ZIPPTORK

Bolting Technology

Torque Control、Bolt Load Control

www.zipptork.com

Smart Bolting Technology

Passion for Innovation

Your Problem ~Our Inspiration

Content

Overview

ZIPPTORK has been working for decades on the development of various assembly technologies, such as the bolting of thread fasteners, the riveting or squeezing of solid or hollow rivets, the blind riveting of blind rivets or rivet nuts and HUCK type bolts, etc., with an emphasis on the intelligence of the related products.

The bolting control technology is an important development target for **ZIPPTORK**, mainly for torque control of thread fasteners, bolt load (clamping force) control and monitoring of bolted joint status. The portfolio brings together key equipment such as torque testers for the calibration, verification and simulation of tool torque capability before assembly, monitoring or controlling the tightening torque and bolt load (clamping force) during assembly, and residual torque detection after bolted, and continuous monitoring of the bolted joint status, either immediately or periodically, to ensure the highest reliability of the assembled equipment, all under one system with a complete patented layout.

With the advent of the smart factory, **ZIPPTORK** is an essential source of technological and engineering information to help you make Industry 4.0 a reality.

ZIPPTORK Bolting 4.0 - Smart Bolting Solution

Quality, efficiency and flexibility are three drivers of Industry 4.0. Digitalization allows industries to introduce effective processes to mass produce higher-quality products at lower costs. When talking about technologies, the cornerstones that are shaping Industry 4.0 for businesses are cloud computing; the Internet of Things; big data and analytics; additive manufacturing(3D Printing); and autonomous robotics. No wonder most industries are willing to move toward the industry of tomorrow. However, the budget for relevant investments becomes the most significant obstacle. Narrow the problem down to the bolting works popular in most industries. How to do the job faster, safer and more reliably while requiring the production record to be traceable for reliability and assurance of quality.

ZIPPTORK Bolting 4.0 provides innovative, effective, yet economical solutions for various industries in their daily bolting works, such as torque tool calibration, torque simulation before work, bolting control during the process and residual torque verification after bolt, and even the highest requirement to control every bolted joint with the same bolt load. At the same time, keep monitoring the bolted joint status remotely, periodically or continuously. It meets the application requirement of IoT.

You are welcome to visit and browse the website – www.zipptork.com for more information and videos.

ZIPPTORK Bolting Solutions Q & A

Bolting Torque / Bolt Load Control, Bolting Sequence Control, Bolted Joint Status Monitoring, Job Traceability & Data Collection/Logging

1. How to control the bolting torque of air or DC-driven impact wrench or pulse wrench?
   Air torque tools with **TCA/TCB Controller** or DC tool **with built-in ECB Control board** attached with **TTE Torque Transducer** under **Transducer Mode** ~ Torque controllability ±10% ~ ±15% accuracy for impact wrench, ±5% ~ ±10% for oil pulse wrench
   Air torque tools with **TCA/TCB Controller** or DC tool **with built-in ECB Control board** only under **Pressure or Voltage Mode** ~ Torque controllability ±15% ~ ±20% accuracy for impact wrench, ±10% ~ ±15% for oil pulse wrench
2. How to monitor the bolting torque of pulse wrench and clutch type tool?
   Auto shut off type oil pulse wrench or Clutch type wrench ~ Use **TTE Transducer + DR-RF Dongle** + Tablet for torque monitoring and data logging. Accuracy depends on tool quality.
   Non-shut-off type oil pulse wrench ~ Use method and apparatus of 1 mentioned above.
3. How to collect bolting data of a click-type wrench?
   Use Click type wrench + **TTA/STA wireless Torque Transducer + DR-RF Dongle** + Tablet to **make audible "CLICKs" visible and data collectable**.
4. How to measure the residual torque of a bolted joint with 1st movement method?
   Use any manual torque wrench + **TTA/STA wireless Torque Transducer + DR- RF Dongle** + Tablet to obtain the residual torque just at the 1st movement of the bolted joint while keep tightening.
5. How to measure the residual torque of an extremely high torque (over 500NM) bolted joint?
   Use any manual torque wrench + **TTA/STA wireless Torque Transducer + TM(Torque Multiplier ~ up to 3 stacks of TM) + DR-RF Dongle** + Tablet to obtain the residual torque just at the 1st movement of the bolted joint.
6. How to do torque simulation of power-driven torque tools before bolting?
   Use the tool with or without the **TTE Torque Transducer** attached **→TTT/LTT Torque Tension Tester+ DR-RF Dongle**+ Tablet to measure the device's working torque under specific air pressure or voltage to tighten the particular fastener and acquire the working torque with correspondent bolting seconds.

Please refer to the 『appendix』 for the solutions to the following questions!

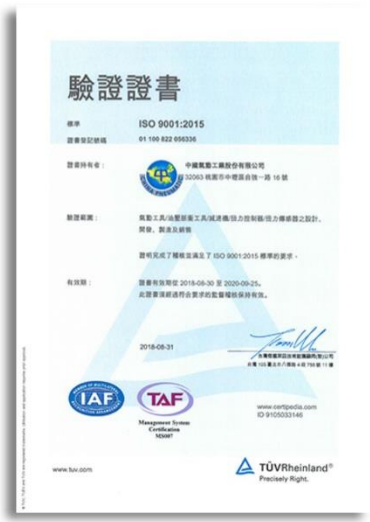
- How to do torque control for car wheel bolting precisely and efficiently?
- Is there any practical alternative for ultrasonic bolting technology?
- How to monitor the bolted joint condition continuously or periodically?
- How to do high torque bolting?
- How to do bolting sequence control?
- What is the most advanced transducerized power-driven torque multiplier?
- What is the ultimate solution of bolting works?

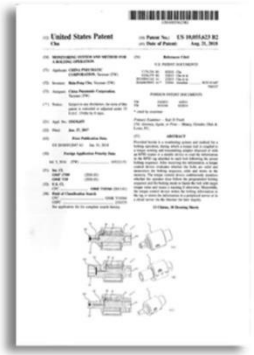
Bolting Technology

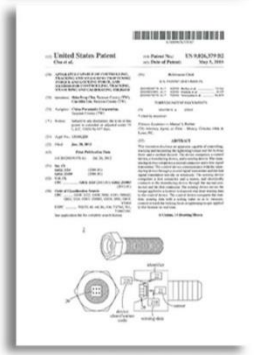
Common Issues in the Field

- How to select a proper torque tool? Tool Cost vs Control Accuracy
- How to manage bolting work before, during & after?
- How to do daily or periodic calibration with a record for traceability ?
- How to control the bolting torque of discontinuous drive torque tools such as an impact or pulse wrench?
- How to monitor the bolting torque of a clutch-type screwdriver and obtain relevant bolting data?
- How to monitor the bolting torque of a power torque tool with an auto shutoff mechanism and obtain relevant data?
- How to collect the bolted data once a click wrench checks it?
- How to digitalize an interchangeable head torque wrench and make it accessible with various types of heads from other brands?
- How can digital torque wrenches or transducers simultaneously measure the bolt load?
- How to do high torque bolting by several stages while bolting sequentially?
- How to verify the high residual torque over 500NM effectively & correctly?
- How to make an air motor with servo control?
- How to tighten wheel lug nuts properly with accurate torque control and bolting sequence while recording relevant data?
- How to measure & control the bolt load during the bolting process? Bolt Load Transducer is the answer
- How to control the bolt load of a bolted joint? A sensing Washer or Sensing Bolt will be an effective and economical alternative to ultrasonic bolting technology.
- How to monitor the tightened status of a bolted joint remotely? A sensing Washer or Sensing Bolt is the best choice.

Patents & ISO Certification







Patents Granted for Bolting Technology

Item	Title	Country	Reference	Expiry Date
1	A method of programmable toque controlling for sensing bolt	USA	US 2015/0041162 A1	Feb.12, 2035
2	Anti-Vibration Torque Sensing and Control Device for Tools	USA	US 7,779,704 B1	Aug. 24,2030
3	Apparatus Capable of Controlling, Tracking and Measuring Tightening Torque and Locking Force, and Method for Controlling, Tracking, Measuring and Calibrating Thereof	USA	US 9,026,379 B2	May 5, 2035
4	Apparatus and Control System of Programmable Air Servo Motor	USA	US 10,422,356 B2	Feb. 06, 2038
5	Torque Control System and Torque Control Method for Power Impact Torque Tool	USA	US 10,940,577 B2	Sept. 10, 2038
6	Method of Torque Control and Apparatus Thereof	USA	US 10,564,657 B2	Feb. 18, 2040
7	WIRELESS TORQUE TRANSDUCER	USA	US D887,881 S	Jun.23, 2035
8	Monitoring System and Method for a Bolting Operation	USA	US 10,055,623 B2	Aug. 21,2038
9	扭力制御方法及方法的制御裝置	Japan	特許第 6420848 號	Oct. 19, 2039
10	扭力感知及傳導裝置	Japan	特許第 6871351 號	April 19, 2041
11	Drehmomentverstarker	Germany	Pat. Nr. 10 2017 127 762	15.11.2038
12	Digitales Anzeigegerat fur ein werkzeug zum Anziehen von Befestigungsmitteln	Germany	Pat. Nr. 20 2010 005 469.9	20.05.2030
13	Drehmomentsteteuersystem und Drehmomentsteuerve fahren fur Elektro Schlagwerkzeug mit Einstellbarem drehmoment-有動扭控	Germany	Pat. Nr. 10 2017 119 623	28.08.2037
14	Druckluftsteuerungsmoduleinhelt fur traghare druckluftbetatigte Werkzeuge	Germany	Pat. Nr. 20 2007 007 127.2	04.11.2030
15	Uberwachungssystem und Uberwachungsverfahren zur Schraubenverbindung	Germany	Pat. Nr. 10 2017 104 224	10.12.2040
16	Darstellung 1 von 7 (Wireless Torque Transducer-(無線扭力傳感器外型專利)	Germany	Designs Nr. 402018100941-0001, 0002, 0003	09.18.2043
17	螺栓夾緊力感應墊圈	Taiwan	新型第 M598351 號	2030.04.12
18	動力鎖緊工具之扭矩控制裝置及其控制程序	Taiwan	發明第 I 396609 號	2030.07.13
19	扭力感測與傳輸裝置	Taiwan	發明第 I 703315 號	2039.01.09
20	感應螺栓的電源與訊號傳輸裝置及感應螺栓裝置	Taiwan	發明第 I 664356 號	2037.03.23
21	螺栓分次鎖固的扭力控制方法及扭力控制裝置	Taiwan	發明第 I 670149 號	2038.06.06
22	可程式氣動伺服馬達	Taiwan	發明第 I 584919 號	2036.05.18
23	螺栓鎖固作業的監控系統及其方法	Taiwan	發明第 I 569923 號	2036.07.04
24	具扭力、角度感測及訊號傳輸功能的套筒	Taiwan	發明第 I 631323 號	2037.10.29
25	電動衝擊式扭力工具的扭力控制系統及其扭控制方法	Taiwan	發明第 I 619582 號	2037.06.08
26	氣動衝擊式扭力工具的扭力控制方法及其扭力控制系統	Taiwan	發明第 I 592778 號	2036.02.01
27	扭矩顯示系統及其方法	Taiwan	發明第 I 435795 號	2031.10.02
28	具有抗振作用之工具扭力感應與控制裝置	Taiwan	發明第 I 342821 號	2029.01.20
29	扭力控制方法及其扭力控制裝置	Taiwan	發明第 I 509379 號	2034.07.30
30	衝擊式氣動扭力板手之扭矩控制裝置	Taiwan	發明第 I 432293 號	2032.01.03
31	可控制與追蹤量測鎖緊扭矩及鎖緊力的裝置及其控制方法、追蹤量測方法與校驗的方法	Taiwan	發明第 I 454346 號	2031.12.29
32	動力鎖緊工具之扭矩控制裝置及其控制程序	Taiwan	發明第 I 396609 號	2030.07.13
33	無線扭力傳感器之部分	Taiwan	設計第 D197509 號	2030.07.13
34	間接耦合之扭矩控制方法及其機構	Taiwan	發明第 I 498196 號	2032.10.04
35	間接耦合的扭矩控制方法及其機構	China	ZL 2012 1 0414390. 8	2035.09.16
36	具有抗振作用的工具扭力感應與控制裝置	China	ZL 2010 1 0101192. 7	2032.02.01
37	扭矩顯示系統及其方法	China	ZL 2011 1 0138293. 6	2033.12.25
38	感應螺栓的電源與訊號傳輸裝置及感應螺栓裝置	China	ZL 2017 1 0181401. 5	2039.11.22
39	電動衝擊式扭力工具的扭力控制系統及其扭控制方法	China	ZL 2017 1 0492652. 5	2037.06.25
40	無線扭力傳感器	China	ZL 2018 3 0512525. 2	2029.01.11
41	扭力控制方法及其扭力控制裝置	China	ZL 2014 1 0371437. 6	2037.06.06
42	可控制與追蹤測量鎖緊扭矩及鎖緊力的裝置及相關方法	China	ZL 2012 1 0011877. 1	2034.02.26
43	可程式氣動伺服馬達的裝置與控制系統	China	ZL 2016 1 0373780. 3	2036.05.29
44	氣動衝擊式扭力工具的扭力控制方法及其扭力控制系統	China	ZL 2016 1 0072863. 9	2039.11.29
45	螺栓鎖固作業的監控方法	China	ZL 2016 1 0527106. 6	2040.01.31
46	螺栓分次鎖固的扭力控制方法及扭力控制裝置	China	ZL 2018 1 0577911. 9	2038-06-06

申請中的專利~

- → 美國還缺夾緊力傳感器+可擴充倍力板手扭力的裝置
- → 日本還缺夾緊力傳感器+可擴充倍力板手扭力的裝置
- → 德國還缺夾緊力傳感器+可擴充倍力板手扭力的裝置
- → 台灣還缺夾緊力傳感器外型專利+夾緊力傳感器+可擴充倍力板手扭力的裝置
- → 大陸還缺夾緊力傳感器+夾緊力傳感器+可擴充倍力板手扭力的裝置

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Smart Bolting Technology

Bolting Control Products Portfolio

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ZIPPTORK Smart Bolting Technology

As technology continues to transform the world of bolting threaded fasteners, more and more industries are exploring the benefits of intelligent bolting over manual or traditional torque tools. With promises of enhanced productivity, increased reliability, controllability and traceability, ZIPPTORK provides bolting technologies with extraordinary patented designs, control algorithms and devices not only make impact wrenches torque controllable but also make the bolted joint condition such as bolt load, ambient temperature and vibration detection possible for remote monitoring periodically or continuously.

ZIPPTORK Bolting Technologies includes two categories, i.e.

1. Torque Control System - consists of

a. Torque Controller - For controlling the torque of air or DC-powered impact and pulse wrenches.
b. Anti-vibration Wireless Rotary Torque Transducer - For monitoring static or dynamic bolting torque wirelessly.
c. Wireless Swing Type Torque Transducer - For monitoring bolting torque of interchangeable head torque wrench.
d. Torque Tester - For the test, calibrate torque tool output torque capability.
e. Torque Tension Tester - For measuring or simulating the bolt load induced with its equivalent residual torque while tightening specific thread fasteners to form a bolted joint under predetermined operating conditions.

2. Bolt Load Control System - consists of

a. Anti-vibration Sensing Washer – To control the bolt load induced on the bolted joint throughout the process and monitor the bolted joint status remotely, periodically or continuously.
b. Anti-vibration Bolt Load Transducer - Sensing and controlling the bolt load induced on the threaded fasteners throughout the bolting process. It's an evolution of torque tool to measure the bolt load instantly during the process.

Torque Control & Bolt Load Control System

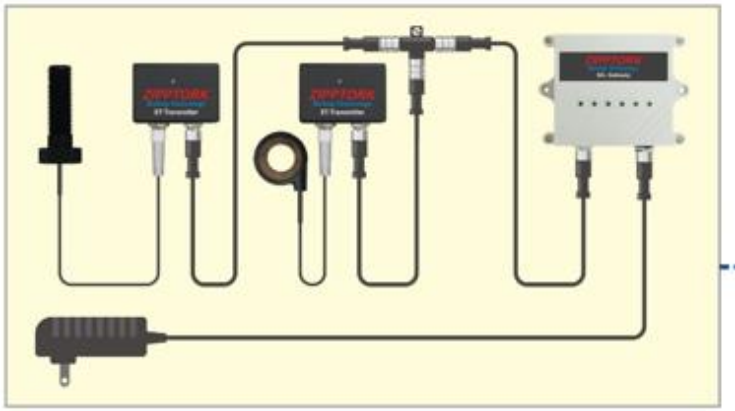
Bolt Load Control System

Applicable To

Control Bolt Load / Control Bolting Sequence

Monitor bolted Joint Status / Bolting Work Record and Uploading

The Ultimate Solution of Bolting Technology



SWC Sensing Bolt / **SBC** Sensing Washer

Granted Patents Anti-vibration wireless Bolt Load Transducer

Anti-vibration Sensing Washer Bolting Sequence Control Method

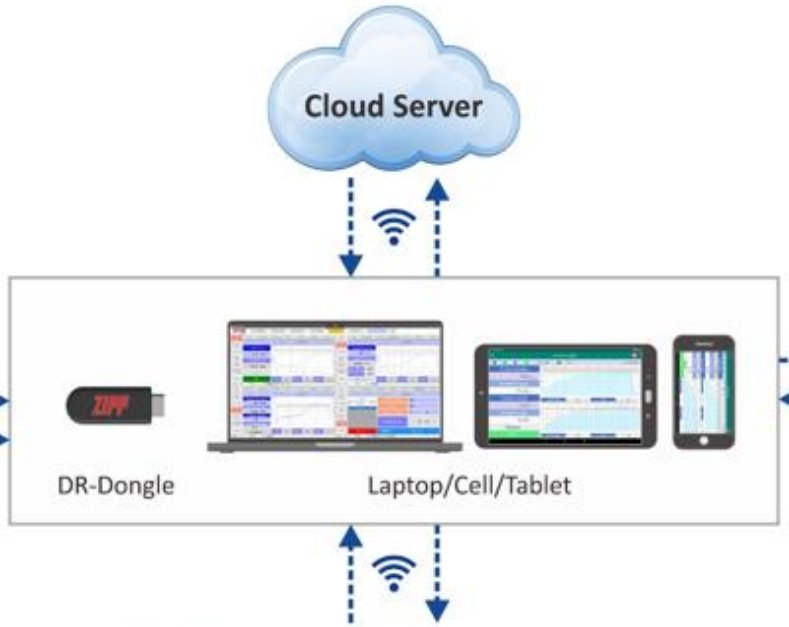
WTT

Wireless Tension Transducer

BLT

Bolt Load Transducer

Can be fastened by any type of manual & air or DC driven impact or pulse wrench of ANY BRAND with ANY TORQUE MECHANISM



The ONLY Torque Controller capable to control

Air or Cordless impact & pulse wrenches in the field

Cordless Wrench with

built-In **ECB Controller**

Torque Control System

Applicable To

Calibrate tool Torque ~ Prior to Work

Monitor/Control Bolting Torque ~ During the Process

Verify Residual Torque ~ After Bolted

With great control accuracy, durability

and complete process record for traceability

TCA/TCB/TCC Torque Controller

Unique Bolting Torque Controllability

+

Patented & the ONLY wireless anti-vibration

Torque Transducer in the field

STA

Swing Type Torque Transducer

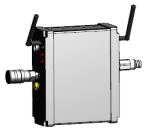
TTAS/TTES/TTEH/TTEB

Rotary Type Torque Transducer

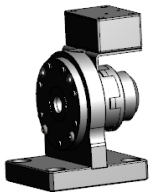
Applicable to any type of air & cordless impact or pulse wrench of ANY BRAND with ANY TORQUE MECHANISM

ZIPPTORK Bolting Control Series Products

TCA / TCB / TCC
Torque Controller

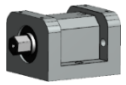


ETCI / ETCP
Built-In Controller

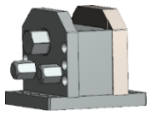


TTT
Torque Tension Tester

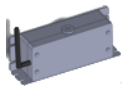
LTT
Torque Tension Tester



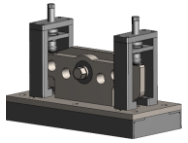
TTS
Torque Tester



TTL
Torque Tester



LTS
Torque Tester



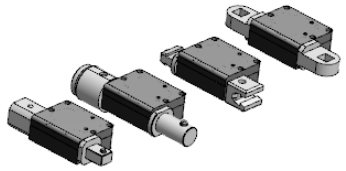
LTL
Torque Tester

TTAS/TTES
Torque Transducer

TTEB
Torque Transducer With bits

TTEH
Torque Transducer
With Socket

TTEH
Torque Transducer
with Reader



STA
Swing Type Torque Transducer

BLT
Bolt Load Transducer

WTE
Wireless Tensioner

SWB
Sensing Washer

SWC
Sensing Washer

SBC
Sensing Bolt

STR/STL
Transmitter

SG
Gateway

TDR
RF Dongle

SG
SW/SB-Gateway

Type No.	Description	Functions
TCA/TCB/TCC	Torque Controller	For any type of air torque tools torque control regardless of type and brand
ETCI / ETCP	Cordless Controller	For torque control of any type of DC Cordless torque tools with built-in Control Board
TTT/LTT	Torque Tension Tester	For measuring or simulating the bolt load induced with its equivalent residual torque while tightening specific thread fasteners to formed a bolted joint under predetermined operation condition.
TTS/TTL	Torque Tester	For test, calibrate torque tool output torque capability TTS - 10 ~ 500NM, TTL-1,000 ~ 5,000NM
LTS/LTL	Torque Tester	For test, calibrate torque tool output torque capability ， LTS - 1 ~ 50NM, LTL - 100 ~ 50,000NM
TTAS	Static Transducer	For manual torque tool calibration and residual torque verification with torque and angle.
TF	Test Fixture	Used with TTAS for static torque calibration or measurement.
TTES	Dynamic Transducer	Attached to tool anvil for dynamic torque control or torque monitoring during the bolting process.
TTEH	Dynamic Transducer with Socket in One	TTES built with Socket at output end instead of the square anvil
TTER	Dynamic Transducer with Reader	TTEH with built-In Reader for reading ID of Tagged Bolt or Tag Cell on the bolt end and transmitting to Torque Controller for bolting sequence control
BLT	Bolt Load Transducer	For sensing and controlling the bolt load induced during bolting process with pre-calibrated parameter for each type of specific thread fastener
WTT	Wireless Tensioner	For sensing the tension (load) of the crane , hoist or winch and transmitting wirelessly with functions of overload alert and data collection or uploading
SWB	Sensing Washer-One Piece Type	Designed for fastener size over M20 或 3/4" for bolt load sensing and bolted joint remote monitoring
SWC	Sensing Washer-split Type	Designed for small size under M20 或 3/4" for bolt load sensing and bolted joint remote monitoring
ZG-SW	Gateway-SW	For collecting data and transmitting to peripheral device or cloud server and functions for monitoring bolted joint status
BP	Bolt Positioner	For bolt positioning and pair with Controller during the bolting sequence control
TB	Tagged Bolt	Bolt with RFID Tag embedded on bolt end for identification during bolting sequence control and read by Transducer with Reader
TC	Tag Cell	To be adhered to bolt end for bolt identification during bolting sequence control and read by Transducer with Reader
ZD	Dongle	For transferring sensed torque or bolt load or tension data to cellphone, tablet or laptop

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Smart Bolting Technology

Torque Control Products Portfolio

P.15～P.32

ZIPPTORK Bolting Technology

Torque Control Series

ZIPPTORK provides a full range of intelligent solutions for bolting works in various industries, including daily calibration of torque tools for bolting operations, torque simulation and adjustment of torque tools before bolting, monitoring or controlling tightening torque during the bolting process and residual torque verification after a run, etc.

Regardless of the brand and type of torque tools used in the production line, almost all torque monitoring, controlling and related data collection and uploading can be achieved.

Through this cost-effective solution, Industry 4.0 can be implemented to improve production with efficiency and industrial competitiveness.

You are welcome to visit and browse the website – www.zipptork.com for more information and videos.

Torque control for discontinuous drive torque tools

To meet the industrial development trend of Industry 4.0, our company has launched a full range of patented products related to bolting technology, providing cost-effective solutions for the industry. Such as torque tool calibration, tool torque simulation & adjustment before work, bolting torque monitor or control during the bolting process, and residual torque verification after bolting; we can fully satisfy the application requirements of the Industrial Internet of Things(**IIoT**).

Wireless Rotary Torque Transducer / Swing Type Torque Transducer

- It is suitable for various types of torque tools output torque calibration or residual torque verification, as well as with various pneumatic or electric impact type, oil pulse type, clutch type torque tools with automatic shutoff mechanism for real-time torque monitoring and data collection of bolting torque.
- With a patented anti-vibration design, it is the only wireless torque transducer in the industry that can be used for high-vibration impact torque tools and torque control.
- Digitalization of "Interchangeable Head Torque Tools" for control & display bolting torque and angular movement in real-time and accessible with “HEADs” from any brand and joint mechanism.

Torque Controller

- Capable of controlling bolting torque of any discrete type air/DC cordless impact wrenches, oil pulse wrenches of any brand and any impact mechanism, and collecting data for uploading in real-time.
- Designed with patented control device and algorithm. It’s the only air/DC driven continuous or discontinuous torque tool controller in the field, Three control modes are available for option, with the following control accuracy;

Pressure/Voltage Mode

Air/DC Impact Wrenches within ±15%～±20% & Air/DC Oil Pulse Wrenches within ±10%～±15%

Transducer Mode

Air/DC Impact Wrenches within ±10%～±15% & Air/DC Oil Pulse Wrenches within ±5%～±10%

Accumulated Mode

Air/DC Impact Wrenches within ±10%～±15% & Air/DC Oil Pulse Wrenches within ±5%～±10%

ZIPPTORK Torque Control Series Products

Smart Series

Torque Controller / Wireless Torque Transducer / Torque Tension Tester / Dongle

Applicable to any Air Impact wrench/ Oil Pulse tool regardless of brand & torque mechanism

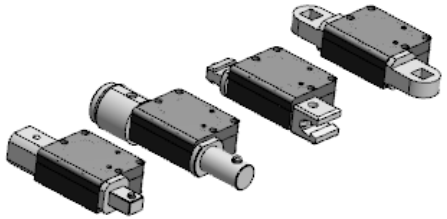
- Patented control device & algorithm
- Cost-Effective Solutions
- Easy set-up in minutes
- Data collection for traceability
- Remote configuration and monitoring with IoT Gateway
- Dynamic Torque Control for discrete type tools

TCA / TCB / TCC

Torque Controller

TTAS/TTES/TTEB/TTEH

Wireless Rotary Torque Transducer

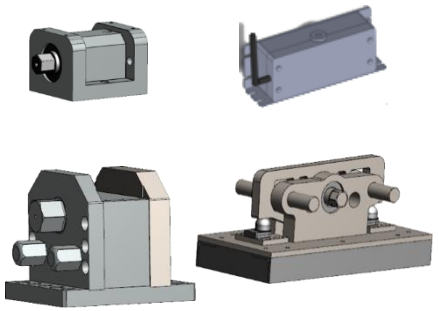


STA

Swing Type Torque Transducer

DR

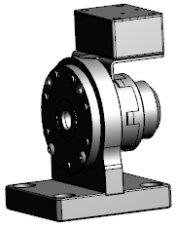
RF Dongle



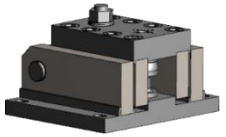
TTS/TTL

LTS/LTL

Torque Tester



TTT



LTT

Torque Tension Tester

ZIPPTORK Bolting Control Series Products

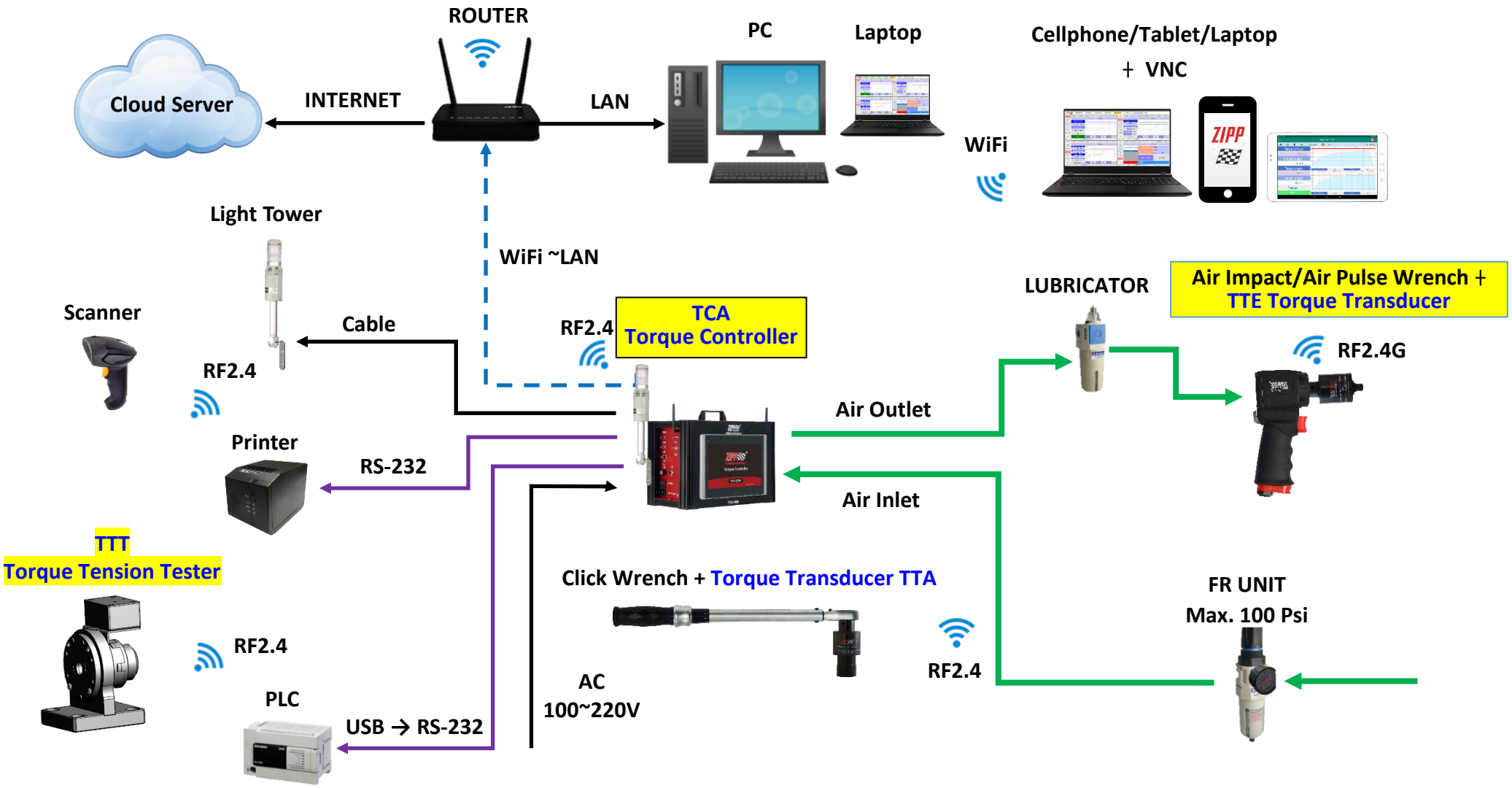
Torque Controller

TCA
Torque Controller

Features

1. Applicable to any brand air-driven continuous or discontinuous torque tool with any mechanism.
2. Patented torque control device and control algorithm.
3. Patented programmable bolting sequence control.
4. Three control modes - Pressure / Transducer / Accumulated
5. Batch count, barcode scanner, light Indicator, OK/NOK alert and record, and various job assemblies are available for ease of operation and user-friendliness.
6. Support POS for printing job result.

Torque Controller Application System Architecture



ZIPPTORK Torque Control Series Products

Torque Controller

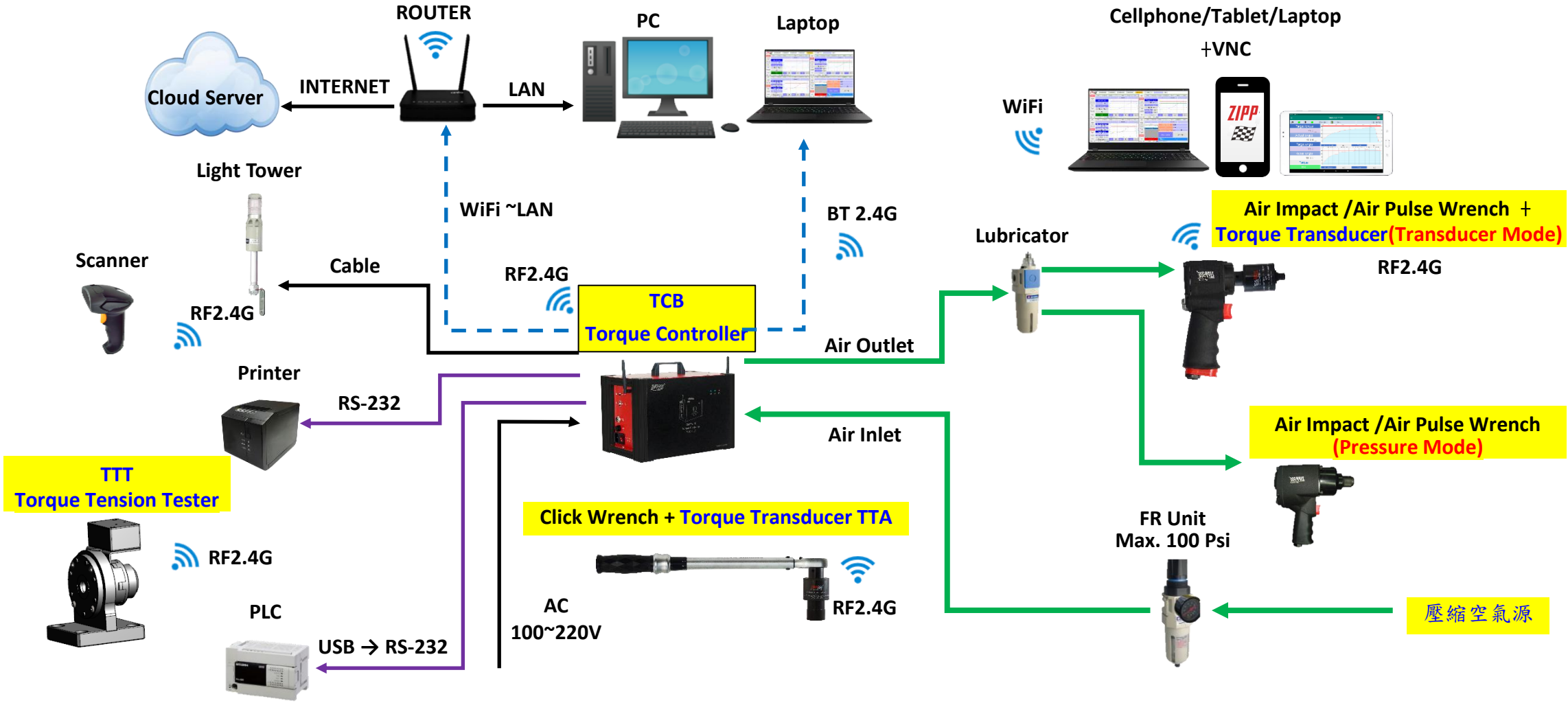
Laptop/Tablet

TCB
Torque Controller

Features

1. Applicable to any brand air discontinuous drive torque tools with any mechanism.
2. The only torque controller for air impact/pulse/torque multiplier wrenches.
3. Patented control algorithm with excellent controllability.
4. Patented control method for bolting sequence control.
5. Three control modes - Pressure / Transducer / Accumulated
6. Batch count, barcode scanner, light Indicator, OK/NOK alert and record and various job assemblies are available for ease of operation and user friendly.
6. Support POS for printing job results.

Torque Controller Application System Architecture



ZIPPTORK Torque Control Series Products

Torque Controller

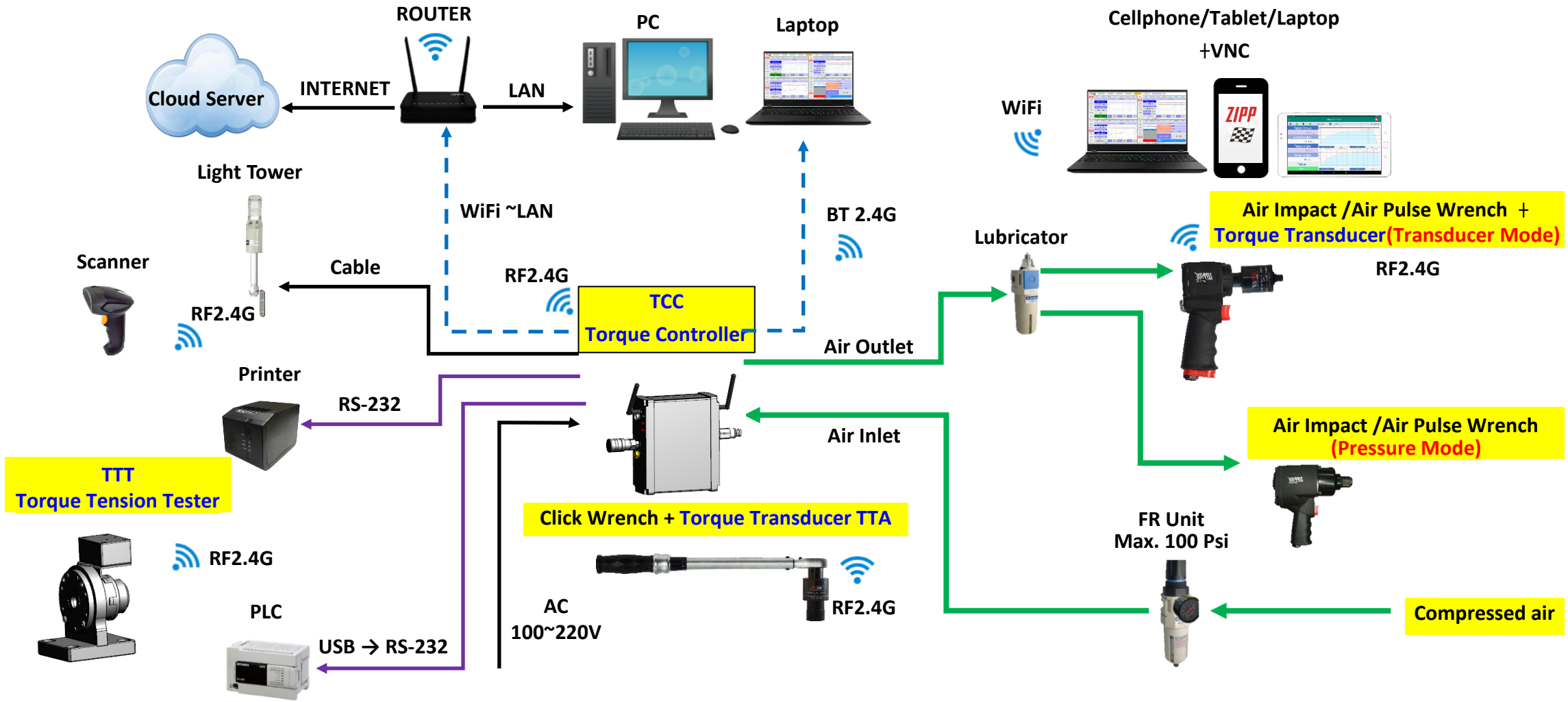
Laptop/Tablet

TCC
Torque Controller

Features

1. Applicable to any brand air discontinuous drive torque tools with any mechanism.
2. The only torque controller for air impact/pulse/torque multiplier wrenches.
3. Patented control algorithm with excellent controllability.
4. Patented control method for bolting sequence control.
5. Three control modes - Pressure / Transducer / Accumulated
6. Batch count, barcode scanner, light Indicator, OK/NOK alert and record and various assemblies are available for ease of operation and user friendly.
1. Support POS for printing job results.

Torque Controller Application System Architecture



ZIPPTORK Torque Control Series Products

Cordless Wrench with built-in Torque Controller

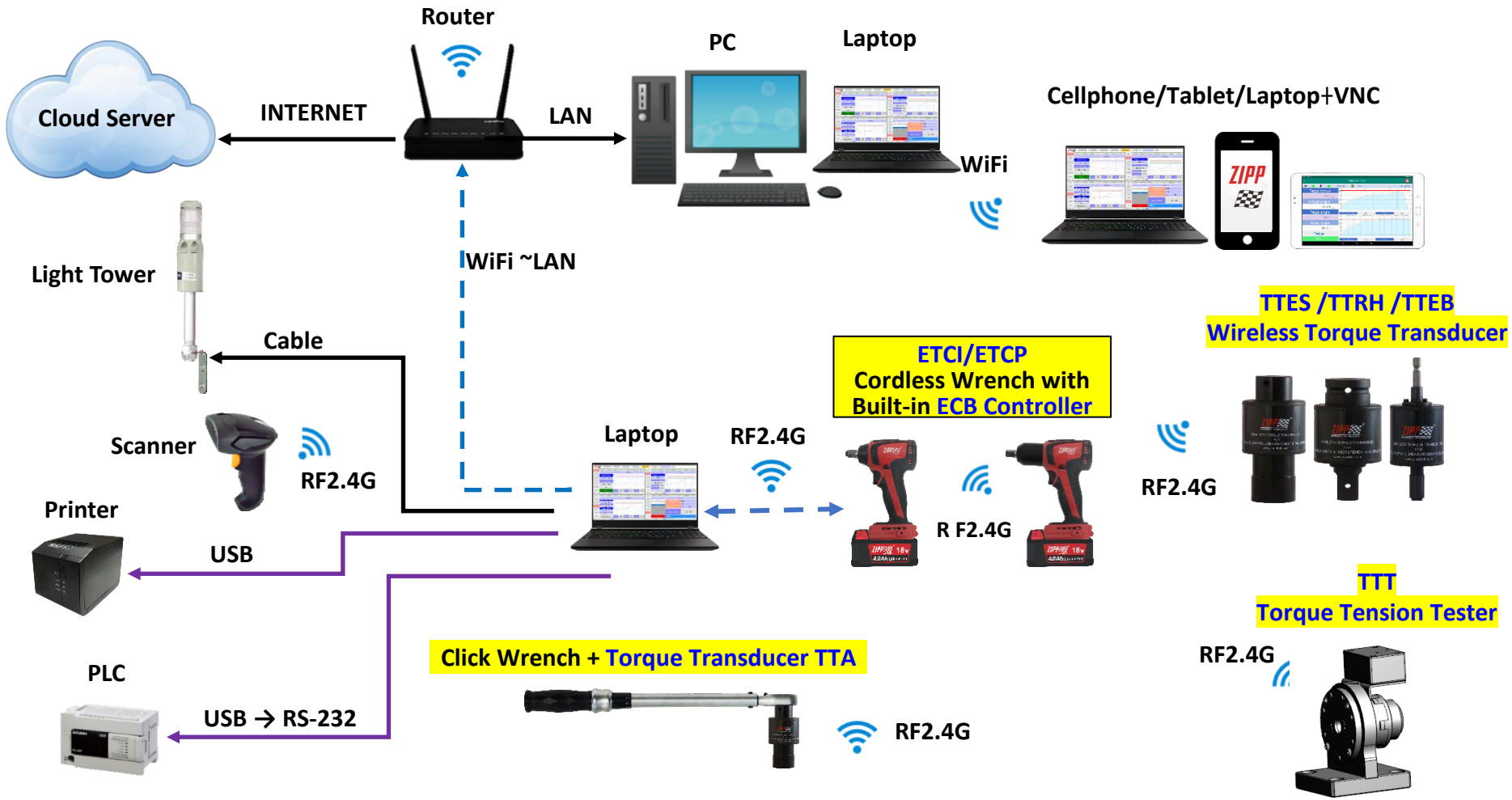
Laptop or Tablet

ETBI/ETBP
Cordless Impact/Pulse Wrench with built-in ECB Torque Controller

Features

1. Patented control board and control algorithm applicable to any continuous or discontinuous types of cordless torque tools.
2. Three control modes ~ Voltage / Transducer / Accumulated
3. Bluetooth communicate with a laptop or tablet for data access and up-loading.
4. Batch count, barcode scanner, light Indicator, OK/NOK alert and record various of job assembly are available the ease of operation and user friendly.
5. Support POS for printing job result.

Cordless Wrench Application System Architecture



ZIPPTORK Torque Control Series Products

Wireless Rotary Torque Transducers

DR-RF DONGLE+ Laptop / Tablet

TTAS/TTES/TTEH/TTEB/TTER
Wireless Rotary Torque Transducers

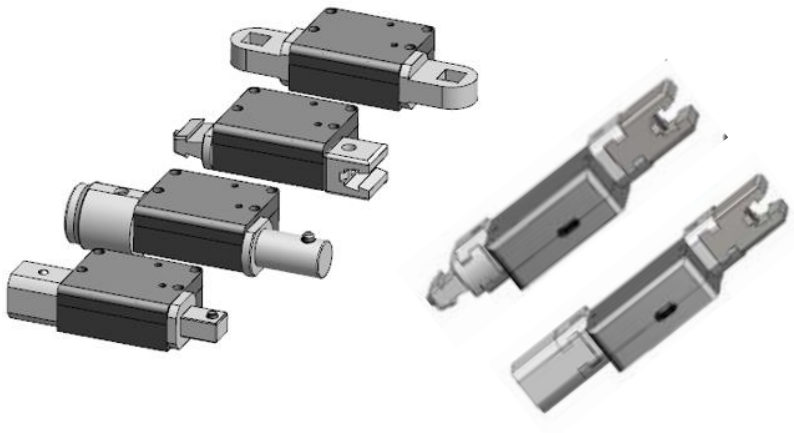
Features

1. Patented anti-vibration design for durability.
2. The only wireless torque transducer applicable to air impact wrenches and Air/DC driven impulse wrenches.
3. Wireless features for the most excellent maneuverability, especially during bolting.
4. For measuring, monitoring and recording torque before, during or after assembly.
5. Designed for torque testing Provide solutions for most torque auditing applications in the manufacturing and quality department.
6. For testing the capability of your power torque tools, verifying the accuracy of your hand tools, monitoring the capability of your fastening process or auditing the quality of your assembled joints.
7. Data logging to peripheral devices or cloud servers for multiple transducers via Gateway.
8. Capacity range from 5NM ~ 3, 000NM.
9. Socket drive type-TTEH can be custom-made.
10. The only durable wireless transducer with a warranty of ONE year or 200 000 times dynamic bolting & 500 000 cycles of static bolting in the field.

ZIPPTORK Torque Control Series Products

Wireless Swing Type Torque Transducers

DR-RF DONGLE+ Laptop / Tablet



STA

Wireless Swing Type Torque Transducers

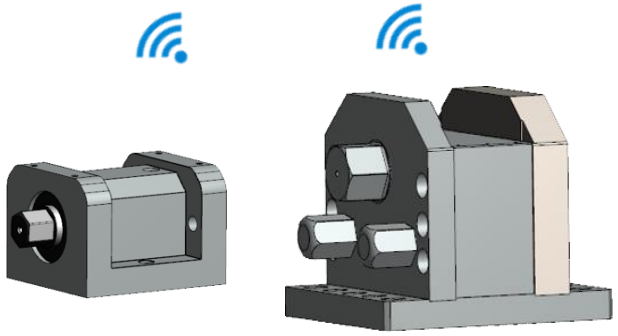
Features

1. Patented design - the only swing-type torque transducer to be mounted & detachable between the “Interchangeable Head Wrench” & “Head”.
2. Wireless design for excellent maneuverability.
3. Digitalize conventional “ Interchangeable Head Wrenches” for torque and angle control throughout the process & residual torque verification after bolting.
4. Head Adaptor design for easy replacing various types of HEADs, increasing the maneuverability and convenience of use.
5. Transmitting data wirelessly via RF2.4G to Gateway and a peripheral device or cloud server.
6. Available torque capacity range from 20NM to 1 000NM.
7. One year or 500 000 cycles warranty.

ZIPPTORK Torque Control Series Products

Torque Tester

DR-RF DONGLE+ Laptop / Tablet



TTS / TTL
Torque Tester

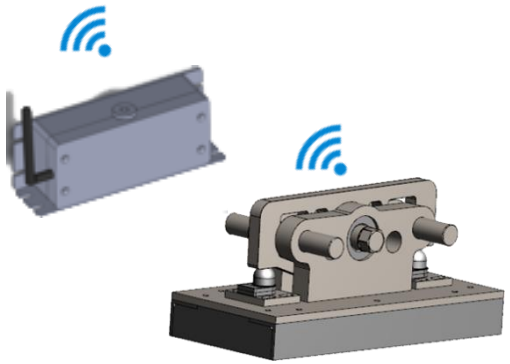
Features

1. Ideal for torque calibration of manual, click, clutch type wrenches and torque multipliers
2. For measuring output torque of discontinuous type torque tools such as air or DC driven impact or impulse type wrenches.
3. Use torque sensor instead of hydraulic fluid to avoid oil leakage
4. Data logging to peripheral devices or cloud servers for multiple transducers via Gateway.
5. TTS series Torque Tester capacity available from 10NM up to 500NM
6. TTL series Torque Tester capacity available from 500NM up to 5, 000NM
7. Free software for self-calibration
8. To be equipped with Dongle & laptop or tablet for display and data collection.
9. One year or 500 000 cycles warranty.

ZIPPTORK Torque Control Series Products

Torque Tester

DR-RF DONGLE+ Laptop/Tablet



LTS / LTL
Torque Tester

Features

1. Robust structure with leverage mechanism as calibration beam design.
2. Ideal for torque calibration of manual, click, clutch type wrenches and torque multipliers
3. For measuring output torque of discontinuous type torque tools such as air or DC driven impact or impulse type wrenches.
4. Use load sensor instead of weights on calibration beam (NORBAR) for compact design and easy operation.
5. Data logging to peripheral devices or cloud servers for multiple transducers.
6. LTS series Torque Tester capacity available from 1NM up to 50NM
7. LTL series Torque Tester capacity available from 100NM up to 50,000NM
8. To be equipped with Dongle & laptop or tablet for display and data collection.
9. One year or 500,000 cycles warranty.

ZIPPTORK Torque Control Series Products

TTA/TTE (Wireless Torque Transducer) + TF (Test Fixture)

DR-RF DONGLE+ Laptop/Tablet

Wireless Torque Transducer
+
Test Fixture

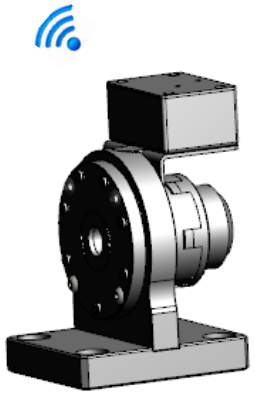
Features

1. Ideal for torque calibration of manual, click, clutch type wrenches and torque multipliers
2. For measuring output torque of discontinuous type torque tools such as air or DC driven impact or impulse type wrenches.
3. Portable for easy operation.
4. Data logging to peripheral devices or cloud servers for multiple transducers.
5. This series Torque Tester capacity is available from 10NM up to 3, 000NM
6. Free software for self-calibration
7. To be equipped with Dongle & laptop or tablet for display and data collection.
8. One-year or 500,000 cycles warranty.

ZIPPTORK Torque Control Series Products

Torque Tension Tester

DR-RF DONGLE+ Laptop/Tablet



TTT
Torque Tension Tester

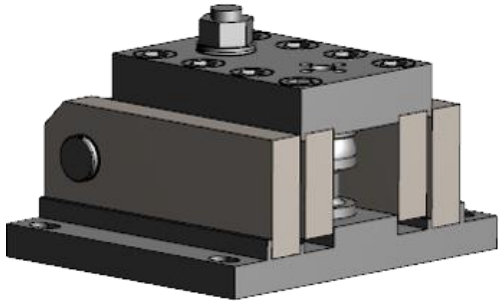
Features

1. Measure bolt load and residual torque equivalent induced after tightening by power-driven impact or pulse-type torque tools to fasten specific sizes of fasteners (bolt/ nut and washer) through the threaded mechanism.
2. Ideal for tool manufacturers to specify the dynamic tool specification accurately.
3. Can be used with hand torque wrenches, air impact/pulse wrenches, electric impact/pulse wrenches and hydraulic wrenches.
4. Good devices for simulating dynamic bolting torque of impact or pulse wrenches.
5. TTT series designed with one tester for replacing two sizes of sensors for fasteners in metric or imperial specifications.
6. 10 NM up to 5, 000NM test capacity ~ special requirement can be custom made.
7. Free software for self-calibration with different specifications of fasteners.
8. Connect Gateway to collect data and upload it to the cloud server.
9. Equipped with Dongle to display the torque and force curve on a tablet or laptop.
10. One year or 500 000 cycles warranty.

ZIPPTORK Torque Control Series Products

Torque Tension Tester

DR- RF DONGLE+ Laptop/Tablet



LTT
Torque Tension Tester

Features

1. Measure bolt load and residual torque equivalent induced after tightening by power-driven impact or pulse-type torque tools to fasten specific sizes of fasteners (bolt/ nut and washer) through the threaded mechanism.
2. Ideal for tool manufacturers to specify the dynamic tool specification accurately.
3. Can be used with hand torque wrenches, air impact/pulse wrenches, electric impact/pulse wrenches and hydraulic wrenches.
4. Good devices for simulating dynamic bolting torque of impact or pulse wrenches.
5. LTT series designed with one tester for replacing four sizes of fasteners in metric and imperial specifications.
6. 10NM up to 5, 000NM test capacity - special requirement can be custom made.
7. Free software for self-calibration with different specifications of fasteners.
8. Connect Gateway to collect data and upload it to the cloud server.
9. Equipped with Dongle to display the torque and force curve on a tablet or laptop.
10. One year or 500 000 cycles warranty.

Bolt Load Control Products Portfolio

P.34～P.44

ZIPPTORK Bolting Technology

Bolt Load Control Series

ZIPPTORK not only provides a full range of intelligent solutions for bolting operations in various industries but also provides control of bolt load (clamping force) during the bolting process for applications that require precise control of the clamping force of thread fasteners and monitoring the bolted joint status for abnormalities, such as high-pressure vessels, precision transmission or transportation facilities, or high-risk equipment for nuclear power and wind power. It also remotely monitors the bolted joint status after bolting and collecting and uploading relevant data.

It is the best alternative to the ultrasonic bolting technology commonly used in the industry, as it can be used with any brand and different structural designs of torque tools. Through this cost-effective solution, we can help the industry to realise the Industry 4.0 plan and further improve the productivity and competitiveness of the industry.

Bolt Load Control of Threaded Fasteners

To meet the industrial development trend of Industry 4.0, our company has introduced a full range of patented products related to bolt-tightening technology, which provides a cost-effective solution for the industry. Bolting of threaded fasteners is affected by many factors, such as the softness of the material of the fasteners (bolts, nuts and washers) and the surface roughness of the fasteners to be tightened, the influence of bruises or oil contamination on the threads during the process, and the difference in the structure and quality of the tools used, all of which make it difficult to control accurately and effectively.

Furthermore, for the most crucial purpose of bolting works ~ the clamping force applied to the bolted joint, most of the industry can only control the clamping pressure of the bolt load by ultrasonic sensing & bolting technology. Some applications even require monitoring the bolted joint status after bolted and real-time notification when abnormal conditions occur. For this purpose, **ZIPPTORK** has developed a series of bolt load control technologies to provide the ultimate solution for threaded fastener tightening works, fully meeting the requirements of the Industrial Internet of Things(**IIoT**) applications.

Sensing Bolt & patented anti-vibration Sensing Washer for bolt load control & monitoring

It is ideal for all bolt-tightening operations requiring precise clamping force control and monitoring of the bolted joint status at any time. The patented anti-loosening design and ease of use make it more advantageous than the conventional ultrasonic sensing & bolting technology in mainstream applications as a great cost-effective alternative.

Patented Bolt Load Transducer

It can be used with any brand, type, or design of manual, pneumatic or electric torque tools to directly control and display the corresponding clamping force generated on the bolted joint by the applied torque at the time and can collect relevant data. It overturns the traditional method of controlling the bolting torque with torque tools. It directly measures the clamping force induced in the bolted joint instead, effectively improving the quality of bolting operations. A new era of **"Bolt Load Wrench**" is to come! For more product-related information and operation videos, please visit the following website – **www.zipptork.com**

The Ultimate Solution of Bolting Technology

Sensing Washer with functions of anti-loosening for controlling bolt load and monitoring the bolted joint status

1. What is different from past products or current market products?

Currently, the following methods are commonly used to test the clamping force in the market:

- Ultrasonic inspection method - This inspection method is time-consuming, labor-intensive and expensive.
- Wired sensor bolt - This test method is wired, challenging to achieve wirelessly, and expensive.
- Load cell This inspection method is wired, challenging to achieve wirelessly, and expensive.
- The clamping force control is only for the sensor to connect to the PLC or other display device by wired; the layout of the bolt load sensor of these methods is laborious and time-consuming, and the clamping force sensor does not have any anti-loosening design and does not have the bolting sequence control function.

2. Our company has been in the field of pneumatic tools for more than 40 years and has been dedicated to research and development of bolting technology for decades. However, in the area of bolting operation, torque control is not the most accurate technology, but bolt load (clamping force) control is the ultimate and most precise method; since the bolt load sensor is more expensive than the torque sensor, the market is still dominated by torque control. In recent years, customers' demand for bolting work and data recording has been increasing, and there is an urgent demand for clamping force control in the market. Therefore, our company has spared no effort to innovate and break through in research and development to make the best and ultimate clamping force control and monitoring for thread fasteners.

The Ultimate Solution of Bolting Technology

Sensing Washer with functions of anti-loosening for controlling bolt load and monitoring the bolted joint status

3. Due to the difficulty in mass production of the wireless bolt load sensor, the Sensing Bolt developed by our company at the beginning is hard to improve the yield rate and reduce the cost. With our efforts, we have finally developed a new generation of Sensing Washers to replace the **Sensing Bolts**, which have the following advantages:

- The **Sensing Washer** is suitable for both wireless communication and wired connection.
- The wireless **Sensing Washer** is ideal for small magnetic field interference fields - such as the automotive industry, oil mining industry, etc.; the wired induction spacer is suitable for large magnetic field interference fields, including the construction and bridge industry, aerospace industry, etc.
- Low production cost and high yield rate
- Anti-loosening design (the sensing bolt itself does not have an anti-loosening plan) - this anti-loosening design is patented.
- In practice, it is easy to carry, install, and operate.
- Higher accuracy and stability than sensing bolts, with dynamic bolt load control accuracy of ±10% and static bolt load control accuracy of±5%.
- No need to use special or custom-made bolts. Use available bolts and sensing washers to achieve the following functions:

During the bolting process:

- The bolting sequence can be controlled with our innovative controller and tag.
- Bolt load control
- Torque equivalent for reference

After bolted, combined with Industry 4.0-IoT:

- Bolted joint (bolt load-clamping force) monitoring
- Torque equivalent display
- Clamping force, torque equivalent abnormal alarm
- Applicable tools: Any brand of manual, pneumatic and electric torque tools (static, impact, hydraulic pulse)
- Application: Construction, oil, mining, automotive, aerospace, etc., where clamping force monitoring is required.
- Applicable environment: High magnetic field interference environment, lightning strike environment...etc.
- The application can be used not only with our self-developed controller to achieve the clamping force and bolting sequence control but also as a stand-alone device. The detailed application structure is attached.

The Ultimate Solution of Bolting Technology

Bolt load **Sensing Washer** features with patented anti-vibration design for loose-proof and functions of remote monitoring the joint status instantly, periodically or continuously

1. What's the difference with compatible products in the field?

   Current bolt load measuring methods, such as:

   (1)Ultrasonic bolting technology—Time-consuming and expensive, no vibration loose-proof after bolting.

   (2)Sensing Bolt—Hard to be built wirelessly and expensive, no vibration loose-proof after bolting.

   (3)Load cells—No vibration loose-proof, only suitable for load testing, not ideal for industrial use.

2. Why use **ZIPPTORK** Sensing Washer?

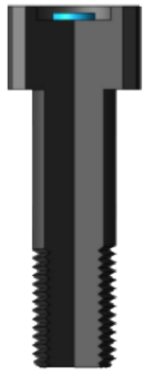
   a. High sensitivity. As accurate as ultrasonic bolting technology.
   b. Patented anti-vibration design for perfect loose-proof and meet DIN65151 standard.
   c. Ideal for high-precision bolting work where clamp load control is critical and remote monitoring is required.
   d. Data collection for the highest traceability to ensure the most excellent safety.
   e. This is the ultimate solution for bolting works to reach the excellence of the bolted joint.

Bolt Load Control Series Products

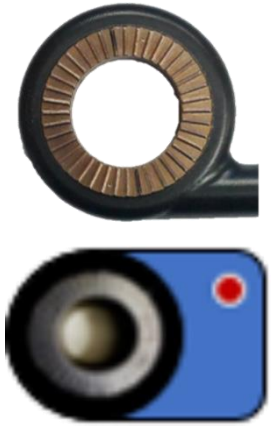
Sensing Bolt / Sensing Washer / Wireless Bolt Load Transducer

Ideal for critical bolted joints where bolt load control is important & bolted joint status monitoring is required

Precision bolt load control / Patented anti-vibration design / ideal for transmission equipment
Remote monitoring after bolted / The ultimate solution of bolting technology
The most economic & effective alternative of ultrasonic bolting technology



SBC
Sensing Bolt



SWB / SWC
Sensing Washer

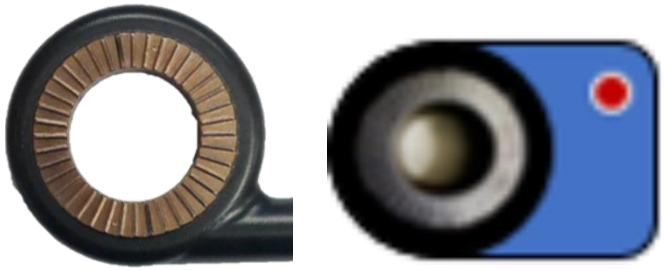
ST
Transmitter

SG
Gateway

BLT
Wireless
Bolt Load Transducer

Anti-vibration Sensing Washer

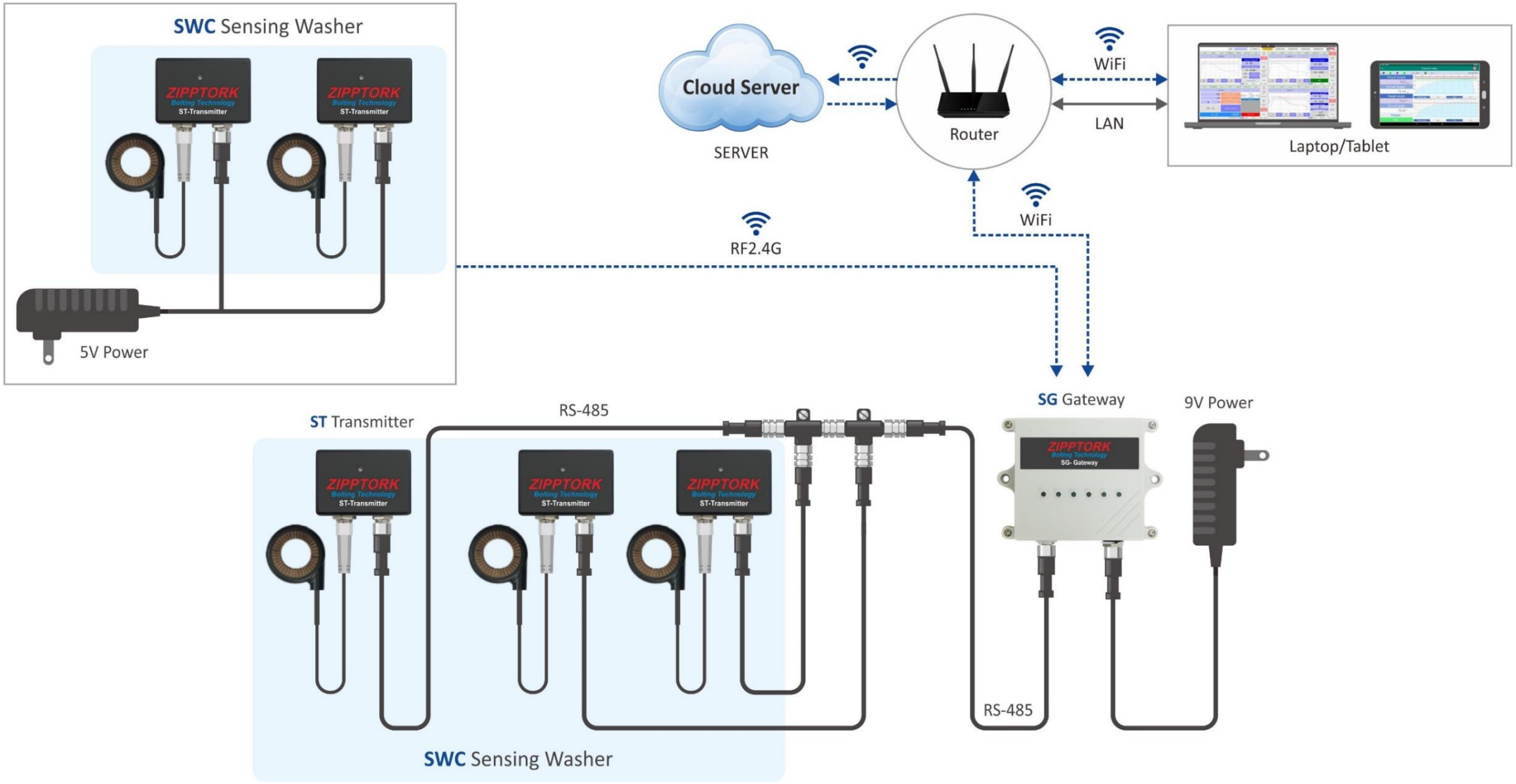
SW Sensing Washer



data link

1. Patented anti-vibration design to ensure the best stability of the bolted joint.
2. Bolt axial load control during bolting process by any torque tool.
3. Bolt joint status such as bolt load, temperature and vibration variation remote monitoring.
4. The best alternative for transmission equipment preventive maintenance work.
5. Applicable to any axial load joint status monitoring including HUCK lockbolt.
6. Remote monitoring bolted joint periodically or continuously and alert as soon as reach the preset threshold.
7. The most economic yet effective alternative of ultrasonic bolting technologies.
8. SWBN/SWBR should be custom-made. Please contact Sales personnel.

Anti-vibration Sensing Washer Application System Architecture



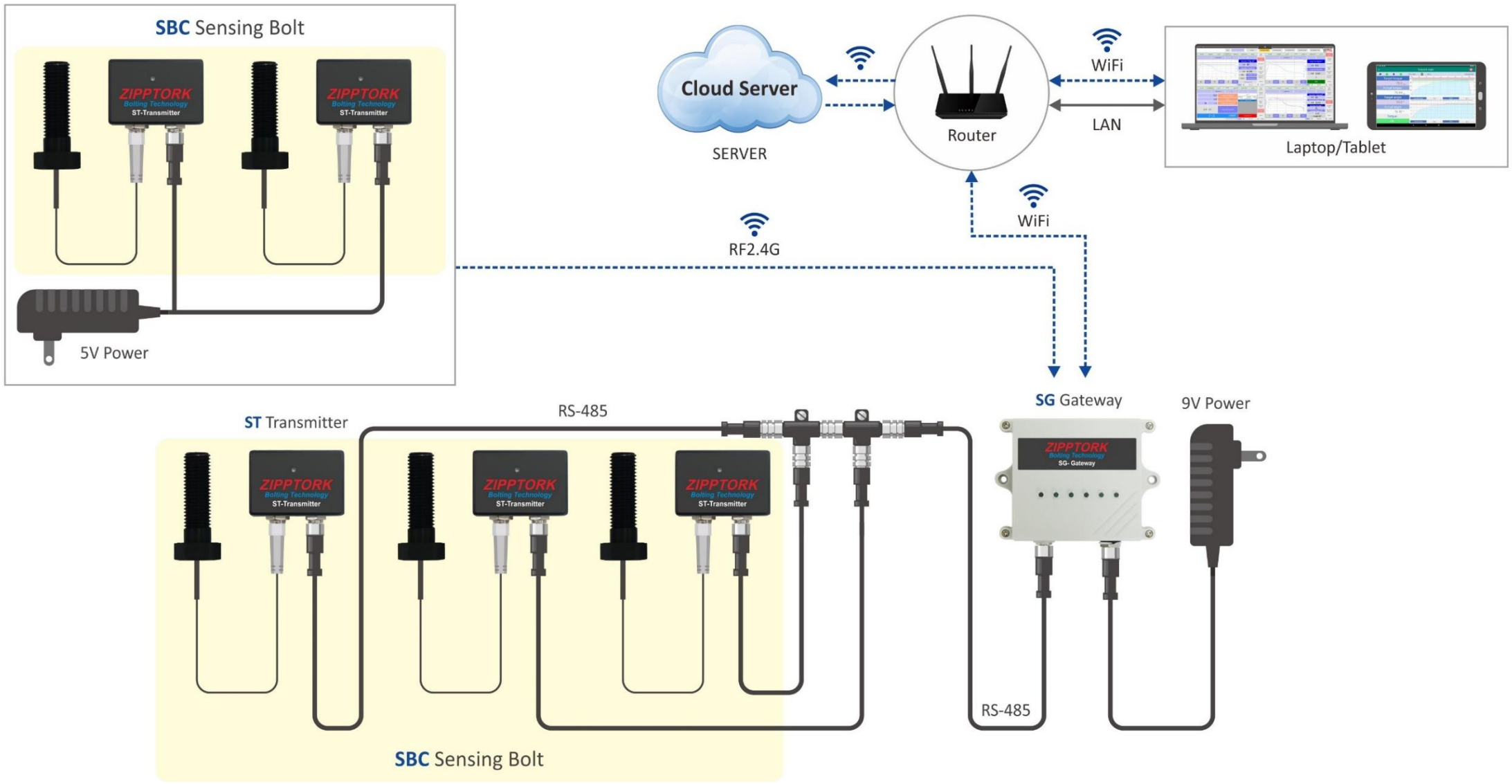
Sensing Bolt

SBC Sensing Bolt

data link

1. Bolt axial load control during bolting process by any torque tool.
2. Bolt joint status such as bolt load, temperature and vibration variation remote monitoring.
3. The best alternative for transmission equipment preventive maintenance work.
4. Remote monitoring bolted joint periodically or continuously and alert as soon as reach the preset threshold.
5. The most economic yet effective alternative of ultrasonic bolting technologies.

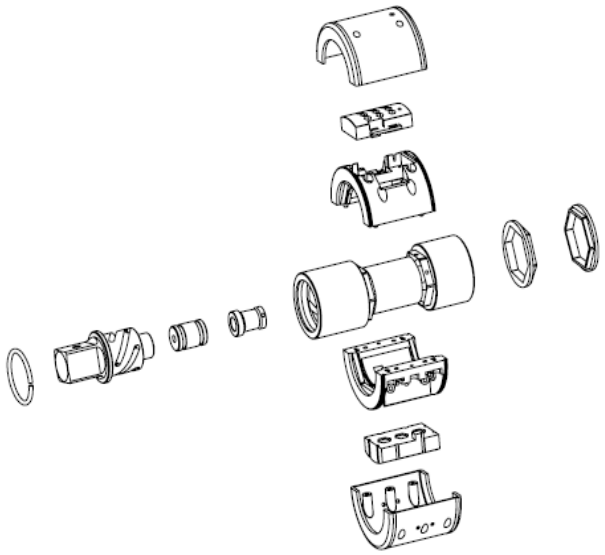
SBC Sensing Bolt Application System Architecture



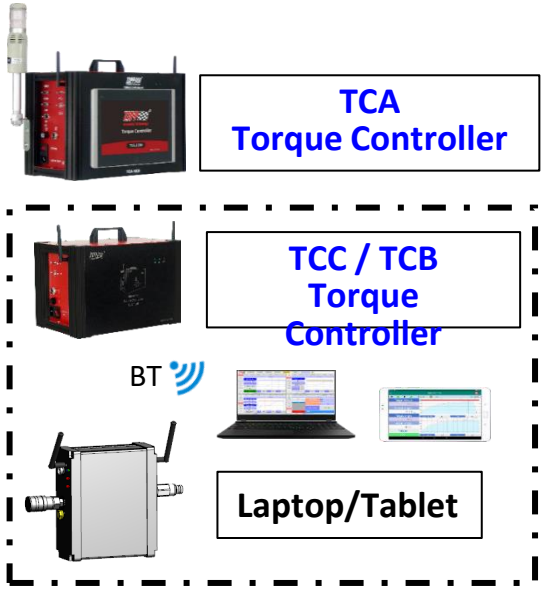
ZIPPTORK Bolt Load Control

Wireless Bolt Load Transducer

For sensing and controlling bolt load generated in the bolted joint instantly throughout the bolting process



BLT
Bolt Load Transducer



1. Patented design for direct sensing the bolt load induced on the joint during the bolting process.
2. With data logging functions and upload to a peripheral device or cloud server.
3. To be attached to the driving anvil of any torque tool for direct bolt load control.
4. Patented vibration-proof design, also suitable for impact torque tools.
5. RF2.4G wireless transmission and data collection.

Torque Control Products

Application Embodiments

P.46～P.107

Examples of Common Applications for Torque Control

Data Collection for Manual Torque Wrenches, Click Wrenches and Interchangeable Head Torque Wrenches

Monitor the bolting torque of any torque tool with auto shutoff or clutch mechanism throughout the process

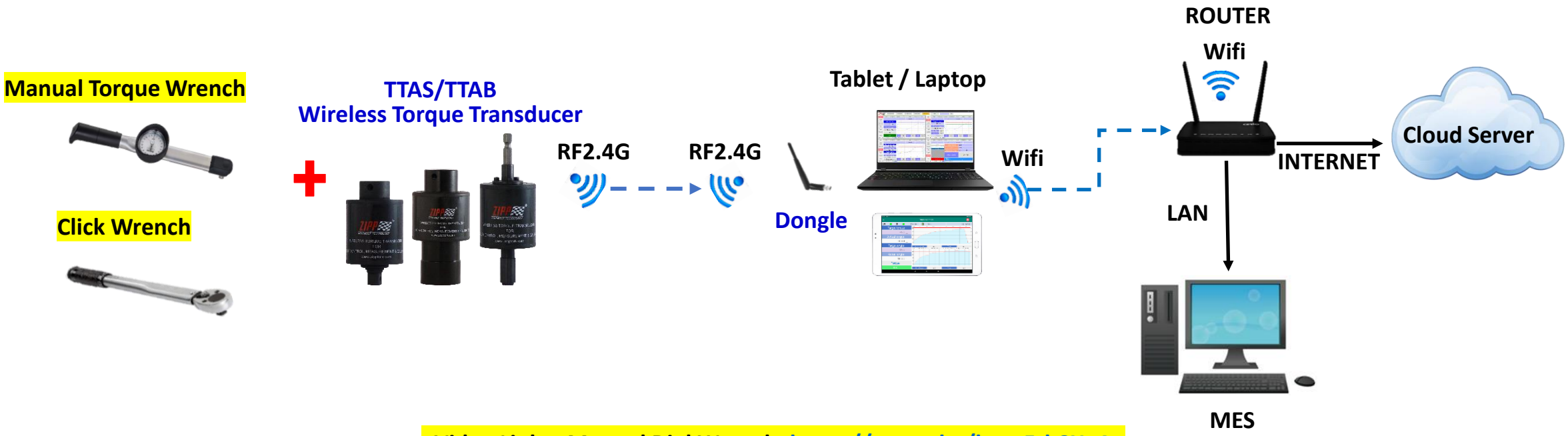
- Bolting Torque Control of **Air Pulse Wrenches-** under Pressure Mode
- Bolting Torque Control of **Air Pulse Wrenches-** under Transducer Mode
- Bolting Torque Control of **Air Impact Wrenches-** under Pressure Mode
- Bolting Torque Control of **Air Impact Wrenches-** under Transducer Mode
- Bolting Torque Control of **Cordless Pulse Wrenches-** under Voltage Mode
- Bolting Torque Control of **Cordless Pulse Wrenches-** under Transducer Mode
- Bolting Torque Control of **Cordless Impact Wrenches-** under Voltage Mode

Data Collection for Manual Torque Wrenches or Click Wrenches

Manual Torque Wrench / Click Wrench + **TTAS/TTAB wireless Torque Transducer** →RF2.4G→ **DR- RF Dongle** + Tablet/Laptop (**Android APP/Windows software**) → WiFi → peripheral devices or Cloud Server

Torque control accuracy within ± 5% or less, depending on the quality and stability of the tool used and the grip of the tool during operation

Application System Architecture



Video Link ~ Manual Dial Wrench: https://youtu.be/kuxeFsh8XuA

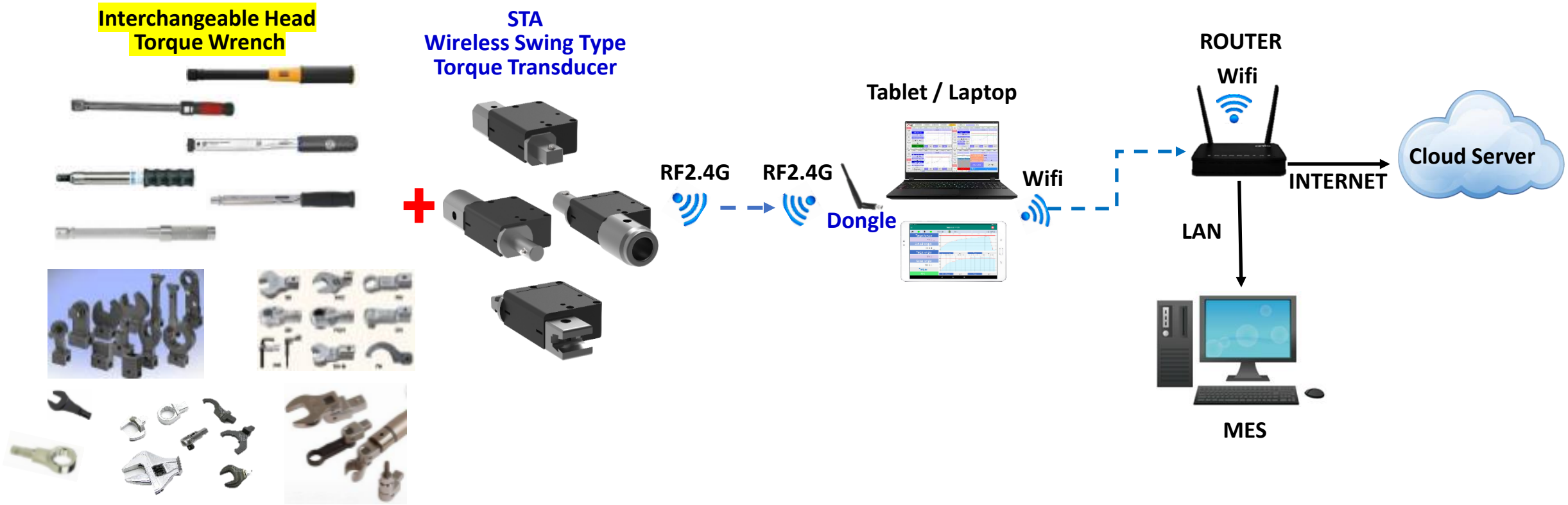
Video Link ~ Click Wrench: https://youtu.be/TGKpKfa5MM8

Data Collection for Manual Torque Wrenches or Click Wrenches

Interchangeable Head Torque Wrench + **STA wireless Swing Type Torque Transducer** →RF2.4G→ **DR-RF Dongle** + Tablet/Laptop (**Android APP/Windows software**) → WiFi → peripheral devices or Cloud Server

Torque control accuracy within ± 5% or less, depending on the quality and stability of the tool used and the grip of the tool during operation

Application System Architecture

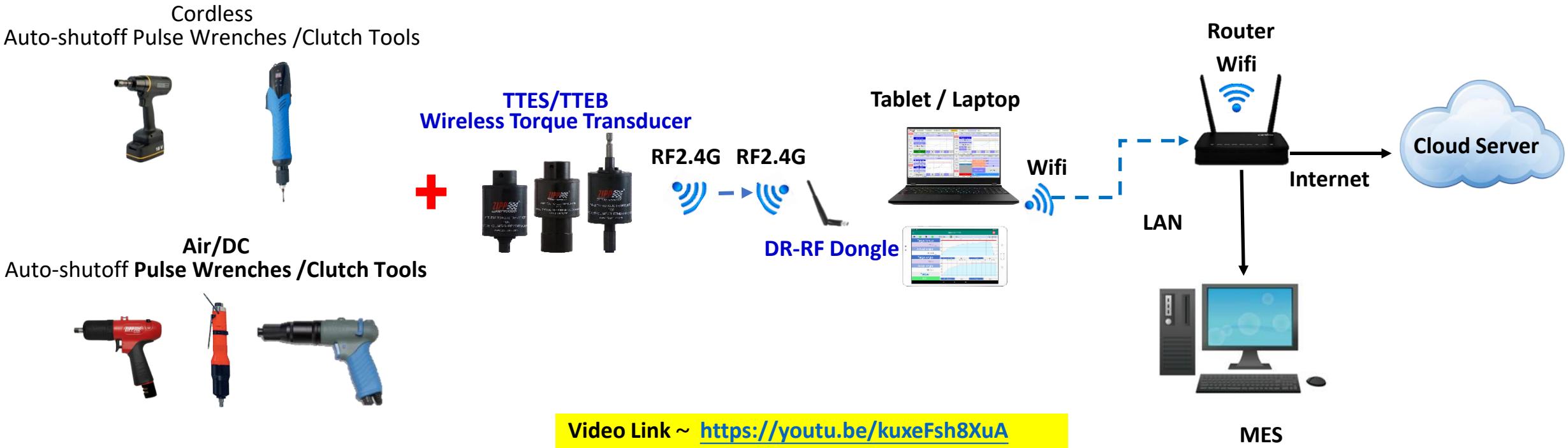


Monitor the bolting torque of any torque tool with a clutch or auto-shutoff mechanism throughout the process

Air or DC driven torque tool with the clutch or auto-shutoff mechanism + **TTES/TTEB wireless Rotary Torque Transducer**→RF2.4G→**DR-RF Dongle** + Tablet/Laptop (**Android APP/Windows software**) → WiFi →peripheral devices or cloud server

Torque control accuracy within ±5% or less, depending on the quality and stability of the tool used and the grip of the device during operation

Application System Architecture



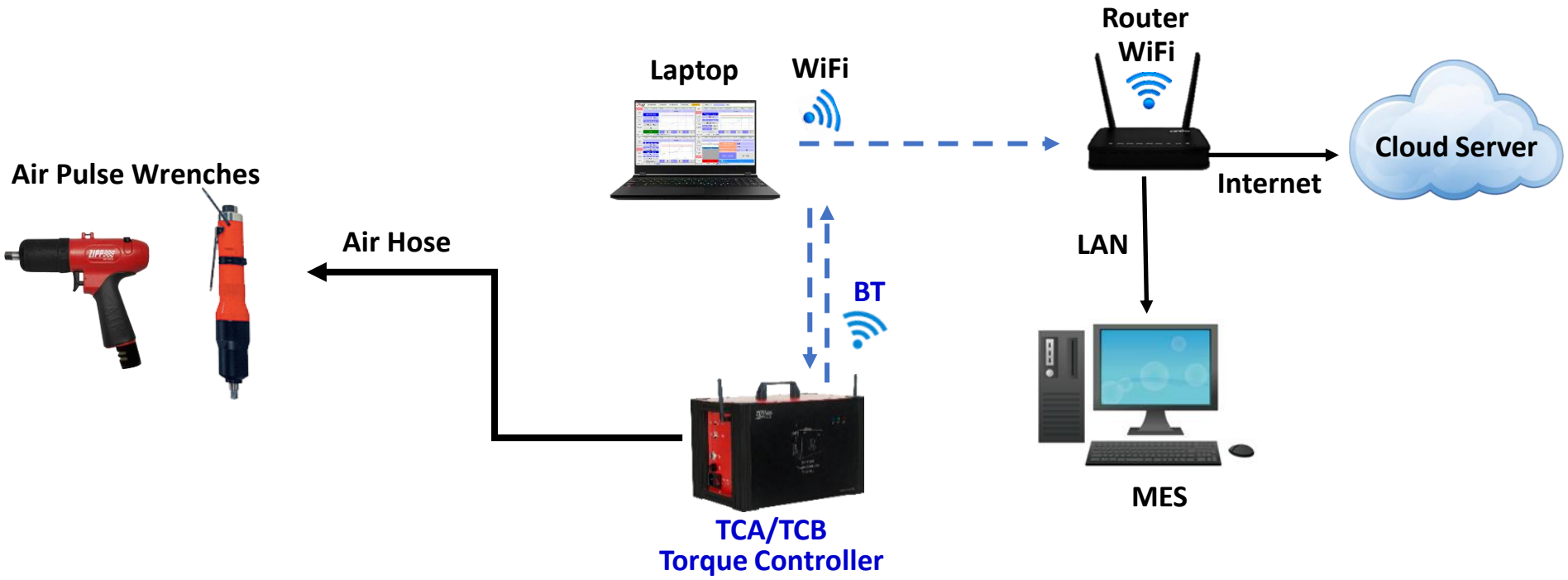
Video Link ~ https://youtu.be/kuxeFsh8XuA

Video Link ~ https://youtu.be/oZ5SyGbxnbI

Bolting Torque Control of Air Pulse Wrenches

Air Pulse Wrenches + **TCA/TCB Torque Controller** + Laptop, under **Pressure Mode** → WiFi → peripheral devices or cloud server
Torque control accuracy within ±10% ~ ±15%

Application System Architecture



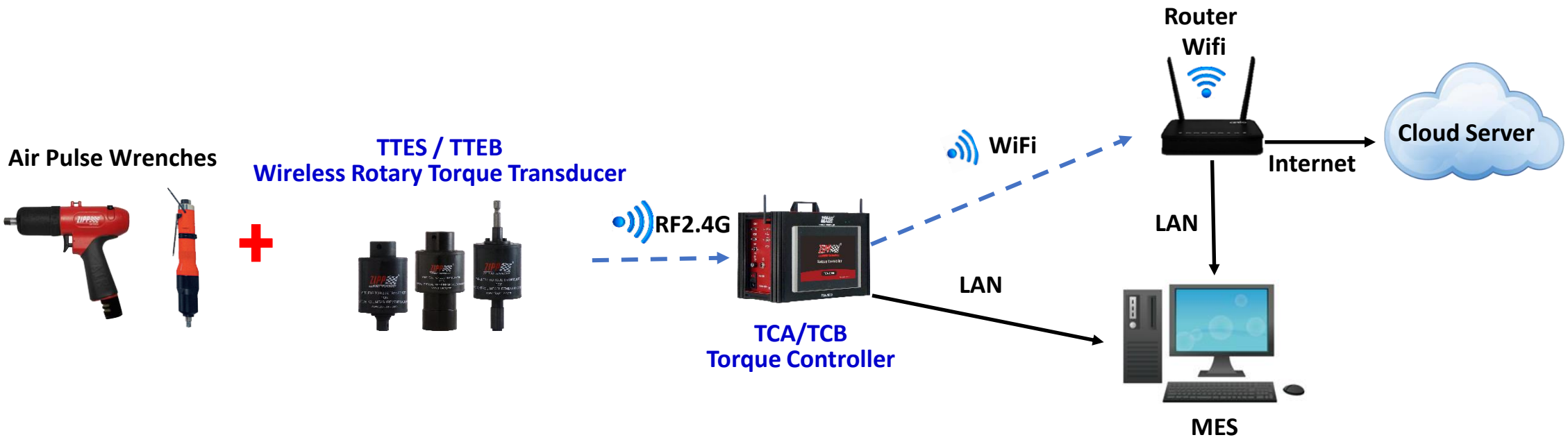
Video Link ~ https://youtu.be/qbCnCPIpYG4

Bolting Torque Control of Air Pulse Wrenches

Air Pulse Wrenches + **TCA/TCB Torque Controller** + **TTES wireless Torque Transducer** + Laptop, under **Transducer Mode**→ Wi-Fi → peripheral devices or cloud server

Torque control accuracy within ±5% ~ ±10%

Application System Architecture



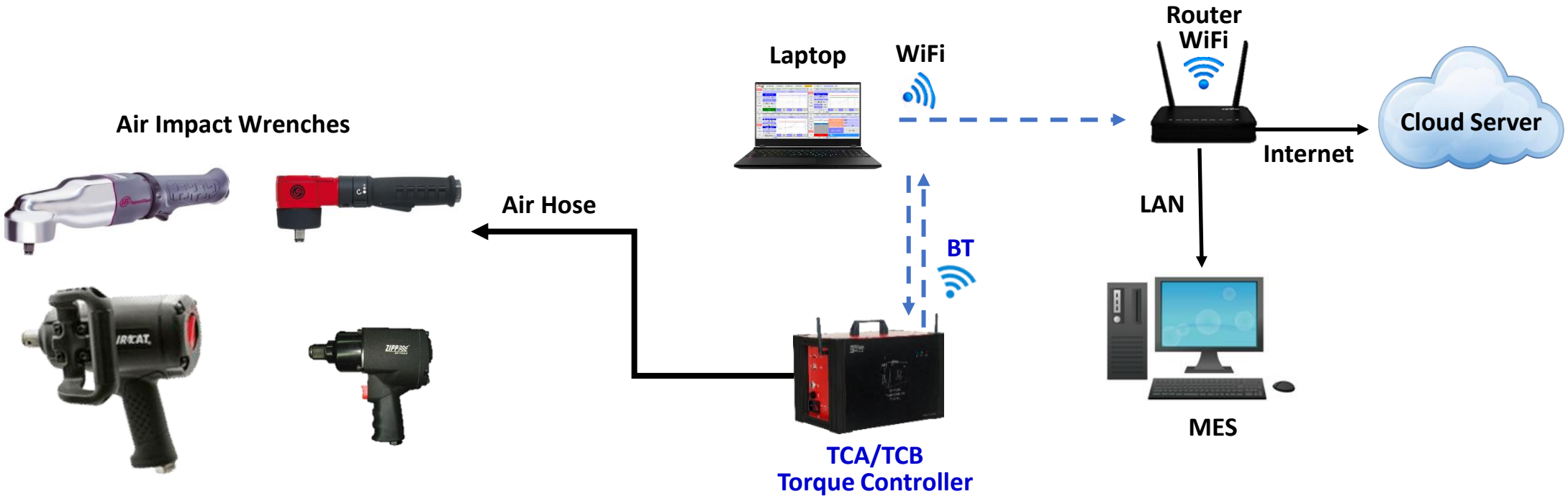
Video Link ~ https://youtu.be/z8u67jIDkRA

Bolting Torque Control of Air Impact Wrenches

Air Impact Wrenches + **TCA/TCB Torque Controller** + Laptop, under **Pressure Mode**→ WiFi → peripheral devices or cloud server

Torque control accuracy within ±15% ~ ±20%

Application System Architecture



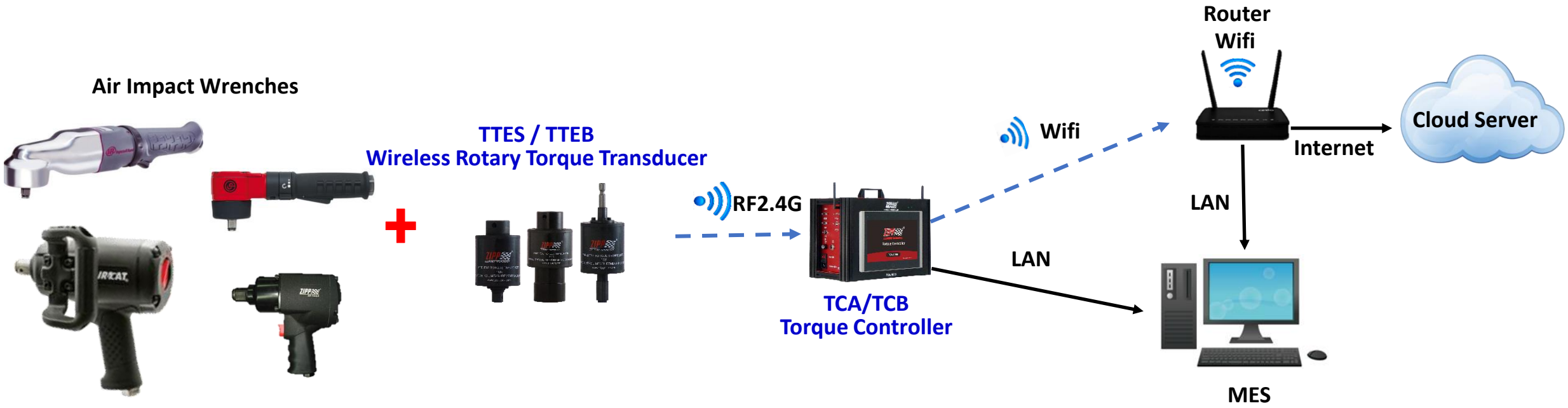
Video Link ~ https://youtu.be/dZVsEpeSrp4

Bolting Torque Control of Air Impact Wrenches

Air Impact Wrenches + **TCA/TCB Torque Controller** + **TTES wireless Torque Transducer** + Laptop, under **Transducer Mode**→ Wi-Fi →peripheral devices or cloud server

Torque control accuracy within ±10% ~ ±15%

Application System Architecture



Video Link ~ https://youtu.be/ZcE4XDcLGqE

Torque Control Products Application Examples

- Prior to Bolting
- During Bolting Process
- After Bolted

Torque Control Products Application Examples

Prior To Bolting

Tool Torque Calibration

Manual Torque Wrenches Torque Calibration

Output Torque Capability of Power Torque Tools

Torque Multiplier Torque Ratio Calibration

Power Driven Torque Multiplier Torque Calibration

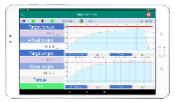
Torque Control Products Application Examples

Manual Torque Tool Calibration

Monitor + APP

PC / Laptop

Dongle



Android
Cellphone / Tablet

RF2.4G

RF2.4G

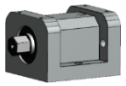
Wireless Torque Transducer

TTAS

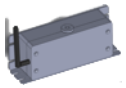
TTEB

Torque Tester

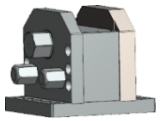
TTS



LTS



TTL



LTL

Applicable Torque Tools

Dial Torque Wrench

Click Wrench

Digital Torque Wrench

Support Functions

USB
Flash Drive

Scanner

Printer

Torque Control Products Application Examples

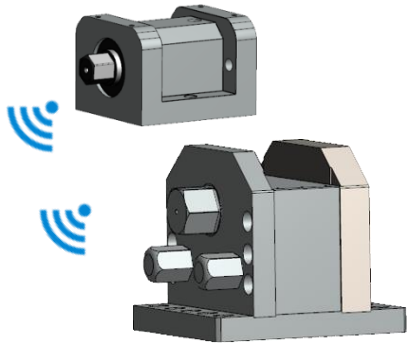
Tool Torque Capacity Test

DR-Dongle

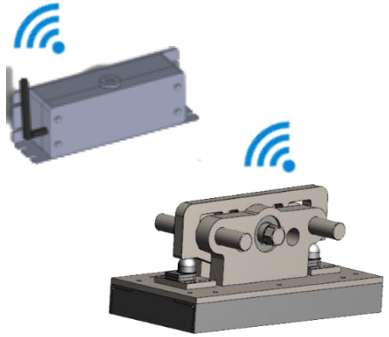
PC / Cellphone / Tablet

When testing, set the relevant conditions, such as;

- The working air pressure and the air flow of the tool for the pneumatic tool, in order to test the peak of the maximum output torque that can be achieved in a few seconds.
- The working voltage and current of the electric tool to test the maximum output torque peak that can be achieved in a few seconds.



TTS / TTL Torque Tester



LTS / LTL Torque Tester

Digital Torque Wrench

Click Type Wrench

Clutch Type Wrench

Ratchet Type Wrench

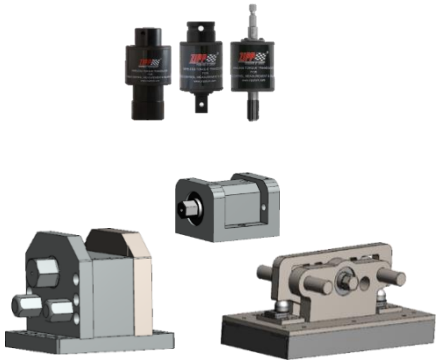
Impact Type Wrench

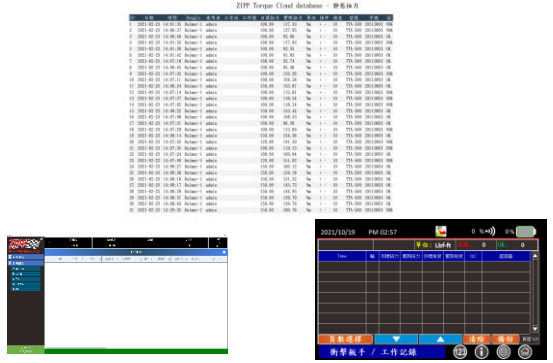
Oil Pulse Type Wrench

Torque Multiplier

Torque Control Products Application Examples

Torque Wrench Calibration + Torque tuning before work





Torque Tool	
DC Screwdriver	Click Wrench
DC Impact Wrench	Dial Torque Wrench
DC Pulse Wrench	Digital Torque Wrench
DC Torque Multiplier	
Air Screwdriver	
Air Impact Wrench	
Air Pulse Wrench	
Air Torque Multiplier	

Torque Tester
TTEB- Torque Transducer
TTAS- Torque Transducer
TTES- Torque Transducer
TT-Torque Tester
LT-Torque Tester

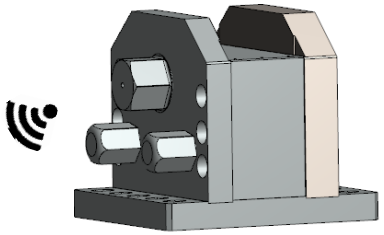
Torque Controller
TCA- Torque Controller
TCA- Torque Controller
ECB-DC Tool with built-in Controller

Work Record	
Operator ID	Date
Time	Station ID
Tool ID	Job ID
Target Torque	Actual Torque
Tolerance	Accuracy %
QC Status	CPK-Value
Tester-Model	Tester-Serial
Transducer-Model	Transducer-Serial

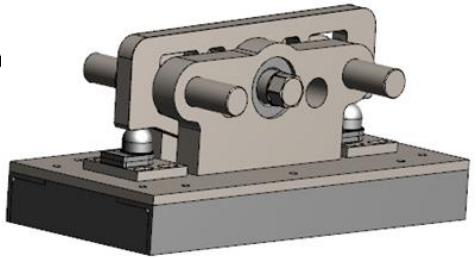
Torque Control Products Application Examples

High Torque Multiplier Torque Ratio / Torque Capacity Test

Dongle



TT-Torque Tester



LT-Torque Tester

Torque Multiplier

Air Torque Multiplier

Electric Torque Multiplier

Torque Control Products Application Examples

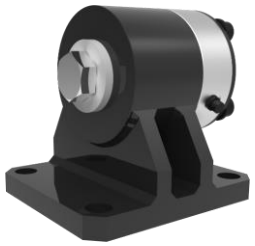
Prior to Bolting

Dynamic Bolting Torque Simulation

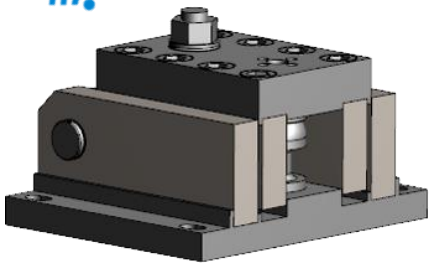
Torque Control Products Application Examples

It should be noted that the dynamic bolting torque simulation requires the use of the same threaded fasteners to be tightened by the tool in its assembly operation

Dongle + Laptop /Tablet



TTT
Torque Tension Tester



LTT
Torque Tension Tester

TTAS/TTES/TTEH/TTEB/TTER
Wireless Torque Transducer

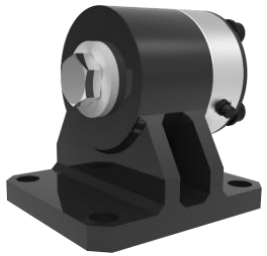
TCA
Torque Controller

TCB / TCC
Torque Controller

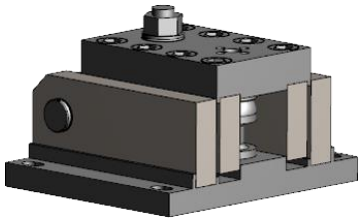
Torque Control Products Application Examples

Use the Torque Tension Tester to do bolting torque simulation

Insert the threaded fastener in the assembly work to simulate the tool's dynamic bolting torque on the Torque Tension Tester.



TTT
Torque Tension Tester

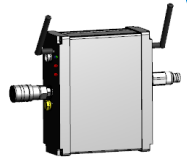


LTT
Torque Tension Tester

Any air driven torque tool

Any Electric Torque Tool

TCA
Torque Controller



TCC / TCB
Torque Controller

Laptop / Tablet

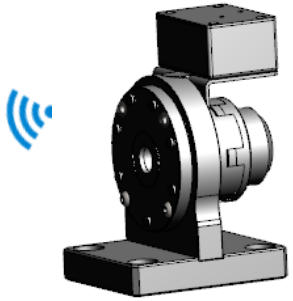
Torque Control Products Application Examples

Dynamic Bolting Torque Simulation of Discrete Type Torque Tools

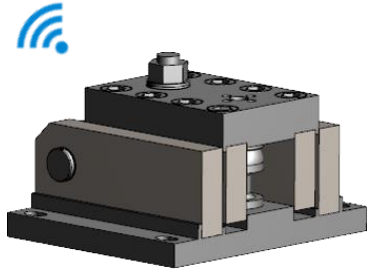
DR-Dongle

PC / Cellphone / Tablet

- In order to test the bolting torque capability of a tool, it is necessary to enter the tool type/ specification /capability, power supply conditions-such as air pressure and air flow or voltage and electric current, as well as the specification of the test bolt and nut what to be fastened, such as soft and hard.
- To simulate the bolting torque of the tool, use the tool from the assembly line and the bolts and nuts to be fastened by the tool.
- When testing or simulating , the bolting torque and the clamping force generated on the fastener, as well as the time of bolting in seconds corresponding to the whole bolting process, will be displayed in real time for easy reference or adjustment by the operator.
- All data related to testing or simulation / tuning will be recorded for post-tracing purposes.



TTT
Torque Tension Tester



LTT
Torque Tension Tester

Clutch Type Wrench

Ratchet Type Wrench

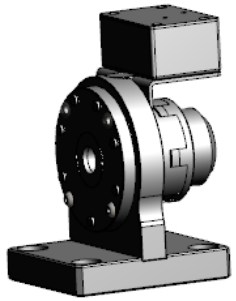
Impact Type Wrench

Oil Pulse Type Wrench

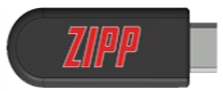
Torque Control Products Application Examples

Dynamic Bolting Torque Simulation of Power Driven Torque Tools

Use the power torque tool + Torque Transducer to fasten the threaded fastener to be bolted in the torque/tension tester to simulate the bolting torque to adjust.

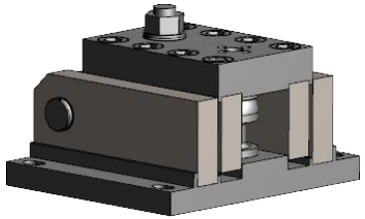


TTT
Torque Tension Tester



DR-Dongle

PC / Cellphone / Tablet



LTT
Torque Tension Tester

TTES/TTEH/TTEB/TTER
Wireless Torque Transducer

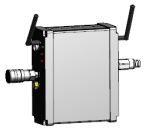
Any type of Torque Tool

Any Type Electric Torque Tool

TCA
Torque Controller

TCC / TCB
Torque Controller

BT



Laptop / Tablet

Torque Control Products Application Examples

Tool Bolting Torque Simulation

To be simulated with specific fasteners to be used in assembly line

Monitor + APP

PC / Laptop

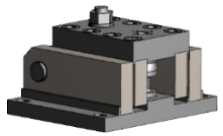
Dongle

RF2.4G

TTT
Torque Tension Tester

Torque Tool to be used with Wireless Torque Transducer and under Transducer Mode

LTT
Torque Tension Tester



Torque Tool to be used without Wireless Torque Transducer and under Pressure/Voltage Mode

Support Functions

USB
Flash Drive

Printer

Scanner

Applicable Torque Tools

Air
Impact Wrench

Air
Pulse Wrench

Air
Torque Multiplier

Air
Clutch Tool

Cordless
Impact Wrench

Cordless
Pulse Wrench

Cordless
Torque Multiplier

Cordless
Clutch Tool

Torque Control Products Application Examples

During Bolting Process

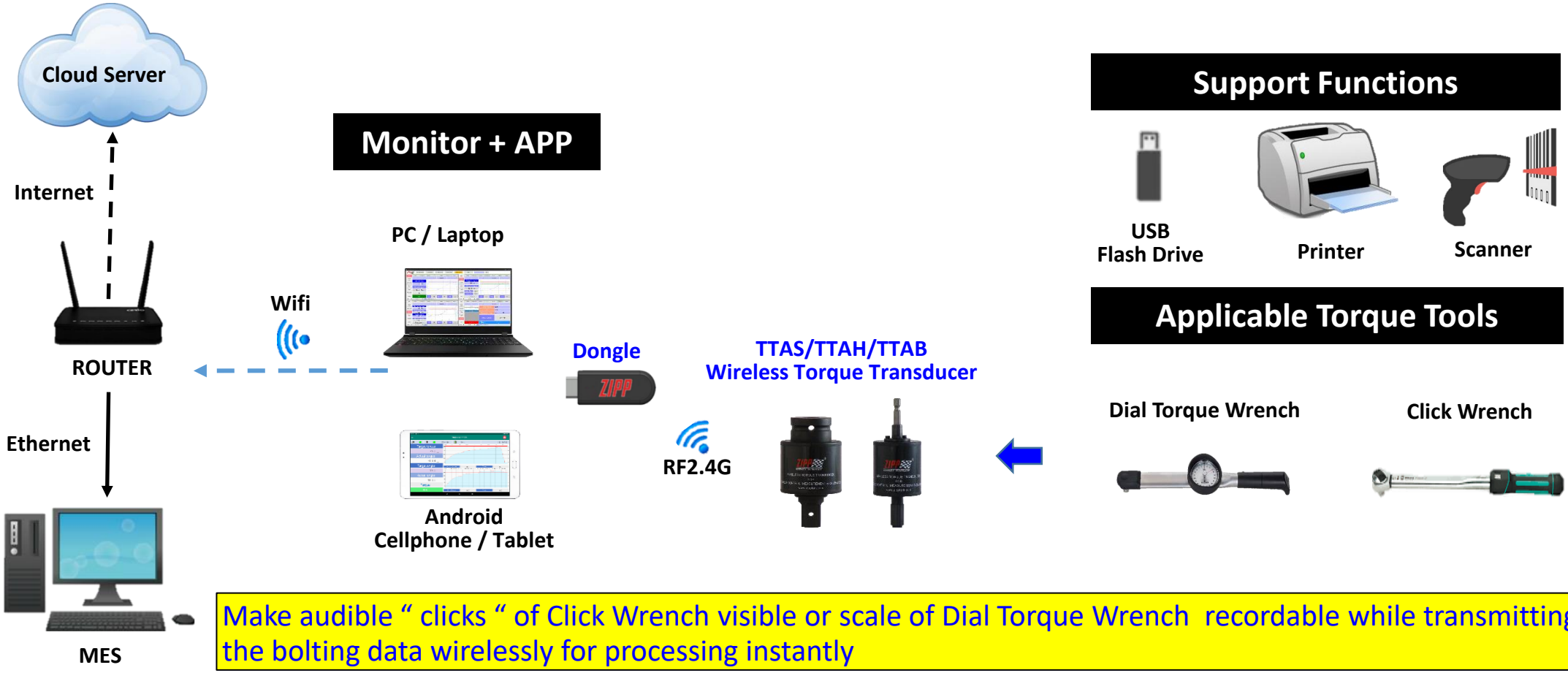
Monitoring Bolting Torque & Collecting Data

Clutch Type Torque Tools

Torque Tools with Auto Shutoff Mechanism

Torque Control Products Application Examples

Monitor Bolting Torque During the Process



Make audible " clicks " of Click Wrench visible or scale of Dial Torque Wrench recordable while transmitting the bolting data wirelessly for processing instantly

Torque Control Products Application Examples

Tool Bolting Torque Monitoring During the Process

Monitor + APP

Attached the Transducer with the Torque Tool

Applicable to Torque Tools with clutch or auto shutoff mechanism

Internet

PC / Laptop

TTES/TTEH/TTEB
Wireless Torque Transducer

Wifi

RF2.4G

ROUTER

Dongle

Ethernet

Android
Cellphone / Tablet

MES

Support Functions

USB
Flash Drive

Printer

Scanner

Air
Impact Wrench

Air
Pulse Wrench

Air
Torque Multiplier

Air
Clutch Tool

Cordless
Impact Wrench

Cordless
Pulse Wrench

Cordless
Clutch Tool

Dial Torque Wrench

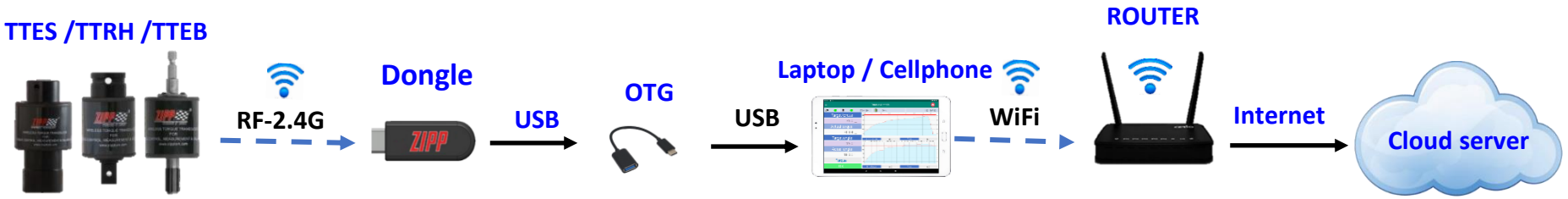
Click Wrench

Make audible “ clicks “ of Click Wrench visible or scale of Dial Torque Wrench recordable while transmitting the bolting data wirelesslyfor processing instantly

Torque Control Products Application Examples

Torque monitoring & data collecting System with wireless Torque Transducer

Android System

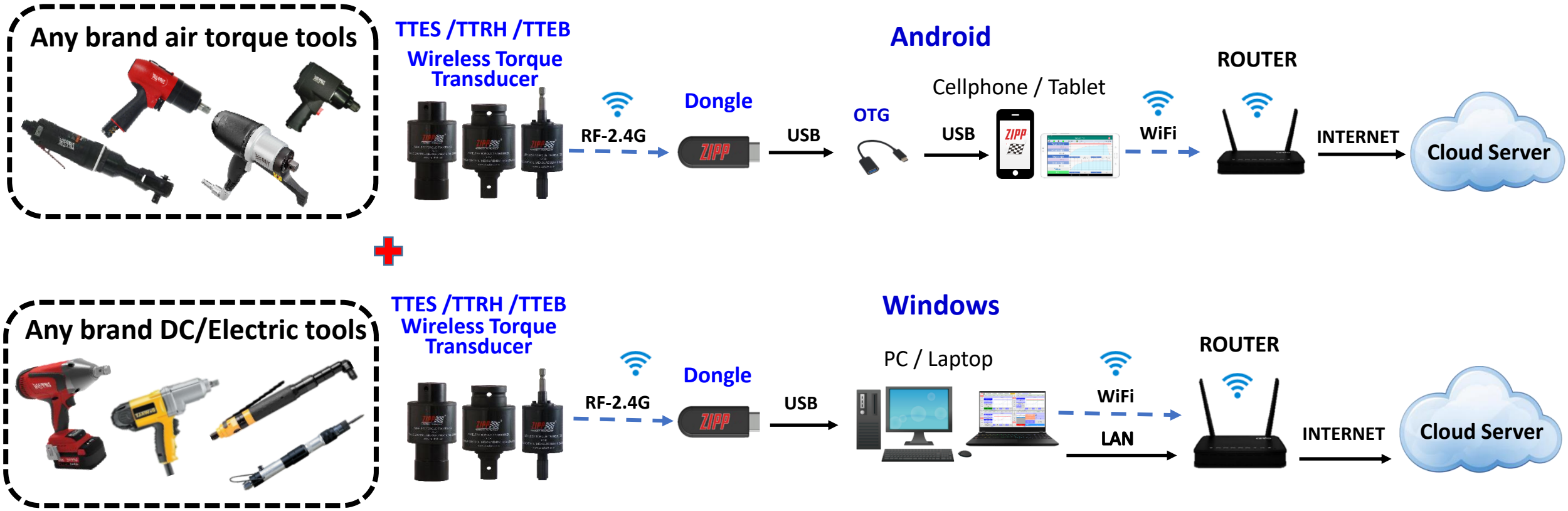


Windows System

Torque Control Products Application Examples

Monitor bolting torque & collect data during the bolting process

Applicable to Torque Tools with the clutch or auto shutoff mechanism



Torque Control Products Application Examples

Monitor bolting torque, collecting and recording relevant data

Assembly Tools

Wireless Torque Transducer

Dongle + Monitor+ APP

Data record + upload

Torque Tools	
DC Clutch Screwdriver	Click Wrenches
Air Clutch Screwdriver	Dial Torque Wrenches
DC Torque Multiplier	Digital Torque Wrenches
Air Torque Multiplier	
DC Pulse Wrench-Auto shutoff	
Air Pulse Wrench-Auto shutoff	

Torque Transducer
TTEB-Torque Transducer
TTAS-Torque Transducer
TTES-Torque Transducer

Monitor
Tablet/Cell-Android
Laptop /PC-WIN10
Dongle

What to be recorded	
Operator ID	Date
Time of Bolting	Station ID
Tool ID	Job ID
Target Torque	Actual Torque
Tolerance	Accuracy
QC Status	OK / NOK
Transducer Type	Transducer Serial No.

Torque Control Products Application Examples

During Bolting Process

Bolting Torque Control

Torque Control Products Application Examples

Torque Control throughout the bolting process with data recording

Assembly Tools

Wireless Rotary Torque Transducer

Torque Controller

Data record + upload

Torque Tools	
DC Clutch Screwdriver	Click Wrenches
Air Clutch Screwdriver	Dial Torque Wrenches
DC Torque Multiplier	Digital Torque Wrenches
Air Torque Multiplier	
DC Pulse Wrench-Auto shutoff	
Air Pulse Wrench-Auto shutoff	

Torque Transducer
TTEB-Torque Transducer
TTAS-Torque Transducer
TTES-Torque Transducer

Controller
TCA-Torque Controller
TCB-Torque Controller
ECB-Built-in Controller

What to be recorded	
Operator ID	Date
Time of Bolting	Station ID
Tool ID	Job ID
Target Torque	Actual Torque
Tolerance	Accuracy
QC Status	OK / NOK
Transducer Type	Transducer Serial No.

Torque Control Products Application Examples

Torque Control throughout the bolting process with data recording

Dynamic bolting torque control with automatic torque compensation

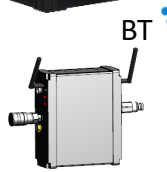
TTAS/TTES/TTEH/TTEB/TTER
Wireless Rotary Torque Transducer

Any Brand Torque Tools

Any DC torque Tool with built-in Controller

TCA
Torque Controller

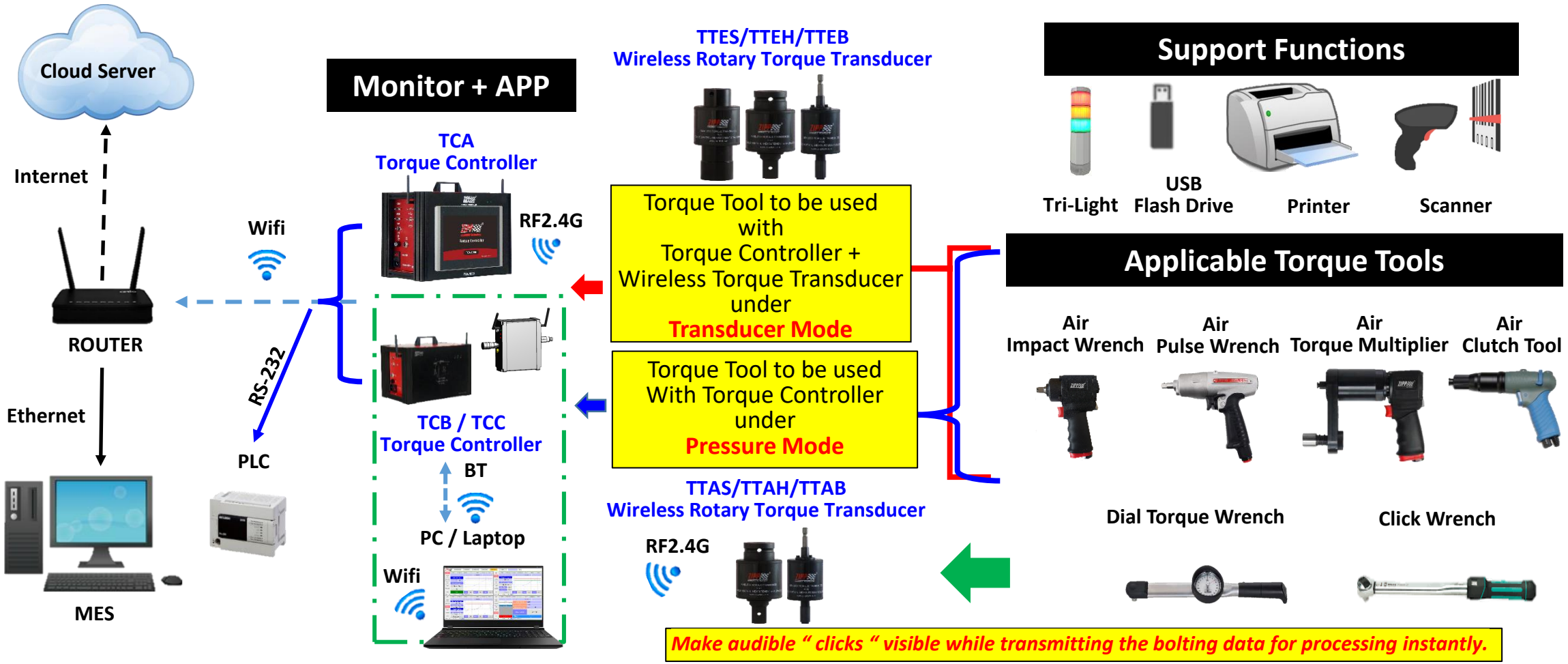
TCC / TCB
Torque Controller



Laptop / Tablet

Torque Control Products Application Examples

Manual / Air Torque Tool Bolting Torque Control During the Process



Torque Control Products Application Examples

High Torque Bolting Alternative

DR-RF Dongle

PC / Cellphone / Tablet

Second Step

TM-Torque Multiplier

TTAS
Wireless Rotary Torque Transducer

Torque Wrench

First Step

Impact Wrench

1. Input Target Torque, and torque wrench capacity, and then the monitor will show the recommended TM specification,
2. Select the TM close to the recommended one and input the torque and gear ratios.
3. Use Torque Wrench or Click Wrench + **Torque Transducer** + Torque Multiplier to tighten the joint to 100% of the Target Torque
4. The monitor will alert with a buzz while closer to the target and display the result as fulfilled.

Tighten the joint to 70 ~ 90% of the Target Torque.

Torque Control Products Application Examples

DC Torque Tool Bolting Torque Control During the Process

Internet

ROUTER

Wifi

PC / Laptop

BT

Ethernet

MES

Monitor + APP

TTES/TTEH/TTEB
Wireless Rotary Torque Transducer

Transducer Mode
Use Tool w/built-in Controller & attached with Transducer and applicable to DC Pulse Wrench only

Voltage Mode
Use Tool w/built-in Controller w/o Transducer

Support Functions

USB
Flash Drive

Printer

Scanner

Applicable Torque Tools

Cordless
Impact Wrench

BT

Cordless
Pulse Wrench

BT

Torque Control Products Application Examples

After Bolted

Verify the Residual Torque of the Bolted Joint

Verify Small Residual Torque under 500NM

Verify High Residual Torque above 500NM

Residual Torque Verification

Measure the residual torque under 500Nm of a bolted joint by the first movement method

For example- residual target torque 120NM is to be measured and verified at angular movement 1° of the bolt or nut

A torque wrench with 340NM capacity and a wireless rotary torque transducer TTAS-180 are to be used.

Input Target Torque 120NM to be measured in the tablet and the tolerance ± 5% as well as the angular movement 1°, for example.

Use the torque wrench attached with the Torque Transducer to drive the socket for tightening the bolted joint.

In this example, the tablet will calculate and judge **OK**/**NOK** according to the algorithm as follows;

1. Judge **OK** if the sensed angular movement 1° appeared while the sensed torque ≥low limit or ≤high limit or between low and high limit.
2. Judge **NOK** if the sensed angular movement 1° appeared while the sensed torque <low limit or >high limit.

High Torque Residual Torque Verification

Measure the residual torque of a high-torque bolted joint by the first movement method and ZIPPTORK patented algorithm

For example- residual target torque 5, 500NM is to be measured and verified at angular movement 1° of the bolted joint

A torque wrench with 340NM capacity is to be used while one Torque Multiplier with a Gear Ratio 3:1 /Torque Ratio 2.7:1 and the other one with a Gear Ratio 12:1/Torque Ratio 9.6:1 are available.

Input Target Torque 5, 500 NM to be measured in the tablet and the tolerance ± 10%, for example, target angular movement 1°, gear ratio 3 &12 and torque ratio 2.7 & 9.6 of both Multiplier.

The microprocessor in the tablet will calculate and display the Torque Transducer TTA capacity 250NM to be selected and angular movement 36° of the Torque Transducer TTA to be fulfilled during the verification.

In this example, the tablet will calculate and judge **OK**/**NOK** according to the algorithm as follows;

1. Judge **OK** if the sensed angular movement 36° appeared while the sensed torque ≥low limit or ≤high limit or between low and high limit.
2. Judge **NOK** if the sensed angular movement 36° appeared while the sensed torque <low limit or >high limit.

Various advanced applications

Applications of wireless Torque Transducer-1

Features

- It can be used with a manual torque wrench, pneumatic or electric or hydraulic driven wrench and torque multiplier for high torque bolting or torque inspection.
- It can monitor the bolting torque in real-time and collect and upload the result with the operator ID, workpiece code and operation time.
- Patented control algorithm facilitates the flexible combination of torque tool and torque multiplier when doing high torque bolting, effectively reducing equipment cost and improving operation efficiency and convenience.
- The patented control algorithm also facilitates the residual torque verification of the high torque bolted joint, which can measure the residual torque value at any angular displacement and record the inspector's code, object, and inspection time.

For Bolting

1. Application 1 - Any brand manual torque wrench /Click Wrench + TTA series of Torque Transducer+ Dongle +Cellphone/Tablet/Laptop tighten to Target Torque till warning alert & stop. Display and judge OK/NOK while recording and transmitting relevant data to peripheral devices. "Make audible clicks visible".
   Controllable accuracy within ± 5%

2. Application 2 - Any brand manual torque wrench /Click Wrench + TTA series of Torque Transducer+ Torque Multiplier (1 ~ 3unit) + Dongle + Cellphone / Tablet /Laptop tighten to Target Torque till warning alert & stop. Display and judge OK/NOK while recording and transmitting relevant data to peripheral devices. "Make audible clicks visible" .
   Controllable accuracy within ± 5%

3. Application 3 -
   a. Use any brand air or DC-driven impact wrench to tighten to 80% of the Target Torque, then
   b. Use any brand manual torque wrench /Click Wrench + TTA series of Torque Transducer+ Dongle +Cellphone/Tablet/Laptop tighten to Target Torque till warning alert & stop. Display and judge OK/NOK while recording and transmitting relevant data to peripheral devices. Make audible clicks visible."

   Controllable accuracy within ± 5%.

For Residual Torque Verification

1. Tool to be used - Any brand manual or click wrench + + TTA series of Torque Transducer+ Dongle +Cellphone/Tablet/Laptop
   Method & procedures -
   a. Pairing the Torque Transducer TTA to a Cellphone/Tablet/Laptop via Dongle
   b. Select & set language & torque unit while scanning the operator's ID or workpiece code if required.

Applications of wireless Torque Transducer-2

c. Select type of torque tool on Tablet ~ manual/digital or click wrench & Torque Verification Mode
d. Input Torque tool capacity, target torque, target angle and tolerance of inspection accuracy on the Tablet
e. Tablet will display the torque value on the digital wrench or the scale to be adjusted on click wrench
f. Tighten the bolt till the buzz alerts from the digital wrench or clicks from the click wrench and stop.
g. Tablet will display the result with OK/NOK while recording or uploading.

2. Tool to be used –
Any brand manual or click wrench + **TTA series of Torque Transducer+** Torque Multiplier (1 ~ 3 units) **+ Dongle** +Cellphone/Tablet/Laptop

Method & procedures

a. Pairing the Torque Transducer **TTA** to a Cellphone/Tablet/Laptop via **DR-RF Dongle**
b. Select & set language & torque unit while scanning the operator's ID or workpiece code if required.
c. Select the type of torque tool on Tablet ~ manual/digital or click wrench & Torque Multiplier Mode under Torque Verification Mode
d. Input Torque tool capacity, target torque, target angle and tolerance of inspection accuracy on the Tablet, Torque Ratio & Gear Reduction Ratio of the Torque Multiplier.
e. Tablet will display the torque value on the digital wrench or the scale to be adjusted on click wrench
f. Tighten the bolt till the buzz alerts from the digital wrench or clicks from the click wrench and stop.
g. Tablet will play the result with **OK**/**NOK** while recording or uploading.

ZIPPTORK Torque Control Series Products

How to select a torque wrench & Torque Transducer properly

Depending on the specification of the bolt/nut and washer, how many seconds is expected to tighten a soft or hard joint to be bolted, and how to select the appropriate torque tool and torque transducer?

1. How to select the torque tool～

Manual Torque Tools～

Includes a variety of click wrenches, digital torque wrenches, dial torque wrenches, interchangeable head torque wrenches, torque multipliers, and pneumatic or electric nut -runners & torque multipliers.

It is recommended to use a torque tool with torque capacity more than 30% greater than the target torque.

Air or DC driven discontinuous type Torque Tools～

Includes a variety of Air or DC driven clutch type tools or impact type and oil pulse type wrenches
It is necessary to measure the output torque of the pneumatic or electric torque wrench under which "operating conditions" are defined.
The "operating conditions" refer to the stable working air pressure that can be maintained when the pneumatic tool is in use and the size of the air hoses used to connect the air source or the stable working voltage and electric current that can be maintained when the cordless tool is in use。

A torque tester can be used to pre-check the output torque of the tool (T-output)

- The residual torque of a bolted joint is generated by the spiral mechanism of the thread fastener via the torque tool during the bolting process. Depending on the pitch of the thread, the surface roughness and lubrication condition，the softness or hardness of the object, as well as the duration of continuous tightening, the tool can effectively tighten the object to a residual torque (T-residual) that is higher than the tool output torque (T-output).

ZIPPTORK Torque Control Series Products

How to select a torque wrench & Torque Transducer properly

A torque/tension meter can be used to pre-test the tool's output torque (T-output) to produce a residual torque equivalent (T-residual) in any moment of duration within 5 or 10 seconds

- During the inspection, just assemble the bolts/nuts and washers to be bolted in the torque /tension meter, input the maximum seconds for the expected completion of the bolting operation, actuate the tool, and then get the clamping force (tension) that can be generated on the display and the corresponding residual torque equivalent (Residual Torque Equivalent) on every moment throughout the process, and then find out the target torque in the seconds corresponding to the target torque. (the so-called target torque-T-target here refers to the torque value measured after bolted with a digital torque wrench when the quality inspector uses a digital torque wrench to reapply the bolting force and at the moment when the bolt or nut start to rotate).

- Simulate the tightening torque of the tool with the thread fastener to be tightened using a **TTT** to know whether the tool has sufficient torque capacity to tighten the joint to the target torque within the expected seconds.

  The softness/hardness of the joint should be taken into account to select the tool's torque capacity.

  The 5 or 10 second torque listed in the tool catalogue does not define the operating conditions and is for reference only. It is recommended that the user select the appropriate torque tool according to the above instructions.

Please refer to the following operation video and instructions to select the applicable torque tool

- Please also refer to the attached table, as long as the target torque is greater than the output torque of the tool, the selection of the tool must take into account the degree of softness or hardness of the object to be tightened and the number of seconds required to complete the bolting operation. The softer the object or the shorter the seconds of bolting, the higher the output torque of the tool will be required.

ZIPPTORK Torque Control Series Products

2. How to select the torque transducer～

Torque Transducer for static or non-impact type torque tools～

Includes **TTA series Rotary type Torque Transducers and STA series Swing type Torque Transducers** 。

It is recommended that static torque transducers be selected with a torque more than **30% greater** than the target torque for bolting.

Rotary type Torque Transducers for dynamic air or electric driven clutch type, impact type or pulse type torque tools～

- Adjust the conditions for stable operation of the tool at the station where it is to be used, most importantly air pressure/flow and voltage, etc. Use a torque meter to pre-check the amount of tool output torque **(T-output)**.
- The nominal torque of the dynamic torque sensor must be at least **1.25 times** the output torque T-output of the tool.
  For example, if the output torque of the tool is 100Nm, the sensor can be **TTES-150** or **TTES-180**, i.e. the target torque **(residual torque)** of the tool can be tightened by the tool.
  The sensor will not be over-torqued even if the target torque (residual torque) is greater than 180Nm (nominal torque of **TTES-180**).

Please refer to the following operation video and instructions to select the applicable torque transducer

Selection of Rotary type Torque Transducers and dynamic air or electric driven clutch type, impact type or pulse type torque tools

Torque Controller Flow Rate	Joint Hardness	Tool Output Torque	Suggested TTE Capacity	Tightening time (Seconds)	Tool Output Torque Capacity within 5 or 10 seconds under 90PSI
TCA-Measured by Flow Meter automatically **TCB**-Flow sensor equipped only Tool air consumption should be lower than the specified max. flow rate of the Controller	S(Soft)	$T\text{-}_{output}$	1.25～2 $T\text{-}_{output}$	t- 5 s	$T_5 \geqq 2 \times T\text{-}_{Target}$
				t- 4 s	$T_4 \geqq 3 \times T\text{-}_{target}$
				t- 3 s	$T_3 \geqq 4 \times T\text{-}_{Target}$
				t- 2 s	$T_2 \geqq 5 \times T\text{-}_{Target}$
	H(Hard)	$T\text{-}_{output}$	1.25～2 $T\text{-}_{output}$	t- 5 s	$T_5 \geqq 1.5 \times T\text{-}_{Target}$
				t- 4 s	$T_4 \geqq 2 \times T\text{-}_{Target}$
				t- 3 s	$T_3 \geqq 2.5 \times T\text{-}_{Target}$
				t- 2 s	$T_2 \geqq 3 \times T\text{-}_{Target}$

Why use ZIPPTORK Bolting Technology

Provide a full range of solutions to assist operators in choosing the right torque tool for intelligent bolting methods

Implementation of Industry 4.0 with Industrial Internet of Things

Successful thread fastener assembly depends on whether the operator has a complete understanding of the characteristics of the object to be bolted and the actual tightening torque accuracy required, as well as whether the chosen torque tool and bolting method are appropriate.

Not all assembly operations require complex and expensive precision electric servo-controlled torque tools.

The Key is

Suppose the operator is aware of the actual torque control accuracy required for the station and the characteristics of the threaded fastener to be tightened. Then choose the appropriate torque tool and control method. Depending on the pneumatic or electric torque tool used and the surrounding operating environment and power source, the relevant control and bolting strategies are developed.

To achieve the production goals and meet the quality requirements efficiently with the most economical budget and through the use of intelligent machines, we make good use of the data collected from the manufacturing process to grasp the quality and responsibility of the job to improve the efficiency of production and quality management to make the industry more competitive.

TCA

Torque Controller

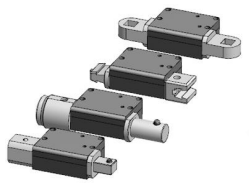
TCC / TCB

Torque Controller

Laptop/Cellphone/Tablet

TTAS/TTES | **TTEB** | **TTEH**

Wireless Rotary Torque Transducer



STA

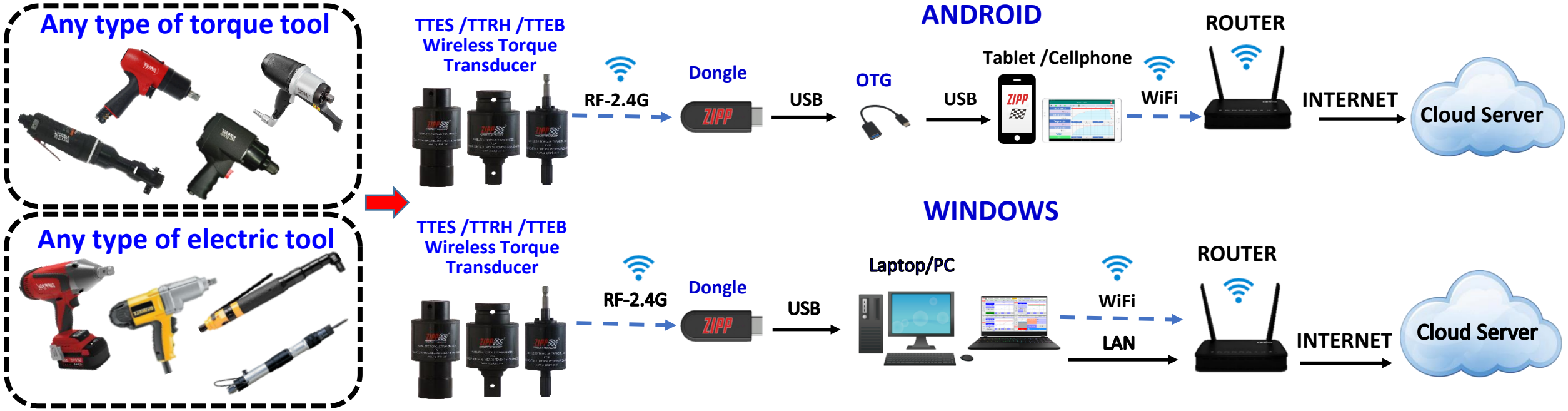
Wireless Swing Type Torque Transducer

ZIPPTORK Bolting 4.0 - Smart Bolting Alternative

Cost-effective product portfolio for basic applications

Bolting torque monitoring and data collection

It is possible to use any brand of pneumatic or electric impact, oil pulse wrenches, clutch type torque driver with auto shutoff mechanism, with wireless torque transducer attached to connect with cell phone /tablet or notebook through a Dongle to detect whether the torque of the tool is due to improper grip of the tool or the tool is affected by changes in air pressure/airflow or voltage/electricity flow or the oil pressure type torque tool is affected by rising oil temperature, resulting in abnormal torque, and provide timely warning and counting, data collection and transmission functions.

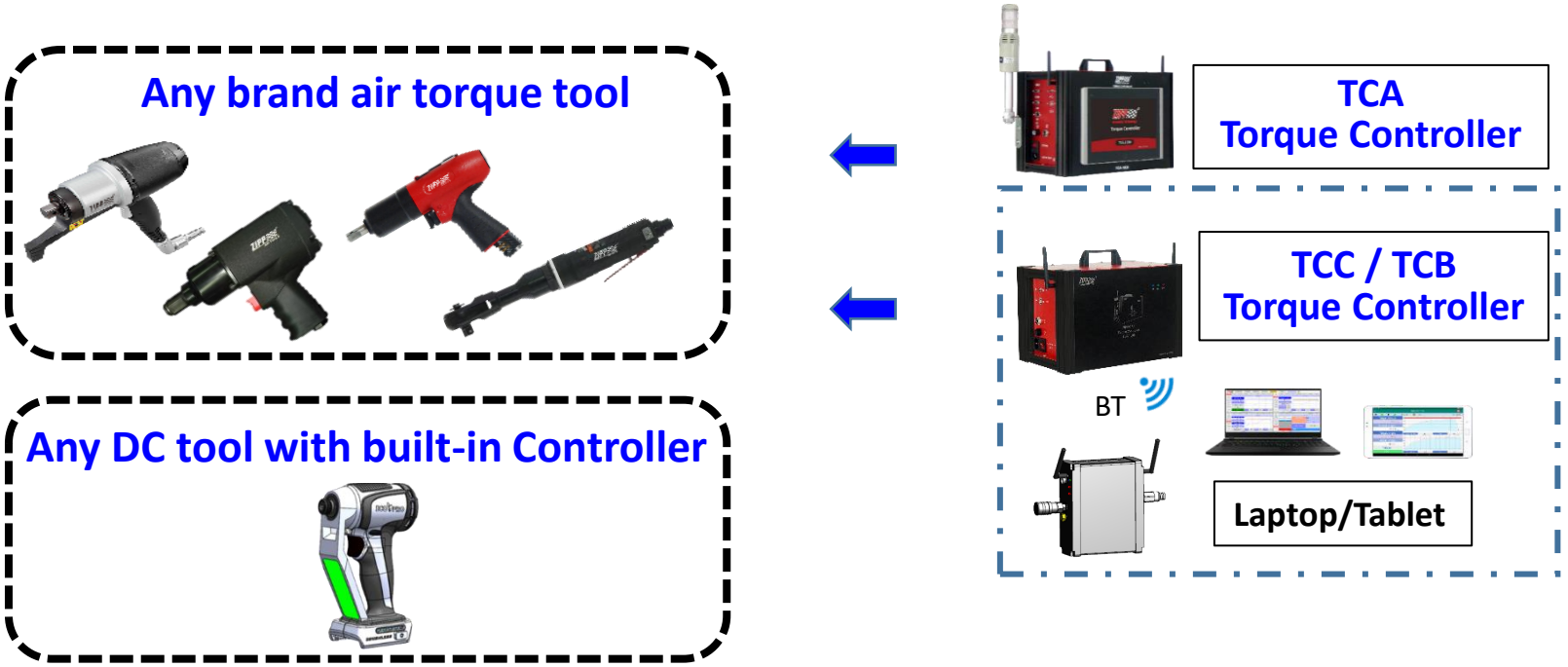


ZIPPTORK Bolting 4.0 - Smart Bolting Alternative

An advanced application of product portfolio with precision and high-cost performance

Control bolting torque - under Air or Voltage Mode

Any brand of pneumatic impact, oil pulse wrenches, or clutch type torque driver can achieve ±10 to ±20% torque control accuracy under **Air Pressure Mode** or cordless oil pulse wrenches or clutch type torque driver under **Voltage Mode** through the built-in controller, and collecting data and information for uploading.



ZIPPTORK Bolting 4.0 - Smart Bolting Alternative

Affordable professional-grade application product portfolio for customers

Control bolting torque - Under Transducer Mode or Accumulated Mode

Any brand of pneumatic impact, oil pulse wrenches, clutch type torque driver or cordless oil pulse wrenches with a wireless torque transducer attached can be used under **Transducer Mode or Accu Mode** for achieving the torque control accuracy of ±5% to ±15% while collecting data and uploading information.

Dongle

PC / Cellphone / Tablet

TTES/TTEH/TTEB/TTER
Wireless Torque Transducer

Any brand air impact or pulse wrench

Any cordless pulse wrench with built-in Controller

TCA
Torque Controller

TCC / TCB
Torque Controller

BT

Laptop / Tablet

Tool Torque Controllability & ZIPPTORK Solutions

Current Status		Improvement By	
Type of Tool	**Accuracy**	**ZIPPTORK Solutions**	**Accuracy**
Air Impact Wrench	±30% ~ Above	TCA or TCC Torque Controller+ Dongle + Laptop **+ Impact Tool** → **Pressure Mode**	±15% ~ ±20%
		TCA or TCC Torque Controller+ Dongle + Laptop **+ Impact Tool +** TTE Torque Transducer → **Transducer Mode**	±10% ~ ±15%
		TCA or TCC Torque Controller+ Dongle + Laptop **+ Impact Tool +** TTE Torque Transducer → **Accu Mode**	±10% ~ ±15%
Air Pulse Wrench	±10% ~ ±30%	TCA or TCC Torque Controller+ Dongle + Laptop **+ Pulse Tool** → **Pressure Mode**	±10% ~ ±15%
		TCA or TCC Torque Controller+ Dongle + Laptop **+ Pulse Tool +** TTE Torque Transducer → **Transducer Mode**	±5% ~ ±10%
		TCA or TCC Torque Controller+ Dongle + Laptop **+ Pulse Tool +** TTE Torque Transducer → **Accu Mode**	±5% ~ ±10%
Air/DC Driven Pulse Tool	±10% ~ ±30%	**Pulse Tool +** TTE Torque Transducer + Dongle +Tablet → **Torque Monitoring**	±10% ~ ±30%
Air Clutch Type Tool	±7.5% ~ ±10%	**Clutch Type Tool +** TTE Torque Transducer + Dongle +Tablet → **Torque Monitoring**	±7.5% ~ ±10%
DC Driven Impact/Pulse Tool	±30% ~ Above	ECC Control Board built-in Type DC Driven Impact/Pulse Wrench + Laptop→ **Voltage Mode**	±15% ~ ±20%
		ECC Control Board built-in Type DC Driven Impact/Pulse Wrench + Laptop + TTE Torque Transducer → **Transducer Mode**	±10% ~ ±15%
		ECC Control Board built-in Type DC Driven Impact/Pulse Wrench + Laptop + TTE Torque Transducer → **Accu Mode**	±10% ~ ±15%
Air Driven Torque Multiplier	±5% ~ ±10%	TCC Torque Controller+ Dongle + Laptop + ATM-200T Transducerized Torque Multiplier→ **Transducer Mode**	±5% ~ ±10%
DC Driven Torque Multiplier	±5% ~ ±10%	ECC Control Board built-in Type DC Driven Transducerized Torque Multiplier + Laptop→ **Transducer Mode**	±5% ~ ±10%
Click Wrench	±5% ~ ±10%	**Click Wrench +** TTA Torque Transducer + Dongle +Tablet → Torque Monitoring & **make audible "CLICKs" visible**	±5% ~ ±10%

Bolting Works Description & ZIPPTORK Solutions

Bolting Works Description	ZIPPTORK Solutions	Accuracy
Tool torque calibration ~ includes torque wrench, click wrench, digital torque wrench, power driven screw driver, clutch type , impact or pulse type tool, torque multiplier, etc.	Use the **TT/LT Torque Tester + Dongle +Tablet** to calibrate or check tool torque capacity	< ±5%
Discontinuous type torque tool dynamic bolting torque capacity ~ includes power driven impact or pulse type tool	Use the tool to tighten the specific bolt/nut +washer on **TTT/LTT Torque Tension Tester + Dongle +Tablet** under specific power supply condition (air pressure + flow rate, voltage + electric current) to measure the bolt load & equivalent residual torque capacity	< ±5%
Wheel stud bolting with air impact wrench	1. Use air impact wrench tighten the stud to 80%-90% target torque T_T, then 2. Use a click wrench **+ TTA transducer + Dongle +Tablet** tighten the stud to T_T & collect data.	±5% ~ ±10%
Wheel stud bolting with air impact wrench + Air Torque Multiplier		±5% ~ ±10%
Wheel stud bolting with DC driven impact wrench	1. Use DC driven impact wrench tighten the stud to 80%-90% target torque T_T, then 2. Use a click wrench + **TTA transducer + Dongle +Tablet** tighten the stud to T_T & collect data.	±5% ~ ±10%
Wheel stud bolting with DC driven impact wrench	1. Use DC driven impact wrench tighten the stud to 80%-90% target torque T_T, then 2. Use a click wrench + **TTA transducer + Dongle +Tablet** tighten the stud to T_T & collect data.	±5% ~ ±10%
Torque monitoring during bolting process by air impact wrench or pulse wrench	Use air impact wrench or pulse wrench + **TTE transducer + Dongle +Tablet**	±10% ~ ±15%
Torque monitoring during bolting process by air clutch type wrench	Use air clutch type wrench + **TTE transducer + Dongle +Tablet**	±5% ~ ±10%

Bolting Works Description & ZIPPTORK Solutions

Bolting Works Description	ZIPPTORK Solutions	Accuracy
Torque monitoring during bolting process by DC driven pulse wrench	Use a DC driven pulse wrench + TTE transducer + Dongle +Tablet	±10% ~ ±15%
Torque monitoring during bolting process by DC clutch type wrench	Use DC clutch type wrench + TTE transducer + Dongle +Tablet	±5% ~ ±10%
Torque control during the bolting process by air driven torque Multiplier	Use TCC Controller + air driven torque Multiplier + Dongle +Tablet→ **Pressure Mode**	±5% ~ ±10%
Torque control during bolting process by using air impact wrench	Use TCC Controller + Dongle +Tablet + air impact wrench→ **Pressure Mode**	±15% ~ ±20%
	Use TCC Controller + Dongle +Tablet + air impact wrench + TTE Torque Transducer→ **Transducer Mode or Accumulated Mode**	±10% ~ ±15%
Torque control during bolting process by using air pulse wrench	Use TCC Controller + Dongle +Tablet + air pulse wrench→ **Pressure Mode**	±10% ~ ±15%
	Use TCC Controller + Dongle +Tablet + air pulse wrench + TTE Torque Transducer→ **Transducer Mode or Accumulated Mode**	±5% ~ ±10%
Torque control during bolting process by using torque controlled DC impact /pulse wrench	Use ECC equipped DC impact/pulse wrench + Dongle +Tablet→ **Voltage Mode**	±15% ~ ±20%
Torque control during bolting process by using torque controlled DC impact/pulse wrench	Use ECC equipped DC impact/pulse wrench + TTE + Dongle +Tablet→ **Transducer Mode or Accumulated Mode**	±10% ~ ±15%
Torque control during bolting process by using click wrench	Use click wrench + TTA Torque Transducer + Dongle +Tablet ~ **Make audible " clicks " visible** & data collection	±5% ~ ±10%
Residual torque verification	Use torque wrench + TTA Torque Transducer + Dongle +Tablet to measure the residual torque on the bolted joint by 1st movement method for 1° angular movement	±5% ~ ±10%
High residual torque verification	Use torque wrench + TTA Torque Transducer +TM + Dongle +Tablet to measure the residual torque on the bolted joint by 1st movement method for 1° angular movement	±5% ~ ±10%

Products Combinations Related to Torque Control

1. Bolting Torque Range 10NM ~ 100NM & control accuracy requirement

Type of Tools	Controller	Transducer	Dongle	Laptop / Tablet	Operation Mode	Control Accuracy
Air or DC tool with auto-shutoff or clutch mechanism		TTEB / TTES	DR	Laptop	Torque	Depends on toolself
Air Impact wrench	TCA/TCB/TCC				Pressure Mode	± 15% ~ ± 20%
Air Impact wrench	TCA/TCB/TCC	TTEB / TTES			Transducer Mode	± 10% ~ ± 15%
Air Pulse Wrench	TCA/TCB/TCC				Pressure Mode	± 10% ~ ± 15%
Air Pulse Wrench	TCA/TCB/TCC	TTEB / TTES			Transducer Mode	± 5% ~ ± 10%
Cordless Impact Wrench	ECB embedded				Voltage Mode	± 15% ~ ± 20%
Cordless Pulse Wrench	ECB embedded				Voltage Mode	± 10% ~ ± 15%
Cordless Pulse Wrench	ECB embedded	TTEB/TTES			Transducer Mode	± 5% ~ ± 10%
Click Wrench		TTAB/TTAS	DR		Torque/Torque + Angle Mode	± 4%
Interchangeable Head Torque Wrench		STA	DR		Torque/Torque + Angle Mode	± 4%

Products Combinations Related to Torque Control

2. Bolting Torque Range 100NM ~ 1000NM & control accuracy requirement

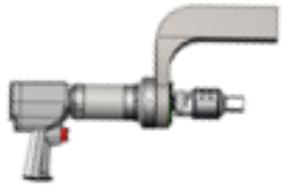
Type of Tools	Controller	Transducer	Dongle	Laptop / Tablet	Operation Mode	Control Accuracy
Air Impact wrench	TCA/TCB/TCC				Pressure Mode	± 15% ~ ± 20%
Air Impact wrench	TCA/TCB/TCC	TTEB / TTES			Transducer Mode	± 10% ~ ± 15%
Air Pulse Wrench	TCA/TCB/TCC				Pressure Mode	± 10% ~ ± 15%
Air Pulse Wrench	TCA/TCB/TCC	TTEB / TTES			Transducer Mode	± 5% ~ ± 10%
Air Torque Multiplier	TCC	TTAS			Transducer Mode	± 5%
Cordless Impact Wrench	ECB embedded				Voltage Mode	± 15% ~ ± 20%
Cordless Pulse Wrench	ECB embedded				Voltage Mode	± 10% ~ ± 15%
Cordless Pulse Wrench	ECB embedded	TTEB/TTES			Transducer Mode	± 5% ~ ± 10%
Cordless Torque Multiplier	ECB embedded	TTAS			Transducer Mode	± 5%
Click Wrench		TTAB/TTAS	DR		Torque/Torque + Angle Mode	± 4%
Interchangeable Head Torque Wrench		STA	DR		Torque/Torque + Angle Mode	± 4%

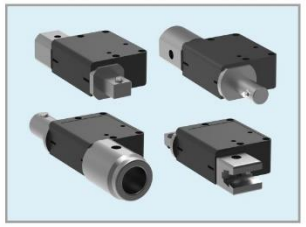








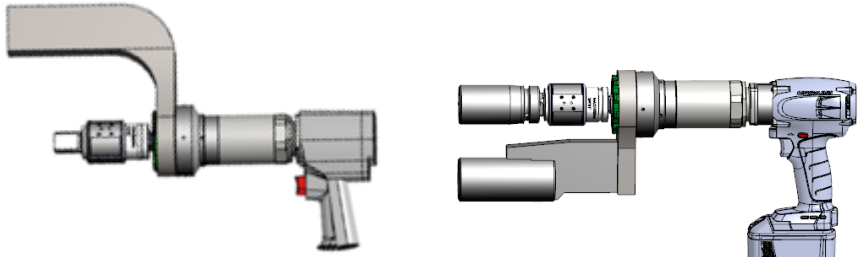


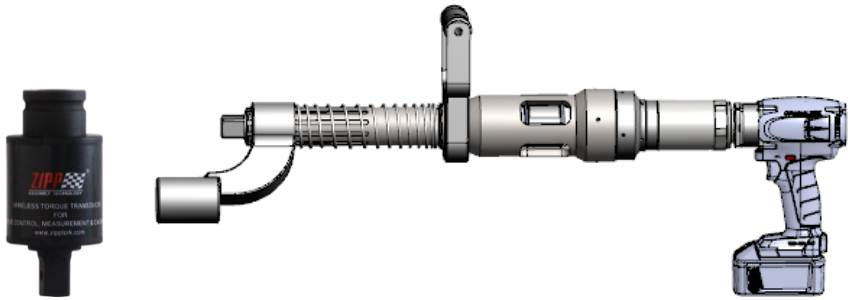



Products Combinations Related to Torque Control

3. Bolting Torque Range 1000NM ~ 3000NM or above & control accuracy requirement

Type of Tools	Controller	Transducer	Dongle	Laptop / Tablet	Operation Mode	Control Accuracy
Air Impact wrench	TCA/TCB/TCC				Pressure Mode	± 15% ~ ± 20%
Air Impact wrench	TCA/TCB/TCC	TTEB / TTES			Transducer Mode	± 10% ~ ± 15%
Air Torque Multiplier	TCA/TCB/TCC		DR		Transducer Mode	Within ± 5%
Air Torque Multiplier-2 speed	TCA/TCB/TCC	TTEB / TTES	DR		Transducer Mode	Within ± 5%
Cordless Torque Multiplier	ECB embedded		DR		Transducer Mode	Within ± 5%
Cordless Torque Multiplier-2 speed	ECB embedded		DR		Transducer Mode	Within ± 5%
Torque Wrench + Torque Multiplier	ECB embedded	TTAS/STA	DR		Transducer Mode	Within ± 5%





Bolting & Residual Torque Verification of Wheel Lug Nut/Stud

Torque: It's the Law

https://www.youtube.com/watch?v=TtzAT4BYcgw

Tighten your wheel stud faster & safer

Still use heavy & slow Nut Runners?

What's ZIPPTORK's Solution

New Strategy for wheel Stud Bolting

Torque-controlled transducerized bolting with impact wrenches

Option-1 **TCA** + any brand air impact wrench + **TTES/TTEH** → control accuracy ±15% ~ ±20%

Option-2 **TCC** + any brand air impact wrench + **TTES/TTEH** + **Dongle** + Tablet→ control accuracy ±15% ~ ±20%

Option-3
1. Use Option 1 or 2 or any cordless wrench to tighten the joint to 80% ~ 90% of Target Torque, then,
2. Use a click wrench + **TTAS + Dongle** + Tablet and tighten to target torque.→ control accuracy ±5%

Option-4 ATMT/ATMTD Air Torque Multiplier + Dongle + Tablet→ control accuracy within ±5%

Typical stud bolting torque:	Car ½”	up to	165 lb-ft
	Bus ¾”	up to	535 lb-ft
	Truck 1”	up to	1, 100 lb-ft

Wheel Stud Bolting Solution – Standard

1

FRL + Air Impact Wrench

Set to 80% max. of the Target Torque

After tightened the bolt or stud to 80% maximum of the target torque, then, use a **Click Wrench** to drive the **Transducer** for final torque. An angular movement to be preset with the threshold by user to assure that it reaches the target torque and avoid to make wrong judgment.

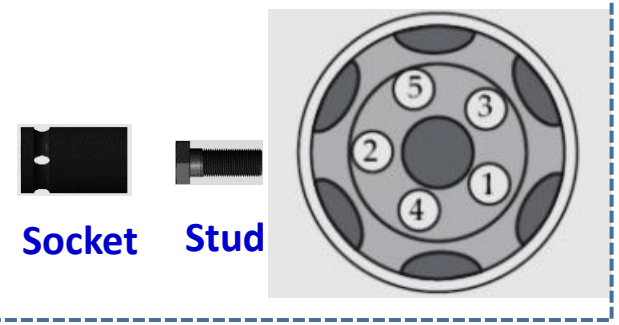
2

Set to target torque

TTA/TTE-Wireless Torque Transducer

Angle threshold to be set by the user

Cloud Server



Socket **Stud**

Video link

Real-time data monitor, Collect and Server upload

Dongle **Tablet** **Cellphone**

Make The Audible "Click" Visible

Wheel Stud Bolting Solution – Standard

Prevent over-torque and under torque

Get Real-time torque control with angle detection

Get real-time Torque monitoring and display

Customer satisfaction with visible data

Data collection with IoT, a step towards the trend of Industry 4.0

Wheel Stud Bolting Solution – Pro

Air Source + FR

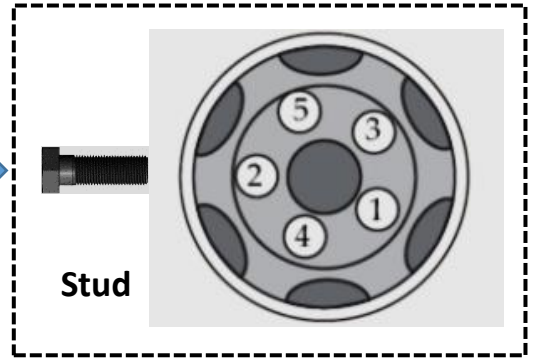
TCA/TCB Torque Controller

Lubricator

Any brand of Air Impact Wrench

Impact Socket

TTES/TTEH Torque Transducer



Video link

Dongle

Tablet

Cellphone

Real-time data upload and monitoring on PC / Smartphone / any remote device

Sequential tightening in two rounds

First round
Set 60% of target torque within + 20~30% tolerance

Second round
Set the Target torque within +10~15% tolerance

It's recommended to use the Transducer- TTE with a hexagonal opening for specific lug studs or lug nuts.

Wheel Stud Bolting Solution – Advanced

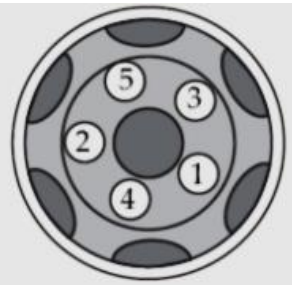
Air Source + FR

TCB/TCC Controller

Lubricator

ATMT/ATMTD
Torque Multiplier with built-in Transducer

Stud



Dongle

Tablet

Cellphone

Real-time data upload and monitoring on Tablet / Smartphone / any remote device

Sequential tightening in two Rounds

First round
Set 60% of target torque within +20~30% tolerance

Second round
Set the Target torque within +10~15% tolerance

Air Torque Multiplier with built-in **Torque Transducer** **applied with Torque Controller for**

- Bolt Production Record and traceability
- Bolting Sequence Control and data record/logging
- Assure highest safety and reliability of the bolted joint
- Instant bolting torque control
- ATMTD double speed version for higher efficiency

Achieving the Most Accurate Bolted Joint Tightness

An efficient yet cost-effective alternative of wheel torque solution

Wheel Torque Solution

OPTIMIZE YOUR PROCESS

STEP 1
Clean bare hub pilots, inspect for wear, and lubricate pads.

STEP 2
Clean the drum and studs. Inspect for fatigue with thread gauge.

STEP 3
Thoroughly clean both sides of each wheel with the CP7202D sander and an appropriate abrasive. Inspect all surfaces for cracks and unusual wear.

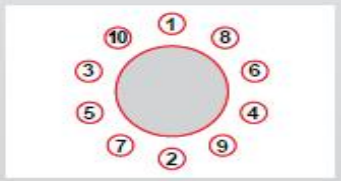
STEP 4
Install both wheels.

STEP 5
Place two drops of oil near the end of the stud.

STEP 6
Lubricate each nut with one drop of oil between the nut and washer. Rotate the washer to distribute the oil evenly.

STEP 7
Install the nuts by hand.

STEP 8
Use a CP7748 impact wrench on the lowest torque setting to quickly snug all the nuts prior to final torquing.



STEP 9
Using the BlueTork, follow the star pattern above to tighten the nuts to the specified torque.

STEP 10
To ensure each nut has been torqued, a clockwise check may be performed. The BlueTork is pre-calibrated and is designed for precise torquing.

*Procedure illustrated is for reference only. Actual wheel preparation and assembly is dependant on wheel type and may vary. Please refer to the manufacturer's recommendations for proper wheel assembly procedures.
Non-contractual pictures. Products color may vary.

An efficient yet cost-effective alternative of wheel torque solution

Take the Wheel Torque Solution above, for example. It tightens the wheel nuts to 900NM according to the steps until the preparation at the end of Step 7,
1. a CP7748 is used with the lowest torque to snug all the nuts, then quickly
2. using the CP7600, follow the star pattern to the specified torque. And
3. finally, use a click wrench to perform a clockwise check to ensure each nut has been torqued precisely.

It proceeds in 3 steps as - **CP7748 → CP7600 → Click Wrench**

Our alternatives for passenger cars and trucks/trailers are as follows;

For passenger cars

Use a Mini Air Impact Wrench to follow the star pattern to tighten the nut to 80～90NM → then,
Use a Click Wrench (340NM capacity)+ TTAS-180 (wireless torque transducer～180NM capacity) + Dongle + Tablet (Android or Window APP). Follow the star pattern to tighten the nut to 100～120NM as specified and set on the click wrench. It makes the audible " clicks " of the Click Wrench visible while keeping the operator I.D., the serviced wheel position, the number of nuts and torque applied with the time recorded simultaneously with accuracy within ±5%.
It proceeds within 2 steps - Mini Air Impact Wrench → Click Wrench + TTAS-180 + Dongle + Tablet

For Truck / Trailer

Use an Air Impact Wrench to follow the star pattern to tighten the nut to 450～550NM → then,
Use a Click Wrench(1000NM capacity) + TTAS-1000 (wireless torque transducer～1000NM capacity) + Dongle + Tablet (Android or Windows APP). Follow the star pattern to tighten the nut to 650～700NM as specified and set it on the click wrench. It makes the audible " clicks " of the Click Wrench visible while keeping the operator I.D., the serviced wheel position, the number of nuts and torque applied with the time recorded simultaneously with accuracy within ±5%.
It proceeds within two steps - Air Impact Wrench → Click Wrench +TTAS-1000+ Dongle + Tablet.

Using innovative and patented anti-vibration wireless torque transducer, process streaming, improving efficiency and promoting quality, reliability and traceability, we provide value-for-money and cost-effective services for our customers and strive to exceed customers' expectations.

ZIPPTORK Wheel Stud Bolting Strategy

A breakthrough in rim security bolting technology :
Using ZIPPTORK's patented torque controller and vibration and shock-resistant wireless torque transducer, operators can achieve secure bolting with pneumatic impact wrenches that use high speed but cannot control the torque. This solution can be controlled within ±20% accuracy.

High working efficiency:
The effective efficiency, no manual bolting, without using a torsion bar or click of the wrench, is easy and convenient. All bolting operations can be done while the vehicle is up and suspended. Each wheel bolting time can be shortened by 4-6 minutes.

Recorded work, quality assurance and traceability of responsibility :
The operator's ID, vehicle number and rim position, the number of nuts and the torque of the respective bolting. The number of lug nuts, the torque applied, and the bolting time are recorded simultaneously and judged to be qualified or not. Also, it can be transferred to a peripheral server or cloud database, etc. Easy to track and manage.

Bolt Load Control During Bolting Process

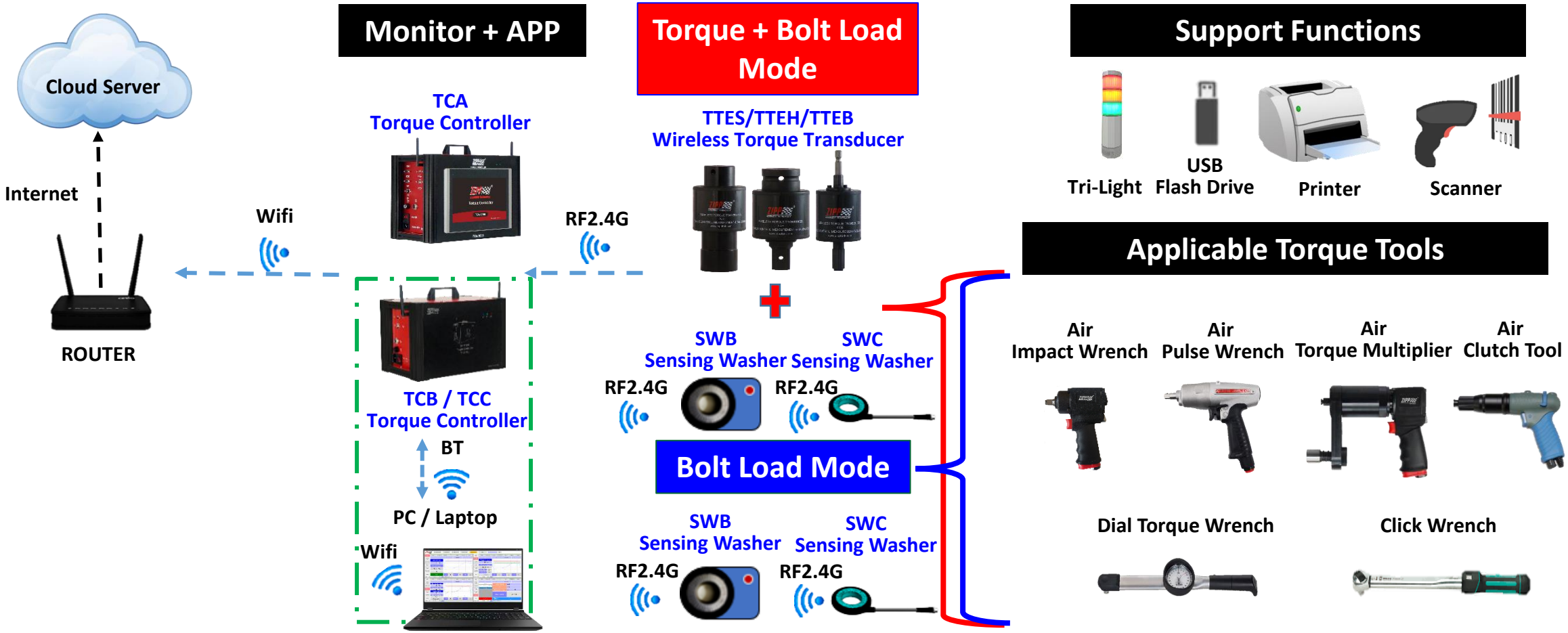
Bolted Joint Status Monitoring

P.109～P.112

Application Examples

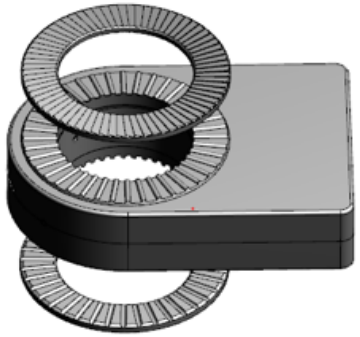
Bolt Load Control During the Process

The best alternative of ultrasonic bolting technology

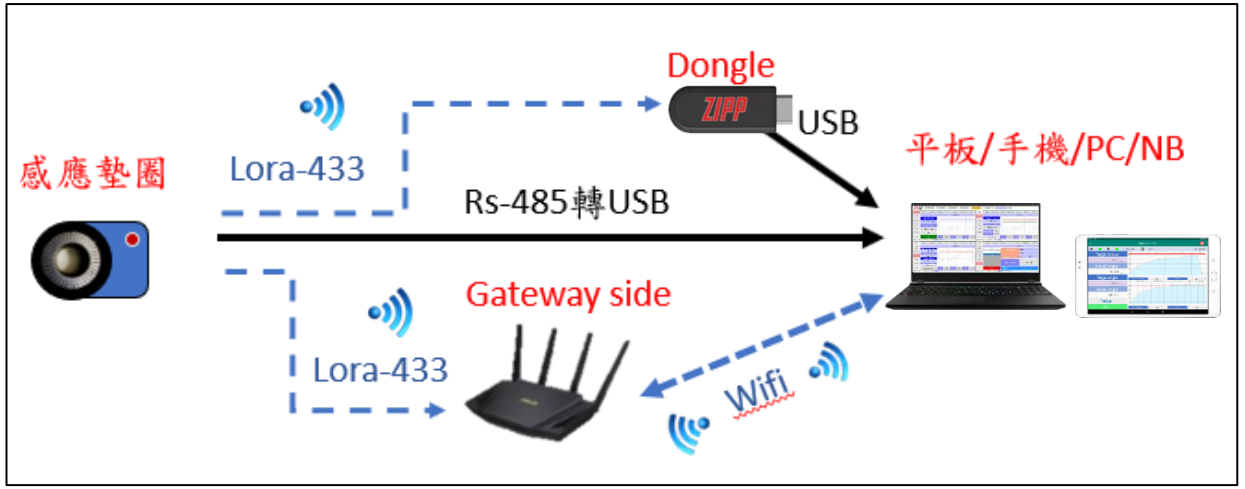


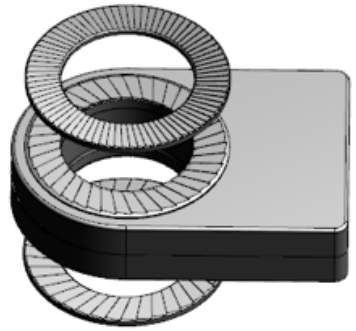
ZIPPTORK Bolt Load Control Technology

Sensing Washer (Bolting)



Sensing Washer SWR with **RIPPLOCK** type face on both ends + A pair of hardened washer (HV 650) with serrated face toward opposite side of the **Sensing Washer** and concave radial ribs to match radial ribs of **RIPPLOCK** face on both end of the Sensing Washer.





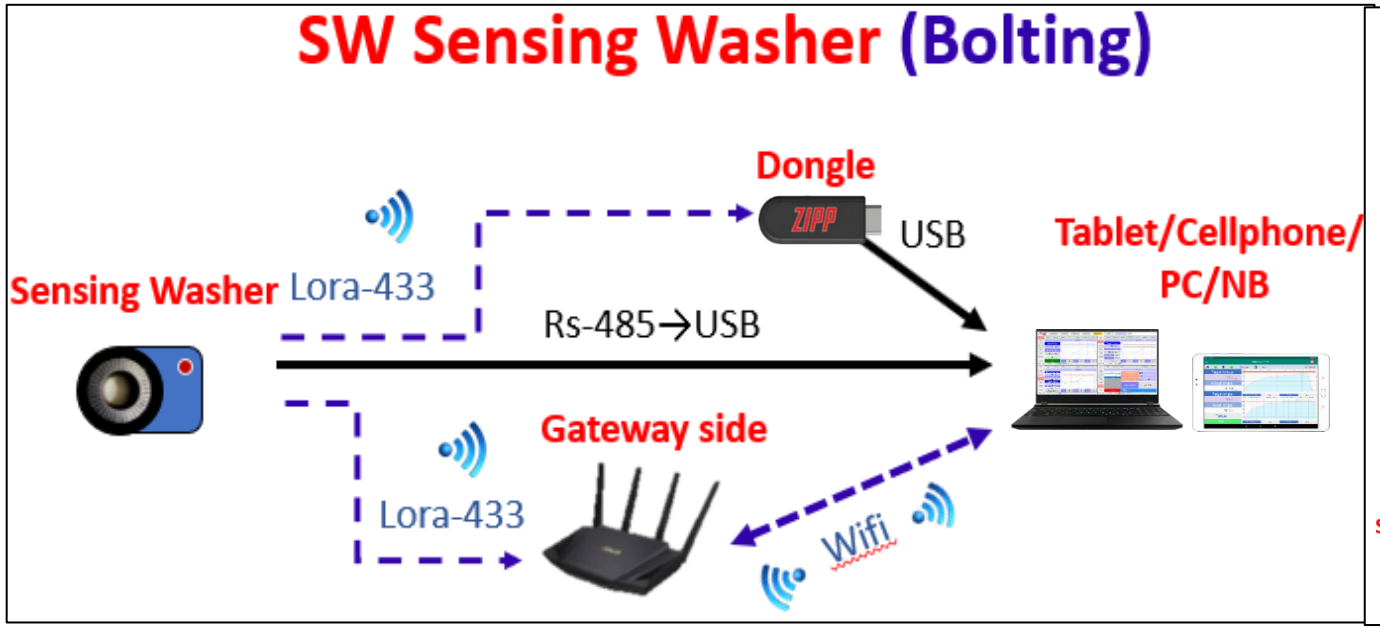
Sensing Washer SWN with **NORDLOCK** type face on both ends + A pair of **NORDLOCK** type lock washer with serrated face toward opposite side of the **Sensing Washer** and wedge face to match **NORDLOCK** wedge locking face on both end of the Sensing Washer

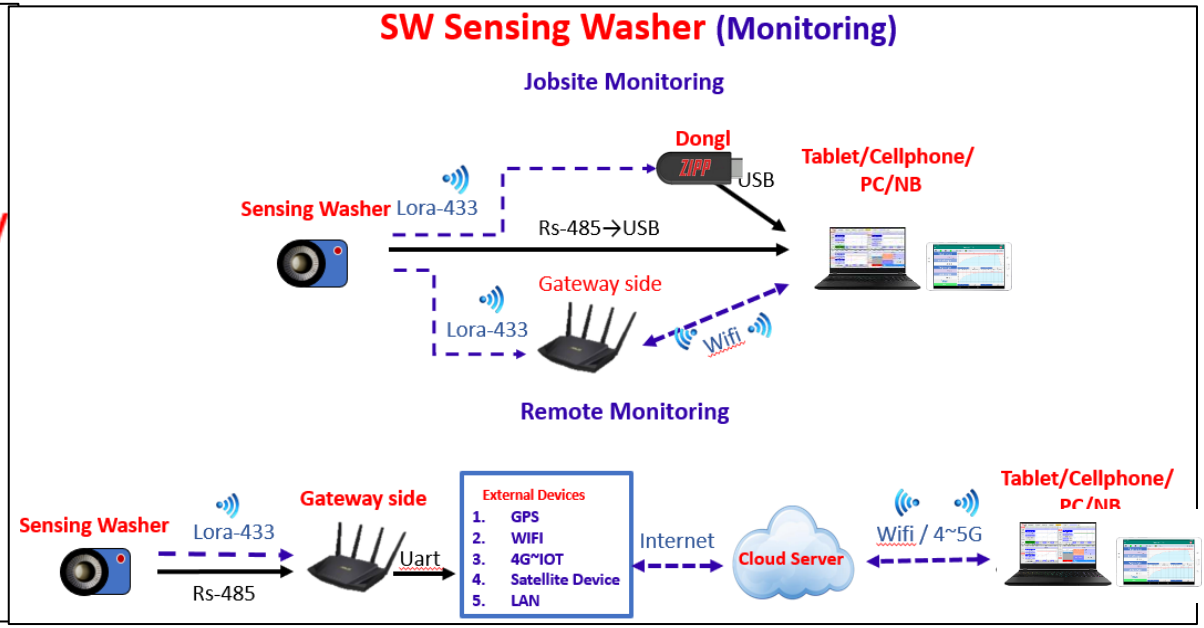
ZIPPTORK Bolting 4.0 - Smart Bolting Alternative

The ultimate solution for thread fasteners bolting operations

Control the bolt load on the joint & keep monitoring the bolted joint status remotely

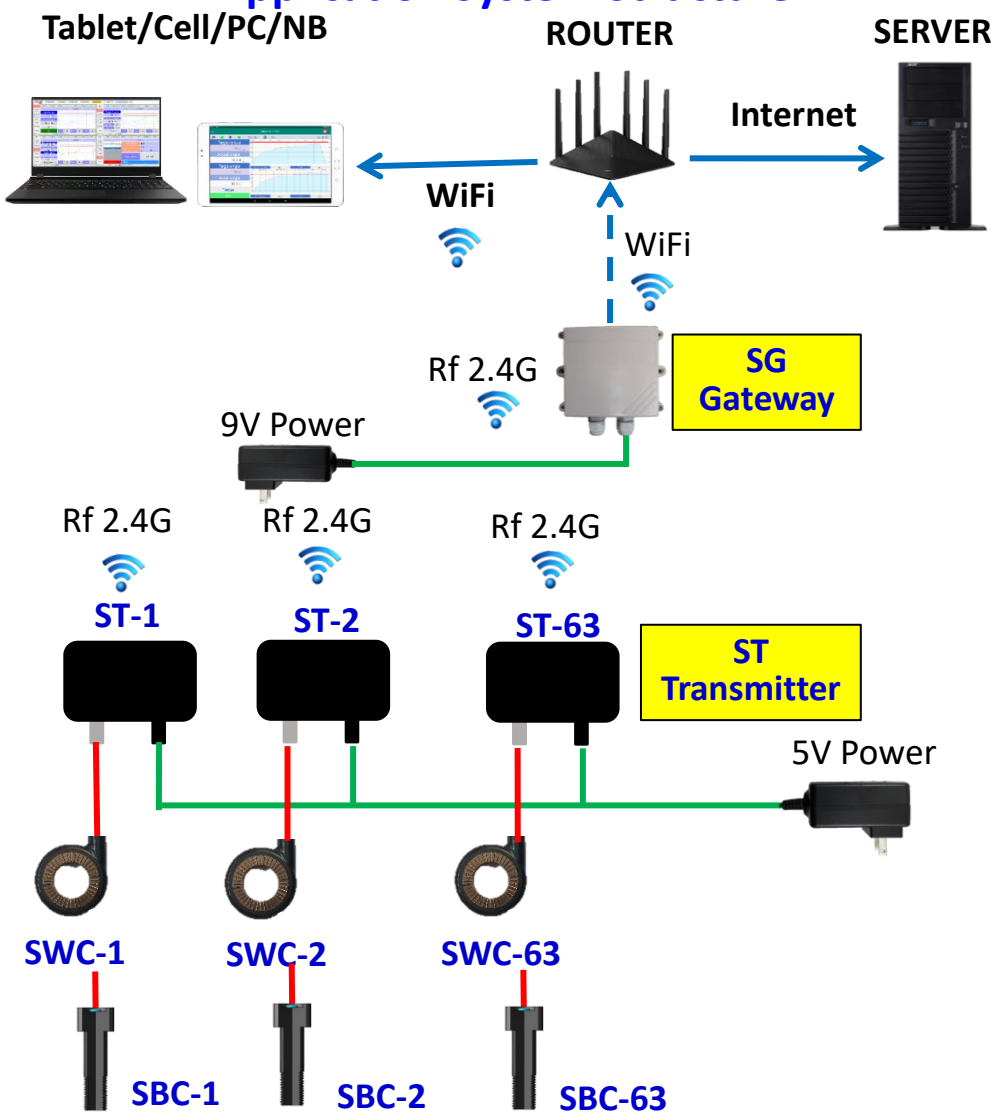
The use of anti-vibration and anti-loosening Sensing Washer + Signal Transmitter + Gateway to control the threaded fastener to achieve uniform bolt load (clamping force) not only can replace the currently commonly used ultrasonic bolting technology, in addition to monitoring the bolted joint status, continuously or periodically while detecting the ambient temperature or vibration of the bolted transmission device and raising a warning as soon as abnormal for doing an excellent job of machine and equipment preventive maintenance, and effectively improve safety and equipment crop rate.





Sensing Washer/Sensing Bolt-Wireless Remote Monitoring

Application System Structure



Demo Video

Wireless Remote Monitoring

Application Architecture

- SWC-Sensing Washer
- SBC- Sensing Bolt
- ST-Transmitter
- SG-Gateway
- Router
- Server
- APP
- Tablet/Cell/PC/NB

Software

- Multiple Units
- Multiple Languages
- Abnormality record
- Bolt Load Limit Setting
- Ambient Temperature upper Limit Setting
- Power Capacity Lower Limit Setting
- Location Setting
- Notification Mailbox Setting
- Notification Message Setting
- Update time setting

Application

1. Software configuration via RF wireless link ST-Transmitter and SG-Gateway enables monitoring of up to 63 SWC-Sensing Washers / SBC-Sensing Bolts.
2. After connecting to the SG-Gateway with the software, establish the serial number and information update method (how often to update) for all SWC-Sensing Washer / SBC-Sensing Bolts to be monitored.
3. Connect to the nearest wireless Router via WIFI connection.
4. Login to the MQTT server, set all the SWC-Sensing Washers / SBC-Sensing Bolts, the upper and lower limits of each item to be monitored, and (if necessary) the number of SWC-Sensing Washers / SBC-Sensing Bolts, the upper and lower limits of each data to be monitored (clamping force, temperature, vibration, power, location of SWC-Sensing Washers / SBC-Sensing Bolts
6. When the system finds that the monitored data exceeds the set upper and lower limits, the system will display NOK on the UI until the data is improved.
7. The system will notify the contact person through Email or SMS when the system finds any data abnormality.
8. The system will record the time of each abnormal data.