



Modulation Analyzer FMAV

Modulation analysis for VOR/ILS air navigation

Modulation Analyzer FMAV, a member of the FMA family, features the versatile measurement functions of the FMA basic model and fulfills the requirements for measurements on ground stations of VOR/ILS air navigation systems.

With its extremely low measurement error achieved by means of digital signal processing, FMAV meets the stringent

requirements placed on measuring instruments for ILS systems of category III.

The comprehensive measurement functions make FMAV ideal for all modulation measurements including phase measurements on ILS/VOR systems as well as for use as a calibrator for VOR/ILS signal generators.

FMAV has been designed especially for air-traffic control authorities, airport operators as well as for manufacturers of air navigation test systems and airborne systems.

Due to its unrivalled measurement accuracy, comprehensive measurement functions and great ease of operation, FMAV ensures an extremely high reliability standard of air navigation systems.



All essential test parameters can be read at a glance on clearly arranged LCD displays

Special FMAV measurements

- Selective modulation depth measurement on VOR/ILS systems with an error of less than 0.8% (for ILS: $\leq 0.5\%$)
- DDM measurement with an error of ≤ 0.0002 DDM for localizer and ≤ 0.0005 DDM for glide path
- Deviation measurement of VOR subcarrier
- Modulation frequency measurement of VOR/ILS signals
- ILS/VOR phase measurement with extremely high accuracy and resolution down to 0.001°

General FMAV measurements

- RF frequency measurement with 10-digit readout and error ≤ 10 Hz at 100 MHz within calibration interval thanks to highly stable reference oscillator (aging $< 10^{-9}$ /day)
- AM, FM and ϕ M measurements over a wide modulation frequency range
- AF measurement with 5-digit readout
- Selective distortion and intermodulation measurement
- Universal filter capabilities, psophometric weighting filters (optional)
- AF voltage measurement
- RF power measurement with error of typ. < 0.5 dB

Characteristics

In addition to the broadband analog demodulators, AF filters and detectors of the FMA basic model, FMAV has a signal processor.

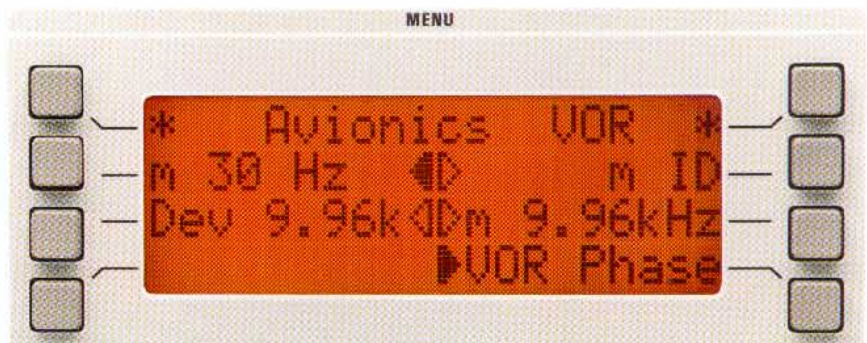
This signal processor module allows the relatively narrowband modulation contents of air navigation signals to be sampled at the IF already and then digitally demodulated, filtered and evaluated.

The IF is digitized by a 16-bit A/D converter; the digital sampling values are further processed by the signal processor.

In contrast to analog demodulators, filters and detectors, the digital AF filters of the signal processor module are practically error-free and have no drift whatsoever due to aging or temperature.

The digitally demodulated and filtered signals are additionally converted into analog signals by a D/A converter and are available as two channels at two BNC connectors on the rear panel, eg for visual checking on an oscilloscope.

Softkeys enable fast access to desired measurement functions



Operation

Due to its versatile measurement functions, the FMAV is menu-controlled so that there is no need for a great number of individual keys.

A minimum number of main function keys as well as an alphanumeric menu display with four softkeys down each side make for clear front-panel layout and fast access to the desired measurement functions. Important functions are at the top of the menu hierarchy, the number of submenu levels being limited to a maximum of three so that finding one's way in the menu is easy.

Three large, illuminated LCD displays simultaneously read out the measured values for:

- carrier frequency or power
- modulation depth, deviation or DDM
- modulation frequency, distortion or phase

Device status and settings are also displayed.

Parameters, like for instance a reference value for relative display, can be entered via the numeric keypad and are terminated with one of the ENTER keys (unit/multiplier key). The fact that up to 20 complete setups can be stored considerably enhances the measurement reliability in complex applications.

Modulation Analyzer FMAV features full remote-control capability. The IEC-bus interface complies with the IEEE 488.2 standard and enables plain-text

programming, which greatly facilitates program writing. The inquiry for the ILS DDM value, for instance, reads: DEMODULATION: AVIONICS:ILS:DDM?

Measurement functions

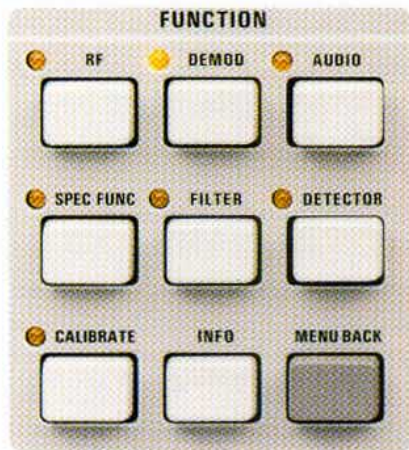
ILS signals

- Selective measurement of 90-Hz, 150-Hz and sum modulation depth without influence from additional signals (identifiers) with an error of less than 0.5% of reading
- Measurement of modulation depth of identifier signal in the range from 300 Hz to 4 kHz without influence from ILS signals
- High-precision DDM measurement with an error of less than 0.0002 DDM for localizer and 0.0005 DDM for glide path

- Selective measurement of modulation frequency
- 90-Hz/150-Hz phase measurement
- Unaffected selective measurement of all ILS distortion products

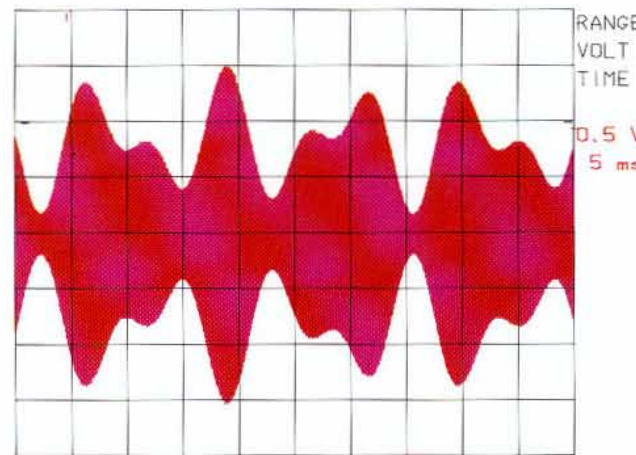
VOR signals

- Selective measurement of 30-Hz and 9.96-kHz modulation depth
- Modulation-depth measurement of identifier signal in the range from 300 Hz to 4 kHz without impairment from VOR signal
- Deviation measurement on 9.96-kHz subcarrier
- Modulation-frequency measurement at 30 Hz, 9.96 kHz and of FM-demodulated 30-Hz signal
- High-precision phase measurement on 30-Hz signals (error <math><0.02^\circ</math>)

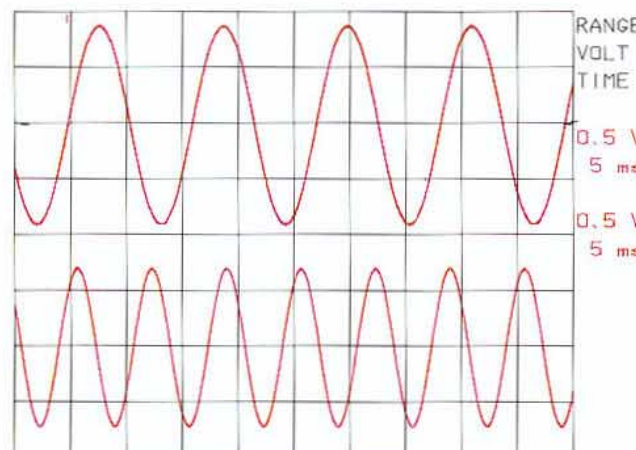


The few main function keys make the FMAV user-friendly:

- RF** All RF settings such as tuning frequency, input level, RF frequency counter
- DEMOD** Selecting the demodulation modes
- AUDIO** Setting the audio frequency counter or the DIST/SINAD meter
- SPEC FUNC** Special functions like voltmeter mode, IEC/IEEE-bus address, bargraph indicator, control etc.
- FILTER** Selecting the audio filters
- DETECTOR** Selecting the detector for the modulation display
- CALIBRATE** Calibration functions
- INFO** Readout of all internal settings on the menu display
- MENU BACK** Going back a level in the menu tree



ILS signal
 DDM=0.1 $\Delta\phi=45^\circ$;
 90 Hz: m=45 %, $\phi=0^\circ$;
 150 Hz: m=35 %, $\phi=45^\circ$



Demodulated ILS signal
 top: 90 Hz ($\phi=0^\circ$), filtered;
 bottom: 150 Hz ($\phi=45^\circ$), filtered

TACAN signals*)

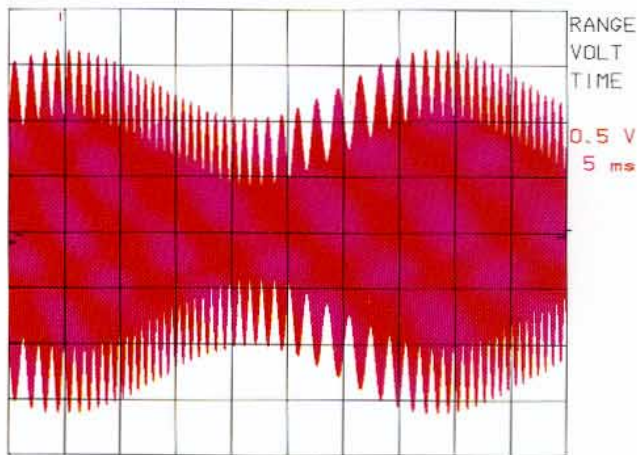
- Selective measurement of 15-Hz, 135-Hz and sum modulation depth with an error of less than 0.5% of reading
- Phase measurement 15 Hz/135 Hz
- Selective measurements of modulation frequency
- Distortion measurement (optional) using the standard analog AM demodulator at all modulation frequencies from 10 Hz to 100 kHz

- Selective harmonic distortion measurement of $d_2, d_3, \dots d_i$
- True THD measurement of intermodulation products to IEC 268-3
- Universal measurement of intermodulation products to IEC 268-3
- Scaled display of AF spectrum by direct connection of an oscilloscope
- Selective distortion measurement on $n \times 30$ Hz components (ILS signal)
- Baseband ILS and VOR measurements at voltmeter input

In-depth AF analysis

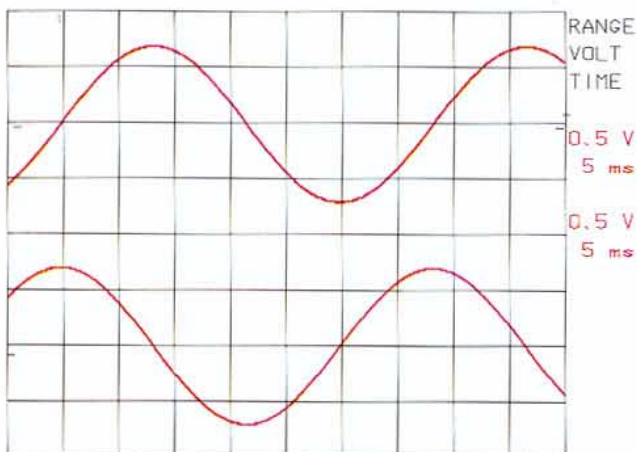
based on selective harmonic distortion and intermodulation measurement is standard with the FMAV

*) Measurements are possible only on nonpulsed signals, not on realworld TACAN signals.



VOR signal
 30 Hz: $m=30\%$,
 $\varphi=90^\circ$
 9.96 kHz¹⁾: $m=30\%$
 FM:
 deviation 480 Hz
 $f_{mod}=30$ Hz
 phase= 0°
 (reference)

¹⁾ Frequency not to scale



Demodulated VOR signal
 top:
 FM-demodulated reference signal ($\varphi=0^\circ$)
 bottom:
 AM-demodulated signal, 30-Hz filtering ($\varphi=90^\circ$)

Options

The options available for the FMA basic model can also be used for the FMAV as far as they are appropriate for the FMAV applications.

Filter FMA-B1

This filter option contains universal analog AF filters, of which CCITT filter P53 is of special interest, since it allows weighted noise measurements in radio-telephone systems.

AM/FM Calibrator/AF Generator

FMA-B4

The high-precision internal modulation source (error $<0.1\%$) is used for calibrating the built-in analog demodulators and the AF measurement section. It also enables a simple performance check of the digital VOR/ILS measurement section.

Since this option is able to produce high-precision VOR/ILS baseband signals (2 rear AF outputs), signal generators can be modulated and hence be used in VOR/ILS systems.

RF/IF Selection FMA-B9 (model .57)

The retrofittable option RF/IF selection from 5 to 400 MHz extends the FMAV to a calibrated VOR/ILS receiver of high sensitivity for off-air measurements.

Specifications

Frequency range	50 kHz to 1360 MHz
Frequency tuning	automatic ¹⁾ or manual
Display	10-digit readout
Resolution	0.1/1/10/100 Hz selectable
Frequency error	±1 digit + error of reference frequency
Reference oscillator	
Aging	1 x 10 ⁻⁷ /year
After 30 days of operation	1 x 10 ⁻⁹ /day
Temperature effect	2 x 10 ⁻⁹ /°C
Warmup time	15 min
External reference input/output	manual or remote-controlled switchover

RF input	Z _{in} = 50 Ω, N connector, VSWR < 1.4 with 10-dB attenuation up to 5 W (15 V RMS)
Overload protection	25 V (including DC)
Maximum peak voltage	

RF power measurement	
Frequency range	50 kHz to 1360 MHz
Power measurement range	0.18 μW to 1 W (-37.5 to +30 dBm)
Measurement error	
0.18 μW ≤ P < 0.1 mW	≤ 1.5 dB ± 0.05 μW
P ≥ 0.1 mW	≤ 1 dB (typ. 0.5 dB)

Amplitude modulation measurement	
Modulation frequency range	10 Hz to 200 kHz
Resolution	0.1% of rdg; max 0.001% AM

Measurement error²⁾ with peak detection (% of rdg, plus peak residual AM)

f _{in}	50 to 300 kHz	300 kHz to 10 MHz	≥ 10 MHz	error
	f _{mod}			
m ≤ 80%	30 Hz to 3 kHz	30 Hz to 10 kHz	30 Hz to 20 kHz	≤ 0.8%
m ≤ 95%	–	30 Hz to 20 kHz	30 Hz to 100 kHz	≤ 1%
	10 Hz to 8 kHz	10 Hz to 20 kHz	10 Hz to 100 kHz	≤ 2%
	–	10 Hz to 50 kHz	10 Hz to 200 kHz	≤ 5%

Residual AM ³⁾	
to CCITT	≤ 0.01%
20 Hz to 23 kHz, RMS	≤ 0.03%
to CCIR	≤ 0.05%

Incidental AM in FM mode	
(f _{mod} = 1 kHz, meas. bandwidth: 20 Hz to 3 kHz)	
f _{in} = 50 kHz to 10 MHz, deviation = 5 kHz	≤ 0.2%
f _{in} ≥ 10 MHz, deviation = 50 kHz	≤ 0.1%

AF distortion ⁴⁾ for	
f _{mod} = 10 Hz to 20 kHz	≤ 0.2%
m = 40%	≤ 0.4%
40% < m ≤ 80%	

Frequency modulation measurement	
Modulation frequency range	10 Hz to 200 kHz

Maximum measurable deviation for

f _{in}	50 to 300 kHz	300 kHz to 10 MHz	≥ 10 MHz
	f _{in} /10	150 kHz	700 kHz

Measurement error²⁾ with peak detection (plus peak residual FM)

f _{in}	50 to 300 kHz		300 kHz to 10 MHz		≥ 10 MHz	
	f _{mod}	error	f _{mod}	error	f _{mod}	error
	30 Hz to 5 kHz	≤ 0.5%	30 Hz to 10 kHz	≤ 0.5%	30 Hz to 20 kHz	≤ 0.5%
	10 Hz to 8 kHz	≤ 2%	30 Hz to 20 kHz	≤ 1%	30 Hz to 100 kHz	≤ 1%
			10 Hz to 50 kHz	≤ 2%	10 Hz to 200 kHz	≤ 2%

Resolution better than 0.1% of rdg (min. 0.1 Hz)

Residual FM ³⁾ for f _{in}	≤ 340 MHz	≤ 680 MHz	≤ 1360 MHz
to CCITT, RMS	≤ 0.5 Hz	≤ 0.7 Hz	≤ 1 Hz
20 Hz to 23 kHz, RMS	≤ 2 Hz	≤ 3 Hz	≤ 5 Hz
CCIR, quasipeak + 50 μs deemph.	≤ 3 Hz	≤ 4 Hz	≤ 6 Hz

AF distortion for deviation	75 kHz	500 kHz
f _{in} ≥ 10 MHz		
f _{mod} = 30 Hz to 20 kHz ⁵⁾	≤ 0.05%	≤ 0.2%
f _{mod} = 20 to 100 kHz	≤ 0.15%	≤ 0.5%
f _{in} > 500 kHz		
f _{mod} = 30 Hz to 20 kHz	≤ 0.1%	
Incidental FM (m = 50%, f _{mod} = 1 kHz, BW = 20 Hz to 3 kHz, plus peak residual FM)	≤ 10 Hz	
Deemphasis	50/75/750 μs selectable, effective at AF output and, if selected, for readout of results	

Phase modulation measurement

Modulation frequency range	200 Hz to 200 kHz
Maximum measurable deviation (up to max. 1 kHz AF, -6 dB/octave for f > 1 kHz)	

f _{in}	50 to 300 kHz	300 kHz to 10 MHz	≥ 10 MHz
	1/10 x f _{in} /kHz x 1 rad	150 rad	700 rad

Error²⁾ of peak detection (plus peak residual φM)

f _{mod}	300 Hz to 5 kHz	300 Hz to 10 kHz	300 Hz to 100 kHz
	≤ 2%	≤ 2%	≤ 2%

Resolution < 0.1% (minimum 0.0001 rad)

Residual φM ³⁾ for f _{in}	≤ 680 MHz	> 680 MHz
CCITT weighting	≤ 0.002 rad	≤ 0.004 rad
300 Hz to 23 kHz	≤ 0.005 rad	≤ 0.01 rad

AF distortion (at AF output), f _{mod} = 200 Hz to 20 kHz, Δφ = 4 rad, f _{in} ≥ 500 kHz	≤ 0.1%
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AF voltmeter

DC voltage measurement	
Range	± 10 μV to 20 V
Offset voltage ⁶⁾	
unbalanced input	≤ 1 mV } can be corrected to ≤ 30 μV
balanced input	≤ 3 mV } using offset function
Resolution	< 0.1%
Error	
3-kHz lowpass filter	± 0.5% ± 100 μV ± offset voltage
5-Hz lowpass filter (with filter option)	± 0.5% ± 10 μV ± offset voltage

AC voltage measurement

Frequency range	10 Hz to 300 kHz
Measurement range	30 μV to 20 V
Resolution	0.1% of rdg
Error (RMS detector)	
30 Hz to 20 kHz	≤ 1% ± 30 μV (100-kHz lowpass filter)
10 Hz to 100 kHz	≤ 2% ± 100 μV (without lowpass filter)
10 Hz to 200 kHz	≤ 3% ± 100 μV (without lowpass filter)
Weighting facilities	all AF measuring facilities, such as detector, filter, frequency counter and distortion meter, can also be used in voltage measurements

Inputs

unbalanced	input impedance 100 kΩ 50 pF, BNC connector
balanced	input impedance 600 Ω, three-contact connectors to DIN 41628

AF detector

Peak detector	positive or negative peak of AF or the arithmetic mean of the two
RMS detector	true RMS-responding rectifiers, readout as RMS value or converted to peak for sinewave
Quasipeak detector	detector to CCIR Rec. 468-4

Weighting filters

Highpass filters	10 Hz (2nd order) 20 Hz (3rd order) 300 Hz (2nd order)
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Lowpass filters

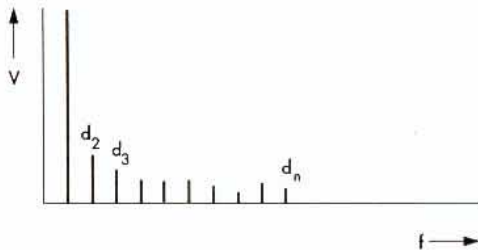
Lowpass filters	3 kHz (4th order) 23 kHz (4th order, combined with 20-Hz highpass filter to CCIR 468-4, unweighted) 100 kHz (4th order)
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Filter option
 CCIR 468-4 (weighted)
 CCITT P53
 5-Hz lowpass (for DC measurement)
 30-kHz Bessel lowpass, 4th order
 120-kHz Bessel lowpass, 4th order
 4.2-kHz Cauer lowpass
 special ϕ M filter (phase modulation for modulation frequency ≤ 10 Hz)
 external filters possible

AF frequency display
 Frequency range 10 Hz to 300 kHz
 Resolution 1 mHz to 10 Hz
 Error $\pm 0.005\% \pm 3$ mHz ± 1 digit

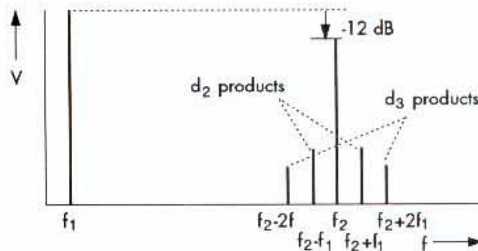
Selective distortion measurement
 Readout in % or dB
 Display range 0.001 to 20%,
 -100 to -14 dB
 Measurement of individual distortion d_i ($i = 2, 3, \dots, 10$)
 Measurement error
 $10 \text{ Hz} \leq f_1 \leq 14 \text{ kHz}$, $f_{d1} \leq 42 \text{ kHz}$ $\leq 5\%$ of rdg $\pm 0.02\%$ absolute

THD measurement
 Measurement of harmonic $i = n$ ($n = 2$ to 10 selectable)
 Measurement error
 $10 \text{ Hz} \leq f_1 \leq 14 \text{ kHz}$, $f_{dn} \leq 42 \text{ kHz}$ $\leq 5\%$ of rdg $\pm 0.03\%$ absolute

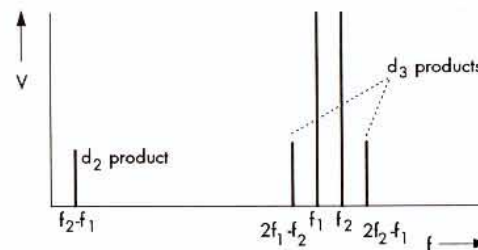


Intermodulation measurement

Intermodulation distortion d_2, d_3 to DIN 45403 and IEC 268-3
 Readout in % or dB
 Display range 0.001 to 20%,
 -100 to -14 dB
 Measurement error
 $f_2 + 2 \times f_1 \leq 42 \text{ kHz}$, $f_1 \geq 10 \text{ Hz}$ $\leq 5\%$ of rdg $\pm 0.1\%$ absolute



Difference-frequency distortion d_2, d_3 to DIN 45403 and IEC 268-3
 Readout in % or dB
 Display range 0.001 to 20%,
 -100 to -14 dB
 Measurement error ($f_2 - f_1 \geq 30$ Hz)
 $2 \times f_2 - f_1 \leq 42 \text{ kHz}$ $\leq 5\%$ of rdg $\pm 0.05\%$ absolute



Measurement of distortion and intermodulation products on ILS signals

(AM with 90 Hz, 150 Hz (DDM=0) and identifier signal 1020 Hz)

Selectable single or total harmonic distortion (THD) measurement on 90 Hz, 150 Hz and 1020 Hz components

Accuracy $\leq 5\%$ of rdg $\pm 0.1\%$ absolute

Selective distortion measurement of $n \times 30$ Hz components from 30 to 1200 Hz relative to 90 Hz component (=100%)

Accuracy $\leq 5\%$ of rdg $\pm 0.1\%$ absolute

Total harmonic distortion (THD) measurement of speech channel from 300 Hz to 3 kHz (90, 150 Hz components on, 1020 Hz comp. off)

Accuracy $\leq 5\%$ of rdg $\pm 0.1\%$ absolute

Measuring time

Automatic tuning; RF, modulation and modulation frequency measurement with 10 Hz RF resolution (highpass filter and PK detector switched on)

typ. 1 s

Fast modulation measurement (RF, modulation range and level programmed)

≤ 120 ms

DIST measurement $f_{mod} \geq 30$ Hz
 $f_{mod} \geq 300$ Hz

typ. 2.5 s

typ. 1 s

Outputs

IF output max. 200 mV into 50 Ω

AM output max. 1 V into 600 Ω
 (can be DC-coupled)

FM/ ϕ M output for FM 6 dBm (1.545 V) into 600 Ω ,
 40 kHz deviation (DC-coupled)
 1.545 V into 600 Ω , 40 rad

Distortion output (with optional DIST/SINAD meter)

max. 1 V into 600 Ω

AF output 1 to 4 V into 600 Ω (peak voltage)

10-MHz reference frequency
 Output +12 dBm, 50 Ω
 Input -10 to +12 dBm

Deflection for external oscilloscope

Y deflection, 0 to 4 V, BNC female
 X deflection, 0 to 4 V, BNC female

DSP1

DSP2

Scale markers

13 markers, 10 dB/div
 10 markers

Vertical

Horizontal

Remote control

Interface IEC 625-1/625-2 (IEEE 488.1/488.2) connector: 24-contact Amphe-rol; controlling all device functions including Serial Poll and Parallel Poll
 SH1, AH1, L4, T5, SR1, RL1, DC1, DT1, PP1, CO
 Interface functions

VOR/ILS-specific data

These data are guaranteed within the frequency ranges specified (f_{in}). They are typical values for all frequencies ≥ 10 MHz

VOR

f_{in} : 10 MHz; 108 to 120 MHz

Amplitude modulation measurement

m: 10 to 90%

f_{mod}
 30 Hz $\pm 1\%$

measurement error⁷⁾ (% of rdg)

9.96 kHz $\pm 1\%$

$\leq 0.8\%$

300 Hz to 4 kHz

$\leq 1.2\%$ (typ. $\leq 0.8\%$)

Frequency modulation measurement

at 9.96-kHz carrier

Max. measurable deviation

700 Hz

f_{mod}
 30 Hz $\pm 1\%$

measurement error⁷⁾ (% of rdg)

Phase difference measurement

$\leq 0.5\% \pm 0.1$ Hz

at 30 Hz

Measurement range

0 to 360°

Measurement error

$\leq \pm 0.03^\circ$ (typ. $\leq \pm 0.02^\circ$)

Resolution

$\leq 0.01^\circ$

ILS

f_{in} : 10 MHz; 108 to 120 MHz; 328 to 336 MHz

Amplitude modulation measurement

m : 10 to 90%	measurement error ⁷⁾ (% of rdg)
f_{mod} 90 Hz \pm 2%	$\leq 0.5\%$
150 Hz \pm 2%	$\leq 0.5\%$
300 Hz to 4 kHz (identifier)	$\leq 1.5\%$ (typ. $\leq 0.8\%$)

DDM measurement

Measurement range: 0 to ± 0.2 DDM	
f_{mod} : 90 Hz \pm 1% and 150 Hz \pm 1%	
m	measurement error ⁷⁾
18 to 22%	$\leq \pm 0.0002$ DDM $\pm 0.1\%$ of rdg
32 to 48%	$\leq \pm 0.0005$ DDM $\pm 0.1\%$ of rdg
Resolution: ≤ 0.0001 DDM	

Measurement of phase angle between 90-Hz and 150-Hz signals

Measurement range	$\pm 60^\circ$
Measurement error	$\leq \pm 0.2^\circ$
Resolution	$\leq 0.01^\circ$

TACAN*)

f_{in} : 10 MHz; 950 to 1250 MHz

Amplitude modulation measurement

m : 10 to 90%	measurement error ⁷⁾ (% of rdg)
f_{mod} 15 Hz \pm 2%	$\leq 0.5\%$
135 Hz \pm 2%	$\leq 0.5\%$

Measurement of phase angle between 15-Hz and 135-Hz signals

Measurement range	$\pm 180^\circ$ (135 Hz)
Measurement error	$\leq \pm 0.5^\circ$
Resolution	$\leq 0.01^\circ$

*) Measurements are possible only on nonpulsed signals (not on realworld TACAN signals)

AF outputs DSP1, DSP2	max. 4 V into 600 Ω
DC offset	$\leq \pm 3$ mV
Additional error	
Scaling for AM	4 V/100% $\pm 1\% \pm 2$ mV
Scaling for FM	4 V/1 kHz $\pm 1\% \pm 2$ mV
Gain difference for ILS (90 to 150 Hz)	0.2%
Phase difference for VOR (30 Hz)	0.05°
TACAN (15 to 135 Hz)	0.2°
ILS (90 to 150 Hz)	0.3°

VOR/ILS baseband at voltmeter UNBAL input

AM sensitivity 100 mV to 10 V peak, 100% AM

VOR:

Amplitude modulation measurement

f_{mod}	measurement error ⁷⁾ (% of rdg)
30 Hz $\pm 1\%$, 9.96 kHz $\pm 1\%$	$\leq 0.8\%$
300 Hz to 4 kHz (identifier)	$\leq 1.2\%$

Frequency modulation measurement

at 9.96 kHz carrier
Maximum measurable deviation 700 Hz

f_{mod}	measurement error ⁷⁾
30 Hz $\pm 1\%$	$\leq 0.5\% \pm 0.1$ Hz

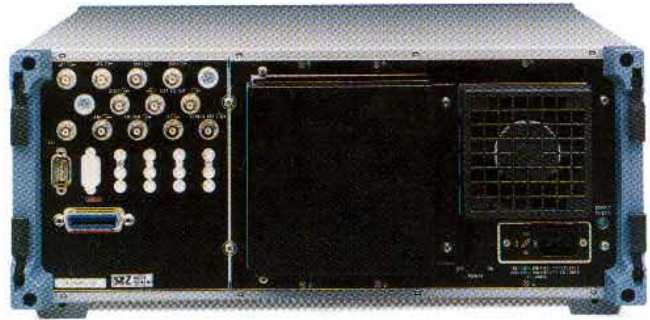
Phase difference measurement

at 30 Hz	
Measurement range	0 to 360°
Measurement error	$\leq \pm 0.02^\circ$
Resolution	$\leq 0.01^\circ$

ILS:

Amplitude modulation measurement

f_{mod}	measurement error ⁷⁾ (% of rdg)
90 Hz $\pm 2\%$, 150 Hz $\pm 2\%$	$\leq 0.5\%$
300 Hz to 4 kHz (identifier)	$\leq 1.5\%$



Rear view of FMAV

DDM measurement	0 to ± 0.2 DDM
Measurement range	
f_{mod}	90 Hz $\pm 1\%$, 150 Hz $\pm 1\%$

m	measurement error ⁷⁾
18 to 22%	$\leq \pm 0.0002$ DDM $\pm 0.1\%$ of rdg
32 to 48%	$\leq \pm 0.0005$ DDM $\pm 0.1\%$ of rdg

General data

Environmental conditions	to IEC 359, class I
Rated temperature range	0 to +55 °C
Storage temperature range	-40 to +70 °C
RFI suppression	complies with VDE 0871, limit B and German PTT regulations 527/1979
Power supply	100/120/220/240 V $\pm 10\%$, 47 to 440 Hz (170 VA)
Dimensions, weight	435 mm x 192 mm x 460 mm, 19 kg

- 1) For amplitude-modulated signals: $P_{in} \geq -27$ dBm, $m \leq 80\%$.
- 2) In temperature range 20 to 30 °C, additional error of $\pm 0.5\%$ over entire temperature range; error of RMS detection may be up to twice as high as of peak detection.
- 3) For input level ≥ 20 dB above specified minimum input level.
- 4) For $f_{in} < 300$ kHz: $f_{mod} = 10$ Hz to 8 kHz.
- 5) 100-kHz lowpass filter switched in.
- 6) Input attenuator switched on: value $\times 10$.
- 7) In temperature range 20 to 30 °C, additional error $\pm 0.3\%$ over entire temperature range.

Ordering information

Order designation	VOR/ILS Modulation Analyzer FMAV 856.4509.52
Accessories supplied	special cable for firmware update, manual, power cable, spare fuses

Options		
Filter	FMA-B1	855.2002.52
AM/FM Calibrator/AF Generator	FMA-B4	855.6008.52
RF/IF Selection	FMA-B9	856.6501.57

Recommended extras		
High-power Attenuator, 20 dB, 50 W	RDL 50	1035.1700.52
19" Adapter	ZZA-94	396.4905.00
Set of Front Handles	ZZG-94	396.5160.00
Transit Case	ZZK-944	1013.9366.00
Service Kit	FMA-Z1	856.4009.52





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