

ODU-MAC[®] **Black-Line**

THE MASS INTERCONNECT SOLUTION

The flexibility of mass interconnect



Innovative
engagement option:
**electromechanical
version**

WHY ODU?

OUR IN-HOUSE COMPETENCE

Customer service & technical support

First, our internal and field sales staff gets to know all about your application and really gets to grips with exactly what you want. We align closely with the production and quality assurance departments to define the relevant technical and commercial requirements for the product.

Development

We have development centers in Germany, the USA and China, so we're always by your side no matter where in the world you are. Not only will you benefit from ODU's experience in developing new ideas, but also from the opportunity to combine this expertise with new knowledge arising from the company's very own research.

Design

We have around 100 design specialists who will discuss the technical feasibility of your project with you. We base this work on the latest scientific standards, but are always happy to go one step further.

Product manufacturing

When development is completed, the product moves on to manufacturing. If new tools are required, ODU is also able to design these in-house. This enables ODU to achieve vertical integration of 80 %.

Cable assembly

ODU also offers a comprehensive service for complete system solutions including cable assembly. We give you a complete system solution from one source. By providing this complete package, we offer the best possible guarantee for a perfect result.

Technology Test Center

We conduct tests and inspections in our on-site laboratory. Our Technology Test Center was founded in 2014. Once the product has passed all the tests, it is sent to the customer, ready for operation.

GLOBAL
AVAILABILITY

RELIABLE AND
IMPRESSIVE
CUSTOMER SERVICE

GERMAN
ENGINEERING

YOUR BENEFITS

80 YEARS
EXPERIENCE IN THE
FIELD OF CONNECTORS

OPTION OF
CABLE ASSEMBLY

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Printed on certified recycled paper.



All shown connectors are according to IEC 61984:2008 (VDE 0627:2009-11); connectors without breaking capacity (COC).



MASS INTERCONNECT SOLUTIONS

Mass interconnect solutions are used in test and measurement engineering to test printed circuit boards (PCBs) and electronically assembled units.

They operate as an interface between devices / units under test (D / UUT) and test instruments.

The tester side (receiver) is connected with the side that is under test via the interchangeable test adapter (ITA).

References

ODU-MAC® Black-Line –

Test and measurement for the next level

The ODU-MAC® Black-Line Mass Interconnect interface stands out by its excellent quality and its fantastic modularity and flexibility.

Unlike the signal blocks that are so typical for the sector, ODU primarily relies on the modular ODU-MAC® Blue-Line Connector System. This gives the user a choice of various modules designed for signals, power, high-current, high-voltage, HF signals (coax), compressed air and fluid coupling, vacuums, fiber optic cables and data rates / high-speed data. PCB termination modules round off the range.

The ODU Mass Interconnect Solution is available in two sizes with either three or five rack units (RU). We offer five types of termination technology for connecting the contacts: crimping, soldering, PCB / print, wire wrap and wire mount.

This modularity and flexibility enable solutions for a wide variety of test requirements.

TEST & MEASUREMENT APPLICATIONS



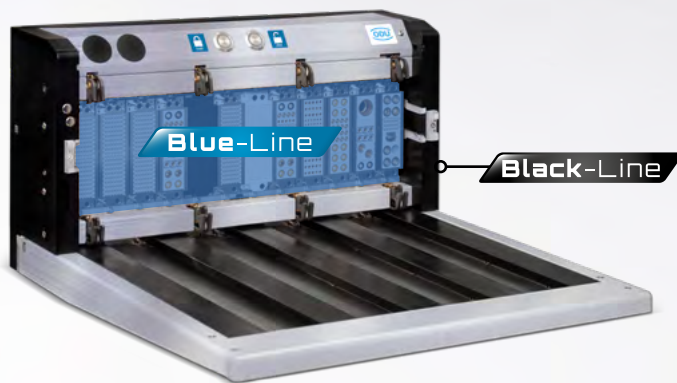
ODU-MAC[®] **Black-Line** OVERVIEW

The ODU-MAC[®] Black-Line Mass Interconnect solution benefits from the principle of the ODU-MAC[®] Blue-Line Modular Connector System.

The modular design and the variety of transmission possibilities are characteristics of the proven, hybrid ODU-MAC[®] Blue-Line System.

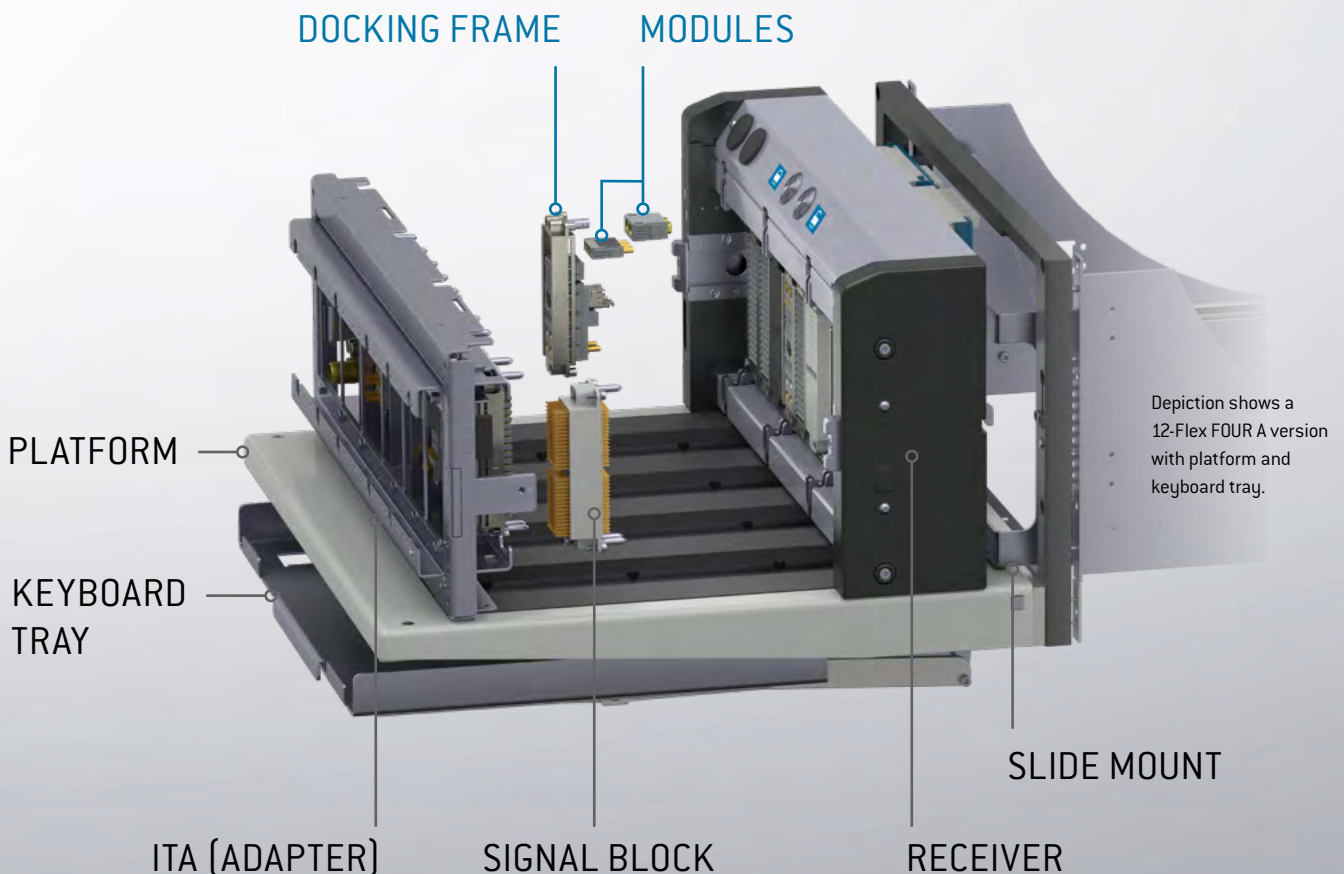
Due to the high compatibility the ODU Mass Interconnect interface can be individually equipped with the existing modules depending on the test requirements.

It is also possible to combine it with signal blocks. Each interface can be equipped with up to 4,608 signal contacts.



FEATURES

- + Innovative engagement option: electromechanical version with remote control available
- + Eight tensioning points stop the frame distortion
- + Adapter frame (ITA) with tolerance compensation for easy mating and extended lifespan
- + Easy maintenance access for a simple and fast modification
- + Maximum flexibility with ODU-MAC[®] modules and signal blocks
- + Optional identification of the adapter available
- + Complete solution including cable assembly
- + Up to 4,608 signal contacts



ODU-MAC[®] **Black-Line** PRODUCT INFORMATION

20,000
mating
cycles



12-Flex TWO M



12-Flex FOUR A

Number of frames	12 modular connectors	
Frame size	TWO	FOUR
Rack unit (RU)	3 ¹	5 ¹
Mating principle	Manual	Automatic
Max. signals	2,304	4,608
Engagement	Hand lever	Electromechanical
Configuration	Rack mount / Tabletop	Rack mount / Inline tester

¹ In the case of using a platform, one more unit is required

Frames

There is space for a maximum of 12 ODU-MAC[®] Blue-Line docking frames in one receiver or adapter. So up to 4,608 signal contacts can be accommodated in the larger version, due to the high contact density of the modules and their compact design. ODU-MAC[®] Blue-Line modules boast a simple method of clip-in assembly into the frame without the need for tools. Furthermore, the quick-locking system ensures that the ODU-MAC[®] frames and signal blocks can be locked quickly and reliably on the receiver side.

Sizes

A variety of ODU-MAC[®] Blue-Line modules can be integrated in different frame sizes (size 2 or 4).

Engagement

The ODU-MAC[®] Black-Line is available with different engagement options. You can choose between hand lever and an electromechanical version.

Manual mating principle (M)

This version of the ODU-MAC[®] Black-Line with hand lever matches the standard, tried-and-tested designs already on the market. The receiver and adapter sides are connected to one another via the hand lever. It is possible to use it as rack mounted or tabletop configuration (M Tabletop).

Electromechanical engagement (A)

The innovative electromechanical engagement mechanism remains unique. Rather than being operated via a handle, the two sides of the system are connected simply by pushing a button (ergonomic design). This means there is no need for a locking hand lever, which can be an interfering contour in practice. In addition, the electromechanical system enables remote control and is ready to use for integration into an inline tester.

The electromechanical version of ODU-MAC[®] Black-Line and the quick-locking system on the receiver side have patents pending.

SYSTEM FEATURES

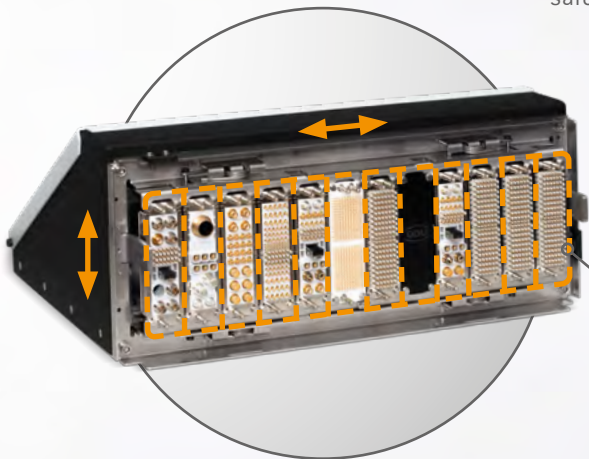


QUICK-LOCK

Time-saving **socket frame unlock / lock** on receiver side with just a 1/4 turn

HIGH LEVEL OF CONTACT SAFETY

8 tensioning points prevent ITA frame distortion. Equal tensioning ensures safe and reliable connections.

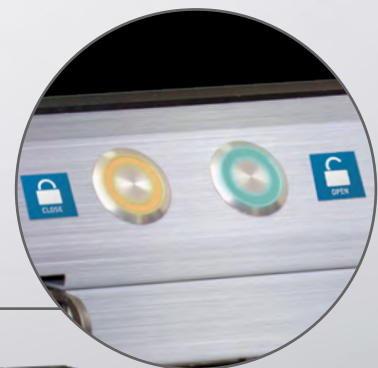


TOLERANCE PROTECTION

12 individual floating docking frames for extended lifespan

ELECTROMECHANICAL ENGAGEMENT OPTION

- + Increased safety through push-button operation compared to the mechanical version
- + Optimum use of space by eliminating the hand lever (reduced space requirement)
- + Higher ergonomic operation
- + Time-saving automation is possible through remote control
- + Suitable for easy integration into an inline tester
- + Energy-efficient drive – power consumption only during mating and demating

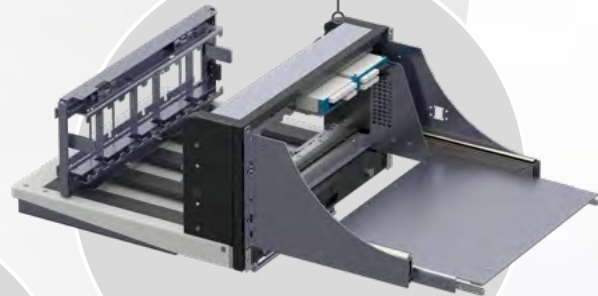
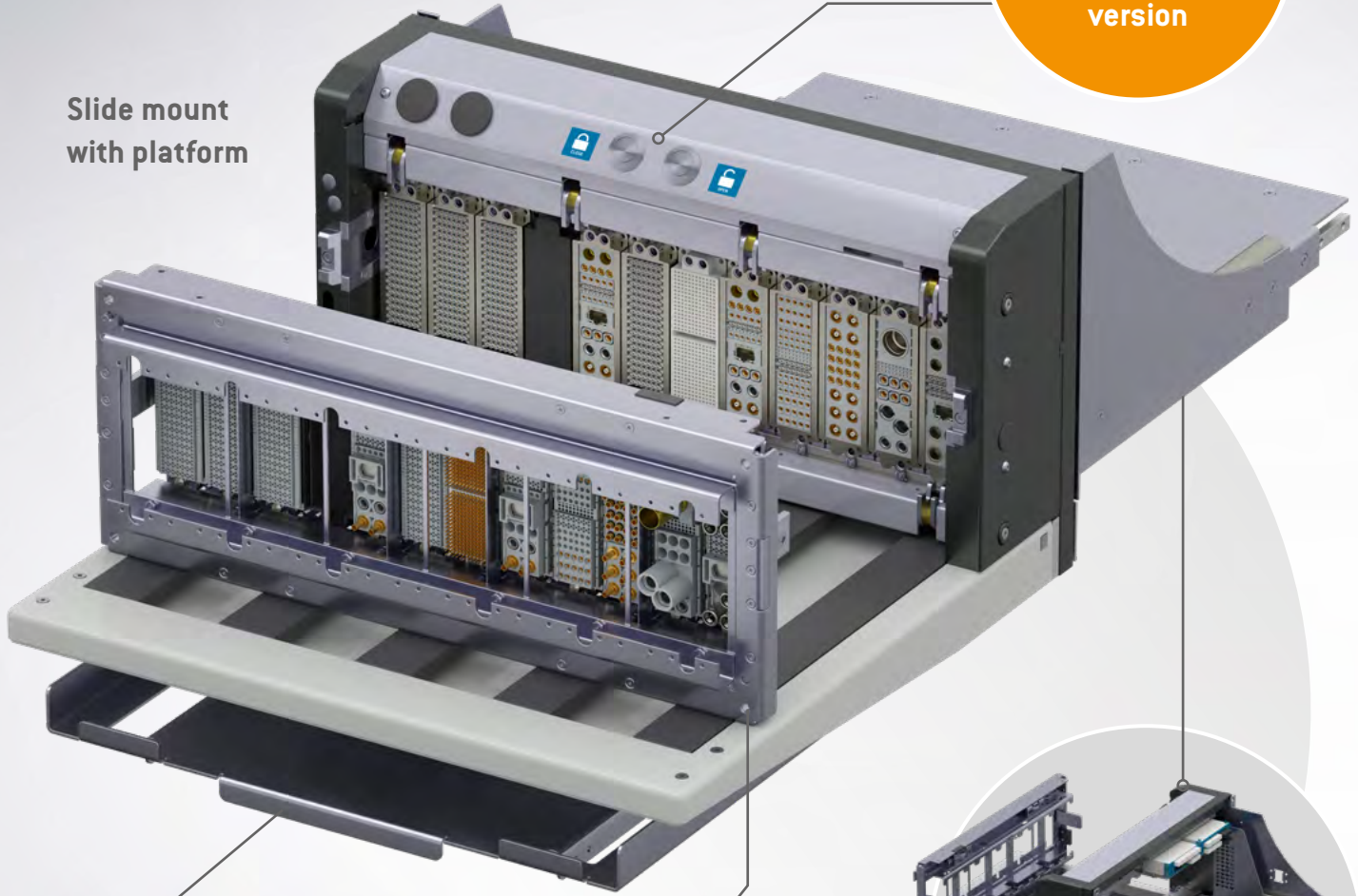


ODU-MAC[®] **Black-Line**

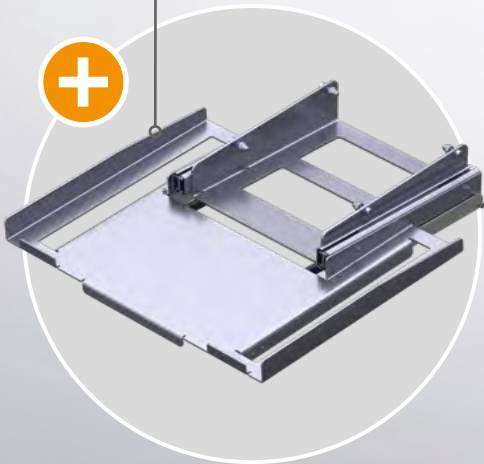
12-Flex FOUR A

Innovative engagement option:
electromechanical version

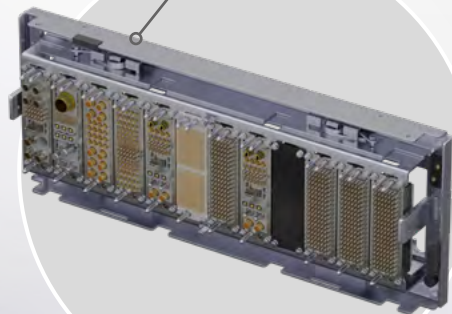
Slide mount with platform



Back view of slide mount

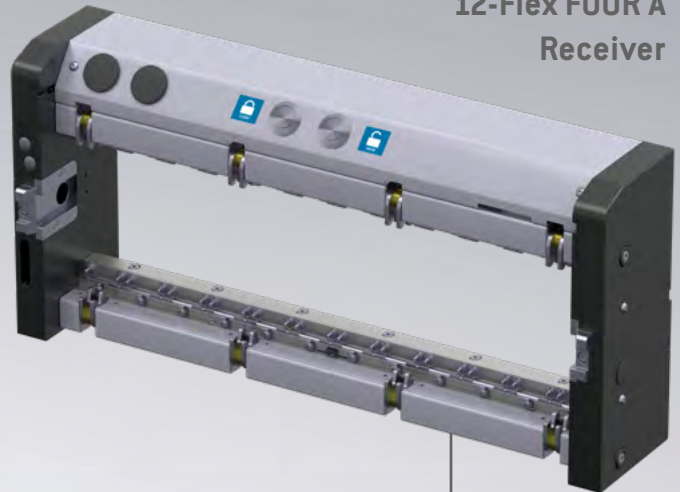


Optional:
keyboard tray kit



Front view of
12-Flex FOUR A Adapter
(ITA)

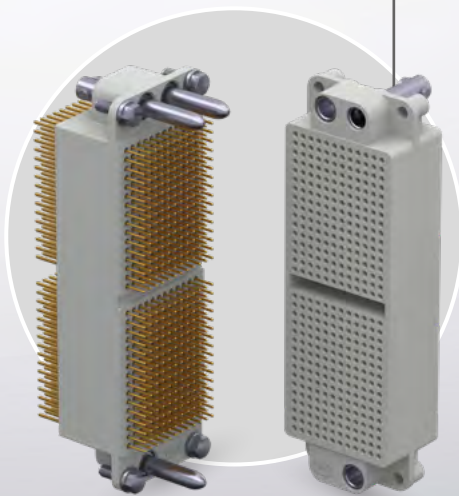
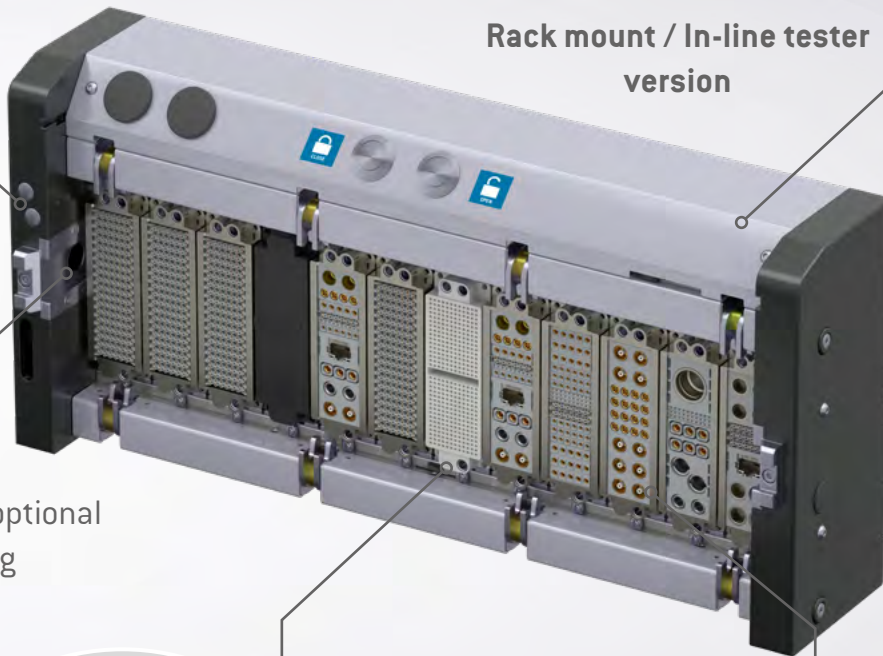
12-Flex FOUR A
Receiver



Optional
resistance
coding

Rack mount / In-line tester
version

Space for optional
RFID coding



Signal blocks
Size 4

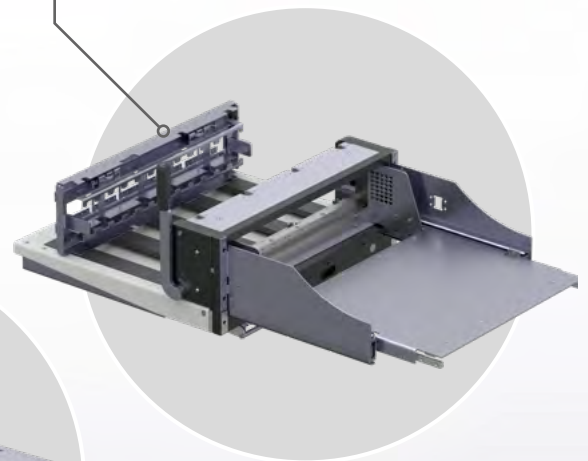
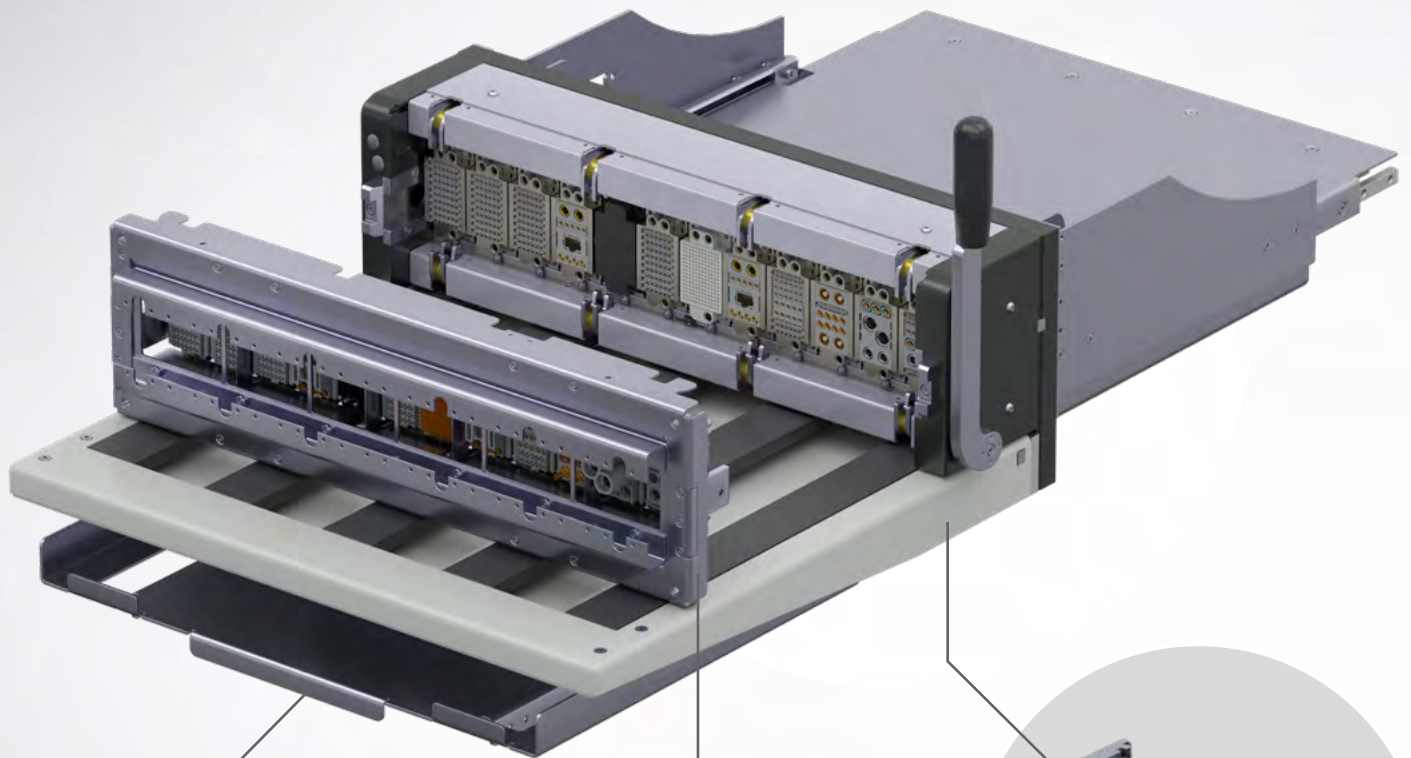


Frames
Size 4

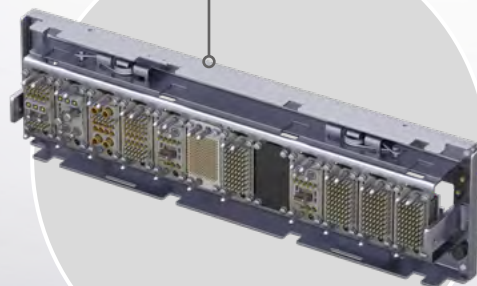
ODU-MAC[®] **Black-Line**

12-Flex TWO M

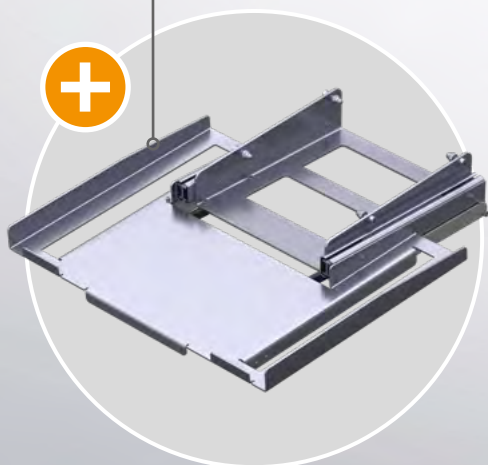
Slide mount
including platform



Back view of
slide mount



Front view of
12-Flex TWO M Adapter
(ITA)

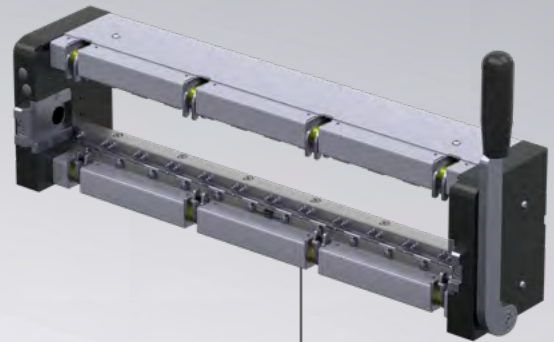


Optional:
keyboard tray kit

Tabletopcover including platform



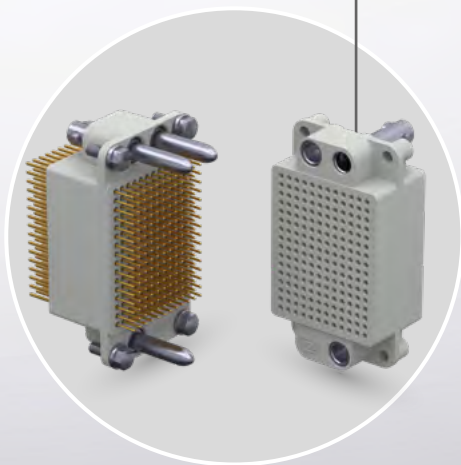
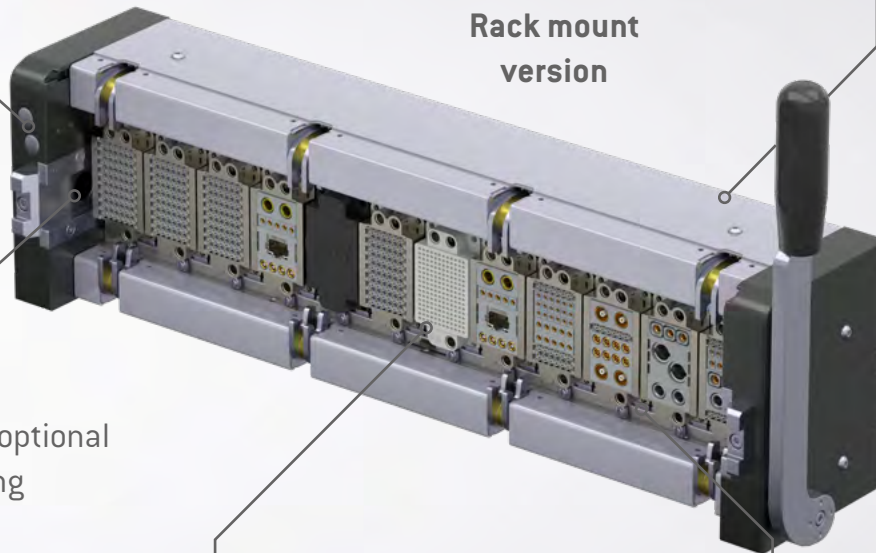
12-Flex TWO M Receiver with hand lever



Optional resistance coding

Rack mount version

Space for optional RFID coding



Signal blocks
Size 2

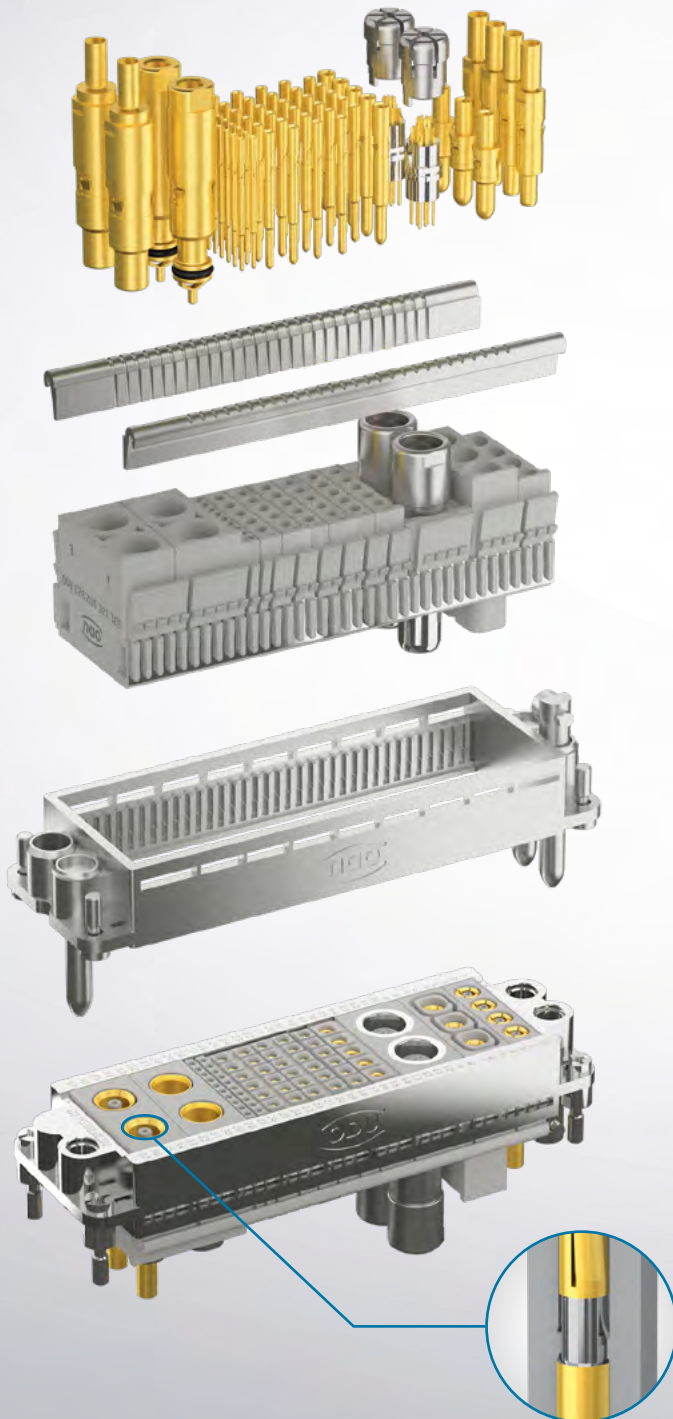


Frames
Size 2

ODU-MAC[®] **Blue-Line**

THE MODULAR SYSTEM AT A GLANCE

The modules of the ODU-MAC[®] Blue-Line stand out due to their easy handling, flexibility and high performance. You can choose between a variety of modules to get the perfect solution for every application. Due to the tool-free assembly and removal of the modules in the frame, the system is very user-friendly. The exchange of the crimp-clip contacts is easy, even when assembled.



+ Contacts for solder, crimp, PCB termination, wire wrap and wire mount

+ Secondary locking part

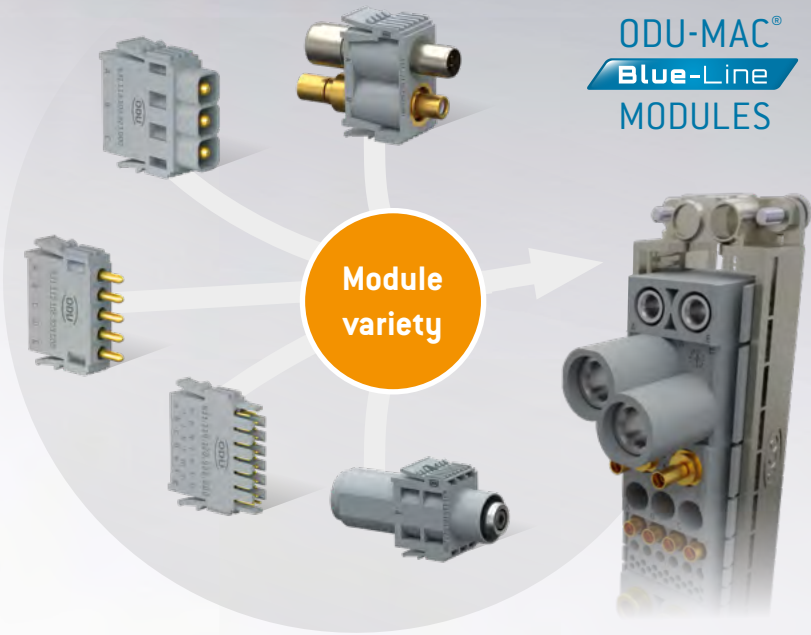
+ Variety of modules to choose from

+ Pin frame

+ Socket frame

+ Contacts with clip principle can be removed even when assembled

PROVEN ODU-MAC[®] MODULARITY



ODU-MAC[®]
Blue-Line
MODULES

- + Economical**
Easy handling: clip-in assembly and removal of the modules in the frame without using tools
- + Flexible**
 - 2 frame sizes
 - Different modules available: transmission of signals, power, high-current, high-voltage, coax, compressed air, fluid, vacuum, data and fiber optic
 - Maximum contact density via the 2.4 mm grid (1 unit)
 - Easy disassembling of most contacts from the module front side
- + Rugged**
 - Impressive adapter frame (ITA) including a pre-guiding system
 - Each of the 12 connectors that can be integrated is also fitted with guiding pins and bearings that allow for radial play of +/- 0.6 mm.

DOCKING FRAMES

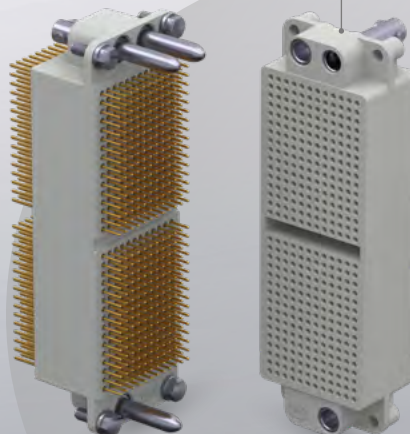
Size 2 **+**



+ Size 4



384
contacts



Size 4 **+**

192
contacts



Size 2 **+**

SIGNAL BLOCKS

ODU-MAC[®] **Blue-Line**

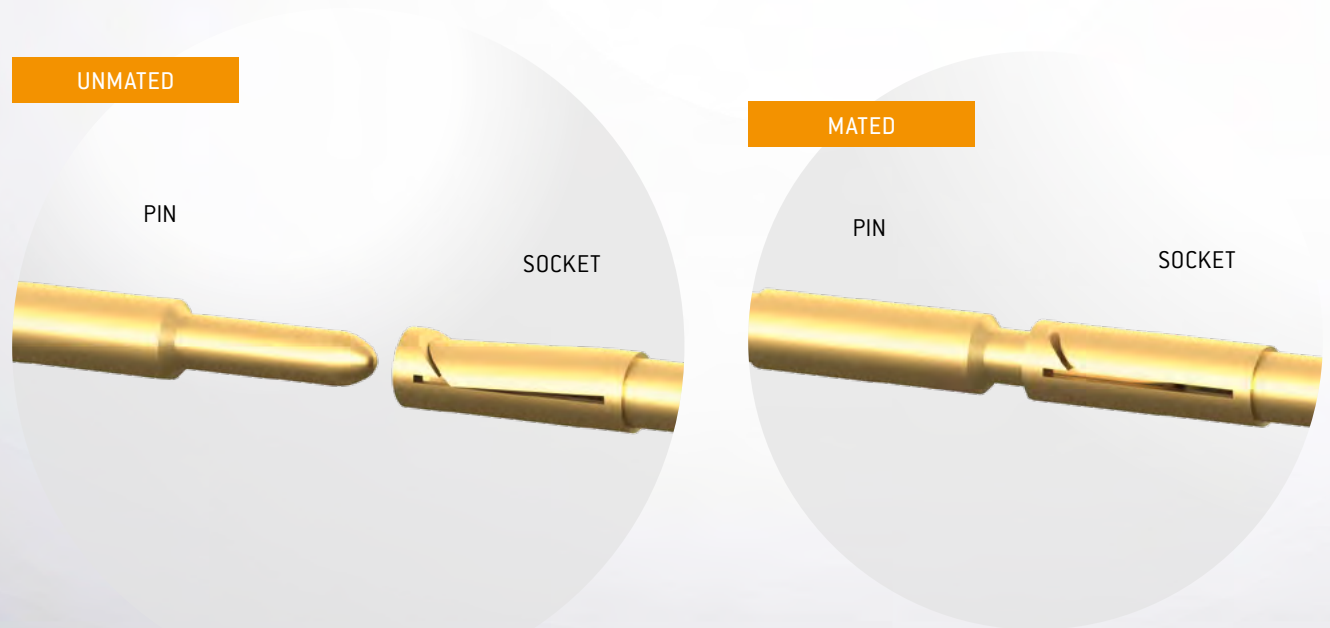
THE CONTACT PRINCIPLE

ODU Contacts meet the highest quality standards and enable safe and reliable connections. In order to achieve this, ODU relies on high-performance contact technologies with constant contact resistance. In the turned contact category, we essentially distinguish between lamella and slotted contacts. The socket pieces differ, but the pins are always the same and always solid.

ODU TURNTAC[®]

Slotted contacts

The universal ODU TURNTAC[®] contact system combines the very best contact properties and high quality with economical prices.



BENEFITS

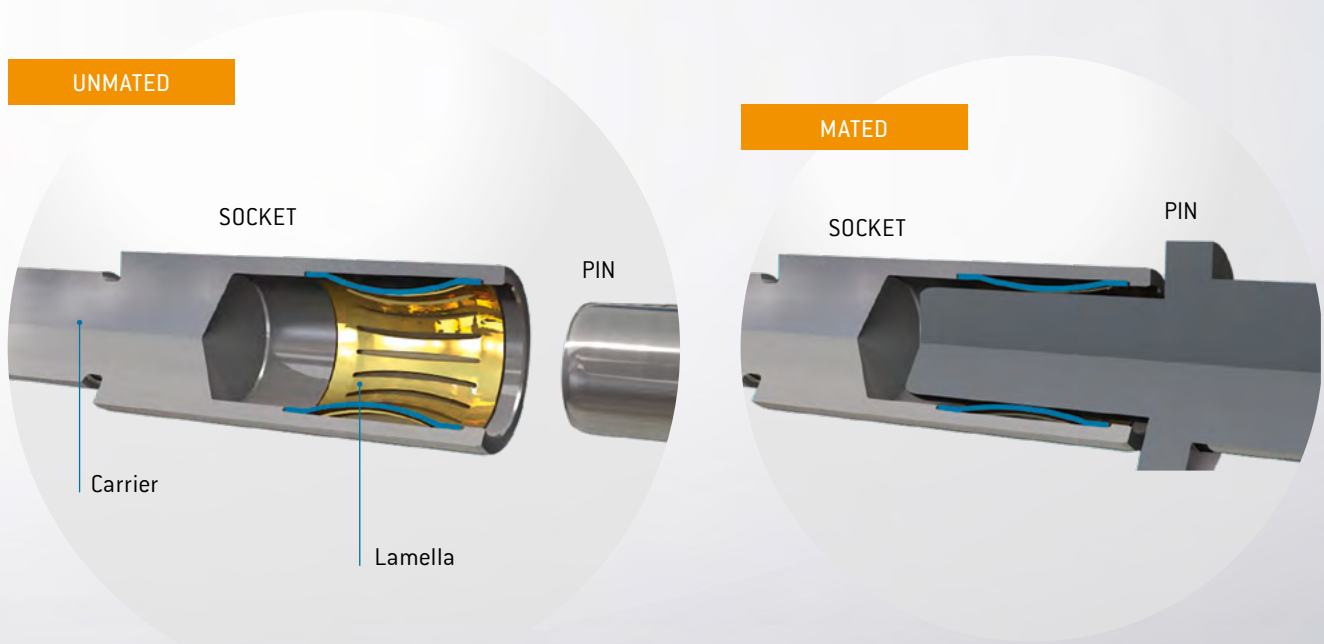
- Economical solution
- Self-cleaning system
- Constant contact resistance
- Rugged and universal contact system

Standard contact principle for:	
Signal / high-voltage contact	Ø 0.7–2 mm
Power contact	Ø 3.5 mm
Coax	2 and 4 contacts
Shielded feedthrough	Signal contacts

ODU LAMTAC®

Contacts with lamella technology

The ODU LAMTAC® consists of a turned carrier in which one or several stamped lamella strips are mounted in a fully automated process. The lamella's individual slats make for a multitude of contact points, thereby guaranteeing a high level of contact safety and ease of connecting. The adapted contact force ensures low mating and demating forces, and a long service life with low wear.



BENEFITS

- High current-carrying capacity – surge current capacity
- Low mating and demating forces
- Constant contact resistance

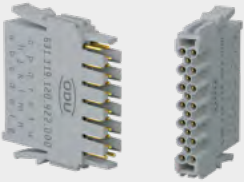

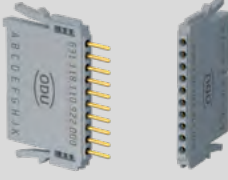







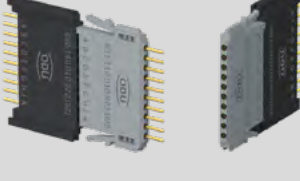

Standard contact principle for:	
Power contact	Ø 5–12 mm
Shielded feedthrough	Shielded transmission
PE	Ø 8 mm

OVERVIEW OF ALL MODULES



Suitable for ODU-MAC® Black-Line

All modules are also pre-assembled available.

	Modules	Description	Units / width	Features
Signal		20 contacts Contact-Ø: 0.7 mm	 4.8 mm	Operating voltage ¹ 200 V Test voltage ¹ 1,076 V AC Nominal current ² 7 A for 0.14 mm ² Pollution degree ¹ 2 + Maximum contact density & pin protection
		10 contacts Contact-Ø: 0.7 mm	 2.4 mm	Operating voltage ¹ 320 V Test voltage ¹ 1,320 V AC Nominal current ² 7 A for 0.14 mm ² Pollution degree ¹ 2 + Maximum contact density
		6 contacts Contact-Ø: 1.3 mm	 4.8 mm	Operating voltage ¹ 500 V Test voltage ¹ 1,730 V AC Nominal current ² 12.5 A for 1 mm ² Pollution degree ¹ 2
		5 contacts Contact-Ø: 2 mm	 7.2 mm	Operating voltage ¹ 672 V Test voltage ¹ 1,959 V AC Nominal current ² 24 A for 2.5 mm ² Pollution degree ¹ 2
PCB termination modules		20 contacts Contact-Ø: 0.7 mm	 4.8 mm	Operating voltage ¹ 200 V Test voltage ¹ 1,076 V AC Nominal current ² 4.5 A Pollution degree ¹ 2
		10 contacts Contact-Ø: 0.7 mm	 2.4 mm	Operating voltage ¹ 320 V Test voltage ¹ 1,320 V AC Nominal current ² 4.5 A Pollution degree ¹ 2 + Maximum contact density

¹ According to IEC 61010-1:2010 (VDE 0411-1:2020-03), supply voltage from grid supply circuit (Cat.2)
Design with values according to IEC 61010-1:2010 can be found in the ODU-MAC® Blue-Line catalog.

² Determined according to IEC 60512-5-2:2002 (DIN EN 60512-5-2:2003-01) at increased temperature 45 K



All modules are also pre-assembled available.

Modules	Description	Units / width	Features
PCB termination modules	 <p>6 contacts Contact-Ø: 1.3 mm</p>	 4.8 mm	Operating voltage ¹ 500 V Test voltage ¹ 1,730 V AC Nominal current ² 8 A Pollution degree ¹ 2
	 <p>5 contacts Contact-Ø: 2 mm</p>	 7.2 mm	Operating voltage ¹ 555 V Test voltage ¹ 1,959 V AC Nominal current ² 16 A Pollution degree ¹ 2
PE-Module	 <p>1 contact for turned contacts with ODU LAMTAC^{®3} Contact-Ø: 8 mm</p>	 12 mm	Conduct cross-section 10 / 16 / 25 mm ²
High-voltage	 <p>2 contacts Contact-Ø: 1.3 mm</p>	 12 mm	Operating voltage ¹ 4,000 V Test voltage ¹ 7,198 V AC Nominal current ² 12.5 A for 1 mm ² Degree of pollution ¹ 2 + High-voltage
Power	 <p>3 contacts Contact-Ø: 3.5 mm</p>	 9.6 mm	Operating voltage ¹ 3,260 V Test voltage ¹ 7,514 V AC Nominal current ² 39 A for 6 mm ² Pollution degree ¹ 2 + High-voltage
High-current	 <p>2 contacts for turned contacts with ODU LAMTAC^{®3} Contact-Ø: 5 mm</p>	 12 mm	Operating voltage ¹ 611 V Test voltage ¹ 2,251 V AC Nominal current ² 68 A for 16 mm ² Pollution degree ¹ 2 + Maximum current

¹ According to IEC 61010-1:2010 (VDE 0411-1:2020-03), supply voltage from grid supply circuit (Cat.2)

Design with values according to IEC 61010-1:2010 can be found in the ODU-MAC[®] Blue-Line catalog.

² Determined according to IEC 60512-5-2:2002 (DIN EN 60512-5-2:2003-01) at increased temperature 45 K

³ Contact with lamella technology

OVERVIEW OF ALL MODULES



Suitable for ODU-MAC® Black-Line

All modules are also pre-assembled available.

	Modules	Description	Units / width	Features
High-current		2 contacts for turned contacts with ODU LAMTAC® ³ Contact-Ø: 8 mm	 21.6 mm	Operating voltage ¹ 537 V Test voltage ¹ 1,844 V AC Nominal current ² 105 A for 25 mm ² Pollution degree ¹ 2
		1 contact for turned contacts with ODU LAMTAC® ³ Contact-Ø: 12 mm	 19.2 mm	Operating voltage ¹ 2,700 V Test voltage ¹ 6,388 V AC Max. continuous current ² 155 A for 50 mm ² Pollution degree ¹ 2
Coax		4 contacts for 50 Ω coax contacts	 7.2 mm	Frequency range 0–2.8 GHz
		2 contacts for 50 Ω coax contacts	 12 mm	Frequency range 0–4 GHz
		2 contacts for 50 Ω coax contacts SMA termination	 12 mm	Frequency range 0–12 GHz
		2 contacts for 75 Ω coax contacts	 12 mm	Frequency range 0–2.7 GHz

¹ According to IEC 61010-1:2010 (VDE 0411-1:2020-03), supply voltage from grid supply circuit (Cat.2)

Design with values according to IEC 61010-1:2010 can be found in the ODU-MAC® Blue-Line catalog.

² Determined according to IEC 60512-5-2:2002 (DIN EN 60512-5-2:2003-01) at increased temperature 45 K

³ Contact with lamella technology



All modules are also pre-assembled available.

	Modules	Description	Units / width	Features
Compressed air / fluid / vacuum coupling		2 contacts	5 Units 12 mm	Tube-Ø + 12 bar inner-Ø: max. 4 mm outer-Ø Push-in: max. 6 mm
		2 contacts	5 Units 12 mm	Tube-Ø + 10 bar M5 to max. 4 mm
		2 contacts	5 Units 12 mm	Tube-Ø + 10 bar M5 inside thread
		1 contact	12 Units 28.8 mm	Tube inner-Ø + -0.8 bar 16 mm
Shielded feedthrough/ high-speed connector		2 to 14 contacts for 2 insert size 1	6 Units 14.4 mm	Suitable for all common bus systems CAT 5, USB® 2.0 ¹ , USB® 3.2 Gen 1x1 ¹ , FireWire® ¹ , Ethernet, SPE 1000BASE-T1 ²
		2 to 14 contacts for 1 insert size 1	6 Units 14.4 mm	Suitable for all common bus systems CAT 5, USB® 2.0 ¹ , USB® 3.2 Gen 1x1 ¹ , FireWire® ¹ , Ethernet, SPE 1000BASE-T1 ²

¹These ODU specific connectors can transmit common data transmission protocols such as USB® 2.0, USB® 3.2 Gen 1x1 and FireWire®, but they are not USB®- and FireWire®-standard connectors.

²Single Pair Ethernet according to IEC 63171-6:2020 [IEEE 802.3bp]

OVERVIEW OF ALL MODULES



Suitable for ODU-MAC® Black-Line

All modules are also pre-assembled available.

	Modules	Description	Units / width	Features
Shielded feedthrough/ high-speed connector		3 to 22 contacts for 1 insert size 2	 16.8 mm	Suitable for all common bus systems CAT 5, CAT 6 _A , USB® 3.2 Gen 1x2 ¹ , Ethernet, HDMI® ¹ 2.1, DisplayPort® ¹ 2.0
		1 contact RJ45 insert	 16.8 mm	10 Gigabit Ethernet according to IEEE 802.3an, CAT 6 according to ANSI/TIA/EIA-568-C.2, CAT 6 _A according to ANSI/TIA-568.2-D
Combination module		2 contacts High-speed & coax	 14.4 mm	Coax 50 Ω/4 GHz or 75 Ω/2.2 GHz Selected inserts are suitable and qualified for data rates up to 5 Gbit/s. Suitable for USB® 2.0 ¹ , USB® 3.2 Gen 1x1 ¹ , FireWire® ¹ , Ethernet, SPE 1000BASE-T1 ²
		2 contacts High-speed & compressed air	 14.4 mm	Compressed air 12 bar Selected inserts are suitable and qualified for data rates up to 5 Gbit/s. Suitable for USB® 2.0 ¹ , USB® 3.2 Gen 1x1 ¹ , FireWire® ¹ , Ethernet, SPE 1000BASE-T1 ²
Fiber optic (on request)		4 contacts for fiber optic only pre-assembled Physical Contact	 7.2 mm	Max. Insertion loss 0.5 dB Single mode 9 / 125 μm Multi mode 50 / 125 μm
		4 contacts for fiber optic only pre-assembled Expanded Beam	 7.2 mm	Max. Insertion loss 1.5 dB Multi mode 50 / 125 μm

¹These ODU specific connectors can transmit common data transmission protocols such as USB® 2.0, USB® 3.2 Gen 1x1, USB® 3.2 Gen 1x2, FireWire® and DisplayPort®, but they are not USB®, FireWire® and DisplayPort® standard connectors.

²Single Pair Ethernet according to IEC 63171-6:2020 [IEEE 802.3bp]



All modules are also pre-assembled available.

Modules	Description	Units / width	Features
	5 contacts for fiber optic POF	<div style="border: 1px solid black; padding: 2px; display: inline-block;">3</div> Units 7.2 mm	Insertion loss typical 1,5 dB for 670 nm
	Blank modules	<div style="border: 1px solid black; padding: 2px; display: inline-block;">1</div> 2.4 mm <div style="border: 1px solid black; padding: 2px; display: inline-block;">3</div> 7.2 mm <div style="border: 1px solid black; padding: 2px; display: inline-block;">5</div> 12 mm	Used to fill incomplete frames.

SIGNAL BLOCKS FOR ODU-MAC® BLACK-LINE

Signal blocks		Size 2 / Contact grid 2.54 mm contact-Ø 0.7 mm <div style="background-color: orange; color: white; border-radius: 50%; padding: 10px; display: inline-block; font-weight: bold;">192</div> contacts	<table border="1"> <thead> <tr> <th>Connection option</th> <th>Wire wrap</th> <th>Crimp, solder, PCB / print, wire mount</th> </tr> </thead> <tbody> <tr> <td>Operating voltage¹</td> <td>118 V</td> <td>370 V</td> </tr> <tr> <td>Test voltage¹</td> <td>960 V</td> <td>1,588 V</td> </tr> <tr> <td>Nominal current single contact²</td> <td>7 A for 0.38 mm²</td> <td>7 A for 0.38 mm²</td> </tr> <tr> <td>Nominal current fully equipped²</td> <td>2.1 A for 0.38 mm²</td> <td>2.1 A for 0.38 mm²</td> </tr> <tr> <td>Pollution degree¹</td> <td>2</td> <td>2</td> </tr> </tbody> </table> <div style="background-color: orange; color: white; border-radius: 15px; padding: 5px; display: inline-block; font-weight: bold;">+ Signal block with highest contact density</div>	Connection option	Wire wrap	Crimp, solder, PCB / print, wire mount	Operating voltage ¹	118 V	370 V	Test voltage ¹	960 V	1,588 V	Nominal current single contact ²	7 A for 0.38 mm ²	7 A for 0.38 mm ²	Nominal current fully equipped ²	2.1 A for 0.38 mm ²	2.1 A for 0.38 mm ²	Pollution degree ¹	2	2
	Connection option	Wire wrap	Crimp, solder, PCB / print, wire mount																		
Operating voltage ¹	118 V	370 V																			
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Nominal current fully equipped ²	2.1 A for 0.38 mm ²	2.1 A for 0.38 mm ²																			
Pollution degree ¹	2	2																			
	Size 4 / Contact grid 2.54 mm contact-Ø 0.7 mm <div style="background-color: orange; color: white; border-radius: 50%; padding: 10px; display: inline-block; font-weight: bold;">384</div> contacts	<table border="1"> <thead> <tr> <th>Connection option</th> <th>Wire wrap</th> <th>Crimp, solder, PCB / print, wire mount</th> </tr> </thead> <tbody> <tr> <td>Operating voltage¹</td> <td>118 V</td> <td>370 V</td> </tr> <tr> <td>Test voltage¹</td> <td>960 V</td> <td>1,588 V</td> </tr> <tr> <td>Nominal current single contact²</td> <td>7 A for 0.38 mm²</td> <td>7 A for 0.38 mm²</td> </tr> <tr> <td>Nominal current fully equipped²</td> <td>2.1 A for 0.38 mm²</td> <td>2.1 A for 0.38 mm²</td> </tr> <tr> <td>Pollution degree¹</td> <td>2</td> <td>2</td> </tr> </tbody> </table> <div style="background-color: orange; color: white; border-radius: 15px; padding: 5px; display: inline-block; font-weight: bold;">+ Signal block with highest contact density</div>	Connection option	Wire wrap	Crimp, solder, PCB / print, wire mount	Operating voltage ¹	118 V	370 V	Test voltage ¹	960 V	1,588 V	Nominal current single contact ²	7 A for 0.38 mm ²	7 A for 0.38 mm ²	Nominal current fully equipped ²	2.1 A for 0.38 mm ²	2.1 A for 0.38 mm ²	Pollution degree ¹	2	2	
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Pollution degree ¹	2	2																			

¹ According to IEC 61010-1:2010 (VDE 0411-1:2020-03), supply voltage from grid supply circuit (Cat.2) Design with values according to IEC 61010-1:2010 can be found in the ODU-MAC® Blue-Line catalog.

² Determined according to IEC 60512-5-2:2002 (DIN EN 60512-5-2:2003-01) at increased temperature 45 K

ODU-MAC[®] BLACK-LINE CONFIGURATOR AND PRODUCT VIDEO

The ODU Mass Interconnect Solution – a modular interface for test systems

Use this configurator for your existing ODU-MAC[®] Black-Line products.
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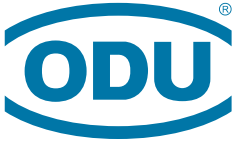


CABLE ASSEMBLY

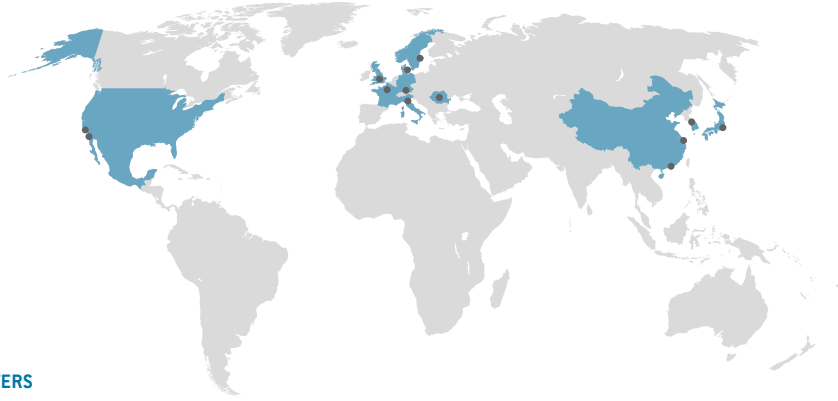
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- + State-of-the-art production facilities with 100 % end testing, high-voltage testing and component testing
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