DTV Recorder Generator DVRG

Recording and generation of digital video streams

◆ Replay of recorded transport streams
◆ Endless and seamless MPEG2 genera-tion
◆ Triggered recording for error analysis
◆ RAM or hard-disk based operation

◆ Large choice of test signals compliant to ATSC and DVB
◆ Optional record and replay of uncom-pressed SDI video streams (ITU-R 601)
◆ Embedded Windows NT platform

◆ Software options
  – STREAM COMBINER™ for creating user-specific transport streams
  – QUALITY EXPLORER™ for analy-zing video elementary streams
◆ Easy and self-explanatory operation
◆ Compact design (2 HU)

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The universal processing platform for digital video streams.

DVRG is a universal processing platform for digital video streams. It allows the record and play of MPEG2 transport streams. This is done either degradation free using the RAM when the transport stream is of limited length or directly using the hard disk. Minimum wear an tear can thus be achieved during continuous operation.

For error analysis, recording can be controlled by means of an external trigger signal. The stored signal includes time sections of different lengths before and after the trigger event.

In its key functions, DVRG is operated as a separate unit via keys on the front panel and the LC display. DVRG contains a PC platform with the Windows NT embedded operating system whose features are available through the connection of VGA monitor, keyboard and mouse. For example, further software packages for

the analysis and generation of transport streams can be installed and used. With the standard 100baseT connector, DVRG is easy to network for the remote control and transfer of transport stream files.

As a novelty, DVRG fitted with option DVRG-B4 and -B2 allows the recording and replay of uncompressed video streams in SDI format (to ITU-R B.T. 601/656 or SMPTE259M) on the same platform at a data rate of 270 Mbit/s.

Thanks to its versatility and configurability, DVRG is a highly flexible working platform for all those handling digital video signals to the MPEG2, DVB and ATSC or SDI standard.

Characteristics

Basically, DVRG assumes three modes for MPEG2 transport streams:

Recording

A transport stream is first recorded in the RAM either by the parallel (SPI/LVDS) or serial (ASI with loop-through output) interface. If the volume of recorded data exceeds the available RAM capacity or if the transport stream is to be achieved, storage is in the form of a file on the hard disk in TRP format. This file format contains all consecutive tranport stream packets in sequential order and can be easily exchanged with other systems.

For error analysis, recording can be performed as a function of an external trigger signal applied to the trigger input on the rear panel. The transport stream is recorded continuously and cyclically in the
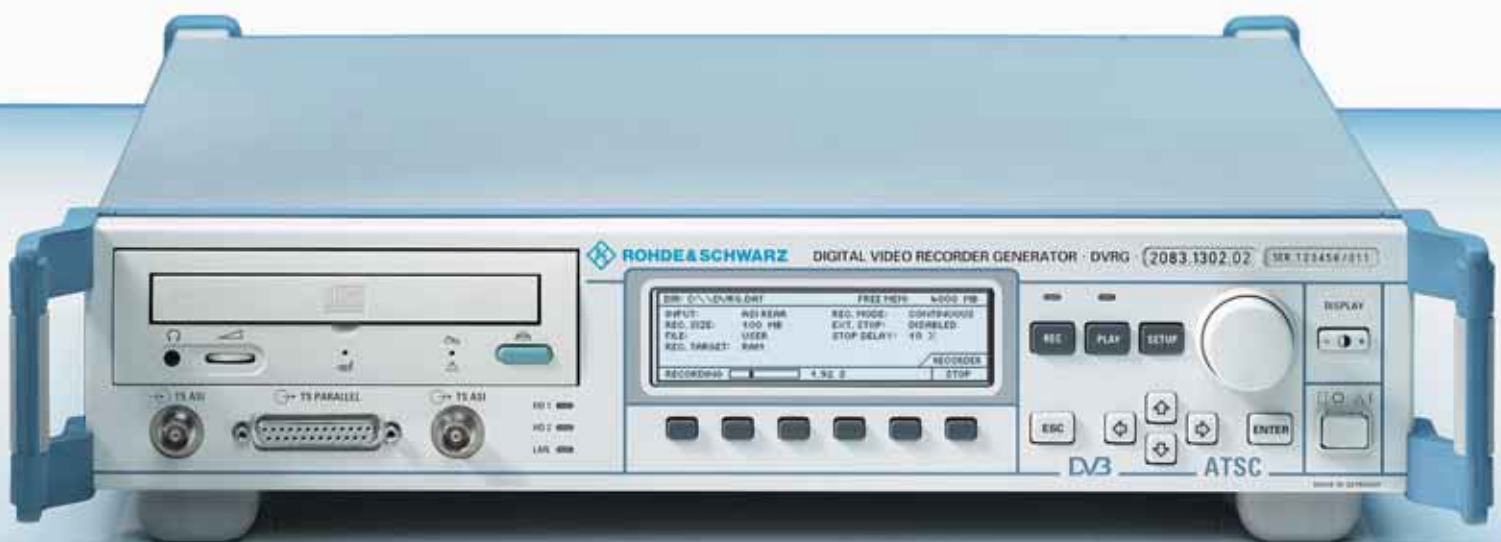
Test signals

DVRG produces a large number of predefined MPEG2 transport streams to the ATSC and DVB standards at a keystroke. The transport streams contain several elementary streams and consist of video, audio and other data (eg teletext or PRBS). Video streams with different data rates, formats, frame rates and contents are available.

The signal set comprises sequences with moving picture contents and some static test patterns. It includes known test patterns such as colour bar signals, zone plate, CCIR17/18/331, ITS1 to 4 and many others as well as the Rohde & Schwarz CODEC test pattern. Thanks to integrated test signals in the upper and lower picture area, the analog outputs of a set-top box (or IRD) can be tested within seconds with the aid of a suitable video analyzer, eg VSA from Rohde & Schwarz. In addition, integrated moving picture elements allow visual checking of the decoder functionality.

Audio data streams with different rates and frequencies contain the accompanying sound for the video sequences as well as special audio test signals. Of course, the transport streams contain all program information, service and system tables (SI, PSI and PSIP) required by MPEG2 and ATSC or DVB as stipulated by the selected standard.

Operation

DVRG can be controlled manually via the front-panel keypad with fast-access keys for the main menus and softkeys for the submenus. Some LC displays for typical operating steps are shown in Fig. 2.

RAM already before the trigger event occurs. Recording is completed after a settable delay following the trigger signal. Thus transport streams (of any length depending on the setting) can be stored before (pretrigger) and after (posttrigger) the trigger time (Fig 1).

Replay of GTS files

In this mode, transport stream files are replayed in an endless loop and are available both at a parallel (SPI/LVDS) and a serial (ASI) interface simultaneously as well. The use of the GTS format provides discontinuity-free signal generation in an endless and seamless loop (see box). Files created in this format can be used even on a DVG provided the limits for maximum data rate and data volume are not exceeded.
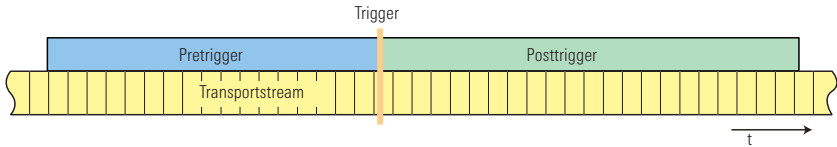

Fig 1: The length of the pretrigger and posttrigger parts of a transport stream can be defined for a triggered recording with DVRG

Replay of TRP files

Recorded transport streams can be replayed as often as required and are available both at a parallel (SPI/LVDS) and a serial (ASI) interface simultaneously. The replay starts immediately after selecting the file with the data being buffered in the RAM. Correct decoding of the video and audio sequences contained in the replayed transport stream is ensured at the original data rate of the recording. This original data rate is automatically determined from the transport stream file. Any other data rate can be used for test purposes. In this mode, DVRG supports files in TRP /TS format.

During replay a jitter of up to ±10 ms with settable frequency and waveform can be superimposed on the PCR values. This function can be used for stress tests of multiplexers and decoders. The replay data rate can be varied within wide limits. The minimum data rate is obtained by adding the individual data rates of all elementary streams plus system and service tables. Higher data rates up to the maximum value is achieved by filling the transport stream with null packets.
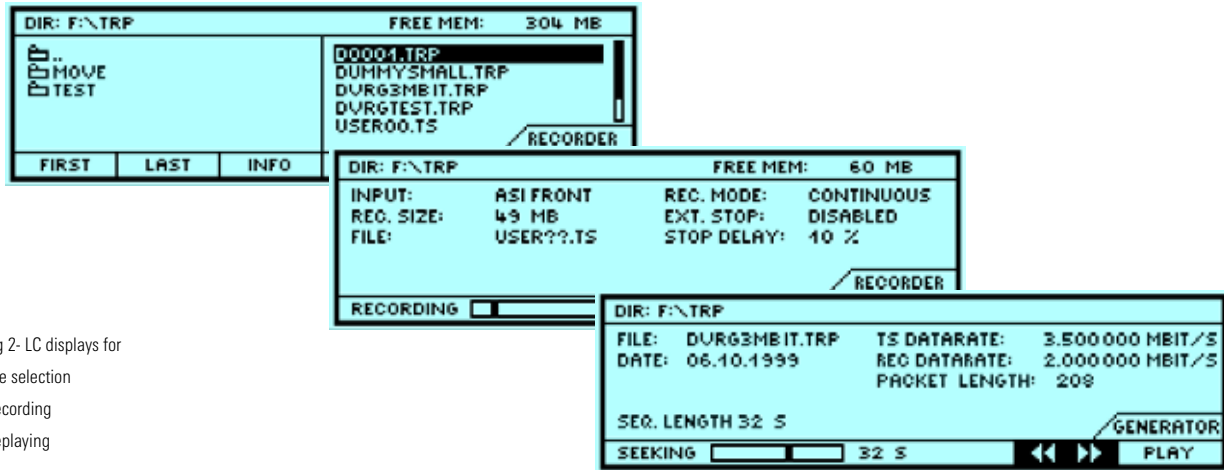
Fig 2- LC displays for

File selection

Recording

Replaying

As an alternative, DVRG can be operated via a Windows software (Fig. 3). The software can be used on DVRG as a workstation with connected VGA monitor, keypad and mouse or on any PC with Windows NT or Windows 95/98 connected to DVRG via LAN (Ethernet). The network protocol is TCP/IP with SCPI commands. Any sequence recorded or replayed by DVRG can be transferred from and to other PCs or DVRG units via the network connection.

Remote control via RS232 is possible with the same SCPI commands as via Ethernet.

What is a transport stream?

Transport stream structure and data reduction methods have been developed and stipulated by the Motion Pictures Experts Group (MPEG), the DVB (Digital Video Broadcasting) and ATSC Project (Advanced Television Systems Committee). An essential feature of the transport stream is that it is made up of several programs which consist of several elementary streams (vision, sound and data signals) the contents of which can be compressed to different degrees. In contrast to conventional analog TV, program multiplexing no longer takes place after the modulator at the RF but a program and signal multiplex is formed in the baseband.

DVRG is a universal processing platform for transport streams. It is able to record and replay such a multiplex signal and is therefore an attractively priced and compact alternative to a more complex solution including expensive MPEG2 encoders plus signal generators and realtime multiplexer connected. DVRG replays short signals from the RAM in a seamless and endless loop without interruption and free from wear and tear, so it is ideal for continuous operation, eg in production or as a substitution signal source.

How is a transport stream replayed in a seamless and endless loop?

All available time stamps (PCR, PTS & DTS values as well as entries in the TDT, TOT and STT tables) are updated in real time. Although the video, audio and data contents occur repeatedly, the transport stream seems to be continuous due to the variable time stamps, as if it would be generated in real time from a multiplexer and several encoders connected to it.

In addition, it should be ensured that the buffer fill states of each individual video sequence are identical at the intersection time. If this is not the case, even a slight offset causes an overflow or underflow of the video buffer in the long run after several repetitions. A DUT, eg MPEG2 decoder, connected to the transport stream output of DVRG would unavoidably get into an error condition and re-synchronize. To prevent such error condition, all test sequences factory-installed on DVRG are prepared accordingly and can be used immediately. For user-defined video sequences, the optional software Stream Combiner™ DVG-B1 includes a tool for correcting the video buffer fullness.

Options

DVRG-B2: Additional hard disk

A fast 18 GB hard disk is integrated as standard in DVRG for the storage of transport stream files and video sequences in SDI format (together with option DVRG-B4). The hard disk memory can de doubled to 36 GB in the factory using the option DVRG-B2. The additional hard disk is installed for the special file system and can be used immediately.

DVRG-B4: Recording and replaying SDI video signals

Uncompressed digital video signals to ITU-R B.T.601/656 or SMPTE259M with a data rate of 270 Mbit/s can be recorded and replayed by DVRG thanks to the fast hard disks and a cleverly thought out file system. Such signals can of course contain so-called embedded audio streams within the ancillary data.

Option DVRG-B4 is already contained in the basic unit and is enabled simply using a software key which can be saved any time. It is mandatory to use the option DVRG-B2 at the same time since one 18 GB hard disk cannot provide the required high data rate of uncompressed video sequences.

DVRG-B5: CD drive read/write

The basic configuration of DVRG includes a read-only drive for CD-ROMs. Software updates can thus be performed and new transport streams stored. Option DVRG-B5 offers additionally a write capability for CD-Rs (650MB) to even store recorded transport streams. This drive can also read DVD-ROMs so that MPEG2 sequences from DVDs can be transferred to and replayed by DVRG.

It is not possible to replay transport streams direct from the drive or record them straight to a CD-ROM. Transport streams can only be recorded on and replayed from hard disk. Commercial DVD videos cannot be replayed

DVRG-B6: SMTPE-310M Interface

The synchronuous serial Transport-streaminterface SMTPE-310M provides an additional In/Output (BNC) at the rear panel, used for 8-VSB modulation in the ATSC standard.

DVG-B1: Stream Combiner™ software

With this software it is possible to create any new transport stream from supplied or recorded elementary streams (ES) in addition to those stored in DVRG. The Stream Combiner™ is used as an offline multiplexer and automatically integrates all program information, service and system tables required by MPEG2 and the selected standard (ATSC or DVB). Moreover, all table contents can as required be processed, completed/deleted with the Stream Combiner™ beyond the limits of standards, so that test signals can be created for any specific applications.
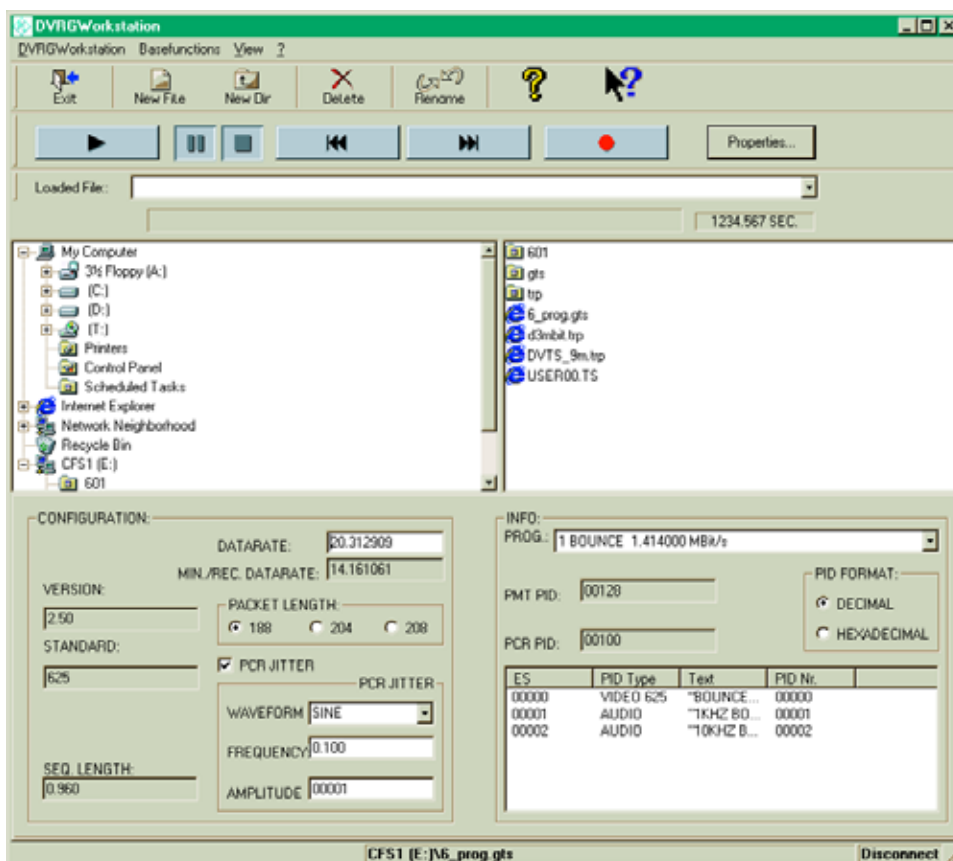

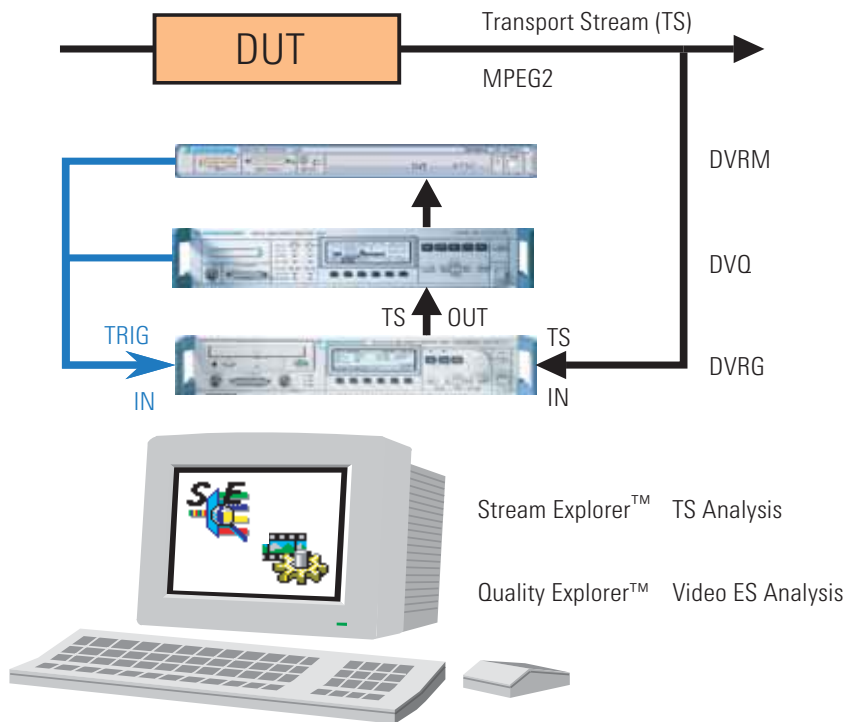Fig 3: Windows user interface of DVRG in workstation mode

Fig 4: Error analyses with DVRG and realtime analyzers

Transport Stream (TS)
MPEG2

DVRM

DVQ

DVRG

Stream Explorer™   TS Analysis

Quality Explorer™   Video ES Analysis

DVQ-B1: Quality Explorer™ software

Video elementary streams contained in recorded transport streams can be examined in detail using the Elementary Stream Analyzer included in the software. The representations include sequence, GOP and picture headers, macroblock data, motion vectors, picture decoding and statistics and much more. In addition, elementary streams can be extracted for further processing with the Stream Combiner™. With the tool Quality Monitor, the quality values determined by a connected DVQ in real time can be read, displayed graphically and recorded.

Certified Quality System
ISO 9001
DQS REG. NO 1954

Certified Environmental System
ISO 14001
REG. NO 1954

Applications

Thanks to its versatility, flexibility and wide range of options, DVRG is the platform for a whole variety of applications:

Development

In the development of set-top boxes and all other instruments that process digital TV signals to the MPEG2 standard, DVRG can be used for replaying standardized transport streams and those created for special tests. Transport streams can be recorded, de- and re-multiplexed to totally new configurations.

Quality management

The test signals of DVRG are always replayed in the same way and can thus serve as reference standard for QM tests.

Production

The following characteristics make the DVRG the ideal choice for use in the production of digital TV components (eg set-top boxes, MPEG2 decoders and multiplexers):

◆ Fast loading of test signals from the hard disk: replay starts immediately while the data are being buffered in the RAM.
◆ Replay free from wear and tear exclusively from the RAM for sequences of limited length.
◆ Sequences of any length for loading device software and configuration during testing
◆ Compact design (2 HU) for 19" rack-mounting
◆ Simple system integration ensured by RS232 and Ethernet interfaces

Networks

DVRG can be used in digital TV networks for two types of application:

As a substitution signal source, DVRG provides an endless and seamless transport stream in the event that the signal feed to the playout center, the cable headend and the satellite uplink or downlink fails. Due to the large storage capacity of the hard disk (18 GB or 36 GB), very long sequences can be played which are generated with the Stream Combiner™ software according to user requirements.

For error analysis, DVRG records a part of the transport stream either before or after an external trigger event. During realtime analysis, this trigger signal is obtained by means of another instrument, such as MPEG2 Measurement Decoder DVMD, MPEG2 Realtime Monitor DVRM or Digital Video Quality Analyzer DVQ. Further analyses can subsequently be performed on the recorded transport stream (Fig. 4).

Specifications

Signal inputs

MPEG2 transport stream

Synchronous parallel (SPI), LVDS (to DVB-A010)	25-pin connector at rear, 410 mV (peak), 1.25 V DC, 100 Ω
Asynchronous serial (ASI), 270 Mbit/s (to DVB-A010)	BNC (front and rear panel) 800 mV (peak), 75 Ω
Synchronous serial (SSI), (to SMTPE-310M) Datarate	BNC (rear) with option DVRG-B6 19,392658 Mbit/s
Video serial digital 270 Mbit/s (SDI to ITU-R B.T.601/656 or SMPTE 259M)	BNC (rear), 800 mV(peak), 75 Ω only with option DVRG-B4

Signal outputs

MPEG2 transport stream

Synchronous parallel (SPI), LVDS (to DVB-A010)	25-pin connector at front, 410 mV (peak), 1.25 V DC, 100 Ω
Asynchronous serial (SSI), 270 Mbit/s (to DVB-A010)	BNC (front and 2x rear, one of them as loop-through output of input), 800 mV (peak), 75 Ω
Synchronous serial (SSI), (to SMTPE-310M) Datarate	BNC (rear) with option DVRG-B6 19,392658 Mbit/s
Video serial digital 270 Mbit/s (SDI to ITU-R B.T.601/656 or SMPTE 259M)	BNC (rear), 800 mV (peak), 75 Ω only with option DVRG-B4

Signal characteristics

Transport stream	to ISO/IEC 1-13818
Length of transport stream packets	
ATSC:	188/208 bytes (settable)
DVB:	188/204 bytes (settable)
Sequence length	endless or limited by hard disk size
Typical	
(at a net data rate of 5 Mbit/s)	100 s (RAM) or 8 h (hard disk)
Data jitter	typ. < 0.05 UI_{pp} (10 Hz to 100 kHz)
ASI outputs	typ. < 0.1 UI_{pp} (10 Hz...8 MHz)
SPI output	typ. < 0.05 UI_{pp} (10 Hz to 200 kHz)
PCR jitter	only in GTS -Mode
Amplitude	0 ms to 10 ms, settable in 0.1 µs steps
Signal set	test patterns with test tones, moving picture sequences
Sequence length	
ATSC:	typ. 960 video frames (32.032 s)
DVB:	typ. 192 video frames (7.68 s)
Serial video signal	to ITU-R B.T. 601/656 or SMPTE 259M
Data rate	270 Mbit/s

Operation

Manual operation	keys on front panel with LC display
Remote control	with SCPI commands via TCP/IP (Ethernet 100baseT) or serial interface (RS232)

PC platform

Processor	Pentium II with 266 MHz
BIOS	Award Rohde & Schwarz
RAM	128 MB
SCSI hard disk(s)	18 GB (basic unit) or 2x 18 GB (with option DVRG-B2)
CD drive	CD-ROM (650 MB) 48-fold reading (basic unit) or CD-ROM (650 MB) 24-fold reading, CD-R (650 MB) 4-fold writing and CD-DVD (2.5 to 6.5 GB) 4-fold reading (with option DVRG-B5)
Graphics card	Savage/MX, 8 MB memory 1600x1200, 82 Hz, True Color (4 million colours)
Operating system	Microsoft Windows NT 4.0 embedded

Interfaces	at instrument rear panel
VGA	15-pin sub-D connector, for SVGA or TFT monitor
PS/2	PS/2 connector, combined for mouse and keypad
Serial interface	9-pin sub-D connector, RS232, 9.6 kBaud to 115 kbaud connection of other instruments and remote control (SCPI)
Parallel interface	25-pin sub-D connector, printer output
Network	RJ45 connector, Ethernet 100baseT for 100 Mbit/s, TCP/IP protocol remote control (SCPI) and system integration
USB	USB connector, connection of peripheral equipment

General data

Nominal temperature range	+ 5 °C to +40 °C (specs guaranteed)
Operating temperature range	+ 5 °C to +40 °C
Storage temperature range	-40 °C to +70 °C
Mechanical resistance	
Sinewave vibration	5 Hz to 150 Hz, max. 2 g at 55 Hz, 0.5 g from 55 Hz to 150 Hz, complies with IEC 68-2-6, IEC1010-1, MIL-T-28800 D class 5
Random vibration	10 Hz to 300 Hz, at 1.2 g_{rms}
Shock	40 g shock spectrum, complies with MIL-STD 810 D and MIL-T-28800 D class 3 and 5
Climatic stressing	+25 °C/+40 °C cyclically at 95% rel. humidity, to IEC 68-2-30
Electromagnetic compatibility	to EN50081-1and EN50082-2 (EMC directive of EU)
Power supply	100 V to 240 V ±10% /150 VA 50 Hz to 60 Hz ±5%
Dimensions (W x H x D)	427 x 88 x 450 mm 16.8 x 3.5 x 17.7 in.
Weight	9.7 kg 21.4 lb.

Ordering information

DTV Recorder Generator	DVRG	2083.1302.02
Accessories supplied	power cable, operating manual	

Hardware options

Additional hard disk internal, 18 GB	DVRG-B2	2083.1919.02
SDI (ITU-R B.T. 601/656) Record & play	DVRG-B4	2083.1931.02
CD-R R/W drive (DVD read only)	DVRG-B5	2083.1948.02
SMTPE-310M interface	DVRG-B6	2083.1954.02

Software options

Stream Combiner™ [1]	DVG-B1	2068.9835.02
Quality Explorer™ [2]	DVQ-B1	2079.7151.02

Recommended extras

Documentation of calibration test values	DRG-DCV	2082.0409.21
19" Adapter (2 HU) for installation with handles (rackmount without handles on request)	ZZA-211	1096.3260.00
Service manual		

[1] see data sheet PD 757.3611
[2] see data sheet PD 757.5450

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