

# SIEMENS

Tronic, a Siemens Subsea Business

**Document No:**  
**IOM-007**

**Title:**  
**IOM – TC3A-107 and Similar EDUs**

Installation, Operation & Maintenance Manual  
For  
**TC3A-107 Disconnectable junction box  
and associated diver EFL'S and similar EDUs.**

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REV	SECTION	CHANGE DESCRIPTION
01		INITIAL RELEASE
02		Updated for use with similar EDUs

## Document Holds

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## 1. INTRODUCTION

This manual details procedures for the following:

Installation Operation and Maintenance of disconnectable junction box TC3A-107 and similar EDUs

## 2. SCOPE

This manual Includes details of installing a DigiTRON disconnectable junction box and its associated connecting EFL's with diver installable connectors.

Electrical and mechanical specification of connectors and hose is also detailed in this document.

**The back page includes a sign off point which must be completed by the user of this manual.**

Any information, records or Health and Safety feedback that needs to be detailed can be recorded in the punch list at the rear of the document.

Sensor installation shall be covered by manufacturer specific procedures.

## 3. ABBREVIATIONS

<b>A</b>	<b>Ampere</b>
<b>AC</b>	<b>Alternating Current</b>
<b>Assy</b>	<b>Assembly</b>
<b>API</b>	<b>American Petroleum Institute</b>
<b>AWG</b>	<b>American Wire Gauge</b>
<b>BOM</b>	<b>Bill of Material</b>
<b>°C</b>	<b>Degree Celsius</b>
<b>CE</b>	<b>Community European</b>
<b>Comms</b>	<b>Communication Signal</b>
<b>CP</b>	<b>Cathodic Protection</b>
<b>DC</b>	<b>Direct Current</b>
<b>DWG</b>	<b>Drawing</b>
<b>EFL</b>	<b>Electrical Flying Leads</b>
<b>FAT</b>	<b>Factory Acceptance Test</b>
<b>IR</b>	<b>Insulation Resistance</b>
<b>ISO</b>	<b>International Organization for Standardization</b>
<b>ITP</b>	<b>Inspection Test Plan</b>
<b>K</b>	<b>Kelvin</b>
<b>LTC</b>	<b>Long Term Cover</b>
<b>M</b>	<b>Metres</b>
<b>Max.</b>	<b>Maximum</b>
<b>MFG</b>	<b>Manufacturer</b>
<b>Min.</b>	<b>Minimum</b>
<b>No.</b>	<b>Number</b>
<b>ROV</b>	<b>Remotely Operated Vehicle</b>
<b>SI</b>	<b>Standard International</b>
<b>SRT</b>	<b>Site Received Test</b>
<b>SST</b>	<b>Stainless Steel</b>
<b>TBD</b>	<b>To Be Defined</b>
<b>TSP</b>	<b>Twisted Screened Pairs</b>
<b>UNS</b>	<b>Unified Numbering System for Metals and Alloys</b>
<b>V</b>	<b>Volt</b>

#### 4. HEALTH AND SAFETY

Manual Handling, Lifting and Carrying are known to be the largest contributors to occupational ill-health.

Ensure that mechanical handling aids are used whenever 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.

Good Housekeeping avoids Slips Trips and Falls, keep your area clean and tidy.

It is the operator's responsibility to comply with current Company & regional health and safety legislation.

Caution shall be exercised during assembly to ensure that fittings and hydraulic / pneumatic equipment are properly installed.

In the event of a safety incident or any safety improvement suggestions please contact the Health and Safety Department at [prodsafe.gb@siemens.com](mailto:prodsafe.gb@siemens.com) and/or complete and return the punch list in section 16.

#### 5. PROTECTION, HANDLING AND SHIPMENT (INCLUDING FROM CUSTOMERS)

Siemens Subsea connectors are manufactured primarily from materials such as 316L stainless steel (UNS S31603), and Super Duplex stainless steel (UNS S32550), and as such are designed to withstand harsh saliferous environments. However, the connector insert and exposed parts are susceptible to mechanical damage if not adequately protected. Dust caps are fitted to all Tronic connectors before transport, but can be fitted with protective caps if specified by the customer. Caps are recommended to remain in place until connectors are deployed subsea.

The connectors are generally relatively small items of equipment, and therefore, can be shipped singularly or in multiples. Care should be taken to protect the connector with either Instapak (or similar), bubble wrap or similar wrapping materials to avoid surface damage during transit. If large numbers are shipped in one consignment a suitably reinforced box will be necessary to withstand the weight. Protection caps must be fitted at all times during transport.

#### ACCEPTABLE PACKAGING FOR SHIPMENT



Instapak (or similar)



bubble wrap (or similar)

#### UNACCEPTABLE



If storage is carried out in saline conditions, e.g. on a ship's deck or hold, then full dummy connectors should be used.

The junction box must be secured in a dedicated transit box and always remain in a horizontal position to prevent risk of damage to the diaphragms.

If storage is carried out in saline conditions, e.g. on a ship's deck or hold, then full dummy connectors should be used.

The following bend radii are recommended for storage/transport of hoses.

AquaTRON 50, TC6A-700 – Minimum inside bend radii - 125mm

AquaTRON 75, TC6A-712 – Minimum inside bend radii - 180mm

Connectors are designed & qualified to withstand vibration that occurs during transportation and to withstand being dropped from a height of 1m whilst in packaging.

Any connector-specific handling and transport advice is contained within the appropriate section further on in this document.

Ensure that mechanical handling aids are used whenever possible to avoid manual handling.

## **6. UNPACKING**

Remove wrapping material taking care to inspect for any surface damage or items that may have become separated from the unit. 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 protection caps until connectors are ready for installation. On removal do not allow the hoses to drag over the edges of the packing crate.

Connectors/Equipment supplied in boxes must be stored in the box.

## **7. STORAGE**

### **7.1 Short Term Connector 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 their protective wrapping material or similar. Protection caps must be fitted if supplied.

No carbon steel must be present in the storage of the products.

Please note; maximum storage temperature takes into account solar gain. Skin temperature must not exceed 70°C. Suitable protection must be used to ensure maximum storage temperature is not exceeded.

### **7.2 Long Term Connector Storage**

The 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. Humidity of the store room should be below 75%. Very moist or very dry conditions should be avoided. The Plug connector should be protected from strong sunlight and strong artificial light with a high ultra violet content. The connectors should not be allowed to come into contact with solvents, oil, greases or any other semi-solid materials. If glanded connectors are to be stored bolted into their interfaces ensure the cable entry point into the gland is covered to prevent water ingress.

No carbon steel must be present in the storage of the products.

Please note; maximum storage temperature takes into account solar gain. Skin temperature must not exceed 70°C. Suitable protection must be used to ensure maximum storage temperature is not exceeded.

### 7.3 AquaTRON Oil Tube Storage

Storage temperature range: -40°C to 70°C

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

Maximum 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.

### 7.4 Long term storage of elastomers

For the recommended storage of elastomeric components e.g. termination sleeves and cable boots, please refer to Tronic document MH006 - Procedure for Storage and Handling of Elastomeric Materials.

## 8. ELECTRICAL FLYING LEADS DESIGN

The EFL's associated with this assembly are completely independent and are fitted with Diver installable connectors at each end. All EFL'S are oil filled, pressure compensated and are supplied complete. They are used to connect various subsea equipment.

All EFL'S should be retrievable and when installed should not cross-over each other.

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

All mild steel sealing surfaces shall be inlaid with Inconel 625, or similar, with no additional protection (e.g. CP, Paint etc.) required. This is to prevent localised pitting of the interface.

If the connectors are to be left unmated, in seawater, for any length of time 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 do not require full dummy connectors for protection. Tronic 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.

**NOTE: 28 DAYS IS THE MAXIMUM CUMMULATIVE ALLOWABLE EXPOSURE OF UNPROTECTED CONTACT PINS TO SEAWATER OVER THE LIFE OF THE CONNECTOR. THIS ONLY APPLIES WITH POWER OFF.**

## 9. CATHODIC PROTECTION

EDU is equipped with external earth straps to provide CP protection to each connector installed on the junction box. 2 off earth straps are also provided to be fitted to the mounting bracket and the host structure that is providing a CP connection



Stainless steel 316L (UNS S31603) diver mate connectors must be connected to the CP (Cathodic Protection) system at all times. Super Duplex stainless steel (UNS S32550) connectors should be isolated from the CP system to reduce the possibility of hydrogen embrittlement.

## 10. INSTALLATION & DEPLOYMENT

### Tools Required for installation

1. Allan keys 5mm and 6mm
2. ¼ inch drive torque wrench 0-25 Nm – with 5mm and 6mm Allan key drive

### 10.1 Pre – installation checks for EFL's and EDU

The following section details installation & deployment of Electrical Flying Leads and the EDU.

- Check tagging and any label information is correct according to Project tagging document.
- Ensure all equipment has passed Site installation Test.
- Make sure prior to installation a final visual inspection of the equipment is completed.
- No part of the connectors should be dismantled prior to or during deployment, apart from the removal of protective caps, since there are no user serviceable parts inside.
- Any defects need to be recorded on the punch list at section 16 of this document and where possible take photos of any issues that need to be recorded and inform Technical Dept.
- Before mating, the receptacle connector should be checked for debris. 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.
- Before mate / demate all power is to be switched off – The DigiTRON range is designed to be mated with POWER OFF. In exceptional circumstances it is possible to mate the connectors with power on but the following is to be considered:

**Note:**

**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.**

### 10.2 Installation of Junction box and mounting brackets

- The junction box is designed to be mounted and deployed in a horizontal position only .
  - It is critical the brackets for the junction box are installed as identified on DRG T31014
1. Drill interface holes as required for installation as per drawing T31014 sht 1.  
4-off M8X1,25-6H TAPPED HOLES MIN THREAD LENGTH 40mm  
Or  
4-off M8 THRO' HOLES – (Client to provide nuts for thro hole fitting option).  
**See fig 1 & 2 which highlight dimensions from drg T31014 sht1 for hole centres (images provided for reference only.)**



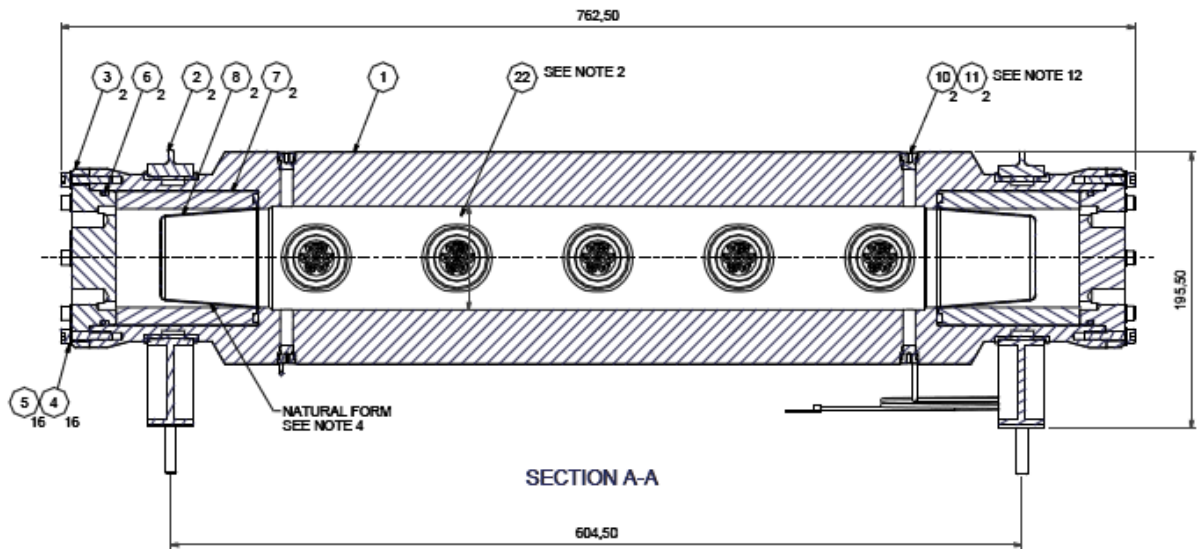


Figure 1 (ref) – Indicates distance of 604.50mm for mounting interface hole positions (tol. +/- 0.25mm)

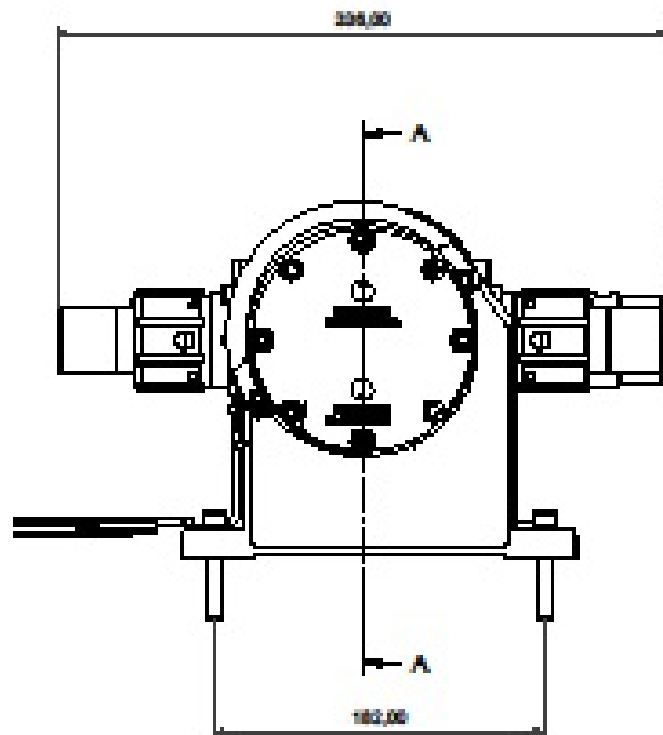


Figure 2 (ref) – Indicates distance of 182.00mm for mounting interface hole positions (tol. +/- 0.25mm)

2. Drill interface holes for CP connection in mating structure for 2 x earth straps (supplied length max 1 meter).  
2 off M8X1,25-6H TAPPED HOLES MIN THREAD LENGTH 20mm. See fig 3

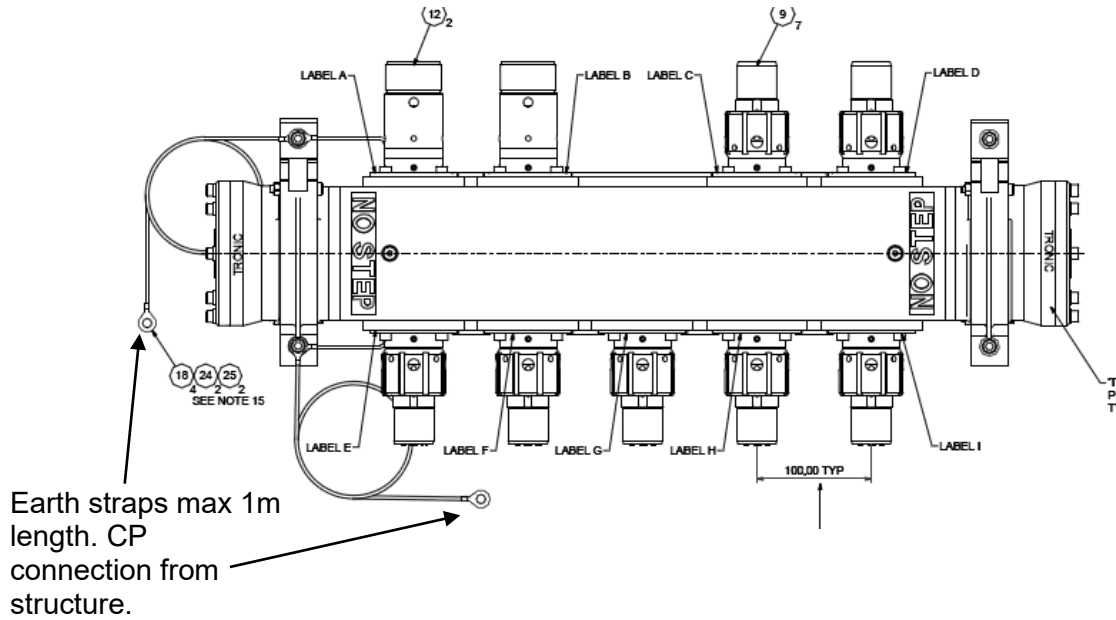


Figure 3 – Highlighting length of earth straps for CP connection to structure.

3. The mounting brackets and junction box are required to be installed together due to the earth strap arrangement securing under the fixing bolts for the mounting brackets. See fig 4.

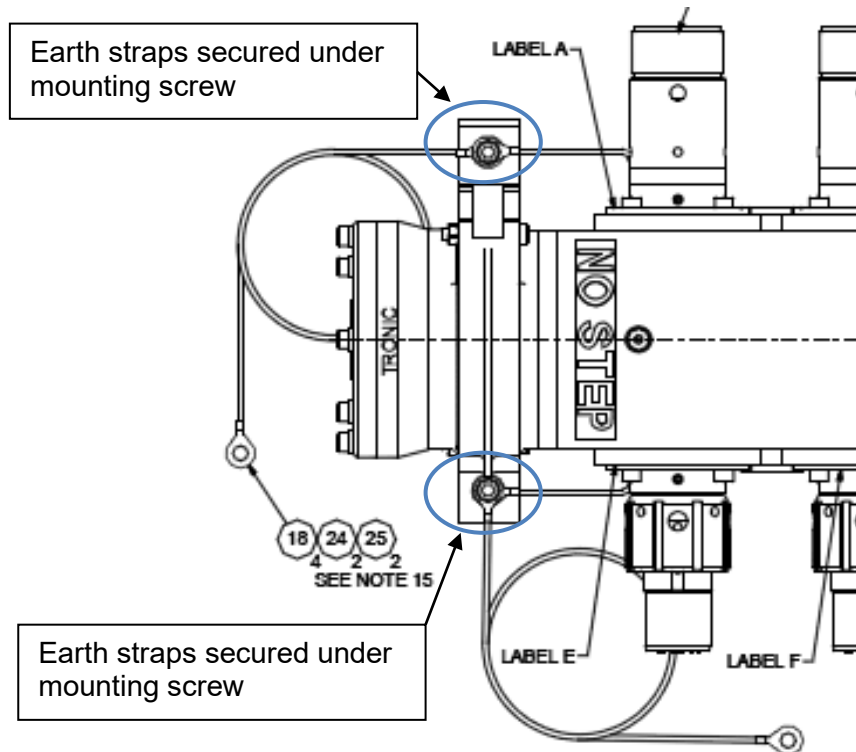
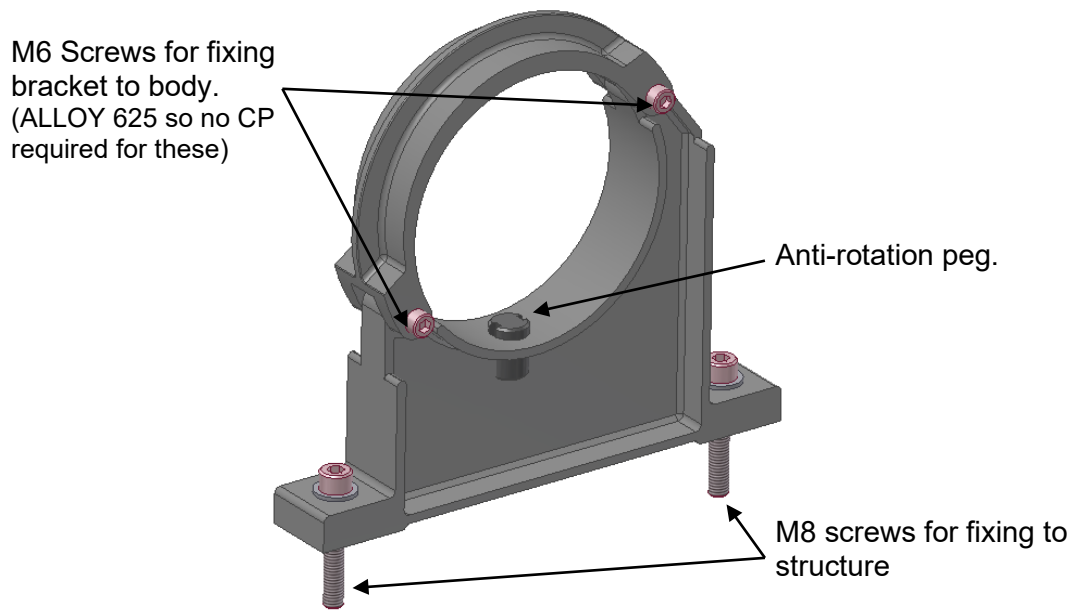


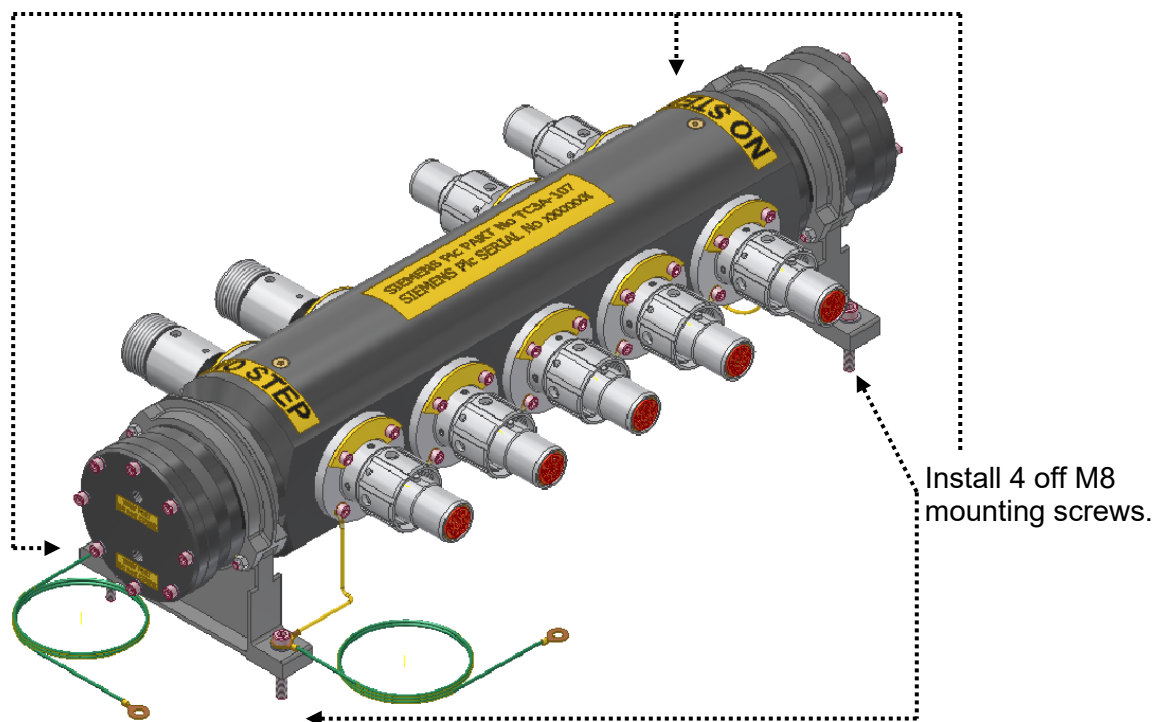
Figure 4. Image to show earth straps secured under bracket mounting screws

4. In the event that the brackets are not installed 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 is to be situated on the underside of the unit and locates into a recess in the body. Tighten the M6 fasteners to 3.5Nm to complete the bracket installation. See fig 5



**Figure 5. Mounting bracket assembly**

- Secure the mounting brackets to the structure via the previously drilled interface holes identified in step 1. Install with the 4 x M8\*40 screws and 4 x M8 washers provided  
**Note: Fit the earth straps under the required mounting screws and torque to 10Nm.** See Fig 6



**Figure 6. ISO view of box indicating mounting screw positions for reference.**

- Route and fit CP connecting earth strap to structure via the previously drilled interface holes detailed in step 2 and secure with 2 off item SC-M8\*20 cap head screws fitted with the supplied M8 washers torque to 10Nm.

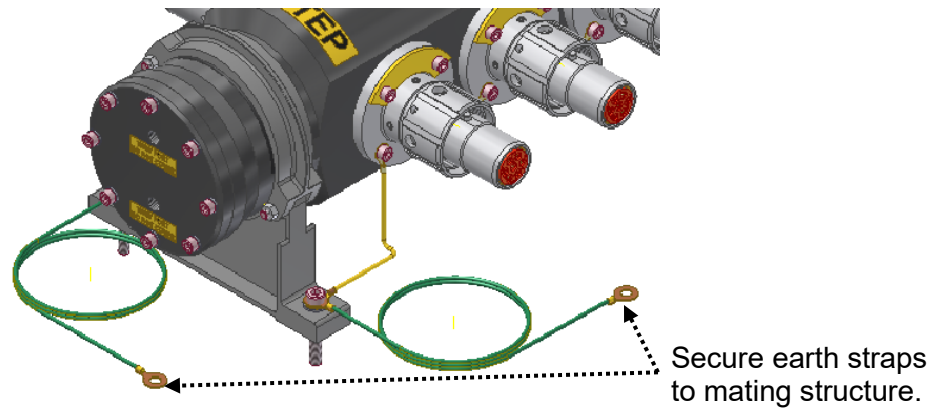


Figure 7. Shows earth straps for to be secured to mating structure.

7. Ensure mounting brackets are secure and the junction box is orientated correctly with any required protective caps still installed. The Junction box is only designed to operate in a **fixed horizontal position** only. This completes the installation of the Junction box.

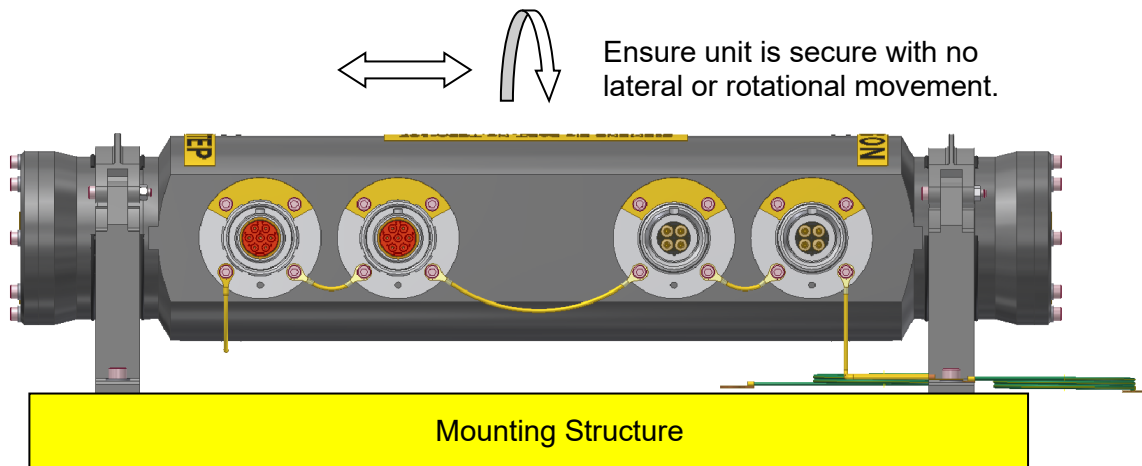


Figure 8. Shows junction box installed on structure

## 11. INSTALLATION OF EFLS

The following section will provide information for the correct installation of the required EFL's.

### 11.1 Equipment required

- A 2-3" C-spanner or purpose made Tronic tool (T11367) may be used.

## 11.2 Live Mate / De-mate

### 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. 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.

#### Note:

**The maximum number of live mate / demate operations under the above conditions is ONE only.**

**NOTE: 28 DAYS IS THE MAXIMUM CUMMULATIVE ALLOWABLE EXPOSURE OF UNPROTECTED CONTACT PINS TO SEAWATER OVER THE LIFE OF THE CONNECTOR. THIS ONLY APPLIES WITH POWER OFF.**

## 11.3 Diver connectors

- **Alignment**

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.

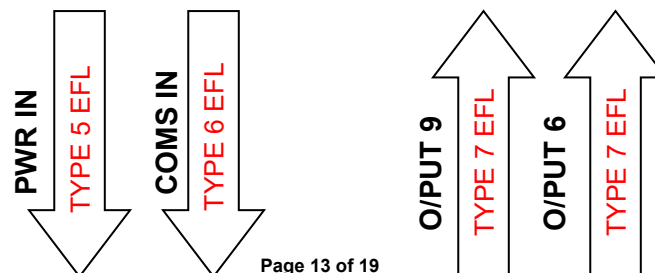
- **Pre Mating Check**

Before mating remove any protective caps, the connectors should be checked for debris. The connectors have been designed to accommodate sand and silt contamination, however large pieces of debris should be removed using a water jet as per section 15.3

- **Check EFL location/position**

Prior to mating the EFL with the corresponding mating connector, Check the tagging label on the efl corresponds to the connector label identified on the junction box to prevent any cross connection.

### Schematic provided for EFL installation



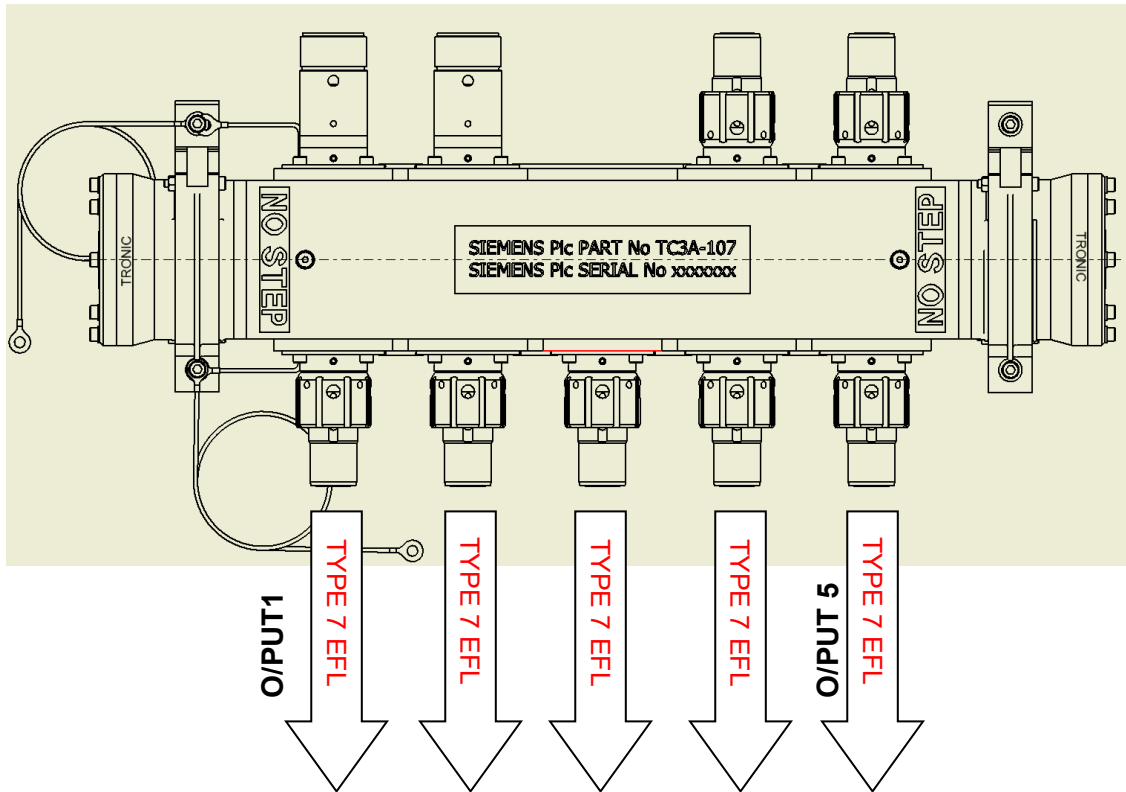


Figure 9 – EFL Schematic

- **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 required this **MUST NOT** exceed 15 ft-lbs. [20Nm]. A 2-3" C-spanner or purpose made Tronic tool (T11367) may be used to apply this torque.

- **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.

- **Cathodic Protection**

Stainless steel 316L (UNS S31603) diver mate connectors must be connected to the CP (Cathodic Protection) system at all times. Super Duplex stainless steel (UNS S32550) connectors should be isolated from the CP system to reduce the possibility of hydrogen embrittlement.

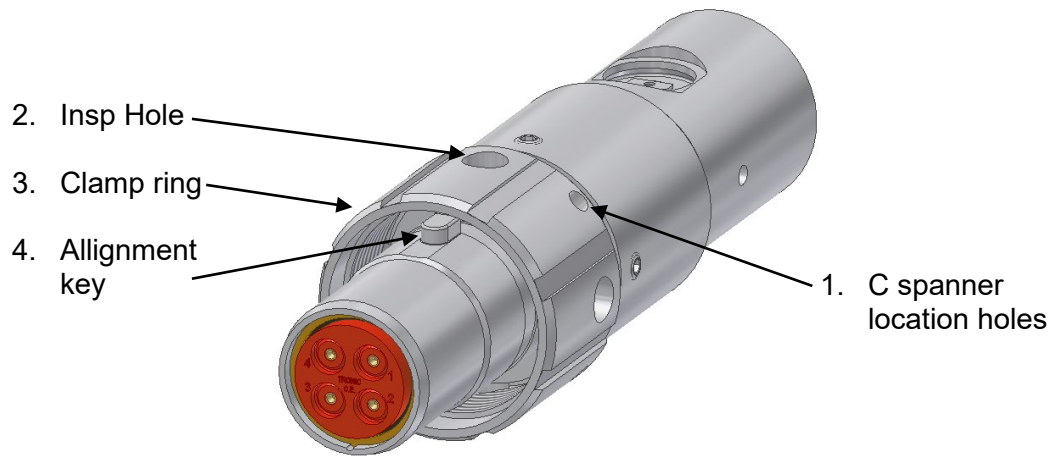


Figure 10

Image to show inspection holes, clamp ring, C-spanner location holes and alignment key on a diver plug connector.

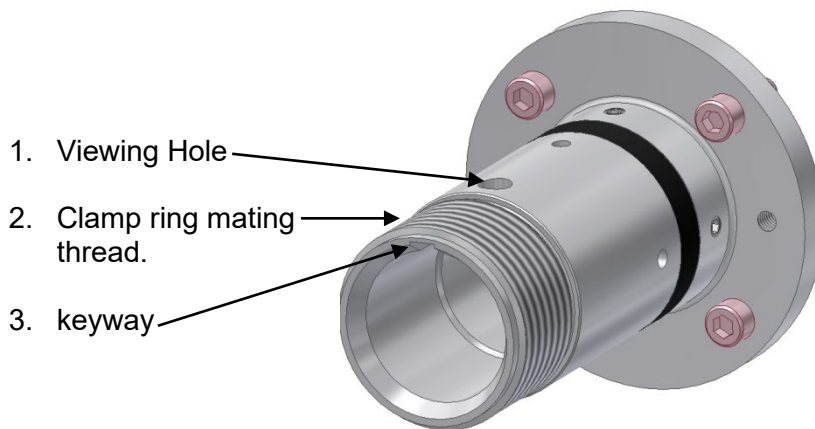


Figure 11

Image to show inspection hole, clamp ring mating thread, and keyway on a diver receptacle connector.

## 12. TESTING OF EFL'S

- 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 warranty of the connector.



- Guide pins must never be removed from test connectors as this can lead to damage and will invalidate the connector warranty.



Figure 12 . Tronic test connector examples

- To perform any testing refer to specific project documentation for details of procedures.

**NOTE: No part of the connectors should be dismantled prior to or during deployment, apart from the removal of protective caps, since there are no user serviceable parts inside.**

### 13. DIGITRON + CONNECTOR SPECIFICATION

#### Electrical and Mechanical

Maximum current (dry topside)

4-way = 18A

7-way = 14A

12-way = 11A

Maximum current (submerged)

4-way = 35A

7-way = 22A

12-way = 20A

Maximum working voltage: 1000V rms phase to earth, 2000V rms phase to phase

Rated number of operations: 1000 mate / de-mate cycles (Power off)

Working pressure: 5800 psi (13,123 ft / 4000 metres water depth)

Working temperature range: -5 to +60°C

Onshore testing temperature range: -20°C to +50°C

Storage temperature range: -40 to +70°C

Please note; maximum storage temperature takes into account solar gain. Skin temperature must not exceed 70°C. Suitable protection must be used to ensure maximum storage temperature is not exceeded.

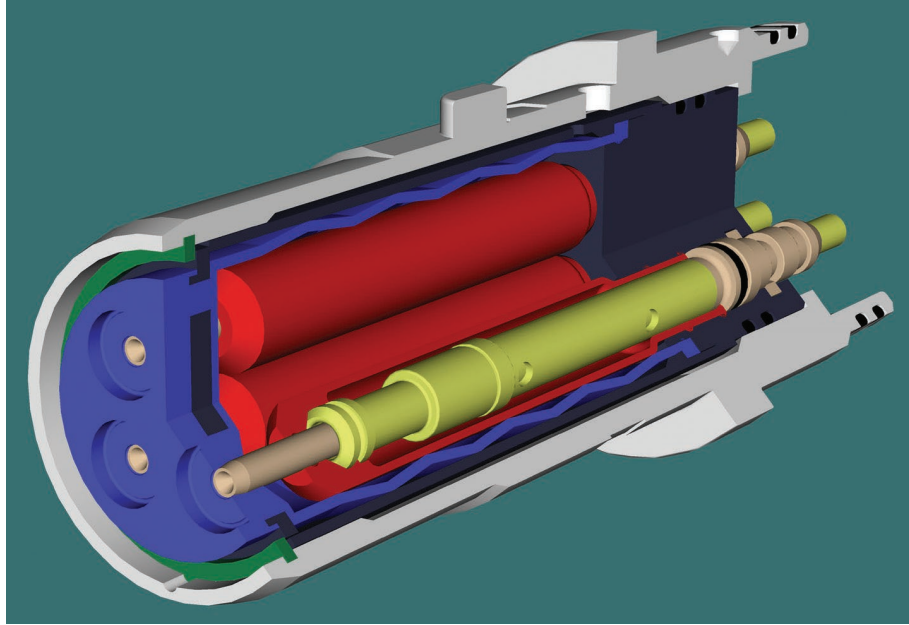


Figure 13  
View to show DigiTRON Front end assembly  
(Fully factory acceptance tested)

## 14. AQUATRON HOSE SPECIFICATION



Figure 14 – AquaTRON hose size 50 & 75

Design life: 30 years  
 External pressure: 0 to 400 bar (depth pressure)  
 Recommended fill pressure: 15 bar  
 Deployment rate: 10 metres / minute  
 Operational temperature range: -5°C to +55°C  
 Hose Burst Strength: 90 Bar  
 Max twisting of AquaTRON Hose: 180° per 5m length  
 Recommend hose be protected with tarpaulin sheet or equivalent if in direct sunlight.

Axial loads for AquaTRON oil tube

AquaTRON hose can withstand an axial load of 5000N. It has been tested to failure at 11000N. If cable ties are used leave loose on the hose. Do not compress.

Chemical Compatibility for AquaTRON oil tube

For chemical compatibility use with AquaTRON oil tube see qualification report TR-422 section 3.11 and ERP-001-06.

## 15. MAINTENANCE

All EFL'S are designed for Subsea immersion and require no maintenance while installed.

### 15.1 Protection of Receptacle Contact Pins

Under no circumstances must the contact pins in the receptacle connector be exposed to seawater with power on. If this situation does occur 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.

### 15.2 Over Current Capacity

Over current capacity for all DigiTRON connectors is 100A for 5 seconds at no more than 2 per hour.

