ROV Tools

Remote Control Unit

Client: FMC Kongsberg Subsea as

Client DR-Code:

Client P/N: 100035993

Oceaneering P/N: 0282400

C	08.10.09	Re-Issued for Project Acceptance	LIH	PB
B	11.09.09	Re-Issued for Project Acceptance	LIH	PB
A	06.03.09	Issued for Project Acceptance	DHD	PB
Rev.	Date	Reason for Issue	Made by	Approved by

Client Doc. No.:

100035993-OMM

Client Logo :

FMC Technologies

Oceaneering AS
P.O.Box 8024
4068 Stavanger, Norway
Phone: 51 82 51 00 - Telefax: 51 82 52 90

Oceaneering Doc. No.

101754-DTS-OPR-001

Rev.

03

Document Title:

Operation & Maintenance Manual

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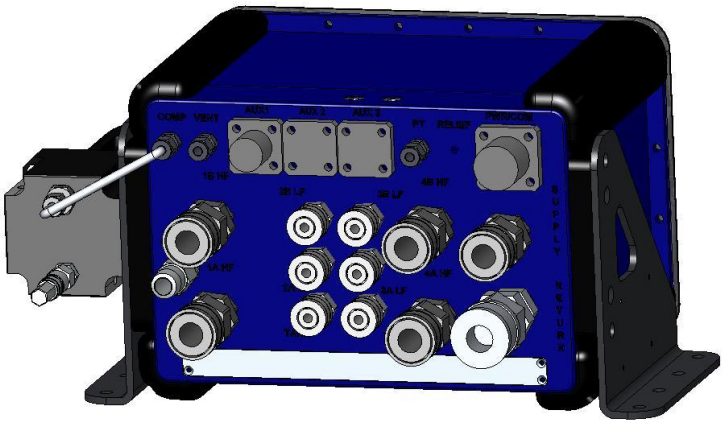
User Manual

Remote Control Unit



101754-DTS-OPR-001

Rev.03

Document No.:	**101754-DTS-OPR-001**
Title:	**USER MANUAL REMOTE CONTROL UNIT**
Project:	
Oceaneering P/N:	**0282400/0282420/0297900/0301695/0301700 & 0301720**
Oceaneering S/N:	
Client:	
Client P.O.:	
Client P/N:	
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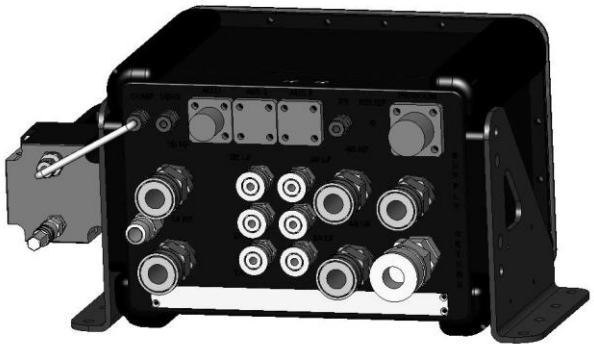


Rev.	Reason for Issue	Date	By	Check	Approval
03	Reissued for Approval	01.10.09	PB	AV	TAB
02	Issued for Approval	18.05.09	PB	AV	TAB
01	Issued for Approval	27.03.08	LAL	AV	TAB

TABLE OF CONTENTS

1.0 GENERAL

1.1 Objective

The objectives of the User Manual are as described below:

- Give a technical and functional description of the Tool
- Ensure that all relevant information for operation is included
- Ensure that all information for maintenance is included
- Ensure that all information for preservation and storage is included

1.2 Reference specification

- N/A

1.3 Reference Drawings

OAS. Dwg.NO	Description
0282400	Remote Control Unit
0282420	Remote Control Unit, w/quick connectors
0297900	Remote Control Unit, w/Back Seal Test Unit
0301695	Remote Control Unit, w/quick connectors/Back Seal Test Unit
0301700	Remote Control Unit, ROV
0301720	Remote Control Unit, ROV, w/Back Seal Test Unit
0291974	Remote Control Unit, Electrical interface, wiring diagram
0314069	Remote Control Unit, Electrical diagram
0314070	Remote Control Unit, Hydraulic diagram
0291976	Remote Control Unit, Electrical diagram w/Back Seal Test Unit
0291972	Remote Control Unit, Hydraulic diagram w/Back Seal Test Unit

1.4 Introduction and Scope

The purpose of this document is to provide a functional description of Oceaneering Remote Control Unit (RCU). The unit provides controlled hydraulic functions for operation of various intervention tools independent of the ROV control system.

The Remote Control Unit is to be used by trained and competent personnel only.

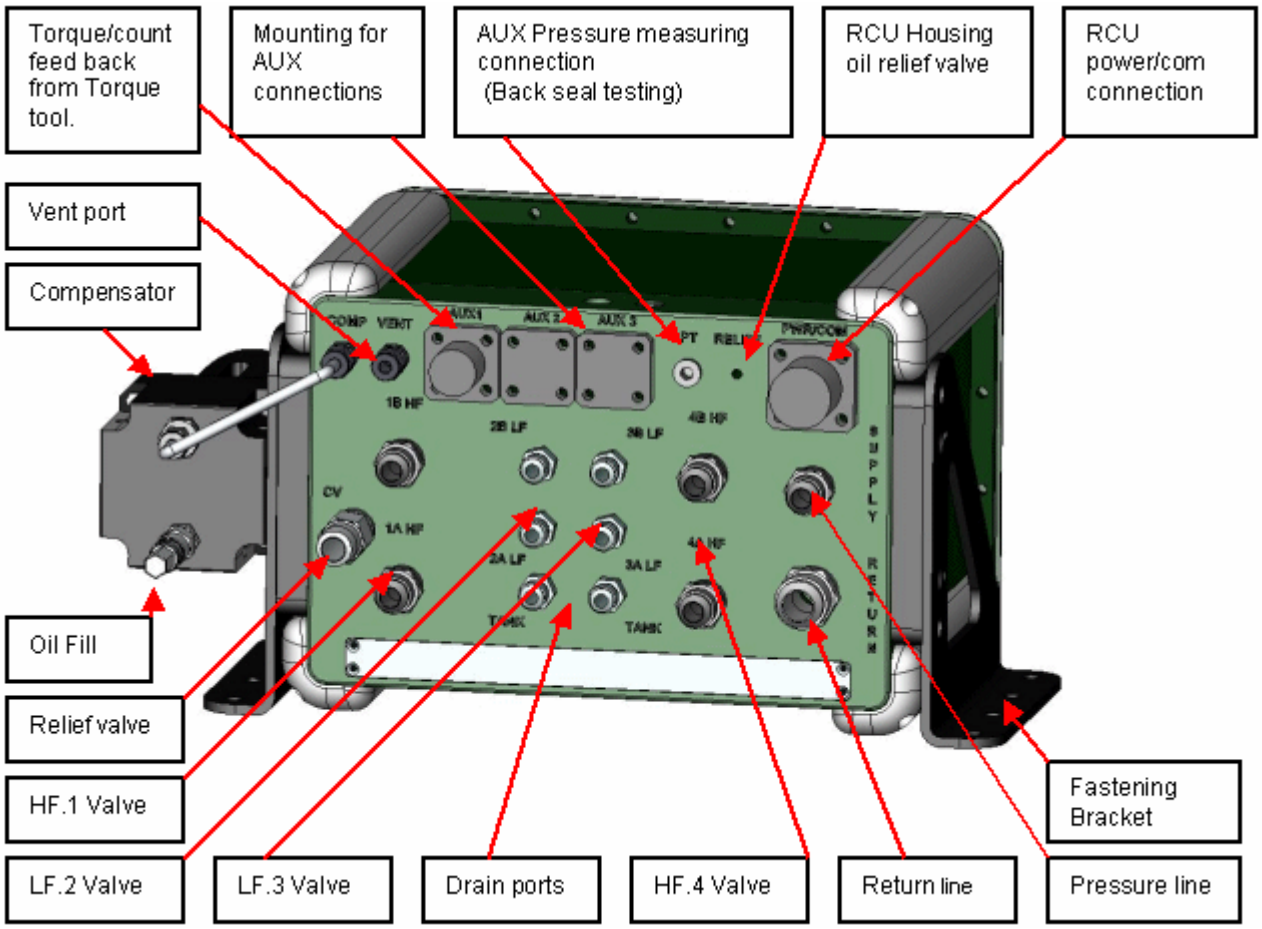
1.5 Definitions / Abbreviations

Some terms are used throughout this document to describe the use of software running under Microsoft products. It is assumed that the user is already familiar with terms like windows, menu items and using a mouse or trackball.

RCU	Remote Control Unit
ROV	Remote Operated Vehicle
GUI	Graphical User Interface

1.6 RCU Overview

Figure 1 RCU overview



2.0 TECHNICAL DESCRIPTION

2.1 Functional Description

The Remote Control Unit consists of two main parts; the surface control unit and the sub-sea unit. The surface unit consists of a laptop PC with an RS 232-485 converter providing communication interface to the sub-sea unit. The PC comes with pre-installed software for controlling the sub-sea unit.

The sub sea valve module is capable of setting two different pressures; this gives the advantage of separate pressure to i.e. the latch cylinders versus the torque motor on the API 17D Class 1-4 Torque Tool. The Subsea valve module controls and operates the different Intervention/ROV tools by means of topside control station controlling pressure / flow and monitoring, torque, turns and speed (RPM) in use with Oceaneering Torque Tool. The unit consists of a compensated housing, hydraulic valves, power supply, electronics and all the necessary fittings and connectors to allow easy interfacing to the ROV. The main features of the unit are:

- Fluctuate two separate pressures in the range of 10 - 210 bar.
- Two directional hydraulic variable high flow circuits (HF1 / HF4) with proportionally controllable flow from about 0 to 50 lpm (HF1) and 0 to 95 lpm (HF4) in each direction.
- Two directional hydraulic variable low flow circuits LF2 (closed centre) and LF3 (open centre), with proportionally controllable flow from about 0 to 5 lpm in each direction.
- 4-20mA input providing electrical interface for strain gauge - based torque sensor system. This system is used on Oceaneering Torque Tools.
- One electronic counter circuit for external limit switch type rotation counting devices, scaled as 1 pulse = 1/10 rotation.
- 232 protocol for communication with other tools.

2.2 Surface Control System

The surface control system consists of a PC with an RS 232-485 converter. The operation of the PC is described in the documentation provided with the PC. The RCU can be run from any PC with Microsoft Windows 2000 or XP installed.

Communication with the sub-sea unit is provided through the RS 485 converter (when using RS485 protocol), which is connected to the PC's serial port (COM 1).

When delivered from Oceaneering, the PC has the RCU topside control system software pre-installed.

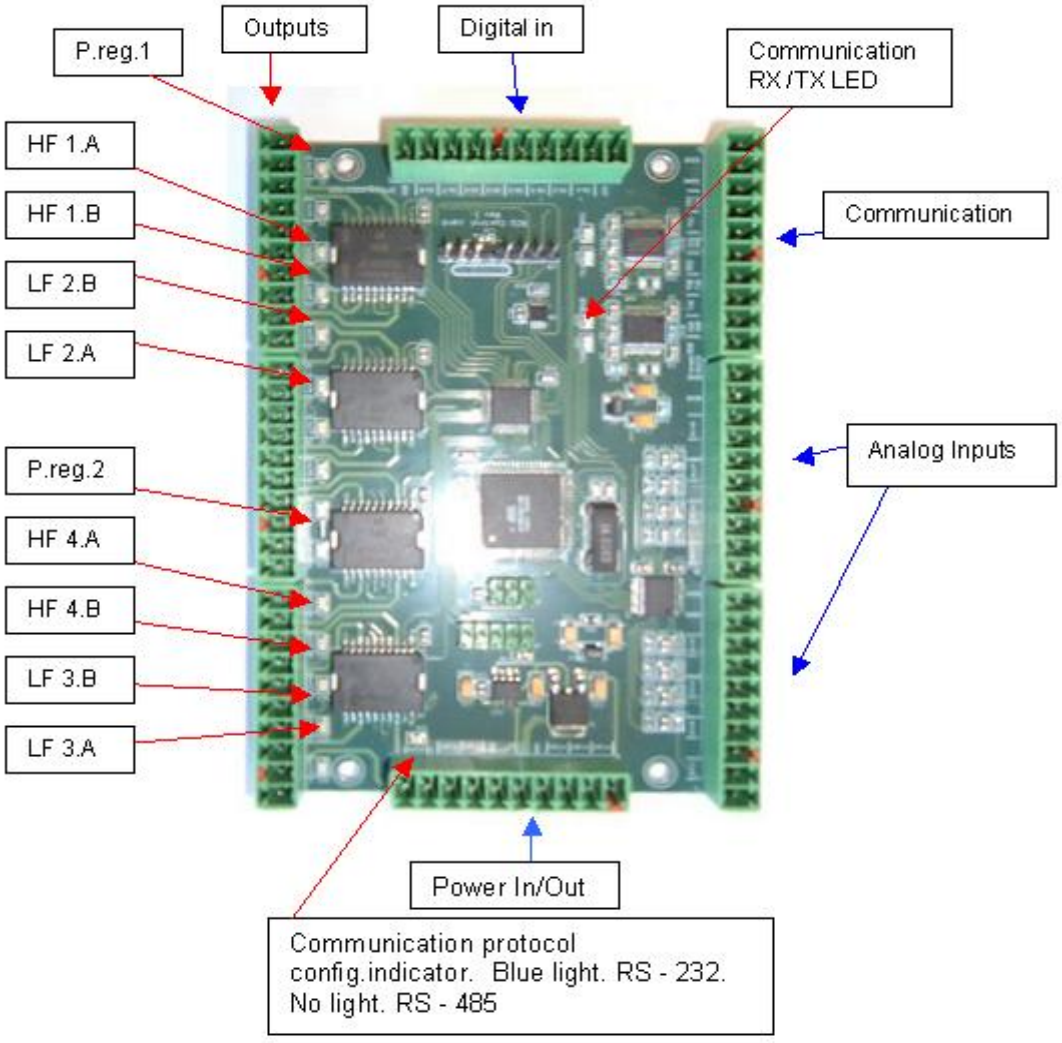
2.3 Subsea Unit

The Sub-sea Unit is a compensated housing with the necessary valve ports for the hydraulic functions and connectors machined in one block. The hydraulic functions included in the unit are:

- Two off Proportional Pressure Reducing Valves
- One off 4/3 Symmetrical Directional Proportional Flow Control Valves (60 lpm max)
- One off 4/3 Symmetrical Directional Proportional Flow Control Valves (95 lpm max)
- Two off 4/3 Symmetrical Directional Proportional Flow Control Valves (5 lpm max)
- Two off pressure Transducers – Measuring the regulated pressure
- One off pressure Transducer – Measuring the units return pressure

The subsea control system consists of a Single Board Computer. It is programmed to control and monitor the hydraulic functions, communicate with the Surface Control System, and neutralize the hydraulic system in the event of communication loss with the surface console.

Figure 2 Controller card indicator LED's



NB. Observe direction of the card

2.4 Data Sheet

PC based surface controller

General

Manufacturer	NA
Type	Lap Top Pentium®
Memory	Min 256 MB
Communications	RS 232or RS 485. RS-485 trough converter unit on the RS 232 port
Baud Rate	38400 Baud
Size	NA
Weight	NA
Display type	TFT active-matrix colour
Display size	NA
Temperature Range	NA

Subsea Unit

General

Size	412 x 229 x 284 mm (ex. fittings)
Weight in Air	30 kg
Weight in Water	17 kg
Depth Rating	3000 Metres
Hydraulic Working Pressure	250 bar (max)
Hydraulic Flow	95 lpm (max)
Return Pressure	17 bar (max.)
Manufacturer	Oceaneering A/S

Subsea Control Card

Type	OAS Controller Board
Power Consumption	1W at 24VDC
Communications	RS-485 / RS-232
Temperature Range	0oC to 60 °C
Manufacturer	Oceaneering AS

Power System

Type	OAS Power Board
Input power	90-132 or 180-264 VAC
Frequency	47-63 Hz
Max power consumption RCU.	(110VAC) 1,8 Ampere./ (230VAC) 1,1 Ampere
Output	24VDC
Max power	150W
Temperature Range	0 °C to 60 °C
Manufacturer	Oceaneering AS

High Flow Control / Pressure Reducing Valve (2 off)

Type	4/3-Way Symmetrical Proportional Flow and Pressure Control
Flow rangeHF1	0 - 50 lpm
Flow rangeHF4	0 - 95 lpm
Pressure range	10 - 250 bar
Temperature range	0 °C – 60 °C
Manufacturer	Oceaneering AS

Flow Control Valve (2 off)

Type	4/3-Way Symmetrical Proportional Flow Control
Flow range	LF2 (Closed centre) 0 - 5 lpm
Flow range	LF3 (Open centre) 0 - 5 lpm
Pressure range	10 - 250 bar
Temperature range	0 °C – 60 °C
Manufacturer	Oceaneering AS

Transducer for regulated pressure

Type	MSP-300-250-B-5-N-1
Pressure Range	0-250 bar
Temperature Range	-20 – 85 °C
Accuracy	>1% FS
Manufacturer	MSI

Transducer for return pressure

Type	MSP-300-35-B-4-N
Pressure Range	0-35 bar
Temperature Range	-20 – 85 °C
Accuracy	>1% FS
Manufacturer	MSI

RS232 - RS485 converter

Type	Con-TCC80I
Manufacturer	Moxa

3.0 INSTALLATION AND SOFTWARE INSTRUCTIONS

3.1 Subsea Unit

When installing / uninstalling the Subsea Unit to the ROV, it is important to ensure that the RCU and associated cables and hoses are properly protected.

The required connections are as follows (see also the electrical and hydraulical schematics):

- ROV system hydraulic pressure, 250 bar max.
- ROV hydraulic return, 17 bar max.
- ROV power supply, 110 or 230 VAC, connects to pin 1 and 2 on the “Power/Signal” cable.
- ROV AC ground connects to pin 3 on the “Power/Signal” cable.
- The ROV umbilical twisted pair, connects to Pin 4 and Pin 5 on the “Power/Signal” cable for RS-485 use. Pin 4 is the RS-485 “positive” conductor while Pin 5 is the “negative” conductor. For RS-232 use Pin 7 and 8 for twisted pair, and pin 6 for shield.

3.2 Surface Unit

Installation and start-up of the surface control unit is performed in the following steps:

- Connect the AC adapter cable to the PC.
- Connect the power cable between the AC adapter and a 220 VAC 50/60 Hz power supply.
- If using RS 485 .Connect the 9-9 pin cable to the RS 232-485 converter
- Connect the 9-9 pin cable to the PC serial port (com1)
- Connect the power cable to the RS 232-485 converter.
- **NOTE: Check dip switch settings.**

1 – on
2 – on
3 – on
Test - off

- Turn on the PC
- For RS-232, connect the 9 pin cable with open end to the PC serial port (com 1) and connect the open end to the power cable according to electrical wiring drawing (0314069/0291976)

-

IMPORTANT **WIRING FOR 232 AND 485 COMMUNICATION, NOT TO BE CONNECTED TO ELECTRICAL JUMPER (PIGTAIL) SIMULTANEOUSLY!**

THE COMMUNICATION BETWEEN THE SURFACE AND THE SUBSEA UNIT WILL BE LOST IF THE PC ENTERS "HIBERNATION" MODE. MAKE SURE THAT SUCH POWER SAVING FEATURE IS DISABLED.

CORRECT POLARITY ON THE COMMUNICATION CONDUCTORS IS VITAL FOR THE OPERATION OF THE COMMUNICATION LINK. IF COMMUNICATION ALARM IS RED AFTER START UP OF THE SUBSEA UNIT, TURN OFF POWER ON SUBSEA UNIT. REVERSE THE POLARITY ON THE COMMUNICATION CONDUCTORS. TURN ON POWER ON SUBSEA UNIT.

3.3 Control System Software

Launch the RCU program through Windows XP "Start" - button, or by double-clicking the program icon on the desktop. The application consists of a window with a menu bar at the top and control slides and buttons for RCU operation.

3.4 Tool Connections General

The Remote Control Unit provides proportional pressure control of four separate controlled hydraulic circuits, arranged as follows:

2 off 4/3 High Flow Proportional Control Valve. These are labelled HF1 A / B and HF4 A / B on the valve block. The standard setting for HF1 Valve is 50 l/min and for HF4 95 l/min. Control of the flow is accomplished from the surface control unit tool control page. The flow is fully variable from 0 l/min to maximum flow. The flow valve is a symmetrical valve, which means the return flow is also controlled in proportion to the flow setting.

IMPORTANT **IF USE OF AN OCEANEERING 2.7 KNM TORQUE TOOL THE HF 1 VALVE ON RCU HAVE TO BE CONNECTED TO THE TOOL.**

2 off 4/3 Low Flow Proportional Control Valve. These are labelled LF2 A / B and LF3 A / B on the valve block. Control of the flow is accomplished from the surface control unit tool control page. The flow is fully variable from 0 l/min to maximum flow. The flow valve is a symmetrical valve, which means the return flow is also controlled in proportion to the flow setting. LF2 is a closed centre valve.

NOTE: IF A CASE DRAIN CONNECTION IS REQUIRED FOR AN ATTACHED TOOL, ACCESS TO THE RETURN LINE IS POSSIBLE. BY CONNECTING TO THE JIC 4 FITTING (QUICK CON) ON THE VALVE BLOCK MARKED "TANK". UNUSED CONNECTORS OR FITTINGS MUST BE CAPED.

4.0 OPERATING INSTRUCTIONS

4.1 Pre Dive Checks

The following procedures must be followed before each dive.

1. Visually inspect the subsea cables and connectors for damage
2. Visually inspect the hydraulic connections for signs of hydraulic fluid leakage.
3. If use of torque tool, visually inspect that the tool is connected to the HF 1 valve A/B line.
4. Check that the Oil compensator is filled with the piston in middle position and no air bubbles in the transparent RCU lid.
5. Check that all fasteners and fittings are tight
6. Perform a function test of the system

4.2 Post Dive Checks

The following procedures must be followed after each dive.

1. Thoroughly rinse the subsea unit with fresh water.
2. Visually inspect the subsea cables and connectors for damage
3. Visually inspect the hydraulic connections for signs of hydraulic fluid leakage
4. Check that all fasteners and fittings are tight
5. Perform a function test of the system.

4.3 Storage Procedure

The following procedures must be followed prior to storing of the RCU

1. Thoroughly rinse the subsea unit with fresh water.
2. Visually inspect the subsea cables and connectors for damage.
3. Visually inspect the hydraulic connections for hydraulic fluid leakage.
4. Check that all fasteners and fittings are tight
5. Perform a function test of the system
6. Flush hydraulic oil through all the hydraulic circuits
7. Disconnect the control cables and insert dummy connectors into the unit bulkhead connectors
8. Disconnect the hydraulic hoses. Put blanking caps on all valve block fittings and hydraulic hoses
9. Place the components into the transport case, and store in a dry area.

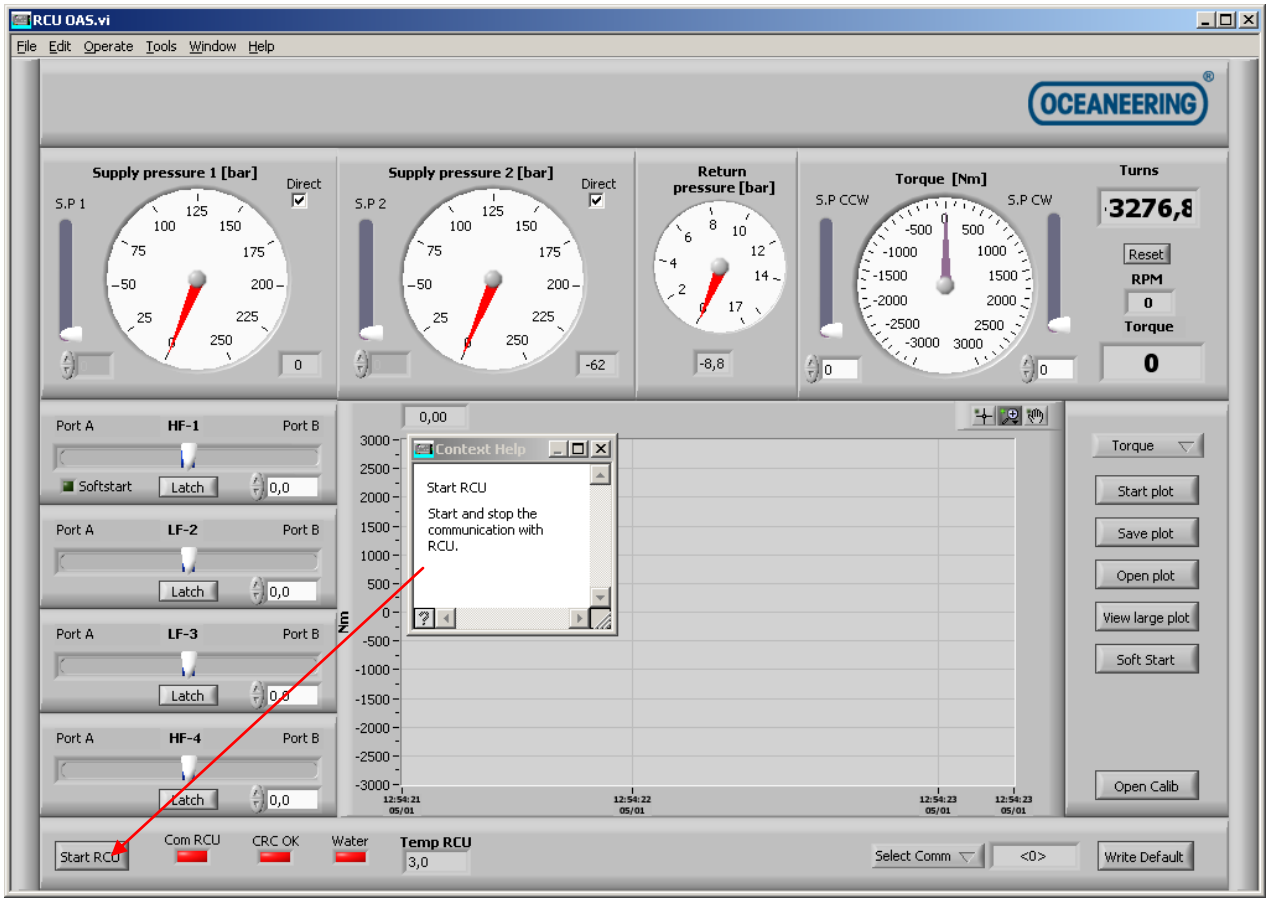
5.0 USER HELP MENU, RCU GENERAL

The following section covers the online help menu in the RCU software. To activate the online help Menu click “help” in the RCU software window and tag the “show context help” button.

NOTE: Some of the picture in this manual can different from the GUI operation window on the PC.

5.1 Start up

Figure 3 Start Up of RCU

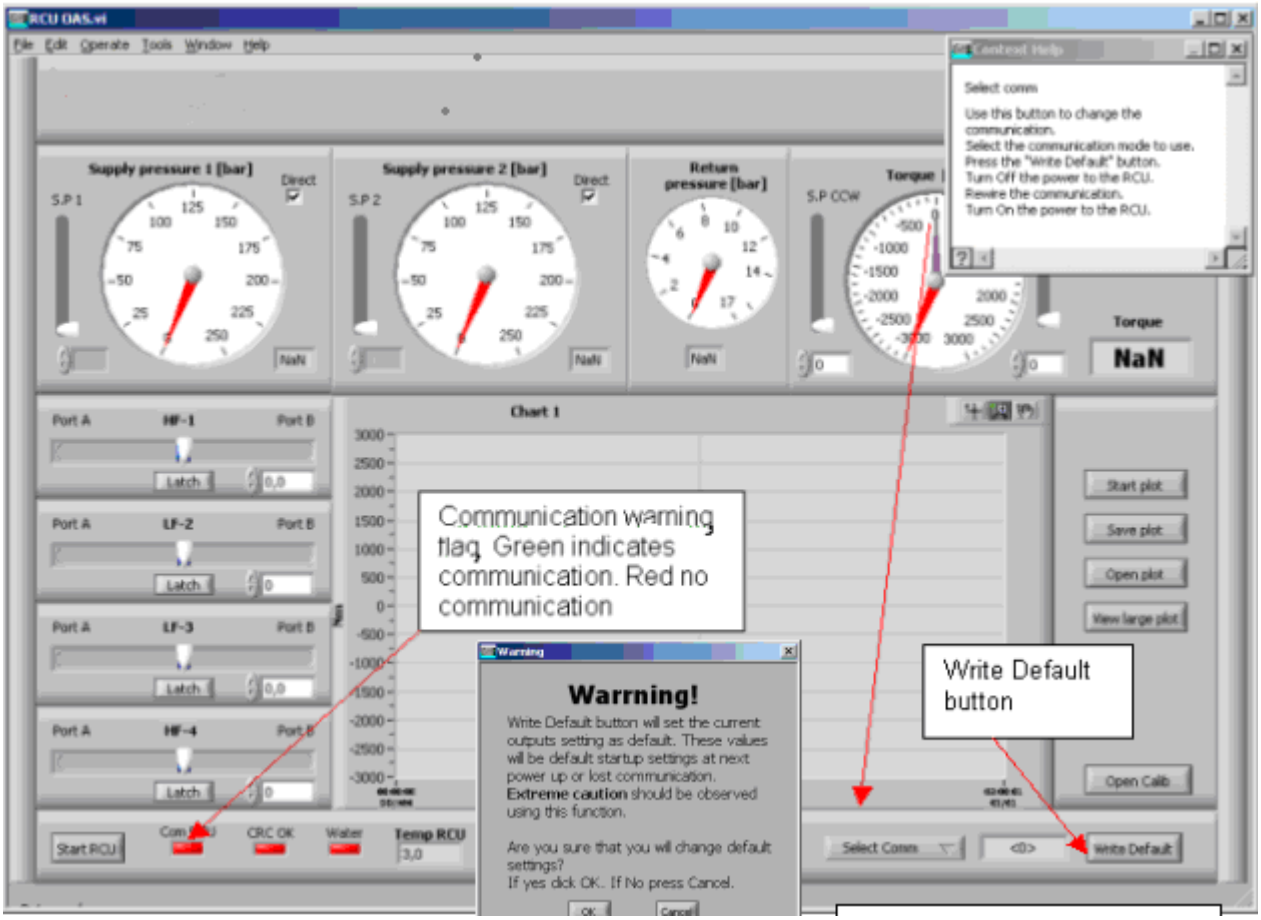


Moving the cursor over the relevant object, the “context help” displays as follows (see picture):

“Start and stop the communication with the RCU.”

This button starts and stops the communication between the surface and the subsea unit

Figure 4 RCU Communications. Change between RS 232/485 protocols



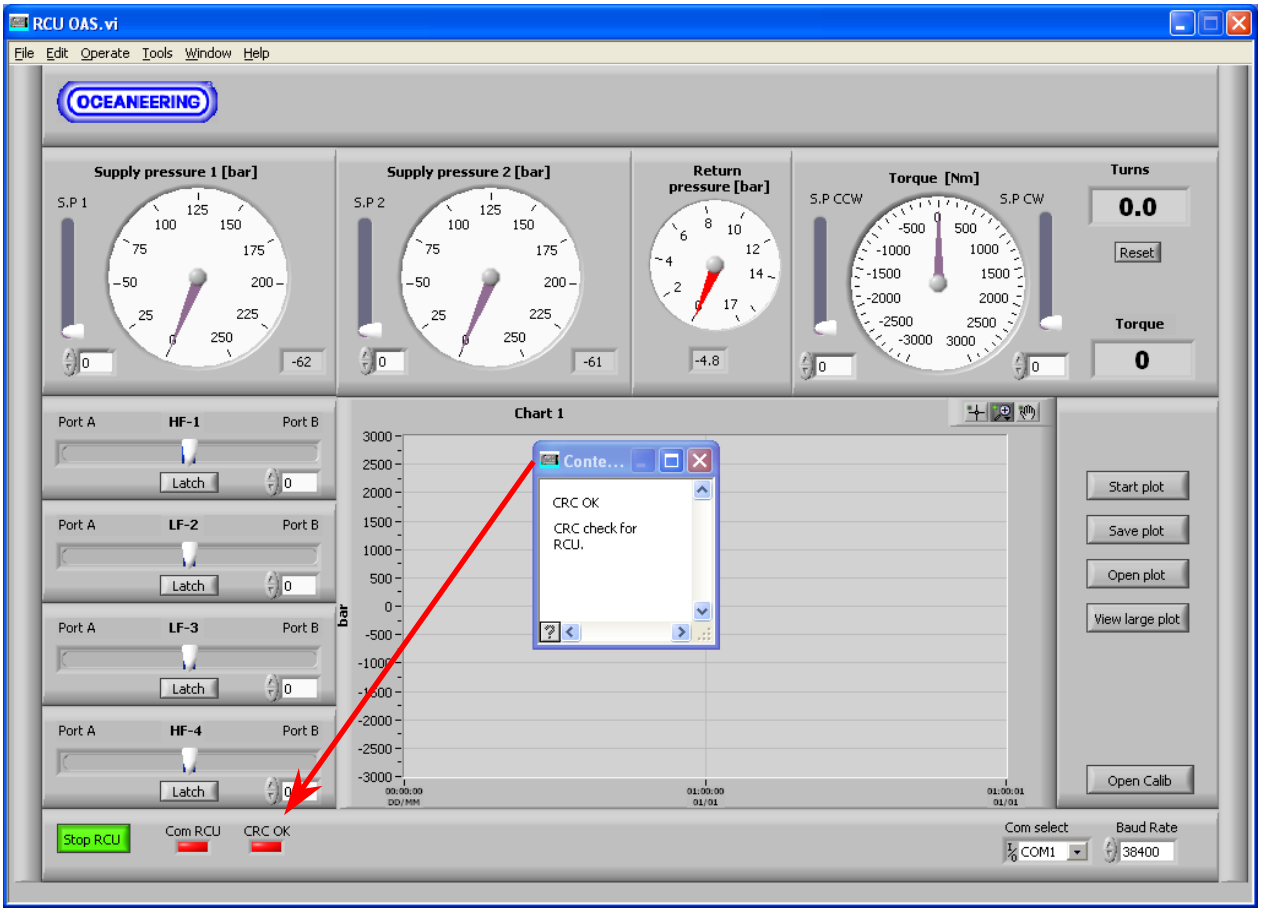
Moving the cursor over the relevant object, the “context help” displays as follows (see picture):

“Use this button to change communication. Select the communication mode to use Press the “Write Default” button. A warning dialog box will appear. Type in the password ”oceaneering” **(Key sensitive)** and click the OK. button. Turn off the power to the RCU. Rewire the communication interface according to DWG 0291974 for the new selected communication mode.. Turn on the power to the RCU.”

FYI: If communication LED (figure.2) on RCU controller card is lightening blue, RCU is configured for RS- 232.

NOTE: The write default button will also write down all pressure and valve settings shown in operation window as default settings. This default will be present under power up and after communication loss. Normal settings is that all pressure and valve functions shall be deactivated (Zero Value).Make sure that functions are deactivated before writing default if standard default is wanted.

Figure 5 Cyclic Redundancy Check

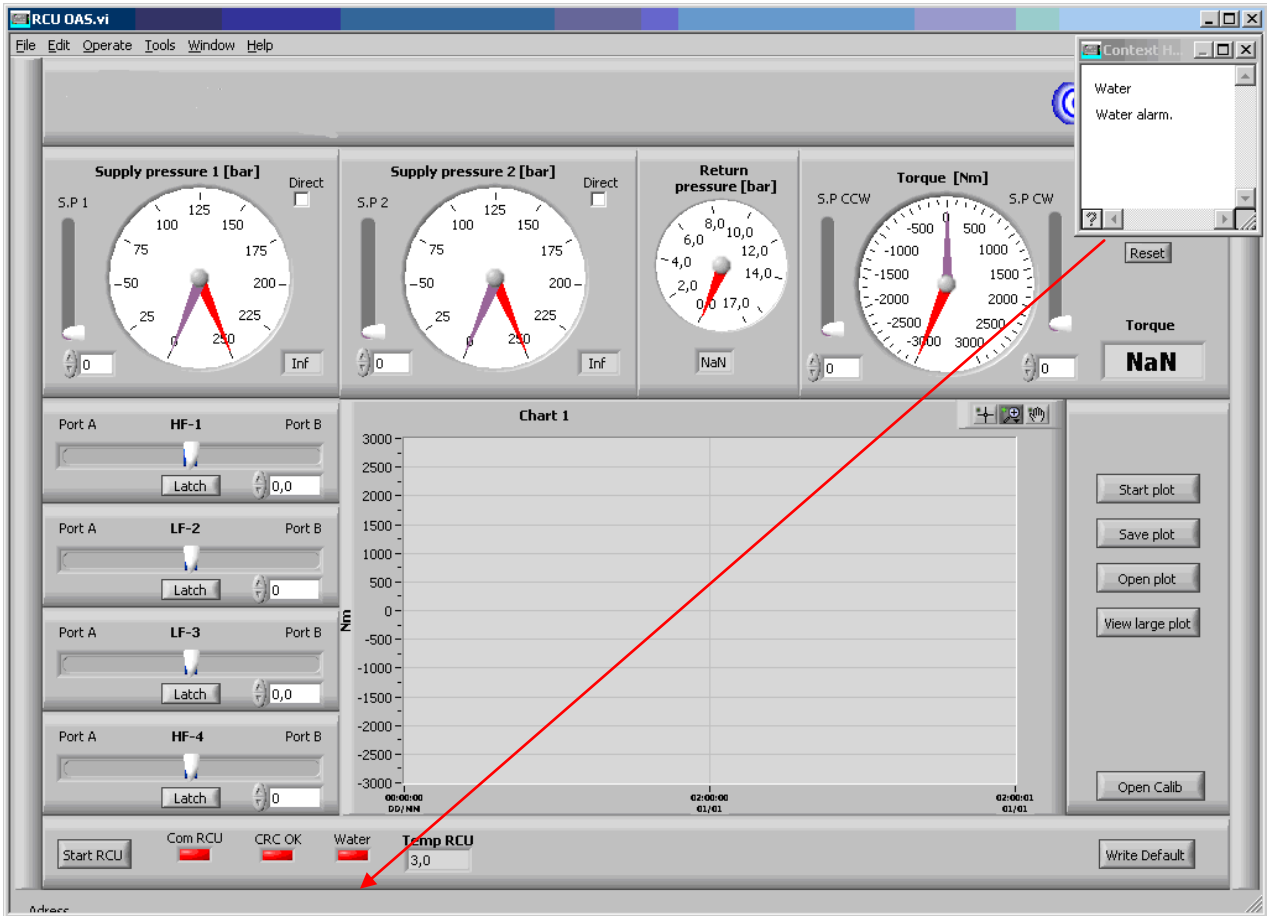


Moving the cursor over the relevant object, the “context help” displays as follows (see picture):

“CRC check for the RCU.”

Green light indicates that the surface unit receives the same data as sent from the sub sea unit; red light indicates that the received data differs from the data sent from the sub sea unit. This can be caused by disturbance on telemetry line; the CRC ensures that the received data is in fact a proper data package.

Figure 6 Water Alarm

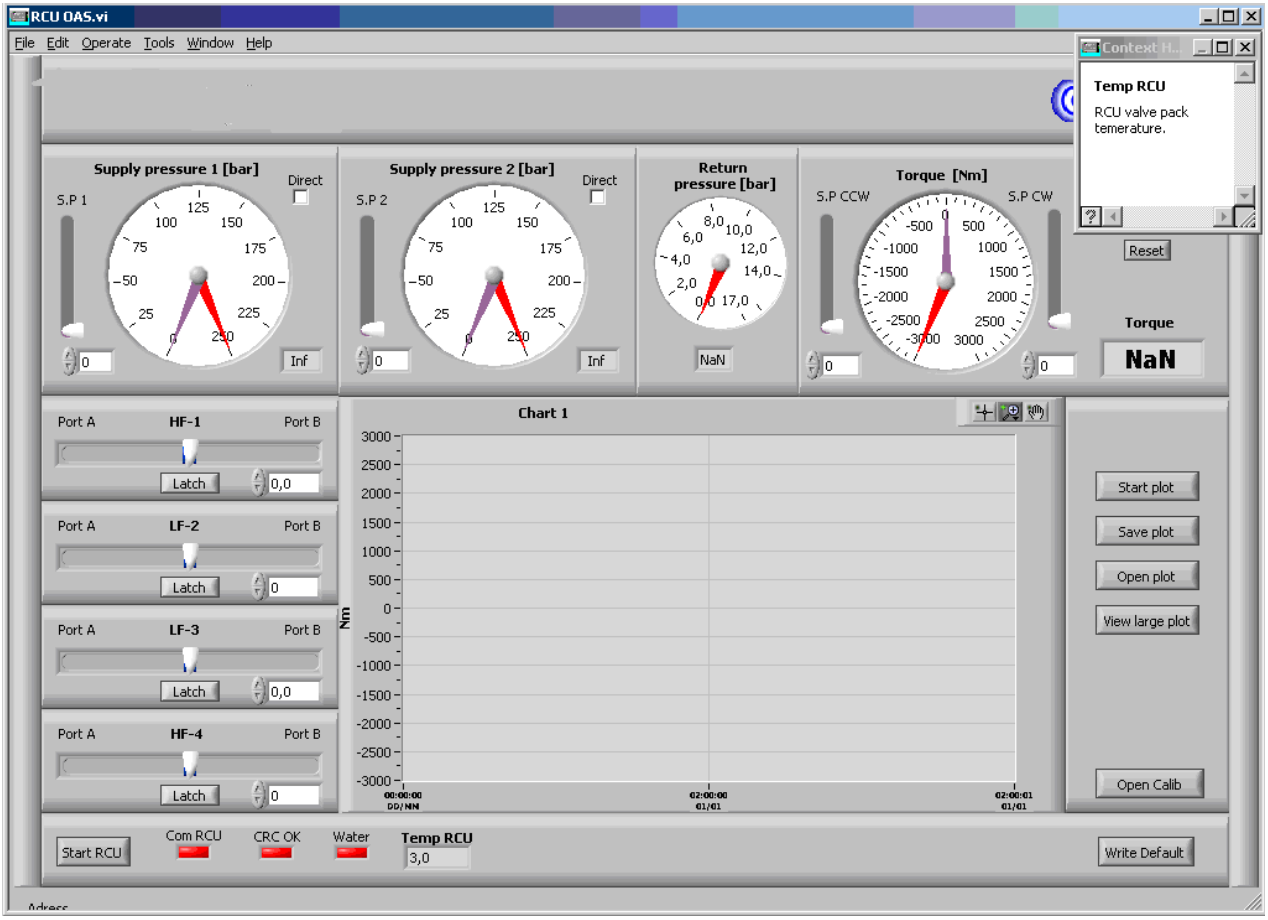


Moving the cursor over the relevant object, the “context help” displays as follows (see picture):

“Water Alarm”

RCU housing is oil filled. Inspect for water ingress.

Figure 7 Temperature reading

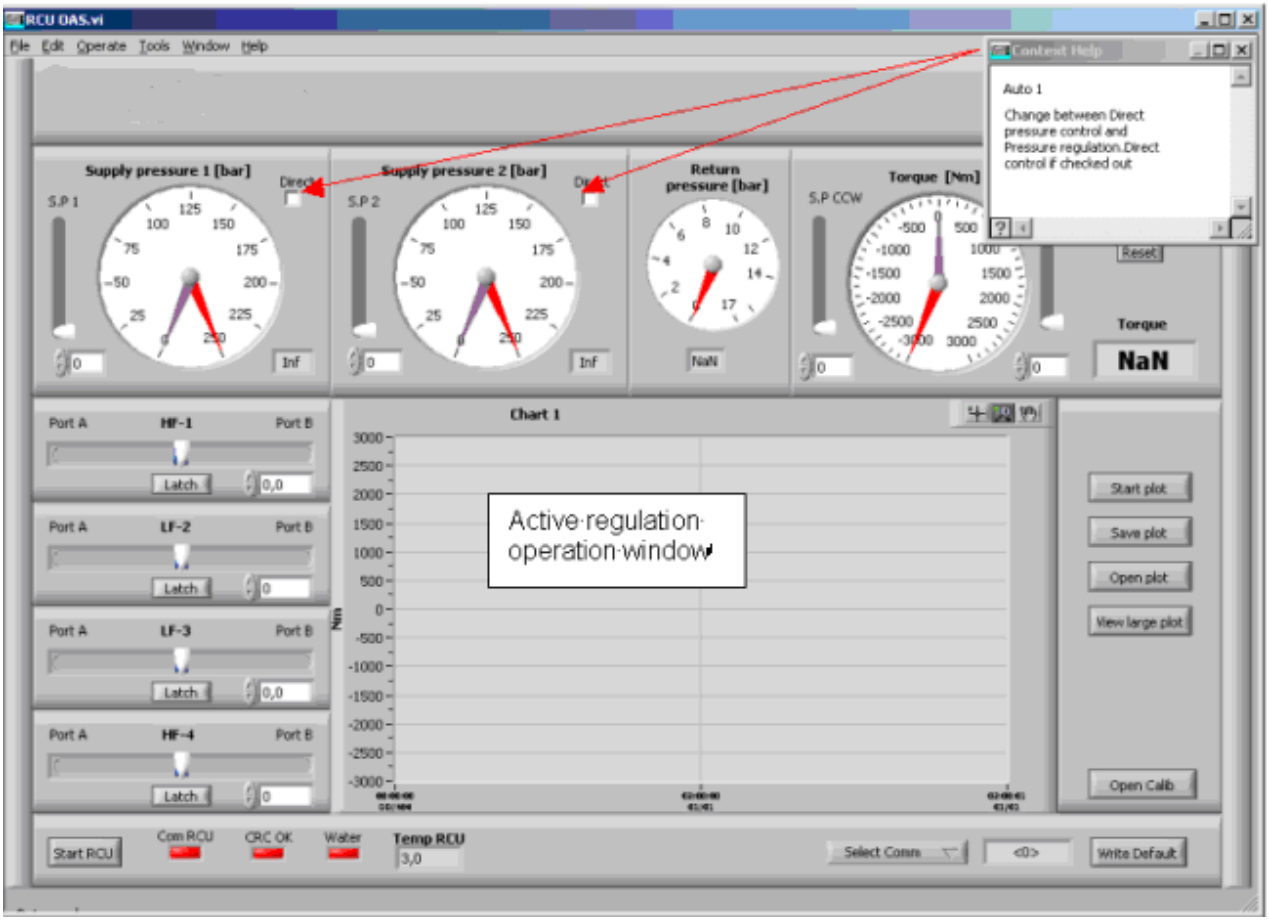


Moving the cursor over the relevant object, the “context help” displays as follows (see picture):

“Temp RCU. RCU valve pack temperature “

5.2 Pressure Control

Figure 8 Active regulation



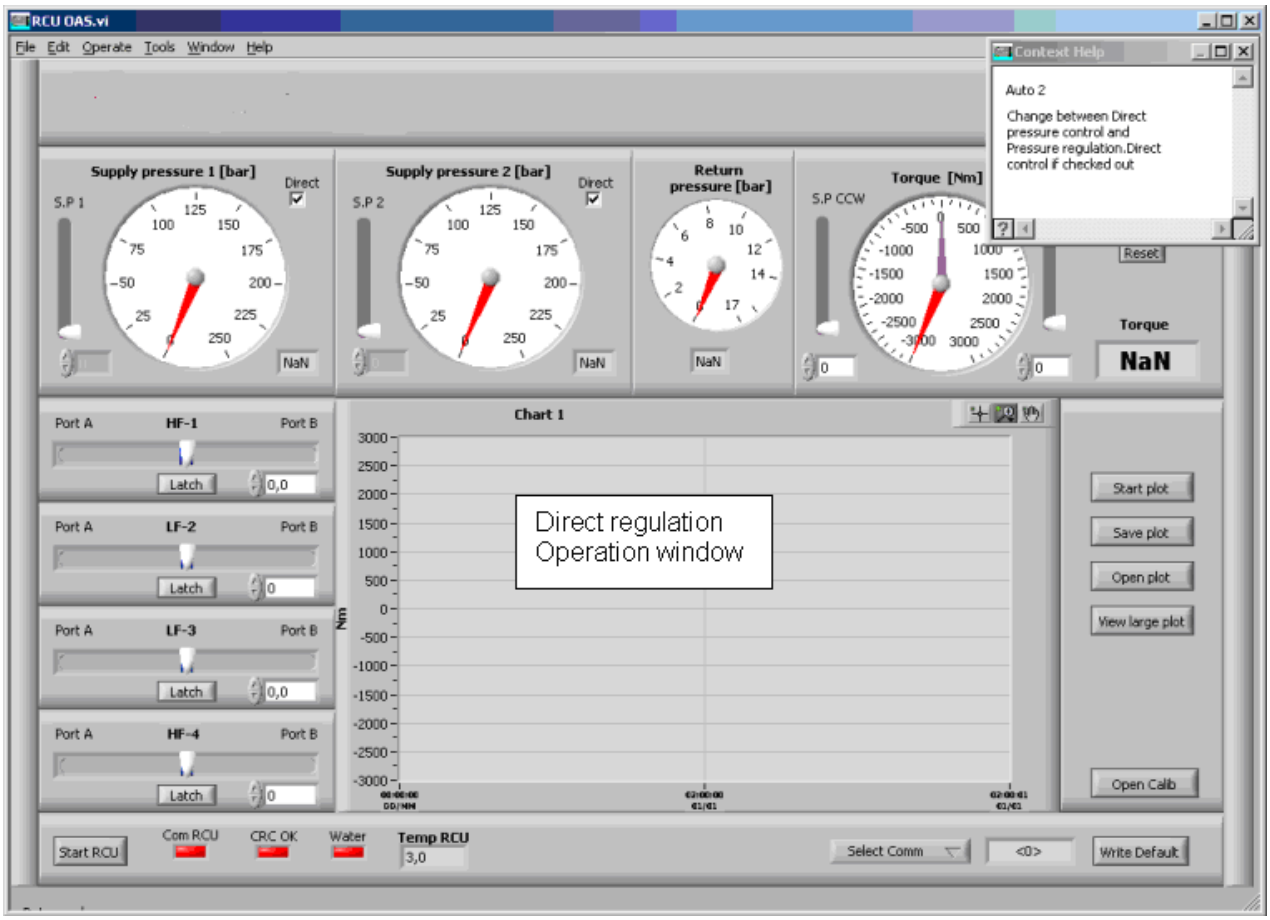
Active regulation (Closed loop regulation): If using active regulation the set pressure from RCU will maintain with various flow.

Electrical signal from controller board to pressure regulator to be increase/decrease to maintain pressure with various flow

Warning:

If using a underpowered hydraulic supply that cannot provide the wanted flow it is strongly recommended to use Direct regulation mode. See figure 9

Figure 9 Direct regulation



Direct regulation: If using direct regulation pressure from RCU will drop by increase flow.

Moving the cursor over the relevant object, the “context help” displays as follows (see pictures):

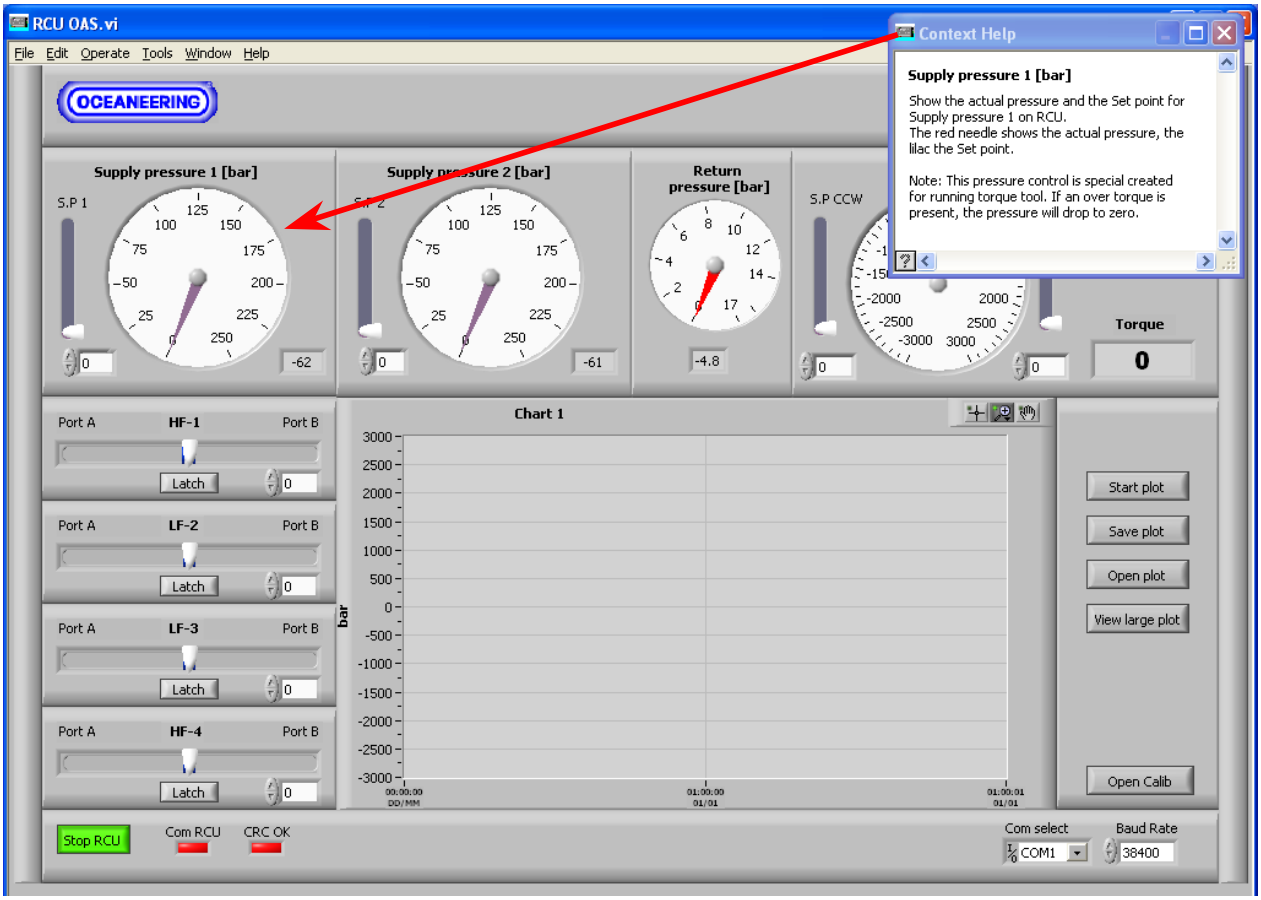
“Change between Direct pressure control and Pressure regulation. Direct control if checked out”.

Electrical signal from controller board to pressure regulator is fixed. No active regulation.

Recommended, if using an underpowered hydraulic supply.

Direct regulation is set as Default on RCU.

Figure 10 Supply Pressure 1



The Pressure Control Section allows adjustment of the output pressure over the entire pressure range. The minimum pressure is 10 bar, the maximum pressure is as defined in the Set up Window, or the ROV system pressure if less. The Pressure Control Section consists of:

- 2 buttons to increase/decrease pressure.
- A display showing the pressure set point.
- A display showing the calculated pressure across the connected hydraulic device

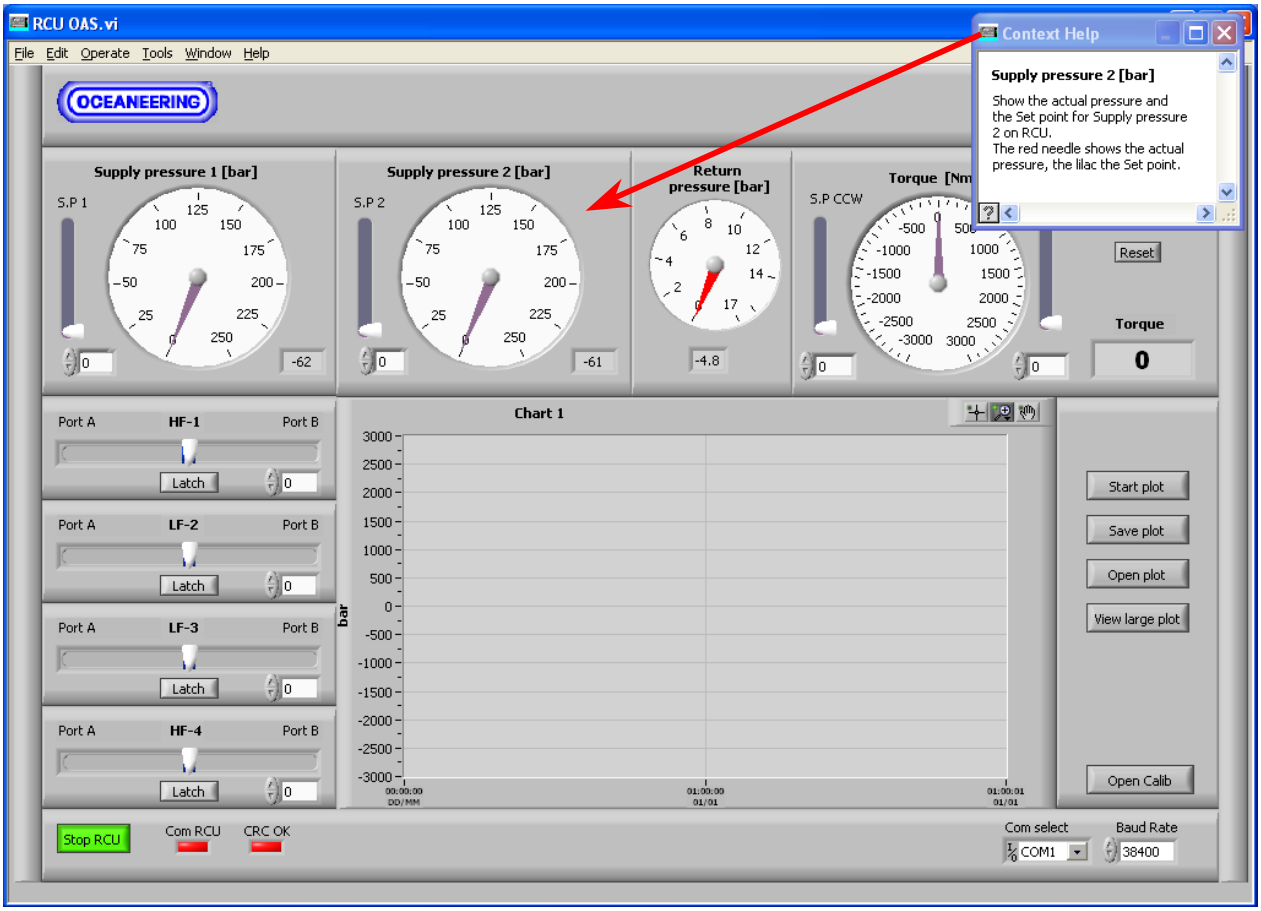
Use the slider to regulate RCU tool pressure.

Moving the cursor over the relevant object, the “context help” displays as follows (see picture):

“Show the actual pressure and the Set point for Supply pressure 1 on RCU. The red needle shows the actual pressure, the lilac the shows the set point. Note: This pressure control is special created for running the torque tool. If an over torque is present, the pressure will drop to zero.”

NOTE: Pressure 1 supplies HF1 and LF2 direction valve

Figure 11 Supply Pressure 2

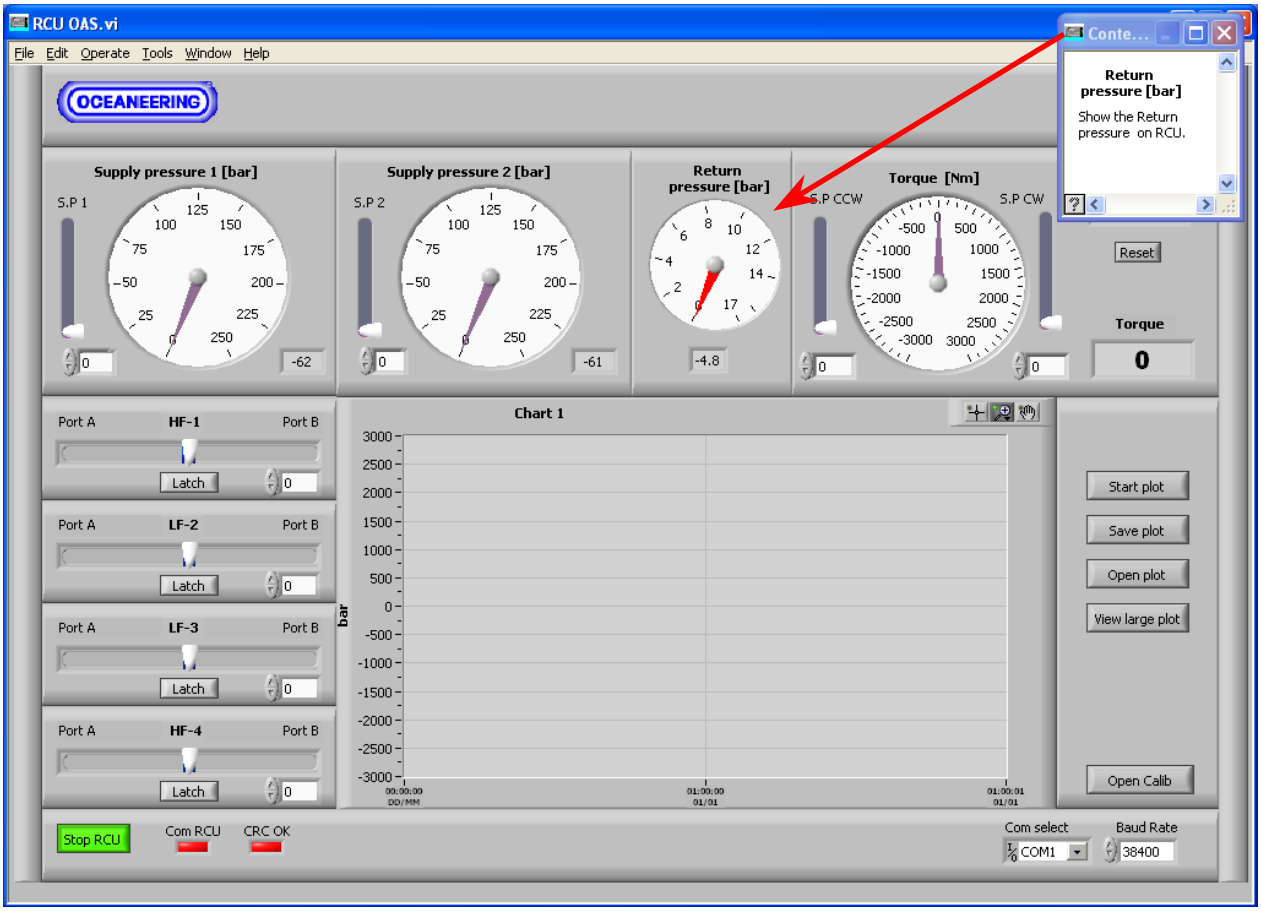


Moving the cursor over the relevant object, the “context help” displays as follows (see picture):

“Show the actual pressure and the Set point for Supply pressure 2 on the RCU. The red needle shows the actual pressure, the lilac the shows the set point.”

NOTE: Pressure 2 supplies HF4 and LF3 direction valve

Figure 12 Return Pressure



Moving the cursor over the relevant object, the “context help” displays as follows (see picture):

“Show the Return pressure on the RCU.”

This meter shows the actual pressure on the RCU return line.

5.3 Flow Control

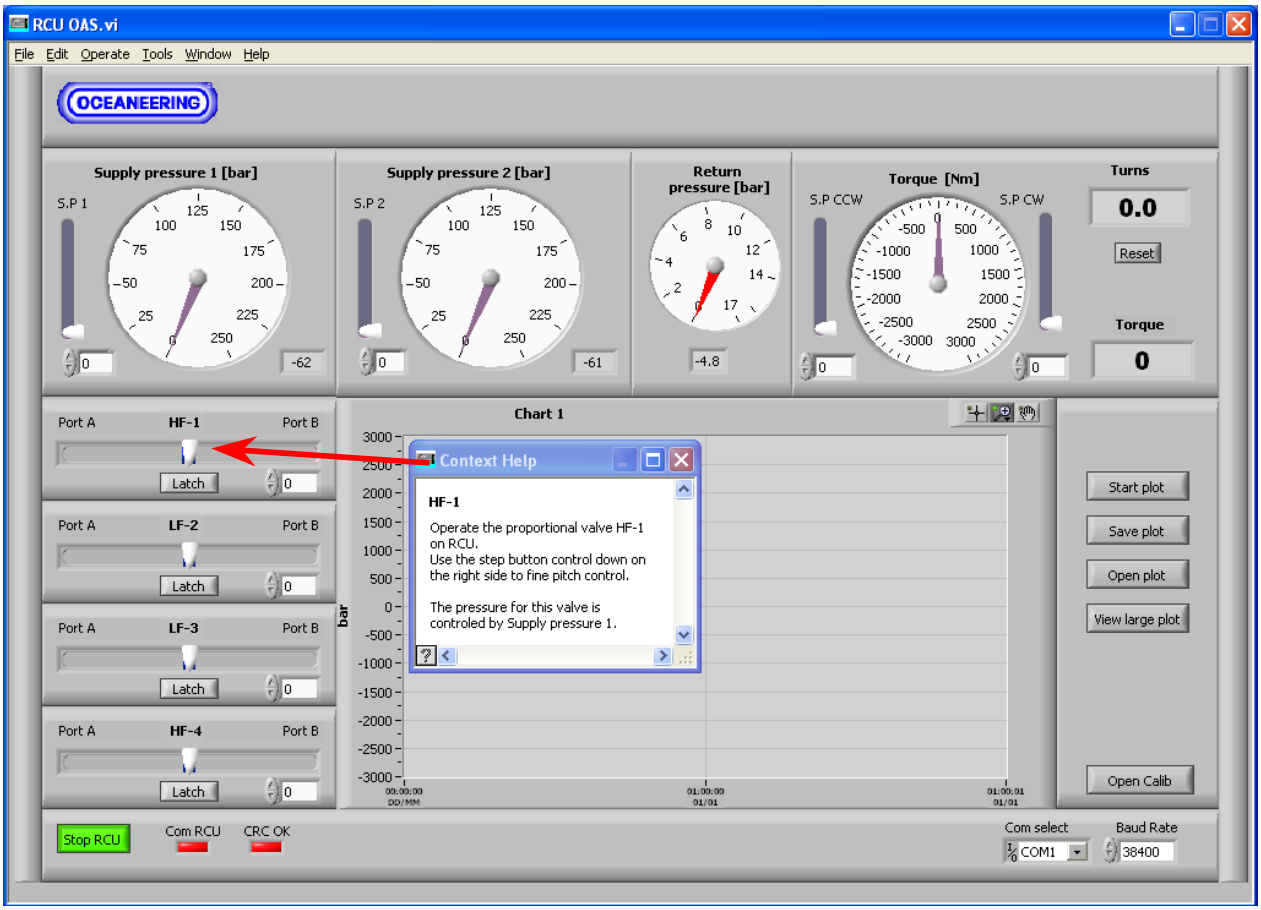
The Flow Valve Section is a slide bar located in the tool control window. The slider is used to control the proportional flow valve. When the slider is centred, the valve is closed. Dragging the slider to the left opens Port A, to the right opens Port B. The flow will be proportional with the value of the slide bar. There are also two buttons were you can step up/down in preset steps.

The slide pot can be operated in normal "momentary" mode, i.e. the slider jumps back to zero position when the mouse button is released, or in "latched" mode. Latched mode is selected by tagging the “Latch” check box. A “Stop” button appears to the right, and pressing this button will set the slider back to zero position.

The valve controls are labelled Port A/B as default. Those text labels can be renamed. Example: TT CW.

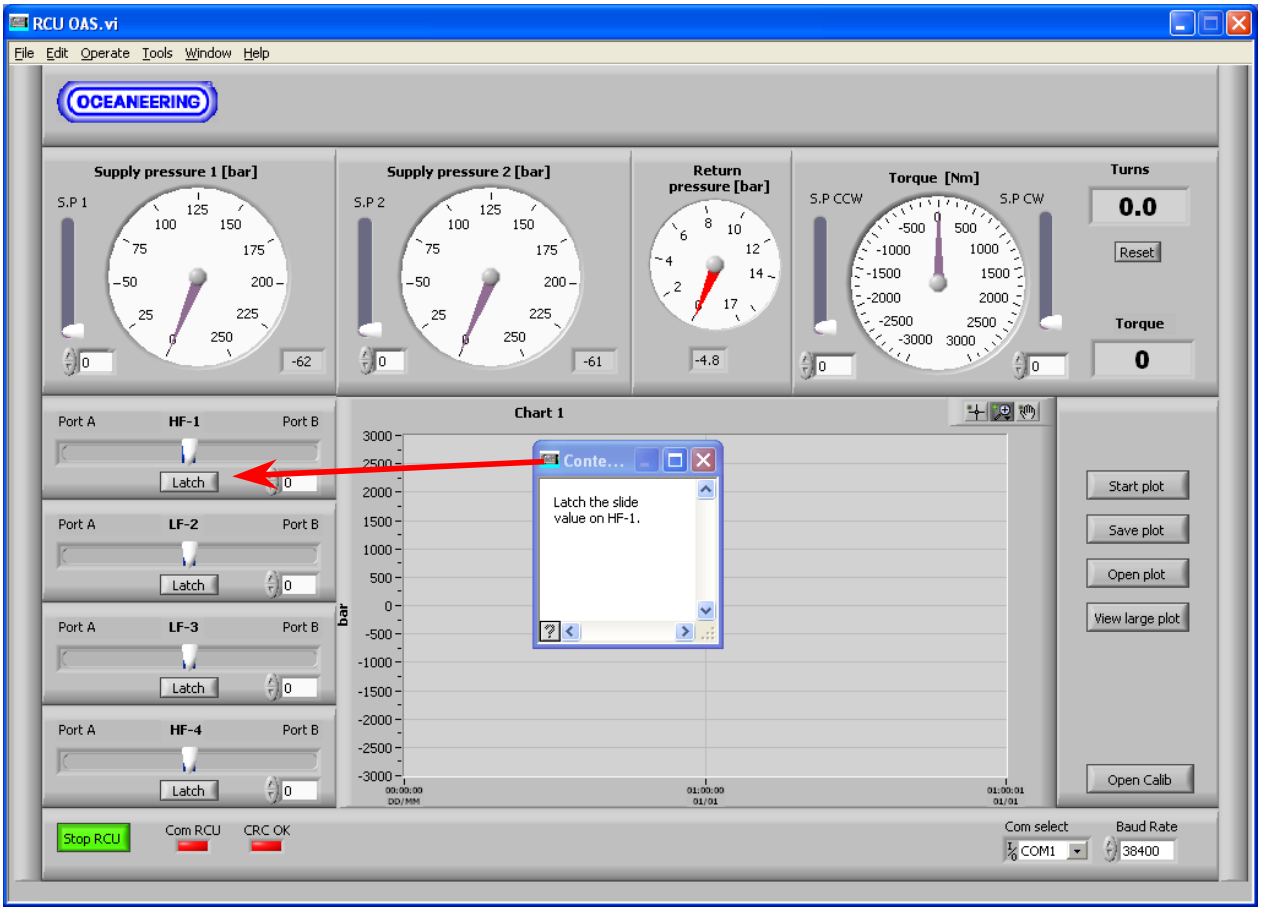
TT latch

Figure 13 Flow Control



Moving the cursor over the relevant object, the “context help” displays as follows (see picture):“Operates the proportional valve HF-1 on the RCU. Use the step button control on the right side to fine pitch control. The pressure for this valve is controlled by Supply pressure 1.”The operation sequence is the same for all proportional valves.

Figure 14 Valve latch



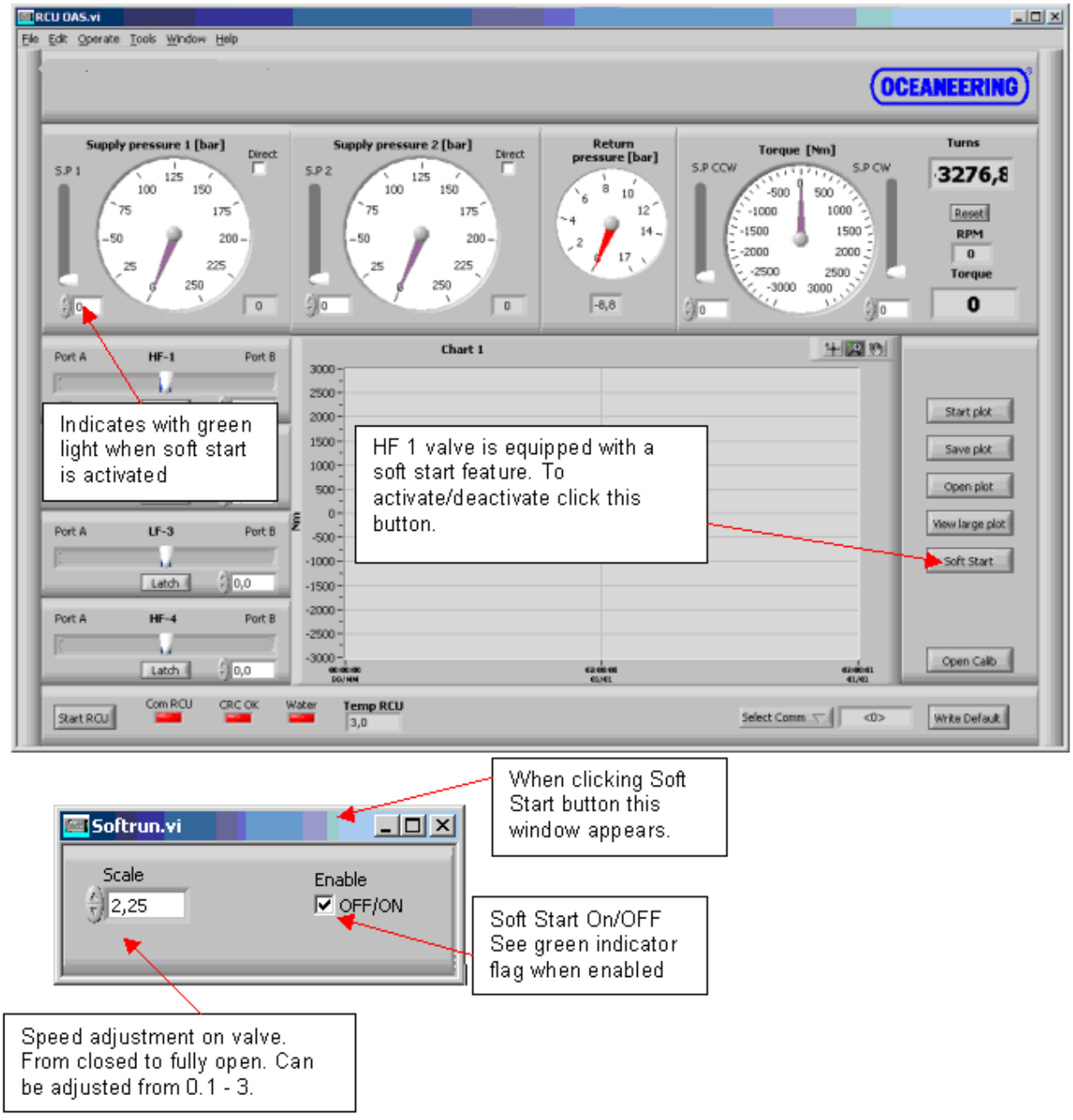
Moving the cursor over the relevant object, the “context help” displays as follows (see picture):

“Latch the slide value on HF-1.”

Latch button to be used if operation slide is wanted to maintain in given position.

The operation sequence is the same for all proportional valves.

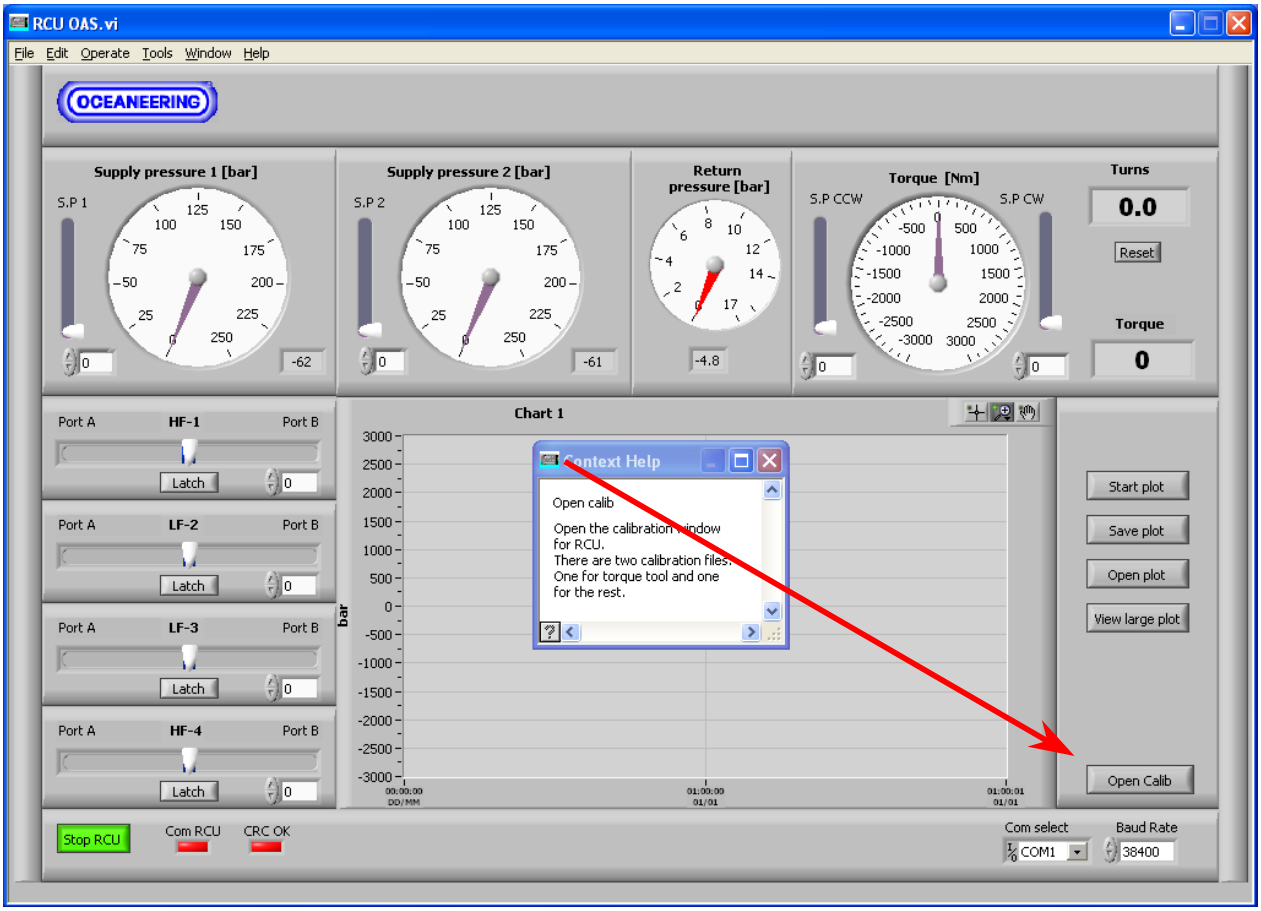
Figure 15 Soft Start on HF 1 Valve



On HF1 direction valve a Soft Start feature is implemented as an option in use with operating Torque Tool. These, for controlling opening speed on direction valve and for better repeatable output on the torque tool. Pressure versus torque.

5.4 Sensor Calibration

Figure 16 Sensor calibration



Moving the cursor over the relevant object, the “context help” displays as follows (see picture):

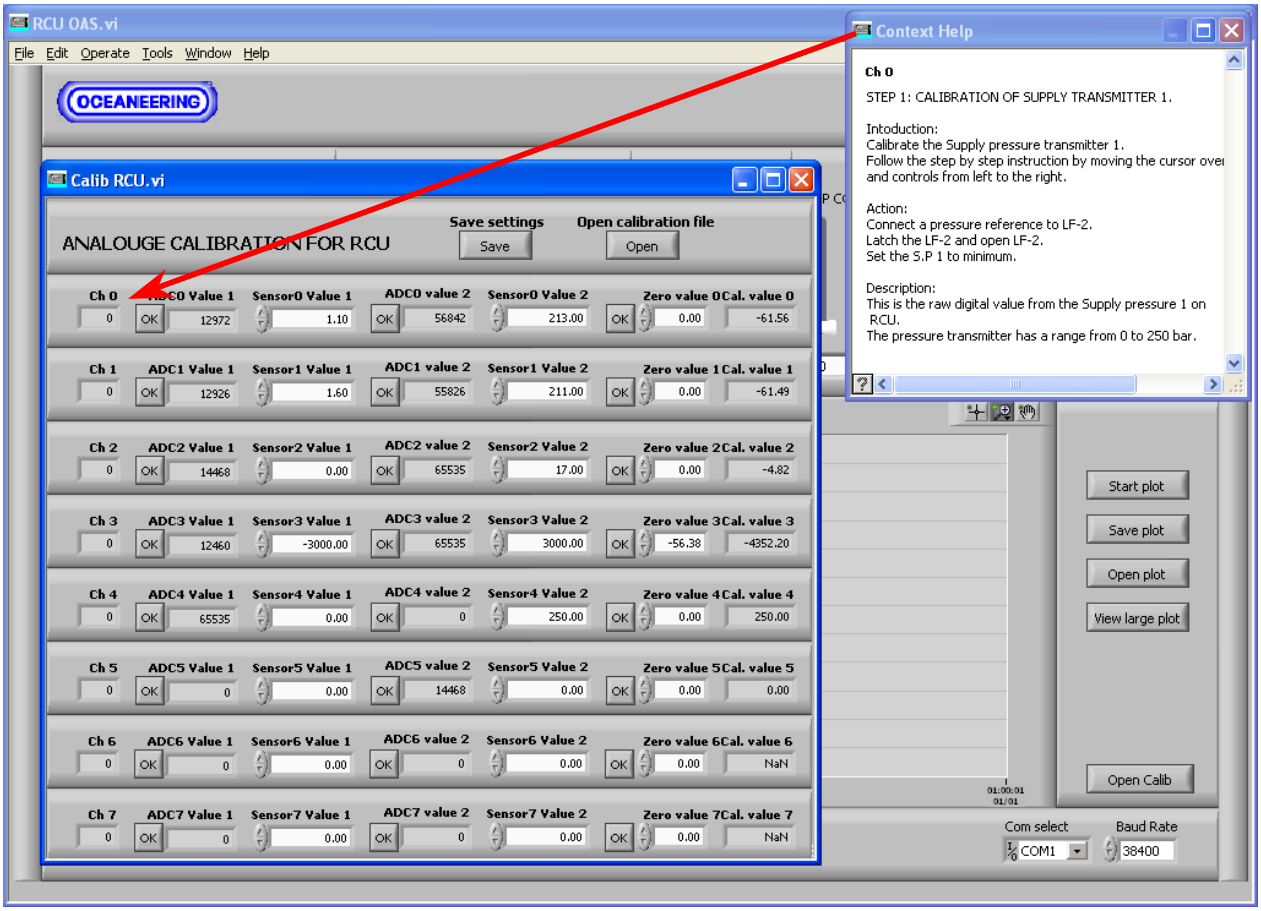
“Open the calibration window for the RCU. There are two calibration files. One of these is for torque tool calibration only.”

There are two different types of calibration files. The RCU calibration file is the file for calibrating the internal sensors in the RCU. The Torque Tool calibration file is the file for calibrating external sensors located in Oceaneering Smart Torque Tools. The Torque Tool calibration is shown in the next chapter.

Supply Pressure 1 Calibration step 1

The following shows how to calibrate the pressure sensors in the RCU. The sensors are pre-calibrated from the factory. Under normal circumstances it will therefore not be necessary to calibrate these sensors.

Figure 17 STEP 1: CALIBRATION OF SUPPLY TRANSMITTER 1



Moving the cursor over the relevant object, the “context help” displays as follows (see picture):

“STEP 1: CALIBRATION OF SUPPLY TRANSMITTER 1.

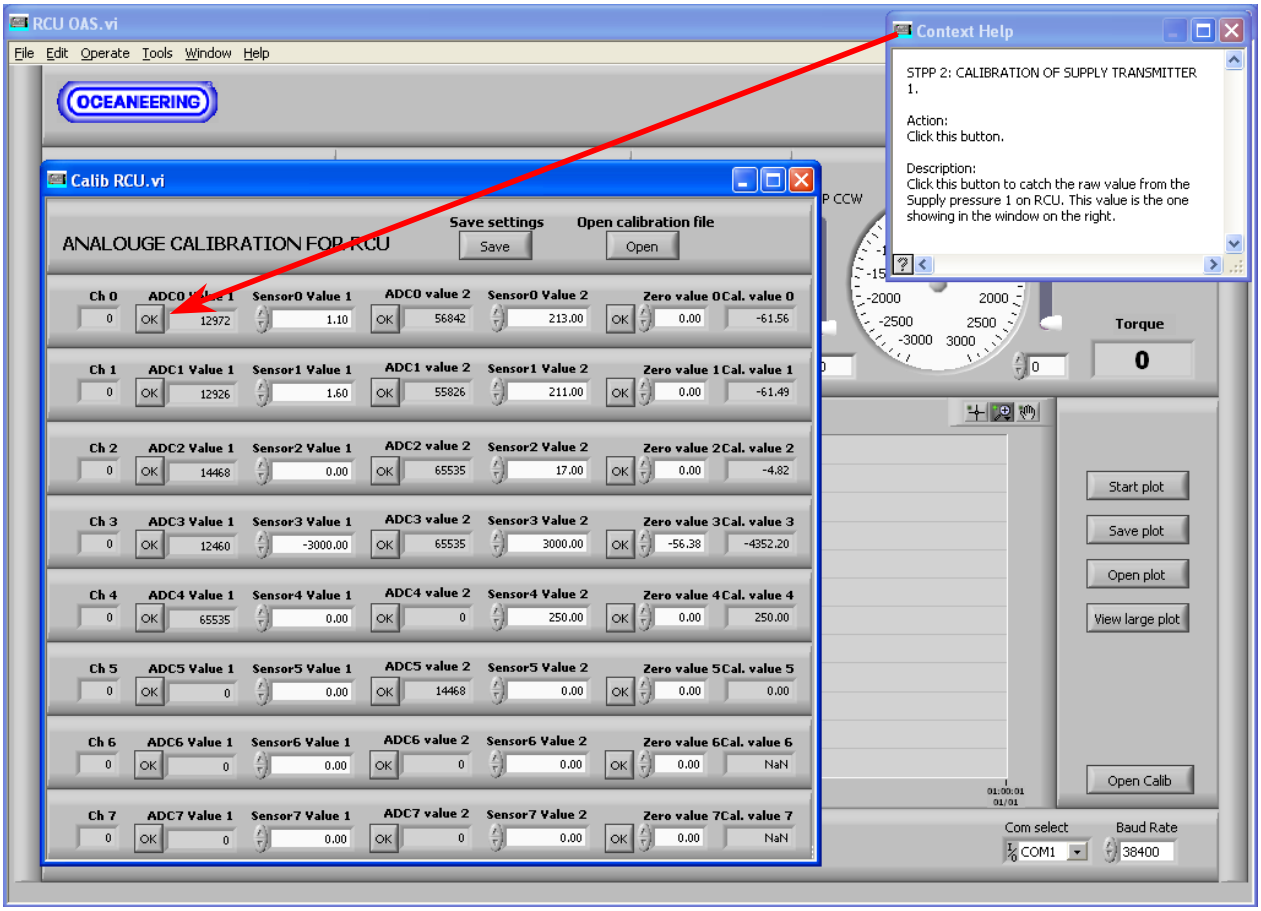
Introduction: Calibrate the Supply pressure transmitter 1. Follow the step-by-step instruction by moving the cursor over the buttons and controls from left to the right.

Action: Connect a pressure reference to LF2. Latch the LF2 and open LF2. Set the SP1 to minimum.

Description: This is the raw digital value from the Supply pressure 1 on the RCU. The pressure transmitter has a range from 0 to 250 bar.”

Supply Pressure 1 Calibration step 2

Figure 18 STEP 2: CALIBRATION OF SUPPLY TRANSMITTER 1



Moving the cursor over the relevant object, the “context help” displays as follows (see picture):

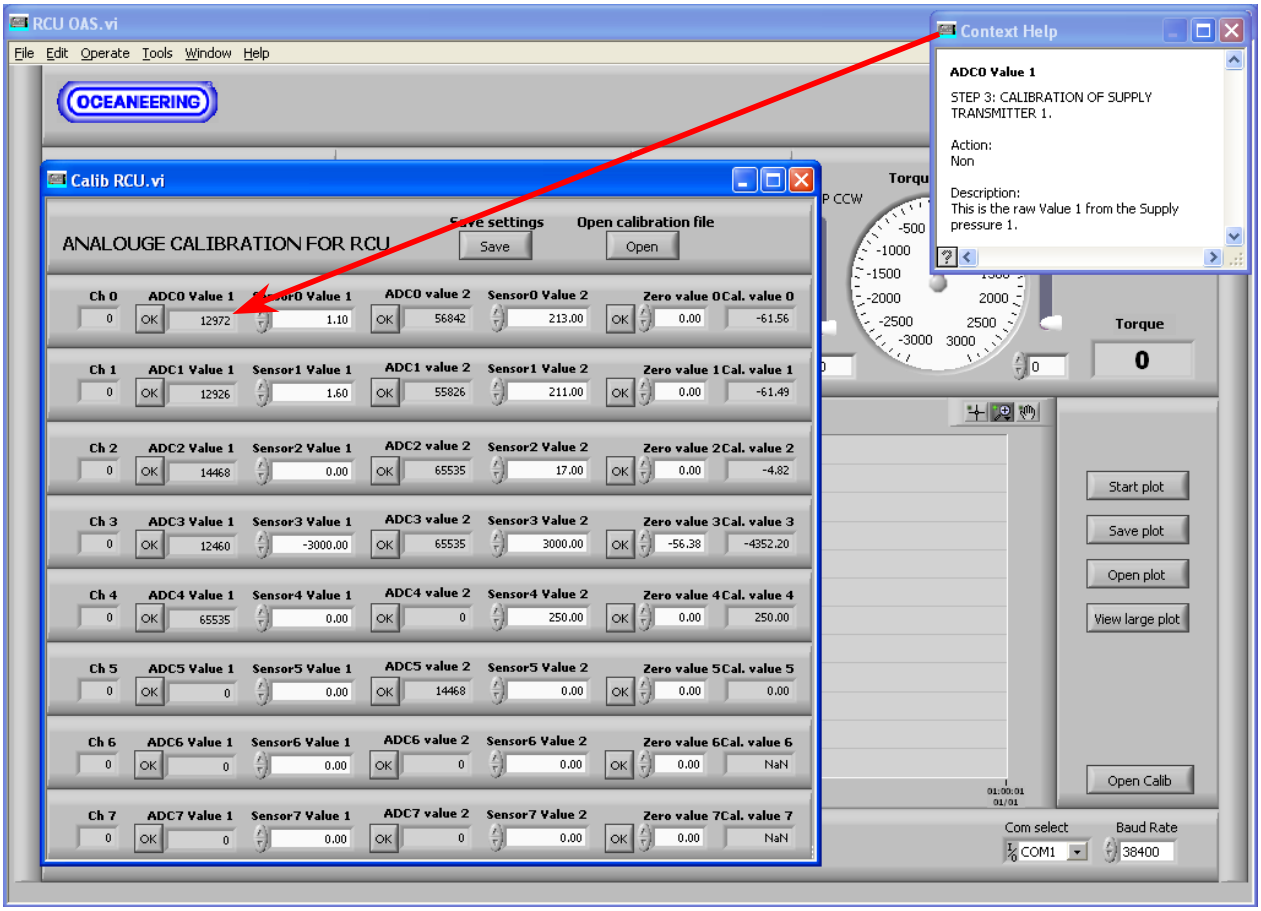
“STEP 2: CALIBRATION OF SUPPLY TRANSMITTER 1.

Action: Click this button.

Description: Click this button (“OK”) to catch the raw value from the Supply pressure 1 on the RCU. This value is the one showing in the window on the right.

Supply Pressure 1 Calibration step 3

Figure 19 STEP 3: CALIBRATION OF SUPPLY TRANSMITTER 1



Moving the cursor over the relevant object, the “context help” displays as follows (see picture):

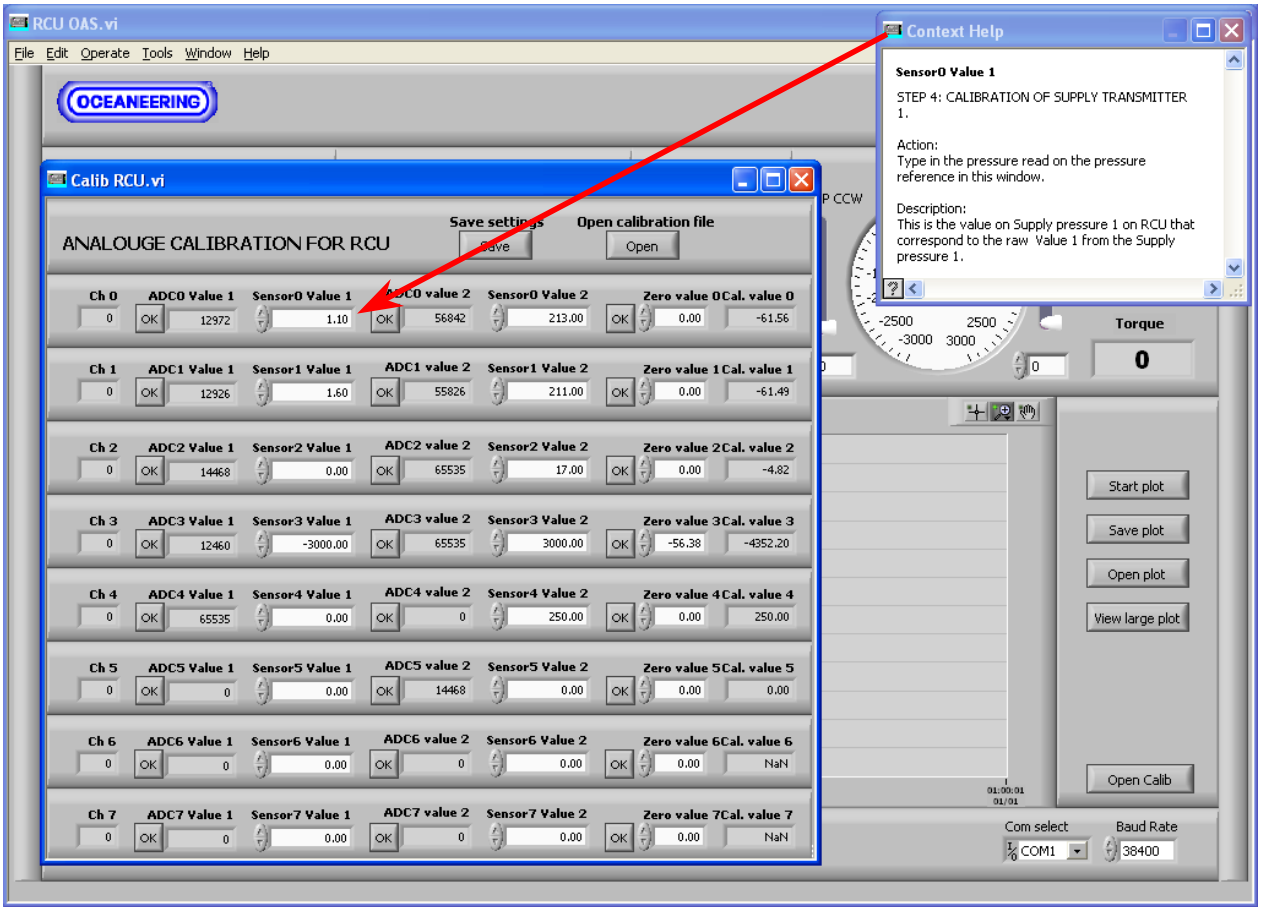
“STEP 3: CALIBRATION OF SUPPLY TRANSMITTER 1.

Action: None

Description: This is the raw Value 1 from the Supply pressure 1.”

Supply Pressure 1 Calibration step 4

Figure 20 STEP 4: CALIBRATION OF SUPPLY TRANSMITTER 1



Moving the cursor over the relevant object, the “context help” displays as follows (see picture):

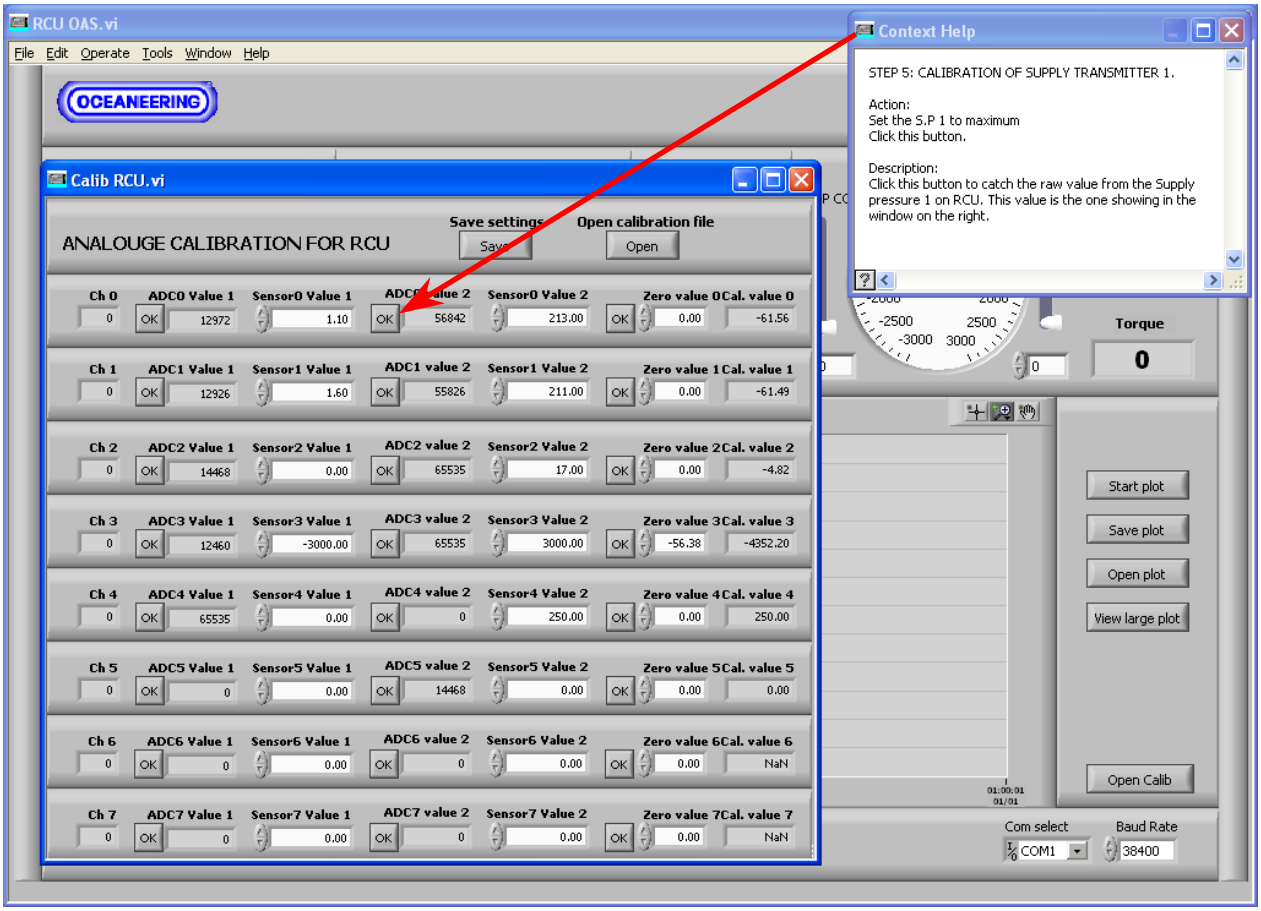
“STEP 4: CALIBRATION OF SUPPLY TRANSMITTER 1.

Action: Type in the pressure read on the pressure reference in this window.

Description: This is the value on Supply pressure 1 on RCU that correspond to the raw Value 1 from the Supply pressure 1.”

Supply Pressure 1 Calibration step 5

Figure 21 STEP 5: CALIBRATION OF SUPPLY TRANSMITTER 1



Moving the cursor over the relevant object, the “context help” displays as follows (see figure):

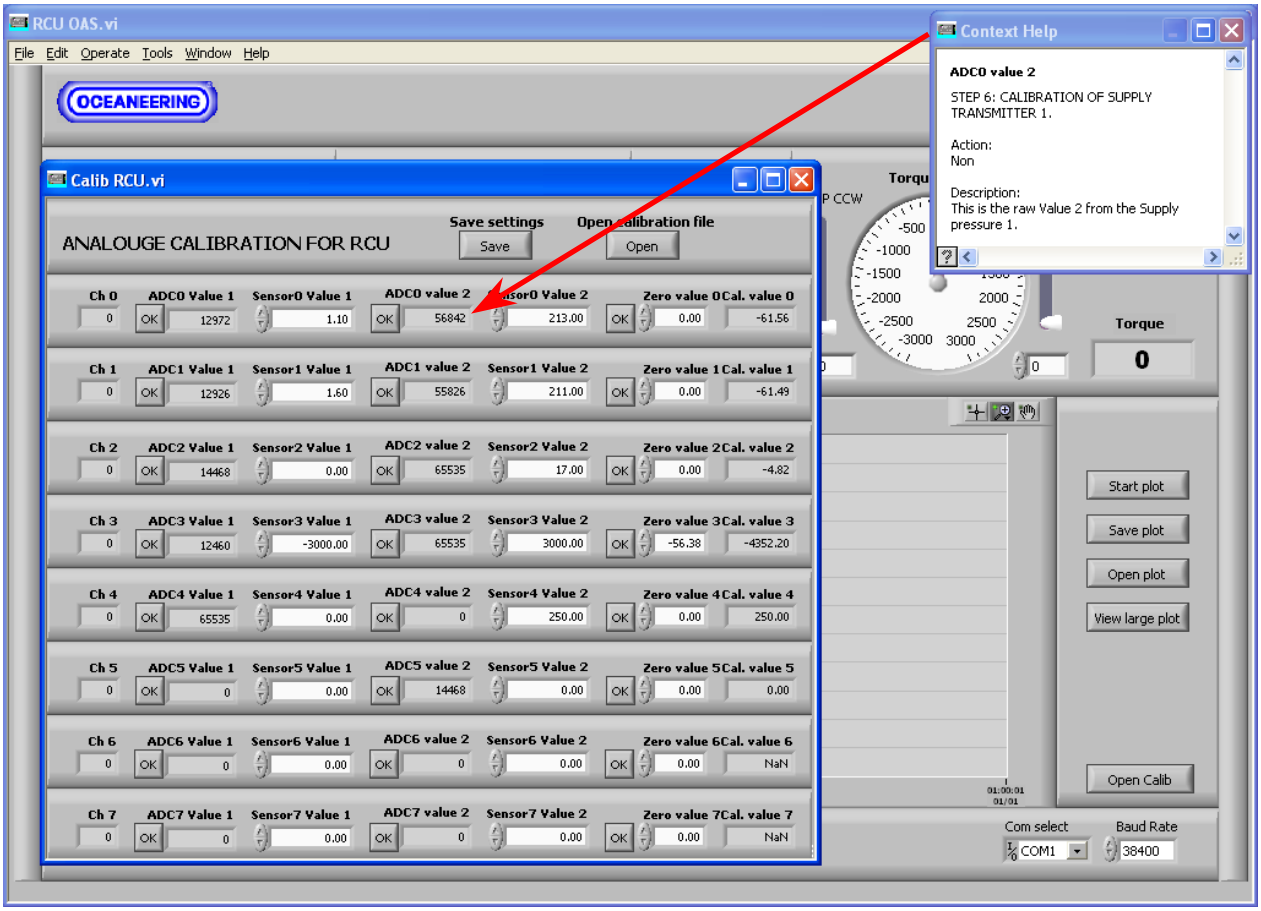
“STEP 5: CALIBRATION OF SUPPLY TRANSMITTER 1.

Action: Set the SP1 to maximum. Click this button.

Description: Click this button to catch the raw value from the Supply pressure 1 on RCU. This value is the one showing in the window on the right.”

Supply Pressure 1 Calibration step 6

Figure 22 STEP 6: CALIBRATION OF SUPPLY TRANSMITTER 1



Moving the cursor over the relevant object, the “context help” displays as follows (see picture):

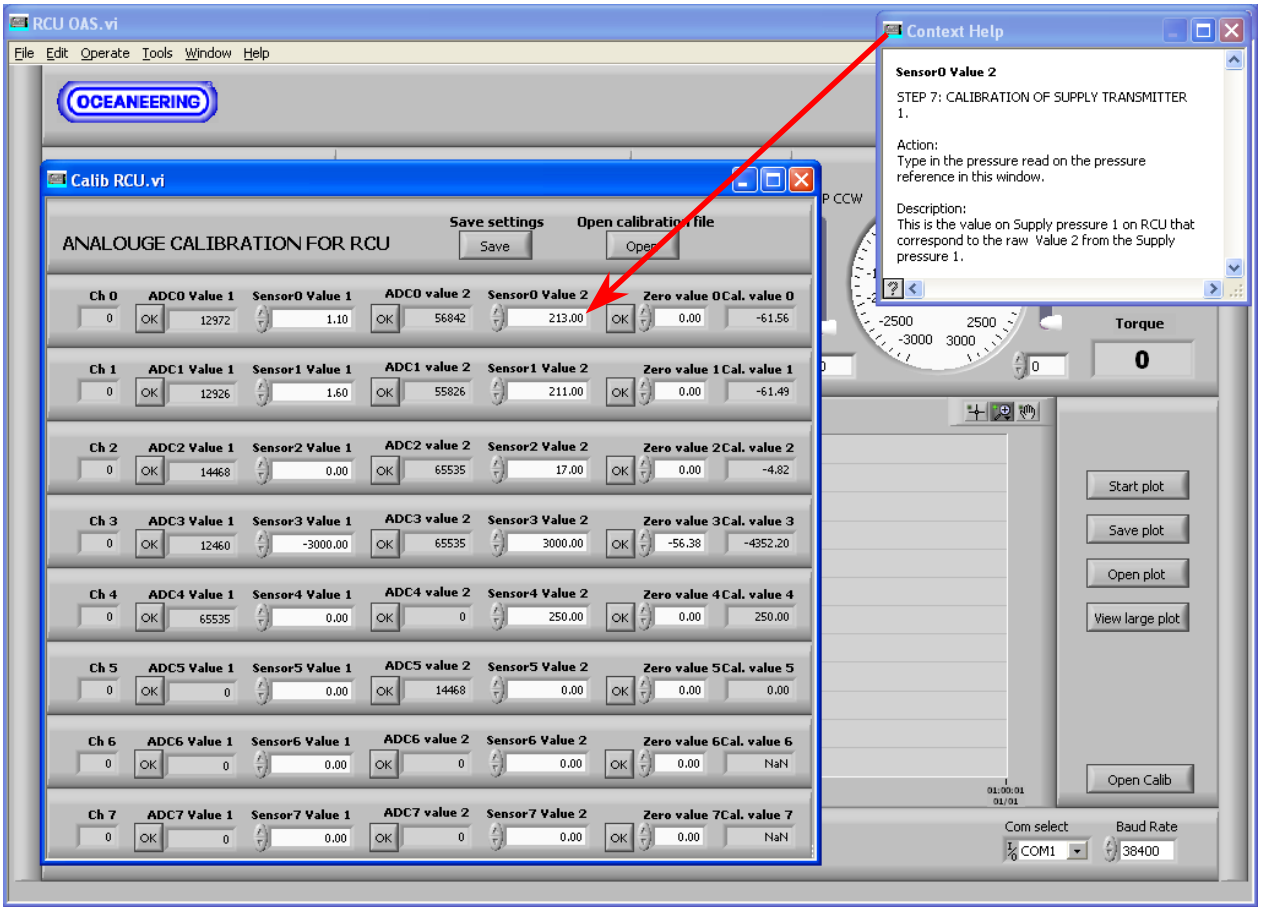
“STEP 6: CALIBRATION OF SUPPLY TRANSMITTER 1.

Action: None

Description: This is the raw value 2 from the Supply pressure 1.”

Supply Pressure 1 Calibration step 7

Figure 23 STEP 7: CALIBRATION OF SUPPLY TRANSMITTER 1



Moving the cursor over the relevant object, the “context help” displays as follows (see picture):

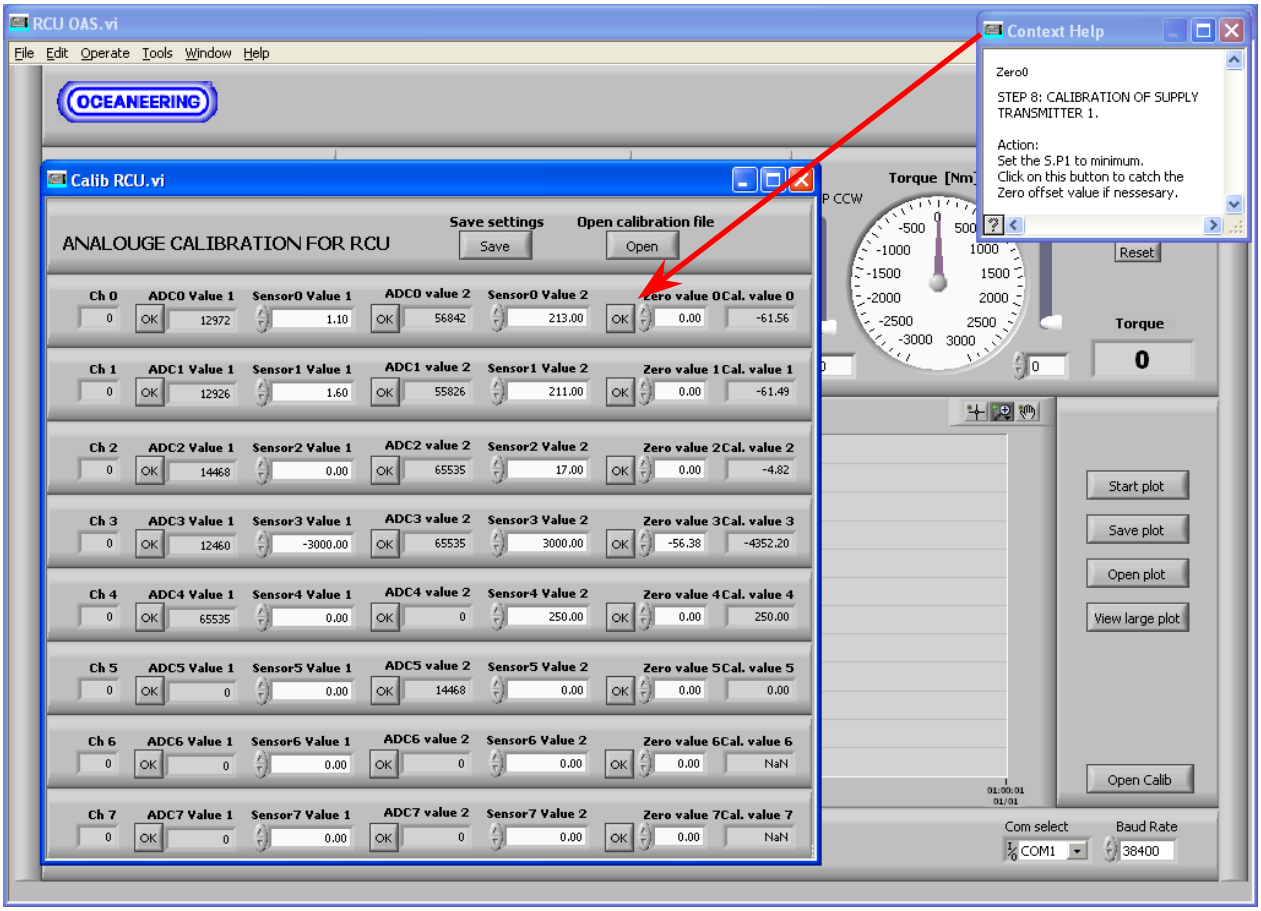
“STEP 7: CALIBRATION OF SUPPLY TRANSMITTER 1.

Action: Type in the pressure read on the pressure reference in this window.

Description: This is the value on Supply pressure 1 on RCU that correspond to the raw value 2 from the Supply pressure 1.”

Supply Pressure 1 Calibration step 8

Figure 24 STEP 8: CALIBRATION OF SUPPLY TRANSMITTER 1



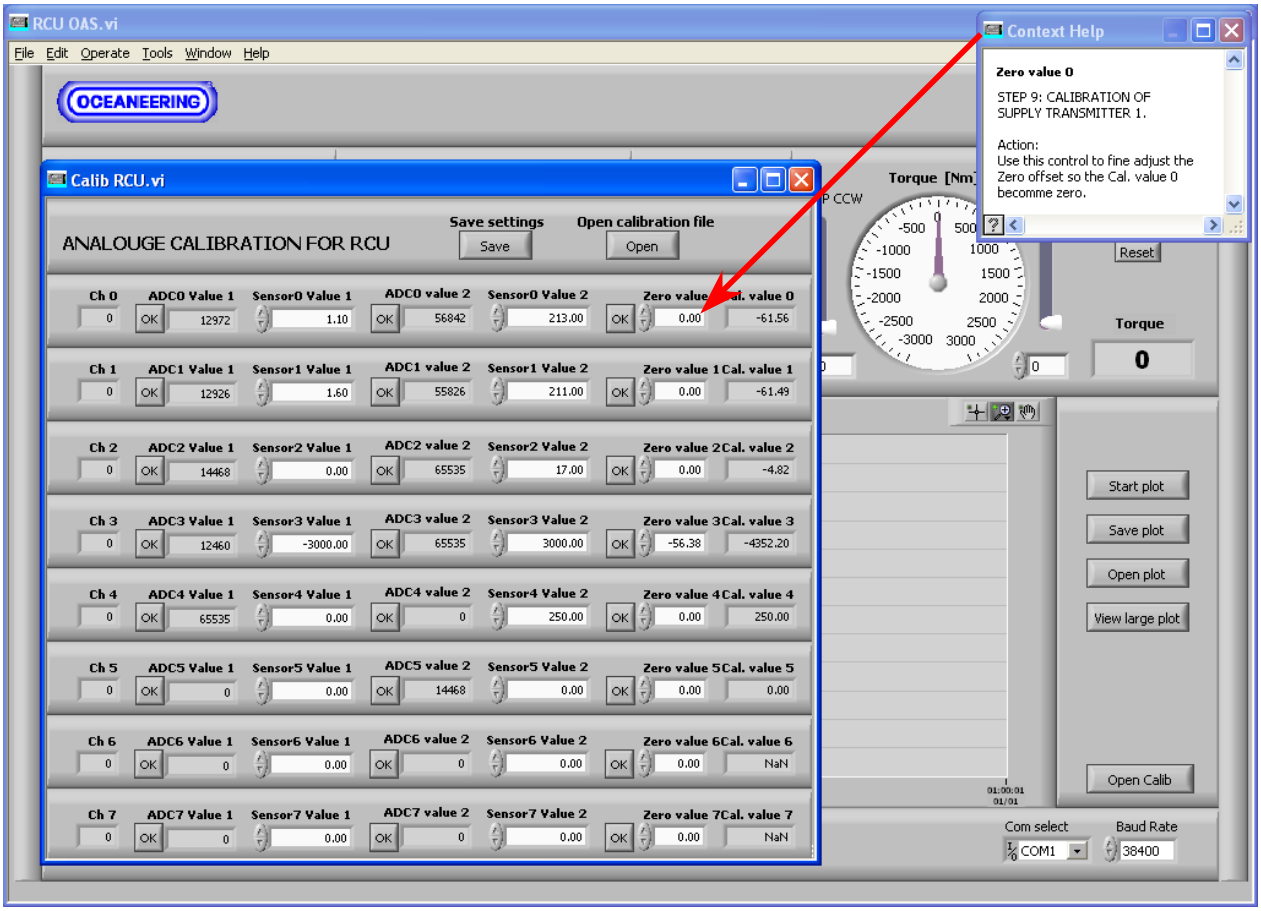
Moving the cursor over the relevant object, the “context help” displays as follows (see picture):

“STEP 8: CALIBRATION OF SUPPLY TRANSMITTER 1.

Action: Set the S.P1 to minimum. Click on this button to catch the Zero offset value if necessary.”

Supply Pressure 1 Calibration step 9

Figure 25 STEP 9: CALIBRATION OF SUPPLY TRANSMITTER 1



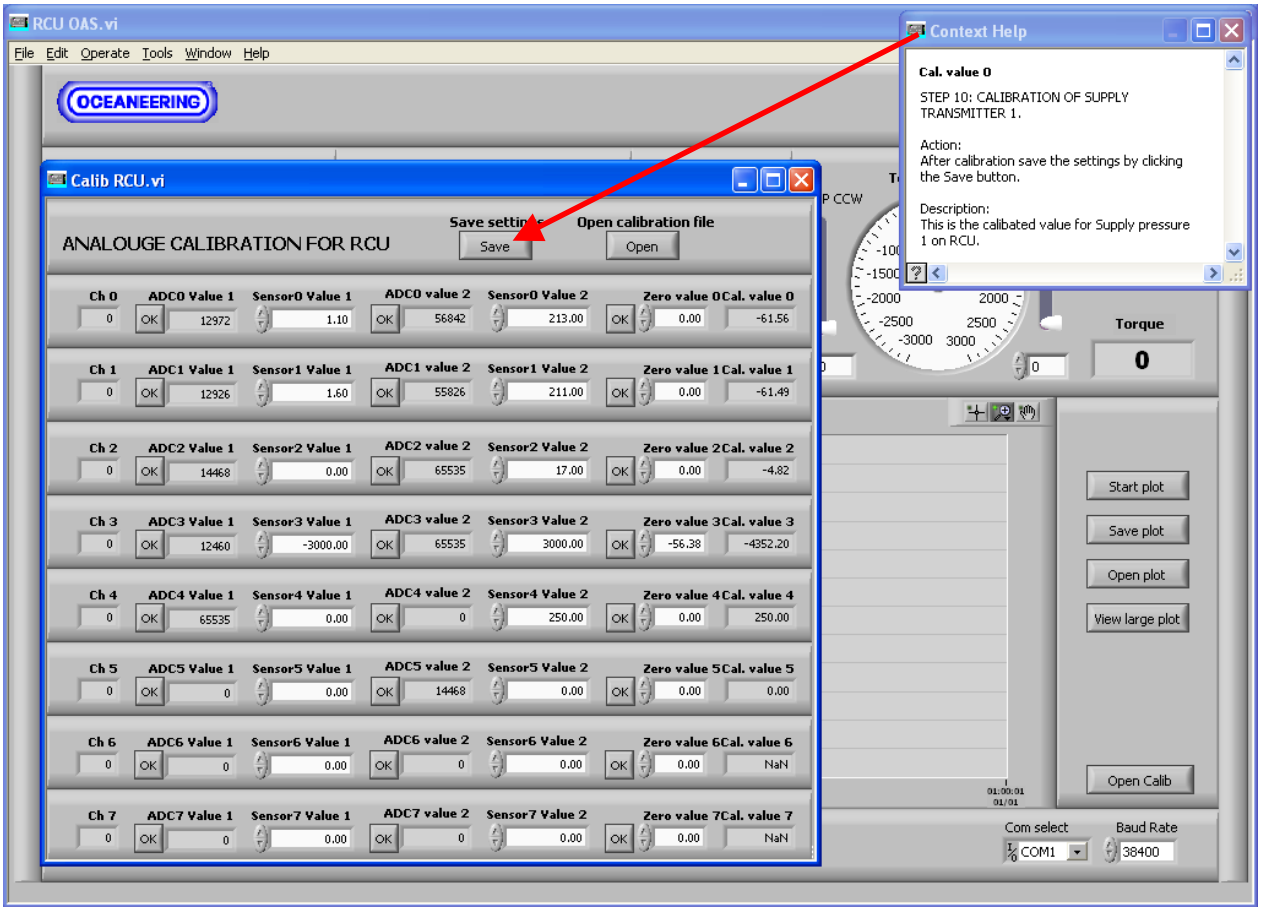
Moving the cursor over the relevant object, the “context help” displays as follows (see picture):

“STEP 9: CALIBRATION OF SUPPLY TRANSMITTER 1.

Action: Use this control to fine adjust the Zero offset so the Cal. value becomes zero.”

Supply Pressure 1 Calibration step 10

Figure 26 STEP 10: CALIBRATION OF SUPPLY TRANSMITTER 1



Moving the cursor over the relevant object, the “context help” displays as follows (see picture):

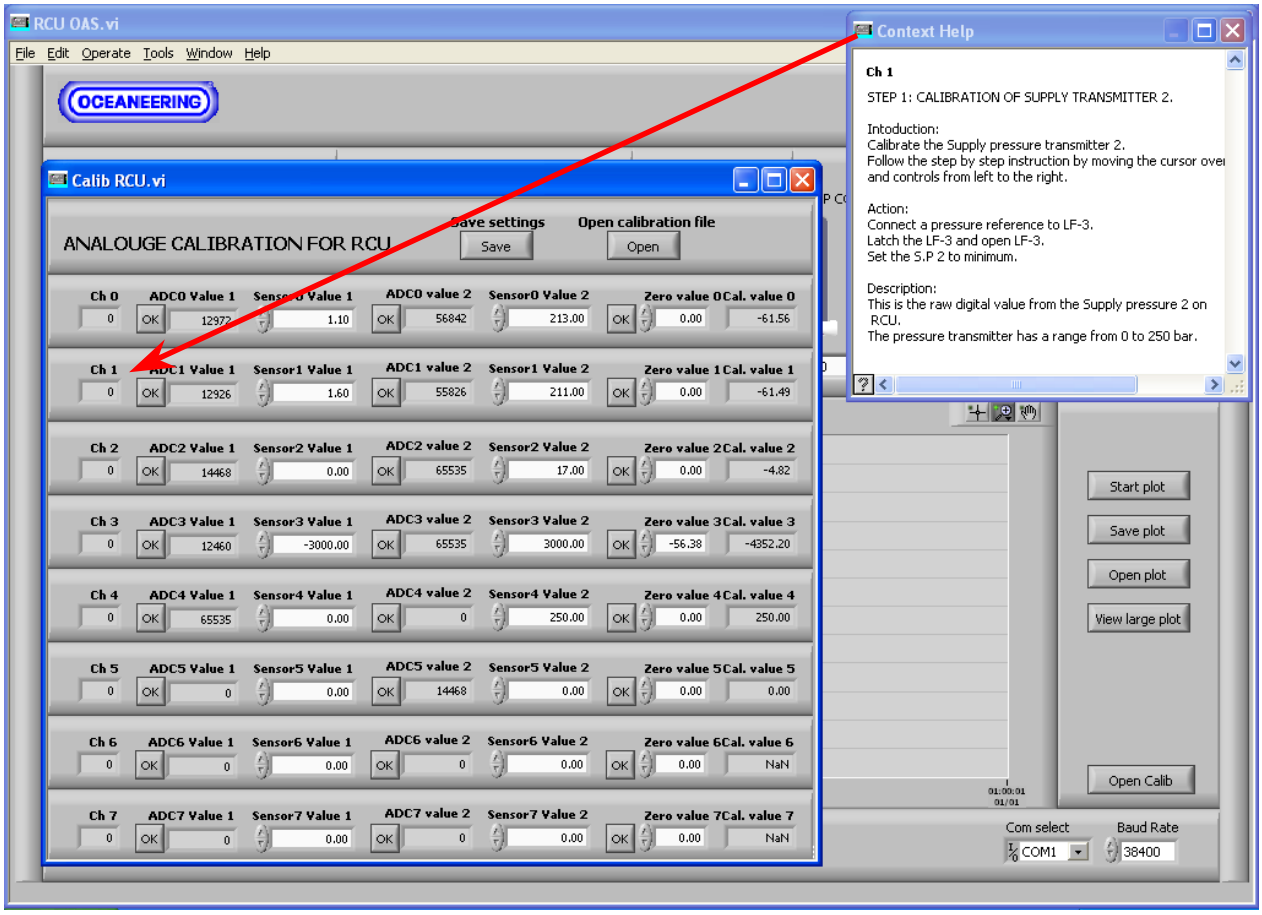
“STEP 10: CALIBRATION OF SUPPLY TRANSMITTER 1.

Action: After calibration save the settings by clicking the Save button.

Description: This is the calibrated value for Supply pressure 1 on RCU.”

Supply Pressure 2

Figure 27 STEP 1: CALIBRATION OF SUPPLY TRANSMITTER 2.



NOTE THE CALIBRATION STEPS FOR PRESSURE 2 IS THE SAME AS FOR PRESSURE 1

Moving the cursor over the relevant object, the “context help” displays as follows (see picture):

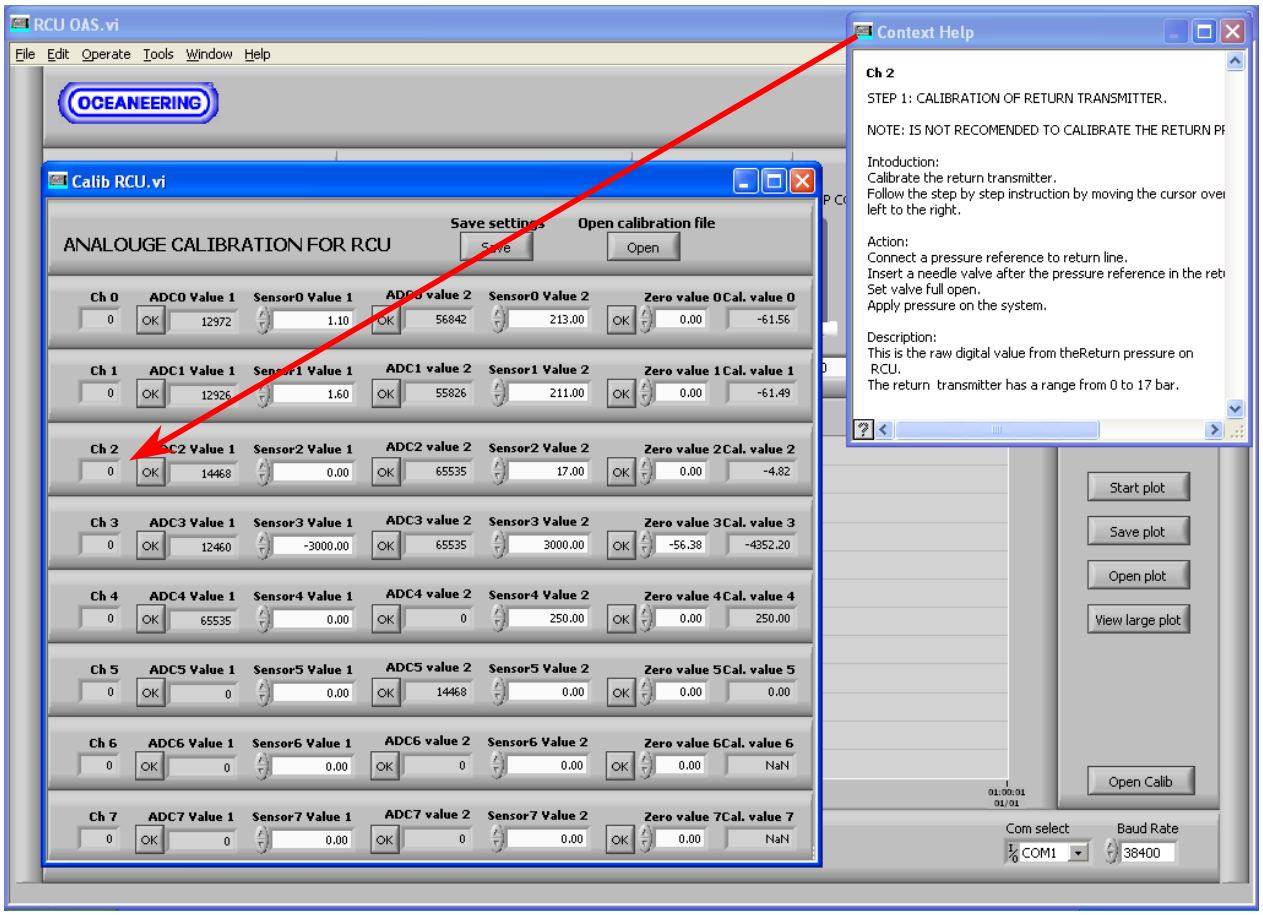
STEP 1: CALIBRATION OF SUPPLY TRANSMITTER 2.

Introduction: Calibrate the Supply pressure transmitter 2. Follow the step by step instruction by moving the cursor over the buttons and controls from left to the right. Action: Connect a pressure reference to LF-3. Latch the LF3 and open LF3. Set the SP to minimum.

Description: This is the raw digital value from the Supply pressure 2 on the RCU. The pressure transmitter has a range from 0 to 250 bar.”

Return Pressure

Figure 28 STEP 1: CALIBRATION OF RETURN TRANSMITTER



NOTE THE CALIBRATION STEPS FOR RETURN PRESSURE IS THE SAME AS FOR PRESSURE 1

Moving the cursor over the relevant object, the “context help” displays as follows (see picture):

“STEP 1: CALIBRATION OF RETURN TRANSMITTER.

NOTE: IT IS NOT RECOMMENDED TO CALIBRATE THE RETURN PRESSURE TRANSMITTER.

Introduction: Calibrate the return transmitter. Follow the step-by-step instruction by moving the cursor over the buttons and controls from left to the right.

Action: Connect a pressure reference to return line. Insert a needle valve after the pressure reference in the return line. Set valve full open.

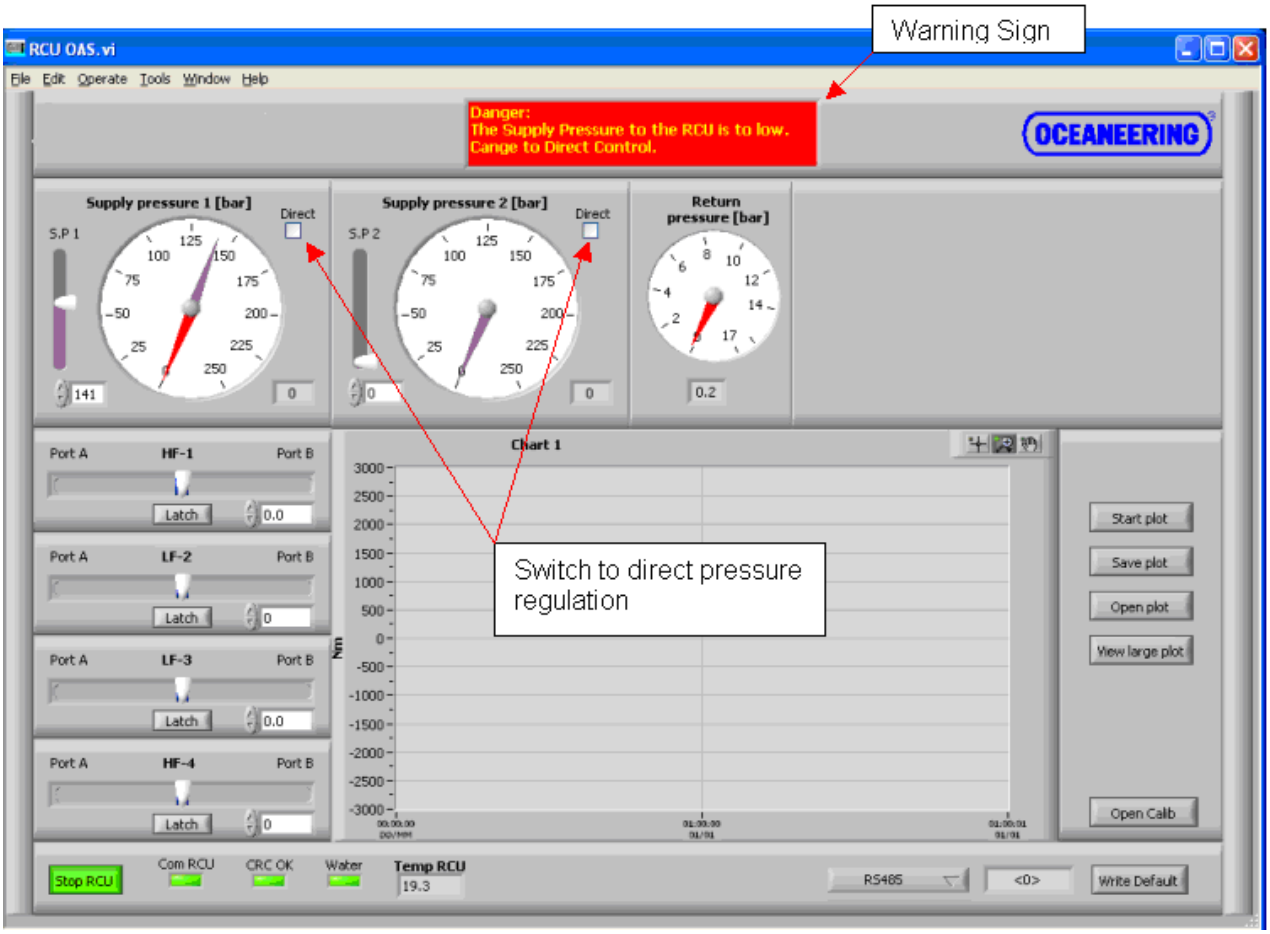
Apply pressure on the system.

Description: This is the raw digital value from the return pressure on the RCU. The return transmitter has a range from 0 to 17 bar.

5.5 Alarm / Warning

When operating RCU in active pressure regulation, a Warning sign will arise in the operation window if supply pressure is below set pressure. This can be caused by using a under dimensioned HPU in connection with RCU. It is recommended to switch to direct pressure regulation when alarm flag arise.

Figure 29 Alarm/Warning



If still using active pressure regulation mode when alarm flag is present, damage to connected tools (torque tool) and equipment (sub sea valves) to be operated can be done.

The RCU is equipped with Water alarm and sensing of oil temperature

- Water alarm flag turns red with water ingress
- Oil temperature is not recommended to exceed 50°C
- Warning flag for DLB button on Black Box Modem.(Not shown in picture)

6.0 USER HELP MENU, TORQUE TOOL HOOK UP AGAINST RCU.

Using Torque Tool with Torque feedback with the RCU: Connect the supply/return lines from the Torque tool to the dedicated torque tool valve; HF1 and the Torque Tool drain line to the “tank” on RCU valve block. Connect latch line to an open centre valve (LF3) on RCU. Connect the torque feedback / counter cable to “aux 1” connector on the RCU valve block. By connecting the torque tool this way enables functions as follows.

Warning:

Always use HF1 valve in use with Oceaneering Torque Tool. This valve is the dedicated Torque Tool valve that provides the functionality as shout down the hydraulic supply when achieving the preset torque limit.

6.1 Torque Setting and monitoring

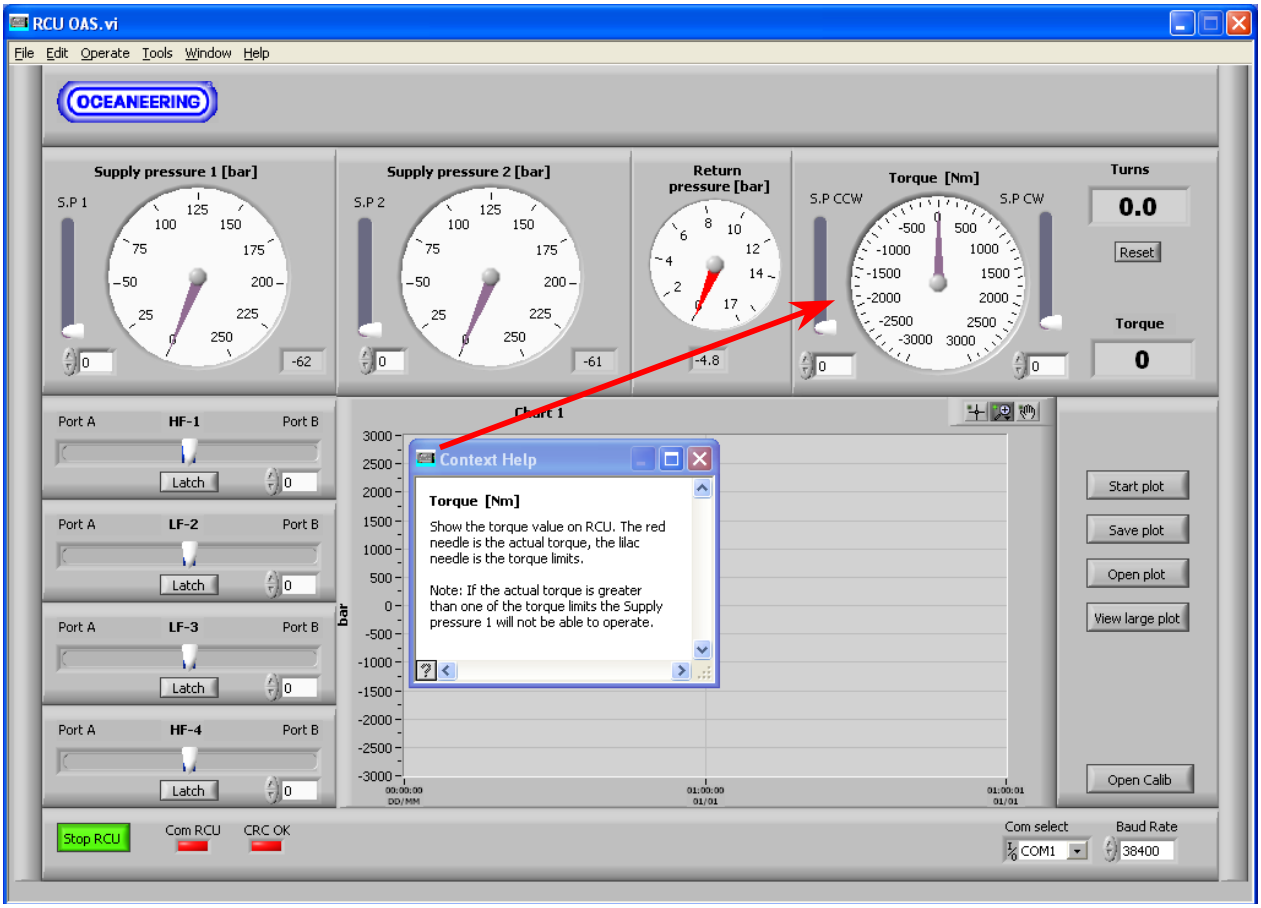
The Torque Control Section allows adjustment of the torque limit. A measured torque value above the torque limit will result in a reset of the hydraulic settings

The Torque Control Section shows:

- 2 slides to increase/decrease max torque limit value.
- An arrow showing the max torque value in CCW direction.
- An arrow showing the max torque value in CW direction.
- An arrow showing the current torque value.
- Counter that indicates turns of Torque Tool in CW/CCW direction
- R.P.M. monitoring that indicates Speed of Torque Tool. In rounds pr.minute.

Torque Monitoring

Figure 30 Torque monitoring



Moving the cursor over the relevant object, the “context help” displays as follows (see picture):

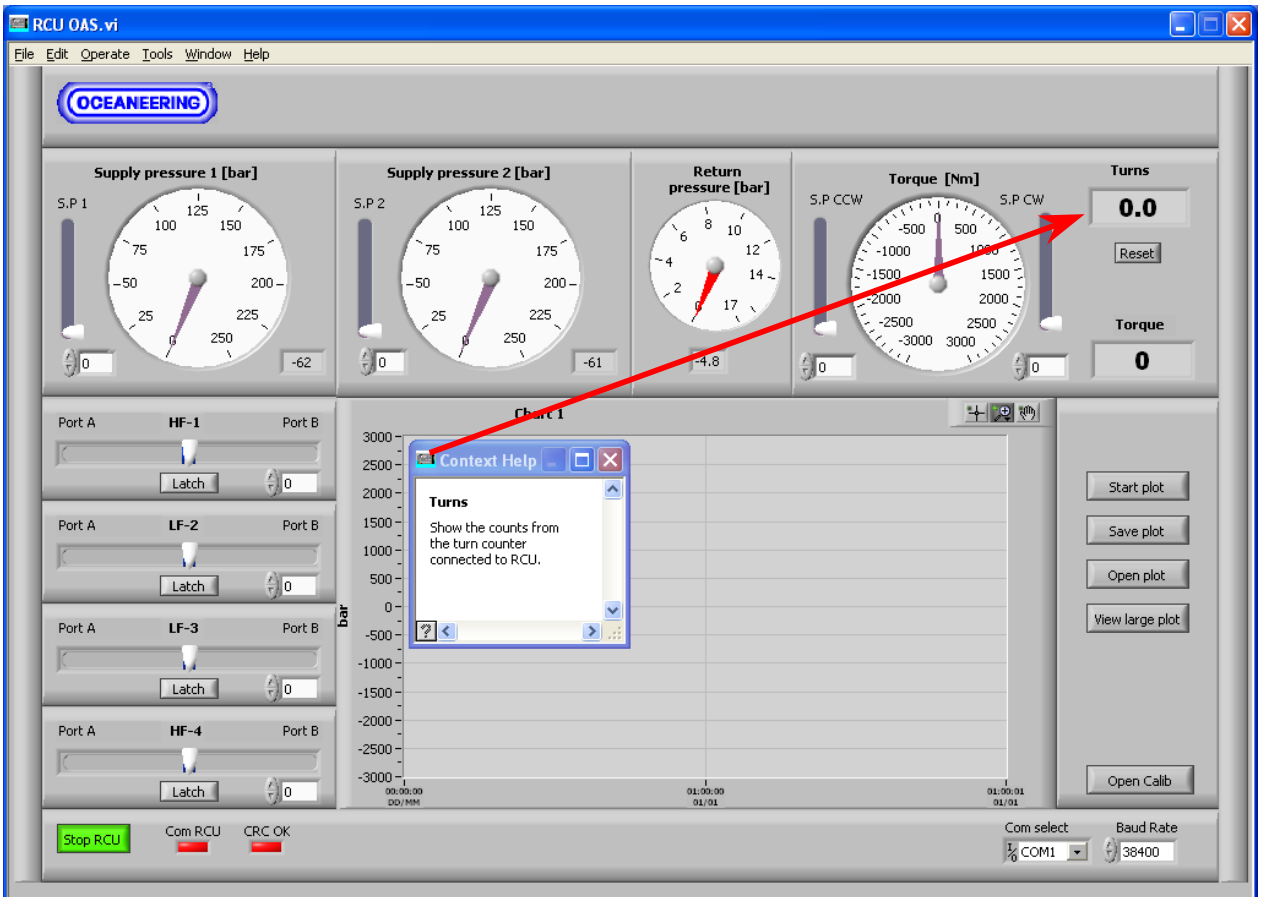
“Show the torque value on the RCU. The red needle is the actual torque; the lilac needle is the torque limit. Note: If the actual torque is greater than the torque limit, the supply pressure 1 will not be able to operate.”

NOTE:

Torque monitoring display will only show if a Oceaneering Torque Tool with torque feed back and counter is connected to the RCU.

Turn Counter

Figure 31 Show the counts from the turn counter connected to the RCU



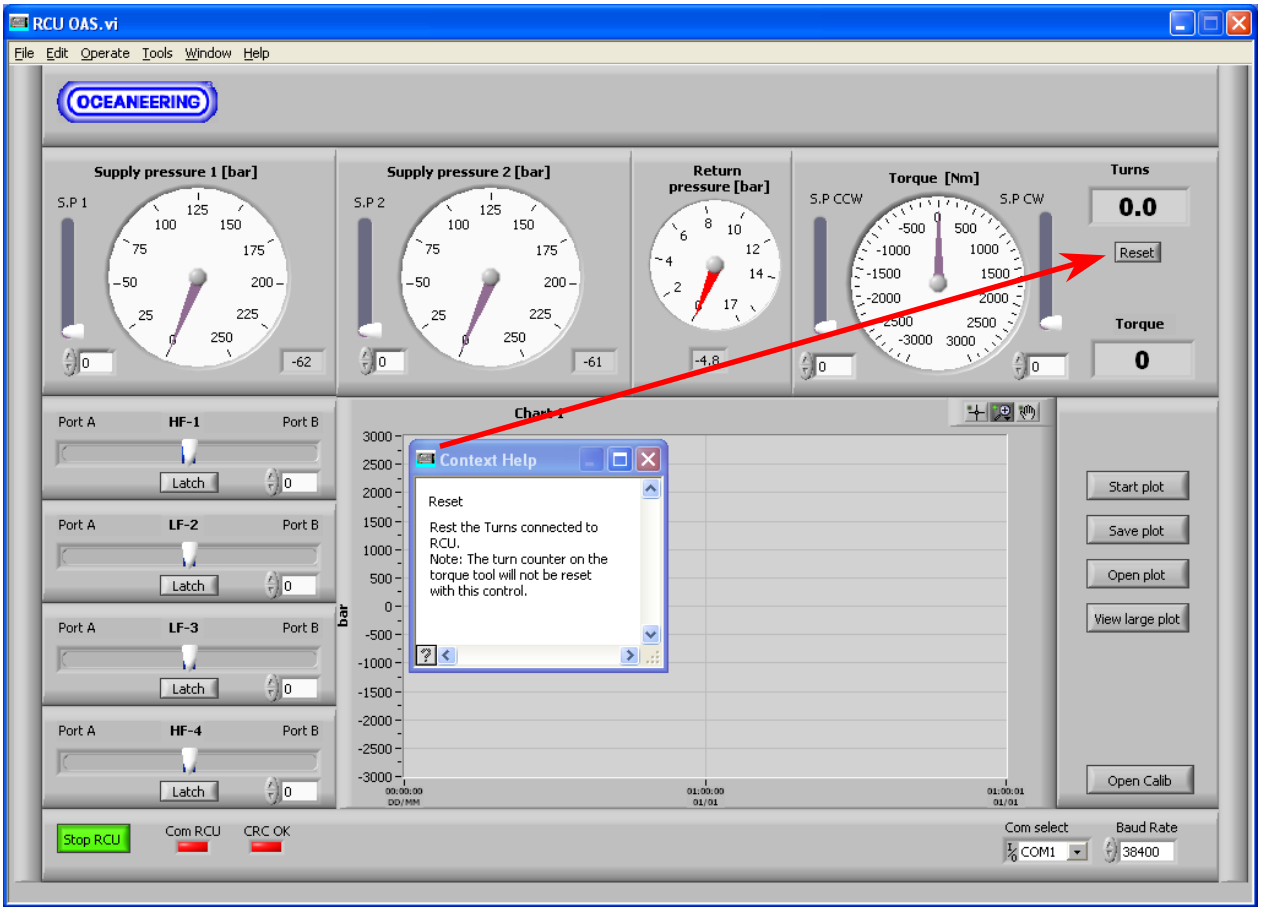
The Tool Turns section displays the output from the tool turns counter, if any. The Reset button resets the turn counter on the RCU. The torque tool's turn counter is not reset.

Moving the cursor over the relevant object, the “context help” displays as follows (see picture):

“Show the counts from the turn counter connected to the RCU.”

Turn Counter Reset

Figure 32 Resets the Turns connected to the RCU



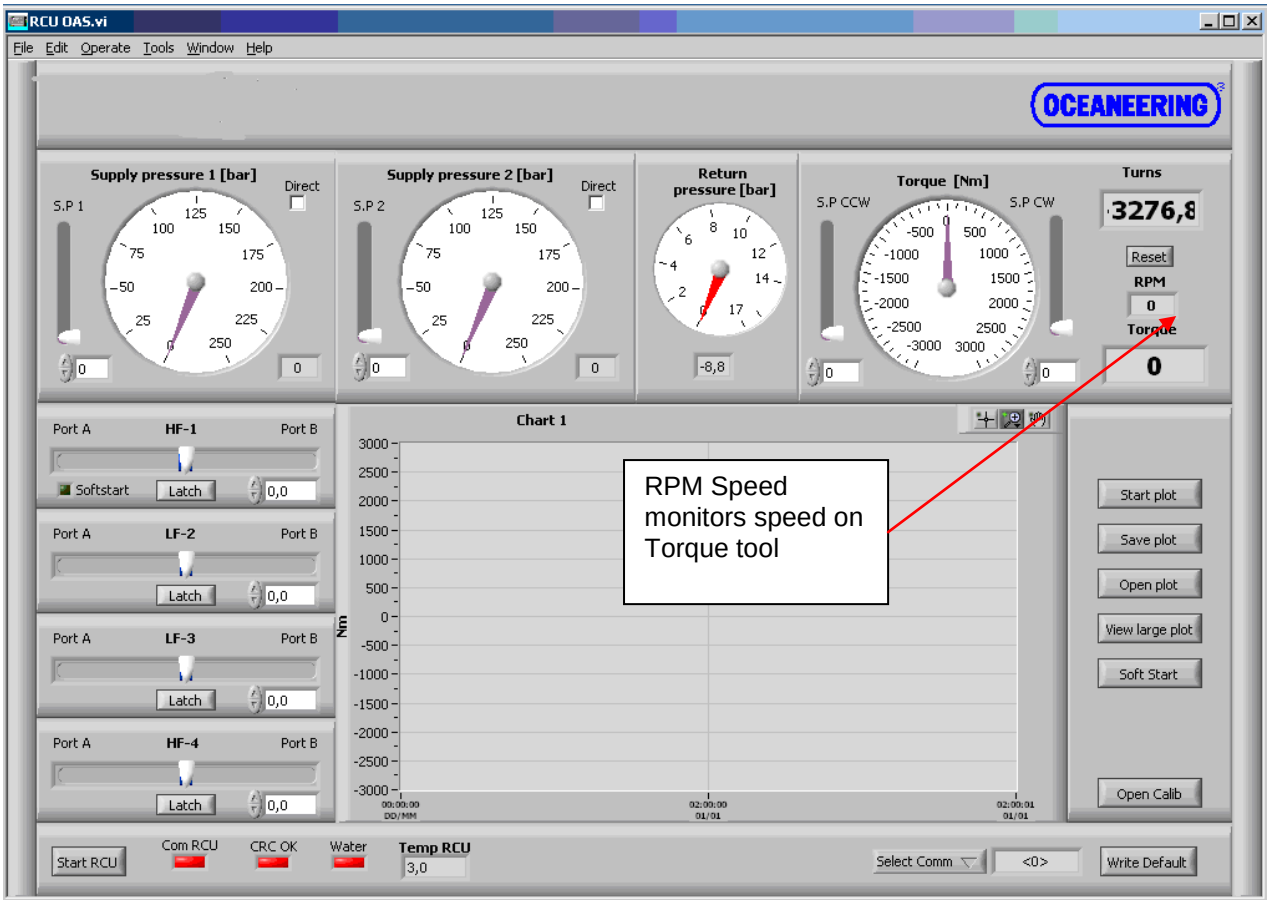
Moving the cursor over the relevant object, the “context help” displays as follows (see picture):

“Resets the Turns connected to the RCU.

NOTE: THE TURN COUNTER ON THE TORQUE TOOL WILL NOT BE RESET WITH THIS CONTROL.”

RPM Speed on Torque Tool

Figure 33 RPM speed on Torque Tool

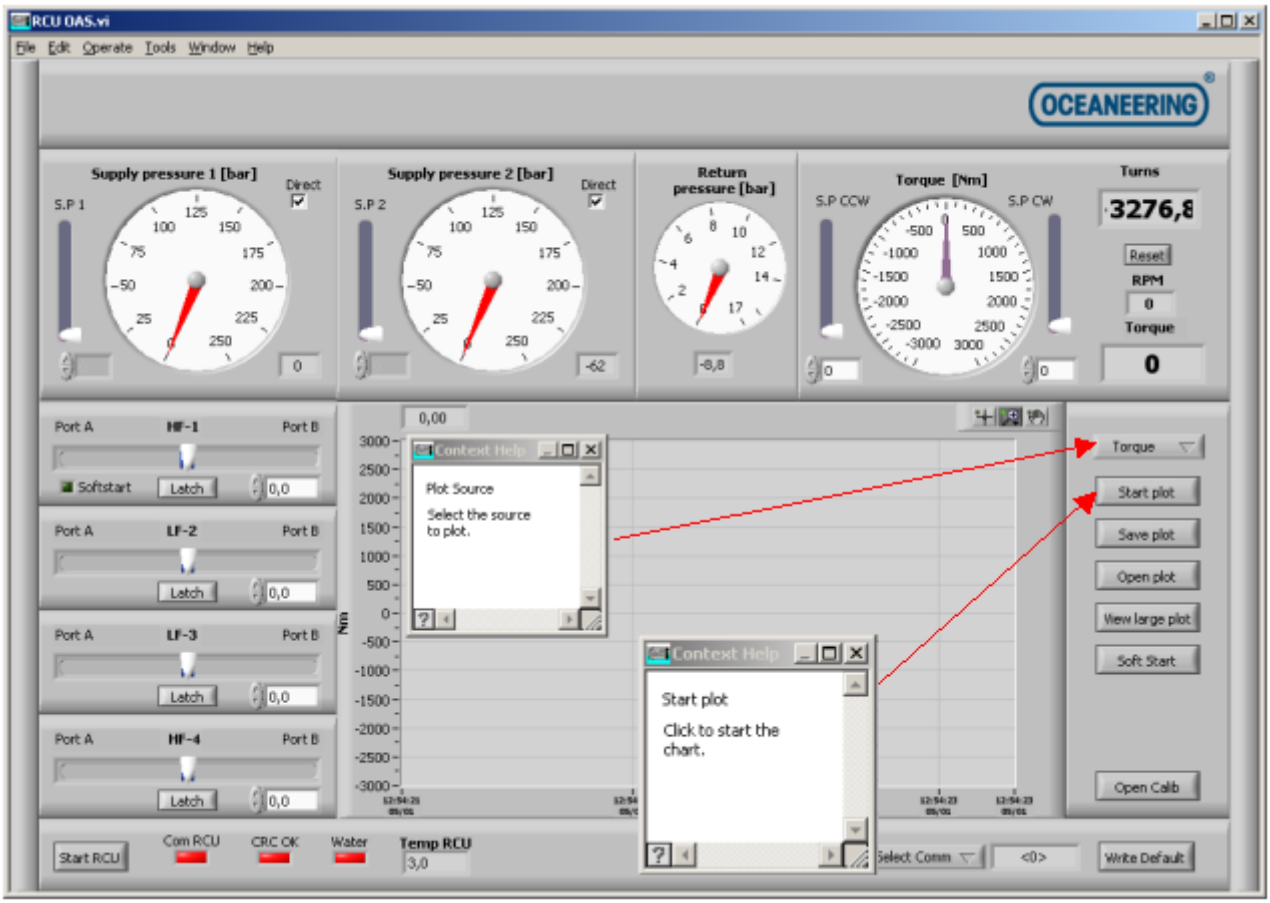


RPM Speed, monitors speed you are using on torque tool.

6.2 Logging Features

Start Plot

Figure 34 Start plot



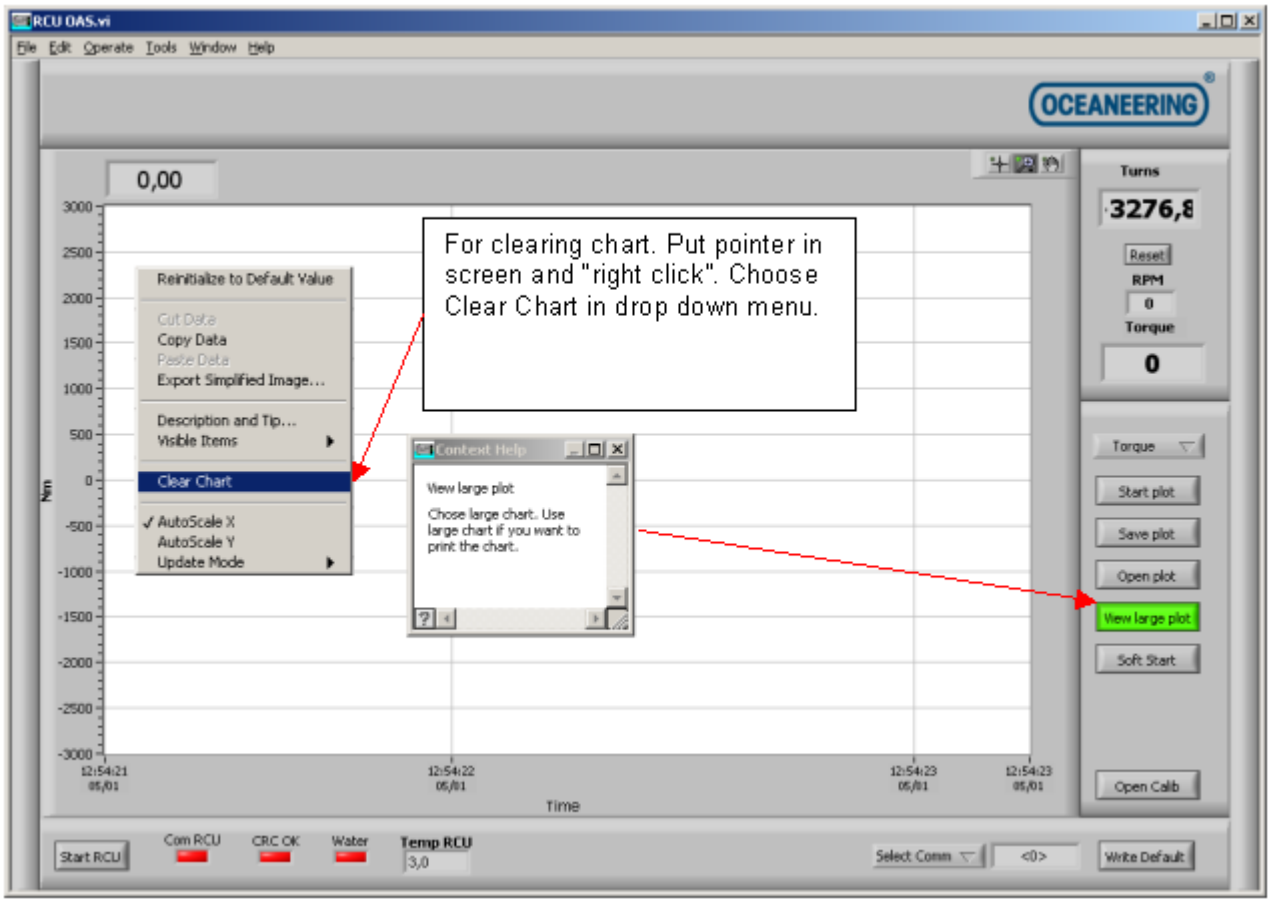
This function enables logging opportunities of the actual torque when operating the torque tool

As an option the RCU can be equipped with a Back Seal test log feature. **See chapter 7**.

Moving the cursor over the relevant object, the “context help” displays as follows (see picture):

“Click to start the chart.”

Figure 35 Start plot



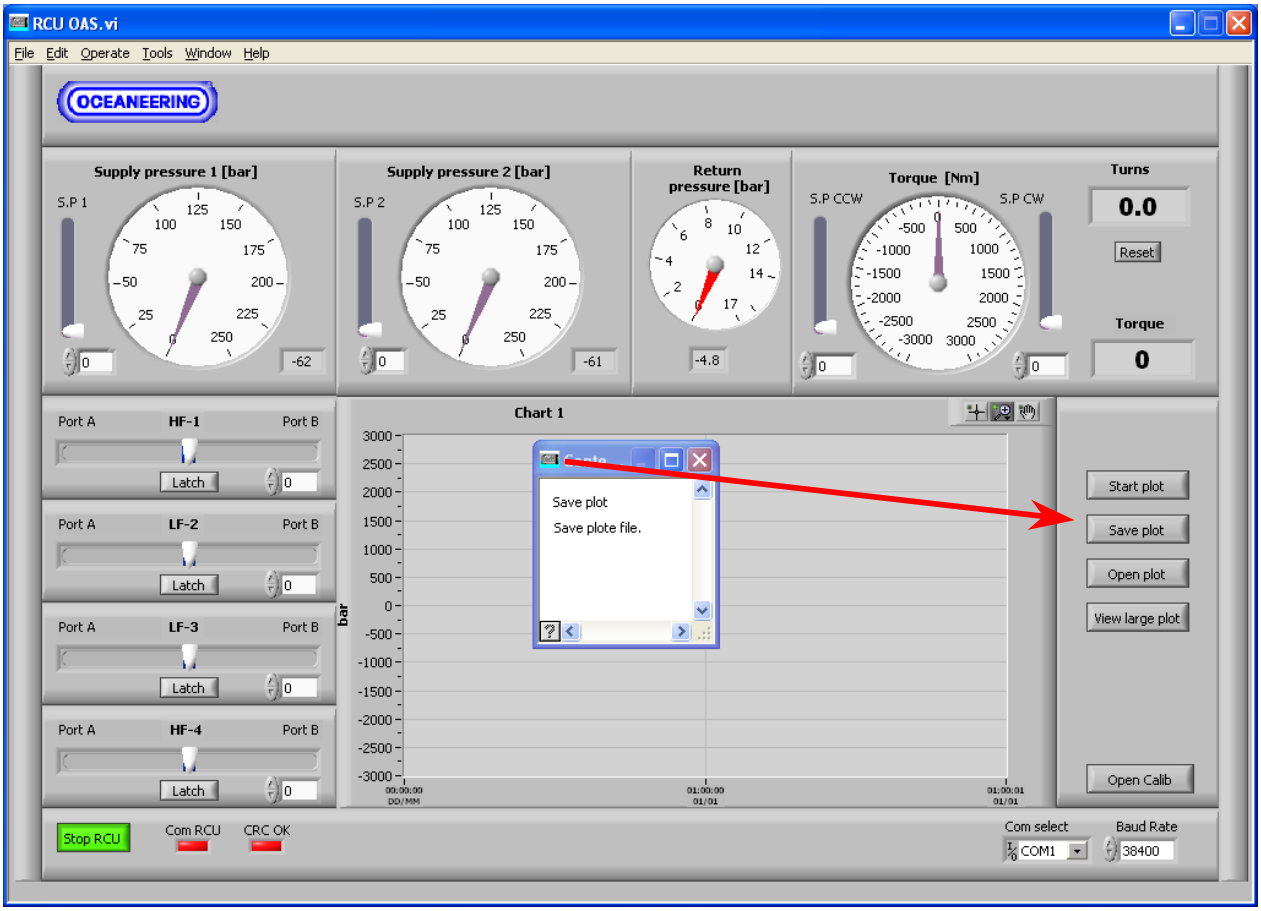
For max/minimizing the logging screen press “View large plot button”

For printing chart always use large plot mode.

For clearing the chart. Put pointer in screen and “right click”. Choose Clear Chart in drop down menu.

Saving of Logged Chart/Plot

Figure 36 Save plot



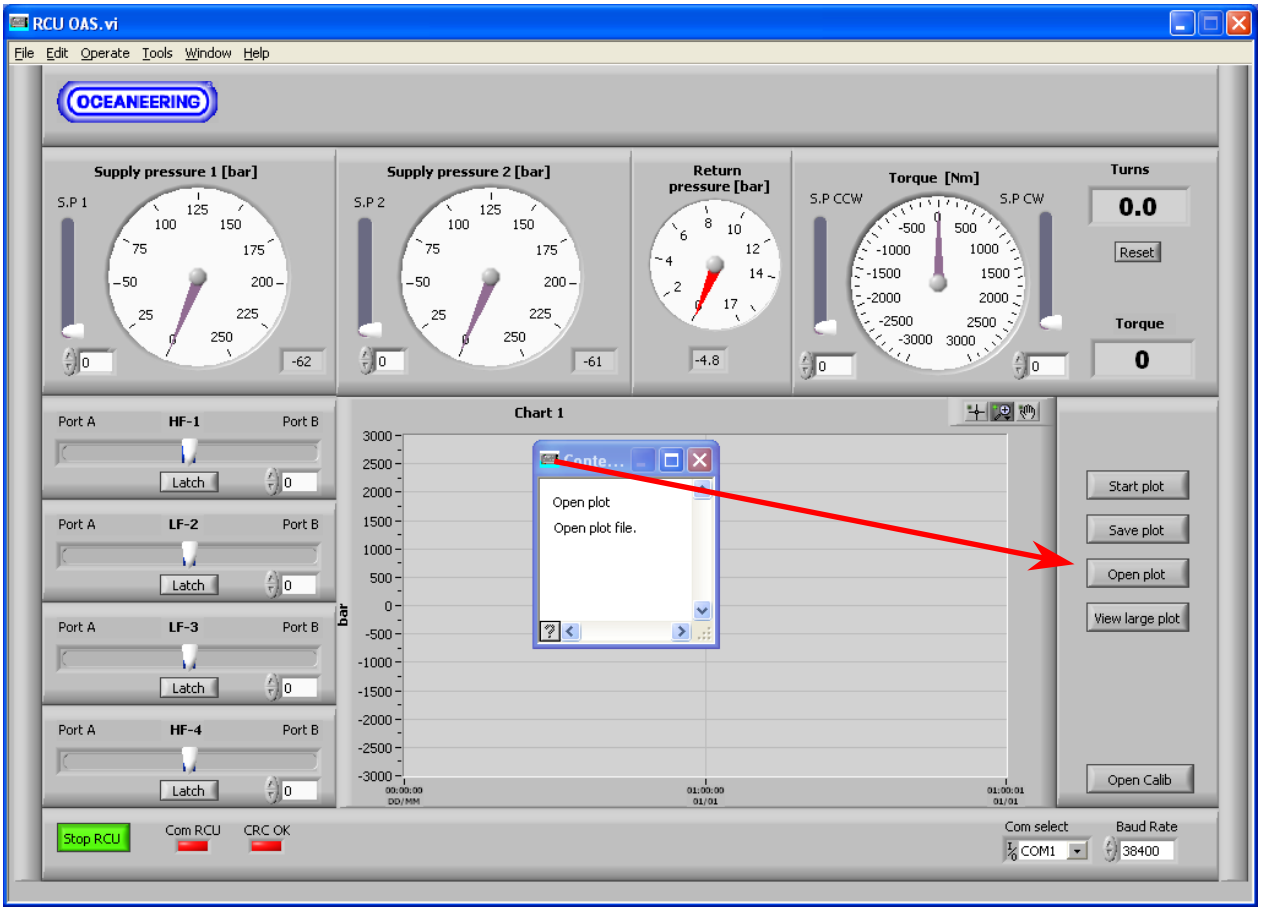
Moving the cursor over the relevant object, the “context help” displays as follows (see picture):

“Save plot file.”

Save plot; name the file, and where to save it.

Open saved Chart/Plot

Figure 37 Open plot file



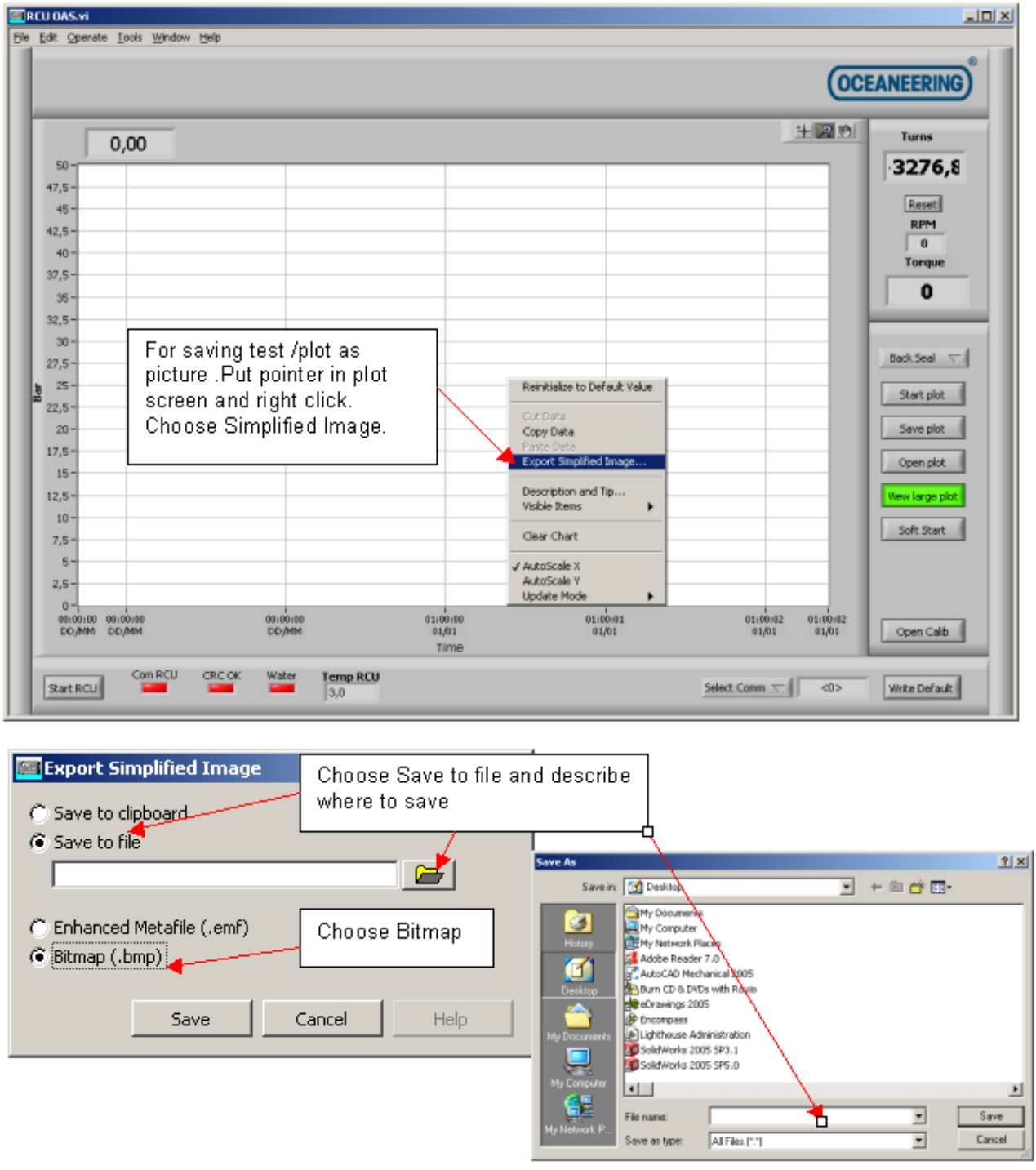
Moving the cursor over the relevant object, the “context help” displays as follows (see picture):

“Open plot file.”

If an earlier saved log file is wanted for viewing. Press “Open plot” button and describe what and where to be opened.

Save Plot as picture

Figure 38 Save Plot as a Picture



For saving test/plot as picture, this can be done by pointing in screen with pointer and “right click”.

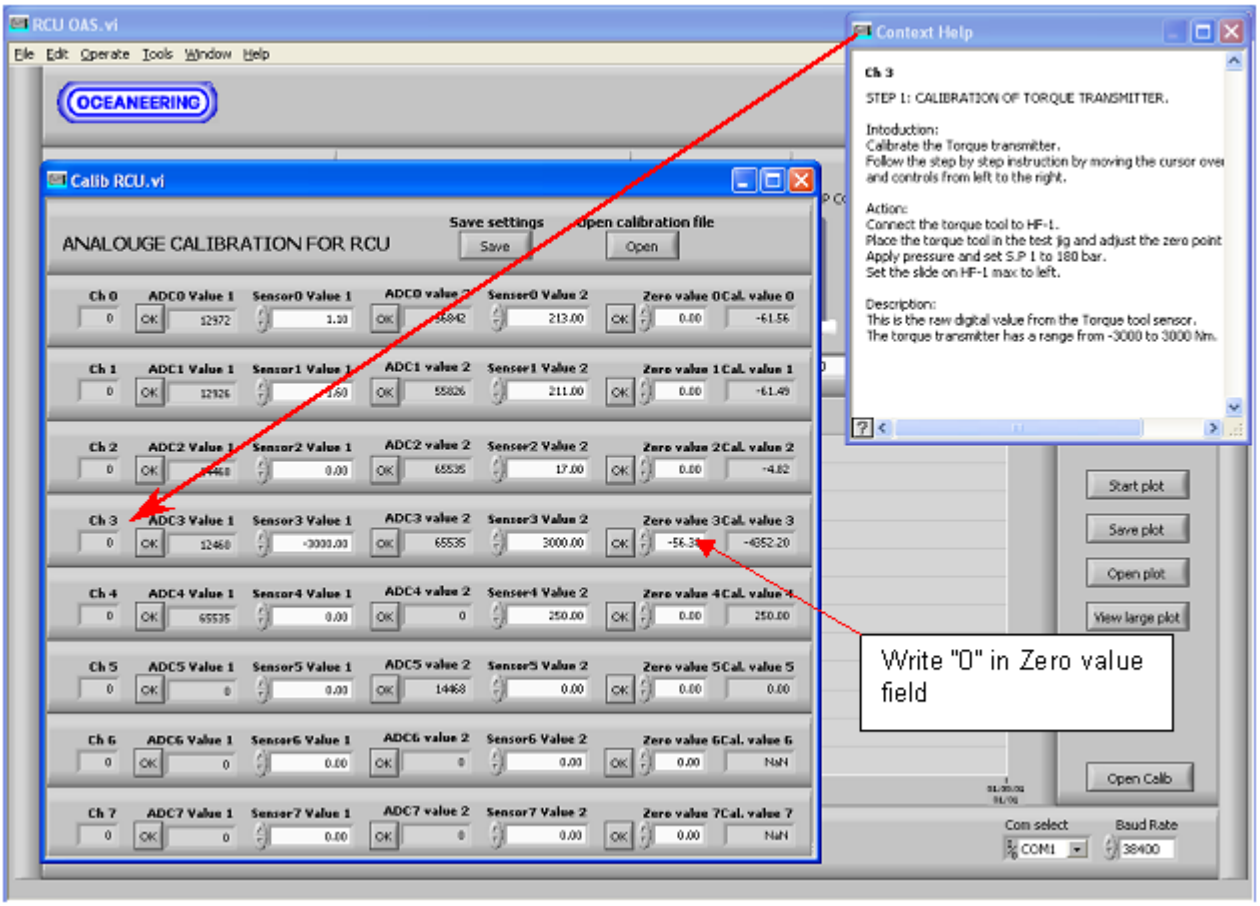
Choose simplified image and then tick off. Save to file and Bitmap. Describe where and what to save.

6.3 Torque Calibration

The torque tool consists of a 4-20mA torque feedback sensor. The torque sensors may differ from each other concerning zero point and gain. It might be necessary to calibrate the torque feedback from the tool, if the read out torque on the top side controller don't corresponds with the read outs from the test jig read out unit. Perform the following procedure for calibration of the torque.

- Connect the torque tool to the HF1 prop. valve on the RCU.
- Adjust the zero point on the test jig read out unit.
- Set the torque tool in the test jig. Verify TT to be loose in Test Jig.
- Open calib window.
- Adjust/Write "0" in **Zero Value** field in Ch.3 and press "OK" button.
- Operate TT in CCW direction (Enable Latch button)
- Adjust pressure to what is needed for the torque value you want to calibrate, close to operation torque on the specific valve.
- Verify value in Test-Jig read out unit.(CCW direction)
- Open calib window.
- Write test jig torque value in the calib window; Ch.3. Sensor 3 Value 1 field. (Make sure that the character "-"is typed before value.)
- Press ADC3 value1 "OK" button.
- Minimize calib window.
- Set pressure reg.1. To zero. Operate TT in CW direction
- Adjust pressure to what is needed for the same torque value calibrated in CCW direction.
- Verify value in Test-Jig read out unit. .(CW direction)
- Maximize calib window
- Write test jig torque value in calib window Ch.3. Sensor 3 Value 2 field.
- Press ADC3 value2 "OK" button.
- Press Save button in top of calib window, Choose Default TT file and press OK.
  NOTE: When Default RCU file occurs, press Cancel .
- Verify Torque readings on RCU laptop against Test Jig readings. Repeat calibration if necessary.

Figure 39 STEP 1: CALIBRATION OF TORQUE TRANSMITTER



Moving the cursor over the relevant object, the “context help” displays as follows (see picture):

“STEP 1: CALIBRATION OF TORQUE TRANSMITTER.

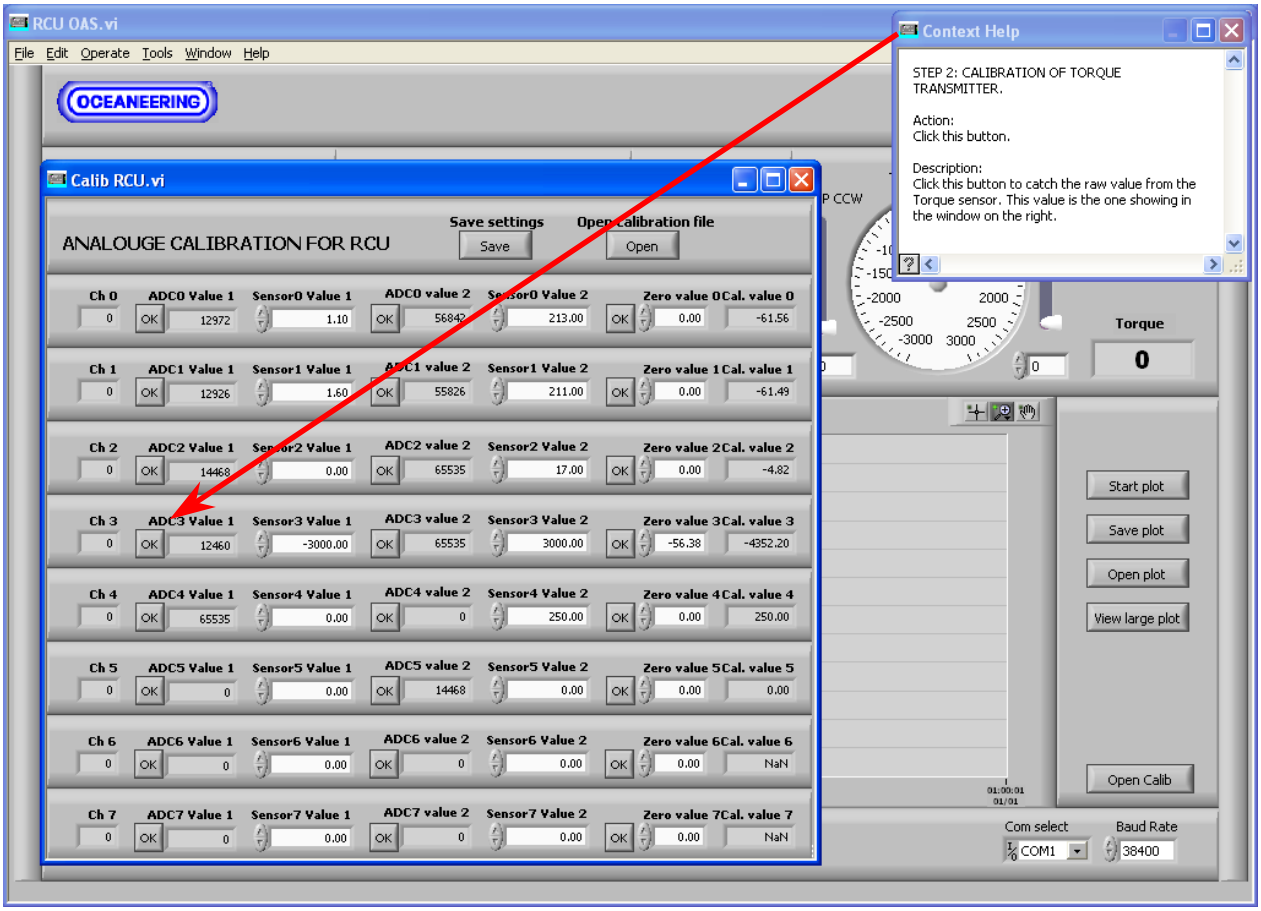
Introduction: Calibrating the Torque transmitter. Follow the step-by-step instruction by moving the cursor over the buttons and controllers from left to the right.

Action: Connect the torque tool to HF1. Place the torque tool in the test jig and adjust the test jig zero point. Write “0” in Zero value field Ch.3 and press “OK” button. Apply pressure and set SP1 to 180 bar. Set the slide on HF1 max to left.

Description: This is the raw digital value from the Torque tool sensor. The torque transmitter has a range from -3000 to 3000 Nm.”

Torque Calibration step 2

Figure 40 STEP 2: CALIBRATION OF TORQUE TRANSMITTER



Moving the cursor over the relevant object, the “context help” displays as follows (see picture):

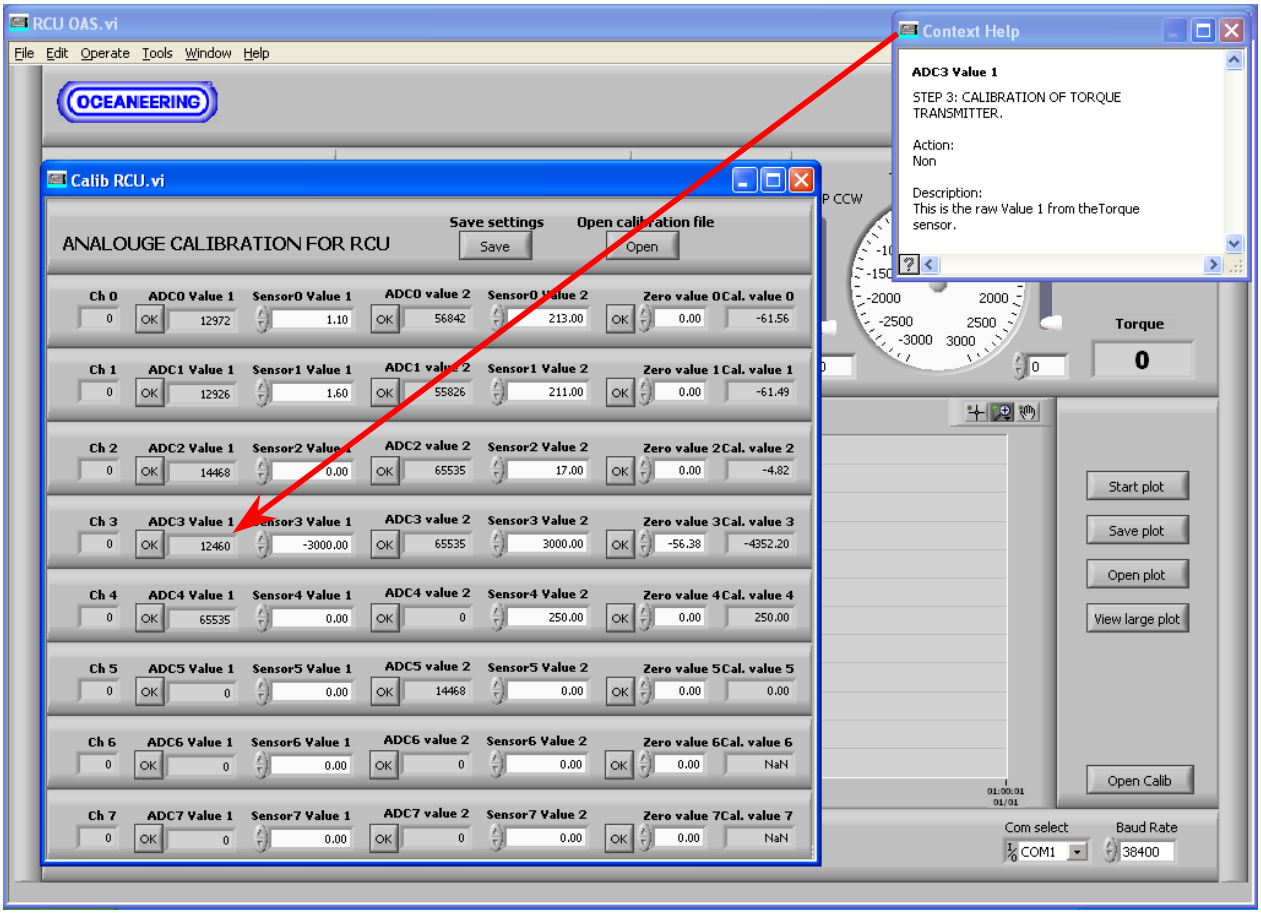
“STEP 2: CALIBRATION OF TORQUE TRANSMITTER.

Action: Click this button.

Description: Click this button to catch the raw value from the Torque sensor. The value is the one showing in the window on the right.”

Torque Calibration step 3

Figure 41 STEP 3: CALIBRATION OF TORQUE TRANSMITTER



Moving the cursor over the relevant object, the “context help” displays as follows (see picture):

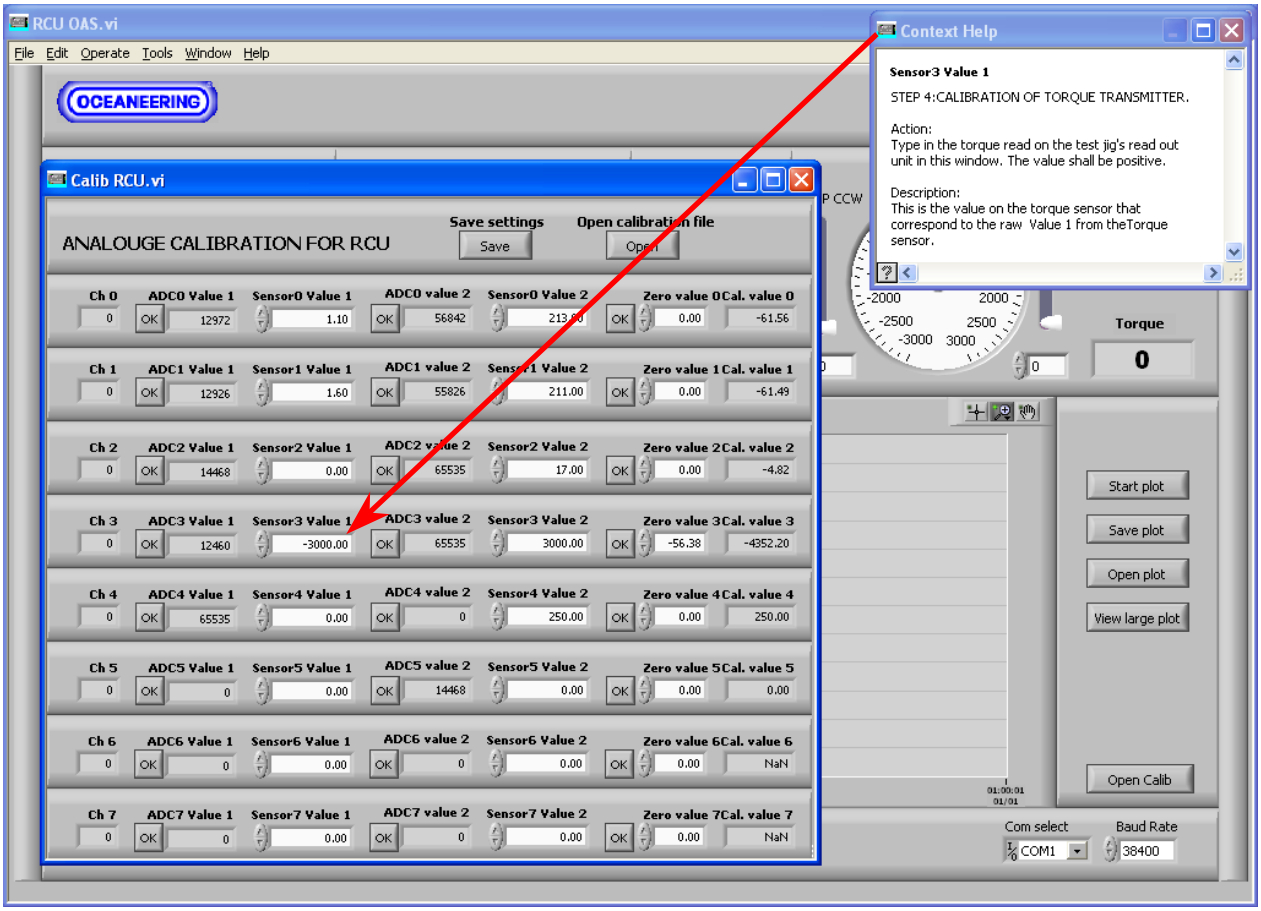
“STEP 3: CALIBRATION OF TORQUE TRANSMITTER.

Action: None

Description: This is the raw Value 1 from the Torque sensor.”

Torque Calibration step 4

Figure 42 STEP 4: CALIBRATION OF TORQUE TRANSMITTER



Moving the cursor over the relevant object, the “context help” displays as follows (see picture):

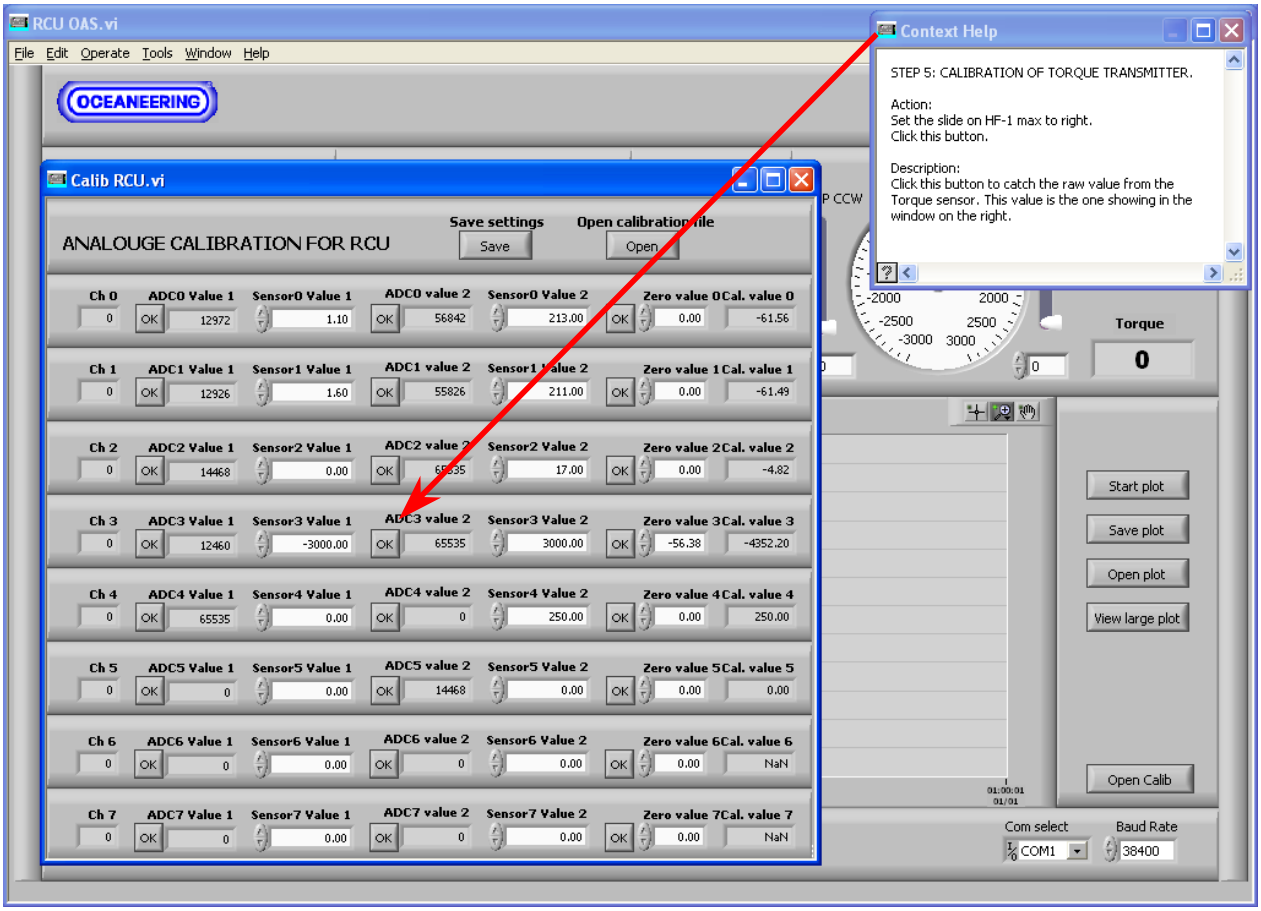
“STEP 4: CALIBRATION OF TORQUE TRANSMITTER.

Action: Type in the torque readings on the test jig's read out unit in this window. The value shall be positive.

Description: This is the value on the torque sensor that correspond to the raw value 1 from the Torque sensor.”

Torque Calibration step 5

Figure 43 STEP 5: CALIBRATION OF TORQUE TRANSMITTER



Moving the cursor over the relevant object, the “context help” displays as follows (see picture):

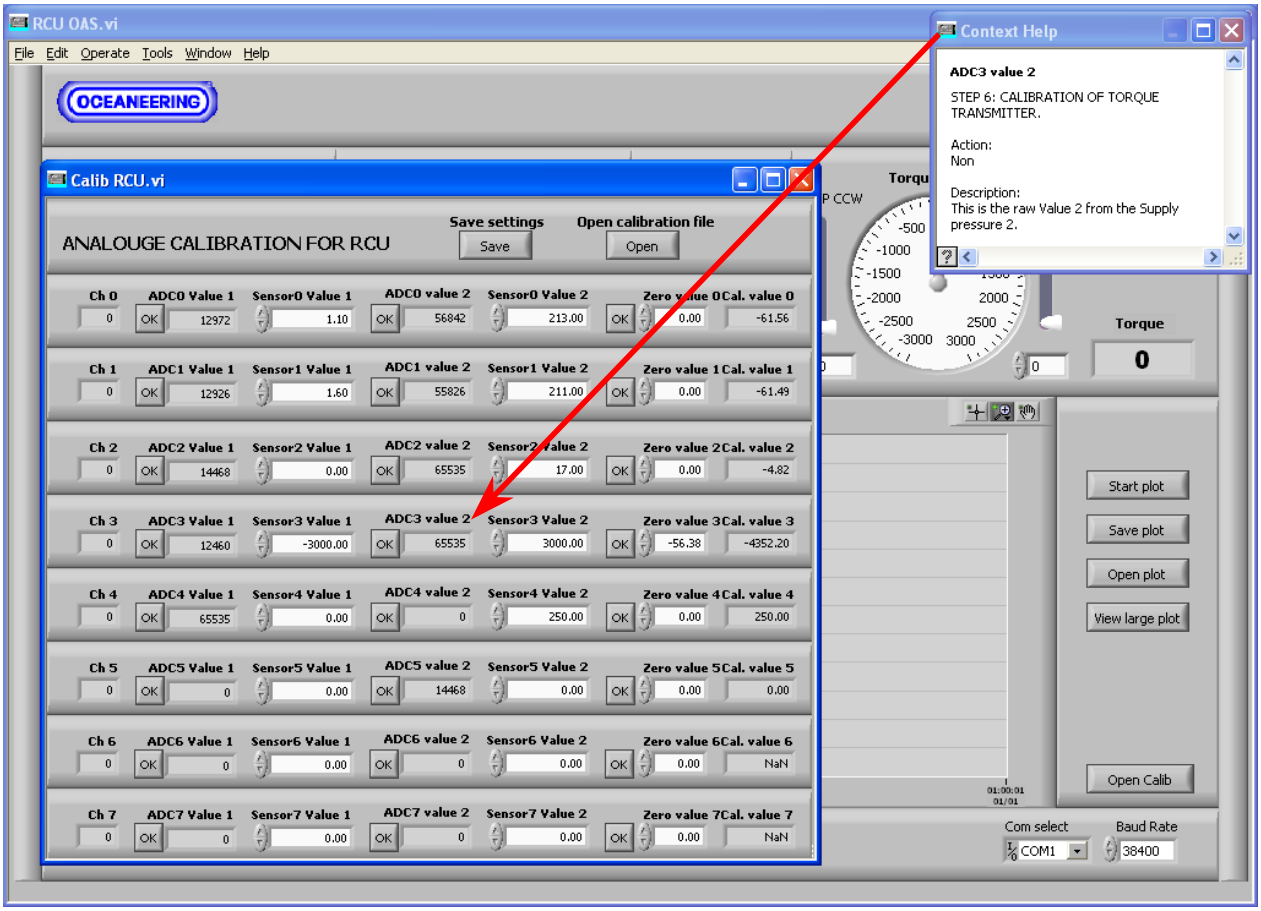
“STEP 5: CALIBRATION OF TORQUE TRANSMITTER.

Action: Set the slide on HF1 max to right. Click this button.

Description: Click this button to catch the raw value from the Torque sensor. This value is the one showing in the window on the right.”

Torque Calibration step 6

Figure 44 STEP 6: CALIBRATION OF TORQUE TRANSMITTER



Moving the cursor over the relevant object, the “context help” displays as follows (see picture):

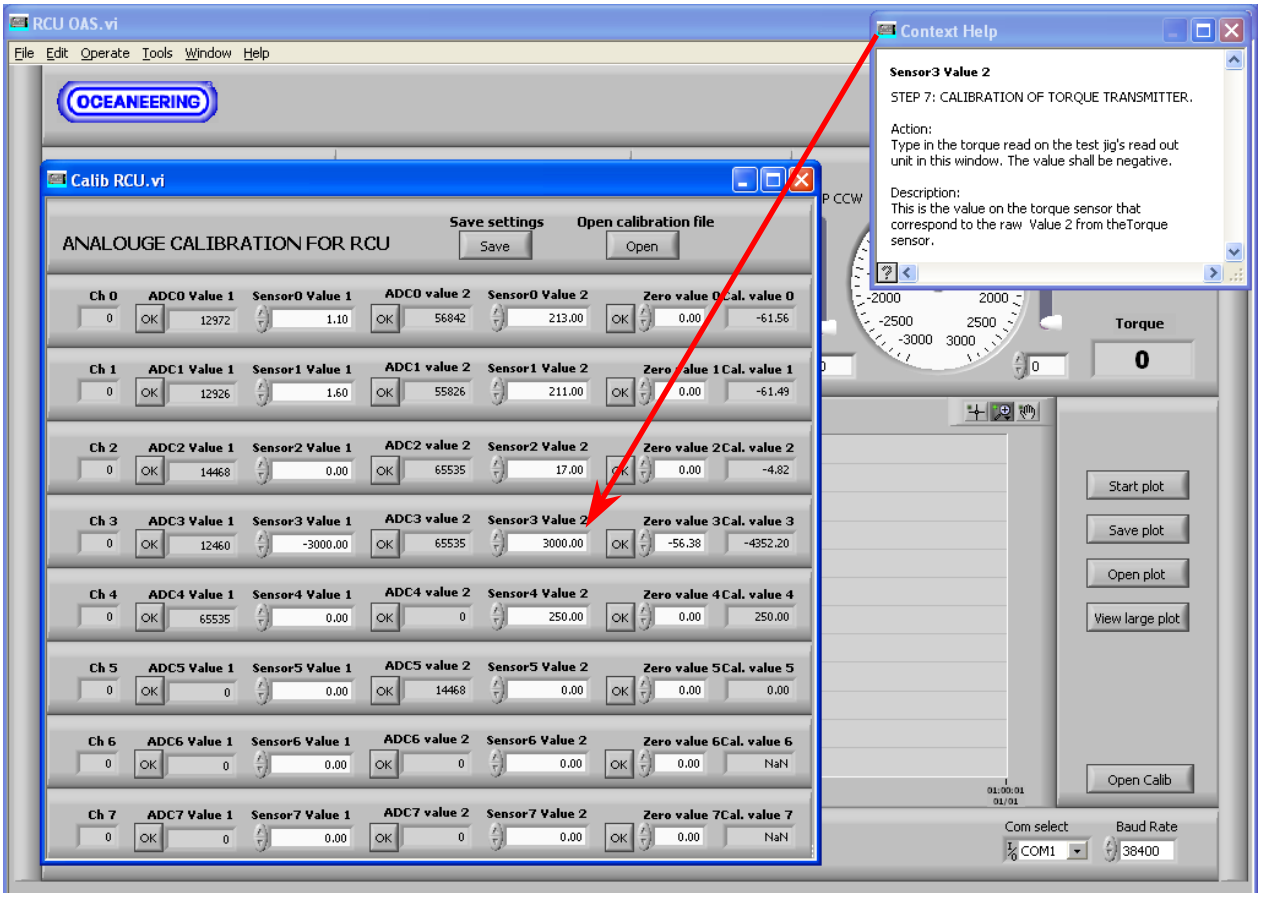
“STEP 6: CALIBRATION OF TORQUE TRANSMITTER.

Action: None

Description: This is the raw Value 2 from the Supply pressure 2.”

Torque Calibration step 7

Figure 45 STEP 7: CALIBRATION OF TORQUE TRANSMITTER



Moving the cursor over the relevant object, the “context help” displays as follows (see picture):

“STEP 7: CALIBRATION OF the TORQUE TRANSMITTER.

Action: Type in the torque read on the test jig's read out unit in this window.

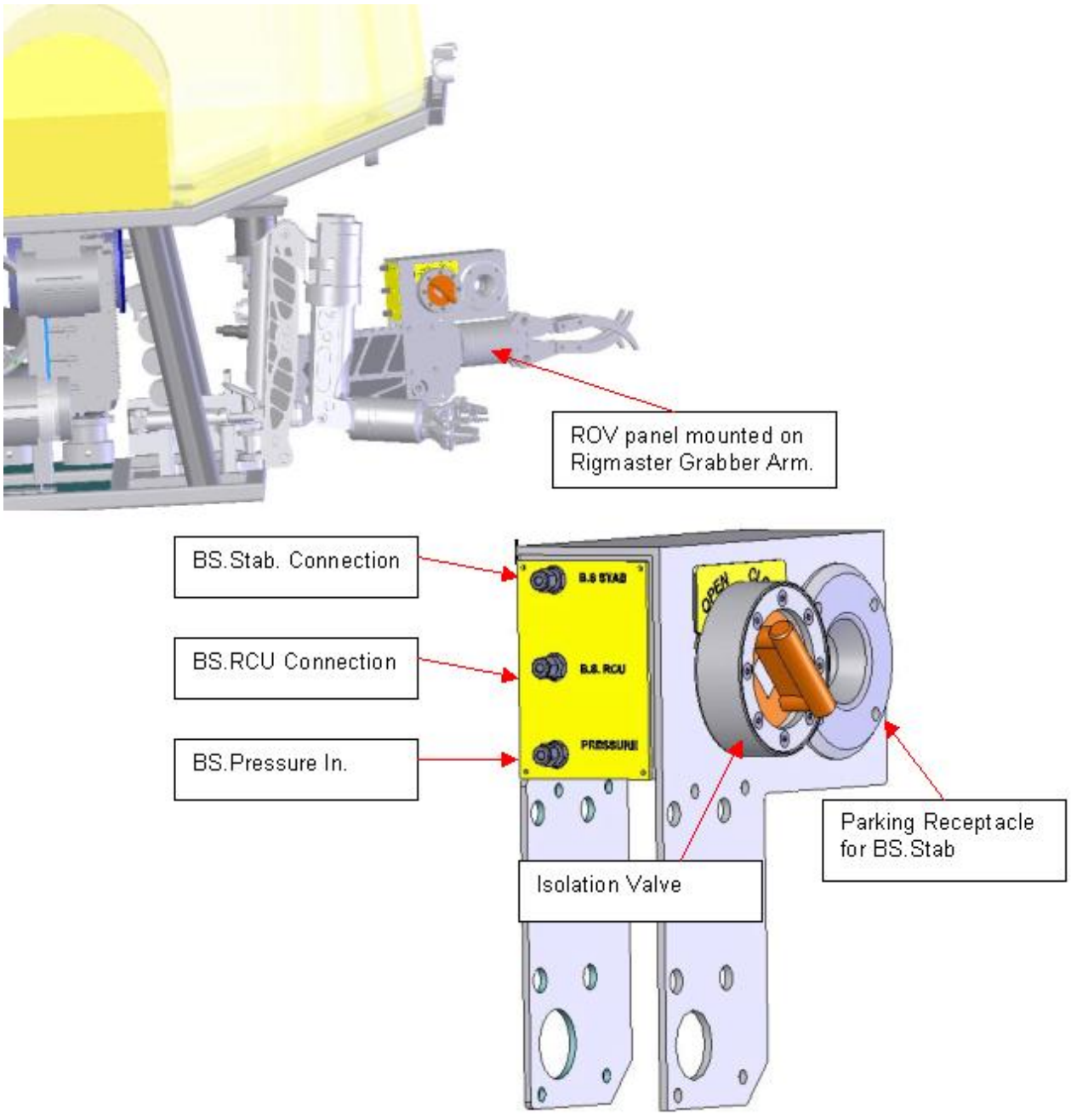
Description: This is the value on the torque sensor that corresponds to the raw Value 2 from the Torque sensor.”

NOTE: VERIFY CALIBRATED VALUES IN TEST JIG. RECALIBRATE IF NECESSARY.

7.0 BACK SEAL TESTING (OPTIONAL)

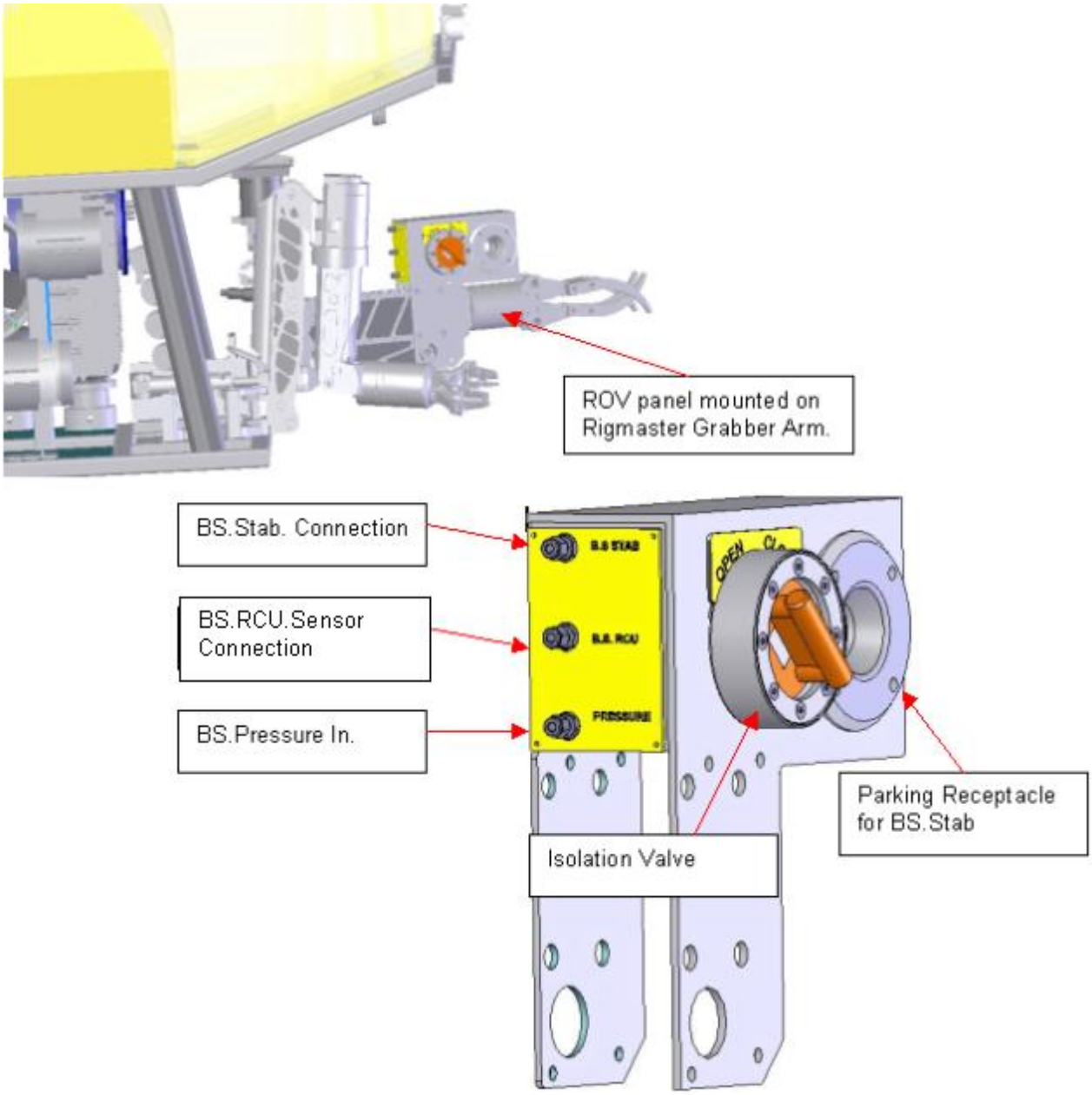
7.1 General Description

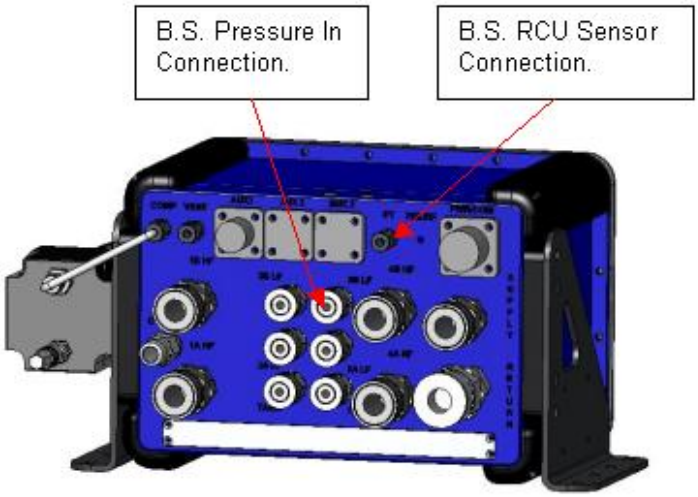
The Remote Control Unit is equipped with an optional feature for Back Seal Testing, and logging of test results. The Back Seal Test Unit consists of a purpose made ROV panel, with a ROV operated isolation valve. The ROV panel is normally mounted on the ROV “Rigmaster” five function grabber arm. The ROV panel is hydraulically connected to the RCU, for supply and monitoring of the Back Seal pressure. The Back Seal Stabber is hydraulically connected /supplied from the ROV panel. The Panel is equipped with an Isolation valve, for isolating the Back Seal Pressure.



7.2 Installation Back Seal Panel

Install Back Seal panel on ROV manipulator Grabber Arm. (Prepared for Rigmaster). Fit Back Seal Panel with retainer plate on arm. Tighten fastening bolts (4 of). Connect hydraulic Hoses (3 of) from Panel to Stab and RCU. The 4 metres hoses from panel to RCU, and the 2 metre hose from panel to Stab. Supply hose from RCU to be connected to LF 2 valve A or B port.





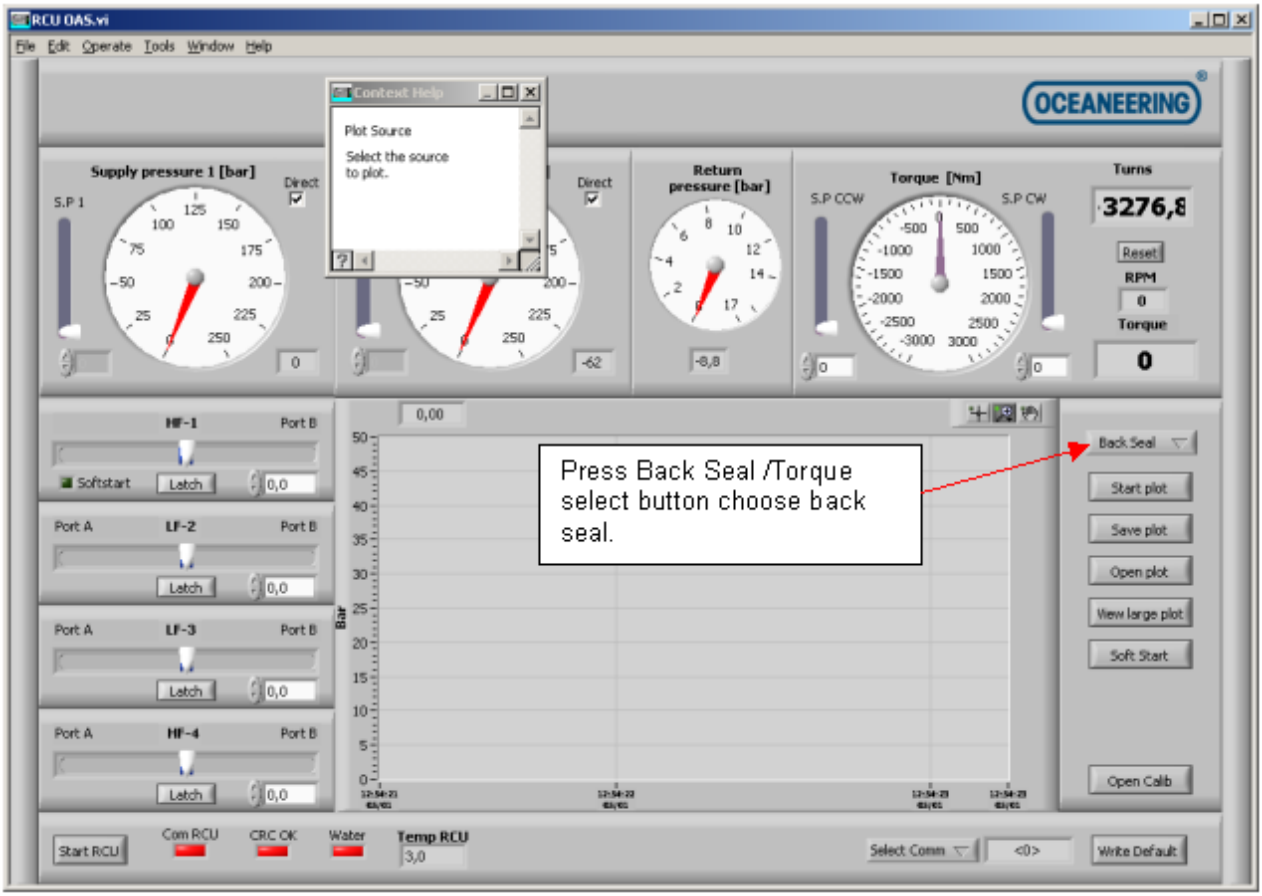
7.3 Operation Back Seal Panel

Connect Stabber to the actual seal connection to test. Operate Back Seal Panel Isolation valve in open position. Pressurise Back Seal Test line from RCU with the given test pressure to use. Operate Isolation valve in closed position. Monitor back seal pressure and wait for pressure to stabilize. Start logging of Back Seal Testing. Save or print log if wanted.

7.4 Back Seal Test GUI Operation

Choose Back Seal Plot Screen

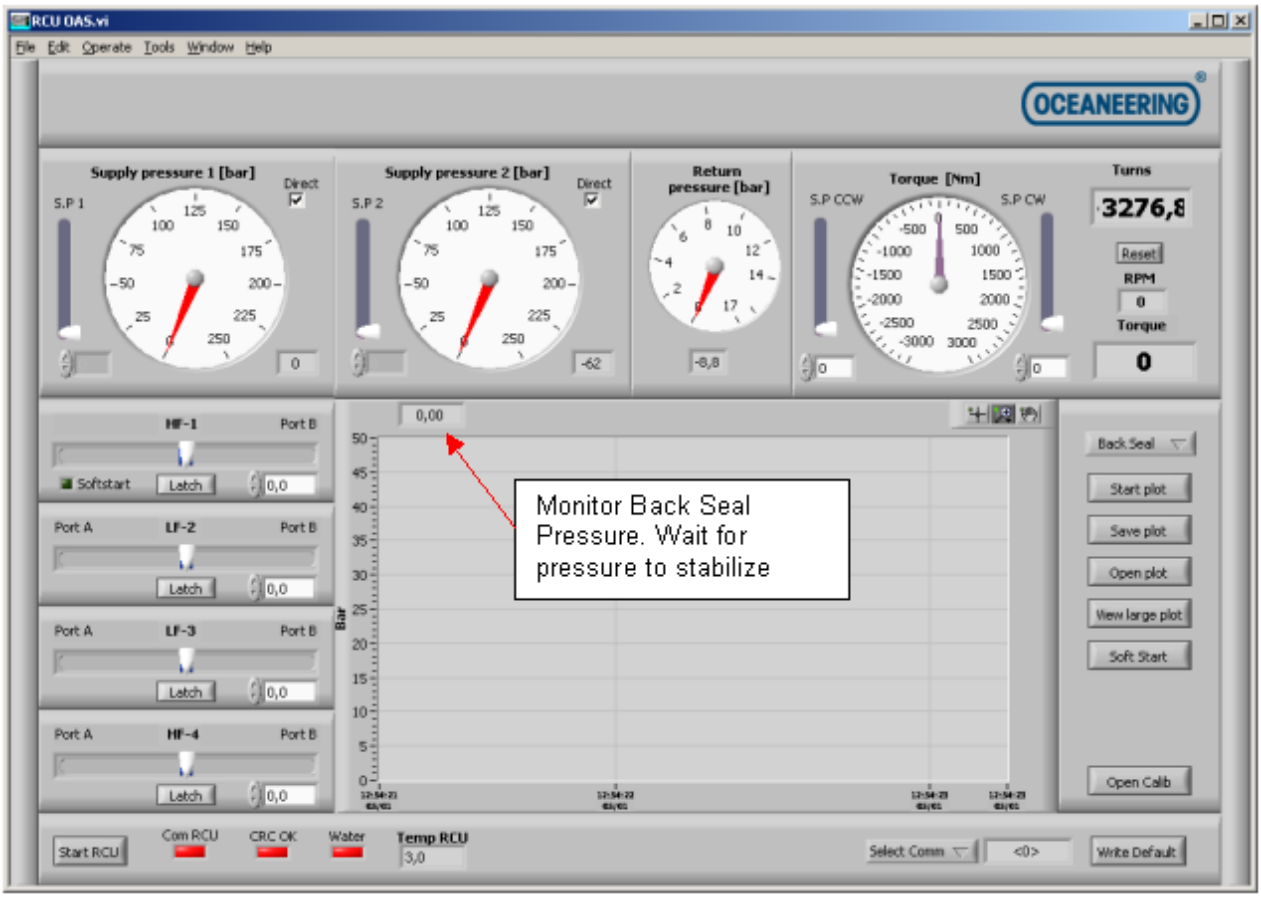
Figure 46 STEP 1: BACK SEAL TEST OPERATION



Press Torque/Back Seal drop down button, and choose Back Seal.

Monitor Back Seal Test Pressure

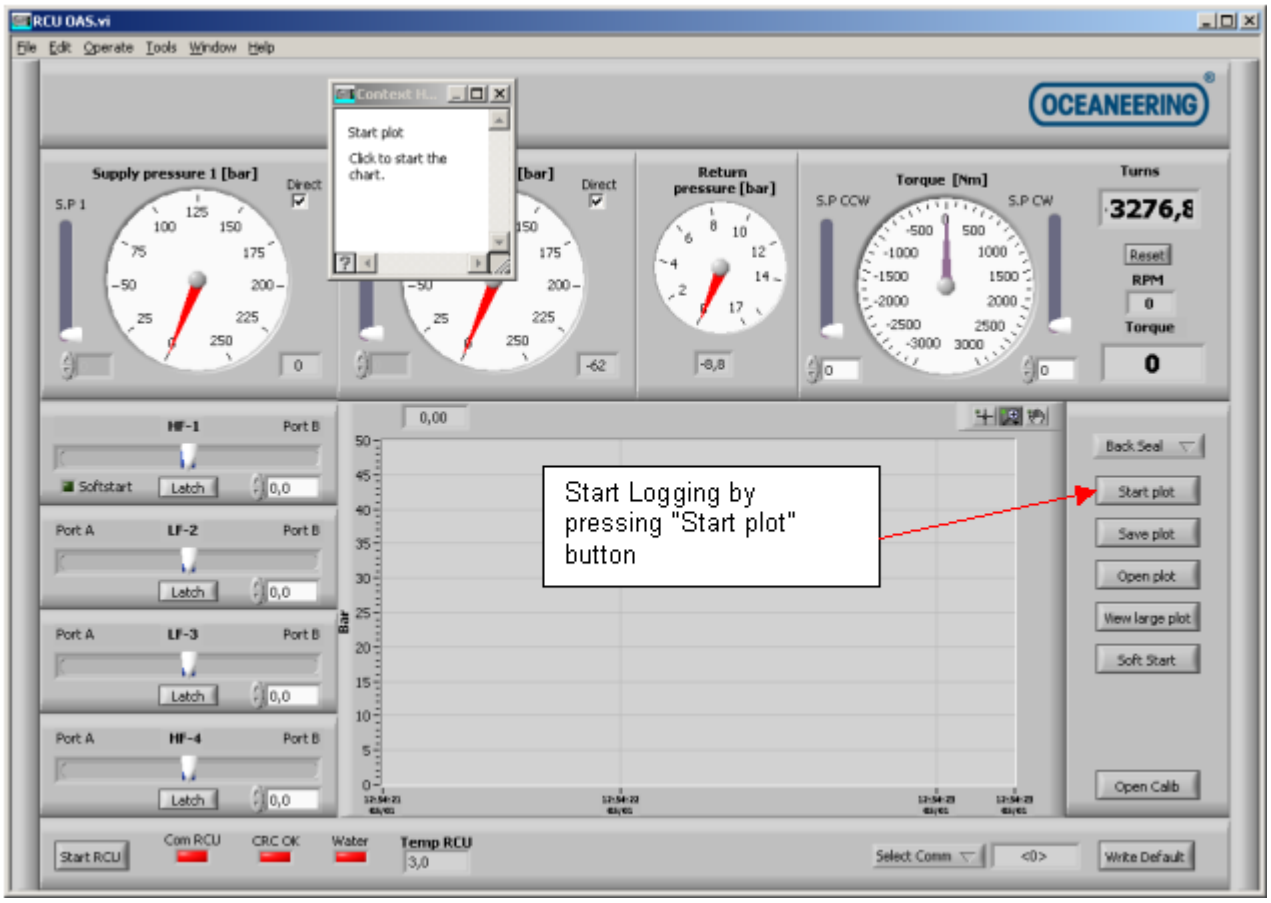
Figure 47 STEP 2: BACK SEAL TEST OPERATION



Monitor Back Seal Test pressure and wait for pressure to stabilize.

Start Back Seal Logging

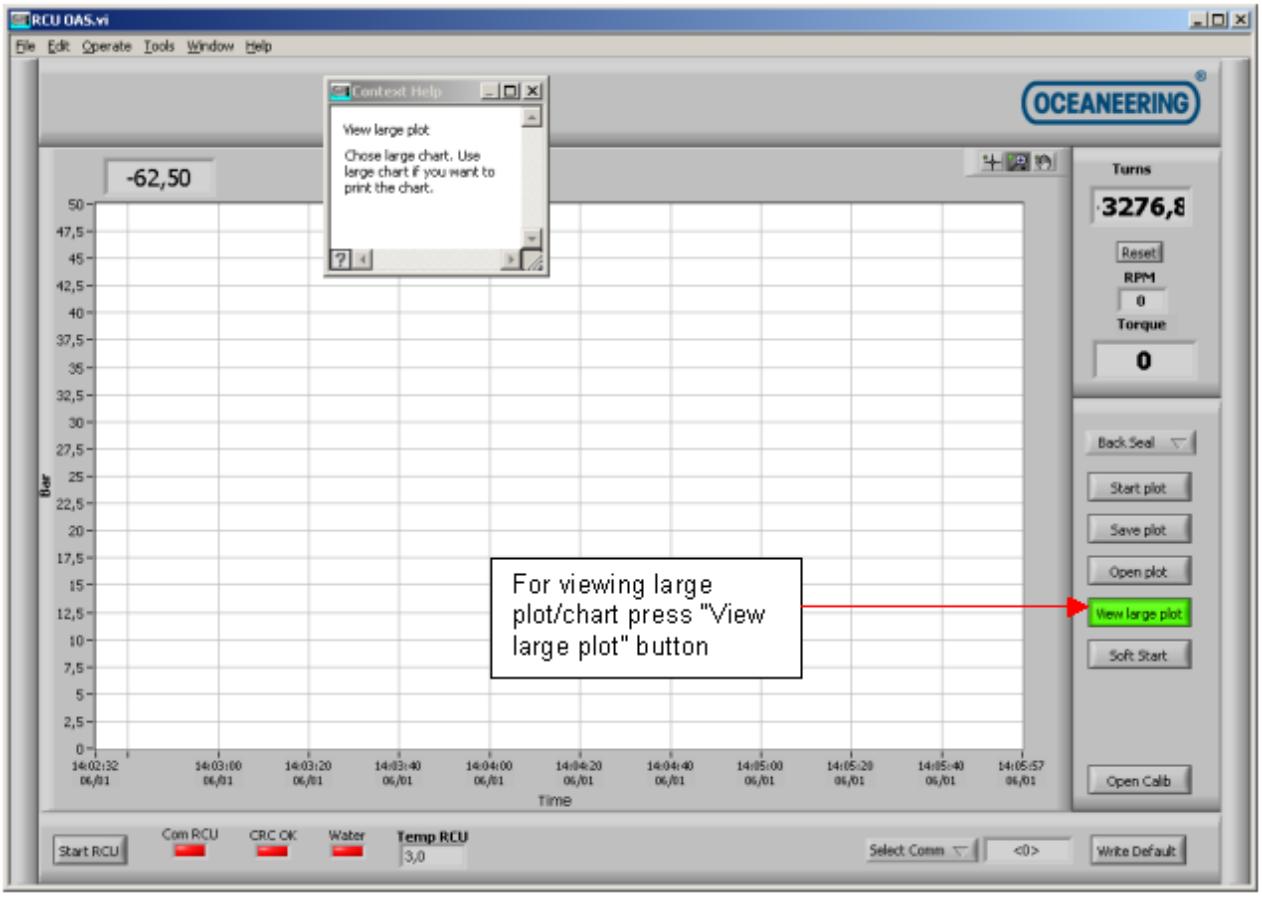
Figure 48 STEP 3: BACK SEAL TEST OPERATION



For Start/Stop logging. Press “Start plot” button in GUI

View large plot screen

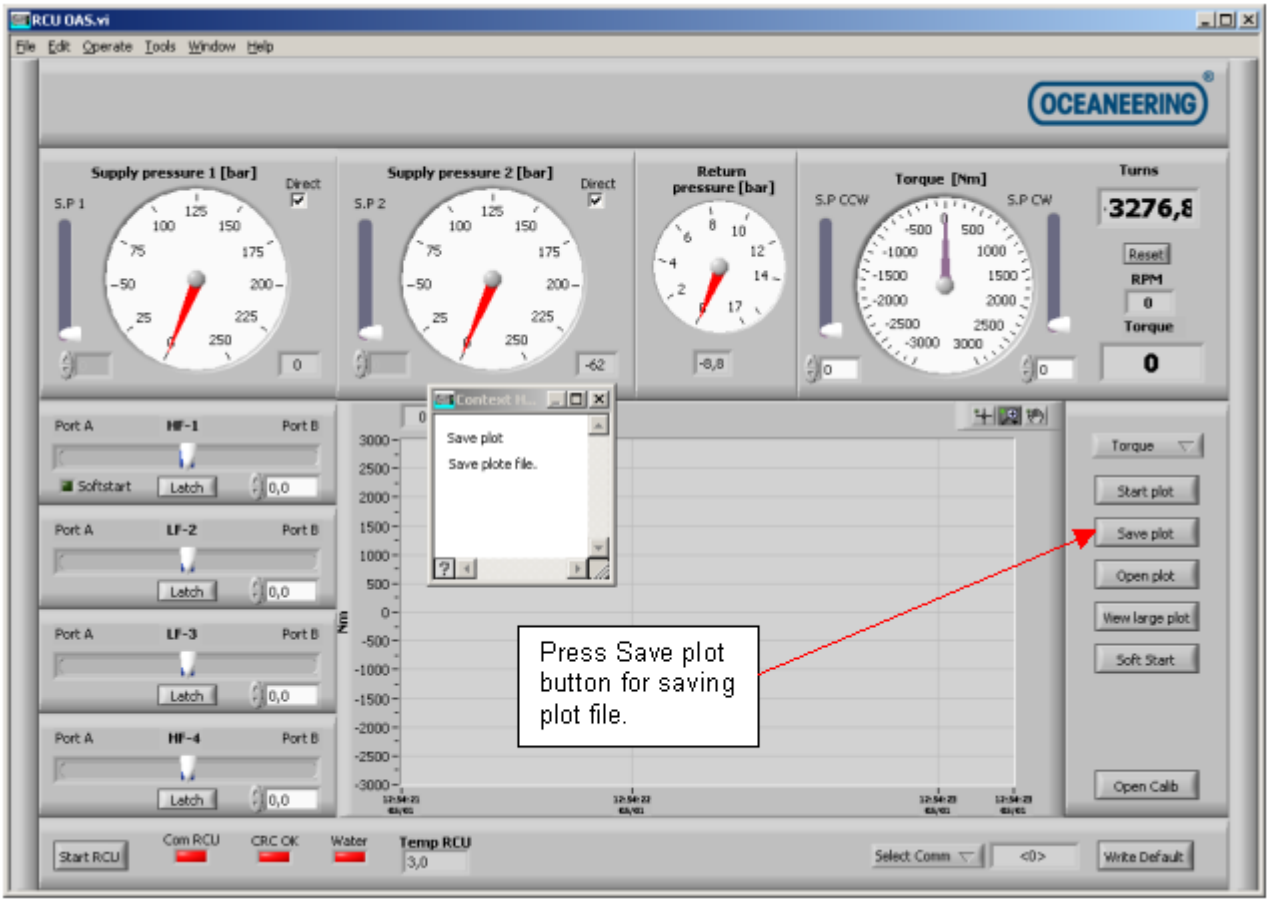
Figure 49 STEP 4: BACK SEAL TEST OPERATION



For a larger screen view, press “View large plot” button

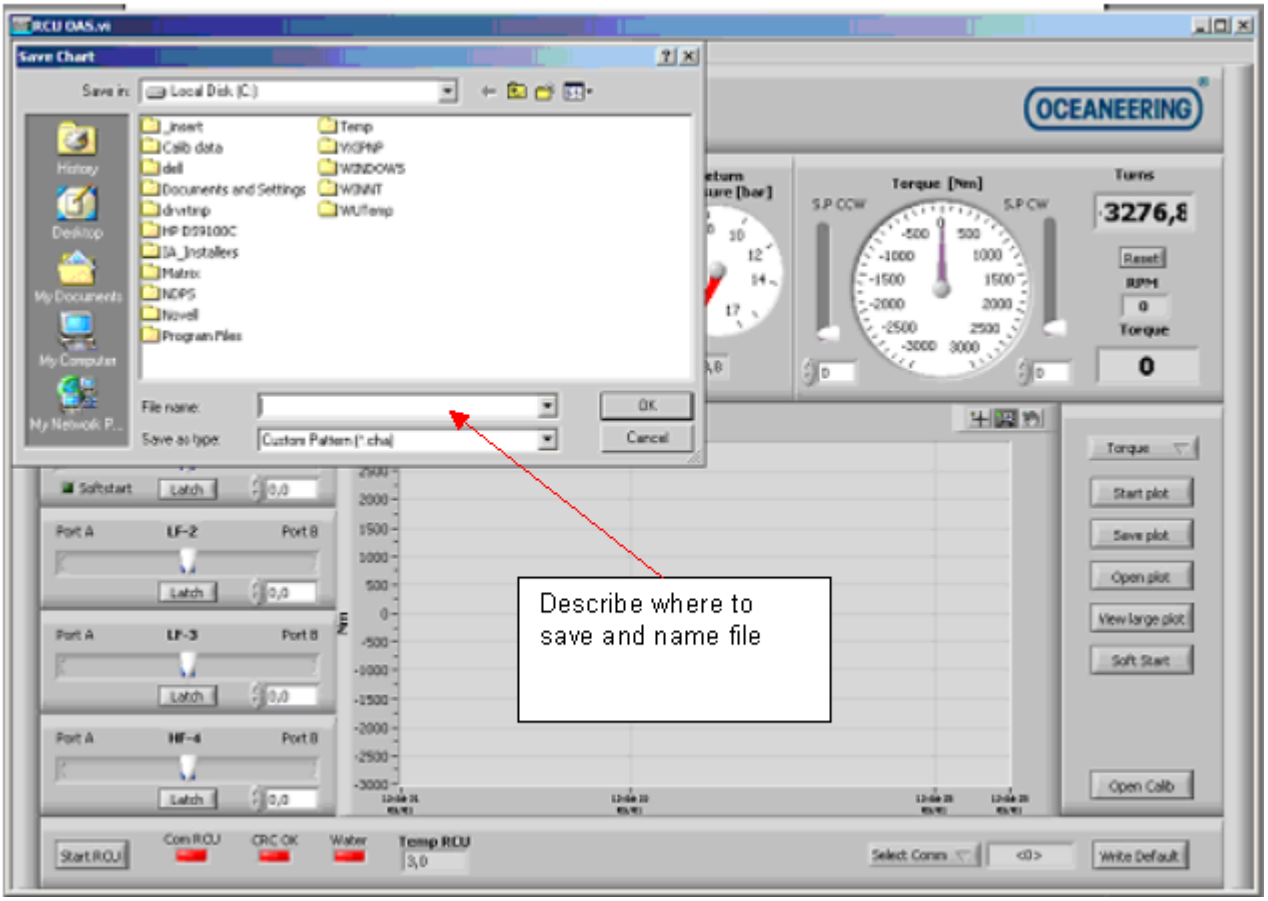
Save Plot

Figure 50 STEP 5: BACK SEAL TEST OPERATION



For saving plot to file, press Save plot button.

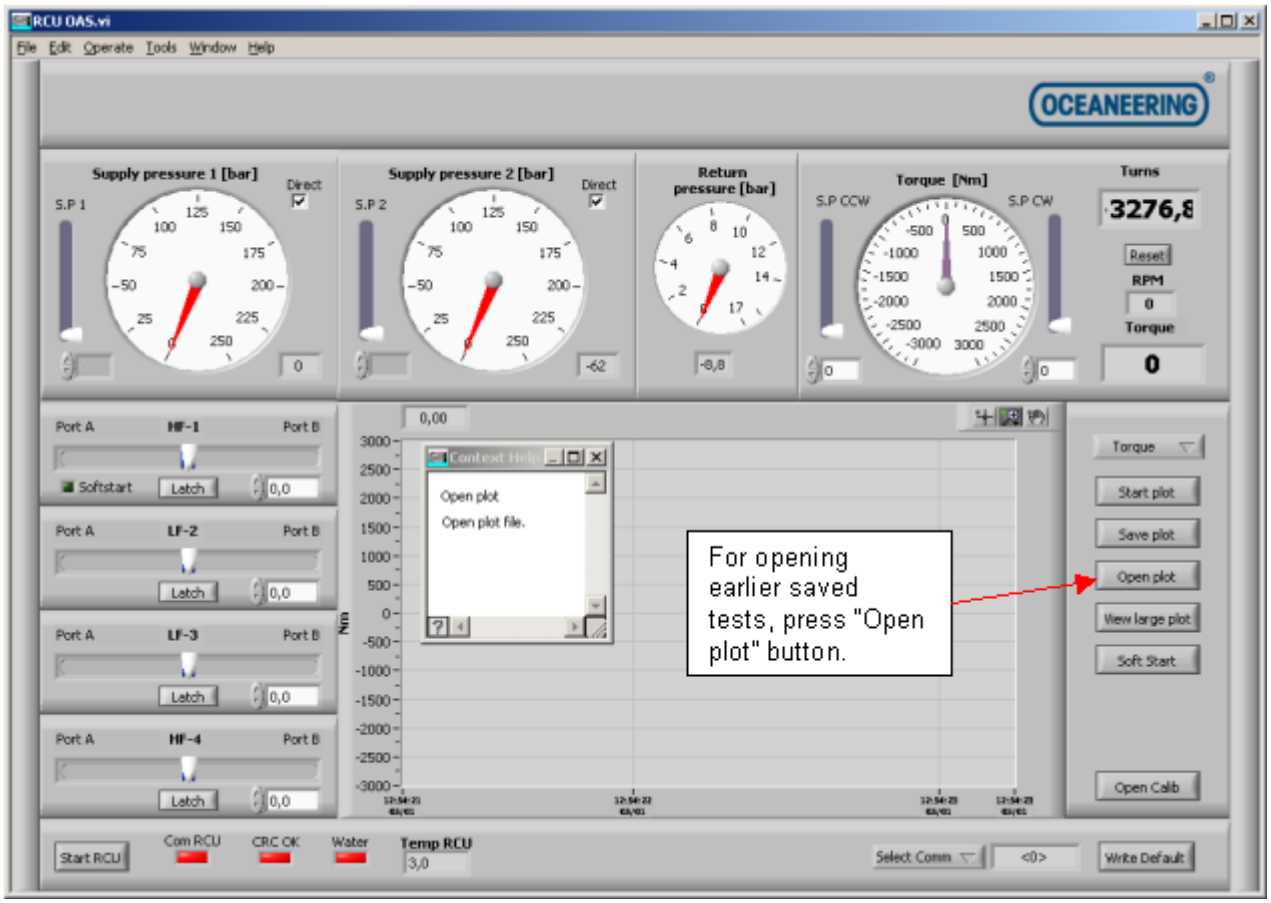
Figure 51 STEP 6: BACK SEAL TEST OPERATION



Describe where to save and name the file. Saved file can only be opened in the RCU program.

Open Plot

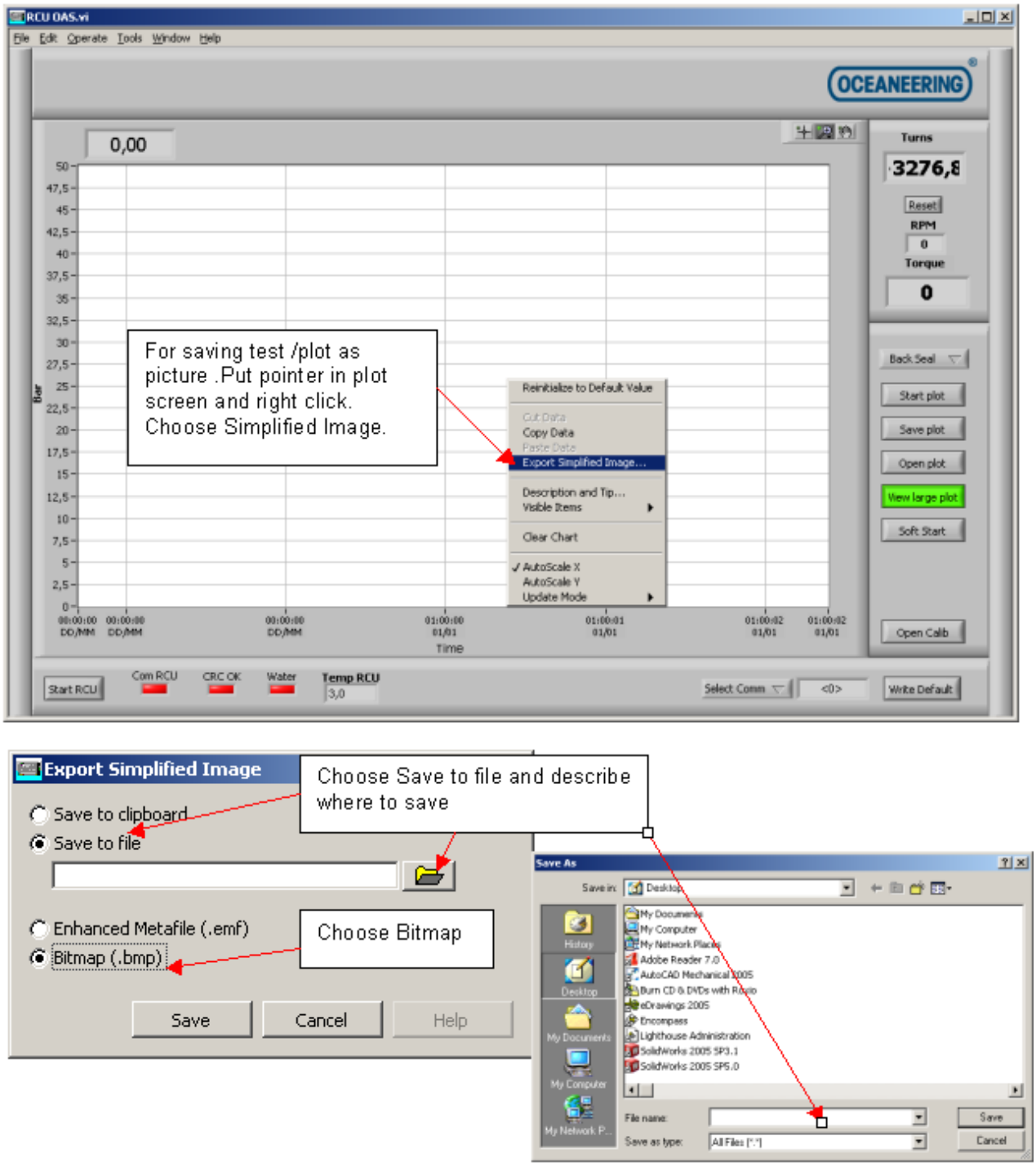
Figure 52 STEP 7: BACK SEAL TEST OPERATION



For opening earlier saved tests plots. Press “Open plot “button ad dedicate file to be opened.

Save Plot as picture

Figure 53 STEP 8: BACK SEAL TEST OPERATION

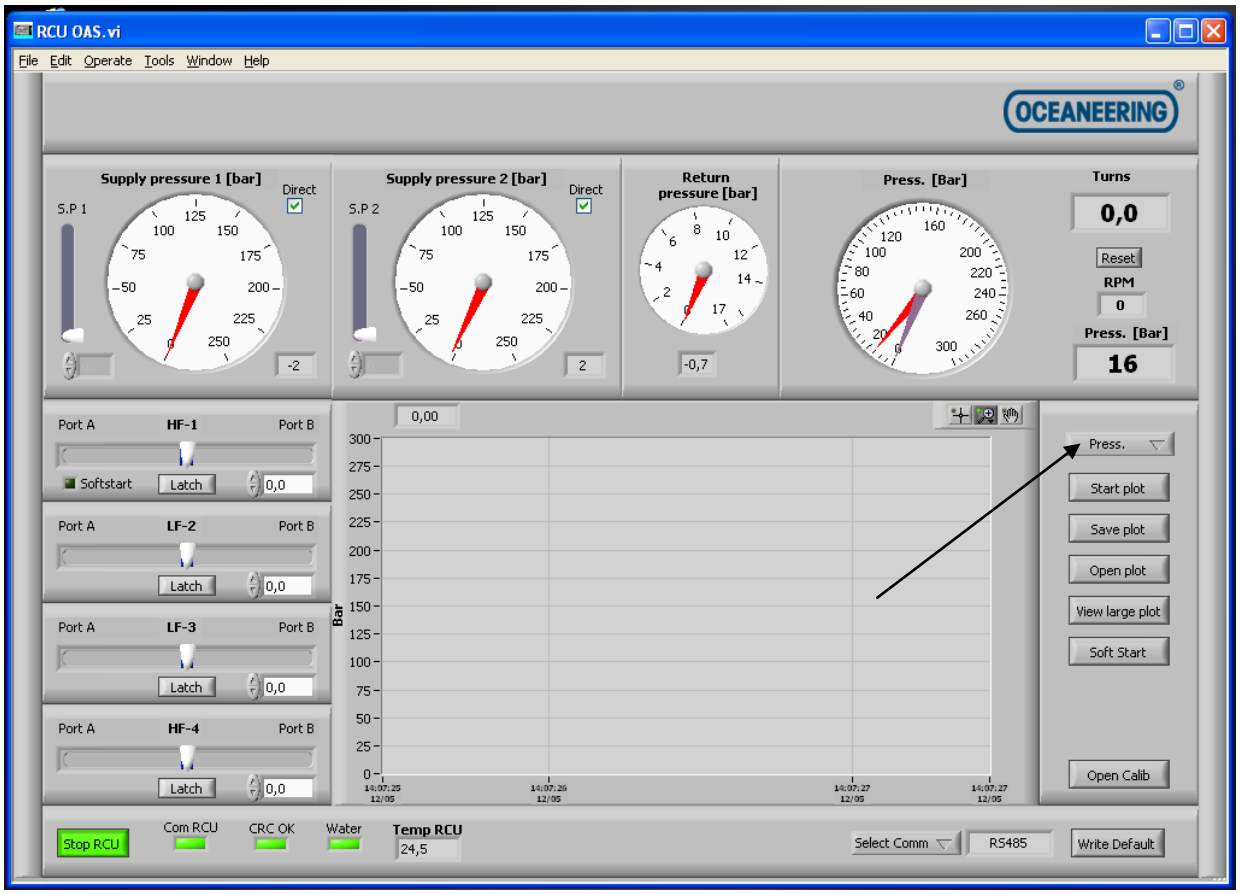


For saving test/plot as picture, this can be done by pointing in screen with pointer and “right click”. Choose simplified image and then tick off. Save to file and Bitmap. Describe where and what to save.

8.0 PRESSURE TESTING W/ EXTERNAL SENSOR (OPTIONAL)

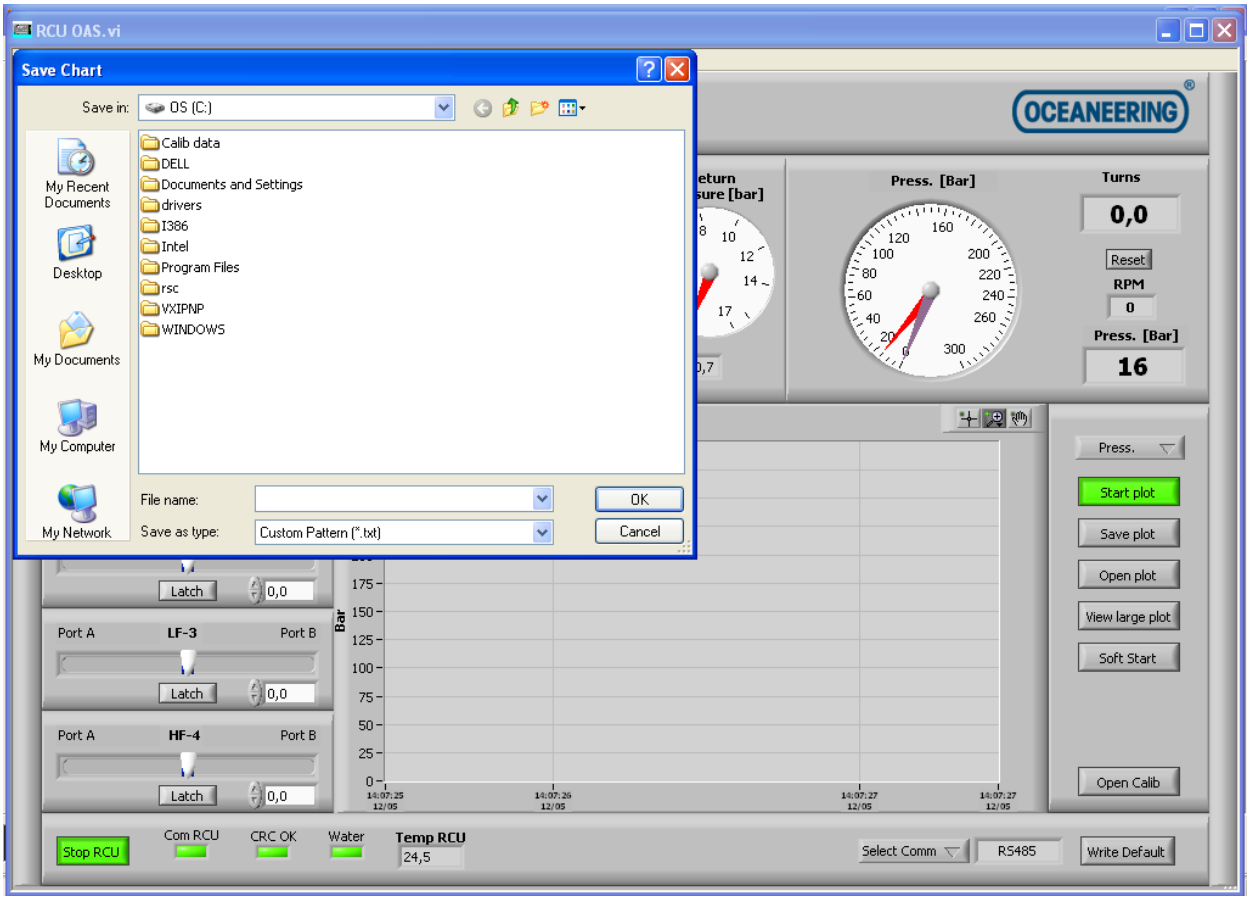
The Remote Control Unit is equipped with an optional feature for pressure testing with an external pressure sensor, and logging of test results. Connect the pressure sensor cable to “aux 1” connector on the RCU valve block. By connecting the sensor this way, enables functions as follows.

Figure 54 STEP 1 PRESSURE TESTING W/ EXTERNAL SENSOR



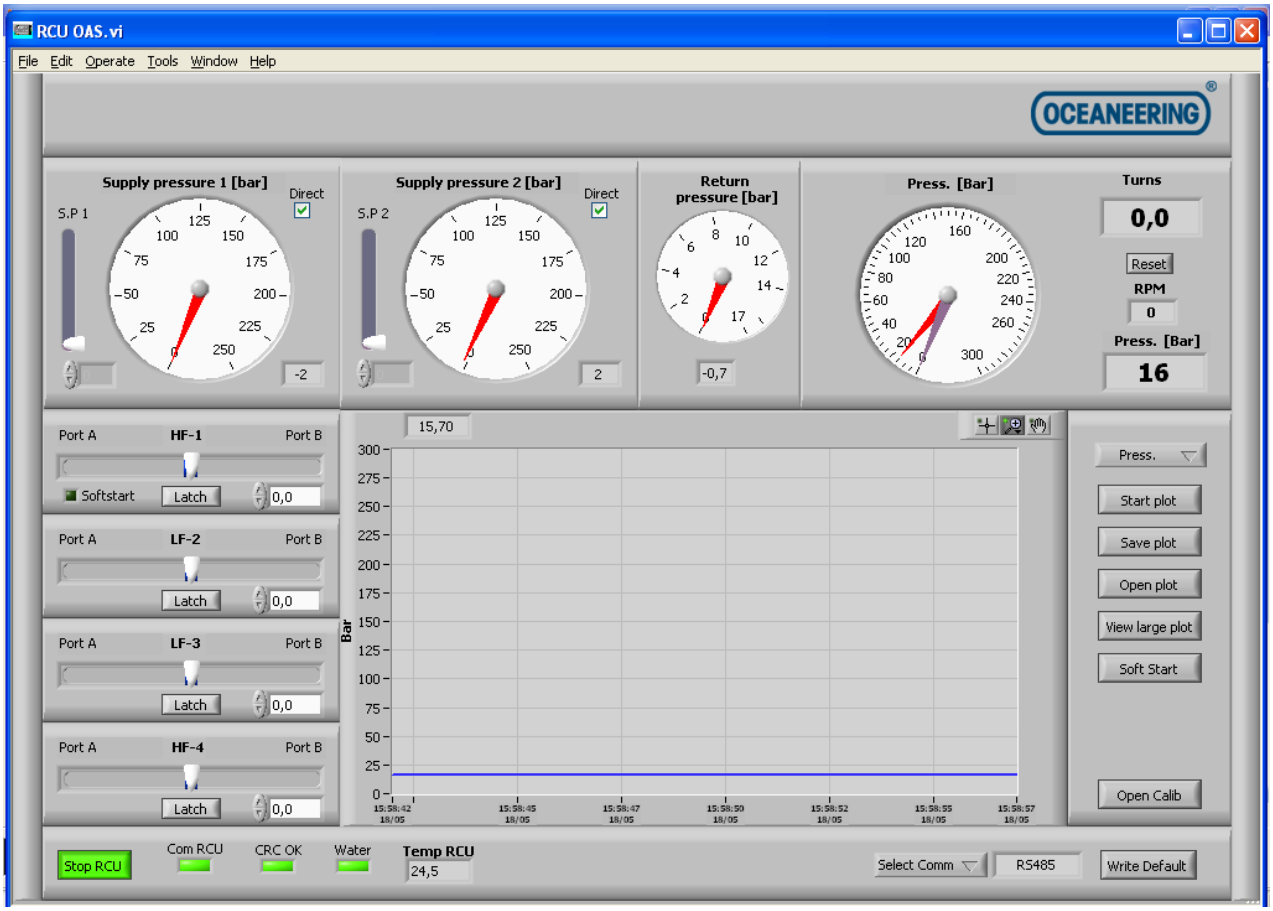
In the Main window choose Press. from the drop down menu and press ”start plot”. This will bring up a new dialogue box.

Figure 55 STEP 2 PRESSURE TESTING W/ EXTERNAL SENSOR



In this window, you will need to enter the location and the name off the log file. Press “ok” when finished

Figure 56 STEP 3 PRESSURE TESTING W/ EXTERNAL SENSOR



The Software will now start to log both on a chart on the screen, and write the values into the txt file.

After logging is finished, the ”start plot is once again pressed and the logging will stop. at this point the values from the txt files can be used as pleased.

To save the graph as a photo, rigth click on the graph and then choose export simpified image. you wil now have to choose how and what to export.

“Save plot” wil save the file in a format that the RCU SW will recognise, and you then later can zoom etc. But the graph will need te be “exported” to be read by another computer/printed.

The next time you pres start plot, the same sequence wil start again.

External Pressure Transmitter Calibration (optional)

Perform the following procedure for calibration of external pressure transmitter.

- Connect the pressure sensor cable to “aux 1” connector on the RCU valve block.
- Connect a pressure reference to the same hydraulic system as the external pressure transmitter.
- Open calib window.
- Adjust/Write “0” in **Zero Value** field in Ch.3 and press “OK” button.

- Activate the hydraulic system with a pressure of 25bar.
- Verify value on pressure reference.
- Write pressure reference value in the calib window; Ch.3. Sensor 3 Value 1 field. Press ADC3 value1 “OK” button.
- Set pressure on hydraulic system to 250bar.
- Verify value on pressure reference.
- Write pressure reference value in calib window Ch.3. Sensor 3 Value 2 field.
- Press ADC3 value2 “OK” button.
- Press Save button in top of calib window, Choose Default TT file and press OK.
  NOTE: When Default RCU file occurs, press Cancel .

9.0 MAINTENANCE INSTRUCTIONS

9.1 Planned Maintenance

The following minimum planned maintenance in operation is required for the components in the system.

Weekly

1. Check all cables and hoses for signs of damage. Repair or replace when necessary.
2. Visually check anodised surfaces for signs of damage or corrosion. If corrosion is evident, scrape away any white residue and touch up with paint.
3. Check that all fasteners and fittings are tight.
4. Visually inspect for water ingress inside the RCU housing.

Monthly

1. All the above weekly checks.
2. Disconnect the electrical connectors. Visually check the condition of the connector pins. Carefully clean and re-lubricate the connectors with Silicon Oil. NOTE: Do not lubricate Burton underwater connectors with silicon grease. Lubricating with silicon grease will result in solids building up inside the female connector and result in connector failure.
3. Take a sample of the hydraulic oil from the valve block and check for water intrusion. If water is present, thoroughly flush the unit with clean hydraulic oil.
4. Function test the RCU.

9.2 Disassembly/Assembly Procedure

Disassembly of RCU

Oceaneering don't recommend opening RCU by untrained and inexperienced personnel.

Even so the section beneath demonstrates to change valves or components in RCU.

It is strongly recommended to contact Oceaneering for support and guidance during the disassembly/assembly procedure.

Procedure

Ventilate the RCU Compensator and drain the oil. Remove lid from RCU and pour the rest of the oil into a used oil-collecting tank.

Figure 57 Ventilate RCU

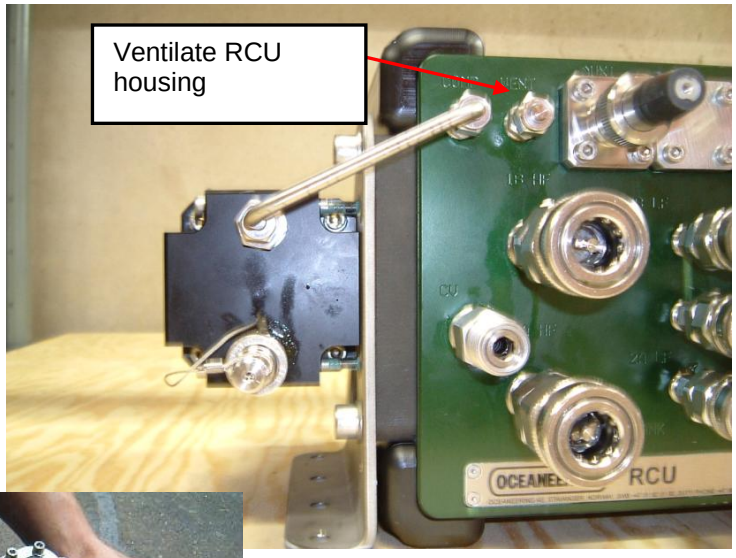


Figure 58 Open RCU

Figure 59 Dismount RCU cover

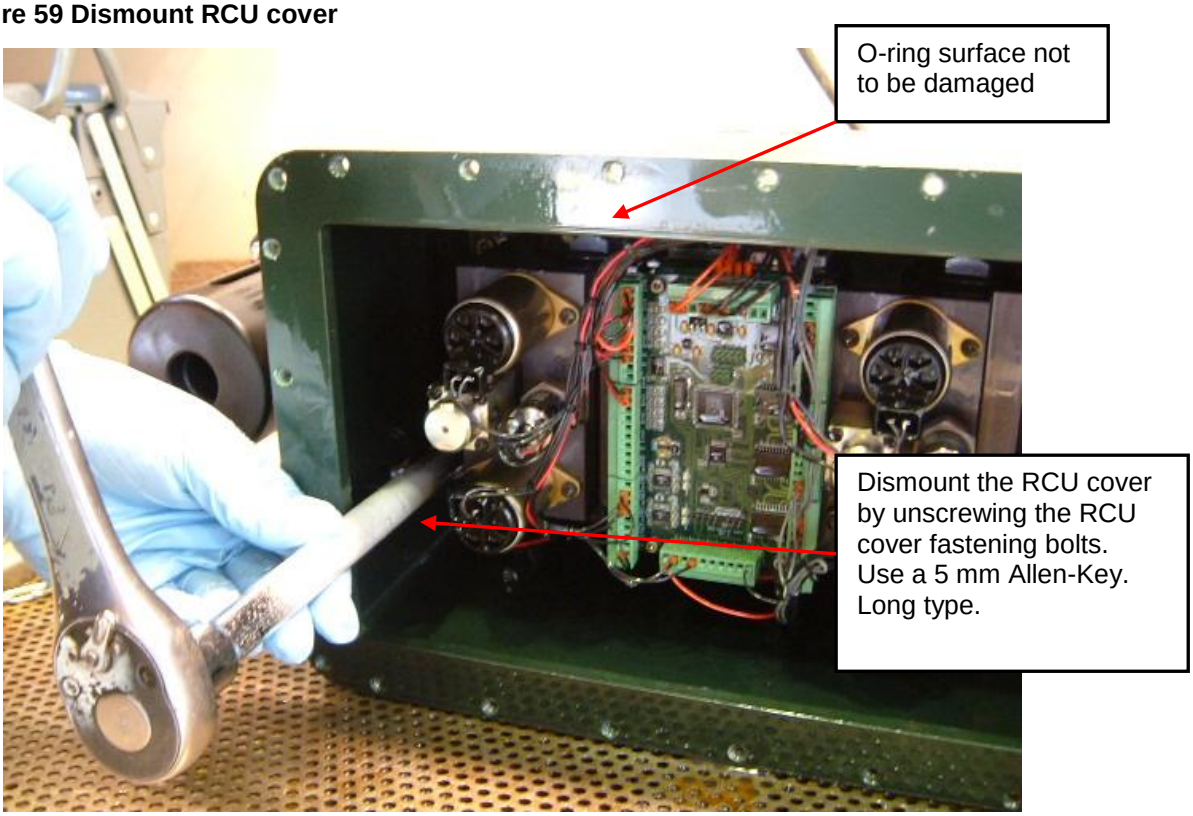


Figure 60 RCU cover fastening bolts

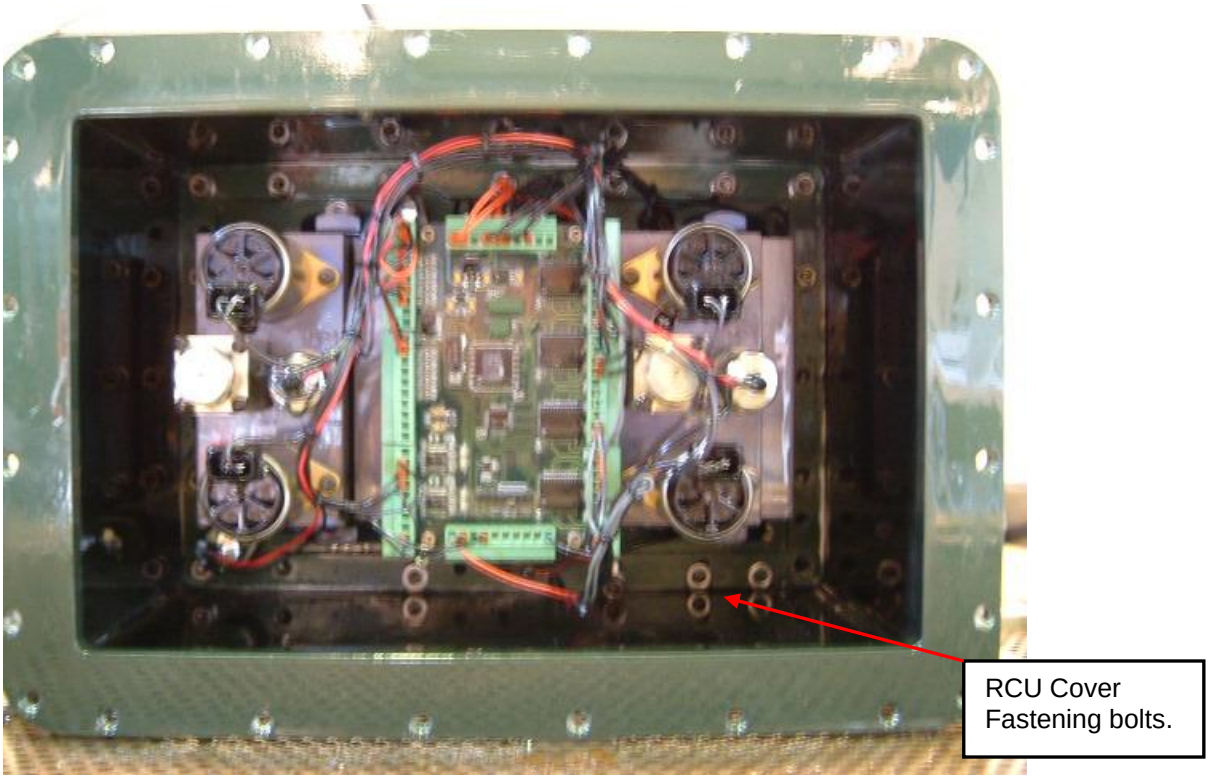


Figure 61 Remove RCU cover

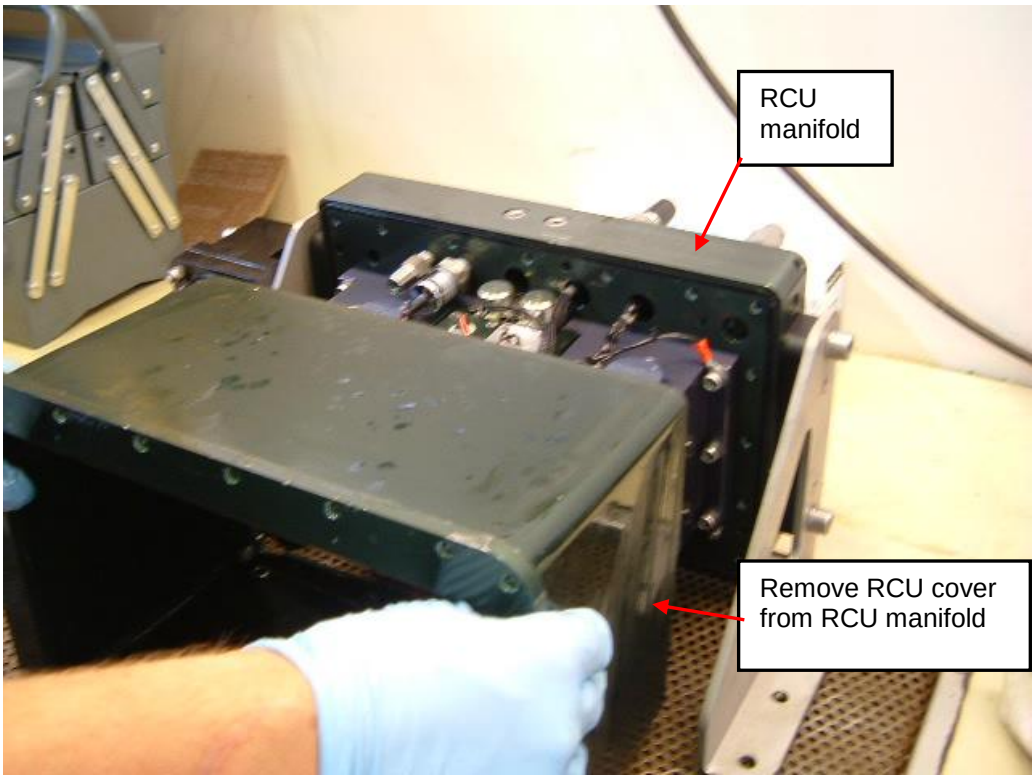


Figure 62 Dismount controller card

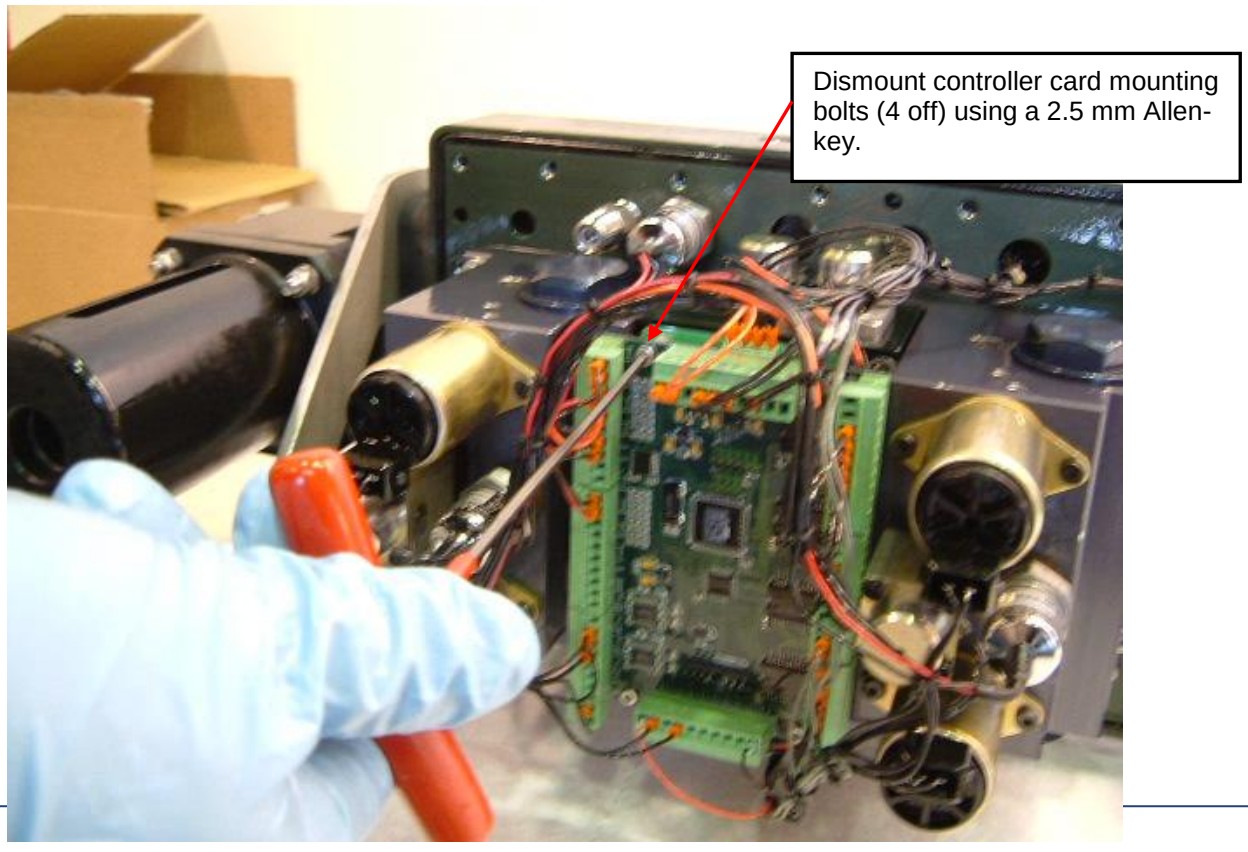


Figure 63 Disconnect controller card

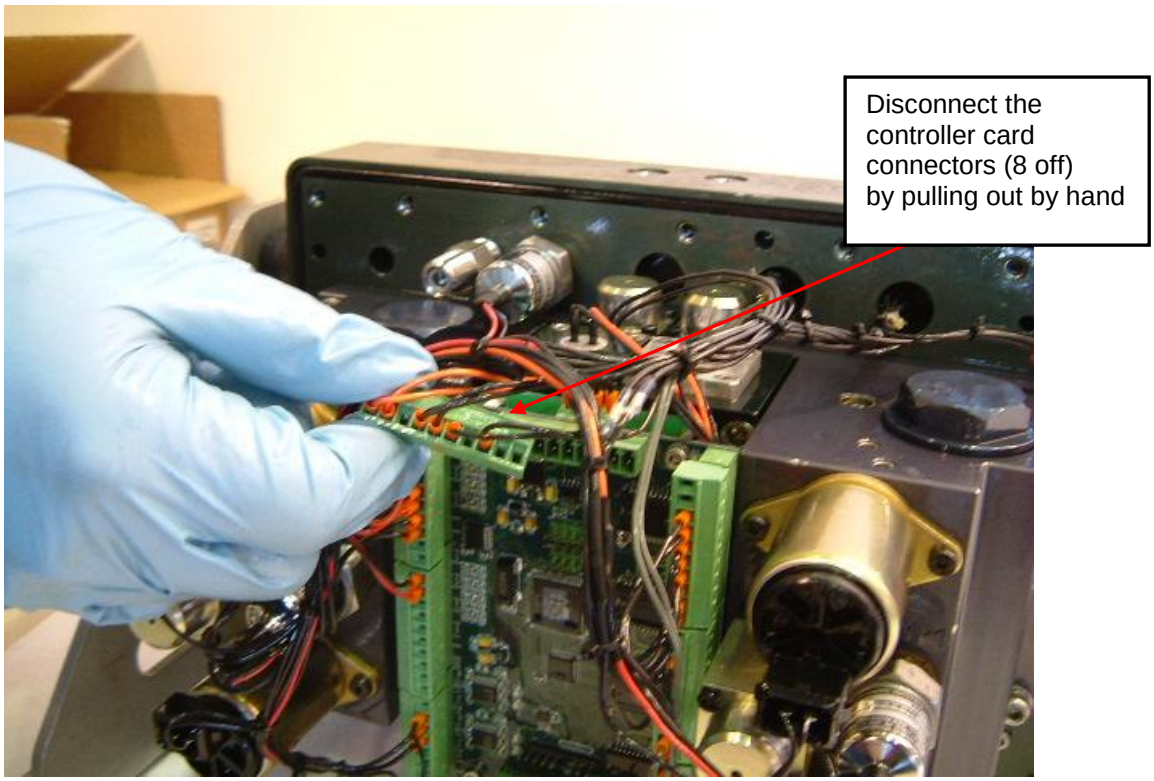


Figure 64 Remove controller card

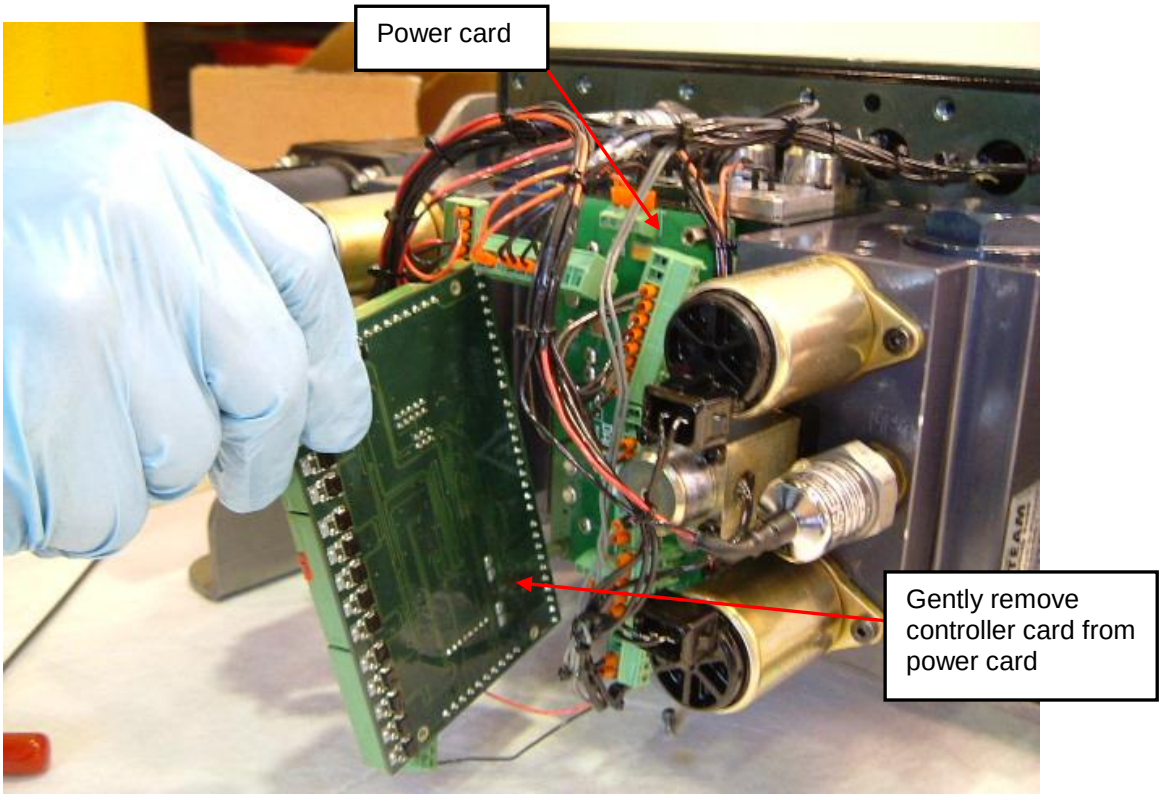


Figure 65 Release power card

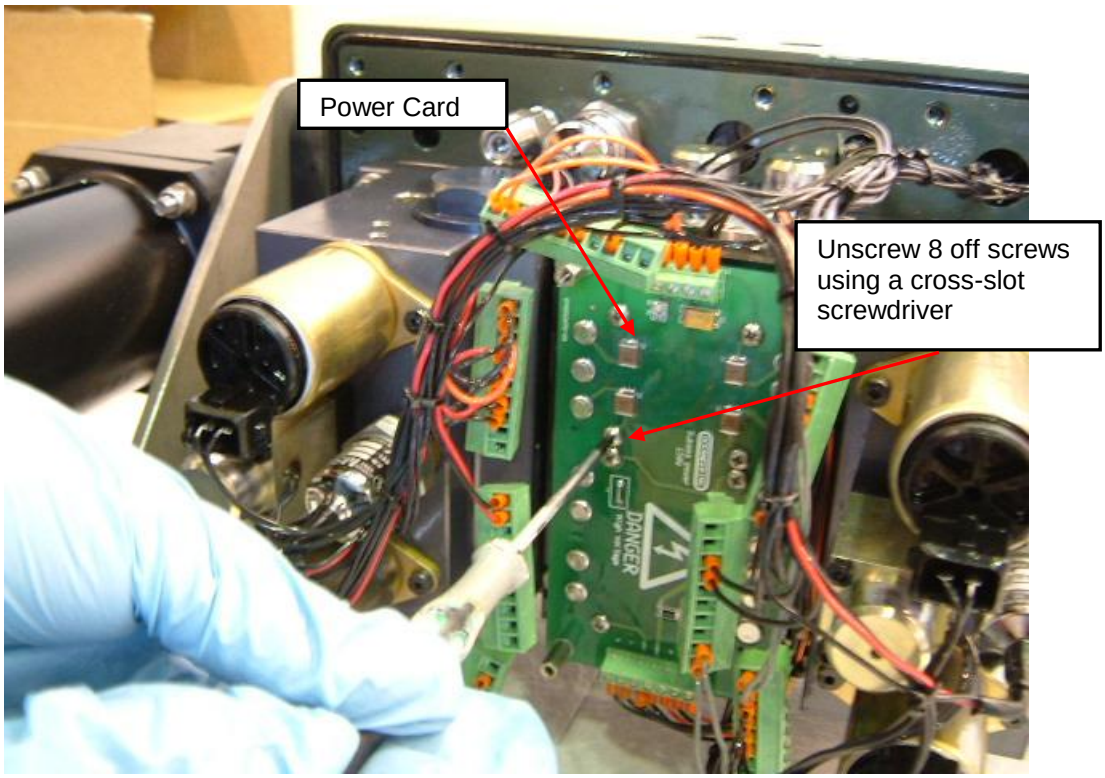


Figure 66 Slide off power card

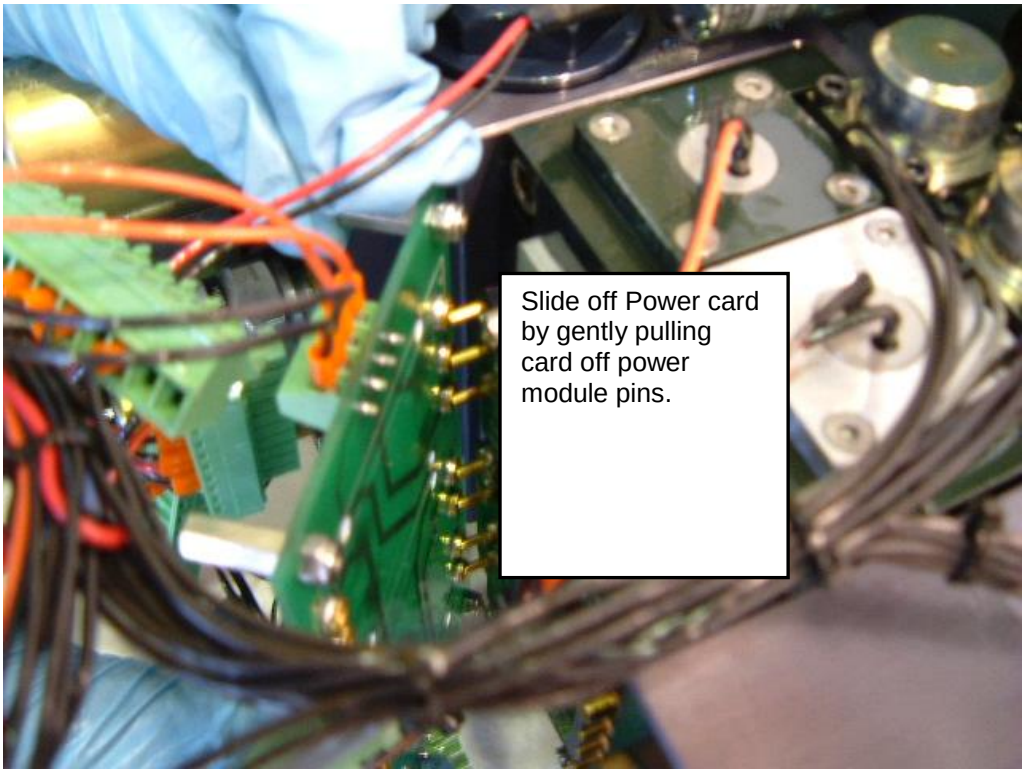


Figure 67 Capacitor box

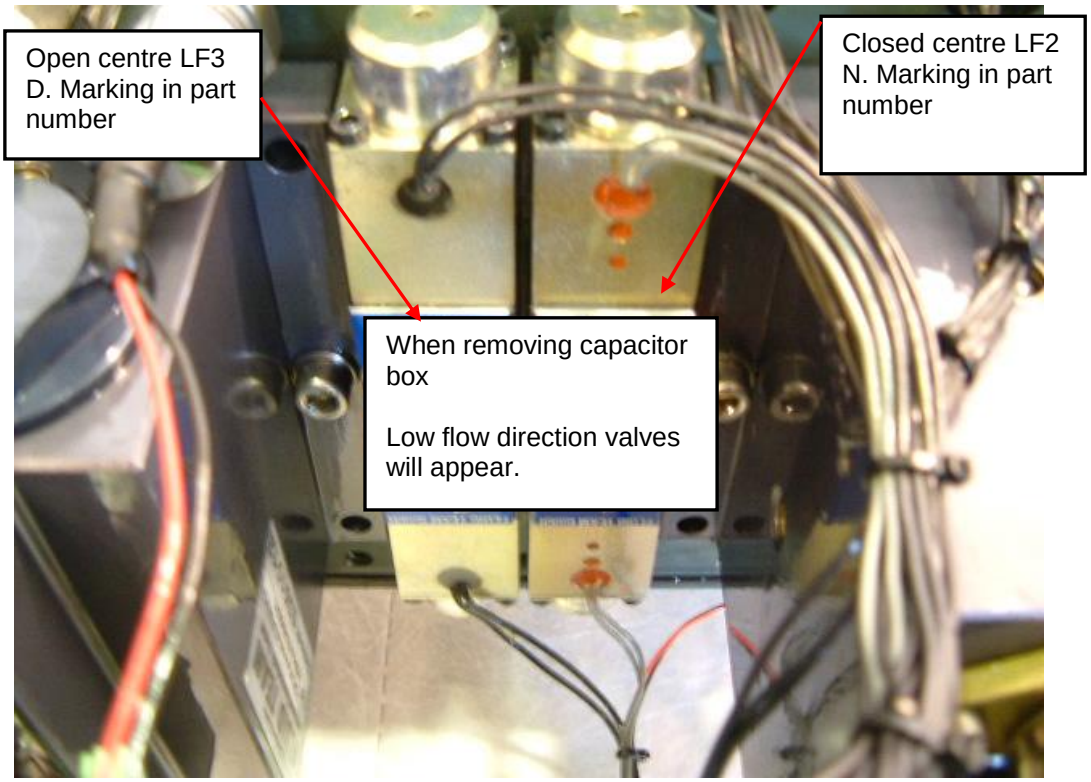
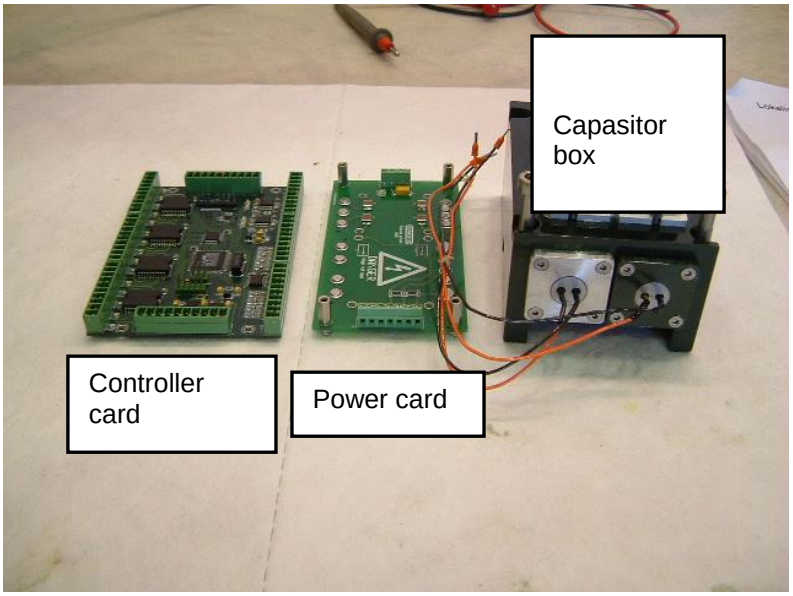


Figure 68 Capacitor box



Dismounting of High and Low flow valves.

Figure 69 Flow valves

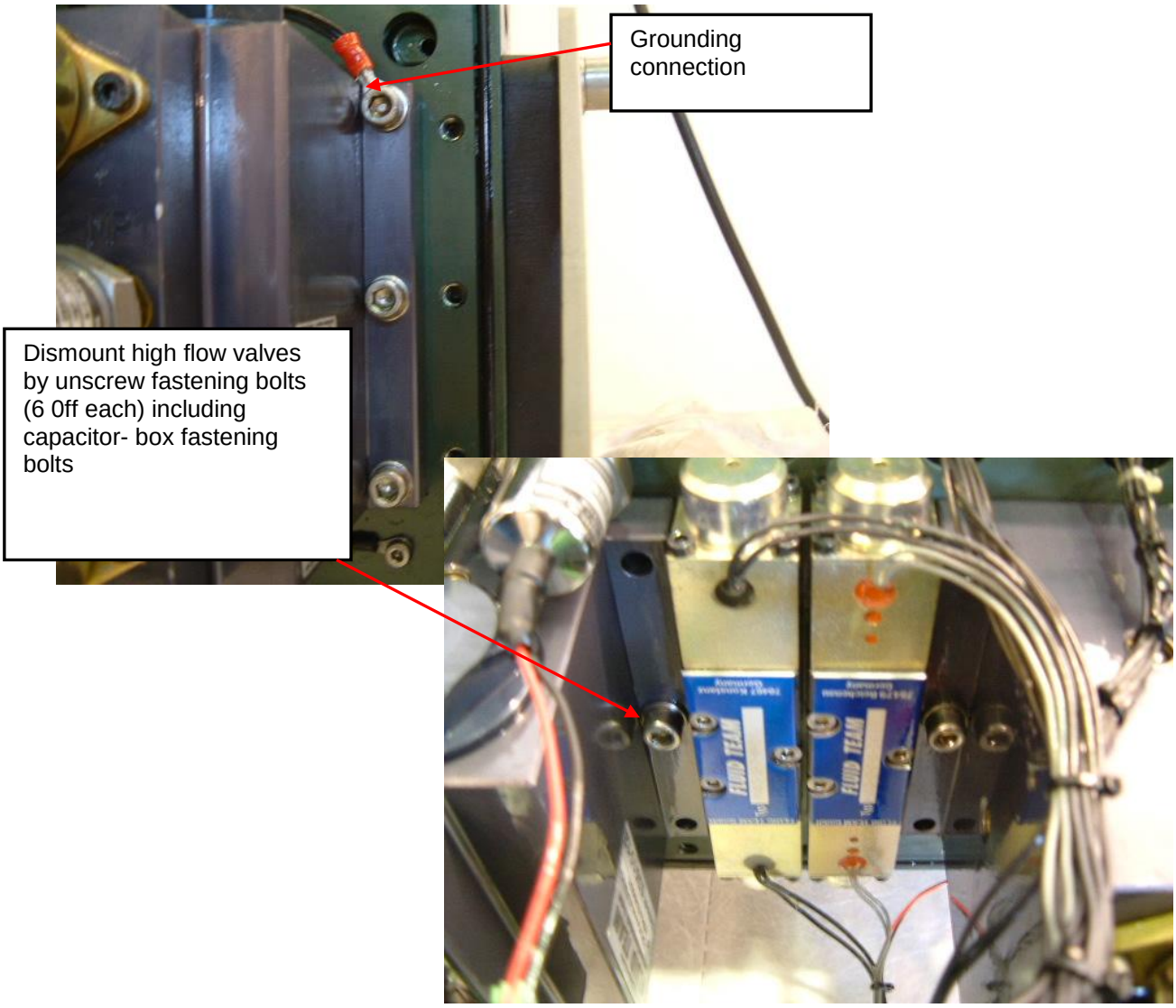


Figure 70 Valves

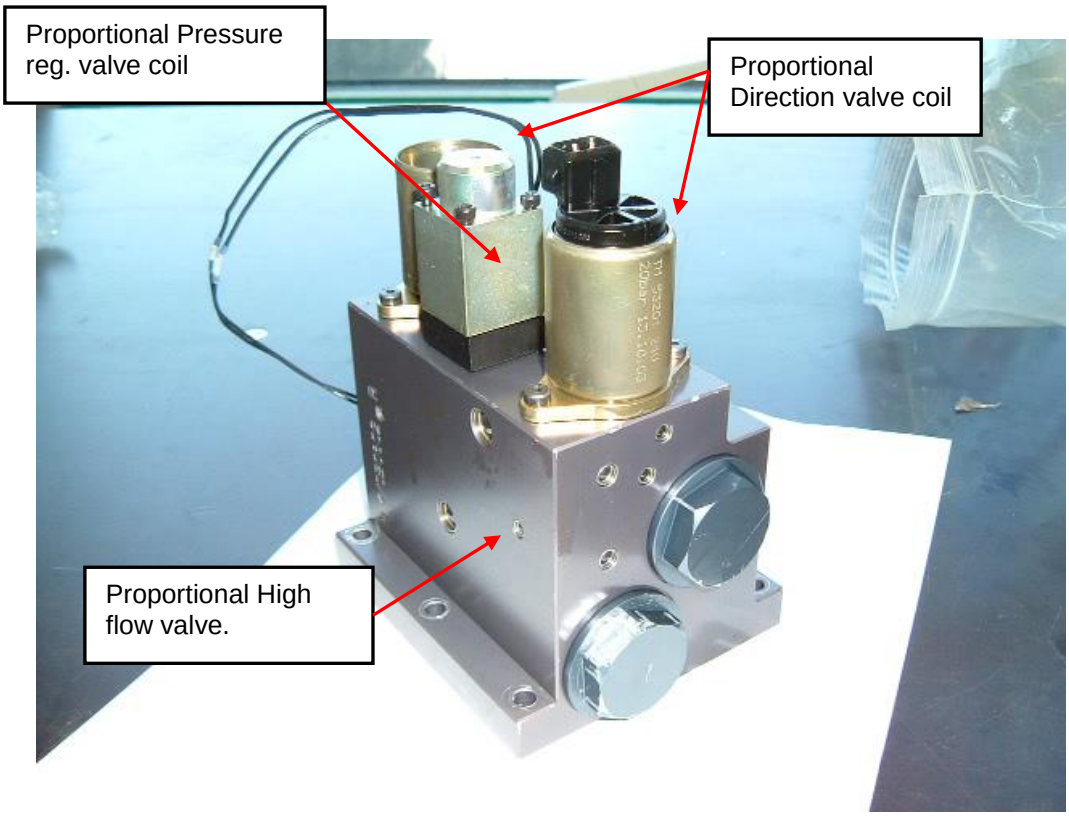
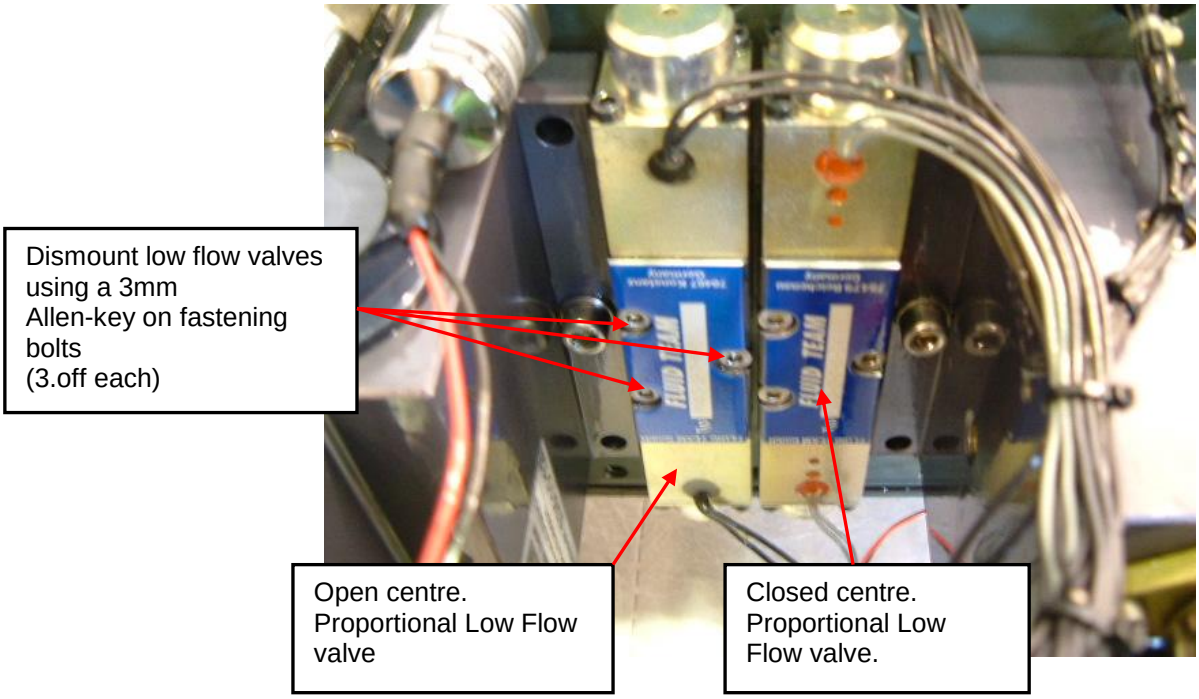
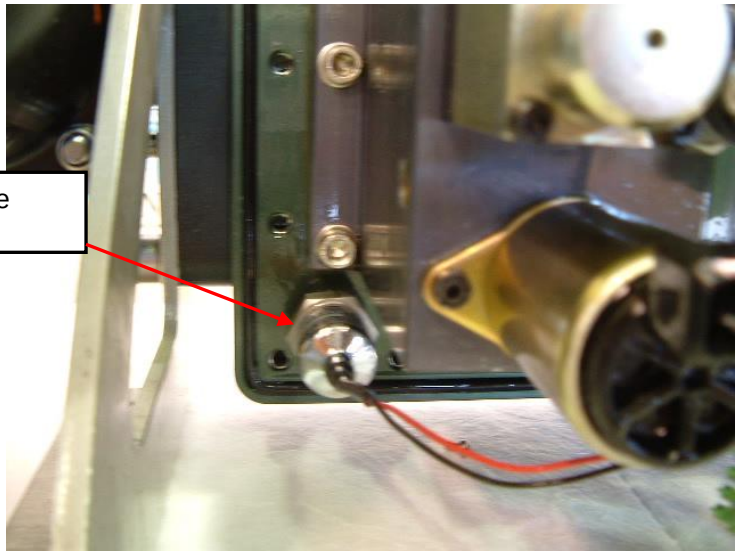


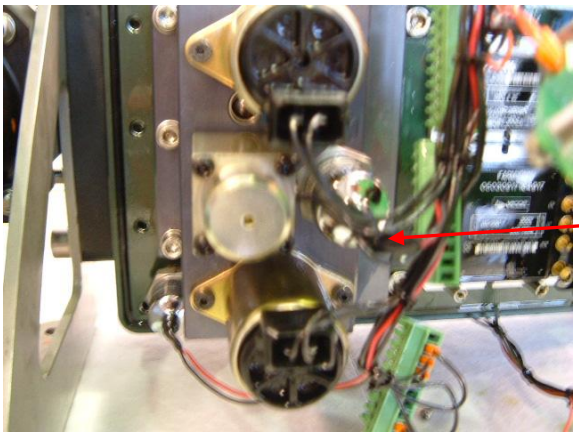
Figure 71 Dismount flow valves

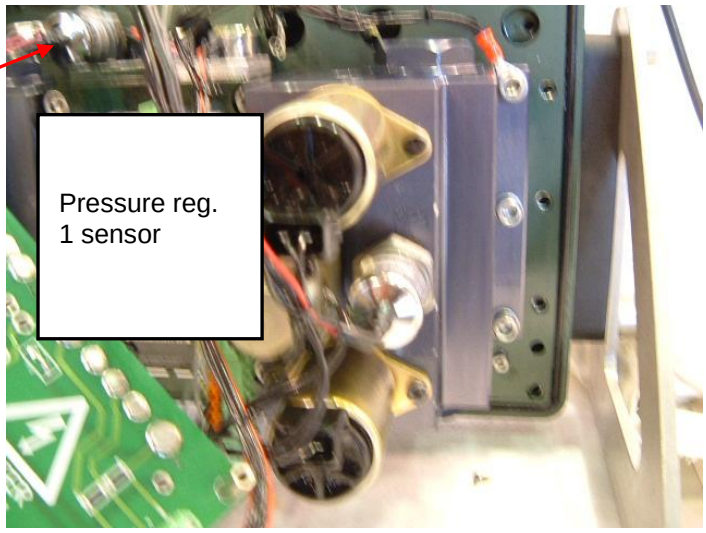


Pressure sensors

Figure 72 Pressure sensors

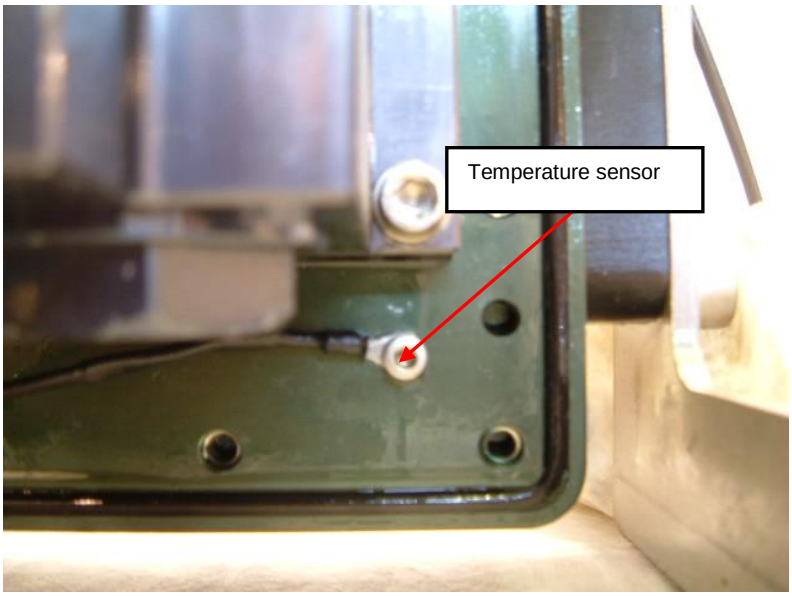






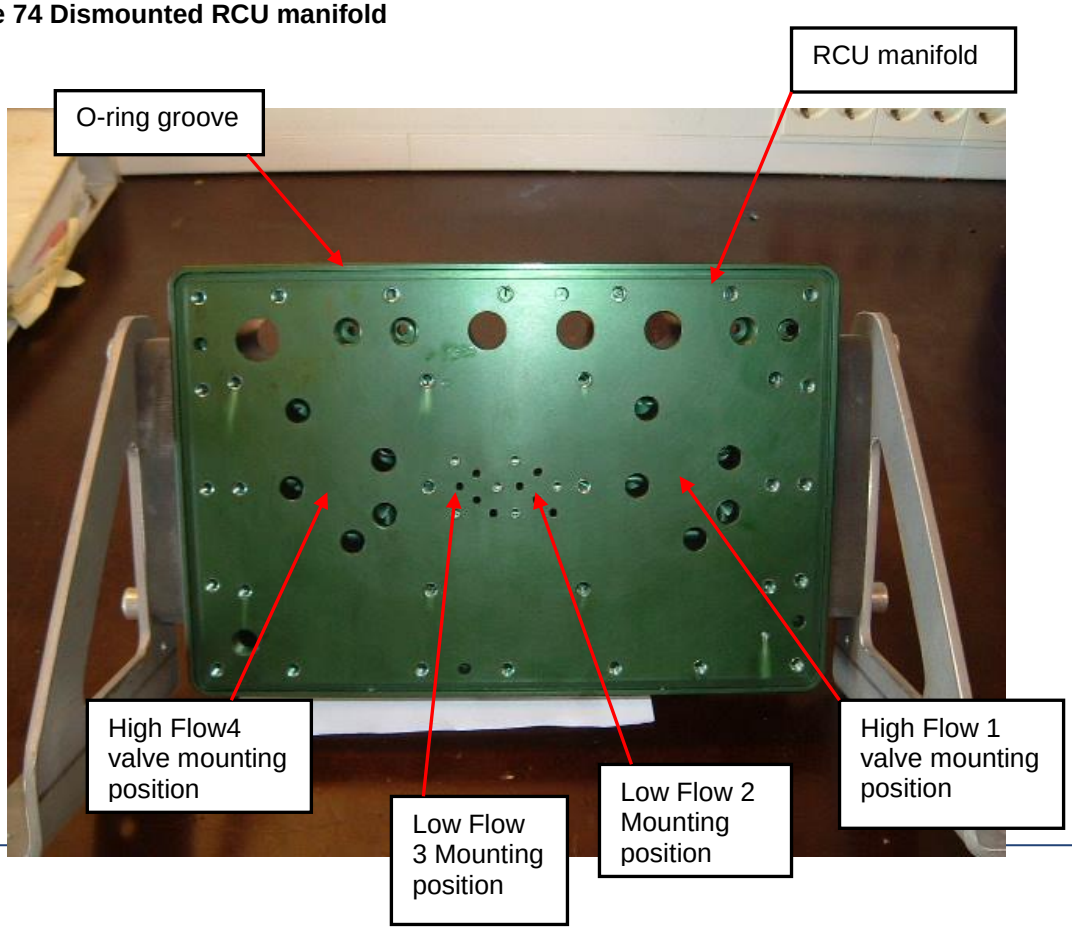
Temperature sensor

Figure 73 Temperature sensors



RCU manifold fully dismounted.

Figure 74 Dismounted RCU manifold



Assembly of RCU.

Assembly of RCU shall be performed as disassembly procedure in opposite direction

Oil filling of RCU

Figure 75 Oil filling RCU

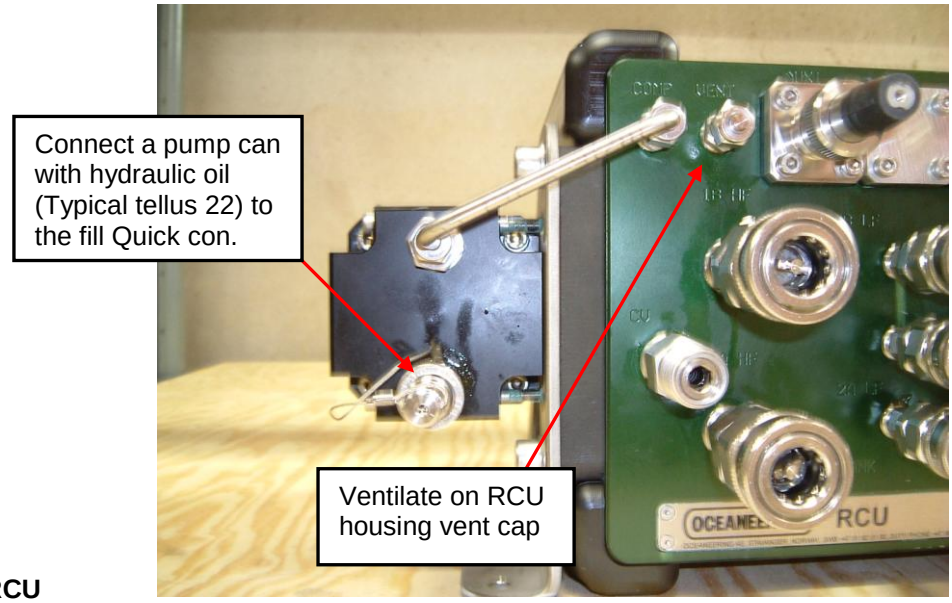
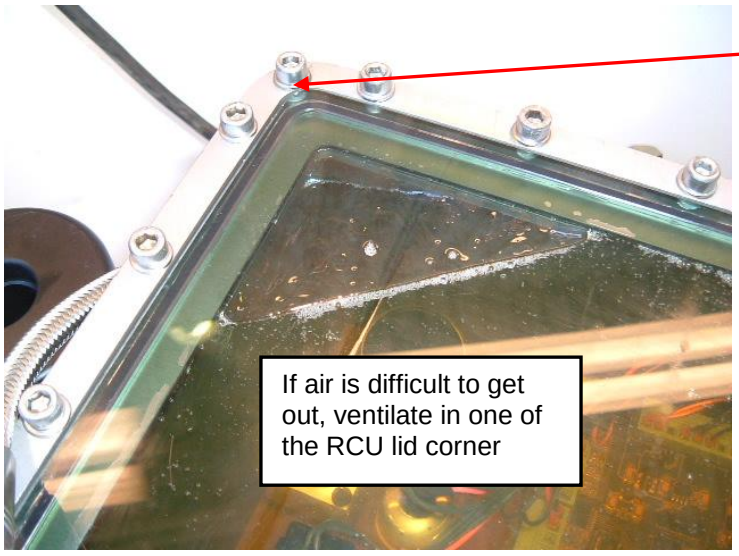


Figure 76 Ventilate RCU



NOTE UNDER NORMAL OPERATION IT SHOULD NOT BE NECESSARY TO OPEN THE SUBSEA UNIT. IF IT DOES BECOME NECESSARY TO ACCESS THE INTERNAL COMPONENTS, PLEASE CONTACT OCEANEERING NORWAY

10.0 TROUBLE SHOOTING

10.1 Loss of Communication

1. Confirm that power is applied to the surface control unit and the PC boots successfully.
2. Confirm that power is applied to pin 1 and 2 of the Power/Signal connector.
3. Check electrical continuity of the RCU communications twisted pair from the surface unit to pin 4 and 5 of the Power/Signal connector. If a single conductor resistance exceeds 200 ohms, check for bad connections in the conductor run.
4. If the above checks are good, reverse the twisted pair connections.
5. If there is still no communications, connect a jumper cable direct from the surface unit to the RCU. Wire for 232 communication at first. Make sure that com select button in operation window is set for 232 communication. Start RCU communication. If no communication reverse twisted pair. If still no communication wire up RCU for 485 communication. Make sure that COM select button in operation window is set for 485 communications. Reverse twisted pair if necessary. **NOTE: Wiring for 232 and 485 communication, not to be connected to electrical jumper (pigtail) simultaneously!**
6. Verify Baud Rate settings at communication link on ROV system (38400)
7. If no communication. Controller card in RCU might have lost its factory settings (EEPROM). Replace controller Card or contact Oceaneering (NORWAY) for support to reprogramming controller card with Com Test Program.
8. If there is still no communications, replace the RCU with a backup unit and return the malfunctioning RCU to Oceaneering Norway for repair.

10.2 RCU controls not working

1. If using Black Box RS 232/485 Modem. Make sure that DLB (Data loop back) button in front is **not** pressed in.
2. If using Moxa, check dip switch settings:

1 – on
2 – on
3 – on
Test - off

3. If use of Torque Tool, verify that torque limits are set higher than zero to be able for operating HF1 valve.
4. *For additional support please use the following e-mail address*: **rcu-support@oceaneering.com**

FOR OTHER ISSUES PLEASE CONTACT OCEANEERING NORWAY.

Oceaneering Norway:
Jåttåvågen, Hinna
P.Box 8024
4068 STAVANGER, NORWAY
Switch Board: +47 51 82 51 00
Duty Phone: +47 90 64 44 77

11.0 Figures and tables

11.1 List of figures

11.2 List of tables

12.0 APPENDICES

APPENDIX 1

DRAWINGS

1 RCU GENERAL ASSEMBLY
2 RCU ELECTRICAL SCHEMATIC
3 RCU HYDRAULIC SCHEMATIC
4 RCU ELECTRICAL INTERFACE

APPENDIX 2

OPERATIONAL LOG

1 OPERATIONAL LOG
2 MOBILISATION CHECK LIST
3 USERS NOTES

APPENDIX 1 DRAWINGS

OAS. Dwg.NO	Description
0282400	Remote Control Unit
0282420	Remote Control Unit, w/quick connectors
0297900	Remote Control Unit, w/Back Seal Test Unit
0301695	Remote Control Unit, w/quick connectors/Back Seal Test Unit
0301700	Remote Control Unit, ROV
0301720	Remote Control Unit, ROV, w/Back Seal Test Unit
0291974	Remote Control Unit, Electrical interface, wiring diagram
0314069	Remote Control Unit, Electrical diagram
0314070	Remote Control Unit, Hydraulic diagram
0291976	Remote Control Unit, Electrical diagram w/Back Seal Test Unit
0291972	Remote Control Unit, Hydraulic diagram w/Back Seal Test Unit

APPENDIX 2 OPERATIONAL LOG

1 OPERATIONAL LOG

2 MOBILISATION CHECK LIST

3 USERS NOTES

OPERATIONAL LOG

RCU S/N:_____

DATE:	LOCATION:	OPERATION:	COMMENTS:

MOBILISATION CHECK LIST

When the unit is mobilised, the list below shall be used to confirm functionality of the unit. Any "Non conformances" must be noted.

Table 1 Mobilisation checklist

No	DESCRIPTION:	OK	DATE:	SIGN:
1	GENERAL			
1.1	Check that all items noted in inventory list is present.			
1.2	Check all items for mechanical damages			
2	FUNCTIONAL TEST - ELECTRICAL			
2.1	Connect power (230 VAC) to topside unit.			
2.2	Connect power (110 or 230VAC) to sub-sea unit.			
2.3	Connect communication link (RS232 or RS485).			
2.4	Power up sub-sea unit and topside controller, confirm error-free boot up.			
2.5	Operate the direction valves. Observe that LED’s on controller card is lightening when operating valve. Red /Blue in different directions.			
2.6	Operate Pressure control valve. Observe that LED’s on controller card is lightening when operating valve. Red colour.			
3	FUNCTIONAL TEST - HYDRAULIC			
3.1	System connected as described in 2.0 above, connect hydraulic pressure and return to adequate HPU.			
3.2	Operate pressure set function, confirm that pressure can be controlled from 10-210bar			
3.3	Connect a loop to direction valves A/B port. Operate direction valves in both directions. Confirm hydraulic flow to be regulated (Flow-meter).			
3.4	Check for any oil leakages.			
3.5	Cap all hydraulic connections.			
4	PACKING AND SHIPMENT			
4.1	Pack all items into the transportation box. Ensure that parts are stabile in the box. Compare with inventory list.			
4.2	All necessary transportation documentation prepared. (EMO)			

USERS NOTES PAGE

This page(s) shall be used to give comments to operation, maintenance and repair of the RCU. Information will be used when the unit is sent to shore for refurbishment/repair or storage.