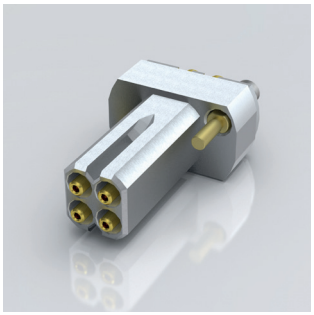
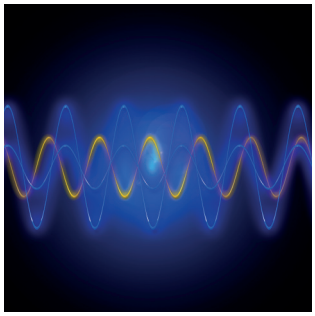
PRODUCT PORTFOLIO CONTACT PROBES

FOR RADIO FREQUENCY MEASUREMENTS



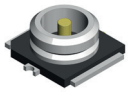
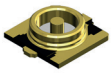
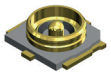
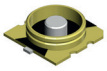
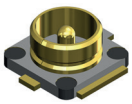
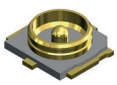
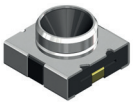
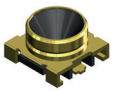
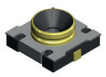
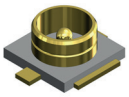
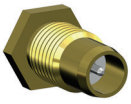
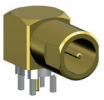
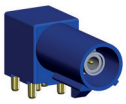
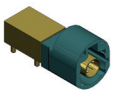
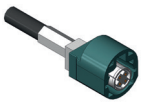
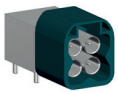
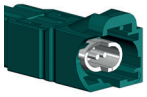
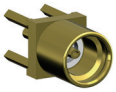
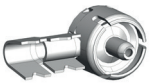
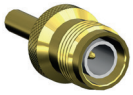
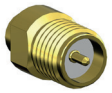
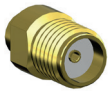




Version 2.1

FEINMETALL
Contact Technologies

OVERVIEW OF CONNECTORS

GSC-Male	HSC-Male	JSC-Male	KSC-Switch	LSC-Male
				
MHF-Male	MHF5-Male	SWD-Switch	SWF-Switch	SWG-Switch
				
SWH-Switch	SWJ-Switch	U.FL-Male		
				
BMA-Male	BNC-Female	DIN 1,0/2,3-Female	FME-Male	FAKRA-Male
				
FAKRA-Female	GT16 Male	HSD-Male	HSD-Female	HFM®-Male
				
H-MTD®-Male	MATE-AX®-Male	MMBX-Female	MMCX-Female	mSMP-Male
				
N-Type-Female	QMA-Female	RF-Male	R-TNC-Female	R-SMA-Female
				
SMA-Female	SMB-Female	SMB-Male	SMC-Male	SMP-Male
				
PCB GSG	PCB-coax-closed	PCB-coax-open	PCB-coax-kidney	PCB GSG
				
PCB GGSGG	F-Type	HDMI 1.4	HDMI 2.0	RCA
RJ-9	RJ-11	RJ-45	RJ-50	MATEnet®
Mikro-USB	Mini-USB	USB 2.0 A	USB 3.0 A	USB 3.1 C

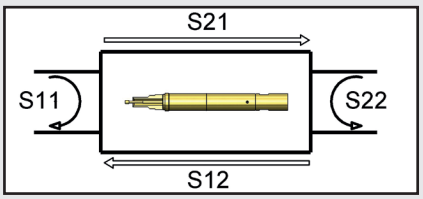
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Design of RF-Probes

Spring contact probes for RF-applications are coaxial probes. The inner and outer conductors are designed and dimensioned according the RF specific requirements. That means the signals within a wide frequency band are transmitted with a minimum loss. For evaluation of RF-probes various definitions and parameters are relevant.

Two-Port Network

The common two-port network describes the characteristics of possible transmission paths. These can be wires, radio transmissions or RF-contact probes.



S-Parameters

In radio frequency technology the transmission characteristics of two-port networks are described by S-parameters (scattering parameters). The S-parameters are typically specified as attenuation given in decibel [dB].

S11: Reflection loss input side
S21: Insertion loss forward
S12: Insertion loss backward
S22: Reflection loss output side

Matching

The matching always refers to the impedance of the DUT and its RF related environment. The more constant the impedance on the transmission path, the better is the reflection and transmission behavior. For RF testing always the complete transmission path of DUT, RF-probe and connecting element has to be considered. A major part of the signal loss is caused by mismatching between RF probe and DUT. The frequency response charts in the specification sheets of the probes HF60 include the probe as well as an RF-connector (representing the DUT) and a connecting element with connected cable. The type and length of the cable is also influencing the transmission of the signal and may lead to a reduced bandwidth. For reference, the values S21 and S11 for the HF60 without DUT and connecting element are shown as well.

Insertion Loss

The insertion loss describes the transmission behavior of a two-port network and is represented by the value S21. Very often the 3dB cutoff frequency is used as characteristic value. This is the frequency with an attenuation of -3dB. At this frequency the power has reduced by 50% and the voltage by 30%.

Frequency

The values for frequency specified in the catalogue correspond to the maximum operating frequency recommended by FEINMETALL. Depending on the application and the permissible transmission quality, the high-frequency probes can also be used above this. On request, diagrams with the frequency characteristics are available.

New generation for RF-Probes

RF-Series	DUT	Mounting version	Center
z.B. HF60-0001	SMA-F	8 P	MCX -
Number		Cutoff frequency *	Connection

Type number:

Is composed of RF-Series and number

DUT (e.g.):

SMA-F (Female)
SMB-M (Male)
GSG (Ground-Signal-Ground)

Mounting options:

F (flange)
P (plug-in)
S (threaded)

Center:

Center specifies only distance ground to signal, otherwise the field is left blank

* the specified value is the recommended maximum operating frequency.

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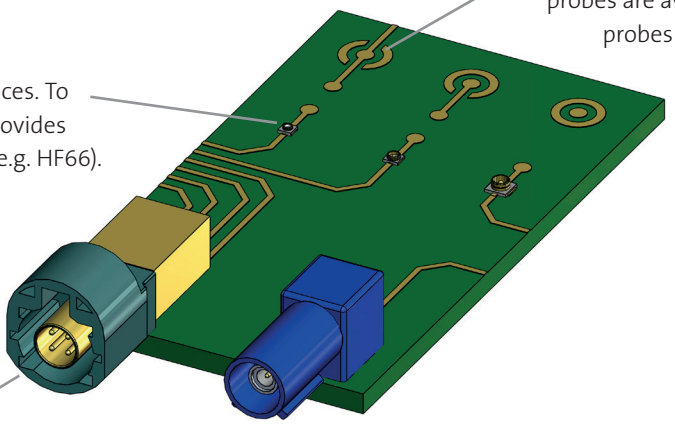
COAXIAL PROBES FOR RADIO FREQUENCY MEASUREMENTS



FEINMETALL offers sophisticated contact solutions for various industries and applications. Coaxial probes cover a wide range of radio frequency applications like contacting standard RF connectors, switch connectors or RF test points on the PCB.

SMD mini coax and SMD switch connectors
be used on PCBs as RF interfaces. To contact these FEINMETALL provides different types of RF probes (e.g. HF66).

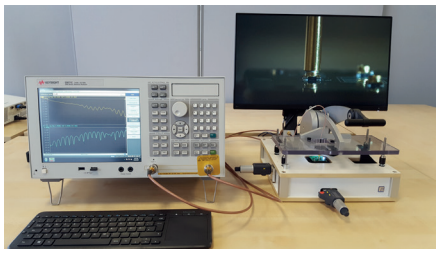
PCB test points
For RF contacts directly on the PCB special RF probes are available. The probe design of these probes (e.g. HF05, HF60) is adapted to the typical requirements of the test points.



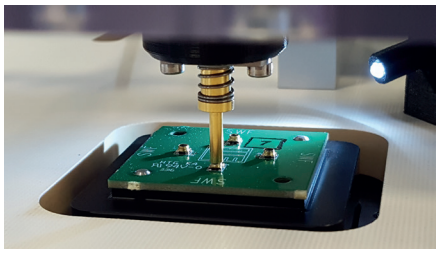
Connectors
In various telecommunications, consumer electronics and automotive applications different standard connectors like SMA, SMB, SMC, HSD are used. FEINMETALL offers different probe series for contacting these connectors (e.g. HF60, HF19, HF66).

RF type		DUT		Mounting version	Pitch
e.g. HF60	-0001	SMA-F	8	P	MCX -
	Number		Cutoff frequency		Connection type

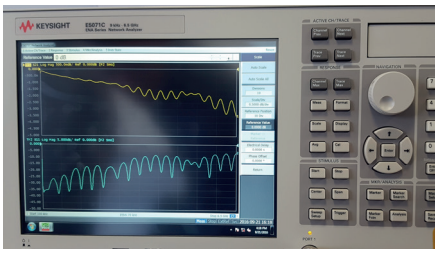
RF test set-up



Contacting RF connector



RF monitoring



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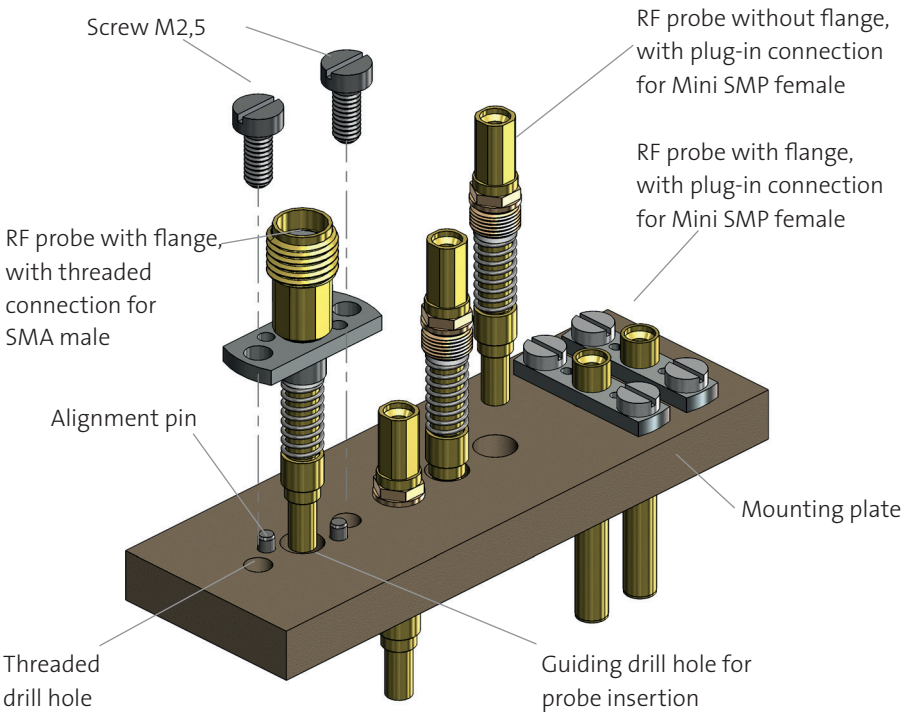
Mounting Options

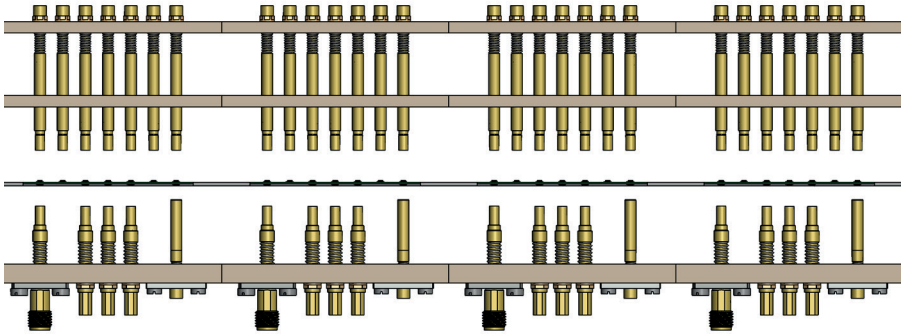
For the new RF probe series HF66 and HF05 different mounting options are possible.

Some probes can be threaded directly into the mounting plate.

Some versions have a flange that is screwed to the mounting plate, this version allows a simple adjusting and contacting of the DUT. The drill hole for mounting needs to have a sufficient diameter to allow a movement of the probe.
For mounting RF probes with flange drill holes for the centering pins, threaded holes for the fixing screws as well as guiding holes for the probe are needed. These need to correspond with the pattern of the flange.

Mounting example HF66

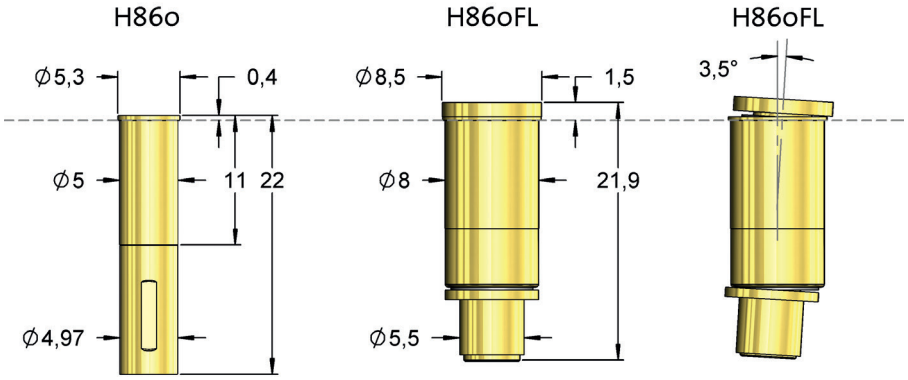




Mounting Options

The new receptacle H860FL allows a flexible (floating) mounting of the high frequency probe HF60. It permits a wobbling by 360 degrees in case of a small offset to the DUT. Such a possible offset is compensated without damaging the DUT. In released mode the HF probe is returned to its zero point position.

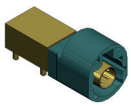
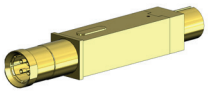
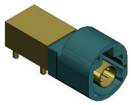
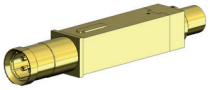
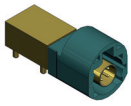
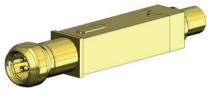
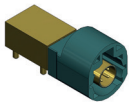
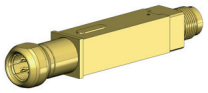
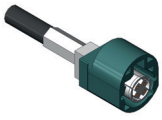
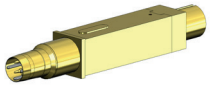
Mounting example HF60



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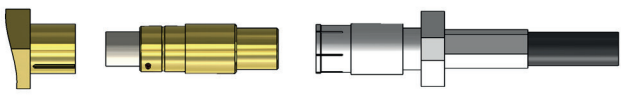
COAXIAL PROBES FOR RADIO FREQUENCY MEASUREMENTS



Connector	Probe	Frequency	Mounting	Connection	Order number	Data sheet
HSD-Male			2 GHz	pluggable	H819AE2/3	HF81905B0001G1270	
HSD-Male			3 GHz	pluggable	HSD	HF81955B1005G2000	
HSD-Male			3 GHz	pluggable	HSD	HF81955B1006G2020	
HSD-Male			2 GHz	pluggable	H819AE4	HF81914S0004L1270	
HSD-Female			2 GHz	pluggable	H819AE2/3	HF81912B0002G1270	

Connection Cables for HF19

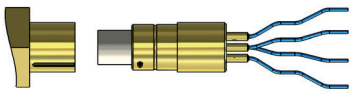
By combining the connection elements H819AE2 and H819AE1 a **defined and reproducible measuring** setup with fix parameters can be realized.



HF19 H819AE2 H819AE1 (HSD-Female)

Connection on both sides:
D4K- Dacar 535,
socket 4-pole, straight
Length: 500 mm (± 10 mm)

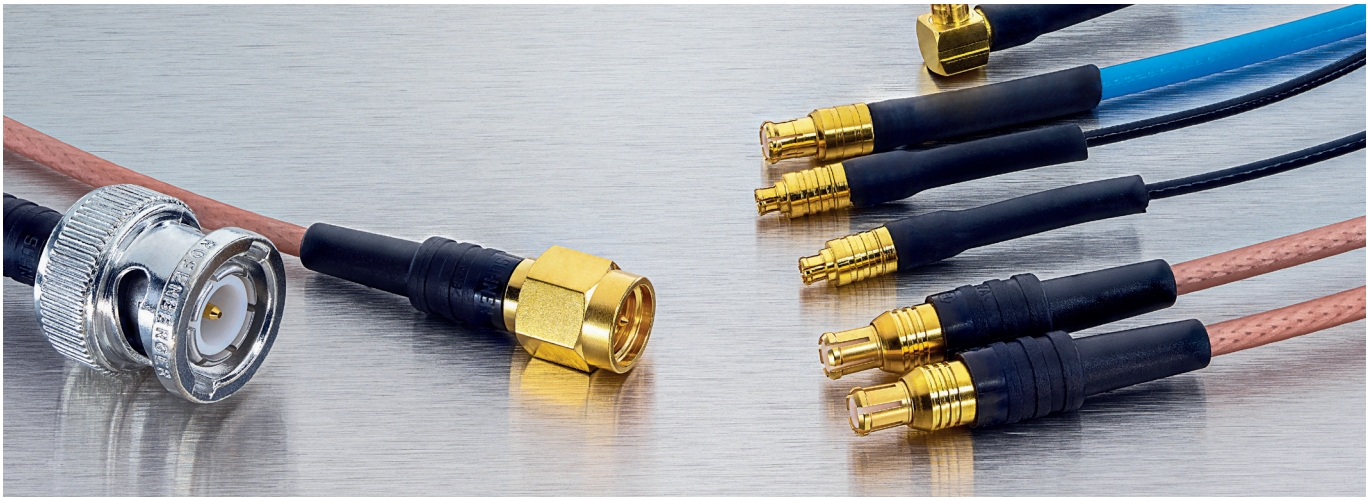
Connection units selectable



HF19 H819AE3

for direct soldering

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Connection Cables for HF60

Connection element with pre-assembled coaxial cable RG 316.
Impedance: 50 Ohm
Cutoff frequency: recommended up to **3 GHz**
Standard length: 700 mm

Connector with pre-assembled coaxial cable Multiflex 86.
Impedance: 50 Ohm
Cutoff frequency: recommended up to **10 GHz**
Standard length: 700 mm

H860AE1	MCX-M straight	Coax cable 3GHz 700 mm	unassembled
H860AE3	MCX-M straight	Coax cable 3GHz 700 mm	SMA-M straight
H860AE4	MCX-M straight	Coax cable 3GHz 700 mm	BNC--M straight
H860AE2	MCX-M straight	Coax cable 10GHz 700 mm	SMA-M straight
H860AE5	MCX-M straight	Coax cable 10GHz 1500 mm	SMA-M straight
H860AE6	MCX-M angled	Coax cable 10GHz 800 mm	SMA-M straight

Connection Cables for HF66

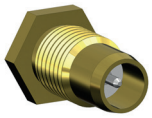
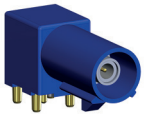
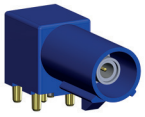
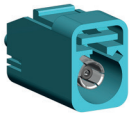
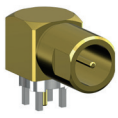
Connector with pre-assembled highly flexible coaxial cable.
Impedance: 50 Ohm
Cutoff frequency: recommended up to **6 GHz**

H66AE1	SMA-M angled	Coax cable 6GHz 300 mm	mSMP-F straight
H66AE2	SMA-M straight	Coax cable 6GHz 500 mm	mSMP-F straight
H66AE3	SMA-M angled	Coax cable 6GHz 300 mm	SMA-M straight

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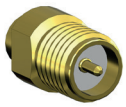
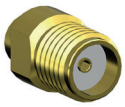
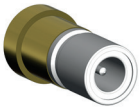
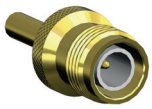
COAXIAL PROBES FOR RADIO FREQUENCY MEASUREMENTS



Connector		Probe	Frequency	Mounting	Connection	Order number	Data sheet
BMA-Male			4 GHz	pluggable	MCX	HF86005B0011G530	
			4 GHz	screwable	MCX	HF86005B0011G530M	
BNC-Female			4 GHz	pluggable	MCX	HF86002B0016G550	
			4 GHz	screwable	MCX	HF86002B0016G550M	
DIN 1.0/2.3-Female			4 GHz	pluggable	MCX	HF86002B0021G530	
			4 GHz	screwable	MCX	HF86002B0021G530M	
Fakra-Male			6 GHz	pluggable	MCX	HF86005B0006G470	
			6 GHz	screwable	MCX	HF86005B0006G470M	
Fakra-Male			6 GHz	pluggable	MCX	HF86005B0026G550	
			6 GHz	screwable	MCX	HF86005B0026G550M	
Fakra-Female			5 GHz	pluggable	MCX	HF86002B0012G930	
			5 GHz	screwable	MCX	HF86002B0012G930M	
FME-Male			4 GHz	pluggable	MCX	HF86005B0022G790	
			4 GHz	screwable	MCX	HF86005B0022G790M	

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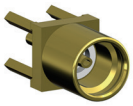


Connector	Probe	Frequency	Mounting	Connection	Order number	Data sheet
R-SMA-Female			6 GHz	pluggable	MCX	HF86005B0018G530	
		6 GHz	screwable	MCX	HF86005B0018G530M	
SMA-Female			8 GHz	pluggable	MCX	HF86002B0001G530	
		8 GHz	screwable	MCX	HF86002B0001G530M	
SMB-Female			6 GHz	pluggable	MCX	HF86002B0005G530	
		6 GHz	screwable	MCX	HF86002B0005G530M	
SMB-Male			5 GHz	pluggable	MCX	HF86005B0004G530	
		5 GHz	screwable	MCX	HF86005B0004G530M	
SMC-Male			5 GHz	pluggable	MCX	HF86005B0003G530	
		5 GHz	screwable	MCX	HF86005B0003G530M	
R-TNC-Female			2 GHz	pluggable	MCX	HF86005B0015G450	
		2 GHz	screwable	MCX	HF86005B0015G450M	
U.FL Male			5 GHz	pluggable	MCX	HF86005B0002G530	
		5 GHz	screwable	MCX	HF86005B0002G530M	

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COAXIAL PROBES FOR RADIO FREQUENCY MEASUREMENTS



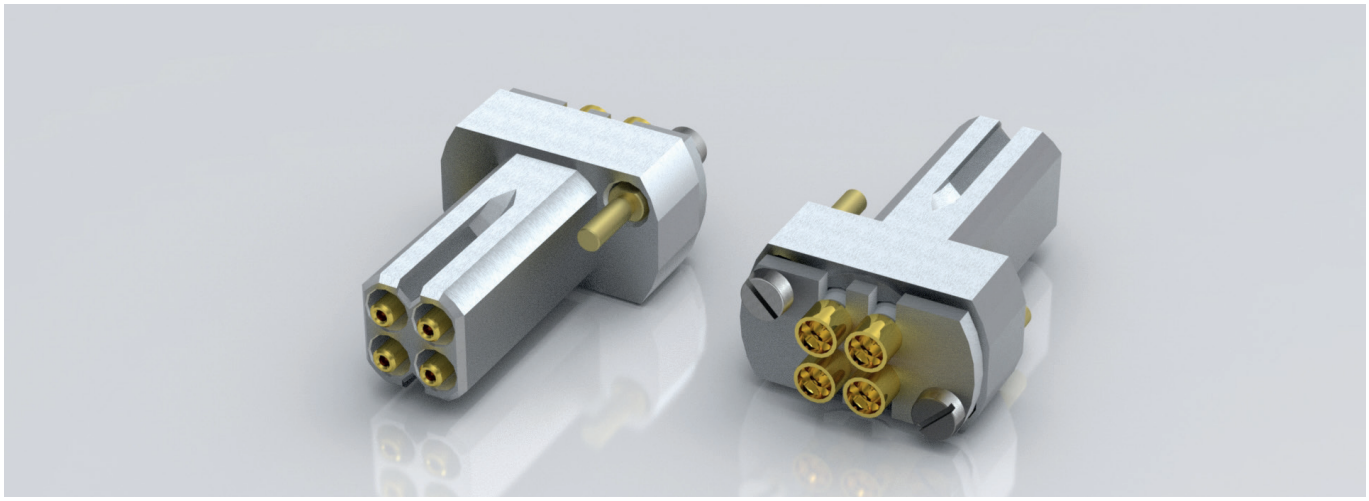
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GT16-Male			4 GHz	pluggable	MCX	HF86005B0023G530	
			4 GHz	screwable	MCX	HF86005B0023G530M	
MMBX-Female			4 GHz	pluggable	MCX	HF86002B0024G530	
			4 GHz	screwable	MCX	HF86002B0024G530M	
MMCX-Female			6 GHz	pluggable	MCX	HF86002B0014G530	
			6 GHz	screwable	MCX	HF86002B0014G530M	
mSMB-Male			6 GHz	pluggable	MCX	HF86005B0013G530	
			6 GHz	screwable	MCX	HF86005B0013G530M	
N-Connector-Female			6 GHz	pluggable	MCX	HF8602B0027G430	
			6 GHz	screwable	MCX	HF8602B0027G430M	
QMA-Female			6 GHz	pluggable	MCX	HF86002B0017G730	
			6 GHz	screwable	MCX	HF86002B0017G730M	
RF-Male			5 GHz	pluggable	MCX	HF86005B0007G530	
			5 GHz	screwable	MCX	HF86005B0007G530M	

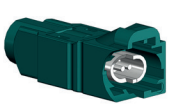
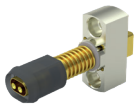
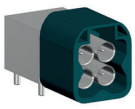
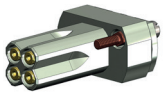
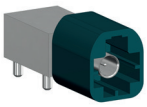
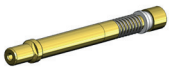
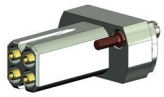
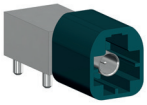
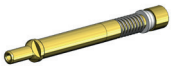
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Connector	Probe	Frequency	Mounting	Connection	Order number	Data sheet
PCB GSG		4 GHz	pluggable	MCX	HF86002B0009G960	
		4 GHz	screwable	MCX	HF86002B0009G960M	
PCB GGSGG		4 GHz	pluggable	MCX	HF86002B0025G960	
		4 GHz	screwable	MCX	HF86002B0025G960M	
PCB Coax closed		4 GHz	pluggable	MCX	HF86018B0019G530	
		4 GHz	screwable	MCX	HF86018B0019G530M	
PCB Coax open		4 GHz	pluggable	MCX	HF86002B0008G530	
		4 GHz	screwable	MCX	HF86002B0008G530M	
PCB Coax open		4 GHz	pluggable	MCX	HF86018B0010G530	
		4 GHz	screwable	MCX	HF86018B0010G530M	
PCB Coax kidney		4 GHz	pluggable	MCX	HF86018B0020G530	
		4 GHz	screwable	MCX	HF86018B0020G530M	

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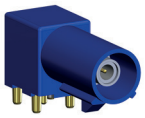
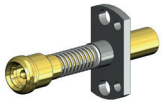
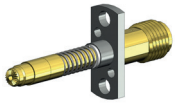
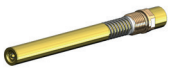
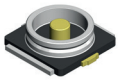
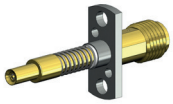
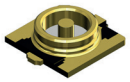
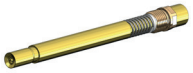
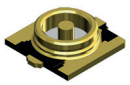
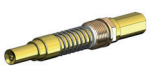
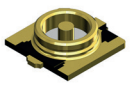
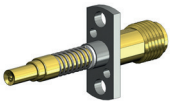


Connector	Probe	Frequency	Mounting	Connection	Order number	Data sheet
H-MTD® Male			14 GHz	with flange	H-MTD-F	NEW HF77-0003BG01-1	
4-fold HFM® Male			12 GHz	pluggable	M-SMP	HF77-0001BG04-1	
1-fold HFM® Male			12 GHz	pluggable	M-SMP	HF7716B0001G530	
4-fold MATE-AX ® Male			12 GHz	pluggable	M-SMP	HF77-0002BG04-1	
1-fold MATE-AX ® Male			12 GHz	pluggable	M-SMP	HF7716B0002G530	
PCB-GSG			6 GHz	with flange	M-SMP	HF05-0001	
PCB-GSG			6 GHz	with flange	M-SMP	HF05-0002	

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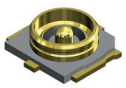
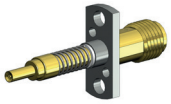
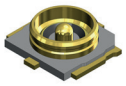
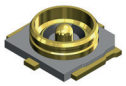
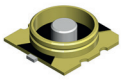
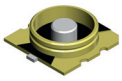
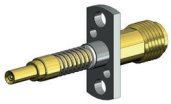
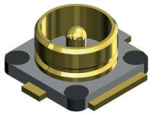
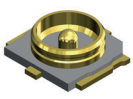
COAXIAL PROBES FOR RADIO FREQUENCY MEASUREMENTS



Connector		Probe	Frequency	Mounting	Connection	Order number	Data sheet
Fakra-Male			6 GHz	with flange	MCX	NEW HF66-0017	
SMP-Male			18 GHz	with flange	SMA	NEW HF66-0018	
HSC-Male			6 GHz	pluggable	M-SMP	HF66-0006	
HSC-Male			6 GHz	with flange	SMA	HF66-0008	
JSC-Male			6 GHz	pluggable	M-SMP	HF66-0002	
JSC-Male			6 GHz	pluggable	M-SMP	HF66-0010	
JSC-Male			6 GHz	with flange	SMA	HF66-0012	

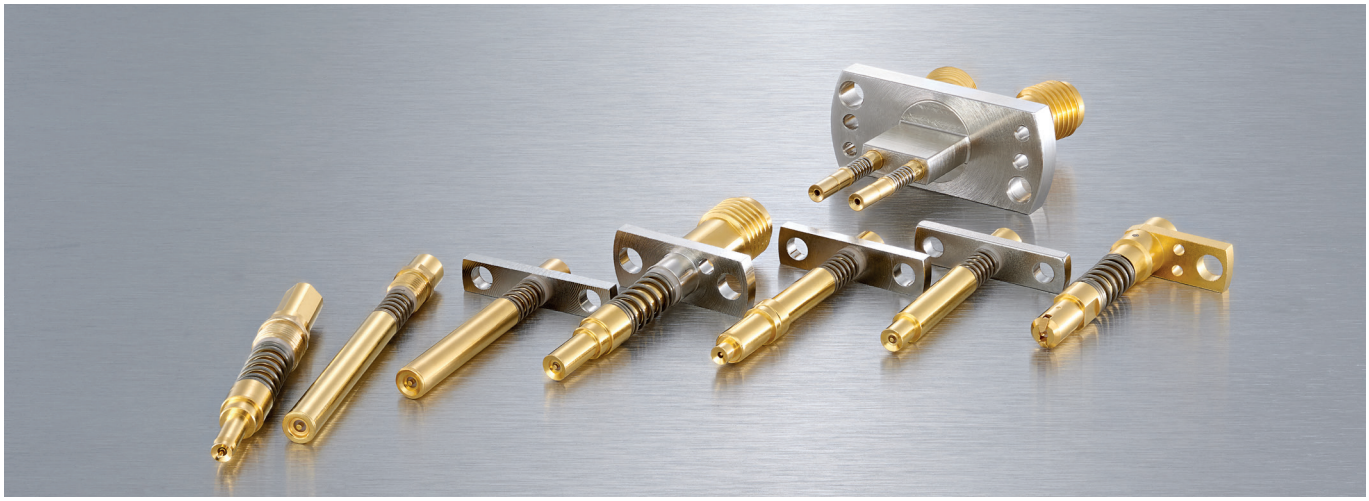
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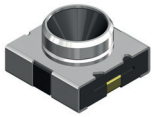
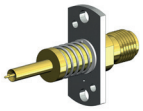
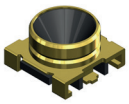
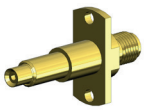
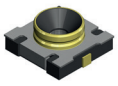
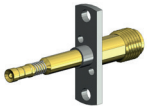
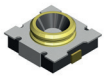
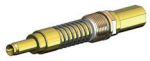
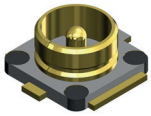
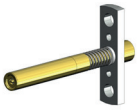


Connector		Probe	Frequency	Mounting	Connection	Order number	Data sheet
KSC-(Switch)			6 GHz	with flange	SMA	HF66-0003	
KSC-(Switch)			6 GHz	with flange	M-SMP	HF66-0005	
KSC-(Switch)			6 GHz	with flange	M-SMP	HF66-0016	
LSC-Male			6 GHz	with flange	M-SMP	HF66-0004	
LSC-Male			6 GHz	with flange	SMA	HF66-0011	
MHF-Male			6 GHz	with flange	M-SMP	HF66-0014	
MHF5-Male			6 GHz	with flange	M-SMP	HF66-0016	

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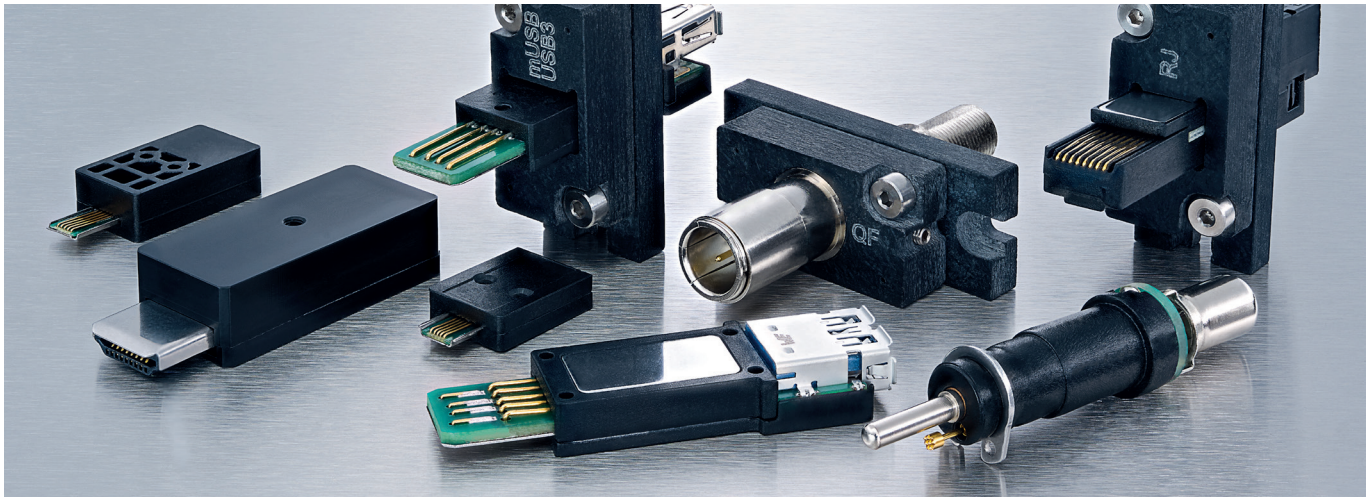
COAXIAL PROBES FOR RADIO FREQUENCY MEASUREMENTS



Connector		Probe	Frequency	Mounting	Connection	Order number	Data sheet
SWD/ SWF/ SWG - (Switch)			6 GHz	with flange	SMA	HF66-0013	
SWF- (Switch)			6 GHz	with flange	SMA	HF66-0015	
SWG- (Switch)			6 GHz	with flange	SMA	HF66-0007	
SWH- (Switch)			6 GHz	pluggable	SMA	HF66-0009	
SWJ- (Switch)			6 GHz	with flange	M-SMP	HF66-0001	
U.FL Male			6 GHz	with flange	M-SMP	HF66-0014	

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CONTACTS FOR COMMON CONNECTOR TYPES



Long-life test connectors for in-circuit, functional and wire harness testing

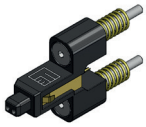
The need for contacting common USB, RJ or HDMI connector types is not only increasing in the **in-circuit and functional test** of printed circuit boards, but is also becoming more and more important in the **wire harness test**.

Advantages when using FEINMETALL test connectors

- Very high contact cycles; up to 200,000 (depending on test specimen)
- Test connectors do not snap into the DUT compared to normal plugs
- Unnecessary loading or damage to the contact springs in the test piece is avoided
- fixture-side connection of the test connector is very simple and solder-free, using a standard connector (plug and play). In case of maintenance, it is very easy to replace the test connector.

MATEnet®



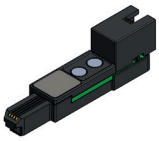


NEW

TC-P 000 002 MATEnet
Order code: 2112849
Max. data rate: 500MHz
Number Poles: 2

RJ 09

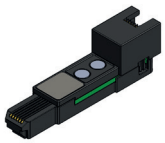




TC-P 201 004 RJ 09
Order code: 2112151
Max. data rate: 1 Gbit/s
Contact cyles: 200.000
Current: 1,5 A at 25°C
Number Poles: 4

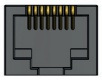
RJ 11

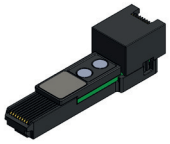




TC-P 201 006 RJ 11
Order code: 2112152
Max. data rate: 1 Gbit/s
Contact cyles: 200.000
Current: 1,5 A at 25°C
Number Poles: 6

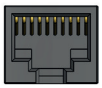
RJ 45

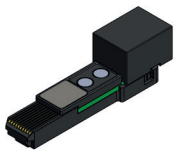




TC-P 201 008 RJ 45
Order code: 2112142
Max. data rate: 1 Gbit/s
Contact cyles: 200.000
Current: 1,5 A at 25°C
Number Poles: 8

RJ 50





TC-P 201 010 RJ 50
Order code: 2112153
Max. data rate: 1 Gbit/s
Contact cyles: 200.000
Current: 1,5 A at 25°C
Number Poles: 10

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CONTACTS FOR COMMON CONNECTOR TYPES

Micro-USB

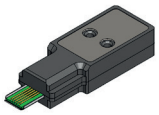




TC-P 195 005 USB 2.0 B micro
Order code: 2112145
Max. data rate: 480 Mbit/s
Contact cyles: 200.000
Current: 1,5 A at 25°C
Number Poles: 5

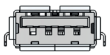
Mini-USB

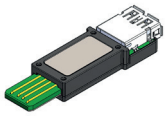




TC-P 198 005 USB 2.0 B mini
Order code: 2112757
Max. data rate: 480 Mbit/s
Contact cyles: 200.000
Current: 1,0 A at 25°C
Number Poles: 5

USB Type A

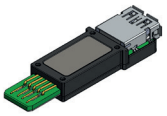




TC-P 198 004 USB 2.0 A
Order code: 2112143
Max. data rate: 480 Mbit/s
Contact cyles: 200.000
Current: 1,5 A at 25°C
Number Poles: 4

USB Type A





TC-P 198 009 USB 3.0 A
Order code: 2112159
Max. data rate: 4 Gbit/s
Contact cyles: 50.000
Current: 1,5 A at 25°C
Number Poles: 9

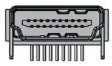
USB Type C





TC-P 756 024 USB 3.1 C
Order code: 2112853
Max. data rate: 5 Gbit/s
Contact cyles: 50.000
Current: 5,0 A at 25°C
Number Poles: 24

HDMI 1.4

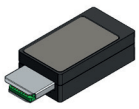




TC-P 197 019 HDMI 1.4
Order code: 2112148
Max. data rate: 8,16 Gbit/s
Contact cyles: 50.000
Current: 0,5 A at 25°C
Number Poles: 19

HDMI 2.0





TC-P 226 019 HDMI 2.0
Order code: 211218
Max. data rate: 14,4 Gbit/s
Contact cyles: 50.000
Current: 0,5 A at 25°C
Number Poles: 19

F-Type for SAT / Loop





TC-P 196 001 F QF
Order code: 2112149
Max. data rate: 300 khz - 3 Ghz
Contact cyles: 50.000
Current: 1,5 A at 25°C
Number Poles: (Coaxial)

RCA (Chinch) audio/video



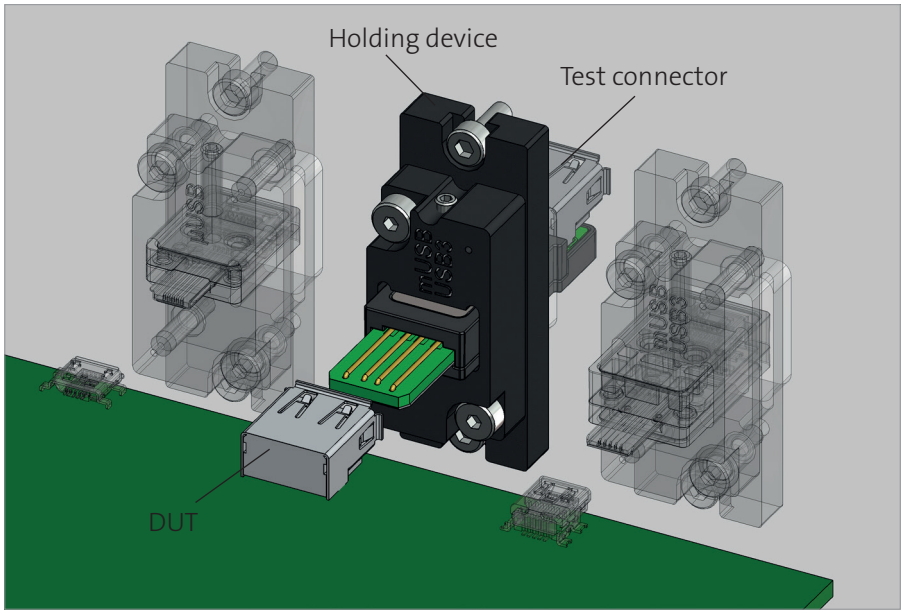


TC-P 200 002 RCA
Order code: 2112150
Max. data rate: 500 khz
Contact cyles: 200.000
Current: 1,5 A at 25°C
Number Poles: (Coaxial)

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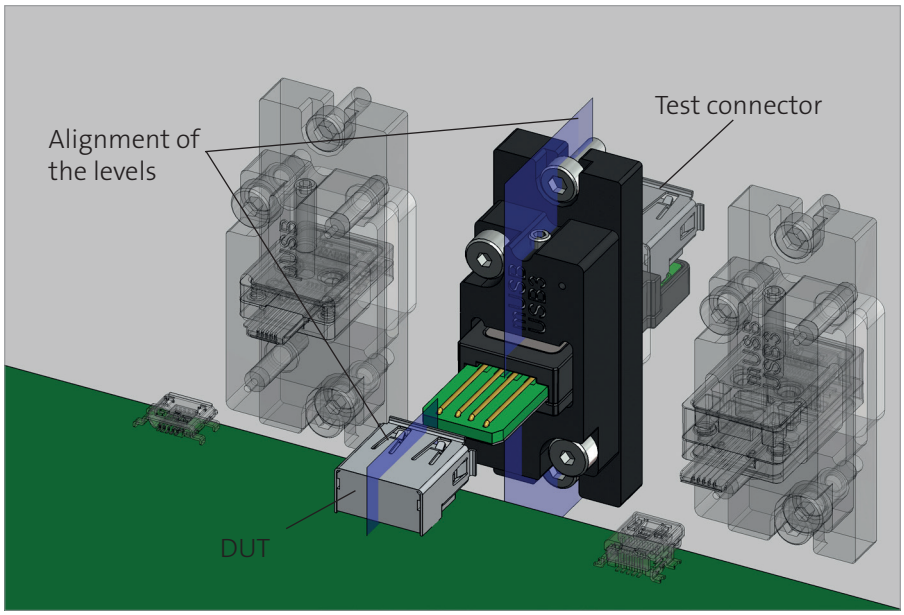
MOUNTING OF TEST CONNECTORS

Choose the test connector and holding device according to your needs.
In this example: USB

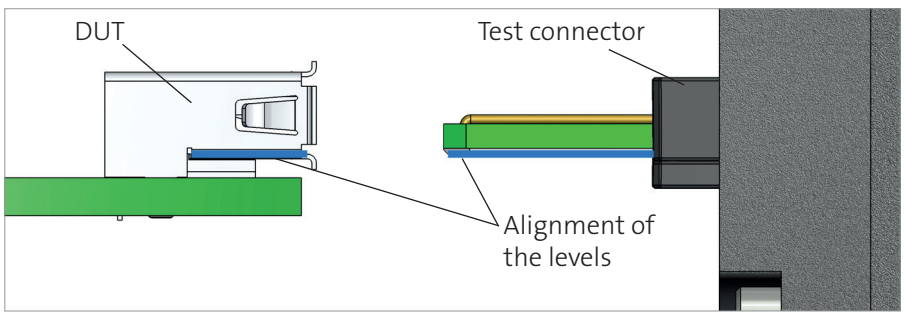


Please note the following guidelines for building up a test fixture

Align the median level of the connector to be tested (DUT) and of the test connector.

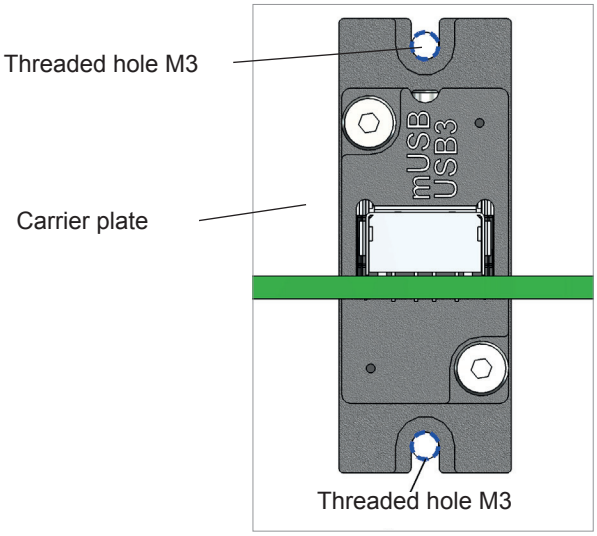


Align the lower level of the test connector on the lower internal level of the connector to test (DUT)

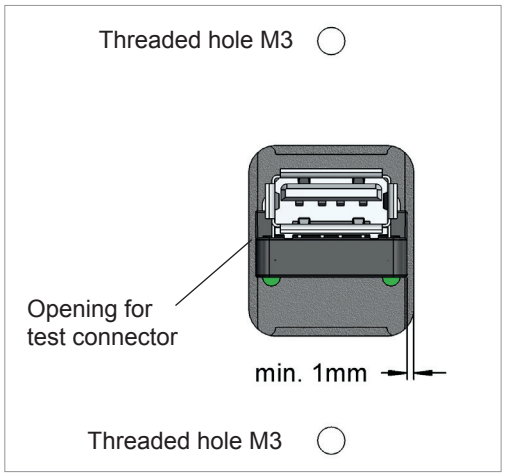


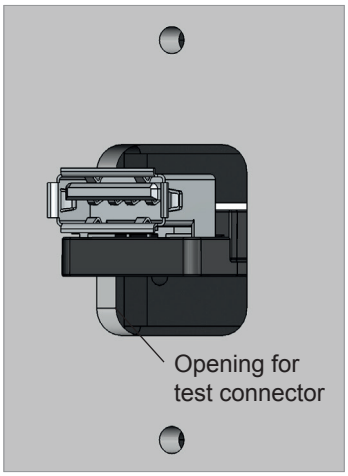
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Place two opposite threaded holes M3 onto the carrier plate. For fixing of the holding device, two screws M3x8 (ISO4768) are required - **not included in delivery!**



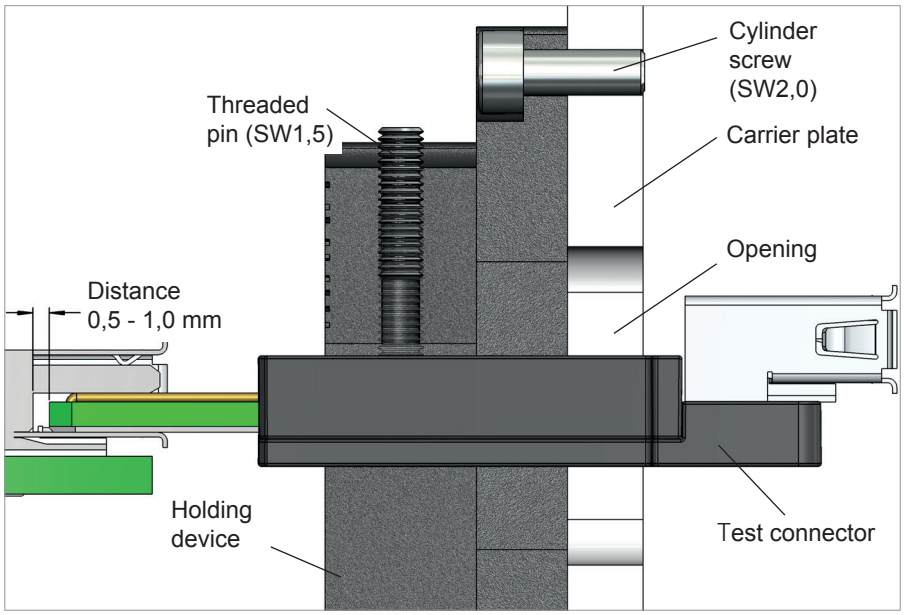
Cut a sufficient opening into the carrier plate to have enough space for later insertion of the test connector from the back. Leave at least 1 mm space between opening and test connector.





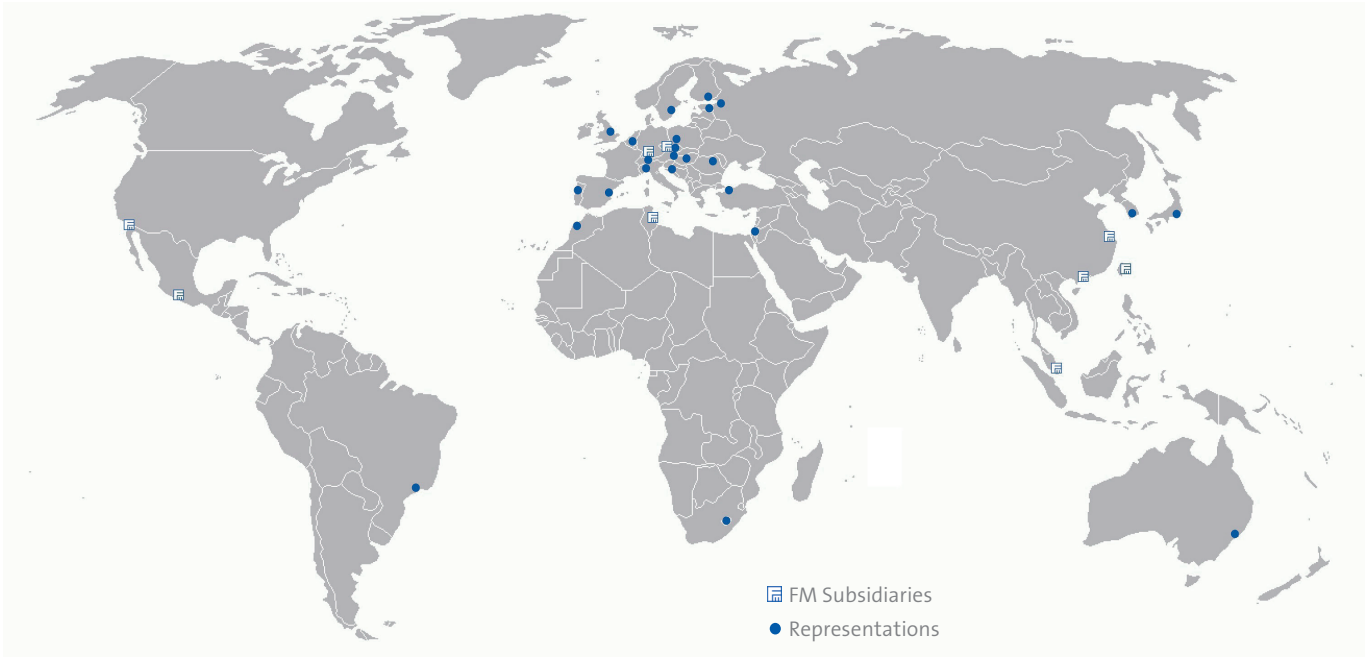
Loosen the retaining screw of the test connector.
Insert the test connector into the DUT until it comes to rest. Retract the test connector for 0.5 to 1 mm in order to prevent damages of the DUT.

Now the test connector can be fixed by using the threaded pin.



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