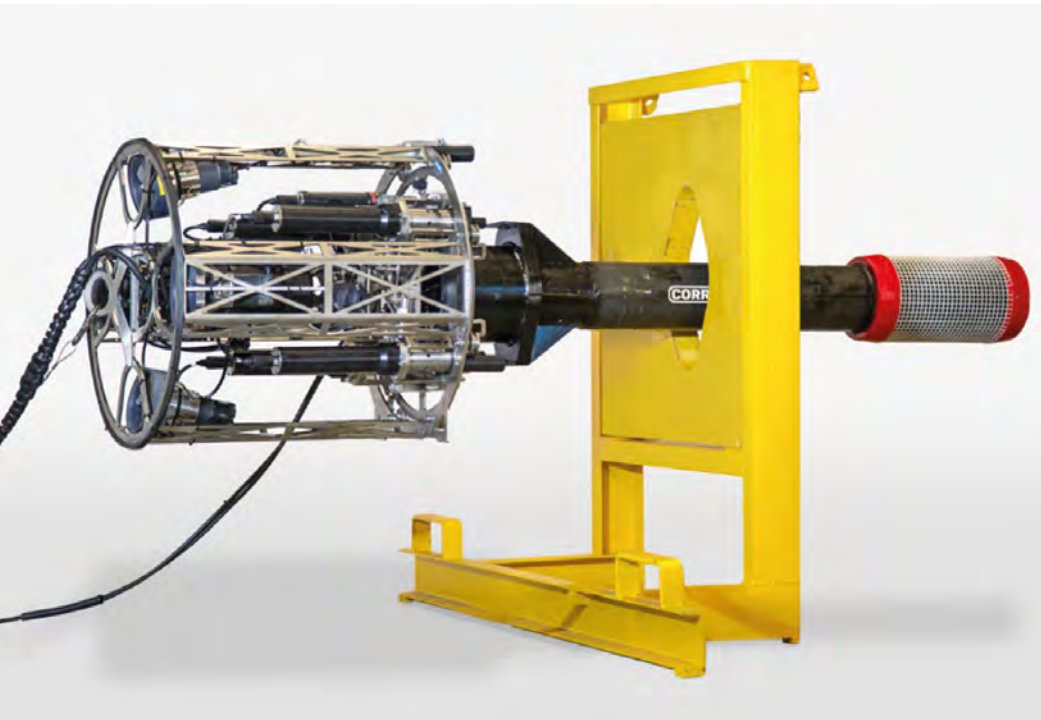


## ICCP-SAM



The ICCP-Subsea Assembly Method (ICCP-SAM) is an innovative anode installation tool specifically designed to install ICCP anodes from the inside of a monopile foundation in an easy and efficient way and suitable for any water depth.

**With increasing sizes of monopile foundations, corrosion protection is becoming more challenging. To achieve a adequate level of protection over the entire structure, the anodes need to be placed deeper down on the foundation. Placing these anodes externally comes with significant secondary steel structures and an installation process from more expensive installation vessels. Also the cables from the ICCP anodes still need to be pulled into the monopile, which comes with a risk of cable damage.**

With an outer diameter less than 800 mm, the anode + ICCP-SAM can be lowered vertically through typical oval hatches with minimum dimensions of 850 x 950 mm inside the monopile foundation.

The ICCP-SAM holds the ICCP anode firmly attached to the ICCP-SAM with hydraulic clamps. The setup can be controlled accurately by means of several thrusters, and the anode is locked in-place in the monopile wall by a simple rotation and a 4-bolt fixation.

### Installing the anode from inside out provides various benefits:

- The installation does not require a large and expensive installation vessels;
- There is no secondary steel requirement for installing the anodes;
- Significant workability increase as there is a little to none current inside the foundation;
- The cable remains fully inside the foundation, being protected from the elements.

# ICCP-SAM Configuration



The setup is build-up of the following components:

## ICCP-SAM Tool featuring

- 5 thrusters
- 4 torque motors
- Depth sensor
- Pitch and Roll sensor
- Lighting
- Electronic pods

## 50 metres of Umbilical comprising of

- Electrical umbilical
- 2 hydraulic lines

## Topside Control Box featuring

- On-board video screen
- Control PC incl. recording of video images
- Gamepad controller
- Power supplies and electronics

## Manual HPU featuring

- 1 L tank with handpump
- Accumulator
- Digital and analogue pressure sensor

## Software

Custom software has been developed to help the operator use the ICCP-SAM.

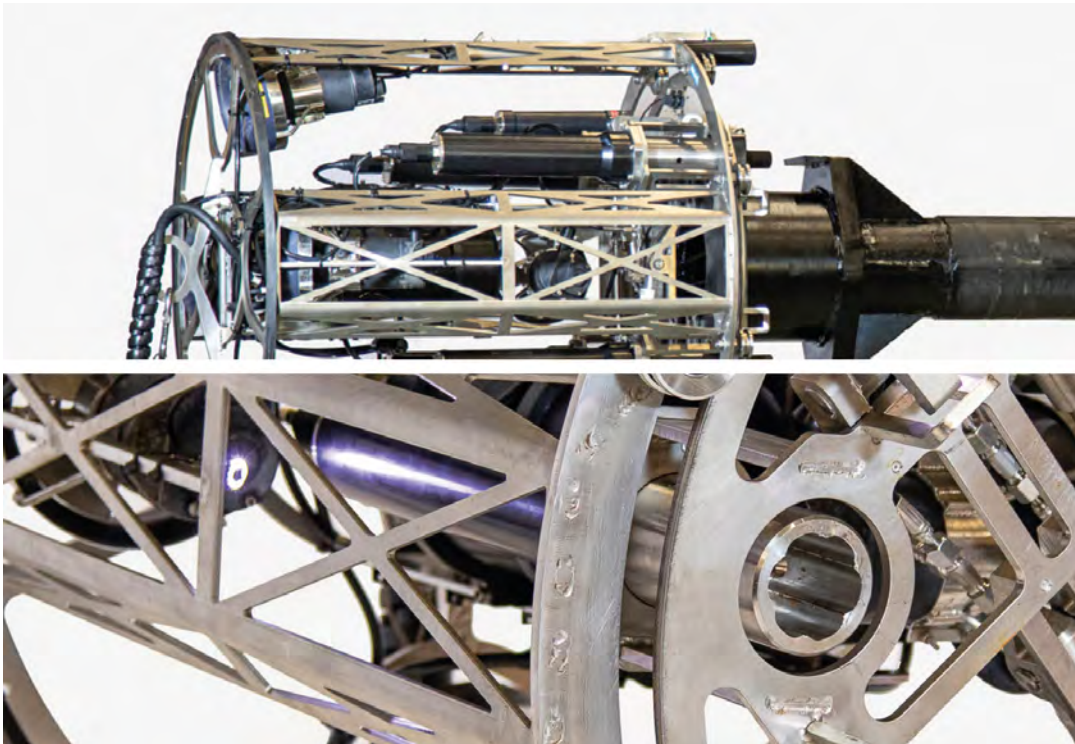
The software accurately controls thrusters, provides real-time information on pitch, roll, depth and further diagnostic information on torque motors and thrusters.



## Torque motors

The torque motors are developed specifically for the ICCP-SAM. They can output a maximum of 650 Nm whilst remaining compact.

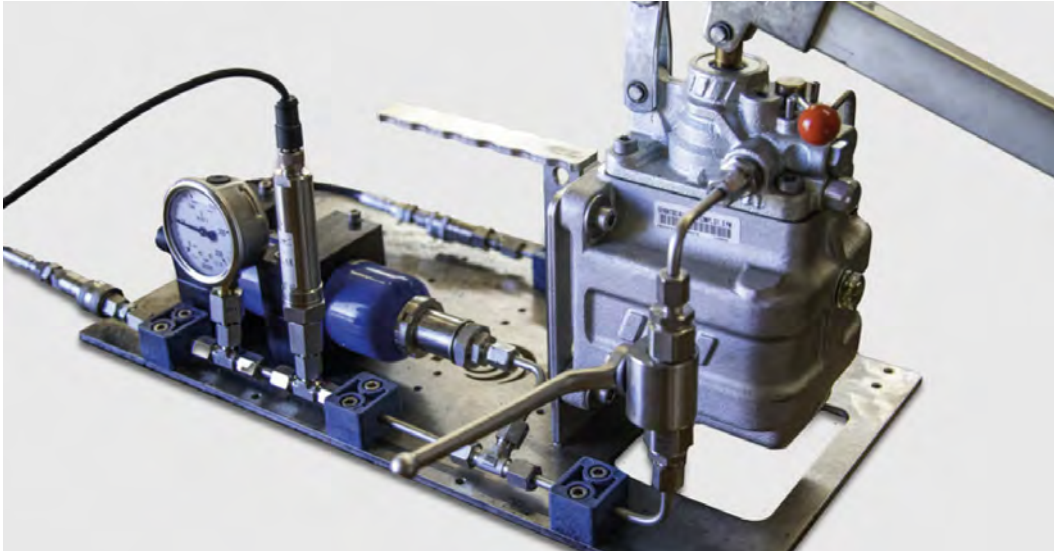
The torque of each motor can be set and monitored real-time and rotations are also monitored to determine the displacement of each bolt.



## Hydraulics

To keep the hydraulics simple and fail-safe, no subsea valves or pumps are included. A handpump topside does not require any electrics to work, and an on-board accumulator can account for any pressure drop.

Should the hydraulic pressure drop below a threshold, the digital pressure sensor will warn the operator that something is wrong so appropriate action can be taken.



## Power supply

The power supply of the system is single phase 230 VAC @32 A. The thrusters are powered by 2 individual power supplies distributed over separate power lines to accommodate for redundancy.

In case of a failure of a power supply, there is still a redundant supply allowing to control the tool with 50% of the power.

## Hand controller



# Specifications

## General Information

<b>Depth Rating:</b>	100 m
<b>Length:</b>	1,000 mm
<b>Diameter:</b>	780 mm
<b>Length with Typical Anode:</b>	2,900 mm
<b>Weight:</b>	130 Kg (fully assembled)
<b>Minimum Hatch Dimensions:</b>	850 x 950 mm oval

## Cameras

<b>3 x SD:</b>	1 front flying, 2 internal
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## Hydraulics

<b>1 L tank c / w Handpump:</b>	@50 bar
<b>Accumulator:</b>	
<b>Pressure Sensor:</b>	Analog and digital

## Thrusters

<b>250 VDC:</b>	4.5 A each
<b>Total of 5 kW of thrust:</b>	100 Kgf

## Topside

<b>Power 230 VAC:</b>	@32 A single phase
<b>Communications:</b>	CAN-bus and Ethernet Twisted pair optional

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