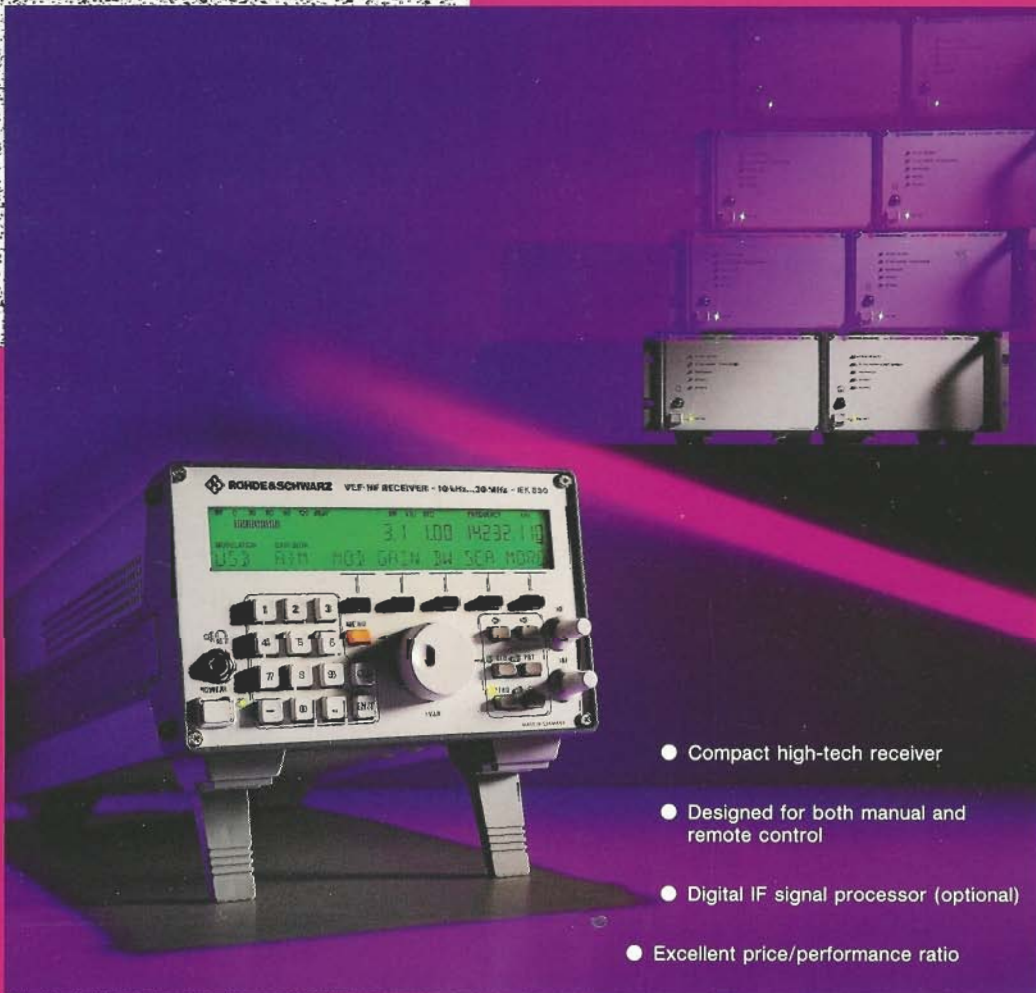




**ROHDE & SCHWARZ**

# VLF-HF Receiver



## EK 890

10 kHz to 30 MHz

- Compact high-tech receiver
- Designed for both manual and remote control
- Digital IF signal processor (optional)
- Excellent price/performance ratio

For all shortwave applications

Basispreis: 50,-

## VLF-HF Receiver EK 890



### Special features

- Excellent large-signal behaviour, very good intercept points
- High resolution of tuning frequency down to 1 Hz
- Fast and low-noise synthesizer
- Demodulators for AM, CW, LSB and USB included in basic configuration
- Can be extended to up to six IF filter bandwidths
- Interface fully complying with international standards
- Low power consumption (< 25 VA), therefore little self-heating
- Powerful microprocessor for bus interfacing, menus and user programs

### Operational features

- Easy to operate via terminal, computer or front panel
- High rejection of strong interfering signals
- 1000 programmable channel memory locations

- Scan mode for programmable frequency ranges, channel ranges and any desired channel sequences
- Remote control of all instrument settings — over any distance when using modems
- Ideal hand-off receiver in stationary, mobile and remote receiving systems
- High availability thanks to long MTBF and short MTTR
- Easy to adapt to special requirements by means of optional plug-in modules
- Highly versatile thanks to flexible software

### Logistic features

- Highly compact, 19" half-rack width
- Complete configuration consisting of four basic modules, two free slots
- Self-test with fault detection down to module level
- Available as a single receiver with operator front panel or remote-control-only front panel or as a
- dual-receiver version in 19" rack adapter



# Overview

## Characteristics

With the EK 890, Rohde & Schwarz is presenting a new generation of VLF-HF Receivers which represent the state of the art in line with our many years of experience in receiver design and our philosophy of "electronic precision". With its compact design resulting from the use of large-scale integration SMD components as well as full system compatibility, the EK 890 provides the basis for an extremely economical solution to the specific requirements of our customers.

Due to the excellent RF characteristics and the uncomplicated and full remote control capability via standardized data interfaces, the EK 890 is suitable for all civil and military shortwave applications. This receiver is an ideal choice for receiving systems which have to fulfill extremely high reliability requirements, in particular under harsh environmental and EMC conditions.

The EK 890 can be operated via an ASCII terminal, a computer or via the front panel which may also be integrated into a nearby detached console (on request). In master-slave operation, the EK 890 as a master receiver can control up to 99 slave receivers. The well-proven EK 085 Receiver can also be used as a master receiver.

Two wired and bus-integrated slots for plug-in modules are provided for user-specific extensions, eg special digital demodulators, IF converters or preselectors.

## Uses

We have put a lot of logic circuitry and programming into the EK 890, so it can be used for all demanding shortwave reception tasks. Due to the flexible programming of the processor, the following operating modes are possible:

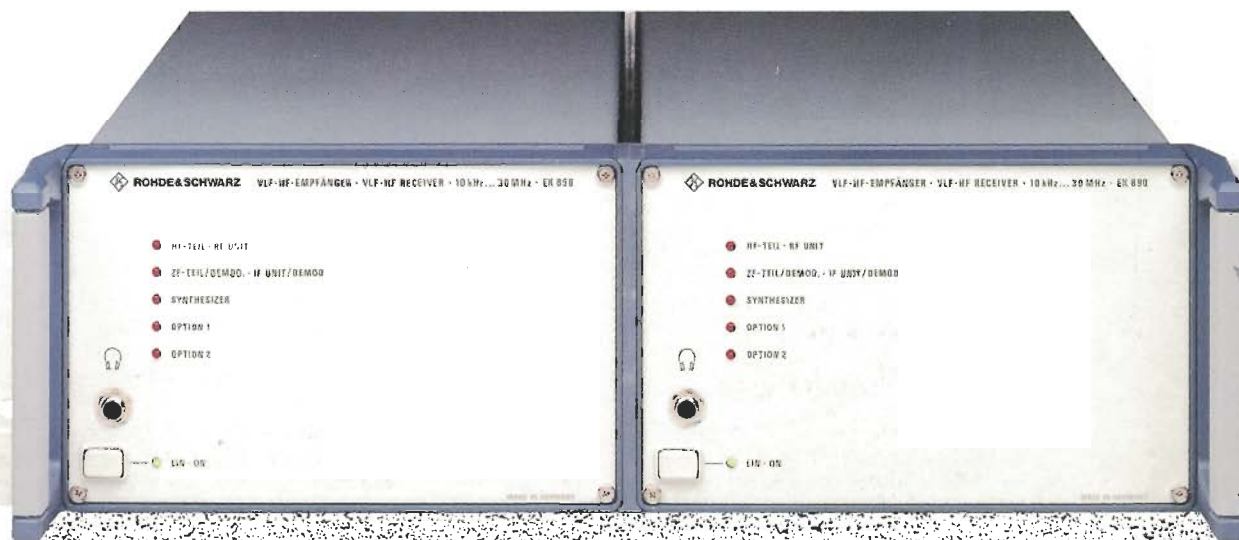
- manual
- channel scanning, sequential and programmable
- frequency scanning
- channel reception

The EK 890 thus fulfills the requirements for versatile use in voice receiving and any kind of data communication systems as well as for all radiomonitoring, radio detection and radio intelligence (COMINT) applications.

The built-in memory has capacity for non-volatile storage of 1000 complete channel settings, so that channel management and control by an external computer is not required (but it is additionally possible).

Due to its excellent receiver characteristics — regarding dynamic range, low synthesizer noise and gain control range — the EK 890 is an ideal high-performance front end for subsequent signal processing.

Two independent EK 890 Receivers with remote control panel in a 19" rackmounting adapter





# Design

## HF unit

The antenna signal is routed via a lowpass filter, which is provided for rejecting image frequencies and suppressing oscillator reradiation, and applied to the input mixer where it is converted into the first IF of 41.44 MHz by means of an oscillator variable in 1-Hz steps. The crystal filter that follows determines the maximum receiving bandwidth of 8 kHz and provides for rejection of the second image frequency. A fixed frequency of 40 MHz is used for conversion into the second IF of 1.44 MHz.

The high-performance mixer at the receiver input ensures excellent large-signal behaviour. The intercept points are typically +70 dBm ( $IP_2$ ) and +35 dBm ( $IP_3$ ); the crossmodulation transfer is 10% for an interfering signal of +21 dBm. In most cases, additional filters such as suboctave filters are therefore not required.

## IF unit/demodulator

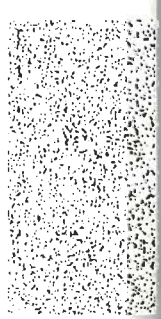
Six filter slots for crystal filters with bandwidths between 200 Hz and 6 kHz are available for main selectivity. All filters are employed in three different modes, ie as a center-frequency filter and — in the USB and LSB modes — as a sideband filter; the sideband filter response is obtained by shifting the first conversion frequency and the BFO frequency. The filter section is followed by a multi-stage IF amplifier. Its gain control voltage, which is a measure of the signal voltage at the antenna, is indicated as the receive level in 5-dB steps between 0 and 120 dB.

Gain control is possible automatically (AGC), remotely (DGC) or manually (MGC, via front panel). In the AM mode, the IF signal is converted into AF by means of an envelope detector, and in the CW and SSB modes by means of the BFO which is variable in 10-Hz steps.

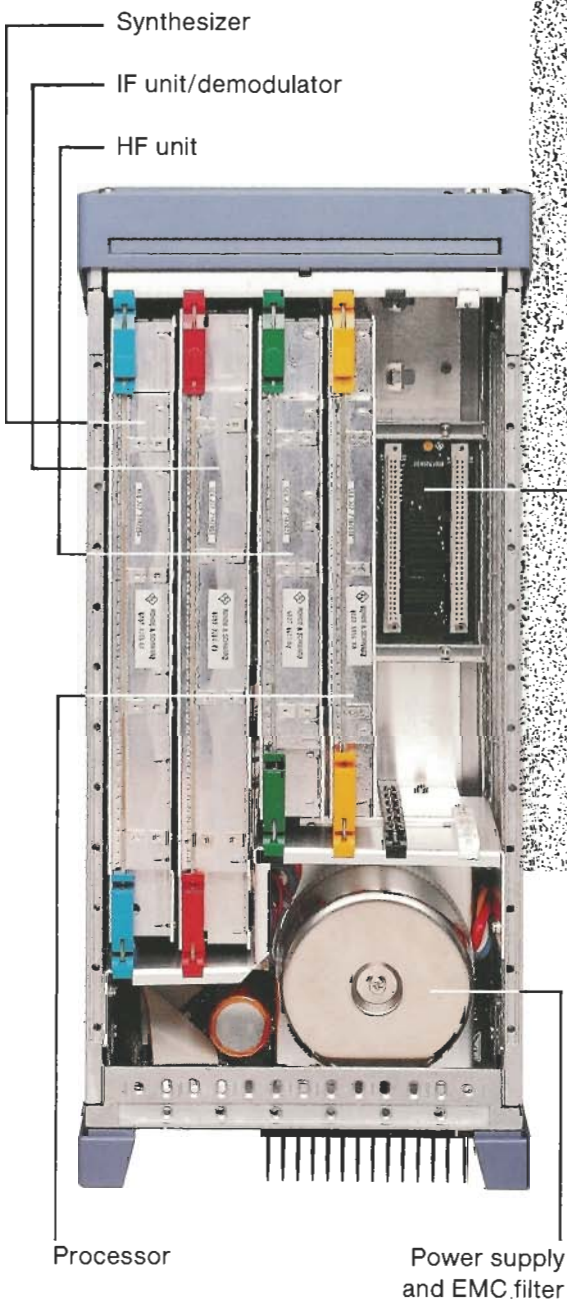
## Synthesizer

The synthesizer supplies all the conversion frequencies required for the HF and the IF demodulator units. Due to direct digital frequency synthesis, the first conversion oscillator can be varied in 1-Hz steps. The settling time of the oscillator is  $\leq 5$  ms for any frequency variation. Two phase-locked loops (PLLs) produce the 40-MHz fixed frequency and the BFO frequency. The operation of the total of four PLLs in the synthesizer is continuously monitored.

In the basic version, all the frequencies are derived from a temperature-compensated crystal oscillator. Higher accuracy requirements can be fulfilled by including an (optional) oven-controlled crystal oscillator or using an external frequency standard (1, 5 or 10 MHz).







# Design

## Processor and software

The modern 16-bit microprocessor using power-saving CMOS technology is what makes the high-performance, reliable and user-friendly concept of the EK 890 possible. The microprocessor is not only responsible for setting and managing the module functions, it also communicates with the outside world via the operating controls and the data interface, executes the internal programs and ensures operational reliability through various measures:

- nonvolatile storage of all settings
- continuous testing of CPU, RAM and PROM functions
- continuous monitoring (CM) of synthesizer specs
- BIT (built-in test) for module testing

The simple and logical ASCII command syntax for controlling the receiver via the serial interface includes control commands for

### basic settings

- frequency
- BFO
- bandwidth
- demodulation mode
- gain control mode
- digital threshold
- passband tuning

### search operations

- frequency scanning
- channel scanning
- hold time
- dwell time
- stop criterion

### test operations

- read CM status
- BIT start
- BIT readout

### system operations

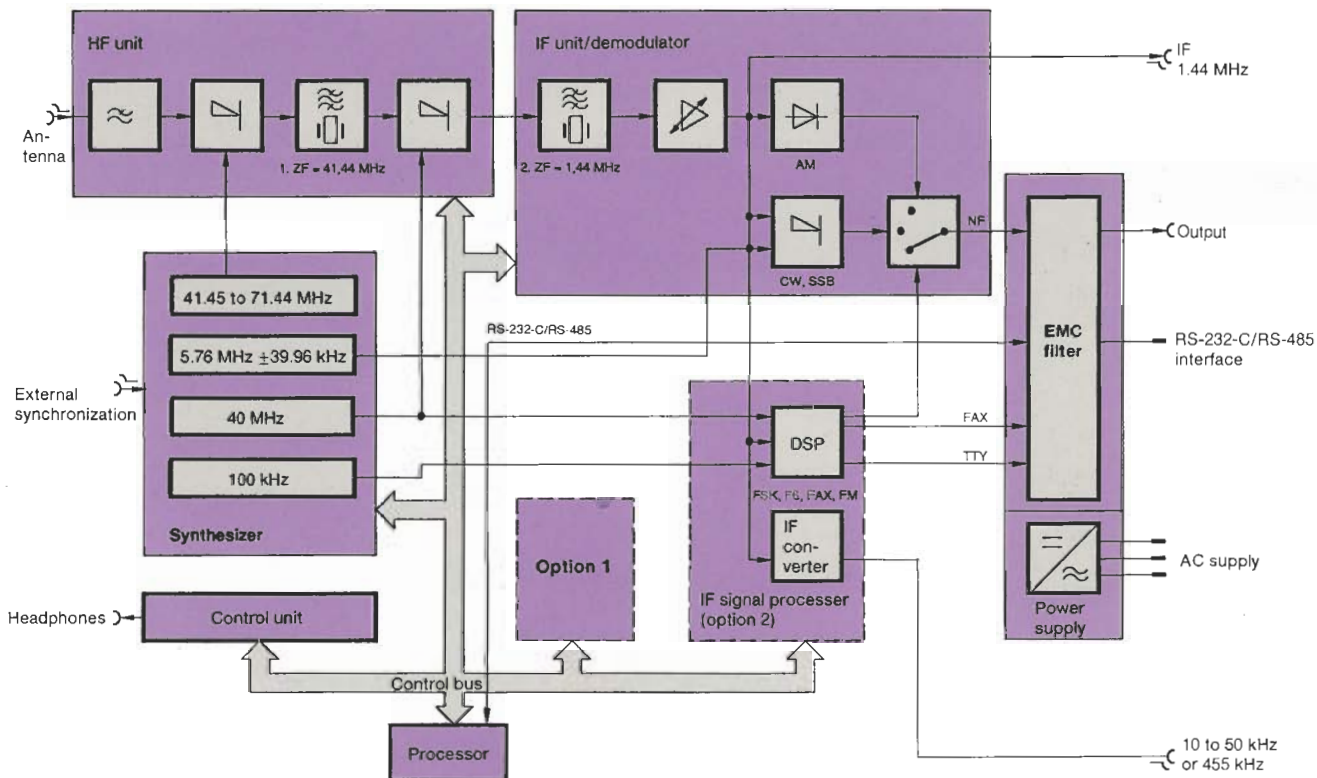
- readout of:
  - software version
  - options
  - error messages
  - signal level
  - filters inserted

### channel operations

- store channel
- erase channel
- select channel
- read out channel

### special operations

- master-slave operation
- operation with EK 085
- complete erasure of channel memory





# Various configurations

## EK 890 with remote control panel

In its standard version, the EK 890 is remote-controlled by ASCII command sequences via a multi-standard interface (RS-232-C, RS-485, RS-422/423, 2-/4-wire). In the simplest case, a terminal can be used as the control unit; for more convenience a computer can be used: then the system can handle complex tasks, as well as presenting any desired user interface. A demo program for generating a virtual front panel is available.

The receivers can be screwed together to yield a 19" unit for rackmounting, but operated independently of each other (see photo on page 3).

## EK 890 with Control Unit GB 890

The EK 890 is optionally available with the GB 890, an operator front panel, which can also be retrofitted. This front panel permits manual control of all functions, while full remote-control capability is maintained. This EK 890 model is particularly suitable for use as a master receiver in receiving systems or as a stand-alone unit.

The operator interface provides for a combination of hard-key and softkey entries. Parameters that are frequently varied, ie receive frequency, channel, BFO frequency and passband tuning (PBT), can be entered directly via a separate keypad. All current receiver settings are continuously indicated in large high-contrast characters on a backlit LCD. An additional analog bargraph indicator allows indication of either the receive level (0 to 120 dB $\mu$ V, in 5-dB steps), the DGC or MGC settings or the frequency offset (as a tuning aid and deviation indication if the optional IF signal processor is installed).

## IF filter configuration

The EK 890 is available in three standard models with 2, 3 or 6 fixed IF filter bandwidths (see page 11). Special bandwidths are available on request.

## IF Signal Processor GM 890 (optional)

In the IF signal processor, the second IF is down-converted, digitized by a 12-bit A/D converter and applied to a single-chip processor for demodulation and signal processing (DSP).

The basic version of this module is designed for TTY operation (FSK, AFSK) and can optionally be extended for the following functions:

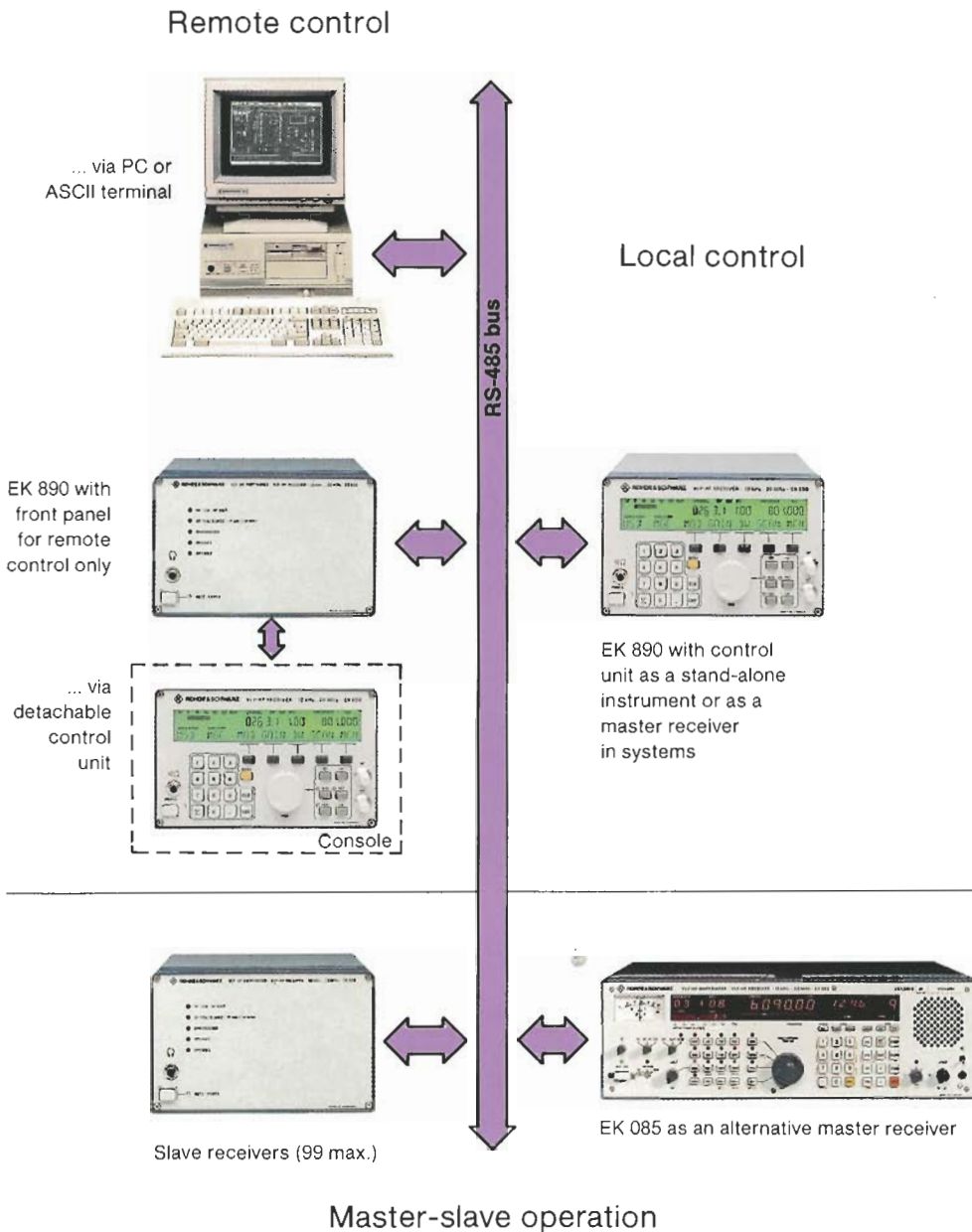
- voice/NBFM (F3E)
- TTY 2-channel (F7B)
- FAX (F1C) black-and-white; F3C with grey levels
- IF conversion to 10 to 50 kHz or 455 kHz

## Preselector FK 890 (optional)

The preselector module with lowpass filter, bandpass filter and eight suboctave filters is available as an option on request.

# Control modes

The EK 890 has a suitable operating mode for every application. The remote-control interface is configured to the RS-485 standard and is bus-compatible for system operation. Users who want to control their radiomonitoring system from a central control unit (front panel) instead of from a computer can use the EK 890 as a master receiver.





The softkey-menu operator interface provides the ergonomic advantage of clean front panel layout as well as access to a large number of setting parameters. When you insert extension modules, they are automatically included in the menu system. The following table shows all setting possibilities down to the second menu level.

<b>Main menu: MOD GAIN BW SCA MORE</b>		
	↓	Indication at 2nd menu level
<b>MOD</b>	Demodulation modes MORE, if options are inserted	<b>AM CW USB LSB MORE</b>
<b>GAIN</b>	Control modes auto, manual, auto + manual, auto + digital MORE: fast or slow response of AGC	<b>AGC MGC A+M A+D MORE</b>
<b>BW</b>	Bandwidth	<b>BW ↓ BW ↑</b>
<b>SCA</b>	Scan mode Frequency sweep, channel sweep (any sequence), channel sweep (incremental), stop or continue sweep, program sweep	<b>FRQ CHP CHS S/C PRO</b>
<b>MORE: M/S SYS SPEC CHM MEM</b>		
	↓	
<b>M/S</b>	Master-slave operation Address slave, read out or vary slave settings	<b>ADR GET PUT</b>
<b>SYS</b>	System status Read out firmware version, built-in options, error messages; start self-test	<b>VERS OPT CM BITE</b>
<b>SPEC</b>	Special functions Rotary knob: step size, on/off; level setting for threshold-controlled external switching signal; indicate serial interface setting; switch to remote control	<b>KNOB LEV SER REM</b>
<b>CHM</b>	Channel manipulation parameters Channel memory indication and channel- specific parameter variation without interrupting reception	<b>MOD GAIN BW THLD</b>
<b>MEM</b>	Channel memory operations Clear all memory, clear certain memory, store to certain memory, use the next free memory	<b>CLA CLCH STCH STO</b>

