DigiTRON Retrievable Electrical Distribution Unit (REDU), 2nd generation - Installation, Operations and Maintenance Manual

Protection, Storage, Shipment, Unpacking, Deployment & Maintenance Instructions
Foreword
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 Retrievable Electrical Distribution Unit (REDU) and mounting plate.

IMPORTANT
READ CAREFULLY BEFORE USE
KEEP FOR FUTURE REFERENCE

Revision Summary
This page records the revision status of the entire document and its authorisation for issue.

<table>
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<tr>
<th>Rev</th>
<th>Compiled by</th>
<th>Date</th>
<th>Approved by</th>
<th>Issue Date</th>
<th>Page(s) Affected/Remarks</th>
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<tr>
<td>2</td>
<td>R Wyatt</td>
<td>16/11/2020</td>
<td>Eric Chaize</td>
<td>16/11/2020</td>
<td>Updated onto new IOM template with product safety advice clearly identified.</td>
</tr>
<tr>
<td>1</td>
<td>XY Teng</td>
<td>01/11/2018</td>
<td>JP Smith</td>
<td>01/11/2018</td>
<td>First issue</td>
</tr>
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</table>
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1 PRODUCTS COVERED BY THIS MANUAL

This document is an overview of the protection, storage, shipment, unpacking, deployment, and maintenance instructions for the 2nd generation Retrievable Electrical Distribution Unit (REDU). The document applies for all Retrievable Electrical Distribution Unit (REDU) of the welded fabrication type.

Products covered by this IOM can be readily identified visually, all looking very similar to the examples given section 2.7.

Part numbers for these REDU products all begin with:

S1Uxxxxxxx - where xxxxxxxxx are part numbers for specific variants of REDU, differences mainly being quantity of connectors, and connector types.

Installation, Operation and Maintenance manuals for other DigiTRON products not covered by this document can be found on Siemens Subsea website www.siemens-energy.com /search Subsea, as follows:

<table>
<thead>
<tr>
<th>DOC. No.</th>
<th>PRODUCT</th>
</tr>
</thead>
<tbody>
<tr>
<td>IOM-001</td>
<td>DigiTRON electrical flying leads, Jumper and Sensor Harnesses</td>
</tr>
<tr>
<td>IOM-002</td>
<td>DigiTRON 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-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 REDUs intended use is communication and distribution of low voltage between pieces of electrical equipment that are submerged in water, e.g. subsea. The REDUs utilizes DigiTRON connectors. 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 mating capacity of these connectors is achieved using pressure compensated electrical inserts employing the CE principle.

Some illustrations are shown in section 2.7 to help identify the REDU product.

2.2 Product specification and certification

Basic specifications relating to all products covered by this manual are below in Table 2. Additional specifications can be found in section 5.

<table>
<thead>
<tr>
<th>Specification</th>
<th>Specification Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design Life</td>
<td>30 years in subsea environment</td>
</tr>
<tr>
<td>Rated voltage</td>
<td>1,000Vac 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>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>Deployment and retrieval rate</td>
<td>Max. 350m/min (1,150ft/min)</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>-40°C +70°C (-40°F +158°F) (upper limit is surface</td>
</tr>
<tr>
<td></td>
<td>temperature of the product and includes solar gain</td>
</tr>
<tr>
<td></td>
<td>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>Weight</td>
<td>REDU box up to 91kg (200 lb) (11-way unit).</td>
</tr>
<tr>
<td></td>
<td>REDU base-plate 36kg (79 lb)</td>
</tr>
</tbody>
</table>

Table 2 DigiTRON product specification and certification

Note: Self-certified via in-house testing.
2.3 Contact details and feedback

For additional information or questions regarding the products visit the Siemens website [www.siemens-energy.com](http://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 3  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 3.

2.4 Product advice label

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

This label is not to be removed until immediately prior to installation.

The testing and installation of this product must only be performed by a suitably qualified and experienced technician.


Product Support: connectortechnicalsupport.gb@siemens-energy.com / +44 (1229) 580500

Product Safety Reporting: Subsea.connectors.Productsafety.gb@Siemens.com

Siemens Product Ranges

- DigiTRON
- ElecTRON
- MiniCE
- SpecTRON

Delivery Notice to Customers

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 REDU products are marked with the Siemens Energy part number and unique serial number. Also, the voltage, temperature and water depth ratings are indicated.

Typically, these are etched on a yellow-coloured label permanently attached to the product (refer to Figure 3).

Also, similar information relating to each connector is etched onto the connector metal body, refer to Figure 2.

![Product marking on DigiTRON product](image)

**Figure 2**  Product marking on DigiTRON product

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 REDU Box Assembly and Base Plate Assembly
3 PRODUCT SAFETY

Siemens Energy Subsea recommends that the use this 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:

<table>
<thead>
<tr>
<th>Warning symbols and signal words</th>
</tr>
</thead>
<tbody>
<tr>
<td>Danger!</td>
</tr>
<tr>
<td>Imminent danger to life or risk of severe personal injury</td>
</tr>
<tr>
<td>Danger!</td>
</tr>
<tr>
<td>Risk of death from electric shock</td>
</tr>
<tr>
<td>Warning.</td>
</tr>
<tr>
<td>Risk of minor personal injury</td>
</tr>
<tr>
<td>Caution.</td>
</tr>
<tr>
<td>Risk of material or environmental damage</td>
</tr>
</tbody>
</table>

3.2 Intended use

The product is intended as a Low Voltage electrical connection and distribution 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.

| Caution. Risk of material or environmental damage, improper use of any kind is prohibited. |
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 at susultlcmsupport.gb@siemens-energy.com (Site Team).

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

**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 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 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 de-mate the product while live
- Never 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 REDUs 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.

**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). 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.
### 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.

### Warning
Risk of musculoskeletal injury from mating or de-mating connectors by hand.
- Referring to the mate / de-mate forces specified herein, ensure suitable manual handling precautions are taken.

Ensure all product testing activities are completed by competent persons in accordance with relevant procedures.

### Warning
Risk of musculoskeletal injury from manual handling of heavy products. Refer to section 2.2 (Table 2) or shipping information or product datasheet for weights of the product.
- 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.
Warning. Risk of bodily injury from heavy product falling during lift with machinery.
- Ensure machinery/slings used have been tested and are within their expiry date.
- Safe lifting guidelines must be followed, e.g. lifting plan, banksman, etc.
- Correct lifting points must be identified and used.

Only competent persons are permitted to perform tasks without supervision, if in doubt ask.

Warning. Risk of minor personal injury to persons with sensitivities to silicone or mineral based oils.

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.

Warning. Risk of minor personal injury and material damage due to slips, trips and falls.

Good housekeeping avoids slips, trips and falls, keep all work areas clean and tidy.

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 installers 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.productsafety.gb@siemens-energy.com.
4 ABBREVIATIONS

°C Degree Celsius
°F Degree Fahrenheit
A Ampere
ac Alternating Current
API American Petroleum Institute
CE Community European
COSHH Control of substances hazardous to health
CP Cathodic Protection
dc Direct Current
DWG Drawing
EMF Electrical Magnetic Field
M Metres
Max. Maximum
Min. Minimum
No. Number
PPE Personal Protective Equipment
REDU Retrievable Electrical Distribution Unit
ROV Remotely Operated Vehicle
SIT Site Installation Test
UNS Unified Numbering System for Metals and Alloys
V Volt
5 SPECIFICATIONS

The following is a basic specification for DigiTRON ROV connectors utilized in the REDUs. Actual product may vary. Please refer to product specific data sheet(s), website [www.siemens-energy.com](http://www.siemens-energy.com) /search Subsea, or contact Siemens Energy Technical Support at [connectortechnicalsupport.gb@siemens-energy.com](mailto:connectortechnicalsupport.gb@siemens-energy.com) for more detailed information.

General specification of the product is listed in section 2.2. ROV operated Connector Specification

5.1 Connector Specification – ROV type

<table>
<thead>
<tr>
<th>Misalignment Type</th>
<th>4 &amp; 7-way</th>
<th>12-way</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rotational (0º)</td>
<td>±15º</td>
<td>±15º</td>
</tr>
<tr>
<td>Radial</td>
<td>±20mm (0.787&quot;)</td>
<td>±20mm (0.787&quot;)</td>
</tr>
<tr>
<td>Angular</td>
<td>±20º</td>
<td>±20º</td>
</tr>
</tbody>
</table>

| Mate force        | <300N (67 lb) | <500N (67 lb) |
| De-mate force     | 240 – 360N (54 – 81 lb) | 480-800N (54 – 81 lb) |
| Maximum mate and de-mate speeds | 1 m/s (3.3 ft/s) | 1 m/s (3.3 ft/s) |

<table>
<thead>
<tr>
<th>Overload withstand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Axial load</td>
</tr>
<tr>
<td>Bending load</td>
</tr>
<tr>
<td>Torsion load</td>
</tr>
</tbody>
</table>

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

**Table 4 DigiTRON ROV 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 topside 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.

Unrestricted
6 PREPARING PRODUCT FOR USE OR STORAGE

6.1 Product protection and packaging

The REDU is designed to withstand vibration that occurs during transportation. The REDU is manufactured primarily from 316L stainless steel (UNS S31603), and as such is designed to withstand harsh environments. However, if not adequately protected, the connector inserts and exposed parts are susceptible to mechanical damage. Transport caps are fitted to all DigiTRON connectors before transport, but topside protective caps will be fitted if specified by the customer. Care should be taken to protect the connectors with bubble wrap or similar wrapping materials to avoid surface damage during transit.

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

6.2 Lifting

Never attempt to lift the assembly or any part of it manually. Always use a crane or other suitably rated lifting device.

Typically, the REDU box is equipped with two ROV compliant lifting eyes. These two lifting eyes are to be used to secure buoyancy aids when deployed; they may also be used for handling of the REDU box prior to deployment. Ensure the lifting eyes have been assembled and fixed in the correct orientation as shown on the relevant assembly drawing (Figure 4).

The ‘T’ bar handle should not be used as a sole lifting point until the assembly is Subsea and should only be used to lift the REDU Box from the base plate (Figure 4).

Figure 4 REDU lifting points
The REDU box and base plate are NOT to be lifted as a single assembly; there is no locking feature between the base and the main body. Utilize the two lifting bolts on the REDU box and the 4 lifting eyes on the Base assembly during any handling manoeuvre.

6.3 Unpacking

Remove wrapping material taking care to inspect for any surface damage or items that may have become separated from the product.

For parts supplied individually and wrapped in materials, do not use a knife to cut the wrapping material, as this may cause damage to any elastomeric parts or painting of the product.

Do not remove transport or topside protection caps until the REDU is ready for installation.

6.4 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 Topside Protective Cap (Figure 13), 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 saltwater on the products.
6.4.1 Short term storage

Refer to Figure 5. Prior to subsea installation, the connectors (1) and compensators (2) 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 the connectors should be protected by transport caps or topside protection caps. Transport caps or topside protection caps to be removed prior to deployment.

No carbon steel must be present in the storage of the products to avoid contamination of the stainless steel.

The fluorescent pigments used in the Aquasign® labels (3) are susceptible to fading when exposed to direct sunlight. It is therefore essential that the protective covers supplied with the labels are only removed prior to deployment.

Transport Cap or Topside Protection Cap (5) for the Stab Plate Connector (Dummy Connector) on the Base to be removed prior to deployment. The protection caps should be removed as late as possible prior to the Box being installed onto the Base. The Locking Caps (4) are supplied together with the Base.

**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.
6.4.2 Long term storage

The product must be stored in a clean dry area and should be kept in the packing box. Transport caps or topside protection caps must be fitted, 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 connectors and Aquasign® labels should be protected from strong sunlight and strong artificial light with a high ultra violet content.

| 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. |

6.4.3 Repackaging to prevent damage in transport

In the event of a requirement to return the REDU back to Siemens Energy, the REDU should be transported back in its designated transportation Box. Transport or topside protective cap should be 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. Contact Siemens Energy Technical Support connectortechnicalsupport.gb@siemens-energy.com to discuss details of typical boxes.

6.4.4 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.

7.1 Cathodic protection

The REDU and base plate assembly has been manufactured primarily from 316L stainless steel (UNS S31603) and must be connected to the host structures CP (Cathodic Protection) system at all times using the leads provided. Once installed, the REDU box is connected to the CP system via the REDU base and does not need additional CP connections to be made.

ROV Connectors in the REDUs are designed to operate isolated from the CP (Cathodic Protection) system. The ROV connectors are isolated from the main body of the REDU and should not be connected to the CP system.

7.2 REDU

Prior to deployment, remove the protective cover from the Aquasign® Labels and remove transport or topside protective caps from connectors.

If any connectors are to be left unmated in seawater for any length of time, dummy connectors or subsea environment caps must be used to protect the pin contacts in the receptacle connectors (see section 9.4.2). If the Base is to be deployed for a long period of time without REDU box, then the Protection Cap (Figure 5, item 5) must be deployed with the Base.

**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 caps or dummy connectors must be used 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 socket contacts. Plug connectors require only subsea protective cap, not a dummy connector for protection. It is good practice to always fit transport cap or topside protective cap when a connector is unmated topside prior to deployment to provide mechanical protection.
7.2.1 Testing of REDU

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 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.

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**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.

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**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 if 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 may 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.

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Below are some images of standard Siemens Energy test connectors.

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Figure 6  Dry (topside) test connectors, ROV, Diver and Stab-plate type
Alternatively, a standard subsea connector (e.g. Figure 7) 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 7  Example of standard subsea connector (shown untailed)

7.3 Base plate installation

The standard base plate is supplied with 6-off M10 x 40mm socket head cap screws. Torque to 35Nm (25.8 lbf.ft) and apply a spot of Loctite 243 to the threads during installation (other fixing options are available upon request).

Mount the base plate in a horizontal position, ensure that the floating spring mounted stab plate connector hose assembly (or dummy connector) is not constrained in its movements and that the connector is aligned at 90 degrees to the base plate. It is integral to the design that the connector must be allowed to float so that misalignment tolerances can be accommodated.

The Aquasign® Labels utilized on this product are antifouling, providing exceptional long-lasting resistance to all forms of marine growth.

The Locking Caps (item 4 in Figure 5) are supplied together with the Base. To avoid losing the Locking Caps, Siemens Energy advise that the customer ties the Locking Handles onto the Base Plate Lifting Eyes allowing enough wire length (ref. to Figure 5) to enable locking / unlocking and removal. If the Base is to be deployed without the REDU Box, the Locking Caps should be fitted to the Base during deployment but MUST be removed prior to the REDU Box being installed onto the Base.
7.4 Mate/de-mate of REDU box to REDU base plate

To complete a safe and successful mate/de-mate of the REDU Box to or from the Base Plate, the assembly must be horizontal to the vertical lift (optionally with the use of buoyancy aids). The maximum angular displacement must not be more than the maximum misalignment values shown in Table 5. The values stated relate to the offset between the primary location pin and the stated misalignment type.

<table>
<thead>
<tr>
<th>Misalignment type</th>
<th>Values – refer to Figure 9 to Figure 12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horizontal</td>
<td>5° above the horizontal plane</td>
</tr>
<tr>
<td>End View</td>
<td>+/- 5° from the vertical plane</td>
</tr>
<tr>
<td>Plan View</td>
<td>+/- 3° from the centre line of the primary guide post</td>
</tr>
<tr>
<td>Cone to Pin Concentric</td>
<td>Within a 35mm (1.38&quot;) radius of the centre of the primary guide post</td>
</tr>
</tbody>
</table>

Table 5 Maximum misalignment values REDU box to Base plate

Make sure that the Protection Cap (if applicable) for the stab plate connector on the base plate is removed prior to mating. Ensure the Protection Cap is retrieved.

Prior to mating the REDU box, make certain that the stab plate connector located in the base plate is at 90 degrees to the base plate.

Make sure that Locking Caps are removed from the posts prior to mating (if fitted on the posts earlier). And make sure that the REDU Box is locked correctly with Locking Caps after being mated onto the Base Plate (see Figure 8).

Figure 8 REDU box locked on the Base plate

To locate / land on both guideposts, the REDU box must be no more than +5 degrees above the horizontal plane and +/- 5 degrees from the vertical plane and within +/- 3 degrees between the centrelines of the guideposts (see Figure 9 to Figure 12).
Figure 9  Misalignment 5° above the horizontal plane (Partial section showing engagement)

Figure 10  Misalignment 5° from the vertical plane (Partial section showing engagement)
Maximum cone to pin misalignment: Figure 12 shows that location cone has a maximum allowable radial misalignment of 35mm (1.38") around the vertical axis of the Guideposts.
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 REDU
- 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>
</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>
</tbody>
</table>

Table 6 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 de-mate cycles.

There are no user serviceable parts in the REDUs. 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

<table>
<thead>
<tr>
<th>Caution. Risk of material damage, corrosion of the exposed male pin in the receptacle connector.</th>
</tr>
</thead>
<tbody>
<tr>
<td>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.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Caution. Risk of material damage. Under no circumstances must the contact pins in the receptacle connector be exposed to seawater with power on.</th>
</tr>
</thead>
<tbody>
<tr>
<td>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.</td>
</tr>
</tbody>
</table>

| 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
Topside caps can simply be pushed on or removed by hand. They should not be deployed subsea.

- Transport cap: Supplied with the connector to protect it against damage during transport (Figure 13)
- 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 13)
9.4.2 Subsea caps

- **Subsea Protective Caps**: Provides mechanical protection to the plug or receptacle connector (Figure 14). 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 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 15). 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 15). These 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.

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![Figure 13 ROV-type Transport Caps (left) and Topside Protective Caps](image)

**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.

![Figure 14 ROV-type Subsea Caps](image)

![Figure 15 ROV-type Subsea Environmental Cap and Dummy Connectors, flying and flanged types.](image)
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 de-mated while electrically energised. Depending on the type of electrical load, the following advice should be followed.

| **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. |
| **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 calcite growth from DigiTRON connectors or the REDU, a solution of 50% Citric Acid is recommended. All seawater exposed elastomeric materials in DigiTRON 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. Wear appropriate hand and eye protection when handling the 50% citric acid solution. |
| **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 7.2.1.

9.8 Checks before mating the connectors
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 16 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 lip seal will not be visible, and connection should look like as shown in Figure 16.

If 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
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.

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 17.

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

**Warning.** Risk of musculoskeletal injury from hand-mating or de-mating connectors.

- Referring to the mate / de-mate forces specified herein, ensure suitable manual handling precautions are taken and the topside de-mate tool is used.
- Ensure all product testing activities are completed by competent persons in accordance with relevant procedures.
10    CUSTOMER COMMENTS/FEEDBACK

Please complete the Sign Off section at the bottom of form to confirm each page of this document has been read and complied with in full.

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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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Sign Off Section

Please e-mail completed form to the Product Safety Officer at the following address:
subsea.connectors.productsafty.gb@siemens-energy.com