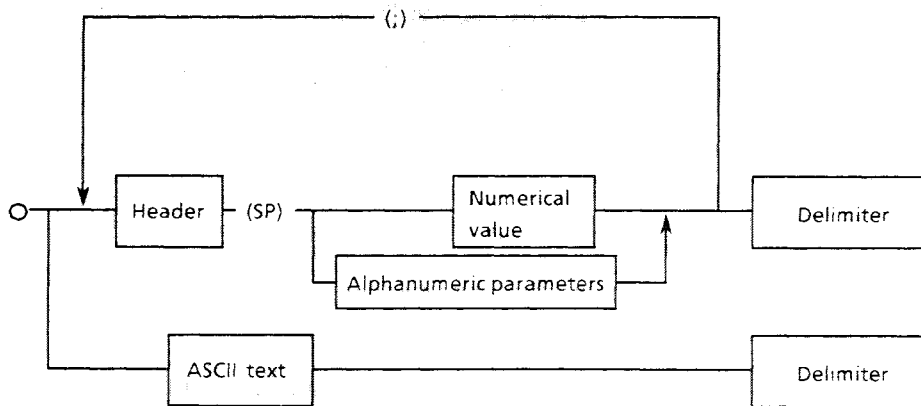


**Numerical value**
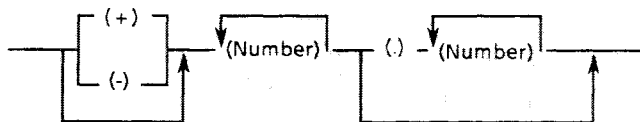


SP:          Space (ASCII code 32 decimal)

ASCII-text:  Response to queries *IDN? and *OPT? (see Table 3-11)

**Fig. 3-6**    Syntax diagram of messages sent by SGPF

**Example with header:**
SIGNAL 22; AMPLITUDE CALIBRATED; BOUNCETIME 4.00 (LF+END)

**Example without header:**
22; CALIBRATED; 4.00 (LF+END)

## 3.3.7   Service Request (according to IEEE 488.2) and Status Registers

The figure below shows the status registers and how they are linked together.

In line with IEEE 488.2, the status byte (STB) and its enable register (SRE), which are also used with older devices, are supplemented by the event status register (ESR) and the associated event status enable register (ESE).
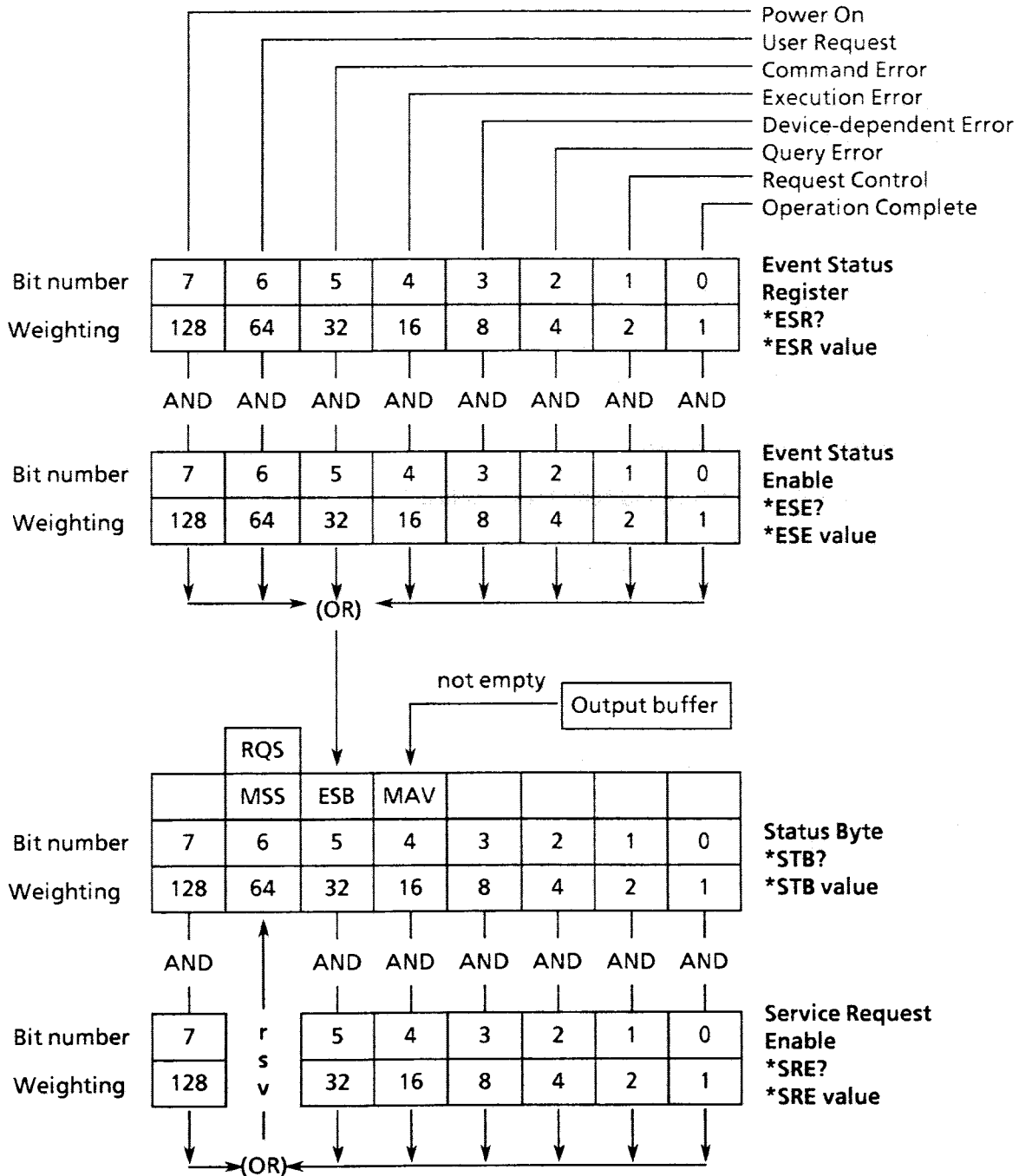


Fig. 3-7   Status registers

**Table 3-14**   Description of event status register

| Bit number | Description |
|---|---|
| 7 | **Power on**<br><br>This bit is set when the SGPF is switched on or when the power returns after an AC supply failure. |
| 6 | **User request**<br><br>This bit is set if a key has been pressed on the SGPF.<br>If the enable registers are set accordingly, a service request will be triggered. This function proves useful for test setups which require both manual operation and IEC/IEEE-bus control. |
| 5 | **Command error**<br><br>This bit is set if one of the following errors is detected during the analysis of the commands received:<br><br>● general syntax error<br>● illegal unit of measurement<br>● illegal header |
| 4 | **Execution error**<br><br>This bit is set if one of the parameters is outside of the legal input range when the commands received are executed. |
| 3 | Not used in the SGPF |
| 2 | **Query error**<br><br>This bit is set<br><br>● if the controller tries to read data from the SGPF without having issued a query,<br><br>● if data available in the SGPF output buffer have not been read out and if a new command is sent to the SGPF instead. In this case, the output buffer will be cleared. |
| 1 | **Request control**<br><br>Not used in the SGPF |
| 0 | **Operation complete**<br><br>This bit is set in response to the command *OPC if all preceding commands have been executed. |

In the event status register (ESR), a bit is set to 1 when specific events occur (eg error, operation complete message); see Fig. 3-7.

These bits remain set until they are reset by reading the event status register (by means of *ESR?) or by the following conditions:

● the command *CLS

● switching on the AC supply voltage (however, the power-on bit is then set)

With the event status enable register (ESE) the user can determine which bits in the event status register should set the event summary bit ESB (bit 5 of the status byte), which in turn may produce a service request. The summary bit is only set if at least one bit in the ESR and the corresponding bit in the ESE are set to 1. The summary bit is automatically reset if above condition is no longer met, eg if the bits in the ESR have been reset by reading the event status register or if the contents of the event status enable register (ESE) have been modified.

The event status enable register is written to with the command "*ESE value" ("value" being the contents in decimal) and can be read with the query *ESE?. This enable register is cleared upon power on when the power-on-status-clear flag is 1 (*PSC1).

The ESE register cannot be changed by other commands or interface messages (DCL, SDC).

Note that the bits of the status registers are numbered from 0 to 7 in accordance with IEEE 488.2, but that the bus data lines are designated DIO1 to DIO8.

With the service request enable register (SRE) the user can determine if a 0-to-1 transition of the MAV or ESB bit is to set the RQS bit of the status byte and if activation of the SRQ line is to cause a service request to be sent to the controller. As every bit in the service request enable register is assigned a corresponding bit in the status byte, the following configurations or combinations are possible:

| Contents of SRE (dec.) | Bit No. (0 to 7) set in SRE | Effect |
|---|---|---|
| 0 | -- | No service request |
| 16 | 4 | Service request if the MAV bit is set (message in output buffer) |
| 32 | 5 | Service request if the ESB bit is set (at least 1 bit in the event status register is set and not masked) |
| 48 | 4 + 5 | Service request in the two cases mentioned above |

The service request enable register (SRE) is written to with the command "*SRE value" ("value" being the contents in decimal) and can be read with the query *SRE?. This register is set to 0 upon power-on when the power-on-status-clear flag is 1; this inhibits the service request function of the SGPF. The SRE register cannot be changed by other commands or interface messages (DCL, SDC).

Several devices may simultaneously issue a service request, the open-collector drivers acting as an OR function on the SRQ line. To identify the device that issued the service request, the controller has to read the status bytes of the devices. A set RQS bit (bit 6/DIO 7) shows that the device is sending a service request.

| Bit No. (0 to 7) | Bus line | Acronym | Description |
|---|---|---|---|
| 4 | DIO 5 | MAV | Message available<br><br>Shows that a message is available in the output buffer to be read out.<br>The bit is 0 if the output buffer is empty. |
| 5 | DIO 6 | ESB | Summary bit of event status register |
| 6 | DIO 7 | RQS MSS | Request service (read by serial poll) Master summary status (read by *STB?) |

The SGPF status byte can be read in the following ways:

- **By the query *STB?**

MSS (master summary status) is transferred in this case as bit 6. MSS is 1 if at least one bit in the status byte and the corresponding bit in the service request enable register (SRE) are set.

The contents of the status byte, including the MSS bit, are output in decimal. However, it is not possible to recognize in this way whether the MAV bit is set. Reading does not change the status byte nor does it clear any service request.

- **By a serial poll**

(With R&S controllers: IECSPL address, status)
The contents are transferred in the form of a binary byte. RQS (request service) is sent as bit 6. RQS is set if the addressed device has caused the service request. Then the RQS bit is reset to 0 and the service request is inactive; the remaining bits of the status byte are not changed. RQS is also cleared if MSS is cleared, eg by clearing the service request enable register (SRE).

The status byte is cleared:

- By *CLS at the beginning of a command line.

At the beginning of a command line the output buffer (and thus the MAV bit) is cleared. *CLS clears the event status register (and thus the ESB bit). This causes the MSS and the RQS bits as well as the service request to be cleared.

- By responding to the entries in the status byte:
  With the MAV bit set:
  by reading the contents of the output buffer (IECIN address,A$)
  With the ESB set:
  by reading the event status register (*ESR?)

This also clears the MSS and RQS bits in the status byte as well as the service request.

### Program example

In this example, a service request is issued if an error is detected and subsequently identified from the event status register. (The command set of the IEC/IEEE-bus controller PCA5 is used; the IEC/IEEE-bus address of SGPF is assumed to be 8).

```
10 IECTERM 10        ...............................    Input terminator: NL
20 ON SRQ GOSUB 100
30 IECOUT 8, "*CLS; *HDR 0; *ESE 60; *SRE 32"
:                            | ........|..........     For service request in the case
:                                                      of an error
100 REM
110 REM    SERVICE REQUEST ROUTINE
120 REM
130 IECSPL 8, S%
140 IF (S% AND 64) = 0 THEN GOTO 300
150 IECOUT 8,"*ESR?"
160 IECIN 8,E$   ...  ...............................  SRQ not from SGPF?
170 E% =VAL(E$)   . .  ...............................  Read event status register
180 IF (E% AND 32) <>0 THEN PRINT "COMMAND ERROR"
190 IF (E% AND 16) <>0 THEN PRINT "EXECUTION ERROR"
200 IF (E% AND  8) <>0 THEN PRINT "DEVICE-DEPENDENT ERROR"
210 IF (E% AND  4) <>0 THEN PRINT "QUERY ERROR"
220 ON SRQ GOSUB 100
230 RETURN
240 REM
300 REM service request from another unit
:
:
380 ON SRQ GOSUB 100
390 RETURN
```

**Note:** If the status byte is changed during the execution of the SRQ routine and if there is still a condition for a service request, the SRQ line goes active again. The result may be that after executing the SRQ routine the controller again detects a SRQ.

### 3.3.8   Timing of Command Execution and Synchronization

Commands received by the SGPF are first stored in an input buffer which can hold a maximum of 255 characters. After the delimiter has been received, the commands are executed in the sequence in which they have been sent. During this time, the IEC/IEEE bus may be used for communication with other devices.

**Note:**

*Command lines exceeding the input buffer capacity result in errors.*

Commands *OPC and *OPC? (operation complete) are used for signalling back the time when the execution of the commands received has been terminated and the output signal of the SGPF has settled to the new values.

*OPC sets bit 0 in the event status register so that a service request can be triggered when all preceding commands have been executed.

*OPC? places the message "1" in the output buffer and sets bit 4 (MAV) in the status byte if all preceding commands have been executed.

This synchronization method is recommended if another device requiring the settled signal of the SGPF is to be requested to start a measurement via the IEC/IEEE bus.

After *WAI the SGPF delays the execution of new commands until all preceding commands have been completely executed. This prevents the execution of commands to overlap.

### 3.3.9   Error Handling

All errors detected by the SGPF in connection with IEC/IEEE-bus control are signalled by setting a bit (bit 2, 4 or 5) in the event status register (see Table 3-14). These bits remain set until the event status register is read out or cleared by means of command *CLS. This complies with IEEE 488.2 and permits issuing a service request and program-controlled error evaluation.

**Program example**

(The command set of the IEC/IEEE-bus controller PCA5 is used; the IEC/IEEE-bus address of the SGPF is assumed to be 8).

This program shows a simple synchronization method. Query *OPC? generates a message as soon as all preceding commands have been executed and the SGPF output signal has settled. Since this message is to be read into line 30, the bus handshake is stopped until the message is available and the SGPF output signal has settled.

```
10 IECTERM 10
20 IECOUT 8, "SIG 12; AMPL 0.65; *OPC?"
30 IECIN 8,A$: REM A$ no longer used
40 REM From now on, signal 12 is available at the SGPF output
50 REM with an amplitude of 0.65 V. Since the signal of the
60 REM SGPF is only changed if the full field changes and since
70 REM the output amplitude requires a certain time for
80 REM settling, it may take up to about 120 ms before the OPC
90 REM message is output in line 30.
 :   :
 :   :
```

## 3.3.10    Resetting Device Functions

The table below holds the various commands and events causing a reset of individual device functions.

**Table 3-15** Resetting device functions

| Event / Effect | Switching on operating voltage | | CAL/VAR key pressed? = MASTER RESET | DCL, (Device Clear) SDC (Selected Device Clear) | *RST | *CLS |
|---|---|---|---|---|---|---|
| | Power On Status Clear Flag | | | | | |
| | 0 | 1 | | | | |
| Basic device setup | -- | -- | yes | -- | yes | -- |
| Clearing event status register ESR | yes | yes | yes | -- | yes | yes |
| Clearing ESE and SRE registers | -- | yes | yes | -- | -- | -- |
| Clearing output buffer | yes | yes | yes | yes | -- | 3) |
| Clearing service request | yes | 1) | yes | 2) | 2) | 3) |
| Messages from SGPF with header | -- | -- | yes | -- | yes | -- |
| Resetting command processing and clearing input buffer | yes | yes | yes | yes | -- | -- |

1) Yes, but "service request on power on" possible.
2) Yes, if only caused by a message in the output buffer.
3) Yes, if *CLS is sent at the beginning of a command line.

# 4 Maintenance

The SGPF requires no regular maintenance.

**Note:** *This chapter describes troubleshooting at the module level. For troubleshooting at a deeper level, we recomment the Service Manual with the order number: 2016.4149.24.*

## 4.1 General Information

### 4.1.1 Cleaning

It is recommended that a soft, lint-free duster or a brush be used for cleaning on the outside. For heavier soiling, meths or mild detergents may be used. Do not use any nitro thinners, acetone, etc. since these solvents may damage the front-panel labelling or plastic parts (keys).

### 4.1.2 Storage

The instrument can be stored at temperatures between -40 and + 70°C.
The instrument should be protected against dust if it is stored for a prolonged period.

### 4.1.3 Opening and Closing the Instrument

▶ Switch off the instrument and disconnect the power plug.
▶ Disconnect all other cables.
▶ Unscrew the two supporting feet from the rear panel (2 screws each).
▶ Use a small screwdriver to lift off the upper cover. To do this, insert the screwdriver in the recess on the side near the supporting feet.
▶ If necessary, unscrew the shielding plate from the process controller (rear PC board) or from the generator (front PC board).

To close the instrument, proceed in reverse order. When sliding on the cover, make sure that it fits tightly in the frame. When screwing down the feet, press the cover to the instrument until it locks in position.

### 4.1.4 Replacing the Lithium Battery

The SGPF has a RAM which is backed up by a lithium battery. The service life of this battery depends on how the instrument is used (eg after long storage at high temperatures). The battery should be replaced from time to time (about once in three years) by one of the same type. To open the instrument, proceed as described in section 4.1.3 and replace the battery properly (solder lugs and use cable ties for fastening).

**CAUTION:** The battery used in the instrument is a high-power lithium cell. It must not be short-circuited or recharged under any circumstances. Do not open used cells and handle them as HAZARDOUS WASTE.

## 4.2 Checking the Crystal Oscillator

The crystal oscillator of the generator is subject to aging. To maintain the accuracy of $4 \times 10^{-6}$, the oscillator should be checked once a year and readjusted, if required. For measuring the clock frequency of 15 MHz refer to section 4.3.2.

# 4.3 Checking the Rated Specifications

Checking the main performance data of the SGPF is described in the following. After replacing components, readjustment may be necessary for which the following instruments are required:

▶ Video Noise Meter       UPSF 2
▶ TV Digital Oscilloscope     ODF
▶ Video Timing Analyzer      TIF
▶ Frequency counter
▶ 200-kHz highpass filter 75Ω
▶ RMS Voltmeter           URE 2

## 4.3.1 Signal Amplitude
(see Fig. 4-1)

The signal amplitude is measured with the aid of the Video Noise Meter UPSF 2. The SGPF signal is applied to the rear test input of the UPSF 2. The test signal CCIR 17 is selected on the generator. The reference bar measurement of the UPSF 2 allows the amplitude to be measured in a line of the picture (eg line 30). The first sampling point must be set to 17 µs and the second to 37 µs. At the UPSF 2 monitor output, the following signal should now be in the line selected:

Readout on the UPSF 2 is:       **700 mV ± 4 mV.**

If the SGPF is set to VAR, the setting range of the signal amplitude can be checked. It is between
**347 mV and 992 mV.**

The signal amplitude measurement is repeated for the second generator output. The TV Digital Oscilloscope ODF or the Video Timing Analyzer TIF can also be used for these measurements.

## 4.3.2 Clock Frequency

The SGPF clock frequency can be measured indirectly based on the line frequency of the composite sync (output X7, rear panel) in the line-repetitive mode.
**15625 ± 0.0625 Hz**

However, the clock frequency can also be measured directly. To this effect, remove the panelling and the shielding cover of the generator board and measure at pin 1 of D300.
The clock frequency is:
**15 MHz ± 60 Hz**
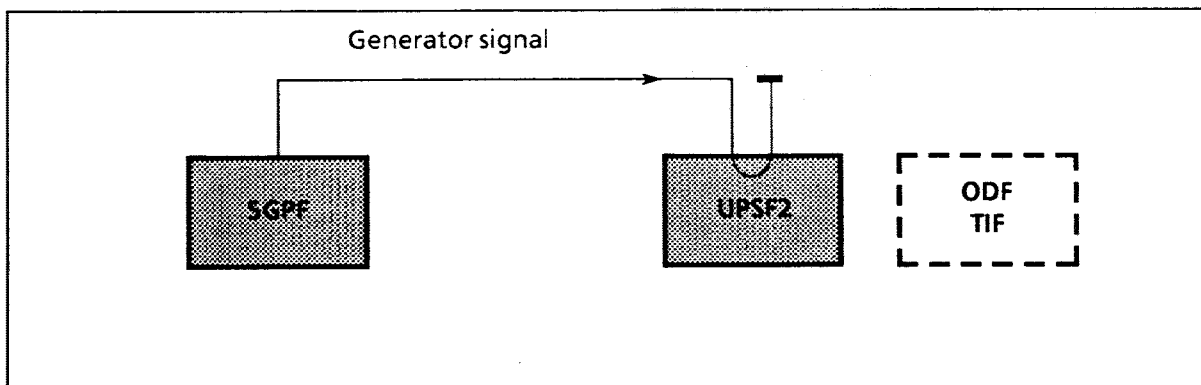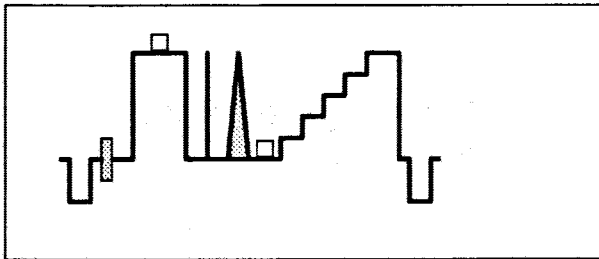




**Fig. 4-1**     Test setup for measuring signal amplitude

### 4.3.3 Signal Waveform
(see Fig. 4-2)

SGPF Signal generation is purely digital, ie the signal is stored in the form of samples and converted to analog form by means of a D/A converter. A fault in the digital generation may affect all signals. A ramp signal is best for checking the performance of the generator, since it runs through all steps of the D/A converter. An oscilloscope triggered by the H sync pulse of the CCVS is used for checking.

The signal is checked for quality. The ramp rises by 3 mV approximately every 200 ns. Apart from a small ripple caused by the glitches of the D/A converter, the signal should rise monotonically.

The quality of the ramp signal can also be checked by measuring the S/N ratio using the UPSF 2. The test setup in section 4.3.1 is required, the signal being applied via an external 200-kHz highpass filter (UPSF2-Z); see Fig. 4-2.

A full-field S/N ratio measurement should yield the following result (referred to 0.7 V of UPSF 2):
$\geq$ 70 dB, rms, weighted, 0.2 to 5 MHz
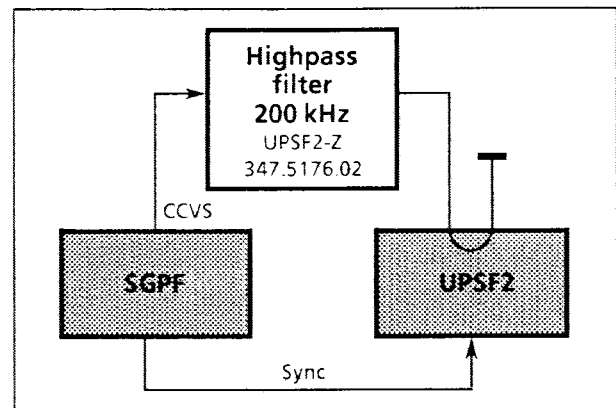


**Fig. 4-2**     Test setup for measuring S/N ratio

# Waveforms of TV Generator PAL SGPF

## Overview

Signal description follows the order in which the front-panel keys are arranged.
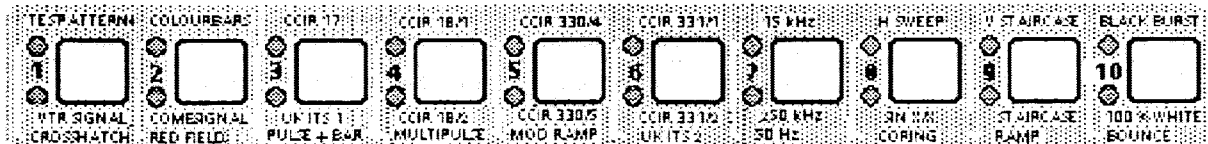


| Key No. | Direct signal selection | | | Page |
|---|---|---|---|---|
| | Text top LED top (a) | Text centre LED bottom (b) | Text bottom both LEDs (c) | |
| 1 | TEST PATTERN | VTR SIGNAL | CROSSHATCH | 7.2 to 7.3 |
| 2 | COLOUR BARS | COMB SIGNAL | RED FIELD | 7.4 |
| 3 | CCIR 17 | UK ITS 1 | PULSE + BAR | 7.5 |
| 4 | CCIR 18/1 | CCIR 18/2 | MULTIPULSE | 7.6 |
| 5 | CCIR 330/4 | CCIR 330/5 | MOD RAMP | 7.7 |
| 6 | CCIR 331/1 | CCIR 331/2 | UK ITS 2 | 7.8 |
| 7 | 15 kHz | 250 kHz | 50Hz | 7.9 |
| 8 | H SWEEP | SIN X/X | CORING | 7.10 to 7.11 |
| 9 | V STAIRCASE | STAIRCASE | RAMP | 7.12 |
| 10 | BLACK BURST | 100 % WHITE | BOUNCE | 7.13 |

50% grey pedestal (signal #0): Selectable by pressing keys CAL / VAR and 10 together
(indicated by upper LEDs 8 and 10)

## Test Signal 1a  TEST PATTERN

*Description:*

This universal test pattern is internationally used for testing TV receivers. It comprises a number of signal elements which permit virtually all distortions of a receiver, for instance, to be assessed at at glance. As an option, the FuBK test pattern can be implemented as well.

*Uses:*

| No. | Designation | Aspects checked |
|---|---|---|
| 1 | Border | Picture size, deflection, effect of blanking, synchronization |
| 2 | Crosshatch, circle | Convergence, linearity, beam deflection, focussing and geometrical distortion |
| 3 | Anti PAL + V, ± U | Group delay errors in the PAL decoder, no delay errors = areas colourless |
| 4<br>4a<br>4b<br>4c<br>4d<br>4e<br>4f | R-Y, G-Y and B-Y<br>B-Y = 0, $\phi_{sc}$ = 270°<br>B-Y = 0, $\phi_{sc}$ = 90°<br>G-Y = 0, $\phi_{sc}$ = 326°<br>G-Y = 0, $\phi_{sc}$ = 146°<br>R-Y = 0, $\phi_{sc}$ = 180°<br>R-Y = 0, $\phi_{sc}$ = 0° | Colour decoding |
| 5 | Black window and pluge (no text) | Streaking, rounding, brightness adjustment of monitors |
| 6 | White window with negative-going 2T pulse | Reflection, group delay |
| 7 | 250 kHz squarewave | Overshoot |
| 8 | Colour bars | Colour characteristics |
| 9 | Centre marker | Picture centering |
| 10 | Multiburst | Resolution (0.8 MHz, 1.8 MHz, 2.8 MHz, 3.8 MHz, 4.8 MHz) |
| 11 | 6-step staircase | Linearity, brightness and contrast |
| 12 | Black window with positive-going 2T pulse (no text) | Reflection, group delay |
| 13 | Yellow-red-yellow | Chrominance-to-luminance delay differences |
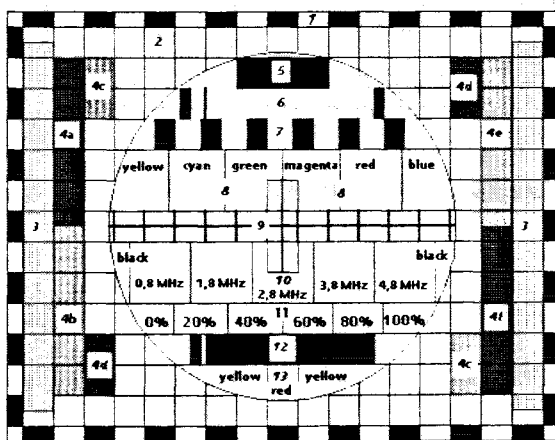


Universal test pattern
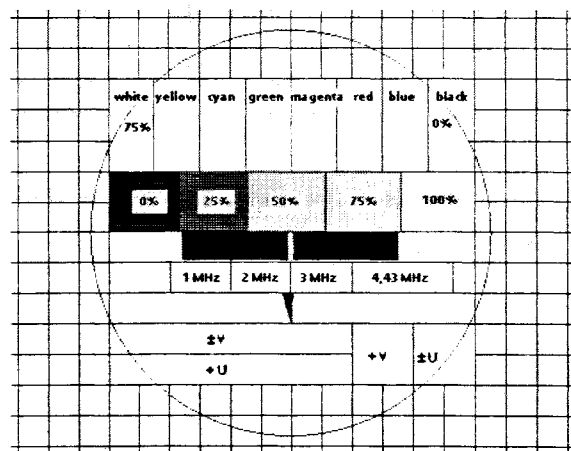


FuBK test pattern

Signal 1a  TEST PATTERN

## Test Signal 1b      VTR SIGNAL

*Description:*

At the beginning of the picture, the test line region is repeated three times at a spacing of 16 lines. The remaining picture area consists in half of the CCIR 330 signal, in half of the EBU colour bar 100/0/75/0.

*Uses:*

The signal is used as the reference leader for manual or automatic adjustment of video tape recorders (according to CCIR Rec. 469-3). With the test lines being repeated three times, each video head can be examined separately using a test line analyzer

| Luminance bar | | 2T pulse | | Staircase | | | |
|---|---|---|---|---|---|---|---|
| white | yellow | cyan | green | mag. | red | blue | black |
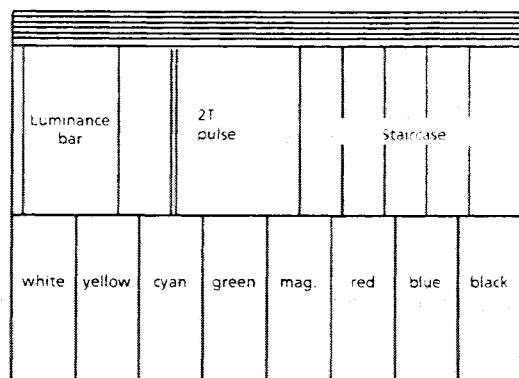
Test lines repeated three times

CCIR330

Colour bars

Signal 1b   VTR SIGNAL

## Test Signal 1c      CROSSHATCH

*Description:*

The signal consists of    18 vertical and 14 horizontal lines (universal test pattern) or
19 vertical and 15 horizontal lines (FuBK test pattern).

The vertical lines are produced by 2T pulses at 100% amplitude, whereas the horizontal lines are all-white lines at 100% amplitude, (1 all-white line per field).

*Uses:*

This signal permits convergence errors and geometrical distortion of TV receivers and monitors to be assessed. In the case of convergence errors, the lines are no longer white but run into the three primary colours RGB. In the case of geometrical distortion, the squares do not have the same size over the whole screen and are not quadratic.
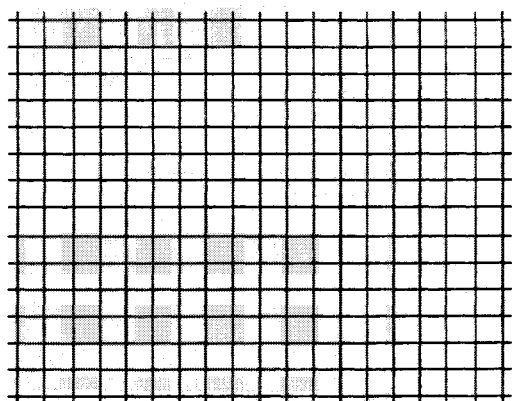
Horizontal lines:      one all-white line

Vertical lines:      19 (18) × 2T pulse

Signal 1c   CROSSHATCH

## Test Signal 2a      COLOUR BARS

*Description:*

According to CCIR and EBU specifications, the colour bars exhibit 100% luminance amplitude and 75% colour saturation.

*Uses:*

The colour bars are the standard signal for testing and adjusting phase and level of a CCVS. Especially colour coding during signal generation can be checked rapidly and easily on a vectorscope.

## Test Signal 2b      COMB SIGNAL

*Description:*

This signal consists of a white window (100% amplitude), a pluge signal ($\pm 2\%$ amplitude), a 2T pulse and a modulated 20T pulse with 100% amplitude each. The signal elements are arranged on a black background (0% amplitude).

*Uses:*

The built-in window makes field-repetitive tilts (50 Hz) and line-repetitive tilts (15 kHz) directly visible on the monitor. The same holds for reflection and echos.
This signal is furthermore used for adjusting the brightness of monitors.

## Test Signal 2c      RED FIELD

*Description:*

Amplitude, phase and rise time of the red field are the same as those of the red bar in the 100/0/75/0 colour bar signal (test signal 2a).

*Uses:*

The red-field signal is particularly suited for assessing and measuring unwanted amplitude and phase noise of the colour subcarrier, such as it occurs especially with VTRs.

The signal is also used for measuring intermodulation products of colour subcarrier and sound subcarrier in system B/G (1.07-MHz moiré patterning)



Signal 2a
COLOUR BARS
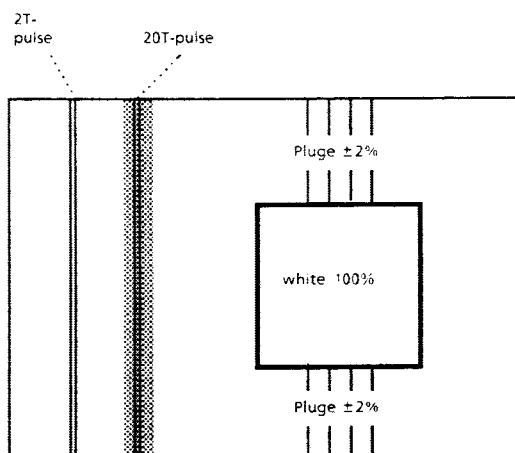
Signal 2b
COMB SIGNAL
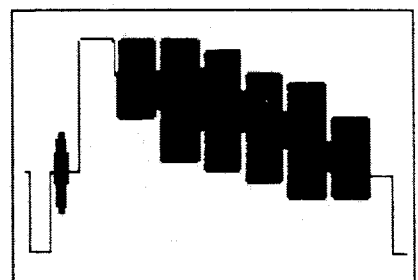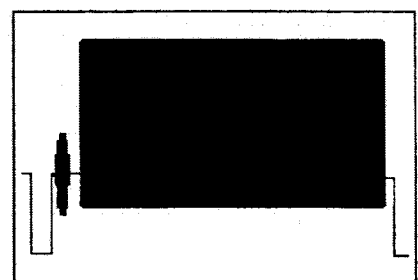
Signal 2c
RED FIELD

## Test Signal 3a     CCIR 17

*Description:*

The line begins with a luminance bar which is followed by a 2T pulse, a modulated 20T pulse and a 5-step staircase.

*Uses:*

The setup of the signal complies with CCIR Recommendation 473-4. The signal is mostly used as a test line for automatic measurement and monitoring of TV transmitters. The luminance bar furthermore serves as the amplitude reference for automatic level control. The CCIR 17 signal allows the following distortions to be measured:

Luminance bar:    level errors, line-repetitive tilt, overshoot and rounding

2T pulse:             amplitude errors, pulse distortion and reflection

20T pulse:           amplitude and group delay between luminance and chrominance

Staircase:            Luminance non-linearity

## Test Signal 3b     UK ITS 1

*Description:*

This insertion test signal contains a luminance bar followed by a 2T pulse, a modulated 10T pulse and a 5-step staircase with superimposed chrominance subcarrier. The signal is in line with standard specifications in Great Britain.

*Uses:*

The signal allows the same errors to be measured as the insertion test signals CCIR 17 and 330.

## Test Signal 3c     PULSE + BAR

*Description:*

The signal contains the modulated 10T pulse, the 2T pulse and the 15-kHz squarewave in one line. All pulses are generated with 100% amplitude.

*Uses:*

As the pulses directly follow one another, frequency-dependent amplitude errors such as streaking, sag and tilt, and reflection can be easily assessed on an oscilloscope.

The distortion of the 10T pulse furthermore allows luminance-to-chrominance intermodulation and group delay errors to be determined.
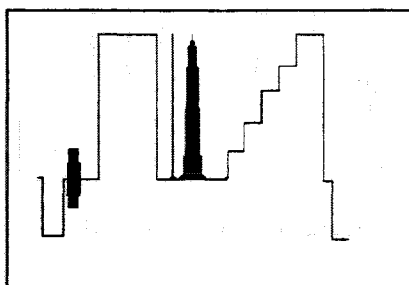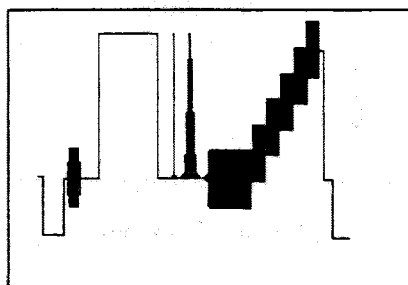


Signal 3a   CCIR 17          Signal 3b   UK ITS 1          Signal 3c   PULSE + BAR
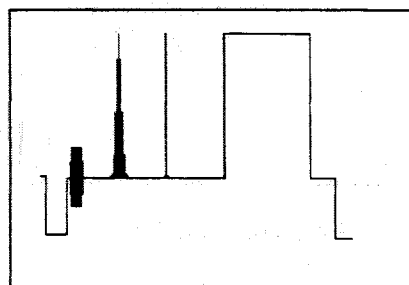
## Test Signal 4a      CCIR 18/1

## Test Signal 4b      CCIR 18/2

*Description:*

The CCIR 18 multiburst signal is generated in two versions:

**Test signal 4a**
According to CCIR Rec. 473-4 with a squarewave reference pulse and 6 sinewave bursts of 0.5 MHz, 1.0 MHz, 2.0 MHz, 4.0 MHz, 4.8 MHz and 5.8 MHz (420 mV$_{pp}$ at 50% luminance).

**Test signal 4b**
According to the specifications of the German PTT with a 0.2-MHz reference signal and 4 sinewave bursts of 0.5 MHz, 1.5 MHz, 3.0 MHz and 4.43 MHz (420 mV$_{pp}$ at 50% luminance).

*Uses:*

The multiburst signal allows amplitude/frequency response distortions to be assessed. Therefore, the signal is also used as a test line in the automatic measurement and monitoring of TV transmitters.

## Test Signal 4c      MULTIPULSE

*Description:*

A luminance bar and a 2T pulse at 100% amplitude at the beginning of the line are followed by a number of modulated sin$^2$ pulses at 100% amplitude:

- 20T pulse modulated with 1 MHz
- 10T pulse modulated with 2 MHz, 3 MHz, 4 MHz and 5 MHz

*Uses:*

The amplitudes of the modulated sin$^2$ pulses are referred to the luminance bar at the beginning of the line to determine the amplitude/frequency response. Thus, the deviation from the nominal amplitude can be determined for each frequency. To determine the group-delay/frequency response, the baseline distortion of the individual pulses or the amplitudes of the sinewaves which are symmetrical about the pulse centre are evaluated.
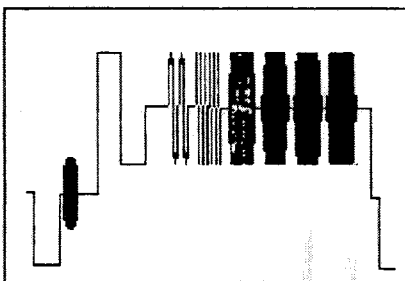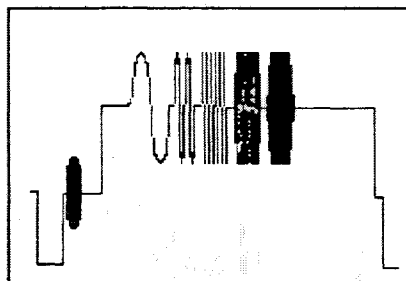


Signal 4a   CCIR 18/1          Signal 4b   CCIR 18/2          Signal 4c   MULTIPULSE
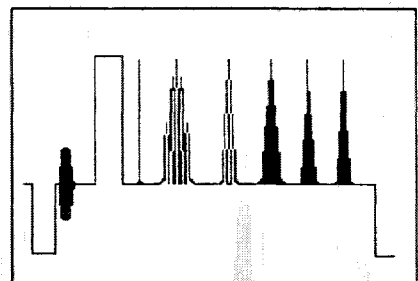
**Test Signal 5a     CCIR 330/4**

**Test Signal 5b     CCIR 330/5**

*Description:*

These insertion test signals resemble the CCIR 17 signal. The luminance bar and the 2T pulse are followed by a 5-step staircase with superimposed colour subcarrier (280 mV$_{pp}$). The colour subcarrier is either superimposed on the first 4 steps (CCIR 300/4) or on all 5 steps (CCIR 330/5).

*Uses:*

The staircase signal allows non-linear distortions in the colour subcarrier region to be determined (differential gain and differential phase). By using the two signals alternately, it is possible to assess the distortion caused by the top step. This furthermore permits to determine which part of the DUT characteristic is used. The CCIR 330/5 signal complies with CCIR Rec. 473-4 and is used as a test line in the automatic measurement and monitoring of TV transmitters.

**Test Signal 5c     MOD RAMP**

*Description:*

A colour subcarrier with 200 mV$_{pp}$ is superimposed on a sawtooth with 100% amplitude.

*Uses:*

The signal is used for measuring non-linear distortions in the colour subcarrier region (differential gain, differential phase).
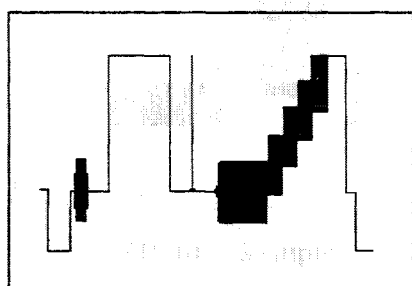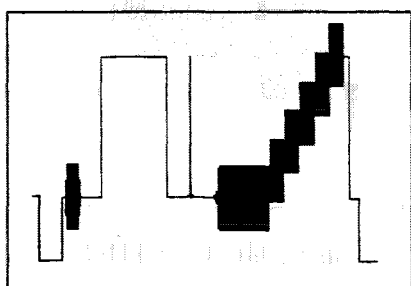


Signal 5a    CCIR 330/4          Signal 5b    CCIR 330/5          Signal 5c    MOD RAMP
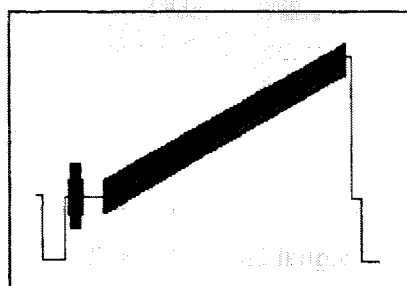
**Test Signal 6a       CCIR 331/1**

**Test Signal 6b       CCIR 331/2**

*Description:*

According to CCIR Rec. 473-4 the signal is generated in two versions:

**Test Signal 6a**

Two colour subcarrier bursts are superimposed on a 50% grey pedestal.
The first burst is multipedestal with 20%, 60% and 100% amplitude. The second burst has a constant amplitude of 60%.

**Test Signal 6b**

Two single-pedestal colour subcarrier bursts are superimposed on a 50% grey pedestal.
The first burst is at full amplitude, whereas the second one is of 60% amplitude.

*Uses:*

These signals enable transmission errors in the colour subcarrier region to be determined. The CCIR 331/1 signal is used for assessing simple amplitude errors as well as non-linear amplitude and phase errors as a function of the colour subcarrier amplitude. It furthermore allows luminance-to-chrominance intermodulation to be determined, with system B/G also intermodulation between colour subcarrier and sound subcarrier (1.07-MHz moiré patterning). The signal is used as a test line in the automatic measurement and monitoring of TV transmission systems.

**Test Signal 6c       UK ITS 2**

*Description:*

The signal resembles the CCIR 331/2 signal. The full-amplitude colour subcarrier burst is superimposed on a 50% grey pedestal, whereas the second colour subcarrier burst of 43% amplitude (300 mV$_{pp}$) is superimposed on the black level.

*Uses:*

The signal is used as a test line in the automatic measurement and monitoring of TV transmitters. It is in line with standard specifications in Great Britain. It enables evaluation of the same parameters as the CCIR 331 signal.
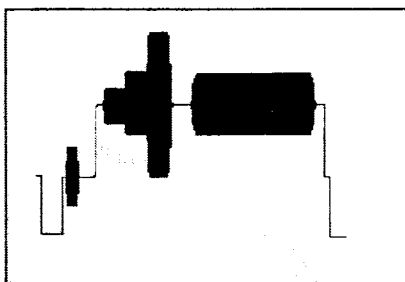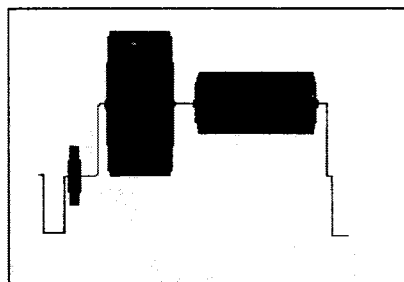


Signal 6a   CCIR 331/1        Signal 6b   CCIR 331/2        Signal 6c   UK ITS 2
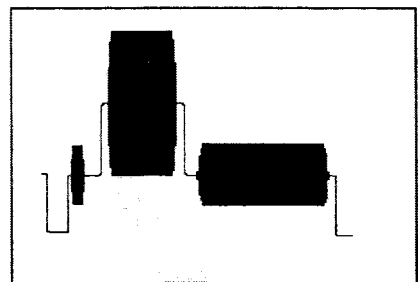
## Test Signal 7a      15-kHz Squarewave

*Description:*

A line-repetitive squarewave signal with an amplitude of 100% and a rise time of 200 ns is generated.

*Uses:*

The signal is used for measuring the gain and the pulse transmission response in the lower frequency range, which is shown by line-repetitive sag and tilt.


## Test Signal 7b      250-kHz Squarewave

*Description:*

This signal is a squarewave pulse train with a rise time of 200 ns and a frequency of 250 kHz.

*Uses:*

The signal is used for measuring the pulse transmission response in the medium frequency range, e.g. overshoot and rounding.


## Test Signal 7c      50-Hz Squarewave

*Description:*

The signal is a field-repetitive squarewave, which means that the upper half of the screen is black and the lower one is white at 100% amplitude.


*Uses:*

The signal allows errors in the bottom frequency range of the video signal to be detected such as they are caused by faulty clamping circuits. Such errors are displayed as field-repetitive sag and tilt or as black-level discontinuities.
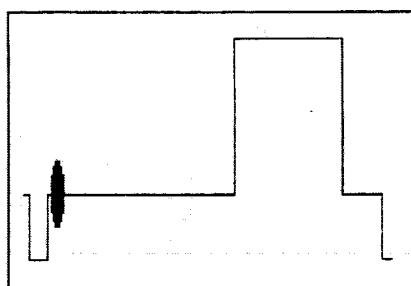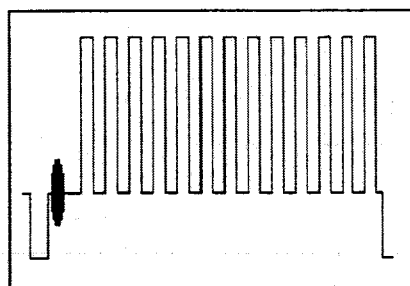
Signal 7a   15-kHz Squarewave      Signal 7b   250-kHz Squarewave      Signal 7c   50-Hz Squarewave
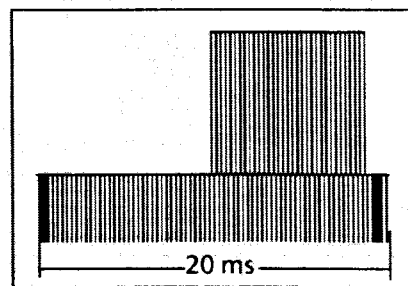
## Test Signal 8a    H SWEEP

### Description:

With this signal the complete video-frequency range is swept over the length of one line from 5.5 MHz at the start of the line through 0 Hz at midline to 5.5 MHz at the end of the line. The signal is produced with an amplitude of 100%, exhibits constant frequency response over the entire frequency range at high energy density and is superimposed on a 50% grey pedestal. It is generated with 0° phase (upper half of the picture) and 90° phase (lower half of the picture).

### Uses:

If the signal is evaluated in the time domain, the amplitude/frequency response and frequency-dependent phase distortion are made visible. With a pure amplitude/frequency response, the sweep envelope is distorted symmetrically about midline, whereas in the case of pure group-delay distortions a non-symmetrical ripple of the sweep envelope with respect to midline is obtained. If both amplitude/frequency response and group-delay distortions are present, the non-symmetrical ripple and the envelope which is symmetrical about midline are superimposed.

As the H sweep is produced with 0° and 90°, it is possible to display amplitude and phase response in the frequency domain by means of a complex Fourier transform without the disturbing dips which are due to the sync pulses.
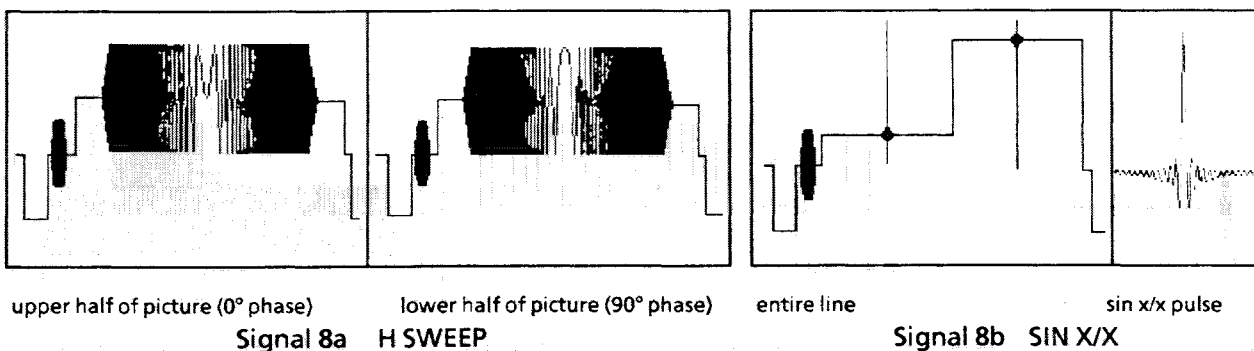
## Test Signal 8b    SIN X/X

### Description:

The sin x/x pulse is produced by applying an as ideal as possible spike (Dirac delta function) to a group-delay-corrected filter. The spike thus produced features constant energy distribution over the entire frequency range.

The sin x/x signal of the SGPF contains two of these pulses. The first pulse with positive polarity and an amplitude of 560 mV is superimposed on a 140-mV grey pedestal, the second one with negative polarity and an amplitude of 560 mV on a 560-mV grey pedestal. The sin x/x signal is dimensioned for a video bandwidth of 5 MHz.

### Uses:

The sin x/x signal can be evaluated directly on a spectrum analyzer, for instance in order to determine the frequency response of the DUT. To assess also the effect of non-linear distortion, the sin x/x pulse is generated both with positive and with negative polarity. Non-linear distortions are present if two different envelopes appear on the spectrum analyzer.

Moreover, the signal is a highly sensitive indicator for group-delay response which is shown on an oscilloscope by the different amplitudes of preshoot and postshoot.



upper half of picture (0° phase)    lower half of picture (90° phase)    entire line    sin x/x pulse

Signal 8a    H SWEEP    Signal 8b    SIN X/X

## Test Signal 8c    CORING

*Description:*

The coring signal consists of three triangular pulses modulated with 1 MHz, 2 MHz and 3 MHz. Each of the pulses has a width of 16 µs and an amplitude of 70 mV$_{pp}$ on a 50% grey pedestal.

*Uses:*

Coring circuits are used in cameras and video recorders and help to improve the S/N ratio. The coring circuit eliminates high-frequency noise of low amplitude by "selective muting". However, this may impair the resolution of fine picture details. The coring signal is an important tool for adjusting and checking the switch-off level of coring circuits.
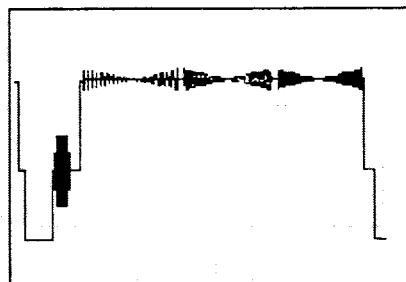
Signal 8c   CORING

## Test Signal 9a     V STAIRCASE

*Description:*

With this signal the screen is subdivided into eleven horizontal bars that cover the entire screen width and have a duration of 26 lines per field, which yields a vertical grey scale of constant step height. The luminance bar is at full amplitude, the scaling amounts to 10%.

*Uses:*

The signal is used for checking the linearity in the region of the frequency deviation in FM systems (e.g. video recorders).

## Test Signal 9b     STAIRCASE

*Description:*

The staircase consists of 10 steps with 10% amplitude each, the maximum amplitude (white) thus amounting to 100%.

*Uses:*

The signal enables the measurement of luminance non-linearity, e.g. using an oscilloscope with spike filter connected upstream.

## Test Signal 9c     RAMP

*Description:*

The signal is a full-amplitude sawtooth which is positive-going over the active line length.
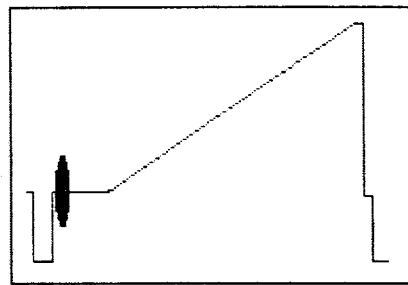
*Uses:*

Like the staircase signals, the sawtooth is used for checking luminance non-linearity. Furthermore, it is used for measuring the noise voltage over the entire range between black and white or the quantization noise in A/D and D/A converter systems.
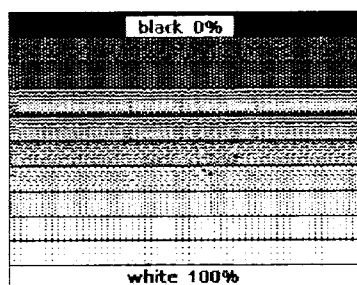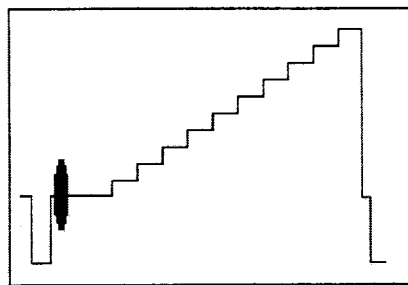
Signal 9a   V STAIRCASE          Signal 9b   STAIRCASE          Signal 9c   RAMP

## Test Signal 10a    BLACK BURST

*Description:*

The signal furnishes the standard composite sync of a PAL CCVS without picture contents. The black burst is furthermore generated with the correct PAL phase switching as well as with a standard and stable SC/H phase.

*Uses:*

The signal can be used as the reference clock for synchronizing other equipment. For use in studios and in program follow-up, it is possible (like with all other signals) to insert a luminance bar into line 7 of the first field of the PAL eight-field sequence for identification.

## Test Signal 10b    100 % WHITE

*Description:*

The signal features 100% amplitude over the entire picture.

*Uses:*

The signal is used for noise voltage measurements at 100% white level as well as for setting the maximum beam current of a TV receiver or monitor.

In FM systems, the signal is used for measuring the maximum frequency deviation.

## Test Signal 10c    BOUNCE

*Description:*

The APL (average picture level) is automatically switched over between 10% ( = 10% luminance = black) and 90% ( = 90% luminance = white). The period can be set between 0.08 and 16 seconds via the IEC-625/IEEE-488 bus.

*Uses:*

The sudden change of the APL is particularly useful for testing clamping circuits. Moreover, it is possible to check the effect of the APL on other linear and non-linear distortions that can be measured in the test lines.
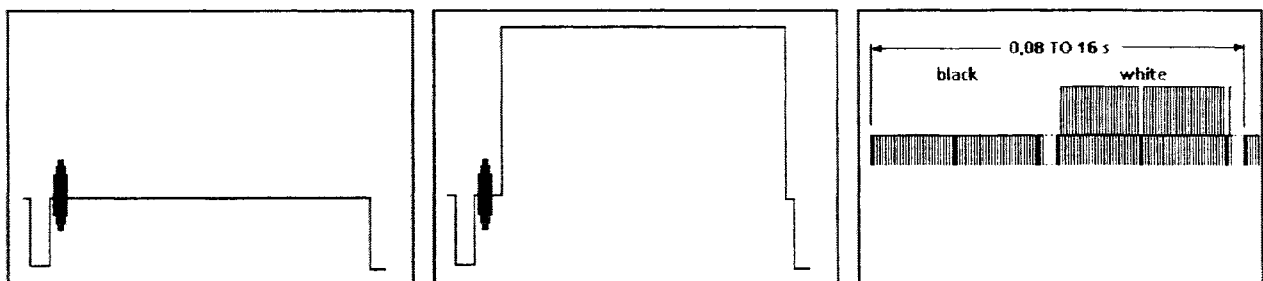


Signal 10a  BLACK BURST          Signal 10b  100 % WHITE          Signal 10c  BOUNCE

Description

# JUNCTION PANEL

# SG.F-Z
**2016.1679.02**

# SG.F-Z  Contents

# 1 Characteristics

## 1.1 Description

The Junction Panel with Bypass SG.F-Z 2016.1679.02 is designed for use in the TV Generators SGMF, SGSF, SGPF and SKDF. It contains a bypass device providing delay equalization of the program path with test signal insertion.

If one of the operating voltages in the generator is not present, the passive bypass is activated via a control line. For this purpose, jumper X170 of the generator must be set to position 2-3.

In this position of the link, connector X7 of the generators does not provide the sync signal but the voltage for energizing the bypass relay. To indicate this state, connector X7 should be marked with the label "bypass".

The Junction Panel is also suitable for rackmounting. In the case of an error it is thus possible to remove the TV generator from the rack without interrupting the program.

## 1.2 Specifications

Input / outputs ......... 75 Ω BNC
Return loss ............. ≥ 34 dB up to 6 MHz
Crosstalk ............. ≥ 66 dB
at colour subcarrier
≥ 60 dB up to 6 MHz

*Amplitude/frequency response*
of delay line ........... ≤ 0.1 dB up to 6 MHz
Delay ............. 25 ns ± 5 ns
Temperature range ..... + 5 to + 45° C

*Order designation*
Junction Panel with Bypass SG.F-Z
2016.1679.02

# 2 Connectors
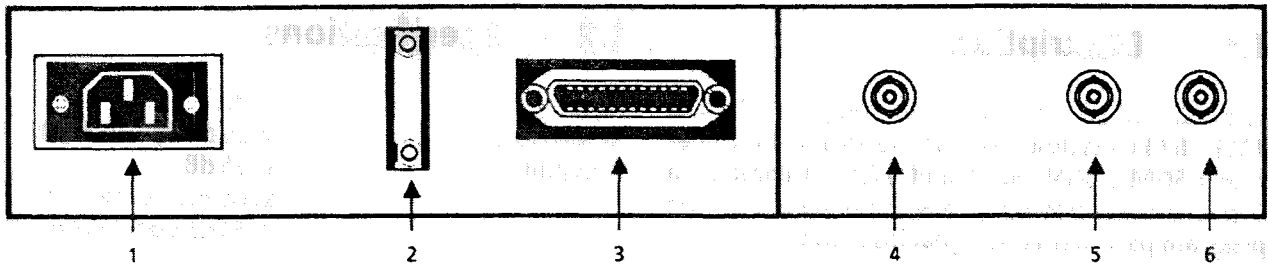


**Fig. 2-1** Connectors

| Item | Engraving | Function |
|------|-----------|----------|
| 1 | 47 to 63 Hz | Power connector |
| 2 | | Opening for protective ground link<br><br>⚠️ *Attention: See manual of Generator, section 2.1.3* |
| 3 | IEC 625<br>IEEE 488 bus | Connector for IEC 625/IEEE 488 bus |
| 4 | Programm<br>⊙→ | Program output socket 75 Ω |
| 5 | Programm<br>→⊙ | Program input socket 75 Ω |
| 6 | Generator<br>⊙→ | Generator output socket 75 Ω |

# 3 Circuit Description

## 3.1 Bypass

In the bypass function, no voltage is applied to X7 (either because the generator is switched off or due to incorrect operating voltage in the generator). Therefore, the program signal passes through the delay line via the contacts 9 and 8 of relay K103 and is then taken to the program output socket X11 via the contacts 5 and 6 of relay K103. In this case, the contacts 7 and 1 of relays K101 and K102 are open.

## 3.2 Normal Operation

A voltage of approx. + 4.8 V is available at X7. All relay contacts are closed. The program signal is taken to the test signal insertion circuit of the generator via the contacts 9 and 10 of K103 and via X6. With the test line added, the program signal leaves the generator via X5 and is passed on to the program output socket X11 via contacts 7 and 6 of K103. The relays K101 and K102 connect the input and output of the delay network to ground in order to minimize crosstalk.

# 4 Checking the Rated Specifications

## 4.1 Required Measuring Equipment

Sweep assembly for amplitude /
frequency-response and group-
delay measurements             LFM2
Power Supply                   NGT20
SWR bridge

## 4.2 Bypass Functions

Apply sweep signal to X10 (11); X7 must be open.
Measure at X11 (10):

Amplitude/frequency
response  . . . . . . . . . . . . . . . .  0 to 6 MHz ± 0.1 dB
Group delay  . . . . . . . . . . . . . .  0 to 6 MHz  ± 3 ns

Terminate X11 (10) with 75 Ω.

Measure return loss at
X10 (11)  . . . . . . . . . . . . . . . . .  0 to 6 MHz ≥ 34 dB

Repeat the measurements at the connectors in parentheses.

## 4.3 Normal Operation

Apply + 4.8 V to the inner conductor of X7.
Terminate X6 and X5 with 75 Ω.
Apply a sweep signal to X10 and measure at X11.

Crosstalk  . . . . . . . . . . . . . . . .  0 to 6 MHz ≥ 60 dB
                                           4.43 MHz  ≥ 66 dB

Return loss at X10 and X11     0 to 6 MHz ≥ 34 dB