



RDS Codec DMC 01

Coder and decoder in one –
as a bench model or system rackmount

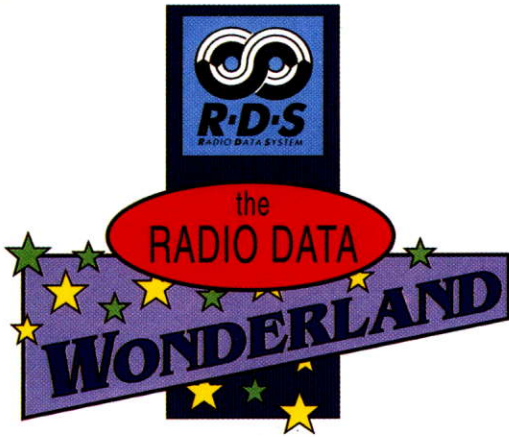
DMC01 represents the third generation of RDS equipment from Rohde & Schwarz. Thanks to the know-how gained over many years and the use of advanced technology, it was possible to produce an extremely compact and fa-

vourably priced device. Its range extends from general RDS applications via paging, TMC and EWS functions through to the use as an RDS/VRF system unit in broadband communication systems and low-power FM transmitters.



ROHDE & SCHWARZ

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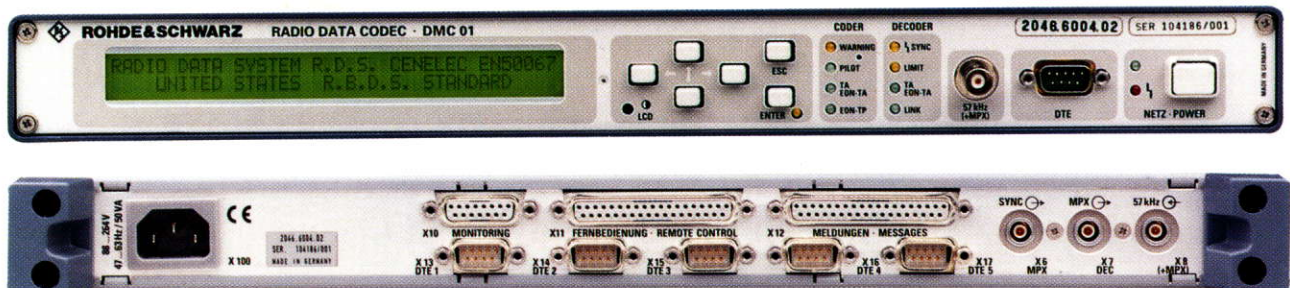
For several years, the Radio Data System (RDS) has been an integral part of public and private VHF-FM broadcasting in most European countries. In the USA, the Radio Broadcast Data System (RBDS), an adaptation of the European RDS standard, opens up another wide field of application so that RDS will gain increasing importance worldwide. Future applications by a multitude of users as described in the Rohde & Schwarz brochure "The Radio Data Wonderland" (PD 756.8955.22) present new requirements as regards the price and functions of RDS coding and decoding equipment. For this reason Rohde & Schwarz developed the favourably priced RDS Codec DMC01 in addition to the FM Radio Data Coder DMC05 and FM Radio Data Decoder DMDC05 to ARD/Telecom specifications. The following features played a key role in the new development:

- reducing the size to a minimum thanks to the use of special LSI components (eg communication controller, ASICs)
- communication of several codecs (master-slave operation) via RS-485 interface or serial bus (SERBUS) (under preparation)
- simple firmware update (eg for future RDS functions) via serial interface with the aid of flash EPROMs and special gate array

To enable universal use of the equipment in different countries and for different transmitters, the codecs comply with a number of technical prerequisites. It is for instance possible to vary the RDS signal level at the coder output within wide limits so that a defined RDS deviation can be set for different transmitter input impedances. Moreover, DMC01 enables the summation of the stereo MPX and the RDS signal. This proves useful if the associated stereocoder is not equipped with an RDS signal input. Synchronization of DMC01 is possible by way of the 19-kHz pilot or directly to the MPX signal of the stereocoder. Finally there is the versatile remote-control capability of DMC01 which allows system integration without any problem.

- maximum performance both in terms of hardware and software (RDS coder/decoder functions and VRF signal generation in one unit)
- use with any VHF-FM transmitter for all applications (hardware and software flexibility)

Front and rear panels of DMC01 bench model



Technical description

The hardware ...

The RDS equipment comes in two models using the same basic module:

- bench model DMC 01 (1 height unit)
- plug-in unit DMC 01 C for 19" adapters
 - upright incorporation in NU system adapter (5 height units) and
 - lying flat in 19" Adapter ADAPT-R (1 height unit)

The heart of the **basic module** is a powerful microcomputer for controlling the hardware functions, managing the RDS data and driving the interfaces. Depending on the extension, four to six RS-232-C interfaces are available (partly switchable to RS-485). The software is organized in electrically erasable flash memories so that firmware update is possible via the serial interfaces without exchanging EPROMs. Functions such as non-volatile data storage, watchdog, real-time clock, remote-control inputs and signalling relays are standard with DMC 01.

Two DMC 01 C units in a KB-80 cabinet, the 19" Adapter ADAPT-R being required for incorporation. Also fitted: two horizontal front panels (Mounting Kit DMC 01-R)

The RDS and VRF signals are produced by digital synthesis. The stored samples are read out by an **RDS/VRF ASIC**, which includes the complete logic circuitry, and then D/A-converted. The ASIC also contains the digital circuits of clock and synchronization processing.

The analog **RDS/VRF level amplifier** can be adjusted in 10-dB steps from 0 to 30 dB for matching with different transmitter input impedances, fine level adjustment is quasi-continuous in the selected gain range. The signals are applied and brought out via decoupled balanced and unbalanced inputs and outputs on the front and/or the rear panel depending on the codec model.

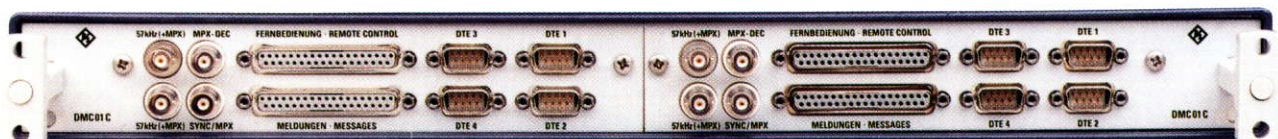
If DMC 01 is operated with a stereo-coder that comes without an auxiliary signal input (eg SCA), the **internal summing amplifier** of DMC 01 combines the stereo MPX and RDS as well as VRF signals. In the case of an AC supply failure for instance, the transmitted program signal is through-connected from the MPX input to the MPX/RDS output via a bypass circuit.

The **RDS decoder chip** decodes the received MPX/RDS signal and retrieves the RDS data. With the data-link (re-broadcasting) function, these data are applied to the microcomputer which generates the new RDS data stream.

... and the associated software

The software for RDS Codec DMC 01 is based on software proven many times over and implemented to ARD/Telecom specifications in DMC 05 and DMDC 05, the separate software for coder and decoder being combined to form the software for DMC 01. Existing protocols for interfaces, internal software configurations and customer-specific extensions have been maintained and new functions (eg menu and device control) included. This ensures maximum compatibility with the existing product line. Although the hardware is new, the customer can continue to use the existing application software and add only the required new functions. As before, the coder software supports several data sets, the data input and output via line interfaces (important for instance for CLUB, a coder loading and utilization program) and the internal sequence control. New implementations are TNPP and the universal EBU protocol for paging applications for instance.

With the decoder software all RDS data are evaluated, read out on the display (of the bench model) and output via interfaces. In the case of out-of-tolerance conditions monitoring functions for RDS data and block error rates release messages allowing continuous check of the transmission quality.



Specifications

RDS signal	to CENELEC EN 50067 and ARD standard specifications 5/3.8 differential and biphase double-sideband amplitude modulation (DSB-AM) with suppressed carrier
Coding	57 kHz \pm 6 Hz
Modulation	\pm 2.4 kHz
Centre frequency	
Bandwidth	
Level	
RDS level ranges	55 to 437 mV _{pp}
with 0-dB gain	174 to 1,381 mV _{pp}
with 10-dB gain	550 to 4,370 mV _{pp}
with 20-dB gain	1,740 to 13,800 mV _{pp}
with 30-dB gain	
Phase	
RDS pilot	adjustable in steps of $< 2^\circ$, range 0 to 360° referred to 57 kHz
RDS-VRF	switchable 0°/90°
Linear distortion	< 0.5 dB between upper and lower sidebands
VRF signal	to ARD standard specifications 5/3.6
VRF level ranges	all with area (BK) and traffic announcement (DK) identification
with 0-dB gain	416 to 950 mV _{pp}
with 10-dB gain	1,315 to 3,004 mV _{pp}
with 20-dB gain	4,160 to 9,500 mV _{pp}
with 30-dB gain	... to 14,000 mV _{pp}
Modulation depth	
A to F area identification	60% \pm 5%
Traffic announcement identification	30% \pm 5%
(area identification (BK) can be switched off)	
Signal generation	digital signal synthesis by RDS/VRF gate array (ASIC)
RDS/VRF amplifier	
Max. output level	14 V _{pp} into 600 Ω
Gain	link-selected, 0/+10/+20/+30 dB
Level variation	< 0.5 dB
Synchronization	
External	to auxiliary pilot of stereocoder or to pilot of MPX signal, frequency 19 kHz \pm 2 Hz
Internal	automatic switchover to internal crystal oscillator if external pilot fails, frequency 19 kHz \pm 2 Hz
Inputs	
Sync/MPX summation	either for 19-kHz pilot or for complete FM stereo MPX signal
Connector	Lemosa Triax series 0 or BNC
Type	balanced or unbalanced
Max. input level	9 V _{pp}
Pilot level	TTL (squarewave) or 0.4 V _{pp} to 1 V _{pp} (sinewave)
Input impedance	> 5 k Ω
Unbalance rejection	> 34 dB to DIN 45404 (40 Hz to 76 kHz)
MPX decoder (rebroadcasting) input	MPX input for RDS decoder; the decoded RDS information may be used for rebroadcasting applications (internal data link)
Connector	Lemosa Triax series 0 or BNC
Type	balanced or unbalanced
Max. input level	9 V _{pp}
Input impedance	> 5 k Ω
Unbalance rejection	> 34 dB to DIN 45404 (40 Hz to 76 kHz)
Decoding	evaluation in part to ARD standard specifications 5/3.9
Functions	display and output of decoded RDS data, detection of information change, synchronization errors, block error rates with fault message, source monitoring, error detection switchable to error correction

Outputs

57-kHz (+MPX) main output

Connector	Lemosa Triax series 0 or BNC
Type	balanced or unbalanced, no DC component, with bypassing circuit
Max. load	300 Ω 5000 pF
MPX summation	link-selected, DC-coupled
Gain	0 dB
Level variation	< 0.5 dB
Frequency response flatness	< 0.5 dB
(40 Hz to 53 kHz)	

57-kHz (+MPX) test output

Connector	BNC
Type	unbalanced

Interfaces

Remote control

Connector	16 active-low TTL inputs with internal pull-up resistors
Messages	37-contact D female, subminiature
	16 floating relay contacts (for DC: max. 100 V, 0.5 A, 10 W); two messages codable to optocouplers or TTL ports

Data interfaces

DMC 01	for input and output of RDS data and setup functions; two interfaces switchable to RS-485
DMC 01 C	6 serial interfaces, asynchronous, RS-232-C
	4 serial interfaces, asynchronous, RS-232-C
Connector	9-contact D male, subminiature
Transmission rate	300 to 19,200 baud
Data format	selectable

Data processor

16-bit microprocessor 80C186 EC-16, flash memory, battery-supported SRAM, EEPROM, realtime clock, enhanced serial communication controller, gate array for firmware update via serial interface; RDS data management for 8+1 software-defined data sets and for nonvolatile device control (modulators, interfaces, front panel) and storage of device status

Front panel (DMC 01 only)

software-driven menu functions for device setup, selection of operating mode, level, data sets, fault message and all decoder functions as well as display of RDS information and operating parameters

LCD with 2 x 40 characters

Display

General data

Rated temperature range	+5 to +45°C
Operating temperature range	0 to +50°C
Storage temperature range	-40 to +70°C
Power supply	88 to 264 V, 47 to 63 Hz
Dimensions (W x H x D)	
Bench model (DMC 01)	426.7 mm x 43.2 mm x 460 mm
Plug-in RDS Codec (DMC 01 C)	37.1 mm x 207.5 mm x 437 mm
19" rackmount (ADAPT-R)	482.6 mm x 43.2 mm x 465 mm



Versatile RDS applications

The increasing importance of RDS as a commercial multidata service with VHF-FM sound broadcasting opens up numerous applications for the RDS codecs:

DMC 01 for low-cost applications

Many local transmitters or small transmitter networks use RDS merely to transmit the program service name (PS) for program identification. If a transmitter network operates on different frequencies, the alternative frequencies (AF) included in the RDS data stream allow the car driver to receive the same program during an extended drive. To cost-conscious users in particular, DMC 01 offers a professional, low-cost entry into RDS and allows step-by-step system extension for dynamic data, paging, remote control and diverse other services.

DMC 01 for paging systems

For operating an RDS paging system, especially reliable and powerful coders are indispensable to ensure safe and fast RDS information processing. Application of the paging data is by TNPP (Telocator network paging protocol) or the universal EBU protocol. The decoder functions of DMC 01 with its paging evaluation software allow decoding of the transmitted paging data for monitoring with full display of the paging information on a PC. Moreover, monitoring of the RDS transmission quality in general is possible using the integrated RDS monitoring functions.

DMC 01 for TMC applications

With digital traffic radio, ie traffic message channel (TMC), coded information is sent via RDS on the place, cause, type and duration of traffic holdups combined with instructions for the road users. Codecs DMC 01 handle insertion of the TMC data at the transmit end as well as evaluation, monitoring and display at the receive end, eg for intelligent traffic-jam indicators and active road signs along critical road sections.

DMC 01 for emergency broadcasting systems

If disasters or major accidents occur, RDS emergency warning systems (WARI, EWS) are used to transmit, over the regions concerned, digital switching signals for siren control, alarms addressed to the emergency services and instructions for the population at large. For this reason DMC 01 is equipped with special remote-control functions for switching over between normal and emergency operation as well as with EWS-specific RDS data generation.

DMC 01 for RDS applications in broadband communication

A growing number of FM programs distributed in broadband communication (cable) networks are provided with RDS. The RDS data are generated either directly at the broadband communication headend or, with FM programs received, retrieved from the multiplex signal, processed and applied as the new RDS signal to the FM

modulator for feeding the cable network (rebroadcasting). For this purpose, the plug-in RDS Unit DMC 01 C with integrated rebroadcasting functions is available for use in the NU system from Rohde & Schwarz.

DMC 01 for low-power FM transmitters

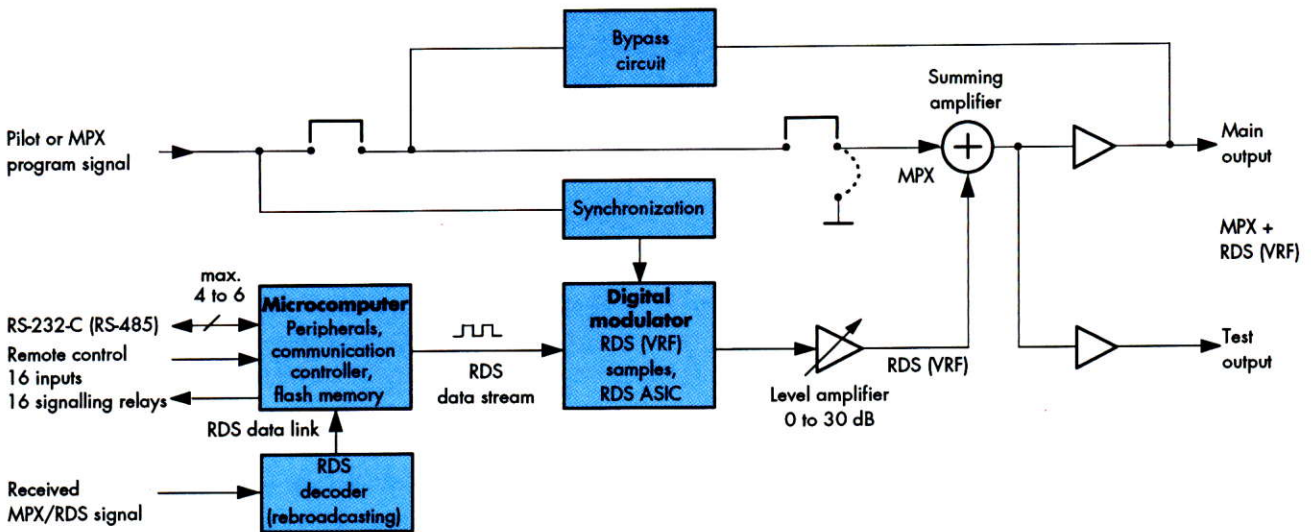
In the NU system RDS Unit DMC 01 C allows low-power FM transmitters between 20 and 400 W to be equipped with RDS at a favourable price, the installation requiring a minimum of space and effort.

DMC 01 to ARD/Telekom specifications

The ARD/Telekom RDS specifications stipulate in detail the hardware and software characteristics of RDS/VRF equipment. To enable the use of Codecs DMC 01 in accordance with the specifications, these standards were taken as a reference in the design of the implemented functions. This holds for the data interfaces, hardware and software functions, signal parameters, internal sequence control, monitoring functions, data link function, etc.

Further applications

DMC 01 is also suitable for use in navigation and localization systems based on DGPS (Differential Global Positioning System), for text and data transmission to newspanels and large-size displays as used in advertising, news distribution, traffic control, etc.



Ordering information

Order designations

Order designation	Code	Part number
Bench model (basic model)	RDS Codec DMC01	2046.6004.02
Plug-in unit (basic model) including power supply, suitable for NU broadband communication system or for use in 19" racks	Plug-in RDS Codec DMC01 C	2046.7000.02

Special models of DMC01/DMC01 C on request

Accessories for bench model

19" Mounting Kit with connectors (3 x Lemosa)	DMC01-T	2046.6404.02
Set of Mating Connectors (2 x 37-contact D subminiature)	DMC01-T	2046.6410.02

Accessories for plug-in unit

Set of Mating Connectors (2 x 37-contact D subminiature)	DMC01-T	2046.6410.02
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For incorporation into 19" racks an adapter is available accepting one or two DMC01 C plug-ins. For this purpose the following accessories are required:

19" Adapter including blank panel	ADAPT-R	2046.7300.02
Mounting Kit for ADAPT-R (two DMC01 C horizontal front panels)	DMC01-R	2046.7100.02



ROHDE & SCHWARZ

ROHDE & SCHWARZ GmbH & Co. KG · Mühldorfstraße 15 · D-81671 München
 P.O.B. 801469 · D-81614 München · Telephone +4989 4129-0 · Fax +4989 4129-3567