

# CAPAC<sup>®</sup> HS



Capacitance Measurement Systems  
For Cable Production Lines

## IN-LINE CAPACITANCE MEASURING SYSTEMS

The **CAPAC® HS** high speed capacitance measurement systems from ZUMBACH guarantee accurate and reliable measurements of the coaxial capacitance of telephone cables, coax cables, data and LAN cables (cat. 5, 6, 7, 8) at the high bandwidth and low noise level. The systems offer various advantages and possibilities of in-line capacitance measurement, such as:

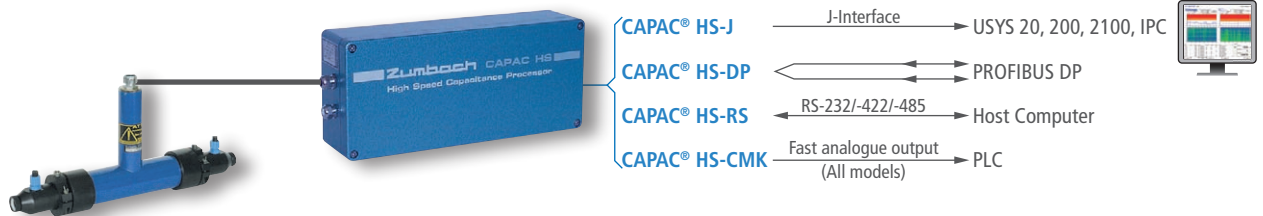
- Accurate, continuous measurement and monitoring of the products capacitance
- Communication with higher level systems, including PROFIBUS DP
- FFT analysis and absolute value simultaneously
- SRL prediction up to 6.5 GHz
- Process control as well as statistical monitoring and production logging
- Pinhole function; pinhole and bare patch detection in the production
- High speed analogue output
- Very low noise level
- Digital output for connection to processors and display units
- Separate processor and display for mounting flexibility
- OEM application solutions

## SYSTEM OVERVIEW

The **MR** measuring tube is the measuring sensor. It measures the coaxial capacitance of the cable over a defined length.

The **CAPAC® HS** electronics treats the signals acquired by the measuring tube. It transmits the capacitance over different interfaces to the connected data processing system.

Data processing and display units from ZUMBACH (**USYS 20/200/2100, USYS IPC CELLMASTER®**) or customer systems, such as PLC's and Host computers.



## MEASURING TUBES

### Standard tubes with a measuring length of 50 mm (2 in.)

These measuring tubes are specially designed for the measurement of CAT type communication cables. These tubes feature a very high signal to noise ratio as well as a large band width. This is especially advantageous when capacitance variations must be monitored e.g. for FFT/SRL analysis.

Model	MR.12.50HS	MR.12.50HSD <sup>1)</sup>	MR.20.50HS	MR.36.50HS	MR.68.50HS
	mm inch	mm inch	mm inch	mm inch	mm inch
Inner diameter	12 0.5	12 0.5	20 0.8	36 1.4	68 2.7
Active measuring length	50 1.9	50 1.9	50 1.9	50 1.9	50 1.9
Max. cable diameter <sup>2)</sup>	8 0.3	8 0.3	13 0.5	24 0.9	45 1.7
Measuring frequency	20 kHz/2V	20 kHz/2V	20 kHz/2V	20 kHz/2V	20 kHz/2V
Weight	3.3 kg / 7.2 lbs	4 kg / 8.8 lbs	4.9 kg / 10.8 lbs	7.4 kg / 16.3 lbs	15.4 kg / 34 lbs
Max. water temperature	70°C / 158°F	70°C / 158°F	70°C / 158°F	70°C / 158°F	60°C / 140°F



### Ultra short tubes with a measuring length of only 10 mm (0.4 in.)

Drawing from a vast experience with thousands of measuring tubes of a variety of models, ZUMBACH has developed an extremely short but accurate measuring tube with an electrode length of a mere 10 mm (.39 in.) for high frequency coaxial cables. These tubes feature a surprisingly low noise level and meet the highest demands for absolute accuracy and bandwidth with the following advantages:

- High length resolution with low noise level
- SRL prediction up to 6.5 GHz
- 600Hz bandwidth of the measuring system
- High absolute accuracy
- Compact and robust design

Model	MR.12.10HS	MR.36.10HS	MR.68.10HS
Inner diameter	12 mm / 0.5 in.	36 mm / 1.4 in.	68 mm / 2.7 in.
Active measuring length	10 mm / 0.4 in.	10 mm / 0.4 in.	10 mm / 0.4 in.
Max. cable diameter <sup>2)</sup>	8 mm / 0.3 in.	24 mm / 0.9 in.	45 mm / 1.7 in.
Measuring frequency	80 kHz/2V	80 kHz/2V	80 kHz/2V
Weight	3.3 kg / 7.2 lbs	7.4 kg / 16.3 lbs	15.4 kg / 34 lbs
Max. water temperature	70°C / 158°F	70°C / 158°F	60°C / 140°F

<sup>1)</sup> MR.12.50.HSD equipped with pressure chamber to be installed in spray cooling tanks on production lines reaching up to 3000 m/min. (9000 ft./min.).

<sup>2)</sup> Indicative value only; the max. diameter depends on the largest cable diameter to be expected.

## ELECTRONICS

The CAPAC HS electronic unit is connected to the measuring tube via a 2 m length cable. The electronic unit is assembled in a robust aluminium housing meeting IP 65 protection standards. Depending on the model, the unit is equipped with a "J" interface, for the connection of ZUMBACH processors, serial or PROFIBUS DP interfaces for the communication with higher level systems. All models include a fast analogue output with selectable band width for connection to FFT systems as well as a pinhole detection feature with variable sensitivity for the detection of holes and bare patches.

### CAPAC® HS-J-xx

#### J-interface connection

- J interface for the connection to a ZUMBACH USYS processor
- Fast analogue output 0...10VDC/5 mA (short-circuit proof)
- Relay outputs for pinhole and general alarm

### CAPAC® HS-RS-xx

#### Serial interface RS

- Serial interface for Host, RS-232C and RS485/RS-422.  
Max. 19.2 kBaud ZUMBACH ASCII protocol or ANSI X3.28-2.5-A4 multidrop protocol.
- Serial interface for service, RS-232C, ZUMBACH ASCII protocol
- Fast analogue output 0...10VDC/5 mA (short-circuit proof)
- Relay outputs for pinhole and general alarm

### CAPAC® HS-DP-xx

#### PROFIBUS DP

- PROFIBUS DP interface, max. 12 MBaud.  
Protocol in compliance to DIN 19245-1 and 19245-3
- Serial interface for service, RS-232C, ZUMBACH ASCII protocol
- Fast analogue output 0...10VDC/5 mA (short-circuit proof)
- Relay outputs for pinhole and general alarm

### CAPAC® HS-CMK-xx

#### Analogue output

- Fast analogue output 0...10VDC/5 mA (short-circuit proof)
- Relay outputs for pinhole and general alarm



#### Main data

Measuring Range (selectable)	0...300 pF/m, 0...600 pF/m, 0...1800 pF/m 0...100 pF/ft, 0...200 pF/ft, 0... 600 pF/ft
Bandwidth analogue output	1...600 Hz (adjustable)
Ground potential analogue output	With IA <sup>1)</sup> : free of potential; without IA <sup>1)</sup> : earth potential
Accuracy	+/- 0.1 pF/m (+/- .03 pF/ft.) +/- 0.3 %
Repeatability <sup>2)</sup>	- MR.xx.50HS: +/- 0.018 pF/m (+/- .006 pF/ft.) - MR.12.10HS: +/- 0.020 pF/m (+/- .006 pF/ft.) - MR.36.10HS: +/- 0.033 pF/m (+/- .010 pF/ft.) - MR.68.10HS: +/- 0.040 pF/m (+/- .013 pF/ft.)
Relay output / load capacity	Change-over contact 250 VAC 1A/50 VDC 1A
External control voltage	12...30 VDC "Remote ON/OFF"
Environmental temperature	Max. 0...40° C (32...104° C)
Max. humidity	95% non condensing
Type of protection	IP 65
Power supply	110...115/220...230VAC, 50/60 Hz, 16 VA
Weight	4.1 kg (9 lbs)

<sup>1)</sup> IA = Isolation Amplifier

<sup>2)</sup> Values within  $\pm 3$  Sigma (99.7 %)  $U_{95}$ , averaging time 0.1 s.

## FFT Master – FFT/SRL

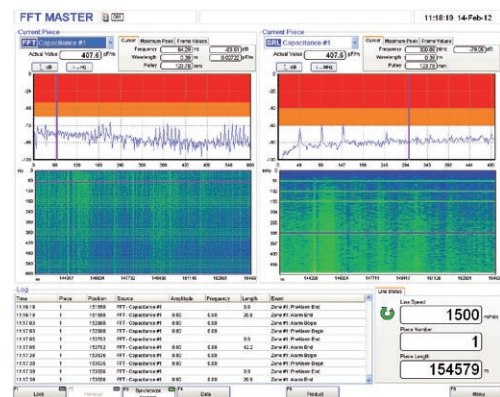
The CAPAC® systems from ZUMBACH meet all the requirements for on-line prediction of structural return loss during the cable production process. These predictions are based on an FFT analysis of actual measured cable parameters. With ZUMBACH's **FFT Master**, early detection of periodic irregularities resulting from the manufacturing process is possible during the production stage.

### FFT Analysis – Fast Fourier Transformation

Particularly during the manufacture of communication cables, periodic fluctuations of capacitance and diameter alter the performance of the data transmission. The on-line FFT analysis of the measured data represents a powerful monitoring tool for the determination of periodically occurring irregularities during the cable extrusion.

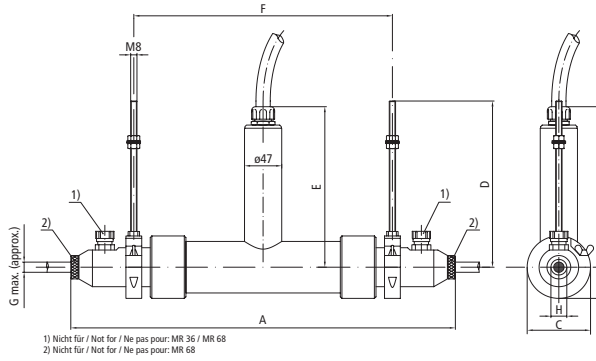
### SRL Prediction of the Structural Return Loss

The most commonly used method for quality control is to measure the return loss over the frequency bandwidth to be transmitted by the cable.



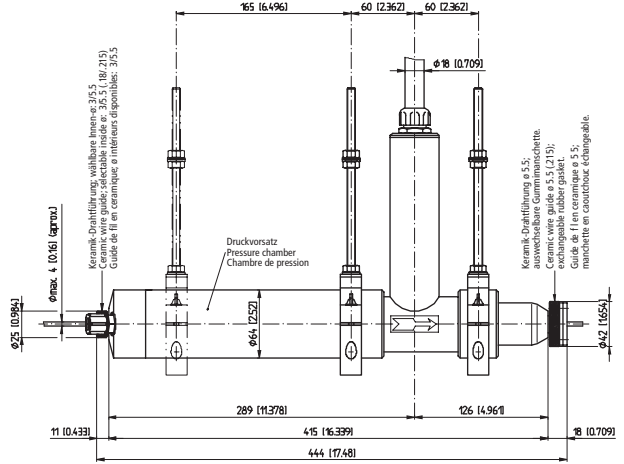
# DIMENSIONS

## MR.xx.50HS

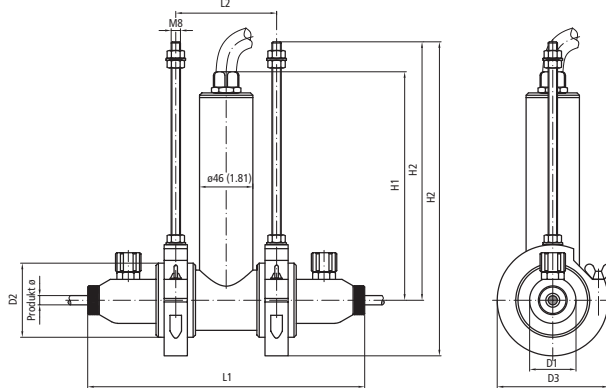


Model	A	B	C	D	E	F	G	H
MR.12.50HS	272 (10.71)	253 (9.96)	96 (3.78)	223 (8.78)	205 (8.08)	102-138 (4.02-5.43)	8 (0.31)	12 (0.47)
MR.20.50HS	484 (19.06)	253 (9.96)	80 (3.15)	216 (8.50)	213 (8.39)	302-348 (11.89-13.70)	13 (0.51)	20 (0.78)
MR.36.50HS	734 (28.89)	270 (10.63)	100 (3.94)	223 (8.78)	220 (8.66)	424-654 (1.67-25.75)	24 (0.94)	36 (1.42)
MR.68.50HS	1204 (47.40)	330 (12.99)	160 (6.30)	238 (9.37)	250 (9.84)	385-1135 (15.16-44.69)	45 (1.77)	68 (2.68)

## MR.12.50HSD

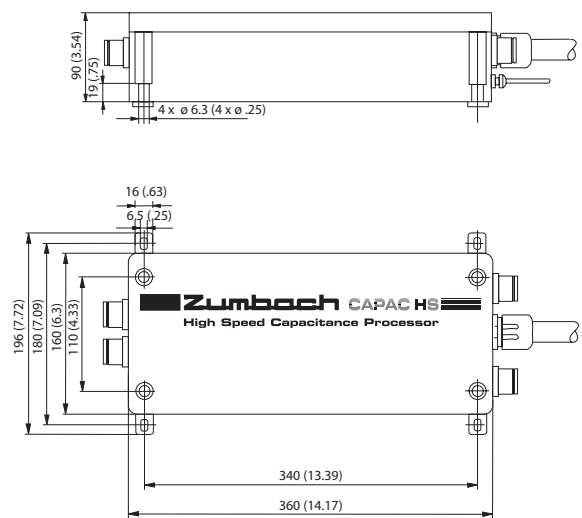


## MR.xx.10HS



Model	MR 12		MR 36		MR 68	
	mm	inch	mm	inch	mm	inch
L1	239	9.41	680	26.77	1100	43.30
L2	~ 87	~ 3.43	220...600	8.66...23.62	295...525	11.61...20.67
Product ø	8	0.31	24	0.94	45	1.80
D1	40	1.57	64	2.52	95	3.74
D2	64	2.52	100	3.94	160	6.30
D3	96	3.78	96	3.78	140	5.51
H1	197	7.76	212	8.35	242	9.53
H2	223	8.78	223	8.78	239	9.39
H3	271	10.67	273	10.75	319	12.56

## CAPAC® HS



Dimensions in mm (inch)

# ACCESSORIES

Special capacitors and tube adapters are available for the calibration of the CAPAC® HS systems. They allow a simple yet effective check of the measuring accuracy.

## Calibration capacitors CC1-xx



Measuring tube	Capacitance in the range 0...300 pF/m 0...100 pF/ft.	Capacitance in the range 0...600 pF/m 0...200 pF/ft.	Capacitance in the range 0...1800 pF/m 0... 600 pF/ft.
MR.xx.10HS	CC1-3	CC1-3	
MR.xx.50HS	CC1-14	CC1-27	CC1-36

## Measuring tube adapters MA-MR-xx



Measuring tube	Adapter
MR.12.xx.xx	MA-MR12
MR.20.xx.xx	MA-MR20
MR.36.xx.xx	MA-MR36
MR.68.xx.xx	MA-MR68

**Additional accessories:** Cleaning sets for measuring tubes, cable guides for different diameters

• Technical specifications are subject to change without notice

# WORLDWIDE CUSTOMER SERVICE AND SALES OFFICES

Zumbach Electronic AG, SWITZERLAND (H.Q.), sales@zumbach.ch  
 Zumbach Electrónica Argentina S.R.L., ARGENTINA, ventas@zumar.com.ar  
 Zumbach Electronic S.A., BELGIUM, info@zumbach.be  
 Zumbach do Brasil Ltda, BRAZIL, vendas@zumbach.com.br  
 Zumbach Electronic Co. Ltd., CHINA P.R., sales@zumbach.com.cn  
 Zumbach Bureau France, FRANCE, ventes@zumbach.com.fr  
 Zumbach Electronic GmbH, GERMANY, verkauf@zumbach.de

Zumbach Electronic India Pvt. Ltd., INDIA, rupesh@zumbachindia.com  
 Zumbach Electronic Srl, ITALY, zumit@zumbach.it  
 Zumbach Electrónica S.L., SPAIN, gestion@zumbach.es  
 Zumbach Electronics Far East, TAIWAN, zumfareast@giga.net.tw  
 Zumbach Electronics Ltd., UK, sales@zumbach.co.uk  
 Zumbach Electronics Corp., USA, sales@zumbach.com



CAPA.002.0002.E F12