



## DELTA WRENCH – User Guide



### WARNING

To reduce the risk of injury, before using or servicing tool, read and understand the following information.  
The features and descriptions of our products are subject to change without prior notice.





## Revision history

<i>Issue</i>	<i>Date</i>	<i>Description</i>	<i>Delta Wrench Firmware version</i>	<i>DeltaQC minimum software version</i>
01	02 May 2012	First issue	1.0x	2.0.x
02	25 May 2012	Curves viewer added	1.1x	2.1.x
03	13 May 2013	Residual torque/angle automatic strategy added (par. 6.7.2.1), Settings updated (par. 8.2), Curves viewer updated (par. 11), Pset execution updated (par. 6)	1.2x	2.4.x
04	21 January 2014	Rechargeable battery added, RFID TAG management in end fitting tool added, WLAN radio module added, Product name changed	2.0x	2.6.x
05	20 October 2014	Statistics added (par. 9), WLAN program source added	2.1x	3.0.x
06	28 May 2015	About this document updated (par. 1.1), Specifications updated (par. 1.2), Getting Started with Delta Wrench updated (par. 4), Manual Zero Adjustment added (par. 4.1), WLAN Communication Protocol updated (chapter 12)	2.2x	3.2.x
07	27 August 2015	General User Guide update, ZIGBEE Radio Module added (par. 2.5), ElitBox added (par. 8.1.4), Open Protocol settings added (par. 8.2.5), Working with Open Protocol added (chapter 13)	2.3x	3.4.x
08	13 May 2016	Specifications updated (par. 1.2), Software Installation updated (par. 4.1), Executing a Demo Test updated (par. 5.2), Residual Torque/Angle Automatic added (par. 5.2.5), Pset updated (chapter 6), Options updated (par. 6.5), Residual Torque/Angle Automatic updated (par. 6.7.2.1), Create a Route updated (par. 7.1), Configuration updated (par. 8.2.1), Tag Identifier updated (par. 8.2.1.10), WLAN/Open Protocol: number of results before wrench lock added (par. 8.2.1.11), Curves Viewer updated (chapter 11), View one curve updated (par. 11.1), Curves comparison updated (par. 11.3), WLAN Communication Protocol updated (chapter 12), Working with Open Protocol updated (chapter 13)	2.4x	3.5.x
09	30 September 2016	General User Guide update, Menu list updated (par. 4.2.2), Real Time option added (par. 4.6), Working with open Protocol updated (chapter 13)	2.5x	3.6.x
10	03 October 2017	Specifications updated (par. 1.2), Models updated (par. 2.1), Getting started with Delta Wrench updated (chapter 5), Tightening updated (par. 5.2.3), Residual Torque/Angle updated (par. 5.2.4), Residual Torque/Angle Automatic updated (par. 5.2.5), VDI-VDE 2648 strategy added (par. 5.2.6), Configuration updated (par. 8.2.1), Tag identifier updated (par. 8.2.1.11), Results viewer updated (chapter 10), Delta Wrench diagnostic updated (par. 15.1)	2.7x	3.7.x



Issue	Date	Description	Delta Wrench Firmware version	DeltaQC minimum software version
11	23 November 2017	Models updated (par. 2.1), Tightening updated (par. 5.2.3), Residual Torque/Angle updated (par. 5.2.4), Residual Torque/Angle Automatic updated (par. 5.2.5), Vibration parameter added (par. 6.3), Delta Wrench Diagnostic updated (par. 15.1)	2.6x	3.8.x
12	21 March 2018	General User Guide update, Torque Parameters added (par. 6.1), Angle Parameters added (par. 0), Vibration Parameter added (par. 6.3), Options updated (par. 6.6), Running a Pset updated (par. 0), Torque Time strategy updated (par. 6.8.1.1), Torque & Angle strategy updated (par. 6.8.1.2), Torque + Angle strategy updated (par. 6.8.1.3), Prevailing Torque Automatic Compensation strategy added (par. 6.8.1.4), Residual Torque/Angle updated (par. 6.8.2.2), Configuration updated (par. 8.2.1), Change Screw Check updated (par. 8.2.1.12), Power Off [minutes] updated (par. 0), Results Viewer updated (chapter 10), View One Curve updated (par. 11.1)	2.8x	3.9.x
13	29 June 2018	Software Installation updated (par. 4.1), Menu list updated (par. 4.2.2), Connecting to the Delta Wrench updated (par. 4.4), Database backup (par. 4.6), Residual Torque/Angle updated (par. 5.2.4), Residual Torque/Angle Automatic updated (par. 5.2.5), Running a Pset updated (par. 0), Configuration updated (par. 8.2.1), Results confirmation options updated (par. 8.2.1.4), Curves confirmation options added (par. 8.2.1.5), Batches running mode updated (par. 8.2.1.7), Gyroscope overspeed updated (par. 8.2.1.8), Results Viewer updated (par. 10), View One Curve updated (par. 11.1)	2.9x	4.0.x
14	5 September 2018	Specifications updated (par. 1.2), Display updated (par. 3.1), Running a Pset updated (par. 0), WLAN Communication Protocol updated (chapter 12)	2.10x	4.1.x
15	30 November 2018	Specifications updated (par. 1.2), DeltaQC Overview updated (par. 4.2), Search function updated (par. 4.2.1), Online mode updated (par. 4.2.5), Delta Wrench transducer information updated (par. 4.2.5.2), Connecting to the Delta Wrench updated (par. 4.4), Real Time option updated (par. 4.7), GETTING STARTED WITH DELTA WRENCH updated (chapter 5), Tightening updated (par. 5.2.3), PSET updated (chapter 6), Torque Parameters updated (par. 6.1), Angle Parameters updated (par. ), Vibration parameter updated (par. 6.3), Drag Torque added (par. 6.8.2.4), Running a Pset updated (par.6.7), OFFLINE MODE updated (chapter 7), Create a Route updated (par. 7.1), Configuration updated (par. 8.2.1), Tag identifier updated (par. 8.2.1.11), Delta Wrench display switch off [minutes] added (par. 8.2.1.14), STATISTICS updated (chapter 9), RESULTS VIEWER updated (chapter 10), WORKING WITH OPEN PROTOCOL	2.11x	4.1.x





Issue	Date	Description	Delta Wrench Firmware version	DeltaQC minimum software version
		(chapter 13), APPENDIX B – DELTA WRENCH FACTORY SETTINGS updated (chapter 17)		
16	12 July 2019	Torque Parameters updated (par. 6.1), Vibration parameter updated (par. 6.3), Yield Point strategy added (par. 6.8.2.5), Residual Loose and Tighten strategy added (par. 6.8.2.6)	2.12x	4.3.x
17	19 November	Yield Point (par. 6.8.2.5), Residual Loose and Tighten (par. 6.8.2.6)	2.12x	4.3.x



**NOTE:** The programming software DeltaQC may be updated with no changes regarding the Delta Wrench functionalities.  
 The minimum version indicated here is required for the reference firmware version.

## Table of Contents

<b>Table of Contents</b> .....	<b>4</b>
SAFETY INFORMATION .....	7
BATTERIES INFORMATION according to European regulation 2006/66/EC .....	8
<b>1 INTRODUCTION</b> .....	<b>9</b>
1.1 About this document .....	9
1.2 Specifications .....	10
1.3 EC Declaration of Conformity.....	13
<b>2 DELTA WRENCH OVERVIEW</b> .....	<b>14</b>
2.1 Models .....	14
2.2 Battery .....	16
2.3 Battery charger .....	17
2.4 WLAN Radio Module .....	18
2.5 ZIGBEE Radio Module.....	18
2.6 End fitting tools .....	19
<b>3 USER INTERFACES</b> .....	<b>20</b>
3.1 Display .....	20
3.2 Keyboard .....	21
3.3 Buzzer .....	21
3.4 Mini USB Port.....	21
<b>4 WORKING WITH “DELTA QC” SOFTWARE</b> .....	<b>22</b>
4.1 Software Installation .....	22
4.1.1 Software registration .....	32
4.1.2 DeltaQC “Evaluation version” .....	37
4.1.3 DeltaQC “Free version” .....	37
4.1.4 DeltaQC <i>Licensed</i> and <i>Advanced</i> versions .....	38
4.1.5 DeltaQC software upgrade .....	38
4.2 DeltaQC Overview .....	39
4.2.1 Search function .....	41
4.2.2 Menu list.....	42



4.2.3	Toolbar.....	43
4.2.4	Status bar.....	44
4.2.5	Online mode.....	44
4.2.5.1	Transfer online data to the database.....	45
4.2.5.2	Delta Wrench transducer information.....	47
4.3	Language settings in DeltaQC.....	48
4.4	Connecting to the Delta Wrench.....	49
4.5	Delta Wrench LOG Viewer.....	52
4.6	Database backup.....	53
4.7	Real Time option.....	55
<b>5</b>	<b>GETTING STARTED WITH DELTA WRENCH.....</b>	<b>66</b>
5.1	Manual Zero Adjustment.....	67
5.2	Executing a Demo Test.....	69
5.2.1	Track.....	69
5.2.2	Peak.....	70
5.2.3	Tightening.....	70
5.2.4	Residual Torque/Angle.....	72
5.2.5	Residual Torque/Angle Automatic.....	73
5.2.6	VDI-VDE 2648.....	74
<b>6</b>	<b>PSET.....</b>	<b>75</b>
6.1	Torque Parameters.....	82
6.2	Angle Parameters.....	84
6.3	Vibration parameter.....	85
6.4	Time.....	87
6.5	Batch Parameters.....	88
6.6	Options.....	89
6.7	Running a Pset.....	90
6.8	Tightening strategies.....	93
6.8.1	Production strategies.....	93
6.8.1.1	Torque Time.....	95
6.8.1.2	Torque & Angle.....	96
6.8.1.3	Torque + Angle.....	97
6.8.1.4	Prevailing Torque Automatic Compensation.....	99
6.8.2	Quality Control Strategies.....	101
6.8.2.1	Residual Torque/Angle Automatic.....	101
6.8.2.2	Residual Torque/Angle.....	102
6.8.2.3	Residual Peak/Torque.....	103
6.8.2.4	Drag Torque.....	104
6.8.2.5	Yield Point.....	106
6.8.2.6	Residual Loose and Tighten.....	108
<b>7</b>	<b>OFFLINE MODE.....</b>	<b>111</b>
7.1	Create a Route.....	112
7.2	Transfer a <i>Route</i> to the Delta Wrench.....	117
<b>8</b>	<b>DELTA WRENCH SETTINGS.....</b>	<b>118</b>
8.1	Settings Menu on Delta Wrench.....	118
8.1.1	Language.....	118
8.1.2	Date - time.....	118
8.1.3	Demo mode unit.....	119
8.1.4	ElitBox / WiFi.....	119
8.1.4.1	ElitBox (for models with ZigBee radio module).....	119
8.1.4.2	WiFi (for models with WLAN radio module).....	120
8.1.5	Diagnostic.....	120
8.1.6	Power off.....	120



8.2	Delta Wrench Controller Setup .....	121
8.2.1	Configuration.....	122
8.2.1.1	Delta Wrench name.....	122
8.2.1.2	Delta Wrench date and time.....	123
8.2.1.3	Delta Wrench display language.....	123
8.2.1.4	Results confirmation options .....	123
8.2.1.5	Curves confirmation options.....	123
8.2.1.6	Batch increment condition .....	124
8.2.1.7	Batches running mode.....	124
8.2.1.8	Gyroscope overspeed .....	124
8.2.1.9	Source type .....	124
8.2.1.10	Tag required .....	125
8.2.1.11	Tag identifier .....	125
8.2.1.12	Change screw check .....	125
8.2.1.13	Delta Wrench power off [minutes] .....	126
8.2.1.14	Delta Wrench display switch off [minutes].....	126
8.2.1.15	WLAN/Open Protocol: number of results before wrench lock.....	126
8.2.2	Information .....	127
8.2.3	Memory .....	128
8.2.4	WLAN settings .....	128
8.2.5	Open Protocol settings.....	128
<b>9</b>	<b>STATISTICS.....</b>	<b>129</b>
9.1	Exporting the Graph.....	137
9.2	Statistical Computation .....	138
9.2.1	CNOMO standard E41.32.110N .....	138
9.2.2	ISO standard.....	140
9.2.3	NF standard E 60-181.....	141
9.2.4	Normal Distribution Test: Population under 50 measurements (Shapiro-Wilk test) ...	141
9.2.5	Normal Distribution Test: Population under 50 measurements (Chi-Squared test) ...	143
9.2.6	Q544000 .....	145
<b>10</b>	<b>RESULTS VIEWER .....</b>	<b>148</b>
<b>11</b>	<b>CURVES VIEWER.....</b>	<b>154</b>
11.1	View One Curve.....	155
11.2	Export a Curve.....	159
11.3	Curves Comparison .....	160
<b>12</b>	<b>WLAN COMMUNICATION PROTOCOL .....</b>	<b>161</b>
<b>13</b>	<b>WORKING WITH OPEN PROTOCOL .....</b>	<b>169</b>
<b>14</b>	<b>MAINTENANCE .....</b>	<b>179</b>
14.1	Yearly Calibration .....	179
14.2	Cleaning .....	179
14.3	Battery Pack Maintenance .....	179
<b>15</b>	<b>TROUBLESHOOTING GUIDE .....</b>	<b>180</b>
15.1	Delta Wrench Diagnostic .....	181
<b>16</b>	<b>APPENDIX A – CALCULATING CORRECTION COEFFICIENTS FOR EXTENSIONS</b>	<b>183</b>
16.1	Torque Correction Coefficient .....	183
16.2	Angle Correction Coefficient .....	184
16.3	Correction Formulas .....	186
<b>17</b>	<b>APPENDIX B – DELTA WRENCH FACTORY SETTINGS.....</b>	<b>187</b>
<b>18</b>	<b>ABBREVIATIONS .....</b>	<b>189</b>



## SAFETY INFORMATION



**WARNING: PLEASE CAREFULLY READ THE DELTA WRENCH SAFETY INFORMATION (No. 6159920940) PRIOR TO USE THE PRODUCT AND PAY ATTENTION TO THE SAFETY INSTRUCTIONS PROVIDED.**





## BATTERIES INFORMATION according to European regulation 2006/66/EC

### BATTERY SPECIFICATION

**TYPE:** Lithium-ion, 3.6 V, 2.9 Ah  
**CELL WEIGHT:** 50 g

Install the battery in the handle of the Delta Wrench (see the picture below):



**NOTE:** Once removed, dismiss the wasted batteries depending on local regulations.





# 1 INTRODUCTION

## 1.1 About this document

This document is a User Guide for the Delta Wrench. It has the main following parts:

Part	Name	Description
Chapter 1	Introduction	This part introduces this User Guide and provides the Delta Wrench technical specifications.
Chapter 2	Delta Wrench Overview	This part introduces the Delta Wrench with its models and accessories.
Chapter 3	User Interfaces	This part provides an overview of the user interfaces available on the Delta Wrench (Display, keyboard, ports, etc.).
Chapter 4	Working with DeltaQC Software	This part introduces the operations of the Delta Wrench management software.
Chapter 5	Getting started with Delta Wrench	This part explains to the operator how to perform the Manual Zero Adjustment and how to execute a Demo test.
Chapter 6	Pset	This part details all the parameters and tightening strategies available for a tightening or quality control program.
Chapter 7	Offline mode	This part describes how to create Psets offline, without a Delta Wrench connected to the PC.
Chapter 8	Delta Wrench settings	This part leads the operator in all the settings of the Delta Wrench, in order to customize the product to the customer's needs.
Chapter 9	Statistics	This part explains the statistics calculated after the tests and the formulas used.
Chapter 10	Results viewer	This part describes how to retrieve the results from the Delta Wrench to the DeltaQC.
Chapter 11	Curves viewer	This part describes how to retrieve the curves from the Delta Wrench to the DeltaQC.
Chapter 12	WLAN Communication Protocol	This part explains the operations of the optional WLAN radio module.
Chapter 13	Working with Open Protocol	This part explains the use of the Delta Wrench with the Open Protocol Interface.



Part	Name	Description
Chapter 14 and 15	Maintenance and Troubleshooting Guide	These chapters are dedicated to the instrument maintenance and troubleshooting.
Chapter 16	Appendix A - Calculating correction coefficients for extensions	This part explains how to calculate the correction coefficients for extensions.
Chapter 17	Appendix B – Delta Wrench Factory settings	This part summarizes the default setting of the delta Wrench.
Chapter 18	Abbreviations	Table of the abbreviations used in this User Guide.

## 1.2 Specifications

### TECHNICAL

- Operating torque range: from 10% to 100% of the capacity
- Torque static accuracy: 1% of torque reading  $\pm$  1 digit (within the operating torque range)
- Torque overload capacity: 20% of FSD
- Minimum angular speed: 3 °/s
- Angle measurement accuracy:
 

3 °/s	$\leq$	angular speed	$<$	15 °/s	$\rightarrow$	4,0 %
15 °/s	$\leq$	angular speed	$\leq$	30 °/s	$\rightarrow$	1,5 %
30 °/s	$<$	angular speed	$\leq$	150 °/s	$\rightarrow$	4,0 %
- Maximum angular speed: 150 °/s
- Stability of zero offset with temperature:  $\pm$  0.1% of FSD/°C
- Results memory capacity: 1000
- Unit of measurement supported: N·m, kgf·m, kgf·cm, lbf·ft, lbf·in, ozf·ft, ozf·in, kp·m, dN·m

### BATTERIES

- Battery power supply: Rechargeable battery, Li-ion 3.6 V, 2.9 Ah
- Full charging time: 4 hours 30 minutes
- Battery life:
  - Delta Wrench without radio modules: 10 hours (typical)
  - Delta Wrench with WLAN radio module (connected to CVI3):
    - 5 hours (2,4 GHz)
    - 4 hours (5 GHz)



**NOTE:** In case of Delta Wrench with WLAN radio module, the battery life changes depending on the tool connected.

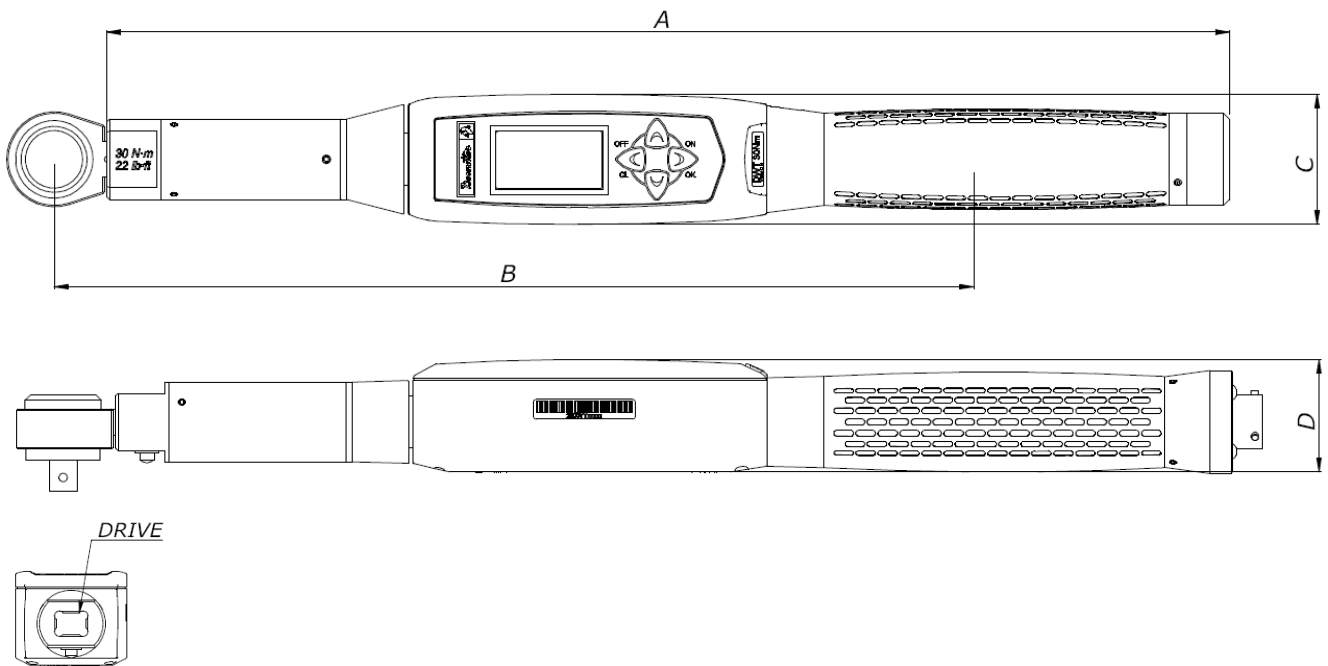


**NOTE:** In case the Delta Wrench is connected to a third-party application like *Open Protocol* or *WLAN Protocol*, the battery life may change depending on messages sent during connection.





## DIMENSIONS AND WEIGHT



Model	A	B**	C*	D*	Drive	Weight (kg)
Delta Wrench 30 Nm	402.0	320.3	45.0	39.4	9x12	0.7
Delta Wrench 150 Nm short	418.0	342.5	45.0	39.4	14x18	0.8
Delta Wrench 150 Nm	627.0	552.5	45.0	39.4	14x18	1.6
Delta Wrench 200 Nm	625.0	550.5	45.0	39.4	14x18	1.6
Delta Wrench 400 Nm	1028.0	953.5	45.0	39.4	14x18	2.7
Delta Wrench 500 Nm	1137.0	1100.0	45.0	39.4	21x26	4.2
Delta Wrench 800 Nm	1314.0	1362.0	Ø 55	Ø 55	Ø 28	4.5

\* Dimension C and D are the maximum dimensions; for the Delta Wrench 800 Nm models, they correspond to the maximum diameter of the transducer.

\*\* Dimension B is the standard arm (measured at the center of the end-fitting tool); these data are used to calculate the torque correction coefficient when an extension is used. This dimension is calculated for the standard end-fitting tools; if a different end-fitting tool is used, this measure must be calculated again.  
 Refer to the "Appendix A – Calculating Correction Coefficient for Extension" for further details.

Dimensions are expressed in millimeters (mm).




## ENVIRONMENTAL

Obey the followings during operation:

- Internal Use only
- Environmental Class: II
- IP Grade according to EN IEC 60529 (except connector): IP40
- Ambient Temperature: 5 to 40°C
- Operation to reduced specification over a temperature range of -10 to 60°C (Delta Wrench models only)
- Atmospheric humidity: 10% to 75% (non-condensing)
- Altitude: Up to 2000m

## INTERFACES

- MiniUSB 2.0 port
- **WLAN** radio module (optional):
  - Type: 802.11a/b/g/n
  - Frequency: 2.412 - 2.484 GHz, channel 1 – 14, 5 MHz channel separation  
5.180 - 5.240 GHz, U-NII-1, channel 36, 40, 44, 48, 20 MHz channel separation
  -  5 GHz frequency band not available in the European Union.
  - RF output power: 802.11b (DSSS): +20dBm (typ.)  
802.11g/n (OFDM): +17dBm (typ.)  
802.11a/n (OFDM): +15dBm (typ.)
  - Receive input level (max): -10 dBm
- **ZigBee** radio module (optional):
  - Type: Based on the Ember EM351 or EM357 single chip ZigBee solutions
  - Frequency: 2.4 GHz ISM Band  
250 kbit/s over the air data rate  
16 channels (IEEE802.15.4 Channel 11 to 26)
  - RF output power: +3 dBm output power (+8 dBm in boost mode)





## SYSTEM REQUIREMENTS

Below are the PC minimum requirements for installation of the management software DeltaQC:

- Processor: 800 MHz or above
- Memory: 256 Mb or above
- Hard disk space: 10 GB
- Display: 800 x 600, 256 colors (1024 x 768, High Color (16-bit) recommended)
- Operating Systems: Windows XP SP3, Windows 7, Windows 8, Windows 8.1, Windows 10
- Microsoft Excel (required to view the exported file with the tightening results)

## CALIBRATION CERTIFICATE

Delta Wrench has a Desoutter factory calibration certificate.

## 1.3 EC Declaration of Conformity

The Delta Wrench is in conformity with the requirements of the council Directives on 06/22/1998 on the approximation of the laws of the Member States relating:

- 2004/108/EC EMC Directive – Electromagnetic Compatibility
- 2011/65/EC ROHS Directive – Risk Of Hazardous Substances
- 1999/05/EC R&TTE Directive – Radio and Telecommunications Terminal Equipment

The Delta Wrench complies with the following normative:

- EN61010-1:2010 Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use – Part 1: General Requirements.

The Delta Wrench is marked with the following symbol:



The Delta Wrench may be operated in the following countries:

Country	ISO 3166 2 letter code	Country	ISO 3166 2 letter code	Country	ISO 3166 2 letter code	Country	ISO 3166 2 letter code
Austria	AT	Germany	DE	Malta	MT	United Kingdom	GB
Belgium	BE	Greece	GR	Netherlands	NL	Iceland	IS
Cyprus	CY	Hungary	HU	Poland	PL	Liechtenstein	LI
Czech Republic	CZ	Ireland	IE	Portugal	PT	Norway	NO
Denmark	DK	Italy	IT	Slovakia	SK	Switzerland	CH
Estonia	EE	Latvia	LV	Slovenia	SI	Bulgaria	BG
Finland	FI	Lithuania	LT	Spain	ES	Romania	RO
France	FR	Luxembourg	LU	Sweden	SE	Turkey	TR



## 2 DELTA WRENCH OVERVIEW

The Delta Wrenches are electronic wrenches designed for optimal operation in:



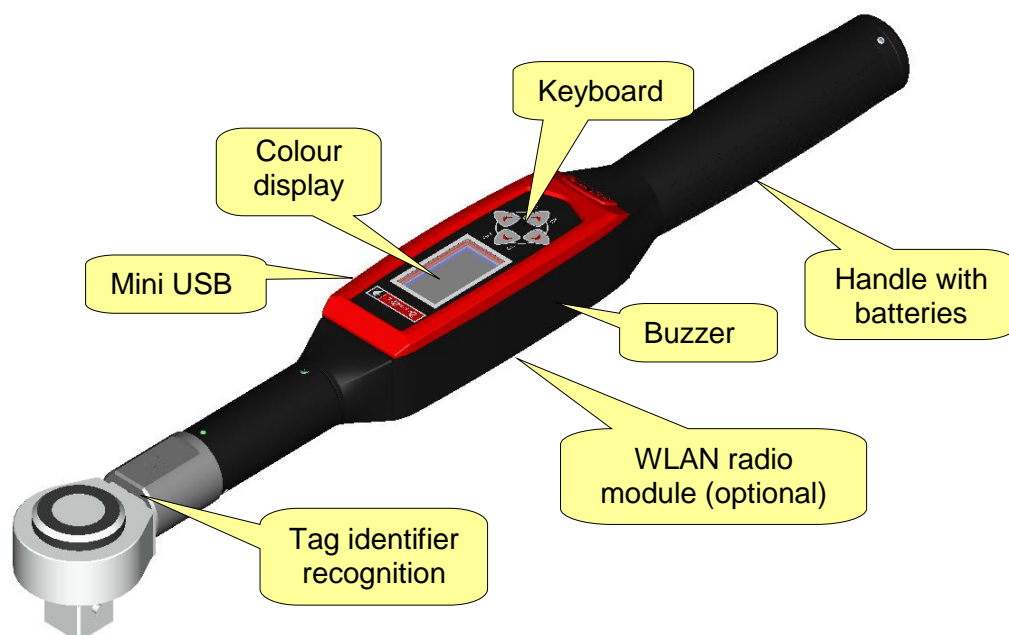
- **Tightening operations in production:** The Delta Wrench performs tightenings by offering a wide variety of tightening strategies. The test results can be retrieved by the Delta Wrench management software (DeltaQC), exported in Microsoft Excel and then printed (according to the customer's needs).
- **Quality control:** The Delta Wrench offers a set of methods to evaluate the residual torque; this makes higher the quality of the tightening operations on a production line under control. The test results can be retrieved by the Delta Wrench management software (DeltaQC), exported to Microsoft Excel and then printed (according to the customer needs).

### 2.1 Models

The Delta Wrench is an instrument designed to execute tightening operations and quality control test on joints.

The Delta Wrench torque/angle models feature a gyroscope to provide also angle measurement and thus providing a wider set of tightening and quality control strategies.

Powered by batteries, these instruments work as stand-alone devices; a specific software (DeltaQC) has been developed to program the instruments, to retrieve the test results and generated detailed statistics to monitor the quality of the tightening process.





Below are the available Delta Wrench models:

#### **TORQUE MODELS**

- Delta Wrench 30 *P/N 6151657710*
- Delta Wrench 150 *P/N 6151657720*
- Delta Wrench 150 short *P/N 6151657570*
- Delta Wrench 400 *P/N 6151657730*
- Delta Wrench 800 *P/N 6151657740*

#### **TORQUE/ANGLE MODELS**

- Delta Wrench 30-A *P/N 6151657750*
- Delta Wrench 150-A *P/N 6151657760*
- Delta Wrench 150-A short *P/N 6151657670*
- Delta Wrench 200-A *P/N 6151657970*
- Delta Wrench 400-A *P/N 6151657770*
- Delta Wrench 500-A *P/N 6151657980*
- Delta Wrench 800-A *P/N 6151657780*

#### **TORQUE MODELS WITH WLAN RADIO MODULE**

- Delta Wrench 30 WLAN *P/N 6151657810*
- Delta Wrench 150 WLAN *P/N 6151657820*
- Delta Wrench 150 WLAN short *P/N 6151657590*
- Delta Wrench 400 WLAN *P/N 6151657830*
- Delta Wrench 800 WLAN *P/N 6151657840*

#### **TORQUE/ANGLE MODELS WITH WLAN RADIO MODULE**

- Delta Wrench 30-A WLAN *P/N 6151657850*
- Delta Wrench 150-A WLAN *P/N 6151657860*
- Delta Wrench 150-A WLAN short *P/N 6151657890*
- Delta Wrench 200-A WLAN *P/N 6151657690*
- Delta Wrench 400-A WLAN *P/N 6151657870*
- Delta Wrench 500-A WLAN *P/N 6151657700*
- Delta Wrench 800-A WLAN *P/N 6151657880*

#### **TORQUE MODELS WITH ZIGBEE RADIO MODULE**

- Delta Wrench 30 ZigBee *P/N 6151658000*
- Delta Wrench 150 ZigBee *P/N 6151658010*
- Delta Wrench 150 ZigBee short *P/N 6151658040*
- Delta Wrench 400 ZigBee *P/N 6151658020*
- Delta Wrench 800 ZigBee *P/N 6151658030*

#### **TORQUE/ANGLE MODELS WITH ZIGBEE RADIO MODULE**

- Delta Wrench 30-A ZigBee *P/N 6151658050*
- Delta Wrench 150-A ZigBee *P/N 6151658060*
- Delta Wrench 150-A ZigBee short *P/N 6151658100*
- Delta Wrench 400-A ZigBee *P/N 6151658070*
- Delta Wrench 800-A ZigBee *P/N 6151658080*

#### **TORQUE/ANGLE MODELS WITH VIBRO**

- Delta Wrench 30-AV *P/N 6159352300*
- Delta Wrench 150-AV short *P/N 6159352310*
- Delta Wrench 200-AV *P/N 6159352320*
- Delta Wrench 400-AV *P/N 6159352330*
- Delta Wrench 500-AV *P/N 6159352340*
- Delta Wrench 800-AV *P/N 6159352350*



### **TORQUE/ANGLE MODELS WITH VIBRO AND WLAN RADIO MODULE**

- |                                  |                |
|----------------------------------|----------------|
| - Delta Wrench 30-AV WLAN        | P/N 6159352360 |
| - Delta Wrench 150-AV short WLAN | P/N 6159352370 |
| - Delta Wrench 200-AV WLAN       | P/N 6159352380 |
| - Delta Wrench 400-AV WLAN       | P/N 6159352390 |
| - Delta Wrench 500-AV WLAN       | P/N 6159352400 |
| - Delta Wrench 800-AV WLAN       | P/N 6159352410 |



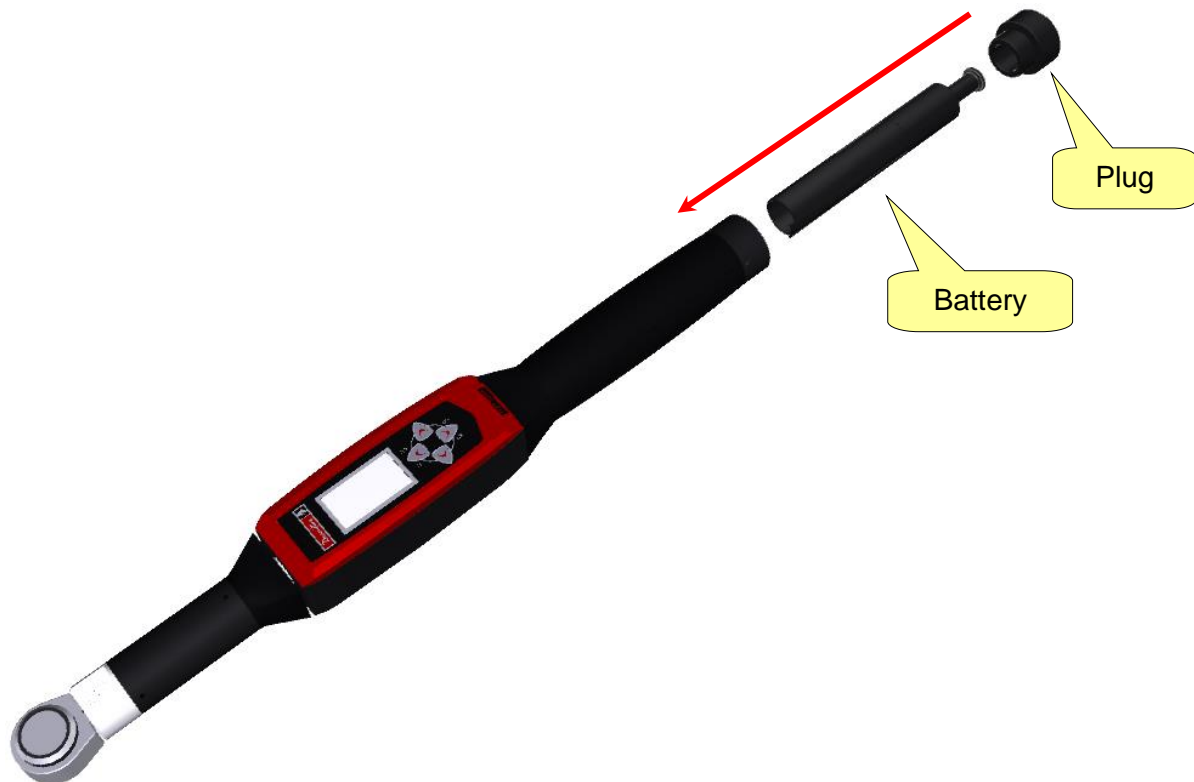
**NOTE:** The number inside each model indicates the Delta Wrench torque capacity.



**NOTE:** For starting to work with the Delta Wrench immediately, refer to the paragraph "Getting Started with Delta Wrench".

## **2.2 Battery**

The Delta Wrench is powered by its battery.



To install or replace the Delta Wrench battery, perform the following procedure:

1. Turn off the device.
2. Unscrew the plug.
3. Insert the battery.
4. Reinstall the plug.

The Delta Wrench battery model is the following:

*Delta Wrench battery*

**P/N 6159361500**





## 2.3 Battery charger



When the Delta Wrench battery level is low, remove the battery from the device and plug it on the battery charger.  
 Thus, connect the battery charger to the AC power line.



The three LEDs located on the Delta Wrench battery charger show the battery charge status:

<i>LED</i> <i>Status</i>	POWER ON	CHARGING	COMPLETE
Power on	●		
Charging in progress	●	●	
Charging complete	●		●
Over temperature	●	<i>Blinking</i>	
Error	●	●	●



**NOTE:** In case of *Over temperature*, disconnect the Delta Wrench battery from the battery charger; then disconnect the battery charger from the AC power.  
 Wait few minutes.

Thus, reconnect the battery charger to the AC power and the Delta Wrench battery to the battery charger, and check if the problem gets solved.



**NOTE:** In case of *Error*, disconnect and then reconnect the Delta Wrench battery to the battery charger and check if the problem gets solved.

The Delta Wrench battery charger model is the following:

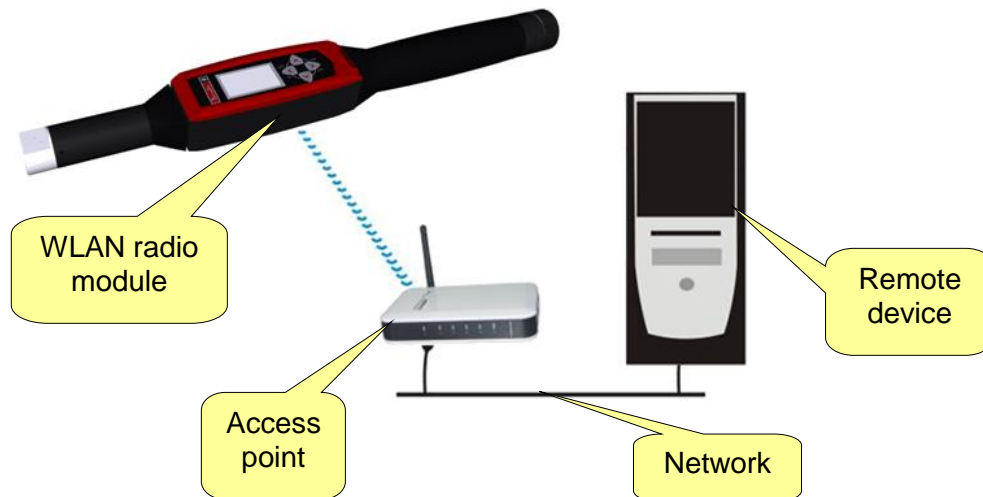
*Delta Wrench battery charger*

**P/N 6159361510**



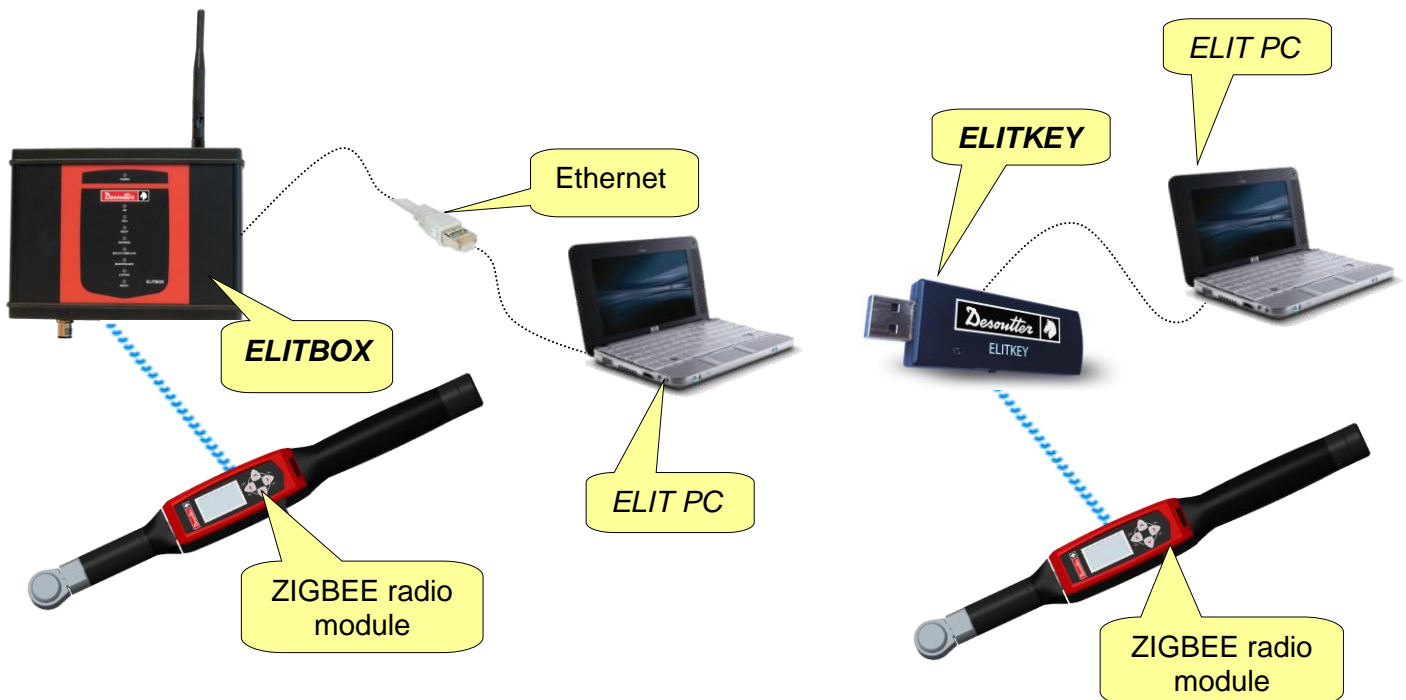
## 2.4 WLAN Radio Module

The WLAN Radio Module is an optional module which provides a bidirectional communication with an external device:



## 2.5 ZIGBEE Radio Module

The ZIGBEE Radio Module is an optional module that provides a bidirectional communication with an ELIT PC either by means of an ELITBOX or an ELITKEY (refer to the picture below):








**NOTE:** For further details about the ZIGBEE settings refer to the paragraph "ElitBox".



## 2.6 End fitting tools

The end-fitting tools for the Delta Wrench must be ordered separately, according to Desoutter price list.

A wide selection of end-fitting tools is available:

	<p><b>Open end</b></p>
	<p><b>Box end</b></p>
	<p><b>Flared end</b></p>
	<p><b>Reversible ratchet</b></p>
	<p><b>Blacked end</b> (This tool can be welded to customized Delta Wrench extensions. This can be helpful in order to maintain the end-fitting tool recognition function when using the extension)</p>



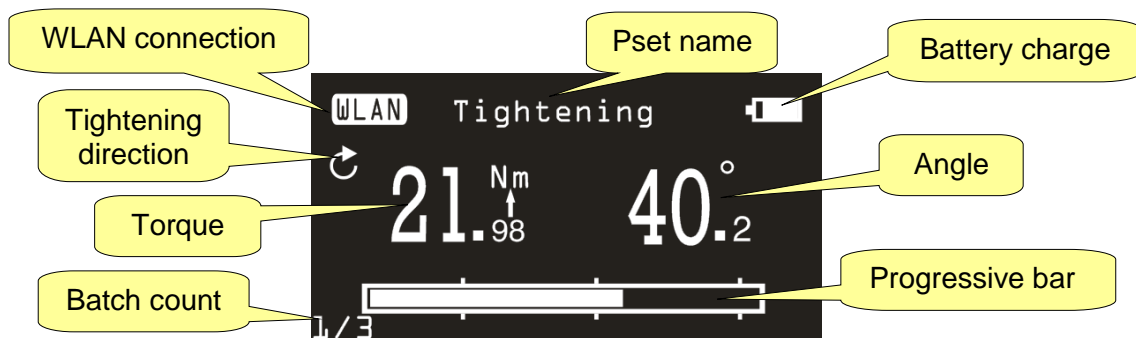
**NOTE:** Each end-fitting tool contains a RFID TAG which stores a number that can be programmed by the DeltaQC software. The Delta Wrench uses this number to recognize the tool automatically.




### 3 USER INTERFACES

#### 3.1 Display

The Delta Wrench display explores the Delta Wrench menus, and shows the torque and the angle during the tightening operation:



<b>Pset name</b>	It indicates the Pset name. In the <i>Demo Mode</i> shows the test type.
<b>WLAN connection</b>	This icon is active for the Delta Wrench models equipped with the WLAN radio module, when it is connected to the network.
<b>Tightening directions</b>	It indicates whether tightening must be executed in the clockwise or counterclockwise direction.
<b>Torque/Angle</b>	It indicates the current measurements. The arrow placed below the Nm label indicates whether the result is considered on the torque peak or angle peak (when applicable).   If the torque applied is outside the operating torque range, the torque value displayed on the Delta Wrench flashes and a warning icon (⚠) appears (for further information, refer to the paragraph <i>Specifications</i> ).
<b>Progressive bar</b>	This bar gets filled by increasing the torque (or the angle depending from the strategy), and leads the operator to reach the target value.
<b>Battery charge</b>	It indicates the battery charge level.
<b>Batch count</b>	Number of the current tightening over the job step total tightenings.

The display background color changes according to the tightening phase and result:

<b>White</b>	Default color for all the menus and settings.
<b>Blue</b>	When a test is started, the display is backlight in blue.
<b>Green</b>	During the test execution, the display turns green when the result is <i>OK</i> .
<b>Red</b>	Color used to indicate an error. During the test execution, the red color is used to indicate that torque and/or angle value exceeds the maximum limit.

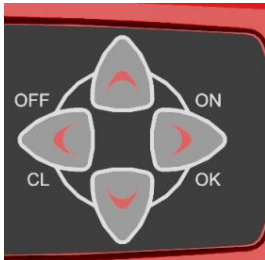


**NOTE:** For better printing contrast, and for black/white printing, in this manual the display figures are always shown in black/white.



## 3.2 Keyboard

Use the keyboard to browse the Delta Wrench menu:

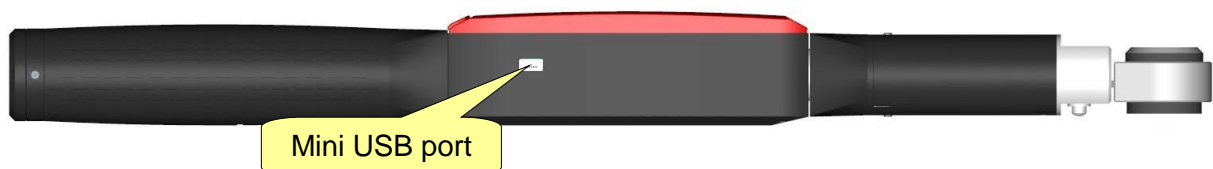


Icon	Name	Description
	ON, ENTER	Switch on the Delta Wrench, enter menu and confirm.
	OFF, ESC	Switch off the Delta Wrench, exit menu.
	UP	Up (browse menu), increase value in settings menus.
	DOWN	Down (browse menu), decrease value in settings menus.

## 3.3 Buzzer

The Delta Wrench features a buzzer, to provide more indications on the result of the current operation. A high tone is emitted in case of *OK* result, while a lower tone is emitted in case of test *Not OK*. For further details, refer to the specific paragraphs related to the various tests available on the Delta Wrench.

## 3.4 Mini USB Port

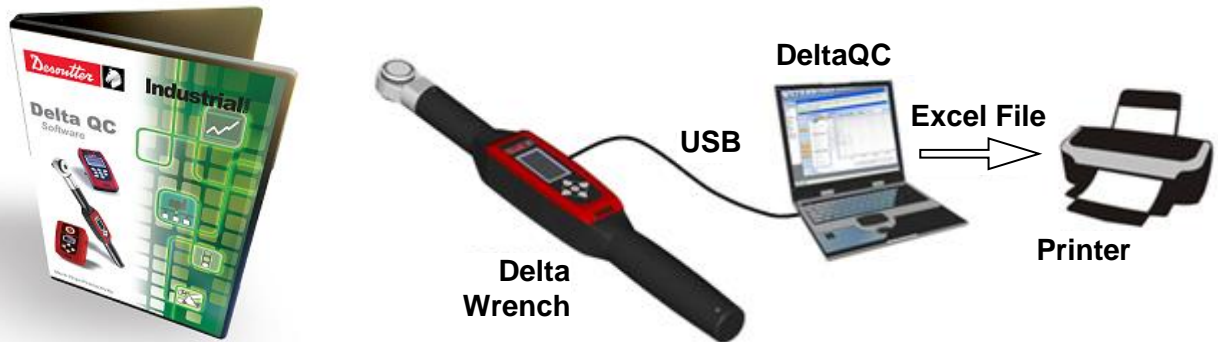


The mini USB port is available for programming the Delta Wrench with DeltaQC software. For further details, refer to the paragraph "*Connecting to the Delta Wrench*".

It is used also for firmware upgrade (reserved for authorized Desoutter Service Personnel).



## 4 WORKING WITH “DELTA QC” SOFTWARE



DeltaQC is a PC software package developed to manage the Delta Wrench.

It offers easy user-friendly programming and real time monitoring of the instrument.

DeltaQC serves as an interface between the user and the Delta Wrench. With DeltaQC, users can configure the Delta Wrench and receive the results and curves.

The main features that characterize the interaction between DeltaQC and Delta Wrench are as follows:

- Psets definition
- Review of results from the Delta Wrench
- Review of curves from the Delta Wrench
- Settings of the Delta Wrench



**NOTE:** DeltaQC saves the tightening programs, results and curves in a local database.

### 4.1 Software Installation



**NOTE:** Do not install the software from a shared folder/drive. Install the software from the supplied CD/USB key; if the CD/USB key content is copied into a PC folder, it must be a PC local folder.



**NOTE:** If a version equal to 3.9.0 (or previous) is upgraded to a version equal to 4.0.0 (or later), it is recommended to perform the migration of data from SQL Server database to SQLite database before launching DeltaQC.



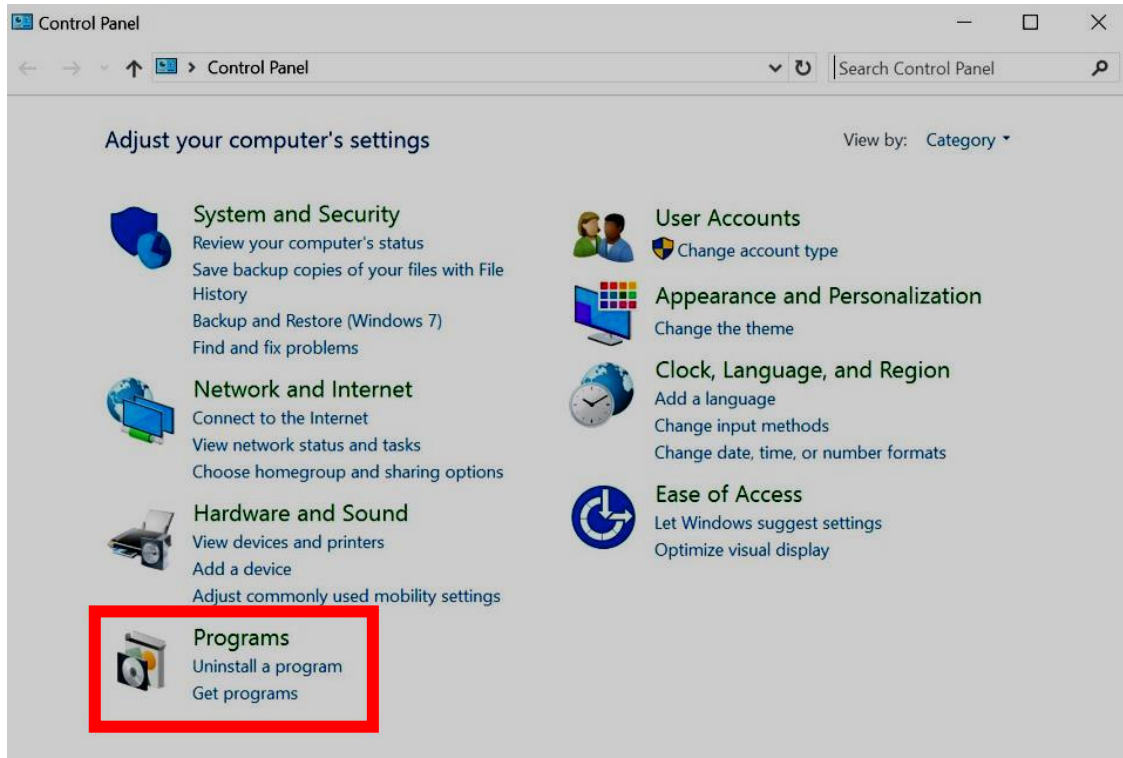
**NOTE:** Make sure to read the Installation Instructions contained in the **ReadMe** file before starting DeltaQC installation.



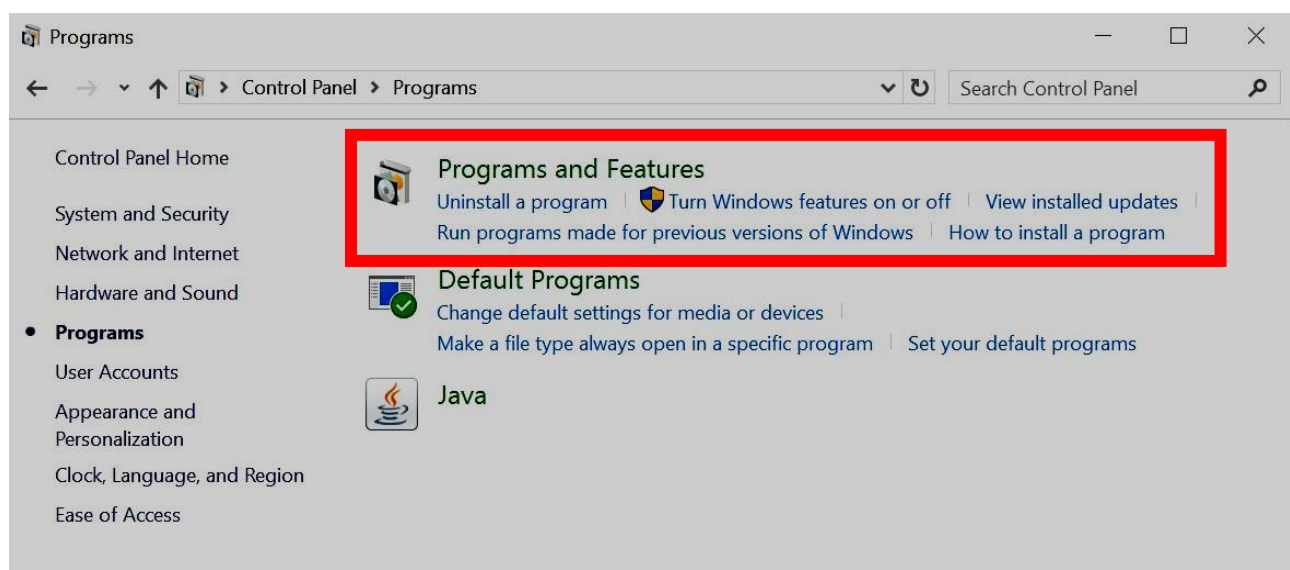
If DeltaQC is already installed on the PC and it is characterized by a version equal to 3.9.0 (or previous), it is MANDATORY to uninstall it BEFORE executing the new setup.

To uninstall previous versions, act on the control panel as explained in the following procedure:

- Open the “**Control Panel**” and click on “**Programs**”:

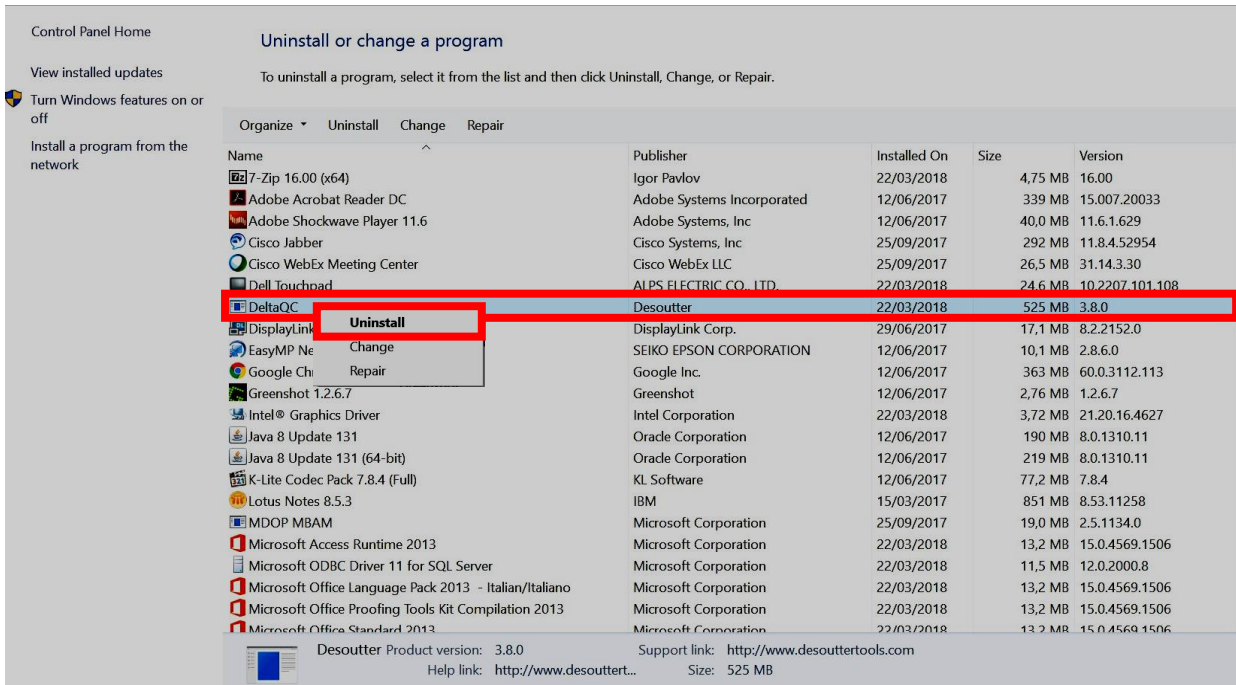


The following screen is shown:



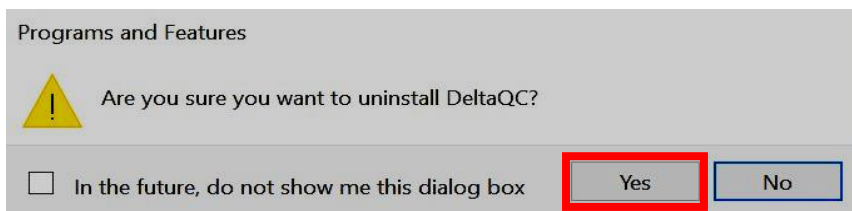


- To uninstall (or change) programs on the PC, click on “**Programs and Features**” (refer to the above screen). The following screen is displayed:



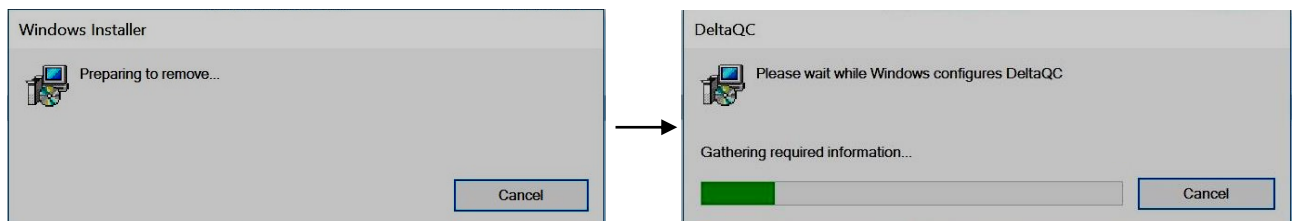
Select “DeltaQC” from the list. Click on the right button of the mouse and finally select “Uninstall” in order to uninstall DeltaQC from the PC.

- After clicking on “Uninstall”, the following pop-up is shown:



Click on Yes to confirm uninstalling the DeltaQC.

- After clicking on Yes (refer to the above pop-up), *Windows Installer* is preparing to remove DeltaQC. The following pop-up are shown until DeltaQC is completely removed:







If DeltaQC is either not installed, or already installed on the PC and it is characterized by a version equal to 4.0.0 (or higher), execute the new setup.



**NOTE:** For the operating systems *Windows 7*, *Windows 8*, *Windows 8.1* and *Windows 10*, run the executable file by clicking on the right button of the mouse and selecting “*Run as administrator*”.

To install DeltaQC Software, insert either the *CD* or the *USB key* in the PC.

If the CD is inserted in the PC, the following pop-up is shown (according to *Autoplay Settings* set on the PC):



Click on “*Run DesoutterAutorun.vbs*” and wait for the following window:





If a *USB key* (refer to the figure on the right) is inserted in the PC, the following pop-up is shown (according to *Autoplay Settings* set on the PC):



Double-click on “**Open folder to view files**”. The following folder is shown:

Name	Date modified	Type	Size
DatabaseMigrationTool	22/03/2018 12:30	File folder	
Documentation	22/03/2018 12:30	File folder	
Installer	22/03/2018 12:30	File folder	
Autorun.inf	14/03/2018 10:17	Setup Information	1 KB
DesoutterAutorun.exe	22/03/2018 10:24	Application	281 KB
DesoutterAutorun.exe.config	14/03/2018 10:11	CONFIG File	1 KB
<b>DesoutterAutorun.vbs</b>	14/03/2018 11:04	VBScript Script File	2 KB
DesoutterLogo.bmp	14/03/2018 10:11	BMP File	4 KB

Double-click on “**DesoutterAutorun.vbs**” and wait for the following window:





**Install DeltaQC Software**

Firstly, click and read the **ReadMe** file containing information about the installation.

Then, click on the button **Install Driver (ADMIN)** to start the device driver installation.

Click on the **Install Software** button to start DeltaQC installation.

Finally, click on the **DB Migration** button to start the database migration.

**View User Manual**

Open the "**Delta Wrench User Guide**" in PDF.

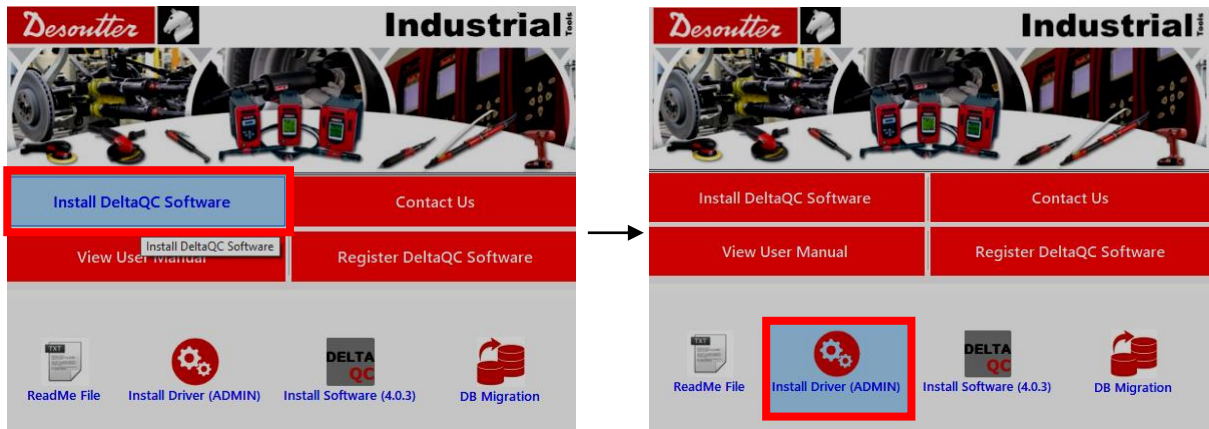
**Contact Us**

It provides the website link to Desoutter contact details.



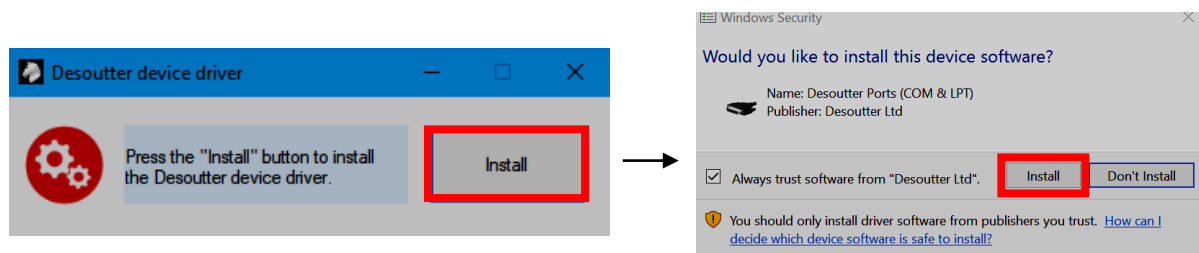
<p><b>Register DeltaQC Software</b></p> <p>It provides the website link to register the DeltaQC Software. Registration must be executed after the installation. Refer to the paragraph “<i>Software registration</i>” for further details.</p>	<p>Install DeltaQC Software</p>	<p>Contact Us</p>
	<p>View User Manual</p>	<p>Register DeltaQC Software</p>
<p><a href="http://licences.desouttertools.com/auth/login">http://licences.desouttertools.com/auth/login</a></p>		

To start the device driver installation, click on the **Install Driver (ADMIN)** button and follow the steps described below:



**NOTE:** If the device driver installation is executed on a PC without administrator rights, a dialog box for the “*User Account Control*” opens. Enter the administrator username and password in the related fields to continue.

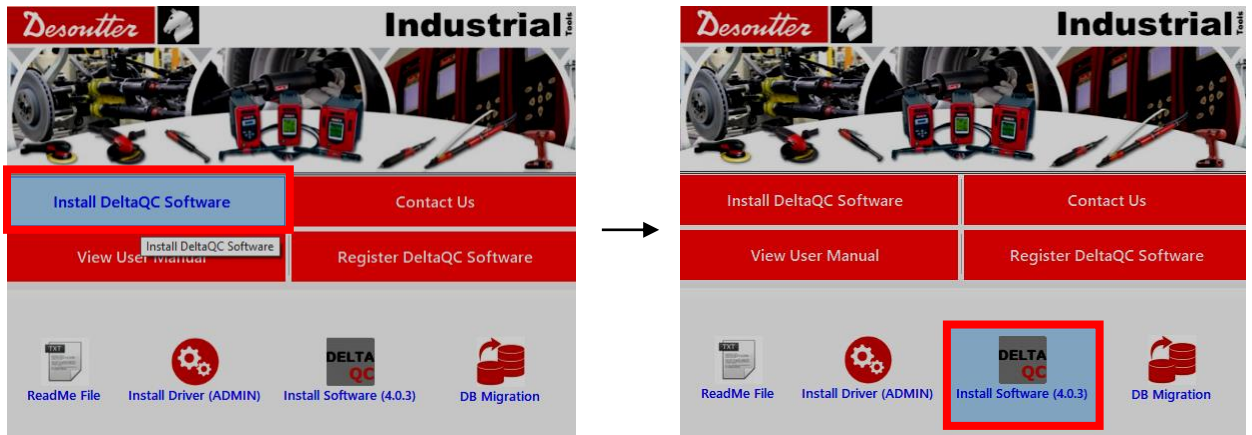
Click on the **Install** button (refer to the figures below):



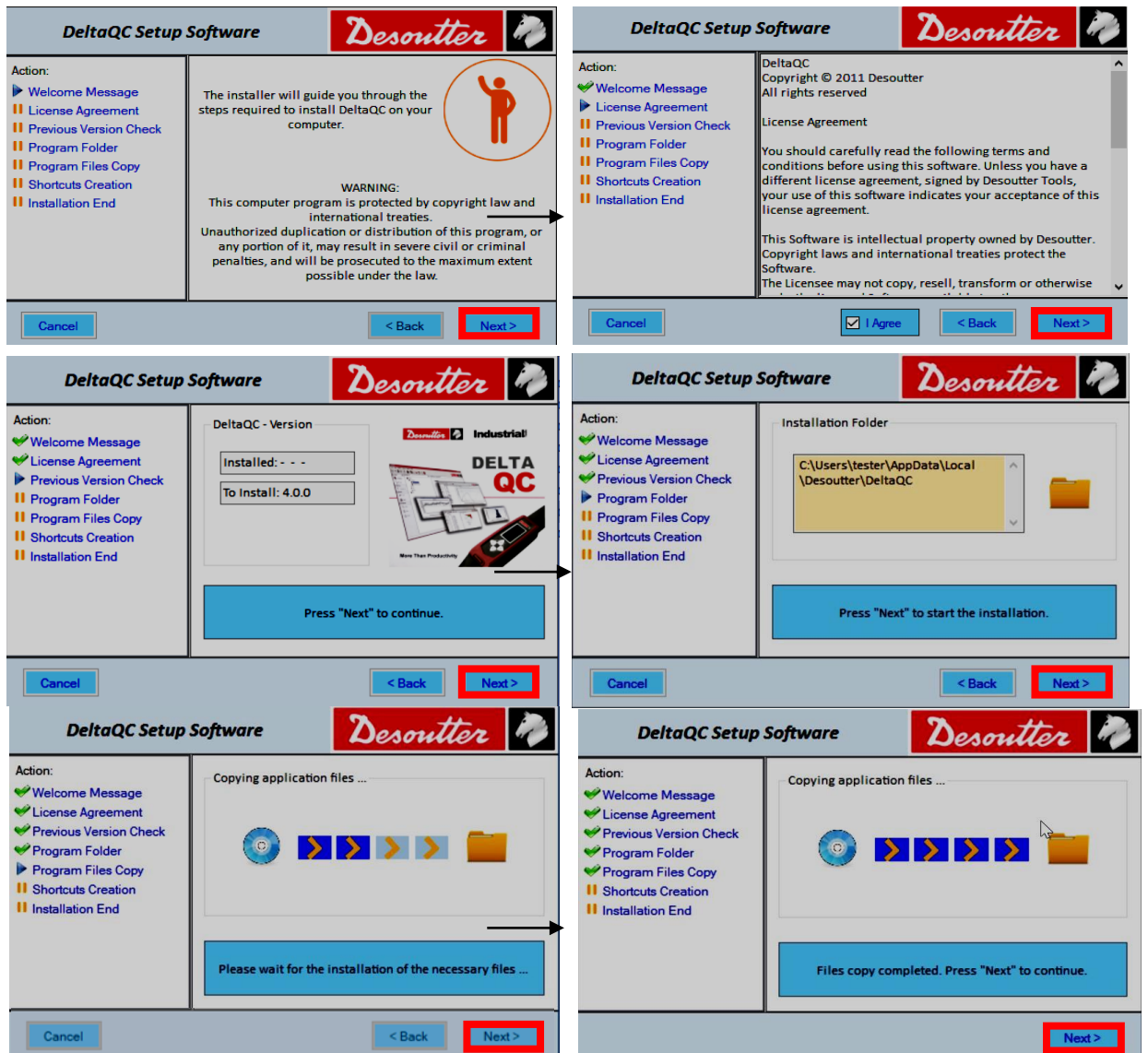
At the end of the process a message confirms that the device driver are installed with success.

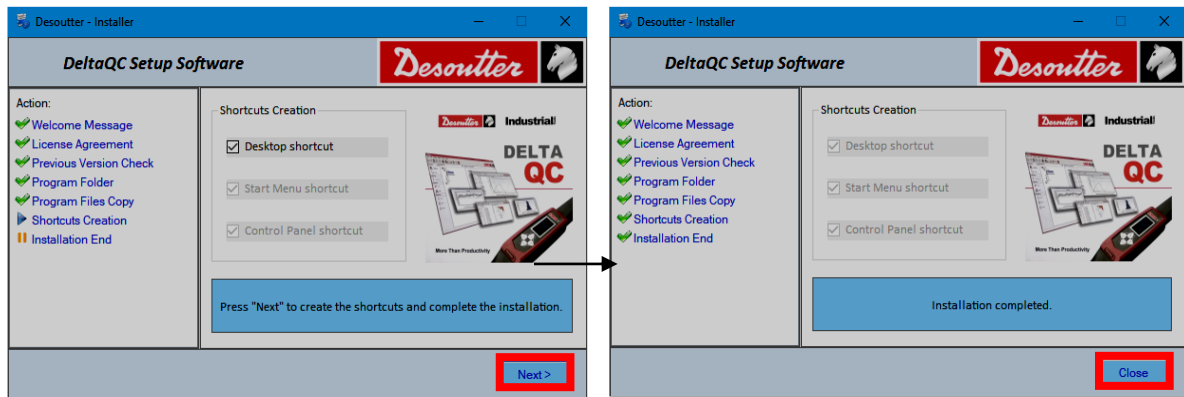


To install DeltaQC Software, click on the button **Install Software** (refer to the following figures):



Then, follow the installation steps described below:





After installing DeltaQC Software, the program is automatically added to **Start Menu** → **Desoutter** → **DeltaQC** and to **Start Menu** → **Control Panel** → **DeltaQC**.

If not deselected during the installation procedure, a Desktop shortcut will be created by default too.



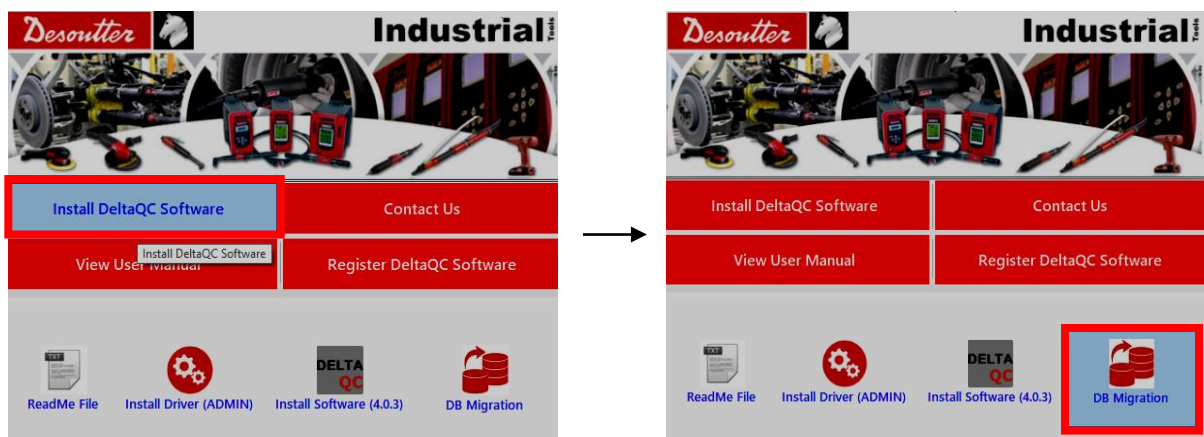
**NOTE:** The first time DeltaQC Software is executed, it is MANDATORY to register it (refer to the paragraph “Software registration” for further details).

If a version equal to 3.9.0 (or previous) is upgraded to a version equal to 4.0.0 (or later), it is recommended to perform the migration of saved data from SQL Server database to SQLite database.



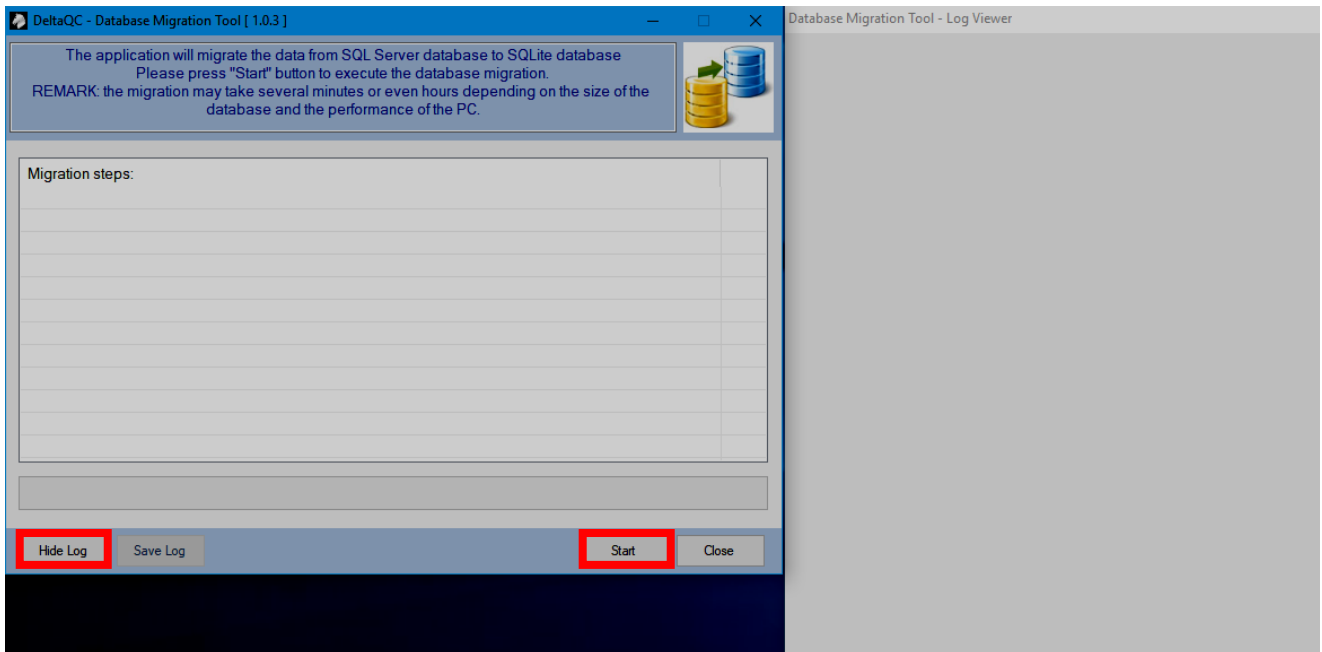
**NOTE:** If the database migration is not performed before launching DeltaQC, data possibly present in the new database are deleted.

To start the database migration, click on the button **DB Migration** (refer to the following figures):





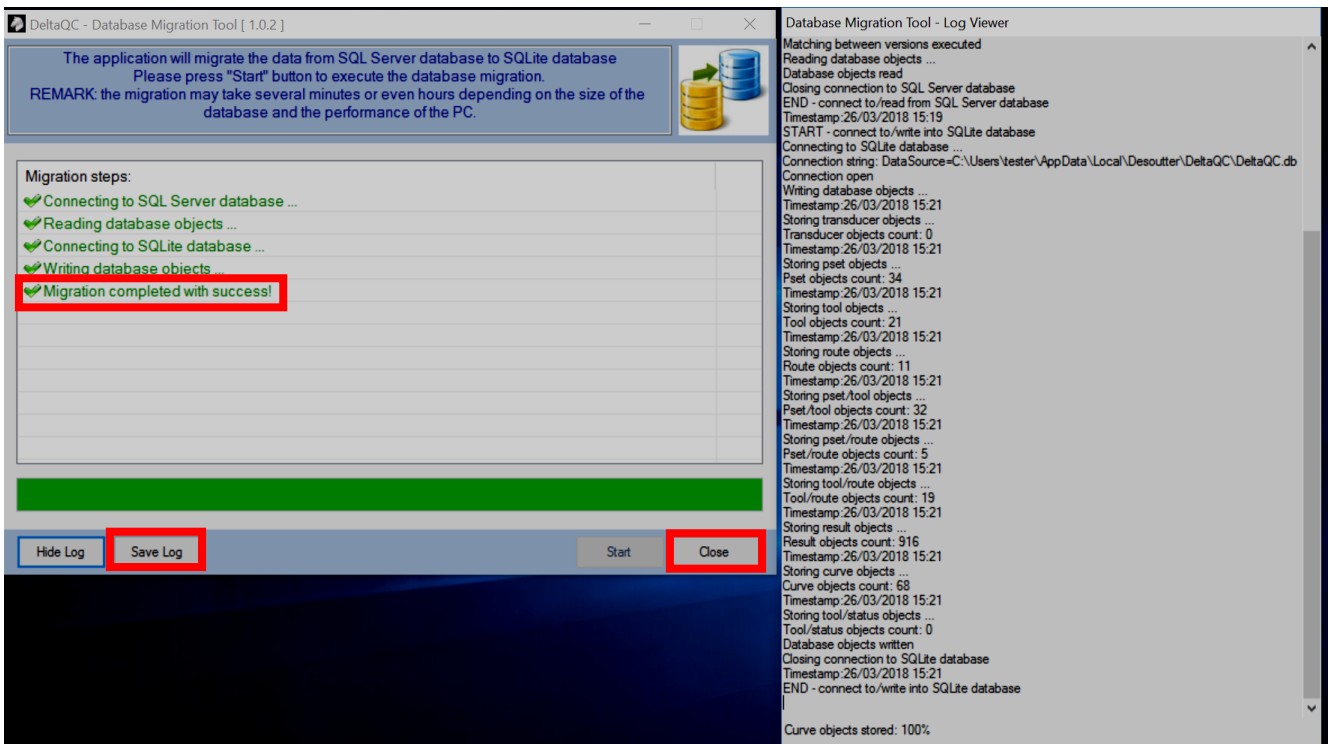
The following windows are shown:



Click on **Start** to execute the database migration (the operation may take a few minutes, depending on the size of the database).

Click on **Hide Log** to hide the *Database Migration Tool – Log viewer* window.

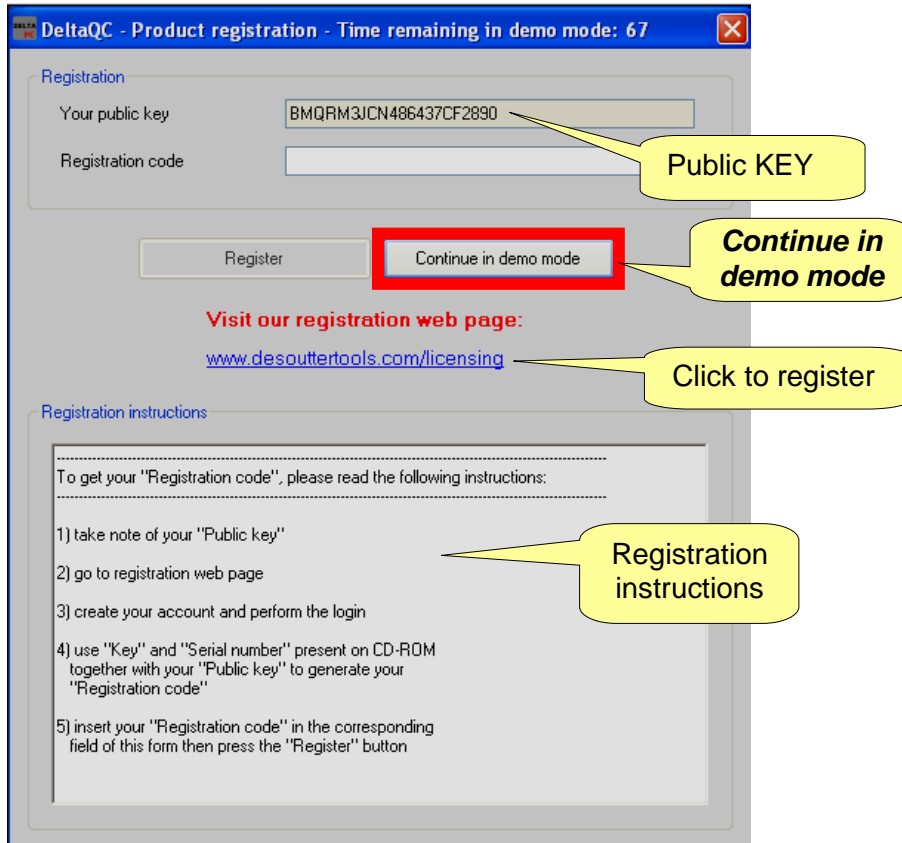
At the end of the process, the message “**Migration completed with success!**” is shown (refer to the figure below):





### 4.1.1 Software registration

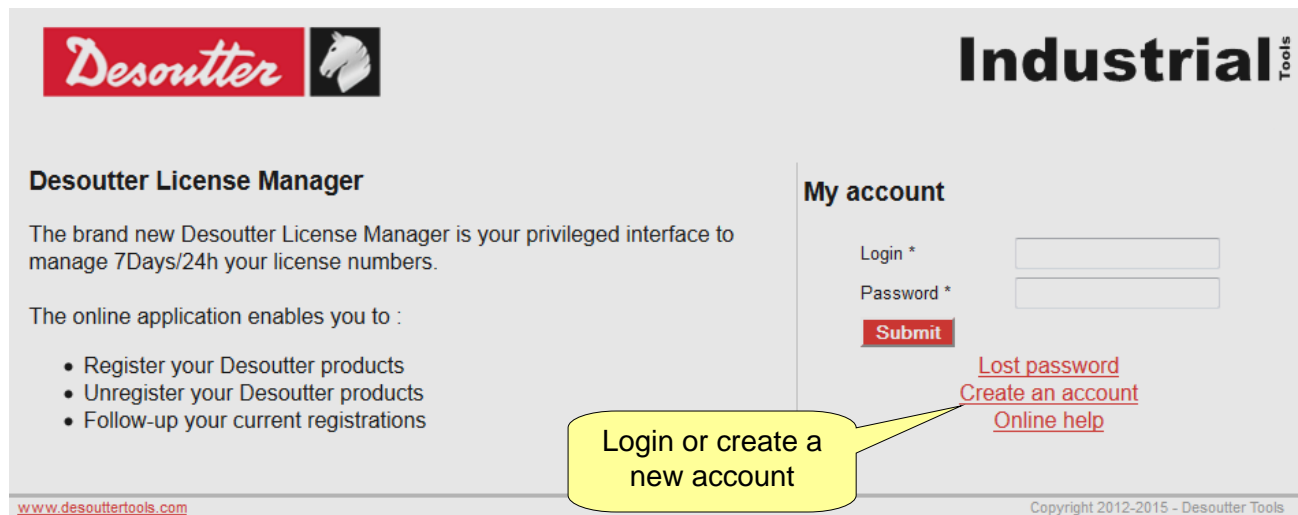
The first time DeltaQC Software is executed, the following window is shown:



Click on **Continue in demo mode** to skip the registration and working in demo mode (the registration can be done later).

To proceed with the registration, take note of the **Public KEY** given in the form above, and click on the link [www.desouttertools.com/licensing](http://www.desouttertools.com/licensing)

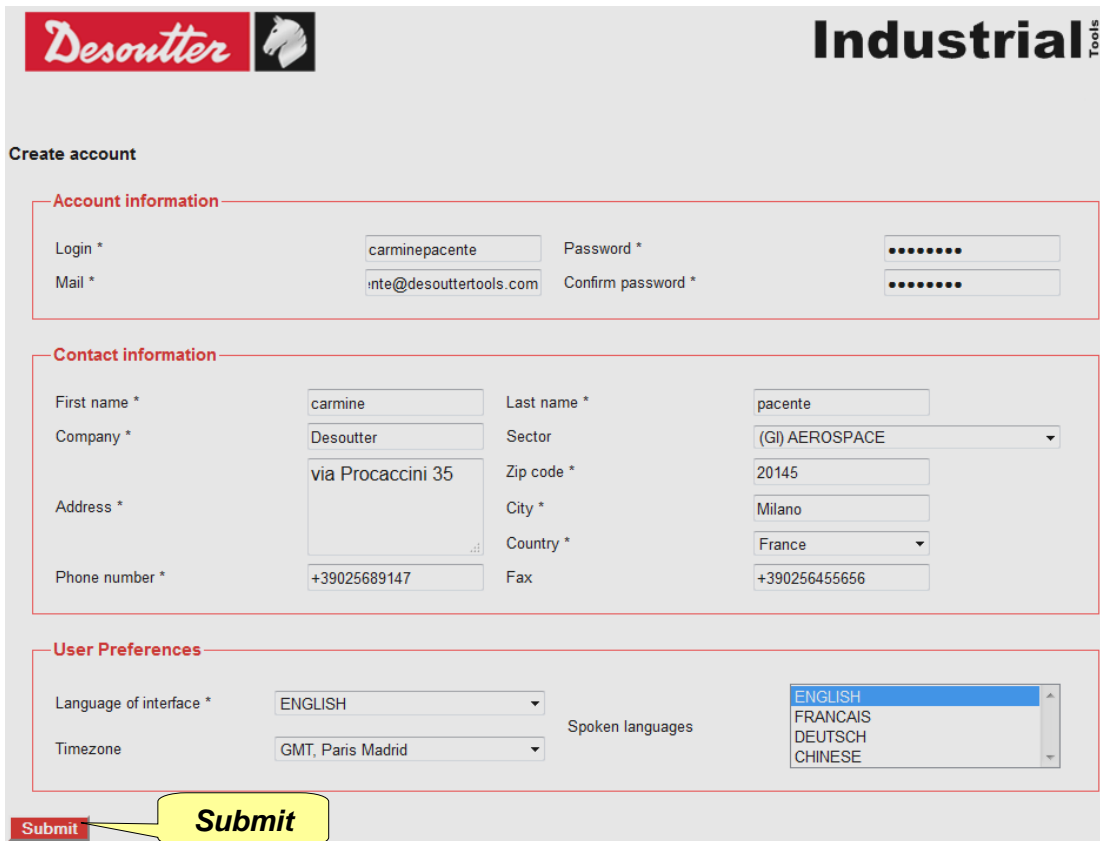
The following window is shown:








Create a new account, if it is not created yet:



**Desoutter**  **Industrial** Tools

**Create account**

**Account information**

Login \*  Password \*   
Mail \*  Confirm password \*

**Contact information**

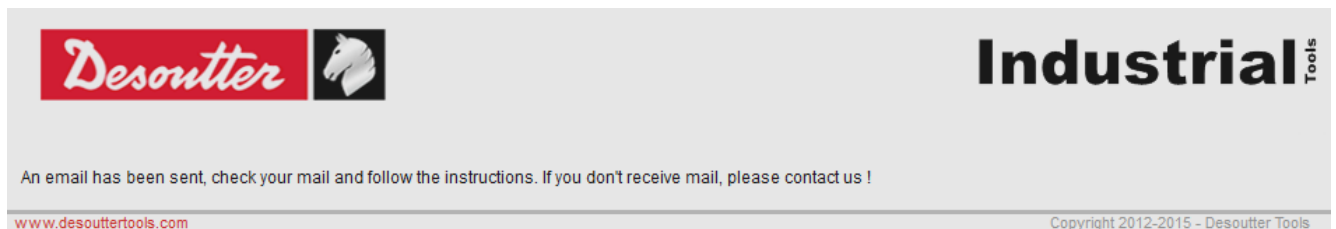
First name \*  Last name \*   
Company \*  Sector   
Address \*  Zip code \*   
City \*   
Country \*   
Phone number \*  Fax

**User Preferences**

Language of interface \*  Spoken languages   
Timezone

**Submit**

Enter your information and click on **Submit**. The following confirmation message is shown:

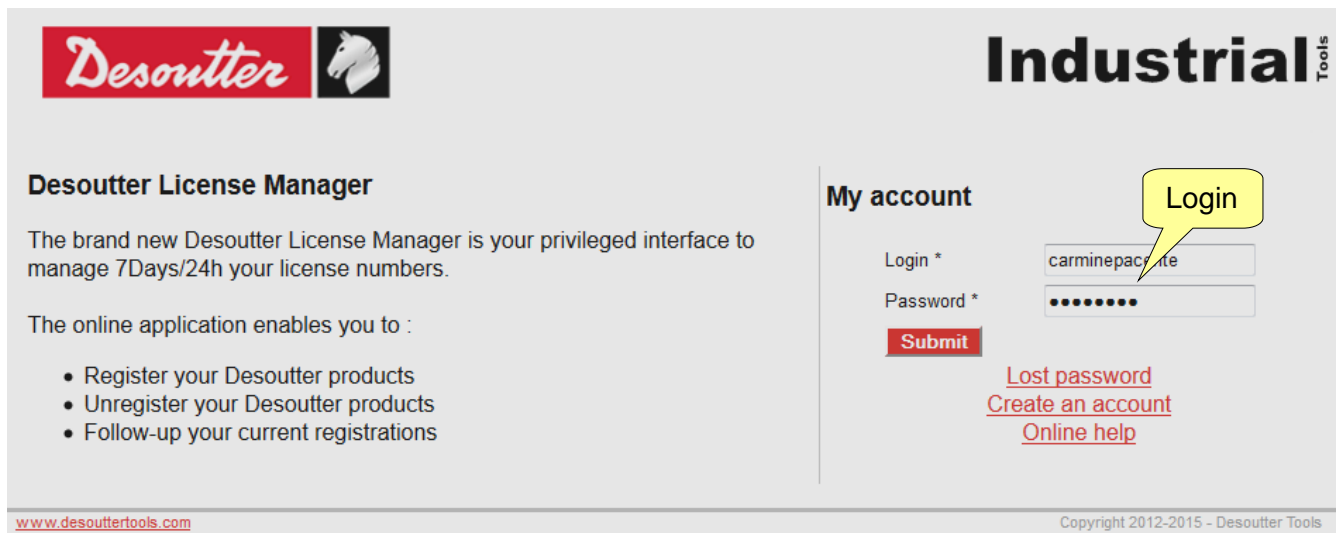


On the email address given in the account above, a link is sent. Click on the link provided.





Click on "**home**"; now it is possible to login:



**Desoutter License Manager**

The brand new Desoutter License Manager is your privileged interface to manage 7Days/24h your license numbers.

The online application enables you to :

- Register your Desoutter products
- Unregister your Desoutter products
- Follow-up your current registrations

**My account**

Login \*

Password \*

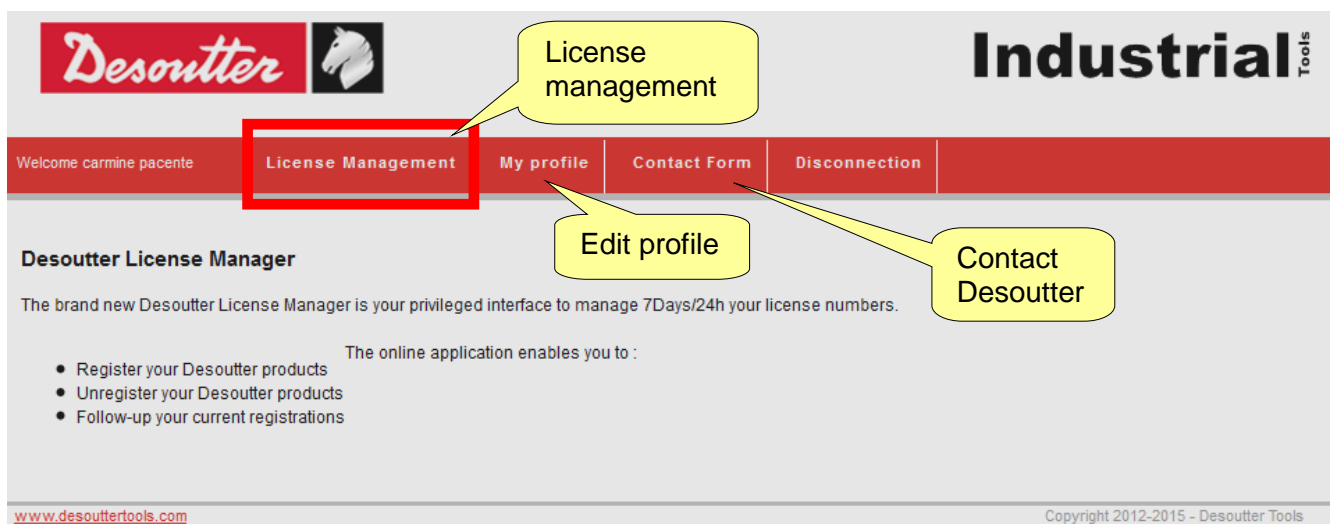
**Submit**

[Lost password](#)  
[Create an account](#)  
[Online help](#)

**Login**

[www.desouttertools.com](http://www.desouttertools.com) Copyright 2012-2015 - Desoutter Tools

On the following window, select **License Management** (from the same window, it is possible either to edit the profile information or to open the Desoutter contact form):



**Desoutter License Manager**

Welcome carmine pacente

**License Management** | My profile | Contact Form | Disconnection

**License management**

The brand new Desoutter License Manager is your privileged interface to manage 7Days/24h your license numbers.

The online application enables you to :

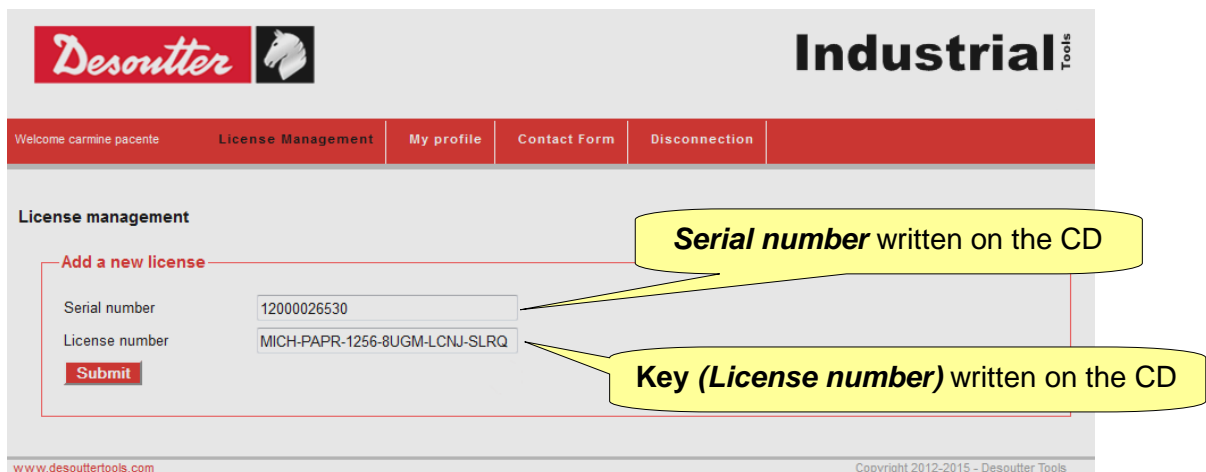
- Register your Desoutter products
- Unregister your Desoutter products
- Follow-up your current registrations

**Edit profile**

**Contact Desoutter**

[www.desouttertools.com](http://www.desouttertools.com) Copyright 2012-2015 - Desoutter Tools

Enter the **Serial number** and the **Key (License number)** provided on the installation CD:



**License management**

**Add a new license**

Serial number

License number

**Submit**

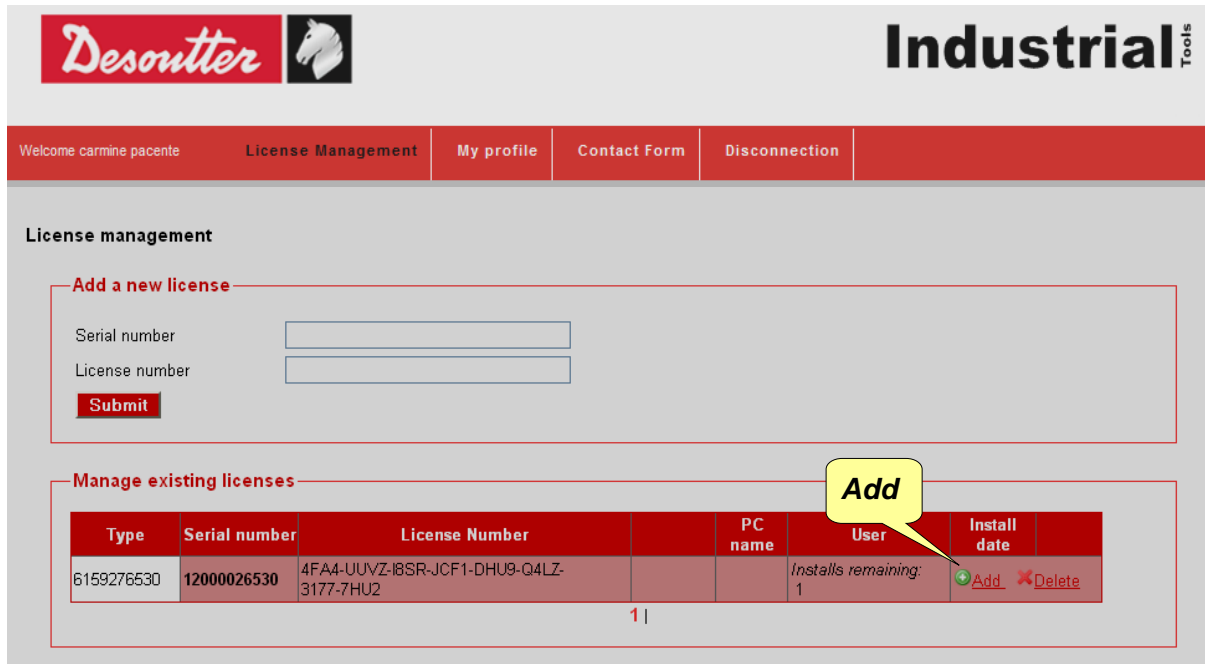
**Serial number written on the CD**

**Key (License number) written on the CD**

[www.desouttertools.com](http://www.desouttertools.com) Copyright 2012-2015 - Desoutter Tools



Click on **Submit** and the following window is shown:



**License management**

**Add a new license**

Serial number

License number

**Submit**

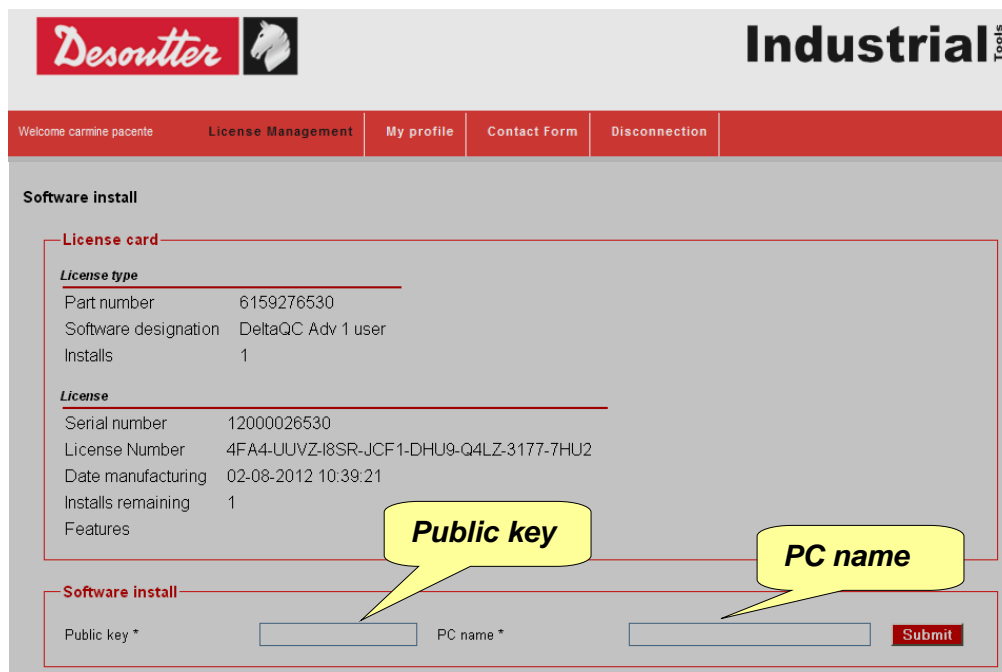
**Manage existing licenses**

Type	Serial number	License Number	PC name	User	Install date	
6159276530	12000026530	4FA4-UUVZ-I8SR-JCF1-DHU9-Q4LZ-3177-7HU2		Installs remaining: 1		<a href="#">Add</a> <a href="#">Delete</a>

1 |

Click either on **Add** to proceed with the registration or on **Delete** to delete the serial number and key already entered.

After clicking on **Add**, the following screen is shown:



**Software install**

**License card**

**License type**

Part number 6159276530  
 Software designation DeltaQC Adv 1 user  
 Installs 1

**License**

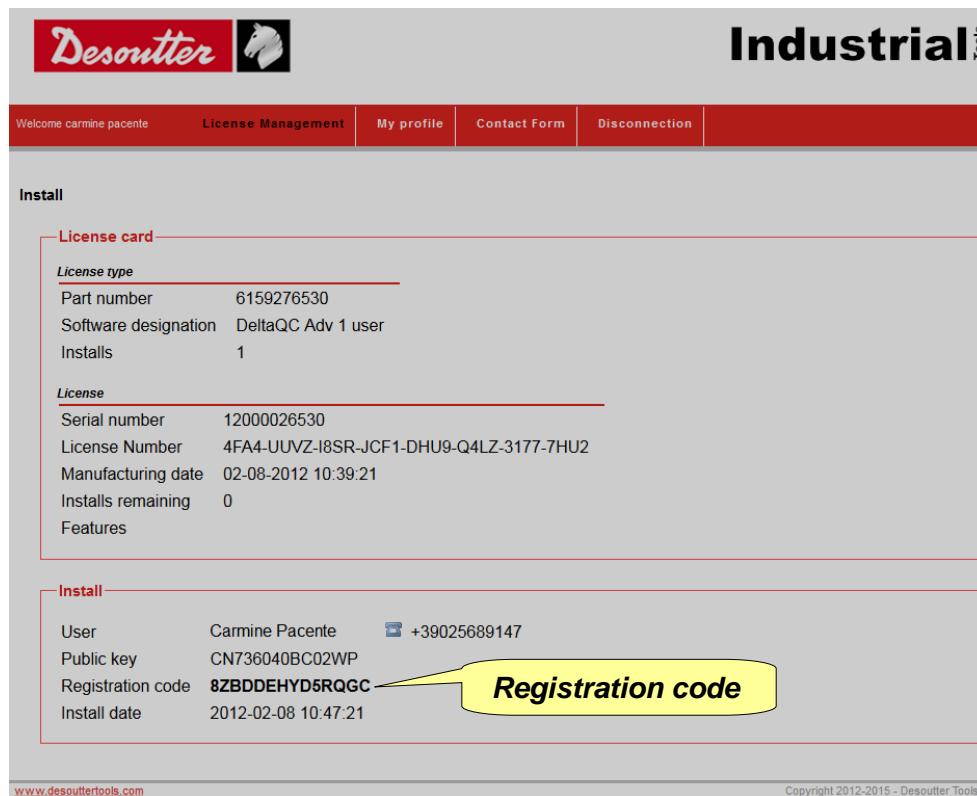
Serial number 12000026530  
 License Number 4FA4-UUVZ-I8SR-JCF1-DHU9-Q4LZ-3177-7HU2  
 Date manufacturing 02-08-2012 10:39:21  
 Installs remaining 1  
 Features


**Software install**

Public key \*  PC name \*  **Submit**



Enter the **Public key** generated by the DeltaQC registration form and the **PC name** (choose any name) and click on **Submit** to get the registration code:



**Desoutter**  **Industrial** Tools

Welcome carmine pacente   License Management   My profile   Contact Form   Disconnection

**Install**

**License card**

**License type**

Part number	6159276530
Software designation	DeltaQC Adv 1 user
Installs	1

**License**

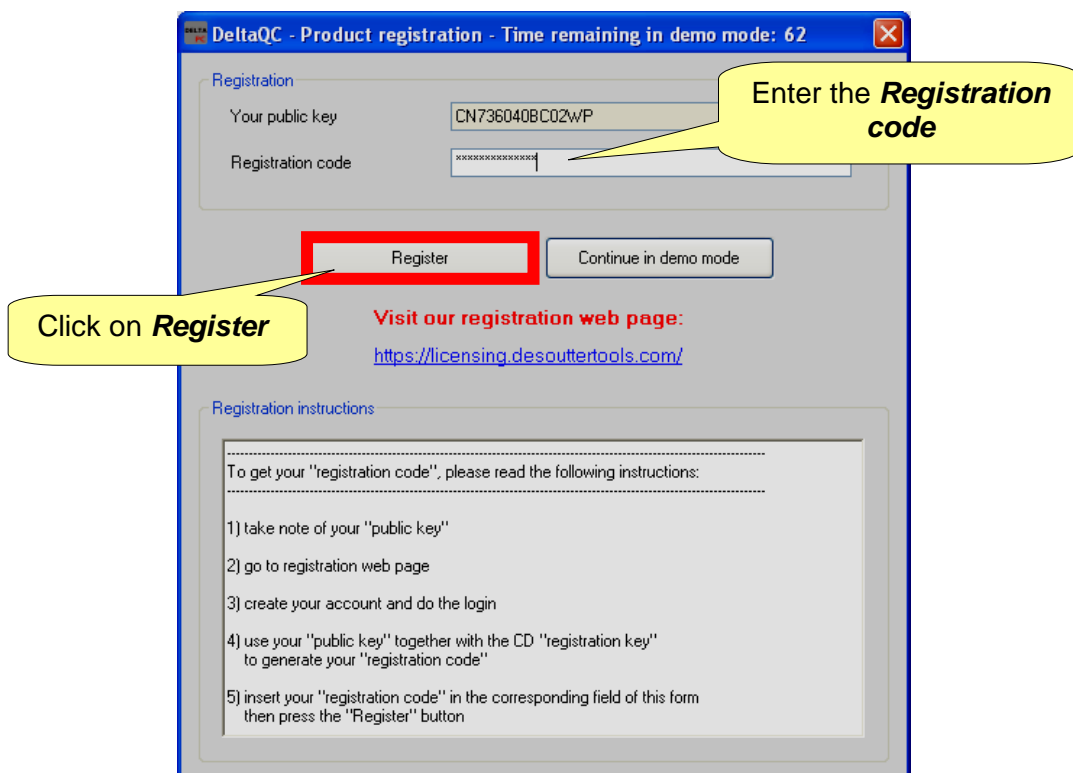
Serial number	12000026530
License Number	4FA4-UUVZ-I8SR-JCF1-DHU9-Q4LZ-3177-7HU2
Manufacturing date	02-08-2012 10:39:21
Installs remaining	0
Features	

**Install**

User	Carmine Pacente	+39025689147
Public key	CN736040BC02WP	
Registration code	<b>8ZBDDHYD6RQGC</b>	<b>Registration code</b>
Install date	2012-02-08 10:47:21	

[www.desouttertools.com](http://www.desouttertools.com)   Copyright 2012-2015 - Desoutter Tools

Copy the above **Registration code** in the DeltaQC registration form and click on **“Register”** to complete the registration:



DeltaQC - Product registration - Time remaining in demo mode: 62

Registration

Your public key: CN736040BC02WP

Registration code: [XXXXXXXXXX] **Enter the Registration code**

**Register**   Continue in demo mode

**Click on Register**

Visit our registration web page:  
<https://licensing.desouttertools.com/>

Registration instructions

To get your "registration code", please read the following instructions:

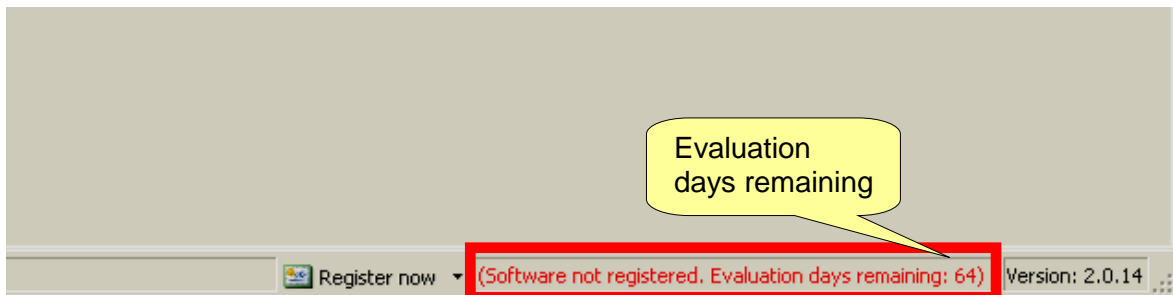
- 1) take note of your "public key"
- 2) go to registration web page
- 3) create your account and do the login
- 4) use your "public key" together with the CD "registration key" to generate your "registration code"
- 5) insert your "registration code" in the corresponding field of this form then press the "Register" button



### 4.1.2 DeltaQC “*Evaluation version*”

If DeltaQC Software is not registered after the installation, it works as *Evaluation* for 90 days; the *Evaluation* version provides all the functionalities of the registered version. When the trial period expires, the software turns into *Free* version.

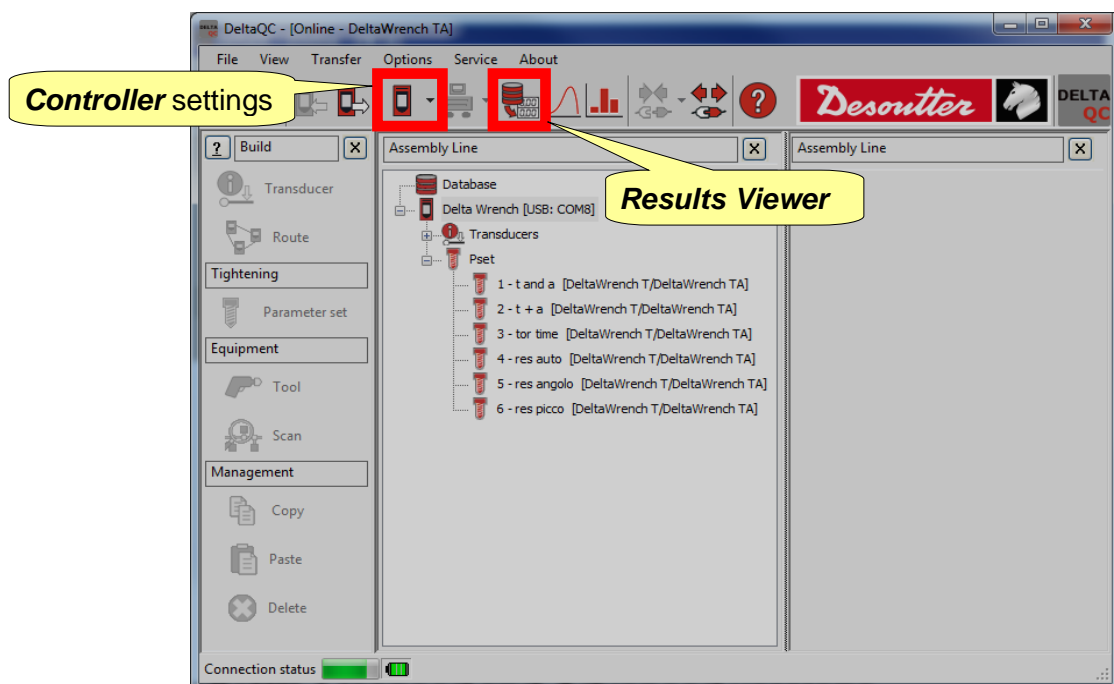
The number of days that remain for the trial period is shown on the bottom part of the DeltaQC Software page (refer to the picture below):



### 4.1.3 DeltaQC “*Free version*”

When the trial period expires, the software turns from “*Demo*” into “*Free*” version.

The *Free* version has a limited set of function. It is possible only to define tightening programs (Pset), review the results from the Delta Wrench (exporting them in an Excel file) and define the settings of the instrument; all the other features are not available.





#### 4.1.4 DeltaQC *Licensed* and *Advanced* versions

It is possible to register DeltaQC Software in two different versions: *Licensed* or *Advanced*.

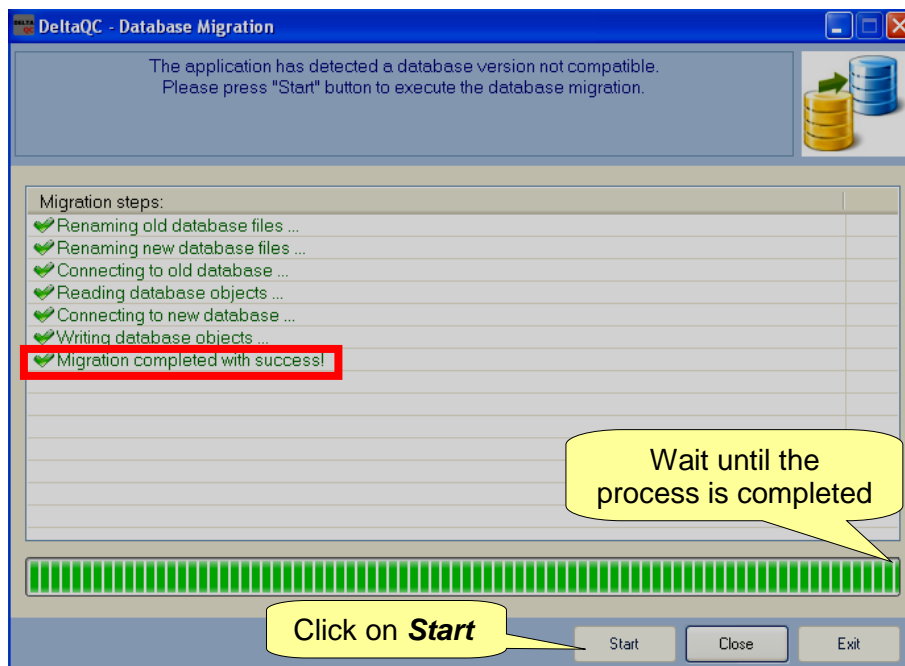
The *Advanced* version, compared to the *Licensed* version, can save the results and curves on the database; on the *Licensed* versions the results and curves can be viewed online only when the software is connected with the Delta Wrench.

#### 4.1.5 DeltaQC software upgrade

In case a new version of the DeltaQC Software is available, the new installation wizard automatically overwrites and upgrades the previous one.

In case a new version features a new database structure, the first time the new version is launched a database migration wizard is automatically started.

Click on **Start** and wait until the process is completed:



Ensure that the message "**Migration completed with success!**" is shown in the window above; then click on **Close**.

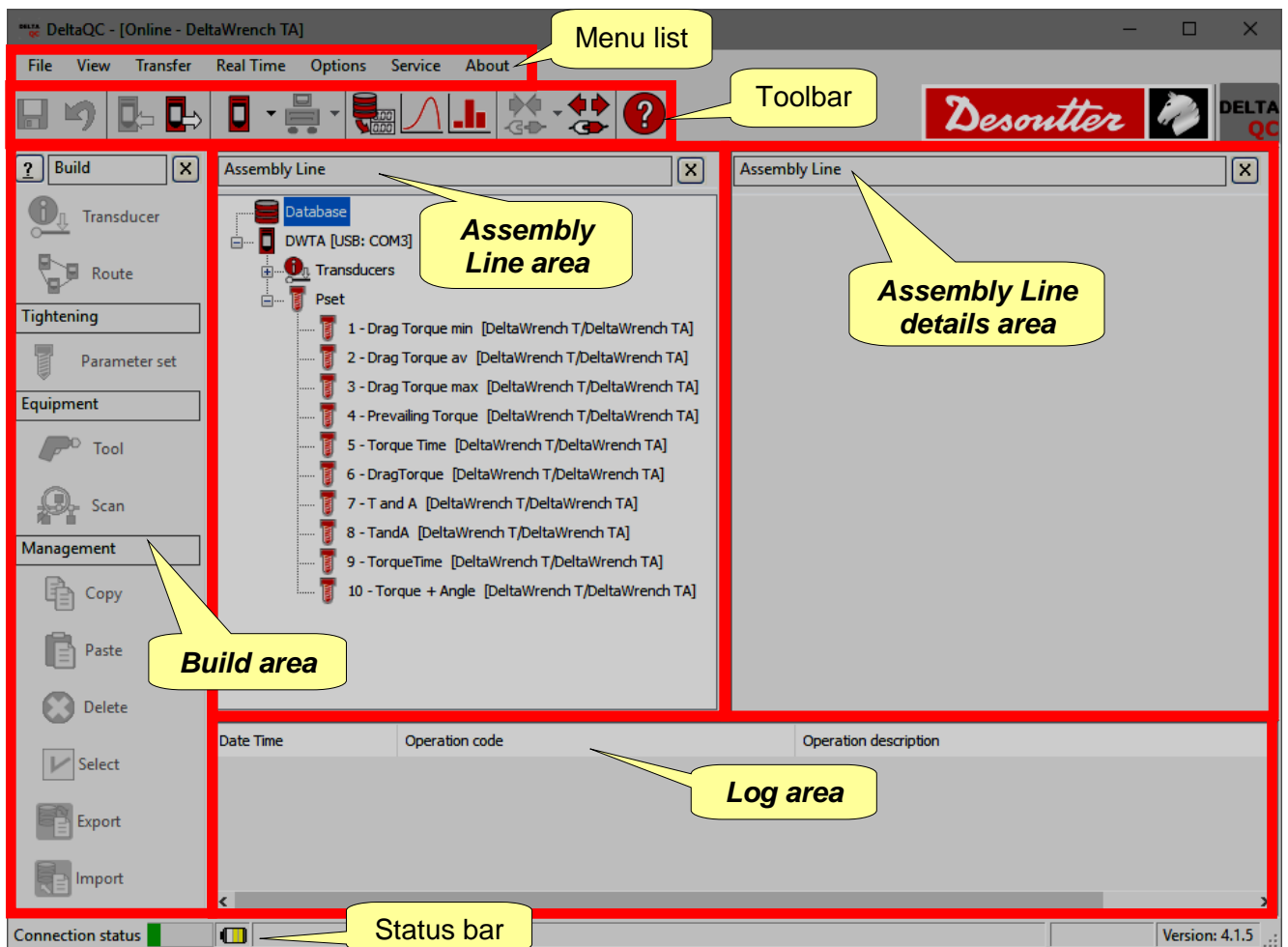


## 4.2 DeltaQC Overview



Click on the DeltaQC icon to launch the software.

After connecting the Delta Wrench to the PC (refer to the paragraph “Connecting to the Delta Wrench”), the following main menu is shown:



**NOTE:** The DeltaQC adapts automatically to the Delta Wrench type and firmware version; therefore, some menus or commands may be hidden or disabled, if not supported by your version of the Delta Wrench.

Working in the Delta Wrench Map area (**Online mode**), all the data are directly written in the Delta Wrench connected.

Working **Offline**, it is possible to define the test programs and transfer them to the Delta Wrench later. The DeltaQC stores the following data in a local database:

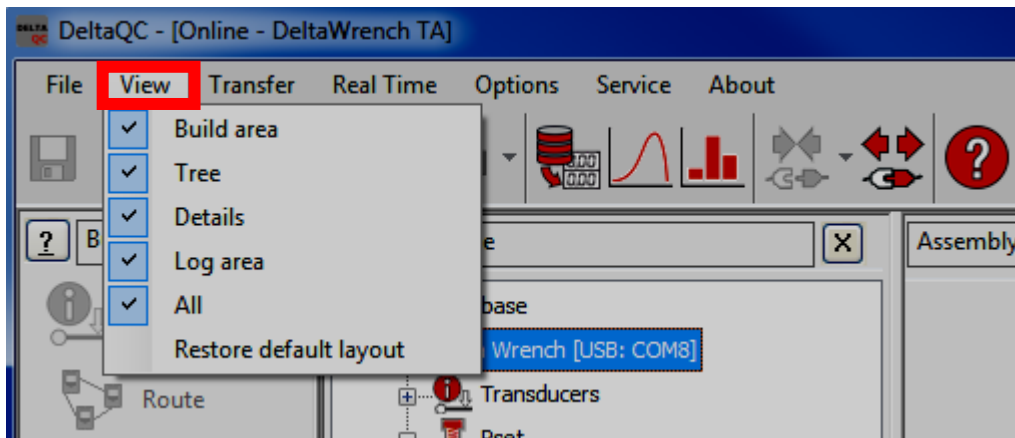
- Test programs (Psets)
- Test results
- Tools
- Test curves



**NOTE:** Refer to the paragraph “Offline mode” for further details.




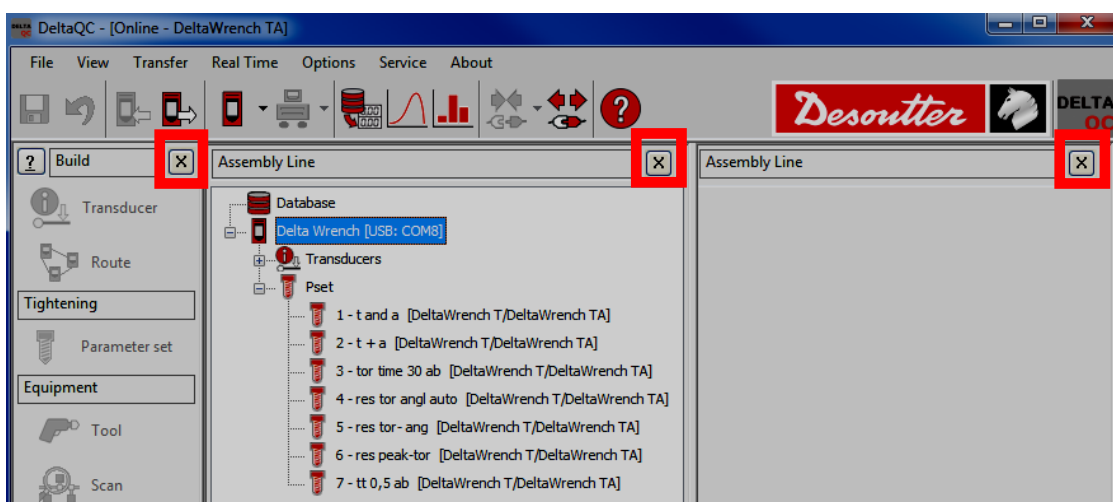
The *areas* shown in the main menu (refer to the above picture) can be customized; select **View** to define which areas to enable or disable:



The *areas* listed in “**View**” are the following:

<b>Build area</b>	Enable/disable the <i>Build</i> area. It contains the commands to create tightening and test programs, tools, route of test.
<b>Tree</b>	Enable/disable the <i>Assembly line</i> area. It contains the list of the tightening programs and tools created in <i>Online / Offline mode</i> .
<b>Details</b>	Enable/disable the <i>Assembly line details</i> area. It details the items selected in the <i>Assembly line</i> area.
<b>Log area</b>	Enable/disable the <i>Log</i> area that lists the list of the log messages.
<b>All</b>	Enable/disable all the possible items in the main menu.
<b>Restore default layout</b>	Restore the default layout that enables all the items except the <i>Log</i> area.

To hide one *area* directly from the main menu, click on the  icon (refer to the picture below):







## 4.2.1 Search function

The DeltaQC is characterized by a search function, available to search the various items (*Psets*, *Tools*, *Routes*) displayed in the **Assembly Line** area; in the following example, it is shown the **Assembly Line/Pset** area with the relative Search function:

The screenshot shows the DeltaQC software interface. The 'Assembly Line / Pset' panel is active, displaying a list of parameter sets. A search function dialog is open at the bottom, with a red box highlighting it. A yellow callout points to the search function dialog, and another yellow callout points to the list of items to be searched.

Id	Name	Device type	Test type
1	Drag Torque min	DeltaWrench T/DeltaWrench TA	--
2	Drag Torque av	DeltaWrench T/DeltaWrench TA	--
3	Drag Torque max	DeltaWrench T/DeltaWrench TA	--
4	Prevailing Torque	DeltaWrench T/DeltaWrench TA	--
5	Torque Time	DeltaWrench T/DeltaWrench TA	--
6	DragTorque	DeltaWrench T/DeltaWrench TA	--
7	T and A	DeltaWrench T/DeltaWrench TA	--
8	TandA	DeltaWrench T/DeltaWrench TA	--
9	TorqueTime	DeltaWrench T/DeltaWrench TA	--
10	Torque + Angle	DeltaWrench T/DeltaWrench TA	--

Find parameter set

Id:  Name:  Tool SN:

Test type:  Status:  Device type:   Match whole word

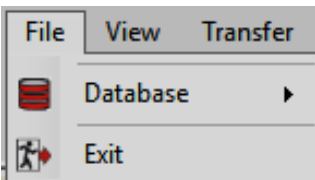
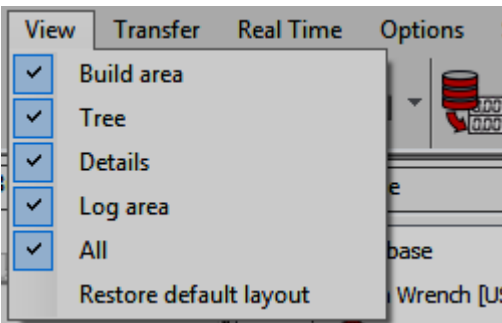
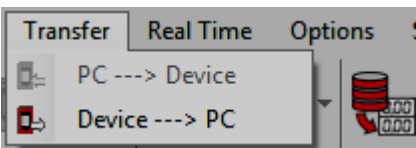
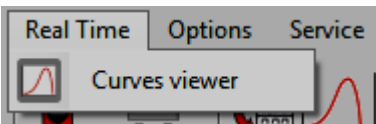
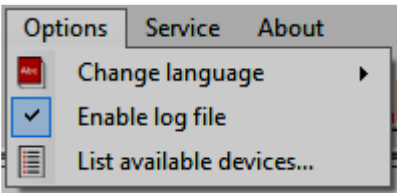
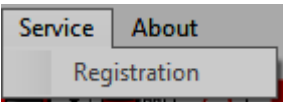
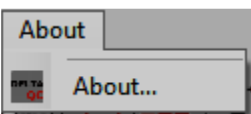
Enter the search criteria and click on **Find** to filter the items displayed according to the criteria entered. Click on **Clear** to reset the filter and display all the items.

This function searches also strings partially included in the items (for example, looking for the word "tight" searches also items containing the word "tightening" or "tighten"); the **Match whole word** option disable this function.



## 4.2.2 Menu list













The following options are available in the *DeltaQC Menu list*:

Illustration	Name	Description
	File	The <i>File</i> option allows to: <ul style="list-style-type: none"> <li>- create and restore a database backup file (see paragraph "<i>Database backup</i>").</li> <li>- exit from the DeltaQC software.</li> </ul>
	View	The <i>View</i> option selects the areas to show/hide in the main menu.
	Transfer	The <i>Transfer</i> option transfers data either from the PC to the Delta Wrench or from the Delta Wrench to the PC.
	Real Time	The <i>Real Time</i> option allows the operator to display curves either in real time (during Delta Wrench operations) or at the end of tightening. For further details refer to the paragraph " <i>Real Time option</i> ".
	Options	The <i>Options</i> tab sets the DeltaQC language and enables/disables the log file. Furthermore, a list of available devices can be viewed.
	Service	The <i>Service</i> option allows to register the software.
	About	The <i>About</i> tab gives software information, including registration details.





### 4.2.3 Toolbar

The toolbar icons are shortcuts to the basic functions in DeltaQC.

Icon	Icon name	Description
	Save	This icon saves the items (for example <i>Pset</i> or <i>Tool</i> ) that are defined in the <i>Assembly Line</i> area.
	Undo	The icon " <i>Undo</i> " deletes the operations executed on the item (for example <i>Pset</i> or <i>Tool</i> ) that are defined in the <i>Assembly Line</i> area.
	Transfer PC → Device	This icon transfers the data defined offline to the Delta Wrench connected to the PC.
	Transfer Device → PC	This icon transfers the data defined online from the Delta Wrench to the PC.
	Controller	Click on the arrow of this icon to open the Controller programming menu. <i>Controller</i> icon contains information and settings for Delta Wrench.  Refer to the paragraph " <i>Delta Wrench Settings</i> " for further details.
	Bench programming	This icon is reserved for the use of the DeltaQC with the Delta Cart; thus it is not used for the Delta Wrench.
	Results Viewer	This icon opens the Results Viewer page.  Refer to the paragraph " <i>Results Viewer</i> " for further details.
	Curves Viewer	This icon opens the <i>Curves Viewer</i> page.  Refer to the paragraph " <i>Curves Viewer</i> " for further details.
	Statistics	This icon is not applicable for the Delta Wrench operations.
	Connect	This icon establishes the connection between the Delta Wrench and the PC (the icon is disabled when the device is already connected).  Refer to the paragraph " <i>Connecting to the Delta Wrench</i> " for further details.
	Disconnect	Once a connection is established, this icon gets active. Click to disconnect the PC from the Delta Wrench.
	Help	This icon opens the <i>Help</i> section (not active in this software version).

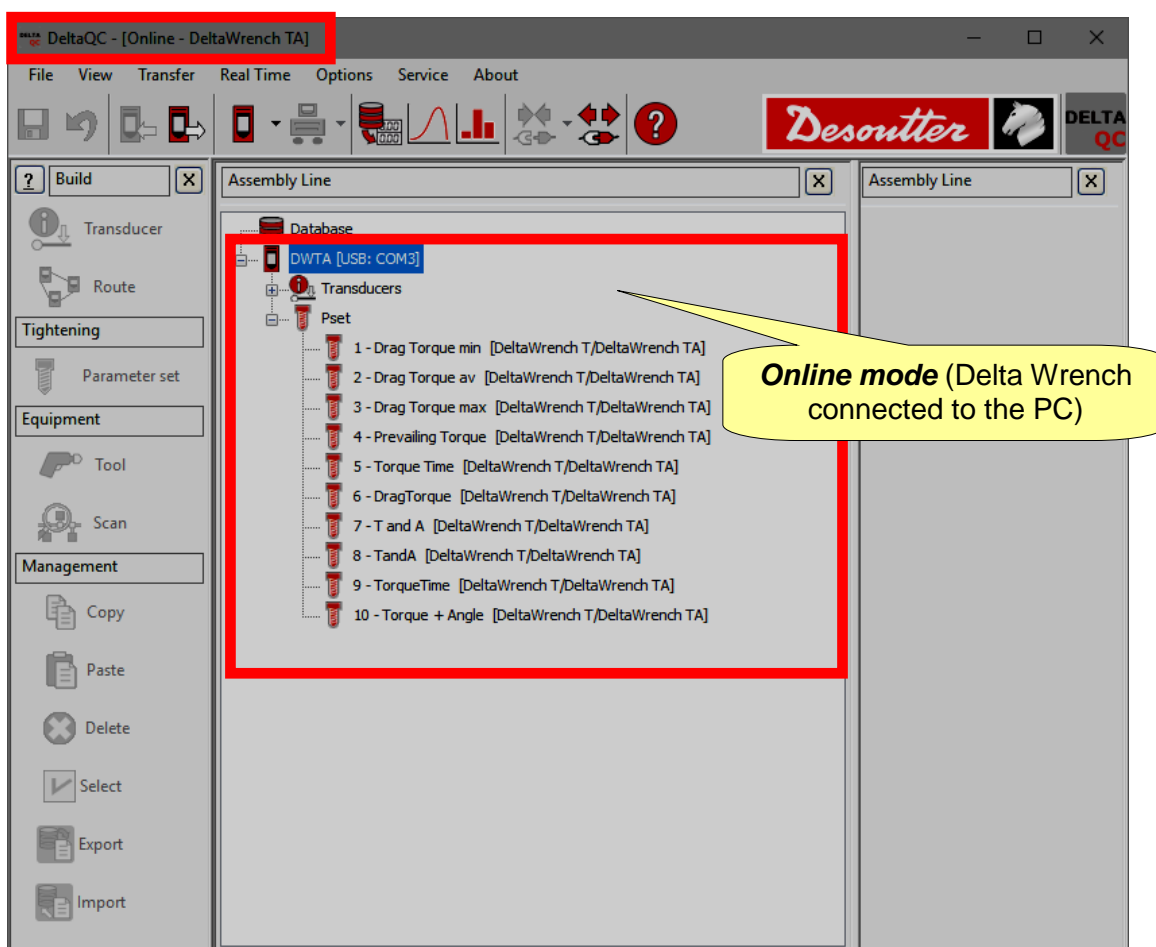


#### 4.2.4 Status bar

Connection status   Min torque (Min. 0.01 Nm - Max. 99999.99 Nm) - Dependency: min torque <= max torque

The status bar shows the connection between the Delta Wrench and the DeltaQC. It shows information about the Pset parameters, during programming the Delta Wrench with the DeltaQC.

#### 4.2.5 Online mode



The **Online mode** is active only when a Delta Wrench is connected to the PC. It defines the tests programs directly on the instrument. The **Online mode** provides also shortcuts to Delta Wrench configuration, results and curves viewers. The **Online mode** adapts and slightly change its submenus according to the specific Delta Wrench connected.

Click on the minus or plus symbols to close and open menus, and double-click on function names to open the corresponding function.



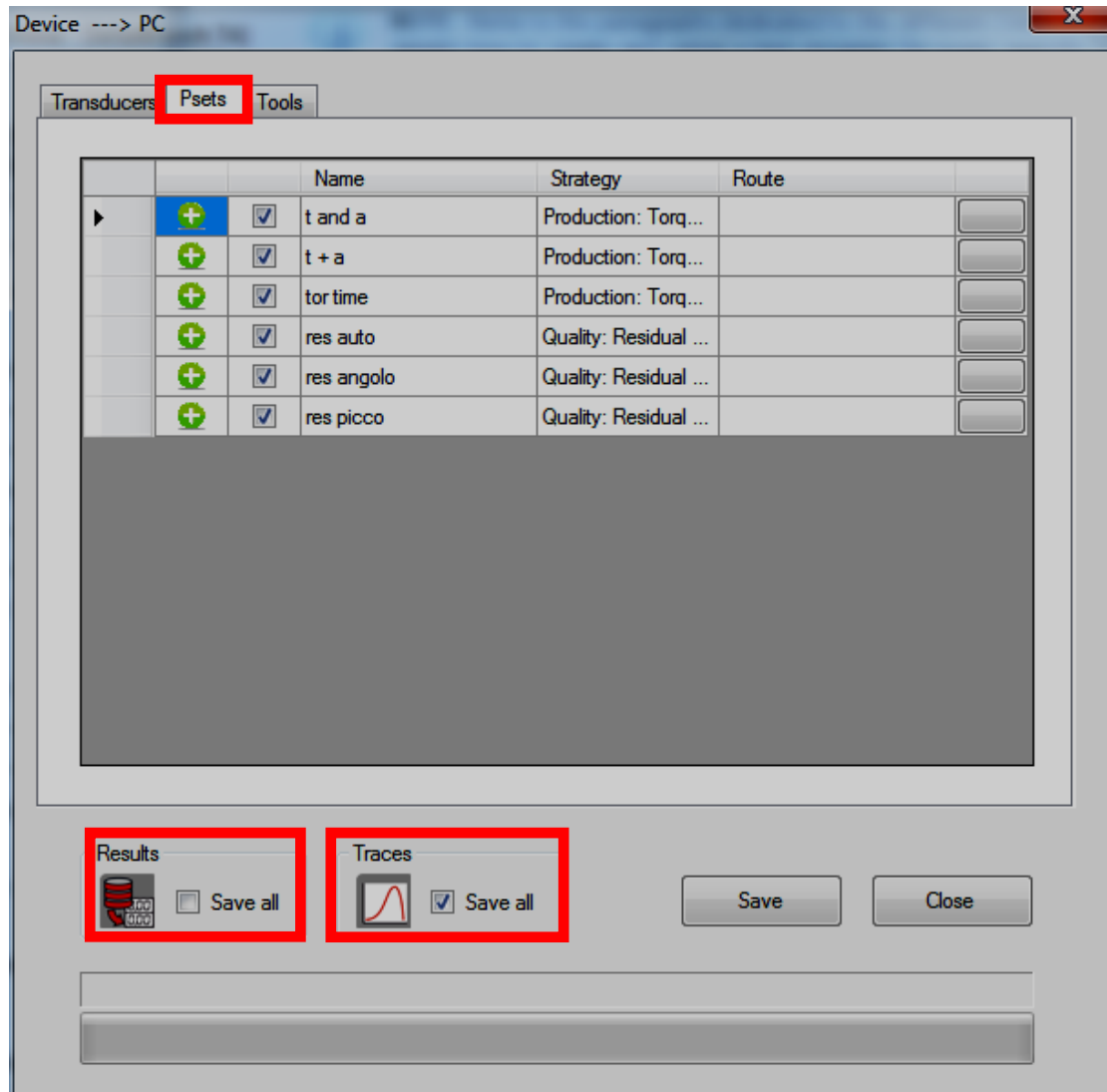
**NOTE:** Refer to the paragraphs dedicated to the different Delta Wrench versions to view in detail how to create and setup a test program for every specific Delta Wrench.



#### 4.2.5.1 Transfer online data to the database




All the information defined online can be saved in the local database file (including test results and curves), by selecting **Transfer** → **Device** → **PC** in the Toolbar of the main DeltaQC screen.

The following window is shown:



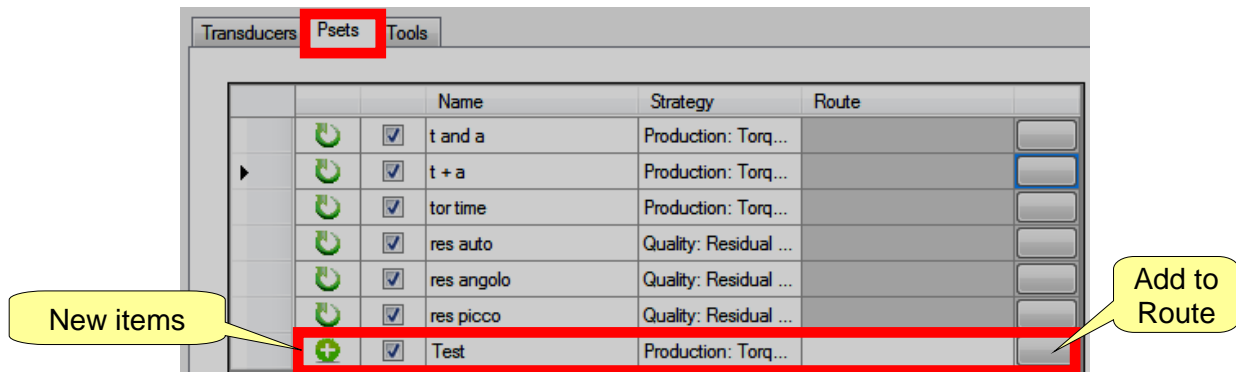
Select the items (*Psets/Tools*, *Results* and *Traces*) to be transferred from the Delta Wrench to the local database (placed on the PC) and click on **Save** to confirm.

*Psets* can be marked with three different icons:

-  The Pset is already present in the database and it is updated if some of its parameters have been changed.
-  The Pset has been created directly on the Delta Wrench and it is added to the database.
-  In the database there is already a Pset with that name, but created for another device and not for the Delta Wrench; the Pset cannot be saved (it should be renamed).

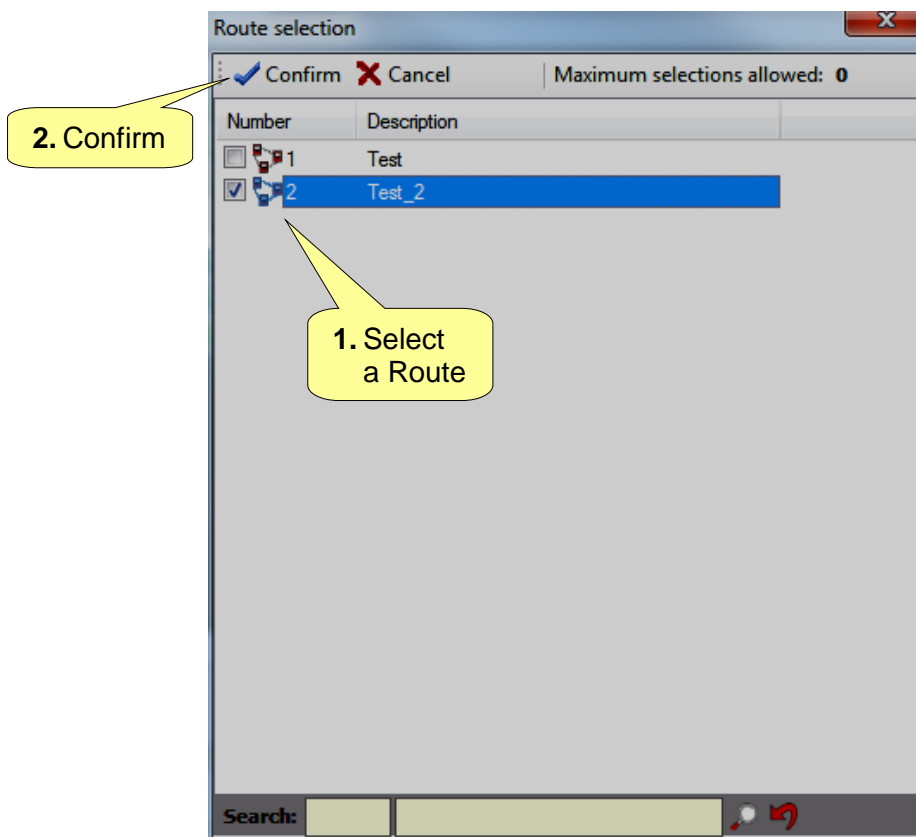


Psets marked as **new** can be added here to a Route (refer to the paragraph “*Offline mode*” for further details):



The “*Add to Route*” option is available only if there is a relevant Route for the new Pset/Tool. In the figure above only the last Pset can be added to a Route.

When clicking on the “*Add to Route*” key the following screen is shown:



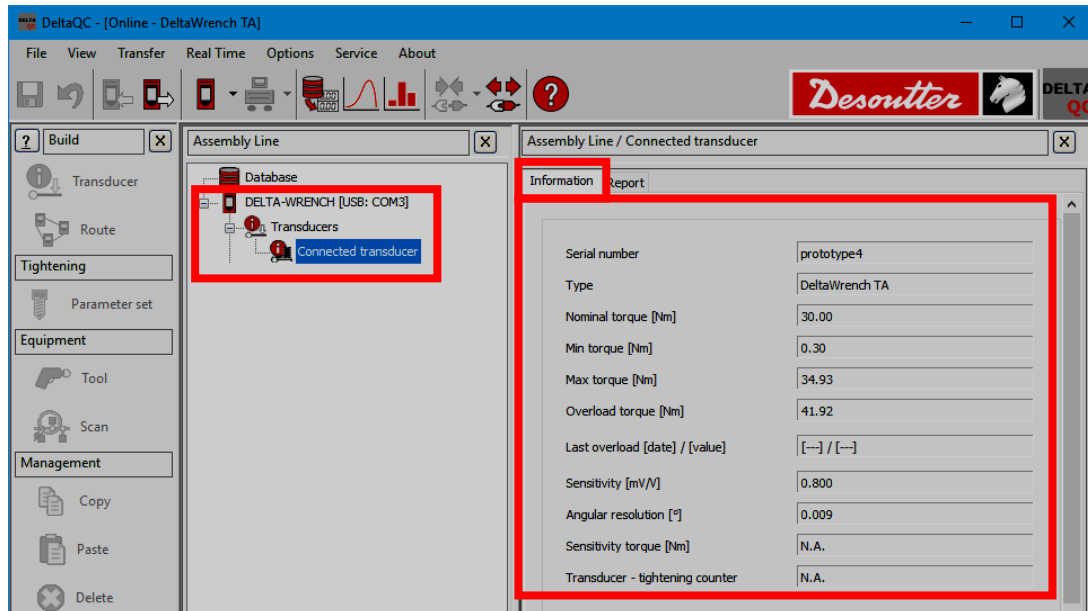
**NOTE:** The route must be defined **offline** with at least one item already linked. Empty routes are not shown here.

Select the Route and click on **Confirm** to save.



#### 4.2.5.2 Delta Wrench transducer information

In the **Transducer** → **Connected transducer** menu of the *online mode* it is possible to view the details of the Delta Wrench torque and angle transducers:

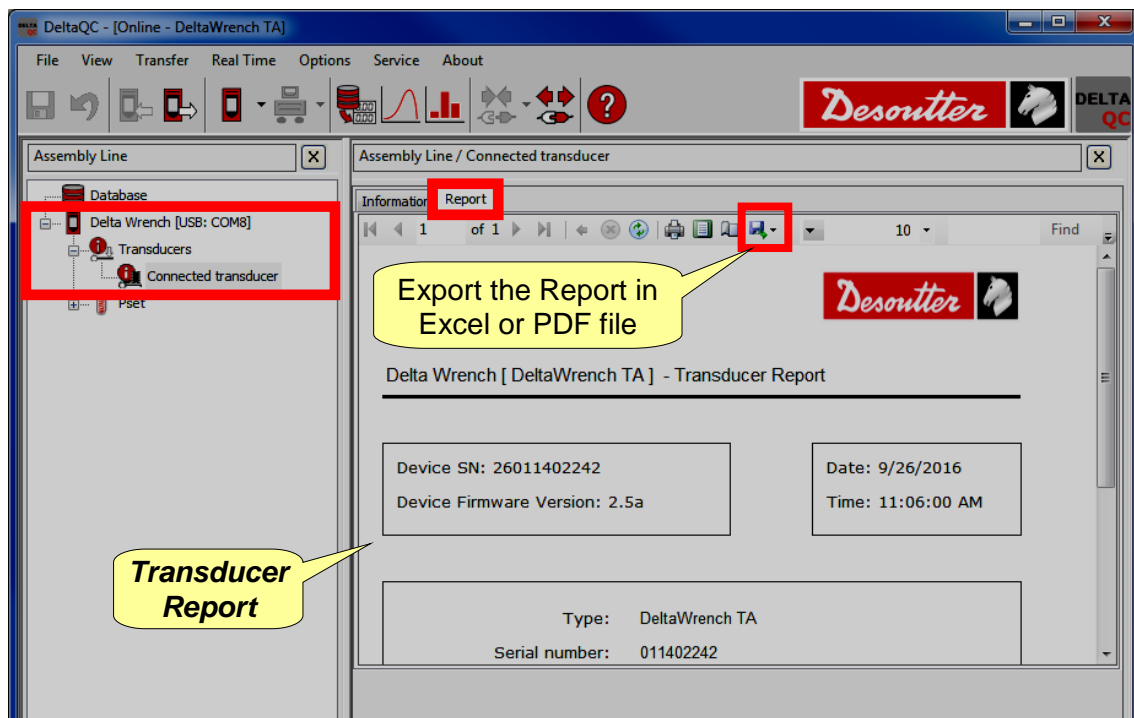


The following data are available in the above **Information** page:

<b>Serial number</b>	Transducer serial number (in general different from the Delta Wrench serial number).
<b>Type</b>	Delta Wrench type.
<b>Nominal torque</b>	This value is the capacity value written on the Delta Wrench. Generally, it differs slightly from the real capacity of the Delta Wrench (specified in the Max. Torque).
<b>Min. Torque</b>	Minimum load of the Delta Wrench, that is equal to the 1% of the <i>Max torque</i> .
<b>Max. Torque</b>	Torque capacity of the Delta Wrench.
<b>Overload torque</b>	Maximum torque applicable to the Delta Wrench without producing damages.
<b>Last overload</b>	Date, time, and value of the last torque overload detected by the connected transducer. <i>This option is not available for the Delta Wrench.</i>
<b>Sensitivity</b>	Sensitivity value of the torque transducer.
<b>Angular resolution</b>	Angular resolution of the gyroscope.
<b>Sensitivity torque</b>	<i>This option is not available for the Delta Wrench.</i>
<b>Transducer - tightening counter</b>	It is the number of tightenings performed by the Delta Wrench.



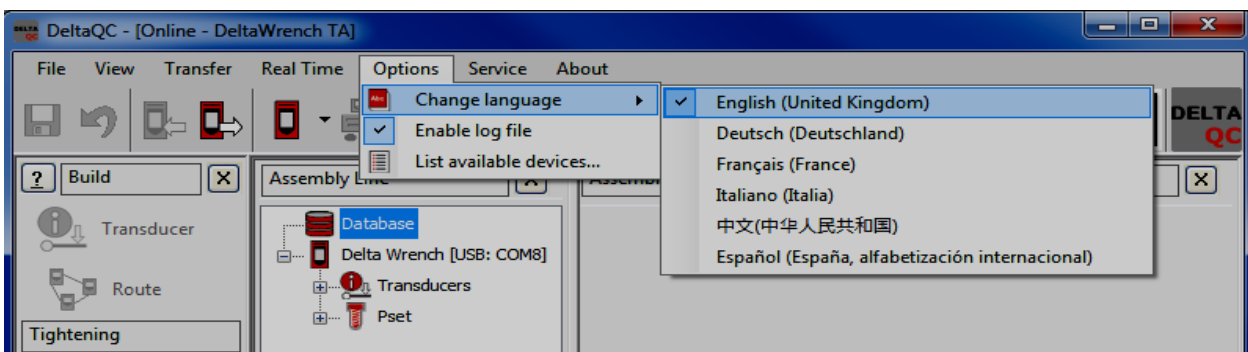
In the **Report** area it is possible to see and print a report:



The toolbar in the upper area of the **Report** provides functions to print the report, or export it in Excel or PDF file.

### 4.3 Language settings in DeltaQC

It is possible to set the language from the **Options** → **Change language** menu:



**NOTE:** After changing the language, restart the software to make the change effective.





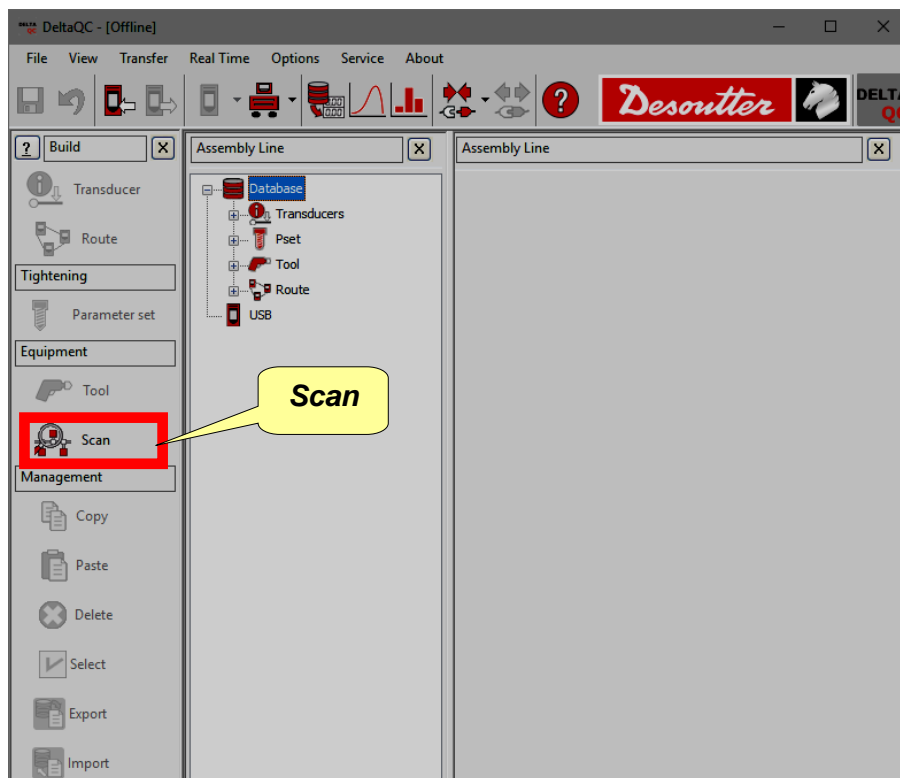
## 4.4 Connecting to the Delta Wrench

The connection between the DeltaQC and the Delta Wrench is via USB cable.

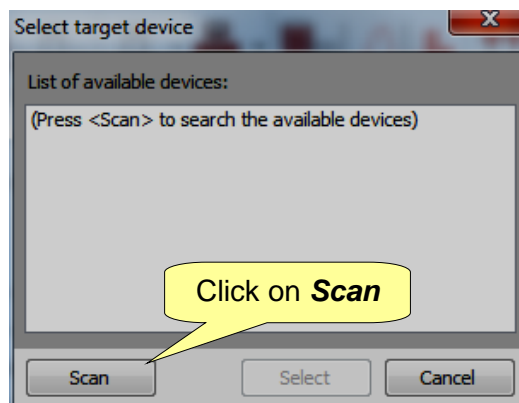


**WARNING:** Disconnect the USB cable to perform a test; a warning is shown on the display if the USB is connected.

After connecting the Delta Wrench to the PC with the DeltaQC software for the first time, select **Scan** (refer to the screen below):

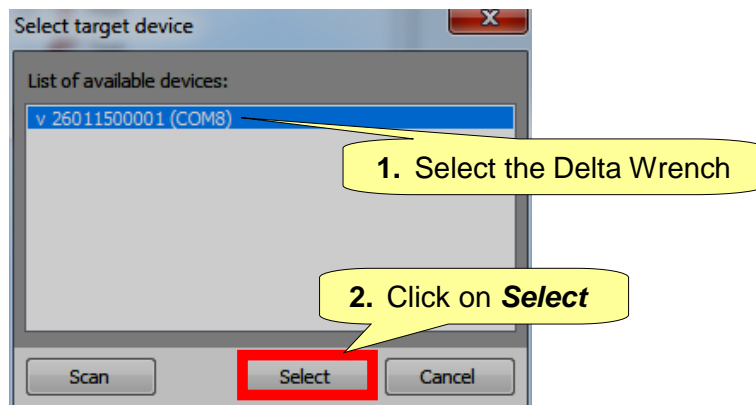


After selecting **Scan**, the following screen is shown:





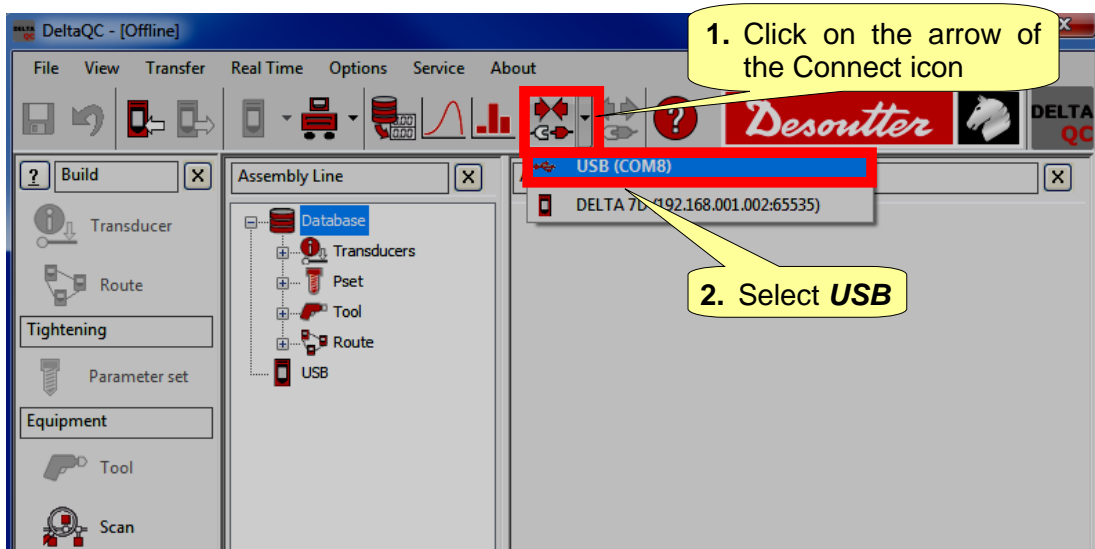
After clicking on **Scan**, select the available Delta Wrench from the list; then click on **Select**.



**NOTE:** This operation is necessary only once.

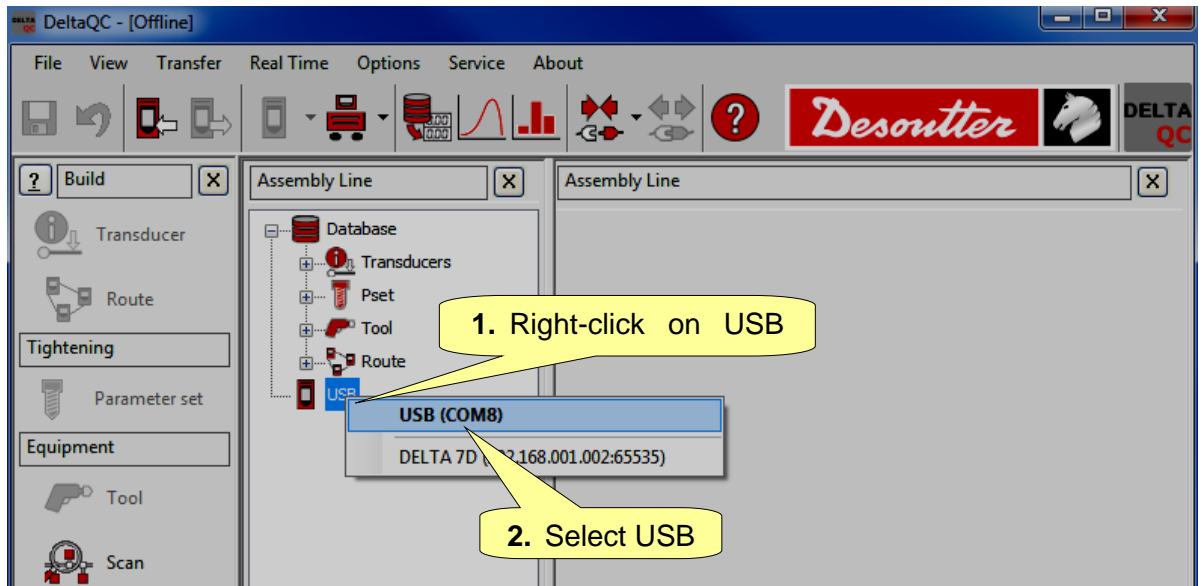
After the first time, perform the following steps:

- Launch the DeltaQC software.
- Turn on the Delta Wrench and wait for its startup (the main menu is shown on the display).
- Connect the Delta Wrench to the PC through USB cable (with the Delta Wrench already turned on).
- Click on the arrow of the **Connect** icon placed on the main toolbar and select USB to establish the connection between the Delta Wrench and the PC:

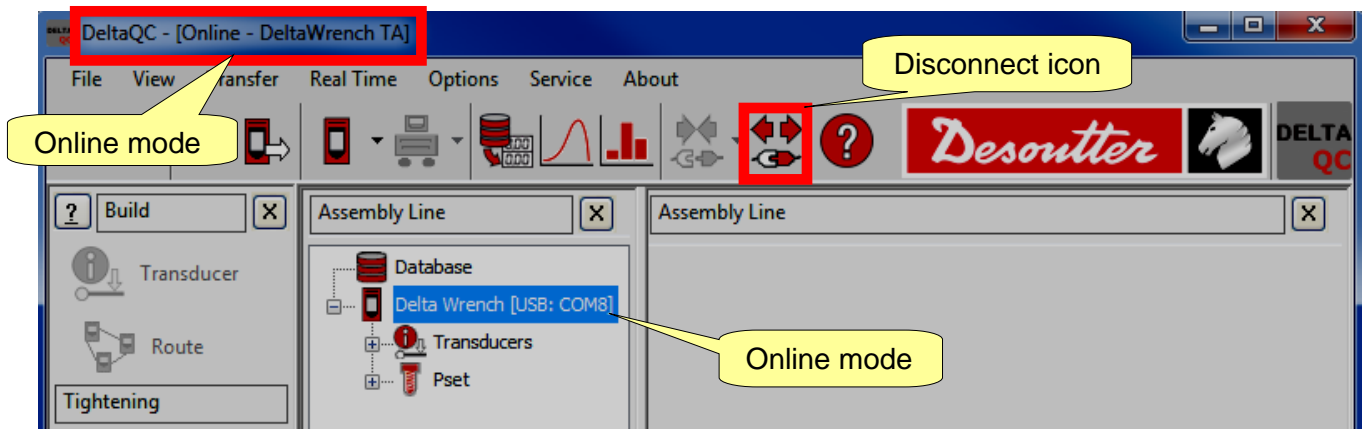




**NOTE:** To establish the connection between the Delta Wrench and the PC, it is also possible to right-click on *USB* icon in the *Assembly Line* area (refer to the screen below):



When the Delta Wrench is connected, the **Connect** icon is disabled and the **Disconnect** icon is active:

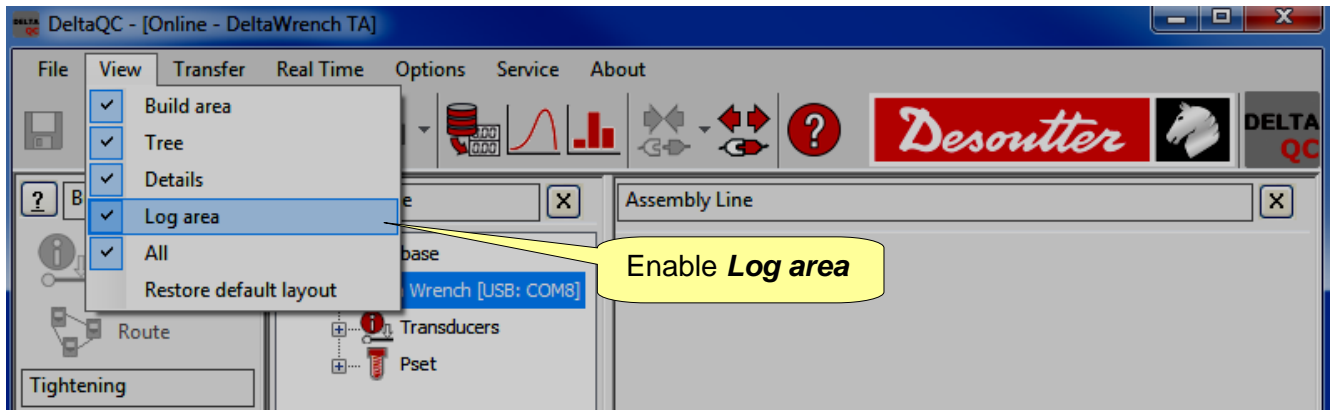




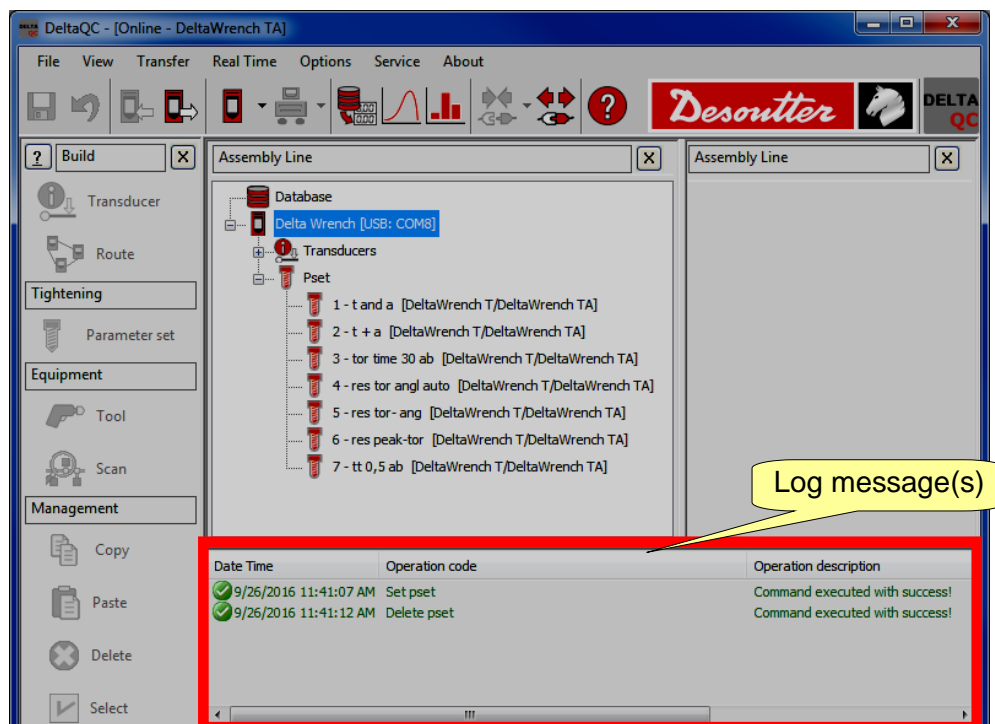
## 4.5 Delta Wrench LOG Viewer

The **Log viewer** function displays information about the Delta Wrench – DeltaQC communication. This can be helpful for troubleshooting activities.

To enable the **Log area** click on “Log area” command placed in *View* option of the toolbar (refer to the paragraph “Menu list” for further details):



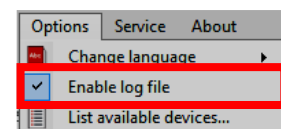
A “Log file” is automatically created in a subfolder of the installation directory of the DeltaQC (typically: **C:\Program Files\Desoutter\DeltaQC\Log**).



**NOTE:** A new file is created each day the software is used; the old files can be deleted.



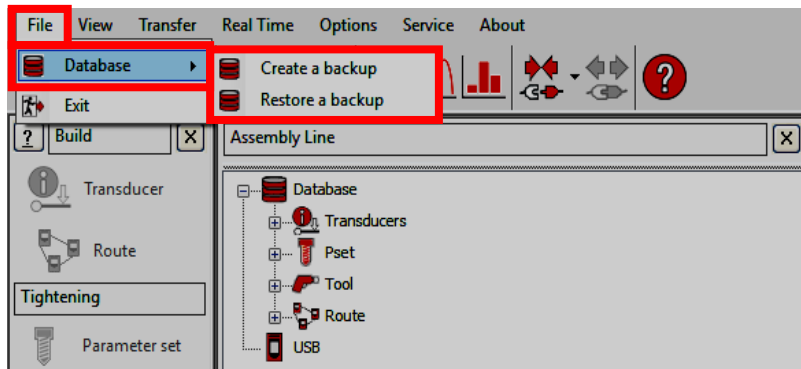
**NOTE:** The “Log file(s)” option can be enabled or disabled in the menu **Options** → **Enable log file**.





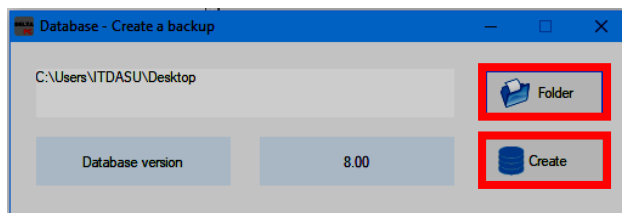
## 4.6 Database backup

From the **File** tab it is possible to create and restore a database backup.



To create a database backup file, click on the tab **File** → **Database** → **Create a backup**. From the dialog box that opens (see the figure below):

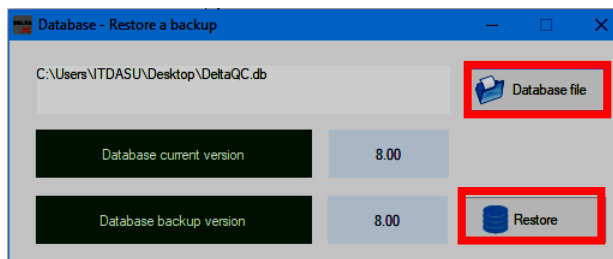
1. Click on the **Folder** button to select the destination folder.
2. Click on the **Create** button.



At the end of the process, a confirmation message informs that the database backup file is created with success.

To restore a database backup, click on the tab **File** → **Database** → **Restore a backup**. From the dialog box that opens (see the figure below):

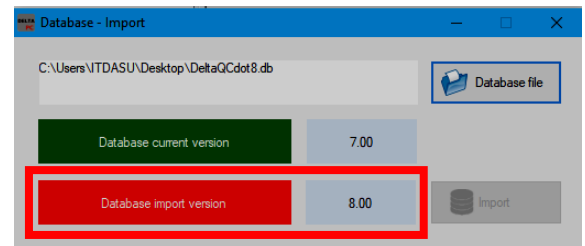
1. Click on the **Database file** button to select the database to import.
2. Click on the **Restore** button.



At the end of the process, a confirmation message informs that the database backup file is restored with success.



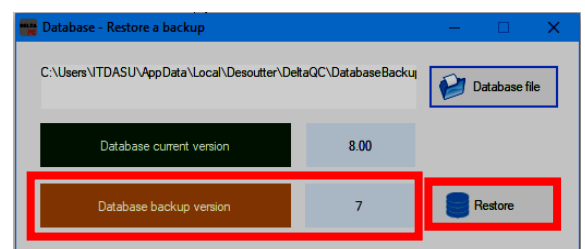
**NOTE:** If the database to restore is characterized by a version higher than the destination database, it is marked in red and it is not possible to restore it (see the figure on the right):



Upgrade DeltaQC Software to the latest version in order to complete the operation. For further information, refer to the paragraph “*DeltaQC software upgrade*”.



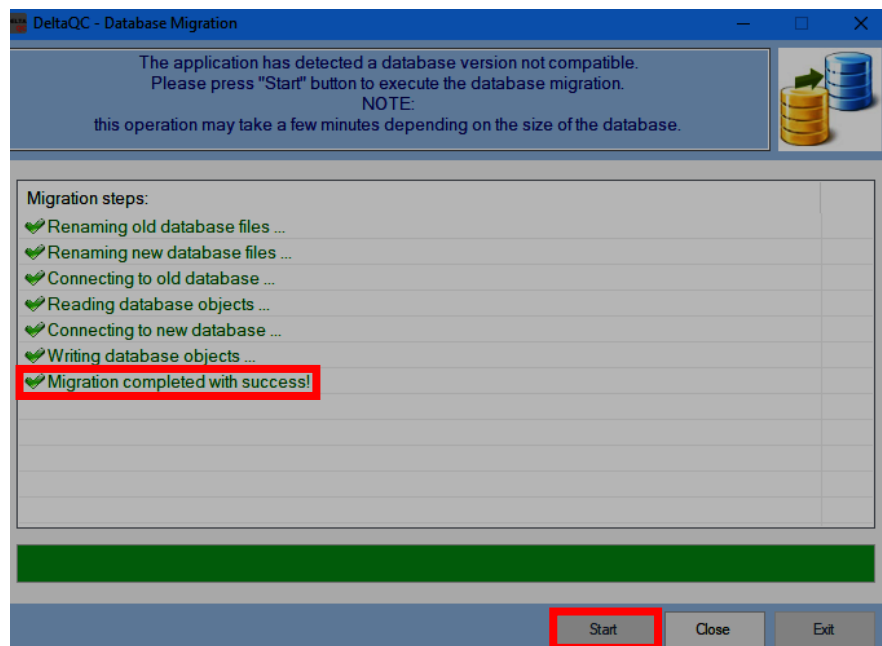
**NOTE:** If the database to restore is characterized by a version lower than the database current version, it is marked in yellow (see the figure on the right):



Click on the **Restore** button, and then on **Yes** in the dialog box that opens.

From the *DeltaQC - Database Migration* window (see figure below), click on **Start** to execute the database migration and wait until the process is completed.

The operation may take a few minutes, depending on the size of the database; a green progress bar indicates the status of the operation.



At the end of the process, the message “***Migration completed with success!***” is shown in the window.



## 4.7 Real Time option

The *Real Time* option allows the operator to display curves either in real time (during Delta Wrench operations) or at the end of tightening.



**IMPORTANT NOTE:** Before using the *Real Time* option, configure the Delta Wrench in order to be connected with a remote PC by means of the Open Protocol (for further details about the Open Protocol, refer to the paragraph “*Working with open Protocol*”).

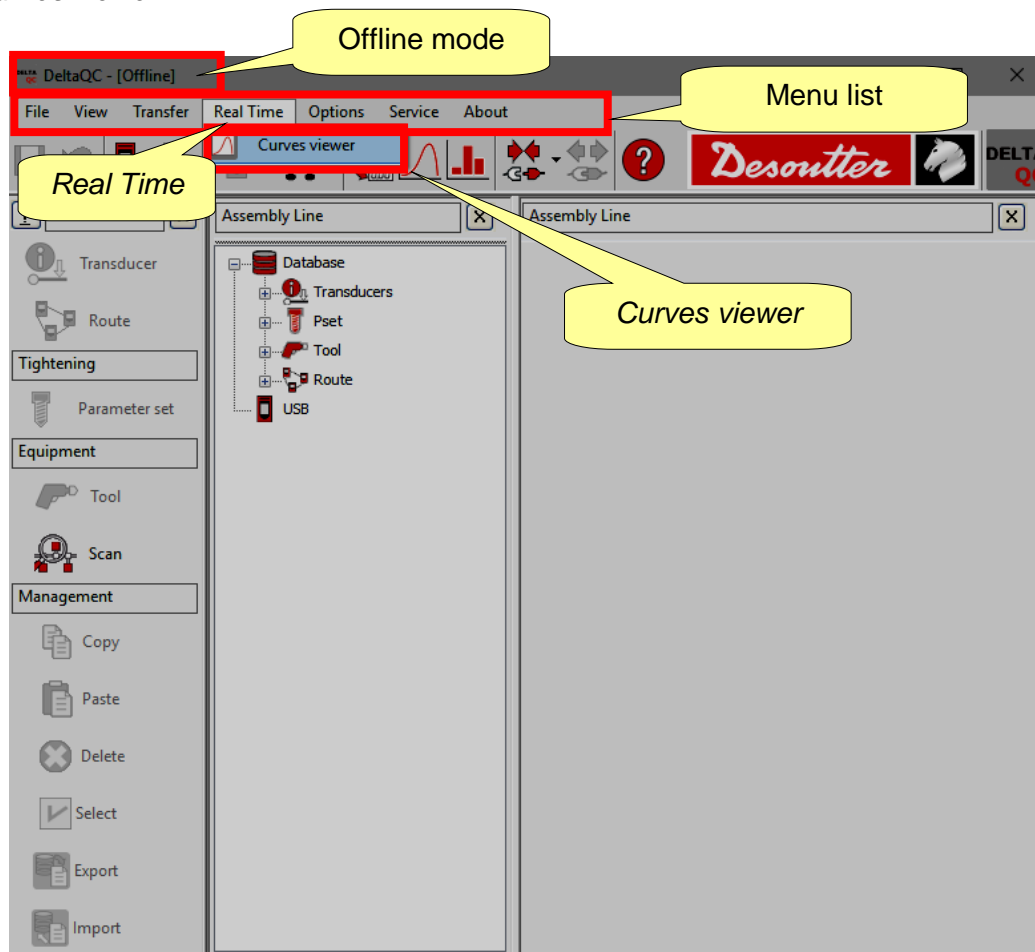


**NOTE:** The *Real Time* option is available during the trial period of the DeltaQC Software. Once the trial period expires, the *Real Time* option is available only for *Advanced* version of the DeltaQC Software.



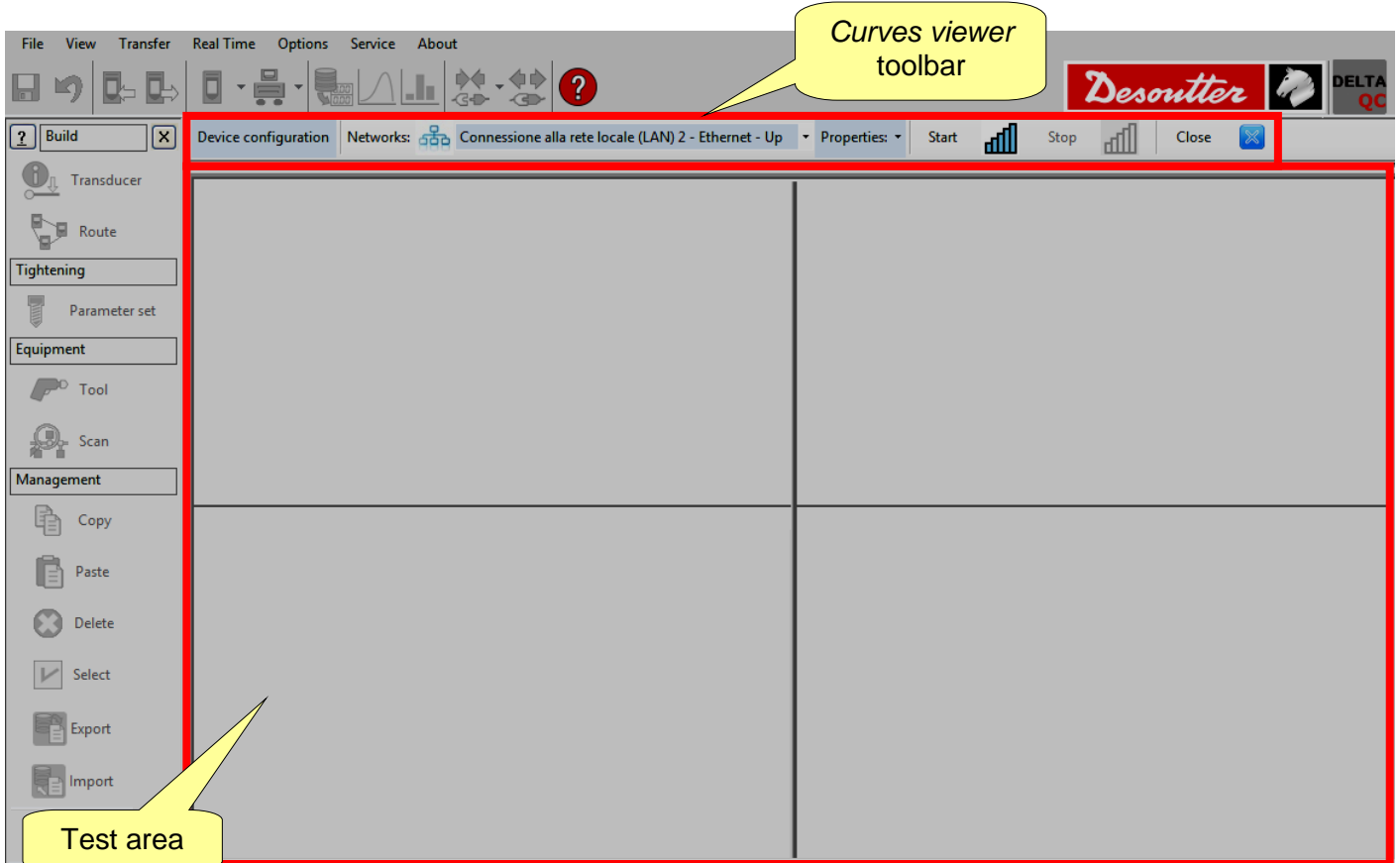
**NOTE:** The *Real Time* option works ONLY when DeltaQC Software is in offline mode.

Once DeltaQC Software is in offline mode, by acting on the menu list, click on *Real Time* tab; then click on *Curves viewer*.





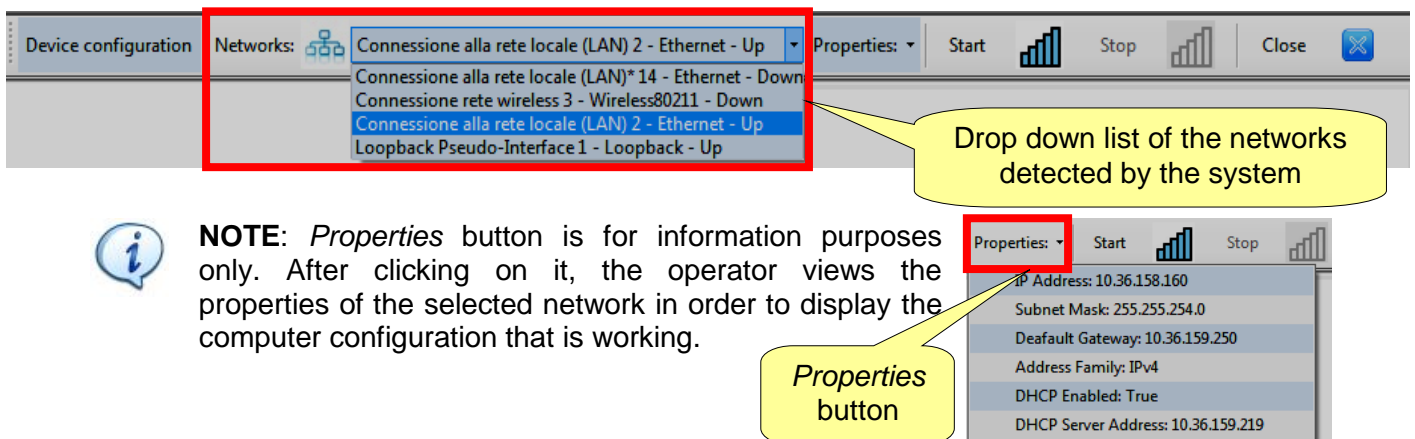
The following screen is displayed:



DeltaQC Software can interface at the same time with four Delta Wrenches (at most). In the above screen, the test area contains four sections and each of them corresponds to a specific Delta Wrench. After configuring the devices, each section shows curves and results of the tightening done with the Delta Wrench configured for that specific section.

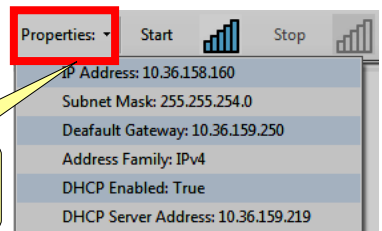
Do the following steps in order to work with *Real Time* option:

1. Select the network whereby DeltaQC Software communicates with Delta Wrench. At this purpose click on the drop-down list (placed on the *Curves viewer toolbar*) of the networks detected by the system:



**NOTE:** *Properties* button is for information purposes only. After clicking on it, the operator views the properties of the selected network in order to display the computer configuration that is working.

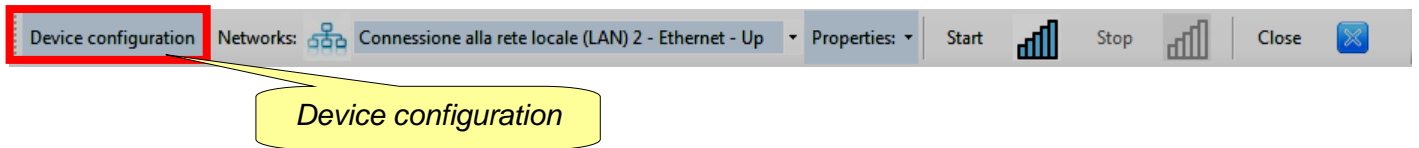
Properties button



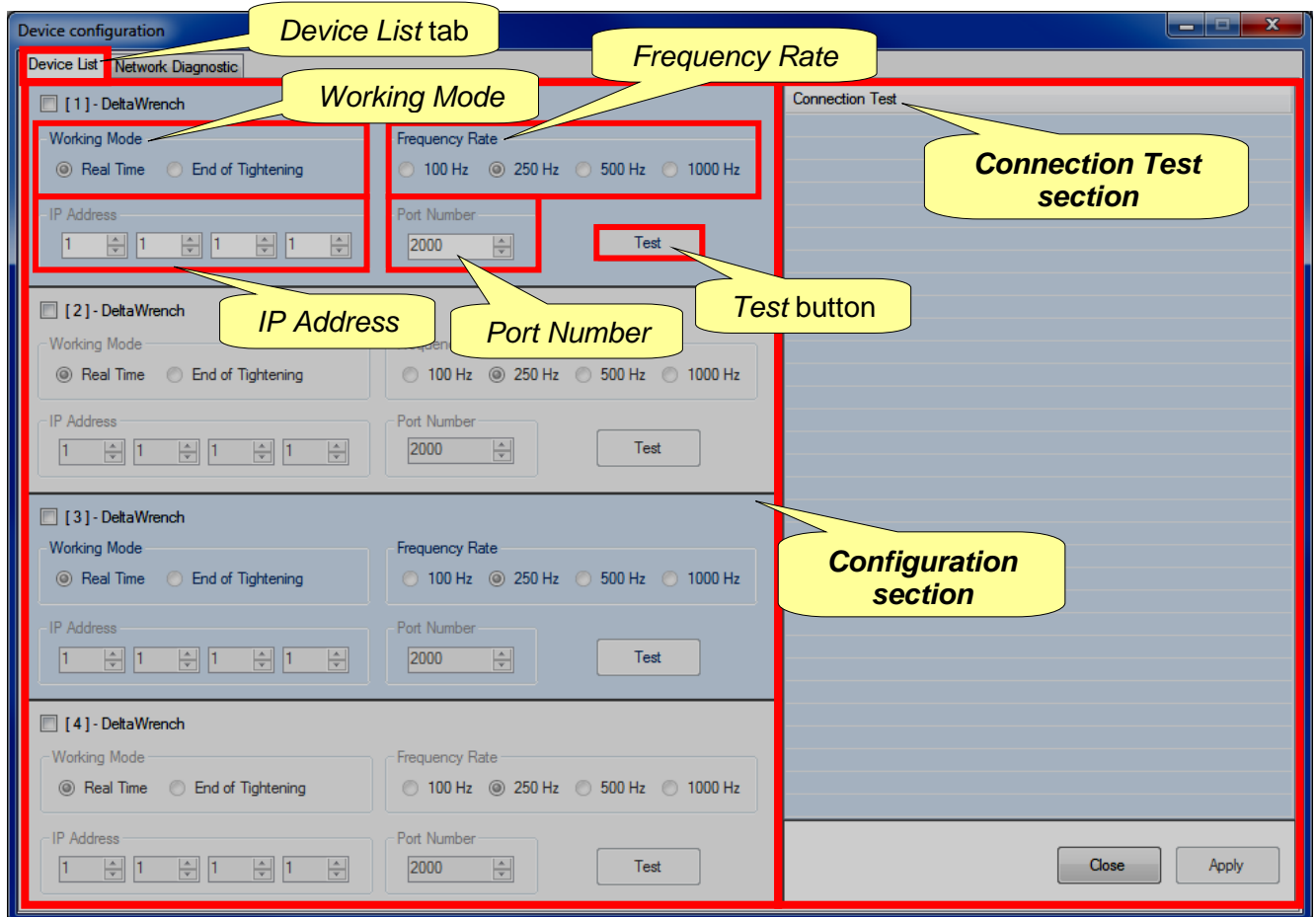




2. By acting on the *Curves viewer* toolbar, click on *Device configuration*:



The following screen is displayed:




The above *Device Configuration* screen includes two tab: *Device List* and *Network Diagnostic*.

The *Device List* tab is divided in two sections: *Configuration* section and *Connection Test* section. The *Configuration* section includes four areas and each of them corresponds to a specific Delta Wrench.

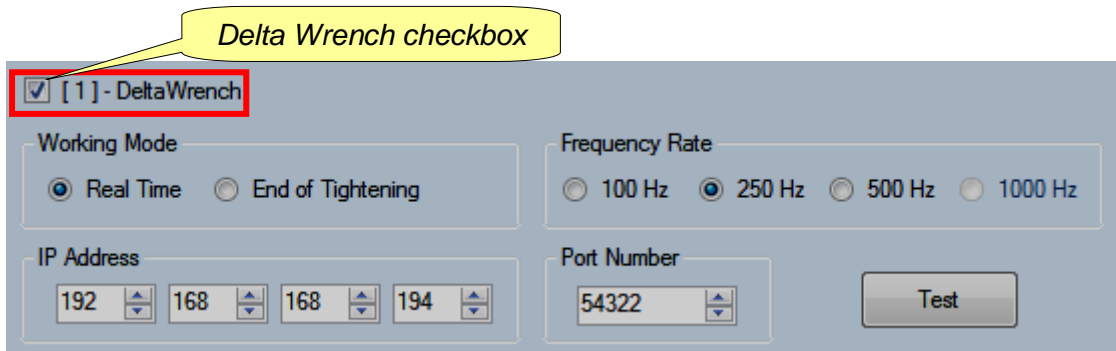
To configure the Delta Wrench, it is MANDATORY to define the following fields:

<p><b>Working Mode</b></p>	<p>Select between:</p> <ul style="list-style-type: none"> <li>• <i>Real Time</i>: <i>Real Time</i> option displays curves in real time (during Delta Wrench operations).</li> <li>• <i>End of Tightening</i>: <i>End of Tightening</i> option displays curves only at the end of the tightening.</li> </ul>
----------------------------	---

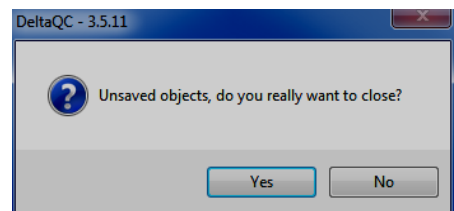


<p><b>Frequency Rate</b></p>	<p>It is the sampling rate that sets the operating mode of the Delta Wrench. Highest is the frequency, the most defined is the curve. The frequency rates available are as follows:</p> <ul style="list-style-type: none"> <li>• 100 Hz (<i>Default value</i>)</li> <li>• 250 Hz</li> <li>• 500 Hz</li> <li>• 1000 Hz</li> </ul> <p> <b>NOTE:</b> The frequency rate equal to 1000 Hz is not available, if the <i>Working Mode</i> is set on “<i>Real Time</i>”.</p>
<p><b>IP Address</b></p>	<p>Specify the IP Address of the Delta Wrench.</p>
<p><b>Port Number</b></p>	<p>Specify the Port Number of the Delta Wrench.</p>
<p><b>Test button</b></p>	<p>Once inserted the IP Address, click on Test button in order to verify the communication between DeltaQC Software and Delta Wrench.</p> <div data-bbox="963 689 1434 1032" style="border: 1px solid black; padding: 5px;"> <p>Connection Test</p> <pre>Response from 192.168.168.194: byte=32 duration&lt;3ms TTL=255&gt; Success Response from 192.168.168.194: byte=32 duration&lt;3ms TTL=255&gt; Success Response from 192.168.168.194: byte=32 duration&lt;4ms TTL=255&gt; Success Response from 192.168.168.194: byte=32 duration&lt;5ms TTL=255&gt; Success Response from 192.168.168.194: byte=32 duration&lt;7ms TTL=255&gt; Success Response from 192.168.168.194: byte=32 duration&lt;5ms TTL=255&gt; Success Response from 192.168.168.194: byte=32 duration&lt;5ms TTL=255&gt; Success Response from 192.168.168.194: byte=32 duration&lt;4ms TTL=255&gt; Success Response from 192.168.168.194: byte=32 duration&lt;3ms TTL=255&gt; Success Response from 192.168.168.194: byte=32 duration&lt;220ms TTL=255&gt; Succ... TimedOut Response from 192.168.168.194: byte=32 duration&lt;172ms TTL=255&gt; Succ... Response from 192.168.168.194: byte=32 duration&lt;7ms TTL=255&gt; Success TimedOut Response from 192.168.168.194: byte=32 duration&lt;26ms TTL=255&gt; Success</pre> </div>

Once configured the Delta Wrench, flag the related checkbox (see the following screen) in order to enable it.



**NOTE:** If the operator changes any configuration parameter and click on *Close* button (placed on the right bottom corner of the above *Device Configuration* screen) without saving, the screen on the right is displayed:





The *Network Diagnostic* tab analyzes the IP Address inserted into the *Device List* tab and checks if the real time feature can be executed with the existing “company network” conditions. Set the *Ping frequency (ms)*, the *Ping timeout (ms)* and the *Message size (byte)*. Verify the IP Address in the related box and finally click on *Start* button.

The screenshot displays the 'Device configuration' window with the 'Network Diagnostic' tab selected. Key elements are annotated with yellow callouts:

- Network Diagnostic tab**: Points to the active tab at the top.
- Ping frequency (ms)**: Points to the input field set to 500.
- Ping timeout (ms)**: Points to the input field set to 10.
- Message size (byte)**: Points to the input field set to 512.
- Start button**: Points to the 'Start' button.
- IP Address**: Points to the input field containing '192.168.168.194'.
- Diagnostic analysis**: Points to the log area showing 'Response from 192.168.168.194: byte=512 duration<6ms TTL=255> Success' and 'TimedOut' entries.
- Final feedback**: Points to the feedback box on the right.

At the end of the network diagnostic test, a feedback summarizes the analysis done.

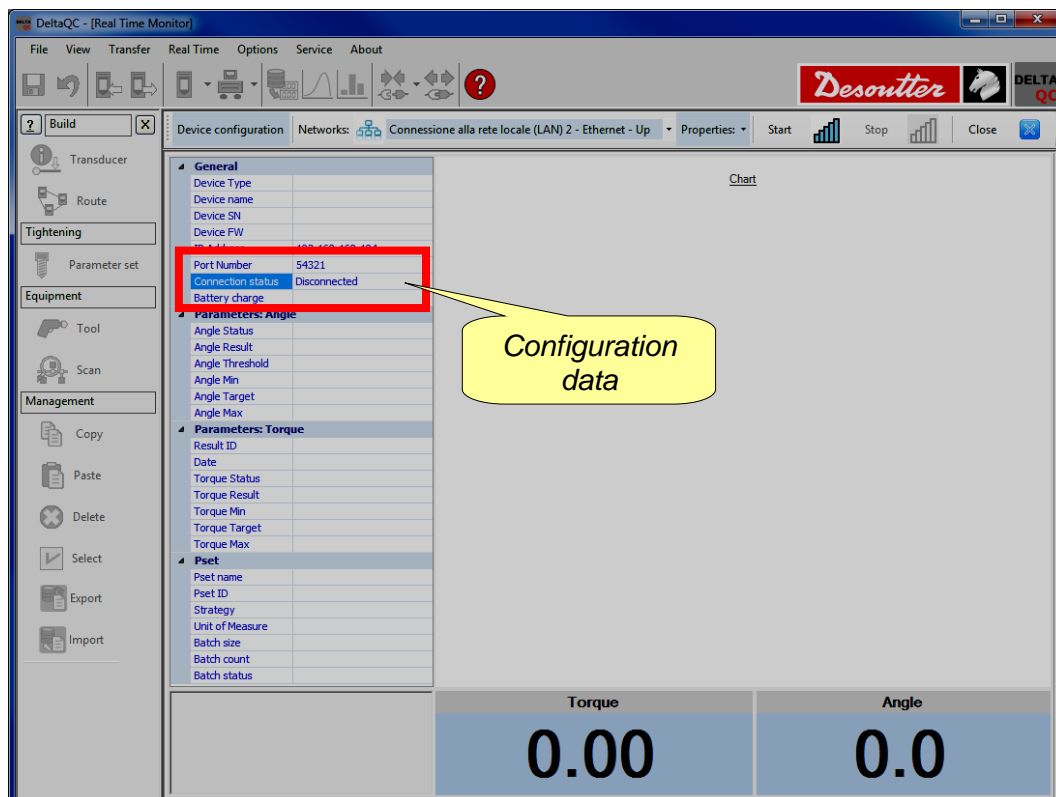
- Once configured a specific Delta Wrench, click on *Apply* button (placed on the right bottom corner of the above *Device Configuration* screen) in order to save it.



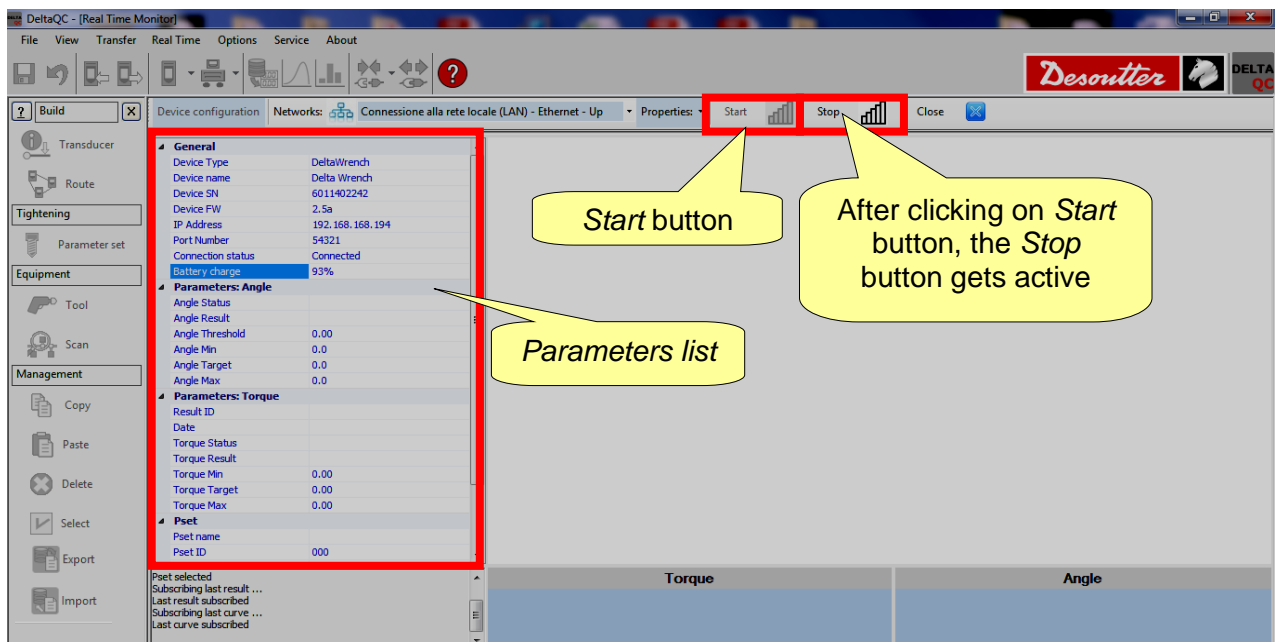
**NOTE:** Once defined a Delta Wrench configuration, it is kept in memory, regardless of Delta Wrench connection status.



The following screen is displayed:



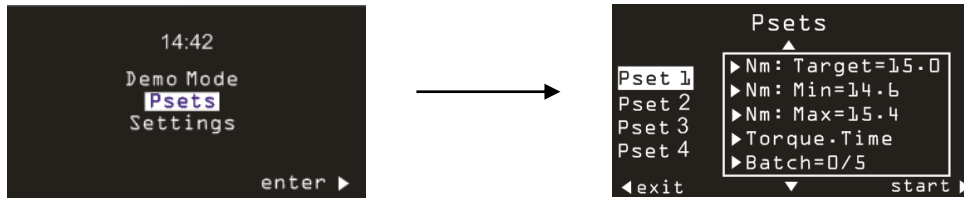
4. Click on *Start* button in order to connect the Delta Wrench with the DeltaQC Software:



**NOTE:** If the network connection is up, the data inserted inside the parameters list (placed on the left side of the above screen) are blue colored. If the network connection is down, the data inserted inside the parameters list are red colored.

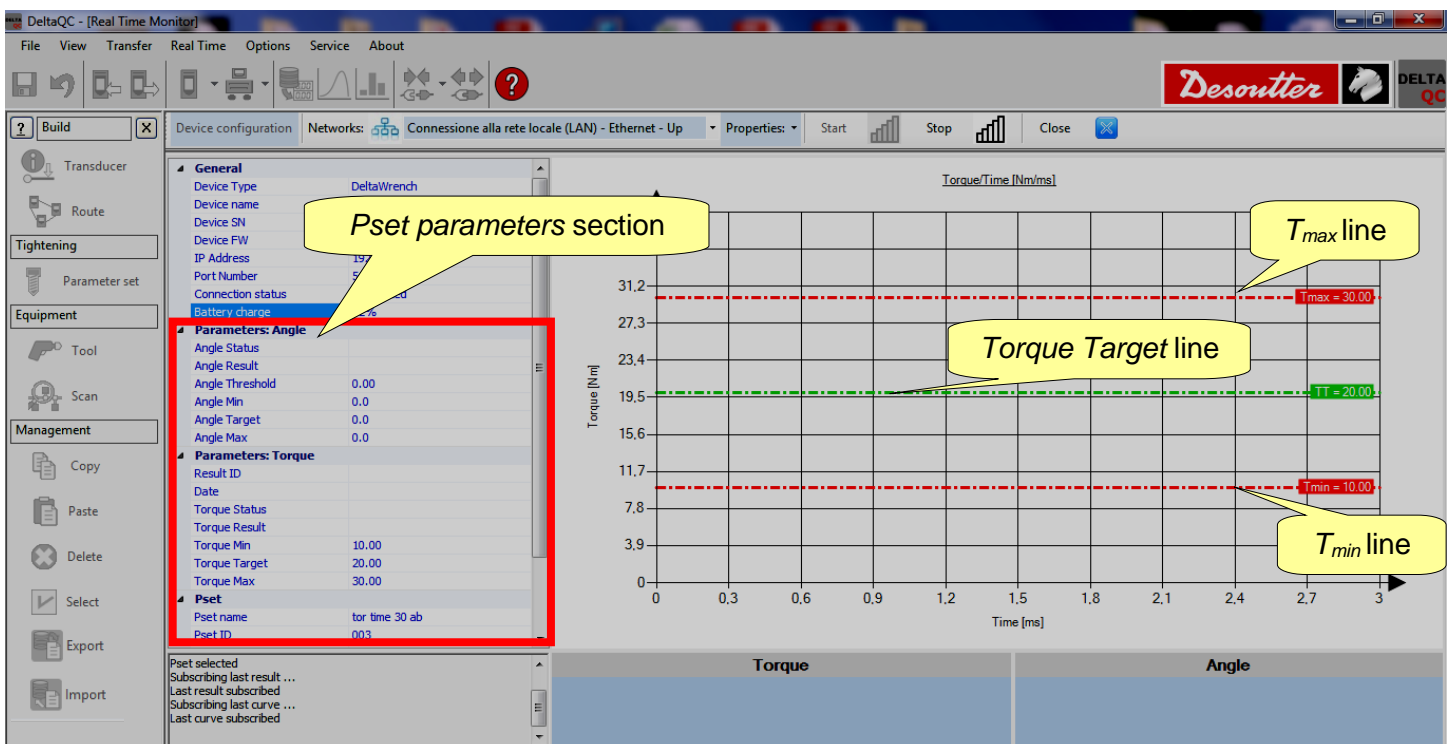


- Configure a Pset (for further details about the Pset configuration, refer to the paragraph “Pset”). Select the configured Pset manually in the **Pset** menu from the main menu of the Delta Wrench:



Finally, click on *Start* (placed on the right lower corner of the above Pset menu).

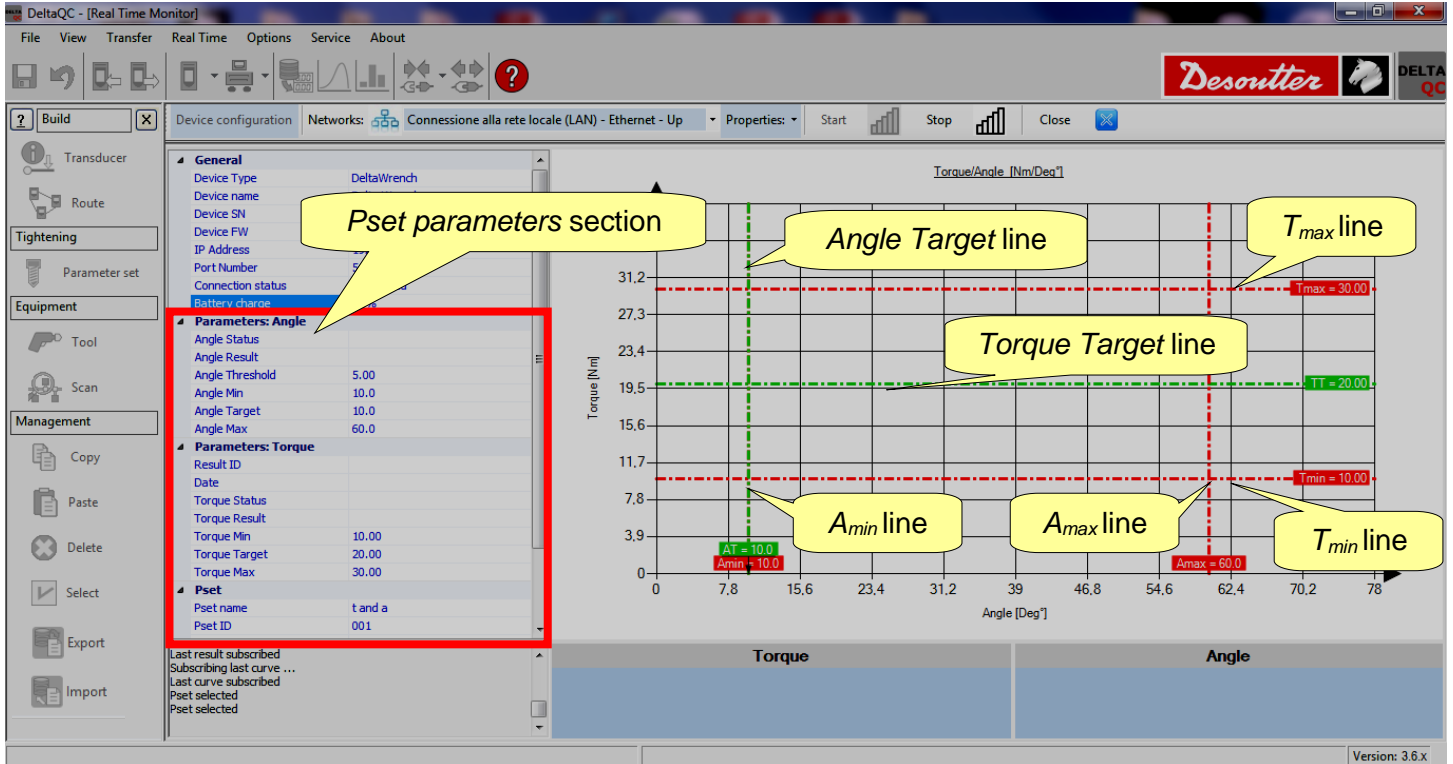
- The *DeltaQC Real Time Monitor* shows the following screen:



**NOTE:** The above example refers to a *Torque Time* control strategy: in fact, the *Angle Parameters* (see the Pset parameters section) are equal to 0. On the graph, it is possible to display only  $T_{max}$  and  $T_{min}$  lines (red lines) and *Torque Target* line (green line).

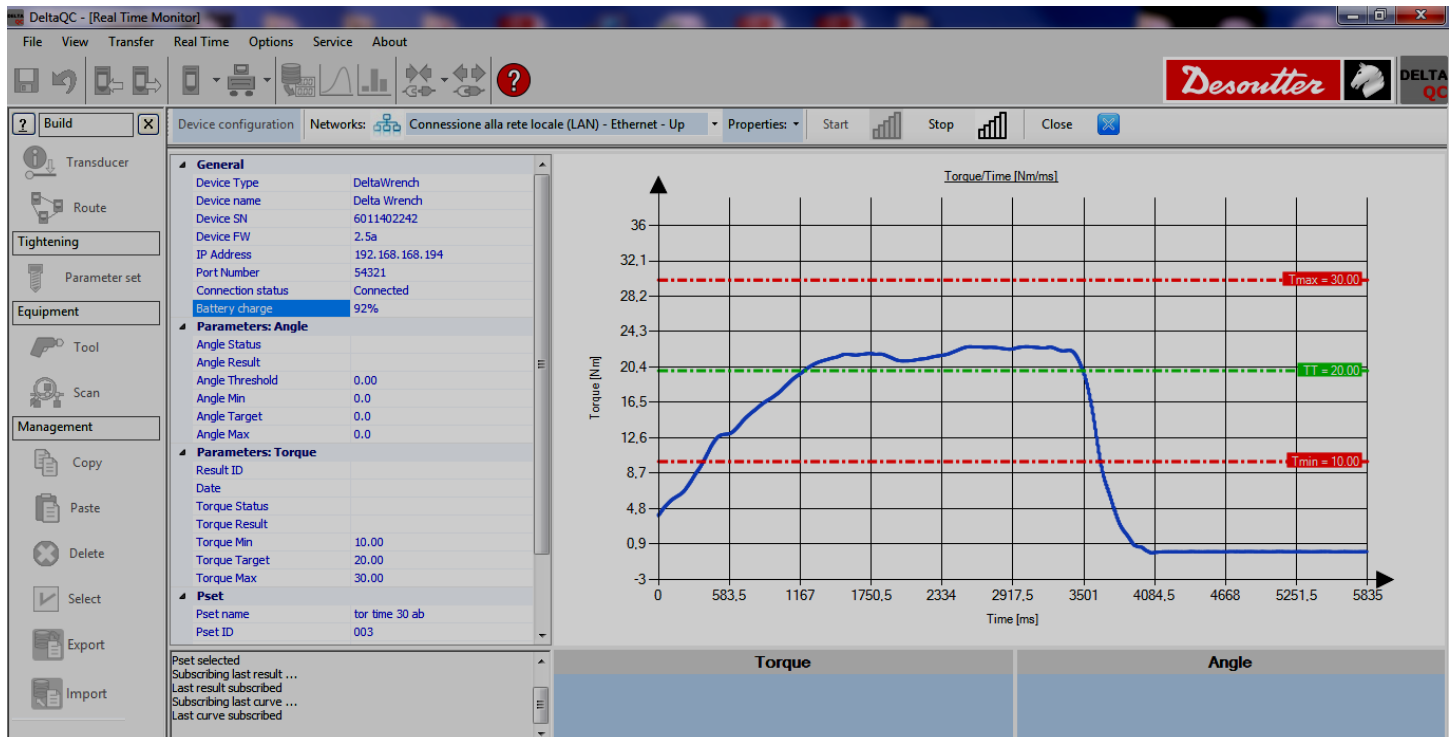


**NOTE:** If the control strategy of the Pset selected is either *Torque + Angle* or *Torque & Angle*, the graph displays also the *Angle Parameters* listed in the Pset parameters section (see the screen below).



## 7. Do the test tightening.

- If the control strategy of the Pset selected is *Torque Time*, the following screen is displayed:





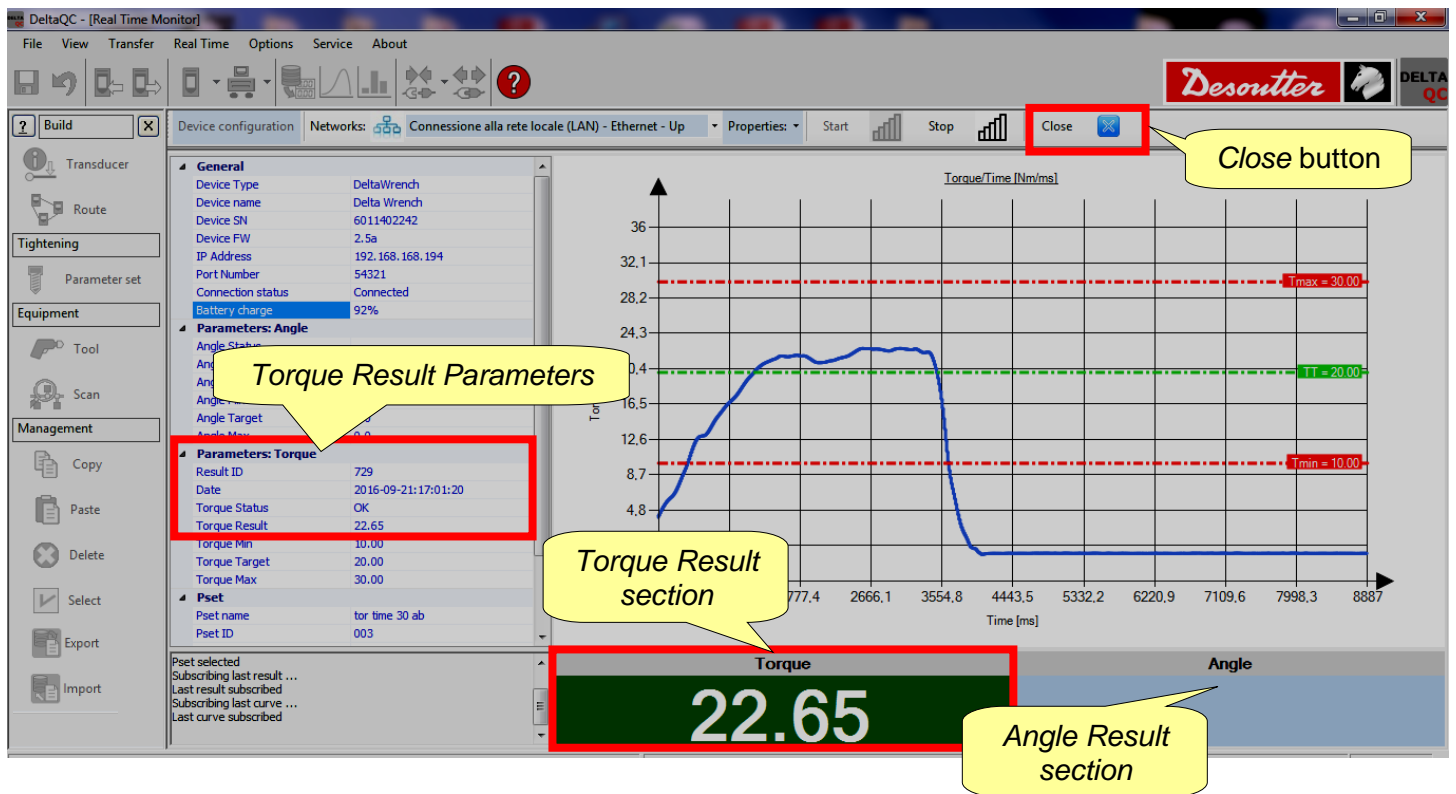
At the end of the test tightening, *Torque Status*, *Date* and *Result ID* update the *Torque Result Parameters* section according to the final outcome.

Below the graph, in the *Torque Result* section, the value of the maximum torque reached is displayed.

If the maximum torque reached is within the torque limits, the *Torque Result* section is green colored.

In case the maximum torque reached is over the maximum torque, the *Torque Result* section is red colored.

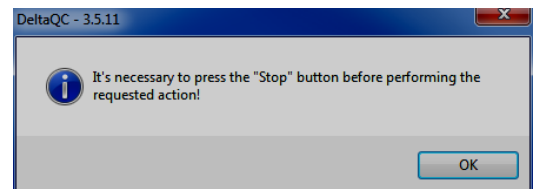
When the *Torque Result* section is yellow colored, the maximum torque reached is lower than the minimum torque.



**NOTE:** The *Angle Result* section is empty due to the fact that the control strategy of the Pset selected is *Torque Time*.

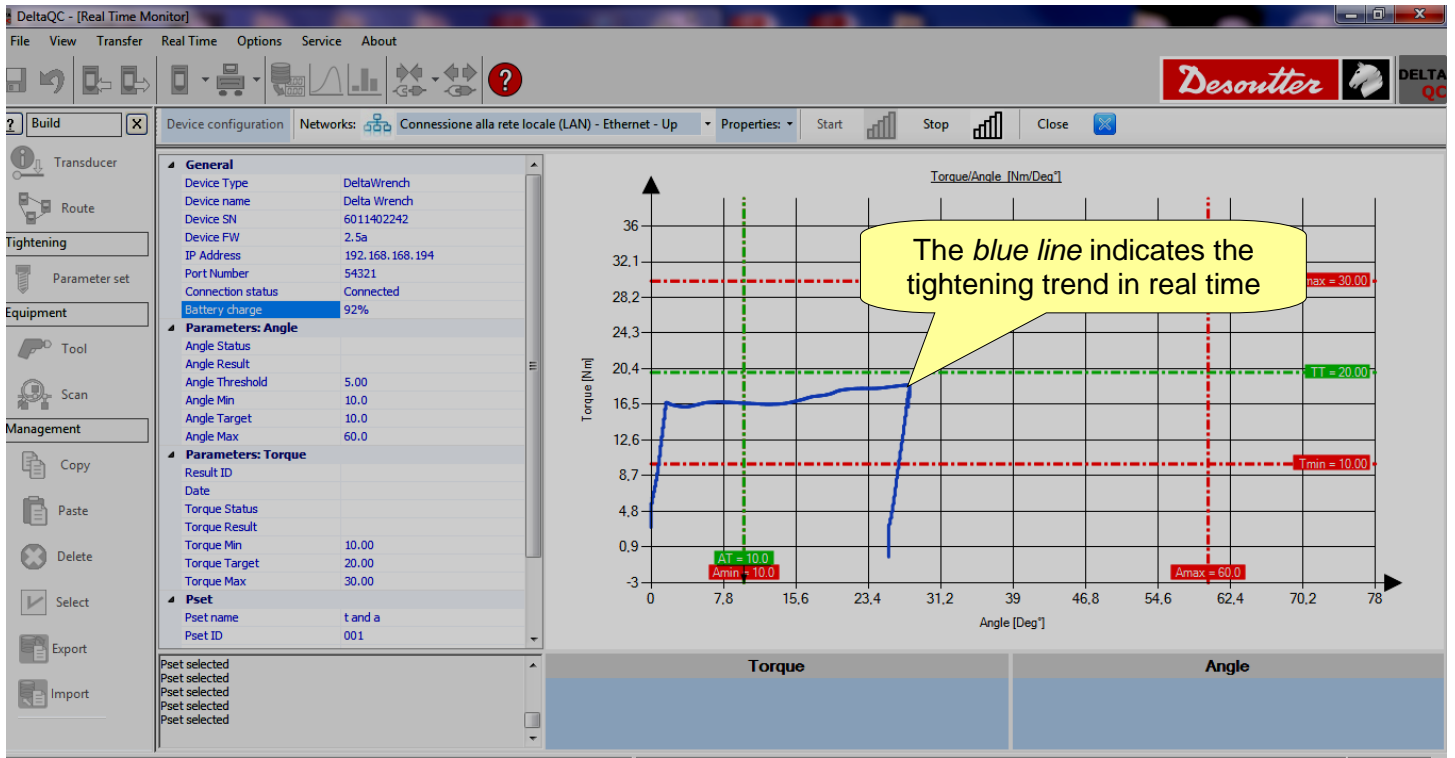


**NOTE:** Before clicking on *Close* button (placed on the Curves viewer toolbar) it is **NECESSARY** to click on *Stop* button in order to stop the communication between Delta Wrench and DeltaQC Software. If the operator clicks on *Close* button before than on *Stop* button, the pop up on the right appears:

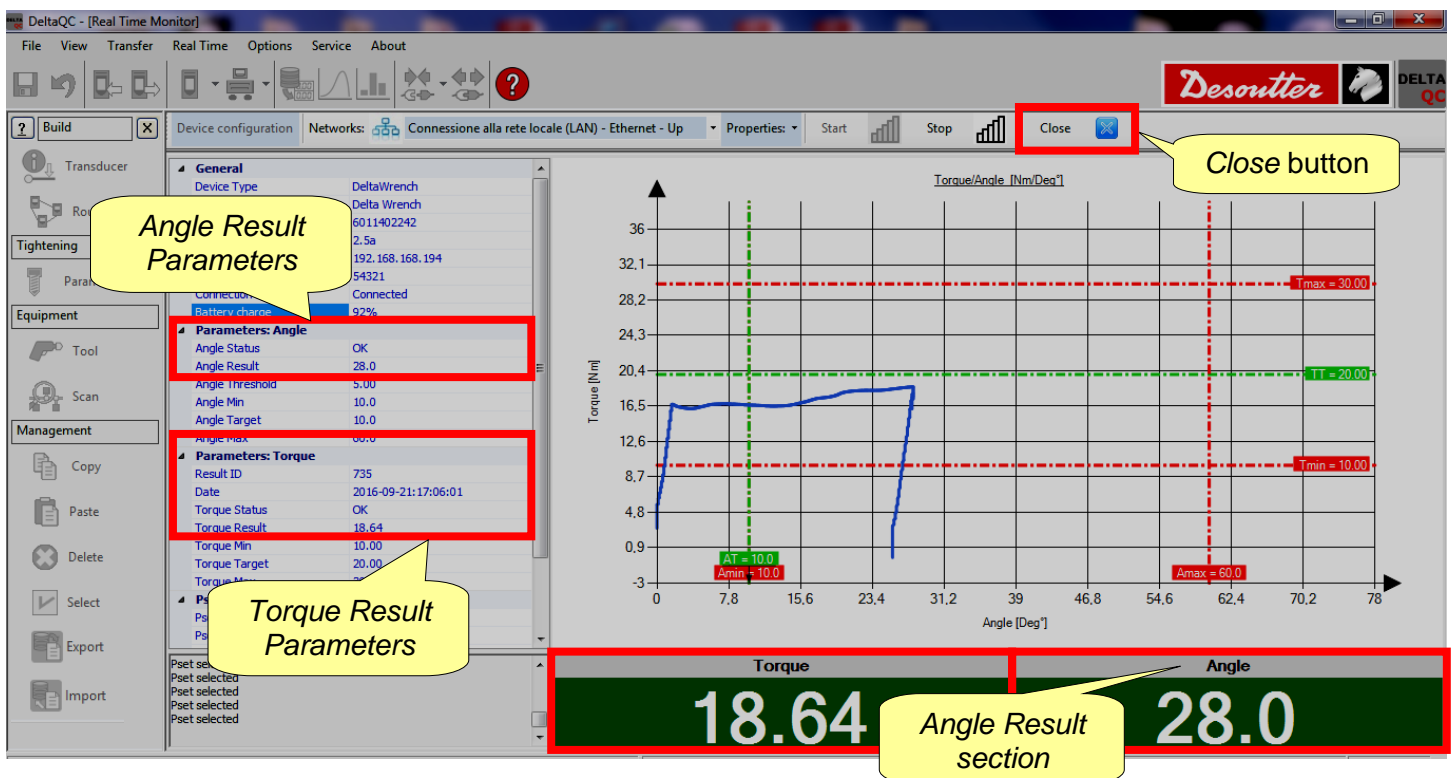




- If the control strategy of the Pset selected is either *Torque + Angle* or *Torque & Angle*, the following screen is displayed:



At the end of the test tightening, *Torque Status*, *Date* and *Result ID* update the *Torque Result Parameters* section, and *Angle Status* and *Angle Result* update the *Angle Result Parameters* section according to the final outcome.







Below the graph, in the *Torque Result section*, the value of the maximum torque reached is displayed. In the *Angle Result section*, the value of the maximum angle reached is displayed.

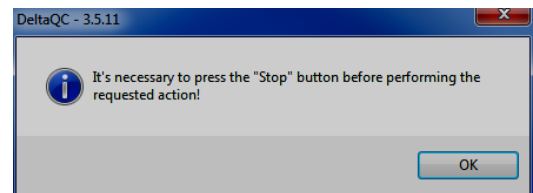
If the maximum torque / maximum angle reached is within the torque / angle limits, the *Torque Result section* / *Angle Result section* is green colored.

In case the maximum torque / maximum angle reached is over the maximum torque / maximum angle, the *Torque Result section* / *Angle Result section* is red colored.

When the *Torque Result section* / *Angle Result section* is yellow colored, the maximum torque / maximum angle reached is lower than the minimum torque / minimum angle.



**NOTE:** Before clicking on *Close* button (placed on the Curves viewer toolbar) it is **NECESSARY** to click on *Stop* button in order to stop the communication between Delta Wrench and DeltaQC Software. If the operator clicks on *Close* button before than on *Stop* button, the pop up on the right appears:

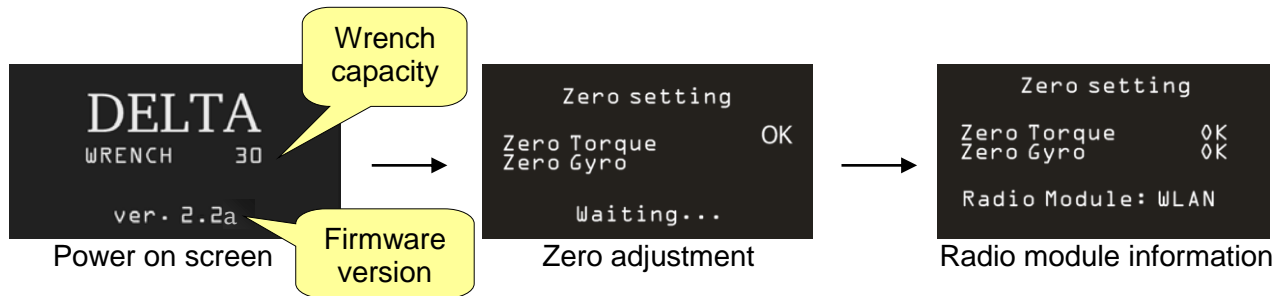




## 5 GETTING STARTED WITH DELTA WRENCH

To turn on the Delta Wrench, press the **ON** button placed on the Delta Wrench keyboard; to turn it off, press the **OFF** button (even placed on the Delta Wrench keyboard) and hold it down for few seconds.

At power, the power on screen is shown for few seconds, followed by the zero adjustment and the radio module information (for models equipped with radio module). Thus, the wrench capacity and firmware version are displayed:



**NOTE:** Leave the Delta Wrench in a fixed position without applying any torque to the transducers during the power on; this permits proper Automatic Zero Adjustment of the transducer and gyroscope.

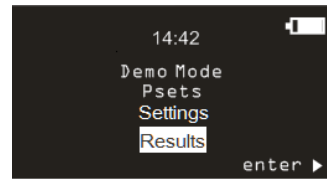


At the end of the zero adjustment process the OK is displayed to indicate the process has been completed; in case of error during the zero adjustment, a message “Error Torque” or “Error Zeroing Gyro” is shown when trying to execute a tightening.

Switch off and on again the Delta Wrench to execute again the zeroing or perform the Manual Zero Adjustment (for further details, refer to the following paragraph “Manual Zero Adjustment”).



After the power on sequence, the main menu is shown on the display:



Main menu

- **Demo Mode:** This menu enters the free test, without the need of programming the Delta Wrench with a specific tightening program (for further details, refer to the paragraph “Executing a Demo Test”).
- **Pset:** This menu enters the tightening programs (*Pset*) defined and sent to the Delta Wrench by DeltaQC (for further details, refer to the paragraph “Pset”).
- **Settings:** This menu sets the language, the date/time, the Demo Mode measurement unit and enters the diagnostic menu (for further details refer to the paragraph “Delta Wrench Settings”).
- **Results** This menu shows the last 99 Pset results



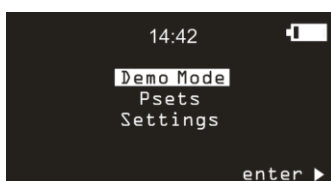
**NOTE:** It is possible to specify a time frame of inactivity after which the Delta Wrench display enters in power save mode and reduces the display brightness. To exit the power save mode, press any button on the Delta Wrench keyboard. For more information on the configuration of the power save mode, see the paragraph “Delta Wrench display switch off [minutes]”.

Likewise, it is possible to specify a time frame of inactivity after which the Delta Wrench automatically switches off. This function is disabled while the Delta Wrench is performing a test, when it is connected to the DeltaQC, or when the WLAN connection is enabled. For more information on the configuration of the power off mode, see the paragraph “Delta Wrench power off [minutes]”.

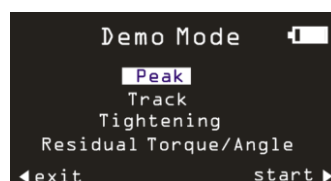
## 5.1 Manual Zero Adjustment

The Manual Zero Adjustment of the transducer and gyroscope prevents both Zero Gyro and Zero Torque changes over time.

It can be performed in four different cases (provided the Delta Wrench is in a fixed position without applying any torque to the transducers):



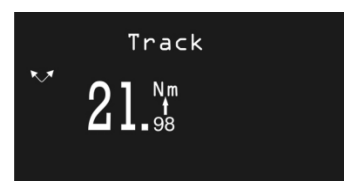
When the “main menu” is shown



When the “Demo Mode” screen is shown



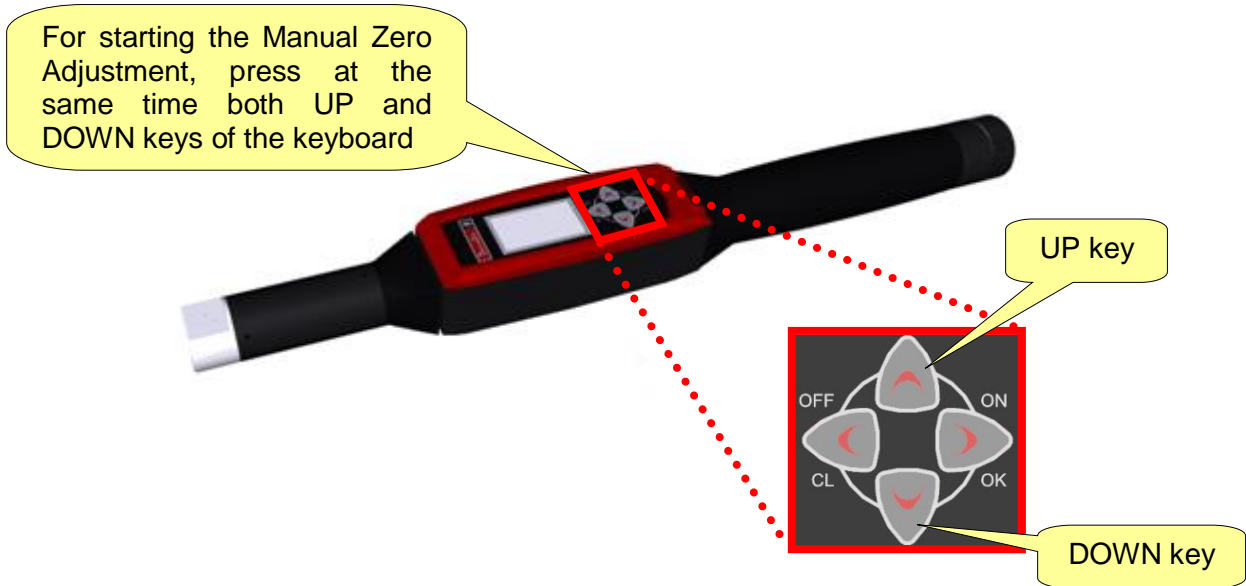
When the “Psets” screen is shown



For each measure screen (in the above example: “Track mode”)



For starting the Manual Zero Adjustment, press **at the same time** both UP and DOWN keys of the keyboard (refer to the figure below):



Once the Manual Zero Adjustment process is complete, the operator must perform a data analysis of the Manual Zero Adjustment results in order to complete the measures successfully.



**NOTE:** Sometimes it needs to compare the Automatic Zero Adjustment results and the Manual Zero Adjustment results (refer to the following table).

CASES	Torque - Angle	Automatic Zero Adjustment result	Manual Zero Adjustment result	DATA ANALYSIS
1	Torque	OK	OK	In this case, the values measured during the Automatic Zero Adjustment process are updated, since the Manual Zero Adjustment process is OK. The operator can proceed with the measures.
	Angle	OK	OK	
2	Torque	OK	NOK	In this case, since the Torque measured during the Manual Zero Adjustment is NOK, the Angle (during the Manual Zero Adjustment) is not measured. The Delta Wrench takes in account the last previous valid values measured. The operator can proceed with the measures.
	Angle	OK	---	
3	Torque	OK	OK	In this case, the Angle measured during the Manual Zero Adjustment is NOK, therefore it takes in account the last valid Angle value measured previously. On the other hand, the Torque measured during the Automatic Zero Adjustment is updated, since the respective value measured during the Manual Zero Adjustment is OK. The operator can proceed with the measures.
	Angle	OK	NOK	



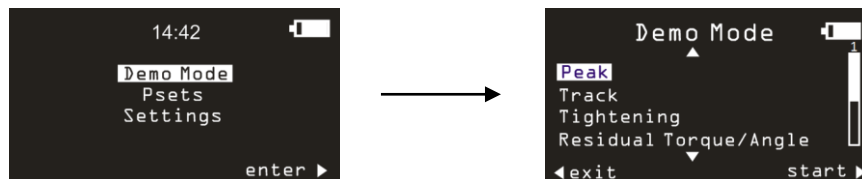
## 5.2 Executing a Demo Test

The *Demo Mode* executes a test (tightening operation or quality control test) by accessing the Delta Wrench from the keyboard; during the test, it is not mandatory to program Delta Wrench with DeltaQC Software.



**NOTE:** In the *Demo Mode* the results are not saved in the Delta Wrench memory.

To perform a Demo Test, select **Demo Mode** from the main menu:



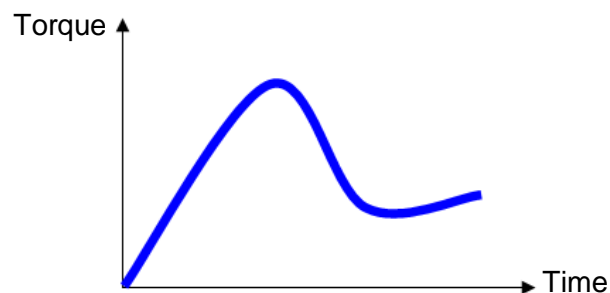
Then, select the desired operation and click on **OK** on the Delta Wrench keyboard to start the test.



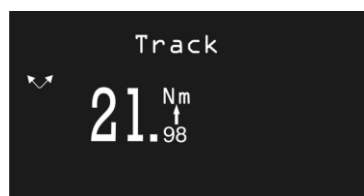
**NOTE:** The *Demo Mode* measurement unit can be set in the **Settings** menu of the Delta Wrench.

### 5.2.1 Track

**Track** mode can be used to execute a very simple tightening operation in which the operator tightens the screw at the desired torque, monitoring the torque applied on the Delta Wrench display.



In **Track** mode, the Delta Wrench displays the applied torque in real time.



Torque can be applied in either the clockwise (positive torque) or counterclockwise (negative torque) direction.

By clicking on **OK** on the Delta Wrench keyboard the Delta Wrench executes a torque zero adjustment.



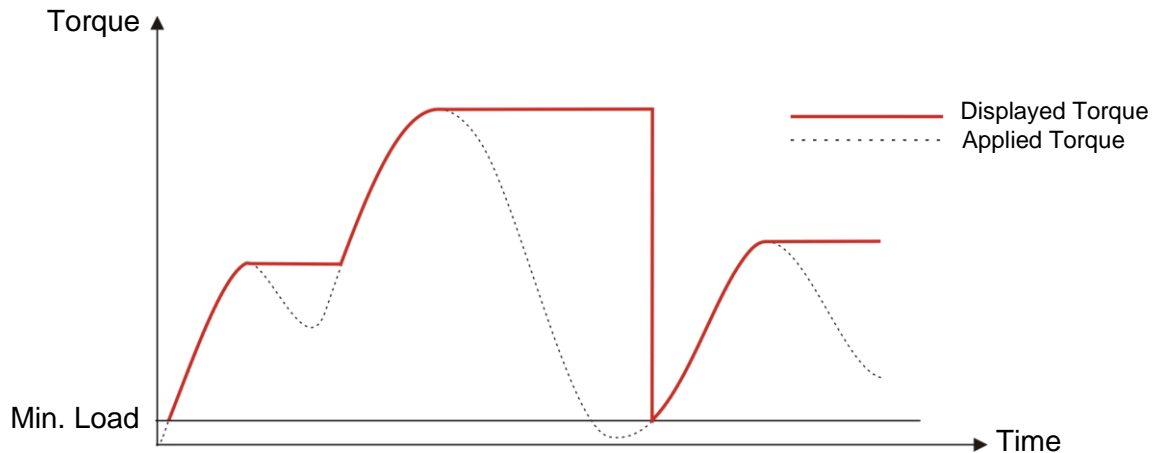
**NOTE:** The zero adjustment is applied only for this test; it is not applied as a global zero reference for the Delta Wrench.



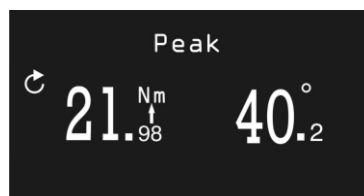
## 5.2.2 Peak

As for **Track** mode, **Peak** mode can be used to perform a very simple tightening operation in which the operator tightens the screw at the desired torque, monitoring the torque applied on the Delta Wrench display.

In **Peak** mode, the maximum value reached during tightening remains frozen on the Delta Wrench display.



The Delta Wrench displays torque and angle in real time, starting from the *Min. Load* value, and the peak value (measured on the torque) is frozen on the display.



A new cycle starts when the applied torque is released, and applied again over the *Min. Load* of the Delta Wrench, which is the 1% of the Delta Wrench maximum torque (capacity). The angle calculation is reset when a new cycle is started.

By clicking on **OK** on the Delta Wrench keyboard the torque and angle values are reset.

The torque must be applied in the clockwise direction.

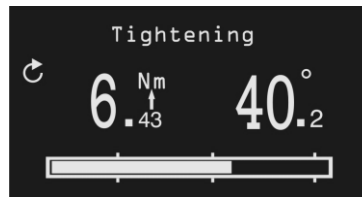
## 5.2.3 Tightening

This mode executes a tightening operation to the torque assigned.





Set the desired target torque value by clicking on the **UP** and **DOWN** arrows on the Delta Wrench keyboard and click **OK** to confirm and execute the tightening.



<b>Torque and angle</b>	The torque and angle values are shown starting from the minimum load value.
<b>Tightening direction</b>	It must be clockwise.
<b>Progress bar</b>	The progress bar leads the operator to reach the target value, with three markers placed at the 30%, 60% and 95% of the target torque.
<b>Buzzer</b>	<ul style="list-style-type: none"> <li>- 30% of the target value: Starts emitting a signal</li> <li>- 60% of the target value: Increases the signal</li> <li>- 95% of the target value: Increases the signal</li> <li>- Over 105% of the target value: Emits a repeat high frequency tone</li> </ul>
<b>Display color</b>	<ul style="list-style-type: none"> <li>- Blue: Default color</li> <li>- Green: Target value is reached (within 5% of the specified value).</li> <li>- Red: Torque over than 105% of the target value</li> </ul>
<b>Vibration</b>	<p>Vibration is available only for the following Delta Wrench models:  <i>TORQUE/ANGLE MODELS WITH VIBRO</i> and <i>TORQUE/ANGLE MODELS WITH VIBRO AND WLAN RADIO MODULE</i>.</p> <p>The Delta Wrench starts vibrating after getting 95% of the target torque.</p> <p>During the demo test, if the tightening is more than 5% against the target torque, the vibration is alternate.</p> <p>At the end of the demo test, if the tightening is OK, the Delta Wrench vibrates for three times at a specified interval (1 second). In case the tightening is NOK, the Delta Wrench vibrates at specified intervals continuously; stop the vibration with one of the following procedures:</p> <ul style="list-style-type: none"> <li>- do a new tightening;</li> <li>- press OK → the Delta Wrench is ready for a new measurement;</li> <li>- press CL → the Delta Wrench is out of the Pset.</li> </ul>

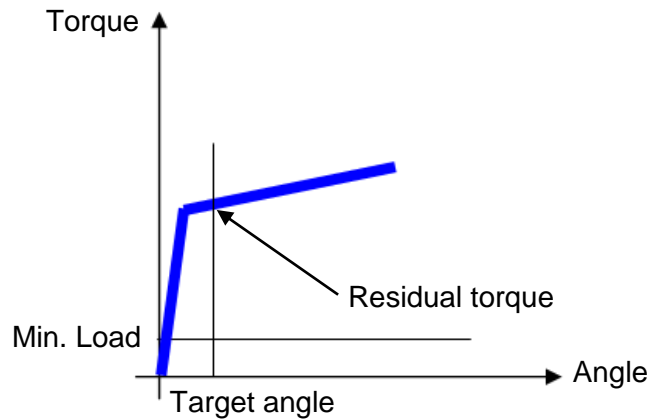


## 5.2.4 Residual Torque/Angle

The **Residual Torque/Angle** test evaluates the residual torque on a bolt, measuring the torque necessary to rotate the screw further. To get that, the residual torque is measured as the torque at the specified target angle, which is typically set to few degrees.

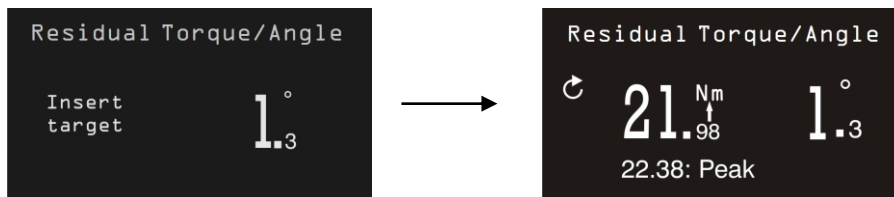


**NOTE:** Cycle start = Angle threshold = 10% transducer nominal torque.



Enter the target angle; then apply the torque on the bolt and increase it until it starts moving to reach the target angle.

The analysis starts when the applied torque gets over the *Min. Load* value.



<b>Torque and angle</b>	The torque and angle values are shown in real time. They freeze the residual torque value when the target angle is reached. The peak value reached during the test is shown below the torque result.
<b>Tightening direction</b>	It must be clockwise.
<b>Buzzer</b>	<ul style="list-style-type: none"> <li>- High tone when the target angle is reached</li> <li>- Low tone when the target angle is not reached.</li> </ul>
<b>Display color</b>	<ul style="list-style-type: none"> <li>- Blue: Default color</li> <li>- Green: Target angle is reached</li> <li>- Red: Target angle not reached</li> </ul>
<b>Vibration</b>	<p>Vibration is available only for the following Delta Wrench models:  <b>TORQUE/ANGLE MODELS WITH VIBRO</b> and <b>TORQUE/ANGLE MODELS WITH VIBRO AND WLAN RADIO MODULE</b>.</p> <p>The Delta Wrench starts vibrating after getting an angle equal or higher than the target angle.</p> <p>At the end of the demo test, if the tightening is OK, the Delta Wrench vibrates for three times at a specified interval (1 second). In case the tightening is NOK, the Delta Wrench vibrates at specified intervals continuously; stop the vibration with one of the following procedures:</p> <ul style="list-style-type: none"> <li>- do a new tightening;</li> <li>- press OK → the Delta Wrench is ready for a new measurement;</li> <li>- press CL → the Delta Wrench is out of the Pset.</li> </ul>





## 5.2.5 Residual Torque/Angle Automatic

The **Residual Torque/Angle Automatic** test evaluates the residual torque on a joint, measuring automatically the torque necessary to rotate the screw further.

After starting the “**Residual Torque/Angle Automatic**” test, apply torque on the joint. The Delta Wrench display is as follows:



**NOTE:** Cycle start = Angle threshold = 10% transducer nominal torque.

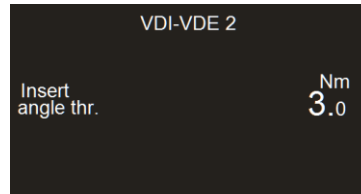
<b>Torque and Angle</b>	The <i>Torque</i> and <i>Angle</i> values are shown in real time. The peak value (marked as <b>P</b> ) reached during the test is shown below the torque result. The breakaway value (marked as <b>B</b> ) reached during the test is shown below the angle result.
<b>Tightening direction</b>	It must be clockwise.
<b>Buzzer</b>	The beep emitted by the buzzer starts when the torque goes over the mid-point between the minimum and maximum torque values.  At the end of the tightening operation three more beeps inform the operator about the end of the operation.
<b>Display color</b>	<ul style="list-style-type: none"> <li>- Blue: Default color</li> <li>- Green: Residual torque measured is between the minimum and maximum torque</li> <li>- Red: Residual torque measured is either lower the minimum torque or higher the maximum torque. Furthermore, the red screen is lit when the residual torque point is not detected.</li> </ul>
<b>Vibration</b>	<p>Vibration is available only for the following Delta Wrench models:  <i>TORQUE/ANGLE MODELS WITH VIBRO</i> and <i>TORQUE/ANGLE MODELS WITH VIBRO AND WLAN RADIO MODULE</i>.</p> <p>The Delta Wrench starts vibrating after getting the half of the torque limits of the connected transducer: <math>(Max\ Torque + Min\ Torque) / 2</math>.</p> <p>During the demo test, if the tightening is over the <i>Max Torque</i>, the vibration is alternate.</p> <p>At the end of the demo test, if the tightening is OK, the Delta Wrench vibrates for three times at a specified interval (1 second). In case the tightening is NOK, the Delta Wrench vibrates at specified intervals continuously; stop the vibration with one of the following procedures:</p> <ul style="list-style-type: none"> <li>- do a new tightening;</li> <li>- press OK → the Delta Wrench is ready for a new measurement;</li> <li>- press CL → the Delta Wrench is out of the Pset.</li> </ul>



## 5.2.6 VDI-VDE 2648

This option allows performing the angle test according to VDI-VDE 2648 protocol.

Insert the angle threshold to start the angle measurement by adjusting the value clicking on **UP** and **DOWN**:



After starting the “**VDI-VDE 2648**” test, apply torque on the joint. The Delta Wrench display is as follows:



<b>Torque and angle</b>	The torque is shown at torque peak, the angle at angle peak. Once the operator starts applying torque, the angle is reset only in one of the following cases: <ul style="list-style-type: none"> <li>• after clicking <b>OK</b> on Delta Wrench display (also the displayed torque value is reset)</li> <li>• after releasing the wrench at a torque lower than its <b>Min Load</b> and then starting a new tightening in the opposite direction</li> </ul>
<b>Tightening direction</b>	The operator can tighten in both clockwise and counterclockwise directions
<b>Buzzer</b>	- Not used
<b>Display color</b>	- Blue: Default color

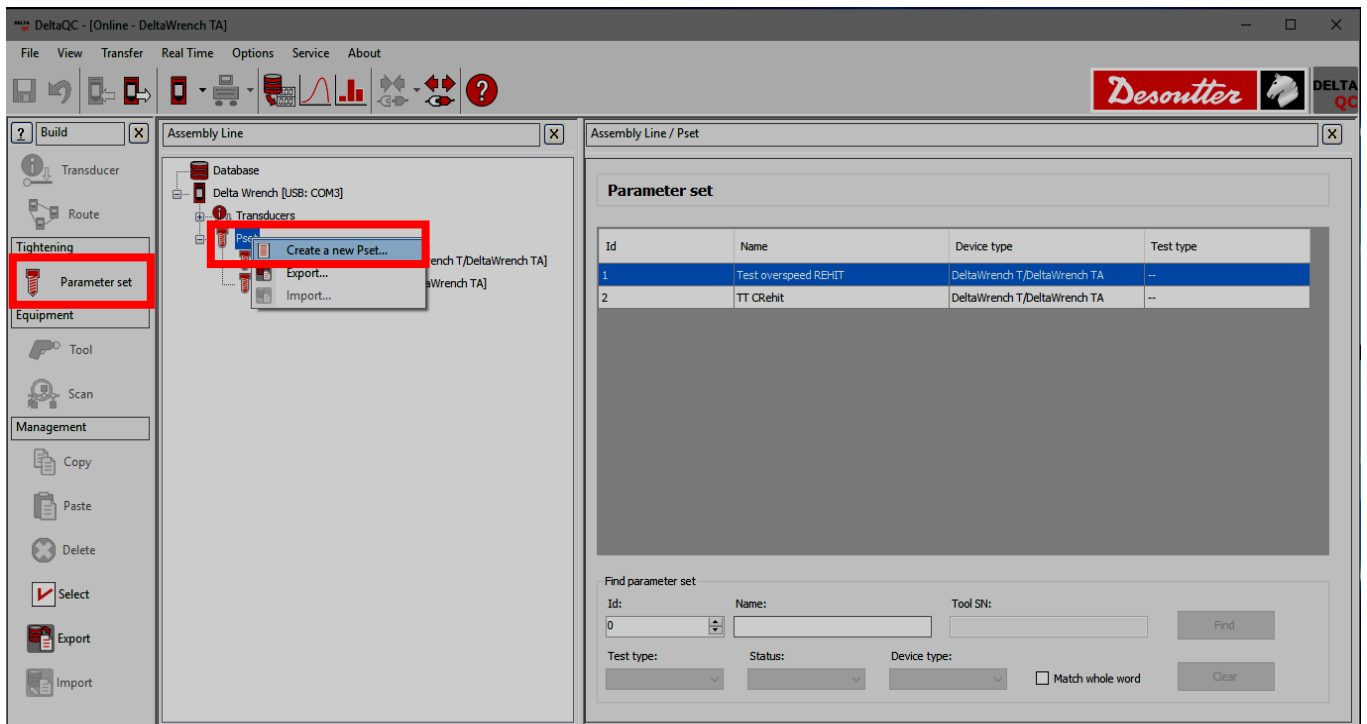


## 6 PSET

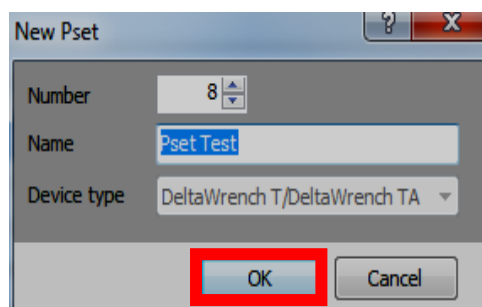
The set of parameters that controls the tightening process is contained in a so-called **Pset**. This section describes how to setup the Pset parameters necessary to perform a tightening.

The Delta Wrench can store up to **200 Psets** in its memory.

To create a new **Pset**, either click on “**Parameter set**” icon placed in the **Build area** or right-click on **Pset** in the **Assembly Line area** (and then, click on “**Create a new Pset...**”):



From the pop-up that appears (see figure below), select the Pset **Number** and type the Pset **Name**. Then, click on the **OK** button to confirm the creation of a new Pset:

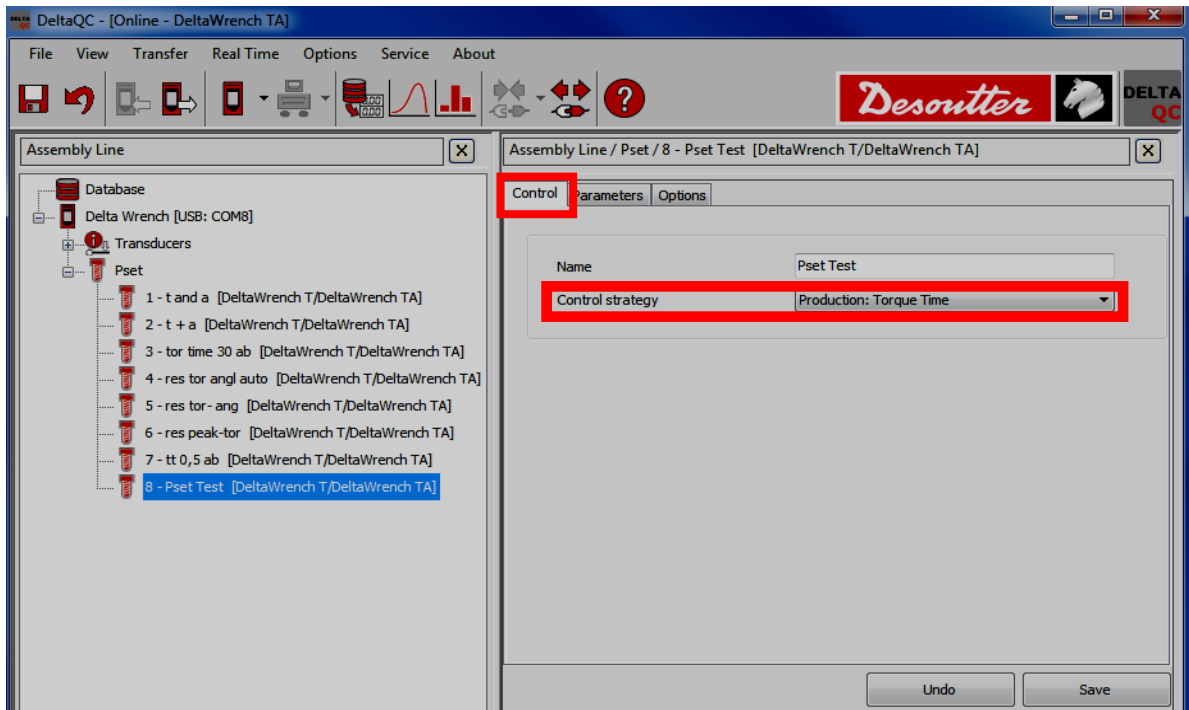


**NOTE:** By default, the Pset **Number** assigned is the first number available. It is not possible to use numbers already assigned to other Psets.

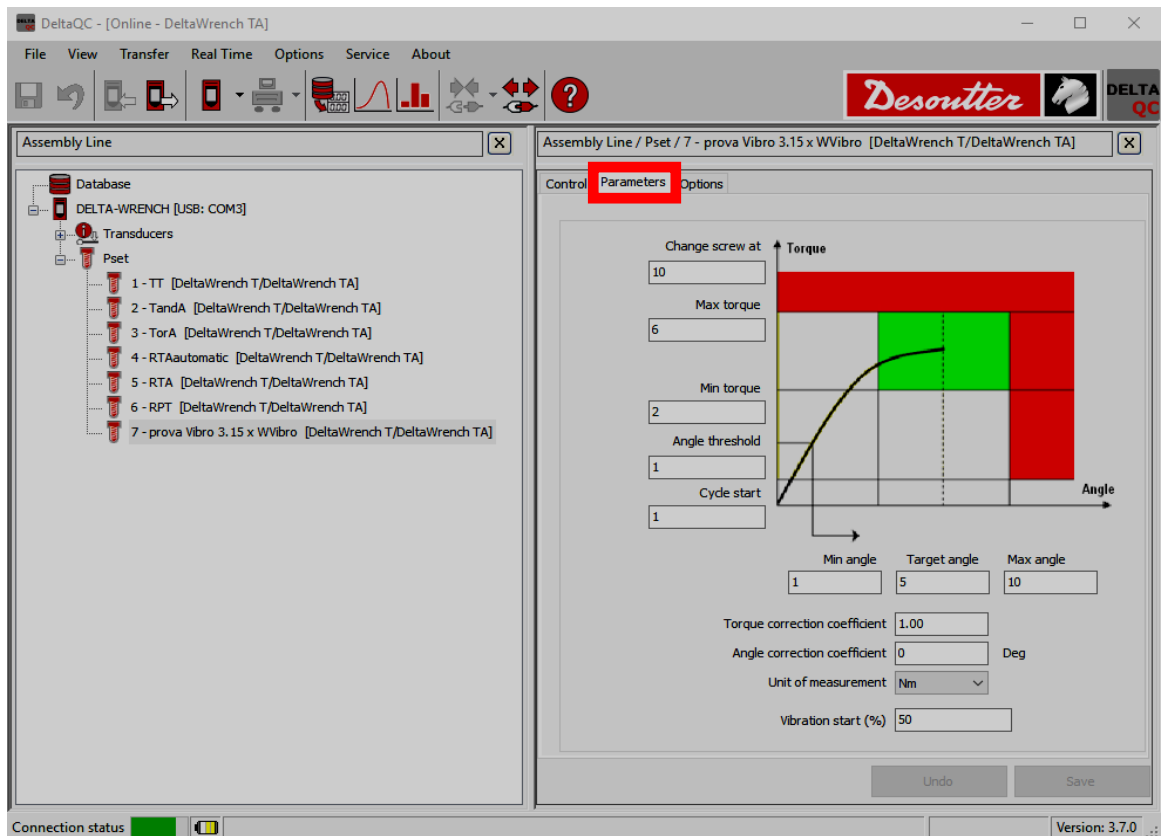
After clicking on **OK**, proceed programming the Pset.



In the *Control* tab, select the **Control strategy** from the drop-down menu (see figure below):



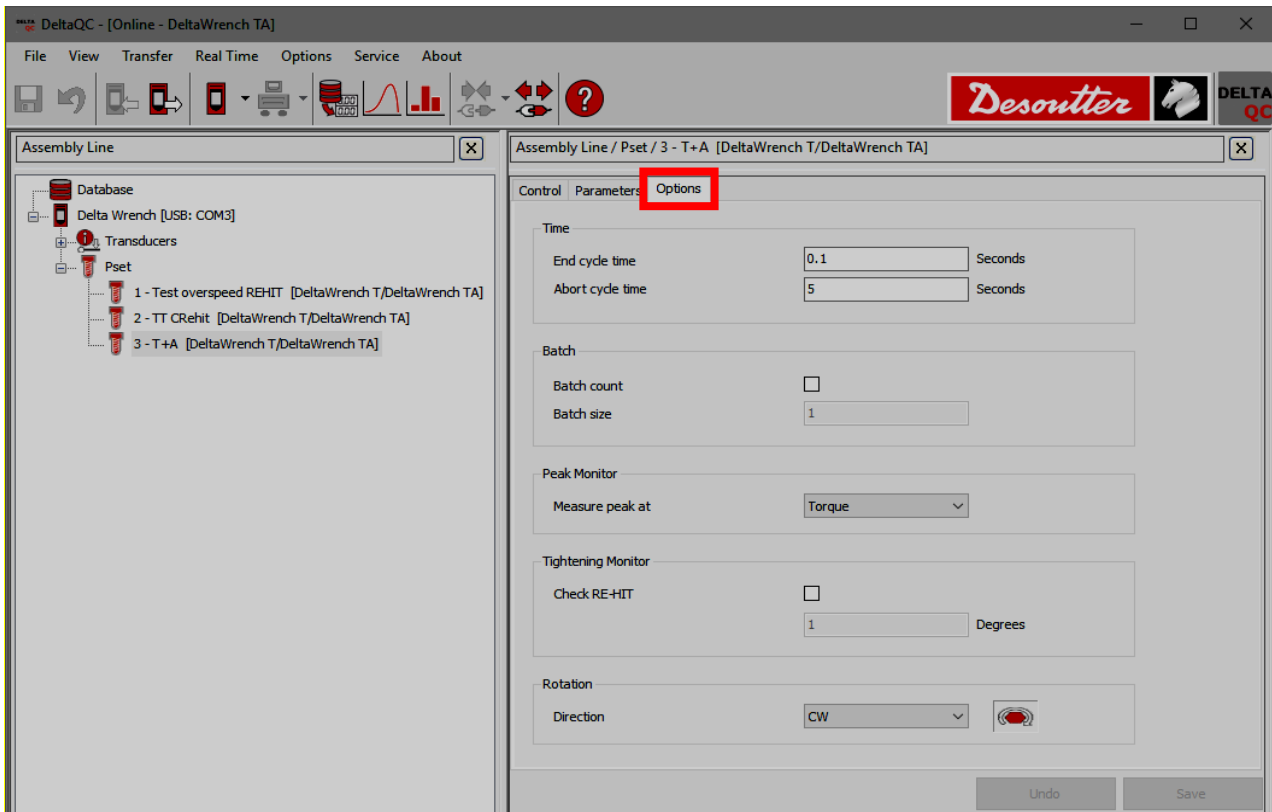
In the *Parameters* tab, set the strategy parameters (see figure below):



**NOTE:** The parameters displayed change according to the **Control Strategy** and the device version.

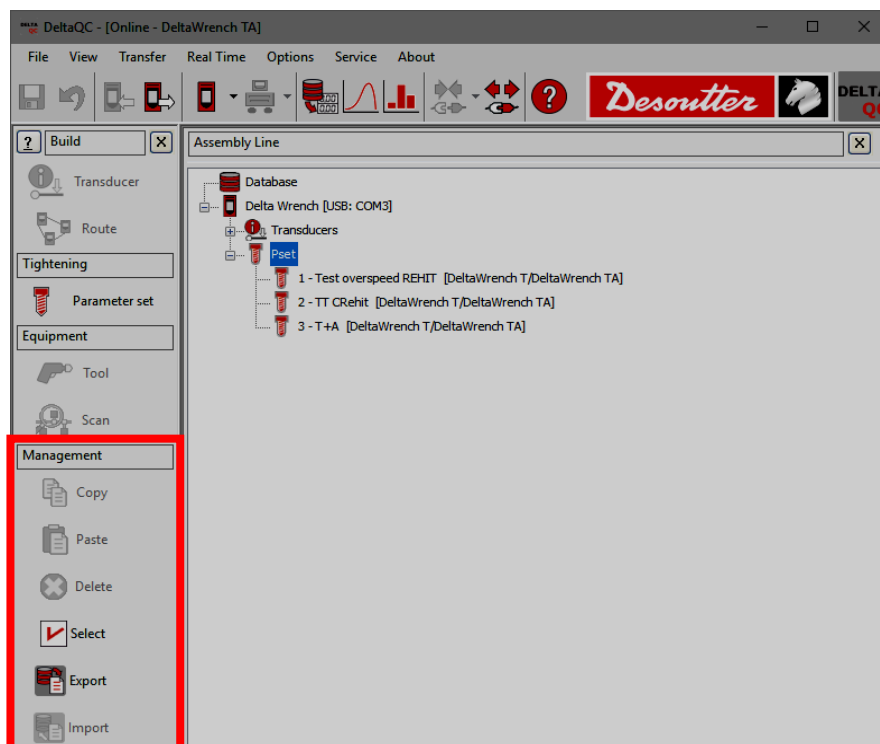


In the *Options* tab, select the Pset options (see figure below):



The *Management* area (placed in the *Build* area) provides the commands to:

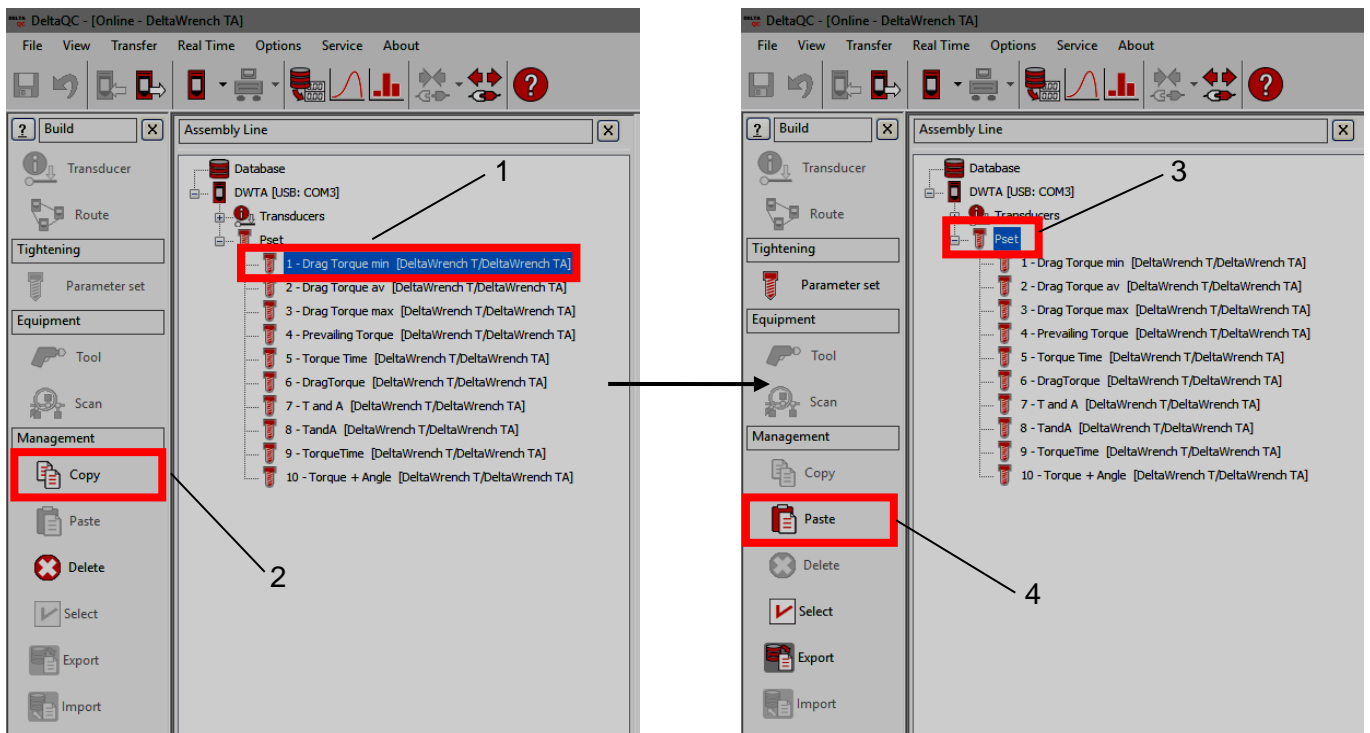
- *copy* and *paste* a Pset;
- *delete* one or more Psets;
- *export* and *import* one or more Psets.





Copy and paste a Pset as described below (refer to the following figures):

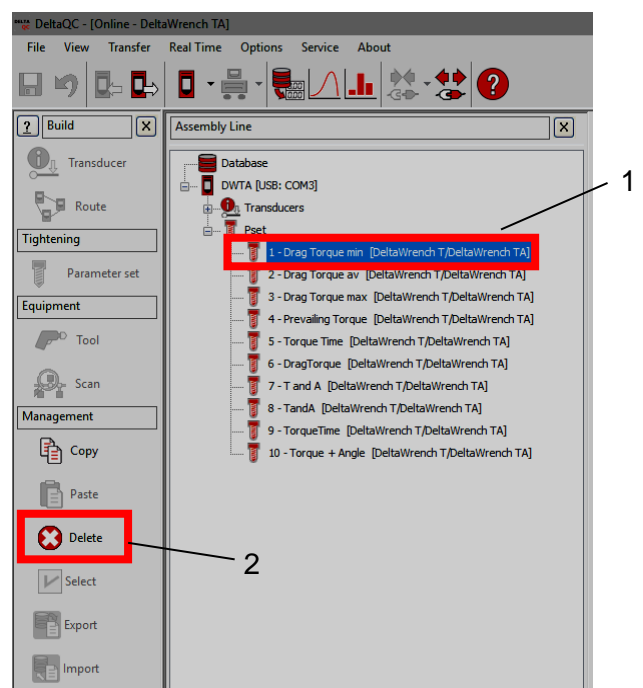
1. In the *Assembly Line* area, select a Pset from the list.
2. In the *Management* area, click on the **Copy** icon.
3. In the *Assembly Line* area, click on the **Pset** node.
4. In the *Management* area click on the **Paste** icon.



Delete one Pset as described below (refer to the figure on the right):

1. In the *Assembly Line* area, select the Pset to delete.
2. In the management area, click on the **Delete** icon.

Finally, click on **Yes** in the warning message appears to confirm the deletion of the selected Pset.





Delete more Psets at the same time as described below (refer to the following figures):

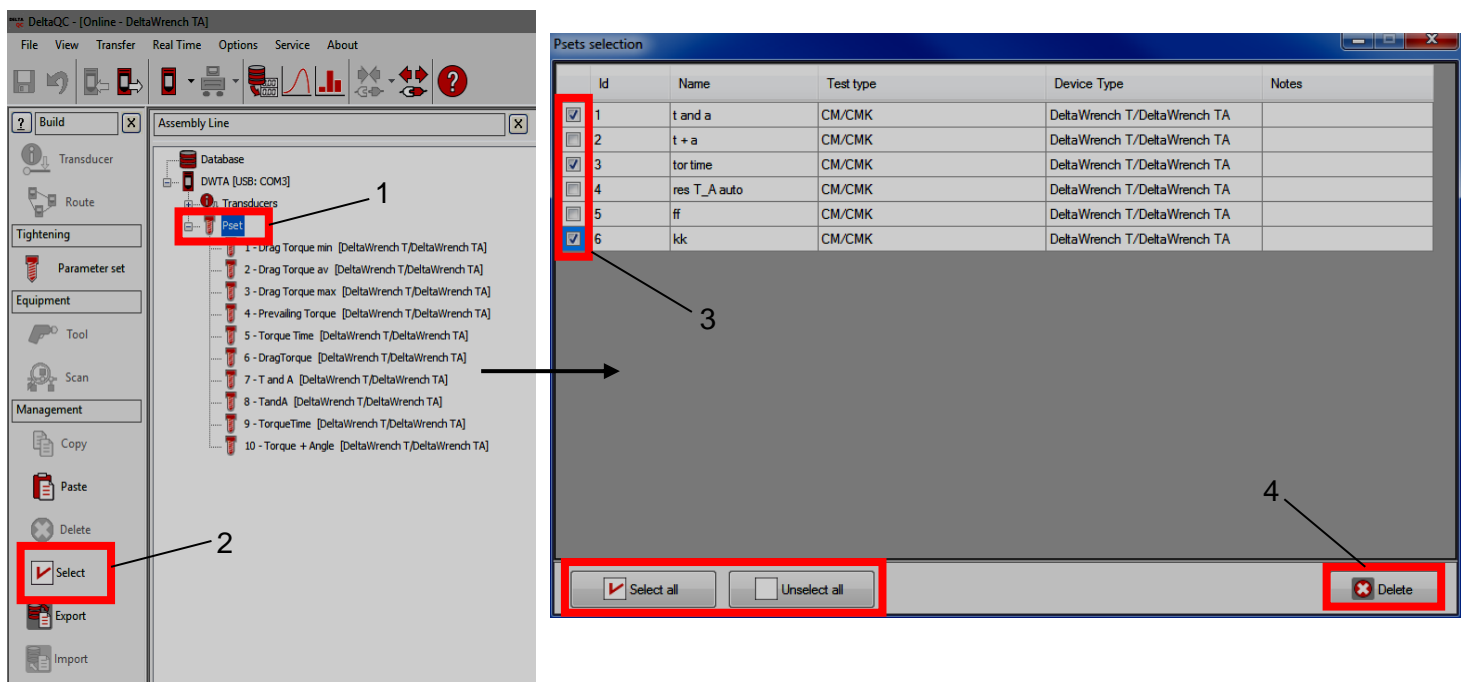
1. In the *Assembly Line* area, click on the **Pset** node.
2. In the *Management* area click on the **Select** icon.
3. In the *Pset selection* pop-up that opens, select the Pset / Psets to delete.



**NOTE:** In the lower section of the pop-up, the **Select all** and the **Unselect all** buttons allow respectively to select all the available Psets and to unselect all the Psets.

4. In the *Pset selection* pop-up, click on the **Delete** button.

Finally, click on **Yes** in the confirmation message that appears to confirm the deletion of the selected Psets.





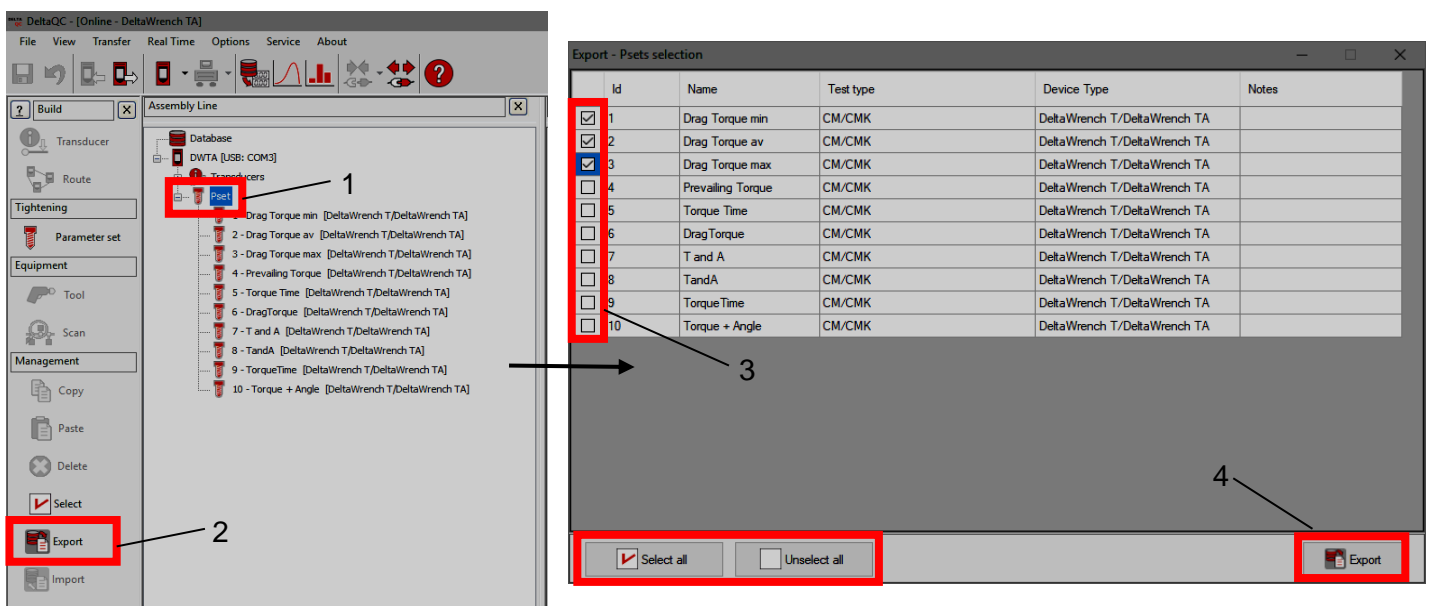
Export one or more Psets from DeltaQC to the PC as described below (refer to the following figures):

1. In the *Assembly Line* area, click on the **Pset** node.
2. In the *Management* area, click on the **Export** icon.
3. From the pop-up that opens, select the Pset / Psets to export.

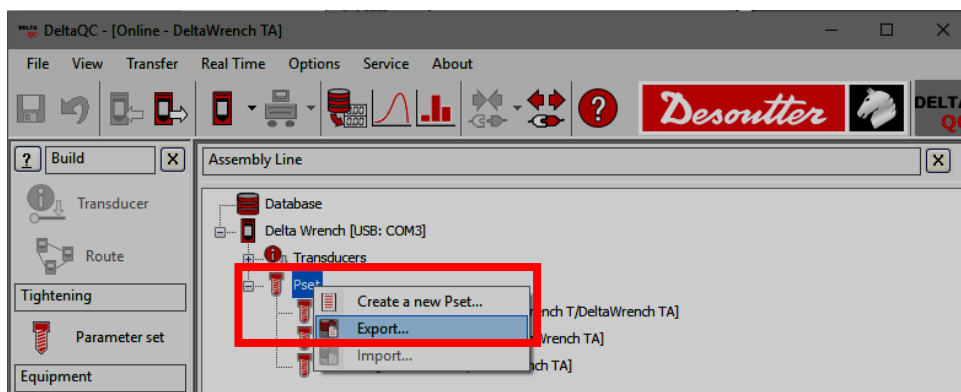


**NOTE:** In the lower section of the pop-up, the **Select all** and the **Unselect all** buttons allow respectively to select and to unselect all the available Psets.

4. From the *Export – Pset selection* pop-up that appears, click on the **Export** button and save the Psets on the PC as an XML file.



**NOTE:** It is also possible to export one or more Psets by right-clicking on the **Pset** node in the *Assembly Line* area and then on **Export...** (see figure below):







The *import* of one or more Psets can be performed only in the *Offline* mode.

Before proceeding with the import, click on the **Disconnect**  icon to disconnect the Delta Wrench from the PC.

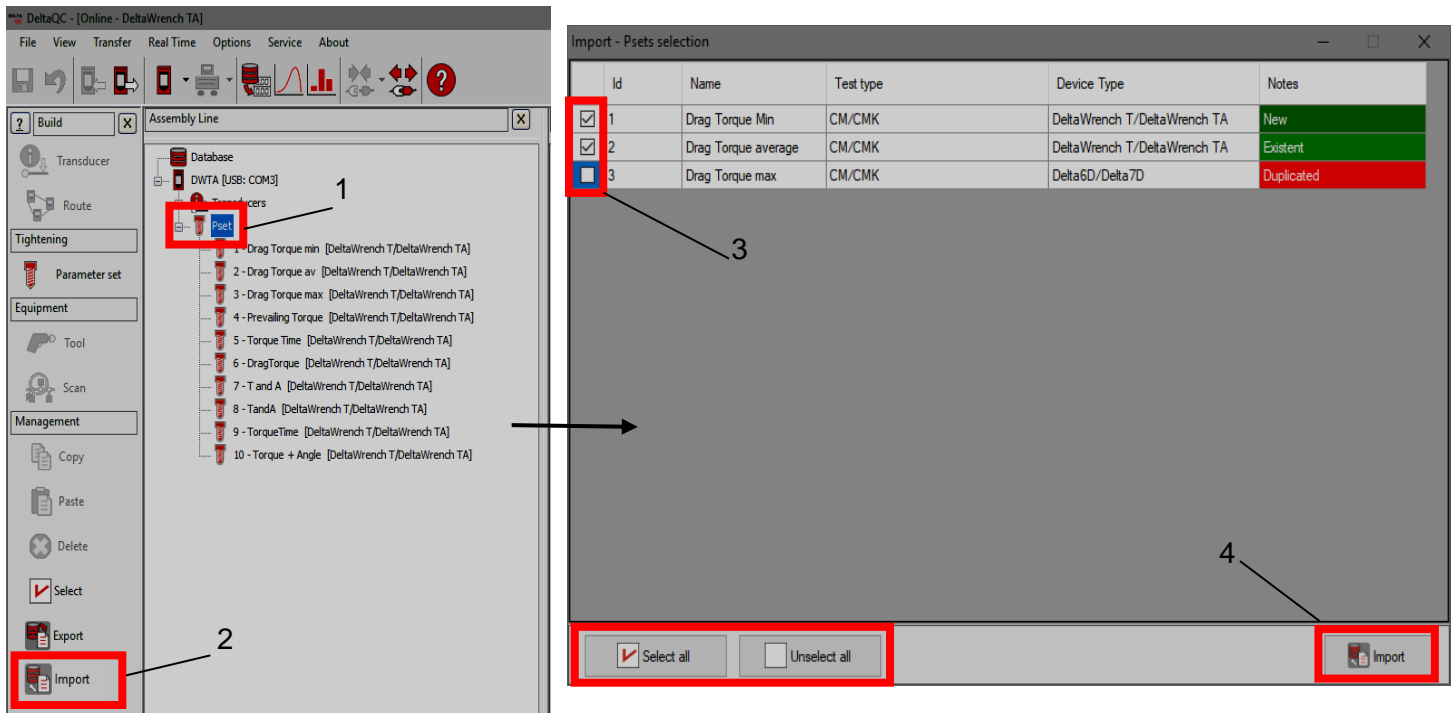
Then, *import* one or more Psets from the *XML* files as described below (refer to the following figures):

1. In the *Assembly Line* area, click on the **Pset** node.
2. In the *Management* area, click on the **Import** icon and select the *XML* file from the PC.
3. In the *Import – Pset selection* pop-up that opens, select the Pset / Psets to import.

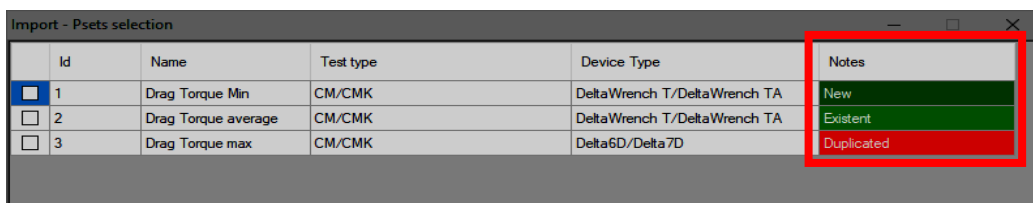


**NOTE:** In the lower section of the pop-up, the **Select all** and the **Unselect all** buttons allow respectively to select all the available Psets and to unselect all the Psets.

4. In the *Import – Pset selection* pop-up, click on the **Import** button.



In the *Import – Pset selection* pop-up, the **Notes** column (last column of the table) shows details about the Psets (see figure below):



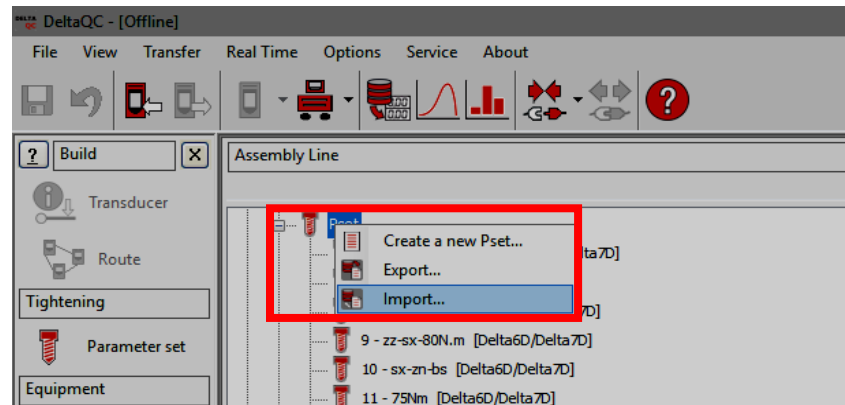
If a Pset is marked in green as “*New*”, there is no existing match in the destination database and it is possible to import the Pset.

If a Pset is marked in light green as “*Existent*”, a Pset with the same name but different configuration already exists in the destination database, and the Pset imported will overwrite the existing one.

If a Pset is marked in red as “*Duplicated*”, a Pset with the same name but linked to a different tool already exists in the destination database and it is not possible to import it.




**NOTE:** It is also possible to import one or more Psets by right-clicking on the **Pset** node in the *Assembly Line* area, and then on **Import...** (see figure below):



## 6.1 Torque Parameters

<b>Cycle Start</b>	Torque value from which the tightening operation starts. This must be higher than the <i>min. load value</i> ; if it is not, when the Pset starts, a “ <b>Min load error</b> ” message is shown on the display.
<b>Angle threshold</b>	For strategies that include the angle measurement, this parameter specifies the torque value from which the measure of the angle starts.
<b>Min torque</b>	Lower torque limit.
<b>Target torque</b>	Torque value set by user as <i>tightening goal</i> . This parameter is available only in the “Production: Torque Time” and “Production: Torque & Angle” strategies.
<b>Max torque</b>	Higher torque limit.
<b>Torque correction coefficient</b>	For normal operations, this parameter is set to 1 (default value for <i>Torque correction coefficient</i> ). If an extension is used, this coefficient permits to compensate the effect of the extension on the torque measurement. Refer to the “Appendix A – Calculating Correction Coefficient for Extension” for further details about how to calculate this coefficient.
<b>Change screw at</b>	If the torque reaches this limit, the message “change screw” is shown on the display. This parameter must be set higher than the <i>Final Torque max</i> value.
<b>Unit of measurement</b>	Select the desired unit.
<b>Drag Torque type (Min, Max and Average)</b>	Valid only for the strategies “Production: Prevailing Torque – Automatic compensation” and “Quality: Drag torque”. It is the torque value resulting from the measurements taken within a pre-established angle interval. Select <i>Min</i> , <i>Max</i> or <i>Average</i> to calculate the <i>Drag torque</i> value.
<b>Prevailing min torque</b>	Valid only for the strategy “Production: Prevailing Torque – Automatic compensation”; it is the <i>Drag torque</i> lower limit of the first stage of the strategy.
<b>Prevailing max torque</b>	Valid only for the strategy “Production: Prevailing Torque – Automatic compensation”; it is the <i>Drag torque</i> upper limit of the first stage of the strategy.



<b>Drag torque compensation</b>	Valid only for the strategy “ <i>Production: Prevailing Torque – Automatic compensation</i> ”; this option permits to add or subtract the <i>Drag torque</i> to the torque peak in the second stage of the strategy.
<b>Final min torque</b>	Valid only for the strategy “ <i>Production: Prevailing Torque – Automatic compensation</i> ”; it is the lower limit of the <i>Final target torque</i> during the second stage of the strategy.
<b>Final target torque</b>	Valid only for the strategy “ <i>Production: Prevailing Torque – Automatic compensation</i> ”; it is the torque result of the tightening, considering the <i>Drag Torque</i> value.
<b>Final max torque</b>	Valid only for the strategy “ <i>Production: Prevailing Torque – Automatic compensation</i> ”; it is the upper limit of the <i>Final target torque</i> during the second stage of the strategy.
<b>Linear slope coefficient</b>	<p>Valid only for the strategy “<i>Quality: Yield Point</i>”.</p> <p>This parameter characterizes the joint stiffness in the linear part of the curve, as torque/angle slope.</p> <p>The minimum value of the <i>Linear slope coefficient</i> is 0.1; it suits also very soft joints with a ration less than 0.1.</p> <p>The default value is 0.5.</p> <p> <b>NOTE:</b> If the unit of measurement used is different from Nm, the <i>Linear slope coefficient</i> is automatically converted according to the unit of measurement selected.</p>

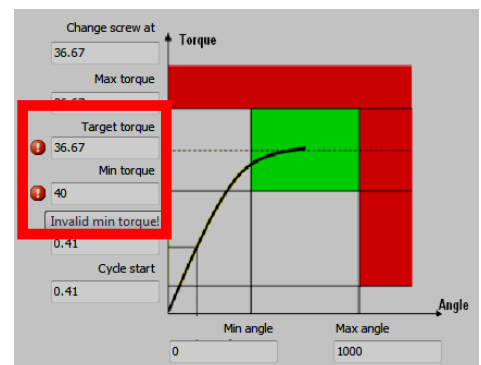
If a Delta Wrench is connected while programming, the Torque parameters are set per default as follows:

- *Cycle start* = *Angle threshold* = *Minimum torque* = *Maximum torque* = 1% transducer nominal torque.
- *Change screw at* = Transducer nominal torque.
- *Target torque* (if present in the Pset control strategy) = Transducer nominal torque (*in this case also the Maximum torque is set to this value*).



**NOTE:** All the Torque parameters defined for a Pset must be higher than the minimum load and lower than the capacity of the Delta Wrench; otherwise, a *Min Load error* or a *Capacity Error* will be shown on the display when the Pset starts.

Furthermore, the set of parameters must be reliable. For example, when storing a Pset, if the *Min Torque* is greater than the *Target Torque*, an error message is shown (refer to the picture on the right):






## 6.2 Angle Parameters

<b>Angle threshold</b>	This parameter specifies the torque value from which the measure of the angle starts.
<b>Min angle</b>	Lower angle limit.
<b>Max angle</b>	Higher angle limit.
<b>Target angle</b>	Valid only for the strategies “ <i>Production: Torque + Angle</i> ” and “ <i>Quality: residual torque/angle</i> ”; this parameter specifies the angle where to measure the residual torque.
<b>Angle correction coefficient</b>	For normal operations, this parameter is set to 0 (default value for <i>Angle correction coefficient</i> ). If an extension is used, this coefficient permits to compensate the error in the angle reading due to the bending of the extension. Refer to the “ <i>Appendix A – Calculating Correction Coefficient for Extension</i> ” for further details about how to calculate this coefficient.
<b>Prevailing angle min</b>	Valid only for the strategy “ <i>Production: Prevailing Torque – Automatic compensation</i> ”; it is the lower limit of the angle interval during which torque values have to be checked in the first stage of the strategy.
<b>Prevailing angle max</b>	Valid only for the strategy “ <i>Production: Prevailing Torque – Automatic compensation</i> ”; it is the upper limit of the angle interval, during which torque values have to be checked in the first stage of the strategy.
<b>Final min angle</b>	Valid only for the strategy “ <i>Production: Prevailing Torque – Automatic compensation</i> ”; it is the lower limit of the angle interval, during which the final torque value has to be checked.
<b>Final max angle</b>	Valid only for the strategy “ <i>Production: Prevailing Torque – Automatic compensation</i> ”; it is the upper limit of the angle interval, during which the final torque value has to be checked.
<b>Start angle</b>	Valid only for the strategy “ <i>Quality: Drag torque</i> ”; it is the lower limit of the angle interval within which the torque value has to be checked.
<b>Stop angle</b>	Valid only for the strategy “ <i>Quality: Drag torque</i> ”; it is the upper limit of the angle interval within which the torque value has to be checked.



## 6.3 Vibration parameter

<b>Vibration start (% / Nm / Deg)</b>	<p>It is possible to set <b>Vibration start</b> as a value expressed in percentage, torque, or angle. <b>Vibration start (% / Nm / Deg)</b> parameter is available on any models of Delta Wrench, even though it is fully functional only for the following models: <i>TORQUE/ANGLE MODELS WITH VIBRO</i> and <i>TORQUE/ANGLE MODELS WITH VIBRO AND WLAN RADIO MODULE</i>.</p> <p><b>Vibration start (% / Nm / Deg)</b> parameter is available for the following control strategies: “<i>Production: Torque Time</i>”, “<i>Production: Torque &amp; Angle</i>”, “<i>Production: Torque + Angle</i>”, “<i>Production: Prevailing Torque – Automatic compensation</i>”, “<i>Quality: Residual Torque/Angle</i>”, and “<i>Quality: Drag Torque</i>”.</p> <p>Set <b>Vibration start (% / Nm / Deg)</b> parameter in one of the following conditions:</p> <ul style="list-style-type: none"> <li>• during the creation of a new Pset</li> <li>• when, for a pre-existing Pset, it is necessary to change the control strategy</li> </ul> <p> <b>NOTE:</b> By default, <b>Vibration start (%)</b> parameter is equal to 95%. It can range from 1 to 100%.</p>
---------------------------------------	---

Set **Vibration start (%)** or **Vibration start (Nm)** parameter. In case of **Production: Torque Time control strategy**, the Delta Wrench starts vibrating after getting the percentage or torque related to the “vibrating target torque”.

If **Vibration start (%)** is selected, below is an example to calculate the “vibrating target torque”:

If:

Cycle start = 2 Nm

Target torque = 12 Nm

Vibration start = 50%

Then:

“Useful torque interval” = (Target torque – Cycle start) × Vibration start = (12 – 2) Nm × 50% = 5 Nm

Finally:

Vibrating target torque = “Useful torque interval” + Cycle start = (5 + 2) Nm = 7 Nm

During the test, if the tightening is within the limits (*Max Torque* and *Min Torque*) the vibration is continuous. In case the tightening is out of the limits (*Max Torque* and *Min Torque*), the vibration is alternate.

At the end of the test, if the tightening is OK, the Delta Wrench vibrates for three times at a specified interval (1 second). In case the tightening is NOK, the Delta Wrench vibrates at specified intervals continuously; stop the vibration with one of the following procedures:

- do a new tightening;
- press **OK** → the Delta Wrench is ready for a new measurement;
- press **CL** → the Delta Wrench is out of the Pset.



Set **Vibration start (%)** or **Vibration start (Nm)** parameter. In case of **Production: Torque & Angle control strategy**, the Delta Wrench starts vibrating after getting the percentage or torque related to the “vibrating target torque”.

If **Vibration start (%)** is selected, below is an example to calculate the “vibrating target torque”:

If:

Cycle start = 2 Nm

Target torque = 12 Nm

Vibration start = 50%

Then:

“Useful torque interval” = (Target torque – Cycle start) × Vibration start = (12 – 2) Nm × 50% = 5 Nm

Finally:

Vibrating target torque = “Useful torque interval” + Cycle start = (5 + 2) Nm = 7 Nm

During the test, if the tightening is within the limits (*Max/Min Torque* and *Max/Min Angle*) the vibration is continuous. In case the tightening is out of the limits (*Max/Min Torque* and *Max/Min Angle*), the vibration is alternate.

At the end of the test, if the tightening is OK, the Delta Wrench vibrates for three times at a specified interval (1 second). In case the tightening is NOK, the Delta Wrench vibrates at specified intervals continuously; stop the vibration with one of the following procedures:

- do a new tightening;
- press **OK** → the Delta Wrench is ready for a new measurement;
- press **CL** → the Delta Wrench is out of the Pset.

Set **Vibration start (%)** or **Vibration start (Deg)** parameter. In case of **Production: Torque + Angle control strategy**, the Delta Wrench starts vibrating after getting the percentage or angle related to the “target angle”.

During the test, if the tightening is within the limits (*Max/Min Torque* and *Max/Min Angle*) the vibration is continuous. In case the tightening is out of the limits (*Max/Min Torque* and *Max/Min Angle*), the vibration is alternate.

At the end of the test, if the tightening is OK, the Delta Wrench vibrates for three times at a specified interval (1 second). In case the tightening is NOK, the Delta Wrench vibrates at specified intervals continuously; stop the vibration with one of the following procedures:

- do a new tightening;
- press **OK** → the Delta Wrench is ready for a new measurement;
- press **CL** → the Delta Wrench is out of the Pset.

Set **Vibration start (%)** or **Vibration start (Nm)** parameter. In case of **Production: Prevailing Torque – Automatic compensation** the Delta wrench starts vibrating after getting the percentage or torque related to the “target torque”.

During the test, if the tightening is within the limits the vibration is continuous. In case the tightening is out of the limits, the vibration is alternate.

At the end of the test, if the tightening is OK, the Delta Wrench vibrates for three times at a specified interval (1 second). In case the tightening is NOK, the Delta Wrench vibrates at specified intervals continuously; stop the vibration with one of the following procedures:

- do a new tightening;
- press **OK** → the Delta Wrench is ready for a new measurement;
- press **CL** → the Delta Wrench is out of the Pset.





Set **Vibration start (%)** or **Vibration start (Deg)** parameter. In case of **Quality: Residual Torque/Angle** and **Quality: Drag Torque control strategies**, the Delta Wrench starts vibrating after getting the percentage or angle related to the Target angle or Stop angle respectively.

During the test, if the tightening is within the limits (*Max Torque* and *Min Torque*) the vibration is continuous. In case the tightening is out of the limits (*Max Torque* and *Min Torque*), the vibration is alternate.

At the end of the test, if the tightening is OK, the Delta Wrench vibrates for three times at a specified interval (1 second). In case the tightening is NOK, the Delta Wrench vibrates at specified intervals continuously; stop the vibration with one of the following procedures:

- do a new tightening;
- press **OK** → the Delta Wrench is ready for a new measurement;
- press **CL** → the Delta Wrench is out of the Pset.

In case of **Quality: Residual Torque/Angle Automatic**, **Quality: Residual Peak/Torque** and **Quality: Yield Point control strategies**, the Delta Wrench starts vibrating after getting the half of the torque limits: (*Max Torque* + *Min Torque*) / 2.

During the test, if the tightening is over the *Max Torque*, the vibration is alternate.

At the end of the test, if the tightening is OK, the Delta Wrench vibrates for three times at a specified interval (1 second). In case the tightening is NOK, the Delta Wrench vibrates at specified intervals continuously; stop the vibration with one of the following procedures:

- do a new tightening;
- press **OK** → the Delta Wrench is ready for a new measurement;
- press **CL** → the Delta Wrench is out of the Pset.

In case of **Quality: Residual Loose and Tighten**, the Delta Wrench vibrates for 2 seconds when the loosening phase is completed, and at the end of the test when the Zero position is reached.

During the test, if the tightening is over the *Max Torque*, the vibration is alternate.

At the end of the test, if the tightening is OK, the Delta Wrench vibrates for three times at a specified interval (1 second). In case the tightening is NOK, the Delta Wrench vibrates at specified intervals continuously; stop the vibration with one of the following procedures:

- do a new tightening;
- press **OK** → the Delta Wrench is ready for a new measurement;
- press **CL** → the Delta Wrench is out of the Pset.

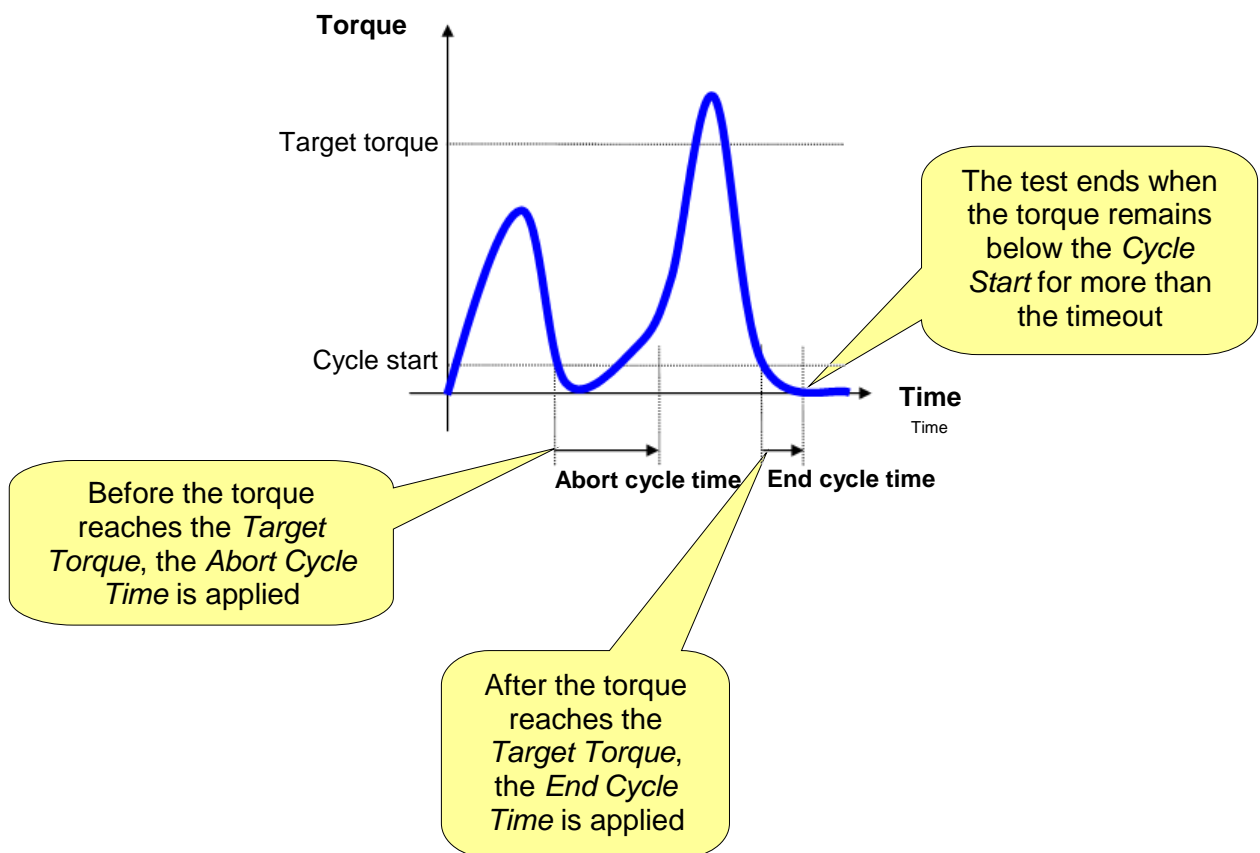
## 6.4 Time

<b>End cycle time</b>	<p>This parameter is applied when the torque goes below the cycle start after the <i>target torque</i> value is reached; the default value is 0.1 second.</p> <p><b>Minimum value: 0.1 Sec</b> <b>Maximum value: 5 Sec</b></p> <p>This parameter is not used for <i>residual torque</i> strategies.</p>
-----------------------	---



<b>Abort cycle time</b>	<p>This parameter is applied when the torque goes down the cycle start but has not reached the <i>target torque</i> value yet. This allows the operator to release the torque for a while and recharge during the tightening operation; the default value is 5 seconds.</p> <p><b>Minimum value: 0.1 Sec</b>  <b>Maximum value: 30 Sec</b></p>
-------------------------	--

The Delta Wrench ends the tightening operation if the torque drops beneath the *Cycle Start* value for a longer time than the timer.



For *Residual torque* strategies, the *Abort Cycle Time* is the only timeout available in the test strategy; for *Residual Torque/Angle* and *Residual Torque/Angle Automatic*, when the residual torque is detected the test ends even if the timeout has not expired.

## 6.5 Batch Parameters

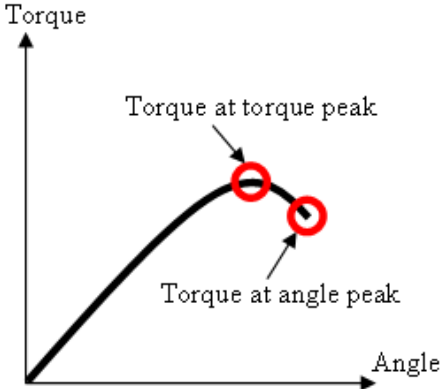
<b>Batch count</b>	Enable this flag to execute the Pset more than once.
<b>Batch size</b>	<p>If <i>Batch count</i> is enabled, it specifies how many times the Pset must be executed.</p> <p><b>Maximum value: 99</b></p>





**NOTE:** If the *Batch count* is disabled, the *Batch status* in the tightening results is always OK.  
 By enabling the *Batch count* and setting the *Batch size* to 1, it is possible to have the *Batch result* OK only if the Pset gives result OK.  
 If the *Batch size* is greater than 1, the *Batch result* is OK only if all the Pset give result OK.

## 6.6 Options

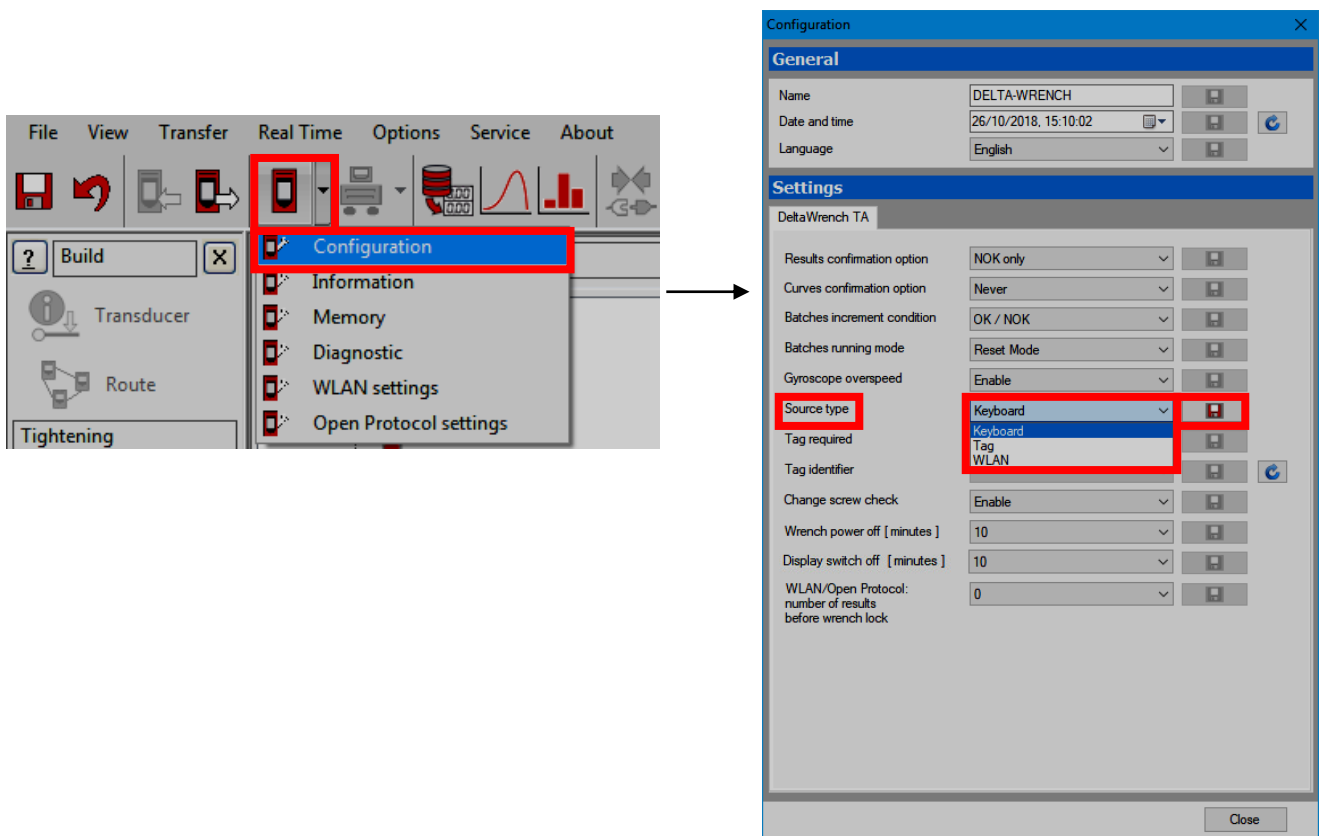
<b>Direction</b>	Select the desired tightening direction between clockwise ( <b>CW</b> ) and Counterclockwise ( <b>CCW</b> ).
<b>Measure Peak at</b>	<p>Select between <b>Torque</b> and <b>Angle</b></p> <div data-bbox="715 840 1157 1227" data-label="Figure">  </div> <p><b>NOTE:</b> The torque result of a tightening changes according to the tightening strategy. Refer to the paragraph "<i>Tightening strategies</i>" for further details.</p>
<b>Check RE-HIT</b>	<p>If the operator tightens a screw that is already tightened, the torque increases with just a little rotation (or without any rotation) of the screw. This function monitors this event and shows an error message on the display.</p> <p>Enable the flag to activate this function, and specify the <b>Check RE-HIT</b> value, that is typically set to few degrees.</p> <p>If the torque reaches the <i>Min. Torque</i> value within this angle, the error message "RE-HIT" is shown.</p> <p><b>NOTE:</b> "Check RE-HIT" option is enabled ONLY for <b><u>Production control strategies</u></b>.</p>



## 6.7 Running a Pset

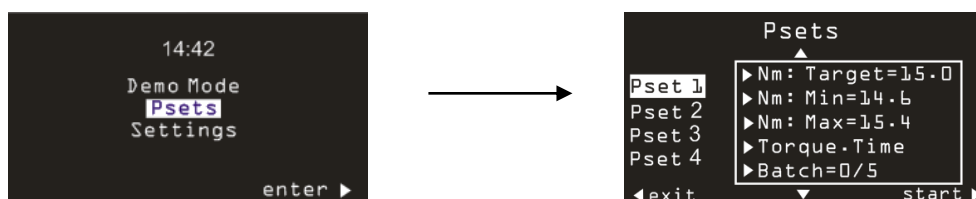
A Pset can be started in three ways (see figures below):

1. By selecting the Pset manually with the keyboard: **Controller** → **Configuration** → **Source Type** set to **Keyboard**.
2. By starting the Pset automatically inserting the end fitting tool with RFID TAG corresponding to the Pset number: **Controller** → **Configuration** → **Source Type** set to **Tag**.
3. By starting the Pset automatically via WLAN: **Controller** → **Configuration** → **Source Type** set to **WLAN**.



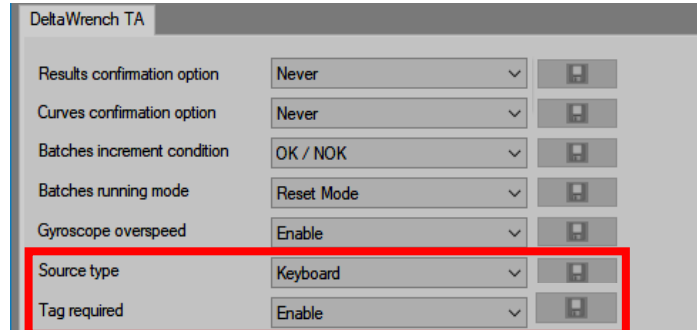
Set the **Source Type** as preferred and click on the corresponding **Save** icon.

If the **Source type** is set to **Keyboard**, select the Pset manually in the **Pset** menu from the main menu of the Delta Wrench:

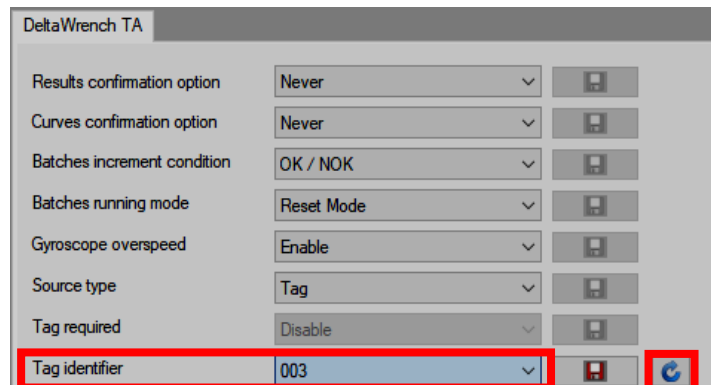




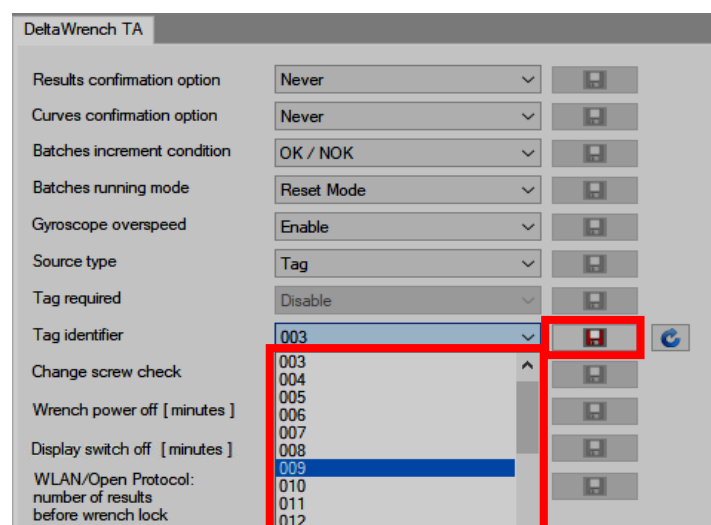
If the **Source type** is set to **Keyboard** and the **Tag required** is enabled, the Pset is selected manually by the keyboard, but it starts only if the end fitting tool with **Tag identifier** corresponding to the Pset number that is plugged into the Delta Wrench:



It is possible to view / change the **Tag identifier**.  
Insert the end fitting tool in the Delta Wrench and click on **Refresh** icon to display the current value:



To change the value, select it from the drop-down list. Then, click on the corresponding **Save** icon:













During the *Pset* execution, the display shows the torque and angle values, and the tightening direction:



Pset execution

	Pset name.
	Torque and Angle values. The arrow placed below the Nm label indicates whether the result is considered on the torque peak or angle peak (when applicable). At the end of a Pset execution, press the <b>OK</b> button on the keyboard to reset the torque and angle values to zero.   If the torque applied is outside the operating torque range, the torque value displayed on the Delta Wrench flashes and a warning icon (  ) appears (for further information, refer to the paragraph <i>Specifications</i> ).
	The arrow indicates the direction that the tightening must follow (Clockwise or Counterclockwise).
	If the Pset batch size is greater than one, the batch count number is displayed on the right side of the bottom part of the screen. The first Pset of the batch is marked as 0. For <i>Production strategies</i> , if the batch is quit before completing all the tests, the batch count is reset (the results are saved anyway). For <i>Quality Control strategies</i> , it is possible to exit a batch before completing and restore it (refer to the paragraph “Delta Wrench Controller Setup” for further details).   <b>NOTE:</b> a warning message asking to confirm the exit from the Pset is displayed. Press <b>OK</b> to exit, or <b>CL</b> to return to the Pset.
	The progressive bar shows the actual torque applied, starting from the cycle start value. The bar is filled up when the torque reaches the target value. Three markers are placed at the 30%, 60% and 95% of the range between the cycle start and the target torque. The bar is shown only for <i>Production strategies</i> .



At the end of the tightening operation, additional information is displayed:



<b>Torque peak</b>	For <i>residual torque/angle test strategies</i> , it shows the maximum torque reached during the test (the torque result is the residual point, that is normally lower than the peak value).
<b>Details of Not OK</b>	If the torque and/or angle are greater/smaller than the limits specified in the Pset, it is shown here.

For each tightening operation, the LEDs and buzzer are activated according to the selected control strategy (refer to the paragraph “*Tightening strategies*” for further details).

Tightening results data and curves are stored automatically in the memory (refer to the paragraph “*Results Viewer*” for further details about how to retrieve results with DeltaQC software).

## 6.8 Tightening strategies

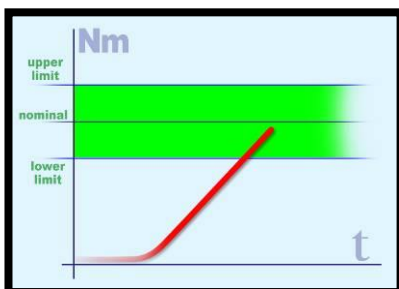
**Tightening strategies** can be divided into two main categories:

- **Production:** Strategies for tightening a screw (refer to the paragraph “*Production strategies*”).
- **Quality Control:** Strategies for evaluating residual torque (refer to the paragraph “*Quality Control strategies*”).

### 6.8.1 Production strategies

Production strategies can be divided into three main categories:

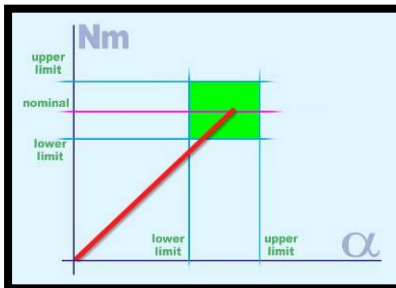
#### 1. Tightening within torque limits



This is the easiest tightening method; it is enough applying the torque within the limits.

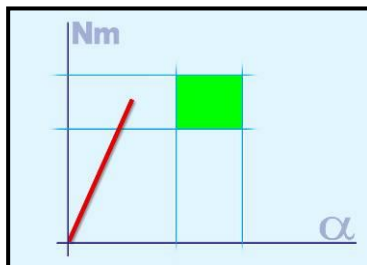


## 2. Tightening within torque and angle limits (tightening to a window)



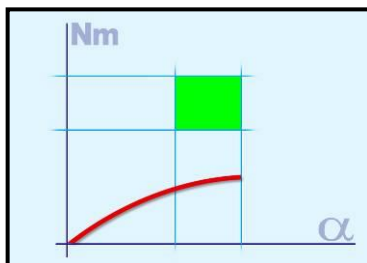
This is a more accurate way to tighten, because an additional information (**angle**) is used during the tightening process. Using this method, it is possible to detect eventual problems on the joint (refer to the above examples).

a) Torque is correct, but angle is too short.



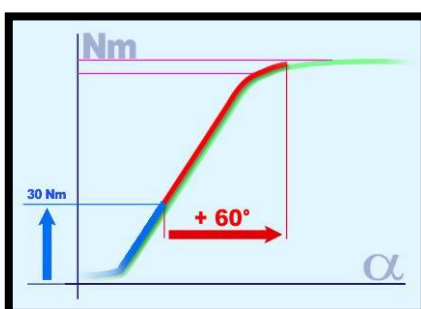
- Misalignment problem
- The hole is not completely threaded (or it is not deep enough)
- The bolt is stopped by oil in a dead hole
- There is dirt in the threads
- The threads are damaged
- The screw is already tightened

b) Angle is correct, but torque is too low.



- The thread may be stripped out
- The screw is too soft (tightened over yield)
- Unexpected low  $\mu$  (friction coefficient)

## 3. Tightening with torque and additional angle rotation (torque + angle)



The bolt is first tightened to a certain torque and then it is further tightened to a specific angle.

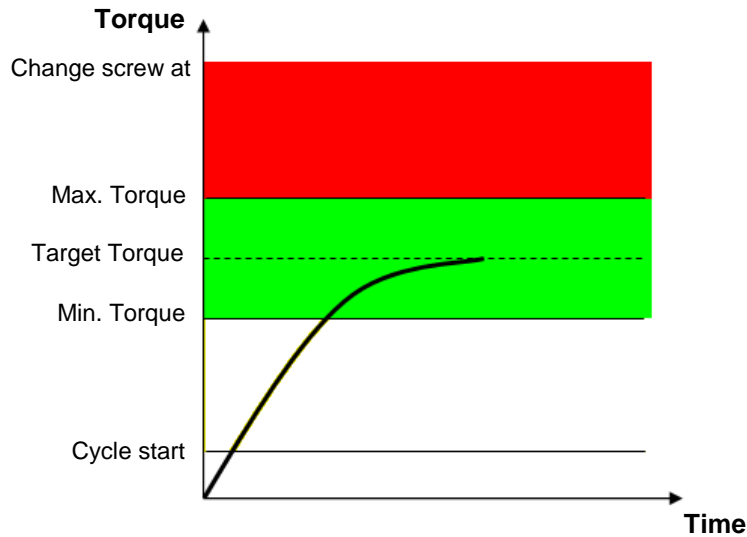
The goal is to stress the bolt over the yield point. Even with differences in the angle the torque (causing clamping force) is quite reliable. Sometime the joint is specially designed: consequently, experiments have been done (joint analysis) to be sure that strain is far away from the breaking point.





### 6.8.1.1 Torque Time

This strategy leads the operator in reaching the desired target torque, without any angle reading. It is enough to define the *Cycle start*, *Minimum Torque*, *Target Torque* and *Maximum Torque*, and the *Change Screw Torque*.



The “green area” identifies the OK result area.

If the torque goes over the “change screw” value, a message is shown on the Delta Wrench display in order to advise the operator to replace the screw.

The torque result is the maximum torque measured during the tightening.

The Delta Wrench display background is colored as follows:

<b>Blue</b>	Default color used for Pset execution.
<b>Green</b>	The display turns green if the test ends with OK result.
<b>Red</b>	Torque and/or angle over the maximum limits.

The buzzer is activated as follows:

<b>Buzzer</b>	<p>The beep emitted by the buzzer starts when the torque goes over the <i>Cycle Start</i> value, and it increases its signal when approaching the target.</p> <p>At the end of the tightening operation three more beeps inform the operator of the end of the operation; if the torque goes over the maximum values, the beep is repeated at high frequency to indicate the error.</p>
---------------	---

For information on the vibration function, refer to the paragraph “Vibration parameter”.



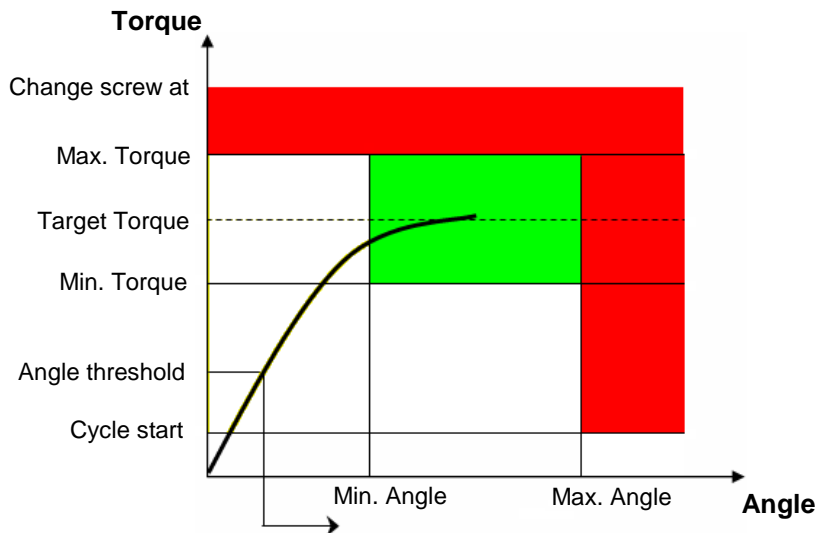
**NOTE:** Vibration is available only for the following Delta Wrench models: TORQUE/ANGLE MODELS WITH VIBRO and TORQUE/ANGLE MODELS WITH VIBRO AND WLAN RADIO MODULE.



### 6.8.1.2 Torque & Angle

This strategy leads the operator in reaching the desired target torque and monitoring the angle.

The *Angle threshold* parameter is the threshold from which to start angle measurement (normally set to 50% of the *Target Torque*).

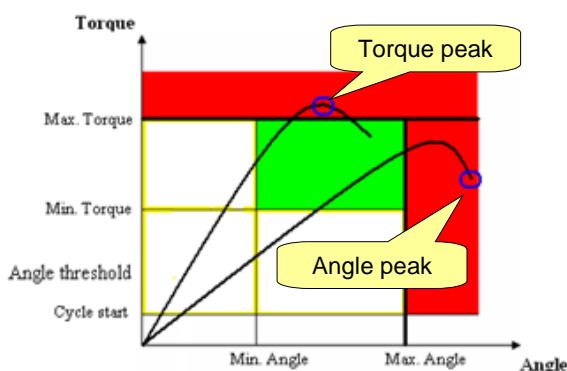


The “green area” identifies the OK result area.

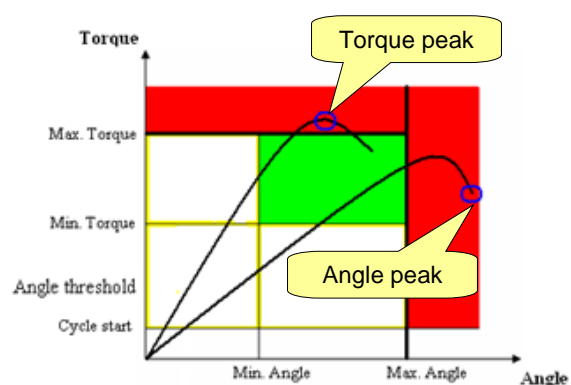
If the torque goes over the “change screw” value a message is shown on the Delta Wrench display advising the operator to replace the screw.

#### Torque/angle results:

- If the *torque/angle* does not exceed the torque/angle limits, the result is taken at the torque peak or angle peak as specified in the Pset options.
- If the *torque/angle* goes over the limit, the result is taken as follow:



Torque peak selected in the Pset options



Angle peak selected in the Pset options

The Delta Wrench display background is colored as follows:

<b>Blue</b>	Default color used for Pset execution.
<b>Green</b>	The display turns green if the test ends with OK result.
<b>Red</b>	Torque and/or angle over the maximum limits.





The buzzer is activated as follows:

<b>Buzzer</b>	<p>The beep emitted by the buzzer starts when the torque goes over the <i>Cycle Start</i> value, and it increases its signal when approaching the target.</p> <p>At the end of the tightening operation three more beeps inform the operator of the end of the operation; if the torque (or angle) goes over the maximum values, the beep is repeated at high frequency to indicate the error.</p>
---------------	--

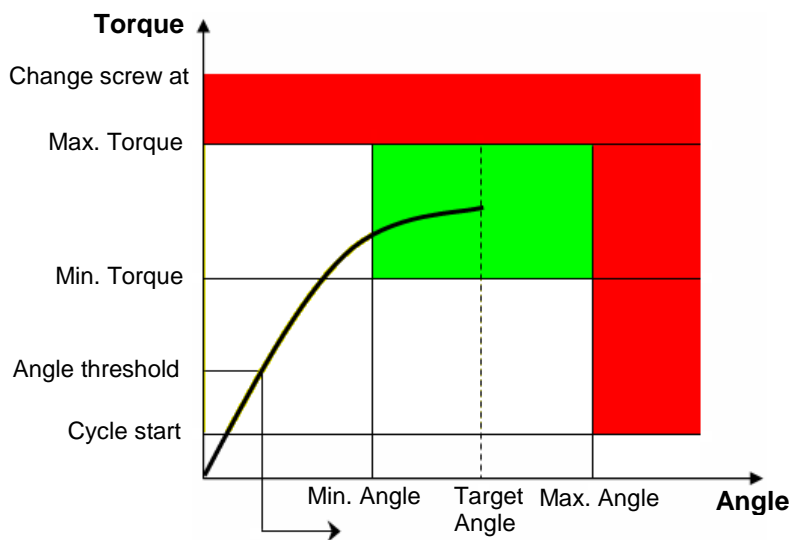
For information on the vibration function, refer to the paragraph “Vibration parameter”.



**NOTE:** Vibration is available only for the following Delta Wrench models: TORQUE/ANGLE MODELS WITH VIBRO and TORQUE/ANGLE MODELS WITH VIBRO AND WLAN RADIO MODULE.

### 6.8.1.3 Torque + Angle

This strategy guides to operator in reaching the desired target angle and monitoring torque.



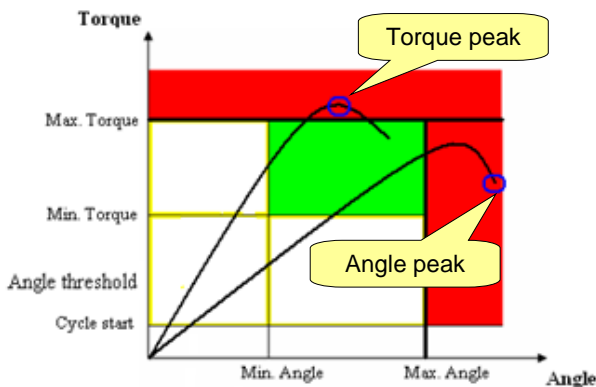
This strategy is similar to **Torque & Angle**; the *Target Angle* value is required instead of the *Target Torque*, and the progressive bar increases with the angle and not with the torque.

#### **Torque/angle results:**

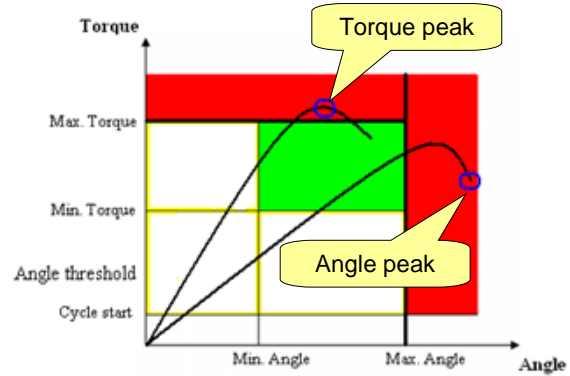
- If the *torque/angle* does not exceed the torque/angle limits, the result is taken at the torque peak or angle peak as specified in the Pset options.



- If the *torque/angle* goes over the limit, the result is taken as follow:



Torque peak selected in the Pset options



Angle peak selected in the Pset options

The Delta Wrench display background is colored as follows:

<b>Blue</b>	Default color used for Pset execution.
<b>Green</b>	The display turns green if the test ends with OK result.
<b>Red</b>	Torque and/or angle over the maximum limits.

The buzzer is activated as follows:

<b>Buzzer</b>	<p>The beep emitted by the buzzer starts when the torque goes over the <i>Cycle Start</i> value, and it increases its signal when approaching the target.</p> <p>At the end of the tightening operation three more beeps inform the operator of the end of the operation; if the torque (or angle) goes over the maximum values, the beep is repeated at high frequency to indicate the error.</p>
---------------	--

For information on the vibration function, refer to the paragraph "Vibration parameter".

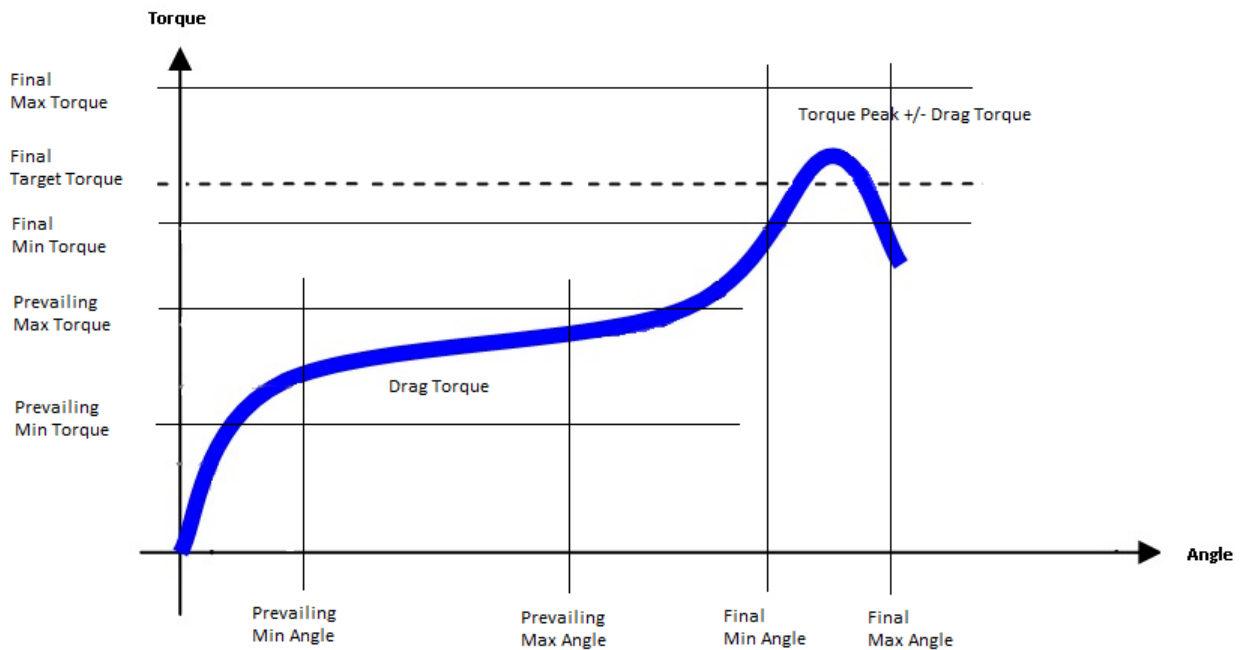


**NOTE:** Vibration is available only for the following Delta Wrench models: TORQUE/ANGLE MODELS WITH VIBRO and TORQUE/ANGLE MODELS WITH VIBRO AND WLAN RADIO MODULE.



### 6.8.1.4 Prevailing Torque Automatic Compensation

The purpose of the present strategy is to reach the desired *Target torque* and to verify whether torque values result within configured limits during a pre-established angle interval.



This strategy execution consists in two stages:

- *Prevailing phase*: once the cycle start and the angle threshold are exceeded, the first stage of the strategy begins and the value of the measured torque and angle peak appears on the display. The first progress bar indicates the approach to the *Prevailing max angle*. The minimum, maximum or average torque calculated during this phase is called *Drag torque* and will be used in the next phase.

#### **Drag Torque results:**

- Once the *Prevailing max angle* is reached, if the *Drag torque* does not exceed the prevailing torque limits the strategy will continue in the second phase.
- If the *Drag torque* goes over the configured prevailing limits, this first step fails and the strategy will end with a NOK result.

The Delta Wrench display background is colored as follows:

<b>Blue</b>	Default color used for Pset execution.
<b>Green</b>	The display turns green if the test ends with OK result.
<b>Red</b>	Torque and/or angle over the maximum limits.



The buzzer is activated as follows:

<b>Buzzer</b>	<p>The beep emitted by the buzzer starts when the torque goes over the <i>Cycle Start</i> value, and it increases its signal when approaching the target.</p> <p>At the end of the tightening operation three more beeps inform the operator of the end of the operation; if the result is NOK, the beep is repeated at high frequency to indicate the error.</p>
---------------	---

- *Torque and Angle phase*: the second stage of the strategy behaves like a **Torque & Angle** strategy, where a desired *Target torque* must be reached within a specific angle interval. The displayed torque is the *torque peak +/- Drag torque*, depending on the compensation option selected in the Pset. The second progress bar indicates the approach to the *Final Target Torque*. The torque values stored for the trace are the actual torque values, without considering the value of the Drag Torque.

#### Results:

- If the *Final target torque* (torque peak +/- Drag torque) does not exceed the limits during the specified angle interval, the result will be OK.
- If the *Final target torque* (torque peak +/- Drag torque) goes over the limits during the specified angle interval, the second phase of the strategy will end with a NOK result.

The Delta Wrench display background is colored as follows:

<b>Blue</b>	Default color used for Pset execution.
<b>Green</b>	The display turns green if the test ends with OK result.
<b>Red</b>	Torque and/or angle over the maximum limits.

The buzzer is activated as follows:

<b>Buzzer</b>	<p>The beep emitted by the buzzer starts when the torque goes over the <i>Cycle Start</i> value, and it increases its signal when approaching the target.</p> <p>At the end of the tightening operation three more beeps inform the operator of the end of the operation; if the result is NOK, the beep is repeated at high frequency to indicate the error.</p>
---------------	---

For information on the vibration function, refer to the paragraph "Vibration parameter".



**NOTE:** Vibration is available only for the following Delta Wrench models: TORQUE/ANGLE MODELS WITH VIBRO and TORQUE/ANGLE MODELS WITH VIBRO AND WLAN RADIO MODULE.



## 6.8.2 Quality Control Strategies

**Quality Control strategies** are not the strategies used to tighten a screw; they are used to check tightening operations already performed, measuring the residual torque.

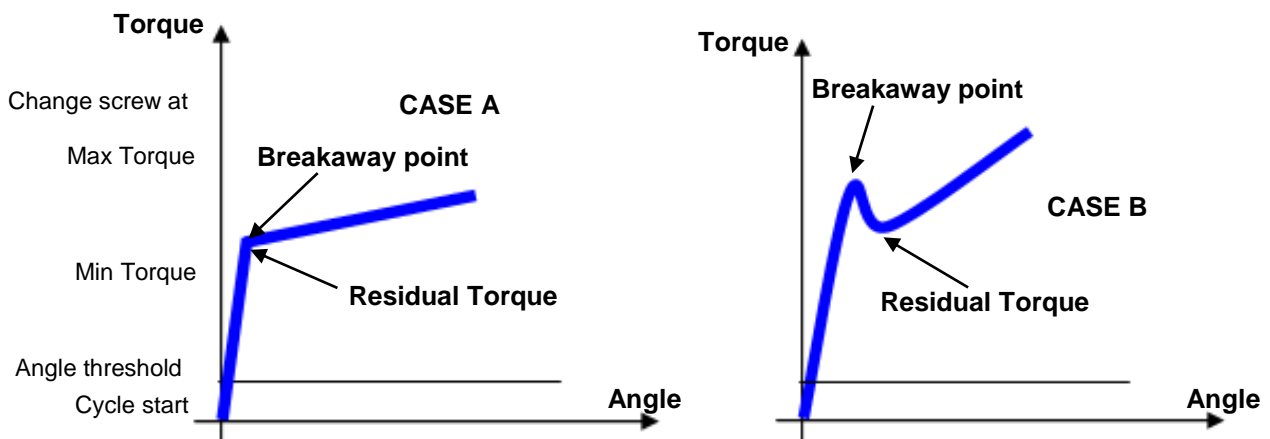
The strategies for evaluating residual torque can be divided in two main categories:

- **Residual Check Angle:** it measures the torque necessary to rotate the screw further, measuring it at the specified angle.
- **Peak Torque:** it measures the peak of the torque necessary to rotate the screw further: the operator must stop as soon as the screw starts rotating.

The paragraphs below describe in detail how the Delta Wrench performs these strategies.

### 6.8.2.1 Residual Torque/Angle Automatic

This strategy evaluates the residual torque on a joint, measuring the torque necessary to rotate the screw further.



**CASE A:** Normally there is a rapid change of the gradient of the *torque/angle* function when the bolt starts moving.

**CASE B:** Sometimes, due to high static friction built into the joint (for instance, for no lubrication, conical seat) as soon as the bolt moves the torque decreases, and the real residual torque is lower than the peak torque necessary to overcome the static friction.

In both the above cases, the Delta Wrench algorithm detects automatically the correct breakaway point.

*Min Torque* and *Max Torque* define the torque limits where the result is considered as OK.

The *Angle threshold*, that must be greater than the *Cycle start*, defines the point from which the Delta Wrench starts measuring the angle.

The result of this test is available when the test is finished (after the operator release the torque and the timeout is expired).



**Torque result:**

- Residual torque, if the breakaway point is detected.
- Maximum torque measured, if the breakaway point is not detected, or if the torque goes over the *Change Screw* value.

If during the residual torque check the operator goes over the **Change Screw** value, a message is shown on the Delta Wrench display to indicate that the screw must be replaced with a new one.

At the end of the test, the Delta Wrench display background is colored as follows:

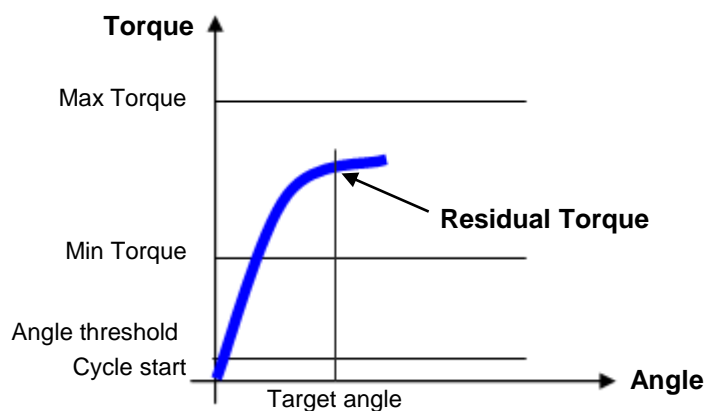
<b>Blue</b>	Default color used for Pset execution.
<b>Green</b>	The display turns green if the residual torque measured is between the minimum and maximum torque.
<b>Red</b>	The display turns red if the residual torque is either below the minimum or over the maximum torque, or if the residual torque point is not detected.

The buzzer is activated as follows:

<b>Buzzer</b>	<p>The beep emitted by the buzzer starts when the torque goes over the mid-point between the minimum and maximum torque values.</p> <p>At the end of the tightening operation three more beeps inform the operator about the end of the operation. If the result is <i>Not OK</i> (because the <i>Torque</i> is either over the maximum Torque or under the minimum Torque), the last beep remains active to indicate the error, and it is reset when either the <b>OK</b> or <b>CL</b> button is pressed.</p>
---------------	--

**6.8.2.2 Residual Torque/Angle**

This strategy evaluates the residual torque on a joint, measuring the torque necessary to rotate the screw further.



*Min Torque* and *Max Torque* define the torque limits where the result is considered as OK. The **Angle threshold**, which must be greater than the **Cycle start**, defines the point from which the Delta Wrench starts measuring the angle. The recommended values are **Target Angle** set to 2 degrees and the **Angle Threshold** set to the 50% of the expected residual torque.



**Torque result:**

- Torque measured at the target angle, if the target angle is reached.
- Maximum torque measured, either if the target angle is not reached or if the torque goes over the *Change Screw* value.

If during the residual torque check the operator goes over the **Change Screw** value, a message is shown on the Delta Wrench display to indicate that the screw must be replaced with a new one.

The Delta Wrench display background is colored as follows:

<b>Blue</b>	Default color used for Pset execution.
<b>Green</b>	The display turns green if the torque measured at the target angle is between the minimum and maximum torque.
<b>Red</b>	The display turns red if the torque result is below the minimum or over the maximum torque.

The buzzer is activated as follows:

<b>Buzzer</b>	<p>The beep emitted by the buzzer starts when the torque goes over the <i>Cycle Start</i> value.</p> <p>At the end of the tightening operation three more beeps inform the operator of the end of the operation; if the result is <i>Not OK</i>, the last beep remains active to indicate the error, and it is reset when either the <b>OK</b> or <b>CL</b> button is pressed.</p>
---------------	--

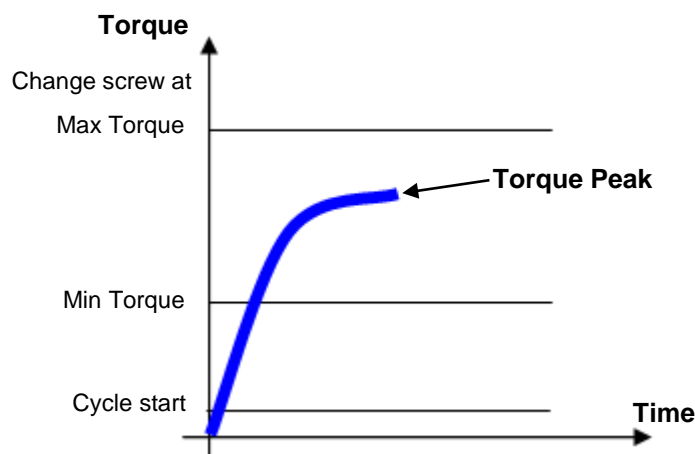
For information on the vibration function, refer to the paragraph “Vibration parameter”.



**NOTE:** Vibration is available only for the following Delta Wrench models: TORQUE/ANGLE MODELS WITH VIBRO and TORQUE/ANGLE MODELS WITH VIBRO AND WLAN RADIO MODULE.

**6.8.2.3 Residual Peak/Torque**

This strategy evaluates the residual torque on a joint as the peak of the torque necessary to rotate the screw further. The result of this strategy is affected by operator movement; it is important to release the torque as soon as the screw starts moving.





Specify the *Cycle start* and the *Torque limits*.

Furthermore, it is MANDATORY to set a **Change Screw** value: if the operator goes over this value, a message is shown on the Delta Wrench display to indicate that the screw must be replaced with a new one.

The Delta Wrench display background is colored as follows:

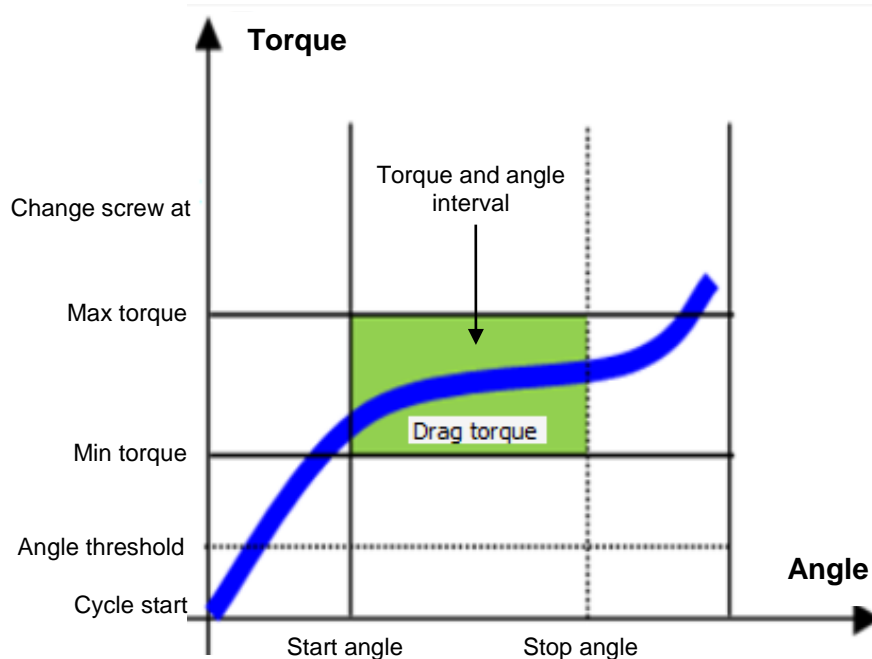
<b>Blue</b>	Default color used for Pset execution.
<b>Green</b>	The display turns green if the torque peak is between the minimum and maximum torque.
<b>Red</b>	The display turns red if the torque peak is below the minimum or over the maximum torque.

The buzzer is activated as follows:

<b>Buzzer</b>	<p>The beep emitted by the buzzer starts when the torque goes over the <i>Cycle Start</i> value.</p> <p>At the end of the tightening operation three more beeps inform the operator of the end of the operation; if the result is <i>Not OK</i>, the last beep remains active to indicate the error, and it is reset when either the <b>OK</b> or <b>CL</b> button is pressed.</p>
---------------	--

#### 6.8.2.4 Drag Torque

The purpose of the present strategy is to verify that the value of the *Drag torque type* (*Minimum*, *Maximum* or *Average*) results within configured torque limits during a pre-established angle interval.







The *Angle threshold*, that must be greater than the *Cycle start*, defines the point from which the Delta Wrench starts measuring the angle.

*Min torque* and *Max torque* define the torque limits within which the value of the *Drag torque type* is considered as OK.

*Start angle* and *Stop angle* define the angle limits within which the value of the *Drag torque type* is calculated.

#### **Torque/Angle results:**

- If the value of the chosen *Drag torque type* (*Minimum*, *Maximum* or *Average*) falls within the established torque and angle interval, the result is OK.
- If the value of the chosen *Drag torque type* (*Minimum*, *Maximum* or *Average*) does not result within the established torque and angle interval, the result is NOK.

If during the residual torque check the operator goes over the *Change Screw* value, a message is shown on the Delta Wrench display to indicate that the screw must be replaced with a new one.

The Delta Wrench display background is colored as follows:

<b>Blue</b>	Default color used for Pset execution.
<b>Green</b>	The display turns green if the <i>Drag torque</i> ( <i>Minimum</i> , <i>Maximum</i> or <i>Average</i> ) at the <i>Stop angle</i> is between the minimum and maximum torque.
<b>Red</b>	The display turns red if the torque result is below the minimum or over the maximum torque.

The buzzer is activated as follows:

<b>Buzzer</b>	<p>The beep emitted by the buzzer starts when the torque goes over the <i>Cycle Start</i> value and increases its signal when approaching the <i>Stop angle</i>.</p> <p>At the end of the tightening operation three more beeps inform the operator of the end of the operation; if the result is <i>Not OK</i>, the last beep remains active to indicate the error, and it is reset when either the <b>OK</b> or <b>CL</b> button is pressed.</p>
---------------	--

For information on the vibration function, refer to the paragraph "Vibration parameter".



**NOTE:** Vibration is available only for the following Delta Wrench models: TORQUE/ANGLE MODELS WITH VIBRO and TORQUE/ANGLE MODELS WITH VIBRO AND WLAN RADIO MODULE.

#### **Algorithm used to detect the yield point:**

The torque/angle trace is sampled at 1 kHz.

Several Torque and angle values  $T_i$  and  $A_i$  are calculated as moving averages of 128 torque/angle samples measured by the Delta wrench. This means that for each next value acquired, new  $T_i$  and  $A_i$  values are calculated:

10  $T_i$  and  $A_i$  values are considered step by step to calculate the following parameters:

- Sum of the torque values.
- Sum of the angle values.



- Sum of torque values multiplied by angle values.
- Sum of the square of the angle values.

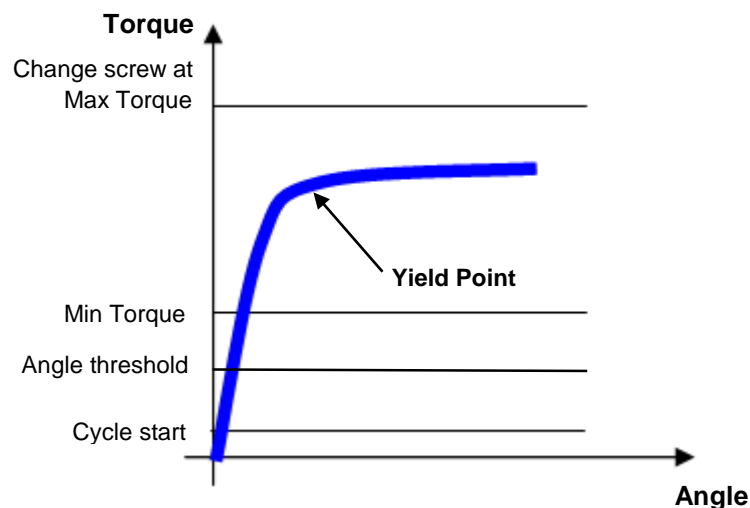
From these terms calculated above, linear regression is applied to obtain the gradient of the torque/angle trace:

The gradient  $at$  is recalculated by linear regression each next sample acquired, and the average of 20 different values  $at$  is calculated

This average is also recalculated sample by sample. If 30 consecutive values of this average (absolute value) are not greater than a threshold value of the Linear slope Coefficient (LSC) multiplied by 0.4, and for 2 degrees they stay under the Linear slope Coefficient multiplied by 1.6, the yield point is considered to have been detected.

### 6.8.2.5 Yield Point

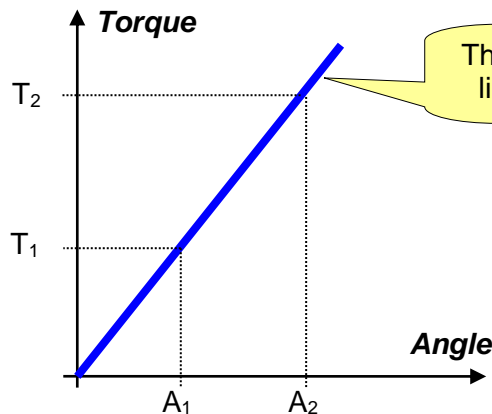
The purpose of the strategy is to detect the *Yield point* of the joint under analysis that is the bolt elastic limit (yield).



**NOTE: It is recommended to reach the *Yield Point* with a single tightening;** ratcheting is allowed if it is executed at the 50 ÷ 60 % (MAXIMUM) of the supposed *Yield Point*.

In order to investigate the elastic characteristic of the bolt the pset should be configured in this way:

- The *Cycle start* must be set at least to 10% of the supposed *Yield point*.
- The *Angle threshold*, that must be greater than the *Cycle start*, defines the point from which the Delta Wrench starts measuring the angle.
- The *Min torque* and the *Max torque* define the torque limits within which the value of the *Yield point* detected will be considered as OK.
- Furthermore is necessary to set an appropriated coefficient, the linear slope coefficient. This parameter is active only for the *Yield Point* strategy, and characterizes the joint stiffness in the linear part of the curve, as torque/angle slope in the Nm/° measurement unit. In other terms, the LSC is the slope of the torque/angle characteristic of the joint in the first part (linear). The minimum value is 0.1, which suits also very soft joints with a ration smaller than 0.1. The default value is 0.5. The Linear slope coefficient may be calculated experimentally for each single joint (only after executing a trial test to get data for calculating it) as follows:



$$\frac{\Delta T}{\Delta A} = \frac{T_2 - T_1}{A_2 - A_1} = \text{Linear slope coefficient}$$

Once analyzed the curve as described before user have to choose the right LSC and



**NOTE:** If the unit of measurement used is different from Nm the *Linear slope Coefficient* must be converted to Nm/° anyway.  
 For instance, for a joint with a stiffness of 0.6 lbf\*ft/°, since 1 lbf\*ft = 1.3558 Nm, the *Linear Slope Coefficient* must be converted to:

$$0.6 \text{ lbf}^{\circ}/\text{ft} \rightarrow 0.6 \times 1.3558 = 0.81 \text{ Nm}^{\circ}$$

With this strategy, the wrench detects the yield point automatically and in base of the specified torque limits range, the “Torque result” may be one of the following options:

- If the *Yield Point* is detected (within torque limits), the result of the test is taken at the *Yield Point*.
- If the *Yield Point* is not detected, the result of the test is the torque peak.
- If the torque goes over the *Change Screw* value, the *Yield Point* is no longer detected and the torque result is the torque peak.

The Delta Wrench display background is colored as follows:

<b>Blue</b>	Default color used for Pset execution.
<b>Green</b>	The display turns green if the <i>Yield point</i> is detected within torque limits.
<b>Red</b>	The display turns red if the <i>Yield point</i> is below or above the torque limits or not detected.

The buzzer is activated as follows:

<b>Buzzer</b>	<p>The beep emitted by the buzzer starts when the torque goes over the mid-point between the minimum and maximum torque values.</p> <p>At the end of the tightening operation three more beeps inform the operator of the end of the operation; if the result is <i>Not OK</i>, the last beep remains active to indicate the error, and it is reset when either the <b>OK</b> or <b>CL</b> button is pressed.</p>
---------------	---

For information on the vibration function, refer to the paragraph “Vibration parameter”.



**NOTE:** Vibration is available only for the following Delta Wrench models: TORQUE/ANGLE MODELS WITH VIBRO and TORQUE/ANGLE MODELS WITH VIBRO AND WLAN RADIO MODULE.

Algorithm used to detect the yield point is the following:

The torque/angle trace is sampled at 1 kHz.

Several torque and angle values  $T_i$  and  $A_i$  are calculated as moving averages of 128 torque/angle samples measured by the Delta wrench. This means that for each next value acquired, new  $T_i$  and  $A_i$  values are calculated:

10  $T_i$  and  $A_i$  values are considered step by step to calculate the following parameters:

- Sum of the torque values
- Sum of the angle values
- Sum of torque values multiplied by angle values
- Sum of the square of the angle values

From these terms calculated above, linear regression is applied to obtain the gradient of the torque/angle trace:

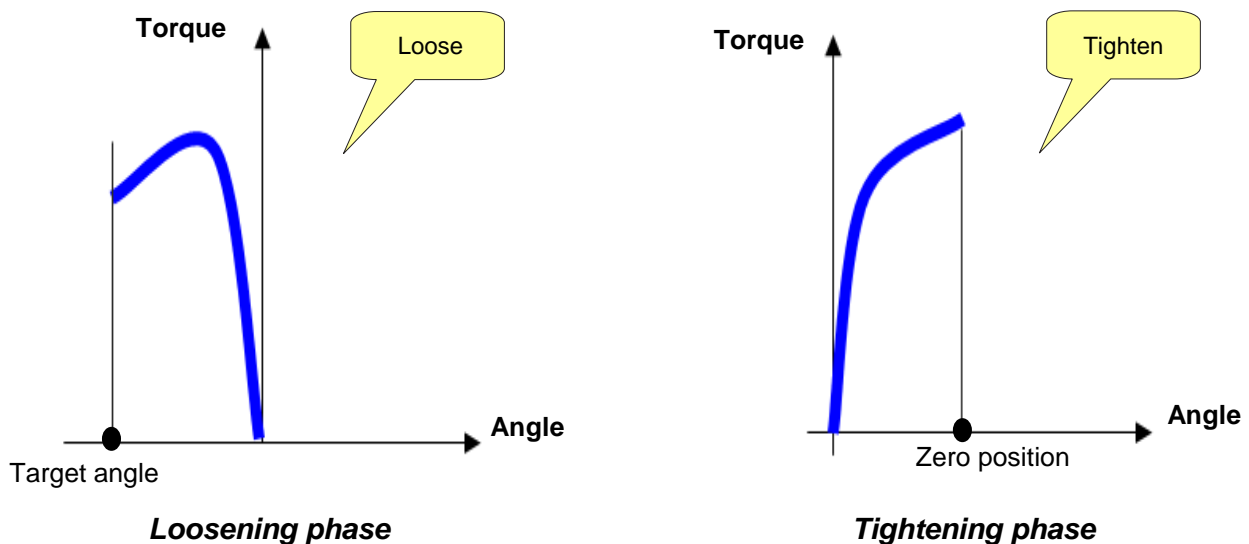
The gradient  $\alpha_t$  is recalculated by linear regression each next sample acquired, and the average of 20 different values  $\alpha_t$  is calculated.

This average is also recalculated sample by sample. If 30 consecutive values of this average (absolute value) are not greater than a threshold value of the *Linear slope Coefficient* (LSC) multiplied by 0.4, and for 2 degrees they stay under the *Linear slope Coefficient* multiplied by 1.6, the yield point is considered to have been detected.

### 6.8.2.6 Residual Loose and Tighten

The strategy is composed by two steps: in the first operator have to unscrew the bolt for a few degrees and after that screw it again till to restore the previously position.

In particular the purpose is to loosen the bolt up to the target angle and then in the same tightening procedure perform a tighten back to the original Zero position.





Parameters to set are Torque limits, Target angle and Torque and the **Angle correction coefficient if necessary**.

In particular, Set the **Target Angle** to a few degrees, so that the torque during the loosening phase does not fall under the Cycle start value.

If the torque goes over the **Change Screw** value during the residual torque check, a message is shown on the display to indicate that the screw must be replaced.

The residual torque result is the torque at the end of the tightening operation (measured when the original **Zero position** is reached back).

Results:

- If the original Zero position is reached within 30s and within torque limits, the result of the test is OK; the torque result is the torque measured at the Zero position and the angle result is equal to zero.
- If the Zero position is not reached within 30s, the result of the test is NOK; the angle result is negative and the torque result is the last torque value measured.
- If the Zero position is reached within torque limits, but the Peak torque is over the Change screw value, the result is NOK.

During the loosening phase of the strategy, the Delta Wrench display background is colored as follows:

<b>Blue</b>	Default color used for Pset execution.
<b>Green</b>	The display turns green when the Target angle of the loosening process is reached (when the tightening phase starts, the green led switches off).
<b>Red</b>	The display turns red if one of the following conditions verify: <ul style="list-style-type: none"> <li>- The Target angle is not reached, or reached but 30s timeout expire.</li> <li>- The tightening operation starts before the Target angle is reached.</li> </ul>

During the loosening phase of the strategy, the buzzer is activated as follows:

<b>Buzzer</b>	At the end of the loosening operation a beep informs the operator that the Target angle is reached and that the second phase of the strategy can start.
---------------	---

During the retightening phase of the strategy, the Delta Wrench display background is colored as follows:

<b>Blue</b>	Default color used for Pset execution.
<b>Green</b>	The display turns green when the Loose and Tighten process is successfully completed within Torque limits.
<b>Red</b>	The display turns red if one of the following condition verifies:



- |  |  |
|--|--|
|  | <ul style="list-style-type: none"> <li>- The loosening and tightening process is completed but the torque result is below or above the torque limit, or over the Change screw value.</li> <li>- The retightening operation started before the Target angle was reached.</li> <li>- The 30s timeout expires.</li> </ul> |
|--|--|

During the retightening phase of the strategy, the buzzer is activated as follows:

<b>Buzzer</b>	At the end of the tightening operation three beeps inform the operator of the end of the operation; if the result is <i>Not OK</i> , the last beep remains active to indicate the error, and it is reset when either the <b>OK</b> or <b>CL</b> button is pressed.
---------------	--

For information on the vibration function, refer to the paragraph "Vibration parameter".



**NOTE:** Vibration is available only for the following Delta Wrench models: TORQUE/ANGLE MODELS WITH VIBRO and TORQUE/ANGLE MODELS WITH VIBRO AND WLAN RADIO MODULE.



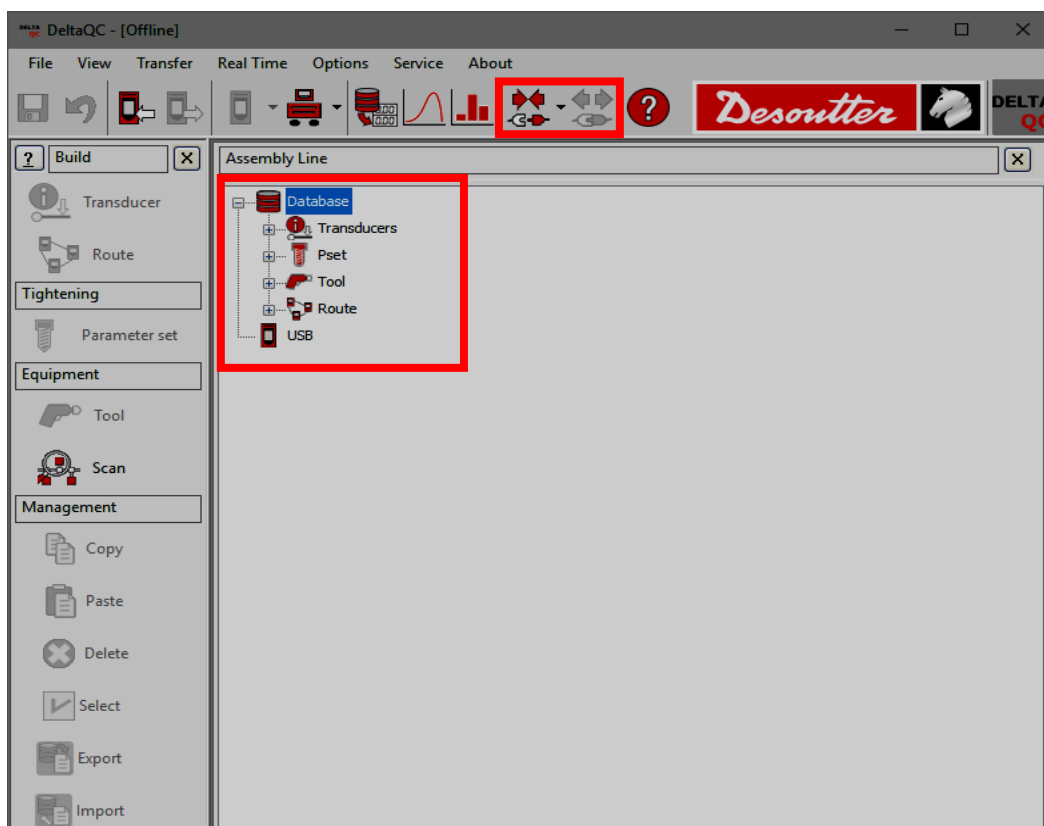


## 7 OFFLINE MODE

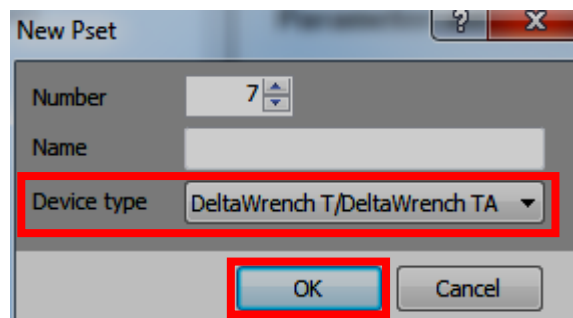
The **Offline** mode allows the user to create Pset without a Delta Wrench connected to the PC. All the data are stored in a local database. The Psets defined offline can be grouped into “Routes” and transferred to the Delta Wrench.

The database stores also all the results (up to 32000) downloaded from the Delta Wrench. Refer to the paragraph “Results Viewer” for further details about how to download results from the Delta Wrench to the database.

To work in this mode, disconnect the Delta Wrench from DeltaQC, and select the **Database** menu.



When creating a Pset, an additional field is shown, to select for which device the new Pset is assigned. Select **Delta Wrench** from **Device type** the drop-down list and click on the **OK** button to create a new Pset.

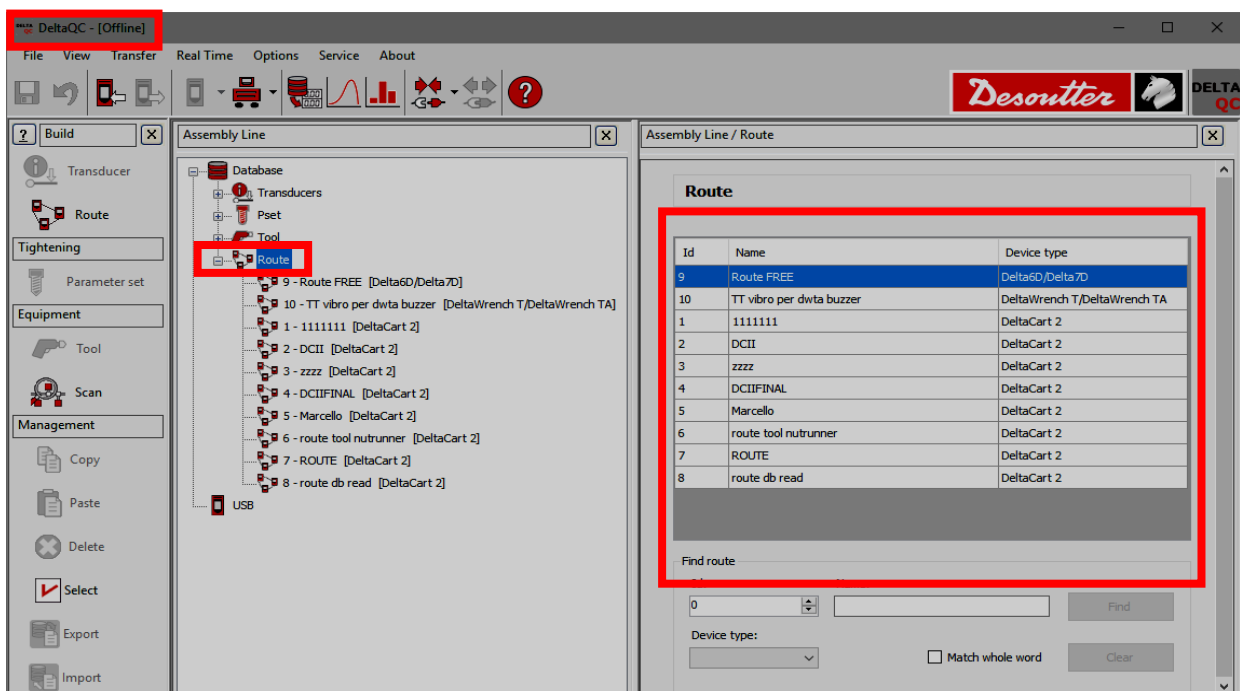




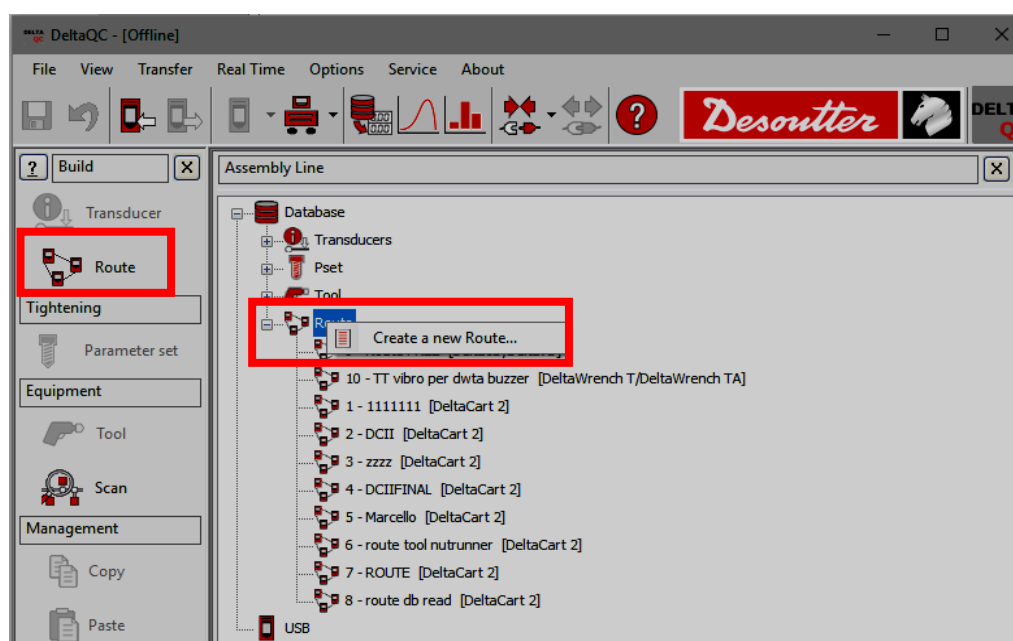
## 7.1 Create a Route

When working *offline*, it is possible to create up to 32.000 test programs (Pset). The Delta Wrench can store up to **200 Psets**. The *Route* is used to select the test programs to be transferred to the Delta Wrench. It is possible to create various Routes (up to 32.000) to transfer different set of tests to different Delta Wrenches.

In the *Assembly Line* area of the offline mode, select **Route**. The *Routes* already created are shown in the right area of the window (see figure below):



To create a new *Route*, either click on the **Route** icon placed in the *Build* area, or right-click on **Route** in the *Assembly Line* area (and then, select on “**Create a new Route...**”):







From the pop-up that appears (see figure below), select the Route **Number**, type the Route **Name**, enter a Route **Description** and select **Delta Wrench** from the **Device type** drop-down list. Then, click on the **OK** button to confirm the creation of a new Route:

New Route

Number 3

Name Route Test

Description Route Test (Documentation)

Device type DeltaWrench T/DeltaWrench TA

OK Cancel



**NOTE:** By default, the Route **Number** assigned is the first number available. It is not possible to use numbers already assigned to other Routes.

After clicking on **OK**, the Route data are displayed on the right side of the window in the **General** tab (see figure below):

DeltaQC - [Offline]

File View Transfer Real Time Options Service About

Build Assembly Line Assembly Line / Route / 11 - New Route [DeltaWrench T/DeltaWrench TA]

General linked Psets/Tools

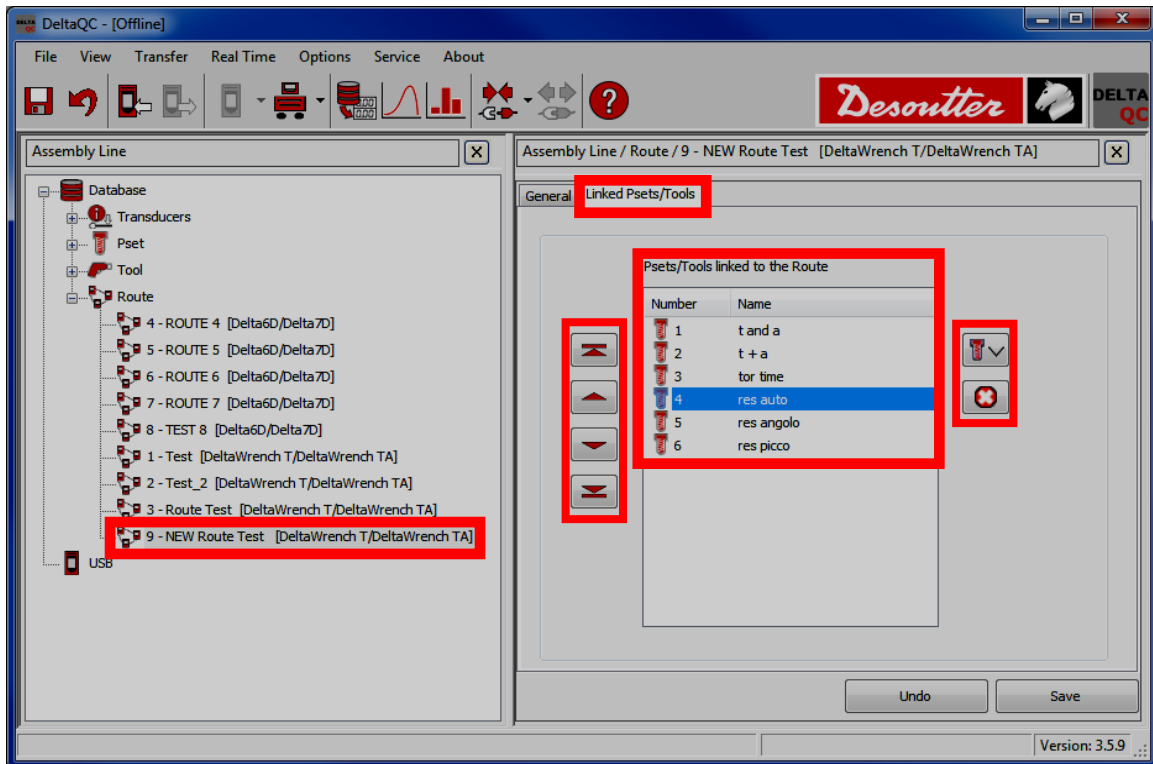
Name New Route

Description Test

Undo Save



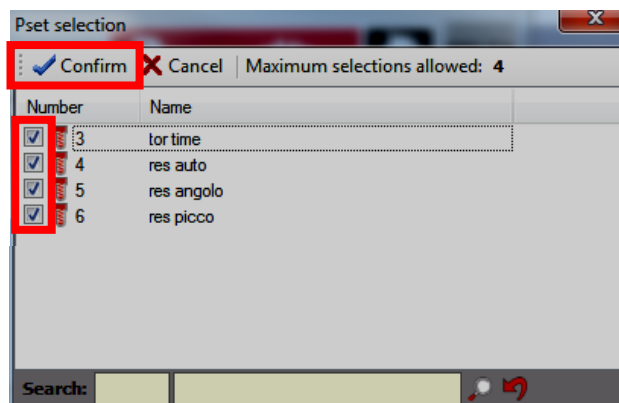
Select the *Linked Psets* tab to add (or delete) up to **200 Psets** to the Route:



Configure the Route as described below:

- Click on the icon on the right to add *Pset(s)* to the *Route(s)*.
- Click on icon on the right to delete an item from the *Route(s)*.
- Click on a Pset and use the arrows icons on the left to change the order of the Psets/Tools linked to the Route.
- Click on the **Save** button to save the data.

When adding an item to the *Route*, the following screen is shown:



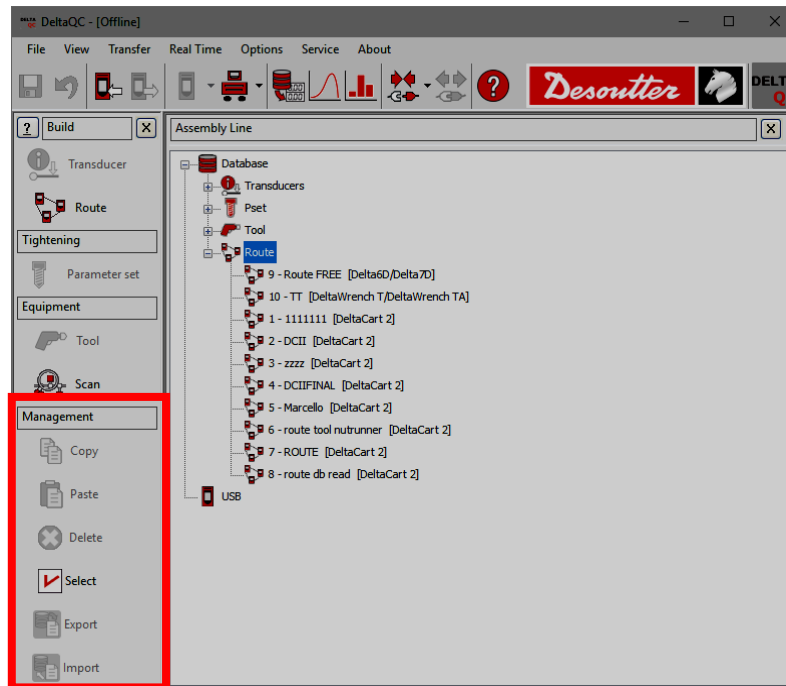
Select the Pset (s) to add to the Route and click on **Confirm** to save.



**NOTE:** If a large number of Psets is present in the list, use the search function to filter it.

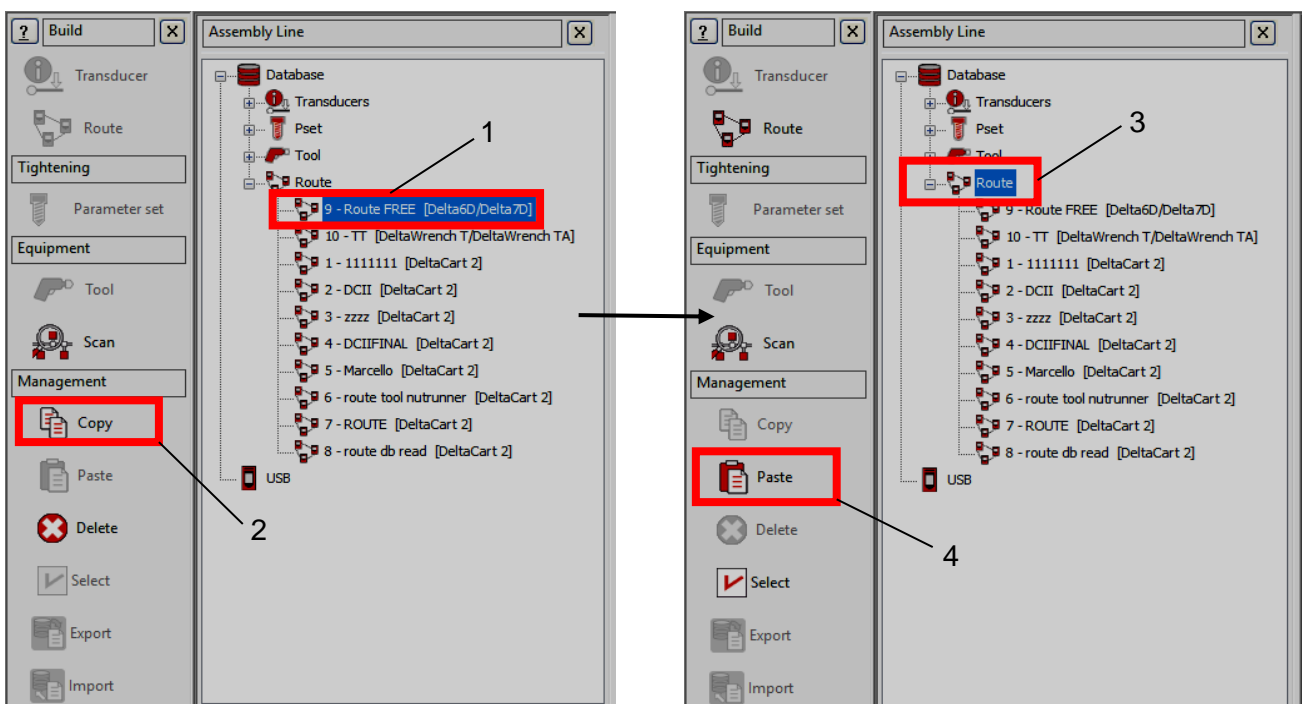


The **Management** area (placed in the *Build* area) provides also the commands to *copy* and *paste* or *delete* one or more routes.



Copy and paste a Route as described below (refer to the following figures):

1. In the *Assembly Line* area, select a Route from the list.
2. In the *Management* area, click on the **Copy** icon.
3. In the *Assembly Line* area, click on the **Route** node.
4. In the *Management* area click on the **Paste** icon.

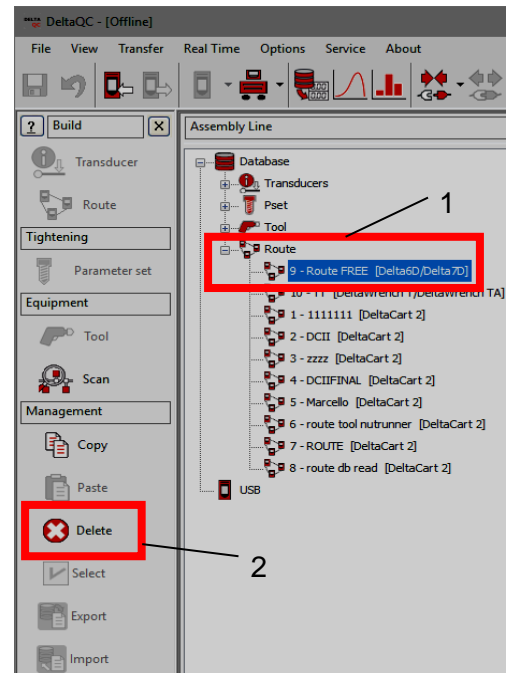




Delete one Route as described below (refer to the figure on the right):

1. In the *Assembly Line* area, select the Route to delete.
2. In the management area, click on the **Delete** icon.

Finally, click on **Yes** in the warning message appears to confirm the deletion of the selected Route.



Delete more Routes at the same time as described below (refer to the following figures):

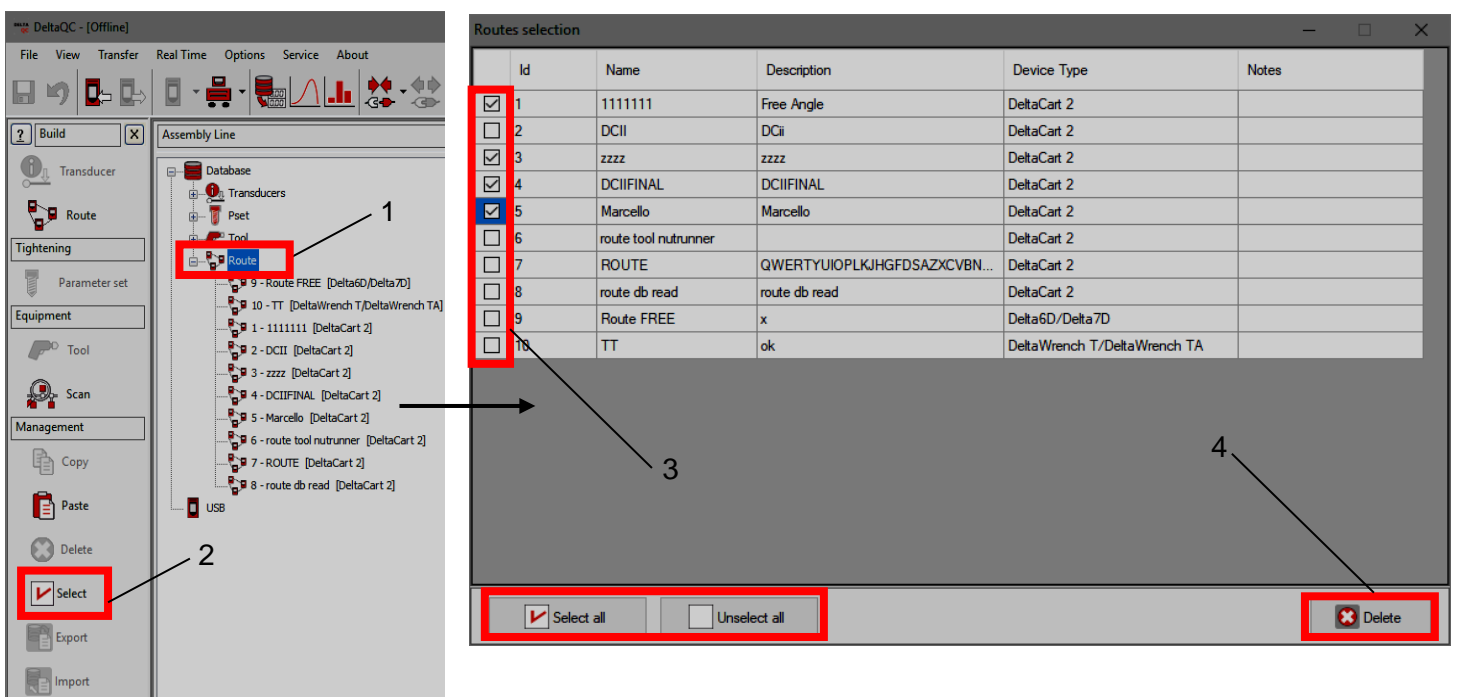
1. In the *Assembly Line* area, click on the **Route** node.
2. In the *Management* area click on the **Select** icon.
3. In the *Routes selection* pop-up that opens, select the Routes to delete.



**NOTE:** In the lower section of the pop-up, the **Select all** and the **Unselect all** buttons allow respectively to select all the available Routes and to unselect all the Routes.


4. In the *Routes selection* pop-up, click on the **Delete** button.

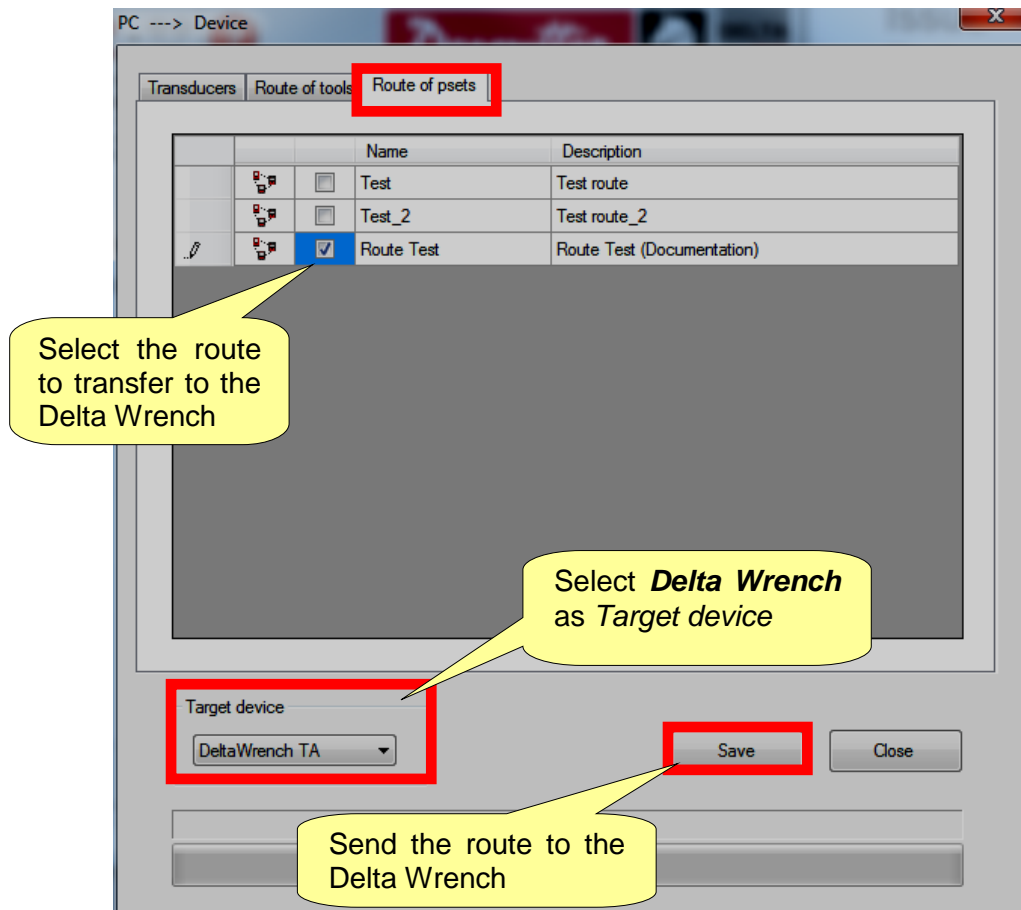
Finally, click on **Yes** in the confirmation message that appears to confirm the deletion of the selected Routes.





## 7.2 Transfer a *Route* to the Delta Wrench

Once the *Route* is defined in the *Offline mode*, click on the  icon (placed on the toolbar), or select the **Transfer** → **PC** → **Device** menu (refer to the paragraph “*Menu list*”) to transfer it to the Delta Wrench:



Select the *Route* and click on **Save** to send it to the Delta Wrench.



**NOTE:** When the *Route* is sent to the Delta Wrench, all the Psets previously stored in the Delta Wrench memory are deleted! If the user wants to keep a copy of the existing *Psets* currently in use on the Delta Wrench, he must save them to the database before sending the *Route* to the Delta Wrench (refer to the paragraph “*Online mode*” for further details).



## 8 DELTA WRENCH SETTINGS

### 8.1 Settings Menu on Delta Wrench

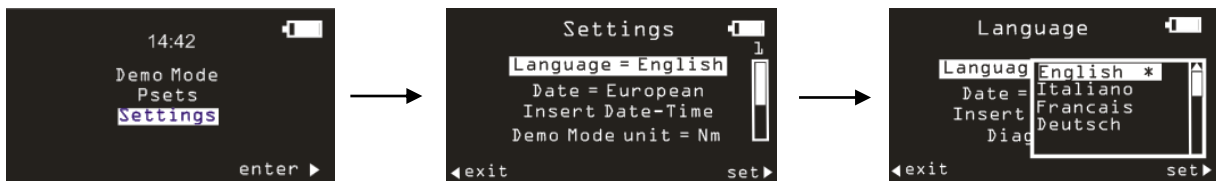
The **Settings** menu on the Delta Wrench display is active only if enabled (refer to the paragraph “*Delta Wrench Controller Setup*” for further details about how to enable / disable this menu).

The **Diagnostic** menu is explained in the paragraph “*Troubleshooting Guide*” of this manual.

For further details about the default configuration, refer to the paragraph “*Appendix B – Delta Wrench Factory Settings*”.

#### 8.1.1 Language

To set the Delta Wrench display language, select **Settings** → **Language** from the Delta Wrench main menu:



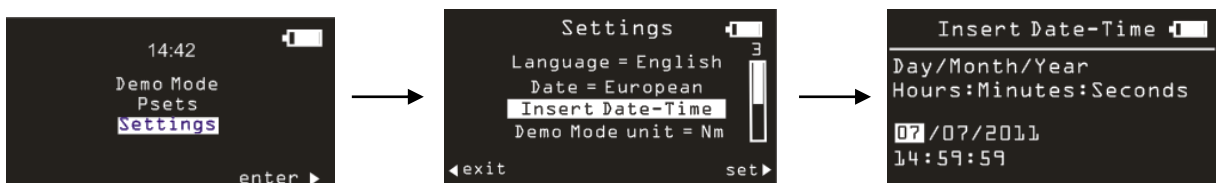
Select the language and confirm with the **OK** button placed on the keyboard.



**NOTE:** It is also possible to set the language through DeltaQC (refer to the paragraph “*Delta Wrench display language*” for further details).

#### 8.1.2 Date - time

To set the Delta Wrench date and time, select **Settings** → **Insert Date-Time** from the Delta Wrench main menu:



Use the right/left arrows on the keyboard to choose the field to edit, and use the up/down arrows to increase/decrease the selected field.



**NOTE:** To select either *European* or *American* date format, select **Settings** → **Date** menu.



### 8.1.3 Demo mode unit

To set the Delta Wrench unit of measurement for the Demo Mode, select **Settings** → **Demo Mode unit** from the Delta Wrench main menu:

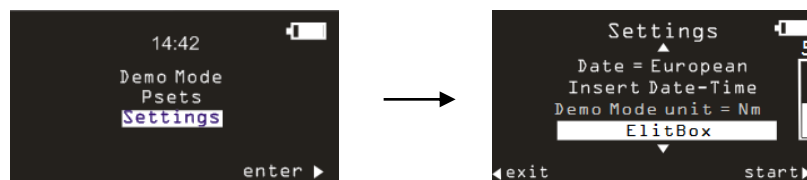


### 8.1.4 ElitBox / WiFi

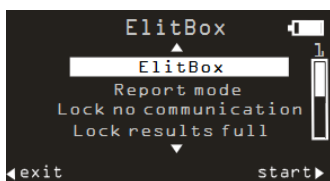
This item of the Settings menu changes according to the radio module installed on the Delta Wrench model.

#### 8.1.4.1 ElitBox (for models with ZigBee radio module)

For the Delta Wrench equipped with a ZIGBEE radio module, there the ElitBox settings section. To set the Delta Wrench ElitBox parameters, select **Settings** → **ElitBox** from the Delta Wrench main menu:



After selecting *ElitBox* option (refer to the above screen), it is possible to set a bidirectional communication with an ELIT PC either by means of an ELITBOX or an ELITKEY. In fact, by clicking on *ElitBox* option, the following screens are shown:

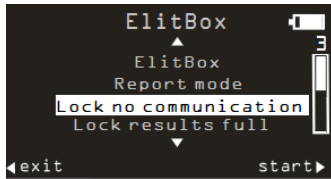


*ElitBox* option either enable or disable this function.

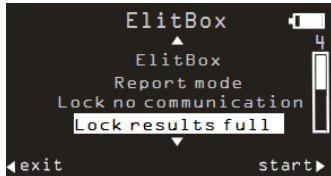


**Report mode** option allows to select between the following:

- **NONE**: to disable results transmission.
- **BASIC**: this mode allows the Delta Wrench to communicate only with the ELITBOX.
- **EXTENDED**: this mode allows to check the results only on the ELIT PC (independently if the user is using either the ELITBOX or ELITKEY for a ZIGBEE communication).



**Lock no communication** option is enabled to save every result: once this option is enabled, the Delta Wrench is automatically locked when it is out of network coverage. In this case, no tightenings are allowed.



**Lock results full** option is enabled to save every result: once this option is enabled, the Delta Wrench is automatically locked if 25 results (maximum) are not received by the ELITBOX / ELIKEY.



Usually, if the Delta Wrench is not linked yet, every 60 seconds it tries to join to the best available network automatically (once this is unlocked on the ELITBOX / ELITKEY).

**Join Pan** option forces the pairing with the ELITBOX / ELITKEY (provided the pairing is already activated on the ELITBOX / ELITKEY (for further details about the ELITBOX / ELITKEY refer both to “ELITBOX User Guide” and “ELITKEY User Guide”)).

#### 8.1.4.2 WiFi (for models with WLAN radio module)

For the Delta Wrench equipped with a WLAN radio module, there the WIFI section. Selecting this menu item, the current Delta Wrench IP address is shown.

#### 8.1.5 Diagnostic

Select **Settings** → **Diagnostic** to launch a diagnostic test. Follow the instructions on the screen during the execution of this test. See the *Delta Wrench Diagnostic* paragraph for details.

#### 8.1.6 Power off

To disable or to set the power off timeout of the Delta Wrench, select **Settings** → **Power off**. Then select the desired timeout value by using UP, DOWN and OK keys. This menu works in the same way as described in the *Power off* paragraph.

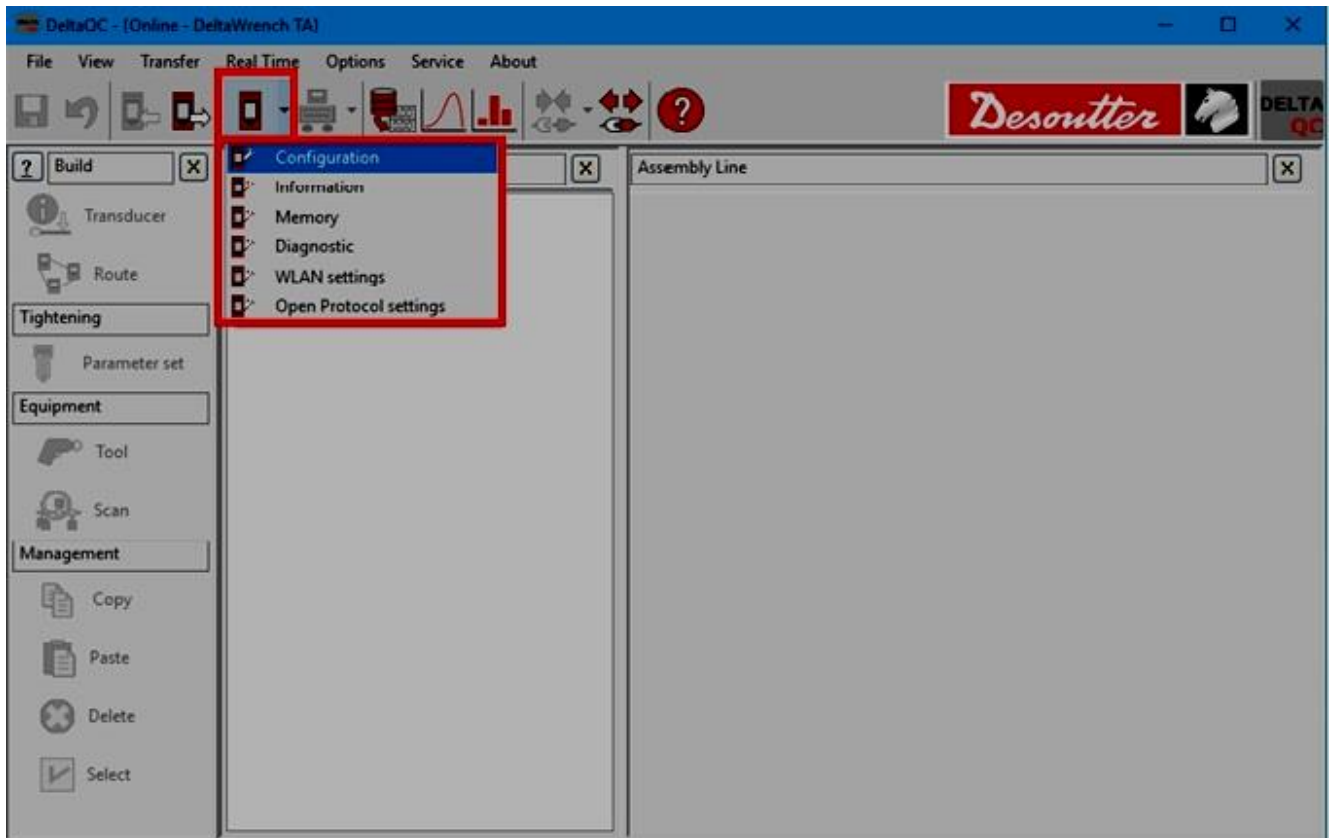




## 8.2 Delta Wrench Controller Setup



The **Controller** icon (active only in *Online mode*) allows the user to enter the instrument settings:

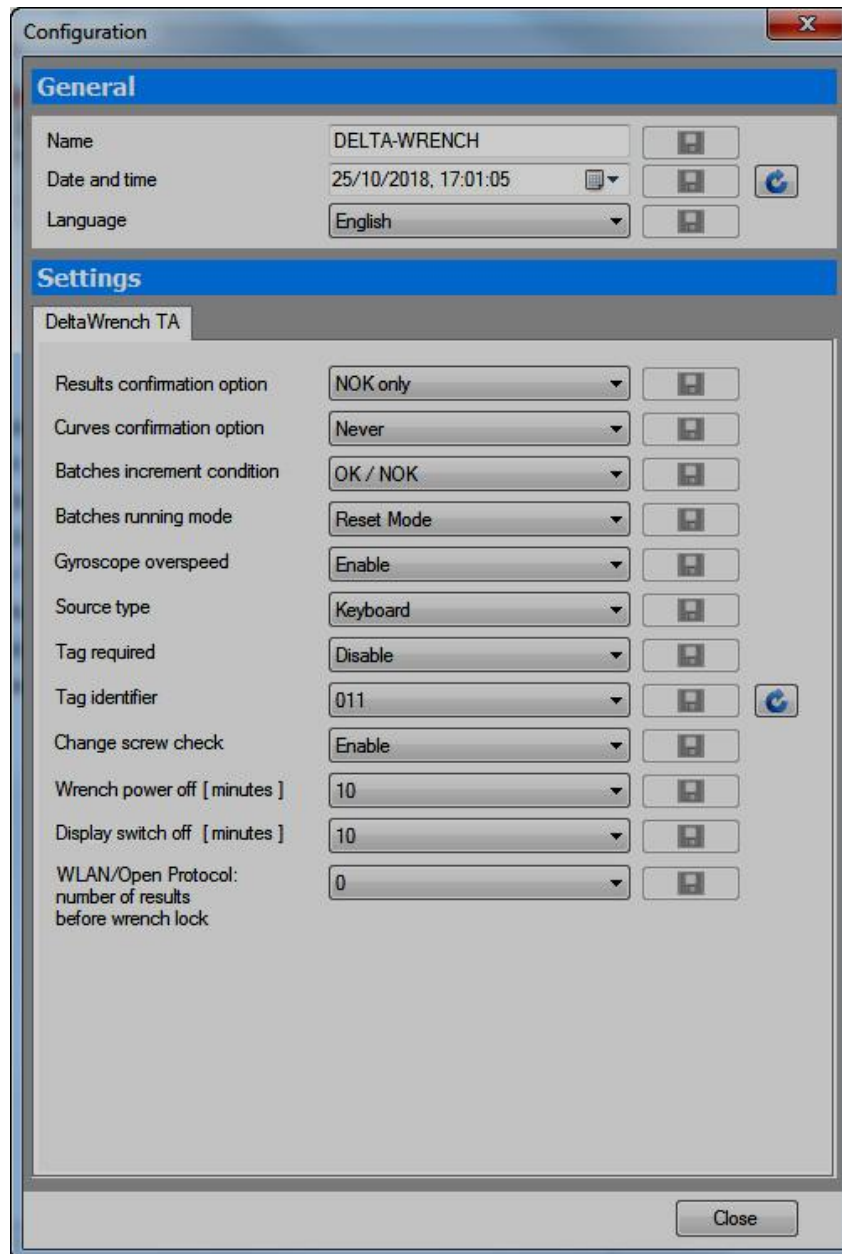


**NOTE:** The Delta Wrench must be connected to the DeltaQC to access this menu.

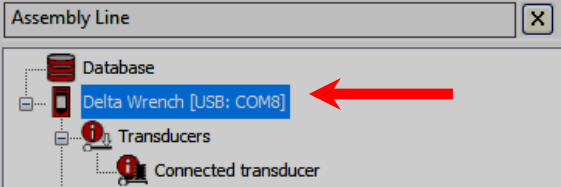


## 8.2.1 Configuration

By selecting the **Configuration** submenu, the following window is shown:




### 8.2.1.1 Delta Wrench name

<p><b>Name</b></p>	<p>Name reported in the Assembly line area of the DeltaQC:</p> 
--------------------	---



### 8.2.1.2 Delta Wrench date and time

<p><b>Date and time</b></p>	<p><i>Date and time</i> shown on the main menu of the Delta Wrench display. These <i>date and time</i> are associated to the tightening results and curves.</p> <p>Click on  to align the Delta Wrench date and time to the date and time of your PC connected to the Delta Wrench.</p>
-----------------------------	--

### 8.2.1.3 Delta Wrench display language

<p><b>Language</b></p>	<p>Select the language of the Delta Wrench menu. This is also possible from the Delta Wrench <i>Settings</i> menu (refer to the paragraph “<i>Settings Menu on Delta Wrench</i>”).</p> <p>The <b>Settings</b> menu on the Delta Wrench display is active only if enabled (refer to the paragraph “<i>Delta Wrench Controller Setup</i>” for further details).</p>
------------------------	---

### 8.2.1.4 Results confirmation options

<p><b>Results confirmation option</b></p>	<p>Select between:</p> <ul style="list-style-type: none"> <li>▪ <b>Never:</b> All the tests executed are acquired as test result.</li> <li>▪ <b>Always:</b> At the end of each test, the Delta Wrench asks if the result must be considered or discarded. If the result is discarded, the batch count (if enabled) is not incremented.</li> <li>▪ <b>NOK only:</b> At the end of each <i>Not OK</i> test, the Delta Wrench asks if the result must be considered or discarded. If the result is discarded, the batch count (if enabled) is not incremented.</li> </ul>
---	--

### 8.2.1.5 Curves confirmation options


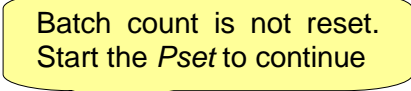
<p><b>Curves confirmation option</b></p>	<p>Select between:</p> <ul style="list-style-type: none"> <li>▪ <b>Never:</b> All the curves are acquired.</li> <li>▪ <b>Always:</b> At the end of each test, the Delta Wrench asks if the curve must be considered or discarded.</li> <li>▪ <b>NOK only:</b> At the end of each <i>Not OK</i> test, the Delta Wrench asks if the curve must be considered or discarded.</li> </ul>
--	---




### 8.2.1.6 Batch increment condition

<b>Batches increment condition</b>	It selects if the batch number for a Pset is incremented only if the result is OK, or if it is incremented anyway, regardless of the result (OK + NOK).
------------------------------------	---

### 8.2.1.7 Batches running mode

<b>Batches running mode</b>	<p>Select between:</p> <ul style="list-style-type: none"> <li>▪ <b>Reset mode:</b> When a batch is quit, the batch count is reset.</li> </ul> <p> <b>NOTE:</b> a warning message asking to confirm the exit from the Pset is displayed. Press <b>OK</b> to exit, or <b>CL</b> to cancel.</p> <ul style="list-style-type: none"> <li>▪ <b>Restore mode:</b> When a batch is quit, the batch count is not reset, and it is possible to continue the batch later:</li> </ul> <p>This parameter is available only for <i>Quality Control strategies</i>.</p> <div data-bbox="608 1010 975 1205" style="border: 1px solid black; padding: 5px; margin: 10px 0;"> <pre> Psets   ▲ Pset 1  ▶ Nm: Target=15.0 Pset 2  ▶ Nm: Min=14.6 Pset 3  ▶ Nm: Max=15.4 Pset 4  ▶ Torque.Time         ▶ Batch=2/5   ▼ ◀ exit          start ▶           </pre> </div> <p> Batch count is not reset. Start the Pset to continue</p>
-----------------------------	--

### 8.2.1.8 Gyroscope overspeed


<b>Gyroscope overspeed</b>	<p>Disabling this option, the Delta Wrench does not show the warning message when the operator exceeds the maximum angular speed during the tightening operation.</p> <p> <b>NOTE:</b> It is recommended to keep this option enabled.</p>
----------------------------	--

### 8.2.1.9 Source type

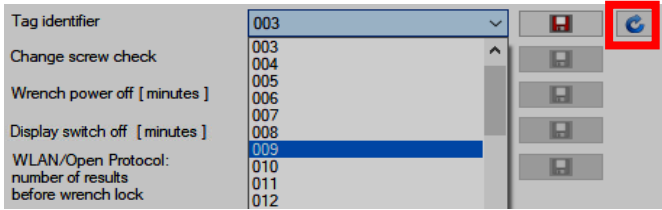
<b>Source type</b>	<p>Select between:</p> <ul style="list-style-type: none"> <li>▪ <b>Keyboard:</b> The Pset to be started is selected by the Delta Wrench keyboard.</li> <li>▪ <b>Tag:</b> The Pset is automatically started inserting the end fitting tool in the Delta Wrench. The Pset number is chosen by the number written in the end fitting tool RFID TAG.</li> <li>▪ <b>WLAN:</b> The Pset is started by the remote device connected via WLAN.</li> </ul>
--------------------	--



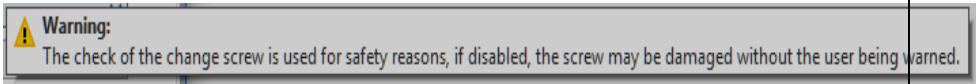
### 8.2.1.10 Tag required

<p><b>Tag required</b></p>	<p>If enabled, the Pset is started only if the end fitting tool plugged into the Delta Wrench is programmed with the <i>tag identifier</i> that matches the Pset number.</p> <p> <b>NOTE:</b> If the <i>Source Type</i> is set to <i>Tag</i>, this option is not considered.</p>
----------------------------	---

### 8.2.1.11 Tag identifier

<p><b>Tag identifier</b></p>	<div data-bbox="683 728 1348 936" data-label="Image">  </div> <p>This parameter shows the number written in the RFID TAG of the end fitting tool. Click on the <b>refresh</b> icon on the right to refresh the parameter in case a new end fitting tool is plugged into the Delta Wrench.</p> <p>It is possible to modify the <i>Tag identifier</i> value by opening the relative drop-down list and selecting the new one according to customer needs.          The <i>Tag identifier drop-down list</i> can range from <b>001</b> to <b>200</b> (refer to the picture on the right).</p>
------------------------------	--

### 8.2.1.12 Change screw check

<p><b>Change screw check</b></p>	<p>This parameter allows enabling or disabling the warning message when the Change screw torque is reached during the execution of a Pset. In the case <b>Change screw check</b> is set to <i>Disable</i>, a popup message is shown on DeltaQC that informs that the operator may damage the tightened screw without receiving any warning:</p> <div data-bbox="564 1668 1544 1751" data-label="Image">  </div>
----------------------------------	---



### 8.2.1.13 Delta Wrench power off [minutes]

<p><b>Wrench power off [minutes]</b></p>	<p>This parameter allows setting the power off timeout.          The available values are:</p> <ul style="list-style-type: none"> <li>• Disabled: Delta Wrench does not switch off if not active.</li> <li>• 5-10-15-30: if not active, Delta Wrench switches off after 5-10-15-30 minutes. Delta Wrench is active in the following cases:             <ul style="list-style-type: none"> <li>○ the operator is navigating in the menu items</li> <li>○ a Pset or a Demo mode tightening is being executed</li> <li>○ Delta Wrench is connected to DeltaQC</li> <li>○ Wi-Fi connection is enabled from DeltaQC</li> </ul> </li> </ul>
--	---

### 8.2.1.14 Delta Wrench display switch off [minutes]

<p><b>Display switch off [minutes]</b></p>	<p>This parameter allows setting the Delta Wrench display switch off timeout.          The available values are:</p> <ul style="list-style-type: none"> <li>• Disabled: Delta Wrench display does not switch off if not active.</li> <li>• 5-10-15-30: if not active, Delta Wrench display switches off after 5-10-15-30 minutes. Delta Wrench is active in the following cases:             <ul style="list-style-type: none"> <li>○ the operator is navigating in the menu items</li> <li>○ a Pset or a Demo mode tightening is being executed.</li> </ul> </li> </ul>
--	--

### 8.2.1.15 WLAN/Open Protocol: number of results before wrench lock

<p><b>WLAN/Open Protocol: number of results before wrench lock</b></p>	<p><u><i>This option is available only for Delta Wrench provided with a WLAN radio module.</i></u></p> <p>When the WLAN radio module is enabled (for further details about how to enable the WLAN radio module, refer to the chapter “<i>WLAN Communication Protocol</i>”), the Delta Wrench can communicate with a remote device via connection without cables.</p> <p>If, during test, the Delta Wrench is out of transmission coverage, the option “<i>WLAN/Open Protocol: number of results before wrench lock</i>” defines the number of results allowed before to completely lock the Delta Wrench.</p> <p>It is possible to set the number of results before wrench lock by selecting among the following options:</p> <ul style="list-style-type: none"> <li>• 0</li> <li>• 50</li> <li>• 100</li> <li>• 250</li> <li>• 500</li> </ul> <p>By default, the number of results before wrench lock is equal to <b>500</b>.</p>
--	--

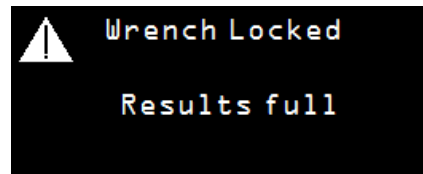


**NOTE:** The option “*WLAN/Open Protocol: number of results before wrench lock*” is disabled if it is set to **0**.



**NOTE:** It is necessary to disable the radio module connection before saving the “*WLAN/Open Protocol: wrench lock*” parameter. The radio module connection is disabled and enabled again automatically.

Once the Delta Wrench gets out of transmission coverage during measurement, and the “*number of results before wrench lock*” is reached, the following Delta Wrench display is shown:



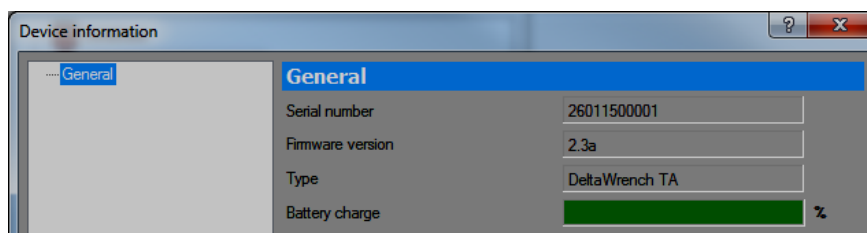
When the Delta Wrench returns within the transmission coverage, the above “*Wrench Locked*” screen is no longer displayed and the measure screen is shown again.



**NOTE:** If the Delta Wrench is locked (out of transmission coverage), no one Pset can start, even if the Delta Wrench is switched off and on again.

## 8.2.2 Information

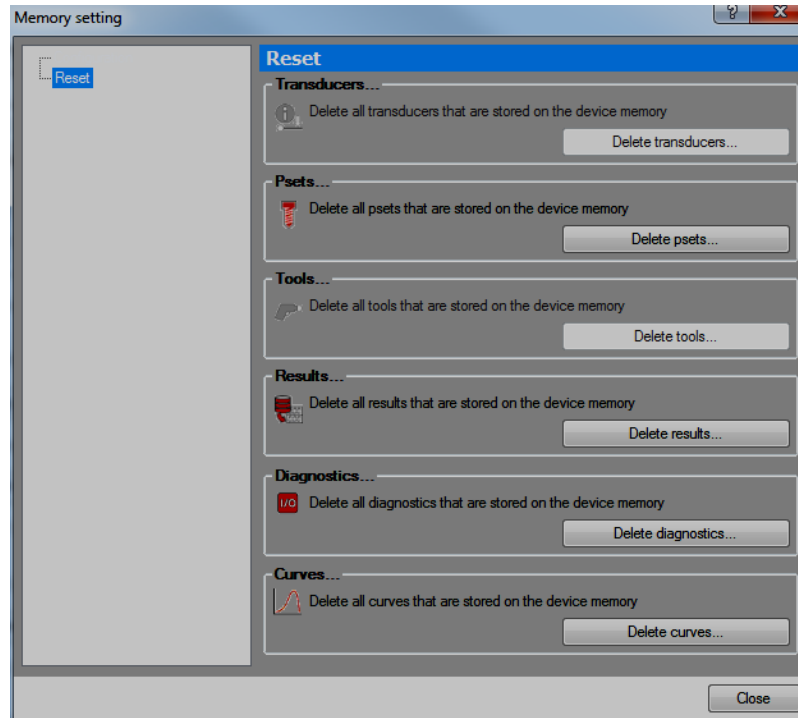
This window provides some general information about the serial number, firmware version, the Type and the Battery charge status:





### 8.2.3 Memory

From this menu it is possible to delete the Psets, the results, the diagnostic results and the curves stored in the Delta Wrench memory:



### 8.2.4 WLAN settings

From this menu it is possible to configure the WLAN radio module (for Delta Wrench models equipped with WLAN radio module). Refer to the paragraph "*WLAN Communication Protocol*" for further details.

### 8.2.5 Open Protocol settings

From this menu it is possible to configure the Open Protocol. It allows a remote device to interface with the Delta Wrench by means of custom-made applications. (Refer to the paragraph "*Working with Open Protocol*" for further details).

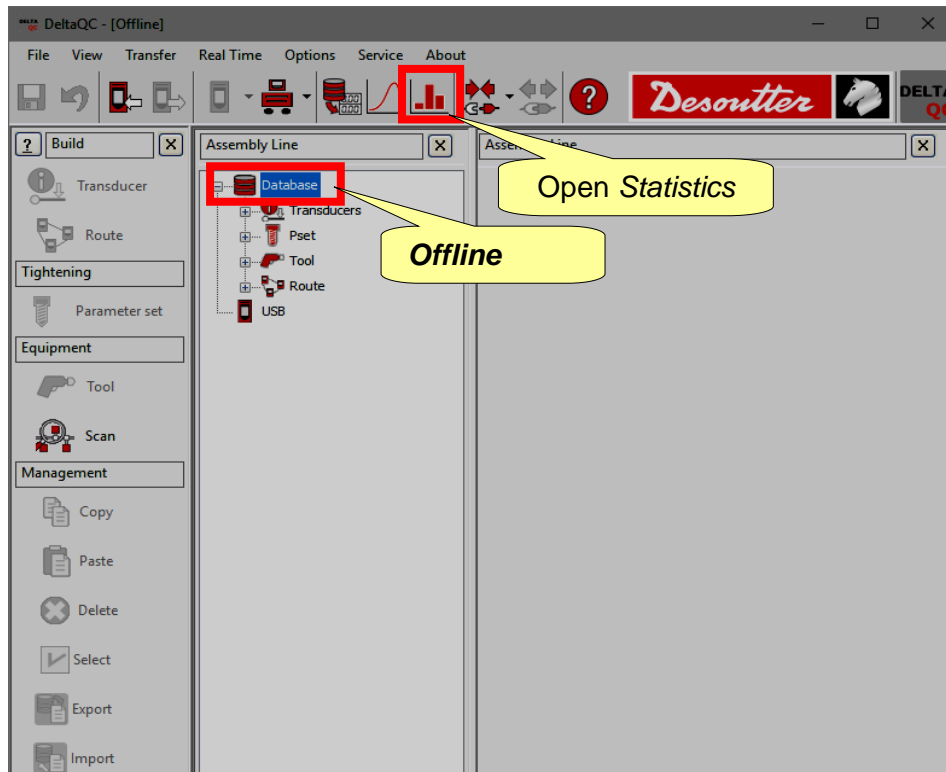




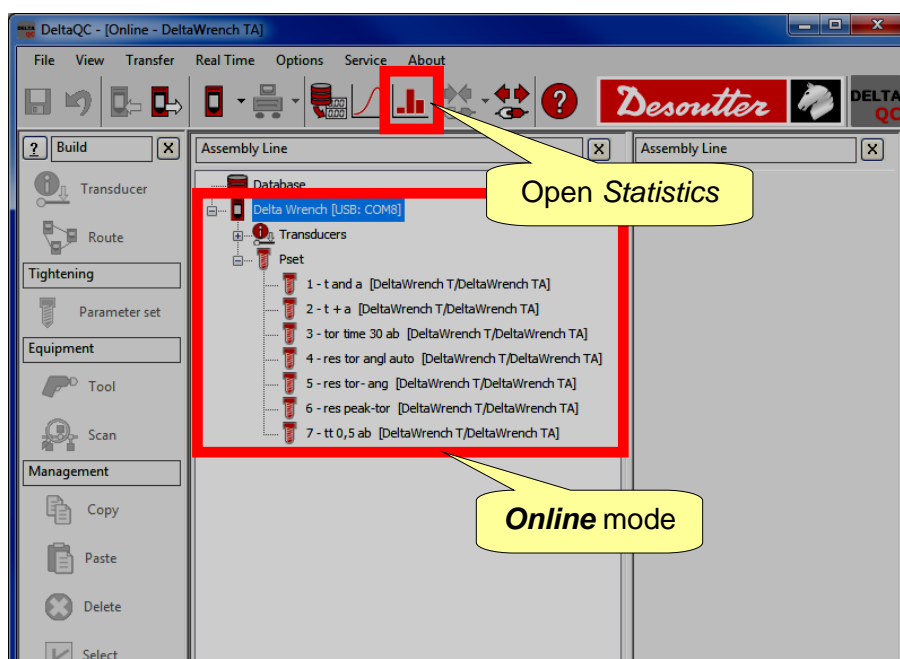
## 9 STATISTICS

Statistics can be calculated either on the results stored into the Delta Wrench or on the results located into the database:

- **Database statistics:** In *Offline* mode, click on *Statistics*:



- **Delta Wrench statistics:** Connect to the Delta Wrench, download the results, and then click on *Statistics*:





When opening the *Statistics* page, the following screen is shown:

Select the **General** folder of this window.

When *offline*, select **Delta Wrench** as device to view statistics from the results produced by the Delta Wrench; if *online*, the device field is automatically set (**Delta Wrench**).

Select the **Measure** (**Torque** or **Angle**) on which to calculate the statistics.

The **Test** type is automatically set to **Quality/Production**.

Select the **Check** (**Cmk/Cpk** or **SPC**).

Select the **Standard** (**ISO**, **CNOMO (E41.32.110N)**, **NF (E 60-181)**, **Normal distribution test (Shapiro-Wilk)**, **Normal distribution test (Chi-Squared)**, **Q544000:2004**, **Q544000:1990**). This field selects the method used to calculate the statistical parameters (refer to the next paragraphs of this chapter for further details about the statistical computation formulas used by the DeltaQC software).

Set the expected value (minimum values acceptable) for the parameters shown in the **Parameters** box.



**NOTE:** In the **Parameters** box, only the parameters applicable to the **Test** and **Standard** type selected are shown.





Once the **General** page is set, select the **Results** page:

**Psets**

Number	Name	Strategy	Torque tolerance (min-max)	Torque ta
1	t and a	Production: Torque & Angle	(5,00 - 32,00)	20,00
1	t and a	Production: Torque & Angle	(10,00 - 32,00)	20,00
2	t + a	Production: Torque + Angle	(5,00 - 25,00)	15,00
2	t + a	Production: Torque + Angle	(5,00 - 30,00)	17,50
2	t + a	Production: Torque + Angle	(10,00 - 30,00)	20,00
4	res auto	Quality: Residual Torque/Angle Auto...	(10,41 - 36,67)	18,54
5	res angolo	Quality: Residual Torque/Angle	(10,41 - 36,67)	18,54
5	res angolo	Quality: Residual Torque/Angle	(10,41 - 36,67)	18,55
6	res picco	Quality: Residual Peak/Torque	(10,41 - 36,67)	18,54
7	tor time	Production: Torque Time	(5,00 - 30,00)	20,00

**Batches of test executed with the selected Pset**

Size	Date time
5	17/07/2015 12:14:16
5	17/07/2015 12:20:12
5	17/07/2015 12:23:42
5	17/07/2015 12:27:24
5	17/07/2015 12:27:34
5	17/07/2015 15:04:10
5	17/07/2015 15:04:35
5	17/07/2015 18:05:52
5	17/07/2015 18:10:12
5	17/07/2015 18:26:43

**Results associated to the selected Batch(es)**

Date time	Device	Strategy	Unit of m...	Torque min	Torque target	Torque	Torque max	Angle min	Angle target	Angle	Angle max
17/07/2015 12:20:07	DeltaWre...	Production: Tor...	Nm	10,00	20,00	12,692	32,00	5,0	502,5	13,9	1000,0
17/07/2015 12:20:12	DeltaWre...	Production: Tor...	Nm	10,00	20,00	16,406	32,00	5,0	502,5	19,2	1000,0
17/07/2015 12:27:34	DeltaWre...	Production: Tor...	Nm	10,00	20,00	8,541	32,00	5,0	502,5	3,8	1000,0
17/07/2015 15:03:08	DeltaWre...	Production: Tor...	Nm	10,00	20,00	8,572	32,00	5,0	502,5	13,4	1000,0
17/07/2015 15:03:12	DeltaWre...	Production: Tor...	Nm	10,00	20,00	10,296	32,00	5,0	502,5	11,9	1000,0
17/07/2015 15:03:42	DeltaWre...	Production: Tor...	Nm	10,00	20,00	11,835	32,00	5,0	502,5	17,5	1000,0
17/07/2015 15:03:47	DeltaWre...	Production: Tor...	Nm	10,00	20,00	12,330	32,00	5,0	502,5	16,1	1000,0
17/07/2015 15:04:10	DeltaWre...	Production: Tor...	Nm	10,00	20,00	11,494	32,00	5,0	502,5	15,3	1000,0
17/07/2015 15:04:31	DeltaWre...	Production: Tor...	Nm	10,00	20,00	14,217	32,00	5,0	502,5	19,1	1000,0
17/07/2015 15:04:35	DeltaWre...	Production: Tor...	Nm	10,00	20,00	12,570	32,00	5,0	502,5	18,3	1000,0

Select a **Pset**.

Select one or more **Batches** containing the results of the tests executed with the selected **Pset**. Note that a multiple selection is allowed only for batches with same **Size** (shown on the column on the right).

In **Results** section select the results to be used to calculate the statistics. When all of the batches are selected, highlighting a batch makes all of the related results highlighted automatically, and it is possible to select all of them:

**Results of the highlighted batch automatically highlighted**

**Highlight a Batch**

**Click here to select all of the highlighted results**



To select all the results shown in the window above, right-click on one of it and select **Select all**:

**Results:**

Date time	Device	Strategy	Unit of m...	Torque min	Torque target	Torque	Torque max	Angle min	Angle target	Angle	Angle max
17/07/2015 12:20:07	DeltaWre...	Product...		10,00	20,00	12,692	32,00	5,0	502,5	13,9	1000,0
17/07/2015 12:20:12	DeltaWre...	Product...		10,00	20,00	16,406	32,00	5,0	502,5	19,2	1000,0
17/07/2015 12:27:34	DeltaWre...	Product...		10,00	20,00	8,541	32,00	5,0	502,5	3,8	1000,0
17/07/2015 15:03:08	DeltaWre...	Product...		10,00	20,00	8,572	32,00	5,0	502,5	13,4	1000,0
17/07/2015 15:03:12	DeltaWre...	Production: Tor...	Nm	10,00	20,00	10,296	32,00	5,0	502,5	11,9	1000,0
17/07/2015 15:03:42	DeltaWre...	Production: Tor...	Nm	10,00	20,00	11,835	32,00	5,0	502,5	17,5	1000,0
17/07/2015 15:03:47	DeltaWre...	Production: Tor...	Nm	10,00	20,00	12,330	32,00	5,0	502,5	16,1	1000,0
17/07/2015 15:04:10	DeltaWre...	Production: Tor...	Nm	10,00	20,00	11,494	32,00	5,0	502,5	15,3	1000,0
17/07/2015 15:04:31	DeltaWre...	Production: Tor...	Nm	10,00	20,00	14,217	32,00	5,0	502,5	19,1	1000,0
17/07/2015 15:04:35	DeltaWre...	Production: Tor...	Nm	10,00	20,00	12,570	32,00	5,0	502,5	18,3	1000,0



**NOTE:** Results with one of the following messages in the *Result details* column

- *Overload detected*
- *Re-hit detected*

can not be included into statistics. For this reason, they can not be selected.

After having set the **Results** page, select the **Values** page to load and show the results:

General Results **Values** Statistics

#	Min Tolerance	Target Value	Torque	Angle	Max Tolerance	Date time
1	10,00	20,00	18,432		32,00	17/07/2015 12:02:23
2	10,00	20,00	11,639		32,00	17/07/2015 12:08:14
3	10,00	20,00	6,306		32,00	17/07/2015 12:08:19
4	10,00	20,00	10,067		32,00	17/07/2015 12:08:22
5	10,00	20,00	13,822		32,00	17/07/2015 12:14:16
6	10,00	20,00	12,692		32,00	17/07/2015 12:20:07
7	10,00	20,00	16,406		32,00	17/07/2015 12:20:12
8	10,00	20,00	7,096		32,00	17/07/2015 12:23:34
9	10,00	20,00	5,322		32,00	17/07/2015 12:23:36
10	10,00	20,00	6,161		32,00	17/07/2015 12:23:38
11	10,00	20,00	5,552		32,00	17/07/2015 12:23:39
12	10,00	20,00	5,983		32,00	17/07/2015 12:23:42
13	10,00	20,00	8,608		32,00	17/07/2015 12:27:05
14	10,00	20,00	10,232		32,00	17/07/2015 12:27:07
15	10,00	20,00	7,720		32,00	17/07/2015 12:27:12
16	10,00	20,00	8,523		32,00	17/07/2015 12:27:14
17	10,00	20,00	8,585		32,00	17/07/2015 12:27:24
18	10,00	20,00	8,541		32,00	17/07/2015 12:27:34
19	10,00	20,00	8,572		32,00	17/07/2015 15:03:08
20	10,00	20,00	10,296		32,00	
21	10,00	20,00	11,835		32,00	
22	10,00	20,00	12,330		32,00	
23	10,00	20,00	11,494		32,00	
24	10,00	20,00	14,217		32,00	
25	10,00	20,00	12,570		32,00	
26	10,00	20,00	12,712		32,00	
27	10,00	20,00	16,050		32,00	

Torque or Angle values are shown according to what is selected in the **General** page



**NOTE:** After any change in the previous windows is made (for instance, changing the statistic type or including different batches), click again on this folder to load the relevant results that are shown in the next folder (**Statistics**).

Right-click on the table to copy in the clipboard the results selected:

General Results Values **Statistics**

#	Min Tolerance	Target Value	Torque	Angle	Max Tolerance	Date time
1	10,00	20,00	18,432		32,00	17/07/2015 12:02:23
2	10,00	20,00	11,639		32,00	17/07/2015 12:08:14
3	10,00	20,00	6,306		32,00	17/07/2015 12:08:19
4	10,00	20,00	10,067		32,00	17/07/2015 12:08:22
5	10,00	20,00	13,822		32,00	17/07/2015 12:14:16
6	10,00	20,00	12,692		32,00	17/07/2015 12:20:07
7	10,00	20,00	16,406		32,00	17/07/2015 12:20:12
8	10,00	20,00	7,096		32,00	17/07/2015 12:23:34
9	10,00	20,00	5,322		32,00	17/07/2015 12:23:36
10	10,00	20,00	6,161		32,00	17/07/2015 12:23:38
11	10,00	20,00	5,552		32,00	17/07/2015 12:23:39

Right-click to copy the results selected

Copy selected lines to clipboard ...



Once the three previous pages have been properly set, the statistics and reports (for the selected results) are shown in the **Statistics** page:

The folder is selected automatically

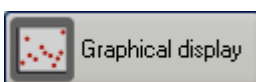
Statistics

Remarks

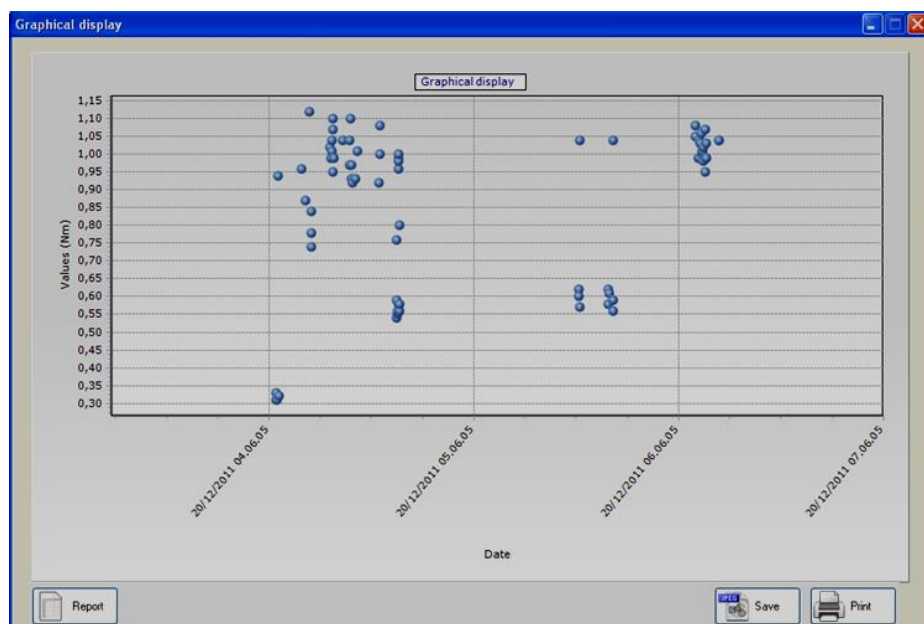
Graphs

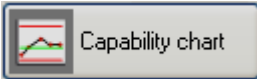
This window selects automatically the folder ISO, CNOMO, NF or Normal Distribution, according to what has been chosen previously (in the **General** page). The main window shows the statistics associated to the results (refer to the paragraph “*Statistical Computation*” for further details).

In the bottom part of the above screen, the user can choose one of four graphs. In each graph it is possible to zoom an area by selecting it with the mouse, and browse the zoomed view by right-clicking and moving the mouse.

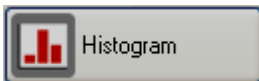
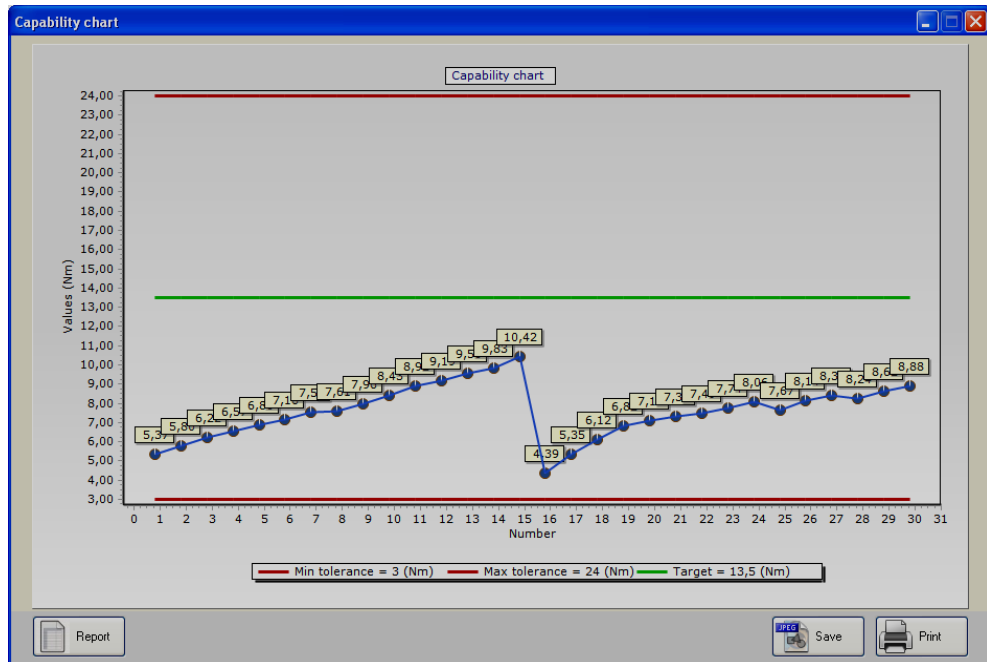


The **Graphical display** shows all the results versus the date of the test:

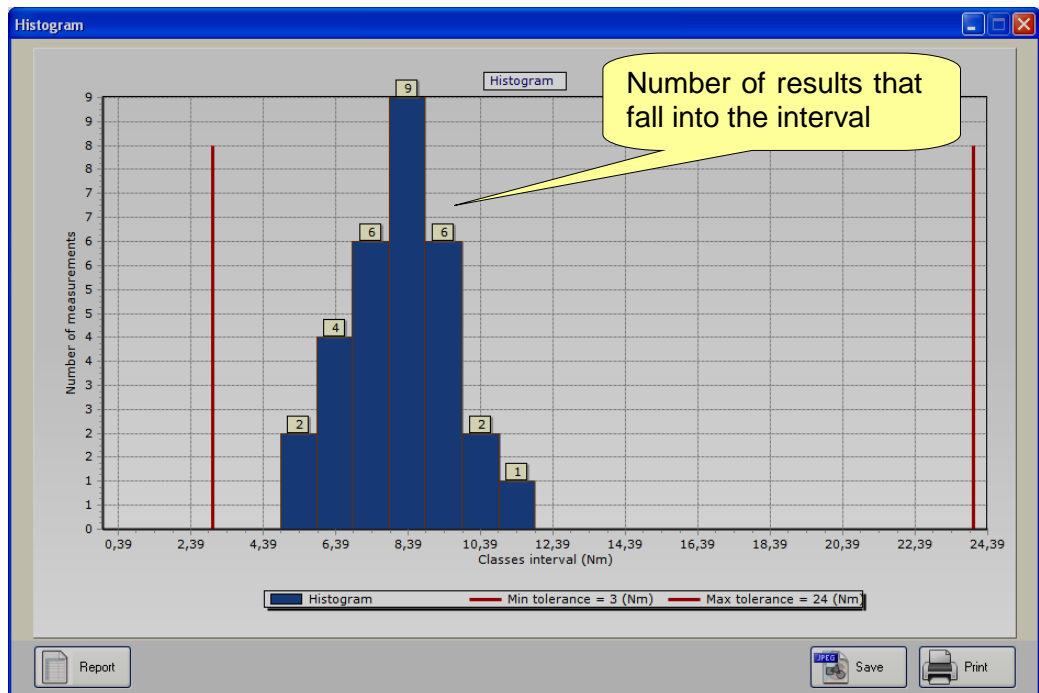


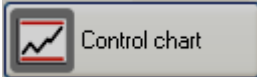


The **Capability chart** shows all the results in sequence:



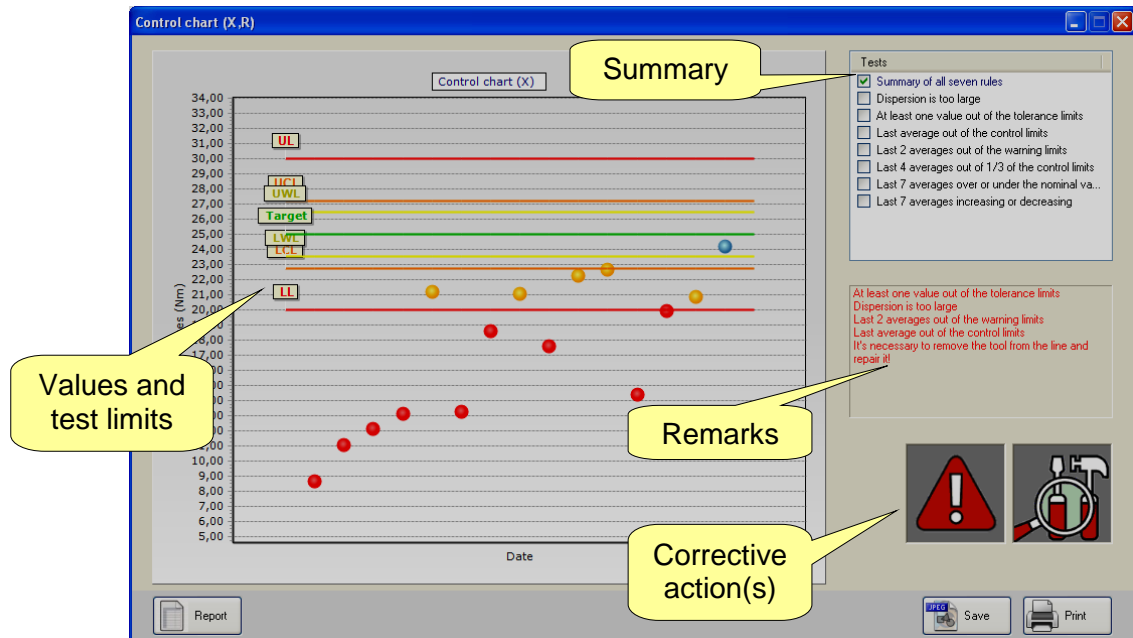
The **Histogram** shows all the results in a histogram graph detailing how many results fall into a certain interval:





Control chart

The **Control chart** shows the X,R graphs for the statistic control tests:



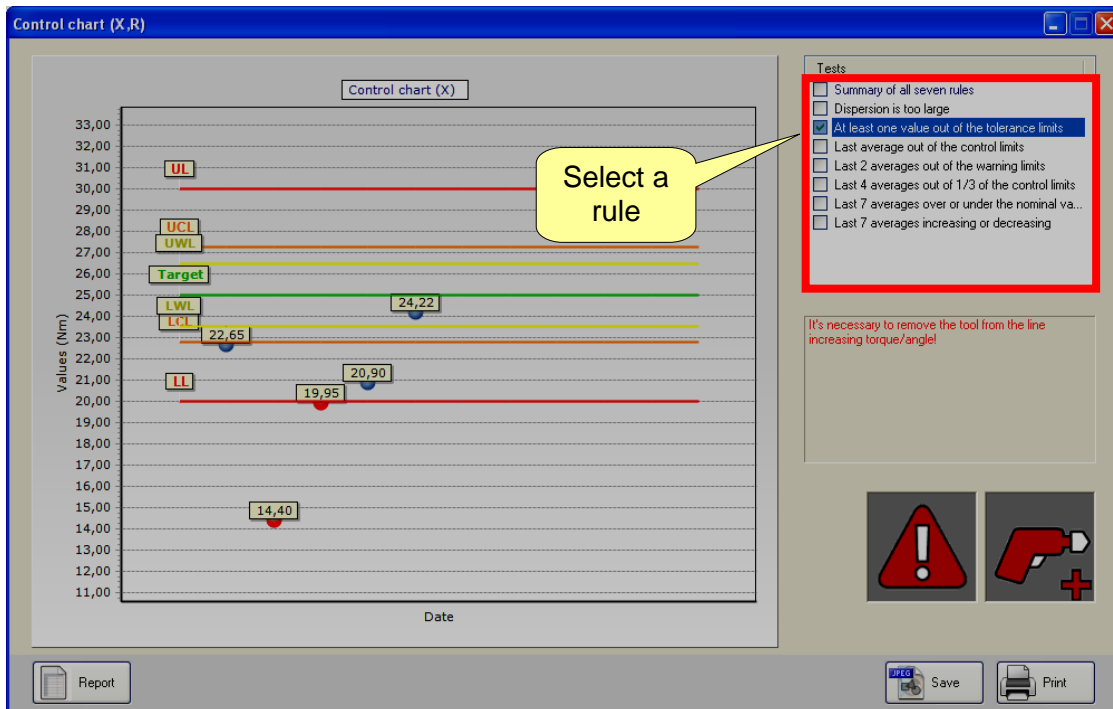
The summary shows all the results with the test target and limits values (note that if a set of tests was performed in a Cm-Cmk test having batch number over ten, only the last ten results of that batch are considered).

On the right the **Remarks** box details which rule(s) has been failed the test.

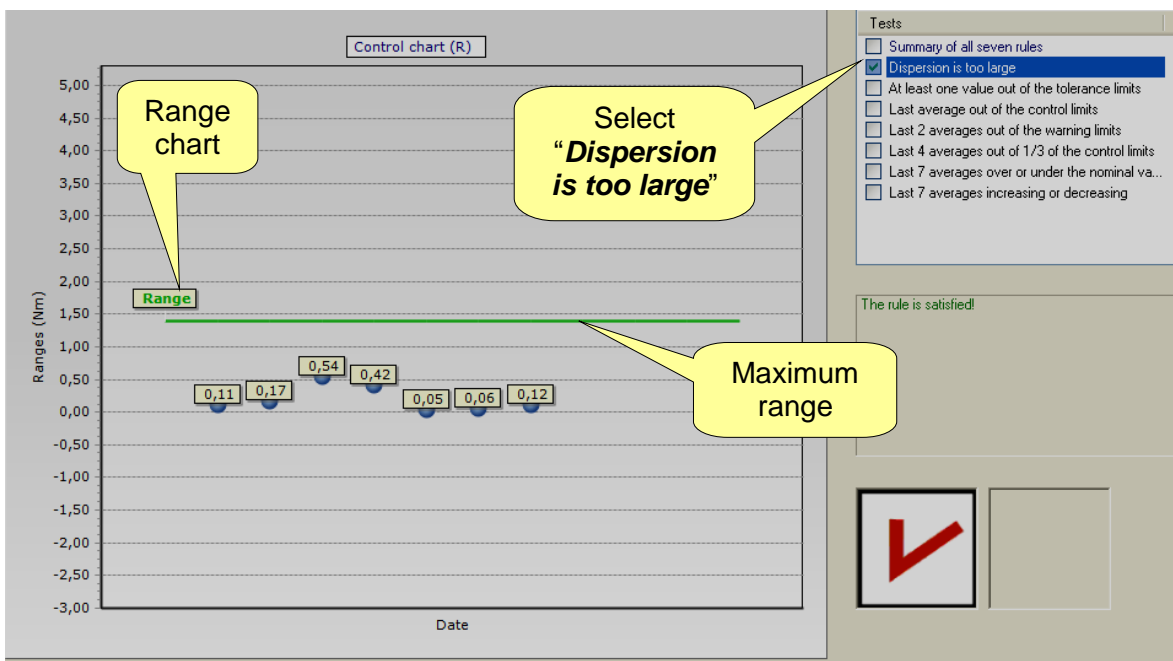
The **Corrective action** icons show if the tool/process is OK, or if it needs to be recalibrated increasing or decreasing the torque. The exclamation mark is shown when the values are out of the tolerance limit; if the exclamation mark is not shown the corrective action should be taken to prevent errors, but the tool/process is still within the tolerance limits.



By selecting only one statistic control rule and not the summary, the graph shows only the relevant data:



By selecting the “*Dispersion is too large*” rule, the R (range) graph is shown:



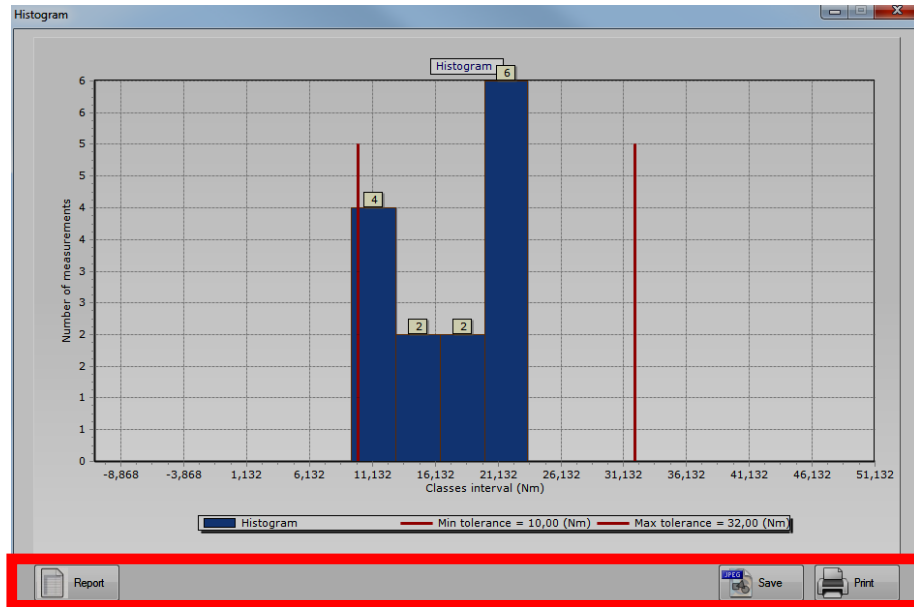
In the above chart the result is **OK** if the last range is within the range limit.





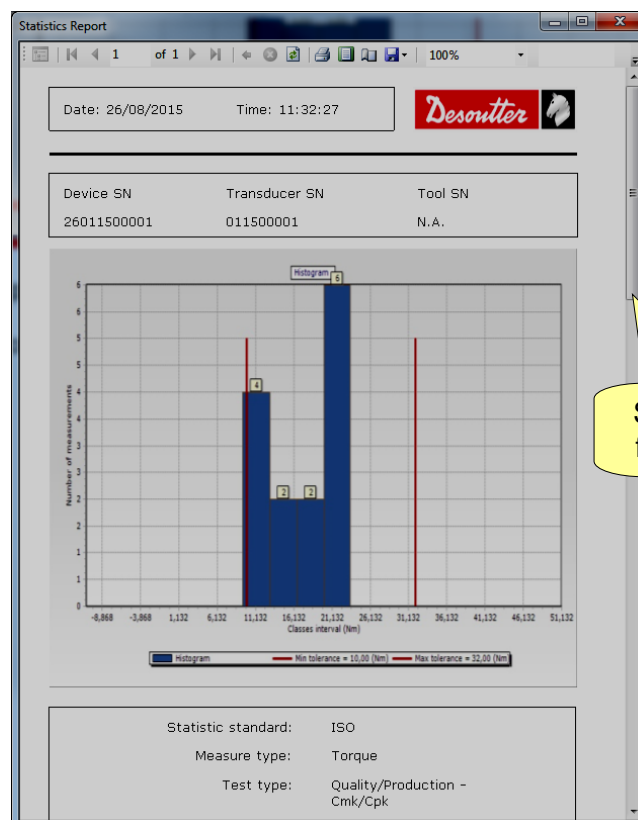
## 9.1 Exporting the Graph

Each graph shown above provides few commands to create/export/print the report:



Click on **Save** to export the graph into a JPEG file, or **Print** to print the graph.

Click on **Report** to create the following report:



This report shows detailed information about the results. The toolbar in the upper area of this report provides commands to print the report, or to export it into an Excel or PDF file.



## 9.2 Statistical Computation

### 9.2.1 CNOMO standard E41.32.110N

#### Instantaneous standard deviation: $\sigma_i$

Estimated from the mean range  $\bar{W}$  of the samples of 5 measurements which form the population.

$$\sigma_i = \frac{\bar{W}}{d5}$$

Where:

$$\bar{W} = \frac{\sum W}{K}$$

W = range of measurements on each sample = max. value - min. value

K = number of samples of 5 measurements

$$d5 = 2.326 - \frac{1.645 \times 0.864}{\sqrt{K}}, \text{ coefficient for a 95\% confidence threshold.}$$

#### Instantaneous dispersion: $D_i$

$$D_i = 6 \times \sigma_i$$

Process capability: CAM

$$CAM = \frac{IT}{D_i}$$

Where:

IT (Tolerance Interval) = Max. tolerance - Min. tolerance

#### Testing the homogeneity of the population:

Each sample of measurements W must comply with:

$$\bar{W} < 0.643 \times \frac{IT}{CAMcdc}$$





**Standard deviation:  $\sigma$**

$$\sigma = \sqrt{\frac{\sum_{i=1}^N (x_i - \bar{x})^2}{N-1}}$$

Where:

$$\bar{x} = \frac{\sum_{i=1}^N x_i}{N} \text{ (population mean)}$$

$x_i$  = population value

N = number of measurements of the population

**Corrected overall standard deviation:  $\sigma_0$**

$$\sigma_0 = C \times \sigma$$

Where:

C is a function of the number of samples:

Number of samples	Coefficient C
3	1.51
4	1.41
5	1.34
6	1.28
7	1.26
8	1.24
9	1.22
10	1.21
11	1.19
12	1.18
13	1.17
14	1.17
15	1.16
16	1.15
17	1.15
18	1.14
19	1.14
20 to 22	1.13
23 to 25	1.12
26 to 31	1.11
32 to 35	1.10
36 to 44	1.09
45 to 51	1.08





### Coefficient of position and dispersion: C<sub>pk</sub>

$$C_{pk} = \min \left[ \frac{Tol_{\max} - \bar{X}}{3\sigma_0}, \frac{\bar{X} - Tol_{\min}}{3\sigma_0} \right]$$

The station is “capable” if the CAM is higher than the “specified CAM”.

The setting is correct if the C<sub>pk</sub> is higher than the “specified C<sub>pk</sub>”.

## 9.2.2 ISO standard

### Standard deviation: $\sigma$

$$\sigma = \sqrt{\frac{\sum_{i=1}^N (x_i - \bar{x})^2}{N-1}}$$

Where:

$$\bar{x} = \frac{\sum_{i=1}^N x_i}{N} \quad (\text{population mean})$$

$x_i$  = population value

N = number of measurements of the population

### Process Capability: C<sub>p</sub>

$$C_p = \frac{IT}{6\sigma}$$

Where:

IT (Tolerance Interval) = Max. tolerance - Min. tolerance

$\sigma$  = Standard deviation

### Coefficient of position and dispersion: C<sub>pk</sub>

$$C_{pk} = \min \left[ \frac{Tol_{\max} - \bar{X}}{3\sigma}, \frac{\bar{X} - Tol_{\min}}{3\sigma} \right]$$





### 9.2.3 NF standard E 60-181

$s_{ie}$  = estimator of the intrinsic standard deviation for each mode number, where  $2 \leq e \leq k$ , and  $k$  is the number of samples.

$$S_{ie} = \sqrt{\frac{\sum_{i=1}^N (x_{ie} - \bar{x}_e)^2}{N-1}}; \bar{x}_e = \frac{\sum_{i=1}^N x_{ie}}{N} \text{ (where N is the size of the sample)}$$

$$S_i = \sqrt{\frac{1}{k} \sum_{e=1}^k S_{ie}^2}; D_i = 6 \times S_i$$

$$CAM = \frac{IT}{D_i} \text{ (where IT (Tolerance Interval) = Max. tolerance - Min. tolerance)}$$

$$S_p = \sqrt{\frac{\sum_{i=1}^N (x_i - \bar{x})^2}{N-1}}; \bar{x} = \frac{\sum_{i=1}^N x_i}{N}$$

$$C_{pk} = \min \left[ \frac{Tol_{\max} - \bar{X}}{3\sigma}, \frac{\bar{X} - Tol_{\min}}{3\sigma} \right]$$

$$Cap = \frac{IT}{6S_p}$$

### 9.2.4 Normal Distribution Test: Population under 50 measurements (Shapiro-Wilk test)

1) Calculation of  $S^2$ :

$$S^2 = \sum_{i=1}^N (x_i - \bar{x})^2 \text{ (where } \bar{x} = \frac{\sum_{i=1}^N x_i}{N} \text{ and N is the number of measurements of the population)}$$



2) Calculation of b:

$$b = \sum_{i=1}^K a_i \times d_i$$

Where:  $d_i = X_{N-i+1} - X_i$

$a_i$ : See table below

$K=N/2$  if  $N$  is even, and  $K=(N-1)/2$  if  $N$  is odd

I/N	15	20	25	30	35	40	45	50
1	0.5150	0.4734	0.4450	0.4254	0.4096	0.3964	0.3850	0.3751
2	0.3306	0.3211	0.3069	0.2944	0.2834	0.2737	0.2635	0.2574
3	0.2495	0.2565	0.2543	0.2487	0.2427	0.2368	0.2313	0.2260
4	0.1878	0.2085	0.2148	0.2148	0.2127	0.2098	0.2065	0.2032
5	0.1353	0.1686	0.1822	0.1870	0.1883	0.1878	0.1865	0.1847
6	0.0880	0.1334	0.1539	0.1630	0.1673	0.1691	0.1695	0.1691
7	0.0433	0.1013	0.1283	0.1415	0.1487	0.1526	0.1545	0.1554
8	0.0000	0.07111	0.1046	0.1219	0.1317	0.1376	0.1410	0.1430
9		0.0422	0.0823	0.1036	0.1160	0.1237	0.1286	0.1317
10		0.0140	0.0610	0.0862	0.1013	0.1108	0.1170	0.1212
11		0.0000	0.0403	0.0697	0.0873	0.0986	0.1062	0.1113
12			0.0200	0.0537	0.0739	0.0870	0.0959	0.1020
13			0.0000	0.0381	0.0610	0.0759	0.0860	0.0932
14				0.0227	0.0484	0.06510	0.0765	0.0846
15				0.0076	0.0361	0.0546	0.0673	0.0764
16				0.0000	0.0239	0.0444	0.0584	0.0685
17					0.0119	0.0343	0.0497	0.0608
18					0.0000	0.0244	0.0412	0.0532
19						0.0146	0.0328	0.0459
20						0.0049	0.0245	0.0386
21						0.0000	0.0163	0.0314
22							0.0081	0.0244
23							0.0000	0.0174
24								0.0104
25								0.0035



3) Calculation of W:

$$W = \frac{b^2}{S^2}$$

Could be a 5% probability that there is not a normal distribution if W is lower than W95 given in the following table:

N	W95
15	0.881
20	0.905
25	0.918
30	0.927
35	0.934
40	0.940
45	0.945
50	0.947

### 9.2.5 Normal Distribution Test: Population under 50 measurements (Chi-Squared test)

- 1) Distribute into classes of at least 4 or 5 measurements
- 2) Calculate the mean and standard deviation mean:

$$\bar{x} = \frac{\sum_{i=1}^N x_i}{N}$$

Standard deviation:

$$\sigma = \sqrt{\frac{\sum_{i=1}^N (x_i - \bar{x})^2}{N - 1}}$$

- 3) Calculate for each class limit  $l_i$ :

$$u_i = \frac{l_i - \bar{x}}{\sigma}$$



4) Calculate:

$$\chi_i = \sum \frac{(n_i - n'_i)^2}{n'_i}$$

Where:

$n$  = number of measurements in class  $i$

$n'$  = theoretical number of measurements for a normal distribution

$$n'_i = N[F(u_i) - F(u_{i-1})]$$

$F(u_i)$ : Reduced table of normal distribution

There is a 5% probability of not having a normal distribution if  $\chi^2$  is higher than  $\chi^2$  given in table below:

<b>d</b>	$\chi^2$
1	3.84
2	5.99
3	7.81
4	9.49
5	11.07
6	12.59
7	14.07
8	15.51
9	16.92
10	18.31
11	19.67
12	21.03
13	22.36
14	23.68
15	25.00
16	26.30
17	27.59
18	28.87
19	30.14
20	31.41







## 9.2.6 Q544000

### Q544000\_1990:

The **dispersion** for the j-th group is calculated as follows:

$$W_j = Max_j - Min_j$$

Where:

Max<sub>j</sub> is the maximum value in the samples of the j-th group.

Min<sub>j</sub> is the minimum value in the samples of the j-th group.

The **average value** of the W<sub>j</sub> is calculated as follows:

$$\bar{W} = \frac{\sum W_j}{K}$$

The  $\sigma_i$  is calculated as follows:

$$\sigma_i = \frac{\bar{W}}{dn^*}$$

Where:

dn\* is calculated from the following table based on the number of samples:

N	dn*	C
10	0.500	1.64
12	0.555	1.55
14	0.598	1.48
16	0.632	1.43
18	1.097	1.40
20	1.412	1.37
24	1.468	1.32
28	1.521	1.30
30	1.746	1.28
35	1.789	1.26
40	1.824	1.24
50	1.877	1.21

And  $\sigma_i$  refers to the whole set of samples.



The  $\sigma_0$  is calculated as follows:

$$\sigma_0 = C \cdot \sigma$$

Where:

C is given in the table above

$$\sigma = \sqrt{\frac{1}{N-1} \sum_{i=1}^N (X_i - \bar{X})^2}$$



**NOTE:**  $\sigma_0$  is used as threshold for  $\sigma_i$ ; if  $\sigma_i$  is greater than  $\sigma_0$ , then  $\sigma_1 = \sigma_0$

CAM is calculated as follows:

$$CAM = \frac{UTL - LTL}{6\sigma_i}$$

Where:

LTL is the lower tolerance limit

UTL is the upper tolerance limit

The  $C_{mk}$  is calculates as follows:

$$C_{mk} = \min \left[ \frac{UTL - X_m}{3\sigma_0}, \frac{X_m - LTL}{3\sigma_0} \right]$$

Where  $X_m$  is the average of the sample

#### **Q544000\_2004:**

The **dispersion** for the j-th group is calculated as follows:

$$W_j = Max_j - Min_j$$

Where:

$Max_j$  is the maximum value in the samples of the j-th group.

$Min_j$  is the minimum value in the samples of the j-th group.

The **average value** of the  $W_j$  is calculated as follows:

$$\bar{W} = \frac{\sum W_j}{K}$$





The  $\sigma_i$  is calculated as follows:

$$\sigma_i = \frac{\bar{W}}{dn}$$

Where dn is calculated from the following table based on the number of samples:

N	dn
10 ÷ 16	1.128
18	1.693
20 ÷ 28	2.059
30 ÷ 100	2.326
110 ÷ 5000	3.078



**NOTE:**  $\sigma_i$  refers to the whole set of samples.

CAM is calculated as follows:

$$CAM = \frac{UTL - LTL}{6\sigma_i}$$

Where

LTL is the lower tolerance limit

UTL is the upper tolerance limit

The average of the  $M_j$  is calculated as follows:

$$M_j = \frac{\sum X_{ij}}{N}$$

Where:

$X_{ij}$  is the  $i$ -th sample of the  $j$ -th group.

Considering  $M_{\min}$  and  $M_{\max}$  as the minimum and maximum averages, the  $C_{mk}$  is calculated as follows:

$$C_{mk} = \min \left[ \frac{M_{\min} - LTL}{3\sigma}, \frac{UTL - M_{\max}}{3\sigma} \right]$$



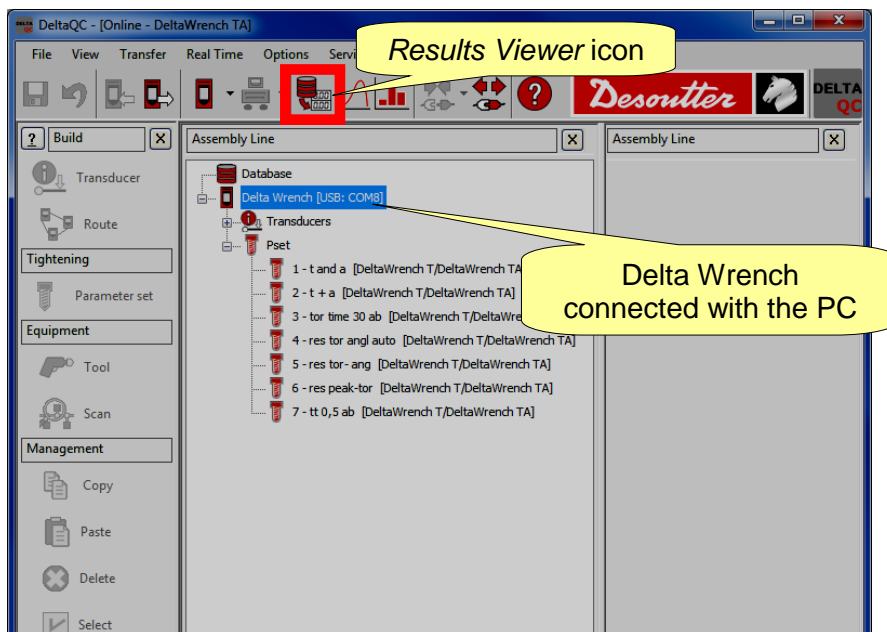
## 10 RESULTS VIEWER



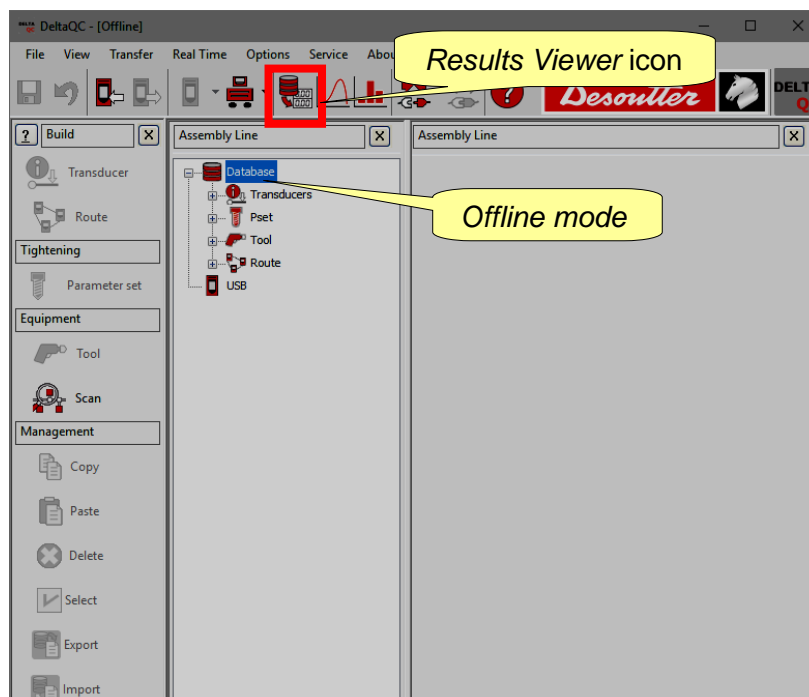
The **Results Viewer** function allows the user to retrieve the results from the Delta Wrench or from the database.

The Delta Wrench can store up to 1000 results; when the memory is full the new results overwrite the oldest results stored.

To view the results stored on the Delta Wrench, connect the instrument to the DeltaQC and click on the *Result Viewer* icon:

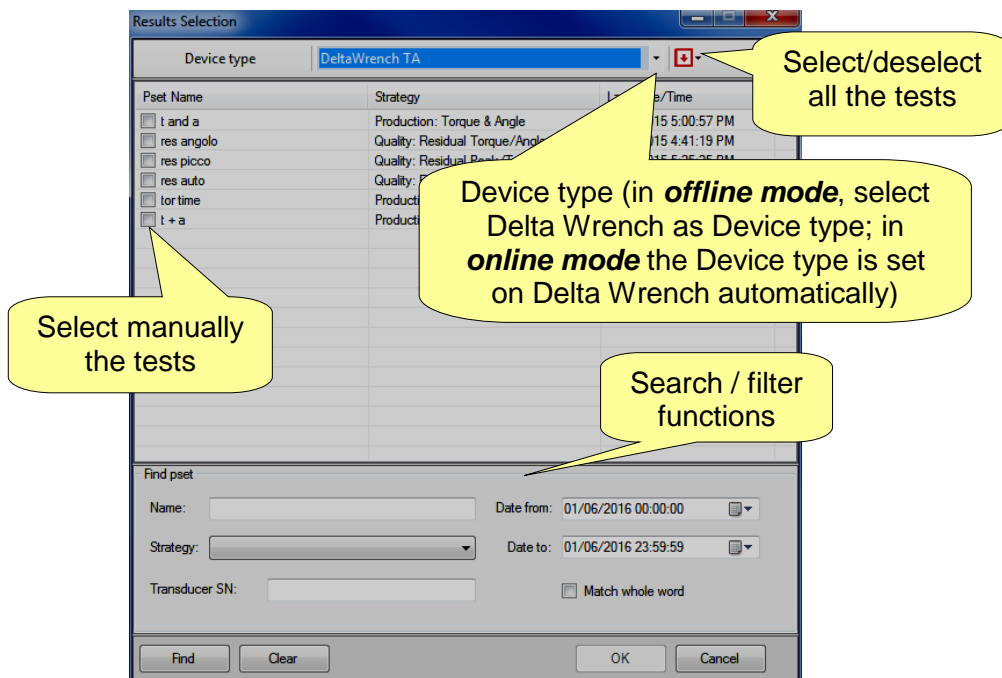


To view the results downloaded from the Delta Wrench and stored in the database, work in *Offline mode*:



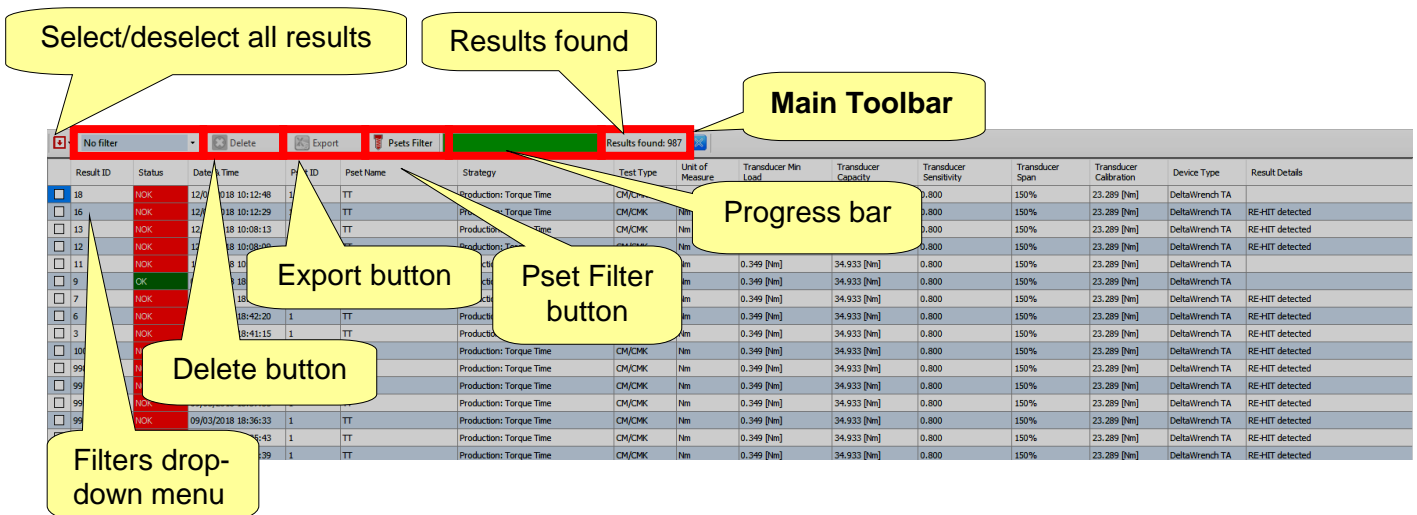


When clicking on the **Results Viewer** icon, the following screen is shown:



Select the **Device type** (when working *offline*, otherwise the instrument connected is automatically selected) and the tests to be reviewed. Finally click on **OK**.

The following "**Results Viewer page**" is shown:



Click on a column heading to organize the results according to the column selected.

All the information related to the tightening operation is displayed in the whole set of columns.

When working connected with the *Delta Wrench*, if a *Pset* has been deleted after the test execution, the related row is marked as "**deleted**".

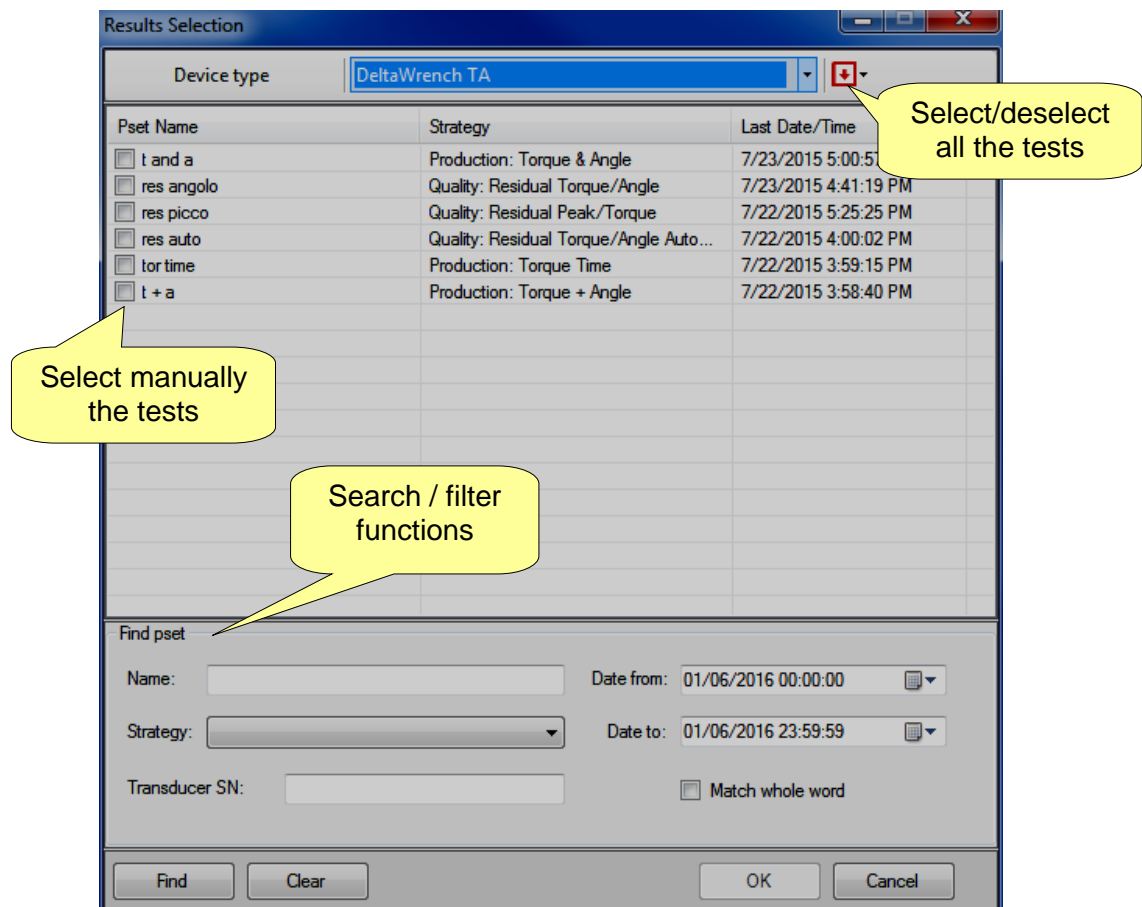


The *Main Toolbar* (refer to the above screen) allows the user to customize the **Results Viewer** page. Furthermore, it provides important data.

The “*Filters drop-down menu*” (refer to the above screen), filters the results according to customer needs. It is possible to display the results after selecting among the following options: **No Filter**, **Status OK**, **Status KO**, **Torque status OK**, **Torque status KO**, **Angle status OK**, **Angle status KO**.

The “*Pset Filter*” button (refer to the above screen), allows the user to filter the results according to the test that made them.

After clicking on “*Pset Filter*” button, the following pop-up is shown:



Select the test to be reviewed and click on **OK**.

The “*Progress bar*” and the “*Results found*” options provide important data related to the results.

The “*Progress bar*” (refer to the above screen) is a graphical control element used to visualize the progression of the results downloaded: when it is totally green, all the results are downloaded.

The “*Results found*” option (refer to the above screen) indicates the number of results either performed (*Online mode*) or stored into the database (*Offline mode*).

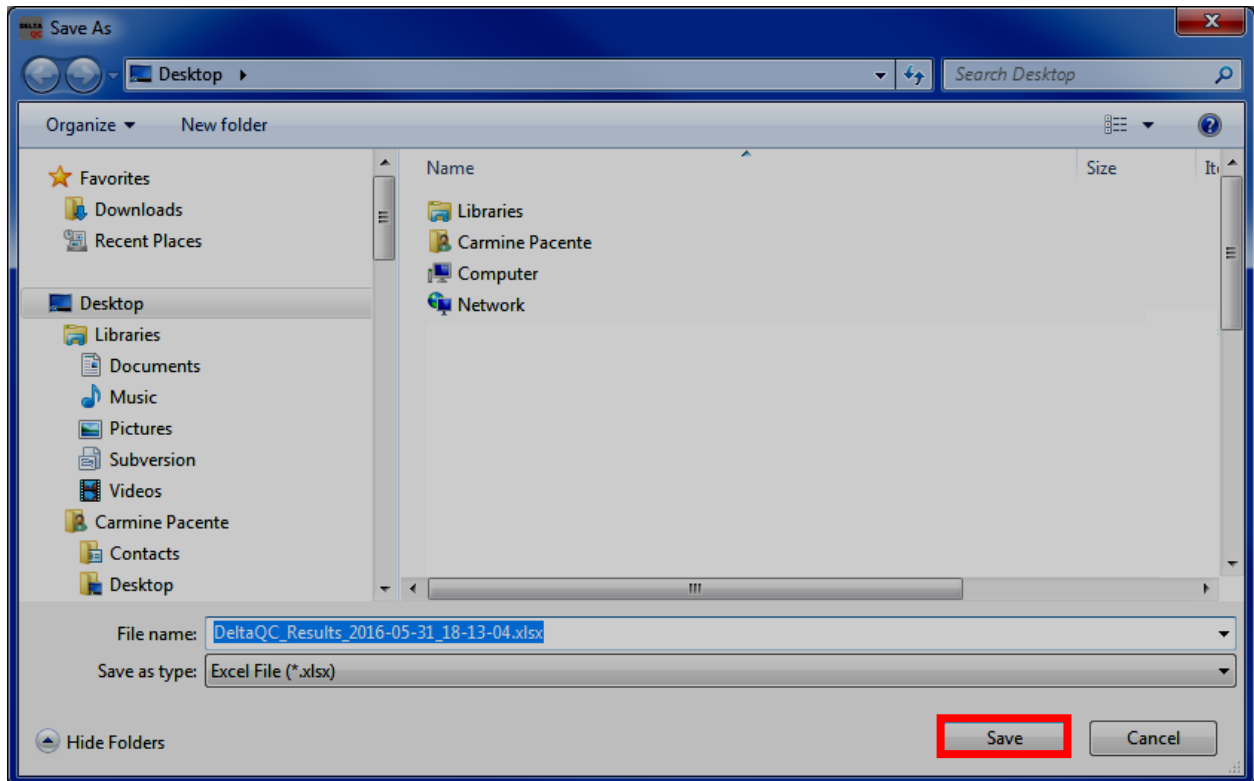
The “*Delete*” button (refer to the above screen) discards the selected item(s).



**NOTE:** The “*Delete*” button is available ONLY working in *Offline mode*.



The “Export” button (refer to the above screen) allows the user to save the results list in an Excel (.xlsx) file. Manually select the result(s) to be saved. Then click on “Export” button; the following window is shown:



The File name is automatically assigned, even if it is editable according to customer needs. Select the Destination Folder and click on **Save**. The Excel file is automatically open:

Result ID	Status	Date & Time	Pset ID	Pset Name	Strategy	Test Type	Unit of Measure	Torque Status	Torque Result	Torque Peak	Cycle Start	Torque Min
193	OK	7/23/2015 5:00:57 PM	1 t and a		Production: Torque & Angle	CM/CMK	Nm	OK	16.85		5	10
192	OK	7/23/2015 5:00:50 PM	1 t and a		Production: Torque & Angle	CM/CMK	Nm	OK	10.709		5	10
191	OK	7/23/2015 5:00:42 PM	1 t and a		Production: Torque & Angle	CM/CMK	Nm	OK	16.468		5	10
190	OK	7/23/2015 5:00:31 PM	1 t and a		Production: Torque & Angle	CM/CMK	Nm	OK	13.507		5	10
189	OK	7/23/2015 5:00:27 PM	1 t and a		Production: Torque & Angle	CM/CMK	Nm	OK	17.346		5	10
188	OK	7/23/2015 4:59:49 PM	1 t and a		Production: Torque & Angle	CM/CMK	Nm	OK	12.748		5	10
187	OK	7/23/2015 4:59:41 PM	1 t and a		Production: Torque & Angle	CM/CMK	Nm	OK	13.035		5	10
186	OK	7/23/2015 4:59:33 PM	1 t and a		Production: Torque & Angle	CM/CMK	Nm	OK	11.182		5	10
185	OK	7/23/2015 4:59:11 PM	1 t and a		Production: Torque & Angle	CM/CMK	Nm	OK	14.759		5	10
183	OK	7/23/2015 4:40:44 PM	1 t and a		Production: Torque & Angle	CM/CMK	Nm	OK	18.13		5	10
182	NOK	7/23/2015 4:35:45 PM	1 t and a		Production: Torque & Angle	CM/CMK	Nm	OK	10.069		5	10
181	NOK	7/23/2015 4:32:20 PM	1 t and a		Production: Torque & Angle	CM/CMK	Nm	LOW	9.396		5	10
180	NOK	7/23/2015 4:28:34 PM	1 t and a		Production: Torque & Angle	CM/CMK	Nm	LOW	6.961		5	10
179	NOK	7/23/2015 4:28:28 PM	1 t and a		Production: Torque & Angle	CM/CMK	Nm	LOW	5.823		5	10
178	OK	7/23/2015 4:28:25 PM	1 t and a		Production: Torque & Angle	CM/CMK	Nm	OK	10.02		5	10
163	NOK	7/23/2015 4:24:47 PM	1 t and a		Production: Torque & Angle	CM/CMK	Nm	OK	14.46		5	10
162	NOK	7/23/2015 4:24:22 PM	1 t and a		Production: Torque & Angle	CM/CMK	Nm	OK	13.592		5	10
161	NOK	7/23/2015 4:23:51 PM	1 t and a		Production: Torque & Angle	CM/CMK	Nm	LOW	9.114		5	10
160	NOK	7/23/2015 4:23:31 PM	1 t and a		Production: Torque & Angle	CM/CMK	Nm	LOW	7.403		5	10
159	OK	7/23/2015 4:23:15 PM	1 t and a		Production: Torque & Angle	CM/CMK	Nm	OK	18.329		5	10
158	NOK	7/23/2015 4:15:49 PM	1 t and a		Production: Torque & Angle	CM/CMK	Nm	OK	14.932		5	10



The **Results Viewer** page shows a group of records (organized in columns) that meet the search criteria set by the customer.

The most important columns are summarized in the following table:

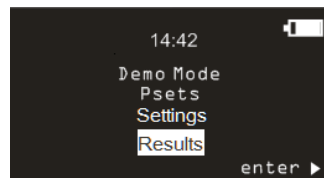
<b>Pset number</b>	The Pset number is defined in the Pset data.
<b>Status</b>	This is the global status of the test. It is <i>OK</i> when the result has been detected according to the thresholds and limits specified, and if the torque does not exceed the maximum transducer overload.
<b>Torque Status</b>	<p>These fields indicate the result for the torque. If the result is within the torque limits, the status is <b>OK</b>.</p> <p>If the <i>Check Type</i> in the Pset parameters is set to <i>Angle</i>, the torque status is marked as <i>OK</i> regardless the torque is inside or outside the torque limits specified in the Pset.</p> <p>If the torque goes over the maximum transducer overload the result is marked as <b>HIGH</b>. With reference to the <i>Result details</i> field, an overload result is marked with the "Overload detected" message.</p>
<b>Angle Status</b>	<p>These fields indicate the result for the angle. If the result is within the angle limits the status is <b>OK</b>.</p> <p>If the <i>Check Type</i> in the Pset parameters is set to <i>Torque</i>, the angle status is marked as <i>OK</i> regardless the angle is inside or outside the torque limits specified in the Pset.</p>
<b>Result number</b>	<p>Progressive number automatically assigned by the Delta Wrench to every tightening result.</p> <p><b>Min value: 1</b> <b>Max value: 1000</b></p> <p>When 1000 results are stored in the Delta Wrench memory, the new results overwrite the oldest starting from result number <b>1</b>.</p>
<b>Strategy</b>	Type of test executed.
<b>Torque peak</b>	For <i>Residual Torque/Angle</i> and <i>Residual Torque/Angle Automatic</i> strategies, it indicates the maximum torque reached during the test.
<b>Torque result and Angle results</b>	Torque and angle values measured by the Delta Wrench.
<b>Date / Time</b>	Fields indicating the date and time of the tightening operation. Date and time are taken from the date and time set on the Delta Wrench.
<b>Batch status</b>	<p>If the batch size is zero, the <i>Batch status</i> is always OK.</p> <p>If the batch size is one or more, the <i>Batch status</i> is OK when all the Psets of the batch are OK.</p>
<b>Unit of Measurement</b>	Unit of measurement.





<b>Result details</b>	<p>This field explains the reason for a <i>Not OK</i> test. For example, the following messages can be shown:</p> <ul style="list-style-type: none"> <li>• <i>Overload detected</i>: during the tightening, a value higher than the maximum transducer overload is reached</li> <li>• <i>Re-hit detected</i>: during the tightening, the torque reaches the <i>Min. Torque value</i> in an angle lower or equal to the <b>Check RE-HIT</b>. To show this message, the <b>Check RE-HIT</b> option must be enabled (see for details the <i>Options</i> paragraph).</li> <li>• <i>Overspeed detected</i>: during the tightening, the maximum angle speed is exceeded.</li> </ul>
<b>Drag Torque (Min, Max and Average)</b>	<p>For <i>Production: Prevailing Torque – Automatic compensation</i> strategy, this field indicates the torque result of the first stage of the strategy. The <i>Drag torque</i> value depends on the option <i>Min, Max</i> or <i>Average</i> selected in the Pset.</p>
<b>Breakaway Torque</b>	<p>Valid only for <i>Quality: Residual Torque/Angle Automatic</i> strategy.          If detected, this field indicates the breakaway result reached during the test.</p>

The last ninety-nine results can be also shown on the Delta Wrench display. Select **Results** in the main menu of the Delta Wrench:



For each result, the following fields are shown:

- Pset name
- Result status (OK/NOK)
- Torque value
- Torque measurement unit
- Angle value (if available)
- Date / time
- Current batch index (if the Pset is a part of a batch)

By keeping pressed the UP or DOWN keys for at least one second, the results are scrolled with an increasing speed. When a result row is selected, by keeping pressed the key for at least one second, information of these results is scrolled with an increasing speed.



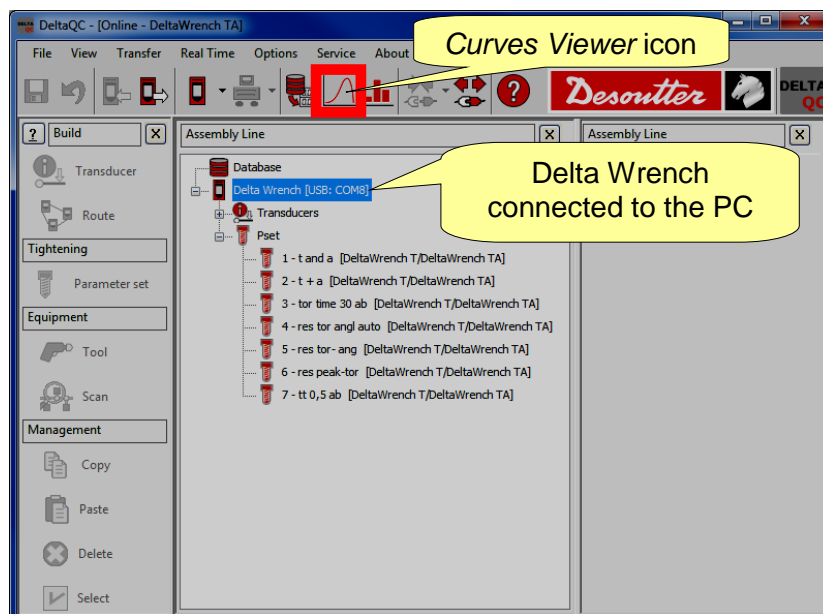
# 11 CURVES VIEWER



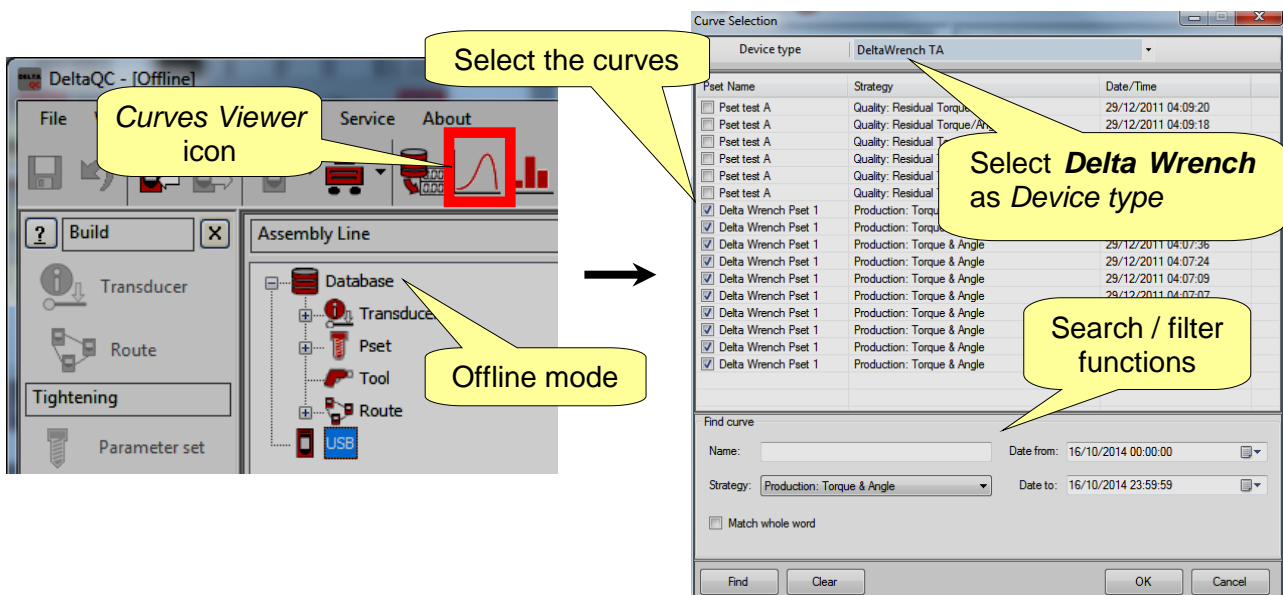
Click on the **Curves Viewer** icon to retrieve the curve from the Delta Wrench or from the database.

The Delta Wrench can store up to **25 curves** (the maximum time length allowed per each curve is equal to 30 seconds); when the memory is full, the new curves overwrite the oldest ones stored.

To view the curves stored on the Delta Wrench, connect the instrument to the DeltaQC and select the **Curves Viewer** icon (refer to the screen below):



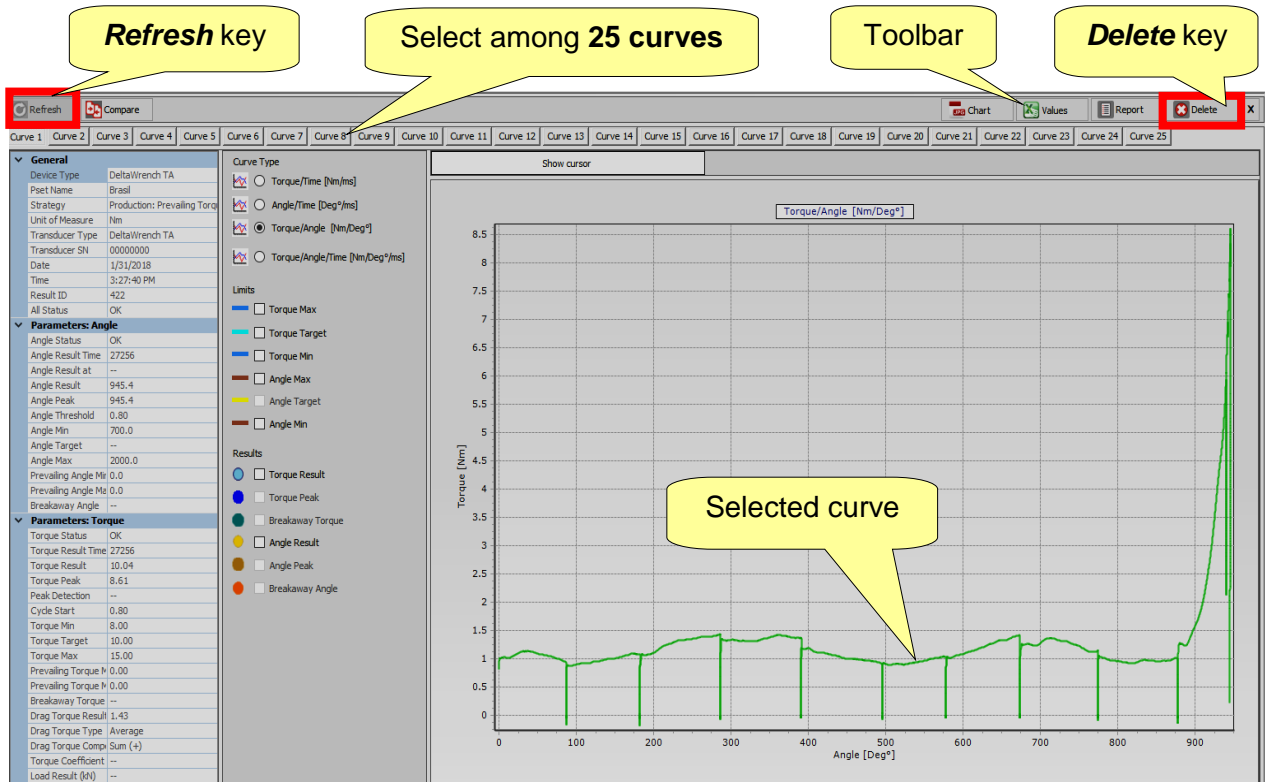
Working in offline mode it is possible to display the curves downloaded from the Delta Wrench and stored in the database (refer to the paragraph "Transfer online data to the database"). An additional window is shown, to select up to **25 curves**:





## 11.1 View One Curve

Select the curve to display by clicking on the bar placed at the top of the following screen:

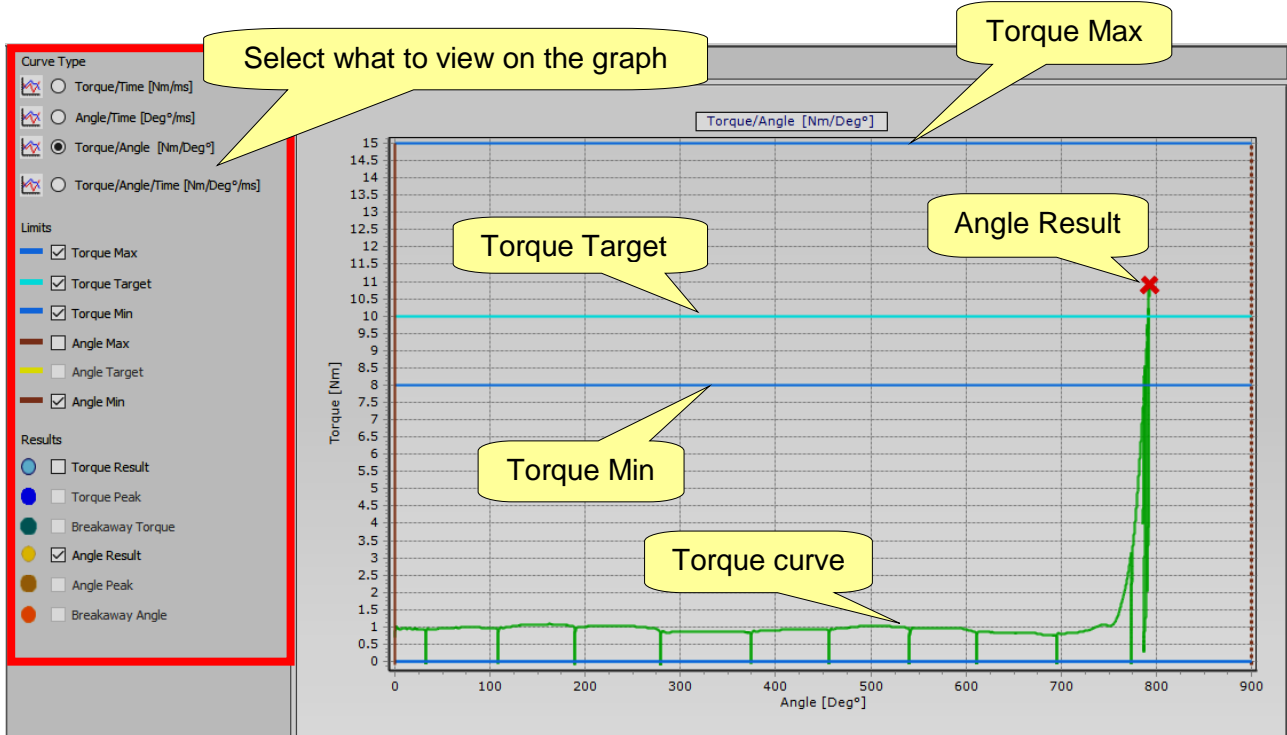


When the Delta Wrench is connected to the DeltaQC Software (**online** mode), the last curve performed can be recognized by the “**(LAST)**” placed close to the *curve number*. The **Refresh** key (placed on the left upper corner of the above screen) refreshes the window in case a new curve is available.

When the Delta Wrench is not connected with the DeltaQC Software (**offline** mode), the **Delete** key (placed on the right upper corner of the above screen) is available.



In the **Curve Type**, **Limits** and **Results** areas it is possible to select what to display on the graph:

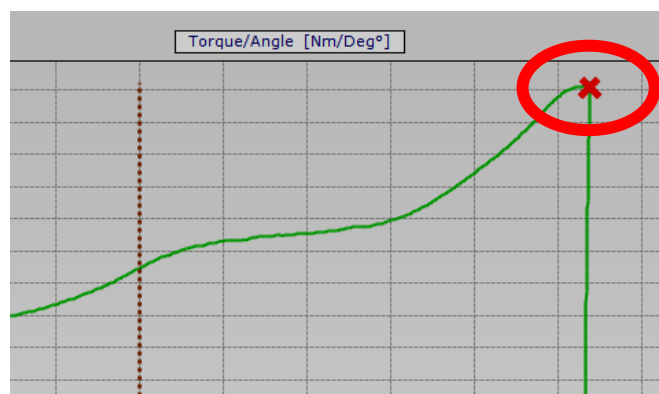


**NOTE:** The **Torque peak** option (placed in **Results** area) is available only for *Residual Torque/Angle* and *Residual Torque/Angle Automatic* strategies.

It is possible to select the *Torque curve*, *Angle curve*, *Torque/Angle curve* or both *Torque* and *Angle curve* on the same graph.

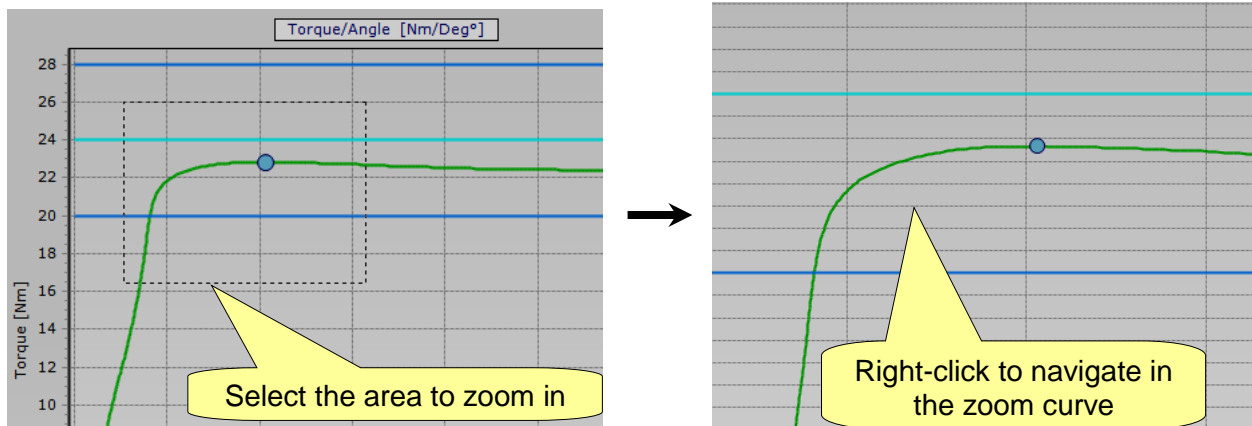
If limits and results are enabled, they are shown in the graph.

The **Result** indicates (on the curve) the point where it is taken. If the result is *Not OK*, it will be marked with a red X (refer to the example below):



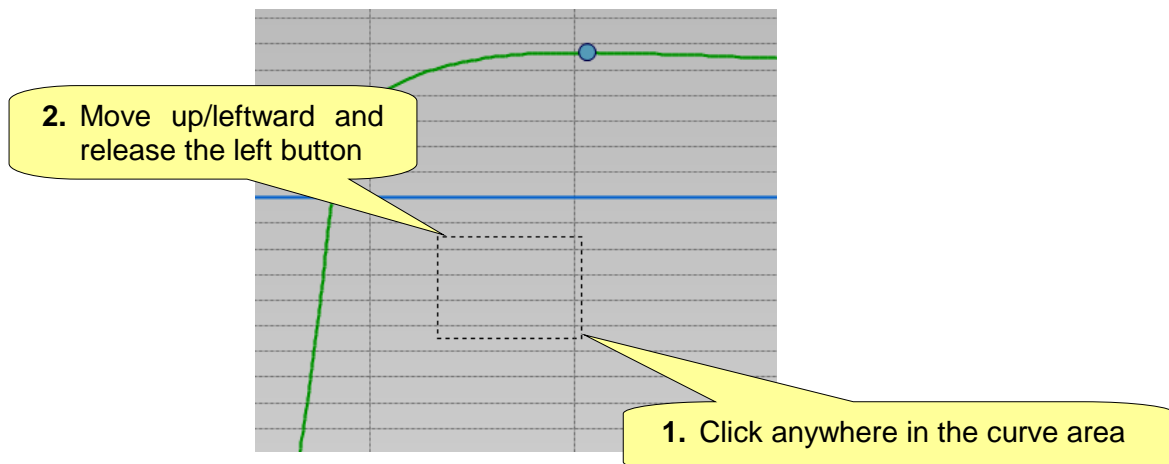


To zoom in on a section of the curve, simply select the desired area with the mouse:



While zoomed in, to navigate the graph right-click on the curve and move the mouse pointer on the graph.

To zoom out to the whole curve, press the left button of the mouse, move the cursor up/leftward, and release the left button:

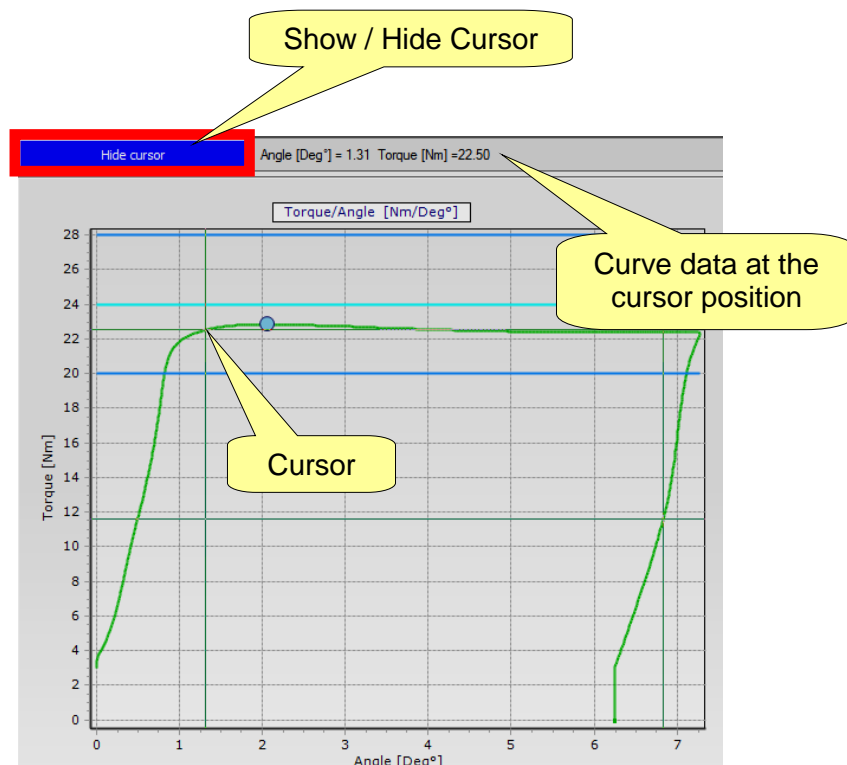




The curve parameters are shown on the left side:

<b>General</b>	
Device Type	DeltaWrench TA
Pset Name	Brasil
Strategy	Production: Prevailing T
Unit of Measure	Nm
Transducer Type	DeltaWrench TA
Transducer SN	00000000
Date	31/01/2018
Time	14:53:18
Result ID	417
All Status	NOK
<b>Parameters: Angle</b>	
Angle Status	LOW
Angle Result Time	22772
Angle Result at	--
Angle Result	819.5
Angle Peak	819.6
Angle Threshold	0.41
Angle Min	1000.0
Angle Target	--
Angle Max	9999.0
Prevailing Angle Min	0.0
Prevailing Angle Max	720.0
<b>Parameters: Torque</b>	
Torque Status	HIGH
Torque Result Time	22772
Torque Result	12.94
Torque Peak	11.65
Peak Detection	--
Cycle Start	0.41
Torque Min	8.00
Torque Target	10.00
Torque Max	12.00
Prevailing Torque Min	1.00
Prevailing Torque Max	2.50
Drag Torque Result	1.29
Drag Torque Type	Minimum
Drag Torque Comp	Sum (+)
Torque Coefficient	--
Load Result (kN)	--



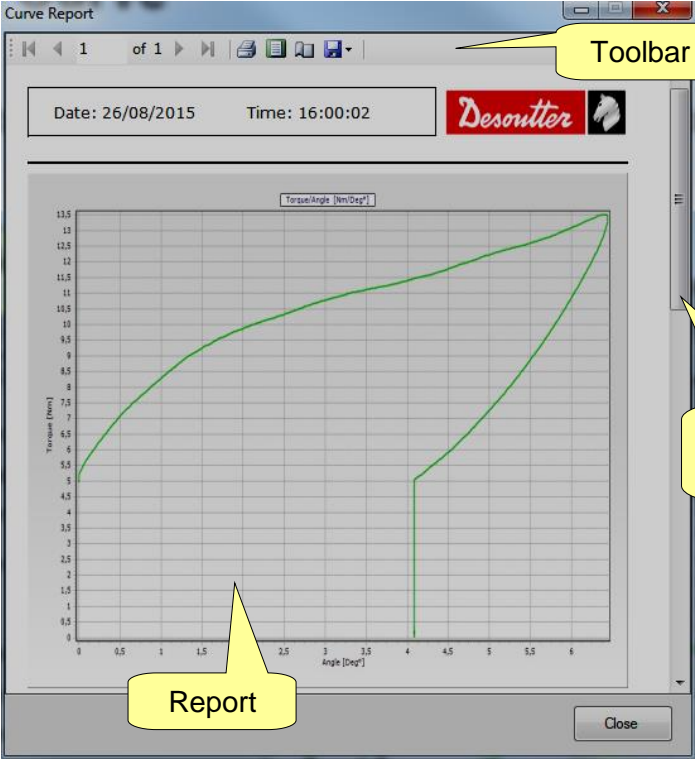

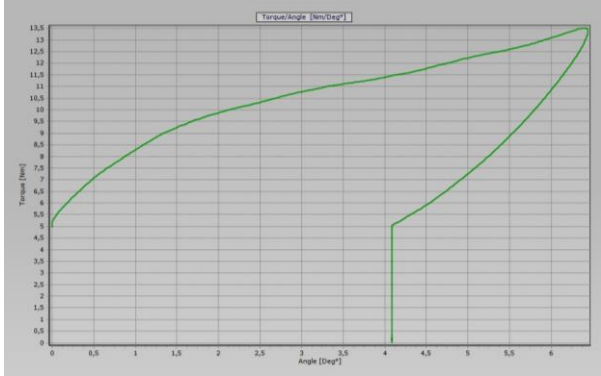
To evaluate the curve in detail, click on **Show cursor** to activate the cursor on the graph:





## 11.2 Export a Curve

The following useful keys are available in the toolbar:

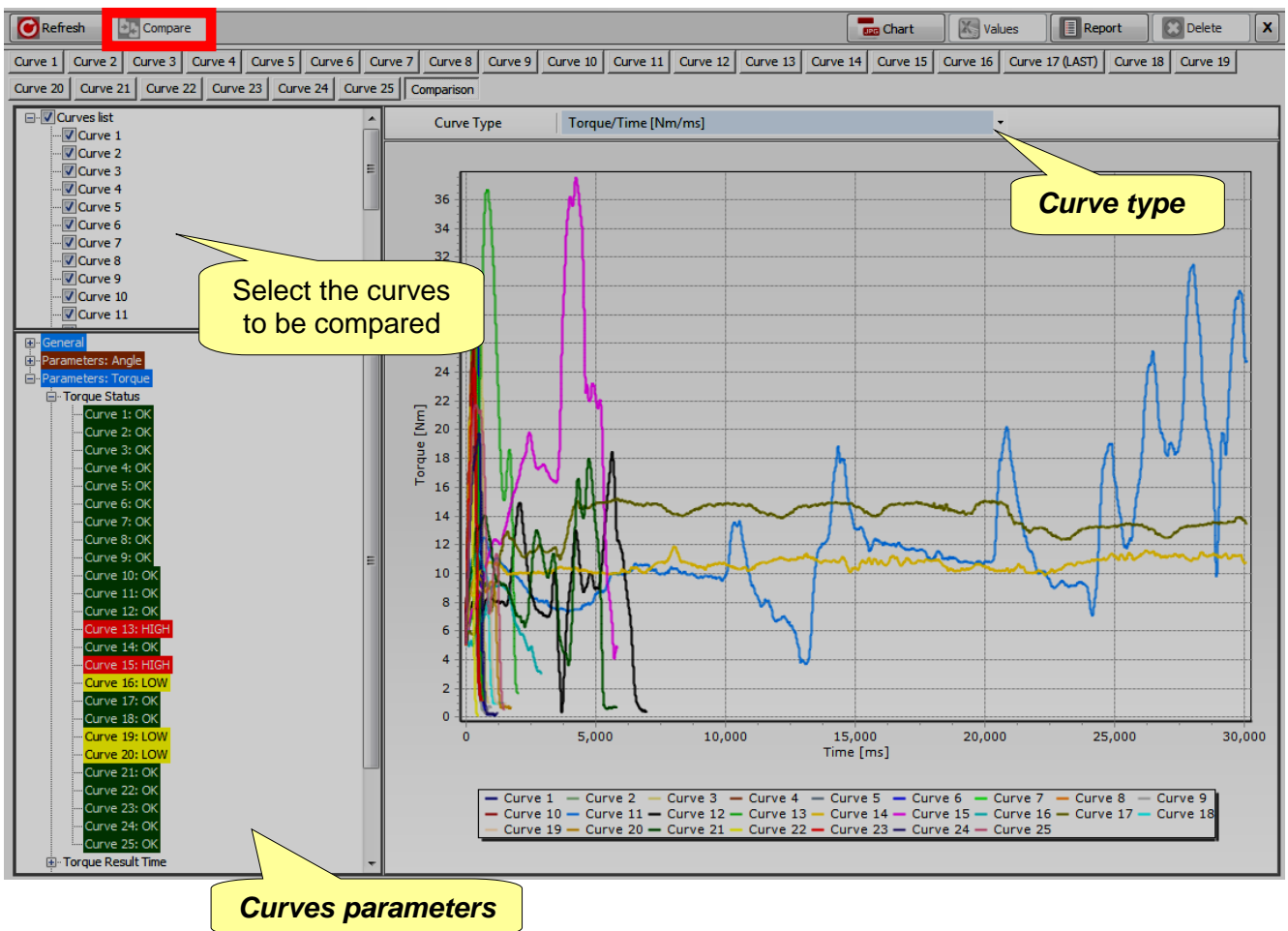
 Values	<p>This key exports the curve values in an Excel file.</p>
 Report	<p>This key creates a <i>Report</i>.</p>  <p>The <i>Report</i> can be printed or exported into either Excel or PDF file by means of the icons placed in the report toolbar.</p>
 Chart	<p>This key creates a .jpg file of the curve:</p> 



## 11.3 Curves Comparison

This feature overlaps the curves for a comparison of the tightening operations.

Click on **Compare** icon to open the “*comparison screen*”:



Select the curves to be compared on the left side of the above screen (refer to the **Curves list**).

Select the type of graph (*Torque/Time*, *Angle/Time*, or *Torque/Angle*) by means of the **Curve Type** drop-down menu.

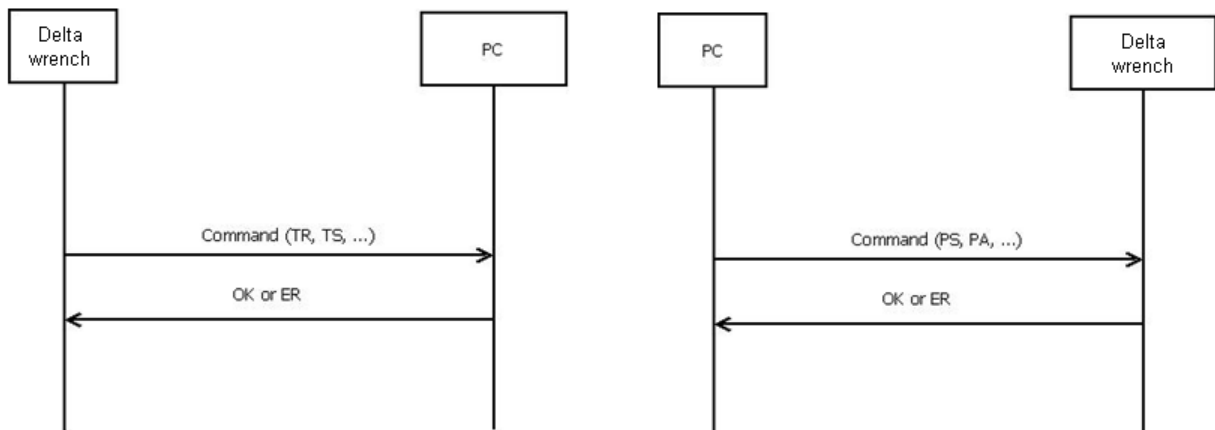
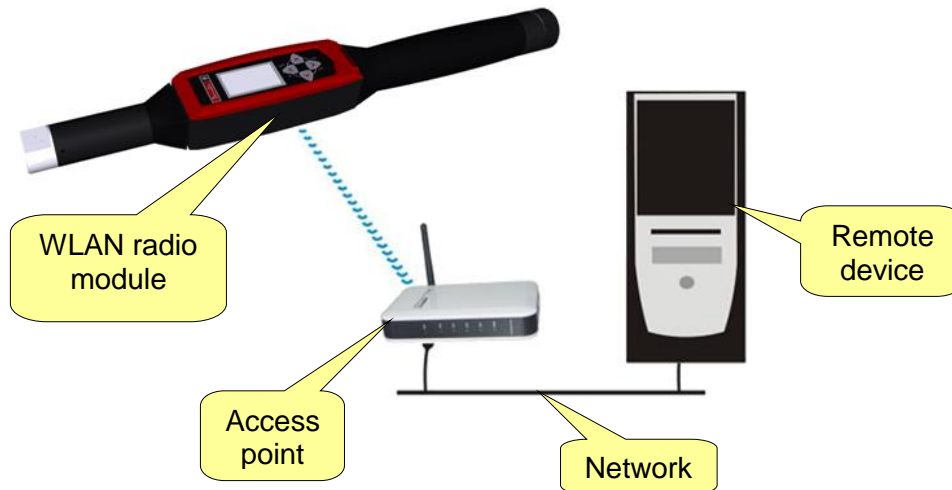
All the *parameters* and *results* of the curves can be displayed in the **Curves parameters** section. Click on the + or – icons to expand or collapse the nodes.





## 12 WLAN COMMUNICATION PROTOCOL

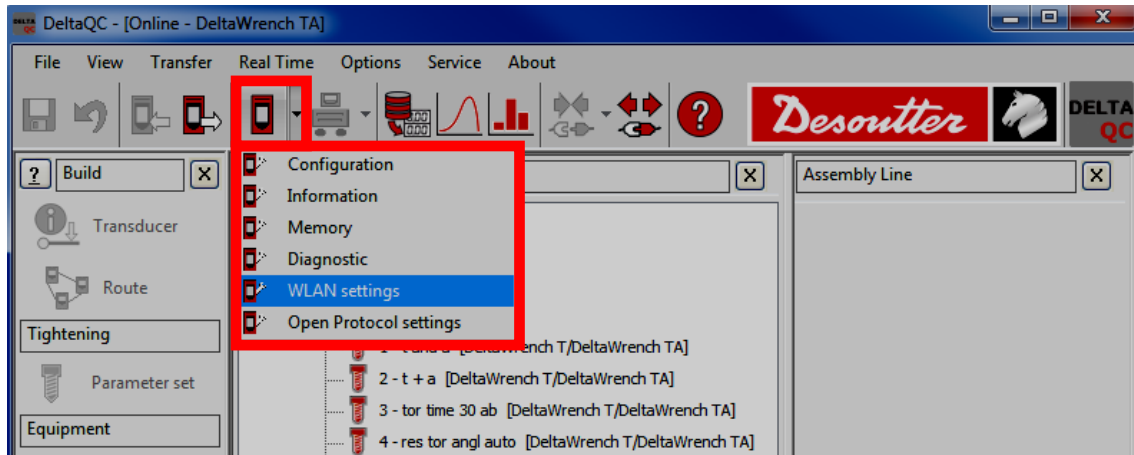
The Delta Wrench can be ordered with the WLAN radio module. The WLAN radio module allows the communication with a remote device. The remote device, for example, can get information about the Delta Wrench status, or start/stop a Pset.



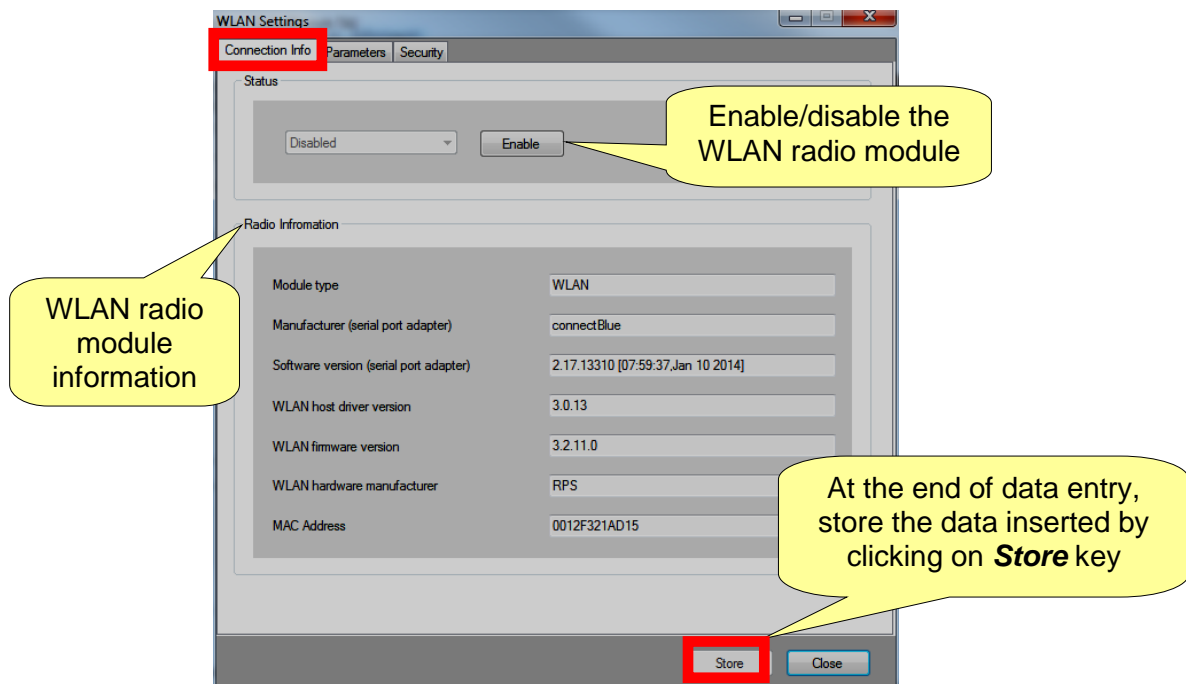
**NOTE:** For further details about the protocol and the commands available to exchange data to/from the Delta Wrench, refer to the document *Delta Wrench WLAN Protocol*.



The WLAN radio module must be configured by the DeltaQC. Connect the Delta Wrench to the DeltaQC and select the **Controller** → **WLAN settings** menu:



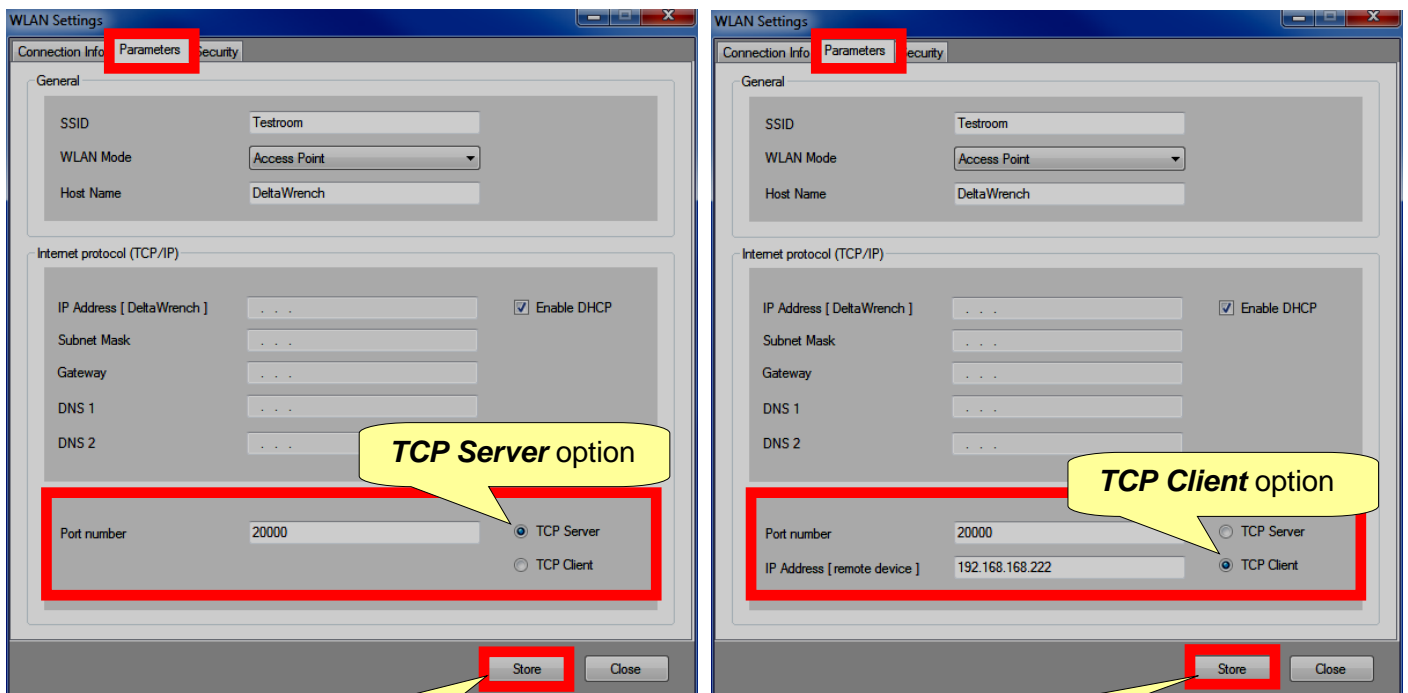
The following window is shown:



Set the *Status* to **Enabled** to activate the WLAN radio module.



Select the **Parameters** page to set the WLAN radio module parameters:



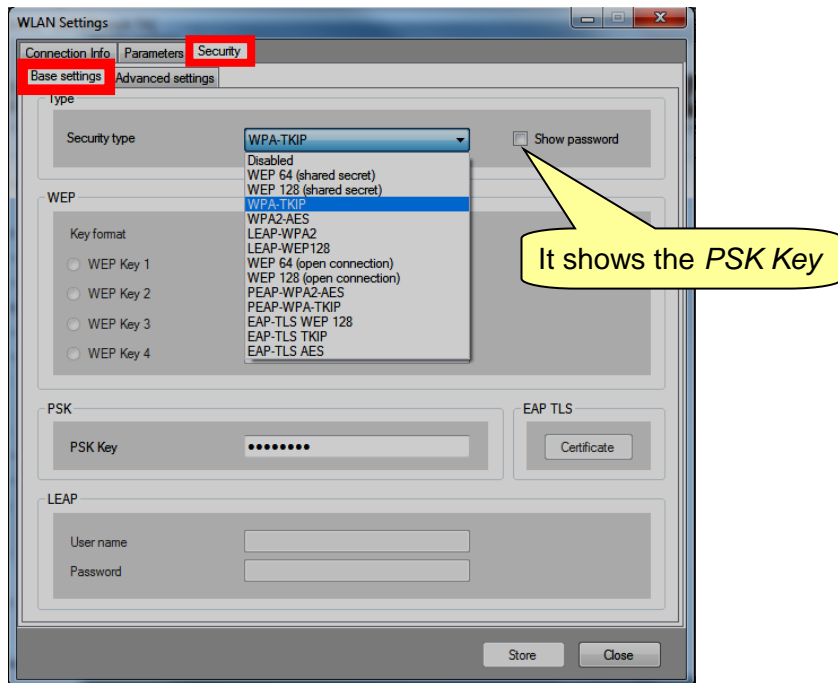
At the end of data entry, store the data inserted by clicking on **Store** key

At the end of data entry, store the data inserted by clicking on **Store** key

<b>SSID</b>	Enter the SSID name of the own wireless network.
<b>WLAN mode</b>	<b>Access Point</b> is selected.
<b>Host name</b>	Specify the name of the Delta Wrench; if there are more than one Delta Wrench the names must be different.
<b>Internet protocol (TCP/IP)</b>	Select <b>Enabled DHCP</b> if the network works with the DHCP protocol: the Internet protocol configuration is set automatically.  On the other hand, it is possible to set manually the Internet Protocol configuration by disabling the <b>DHCP</b> .
<b>Port number</b>	Specify the port number of the remote device that interfaces with the Delta Wrench.  <b>NOTE:</b> The <b>Port number</b> has to be set both if the user selects <b>TCP Server</b> option and if the user selects <b>TCP Client</b> option.
<b>IP address (remote device)</b>	Specify the IP address of the remote device that interfaces with the Delta Wrench.  <b>NOTE:</b> The <b>IP address (remote device)</b> has to be set <b>ONLY</b> if the user selects <b>TCP Client</b> option.



Select the **Security** page to set the WLAN radio module security type (**Base settings**) and to change the **Advanced settings**:

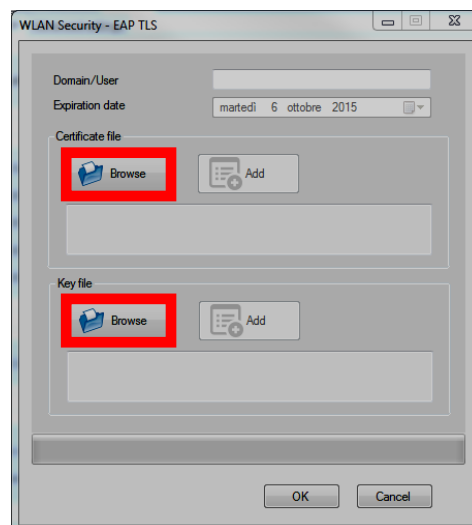


### Security type

Select the same security type as the own wireless network. According to the option chosen, set the key/user name/password in the fields enabled below.

For the options **EAP-TLS WEP128**, **EAP-TLS TKIP** and **EAP-TLS AES** the procedure is as explained below.

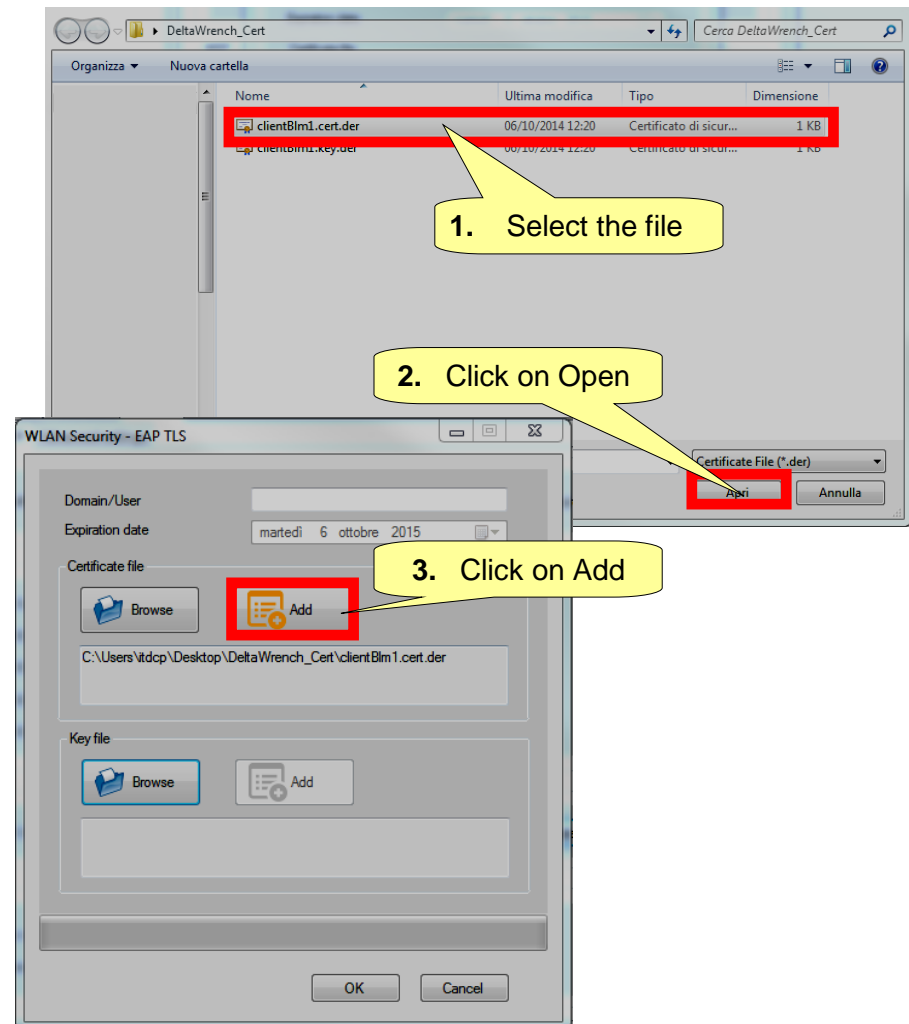
For instance, by clicking on **EAP-TLS WEP128** the following screen is shown:



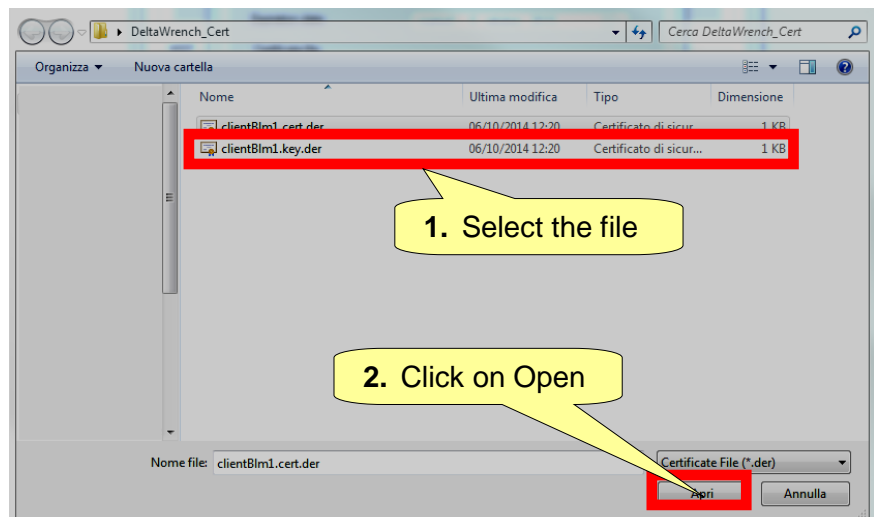
Upload both the **Certificate file** and **Key file** in the respective fields enabled above.

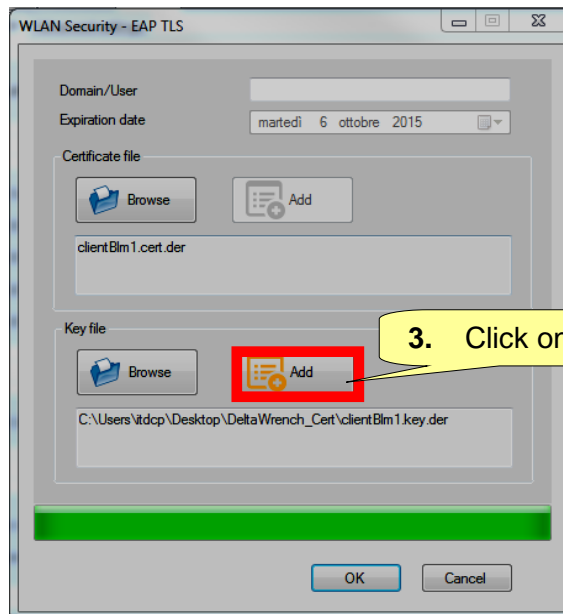


For example, for **Certificate file** field, once clicking on *Browse*, select **clientBlm.cert.der** in the relative folder. Then click on *Add*.

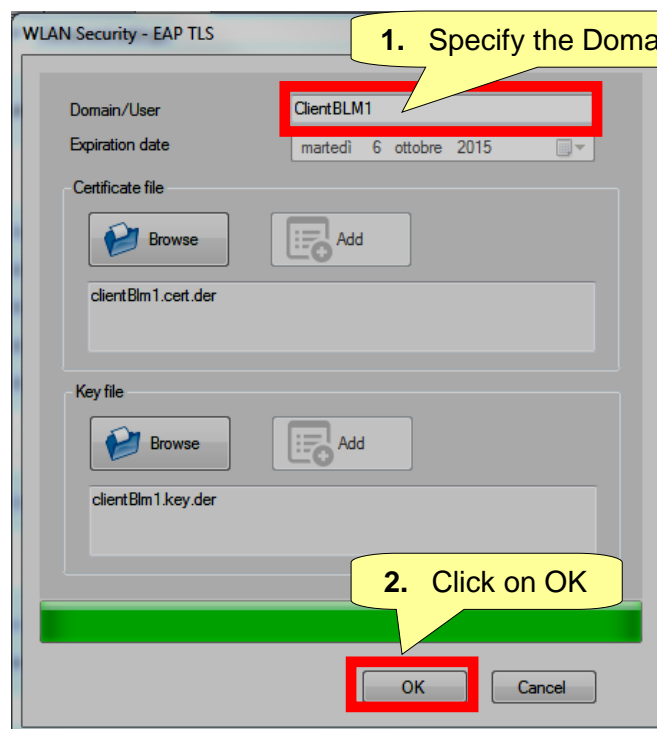


Repeat the same procedure for **Key file** field. Then, after clicking on *Browse*, select **clientBlm.key.der** in the relative folder. Then click on *Add*.



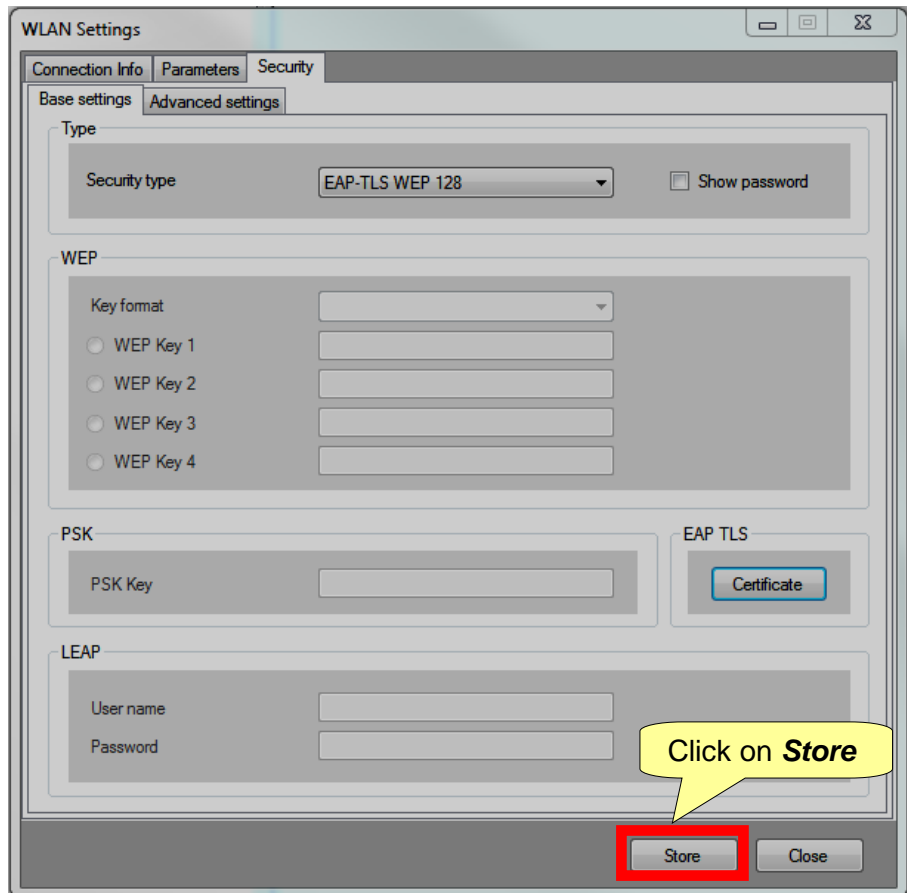


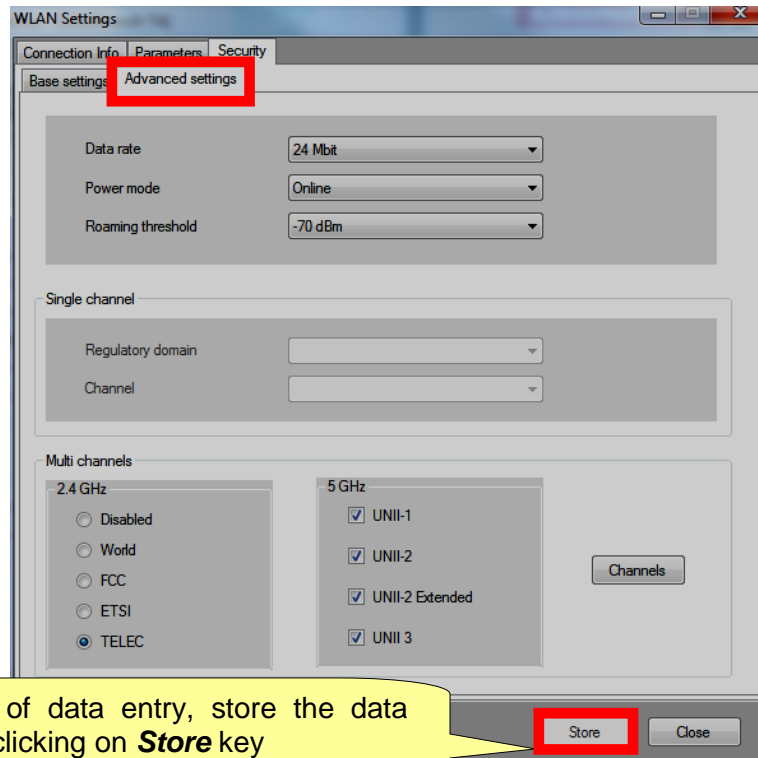
Once both the **Certificate file** and **Key file** are upload, specify the Domain/User (in the following example, *ClientBLM1*). Then, click on OK.




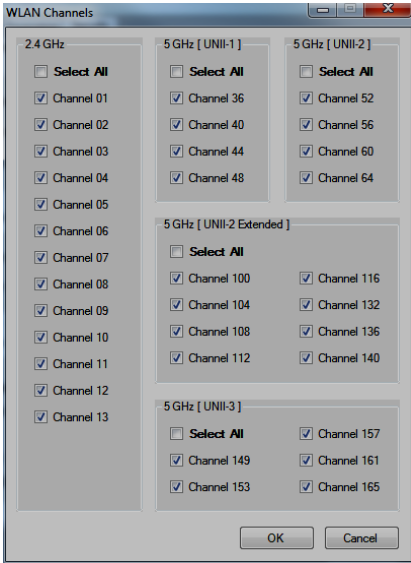


Finally, store the data inserted by clicking on **Store** key (refer to the screen below):





At the end of data entry, store the data inserted by clicking on **Store** key

<p><b>Data rate</b></p>	<p>Select the data rate. A slower value may help when the communication is not high-performance.</p>
<p><b>Power mode</b></p>	<p>The <b>Sleep</b> mode is recommended for lower power consumption.</p>
<p><b>Roaming threshold</b></p>	<p>Select the threshold under which the Delta Wrench will search for a new access point to connect through.</p>
<p><b>Multi channels</b></p>	<p>Once the regulatory domain has been chosen between 2.4 and/or 5 GHz, click on <b>Channels</b> to view/change the channels selected by default (see figure below).</p> <p> 5 GHz frequency band not available in the European Union.</p>  <p>The available channels depend from the regulatory domain selected. Select the channel(s) and click on <b>OK</b> to confirm.</p>

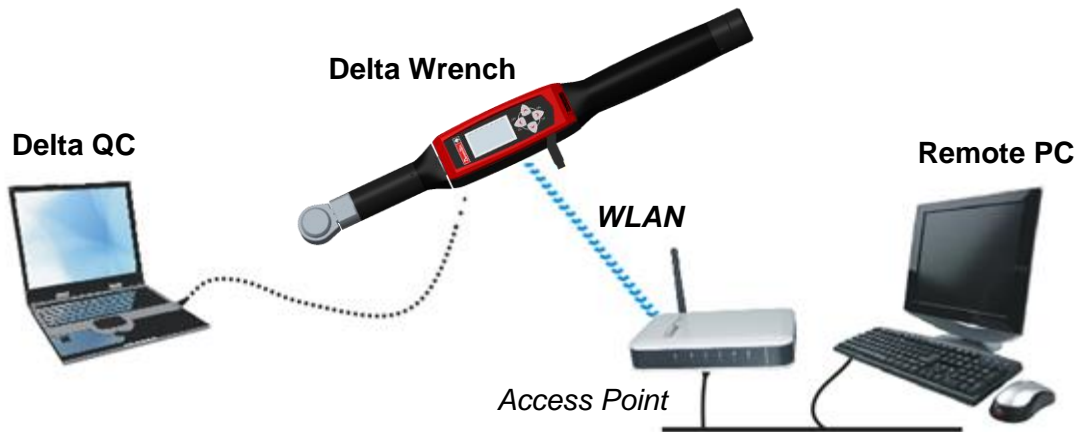




## 13 WORKING WITH OPEN PROTOCOL



**NOTE:** Delta Wrench minimum firmware version: 2.3a



The Open Protocol allows a remote device to interface with the Delta Wrench by means of custom-made applications.

In this scenario, the Delta Wrench is connected with a remote PC via WLAN, through the Open Protocol.

The following **MIDs (Message Identification)** are compatible:

<b>MID</b>	<b>Description</b>	<b>Revision ranges</b>
1	Communication start	0 ÷ 5
2	Communication start acknowledge	0 ÷ 5
3	Communication stop	0 ÷ 1
4	Command error	0 ÷ 1
5	Command accepted	0 ÷ 1
10	Pset ID upload request	0 ÷ 2
11	Pset ID upload reply	0 ÷ 2
12	Pset data upload request	0 ÷ 2
13	Pset data upload reply	0 ÷ 2
14	Pset selected subscribe	0 ÷ 2
15	Pset selected	0 ÷ 2
16	Pset selected acknowledge	0 ÷ 1
17	Pset selected unsubscribe	0 ÷ 1
18	Select Pset	0 ÷ 1
19	Set Pset batch size	0 ÷ 1
20	Reset Pset batch counter	0 ÷ 1
40	Tool data upload request	0 ÷ 5
41	Tool data upload reply	0 ÷ 5



<b>MID</b>	<b>Description</b>	<b>Revision ranges</b>
42	Disable tool	0 ÷ 1
43	Enable tool	0 ÷ 1
60	Last tightening result data subscribe	0 ÷ 7
61	Last tightening result data	0 ÷ 7
62	Last tightening result data acknowledge	0 ÷ 7
63	Last tightening result data unsubscribe	0 ÷ 7
64	Old tightening result upload request	0 ÷ 6
65	Old tightening result upload reply	0 ÷ 6
70	Alarm subscribe	0 ÷ 2
71	Alarm	0 ÷ 2
72	Alarm acknowledge	0 ÷ 2
73	Alarm unsubscribe	0 ÷ 2
74	Alarm acknowledged on controller	0 ÷ 2
75	Alarm acknowledged on controller acknowledge	0 ÷ 1
76	Alarm status	0 ÷ 1
77	Alarm status acknowledge	0 ÷ 2
78	Acknowledge alarm remotely on controller	0 ÷ 2
80	Read time upload request	0 ÷ 1
81	Read time upload reply	0 ÷ 1
82	Set time	0 ÷ 1
7408 *	Last tightening curve data subscribe	0 ÷ 1
7409 *	Last tightening curve data unsubscribe	0 ÷ 1
7410 *	Last tightening curve data	0 ÷ 1
7411 *	Last tightening curve data acknowledge	0 ÷ 1
7420 *	Information data subscribe	0 ÷ 1
7421 *	Information data change event	0 ÷ 1
7422 *	Information data change acknowledge	0 ÷ 1
7423 *	Information data change unsubscribe	0 ÷ 1
7424 *	Information data request	0 ÷ 1
7425 *	Information data reply	0 ÷ 1
7500 *	Last trace data subscribe	0 ÷ 1
7501 *	Last trace data acknowledge	0 ÷ 1
7502 *	Last trace data acknowledge	0 ÷ 1
7503 *	Last trace data unsubscribe	0 ÷ 1
9999	Keep alive message	0 ÷ 1

\* For further details about the marked MIDs, refer to the "Desoutter Open Protocol Manual" (Part number 6159275850).



The **supported alarms** (with the relative codes) are as follows:

ALARM CODE	SUPPORTED ALARM		DESCRIPTION
1	OP_GYRO_REQUIRED_ERR	→	This alarm alerts the user if an <i>angle control strategy</i> is performed with the " <u>Delta Wrench ONLY Torque model</u> ".
2	OP_CELL_CALIBRATION_ERR	→	This alarm alerts the user if the transducer has not performed the torque calibration.
3	OP_CELL_ZERO_ERR	→	This alarm alerts the user if a zero torque error is verified.
4	OP_GYRO_CALIBRATION_ERR	→	This alarm alerts the user if the gyro is not calibrated.
5	OP_GYRO_ZERO_ERR	→	This alarm alerts the user if a zero gyro error is verified.
6	OP_CELL_AND_GYRO_CALIB_ERR	→	This alarm alerts the user if both the torque and the gyro of the transducer are not calibrated.
7	OP_CELL_AND_GYRO_ZERO_ERR	→	This alarm alerts the user if both a zero torque error and a zero gyro error is verified.
8	OP_TORQUE_OVERLOAD_ERR	→	This alarm alerts the user if, during tightening, a torque higher than the overload torque is applied.
9	OP_GYRO_OVERSPEED_ERR	→	This alarm alerts the user if the tightening is too quick, exceeding the maximum angle speed.
10	OP_REHIT_ERR	→	This alarm alerts the user if the screw is already tightened during tightening (it is available ONLY IF the " <i>Check RE-HIT</i> " option is flagged into Pset parameter of <u>Production control strategies</u> – for further details refer to the paragraph " <i>Pset - Options</i> ").
11	OP_CHANGE_SCREW_ERR	→	This alarm alerts the user if, during tightening, a torque higher than the change screw (set into the <i>Torque parameter</i> – for further details refer to the paragraph " <i>Torque parameters</i> ") is applied.
12	OP_MINLOAD_ERR	→	This alarm alerts the user if, during tightening, the cycle start is lower than the minimum load transducer.
13	OP_CAPACITY_ERR	→	This alarm alerts the user if, during tightening, the change screw is higher than the transducer capacity.
14	OP_MEMORY_ERR	→	This alarm alerts the user if an access error into the memory of the Delta Wrench is verified.
15	OP_BATTERY_LOW_ERR	→	This alarm alerts the user if battery level is lower than 15%.
16	OP_TAG_REQUIRED_ERR	→	This alarm alerts the user if <i>tag required</i> option (for further details about this option, refer to the paragraph " <i>Tag required</i> ") is enabled and the Pset is started without the relative tag inserted into the Delta Wrench.
17	OP_WRENCH_LOCK_ERR	→	This alarm alerts the user if the Delta Wrench is locked (for further details about this error, refer to the paragraph " <i>WLAN/Open Protocol: number of results before wrench lock</i> ").

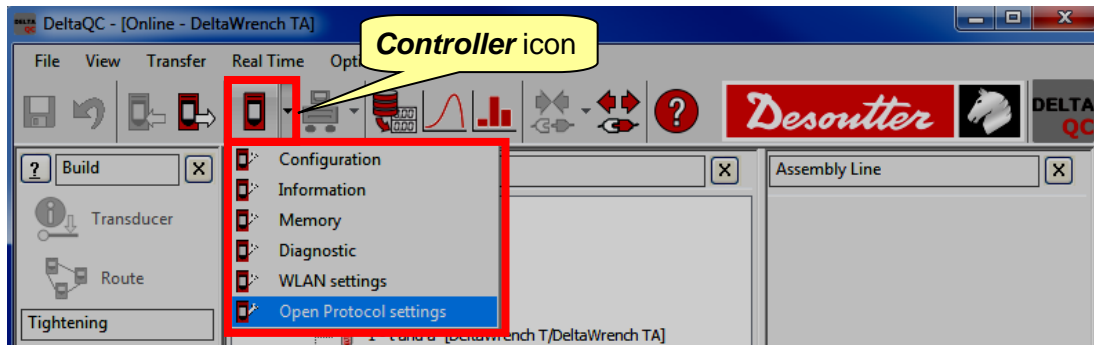


The WLAN module must be properly configured.

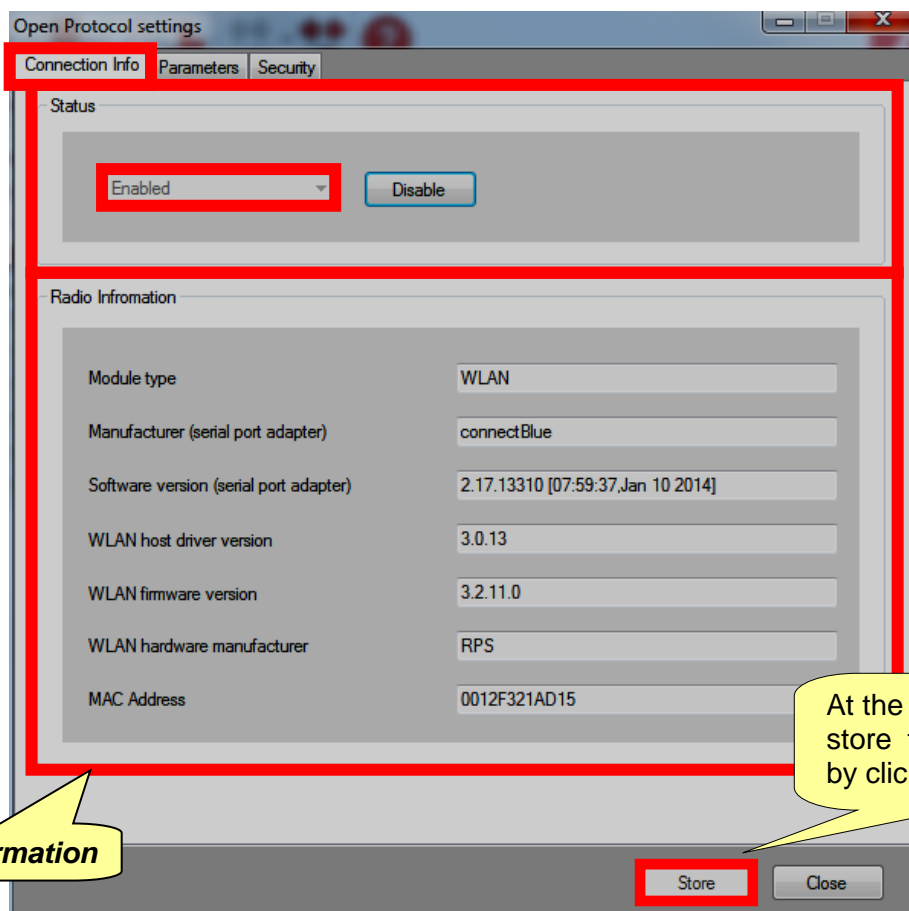
Connect the Delta Wrench by means of the USB cable to the PC where DeltaQC software is installed.

Start the DeltaQC software; then click on the “**Connect**” icon.

After clicking on “**Controller**” icon, select “*Open Protocol settings*” item in the combo box shown (refer to the picture below):



In the **Connection Info** page, enable the *Status* by clicking on the relative key (refer to the screen below); if the *Status* is not enabled, the *Delta Wrench* cannot work with *Open Protocol* even if the WLAN module is properly configured.



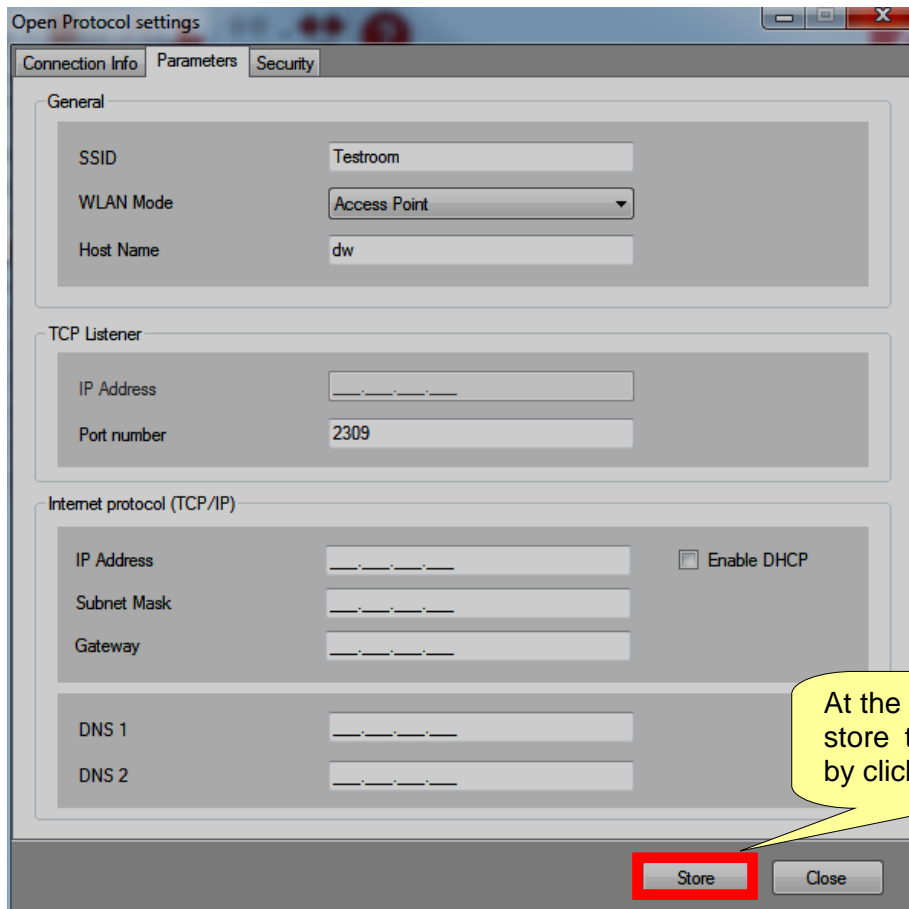
Radio Information

At the end of data entry, store the data inserted by clicking on **Store** key





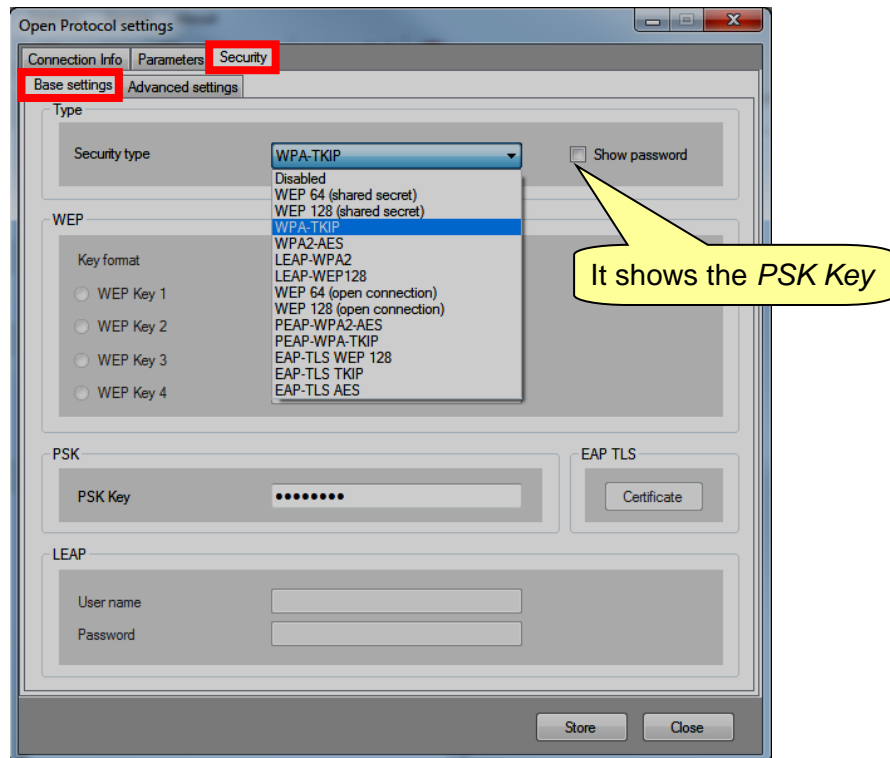
In the **Parameters** page, insert the network parameters in order to establish the connection between the Delta Wrench and the Open Protocol:



<b>SSID</b>	Enter the SSID name of the own wireless network.
<b>WLAN mode</b>	<b>Access Point</b> is selected.
<b>Host name</b>	Specify the name of the Delta Wrench; if there are more than one Delta Wrench the names must be different.
<b>Port number</b>	Specify the port number of the Delta Wrench that the remote device must use to link with.
<b>Internet protocol (TCP/IP)</b>	Select <b>Enabled DHCP</b> if the network works with the <i>DHCP protocol</i> : the Internet protocol configuration is set automatically.  On the other hand, it is possible to set manually the Internet Protocol configuration by disabling the <b>DHCP</b> .



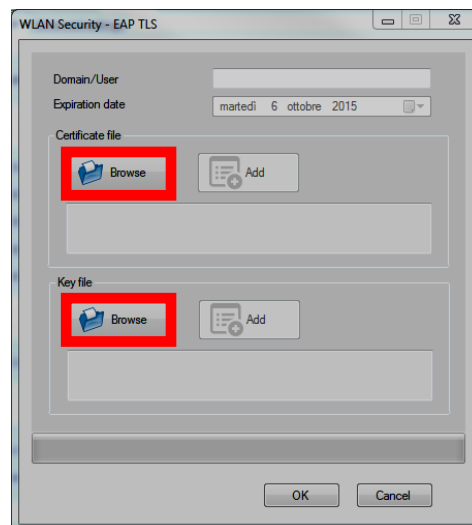
Select the **Security** page to set the Open Protocol radio module security type (**Base settings**) and to change the **Advanced settings**:



### Security type

Select the same security type as the own wireless network. According to the option chosen, set the key/user name/password in the fields enabled below.

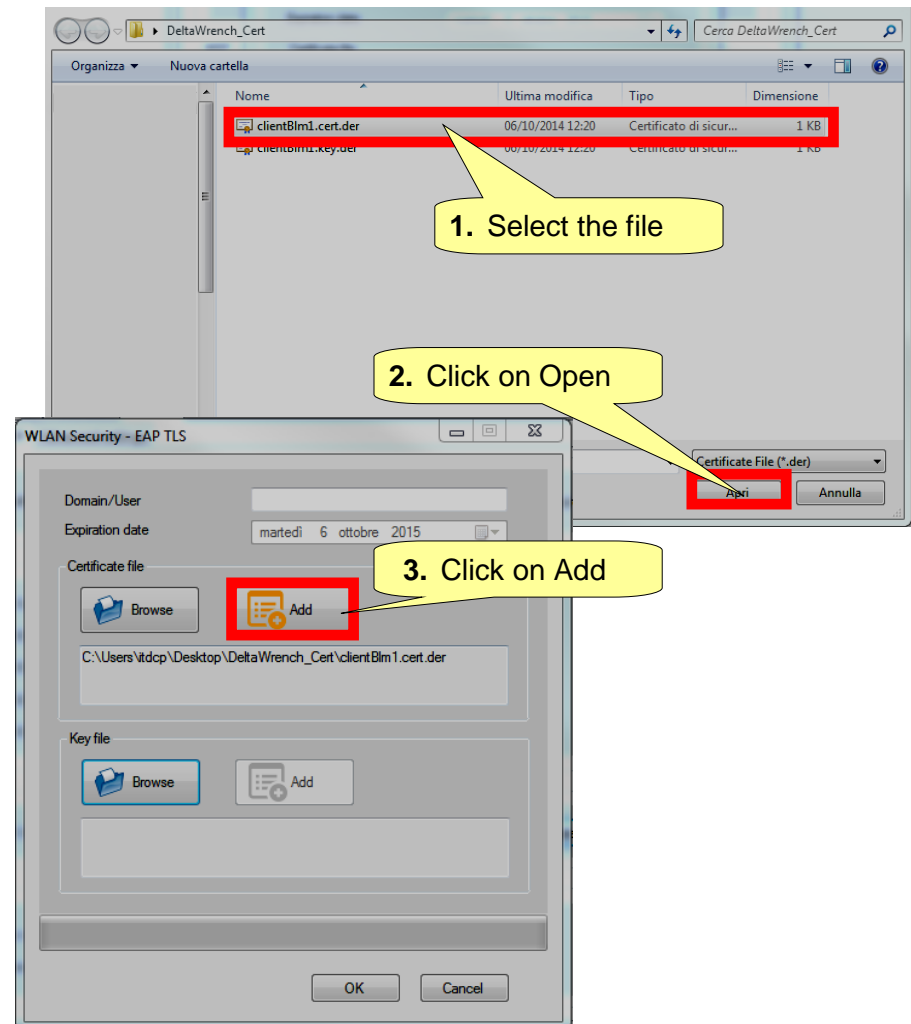
For the options **EAP-TLS WEP128**, **EAP-TLS TKIP** and **EAP-TLS AES** the procedure is as explained below. For instance, by clicking on **EAP-TLS WEP128** the following screen is shown:



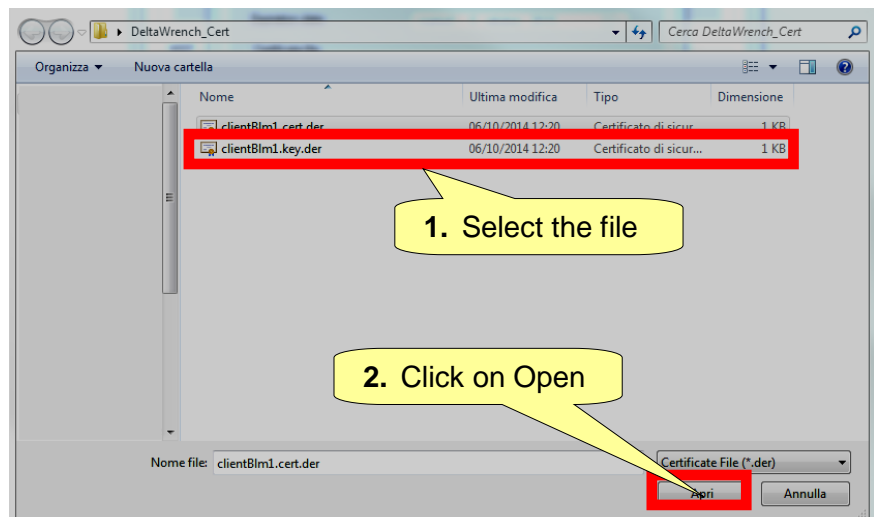
Upload both the **Certificate file** and **Key file** in the respective fields enabled above.

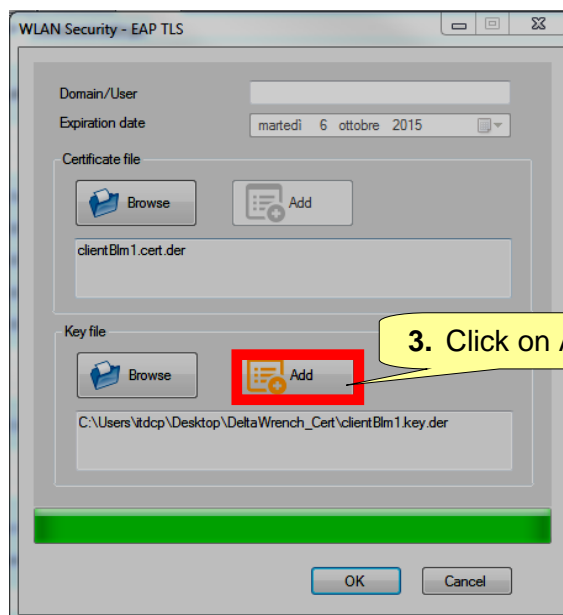


For example, for **Certificate file** field, once clicking on *Browse*, select **clientBlm.cert.der** in the relative folder. Then click on *Add*.

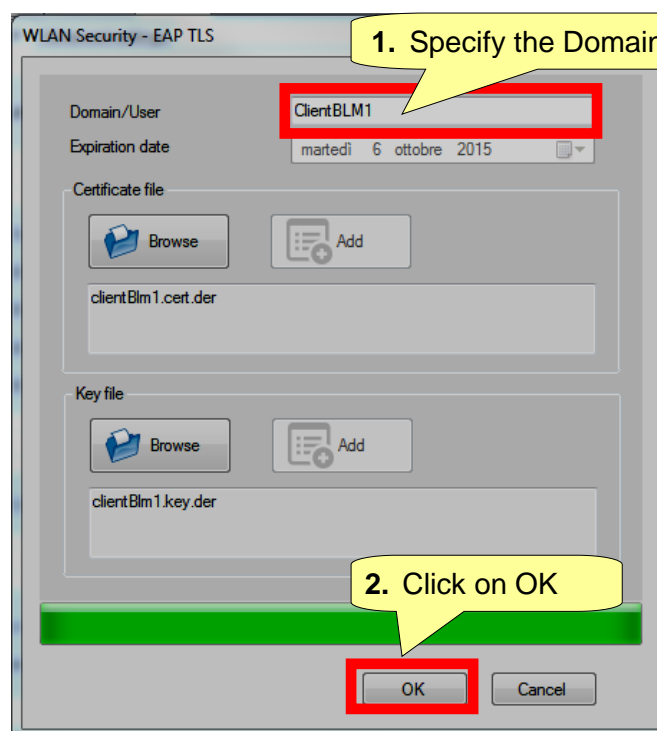


Repeat the same procedure for **Key file** field. Then, after clicking on *Browse*, select **clientBlm.key.der** in the relative folder. Then click on *Add*.





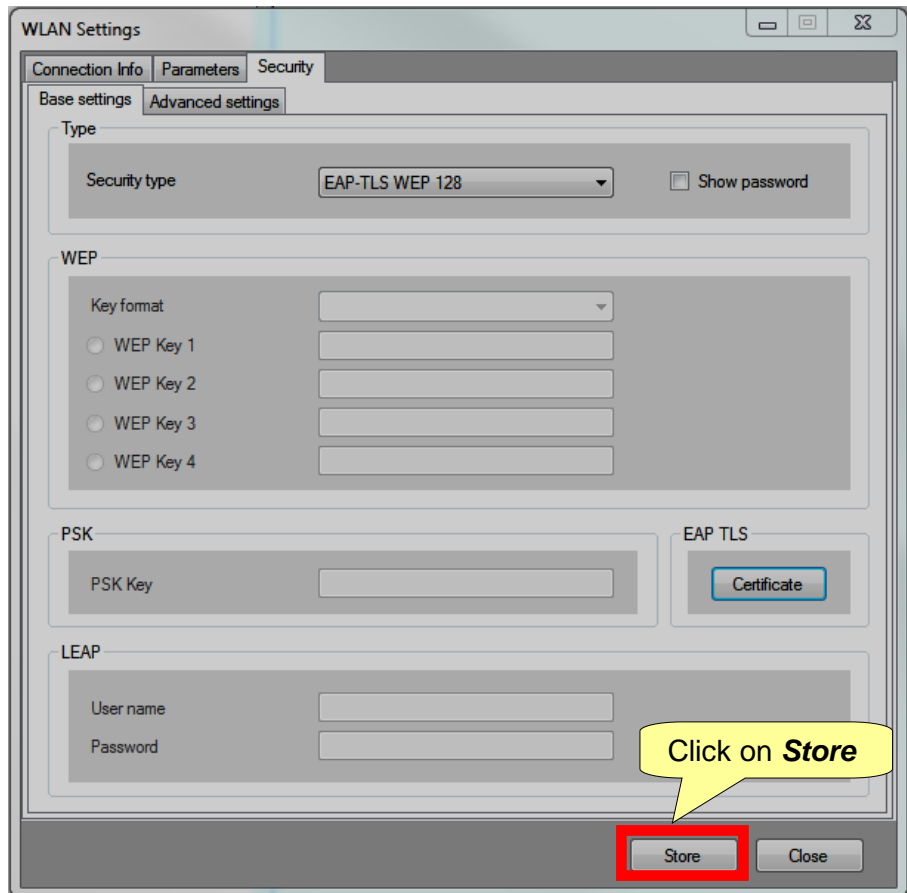
Once both the **Certificate file** and **Key file** are upload, specify the Domain/User (in the following example, *ClientBLM1*). Then, click on OK.

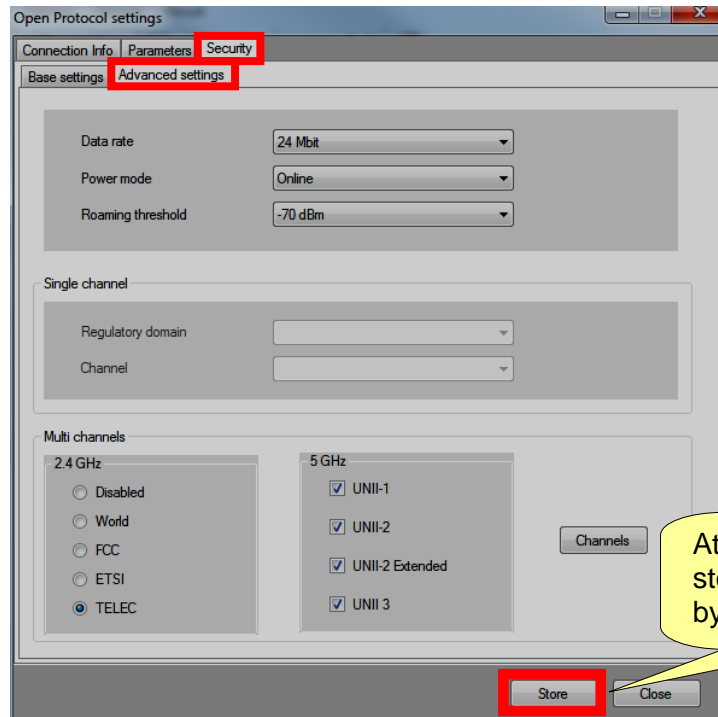



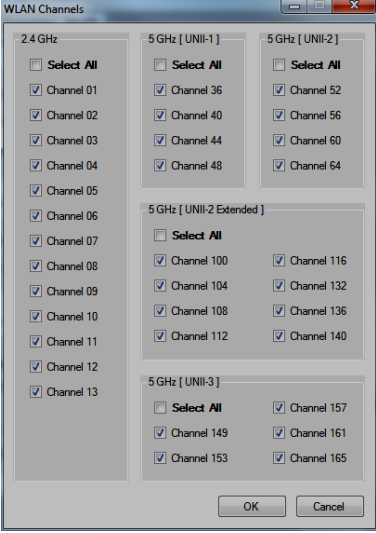




Finally, store the data inserted by clicking on **Store** key (refer to the screen below):





<p><b>Data rate</b></p>	<p>Select the data rate. A slower value may help when the communication is not high-performance.</p>
<p><b>Power mode</b></p>	<p>The <b>Sleep</b> mode is recommended for lower power consumption.</p>
<p><b>Roaming threshold</b></p>	<p>Select the threshold under which the Delta Wrench will search for a new access point to connect through.</p>
<p><b>Multi channels</b></p>	<p>Once the regulatory domain has been chosen (2.4 and/or 5 GHz), click on <b>Channels</b> to view/change the channels selected by default:</p> <p> 5 GHz frequency band not available in the European Union.</p>  <p>The available channels depend from the regulatory domain selected. Select the channel(s) and click on <b>OK</b> to confirm.</p>



## 14 MAINTENANCE

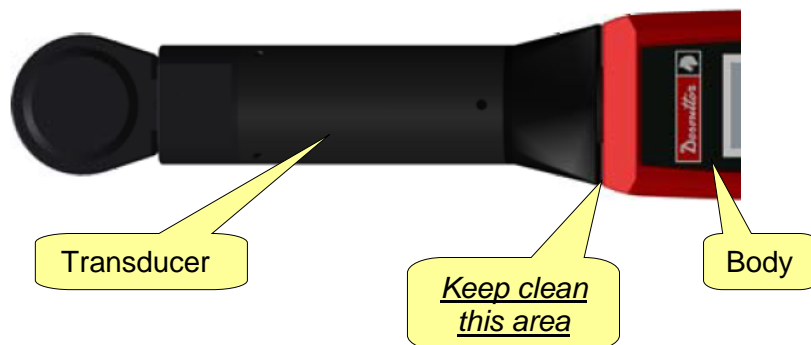
### 14.1 Yearly Calibration

The Delta Wrench needs to be recalibrated once a year. Contact the customer center for calibration.

### 14.2 Cleaning

Keep the Delta Wrench clean.

It is very important to keep clean from any object the area between the Delta Wrench body and transducer shown in the following figure. If not, the transducer may not operate properly, and thus the torque reading may be altered.



After use, remove any curves of oil, grease and dust from the Delta Wrench, especially from the display, the keyboard, and the connectors.

Avoid using harsh detergents to clean the Delta Wrench.

### 14.3 Battery Pack Maintenance

Keep batteries in a good working order.

Avoid fully discharging the battery. During normal use, recharge the battery when it is low.

For long term storage (as in the case of spare batteries), cells should be kept within a range of a 30%  $\pm$  15% charge. Follow these important rules:

- Store the battery in a dry place not exceeding 30° C
- Recharge the battery for one hour every six months

After long-term storage, fully recharge the battery before use.



## 15 TROUBLESHOOTING GUIDE

Below is a quick *Troubleshooting Guide* for the Delta Wrench.

If a problem is shown, before taking any action (replacing parts or contacting customer support), be sure to check that the Delta Wrench is being used properly; improper operation can cause defeats even if the system is in good working order.

In case of issues, the log file can provide information about the problem (refer to the paragraph "*Delta Wrench LOG Viewer*" for further details).

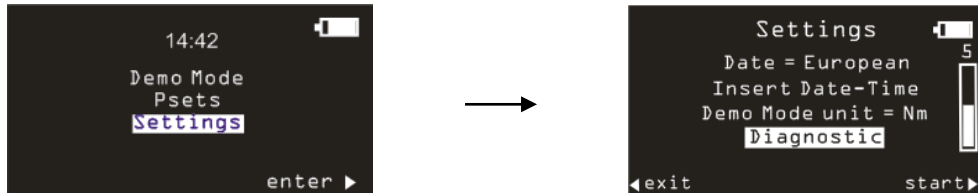
Symptom	Possible cause	Solution
Cannot enter the test menu	- Transducer not connected	- Contact Desoutter Service Personnel
Cannot connect the DeltaQC to the Delta Wrench	- Cable disconnected and Delta Wrench not found	- Before clicking on the Connect icon, ensure that the USB is selected. Click on "Scan" on the DeltaQC to search the Delta Wrench connected
"Min Load Error" is shown on the Delta Wrench display when starting a test	- Pset data not matching the Delta Wrench data	- Check the Pset data; all the parameters must be greater than the minimum load
"Capacity error" is shown on the Delta Wrench display when starting a test	- Pset data not matching the Delta Wrench data	- Check the Pset data; all the parameters must be lower than the Delta Wrench capacity
"Overload error" is shown on the Delta Wrench display	- The Delta Wrench has been overloaded over the maximum value	- The message is shown each time the Delta Wrench is switched on: to reset the overload condition, the Delta Wrench must be recalibrated
"Error Zeroing Torque" is shown on the Delta Wrench display at the power on	- Delta Wrench powered on with a load applied	- Switch off the Delta Wrench; then switch on the Delta Wrench again, without applying any torque
"Error Zeroing Gyro" is shown on the Delta Wrench display at the power on	- Delta Wrench has been moved during the power on phase	- Switch off the Delta Wrench; then switch on the Delta Wrench again, leaving it in a fixed position during the power on phase



## 15.1 Delta Wrench Diagnostic

The diagnostic menu makes a check of the Delta Wrench hardware.

Select **Diagnostic** from the **Settings** menu to start the diagnostic procedure:



The diagnostic procedure leads the user to examine the hardware of the Delta Wrench.

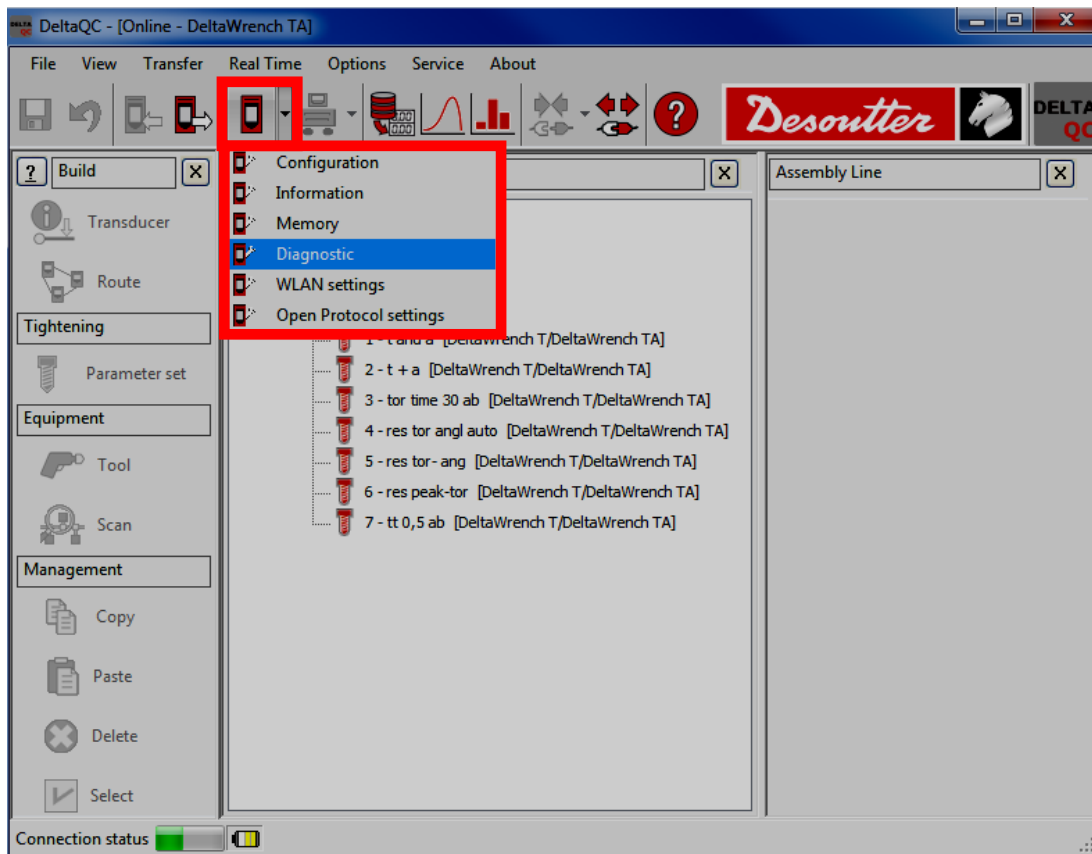
The diagnostic procedure is interactive: simply follow the instructions given on the Delta Wrench display to complete the diagnostic. In case a test gives a *Not OK* result during the test, it means that the related component needs to be repaired or replaced.



**NOTE:** If the test on some buttons of the Delta Wrench keyboard gives *Not OK* result, all the following tests requiring the operator to use that button to confirm the test result will not be performed, and will be marked as *N.A.* (Not Applicable).

The last ten diagnostic reports are in the Delta Wrench memory. It is possible to retrieve each diagnostic report with the DeltaQC software.

Connect the Delta Wrench to the DeltaQC and select the **Controller** → **Diagnostic** menu:





The following screen appears:



**NOTE:** In case of Delta Wrench models with **Buzzer**, the diagnostic item “Sound” is marked as *OK/NOK* (depending on the related test result) while the diagnostic item “Vibration” is marked as *N.A.* (Not Applicable).

In case of Delta Wrench models with **Vibration** (*TORQUE/ANGLE MODELS WITH VIBRO* and *TORQUE/ANGLE MODELS WITH VIBRO AND WLAN RADIO MODULE*), the diagnostic item “Vibration” is marked as *OK/NOK* (depending on the related test result) while the diagnostic item “Sound” is marked as *N.A.* (Not Applicable) (see the diagnostic report above).

Each report is marked (in the left column) either in green (if all of the tests are *OK* or not applicable) or in red (if at least one test gives a *Not OK (NOK)* result).

The last report is marked as **LAST**.

The toolbar in the upper area of the *Diagnostic Report* provides functions to print the report or export it to Excel or PDF file.

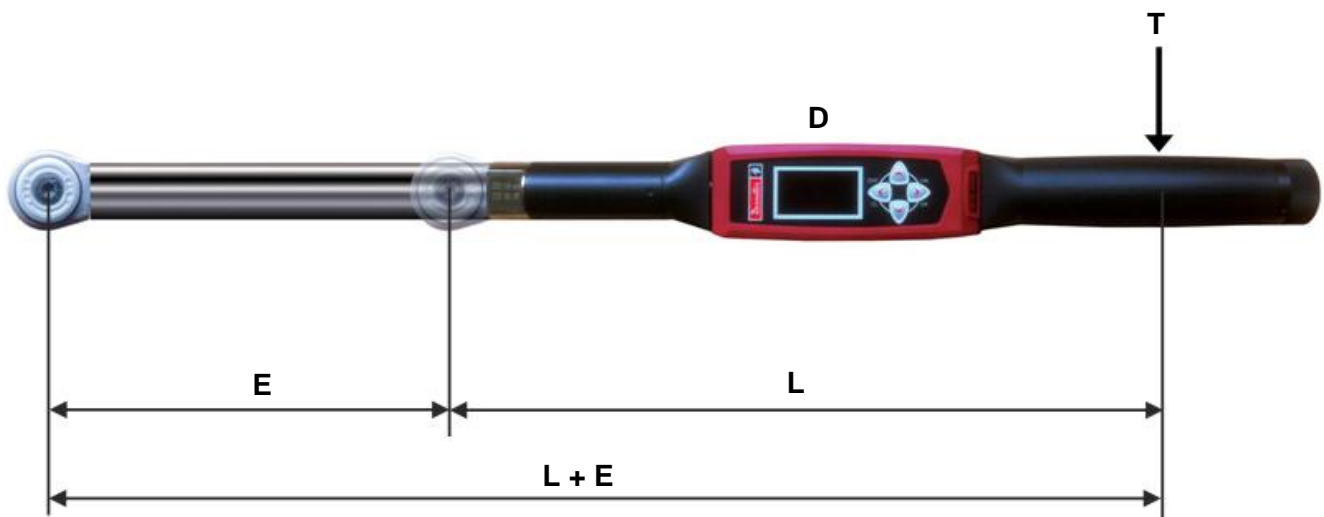


## 16 APPENDIX A – CALCULATING CORRECTION COEFFICIENTS FOR EXTENSIONS

When the joint design or space limitations preclude use of standard sockets / tools, it may be necessary to use special extension spanners to fit the application.

In these cases, the Delta Wrench measure must be adequately compensated because the factory calibration is made for the standard arm (L) and the extension arm (E) increases the measured torque. The angle measure is also affected by the extensions, due to its specific torsion when the torque is applied.

### 16.1 Torque Correction Coefficient



$T$	=	<i>applied torque</i>
$D$	=	<i>displayed torque</i>
$L$	=	<i>standard arm (from mid point of the handle to the center point of end fitting tool)</i>
$E$	=	<i>extension arm</i>
$L + E$	=	<i>total arm</i>

From the relation between the displayed and applied torque  $T = \frac{D \times (L + E)}{L}$ , the torque correction coefficient is given by the following formula:

$$\text{Torque correction coefficient} = \frac{L + E}{L}$$



## 16.2 Angle Correction Coefficient

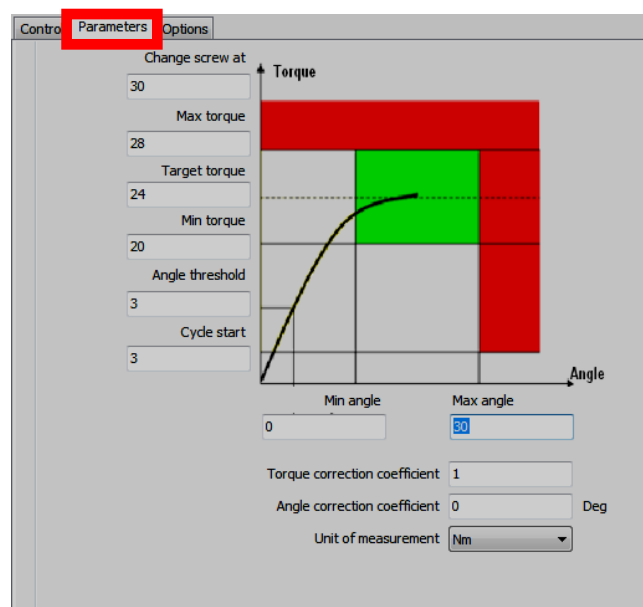
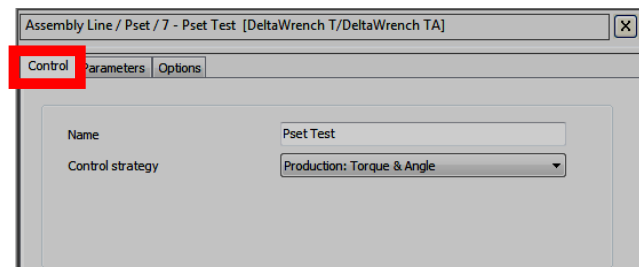
When an extension is used, the angle correction coefficient allows linear compensation of extension torsion due to the torque applied. The value is expressed in degrees at the Delta Wrench capacity.

To calculate the proper angle correction coefficient, the torque coefficient of the extension must be already calculated (as described above) and specified in the Pset used for calculating the angle correction coefficient.

Thus, follow the procedure below:

1. Create a Pset with the following parameters:
  - *Control strategy*: **Torque & Angle**
  - *Torque correction coefficient*: **1**
  - *Target torque*: **80% of the Delta Wrench capacity**
  - *Cycle start and Angle threshold*: **10% of Delta Wrench capacity**
  - *Minimum angle*: **0**
  - *Target angle*: **15**
  - *Maximum angle*: **30**
  - *Check RE-HIT*: **Disabled**

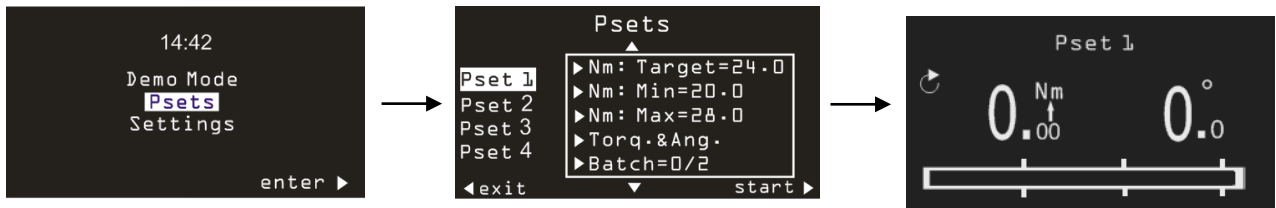
For instance, it could be a proper Pset for a Delta Wrench with 30 Nm capacity:



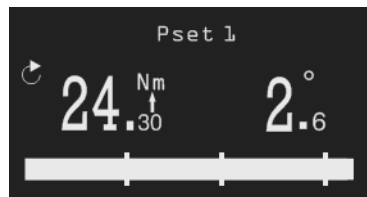




2. Execute the Pset:



3. Apply the target torque specified in the Pset, operating the Delta Wrench on a vise (or on static transducer):

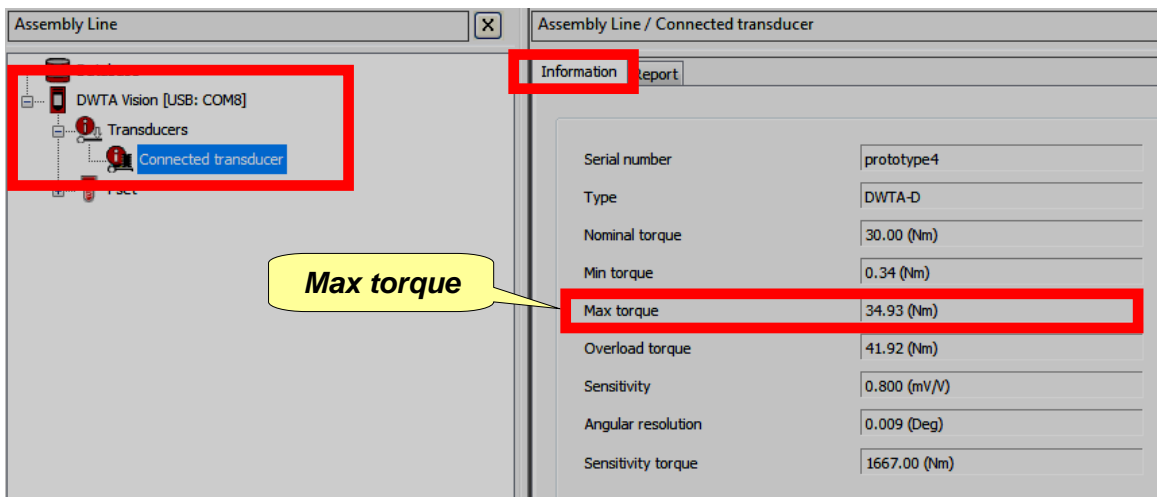


**WARNING:** Since for this test the *Torque Correction Coefficient* is set to 1, the torque applied to the vise is higher than the torque shown on the display. The vise must support at least the maximum torque of the Pset multiplied by the *Torque Correction Coefficient* calculated above.

4. The angle displayed is the bending of the extension applied to the torque shown on the display. Therefore, the *Angle Correction Coefficient* is equal to the following formula:

$$\text{Angle Correction Coefficient} = \frac{\text{Delta Wrench Capacity}}{\text{Torque measured} - \text{Angle threshold}} \times \text{Angle measured}$$

The *Delta Wrench Capacity* is the **Max torque** shown in the DeltaQC transducer information:



In the example of the figure above, the *Angle Correction Coefficient* is:  $(34.93 / (24.3 - 3)) \times 2.6 = 4.26$ .



**NOTE:** After storing the *Angle Correction Coefficient*, in order to verify the correct operation of the angle coefficient, it is NOT possible to use the demo mode, since the demo mode does not consider the correction coefficients. Therefore, for a verification test, a Pset must be used.



## 16.3 Correction Formulas

During the tightening, the torque and angle measured by the transducers are corrected to obtain the real torque and angle values that are displayed on the Delta Wrench and used in the tightening curves and results.

The *correction formulas* are as follows:

*Torque displayed = Torque measured x Torque Correction Coefficient*

$$\text{Angle displayed} = \frac{\text{Angle measured} - \text{Angle Correction Coefficient}}{\text{Delta Wrench Capacity} - \text{Torque Correction Coefficient}} \times \frac{\text{Torque displayed} - \text{Angle Threshold}}{\text{Delta Wrench Capacity} - \text{Torque Correction Coefficient}}$$





# 17 APPENDIX B – DELTA WRENCH FACTORY SETTINGS

The following table details the Delta Wrench factory configuration:



## GENERAL

- Name** → *This field is left blank as factory settings*
- Date and time** → *Current date and time*
- Language** → *English*

## SETTINGS

- Result confirmation option** → *Never*
- Curves confirmation option** → *Never*



<b>Batches increment condition</b>	→	<i>OK</i>
<b>Batches running mode</b>	→	<i>Reset mode</i>
<b>Gyroscope overspeed</b>	→	<i>Enable</i>
<b>Source type</b>	→	<i>Keyboard</i>
<b>Tag required</b>	→	<i>Disable</i>
<b>Tag identifier</b>	→	<i>It depends on the end fitting tool RFID TAG</i>
<b>Change screw check</b>	→	<i>Enable</i>
<b>Wrench power off [minutes]</b>	→	<i>5</i>
<b>Display switch off [minutes]</b>	→	<i>5</i>
<b>WLAN/Open Protocol: number of results before wrench lock</b>	→	<i>500</i>





## 18 ABBREVIATIONS

Abbreviation	Description
A	Ampere
AC	Alternating current
Avg	Average
CCW	Counterclockwise
CW	Clockwise
dBm	Decibel referred to milliwatt
DC	Direct current
DRT	Digital rotary transducer
DST	Digital static transducer
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
ESC	Exit
FSD	Full scale deflection
ID	Identification
IP	Internet Protocol
LED	Light-Emitting Diode

Abbreviation	Description
Max	Maximum
Min	Minimum
ms	millisecond
n	Numbers (of values)
N.A.	Not Applicable
Nm	Newton meter
Nr.	Number
OK	Approved (test)
NOK	Not approved (test)
PC	Personal Computer
Std	Standard deviation
SW	Software
USB	Universal Serial Bus
V	Volt
VIN	Vehicle Identification Number
WEEE	Waste Electrical and Electronic Equipment

### © Copyright 2017, Desoutter

All rights reserved. Any unauthorized use or copying of the contents or part thereof is prohibited. This applies in particular to trademarks, model denominations, part numbers and drawings. Use only authorized parts. Any damage or malfunction caused by the use of unauthorized parts is not covered by Warranty or Product Liability



- (2) **We:**  
(Fr) Nous  
**Ets Georges Renault**  
**38 rue Bobby Sands**  
**44818 Saint Herblain – FR**
- (3) Technical file available from EU headquarter.  
(Fr) Dossier technique disponible auprès du siège social  
**Pascal Roussy, R&D Manager**  
**Ets Georges Renault**  
**38 rue Bobby Sands – BP 10273**  
**44818 Saint Herblain – France**

- (4) **Declare that the product(s):**  
(Fr) déclarons que les produits
- Delta Wrench**  
*Delta Wrench*

- (5) **Machine type(s):**  
(Fr) type(s)

Model (Modèle)	Part Number (Référence)	Serial Number (N° série)
ANY	ANY	ANY

- (6) Origin of the product: Italy  
(Fr) Origine du produit
- (7) **Is in conformity with the requirements of the council Directives on the approximation of the laws of the Member States relating:**  
(Fr) est (sont) en conformité avec les exigences de la Directive du conseil, concernant les législations des états membres relatives:
- (8) **To "Risk of Hazardous Substances (ROHS)" 2011/65/EC (21/07/2011)**  
(Fr) aux "Risque de substances dangereuses (ROHS)" 2011/65/EC (21/07/2011)
- (9) **To "Electromagnetic Compatibility" 2004/108/EC (15/12/2004)**  
(Fr) aux "Compatibilité électro-magnétique" 2004/108/EC (15/12/2004)
- (10) **To " Radio and Telecommunications Terminal Equipment (R&TTE) " 1999/05/EC (09/03/1999)**  
(Fr) aux "Équipements radio et équipements terminaux de telecommunication (R&TTE)" 1999/05/EC (09/03/1999)

- (11) **Applicable harmonised standard(s):**  
(Fr) Norme(s) harmonisée(s) applicable(s):

<b>EN 61010-1:2010</b>	→	Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use – Part 1: General Requirements
<b>EN 61326-1:2013</b>	→	Electrical Equipment for Measurement, Control and Laboratory Use – EMC Requirements

- (12) **NAME and POSITION of issuer:**  
(Fr) NOM et FONCTION de l'émetteur:

**Pascal ROUSSY**  
**(R&D Manager)**

- (13) **Place: Saint Herblain**      **Date: 12/11/2017**  
(Fr) Place & Date



**DEUTSCH (GERMAN)** (1) **EG-KONFORMITÄTSERLÄRUNG** - (2) Wir, **DESOUTTER** - (3) Technische Datei beim EU - (4) erkläre hiermit, daß das (die) Produkt(e) : - (5) Typ(en): - (6) Produktherkunft - (7) den Anforderungen der EG-Richtlinie zur Angleichung der Rechtsvorschriften der Mitgliedsstaaten - (8) für **"Maschinen" 2006/42/EG** (17/05/06) - (9) für **"Elektromagnetische Störfreiheit" 2004/108/EG** (15/12/04) - (10) für **"Niederspannung" 2006/95/EG** (12/12/06) - entspricht (entsprechen). - (11) geltende harmonisierte Norme(n) - (12) NAME und EIGENSCHAFT des Ausstellers: - (13) Datum:

**NEDERLANDS (DUTCH)** (1) **E.G.-VERKLARING VAN OVEREENSTEMMING** - (2) De firma: **DESOUTTER** - (3) Technisch bestand verkrijgbaar - (4) verklaart hierbij dat het (de) produkt(en): - (5) type: - (6) Herkomst van het product - (7) in overeenstemming is (zijn) met de vereisten van de richtlijn van de Raad inzake de onderlinge aanpassing van de wetgevingen van de lidstaten betreffende: - (8) **"machines" 2006/42/CEE** (17/05/06) - (9) **"elektromagnetische compatibiliteit" 2004/108/EG** (15/12/04) - (10) **"laagspanning" 2006/95/EG** (12/12/06) - (11) geldige geharmoniseerde norm(en) - (12) NAAM en FUNCTIE van de opsteller: - (13) Datum:

**SVENSKA (SWEDISH)** (1) **EG-DEKLARATION OM ÖVERENSSTÄMMELSE** - (2) Vi **DESOUTTER** - (3) Teknisk fil tillgänglig från - (4) Förklarar att maskinen: - (5) Maskintyp: - (6) Produktens ursprung - (7) För vilken denna deklARATION gäller, överensstämmer med kraven i Ministerrådets direktiv om harmonisering av medlemsstaternas lagar rörande - (8) **"maskiner" 2006/42/EEG** (17/05/06) - (9) **"elektromagnetisk kompatibilitet" 2004/108/EEG** (15/12/04) - (10) **"lågspänning" 2006/95/EEG** (12/12/06) - (11) Harmoniserade standarder som tillämpats: - (12) Utfärdarens namn och befattning: - (13) Datum:

**NORSK (NORWEGIAN)** (1) **EF ERKLÆRING OM OVERENSSTEMMELSE** - (2) Vi **DESOUTTER** - (3) Teknisk dokument tilgjengelig - (4) Erklærer at produktet/produktene: - (5) av type: - (6) Produktets opprinnelse - (7) er i overensstemmelse med de krav som finnes i Ministerrådets direktiver om tilnærming av Medlemsstatenes lover vedrørende: - (8) **"maskiner" 2006/42/EF** (17/05/06) - (9) **"elektromagnetisk kompatibilitet" 2004/108/EF** (15/12/04) - (10) **"lavspenning" 2006/95/EF** (12/12/06) - (11) Harmoniserende standarder som er anvendt: - (12) Utsteders navn og stilling: - (13) Dato:

**DANSK (DANISH)** (1) **EF OVERENSSTEMMELSESERKLÆRING** - (2) Vi **DESOUTTER** - (3) Teknisk dokument kan fås på - (4) erklærer at produktet(erne): - (5) type: - (6) Produktets oprindelse - (7) er i overensstemmelse med kravene i Rådets Direktiv vedr. Tilnærmelse mellem medlemslandenes love for - (8) **"maskiner" 2006/42/EF** (17/05/06) - (9) **"elektromagnetisk kompatibilitet" 2004/108/EF** (15/12/04) - (10) **"lavspænding" 2006/95/EF** (12/12/06) - (11) Gældende harmoniserede standarder: - (12) Udsteder, navn og stilling: - (13) Dato:

**SUOMI (FINNISH)** (1) **ILMOITUS YHDENMUKAISUUDESTA EY** - (2) Me **Toiminimi DESOUTTER** - (3) Tekniset tiedot saa EU:n - (4) vakuutamme, että tuote / tuotteet: - (5) tyyppi(-pit): - (6) Tekniset tiedot saa EU:n - (7) on / ovat yhdenmukainen(-sia) neuvoston jäsenmaiden lainsäädäntöä koskevien direktiivien vaatimusten kanssa, jotka koskevat: - (8) **"koneita" 2006/42/EY** (17/05/06) - (9) **"elektromagneettista yhteensopivuutta" 2004/108/EY** (15/12/04) - (10) **"matalajännitteitä" 2006/95/EY** (12/12/06) - (11) yhdenmukaistettu(-tut) soveltuva(t) standardi(t): - (12) ilmoituksen antajan NIMI ja ASEMA: - (13) Päiväys:

**ESPAÑOL (SPANISH)** (1) **DECLARACION DE CONFORMIDAD CE** - (2) Nosotros **DESOUTTER** - (3) Archivo técnico disponible en - (4) declaramos que el producto: - (5) tipo de máquina: - (6) Origen del producto - (7) es conforme a los requisitos de la Directiva del Consejo sobre la aproximación de las leyes de los Estados Miembros con relación - (8) a la **"maquinaria" 2006/42/CE** (17/05/06) - (9) a la **"compatibilidad electromecánica" 2004/108/CE** (15/12/04) - (10) a la **"baja tensión" 2006/95/CE** (12/12/06) - (11) normas armonizadas aplicadas: - (12) Nombre y cargo del expedidor: - (13) Fecha:

**PORTUGUÊS (PORTUGUESE)** (1) **DECLARAÇÃO DE CONFORMIDADE CE** - (2) Nós **DESOUTTER** - (3) Ficheiro técnico disponível na - (4) declaramos que o produto: - (5) tipo de máquina: - (6) Origem do produto - (7) está em conformidade com os requisitos da Directiva do Conselho, referente às legislações dos Estados-membros relacionados com: - (8) **"maquinaria" 2006/42/CE** (17/05/06) - (9) **"compatibilidade electromagnética" 2004/108/CE** (15/12/04) - (10) **"baixa tensão" 2006/95/CE** (12/12/06) - (11) Normas harmonizadas aplicáveis: - (12) Nome e cargo do emissor: - (13) Data:

**ITALIANO (ITALIAN)** (1) **DICHIARAZIONE DI CONFORMITÀ CE** - (2) La Società : **DESOUTTER** - (3) File tecnico disponibile dal - (4) dichiara che il(i) prodotto(i): - (5) tipo: - (6) Origine del prodotto - (7) è (sono) in conformità con le esigenze previste dalla Direttiva del Consiglio, sulle legislazioni degli Stati membri relative: - (8) alle **"restrizioni dell'uso di sostanze pericolose (ROHS)" 2011/65/CE** (21/07/11) - (9) alla **"compatibilità elettromagnetica" 2004/108/CE** (15/12/04) - (10) alle **"apparecchiature radio e terminali telecomunicazioni (R&TTE)" 1999/05/CE** (09/03/99) - (11) norma(e) armonizzata(e) applicabile(i): - (12) NOME e FUNZIONE del dichiarante: - (13) Data:

**ΕΛΛΗΝΙΚΑ (GREEK)** (1) **\_ΗΛ ΣΗ ΠΙΣΤΟΤΗΤΑΣ ΕΚ** - (2) Η εταιρεία : **DESOUTTER** - (3) Τεχνικός φάκελος διαθέσιμος - (4) δηλώνει υπεύθυνα ότι το(τα) προϊόν(-ντα): - (5) τύπου(-ων): - (6) Προέλευση προϊόντος - (7) είναι σύμφωνο(-α) προς τις απαιτήσεις της Οδηγίας του Συμβουλίου που αφορά την προσέγγιση των νομοθεσιών των κρατών μελών τις σχετικές με: - (8) τα **"μηχανήματα" 2006/42/EOK** (17/05/06) - (9) την **"ηλεκτρομαγνητική συμβατότητα" 2004/108/EOK** (15/12/04) - (10) τη **"χαμηλή τάση" 2006/95/EOK** (12/12/06) - (11) εφαρμοστέο(-α) εναρμονισμένο(-α) πρότυπο(-α): - (12) ΟΝΟΜΑ και ΑΠΟΜΟΙΟΤΗΤΑ του δηλούντος: - (13) Ημερομηνία:

**ČESKY (CZECH)** (1) **PROHLÁŠENÍ O SOULADU S PŘEDPISY ES** - (2) My, firma **DESOUTTER** - (3) Technický soubor, dostupný - (4) prohlašujeme, že výrobek (výrobky): - (5) typ přístroje (přístrojů): - (6) Původ výrobku - (7) je v souladu s požadavky směrnice Rady EU o aproximaci práva členských států EU, a to v těchto oblastech: - (8) „**přístroje**“ **2006/42/EC** (17/05/06) - (9) „**Elektromagnetická kompatibilita**“ **2004/108/EC** (15/12/04) - (10) „**Nízké napětí**“ **2006/95/EC** (12/12/06) - (11) *relevantní harmonizované normy*. - (12) Jméno a funkce osoby, která prohlášení vystavila - (13) Datum:

**MAGYAR (HUNGARIAN)** (1) **CE MEGFELELISÉGI NYILATKOZAT** - (2) Mi, az: **DESOUTTER** - (3) kijelentjük, hogy a termék(ek) - (4) géptípus(ok): - hogy a termék(ek): - (5) géptípus(ok): - (6) A műszaki leírás az EU-s - (7) megfelel(nek) a tagországok törvényeiben megfogalmazott, alábbiakban szereplő tanácsi irányelvek követelményeinek: - (8) **"Gépek, berendezések" 2006/42/EC** (17/05/06) - (9) **"Elektromágneses kompatibilitás" 2004/108/EC** (15/12/04) - (10) **"Alacsony feszültségű szabványok" 2006/95/EC** (12/12/06) - (11) alkalmazható harmonizált szabvány(ok): - (12) Kibocsátó neve és adatai: - (13) Dátum:



**LIETUVIŠKAI (LITHUANIAN)** (1) **EB ATITIKTIES DEKLARACIJA** - (2) Mes: **DESOUTTER** - (3) Techninius duomenis galite - (4) pareiškiamo, kad gaminys(-iai): - (5) mašinos tipas(-ai): - (6) Produkto kilmė - (7) atitinka Europos Tarybos Direktyvų reikalavimus dėl valstybių narių įstatymų, susijusių: - (8) su „mašinomis“ **2006/42/EB** (17/05/06) - (9) su „**Elektromagnetiniu suderinamumu**“ **2004/108/EB** (15/12/04) - (10) su „**Žema įtampa**“ **2006/95/EB** (12/12/06), suderinimo - (11) *taikomi harmonizuoti standartai*: - (12) išdavusio asmens pavardė ir pareigos: - (13) Data:

**SLOVENŠČINA (SLOVENIAN)** (1) **IZJAVA ES O SKLADNOSTI** - (2) Mi: **DESOUTTER** - (3) Tehnična kartoteka je na voljo - (4) izjavljamo, da je izdelek (oziroma izdelki): - (5) vrsta stroja (oziroma vrste): - (6) Izvor izdelka - (7) v skladu z zahtevami direktiv Sveta Evrope o približevanju zakonodaje držav članic glede: - (8) "**strojev**" **2006/42/ES** (17/05/06) - (9) "**Elektromagnetne združljivosti**" **2004/108/ES** (15/12/04) - (10) "**Nizke napetosti**" **2006/95/ES** (12/12/06) - (11) *veljavnih harmoniziranih standardov*: - (12) Ime in funkcija izdajatelja - (13) Datum:

**POLSKI (POLISH)** (1) **UE –DEKLARACJA ZGODNOŚCI** - (2) My, firma **DESOUTTER** - (3) Plik techniczny jest dostępny w - (4) oświadczamy, że produkt (produkty): - (5) urządzenie typu (typów): - (6) Pochodzenie produktu - (7) jest (są) zgodne z wymogami Dyrektywy Rady, odpowiadającej ustawodawstwu krajów członkowskich i dotyczącej: - (8) "**maszyn i urządzeń**" **2006/42/UE** (17/05/06) - (9) "**Zgodności elektromagnetycznej**" **2004/108/UE** (15/12/04) - (10) "**niskich napięć**" **2006/95/UE** (12/12/06) - (11) *stosowanych norm, wzajemnie zgodnych*: - (12) Nazwisko i stanowisko wydającego deklarację: - (13) Data:

**SLOVENSKY (SLOVAK)** (1) **DEKLARÁCIA ER O SÚHLASE** - (2) My: **DESOUTTER** - (3) Technický súbor k dispozícii z - (4) prehlasujeme, že výrobok (y): - (5) strojový typ(y): - (6) Pôvod produktu alebo výrobku - (7) zodpovedá požiadavkom Smerníc rady, týkajúcich sa aproximácie zákonov členských štátov, pre: - (8) "**strojné zariadenia**" **2006/42/EC** (17/05/06) - (9) po "**Elektromagnetickú kompatibilitu**" **2004/108/EC** (15/12/04) - (10) po "**Nízke napätie**" **2006/95/EC** (12/12/06) - (11) *zodpovedajúce harmonizačné normy*: - (12) Meno a funkcia vystavovateľa dokladu: - (13) Dátum:

**LATVISKI (LATVIAN)** (1) **EK ATBILSTĪBAS DEKLARĀCIJA** - (2) Mēs, kompānija **DESOUTTER** - (3) Tehniskais fails pieejams ES - (4) deklarējam, ka šis (-ie) izstrādājums (-i): - (5) ierīces tips (-i): - (6) Izstrādājuma izcelsme - (7) atbilst Padomes Direktīvu prasībām par dalībvalstu likumu piemērošanu, kas attiecas uz: - (8) "**mehānismiem**" **2006/42/EK** (17/05/06) - (9) "**elektromagnētisko savietojamību**" **2004/108/EK** (15/12/04) - (10) "**zemspriegumu**" **2006/95/EK** (12/12/06) - (11) *spēkā esošajam (-iem) saskaņotajam (-iem) standartam (-iem)*: - (12) Pieteicēja vārds un amats: - (13) Datums:

**中文 (CHINESE)** (1) **EC 一致性声明** - (2) 我们: **DESOUTTER** - (3) 技术参数资料可以从EU总部获得。 - (4) 声明其产品: - (5) 机器类型: - (6) 产品原产地 - (7) 符合会员国立法会议“决定”的相关要求: - (8) "**机械**" **2006/42/EC** (17/05/06) - (9) "**电磁相容性**" **2004/108/EC** (15/12/04) - (10) "**低电压**" **2006/95/EC** (12/12/06) - (11) 适用协调标准: - (12) 发行者名称和地点: - (13) 日期:

**РУССКИЙ (RUSSIAN)** (1) **ДЕКЛАРАЦИЯ СООТВЕТСТВИЯ** - (2) Мы: **DESOUTTER** - (3) Технический файл можно - (4) заявляем, что продукция: - (5) тип оборудования: - (6) Происхождение продукта - (7) соответствует требованиям директивы европейского совета относительно законодательств стран-участниц по: - (8) "**Машинному оборудованию**" **2006/42/EC** (17/05/06) - (9) по "**Электромагнитной совместимости**" **2004/108/EC** (15/12/04) - (10) по "**Низкому напряжению**" **2006/95/EC** (12/12/06) - (11) применяемые согласованные нормы: - (12) Фамилия и должность составителя: - (13) Дата: