OPERATION AND MAINTENANCE MANUAL

BLUE LOGIC

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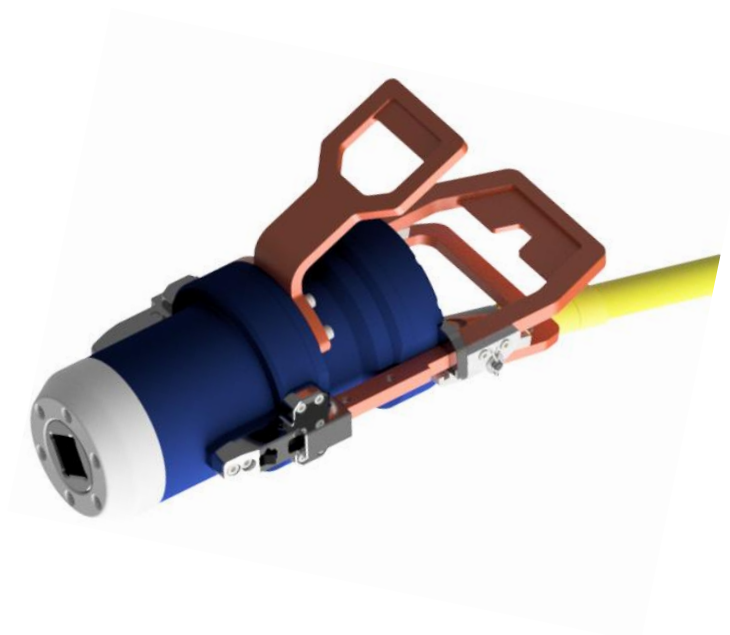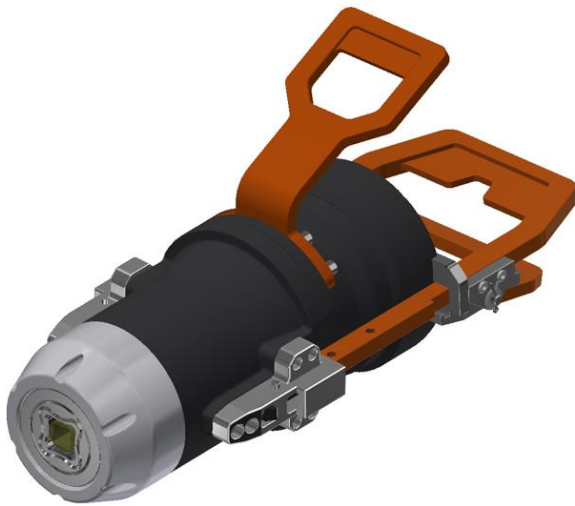
REVISION CHANGE/RECORD

REV	REASON FOR REVISION/ DESCRIPTION OF CHANGES
01	Document initiated for use. New software/GUI implemented.
02	Torque Tool with Auto Select added
03	Data for supply voltage updated and synchronized. Information for installation and use of hydraulic latch mechanism added. Datasheet and safety data sheet for gear-oil added as appendix.

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1. INTRODUCTION

1.1. PURPOSE AND SCOPE

The objective of this document is to present a comprehensive user manual for the Blue Logic standard Electrical Torque Tool, ELTT and Light Weight Electrical Torque Tool, LWETT. Relevant technical aspects for information and familiarization are covered as well as detailed technical data.
The Blue Logic Electrical Torque Tool Systems are designed as compact and accurate multipurpose Torque Tool System designed for all typical Subsea Torque Tool operations.

Note 1:
This manual is only valid for torque tools with the latest software/GUI implemented in 2022. For tools with old GUI version, reference is made to 600144-TD-0003.

Note 2:
Make sure that serial number on actual torque tool and label on PC corresponds. The Torque Tool can only be operated by the PC labelled with the correct TT serial number.

This OMM covers the following specific Torque Tool kits:

Art. No.:	Description:
BB3306	2,7kNm Torque Tool Kit
BA8949	2,7kNm Torque Tool Kit w.Inductive Connector
BB3151	2kW Subsea USB Kit for Electrical Torque Tool
BB3551	2,7kNm Light Weight El TT System for ROV/Diver/AUV
BC0454	2,7kNm Torque Tool wAutomatic Class Switch Kit

1.2. ABBREVIATIONS

ELTT	Electrical Torque Tool
ELTTS	Electrical Torque Tool System
LWETT	Light Weight Electrical Torque Tool
EPC	Electrical Power Can
GUI	Graphical User Interface
IC	Inductive Connector
OMM	Operation and Maintenance Manual
ROV	Remotely Operated Vehicle
TT	Torque Tool

EFR	Equipment Failure Report
CP	Cathodic Protection
PFC	Power Factor Control
CW	Clockwise
CCW	Counterclockwise

1.3. SYMBOLS

The following words and symbols found throughout this manual, highlights special messages to alert the operator of specific information.

WARNING: The equipment to which this manual applies must only be used for the purpose for which it was designed. Improper use or maintenance may cause damage to the equipment and/or injury to personnel. All users must be familiar with the contents of the appropriate manuals before attempting to install, operate, maintain or in any other way work on the equipment. Blue Logic AS disclaims any responsibility for damage or injury caused by improper installation, use or maintenance of the equipment.

CAUTION: The equipment to which this manual applies operates on high voltage and has the potential to results in death or severe injury if handled incorrect. The equipment should only be used by qualified personnel. The equipment contains no serviceable parts inside.

1.4. WARRANTY CONDITIONS AND GUARANTEES

It is the responsibility of the end user to make sure that the product is used in such a manner for which it is designed. This includes accounting for material/fluid compatibility, sour service, temperature, pressure rating etc.

When performing operation above water do not run tool on full load for prolonged periods. Consider water-cooling if operation is expected to take time. Consider ambient temperature.

1.5. REFERENCES

Latest version of the following documents

Id.	Doc. No	Originator	Document Title
/01/	BB3306	Blue Logic	2,7kNm Torque Tool Kit
/02/	BA8949	Blue Logic	2,7kNm Torque Tool Kit wInductive Connector
/03/	600128-TD-0013	Blue Logic	Operation and Maintenance Manual 2KW Subsea USB System
/04/	BB3151	Blue Logic	2kW Subsea USB Kit for Electrical Torque Tool
/05/	600144-TD-0008	Blue Logic	ETT Check List Mob/Demob
/06/	600144-TD-0024	Blue Logic	Operation and Maintenance Manual for Change Out Tool
/07/	BC0454	Blue Logic	2,7kNm El. Torque Tool wAutomatic Class Switch Kit

2. HEALTH, SAFETY AND ENVIRONMENT

Safety must always be the highest priority when performing operations, maintenance and tests when using the ELTT.
Personnel involved in the test/work operation shall be familiar with the contents of this document.

2.1. PERSONAL PROTICTIVE EQUIPMENT

The following minimum PPE must be worn when operating the ELTT.

Personal Protective Equipment
Protective glasses
Protective shoes
Protective gloves

2.2. QUALIFIACTIONS AND TRAINING

It is essential that all operating personnel have been given training and education, in how to operate and maintain the equipment as described in this manual.

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3. 2,7KNM TORQUE TOOL KIT

The Electric Torque Tool System is typically supplied in kits containing relevant equipment for use. Although client specific setup and/or kits can be agreed and delivered, there are two available standard kits. In one kit the ELTT is powered by an Electic Power Can (EPC), see Figure 1. In the other kit the ELTT is powered via an inductive Type- C connector, see Figure 9.

Figure 1: BB3306 Torque Tool Kit

The BB3306 kit consists of:

Item	QTY	Art No.:	Description
1.	1	BB3254	2700Nm Class 4 El Tool V2
2.	1	BB2985	ETT Control PC wGUI Software and Pelicase
3.	1	BB1086	Alu Box 240L incl. Foams
4.	1	BA7297	Class 4 Interface Socket Low Torque
5.	1	BA6615	Class 3 Interface Socket
6.	1	BA2951	Class 1 & 2 Interface Socket
7.	1	600144-TD-0003	Operation and Maintenance Manual Electric Torque Tool Class 1 - 4
8.	1	102860	Burton Dummy
9.	1	102354	Burton Test Cable

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Item	QTY	Art No.:	Description
10.	1	100499	Burton Pigtail
11.	1	BC0309	Compensator 0,5L Kit for 2,7kNm Torque Tool

*NOTE:
For rental tools, Item 10 Burton Pigtail, is regarded as consumables and will be invoiced if used in operation.

Figure 2: Electrical Torque Tool powered by EPC

3.1. TECHNICAL DESCRIPTION FOR ELECTRICAL TORQUE TOOL

The Blue Logic Class 1-4 Electrical Torque Tool (ELTT) is a module designed Torque Tool (TT). The ELTT is a compact, flexible, and robust precision tool for subsea and ROV operations.

The Blue Logic ELTT System combines all known advantages from a hydraulic torque tool system with the technology and advantages from a modern servo based electrical controlled drive system. Also included is an auto detect system which detects what type of *mechanical interface class 1-4 socket* has been installed, and automatically switches between Low Torque (LT) mode and High Torque (HT) mode accordingly.
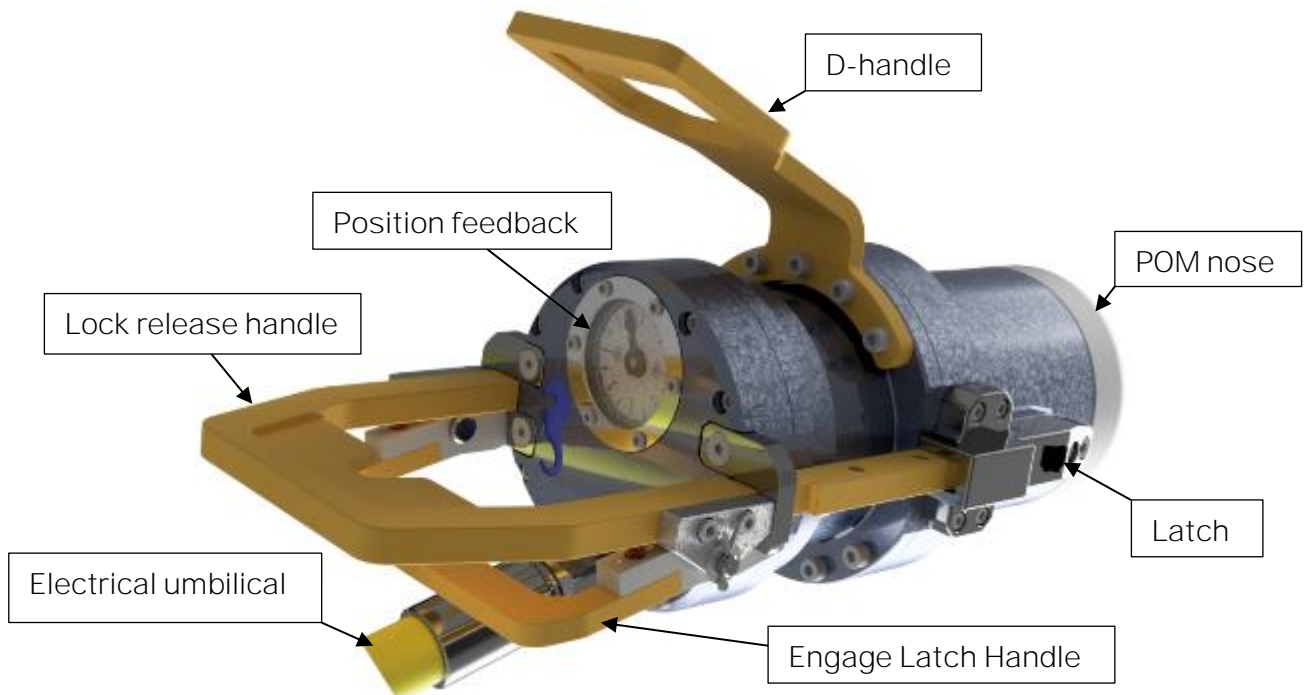
Figure 3: ELTT

HIGH VOLTAGE: The Torque Tool operates on high voltage and has the potential to result in death or severe injury if handled incorrect. The equipment should only be used by qualified personnel. The equipment contains no serviceable parts inside.

WARNING: Rotating parts can be hazardous. Keep hands and body out of the operating area. Failure to follow these warnings could result in death or severe personal injury.

3.1.1. Technical Data

Depth rating	3000 m
Supply voltage	110-250 VAC 50/60Hz or 145-350 VDC
Standards	API17D/ISO 13628-8
Output sockets	API17D/ISO 13628-8 Class 1 - 4
Weight in air	34,0 kg
Weight in seawater	25,7kg
Torque range, CI1-2	100 – 500Nm
Torque range, CI3-4	500 – 2700Nm
Low torque max speed	30 RPM
High Torque max speed	6 RPM
High torque accuracy	+/-10% @torque above 250Nm
Low torque accuracy	+/-5% @torque below 250Nm
Positioning precision	+/- 1°
Max. power consumption*	4000 W
Min. current required	2,7A
Max current draw	10 A
Communication	RS232 or RS485, Modbus RTU Protocol Baud rate 38 400
Electrical interface	8 pin Burton 5506-2008 connector
Gear oil	Q8 T 65 75W-90
Gear oil, total volume	Approx. 2L

*Maximum allowed power consumption can be limited in GUI to suit available power from ROV, ref. section 6.

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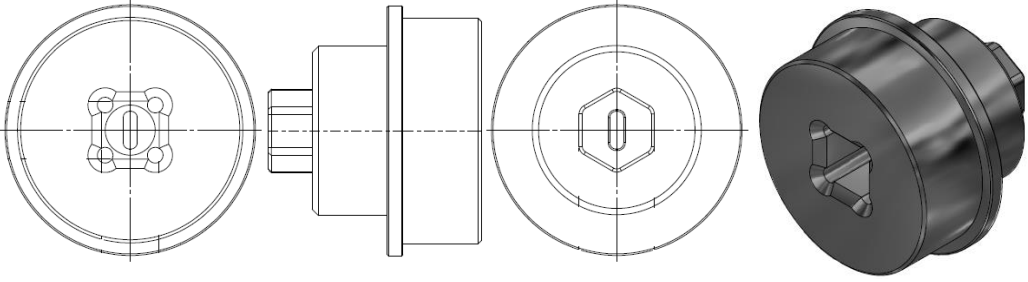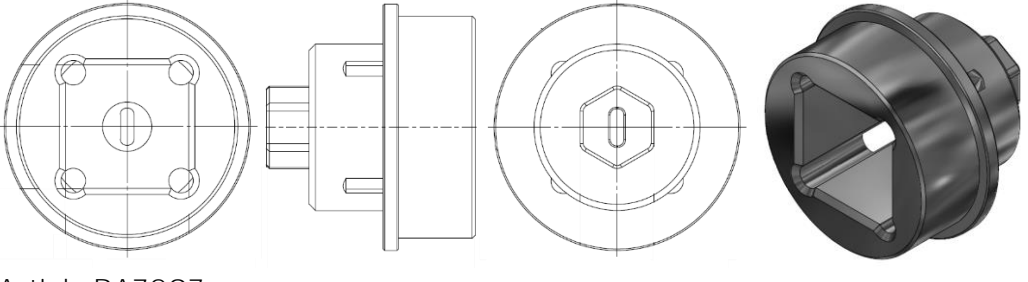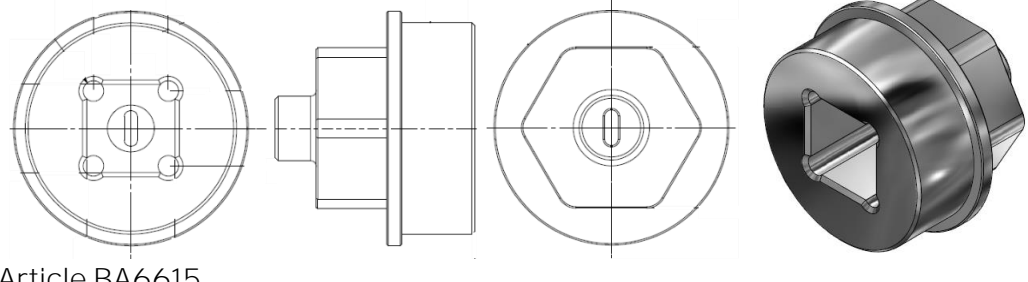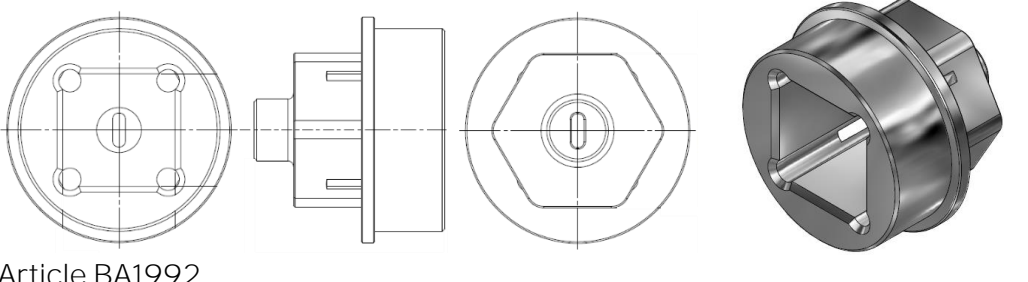
3.1.2. Interface Description – Standard Torque Tool

NOTE:
Make sure to install correct socket according to torque class and required torque!

ISO Class 1 & 2: 67,5 – 270 Nm Article BA2951	Select Class 1-2 in GUI Class Detect, ref. 9.3.2
ISO Class 4, Low-Torque: 67,5 - 270 Nm Article BA7297	Select Class 1-2 in GUI Class Detect, ref. 9.3.2
ISO Class 3: 500 - 1355 Nm Article BA6615	Select Class 3-4 in GUI Class Detect, ref. 9.3.2
ISO Class 4, High-Torque: 500 - 2700 Nm Article BA1992	Select Class 3-4 in GUI Class Detect, ref. 9.3.2

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ELTT has *mechanical interface class 1-4 socket* designed according to ISO 13628-8 valves class 1-4. *Mechanical socket* is easily changed topside by removing the POM Nose. ELTT will automatically switch between High Torque (HT) and Low Torque (LT) mode. Class 1 and 2 valves are operated in Low Torque mode, whereas Class 3 and 4 are operated in High Torque mode. It is not necessary to change the ELTT motor between HT and LT mode.

POM nose

Mechanical interface class 1-4

Figure 4: Mechanical Interface socket

To replace the mechanical socket, see section O.

3.1.3. Interface Description – Auto Class Select Version

The 2,7kNm El. Torque Tool wAutomatic Class Switch, article BCO454, has a multi-socket interface nose including all classes, i.e. Class 1&2, Class 3 and Class 4. The tree sockets are mounted in a co-centric configuration with spring suspension to ensure engagement of correct socket whenever docking onto interface bucket with CI 1&2, CI3 or CI4.

If not aligned when installed, the correct socket will engage with the square stem once rotated and aligned. There is a docking feature in the GUI to slowly operate tool until engaged. Once engaged, the GUI will ask user to confirm the auto-detected class selection prior to operation.

Class 4 socket

Class 3 socket

Class 1&2 socket
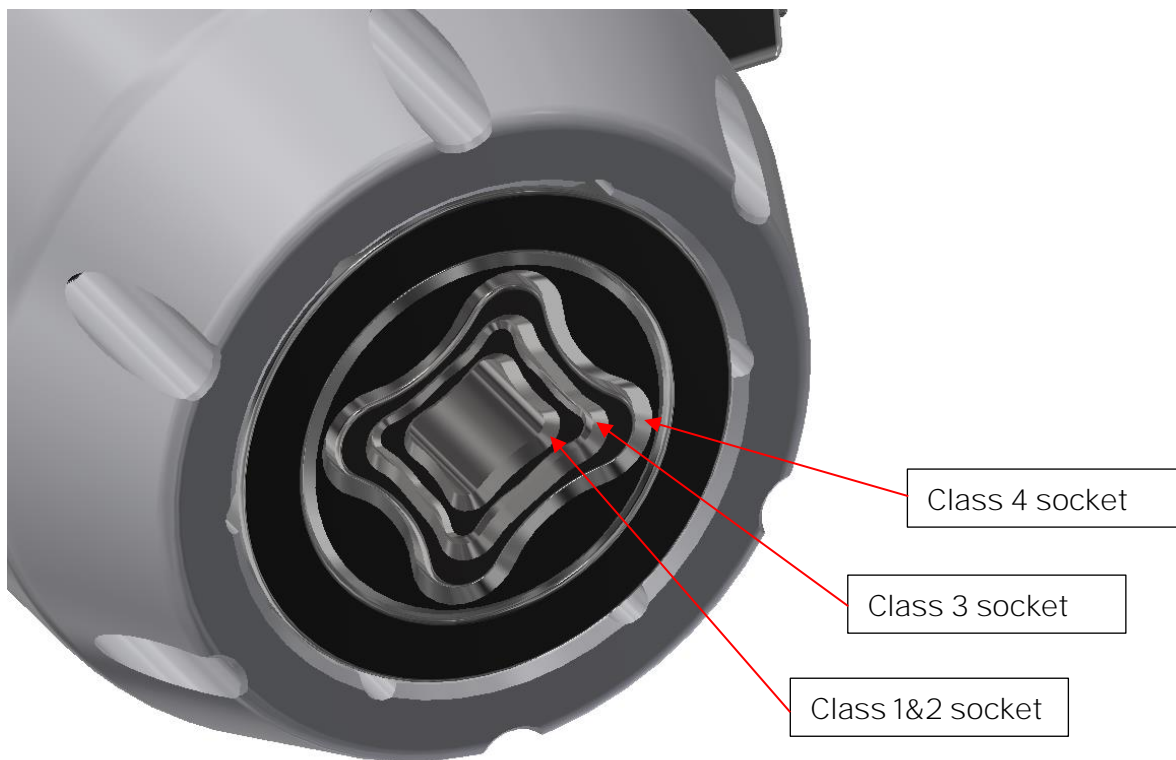
Figure 5, Interface nose for Torque Tool with Auto Class Select

Note:
For the Auto Class Select version, CI1&2 will have similar parameters as for CI4 operation, except from available torque that will be limited to 300Nm. This means that speed and accuracy will be identical to CI4 operation.

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3.1.4. Locking System

The ELTT locking system is manually operated by use of the ROV manipulator arm. The locking system has three positions, Latch Open, Auto Latch and Latch Locked. The lock is operated by use of a push-pull mechanism connected to the ROV handle. With the spring activated handle pushed in, the main handle can be moved up and down to shift between latch-modes.

It is highly recommended that all operators get familiar with the handle operation on deck prior to operation.

Slide main handle up/down to shift between latch-modes when spring-activated handle is pushed in

Spring-activated handle to allow shift between latch-modes

Position selector, in this case shown in locked mode

Spring-activated locking dogs
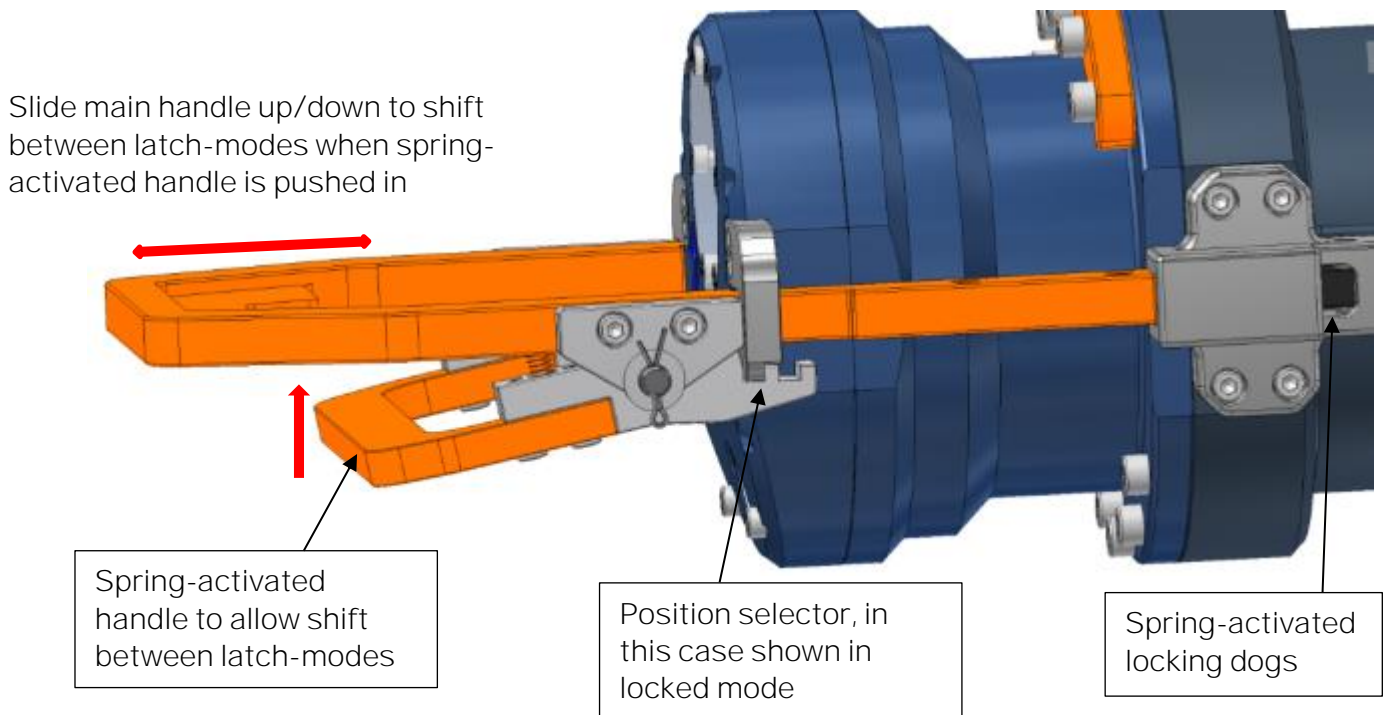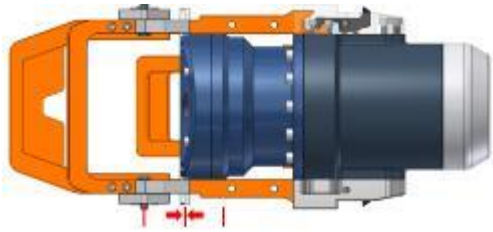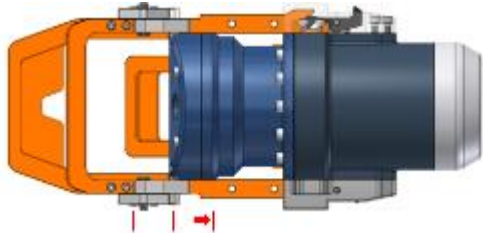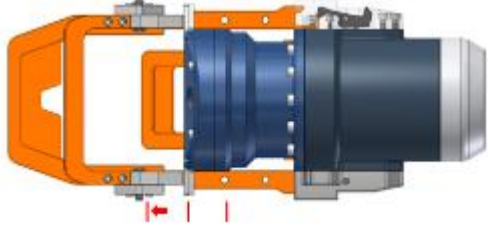
Figure 6: Locking system

Auto Latch:		
O1	Mid position. The latches are spring loaded. When ELTT is being guided into the valve interface, the latches will auto lock the tool in the correct position. If auto-lock not required, the ELTT may also be installed with the handle in Latch Open mode, see below.	

Latch Locked:		
O2	Handle is positioned all the way down. In order to lock the ELTT to the valve interface, the lock will complete full engagement of the system. Note: It is not possible to install the tool with the latch in locked position.	

Latch Open:		
O3	Handle in fully outward position. This position can also be used when inserting the tool into the interface bucket. Different from latch-mode, the tool will not be auto-locked in this mode.	

3.1.4.1. Hydraulic Operated Latch

To ease operation of the latch-mechanism, a hydraulically operated add-on device can be installed. The hydraulic latch-mechanism is designed to be fitted onto the main handle and uses a single-acting hydraulic cylinder with spring-return to ensure fail-safe release if hydraulic pressure is lost.

Hydraulic interface is represented by 2 off 1/8" BSP ports, and minimum operating pressure is 140 Bar. It is recommended to connect the hydraulic cylinder's second port of the ROV's compensation system.
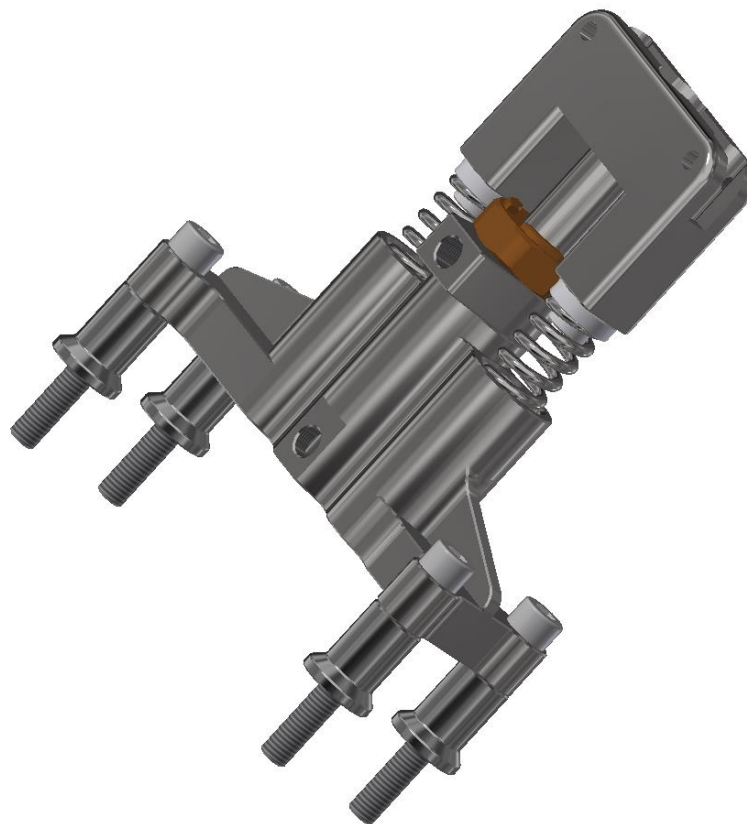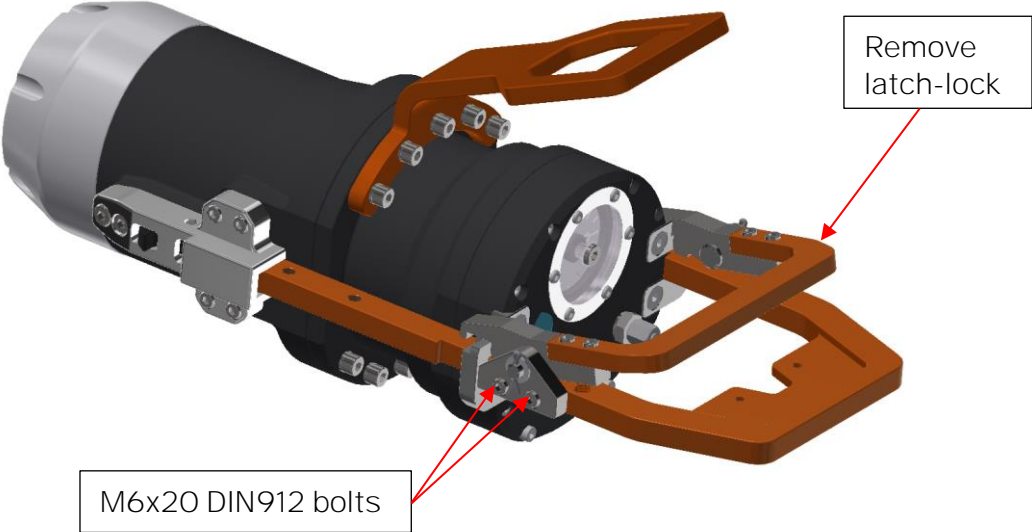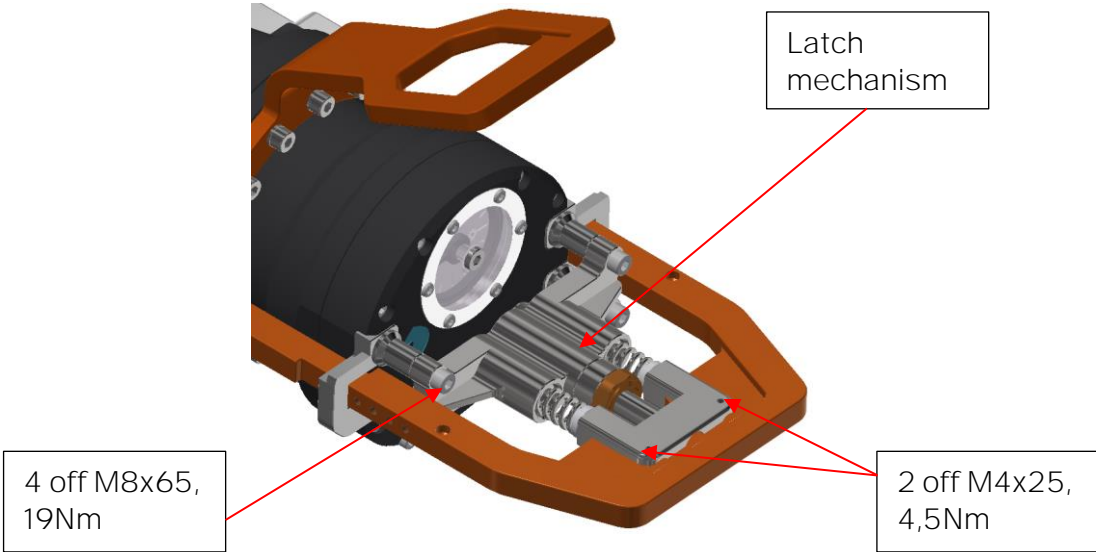
Figure 7, Hydraulic latch mechanism

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Installation of Latch Mechanism:

No.	Description
1.	Remove latch-lock handle, unscrew 4 off M6 bolts to remove. Remove latch-lock M6x20 DIN912 bolts
2.	Install the latch mechanism onto the TT handle as shown below. Latch mechanism 4 off M8x65, 19Nm 2 off M4x25, 4,5Nm Note: For earlier versions of the TT, the M4 holes may be missing. Drill and tap M4 holes using the hydraulic latch mechanism as drill-template.
3.	Connect the hydraulic hose **to the 1/8" BSP port**. An open-centre valve is required for this feature. The second port at the cylinder can be open to sea, but it is **recommended to connect it to the ROV's compensation system.**
4.	Test activation and fail-safe-release several times to ensure correct functionality.

3.1.5. Position Feedback

ELTT is featured with two types of socket position feedback systems, one mechanically – directly coupled to the output shaft presenting the information through the gauge close to the ROV handle, and one electrically – providing feedback through the GUI. The position feedback presented in the GUI has a reset function making it possible to reset rounds and angle at any time.

Gauge – Mechanical Position Feedback
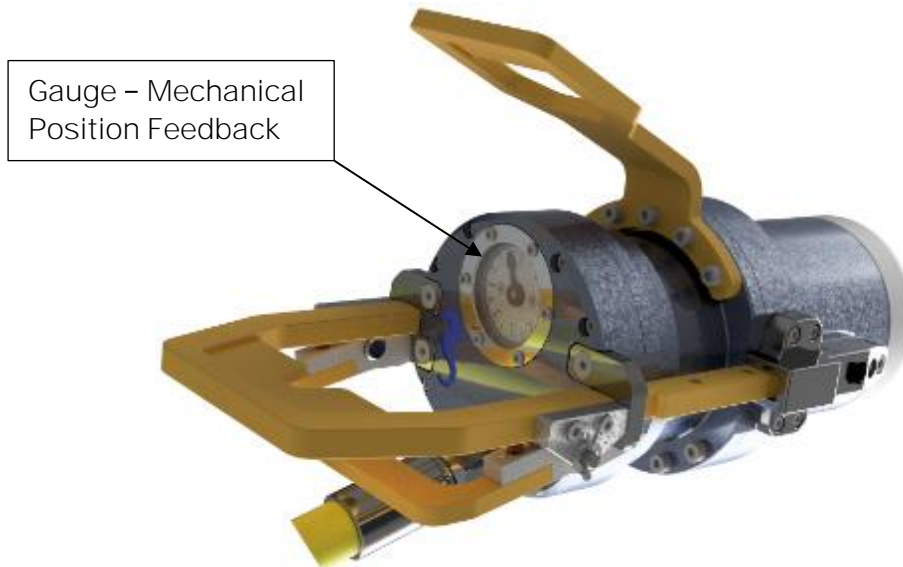
Figure 8: TT rear end with position feedback instrument

Note:
When shifting between CW and CCW operation, there will be a deviation with respect to accurate position of the output socket and reading in GUI. This is caused by internal, mechanical tolerances in the gearbox. The slack will typically represent 5 - 10° before the output socket starts rotating in opposite direction. Stop and restart in same direction will not cause any slack.

3.1.6. Electrical Power Canister, EPC

The EPC is a separately installed power and control unit. The El Power Can (EPC) is an atmospheric can converting supplied power 110 - 250 VAC to 145 – 350 VDC.

The EPC will normally be installed onto the ROV frame at a suitable location and is equipped with connectors for input power/ signal and tool output power and signal.
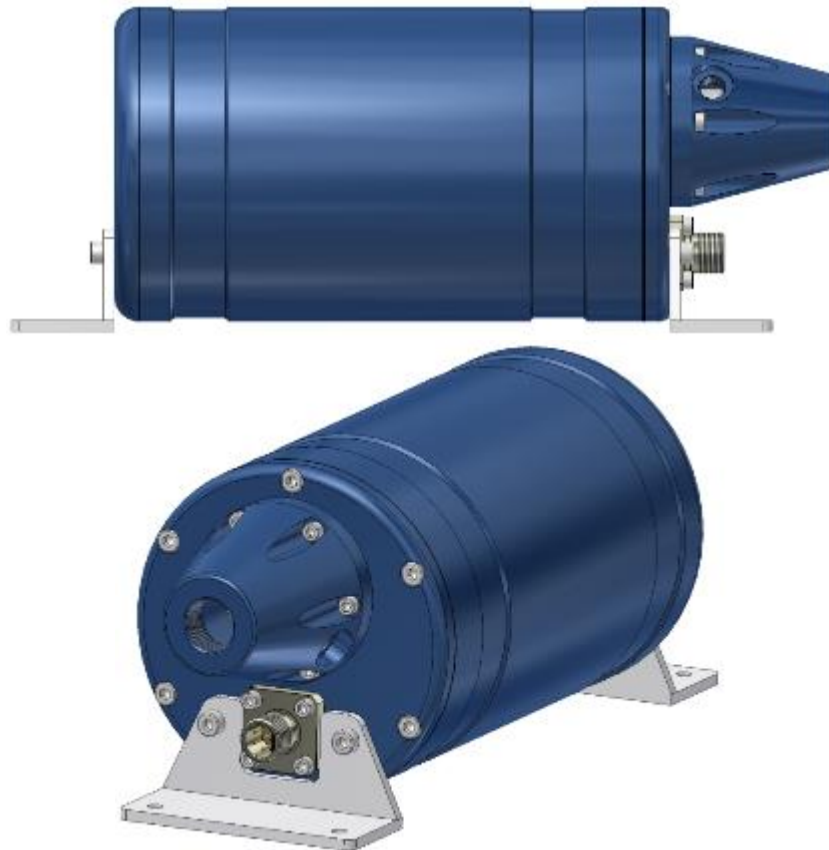
⚠️ **HIGH VOLTAGE:**
The El Power Can operates on high voltage and has the potential to result in death or severe injury if handled incorrect. Qualified personnel should only use the equipment. The equipment contains no serviceable parts inside.

The cable/umbilical between the EPC and TT is equipped with a safety wire to protect against damaging snap-force in case of dropped TT, ROV drift-off etc. The safety wire shall be shorter than the cable/umbilical and connected to TT and ROV.

A 0,5L pressure compensator is included in the kit, and shall be connected to the EPC's termination adapter to ensure pressure compensation of both umbilical and TT. The pressure compensator comes with a 1,5m hose to allow flexibility wrt. installation on the ROV.

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3.1.6.1. Technical Data El Power Can

Table 1: Mechanical Data
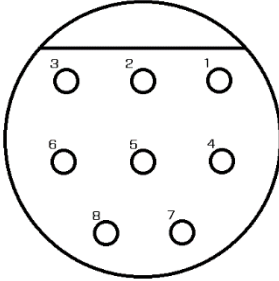
Description	Specifications
Dimensions	Ø185 x 325 mm
Mechanical interface	4 off Ø8,5 holes @415 x 110 mm
Depth rating	3000 m
Weight in air	17,9 kg
Weight in water	12,6 kg

For power and communication interface, reference is made to section 3.1.1.

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3.1.6.2. Interface Description

Table 2: Electrical Interface

Interface	Interface Type
Burton connector 5507	2008 8 pin connector

Pin #	5506-2008-0004
1	110-250 VAC / 145-350 VDC
2	110-250VAC / 0VDC
3	Chassis
4	N.C.
5	RX RS232
6	TX RS232
7	N.C.
8	Com/GND

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4.   2,7KNM TORQUE TOOL KIT W/INDUCTIVE CONNECTOR

This optional kit includes a pair of inductive connectors to enable quick and easy connect/disconnect form ROV subsea. Hence the torque tool can be put in a basket when not operated. The system consists of two kits:

- BA8949 with secondary inductive connector and torque tool, i.e. tool side
- BB3151 with primary inductive connector and power supply, i.e ROV side

NOTE: For description on the actual torque tool, see section 3.

Figure 9: BA8949 Torque Tool Kit with Inductive Connector

The BA8949 kit consists of:

QTY	Art. No.:	Description
1	BA5247	BA5247 2,7kNm ELTT with 2kW Inductive Connector
1	BB1745	Alu Box 240L incl. Foams Inductive Connector
1	BA6615	Class 3 Interface Socket
1	BA2951	Class 1 & 2 Interface Socket
1	600144-TD-0003	Operation and Maintenance Manual Electric Torque Tool Class 1 - 4
1	102862	Connector Subcon Dummy
1	102859	PC Charger Module
1	102858	Laptop HP Probook
1	102857	Computer Mouse
1	10181	9 Moxa Adapter DB9F to TB
1	10181	7 Pelicase 1495D
1	10106	7 Locking Sleeve Red incl. Snap Ring DLSA M
1	10068	7 Moxa UPort 1150I

Figure 10: BB3151

The BB3151 kit for installation on ROV consists of:

Item	QTY	Art. No.	Description
1	1	BB4242	Alu Box 240L incl. Foams
2	1	BA9029	ROV Male 2kW Primary
3	1	BA7719	BL Power Supply 2kW
4	1	600128-TD-0013	Operation and Maintenance Manual 2KW Type C Subsea USB System
5	1	103721	Cable 4320 4m Subconn Conn. Pigtail
6	1	102768	Test Cable L=3m OM1OF to 250W Prim USB and 2kW Power Supply
7	1	102766	Test Cable L=3m OM1OM to 2kW/250W Sec USB
8	1	101138	Pigtail Cable L=0,5m with Connector SubConn IL1OF wLS2400 Sleeve

This kit contains the power conectors necessary to power the ELTT, either via inductive connector or EPC.

4.1. TECHNICAL DESCRIPTION FOR ELECTRICAL TORQUE TOOL

See section 3.1

4.2. TECHNICAL DATA

See section 3.1.1

4.3. INTERFACE DESCRIPTION

See section 3.1.2

4.4. LOCKING SYSTEM

See section 0

4.5. POSITION FEEDBACK

See section 0

4.6. PERFORMANCE DATA

See section 4.6

4.7. TECHNICAL DESCRIPTION INDUCTIVE CONNECTOR

The Inductive Connector is a Blue Logic USB-C connector, modified to connect to the ELTT cable.
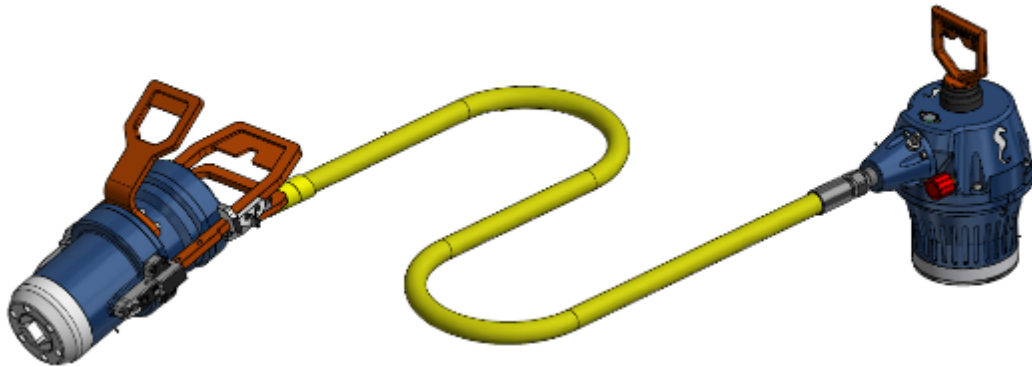
Figure 11: Electrical Torque Tool powered via IC

Figure 12: USB secondary side

Figure 13: USB primary side

CAUTION: The Inductive Connector operates on high voltage and has the potential to result in death or severe injury if handled incorrect. To be operated/handled by trained and qualified personnel only.
The equipment contains no serviceable parts inside.

4.7.1. Technical Data

Table 3: Mechanical Data

Description	Specifications
Depth rating	3000m
Dimensions, Primary USB	405 x 230 x 252 mm
Dimensions, Power Supply	Ø170 x 375 mm
Weight air/water, Primary USB	13,8 / 8,5 kg
Weight air/water, Power Supply	11,1 / 5,2 kg

Table 4: USB Data

Description	Specifications
Power	2kW
SubConn Connector (secondary side)	See /03/
SubConn Connector (primary side)	See /03/

4.7.2. Interface Description ROV-PFC

Table 5: Electrical interface between ROV and PFC canister.

Interface	Interface Type
SubConn connector	BCR2410M 10 pin

Pin #	
1	110-250VAC / 145-350VDC
2	110-250VAC / 0VDC
3	Chassis
4	RS232RX (input)
5	RS232TX (output)
6	RS232GND
7	TX_p
8	TX_n
9	RX_p
10	RX_n

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4.7.3. Interface Description AUX Connector at Secondary Side Connector

Auxiliary equipment such as camera and similar can be connected to the secondary side connector via a 13-pin SubConn connecter with pin-out as described below. The aux equipment will communicate via Ethernet. A blue blinking light on the secondary connector verifies Ethernet communication. Available power limited to 30W.

NOTE:
A dummy connector shall always be connected whenever aux-equipment not connected.

Table 6, AUX connector details
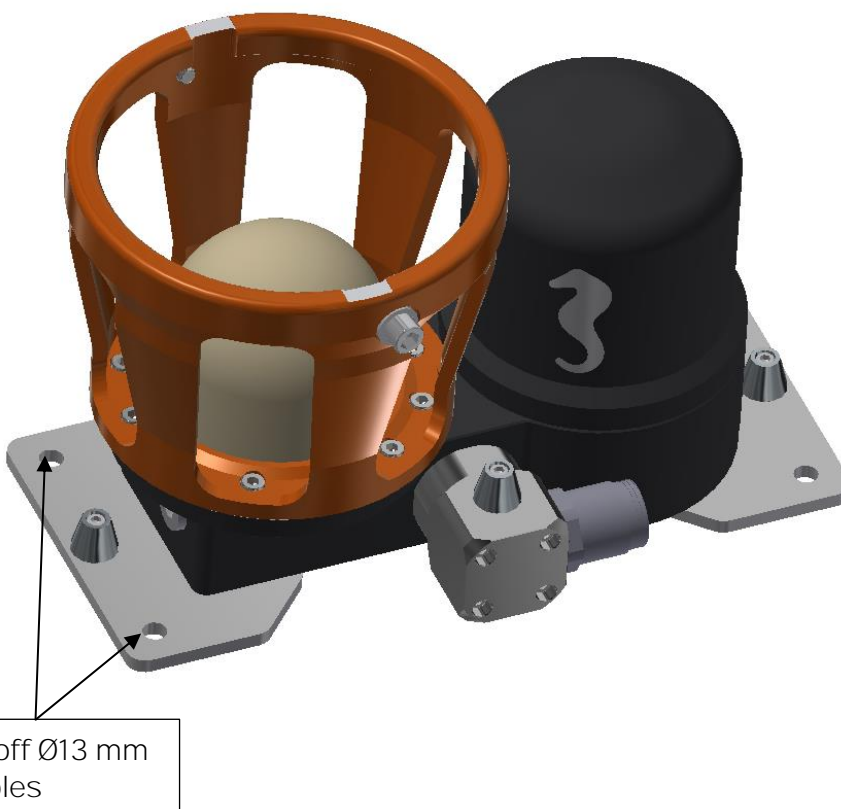
Interface	Interface Type
SubConn connector	DBH13F 13 pin

Pin #	DBH13F
1	0V
2	Chassis
3	24VDC
4	N.C.
5	N.C.
6	N.C.
7	N.C.
8	TXn
9	TXp
10	RXn
11	RXp
12	N.C.
13	N.C.

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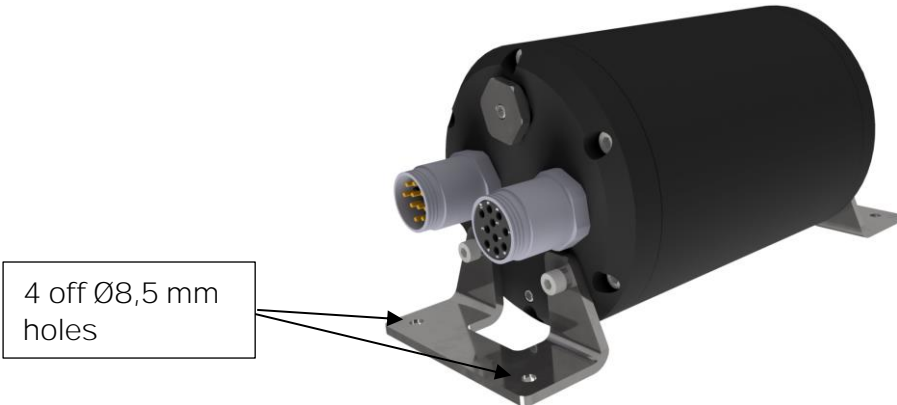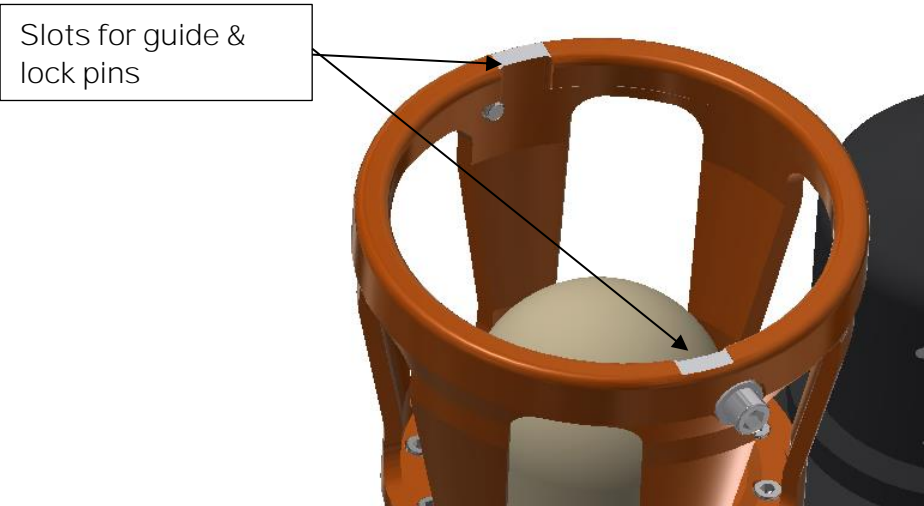
4.8. HOOK-UP AND OPERATION OF TT WITH INDUCTIVE CONNECTOR

The below sequences describe hook-up, subsea connect/disconnect and operation of the TT with inductive connector. It is crucial that all involved personnel attend the hook-up and deck testing to ensure familiarisation prior to subsea connection, operation and disconnection.

4.8.1. Topside Hook-Up

No.	Description	Check/Verified
1	Install the USB Primary Side onto the ROV. Make sure to position the **connector within reach for the ROV's manipulator** and the female cage facing up as shown below. Mechanical interface: bracket-plates with 4 off Ø13 mm holes at 365 x 140 mm. 4 off Ø13 mm holes	

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No.	Description	Check/Verified
2	Install the PFC canister onto the ROV, preferably in a position with minimum electromagnetic radiation. Verify that the cables to ROV and inductive connector have sufficient length for the selected position. Mechanical interface: bracket-plates with 4 off Ø8,5 mm holes at 345 x 110 mm. 4 off Ø8,5 mm holes 	
3	Route and connect cable between ROV system and PFC and cable between PFC and inductive connector, article 103721. Secure both cables with cable ties.	
4	Make sure that the power to the TT system is shut off prior to connecting inductive connectors. Connect the USB Secondary Side (TT side) to the primary connector. Align guide & lock pins with slots in the female cage, rotate minimum 45° CW to lock in position. Slots for guide & lock pins 	

No.	Description	Check/Verified
5	Power up system, start-up will typically take 15-30 seconds. When green and yellow light can be seen at the inductive **connector's status window, a**ctivate software according to instructions in section 6. Verify power and communication in GUI and on the Secondary Side connector; green light for power and yellow blinking light for RS232. If any aux equipment is connected, a blinking blue light will indicate Ethernet communication. Status lights for power and comms 	
6	Operate TT to verify correct function.	
7	Stop TT and deactivate GUI and shut off power, ref. section 6.	
8	Rotate secondary connector CCW to end stop and disconnect from the primary connector.	

4.8.2. Subsea Connection – Operation - Disconnection

No.	Description	Check/Verified
1	Make sure that the power to the TT system is shut off prior to connecting inductive connectors. Connect the USB Secondary Side (TT side) to the primary connector. Align guide & lock pins with slots in the female cage, rotate minimum 45° CW to lock in position.	
2	Power up system, start-up will typically take 15-30 seconds. When green and yellow light can be seen at the inductive **connector's status window, activate software according to** instructions in section 6. Verify power and communication in GUI and on the Secondary Side connector; green light for power and yellow blinking light for RS232. If any aux equipment is connected, a blinking blue light will indicate Ethernet communication.	
3	Perform required TT intervention.	
4	Upon completed intervention, stop TT and deactivate GUI, ref. section 6. Shut off power.	
5	Verfify that power is shut off and rotate secondary side connector CCW to end stop and disconnect by pulling upwards.	

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4.8.3. Subsea Torque Tool Swap

As the Torque Tool with inductive connectors can be connected and disconnected subsea, the ROV may operate different Torque Tools for maximum flexibility. Alternatively, one Torque Tool may be operated by different ROVs if they are pre-equipped with the primary side of the system.

The GUI and power supply shall be shut off prior to any subsea tool swap. Once connected, and powered up, the GUI shall be activated for automatic recognition of the connected tool.

Connection and disconnection to be performed according to instructions in section 4.8.2.

4.8.4. Emergency Disconnect

If case of breakdown of the host-ROV and/or trouble with rotating secondary connector to release position, it can be pulled directly out breaking the two lock pins (plastic).
The locking pins must be replaced prior to further operations.

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5. 2,7 KNM LIGHT WEIGHT ELECTRICAL TORQUE TOOL

The Light Weight Electrical Torque Tool is designed as a low-weight, compact and accurate multipurpose Torque Tool. Due to the low weight, it is suitable for operation by smaller ROVs, subsea drones (AUV) and divers. Separate configurations are available for ROV, AUV and diver and covered by this manual.

This OMM covers the following specific Torque Tool kit:

Art. No.:	Description:
BB3551	2,7kNm Light Weight El TT System for ROV/Diver/AUV
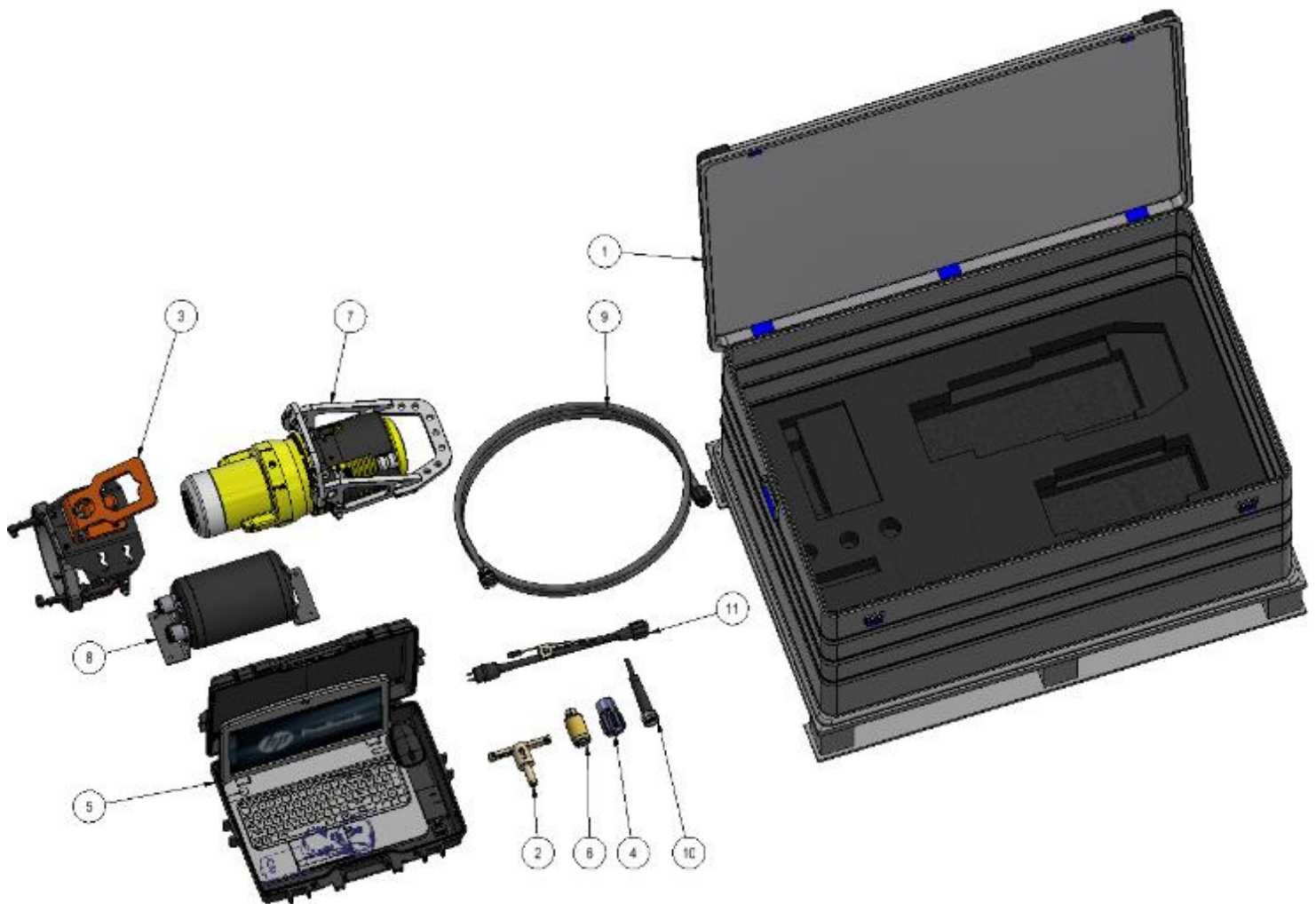
Figure 14: BB3551 Torque Tool Kit

The BB3551 kit consist of:

ID	QTY	Art No.:	Description
1	1	BB3840	Alu Transport Box
2	1	BB3698	Key for Replacement of Sockets
3	1	BB3557	ROV Latch and Handle
4	1	BB3129	Class 3 Adapter, Subsea Replaceable
5	1	BB2958	ETT Control PC w/GUI Software and Pelicase
6	1	BB2962	Class 1 & 2 Adapter
7	1	BB1538	Diver Handle
8	1	BA7719	BL Power Supply, 2kW
9	1	103651	Comm. Cable w/Burton 470 VDC & RS232, 4,5m
10	1	102860	Burton Dummy Connector 5501-2008-0000
11	1	102768	Test Cable OM1OF to 250W Prim USB and 2kW Power Supply, 3m

5.1. TECHNICAL DESCRIPTION OF LW ELECTRICAL TORQUE TOOL

The LWETT is a compact, flexible, and robust precision torque tool for subsea operation by ROV, AUV or diver. This kit contains all required components for shifting between the 3 configurations.

The Blue Logic LWETT System combines all known advantages from a hydraulic torque tool system with the technology and advantages from a modern servo based electrical controlled drive system. Also included is an auto detect system which detects what type of *mechanical interface class 1-4 socket* has been installed, and automatically switches between Low Torque (LT) mode and High Torque (HT) mode accordingly.

The tool is based on Blue Logic's standard electrical torque tool but optimized with respect to reduce the weight to enable operation by small ROVs and subsea drones.

1/4" BSP plug for compensation oil fill, one-way valve

POM nose

1/4" BSP plug for vacuum test of electric can

Connector for comms and power

Pressure compensation hose
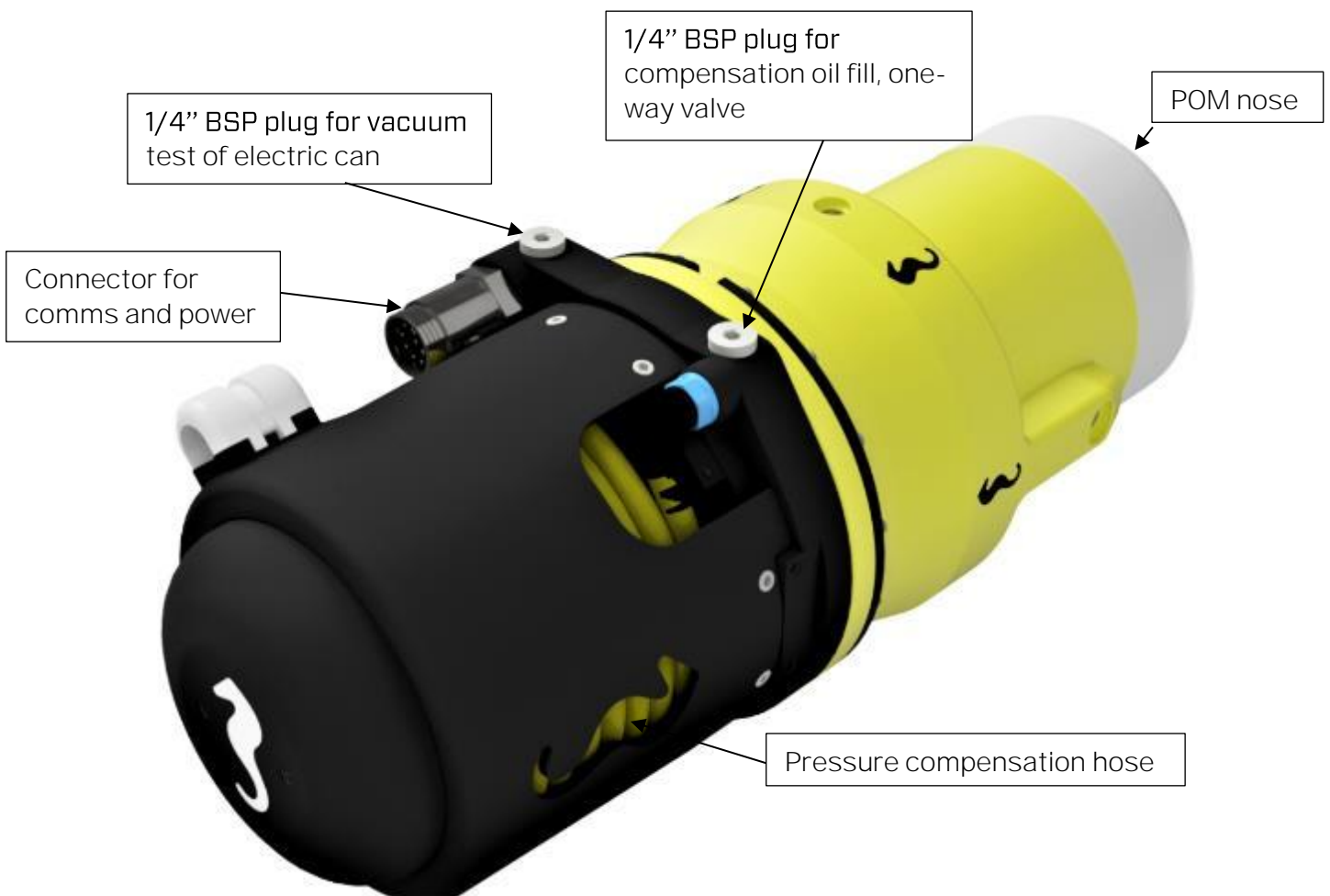
Figure 15: LWETT

⚠ HIGH VOLTAGE: The Torque Tool operates on high voltage and may cause death or severe injury if handled incorrect. The equipment should only be used by qualified personnel. The equipment contains no serviceable parts inside.

WARNING: Rotating parts can be hazardous. Keep hands and body out of the operating area. Failure to follow these warnings could result in death or severe personal injury.

5.1.1. Technical Data

Article No.	BB6795	BB3551	BB6797	BB6796
Depth rating	500 m		3000m	
Supply Voltage	48VDC	400VDC	48VDC	400VDC
Standards	API17D/ISO 13628-8			
Output sockets	API17D/ISO 13628-8 Class 1 - 4			
Weight in air	22,5kg	22,5kg	32,4	32,4
Weight in seawater	11,1kg	11,1kg	18,8kg	18,8kg
Max speed, low torque	2 RPM	6,0 RPM	2 RPM	6,0 RPM
Max speed, 2700Nm	1,0 RPM	6,0 RPM	1,0 RPM	6,0 RPM
High torque accuracy	+/-10% @torque above 250Nm			
Low torque accuracy	+/-10% @torque below 250Nm			
Positioning precision	+/- 1°			
Max. power consumption	650W	2000W	650W	2000W
Max current draw[1]	13,5A	10A	13,5A	10A
Communication[2]	RS232 or RS485, Modbus RTU Protocol Baud rate 38 400			
Electrical Interface	48V:Subconn BCR2010M 400V: Burton BCR 5507-2008			

1: Max. current draw can be set in GUI.
2: Actual protocol type to be labelled on the torque tool.

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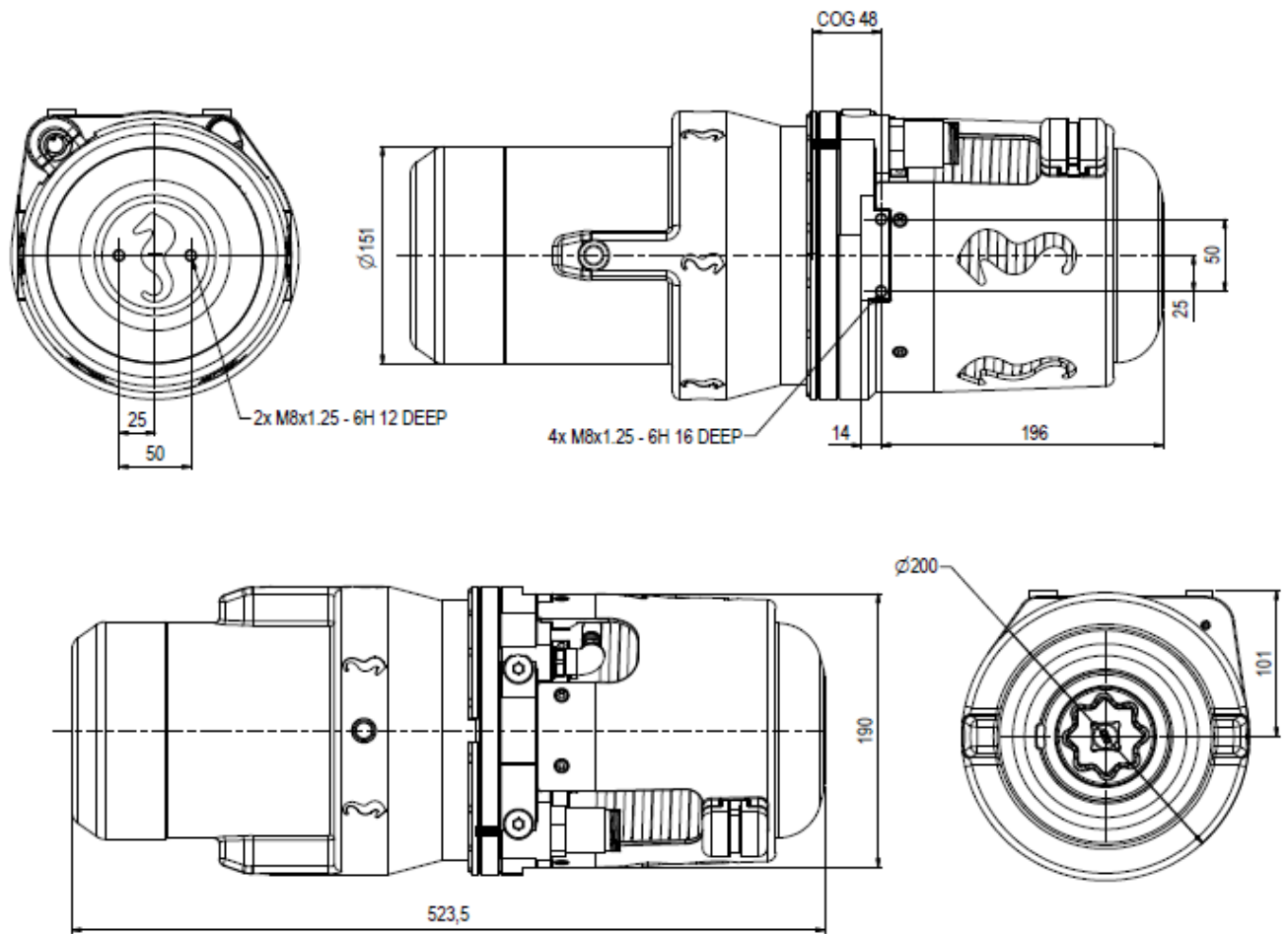
Figure 16, Torque Tool dimensions, AUV configuration

Electrical Interface, Power Supply Canister:

Pin #	Input, Host	Output, Torque tool
	Subconn BCR2410M 10-pin connector, male	Subconn BCR2410F connector, female
1	100-250VAC / 145-350VDC	370VDC
2	100-250VAC / 0VDC	0VDC
3	Chassis	Chassis
4*	RS232 RX or RS485 +D	RS232 RX or RS485 +D
5*	RS232 TX or RS485 -D	RS232 TX orRS485 -D
6	Com Gnd	Com Gnd
7	TX_p	TX_p
8	TX_n	TX_n
9	RX_p	RX_p
10	RX_n	RX_n

*Protocol will be either RS232 or RS485, protocol type to be clearly marked on the tool.
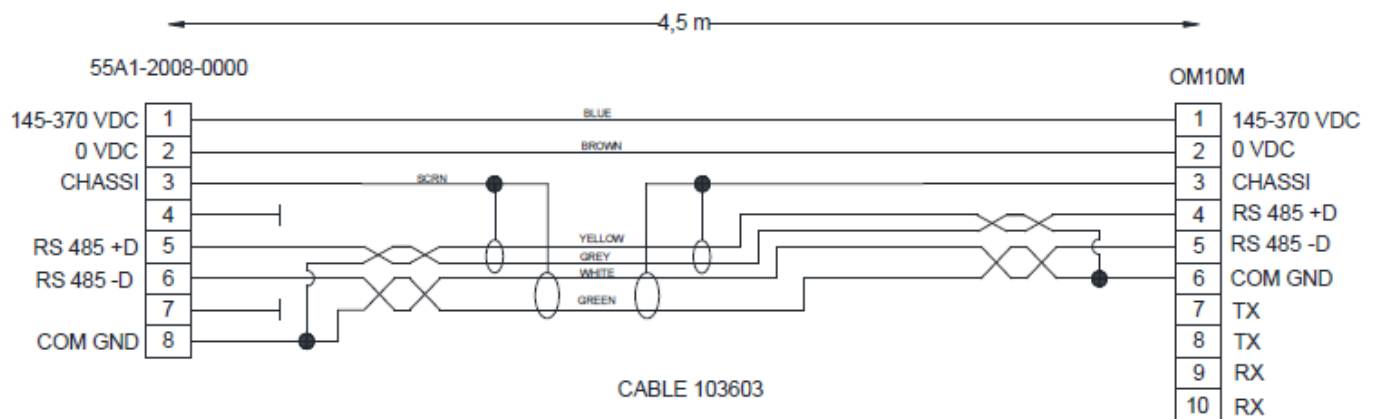
Figure 17 Interface cable

Compensation Fluid Data:

Description	Specifications
Oil*	Q8 T 65 LS
* The LWETT system is partly oil compensated	

5.1.2. Interface Description

Mechanical Interface according to ISO 13628-8:

Interface	Class	Torque
ISO	1	67 Nm
ISO	2	271 Nm
ISO	3	1 355 Nm
ISO	4	2 711 Nm

The LWETT has mechanical interface class 1-4 socket designed according to ISO 13628-8 valves class 1-4. The mechanical socket is easily changed topside using the special key (BB2423). LWETT will automatically switch between High Torque (HT) and Low Torque (LT) mode. Class 1 and 2 valves are operated in Low Torque mode, whereas Class 3 and 4 are operated in High Torque mode. It is not necessary to change the LWETT motor between HT and LT mode.

Class 1 & 2 adapter

Class 3 adapter

Class 4 adapter
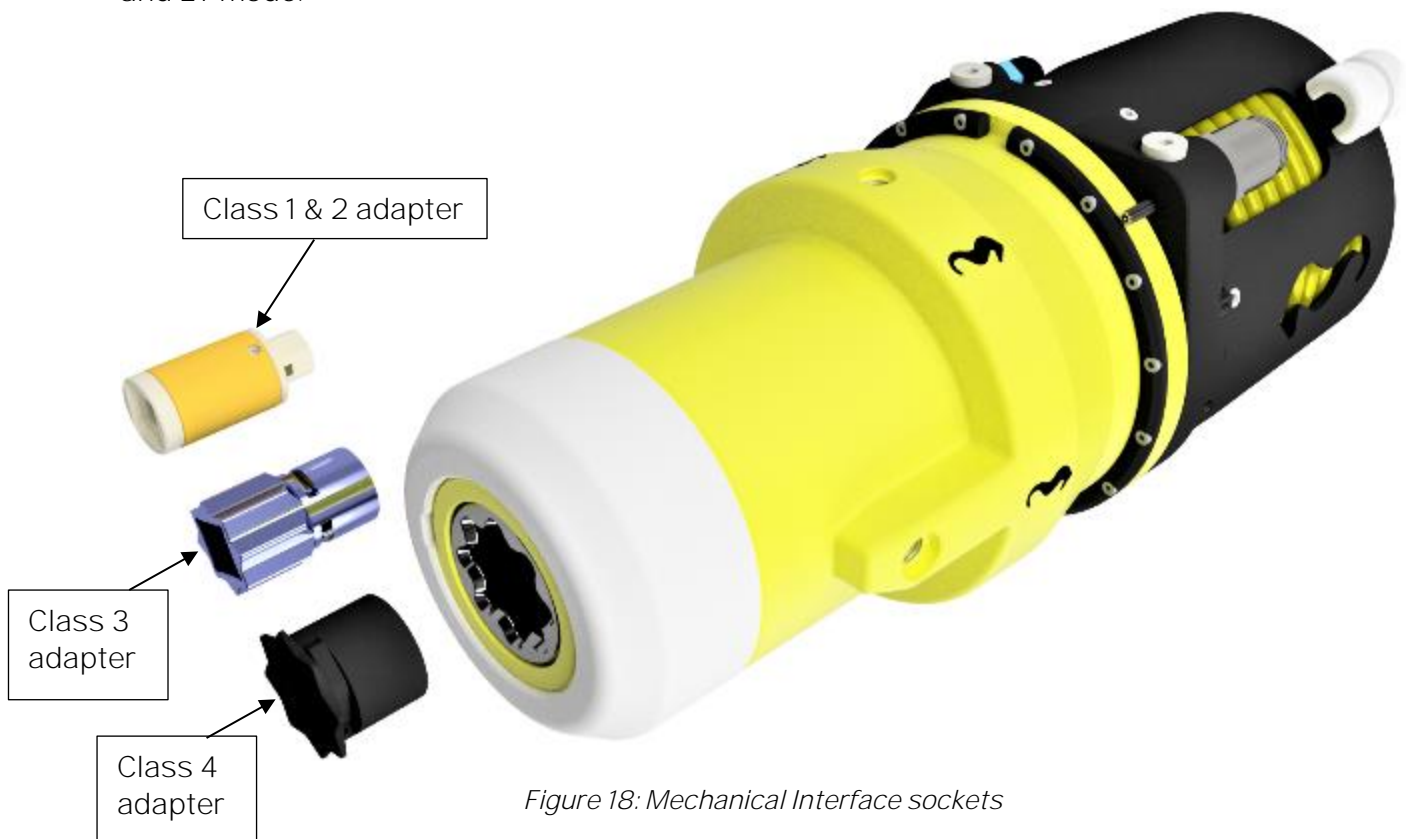
Figure 18: Mechanical Interface sockets

To replace the mechanical socket, see section 0.

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5.1.3. Interface Description – Auto Class Select Version

The 2,7kNm Light Weight Torque Tool wAutomatic Class Switch, article BCO985, has a multi-socket interface nose including all classes, i.e. Class 1&2, Class 3 and Class 4. The tree sockets are mounted in a co-centric configuration with spring suspension to ensure engagement of correct socket whenever docking onto interface bucket with Cl 1&2, Cl3 or Cl4.

If not aligned when installed, the correct socket will engage with the square stem once rotated and aligned. There is a docking feature in the GUI to slowly operate tool until engaged. Once engaged, the GUI will ask user to confirm the auto-detected class selection prior to operation.

Class 4 socket

Class 3 socket

Class 1&2 socket
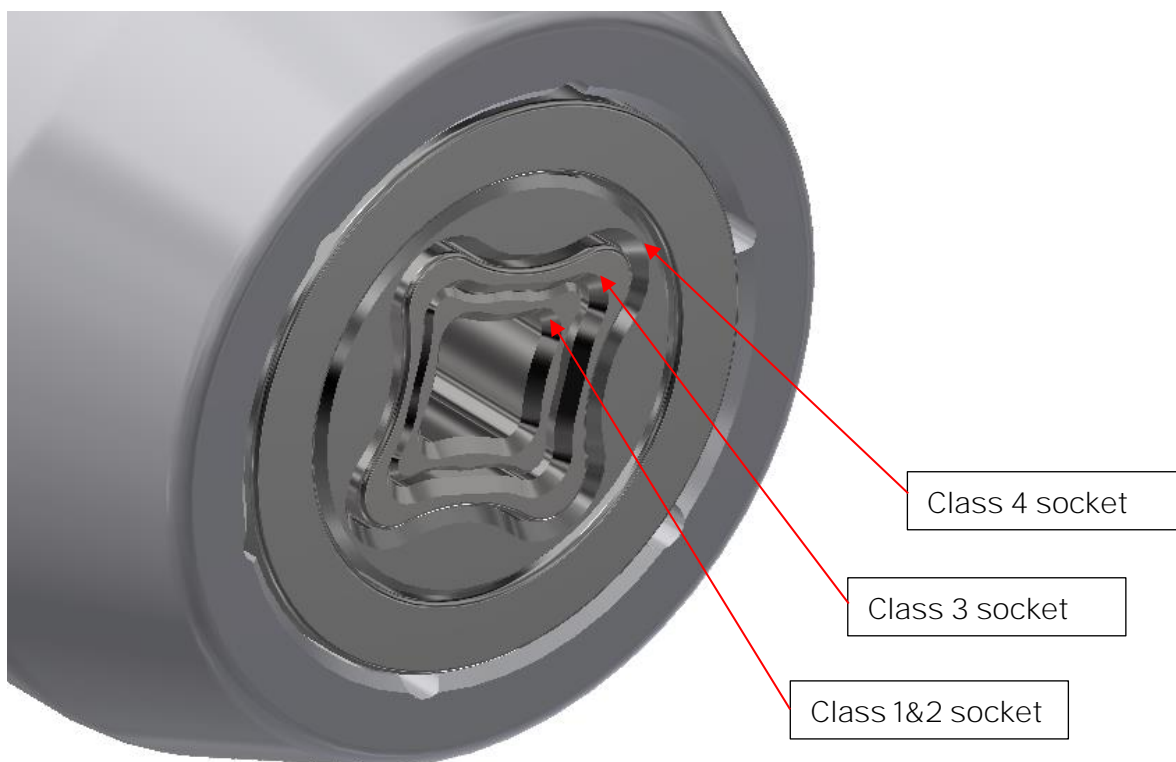
Figure 19, Interface nose for Light Weight Torque Tool with Auto Class Select

Note:
For the Auto Class Select version, Cl1&2 will have similar parameters as for Cl4 operation, except from available torque that will be limited to 300Nm. This means that speed and accuracy will be identical to Cl4 operation.

5.1.4. Position Feedback

The LWETT is featured with electrically socket position feedback system, providing feedback through the GUI. The position feedback presented in the GUI has a reset function making it possible to reset revolutions and angle at any time.

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5.2. LWETT TORQUE TOOL CONFIGURATIONS

The different handling configurations are described in this section; ROV, AUV and diver config. Operation of the torque tool is similar in all configurations, the difference is related to handling the tool.

5.2.1. ROV Configuration

Latch-lock

Latch, 2 off
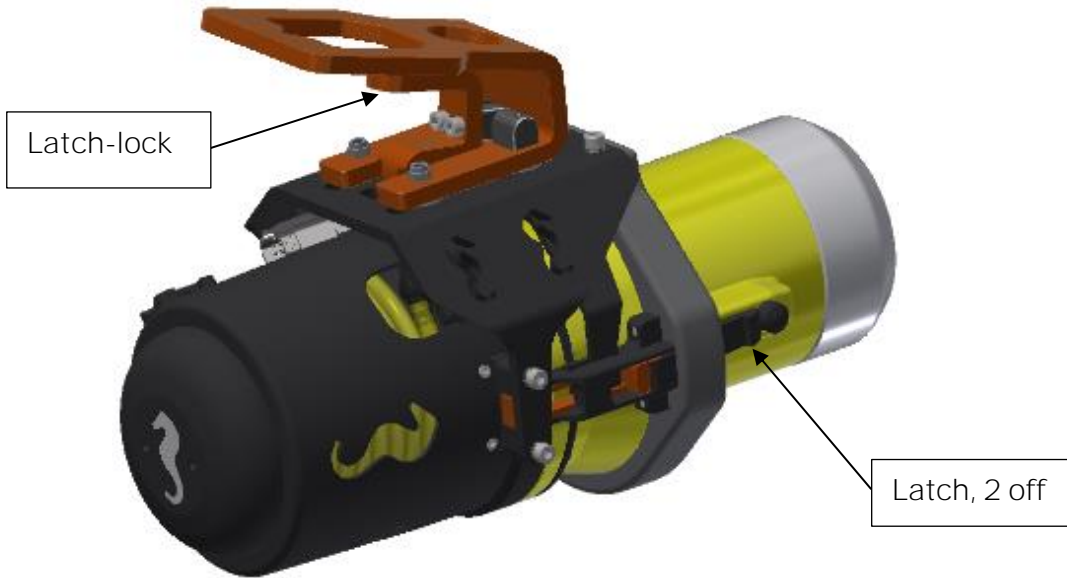
Figure 20 Torque Tool with ROV handle and latch-mechanism
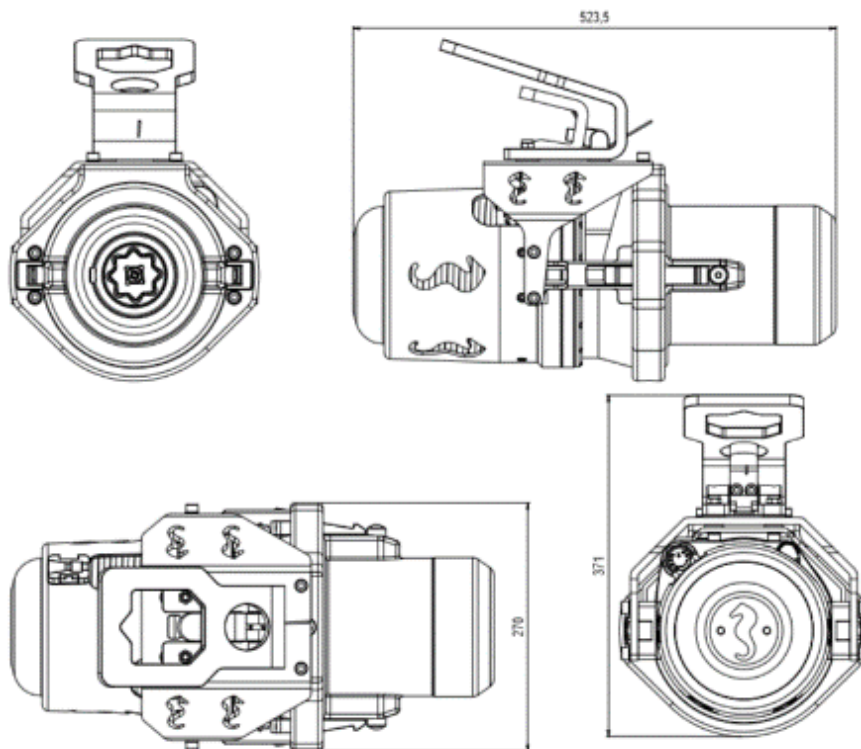
Figure 21 LWETT in ROV configuration - main dimensions

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In the ROV-configuration, the LWETT is equipped with a ROV handle for handling and operation of the latch-locks. The latch/unlatch function is managed by sliding the handle forward/backward. A lever has to be lifted in order to slide the handle.

5.2.2. Latch Lock and Release

The latches' purpose is to lock the tool in the torque-bucket during operation. This mechanism is operated using the ROV manipulator and has two modes; lock and release. Shifting between lock and release is performed by lifting the spring-loaded latch-handle and slide the ROV-handle forward (lock) or backward (release). A spring-loaded mechanism will keep the latch-lock in either position.

Slide handle assembly forward for lock and backward for release

Lift up to enable shift between lock/release

Latch, 2 off
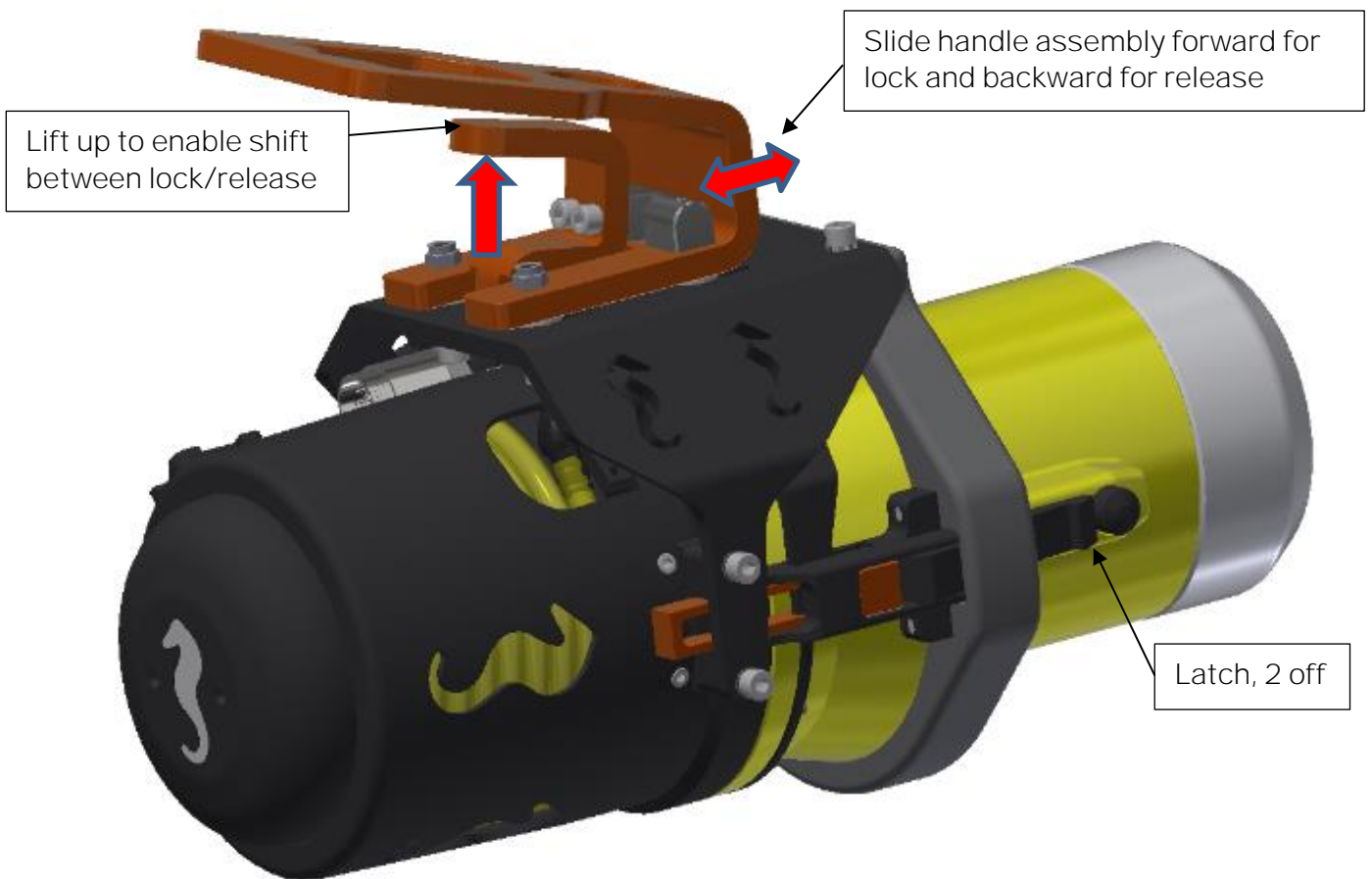
Figure 22, Latch mechanism

Prior to inserting the torque tool into the torque-bucket, the locking mechanism shall be put in backward, unlocked position. The latches will then be able to click into the slots in the torque-bucket and thus locked to the torque-bucket. Once in position, the latches shall be engaged by lifting the latch-lock and slide the ROV handle into forward position.

In order to release the torque tool, the latch-lock must be put in release mode, i.e. in backward position. The tool can then be pulled out of the torque-bucket.

Release and installation mode, i.e. handle in backward position

Lock mode, i.e. handle in forward position
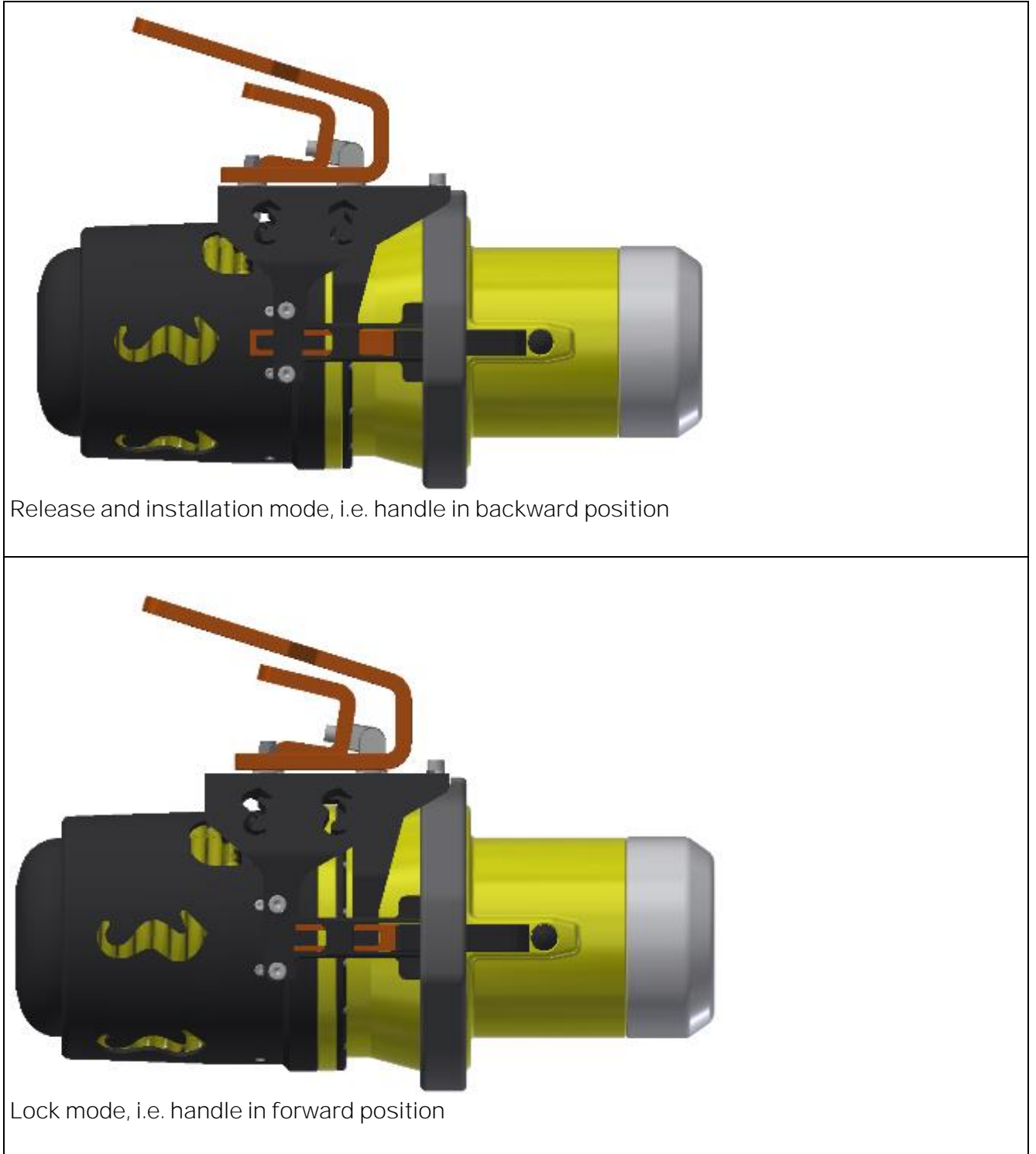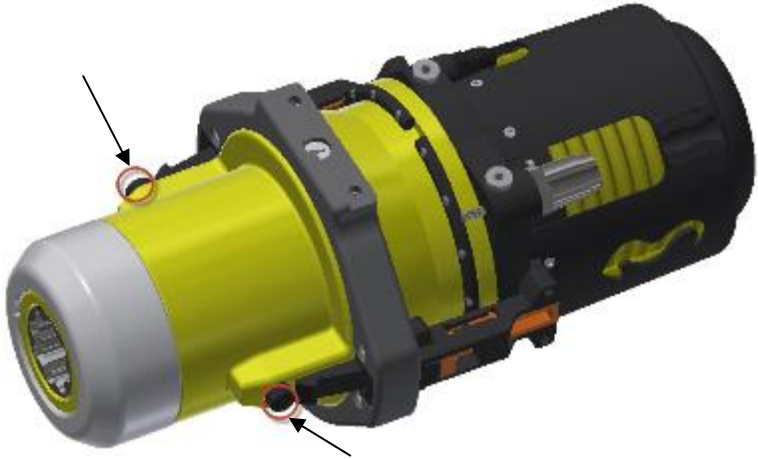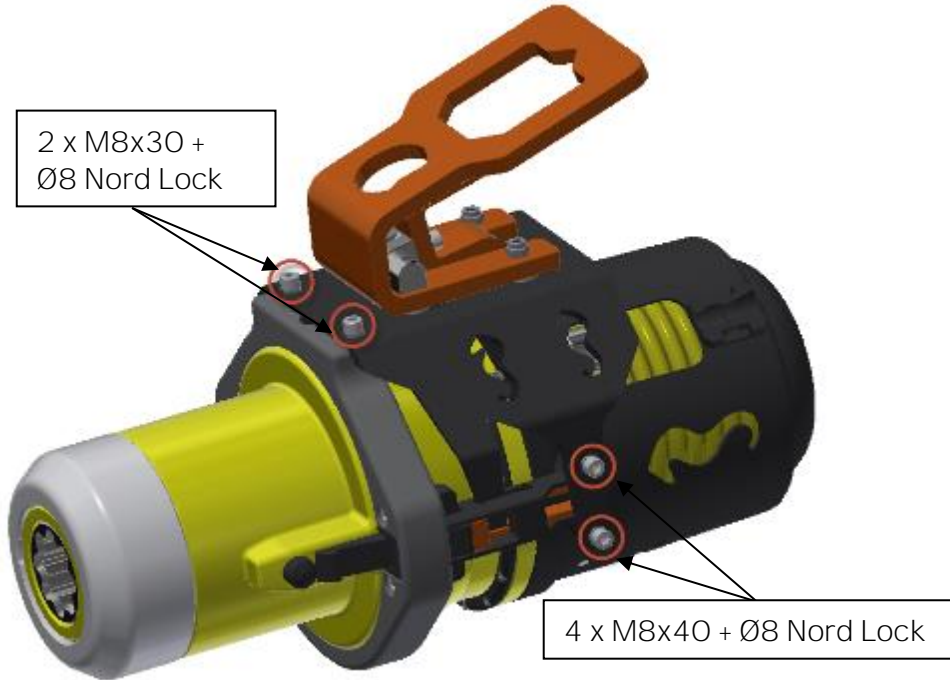
Figure 23, Locked and released mode

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5.2.3.   Installation of ROV Latch & Handle

Installation of the handle must be performed in a specific sequence as described below.

No	Description	Check/Verified
1	Assemble the handle's interface ring as shown.	
2	Slide the ring-assy onto the torque tool from the front and fasten the 2 plastic plugs, top and bottom.	
3	Install the 2 plastic protection plugs.	

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No	Description	Check/Verified
4	Insert the square nuts into the dedicated slots in the main ring.	
5	Install the ROV handle assembly onto the torque tool.	
6	Fasten the M8 bolts with Nord Lock washers as shown below. 2 x M8x30 + Ø8 Nord Lock · 4 x M8x40 + Ø8 Nord Lock	
7	Operate the handle several times to verify correct function. Make sure that the handle locks in correct aft and forward position.	

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5.2.4. AUV Configuration

Figure 24 LWETT in AUV configuration

The above figure shows a typical configuration when operated by AUV or subsea drone. The tool will then be bolted onto the vehicle, i.e. fully integrated. The LWETT has 6 off dedicated threaded M8 bolt-holes to be used for installation onto the AUV.
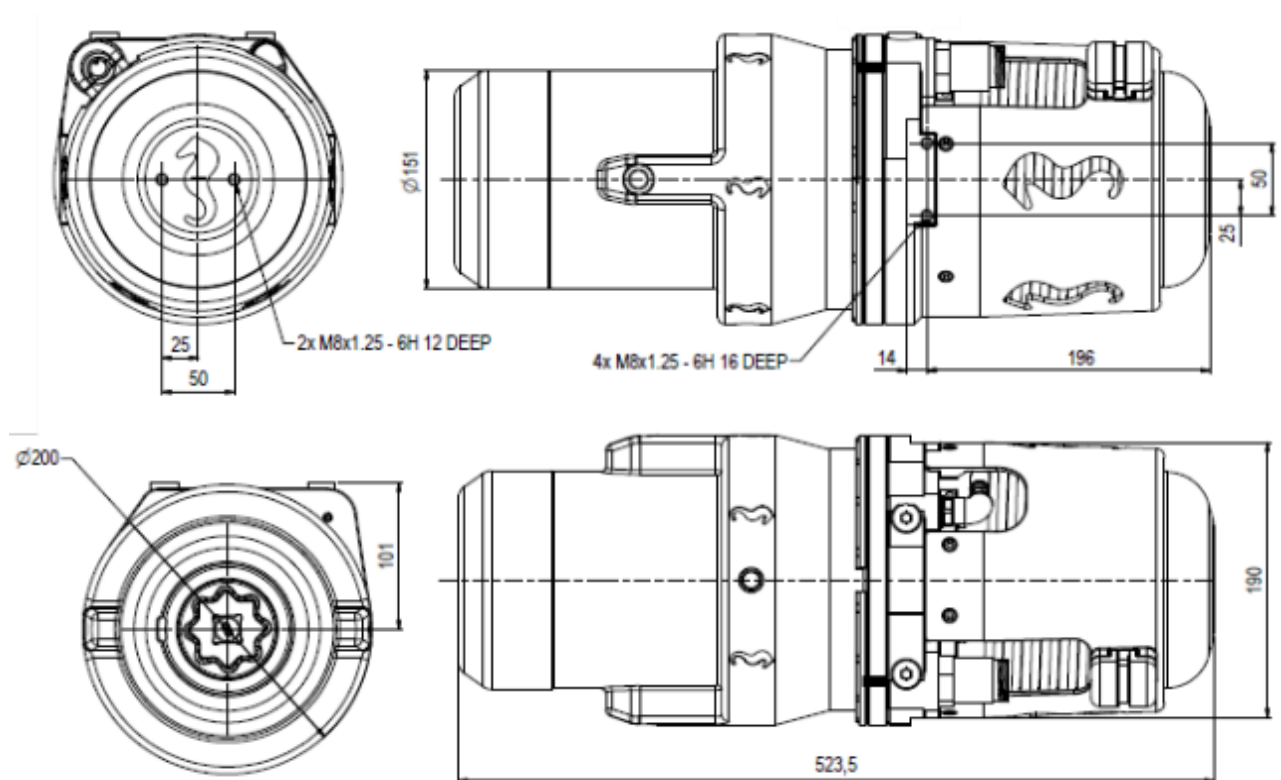
Figure 25 LWETT AUV configuration - main dimensions and bolting interface

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5.2.5. Diver Configuration
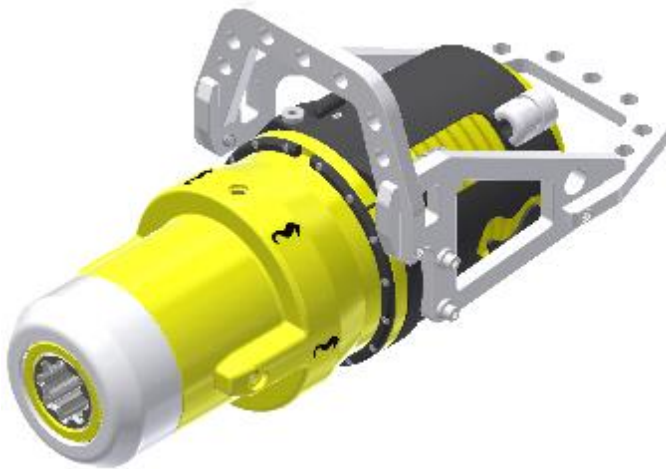
Figure 26 LWETT in diver configuration

For operation by diver, a low-weight handle has been designed. The handle is constructed in plastic, POM, and provides easy operation in both horizontal and vertical orientation.
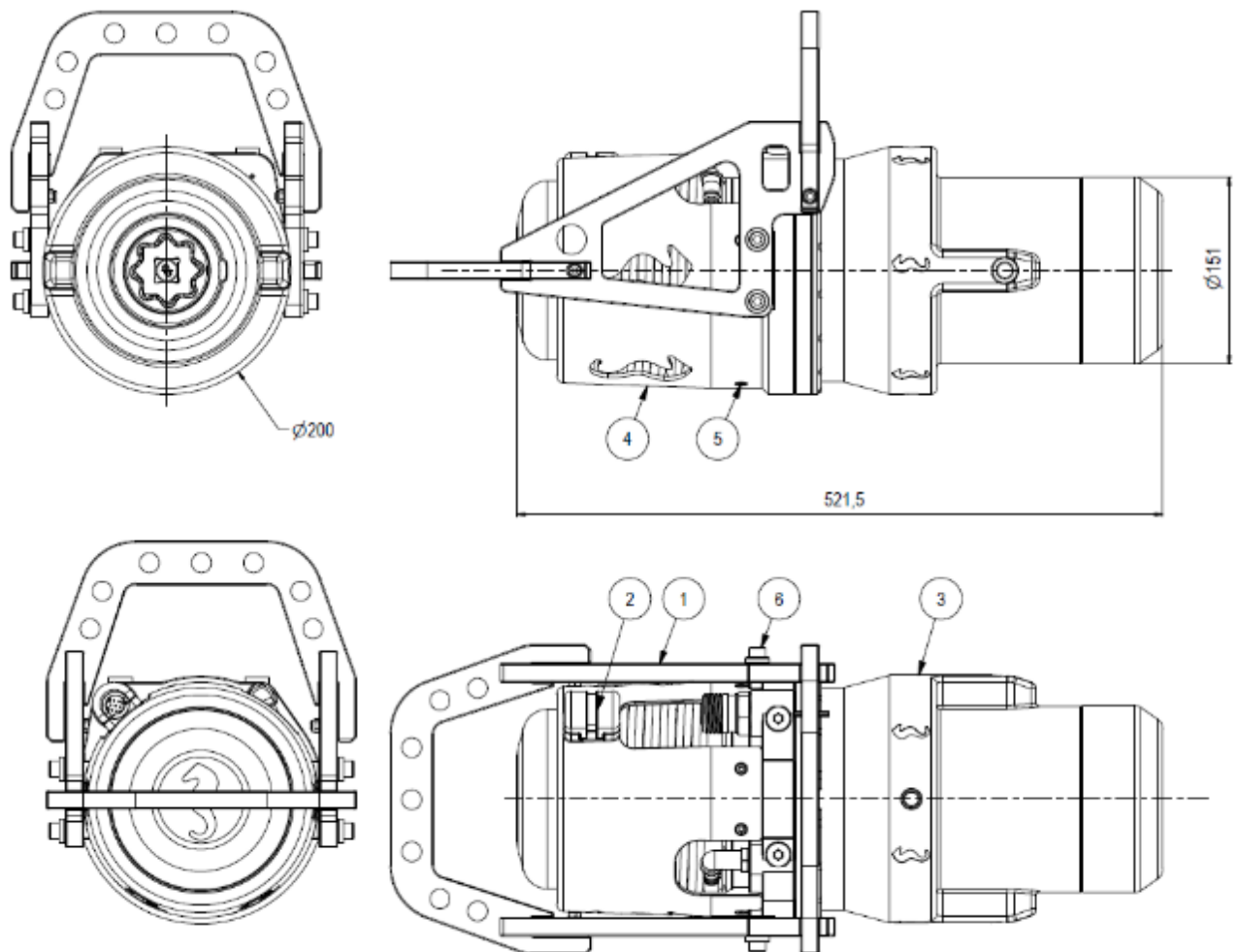
Figure 27 LWETT diver configuration - main dimensions

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Settings

Monitoring Dashboard

Archive Data Board

House keeping monitor

Failsafe Setting monitor

Performance reduction board

Tool status board

Communication Board

Operation time indication board

Operation Mode Bard

Command Dashboard

File Handling board

Class sensor indicators

Graph type setting
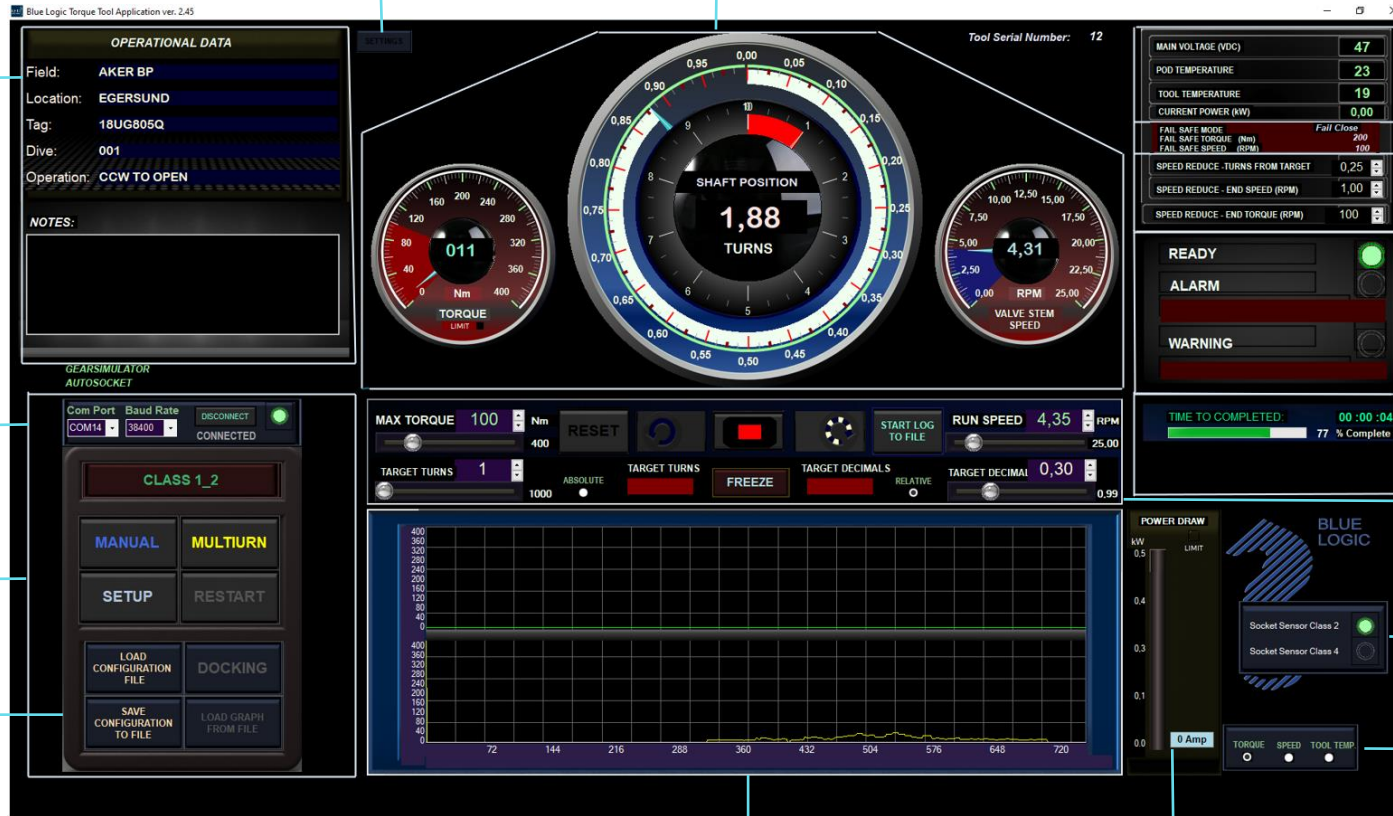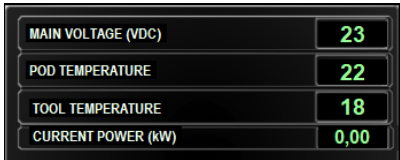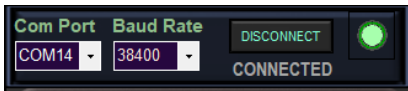
Graph Board

Power draw indicator
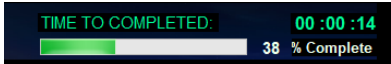
Figure 30: Main Window Overview
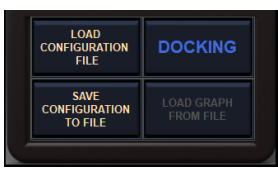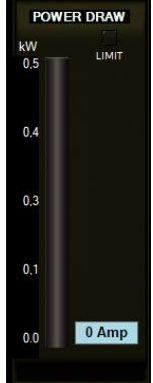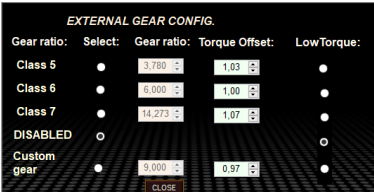
6.1.2. Main Window Information Boards

Board	Model	Description
Operation Mode Board	CLASS 1_2 MANUAL MULTIURN SETUP RESTART	The Operation Mode Board let the user select the different operational modes. In addition, the Setup Window can be entered here. Manual mode: Starts running when command button is clicked and stops when stop button is clicked. Multiturn mode: Rotates the tool towards a preset position. It will move and stops when target position is reached. If self-protect function has shut down the tool, restarting the tool is done via this board.
Housekeeping monitor	MAIN VOLTAGE (VDC) 23 POD TEMPERATURE 22 TOOL TEMPERATURE 18 CURRENT POWER (kW) 0,00	Critical tool information is presented in this board. The Message window shows more detailed messages related to instrument lamps and status. Messages are: - Description of alarms/warnings. - Status indication (e.g. Initializing or Operating.
Communication Board	Com Port Baud Rate DISCONNECT COM14 38400 CONNECTED	Presents communication information. Selection of valid com port and baud rate. *NB! Baud rate must be compatible with the TT controller's baud rate. If wrong the connection lamp will still be green since the lamp only shows connection to the USB/RS converter. (Typical Moxa converter).* Default baud rate is 38400.
Failsafe Setting monitor	FAIL SAFE MODE *Fail Close* FAIL SAFE TORQUE (Nm) 500 FAIL SAFE SPEED (RPM) 300	Board that occurs if fails safe mode differs from fail as is. This board gives information about fail safe operation direction, fail safe torque limit and speed. (Fail safe speed and Torque limit may differ from normal operations torque limit and speed.)
Performance reduction board	SPEED REDUCE -TURNS FROM TARGET 0,25 SPEED REDUCE - END SPEED (RPM) 1,00 SPEED REDUCE - END TORQUE (RPM) 100	Operator can write the position (Degrees) from target (Multiturn mode only) where speed and/or torque will be changed to avoid high speed impact if end stop will be reached.

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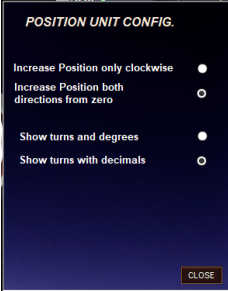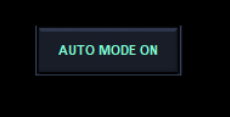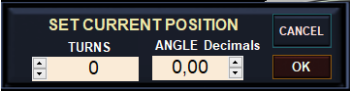
Tool status board		Board showing if no alarms are detected, and TT is ready for operation. If alarm occurs, alarm lamp will light red and detailed alarm message will show below. If more than one alarm occurs the different messages will toggle. Warning lamp is lit yellow with toggling messages below. Errors **may be reset using "RESTART" button.**
Operation time indication board		Board showing completion of operation shown in % and time count down. (Hours, minutes, seconds). Board shown in Multiturn mode only.
Monitoring Dashboard		This board contains instruments showing real time position, torque and speed. Tool serial number is uploaded from TT when connection is established and shown here. NB! If tool serial number value remains 0, indicates no real communication with TT is established. Reason may be no power at TT or wrong baud rate selected. Settings opens menu for quick operator settings.
Class detection		This field will default show the auto detected Iso Class output pipe (governed by if the pipe is connected to stage 2 or 3 in the gear) If External gear mode is selected Class higher than 4 will be shown. In these cases, the text will occur in white color. In special cases where special designed output pipes are used, the field can be manually edited, see section 9.3.2 NOTE: Make sure that the output socket corresponds with torque rating for the job, ref section 3.1.2 / 5.1.2
Command Dashboard		Buttons and indicators for setting torque limit, speed, positions and direction. Which button/Indicators that are shown depends on selected mode. (Multiturn mode is shown).

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Archiving Data Board		Board for operator to tag the following operation with necessary data for file handling and reports. Notes: Text written here will be added as notes to reports. Text may also be loaded to GUI at a later stage.
File Handling board		Board for Saving current setup configurations and loading previous Configurations. Activate docking mode can also be selected here.
Power draw indicator board		This board shows current power drawn from torque tools power source. Range of power bar is limited to maximum power. (Maximum **power is selected in "Setup" window.** If maximum power is reached a limit lamp will illuminate and speed will reduce.
Settings		Setting opens a menu for **operator's** configurations.
External gear configuration		Board for defining and selecting additional classes when TT is connected to an external **gearbox. If external gearbox is selected, GUI's** instruments, settings and graphs will represent the external gears output shaft.

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Position unit configuration		By pressing the unit button, a selection window gives the possibility to change monitored position units.
Auto Mode		In auto mode operating is cycling automatically a given number of cycles using predefined positions in both directions.
Set Position		Torque tools socket position is stored and kept during power cycling. However, if current position is lost, but known it is possible to re-establish current position here.
Class sensor indicators		Only tools equipped with auto socket. Shows which class is connected when docking is completed.

6.1.3. Setup Window

Setup window is divided into four sections holding the different set limits, limiting the operational freedom found in the Main Window. The set limits can have a huge impact on ELTT performance; a password has been applied in order to change values.

Both the Performance Config and Failsafe Configurations are password protected, with two different passwords.

Passwords can be made available on request to Blue Logic.
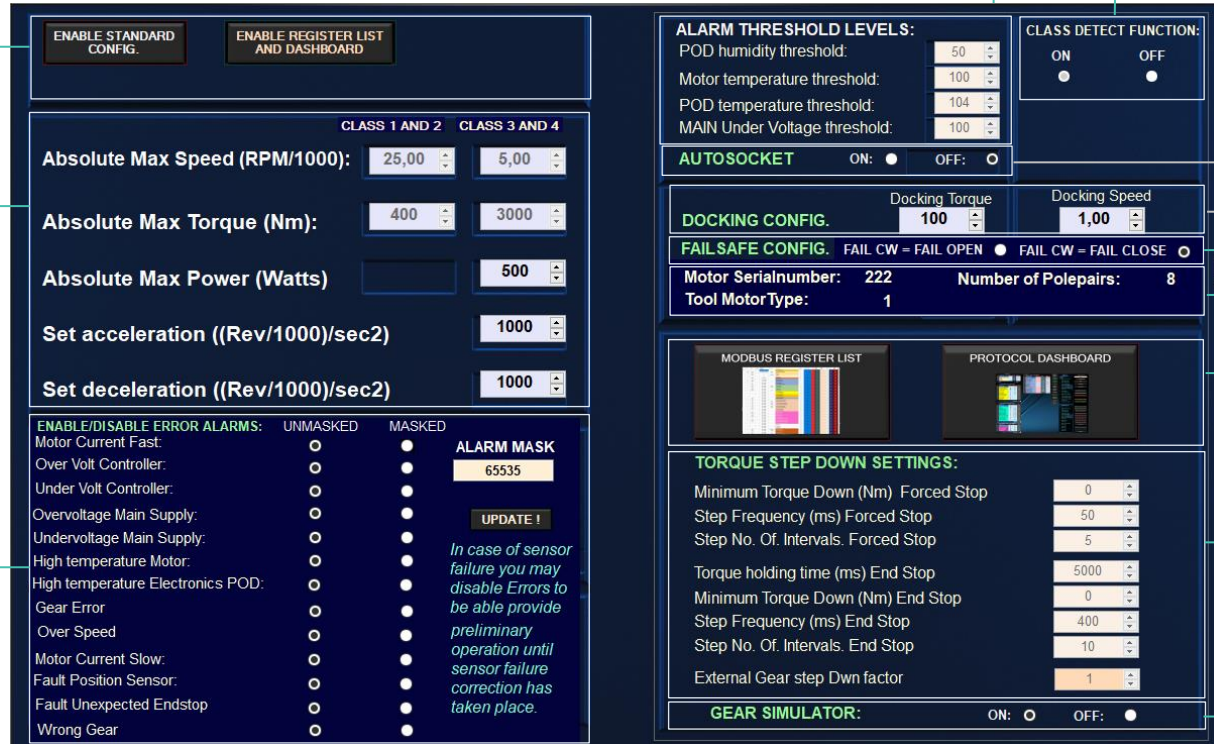
Setup window also shows actuator data that are loaded from the actuator during connection.

An additional "Advanced settings" window may be opened containing Alarm/warning settings and limits.

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Some alarm thresholds. Additional level may be adjusted using the protocol

Class detect

Autosocket selection

Docking configuration.

Password control for setup editing

Performance config

Failsafe configurations. (Decide if FS shall be open or closed.

Tool motor data (Read only)
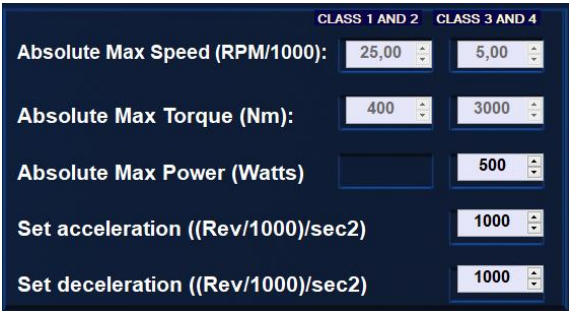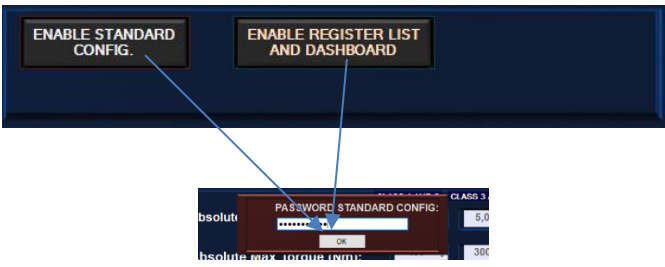
Modbus protocol tools.

Setting Torque step down settings.

Alarm handling

Gear simulator setting

Screenshot contents:

ENABLE STANDARD CONFIG.   ENABLE REGISTER LIST AND DASHBOARD

	CLASS 1 AND 2	CLASS 3 AND 4
Absolute Max Speed (RPM/1000):	25,00	5,00
Absolute Max Torque (Nm):	400	3000
Absolute Max Power (Watts):		500
Set acceleration ((Rev/1000)/sec2)		1000
Set deceleration ((Rev/1000)/sec2)		1000

ENABLE/DISABLE ERROR ALARMS: UNMASKED MASKED

Motor Current Fast:
Over Volt Controller:
Under Volt Controller:
Overvoltage Main Supply:
Undervoltage Main Supply:
High temperature Motor:
High temperature Electronics POD:
Gear Error
Over Speed
Motor Current Slow:
Fault Position Sensor:
Fault Unexpected Endstop
Wrong Gear

ALARM MASK
65535

UPDATE !

In case of sensor failure you may disable Errors to be able provide preliminary operation until sensor failure correction has taken place.

ALARM THRESHOLD LEVELS:
POD humidity threshold: 50
Motor temperature threshold: 100
POD temperature threshold: 104
MAIN Under Voltage threshold: 100

AUTOSOCKET ON: ● OFF: ○

CLASS DETECT FUNCTION:
ON ● OFF ○

Docking Torque 100   Docking Speed 1,00
DOCKING CONFIG.

FAILSAFE CONFIG. FAIL CW = FAIL OPEN ● FAIL CW = FAIL CLOSE ○

Motor Serialnumber: 222   Number of Polepairs: 8
Tool Motor Type: 1

MODBUS REGISTER LIST   PROTOCOL DASHBOARD

TORQUE STEP DOWN SETTINGS:

Minimum Torque Down (Nm) Forced Stop	0
Step Frequency (ms) Forced Stop	50
Step No. Of. Intervals. Forced Stop	5
Torque holding time (ms) End Stop	5000
Minimum Torque Down (Nm) End Stop	0
Step Frequency (ms) End Stop	400
Step No. Of. Intervals. End Stop	10
External Gear step Dwn factor	1

GEAR SIMULATOR: ON: ○ OFF: ●

6.1.4. Setup Window Sections

Section	Mode	Description
Performance Config.		This board holds all absolute max limits towards socket output values (Torque speed). These parameters are password protected. *Contact supplier for change.* Max Power draw can be set. Acceleration/deceleration settings can also be accessed here. Large number = fast speed change. Low number = slow speed change (Ref. section 3.4.1.3)
Password control for setup editing		Writing the correct password here will enable all parameters in setup for editing and enables entering of additional forms. Standard config: *Enable all parameters in the Setup window.* Enable register list and dashboard: *Enable access to Modbus register and protocol dashboard.* Read only parameters will not be accessible.

Section	Mode	Description
Tool motor data (Read only)	Motor Serialnumber: 222 Number of Polepairs: 8 Tool MotorType: 1	Information about motor loaded from tool.
Some alarm thresholds. Additional levels may be adjusted using the protocol dashboard.	ALARM THRESHOLD LEVELS: POD humidity threshold: 50 Motor temperature threshold: 100 POD temperature threshold: 104 MAIN Under Voltage threshold: 100	Pod Humidity and main undervoltage threshold must be adjusted here. The rest is read only but can be adjusted in "Protocol Dashboard".
Failsafe configurations	FAILSAFE CONFIG. FAIL CW = FAIL OPEN ● FAIL CW = FAIL CLOSE ○	Decide if Clockwise rotation will open or close valve. Selection will show correct mode in main window.
Modbus protocol tools.	MODBUS REGISTER LIST PROTOCOL DASHBOARD	Opens the Modbus development tool or a dashboard for handling all protocol registers. (Meant for programmers and for factory tool setup and calibration).
Torque Step down settings.	TORQUE STEP DOWN SETTINGS: Minimum Torque Down (Nm) Forced Stop 0 Step Frequency (ms) Forced Stop 50 Step No. Of. Intervals. Forced Stop 5 Torque holding time (ms) End Stop 5000 Minimum Torque Down (Nm) End Stop 0 Step Frequency (ms) End Stop 400 Step No. Of. Intervals. End Stop 10 External Gear step Dwn factor 1	Setting parameters regarding torque limit down ramping after forced stop or after mechanical end stop.
Alarm handling	ENABLE/DISABLE ERROR ALARMS: UNMASKED MASKED Motor Current Fast: ○ ● ALARM MASK Over Volt Controller: ○ ● 65535 Under Volt Controller: ○ ● Overvoltage Main Supply: ○ ● UPDATE ! Undervoltage Main Supply: ○ ● High temperature Motor: ○ ● In case of sensor High temperature Electronics POD: ○ ● failure you may Gear Error ○ ● disable Errors to Over Speed ○ ● be able provide Motor Current Slow: ○ ● preliminary Fault Position Sensor: ○ ● operation until Fault Unexpected Endstop ○ ● sensor failure Wrong Gear ○ ● correction has taken place.	Alarm handling. If the tool stops as a result of a present alarm and the alarm is obvious not valid. (Typical sensor failure). >It is possible to disable the alarm to be able to continue operations. However, care must be taken since all the alarms are present to protect the tool and performance. When tool

Section	Mode	Description
		power is recycled all alarm will be re activated.
Class detect setting	**CLASS DETECT FUNCTION:** ON OFF	Class detect setting. When function is set to OFF the auto class detect will not work. Shall only be used with Auto socket. In OFF mode accuracy will be reduced during class 1_2 operations.
Docking configuration	**DOCKING CONFIG.** Docking Torque 100 Docking Speed 1,00	Docking configuration Setting for torque and speed for operation in Docking mode.
Autosocket selection	**AUTOSOCKET** ON: OFF:	Autosocket selection. Set ON when tool is equipped with Auto socket front pipe. *NB! If sensor failure occurs in the auto socket pipe operation may be possible by setting this mode to OFF, and then select class manually.*
Gear simulator setting	**GEAR SIMULATOR:** ON: OFF:	Gear simulator setting. If gear error occurs permanently because of socket position sensor failure it is possible to operate by setting gear simulator till ON. *NB! In this mode only motors position sensor is operating, so direct output socket position measuring is deactivated.*

6.1.5. Operational Modes

The different operational modes are pre -fixed operation programs designed to suit ELTT operations. By being able to select between several modes containing different safety and limit features, the operation can be conducted with high safety.

Two modes are available: *Manual* and *Multi Turn.* In addition, a gearbox mode is available for operation of class 5, 6, 7and custom defined gearbox.

Manual:

Figure 31: GUI Manual Mode

In Manual mode the ELTT will start continuously running according to selected speed. If required torque is higher than selected torque, actual speed will be lower than selected speed. Tool output will be stopped when stop button is engaged, or selected torque limit prevents running. Target position or number of rotations cannot be set in this mode.

Multi Turn:
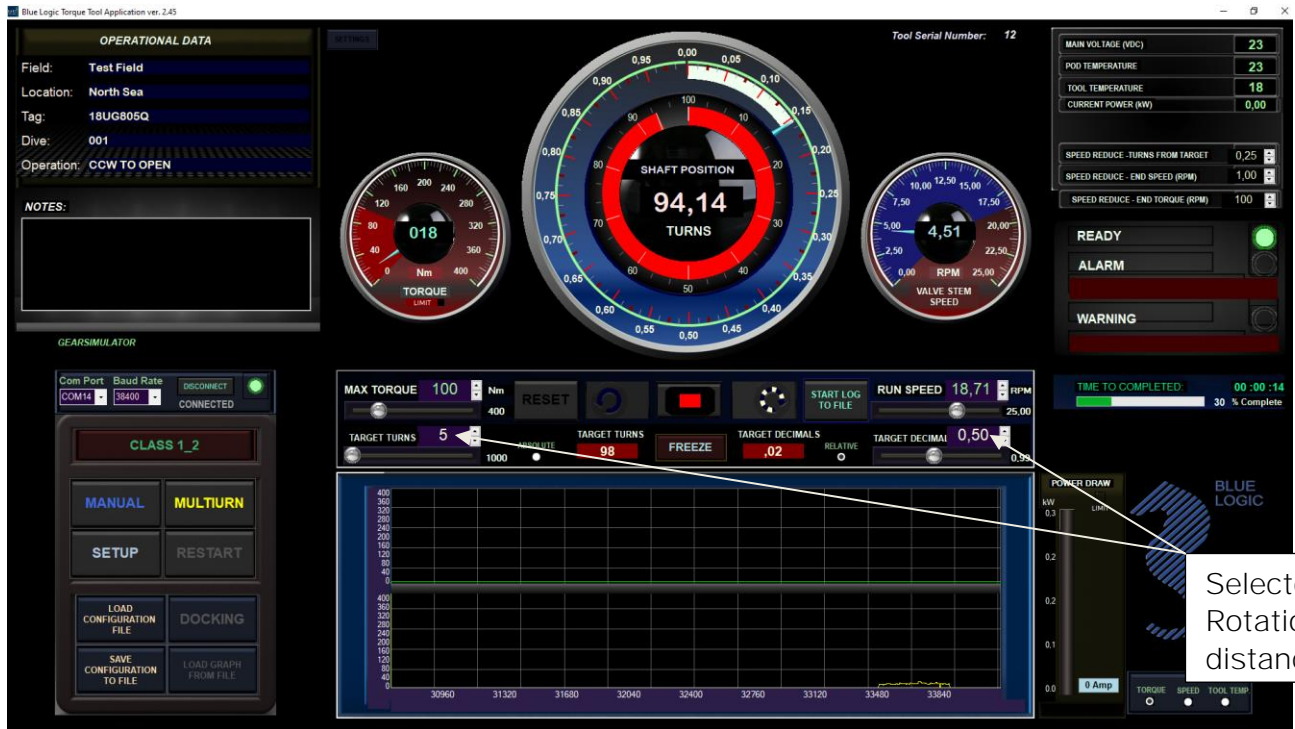
In Multi Turn mode the operator can select relative number of turns and rotational degrees the ELTT shall run before it stops. When in Multi Turn Mode a section in Operation Set Limit Board will appear where to set target position before operation. If "RELATIVE" is selected set position will be relative according to present position. If "ABSOLUTE" is selected the set position is absolute according to positions O.

In "Relative"-mode target position will be different regarding which direction will be started. If cursor is held over the Run-Clockwise-button the red boxes show what will be the target position if the Run Clockwise-button is clicked. If cursor is held over the Run-Counter-Clockwise-button a target position int the Counter-clockwise direction will show.
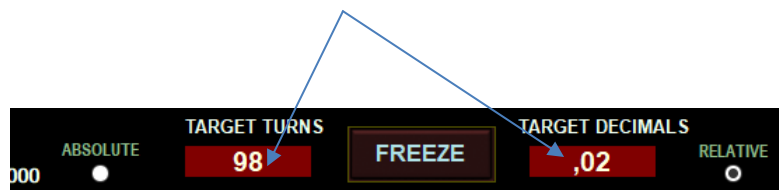
Ex.: If 2 turns and 126 degrees are set, Torque tool will rotate to the given distance in selected direction.

When target position is reached a new operation will rotate the output shaft the same distance in addition.

E.g.: if 1 turn and 180 degrees are set, and the Torque Tool has reached target position. If a new operation activates with the same settings target position will be 3 turns and 0 degrees. Alternatively, if a new operation in opposite direction is activated target position will be 0 turns and 0 degrees. (See point 3 below).

In "**Absolute**"-mode the red target position boxed will be hidden since the target position always will be the same as written in the blue set target position boxes.
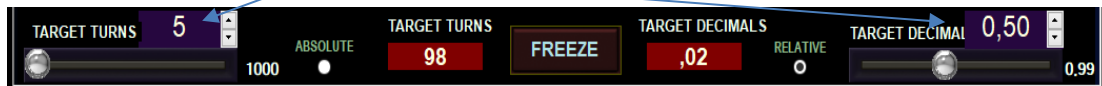
Speed setting and torque limit may be changed during operation.

The Following functions are available in this mode:

1. Stop:
   During operation, it is possible to stop the rotation by pressing the stop button. In "**Relative**"-mode and If target position is not reached the rest of the operation is excluded. Pressing new operation will start a new distance according to selected rotational distance. In "**Absolute**"-mode a new operation will continue to the set target.

2. Freeze:
   If freeze is selected operation will stop temporary. A blinking message will indicate that temporary stop is activated, and the freeze button text **will change to** "unfreeze". Selecting the unfreeze button will continue the operation until target position is reached.

3. Change target position during operation.
   If new target position is changed during operation, output shaft will start to rotate towards new target automatically. If actual position is beyond new target position rotation, will immediately change direction and move towards new target position.

4. Speed and/or torque reduction before target position is reached.
   If a valve's end position is unknown, there is sometimes a risk of reaching mechanical end stop before Target is reached. Under these circumstances it may be desired to enter the target area with low speed and/or low torque to avoid the risk of high-force impact. However, if the operation requires multiple turns, it is not appropriate to run the operation at low speed since the operation time will be too long. Also, sometimes there will be need for a higher torque during the distance. For this reason, the operator can set a given position where speed and/or torque automatically will be reduced.

   Ex.: The target position is 5 turns and 90 degrees. Speed setting is 5 rpm. Torque setting is 1000 Nm. The operator types as follows;
   90 degrees(In degrees mode) or 0,25 turns (in turns mode) (in "Speed reduce – position from Target" and 1 in "Speed reduce – End Speed". Tool will run at 5

rpm and 1000 Nm limit until 5 turns are reached and the reduce speed to 1 rpm and 500Nm limit for the last 90 degrees.
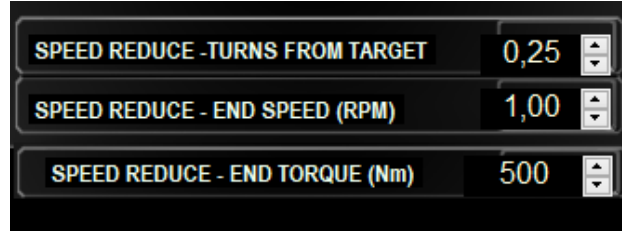
Auto Mode:

Select Auto mode:
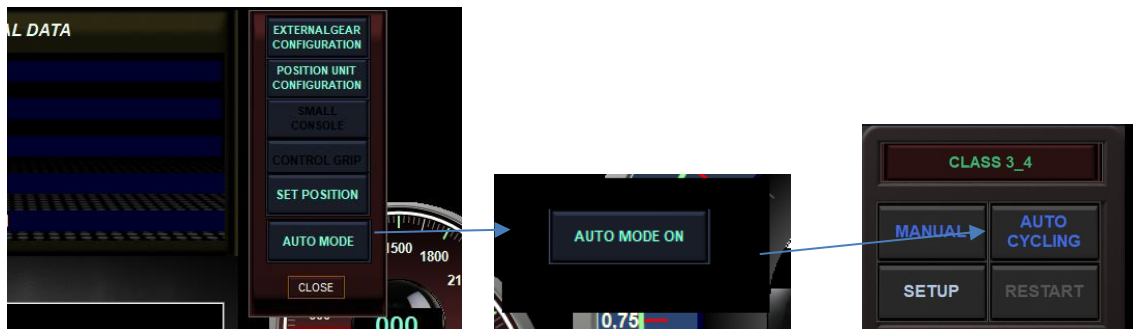
Multiturn mode is replaced with "Auto cycling" mode.

Define start position and end position.
Define pause between each operation.
Press Run button.

A report file will be produced for each performed operation and placed in following folder:
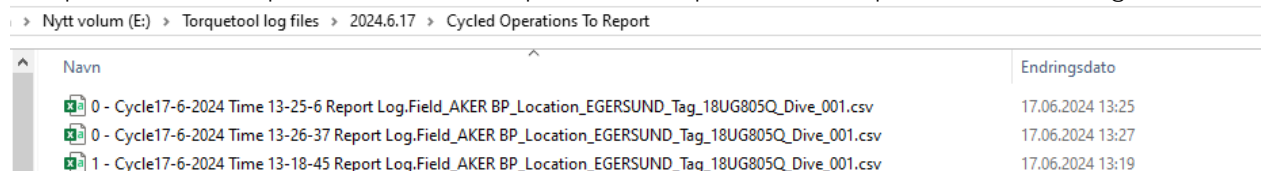
Each filename will start with respective cycle and filename will contain "Cycle".

Auto Socket Mode and Docking:

In auto socket mode Torque tool must be equipped with multi-socket interface nose including all classes. (Ref. section 3.1.3 Interface Description – Auto Class Select Version).

When Tool is not docked, default detected class is 1_2. Otherwise, the socket parts are not in legal position.

- Connect tool. In undocked position Class 1_2. Operator must verify the detect class

- Activate docking mode

- When tool is in position, perform Docking by click and holding button (Docking speed and torque can be changed in Setup).
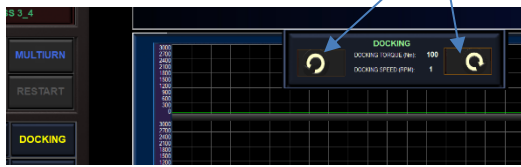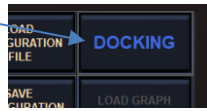
- Deactivate docking by clicking Docking button again.
- If Class 3_4 socket sensor indication will change and detected class need to be verified

    NB! If docking fails and socket remains in an illegal state or sensor fault occurs following will show:

    If sensor fault occurs it may be possible to operate as follows:

    - Open setup.
    - Set "Autosocket" to "OFF"
    - Select class manually.

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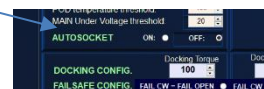
Class 5,6,7 and Custom Gearbox Mode

By activating these modes, the turns and torque output will be displayed as actual output values for the gearbox. 4 different gearboxes can be configured and stored in this window. Configuration is password protected while selection is available for the operator. Torque and turns will be presented as calculated values based on the defined gear ratio of the selected class.
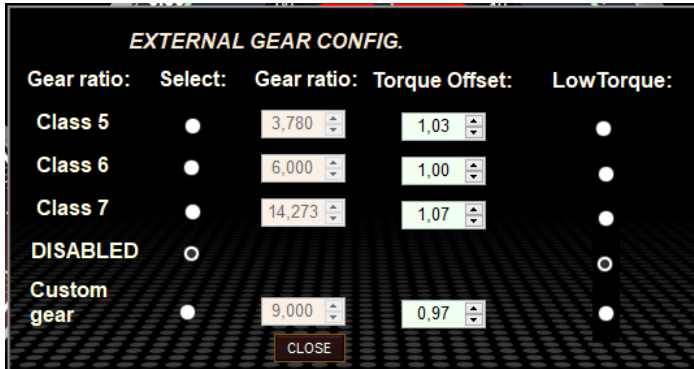
Torque, speed and position settings and monitoring will be calculated, and instruments and graph will represent the output of the external mounted gear.

7. AUXILIARY EQUIPMENT

7.1. EQUIPMENT MATRIX

Action	LOGISTICS	MOBILIZATION	DE-MOBILIZATION	PRE DIVE PREP.	POST DIVE PREP.	OPERATION	MAINTENACE
Typical Tools. Allen Keys, Wrench and sockets.		X		x	x	x	x
PPE	x	x	x	x	x	x	X
Calibration jig		X					x

8. MOBILISATION/DE-MOBILISATION

8.1. ONSHORE PREPARATIONS

Prior to shipping offshore, a mobilization/ verification should be performed. All functions should be tested and verified. The following checklist should be used as a guideline for activities to be performed prior to offshore mobilization.

No.	Description	Check/Verified
1.	Inspect tool for visual damage or unusual wear and tear	
2.	⚠️ Make sure that serial number on torque tool and label on PC corresponds.	
3.	Inspect EPC and/or IC for visual damage or unusual wear and tear. Special attention should be focused on its connectors.	
4.	Inspect Umbilical/Cable for visual damage or unusual wear and tear	
5.	Inspect that the ISO key is secure and fastened.	
6.	Assemble the TT system and connect to power. Make sure that umbilical has the slack necessary to operate the ELTT	
7.	Verify that the TT functions can be operated when connected.	
8.	Verify that the torque is accurate by use of a calibration jig. Note: Max RPM for test in Cl.2 jig: 1 RPM Max RPM for test in Cl.4 jig: 0,5 RPM	
9.	ELTT Oil-Level: Check oil level in compensator, refill as required. Total oil-volume is approx. 2L. Bleed any air through the pressure relief valve on the TT: Let ELTT stand on the floor with the position feedback glass as the highest point. There should be minimal air bubbles visible inside the glass.	

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No.	Description	Check/Verified
10.	LWETT Oil-Level: Check that pressure compensation hose is completely oil-filled and no air bubbles. If refill is required, oil can be topped up from the 1/4" plug with one-way valve. Fill oil here, ¼" BSP Keep the tool in an up-right position, i.e. output socket down. Make sure to evacuate any trapped air through the hose. Black cover must be removed to access the end of the hose. Max pressure 10Psi.	
11.	Disassemble ELTT and store in transport box.	
12.	Verify correct packing and documentation in the transport box. The transport box should include as a minimum Electrical Torque Tool Operation and Maintenance Manual	

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8.2. MOBILISATION PROCEDURE

Item	Procedure
1	Check the condition of the transport box. Repair any damage or replace if necessary.
2	Check all items to be present according to the inventory list.
3	If any, check and follow the check-out procedure before delivering the tool for shipping.

8.3. DE-MOBILISATION PROCEDURE

Item	Procedure
1	Perform preventive maintenance according to /05/
2	Check the condition of the transport box. Repair any damage or replace if necessary
3	Check all items to be present according to the inventory list.
4	Fill in EFR if necessary. (To be stored in transport box.)
5	Storage according to chapter 11.3

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9. OPERATION

9.1. TOPSIDE OPERATION

When performing operation above water do not run tool on full load for prolonged periods.

Observe the Graphical User Interface for temperature warnings.

Consider water-cooling if operation is expected to take time.

Consider ambient temperature.

9.2. OFFSHORE PREPARATIONS

9.2.1. Pre-Dive Check

Prior to dive, the Electrical Torque Tool System shall be inspected and function tested.

No	Description	Check/Verified
01	Inspect tool for visual damage or unusual wear and tear.	
02	NOTE! Make sure that serial number on torque tool and label on PC corresponds. The TT will only operate correctly when connected to correct PC.	
03	Inspect Power Can (EPC) or (PFC (part of Subsea-USB system)) for visual damage or unusual wear and tear	
04	Only Subsea-USB: Inspect Subsea-USB system with special attention to coil surface.	
05	Only Subsea-USB: Verify Subsea-USB connectors mate completely	
06	Inspect Umbilical/Cable for visual damage or unusual wear and tear.	
07	Connect the safety wire to a structural section on the ROV. Make sure that the wire is shorter than the cable to avoid damages to cable if the tool is dropped, ROV drift-off etc. during operation.	
08	Inspect that the ISO key is secure and fastened.	
09	Verify that the TT is connected to power.	

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No	Description	Check/Verified
10	Verify that the TT functions can be operated when connected.	
11	Verify torque using calibration jig if available. Run Torque Tool in static cell at 500, 1000, 1500, 2000, 2500 and 2700Nm load with speed set to 0,5rpm. Compare numbers from GUI with set load. Max. deviation 10%. Run no longer than 5-10 sec. to avoid heat generation. Activate logging of data according to instructions in section 9.8 to document the calibration check. Note: Max RPM for test in Cl.2 jig: 1 RPM Max RPM for test in Cl.4 jig: 0,5 RPM	
12	Verify and test locking mechanism. It is highly recommended that all ROV pilots get familiar with the locking mechanism on deck.	
13	Check oil-level in compensator, refill if required. Ref section 8.1.	

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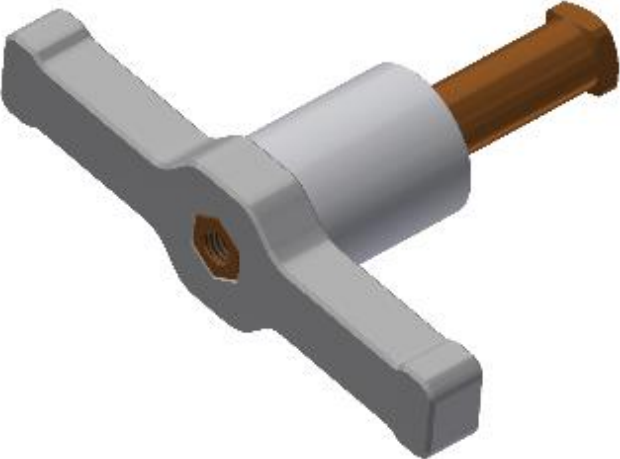
9.2.2.   Changing the ISO Key – ELTT

For tools equipped with interface for subsea change out of socket, reference is made to /6/.

No.	Description	Check/Verified
1	Remove the six M8x35 Socked Head bolts located at ELTT nose	
2	Remove POM nose.	
3	Switch socket to the one desired. Clean socket holder thoroughly if dirty.	
4	Install POM nose and bolts. Note: Use AquaShield and thread lock on bolts before mounting	
5	Operate tool and verify that the system detects correct socket automatically. Override socket type in GUI if auto-detect fails. Caution: It is crucial that correct socket is selected in GUI prior to any operation!	

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9.2.3. Changing the ISO Key - LWETT

No.	Description	Check/Verified
1	Use the special key-tool (BB2423) to loosen the socket installed in the LWETT.	
2	Insert the key into the socket and twist to release the locking dogs. Pull out to remove socket.	
3	For Class 3 & 4 adapter; CCW twist to unlock	
4	For Class 2; CW twist to unlock (Class 2 may require a punch with a soft hammer to remove)	
5	Insert the required socket with the key all the way in. Make sure that the guide slot for indicator pin is aligned	
6	Make sure that the socket clicks into correct position and remove the key.	

9.3. PRE-DIVE OPERATION STARTUP

After communication has been established, the following must be done to start an ELTT operation:
- Check set-up settings
- Detect interface socket
- Select operation mode
- Add archiving information

9.3.1. Check Setup Settings

When defining setup settings, the following checklist should be followed, though not limited to:

No.	Description
1	Max TT power consumption set according to host power supply
2	TT max engine rpm is set according to highest suitable operational socket rpm
3	Max output torque is set according to operation
4	Max output torque, Ball Valve mode, set according to operation
5	Docking torque set according to operation
6	CW acceleration set
7	CCW acceleration set
8	Break torque end position
9	Seating Torque start position
10	Arrange archiving file structure
11	Verify Failsafe Config

9.3.2. Torque Class Detection

By recognizing socket interface class, the tool will automatically select between Low and High Torque mode.

Caution:

It is crucial that correct socket is selected prior to any operation! Verify correct selection, override in GUI if auto-detect fails to recognize correct socket.

No.	Description	Figure
1	Push Class identification button to detect class. Motion starts for sensing output socket type.	
2	Confirm automatic or manual class detection	
3	If manual mode is selected chose class, consider warnings and confirm with OK	
4	When selected class is detected, define configuration and limits respectively. Class is shown Class window	
5	Startup is completed and Torque tool is ready for operation	
6	If socket class is not detected, all operations are disabled. (See trouble shooting section; "Not able to Class Detect")	
7	To change class at a later stage, perform following instructions: Turn off current selected mode. Now the Class Identification button is blinking weakly. Push the button and process class detection as described above.	

9.3.3. Add Archiving Information

To edit Tag information just add the information to the **"Data Fields"**.

Click in the fields and fill in required text.
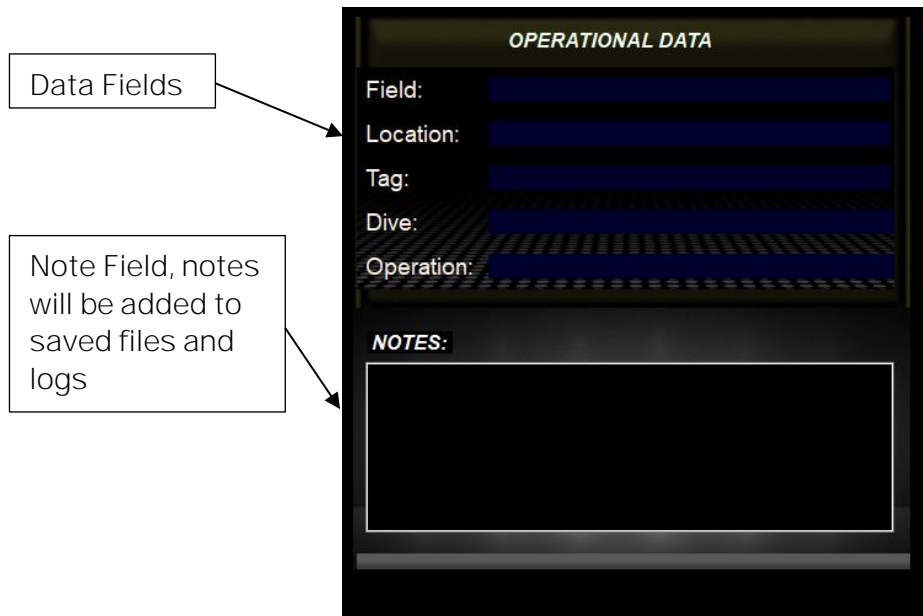
The following operations data may be typed in or imported by loading configuration file (See section 9.9.1).

In the Note Field the operator can include notes or free text related to the operation. This text will be included in the Configuration file together with operational data, date and time. (See section 9.9.1).

9.4. SUBSEA OPERATION

No.	Description	Check/Verified
1	Only Subsea-USB: Inspect the primary/secondary to be mated by ROV visually. Verify that mating surfaces are clean	
2	Only Subsea-USB: By use of the ROV manipulator gently mate the male and female (primary/secondary) connectors.	
3	Only Subsea-USB: Verify that the connectors are fully mated and that cables are undamaged	
4	Start ELTT Software and communication.	
5	Verify ELTT Engage Latch Handle to be positioned in Mid position.	
6	Adjust max torque value according to valve to be operated.	
7	Dock ELTT into selected location by use of D-Handle. If ELTT does not interface valve bucket due to un-alignment of valve stem and interface socket, operate tool at max. 200Nm and 1000RPM/1000.	
8	Change grip to Engage Latch Handle. To complete full engagement on to valve bucket, set Engage Latch Handle in Latch Locked position.	
9	Operate Torque Tool to complete valve operation. Note: If comments to valve operation gains additional track information. Add comments to note board.	
10	Stop Torque Logging	
11	Release Torque Tool from valve bucket.	

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9.5. POST DIVE CHECK

No.	Description	Check/Verified
1	Recover ELTT equipment to deck.	
2	Perform a visual inspection and function test with special attention to the following: Interface section and output socket ROV Handle and latch mechanism Cable and connectors Fittings Surface treatment	
3	Flush all equipment thoroughly with fresh water	
4	Check oil-level in compensator, refill as required	
5	Subsea-USB: Connect system and perform a full system check	
6	Dry off equipment and apply protective oil, WD40 or similar, prior to storage.	

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9.6. HOOK-UP AND COMMUNICATION

The ELTT System is easily installed to its host, connect the Torque Tool to EPC or Inductive Connector. When the program is started communication must be established and verified (see table below).
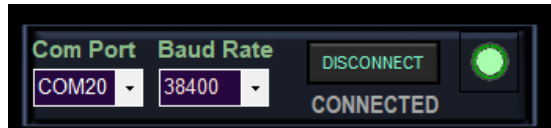
Figure 32: Communication Board

No.	Description
1	Select com port
2	Select Baud Rate. (Default is 38400).
3	Press Connect
4	LIVE: Green – communication with Torque tool established. NB! Connection indicator only refers to connection between PC and USB/Serial converter. This means that communication with tool only **is verified if "Tool serial number" are updated and "Main Voltage" appears. If no Tool communication is verified wrong baud** rate may have been selected. Try the other baud rate! Failure!: Red – Communication with Torque Tool (USB/Serial converter) failed. See trouble **shooting section; "Communication problems".**

9.7.   ELTT OPERATION

9.7.1. Operational Controls

This section describes general operation controls for start, stop and adjustments:

	The right and left arrows will start rotation in direction as indicated (clockwise or counterclockwise). If the symbol is steady lit, the ELTT is ready to operate.
	If any symbols are dark, the ELTT is unable to perform that operation. Typical If the system is not ready or no mode has been selected.
	Only valid in speed mode. Symbol light rolling. This occurs when button is clicked (NOT double-clicked) and left mouse button is held down. Output shaft rotates clockwise according to torque and speed settings and stops when left mouse button is released.
	Output shaft rotates clockwise according to torque and speed settings, even if the left mouse button is released. To stop rotation, stop button needs to be pressed, or target position achieved.
	If stop button is dark the operation is not valid : - No rotation started - No mode set - System not ready
	The stop button light is steady red when output shaft rotates. Pressing stop button will stop the rotation. To activate soft stop according to the set deceleration, press stop button once (do not double-click). Stop button will start blinking until rotation has completely stopped. To activate quick stop, double click the button

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9.7.2. Unit settings
Two units are selectable:
1. Turns and degrees.
2. Turns with decimals

Default unit are "**Increase** Position in both direction from zero". The instrument will change scale when passing 0. This means that Instrument and angle number will show correct proceed distance from 0 in both directions. Counterclockwise side of zero will appear with (-) sign. Valid in both units. Here set angle value will always respond with angle position value and instrument value.

If you select "**Increase** position only clockwise" The position instrument shows the outputs sockets absolute position. If distance to run are 45 degrees counterclockwise from zero, the needle will stop at 270 degrees. To achieve the same output socket rotational position by running clockwise the distance must be 270 degrees.

The position instrument and angle number reports position as an absolute protractor i.e. that during a counterclockwise operation, degrees go from 359 – 0. This may be a bit confusing since if you will go 45 degrees from 0 counterclockwise, the instrument and angle will show - 270 degrees.

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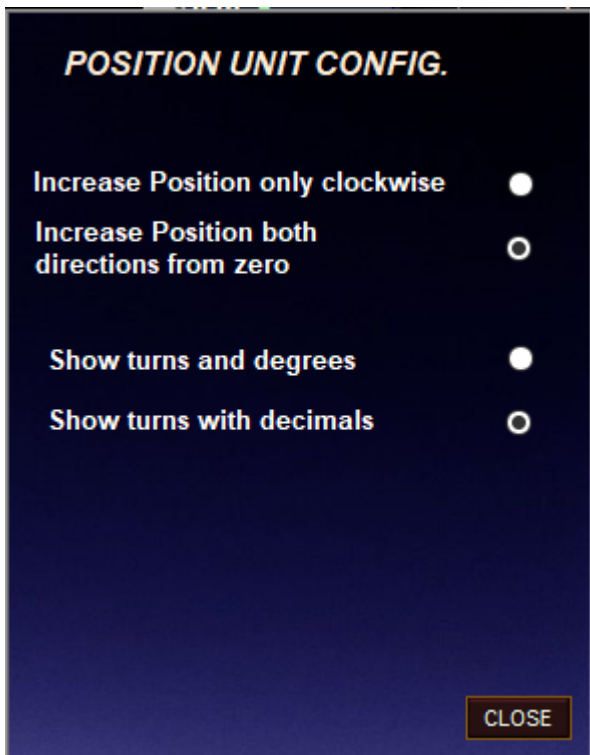
9.7.3. Adjustment Operations

In every mode and before or during operation, Torque limit and speed can be adjusted in the Operation Set Limit Board or Command and Operation Dashboard

Adjustment can be performed by pressing and dragging the slider handles in the Operation Set Limit Board, or by clicking the one-step vice selector. Values can also be typed directly in the Operation Set Limit Board. Slider is moved be holding the cursor over and holding down the left mouse button.

Max. torque value updates as the slider moves. However, values are updates first when the mouse button is lifted.

Maximum values are limited by the absolute max values set in Setup Window (see section 6.1.4). If a higher value is typed, the value will change to predefined absolute max value for safety reasons. The Slider bar range will always be adjusted according to the predefined absolute maximum value in the setup.

9.7.4. Torque and Speed Monitoring (Meters)

Instrument range:
Range for instruments is defined by absolute max values set in the setup window.

Marked Area:
Marked area in instrument are defined by selected max value set in the Operation Set Limit Board (Section 3.4.1.2).

Meter Needle:
Meter needle show measured instrument value. (Also given in text in center).

Torque limit:

If current torque has reached max torque, limit lamp will illuminate.
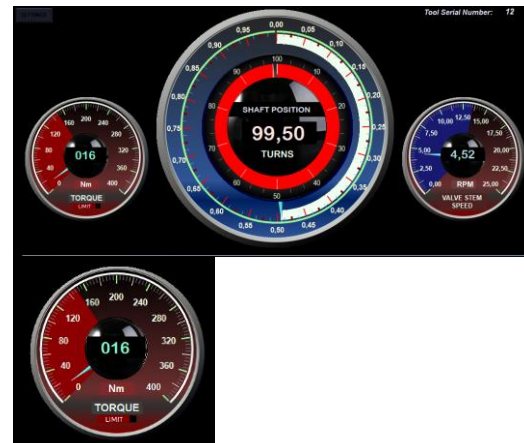
9.7.5. Power Draw limit and monitor

To achieve optimal performance with limited available external power, a limit for maximum power can be set. If required torque and wanted speed exceeds maximum available power, speed will automatically be reduced to prevent exceeding absolute max. power set in setup window.
This feature will thus prevent external fuse trip or overloading.
Range of power draw bar is adjusted from 0 to max. power.
Amp window shows DC-bus current.
(Not external current).
Current power is shown here
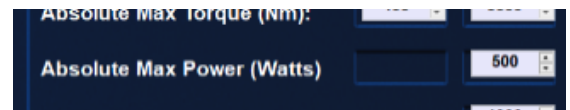
Limit lamp is illuminated when max power is reached

9.7.6. Reset Socket Position

Pressing reset will set actual output socket position to zero.

Reset button will only be active when all modes are off, i.e. **"Manual" and "Multiturn"** -buttons blue.

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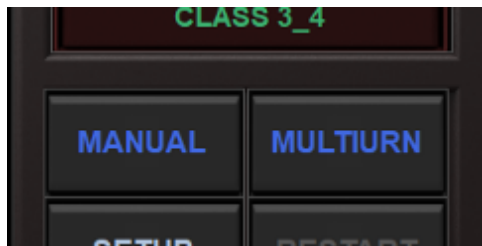
9.7.7. Diagnostics and Restart
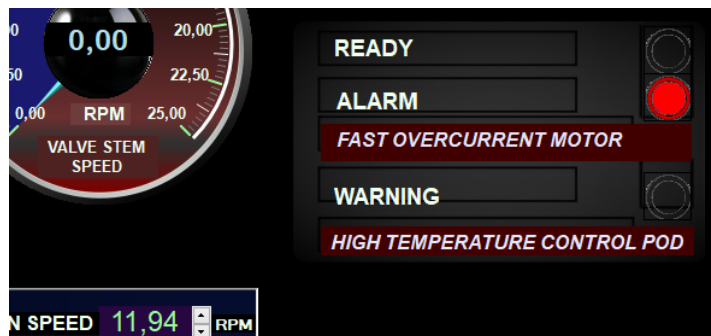
ELTT System Diagnostics contain continuously monitoring of the following parameters:
- El-Pod temperature
- Transistor cooling block temperature
- Actuator temperature
- Main supply voltage
- Motor current
- Performed torque
- Motor position
- Actuator output shaft position

Warnings according to the above list will change the "WARNING" lamp to yellow, and specified details will occur in the "MESSAGE" window below warning lamp.

Error will change the "ERROR" lamp to red and operation is shut down. Exception is if detected error is disabled. (see section 3.7.7)

Specified details will occur in "MESSAGE" window below alarm lamp.

If high temperature is detected, reset will not be possible until acceptable temperature is reached again.

9.7.8. Error Shutdown Override Function

If sensor failure occurs, operation may shut down and the tool will be impossible to operate.

If it is obvious that sensor value is a result of sensor failure, shut down function can be overridden by disabling respective sensor in Setup; advanced settings (Section 3.1.4; Advanced Settings).

If error is disabled in Setup, and confirmed by operator during startup, error message will still occur, but operation will not be shut down.

Disabling an error is done by setting the alarm till "MASKED". Then press "Update" button. The Alarm Mask code number shall change and differ from "65535".
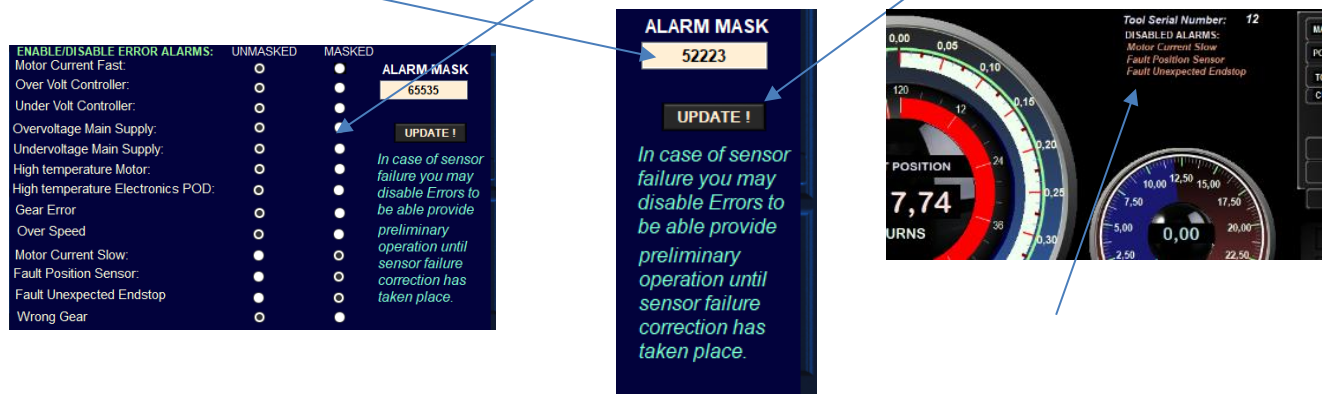
In addition to the error message in the message window, blinking messages will appear below the **"Tool serial number" text** to notify the operator that error shutdown is overridden. If one or more errors are disabled at startup and the operator decide to have all errors enabled select **"Enable all errors" and continue without entering setup.**

For safety reasons, when the torque tool is power cycled all alarmed will return to unmasked (enabled).

Pressing the restart button will reset the error and reactivate the tool. The ready lamp will change from red to green. If the error reset not possible due to hazardous failure, the ready lamp will stay dark and error message will remain. (See section 3.7.6).

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4	Open the following Excel file: E:\Torquetool log files\Torque Import_rev6.xlsm
5	Click the **"Load Data"** button	
6	Open the following Excel file: E:\Torquetool log files\" **Choose desired date folder**" \" **Files To Report**"\ Choose **desired .xlsm rapport**"
7	**Click the "Save PDF" button** The PDF is saved in the relevant	

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9.8.2. Save or Print Report

To print the entire report, the user must select all tabs at the same time:

First select the "Report" tab hold down the "Shift" key on the keyboard and click the "Data1" Tab, now all tabs are white and will be printed or saved to PDF. When all tabs are selected, a change in the spread sheet cells will make a change to the call of all the tabs at the same time.

It is important that you unselect the sheets after print or Save, hold shift and click on **"Report" tab.**

9.8.3. Report Front Page

All operational configuration parameters will be included in the top section:

TORQUE TOOL REPORT

Date of Report:	**24.10.2022 10:50:51**
Field:	**EAST GEKKO NORTH - all Valve Double Seated, Inlet**
Location:	**Open**
Tag #:	**18UG802Q**
Operation#:	1
Dive#	23

Configruation Values

Max config. Values	Class 1 & 2	Class 3 & 4	Oprational Values	Values
Absolute Max. Power (Watts):	1499	1499	Torque Limit GUI (Nm)	2600
Absolute Max Speed (RPM/1000):	6000	6000	Running Speed in GUI (RPM)	5,99
Absolute Max Torque (Nm):	350	2789	Target number of Turns	12
Max Speed Ball Valve (RPM/1000):	6000	6000	Target number of Degrees	0,5
Docking Torque (Nm):	350	2789	Operating torque Class:	CLASS 3_4
Acceleration (Rev/Sec2):	345			
Deceleration (Rev/Sec2):	567			

The max. configuration values should be the damage torque and the Operational values should be the running torque of the task at hand.

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9.8.4.   Chart

The plot of a torque job is presented in a 2D chart. Both Torque (Blue) and Speed (Red) are plotted.

The speed value is plotted in the same value as input on the tool RPM multiplied with 1000. E.g. a plotted speed of 2500 is equal to an RPM of 2.5.

On the X-Axis the Start position and stop position is plotted as a value of 3663 degrees divided by 360= 10,18 revolutions, or 10 revolutions and 63 degrees.

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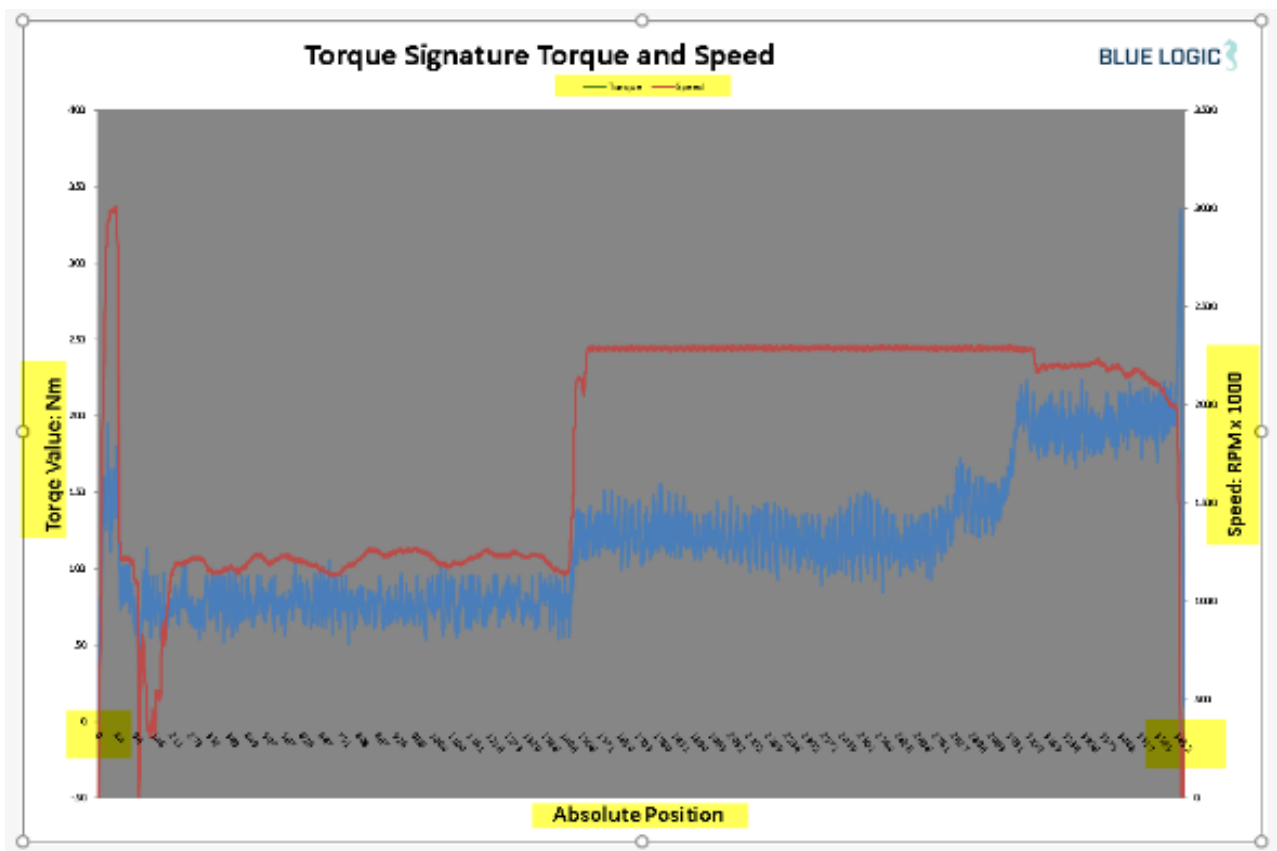
9.8.5. Automatic Filename Calculation

```
        Year 2017
      Month        3
        Day        2
       Hour       16
     Minute        8
     Second        8
   Filename:  2017_3_2_16_8_8_Sandnes_Forus_Blue Logic_No. 001 Close
```

Year, Month, Day, Hrs, Minute, and second + the location parameter.

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9.8.6. Change Log

All keystrokes by the tool operator are logged. The Tool position, time stamp, torque value, speed and system action, and manual notes will be included in the change/event log.

BLUE LOGIC

TORQUE TOOL REPORT

Date of Report: **02.03.2017 16:08:08**
Field: **Sandnes**
Location: **Forus**
Tag #: **Blue Logic**
Oparation#: No. 001 Close

Change Log				
Absolute Pos	**Time Stamp**	**Torque**	**Speed**	**Action**
0	02.03.2017 15:56:01	0	0	Sys_Class manual selected
0	02.03.2017 15:56:05	0	0	Sys_Manual Mode Set
0	02.03.2017 15:56:07	0	0	Sys_Start Clockwise
0	02.03.2017 15:56:07	0	0	Sys_Start Clockwise
0	02.03.2017 15:56:07	0	0	Sys_Start Clockwise
105	02.03.2017 15:56:19	69	1103	Sys_Stop
108	02.03.2017 16:01:38	0	0	Sys_Start Clockwise
108	02.03.2017 16:01:38	13	4	Sys_Start Clockwise
133	02.03.2017 16:01:46	66	368	Sys_Start Clockwise
133	02.03.2017 16:01:46	66	368	Sys_Start Clockwise
134	02.03.2017 16:01:46	67	364	Sys_Start Clockwise
134	02.03.2017 16:01:46	67	364	Sys_Start Clockwise
134	02.03.2017 16:01:46	75	366	Sys_Start Clockwise
134	02.03.2017 16:01:46	75	366	Sys_Start Clockwise
3664	02.03.2017 16:07:53	90	39	Sys_Stop

All reports will also have a time stamp of when they were printed to the csv file.

9.9. PREDEFINED OPERATIONS

It is possible to predefine an operation by manipulating certain files.

9.9.1. Save to/load from Files

Setup Configurations, Operational configurations and torque-position graphs can be loaded from file or saved to new files. Filename will contain operational data. File folder can be defined in the setup window. Otherwise, a folder will automatically be established on the E-drive, with relevant subfolders.

In multiturn mode, predefined target positions will be loaded to file.

NB!
Torque tool position will be reset (set to zero) when file is loaded and Multiturn mode will be set to absolute.

Save configuration to file:

Example:

A specific valve shall be operated. Complete setup for this valve shall be predefined and saved to file. This file will be made for open to close operation.

Valve specification:

- Damage torque   40000 Nm.
- Breakout Torque   38500 Nm.
- Running torque   28500 Nm.
- Max. Valve speed   1 rpm
- Number of turns to Open 0,25
- Direction to Open   Counter-Clockwise (CCW).
- ROV- interface   Class 7

Make configuration file:

1. Fill in operational data:
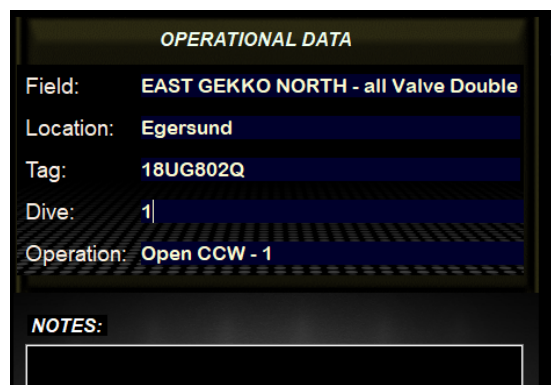
2. Fill in operational values:
    a. Select Class 7

b. Select multiturn. Fill in Specific valves max torque, running speed, Target Turns and Target decimals. Multiturn mode shall be set to absolute.
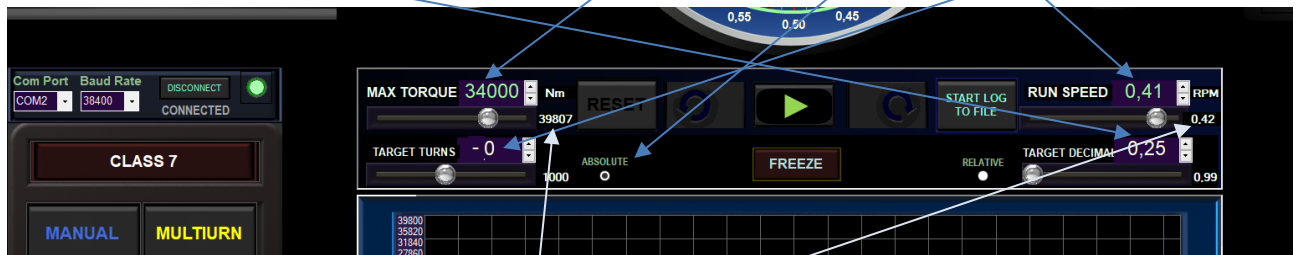
c. Check that **absolute max torque and Max running speed is below valve's** damages torque and Max running speed.
Target Turns >= 0 = CW and Target Turns <= -0 = CCW.

d. Set Position where speed will be reduced before target position has reached and Speed reduced to. (0,10 turns = 36 degrees).
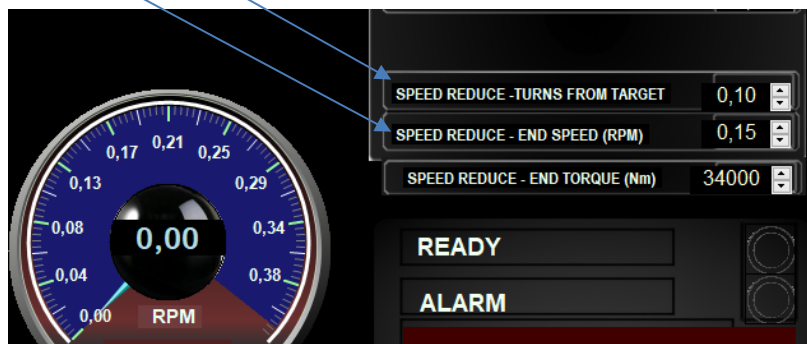
Click to save configuration to file. Saved file location.
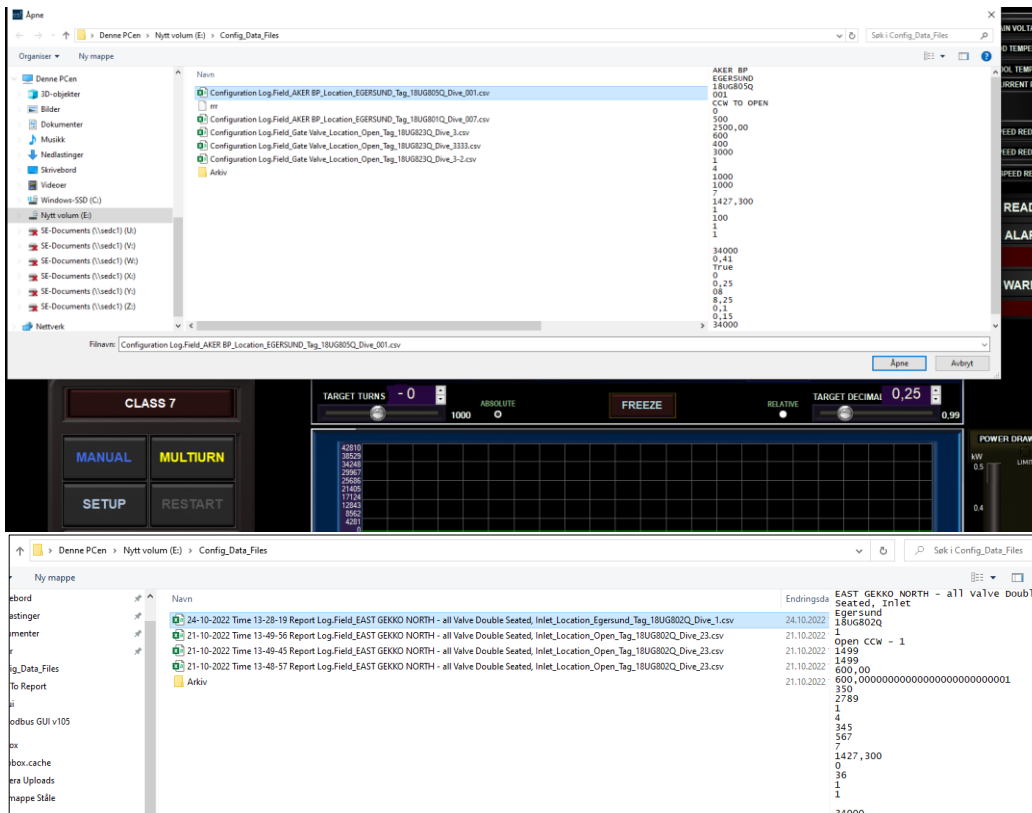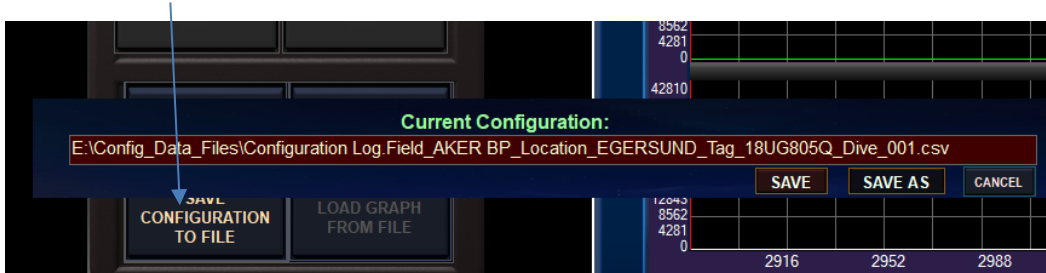
Select «Load Configuration File» to load

Select desired files for loading

Select Multiturn:

Press Run button
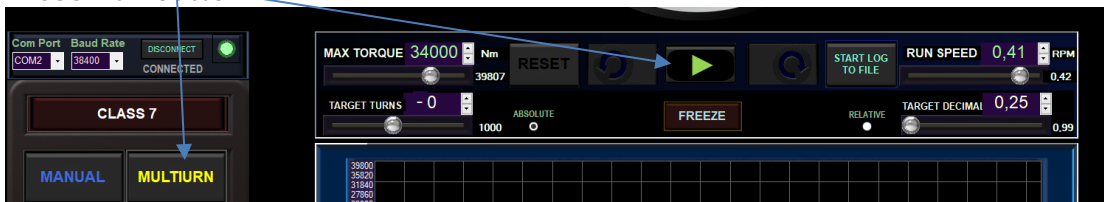
Operation will be executed according to loaded configuration.

Predefined or default folder is shown in the open window. Since operational data is part of the filename, it should be easy to select the relevant file. When the file is selected, press "Open". The configuration is imported and data in setup window and main window will be updated.

It is important to verify that the intended configuration file is correct loaded since configuration files contain limits. These limits can have a huge impact on ELTT performance.

Press Setup and check configuration data.

All files will be saved in .csv format.

When each operation is completed a graph-file are automatically saved to a folder named the current date, in E:\Graphfiles\.

(E.g. E:\Graphfiles\2019.3.26\ReportLog.Field_Location_Tag_dive_3.txt)

9.9.2. Preparation of Configuration Files for Each Activity

```
24.10.2022 10:50:51
EAST GEKKO NORTH - all Valve Double Seated, Inlet
Open
18UG802Q
23
1
1499
1499
6000
6000
350
2789
6000
6000
350|
2789
345
567
350
350
2600
5,99
CLASS_3_4
12
0,50
136;24.10.2022 10:50:51;0;0;
0,38;24.10.2022 10:50:51;0;0,02;Sys_Start Clockwise
0,38;24.10.2022 10:50:51;31;0,52;
0,38;24.10.2022 10:50:52;36;0,67;
0,39;24.10.2022 10:50:52;43;0,84;
0,39;24.10.2022 10:50:52;47;0,99;
0.39;24.10.2022 10:50:52;52;1.15;
```

First 5 lines of the torque report is operational data (in blue)

Max Power in Watts (In green)

Class 1-2 Max torque (in yellow)
Class 3-4 Max torque (in yellow)
Acceleration (Rev/sec2) (in green)
Deceleration (Rev/sec2) (in green)

Valve operation settings;
- Torque
- Speed
- Class
- Target turns
- Target turn decimals (in blue)

Note: the colors do not appear in notepad

Open in Torque Tool GUI to adjust and save new file.

To prepare the ROV operation it can be valuable to prepare separate files for every torque operation. That way it is much easier to change wording on the torque graph reporting during the offshore campaign.

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10.   TROUBLE SHOOTING

10.1.   GENERAL

In case of loss or bad operation, failure in log file production or GUI application crash, the following are helpful to localize and solve the problems.

10.2.   LOSS OF CONFIGURATION

Configuration file with the same name as torque serial number must be present in the folder "c:\TTfiles\". If the file is missing, the following message will appear and following windows message will appear:

Figure 33: Torque Tool Files

Close GUI. A new config file will be generated. NB! The new file is corrupt. Enter TTfiles map and delete the new config file. Copy the backup config file and save it in TTfiles. Rename the file to "Serialnumber".txt. Restart GUI.

- When pressing "CONNECT", the following message appears:

This message appears if the config file has been modified outside GUI. Verify by checking all data in setup window.

Trouble Shooting Table

Error Message/ Behaviour	Explanation	Recommended action
Position sensor fault	Occurs if serial communication **between POD's controller and** position sensor controller are lost or poor. (Sensor failure has no impact).	See section 9.6
Motor overload	Occurs when motor current exceeds **current threshold set in POD's** controller	See section 10.2.1
Motor over temperature	Occurs when tool temperature exceeds tool temperature threshold. (Typical if tool has reached end stop and continues performing high torque over time).	Measure surface temperature at tool. Is the temperature close to reported motor temperature? Yes: Cool down. No: Change motor *over-temperature* threshold setting in GUI. OK? No: Motor temperature sensor failure. Change MENC-LS. (Ref. Section 6.1.4; Advanced Settings).
Motor over speed	Occurs if motor speed exceeds the **max speed threshold set in POD's** controller (Typical reached if spring force rotate rotor with high energy when motor is disabled, or very quick loss of load occurs.	Reduce acceleration and deceleration in Setup OK? No: If possible, reduce set speed and torque to avoid external force back drive. OK? No: Increase parameter 21 (Using MEFCASIM. (Ref. parameter 21 in Extended protocol TT - SEFA protocol v1.1)

Motor Driver tripped	Occurs when motor current exceeds motor Drivers hardware fuse limit.	Reset error. OK? Yes: Reduce performance if possible. OK? No: Follow procedure in section 10.2.1 Reset error OK? No: Power stage failure. Transistor shortened. *Note!* *Frequently repeated errors may cause major control system damage.*
Main overvoltage	Occurs if measured main voltage reaches a dangerous high level	Main overvoltage shall not exceed 500VDC. Reduce external back drive force. (Typical valve spring force).
Main undervoltage	Occurs if measured main voltage reaches a dangerous low level	Check Main undervoltage threshold in Setup Advanced settings. OK? No: Check if System power supply are sufficiently dimensioned. 110VAC min.1500W 230VAC min.2000W. OK? No: Increase power supply power or reduce performance settings. OK? No: Check if voltage drops when tool is enabled, but without any load. YES: Hardware fail; CapController No: Check calibration. (Ref. Section 6.1.4; Advanced Settings).

Controller overvoltage	Occurs if measured controller level reaches a dangerous high level	Open POD: Measure MENC- is 24VDC output. OK? YES: Replace Servo controller. OK? No: Replace MENC-ISI.
Controller undervoltage	Occurs if measured controller level reaches a dangerous low level	Open POD: Measure MENC- is 24VDC output. OK? YES: Replace Servo controller. OK? No: Replace MENC-ISI.
Communication lost	**Occurs if POD's controller has** not received any data from GUI during 1 second after communication is established.	Check system communication device. (Typical MOXA usb/RS232 unit). Are output LED on the device blinking? No: Change unit. OK? Yes: Check communication cable configuration according to wiring diagram. OK? No: Open POD. Measure 24VDC input to Servo controller. Are 24VDC present? Yes: Change Servo controller. No: Change MENC-ISI.
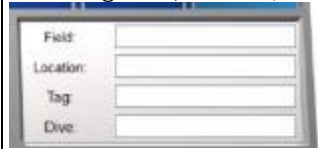
| Poor communication | GUI sends approximately 50 data packets **per second to POD's controller and POD's controller** sends same amount of data packets to GUI. Controller and GUI verifies the data packets validity using Checksum. Number of data packets approved and failed are counted and the percentage of failed packets vs approved are calculated. If the failure percentage reaches a certain level poor communication error are shown and communication are stopped. | Check communication send /receive duration time and fault rate. See section 10.2.2

Check RS232 communication cables shield and ground, and POD shield and ground. OK? NO: Replace system communication device. OK? No: Replace Servo Controller. |
|---|---|---|
| Communication failure | If GUI's communication with the topside communication device (port) fails, communication shuts down and communication failure is indicated. | Check port settings in windows device manager. Are Selected Com number present in the device manager? No: Are there any com ports available in device manager? No: Reconnect communication device. OK? No: Update communication device drive and reconnect. OK? Yes: Try to connect with the present Com number. OK? No: Change the communication device and try again. |

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Data not present in Setup	Configuration file is corrupt. (See section 10.2)	When "connect" is activated "Tool SN-Number" are shown. Open explorer and go to C:\TTfiles". Open the file with the same name as Tool SN-number. If all numbers on first page are 0, copy the file with the same name from folder C:\TTfiles\Backup. OK? No: Continue and open "Setup". Write all data manually in setup and close GUI. Reopen GUI and connect.
Class detect failure	No relative deviation between motor position sensor and socket position sensor occurs during class detect operation.	Check that a socket is mounted. OK? Yes: Make sure that tool is turning freely. (No load). OK? Yes: Select class manually. Operate tool and check that position feedback works correctly. OK? Yes: Close GUI. Open GUI and run class detect. OK? No: Open setup and check value in "class detect value". If 0 increase the value to approx. 40. Try again. OK? No: Increase "class detect value" further. OK? No: Select class manually and run speed in manual. Check that

		mechanical position indicator turns. OK? Yes: Check output shaft calibration using calibration GUI. OK? No: Recalibrate output shaft. Yes: Increase further.
Socket position failure (Output shaft position sensor).	When starting and stopping manually or multiturn operation the GUI's position meter performs a jump larger than 1-2 degrees	If motor unit has been opened there is a risk that the output position sensor shaft is mounted 180 degrees offset since calibration was performed. If so, recalibrate output shaft position sensor using calibration GUI. Thereafter a fine position calibration must be performed using the GUI. When this calibration is completed data is stored automatically when GUI is closed.
Failure in Log file production	When operation has been performed and button "Empty current log to file" has been operated no file are generated in folder: E:\\Torquetool log files\(Current date)".	If a character is typed here that is illegal for wiring filename the file generating will be excluded witout any notice. Following characters are illegal; \/:*?"<>|

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When operation is activated but no torque is output, motion or error message occurs	No failure identified. May be hardware failure, calibration failure or parameter setting failure.	This an abnormal situation where the following action should be taken: If possible, operate output shaft using external force to verify if the position sensor operates correctly and in correct direction. OK? Yes: Open calibration GUI and run; **Motor position sensor; "Load graph". Observe visually that** motor turns during this operation.
Motion or torque is performed when communication is lost or disconnected	Failsafe mode are unintentional activated. Motor runs in a given direction using torque and speed values defined in parameters.	Open Setup in GUI and enable failsafe config. Select failsafe **mode "Fail as is, motor off". Close setup and** close GUI. Reopen GUI and try again. OK? No: Repeat above.
Motion is performed with fixed speed and only in one direction	May occur as a result of calibration failure.	Serious calibration error; Open calibration GUI and check motor position sensor calibration. OK? Yes: Commutation number may be wrong. Check Commutation number (See section 3.4.1.4 Operation times and Motor data). Is the Commutation number equal to the latest documented Commutation number? No: Type the correct Commutation number (HallCAlibrate using Mefca Simulator) and store. Try again. OK? No:

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		Recalibrate. OK? No: Check motor windings. OK? Yes: Try another tool. OK? No: Change Servo controller. OK? No: Change Power stage.
DC-bus voltage drops rapidly when operation mode is activated, and the tool is loaded.	Hardware failure or power supply failure.	Check a different tool system connected to the same power supply. OK? Yes: Probably Cap controller failure. (POD hardware failure)
No error messages, but torque and speed are significant lower than selected limits	Parameter "Max-PWM" may be set low. Reduces general performance	Use MEFCASIM and check parameter Max_PWM. If < 15000 adjust to 15000 press "W1" write and store to flash. Try Again

10.2.1. Motor Overload

1	Check output torque present when overload occurred. If above 2700Nm, reduce torque limit and/or speed, restart and try again. OK? No: run the tool without load for 5 minutes @ speed 2500. Try again. OK?
2	If torque is less than 2600Nm when error occurs check current limit parameters and increase to max. 7800. OK? No: Open calibration GUI. Load graph for Menc-HS. Check deviation. OK?
3	Perform Total calibration. Calibration succeeded? No:
4	Open motor and check magnets regarding metal chips and magnets position. Remove chips and make sure correct position. Calibrate again. OK?
5	Magnet failure or sensor board failure. Load graf when Mag-Sense A are selected. Repeat with mag sense B. Compare graphs with previous stored Mag-Sense graph if possible. Are graphs similar? Yes: Position sensing OK! No: Check rotor friction. OK? Yes: Change magnet. No:
6	Reduce rotor friction to normal and calibrate. OK? No: Change Magnet. OK? No:
7	Check motor winding resistance according to wiring diagram and motor datasheet. OK? No: Replace Power stage in POD (Ref. parameter 22 and 27 in Extended protocol TT - SEFA protocol v1.1)

10.2.2.   Slow Communication

Torque tool communicates at Baud rate 38400. Each command or request packet to/from POD will normally use $(((1/38400)*8 \text{ (bytes)}*8\text{(bits)}*2\text{(1send+1receive)} = 3,3\text{ms}$. Processing time in each side need to be added to achieve communication cycle time.

Normal cycle time will be approx. 4-5 milliseconds.

Most commands include speed command (Manual mode) or position command (Multiturn mode).

If communication lines are distributed through several converters additional delays may occur. Then if cycle updates appear abnormally check communications health:

Hold cursor over com port lamp Communication diagnostic appears

If both send and **receive is "0"** communication is OK.
If any > "0" data packets are lost and communication line needs to be checked.

11.   LOGISTICS

Verify the following:
1. Sender Name and Address clearly visible
2. Receiver Name and address clearly visible
3. Inventory list correctly filled in

11.1.   HANDLING AND LIFTING

To be lifted in dedicated transportation box. Forklift pockets to be used for transportation boxes heavier than 40 Kg.

11.2.   TRANSPORTATION

Transport in dedicated transportation box.

11.3.   STORAGE

Description
Store the TT system in its dedicated transportation box
Thoroughly coat all exposed surfaces of the Tool with a preservation oil (e.g. WD-40)
Long term storage temperature = 15 deg C

BLUE LOGIC

12. MAINTENANCE

The Electric Torque Tools are robust subsea systems with few critical moving parts. There are however a few important inspections points that require attention.

Inspection and maintenance can be performed by the operator, but it is recommended to return the TT to Blue Logic for 6-month inspection, maintenance and calibration.

12.1. DAILY INSPECTION

No.	Description	Check/Verified
1	Perform a visual inspection of ELTT. Special attention should be given to the following: Oil level ELTT; Check for correct oil-volume in compensator, refill as required. Oil type: Q8 T 65 LS. Oil level LWETT: Check that pressure compensation hose is completely oil-filled and no air bubbles. If refill is required, oil can be topped up from the 1/4" plug with one-way valve. Fill oil here, ¼" BSP Keep the tool in an up-right position, i.e. output socket down. Make sure to evacuate any trapped air through the hose. Black cover must be removed to access the end of the hose. Max pressure 10Psi. ROV Handle Mechanism Hose/cable Excessive wear and tear	
2	Flush with fresh water	

12.2.   WEEKLY INSPECTION

No.	Description	Check/Verified
1	Perform a visual inspection of TT. Inspect surface treatment and verify no corrosion. Special attention should be given to the following: Seal areas Output socket ROV Handle Hose Fittings Surface treatment	
2	Flush with fresh water	

12.3.   MONTHLY INSPECTION

No special activities are required monthly. If the Electrical Torque Tool system has been extensively used and repeatedly exposed to dirt and aggressive fluids, pay extra attention to seal areas. Disassemble front socket and clean thoroughly as required.

12.4.   HALF YEARLY INSPECTION AND MAINTENANCE

No.	Description	Check/Verified
1	Half yearly inspection and maintenance is recommended to be performed by blue Logic. The tool will go through a full teardown and calibration. If available, new software will be installed.	

12.5.   ELTT LATCH MECHANISM – WEAKLINK REPLACEMENT

No	Description	Check/Verified
1	Remove the six M8x35 Socked Head located at ELTT nose	
2	Remove POM nose	
3	Switch socket to the one desired. Clean socket holder thoroughly	
4	Replace POM nose and bolts. Note: Use AquaShield and thread lock on bolts before mounting	

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12.1.   END OF PRODUCT LIFE MANAGEMENT

When the Torque Tool has reached the end of its service life and is beyond repair, the equipment shall be disassembled and returned to recycling based on type of material.
Possible re-use of parts and systems shall be investigated prior to discarding.
The Torque Tool system contains no environmental harmful products.

13.   SUPPORT CONTACT

BLUE LOGIC AS
Luramyrveien 29
4313 SANDNES
NORWAY

Phone: +47 910 06 950

https://www.bluelogic.no/home

APPENDIX 1   DRAWINGS

Drawing No	Document Title
BB3306	2,7kNm Torque Tool Kit
BC0454	2,7kNm Torque Tool wAutomatic Class Switch Kit
BA8949	2,7kNm Torque Tool Kit with Inductive Connector
BB3151	2kW Subsea USB Kit for Electrical Torque Tool
BB3551	2,7kNm Light Weight El TT System for ROV/Diver/AUV
BC0985	2,7kNm Light Weight EL TT System for ROV/AUV wAutomatic Class Adaptors

Parts List

ITEM	QTY	PART No.	TITLE	WEBLINK
1	1	BC0309	Compensator 0,5L Kit for 2,7kNm Torque Tool	N/A
2	1	BB3254	2,7kNm Class 4 El. Torque Tool V2	N/A
3	1	BB2985	ETT Control PC wGUI Software and Pelicase	N/A
3.1	1	900279	GUI Software for LTT HardWare 2C Revision 2,9991	N/A
3.2	1	103650	ThinkPad Lenovo	N/A
3.3	1	102857	Computer Mouse	N/A
3.4	1	101819	Moxa Adapter DB9F to TB	N/A
3.5	1	101817	Pelicase 1495D	N/A
3.6	1	100687	Moxa UPort 1150I	N/A
4	1	BB1086	Alu Box 415L incl. Foams	N/A
5	1	BA7297	Class 4 Interface Socket Low Torque	http://e-sea.bluelogic.no/main.aspx?page=article&artno=BA7297
6	1	BA6615	Class 3 Interface Socket	N/A
7	1	BA2951	Class 1 & 2 Interface Socket	http://e-sea.bluelogic.no/main.aspx?page=article&artno=BA2951
8	1	600144-TD-0003	Operation and Maintenance Manual Electric Torque Tool Class 1 - 4	N/A
9	1	102860	Burton Dummy	N/A
10	1	102354	Burton Test Cable	N/A
11	1	100499	Burton Pigtail	N/A

NOTE: 1
DESIGN CODE:
ISO 13628-8

NOTE: 2
TECHNICAL CLASSIFICATION:
Article Type: 008-Actuation
Main Group: 8.01. ISO 1 to 4 Actuation
Intermediate Group: 8.44.01. Tool
Sub Group: 8.44.114.02. Intervention

NOTE: 3
INTERFACE INFORMATION:
Pressure Rating Bar: 3000m
Design Water Depth: N/A
Material: Hard Anodize Aluminium
Weight in Air: 55 kg
Volume: 149,36 dm^3
Surface Area: 242380 cm^2
Hydraulic: N/A
Mechanical: N/A
Electrical: 110-250 VAC / 145-350 VDC
Com. & Protocol: RS232

NOTE: 4
ADDITIONAL INFORMATION:
Complete Class 1-4 Electrical Torque Tool System prepared for offshore
use and operation, includes El Torque Tool, Control Canister, cables,
class 2 and 4 sockets and control pc.

The Blue Logic Class 1-4 Electrical Torque Tool (ELTT) is a module based,
compact, flexible and robust precision tool for operation in all Subsea
and ROV applications.
The system combines all known advantages from a hydraulic torque tool
system with the technology and advantages available from a modern
servo based electrical controlled drive system. The included class 4 and
class 2 interface sockets are easy to change on deck prior to
deployment. The control system will automatically, detect socket and
tool gear ratio and automatically switch between Low torque and High
torque mode. The different sockets will automatically interface the gear
system to utilize the optimal gear ration and power/speed utilization.
The ELTT is designed for operation on ROV's with minimum 5-10A 110
VAC of continuous power available. Maw allowed power consumption
can be limited in the ELTT control system setup. Max continuous current
consumption is 20A. The tool communicates through RS232 protocol.
The ELTT is connected to the ROV thru a 3,5mtr. oil filled yellow umbilical
connected to an electrical power control module mounted on the ROV

The system is delivered in an aluminum transport box size 1182x782x500
for onshore and offshore handling.

*RS485 Optional

Ø185
300
Ø151
325
445
557,5
180

BLUE LOGIC

Dwg Scale: NTS
Dwg Proj:
Dwg Format: A3

Drawing title:
2,7kNm Torque Tool Kit

Drawing number:
BB3306

Rev.
06

Parts List

ITEM	QTY	PART No.	TITLE
1	1	BC0497	2,7kNm El. Torque Tool wAutomatic Class Switch
2	1	BC0309	Compensator 0,5L Kit for 2,7kNm Torque Tool
3	1	BB2985	ETT Control PC wGUI Software and Pelicase
4	1	BB1086	Alu Box 415L incl. Foams
5	1	600144-TD-0003	Operation and Maintenance Manual Electric Torque Tool Class 1 - 4
6	1	102860	Burton Dummy
7	1	102354	Burton Test Cable
8	1	100499	Burton Pigtail

NOTE: 1
DESIGN CODE:
ISO 13628-8

NOTE: 2
TECHNICAL CLASSIFICATION:
Article Type: 008-Actuation
Main Group: 8.01. ISO 1 to 4 Actuation
Intermediate Group: 8.44.01. Tool
Sub Group: 8.44.114.02. Intervention

NOTE: 3
INTERFACE INFORMATION:
Pressure Rating Bar: 3000m
Design Water Depth: N/A
Material: Hard Anodize Aluminium
Weight in Air: 55 kg
Volume: 149,12 dm^3
Surface Area: 243075 cm^2
Hydraulic: N/A
Mechanical: N/A
Electrical: 110-250 VAC / 145-350 VDC
Com. & Protocol: RS232

NOTE: 4
ADDITIONAL INFORMATION:
Complete Class 1-4 Electrical Torque Tool System designed for subsea operations. Including Torque Tool wAuto Class Select, Control Canister, pressure compensator, cables and control PC.

The system combines all known advantages from a hydraulic torque tool system with the technology, advantages and precision only available from a modern servo-based electrical controlled drive system.

The Auto Class Select feature allows for automatic, mechanical adaption between Class 1 thru 4.
The control system will automatically detect engaged socket size.

The ELTT is designed for operation by ROV's with minimum 5-10A, 110 VAC of continuous power available. Max. allowed power consumption can be limited in the ELTT control system setup. Max continuous current consumption 20A.
Communication via RS232* protocol.

The ELTT is connected to the ROV using a 3,5m, oil-filled umbilical connected to an electrical power control module to be mounted on the ROV.

The complete system is delivered in an aluminum transport box size 1182x782x500 for onshore and offshore handling.

*RS485 Optional

Ø185
300
325
445
231
592
Ø151

BLUE LOGIC

Dwg Scale: NTS
Dwg Proj:
Dwg Format: A3

Drawing title:
2,7kNm Torque Tool wAutomatic Class Switch Kit

Drawing number: BC0454
Rev. 03

Parts List

ITEM	QTY	PART No.	TITLE	WEBLINK
1	1	BA5247	BA5247 2,7kNm ELTT with 2kW Inductive Coupler	http://e-sea.bluelogic.no/main.aspx?page=article&artno=BA5247
2	1	BB1745	Alu Box 240L incl. Foams Inductive Connector	
3	1	BA7297	Class 4 Interface Socket Low Torque	
4	1	BA6615	Class 3 Interface Socket	
5	1	BA2951	Class 1 & 2 Interface Socket	
6	1	600144-TD-0003	Operation and Maintenance Manual Electric Torque Tool Class 1 - 4	
7	1	102862	Connector Subcon Dummy	
8	1	102859	PC Charger Module	
9	1	102858	Laptop HP Probook	
10	1	102857	Computer Mouse	
11	1	101819	Moxa Adapter DB9F to TB	
12	1	101817	Pelicase 1495D	
13	1	101067	Lock Sleeve M wSnap Ring	
14	1	100687	Moxa UPort 1150I	
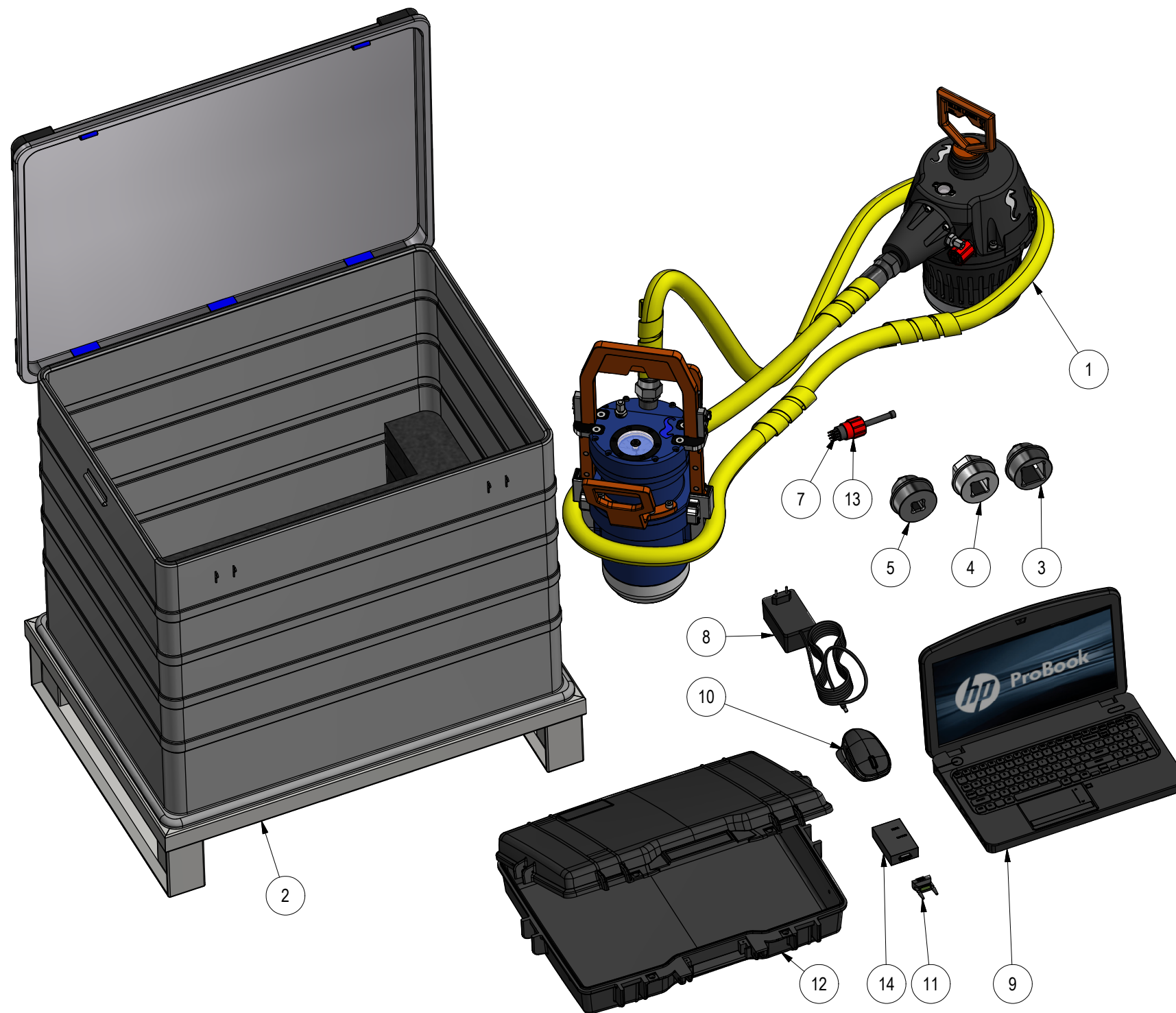
NOTE: 1
DESIGN CODE:
ISO 13628-8

NOTE: 2
TECHNICAL CLASSIFICATION:
Article Type: 008-Actuation
Main Group: 8.01. ISO 1 to 4 Actuation
Intermediate Group: 8.44.01. Tool
Sub Group: 8.44.114.02. Intervention

NOTE: 3
INTERFACE INFORMATION:
Pressure Rating Bar: N/A
Material: Intervention
Weight: 5775,9 kg
Volume: 103,14 dm^3
Submerged Weight: N/A
Surface Area: 173163 cm^2
Hydraulic: N/A
Mechanical: N/A
Electrical: N/A
Com. & Protocol: N/A

NOTE: 4
ADDITIONAL INFORMATION:
Rental kit with Class 1-4 torque tool with inductive Subsea connector for easy ROV integration and subsea changeout.

The rental kit consisting of the Blue Logic electrical Torque Tool (ELTT) with Subsea connector and Control PC (laptop). The electrical torque tool is a compact, flexible ROV friendly torque tool system ideal for all types of AUV and ROV operations. Integration and connection to any ROV system is easy and flexible by use of Blue Logic inductive USB connectors. USB Secondary side connector is included in the Torque Tool assembly. USB Primary side connector is not included in this kit and must be purchased or rented separately. Ref. Blue Logic art. no. BB1170. The torque tool can be "hot" subsea connected and disconnected subsea with full power an infinite number of times.

The Subsea USB connector ensures that the torque tool has ideal working conditions and optimised efficiency (stable 325VDC) regardless of ROV voltage and voltage fluctuations. The separate Power Supply (BA7719) is connected between the USB primary connector and ROV and handles 100-250VAC or 145-350VDC.

The Blue Logic Class 1-4 Electrical Torque Tool (ELTT) is module based, compact, flexible, robust with high precision. The system combines the advantages from a hydraulic torque tool system with the technology and advantages available from a modern servo based electrical controlled drive system. Interface sockets are replaceable on deck prior to deployment to interface ISO Class 1-4 interfaces. The different sockets will automatically interface the gear system to utilise the optimal gear ration and power/speed capacity. The control system automatically detects socket and gear ratio and will automatically switch between Low torque and High torque mode. The ELTT is designed for operation on ROV's with minimum 5A 110VAC of continuous power available. Maw allowed power consumption can be limited in the ELTT control system setup. Max continuous current consumption is 20A. The tool communicates through RS232 protocol. The ELTT is connected to the ROV thru a 3,5 mtr. oil filled yellow umbilical connected to an electrical power control module mounted on the ROV.

The system is delivered in an aluminum box with Pallet (800x600x770) suitable for onshore and offshore handling.

Rev.	Date	Reason for issue	Revision change	Made	Chk'd	Appr.
03	27.10.2020	9-IFU (Issued for Use)		WTJ	LGH	WTJ
02	24.4.2018	9-IFU (Issued for Use)		WTJ	LGH	WTJ
01	31.1.2018	9-IFU (Issued for Use)		WTJ	LGH	WTJ

BLUE LOGIC

Dwg Scale: NTS
Dwg Proj:
Dwg Format: A3

Drawing title:
2,7kNm Torque Tool Kit wInductive Connector

Drawing number:
BA8949

Rev.
03

Parts List

ITEM	QTY	PART No.	TITLE	WEBLINK
1	1	BB4242	Alu Box 240L incl. Foams	
2	1	BA9029	ROV Male 2kW Primary	http://e-sea.bluelogic.no/main.aspx?page=article&artno=BA9029
3	1	BA7719	BL Power Supply 2kW	http://e-sea.bluelogic.no/main.aspx?page=article&artno=BA7719
4	1	600128-TD-0013	Operation and Maintenance Manual 2KW Type C Subsea USB System	
5	1	103721	Cable 4320 4m Subconn Conn. Cable	
6	1	102768	Test Cable L=3m OM10F to 250W Prim USB and 2kW Power Supply	
7	1	102766	Test Cable L=3m OM10M to 2kW/250W Sec USB	
8	1	101138	Connector SubConn Pigtail F L=0,6m Type IL10F	

NOTE: 1
DESIGN CODE:
N/A

NOTE: 2
TECHNICAL CLASSIFICATION:
Article Type: 006-El. Connectors
Main Group: 6.01. Subsea USB
Intermediate Group: 6.28.04. 0,9-3,6KW Subsea USB
Sub Group: 6.28.157.01. Male Connector

NOTE: 3
INTERFACE INFORMATION:
Pressure Rating Bar: 300 (3000m)
Design Water Depth:
Material: Hard Anodized Aluminium
Weight: 18,5 kg
Volume: 7,02 dm^3
Submerged Weight: 11,3 kg
Surface Area: 16918 cm^2
Hydraulic: N/A
Mechanical: Flange
Electrical: 370 VDC, Subconn BCR 2410M
Com. & Protocol: Ethernet and RS232/RS485*

NOTE: 5
ADDITIONAL INFORMATION:
Inductive Subsea Connector for transfer of electrical power and communication type Blue Logic USB C.
The Blue Logic USB C series inductive connector is a multipurpose electrical connector with the capacity of transferring up to 2kW electrical power, 80Mbps Ethernet and 230kbps serial communication. The active part is spherical shaped giving unique properties with regards to guiding and self-alignment between male and female part and very rough angular tolerances. Easy to connect and disconnect by divers, ROV or AUV's. BA7713 is a male connector, configured to be the primary side (transmitting part) in a connector system.

Full galvanic isolation between primary and secondary side connector
Connect and disconnect "hot" with full power and voltage
Possible to transform voltage between primary and secondary side
Built in diagnostic and housekeeping functionality.

* RS485 Optional
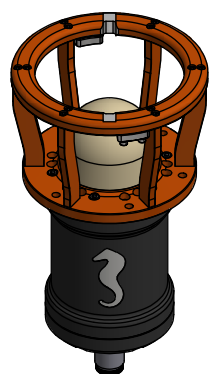
BA7713 BL ROV MALE 2kW
OPTIONAL FOR ITEM 3

BA7714 BL ROV FEMALE 2kW
OPTIONAL TO EL. TT

Rev.	Date	Reason for issue		Made	Chk'd	Appr.
03	13.4.2023	9-IFU (Issued for Use)		WTJ	LGH	WTJ
02	22.1.2020	9-IFU (Issued for Use)		WTJ	LGH	WTJ
01	18.2.2019	9-IFU (Issued for Use)		WTJ	LGH	WTJ

Revision change

BLUE LOGIC

Dwg Scale: NTS
Dwg Proj:
Dwg Format: A3

Drawing title:
2kW Subsea USB Kit for Electrical Torque Tool

Drawing number: BB3151
Rev. 03

NOTE: 1
DESIGN CODE:
API 17H/ISO 13628-8

NOTE: 2
TECHNICAL CLASSIFICATION:
Article Type: 008-Actuation
Main Group: 8.01. ISO 1 to 4 Actuation
Intermediate Group: 8.44.01. Tool
Sub Group: 8.44.114.02. Intervention

NOTE: 3
INTERFACE INFORMATION:
Pressure Rating Bar: N/A
Design Water Depth: N/A
Material: N/A
Weight: 62,1 kg
Volume: 138,6 dm^3
Submerged Weight: -79,93 kg
Surface Area: 257441 cm^2
Hydraulic: N/A
Mechanical: N/A
Electrical: PFC: 100-250 VAC/145-350 VDC
Com. & Protocol: RS232/RS485

NOTE: 4
SPAREPARTS:
BB1852

NOTE: 5
ADDITIONAL INFORMATION:
Complete Light Weight Class 1-4 Electrical Torque Tool System with
Power Supply, Cables, Control PC and Class 1-4 interfaces. Two
alternative handles included: ROV Handle with Latches and Diver friendly
polymerical Handle for easy and precise operation.
Typically powered by ROV/AUV included Cable or Topside powered for
diver operation using additional longer Cable.

Parts List

ITEM	QTY	PART No.	TITLE
6	1	BC0987	2,7kNm El Torque Tool Light Weight 500m ROV Latch Handle wAutomatic Class Adapter
2	1	BB3840	Alu Box wFoam
13	1	BB3676	Handle Assy for ELTT
4	1	BB2985	ETT Control PC wGUI Software and Pelicase
7	1	BA7719	BL Power Supply 2kW
8	1	600144-TD-0014	Operation and Maintenance Manual Electric Torque Tool Class 1 - 4
9	2	103651	Com. Cable wBurton 470 VDC & RS232 4,5m EL-TT
10	1	102860	Burton Dummy
11	1	102768	Test Cable L=3m OM10F to 250W Prim USB and 2kW Power Supply
12	1	101138	Connector SubConn Pigtail F L=0,6m
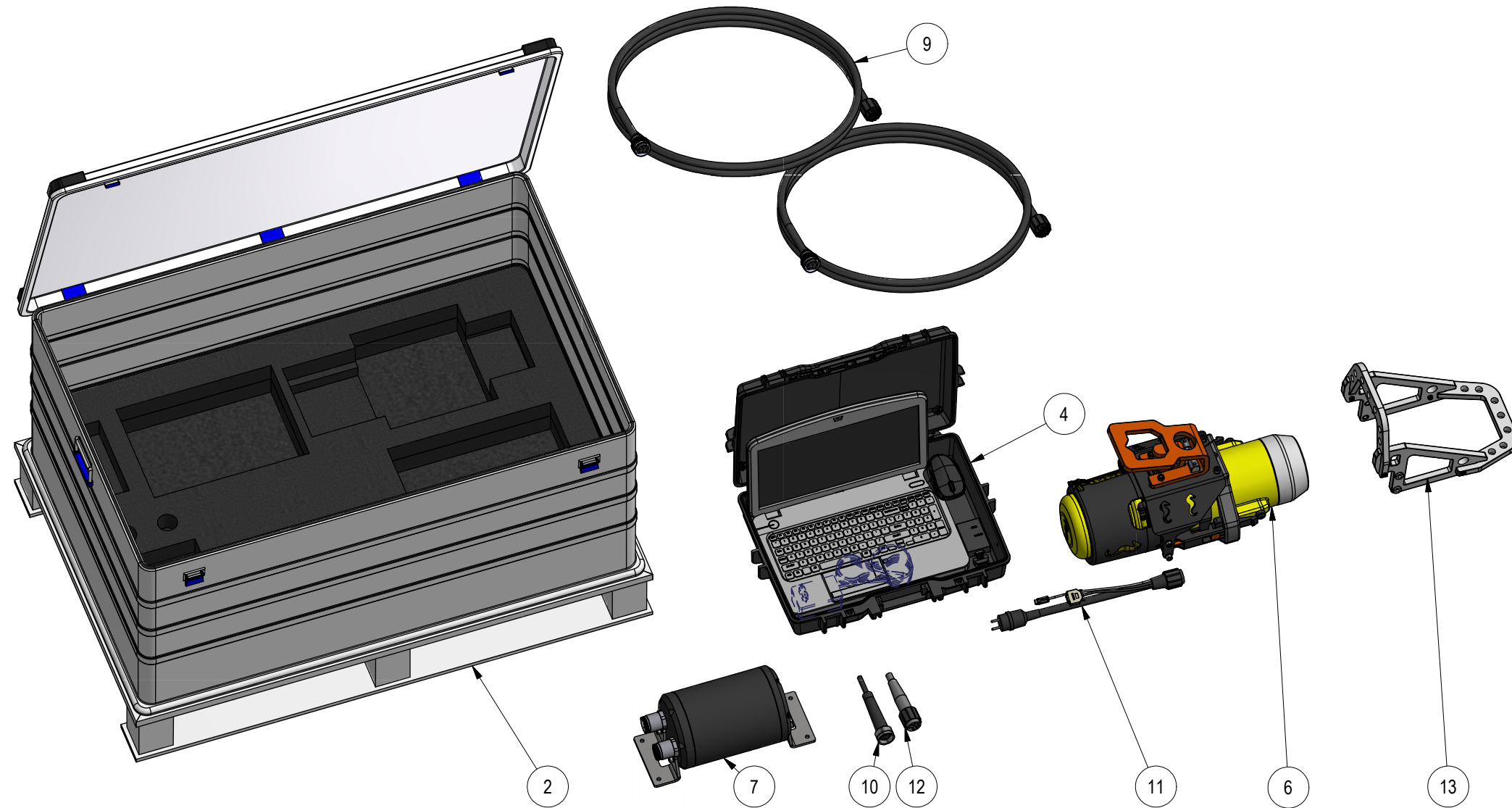
NOTE: 1
DESIGN CODE:
API 17D / ISO 13628-8

NOTE: 2
INTERFACE INFORMATION:
Hydraulic: N/A
Mechanical: API 17D Cl.1-4
Electrical: 400VDC, Burton BCR 5507-2008
Data Com.:   RS232/RS485/Modbus RTU Protocol

NOTE: 3
PROPERTIES:
Material: Aluminium, Devlon V-API, Titanium
Torque Rating: 100-2700Nm
Design Water Depth: 500m
Weight in Air: 72,6 kg
Volume: 136,46 dm^3

NOTE: 4
ADDITIONAL INFORMATION:
Light Weight Cl.1-4 Electrical Torque Tool kit for offshore use and operation. Includes El Torque Tool, control canister, cables, and control pc with dedicated GUI.
The Light Weight Electrical Torque Tool, LWETT has a submerged weight of only 11,1 kg and well suited for operation by ROV, drone or diver.

Multi-socket interface nose including all classes, i.e. Cl.1&2, Cl.3 and Cl.4 mounted in a co-centric configuration to ensure auto-engagement to any Cl.1&2, Cl.3 or Cl.4 interface.
The control system will auto-detect engaged socket and adjust to low or high torque mode accordingly.

Max. allowed power consumption can be limited in the control system setup.
Max. continuous current consumption is 13,5A.
Communication by RS232. RS485 or Modbus RTU protocol.

The system is delivered in a transport box size 1182x782x500mm for onshore and offshore handling.

FOR INFORMATION ONLY

BLUE LOGIC

01	9.4.2024	2-IFT (Issued for Tender)			WTJ	LGH	WTJ
Rev.	Date	Reason for issue	Revision change		Made	Chk'd	Appr.

Dwg Scale: NTS
Dwg Proj:
Dwg Format: A3

Drawing title:
2,7kNm Light Weight EL TT System for ROV/AUV wAutomatic Class Adaptors

Drawing number: BC0985
Rev. 01

APPENDIX 2   DATASHEET AND SAFETY SHEET FOR GEAROIL Q8 T 65 LS

Blue Logic documents 900460 and 900461.

Q8⬛Oils

Q8 T 65 75W-90

Synthetic API GL-5 axle fluid

Description

Q8 T 65 75W-90 is a superior synthetic axle lubricant. The product provides extreme protection due to its low operating temperature capability and oxidation resistance and facilitates easy gear shifting. The lubricant is formulated for heavy duty equipment such as rear-axles, final drives and selected manual transmissions, requiring special low temperature fluidity.

Applications

Q8 T 65 75W-90 is designed for heavy duty equipment such as rear-axles, final drives and selected manual transmissions, requiring special low temperature fluidity. It meets the requirements of the API GL-5 specification.

Benefits

• Full synthetic formulation to provide an extreme thermal stability.
• Superb fuel economy benefits, especially when used in axles.
• Reduces drive-line operating temperatures.
• Outstanding internal friction reduction.
• Outstanding protection against rust and corrosion.

Specifications, recommendations and approvals

API	GL-5	**MB**	235.0
Clark	ALC-1 5M 7-80 KE	**Rockwell International**	O-76-E
Clark	TLC-25 3M 8-83	**Tatra**	TDS 100/40 *
Eaton/Fuller	Bulletin 2052	**Volvo**	97312 (<2013)
Eaton/Fuller	Bulletin 2053	**ZF**	TE-ML 05A
Eaton/Fuller	Form 121	**ZF**	TE-ML 07A
Ford	M2C175-A	**ZF**	TE-ML 12A
Ford	M2C210-A	**ZF**	TE-ML 17B
GM	1940759 (90188629)		

* Pending approval

Properties

	Method	Unit	Typical
Density, 15 °C	D 4052	g/ml	0,860
Viscosity Grade	-	-	SAE 75W-90
Kinematic Viscosity, 40 °C	D 445	mm²/s	92.8
Kinematic Viscosity, 100 °C	D 445	mm²/s	14.1
Viscosity Index	D 2270	-	160
Brookfield Viscosity, -40 °C	D 2983	Pa.s	98
Pour Point	D 97	°C	-45
Flash Point, COC	D 92	°C	216

The figures above are not a specification. They are typical figures obtained within production tolerances.

Sustainability

*The product Carbon Footprint (PCF), cradle-to-gate (Q8Oils state of the art facility in Belgium), of Q8 T 65 75W-90 is **1.87** kg CO_2eq / kg.*
Please contact Q8Oils to learn more about the positive environmental impact, the handprint, of this product.
For more info check here

we
take
care

SAFETY DATA SHEET

Q8 T 65 75W-90

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifier

Product name   :   Q8 T 65 75W-90

Viscosity or Type   :   SAE 75W-90

1.2 Relevant identified uses of the substance or mixture and uses advised against

Material uses   :   Lubricating oil for automotive transmissions

1.3 Details of the supplier of the safety data sheet

Supplier   :   Kuwait Petroleum Companies in the Benelux
Company Office: Brusselstraat 59, 2018 Antwerp, Belgium
Contactaddress: Petroleumkaai 7, 2020 Antwerp, Belgium
Tel. +32 3 247 38 11, Fax +32 3 216 03 42

Manufacturer / Distributor   :   Kuwait Petroleum Belgium N.V./S.A.   **/**   Q8Oils Italia S.r.l.
Petroleumkaai 7   Via Volpedo 2
B-2020 Antwerp   15050 Castellar Guidobono (AL)
Belgium   Italy

e-mail address of person responsible for this SDS   :   SDSinfo@Q8.com, communication preferably in English only.

PCN Information contact   :   PCNinfo@Q8.com, communication preferably in English only.

1.4 Emergency telephone number

Europe   :   +44 (0) 1235 239 670

Global (English only)   :   +44 (0) 1865 407 333

CARECHEM24

National advisory body/Poison Center

Belgium   :   Poison Centre : +32 (0)70 245 245

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

Product definition   :   Mixture

Classification according to Regulation (EC) No. 1272/2008 [CLP/GHS]
Not classified.

The product is not classified as hazardous according to Regulation (EC) 1272/2008 as amended.

Ingredients of unknown toxicity   :   None.

Ingredients of unknown ecotoxicity   :   None.

See Section 11 for more detailed information on health effects and symptoms.

2.2 Label elements

Signal word   :   No signal word.

Hazard statements   :   No known significant effects or critical hazards.

Precautionary statements

Conforms to Regulation (EC) No. 1907/2006 (REACH), Annex II, as amended by Commission Regulation (EU) 2020/878 - Belgium

Q8 T 65 75W-90

SECTION 2: Hazards identification

General	:	P103 - Read carefully and follow all instructions. P102 - Keep out of reach of children. P101 - If medical advice is needed, have product container or label at hand.
Prevention	:	Not applicable.
Response	:	Not applicable.
Storage	:	Not applicable.
Disposal	:	Not applicable.
Supplemental label elements	:	Contains Reaction products of bis(4-methylpentan-2-yl)dithiophosphoric acid with phosphorus oxide, propylene oxide and amines, C12-14-alkyl (branched) and Reaction product of 1,3,4-thiadiazolidine-2,5-dithione, formaldehyde and phenol, heptyl derivs.. May produce an allergic reaction. Safety data sheet available on request.
Annex XVII - Restrictions on the manufacture, placing on the market and use of certain dangerous substances, mixtures and articles	:	Not applicable.

Special packaging requirements

Containers to be fitted with child-resistant fastenings	:	Not applicable.
Tactile warning of danger	:	Not applicable.

2.3 Other hazards

Product meets the criteria for PBT or vPvB according to Regulation (EC) No. 1907/2006, Annex XIII	:	This mixture does not contain any substances that are assessed to be a PBT or a vPvB.
Other hazards which do not result in classification	:	Prolonged or repeated contact may dry skin and cause irritation. May cause endocrine disruption.

SECTION 3: Composition/information on ingredients

3.2 Mixtures   :   Mixture

Product/ingredient name	Identifiers	%	Classification	Specific Conc. Limits, M-factors and ATEs	Type
Severely refined mineral oil (C15 - C50) * - Not classified.	-	≥10 - ≤25	Not classified.	-	[2]
Severely refined mineral oil (C15 - C50) * - H304	-	≤5	Asp. Tox. 1, H304	-	[1] [2]
Reaction products of bis (4-methylpentan-2-yl) dithiophosphoric acid with phosphorus oxide, propylene oxide and amines, C12-14-alkyl (branched)	REACH #: 01-2119493620-38 EC: 931-384-6	<2.5	Acute Tox. 4, H302 Eye Irrit. 2, H319 Skin Sens. 1B, H317 Aquatic Chronic 2, H411	ATE [Oral] = 2000 mg/kg Eye Irrit. 2, H319: C ≥ 50% Skin Sens. 1, H317: C ≥ 9.39%	[1]
Reaction product of 1,3,4-thiadiazolidine-2,5-dithione, formaldehyde and phenol, heptyl derivs.	REACH #: 01-2119971727-23 EC: 939-460-0 CAS: 1471311-26-8	≤0.3	Skin Irrit. 2, H315 Eye Dam. 1, H318 Skin Sens. 1B, H317 Aquatic Chronic 3,	-	[1] [3]

Conforms to Regulation (EC) No. 1907/2006 (REACH), Annex II, as amended by Commission Regulation (EU) 2020/878 - Belgium

Q8 T 65 75W-90

SECTION 3: Composition/information on ingredients

		H412 **See Section 16 for the full text of the H statements declared above.**		

* Contains one or more of the following:
CAS: 64742-54-7, EC: 265-157-1, EU REACH: 01-2119484627-25
CAS: 64742-55-8, EC: 265-158-7, EU REACH: 01-2119487077-29
CAS: 64742-56-9, EC: 265-159-2, EU REACH: 01-2119480132-48
CAS: 64742-65-0, EC: 265-169-7, EU REACH: 01-2119471299-27

The mineral base oils contained in this product are severely refined and contain less than 3% DMSO extract according to IP 346 method, and are therefore not classified as carcinogen according to Regulation (EC) No 1272/2008, note L.

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment, are PBTs, vPvBs or Substances of equivalent concern, or have been assigned a workplace exposure limit and hence require reporting in this section.

Type

[1] Substance classified with a health or environmental hazard
[2] Substance with a workplace exposure limit
[3] Substance of equivalent concern

Occupational exposure limits, if available, are listed in Section 8.

SECTION 4: First aid measures

4.1 Description of first aid measures

Eye contact	:	Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Continue to rinse for at least 10 minutes. Get medical attention.
Inhalation	:	Remove victim to fresh air and keep at rest in a position comfortable for breathing. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Get medical attention if adverse health effects persist or are severe. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.
Skin contact	:	Wash skin thoroughly with soap and water or use recognized skin cleanser. Remove contaminated clothing and shoes. Get medical attention if symptoms occur. Wash clothing before reuse. Clean shoes thoroughly before reuse.
Ingestion	:	Wash out mouth with water. Remove dentures if any. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Stop if the exposed person feels sick as vomiting may be dangerous. Do not induce vomiting unless directed to do so by medical personnel. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Get medical attention if adverse health effects persist or are severe. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.
Protection of first-aiders	:	No action shall be taken involving any personal risk or without suitable training. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

4.2 Most important symptoms and effects, both acute and delayed

Over-exposure signs/symptoms

Eye contact	:	No specific data.
Inhalation	:	No specific data.
Skin contact	:	Adverse symptoms may include the following: irritation dryness cracking
Ingestion	:	No specific data.

Conforms to Regulation (EC) No. 1907/2006 (REACH), Annex II, as amended by Commission Regulation (EU) 2020/878 - Belgium

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SECTION 4: First aid measures

4.3 Indication of any immediate medical attention and special treatment needed

Notes to physician : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Specific treatments : No specific treatment.

SECTION 5: Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media : Use dry chemical, CO_2, alcohol-resistant foam or water spray (fog).

Unsuitable extinguishing media : Do not use water jet.

5.2 Special hazards arising from the substance or mixture

Hazards from the substance or mixture : In a fire or if heated, a pressure increase will occur and the container may burst.

Hazardous combustion products : Decomposition products may include the following materials:
carbon dioxide
carbon monoxide

5.3 Advice for firefighters

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode. Clothing for fire-fighters (including helmets, protective boots and gloves) conforming to European standard EN 469 will provide a basic level of protection for chemical incidents.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilled material. Avoid breathing vapor or mist. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

For emergency responders : If specialized clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

6.2 Environmental precautions : Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

6.3 Methods and materials for containment and cleaning up

Small spill : Stop leak if without risk. Move containers from spill area. Dilute with water and mop up if water-soluble. Alternatively, or if water-insoluble, absorb with an inert dry material and place in an appropriate waste disposal container. Dispose of via a licensed waste disposal contractor.

Conforms to Regulation (EC) No. 1907/2006 (REACH), Annex II, as amended by Commission Regulation (EU) 2020/878 - Belgium

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SECTION 6: Accidental release measures

Large spill	:	Stop leak if without risk. Move containers from spill area. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations. Dispose of via a licensed waste disposal contractor.
6.4 Reference to other sections	:	See Section 1 for emergency contact information. See Section 8 for information on appropriate personal protective equipment. See Section 13 for additional waste treatment information.

SECTION 7: Handling and storage

The information in this section contains generic advice and guidance. The list of Identified Uses in Section 1 should be consulted for any available use-specific information provided in the Exposure Scenario(s).

7.1 Precautions for safe handling

Protective measures	:	Put on appropriate personal protective equipment (see Section 8).
Advice on general occupational hygiene	:	Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

7.2 Conditions for safe storage, including any incompatibilities

Store in accordance with local regulations. Store in original container protected from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10) and food and drink. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination. See Section 10 for incompatible materials before handling or use.

7.3 Specific end use(s)

Recommendations	:	Not available.
Industrial sector specific solutions	:	Not available.

SECTION 8: Exposure controls/personal protection

The information in this section contains generic advice and guidance. Information is provided based on typical anticipated uses of the product. Additional measures might be required for bulk handling or other uses that could significantly increase worker exposure or environmental releases.

8.1 Control parameters

Occupational exposure limits

Product/ingredient name	Exposure limit values
Severely refined mineral oil (C15 - C50) * - Not classified.	**Limit values (Belgium, 5/2021). []** TWA: 5 mg/m³ 8 hours. Form: mist STEL: 10 mg/m³ 15 minutes. Form: mist **EU OEL (Europe).** TWA: 5 mg/m³ 8 hours. Form: Mist STEL: 10 mg/m³ 15 minutes. Form: Mist
Severely refined mineral oil (C15 - C50) * - H304	**Limit values (Belgium, 5/2021). []** TWA: 5 mg/m³ 8 hours. Form: mist STEL: 10 mg/m³ 15 minutes. Form: mist **EU OEL (Europe).** TWA: 5 mg/m³ 8 hours. Form: Mist STEL: 10 mg/m³ 15 minutes. Form: Mist

Biological exposure indices

No exposure indices known.

Conforms to Regulation (EC) No. 1907/2006 (REACH), Annex II, as amended by Commission Regulation (EU) 2020/878 - Belgium

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SECTION 8: Exposure controls/personal protection

Recommended monitoring procedures : Reference should be made to monitoring standards, such as the following: European Standard EN 689 (Workplace atmospheres - Guidance for the assessment of exposure by inhalation to chemical agents for comparison with limit values and measurement strategy) European Standard EN 14042 (Workplace atmospheres - Guide for the application and use of procedures for the assessment of exposure to chemical and biological agents) European Standard EN 482 (Workplace atmospheres - General requirements for the performance of procedures for the measurement of chemical agents) Reference to national guidance documents for methods for the determination of hazardous substances will also be required.

DNELs/DMELs

Product/ingredient name	Type	Exposure	Value	Population	Effects
Reaction product of 1,3,4-thiadiazolidine-2,5-dithione, formaldehyde and phenol, heptyl derivs.	DNEL	Long term Oral	0.33 mg/ kg bw/day	General population	Systemic
	DNEL	Long term Inhalation	0.58 mg/m³	General population	Systemic
	DNEL	Long term Inhalation	2.35 mg/m³	Workers	Systemic
	DNEL	Long term Dermal	33.33 mg/ kg bw/day	General population	Systemic
	DNEL	Long term Dermal	66.7 mg/ kg bw/day	Workers	Systemic

PNECs

No PNECs available.

8.2 Exposure controls

Appropriate engineering controls : Good general ventilation should be sufficient to control worker exposure to airborne contaminants.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists, gases or dusts. If contact is possible, the following protection should be worn, unless the assessment indicates a higher degree of protection: safety glasses with side-shields.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Wear suitable gloves tested to EN374. Recommended: < 1 hour (breakthrough time): nitrile rubber 0.17 mm. Provide employee with skin care programmes.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

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SECTION 8: Exposure controls/personal protection

Respiratory protection	:	Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use. Recommended: Boiling point > 65 °C: A1; Boiling point < 65 °C: AX1; Hot material: A1P2.
Environmental exposure controls	:	Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

SECTION 9: Physical and chemical properties

The conditions of measurement of all properties are at standard temperature and pressure unless otherwise indicated.

9.1 Information on basic physical and chemical properties

Appearance

Physical state	:	Liquid. [Oily liquid.]
Appearance	:	Clear.
Color	:	Yellow [Light]
Odor	:	Characteristic.
Odor threshold	:	Not available.
Melting point/freezing point	:	Not applicable.
Pour point	:	<-39°C (<-38.2°F) [ASTM D 5950]
Initial boiling point and boiling range	:	>300°C (>572°F)
Flammability	:	Not applicable.
Lower and upper explosion limit	:	Not available.
Flash point	:	Open cup: >180°C (>356°F) [ASTM D92.]
Auto-ignition temperature	:	>300°C (>572°F)
Decomposition temperature	:	>300°C
pH	:	Not applicable.
Viscosity	:	Kinematic (40°C (104°F)): 92.8 mm^2/s (92.8 cSt) [ASTM D 445] Kinematic (100°C (212°F)): 14 to 16 mm^2/s (14 to 16 cSt) [ASTM D 445]
Solubility(ies)	:	

Media	Result
cold water	Not soluble
hot water	Not soluble

Solubility in water	:	Not available.
Miscible with water	:	No.
Partition coefficient: n-octanol/ water	:	Not applicable.
Vapor pressure	:	<0.01 kPa (<0.075006 mm Hg)
Density	:	0.87 g/cm³ [15°C (59°F)] [ASTM D 4052]
Vapor density	:	Not available.
Explosive properties	:	Not applicable.
Oxidizing properties	:	Not applicable.

Particle characteristics

Median particle size	:	Not applicable.

9.2 Other information

Conforms to Regulation (EC) No. 1907/2006 (REACH), Annex II, as amended by Commission Regulation (EU) 2020/878 - Belgium

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SECTION 9: Physical and chemical properties

9.2.1 Information with regard to physical hazard classes

Explosive properties	**:** Not applicable.
Oxidizing properties	**:** Not applicable.

9.2.2 Other safety characteristics

Miscible with water	**:** No.

SECTION 10: Stability and reactivity

10.1 Reactivity	**:** No specific test data related to reactivity available for this product or its ingredients.
10.2 Chemical stability	**:** The product is stable.
10.3 Possibility of hazardous reactions	**:** Under normal conditions of storage and use, hazardous reactions will not occur.
10.4 Conditions to avoid	**:** No specific data.
10.5 Incompatible materials	**:** Reactive or incompatible with the following materials: Strong oxidizing materials
10.6 Hazardous decomposition products	**:** Under normal conditions of storage and use, hazardous decomposition products should not be produced.

SECTION 11: Toxicological information

11.1 Information on hazard classes as defined in Regulation (EC) No 1272/2008

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
Severely refined mineral oil (C15 - C50) * - Not classified.	LC50 Inhalation Dusts and mists	Rat - Male, Female	5.53 mg/l	4 hours
	LD50 Dermal	Rabbit	>5000 mg/kg	-
	LD50 Oral	Rat	>5000 mg/kg	-
Severely refined mineral oil (C15 - C50) * - H304	LC50 Inhalation Dusts and mists	Rat - Male, Female	5.53 mg/l	4 hours
	LD50 Dermal	Rabbit	>5000 mg/kg	-
	LD50 Oral	Rat	>5000 mg/kg	-
Reaction products of bis (4-methylpentan-2-yl) dithiophosphoric acid with phosphorus oxide, propylene oxide and amines, C12-14-alkyl (branched)	LD50 Oral	Rat - Male, Female	2000 mg/kg	-

Conclusion/Summary	**:** Not available.

Acute toxicity estimates

Product/ingredient name	Oral (mg/ kg)	Dermal (mg/kg)	Inhalation (gases) (ppm)	Inhalation (vapors) (mg/l)	Inhalation (dusts and mists) (mg/l)
Q8 T 65 75W-90	123571.2	N/A	N/A	N/A	N/A
Severely refined mineral oil (C15 - C50) * - Not classified.	N/A	N/A	N/A	N/A	5.53
Severely refined mineral oil (C15 - C50) * - H304	N/A	N/A	N/A	N/A	5.53
Reaction products of bis(4-methylpentan-2-yl) dithiophosphoric acid with phosphorus oxide, propylene oxide and amines, C12-14-alkyl	2000	N/A	N/A	N/A	N/A

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SECTION 11: Toxicological information

(branched)						

Irritation/Corrosion

Product/ingredient name	Result	Species	Score	Exposure	Observation
Severely refined mineral oil (C15 - C50) * - Not classified.	Eyes - Iris lesion	Rabbit	0	48 hours	72 hours
	Eyes - Redness of the conjunctivae	Rabbit	0.33	48 hours	72 hours
	Skin - Edema	Rabbit	0	72 hours	7 days
	Skin - Erythema/Eschar	Rabbit	0.17	72 hours	7 days
Severely refined mineral oil (C15 - C50) * - H304	Eyes - Iris lesion	Rabbit	0	48 hours	72 hours
	Eyes - Redness of the conjunctivae	Rabbit	0.33	48 hours	72 hours
	Skin - Edema	Rabbit	0	72 hours	7 days
	Skin - Erythema/Eschar	Rabbit	0.17	72 hours	7 days

Conclusion/Summary : Not available.

Sensitization

Product/ingredient name	Route of exposure	Species	Result
Severely refined mineral oil (C15 - C50) * - Not classified.	skin	Guinea pig	Not sensitizing
Severely refined mineral oil (C15 - C50) * - H304	skin	Guinea pig	Not sensitizing
Reaction product of 1,3,4-thiadiazolidine-2,5-dithione, formaldehyde and phenol, heptyl derivs.	skin	Guinea pig	Sensitizing

Conclusion/Summary : Not available.

Mutagenicity

Product/ingredient name	Test	Experiment	Result
Severely refined mineral oil (C15 - C50) * - Not classified.	474 Mammalian Erythrocyte Micronucleus Test	Experiment: In vivo Subject: Mammalian-Animal Cell: Somatic	Negative
Severely refined mineral oil (C15 - C50) * - H304	474 Mammalian Erythrocyte Micronucleus Test	Experiment: In vivo Subject: Mammalian-Animal Cell: Somatic	Negative

Conclusion/Summary : Not available.

Carcinogenicity

Product/ingredient name	Result	Species	Dose	Exposure
Severely refined mineral oil (C15 - C50) * - Not classified.	Negative - Dermal - TC	Mouse - Female	-	78 weeks
Severely refined mineral oil (C15 - C50) * - H304	Negative - Dermal - TC	Mouse - Female	-	78 weeks

Conclusion/Summary : Not available.

Reproductive toxicity

Conforms to Regulation (EC) No. 1907/2006 (REACH), Annex II, as amended by Commission Regulation (EU) 2020/878 - Belgium

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SECTION 11: Toxicological information

Product/ingredient name	Maternal toxicity	Fertility	Development toxin	Species	Dose	Exposure
Severely refined mineral oil (C15 - C50) * - Not classified.	Negative	Negative	Negative	Rat - Male, Female	Oral: 1000 mg/kg	-
Severely refined mineral oil (C15 - C50) * - H304	Negative	Negative	Negative	Rat - Male, Female	Oral: 1000 mg/kg	-

Conclusion/Summary : Not available.

Teratogenicity

Product/ingredient name	Result	Species	Dose	Exposure
Severely refined mineral oil (C15 - C50) * - Not classified.	Negative - Dermal	Rat	2000 mg/kg	7 days per week
Severely refined mineral oil (C15 - C50) * - H304	Negative - Dermal	Rat	2000 mg/kg	7 days per week

Conclusion/Summary : Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Product/ingredient name	Result
Severely refined mineral oil (C15 - C50) * - H304	ASPIRATION HAZARD - Category 1

Information on the likely routes of exposure	: Not available.

Potential acute health effects

Eye contact	: No known significant effects or critical hazards.
Inhalation	: No known significant effects or critical hazards.
Skin contact	: Defatting to the skin. May cause skin dryness and irritation.
Ingestion	: No known significant effects or critical hazards.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact	: No specific data.
Inhalation	: No specific data.
Skin contact	: Adverse symptoms may include the following: irritation dryness cracking
Ingestion	: No specific data.

Delayed and immediate effects and also chronic effects from short and long term exposure

Short term exposure

Potential immediate effects	: Not available.
Potential delayed effects	: Not available.

Long term exposure

Conforms to Regulation (EC) No. 1907/2006 (REACH), Annex II, as amended by Commission Regulation (EU) 2020/878 - Belgium

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SECTION 11: Toxicological information

Potential immediate effects	: Not available.
Potential delayed effects	: Not available.

Potential chronic health effects

Product/ingredient name	Result	Species	Dose	Exposure
Severely refined mineral oil (C15 - C50) * - Not classified.	Sub-acute LOAEL Oral	Rat - Male	125 mg/kg	13 weeks; 5 hours per day
	Sub-chronic NOAEL Oral	Rat - Male, Female	≥2000 mg/kg	13 weeks; 5 days per week
	Sub-acute NOAEL Inhalation Vapor	Rat - Male	>980 mg/m³	4 weeks; 5 days per week
Severely refined mineral oil (C15 - C50) * - H304	Sub-acute LOAEL Oral	Rat - Male	125 mg/kg	13 weeks; 5 hours per day
	Sub-chronic NOAEL Oral	Rat - Male, Female	≥2000 mg/kg	13 weeks; 5 days per week
	Sub-acute NOAEL Inhalation Vapor	Rat - Male	>980 mg/m³	4 weeks; 5 days per week

Conclusion/Summary	: Not available.
General	: Prolonged or repeated contact can defat the skin and lead to irritation, cracking and/ or dermatitis.
Carcinogenicity	: No known significant effects or critical hazards.
Mutagenicity	: No known significant effects or critical hazards.
Reproductive toxicity	: No known significant effects or critical hazards.

11.2 Information on other hazards

11.2.1 Endocrine disrupting properties

Not available.

11.2.2 Other information

Not available.

SECTION 12: Ecological information

12.1 Toxicity

Product/ingredient name	Result	Species	Exposure
Severely refined mineral oil (C15 - C50) * - Not classified.	Acute NEL >100 mg/l Fresh water	Algae	72 hours
	Acute NEL >10000 mg/l Fresh water	Daphnia - *Daphnia Magma*	48 hours
	Acute NEL ≥100 mg/l Fresh water	Fish - *Pimephales promelas*	96 hours
	Chronic NEL 10 mg/l Fresh water	Daphnia - *Daphnia magna*	21 days
Severely refined mineral oil (C15 - C50) * - H304	Acute NEL >100 mg/l Fresh water	Algae	72 hours
	Acute NEL >10000 mg/l Fresh water	Daphnia - *Daphnia Magma*	48 hours
	Acute NEL ≥100 mg/l Fresh water	Fish - *Pimephales promelas*	96 hours
	Chronic NEL 10 mg/l Fresh water	Daphnia - *Daphnia magna*	21 days

Conclusion/Summary	: Not available.

12.2 Persistence and degradability

Product/ingredient name	Test	Result	Dose	Inoculum
Reaction product of 1,3,4-thiadiazolidine-2,5-dithione, formaldehyde and phenol, heptyl derivs.	-	17.4 % - 28 days	-	-

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SECTION 12: Ecological information

Conclusion/Summary   :   Not available.

Product/ingredient name	Aquatic half-life	Photolysis	Biodegradability
Severely refined mineral oil (C15 - C50) * - Not classified.	-	-	Inherent
Severely refined mineral oil (C15 - C50) * - H304	-	-	Inherent
Reaction product of 1,3,4-thiadiazolidine-2,5-dithione, formaldehyde and phenol, heptyl derivs.	-	-	Not readily

12.3 Bioaccumulative potential

Product/ingredient name	LogP$_{ow}$	BCF	Potential
Reaction product of 1,3,4-thiadiazolidine-2,5-dithione, formaldehyde and phenol, heptyl derivs.	9.4	-	High

12.4 Mobility in soil

Soil/water partition coefficient (K$_{oc}$)   :   Not available.

Mobility   :   Not available.

12.5 Results of PBT and vPvB assessment

This mixture does not contain any substances that are assessed to be a PBT or a vPvB.

12.6 Endocrine disrupting properties

May cause endocrine disruption.

12.7 Other adverse effects

No known significant effects or critical hazards.

SECTION 13: Disposal considerations

The information in this section contains generic advice and guidance. The list of Identified Uses in Section 1 should be consulted for any available use-specific information provided in the Exposure Scenario(s).

13.1 Waste treatment methods

Product

Methods of disposal   :   The generation of waste should be avoided or minimized wherever possible. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste should not be disposed of untreated to the sewer unless fully compliant with the requirements of all authorities with jurisdiction.

Hazardous waste   :   Yes.

European waste catalogue (EWC)

Waste code	Waste designation
13 02 05*	mineral-based non-chlorinated engine, gear and lubricating oils

Packaging

Conforms to Regulation (EC) No. 1907/2006 (REACH), Annex II, as amended by Commission Regulation (EU) 2020/878 - Belgium

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SECTION 13: Disposal considerations

Methods of disposal	**:**	The generation of waste should be avoided or minimized wherever possible. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible.
Special precautions	**:**	This material and its container must be disposed of in a safe way. Empty containers or liners may retain some product residues. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

SECTION 14: Transport information

	ADR/RID	**ADN**	**IMDG**	**IATA**
14.1 UN number or ID number	Not regulated.	Not regulated.	Not regulated.	Not regulated.
14.2 UN proper shipping name	-	-	-	-
14.3 Transport hazard class(es)	-	-	-	-
14.4 Packing group	-	-	-	-
14.5 Environmental hazards	No.	No.	No.	No.

14.6 Special precautions for user	**:**	**Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.
14.7 Maritime transport in bulk according to IMO instruments	**:**	Not available.

SECTION 15: Regulatory information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture

  EU Regulation (EC) No. 1907/2006 (REACH)

  Annex XIV - List of substances subject to authorization

  Annex XIV

Intrinsic property	Ingredient name	Status	Reference number	Date of revision
Substance of equivalent concern for environment Endocrine disrupting properties for environment	Reaction product of 1,3,4-thiadiazolidine-2,5-dithione, formaldehyde and phenol, heptyl derivs. reaction products of 1,3,4-thiadiazolidine-2,5-dithione, formaldehyde and 4-heptylphenol, branched and linear (RP-HP) (with ≥ 0,1 % w/w 4-heptylphenol, branched and linear)	Listed Listed	- 57	- 01-05-2022

  Substances of very high concern

Conforms to Regulation (EC) No. 1907/2006 (REACH), Annex II, as amended by Commission Regulation (EU) 2020/878 - Belgium

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SECTION 15: Regulatory information

Intrinsic property	Ingredient name	Status	Reference number	Date of revision
Substance of equivalent concern for environment Endocrine disrupting properties for environment	Reaction product of 1,3,4-thiadiazolidine-2,5-dithione, formaldehyde and phenol, heptyl derivs. reaction products of 1,3,4-thiadiazolidine-2,5-dithione, formaldehyde and 4-heptylphenol, branched and linear (RP-HP) with ≥0.1% w/w 4-heptylphenol, branched and linear (4-HPbl)	Candidate Recommended	- ED/01/2018	- 01-10-2019

Annex XVII - Restrictions on the manufacture, placing on the market and use of certain dangerous substances, mixtures and articles

No listed substance

Other EU regulations

Industrial emissions (integrated pollution prevention and control) - Air	:	Not listed
Industrial emissions (integrated pollution prevention and control) - Water	:	Not listed
Explosive precursors	:	Not applicable.

Ozone depleting substances (1005/2009/EU)

Not listed.

Prior Informed Consent (PIC) (649/2012/EU)

Not listed.

Persistent Organic Pollutants

Not listed.

Seveso Directive

This product is not controlled under the Seveso Directive.

National regulations

Germany

Hazard class for water (WGK)	:	2

Switzerland

VOC content	:	Exempt.

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Informed Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Conforms to Regulation (EC) No. 1907/2006 (REACH), Annex II, as amended by Commission Regulation (EU) 2020/878 - Belgium

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SECTION 15: Regulatory information

Inventory list

Australia	:	All components are listed or exempted.
Canada	:	All components are listed or exempted.
China	:	All components are listed or exempted.
Eurasian Economic Union	:	**Russian Federation inventory**: Not determined.
Japan	:	**Japan inventory (CSCL)**: All components are listed or exempted. **Japan inventory (ISHL)**: Not determined.
New Zealand	:	All components are listed or exempted.
Philippines	:	All components are listed or exempted.
Republic of Korea	:	All components are listed or exempted.
Taiwan	:	All components are listed or exempted.
Thailand	:	Not determined.
Turkey	:	Not determined.
United States of America	:	All components are active or exempted.
Viet Nam	:	Not determined.

15.2 Chemical Safety Assessment	:	Chemical Safety Assessments for all substances in this product are either Complete or Not applicable.

SECTION 16: Other information

▽ Indicates information that has changed from previously issued version.

Abbreviations and acronyms	:	ADN = European Provisions concerning the International Carriage of Dangerous Goods by Inland Waterway
		ADR = The European Agreement concerning the International Carriage of Dangerous Goods by Road
		ASTM = American Society for Testing and Materials
		ATE = Acute Toxicity Estimate
		BCF = Bioconcentration Factor
		CAS = Chemical Abstracts Service
		CLP = Classification, Labelling and Packaging Regulation [Regulation (EC) No. 1272/2008]
		DIN = German Institute for Standardization
		DMEL = Derived Minimal Effect Level
		DNEL = Derived No Effect Level
		EC = European Commission
		EC50 = Half maximal effective concentration
		EN = European Standard (Norm)
		EUH statement = CLP-specific Hazard statement
		GHS - Globally Harmonized System of Classification and Labeling of Chemicals
		IATA = International Air Transport Association
		IBC = Intermediate Bulk Container
		IC50 = Half maximal inhibitory concentration
		IMDG = International Maritime Dangerous Goods
		IMO = International Maritime Organisation
		ISO = International Organization for Standardization
		LC50 = Median lethal concentration
		LD50 = Median lethal dose
		LOAEL / LOAEC = Lowest Observed Adverse Effect Level / Concentration
		MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
		N/A = Not available
		NOAEL / NOAEC = No Observed Adverse Effect Level / Concentration
		NOEL / NOEC = No Observed Effect Level / Concentration
		OECD = Organisation for Economic Co-operation and Development
		OEL = Occupational Exposure Limit
		PBT = Persistent, Bioaccumulative and Toxic
		PNEC = Predicted No Effect Concentration

Conforms to Regulation (EC) No. 1907/2006 (REACH), Annex II, as amended by Commission Regulation (EU) 2020/878 - Belgium

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SECTION 16: Other information

REACH = Registration, Evaluation, Authorisation and Restriction of Chemicals Regulation [Regulation (EC) No. 1907/2006]
RID = The Regulations concerning the International Carriage of Dangerous Goods by Rail
SDS = Safety Data Sheet
SVHC = Substances of Very High Concern
STEL = Short Term Exposure Limit
TLV = Threshold Limit Value
TWA = Time Weighted Average
UFI = Unique Formula Identifier
UN = United Nations
VOC = Volatile Organic Compound
vPvB = Very Persistent and Very Bioaccumulative

Procedure used to derive the classification according to Regulation (EC) No. 1272/2008 [CLP/GHS]

Not classified.

The mineral base oils contained in this product are severely refined and contain less than 3% DMSO extract according to IP 346 method, and are therefore not classified as carcinogen according to Regulation (EC) No 1272/2008, note L.
Note L: The classification as a carcinogen need not apply if it can be shown that the substance contains less than 3 % DMSO extract as measured by IP 346 "Determination of polycyclic aromatics in unused lubricating base oils and asphaltene free petroleum fractions — Dimethyl sulphoxide extraction refractive index method", Institute of Petroleum, London. This note applies only to certain complex oil-derived substances in Part 3.

Full text of abbreviated H statements

H302	Harmful if swallowed.
H304	May be fatal if swallowed and enters airways.
H315	Causes skin irritation.
H317	May cause an allergic skin reaction.
H318	Causes serious eye damage.
H319	Causes serious eye irritation.
H411	Toxic to aquatic life with long lasting effects.
H412	Harmful to aquatic life with long lasting effects.

Full text of classifications [CLP/GHS]

Acute Tox. 4	ACUTE TOXICITY - Category 4
Aquatic Chronic 2	AQUATIC HAZARD (LONG-TERM) - Category 2
Aquatic Chronic 3	AQUATIC HAZARD (LONG-TERM) - Category 3
Asp. Tox. 1	ASPIRATION HAZARD - Category 1
Eye Dam. 1	SERIOUS EYE DAMAGE/ EYE IRRITATION - Category 1
Eye Irrit. 2	SERIOUS EYE DAMAGE/ EYE IRRITATION - Category 2
Skin Irrit. 2	SKIN CORROSION/IRRITATION - Category 2
Skin Sens. 1B	SKIN SENSITIZATION - Category 1B

Training advice	:	Ensure operatives are trained to minimise exposures.
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Prepared by	:	Kuwait Petroleum Research & Technology B.V., The Netherlands

Notice to reader

The information in this SDS is based on the present state of our knowledge and on current laws. The product is not to be used for purposes other than those specified under section 1 without first obtaining written handling instructions. It is always the responsibility of the user to take all necessary steps to fulfill the demands set out in the local rules and legislation. The information in this SDS is meant to be a description of the safety requirements for our product. It is not to be considered a guarantee of the product's properties.