

## PRODUCT DATASHEET

# CM2000

## HIGH INTEGRITY, WET-MATE, ELECTRICAL CONNECTORS



### DESCRIPTION

The **CM2000** underwater mateable electrical connector is modular in design and particularly well suited for adaptation to special designs, however it is also available in industry standard configurations. The unique design features combine superior electrical isolation and ensure the highest connector reliability.

### KEY FEATURES

- Over 2,822 units sold worldwide
- Field proven track record with over 120 million accumulated operating hours
- Mean Time Between Failure (MTBF) of better than 26 million hours
- Modular electrical contacts
- Oil filled, pressure balanced socket contacts
- Redundant sealing barriers for each contact
- No single point failures
- Extensive qualification testing data available
- Successful completion of long-term testing (3 years) by an independent body
- Excellent track record of operation in the field
- Simple and robust with few moving parts
- Voltage ratings up to 3.3kVAC phase-to-earth
- Current ratings up to 100 amps
- Rated for deepwater applications
- PBOF hose or molded interface terminations
- Wide operational temperature rating
- Elastomers have over 20 years of use underwater
- Stab, diver or ROV configurations
- Many different body materials available
- Industry standard mounting for bulkhead connectors
- Patented design and features

### QUALITY

- **SEACON** Advanced Products, LLC operate a Quality Management System certified to ISO 9001:2008.



Certificate No. 6936

**SEACON Advanced Products, LLC.**

1321 Nelius Road, PO Box 767, Bellville, Texas 77418, USA

TEL: +1 (979) 865 8846 FAX: +1 (979) 865 8859

E-Mail: [sales@seacon-ap.com](mailto:sales@seacon-ap.com) Website: [www.seacon-ap.com](http://www.seacon-ap.com)

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### CONFIGURATIONS

- Stab, diver and ROV configurations
- Ø2mm, Ø3mm, Ø6mm and Ø8mm electrical contact sizes available
- Standard 4, 7 and 12 contact configurations available in Ø2mm sizes
- Modular contacts
- Other configurations from 1 to 19 contacts
- Oil filled, pressure balanced socket contacts
- Redundant sealing barriers for each contact
- Available in both plug and receptacle configurations:
  - Flying lead
  - Bulkhead mounted, flange mounted
  - Straight terminations, 90° terminations
  - Omnitec MKII pressure balanced oil-filled hose interface
  - Molded terminations
  - Parking places
  - Long-term & short-term protective caps

### DESIGN RATINGS

- Design life: 25 years
- Depth Rating: Ø2mm, Ø3mm and Ø6mm contacts 100% tested to 517bar (7,500psi), which equates to 5,200m (17,000 feet). Allowing a 50% test-margin, rates these to 345 bar (5,000psi), which equates to 3,500m (11,500 feet) at full differential pressure
- Ø2mm contact also available in an ultra-deepwater configuration, rated to 690 bar (10,000psi) equates to 7,000m (23,000 ft)
- Socket contacts never see the outside environment, are always contained in dual and nested oil-filled bladders
- Voltage rating: Up to 3.3kVAC phase-to-earth
- Current Rating: Up to 100 amps
- Ø2mm contacts, 1kVAC, 10 amps
- Ø3mm contacts, 3.3kVAC, 30 amps
- Ø6mm contacts, 3.3kVAC, 60 amps
- Ø8mm contacts, 1kVAC, 100 amps
- Life-Cycle: Minimum 100 mate/de-mates
- Maintenance-free over design life (within number of mate/de-mate cycles)
- Operating Temperature: 0°C to +65°C (32°F to +149°F)
- Storage Temperature: -20°C to +65°C (-4°F to +149°F)

### OPERATION

- Typical mate force: 3 to 6 lbs (1.36 to 2.72kg) per contact plus latch force (which is dependant on specific configuration).
- De-mate force: 25% of mating force per contact plus de-latch force (which is dependent on specific configuration)
- Typical misalignment tolerances (dependent on model and configuration):
  - Maximum rotational misalignment: 0.5°
  - Maximum angular misalignment: 0.5°
  - Maximum radial misalignment: 0.8mm (0.032 inches)
  - Maximum axial separation: 2.5mm (0.1 inches)

### MATERIALS

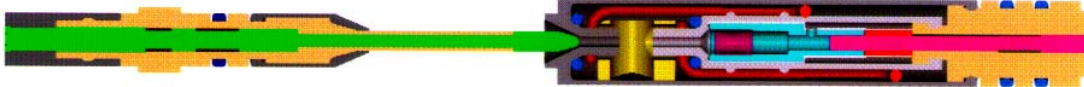
- Housing of choice: Titanium, 17-4 PH, Nitronic 50, Inconel, Ferralium, 316SS, Al Ni Bronze, Beryllium copper and PEEK
- Insulator: PEEK
- Compensation bladders: Natural rubber (Alternative elastomers available for special fluid compatibility requirements)
- O-rings: Nitrile

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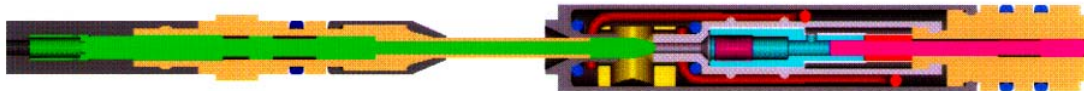
### PRINCIPLE OF OPERATION

The critical electrical contact is made without exposure to external contamination in a harsh subsea environment. This is achieved as described by the following mating sequence:

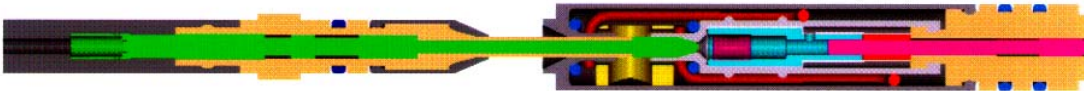
Step 1: The contact pin enters the outer bladder entry of the receptacle contact.



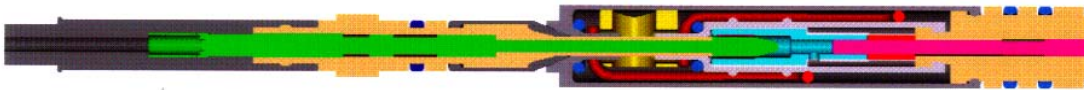
Step 2: The contact pin is wiped and bathed in dielectric fluid as the entry throat maintains a force around the pin ensuring a secure seal.



Step 3: The contact pin continues and enters a second inner bladder entry and is wiped and bathed in dielectric fluid again.



Step 4: The pin engages with the mating socket within the dielectric filled inner bladder enclosure.



Mated Contact: During and after the mating activity, two seals are created and maintained around the pin contact within the oil-filled and pressure-compensated bladders

### CONFIGURATIONS AVAILABLE

#### CM2000 DESIGNATION

CM200X / Ymm

X = Number of Contact

Y = Contact Size

<u>Ø2mm</u> 1kVAC, 10A		<u>Ø3mm</u> 3.3kVAC, 30A		<u>Ø6mm</u> 3.3kVAC, 60A		<u>Ø8mm</u> 1kVAC, 100A	
CM2001	CM2008	CM2004		CM2001		CM2003	
CM2002	CM2012	CM2007		CM2004			
CM2004	CM2016	CM2008		CM2012			
CM2006	CM2019	CM2012					
CM2007							

## PRODUCT DATASHEET

### QUALIFICATION TESTING

Full details of this testing are highlighted in SEA CON® document SC-ENG-1102.

**(1) Original Performance & Qualification Testing - Performed by independent third party**

Insulation resistance, thermal shock, misalignment (radial, angular, rotational and axial-separation), cold temperature (36°F-40°F (2°C-4°C)), silted seawater at ambient and pressure (2700psi (186bar)), clear seawater at ambient and pressure (2700psi (186bar)), drop tests, power on mate/de-mate at 600 volts.

**(2) Long-term testing - Performed by independent third party in Norway**

3 years duration, pressure cycling (0 to 3,625 psi (250 bar)), temperature cycling (ambient to 86°F (30°C)), plus flooded jumper assembly (failure mode simulation) test.

**(3) Deepwater Testing - Performed by SEA CON®**

Mated connector to 10,000 psi (690 bar), open face to 10,000 psi (690 bar)

**(4) Lifecycle Testing - Performed by SEA CON®**

200 cycles extended rating, 1,000 cycles at reduced temperature, 1,000 cycles un-lubricated

**(5) High Current Testing - Performed by SEA CON®**

Temperature rise tests on 3mm contacts and 6mm contacts

**(6) High Voltage Testing**

- 2mm: Tested to 1kVAC phase-to-earth
- 3mm: Tested to 17.5kVAC and 16kVDC phase-to-earth
- 6mm: Tested to 12kVAC and 9kVDC phase-to-earth

**(7) Summary of other testing completed - Performed for US Military**

MIL-S-901C&D Grade "A" Explosive Shock (UNDEX: Underwater Explosive Shock Testing), MIL-STD-464 Hazards of Electromagnetic Radiation to Ordnance (HERO), MIL-STD-167 vibration testing, MIL-STD-461 radiated emissions / susceptibility (EMI), MIL-STD-1344 cable seal flexing (method 2017), thermal shock, wet-mating, hydrostatic pressure testing, accelerated life testing simulating 4 years of operational use.

### TRACK RECORD

**(1)** Over 2,822 CM2000 connectors are being used on a variety of underwater applications including: subsea control systems; seabed seismic systems; sonar systems; umbilicals; deepwater drilling systems; work-over systems; ROV's; scientific research programs; general oceanographic use; submarines and other classified military programs.

**(2)** Deepest recorded actual operating depth to 15,420 feet (4,700m).

**(3)** CM2000's have been used in Africa, Brazil, Canada, Gulf of Mexico, Italy, Japan, Norway, UK and USA.

**(4)** The CM2000's currently in service have now reached accumulated operating hours in excess of 120 million hours with a Mean Time Between Failure of better than 29 million hours.

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SEA CON Advanced Products, LLC.

1321 Nelius Road, PO Box 767, Bellville, Texas 77418, USA

TEL: +1 (979) 865 8846 FAX: +1 (979) 865 8859

E-Mail: sales@seacon-ap.com Website: www.seacon-ap.com

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