



NICOMATIC



CREATIVE  
INTERCONNECT  
SOLUTIONS

# EN 4165

QUALIFIED

# OPTIMUS

EN 4165 BY NICOMATIC  
& CUSTOMIZED  
SOLUTIONS



MODULAR – COMPACT – ROBUST – SEALED  
FROM FULL STANDARD TO FULL CUSTOM

CONNECT  
FURTHER

## **OUR CORE VALUE**

FAMILIAR OR  
NEW TO THE  
PRODUCT  
LINE,  
DISCOVER  
NICOMATIC  
SOLUTIONS,  
BEYOND  
PERFOR-  
MANCE.

TOGETHER  
WE'LL FIND  
THE BEST  
SOLUTION

**WE ARE NICOMATIC**

Creative interconnect solutions provider

## **SUMMARY**

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# MODULAR BY NATURE

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NICOMATIC



CREATIVE  
INTERCONNECT  
SOLUTIONS



PROTECT <sup>WHAT</sup>  
MATTERS

# EN 4165

## MEET THE STANDARD

Recognized for over 30 years for its miniaturized rectangular connectors, it is a natural progression for Nicomatic to now expand its product range further with a new connector, still rectangular, but this time standardised to address increasingly harsh environments. Our modular solutions meet the EN4165 standard and are also developed in accordance with the ARINC 809 committee, which is a standard developed for the civil aviation market. Branded under the Optimus name, our connectors are EN 4165 qualified and certified (details available on our website).



INDUSTRY  
LEADING  
LEAD TIMES

THINK  
ABOUT

...

OUTSIDE  
THE BOX  
RACK  
& PANEL

A modular solution optimized for PCB and panel connection in weight and space constrained applications.

### **RECTANGULAR I/O**

*Based on EN4165 standard /  
Sealing / EMI protection*

### **FULLY INTERMATEABLE & INTERCHANGEABLE**

*With existing EN 4165 solutions*

### **PCB ADAPTED**

*Direct connection to mother board /  
Efficient PCB fixing*

### **SPACE SAVING**

*Slim fit & high density compared  
to circular connectors*

### **STACKABLE**

*Possibility to pile up connectors*

### **RACK & PANEL**

*Robust blind mating / Re-alignment*

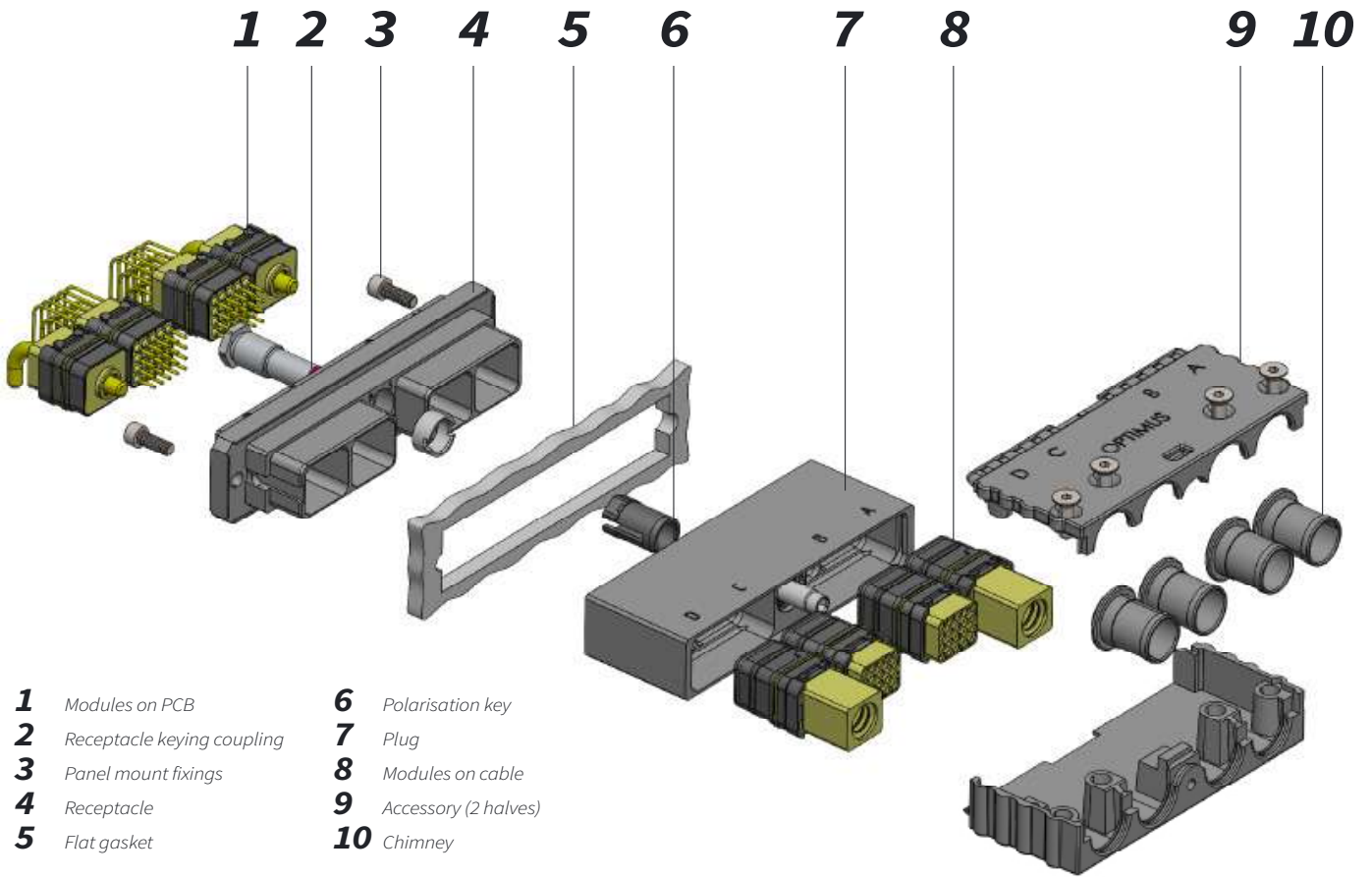
### **EASY MAINTENANCE**

*Removable contacts and modules*

### **AS / EN 9100**

*Aerospace quality standards*

# → ANATOMY OF A STANDARD EN 4165





# Main applications

EN 4165 STANDARD / *Harsh environment requirements*



## → CIVIL AEROSPACE



EN 4165 norm



Modularity



Easy maintenance



→ **MILITARY VEHICLES**



Robustness



Data reliability



Modularity



→ **DEFENCE AVIONICS**



High vibration



Space saving



Modularity



→ **ROBOTICS**



Shock resistance



Space saving

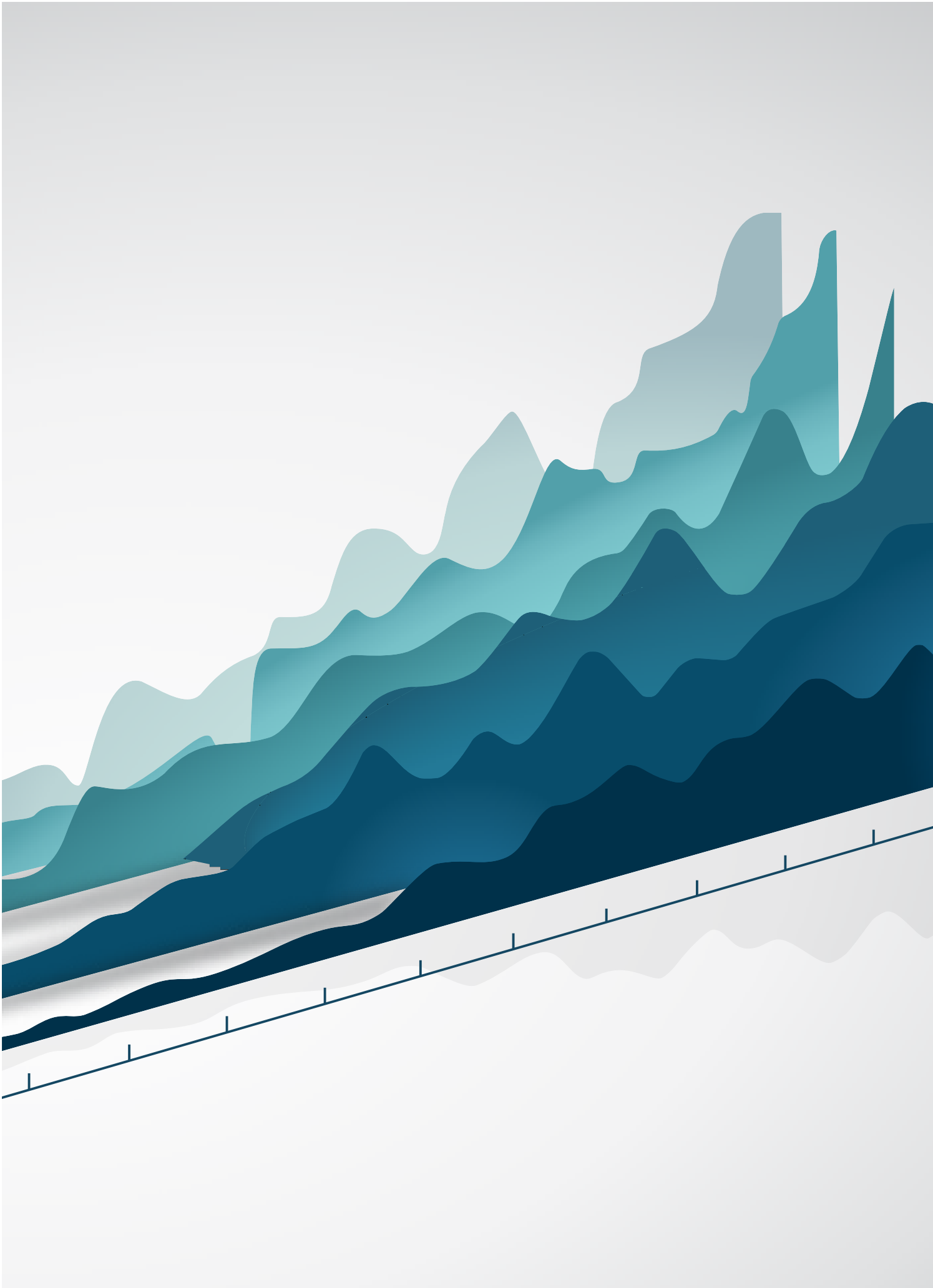


Modularity

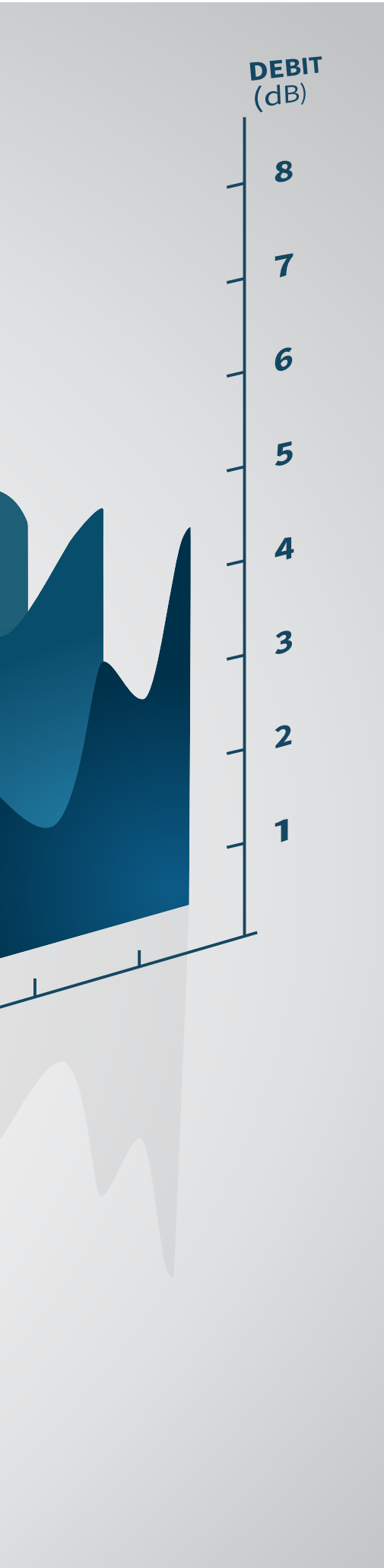
YOUR  
APPLICATION  
DOESN'T  
APPEAR?

WE HAVE  
THE  
SOLUTION

EN 4165\_OPTIMUS  
IS A HIGHLY VERSATILE  
CONNECTOR







# PRODUCT SPECS

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ACCORDING TO  
*EN 4165*  
PERFORMANCES

**ALL OUR  
ENGINEERS  
SUPPORT YOU**

*We bring you concrete tips.  
Saving time, more gains,  
less stress.*



Performance	Results				
<b>Electrical performance requirements</b>					
<b>Contact resistance low level</b> EN2591-201	For shunted modules 8 mΩ initial Rc < 12 mΩ after test				
<b>Contact resistance @ rated current</b> EN2591-202	For shunted modules, In = 5A : 8 mΩ initial Rc < 12 mΩ after test				
<b>Discontinuity of contacts in the microsecond range</b> EN2591-204 Method B	Standard contact: ≤ 1 μs				
<b>Electrical continuity of the shell</b> EN2591-205	<ul style="list-style-type: none"> <li>- Between mated connectors: Class F: 1 mΩ initial; 2 mΩ after test Class W: 2.5 mΩ initial; 5 mΩ after test</li> <li>- Between shell and grounding contacts: 10 mΩ initial; 20 mΩ after test</li> <li>- Between end of chimney and backshell: Class F: 2 mΩ initial; 4 mΩ after test Class W: 2.5 mΩ initial; 5 mΩ after test</li> <li>- Between backshell and plug (or receptacle): Class F: 1 mΩ initial; 2 mΩ after test Class W: 2.5 mΩ initial; 5 mΩ after test</li> </ul>				
<b>Insulation resistance</b> EN2591-206 Method A	<ul style="list-style-type: none"> <li>- @ Ambient temperature: 5 000 MΩ (unmated connectors);</li> <li>- @ Maximum operating temperature: 1 000 MΩ (unmated connectors);</li> <li>- After tests EN 2591-314, and during EN 2591-324: 1 000 MΩ (mated connectors);</li> <li>- After tests EN 2591-315: 1 000 MΩ (unmated connectors) except conductive fluids;</li> <li>- During tests EN 2591-301: 100 MΩ (mated connectors).</li> </ul>				
<b>Temperature rise due to rated current</b> EN2591-208	Applicable for shunted modules only: In = 5 A and Δθ°C ≤ 40 °C				
<b>Surface transfer impedance</b> EN2591-212 Initial and after tests ; connector mated with accessories	1 KHz	1 Mhz	10 Mhz	100 Mhz	
	5 mΩ	10 mΩ	20 mΩ	150 mΩ	
<b>Shielding effectiveness from 100 MHz to 1 GHz</b> EN2591-213 Initial and after tests ; connector mated with accessories	Frequency Mhz		Minimum attenuation (dB) Classes J, M, F and W		
	100		50		
	200		45		
	300		45		
	400		40		
	800		35		
1 000		30			
<b>Lightning strike, current and voltage pulse</b> EN2591-214 Not applicable for class C	Classes F and W: Current pulse F				
<b>Voltage proof</b> EN2591-207 Method A	Max. leakage current	Pressure	Connectors		
			Mated V r.m.s.	Unmated V r.m.s.	
	2 MA	Sea level	(size 22) 1 300 (other) 1 500	(size 22) 1 300 (other) 1 500	
		12,1 kPa (15 000 m)	1 000	600	
		4,7 kPa (21 000 m)	1 000	400	
1,1 kPa (30 000 m)	1 000	200			
<b>Mechanical performance requirements</b>					
<b>Engagement of contacts</b> EN2591-216	Applicable ≥ 1,27 mm (only for standard contact)				
<b>Transverse load (external bending moment)</b> EN2591-404	2 and 4 modules classes F, W Torque N.m Force rear plug: 50; Torque N.m rear accessory: 14				
<b>Mechanical endurance</b> EN2591-406 The rate shall not exceed five cycles/min.	Number of mating and unmating operations: 500				
<b>Durability of contact retention system and seals (Maintenance ageing)</b> EN2591-407	Applicable 50 cycles insertion/extraction for contacts in shunted modules				
<b>Mating and Unmating forces</b> EN2591-408 Screw plug: Method A	a) Mating and unmating of pairs of connectors				
	Housing size	Coupling torque N .m	Uncoupling torque N .m		Overtightening torque N.m
		± 0,1	min.	max.	± 0,1
	2 modules	1,1	0,7	1,7	3,00
	4 modules	1,3	0,7	2,2	3,00
b/ Self-locking system on the plugs only. The rotation torque of the coupling device in the uncoupling direction shall not be < 0,01 N.m during a 360° rotation. The ratio between the torque (uncoupling direction/coupling direction) shall not be less than 1,25.					

Performance		Results			
<b>Contact retention in insert</b> EN2591-409 Preload: 1 daN Displacement <0.3 mm during and afetr application load	Contact size 22: Axial load 44N Contact size 20: Axial load 67N Contact size16: Axial load 110N Contact size 12: Axial load 110N Contact size 8: Axial load 110N				
<b>Holding force of grounding spring system</b> EN2591-413 Not applicable on accessories and on push-pull latching mechanism	Gauge retention force, models W and F 2 modules: min 5 / max10 4 modules: min 10 / max 20				
<b>Stability of male contact in module</b> EN2591-419	Contact size 22: Permitted deflection mm: 0.76 _ Force daN: 1.2 Contact size 20: Permitted deflection mm: 1.37 _ Force daN: 2.4 Contact size 16: Permitted deflection mm: 1.91 _ Force daN: 4.9 Contact size 12: Permitted deflection mm: 1.91 _ Force daN: 4.9 Contact size 8: Permitted deflection mm: 2.54 _ Force daN: 9.7				
<b>Use of tools</b> EN2591-506	Force to be applied on tool: 13 N				
Environmental performance requirements					
<b>Endurance @ temperature</b> EN2591-301 Method B, test under load	Temperature: 175 °C Duration: 1 000 h				
<b>Climatic sequence</b> EN2591-302 EN2591-309 Dry Heat EN2591-310 Cold EN2591-311 Low air pressure EN2591-321 - Damp heat, cyclic test	Minimum temperature: (- 55 ± 2) °C Maximum temperature: (175 ± 2) °C				
<b>Cold / low pressure and damp heat</b> EN2591-303	Five cycles. Minimum temperature: (- 55 ± 2) °C				
<b>Rapid change of temperature</b> EN2591-305	TA: 175 °C +5 -0 TB: -55 °C +0 -5				
<b>Salt mist</b> EN2591-307	Classes W, J, M and C - 50 cycles of mating and unmating at a rate five cycles/min; - exposed to the salt mist: - mated for 452 h*, - then unmated for 48 h*; - subjected to 200 cycles of mating and unmating at the rate five cycles/min Model F * mated for 96h				
<b>Sand and Dust</b> EN2591-308	Wind velocity in the duct: (3,5 ± 0,5) m/s 1 cycle				
<b>Air leakage</b> EN2591-312 Method A	Differential pressure: 100 kPa Maximum leakage flow: 4 cm <sup>3</sup> /h/module				
<b>Immersion at low air pressure</b> EN2591-314	Module size	Contact P/N	Insulation resistance	Leakage current	
	#16	M39029/76 M39029/78	1 Ω min. at 250 V	2 mA max. at 750 V	
	#12	M39029/28 M39029/27	1 GΩ min. at 500 V	2 mA max. at 1 000 V	
	#8	EN3155-068 EN3155-069	1 GΩ min. at 500 V	2 mA max. at 1 000 V	
<b>Fluid resistance</b> EN2591-315	Table 39				
<b>Flammability</b> EN2591-317 Connectors mated. Method A	Test applicable				
<b>Interfacial sealing</b> EN2591-324	Pressure 1,1 kPa				
<b>Shock</b> EN2591-402 Method A	Severity 100 Number of shocks: one each way for each of the three directions (i.e. six shocks in total)				
<b>Sinusoidal and random vibration</b> EN2591-403 Method B	Figure 3 and Table 2, level G Duration: 8 h/axe on the three axis				
<b>Magnetic permeability</b> EN2591-513	< 2				
<b>Mould growth</b> Method A	Duration: 28d, Growth: 0; No prior washing; No surface etching				

Best-in class  
sealing

As per EN2591

MODULE

Secured manufacturing

# A READY-TO-PLUG SEALED COMPONENT

## Reliable connection

The module is at the heart of Optimus solutions: in a single component, it concentrates several high level functions for optimal performance in harsh environments.

Injected in one single operation, which increases reliability and the repeatability of the process, the silicone performs 3 main functions: the interfacial seal ensures a seal between mated modules and reduces arcing; the peripheral seal enables sealing between the module and its shell cavity; the rear grommet will compress around the wires and avoid any liquid ingress from the

harnesses. But that's not all: the module features moulded thermoplastic clips for high class contact retention, and an optimized module retention clip that makes the module able to fit in any adapted cavity: whether it is inside a standard Optimus, shell or directly in your equipment structure!

## → SOME OF OUR AVAILABLE MODULES

**01-08** : 1 contact size 8

**04-12** : 4 contacts size 12

**08-16** : 8 contacts size 16

**12-20** : 12 contacts size 20

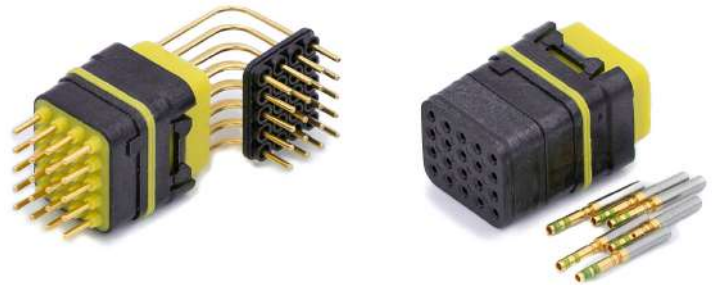
**20-22** : 20 contacts size 22

**30-23** : 30 contacts size 23

**99-01** : 5 contacts size 22 + 6 contact size 16

**99-10** : 8 contacts size 20 + 2 contact size 16

**01Q28** : Quadrax



## → CODIFICATION RULES

### MODULES ON CABLE

AS39029/57 AND /58 AND EN3155 CONTACT COMPLIANT

	Series	Nbr-Size	Sealing	Polarization	Contact
	A	x-x	1: without 2: with	N, A, B, C, D	A: w/o male contact B: w/o female contact M: with male contact F: with female contact
OPT	A	20-22	2	N	F
EN 4165	A	20-22	2	N	F

### MODULES ON PCB

	Series	Nbr-Size	Sealing	Polarization	Gender	Type	PCB thickness	Plating
	A	x-x	1: without 2: with	N, A, B, C, D	P: pin S: socket	Y: straight V: bended 90°	3: 3.2 mm	G: gold T: tin RoHS
OPT	A	20-22	2	N	P	V		

# Shells / ALUMINIUM & COMPOSITE

2 and 4 cavities

## ADAPTED SURFACE TREATMENT

Black Nickel: 96 hours Salt Spray .  
Olive Green Cadmium: 500 hours salt Spray.

## ALUMINIUM SHELL

Optimus receptacles and plugs are machined in aluminium 6061, the recommended alloy for aeronautical application.

## COMPOSITE SHELL

Looking for light weight solutions: check out our composite shells.

### → CODIFICATION RULES

	Surface Treatment	Type	Series	Nbr cavities	Polarization nut	Polarization nut position	Optional design for nut device	Panel gasket
RECEPTACLE	<b>F:</b> alu+black nickel <b>W:</b> alu+cadmium <b>N:</b> alu+nickel <b>M:</b> composite nickel <b>J:</b> composite cadmium	<b>0:</b> stackable <b>7:</b> flange <b>0S:</b> short stackable <b>7S:</b> short flange	<b>A</b>	<b>2:</b> 2 cavities <b>4:</b> 4 cavities	<b>A:</b> standard black <b>0:</b> without <b>1 to 6:</b> w, colour code	<b>0:</b> not mounted <b>1 to 6:</b> mounted	<b>None:</b> std design <b>A:</b> w. hex. groove for nut <b>B:</b> w. captive nut	<b>U:</b> w/o <b>M:</b> w. conductive elastomer <b>S:</b> Non conductive elastomer
EN 4165	F	0	A	2	1	1		
OPT	F	0	A	2	1	1	A	U

	Surface Treatment	Type	Series	Nbr cavities	Reverse fixing	Polarization nut	Polarization nut position
PLUG	<b>F:</b> alu+black nickel <b>W:</b> alu+cadmium <b>N:</b> alu+nickel <b>M:</b> composite nickel <b>J:</b> composite cadmium	<b>6:</b> standard <b>9:</b> rack / rack reversed	<b>A</b>	<b>2:</b> 2 cavities <b>4:</b> 4 cavities	<b>Omit:</b> Standard <b>R:</b> only for rack reversed configuration	<b>A:</b> standard black <b>0:</b> without <b>1 to 6:</b> w, colour code	<b>0:</b> not mounted <b>1 to 6:</b> mounted
EN 4165	F	6	A	2		A	0
OPT	F	6	A	2		A	0



Nicomatic also offers a large range of accessories, including backshells, covers, cable clamps and others: consult us to get the best combination for your need.





# LINKING TECHNOLOGY AND PEOPLE



Meeting the highest quality standards is a lifelong commitment for our company. Certified to EN 9100 and ISO 9001 since 2009, both our organisation and our quality system are continuously improved, driven by a network of men and women committed to always delivering the best service to our customers.

At the heart of this system is a dedication to innovation and performance optimisation. With the adoption of EN 4165, Nicomatic has mastered the challenge of combining state-of-the-art industrialisation within an agile and learning ecosystem. The know-how and commitment of our employees have enabled us to meet this challenge with ease. Our standard Optimus solutions are qualified and certified\* according to the EN 4165 standard.

*\*Further details can be found at [nicomatic.com](http://nicomatic.com)*

CONNECTION  
EMOTION  
HUMAN TO HUMAN

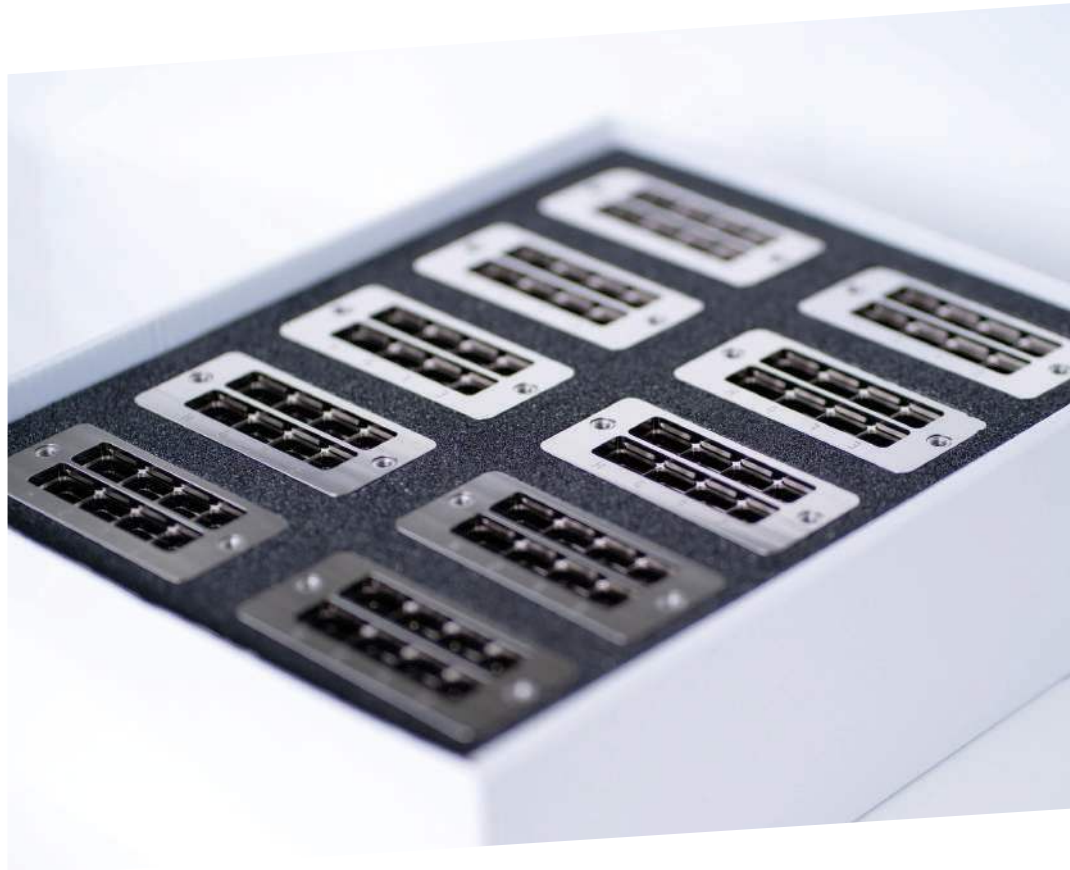


Overmolding capabilities, Nicomatic production site

QUALITY  
REPEATABILITY  
PRODUCTIVITY

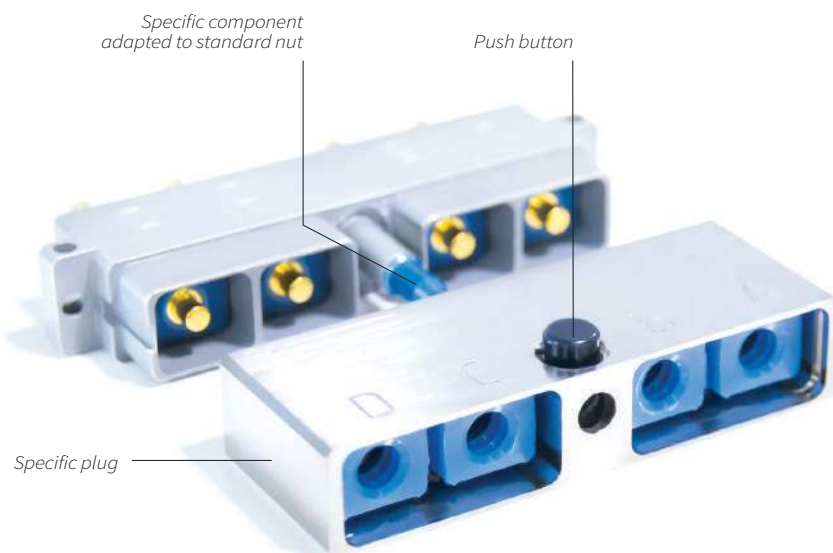
# OPTIMUS | EXPLORING THE SPECIFIC

Particularly agile, autonomous in all techniques, Nicomatic continues to support you with many standard components that deliver a customised solution: Optimus, the superlative form of the Latin word bonus, the origin of the word “bon” meaning good in French, therefore honours its French origin and will delight those who remember “Transformers”: its uniqueness lies here, since the number of possible combinations is infinite.



Standard cavities but custom shells...

→ ....*INNOVATIVE TOUCH*



Nicomatic innovates and brings its special touch in I/O rectangular connectors:

- Mate/Unmate without using any tool
- Nicomatic kit : Plug + Nut Component, adapted to any standard EN 4165 receptacle
- Easier to operate in a handy and timely manner
- Saves assembly and maintenance time

Example of application: when connection/ disconnection cycles are high or when using the connector for test phases.

# CREATIVE INTERCONNECT SOLUTIONS

*With over 40 years of experience, Nicomatic combines a proven track record and continuous innovation.*

*We provide solutions for defense, security, energy, space, civil avionics, and many other applications, respecting our core values based on service, quality and close relationship with our customers.*

## HUMAN FACTOR

*is the key to success.*

*We promote initiative and responsibility,  
We encourage creativity & reactivity,  
To better meet your needs and anticipate your requirements.*

**Ready to join our team ?**

[recruitment@nicomatic.com](mailto:recruitment@nicomatic.com)

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Gifas - Eden  
Aerospace cluster

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