User Guide

STwrench

Atlas Copco Industrial Technique AB

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2014-07
Edition 2.9



Revision history

Edition	Date	Author	Description	Reference Minimum Software version (ToolsTalk BLM)	Reference Firmware version
2009-01	23 February 2009	M. Grippa	First issue for Demo Kit		
2009-02	30 March 2009	M. Grippa	First official release	2.0.x	2.1x
2009-03	07 May 2009	M. Grippa	Added Diagnostic menu (par. 20.1), end fitting tools details (par. 2.4.10), new controller settings (par. 10.2), general manual update	2.0.x	2.1x
2009-04	30 July 2009	M. Grippa	Power Focus connection with IRC-Z, IRC-W and Cable Box added (par. 14.2, 14.3 and 14.4), updated Tag Writer (par. 10.3.2) and Identifiers (par. 9), added IRC-Z module, general manual update	2.1.x	2.3x
2010-01	23 February 2010	M. Grippa	QATnodes added (par. 2.4.9 and 16), trace management settings added (par. 10.2.7), API interface added (par. 18 and 2.3.6), general manual update	3.0.x	3.0x
2010-02	26 May 2010	M. Grippa	New function: Traces to Power Focus and ToolsNet, new wrench settings and units of measurement, update to new details of version 3.1.	3.1.x	3.1x
2010-03	09 July 2010	M. Grippa	Added connection to Torque Supervisor (par. 16), added Appendix B – STwrench factory settings (par. 22)	3.1.x	3.1x

2010-04	28 September 2010	M. Grippa	New minimum load setting (par. 10.2.7.2), added IRC-W TKIP-PEAP module with new security options.	4.0.x	3.2x
2010-05	04 November 2010	M. Grippa	Added IRC-W connection for API (par. 18.1)	4.0.x	3.2x
2.0	01 February 2012	M. Grippa	Added IRC-W Dual Radio module, added battery short HD (par. 2.4.7), STwrench controller settings updated (par. 10.2.1), added STwrench accessories (par. 2.4.11 and 2.4.12), smartHEAD overload control added, quality control strategies updated (par. 6.7.2), Windows 7 compatibility added, general manual update.	7.2.x	3.3x
2.1	12 April 2012	M. Grippa	Added PVT strategy (par. 6.7.1.8)	7.4.x	3.4x
2.2	10 July 2012	M. Grippa	Real time traces added (par. 13), overload function updated, added IRC-W pairing procedure with keyboard.	7.5.x	3.5x
2.3	26 September 2012	M. Grippa	Real Time Traces updated (par. 13 and 18.2)	7.7.x	3.6x
2.4	14 December 2012	M. Grippa	Real time torque traces function updated (par. 13), Traces import/export function added (par. 12.3), Results viewer on STwrench display added (par. 11), smartHEAD 800 Nm added, Settings for trace resolution to Power Focus added (par. 10.2.4.5).	7.8.x	3.7x
2.5	05 April 2013	M. Grippa	Real time traces settings updated (par. 13.1), Power Focus settings updated (par. 10.2.4)	7.9.x	3.8x
2.6	26 July 2013	M. Grippa	smartHEAD 15 Nm and 1000 Nm added, battery inside (BI) added, Overload management updated (par. 2.4.3), EAP-TLS security	7.10.x	3.9x

			type added to IRC-W module (par. 22), Manual barcode (VIN) insertion via keyboard added (par. 6.5).		
2.7	17 December 213	M. Grippa	Residual torque/angle strategy updated (par. 6.7.2.3), Maximum number of traces updated (par. 10.2.7.1), IRC-W PEAP/PEP 128 added (par. 15.1), IRC-W advanced settings updated.	7.11.x	3.10x
2.8	26 March 2014	M. Grippa	Track Angle added in free mode (par. 4.1.6), traces viewer updated (par.12), IRC-W Test added (par. 2.4.6.1), Torque (monitor) / angle (control) strategy updated (par. 6.7.1.3)	7.12.x	3.11x
2.9	17 July 2014	M. Grippa	Offline programming updated (par. 11), Traces viewer function updated (par. 13), Multistage from Power Focus added (par. 15)	8.0.x	3.12x

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Manufacturer: Atlas Copco BLM, via Pepe 11, 20037 Paderno Dugnano (Mi), Italy

NOTE: This manual may be altered without further notice.
For further information log on to Atlas Copco www.atlascopco.com

NOTE: The programming software (ToolsTalk BLM) may be updated with no changes regarding the STwrench functionalities. The minimum version indicated here is required for the reference firmware version.

NOTE: In the event of conflicts between translations of this user guide, always refer to the official English version.

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SAFETY INFORMATION



WARNING: PLEASE READ THE STwrench SAFETY INFORMATION No. 9836 4489 00 CAREFULLY PRIOR TO USING THE PRODUCT AND STRICTLY FOLLOW THE SAFETY INSTRUCTIONS PROVIDED.

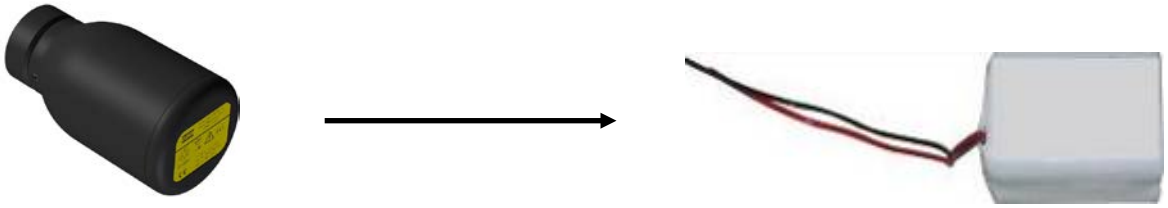
IF THE EQUIPMENT IS USED IN A MANNER NOT SPECIFIED BY ATLAS COPCO BLM, THE PROTECTION PROVIDED BY THE EQUIPMENT MAY BE IMPAIRED.

BATTERY INFORMATION according to European Regulation 2006/66/CE

BATTERY PACK SPECIFICATION

			
MODEL	STwrench battery	STwrench battery short HD	STwrench Battery BI
P/N	8059 0930 86	8059 0930 83	8059 0930 85
TYPE	Lithium-ion, 3.75V 5.2A	Lithium-ion, 3.75V 2.6A	Lithium-ion, 3.7V 2.9A
CELL WEIGHT	215g	110g	50g

The cells are installed inside the battery shell:



NOTE: Once removed, waste batteries must be disposed of in accordance with local regulations.

1 Introduction

1.1 About This Document

This document is a user guide for the STwrench and is divided into the following main parts:

Part	Name	Description
Chapter 1	Introduction	This chapter introduces this user guide and provides the wrench technical specifications.
Chapter 2	System Overview	This chapter introduces the STwrench with its modules and accessories.
Chapter 3	User Interfaces	This chapter provides an overview of the user interfaces available on the STwrench (LEDs, display, keyboard, ports, etc).
Chapter 4	Getting Started with the STwrench	This chapter guides the operator in starting to use the wrench in free test mode.
Chapter 5	Working with ToolsTalk BLM	This chapter introduces the operations of the STwrench management software.
Chapter 6	Pset	This chapter describes all the parameters and tightening strategies available for a tightening program.
Chapter 7	Multistage	This chapter describes how to create, setup and run a Multistage.
Chapter 8	Job	This chapter describes how to create, setup and run a Job.
Chapter 9	Identifier	This chapter describes the use of barcode readings with STwrench.

Chapter 10	STwrench Settings	This chapter guides the operator in all the settings of the STwrench, in order to customize the product to the customer's needs.
Chapter 11	Offline Programming	This chapter explains the function to create the tightening program and STwrench configuration working with ToolsTalk BLM offline (not connected to a STwrench).
Chapter 12	Result Viewer	This chapter describes how the management program retrieves the STwrench result.
Chapter 13	Traces Viewer	This chapter describes how the management program retrieves the STwrench traces.
Chapter 14	Real Time Traces	This chapter explains the use of the Real Time Traces function.
Chapter 15	Working with Power Focus	This chapter explains the use of the wrench with Power Focus.
Chapter 16	Working with ToolsNet	This chapter explains the use of the wrench with ToolsNet.
Chapter 17	Working with Torque Supervisor	This chapter explains the use of the wrench with Torque Supervisor.
Chapter 18	Working with the QATnode	This chapter explains the use of the wrench with the various QATnodes, for printing the tightening results, interfacing the STwrench with a remote device using the I/O module, and connecting to ToolsNet.
Chapter 19	Working with the API	This chapter explains the use of the wrench with the API interface.
Chapter 20 and 21	Maintenance and Troubleshooting Guide	These chapters describe the required maintenance for the STwrench, and how to troubleshoot to solve the most common problems.
Appendix A	Torque / Angle Coefficient Calculation for Wrench Extension	This appendix shows the operator how to calculate the correction coefficients when an

		extension is used with the wrench.
Appendix B	EAP-TLS Security Type	This appendix shows how to load the certificates for the EAP-TLS security type for IRC-W module.
Appendix C	STwrench Factory Settings	This appendix shows the factory configuration of the STwrench settings.



NOTE: This manual explains all the functions available on the STwrench with full options. Your specific wrench may not include all the features, such as angle reading or some tightening strategies.

1.2 Reference Documents

The following is a list of important documents that may be useful to obtain a complete overview of the product and all its applications:

- STwrench Safety Information (No. 9836 4489): Multi-language safety instructions
- ToolsTalk BLM registration procedure: How to register the software on the Atlas Copco website
- STwrench calibration procedure: Procedure to calibrate the STwrench (only for use by authorized calibration centers)
- Installation guides for STwrench modules: Detailed installation instructions, delivered with each module
- BLM Torque Seminar
- ToolsNet User Guide
- Power Focus User Guide
- BLM Torque Supervisor User Guide
- STwrench WEEE manual: Instructions about how to dispose of the product at the end of its life

1.3 Specifications

TECHNICAL

- Operating torque measuring range: 1.5 N·m ÷ 1000 N·m with stated accuracy
- Torque measurement accuracy:

  - smartHEAD 15 Nm ÷ 800 Nm
  0.5 % readout ±1 digit (from 20% to 100% of cell capacity)
  1 % readout ±1 digit (from 10% to 20% of cell capacity)

  - smartHEAD 1000 Nm
  0.5 % readout ±1 digit (from 30% to 100% of cell capacity)
  1 % readout ±1 digit (from 10% to 30% of cell capacity)

- Overload capacity: 120% of cell nominal capacity (value marked on the smartHEAD)
- Temperature stability of torque measurement: 0.1% of capacity/10°C
- Maximum angular speed (for wrench with angle measurement): 150 °/s
- Angle measurement accuracy (for wrench with angle measurement): ±1° over 360°
- Tightening results memory capacity: 5000 tightening results
- Tightening traces memory capacity: Programmable from 90 traces 30 s in length to 1 trace 300 s in length.
- Maximum number of identifier strings: 300
- Units of measurement supported: N·m, kgf·m, kgf·cm, lbf·ft, lbf·in, ozf·ft, ozf·in, kp·m, dN·m

BATTERY PACK

- Battery power supply:
  - STwrench standard battery: 3.75 V, 5.2 Ah
  - STwrench battery short HD: 3.75 V, 2.6 Ah
  - STwrench battery inside BI: 3.7 V, 2.9 Ah
- Battery type: Lithium-ion (Li-ion)
- Battery endurance:

	Operation time	Operation time with IRC-W module installed
Standard battery	16 h	7 h 30 ’
Short HD battery	8 h	3 h 30 ’
Battery inside BI	8 h 30 ’	4 h

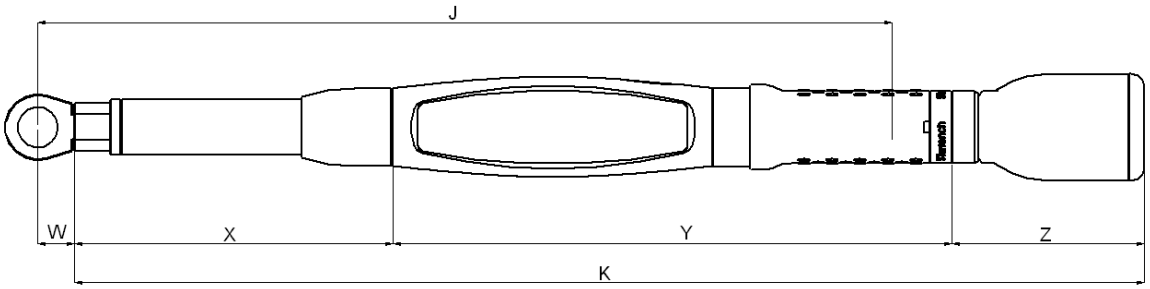
NOTE: Battery endurance gets shorter with the increase of the battery life.

- Recharging: Max. 5 h 30 ’

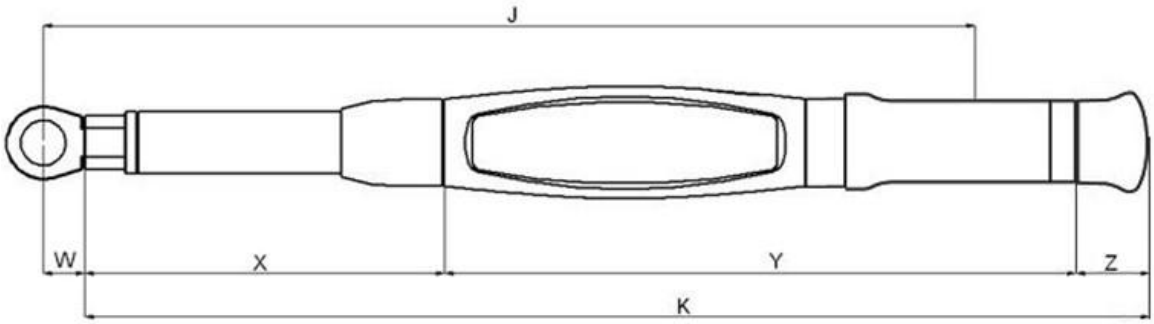
BATTERY CHARGER

- Input power: 100 ÷ 230 VAC
- AC power consumption: 70 W maximum
- Output: 4.2 VDC 13 W maximum
- Overvoltage category: II

DIMENSIONS AND WEIGHT



Standard controller



controller BI

	Length						**Weight** (without end fitting tool)	
	X	Y	Z*	K*	J**	W		
MODEL	mm	mm	mm	mm	mm	mm	kg	lb
STwrench 15 N·m	139	280	96	515	407	18.3	1.00	2.20
STwrench 30 N·m	139	280	96	515	407	18.3	1.03	2.27
STwrench 80 N·m	139	280	96	515	407	18.3	1.06	2.34
STwrench 150 N·m	262	280	96	638	537	24.2	1.28	2.82
STwrench 250 N·m	408	280	96	784	683	24.2	1.51	3.33
STwrench 400 N·m	575	280	96	952	850	24.2	1.71	3.77
STwrench 600 N·m	1040	280	96	1416	1353	63	2.87	6.33
STwrench 800 N·m	1040	280	96	1416	1353	63	2.87	6.33
STwrench 1000 N·m	1270	280	96	1646	1668	148	3.72	8.20
STwrench BI 15 N·m	139	280	32	451	407	18.3	0.80	1.76
STwrench BI 30 N·m	139	280	32	451	407	18.3	0.83	1.83
STwrench BI 80 N·m	139	280	32	451	407	18.3	0.86	1.89

STwrench BI 150 N·m	262	280	32	574	537	24.2	1.08	2.38
STwrench BI 250 N·m	408	280	32	720	683	24.2	1.31	2.89
STwrench BI 400 N·m	576	280	32	887	850	24.2	1.51	3.33
STwrench BI 600 N·m	1040	280	32	1352	1353	63	2.67	5.89
STwrench BI 800 N·m	1040	280	32	1352	1353	63	2.67	5.89
STwrench BI 1000 N·m	1270	280	32	1582	1668	148	3.52	7.76

***** Dimension Z is 50.5 mm when the STwrench battery short HD is installed (and Dimension K decreases by 45.5 mm)

****** Dimension J 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 Atlas Copco end-fitting tools; if a different end-fitting tool is used, this measure must be recalculated.

See *Appendix A – Calculating Torque and Angle Correction Coefficients* for more information.

INTERFACES

- MiniUSB 2.0 port
- IRDA port: 1.2 SIR, 1m range
- IRC-W radio module (optional):
  - Type: 802.11g
  - Frequency: 2.412 ÷ 2.472 GHz (channel 1 – 13, 5MHz separation)
  - RF output power: 15 dBm
  - Receiver sensitivity: -72 dBm
  - Receive input level (max): -10 dBm

- IRC-W dual band 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 (FCC, IC, ETSI domain) 20 MHz channel separation
    5.260 - 5.320 GHz, U-NII-2 Channel 52, 56, 60, 64 (FCC, IC, ETSI domain) 20 MHz channel separation
    5.500 - 5.700 GHz, U-NII-2e Channel 100, 104, 108,112, 116, 120, 124, 128, 132, 136, 140 (FCC, ETSI domain) 20 MHz channel separation
    5.500 - 5.700 GHz, U-NII-2e Channel 100, 104, 108,112, 116, 132, 136, 140 (IC domain) 20 MHz channel separation
    5.745 - 5.825 GHz, U-NII-3* Channel 149, 153, 157, 161, 165 (FCC domain) 20 MHz channel separation
  - 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

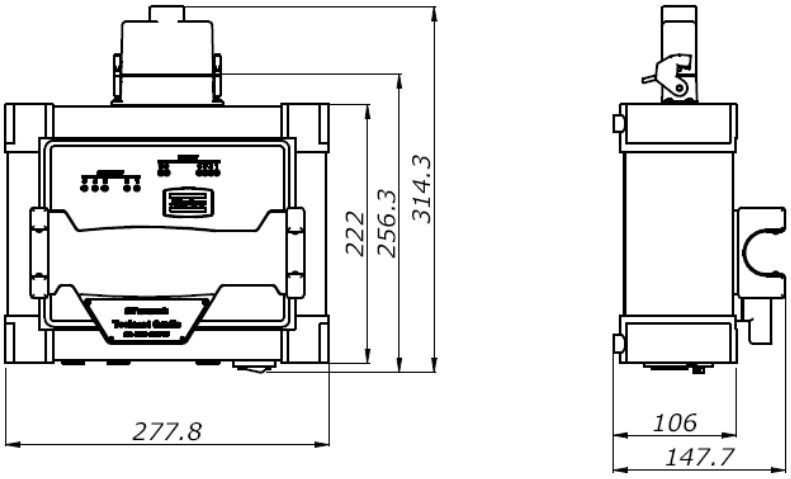
  * Available only for modules from serial number 201500689

- IRC-B radio module (optional):
  - Frequency: 2.402 ÷ 2.480 GHz
  - RF output power: max 16.9dBm (49mW)
  - Receiver sensitivity: -89 dBm
  - Receive input level (max): +16 dBm

- IRC-Z radio module (optional):
  - Channels: 11 ÷ 26
  - Frequency: 2.405 ÷ 2.480 GHz
  - Channel separation: 5 MHz
  - RF output power: max 4 dBm
  - Receiver sensitivity: -100 dBm
  - Receive input level (max): +10 dBm

- Barcode reader module (optional):
  - Visible laser diode 650 nm
  - Output power: 1 mW maximum
  - Scan rate: 104 ± 12 scans/second (bi-directional)
  - Scan angle: 47° ± 3°
  - Scan patterns: Linear
  - Minimum print contrast: Minimum 20% absolute dark/light reflectance measured at 650 nm
  - Ambient light:
    - Sunlight: 10000 ft candles (107640 Lux)
    - Artificial: 450 ft candles (4484 Lux)
  - EMI/RFI: FCC Part 15 Class B, EN 55024/CISPR 22, AS 3548, VCCI
  - Laser Safety: IEC 60825-1:2007 (CEI EN 60825-1:2009) class 1

- QATnode:
  - Input power: 100 ÷ 230 VAC
  - AC fuse: F5AL 250V (in AC power socket)
  - AC power consumption: 15 W average
  - 6 inputs: 12 ÷ 24 VDC (20 mA input current) for high status
  - 5 relays outputs: 24 VDC 1 A max
  - Serial port for STAR printer connection
  - 2 serial ports for settings and maintenance activities
  - IRDA 1.2 SIR, 1m range
  - Ethernet port
  - Dimensions (in millimeters):



  - Weight: 4.26 kg

- RFID reader for end-fitting tool recognition (inside smartHEAD):
  - Working frequency: 125 kHz
  - Manchester coding

ENVIRONMENTAL

The following conditions must be observed during operation:
- Internal use only
- Environmental class: II
- IP grade according to EN IEC 60529: IP40
- Ambient temperature: 5 to 40°C
- Atmospheric humidity: 95%, non-condensing
- Altitude: Up to 2000m
- Shock indicator on STwrench controller.

SYSTEM REQUIREMENTS

The following are the PC minimum requirements for installation of the STwrench management software (ToolsTalk BLM):

- Processor: 400 MHz (800 MHz or above recommended)
- Memory: 256 Mb or above
- Hard disk space: 610 Mb (1 Gb recommended)
- Display: 1024 x 768, 256 colors (1024 x 768, High Color (16-bit) recommended)
- Operating Systems: Windows XP, Windows 7 32/64 bit
- Internet Explorer 5.01 or later (required for installation of the .NET Framework)
- Windows Installer 3.1
- Microsoft Excel (required to view the exported file containing the tightening results)

NOTE: A system should meet these or the minimum requirements for the operating system, whichever is higher.

CALIBRATION CERTIFICATE

STwrench comes with an Atlas Copco BLM factory calibration certificate.
Optional ACCREDIA (ex SIT) certification is available on request and by agreement.
Atlas Copco BLM is an ACCREDIA calibration center.

1.4 Standard Conformity

The STwrench 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:

- 1999/05/EC Radio and telecommunications terminal equipment
- 2004/108/CE EMC Directive - Electromagnetic Compatibility
- 2006/95/CE Low Voltage Directive

Applicable normalized standards:

- ETSI EN 300 328 V.1.7.1:2006 RADIO
- ETSI EN 300 330 V.1.3.1:2006-04 RADIO
- FCC Rules N. 47 Part 15 RADIO FREQUENCY DEVICES
- EN 301 489-1 V1.6.1:2005-04 EMC
- EN 301 489-17 V1.2.1:2002-08 EMC
- EN 61000-4-2:1995 +A1:1998 + A2:2001 EMC
- EN 61000-4-3:2002 EMC
- EN 61000-6-2:2005 EMC
- EN 61326-1:2006 EMC
- CISPR 11:2003 + A1:2004 EMC
- EN 61010-1:2001 SAFETY
- EN 60068-2-1:1993 + A1 + A2 ENVIRONMENTAL TESTING
- EN 60068-2-2 :1993 + A1 + A2 ENVIRONMENTAL TESTING
- EN 60068-2-78:2001 ENVIRONMENTAL TESTING

2 System Overview

The STwrench is a modular wrench designed for optimal operation in:

- ***Tightening operations in production***: The STwrench offers a wide variety of tightening strategies. The test results can be retrieved via the wrench management software (ToolsTalk BLM), exported into Microsoft Excel and printed, or transferred to ToolsNet. The tool can also work connected to Power Focus, which defines and sends the tightening programs to the wrench.
- ***Quality control***: The STwrench offers a vast set of methods for evaluating the residual torque; making it possible to keep the quality of the tightening operations on a production line under control. The test results can be retrieved via the wrench management software (ToolsTalk BLM), exported into Microsoft Excel and printed, or transferred to Torque Supervisor.
- ***Joint analysis***: The STwrench is a perfect tool for studying a joint through the joint analysis feature. The yield point is automatically detected and the trace can be transferred to a PC for analysis.

2.1 STwrench Concept

The STwrench is modular. You can therefore customize your wrench for optimum use in your own environment.
This modularity is provided by interchangeable heads with different capacities, optional IRC-B, IRC-Z or IRC-W radio modules, a barcode scanner, and tightening strategies for quality or production which can be purchased only if needed.



NOTE: Each smartHEAD is intended to be associated with a single STwrench controller! The smartHEAD interchangeability assures easy and fast maintenance operations and wrench upgrade.

IMPORTANT NOTE:

Assembling different heads on the same controller during normal wrench operations represents improper use of the modularity concept and will invalidate the warranty on the wrench components.

2.2 STwrench Versions

This chapter provides a summary of the tightening strategies available on the different STwrench and smartHEAD versions. The STwrench version is defined by the Rapid Backup Unit (RBU) installed:

		RBU Quality		**RBU Production**	
		smartHEAD only torque	smartHEAD torque/angle	smartHEAD only torque	smartHEAD torque/angle
Tightening strategies					
Free mode	Track	**YES**	**YES**	**YES**	**YES**
	Peak	**YES - no angle displayed**	**YES**	**YES - no angle displayed**	**YES**
Production strategies	Torque	-	-	**YES**	**YES**
	Torque control / angle monitor	-	-	-	**YES**
	Torque monitor / angle control	-	-	-	**YES**
	Torque control / angle control OR	-	-	-	**YES**
	Torque control / angle control AND	-	-	-	**YES**
	Yield point	-	-	-	**YES**
	PVT compensate with snug	-	-	-	**YES**
	Loose	-	-	-	**YES**
Quality strategies	Yield point (joint analysis)	-	**YES**	-	**YES**
	Residual Torque / Time	**YES**	**YES**	**YES**	**YES**
	Residual Torque / Angle	-	**YES**	-	**YES**
	Residual Torque / Peak	**YES**	**YES**	**YES**	**YES**
	Loose and retight	-	**YES**	-	**YES**

2.3 STwrench Typical Applications Scenario

This chapter provides a quick overview of the main applications of the STwrench.

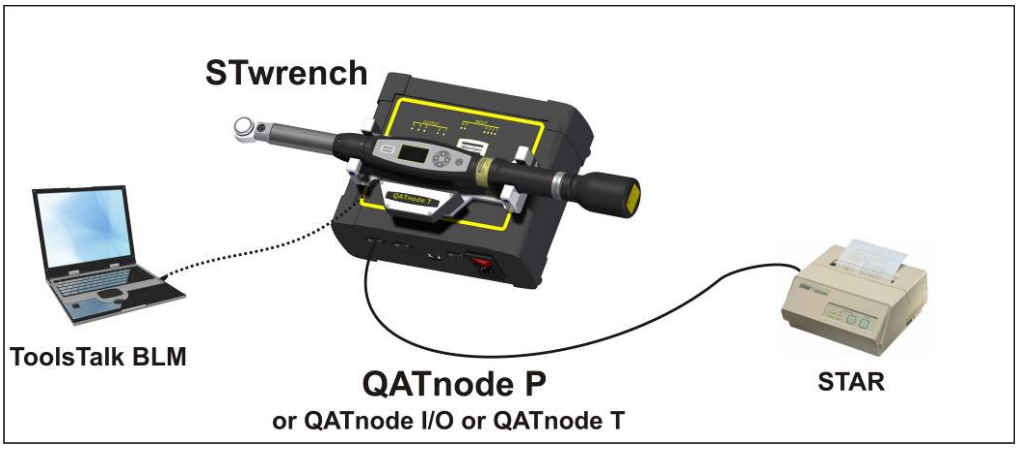
2.3.1 Stand-alone wrench printing the results

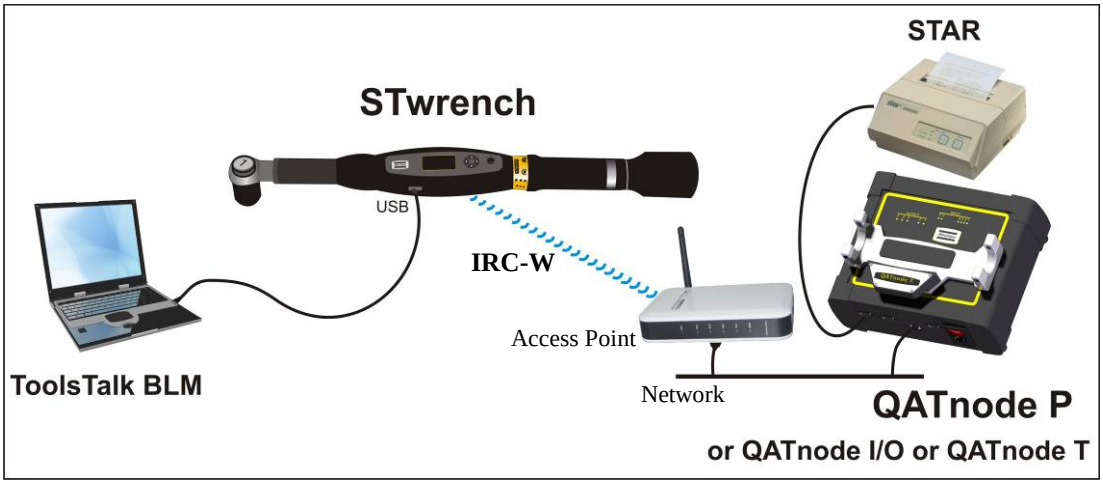


The STwrench can work as a stand-alone instrument for either production or quality control, programmed by its management software (ToolsTalk BLM), which can retrieve tightening results and traces, to be printed and/or exported into a Microsoft Excel file.

See the *Working with ToolsTalk BLM* chapter for more information.

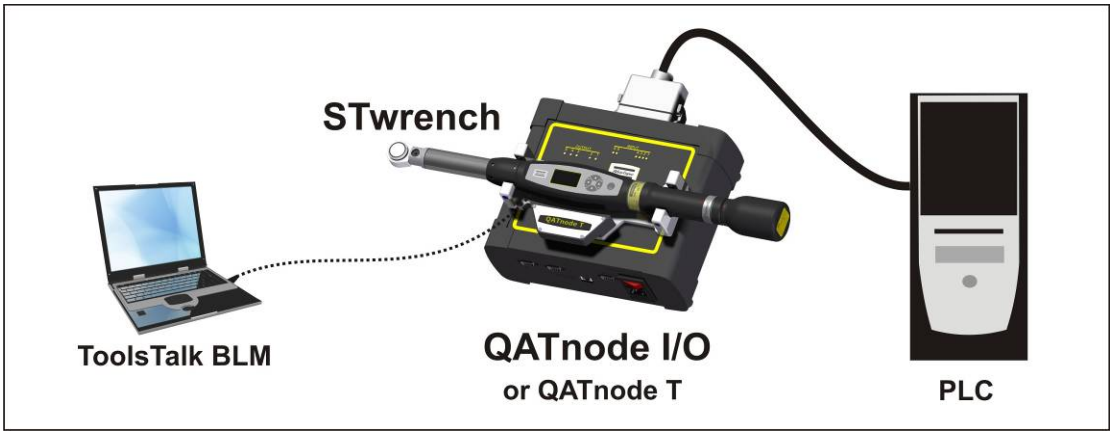
By using the *QATnode P* (but also the other QATnode models provide this function), it is possible to print the results of tightening operations on a STAR printer. The connection can be made via the IRDA port, or IRC-W module:

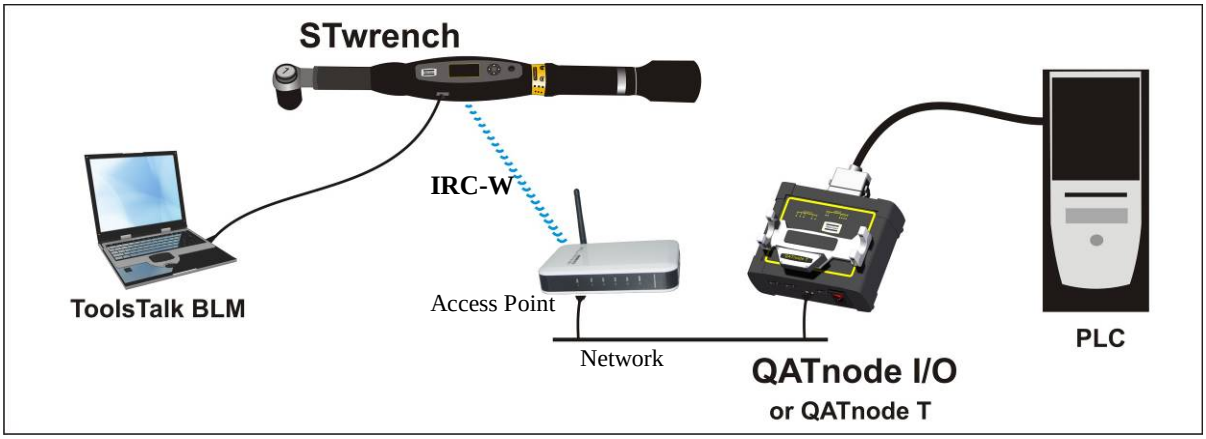




See the *Working with the QATnode* chapter for more information.

2.3.2 Stand-alone wrench driven by remote device, with the option of printing the results

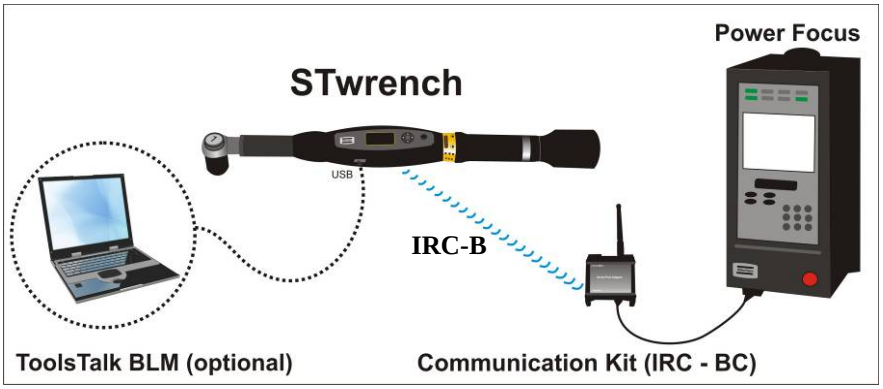


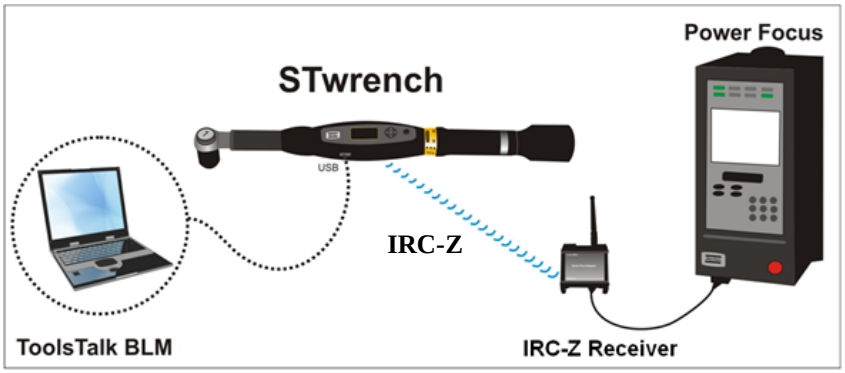


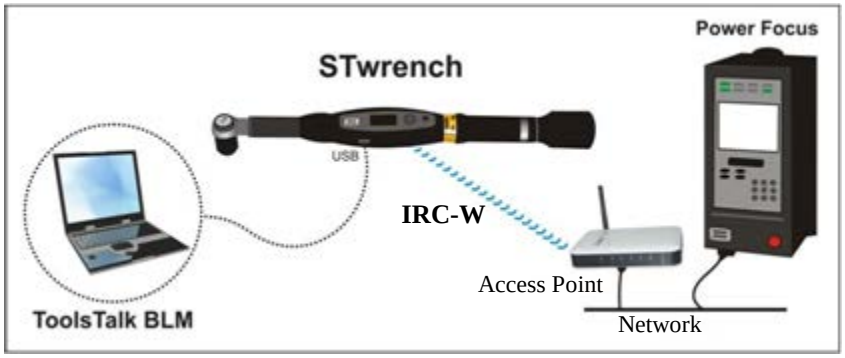
The STwrench can work as a stand-alone instrument for either production or quality control, programmed by its management software (ToolsTalk BLM), which can retrieve tightening results and traces, to be printed in an exported Microsoft Excel file if required.
By using the *QATnode I/O* (but also the *QATnode T* provides this feature), the tightening programs can be selected using a remote device (such as a PLC). This QATnode version allows also the tightening results to be printed on a STAR printer. The connection can be made via the IRDA port, or IRC-W module.

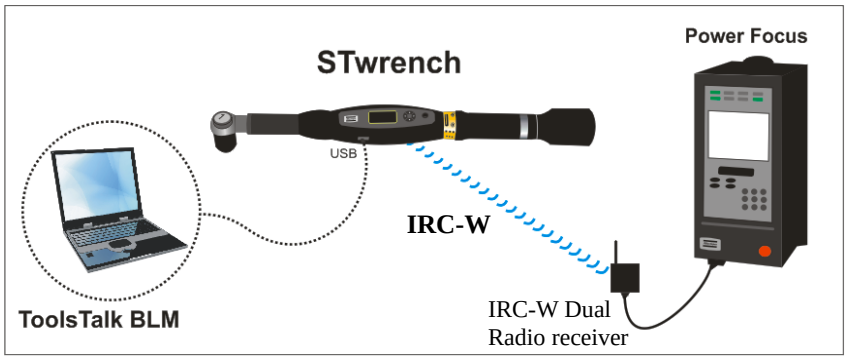
See the *Working with the QATnode* chapter for more information.

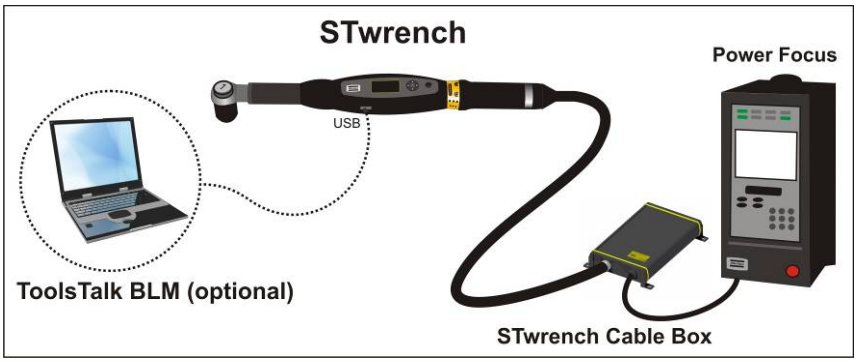
2.3.3 Wrench connected to Power Focus




Power Focus
STwrench
USB
IRC-Z
ToolsTalk BLM
IRC-Z Receiver


Power Focus
STwrench
USB
IRC-W
Access Point
ToolsTalk BLM
Network

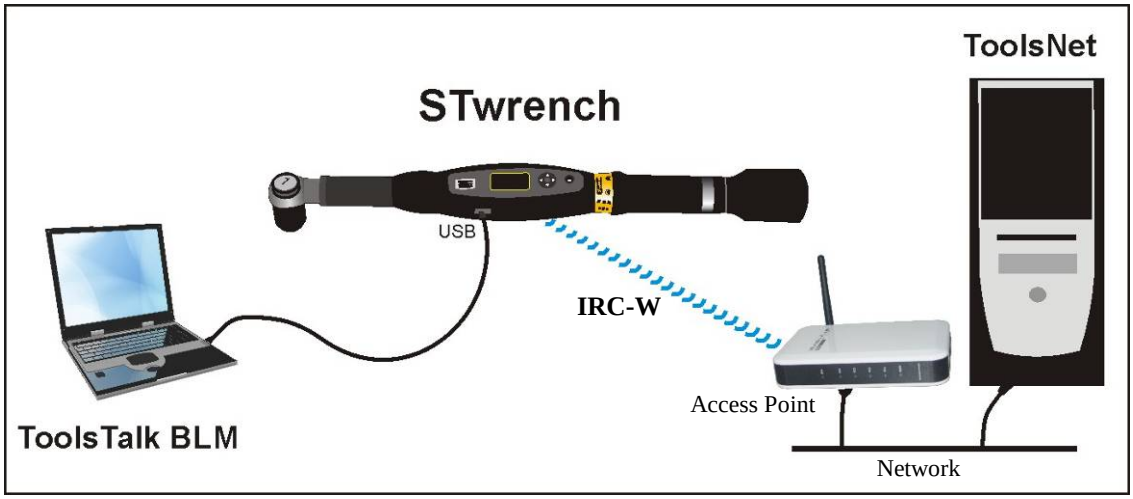

Power Focus
STwrench
USB
IRC-W
ToolsTalk BLM
IRC-W Dual
Radio receiver


STwrench
Power Focus
USB
ToolsTalk BLM (optional)
STwrench Cable Box

The STwrench can work in conjunction with Power Focus, via IRC-B, IRC-Z, IRC-W radio communication, or through the STwrench Cable Box. The RBU must be *Production*.
In this mode, the management software (ToolsTalk BLM) is optional; the tightening programs are created and transferred to the wrench via Power Focus.

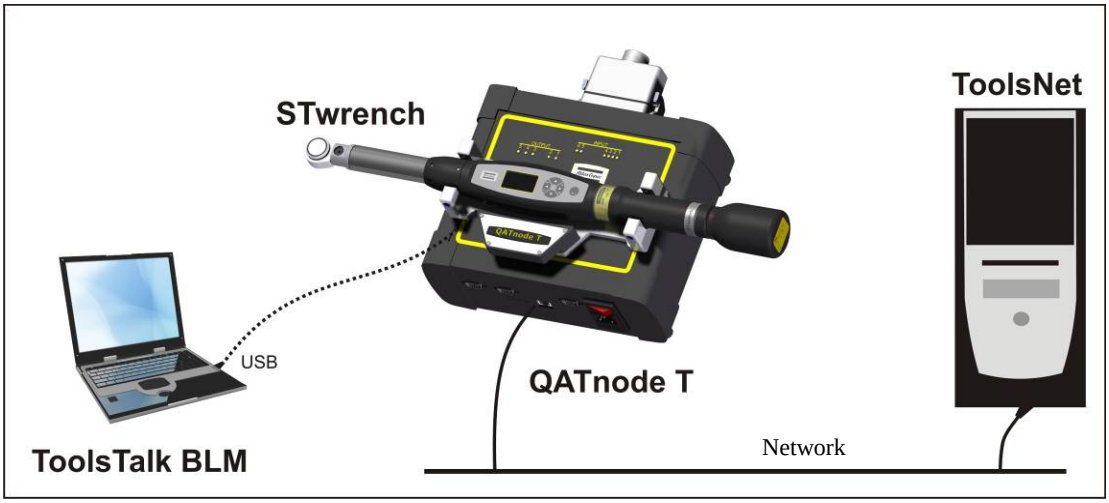
See the chapter *Working with Power Focus* for more information.

2.3.4 Wrench connected to ToolsNet

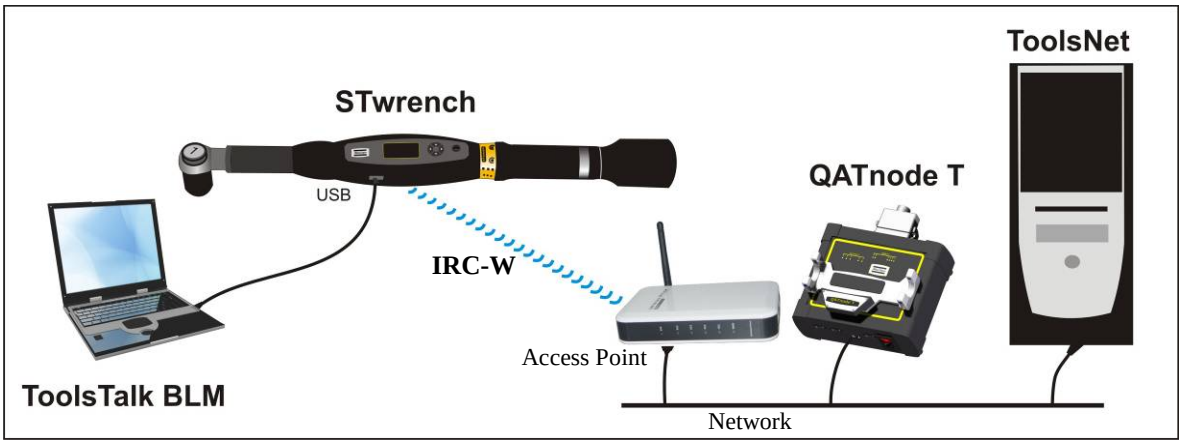


The STwrench can work in conjunction with ToolsNet. In this mode, the management software (ToolsTalk BLM) is required to program the wrench; the tightening results are transferred to ToolsNet via IRC-W.
Connected to ToolsNet, the wrench is typically used for tightening operations on the production line.
See the chapter *Working with ToolsNet* for more information.

The connection to ToolsNet can be also performed by the *QATnode T*; for instance, this can be used when it is not possible to use the IRC-W:

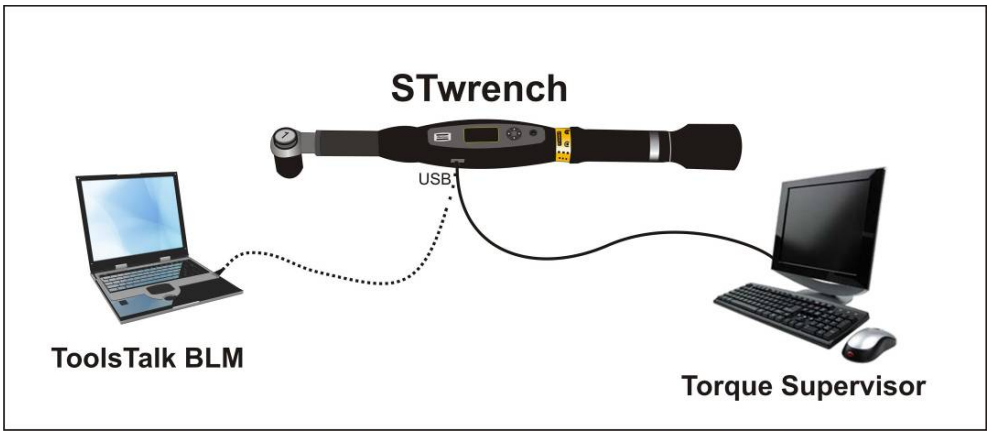


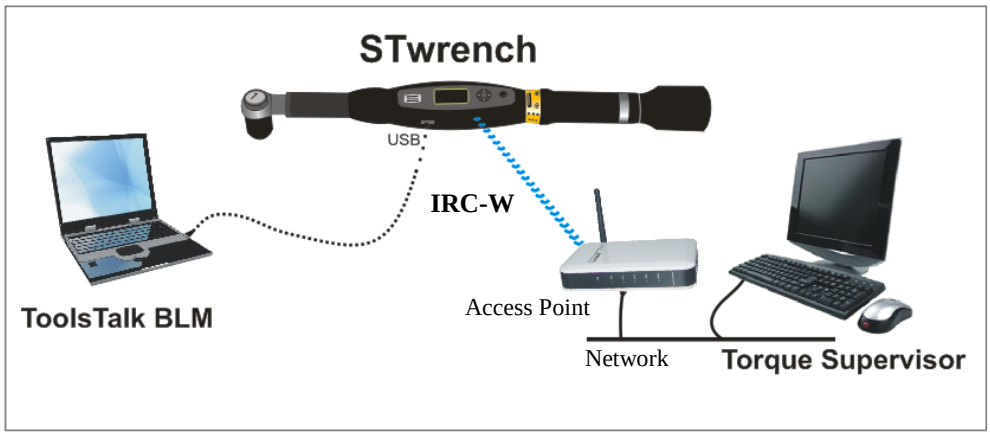
The *QATnode T* allows the I/O module to be used and the tightening results to be printed on a STAR printer. In such cases, the IRC-W connection can be used to connect the STwrench to the QATnode; the QATnode sends the data to ToolsNet and connects to a remote device (through I/O module) and/or STAR printer:



See the *Working with the QATnode* chapter for more information.

2.3.5 Wrench connected to Torque Supervisor





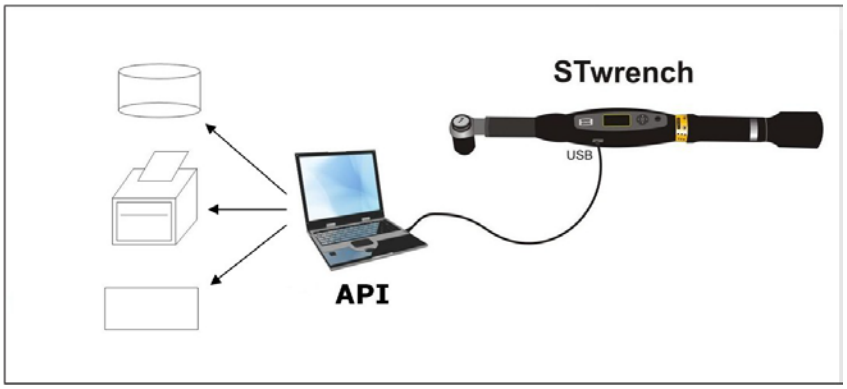
The STwrench can work in conjunction with Torque Supervisor, to make quality control tests on joints. Communication is through via a USB cable or IRC-W Dual Band radio module.

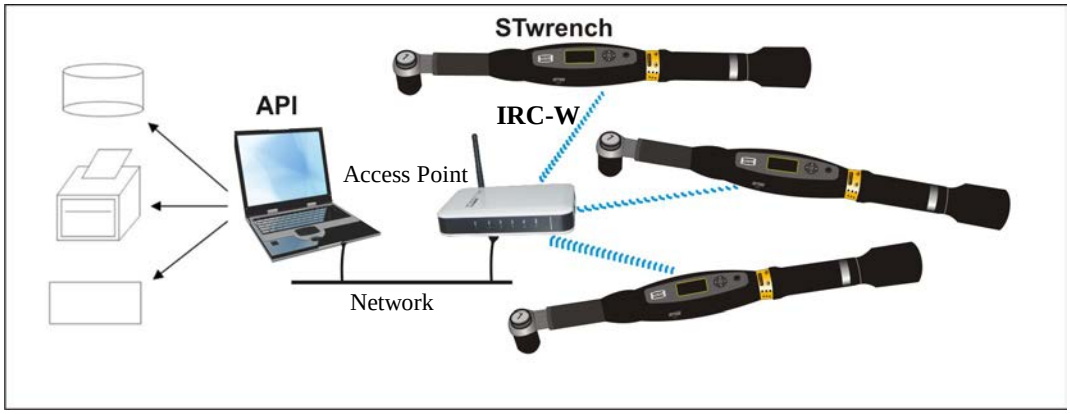
In this application, Torque Supervisor generates and sends to the wrench a list of tests to be done (the "route"). Once the tests have been completed, Torque Supervisor downloads the results and stores them in the joint statistics.

For basic operations of the STwrench with Torque Supervisor the ToolsTalk BLM can be optional; however it is required for advanced STwrench settings. Typically, Torque Supervisor is installed on one or more dedicated PCs, and ToolsTalk BLM on another. However, they can run on the same PC.

See the chapter *Working with Power Focus* for more information.

2.3.6 Custom application with API





In this scenario, the wrench is driven by a custom application using the API (Application Programmer Interface). The connection can be made in two different ways:

- USB cable: Allows only one STwrench to be connected to the API at the same time. It is not possible to send a Pset/Multistage/Job to the wrench via the API.
- IRC-W: Allows more than one STwrench to be connected to the API at the same time. With an IRC-W connection, the API can also send a Pset/Multistage/Job execute command to the STwrench.

The STwrench must be equipped with an API RBU.
The ToolsTalk BLM is optional. The custom application drives the STwrench, retrieves the tightening results and traces and interfaces, if required, with a printer and/or customer database. To connect via IRC-W, the IRC-W module must be properly configured; this can be done via the API, or via ToolsTalk BLM (if purchased).

See the chapter *Working with the API* for more information.

2.4 Presentation

The STwrench is modular. The minimum set of required modules is:

	**STwrench controller** The main module of the wrench containing all the hardware and firmware. The version BI (for which the battery inside must be used) is also available.
	**STwrench RBU (Rapid Backup Unit)** Module to be installed in the STwrench Controller. It defines the wrench functions and stores the tightening programs.
	**smartHEAD** The STwrench head with torque transducer, gyroscope (optional), and smartHEAD light.
	**STwrench battery and battery charger** Power supply. **NOTE**: Battery is not used when the STwrench is connected to Power Focus via the STwrench Cable Box.
	**ToolsTalk BLM** The STwrench management software. It allows wrench configuration, creates the tightening programs and retrieves results and traces from the wrench. **NOTE**: ToolsTalk PF can substitute ToolsTalk BLM when the wrench is used with Power Focus with IRC-B or Cable Box; however, ToolsTalk BLM allows only

	a limited number of wrench settings/customizations. **NOTE**: When the STwrench is used only with Torque Supervisor, ToolsTalk BLM is optional. However, without the software, there is no access to the STwrench settings and TAG writer function.

The following optional modules can be installed in the STwrench controller:

	**QAT barcode reader module** Module for scanning barcode labels on assembly components for easy traceability.
	**QAT IRC-W dual band radio module** Radio module for interfacing the STwrench with ToolsNet, Power Focus, QATnode, API. **NOTE**: The new module, marked ***QAT IRC-W Dual Band***, supports dual band 2.4 GHz and 5 GHz. This manual refers to the firmware version of the radio module 2.14 or later. The old module, marked ***QAT IRC-W***, supports only the 2.5 GHz band.
	**QAT IRC-B radio module** Radio module for interfacing the STwrench with Power Focus.
	**QAT IRC-Z radio module** Radio module for interfacing the STwrench with Power Focus.

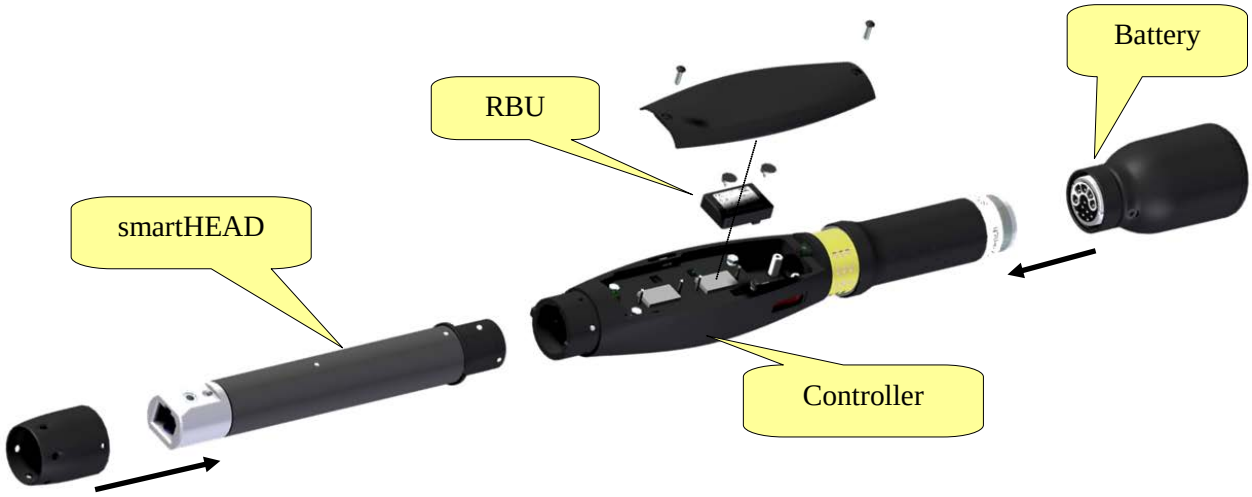
The following accessories are also available:

	**STwrench Cable Box** Kit for interfacing the STwrench with Power Focus via a cable. The Tensor SL Cable (available in 4 different lengths: 3m, 5m, 10m or 15m) must be purchased separately.
	**QATnode P** QATnode for printing the tightening results on a STAR printer.
	**QATnode I/O** QATnode with I/O module, for operating the STwrench from a remote device (for example, a PLC) It allows the tightening results to be printed on a STAR printer.
	**QATnode T** QATnode with ToolsNet connection. It also offers the I/O module and printing function on a STAR printer, provided by the QATnode I/O.
	**Battery short HD** This shorter battery can substitute the standard battery. Its capacity and operating time is half the standard STwrench battery.

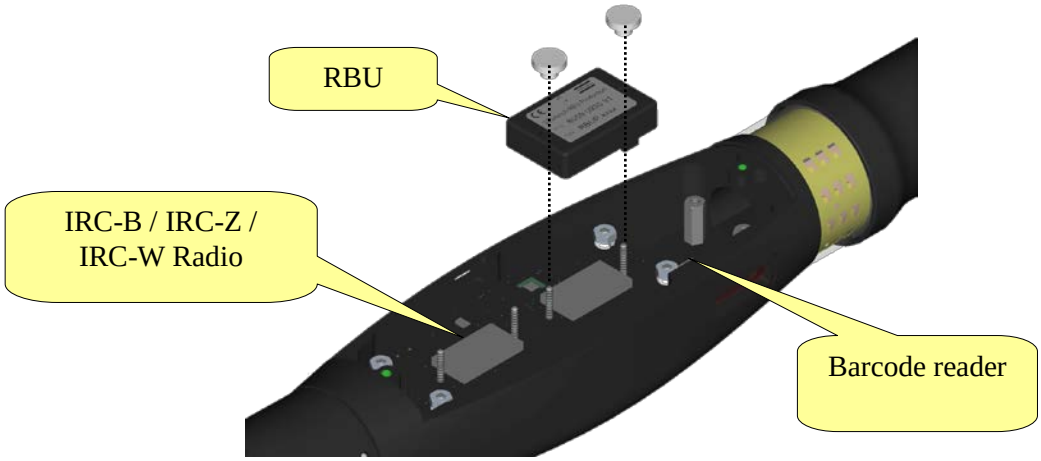
	**Battery Inside (BI)** This battery in used for the STwrench Controller BI version, and it is mounted inside the controller, reducing the wrench length. Its capacity and operating time is about 56% compared to the standard battery.
	**STwrench holder** STwrench holder, which can be installed in horizontal or vertical position.
	**STwrench rubber protections** Rubber protections for STwrench controller, battery and smartHEAD

2.4.1 STwrench assembly

The STwrench is delivered in separated packages for each module; in order to start working with the wrench, you must first put all the pieces together:

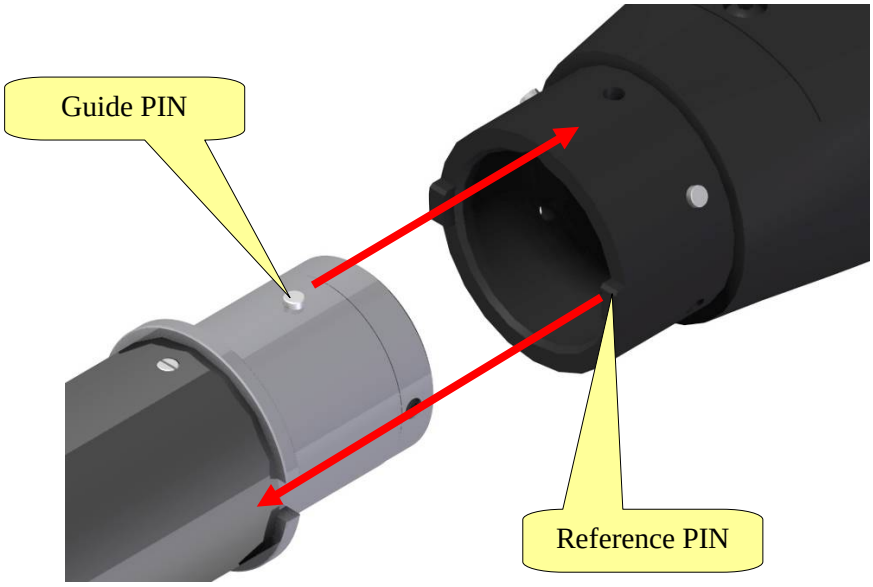


1. Remove the cover from the controller and insert the RBU inside the controller. Tighten the screws (finger-tight - do NOT use pliers):



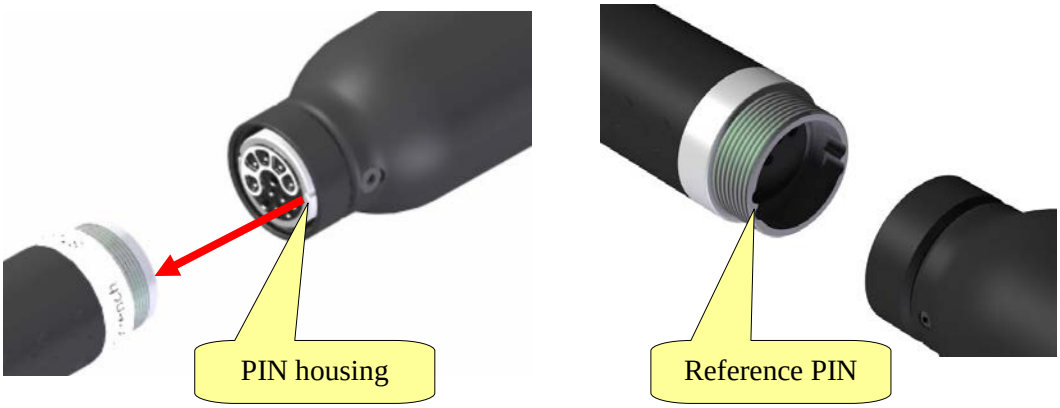
2. Install any optional modules (radio and barcode reader).
3. Install the controller cover (tighten the two screws)

4. Install the smartHEAD on the wrench controller (tighten the locking nut)



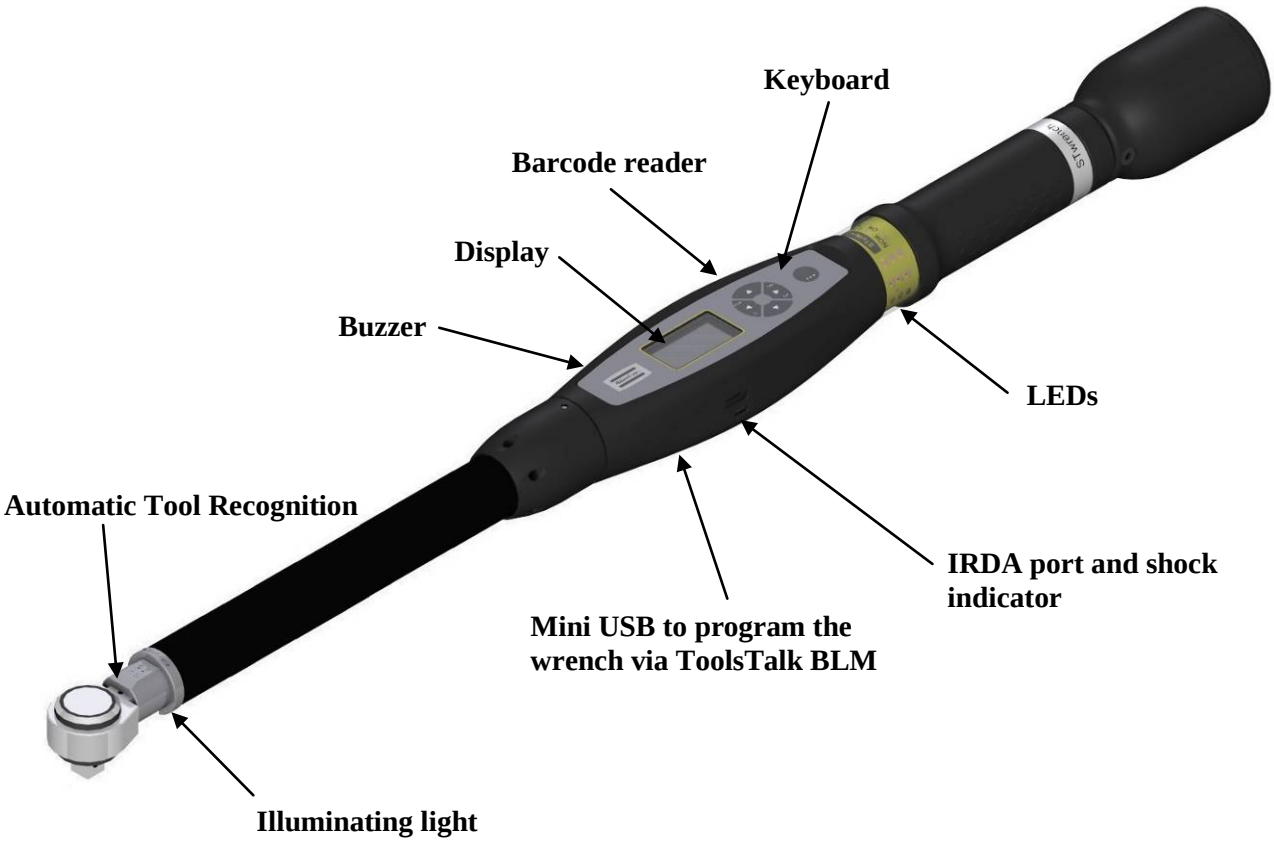
NOTE: There is only one way to insert the smartHEAD into the wrench controller. The guide pin and the reference pin must be inserted in the correct housings; do not force them into other positions.

5. Attach the battery to the controller (tighten the nut ring). There is only one way to attach the battery to the wrench controller. Insert the two reference pins in the correct housings:



For battery inside (BI), insert the battery in the controller and tighten the cover to the controller.

The wrench is now ready for use:



CAUTION: Once assembled, the STwrench modules, with the exception of the battery pack, must not be disassembled during normal operations. For example, do not disassemble the smartHEAD from the controller at the end of the working day.
Controller modules, like radio module or barcode reader, should be not exchanged between different units. Parts are only to be installed and replaced in connection with servicing or system upgrades.

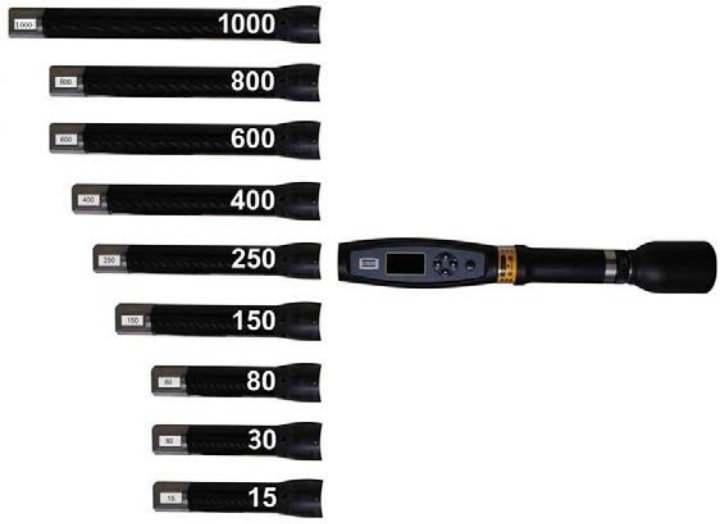
The next paragraphs describe all the wrench modules and user interfaces in detail. To start working with the STwrench immediately, go to the *Getting Started with the* STwrench chapter *Getting Started with the STwrench.*

2.4.2 STwrench controller

The controller is the core of the STwrench: It contains the main hardware boards and firmware.
There are two controller versions:

	**STwrench controller standard** Standard version. It works with standard battery and “short HD” battery.
	**STwrench controller BI** Version to be used with the battery inside (BI), which in installed inside the controller. With this battery the length of the wrench is reduced. **NOTE**: This controller cannot be connected to Power Focus via SL cable.

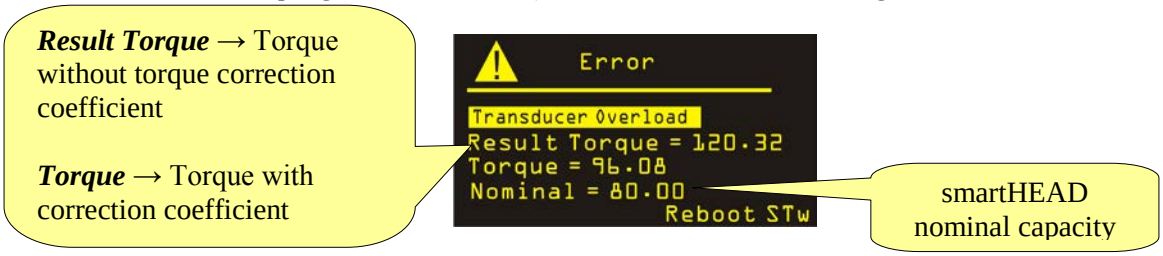
2.4.3 smartHEAD



The smartHEAD of the STwrench contains the torque transducer and defines the wrench’s nominal torque. You can install or change the smartHEAD without any need for further settings or calibration: The wrench automatically loads the transducer data when powering on.

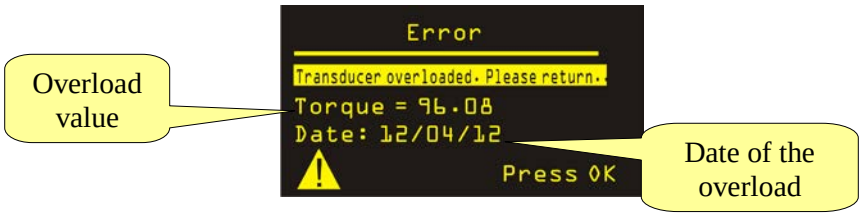
WARNING:

Do not tighten the smartHEAD over its torque capacity. This might damage the transducer and cause improper torque reading. If 120% of the smartHEAD nominal torque (for instance, for a 150 Nm smartHEAD, if the torque goes over 180 Nm) is exceeded, an error message is shown:



In this case the STwrench must be switched off and on again.

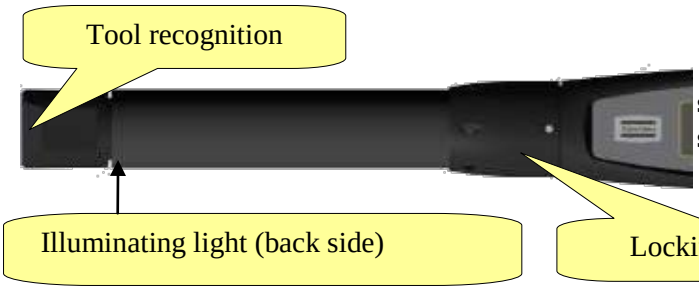
After an overload event, the following message is shown each time the STwrench is switched on:



The smartHEAD must then be sent to the Customer Centre for inspection. The smartHEAD recalibration (procedure to be performed by Atlas Copco service personnel) is required to restore normal operations.
In case of multiple overloads, the information stored is the highest recorded overload value.

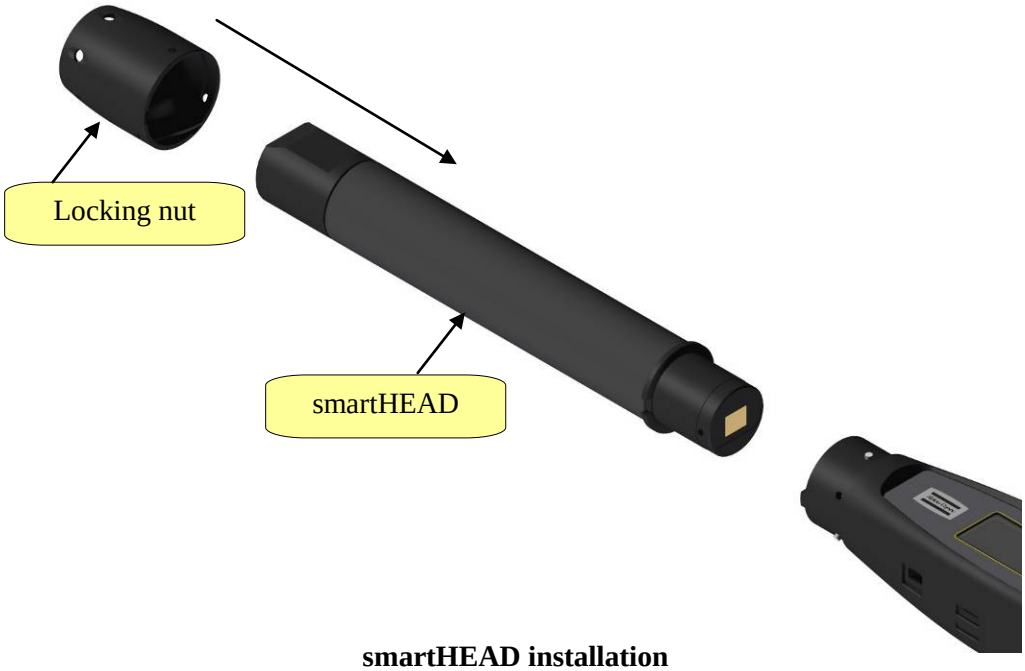
The gyroscope, which allows angle measurement, is optional. With this feature, you can access a wider set of tightening strategies, either for tightening in production or when performing quality control tests, as well as for use in free mode.
The maximum angular speed of the gyroscope is 150°/s; if this speed is exceeded during tightening, the STwrench displays an “overspeed” error message; this will result in the angle result being set to 9999 degrees.
The smartHEAD *Minimum Load* value is calculated as 5% of its wrench capacity (for some special applications the *Minimum Load* can be decreased). In this case, the smartHEAD requires a special calibration. See the chapter *Minimum load settings* for more information).

The smartHEAD features the tool recognition function and contains an illuminating LED. See the chapter *Configuration* for tool recognition and illuminating light settings.



smartHEAD: No angle measurement
smartHEAD A: With angle measurement

NOTE: When installing a new smartHEAD in the STwrench, ensure that it can support all the tightening programs present in the wrench memory.
For instance, if the capacity of the new smartHEAD is lower than the capacity of the old smartHEAD, some of the tightening programs with a target torque higher than the capacity of the new smartHEAD could cause a transducer capacity error. Vice versa, if the capacity of the new smartHEAD is higher than the old one, a minimum load error may occur for tightening programs with a *Cycle Start* parameter set lower than the new smartHEAD *Min. Load* value.



smartHEAD installation

Insert the smartHEAD into the wrench controller and tighten the locking nut.

IMPORTANT: Perform this operation with the wrench switched off!

NOTE: Each smartHEAD is intended to be associated with a single STwrench controller! The smartHEAD interchangeability assures easy and fast maintenance operations and wrench upgrade.

IMPORTANT NOTE:

Assembling different heads on the same controller during the normal wrench operations represents improper use of the modularity concept and will invalidate the warranty on the wrench components.

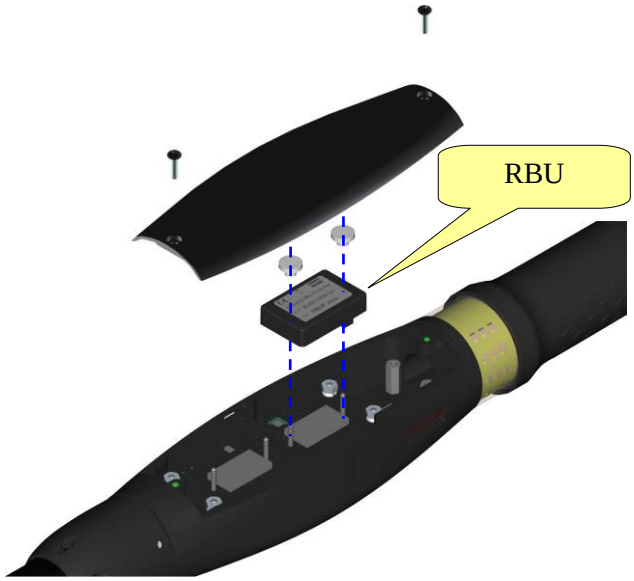
2.4.4 RBU



RBU (Rapid Backup Unit) is a memory chip which defines which functions are activated and provides backup for your tightening programs.
It also stores the specific settings of your STwrench (see the default configuration in *Appendix C - STwrench Factory Settings*); by installing your RBU in another wrench you therefore get an exact copy of the original wrench.

There are four types of RBU available:

- ***RBU Quality***: Enables strategies for quality controls and joint analysis only
- ***RBU Quality API***: Quality RBU with API interface enabled.
- ***RBU Production***: Enables all strategies for quality and production.
- ***RBU Production API***: Production RBU with API interface enabled.

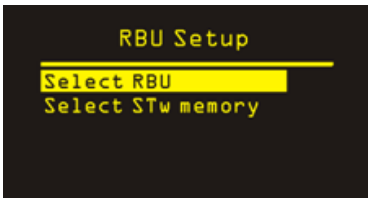


To insert the RBU in the wrench, turn off the wrench, remove the cover, and insert the RBU module.



If the RBU is not present or not properly installed, the ***RBU Not Present*** message is shown on the display.

When you turn on the wrench with the new RBU the following message is shown:

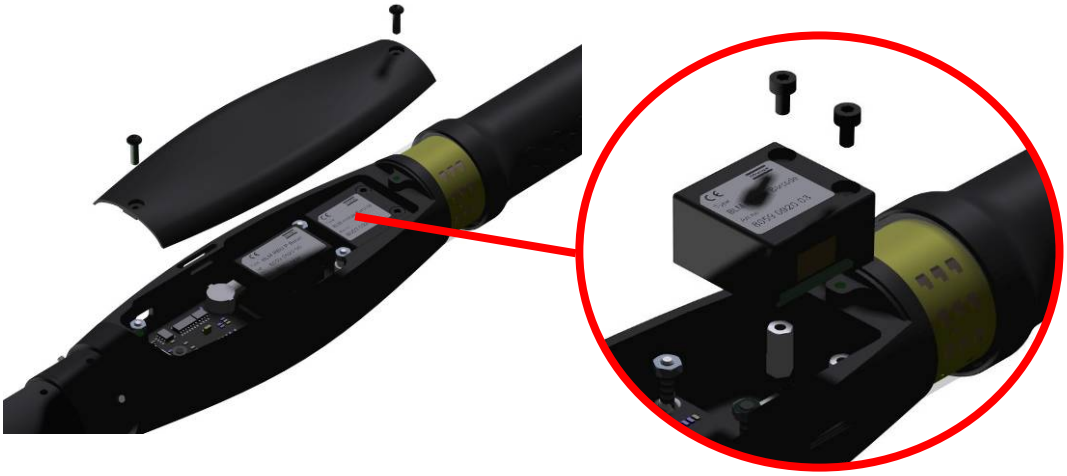


- ***Select RBU***: The data (STwrench settings and all the tightening programs) are loaded from the RBU; all the data stored in the wrench memory are overwritten.
- ***Select STw Memory***: The data are loaded from the wrench memory; all the data present in the RBU are overwritten. This option works only if the new RBU type is compatible with the data stored in the wrench memory (and thus with the old RBU which was installed on the wrench).

2.4.5 QAT Barcode reader



The QAT Barcode reader can be installed in the STwrench controller to permit scanning of barcodes.
An identifier, or barcode string, may be used to select the tightening program to be executed and to identify motor vehicles (VIN) and other work pieces, variants, and operators. The tightening result can then be saved together with this information.



To install the barcode reader module in the wrench, turn off the wrench, remove the cover and insert the module (tighten the two screws).

After having installed the module in the unit you can add the identifiers reading to your tightening programs. See the chapter *Identifier* for more information.

2.4.6 IRC

The Industrial Radio Communication (IRC) technology operates on the free 2.4 and 5 GHz ISM band.

For the STwrench, three different versions for the different IRC standards are available:

- IRC-B
- IRC-Z
- IRC-W



The table below gives an overview of the different standards:

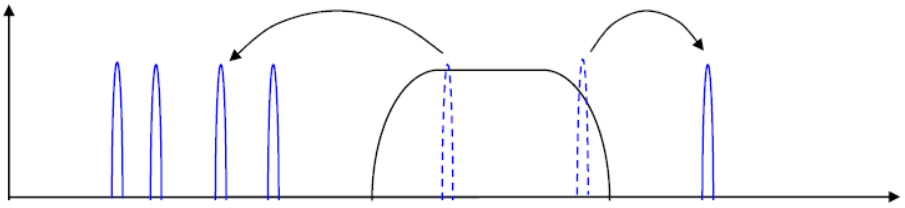
Technique	Latency	Multipath Immunity	Interference Immunity
IRC-B	High	High	High
IRC-Z	Poor	Moderate	Poor
IRC-W	Moderate	Moderate	Moderate

The performance of IRC-W is highly dependent on the infrastructure at the site.

Latency defines the delay times of the communication link i.e. when transferring tightening results. The *Multipath Immunity* indicates how well the signal reflections in the environment are handled, for example against walls or equipments. The *Interference Immunity* indicates how well other radio sources are avoided.

IRC-B

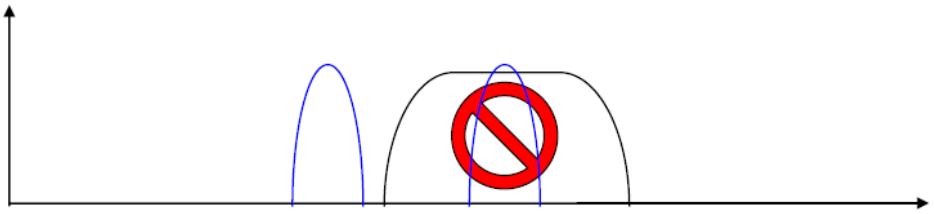
- 79 (1 MHz) channels
- IRC-B features dynamic Adaptive Frequency Hopping (AFH).
- No frequency planning needed.



IRC-B with AFH avoids collisions on the 2.4 GHz ISM band, for example with Wi-Fi networks.

IRC-Z

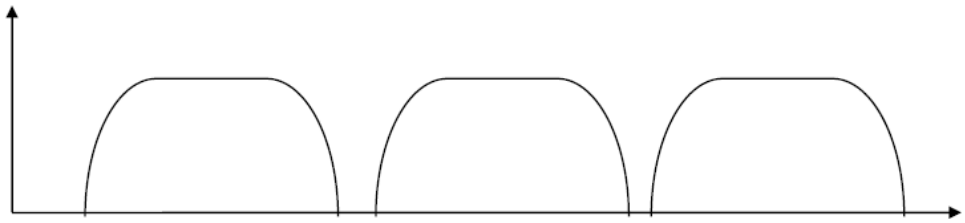
- 16 (5 MHz) channels. Channel 11-26.
- 1 fixed channel used for communication.
- Frequency planning needed.



IRC-Z frequency planning needed to avoid collisions on 2.4 GHz ISM band, for example with Wi-Fi networks.

IRC-W

- 18 channels.
- 1 fixed channel used for communication.
- Frequency planning needed.
- Installation support from IT department needed.

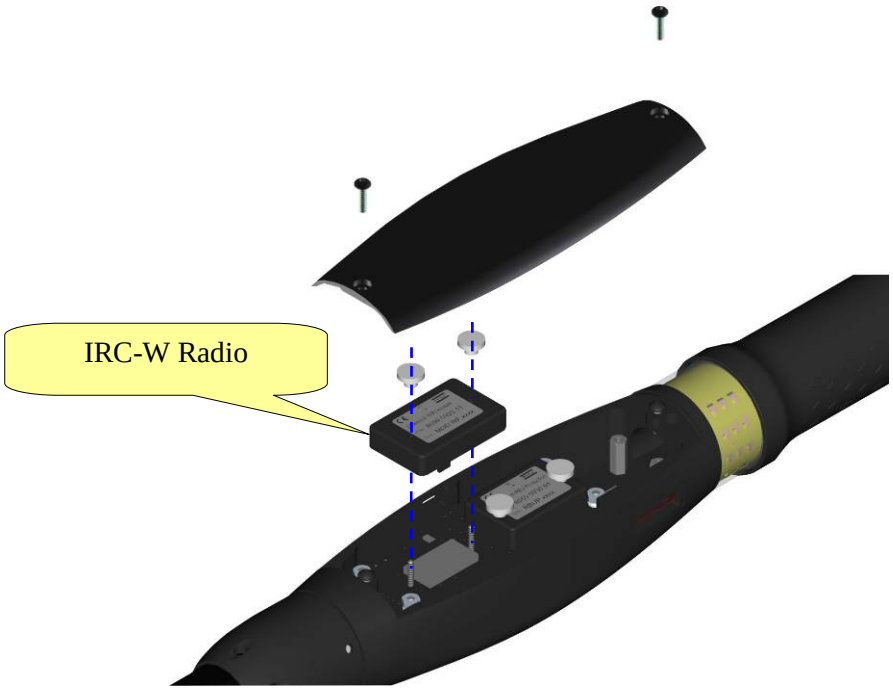


IRC-W, three channels occupying the 2.4GHz ISM band.

2.4.6.1 QAT IRC-W radio module



The IRC-W Dual Band radio module allows the interface between the STwrench and ToolsNet, Power Focus, QATnode, and API.



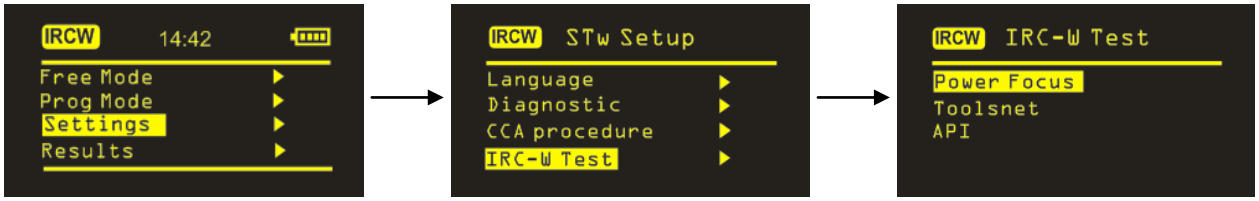
To install the IRC-W module in the wrench, turn off the wrench, remove the cover and insert the IRC-W module (tighten the two screws with your fingers).

After having installed the module in the unit, you need to set radio parameters via ToolsTalk BLM.

- For ToolsNet connection: See the chapter *Establishing Communication between STwrench and ToolsNet* for more information. For ToolsNet connection with *QATnode T*, see the chapter *Working with the QATnode*
- For Power Focus connection: See the section *Interface with IRC-W Radio Module* in the chapter *Working with Power Focus*.
- For QATnode connection: See the chapter *Working with the QATnode*
- For API connection: See the chapter *Working with the API*

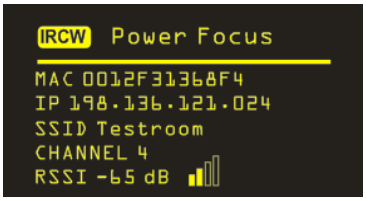
NOTE: If the IRC-W module is not marked as “dual band”, it does not support the 5 GHz band.

A test function is provided to verify the IRC-W signal level. Select ***Settings → IRC-W Test***, and select the device to which the STwrench has to connect:



The module network parameters must be set properly by ToolsTalk BLM.

The following window shows the network parameters (set by ToolsTalk BLM in the IRC-W Module) and the RSSI (received signal strength indicator) level:



The letters of the IRC-W logo are shown in sequence:

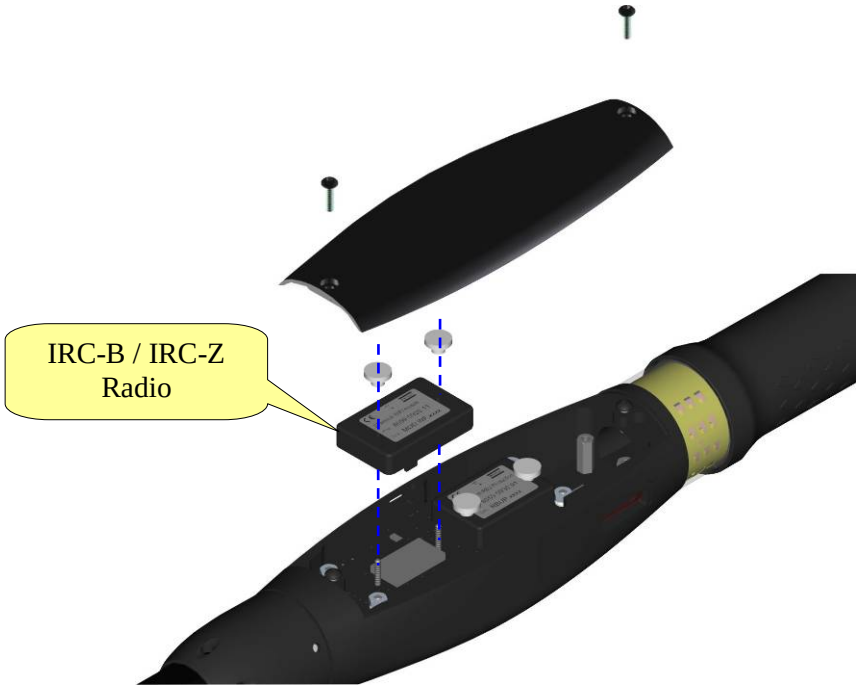
During the initialization process, the IRC-W icon is shown in four steps:

I	Module IRC-W detected.
IR	Module IRC-W configured.
IRCW	Module connected.

2.4.6.2 QAT IRC-B / IRC-Z radio modules



The IRC-B and IRC-Z (Industrial Radio Communication) radio modules allow the interface between the STwrench and Power Focus.

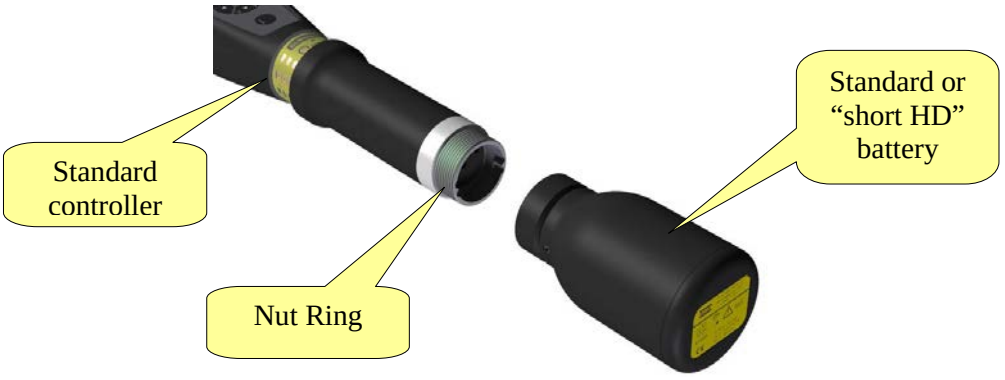


To install the IRC-B or IRC-Z radio module in the wrench, turn off the wrench, remove the cover, and insert the radio module (tighten the two screws with your fingers). See the chapter *Working with Power Focus* for more information of the Power Focus mode.

2.4.7 Battery

Standard battery	Battery short HD	Battery inside BI
		

The STwrench is powered by its battery pack. The rechargeable Lithium-ion standard battery ensures over 16 hours of operating time, or 7.5 hours if the IRC-W module is installed in the controller.



Standard and short HD battery installation



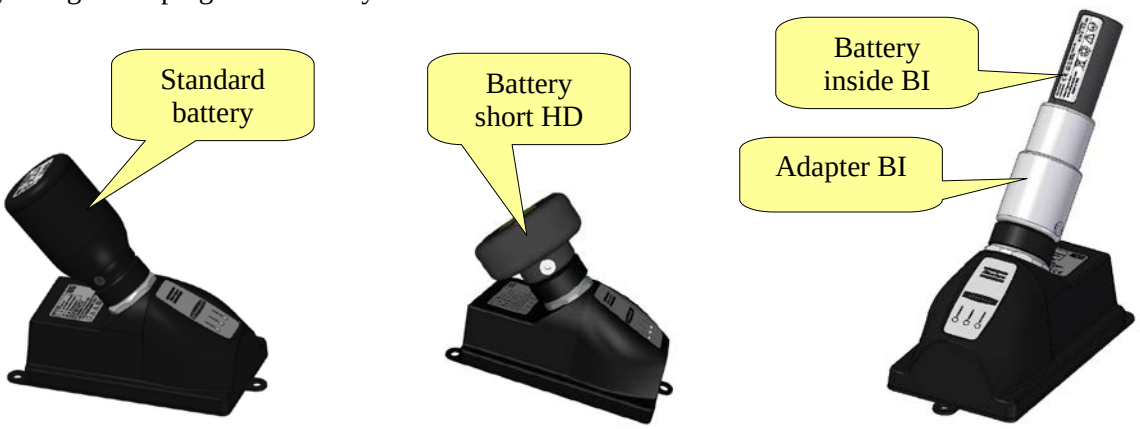
Battery inside installation

To replace the battery, turn off the wrench, loosen the nut ring, remove the battery and replace it).

NOTE: Refer to the chapter *Battery Pack Maintenance* for important notes about how to keep the battery in good working order.

2.4.7.1 Battery charger

Use the battery charger supplied to recharge the battery. Simply connect the input AC power cable to the battery charger and plug in the battery.



There is no power on switch on the battery charger. Install the battery charger in position which makes easy to disconnect the input AC power cable from the AC power line or from the battery charger.
The three LEDs on the battery charger provide the battery charge status:

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



In case of *Over temperature*, disconnect the battery from the battery charger, disconnect charger from AC power, wait few minutes, reconnect the battery charger to AC power and the battery to the charger, and check to see if the red light has stopped blinking.
In case of *Error*, try disconnecting and then reconnecting the battery to the battery charger to solve the problem.

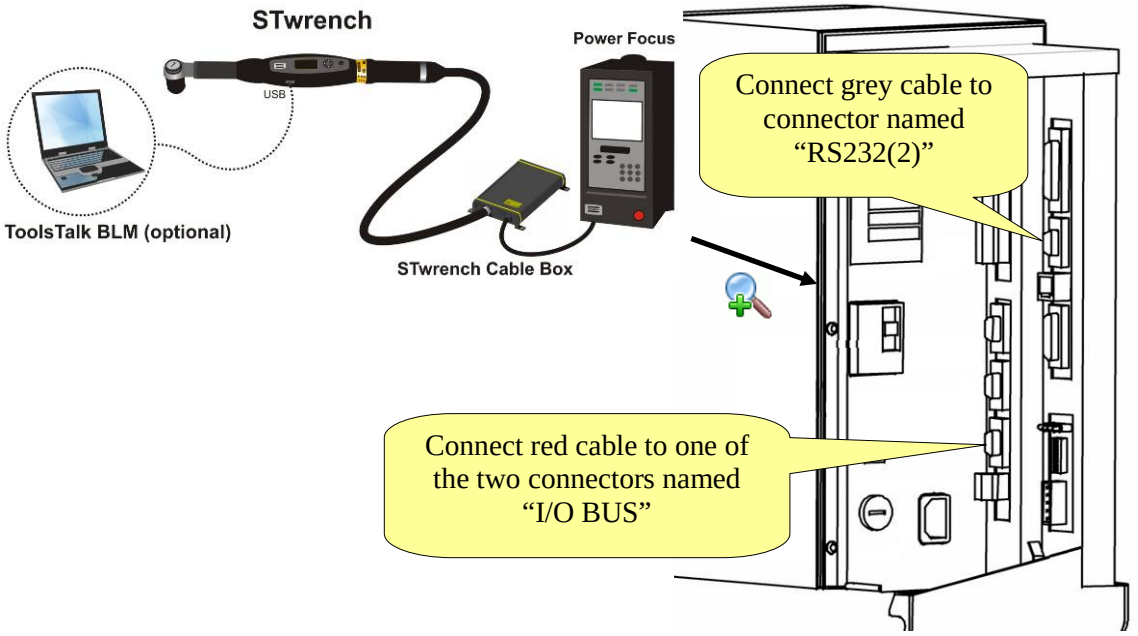
2.4.8 STwrench Cable Box



The STwrench Cable Box allows the interface between the STwrench and Power Focus. With this kind of connection, the STwrench is powered by Power Focus and the battery is no longer required.
A Tensor SL Cable is required to connect the STwrench to the Cable Box, and must be purchased separately.



The STwrench Cable Box does not need to be powered from an external source; simply connect the cable between the STwrench and the Adapter, and connect the two serial connectors of the adapter to the ports of the Power Focus as shown below:



Power Focus – rear panel

See the chapter *Working with Power Focus* for more information of the Power Focus mode.

2.4.9 QATnode



These accessories provide additional functions to the STwrench. The QATnode is available in three different versions:

- ***QATnode P***: QATnode for printing the tightening result on a STAR printer.
- ***QATnode I/O***: QATnode for printing the tightening result on a STAR printer, and I/O module for communication with a remote device.
- ***QATnode T***: QATnode for printing the tightening result on a STAR printer, I/O module for communication with a remote device, and with ToolsNet connection.

With the QATnode, a CD containing the configuring software is provided.

See the *Working with the QATnode* chapter for more information of the QATnode settings and operations.

2.4.10 End-fitting tools

The end-fitting tools for the STwrench must be ordered separately, according to Atlas Copco price list. A wide selection of end-fitting tool is available:

	**Open end**
	**Box end**
	**Flared end**
	**Reversible ratchet**
	**Black end:** This tool can be welded to customized wrench extensions. This can be helpful in order to maintain the end-fitting tool recognition function when using the extension.

Each end-fitting tool contains a RFID TAG which stores a number that can be programmed by the ToolsTalk BLM software. The STwrench uses this number to recognize the tool automatically.

The RFID TAG also stores the torque and angle correction coefficients; these coefficients must be set properly.

If not, the torque and angle readings are incorrect when the wrench is used in the Prog. Mode (the Free Mode does not consider the correction coefficients).
See the chapter *TAG writer* for more information.

The end-fitting tool can be used to start a tightening program automatically when it is plugged into the STwrench smartHEAD (see *Setting the source for Pset/Multistage/Job selection*), or it can be simply associated with the tightening program (the wrench checks that the right tool is used before starting the tightening operation. See the Pset *Options*).
During tightening (i.e. from when the torque goes over the *Cycle Start* value, until the tightening is complete), the function is disabled; this prevents the tightening program from aborting due to loss of the RFID TAG reading caused by vibrations or minor movements of the end-fitting tool during the tightening operation.



NOTE: The end-fitting tools are provided with the following default values:

- Tool number: 1
- Torque coefficient: 1
- Angle coefficient: 0

See the chapter *TAG writer* for how to write a specific number in the RFID TAG.

When a wrench extension with a *black end* tool is used, it is also possible to store the torque and angle correction coefficients in the RFID TAG. See *TAG writer* and *Appendix A – Calculating Torque and Angle Correction Coefficients* for more information.



NOTE: If an end-fitting tool (or an extension) without the RFID TAG is used in order to execute a tightening operation, the tool recognition function must be disabled. See *Enabling STwrench tool recognition*.

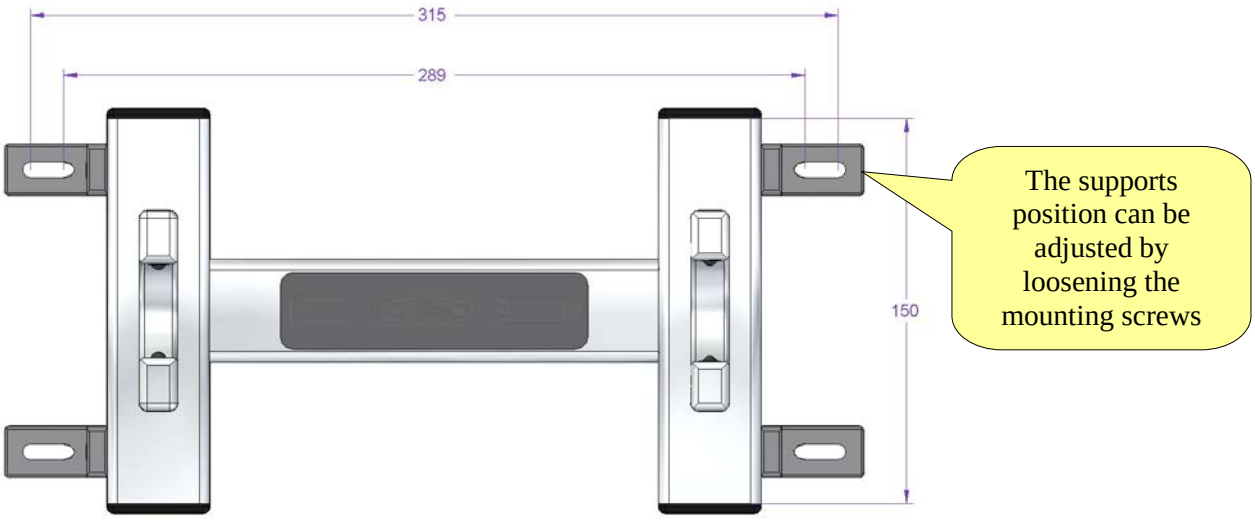
2.4.11 STwrench holder



The STwrench holder can be installed on a table or a wall in a horizontal or vertical position in order to hold the STwrench in a fixed position.
Simply position the STwrench in the holder (push the wrench until hearing the “click”) as shown in the following figure:



To install the holder, refer to the following figure (dimensions are in millimeters):



2.4.12 Rubber protections

The rubber protections are recommended to protect the STwrench and its components:

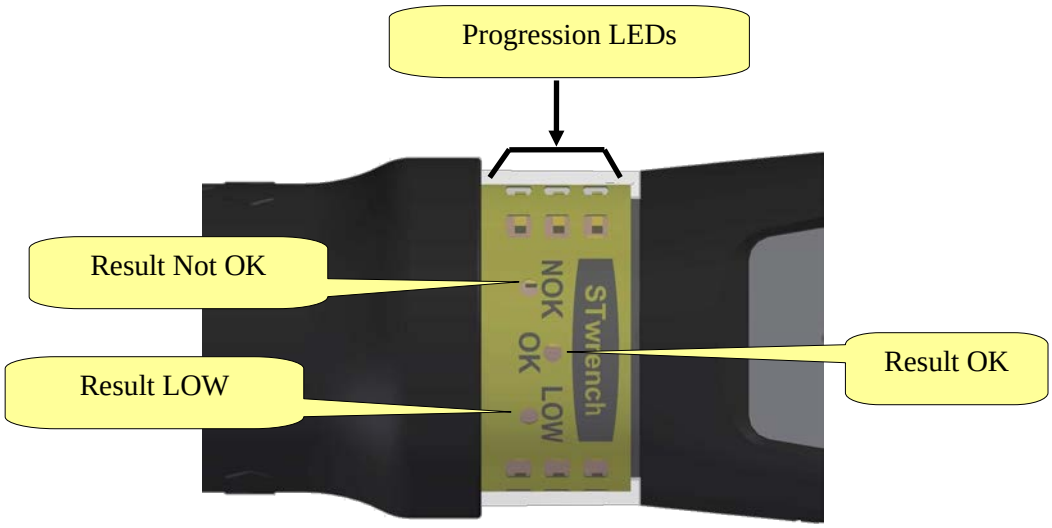
	**Rubber protection for smartHEAD**
	**Rubber protection for controller**
	**Rubber protection for standard battery**

Note that, even if the rubber protections have been fitted, the STwrench must be handled with care to prevent damage.

3 User Interfaces

3.1 LEDs

A set of three LEDs is alighted during the tightening operations, to guide the operator during tightening and to signal the final results. Moreover, three rows of yellow LEDs provide additional information on the ongoing tightening operation and result.

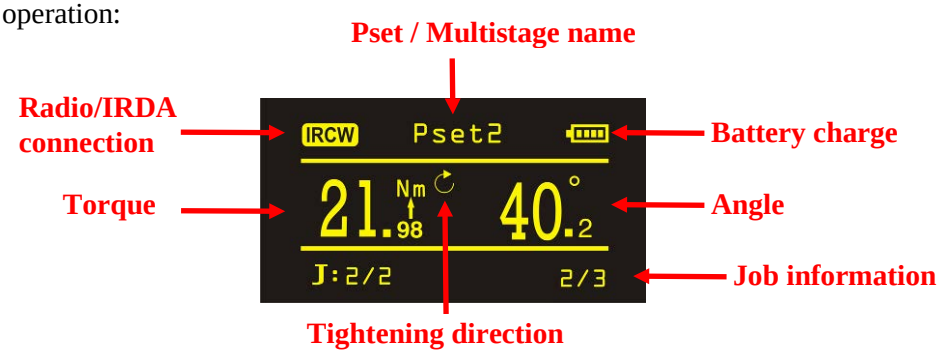


LOW (yellow)	Torque result lower than the minimum limit (defined in the specific tightening program).
OK (green)	Result OK.
NOK (red)	Result Not OK.
Progression LEDs (yellow)	These 3 rows of LEDs light up when torque or angle goes over 3 specific thresholds related to the target value for tightening strategies in production, and OK results for quality control strategies.

The behavior of the LEDs changes depending on the various tightening strategies. See the chapter *Tightening Strategies* for more information.

3.2 Display

The wrench display allows you to explore the wrench menu, and to monitor torque and angle during the tightening operation:



Radio/IRDA Connection	Indicates that the wrench is connected to another device through IRC-W, IRC-B, IRC-Z radio, or IRDA connection to the QATnode.
Battery charge	Indicates the battery charge status. **NOTE**: Due to its technical characteristics, the battery retains the nominal voltage all the time and discharges fast when the charge is running out; therefore, when the bars indicating the battery charge start decreasing, it is recommended to recharge the battery. 
Tightening directions	Indicates whether tightening must be done in a clockwise or counterclockwise direction.
Torque/Angle	Indicates the current measurements. The arrow under the measurement indicates which variable has been selected as the result in the tightening strategy, when applicable.
Job information	The bottom part of the display provides information about the current Pset/ Multistage/Job. ***Example:*** ***J:1/2*** Indicates that the second Pset/Multistage of the Job is currently in progress (the first one is ***J:0/2***) ***2/3*** Indicates the batch count of the current Pset

3.3 Keyboard

Use the keyboard to browse the STwrench menu:



	Switch on the wrench, OK (confirm button).
	Down (browse menu).
	Switch off the wrench, Clear (exit button).
	Up (browse menu).
	Start barcode scanning and turn on the illuminating light (for 10 seconds).

3.4 Buzzer and Vibration Devices

NOTE: Buzzer and vibration devices can be enabled/disabled in the *STwrench Controller Setup* menu of ToolsTalk BLM.

Along with the onboard LEDs, the STwrench also has buzzer and vibration devices to give more information on the result of the current tightening operation:

- **Buzzer**: Like the three LEDs, the buzzer guides you to the target torque (or angle); it increases the frequency of its signals as torque (or angle) increases, and emits a different signal if the torque (or angle) goes over the maximum value.

- **Vibration**: The vibration device indicates that the torque (and/or angle, if included in the tightening strategy) has reached the target value.

See *Tightening Strategies* for more information of buzzer and vibration devices in the various tightening strategies.

3.5 smartHEAD Illuminating Light

The smartHEAD illuminating light provides illumination under the end-fitting tool; it can be helpful for a better view of joints in dark areas. It is activated for 10 seconds when the barcode button on the wrench keyboard is pressed.



The smartHEAD illuminating light can be enabled/disabled in the *STwrench Controller Setup* menu of ToolsTalk BLM.

3.6 IRDA Port

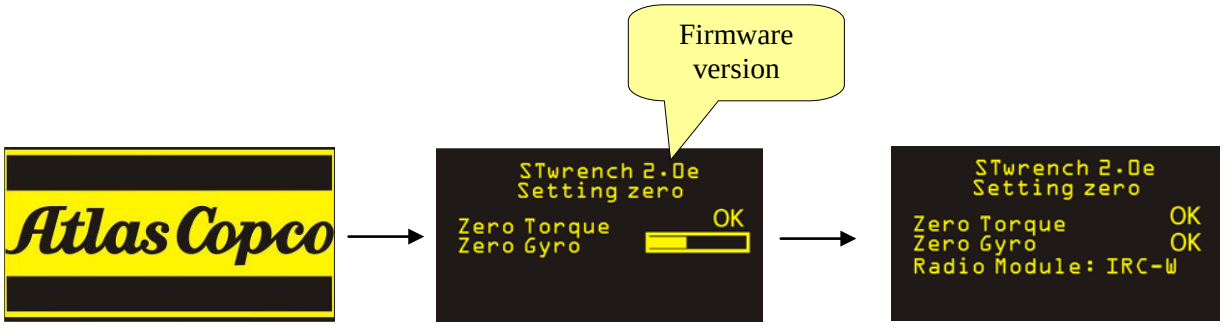
The IRDA (infrared) can be used to communicate with the wrench QATnodes, and is also used for Atlas Copco BLM maintenance activities.
See the *Working with the QATnode* chapter for more information of the QATnode operations.

3.7 Mini USB Port

The USB port is available for programming the wrench with ToolsTalk BLM.
See the *Working with ToolsTalk BLM* chapter for more information.
It also allows the use of the STwrench with the API. See the *Working with the API* chapter for more information.

4 Getting Started with the STwrench

To turn on the STwrench press the ***ON*** button on the wrench keyboard. To turn the wrench off, press the ***OFF*** button and hold it down for a few seconds. The power on screen is shown for few seconds, followed by the zero adjustment and radio module search screen. During zero adjustment, the firmware version is displayed in the upper part of the screen:



Power on screen | Zero adjustment | Radio module search

NOTE: Leave the wrench in a fixed position without applying any torque to the transducers when powering 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 Zeroing Torque” or “Error Zeroing Gyro” is shown under the main menu. If this occurs, the wrench cannot perform any operation.

During the power on phase, a self-test of the wrench LEDs is also performed; all the LEDs light up in sequence. At the end of this test, only the STwrench logo remains lit. To save battery charge, after 30 seconds of inactivity, the display brightness is automatically reduced and the STwrench logo is deactivated, until a button on the wrench keyboard is pressed.



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



Main menu

- ***Free Mode***: This menu allows you to conduct a free test, without having to program the wrench with a specific tightening program. This menu can be disabled if desired (see the *STwrench Settings* chapter for more information).
- ***Prog Mode***: In this menu you can access the tightening programs (Pset, Job and Multistage), defined and sent to the wrench by ToolsTalk BLM (see the chapter *Working with ToolsTalk BLM* for more information)
- ***Settings***: Enter this menu to set the language, and access the diagnostic menu. This menu can be disabled if desired. See the *STwrench Settings* chapter for more information. Also, it allows the CCA coefficient to be calculated and stored when an extension is applied to the wrench. See the *CCA procedure* chapter for more information.
- ***Results***: Enter this menu to view the results stored in the STwrench memory.

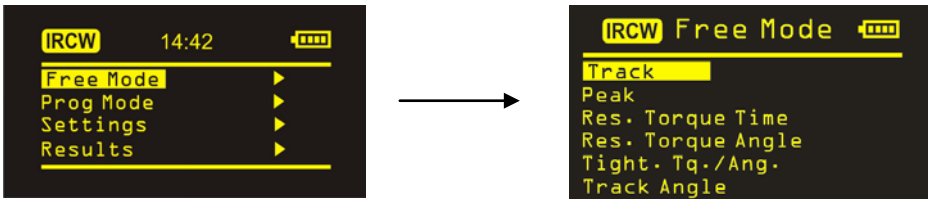
4.1 Executing a Free Test

The free mode is active only if enabled in the *STwrench Settings*.

The free test allows a test (tightening operation or quality control test) to be conducted simply by accessing the wrench from the keyboard, with no need to program the wrench using ToolsTalk BLM.

NOTE: In this mode the results are not saved in the wrench memory and are not transferred to any remote device.
Moreover, in the free mode, the RFID TAG of the end-fitting tool is not read; this means that the torque and angle correction coefficients, possibly set for a wrench extension, have not been considered.

To conduct a free test, select ***Free Mode*** from the main menu:



Select the desired operation and click on the ***OK*** button on the wrench keyboard to start the test.

4.1.1 Track

This 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 wrench display.



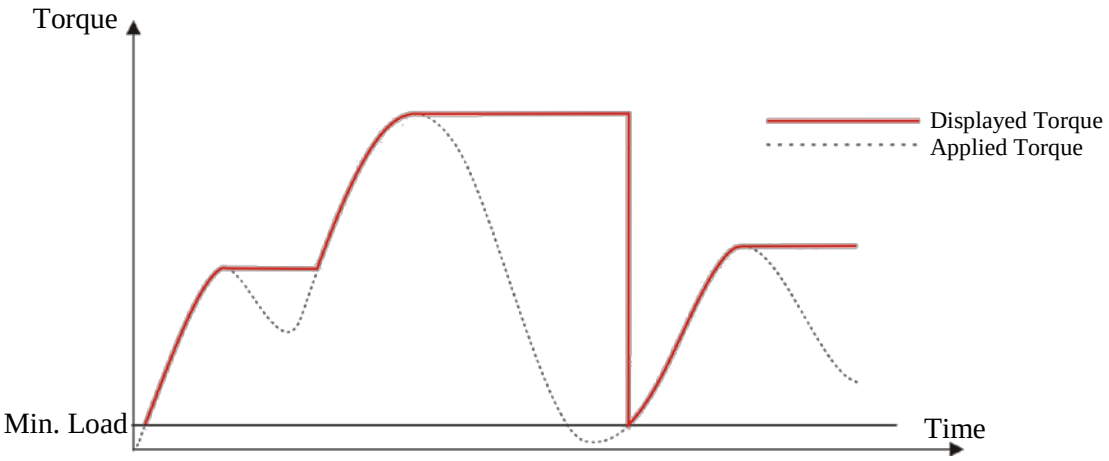
In track mode, the wrench displays the applied torque in real time.



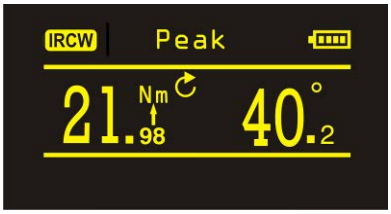
Torque can be applied in either a clockwise (positive torque) or counterclockwise (negative torque) direction.
By clicking on the ***OK*** button on the wrench keyboard, the wrench executes a torque zero adjustment.
NOTE: This zero adjustment is applied only for this test and not applied as a global zero reference for the STwrench.

4.1.2 Peak

Like track mode, this 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 wrench display. In peak mode, the maximum value reached during tightening remains frozen on the wrench display.



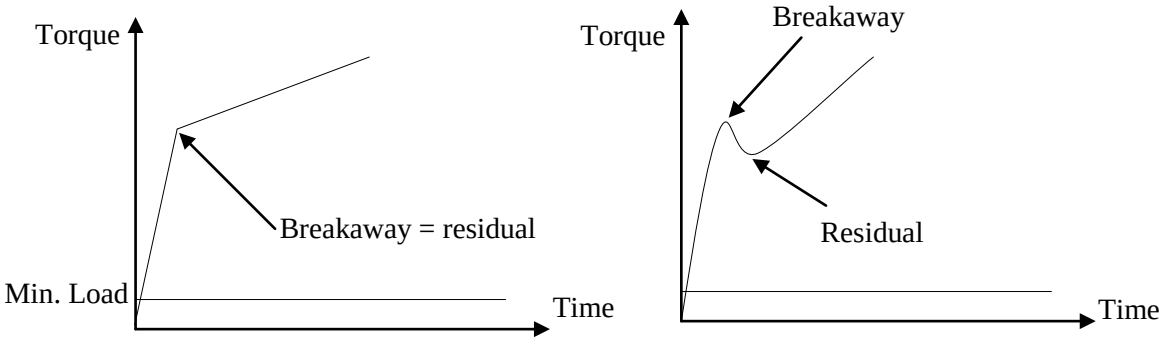
The wrench displays torque and angle in real time, starting from the *Min. Load* value of the smartHEAD, and the peak value (measured on the torque) is frozen on the display.



A new cycle starts when the applied torque is released, and applied again over the *Min. Load* of the wrench transducer (5% of the wrench capacity). The angle calculation is reset when a new cycle is started.
By clicking on the ***OK*** button on the wrench keyboard, the torque and angle values are reset.
The torque must be applied in a clockwise direction.

4.1.3 Residual Torque / Time

This test evaluates the residual torque on a bolt, using the torque / time method.



No input parameters are needed; simply apply the torque on the bolt and increase it until it starts moving; the wrench automatically detects the residual point. The analysis starts when the applied torque goes over the *Min. Load* value.

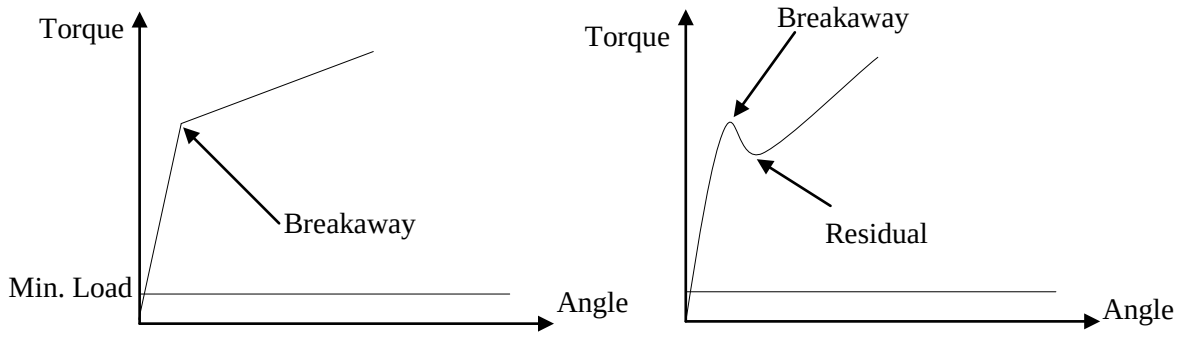
NOTE: Since this mode analyzes the torque trace as a function of the time, it is very important to execute this operation with a single “steady” movement by the operator.



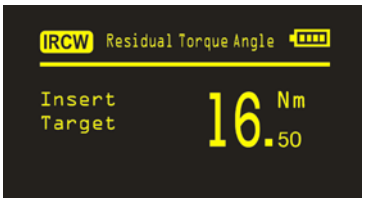
The wrench displays the torque applied in real time, and freezes the residual torque value when the point is detected.
The green LED and the vibration device (active for 1 second) advise the operator that the residual torque point has been detected.
To start a new test, simply apply torque again; click on the ***OK*** button on the wrench keyboard to reset the torque and angle value to zero.

4.1.4 Residual Torque / Angle

This test evaluates the residual torque on a bolt using the torque / angle method. Since torque is analyzed as a function of angle rather than time, this is a more objective method for evaluating residual torque than the torque / time method.



This mode is equivalent to the Residual Torque Time mode, except for the fact that the method used to evaluate the residual point is based on the torque/angle trace.



Set the desired target torque value by clicking on the ***UP*** and ***DOWN*** arrows on the wrench keyboard and click the ***OK*** button to confirm and execute the test. The STwrench start analyzing the torque/angle trace from the half value of the target entered.
The minimum target value is double than the smartHEAD minimum load.

Apply the torque on the bolt and increase it until it starts moving; the wrench automatically detects the residual torque point. The analysis starts when the applied torque goes over the *Min. Load* value.



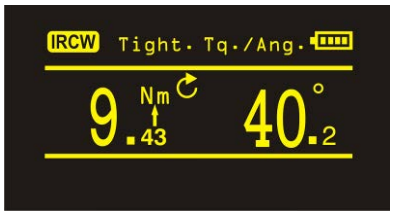
The wrench displays the torque applied in real time, and freezes the residual torque value when the residual point is detected.
The green LED and the vibration device (active for 1 second) advise the operator that the residual torque point has been detected.
To start a new test, simply apply torque again; click on the ***OK*** button on the wrench keyboard to reset the torque and angle value to zero.

4.1.5 Tight Torque / Angle

In this mode the wrench executes a tightening operation to the given torque.



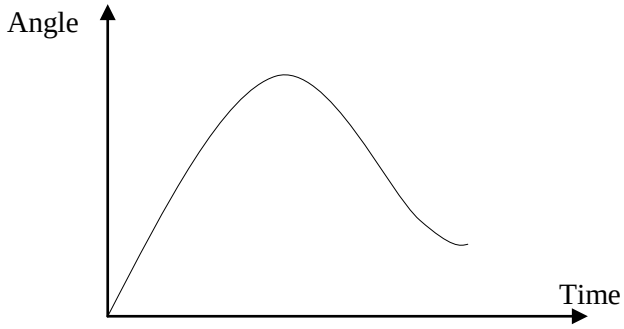
Set the desired target torque value by clicking on the ***UP*** and ***DOWN*** arrows on the wrench keyboard and click the ***OK*** button to confirm and execute the tightening.



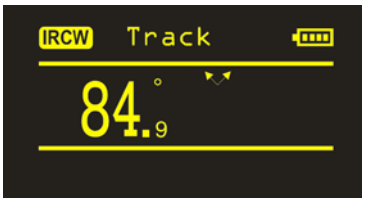
The current torque and angle values are displayed, starting from the *Min. Load* value of the smartHEAD.
Torque must be applied in a clockwise direction.
The green LED, the vibration device and the buzzer advise the operator that target torque value has been reached (within 5% of the specified value).

4.1.6 Track Angle

This mode can be used to track the angle rotation of the STwrench.



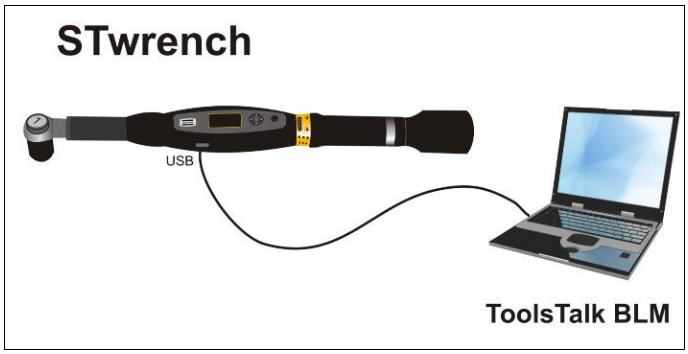
In this mode, the wrench displays the angle in real time.



The STwrench can be rotated in either a clockwise (positive angle) or counterclockwise (negative angle) direction.
By clicking on the ***OK*** button on the wrench keyboard, the angle measurement is reset.

5 Working with ToolsTalk BLM





ToolsTalk BLM is a PC software package developed to manage the STwrench.
It offers easy user-friendly programming and real time monitoring of the wrench.
ToolsTalk BLM serves as an interface between the user and the STwrench. With ToolsTalk BLM, users can create and edit the tightening programs for the wrench; it also allows configuration of wrench settings, and receives the tightening results and traces executed by the wrench.
The settings needed to control the tightening process performed by the STwrench include: Tightening strategies, control parameters, torque parameters, angle parameters, and options.

The main features are:

- Pset, Multistage and Job programming
- Settings of the STwrench controller and end-fitting tool
- Review of results and traces from the wrench

The software saves all of your tightening programs in a ***.ttb*** file; you can use this file to save/load a set of tightening programs.

5.1 Software Installation and Registration

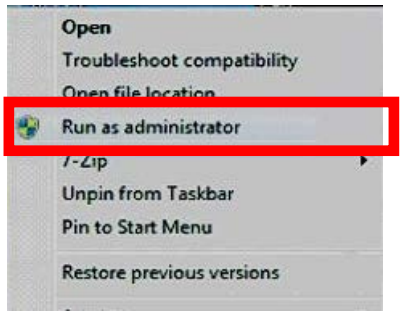
NOTE: Installation requires PC administrator rights.

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

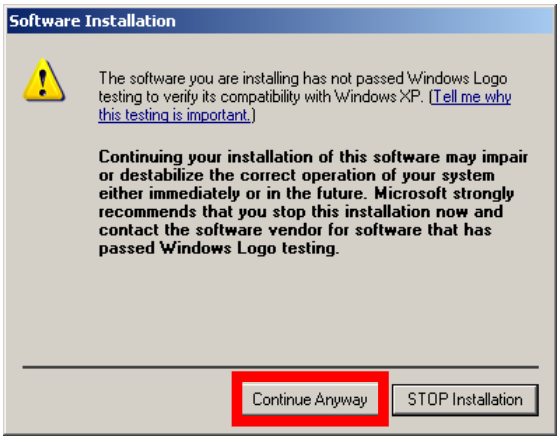
If possible, install the software with a STwrench switched on and connect to the PC via a USB cable.

To install the software, simply double-click on the setup file on the installation CD and follow the instructions.

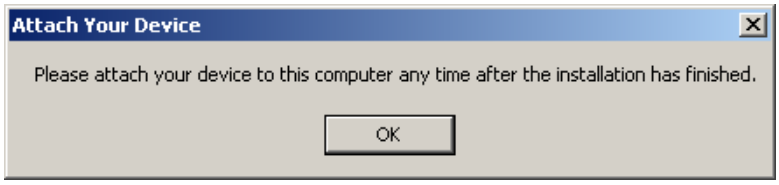
NOTE: For Window 7 operating system, right-click on the setup file and select the ***Run as Administrator*** command:



Click on ***Continue Anyway*** if the following Windows message is shown:



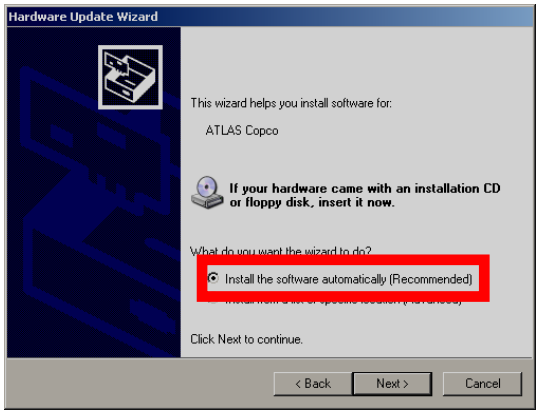
If the software is installed without a STwrench connected, at the end of the installation, the user will be required to connect a STwrench to the PC to continue with driver installation:



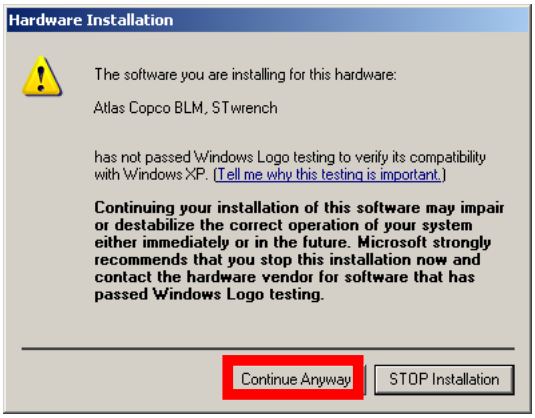
Turn on the STwrench and wait until initialization has finished and the main menu is shown on the wrench display. When you connect the STwrench to the PC via the USB cable, the new hardware setup wizard will start:



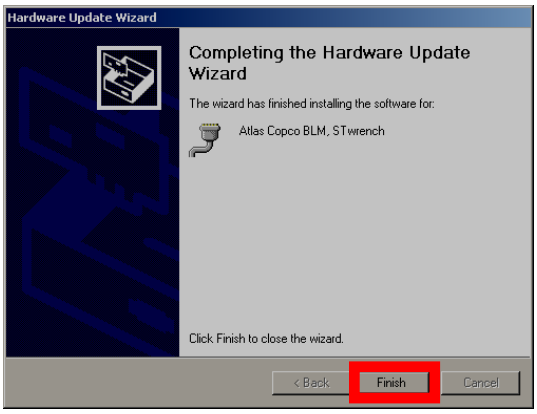
Select ***No, not this time***, and click on ***Next***



Select ***Install the software automatically***, and click on ***Next.***

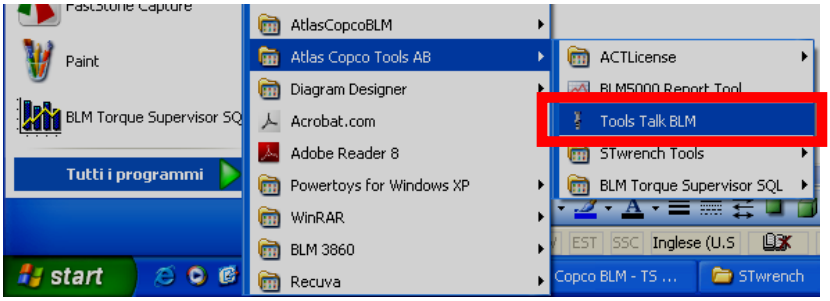


Click on ***Continue Anyway*** if this Windows message is shown.

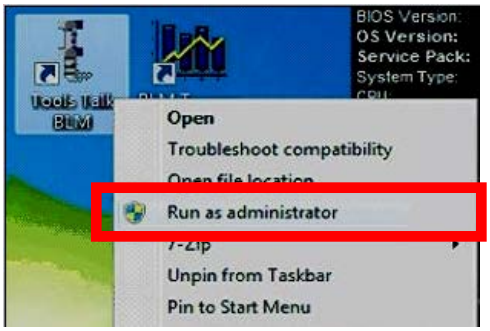


Wait until the end of the installation and click on ***Finish.***

After installation, run the program by selecting **Start → Programs → Atlas Copco Tools AB → ToolsTalk BLM:**



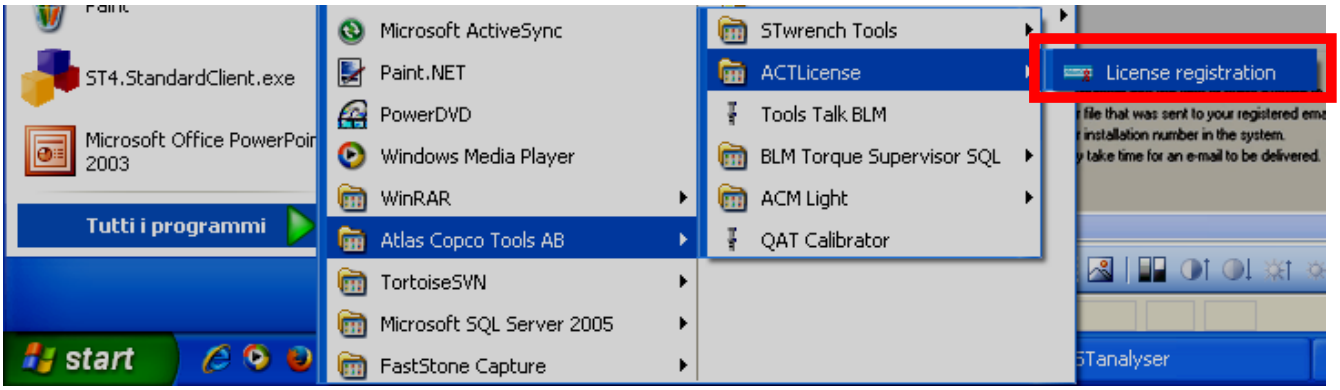
NOTE: For Windows 7 operating system, at the first usage of the software, right-click on the ToolsTalk BLM icon and select ***Run as Administrator*** to start the software; an error message may be shown otherwise:



5.1.1 Software registration

After installing the software, you need to register at www.atlascopco.com/tools/software. If not registered, the software only works as demo for 60 days.

The registration form can be open from the ***Start → Atlas Copco Tools AB → ACTLicense*** menu:



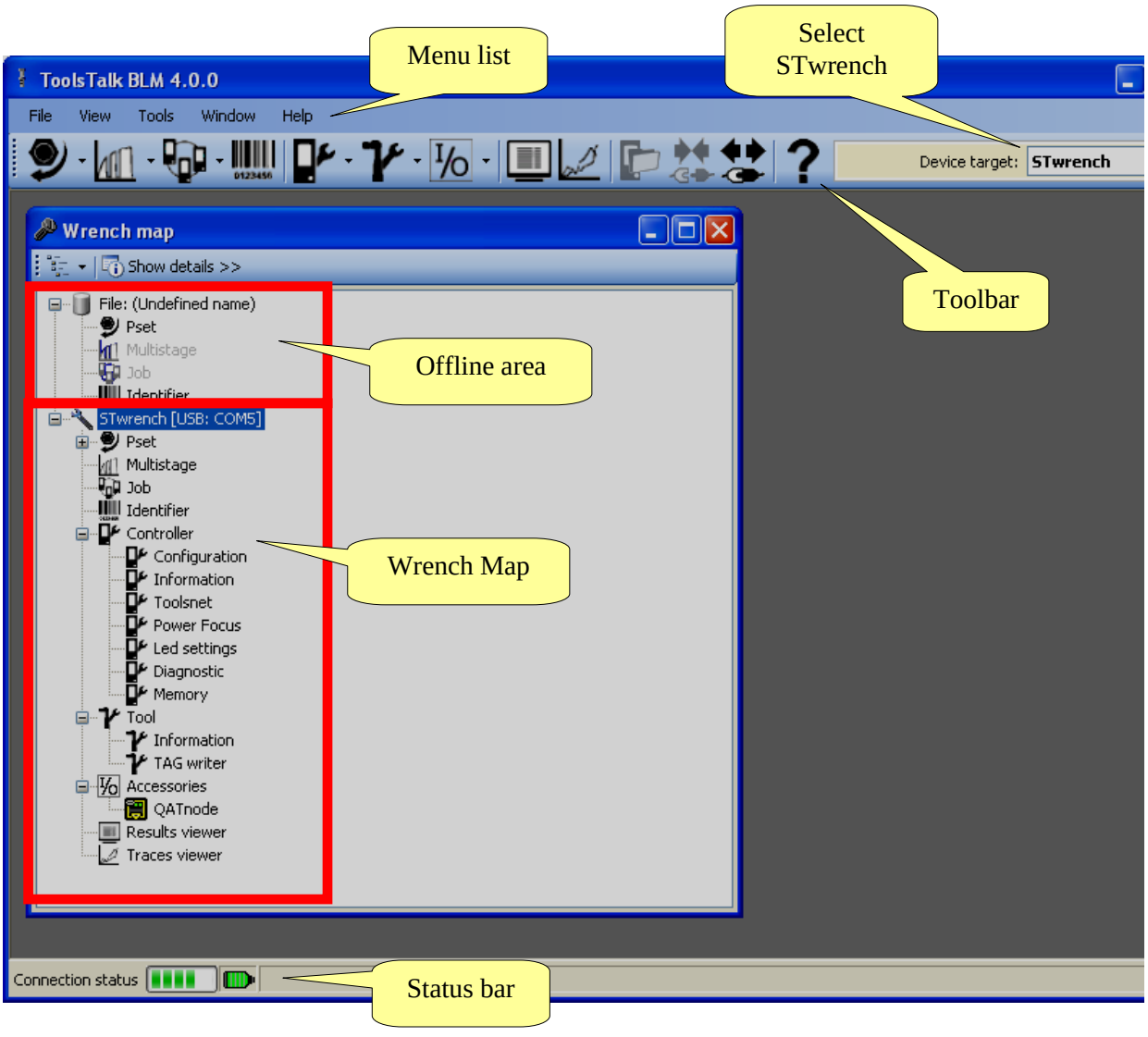
5.1.2 Software upgrade

When upgrading the ToolsTalk BLM software to a new version, simply install the new version. There is no need to uninstall the previous version.
All STwrench settings, tightening programs and results will remain unaffected by the upgrade process.

5.2 ToolsTalk BLM Overview

Almost every function in ToolsTalk BLM has its own window. The figure below shows the ToolsTalk BLM interface with the menu list, toolbar and Wrench Map.

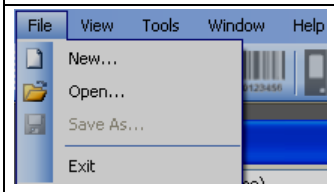
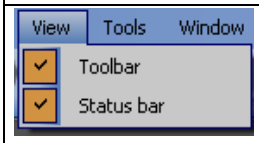
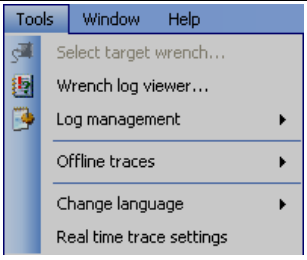
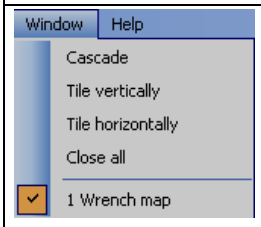
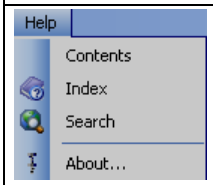
There is more than one way to start a function in ToolsTalk BLM: Click on a symbol in the toolbar or double-click on the text in Wrench Map.



NOTE: ToolsTalk BLM adapts automatically to the STwrench firmware version and RBU type. As a result, some menus or commands may be hidden or disabled if not supported by the firmware/RBU version of the STwrench.

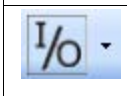
5.2.1 Menu list

The following options are available in the ToolsTalk BLM Menu list:

Illustration	Name	Description
	File	Reads and stores the ***.TTB*** files containing all the tightening programs.
	View	Enables the Toolbar and the Status bar in the main page of ToolsTalk BLM.
	Tools	This menu provides the following options: - Select target wrench: Scan for wrenches connected to ToolsTalk BLM - Wrench log viewer: Provides more information of the ToolsTalk BLM – STwrench communication - Log management: Enables a log file for monitoring all the software operations - Change language: Defines the language for the ToolsTalk BLM - Define settings for the real time traces function
	Window	This sets the layout of the ToolsTalk BLM main page.
	Help	Help menu.

5.2.2 Toolbar

The toolbar icons are shortcuts to the basic functions in ToolsTalk BLM.

Icon	Icon name	Description
	Pset	This icon opens the programming window for the first Pset. A Pset contains all the information the STwrench needs to perform tightening. Click on the arrow to the right of the icon to select one of the existing Psets (identified by number). See the *Pset* chapter for more information.
	Multistage	This icon opens the Multistage programming window. In some instances, it is necessary to perform tightening in several stages. These circumstances require specific tightening strategies. Multistage allows the user to create linear sequences of up to 100 Psets to perform tightening divided into stages. Click on the arrow to the right of the icon to select between existing Multistages (identified by its number). See the *Multistage* chapter for more information.
	Job	This icon opens the programming window for the first Job. A Job is a collection of Psets or Multistages, which are useful when performing several multiple tightening operations, each with different requirements. This is convenient since the operator does not have to select a new Pset or Multistage for every tightening operation. Click on the arrow to the right of the icon to select between existing Jobs (identified by its number). See the *Job* chapter for more information.
	Identifier	This icon opens the Identifier programming section. See the *Identifier* chapter for more information.
	Controller	This icon opens the Controller programming section; use the arrow to the right of the icon to select one of the sub-menus. Controller contains information and settings for STwrench, including network settings for IRC-W and IRC-B modules. See the *STwrench Controller Setup* chapter for more information.
	Tool	This icon opens the Tool programming section; use the arrow to the right of the icon to select one of the sub-menus. The Tool branch includes information, configuration, diagnostic and maintenance for the smartHEAD connected to the STwrench. See the *Tool Setup* chapter for more information.
	Accessories	This icon opens the QATnode settings window. It includes tightening data print setup, configuration of the I/O module, and settings for ToolsNet connection with QATnode.

Icon	Icon name	Description
	Results Viewer	This icon opens the Results Viewer page. See the *Results Viewer* chapter for more information.
	Traces Viewer	Click the Traces Viewer icon to bring up a graphic display of the tightening results. The Trace function can be used to view tightening graphs with different display settings, and overlap the traces for comparison. See the *Traces Viewer* chapter for more information.
	Wrench Map	This icon opens the Wrench Map if it is closed. See the *Wrench Map* chapter for more information.
	Connect	The Connect icon changes appearance depending on the connection status. When the PC is not connected to the STwrench, this icon is visible. Clicking on it establishes a connection between the PC and STwrench. See the *Connecting to the STwrench* chapter for more information.
	Disconnect	This icon becomes active when a connection is established. Clicking on it disconnects the PC from the STwrench.
	Help	This icon is not active in this software version.

5.2.3 Status bar



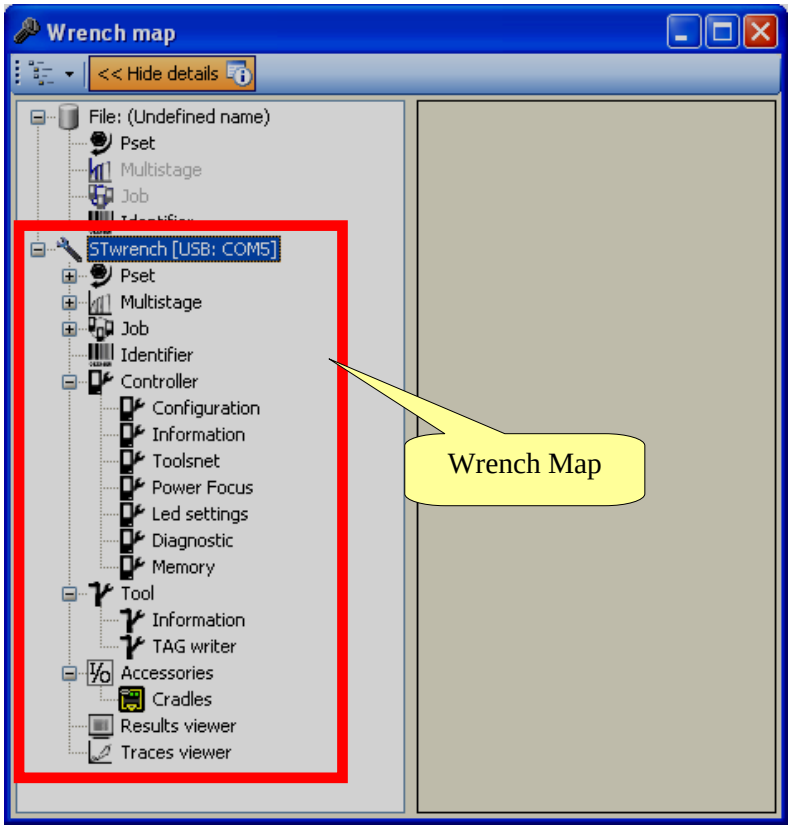
The status bar is shown when the STwrench is connected to ToolsTalk BLM.

It shows the connection status between the PC and the STwrench and the battery charge level:

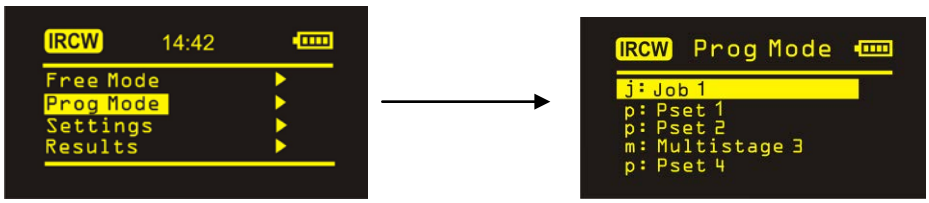
- ***Green***: Battery level over 50%
- ***Yellow***: Battery level under 50%
- ***Red***: Battery level under 30%

When programming a Pset, the status bar displays useful information about maximum and minimum values allowed for the various parameters.

5.2.4 Wrench Map

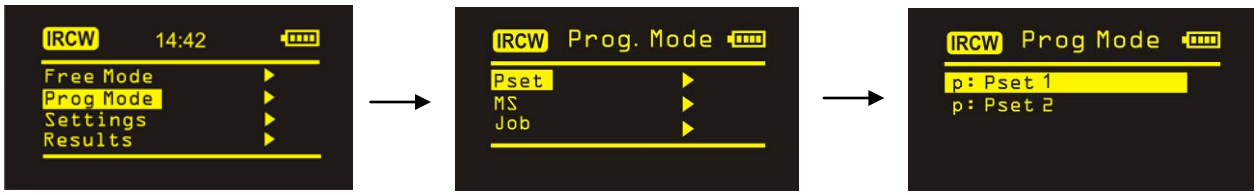


The ***Wrench Map*** defines your tightening programs directly on the STwrench; once created, the tightening programs are automatically transferred to the wrench and stored in the ***Prog Mode*** menu:



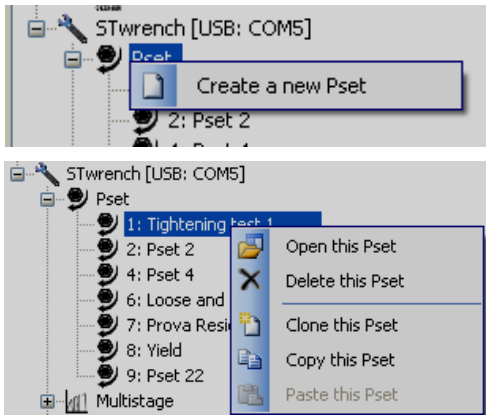
NOTE: In *Prog. Mode*, the STwrench reads the RFID TAG of the end-fitting tool (if the function is enabled in the controller setting). If the torque and/or angle readings are correct in the *Free Mode* but incorrect in the *Prog. Mode*, verify that the torque and angle coefficients of the end-fitting tool have been set properly. See the chapter *TAG writer* for more information.

If the *Group Menu* is enabled in the *STwrench Controller Setup*, the Pset, Multistages and Jobs are grouped into three different folders:



The wrench map also provides shortcuts to all the wrench controller and smartHEAD settings, and to the results and traces viewer.

Click on the minus or plus symbols to open and close menus, and double-click on function names (Pset, Multistage, Job, etc) to open the corresponding function.

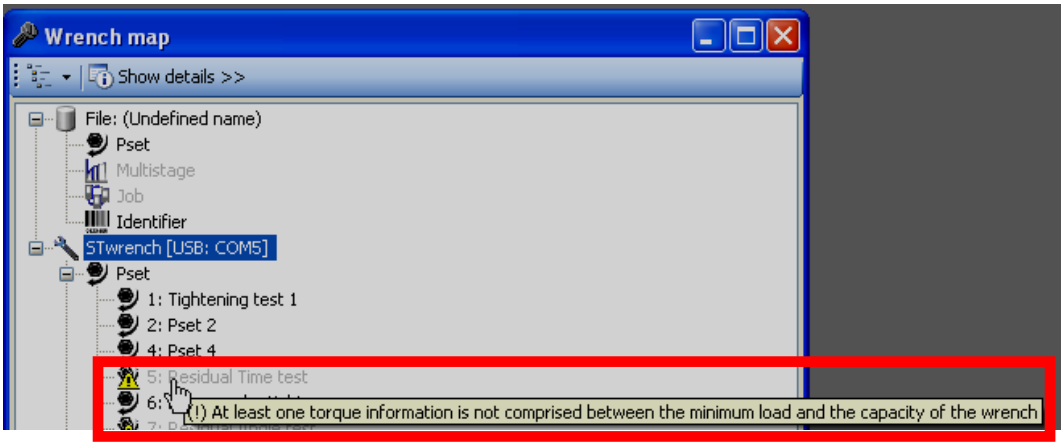


Right-click on the ***Pset***, ***Multistage*** or ***Job*** icon to create a new instance of the function, or to copy (to paste then on an existing item), clone (to create a new item) or delete an existing one.

See the chapters *Pset*, *Multistage*, and *Job* for more information on how to create and setup a tightening program.

All the tightening programs created in the wrench map can be saved in a ***.ttb*** file, by selecting ***File → Save As*** in the main ToolsTalk BLM window.

NOTE: The wrench map checks run time if the Psets are compatible with the smartHEAD currently installed in the STwrench. If not, Psets that cannot be executed by the wrench are marked with an exclamation mark:

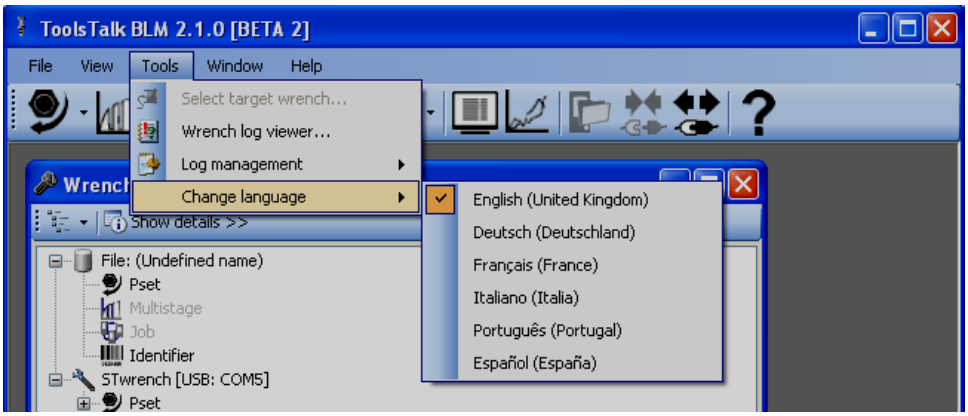


This happens only if the smartHEAD has been replaced by a new one that does not support all the Pset already programmed, which is not a normal operation. The incompatible Pset is disabled and cannot be modified here. A different Pset should be created for use with a different smartHEAD. The disabled Pset can still be modified however by saving all the tightening programs in a .ttb file (by selecting *File* → *Save As*), and modifying the Pset offline before sending it back to the wrench.

NOTE: It is possible to create the tightening programs and configure the STwrench settings also offline, and transfer then the offline file to one or more STwrenches. See the *Offline Programming* chapter for more information.

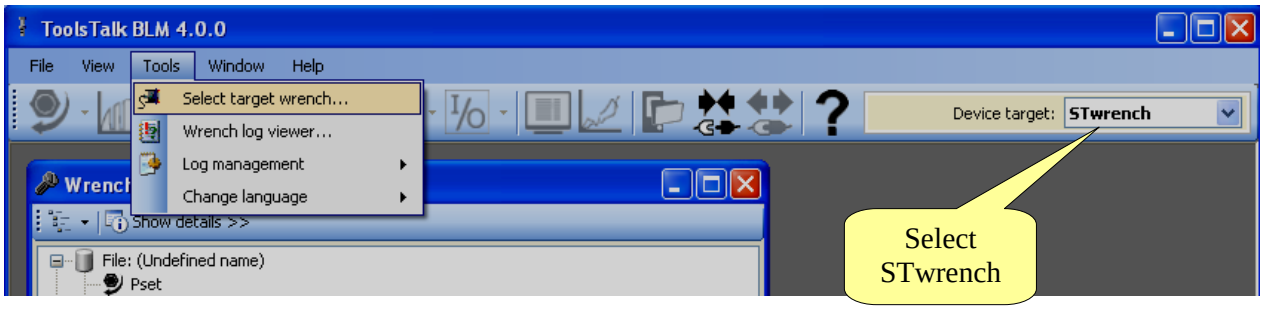
5.3 Settings in ToolsTalk BLM

You can set the language from the ***Tool*** → ***Change language*** menu:

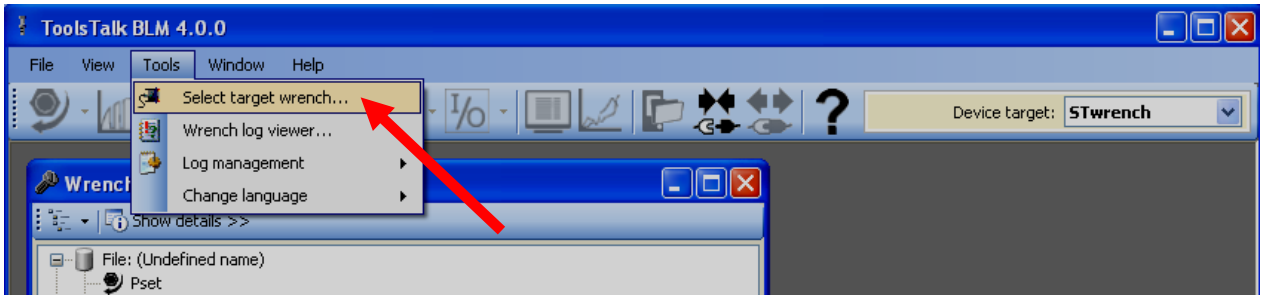


5.4 Connecting to the STwrench

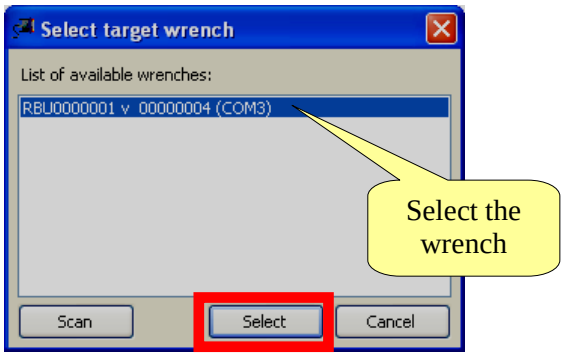
First of all, select the STwrench as the device target:



If you are connecting the wrench to the PC with the software for the first time, you need to enter the ***Tools → Select Target Wrench***:



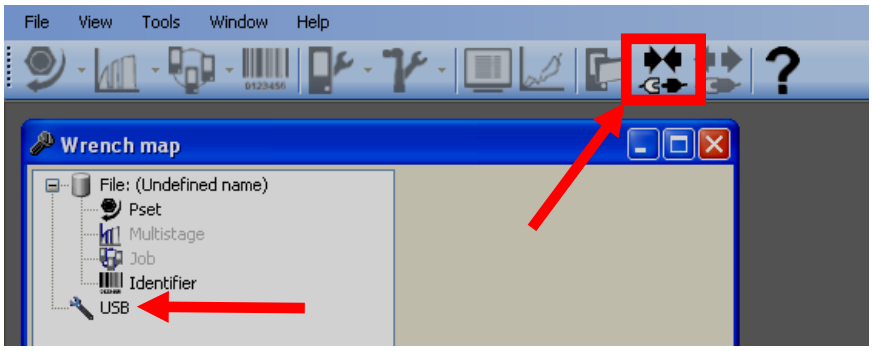




This operation is necessary only once.

After the first time, perform the following sequence:

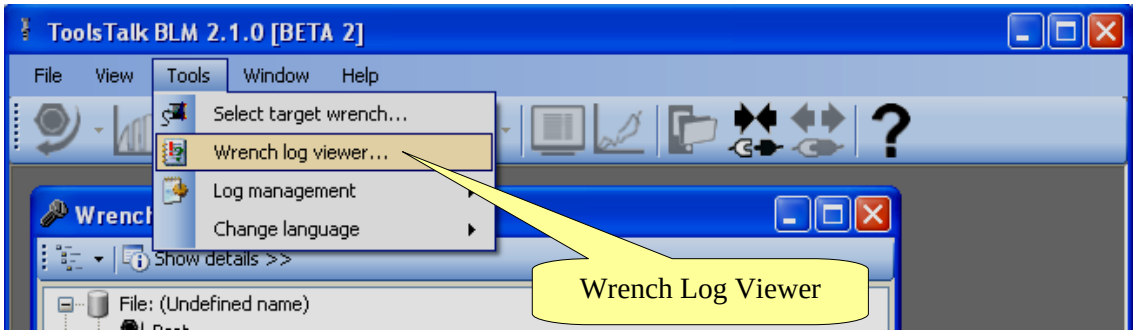
- Launch the ToolsTalk BLM on the PC
- Turn on the STwrench and wait for it to power on (the main menu is shown on the wrench display)
- Connect the STwrench to the PC via a USB cable (with the STwrench already turned on)
- Click on the ***Connect*** icon to connect to the wrench (or double-click on the USB icon in the *Wrench map*):



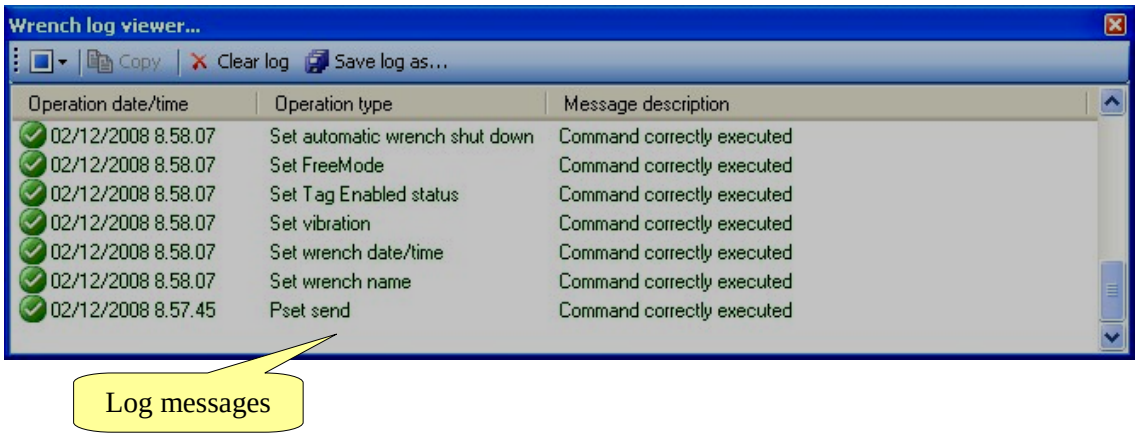
5.5 Wrench LOG Viewer

The ***Wrench log viewer*** function allows you to obtain information about the STwrench – ToolsTalk BLM communication and about the STwrench – ToolsNet communication.
This can be helpful for troubleshooting activities.

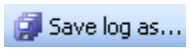
Select ***Tool → Wrench log viewer*** to open the log window.



All the messages related to STwrench – ToolsTalk BLM and STwrench – ToolsNet communication are displayed in the log windows. Click on ***Save log as*** to save the log file.



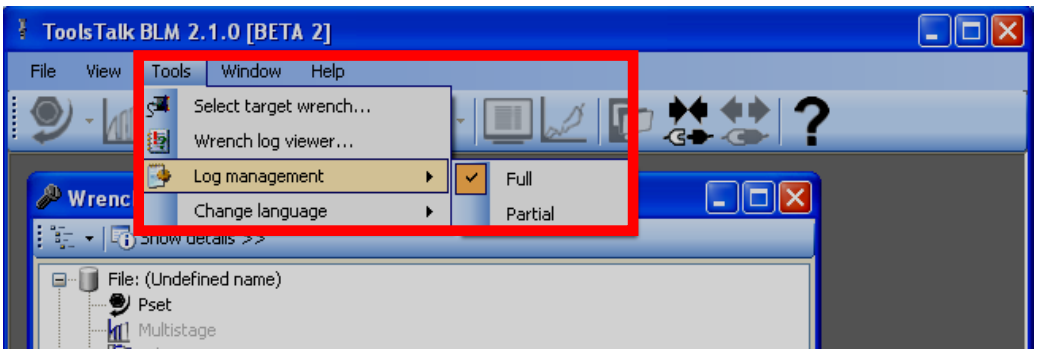
The toolbar in the upper area of the *Wrench LOG Viewer* window provides the following commands:

Icon	Function	Icon	Function
	Select / Deselect all messages.		Delete all messages.
	Copy the selected message(s) to the clipboard.		Save LOG file (CSV, XML or LOG file).

5.6 Enabling LOG File

An additional LOG file can be enabled. This log file is more specific for ToolsTalk BLM operation than the *Wrench LOG viewer*.
Normally, this should be left disabled so as not to generate a large file inside the PC.
Enabling the log file can be helpful to debug/monitor software activities when troubleshooting software operations.

Select ***Tools → Log management*** from the menu list:



Full	Creates a log file containing the following messages: Information, warning, errors and fatal errors.
Partial	Creates a log file containing only warnings, errors and fatal errors.

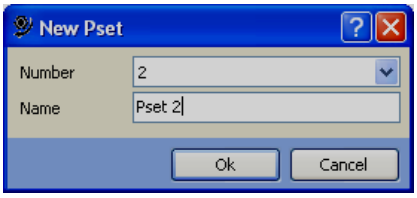
The log file is added in the Log folder, which is automatically created in the same installation directory of the ToolsTalk BLM, typically:
C:\Program Files\Atlas Copco Tools AB\Tools Talk BLM\Log

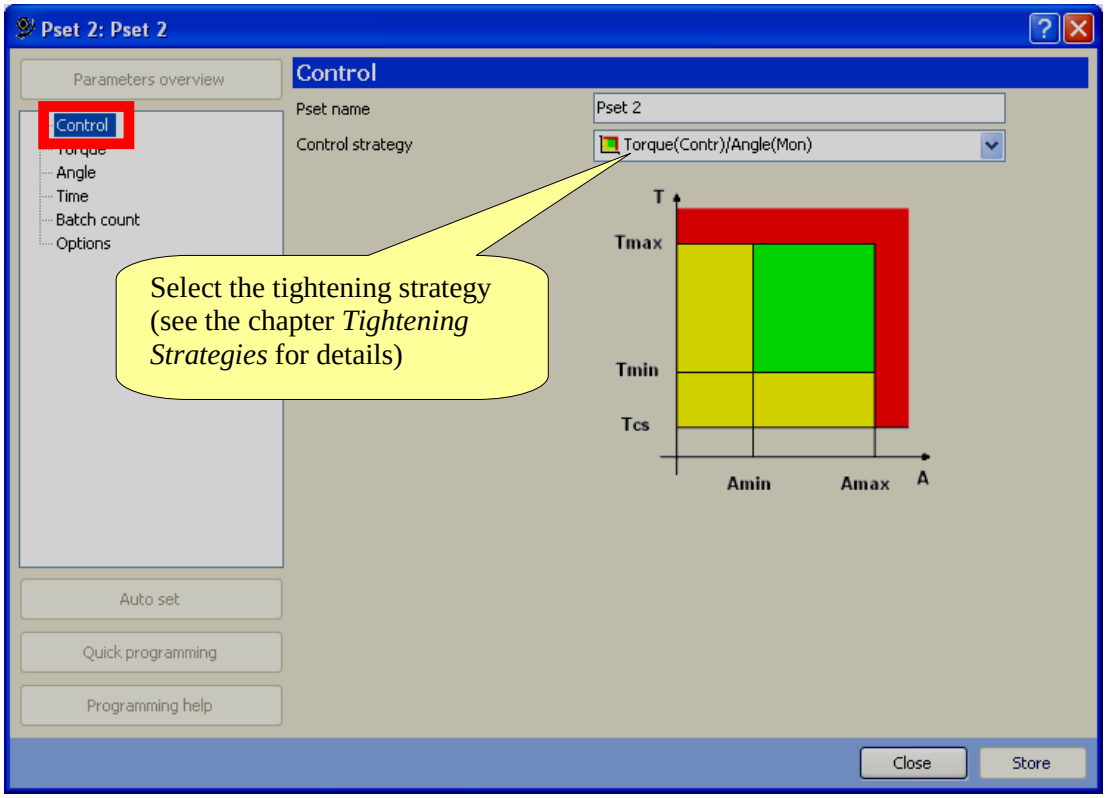
6 Pset

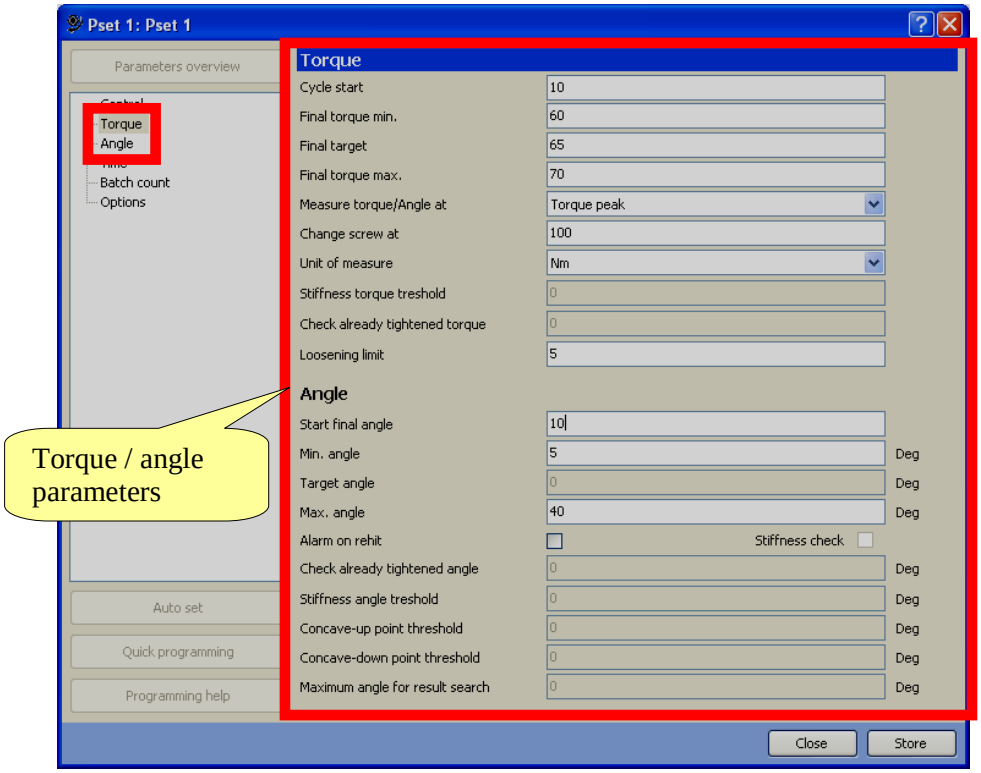
The set of parameters that controls a tightening process or a residual torque test is contained within a so-called **Pset**. This section describes how to setup the Pset parameters necessary to perform a tightening.

The STwrench can store up to 200 Pset/Multistage in its memory.

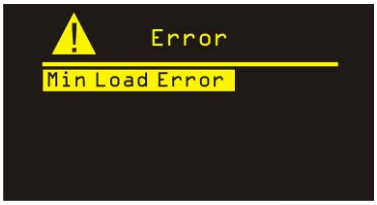
 Click on the Pset icon and enter the Pset ***Number*** and ***Name***.

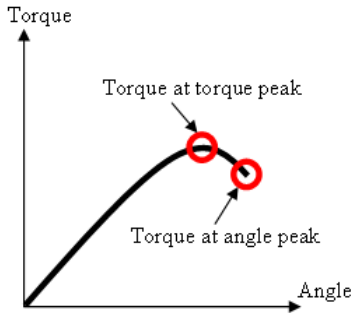






6.1 Torque Parameters

Cycle Start	Torque value from which to start the tightening operation. This must be higher than the smartHEAD *Min. Load* value; if not, when the Pset is started the following error message is shown: 

Final Torque min	Torque limit value (low).
Final Target	Torque target value.
Final Torque max	Torque limit value (high).
Measure Torque at	Select between ***Torque Peak*** and ***Angle Peak***:  **NOTE**: The torque result of a tightening procedure changes according to the tightening strategy, and may vary depending on whether the torque result falls into the torque range or not. See the specific tightening strategies at the end of this chapter for more information. For the *PVT compensate with snug point* control strategy, this parameter become the *Compensate value*. See *PVT compensate with snug* for more information
Change screw at	If the torque reaches this limit, the message “change screw” is shown on the wrench display. This must be higher that the *Final Torque max* value.
Unit of measure	Select the desired unit.
Loosening limit	For production strategies, if the torque goes over this value in the direction opposite to the tightening direction (CW or CCW), the STwrench detects an unwanted loosening operation, and the message “loosening detected” is shown on the display. In this case the result of the test is marked as *Not OK*. When the test ends, the STwrench continues to monitor for unwanted loosening operations for the *loosening monitoring* time (see below). If the loosening occurs after the end of the test, the test result of the tightening is saved, and a new test result is generated and marked as “loosening” in the *result type*.

Status	Torque status	Angle status	Result number	insducer S/N	Torque compensation	Result Type
NOK	LOW	LOW	56	81111	0.00	LOOSENING
OK	OK	OK	55	81111	0.00	TIGHTENING

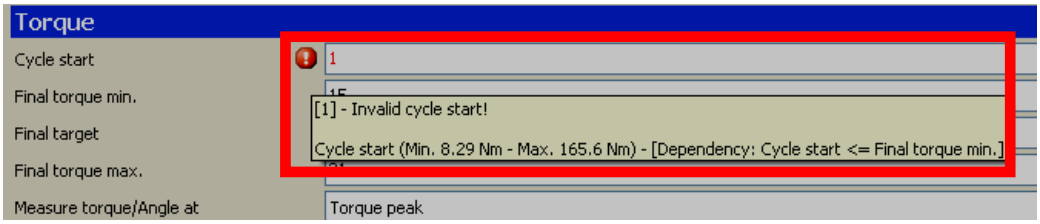
In the figure above (see the *Results Viewer* for more information), the first result marked in red is the results created by loosening occurred after the end of the test. The second row is the tightening performed before the loosening.

The following example is a Pset in which the torque and angle are OK, but the status is marked as Not OK because a loosening was detected during the tightening operation:

Status	Torque status	Angle status	Result number	insducer S/N	Torque compensation	Result Type
NOK	OK	OK	65	81111	0.00	LOOSENING

Set the ***Loosening limit*** to 0 to disable the loosening detection function.

NOTE: All the torque parameters defined for a Pset must be higher than the smartHEAD minimum load and lower than the smartHEAD capacity (see the chapter *Tool Setup*); otherwise, a *Min Load error* or a *Capacity Error* is shown on the wrench display when the Pset is started. During Pset definition, in case of conflict between parameters the error description is displayed by moving the mouse pointer over the red error sign:

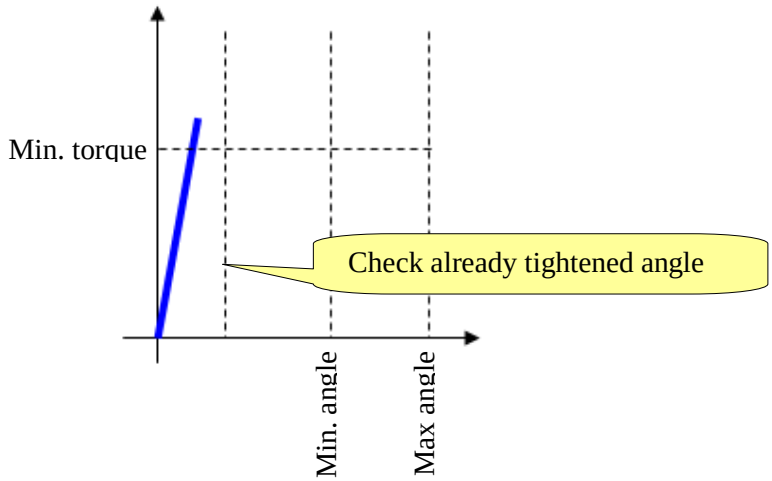


When using the Torque Correction Coefficient (STwrench with extension or torque multiplier), the maximum value for Pset torque parameters is given by the formula:

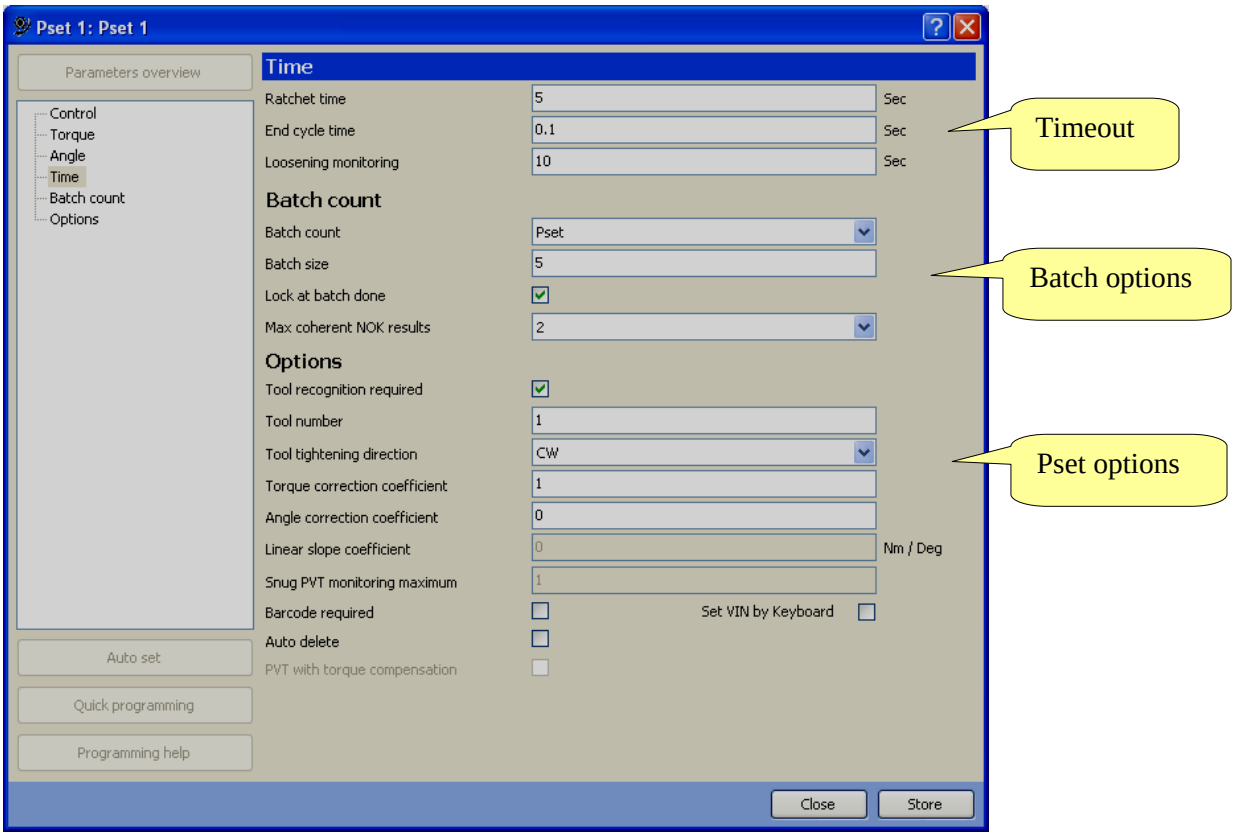
$T\,\max \leq smartHEADcapacity \times TorqueCorrectionCoefficient$

For example, for a smartHEAD 250 Nm with extension or multiplier with Torque Correction Coefficient of 4, the maximum torque in the Pset parameters is 250 x 4 = 1000 Nm.

6.2 Angle Parameters

Start final angle	Torque threshold from which to start the angle count.
Min angle	Angle limit (low).
Max angle	Angle limit (high).
Alarm on rehit	Enable/disable the function to check if the screw is already tightened (defined via the *Check already tightened angle* parameter).
Check already tightened angle	 If the torque reaches the *Min. Torque* value within this angle, the error message "*Already tightened*" is shown on the wrench display:  This field is active only if the ***Alarm on rehit*** is enabled.
Concave-down point threshold and ***Concave-up point threshold***	Valid only for *residual torque/angle* strategy. See the *Residual Torque/Angle* chapter for more information.

Maximum angle for result search	If the ***Measure Torque at*** is set to ***Angle Peak***, the result is taken at the maximum torque in the last angle degrees defined here, starting from the angle peak measured. The maximum value is 4°. It is active only for the *Torque (monitor) / Angle (Control)* control strategy. See the *Torque (Monitor) / Angle (Control)* chapter for more information.

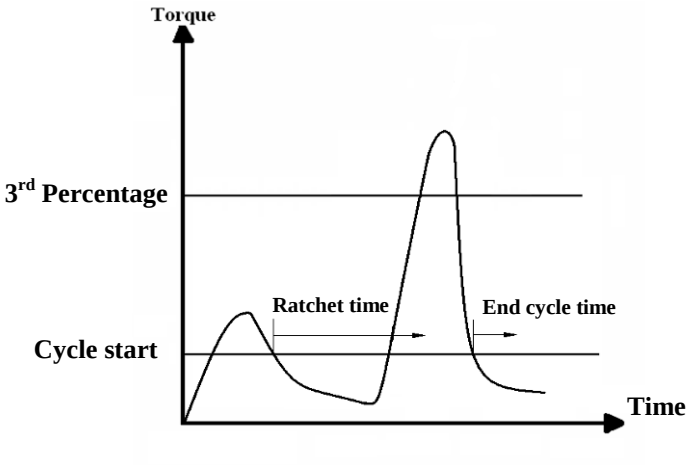


6.3 Timeout

Ratchet time	Applied when the torque goes below the cycle start but has not yet reached the *3rd Percentage* value (see *LED settings*). This allows the operator to release the torque for a while and recharge during the tightening operation; the default value is 5 seconds. Minimum value: 0.1 sec

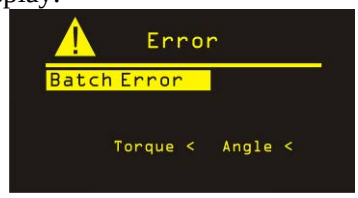
	Maximum value: 30 sec
End cycle time	Applied when torque goes below the cycle start and reaches the *3rd Percentage* value (see *LED settings*); the default value is 0.1 second. Minimum value: 0.1 sec Maximum value: 5 sec
Loosening monitoring	If the *Loosening limit* it is set to a value different from 0, the STwrench continues to search for unwanted loosening operations also after the end of the test, for the time specified here (in seconds). Minimum value: 0 sec Maximum value: 60 sec

The wrench ends the tightening operation if the torque drops beneath the *Cycle Start* value for longer than the ***Ratchet time*** or the ***End cycle time*** as shown in the following figure:



6.4 Batch Parameters

Batch count	Set to ***Pset*** if you want to execute the Pset more than once.
Batch size	If *Batch count* is enabled, specify how many times the Pset must be executed. Maximum value: 99

	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, The *Batch result* status will only be OK if the Pset shows OK. If the *Batch size* is greater than 1, the *Batch result* is OK only if all the Psets show OK.
Lock at batch done	If enabled, at the end of the batch the wrench freezes the display; to exit the menu, the operator must press the OK button. If not enabled, when the batch is completed, a new batch will start again.
Max coherent NOK results	Maximum number of Pset with *Not OK* result. Maximum value: 9 For instance, if this parameter is set to 2, at the second Not OK result during the batch execution, the batch execution stops and the following error message is shown on the wrench display:  This parameter is active only if the *batch increment condition* is set to *OK* in the controller configuration.

6.5 Options

Tool recognition required	If enabled, the Pset execution checks that the specified end-fitting tool is inserted in the wrench head. Note that this function performs only a check, and does not start the Pset automatically; to use the end-fitting tool recognition function to automatically select Pset/Multistage, see the *Setting the source for Pset/Multistage/Job selection* chapter. When this function is used, this flag does not have any effect.

Tool number	Specify the end-fitting tool number required for the Pset. If the tool recognition function is used to select the Pset/Multistage automatically, this is the end-fitting tool number which activates the Pset. Maximum value: 100
Tightening direction	Select Clockwise (***CW***) or Counterclockwise (***CCW***).
Torque correction coefficient and ***Angle correction coefficient***	These parameters are used to correct the torque and angle reading when using an extension or torque multiplier on the wrench. See *Appendix A – Calculating Torque and Angle Correction Coefficients* for more information. Normally these coefficients are stored in the TAG of the end-fitting tool (see *TAG writer*); however, it is possible to specify them here (for example, extension without RFID TAG or when using a torque multiplier on the STwrench). Leave the ***Torque Correction Coefficient*** set to 1, and the ***Angle Correction Coefficient*** set to 0, if these parameters are set into the RFID TAG of the end-fitting tool; if different values are specified, the STwrench corrects torque and angle reading considering all of them (the two torque correction coefficients are multiplied, while the two angle correction coefficients are added together).
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. The minimum value is 0.1, which suits also very soft joints with a ration less than 0.1. The default value is 0.5. **NOTE**: This parameter has been introduced with ToolsTalk BLM version 7.2 and STwrench firmware 3.3. When loading .ttb files created with previous versions, this parameter is not set properly; the desired value must be specified before transferring the .ttb file to the STwrench. **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 lbf*ft/° → 0.6x1.3558 = 0.81 Nm/°

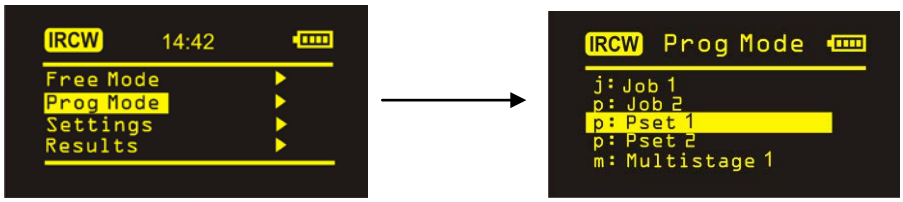
Barcode required	If enabled, before starting the Pset execution, the wrench needs to scan the specified barcode. See the chapter *Identifier*. To use the barcode reading to select Pset automatically, see the *Setting the source for Pset/Multistage/Job selection* chapter. When that function is used, this flag does not have any effect.
Set VIN by keyboard	This function allows the user to associate a barcode string (VIN) to the Pset inserting manually the string and not scanning with the barcode reader; It cannot be activated if the *Barcode required* is activated. If this flag is enabled, before starting the Pset execution the wrench asks to input the VIN string (composed by 4 numbers) by keyboard:  Set the number using the up/down arrows on the wrench keyboard and move from next digit using the left/right arrows. Press ***OK*** to confirm, or press the barcode button to clear the barcode entered. The VIN entered is associated to the barcode result part 3 in the results. If the barcode is set as source for Pset selection, this flag does not have any effect.
Auto delete	This flag should be normally left disabled. If enabled, the Pset will be deleted after its execution. After deletion, the Pset disappears from the wrench menu and from the *Wrench map* of ToolsTalk BLM. If you do not want to lose the Pset definition completely, save the list of Pset in a .ttb file from ToolsTalk BLM. If a batch size is specified, the Pset is only deleted when the batch is completed. The Pset is deleted regardless of whether the result is *OK* or *Not OK*. **NOTE**: Deletion occurs only when the Pset is executed by itself; and not if it is run as a part of a Multistage or Job. However, when a Pset is executed and deleted, it will also disappear from any Multistages or Jobs in which it is included.

	Finally, it will also be deleted from the Identifier strings and from the QATnode I/O settings.
PVT with torque compensation	For PVT strategy, if disabled the torque result is the difference between the snug point and the peak value. If disabled, the torque result is the peak value.

6.6 Running a Pset

Once the Pset is created on the wrench map area in ToolsTalk BLM, it is automatically sent to the STwrench.

To execute the Pset, select ***Prog. Mode*** from the main menu of the STwrench:



Select the Pset from the list of the available Psets and click on the ***OK*** button on the wrench keyboard to start Pset execution.

NOTE: If the source program is set to *Bar code* or *TAG*, instead of manually selecting the Pset with the wrench keyboard, the Pset will be selected automatically by reading the associated bar code or inserting the end-fitting tool in the wrench.
See the *Setting the source for Pset/Multistage/Job selection* and *Identifier* chapters for more information.

If the source program is not set to Barcode, but a barcode reading is required for the Pset, the following message is shown to indicate that the bar code is required:



Barcode required enabled



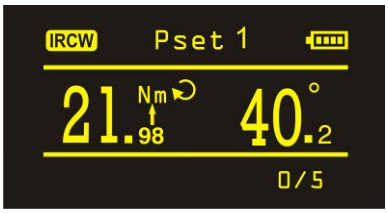
Set VIN by keyboard enabled

If the source program is not the *Tag*, but a specific end-fitting tool number is required for the

Pset, the following message is shown if the specified tool is not inserted in the wrench head:

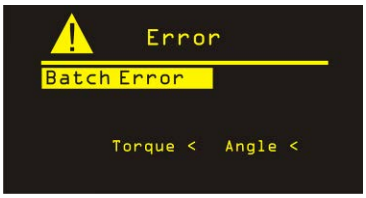


During Pset execution, the wrench display shows the torque and angle values, and the tightening direction:



Pset execution

	Pset name.
	Torque and angle values. The arrow under the measurement unit label indicates whether the result is taken on the torque peak or angle peak (when applicable). At the end of a Pset execution, press the ***OK*** button on the wrench keyboard to reset the torque and angle values to zero.
	The arrow indicates the tightening direction (Clockwise or Counterclockwise). During the tightening operation, it starts blinking when torque goes over the *Cycle Start* value, and returns to steady at the end of the operation. Blinking indicates that the tightening operation has started.
	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. If the tightening is *Not OK*, the batch number is not increased and the Pset must be repeated until the result is *OK*. If a *Max coherent NOK result* is defined in the Pset definition, when the number of *Not OK* results reaches the maximum value, the following message is displayed:

For each tightening operation, the LEDs indicator, buzzer and vibration devices are activated according to the selected tightening strategy. Refer to the *Tightening Strategies* chapter for more information.

Tightening results data and traces are stored automatically in the wrench memory; see the *Results Viewer* and *Traces Viewer* chapters for information on how to retrieve results and traces with ToolsTalk BLM.

6.7 Tightening Strategies

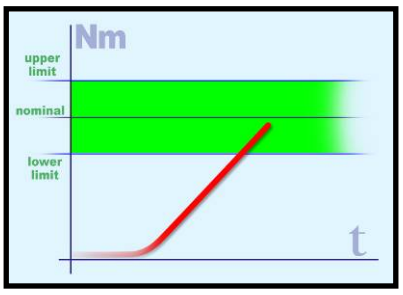
Tightening strategies can be divided into two main categories:

- Production: Strategies for tightening a screw
- Quality Control: Joint analysis and strategies for evaluating residual torque

6.7.1 Production strategies

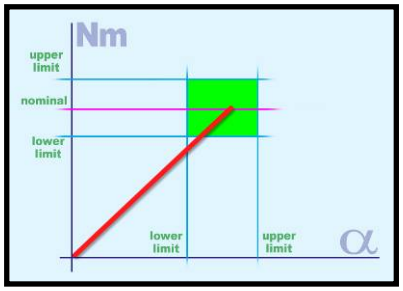
Production strategies can be divided into four main categories:

1. Tightening within torque limits

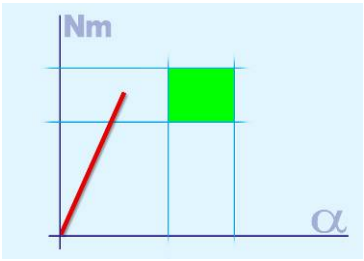


This is the easiest tightening method, simply applying the torque within the limits.

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

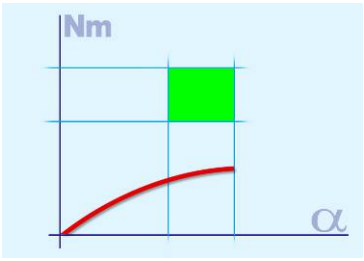


This is a more accurate way to tighten, as we use additional information (angle) during the tightening process.
You can detect possible problems on the joint using this method:



Torque is correct, but angle is too short:

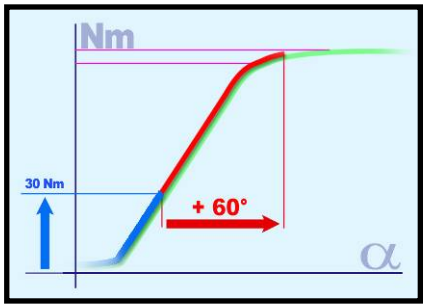
- Misalignment problem
- The hole is not completely threaded (or it is not deep enough)
- The bolt is stopped by oil in a dead hole
- There is dirt in the threads
- The threads are damaged
- The screw is already tightened



Angle is correct, but torque is too low:

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

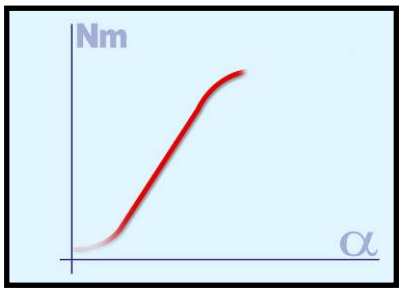
3. Tightening with torque and additional angle rotation (torque + angle)



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

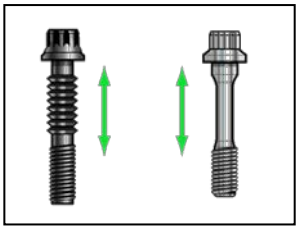
The goal is to stress the bolt over the yield point. Even with differences in the angle, the torque (causing clamping force) is quite consistent. Sometime the joint is specially designed and of course experiments have been done (joint analysis) to ensure that the strain is far from the breaking point.

4. Tightening to elastic limits (yield)



The bolt is tightened until its elastic limit is reached.

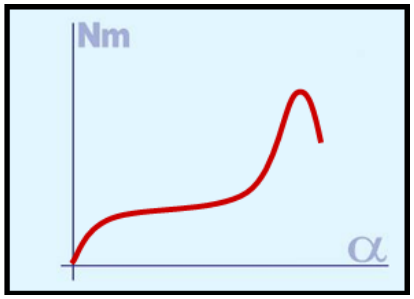
This method is used when each bolt must achieve the maximum clamping force. This method is seldom used in the car industry (example: Connecting rods). It is more common in the aerospace industry.



These bolts are normally used in special applications and the shank of the bolt is designed with a special thin section to be stretched (this bolt works as a precise spring).

The next paragraphs explain in details how the STwrench performs these tightening methods.

Tightening with prevailing torque

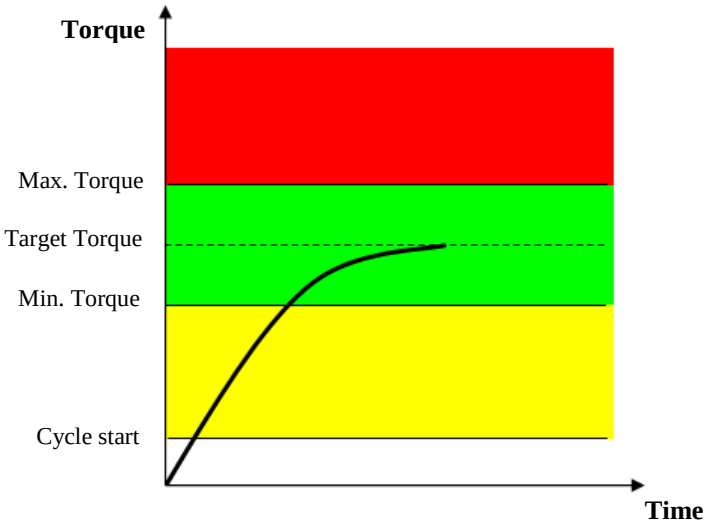


The bolt is tightened in a joint having prevailing torque. The STwrench compensates the prevailing torque in the target value.

6.7.1.1 Torque

This strategy guides the operator in reaching the desired target torque, without any angle reading.

Simply define the *Cycle start*, *Minimum Torque*, *Target Torque* and *Maximum Torque*, and the *Change Screw Torque*.



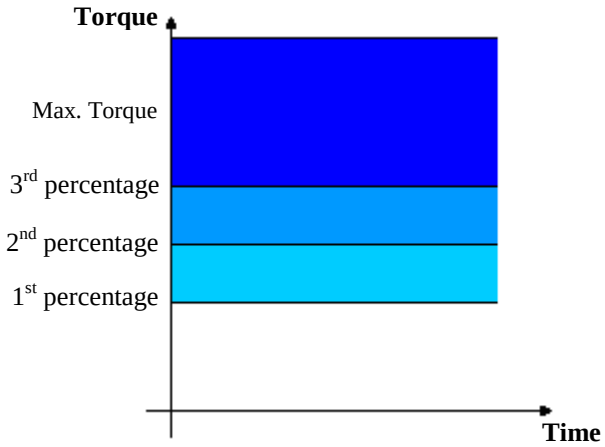
The green area identifies the OK result area.
If the torque goes over the *Change Screw* value, a message is shown on the wrench display advising the operator to replace the screw.

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

The STwrench LEDs, buzzer and vibration devices are activated as follows:

Yellow LED	Torque result between *Cycle Start* and *Min. Torque.*
Green LED	Torque result between *Min. Torque* and *Max Torque.*
Red LED	Torque result over *Max. Torque.*
NOTE: The result LED indicating the result of the tightening is activated only when the tightening operation is completed.	

First line of yellow LEDs	Torque over 1st percentage.
Second row of yellow LEDs	Torque over 2sd percentage.
Third row of yellow LEDs	Torque over 3rd percentage.
NOTE: The three rows of LEDs are all activated if the torque goes over the ***Max. Torque*** value (normally set higher than the 3rd percentage value).	

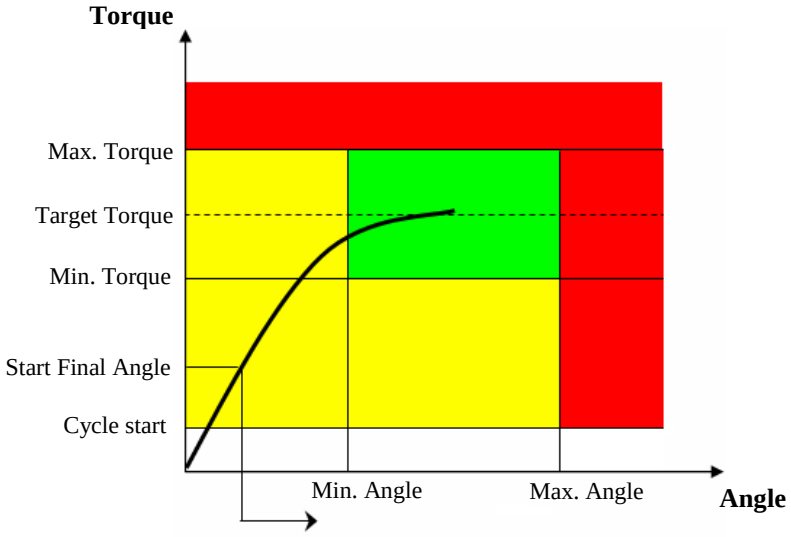


Buzzer	The beep emitted by the buzzer starts when the torque goes over the *Cycle Start* value; it increases its signal when the 1st percentage, the 2nd percentage, the 3rd percentage, and the *Max torque* are reached. At the end of the tightening operation, two more beeps inform the operator of the end of the operation, and if the final result is in the red area, the buzzer signal stays steadily ON.
Vibration	Activated together with the third row of LEDs, and remains active until the torque applied to the wrench is released.

6.7.1.2 Torque (Control) / Angle (Monitor)

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

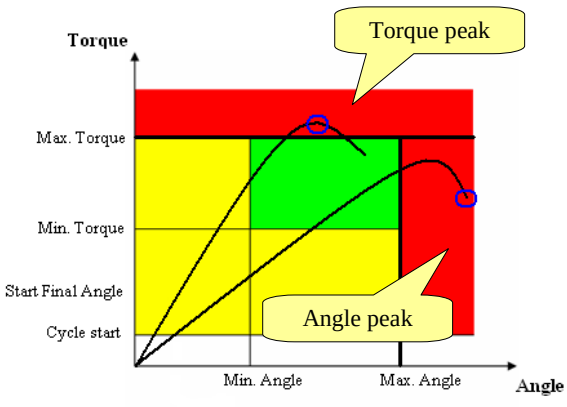
The *Start Final Angle* parameter is the threshold from which to start angle measurement (normally set to 50% of the *Target Torque*).



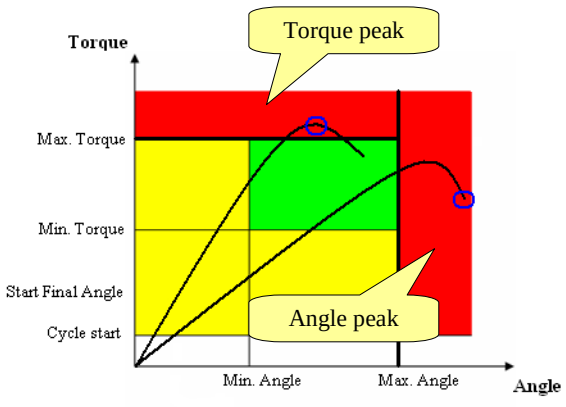
The green area defines the OK result area.
If the torque goes over the *Change Screw* value, a message is shown on the wrench display advising the operator to replace the screw.

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 follows:



Torque peak selected in the Pset options

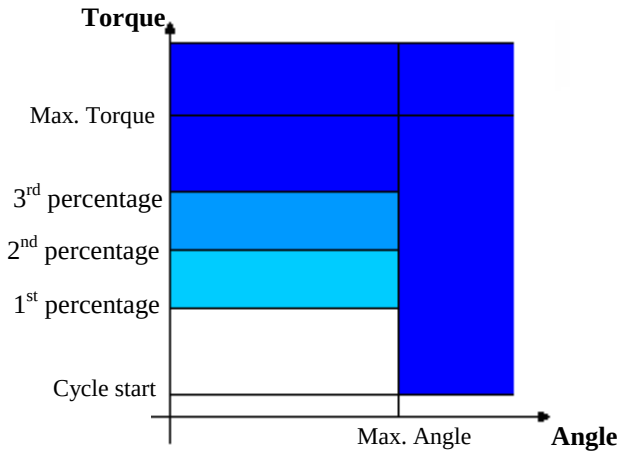


Angle peak selected in the Pset options

The STwrench LEDs, buzzer and vibration devices are activated as follows:

Yellow LED	Torque result between *Cycle Start* and *Min. Torque*, or torque between *Min. Torque* and *Max. Torque* but angle under the *Min. Angle*. If *Measure torque/Angle at* is set to *Angle peak*, the *Start Final Angle* value is used instead of the *Cycle Start*.
Green LED	Torque and angle results within the minimum and maximum limits.
Red LED	Torque result over the *Max. Torque* or angle over *Max. Angle.*
NOTE: The result LED indicating the result of the tightening is activated only when the tightening operation is completed.	

First row of yellow LEDs	Torque over 1st percentage.
Second row of yellow LEDs	Torque over 2sd percentage.
Third row of yellow LEDs	Torque over 3rd percentage; it is also activated if torque or angle goes over the maximum value.

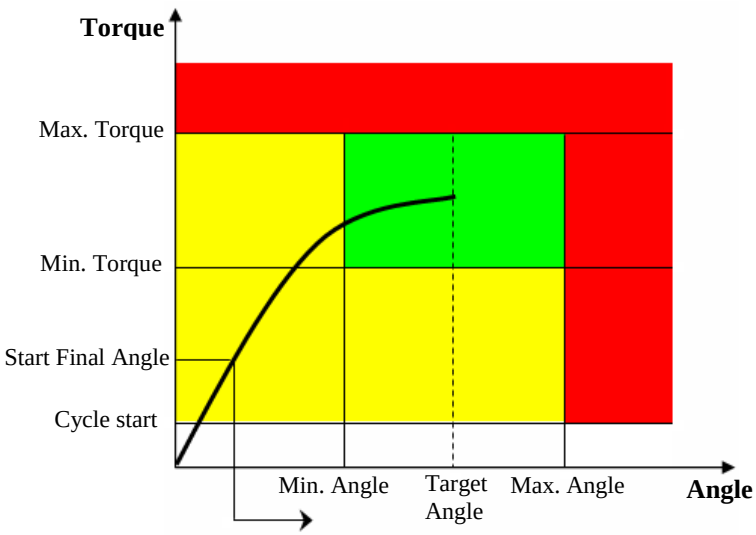


Buzzer	The beep emitted by the buzzer starts when the torque goes over the *Cycle Start* value; it increases its signal when the 1st percentage, the 2nd percentage, the 3rd percentage, and the *Max torque* are reached. At the end of the tightening operation, two more beeps inform the operator of the end of the operation, and if the final result is in the red area, the buzzer signal stays steadily ON.

Vibration	Activated together with the third row of LEDs, and remains active until the torque applied to the wrench is released.

6.7.1.3 Torque (Monitor) / Angle (Control)

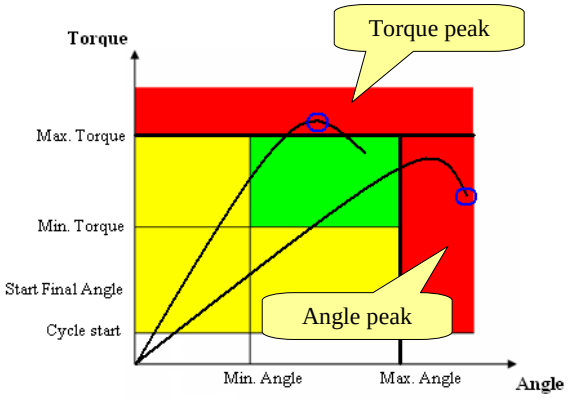
This strategy helps the operator to reach the desired target angle and monitoring torque.



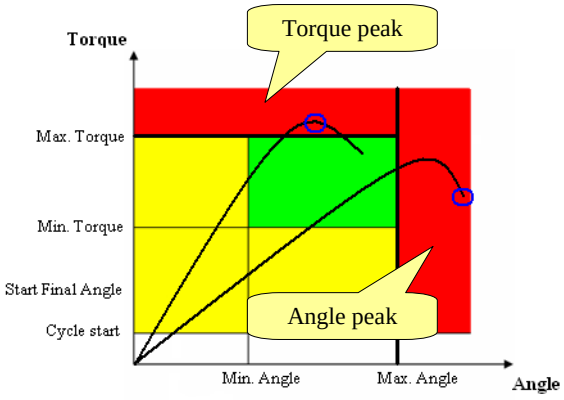
This strategy is similar to ***Torque (Control) / Angle (Monitor)***; the *Target Angle* value is required instead of the *Target Torque*, and the 3 rows of yellow LEDs come on when the 3 percentages of the *Target Angle* are reached, instead of the *Target Torque*.

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 follows:

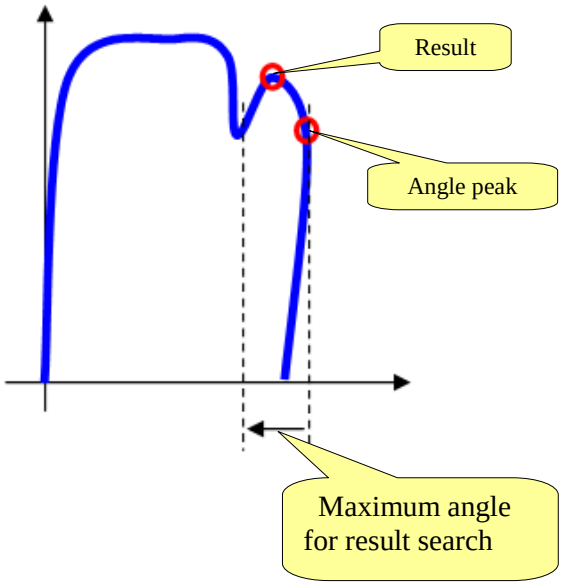


Torque peak selected in the Pset options



Angle peak selected in the Pset options

NOTE: If the angle peak is selected, and the *Maximum angle for result search* is set to a value different from zero, the result is taken at the maximum torque in the following interval:

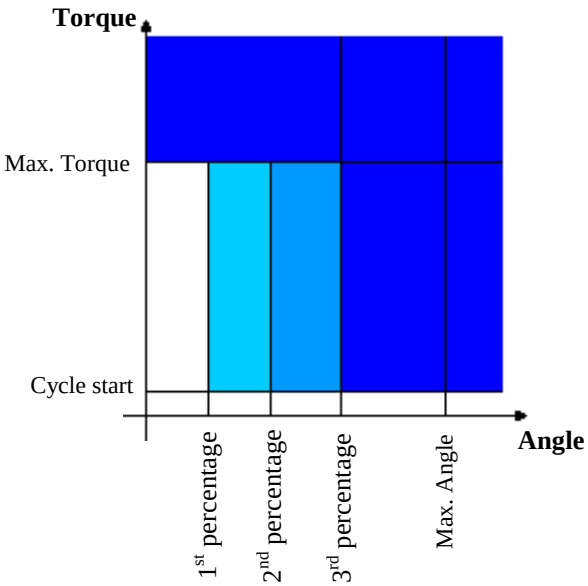


This is applied only if the torque does not exceed the maximum torque and the angle has reached the target angle

The STwrench LEDs, buzzer and vibration devices are activated as follows:

Yellow LED	Angle result between *Cycle Start* and *Min. Angle*, or torque between *Min. Torque* and *Max. Torque* with angle under the *Min. Angle*. If *Measure torque/Angle at* is set to *Angle peak*, the *Start Final Angle* value is used instead of the *Cycle Start*.
Green LED	Angle and torque results within the minimum and maximum limits.
Red LED	Angle result over *Max. Angle* or torque result over *Max. Torque.*
NOTE: The result LED indicating the result of the tightening is activated only when the tightening operation is completed.	

First row of yellow LEDs	Angle over 1st percentage.
Second row of yellow LEDs	Angle over 2sd percentage.
Third row of yellow LEDs	Angle over 3rd percentage; it is also activated if torque or angle goes over the maximum value.

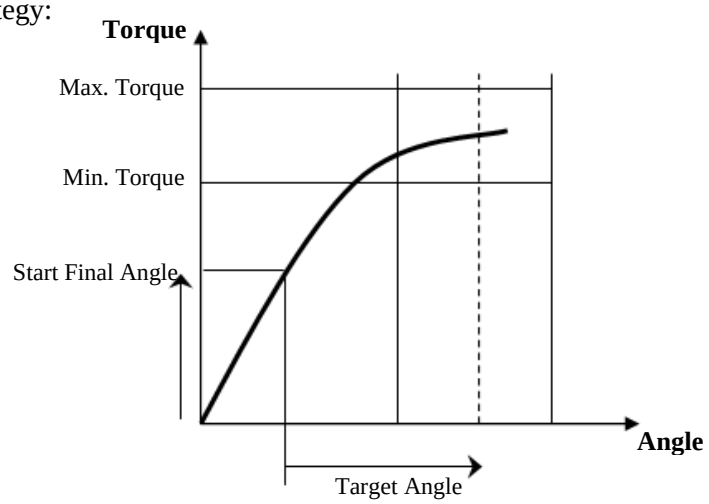


Buzzer	The beep emitted by the buzzer starts when the torque goes over the *Cycle Start* value; it increases its signal when the 1st percentage, the 2nd percentage, the 3rd

	percentage are reached. At the end of the tightening operation, two more beeps inform the operator of the end of the operation, and if the final result is in the red area, the buzzer signal stays steadily ON.
Vibration	Activated together with the third row of LEDs, and remains active until the torque applied to the wrench is released.

6.7.1.3.1 Torque + Angle Strategy

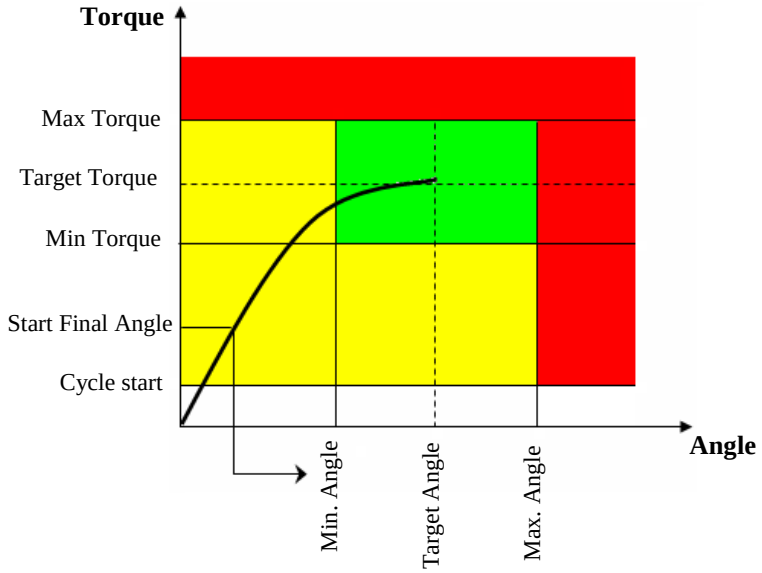
You can also achieve the *Torque + Angle* strategy using the *Torque (Mon) / Angle (Contr)* strategy: Define the *Start Final Angle* value as the torque value from which you want to start performing the "+ Angle" of this strategy:



6.7.1.4 Torque (Control) / Angle (Control) OR

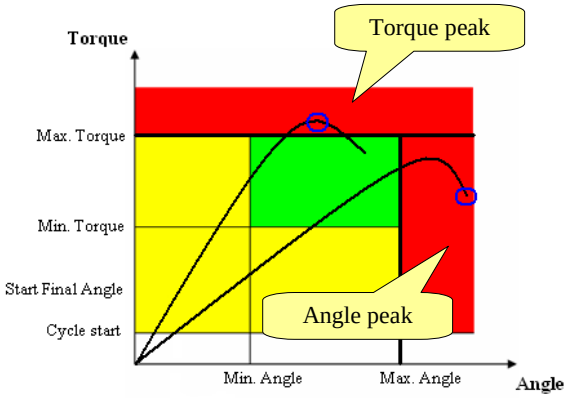
This strategy helps the operator to reach the desired target torque and angle.

The Start Final Angle parameter is the threshold from which the angle measurement starts (normally set to the 50% of the target torque).

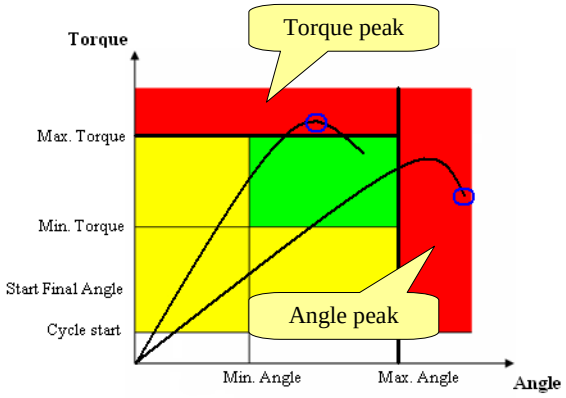


Torque/angle results:

- 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 follows:



Torque peak selected in the Pset options

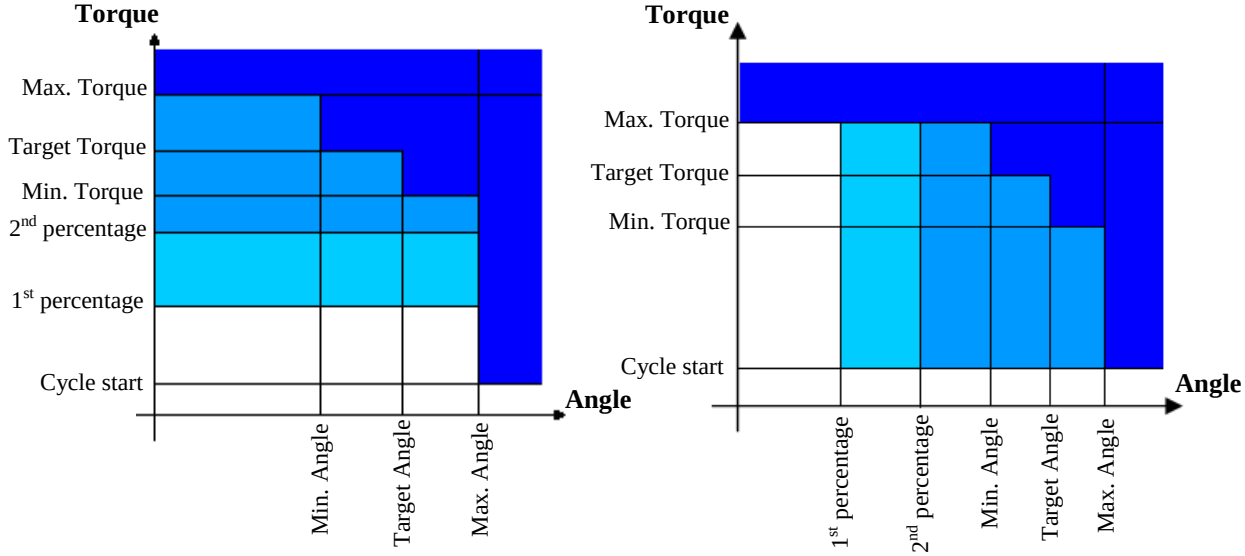


Angle peak selected in the Pset options

The STwrench LEDs, buzzer and vibration devices are activated as follows:

Yellow LED	Angle result between *Cycle Start* and *Min. Angle*, or torque between *Min. Torque* and *Max. Torque* with angle under the *Min. Angle*. If *Measure torque/Angle at* is set to *Angle peak*, the *Start Final Angle* value is used instead of the *Cycle Start*.
Green LED	Torque and angle results within maximum and minimum limits.
Red LED	Torque result over *Max. Torque* or angle result over *Max. Angle*.
NOTE: The result LED indicating the result of the tightening is activated only when the tightening operation is completed.	

First row of yellow LEDs	Torque over 1st percentage (if *Torque Peak* is selected in the torque parameter of the Pset definition). Angle over 1st percentage (if *Angle Peak* is selected in the torque parameter of the Pset definition).
Second row of yellow LEDs	Torque over 2nd percentage (if *Torque Peak* is selected in the torque parameter of the Pset definition). Angle over 2nd percentage (if *Angle Peak* is selected in the torque parameter of the Pset definition).
Third row of yellow LEDs	Torque and angle within the minimum and maximum limits; torque or angle having reached the target value. It is also activated if torque or angle goes over the maximum value.

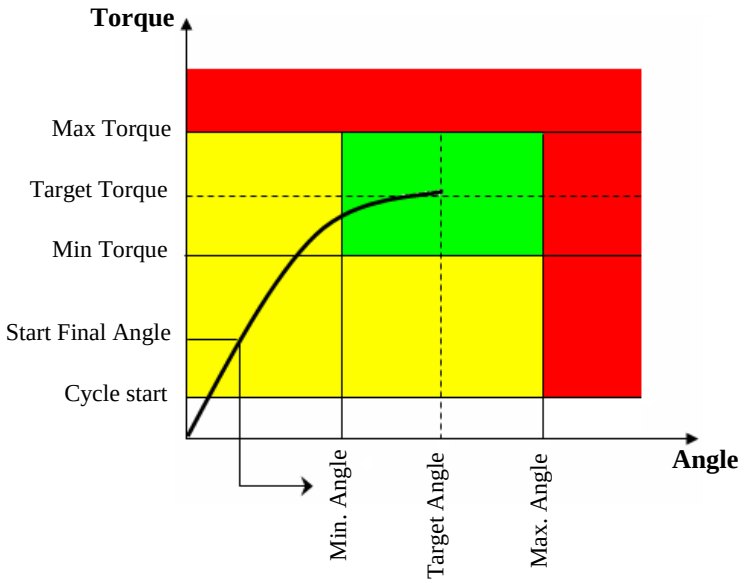


Buzzer	The beep emitted by the buzzer starts when the torque goes over the *Cycle Start* value; it increases its signal when: - Torque reaches 1st percentage - Torque reaches 2nd percentage - Torque and angle within the minimum and maximum limits; torque or angle having reached the target value. - *Max torque* or *Max Angle* is reached. At the end of the tightening operation, two more beeps inform the operator of the end of the operation, and if the final result is in the red area, the buzzer signal remains steadily ON. If Angle Peak is selected in the torque parameter in the Pset definition, the buzzer signal works in the same way, but monitoring angle instead of torque.
Vibration	Activated together with the third row of LEDs, and remains active until the torque applied to the wrench is released.

6.7.1.5 Torque (Control) / Angle (Control) AND

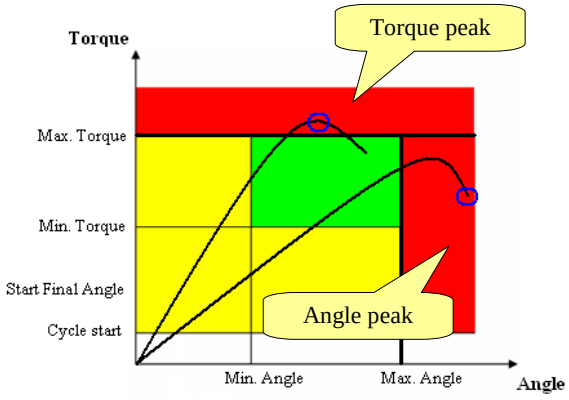
This strategy helps operator to reach the desired target torque and angle.

The Start Final Angle parameter is the threshold from which angle measurement starts (normally set to 50% of the target torque).

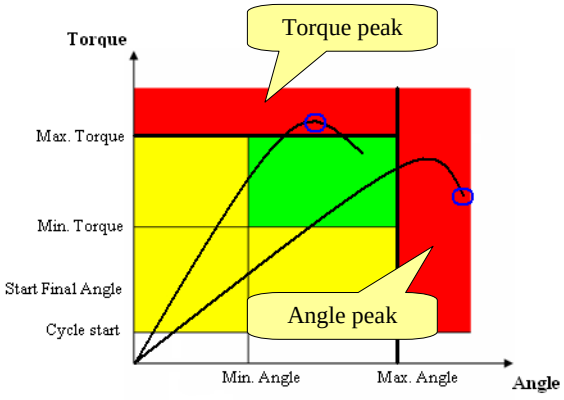


Torque/angle results:

- 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 follows:



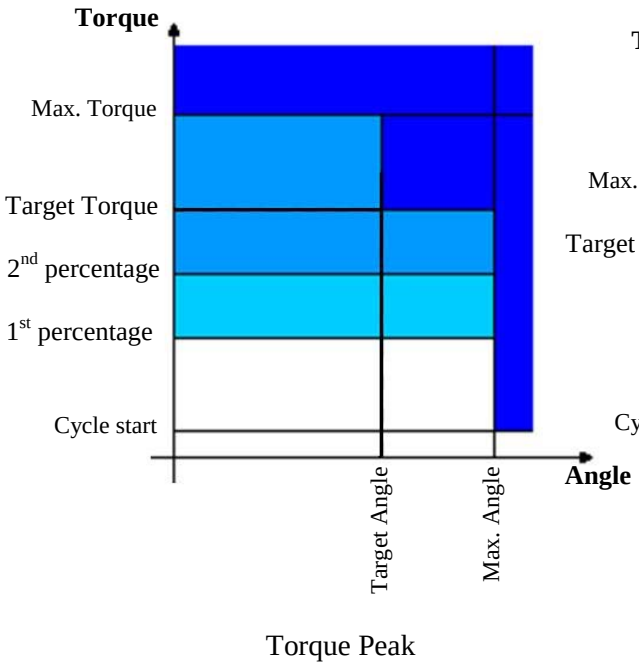
Torque peak selected in the Pset options



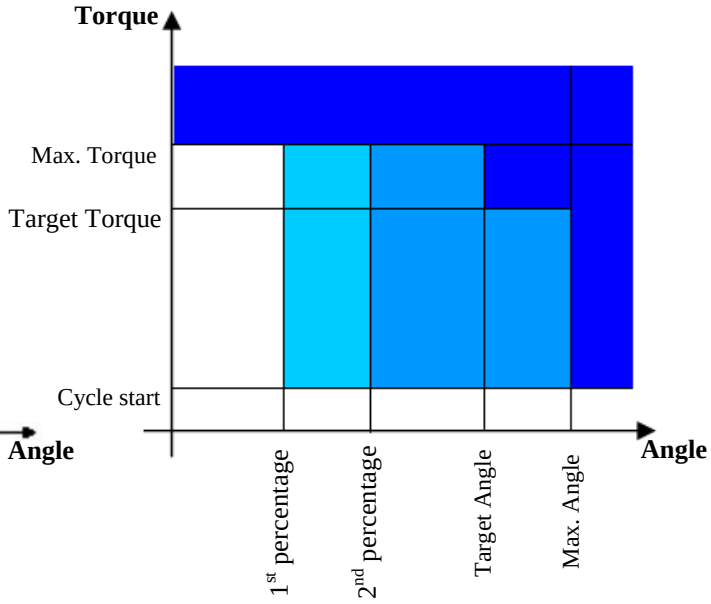
Angle peak selected in the Pset options

The STwrench LEDs, buzzer and vibration devices are activated as follows:

Yellow LED	Angle result between *Cycle Start* and *Min. Torque*, or torque between *Min. Torque* and *Max. Torque* with angle under the *Min. Angle*. If *Measure torque/Angle at* is set to *Angle peak*, the *Start Final Angle* value is used instead of the *Cycle Start*.
Green LED	Torque and angle results within maximum and minimum limits.
Red LED	Torque result over *Max. Torque* or angle over *Max. Angle.*
NOTE: The result LED indicating the result of the tightening is activated only when the tightening operation is completed.	
First row of yellow LEDs	Torque over 1st percentage (if *Torque Peak* is selected in the torque parameter of the Pset definition). Angle over 1st percentage (if *Angle Peak* is selected in the torque parameter of the Pset definition).
Second row of yellow LEDs	Torque over 2nd percentage (if *Torque Peak* is selected in the torque parameter of the Pset definition). Angle over 2nd percentage (if *Angle Peak* is selected in the torque parameter of the Pset definition).
Third row of yellow LEDs	Torque and angle within the minimum and maximum limits; torque and angle having reached the target value. It is also activated if torque or angle goes over the maximum value.



Torque Peak



Angle Peak

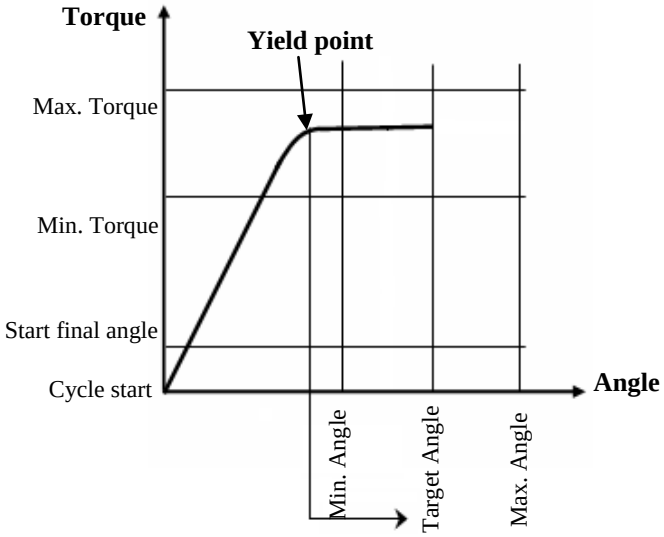
Buzzer	The beep emitted by the buzzer starts when the torque goes over the *Cycle Start* value; it increases its signal when the 1st percentage, the 2nd percentage, the angle and target values, and the *Max torque* are reached. At the end of the tightening operation, two more beeps inform the operator of the end of the operation, and if the final result is in the red area, the buzzer signal is steady ON. If Angle Peak is selected in the torque parameter in the Pset definition, the buzzer signal works in the same way, but monitoring angle instead of torque.
Vibration	Activated together with the *Green LED*, and remains active until the torque applied to the wrench is released.

6.7.1.6 Yield Point

With this strategy, the wrench detects the yield point automatically.
The torque limits specify the range in which the result is OK.
If you also specify the target angle (with its limits), after reaching the yield point this strategy continues tightening to the given angle.

NOTE: The *Target Angle* is defined from the yield point, while the *Min. Angle* and the *Max. Angle* are defined from the *Start Final Angle*.

A target angle is typically used when this strategy is employed for tightening in production. Leave this value at zero if you want to stop at the yield point (a target angle is typically used in joint analysis; see the *Yield Point (JOINT ANALYSIS)*Yield Point (JOINT ANALYSIS)) chapter.



Torque result:

- If the yield point is detected and target angle is reached, the result of the test is taken at the target angle.
- If the operator stops the tightening after the yield point but before reaching the target angle, the torque result is the maximum value.
- If the torque goes over the *Change Screw* value, the yield point is no longer detected and the torque result is the maximum torque.

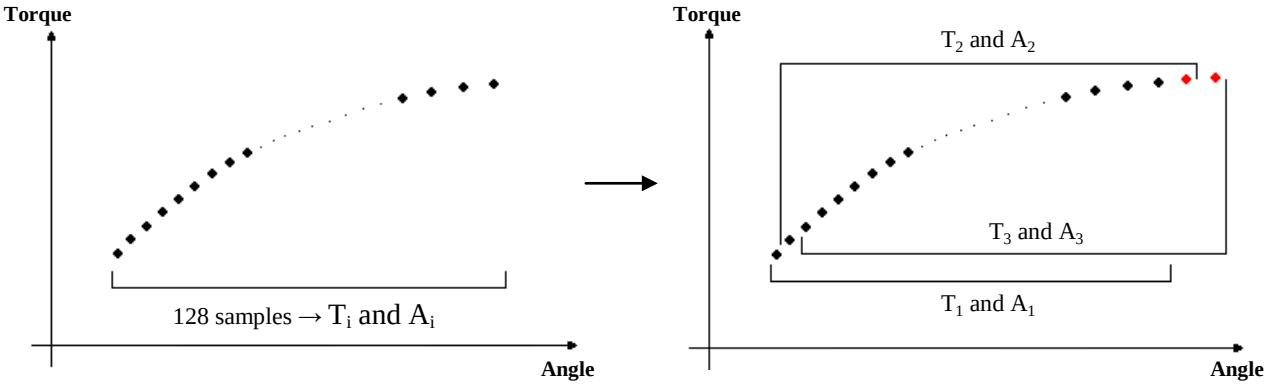
The STwrench LEDs, buzzer and vibration devices are activated as follows:

Yellow LED	Torque result between the *Cycle Start* and the *Min. Torque* value, or *Min. Torque* or *Max. Torque* but the target has not been reached.
Green LED	*Target Angle* reached after yield point is detected (within torque and angle limits).
Red LED	Torque result over *Max. Torque* or angle result over *Max. Angle*.
First, second, and third row of yellow LEDs	Yield point is detected (within torque limits).
Buzzer	Activated when torque goes over the *Cycle Start* value. Increases its signal when the green LED is activated.
Vibration	Activated together with the green LED, and remains active until the torque applied to the wrench is released.

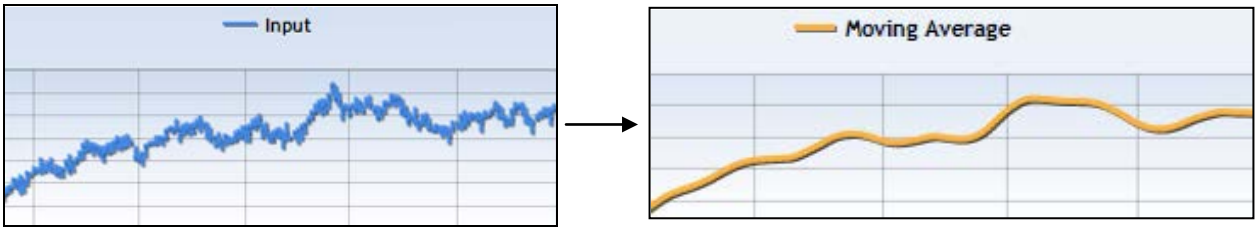
6.7.1.6.1 Yield Point detection algorithm

The following algorithm is used to detect the yield point.

The torque/angle trace is sampled at 1 kHz.
The values T_i and A_i are calculated as moving averages of 128 torque/angle samples measured by the STwrench. This means that each time a new value is acquired, new T_i and A_i values are calculated:



This filtering eliminates the noise from the trace:



torque / angle samples T_i and A_i values

The last 10 T_i and A_i values are considered to calculate the following parameters:

- Sum of the torque values = $\sum_{i=1}^{10} T_i$
- Sum of the angle values = $\sum_{i=1}^{10} A_i$
- Sum of torque values multiplied by angle values = $\sum_{i=1}^{10} T_i \times A_i$
- Sum of the square of the angle values = $\sum_{i=1}^{10} A_i^2$

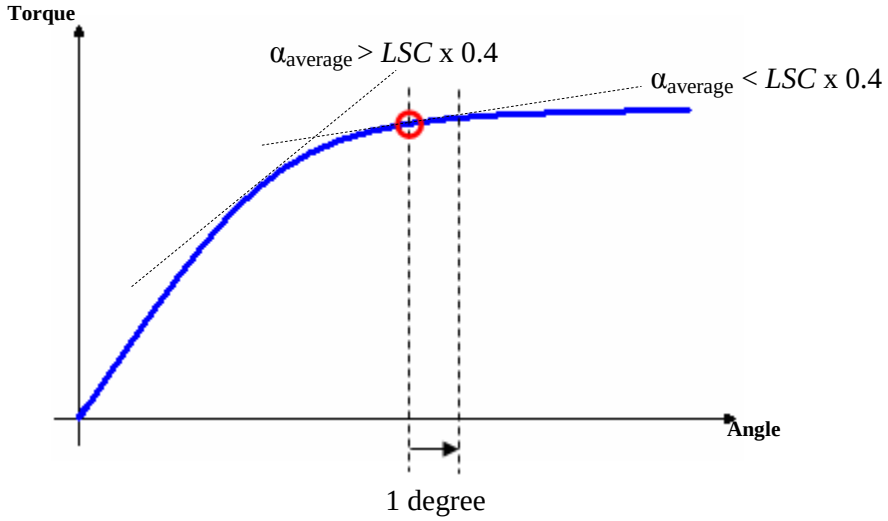
From these terms calculated above, linear regression is applied to obtain the gradient of the torque/angle trace:

$$\alpha_t = \left(\left(\sum_{i=1}^{10} T_i \times A_i \right) - \frac{\sum_{i=1}^{10} T_i \times \sum_{i=1}^{10} A_i}{10} \right) \Bigg/ \left(\left(\sum_{i=1}^{10} A_i^2 \right) - \frac{\left(\sum_{i=1}^{10} A_i \right)^2}{10} \right)$$

The gradient α_t is recalculated by linear regression each time a new sample is acquired, and the average of 20 different values α_t is calculated:

$$\alpha_{average} = \frac{\sum_{t=1}^{20} \alpha_t}{20}$$

Each time a new sample is acquired, this average is also recalculated. If 30 consecutive values of this $\alpha_{average}$ (absolute value) are not greater than a threshold value of the *Linear slope Coefficient* (LSC) multiplied by 0.4, and for 1 degree they stay under the *Linear slope Coefficient* multiplied by 1.6, the yield point is considered to have been detected:



The *LSC* is the slope of the torque/angle characteristic of the joint in the first part (linear), and it is defined inside the Pset.

$\alpha_{average} < 0.4xLSC$ for 30 consecutive samples, and staying under 1.6x*LSC* for 1 degree → YIELD POINT

The yield point result given by the STwrench is the first point when the $\alpha_{average}$ goes below 0.4x*LSC*.

6.7.1.7 Loose

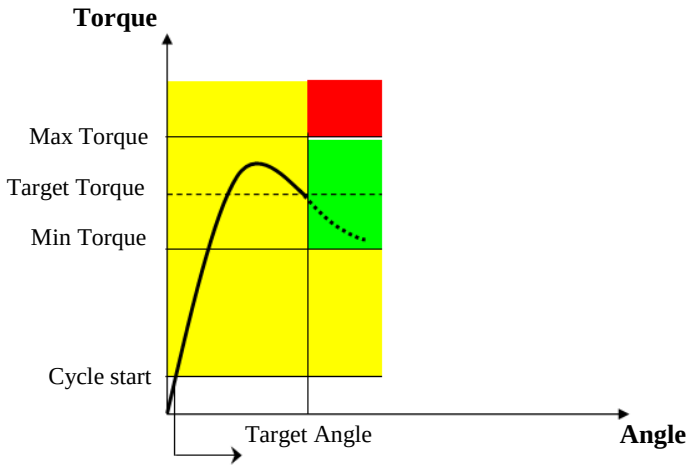
This strategy is used to loosen a tightened screw. This is typically used in the Pset sequence of a Multistage.

For example:

- Tighten the screw to 40 Nm
- Loosen the screw by 30°
- Tighten the screw to 50 Nm

The torque result is measured at the specified *Target Angle* value.

If the *Target Angle* is left at zero, this strategy automatically looks for torque / angle values to detect if the loosening process has been completed.
If a *Target Angle* value is specified, in order to consider the result as OK, loosening must reach the target angle value.



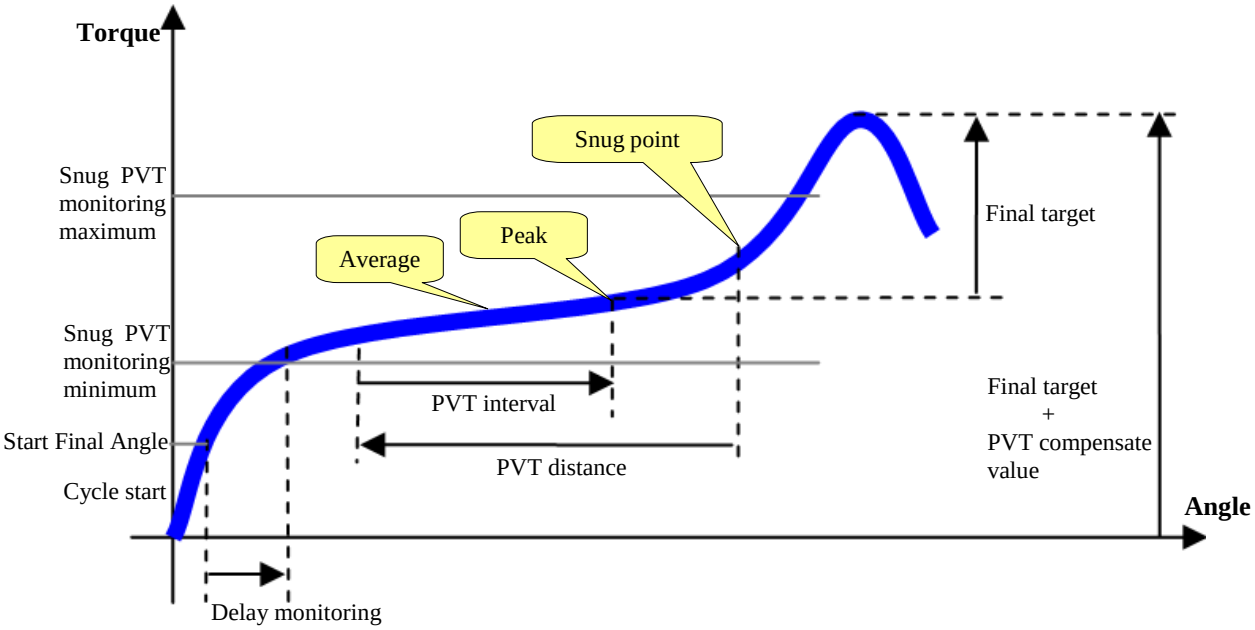
The STwrench LEDs, buzzer and vibration devices are activated as follows:

Yellow LED	Torque over *Cycle Start* value.
Green LED	Torque between *Min. Torque* and *Max. Torque*, and angle at *Target Angle* (if *Target Angle* is not specified, angle is at the necessary value to complete the loosening operation).
Red LED	Torque over *Max. Torque.*
First, second, and third row of yellow LEDs	Angle at *Target Angle*, or loosening completed if *Target Angle* is not specified.

Buzzer	Activated together with the 3 rows of yellow LEDs.
Vibration	Activated together with the 3 rows of yellow LEDs, and remains active until the torque applied to the wrench is released.

6.7.1.8 PVT compensate with snug

This strategy is useful for joints with prevailing torque, in particular when the prevailing torque level is higher than the final target.



- ***Cycle Start:*** Defines the point where to start the torque measurement.
- ***Start Final Angle***: Threshold from which starting the angle measurement.
- ***Delay monitoring***: Parameter for filtering out a certain angle in the beginning of a tightening where monitoring for a certain 'gradient' is not interesting (useful when the gradient is high at cycle start).
- ***PVT distance***: Defines the angle backwards from the snug point. If the tightening process does not provide enough rotation to go back of the angle specified, the software algorithm considers a shorter distance obtained going back from the snug point to the first point after the *Delay monitoring*.
- ***PVT interval***: Defines the angle interval during which the compensate value is calculated. If the tightening process does not provide enough rotation to complete the PVT interval, the software algorithm considers a shorter interval according to the data available.

- ***Compensate value***: Can be selected to the *Average* or *Peak* value measured in the *PVT interval*.
- ***Snug PVT monitoring minimum***: Minimum torque for the software algorithm to look for the snug point. If the snug point is below this value, the torque result is marked as *Low*.
- ***Snug PVT monitoring maximum***: Minimum torque for the software algorithm to look for the snug point. If the snug point is over this value, the torque result is marked as *High*.
- ***Final target***: Compensated torque peak value.
- ***Final target + PVT compensate interval***: Torque peak value not compensate (absolute peak).

The snug point is automatically detected by the software algorithm in real time. After the snug point is detected, the three rows of yellow LEDs on the STwrench LED ring starts guiding the operator to reach the target value.

Torque results: If *PVT with torque compensation* flag is disabled in the Pset parameters, the torque result is the difference between the torque peak value and the compensate value (average or peak depending from *Compensate value* selected. If the flag is enabled, the torque result is the torque peak value.

Angle result: Angle value measured from the *Start final angle* to the angle value measured at the torque peak.

The STwrench LEDs, buzzer and vibration devices are activated as follows:

Yellow LED	Angle result between *Cycle Start* and *Min. Angle*, or snug point below the minimum value.
Green LED	Torque within maximum and minimum limits, and snug point within the limits.
Red LED	Torque result over *Max. Torque*, or snug point over the maximum point.
NOTE: The result LED indicating the result of the tightening is activated only when the tightening operation is completed.	

First row of yellow LEDs	Torque over 1st percentage (calculated from the snug point and the target value).
Second row of yellow LEDs	Torque over 2nd percentage (calculated from the snug point and the target value).
Third row of yellow LEDs	Torque within the minimum and maximum limits; torque having reached the target value. It is also activated if the torque is over the maximum value.

Buzzer	The beep emitted by the buzzer starts when the torque goes over the *Cycle Start* value; it increases its signal when: - Torque reaches 1st percentage - Torque reaches 2nd percentage - Torque within the minimum and maximum limits.

	- *Max torque* is reached. At the end of the tightening operation two more beeps inform the operator of the end of the operation, and if the final result is in the red area, the buzzer signal remains steadily ON.
Vibration	Activated together with the third row of LEDs, and remains active until the torque applied to the wrench is released.

6.7.2 Quality Control Strategies

The quality control strategies are not the strategies used to tighten a screw; they are used to check tightening operations already performed, by executing the residual torque check operation, or to study the characteristics of a joint (Joint Analysis).

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

- ***Breakaway***: This measures the minimum torque to rotate the screw further.
- ***Residual Torque Peak***: This simply measures the peak of the torque necessary to rotate the screw further. The operator must stop as soon as the screw starts rotating.
- ***Loose and Retight***: This loosens the screw to a certain degree and measures the torque necessary to retighten the screw to the original position.

The ***Loose*** strategy is normally considered a production strategy, but is available also in the quality strategies. See the *Loose* chapter for more information.

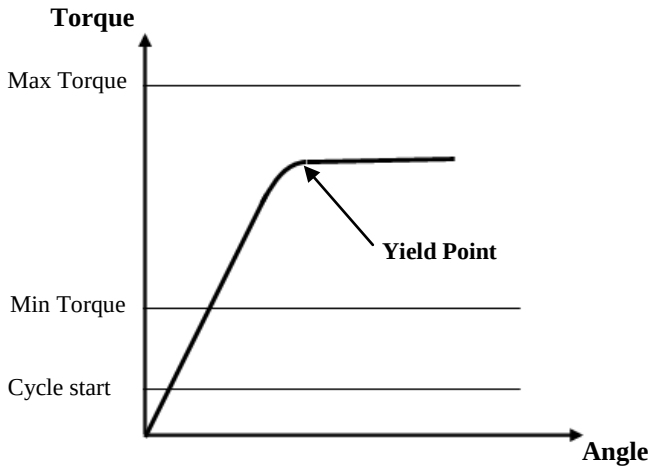
The paragraphs below describe in detail how the STwrench performs these strategies.

6.7.2.1 Yield Point (JOINT ANALYSIS)

This strategy is the same used for the yield point production strategy; in quality control you can use this to evaluate the stiffness of a joint, extracting information about the yield point.

You need to specify the torque limits within which to look for the yield point (outside the limits the torque trace in not analyzed).

In joint analysis, the target angle is normally left set to zero; a specific target angle can be used for tightening to the yield point (see the *Yield Point* chapter).



In joint analysis, instead of setting the torque limits in a narrow range, define a wider area in which to look for the yield point. At the end of the tightening operation, you can download the trace to analyze the joint in details.
Define a wide range for the angle limits (i.e. *Min. Angle* set to 0 and *Max. Angle* set to 999 degrees).

The STwrench LEDs, buzzer and vibration devices are activated as follows:

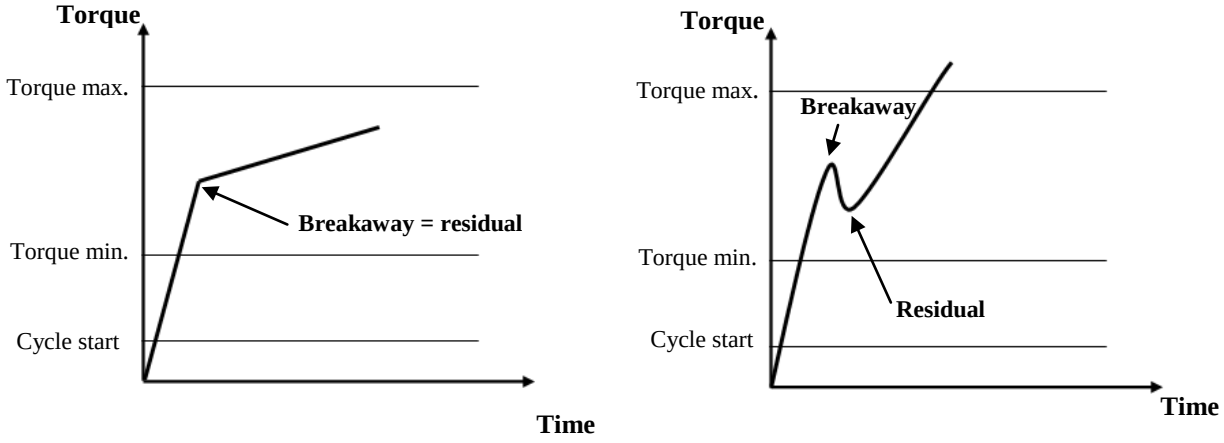
Yellow LED	Torque result between the *Cycle Start* and the *Min. Torque* value, or *Min. Torque* or *Max. Torque* but the yield point has not been detected.
Green LED	Yield point is detected (within torque limits).
Red LED	Torque result over *Max. Torque* or angle result over *Max. Angle*.

First, second, and third row of yellow LEDs	Yield point is detected (within torque limits).
Buzzer	Activated when the torque goes over the *Cycle Start* value. Increase its signal when the yield point is detected.
Vibration	Activated together with the green LED, and remains active for one second.

See the chapter *Yield Point detection algorithm* for the detail of the yield point algorithm.

6.7.2.2 Residual Torque/Time

This strategy evaluates the residual torque on a joint, looking for the residual point of the Torque / Time trace.



Simply specify the torque limits within which to look for the residual point.

Since this strategy analyzes the torque trace as a function of time, it is very important that the operator executes this operation with a single “steady” movement; the wrench automatically recognizes the breakaway and residual point.

Torque result:

- If the residual point is detected, the result of the test is OK and the torque result is the detected point.
- If the residual point is not detected or the torque goes over the maximum torque, the torque result is the maximum value.
  Therefore, if the maximum value falls within the limit, the torque result is still OK, but the overall result is marked as Not OK.

- If the torque goes over the *Change Screw* value, the residual point is no longer detected and the torque result is the maximum torque.

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

The STwrench LEDs, buzzer and vibration devices are activated as follows:

Yellow LED	Torque over *Cycle Start* value, or click-point not detected (and torque not exceeding the maximum value).
Green LED	Result OK. The residual point is detected within the torque limits.
Red LED	Torque over *Max. Torque*.
First, second, and third row of yellow LEDs	Residual point is detected.
Buzzer	Activated when the torque goes over the *Cycle Start* value. Increase its signal when the residual point is detected.
Vibration	Activated when the residual point is detected, and remains active for one second.

6.7.2.2.1 Residual point detection algorithm

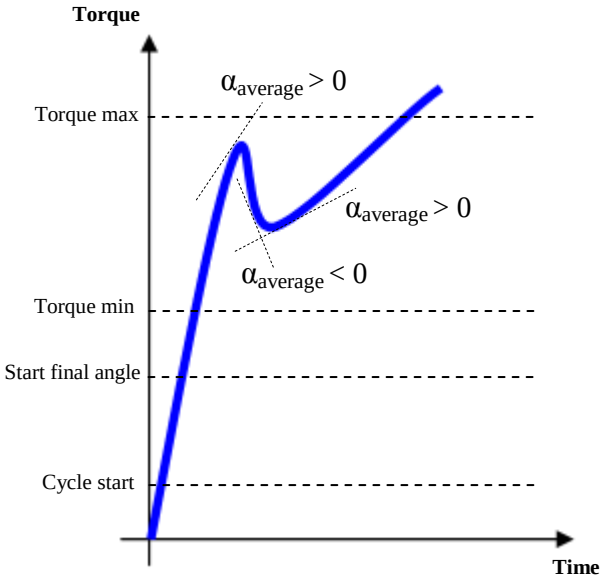
The following algorithm is used to detect the torque/time residual point:

The gradient α_t of the torque/time trace is calculated by linear regression each time a new sample is acquired, and the average of 10 different values α_t is calculated:

$$\alpha_{average} = \frac{\sum_{t=1}^{10} \alpha_t}{10}$$

This $\alpha_{average}$ is used to identify the breakaway point.

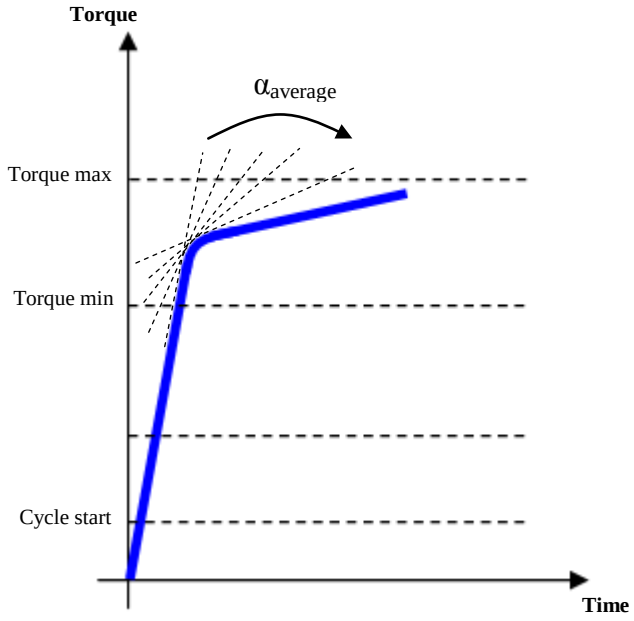
CASE A:



Sometimes very high static friction is built into the joint (for instance, for no lubrication, conical seat). In that case, 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.

The STwrench algorithm monitors the $\alpha_{average}$; if it goes to a negative value, it waits until the $\alpha_{average}$ goes back to a positive value.
The point in which the $\alpha_{average}$ goes back to a positive value is considered as the residual torque.

CASE B:



Normally during breakaway, there is a rapid change of the gradient of the torque/time function when the bolt starts moving.

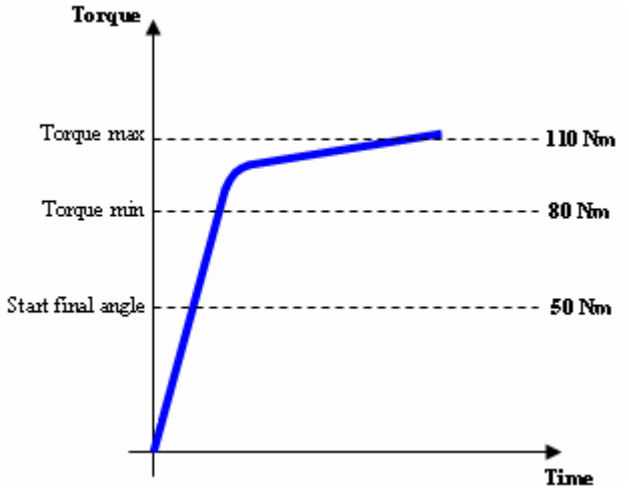
The STwrench algorithm monitors the last 14 values $\alpha_{average}$: If all of them are decreasing, and the last one is less than the 40% of the first one, the breakaway/residual point is detected.
NOTE: When the algorithm detects the breakaway, it still waits for 30 milliseconds in order to monitor if the gradient goes to a negative value; in that case the algorithm continues analyzing the torque/time trace as described in CASE A.

How to set parameters:

- ***Cycle start***: This is the point from where the torque is measured. Set to a low value, but greater than the wrench minimum load.
- ***Torque min***: Minimum residual value for having result OK.

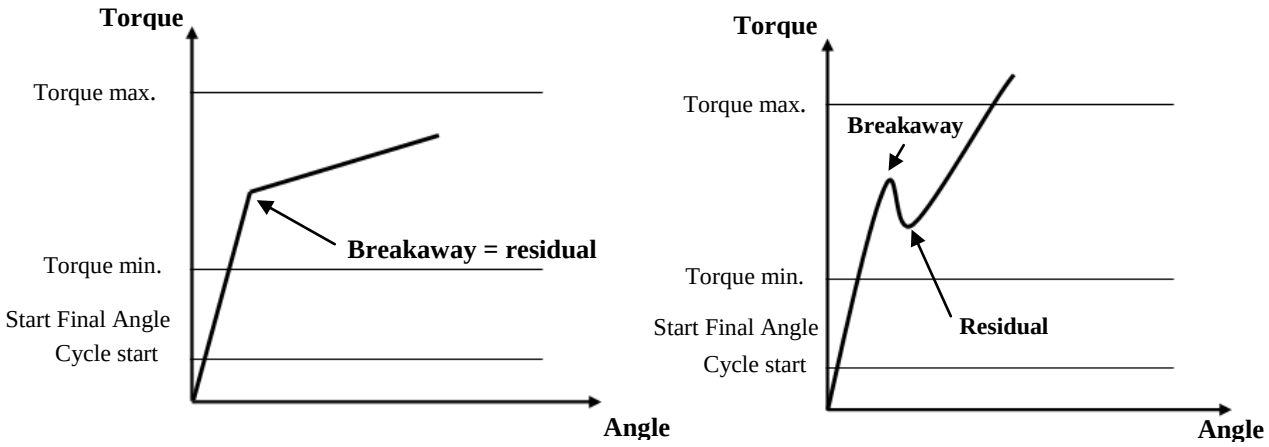
- ***Torque max***: Maximum residual value for having result OK.

For instance, a bolt tightened to 100 Nm and using a STwrench with 150 Nm smartHEAD to detect the residual point could be a proper setting:



6.7.2.3 Residual Torque/Angle

This strategy evaluates the residual torque on a joint, looking for the residual point of the Torque / Angle trace.
Since the torque/angle trace is less dependent on the operator's movements, this is a more objective method than the Residual Torque/Time method for measuring the residual point of a wrench with a built-in gyroscope.



As per the residual torque time, define the torque limits where the residual point is considered as OK in the result.
The ***Start Final Angle***, which must be greater than the ***Cycle start***; defines the point from which the STwrench algorithm starts analyzing the torque/angle trace. This is useful to filter all the noise that may occur at low torque value, and that could be detected as a false residual point.

Torque result:

- If the residual point is detected, the result is associated with the residual point; the test is OK if the residual falls within the limits.
- If the residual is not detected or the torque goes over the maximum torque, the torque result is the maximum value.
  Therefore, if the maximum value falls within the limit, the torque result is still OK, but the overall result is marked as Not OK.
- If the torque goes over the *Change Screw* value, the residual is no longer detected and the torque result is the maximum torque.

If the torque goes over the *Change Screw* value, a message is shown on the wrench display advising the operator to replace the screw.

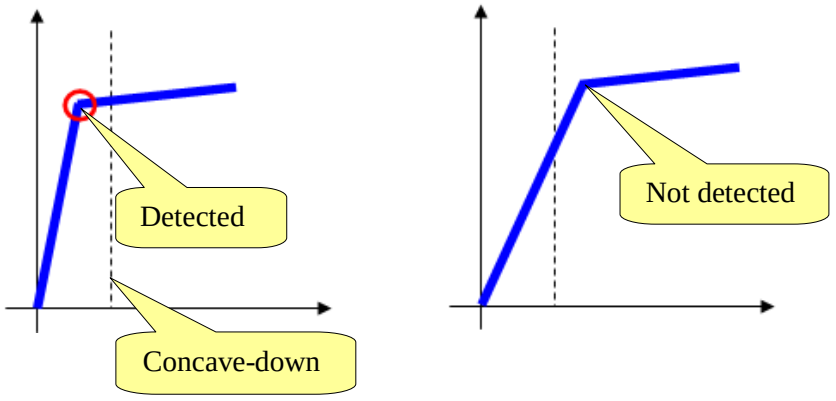
The STwrench LEDs, buzzer and vibration devices are activated as follows:

Yellow LED	Torque over *Cycle Start* value, or click-point not detected (and torque not exceeding the maximum value).
Green LED	Result OK. The residual point is detected within the torque limits.
Red LED	Torque over *Max. Torque*.
First, second, and third row of yellow LEDs	Residual point is detected.
Buzzer	Activated when the torque goes over *Cycle Start* value. Increase its signal when the residual point is detected.
Vibration	Activated when the residual point is detected, and remains active for one second.

In the Pset parameters of the *residual torque/angle* strategy there are two adavanced parameters:

- ***Concave-down point threshold***

  It specifies the maximum angle for the residual torque (measured from the *Start Final Angle*). Over this angle the test result is marked as “not detected”.



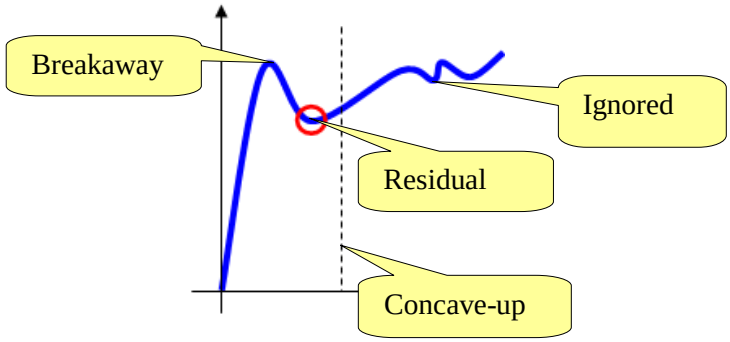
  The default value is 3 degrees.

- ***Concave-up point threshold***

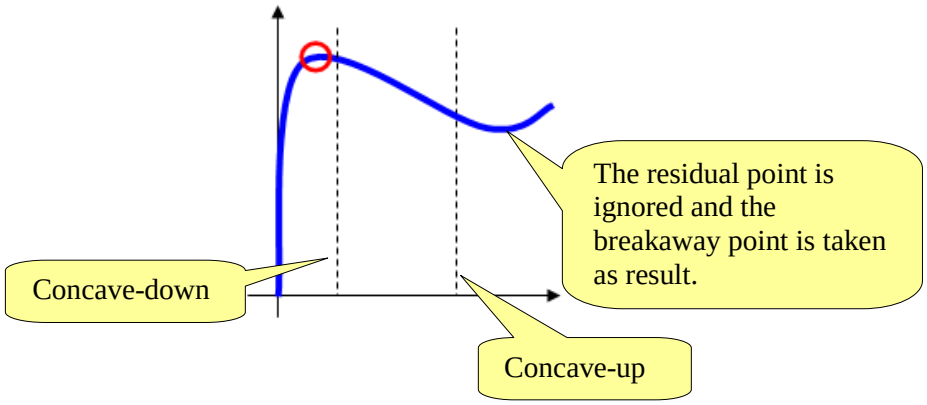
  Is specifies the maximum angle (measured from the *Start Final Angle*) for the residual torque when a the residual torque is lower than the breakaway point.

  The default value for the *Concave-up point threshold* is 20 degrees.

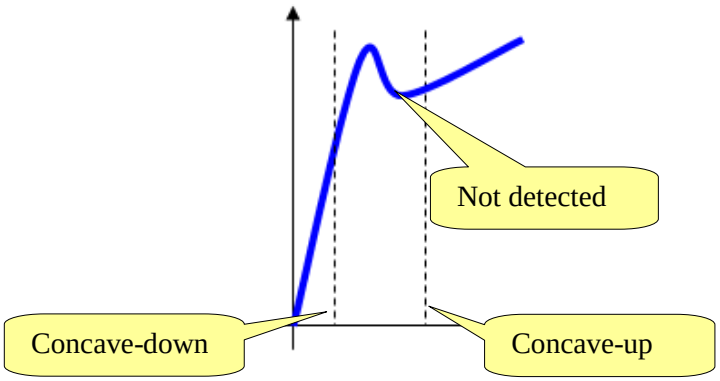
  In the following example the residual torque is before the *Concave-up point threshold* and thus is detected (normal condition for a residual torque test):



  If the residual point is over the *Concave-up point threshold*, the breakaway point is considered as the result of the test. In this case the *Concave-up point threshold* should be increased to detect the proper residual point:



Note that if the breakaway point is over the *Concave-down point threshold***,** the residual point is never detected even if the residual point is before the *Concave-up point threshold*:



6.7.2.3.1 Residual point detection algorithm

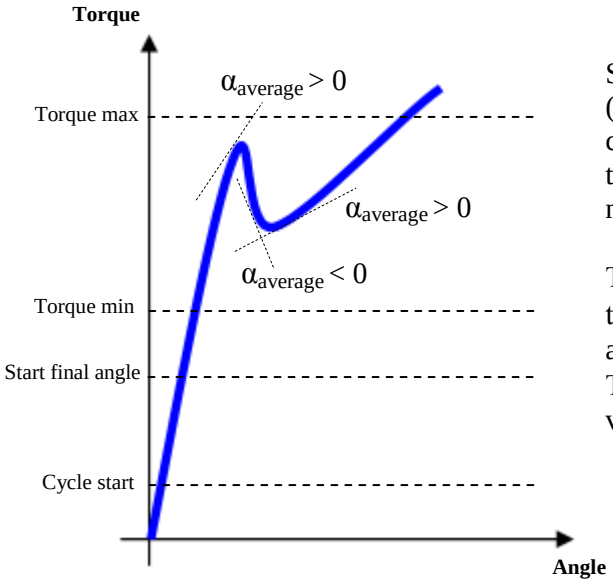
The following algorithm is used to detect the torque/angle residual point:

The gradient α_t of the torque/angle trace is calculated by linear regression each time a new sample is acquired, and the average of 6 different values α_t is calculated:

$$\alpha_{average} = \frac{\sum_{t=1}^{6} \alpha_t}{6}$$

This $\alpha_{average}$ is used to identify the residual point.

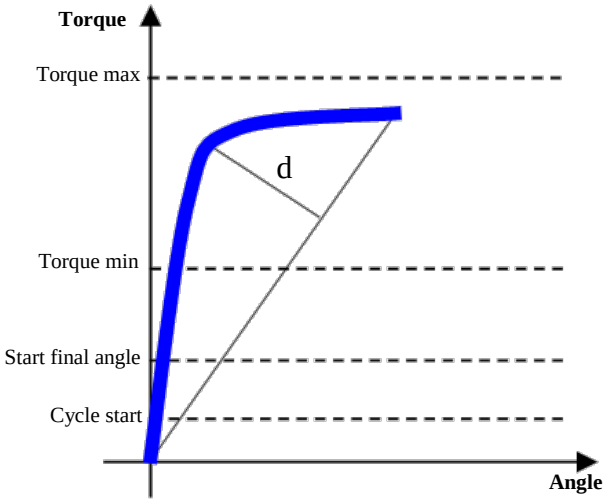
CASE A:



Sometimes very high static friction is built into the joint (for instance, for no lubrication, conical seat). In that case, 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.

The STwrench algorithm monitors the $\alpha_{average}$; if it goes to a negative value, it waits until the $\alpha_{average}$ goes back to a positive value.
The point in which the $\alpha_{average}$ goes back to a positive value is considered to be the residual torque.

CASE B:

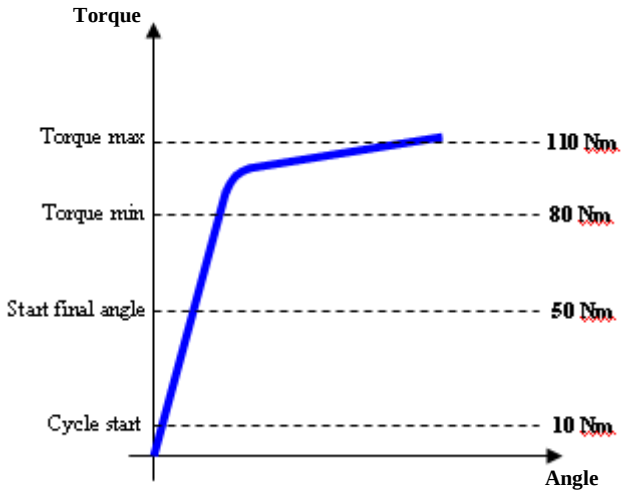


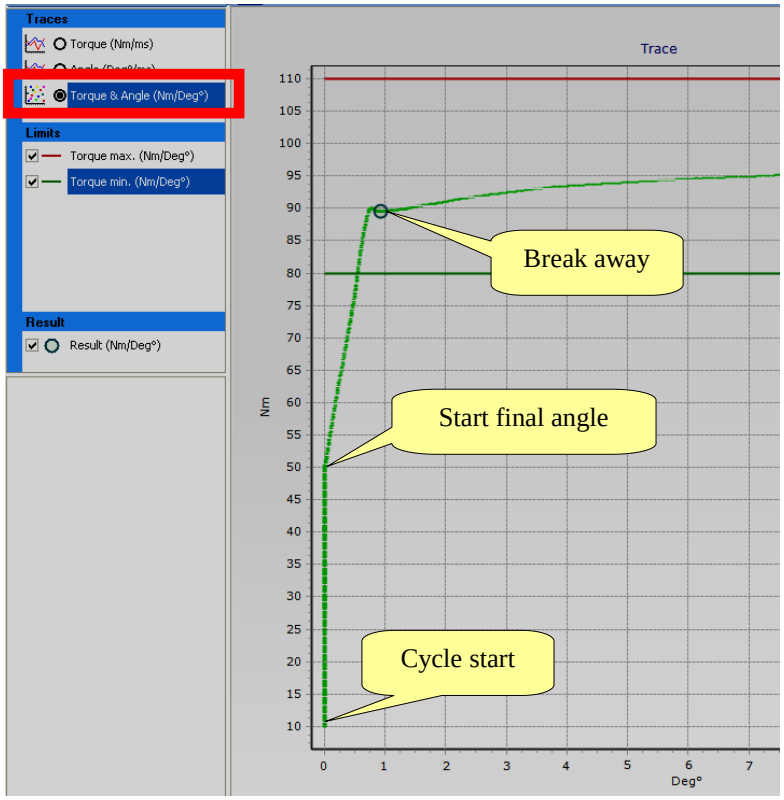
Normally, during breakaway there is a rapid change of the gradient of the torque/angle function when the bolt starts moving.
The STwrench algorithm takes as the breakaway point the point of maximum distance “d” between the torque/angle trace and the straight line from the start to the actual point of the trace. This distance must be greater than a threshold and must be consistent for more samples. Moreover, the average slope of the second part of the trace (after the breakaway point) must be less than 60% of the average slope of the first part of the trace. Once all these conditions are verified, the test ends and the breakaway/residual point is detected.

How to set the parameters:

- ***Cycle start***: This is the point from where the torque is measured. Set to a low value, but greater than the wrench minimum load.
- ***Start final angle***: Set this value between *Cycle Start* and *Torque Min*.
- ***Torque min***: Minimum residual value for achieving result OK.
- ***Torque max***: Maximum residual value for achieving result OK.

For instance, a bolt tightened to 100 Nm and using a STwrench with 150 Nm smartHEAD to detect the residual point could be a proper setting:

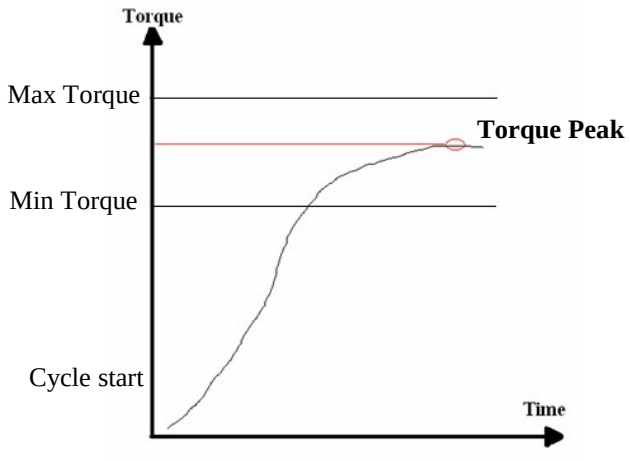




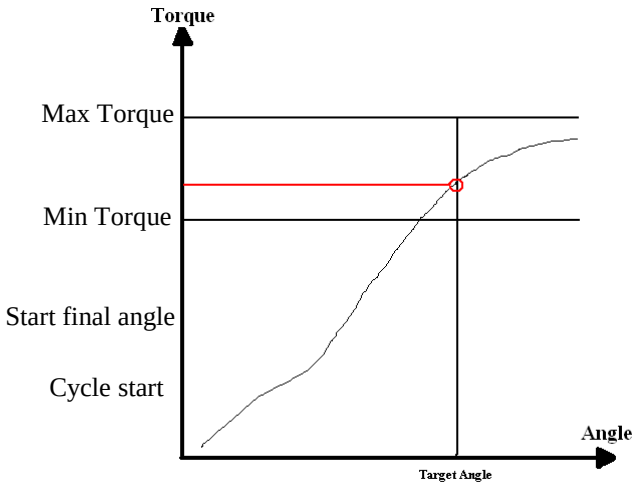
In the wrench torque/angle trace, the torque is left at zero until the torque reaches the *Start Final Angle* (50 Nm). The circle on the trace indicates the detected residual point.
If the residual point falls outside the torque limits, it is marked as *Not OK* with ✖.

6.7.2.4 Residual Torque/Peak

This strategy evaluates the residual torque on a joint as the peak torque necessary to rotate the screw further.
With this strategy the breakaway point is not detected automatically. Therefore, this is a less objective method of evaluating residual torque; it may be used in cases in which the residual torque/time or torque/angle methods cannot be performed.



Simply specify the torque limits to have a *OK* result.
If the ***Target Angle*** is not specified, the angle result is marked as *Not Applicable*.
If you specify a ***Target Angle*** value, the residual torque result is measured at the specified angle (starting from the ***Start final angle***) instead of the peak torque:



If the torque goes over the *Change Screw* value, a message is shown on the wrench display advising the operator to replace the screw.

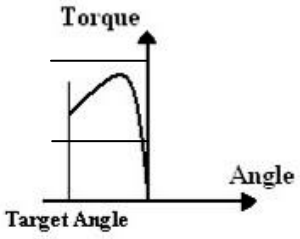
The STwrench LEDs, buzzer and vibration devices are activated as follows:

Yellow LED	Torque over *Cycle Start* value.
Green LED	Peak within torque limits and angle at *Target Angle* (if *Target Angle* is specified).
Red LED	Torque over *Max. Torque*.
First, second, and third row of yellow LEDs	Activated when the target angle is reached (if the *Target Angle* is zero they are never activated).
Buzzer	Activated when the torque goes over the *Cycle Start* value. Increase its signal when the peak is detected.
Vibration	Activated when the *Target Angle* is reached, and remains active for one second. Not activated if the *Target Angle* is zero.

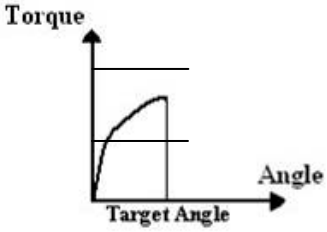
6.7.2.5 Loose and Retight

Breakaway is by far the best and most commonly used method. But, when a bolt has been tightened some time ago and there is rust or other conditions which could increase static torque, the suggested evaluation method is to loosen the bolt and retighten it back to the original position.

Loosening:



Retightening:



Specify the torque limits. The residual torque result is the torque at the end of the retightening operation (measured at the target angle).
The ***Target Angle*** is usually set to a few degrees; if it is set too high, torque during the opening phase could go under the cycle start value. In that case, the angle counting will stop, making the test impossible.

If the torque goes over the *Change Screw* value, a message is shown on the wrench display advising the operator to replace the screw.

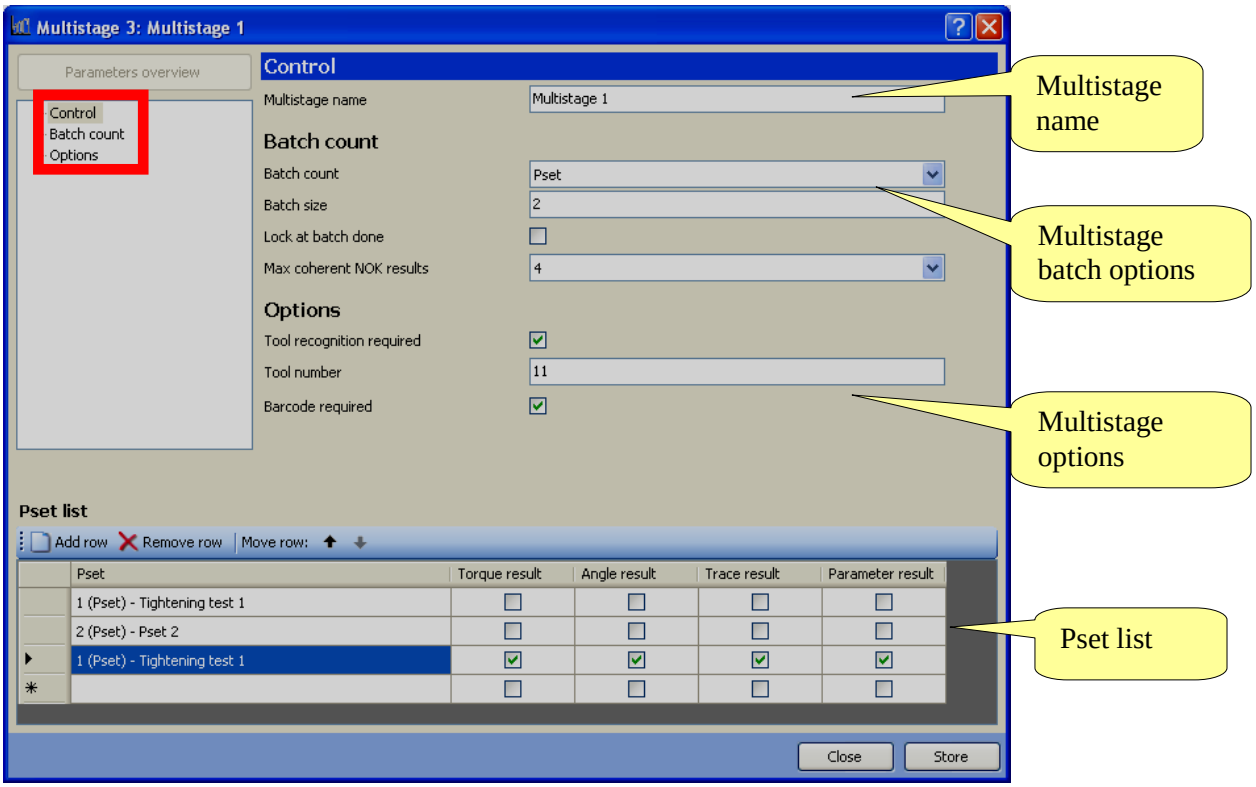
The STwrench LEDs, buzzer and vibration devices are activated as follows:

Yellow LED	Torque over *Cycle Start* value during loosening.
Green LED	Retightening completed (within torque limits).
Red LED	Torque over *Max. Torque*.
First, second, and third row of yellow LEDs	*Target Angle* reached during loosening.
Buzzer	One signal when the *Target Angle* reached during loosening. One signal when retightening is completed (within the torque limits).
Vibration	Activated together with the green LED, and remains active for one second.

7 Multistage

The Multistage feature offers a dynamic link to more than one Pset in several steps in order to perform a sequence of operations.

The STwrench can store up to 200 Psets/Multistages in its memory
A typical application scenario is joint conditioning, in which the fastener is run to a torque level of 10 Nm then backed off by 180 degrees and then fastened to a final torque level of 14 Nm. This operation would be regarded as a three-step Multistage.



First set the Multistage name in the ***Multistage name*** field.
The Multistage sequence is defined in the ***Pset list***. Double-click on the ***Pset*** column to add a Pset to the multistage.
The maximum number of Psets per Multistage is 100.
Next, select the Pset in the Multistage from which you wish to obtain the result, the Pset parameters, and the trace (they are normally taken from the same Pset, but may be chosen separately if necessary).

7.1 Batch Parameters

Batch count	Set to Pset if you want to execute the multistage sequence more than once.
Batch size	If *Batch count* is enabled, specify how many times the multistage sequence is to be executed. Maximum value: 99 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, An OK *Batch result* is only possible if the Multistage result shows OK. If the *Batch size* is greater than 1, the *Batch result* is OK only if all the Multistage results are OK.
NOTE*:* The *Batch count* defined for the single Pset is not considered in the Multistage execution. Each Pset is executed once.	
Lock at batch done	If enabled, at the end of the batch, the wrench freezes the display; to exit the menu, the operator must press the OK button. If not enabled, when the batch is completed, a new batch is started again.
Max coherent NOK results	Maximum number of Psets with *Not OK* result in the Multistage execution Maximum value: 9

7.2 Options

Tool recognition required	If enabled, the Multistage execution checks that the specified tool is inserted in the wrench head. To use the tool recognition function to automatically select Pset/Multistage, see the *Setting the source for Pset/Multistage/Job selection* chapter. When this function is used, this flag does not have any effect.

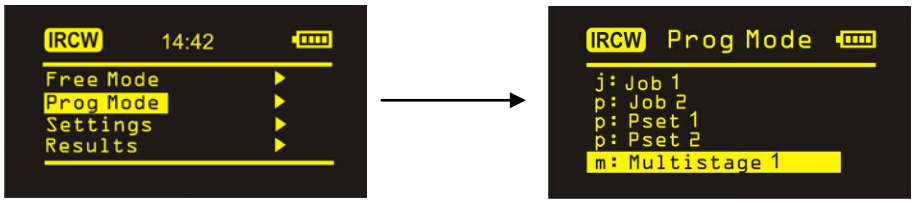
Tool number	Specify the end-fitting tool number required for the Multistage. If the tool recognition function is used to select the Pset/Multistage automatically, this is the end-fitting tool number which activates the Multistage. Maximum value: 100
Barcode required	If enabled, before starting the Pset execution, the wrench needs to scan the specified barcode. See the *Identifier* chapter. To use the tool recognition function to automatically select Pset/Multistage, see the *Setting the source for Pset/Multistage/Job selection* chapter. When this function is used, this flag does not have any effect.

NOTE: These options are applied to all the Psets in the Multistage, and override the settings of the various Psets.

7.3 Running a Multistage

Once the Multistage has been created in the wrench map area in ToolsTalk BLM, it is automatically sent to the STwrench.

To execute the Multistage, select ***Prog. Mode*** from the main menu of the STwrench:



Select the Multistage from the list of available Multistages and click on the ***OK*** button on the wrench keyboard to start Multistage execution.

NOTE: If the source program is set for *Bar code* or *TAG*, instead of selecting the Multistage manually with the wrench keyboard, the Multistage selection is performed automatically by reading the associated Bar Code or inserting the end-fitting tool in the wrench.

See the *Setting the source for Pset/Multistage/Job selection* and *Identifier* chapters for more information.

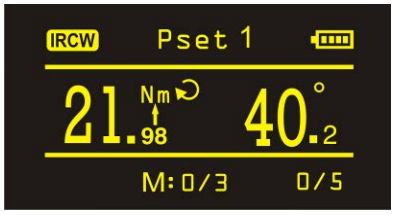
If the source program is the not the *Barcode*, but a barcode reading is required for the Pset, the following message is shown to indicate that the bar code is required:



If the source program is the not the TAG, but a specific end-fitting tool number is required for the Pset, the following message is shown in the event of the specified tool not being inserted into the wrench head:



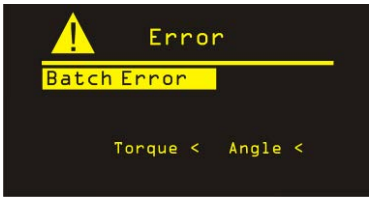
During Multistage execution, the wrench display shows torque and possibly angle values, and the tightening direction:



During Multistage execution, pressing the ***CL*** button on the wrench display will abort the Multistage, and results and traces will be stored in the results.

The display shows the same information as for the Pset execution, with the following differences:

Pset 1	Pset being executed. When the Pset batch is completed, the next Pset is automatically loaded.

	The M: 0/3 indicates that the first Pset of the Multistage is being executed. If the Multistage batch size is greater than one, the batch count number is displayed on the right-hand side of the bottom part of the screen. If the Multistage is *Not OK*, the batch number is not increased and the Multistage must be repeated until the result is *OK*; if a *Max coherent NOK result* is defined in the Multistage definition, when the number of *Not OK* results reaches the maximum value, the following error message is displayed: 

For each tightening operation, the LEDs indicator, buzzer and vibration devices are activated according to the tightening strategy selected.

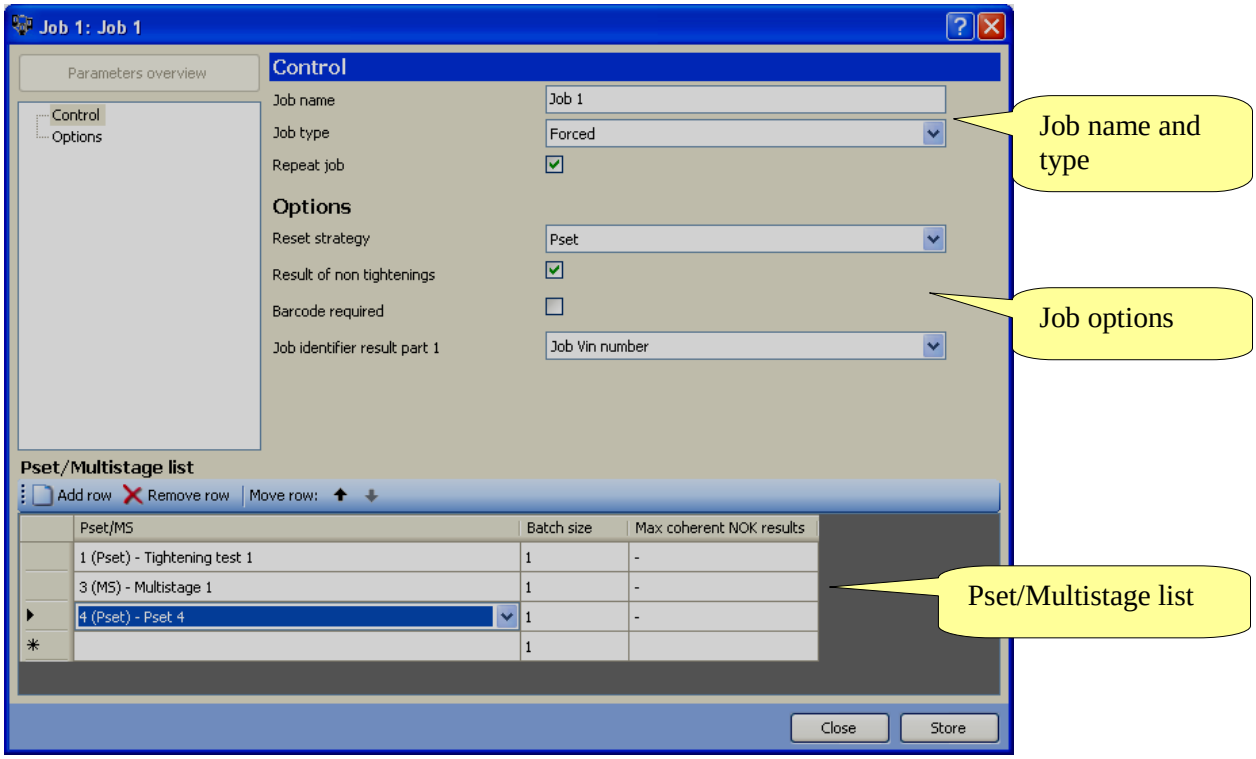
The data and traces from the tightening results are stored automatically in the wrench memory; see the *Results Viewer* and *Traces Viewer* chapters for information on how to retrieve results and traces using ToolsTalk BLM.

8 Job



The **Job** function is advantageous when an object has bolts or screws requiring different torque and angle values for tightening. A Job is useful when an object needs different Psets and Multistages. Instead of manually selecting each Pset or Multistage, the Job function keeps Psets and Multistages in a predefined order.

The STwrench can store up to 100 Jobs in its memory.



The Multistage sequence is defined in the ***Pset/Multistage list***. Double-click on the ***Pset/Ms*** column to add a Pset or Multistage to the job.
The maximum number of Pset/Multistages in a Job is 30.

The following parameters must be specified for each Pset/Multistage in the Job:

Batch size	How many times the Pset (Multistage) must be executed. Maximum value: 99
Max. coherent NOK results	Maximum number of *Not OK* results. Maximum value: 9

8.1 Control

Job name	Job name.
Job type	***Forced***: Job executed in the given sequence. ***Free***: Manually select the order. If the *Sub Source Job* is set for Tag or Barcode (see the chapter *Setting the source for Pset/Multistage/Job selection*), the selection of the Psets/Multistages making up the job is done automatically with the Tag recognition function or with the barcode reader.
Repeat job	If enabled, at the end of the Job (Job summary is shown on display), pressing the ***OK*** button will result in the wrench starting the job again, while pressing the ***CL*** button will cause the wrench to exit the Job. If disabled, after the Job Summary, pressing the ***OK*** or ***CL*** button will cause the wrench to exit the Job.

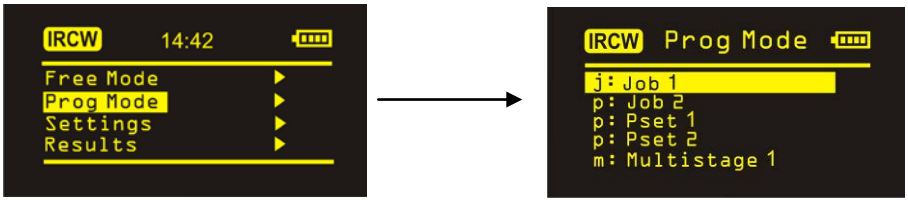
8.2 Options

Reset strategy	In the event of *Not OK*, select whether to repeat just the Pset or the entire batch. This flag does not have effect if the Batch increment condition in the STwrench settings is set to *OK + Not OK*.
Result of non tightenings	If enabled, a *Not OK* result is generated for tightenings that have not been performed.
Barcode required	If enabled, the wrench needs to scan the specified barcode before starting the Job execution. See the chapter *Identifier*.
Job identifier result part 1	***Job VIN number***: The result part 1 of all the Psets belonging to the Job is the same; it is the result part 1 of the identifier strings scanned to start Job. ***Other***: The result part 1 of each Pset belonging to the Job is the result part 1 of each Pset. This parameter is used when the Job source is a barcode. See the chapter *Identifier* for more information about identifier concepts.

8.3 Running a Job

Once the Job has been created on the wrench map area in ToolsTalk BLM, it is automatically sent to the STwrench.

To execute the Job, select ***Prog. Mode*** from the main menu of the STwrench:



Select the Job from the list of the available Jobs and click on the ***OK*** button on the wrench keyboard to start Job execution.

If the Job is defined as ***Forced***, the sequence of the Pset/Multistage is performed automatically; if the Job is defined as ***Free***, individual Psets/Multistages making up the job can be selected via the wrench keyboard, the Tag recognition function or the barcode reading.
See the chapter *Setting the source for Pset/Multistage/Job selection.*

NOTE: If the source program is set for *Bar code* or *TAG*, is not possible to select a job.

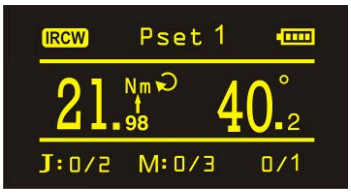
If the barcode reading is required for the Pset or Multistage composing the job, the following message is shown to indicate that the bar code is required:



If a specific end-fitting tool number is required for the Psets/Multistages making up the job, the following message is shown in the event of the specified tool not being inserted into the wrench head:



During Job execution, the wrench display shows the torque and possibly angle values, and the tightening direction:



The same information as for the Pset/Multistage execution is displayed, with the following difference:

	Pset in execution. When the Pset batch is completed, the next Pset will be loaded automatically.
	The J: 0/2 indicates that the first tightening program (Pset or Multistage) of the job is being executed.

During Job execution, clicking on the CL button on the wrench key keyboard will skip the ongoing Pset or Multistage and the batch number will be incremented by one (if the batch size is set to 1, the wrench goes to the next Pset/Multistage of the Job). If the flag ***Result of non-tightenings*** is enabled in the Job option, a Not OK result is associated with the skipped Pset/Multistage.

NOTE: To avoid skipping a Pset/Multistage by mistake, it is possible to set a warning message asking for confirmation before skipping. See the *Enabling warning message for Job skip* chapter.

The following summary is displayed at the end of Job execution:



NOTE: Every Pset/Multistage counts as 1 for the number of ***Results OK*** and ***Results NOK***, regardless of the fact that a Multistage may content many Psets, and regardless of the batch number of each Pset/Multistage in the Job.

For each tightening operation, the LEDs indicator, buzzer and vibration devices are activated according to the selected tightening strategy.

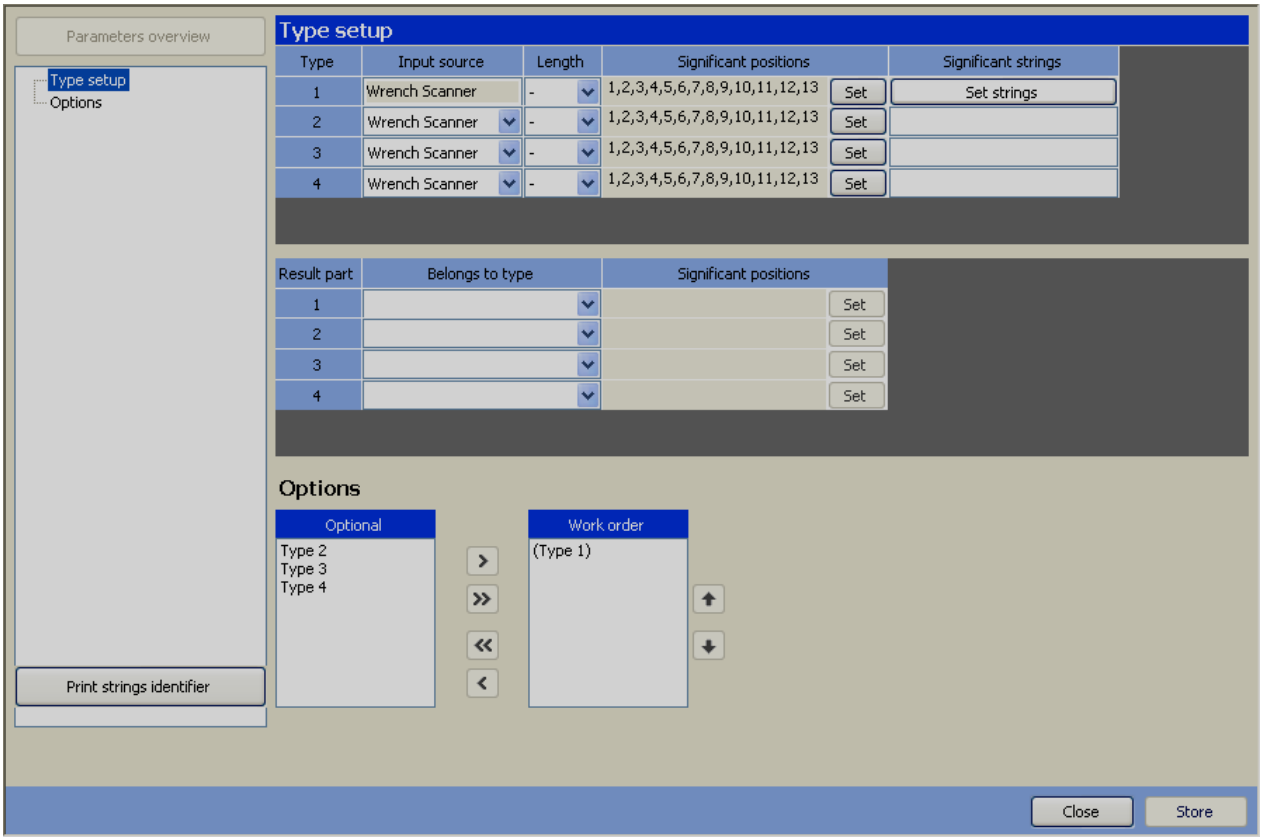
The data and traces from the tightening results are stored automatically in the wrench memory; see the chapters *Results Viewer* and *Traces Viewer*Traces Viewer regarding how to retrieve results and traces using ToolsTalk BLM.

9 Identifier

The **Identifier** section describes the identifier concept, functions and settings.

It is possible to define a maximum number of 300 identifier strings in the STwrench memory.

An identifier, or barcode string, can be used for example to select Psets or Multistages or Jobs, identify motor vehicles (VIN) and other work pieces, variants, and operators. The tightening result can then be saved together with this information.



9.1 Identifier Concepts

There are three ways to use the identifier function, all of which may be used independently of each other:

Select a Pset/Multistage or Job by scanning a barcode string (only Type 1).

Create a work order for identification of, for example, work pieces connected to a tightening.

Store additional information on the tightening result.

An identifier (barcode) string can have different standards and lengths. It can be scanned and stored as it is, but the STwrench can also be configured to identify parts of the string. These parts are called ***significant strings***.

The ***Type 1*** identifier can be configured for selection of Pset/Multistage or Job in addition to being stored as additional information on the tightening result or being selected in a work order.

The ***Type 2***, ***Type 3*** and ***Type 4*** identifiers can be stored as additional information to the tightening result or be selected in a work order.

A ***significant string*** is a set of characters within a barcode string that can be defined.

The ***significant positions*** are the positions where the significant strings are located.

A ***work order*** consists of different types of identifiers (***Type 1*** is mandatory). It is configured when the STwrench is to receive identifiers in a predefined order. An identifier not included in the work order is called an ***Optional identifier***. An optional identifier must not be identical to an identifier included in the work order.

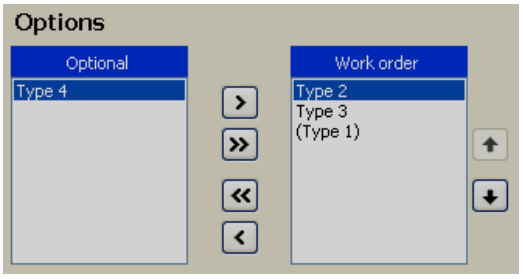
The ***Result part*** is additional information stored together with each tightening result. This information can come from one or more of the defined identifier types independently. The additional information from the result parts is displayed in the ***Result Viewer*** and may be sent to ToolsNet.

Example:

An airbag is mounted in a car.

Type 1 represents the airbag which can be of different variants that need different Psets. Type 2 represents the car (VIN) and Type 3 identifies the workstation.

A work order is configured where Type 2 (VIN) and Type 3 (workstation) have to be scanned before Type 1 (airbag).



Each tightening result from the Psets listed under Type 1 is stored with the VIN, the airbag ID, and the workstation ID.

The STwrench shows the Work order on the display, and the *Result viewer* shows the tightening result. The tightening result with all the additional information can be retrieved via ToolsNet.

9.2 Identifier Prerequisites and Details

Prerequisites for significant strings:

- 50 significant strings can be set for Type 1.
- A string can only be added once in Type 1.
- A Pset, Multistage or Job ID can be added to any string of Type 1.
- The number of characters in the significant string (for example 10) must be the same as the number of significant positions.
- The length can be max 100 characters.
- Only numbers and capital letters are accepted.

Type	Max scanned characters	Max significant positions	Max significant strings	Max stored characters
Type 1	100	50	200	25
Type 2	100	50	1	25
Type 3	100	50	1	25
Type 4	100	50	1	25

Prerequisites for incoming data:

- Identifiers can only be read by the STwrench barcode reader.

Prerequisites for result parts:

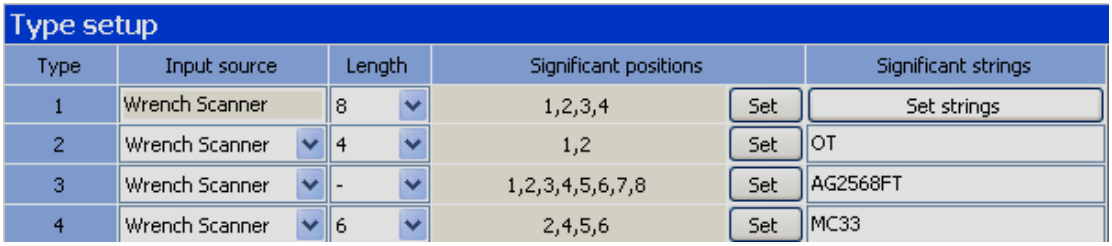
- The information from the identifier types can be displayed in the result parts independently of result part number. For example, all result parts can display information from Type 1.
- A work order must be completed before the STwrench stores the accepted identifiers in the result and selects the next Pset/Multistage or Job.

9.3 Configuration of Identifier Functions

9.3.1 Configuring identifiers

The procedure for setting identifiers differs between identifier Type 1 and Types 2, 3 and 4. Always start with Type 1.

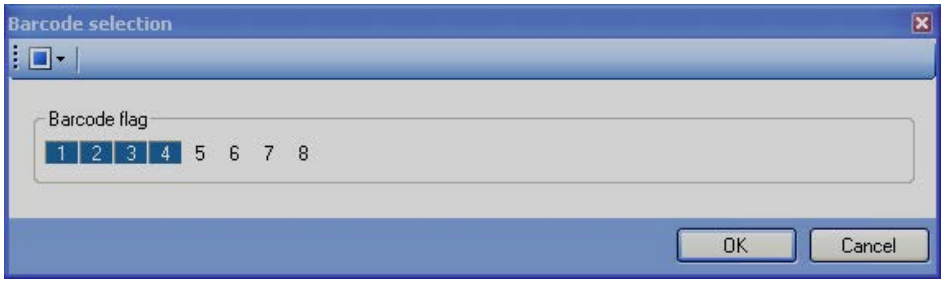
Click on the *Identifier* icon in the *Wrench map* or in the main tool bar:



Select ***Wrench scanner*** as the input source, or OFF, to enable or disable the various barcode types; Type 1 is mandatory.

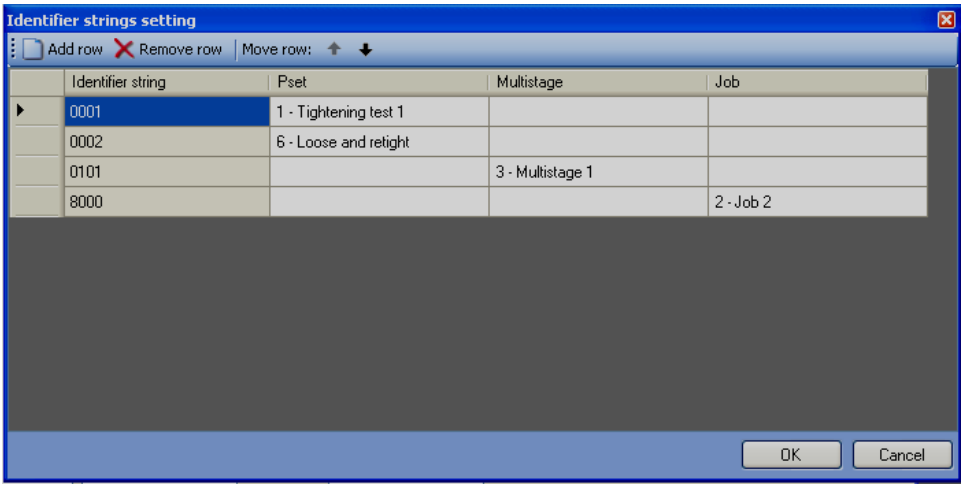
Set the ***Length*** for each type; if not specified, there is no length check.

Click on **Set** to open the following pop-up window for significant position setup:

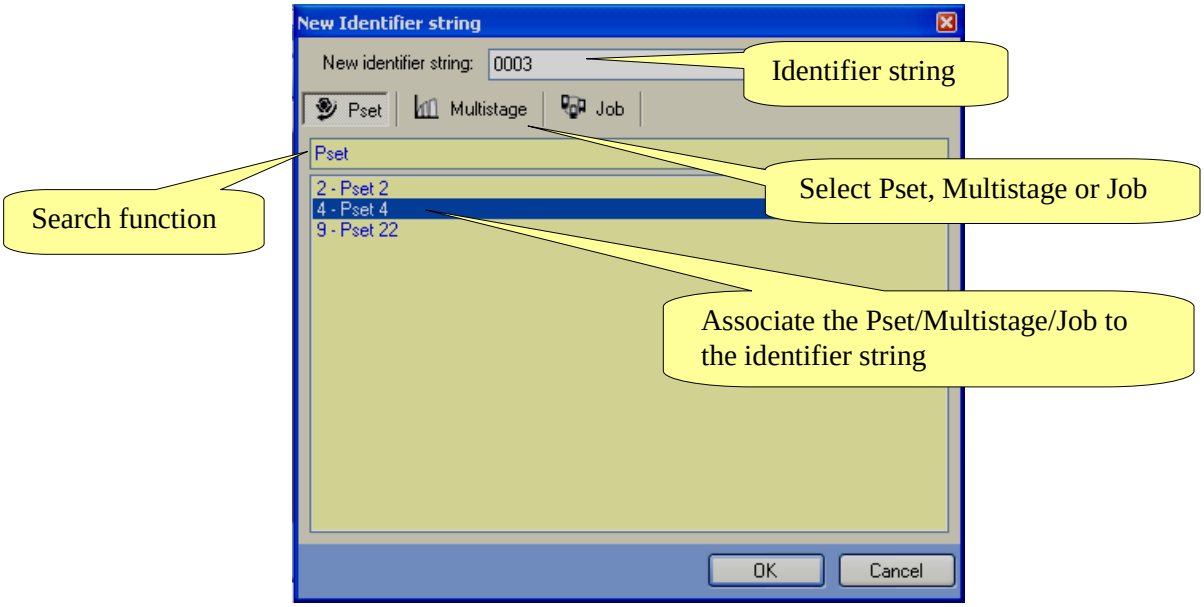


Mark the significant positions for the identifier. The positions can be selected freely. Click on ***OK***.

To define the significant string for identifier Type 1, click on ***Set Strings***.



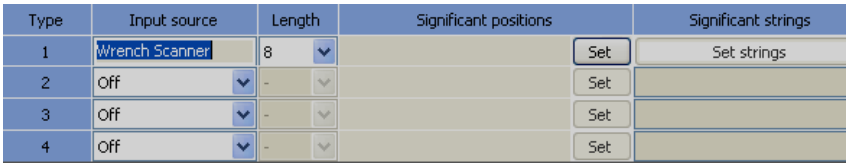
Click on ***Add row*** and enter the identifier string to add a string to be associated with a Pset/Multistage/Job.
Click on ***Remove row*** to delete a row, and use the arrows in the tool bar to move the selected row.
For each ***Identifier string***, double-click to edit.
When creating or modifying an identifier string, the following window is shown:



Enter the identifier string and associate a Pset/Multistage/Job. Enter a text in the filter function to filter and display only the items containing the text entered.

NOTE: The same Pset/Multistage/Job can be associated with different identifier strings, while each identifier string must be different from all the others.

NOTE: If the barcode reading is required for the Pset/Multistage, and is not the source program, it is possible to specify only the *Length* without any *Significant positions* and *Significant strings*. In this case, to start the Pset/Multistage, the STwrench has to scan any barcode of the defined length:



If not desired, the length may also be left undefined (-); in his case any barcode reading is accepted.

When finished, click on ***OK.***

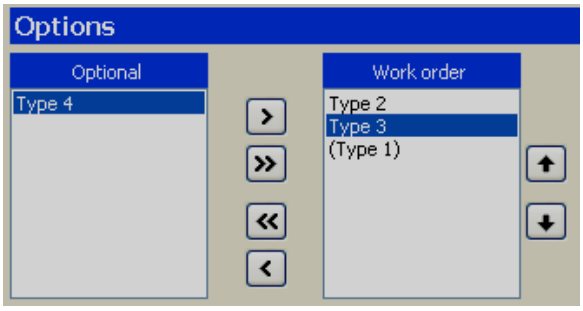
Click ***Store*** to save the settings, or continue with:

- Configuring a new type of identifier
- Configuring a work order
- Configuring Result parts

9.3.2 Configuring a work order

Add identifier types to the work order, and arrange the correct order using the arrow buttons.

NOTE: A Type 1 identifier must always be included in the work order



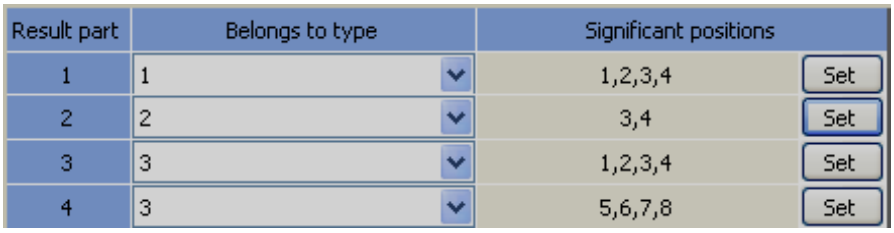
>	Moves the selected identifier type.
>>	Moves all identifier types.
↑	Shift up the selected identifier type in the ***Work order.***
↓	Shift down the selected identifier type in the ***Work order.***

The identifier types added to the ***Work order*** are mandatory to start the Pset/Multistage/Job, and need to be scanned by the wrench in the order specified here; the identifier types left as ***Optional*** are left as optional.

9.3.3 Configuring result parts

In the result part area, it is possible to select which identifier types, or which portions of them, are to be included in the tightening results.

Four result parts are available; for each one, set the identifier type source and the significant positions to be considered.

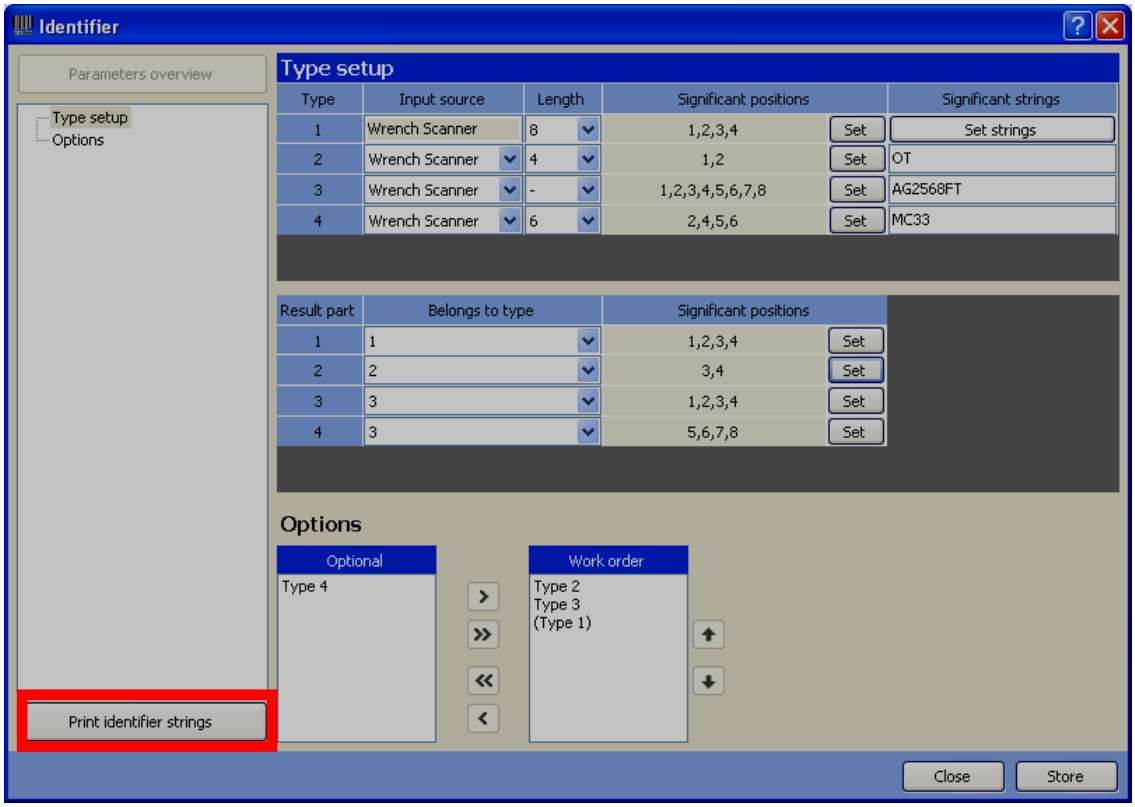


In the example shown in the figure, the first and second result parts take a portion of the Type 1 and 2 identifiers; Identifier type 3 is split into result part 3 (first 4 characters) and result part 4 (last 4 characters).

When a Job is selected by barcode reading, the *Result part 1* can be associated with the identifier string starting the Job, for all the Psets in the Job. See *Job* Options.

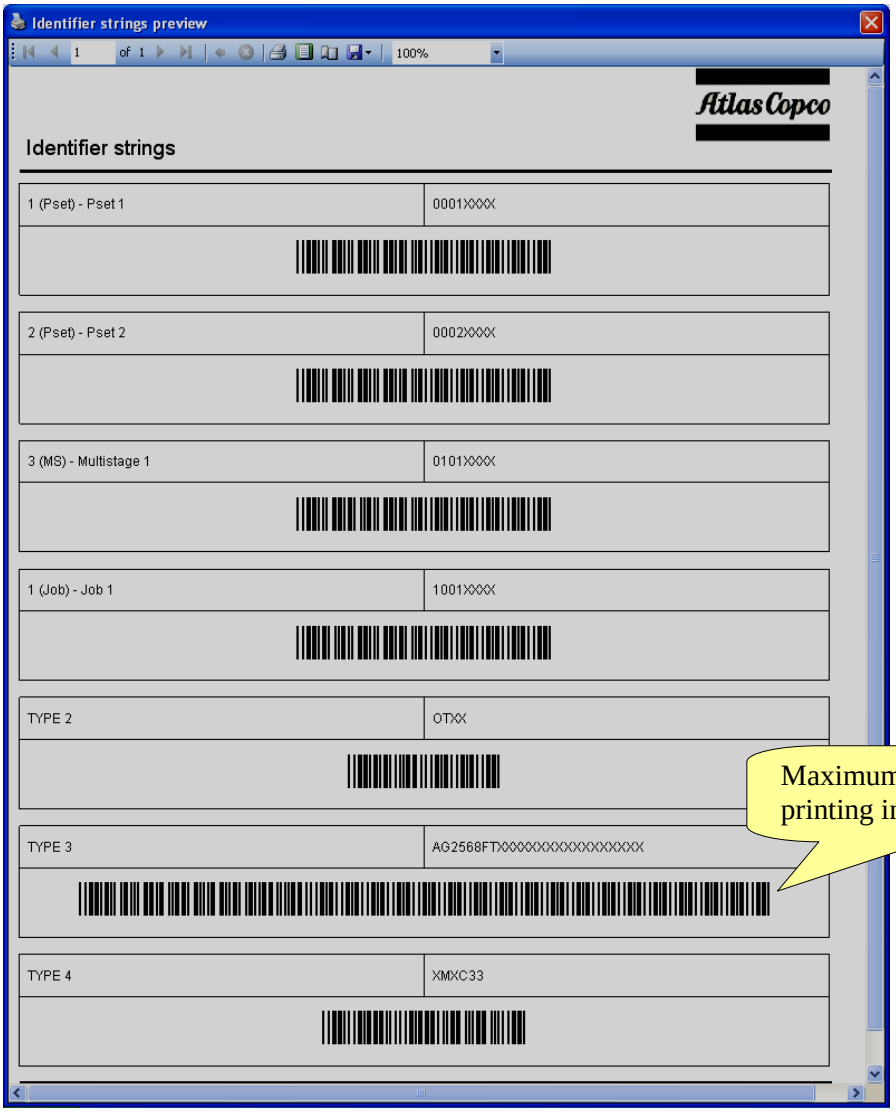
The result parts are associated with barcode, barcode 2, barcode 3 and barcode 4 in the *Result Viewer*, and possibly sent to ToolsNet.

9.3.4 Printing identifier strings



Once the identifiers have been defined, a useful tool allows the operator to generate a printout of the identifiers.

Click on ***Print strings identifiers*** to generate the following preview (available only for strings not exceeding 50 characters):



If the identifier has more characters than specified in the *Significant strings*, or if the identifier length is not specified, the unspecified characters are automatically filled in with an X in this printout.

The commands on the toolbar allow you to print out or export this page:

	Print the page.
	Export the page to an Excel file (export to PDF is active but does not support the barcode font).

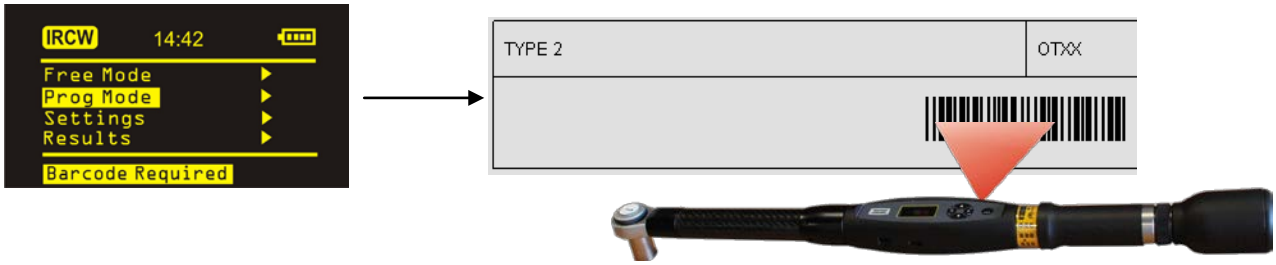
9.4 Scanning Identifiers with STwrench

Taking the set of the identifiers shown in the previous paragraph, here is the sequence needed to start a Pset/Multistage/Job by reading the identifiers.

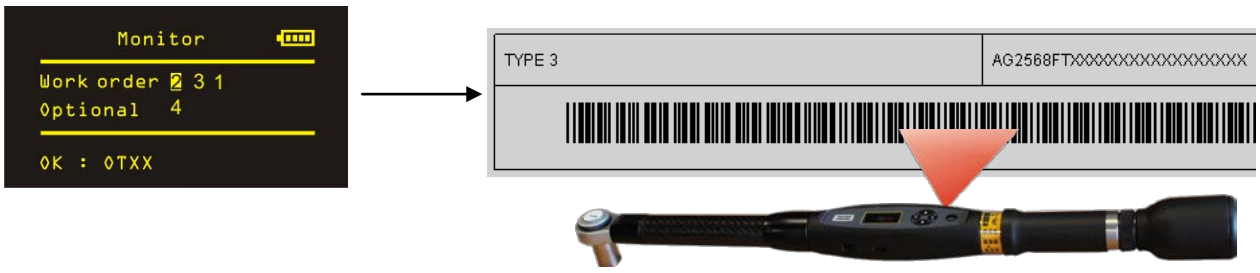
NOTE: The *source program* for the STwrench must be set to *Barcode*.

Identifiers	Type setup Type | Input source | Length | Significant positions | Significant strings 1 | Wrench Scanner | 8 | 1,2,3,4 | Set | Set strings 2 | Wrench Scanner | 4 | 1,2 | Set | OT 3 | Wrench Scanner | - | 1,2,3,4,5,6,7,8 | Set | AG2568FT 4 | Wrench Scanner | 6 | 2,4,5,6 | Set | MC33
Work order	Options Optional: Type 4 Work order: Type 2, Type 3, (Type 1)

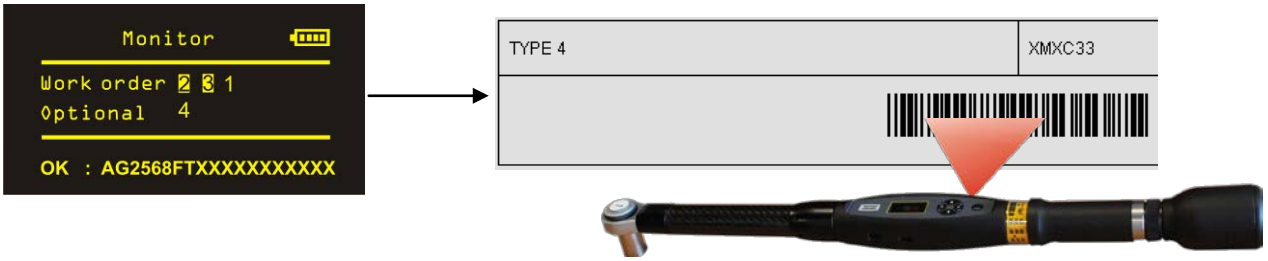
With the STwrench in the main menu, scan the first identifier (Type 2 in this example) in the specified working order:



The wrench display shows that the first identifier (Type 2) in the given working order has been read. Scan the next identifier:



The wrench display shows that the second identifier (Type 3) in the given working order has been read. Scan the optional identifier (the optional identifier can be scanned at any time in the working order sequence):



The wrench display also shows that the optional identifier (Type 4) has been read:



To start the Pset/Multistage/Job, simply scan one of the Type 1 barcodes:



After having scanned the Type 1 barcode, the wrench automatically starts the associated Pset/Multistage/Job.



NOTE: Pressing the ***CL*** button on the wrench keyboard during the identifier reading sequence will result in the wrench exiting to the main menu and canceling the readings already taken; pressing the ***OK*** button on the wrench keyboard will cause the wrench to exit to the main menu without canceling the readings already taken, allowing readings to continue.

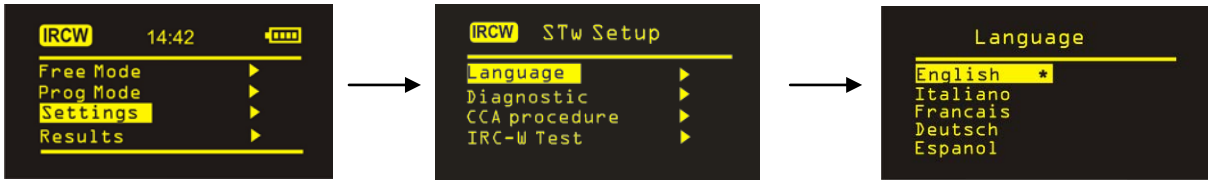
10 STwrench Settings

10.1 Settings Menu on the STwrench

The ***Settings*** menu on the wrench display is active only if enabled. See *STwrench Controller Setup* to enable / disable this menu. The ***Diagnostic*** menu is covered in the *Troubleshooting Guide* chapter of this manual. See *Appendix C - STwrench Factory Settings* for the default configuration.

10.1.1 Wrench display language

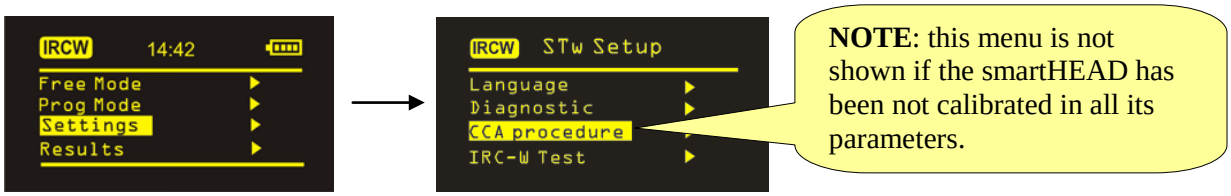
To set the wrench display language, select ***Wrench Setup*** → ***Language*** from the STwrench main menu:



Select the language and confirm with the ***OK*** button on the wrench keyboard.
It is also possible to set the language through ToolsTalk BLM. See the chapter *Setting the STwrench display language*).

10.1.2 CCA procedure

When an extension is used, the proper torque and angle correction coefficients must be set in the TAG. From this menu, it is possible to enter the Torque Correction Coefficient manually and execute the procedure to calculate the Angle Correction Coefficient (CCA). See *Appendix A – Calculating Torque and Angle Correction Coefficients* for more information.

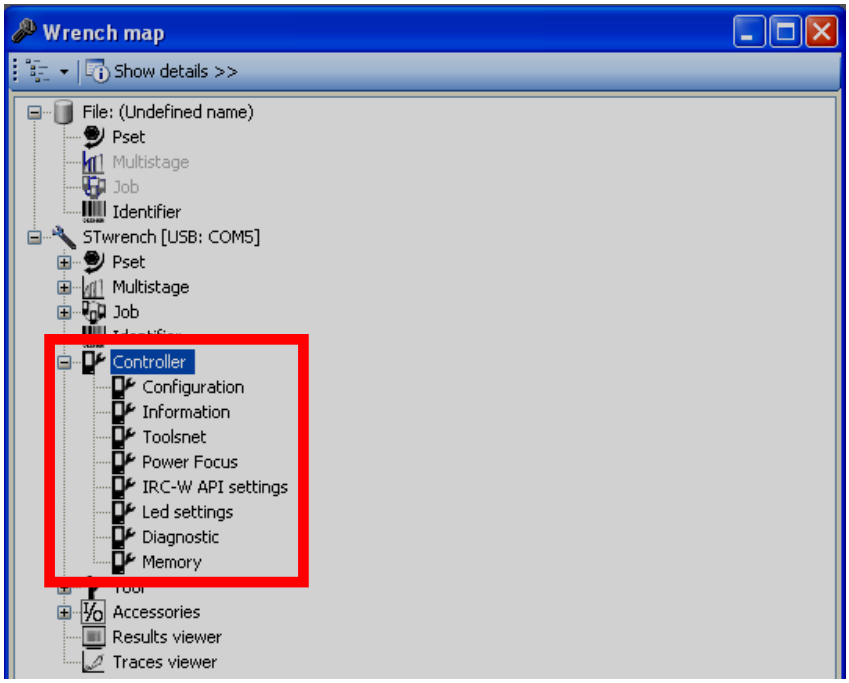


NOTE: The ***CCA Procedure*** function is available from STwrench firmware 2.3a.

10.2 STwrench Controller Setup

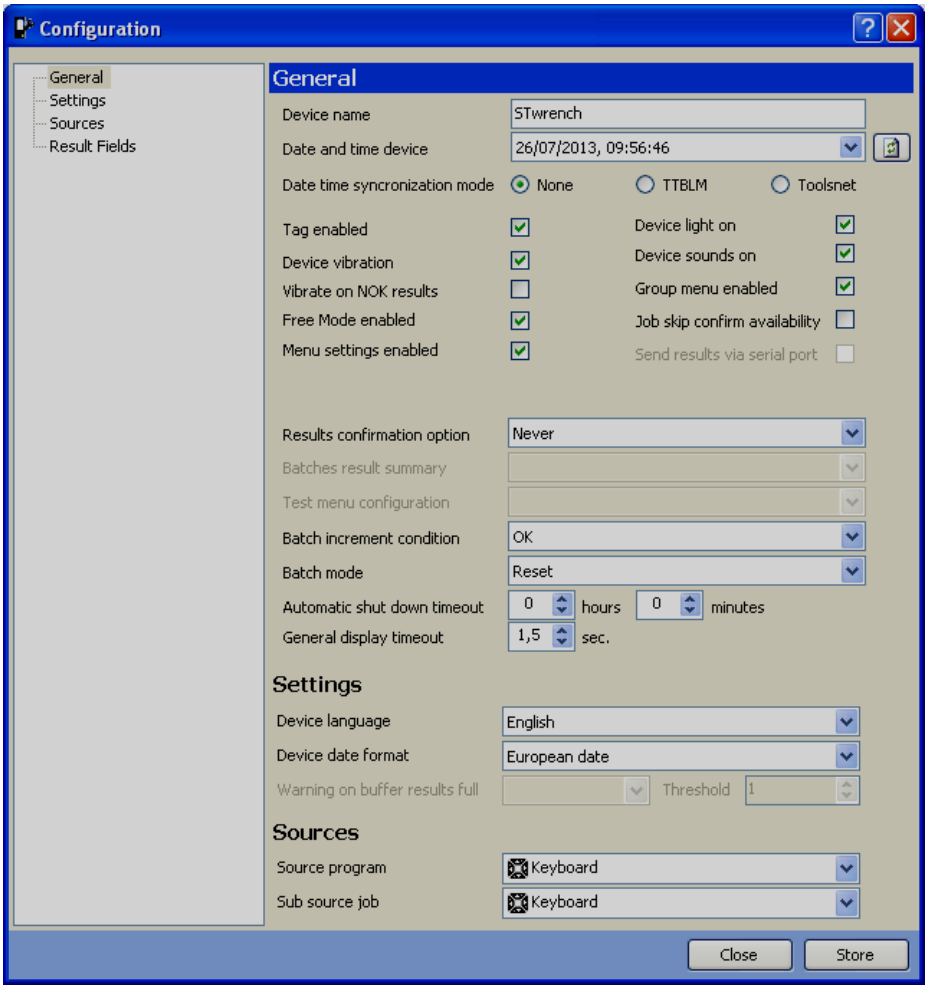


You can access the wrench settings in the Controller section of the Wrench Map:

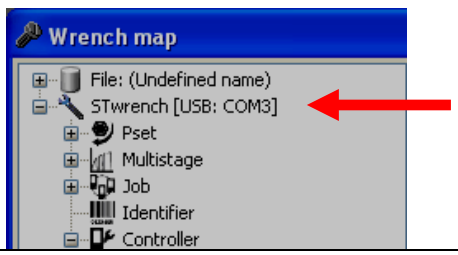


10.2.1 Configuration

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



10.2.1.1 Settings STwrench name

Device Name	Name which is reported in the Wrench Map. 

10.2.1.2 Settings STwrench date and time

Date and time device	Date and time appearing on the main menu of the wrench display. This date and time are associated with the tightening results and traces. Click on  to align the wrench date and time to the date and time of the PC connected to the wrench. Is it possible to enable the automatic synchronization between the date/time of the STwrench to the current date/time of ToolsTalk BLM and ToolsNet, by setting the flag ***Date time synchronization mode***.

10.2.1.3 Enabling STwrench tool recognition

Tag enabled	Enables the tool recognition and TAG writer functions on the STwrench. When enabled, a tightening program is not started unless an end-fitting tool with RFID TAG is plugged into the smartHEAD. This is automatically enabled when the Power Focus connection is activated. **NOTE**: If disabled, the torque and angle correction coefficients possibly defined in the TAG of the end-fitting tool are not considered during the tightening (see *TAG writer*). This means that if an extension is used with TAG disabled, the correction coefficients need to be specified in the *Pset* Options).

10.2.1.4 Enabling STwrench vibration device

Device vibration	Enables the vibration device on the STwrench. This is automatically enabled when the Power Focus connection is activated. If enabled, the option ***Vibrate on NOK results*** makes the STwrench vibrate continuously in case of *Not OK* results, until the ***OK*** or ***CL*** button is pressed on the STwrench keyboard, or a new test is started.

10.2.1.5 Enabling STwrench free mode

Free Mode enabled	Enables the free mode function on the main menu of the STwrench.

10.2.1.6 Enabling STwrench settings menu

Menu settings enabled	Enables the Settings on the main menu of the STwrench.

10.2.1.7 Enabling STwrench illuminating light

Device light on	Enables the illuminating Light device on the STwrench. This is automatically enabled when the Power Focus connection is activated.

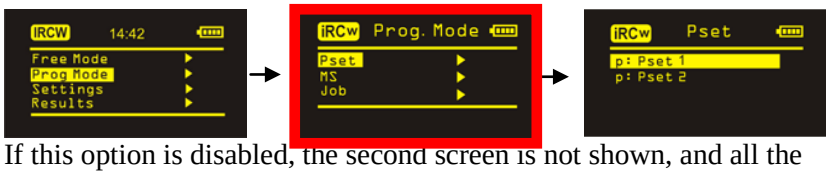
10.2.1.8 Enabling STwrench buzzer

Device sounds on	Enables the buzzer device on the STwrench. This is automatically enabled when the Power Focus connection is activated.

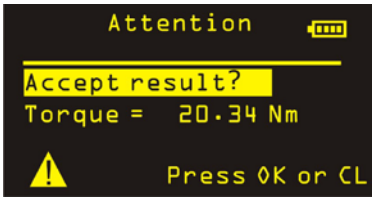
10.2.1.9 Enabling warning message for Job skip

Job skip confirm availability	Enables the confirmation message before skipping a Pset/Multistage during Job execution.

10.2.1.10 Enabling Pset/Multistage/Job grouping in Prog. Mode

Group menu enabled	If active, the Psets, Multistages and Jobs are grouped into 3 different folders when accessing the ***Prog. Mode*** menu:  If this option is disabled, the second screen is not shown, and all the Pset, Multistage and Job are shown together in the same list.

10.2.1.11 Enabling the result confirmation

Result confirmation option	Select between: ▪ ***Never***: All of the tests executed are acquired as test result. ▪ ***Always***: At the end of each test, the STwrench asks if the result must be considered or discarded. ▪ ***NOK only***: At the end of each *Not OK* test, the STwrench asks if the result must be considered or discarded. The result confirmation is shown on the display as follows:  Click on ***OK*** on the STwrench keyboard to accept it, or ***CL*** to discard. If the result is discarded, the batch count (if enabled) is not incremented.

10.2.1.12 Set batch increment options

Batch increment condition	Selects if the batch number for a Pset/Multistage is incremented only if the result is OK, or if it is incremented anyway, regardless of the result (OK + NOK).

10.2.1.13 Set the batch mode

Batch mode	If set to *Reset*, quitting a batch resets the batch count; the results are saved in the wrench memory, but if entered again in the Pset, the batch restarts from the beginning. If set to *Restore*, when reentering a batch, the batch count continues from where the batch was interrupted. **NOTE**: This is applied only to quality control strategies and not for production strategies.

10.2.1.14 Enabling STwrench automatic shutdown

Automatic shutdown timeout	Sets the timeout for automatic shutdown when the STwrench is switched on but not being used and not connected to ToolsTalk BLM. Leave it set to zero to disable automatic shutdown. **NOTE**: When the STwrench works in Power Focus mode, this parameter is not considered and is substituted with the timeout specified inside Power Focus. If the STwrench is connected to Power Focus with the SL Cable, the automatic shutdown function is ignored and the wrench always on.

10.2.1.15 Enabling STwrench general display timeout

General display timeout	This option defines how long the display shows the information before going onto the next screen; it is applied in the following cases: - Result screen if end-fitting tool is removed (if TAG is enabled). - Warning battery. - Result screen before lock (for QATnode). - Result of a Pset with auto delete (in case of batch, only for the last result). - Last result of a Pset in the batch of a Job. - Batch result of a Job. The valid value of the parameter is 0.0 to 6.0 seconds. The value 0.0 means no timeout. In that case, the ***OK*** button must be pressed on the wrench keyboard in order to proceed to the next screen. **NOTE**: The default value is 1.5. It is not recommended to set the value to low.

10.2.1.16 Setting the source for Pset/Multistage/Job selection

When the STwrench is working with the QATnode, these two parameters are overridden by those defined in the STwrench QATnode settings. See the chapter *QATnode and STwrench Settings* for more information.

Source program	This setting defines the way in which you select a Pset /Multistage/Job. ***Keyboard***: Manual Pset/Multistage selection from the ***Prog. Mode*** menu on the wrench display.

	TAG: Automatic Pset/Multistage selection with tool recognition. Ensure that the *Tag enabled* flag is activated. **NOTE**: A Job cannot be selected using this function; therefore, if this method is used to select the various Psets/Multistages, the Job function on the STwrench cannot be used. ***Bar Code***: Automatic Pset/Multistage/Job selection with barcode reading. If a Pset/Multistage has the same barcode as a Job, the Job has priority and is executed first. See the chapter *Identifier* for more information of this working mode. ***QATnode***: Pset/Multistage/Job selected via QATnode. See the chapter*Working with the QATnode* for more information. ***API***: Pset/Multistage/Job selected via API interface (typically, it is set when STwrench is connected to API via IRC-W).
Sub source job	If the Job has been defined as ***Free***, this specifies how to select the Pset/Multistage of the Job. Choose between ***Keyboard***, ***TAG***, ***Bar Code, QATnode***, or ***IRC-W API***. If the Job has been defined as ***Forced***, the Pset/Multistage is executed in the given order (specified in the Job definition), and this setting does not affect job execution.

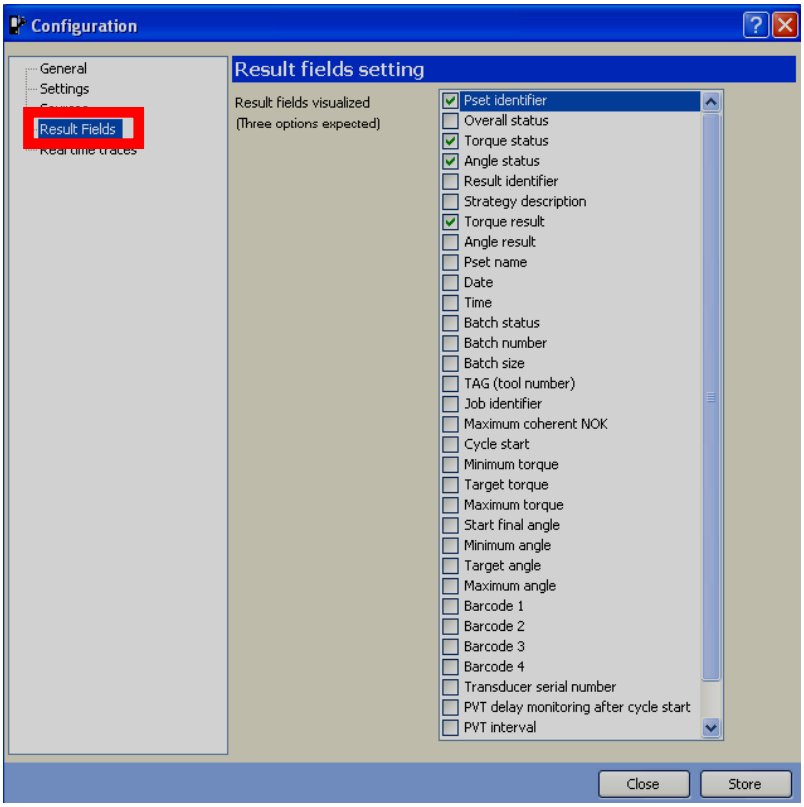
10.2.1.17 Setting the STwrench display language

Device language	Select the language of the STwrench menu. This is also possible from the wrench *Settings* menu (See the chapter *Settings Menu on the STwrench*) The ***Settings*** menu on the wrench display is active only if enabled. See *STwrench Controller Setup* to enable / disable this menu.

10.2.1.18 Setting the STwrench date format

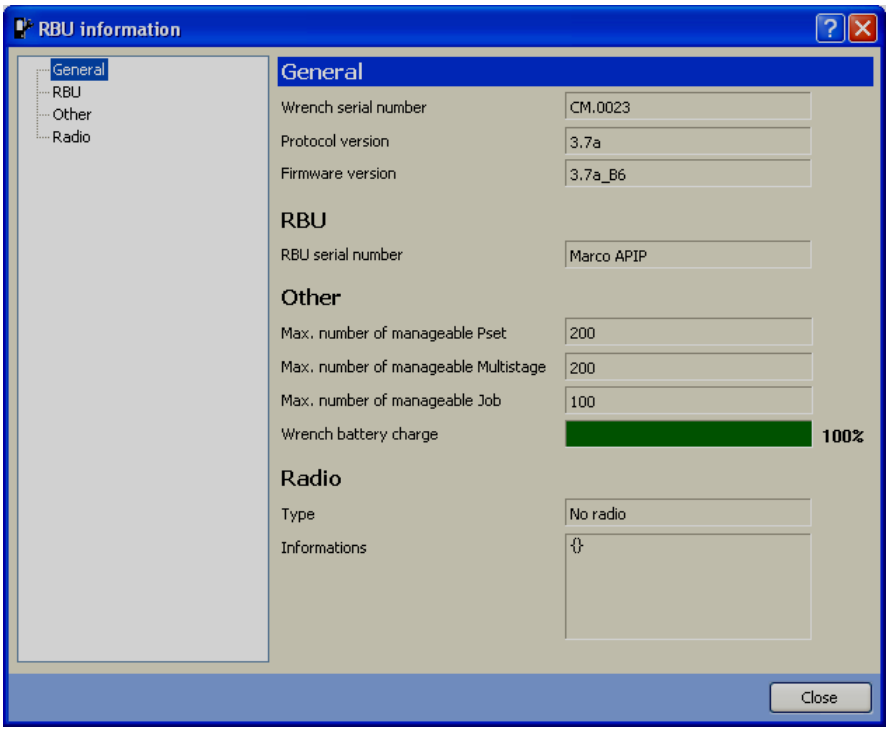
Device date format	Select between European and American format. This is applied to the date appearing on the wrench main menu.

10.2.1.19 Configuring the “results” menu on the STwrench

Results field	Select the *Controller* → *Configuration* menu in ToolsTalk BLM, and select then ***Result fields***:  Select three fields to be displayed in the ***Results*** menu of the STwrench main menu.

10.2.2 Information

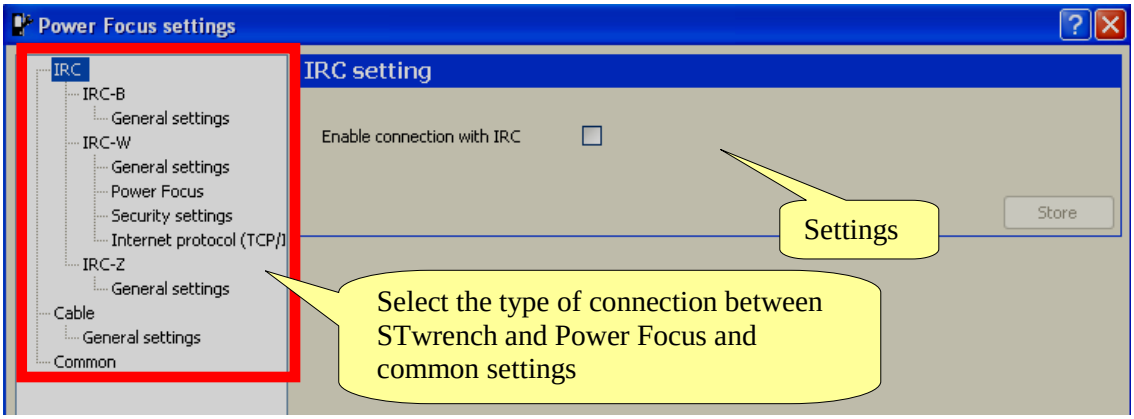
This window provides some general information, battery charge status and radio information (if a radio module is installed in the wrench):



10.2.3 ToolsNet settings

These settings are required when you have added the IRC-W module to the STwrench to communicate with ToolsNet. Set the parameters here according to your own network and your own ToolsNet station. Once all of the parameters have been set, click on ***Store***, enable the ***ToolsNet connection enabled*** flag and click on ***Store*** again. See the *Working with ToolsNet* chapter for more information.

10.2.4 Power Focus settings



If you are working with Power Focus you need to enable the connection. For connection with IRC-B and Cable Box, it is possible to enable/disable the connection from this window or from the wrench keyboard. See the chapter *Working with Power Focus*for for more information).

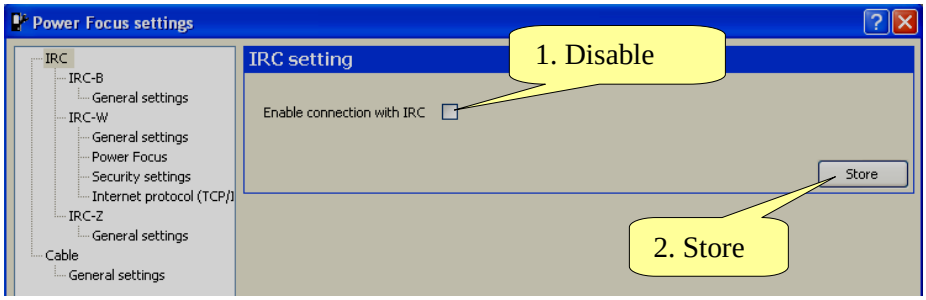
NOTE: When storing the Power Focus configuration, or when the pairing procedure is complete, the STwrench asks if the user want to reset the following parameters to the default values:

- **TAG**: Enabled
- **Vibration device**: Enabled
- **Buzzer (device sound)**: Enabled
- **smartHEAD light (device light)**: Enabled
- **Progression LEDs**: Percentages set to default values (95%, 60%, 30%)

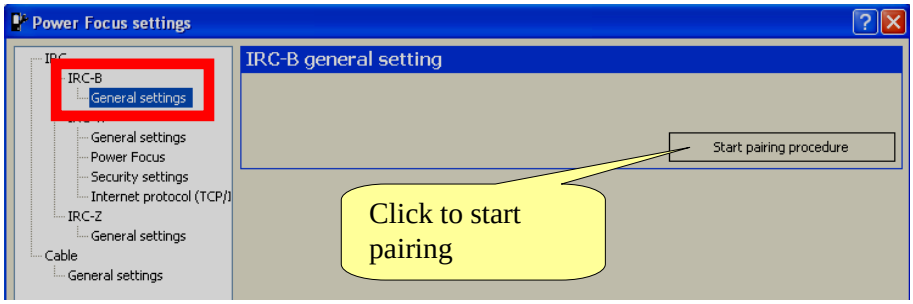
10.2.4.1 IRC-B

For IRC-B, you can also perform the pairing procedure from this window (this is an alternative form of the paring procedure performed directly from the wrench. See the chapter *Working with Power Focus* for details). Pairing is only necessary the first time.

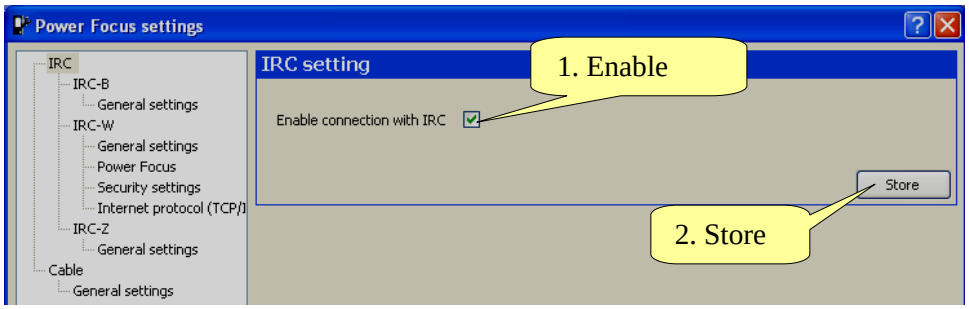
1. Disable the ***Enable connection with IRC*** flag and click on ***Store***:



2. Select submenu ***IRC-B***. Click on ***Start pairing procedure*** and then on ***Store***:



3. Start the pairing procedure on Power Focus.
4. Wait until pairing is complete (ensure that pairing is completed with no errors).
5. Click on ***Store***.
6. Enable the ***Enable connection with IRC*** flag and click on ***Store***.



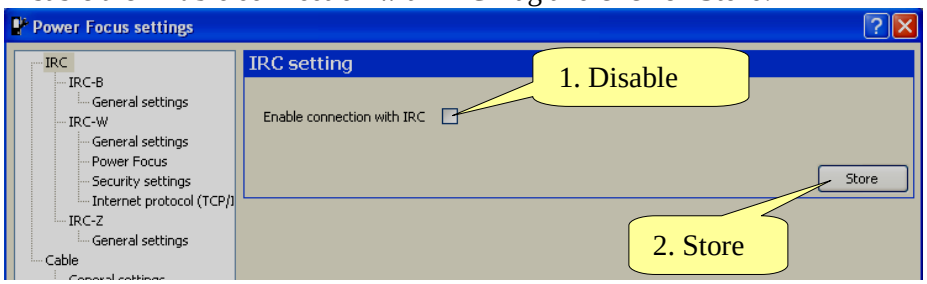
7. The wrench starts working in the Power Focus mode (see the *Working with Power Focus* chapter for details).

NOTE: By deactivating the ***Enable connection IRC*** flag, the wrench reverts to the normal working mode.

10.2.4.2 IRC-Z

For IRC-Z, the pairing procedure must be executed here (is not possible to execute it directly from the wrench). The pairing is necessary only the first time.

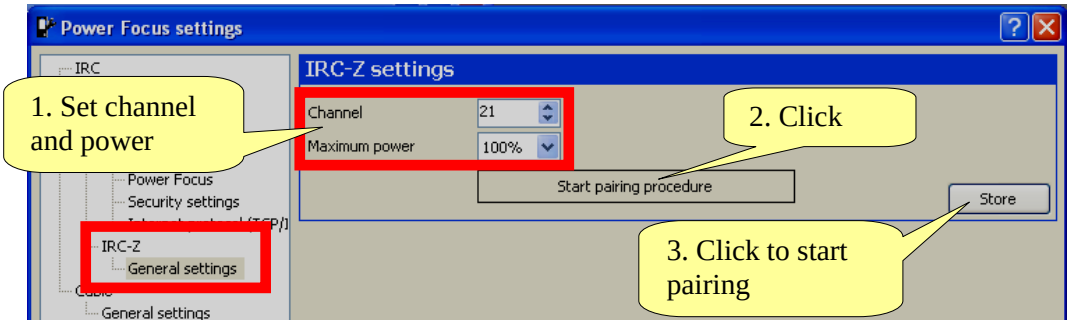
- Disable the ***Enable connection with IRC*** flag and click on ***Store***:



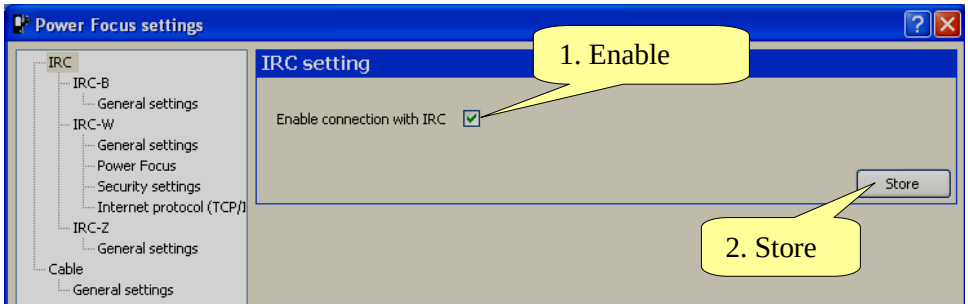
- Select submenu ***IRC-Z***.
- Set the ***Channel*** and ***Maximum power***.

  - ***Channel***: Select a channel from 11 to 26; default value is 21. The same channel must be set on Power Focus.
  - ***Maximum power***: It is possible to set a lower value than 100% of the output RF power in order to reduce the radio range. This can be helpful to reduce possible interference with other devices.

- Click on ***Start pairing procedure*** and then click on ***Store***:



- Start the pairing procedure on Power Focus.
- Wait until pairing is complete (ensure that pairing is completed with no errors).
- Enable the ***Enable connection with IRC*** flag and click on ***Store***:



- The wrench starts working in the Power Focus mode (see the *Working with Power Focus* chapter for details).

NOTE: By deactivating the ***Enable connection IRC*** flag, the wrench reverts to the normal working mode.

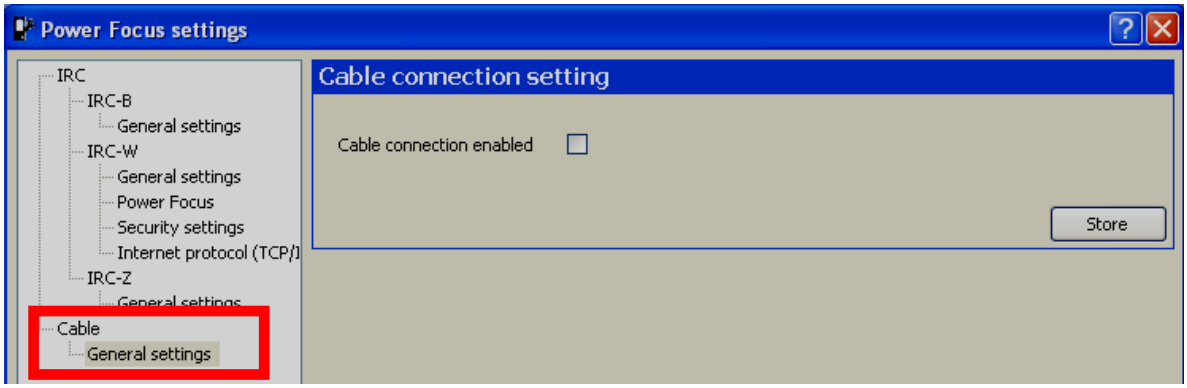
10.2.4.3 IRC-W

For IRC-W, all the network parameters must be set properly according to your specific network parameters. See the chapter *Working with Power Focus* for details.

10.2.4.4 Cable Box

The Cable Box connection between STwrench and Power Focus can be activated directly from the wrench keyboard (See the chapter *Working with Power Focus* for details).

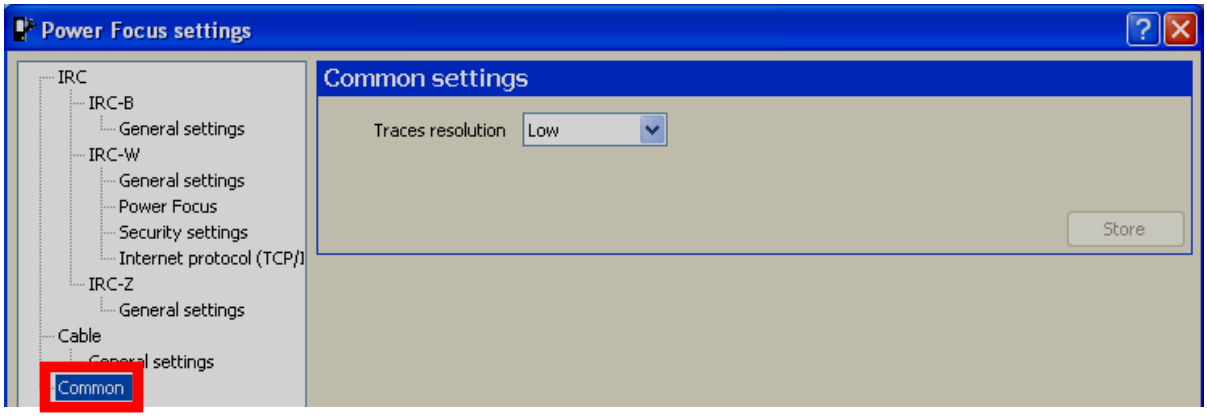
However, it is possible to enable/disable the connection from this window:



After enabling (or disabling) the Cable Box connection, click on ***Store*** to confirm.

10.2.4.5 Trace resolution

In the ***Common*** settings, it is possible to select the resolution of the trace sent to Power Focus:



Low	Default value, recommended.
High	In case the ***Low*** setting does not provide the desired accuracy in the trace displaying, setting this parameters to ***High*** multiplies by 6 the number of points in the trace. **NOTE**: Increasing the resolution of the trace slow down a little the performance; therefore, a delay time is needed to start a new tightening.

10.2.5 IRC-W API settings

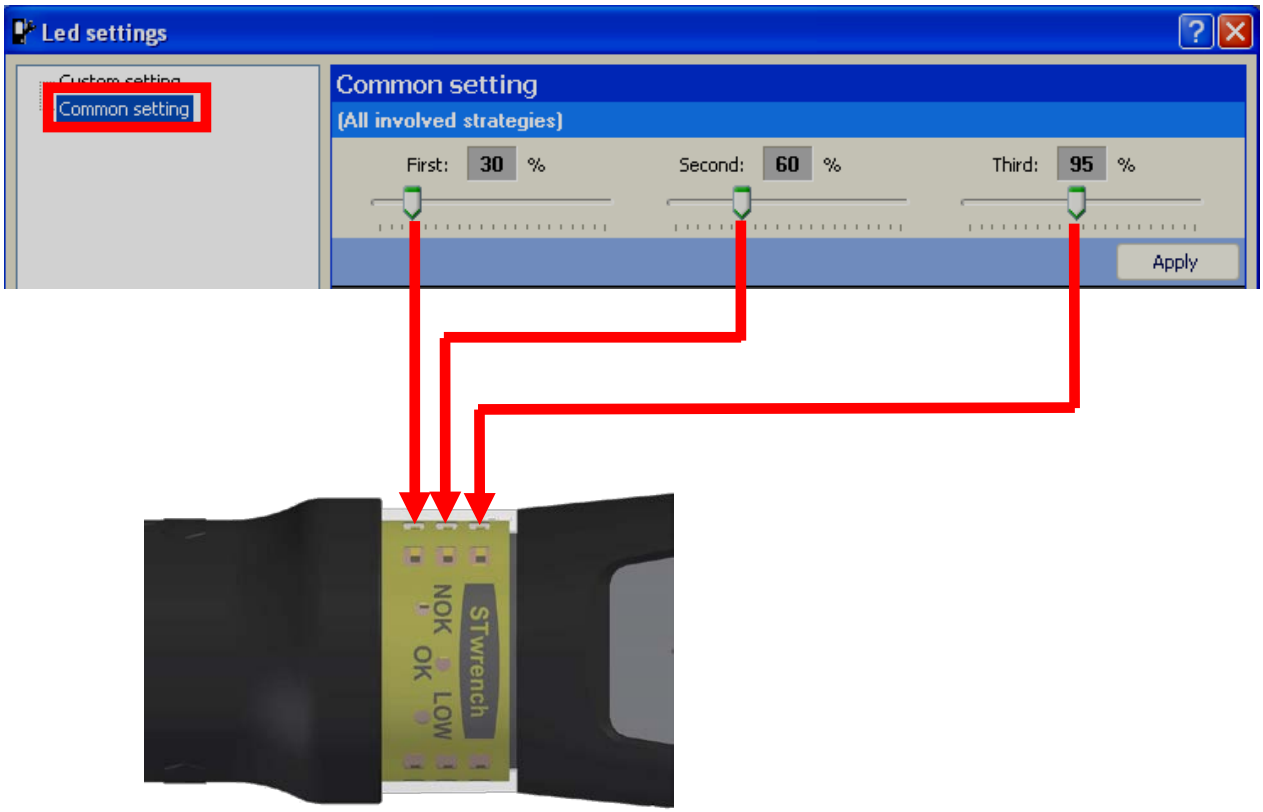
This menu permits the operator to configure the IRC-W module for connection to the API. Note that the configuration can be also done directly from the API. See the chapter *Working with the API* for details.

10.2.6 LED settings

NOTE: This paragraph is not applicable for the following Pset control strategies: residual torque, loose and retight, yield point.

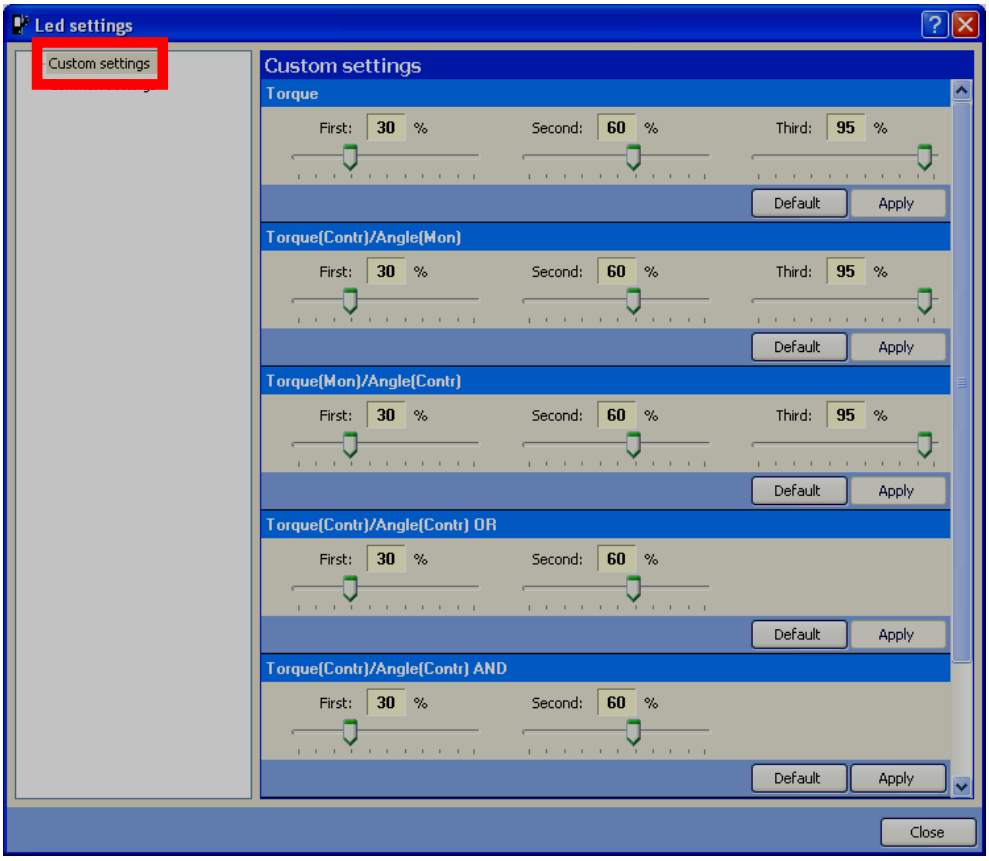
In this area, it is possible to customize the thresholds for the 3 rows of yellow LEDs; during a tightening operation (in Torque or Angle) the 3 rows of LEDs are illuminated when the torque or angle, depending on the tightening strategy, reaches certain percentages of the target value.

By setting the 3 thresholds in the ***Common settings*** window, these are applied to all the tightening strategies in which the 3 rows of LEDs are activated on the basis of these percentages (for instance, this is not applied to the Yield Point strategies, where all the LEDs are activated together when the yield point is detected):



Use the mouse, or the *LEFT* and *RIGHT* arrows on the PC keyboard, to set the values and click on ***Apply*** to save.

In the ***Custom settings*** window, it is possible to define different thresholds for the various tightening strategies:

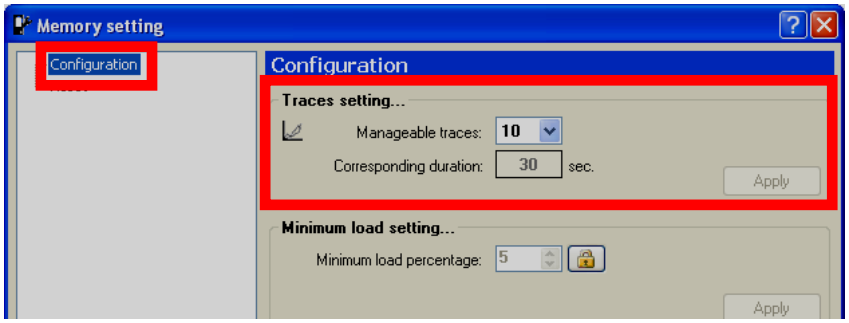


By using the mouse or the *LEFT* and *RIGHT* arrows on the PC keyboard, set the values and click on ***Apply*** to save.
For the tightening strategies *Torque(Contr)/Angle(Contr) OR*, *Torque(Contr)/Angle(Contr) AND*, *PVT compensate with snug*, the third percentage is not available (see the *Tightening Strategies* chapter for more information about the third row of LEDs activation in these strategies).

10.2.7 Memory

From this menu, it is possible to set the options for saving the tightening traces, to define the minimum load default value, and to delete the objects stored in the wrench RBU and memory.

10.2.7.1 Traces settings



In the ***Configuration →Traces settings*** menu, you can customize the number and size of the tightening traces saved in the wrench memory. By decreasing the number of manageable traces, the maximum length of each trace (***Corresponding duration***) increases. These are the available options:

Number or Traces	Maximum length of each trace (second)	Notes
90	30	*
10	30	Default setting
5	60	
3	90	**
2	150	**
1	300	**

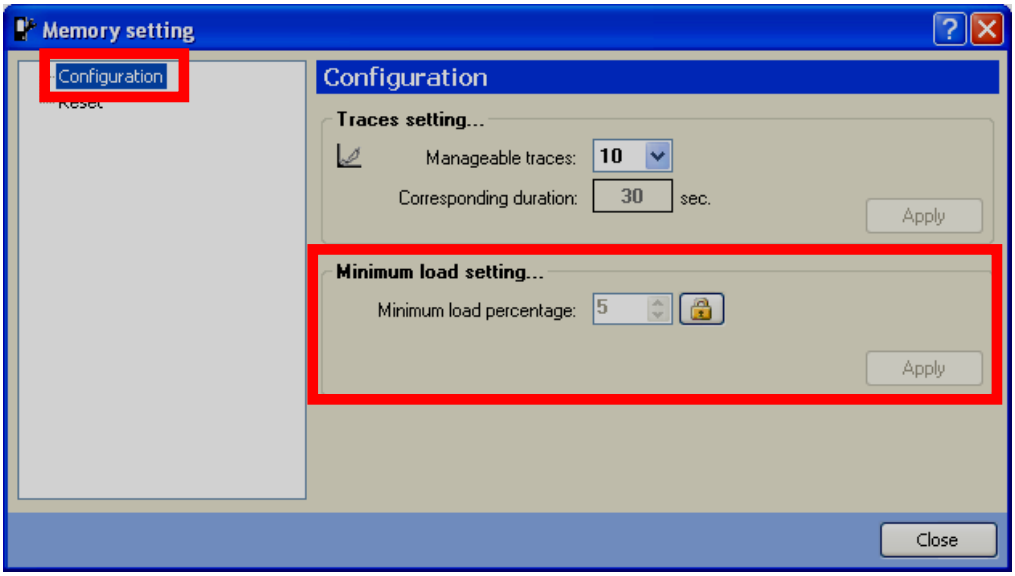
* With this option the traces are sampled at 100 Hz instead of 1 kHz. If working with Torque Supervisor, before setting the number of traces to 90 save to Torque Supervisor all the results and traces, and delete all the RBU objects; see the chapter *Deleting RBU objects* for more information.

** Do not use this option when STwrench is sending traces to Power Focus or ToolsNet.

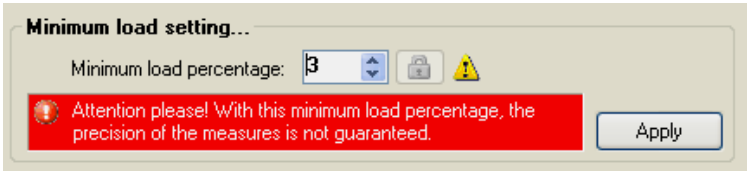
NOTE: When decreasing the number of traces manageable, any traces stored in the wrench memory are deleted.

Click on ***Apply*** to store the setting.

10.2.7.2 Minimum load settings



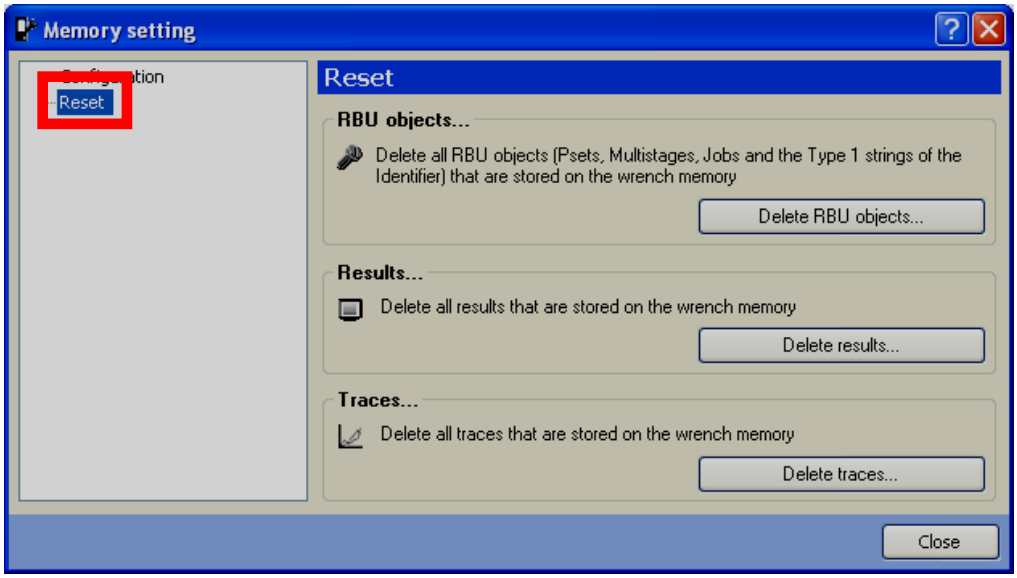
In the ***Configuration → Minimum load setting*** menu, it is possible to decrease the default value for the minimum load of the smartHEAD connected to the wrench. The default 5% value is strongly recommended, and should be changed only for special applications requiring a lower value (with special smartHEAD calibrated properly).
This setting is password-protected. Contact Atlas Copco BLM personnel for more information.
Click on the icon  and enter the password to edit the value.



A warning message alerts the user that the instrument precision indicated in the technical specifications is not guaranteed. Click on ***Apply*** to store the setting, then disconnect and connect again ToolsTalk BLM to the STwrench see the change effective in the ToolsTalk BLM Pset programming window.

10.2.7.3 Deleting RBU objects

In the ***Configuration*** → ***Reset*** menu, it is possible to delete objects from the wrench memory:

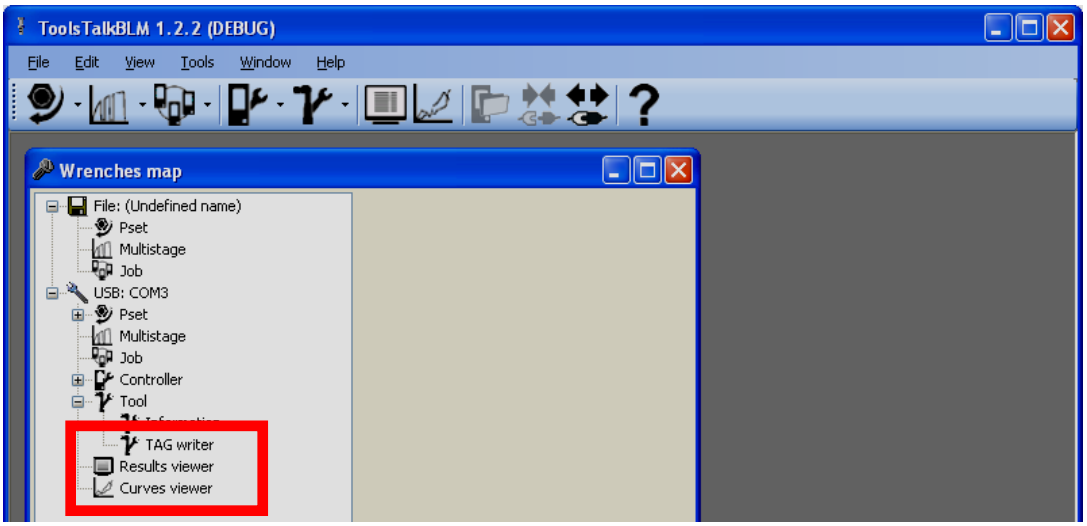


Delete RBU objects	Deletes all the Psets/Multistages/Jobs (and Type 1 strings of the identifiers) from the RBU. **NOTE**: If the tightening programs are not saved in a .ttb file, performing this operation will delete all the objects with no chance to restore them later on.
Delete results	Erases all of the results stored in the wrench memory.
Delete Traces	Erases all of the traces stored in the wrench memory.

10.3 Tool Setup

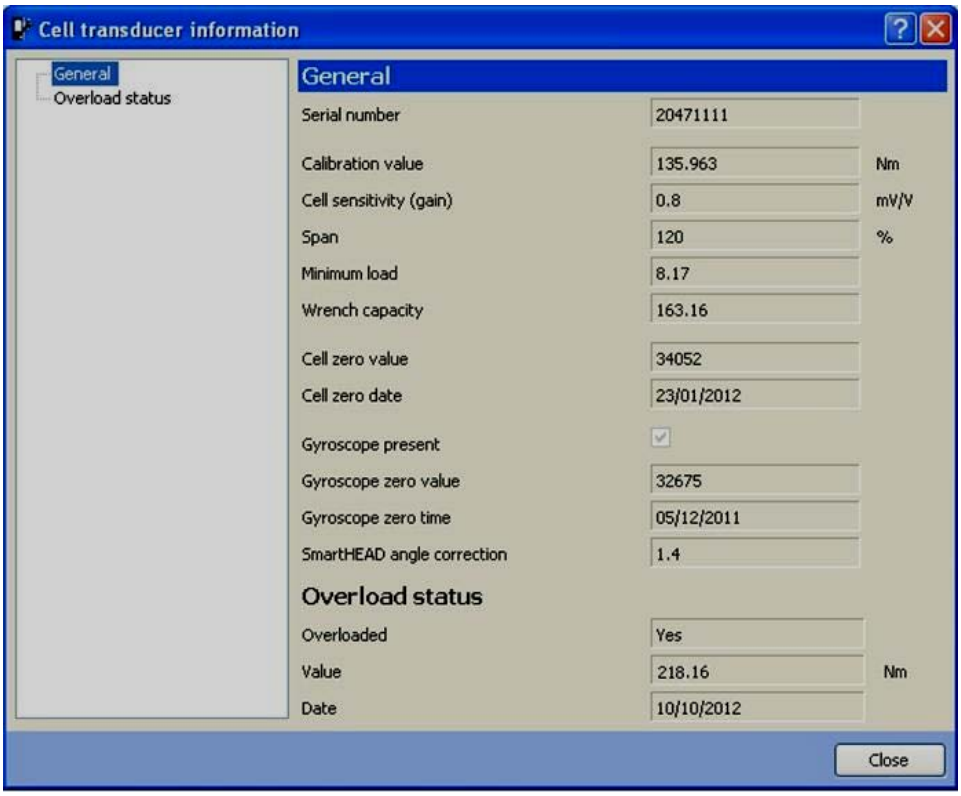


In the ***Tool*** section of the Wrench Map, you can access smartHEAD information and TAG number programming:



10.3.1 Information

This window provides some information about the smartHEAD currently on the STwrench:



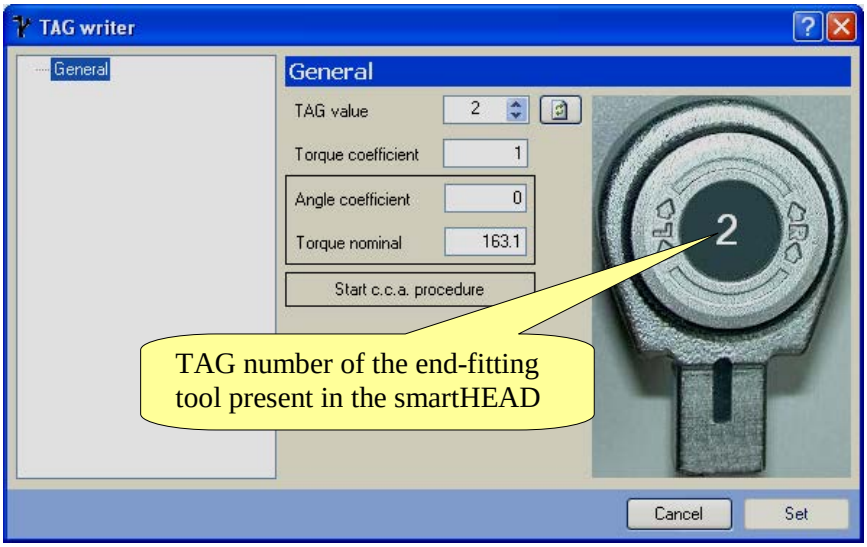
Serial number	Serial number of the STwrench smartHEAD.
Calibration value	Calibration value of the smartHEAD currently installed on the wrench.
Cell sensitivity (gain)	Transducer gain (set to 2, or 0.8, or 0.59).
Span	Value set by factory to 100%, or 120%, or 150%, or 200%. This value, multiplied by the *Calibration value*, gives the *Wrench capacity.*
Min. Load	Minimum torque value readable from the smartHEAD installed on the STwrench.

Wrench capacity	Maximum torque value applicable. This is normally slightly higher than the nominal capacity marked on the smartHEAD.
Cell zero value	Zero factory value for the torque transducer; if the current zero value performed every time the wrench is switched on varies by more than 2% of this value, an error message is shown on the wrench display.
Cell zero date	Last calibration date of the smartHEAD.
Gyroscope present	This flag is automatically enabled if the current smartHEAD plugged into the controller has the gyroscope installed. If yes, the next two fields are also shown.
Gyroscope zero value	Zero factory value for the gyroscope (inside smartHEAD); if the current zero value performed every time the wrench is switched on varies by more than 0.5% of this value, an error message is shown on the wrench display.
Gyroscope zero time	Last calibration date of the gyroscope.
smartHEAD angle correction	Angle correction coefficient for the smartHEAD. Note that this coefficient is related on the torsion of the smartHEAD itself. When a wrench extension is used, its angle correction coefficient must be calculate and added to the end fitting tool or Pset parameters.
Overloaded, ***value*** and ***date***	In case the smartHEAD has been overloaded, the related information is shown here. In case of multiple overloads, the highest one is recorded.

10.3.2 TAG writer

The STwrench features the TAG reading/writing function to aid recognition of the end-fitting tool. Reading the TAG number can be used to automatically select the Pset/Multistage to be executed (see the *Setting the source for Pset/Multistage/Job selection* chapter), or to check that the proper end-fitting tool is used during Pset/Multistage execution.

From this window you can write the TAG number of the end-fitting tool currently mounted on the smartHEAD:



10.3.2.1 Reading the TAG number

When this window is opened, the TAG number connected to the wrench is read and its number is displayed in the figure. The refresh button takes the reading again.

10.3.2.2 Writing the TAG number

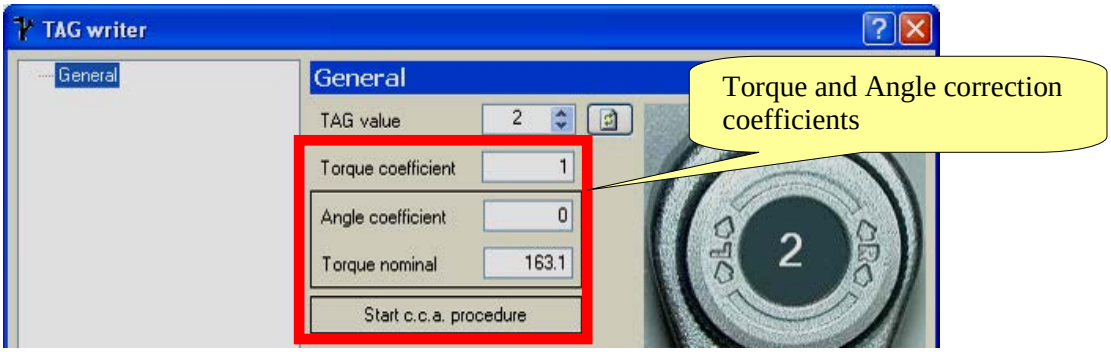
To write a new value in the TAG, simply edit the ***TAG value*** field and click on ***Set***.

10.3.2.3 Torque and Angle correction coefficients

Two coefficients to correct the torque and angle reading can be stored on the end-fitting tool. These coefficients are used to correct the torque and angle measure when an extension is used on the STwrench. The torque correction coefficient is used also to compensate the torque measurement when a torque multiplier is used on the STwrench.

WARNING: Starting from firmware version 3.1, the *Torque Correction Coefficient* is given to two decimal places. The end-fitting tools programmed with the STwrench using firmware 3.1x or later cannot be used on STwrenches with firmware 3.0x or before (however, they will work if re-programmed with firmware version 3.0x or before).

NOTE: These coefficients are not considered in the Free Mode.
Neither are they considered if the tool recognition function on the STwrench is disabled.





When using an extension, the black end-fitting tool should be welded to the extension in order to maintain the automatic tool recognition and correction coefficients utilization.

If these two coefficients are already known, simply write them in this window and click on ***Set*** to store them in the RFID TAG of the end-fitting tool plugged into the smartHEAD. The ***Angle coefficient*** is referred to a ***Torque nominal***, which must be specified together with the coefficient. The ***Torque Nominal*** is the torque value at which the bending angle has been measured.
If these two coefficients are not already known, see the chapter *Appendix A – Calculating Torque and Angle Correction Coefficients* for a detailed description on how to calculate them.

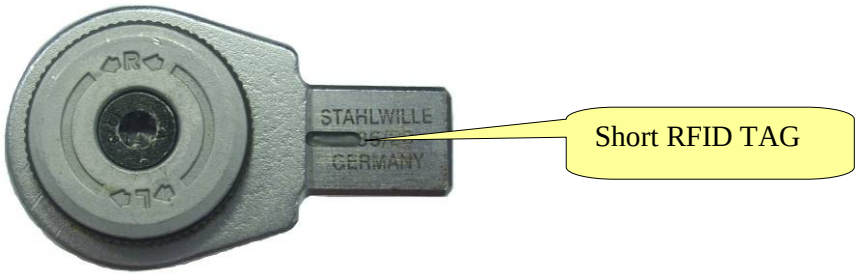
NOTE: It is also possible to define these coefficients in the Pset parameters (see the Pset *Options*) instead of writing them in the end-fitting tool TAG. This can be used when you use an extension without the black end-fitting tool.

In general, when defining the coefficients in the Pset parameters, leave the ***Torque Correction Coefficient*** set to 1, and the ***Angle Correction Coefficient*** set to 0, in the RFID TAG of the end-fitting tool; if different values are specified, the STwrench corrects torque and angle reading considering all of them (the two torque correction coefficients are multiplied, while the two angle correction coefficients are added together).

Warning: The torque correction coefficient alters the STwrench torque measurement; a wrong value of this coefficient may cause an improper torque reading, leading to the risk of executing a tightening at a different target torque compared to what is expected. Ensure the proper value is calculated when a wrench extension is used. For end-fitting tools used without wrench extensions, the torque correction coefficient must be left set to 1.

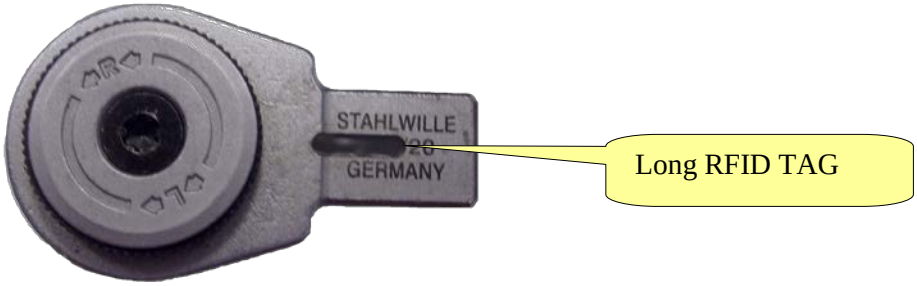
10.3.2.4 Compatibility between different end-fitting tools

Only the following type of end-fitting tool is supported by the STwrench:



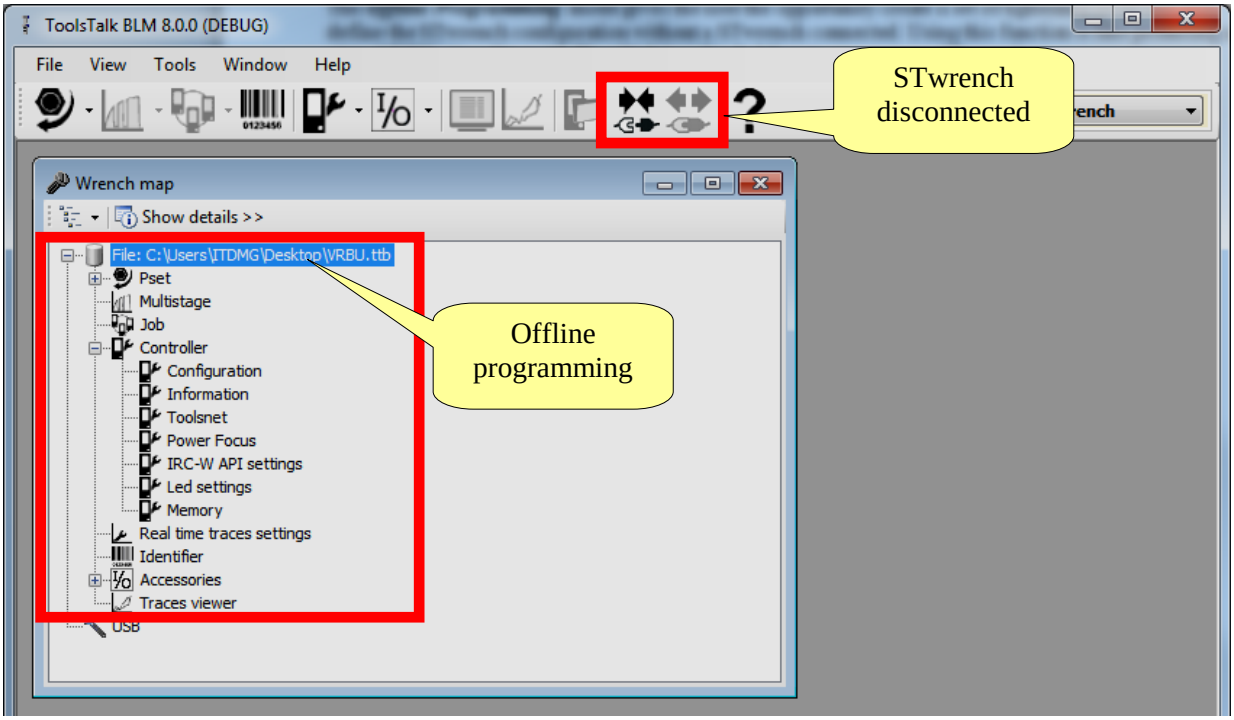
NOTE: If this tool is already used by the LINEwrench, it will not be read by the STwrench. However, once it has been written with the TAG writer function, it can be read and used by the STwrench; when this is done the tool will no longer work with the LINEwrench.

It is not possible to use old end-fitting tools designed for the LINEwrench:



11 Offline Programming

The ***Offline Programming*** mode gives the user the opportunity create a set of tightening programs and define the STwrench configuration without a STwrench connected. Using this function is like producing a virtual RBU, stored in a ***.ttb*** file which is transfer then to one or more STwrenches (with same RBU type and same firmware version).



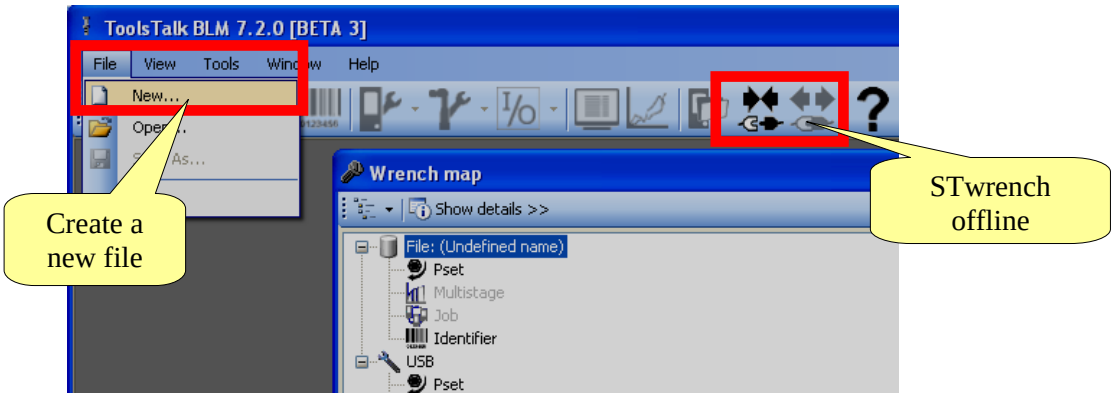
The offline file can be created from scratch (in that case only tightening programs can be created) or from a STwrench (in that case also the STwrench configuration can be programmed offline)

The following items can be programmed offline:

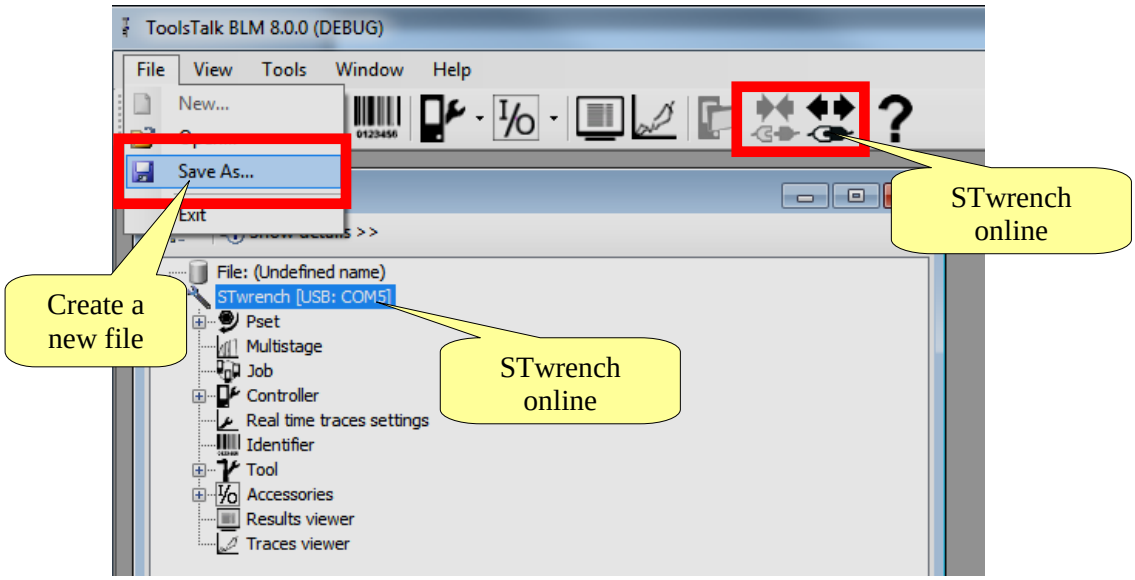
- ***Pset, Multistage and Job***: Always available
- ***Controller setup***: Available only if the file was created from a real STwrench connected
- ***Identifiers setup***: Available only if the file was created from a real STwrench connected
- ***QAT Node Setup***: Available only if the file was created from a real STwrench connected

11.1 Creating the Offline File

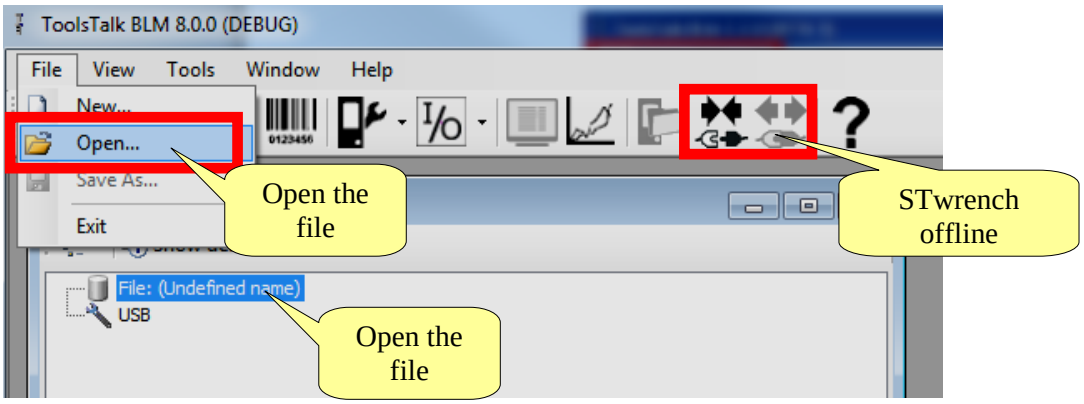
To create a file from scratch, open ToolsTalk BLM, click on ***File*** and then select ***File*** → ***New*** (or double-click on ***File***):



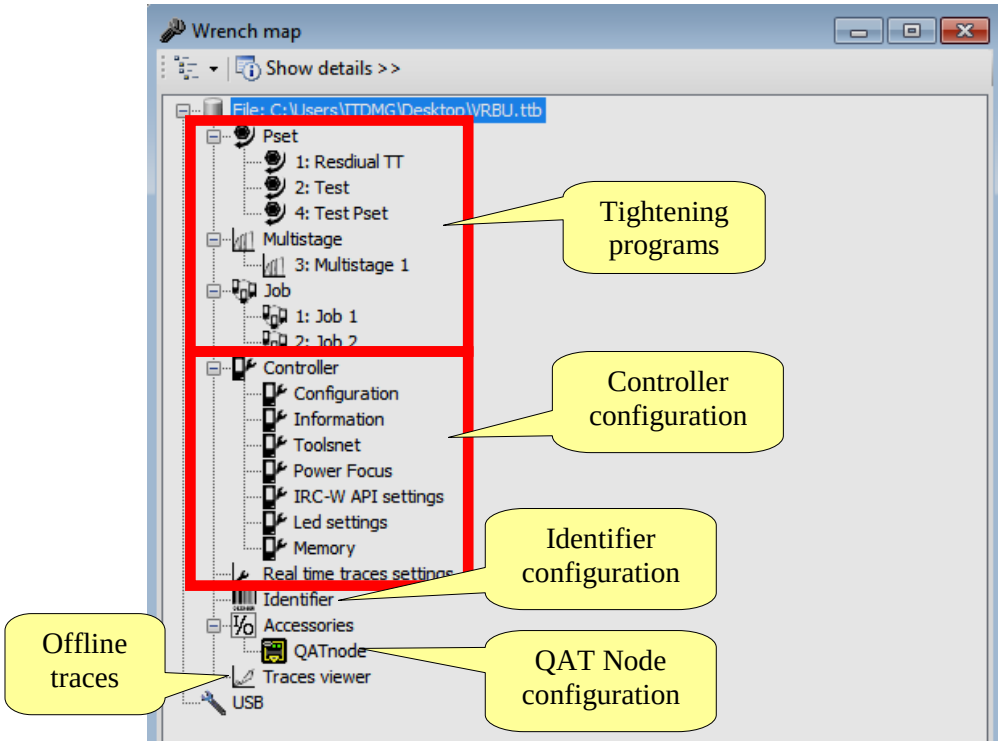
Creating a file from a STwrench gives the full functionality of the offline programming. Connect a STwrench to ToolsTalk BLM, and select ***Save As…***:



Once the file is created, disconnect the STwrench and select ***File*** → ***Open*** (or double-click on ***File***):



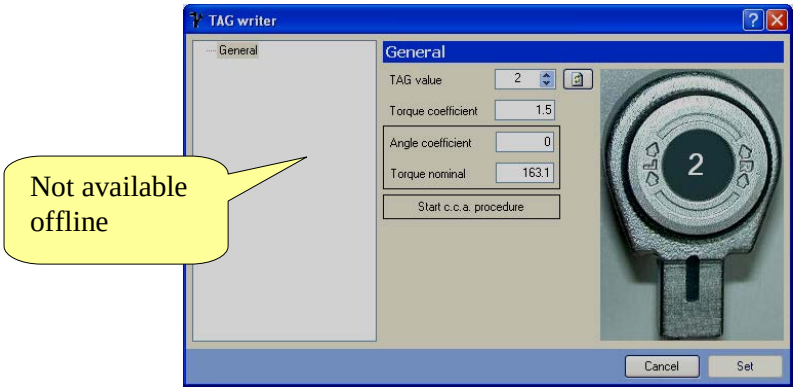
When the file is opened, it is possible to start programming the tightening programs and wrench configuration:



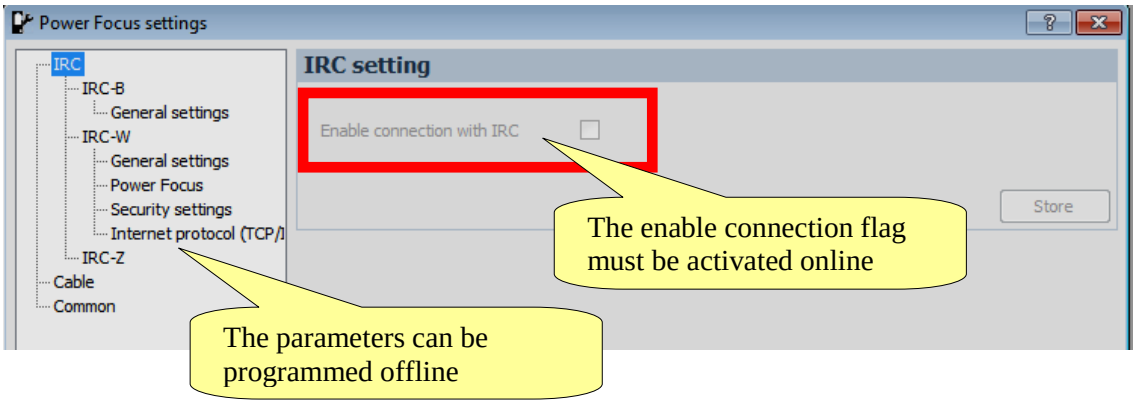
For programming the tightening programs and other STwrench configuration, see the specific chapters of this user guide.

The offline programming has the following limitations:

- TAG Writer: Since this function read and program in real time the end fitting tool plugged into the STwrench smartHEAD, it is not possible to use it in the offline mode.

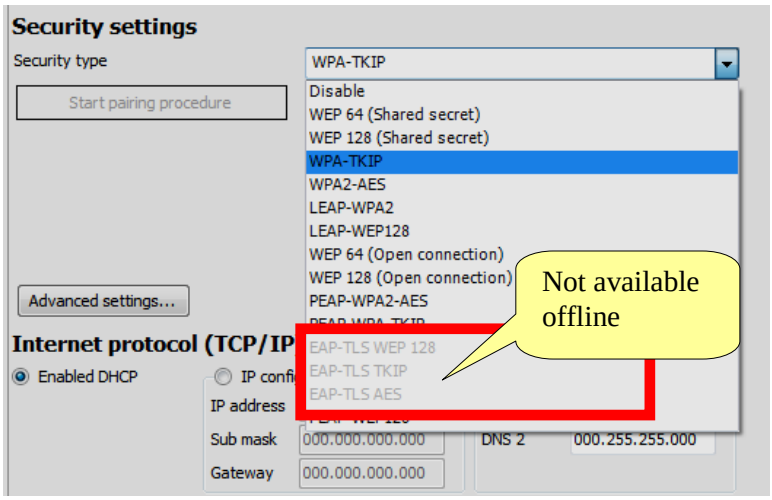


- Remote device communication: The offline mode can program the STwrench communication parameters with the remote devices (Power Focus, ToolsNet, QATnode, API). However, once the offline file is uploaded to the STwrench, the communication must be enabled with the STwrench connected (as shown in the following example for Power Focus communication):

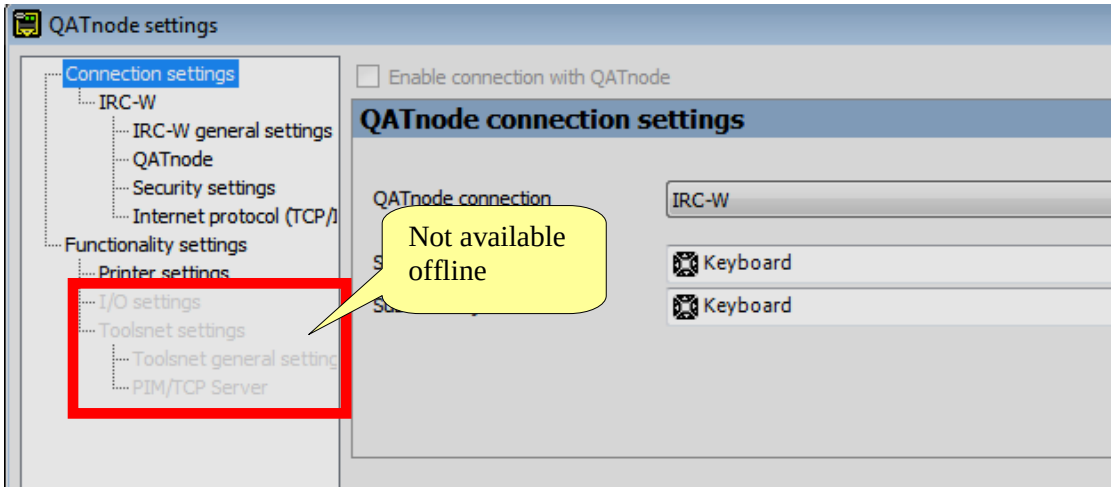


- The Power Focus pairing procedure cannot be perfomed offline.

- The IRC-W security types EAP cannot be programmed offline:



- The QATNode I/O and ToolsNet configuration is not supported offline:



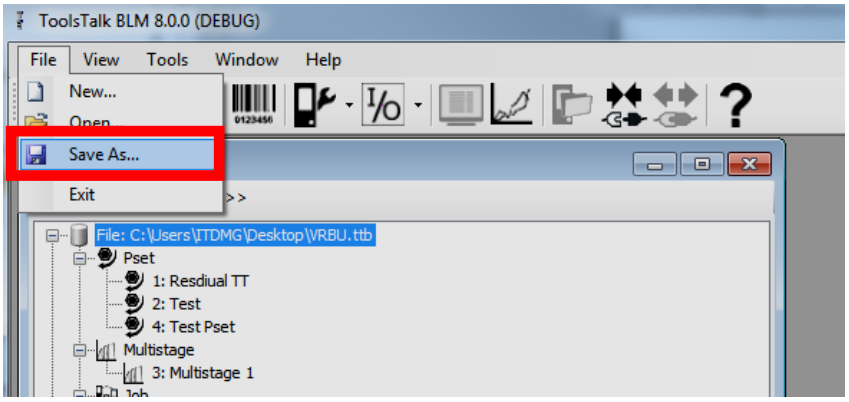
- The .ttb file created with ToolsTalk BLM version 8.0 or later cannot be opened by ToolsTalk BLM versions before 8.0.

11.2 Uploading the Offline File to the STwrench

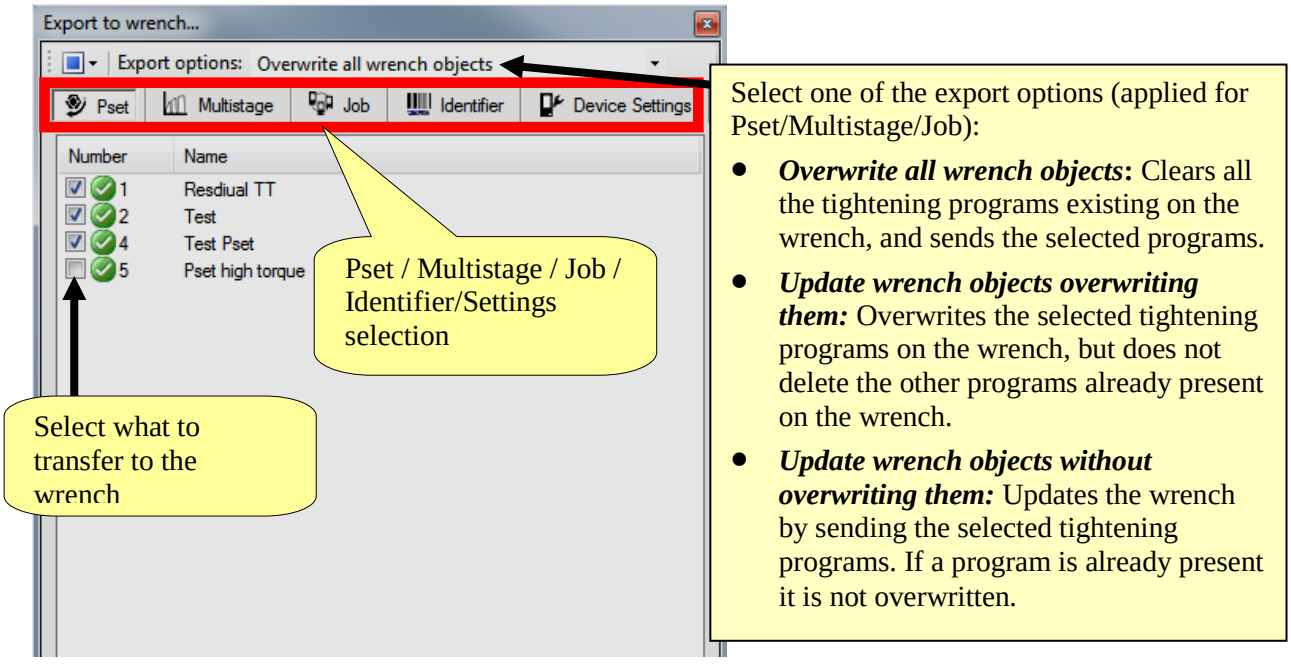
Once the offline .ttb file is created, it is possible to transfer it on one or more STwrenches.

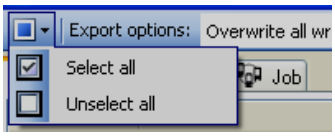
Switch on the STwrench and connect to ToolsTalk BLM.

Select ***File → Save as*** to transfer the programs to the STwrench:



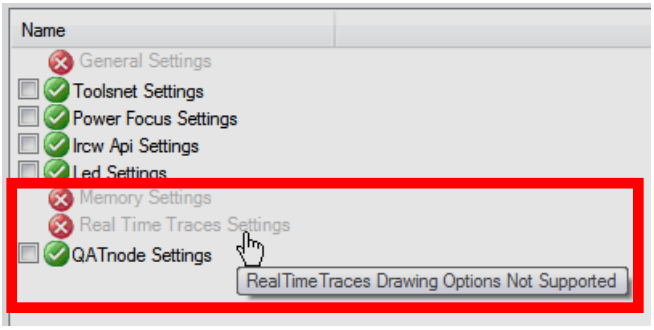
The following window is shown:





Click on the selection icon to select / deselect all items present in each folder.

If on item is not compatible with the STwrench RBU or firmware, it is marked with a red X and cannot be transferred to the STwrench:

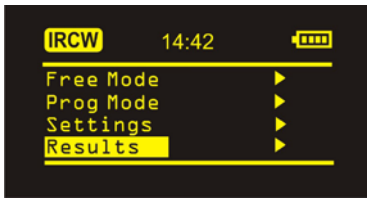


12 Results Viewer

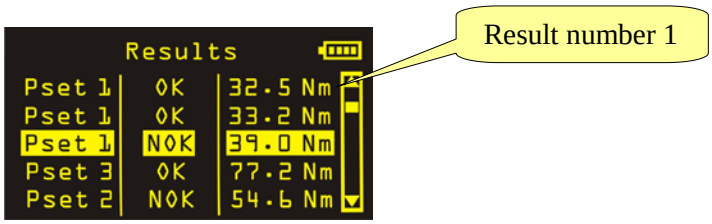
The STwrench can store up to 5000 Pset results; when the memory is full, new results overwrite the oldest results stored.

The results can be viewed in details by ToolsTalk BLM.

It is possible to view them also from the ***Results*** menu from the main menu of the STwrench:



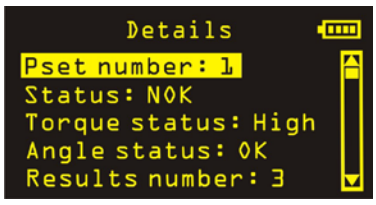
The following window is shown:



The results are ordered from the newest to the oldest. Therefore, the first result shown at the top of the page is the last tightening executed.

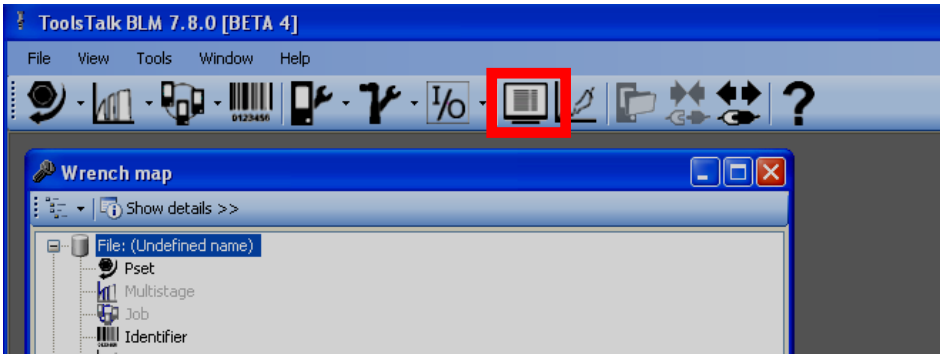
The selection of three fields shown can be customized by ToolsTalk BLM in the *Configuring the "results" menu on the STwrench* menu. The results shown here are all of the results stored in the STwrench memory, regardless of the RBU type installed; even the results from tests executed with a different RBU are shown here.

Select one of the results shown in the list and press the ***OK*** button to see more information:

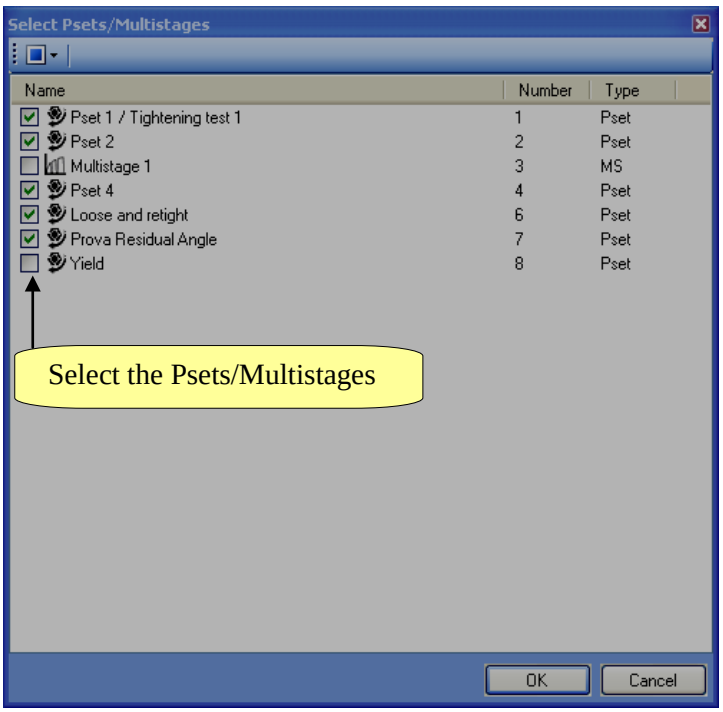


If some of the fields are not applicable, they are marked with "—". Press the ***CL*** button to exit this window.

To retrieve the results with ToolsTalk BLM, click on the ***Results viewer*** icon:

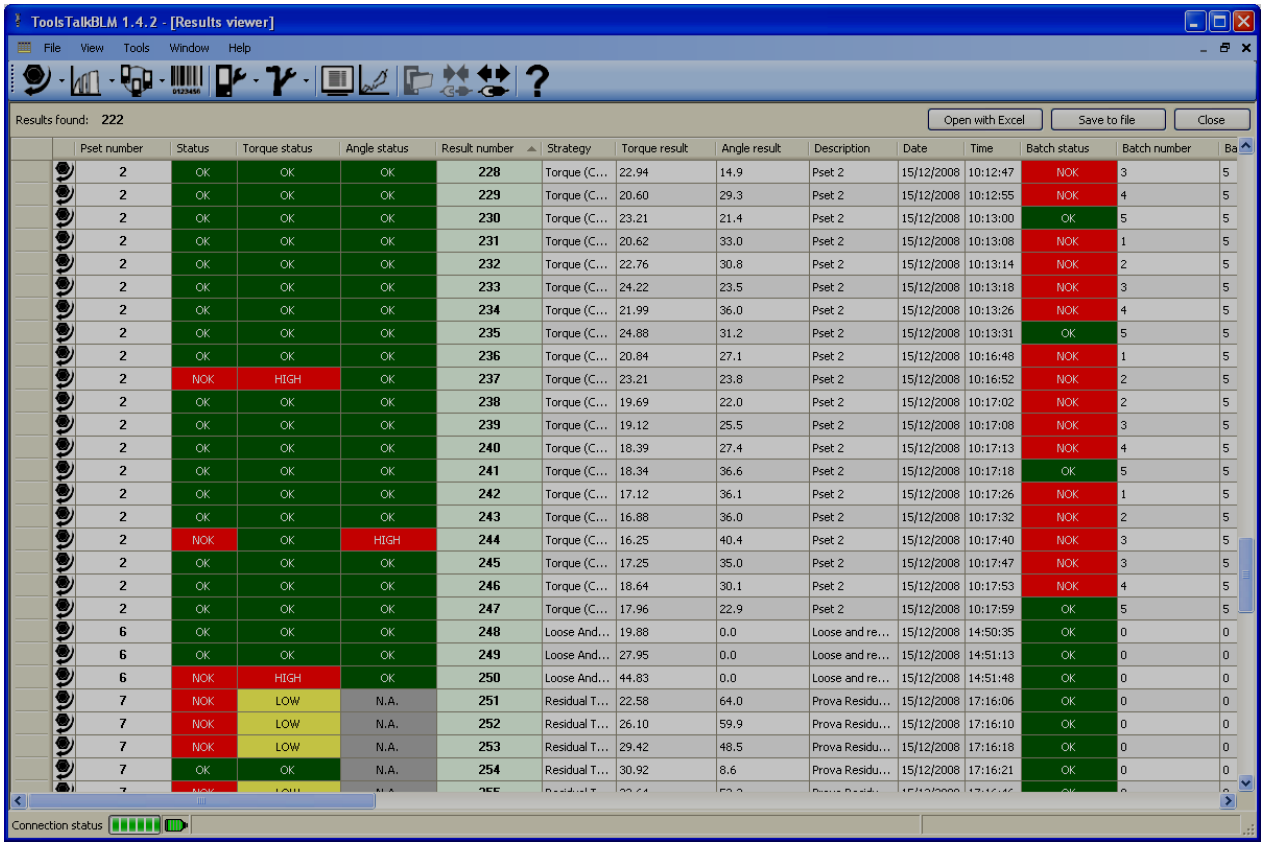


The following window is shown:



The result viewer provides results from Pset and Multistage only, and not Job results. All Job results are grouped with the single Psets/Multistages making up the Job.
If a certain Pset/Multistage has changed its name after having executed at least one tightening, the old and new names are both shown in description. In the example of the figure above, Pset number 1 was called “Pset 1”, and then renamed as “Tightening test 1”.

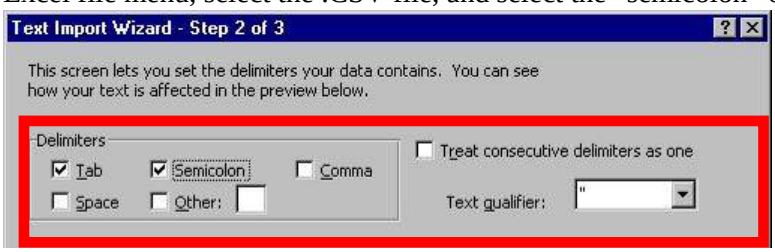
Select the Pset (or Multistage) you want to review (more than one Pset/Multistage can be selected at once):



Pset number	Status	Torque status	Angle status	Result number	Strategy	Torque result	Angle result	Description	Date	Time	Batch status	Batch number	Ba
2	OK	OK	OK	228	Torque (C...	22.94	14.9	Pset 2	15/12/2008	10:12:47	NOK	3	5
2	OK	OK	OK	229	Torque (C...	20.60	29.3	Pset 2	15/12/2008	10:12:55	NOK	4	5
2	OK	OK	OK	230	Torque (C...	23.21	21.4	Pset 2	15/12/2008	10:13:00	OK	5	5
2	OK	OK	OK	231	Torque (C...	20.62	33.0	Pset 2	15/12/2008	10:13:08	NOK	1	5
2	OK	OK	OK	232	Torque (C...	22.76	30.8	Pset 2	15/12/2008	10:13:14	NOK	2	5
2	OK	OK	OK	233	Torque (C...	24.22	23.5	Pset 2	15/12/2008	10:13:18	NOK	3	5
2	OK	OK	OK	234	Torque (C...	21.99	36.0	Pset 2	15/12/2008	10:13:26	NOK	4	5
2	OK	OK	OK	235	Torque (C...	24.88	31.2	Pset 2	15/12/2008	10:13:31	OK	5	5
2	OK	OK	OK	236	Torque (C...	20.84	27.1	Pset 2	15/12/2008	10:16:48	NOK	1	5
2	NOK	HIGH	OK	237	Torque (C...	23.21	23.8	Pset 2	15/12/2008	10:16:52	NOK	2	5
2	OK	OK	OK	238	Torque (C...	19.69	22.0	Pset 2	15/12/2008	10:17:02	NOK	2	5
2	OK	OK	OK	239	Torque (C...	19.12	25.5	Pset 2	15/12/2008	10:17:08	NOK	3	5
2	OK	OK	OK	240	Torque (C...	18.39	27.4	Pset 2	15/12/2008	10:17:13	NOK	4	5
2	OK	OK	OK	241	Torque (C...	18.34	36.6	Pset 2	15/12/2008	10:17:18	OK	5	5
2	OK	OK	OK	242	Torque (C...	17.12	36.1	Pset 2	15/12/2008	10:17:26	NOK	1	5
2	OK	OK	OK	243	Torque (C...	16.88	36.0	Pset 2	15/12/2008	10:17:32	NOK	2	5
2	NOK	OK	HIGH	244	Torque (C...	16.25	40.4	Pset 2	15/12/2008	10:17:40	NOK	3	5
2	OK	OK	OK	245	Torque (C...	17.25	35.0	Pset 2	15/12/2008	10:17:47	NOK	3	5
2	OK	OK	OK	246	Torque (C...	18.64	30.1	Pset 2	15/12/2008	10:17:53	NOK	4	5
2	OK	OK	OK	247	Torque (C...	17.96	22.9	Pset 2	15/12/2008	10:17:59	OK	5	5
6	OK	OK	OK	248	Loose And...	19.88	0.0	Loose and re...	15/12/2008	14:50:35	OK	0	0
6	OK	OK	OK	249	Loose And...	27.95	0.0	Loose and re...	15/12/2008	14:51:13	OK	0	0
6	NOK	HIGH	OK	250	Loose And...	44.83	0.0	Loose and re...	15/12/2008	14:51:48	OK	0	0
7	NOK	LOW	N.A.	251	Residual T...	22.58	64.0	Prova Residu...	15/12/2008	17:16:06	OK	0	0
7	NOK	LOW	N.A.	252	Residual T...	26.10	59.9	Prova Residu...	15/12/2008	17:16:10	OK	0	0
7	NOK	LOW	N.A.	253	Residual T...	29.42	48.5	Prova Residu...	15/12/2008	17:16:18	OK	0	0
7	OK	OK	N.A.	254	Residual T...	30.92	8.6	Prova Residu...	15/12/2008	17:16:21	OK	0	0

Click on a column to sort the results according to the column field.
Using the command ***Open with Excel*** and ***Save to File*** you can open this table with Excel and save the results in an Excel (.xls) file, or in a .csv file, or in a .XML file.

NOTE: The ***.CSV*** file is formatted with the semicolon (;) as a field separator.
If the .CSV file does not open automatically in Excel, select *Data → Import Data* from the Excel file menu, select the .CSV file, and select the "semicolon" option in the import wizard:



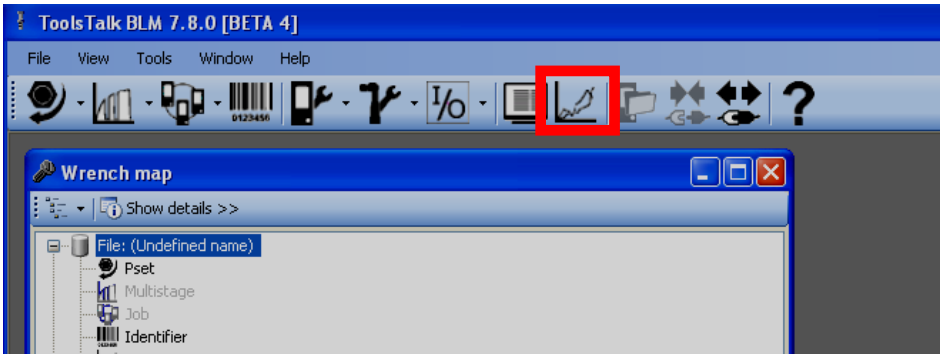
All of the information related to the tightening operation is displayed in the various columns.

Pset number	Pset number.
Status	This is the global status of the tightening operation. It is OK when both the Torque Status and Angle Status are OK.
Torque Status / Angle Status	These fields indicate the result for the torque and angle. If the result is not within the given limits, the field is colored yellow and marked with ***LOW*** or colored in red and marked with ***HIGH***, according to the result status. If the angle is not included in the control strategies, the angle status is colored in grey and marked as N.A. (not applicable).
Result number	Progressive number automatically assigned by the wrench to every tightening result. Min value: 1 Max value: 5000 When 5000 results are stored in the wrench memory, the new results overwrite the oldest starting from result number 1.
Torque result and ***Angle result***	Torque and angle values measured by the wrench. They are measured according with the tightening strategy selected. In case of "overspeed" during the tightening operation, the *Angle result* is set to 9999, and the *Torque result* is the peak value, regardless of the tightening strategy.
Date / Time	Fields indicating the date and time of the tightening operation. Date and time are taken from the date and time set on the STwrench.
Batch status	If the batch size is left to zero, the *Batch status* is always OK. If the batch size is set to one or more, the *Batch status* is OK when all the Psets/Multistages of the batch are OK.
Batch number	Batch number of the Pset/Multistage (from 1 to the *Batch size*).
Batch size	Batch size defined in the Pset definition.
Unit of Measurement	Unit of measurement.
Cycle start, Torque min.,	Torque and angle parameters of the Pset.

Torque target, Torque max., Start angle, Angle min., Angle target, Angle max.	
Barcode, Barcode 2, Barcode 3, Barcode 4	Barcode readings associated with the Pset/Multistage.
Transducer S/N	Serial number of the smartHEAD which executed the tightening.
Max coherent NOK	Maximum value of Not OK result defined for the Pset/Multistage.

13 Traces Viewer

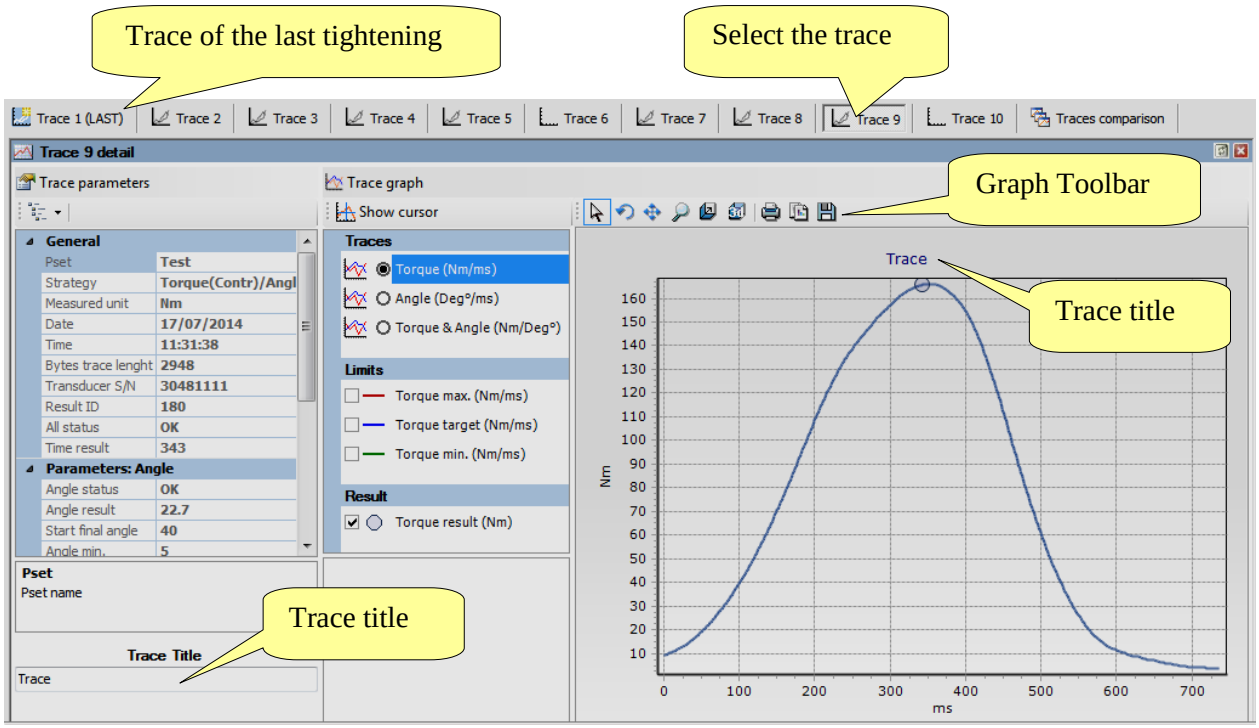
Click on the traces viewer icon to retrieve the traces from the wrench.

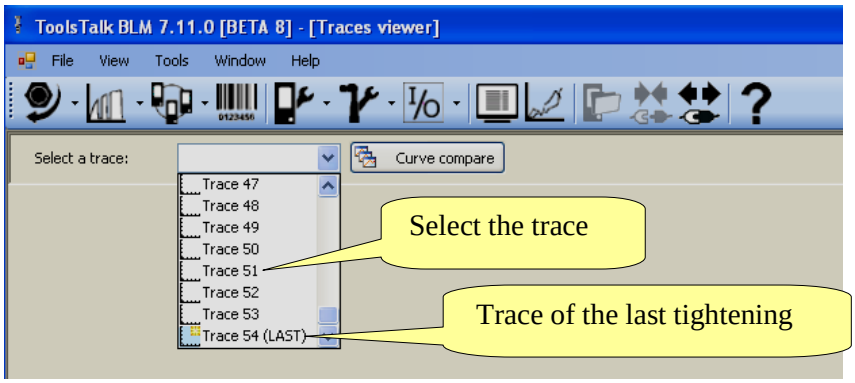


In its default setting, the STwrench can store up to 10 traces, each a maximum of 30 s in length; when the memory is full, the new traces overwrite the oldest traces stored. It is possible to change the default settings to store less traces of longer length. See the paragraph *Memory* in the chapter *STwrench Settings*.

13.1 View one Trace

Select the trace to view by clicking on the bar in the top part of the window (the second figure is applicable when the STwrench is set to store 90 traces and stores more than 10 traces):

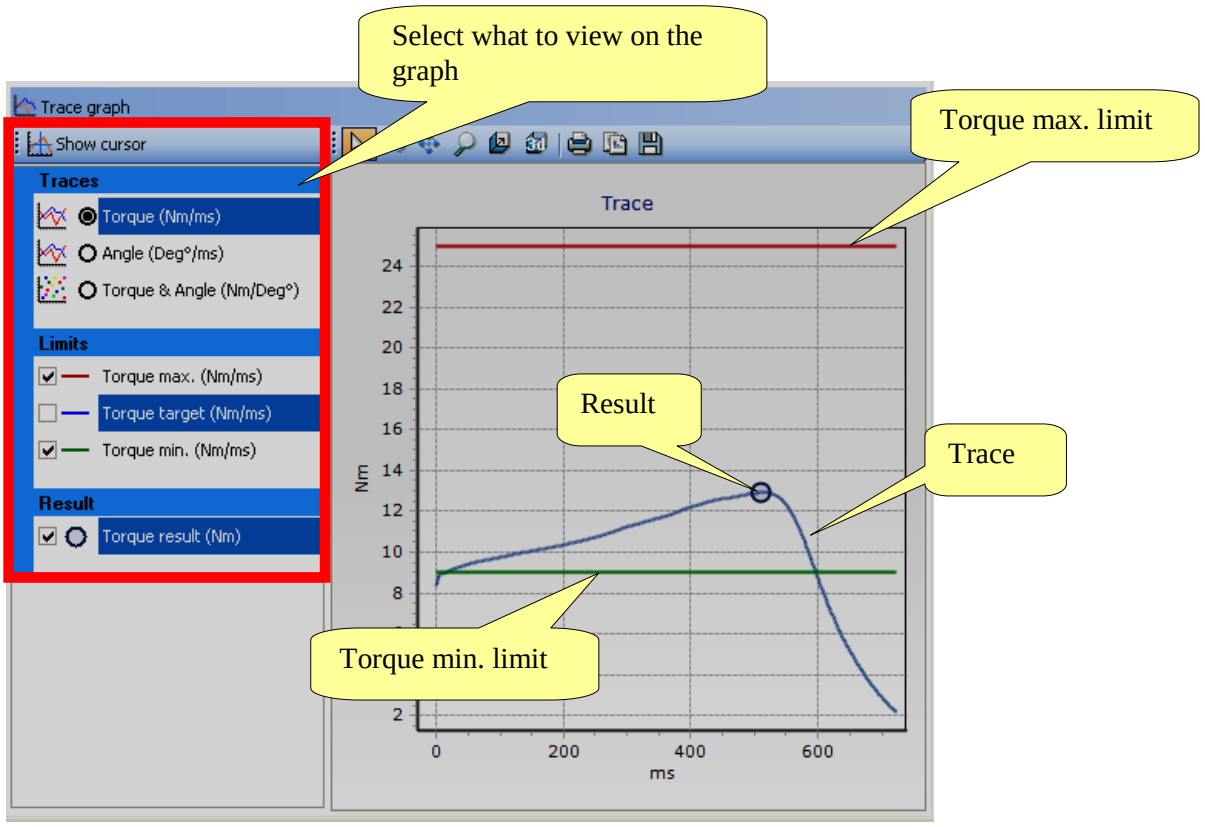




The trace related to the last tightening operation executed by the wrench is marked as ***LAST***.

In the ***trace title*** box on the left-bottom area of the window, it is possible to customize the trace title. This title is shown above the graph. It can be used to copy/print/export a trace assigning to it a specific name. Note that after quitting or refreshing the trace viewer window this information is not saved.

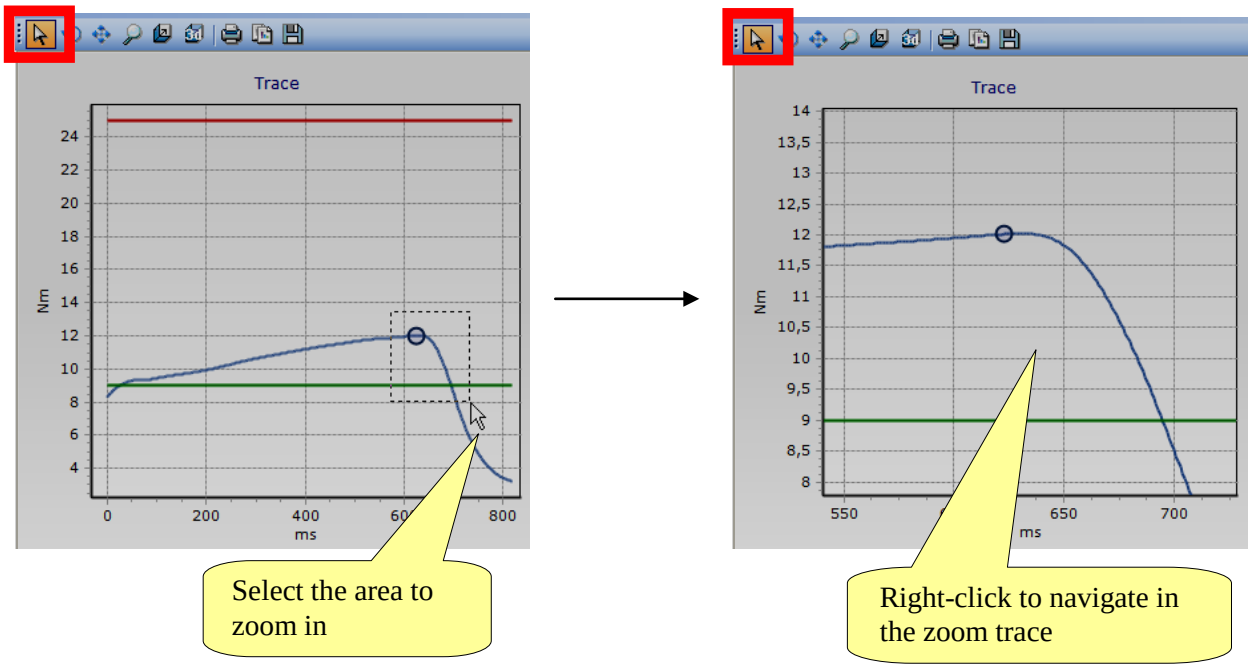
In the ***Traces***, ***Limits*** and ***Results*** areas, it is possible to select what to display on the graph:



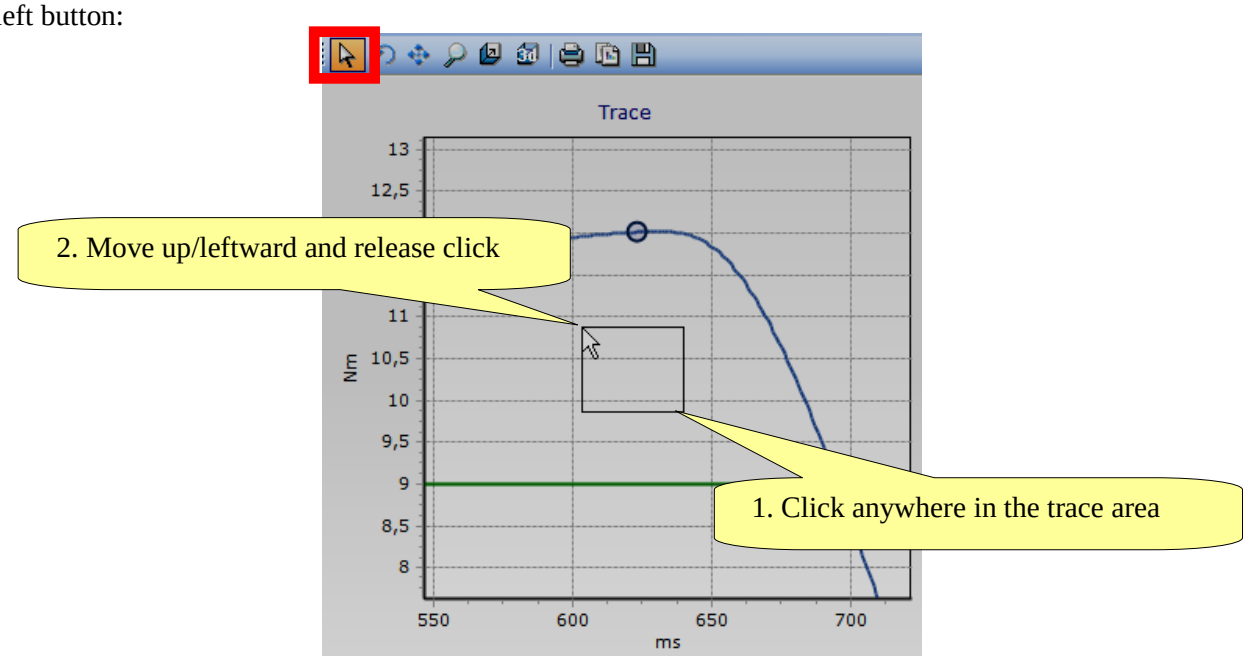
It is possible to select the Torque/Time, Angle/Time or Torque/Angle graphs.
If limits and results are enabled, they are shown in the graph; the ***Result*** indicates on the trace the point at which the result is taken. If the result is *Not OK*, it will be marked with a red X:



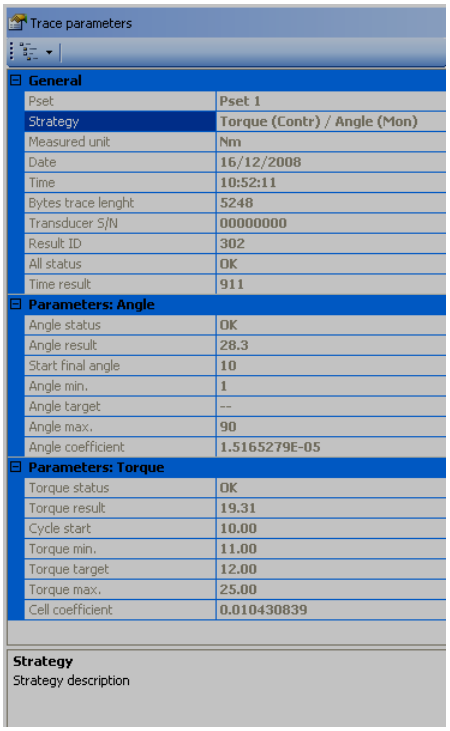
For PVT strategy, also the PVT compensate value is available in the ***Limits*** area.
To zoom in on a section of the trace, simply select the desired area with the mouse:



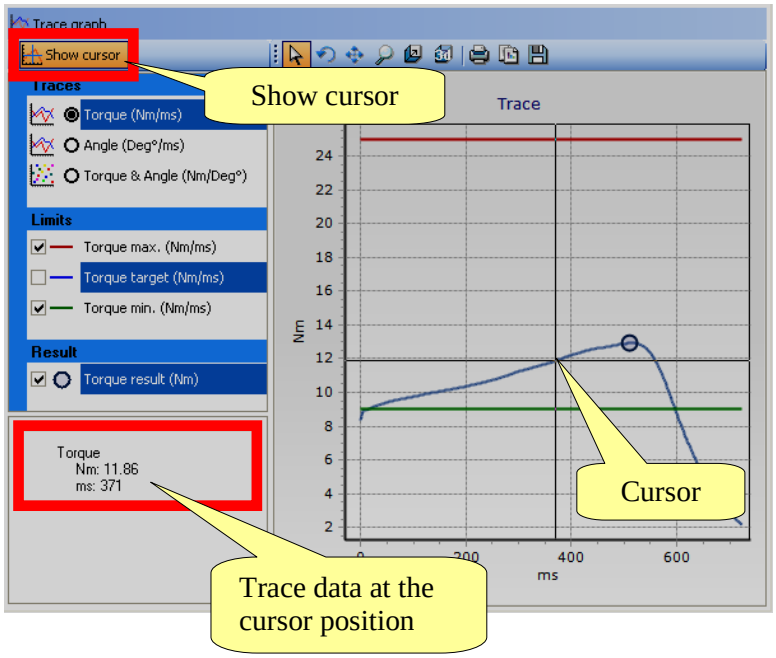
To navigate in the zoomed graph, right-click on the trace and move the mouse pointer on the graph.
To zoom out to the whole trace, left-click and hold while moving the cursor up/leftward, then release the left button:



The ***Trace parameters*** window displays detailed information about the trace:



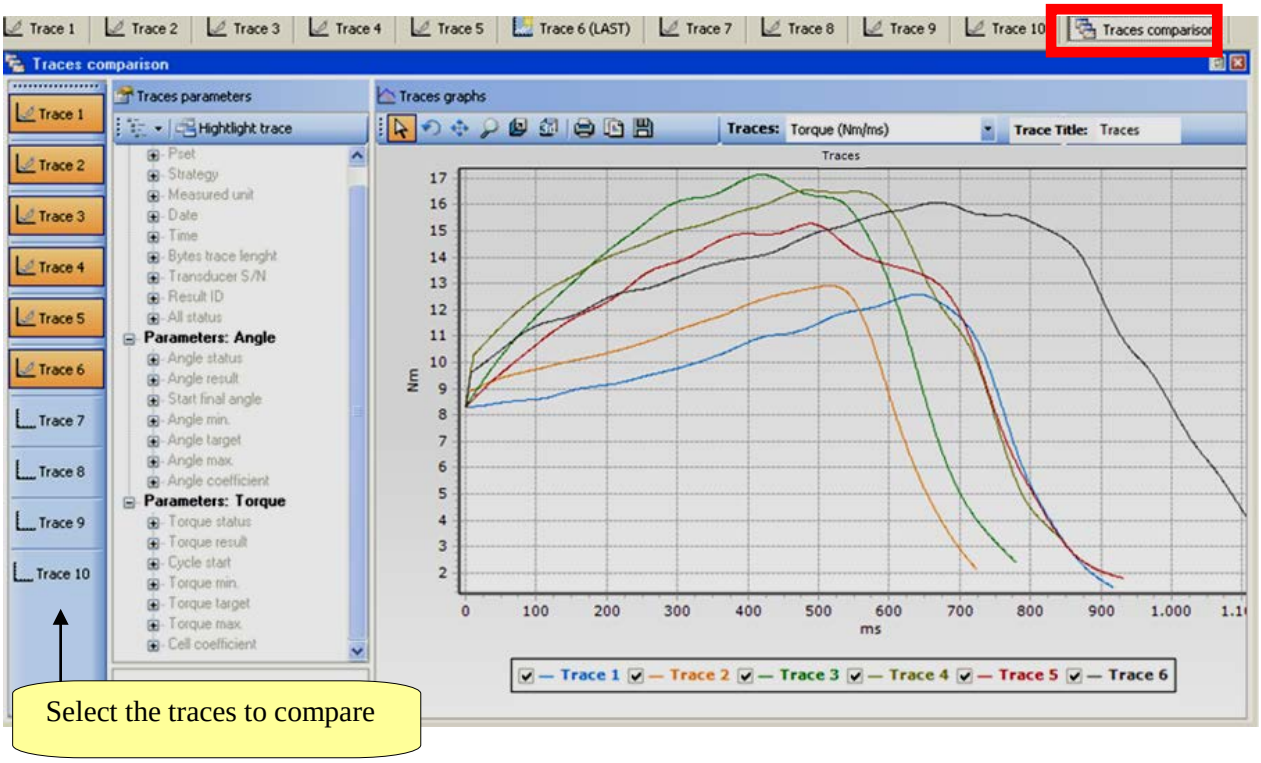
To evaluate the trace in detail, click on ***Show cursor*** to activate the cursor on the graph.

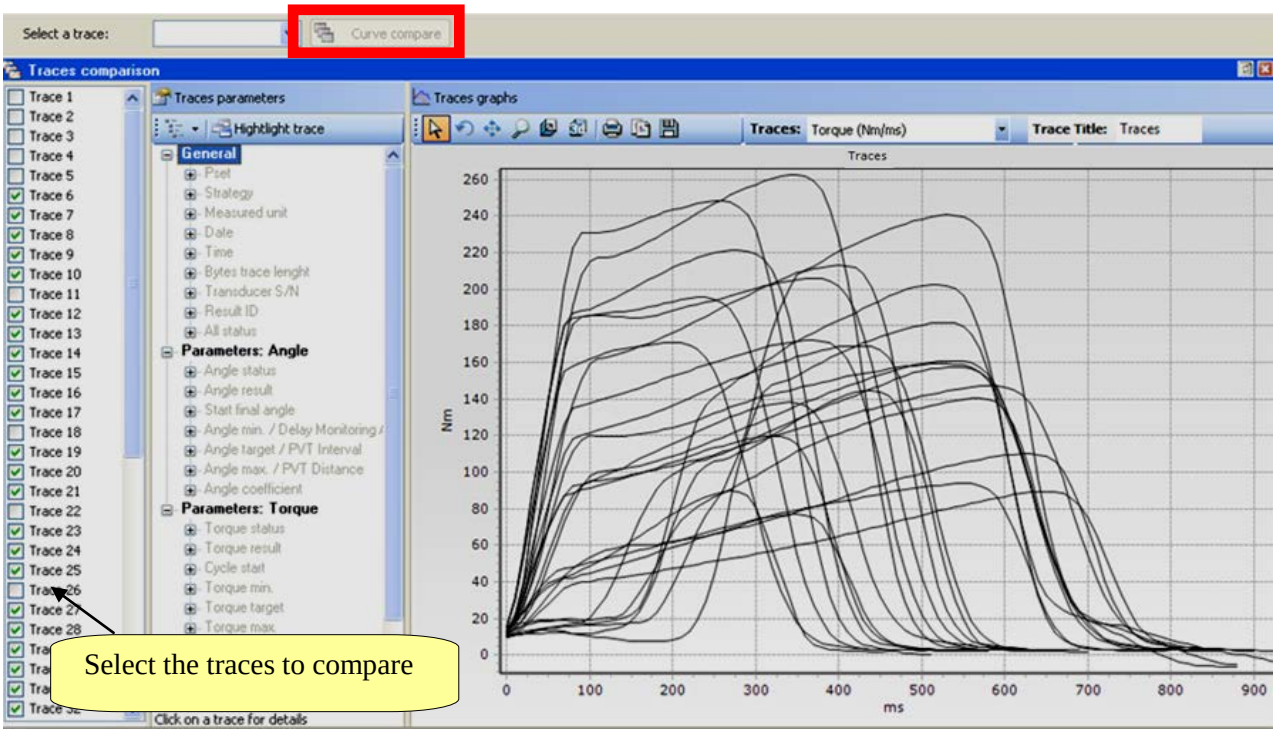


13.2 Traces Comparison

This feature allows the traces to be overlapped so that tightening operations can be compared.

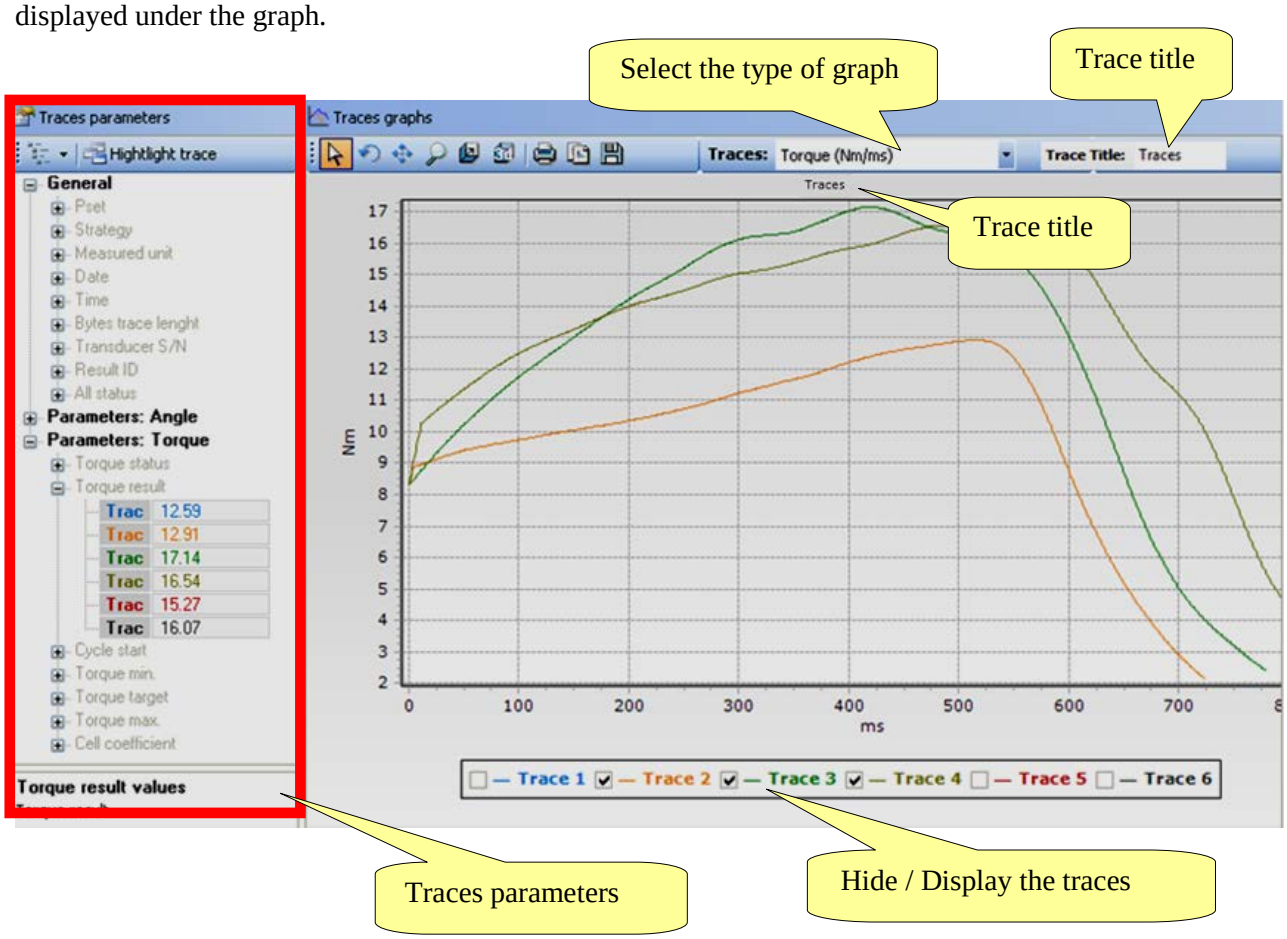
Click on ***Trace comparison*** to open the comparison window (the second figure below is shown when the STwrench is set to store 90 traces and stores more than 10 traces):


Trace 1
Trace 2
Trace 3
Trace 4
Trace 5
Trace 6 (LAST)
Trace 7
Trace 8
Trace 9
Trace 10
Traces comparison
Traces comparison
Traces parameters
Hightlight trace
Pset
Strategy
Measured unit
Date
Time
Bytes trace lenght
Transducer S/N
Result ID
All status
Parameters: Angle
Angle status
Angle result
Start final angle
Angle min.
Angle target
Angle max.
Angle coefficient
Parameters: Torque
Torque status
Torque result
Cycle start
Torque min.
Torque target
Torque max.
Cell coefficient
Traces graphs
Traces: Torque (Nm/ms)
Trace Title: Traces
Traces
Nm
ms
Trace 1
Trace 2
Trace 3
Trace 4
Trace 5
Trace 6
Select the traces to compare


Select a trace:
Curve compare
Traces comparison
Traces parameters
Hightlight trace
General
Parameters: Angle
Parameters: Torque
Traces graphs
Traces: Torque (Nm/ms)
Trace Title: Traces
Traces
Nm
ms
Click on a trace for details
Select the traces to compare

Select the traces you wish to compare on the left side of the screen.

Select the type of graph (Torque/Time, Angle/Time, or Torque/Angle) using the ***Traces*** scroll window. The selected traces are displayed in the graph. You can hide the selected curve using the selection box displayed under the graph.



All the parameters and results of the traces are displayed in the ***Traces parameters*** window. Click on the + or – icons to expand or collapse the nodes.

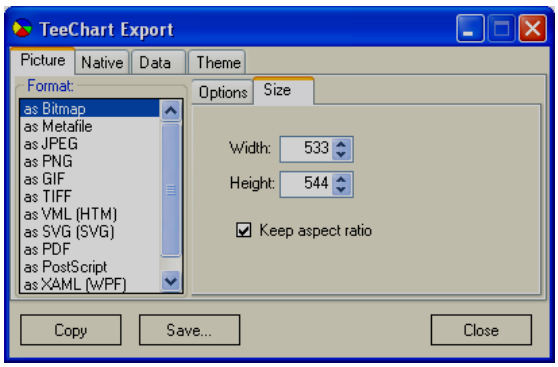
By enabling ***Highlight trace,*** it is possible to highlight a trace in the graph:



13.3 Copy, Print and Export a Trace

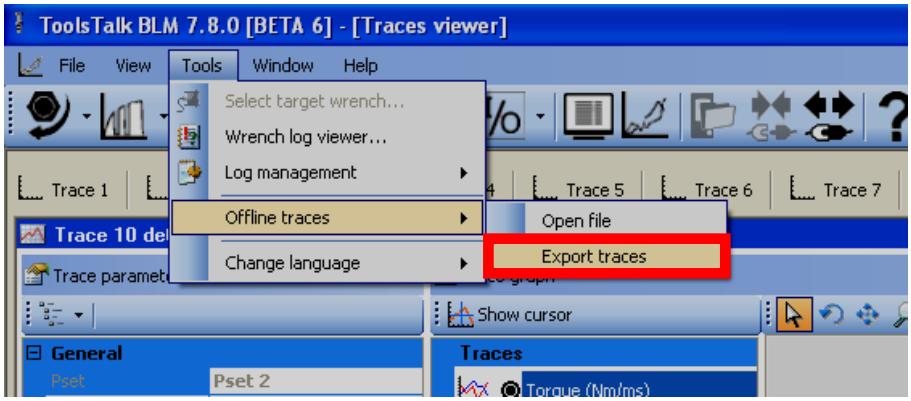
Some useful commands are available in the graph toolbar:

	Prints the trace.
	Copies the trace to the clipboard.

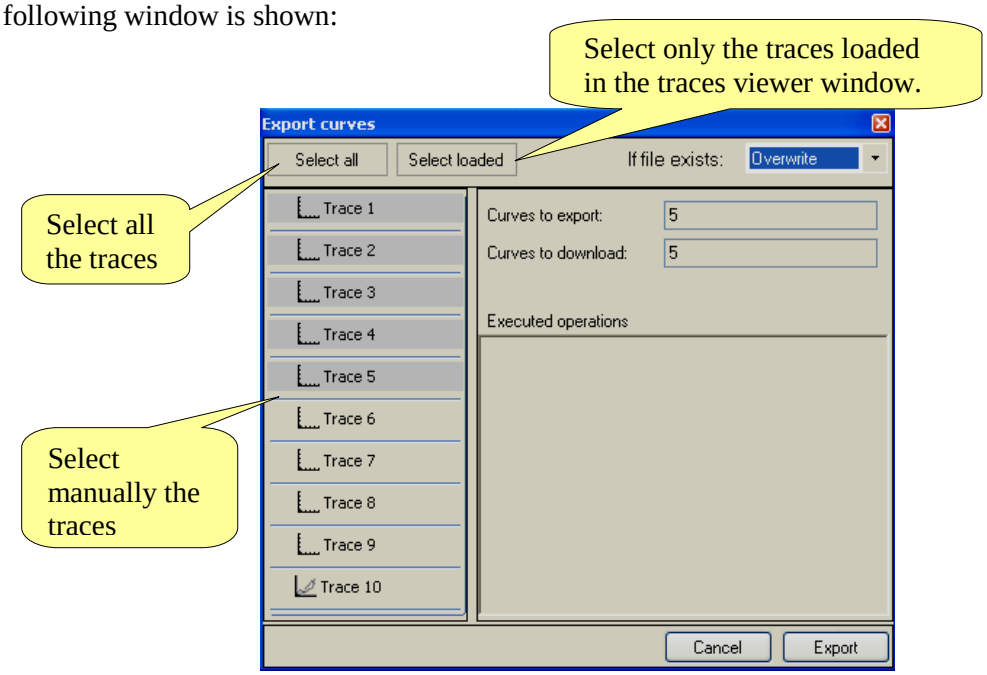
	Exports trace as image:  Select the format to be exported, the size and options, then click on ***Save...*** to export the trace.

It is also possible to export traces to the PC, in a .ttt file, to be re-viewed offline later.

To export the traces from the STwrench memory, connect ToolsTalk BLM to the STwrench and select the ***Tools → Offline traces → Export traces*** menu:



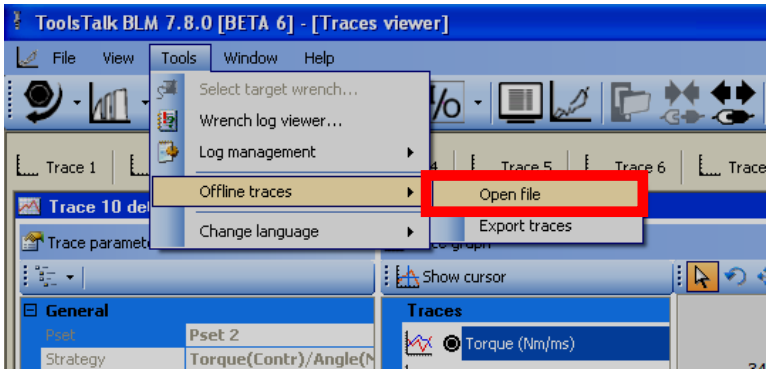
The following window is shown:



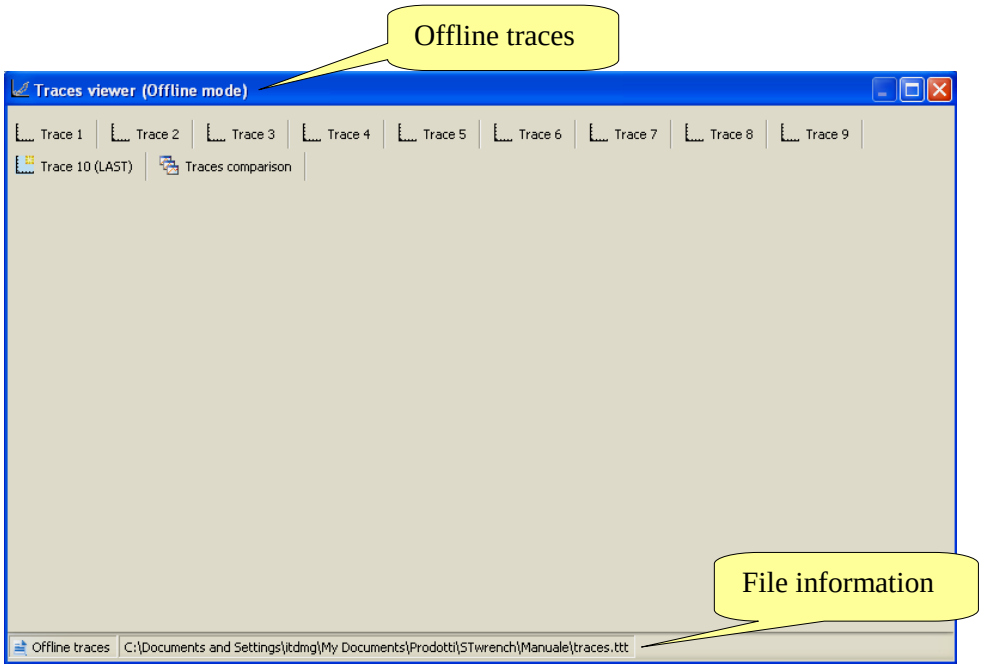
Select the traces to be exported (maximum 10) and click on ***Export*** to create the file. In the combo-box in the upper-right area of this window, choose one of the following options in case the file already exists:

- ***Overwrite***: Overwrite the old file with the new one; the traces in the old file are deleted.
- ***Append***: Append the traces selected to the existing file (in case a trace was already exported, a copy of the same traces is appended to the others)
- ***Abort***: Do not save the new file.

To load a set of traces exported before, select the ***Tools → Offline traces → Export traces*** menu:



Select the file exported before and the traces are loaded in a traces viewer window:



More than one file can be opened at the same time (each file is opened in a new trace viewer window).

14 Real Time Traces

The Real Time Traces function provides a new window with the real-time tightening trace for each test executed.

The STwrench must be connected to the ToolsTalk BLM via:

- USB cable.
- IRC-W, if the RBU installed in the STwrench includes the API interfaces. In this case the function is opened by the API application software and not from ToolsTalk BLM. See the *Working with the API* chapter for more information about how to enable the Real Time Traces via IRC-W.

NOTE: This function must be enabled and configured in the STwrench settings. See the *STwrench Controller Setup* chapter for more information.

Once the function is enabled, the following window is shown by ToolsTalk BLM each time a Pset is executed:



After each test the traces is minimized on the right area of the window, and the new trace is shown.

Click on the icon to the right to review the traces. After 30 traces are shown, a new real time traces window is automatically created to display the next 30 traces, and so on.

Click on the *show tightening data* icon to view more information of the test:

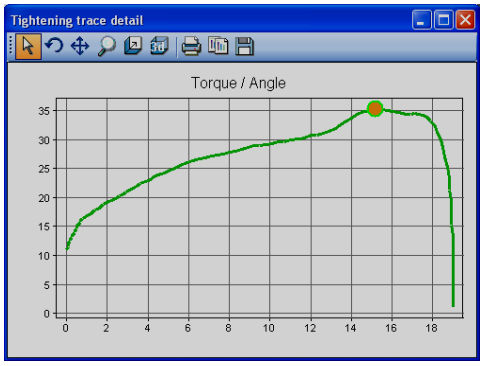


For each tightening strategy the torque/time, angle/time and torque/angle traces, depending from the *STwrench Controller Setup*, can be shown:

- In real time: The trace is drawn in real time during the tightening
- Hidden: The trace is not shown
- At the end of the tightening: The trace is not shown during the tightening. When the tightening is completed, the trace is shown.

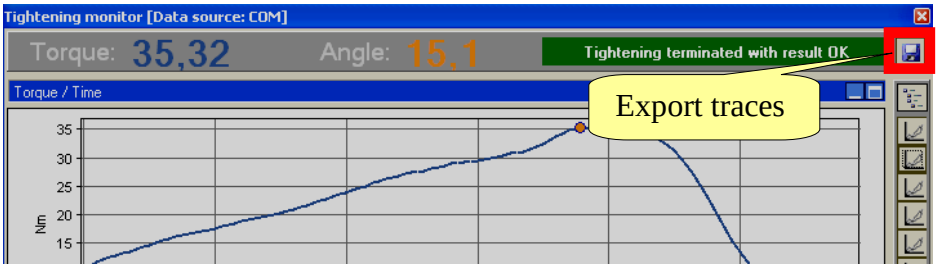
It is also possible to set the real time trace to be shown in full screen.

The torque/time, angle/time and torque/angle traces can be expanded by clicking on the expand icon. The trace is shown in a new window (angle/time and torque/angle are available only for smartHEAD with gyroscope):

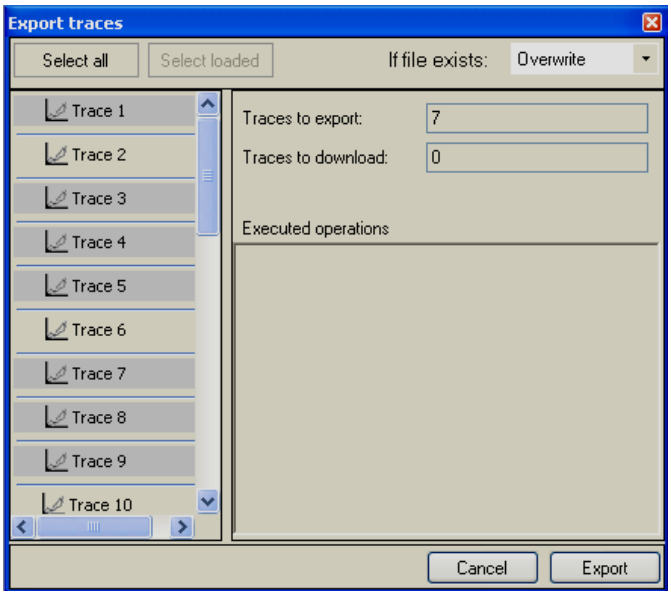


It is possible to zoom in and out the trace, print or export the trace with the same commands provided by the Traces Viewer function. See the *Traces Viewer* chapter for more information.

As per the traces viewer function, also the real time traces window provides the exporting of the traces to the PC. Click on the ***Save*** command to create the file:



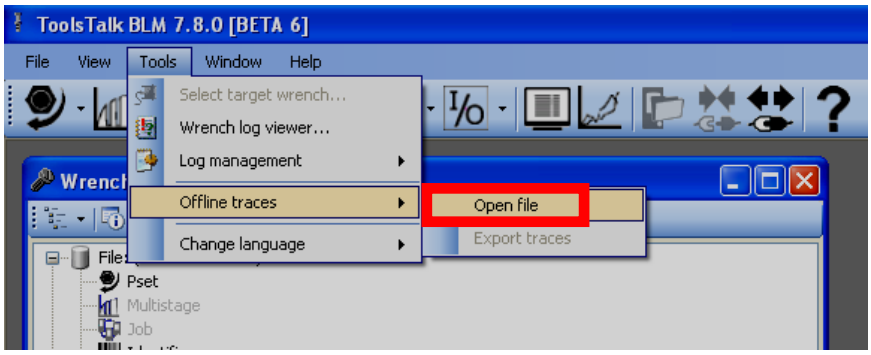
The following window is shown:



Select the traces to be exported and click on ***Export*** to create the file. In the combo-box in the upper-right area of this window, choose one of the following options in case the file already exists:

- ***Overwrite***: Overwrite the old file with the new one; the traces in the old file are deleted.
- ***Append***: Append the traces selected to the existing file (in case a trace was already exported, a copy of the same traces is appended to the others)
- ***Abort***: Do not save the new file.

Once created, the traces stored in the file can be loaded again by the traces viewer function of ToolsTalk BLM, by selecting the ***Tools → Offline traces → Export traces*** menu:



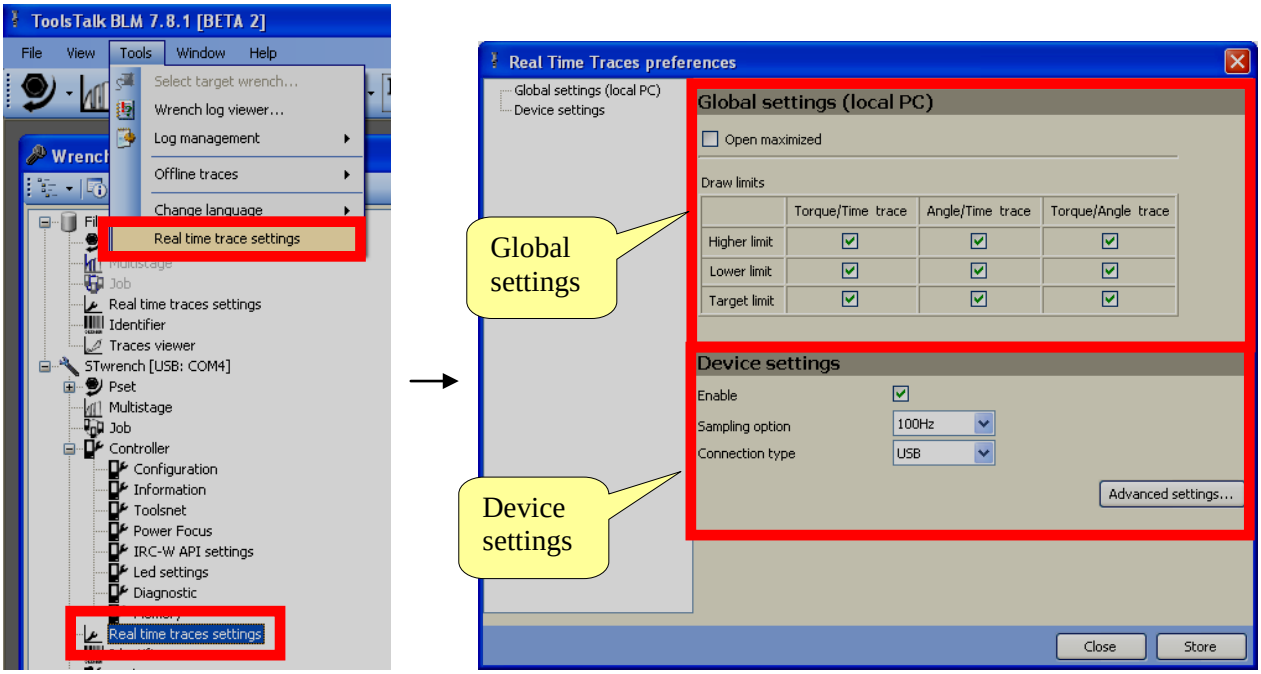
NOTE: When the Real Time Traces function is started, it is not possible to use the other functions of ToolsTalk BLM. To go back to ToolsTalk BLM, close all of the windows opened by the Real Time Traces and exit the Pset execution menu on the STwrench.

WARNING: The Real Time Traces function implies a certain use of the device and network resources. Observe the following rules to obtain a better working of the function:

- After each set of 30 traces, the Real Time Trace opens a new window. Do not leave open more than 4 windows.
- Set the sampling frequency between 100 Hz and 250 Hz.
- Wait until all the traces and values are loaded into the Real Time Trace window before starting a new tightening.
- Keep the length of the tightening below 30 seconds.
- The PC should have these minimum requirements: Intel Core2 Duo 2.66 GHz or AMD Athlon X2 6000 3 GHz, with 4 GB RAM.

14.1 Enabling and Settings the Real Time Traces Function

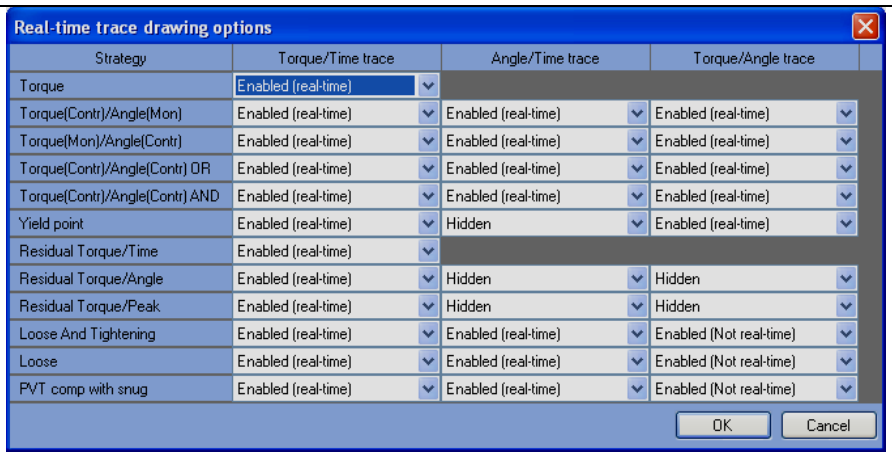
This menu enables the Real Time Traces function. Select ***Tools → Real time traces settings*** or click on the icon on the STwrench map:



The settings are divided in two groups:

- ***Global Settings***: Settings applied for all the STwrench connected to the PC where ToolsTalk BLM is installed
- ***Device Settings***: Settings stored only on the STwrench connected when these settings are performed. The ***Device Settings*** are enabled only if a STwrench is connected to the PC.

Open maximized	If enabled, the real time traces window is shown as full screen.
Higher limit, Lower limit, target	If enabled the real time traces window shows a line on the graph corresponding to the test limit(s) and/or target value.
Enable	Enable the real time traces function.

Sampling frequency	Set the sampling frequency from 25Hz to 500Hz. The sampling frequency defines how many samples per seconds are provided in the traces. The default value of 100 Hz is recommended.
Connection type	Select if the STwrench – PC connection is performed via ***USB*** or ***IRC-W***
Advanced settings	 Select which traces enable/disable for each tightening strategy: Select the traces shown for each tightening strategy and click on ***OK*** to save.

Click on ***Store*** to save the settings.

15 Working with Power Focus

The STwrench, with RBU Production, can be driven by Power Focus.

NOTE: Power Focus 3000/4000 version required: **W10.14**
Power Focus 2000 is not supported

In this mode, Psets/Multistages are created and transferred to the STwrench by Power Focus (refer to the Power Focus manual for tightening strategies available and programming details). The results are sent in real time to Power Focus, but also stored in the wrench memory. The Power Focus can also be set to retrieve STwrench traces (see the *Settings on Power Focus* chapter).

NOTE: To support all of the Psets created by Power Focus, the STwrench must have a smartHEAD with gyroscope enabled. If the gyroscope is not included in the smartHEAD, all the Psets including the angle parameter in the tightening strategies are not supported; a "Communication error" is shown when Power Focus sends one of those Psets.

NOTE: Except from connections with IRC-W and IRC-Z, for which ToolsTalk BLM is required to define the network parameters, the ToolsTalk BLM is optional when in Power Focus mode. However, please note that some functions, such as special settings of the STwrench controller or the TAG Writer function, are not available if the ToolsTalk BLM is not purchased.

NOTE: When the STwrench is connected to the ToolsTalk BLM via the USB cable, the connection with Power Focus is not active. After making wrench settings and/or programming, disconnect the USB cable to make the connection with Power Focus active.

In Power Focus mode, the wrench waits for the Pset send from Power Focus; the wrench keyboard is disabled, so no free test is available in this mode.

When storing the *Controller → Power Focus* configuration, or when the pairing procedure is complete, the STwrench asks if the user want to reset the following parameters to the default values:

- **TAG**: Enabled
- **Vibration device**: Enabled
- **Buzzer (device sound)**: Enabled
- **smartHEAD light (device light)**: Enabled
- **Progression LEDs**: Percentages set to default values (95%, 60%, 30%)

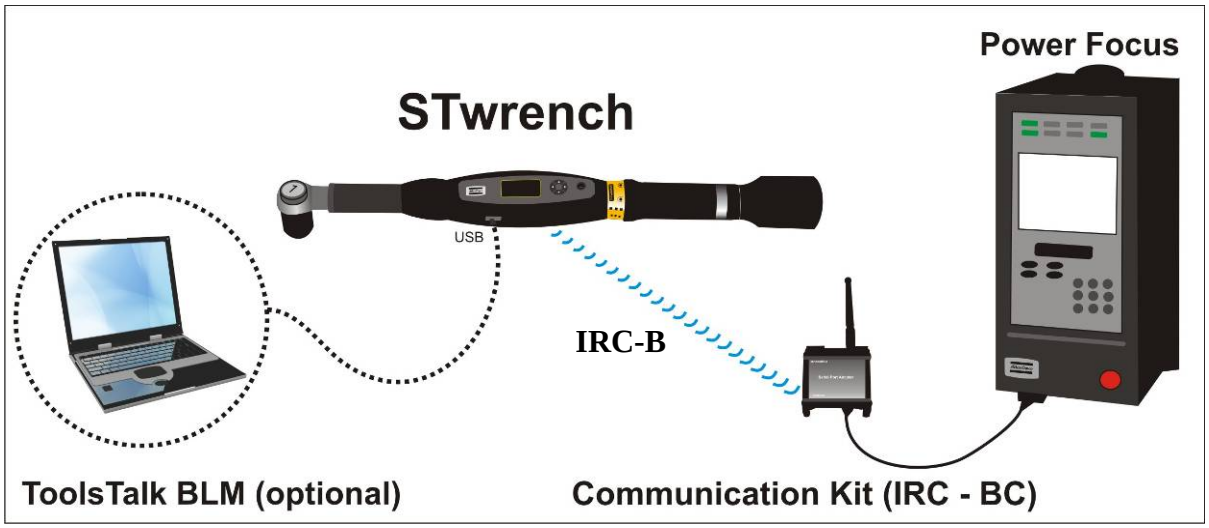
See the chapter *STwrench Controller Setup* for more information of STwrench settings.

The tightening strategies available are those provided by Power Focus, and not the strategies described in this manual, which are provided by ToolsTalk BLM.
The LEDs behavior is also dictated by Power Focus, so the LED settings performed on the STwrench with ToolsTalk BLM do not have any effect in this mode.

There are several ways to connect the STwrench to Power Focus:

- IRC-B radio module interface
- IRC-Z radio module interface
- IRC-W radio module interface
- STwrench Cable Box interface

15.1 Interface with IRC-B Radio Module



Ensure that the IRC-B radio module is installed in the STwrench (see the chapter *QAT IRC-B / IRC-Z radio modules* for more information about the installation).
To allow the IRC-B radio module work with the remote device (Power Focus), you must execute the pairing procedure. This is necessary only once, the first time you connect the STwrench to Power Focus.

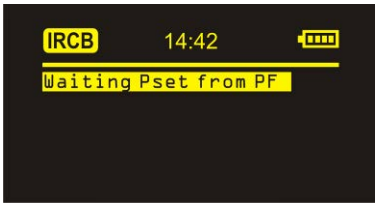
Here is a description of the pairing procedure:

1. Turn on the STwrench
2. During the cell and gyroscope zero automatic adjustment, press the UP, RIGHT and BARCODE buttons on the wrench keyboard in that order:



3. At the end of the zero adjustment, the wrench goes into pairing mode
4. Start the pairing procedure on Power Focus
5. Wait for the end of the procedure (make sure that it ends without error)

The STwrench is now working in the Power Focus mode.



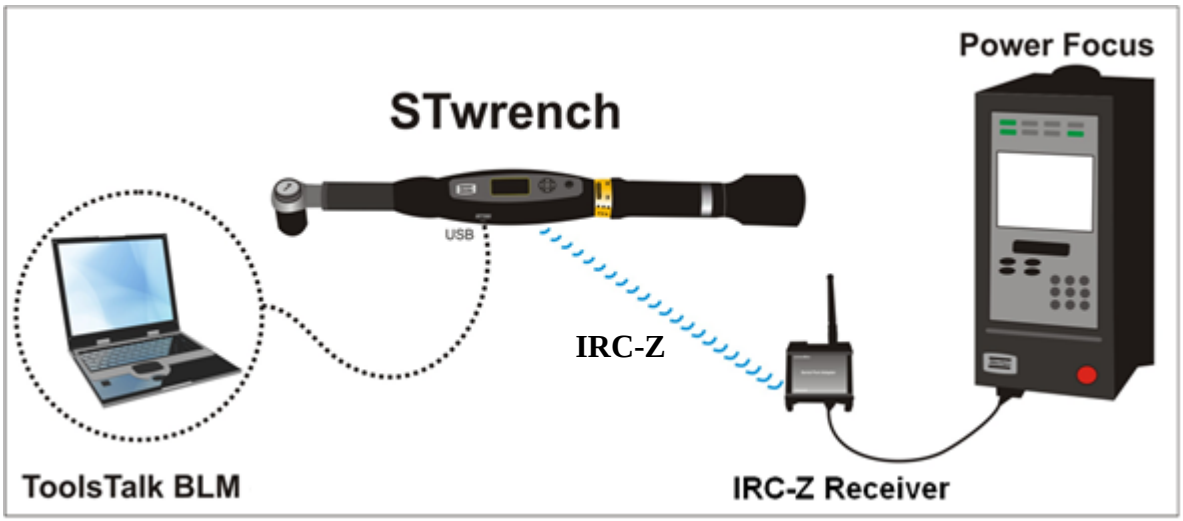
Ensure that Power Focus is also set to work via an IRC-B connection.

NOTE: To restore the normal working mode, perform the same procedure, pressing the wrench buttons in the reverse sequence (BARCODE, RIGHT and UP).

NOTE: The pairing procedure can also be performed from ToolsTalk BLM. See *Power Focus settings* for more information.

NOTE: When the STwrench is connected to the ToolsTalk BLM via the USB cable, the connection with Power Focus is not active. After completing the wrench settings and/or programming, disconnect the USB cable to activate the connection to Power Focus.

15.2 Interface with IRC-Z Radio Module



Ensure that the IRC-Z radio module is installed in the STwrench (see the chapter *QAT IRC-B / IRC-Z radio modules* for more information about the installation).
To make the IRC-Z radio module work with the remote device (Power Focus), you must execute the pairing procedure. This is necessary only once, the first time you connect the STwrench to Power Focus. See the *Power Focus settings* chapter for more information of the paring procedure.

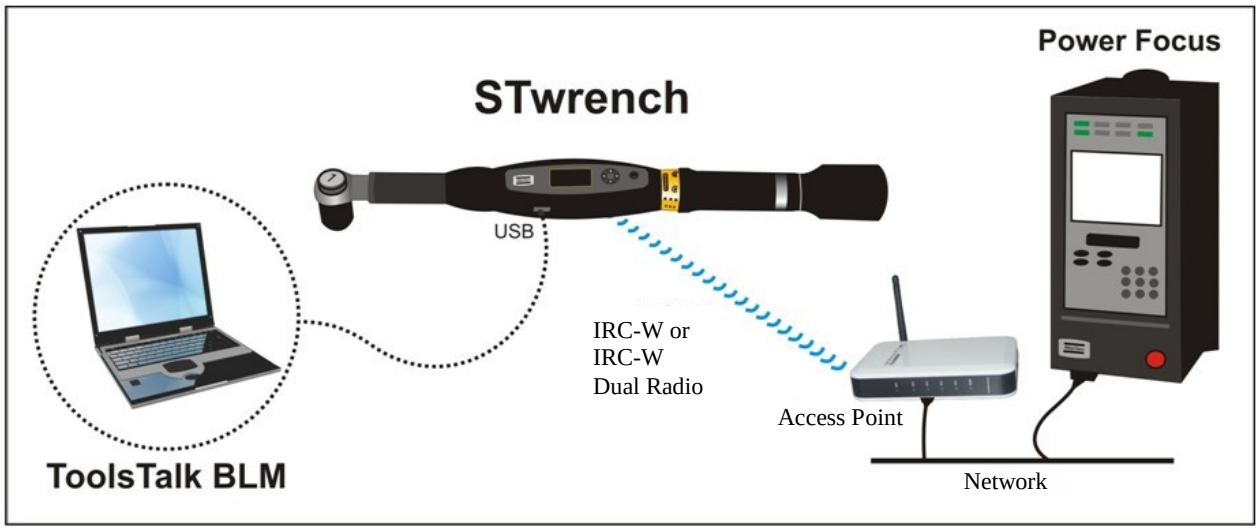
The STwrench is now working in the PF mode.



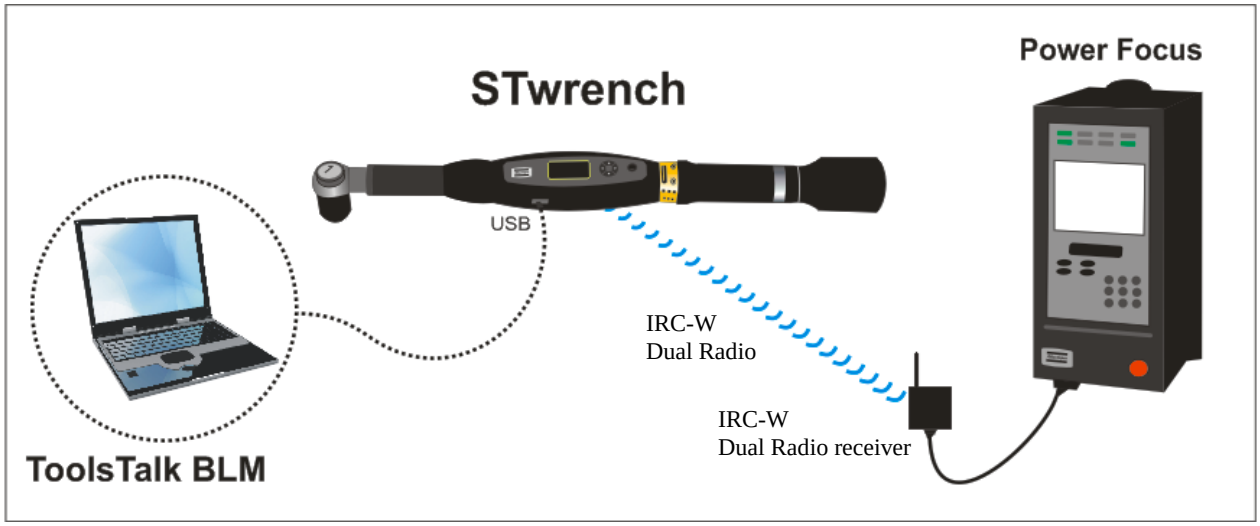
NOTE: To restore the normal working mode, disable the IRC connection by using ToolsTalk BLM (in the menu ***Controller → Power Focus → IRC***).

NOTE: When the STwrench is connected to the ToolsTalk BLM via the USB cable, the connection to Power Focus is not active. After completing wrench settings and/or programming, disconnect the USB cable to activate the connection to Power Focus.

15.3 Interface with IRC-W Radio Module



Access point (infrastructure)

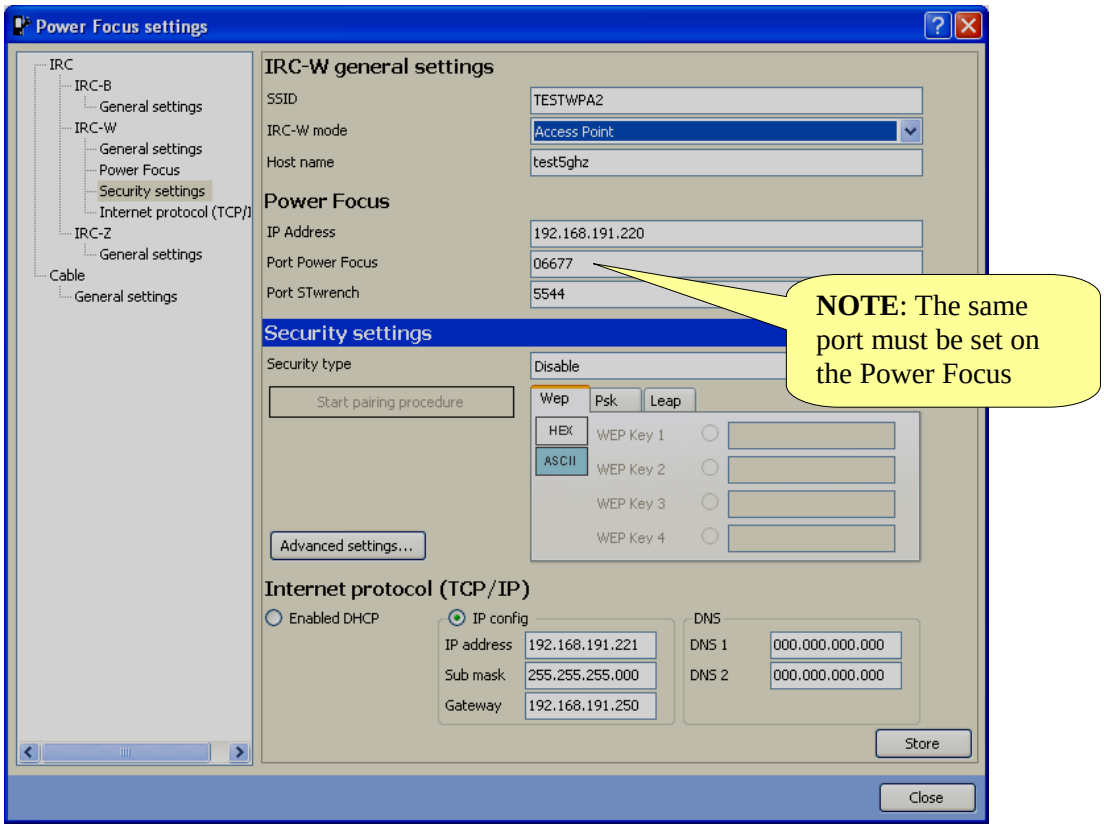


Peer-to-peer (Ad hoc)

Ensure that the IRC-W radio module is installed in the STwrench (see the chapter *QAT IRC-W radio module* for installation more information).
Ensure that the PF is set to work with IRC-W connection.

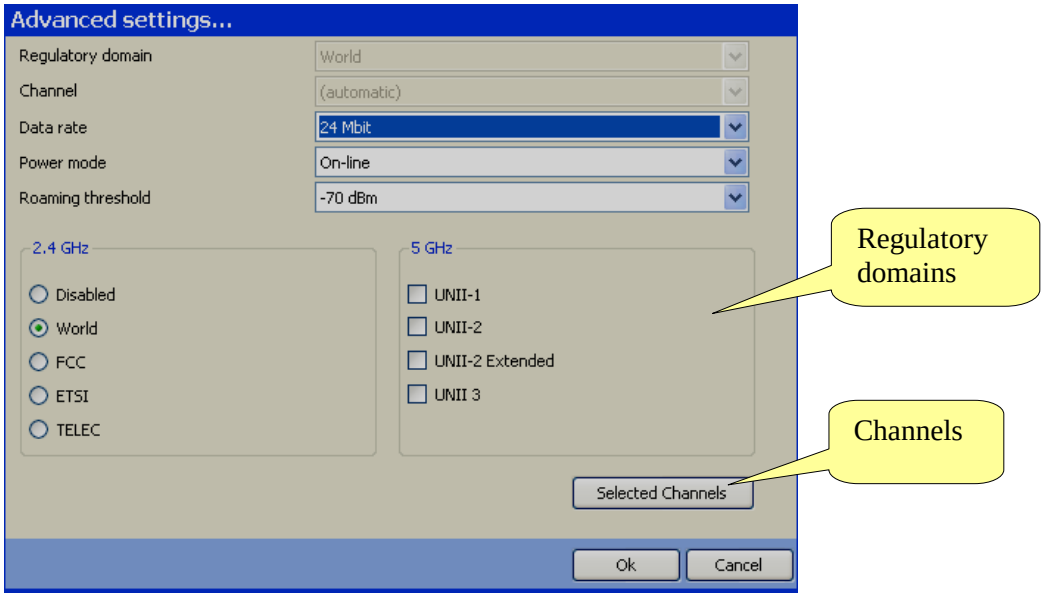
To make the STwrench IRC-W radio module working with the remote device (Power Focus), the radio parameters must be set properly by Tools Talk BLM.

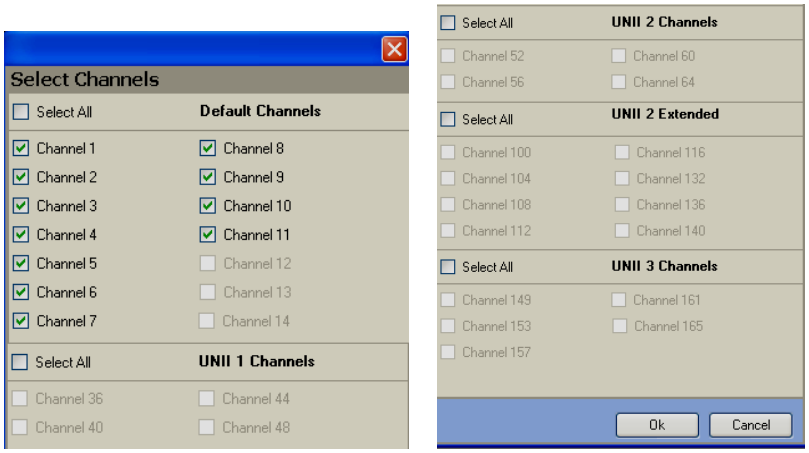
Connect the wrench to ToolsTalk BLM and select the ***Controller → Power Focus*** menu:



Set all the parameters according with your specific network parameters. For EAP-TLS security type, refer to the *Appendix B – EAP-TLS Security Type* for more information.

Use the ***Advanced settings...*** to set the band, channels and parameters for the IRC-W dual band radio module:

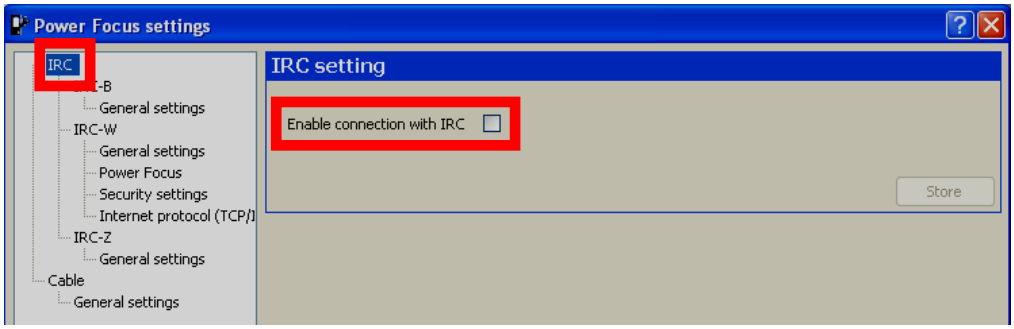


Regulatory domain	Select one of the option for the 2.4 GHz and/or one or more options for the 5GHz.
Channels	Once the regulatory domain has been chosen, click on ***Selected Channels*** to view/change the channels selected by default:  The channels available depend from the regulatory domain selected. Select the channel(s) and click on ***OK*** to confirm.

Data rate	Select the data rate. A slower value may help when the communication is not high-performance.
Power mode	The ***Sleep*** mode is recommended for lower power consumption.
Roaming threshold	Select the threshold under which the STwrench will search for a new access point to connect through.

Once you have completed the configuration, click on ***STORE*** to save.

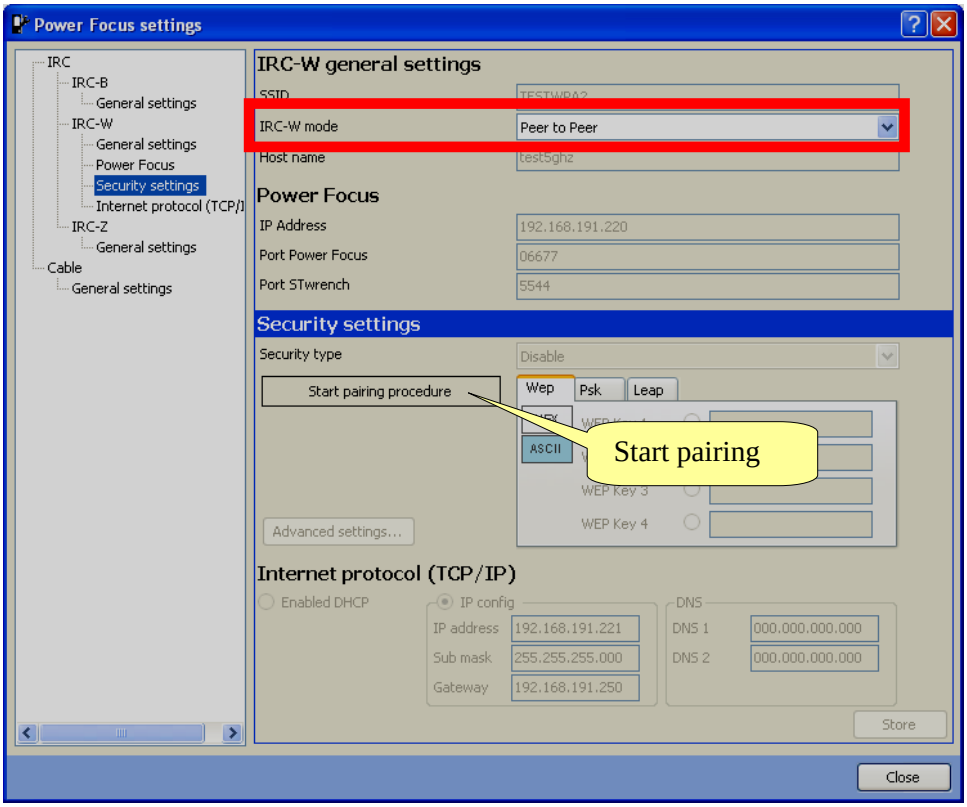
In the IRC menu, enable the ***Enable connection with IRC*** flag:



NOTE: When the STwrench is connected to the ToolsTalk BLM via the USB cable, the connection to Power Focus is not active. After completing wrench settings and/or programming, disconnect the USB cable to activate the connection to Power Focus.

15.3.1 Peer-to-Peer (Ad hoc) connection

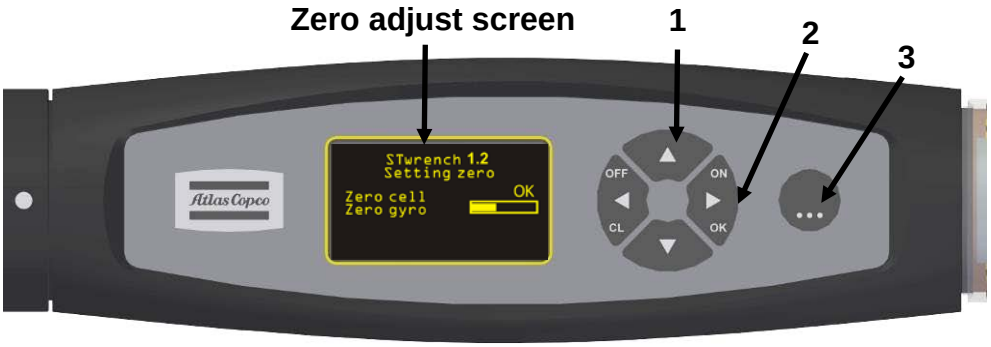
It is possible to work in the Peer-to-Peer mode for the IRC-W dual band radio module.
Select ***Peer to Peer*** in the ***IRC-W mode*** and click on ***Store***. All the parameters are disabled, and the ***Start pairing procedure*** command is activated:



In this mode, the STwrench and Power Focus must be associated with the pairing procedure. Follow the following sequence:

- Click on the ***Start pairing procedure*** command

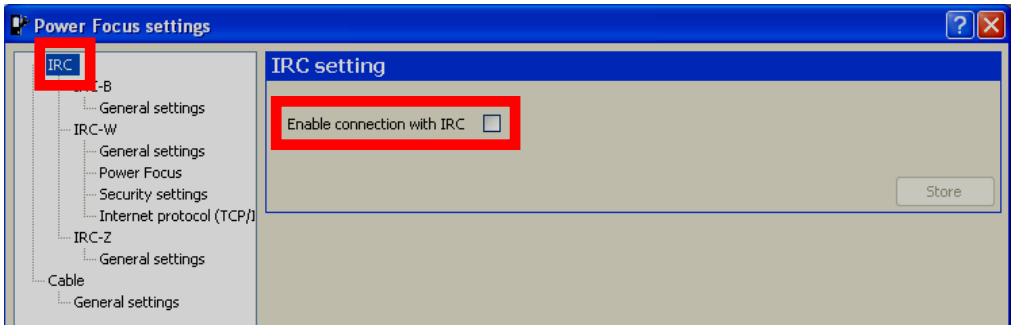
NOTE: It is possible to start the pairing procedure directly from the STwrench: Switch on the STwrench, and press the DOWN, RIGHT and BARCODE buttons in sequence during the cell and gyroscope zero automatic adjustment.



- Within 60 seconds, start the pairing procedure on Power Focus
- If the procedure is successful, the STwrench displays the following message:



In the IRC menu, enable the ***Enable connection with IRC*** flag (not necessary if the pairing procedure has been performed directly by the STwrench keyboard):



Disconnect the STwrench from the ToolsTalk BLM.

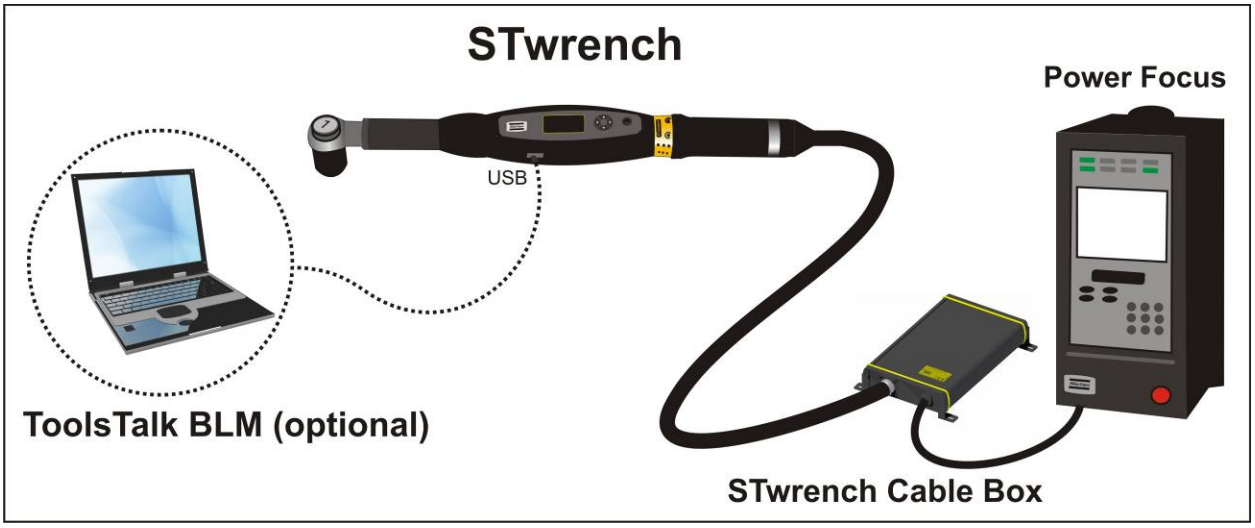
During the initialization process, the IRC-W icon is shown in four steps:

I	Module IRC-W detected.
IR	Initial message for connection sent to Power Focus.
IRC	Reply received from Power Focus.
IRCW	Connection active.

When the connection is fully established, the whole logo is displayed:



15.4 Interface with STwrench Cable Box



NOTE: This connection via cable is not possible with the STwrench Controller BI, but only with the standard STwrench controller.

Ensure that the STwrench Cable Box is properly installed:

- Connect the SL cable between the STwrench and the cable box.
- Connect the red cable of the adapter to the connector named “I/O BUS” on the Power Focus
- Connect the grey cable of the adapter to the connector named “RS232(2)” on the Power Focus

See the chapter *STwrench Cable Box* for more information of Power Focus connectors.
To allow the STwrench to work with the Power Focus, the Power Focus mode must be activated as follows:

1. Turn on the STwrench.
2. During the cell and gyroscope zero automatic adjustment, press the ***DOWN***, ***OK*** and ***BARCODE*** buttons on the wrench keyboard in that order:



3. At the end of the zero adjustment, the wrench goes into Power Focus mode, and the cable icon is shown in the left-upper corner of the display:



For this mode, the Power Focus must be set properly. Enter the ***Tool*** → ***Configuration*** → ***Radio*** menu in Power Focus and set as follows:

- ***T290 Primary Tool***: STwrench cable
- ***T294 Serial Port***: Serial 2

NOTE: To return to the normal working mode, perform the same procedure, pressing the wrench buttons in the reverse sequence (***BARCODE***, ***OK*** and ***DOWN***).

NOTE: The Power Focus mode can also be enabled / disabled from ToolsTalk BLM. See *Power Focus settings* for more information.

NOTE: When the STwrench is connected to the ToolsTalk BLM via the USB cable, the connection to Power Focus is not active. After completing wrench settings and/or programming, disconnect the USB cable to activate the connection to Power Focus.

15.5 Settings on Power Focus

Power Focus must be set properly in order to work with the STwrench.
The following list provides a cross reference between Power Focus and STwrench parameters and some critical Power Focus settings required for proper operations:

Power Focus	STwrench
P100 Control Strategy	*Control strategy*
P110 Cycle start	*Cycle start*
P112 Final tq min	*Final torque min.*
P113 Final Target	*Final Target*
P114 Final tq max	*Final torque max.*
P118 Measure torque at	*Measure torque/angle at*
P119 Loosening limit	If this parameter is set to a value greater than 0, Power Focus checks if a negative torque exceeding this value is applied during the tightening. In that case, the overall status of the tightening is marked as *Not OK*. This function is started when the wrench reaches the *Cycle Start* (before starting the tightening, a loosening is allowed and does not produce results). This function is used to detect unwanted loosening at the end of a tightening (for instance, when the wrench is disengaged from the joint). When the loosening detection is active: - When the operator has not yet started the tightening, and a negative

	torque whose value is greater than the P119 value is applied, then an event "loosening" is sent to the PF. - When the operator has already started the tightening, and a negative torque whose value is greater than the P119 value is applied, then an event "loosening" is sent to the PF; the generated result is forced to be NOK. Set this parameter to zero to disable this function.
P120 Start final angle	*Start final angle*
P121 Measure angle to	Function not available with STwrench
P122 Final angle min	*Min. angle*
P123 Target angle	*Target angle*
P124 Final angle max	*Max. angle*
P128 Rehit angle	*Check already tightened angle*
P130 Soft start speed ***P131 Step 1 speed*** ***P133 Loosening speed***	These parameters are not used by the STwrench. However, they must be set in a consistent way in order not to produce errors. Set them to any value that does not give an error.
P141 End time	*End Cycle time*
P144 Cycle abort time	*Ratchet time*
P150 Batch count	*Batch count*
P151 Batch size	*Batch size*
P152 Lock at batch done	*Lock at batch done*
P153 Max Coherent NOK's	*Max coherent NOK result*
P240 Max coherent NOK result	*Max coherent NOK result*
C502 Speed unit	This parameter must be always set to ***%***. Do not set it as ***RPM***.
T270 Power Save Timeout	When the STwrench is working in Power Focus mode, this

	parameter specifies the automatic shutdown timeout. The timeout specified by ToolsTalk BLM in the STwrench settings is ignored. **NOTE**: When the STwrench is connected to Power Focus via the SL Cable, this parameter is ignored and the automatic shutdown function on the wrench is disabled.
T271 Start Condition	***None***: Suggested settings. In case the connection is lost between STwrench and Power Focus, the batch continues anyway, and the STwrench returns to the "*waiting Pset from Power Focus*" menu. **NOTE**: This setting does not support Jobs defined as "free". ***Connected***: In case the connection is lost between STwrench and Power Focus, the batch run is interrupted, and the STwrench returns to the "*waiting Pset from Power Focus*" menu.
T277 TorqueAndAngle Trace	Set Power Focus to retrieve also the STwrench traces. When this function is enabled, if the STwrench reaches the maximum number of traces stored (which can be set in the wrench settings) and the traces are not transferred to Power Focus (for example, because a radio connection is temporary missing), the STwrench goes into the "wrench locked" mode until the traces are sent to Power Focus. Power Focus can be also set to transfer the traces to ToolsNet.
T296 IRC-W operational mode	When the ST is connected to Power Focus via IRC-W / Access Point, this parameter must be set to ***Infrastructure***. When the connection is made via IRC-W dual band module in peer-to-peer mode, it must be set to ***Ad Hoc***.

When programming a Pset in Power Focus, ensure that all of the torque parameters are higher than the STwrench minimum load (5% of the wrench capacity), and lower than the STwrench capacity; if not, an error is shown on Power Focus.

If a 2-stage Pset is programmed from Power Focus, the STwrench uses the torque/angle parameters of the second stage. The first stage parameters are not considered; however, they must be set in a consistent way (for instance, all the torque parameters must be between the STwrench minimum load and the wrench capacity).



NOTE: For detailed Power Focus settings and operations, please refer also to the latest user guide of Power Focus and ToolsTalk PF.

16 Working with ToolsNet



NOTE: ToolsNet 4000 minimum version: W7 SR5

ToolsNet is a part of the ATS (Assembly Tools Software), which can work together with STwrench to complete the tightening process.
ToolsNet works together with the controllers and the selected database, Microsoft Sequel Server or Oracle, to collect, store and display all historic tightening-related data. ToolsNet allows the user to obtain reports on shifts, lines, individual vehicles or controllers for process improvement purposes. All reports can easily be exported to Excel.
ToolsNet can be used as a standalone product or together with other modules from the ATS. ToolsNet as a standalone product features:

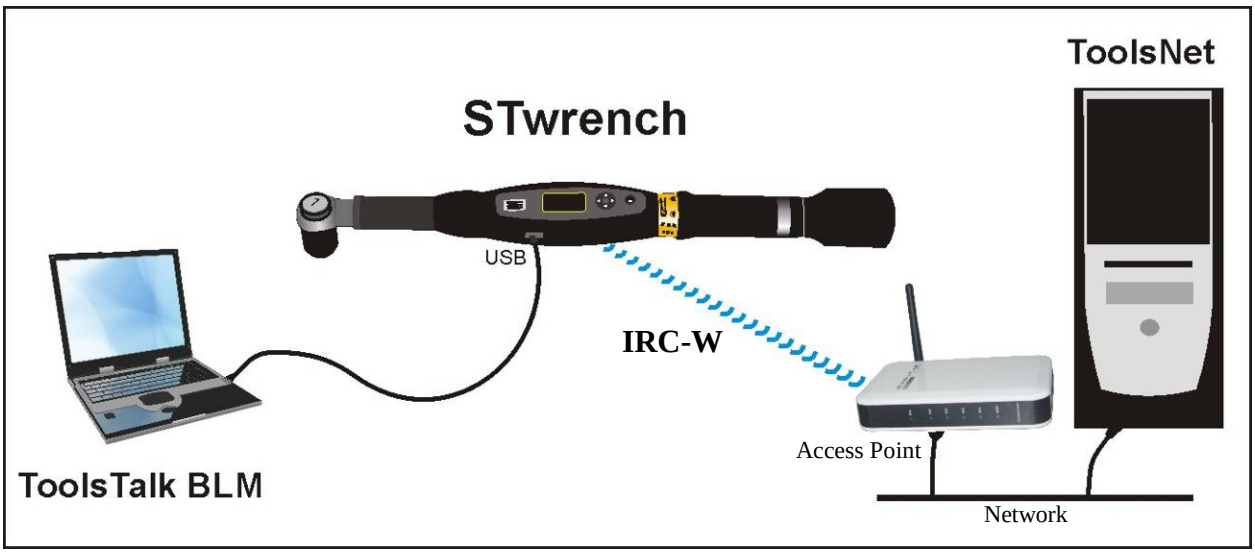
- Tightening data collection and storage in a standard database management system (ORACLE or MS SQL Server).
- Web-based reporting interface with standard reports, statistical information and graphs.
- Process improvement through extensive statistical process control function.
- Full traceability of every tightening performed with a connected controller.

ToolsNet with Factory Overview:

- All the functions of the standalone product.
- Factory Overview integrated with ToolsNet - Right-click in Factory Overview to get web reports from ToolsNet.

ToolsNet with Event Monitor:

- All functions of the standalone product.
- Event history in ToolsNet reports.



The STwrench communicates with ToolsNet via an IRC-W connection. The IRC-W module must therefore be installed first in the STwrench controller (see the chapter *QAT IRC-W radio module* for more information about the installation) before communication can begin.

For connection to the *QATnode T*, see the chapter *ToolsNet Connection via QATnode*.

Tightening programs are created and transferred to the wrench by ToolsTalk BLM, and the results are sent to the ToolsNet station in real time.
If the connection goes down, the wrench stores the tightening results; all of them are transferred to ToolsNet as soon as the connection is active again; if the maximum number of traces is reached while the STwrench is offline, a warning message alerts the user that the new traces are about to start overwriting the oldest traces stored.

When the connection is active, the IRC-W symbol is shown on the wrench display. During the initialization process, the IRC-W icon is shown gradually (for QATnode connection, the whole logo is displayed in a single step):

I	Module IRC-W detected.
IR	Verification telegram message received from PIM server.
IRC	Information telegram message received from PIM server.
IRCW	Connection active.

When the connection is fully established, the whole logo is displayed:



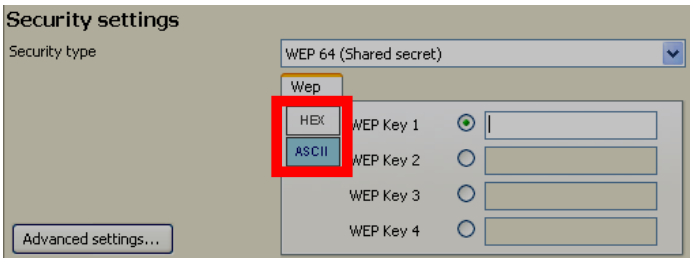
16.1 Establishing Communication between STwrench and ToolsNet

In order to set up the wrench IRC-W module properly, the following parameters of your own wireless network are required:

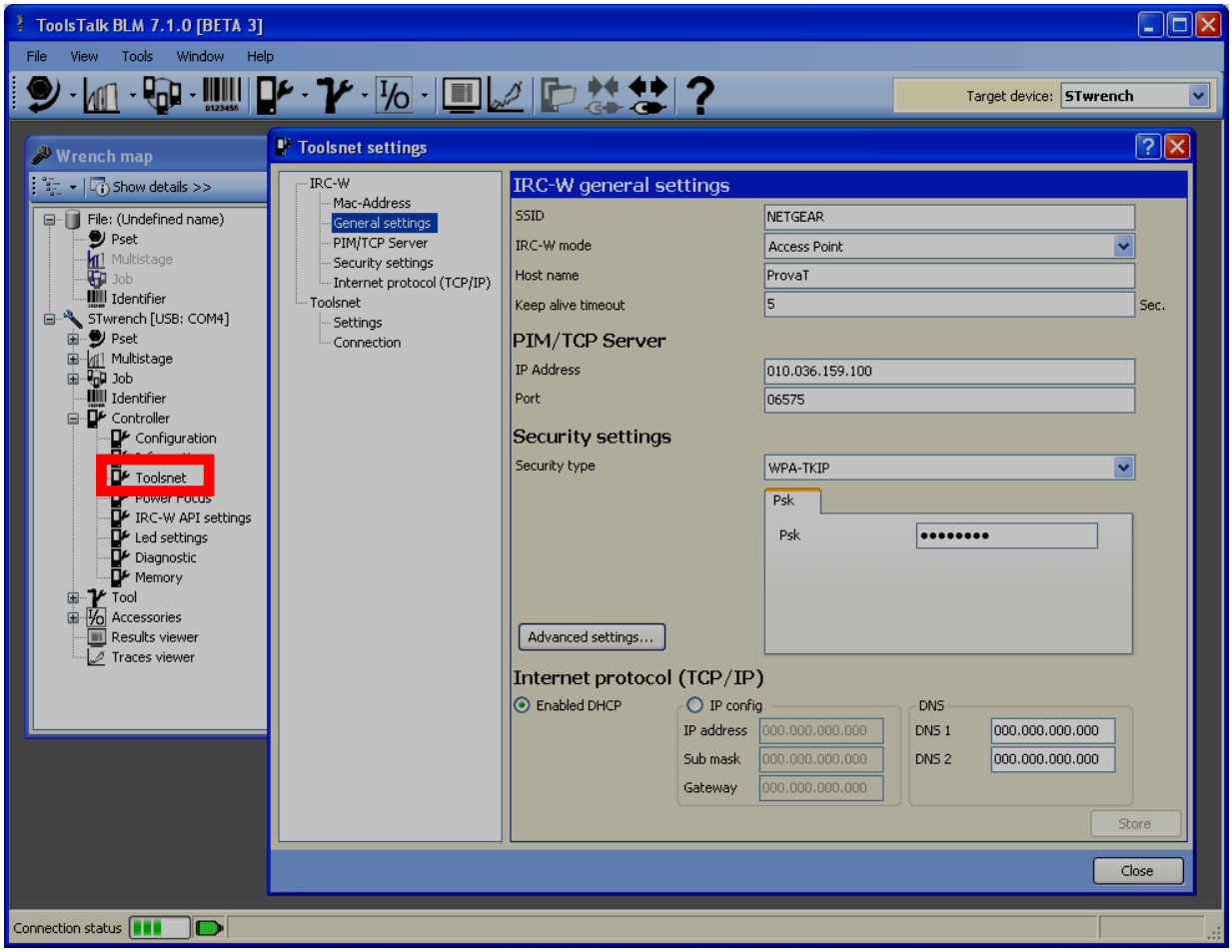
- ***Name (SSID)***: Name of the wireless network.
- ***Security Options***: The STwrench IRC-W module supports the following security options:
  - ***Disable (None)***
  - ***WEP 64***
  - ***WEP 128***
  - ***WPA - TKIP***
  - ***WPA2 - AES***
  - ***LEAP - WPA2***
  - ***LEAP - WEP 128***
  - ***WEP 64 (open connection)***
  - ***WEP 128 (open connection)***
  - ***PEAP -WPA2-AES***
  - ***PEAP -WPA-TKIP***
  - ***EAP-TLS WEP 128***
  - ***EAP-TLS TKIP***
  - ***EAP-TLS AES***
  - ***PEAP-WEP 128***

NOTE: If the IRC-W module is not marked as “dual band”, it does not support the PEAP and EAP security options.

- ***Security Options Password***: Password for wireless network. For WEP 64 and WEP 128 it is possible to choose between hexadecimal or ACII password:

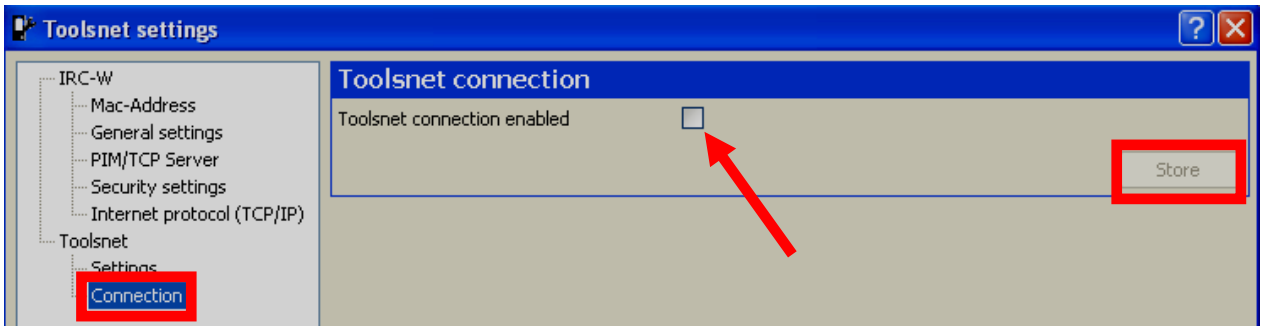


Connect the wrench to ToolsTalk BLM and select the ***Controller → ToolsNet*** menu:

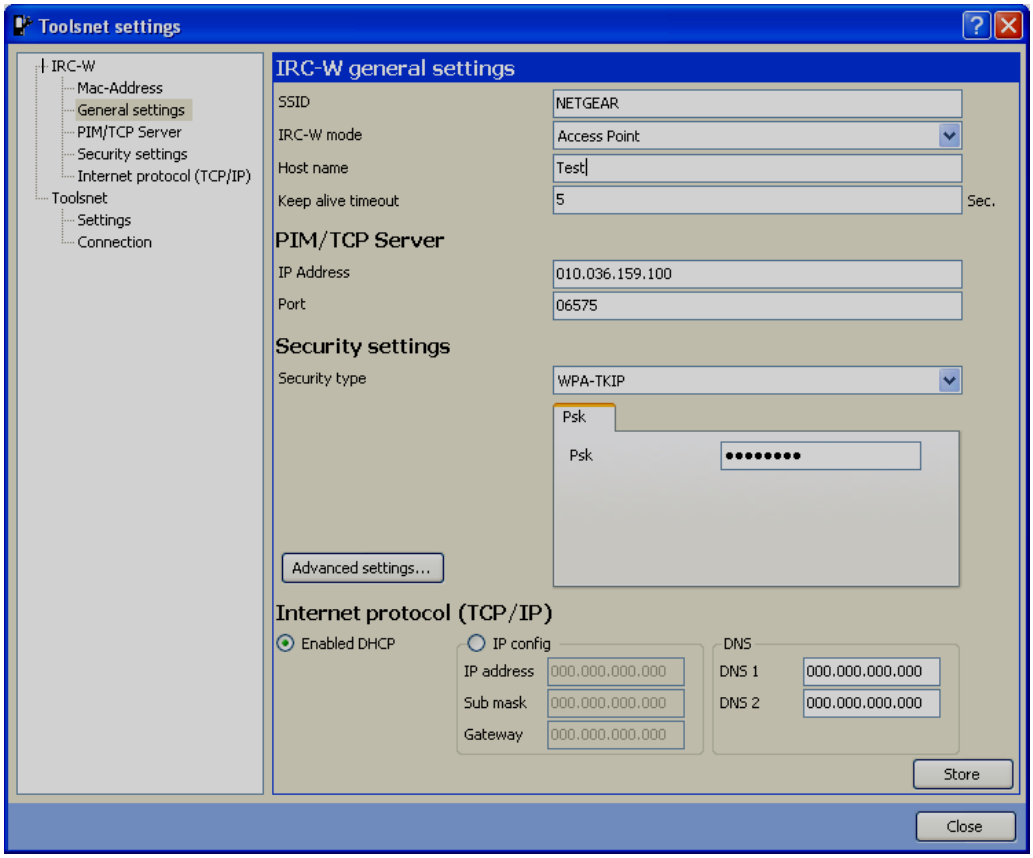


In the ***ToolsNet settings*** window, select ***Connection***:

- Check that the ***ToolsNet connection enabled*** is not selected
- If the flag is enabled, disable it and click on ***Store***



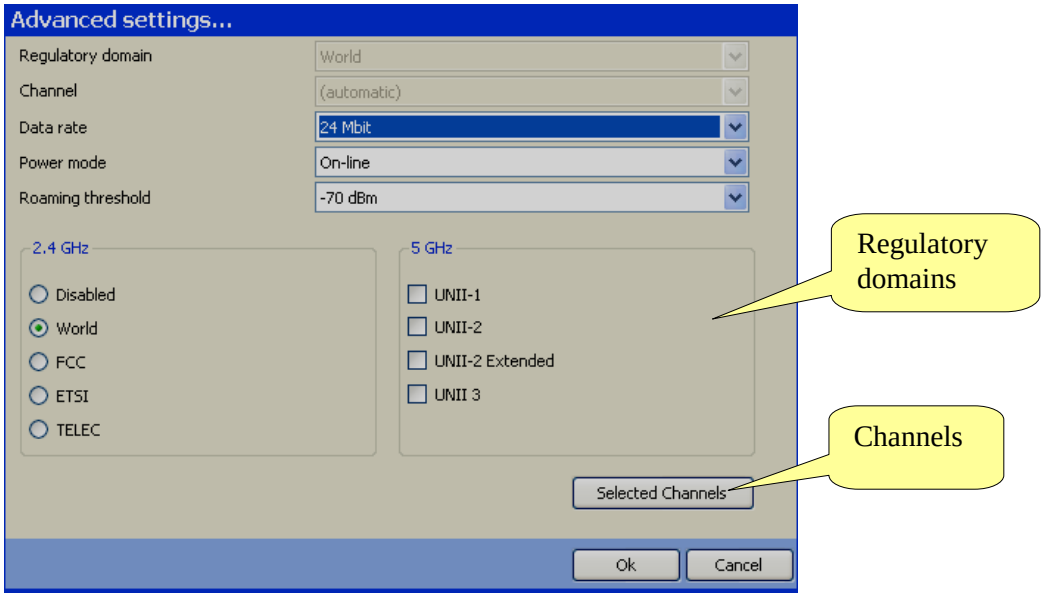
Select ***IRC-W → General Settings*** and enter the following settings:



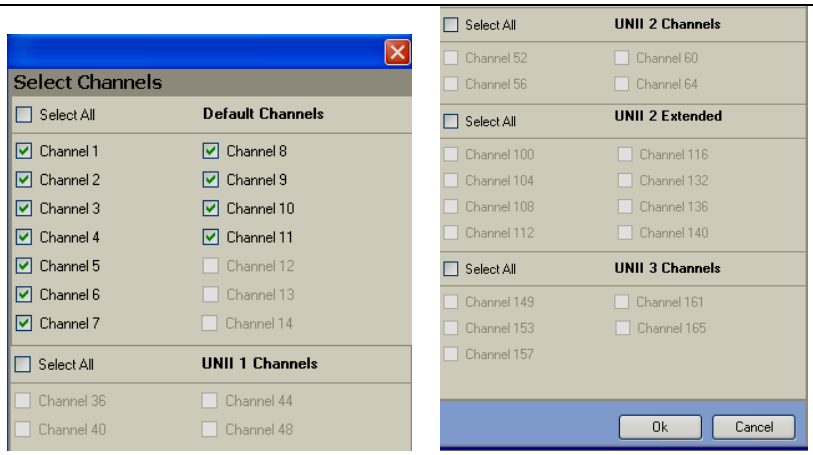
- ***SSID***: Enter the SSID name of your own wireless network
- ***IRC-W mode***: Select ***Access Point***
- ***Host name***: Specify a name of the wrench; if you have more than one wrench the names must be different

- ***Keep alive timeout***: Interval between keep alive messages from the wrench; the default value (5 seconds) is recommended
- ***IP address***: Specify the IP address of the PIM server (part of the ToolsNet configuration)
- ***Port***: specify the port number of the PIM server (part of the ToolsNet configuration)
- ***Security type***: Select the same security type as your own wireless network. For EAP-TLS security type, refer to the *Appendix B – EAP-TLS Security Type* for more information.
- ***Internet protocol (TCP/IP)***: Select ***Enabled DHCP*** if your network uses the DHCP protocol (and specify the ***DNS 1*** and ***DNS 2*** if they are not set automatically by the network). It is also possible to set manually an IP address (with ***Sub mask*** and ***Gateway***) to the STwrench by selecting ***IP Config***.

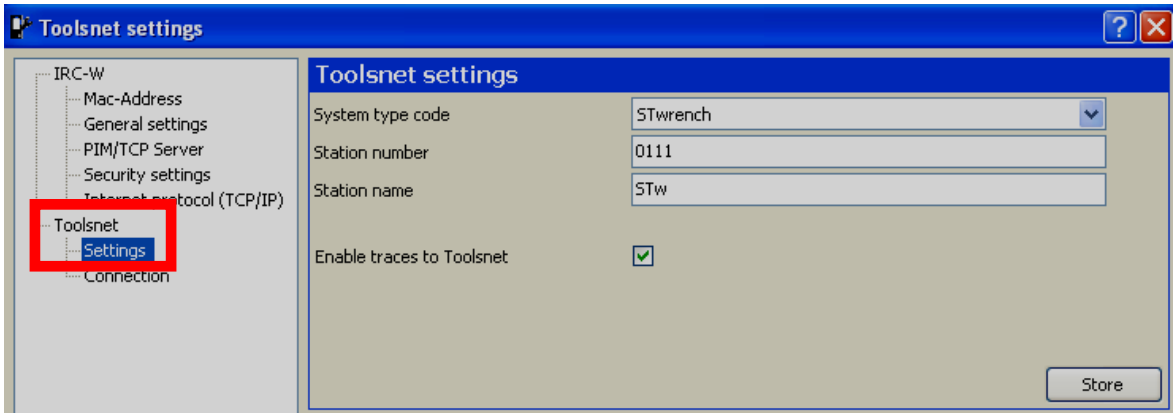
The ***Advanced settings...*** allow you to set the band, channels and parameters for the IRC-W dual band radio module. Set the following parameters according to your specific radio network and access point:



Regulatory domain	Select one of the option for the 2.4 GHz and/or one or more options for the 5GHz.
Channels	Once the regulatory domain has been chosen, click on ***Selected Channels*** to view/change the channels selected by default:

	 The channels available depend from the regulatory domain selected. Select the channel(s) and click on ***OK*** to confirm.
Data rate	Select the data rate. A slower value may help when the communication is not high-performance.
Power mode	The ***Sleep*** mode is recommended for lower power consumption.
Roaming threshold	Select the threshold under which the STwrench will search for a new access point to connect through.

Select ***ToolsNet*** → ***Settings*** and enter the following settings:

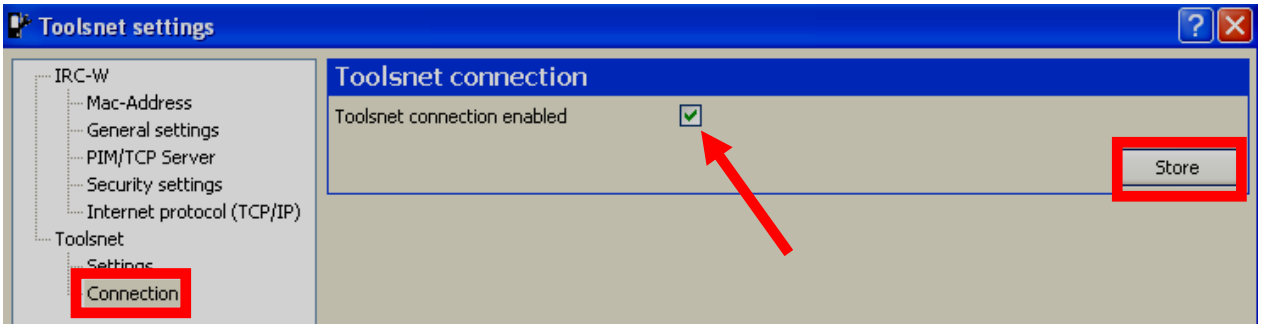


Select ***STwrench*** as ***System Type Code***.
The ***Station Name*** identifies the tree structure which is shown in ToolsNet.
The ***Station Number*** is associated with the tightening results; if more devices (STwrench and other instruments) are connected to ToolsNet, the ***Station Number*** must be unique.

If the ***Enable traces to ToolsNet*** is checked, the tightening traces are sent to ToolsNet 4000. See the *Sending traces to ToolsNet 4000* chapter for more information.

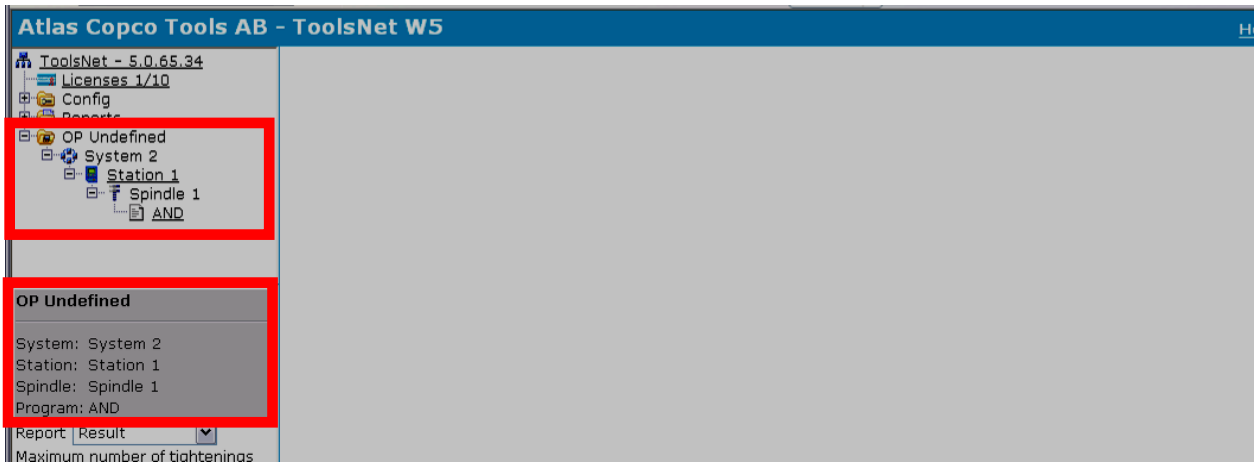
Finally, select the ***Connection*** menu and set it as follows:

- Activate ***ToolsNet connection enabled***
- Click on ***Store***

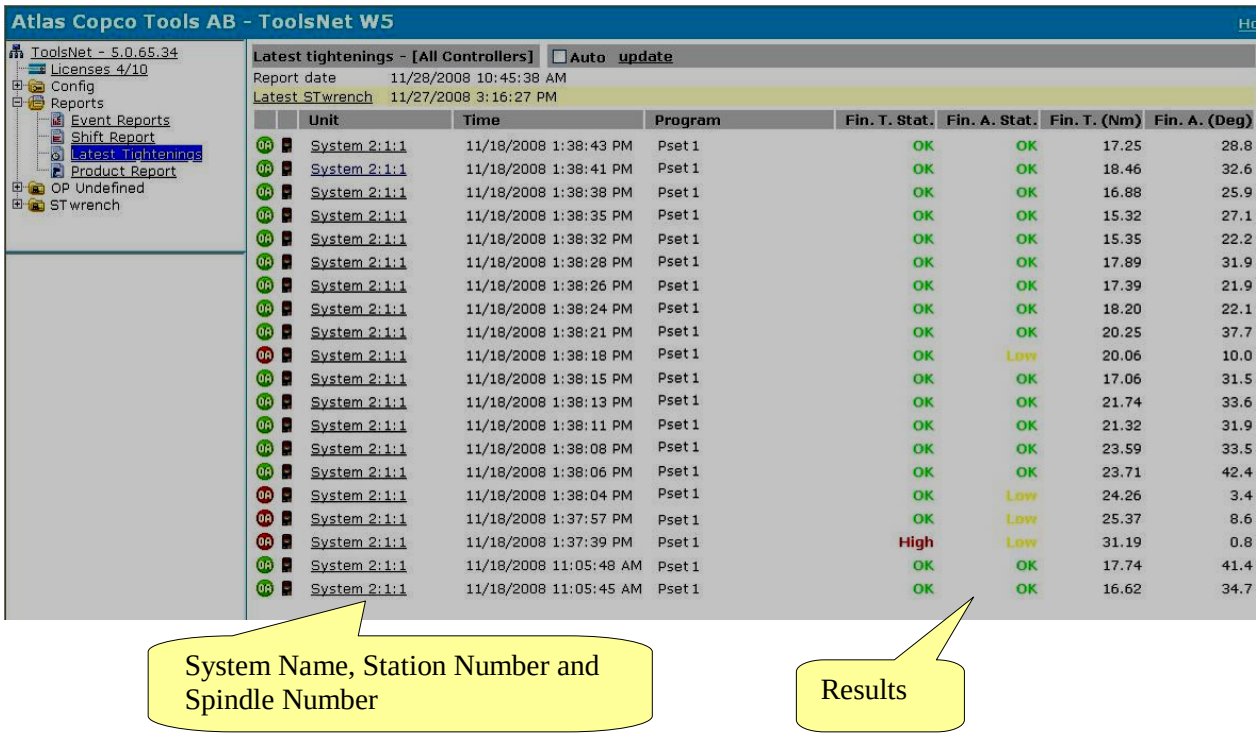


NOTE: If disabling the ToolsNet connection, any results stored in the STwrench memory and not already sent to ToolsNet will no longer be transferred to ToolsNet, even if the connection is enabled again at a later time. For this reason, make sure you do not disable the ToolsNet connection before all of the results have been transferred to ToolsNet (for instance, after executing tests with the STwrench when it is temporary offline from ToolsNet).

The following is shown on ToolsNet 3000:

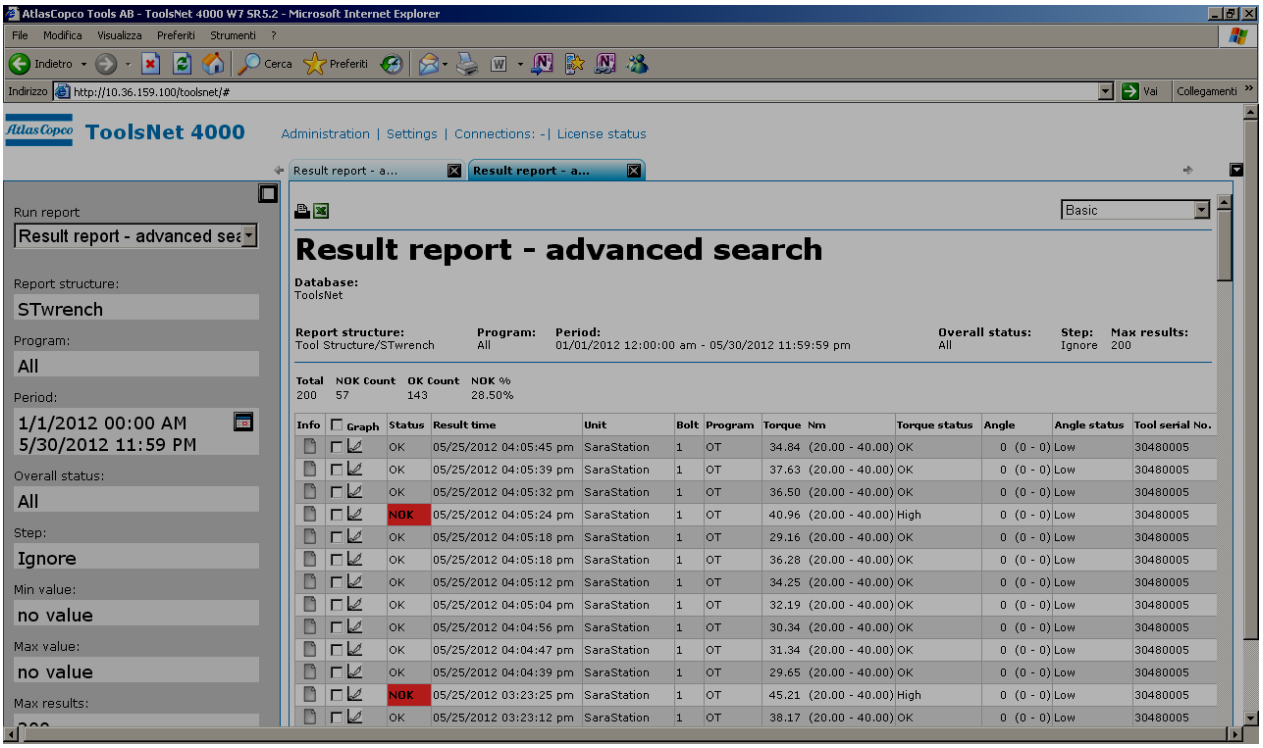


The tightening results are displayed like this:



Double-clicking on a single result brings up a window with more detailed information.

On ToolsNet 4000 the results are presented like this:



16.2 Tightening Data Transferred to ToolsNet

For each tightening operation performed by the STwrench, the following results are sent to ToolsNet:

- ***Tightening program name***
- ***Tightening program number***
- ***Torque Limit Low***
- ***Torque Limit High***
- ***Angle Limit Low***
- ***Angle Limit High***
- ***Time and Date***
- ***Overall result***: OK, Low or High
- ***Final Torque***
- ***Final Torque Status***

- ***Final Angle***
- ***Final Angle Status***
- ***Tool Serial Number***: Serial number of the wrench smartHEAD
- ***Identifiers***: Barcode readings

16.2.1 Sending traces to ToolsNet 4000

ToolsNet 4000 can retrieve the traces from the STwrench. For this mode the following prerequisites are necessary:

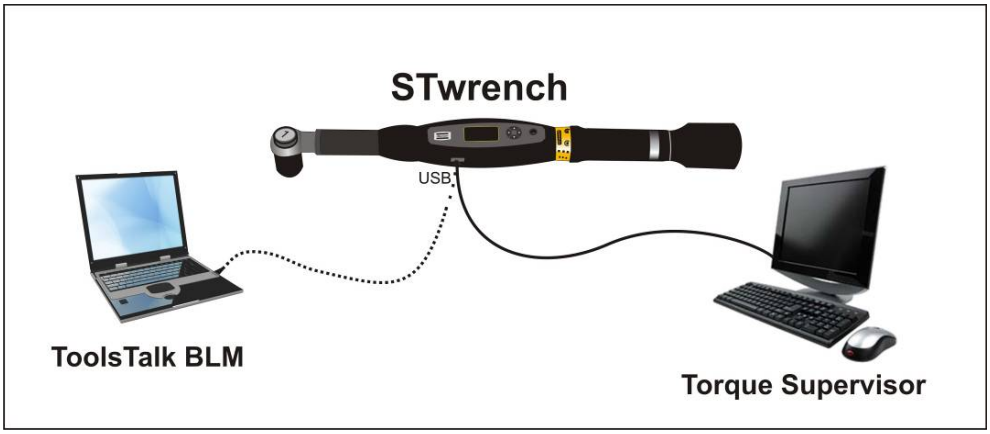
- STwrench settings:
    - The traces transfer to ToolsNet must be enabled (see previous paragraphs with ToolsNet settings from ToolsTalk BLM)
    - The wrench memory settings must be set for 10 traces of 30 seconds in length or 5 traces of 60 seconds in length. See the *STwrench Settings → Memory* chapter for more information.
- QAT Node does not support the traces transfer; the STwrench must be connected directly to ToolsNet via the IRC-W module or via Power Focus.

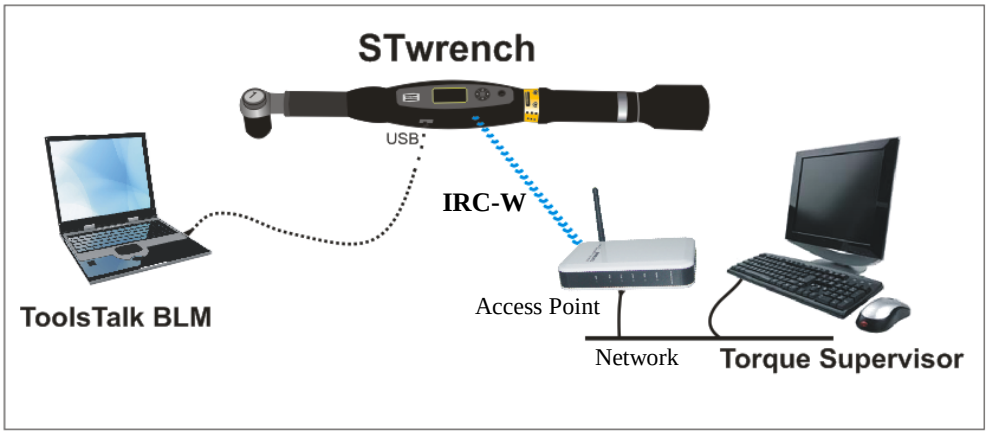
During operation, the traces are sent to ToolsNet after every tightening. If the connection STwrench-ToolsNet is lost and the wrench reaches the maximum number of traces stored, the wrench shows the message "*Trying to send traces to Toolsnet... Please wait or press CL to cancel*". If you wait, the traces will be transferred once the connection is re-established. If you instead pressing the ***CL*** button on the wrench keyboard, the oldest traces will be deleted and replaced by the new ones.

17 Working with Torque Supervisor

Minimum version of Torque Supervisor required: 4.10

When the STwrench is used with Torque Supervisor, the route of tests is created and transferred to the wrench by Torque Supervisor. The wrench only executes the tests and Torque Supervisor downloads the test results.





In this application the tests results are expected to be retrieved by Torque Supervisor. However, it is still possible to review the results and/or traces using ToolsTalk BLM (before transferring them from Torque Supervisor). In any case, the Pset should not modified with ToolsTalk BLM when the STwrench is used with Torque Supervisor.

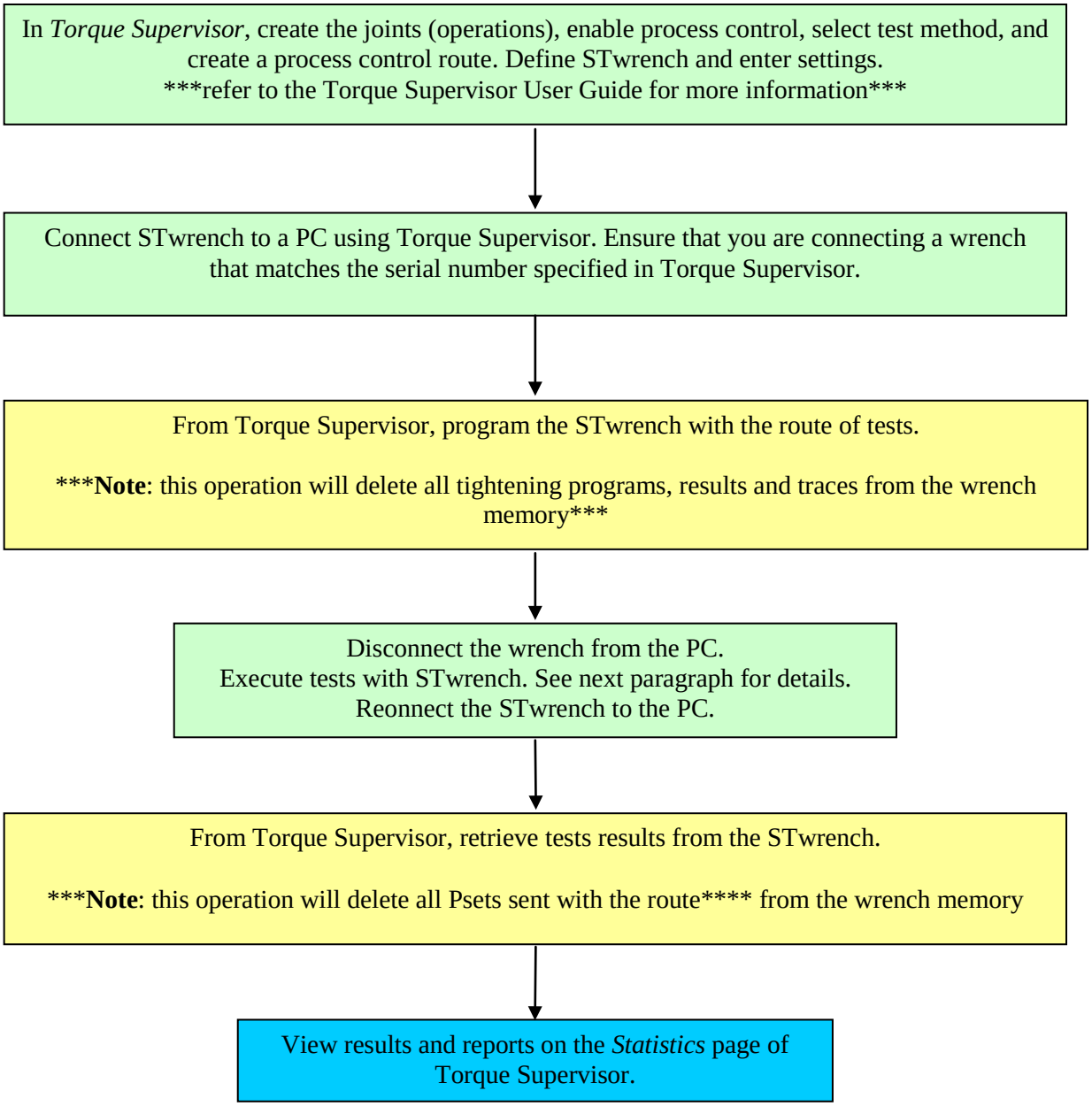


NOTE: When the STwrench is programmed by Torque Supervisor, all the Psets, Multistages, Jobs, results, and traces stored in the wrench memory are deleted. Connect the STwrench to ToolsTalk BLM and save tightening programs (in the .ttb file) and results/traces if you wish to keep a backup.



NOTE: In this application, ToolsTalk BLM is optional. However, if you do not purchase it, you will not be able to access all the STwrench settings defined via ToolsTalk BLM (as described in chapter *STwrench Controller Setup*). Neither will you be able to use the TAG Writer function. For IRC-W connection, the ToolsTalk BLM is mandatory.

The operation flow is as follows:



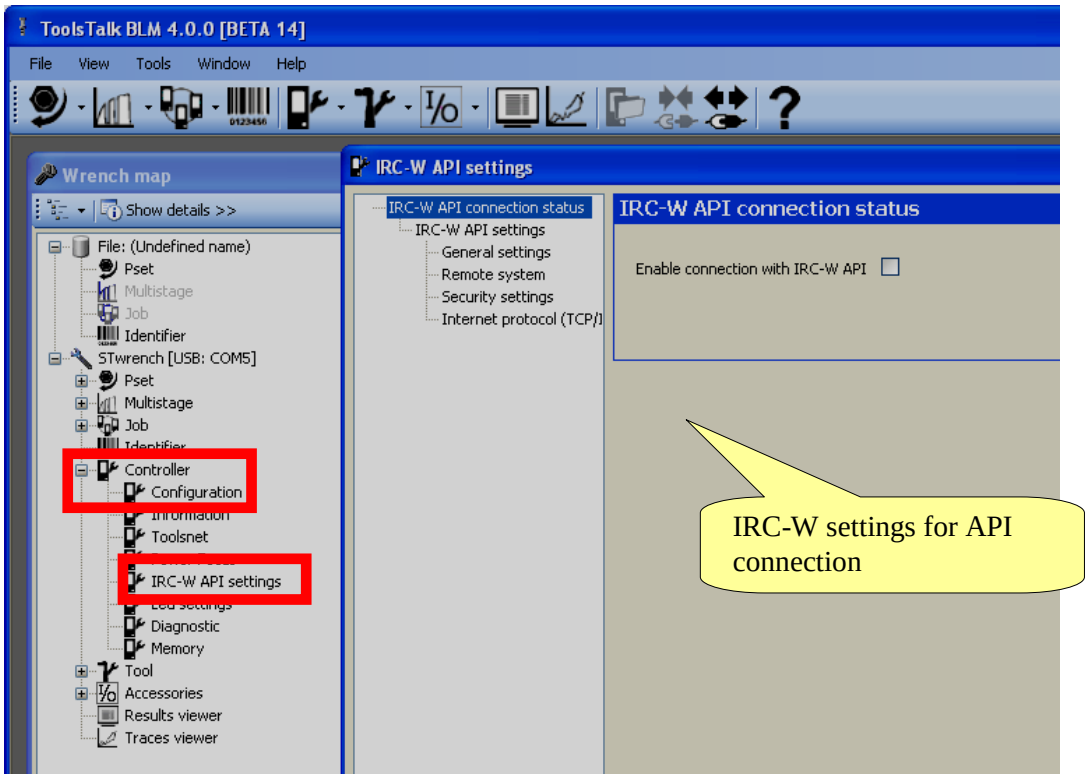
Some wrench settings for this mode are defined in the Torque Supervisor settings. Please refer to the Torque Supervisor User Guide for a full description of the settings and the details of the operations required for this operation mode.

17.1 Connecting the STwrench to Torque Supervisor

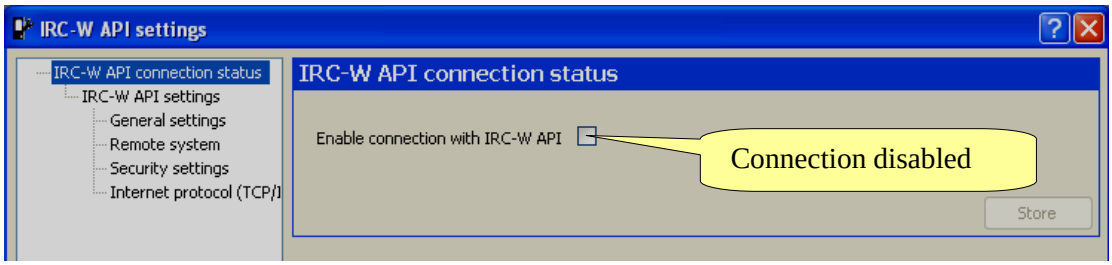
The STwrench can be connected to Torque Supervisor via USB or IRC-W Dual Band radio module.

For USB connection, the STwrench does not need any special settings.

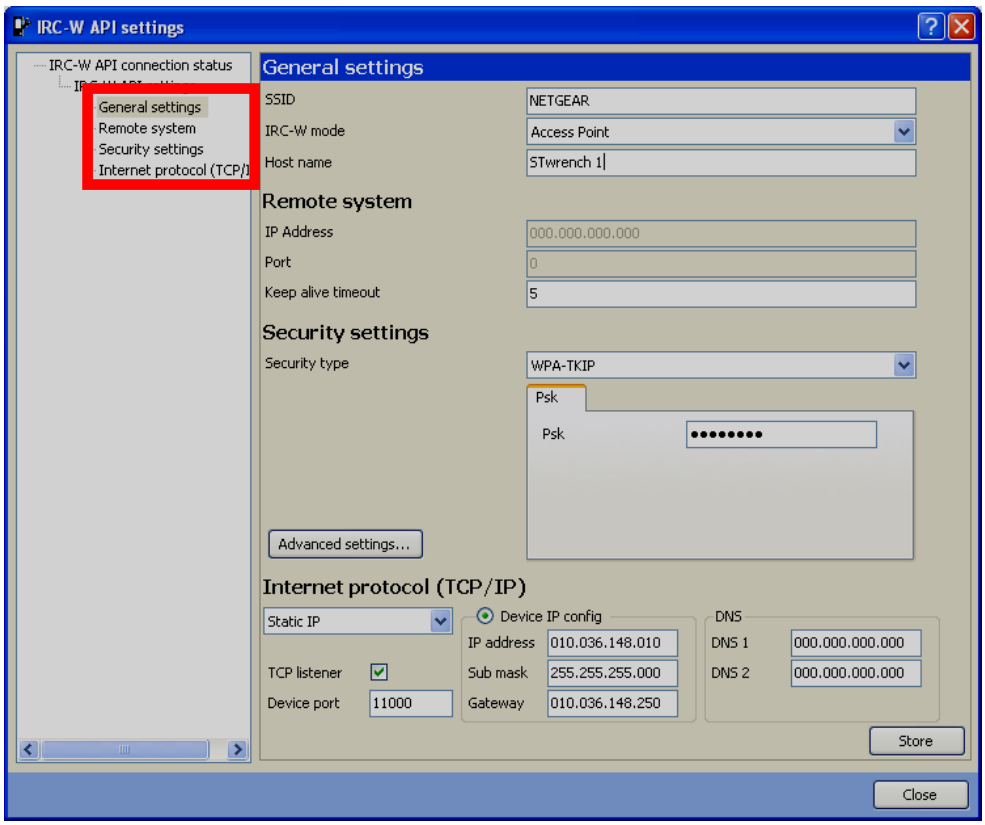
For IRC-W Dual Band radio module connection, the radio module must be properly configured; Connect the STwrench via USB to ToolsTalk BLM. Access the ***Controller → IRC-W API settings*** menu:



To configure the module, ensure that connection is disabled:

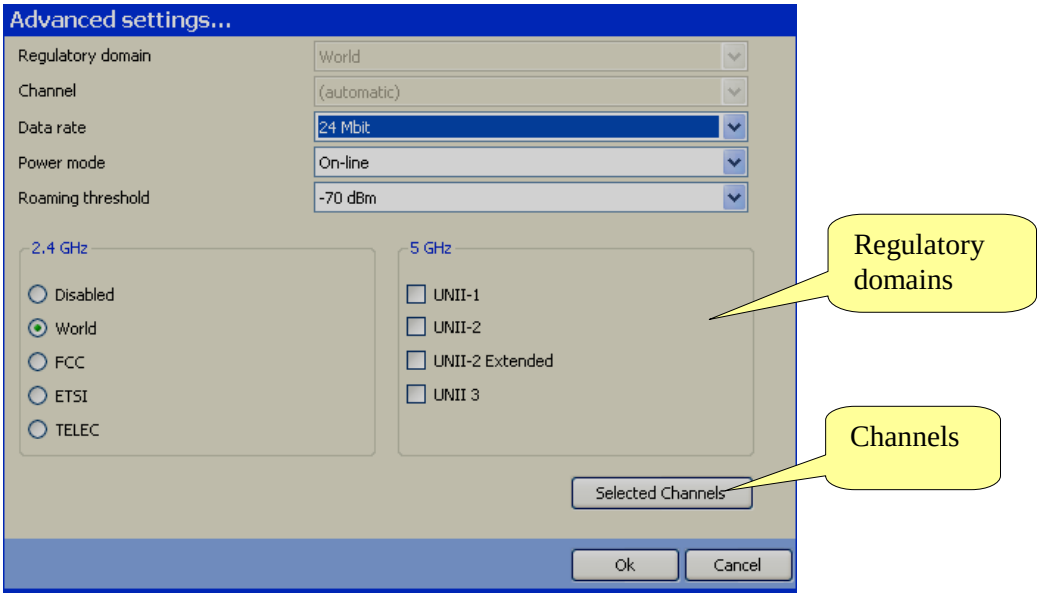


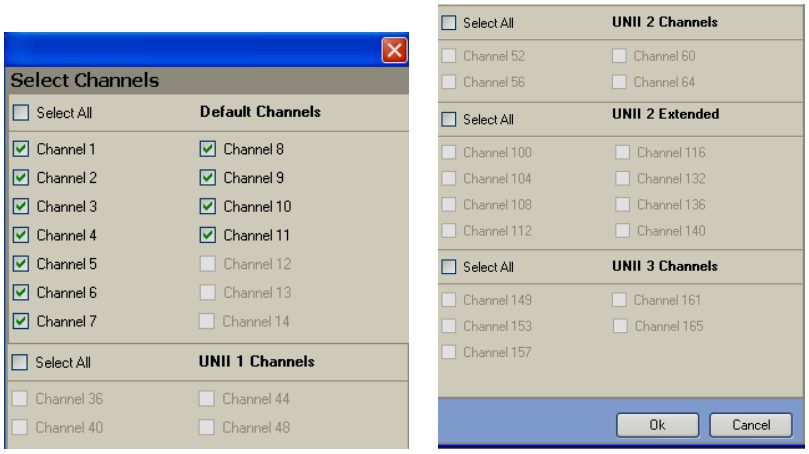
Then select the ***IRC-W API settings*** menu:



- ***SSID***: Enter the SSID name of your own wireless network.
- ***IRC-W mode***: Select ***Access Point***.
- ***Host name***: Specify a name of the wrench.
- ***IP Address***: Not used.
- ***Port***: Not used.
- ***Keep alive timeout***: Interval between keep alive messages from the wrench; the default value (5 seconds) is recommended.
- ***Security Type***: Select the same security type as your own wireless network.
- ***Internet Protocol (TCP/IP)***: Select ***Static IP***, enable the ***TCP listener***, and set the port as in Torque Supervisor (default value 11000). Enable the ***Device IP Config*** (which assigns an IP address to the STwrench), and set the network parameters. The IP address must match the value specified in Torque Supervisor.

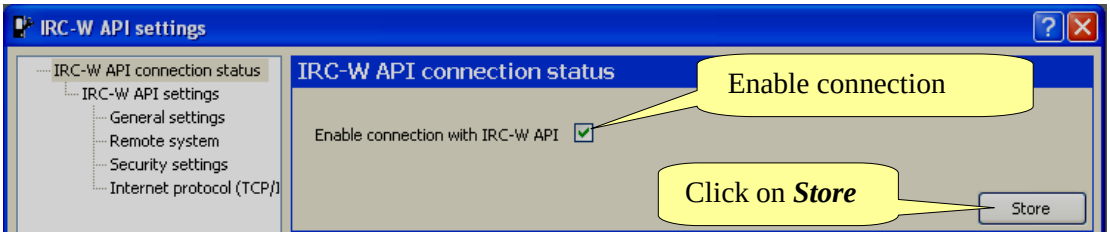
The ***Advanced settings...*** allow you to set the band, channels and parameters for the IRC-W dual band radio module. Set the following parameters according to your specific radio network and access point:



Regulatory domain	Select one of the option for the 2.4 GHz and/or one or more options for the 5GHz.
Channels	Once the regulatory domain has been chosen, click on ***Selected Channels*** to view/change the channels selected by default:  The channels available depend from the regulatory domain selected. Select the channel(s) and click on ***OK*** to confirm.

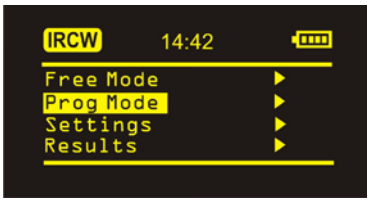
Data rate	Select the data rate. A slower value may help when the communication is not high-performance.
Power mode	The ***Sleep*** mode is recommended for lower power consumption.
Roaming threshold	Select the threshold under which the STwrench will search for a new access point to connect through.

Once all of the settings are done, enable the connection to API and click on ***Store*** to save:



17.2 Test Execution

Once the STwrench has been programmed by Torque Supervisor, the list of Psets to test the joints is available in the ***Prog. Mode*** menu:



Execute the tests and then download the results from Torque Supervisor. Partial results are downloaded from the STwrench memory anyway (in which case the statistics are generated only when the remaining test results are executed and downloaded).

17.3 Tightening Strategies and Parameters

Torque Supervisor defines the Pset parameters and the test method. The following table provides a cross reference between the parameters and test methods inside Torque Supervisor and the Pset parameters of the wrench strategies described in this user guide.

Torque Supervisor		STwrench
Breakaway peak		**Residual torque peak**
	*see formula below	Cycle Start
	Minimum torque	Final Torque Min
	Maximum torque	Final Torque Max
	**see formula below	Change Screw
	Threshold	Start final angle
	0	Target angle
Breakaway time		**Residual torque time**
	*see formula below	Cycle Start
	Minimum torque	Final Torque Min
	Maximum torque	Final Torque Max
	**see formula below	Change Screw
	Threshold	Start final angle
	Analysis Limits (Lower – Higher)	-Not used-

Breakaway angle		**Residual torque peak**
	*see formula below	Cycle Start
	Minimum torque	Final Torque Min
	Maximum torque	Final Torque Max
	**see formula below	Change Screw
	Threshold	Start final angle
	Breakaway torque – degrees	Target angle
	3	Concave-down point threshold
	20	Concave-up point threshold
Loose and tighten		**Loose and tightening**
	*see formula below	Cycle Start
	Minimum torque	Final Torque Min
	Maximum torque	Final Torque Max
	**see formula below	Change Screw
	Nominal angle	Start final angle
Breakaway (Tq/Angle)		**Residual torque angle**
	*see formula below	Cycle Start
	Minimum torque	Final Torque Min
	Maximum torque	Final Torque Max
	**see formula below	Change Screw
	Threshold	Start final angle
	Analysis Limits (Lower – Higher)	-Not used-

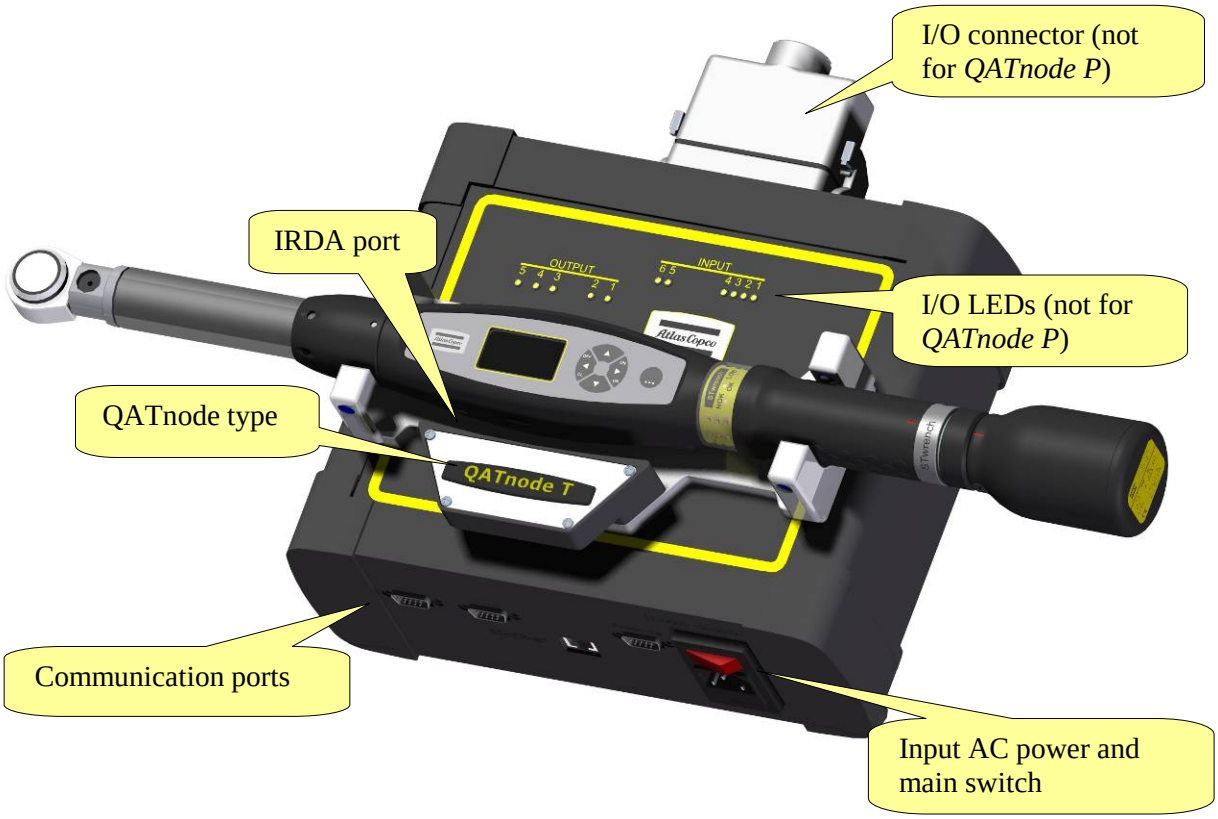
For all the strategies:

$$* \ \textbf{Cycle Start} = 1 + 0.05 \times \left(\textbf{\textit{STwrenchCapacity}} - 1 \right)$$

$$** \ \textbf{Change Screw} = \textbf{min} \left[\textbf{\textit{MaximumTorque}} \times \frac{\textbf{\textit{STwrenchSpan}}}{100} ; \left(\textbf{\textit{STwrenchCapacity}} - 1 \right) \right]$$

18 Working with the QATnode

The QATnode is powered by AC power 110 ÷ 230 VAC (50/60Hz). Connect the AC power cable and turn on the main switch when using the QATnode.



Three serial and one Ethernet port are available:

COM 1	Serial port for a STAR printer.
COM 2	Serial port from the ***QATnode Settings*** software supplied with the QATnode.
Programming	Serial port for maintenance activities (QATnode firmware upgrade).
Ethernet	Network port for ToolsNet communication and QATnode settings via webpage.

The QATnode must be configured and associated with the STwrench before starting the operation.

A QATnode must be associated with a single STwrench and vice versa.

The connection between STwrench and QATnode can be made via:

- ***IRDA port***: When the STwrench is placed on the QATnode, it starts communicating with the QATnode through the IRDA port.
- ***IRC-W radio module***: The STwrench must be equipped with an IRC-W module, and the QATnode must be connected to an access point.

In this chapter, the first paragraphs detail the settings required for the QATnode startup, while the last paragraphs describe how to configure and use the features provided by the QATnode. Please read them all carefully in order to perform all of the steps required for proper operations.

18.1 Associating the STwrench with the QATnode

A new QATnode must be firstly associated with your STwrench. The association is done on the RBU present in the STwrench controller. Replacing the RBU inside the controller will cause the association to be lost, while moving the RBU to another controller will result in the association being transferred to the new controller. The association can be removed if the STwrench needs to be associated with a different QATnode (see the chapter *Removing the STwrench - QATnode association* for more information).

18.1.1 IRDA connection

To establish an IRDA connection, turn on the STwrench and the QATnode.

Place the STwrench on the QATnode and wait until the IRDA logo is shown on the STwrench display:



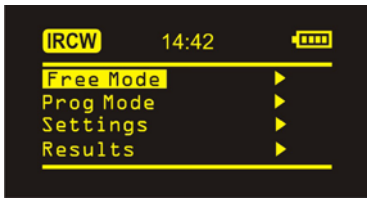
The STwrench and QATnode are now associated.

The IRDA logo is shown only when the connection is active.

18.1.2 IRC-W connection

To establish an IRC-W connection, turn on the STwrench and the QATnode (which must connected to the access point).

The association is automatically performed between the QATnode and the first STwrench found online. When the STwrench is associated with the QATnode, the IRC-W logo is shown on the wrench display:

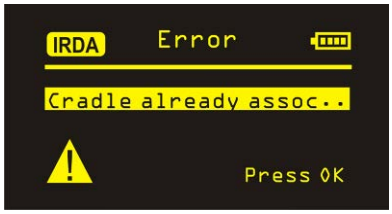


The STwrench and QATnode are now associated.

The IRC-W logo is shown only when the connection is active.

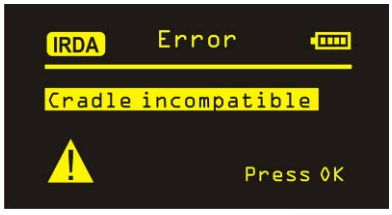
18.1.3 Errors

If the QATnode is already associated with another wrench, the following error message is shown on the wrench display:



To associate a new wrench to the QATnode, the current association with the old wrench must be disabled (see the next paragraphs of this chapter for more information).

If the STwrench settings are not compatible with your QATnode type, the following message is shown:



This can happen, for instance, if the STwrench QATnode settings include a ToolsNet connection for a Printer QATnode, which does not support the ToolsNet connection.

In this case, the STwrench settings for the QATnode (defined via ToolsTalk BLM) must be updated with the proper QATnode you are using, as described in the next paragraphs of this chapter.

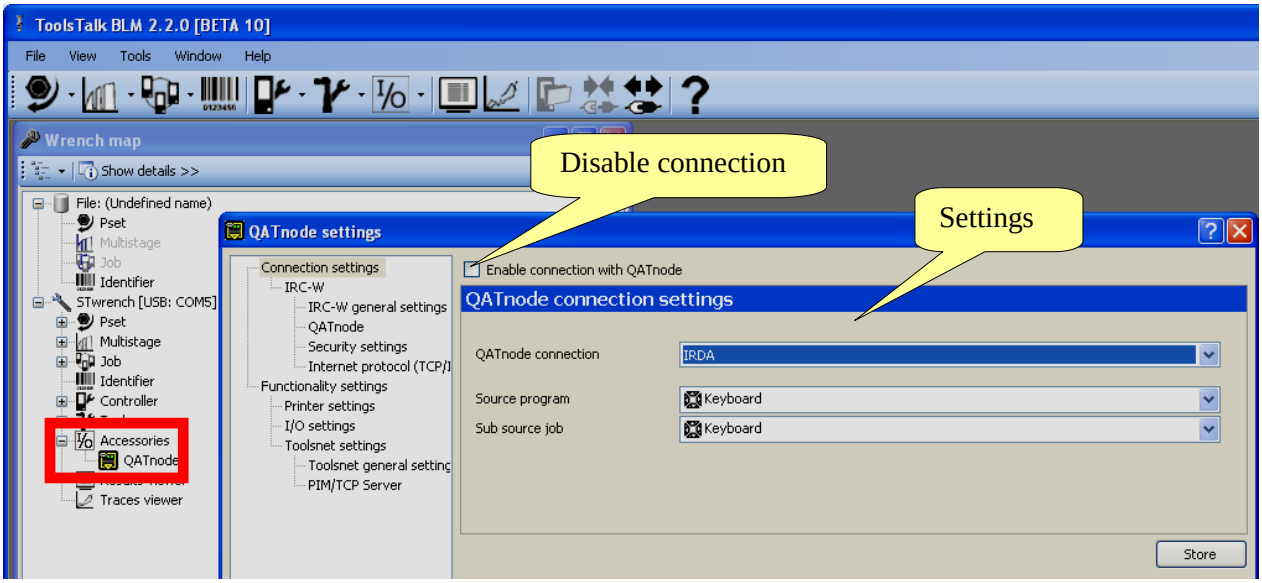
18.2 QATnode and STwrench Settings

Both the STwrench and the QATnode must be configured properly to work together.

18.2.1 STwrench settings

Open the ToolsTalk BLM and connect the STwrench.

Double-click on ***Accessories → QATnode*** to open the ***QATnode Settings*** window:



NOTE: Not all the QATnode settings in this window are stored in the .ttb file saved by ToolsTalk BLM.

To enter the settings, the ***Enable connection with QATnode*** must be disabled (click on ***Store*** after enabling/disabling this flag).

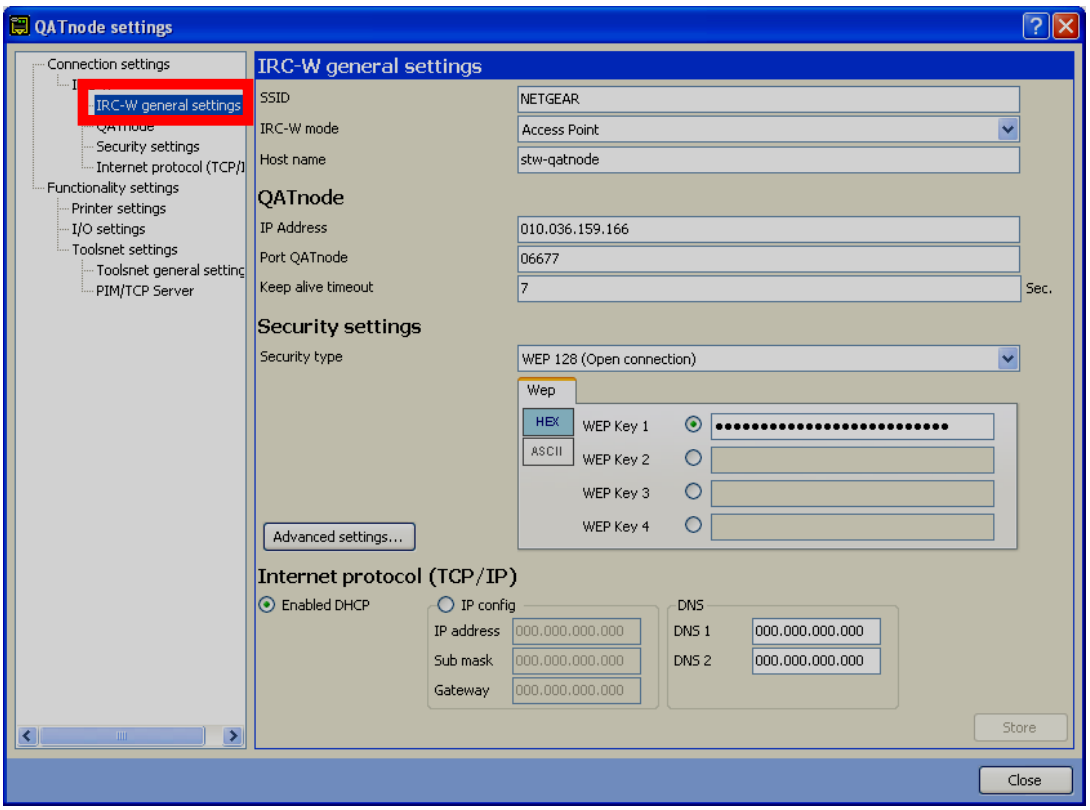
The ***Source program*** and ***Sub source job*** defined here are the same as the parameters defined in the STwrench Controller settings; they are replicated here for convenience. See the chapter *Setting the source for Pset/Multistage/Job selection.*

For IRDA communication:

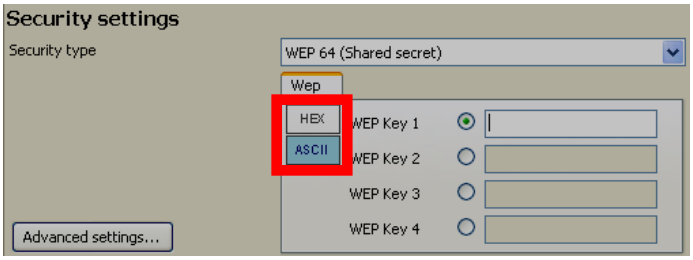
- Set the ***QATnode connection*** to ***IRDA***.
- Select the desired ***Source program*** and ***Sub source job***.
- Enable the ***Enable connection with QATnode***.
- Click on ***Store***.

For IRC-W communication:

- Set the ***QATnode connection*** to ***IRC-W***.
- Select the desired ***Source program*** and ***Sub source job***.
- Click on ***Store***.
- Select ***IRC-W*** and configure as follows:

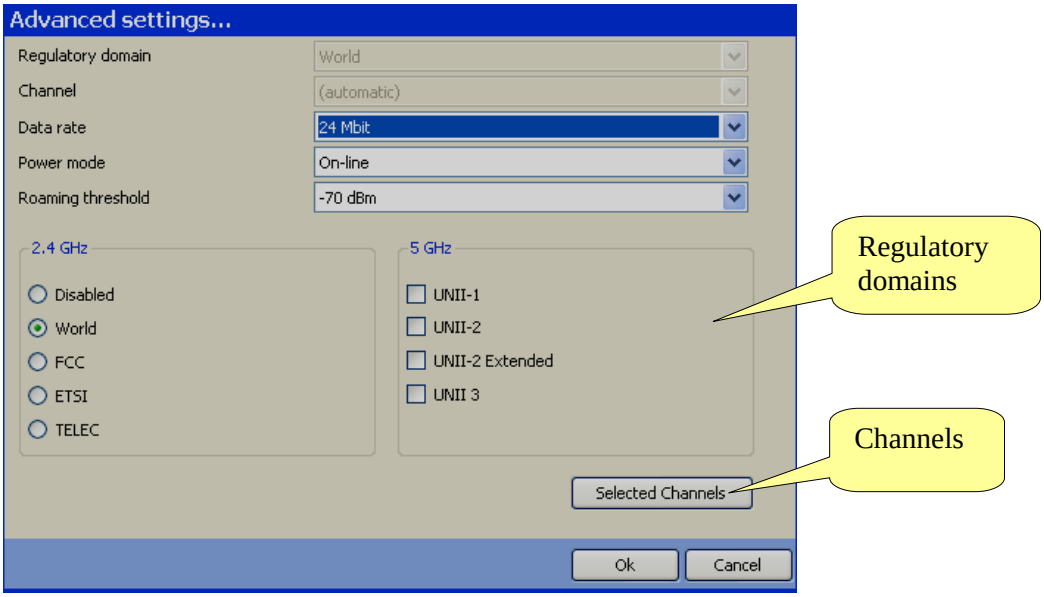


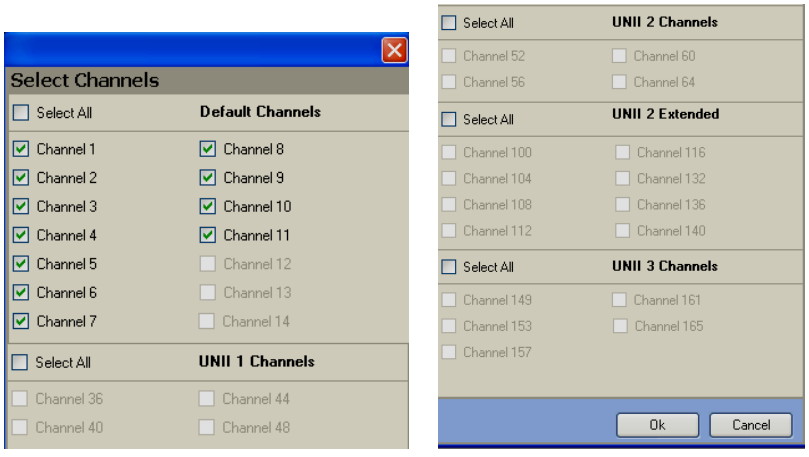
- ***SSID***: Enter the SSID name of your own wireless network
- ***IRC-W mode***: Select ***Access Point***
- ***Host name***: Specify a host name.
- ***IP Address***: Specify the IP address of the QATnode. The default value of the QATnode IP is 192.168.001.001. See the next paragraph for more information on how to check or modify the QATnode IP address.
- ***Port QATnode***: Specify the port number of the QATnode. The port must be the same as the one set in the QATnode. See the next paragraph for more information on how to check or modify the QATnode port.
- ***Keep alive timeout***: The STwrench and QATnode exchange "keep alive" messages with a certain frequency. This parameter specifies the time interval between two messages; the default value of 1 second is recommended. However, for "slow" networks this value may be increased.
- ***Security Type***: Password for wireless network. For WEP 64 and WEP 128 it is possible to choose between hexadecimal or ACII password:



- ***Internet Protocol (TCP/IP)***: Select ***Enabled DHCP*** if your network uses the DHCP protocol (and specify the ***DNS 1*** and ***DNS 2*** if they are not set automatically by the network). It is also possible to set manually an IP address (with ***Sub mask*** and ***Gateway***) to the STwrench by selecting the ***IP Config***.

The ***Advanced settings...*** allow you to set the band, channels and parameters for the IRC-W dual band radio module. Set the following parameters according to your specific radio network and access point:



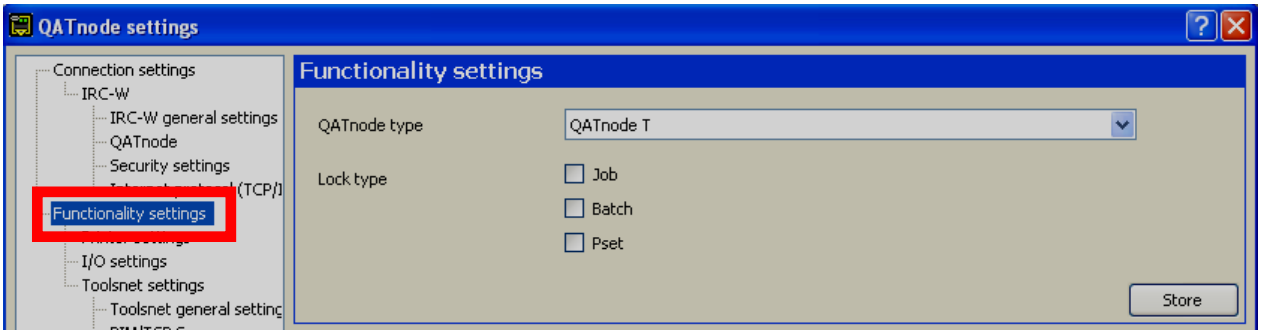
Regulatory domain	Select one of the option for the 2.4 GHz and/or one or more options for the 5GHz.
Channels	Once the regulatory domain has been chosen, click on ***Selected Channels*** to view/change the channels selected by default:  The channels available depend from the regulatory domain selected. Select the channel(s) and click on ***OK*** to confirm.

Data rate	Select the data rate. A slower value may help when the communication is not high-performance.
Power mode	The ***Sleep*** mode is recommended for lower power consumption.
Roaming threshold	Select the threshold under which the STwrench will search for a new access point to connect through.

Once the settings are completed:

- Click on ***Store***
- Enable the ***Enable connection with QATnodes***.
- Click on ***Store***.

In the ***Functionality Settings*** window, set the QATnode type and options:



QATnode Type	Select your QATnode type.
Lock Type	Parameter only valid for IRDA connection, and discarded if an IRC-W connection is established between the wrench and QATnode. If one of these flags is enabled, the STwrench must be put on the QATnode at the end of the Job/Batch/Pset in order to continue with the next tightening program; this applies only if the source of the tightening program is set to *QATnode*.

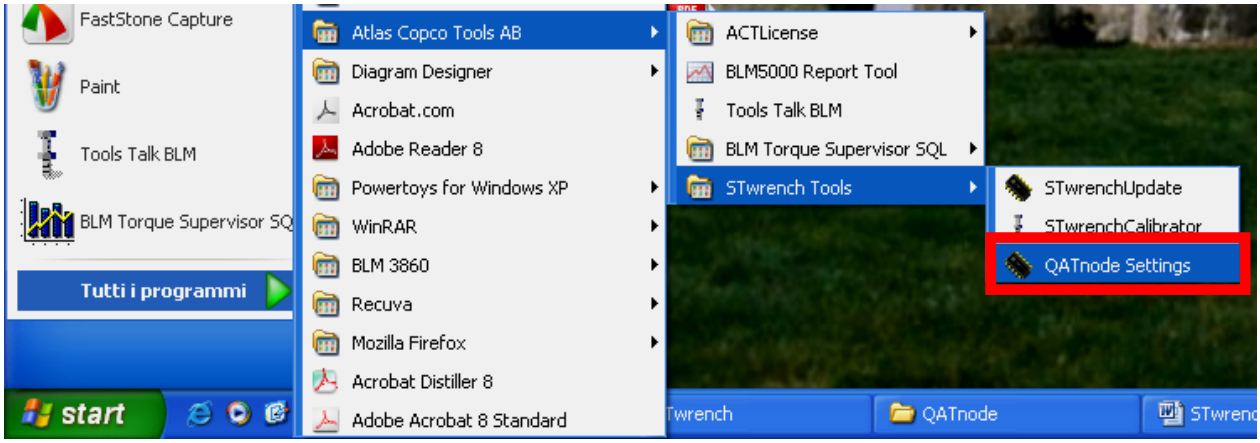
Click on ***Store*** to save the settings.

18.2.2 QATnode settings

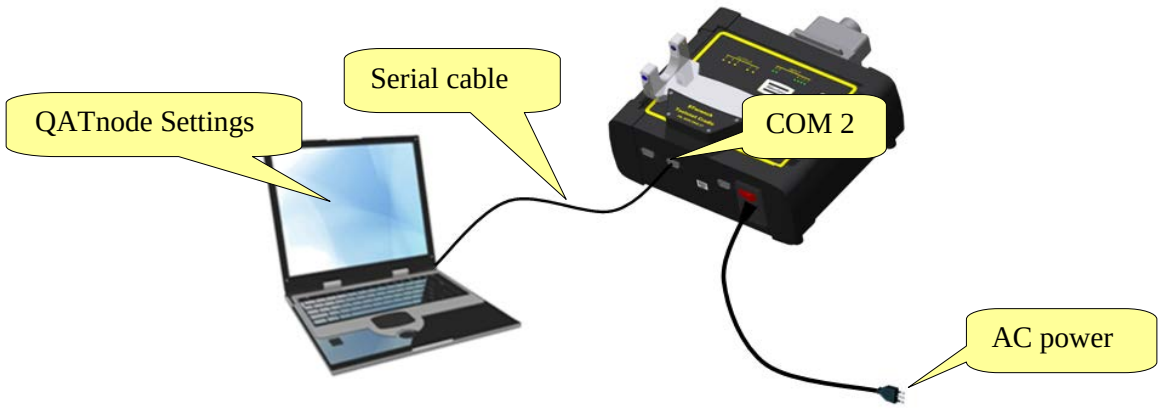
When the STwrench is connected to the QATnode with an IRC-W module, or when the *QATnode T* is connected to ToolsNet, the QATnode Settings software (included with the QATnode) allows you to set a proper IP address suitable for your own network.

The QATnode Settings software CD is provided with all versions of the QATnode. To install the software, simply insert the installation CD in your computer and follow the installation instructions.

Once installed, the software is shown in the ***Start → Program Files → Atlas Copco Tools AB → STwrench Tools*** menu:

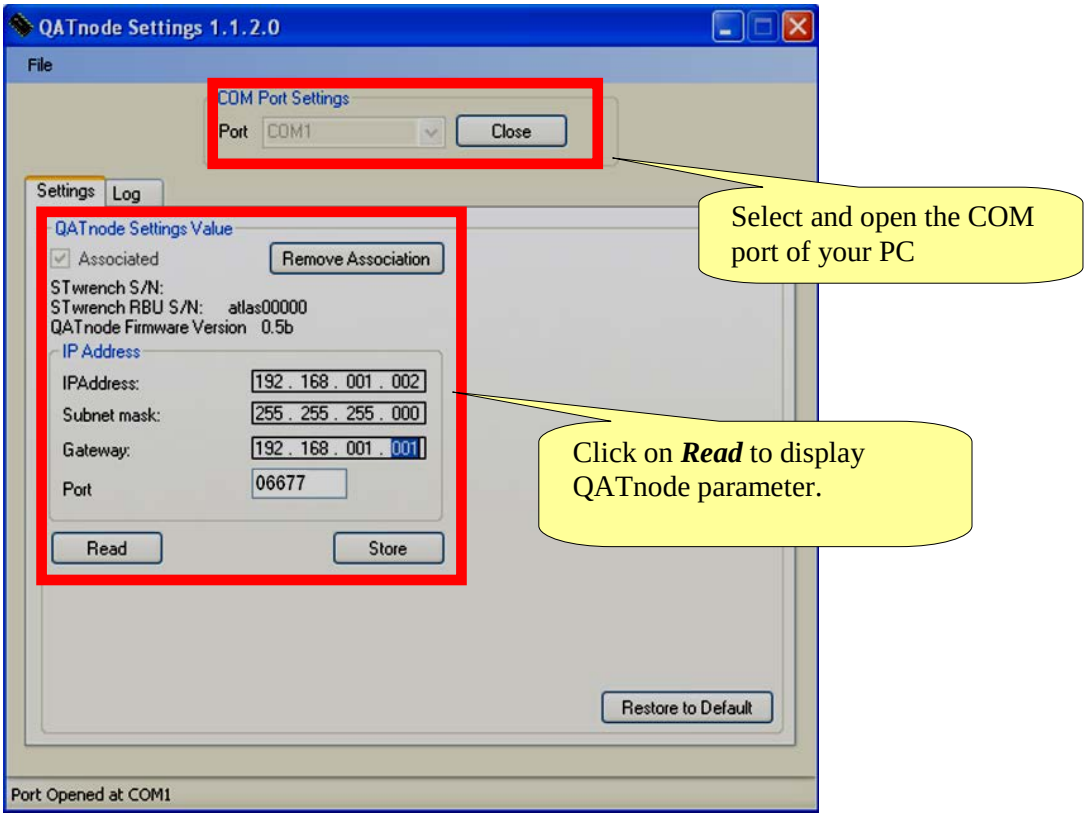


You can connect the PC to the QATnode using a crossed female-female serial cable:



Execute the QATnode Settings software on the PC.

Select the COM port of your PC and click on ***Open***:



Click on ***Read*** to display the QATnode settings.

Change the default ***IP Address*** to a proper address suitable for your own network.

The ***Port*** must be the same port specified in the QATnode settings in ToolsTalk BLM.

Click on ***Store*** to save the settings.

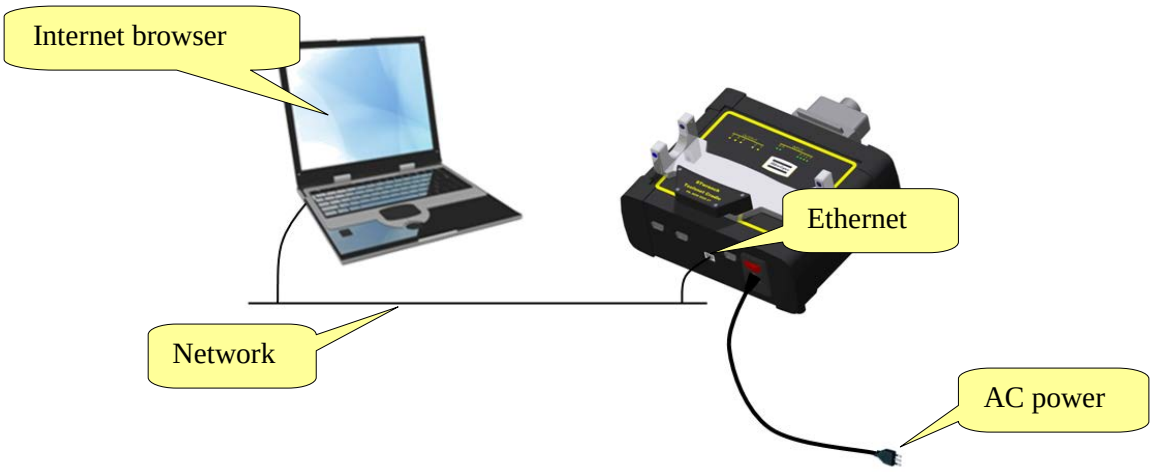
The ***Restore to Default*** command resets the factory values. After having executed this command, click on ***Store***, then restart the QATnode.

NOTE: These QATnode settings are stored inside the QATnode and not in the .ttb file saved by ToolsTalk BLM.

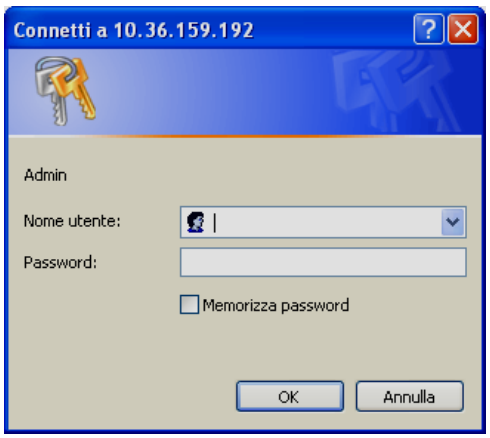
18.2.2.1 Web interface

Once the IP address of the QATnode has been set with a proper value, a web interface is also available to read/set the QATnode parameters. The web interface and the *QATnode Settings* software provide the same functions; it is up to the user to select which to use.

Connect the PC and the QATnode to your network (you can also perform a direct connection between PC and QATnode using a network cable):



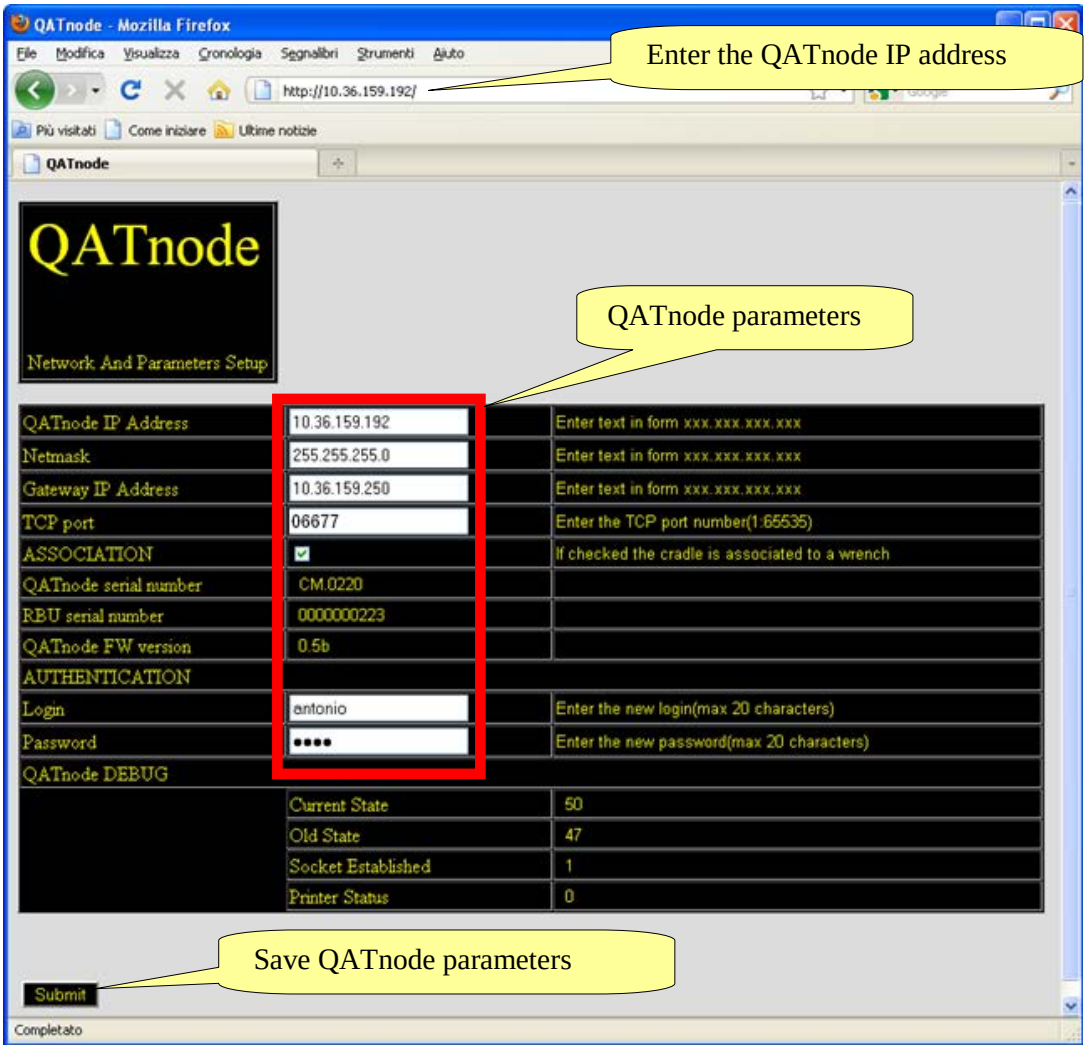
Open the Internet browser on your PC and enter the QATnode IP address. Before accessing the webpage, you must log in:



Default login:

User name: QATnode
Password: 1234

Enter the login and password, and the following page is shown:



The parameters listed here are the same of those you can configure using the *QATnode Settings* software. A ***Login*** and ***Password*** are required to access the web interface page. It is advisable to replace the default login and/or password with customized ones.

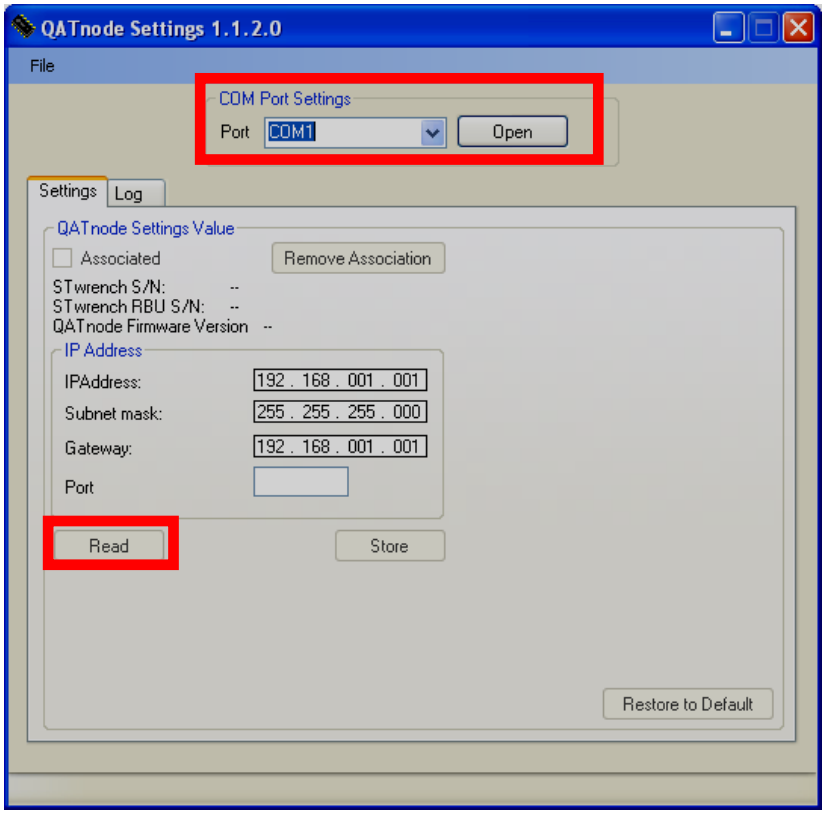
Click on ***Submit*** to save the parameters in the QATnode.

18.2.3 Removing the STwrench - QATnode association

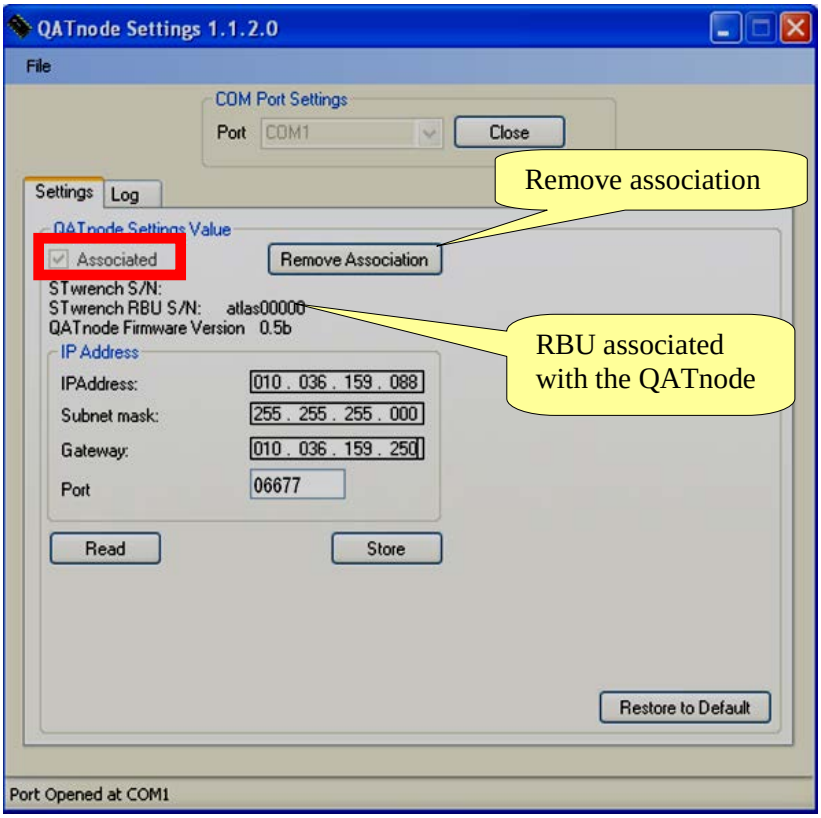
If you want to associate a different STwrench with the QATnode, the current association must be removed before the new association can be established.

Open the ***QATnode Settings*** software supplied with the QATnode. Connect the COM 2 port of the QATnode to your PC via a serial cable.

Select the COM port of the PC to connect to the QATnode, and click on ***Open*** and then on ***Read***:



The current association is shown:



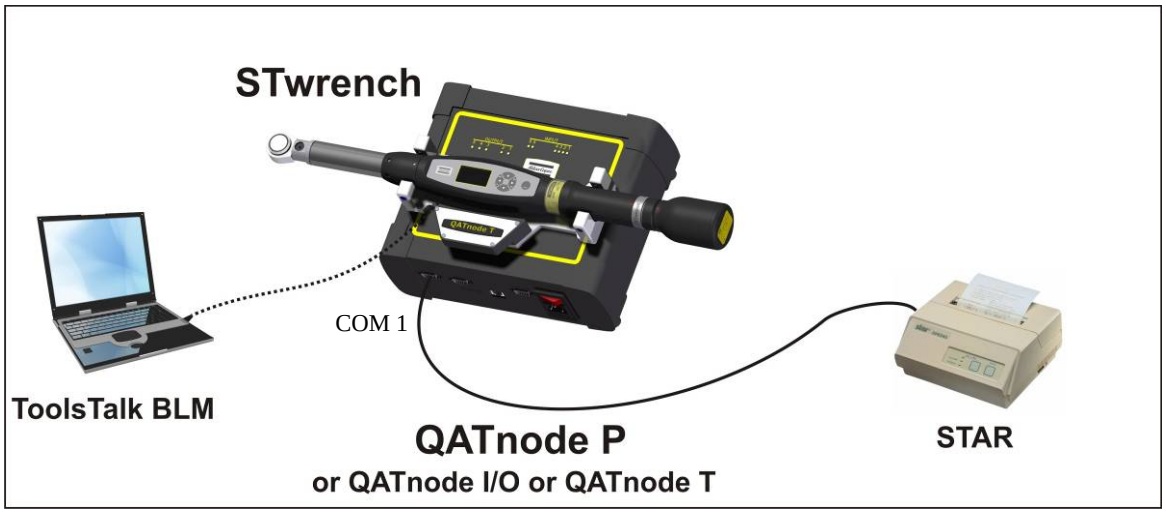
Click on ***Remove Association***.

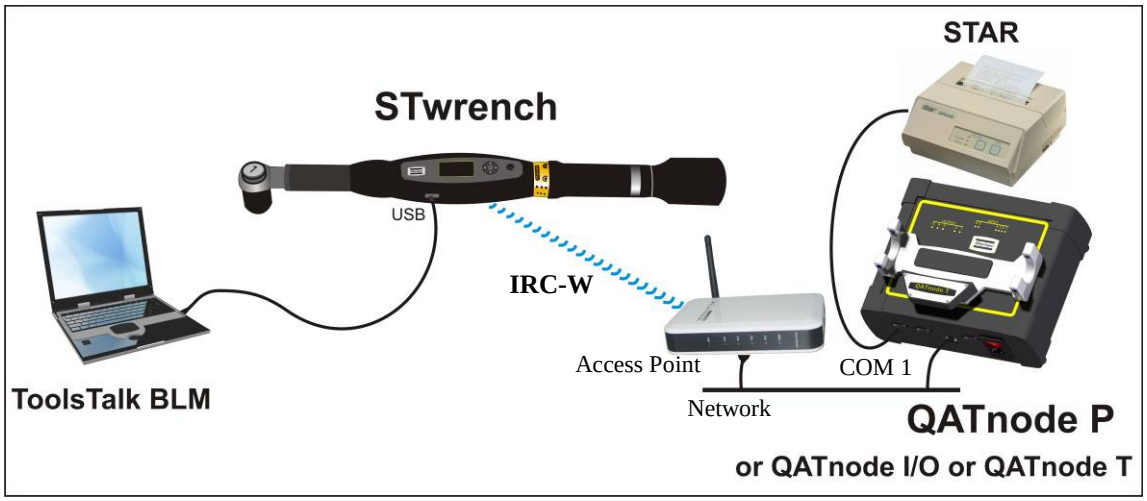
Click on ***Read*** to verify that the association has been removed (the fields ***STwrench S/N*** and ***STwrench RBU S/N*** will be blank).

The association can be also removed by using the web interface (see the previous paragraph of this manual for more information).

18.3 Printing the Tightening Results on a STAR printer

This function is provided in all versions of QATnode.





The supported is the STAR DP8340. Refer to the printer manual for printer operation and settings.

NOTE: The serial cable from the QATnode to the printer must be shielded, and not longer than 10 meters.

Ensure that the STwrench is associated with the QATnode; also, ensure that the settings on STwrench and QATnode are correct as described in the first paragraph of this chapter.

With an IRDA connection, the tightening results are automatically printed on the STAR printer when the wrench is put back on the QATnode. Connect the printer to serial port ***COM 1*** of the QATnode.

With an IRC-W connection, the tightening results are automatically printed at the end of the Pset or Multistage or Job. Connect the printer to serial port ***COM 1*** of the QATnode and using a network cable to the ***Ethernet*** port of the QATnode.

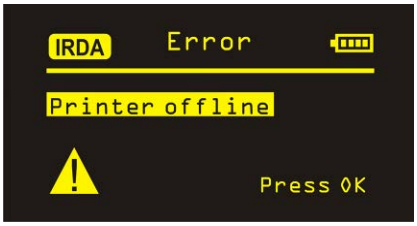
When all the data have been printed, the following message is shown on the wrench display:



Click on ***OK*** to continue.

If for any reason the STwrench-QATnode connection is interrupted during the printing (wrench removed from QATnode with IRDA connection, or IRC-W connection missing, or paper running out), the report is entirely reprinted when the connection is reestablished or when new paper is loaded into the printer.

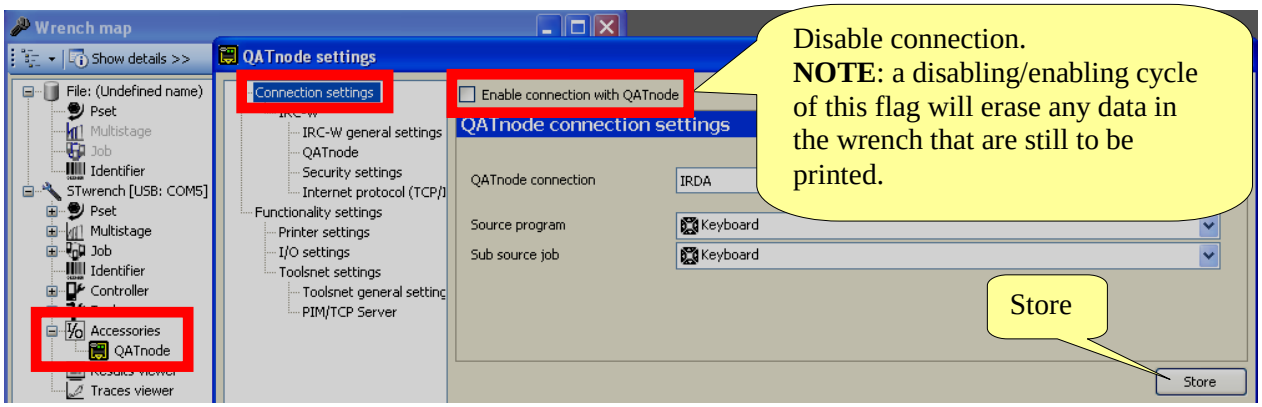
If at the time of printing the printer is offline, the following message is shown on the wrench display:



Ensure that the printer is connected and switched on, and click ***OK*** to continue printing the results.

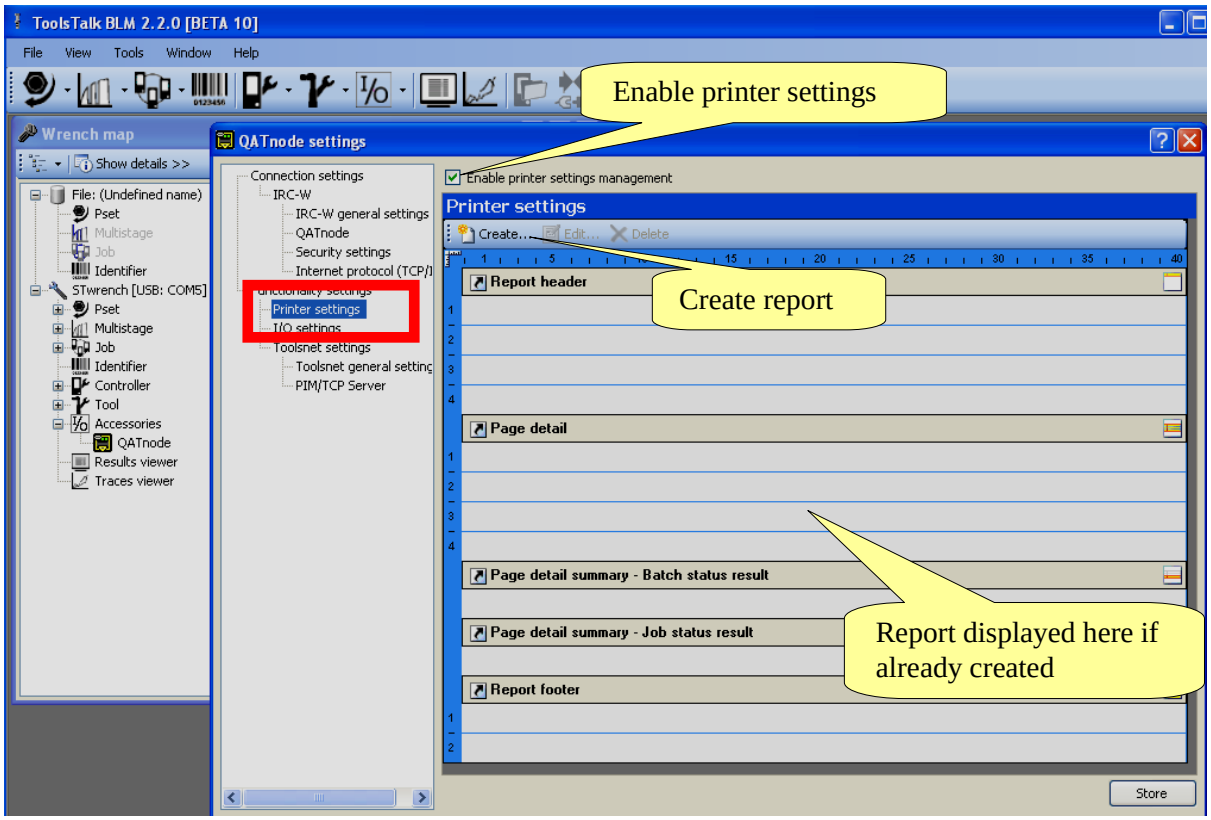
18.3.1 Configuring the report

In ToolsTalk BLM, select ***Accessories → QATnode***:

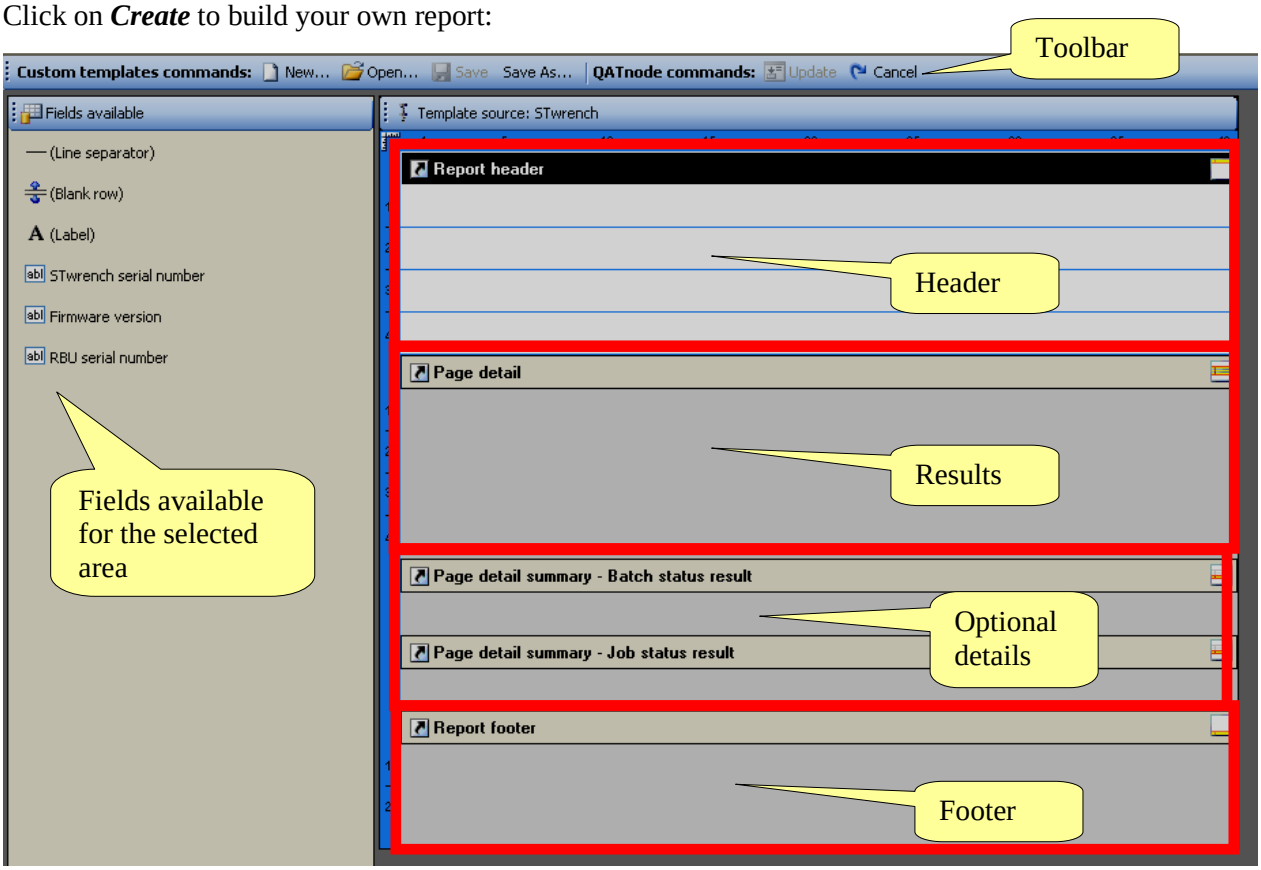


Disable the connection and click on ***Store*** to access the configuration menu.

Select the ***Printer Settings*** menu:



Click on ***Create*** to build your own report:



The report is composed of:

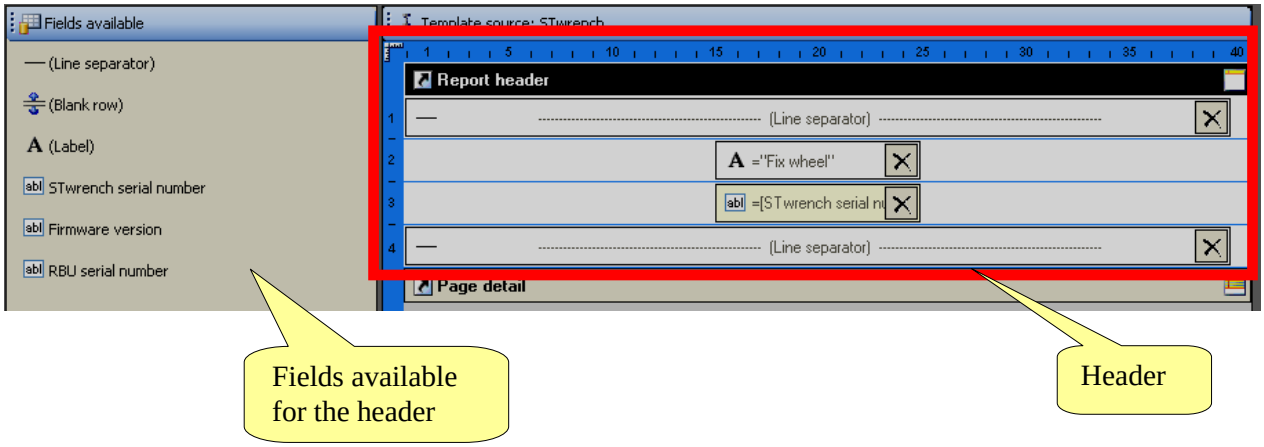
Header	Report header, replicated for every Pset/Multistage/Job.
Page detail	Area with the tightening results, replicated for every result.
Page details summary	Optional. It is possible to add information about the Batch and Job status at the end of each batch or job.
Footer	Report footer, replicated for every Pset/Multistage/Job.

The toolbar at the top of the window provides the following commands:

New	Creates a new report
Open	Opens a saved report

Save As...	Saves the report layout. You can create and save several different report layouts for different printing formats.
Update	Exits the report editing page and updates the printer settings window on which you are working.
Cancel	Exits the report editing page without saving the changes.

18.3.1.1 Configuring the report header



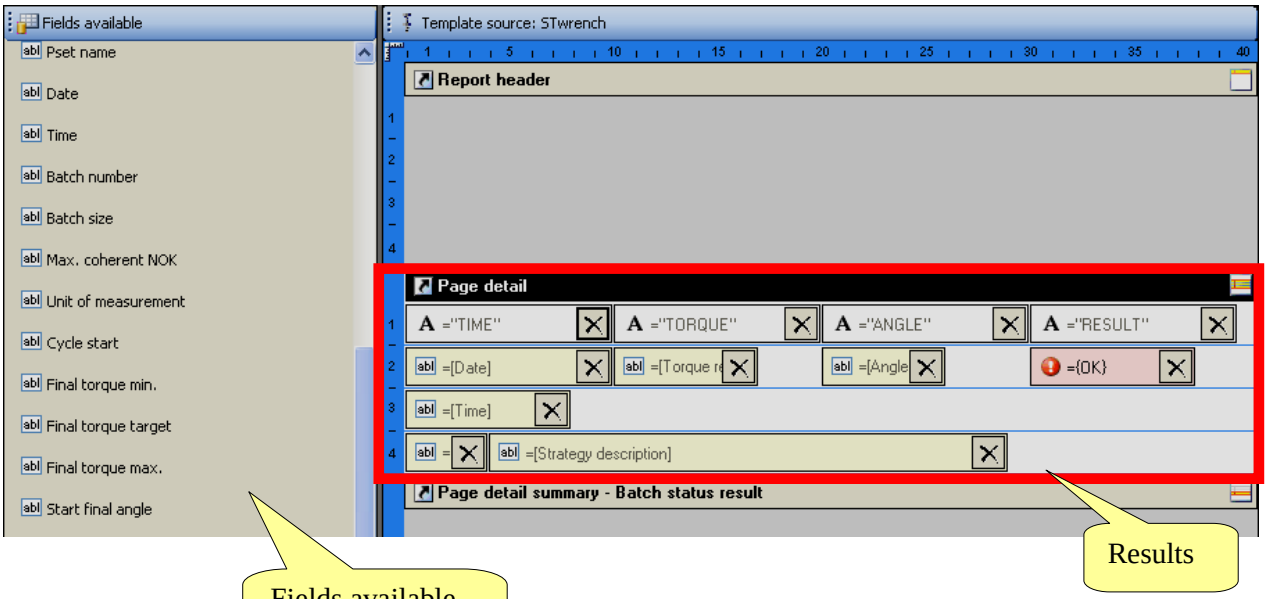
The header is composed of four rows. The objects available for the header are shown in the left area of the window.

Double-click on an object to add it to the header, specifying in which row and, when applicable, in which position of the row, it must be added.

Line separator	Adds a line separator; when added, it is not possible to add other objects on the same row.
Blank row	Adds a blank row.
Label	Adds a label.
STwrench serial number	Adds a field containing the serial number of the STwrench controller.
Firmware version	Adds a field containing the firmware version of the STwrench controller.

RBU serial number	Adds a field containing the serial number of the RBU currently installed on the STwrench.

18.3.1.2 Configuring the results area



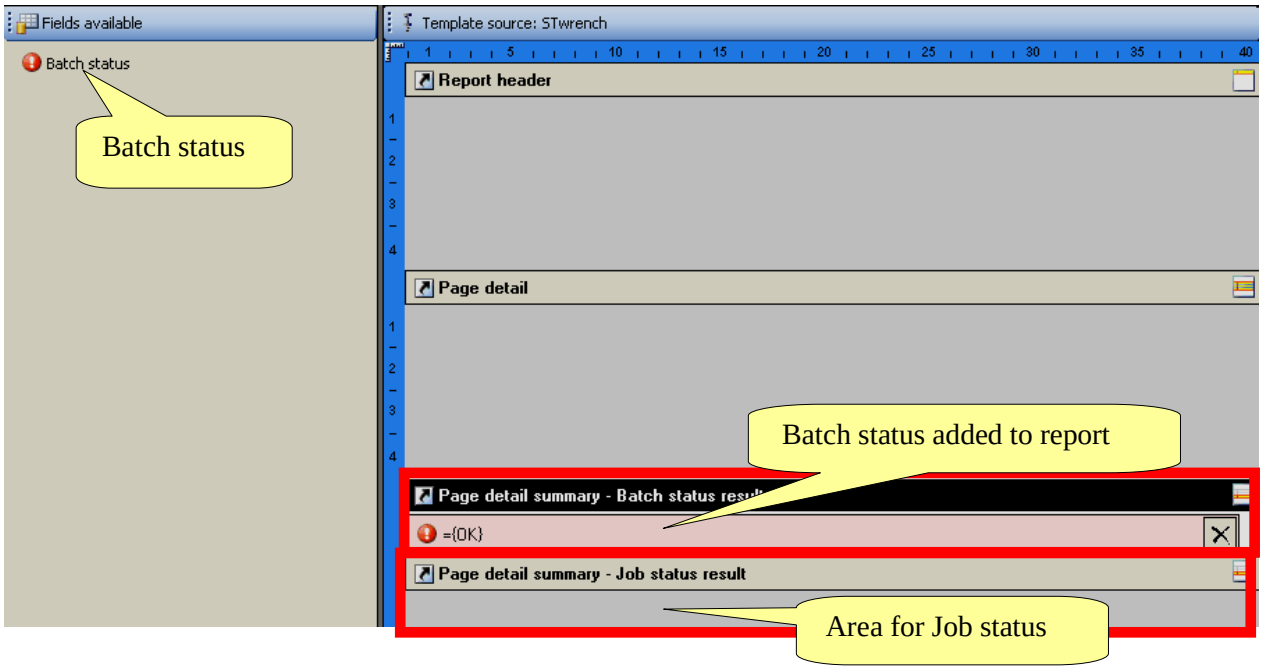
The result area is composed of four rows. The objects available for the header are shown in the left area of the window.

Double-click on an object to add it, specifying in which row and, when applicable, in which position of the row, it must be added.

Line separator	Adds a line separator; when added, it is not possible to add other objects on the same row.
Blank row	Adds a blank row.
Status	Adds the Pset status.
Torque Status	Adds the torque status for the Pset.
Angle Status	Adds the angle status for the Pset (if angle is not included in the tightening strategy, this is marked as *N.A.*).

RBU serial number	Adds a field containing the serial number of the RBU currently installed on the STwrench.
Other objects	All the fields available in the results window of ToolsTalk BLM are available here. See the chapter *Results Viewer* for more information.

At the end of each batch (or job), it is possible to add a row with the batch (or job) status:



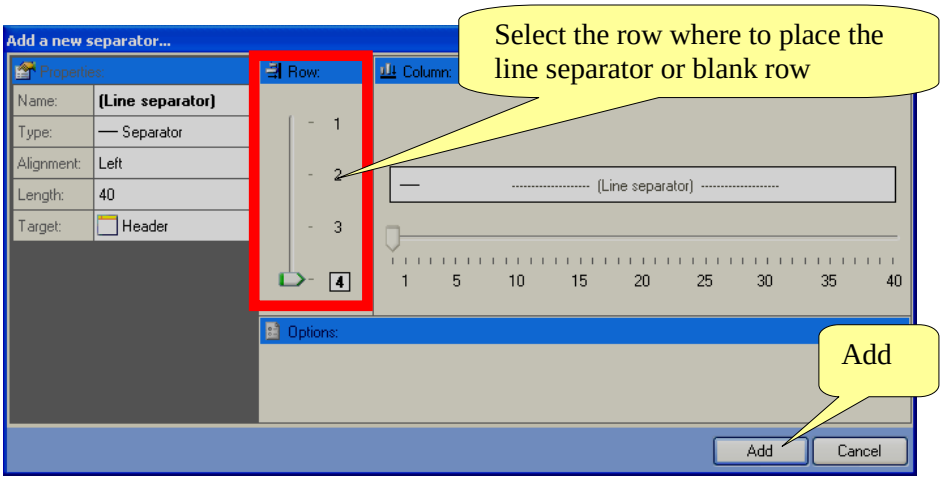
18.3.1.3 Configuring the report footer

The footer is composed of two rows. The objects available are a selection of those available for the header: *Line Separator*, *Blank Row* and *Label*.

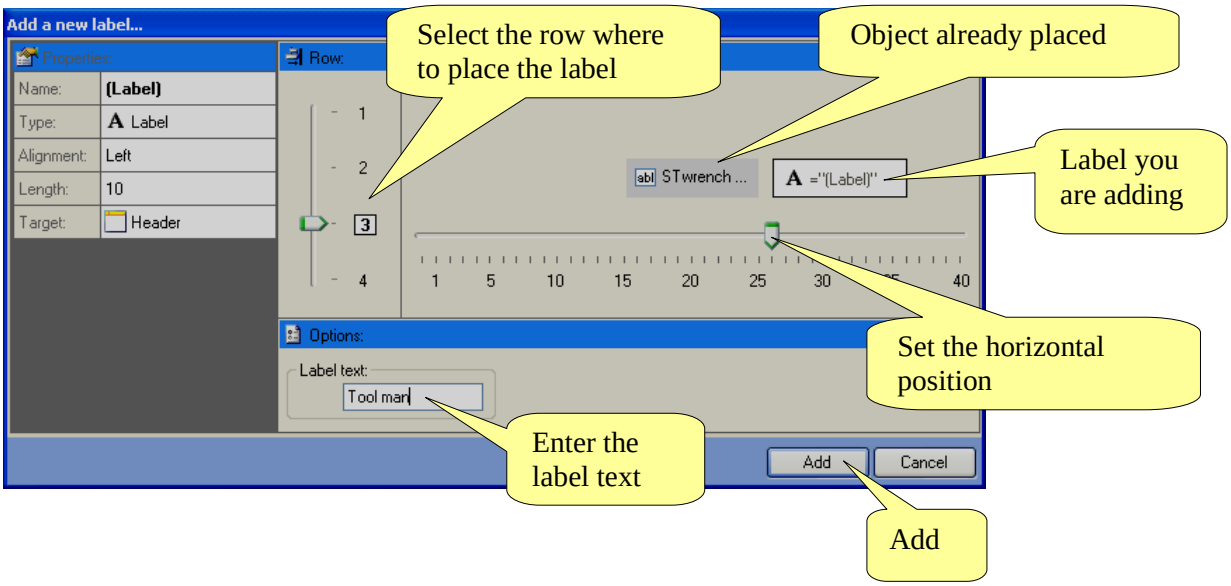
18.3.1.4 Objects available in the report

Here are the details of the various objects available to configure the header, results and footer of the report.

Line Separator and ***Blank Row***: Simply select the row in which placing the item and click on ***Add*** to confirm:

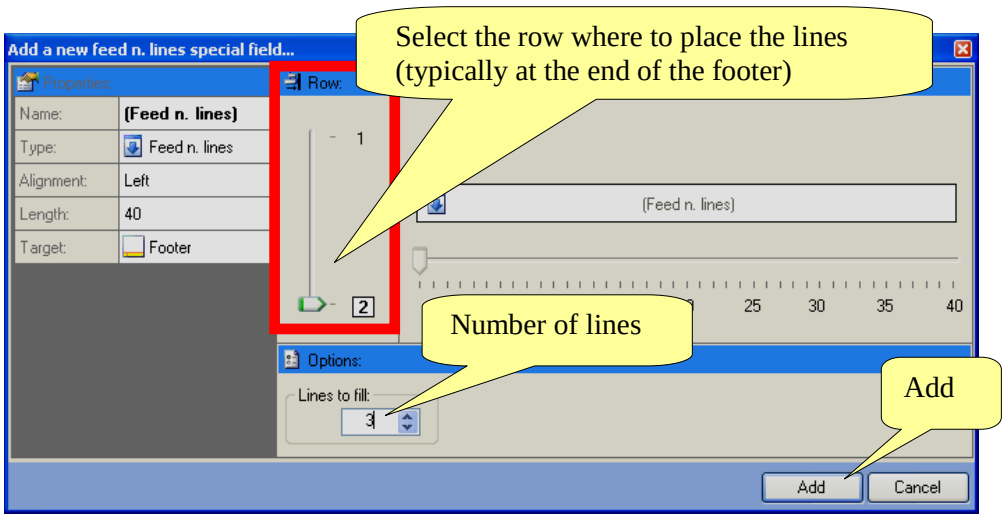


Label: Enter the label text, select the row in which to add the label, and select also the horizontal position of the label on the page:

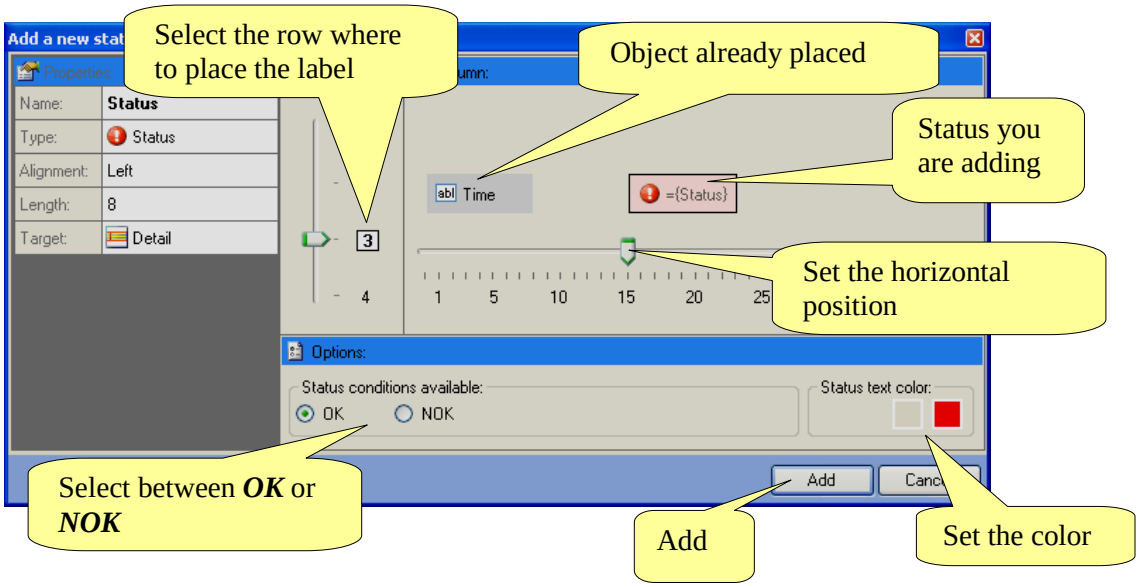


The maximum length of a label is 10 characters; split into two or more different labels to insert a longer label.

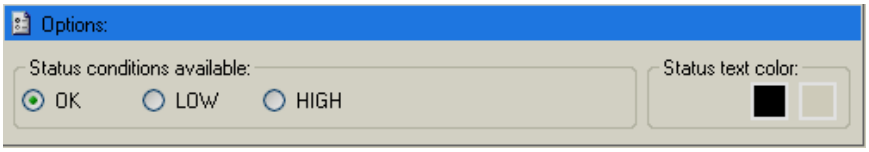
Feed n. lines: Available only in the report footer, makes the printer feed the paper for the number of lines specified. This allows you to create a blank space between two different reports:



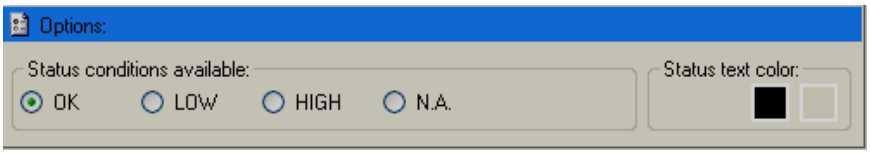
Status: Select the row in which you wish to add the status, and then select the horizontal position of the label on the page. Finally, set the status condition and the color. The default color is black; only the selected condition can be printer in red:



Torque Status: Same as the ***Status*** window except for the ***Status conditions available***:



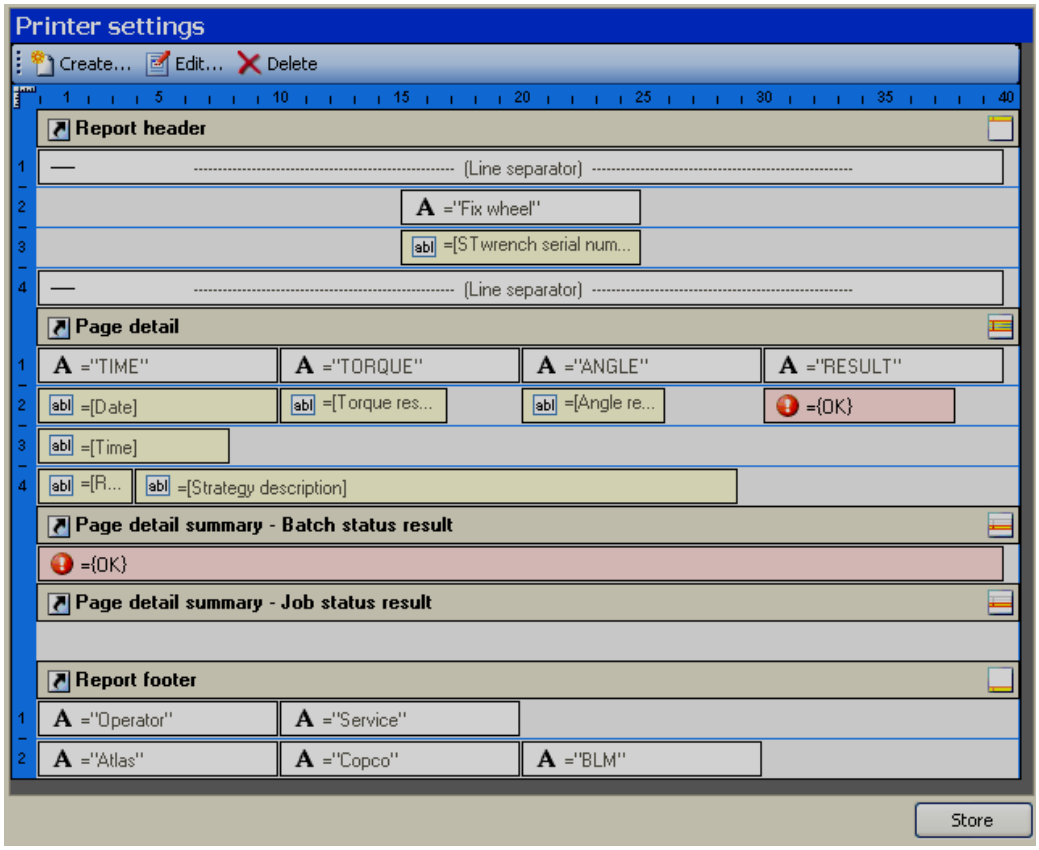
Angle Status: Same as the ***Status*** window, except for the ***Status conditions available***:



Other fields for results area: Same as for a label. Simply place them in the desired row and horizontal position and click on ***Add*** to confirm.

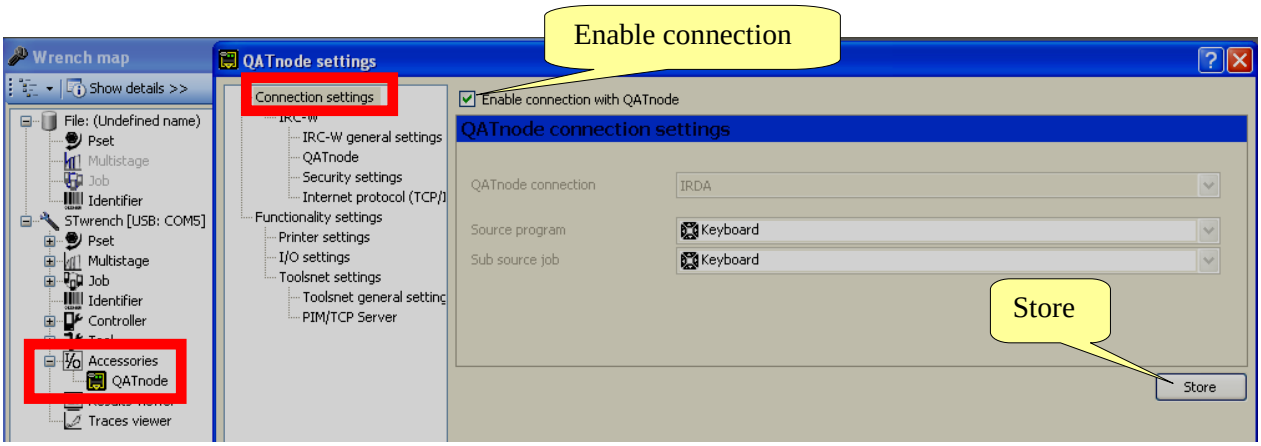
18.3.1.5 Completing the report and saving to the STwrench

When the report is configured, click on ***Update***. The report may look like this:



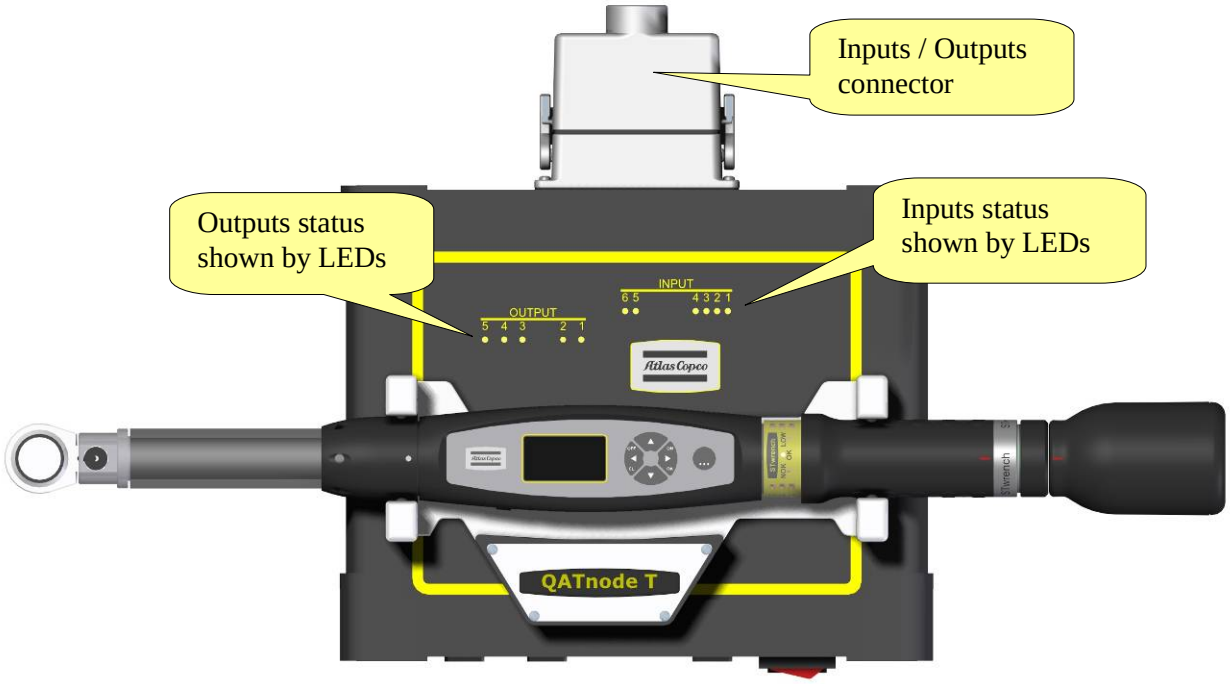
Click on ***Store*** to make this active for the STwrench.

Finally, go back to the ***Connection settings*** and enable the QATnode connection:



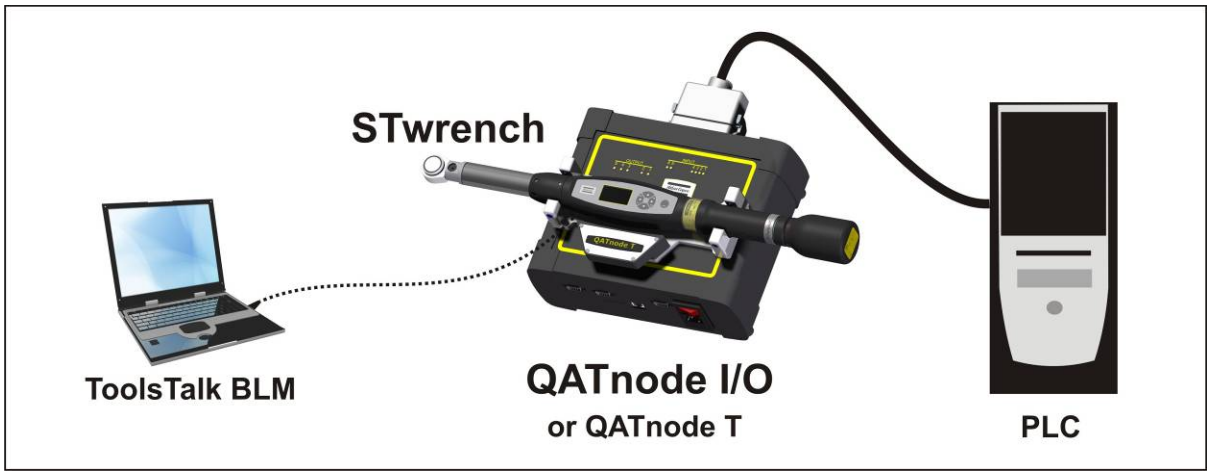
18.4 Input/Output Operations

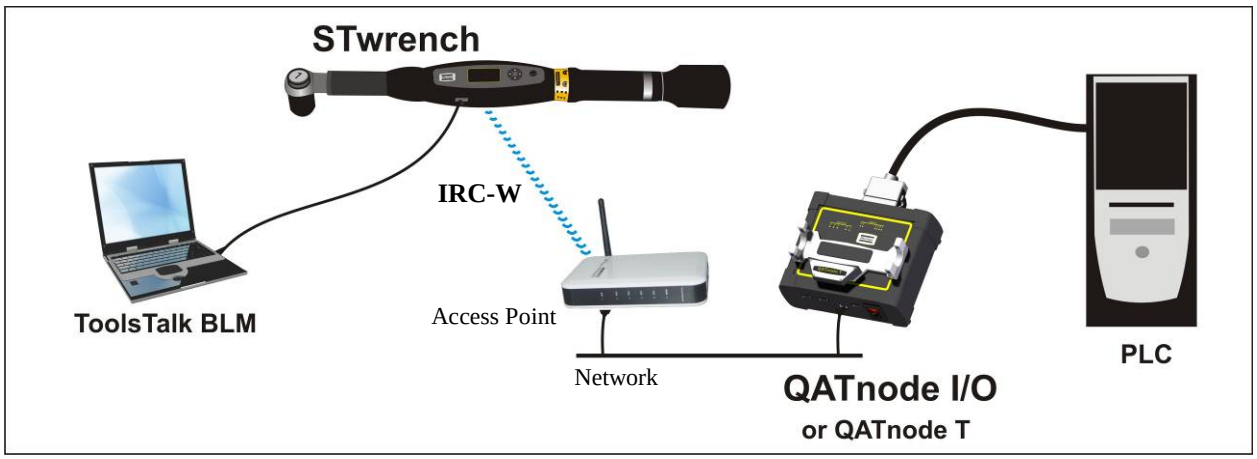
This function is provided only by the *QATnode I/O* and the *QATnode T*.



Ensure that the STwrench is associated with the QATnode.

The STwrench – QATnode connection can be established via an IRDA or IRC-W module:





NOTE: If the QATnode is also used to print the tightening result on a STAR printer, connect and set the printer to the QATnode as described earlier in this chapter.

The following table details the I/O connector pinout:

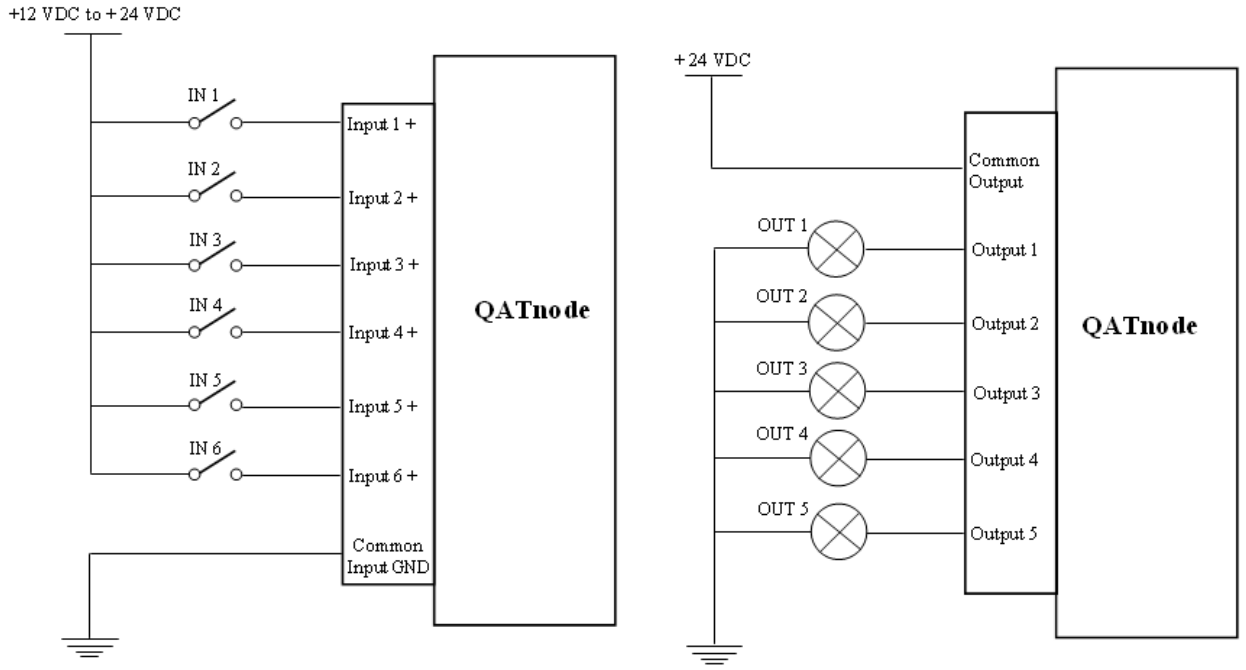
PIN	Description	PIN	Description
1	Common Input GND	9	Common Output
2	Common Input GND	10	Common Output
3	Input 1 +	11	Output 1
4	Input 2 +	12	Output 2
5	Input 3 +	13	Output 3
6	Input 4 +	14	Output 4
7	Input 5 +	15	Output 5
8	Input 6 +	16	Not connected

To activate the input 1, provide a 12 VDC ÷ 24 VDC between the "*Input 1 +*"and the "*Common Input GND*"; the input current required by the input is a maximum of 20 mA.

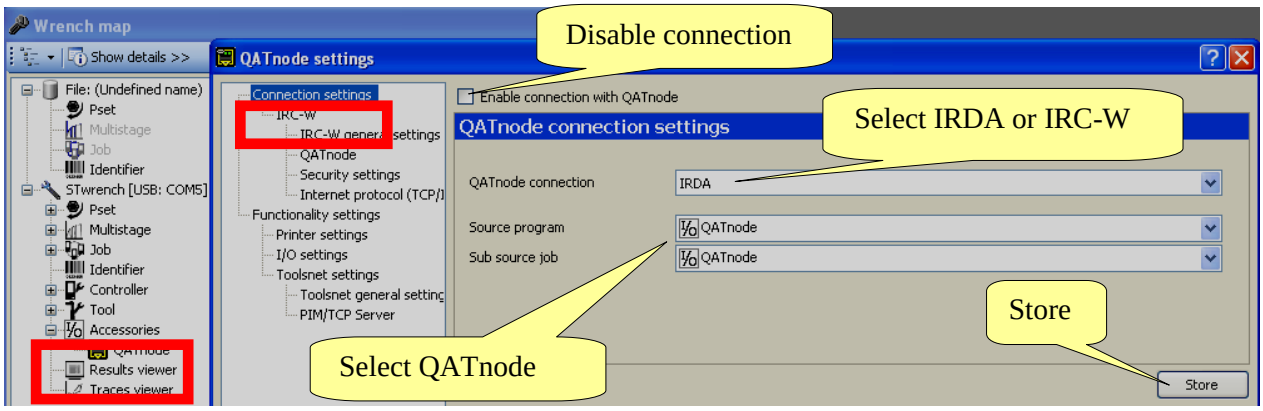
The five outputs are relays, with a common pole "*Common Output*". The outputs can work up to +24 VDC, with 1 A maximum current.

The inputs and outputs status is shown by the LEDs on the QATnode.

Here is an example of a connection, in which six switches are used to command the inputs and five lamps are use to monitor the output status:



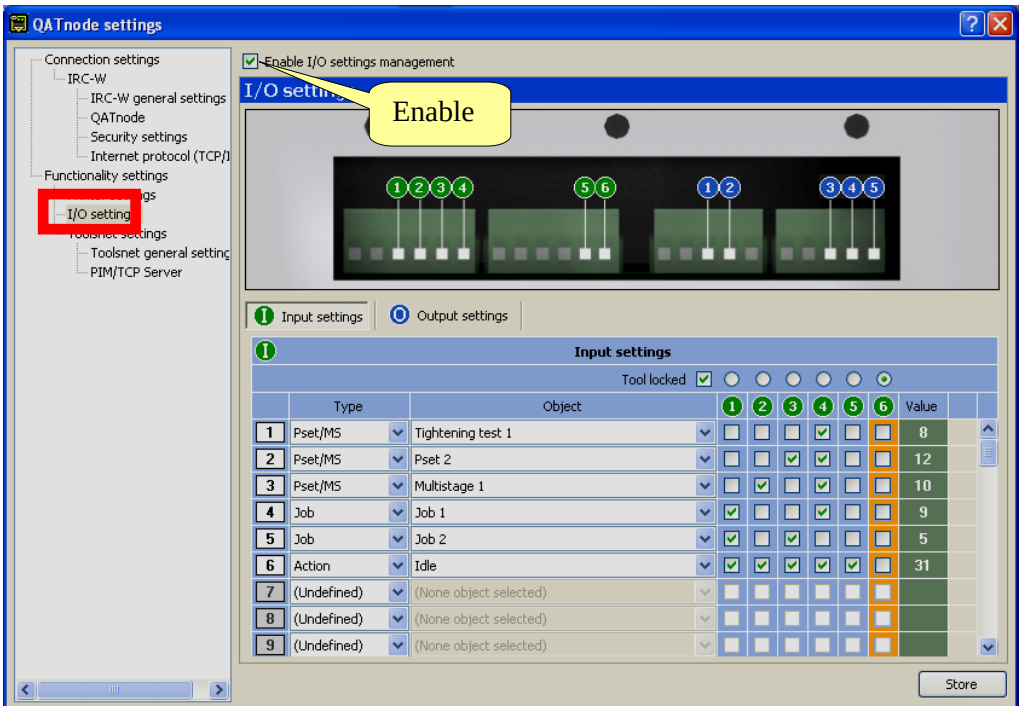
In ToolsTalk BLM, select ***Accessories → QATnode***:



Disable the connection and click on ***Store*** to access the configuration menu.

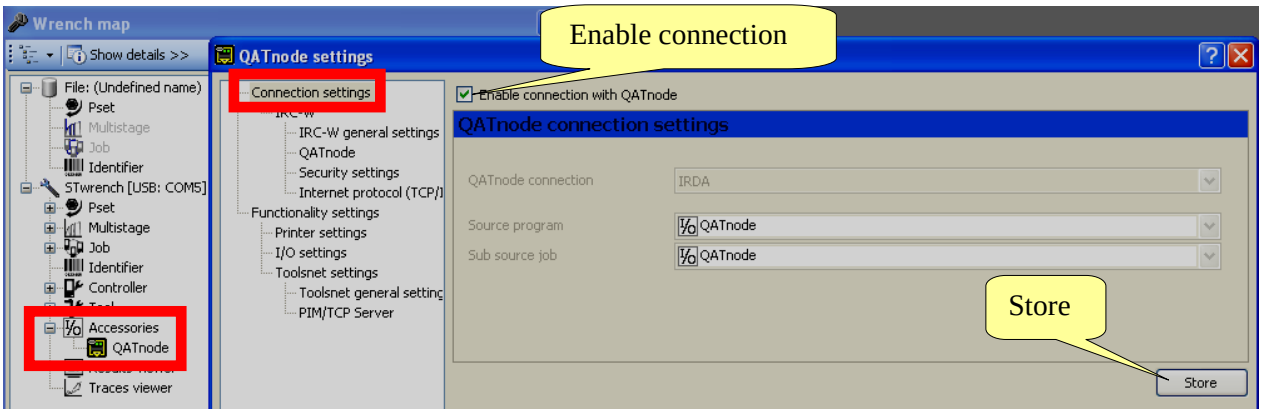
The ***Source program***, and possibly the ***Sub source job***, must be set to *QATnode*; this ensures that tightening program is driven via the I/O inputs of the QATnode.

Select the ***I/O Settings*** menu and enable the ***Enable I/O settings management***:



The next two paragraphs describe how to configure inputs and outputs.

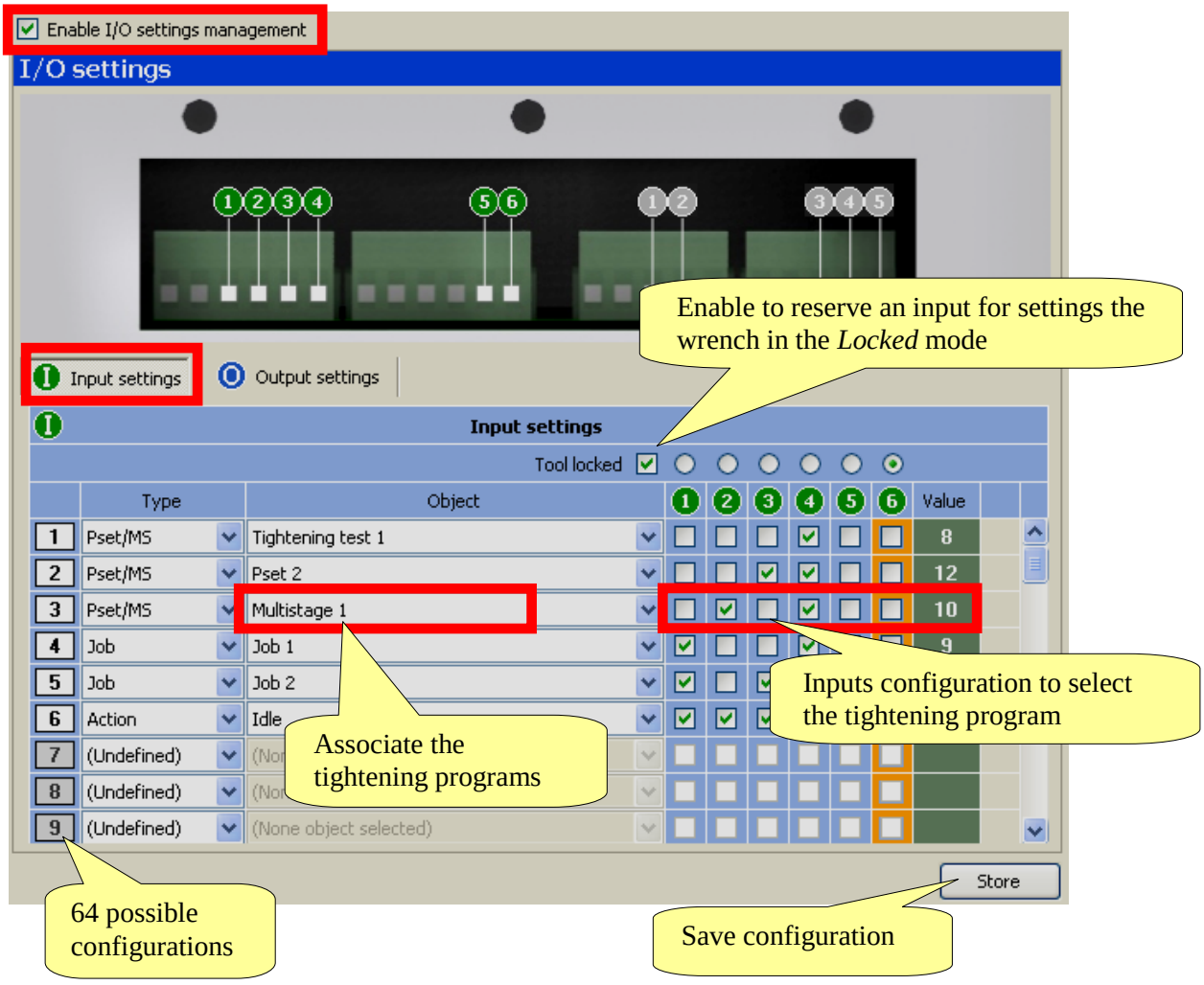
After having configured them, go back to the ***Connection settings*** and enable the QATnode connection:



18.4.1 Configuring the Inputs

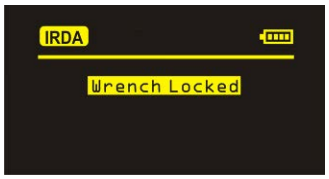
There are 6 inputs available, which means 64 possible configurations; each of them can be used to select a tightening program or an “Action”.

Select ***Input settings***:



NOTE: If neither the *Source Program* nor the *Sub Source Job* is set to QATnode, all the inputs (including the ***Tool locked***) are ignored during the operation.

Type	- ***Pset/MS***: Allows you to select a Pset or a Multistage from the list defined in the wrench map. - ***Job***: Allows you to select a Pset or a Multistage from the list defined in the wrench map. - ***Action***: Allows you to select the "idle" mode. In this mode the STwrench does not execute an operation. For an IRC-W connection, if the "idle" mode is selected during a tightening operation, the Pset/Multistage/Job will be completed before entering the "idle" mode. Examples of the use of the "idle" mode: **Example 1**: Pset 1 is associated with inputs 000001 Pset 2 is associated with inputs 000010 If the PLC driving the QATnode is slow to change the status, between the transition 000001 → 000010, the input configuration may be 000000 or 000011 for a while. If those statuses are programmed to select, for instance, the Pset 3, that Pset 3 would be activated during the change between Pset 1 and Pset 2. Setting the 000000 and 000011 to "idle" will avoid this situation. **Example 2**: A job defined as "free" is composed by: - Pset 1 → inputs 000001 - Pset 1 → inputs 000001 - Pset 2 → inputs 000010 When Pset 1 is completed, the input status needs to be changed before Pset 1 can start again. For instance, the inputs status can be set from 000001 to 000000 and then back to 000001. For a proper transition, the 000000 inputs status must be configured as "idle" in order not start a different tightening program.
Object	Depending on the ***Type*** selected, you can select a tightening program or the idle mode.
Inputs 	Click to select/deselect an input. The decimal value corresponding to the given input configuration is shown on the right,. Input 1 is the least significant Bit, input 6 is the most significant Bit. It is not possible to select an input configuration already in use.

	NOTE: There is a slight millisecond delay between when the input is provided to the QATnode and when the action selected is executed on the wrench. It is possible to use the output "*program loaded*" (see next paragraph for more information of the outputs) to verify that the STwrench has received the tightening program.
Tool locked 	If selected, the specified input cannot be used to define the various configurations. The input is reserved to put the STwrench in the *Tool Locked* mode; when the input is activated, the STwrench will be locked and the following message is shown on the display:  For an IRC-W connection, any ongoing Pset will be completed (and the outputs are set according to the results) before the wrench goes into *Tool Locked* mode. For an IRDA connection, the wrench goes into *Tool Locked* mode when it is put back on the QATnode.

Once the configuration is done, click on ***Store*** to save.

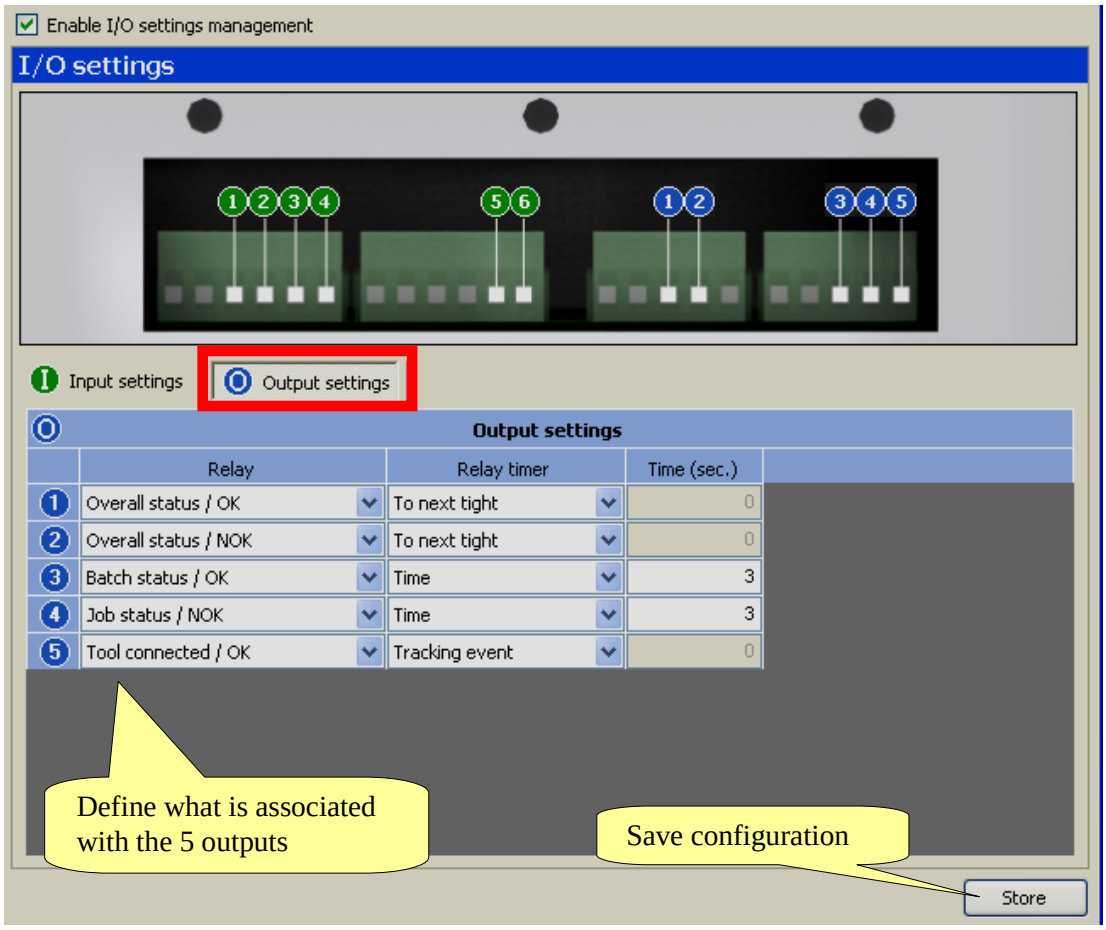
NOTES:

- If the input to select a tightening program is left active, the same program is started on the wrench at the end of the tightening operation (Pset/Multistage/Job); for an IRDA connection, the wrench needs to be put on the QATnode, while for an IRC-W connection, the new program starts immediately.
- For an IRC-W connection, if the input configuration is changed during the tightening operation and the new configuration selects a different tightening program, the ongoing tightening operation will be interrupted and the new tightening program will be started.
- For an IRC-W connection, if the "idle" mode is selected during a tightening operation, the current Pset/Multistage/Job will be completed before entering the "idle" mode.

18.4.2 Configuring the Outputs

There are 5 outputs available, which can be configured to provide indication of an OK or Not OK result, or to provide other information about the system. The output can be set to remain active until a new tightening operation is started, or for a specified timeout.

Select ***Output settings***:



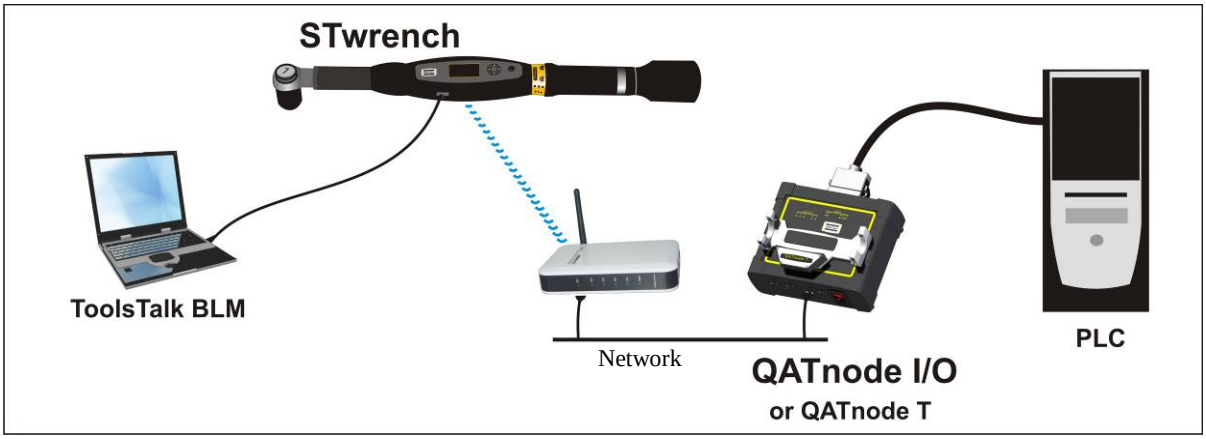
Relay	Selects what to associate with the output from the list of the available signals. The *Tool Connected* output is active when the STwrench is connected to the QATnode, via IRDA or IRC-W. The *Program Loaded* output is an acknowledgement message indicating that a tightening program has been uploaded to the

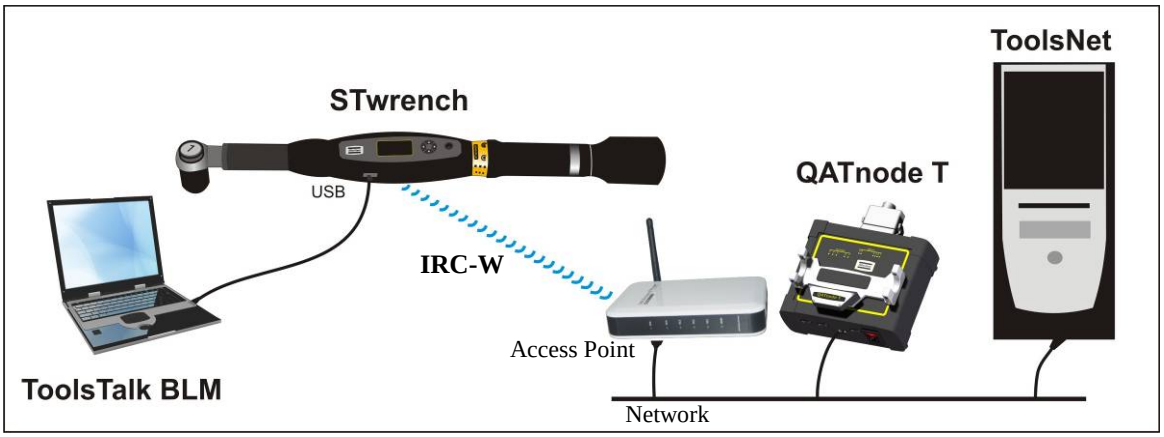
	STwrench; it is active until the end of the tightening. Note that if the input status does not change and the same tightening program is executed again, this output is not activated again; to reactivate it, a different tightening program must be uploaded, or the same tightening program must be selected again after first passing through an "idle" status.
Relay timer	- ***To next tight***: The output is activated at the end of the tightening program, and it remains active until the next tightening program is completed. For an IRDA connection, this means that the output is updated with the new results when the wrench is put back on the QATnode after the new tightening operation. For the output "*Program Loaded OK*", the output is activated immediately when the program is selected on the STwrench, and it remains active until the end of the current tightening operation. - ***Time***: Allows you to define for how long the output must remain active. - ***Tracking event***: Outputs like *Tool Connected* or *ToolsNet Connected* are not related to the ongoing tightening operation; therefore, the output keeps tracking the event in real time.
Time	Setting the ***Relay timer*** to *Time* specifies how long the output will remain active before timing out.

Once the configuration is done, click on ***Store*** to save.

18.5 ToolsNet Connection via QATnode

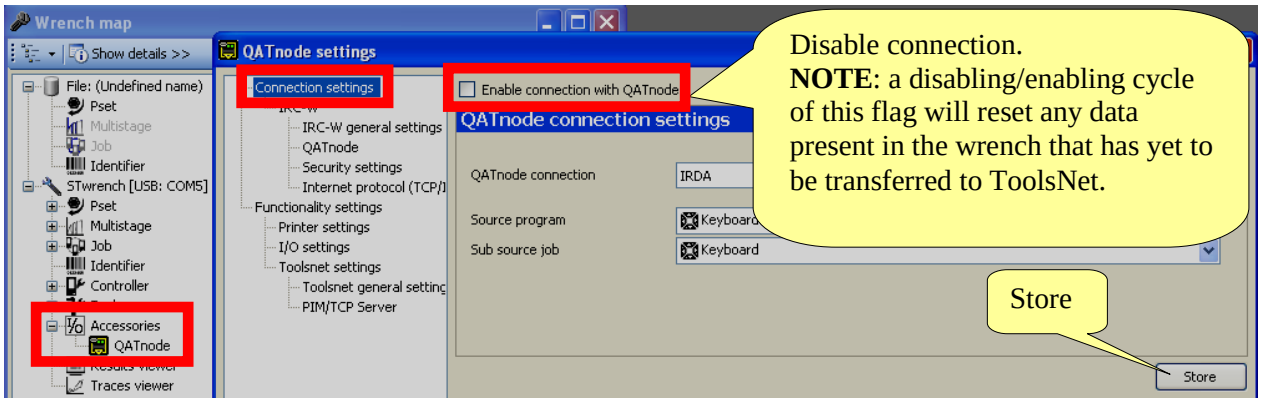
This function is provided only by the *QATnode T*.





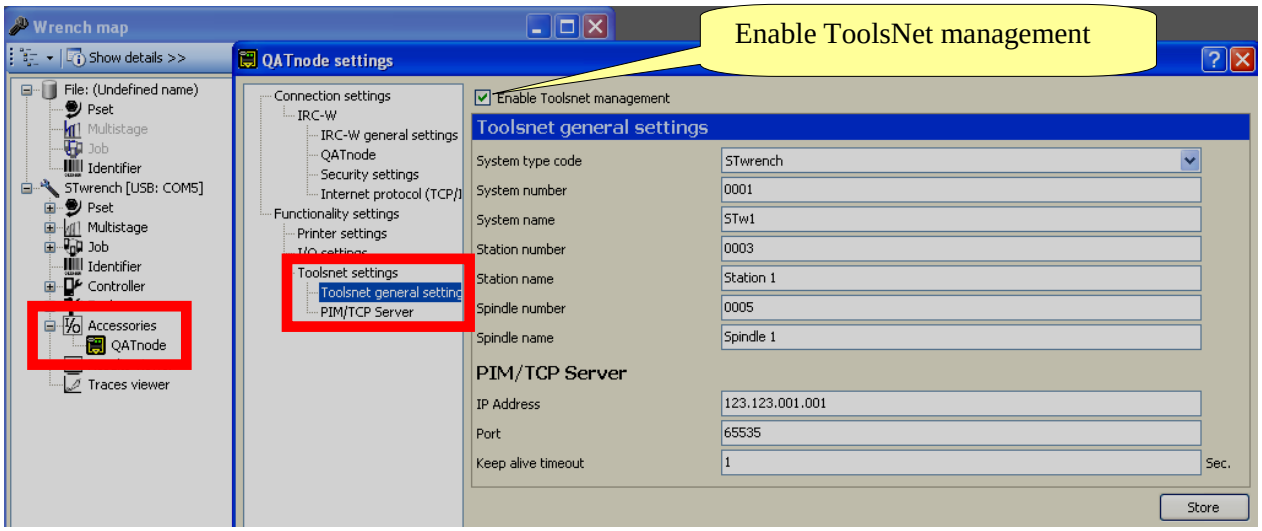
The ToolsNet settings must be specified in a different menu to the one used when the STwrench is connected to ToolsNet directly via the IRC-W radio and not passing through the QATnode.

In ToolsTalk BLM, select ***Accessories → QATnode***



Disable the connection and click on ***Store*** to access the configuration menu.

Select the ***ToolsNet general settings*** inside the ***Accessories → QATnode*** menu:



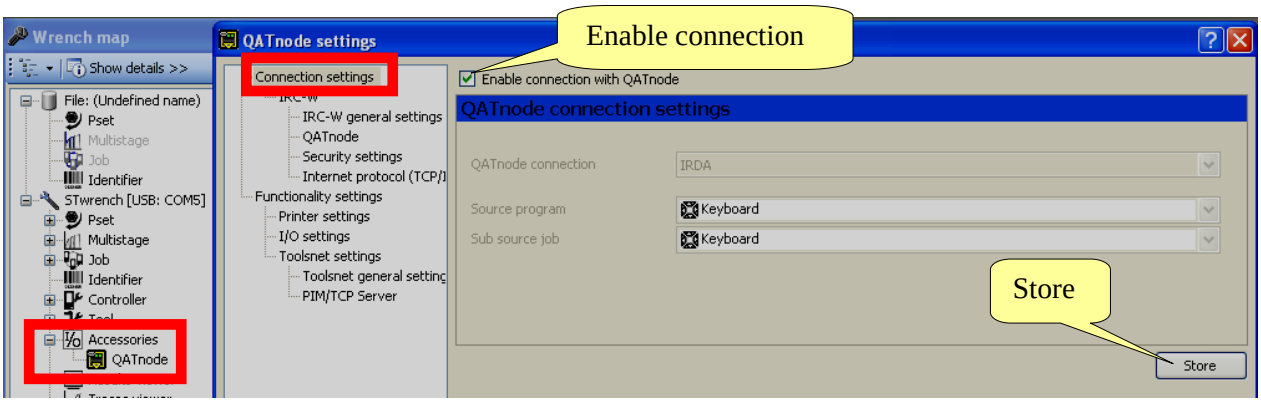
The ***System Name***, ***Station Name*** and ***Spindle Name*** identify the tree structure which is shown in ToolsNet.
The ***System Number*** and ***Spindle Number*** are associated with the tightening results.

PIM/TCP Server settings:

- ***IP address***: Specify the IP address of the PIM server (part of the ToolsNet configuration)
- ***Port***: specify the port number of the PIM server (part of the ToolsNet configuration)
- ***Keep alive timeout***: The STwrench and QATnode exchange a “keep alive” message at a certain frequency. This parameter specifies the time interval between two messages; the default value of 1 second is recommended. However, for “slow” networks this value may be increased.

Click on ***Store*** to save the settings.

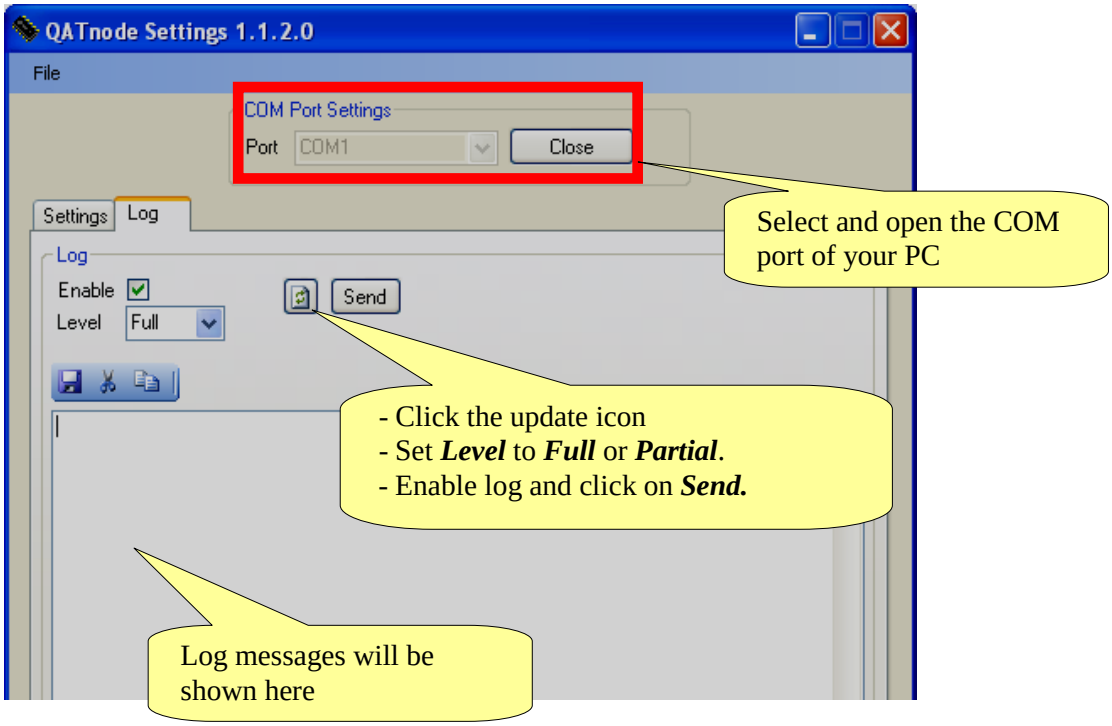
Finally, go back to the ***Connection settings*** and enable the QATnode connection:



NOTE: If the QATnode is also used to print the tightening result on a STAR printer and/or to interface with a remote device via the I/O connectors, set the printer report and/or I/O configuration as described earlier this chapter.

In case of connection problems with ToolsNet, the *QATnode Settings* software allows you to enable and view a log file useful for troubleshooting.

Connect the PC to the COM 2 port of QATnode, and execute the *QATnode Settings* software. Select and open the PC COM port you are using:



Partial	Enables log messages excluding debug messages; it can be useful for troubleshooting.
Full	Enables all log messages including debug messages; useful for advance troubleshooting.

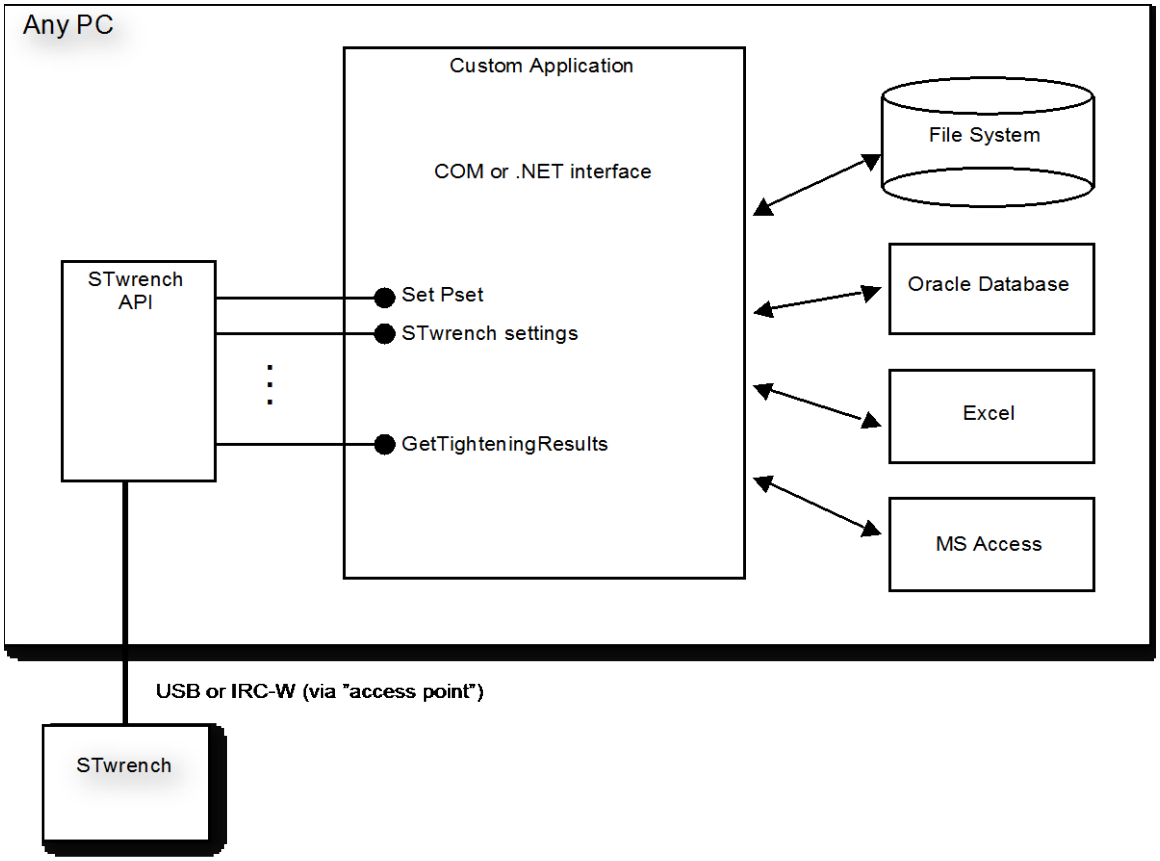
19 Working with the API

NOTE: To use the API interface, the STwrench must be equipped with a RBU that supports the API. See the chapter *RBU* for more information of the different RBUs available.

The *API, Application Programmers Interface*, is an interface with the STwrench that makes it possible to access data in the STwrench units from custom-made applications.

This chapter gives an overview of the API functionality; for more information of the API operations refer to the STwrench API Technical Documentation included in the API installation CD.

The STwrench API is a software library that serves as the interface between the custom application and the actual STwrench units. This means that it exports a number of objects and methods that the custom application can access in order to manipulate the STwrench units.



Examples on what a client can do using the STwrench API are:

- Upload and download configuration data from/to a STwrench unit
- Read tightening results and traces from a STwrench unit
- Get/Set the selected Pset, selected Job, barcode on a STwrench unit
- Get/Set the batch count for a specific Pset on a STwrench unit



NOTE: The STwrench events (new result, new batch result, new job result, TAG removed, TAG inserted, new identifier read, OK key pressed, CL key pressed, UP key pressed, DOWN key pressed, LASER key pressed, OK key released, CL key released, UP key released, DOWN key released, LASER key released, Battery low, Pset started, Pset completed, Cycle start reached, Job started, job completed, multistage started, multistage completed) are available only when connected via IRC-W (not for USB connection). Therefore, since events are available only with IRC-W, the function to execute a Pset/Multistage/Job by the API should be used only with IRC-W connection. To select a Pset/Multistage/Job, the STwrench "source program" must be set to API. See the chapter Setting the source for Pset/Multistage/Job selection for more information.

The STwrench API handles all communication needed between the PC, on which the custom application resides, and the specific STwrench units involved. The developer of the custom application only needs to know which objects and function(s) to call, and in some cases how the returned data are formatted.

When the custom application invokes one of the API functions, the API first translates the request to commands understood by the target unit. These are then sent to the target Unit via the USB connection. Thereafter the API waits for the answer to be returned. When the answer is received, it is interpreted and in some cases translated to a more easily understood format before the API returns the answer to the custom application.

Custom applications using the API can be run on any PC that is connected to a STwrench via USB. However, only one custom application at a time may use the API on a specific PC.

Technically the STwrench API can be used with a COM interface or a .NET interface.

Before using the STwrench API, you must install the component on the PC you are going to use it from. It also installs a small custom application example, written in Visual Basic 6 and Visual Basic .NET, that shows you an example of how the API can be used.

After installing the STwrench API, you can start to develop applications performing tasks not covered by the standard STwrench system. Typical cases are:

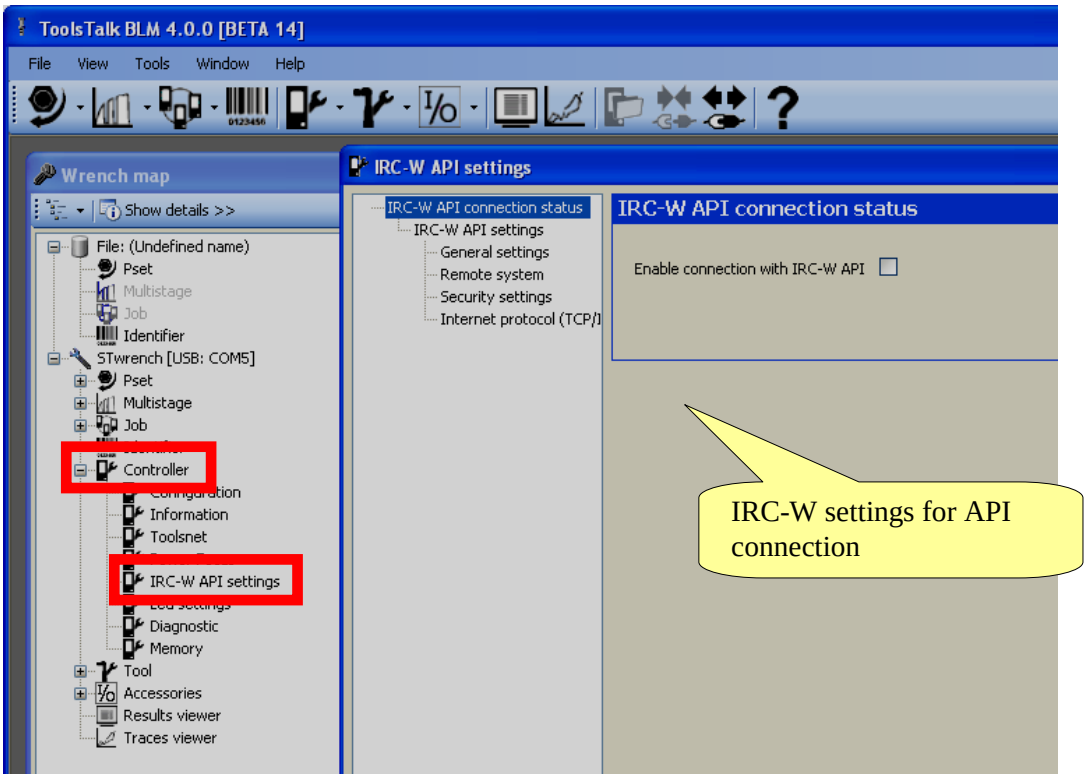
- Storing cycle data on disk, or in a database, in any customer specific format
- Sending cycle data to an external SPC program
- Sending or receiving data via any serial protocol you choose to implement

- Backing up setups on a central server

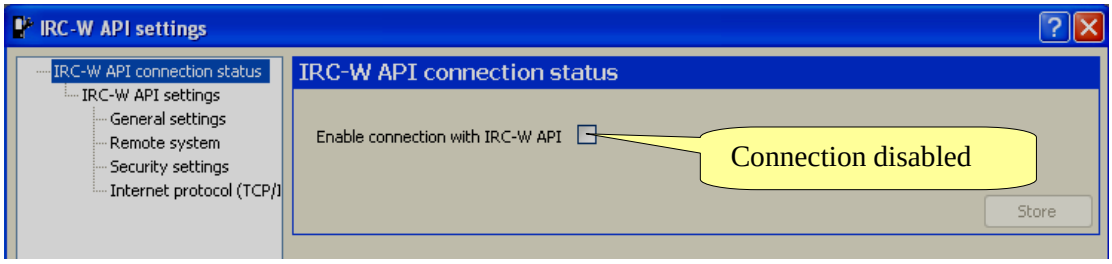
19.1 API Connection with IRC-W

The STwrench and API can be connected via IRC-W. The IRC-W module must be installed in the STwrench (see the chapter *QAT IRC-W radio module* for more information).

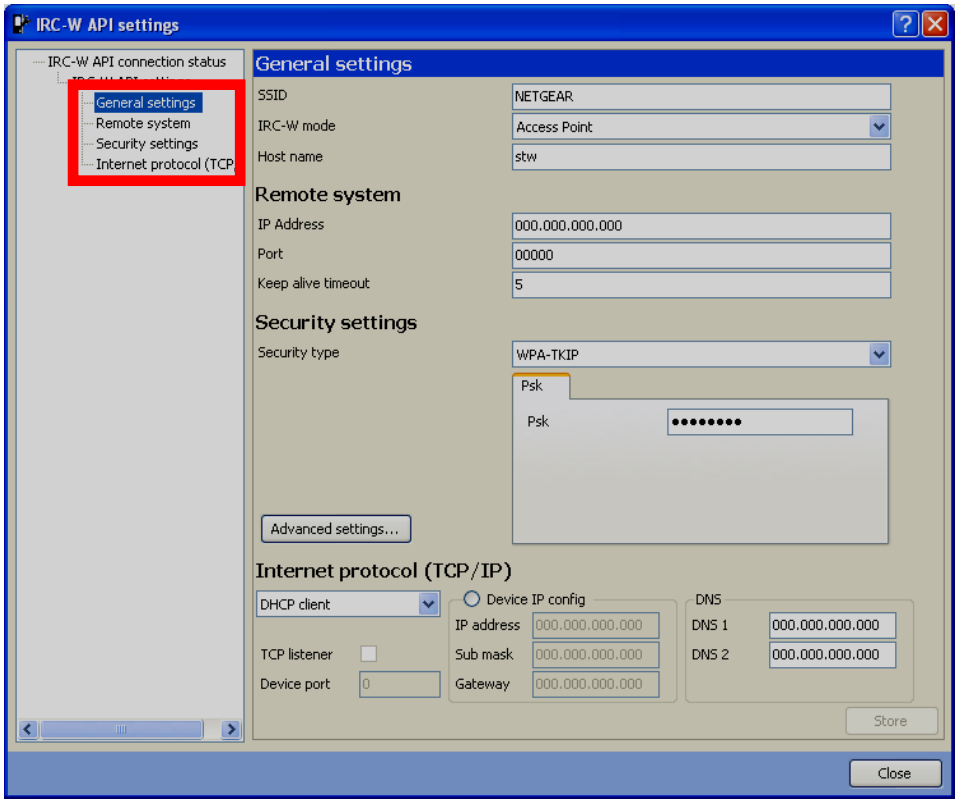
The IRC-W module must be properly configured; the configuration can be done directly from the API (connecting the STwrench via a USB cable). However, the ToolsTalk BLM also allows the module settings in a dedicated menu. Access the ***Controller → IRC-W API settings*** menu:



To configure the module, ensure that connection is disabled:

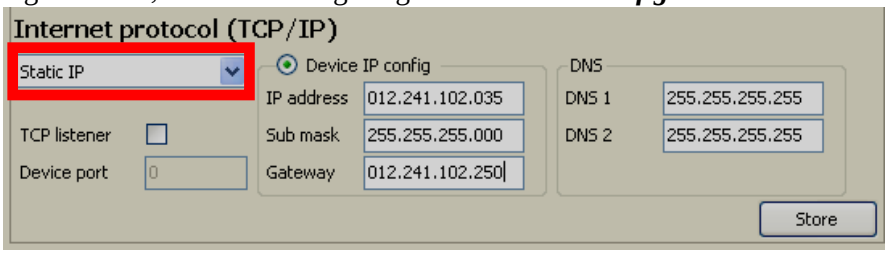


Then select the ***IRC-W API settings*** menu:

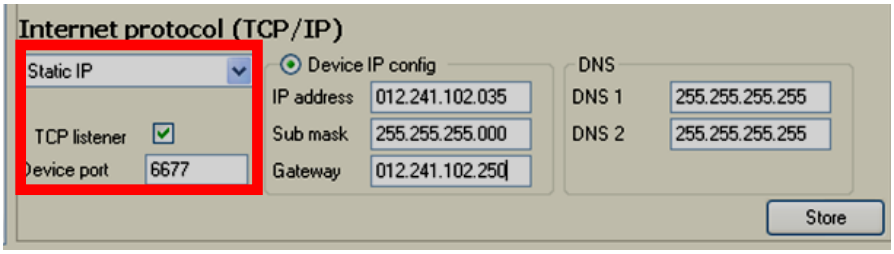


- ***SSID***: Enter the SSID name of your own wireless network.
- ***IRC-W mode***: Select ***Access Point***.
- ***Host name***: Specify a name of the wrench; if you have more than one wrench the names must be different.
- ***IP Address***: Specify the IP address of the PC where API is installed (not used if TCP listener is enabled).
- ***Port***: Specify the port number of the PC where the API is installed (not used if TCP listener is enabled).

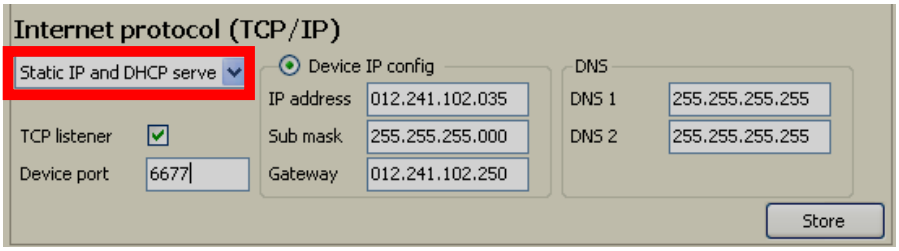
- ***Keep alive timeout***: Interval between keep-alive messages from the wrench; the default value (5 seconds) is recommended.
- ***Security Type***: Select the same security type as your own wireless network. For EAP-TLS, refer to the *Appendix B – EAP-TLS Security Type* for more information.
- ***Internet Protocol (TCP/IP)***: Select ***Enabled DHCP*** if your network uses the DHCP protocol (and specify the ***DNS 1*** and ***DNS 2*** if they are not set automatically by the network). It is also possible to set manually an IP address (with ***Sub mask*** and ***Gateway***) to the STwrench, by selecting ***Static IP***, and then configuring the ***Device IP Config***:



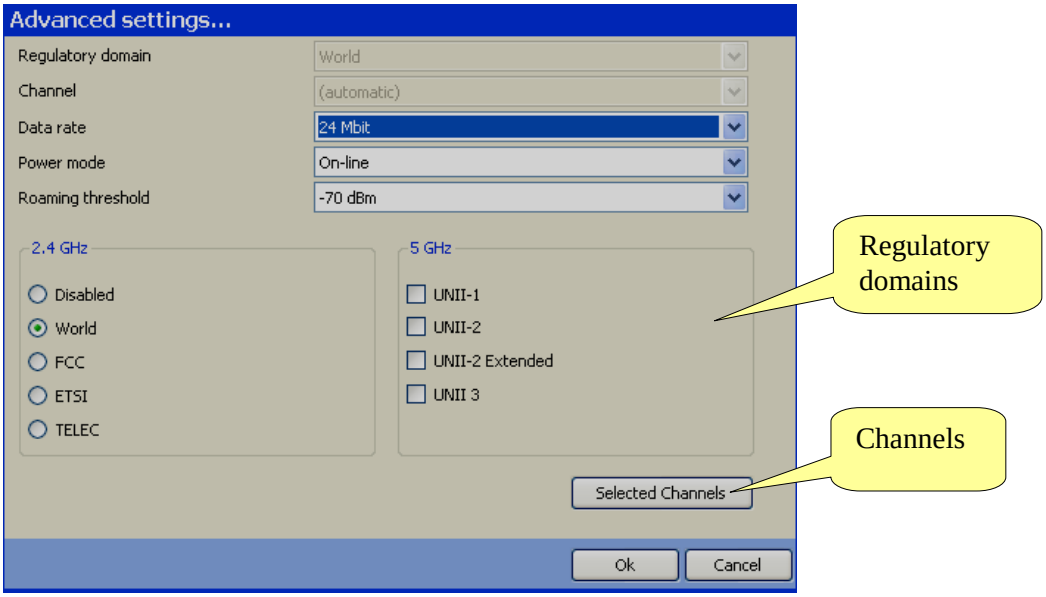
For IRC-W Dual Band radio module, if the ***Internet Protocol (TCP/IP)*** is set to *Static IP*, it is possible to enable the ***TCP Listener*** (and port); in this mode the STwrench serves as listener instead of sender, and vice versa the API serves as sender instead of listener; therefore only one STwrench can interface with the API:

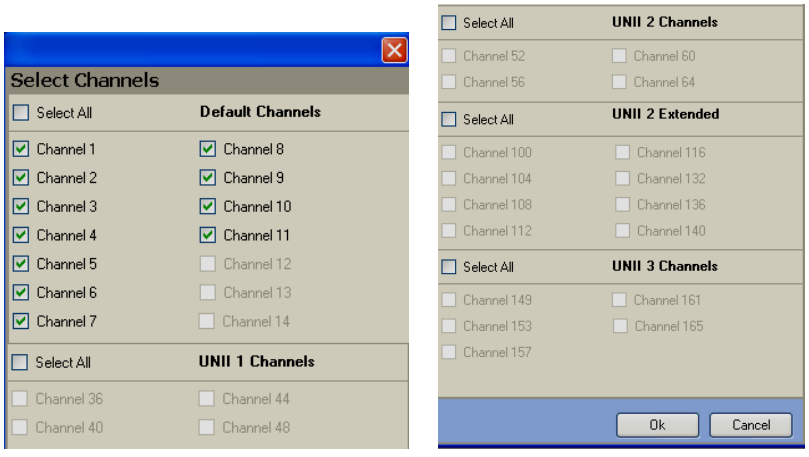


If the ***Internet Protocol (TCP/IP)*** is set to *Static IP and DHCP server*, the STwrench works as DHCP server, which means that the STwrench assigns an IP address to the system connecting to it:



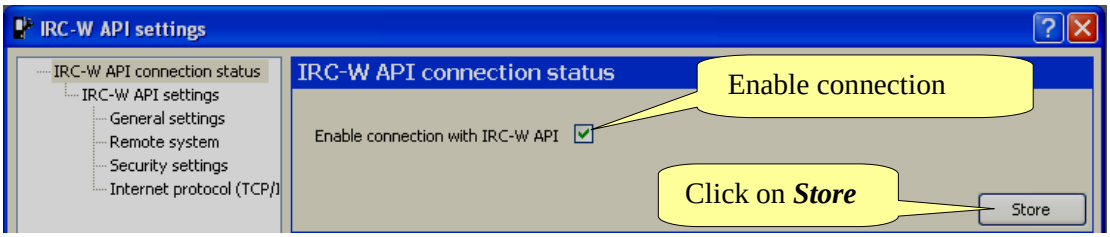
The ***Advanced settings...*** allow you to set the band, channels and parameters for the IRC-W dual band radio module. Set the following parameters according to your specific radio network and access point:



Regulatory domain	Select one of the option for the 2.4 GHz and/or one or more options for the 5GHz.
Channels	Once the regulatory domain has been chosen, click on ***Selected Channels*** to view/change the channels selected by default:  The channels available depend from the regulatory domain selected. Select the channel(s) and click on ***OK*** to confirm.

Data rate	Select the data rate. A slower value may help when the communication is not high-performance.
Power mode	The ***Sleep*** mode is recommended for lower power consumption.
Roaming threshold	Select the threshold under which the STwrench will search for a new access point to connect through.

Once all of the settings are done, enable the connection to API and click on ***Store*** to save:



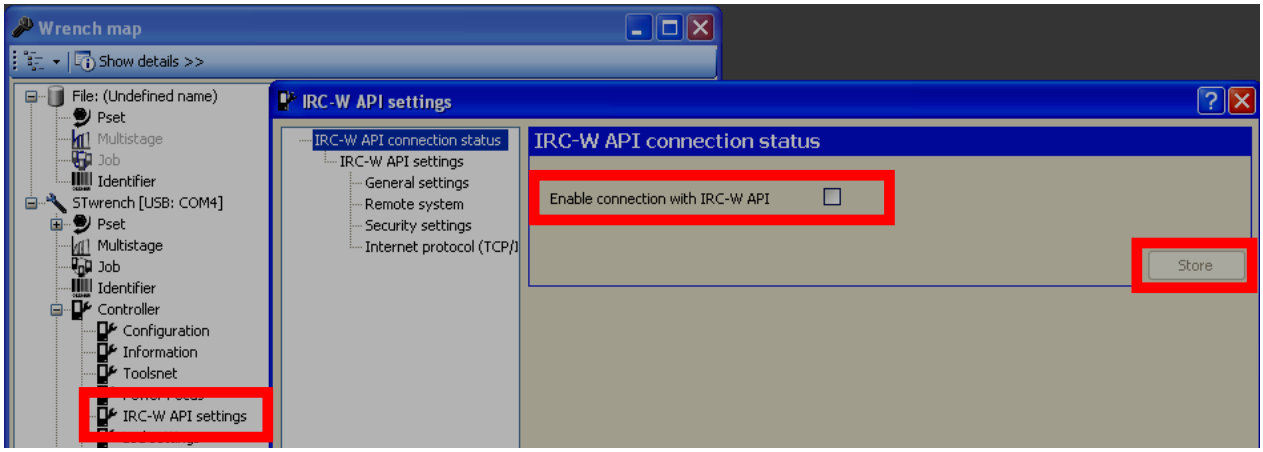
19.2 Using the Real Time Traces with IRC-W

If the STwrench is equipped with RBU supporting the API interface, it is possible to configure and use the Real Time Traces function via IRC-W.

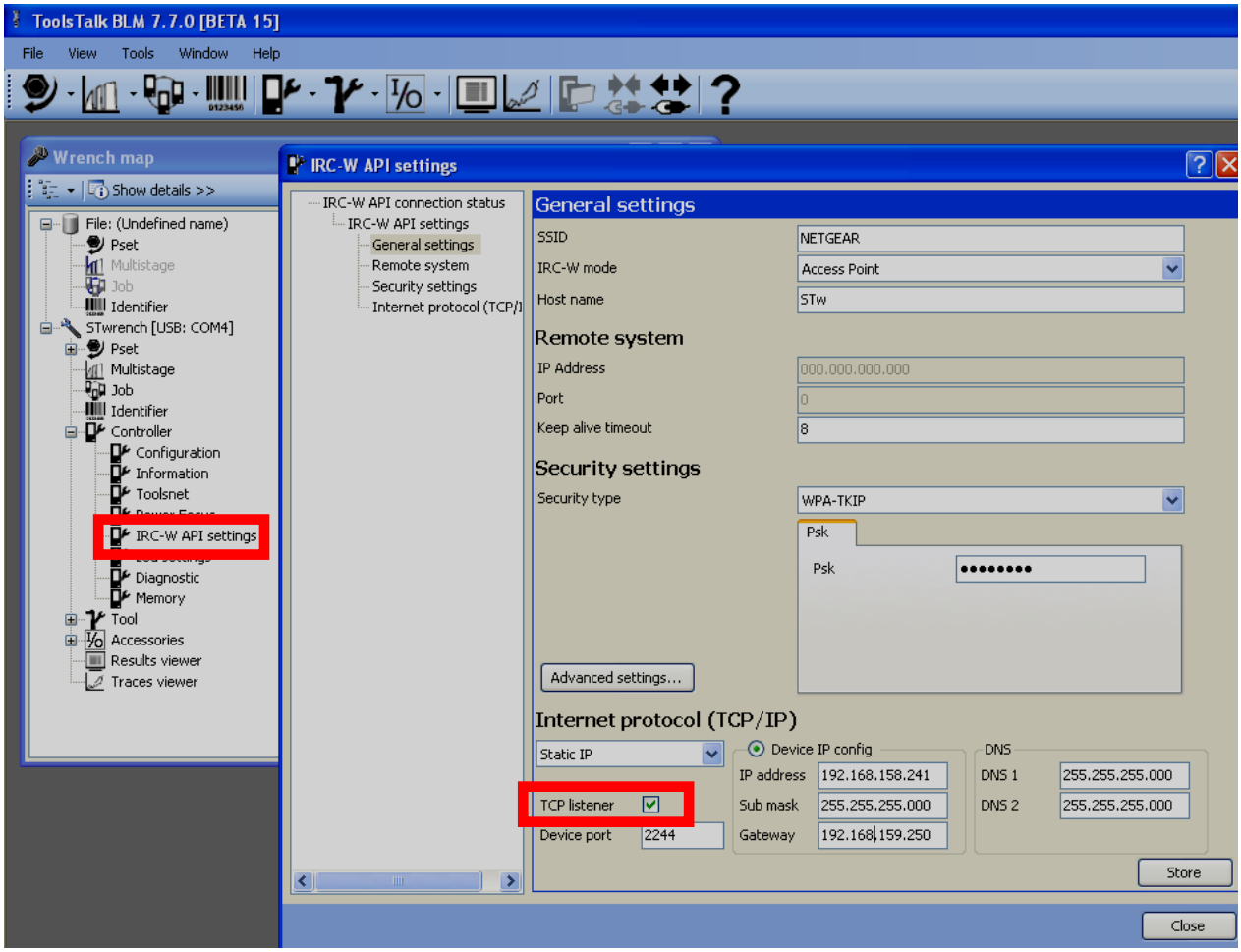
First of all, install the API software. Refer to the *STwrench-STanalyser – Introduction to API* manual for more information about the installation. Minimum API software version: 5.2.0

Install the IRC-W module on the STwrench and configure the module using ToolsTalk BLM as follow:

- Disable the IRC-W connection and click on ***Store***:

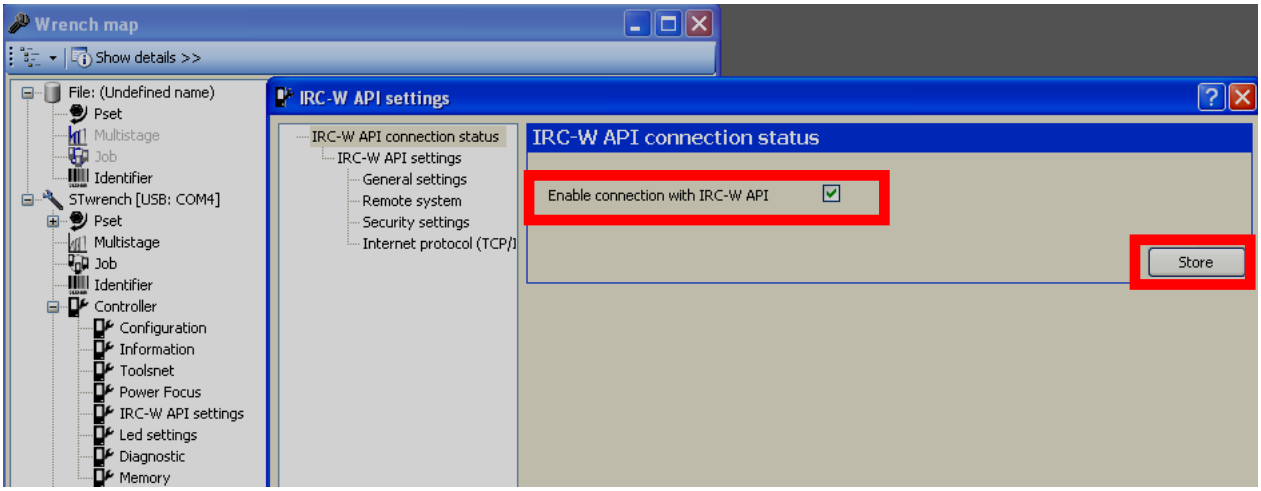


- Configure the network parameters:



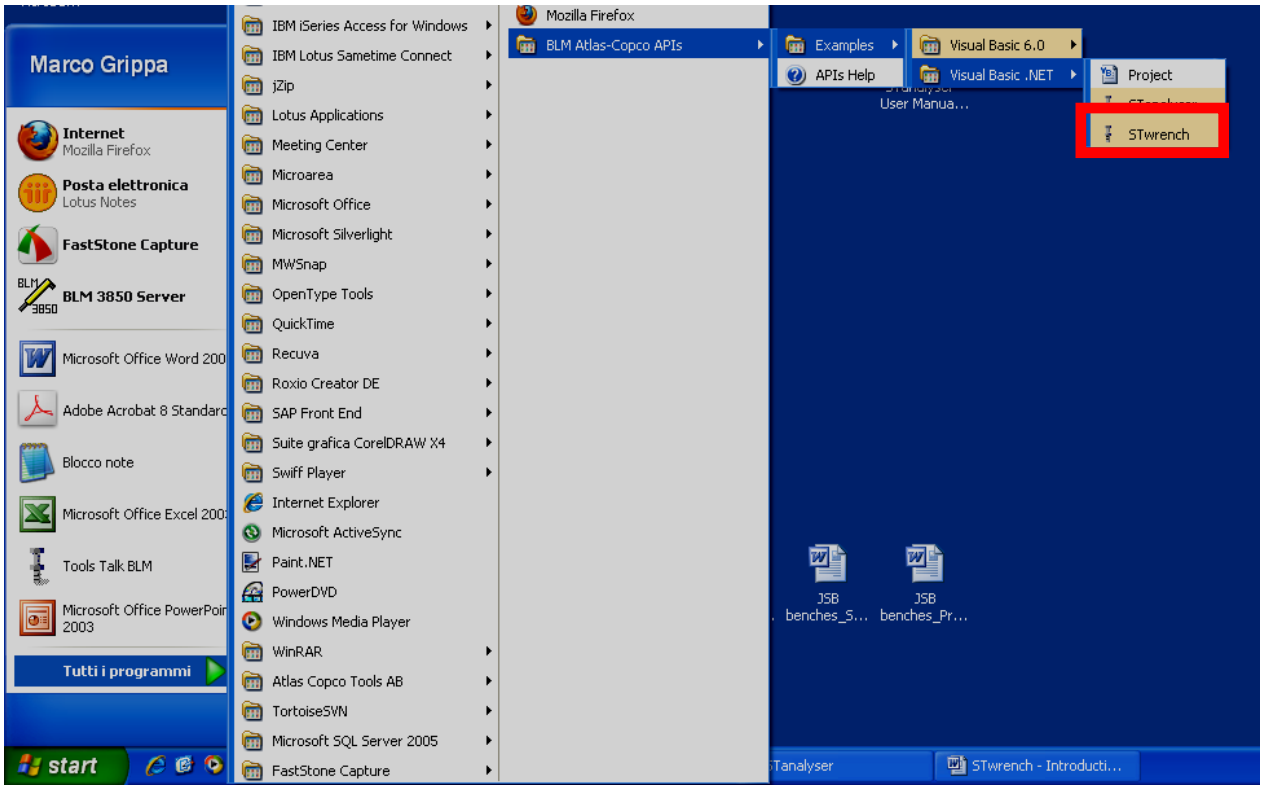
Enable the ***TCP listener*** and configure all the network parameters.

- Enable the IRC-W connection and click on ***Store***:

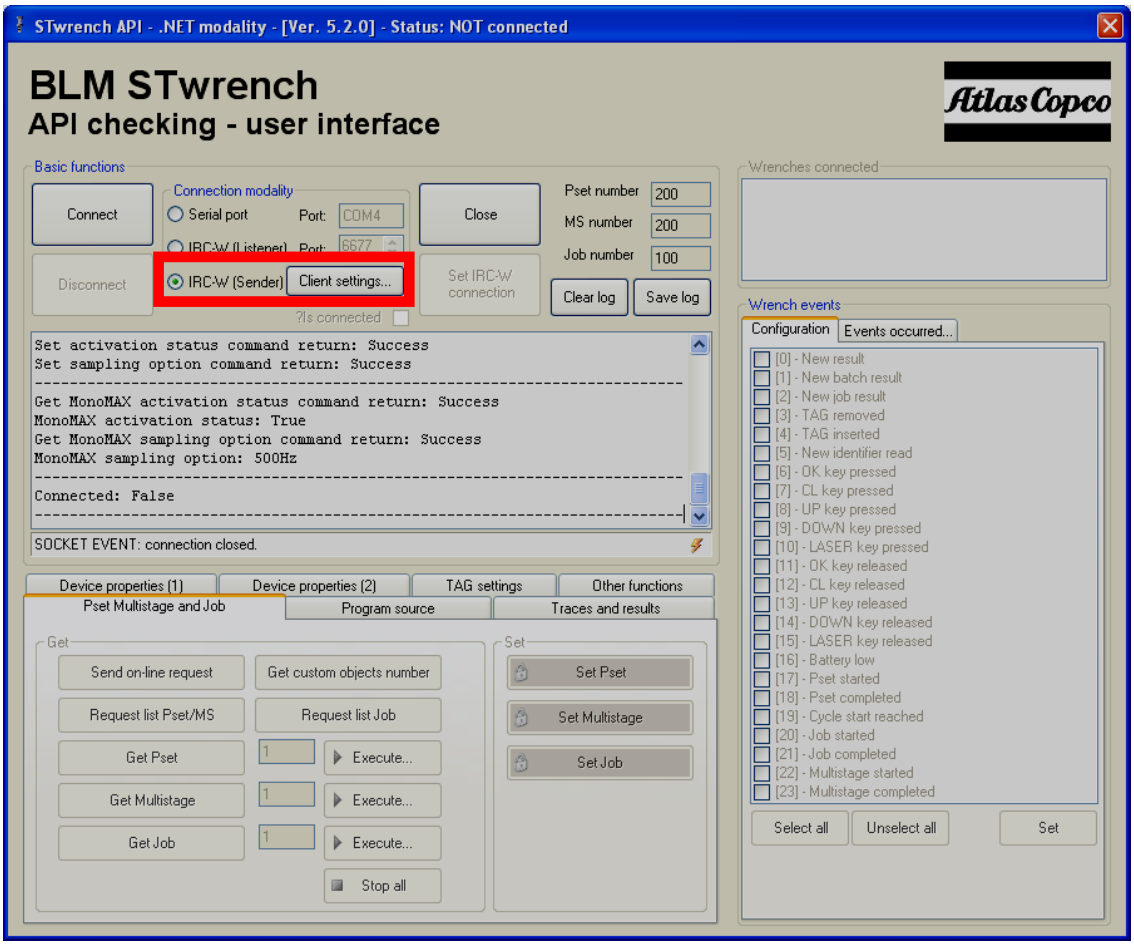


Disconnect the STwrench from ToolsTalk BLM.

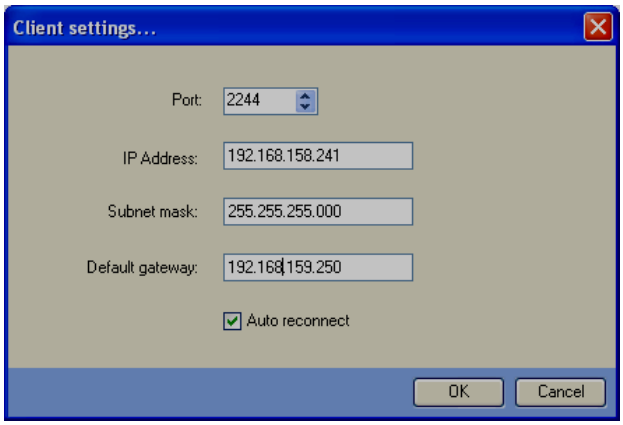
Launch the STwrench API application, available in the ***Start → Programs → BLM Atlas-Copco APIs → Examples***:



The following window is shown:

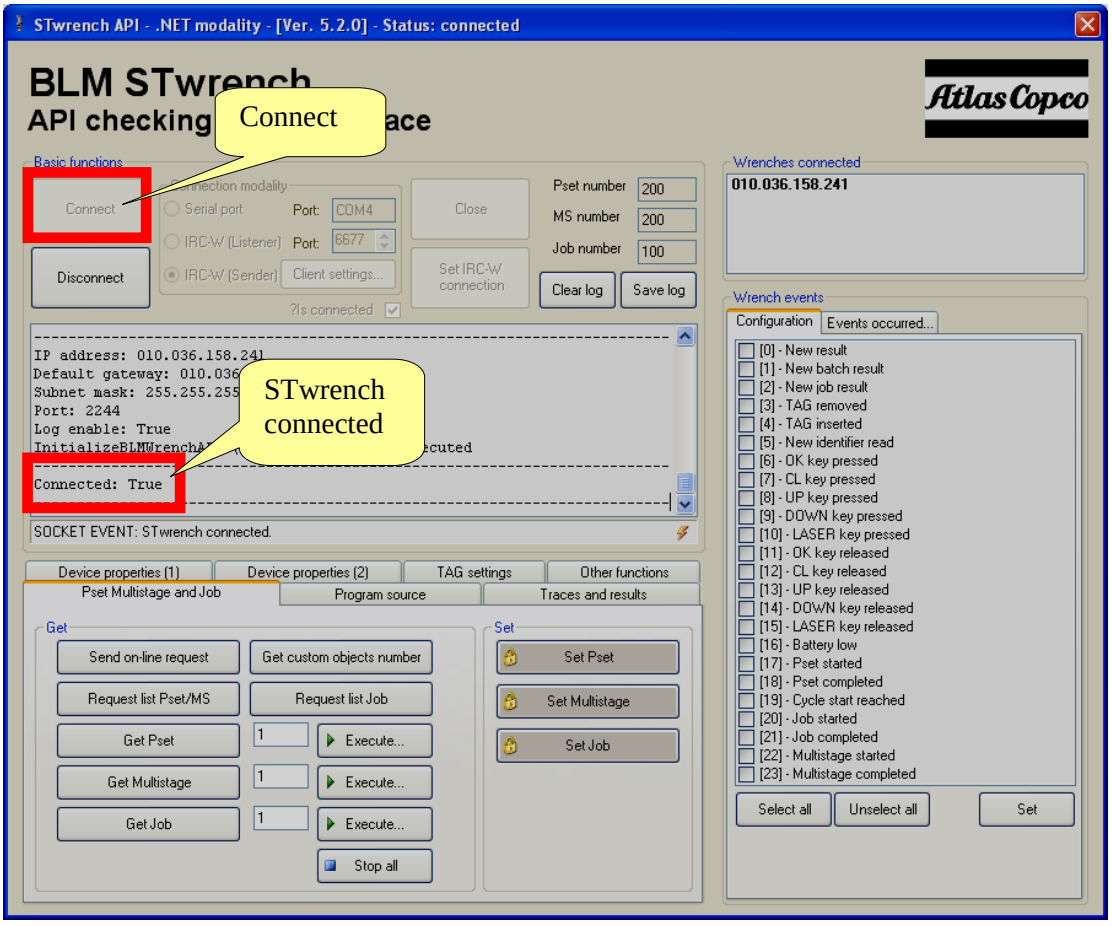


Enable the ***IRC-W (Sender)***, and click on ***Client settings***. The following window is shown:

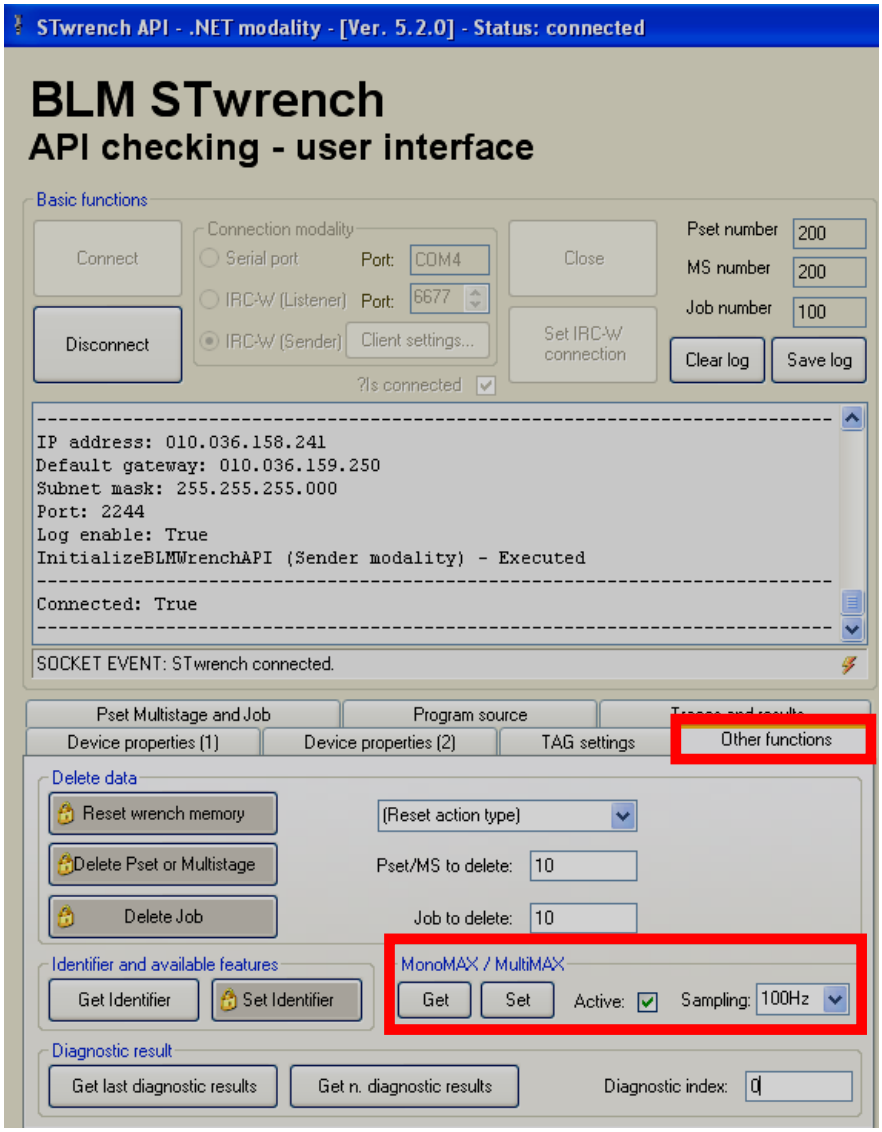


Set the network parameters according to those defined for the IRC-W module in ToolsTalk BLM as described above. Enable the ***Auto reconnect*** to reconnect the wrench automatically in case of communication temporary lost. Click ***OK*** to save.

Click on ***Connect*** and verify that the STwrench is connected (the IRC-W logo is also shown on the STwrench display):



Select ***Other Function***:



Enable the ***Active*** flag, set the ***Sampling frequency*** (100 Hz recommended value), click on ***Set*** and then click on ***Get***.
The Real Time Traces function is now active. Keep the API software application open and connected to the STwrench. Execute a tightening and the Real Time Traces window will be shown.
Refer to the *Real Time Traces* chapter for more information of the Real Time Traces function.

20 Scheduled Maintenance

20.1 Yearly Calibration

The STwrench needs to be recalibrated every year. Calibration must be performed by trained people, with the *STwrench Calibration KIT P/N 8059 0920 95*, which consists of the *STwrench Calibrator Software*, *Calibration smartHEAD* and the *Service RBU*.

20.2 Wrench Cleaning

Keep the STwrench clean.
After use, remove any traces of oil, grease and dust from the wrench, especially from the display, the keyboard, and the mini USB port.
When the USB cable is not connected to the wrench, insert the plug to protect the port from dust.
Always keep the IRDA port and, if installed, the barcode reader module, clean.
Avoid using harsh detergents when cleaning the wrench.

20.3 Shock Indicator



The shock indicator must be white in color.



It turns red when a shock over the limit occurs.
In this case, even if the STwrench does not seem to have any major problems, a wrench check must be performed, including recalibration. The torque transducer and gyroscope could be damaged even if they continue to work without evident faults.
After having checked the wrench (and repaired it if necessary), the shock indicator must be replaced.

20.4 Battery Pack Maintenance

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% ± 15% charge. Follow these 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.

21 Troubleshooting Guide

Here is a quick troubleshooting guide for the STwrench.

If a problem occurs, before taking any action (replacing parts or contacting customer support), be sure to check that the wrench is being used properly; improper operation can cause defects even if the system is in good working order.
In case of problems, the log file can provide useful information; see *Wrench LOG Viewer* and *Enabling LOG File*.

Problem	Cause	Solution
Block transducer is shown on wrench display	- smartHEAD data not read properly	- Ensure proper smartHEAD installation; if problem is not solved, check if a different smartHEAD works without problems.
Capacity error is shown on wrench display	- The smartHEAD currently installed on the wrench has a capacity lower than the torque value(s) specified in the Pset	- Decrease the torque parameters in the Pset.
Error Zeroing Gyro is shown on wrench display	- Bad wrench handling during power on - Gyroscope failure - Controller failure	- Switch off the wrench; switch the wrench back to on, leaving the wrench in a fixed position during the zero adjustment - Replace smartHEAD and check if problem is solved - Replace wrench controller and check if problem is solved
Error Zeroing Torque is shown on wrench display	- Bad wrench handling during power on - Transducer yielded - Controller failure	- Switch off the wrench; switch the wrench back to on, not applying any torque during zero adjustment - Replace smartHEAD - Replace wrench controller and check if problem is solved
Gyro is not enabled is shown on wrench display	- current RBU installed in the wrench controller does not support the gyroscope	- Pset including angle reading cannot be performed with this type of RBU

Insert Tool message is shown on wrench display when starting a Pset	- Tool recognition function enabled, but the tool in use does not have the RFID TAG - RFID TAG inside end-fitting tool not working	- If you want to use an end-fitting tool, or an extension, without the RFID TAG, the tool recognition function must be disabled - Replace end-fitting tool, or disable tool recognition function
IRC-B not Present is shown on wrench display	- Power Focus mode enabled but IRC-B module is not present	- Install IRC-B module in the wrench controller
Memory error is shown on wrench display	- Wrench memory not working	- Restart the wrench; if problem persists, the wrench needs to be repaired
Min load error is shown on wrench display	- The smartHEAD currently installed on the wrench has a Min. Load value higher than the value specified in the Pset	- Increase the *Cycle Start* parameter in the Pset
Need pairing is shown on wrench display	- Power Focus mode enabled but pairing procedure has not been performed	- Perform pairing procedure between STwrench and Power Focus
No program is shown on wrench display	- Pset missing - The tool recognition is used to select a program, but there is no Pset associated with the current end-fitting tool number plugged into the smartHEAD - The barcode is used to select a program, but there is no Pset associated with the barcode reader	- Define at least one Pset in the wrench - Define a Pset associated with the end-fitting tool currently installed in the smartHEAD - Define a Pset associated with the barcode currently being read
No program selected is shown on wrench display	- Pset missing from QATnode	- Pset source set to “QATnode” or “API”, but QATnode or “API” not sending Pset to wrench. Select the Pset from the QATnode or “API”.
Overspeed error is shown on wrench display	- Tightening operation executed too fast. Angle result is set to 9999 degrees	- Repeat the tightening, operating the wrench more slowly
PIN not valid is shown on wrench display	- Power Focus sent an invalid PIN during the pairing procedure	- Repeat pairing procedure

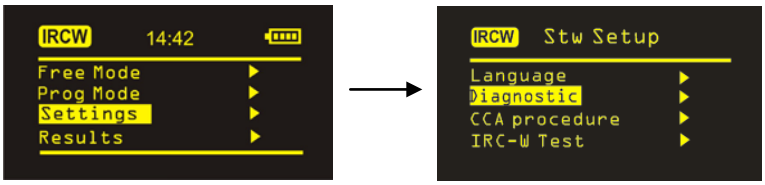
Prog. Missing is shown on wrench display	- A Multistage or Job contains a Pset which is not defined in the Pset list	- Delete the missing Pset from the Multistage/Job, or add the missing Pset to the Pset list
Radio not present is shown on wrench display	- Radio module not present but STwrench connected to Power Focus via radio module.	- Install the radio module in the STwrench, or disable the Power Focus connection.
RBU incompatible is shown on wrench display	- The new RBU installed in the wrench is not compatible with the data store in the wrench memory	- Select RBU data and not wrench data in order to work with the new RBU, or use a different RBU supporting the data stored in the wrench memory.
RBU not Present is shown on wrench display	- RBU missing or not properly installed in the wrench controller	- Verify proper installation of RBU
STw Not Calibrated is shown on wrench display	- smartHEAD not calibrated	- Calibrate smartHEAD or replace smartHEAD with a calibrated one.
Transducer Error or *Transducer Blocked* is shown on wrench display	- smartHEAD not present in the wrench, or data reading not consistent	- Verify that smartHEAD is properly installed on the wrench controller. Verify also that the contacts of the smartHEAD and controller are clean and not damaged.
Transducer overloaded, or *Transducer overloaded please return it to customer center* is shown on wrench display	- smartHEAD has been overloaded (more than 120% of its capacity).	- The smartHEAD must be sent to our customer centre for inspection. Recalibration is then required to restore normal operation.
Wrench not reading torque and/or angle values in Prog. Mode, but reading correct values in free mode	- Incorrect torque and/or angle correction coefficient settings in the RFID TAG of the end-fitting tool	- By using the TAG WRITER function, verify the torque and angle correction coefficients. If no extension is used, the *Torque coefficient* must be set to 1, and the *Angle coefficient* must be set to 0. If a wrench extension is used, perform the CCA procedure to calculate the 2 coefficients.
Shock indicator colored in red	- STwrench exposed to shock over the limit	- Complete check of wrench functionality and recalibration, after which the shock indicator has to be replaced.
Barcode not working	- Wrong BARCODE module installation - Wrong wrench settings	- Verify proper module installation. - Verify that barcode is activated in the tightening programs, and the identifier section of the ToolsTalk BLM is configured properly.

"Communication error" is shown on Power Focus when a Pset is sent to the STwrench	- Pset contains angle parameter but smartHEAD has no gyroscope	- Pset cannot be executed by wrench. Use a Pset with only torque strategy, or use a smartHEAD with gyroscope.
IRC-B radio module not working	- Wrong module installation - Missing pairing	- Verify proper module installation - Execute IRC-B radio pairing procedure
IRC-W module not working	- Wrong module installation - Wrong wrench settings	- Verify proper module installation - Verify network parameters in the ToolsTalk BLM settings
Wrench not communicating with ToolsTalk BLM	- Missing connection	- Verify that the USB cable is present and that the connection status bar in the software shows the connection (disconnect cable and connect again if you are not able to connect; restart wrench if the problem persists; restart the software if problem still persists).
Error while saving a Pset (or Multistage or Job) to the wrench	- Parameters not valid	- Verify all the Pset (Multistage / Job) parameters. If one of them is not valid, the software cannot save the tightening program on the wrench.

21.1 STwrench Diagnostics

The diagnostic menu can be used to perform a check of the wrench hardware. To execute the diagnostic, the ***Settings*** menu must be enabled; see the chapter *STwrench Controller Setup*.

Select ***Diagnostic*** from the ***Settings*** menu to start the diagnostic procedure:

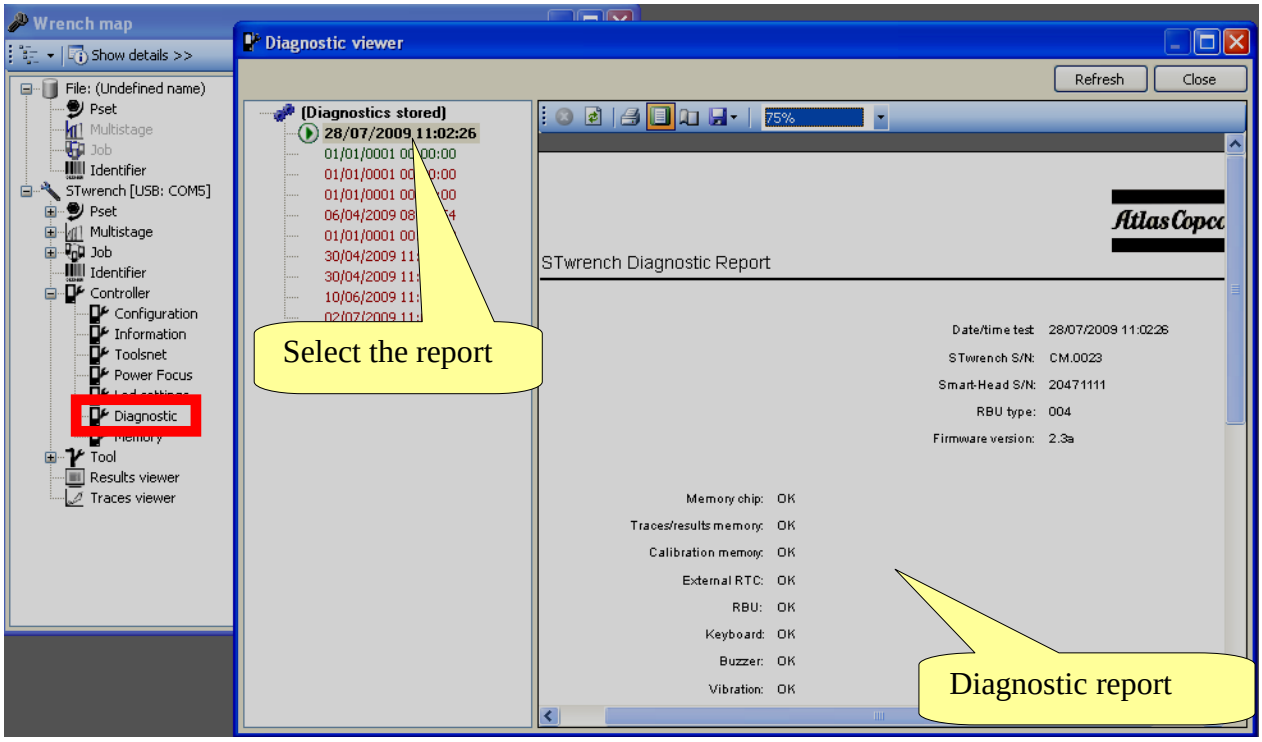


The diagnostic procedure helps the user to check all the wrench hardware: Keyboard, buzzer, vibration devices, illuminating light, barcode reader, wrench memory and RBU, radio modules, smartHEAD and battery.

The diagnostic procedure is interactive: Simply follow the instructions given on the wrench display to complete the procedure; if a component gives a *Not OK* result during the test, it should be repaired or replaced.

NOTE: If the test on some buttons of the wrench keyboard gives a *Not OK* result, all subsequent 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).

A summary is shown on the wrench display at the end of the procedure; the diagnostic reports are also saved in ToolsTalk BLM. Select ***Diagnostic*** from the ***Controller*** menu in the wrench map:



The diagnostic reports are stored in the wrench memory. A maximum number of 10 reports are stored: After this limit is reached, the oldest report is deleted when a new report is created.
Some useful commands are available in the report toolbar:

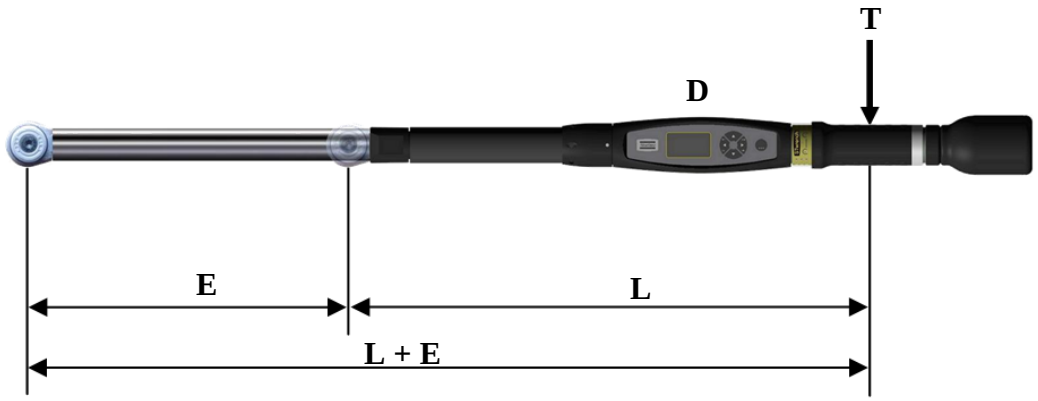
	Prints the report.
	Sets up the report page.
	Exports report to Excel or PDF file.

22 Appendix A – Calculating Torque and Angle Correction Coefficients

When the joint design or space limitations preclude use of standard sockets or tools, it may be necessary to use special extension spanners to fit the application.
In these cases, the 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.

Also when a torque multiplier is used on the STwrench, the torque provided on the joint is greater than the torque produced by the wrench; in this case the torque correction coefficient is needed to adjust the STwrench torque reading (see below). The angle measurement is also affected, but in this case the STwrench cannot compensate the angle measurement.

22.1 Torque Correction Coefficient



T	=	*applied torque*
D	=	*displayed torque*
L	=	*standard arm (see the Specifications chapter for details)*
E	=	*extension arm*
L + E	=	*total arm*

From the relation between the displayed and applied torque $\boldsymbol{T} = \frac{\boldsymbol{D} \times (\boldsymbol{L} + \boldsymbol{E})}{\boldsymbol{L}}$, the torque correction coefficient is given by the following formula:

Torque correction coefficient = $\frac{\boldsymbol{L} + \boldsymbol{E}}{\boldsymbol{L}}$

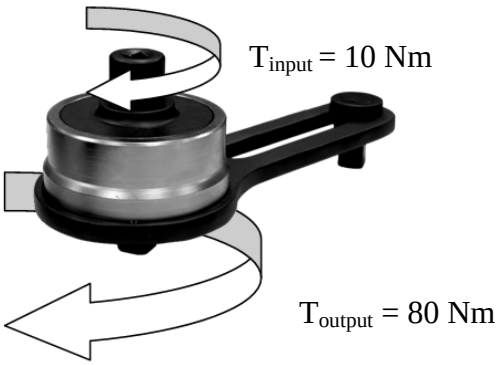
Warning: The torque correction coefficient alters the STwrench torque measurement; a wrong value of this coefficient may cause an improper torque reading, generating the risk of executing a tightening at a different target torque to the one expected. Ensure you have calculated the proper value when a wrench extension is used. For end-fitting tools used without wrench extensions, the torque correction coefficient must be left set to 1.

Warning: When using an extension, the torque reading is affected by the hand positioning. Always place the hand on the middle of the handle of the STwrench:



If a torque multiplier is used on the STwrench, the ***Torque Correction Coefficient*** must be set equal to the torque multiplying coefficient of the torque multiplier.

$$\textbf{\textit{Torque Correction Coefficient}} = \frac{T_{output}}{T_{input}}$$



In the example of figure above, the proper value is 80/10 = 8.

22.2 Angle Correction Coefficient

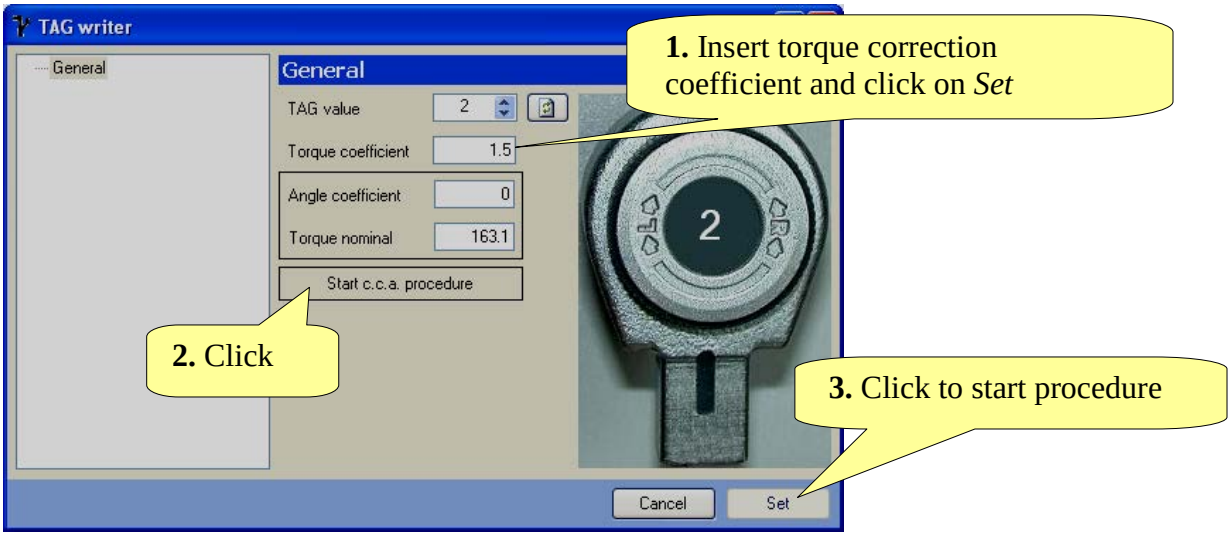
When a wrench extension is used, the angle correction coefficient (CCA) permits linear compensation of extension torsion based on the torque applied. The value is expressed in degrees at the maximum torque of the wrench. When a torque multiplier is used on the STwrench, the angle correction coefficient must be left to zero; in this case the STwrench cannot compensate the angle measurement.

NOTE: Before executing this procedure, ensure the STwrench and smartHEAD are properly calibrated; if not, the CCA Procedure menu is not shown on the wrench display and the smartHEAD should be recalibrated; this is necessary to include the additional smartHEAD bending parameters, and does not affect the Torque/Angle calibration values.

The STwrench features an automatic procedure to calculate the CCA.
To start the procedure, insert the extension with black-end fitting tool into the smartHEAD, and access the ***Settings → CCA procedure*** menu on the wrench:



It is also possible to start the procedure from the *TAG Writer* function of ToolsTalk BLM:



Regardless of whether the procedure is started from the STwrench menu or from ToolsTalk BLM, the wrench display shows the following screen:



The procedure is executed at 75% of the wrench's capacity. The final angle correction coefficient is automatically calculated at wrench capacity, using linear interpolation.
Press the ***OK*** button on the wrench keyboard to proceed.

The procedure asks for the *Torque Correction Coefficient*, which must be calculated as described in the previous paragraph:



Set the **Torque Correction Coefficient** by using the ***DOWN*** and ***UP*** buttons on the wrench keyboard. If the procedure has started from ToolsTalk BLM, the torque coefficient is automatically recalled.

Click on ***OK*** on the wrench keyboard to confirm the value and start the angle correction coefficient calculation:



Apply the target torque of the STwrench on a non-rotating joint; when the target is reached, the display shows the value:



This screen is displayed only when target torque is reached with a proper angle value. Three tests are required to complete this procedure.

Press ***OK*** on the wrench keyboard and repeat until three tests are performed. At the end of the procedure the following screen is displayed:



The angle value displayed here is the value referred to at wrench capacity. In this example, 2.12 degrees at wrench capacity is equivalent to 1.59 degrees at 75% capacity.

Click on ***OK*** on the wrench keyboard to store the Torque and Angle Correction Coefficient in the RFID TAG of the extension. Click on ***CL*** to repeat the three tests.

NOTE: An *Angle Correction Coefficient* with a value lower than 1 degree is not considered relevant, and the value stored is zero.

NOTE: If the difference between maximum and minimum angle results of the three tests is greater than 10% of the maximum values, the results are not considered consistent, and the procedure must be repeated. The following message is displayed:



22.3 Correction Formulas

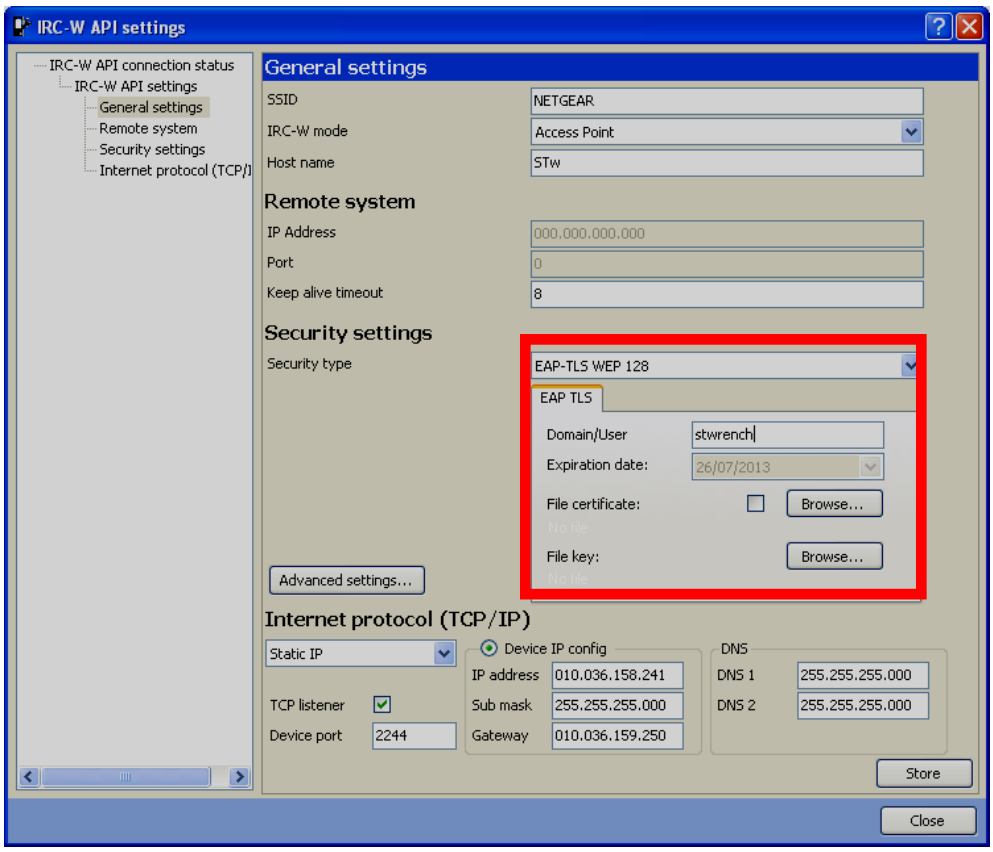
During the tightening, the torque and angle measured by the transducers are corrected to obtain the real torque and angle values, which are displayed on the wrench and used in the tightening traces and results. The correction formulas are:

$$Angle\ displayed = Angle\ measured - Angle\ Coefficient \times \frac{Torque\ measured - Cycle\ Start}{Wrench\ capacity - Cycle\ Start}$$

$$Torque\ displayed = Torque\ measured \times Torque\ coefficient$$

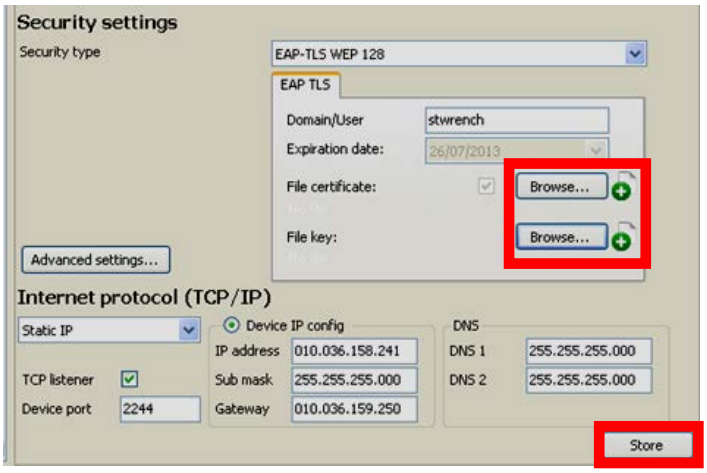
23 Appendix B – EAP-TLS Security Type

When one of the EAP-TLS security types is selected for the IRC-W radio module, the following configuration is required:

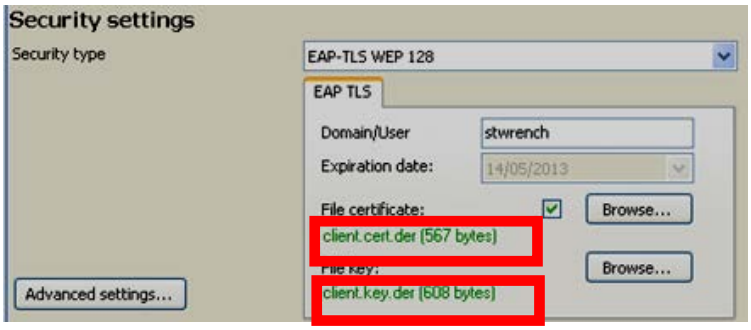


The ***Domain/User*** must be the same of the one used to create the certificates for the server and for the client (the figure above is just as example). The certificates files must be created and saved on the PC with ToolsTalk BLM installed.

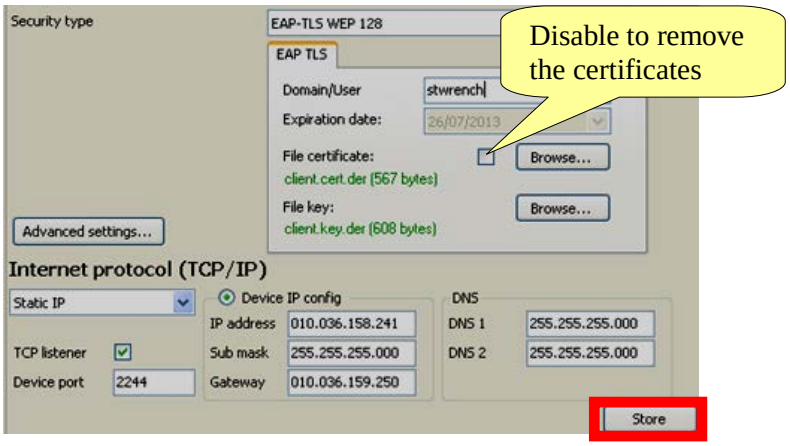
Load the certificate and the key files browsing them from your PC:



Click on ***Store*** on the window above to save.
The certificates are shown:

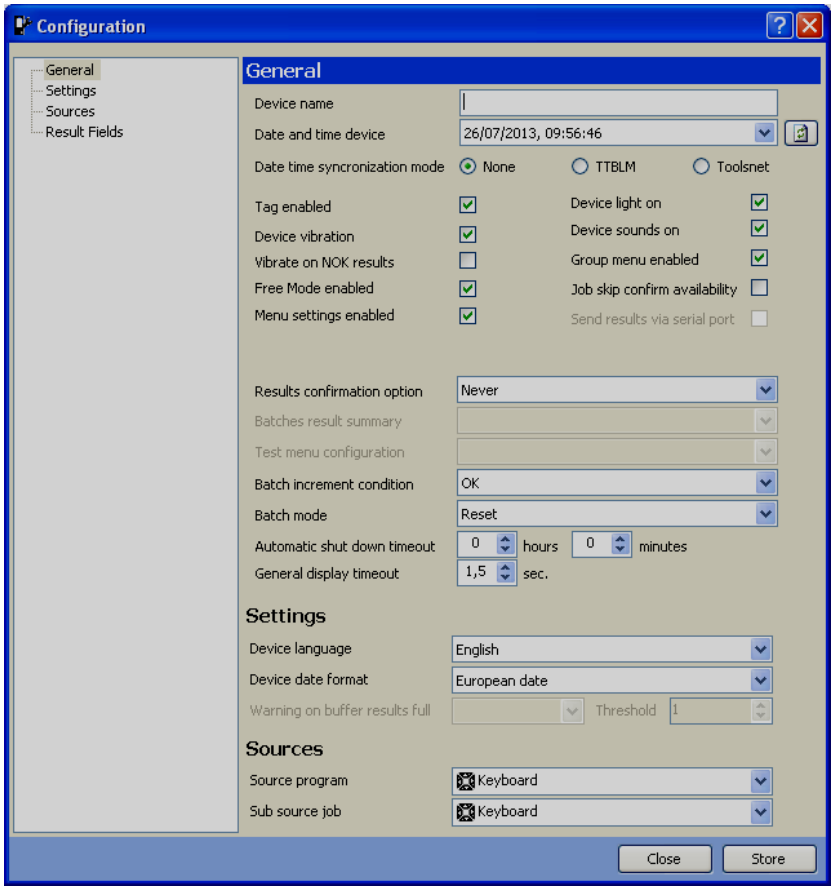


The configuration is completed.
In case the certificates must be replaced, deselect the flag and click on ***Store***. Then it is possible to browse the new certificates:



24 Appendix C - STwrench Factory Settings

The STwrench settings are stored in the RBU. The following table details the RBU default configuration:

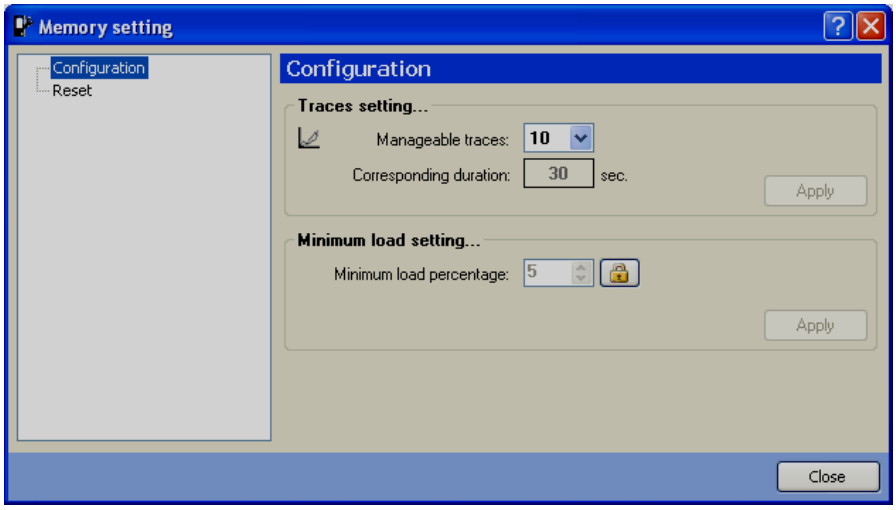


Wrench name	This field is left blank in factory settings
Tag enabled	*YES* Note that it was set to *NO* for RBU produced before serial number *RBU P 01156, RBU Q 00170, RBU PA 0010, RBU QA 0016.*
Wrench vibration	*YES.* Note that it was set to *NO* for RBU produced before serial number *RBU P 01156, RBU Q 00170, RBU PA 0010, RBU QA 0016.*

Date time synchronization mode	None
Vibrate on NOK results	NO
Free Mode enabled	*YES*
Menu settings enabled	*YES*
Wrench light on	*YES*
Wrench sounds on	*YES*. Note that it was set to *NO* for RBU produced before serial number *RBU P 01156, RBU Q 00170, RBU PA 0010, RBU QA 0016*.
Job skip confirm availability	*NO*
Group menu enabled	*YES*
Results confirmation option	*Never*
Batch increment condition	*OK*
Batch mode	*Reset*
Automatic shutdown timeout	*0* (no automatic shutdown)
General display timeout	*1.5*
Source program	*Keyboard*
Sub source job	*Keyboard*
Wrench language	*English*
Wrench date format	*European*
Result Fields	Fields activated: *Overall status, Torque result, Pset name*

Real time traces	*Disabled.* When enabled by the user, the following parameters are set by default: - ***Open maximized***: *Disabled* - ***Higher limit, lower limit, target****: Enabled for all the traces* - ***Sampling option****: 100 Hz* - ***Connection type***: *USB* - ***Advanced settings***: *torque/time* and *angle/time* traces enabled in real time, *torque/angle* trace enabled in not real time.

The traces setting per default is set to 10 traces each a maximum of 30 seconds in length. The minimum load is set by default to 5%:



Traces resultion Set in the menu *Controller → Power Focus Settings → Common*	*Low*

The radio modules (IRC-W, IRC-B and IRC-Z), ToolsNet and QATnode parameters are not set to a specific configuration by default; when installed, they must be set anyway according to the specific customer environment.

25 Abbreviations

Abbreviation	Description	Abbreviation	Description
A	Ampere	n	Numbers (of values)
AC	Alternating current	N.A.	Not Applicable
AFH	Adaptive Frequency Hopping	Nm	Newton meter
Ah	Ampere-hour	Nr.	Number
API	Application Programmers Interface	OK	Approved (tightening)
ATS	Assembly Tools Software	NOK	Not approved (tightening)
CCA	Angle Correction Coefficient	PC	Personal Computer
CCW	Counter clockwise	PF	Power Focus
CL	Clear (button)	PROG	Program
CW	Clockwise	Pset	Parameter Set
dBm	Decibel referred to milliwatt	PVT	Prevailing Torque
DC	Direct current	RBU	Rapid Backup Unit
EMC	Electromagnetic Compatibility	Ref	Reference
EMI	Electromagnetic Interference	RF	Radio Frequency
Hz	Hertz (measurement unit of frequency)	RFI	Radio Frequency Interference
ID	Identification	RFID	Radio Frequency Identification
I/O	Input/Output	RSSI	Received Signal Strength Indicator
IP	Internet Protocol	SIR	Serial Infrared
IRC	Industrial Radio Communication	SSID	Service Set Identifier
IRDA	Infrared Data Association	SW	Software
ISM	Industrial, scientific and medical	TT BLM	ToolsTalk BLM
LED	Light-Emitting Diode	USB	Universal Serial Bus
LSC	Linear Slope Coefficient	V	Volt
Max	Maximum	VIN	Vehicle Identification Number
Min	Minimum	WEEE	Waste Electrical and Electronic Equipment
ms	millisecond		

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