DigiTRON EFL’s, Jumpers and Harness Assemblies - Installation, Operations and Maintenance Manual

Protection, Storage, Shipment, Unpacking, Deployment & Maintenance Instructions
Thank you for purchasing a Siemens Energy Subsea product. The information contained in this document is an overview including the protection, storage, shipment, unpacking, deployment and maintenance for DigiTRON connector product range.

IMPORTANT
READ CAREFULLY BEFORE USE
KEEP FOR FUTURE REFERENCE

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<table>
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<th>Date</th>
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<td>R Wyatt</td>
<td>09/11/2020</td>
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<td>24/09/2020</td>
<td>Eric Chaize</td>
<td>24/09/2020</td>
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<td>M.Bell</td>
<td>07.03.16</td>
<td>N.Atkinson</td>
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<td>Section 11 Split floating flange assembly added, references to Aquatron amended to Siemens Energy Pressure Balanced Oil Filled Hose</td>
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<td>28.05.15</td>
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<td>3</td>
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<td>31.11.13</td>
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<td>Section 7 updated, Section 16 added, general updates. Full reformat and new cover</td>
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<td>P.Westwell</td>
<td>31.11.13</td>
<td>B.Leach</td>
<td>31.11.13</td>
<td>Re-format, various text amendments, pictures of packaging added, pg 11 images changed</td>
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<td>1</td>
<td>P.Westwell</td>
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Unrestricted
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1 PRODUCTS COVERED BY THIS MANUAL

This manual includes information on DigiTRON product range of electrical flying leads (EFL), jumper and sensor harnesses, including connectors that are part thereof, their electrical and mechanical specification.

Also this manual provides details of installing the DigiTRON product range of connectors that are fitted as part of an oil filled hose or cable assembly. These may involve the installation of a flange mounted fixed connector or sensor.

The DigiTRON product range includes the following products:

- DigiTRON+
- DigiTRONe
- DigiTRON3

Installation, Operation and Maintenance manuals for other DigiTRON products not covered by this document can be found on Siemens Energy Subsea website [www.siemens-energy.com](http://www.siemens-energy.com) /search Subsea, as listed in Table 1.

Instructions for sensors are not covered by this manual. The sensor manufacturer should be contacted for their relevant installation, operation and maintenance manual. For Siemens sensor products use the manuals listed in Table 1.

If a non-Siemens connector is fitted as part of the EFL or harness then the manufacturer of that product should be contacted for the IOM manual.

<table>
<thead>
<tr>
<th>DOC. No.</th>
<th>PRODUCT</th>
</tr>
</thead>
<tbody>
<tr>
<td>IOM-002</td>
<td>DigiTRON electrical single connectors</td>
</tr>
<tr>
<td>IOM-003</td>
<td>Obsoleted, replaced by IOM-002.</td>
</tr>
<tr>
<td>IOM-004</td>
<td>Not used</td>
</tr>
<tr>
<td>IOM-005</td>
<td>Retrievable Electrical Distribution unit (REDU), 2nd generation</td>
</tr>
<tr>
<td>IOM-006</td>
<td>Retrievable Electrical Distribution unit (REDU), 1st generation</td>
</tr>
<tr>
<td>IOM-007</td>
<td>Disconnectable junction boxes type TC3A-107 and similar Electrical Distribution Units (EDUs).</td>
</tr>
<tr>
<td>IOM-008</td>
<td>DigiTRONf fiber optic flying leads and harness assemblies</td>
</tr>
<tr>
<td>IOM-009</td>
<td>DigiTRONf fiber optic single connectors</td>
</tr>
<tr>
<td>00003075</td>
<td>Subsea PT/TT sensors</td>
</tr>
<tr>
<td>00007464</td>
<td>Differential Pressure sensors SDP-6 / SDP-8</td>
</tr>
</tbody>
</table>

Table 1 List of other Installation, Operation and Maintenance manuals related to DigiTRON product range
2 BASIC INFORMATION & QUICK REFERENCE

2.1 Product overview

DigiTRON connectors, electric flying leads (EFLs), jumpers and harness assemblies intended use is to provide low voltage and communications links between pieces of electrical equipment that are submerged in water, e.g. subsea.

The DigiTRON range of connectors have been developed for long term reliable communications and low voltage power control system applications associated with offshore installations. The underwater mateable capacity of these connectors is achieved using pressure compensated electrical inserts employing the CE principle.

An EFL is completely independent of other equipment and is fitted with ROV or Diver installable connectors at each end. All EFL’s are oil filled pressure compensated hose or suitable subsea cable assemblies and are supplied as complete finished product from the factory. All EFL’s should be retrievable and when installed should not cross-over each other.

Some illustrations are shown in section 2.7 to help identify an EFL and jumper (harness).

Table 2 below identifies each product type in the DigiTRON product range.

<table>
<thead>
<tr>
<th>Product range</th>
<th>Description</th>
<th>Visual identifier</th>
<th>Typical part number (etched on the connector)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DigiTRON+</td>
<td>4, 7, and 12 pins Voltage rating 1kV pin-ground 2kV pin-pin</td>
<td>White-coloured cone* or disc on ROV connectors. No visual identifier on Stab or Diver type connectors</td>
<td>BROV-......... BRSP-....... BSTA-....... BSSP-....... BDIV-....... BDS-.......</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DigiTRONE</td>
<td>12 pins only. As DigiTRON+, but with 4 or 8 of the pins wired with ethernet cable**.</td>
<td>White-coloured cone* or disc on ROV connectors. No visual identifier on Stab or Diver type connectors</td>
<td>EROV-......... ERS-....... ESTA-....... ESSP-....... EDIV-....... EDSP-.......</td>
</tr>
<tr>
<td>DigiTRON3</td>
<td>4 pin only. Voltage rating 1.8kV pin-ground / 3.6kV pin-pin</td>
<td>Blue-coloured cone* or disc on ROV connectors. Blue-coloured sleeve on Stab and Diver type connectors</td>
<td>D3RV-....... D3ST-....... D3DV-.......</td>
</tr>
</tbody>
</table>

* Occasionally different coloured cones may be fitted, as specified by the customer, e.g. red, green, yellow. In this case also check the part number to identify the product range

** Wiring diagram on the drawing will show how the product is wired. Contact Siemens Technical Support for this information connectortechsupport.gb@siemens-energy.com .

Table 2 DigiTRON product range identification
2.2 Product specification and certification

Basic specifications relating to all products covered by this manual are below in Table 3. Additional specifications can be found in section 5.

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design Life:</td>
<td>30 years in subsea environment</td>
</tr>
<tr>
<td>Rated voltage:</td>
<td>DigiTRON+ 1,000Vac pin-ground, 2,000Vac pin-pin</td>
</tr>
<tr>
<td></td>
<td>DigiTRONe Ethernet lines 50Vdc, other lines as DigiTRON+</td>
</tr>
<tr>
<td></td>
<td>DigiTRON3 1,800Vac pin-ground, 2,000Vac pin-pin</td>
</tr>
<tr>
<td>Rated current:</td>
<td>In water: 4-way 35-40A 7-way 22-32A 12-way 20-28A</td>
</tr>
<tr>
<td></td>
<td>In air: 4-way 18A 7-way 14A 12-way 11A</td>
</tr>
<tr>
<td>(Excludes ethernet lines)</td>
<td></td>
</tr>
<tr>
<td>Over-current</td>
<td>100A for 5 seconds, no more than 2 per hour</td>
</tr>
<tr>
<td>Rated number of operations</td>
<td>1000 (750dry/250wet) mate / de-mate cycles (Power off)</td>
</tr>
<tr>
<td>Water depth</td>
<td>4,000 m (13,123ft)</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>-40°C +70°C (-40°F +158°F) (upper limit is surface temperature of the product and includes solar gain from bright sunlight)</td>
</tr>
<tr>
<td>Operational temp</td>
<td>Subsea: -5°C +60°C (+23°F +140°F)</td>
</tr>
<tr>
<td></td>
<td>In air: -20°C +50°C (-4°F +122°F)</td>
</tr>
<tr>
<td>Product Certification:</td>
<td></td>
</tr>
<tr>
<td>Standard</td>
<td>Description</td>
</tr>
<tr>
<td>EU Directive 2001/95/EC</td>
<td>General Product Safety</td>
</tr>
<tr>
<td>IEC 61984</td>
<td>Connectors - Safety requirements and tests</td>
</tr>
<tr>
<td>API-17F</td>
<td>Standard for Subsea Production Control Systems</td>
</tr>
</tbody>
</table>

Note: Self-certified via in-house testing.

Table 3 DigiTRON product specification and certification
2.3 Contact details and feedback

For additional information or questions regards the products visit the Siemens Energy Subsea website https://www.siemens-energy.com/search Subsea, or contact the following

<table>
<thead>
<tr>
<th>Department</th>
<th>E-mail address</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product Safety Officer</td>
<td><a href="mailto:subsea.connectors.productsafety.gb@siemens-energy.com">subsea.connectors.productsafety.gb@siemens-energy.com</a></td>
</tr>
<tr>
<td>Technical Support</td>
<td><a href="mailto:connectortechnicalsupport.gb@siemens-energy.com">connectortechnicalsupport.gb@siemens-energy.com</a></td>
</tr>
<tr>
<td>Service (Site Team)</td>
<td><a href="mailto:susultlcmsupport.gb@siemens-energy.com">susultlcmsupport.gb@siemens-energy.com</a></td>
</tr>
<tr>
<td>Sales</td>
<td><a href="mailto:connectorsales.gb@siemens-energy.com">connectorsales.gb@siemens-energy.com</a></td>
</tr>
</tbody>
</table>

Table 4  DigiTRON product contact details

Any information, records, or Health and Safety feedback that needs to be detailed can be recorded in section 10 of this document and sent to the relevant department in Table 4

2.4 Product advice label

The following product advice label is supplied with all Siemens Energy Subsea products.

![Product advice label](image)

This item should be inspected against the Delivery Note and any discrepancies reported to Siemens Subsea Global Delivery Account Manager within FIVE (5) days of receipt.

Figure 1  Product advice label
2.5 Product marking

Siemens Energy Subsea DigiTRON products are marked with the Siemens Energy part number and unique serial number. Also, the voltage, temperature and water depth ratings are indicated. Marking locations are typically on the metal bodies of the connectors. Refer to Figure 2.

![Product marking on DigiTRON product](image)

Figure 2 Product marking on DigiTRON product

Harnesses are also marked with the Siemens Energy Subsea unique serial number. Labels are typically black text on a yellow background underneath a clear protective wrap and are typically located at each end of the harness and centrally. Often client's own information is added to these labels.

2.6 CE label/marking

The CE label/marking where applicable shows that the products comply with the requirements of the applicable directives as follows:

- 2014/35/EU – Low Voltage Directive

Declaration of Conformity will be supplied with the goods.
2.7 Product examples

Figure 3   Typical EFL (Electric Flying Lead)
Transport Cap or Protective Cap
(protective cap shown)

DigiTRON Stab-Plate ROV
Receptacle Connector

Siemens Energy Pressure
Balanced Oil Filled Hose oil filled
hose

DigiTRON Compliant Mounted
ROV Receptacle Connector

Transport Cap or Protective Cap
(protective cap shown)

Figure 4 Typical jumper (harness) assembly
Figure 5  Examples of DigiTRON oil hose connectors

Figure 6  Example of EFL (left) and Sensor harness
3 PRODUCCT SAFETY

Siemens Energy Subsea recommends the termination of all equipment shall only be undertaken by trained, suitably qualified and experienced personnel (SQEP) i.e. competent person.

Following installation, commissioning or deployment of product, if you have any feedback please complete and return the Customer Comments/Feedback form (Section 10). Please e-mail completed form to the Product Safety Officer at subsea.connectors.productsafety.gb@siemens-energy.com

3.1 Action-related warnings

Classification of action-related warnings

The action related warnings are classified in accordance with the severity of the possible danger using the following warning signs and signal words:

Warning symbols and signal words

<table>
<thead>
<tr>
<th>!</th>
<th>Danger!</th>
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<tbody>
<tr>
<td>Imminent danger to life or risk of severe personal injury</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>!</th>
<th>Danger!</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk of death from electric shock</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>!</th>
<th>Warning.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk of minor personal injury</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>!</th>
<th>Caution.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk of material or environmental damage</td>
<td></td>
</tr>
</tbody>
</table>

3.2 Intended use

The product is intended as a Low Voltage electrical connection system for subsea use

There is a risk of injury or death to the user or others, or of damage to the product and other property in the event of improper use or use for which it is not intended.

Intended use includes the following:

- observance of the installation and operating instructions included for the product and any other system components.
- compliance with all inspection and maintenance conditions listed in the instructions.
- use of all recommended tooling appropriate for specific tasks.
- all activities to be undertaken by a competent person (see 3.3.1 for definition).

Any other use that is not specified in this document or covered in installation and operating instructions, or beyond that specified in this document shall be considered improper use.

<table>
<thead>
<tr>
<th>!</th>
<th>Danger!</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk of imminent danger to life or risk of severe personal injury.</td>
<td></td>
</tr>
</tbody>
</table>

Sudden release of stored pressure.

DigiTRON products are not intended for use as a penetration for fixed top-side or land-based pressure vessels. They are not designed to comply with the requirements of the Pressure Equipment Directive (2014/68/EU). They are intended for integration into subsea equipment only.

All pressure testing of DigiTRON product must be undertaken by a competent person.
3.3 General safety information

3.3.1 Installation by competent persons only

The installation, inspection, maintenance and repair of the product shall be undertaken by trained, suitably qualified and experienced personnel (SQEP) i.e. competent person, to carry out a specified activity. Installation, inspection, maintenance and repair of products by untrained and deemed non-competent persons could invalidate the product warranty.

For further information contact Siemens Energy Lifecycle Management (Site Team)

susultlcmsupport.qb@siemens-energy.com

3.3.2 Personal protective equipment (PPE)

Personal Protective Equipment (PPE) is legally defined as ‘all equipment (including clothing affording protection against the weather) which is intended to be worn or held by a person at work and which protects the user against one or more risks to their health or safety’.

In the hierarchy of risk control, PPE is considered to rank lowest and represent the option of last resort. PPE is only appropriate where the hazard in question cannot be totally removed or controlled in such a way that harm is unlikely (for example by isolating the hazard or reducing the risk at source to an acceptable level).

All company personnel and operators should wear appropriate Personal Protective Equipment (PPE) defined as a result of relevant risk assessments in accordance with the Personal Protective Equipment (PPE) Regulations.

Wear appropriate PPE according to the product safety advice given in this document

3.3.3 Danger caused by improper operation and foreseeable misuse

Improper operation and foreseeable misuse may present a danger to you and others and cause material damage. Carefully read the enclosed instructions and all other applicable documents, particularly the “Safety” section and the warnings.

<table>
<thead>
<tr>
<th>Danger! Risk of death from electric shock if shuttle pins (on the plug connector) are depressed e.g. with a screwdriver when plug is live (foreseeable misuse).</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Testing activities must only be carried out by a competent person.</td>
</tr>
<tr>
<td>- Correct test connector shall always be fitted for electrical testing.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Danger! Risk of imminent danger to life, risk of severe personal injury caused by a shuttle pin projectile due to damage caused to shuttle pins e.g. with a screwdriver (foreseeable misuse).</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Maintenance and testing activities must only be carried out by a competent person.</td>
</tr>
<tr>
<td>- Correct tools must always be used.</td>
</tr>
</tbody>
</table>
### 3.3.4 Risk of death due to electrocution

<table>
<thead>
<tr>
<th>Risk Description</th>
<th>Preventive Measures</th>
</tr>
</thead>
</table>
| Danger! Risk of death from electric shock due to exposed live pins, e.g. factory or top-side system test and unmated receptacle is energised. | - Never energise a receptacle connector when not mated to a plug.  
- Ensure all test procedures are followed.  
- Communication channels and protocols are observed. |
| Danger! Risk of death from electric shock due to unscreened cables.             | - Do not touch electrical wires while energised. Ensure all test procedures are followed. |
| Danger! Risk of death from electric shock due to any exposed conductors due to stored electrical energy, e.g. capacitance of cable or elsewhere in the system. | - Ground all electrical conductors after testing and do not touch conductors until electrical system is fully discharged. Ensure all procedures are followed. |
| Danger! Risk of death from electric shock, if product is terminated incorrectly e.g. loose conductor touching metal body or terminated to metal body in error. | - Installation/termination activities must be carried out by a competent person.  
- Always electrically ground metal bodies prior to electrically energising a connector.  
- Never hand-hold the product when live. |
| Danger! Risk of death from electric shock or severe personal injury through burning from de-mating live conductors by hand. | - Do not demate the product while live  
- Do not hand-hold the product while live  
- Ensure all procedures are followed for mating/de-mating connectors. |

### 3.3.5 Risk of injury and material damage due to testing, maintenance and repairs carried out incorrectly or not at all

The oil-filled hoses and connectors are non-serviceable by the user. In case of suspected faults with the product (refer to section 8.2), do not use the product and contact Siemens Energy Technical Support or Siemens Energy Product Safety for advice. Never attempt to carry out maintenance work or repairs on the product yourself.

<table>
<thead>
<tr>
<th>Risk Description</th>
<th>Preventive Measures</th>
</tr>
</thead>
</table>
| Danger! Risk of death from electric shock if user dismantles / incorrectly re-assembles / incorrectly terminates product (foreseeable misuse). | - There are no parts of the product that require maintenance or inspection. The product should not be disassembled.  
- Termination of electrical wires to the product must only be carried out by a competent person. |
| Danger! Risk of death from electric shock from improper use of test connector (foreseeable misuse). | - Never disassemble a test connector  
- Removal of the rubber termination sleeves placed over the joint between the cable and the test connector is prohibited, as this will expose live parts to the user. |
| Danger! Risk of imminent danger to life, risk of severe personal injury caused by released pressure and or projectile due to incorrectly installed pressure retaining product. | - (e.g.bulk- |
head connector or penetrator) during system pressure test, or the rated differential pressure of the product is exceeded
- Ensure all product assembly and testing activities are completed by competent persons.
- Do not exceed the maximum differential pressure rating of the product installed.
- Individual products have different differential pressure ratings, refer to the specific product datasheet or contact Siemens Energy Technical Support

**Warning!** Risk of minor personal injury from high temperature of the product due to ohmic heating in short-circuit condition or high over-currents.
- In the event of a high over-current, allow the connectors to cool before touching.
- Ensure all testing of products both factory and deployed in-field have been completed by competent persons.

**Danger!** Risk of severe personal eye injury due to pressurised oil squirting out of damaged hose or removal of fill/vent screw.
- Ensure all testing of products both factory and deployed in-field have been completed by competent persons.

**Warning.** Risk of eye/bodily injury caused by released pressure during product disassembly, in the event of retrieval from subsea with a fault that causes depth pressure to be trapped inside the product.
- Ensure all product disassembly activities are completed by competent persons in accordance with relevant procedures and using relevant personal protective equipment (PPE).

**Warning.** Risk of bodily injury caused by pressure retaining parts becoming projectile due to user over-pressurising the system, e.g. during Site Installation Test (SIT).
- Ensure all product SIT activities are completed by competent persons in accordance with relevant procedures.

### 3.3.6 Risk of injury and material damage due to manual handling

Manual handling, lifting and carrying are known to be one of the largest contributors to occupational ill-health. Ensure mechanical handling aids are used wherever possible to avoid manual handling. Where manual handling is considered appropriate for the task, safe lifting guidelines must be followed, e.g. adopt correct posture, consider team lifting, employ safe lifting technique, etc. Only competent persons are permitted to perform tasks without supervision, if in doubt ask.
<table>
<thead>
<tr>
<th>Warning</th>
<th>Risk of musculoskeletal injury from hand-mating or de-mating connectors.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- Referring to the mate / demate forces specified herein, ensure suitable manual handling precautions are taken.</td>
</tr>
<tr>
<td></td>
<td>- Ensure all product testing activities are completed by competent persons in accordance with relevant procedures.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Warning</th>
<th>Risk of musculoskeletal injury from manual handling of heavy products, e.g. harnesses or sensor assemblies. Refer to shipping information or product datasheet for weights of the product.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- Ensure mechanical handling aids are used wherever possible to avoid manual handling.</td>
</tr>
<tr>
<td></td>
<td>- Where manual handling is considered appropriate for the task, safe lifting guidelines must be followed, e.g. adopt correct posture, consider team lifting, employ safe lifting technique, etc.</td>
</tr>
<tr>
<td></td>
<td>- Only competent persons are permitted to perform tasks without supervision, if in doubt ask.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Warning</th>
<th>Risk of bodily injury from heavy product falling during lift with machinery.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- Ensure machinery/slings used have been tested and are within their expiry date.</td>
</tr>
<tr>
<td></td>
<td>- Safe lifting guidelines must be followed, e.g. lifting plan, banksman, etc.</td>
</tr>
<tr>
<td></td>
<td>- Correct lifting points must be identified and used.</td>
</tr>
<tr>
<td></td>
<td>- Only competent persons are permitted to perform tasks without supervision, if in doubt ask.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Warning</th>
<th>Risk of minor personal injury to persons with sensitivities to silicone or mineral based oils.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- There is a small risk that oil could leak from the product if faulty. Wear appropriate hand protection when handling products or mineral or synthetic based oils in case oils leak from the connector due to a fault.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Warning</th>
<th>Risk of minor personal injury and material damage due to slips, trips and falls.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- Good housekeeping avoids slips, trips and falls, keep all work areas clean and tidy.</td>
</tr>
</tbody>
</table>

### 3.4 Related documents

Installers shall carry out a full site risk assessment and put into place all necessary steps and procedures to comply with applicable area, regional, national or international health and safety legislation, e.g. The Health and Safety at Work Act (HASAWA) in the United Kingdom (UK) and ensure safety of themselves and others regarding manual handling and working at height requirements.

During the product installation (and any subsequent work) it will be necessary to employ caution. All installers and operatives involved from unloading the product until it is deployed in its final installed location must exercise a full duty of care for themselves and others regarding safety. When lifting and handling this product, operatives should employ assistance if required. In certain situations, it may be necessary to use mechanical handling aids. Take care to avoid trip hazards, slippery or wet surfaces.

Employers and installers should refer to the Health and Safety Executive (HSE) web site in the UK for full advice and manual handling assessment charts (MAC) tool.

In addition, where no specific instructions are given then reference shall be made, but not restricted to, where applicable, British Standards and codes of practice such as the following:

- The Health and Safety at Work Act.
- COSHH Control of substances hazardous to health.
- BS 7671 Requirements for electrical installations. IEE Wiring Regulations.
- The Electricity at Work Regulations.

It is the operator’s and installer’s responsibility to comply with current Company, area, regional, national or international health and safety legislation.

3.5 Control of substances hazardous to health (COSHH)

Hazardous substances, Control of substances hazardous to health (COSHH) Assessments regards to materials such as elastomers and oils, etc. used in DigiTRON products are available on request from the Product Safety Officer at subsea.connectors.productsafty.gb@siemens-energy.com
4 ABBREVIATIONS

A Ampere
ac Alternating Current
Assy Assembly
API American Petroleum Institute
AWG American Wire Gauge
BOM Bill of Material
°C Degree Celsius
°F Degree Fahrenheit
CE Community European
Comms Communication Signal
COSHH Control of substances hazardous to health
CP Cathodic Protection
dc Direct Current
DWG Drawing
EFL Electrical Flying Leads
EMF Electrical Magnetic Field
EMI Electromagnetic Interference
FAT Factory Acceptance Test
IR Insulation Resistance
ISO International Organization for Standardization
ITP Inspection Test Plan
LTC Long Term Cover
M Metres
Max. Maximum
Min. Minimum
No. Number
PPE Personal Protective Equipment
ROV Remotely Operated Vehicle
SI Standard International
SIT Site Installation Test
SRT Site Received Test
SST Stainless Steel
TBD To Be Defined
TSP Twisted Screened Pair
UNS Unified Numbering System for Metals and Alloys
V Volt
5 SPECIFICATIONS

The following is a basic specification for DigiTRON products. Actual product may vary. Please refer to product specific data sheet(s), website https://www.siemens-energy.com/search Subsea, or contact Siemens Energy Technical Support connectortechnicalsupport.gb@siemens-energy.com for more detailed information.

General specification of the product is listed in section 2.2. Additional specifications are as follows.

5.1 Connector Specification

<table>
<thead>
<tr>
<th></th>
<th>ROV operated</th>
<th>Stab-plate</th>
<th>Diver operated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Misalignment Type</td>
<td>4 &amp; 7-way</td>
<td>12-way</td>
<td>4 &amp; 7-way</td>
</tr>
<tr>
<td>Rotational</td>
<td>±15°</td>
<td>±15°</td>
<td>±1.6°</td>
</tr>
<tr>
<td>Radial</td>
<td>±20mm (0.787&quot;)</td>
<td>±20mm (0.787&quot;)</td>
<td>±1mm (0.039&quot;)</td>
</tr>
<tr>
<td>Angular</td>
<td>±20°</td>
<td>±20°</td>
<td>±0.7°</td>
</tr>
<tr>
<td>Mate force</td>
<td>&lt;300N (67 lb)</td>
<td>&lt;500N (112 lb)</td>
<td>&lt;300N (67 lb)</td>
</tr>
<tr>
<td>Demate force</td>
<td>240 – 360N (54 – 81 lb)</td>
<td>480-800N (108 - 179 lb)</td>
<td>0</td>
</tr>
<tr>
<td>Overload withstand</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Axial load</td>
<td>9800N (2,198 lb)</td>
<td>9800N (2,198 lb)</td>
<td>9800N (2,198 lb)</td>
</tr>
<tr>
<td>Bending load</td>
<td>500Nm (369 lbf.ft)</td>
<td>500Nm (369 lbf.ft)</td>
<td>n/a</td>
</tr>
<tr>
<td>Torsion load</td>
<td>500Nm (369 lbf.ft)</td>
<td>500Nm (369 lbf.ft)</td>
<td>n/a</td>
</tr>
<tr>
<td>Maximum mate / de-mate speeds</td>
<td>1 m/s (3.3 ft/s)</td>
<td>1 m/s (3.3 ft/s)</td>
<td>1 m/s (3.3 ft/s)</td>
</tr>
</tbody>
</table>

Limit of exposure of male pins to seawater 28 days cumulative over lifetime

Table 5 DigiTRON connector specification

Caution. Risk of material damage. Maximum cumulative exposure of the male pins to seawater is 28 days to prevent corrosion of the pins. If the connectors are to be left unmated, in seawater, for any length of time Subsea Environment Cap or Dummy Plug must be fitted to protect the pin contacts in the receptacle connectors. Over exposure will increase the risk of corrosion damage or marine growth on the contact surfaces of the receptacle contact pins. This could lead to damage to the seals and insulation within the plug socket contacts. Plug connectors do not require full dummy connectors for protection.
Siemens Energy Subsea advise the fitting of acetal caps to protect plugs against marine growth. It is good practice to always fit the protective cap when a connector is unmated topside prior to deployment to provide mechanical protection.

**Caution.** Risk of material damage. Unmated receptacles (exposed male pins) should never be electrically energised subsea (even a small residual voltage). This will very quickly corrode the pins or cause complete electrical failure of the product.

### 5.2 Siemens Energy *AquaTRON* pressure-balanced oil-filled hose specification

![AquaTRON hose](image)

**Figure 7**  *AquaTRON* hose, size 50 (1/2" bore), and size 75 (3/4" bore)

<table>
<thead>
<tr>
<th></th>
<th>size 50, ½&quot; bore</th>
<th>size 75, ¾&quot; bore</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min bend radius</td>
<td>125mm (4.9&quot;)</td>
<td>180mm (7.1&quot;)</td>
</tr>
<tr>
<td>Maximum axial load</td>
<td>5,000N (1,121 lb)</td>
<td>5,000N (1,121 lb)</td>
</tr>
<tr>
<td>Maximum twisting</td>
<td>180° per 5m (16.4ft) length</td>
<td>180° per 5m (16.4ft) length</td>
</tr>
<tr>
<td>Mass (air)</td>
<td>0.66kg/m (0.44lb/ft)</td>
<td>1.04kg/m (0.69lb/ft)</td>
</tr>
<tr>
<td>Mass (water)</td>
<td>0.14kg/m (0.09lb/ft)</td>
<td>0.24kg/m (0.16lb/ft)</td>
</tr>
<tr>
<td>Max water depth</td>
<td>4,000m (13,123ft)</td>
<td>4,000m (13,123ft)</td>
</tr>
<tr>
<td>Oil fill pressure</td>
<td>15 bar (218 psi)</td>
<td>15 bar (218 psi)</td>
</tr>
<tr>
<td>Deployment rate</td>
<td>10 m/min (32.8 ft/min)</td>
<td>10 m/min (32.8 ft/min)</td>
</tr>
</tbody>
</table>

**Table 6**  *AquaTRON* oil-filled hose specification
5.3 Siemens Energy Subsea Cable Specification

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Voltage rating</th>
<th>Min bend radius</th>
<th>Maximum axial load</th>
<th>Mass (air)</th>
<th>Mass (water)</th>
<th>Max water depth</th>
<th>Resistance</th>
<th>Conductor</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-way</td>
<td>600 / 1,000Vac</td>
<td>182mm / 273mm</td>
<td>1,000N (224 lb)</td>
<td>3.71 kg/m (2.47 lb/ft)</td>
<td>1.05 kg/m (0.70 lb/ft)</td>
<td>3,000m (9,843ft)</td>
<td>13.3 Ohm/km</td>
<td>1.5mm² (0.0023in²)</td>
</tr>
<tr>
<td>7-way</td>
<td>600 / 1,000Vac</td>
<td>200mm / 300nm</td>
<td>1,000N (224 lb)</td>
<td>3.99 kg/m (2.66 lb/ft)</td>
<td>1.32 kg/m (0.88 lb/ft)</td>
<td>3,000m (9,843ft)</td>
<td>13.0 Ohm/km</td>
<td>1.5mm² (0.0023in²)</td>
</tr>
<tr>
<td>12-way</td>
<td>600 / 1,000Vac</td>
<td>300mm / 400mm</td>
<td>1,000N (224 lb)</td>
<td>5.65 kg/m (3.77 lb/ft)</td>
<td>1.64 kg/m (1.09 lb/ft)</td>
<td>3,000m (9,843ft)</td>
<td>4.05 Ohm/km</td>
<td>1.5mm² (0.0023in²)</td>
</tr>
</tbody>
</table>

Table 7  DigiTRON subsea cable specification

- Axial loads on terminated ganged connectors should be kept to a minimum unless the connector has been specifically designed to take such a load. The maximum applied loads will depend on the cable type and the gland internals (Contact Siemens Energy Subsea Technical Department for advice).
6 PREPARING PRODUCT FOR USE OR STORAGE

6.1 Product protection and packaging

Siemens Energy Subsea electrical connectors are manufactured primarily from materials such as 316L stainless steel and Super Duplex stainless steel, and as such are designed to withstand harsh saliferous environments. However, the connector inserts and exposed parts are susceptible to mechanical damage if not protected. Transport caps or Acetal protective caps must be fitted to all Siemens Energy Subsea connectors before transport.

| Caution. Risk of material damage. Transport caps or protection caps must always be fitted to an unmated connector during transport, and should remain in place while topside before deployment |

Connectors can be shipped singularly or in multiples. Care should be taken to protect the connector(s) with ‘Instapack’, bubble wrap or similar wrapping materials to avoid surface damage during transit. If large numbers are shipped in one consignment suitably reinforced transport box will be necessary to withstand the weight. See Figure 8 and Figure 9.

![Figure 8 Acceptable packaging for shipment](image1)

![Figure 9 Unacceptable packaging and storage](image2)

Bulkhead type connectors with exposed tailing wires should be packed and shipped in a suitably sized box to allow adequate space for the tailing wires without bending or kinking.

Connectors are designed to withstand vibration that occurs during transportation and to withstand being dropped from a height of 1 m (3.3 ft) whilst in packaging.

If the connectors are assembled onto hoses these must be suitably coiled and secured with tape to prevent uncoiling during transit. Respect the hose minimum bend radius (refer to section 5.2)
6.2 Unpacking
Remove wrapping material taking care to inspect for any surface damage or items that may have become separated from the connector, such as 'O' seals. Do not use a knife to cut the wrapping material, as this may cause damage to any elastomeric parts of the connector. Do not remove protective caps until connectors are ready for installation. On removal do not allow the hoses to drag over the edges of the packing crate. Connectors supplied in boxes must be stored in the box.

6.3 Storage, protection and end of life
All connectors come supplied with a transport cap. It is recommended to leave the caps on whenever possible. The caps must be removed before subsea deployment.

Connector may be fitted with a back plastic Protective Cap (Figure 20), which is available to purchase separately (customer preference). These caps provide a higher degree of mechanical protection to the connector than the transport caps.

Refer to section 9.4 for details on the types of caps and dummy connectors available for protection during storage.

![Caution. Risk of material damage. If storage is carried out in saline conditions, e.g. on a ship’s deck or hold, then a Subsea Environment Cap or Dummy Plug connector should be used to protect the receptacle pins from corrosion.]

If product has been recovered from subsea use, it should be cleaned before storage. Clean only with fresh water or 50% citric acid solution. If 50% citric acid wash is not performed, as a minimum, wash with clean water to remove any salt water on the products.

6.3.1 Short term storage
Prior to installation the connectors are sensitive to environments where grit and dirt are present. To prevent ingress of the above, they should be stored in a clean dry area and be protected by bubble wrap or similar wrapping material. Transport / protective caps must be fitted. Connectors supplied in boxes should be stored in the box.

Carbon steel must not be present in the storage of the products, to avoid contamination of the stainless steel products.

![Caution. Risk of material damage. Maximum storage temperature accounts for solar gain. Skin temperature must not exceed 70°C (158°F). Suitable protection must be used to ensure maximum storage temperature is not exceeded.]

6.3.2 Long term connector storage
Connectors must be stored in a clean dry area and be protected by bubble wrap or similar. Suitable protection caps must be fitted and the storage temperature should be between -40°C and 70°C (-40 to 158°F). Humidity of the storage room should be below 75%. Very moist or very dry conditions should be avoided. The equipment should be protected from strong sunlight and strong artificial light with a high ultraviolet content.

Carbon steel must not be present in the storage of the products, to avoid contamination of the stainless steel products.
Caution. Risk of material damage. Maximum storage temperature accounts for solar gain. Skin temperature must not exceed 70°C (158°F). Suitable protection must be used to ensure maximum storage temperature is not exceeded.

Caution. Risk of material damage. Connectors should not be allowed to encounter solvents, oil, grease or other semi-solid materials.

If glanded connectors are to be stored bolted into their interfaces prior to cable termination, ensure the cable entry point into the gland is covered to prevent dirt and water ingress.

6.3.3 Siemens Energy pressure balanced oil filled hose storage

Recommend for hose be protected with tarpaulin sheet or equivalent if in direct sunlight.

Storage temperature range: -40°C to 70°C ( -40 to 158°F)

Storage humidity: 0% to 85% R.H.

Maximum initial storage period: 2 years stored in accordance with ISO 2230 (pressurised). If storage is outside the above guidelines, then protective covering is available on request. Where Junction Boxes are used ensure protection from strong sunlight and strong artificial light.

Extended storage period: After the initial storage period expires all pressurised hose assemblies must be visibly inspected for:

- Permanent distortions, such as creases or flats
- Mechanical damage, such as cuts, tears, abraded areas or delaminated plies
- Surface cracking
- Changes in surface condition, such as hardening, softness or tackiness.

After the inspection is completed and data recorded the assembly can be stored for a further 2 years.

6.3.4 Cable storage

Storage temperature range: -40°C to 70°C ( -40 to 158°F)

Siemens Energy cable is designed for long life in hazardous environments but for extended storage periods we recommend dry storage, under cover and out of direct sunlight.

6.3.5 Long term storage of elastomers

For the recommended storage of elastomeric components e.g. termination sleeves and cable boots, please refer to Siemens Energy Subsea Document MH006 – Procedure for Storage and Handling of Elastomeric Materials, available from Siemens Energy Technical Support.

6.3.6 Repackaging to prevent damage in transport

In the event of a requirement to return any product back to the manufacturer (Siemens Energy Subsea Connectors), it is recommended that the transport cap, protective cap, or suitable dust cap is fitted to the connector(s) and care should be taken to protect the connector(s) with bubble wrap or similar wrapping materials to avoid any surface damage

If there are multiple connectors to be returned, it is recommended that a suitably reinforced box be used to withstand the weight and allow shipping in one consignment. Contact Siemens Energy Technical Support connectortechnicalsupport.gb@siemens-energy.com to discuss details of typical boxes.
Carbon steel must not be present in the storage of the products, to avoid contamination of the stainless steel products.

6.3.7 Disposal and recycling

Safe disposal or recycling of waste packaging and/or end of life product is recommended by correctly observing and complying with area, regional, national or international environmental legislation where applicable.

To return waste packaging and/or end of life product to the manufacturer, contact the Product Safety Officer at subsea.connectors.productsafety.gb@siemens-energy.com.
7 INSTALLATION AND ASSEMBLY

If in doubt contact Siemens Energy Technical Support connectortechnicalsupport.gb@siemens-energy.com for more detailed information.

Caution. Risk of material damage. All sealing surfaces interfacing to DigiTRON connectors shall be inlayed with Inconel 625 or similar corrosion resistant alloy, with no additional protection required. This is to prevent localised pitting corrosion of the interface.

7.1 Pre-installation checks for EFL’s

- Check hose tagging information is correct according to drawing/tag schedule.
- Ensure Flying Lead has passed Site Received Test (refer to Siemens Energy document SRT-001, available on Siemens Energy Subsea website).
- Make sure prior to installation a final visual inspection of the Flying Lead is completed.
- No part of the connectors should be dismantled prior to or during deployment, apart from the removal of protective caps and installation of split flanges, since there are no user serviceable parts inside.
- Any defects need to be recorded on the form in section 10 of this document and where possible take photos of any issues that need to be recorded and inform Siemens Energy Technical Department.

7.2 Cathodic protection

ROV Connectors are manufactured in super duplex stainless steel and are designed to operate isolated from the CP (Cathodic Protection) system. Such connectors are supplied with all hardware needed to isolate the connector from the structure to which it will be mounted.

ROV connectors that do get connected to the CP system will not be immediately damaged, but there is an increased risk of hydrogen embrittlement of the metal (possible cracking under high mechanical stresses), and increased rate of calcareous deposits on the product (which may cause problems demating the connectors).

Stainless steel 316L (UNS S31603) diver and stab mate connectors must be connected to the CP (Cathodic Protection) system at all times.

Do not fit ‘bracelet’ anodes around hose or cable as part of CP protection. These can easily damage the hose or cable as the anodes corrode.

7.3 Installation of harnesses with flanged connectors and / or junction boxes

Tooling required

- ¼ inch drive torque wrench 0-25 Nm (18.4 lbf.ft) – with 3mm and 5mm Allan key drive
- Flat blade screwdriver
- Loctite 243

If cable ties are used to secure harnesses to structures, leave loose on the hose. Do not compress.
7.3.1 Stab-plate connectors

![Stab-plate connectors](image)

**Figure 10** Typical stab-plate connectors

For stab plate connectors, there are 4 types of flange designs available:
- Solid Fixed
- Solid Floating
- Split Fixed
- Split Floating

Refer to Figure 11 for mounting detail.
Figure 11  Flange styles for stab-plate connectors

- **Solid Fixed flanges**

  The Solid Fixed flange is non-removable and will be supplied pre-assembled as part of the connector. Fasteners are supplied loose with the connector.
Mounting instructions

Apply a spot of Loctite 243 to the threads of the cap head screws. Fix the connector to the stab plate (metal to metal flange contact) using the cap head screws as shown in Figure 11. Torque to 10-12Nm (7.38 – 8.85 lbf.ft)

- **Solid Floating flanges**
  The Solid Floating flange is non-removable and will be supplied pre-assembled as part of the connector. Fasteners and spacers are supplied loose with the connector.

  Mounting instructions
  The spacers should be mounted in the orientation shown in Figure 11 “Floating Flange” detail.
  Place the spacers on the M6 fasteners, apply a spot of Loctite 243 to the threads of the cap head screws and position through the flange into the interface. Fix the connector to the stab plate (metal to metal flange contact) as shown in Figure 11. Torque to 10-12Nm (7.38 – 8.85 lbf.ft).

- **Split Fixed flanges**
  The Split Fixed flange is removable and is supplied loose with the connector. Fasteners, grub screw and dowels are also supplied loose with the connector.

  Mounting instructions
  To mount the flange on the connector, first, pass the connector through the interface hole, the two halves of the flange should be brought together around the connector front end. Make sure that the lip around the through hole is facing forwards toward the connector front end and the key is in-line with the keyway in the flange.
  To secure the two halves together, Insert the 2-off location dowels into the holes in the flange and press fit until flush with the face of the flange.
  A M6 grub screw is supplied for tightening the flange to the connector body. Apply Loctite 243, screw into the M6 tapped hole on the bottom face of the flange and tighten to 3.5 Nm (2.58 lbf.ft).
  Apply a spot of Loctite 243 to the threads of the cap head screws. Fix the connector to the stab plate (metal to metal flange contact) using the cap head screws as shown in Figure 11. Torque to 10-12Nm (7.38 – 8.85 lbf.ft).

- **Split Floating Flanges**
  The Split Floating flange is removable and is supplied loose with the connector. Fasteners, grub screw, dowels and spacers are also supplied loose with the connector.

  Mounting instructions
  To mount the flange on the connector, first, pass the connector through the interface hole, the two halves of the flange should be brought together around the connector front end. Make sure that the lip around the through hole is facing forwards toward the connector front end and the key is in-line with the keyway in the flange.
  To secure the two halves together, Insert the 2-off location dowels into the holes in the flange and press fit until flush with the face of the flange.
  A M6 grub screw is supplied for tightening the flange to the connector body. Apply Loctite 243, screw into the M6 tapped hole on the bottom face of the flange and tighten to 3.5 Nm (2.58 lbf.ft).
The spacers should be mounted in the orientation shown in Figure 11 “Floating Flange” detail. Place the spacers on the M6 fasteners, apply a spot of Loctite 243 to the threads of the cap head screws and position through the flange into the interface. Fix the connector to the stab plate (metal to metal flange contact) as shown in Figure 11. Torque to 10-12Nm (7.38 – 8.85 lbf.ft)

**Note - Floating Flanges**
Floating Flanges have larger fixing holes in the flange, and a steel top hat washer under the screw head. The larger hole means that if an attempt were made to fit the connector without the top hats, the screw head would pass straight through the hole, indicating that something was missing.

### 7.3.2 ROV connectors
Refer to Figure 12 for a typical flange-mounted ROV connector.
Remove M6 mounting screws and orientation disc, pass the front of the connector through the interface, install 4 off M6 mounting screws and orientation disc, secure screws with a spot of Loctite 243 on the threads and torque to 10-12Nm (7.38 – 8.85 lbf.ft):

![Figure 12 Installation of compliant flange-mount ROV plug](image)

For mounting ROV receptacles (male pins) an extra ring is required, to keep the connector captive in the event that the rubber mount is lost. This is supplied with the connector and should be fitted along with the alignment disc, in the orientation shown in Figure 13 and Figure 14.

NOTE:
The alignment cone on the receptacle may require removal in order to install the connector, and re-fitting once installed. Ensure correct orientation to the internal key-way.

Figure 13  Sectional view to show installation and parts of compliant flange-mount connector

Figure 14  View to show ROV compliant mount flange text (note orientation of flange is different plug to receptacle)
7.3.3 Diver operated connectors

Flange mounted diver operated connector have a fixed flange that will be supplied pre-assembled as part of the connector. Fasteners are supplied loose with the connector.

**Mounting instructions**

Apply a spot of Loctite 243 to the threads of the cap head screws. Fix the connector to the mounting position (metal to metal flange contact) using the cap head screws. Torque to 10-12Nm (7.38 – 8.85 lbf.ft).

7.3.4 Installation of AquaTRON junction box and mounting brackets

Referring to Figure 15, the junction box is designed to be mounted and deployed in a horizontal position. If the junction box is to be mounted vertically, the hose will need to be supported on either side of the junction box to maintain the minimum bend radius.

![Figure 15: Junction box mounting horizontal (left) and vertical (right)](image)

It is critical the brackets for the junction box are installed as identified on Siemens Energy drawing T33073, available from Siemens Energy Technical Support.

Drill interface holes as required for installation as per drawing T33073.

In the event that the brackets are supplied separate to the junction box body, these will need to be assembled and installed. If applicable: assemble brackets to the body taking into account the anti-rotation peg, which is to be situated on the underside of the unit and locates into a recess in the body. Fit 1-off black nitrile strip to each bracket on the opposite side to the anti-rotation peg. Tighten the M6 fasteners to 3.5Nm (2.58 lbf.ft) to complete the bracket installation. See Figure 16 and Figure 17.
Figure 16  Junction box mounting bracket assembly

Ensure mounting brackets are secure and the junction box is orientated correctly. This completes the installation of the junction box.

Figure 17  Junction box correctly installed on structure

Ensure unit is secure with no lateral or rotational movement.
7.3.5 SENSOR ASSEMBLY

Sensor installation is specific to each sensor and assembly instructions are to be provided by the sensor manufacturer. Refer to Table 1 for Siemens sensors.

7.3.6 TESTING OF EFL’S

For testing of products in a dry environment (topside) the appropriate test connector must always be used to make electrical contact during testing.

For testing EFL’s in a wet environment, a standard subsea connector must be used. Siemens connectors should not be used as pressure barrier in a pressure vessel, they are not intended for this use.

If present, guide pins must never be removed from test connectors as this can lead to damage and will invalidate the connector warranty.

| Danger! Risk of imminent danger to life or risk of severe personal injury. Sudden release of stored pressure. |
| DigiTRON products are not intended for use as a penetration for fixed top-side or land-based pressure vessels. They are not designed to comply with the requirements of the Pressure Equipment Directive (2014/68/EU). They are intended for integration into subsea equipment only. All pressure testing of DigiTRON product must be undertaken by a competent person. |

| Danger! Risk of death from electric shock from a damaged test connector |
| - Never hold a test connector while electrically energised  |
| - Do not use a test connector is it appears damaged in any way. |

| Danger! Risk of death from electric shock from improper use of test connector. Never disassemble test connectors. In particular, removal of the rubber termination sleeves placed over the joint between the cable and the test connector is prohibited, as this will expose live parts to the user. |
| - Never disassemble a test connector |

| Caution. Risk of material damage. The appropriate test connector must always be used to make electrical contact during testing. Under no circumstances should a foreign object (such as a screwdriver, test probe or crocodile clip) be used as a test connection as this could damage the seals and insulation. Such actions will invalidate the product warranty. |

| Caution. Risk of material damage. Test connectors should never be used in water. There is a high change of damage to the test connector and also to the connector under test. |

- Below are some images of standard dry (topside) Siemens Energy test connectors.
Figure 18  Dry (Topside) Test connectors, ROV, Diver and Stab-plate type

Alternatively, a standard subsea connector (e.g. Figure 19) tailed with cable can be used as a test connector. This is preferred by some users as it hides the rubber termination sleeves inside the body of the connector, eliminating the possibility for the rubber termination sleeves to be removed by the user (refer to Danger! notes above). Siemens can provide such connectors tailed with appropriate cables (Siemens recommendation), or untailed.

Cable tails require soldering into the solder cups on the rear of the connector. Each termination must be protected by a termination sleeve supplied with the connector.

Only a Suitably Qualified and Experienced Person (SQEP) should install the cable tails, e.g. person trained by Siemens Energy. Siemens Energy installation procedure should be used.

Figure 19  Example of standard subsea connector (shown untailed)
8 USER INFORMATION DURING NORMAL OPERATION AND FAULT CONDITIONS

8.1 Visible/audible signals
There are no visible or audible signals from the product during use that identify particular operations to the user.
The product should be silent during operation and its appearance should not change.

8.2 Normal and faulty/dangerous operation
Do not operate the product if there appears to be a fault. If in doubt contact Siemens Energy Technical Support. Below are some indications of a product fault.

- Any loose items such as metal bodies, fasteners, other fixings
- Any oil leak is present, either from the connector or from the oil-filled hoses or junction boxes.
- Bent pins
- Blackening or darkening of the rubber seals on the front face of the plug.
- Any signs of electrical activity on the exterior of the products, such as burning on the front face of the plug or burning of the male pins.
- Green-coloured corrosion on the male pins.
- Damaged insulation on any cables.
- Loose or faulty electrical joint between cables and connector.
- Any noise coming from the product.

8.3 Troubleshooting
If there is any problem with the product failing to operate correctly, please contact Siemens Energy for advice. Do not dismantle the product in any way.: 

<table>
<thead>
<tr>
<th>Department</th>
<th>E-mail address</th>
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<tbody>
<tr>
<td>Product Safety Officer</td>
<td>subsea.connectors.productsafe.gbeiemen.com</td>
</tr>
<tr>
<td>Technical Support</td>
<td>connectortechnicalsupport.gbeiemen.com</td>
</tr>
<tr>
<td>Service (Site Team)</td>
<td>susultlcmsupport.gbeiemen.com</td>
</tr>
</tbody>
</table>

Table 8 Troubleshooting product contact details
9 PRODUCT OPERATION AND MAINTENANCE

9.1 Safety precautions
Before use, read section 3 on product safety advice.

9.2 Product maintenance and servicing
DigiTRON products require zero maintenance for their 30 year subsea lifetime and up to 250 subsea mate and demate cycles.

There are no user serviceable parts in the connectors, EFLs, jumpers or harnesses. Disassembly of the product should not be attempted. If there are any problems developed with the product then the user should contact Siemens Energy Technical Support for advice.

9.3 Subsea protection of receptacle contact pins

| Caution. Risk of material damage, corrosion of the exposed male pin in the receptacle connector. |
| 28 days is the maximum cumulative allowable exposure of unprotected receptacle pins to seawater over the lifetime of the connector |
| **Always immediately fit a Subsea Environment Cap or Dummy Plug to the receptacle in order to protect the pins from corrosion.** |

| Caution. Risk of material damage. Under no circumstances must the contact pins in the receptacle connector be exposed to seawater with power on. |
| If this situation does occur the electrical connector could be destroyed (depending on electrical energy available). At a minimum, the contact surfaces of the pins will very rapidly degrade by electrolytic action. If these damaged pins are subsequently mated into a socket insert there is a very high risk of damage to the insulation and seals within the plug connector. |

| Caution. Risk of material damage. It is important to isolate and earth prior to disconnect in order to remove any stray charges in the system. If left, this can induce corrosion on the exposed pins once the plug is removed. |

9.4 Product protection; caps and dummy connectors
There are five types of caps and dummy connectors available to protect the product in use. The following gives the use case for each type.

9.4.1 Topside caps
- **Transport cap:** Supplied with the connector to protect it against damage during transport (Figure 20)
- **Protective cap:** Provides greater degree of mechanical protection to the connector than the transport cap. Recommended for when connectors are exposed to higher risk of damage outside of transportation (Figure 20)

Topside caps can simply be pushed on or removed by hand
Caution. Risk of material damage. If storage is carried out in saline conditions, e.g. on a ship’s deck or hold, then a Subsea Environment Cap or Dummy Plug connector should be used to protect the receptacle pins from corrosion.

9.4.2 Subsea caps

- **Subsea Protective Caps**: Provides mechanical protection to the plug or receptacle connector (Figure 21). It is a non-electrical cap. The cap for the plug connector (female sockets, oil-filled) can be used for long-term mechanical protection. The cap for the receptacle (exposed male pins) does not protect the exposed male pins in the receptacle from corrosion. It should only be used for very short-term subsea use, e.g. the cap is removed within a few days after deployment and the flying lead connected to receptacle (noting that the 28 days maximum in section 9.3)

- **Subsea Environment Cap**: Provides mechanical protection to the receptacle connector (male pins) including corrosion protection of the exposed pins. This is a non-electrical cap. (Figure 22). To be used where the receptacle connector will be left un-mated for any length of time.

- **Dummy Connectors**: Provides mechanical and electrical protection to the plug or receptacle, including corrosion protection of the exposed pins in the receptacle (Figure 22). These are connectors have full electrical rating. They can be configured at time of order to be open-circuit or looped with wire or resistors. These connectors should be used everywhere the system will be electrically energised or for electrical testing.
Figure 22  **ROV-type Subsea Environmental Cap and Dummy Connectors, flying and flanged types.**

(Note that there is clear subsea visible differentiation between the Environment Cap, and Dummy with open-circuit, looped with wire or resistors. Labels are added for this purpose (not shown on these images).

### 9.5 Live Mate / De-mate

The connectors are not designed to be mated or demated while electrically energised. Depending on the type of electrical load, the following advice should be followed.

<table>
<thead>
<tr>
<th>Danger! Risk of death from electric shock due to exposed live pins, e.g. factory or top-side system test and unmated receptacle is energised.</th>
</tr>
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</table>
| - Ensure all test procedures are followed.  
- Communication channels and protocols are observed. |

| Caution. Risk of material damage. The maximum number of live mate / de-mate operations under any of these conditions is ONE only. There is a high risk of damage to both plug and receptacle connector that would render it unusable. |

**Resistive loads**

Mating the connectors should not lead to any damage to the sealing mechanisms within the plugs.

The speed of de-mating should be between 40mm/s to 60mm/s (1.6 – 2.4”/s). Following this de-mating procedure, testing should be carried out on the connector to establish if any damage has occurred. Under no circumstances shall connectors be partially mated with power on.

**Capacitive loads**

Mating with power on will lead to an in-rush current. The magnitude of this in-rush current will depend on the capacitance of the circuit. It is very important that the in-rush current is no more than 100A for 5 seconds.

**Inductive loads**

Mating the connectors should not lead to any damage to the sealing mechanisms within the inserts. De-mating **must not be attempted** as there is a risk of high back EMF’s which will cause damage to the seals and insulation within the inserts.
9.6 Removal of marine growth and calcareous deposits

To remove calcareous deposits from Siemens Energy Subsea connectors, a solution of 50% Citric Acid is recommended. All seawater exposed elastomeric materials in Siemens Energy Subsea connectors have been fully tested against 50% Citric Acid and are compatible for a duration of 1 hour. In addition, the thermoplastic materials have a good resistance to citric acid.

| Warning | Risk of minor personal injury to persons with sensitivities to a solution of 50% Citric Acid, should wear appropriate hand and eye protection when handling. |
| Caution | Risk of material damage. Other acid cleaners, such as 50% Acetic Acid, should not be used as they may cause deterioration of the elastomeric materials. |
| Caution | Risk of material damage. Chiselling and abrasive methods are not recommended. Use of a water jet is acceptable, but the jet should not be directed into the shuttle pins at the front of the plug as this could result in a risk of water being forced through the primary seals. |

9.7 Testing of product

Refer to section 7.3.6

9.8 Checks before mating the product

Transport and topside protection caps must be removed before subsea deployment

Before mating, the receptacle connector (male pins) should be checked for debris and damage. The connectors have been designed to accommodate sand and silt contamination; however large pieces of debris should be removed. Use a water jet if subsea, but do not direct the water jet at the front face (seals) of the plug connector

Inspect the receptacle pins for any signs of damage, such as bent pins, blackening due to electrical faults, or corrosion of the pins (green colour) or others in section 8.2.

If evidence of such faults exists, do not use the connector. Please contact Siemens Energy Technical Support for advice.

9.9 ROV connectors mating and de-mating

9.9.1 ROV connector alignment and mating

Refer to Figure 23 for images of alignment marks and mating
- DigiTRON connectors have been designed to self-align during mating.
- The connectors must be roughly aligned using the alignment marks on the plug body, flange and receptacle cone.
- The mounting of the ROV handle has sufficient compliance to accommodate fine adjustments during the final approach prior to connector engagement.
- Ensure correct orientation of the alignment disc
- It is important that the ROV compliant flange is orientated correctly.
- Observe the text on the flange and orientate accordingly.
• When fully mated the lip seal will not be visible and connection should look like as shown in Figure 24.
• If the lip seal can still be seen remove and retry making connection by following the procedure again.
• If connectors can’t be mated both the plug and receptacle need to be inspected for any misalignment damage or debris that is preventing connection.
• If any damage has occurred please contact Siemens Energy Technical Support for advice.

9.9.2  ROV connector maximum misalignment values and mating forces

Refer to section 5.1
9.9.3 **ROV connector post-mating checks**

During mating the orange indicator lip seal located on the plug connector will fold back and disappear into the alignment cone on the receptacle connector. After a successful mating of the connectors no part of the indicator lip seal should protrude through the joint between the plug and receptacle connector.

9.9.4 **ROV connector de-mating**

De-mating is achieved by a straight pull on the ROV handle, sufficient to release the latching mechanism.

Force required is detailed under the mechanical forces in section 5.1

For topside use, e.g. during system testing, there is a hand operated ROV de-mate tool available to make connector de-mate by hand easier and safe. It is recommended that this tool should always be used topside. Part number BQ-30090-00. See Figure 24

![Figure 24 ROV de-mate tool, part number BQ-30090-00](image)

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<td>- Referring to the mate / demate forces specified herein, ensure suitable manual handling precautions are taken and the topside demate tool is used</td>
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<td>- Ensure all product testing activities are completed by competent persons in accordance with relevant procedures.</td>
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When an EFL is de-mated and returned to the surface please inspect, store and protect as detailed in section 5.5.

9.10 **Stab-plate connectors mating and de-mating**

9.10.1 **Stab-plate connector mating and demating**

Stab-plate connector do not have any latching mechanism. The connectors are mated together by the force of the stab-plate. There is no special operation needed to demate the connector, simply the stab-plate is withdrawn and the connectors separate.
Only the alignment of the key and the maximum misalignment values need to be adhered to, refer to section 5.1.

9.10.2 Partial disconnection and interrupted connection

Partial disconnection with the contact pin remaining between the primary and secondary diaphragms is not recommended, as there is a risk of damaging the insulation. If it is necessary to operate the connectors partially mated, the connectors should be separated by 8.6 – 9.2mm (0.340 - 0.360") from the nominal, mated, stab distance. In this condition the level of insulation between the contact pin and socket contact is reduced and the connector is relying on the primary seals within the plug. There is also an increased risk of insulation break down at voltages above 500V.

Interrupted connection (i.e. Partial mate to full de-mate) can be carried out without any adverse effect to connectors, as long as the power is off.

9.11 Diver operated connectors mating and de-mating

9.11.1 Diver operated connector mating and de-mating

The clamp ring should be rotated clockwise by hand until tight. The connectors are designed to remain clamped together with only firm hand tightness on the clamp ring. If a clamping torque is used, this MUST NOT exceed 20Nm (15 lbf.ft). A 2-3" C-spanner can be used for this operation.

De-mating is simply a reverse of this process.

9.11.2 Diver operated connector maximum misalignment values

These connectors have been designed to self-align during mating. All that is required is to ensure that the alignment pin on the plug connector is engaged in the alignment groove within the receptacle connector before screwing the clamp ring up.

9.11.3 Diver operated connector post mating checks

Full engagement of the connectors can be checked through the viewing hole in the clamp ring. If the connectors are fully mated, then no gap should be visible between the plug and receptacle, refer to Figure 25.

Figure 25  Diver operated connector mating features
## 10 CUSTOMER COMMENTS/FEEDBACK

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- Contact Details

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Please enter details below e.g. comments; complaints; evidence of good practice; incident reports; observations and recommendations, including any associated with health, safety or the environment, etc., also include any names/contact details of other relevant personnel.

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Please e-mail completed form to the Product Safety Officer at the following address:

subsea.connectors.productsafty.gb@siemens-energy.com