Manufacturer **Endress +Hauser GmbH+Co.**
Hauptstr. 1
D 79689 Maulburg
Germany

Types

Micropilot S FMR53x series-
with Radar Module II.2

FCC ID **LCGFMR53X**

Task

The Radar Modules will be deployed in compact level transmitters for continuous non-contact measurement of liquids in vessels and tanks. Short microwave pulses were sent from the antenna, reflected at the surface of the material and received from the antenna. The time between transmitting and receiving will be evaluated and calculated to an adequate level signal. Because the velocity of light waves is nearly independent of temperature, pressure and humidity, these new radar technologies offer new applications for level measurement under the rough conditions in the industry.

Instrument assembly

The modules are deployed in microwave product families (e.g. Micropilot S FMR53x, of radar level transmitters of Endress + Hauser GmbH + Co. in combination with different types of antennas like horn or rod antennas.

All product families comprise different variants, which can be different from housing, evaluation electronic with signal processing or communication protocol. The microwave performance, however, is fixed by the module itself so that the transmitted microwave power depends only on the gain of the antenna.

System description of the emitting / receipt part:

The RADAR Module consists of two parts:

1) The scanning frequency processing

2) The pulse generator

The output signal of part 1) triggers the generation and emission of the emitting microwave pulse in part 2). The scanning frequency processing also triggers an internal microwave pulse within the module. The trigger signal for the internal pulse is delayed in dependence on time compared to the emitted pulse, so that the receiving pulse reflected by the level will be scanned by this internal pulse. Both signals are fed to an mixer and result in an IF signal. This technique causes a time conversion from the nanosecond range of the HF signal to the millisecond range of the IF signal, enabling the possibility that the signal processing can be performed by low cost standard semiconductor electronic.

The pulse generator emits extreme short pulses of approx. 1.2 ns, which therefore correspond with a bandwidth of approx. $\pm$ 0.83 GHz. This short pulses are required to get an appropriate accuracy and resolution for the level measurement. The pulses comprises a few oscillations and result together with all possible tolerances in the listed values for the spread spectrum.

This scanning principle is comparable with the correlation principle and therefore results in a powerful filter effect. In this way even extreme low power emitted pulses are sufficient for the level measurement with high accuracy.

Summary of the electrical characteristics values of the S / E part:

Emitting frequency	6.3	GHz
Emission pulse clock frequency	3.579545	MHz
Scanning pulse clock frequency	3.57952315	MHz
Frame frequency of the PN-generator	27.96	kHz
Emitting pulse with 6 dB app.	1.2	ns
Emitting pulse peak envelope power	< -9	dBm
Antenna gain	< 24	dBi

Calculation of pulse spectrum:

f_{centre} = 6.3GHz centre frequency
T_{pulse} = 1.2 nsec pulse length

$B = 2/T_{pulse}$ band width

$f_{min} = f_{centre} - 1/T_{pulse}$ = 6.3 GHz- 0.83 GHz = 5.47 GHz = >5.46 GHz

Assembly:

A Radar Module II.2 consists of a multilayer printed circuit board built in a plastic housing. The surface of the housing is electrically conductive.
One face of the printed circuit board of the Radar Module II.2 is the HF Front end according to the schematic 960402-3057 called “Radar- Module II.2”; the other face of the printed circuit board contains the frequency treatment stage according to the schematic 960402-3056 called “Radar Module II.x frequency excitation”.

Inputs / Outputs:

The electrical connection from the Radar Module II.2 to the evaluation stage of the Micropilot FMR53x is made via connector.
The Radar Module has following input / output ports (see drawing n° 960402-3056 / -3057):

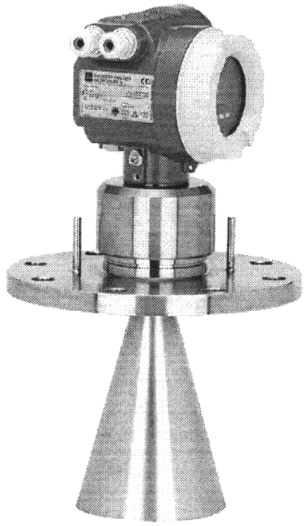
- Supply
- Standby input
- Intermediate frequency output
- Trigger output signal
- GND

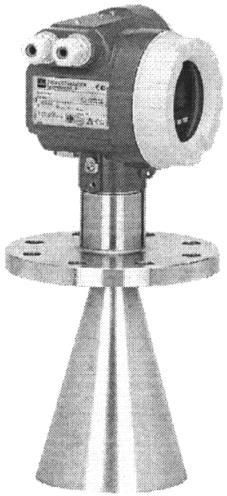
The microwave signals are led to the antenna systems of the Micropilot series by a coaxial cable.

Operating data:

Supply voltage. 3,5V

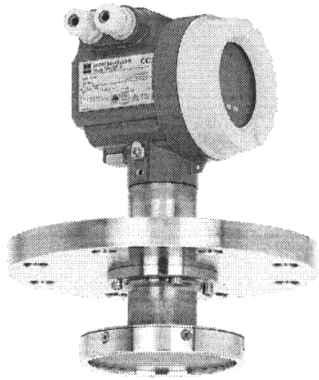
FMR 530
Hornantenne
Horn antenna



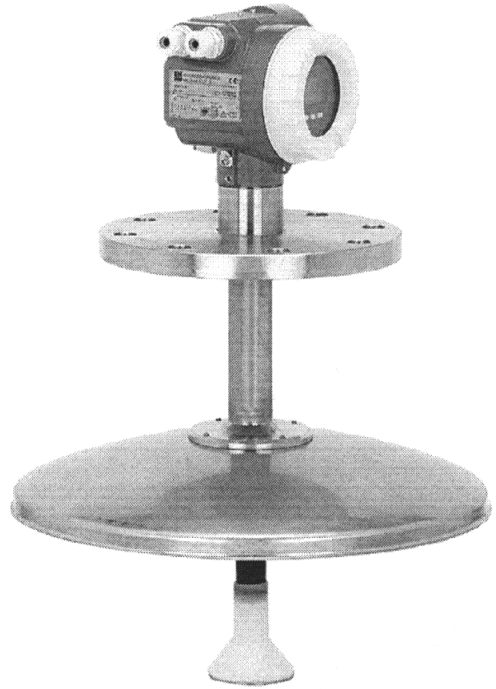


FMR 531
Stabantenne
Rod antenna

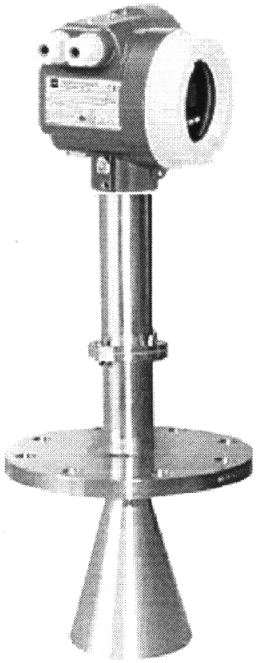
FMR 532
Planarantenne
Planar antenna



FMR 533
Parabolantenne
Parabolic antenna



Hochtemperatur/high temperature



Agency controlled drawing.
No changes without prior
Agency approval.

GEOMETRICAL TOLERANCING DIN ISO 1101 SURFACE TEXTURE DIN ISO 1302 EDGES OF WORKING PARTS DIN 6784	H						DATE	NAME	Endress+Hauser Maulburg, Germany
	G					DESIGN			
	F					DRAWN	21.12.99	fb	DOCUMENT PROTECTED BY DIN 34
	E					APPROVED	21.12.99	KHK	
	D					SCALE	TITLE: Micropilot S FMR 53x		DRAWING NO.: 960399-0001 B
	C								
	B		KT	KHK	06.07.00				
	A					TOLERANCE	MATERIAL		REPL. FOR / REPL. BY
		NO.	DRAWN	APP'D	DATE				C / SHEET SIZE A3