OPERATION AND MAINTENANCE MANUAL

BLUE LOGIC

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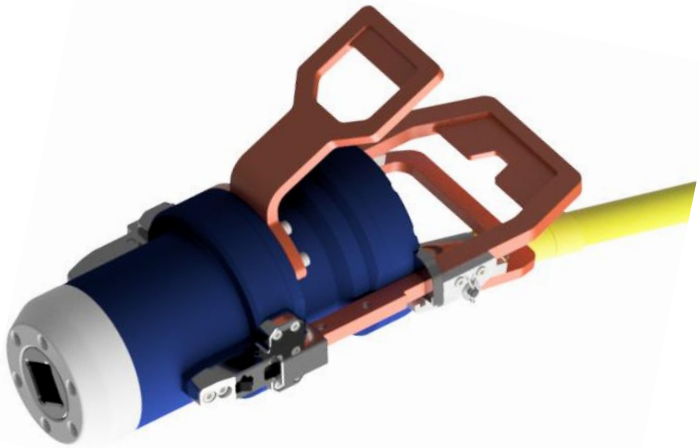

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REVISION CHANGE/RECORD

REV	REASON FOR REVISION/ DESCRIPTION OF CHANGES
01	Document initiated for use. New software/GUI implemented.
02	Torque Tool with Auto Select added

TABLE OF CONTENT

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:
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.

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
BC0497	2,7kNm El. Torque Tool wAutomatic Class Switch

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/	BC0497	Blue Logic	2,7kNm El. Torque Tool wAutomatic Class Switch

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.

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 8.

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

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.

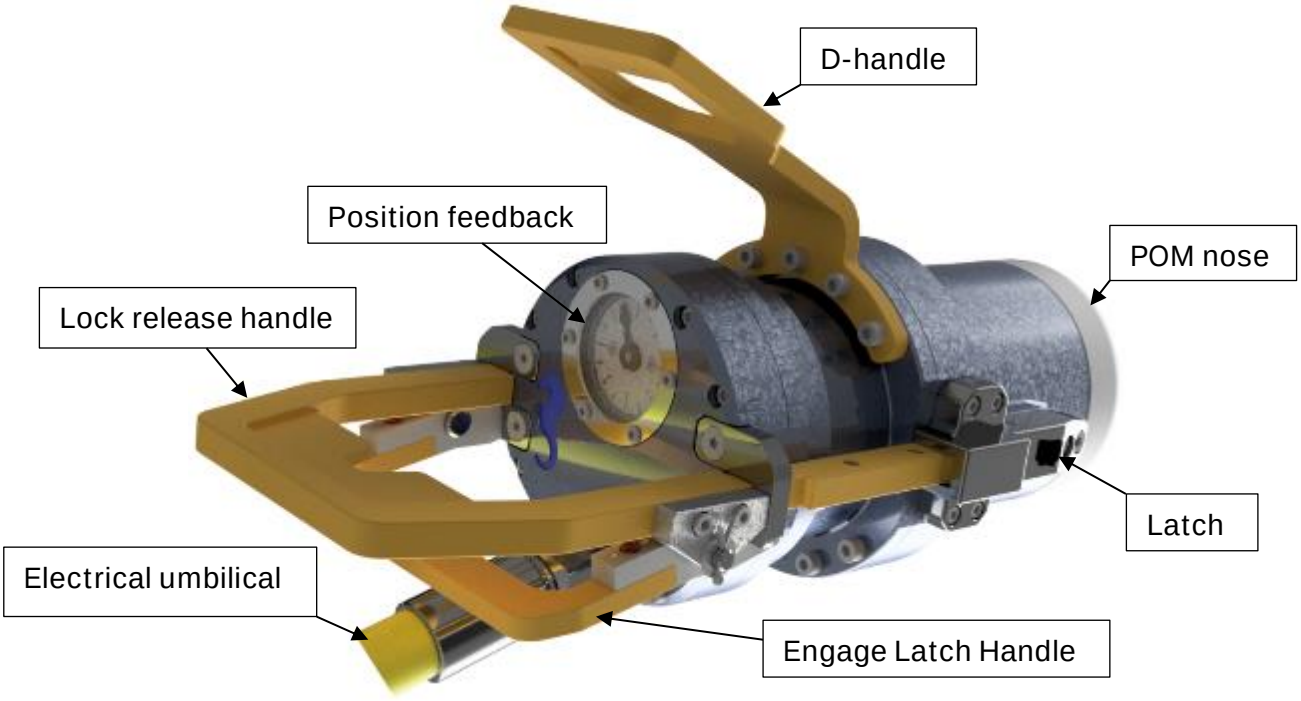


Figure 3: ELTT

HIGH VLOTAGE: 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.

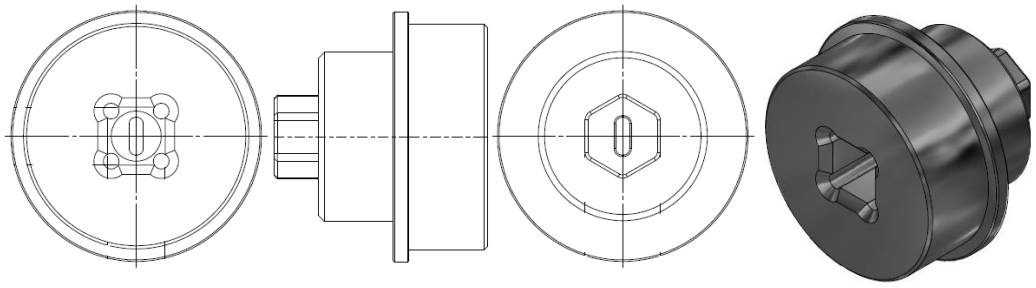
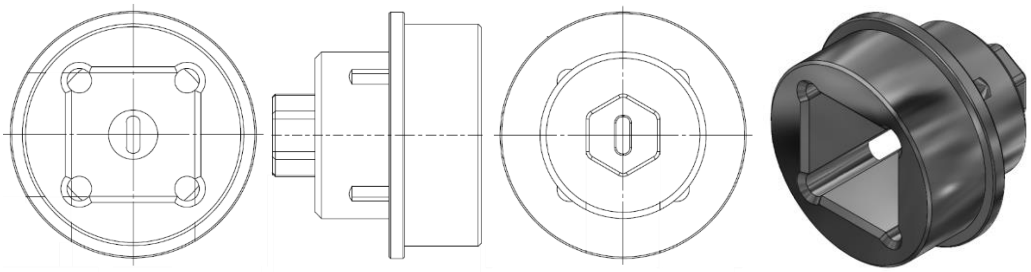
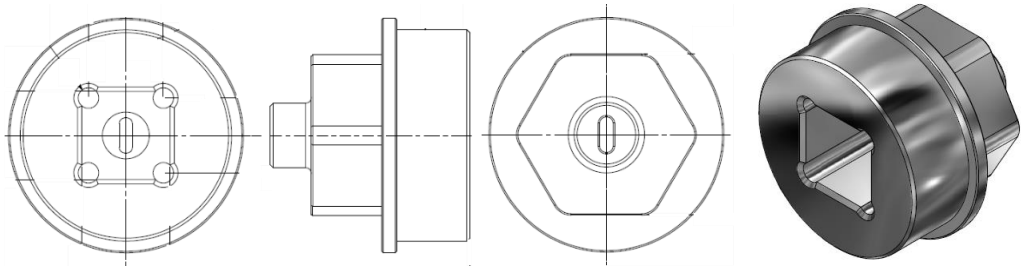
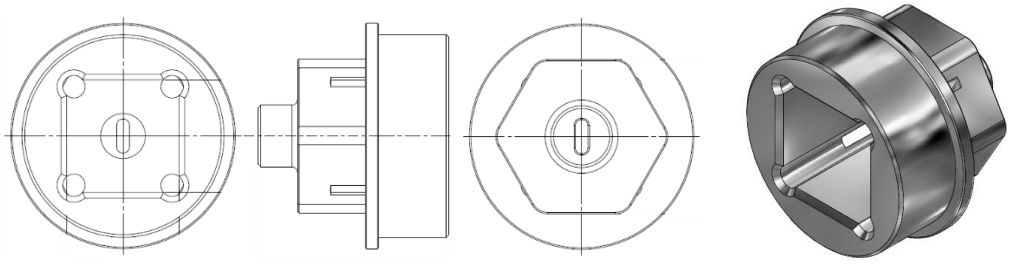
3.1.1. Technical Data

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, Cl1-2	100 – 500Nm
Torque range, Cl3-4	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

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

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

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.

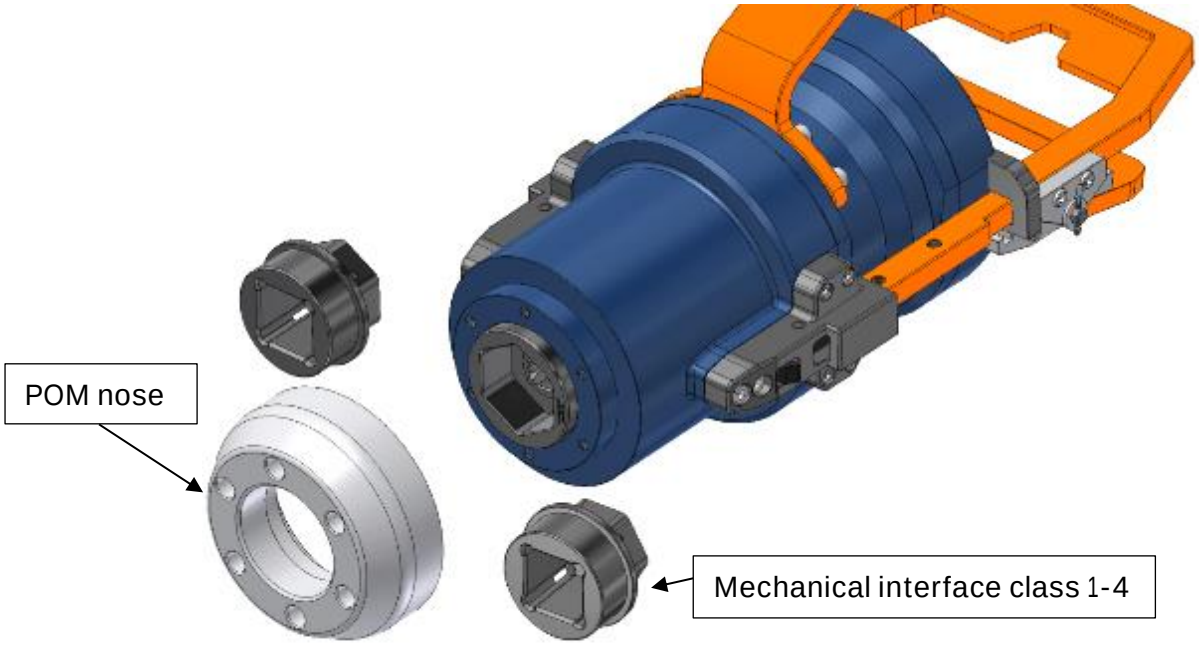


Figure 4: Mechanical Interface socket

To replace the mechanical socket, see section 9.2.2.

3.1.3. Interface Description – Auto Class Select Version

The 2,7kNm El. Torque Tool wAutomatic Class Switch, article BC0497, 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.

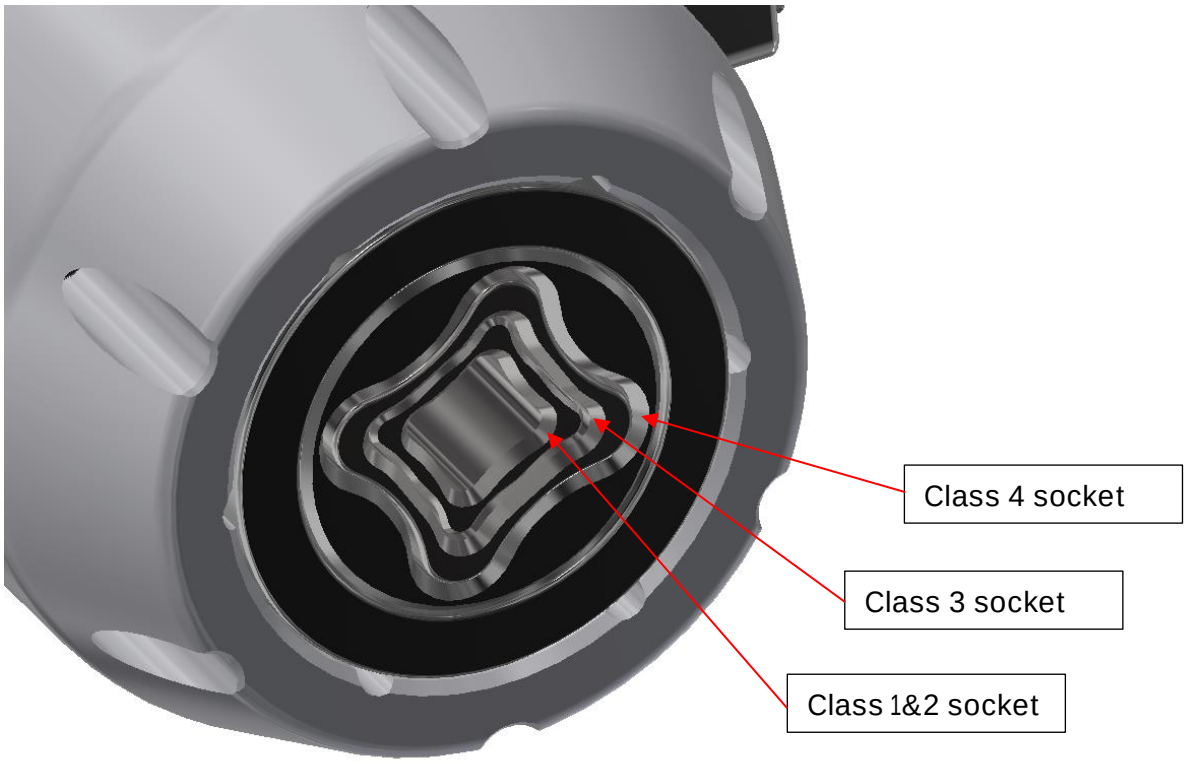


Figure 5, Interface nose for Torque Tool with Auto Class Select

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.

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.

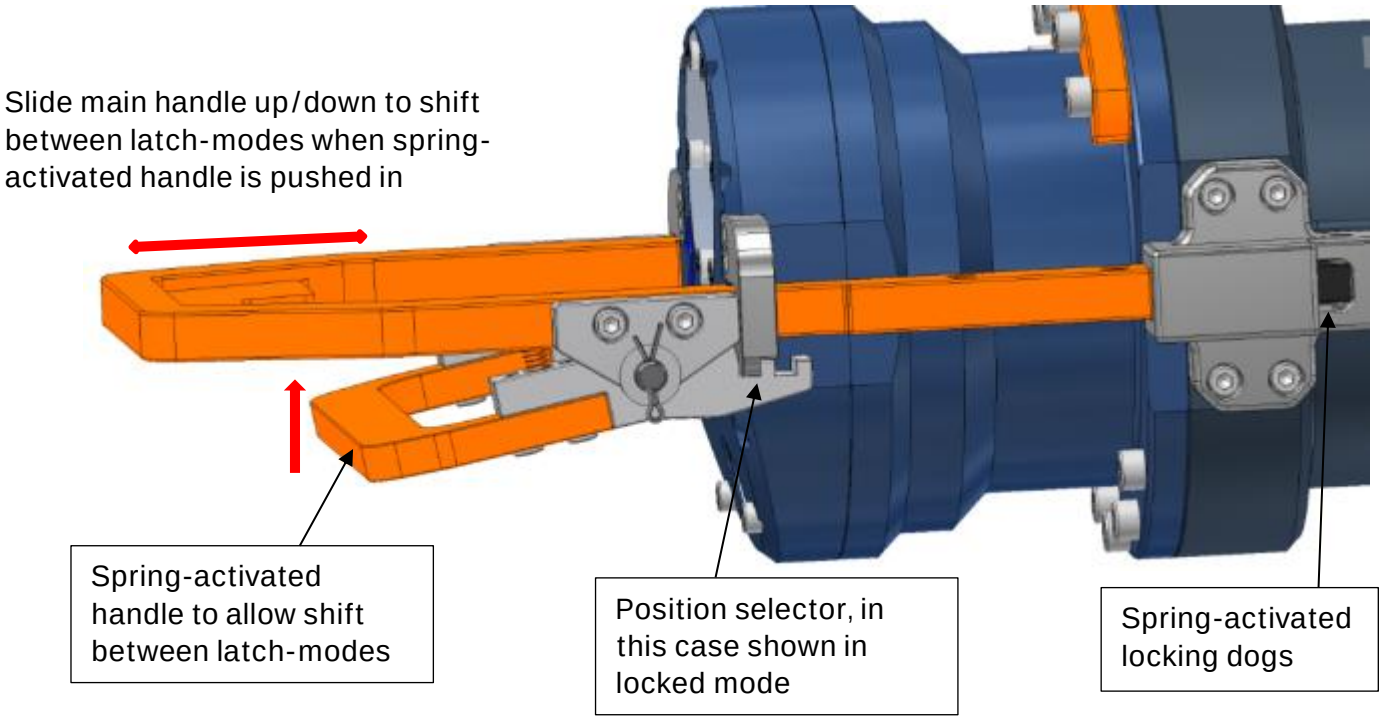
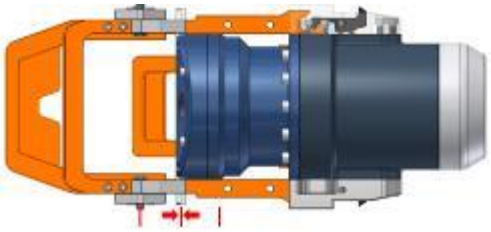
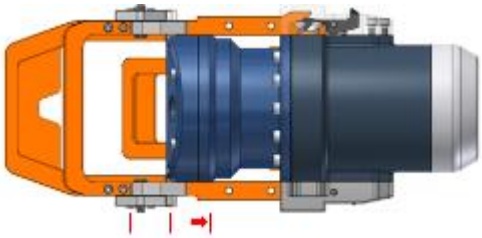
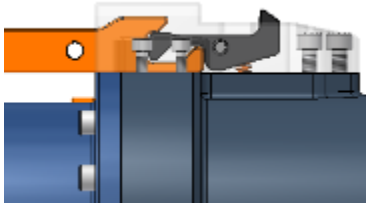
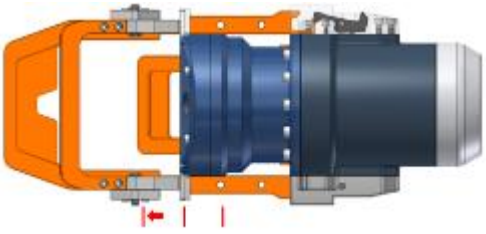


Figure 6: Locking system

Auto Latch:		
01	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:		
02	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:		
03	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.	 

3.1.5. 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.

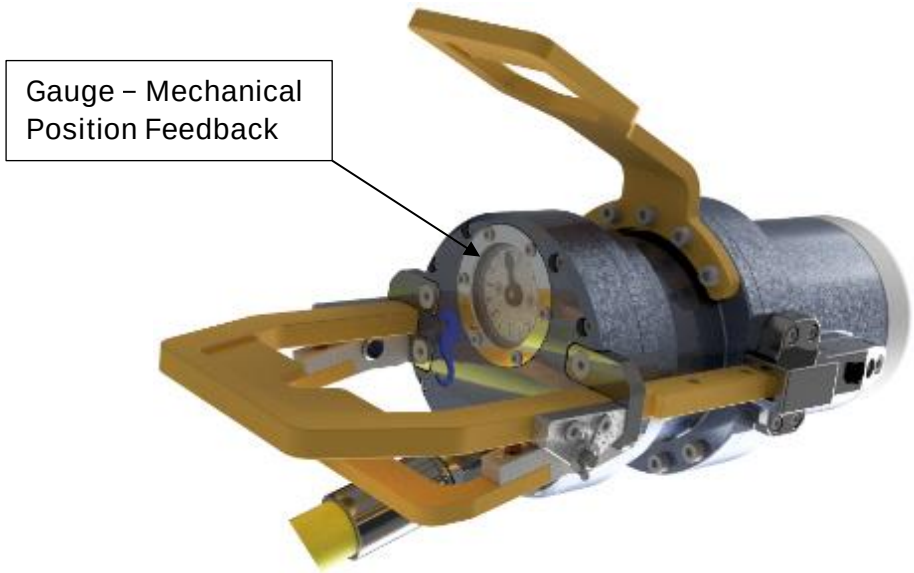


Figure 7: TT rear end with position feedback instrument

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 100 - 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.

3.1.6.1. Technical Data El Power Can

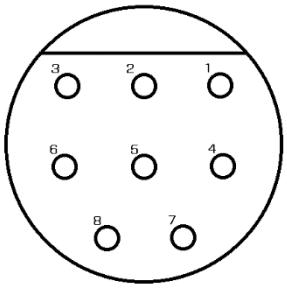
Table 1: Mechanical Data

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.

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	110-230 VAC / 160-320 VDC
2	110-230VAC / 0VDC
3	Chassis
4	N.C.
5	RX RS232
6	TX RS232
7	N.C.
8	Com/GND

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 8: 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 9: 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 OM10F to 250W Prim USB and2kW Power Supply
7	1	102766	Test Cable L=3m OM10M to 2kW/250W Sec USB
8	1	101138	Pigtail Cable L=0,5m with Connector SubConn IL10F 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 3.1.5

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.

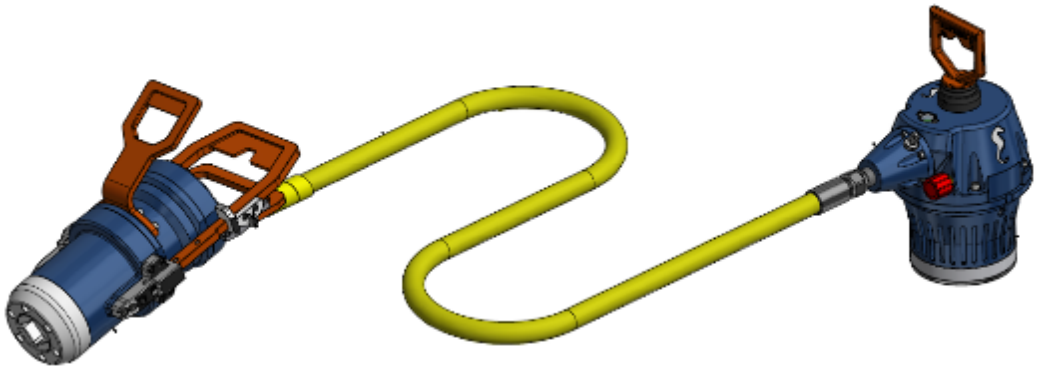


Figure 10: Electrical Torque Tool powered via IC

Figure 11: USB secondary side

Figure 12: 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.

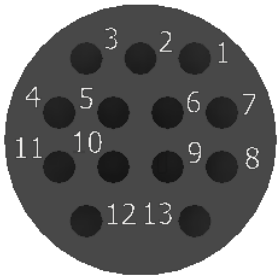
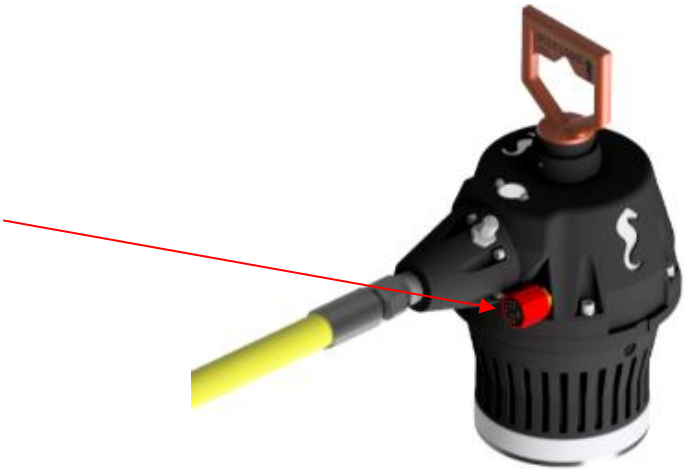
Interface	Interface Type
SubConn connector	BCR2410M 10 pin
	
Pin #	
1	100-250VAC / 145-350VDC
2	100-250VAC / 0VDC
3	Chassis
4	RS232RX (input)
5	RS232TX (output)
6	RS232GND
7	TX_p
8	TX_n
9	RX_p
10	RX_n

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.

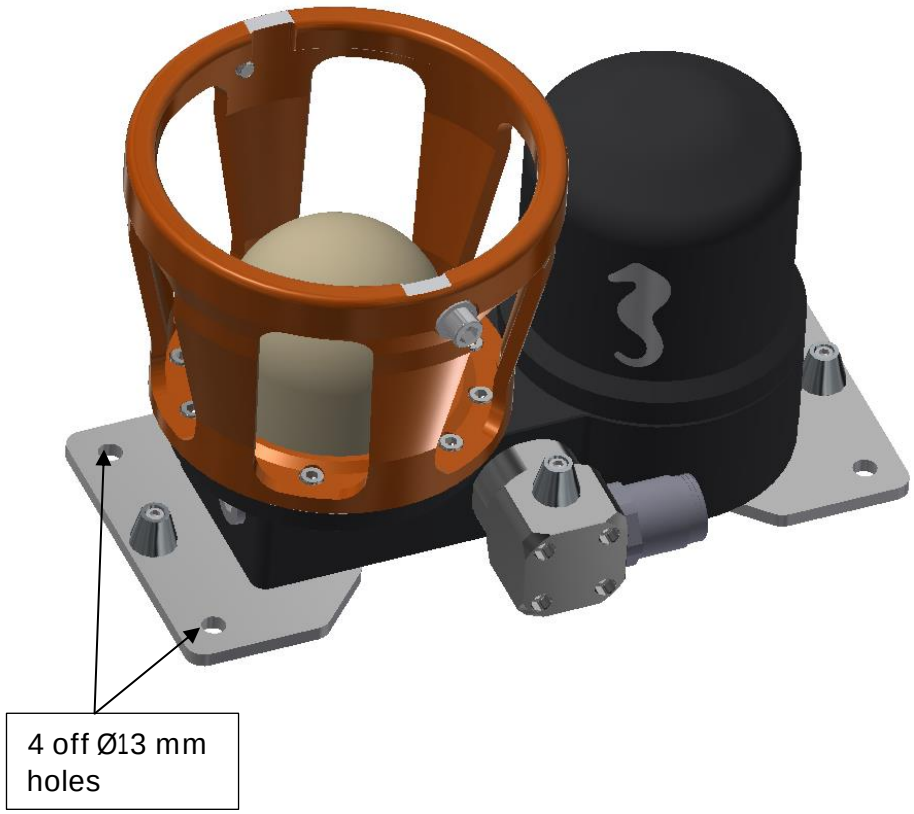
Table 6, AUX connector details

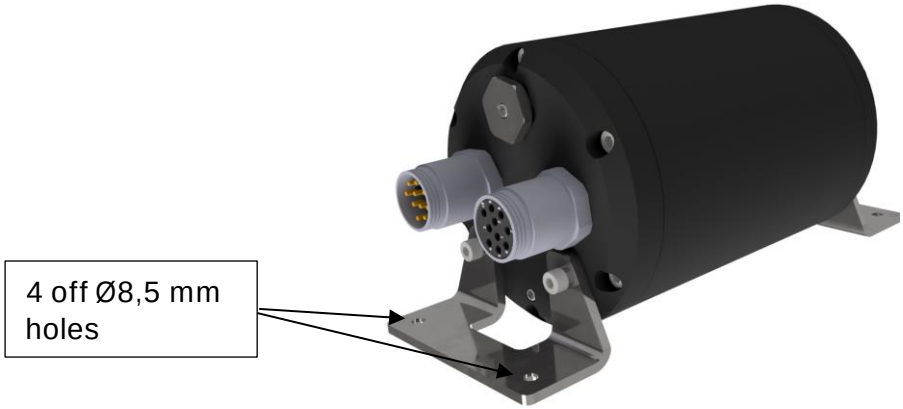
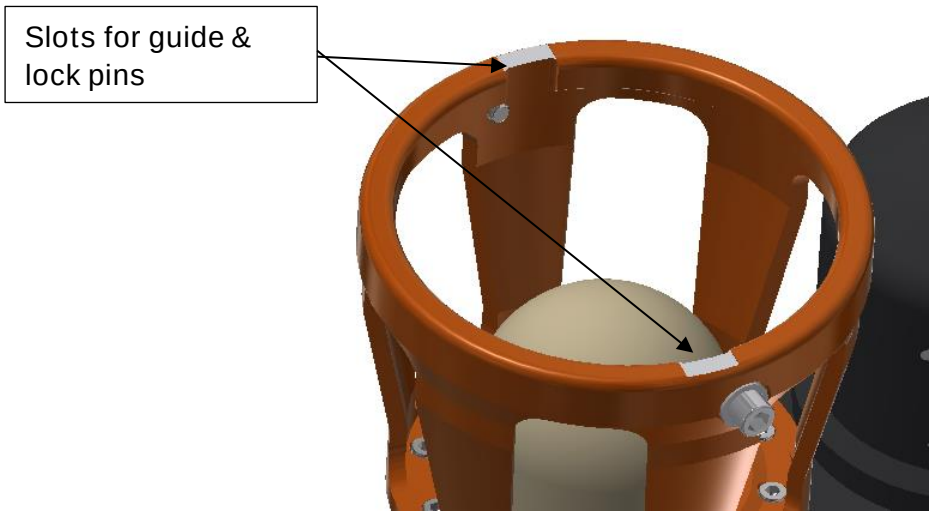
Interface	Interface Type
SubConn connector	DBH13F 13 pin
 	
Pin #	DBH13F
1	0V
2	Chassis
3	24VDC
4	N.C.
5	N.C.
6	N.C.
7	N.C.
8	TXn
9	TXp
10	RXn
11	RXp
12	N.C.
13	N.C.

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.  	

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. 	
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. 	

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, 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. 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.	

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.

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

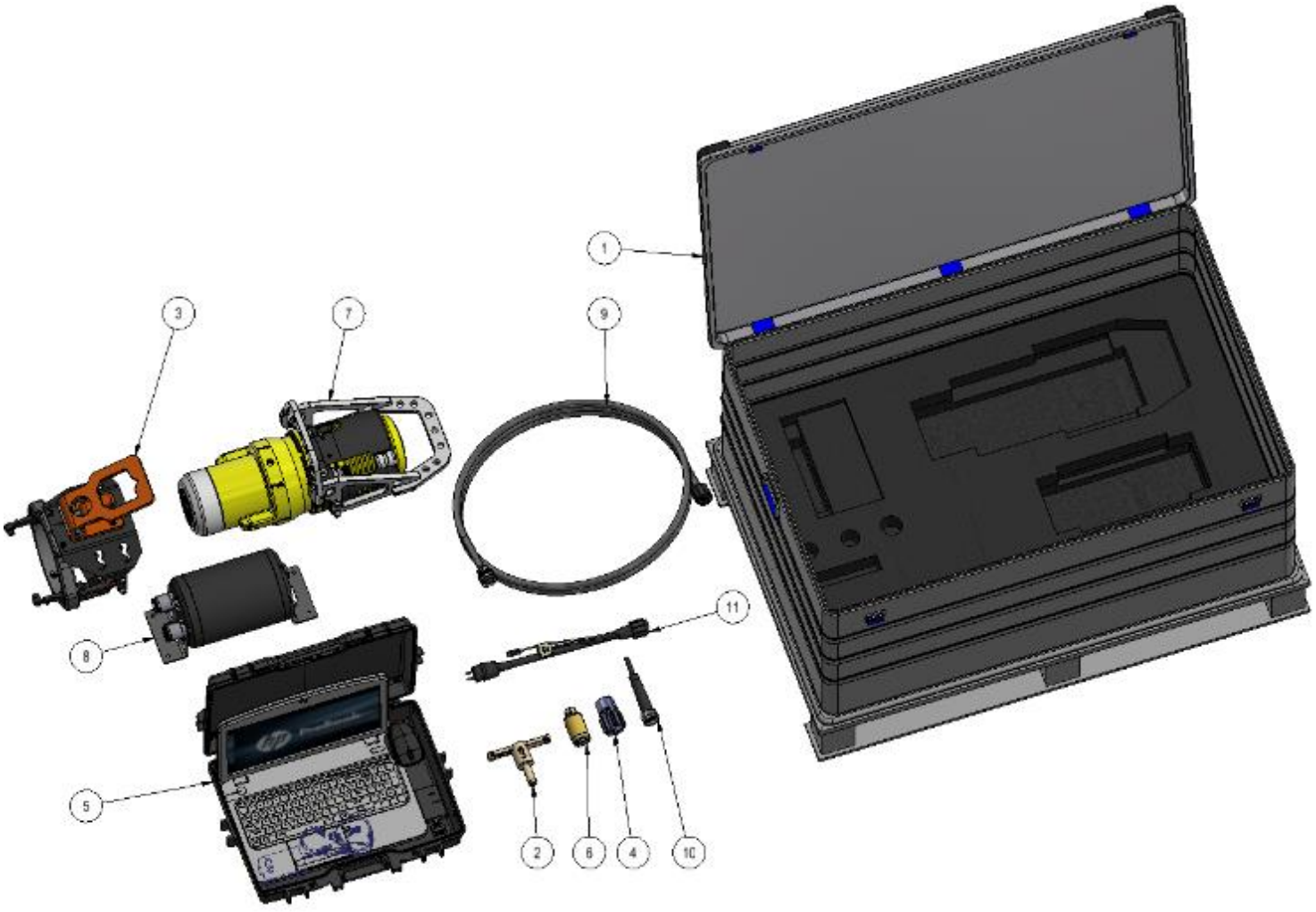


Figure 13: BB3551 Torque Tool Kit

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 OM10F 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.

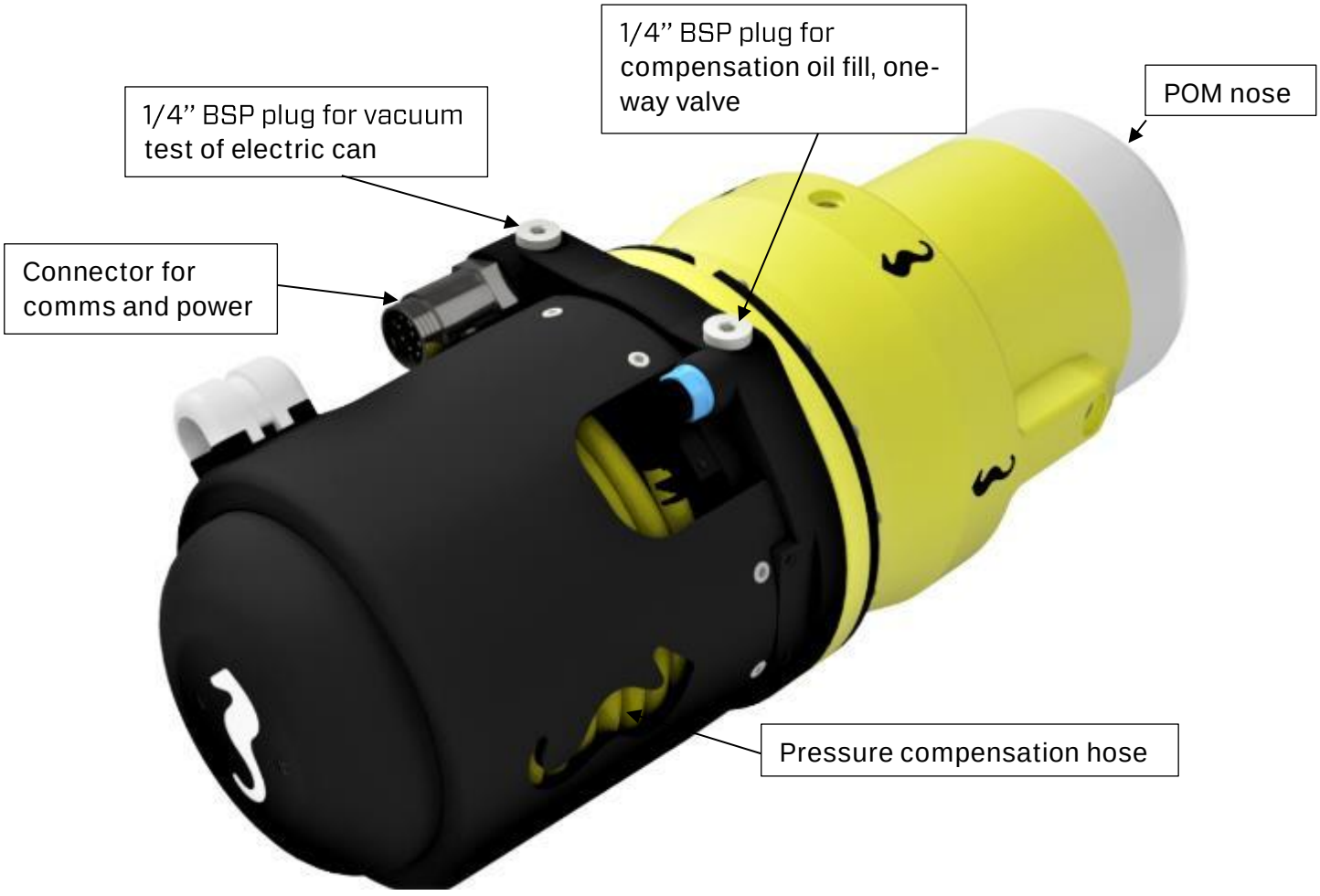


Figure 14: LWETT

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.

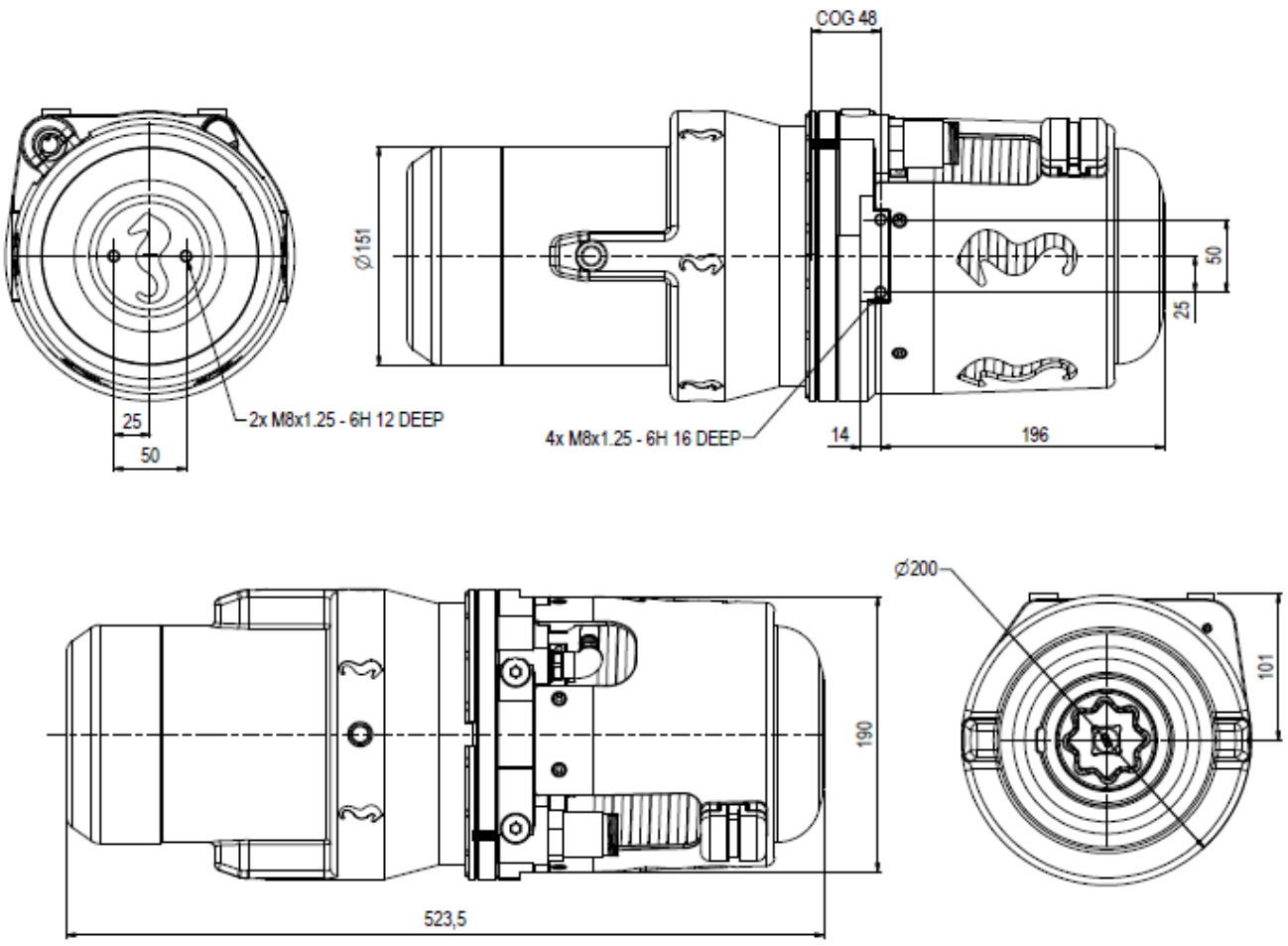


Figure 15, Torque Tool dimensions, AUV configuration

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.

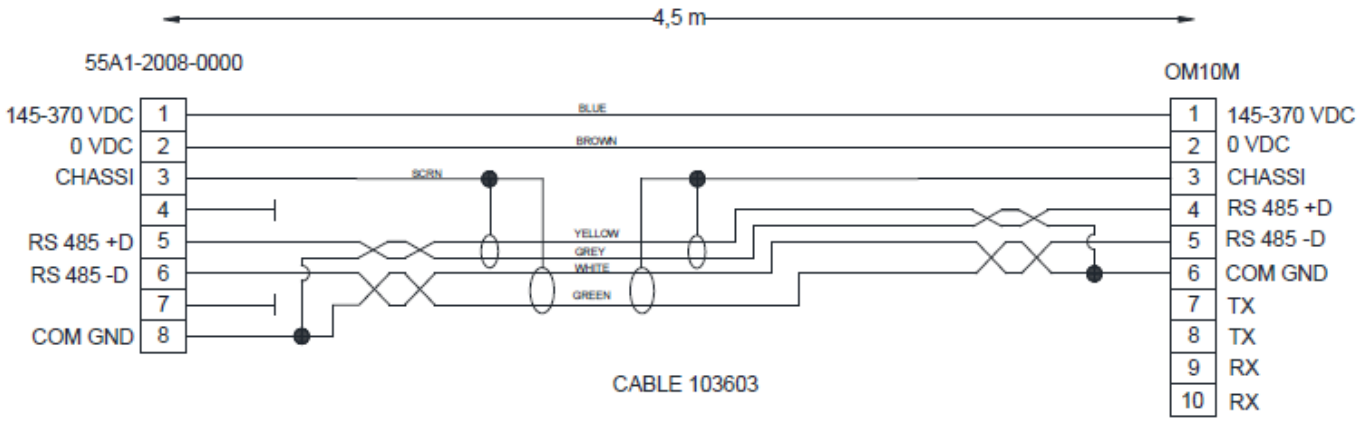


Figure 16 Interface cable

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.

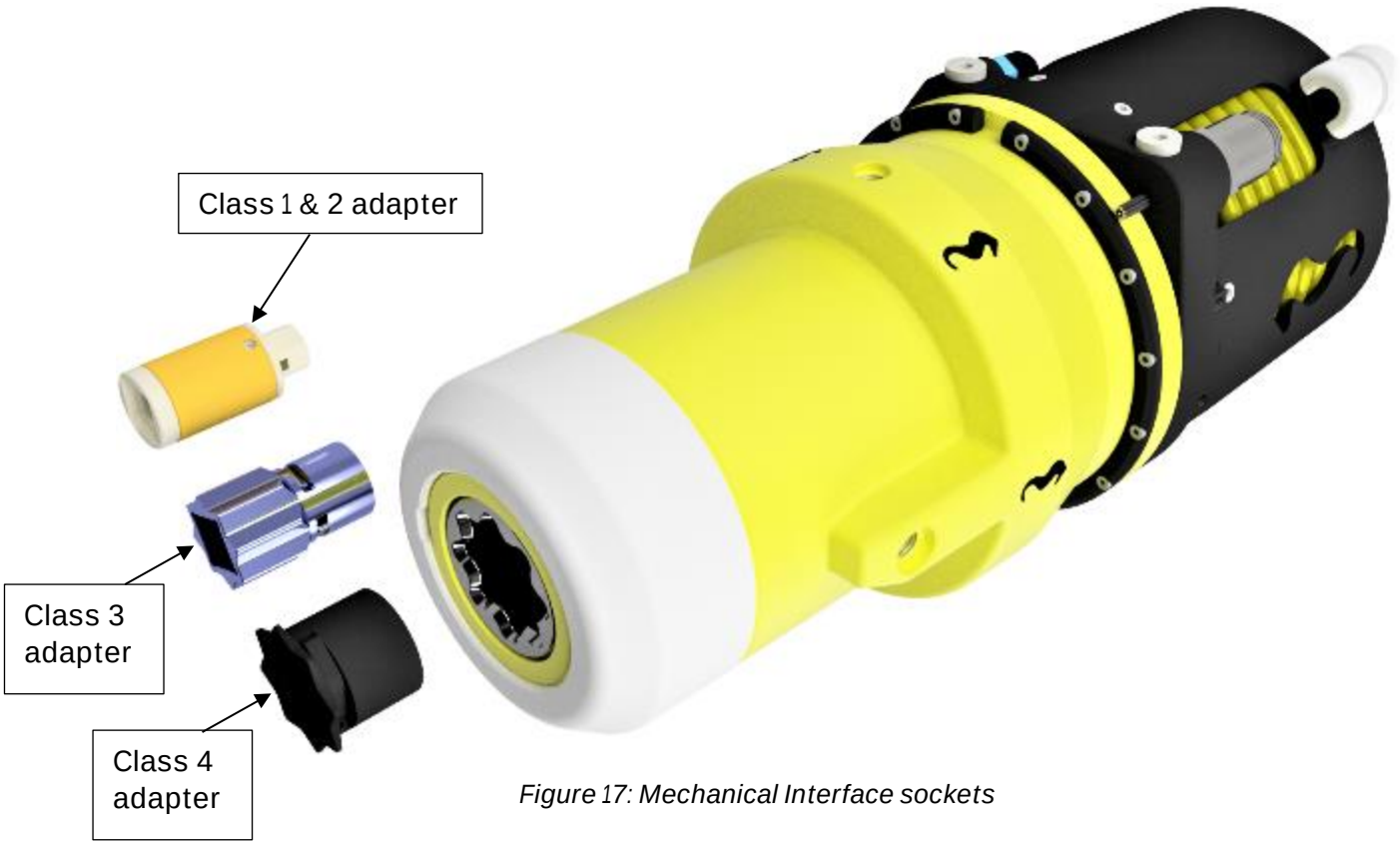


Figure 17: Mechanical Interface sockets

To replace the mechanical socket, see section 9.2.2.

5.1.3. Interface Description – Auto Class Select Version

The 2,7kNm Light Weight Torque Tool wAutomatic Class Switch, article BC0985, 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.

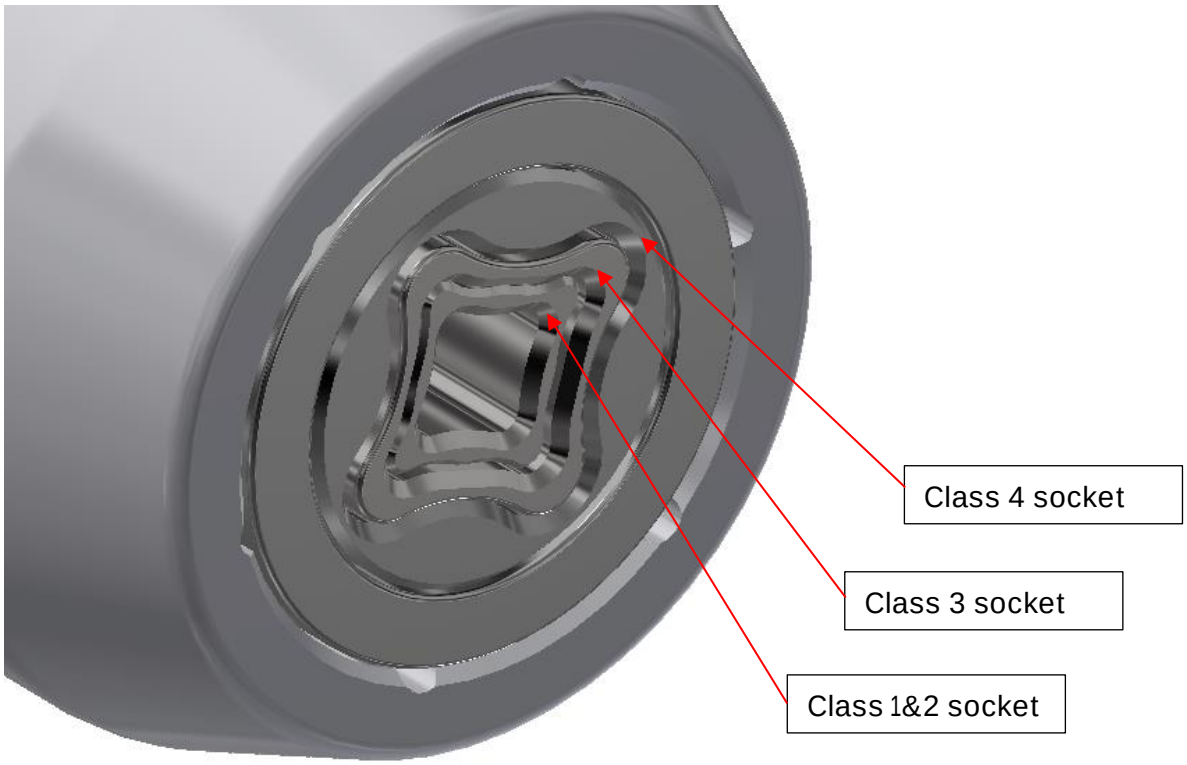


Figure 18, Interface nose for Light Weight Torque Tool with Auto Class Select

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.

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

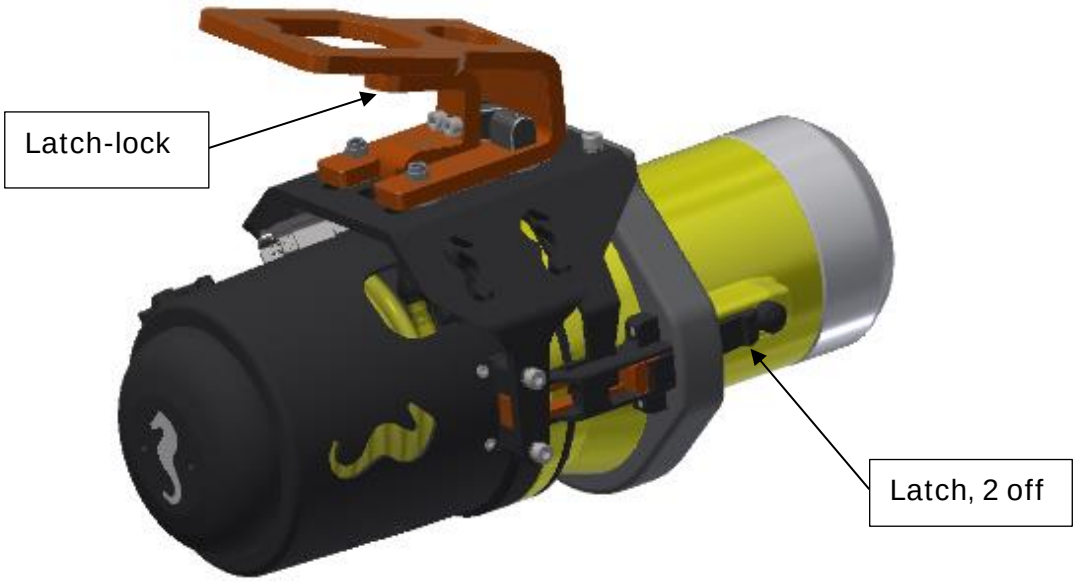


Figure 19 Torque Tool with ROV handle and latch-mechanism

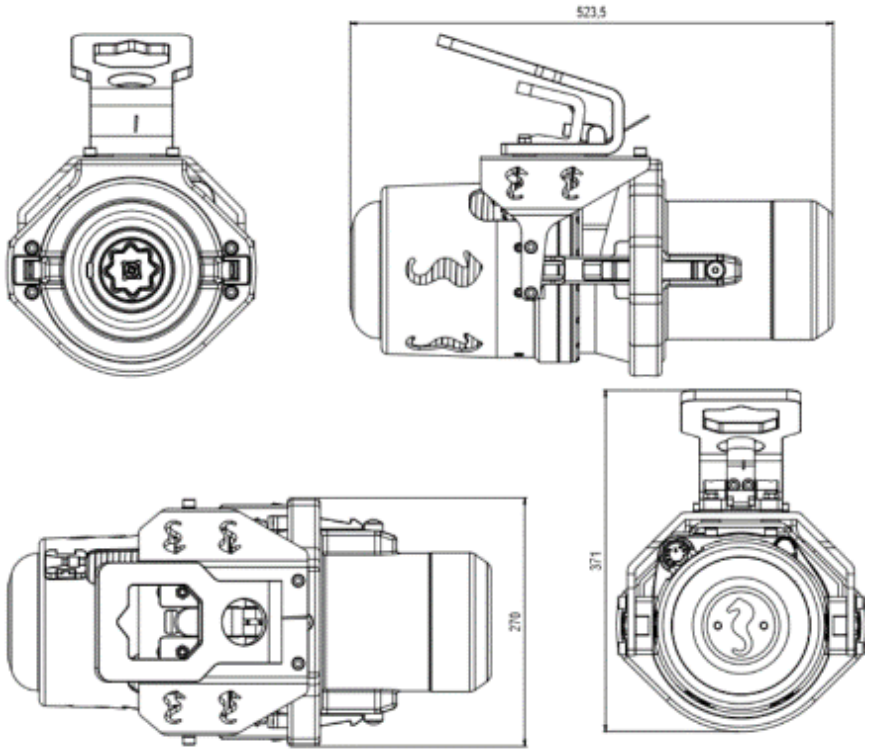


Figure 20 LWETT in ROV configuration - main dimensions

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.

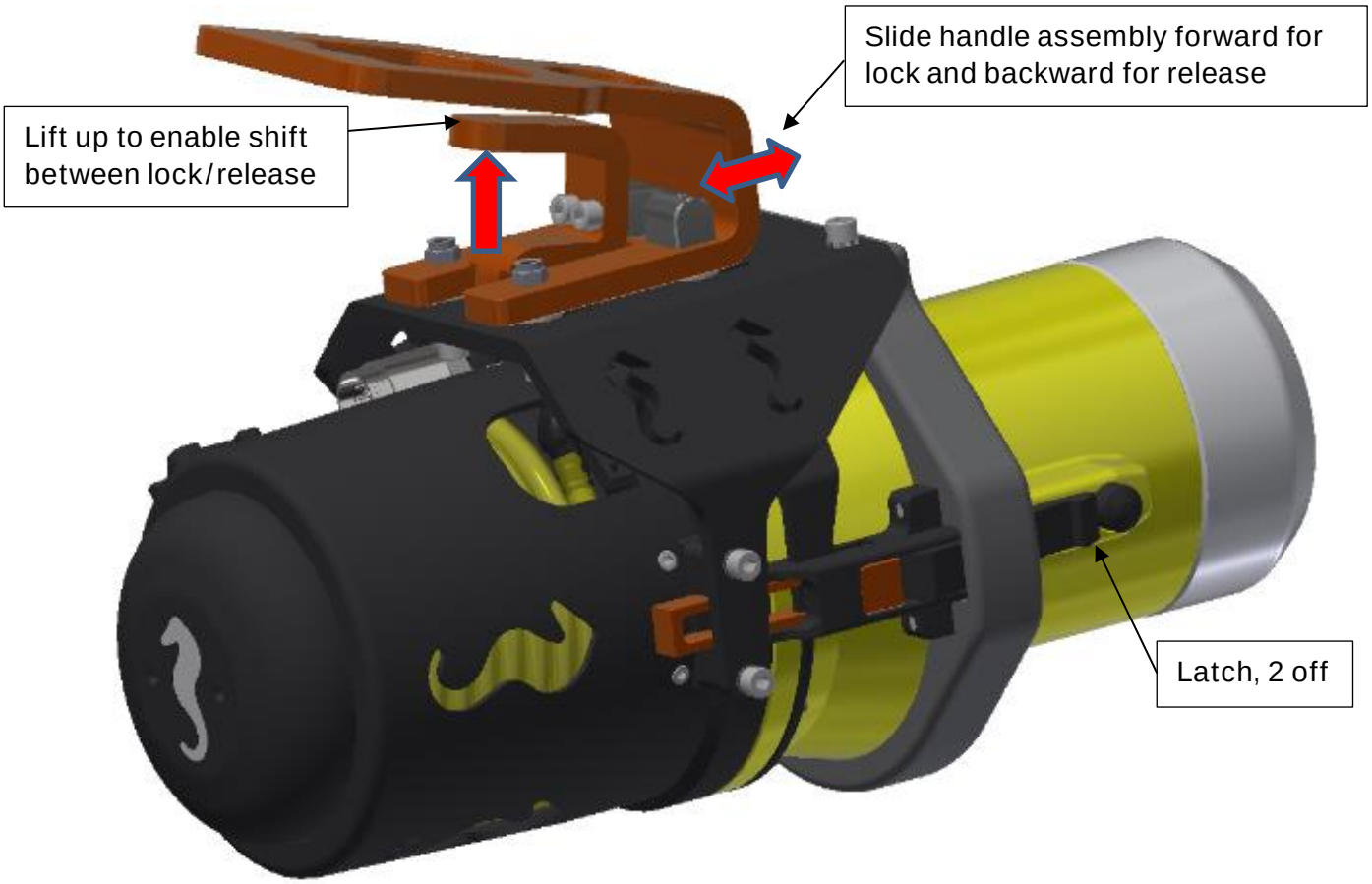


Figure 21, Latch mechanism

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.

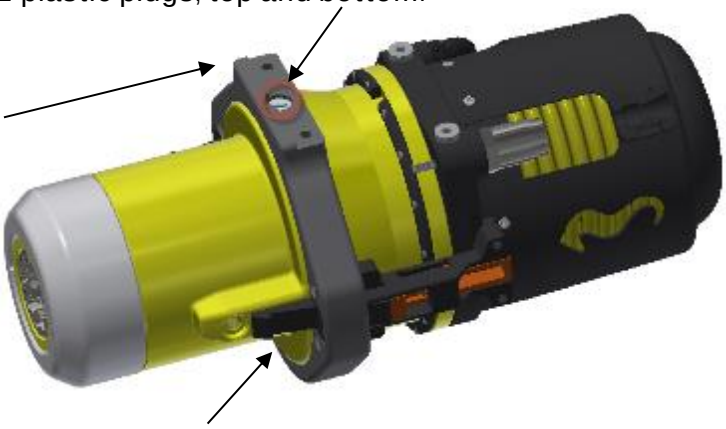
Release and installation mode, i.e. handle in backward position

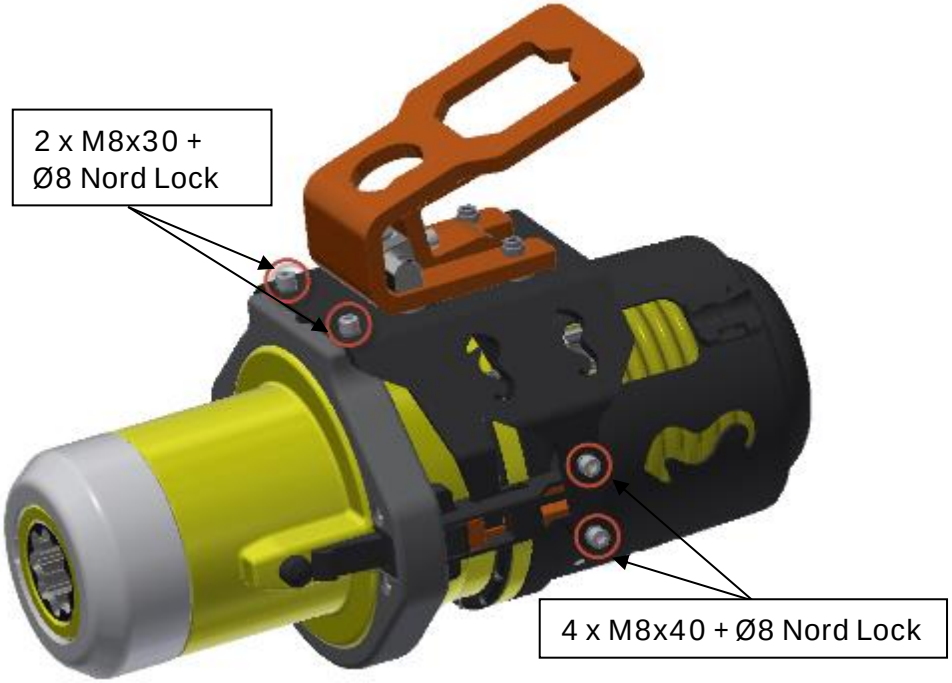
Lock mode, i.e. handle in forward position

Figure 22, Locked and released mode

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. 	

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. 	
7	Operate the handle several times to verify correct function. Make sure that the handle locks in correct aft and forward position.	

5.2.4. AUV Configuration

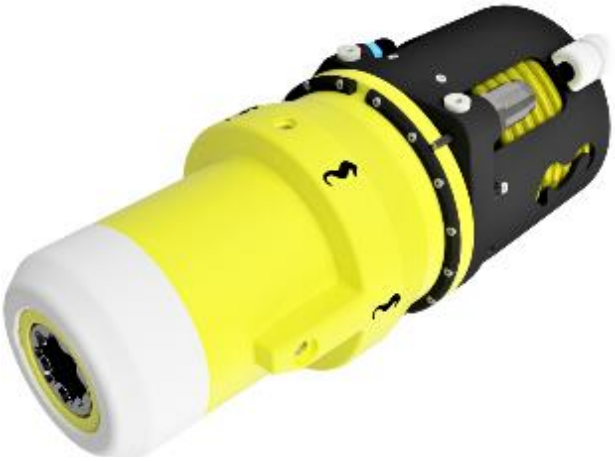


Figure 23 LWETT in AUV configuration

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.

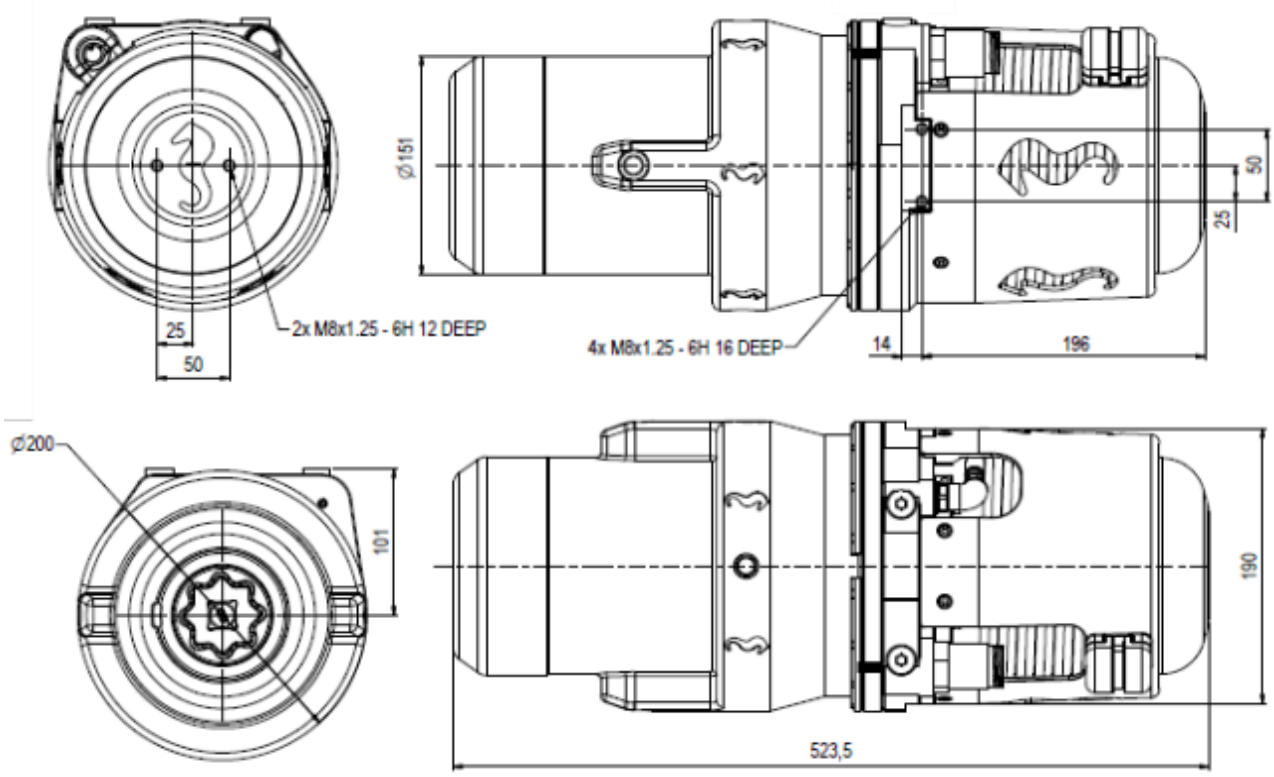


Figure 24 LWETT AUV configuration - main dimensions and bolting interface

5.2.5. Diver Configuration

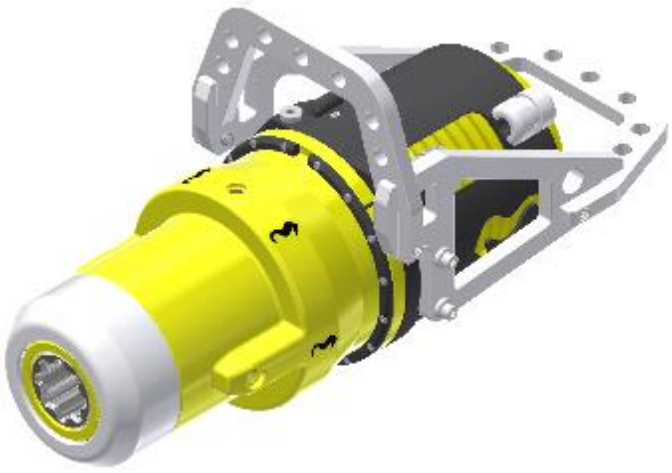


Figure 25 LWETT in diver configuration

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.

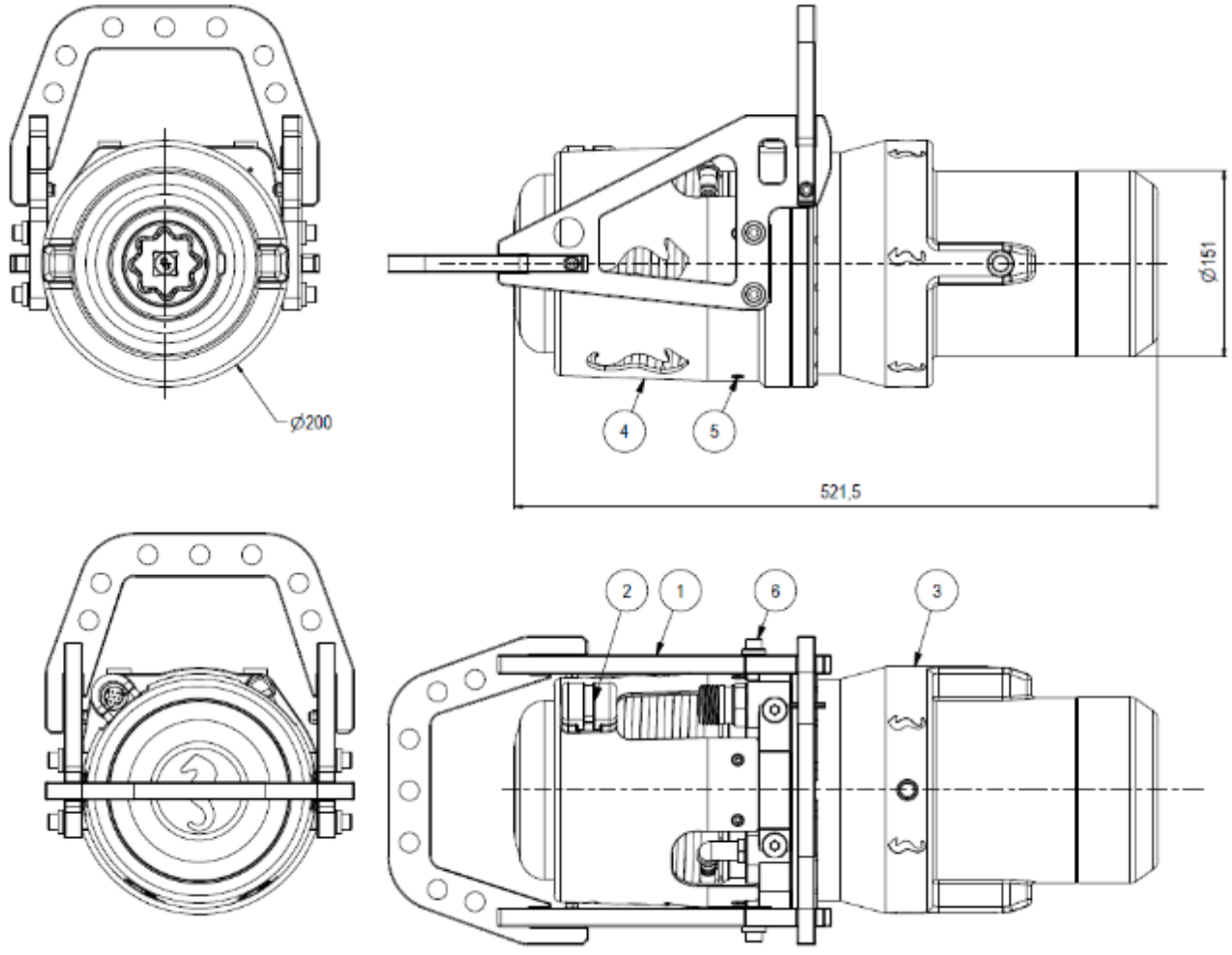


Figure 26 LWETT diver configuration - main dimensions

6. TOPSIDE CONTROL SOFTWARE

The control software is installed on a laptop operated from topside. The software controls the TT output, either in Nm, revolutions per minute or turn count. The software is also able to log/load operational data.

Note:
Each tool is delivered with dedicated PC with correct set-up for actual tool. Make sure to use PC labelled with the same serial number as the torque tool.

6.1. GUI

The GUI has two windows; Main Window and Setup Window. The ELTT/LWETT is operated from the Main Window which displays tool feedback. It contains all operational data such as torque, speed, socket angle, torque graph, set limits and more.

The Setup Window is password protected and enables the user to change parameters as well as selecting set limits.

Password can be made available on request.

Operation Modes	Description
Manual	Normal start/ stop in selected direction, torque limit but no turn or angle limit
Multi turn	Running the tool a specified number of turns and/or angle

Figure 27: Main window

Figure 28: Setup Window

6.1.1. Main Window

Main window is split into eight sections named boards. The different boards contain all tool controls and information on tool feedback.

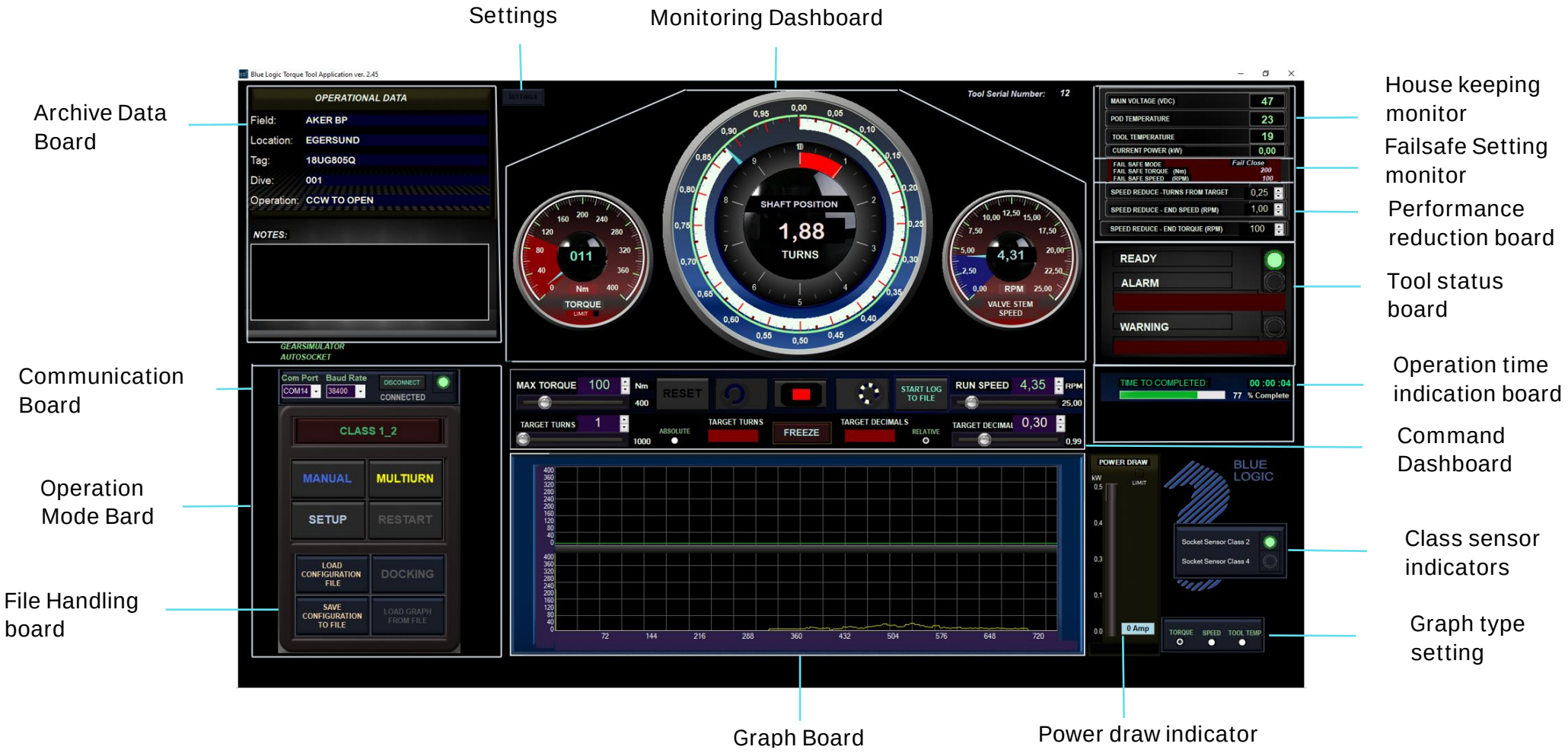
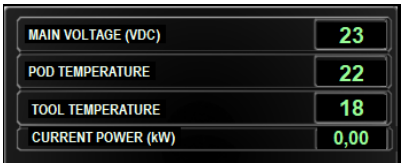
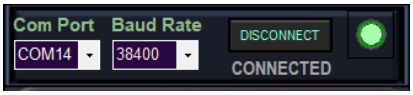
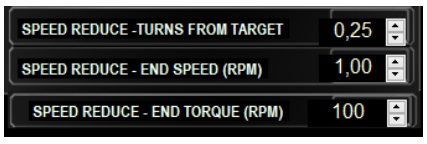
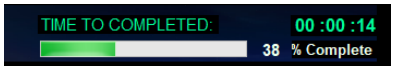
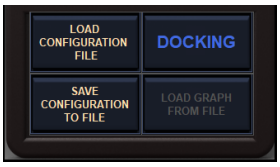
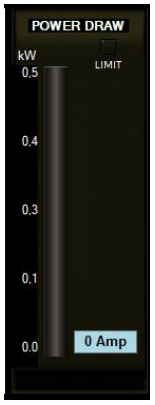
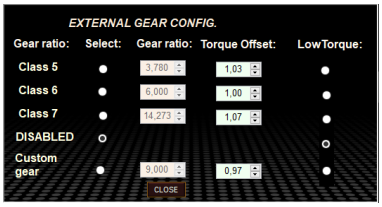


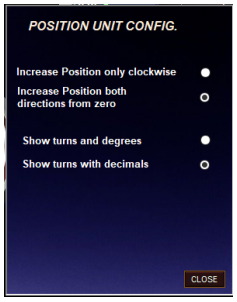
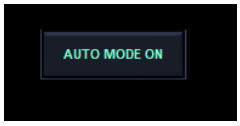
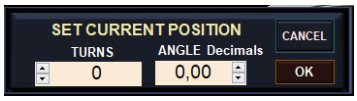
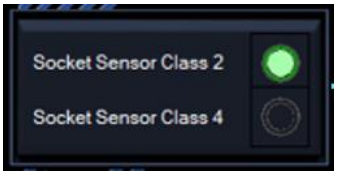
Figure 29: Main Window Overview

6.1.2. Main Window Information Boards

Board	Model	Description
Operation Mode Board		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		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		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		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		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.

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).

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.

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.

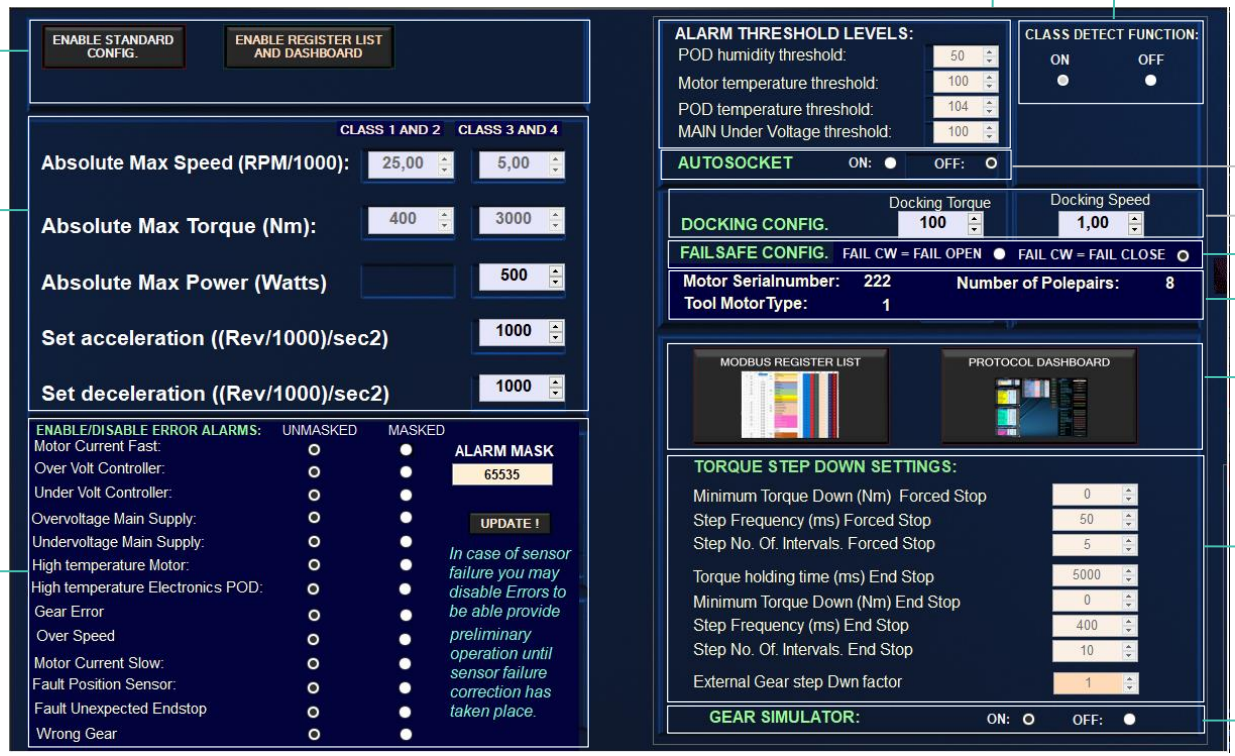
Setup window also shows actuator data that are loaded from the actuator during connection.

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

Password control for setup editing

Performance config

Alarm handling



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

Class detect

Autosocket selection

Docking configuration.

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

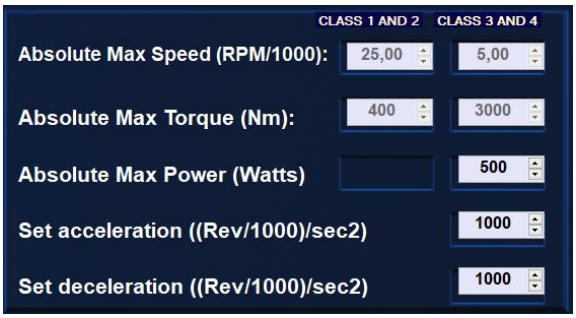
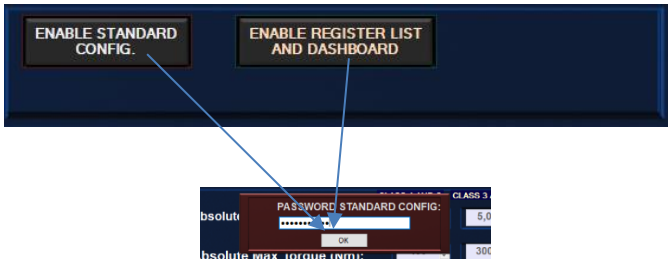
Tool motor data (Read only)

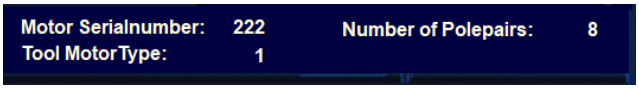
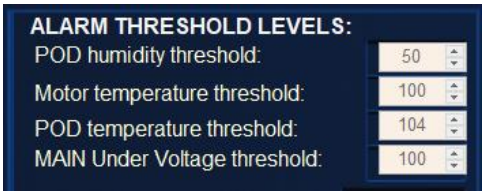
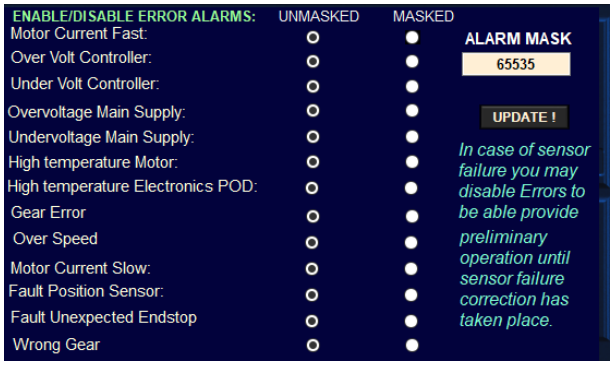
Modbus protocol tools.

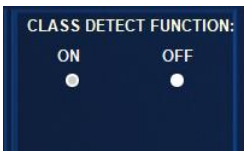
Setting Torque step down settings.

Gear simulator setting

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)		Information about motor loaded from tool.
Some alarm thresholds. Additional levels may be adjusted using the protocol dashboard.		Pod Humidity and main undervoltage threshold must be adjusted here. The rest is read only but can be adjusted in “Protocol Dashboard”.
Failsafe configurations		Decide if Clockwise rotation will open or close valve. Selection will show correct mode in main window.
Modbus protocol tools.		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.		Setting parameters regarding torque limit down ramping after forced stop or after mechanical end stop.
Alarm handling		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 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 configuration Setting for torque and speed for operation in Docking mode.
Autosocket selection		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 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.

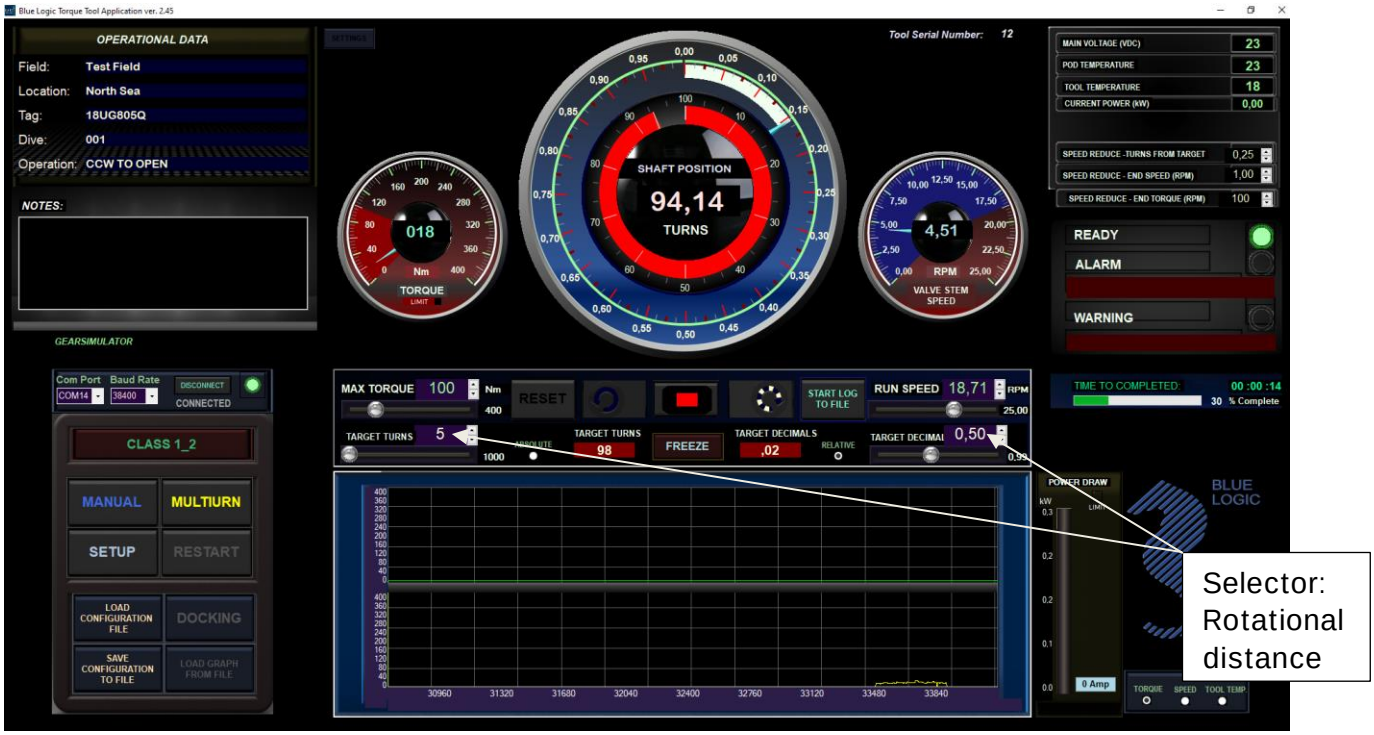
Two modes are available: *Manual* and *Multi Turn.* In addition, a gearbox mode is available for operation of class 5, 6, 7and custom defined gearbox.

Manual:

Figure 30: 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 0.

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.

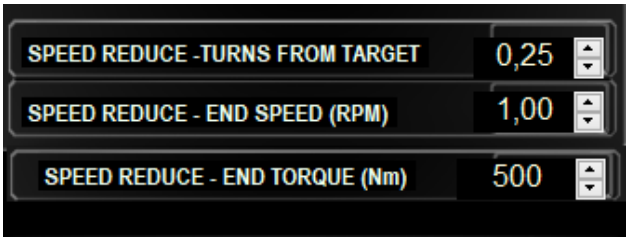
2. Freeze:
   If freeze is selected operation will stop temporary. A blinking message will indicate that temporary stop is activated, and the freeze button text will change to "unfreeze". Selecting the unfreeze button will continue the operation until target position is reached.

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.

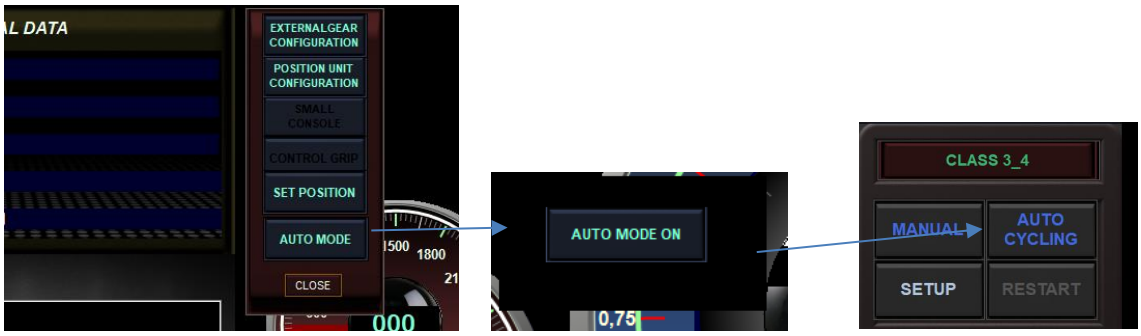
   Ex.: The target position is 5 turns and 90 degrees. Speed setting is 5 rpm. Torque setting is 1000 Nm. The operator types as follows;
   90 degrees(In degrees mode) or 0,25 turns (in turns mode) (in "Speed reduce – position from Target" and 1 in "Speed reduce – End Speed". Tool will run at 5

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:

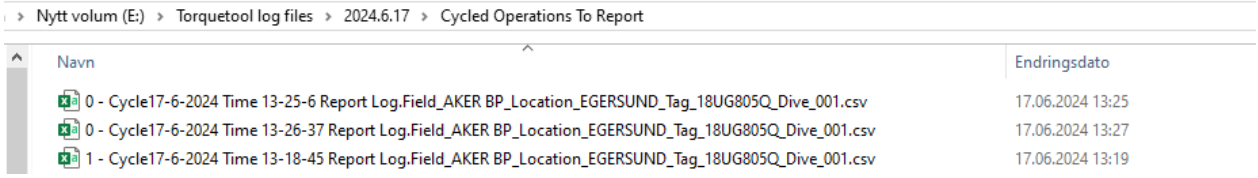
Select Auto mode:



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

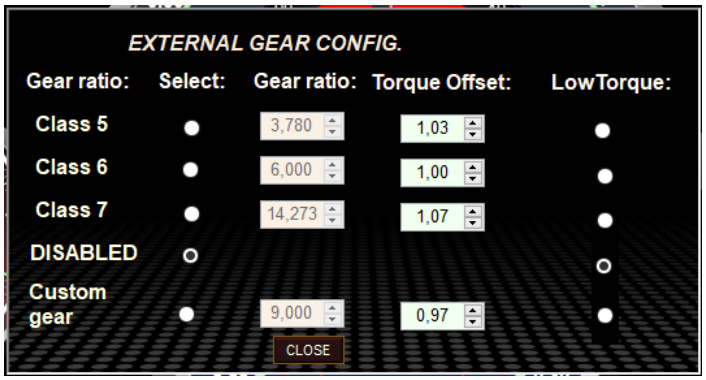
  NB! If docking fails and socket remains in an illegal state or sensor fault occurs following will show:

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

  - Open setup.
  - Set “Autosocket” to “OFF”
  - Select class manually.

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

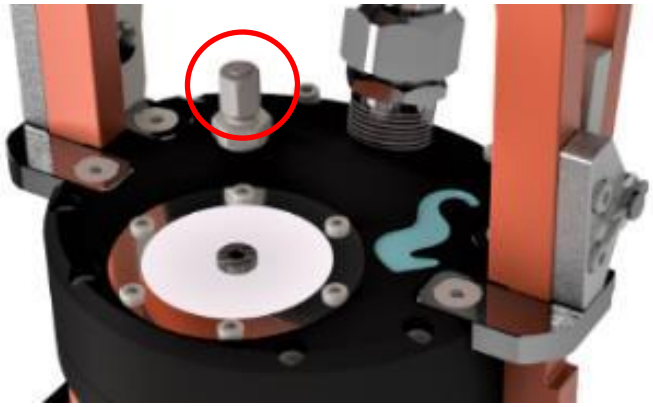
7.1. EQUIPMENT MATRIX

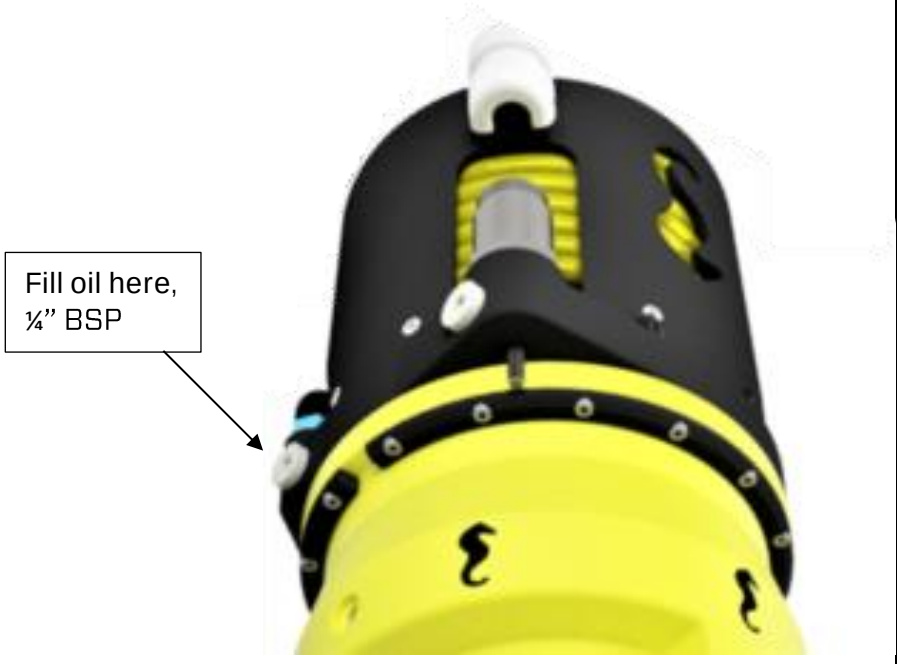
Action	LOGISTICS	MOBILIZATION	DE-MOBILIZATION	PRE DIVE PREP.	POST DIVE PREP.	OPERATION	MAINTENACE
Typical Tools. Allen Keys, Wrench and sockets.		X		x	x	x	x
PPE	x	x	x	x	x	x	X
Calibration jig		X					x

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. 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.	

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.  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	

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

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.

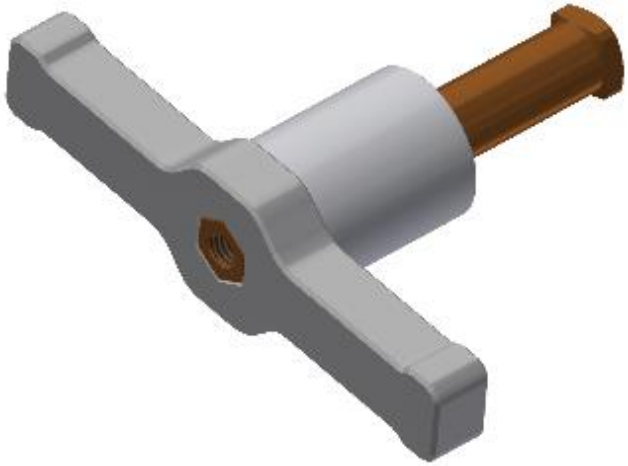
No	Description	Check/Verified
01	Inspect tool for visual damage or unusual wear and tear	
02	Make sure that serial number on torque tool and label on PC corresponds.	
03	Inspect Power Can (EPC) or (PFC (part of Subsea-USB system)) for visual damage or unusual wear and tear	
04	Only Subsea-USB: Inspect 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	
10	Verify that the TT functions can be operated when connected.	
11	Verify torque in calibration jig if available. 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.	

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!	

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

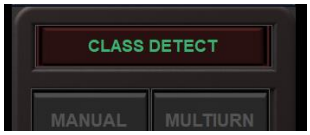
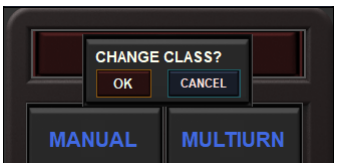
When defining setup settings, the following checklist should be followed, though not limited to:

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.

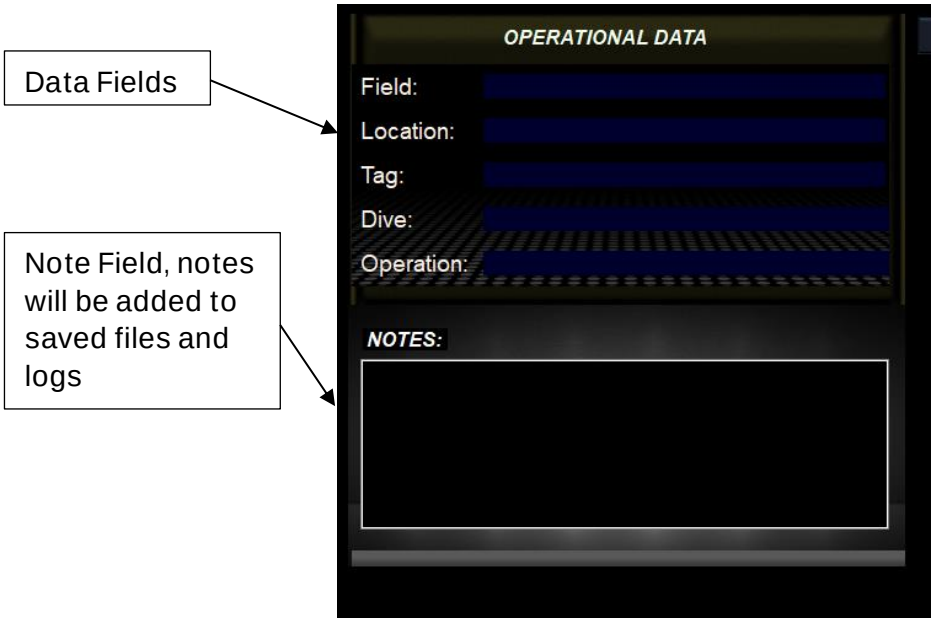
Caution:
It is crucial that correct socket is selected prior to any operation! Verify correct selection, override in GUI if auto-detect fails to recognize correct socket.

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.	

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.	

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).

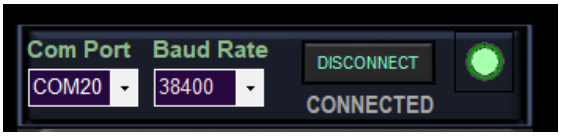


Figure 31: Communication Board

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

9.7.2. Unit settings

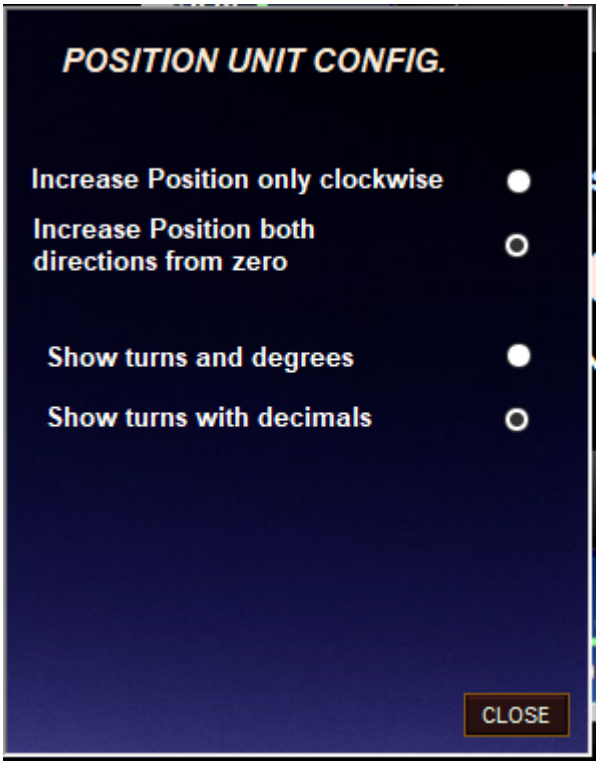
Two units are selectable:

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.

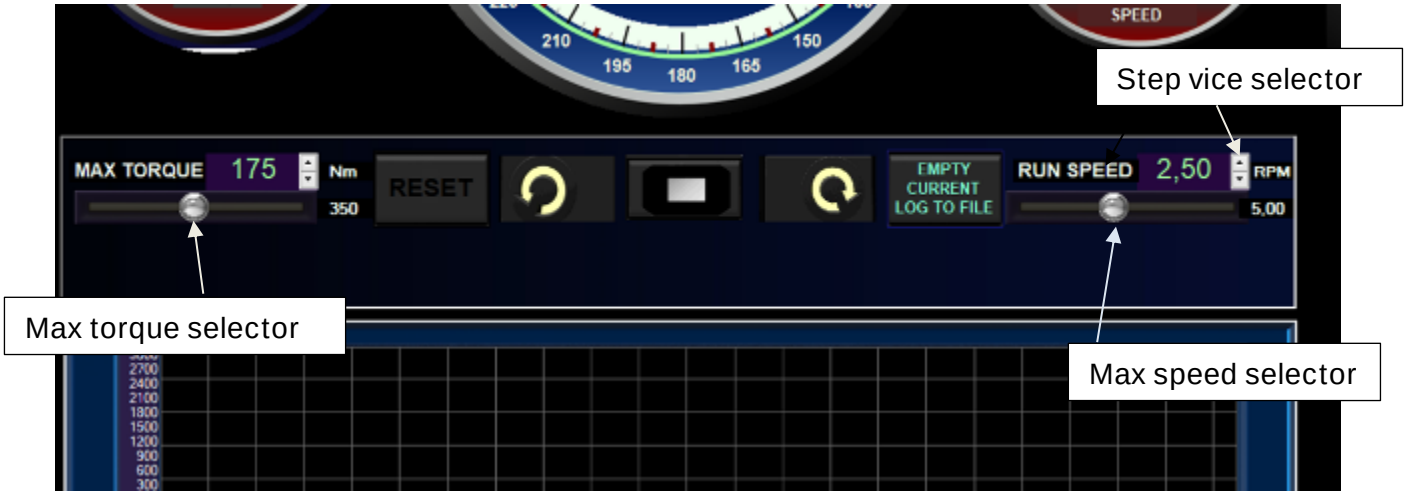
If you select "Increase position only clockwise" The position instrument shows the outputs sockets absolute position. If distance to run are 45 degrees counterclockwise from zero, the needle will stop at 270 degrees. To achieve the same output socket rotational position by running clockwise the distance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



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.

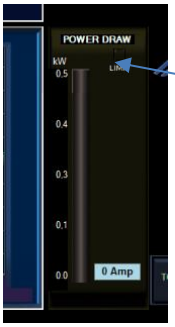
Marked Area:
Marked area in instrument are defined by selected max value set in the Operation Set Limit Board (Section 3.4.1.2).

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

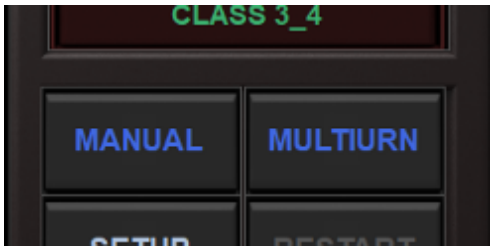


Limit lamp is illuminated when max power is reached

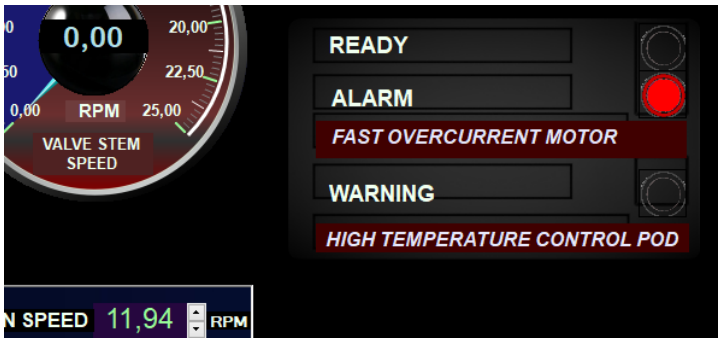
9.7.6. Reset Socket Position

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.



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.

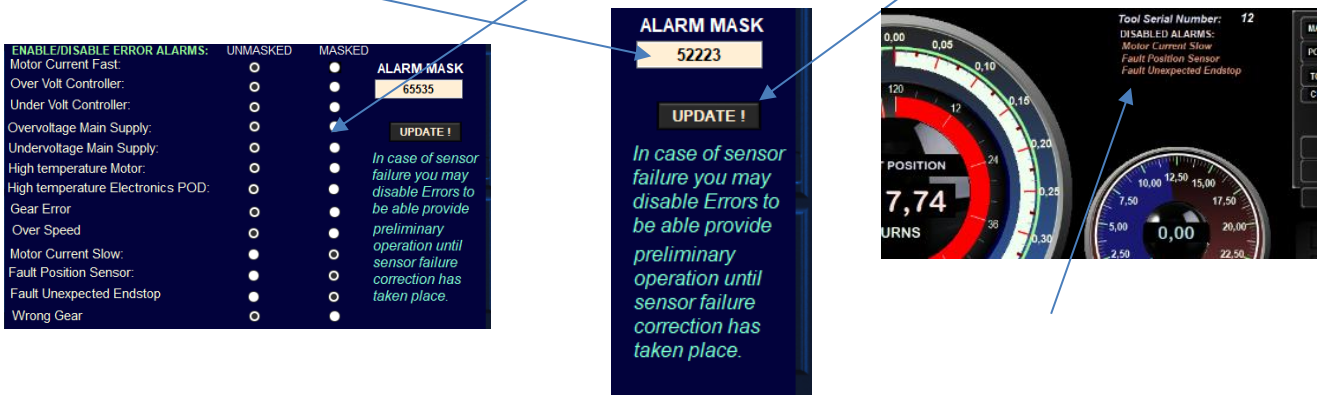
9.7.8. Error Shutdown Override Function

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).

9.8. LOGGING AND REPORTING

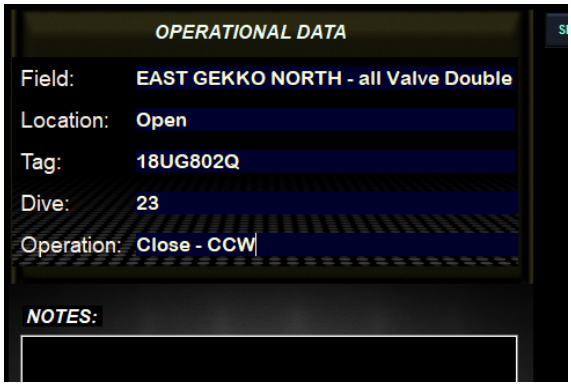
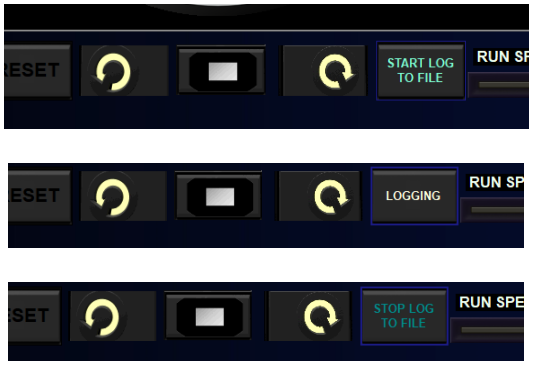
The logging function is divided into 3 levels:

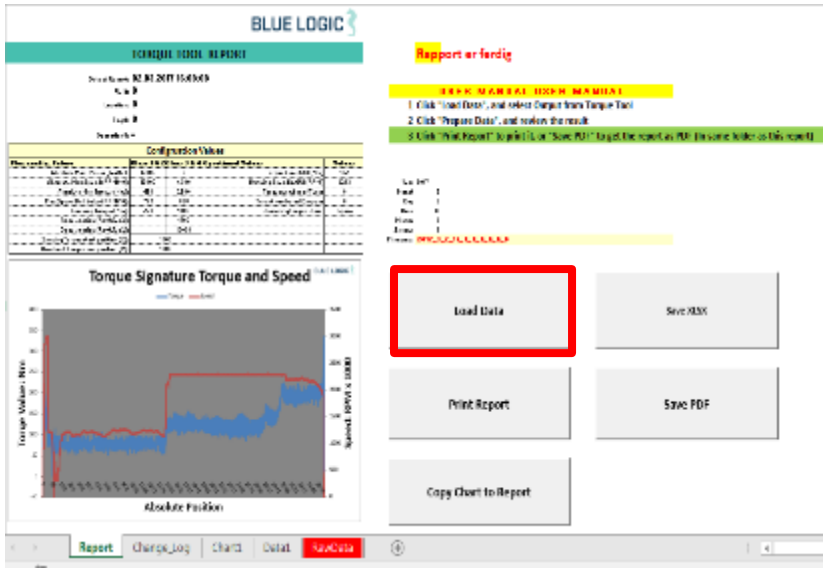
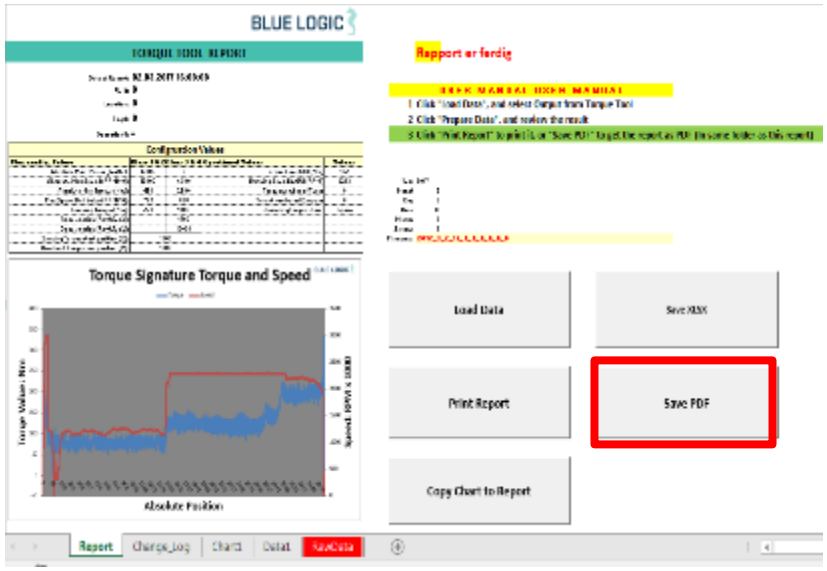
1) Tool Level: Everything done with the tool (automatic)
2) Log Level: one file for every active change in “Archiving Information”
3) Start Stop Level: every time you push “Save Graph to File” button.

All the 3 files can be printed to a report in .xls format.

9.8.1. Generate Operation Report (PDF)

Use the following sequence to generate a PDF rapport:

1	Enter data in the Data Fields	
2	Click the “Start Log to file” in the Archive Board (see Figure 29) prior to operation performance. Button text is toggling between “Logging” and “Stop log to File”. (Means that logging is active).	
3	After operation: Click the “Stop Log to file” in the Archive Board (see Figure 29). (Button color changes back to light green.) Report file is completed. All operations between start and stop log is included in the report.	

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	

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			

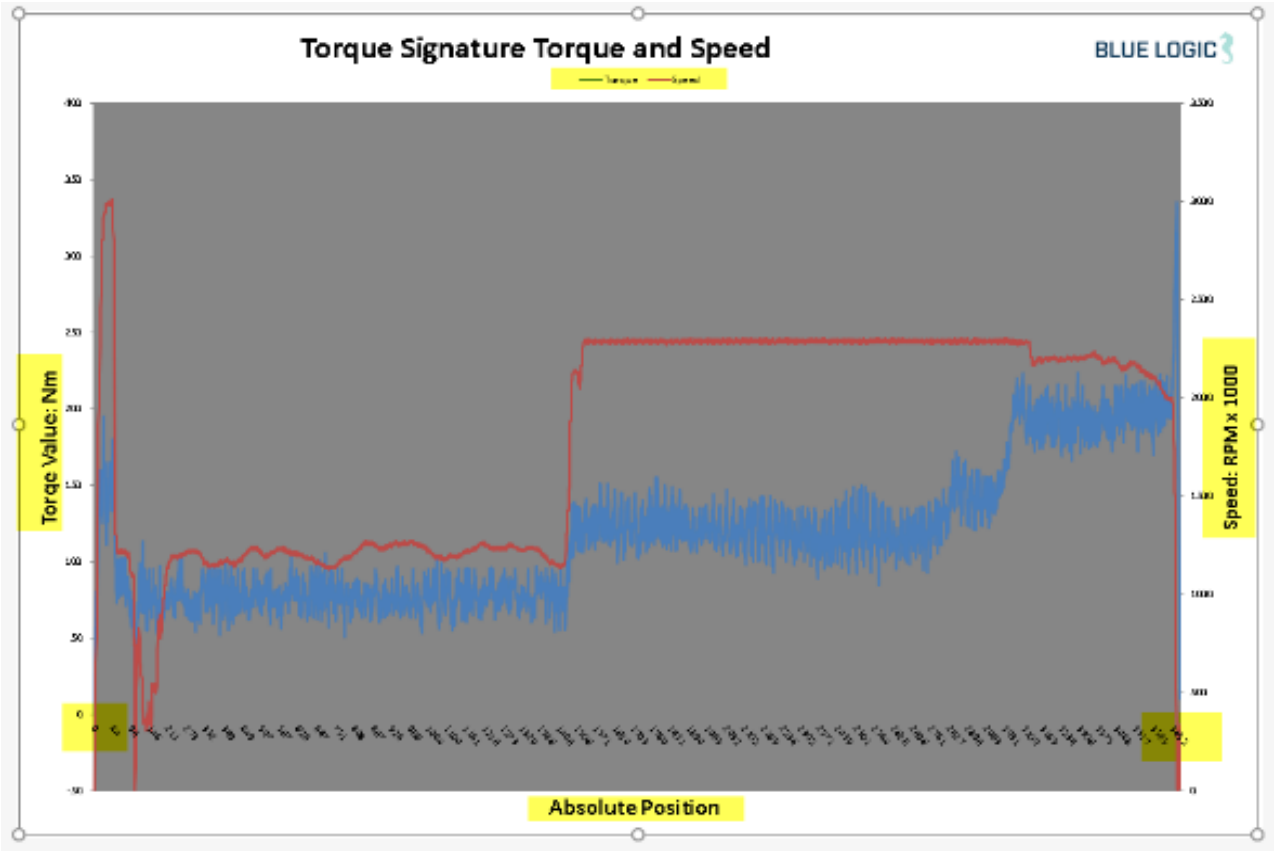
The max. configuration values should be the damage torque and the Operational values should be the running torque of the task at hand.

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.



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.

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:

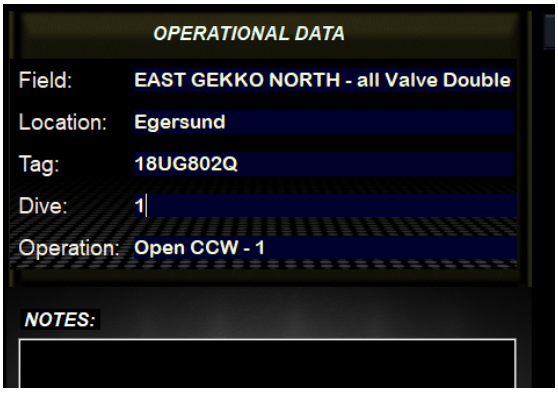
A specific valve shall be operated. Complete setup for this valve shall be predefined and saved to file. This file will be made for open to close operation.

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

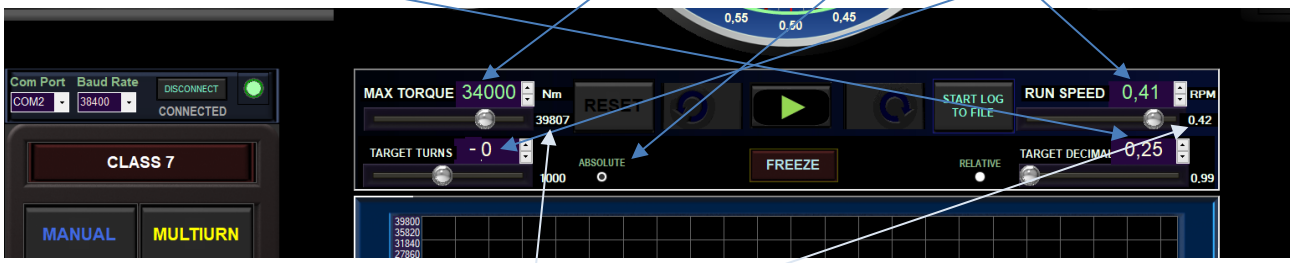
Make configuration file:

1. Fill in operational data:



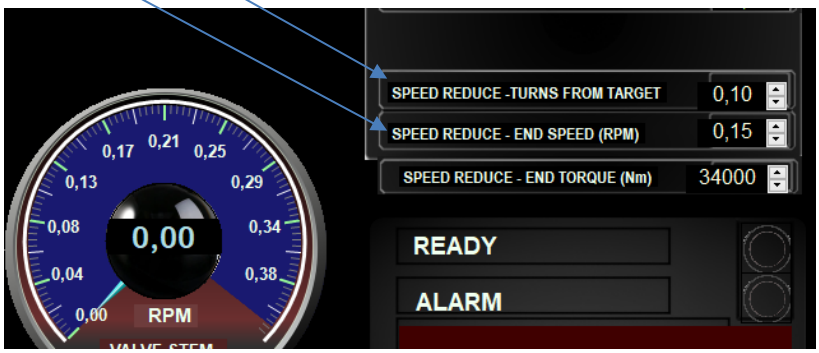
2. Fill in operational values:
   a. Select Class 7

   b. Select multiturn. Fill in Specific valves max torque, running speed, Target Turns and Target decimals. Multiturn mode shall be set to absolute.

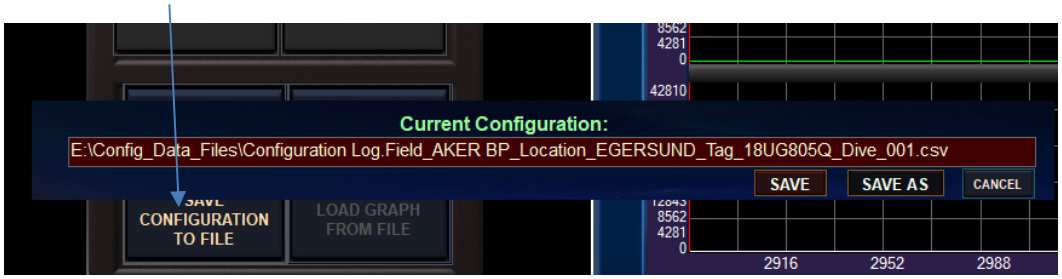


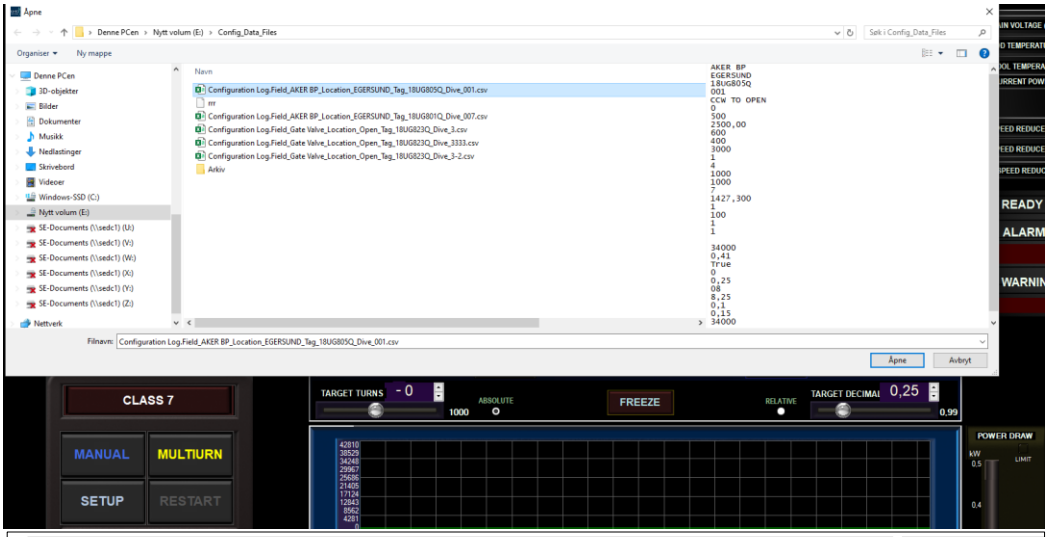
   c. Check that absolute max torque and Max running speed is below valve's damages torque and Max running speed.
   Target Turns >= 0 = CW and Target Turns <= -0 = CCW.

   d. Set Position where speed will be reduced before target position has reached and Speed reduced to. (0,10 turns = 36 degrees).

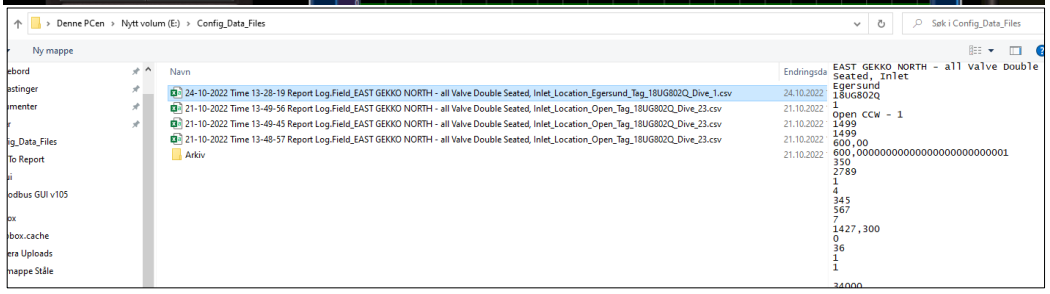


Click to save configuration to file. Saved file location.





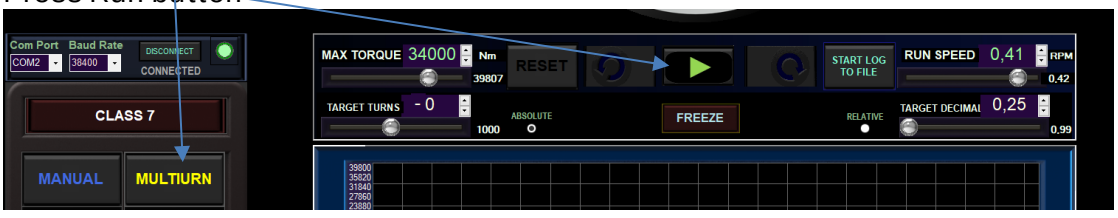
Select «Load Configuration File» to load



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.

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:

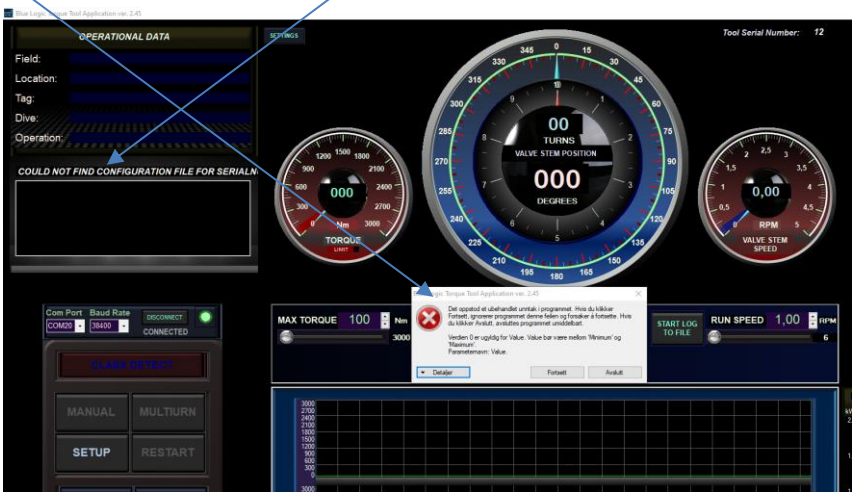


Figure 32: Torque Tool Files

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

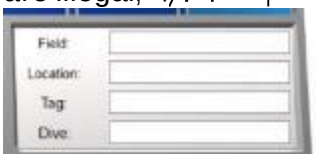
Error Message/ Behaviour	Explanation	Recommended action
Position sensor fault	Occurs if serial communication between POD's controller and position sensor controller are lost or poor. (Sensor failure has no impact).	See section 9.6
Motor overload	Occurs when motor current exceeds current threshold set 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.

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; \/:*?"<>| 

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:

		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 (bytes)*8(bits)*2(1send+1receive) = 3,3ms. 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

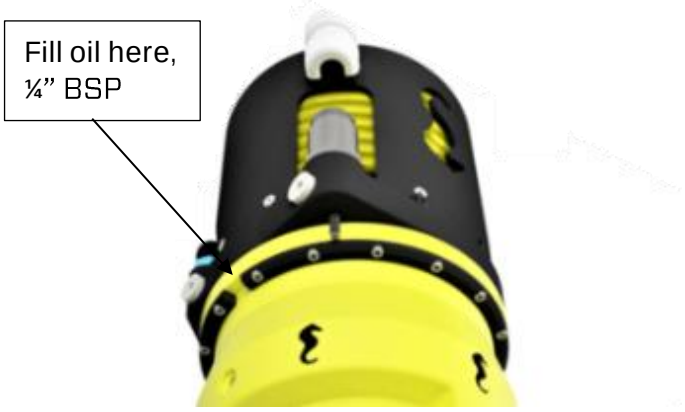
Description
Store the TT system in its dedicated transportation box
Thoroughly coat all exposed surfaces of the Tool with a preservation oil (e.g. WD-40)
Long term storage temperature = 15 deg C

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.  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	

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

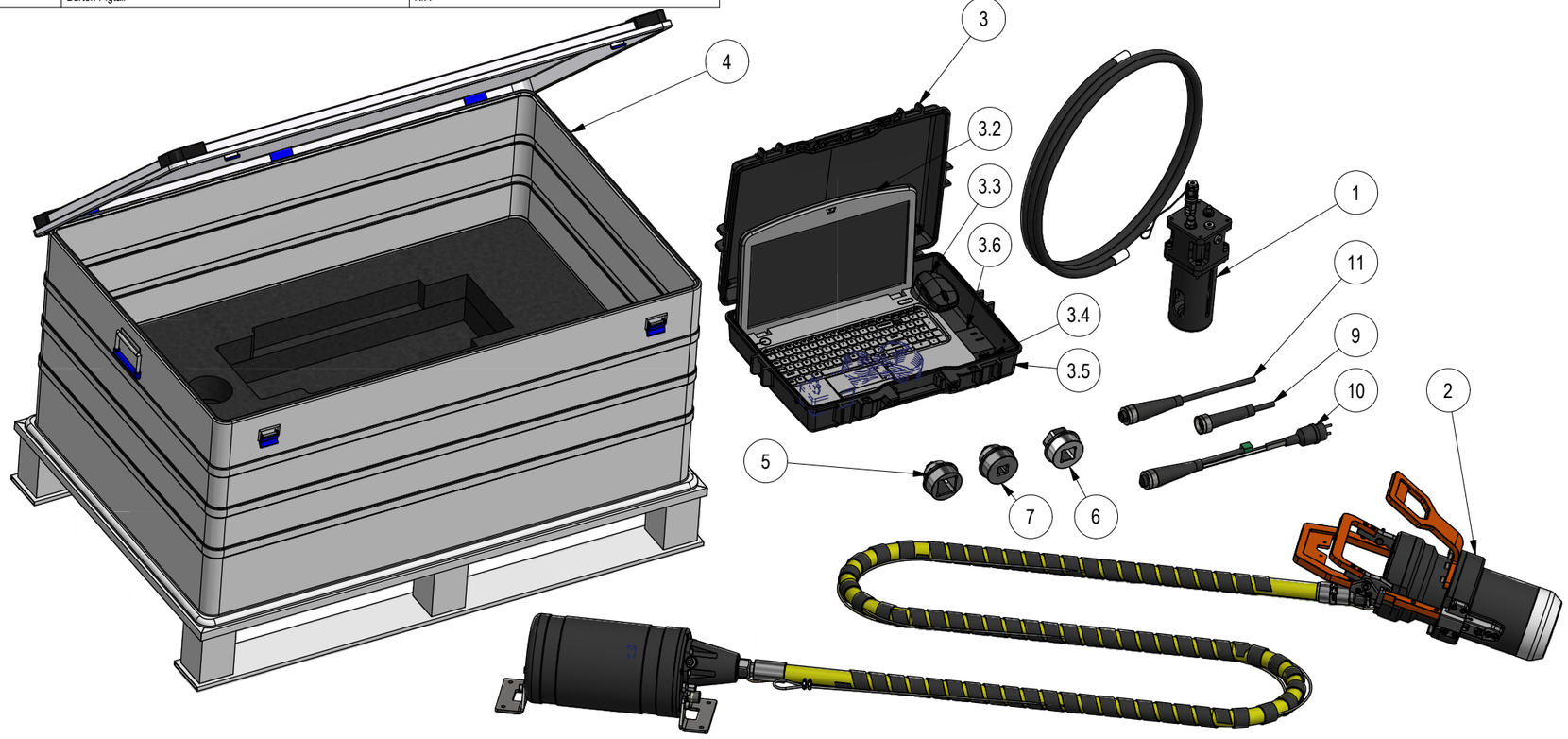
Phone: +47 910 06 950

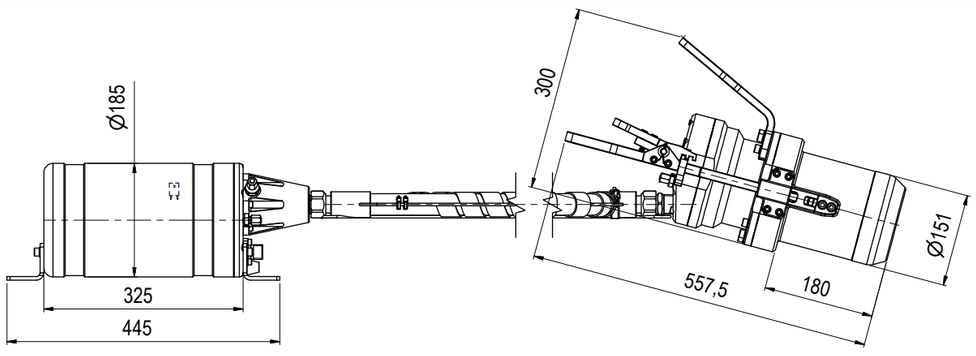
https://www.bluelogic.no/home

APPENDIX 1 DRAWINGS

Drawing No	Document Title
BB3306	2,7kNm Torque Tool Kit
BC0497	2,7kNm El. Torque Tool wAutomatic Class Switch
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

Rev.	Date	Reason for issue	Revision change	Made	Chk'd	Appr.
06	8.11.2023	9-IFU (Issued for Use)		WTJ	LGH	WTJ
05	10.10.2023	9-IFU (Issued for Use)		WTJ	LGH	KHA
04	25.11.2021	9-IFU (Issued for Use)		WTJ	LGH	WTJ
03	11.3.2021	9-IFU (Issued for Use)		WTJ	LGH	WTJ

BLUE LOGIC

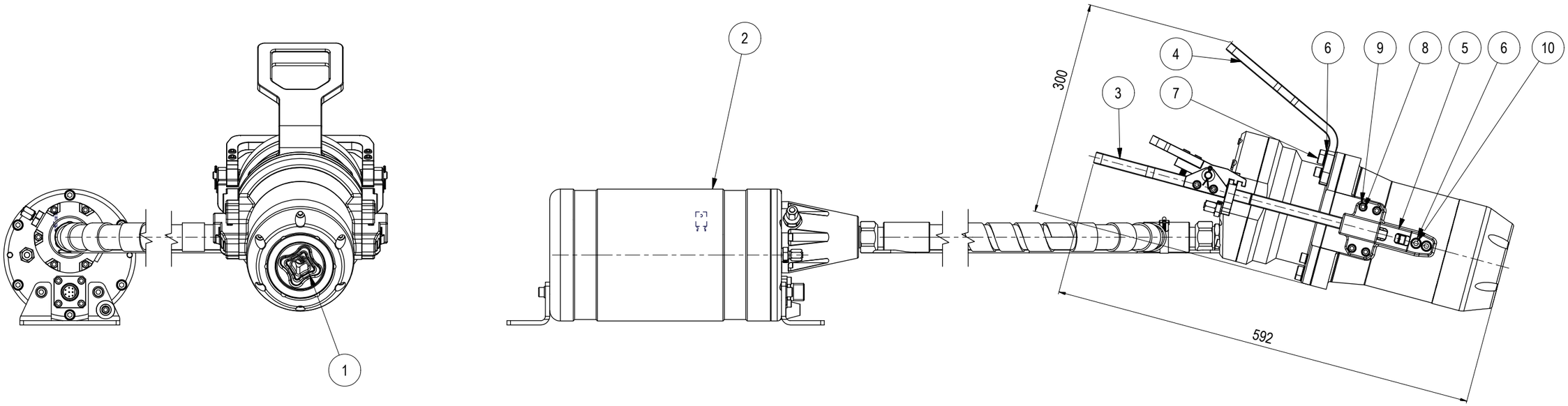
Dwg Scale: NTS
Dwg Proj:
Dwg Format: A3

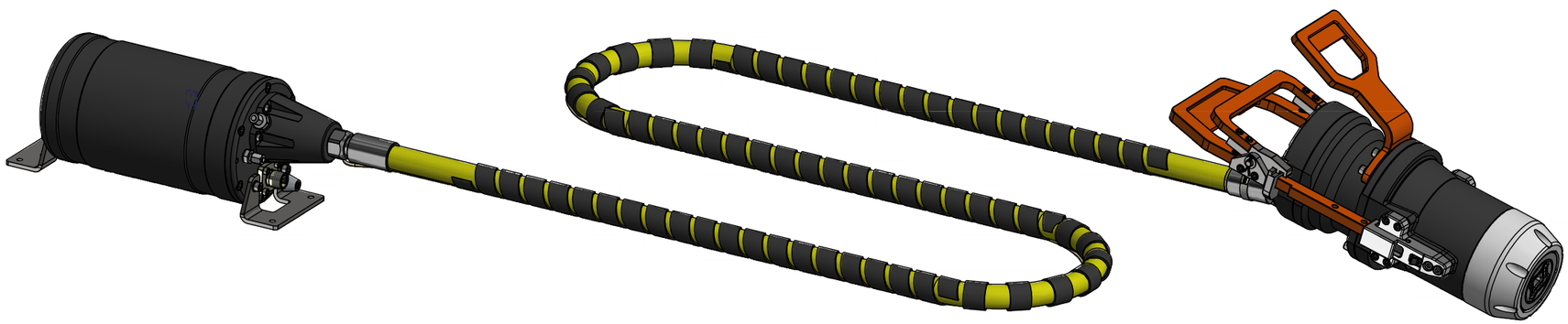
Drawing title: 2,7kNm Torque Tool Kit

Drawing number: BB3306

Rev. 06

Parts List			
ITEM	QTY	PART No.	DESCRIPTION
1	1	BC0451	Automatic Class 1-4 Shift Solution Stage 3 Interface
2	1	BC0146	2,7kNm El. Torque Tool Base wPod and Hose
3	1	BB9885	Handle Assembly Torque Tool V2.
4	1	BA2991	ROV Handle Torque Tool
5	2	BA2759	Bracket for Lock ISO Interface-01
6	9	101313	Ø8 Washer Nord-Lock 254SMO
7	5	100460	M8x40 Socket Head Bolt DIN 912 A4-80
8	8	100363	M6x20 Socket Head Bolt DIN 912 A4-80
9	8	100292	Ø6 Washer Nord-Lock 254SMO
10	4	100171	M8x25 Socket Head Bolt DIN 912 A4-80





Rev.	Date	Reason for issue	Revision change	Made	Chk'd	Appr.
03	29.4.2024	7-IFC (Issued for Construction)		WTJ	LGH	WTJ
02	3.4.2024	7-IFC (Issued for Construction)		WTJ	LGH	WTJ
01	5.12.2023	7-IFC (Issued for Construction)		WTJ	LGH	WTJ

BLUE LOGIC

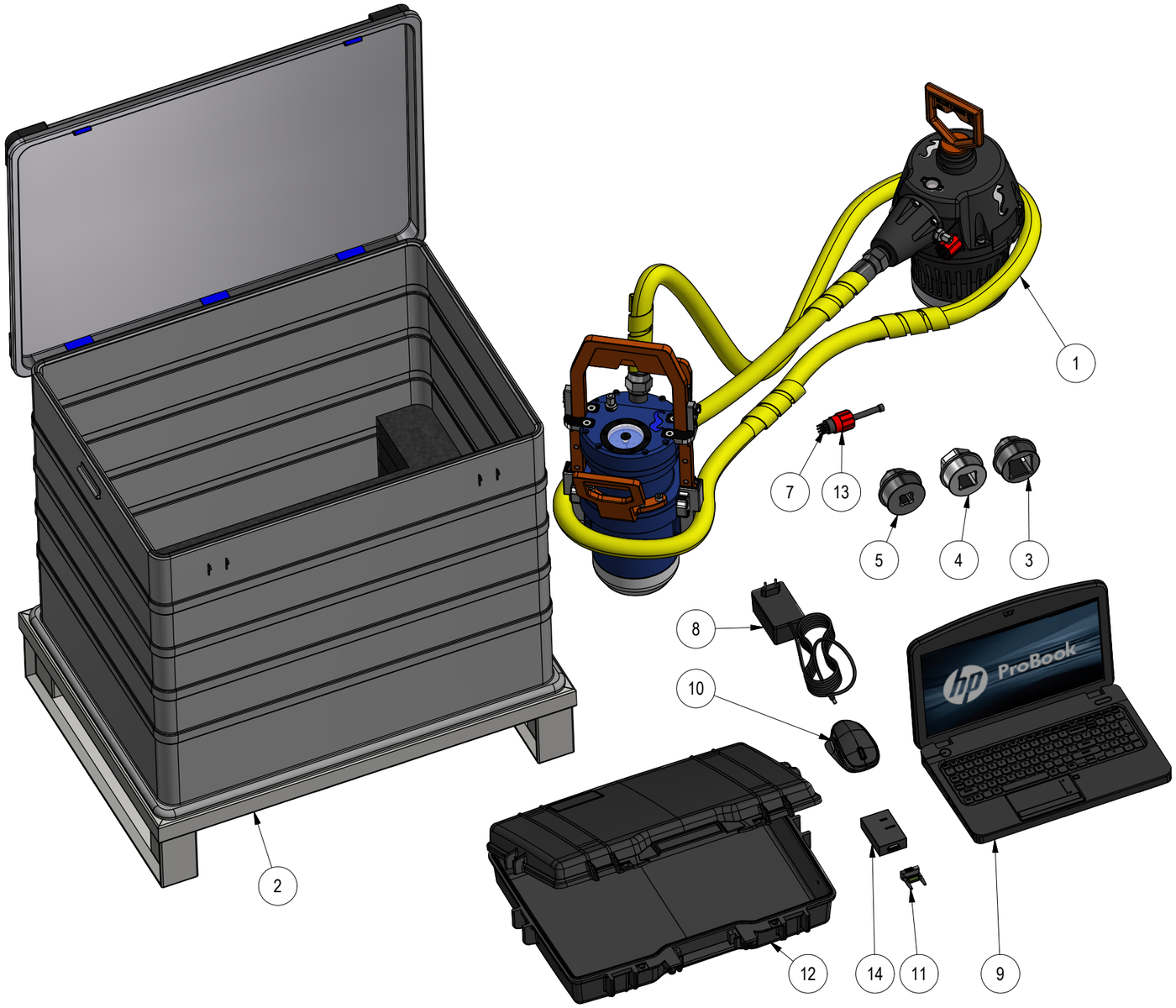
Dwg Scale: NTS
Dwg Proj:
Dwg Format: A3

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

Drawing number: BC0497

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

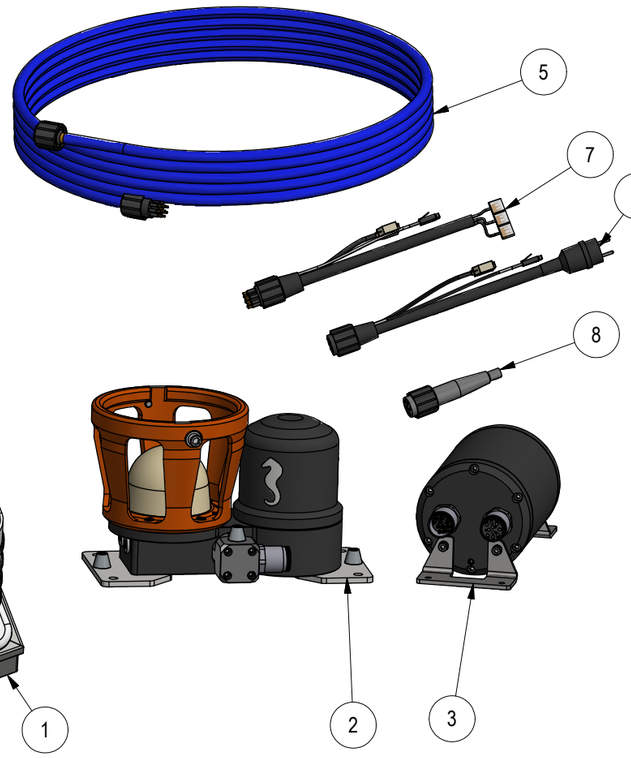
Dwg Scale: NTS
Dwg Proj:
Dwg Format: A3

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

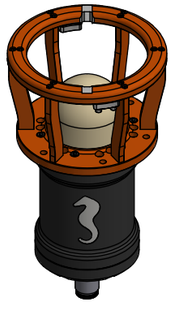
NOTE: 3
INTERFACE INFORMATION:

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	Revision change	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

BLUE LOGIC

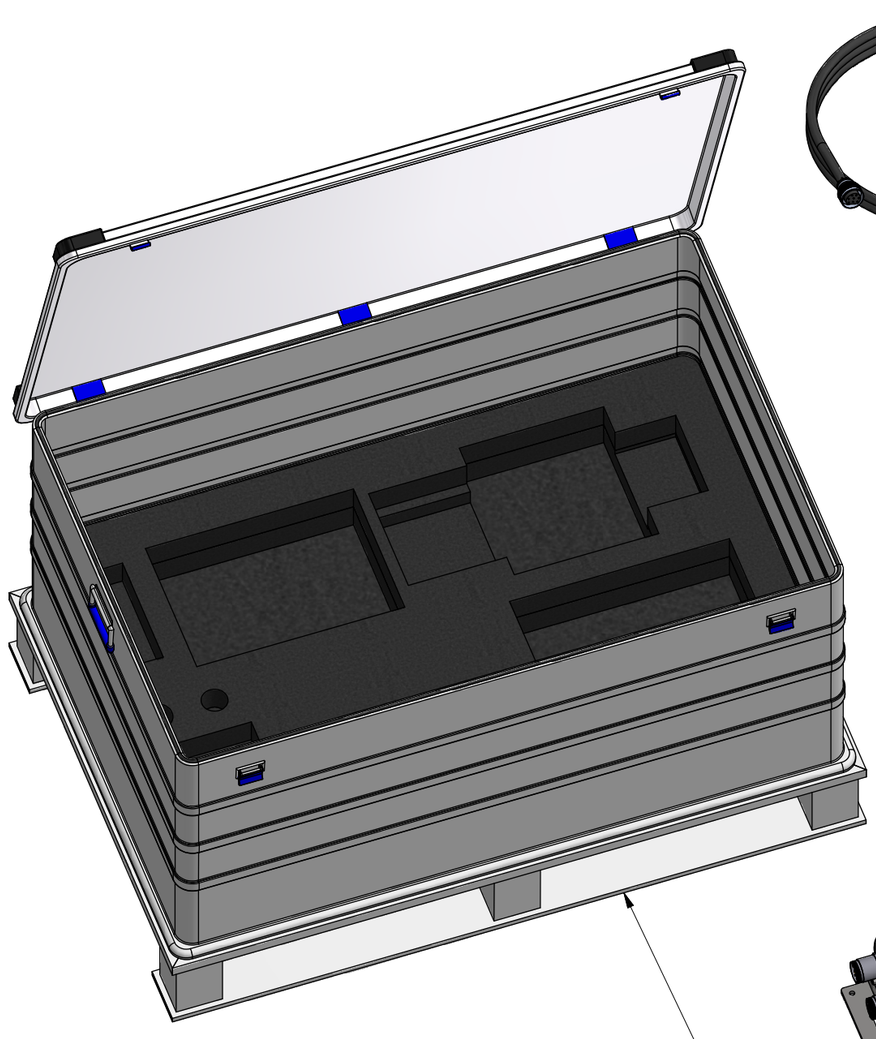
Dwg Scale: NTS
Dwg Proj:
Dwg Format: A3

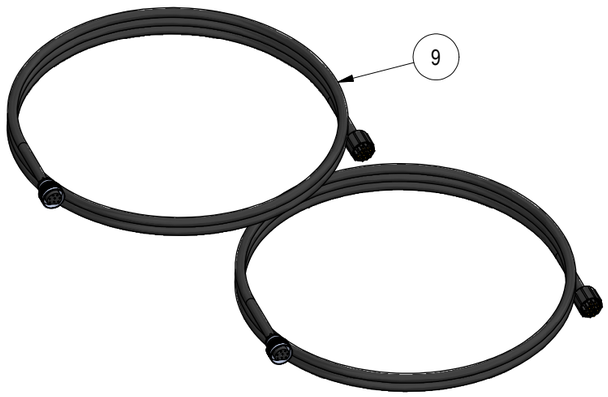
Drawing title: 2kW Subsea USB Kit for Electrical Torque Tool

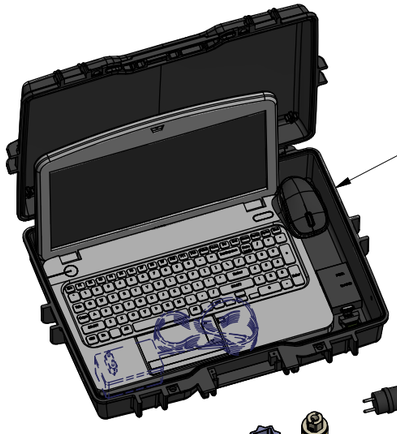
Drawing number: BB3151

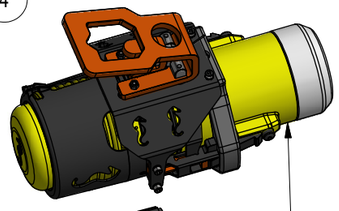
Rev. 03

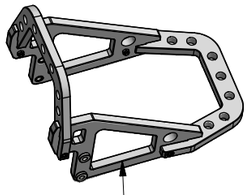
Parts List				
ITEM	QTY	PART No.	TITLE	WEBLINK
1	1	BB3840	Alu Box wFoam	N/A
2	1	BB3698	Key for Top Side	http://e-sea.bluelogic.no/main.aspx?page=article&artno=BB3698
3	1	BB3129	Class 3 Adapter Subsea Replaceable V2	http://e-sea.bluelogic.no/main.aspx?page=article&artno=BB3129
4	1	BB2985	ETT Control PC wGUI Software and Pelicase	N/A
5	1	BB2962	Class 1 & 2 Adapter	http://e-sea.bluelogic.no/main.aspx?page=article&artno=BB2962
6	1	BB1538	2,7kNm El. Torque Tool Light Weight 500m ROV Latch Handle	http://e-sea.bluelogic.no/main.aspx?page=article&artno=BB1538
7	1	BA7719	BL Power Supply 2kW	http://e-sea.bluelogic.no/main.aspx?page=article&artno=BA7719
8	1	600144-TD-0014	Operation and Maintenance Manual Electric Torque Tool Class 1 - 4	N/A
9	2	103651	Com. Cable wBurton 470 VDC & RS232 4,5m EL-TT	N/A
10	1	102860	Burton Dummy	N/A
11	1	102768	Test Cable L=3m OM10F to 250W Prim USB and 2kW Power Supply	N/A
12	1	101138	Connector SubConn Pigtail F	N/A
13	1	BB3676	Handle Assy for ELTT	N/A

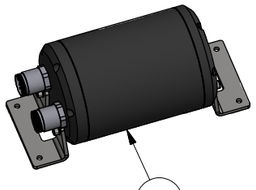


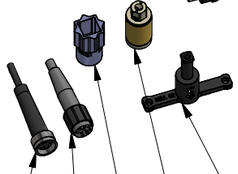












NOTE: 1
DESIGN CODE:
API 17H/ISO 13628-8

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.

Rev.	Date	Reason for issue		Made	Chk'd	Appr.
03	20.12.2021	7-IFC (Issued for Construction)		WTJ	LGH	WTJ
02	25.3.2020	7-IFC (Issued for Construction)		WTJ	LGH	KHA
01	4.11.2019	7-IFC (Issued for Construction)		WTJ	LGH	WTJ
			Revision change			

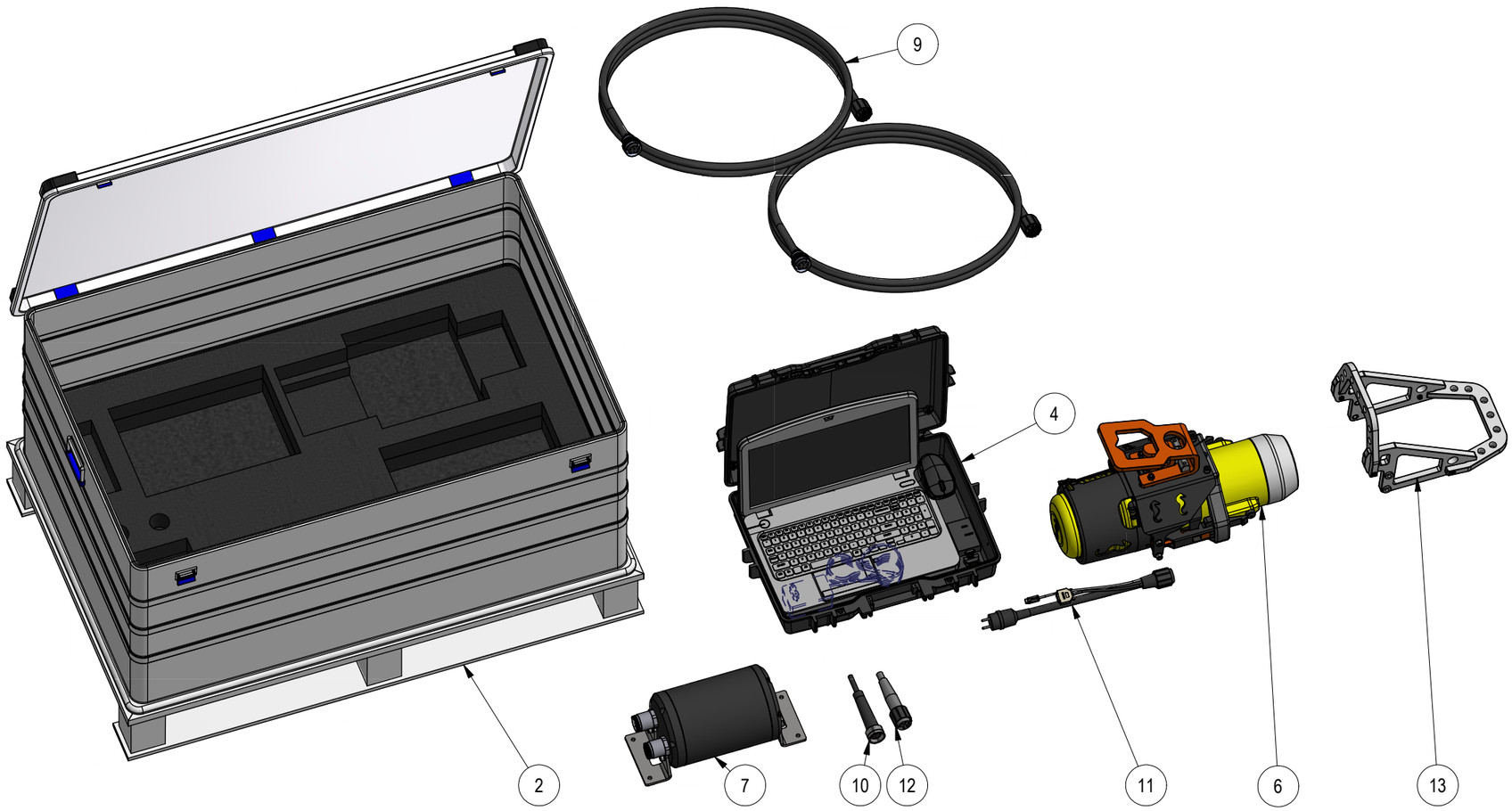
BLUE LOGIC

Dwg Scale: NTS
Dwg Proj:
Dwg Format: A3

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

Drawing number: BB3551
Rev. 03

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

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

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