- Digital analysis of seven teletext parameters
- Measurement of any TV line
- 16-bit microprocessor
- Frozen or continuous signal display
- IEC/IEEE-bus or RS-232-C interface
- Limit value monitoring
- Nonvolatile storage of operating states
- Remote measurement and data transmission via telephone network

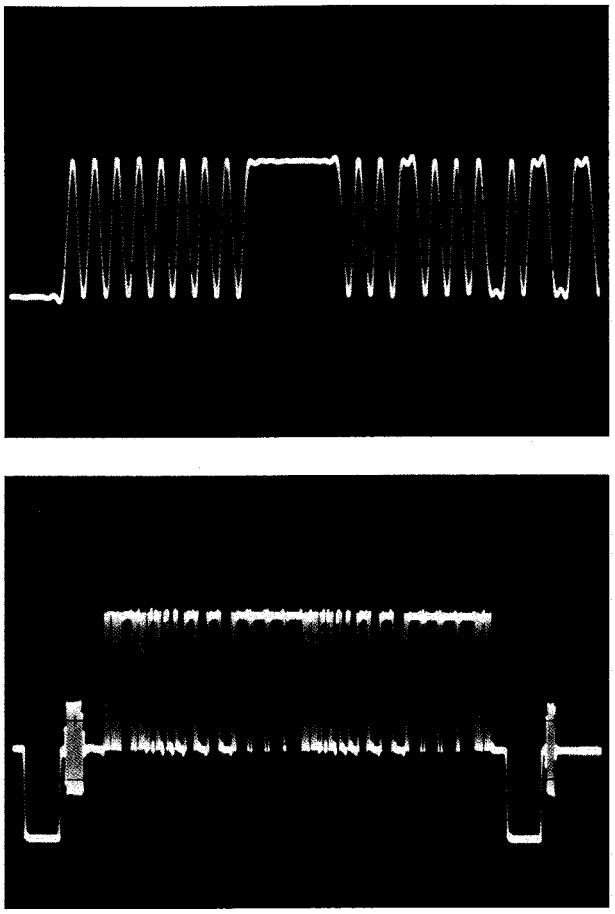
General

With its **Digital Teletext Analyzer ATF,** Rohde & Schwarz introduces a new and extremely versatile instrument designed to assess, measure and monitor teletext and test signals. The ATF may be manually operated with a fast response time for use in laboratory and servicing applications and is suitable in its automatic mode for quality monitoring and data logging. Its digital line memory can capture any of the 625 television lines and present them as digital samples to a powerful 16-bit microprocessor for scrutiny and analysis. This enables virtually any teletext parameter to be accurately assessed. The results from the chosen line are output on an alphanumeric display (see figures on page 8). Parameter and TV-line selection is by dedicated switches on the front panel.

Additionally, the slow-scan video facility allows expanded **continuous or frozen displays** of the selected TV line on an oscilloscope e.g. the R&S Oscilloscope BOL (data sheet 374 200). An oscilloscope triggering output is provided to enable a continuous or frozen linear eye diagram to be displayed upon selection of a TV line. The eye diagram is also expanded along the time axis. These facilities give a much brighter trace than conventional TV oscilloscopes allowing – at a comfortable brightness level – detailed visual analysis of not only the teletext data signal but any other TV waveform.

Remote measurement In the automatic mode, remote measurement and result logging are possible via an IEC/IEEE-bus or RS-232-C interface. In this case, an ATF master may remote-control all the functions of an ATF slave in the master-slave mode via the RS-232-C interface. Here it is of particular interest that the CCIR test signals are available as an analog oscillogram via the telephone network.

Application The Digital Teletext Analyzer ATF can be used wherever the teletext clock frequency is 6.9375 MHz. Models for systems with different clock frequencies are being prepared. The Digital Teletext Analyzer ATF is based on the NEMESIS development (Numerical Eye Measuring Equipment for Surveillance of Insertion Signals). After having been further developed and brought up to batch production standard by Rohde & Schwarz, the ATF will be manufactured under licence from the Independent Broadcasting Authority (IBA), Great Britain.



Slow video display of teletext test line 323, measured with ATF and displayed on Oscilloscope BOL

Characteristics and uses

Operation Thanks to its clear front-panel layout, operation of the Digital Teletext Analyzer ATF is simple. The keys are arranged in functional groups, selection of the functions being acknowledged by LEDs next to the keys. The alphanumeric matrix display (7×5 dots) enables texts to be read out in addition to numerical measured values. Luminous characters are used to display error and status messages.

Inputs and outputs The ATF is fitted with two (switch-selected) 75-Ω inputs for the video signal to be measured. To display the waveform and the eye diagram, an oscilloscope can be connected to the 75-Ω slow video output. A special front-panel output is provided for triggering. No Z signal is required for unblanking. The two outputs and the input are also accessible on the rear panel of the ATF where the connectors for the IEC/IEEE-bus and the RS-232-C interfaces are fitted too. All functions may be remotely controlled.

Measurement capability The following parameters can be measured with the Digital Teletext Analyzer ATF:

- decoding margin (eye height)
- timing margin (eye width)
- basic amplitude (teletext amplitude)
- peak-to-peak amplitude
- data timing (start of data code)
- number of run-in bits
- parity error rate
- signal/noise ratio and
- ITS bar amplitude.

Reference values The ATF accepts four different framing codes (start code in a teletext line) which are freely selectable. This allows the teletext test line (currently line 323 in the Federal Republic of Germany) to be measured in addition to the teletext data lines. The recognized framing code is indicated.

Reference levels The reference for measurement of the basic and the peak-to-peak amplitudes is the ITS bar amplitude. The nominal amplitude of the teletext high level is 66% of the incoming ITS white bar level. Therefore the ITS bar level can be used as the reference for teletext amplitude measurements. If the bar is absent in the user-selected line, the amplitude of the incoming sync pulse is used instead. The reference can also be set to 462 mV which is the fixed nominal value of the teletext bar amplitude.

The peak-to-peak amplitude can also be expressed as a percentage of the basic amplitude.

To measure the eye height, the basic amplitude is used as the reference. Thus it is possible to obtain comparable measurement values in the case of waveforms with different amplitudes. If required, the ITS bar amplitude (66%) or the fixed nominal value of 462 mV can be set as the reference.

Basic setup The position of the teletext line, the ITS line and the noise voltage test line as well as the four selected framing codes are stored in nonvolatile form. After switching the ATF on, measurement is thus possible without any initialization. The reference setup keys allow the default values to be slightly varied.

Noise voltage measurements For a rough check of the noise effects on teletext parameters, noise voltage can be measured up to values of 50 dB (rms, unweighted). The user may choose any TV line for this measurement. The reference is either the ITS bar amplitude or the nominal level of 700 mV.

Limit values All test parameters can be monitored by way of an upper and a lower limit. In this way, clear checking of all measurements for adherence to preset tolerances is possible. The limits can be selected by the user as required and stored in a nonvolatile EEPROM.

Limit value monitoring When monitoring the limits of all parameters, the ATF sequentially measures all parameters, checks the limit values and outputs the corresponding alarm messages. In the case of out-of-tolerance conditions, the LED associated with the corresponding parameter starts to blink.

When monitoring the limits of a specific parameter, the associated measured value is displayed. In addition, the LED of the corresponding parameter and the LED associated with the out-of-tolerance limit start to blink when the tolerance range is not observed.

Expansion The analog display capabilities of the ATF are of special interest, permitting any TV line to be displayed with an expansion factor of 256.

Video function With the video function switched in, any selected video line including sync pulse and burst can be displayed on an oscilloscope, the line being expanded from 64 µs to 256 × 64 µs = 16.4 ms. For the display, the internal 8-bit digital signal is reproduced in the form of an analog signal. The accuracy is satisfactory for in-service measurements and the possibility of transmitting this signal via telephone lines makes this function especially attractive.

Eye function The eye function enables a bright eye diagram of the teletext line to be displayed. Markers indicate the exact middle of the teletext data bits. The markers can be inserted separately.

Both the video and the eye function can be displayed in a continuous or frozen mode. Thus electronic "snapshots" can easily be produced; this considerably facilitates troubleshooting in the case of briefly disturbed video signals and, in fact, permits evaluation of the continuously varying teletext signal content.

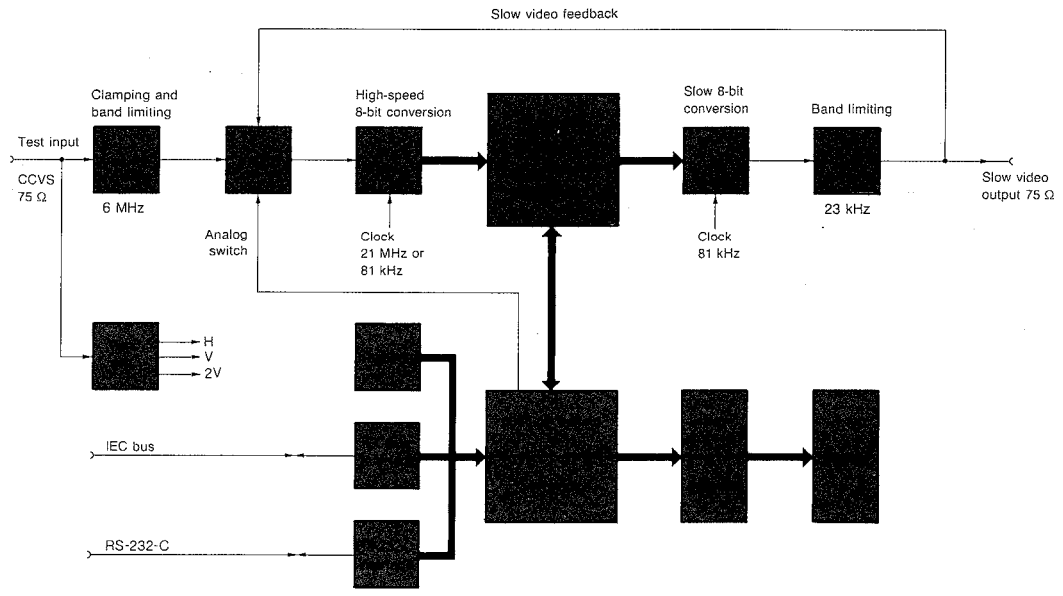
Description

The central subassemblies of the Digital Teletext Analyzer ATF are its **high-speed line memory and 16-bit microprocessor system** plus the associated software. First, the video signal is clamped to black level and band-limited to 6 MHz, then applied to an analog line switch. The latter enables the line that has been selected on the keyboard.

Computation of measured values The 8-bit conversion is performed at a high sampling rate of 20.8125 MHz (three times the teletext data rate of 6.9375 MHz). The sampled values are stored in the high-speed digital line memory once per frame; in the remaining time, the microprocessor has access to the line memory and produces all the measurement results using the appropriate calculation routines. In the case of the eye-height parameter, the calculation covers 8000 teletext bits, for which about 24 lines are required. Out of the 8000 teletext bits, the fourth highest 0 bit and the fourth lowest 1 bit are used to calculate the measured value. This corresponds to a reference error rate of 10^{-3}.

Measurement of eye height To measure the amplitude of each individual bit, phase-correct sampling of the teletext signal is required. The sampling points must always be located at the 1 maximum and the 0 minimum of the run-in synchronizing burst, otherwise the measured eye height will not be correct. Since the phase of the teletext signal may vary with respect to the sync pulse, sampling is generally not performed at the optimum phase with respect to the run-in so that the sampled values cannot be used directly (i.e. without interpolation) for evaluation. The Digital Teletext Analyzer ATF solves this problem by slowly reading out the stored teletext signal during a frame period and by sampling and storing it again at the nominal points, this time with the correct phase. The sampling rate is reduced by a factor of 1/256 with respect to the first entry and the correct phase was calculated by the microprocessor from the run-in data. This method, which uses **analog interpolation of digitally sampled values,** is extremely reliable and fast so that only about 1 s is required to obtain the measured value from 24 lines.

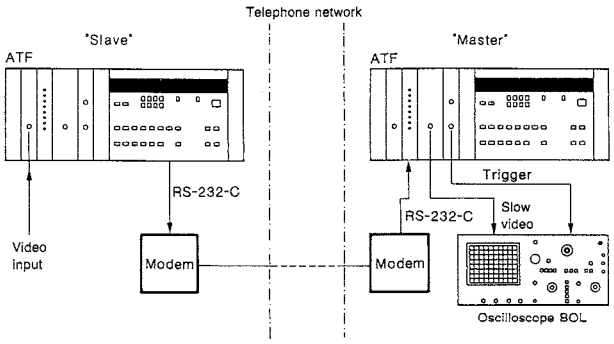
Result display The test result is transferred to the display processor (single-chip CPU) to appear on the 13-digit dot-matrix display.
Comprehensive test software permits fast and convenient checking of the most important subassemblies.



Functional diagram of Digital Teletext Analyzer ATF

Application

Remote control and remote measurement In addition to various test parameters, the signals available from the slow video output can be transmitted via the IEC/IEEE-bus or RS-232-C interface. Thus the ATF permits transmission of a complete video line or of an eye pattern in the master-slave mode. A 1200-baud modem requires about 30 s to transmit a video line.

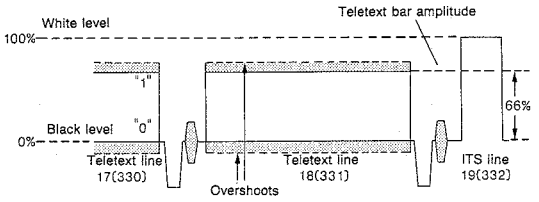


Application example of ATF used in master-slave mode

Definition of teletext test parameters

The parameters used for the more complex teletext tests are described below. Many tests use the ITS bar amplitude as a reference. When no ITS pulse is available, the line sync pulse amplitude is used as a less accurate reference. Different reference values can be set for special applications.

Teletext bar amplitude The teletext bar amplitude is 66 % of the white level in the ITS line and represents the binary "1" level in any teletext data stream.



Teletext bar amplitude

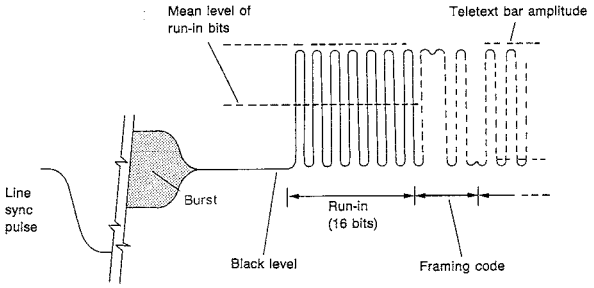
Binary "0" : 0(± 2)%
Binary "1" : 66(± 6)%

Synchronization with teletext bit clock Synchronization with the teletext bit clock is obtained by capturing and averaging all the slice level crossings of the run-in waveform. The slice level can be considered to be the average amplitude between the "1" and "0" levels of the run-in bits. The teletext bits are then sampled with a phase shift of 180° with respect to the mean slice level crossing.

Basic amplitude The basic amplitude algorithm calculates

- the black level of the TV line and
- the mean level of the run-in waveform.

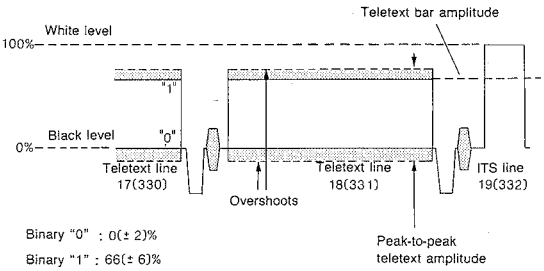
The difference between these levels is doubled and then expressed as a percentage of the reference selected. It is possible to set either the teletext bar amplitude (index I) or the nominal level of the teletext bar amplitude (462 mV, index N) as the reference.



Basic amplitude

Peak-to-peak amplitude The peak-to-peak amplitude algorithm measures the amplitudes of the fourth highest "1" bit and the fourth lowest "0" bit found in 24 teletext lines. This corresponds to about 8000 bits (1000 characters) with a total of 360 bits/line after deduction of the run-in and framing code bits. The difference between these amplitudes is expressed as a percentage of the selected reference.
Possible reference values:

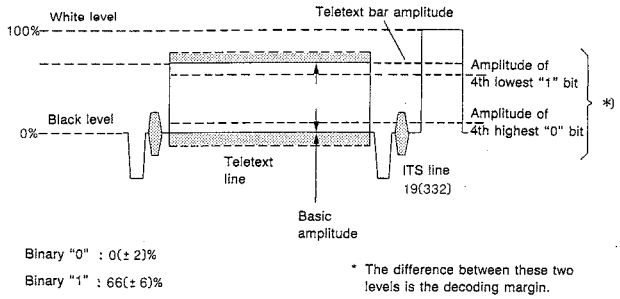
- teletext bar amplitude (index I),
- nominal level of teletext bar amplitude (index N) or
- basic amplitude (index T).



Peak-to-peak amplitude

Decoding margin (eye height) The decoding margin algorithm samples 24 teletext lines – corresponding to about 8000 bits (1000 characters) with a total of 360 bits/line after deduction of the run-in and framing code bits – and measures the amplitudes of the 4th highest "0" bit and the 4th lowest "1" bit. The difference between these two amplitudes is then displayed as a percentage of the reference selected.
Possible reference values:

- teletext bar amplitude (index I),
- nominal level of teletext bar amplitude (index N) or
- basic amplitude (index T).

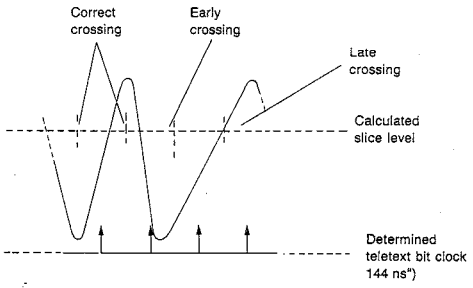


Decoding margin

Timing margin (eye width) The timing margin algorithm calculates the deviation of each slice level crossing from the average slice level crossing of the run-in waveform. The average slice level crossing of the run-in waveform corresponds to the teletext bit clock shifted by 180°.

The slice level can be considered to be the average amplitude between the "1" and the " 0" levels detected in the run-in bits.

The difference between the 4th earliest and the 4th latest in every 8000 slice crossings is displayed as a percentage of the teletext clock period (144 ns).

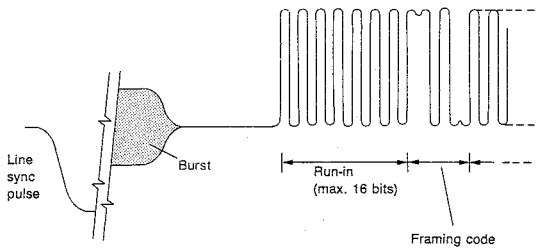


Note: Fault conditions exaggerated for clarity.

*) The theoretical slice level crossing is precisely between these two points.

Timing margin

Number of run-in bits The run-in bits algorithm counts the number of run-in bits present at the start of the teletext waveform prior to the framing code.



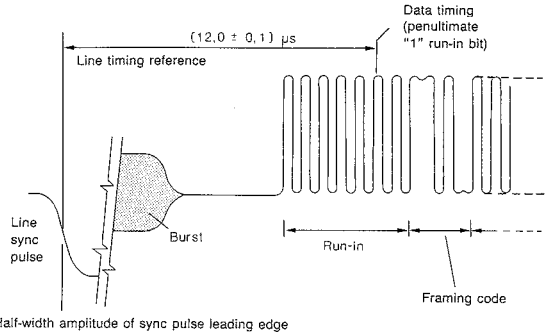
Number of run-in-bits

Error rate The error rate is expressed in dB as a ratio of characters received with parity errors (even parity) to the total number of bits received (1 character = 8 bits). If, for instance, there has been 1 parity error and 100,000 characters have been received, the error rate is – 50 dB.

If no parity errors have occurred, the error rate cannot be definitely determined. In this case, the error rate is worked out as though 1 parity error has occurred and the "<" sign is placed in front of the corresponding value. If, for instance, there have been 0 errors and 100,000 characters have been received, the error rate is < – 50 dB.

The total number of bits received and of errors occurred are reset to zero whenever the video signal is lost or the ERROR RATE key pressed.

Data timing (start of data code) The data timing algorithm calculates the time difference between the peak of the penultimate "1" run-in bit and the half-width amplitude of the sync pulse leading edge.



Data timing of teletext line

Teletext parameters To measure a single teletext parameter, only one key operation is necessary if the appropriate line number has been selected. During the measurement, the line numbers may be varied, each of the keys incrementing or decrementing by one the specific numerics column, e.g. the hundreds.

SPECIFICATIONS

Specifications

Inputs and outputs

Test inputs	
Number	1, front / rear panel, switch-selected
Input impedance	75 Ω
Input level	CCVS, 1 V ±10% for full measuring accuracy, 1 V +15/ −40% with half the measuring accuracy (S/N > 50 dB)
Sync pulse level	300 mV, +50/ −30%
Slow video outputs	
Number	2, front / rear panel
Waveform	video signal slowed down by a factor of 256 for eye pattern display
Display	continuous or frozen
Level	input level ±2%
Output impedance	75 Ω
Trigger outputs	
Number	2, front / rear panel
Waveform	positive-going pulse, approx. 10 µs for video signal; 27 kHz for eye pattern
Level	TTL
Output impedance	approx. 1 kΩ
Test outputs	
Number	7 (input signal, sync pulse, clamping pulses)

Parameters

Number of selectable parameters	9 (7 teletext parameters, S/N ratio, ITS bar amplitude)
Selection	direct, from keyboard
Decoding margin (eye height)	
Measurement range	100 to 0%
Referred to nominal level or bar amplitude	150 to 0%
Error	±2% from 150 to 20%, ±4% from 20 to 0%
Timing margin (eye width)	
Measurement range	100 to 0%
Error	±2% from 100 to 20%, ±4% from 20 to 0%
Basic amplitude	
Measurement range	60 to 150%
Error	±5%
Peak-to-peak amplitude	
Measurement range	0 to 200%
Error	±5%
Data timing (start of data code)	
Measurement range	10.0 to 14.0 µs
Error	±0.1 µs
Number of run-in bits	
Measurement range	6 to 24 bits
Error rate	
Measurement range	−30 to −70 dB corresponding to a parity error rate of 1×10^{-3} to 1×10^{-7}
S/N ratio	
Measurement mode	rms, unweighted
Measurement range	24 to 50 dB
Error	±1 dB
ITS bar amplitude	additional parameter, limit monitoring not possible
Measurement range	60 to 115%; underranging or overranging causes NO ITS message to appear and sync pulse amplitude to be displayed
Error	±2%
Error of indication	±1 digit
Test conditions	
Reference value (selectable)	a) ITS bar amplitude. When no ITS pulse is available, line sync pulse amplitude is used as the reference, index I = ITS b) nominal signal level (462 mV for teletext signal, 700 mV for noise voltage), index N = nominal c) teletext level (for decoding margin and peak-to-peak amplitude only), corresponds to basic amplitude, index T = teletext
Test lines	lines for teletext signal, noise voltage measurement and reference test line
Framing-code (start code in a teletext line)	4 different framing codes can be selected
Limit value monitoring	for each specific parameter or all 8 parameters; disconnectible; limit monitoring not possible for additional parameter "ITS bar amplitude"
Alarm	for specific parameter by limit LED, otherwise by blinking of parameter LED
Limit value setting	an upper and a lower limit can be set separately for each parameter

Data interfaces

IEC / IEEE bus	interface to IEC 625-1 / IEEE 488
Connector	24-contact, Amphenol
RS-232-C	
Baud rate	150, 300, 600, 1200, 2400, 4800, 9600
Mode	synchronous / asynchronous, selectable
Connector	25-contact, Cannon

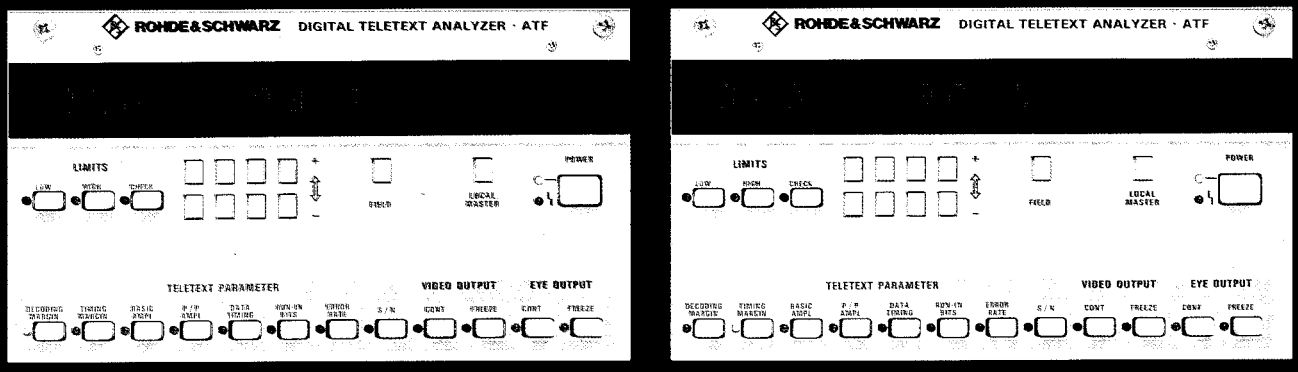
General data

Rated temperature range	+5 to +45 °C
Operating temperature range	0 to +50 °C
AC supply	100 / 120 / 220 / 240 V ±10%, 47 to 63 Hz (approx. 95 VA)
Dimensions, weight	
19"bench model	492 mm × 205 mm × 514 mm, 19 kg
19"bench rackmount	483 mm × 177 mm × 506 mm, 17 kg

Ordering information

Order designation	▶ Digital Teletext Analyzer ATF
19"bench model	377.8015.03[1]

[1] ATF for British teletext system and all related systems with same clock frequency (6.9375 MHz) and same nominal level (66% of ITS bar amplitude). Please inquire for different standards.



ATF display for measurement of eye height (left) and eye width in TV line 328

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