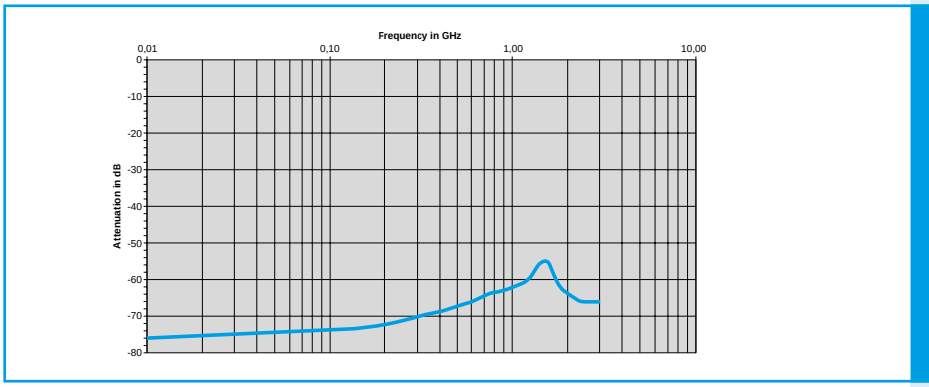
Technical Information



INDEX:

International Protection (IP) Classes DIN EN 60 529 (respectively IEC 529 / VDE 0470 T1)

The housing and the locking system of the ODU MINI-SNAP protect the contacts against outside mechanical influence, such as impact shocks, impurities, dust, unintended contact and penetration of moisture, water or other liquids (coolants, oils, etc.).
Protection classification is indicated with the letters **IP** and two numbers.

IP: International Protection

All IP 68 submersible ODU MINI-SNAP Connectors are rated to 2 m water depth (0,2 bar) for 24 hours in accordance with DIN EN 60529.
A watertight plug requires a cable grommet in the collet. The grommet has to fit tightly over the cable.
The cable jacket must be smooth, cylindrical and free of grooves.
The plug should be potted for watertightness in unmated condition.

(Higher requirements for Watertightness on request)

Code letters (International Protection) — **First Index Figure** (Foreign bodies protection) — **Second Index Figure** (Water protection)

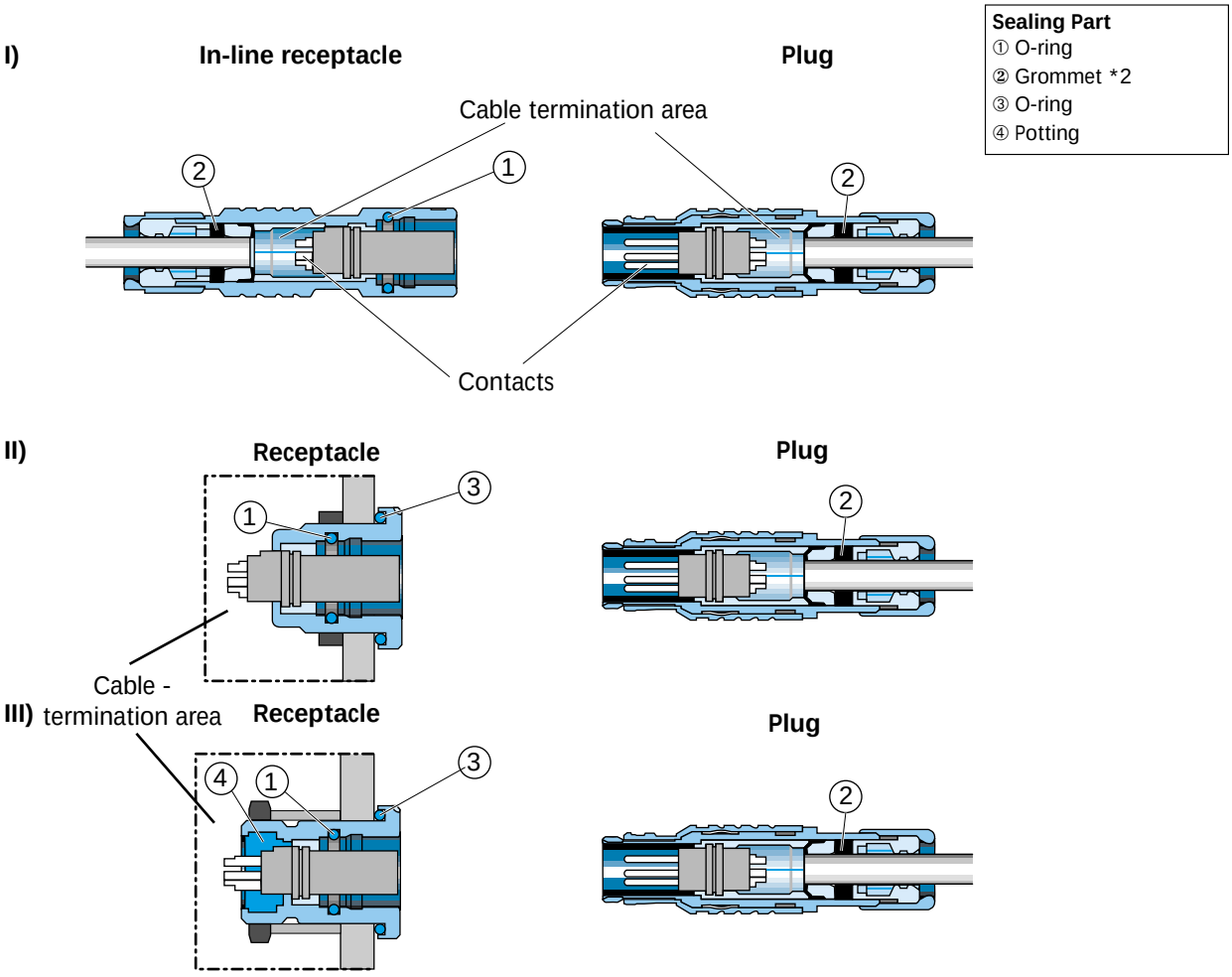
IP 6 8

Index	Degree of protection		Index	Degree of protection	
0		No protection against accidental contact, no protection against intrusion of solid foreign bodies	0		No protection against water
1		Protection against contact with any large area by hand and against large solid foreign bodies with Ø > 50 mm	1		Protection against vertical water drips
2		Protection against contact with the fingers, protection against large solid foreign bodies with Ø > 12 mm	2		Protection against water drips (up to a 15° angle)
3		Protection against tools, wires or similar objects with Ø > 2.5 mm. Protection, against small foreign solid bodies with Ø > 2,5 mm	3		Protection against diagonal water drips (up to a 60° angle)
4		As 3 however Ø >1 mm	4		Protection against splashed water from all directions
5		Full protection against contact. Protection against interior detrimental dust deposition.	5		Protection against water spray from all directions
6		Total protection against contact. Protection against intrusion of dust	6		Protection against temporary flooding
			7		Protection against temporary immersion
			8		Protection against water pressure

In accordance with DIN VDE 0470, DIN EN 60 529, IEC 529
Source: ZVEI = German Association of the Electrotechnical and Electronic Industry e.V.

Watertightness of the ODU MINI-SNAP

→ ODU offers IP 50 and IP 68 connectors in series B and S in the same outside diameter. Because ODU connectors must be compatible with other manufacturers, the company also offers the series K. These connector is larger in diameter than the standard version (series L).



Protection against Water through following seals: ***1**

		mated	unmated
I	**Cable – Cable termination area**	**Yes ① + ②**	**No**
II	**Device – Cable termination area**	**Yes ① + ③ + ②**	**No**
III	**Device – Cable termination area**	**Yes ① + ③ + ②**	**Yes ③ + ④**

*1 Contacts: in mated condition the contacts are protected (in cases I, II, III) . In unmated condition the contacts can be protected using a protective cover (see page 96 - 99). The cover must be removed before mating the plug with the receptacle.

*2 The elastic grommet acts as the cable seal. It requires exact knowledge of the cable dimension.
Important factors: Diameter tolerance, roundness, cable design and cable jacket hardness.

Insulation Groups / Nominal Voltage / Test Voltage

Insulation Groups in accordance with DIN VDE 0110 T1, (1989-01)

Groups of connectors based on ambient and operating conditions.

Example :

A connector used in a shop environment falls into Group B. (Laboratory environment would fall into Group A).

Insulation Group A0 :

For low power equipment in climate-controlled and dry rooms with only minimal heat rise when subjected to short circuit conditions.

Insulation Group A :

For equipment operated in climate-controlled and dry rooms.

Insulation Group B :

For equipment operated in living quarters, offices, and other commercial environments. Also for clean machine shops, laboratories, test stands, and medical environments.

Insulation Group C :

Equipment primarily operated in industrial, commercial, and agricultural establishments. Non climate-controlled warehouses, workshops, boiler rooms, and manufacturing floors.

Insulation Group D :

Equipment operated on vehicles subjected to dirt, brake dust, and splash water or snow. Unprotected by housing.

Determination of Nominal Voltage from Test Voltage in accordance with VDE 0627

The following explains how to derive the nominal voltage from the test voltage. (For practical purposes nominal voltage, rated voltage, and reference voltage are the same.)

The operating voltage must be less than the nominal voltage. A clear definition can be found in DIN VDE 0110, page 139.

Example :

The selected connector has a test voltage of 1,000 VAC and will be operated in a clean mechanical shop environment (Insulation Group B)
According the Table 3 below, the connector has a nominal voltage of 150 VDC. (The example shows both printed in **bold.**)

Notice: According to MIL-STD-1344, Method 3001 higher Test Voltages are acceptable (see next page)**.**

Table 3 from DIN VDE 0627

Reference Voltage / **Nominal Voltage** in Volt		**Test Voltage** in Volt (AC 50 Hz)				
		Insulation Group				
in Volt (DC)	in Volt (AC)	A0	A	B	C	D
15	12	375	500	750	875	1250
36	30	500	500	750	1000	1500
75	60	500	625	875	1000	1500
150	125	625	750	**1000**	1250	1750
300	250	750	875	1250	1750	2250
450	380	875	1000	1750	2250	3000
600	500	1000	1250	2000	2750	3500
800	660	1250	1750	2500	3500	4000
900	750	1500	1750	2750	3500	4500
1200	1000	1750	2250	3500	4500	5500

ODU Steckverbindungssysteme GmbH & Co. KG, Pregelstr. 11, D-84453 Mühldorf/Inn, Tel. +49/86 31/61 56-0, Fax +49/86 31/61 56 49, www.odu.de

Operating voltage acc. to SAE AS 13441-method 3001.1

The values acc. to SAE AS 13441-method 3001.1 comply with MIL-Std. 1344 – method 3001.
The chart values results are acc. to IEC 60512-2; Test 4. The inserts have been tested in mated condition and the test voltage was applied to the pin insert.

75% of the measured break-down voltage is the basic for the further calculation. 1/3 of this value is the corresponding operating voltage.

All tests were performed at standard environment conditions (room temperature) and can be applied up to an altitude of 2000 m.
For any deviations one has to consider the reduction factor acc. to the relevant standards.

Test voltage: Break-down voltage x 0,75

Operating voltage: Break-down voltage x 0,75 x 0,33

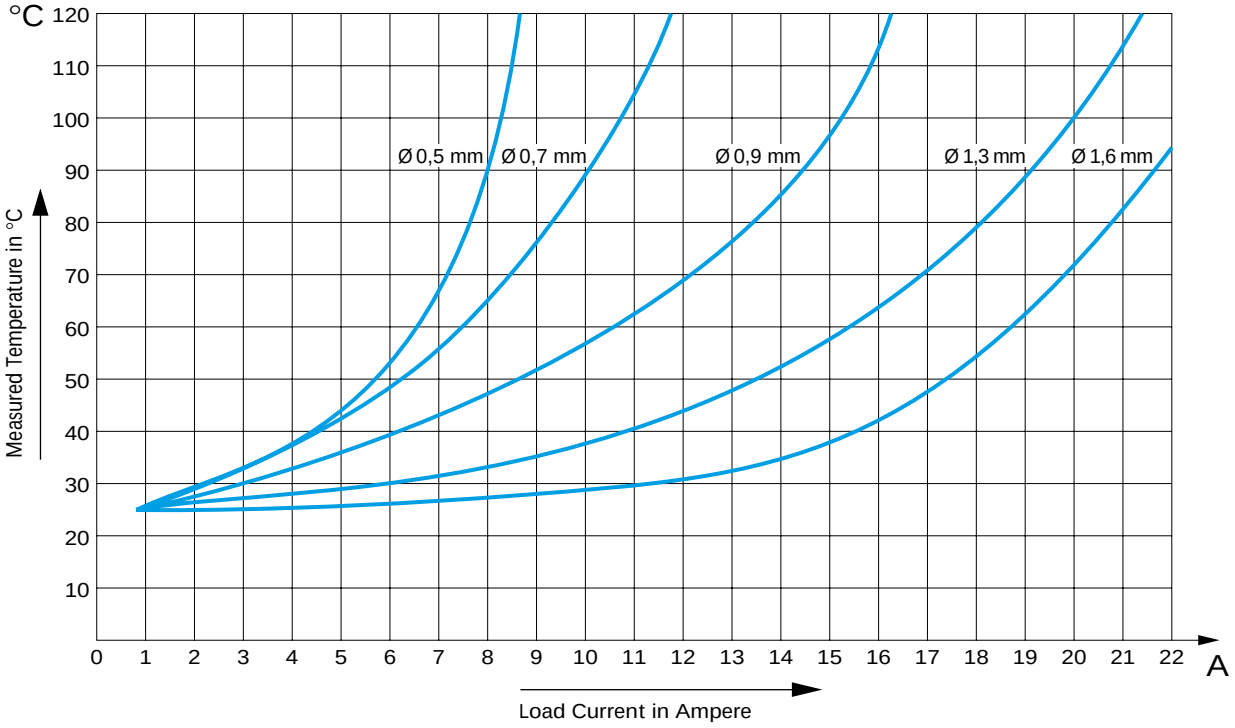
Caution:

Electrical appliances: for various applications the safety requirements regarding the operating voltage is even more severe!
The relevantdatas in such cases for the operating voltage are the creepage and clearance distances. For any advise how to chose the proper connector please consult us and indicate the safty standard which your product has to meet.

Current Load - Contacts

Nominal Single Contact Current Load for pin / slotted socket

(Nominal Diameter 0.5 mm - 1.6 mm)



➔ **Upper Maximum Temperature for Standard Contacts:** + 120 °C

Test contact was terminated to largest possible conductor.

Connectors or cables with more than one contact or conductor generate a higher heat than a single contact. Therefore, a **Derating Factor** must be applied. For connectors the Derating Factor is applied according to DIN 57 298 Teil 4 / VDE 0298 Teil 2. The Derating Factor is used starting with 5 loaded wires (DIN 41 640 T3).

Derating Factor:

Number of loaded wires	Derating Factor
5	0,75
7	0,65
10	0,55
14	0,50
19	0,45
24	0,40

ODU Steckverbindungssysteme GmbH & Co. KG, Pregelstr. 11, D-84453 Mühldorf/Inn, Tel. +49/86 31/61 56-0, Fax +49/86 31/61 56 49, www.odu.de

Termination Styles

Contact blocks (insulation bodies with contacts) are interchangeable between receptacle and plug. As a rule the socket contact blocks are mounted in the part under power.

ODU offers the following contact termination styles:

- **Solder**
- **Crimp**
- **PCB**

Termination Styles for Turned Contacts

Solder Termination:

The contacts come mounted by the factory. The insulation body and the pre-assembled contacts are called a contact block.

Crimp Termination

A single contact is crimped to a single conductor. Subsequently, the crimped contact is pushed into the insulation body. Crimp contacts and insulation bodies are shipped separately.

Crimping creates a reliable, corrosion-free and durable connection between the contact and the conductor.

Crimping causes the crimp barrel of the contact and the conductor material to cold flow. It creates a gas-tight connection between contact and conductor.

The ODU MINI-SNAP generally requires the industry-standard 8-point crimp tool .

Standard-Crimp-Contact for PBT insulator

Crimp-Clip-Contact for PEEK insulator

Printed Circuit Board (PCB) Termination:

PCB pins are used only for receptacles which are mounted directly to the PCB. The contacts are permanently installed in the insulation body.

Conversion / AWG

AWG = American Wire Gauge

The AWG system describes the cross section of a wire using a gauge number for every 26 % increase in conductor cross section. With larger wire diameters, the AWG gauge numbers decrease; as the wire sizes increase, the AWG gauge numbers decrease.

Most wires are made with **stranded conductors.** Compared to solid conductors stranded wires offer higher durability, higher flexibility and better performance under bending and vibration.

Stranded wires are made from wires with smaller gauge sizes (higher AWG gauge number). The AWG gauge number of the stranded wire is equal to that of a solid conductor of the same size wire. The cross section of the stranded conductor is the sum of cross sections of the single conductors.

For example, a AWG-20 stranded wire of 7 AWG-28 conductors has a cross section of 0.563 mm^2; an AWG-20 stranded wire with 19 AWG-32 conductors has a cross section of 0.616 mm^2.

Conversion Table AWG / mm^2

Circular Conductor			
AWG	Diameter		Cross Section
	in	mm	mm2
10 (1)	0,102	2,59	5,27
10 (37/26)	1,109	2,75	4,53
12 (1)	0,0808	2,05	3,31
12 (19/25)	0,0895	2,25	3,08
12 (37/28)	0,0858	2,18	2,97
14 (1)	0,0641	1,63	2,08
14 (19/27)	0,0670	1,70	1,94
14 (37/30)	0,0673	1,71	1,87
16 (1)	0,0508	1,29	1,31
16 (19/29)	0,0551	1,40	1,23
18 (1)	0,0403	1,02	0,82
18 (19/30)	0,0480	1,22	0,96
20 (1)	0,032	0,813	0,52
20 (7/28)	0,0366	0,93	0,56
20 (19/32)	0,0384	0,98	0,62
22 (1)	0,0252	0,64	0,324
22 (7/30)	0,0288	0,731	0,354
22 (19/34)	0,0307	0,780	0,382
24 (1)	0,0197	0,50	0,196
24 (7/32)	0,023	0,585	0,227
24 (19/36)	0,0252	0,640	0,240
26 (1)	0,157	0,40	0,122
26 (7/34)	0,0189	0,48	0,140
26 (19/38)	0,0192	0,487	0,15
28 (1)	0,0126	0,32	0,08
28 (7/36)	0,015	0,381	0,089
28 (19/40)	0,0151	0,385	0,095
30 (1)	0,0098	0,250	0,0506
30 (7/38)	0,0115	0,293	0,055
30 (19/42)	0,0123	0,312	0,072
32 (1)	0,0080	0,203	0,032
32 (7/40)	0,0094	0,240	0,035
32 (19/44)	0,0100	0,254	0,044
34 (1)	0,0063	0,160	0,0201
34 (7/42)	0,0083	0,211	0,0266
36 (1)	0,0050	0,127	0,0127
36 (7/44)	0,0064	0,163	0,0161
38 (1)	0,0040	0,100	0,0078
40 (1)	0,0031	0,080	0,0050
42 (1)	0,0028	0,0700	0,0038
44 (1)	0,0021	0,054	0,0023

(Font: Gore & Associates, Pleinfeld)

ODU Steckverbindungssysteme GmbH & Co. KG, Pregelstr. 11, D-84453 Mühldorf/Inn, Tel. +49/86 31/61 56-0, Fax +49/86 31/61 56 49, www.odu.de

Housing Materials and Surface Finish

MINI-SNAP housings are made from brass and are nickel-plated with a matt-chromate surface finish (sand-blasted). Nickel-plated or black chromate-finished housings are available on special request.

Inside metal components are made from nickel-plated brass.

	Material	Surface
Component Parts	**Designation**	**Thickness of the film**
Housing Back Nut Slotted Nut	→ Cu-alloy	+ 1 µm Cu + 3-6 µm Ni + 0.3-1 µm matt chromate
Collet EMI-Ring Half-Shells Locking Washer Nut Retainer Ring	→ Cu-alloy	→ Ni matt: 6-8 µm
Pin (solder or PCB) Socket (solder or PCB) Pin (crimp) Socket (crimp)	→ Cu-alloy	+ 1.25 µm Ni → + 0.75 µm Au

Insulation Body Material (recognized)

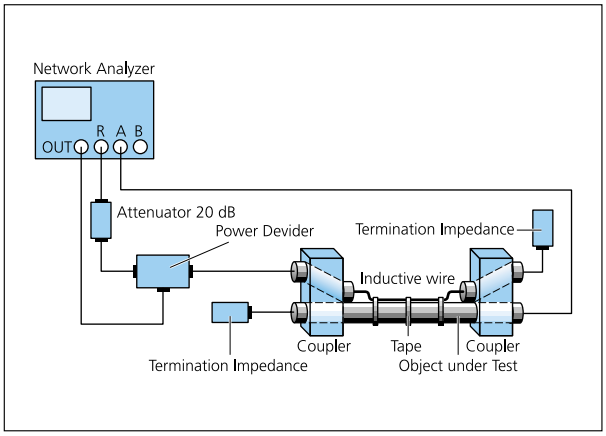
	Norm		Unit	PBT	PTFE 1)	PEEK
Dialectric Strength	DIN 53481	ASTM D-149	KV / mm	27	> 50	19
Operating Temperature	--	--	°C	- 40 / + 140	-100 / + 260	-50 / +250
Flammability rating	UL–94	--	--	V-0	V-0	V-0
Creeping distance acc. to CTI	IEC 60112			275	600	175

[1] PTFE (Teflon) is only used for Coax- and Triax Connectors

Electromagnetic Compatibility (EMC)

When discussing electromagnetic compatibility (EMC) one should not only consider the device or the circuit, but also include the network and the entire data communication link. This involves all connecting elements such as conductors and connectors. Electromagnetic interference from the outside into the connector can lead to system malfunctioning. The best way to prevent this is by providing a high-quality shield between the cable and the connector. In order to provide reliable EMC data to our customers we engaged the services of a certified test laboratory to investigate the EMC characteristics of the ODU MINI-SNAP. They tested for us Size 00, 0, 1, 2 and 3 MINI-SNAP connectors.

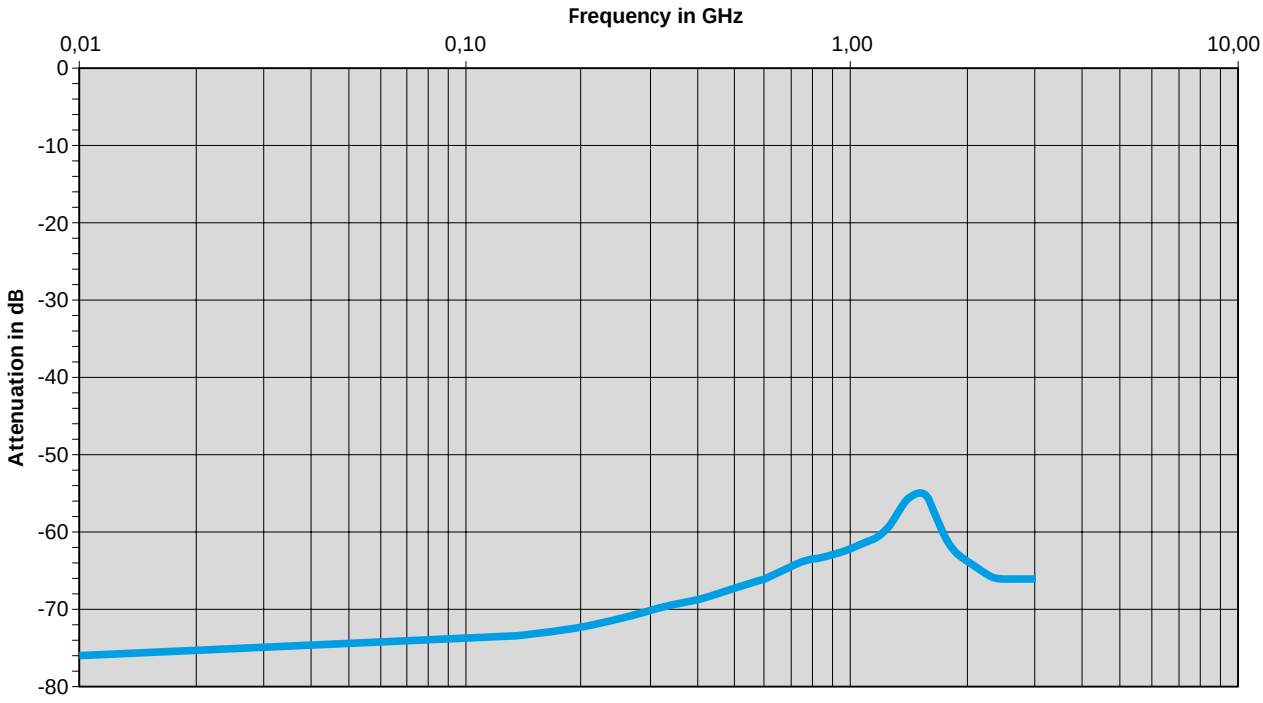
Measurements were conducted using the inductive wire or parallel wire method in accordance with test procedure VG 55214-6-2. In this set-up, the mated connector is connected on one end to a network analyzer and terminated on the other end with a suitable impedance. The inductive wire is then mounted in close proximity along the mated connector pair. The induction wire is a ribbon cable which permits to vary the level of induction by using more or less of the ribbon conductors.



Next, a signal with a frequency range of 10 kHz to 3 GHz is connected to the ribbon cable. The network analyzer is used to measure the amount of signal induced into the connector circuit. The result is shown as the shielding attenuation A_T in dB. It is essential that all leads to the connector are shielded so that no signal can be induced into the circuit at any other place except the connector. The various attenuation values are plotted on a logarithmic scale as attenuation in dB vs. frequency.

An attenuation of better than -55 dB is generally required for reliable connector and system operation. It can be shown that our connectors will meet this requirement in all applications.

The following diagram is valid for all series and standard sizes.



ODU Steckverbindungssysteme GmbH & Co. KG, Pregelstr. 11, D-84453 Mühldorf/Inn, Tel. +49/86 31/61 56-0, Fax +49/86 31/61 56 49, www.odu.de

ODU MINI-SNAP in Signal Bus Applications

Most signal bus applications require standard connectors.

However, there may be special situations which could require watertightness, EMV-protection, or high-frequency performance.

Name	Data-rate	Range of application (example)	Standard connect
USB	12 Mbit/s	computer peripherals	4-position, shielded
Profibus	12 Mbit/s	computer peripherals	4 + 2-position shielded
Interbus	0,5 Mbit/s	process-automation	D-Sub 9-position; Circular connector 12-position
Fire-Wire	400 Mbit/s	CIM, Propulsion	D-Sub 9-position; Circular connector 9-position

Fig. 1: Data rates for different signal bus applications

A MINI-SNAP size 0, 7-position connector was tested for suitability for an application in a fire-wire IEEE 1394-1995 bus.

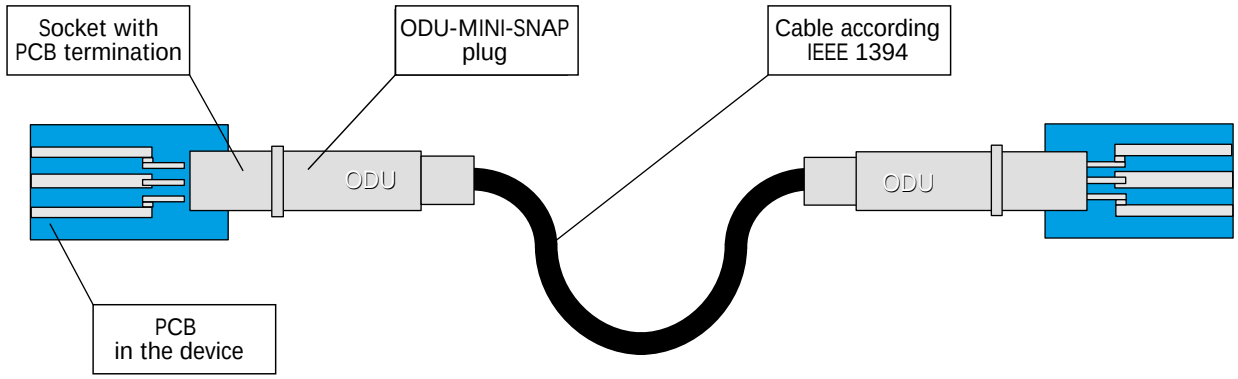


Fig. 2: Test set-up for determination of dynamic system behavior

Result:

In accordance with IEEE 1394-1995 the following parameters were measured:

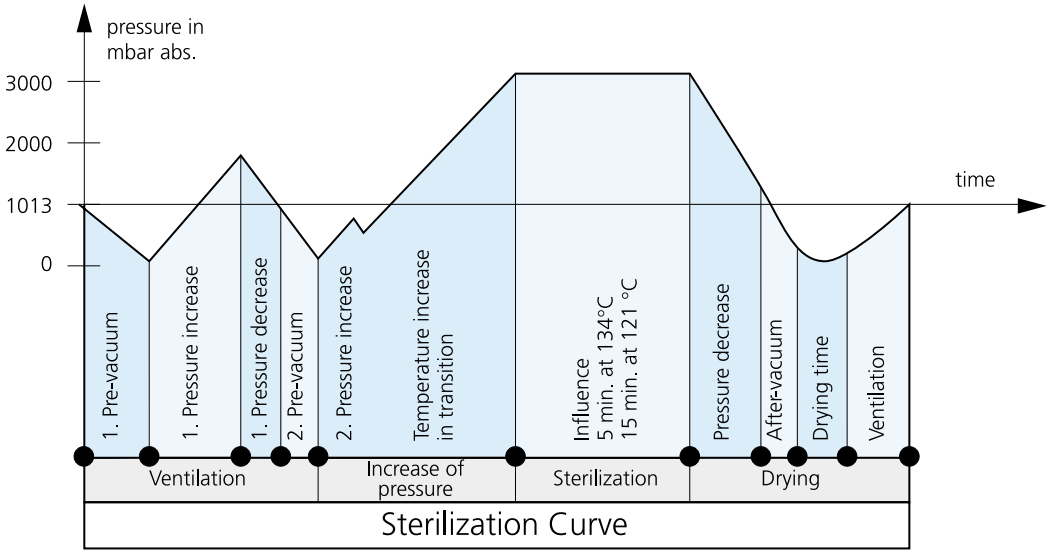
- impedance
- attenuation
- delay
- Cross Talk

Test results showed that the ODU MINI-SNAP connector size 0, 7-position performed within all nominal values.
The ODU MINI-SNAP connectors appear to be suitable for fire-wire bus applications.
Since the other bus systems have lower performance requirements, it is assumed that the ODU MINI-SNAP connector is also suitable for other bus systems.

Autoclaving of ODU MINI-SNAP Connectors

If required ODU can deliver MINI-SNAP connectors for the following sterilization process:
Steam-sterilization with pre-vacuum or gravitation-process. Connectors were tested with autoklave equipment with reference to DIN EN 13 060 at 134° C and 500 cycles.

Sterilization Curve:



For other sterilization-processes please contact our technical support team.

ODU Steckverbindungssysteme GmbH & Co. KG, Pregelstr. 11, D-84453 Mühldorf/Inn, Tel. +49/86 31/61 56-0, Fax +49/86 31/61 56 49, www.odu.de

Quality Management at ODU

In the scope of quality approval the sizes 0 and 3 have been submitted to environmental and mechanical tests acc. to MIL.

All tests have been passed.

Tests carried out:

Definition	Nach Norm
High Temperature	MIL-STD 810 F / PV 501
Low Temperature	MIL-STD 810 F / PV 502
Temperature Shock	MIL-STD 810 F / PV 503
Humidity	MIL-STD 810 F / PV 507
Salt Fog	MIL-STD 810 F / PV 509 and MIL-STD 1344 A / Methode 1001.1
Shock	MIL-STD 810 F / PV 516
Vibration	MIL-STD 1344 A / Methode 2005.1 / IV
Water Thigtness IP 68	IEC 60529

ODU Steckverbindungssysteme GmbH & Co. KG, Pregelstr. 11, D-84453 Mühldorf/Inn, Tel. +49/86 31/61 56-0, Fax +49/86 31/61 56 49, www.odu.de

Technical Terms and Definitions

Air Gap
= Shortest distance between two conductive elements through the air.

Autoclavibility
(See page 136)

AWG
(See page 132)

Creepage Distance
= The distance measured across the surface of a dielectric between two contacts or a contact and a metal part. The longer the distance, the lesser the risk of damage or tracking. Minimum creepage distances are specified according to the operating voltage and the applicable isolation group.

Crimp Area
= The part of a crimp barrel at which the crimp connection is achieved by pressure deformation or by reshaping the barrel around the conductor.

Crimp Barrel
A hollow part of a contact which accepts one or more conductors and which may be crimped through the application of a crimping tool.

Crimp Connection
= The permanent attachment of a contact to a conductor by pressure deformation or by reshaping the crimp barrel around the conductor so that a good electrical and mechanical connection is established.
(See page 131)

Connector
= A component which terminates conductors for the purpose of providing connection and disconnection to a suitable mating component. Depending on the fastening to a cabinet, panel, rack etc. or a cable, they are classification.

Delivery
Delivery of the connectors usually as components (that means not assembled).
Exception: Solder contacts are factory-installed in the insulation body.

Fixed Connector
= A connector for attachment to a rigid surface (panel).

Free Connector
= A connector for attachment to the free end of a wire or cable. Also called free hanging connector or inline receptacle.

Insertion Or Withdrawal Force
= The force required to fully mate or unmate a set of connectors without the effect of coupling, locking or similar devices. The insertion force is usually greater than the withdrawal force. Also called mating and unmating force.

Insulation Body
= Non-conductive part of a connector, to electrically and mechanically separate live parts and to protect against accidental touch.

Insulation Group
= Classification of connectors according to the operating and working conditions (see page 128 insulation groups according DIN VDE 0110).

Keying
= System of projections and grooves on mating connectors which prevent otherwise identical connectors from being mated. This is useful when several connectors of the same style are used in the same application (see page 30, 48, 68).

Lower Limit Temperature
= The lowest permissible temperature which a connector or a plug-in device is allowed to be operated.

Materials
The contacts are made of Cu-alloy and gold-plated. The standard housings are made of Cu-alloy with a matt-chromate surface finish. All other materials and surfaces on special request. (see page 133).

Mating Cycles
= Mechanical operation of connectors and plug-in devices by insertion and withdrawal. One mating cycle comprises one insertion and one withdrawal operation.

Nominal Single Contact Current Load
= Current load, which can load every single contact (see page 130).

Nominal Voltage
Nominal voltage characterizes a component (see page 128).

Operating Temperature of the ODU MINI-SNAP
= Range between upper and lower temperature limits.
- 40 °C to + 120 °C (see page 8)

Print Connection
(see page 131)

Printed Circuit Board
Boards, typically made of epoxy-filled glass fiber fabric, with conductive pattern on one or both sides, or in case of multilayer boards, also imbedded inside the board. They feature metallized holes for soldering wire-mounted components or for the insertion of insertion of resilient or rigid press-in pins or instead, pads for attaching components using surface mount technology (SMT).

Reference Current
= The current at which a connector can be operated permanently simultaneously through all contacts without reaching maximum temperature.

Reference Voltage
Normal voltage (VDE 0110) for a connector (see page 128).

Solder Termination
(see page 131 Termination Styles)

Termination techniques
= Methods for connecting a wire to an electro-mechanical component, e.g. solderless connection according to IEC 60352: respectively such as crimp, press-in etc. or solder connections.

Test Voltage
= The voltage the connectors are tested, and are being referred on definite characteristics (see page 128).

Upper Limit Temperature
= highest permissible temperature at which a connector or a plug-in device is allowed to operate. This temperature includes the self-heating and the ambient temperature. At ODU MINI-SNAP + 120 °C (see page 130).

Watertightness
(See page 126 and 127)

ODU Steckverbindungssysteme GmbH & Co. KG, Pregelstr. 11, D-84453 Mühldorf/Inn, Tel. +49/86 31/61 56-0, Fax +49/86 31/61 56 49, www.odu.de

Wire
= Wires may be provided with an insulation cover, an electrical shielding. Cables or conductors may consist of one or more wires.

Connectors shown in this catalog are designed to operate at high voltages and high frequencies. Care must be taken to assure that no person can come in contact with live conductors during installation or operation of the connectors.

ODU reserves the right to change design and performance of any product to meet changing technical developments without prior notice. ODU reserves the right to discontinue any part in this catalog without prior notice and without obligation to continue production after the change.