DOGA®
ASSEMBLY
TECHNOLOGY

ParaMonAir
PC Software
BM Series

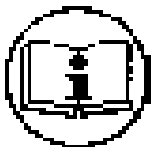
OPERATION MANUAL

IMPORTANT



The tool delivered with this manual may have been modified for specific needs. In that case, please give us the tool code number written on our shipping note or the approximate tool delivery date when you place an order for a new similar tool or for spare parts.
In that way, you will be sure to get the required tool and/or spare part.

WARNING



This information has to be kept in a location known by all users.



Each operator has to read carefully this manual before installing, using, and mending the product.

Be sure that the operator has understood using recommendations and the meaning of signs put on the product.

Most accidents could be avoided respecting this Manual Instructions. As a matter of fact, they were created according to European laws and norms regarding products.

In each case, please respect and follow safety national norms. Do not take off nor damage the stickers or advise put on the product and above all the details imposed by the law.

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1. Software installation

1.1 Required PC specification

- OS : Windows 7 or later version

- COM port : USB 2.0

- Wireless communication : Wi-Fi

1.2 Software

- Software file : ParaMon Air v0.00 yyyymmdd.zip

- Install file : setup.exe

The higher version of software will overwrite the lower version of ParaMon Air software.

2. Operation

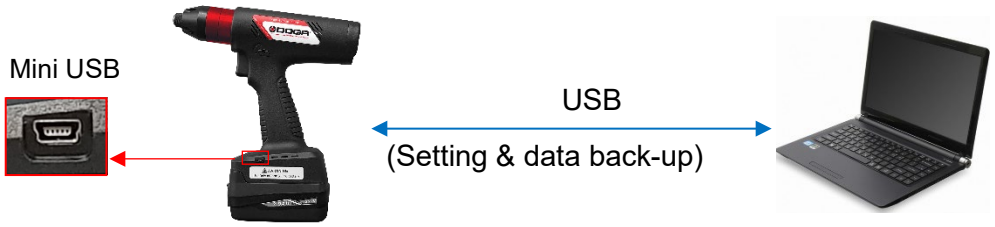
2.1 Connection

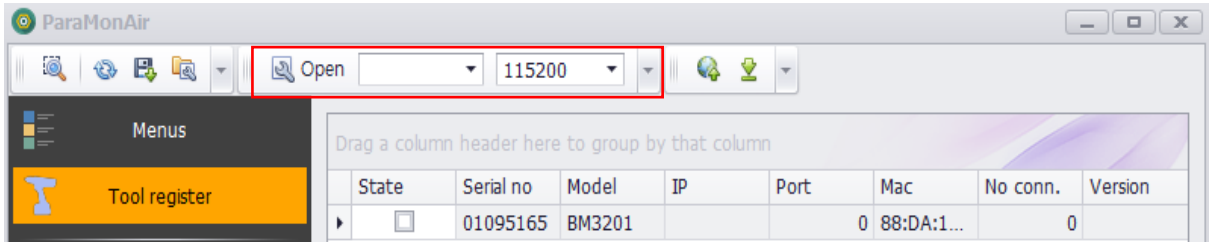
ParaMon Air pc software have 2 selectable connecting options to the BM screwdriver**.**

2.1.1 USB Serial COM port

USB connection requires the information about COM port, Baud rate.
Click refresh icon ( ) to find the selectable COM port no. The factory default setting of baud rate is 115,200 bps.
Click Open (Open/Close) to activate connection.

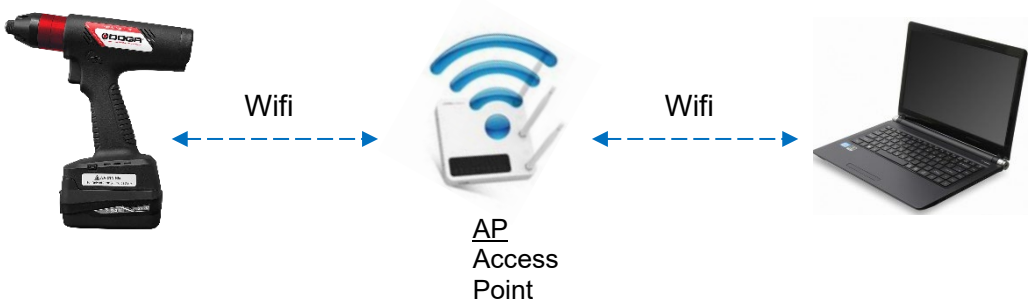
Once the connection is successful, the Client (tool) information will be displayed





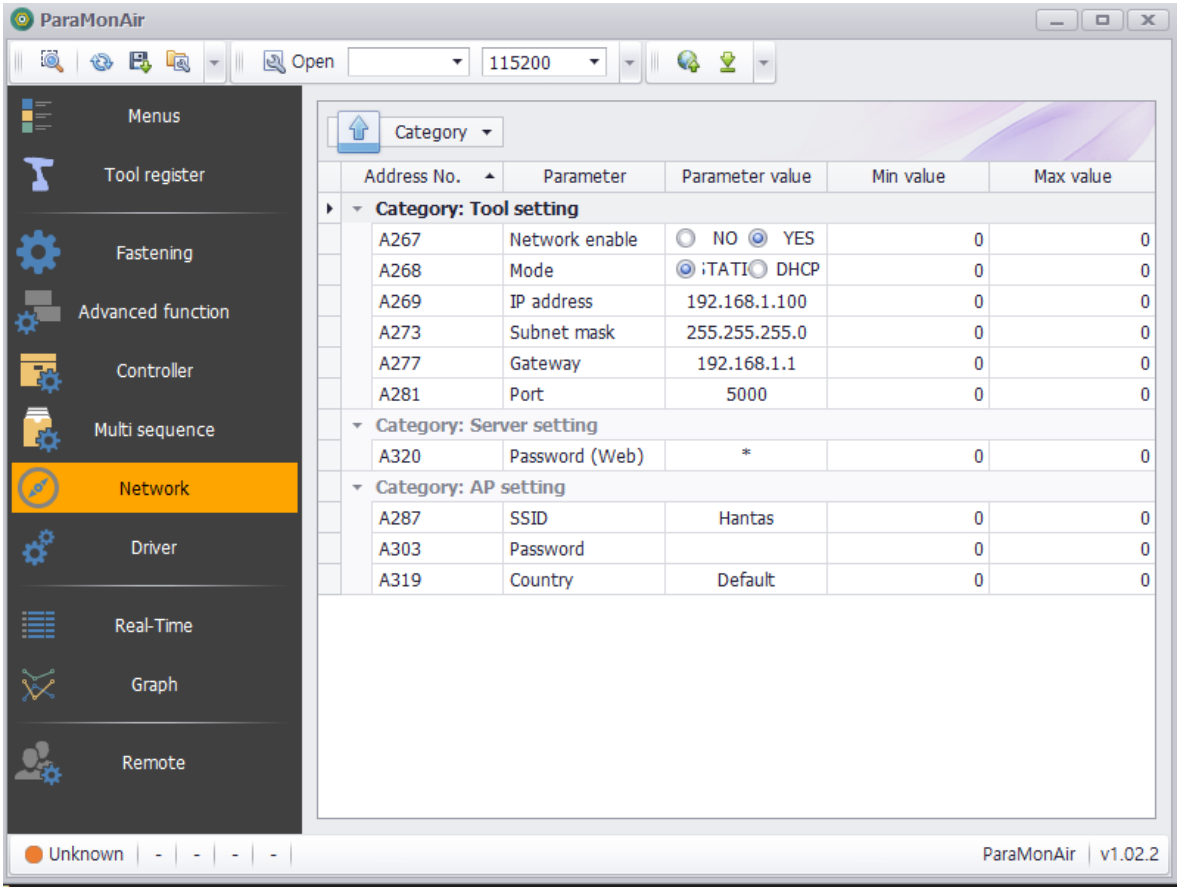
2.1.2 Wi-Fi connection & Prior setting

Prior to make Wifi connection, the parameters should be correctly managed for all required information about the tool, AP and server(PC) through USB port connection



The tool as a client always try to search and connect to the server (PC) through the AP.

All network information as show below should be saved in the tool for Wifi connection.



• PRIOR : required parameter setting to use Wi-Fi connection

- Connect the PC to BM screwdriver via USB.

- Open ParaMon Air software and make parameter settings on Network menu as below.

Tool setting

	Network should be ENABLE to be activated.
A268	IP address can be allocated automatically by the AP whenever the tool system is booted (DHCP) or can be fixed by manually (STATIC).
A269	IP address of the tool that is allocated by the AP. If it is used with STATIC, Keep the same 3 address (192.168.0.-) and have the other number for the last address. The last one should be different with your PC's one.
A273	Subnet mask (255,255,255,0) – No change
A277	Gateway (192.168.0.1) – No change
A281	Port (5000) – No change

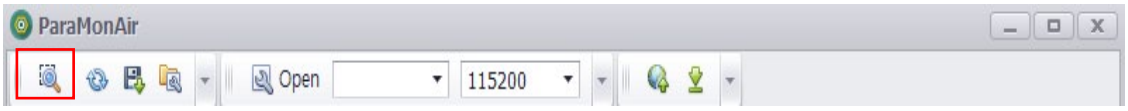
AP (Access Point) setting

A287	SSID of the AP
A303	Password to access to the AP
A319	Country / Depend on the country, there can be regional regulation of Wifi signal operation. Select the country when the tool is operated in the listed country.

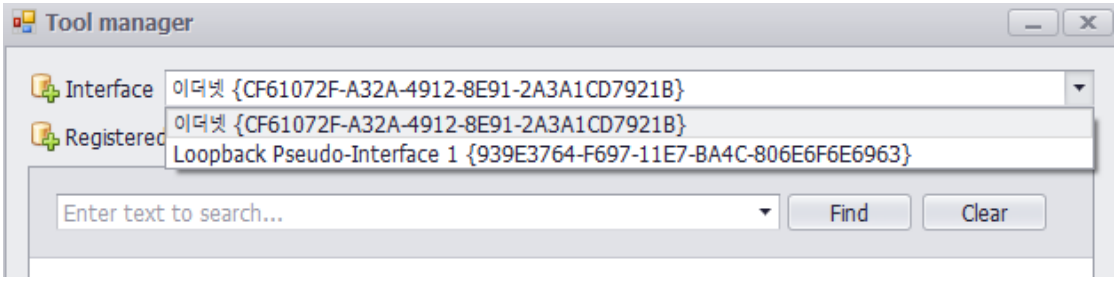
Once the settings are completed, the BM tool should be reboot by disconnecting and connecting the battery pack. Then the network settings are refreshed.

Every single tool should have the same process to be connected to the server PC.

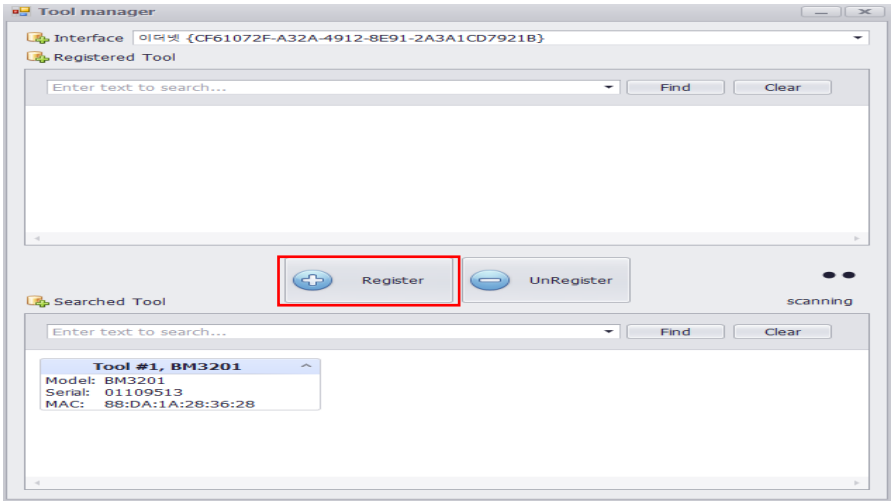
2.1.3 Register Tool to ParaMon Air



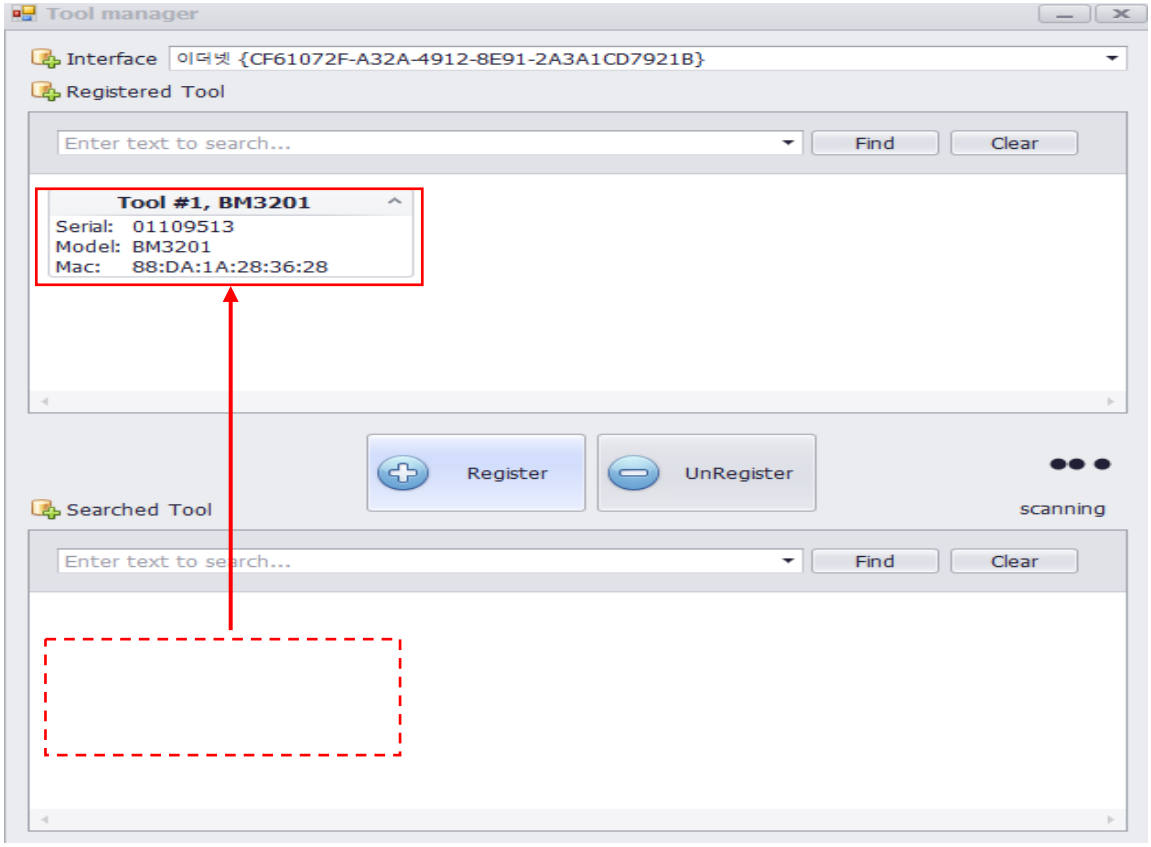
- Click the above icon (Tool manager)



- Select Ethernet or Wi-Fi depend on the connection.

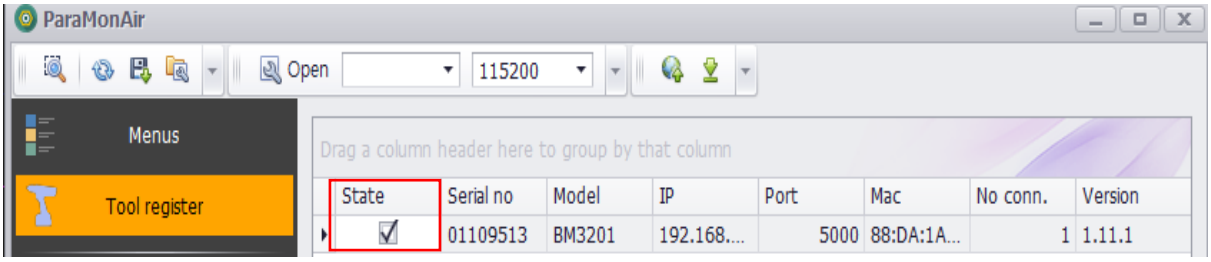


- Once the Searched Tool is displayed on the window of Searched Tool, click Register.



- The registered tool will be connected automatically on the ParaMon Air.

(The tool can be connected to the one PC only.)



- If the tool is connected to PC on ParaMon Air, State will display V mark.

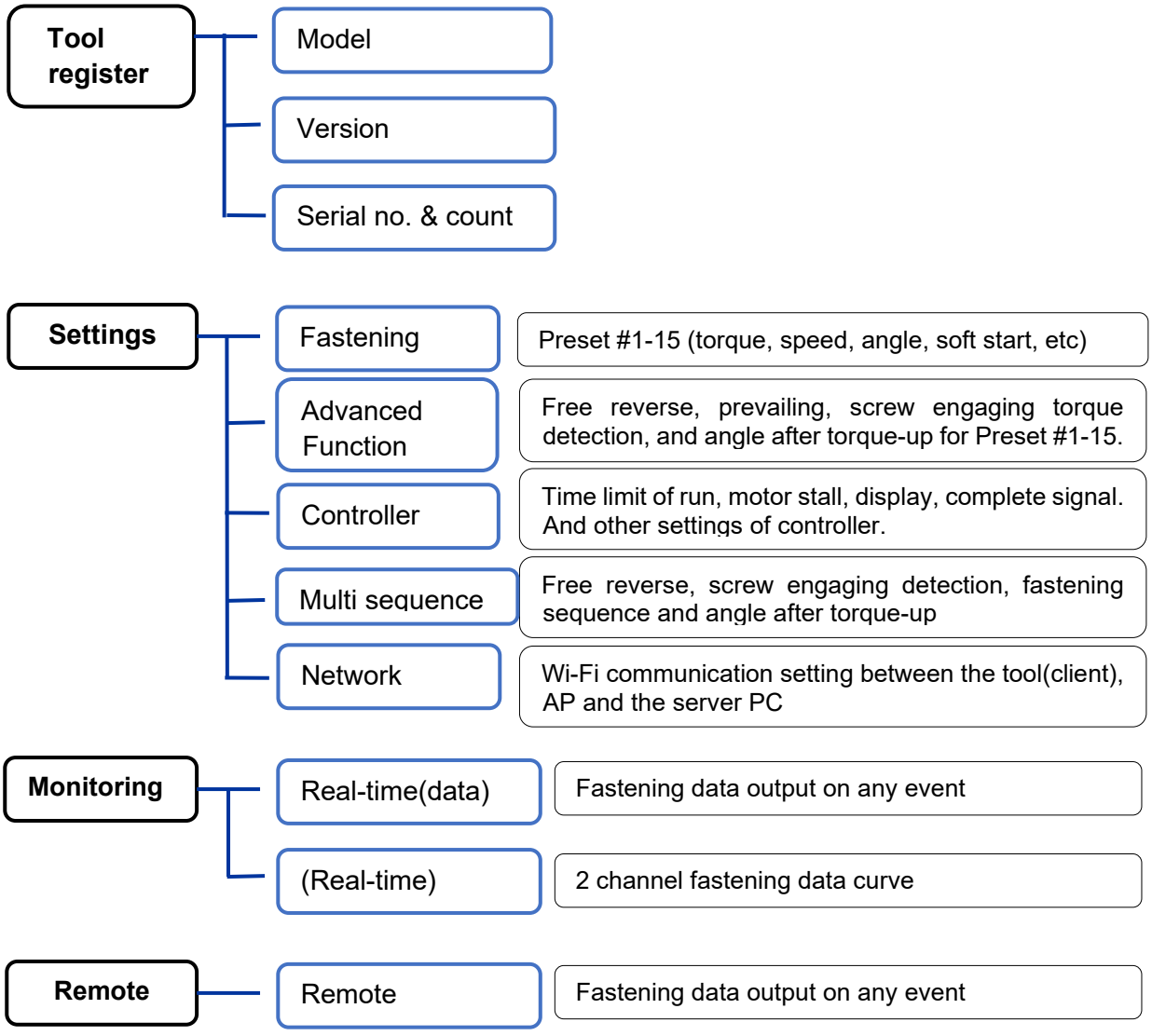
Multiple tools can be registered on ParaMon Air.

Select one of them to change parameters or monitor data.

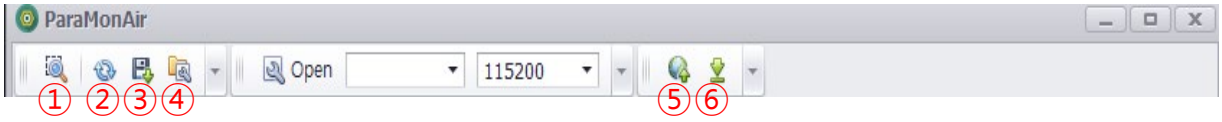
2.2 Menu

There are the top icon menu and 4 main menu at left side on the ParaMon Air pc software.

- **Tool Register** (client info – model, version, serial no. count)
- **Parameters** (fastening, Advanced function, controller, multi-sequence, network)
- **Monitoring** (real-time data, graph)
- **Remote** (remote control)



2.3 Top icon menu



① **Tool manager :** Search tool and Register or Unregister tool.

② **Refresh display:** to read the data from the tool and display on the ParaMon Air.

③**Back-up file creation :** to create the parameter setting back-up file. The file format is csv.

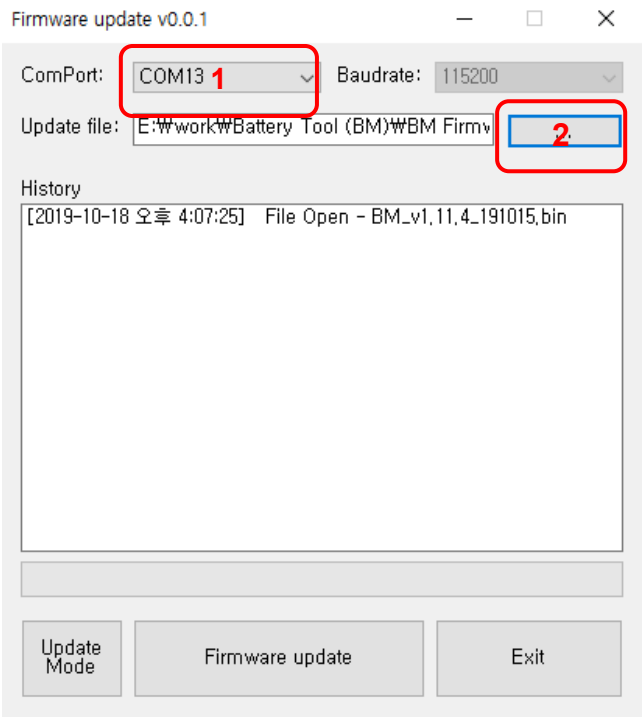
④ **Load file :** The parameter back-up file is loaded to the BM tool.

⑤ **Firmware update :** It opens the Pop-up software for firmware update. Before open the firmware update pop up software, disconnect the USB connection with the ParaMon Air.

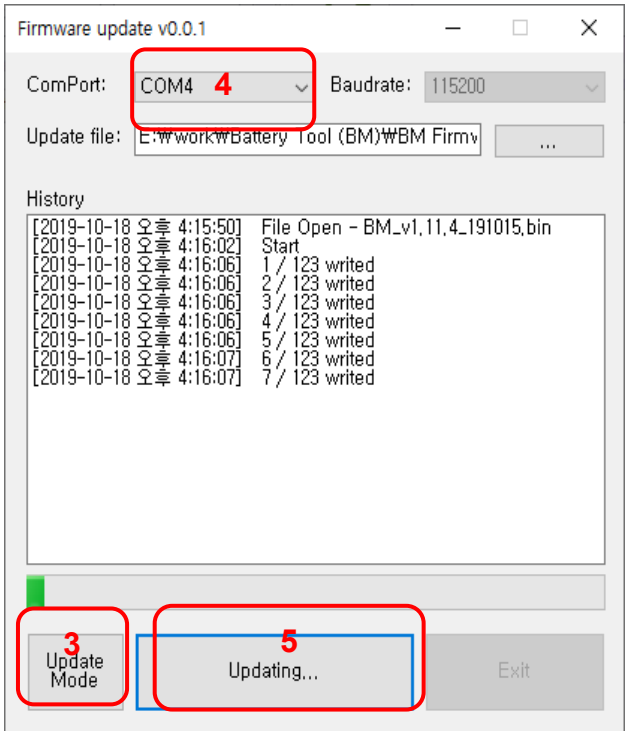
⑥ **Data download from the tool** by USB.

2.3.1 Firmware update (Pop-up software)





1. Select Com port.
2. Open the firmware file



3. Click [Update Mode]
   and check the LCD display of BM tool.
   The screen should display " BM Series bootloader v.x.x.x "



4. Click the COM port again and select the activated one.
   It is normally reflash. Because the tool is rebooted by the bootloader mode

5. Click [Firmware update] and monitor the updating process as shown on the above picture

**** Remark
If the tool screen already display "BM Series bootloader v.x.x.x" which is the update mode, start from no.4. Do not click [Update Mode].

If the updating is not completed by cable connection failure or any reason, reboot the BM tool by disconnecting battery pack.

2.3.2 Data download from the tool (Pop-up software)

The BM tool has the internal data memory to save all fastening data.
This pop up software is for data download from the tool by USB connection.

1. Disconnect any other USB connection before opening this software.

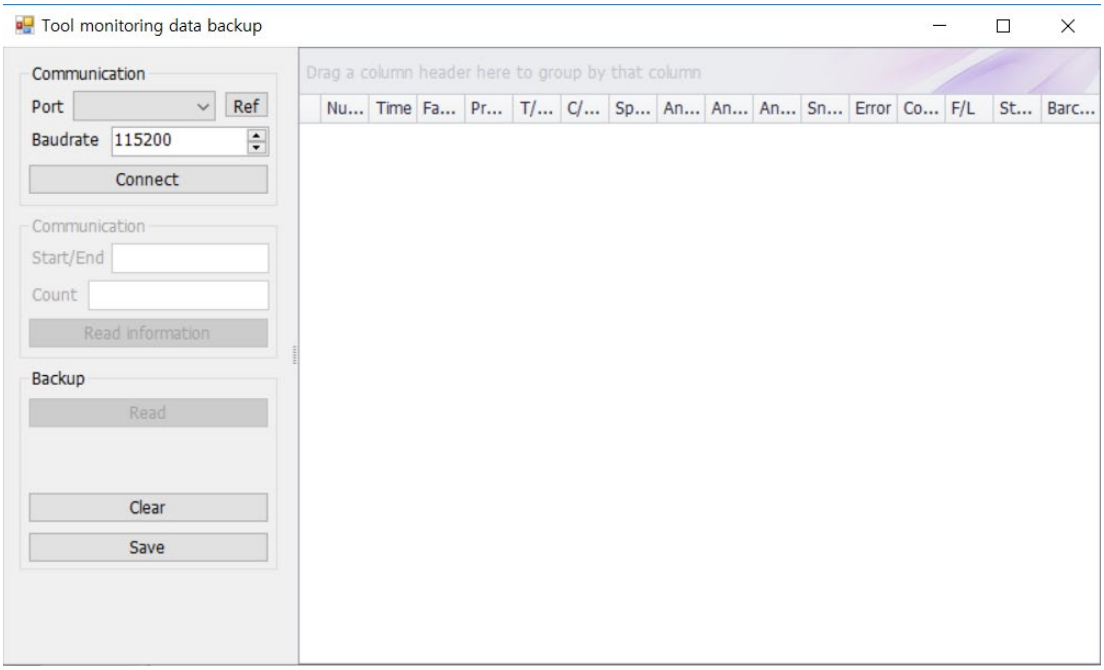
2. Make a correction setting of Com port and baudrate anc click “Connect” icon.

3. Click “Read information” icon to find that how many data are saved which are not downloaded.

4. Click the icon “Read”. Then all data which were not downloaded will be downloaded in same time. Be sure that the data memory of the tool will be clear when the data is downloaded.

5. The downloaded data should be saved in other place.

Total 65,000 fastening data can be saved in the internal memory of the tool.
If they are not downloaded, the data will be refreshed with the latest 65,000 data.

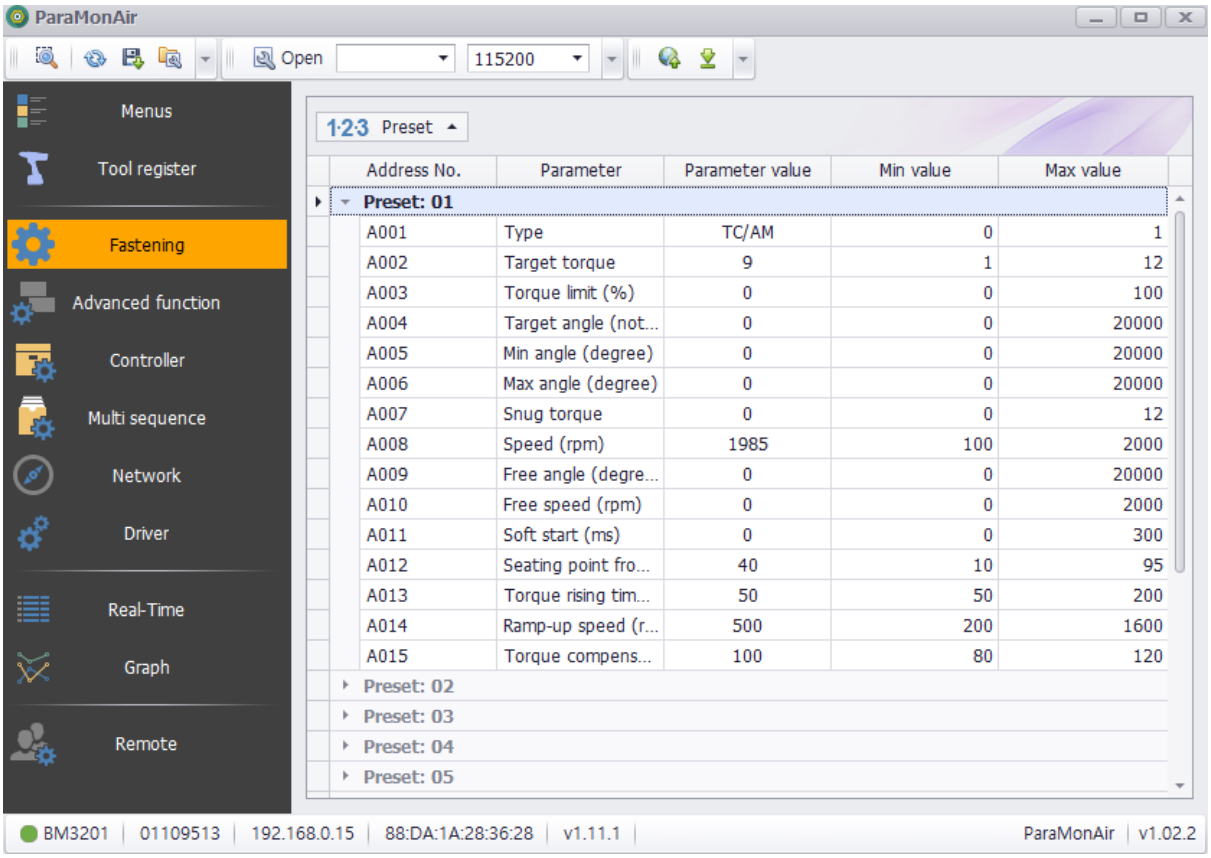


Once the reading is completed, the count no. will be “0” on communication section.

To read again, key in the number of data on the Count field, and click Read

2.4 Main menu

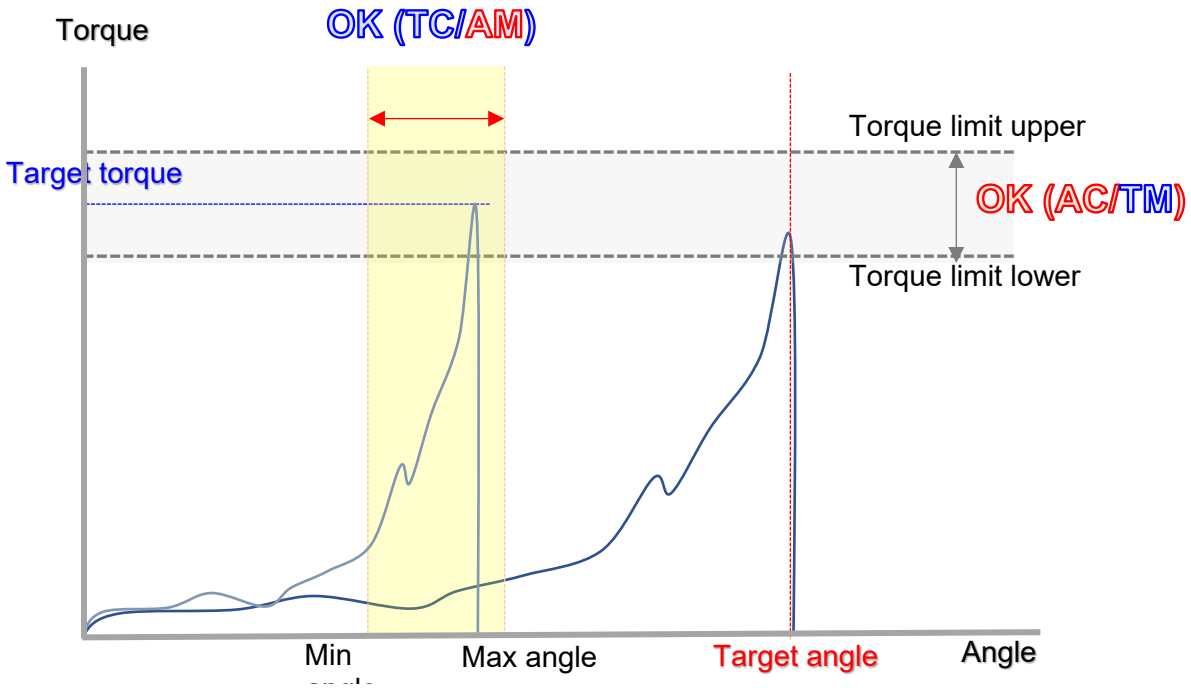
2.4.1 Fastening



There are 15 preset groups for fastening setting. Each preset # consists of torque, speed, Min & Max angle for fastening OK range, soft start, Free speed before tightening.

- **Control type** : TC/AM or AC/TM
  (torque control angle monitoring or angle control torque monitoring)
- **Torque** : Target torque
- **Torque limit (%)** : OK torque range in AC/TM mode
- **Target angle** : Target angle in AC/TM mode
- **Min angle (degree)** : Minimum angle to be OK in TC/AM mode
- **Max angle (degree)** : Maximum angle to be OK in TC/AM mode
- **Snug torque(%)** : Point (% from target torque) to start monitoring angle in TC/AM mode
- **Speed** : Target speed. Speed is changed by torque setting automatically. To change manually, Auto Speed must be Disabled in Control 2
- **Free speed** : Manual setting speed. Shift back to the auto speed after the free angle running
- **Free angle :** Angle for Free speed.

- **Soft start(mS)** : Speed reach to the target in the setting time
- **Seating point(%)** : The point that the screw bottom face touch down to the workpiece face. The rundown speed will be slow down to ramp-up speed and increase the power up to the target torque. If the ramp-up time is too long on the soft joint, increase the seating point accordingly.
- **Torque rising time(mS)** : Time setting from seating point to the target
- **Ramp-up speed(rpm) :** Speed after seating to the end of tightening.
- **Torque compensation(%)** : Every Preset # has the torque compensation value. If the reading torque is not same as the target torque on the torque meter, adjust compensation value from 100% to + or -. For example, 110% will increase the output torque 10% up.

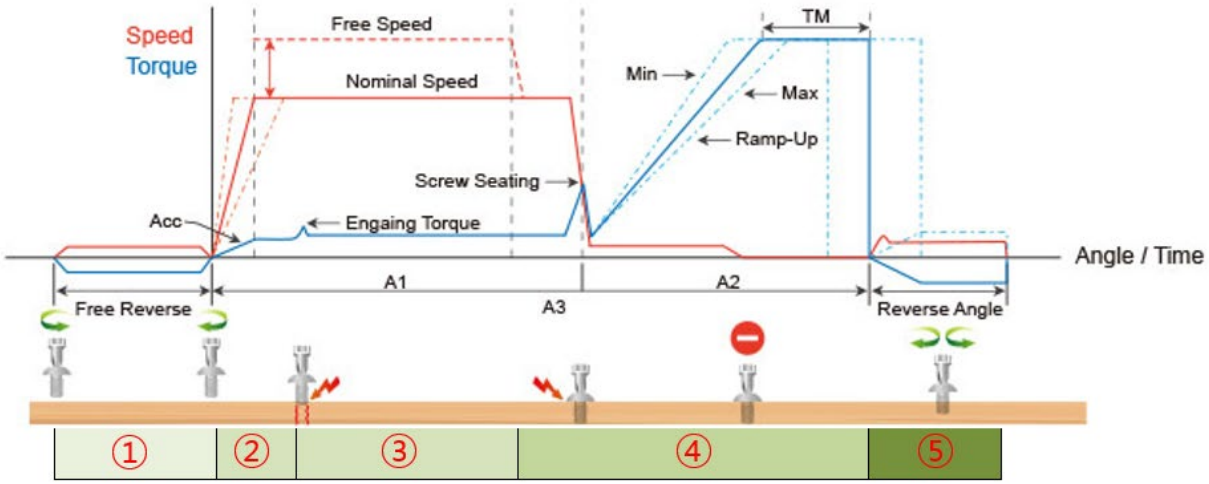


2.4.2 Advanced function

There are total 15 Advanced function settings which is combined to each Preset #.
Advanced #1 is combined to Preset #1. Same combination for all other numbers.
Advanced function setting have 4 group of setting

- Free reverse rotation (Speed and angle)
- Prevailing
- Engaging torque detection
- Angle after torque-up

Address No.	Parameter	Parameter value	Min Value	Max Value
Advanced: 01				
Category: A. Free reverse rotation				
A500	Speed (rpm)	0	0	0
A501	Angle (turn)	0	0	0
Category: B. Thread tapping				
A502	Min torque (unit)	0	0	0
A503	Max torque (unit)	0	0	0
A504	Speed (rpm)	0	0	0
A505	Finish torque (unit)	0	0	0
A506	Angle start from thread t...	○ NO ○ YES	0	0
Category: C. Engaging torque detection				
A507	Speed (rpm)	0	0	0
A508	Torque (%)	0	0	0
A509	Angle limit (turn)	0	0	0
A510	Time limit (sec)	0	0	0
A511	Angle start from engaging	○ NO ○ YES	0	0
Category: D. Angle after torque-up				
A512	Speed (rpm)	0	0	0
A513	Angle (degree)	0	0	0
A514	Direction	○ FOWARD ○ REVERSE	0	0



There are 4 Advanced Function settings to customize the screw fastening process.

Step 1 (Optional)
Free Reverse rotation
Start rotation from reverse to guide the screw into the screw hole smoothly with low speed, and change it to the forward rotation in fastening process

Step 2 (Optional)
Engaging torque detection
The monitoring angle count is reset and start again from the engaging torque selection point which the screw start joining the thread. It is possible only when the screw engaging provide significantly higher torque than previous free run.
Engaging torque setting is by percentage of target torque.

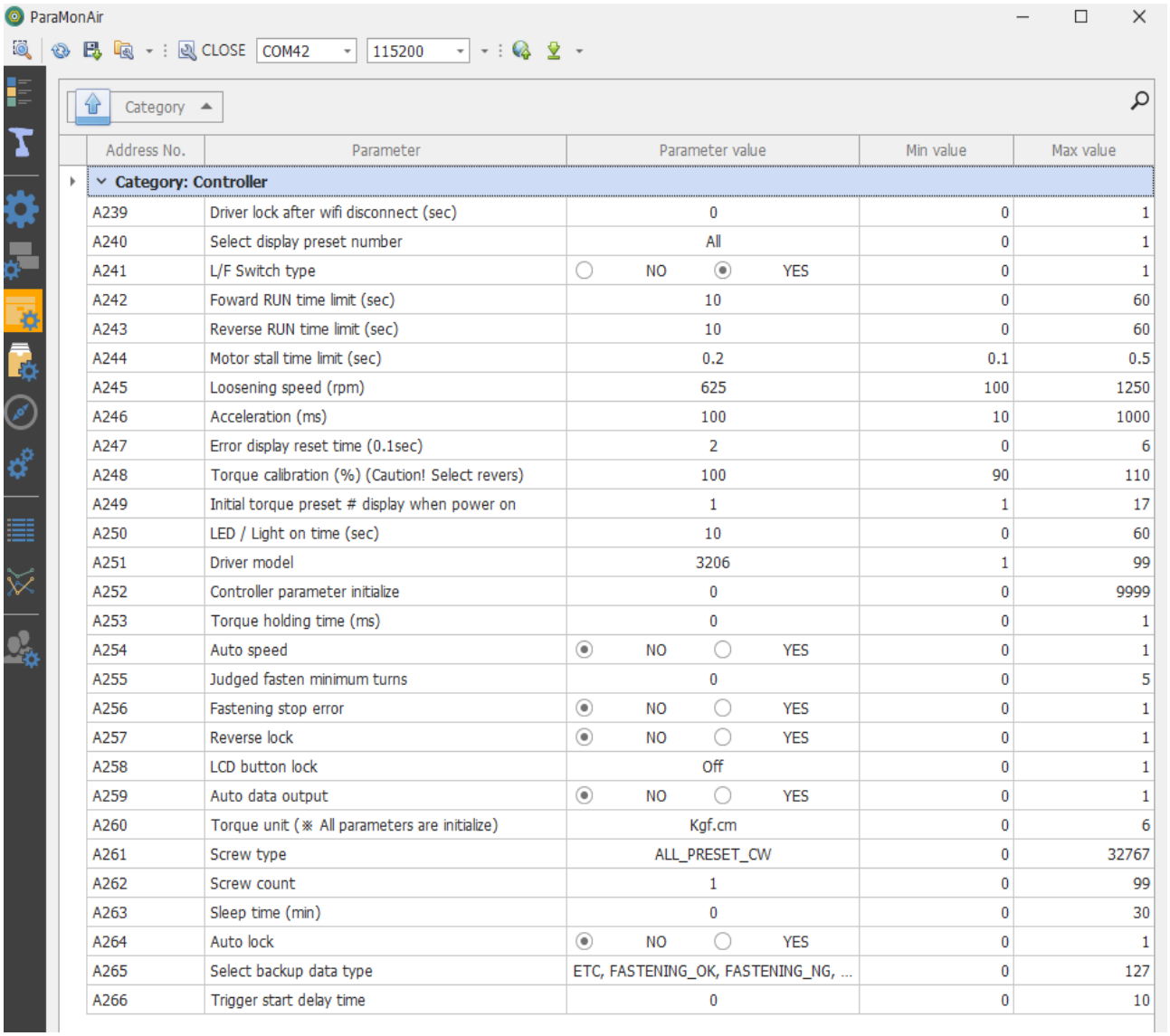
Thread tapping
If the thread cutting torque is higher than the target torque for self threading screw application, there can be two different target torque – Thread tapping torque and Fastening torque. After prevailing rotation, it change the condition to the fastening setting.

Step 3 (Preset)
Free Speed
The system auto speed by torque setting can be manually replaced to have higher or lower speed than it's original auto speed during the limited angle setting. Be sure that the free speed run should stop before the screw seating point which screw start to tightening joint. To use this option, go the Fastening setting menu.

Step 4 (Preset) …… refer to the parameter - Fastening
- Seating point(%)
- Torque rising time(mS)
- Ramp-up speed(rpm)
- Torque holding time : Keep the target torque for the time of Tm setting

Step 5 (Option)
Angle after torque-up
It manages extra angle control in both forward or reverse direction after screw tightening by torque.

2.4.3 Controller



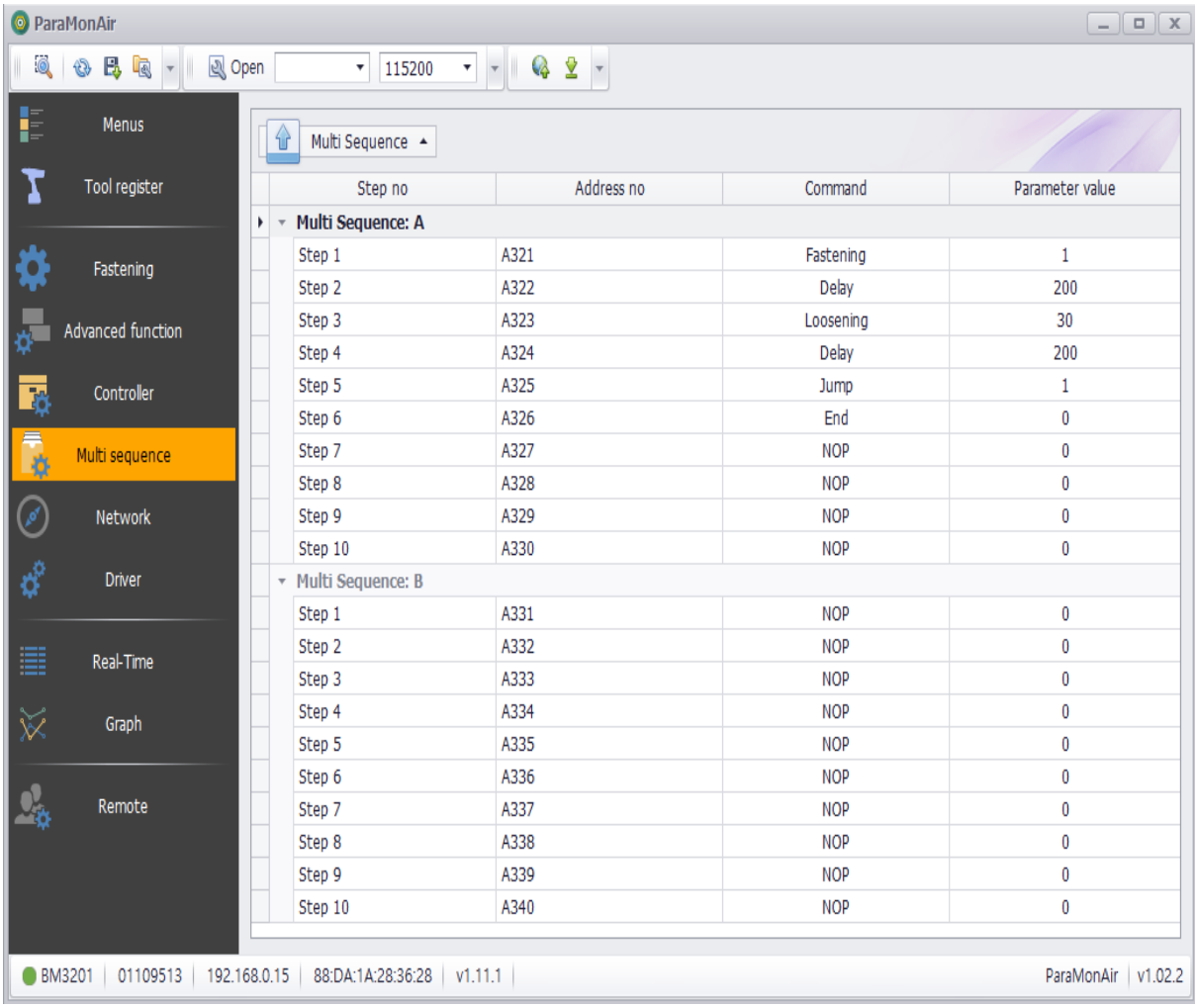
Address No.	Parameter	Parameter value	Min value	Max value
Category: Controller				
A239	Driver lock after wifi disconnect (sec)	0	0	1
A240	Select display preset number	All	0	1
A241	L/F Switch type	○ NO ◉ YES	0	1
A242	Foward RUN time limit (sec)	10	0	60
A243	Reverse RUN time limit (sec)	10	0	60
A244	Motor stall time limit (sec)	0.2	0.1	0.5
A245	Loosening speed (rpm)	625	100	1250
A246	Acceleration (ms)	100	10	1000
A247	Error display reset time (0.1sec)	2	0	6
A248	Torque calibration (%) (Caution! Select revers)	100	90	110
A249	Initial torque preset # display when power on	1	1	17
A250	LED / Light on time (sec)	10	0	60
A251	Driver model	3206	1	99
A252	Controller parameter initialize	0	0	9999
A253	Torque holding time (ms)	0	0	1
A254	Auto speed	◉ NO ○ YES	0	1
A255	Judged fasten minimum turns	0	0	5
A256	Fastening stop error	◉ NO ○ YES	0	1
A257	Reverse lock	◉ NO ○ YES	0	1
A258	LCD button lock	Off	0	1
A259	Auto data output	◉ NO ○ YES	0	1
A260	Torque unit (※ All parameters are initialize)	Kgf.cm	0	6
A261	Screw type	ALL_PRESET_CW	0	32767
A262	Screw count	1	0	99
A263	Sleep time (min)	0	0	30
A264	Auto lock	◉ NO ○ YES	0	1
A265	Select backup data type	ETC, FASTENING_OK, FASTENING_NG, ...	0	127
A266	Trigger start delay time	0	0	10

Forward / Reverse motor RUN time, and motor stall time is limited for motor safety. The following parameters is ideally recommended to be kept with factory setting in all application.

Address	Parameter	Description
A239	Driver lock after wifi disconnect	Time to driver Lock from Wi-Fi disconnected
A240	Select display preset number	Selectable Preset #s on Driver LCD display
A241	L/F Switch type	Loosening / Fastening select
A242	Forward RUN time limit	Run limit to forward rotation
A243	Reverse RUN time limit	Run limit to reverse rotation
A244	Motor Stall time limit	Time to Immediate stop from motor stalled.
A245	Loosening speed	Loosening speed for all presets (rpm)
A246	Acceleration	Slow start of motor to the target speed
A247	Error display reset time	Auto error reset time in mS
A248	Torque calibration	It is master calibration of torque. Keep “Reverse” of the F/R switch of the screwdriver during calibration.
A249	Initial torque preset# display	Preset # display when power on,
A250	LED light ON time	Whenever tool starts, LED light is turn on together for the time setting on A250
A251	Driver model	Select the right driver model
A252	Controller parameter initialize	Key in “ 77 “ to flash the parameters back to the factory settings. Warning ! Data memory is also erased. Please make backup before initializing.
A253	Torque holding time	Screwdriver keep the target torque for the set time. The long holding time can make heat issue of the motor.
A254	Auto speed	ENABLE provides the safe speed from inertia torque on the torque setting
A255	Judged fasten minimum turns	Turns off the OK/NG judgement for the truns from start on A255

A256	Fastening stop error	DISABLE does not creat any NG when the tool stops without fully tightening by torque up.
A257	Reverse lock	Reverse rotation disabled
A258	LCD button lock	the buttons on the tool locked.
A259	Auto data output	Fastening data output automatically on every events as like run, For/Rev change, torque up, preset change, etc.
A260	Torque unit	Kgf.cm / Kgf.m / cNm / Nm / ozf.in / lbf.in / lbf.ft Warning ! Whenever the unit is changed, the tool should be reboot again.
A261	Screw type	Select clockwise screw (0), counterclockwise screw(1)
A262	Screw count	Key in the total number of screw to count down
A263	Sleep time	Time setting to sleep mode. Any operation will awake the sleep mode
A264	Auto lock	Enable default driver lock until the unlock signal provided such as the barcode scanning on Job program.
A265	Select backup data	Select data to be saved in the internal memory of the tool
A266	Trigger start delay time	It is software filter to prevent chattering of the start signal

2.4.4 Multi sequence



It is one fastening cylce but consited of the mixed multiple actions in max 10 steps of programing. The start trigger should be holed during full step completed. Otherwise the cycle will stop immediately when the trigger released (Off).

There are total two programing in Multi-A and Multi-B. They are regarded as also Preset # together with Preset 1 to 15.

The preset #14 and 15 are replaced with Preset Multi-A and Multi-B on the Job program.
So Job programing uses Preset#1 to 13 and Multi-A & B under Preset#14 &15 on fastening step.
In order to use Preset#14 & 15 on Job, make program Multi-A & B as below

Multi-A
Step 1 Fastening P14
Step 2 End

Multi-B
Step 1 Fastening P15
Step 2 End

The last step should be always “End” to finish programing.

Command

Command	Description
NOP	No operation
Fastening	tool start fastening process in forward rotation
Loosening	tool start loosening process in reverse rotation
Select preset#	Select preset #
Delay	time delay for setting time
Jump	Move to the setting step
Count value = A	Total number “A” to count
Sub if (A)	Subtract 1 from “A” and save the value replacing “A” . If the value “ A” is not “0”, then move to the next lower step. If the value “ A” is “0”, then move to 2nd lower step
End	Finish multi-sequence process

[Example #1]

Setp no	Command	Parameter
Step 1	Count Value = A	10
Step 2	Fastening	1 (Preset#1)
Step 3	Delay	200
Step 4	Loosening	30
Step 5	Delay	300
Step 6	Sub if (A)	
Step 7	Jump	2
Step 8	End	

Repeat Fastening and loosening for 10 times and stop.

Step 1 : Total counting number is 10
Step 2 : Start fastening with Preset #1 and stop by torque or angle setting, and move to the next step
Step 3 : Delay 200mS (2 sec)
Step 4 : Loosen 3.0 turns and move to the next step
Step 5 : Delay 300mS (3 sec)
Step 6 : Subtract 1 from “10” and save “9” by replacing “10”. If the value “ A” is not “0”, then move to the next lower step. If the value “ A” is “0”, then move to 2nd lower step
Step 7 : Jump to step no. 2
Step 8 : End

Total 10 cycles are operated automatically by a start signal. Any failure or NG on each step, Multi-sequence process stops and provide the alarm signal. Once all steps are finished successfully, there is FASTENING OK signal output. Every successful fastening in steps provide TORQUE UP signals.

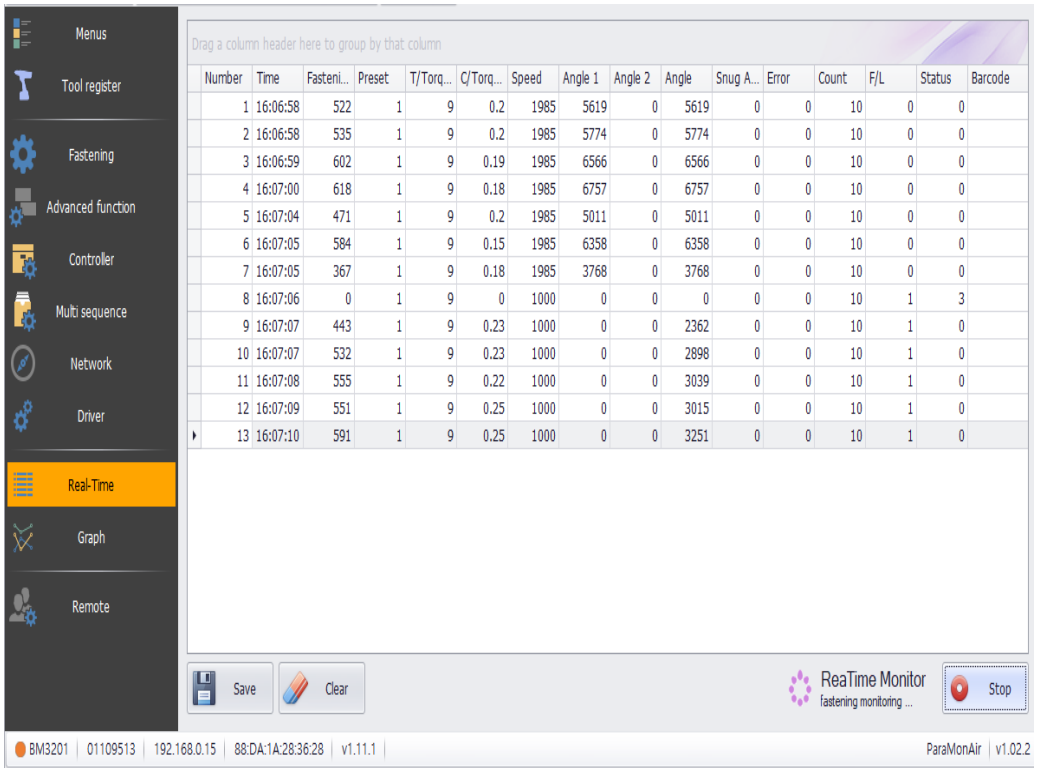
[Example #2]

Setp no	Command	Parameter
Step 1	Fastening	1 (Preset#1)
Step 2	Delay	200
Step 3	Loosening	30
Step 4	Delay	200
Step 5	Jump	1
Step 6	End	

The tool will repeat Fastening and loosening continuously until the start trigger OFF

2.4.5 Real Time Monitoring

Setting of Auto Data Out (A259) should be “ Disable “ for Monitoring

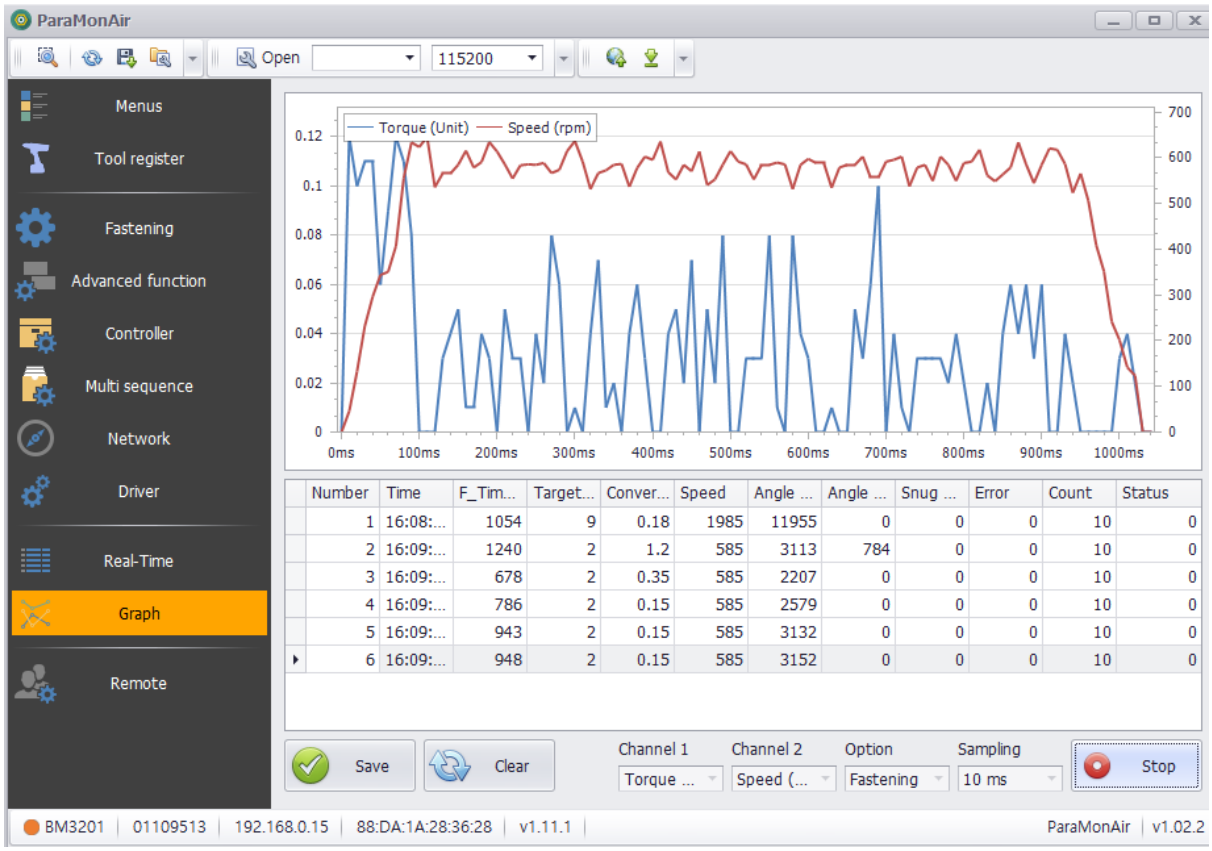


The following data are monitored automatically on every event as like motor run, torque up, Forward / Reverse change, preset # change, etc.

- Date & time
- Fastening time
- Preset #
- Target torque
- Converted torque
- Speed
- Angle 1 (angle from motor start to screw seating point)
- Angle 2 (angle from screw seating point to the end)
- Angle 3 (Angle 1 + Angle 2)
- Snug Angle(degree) : angle from snug torque to the end
- Error code
- Screw count no.
- Forward / Reverse status
- Status (Free run =0, Fastening OK=1, Fastening NG=2, F/R change=3, Preset# change=4, Al arm reset=5, System error=6, Barcode=7, Screw -1=8)
- Barcode data

The monitoring data can be saved in CSV file. And it can open the file.

2.4.6 Graph monitoring



Total 200 data in 2 channels are used to make the curve graph.

- Selectable channel : Torque, Speed, Angle(degree) and current
- Data sampling : 5ms, 10ms, 15ms
- Data display option : Fastening, Loosening, All

The monitoring data can be saved in CSV file. And it can open the file.

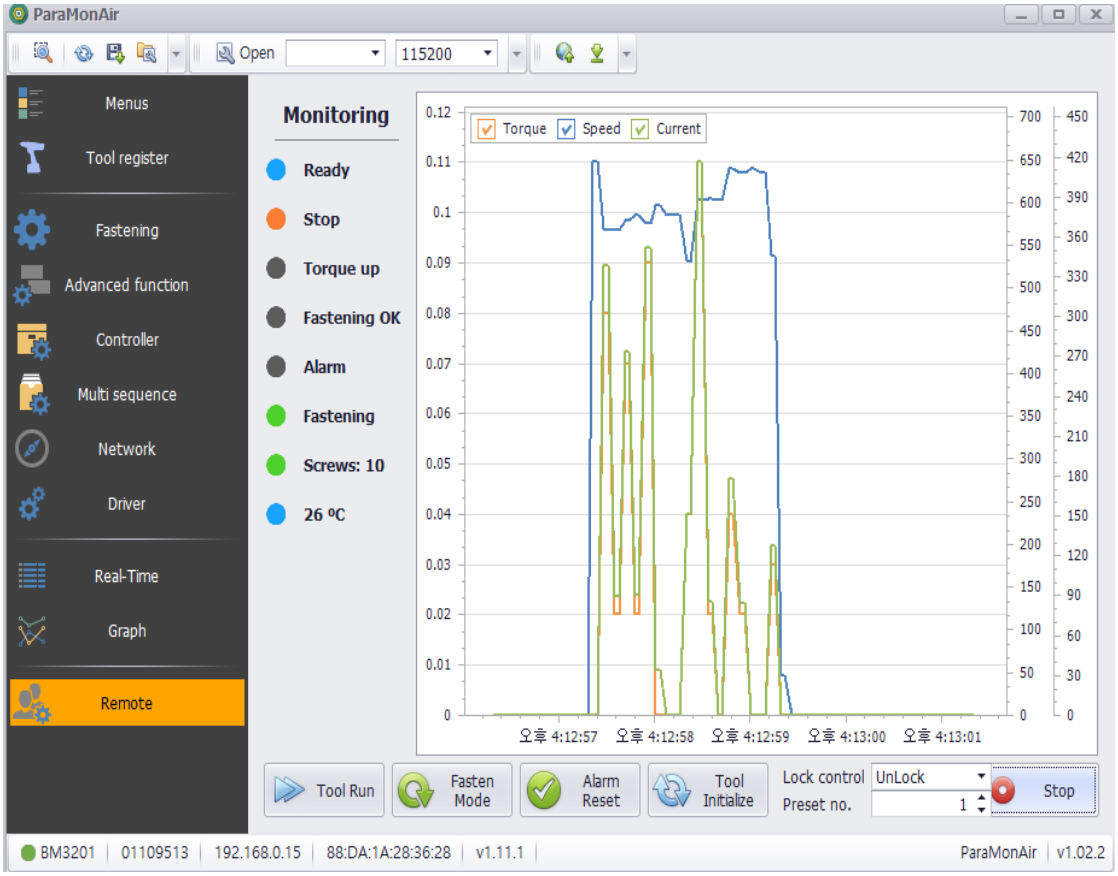
2.4.7 Remote control & I/O status monitoring

The tool is operated remotely for the followings.

- Fastening / loosening rotation,
- Tool Start
- Tool lock & unlock
- Tool initializing

The following main signal status and I/O are monitored and displayed together with torque, speed and current curves.

- Ready, Tool start/stop, Torque up, Fastening OK, Alarm, F/R, I/O

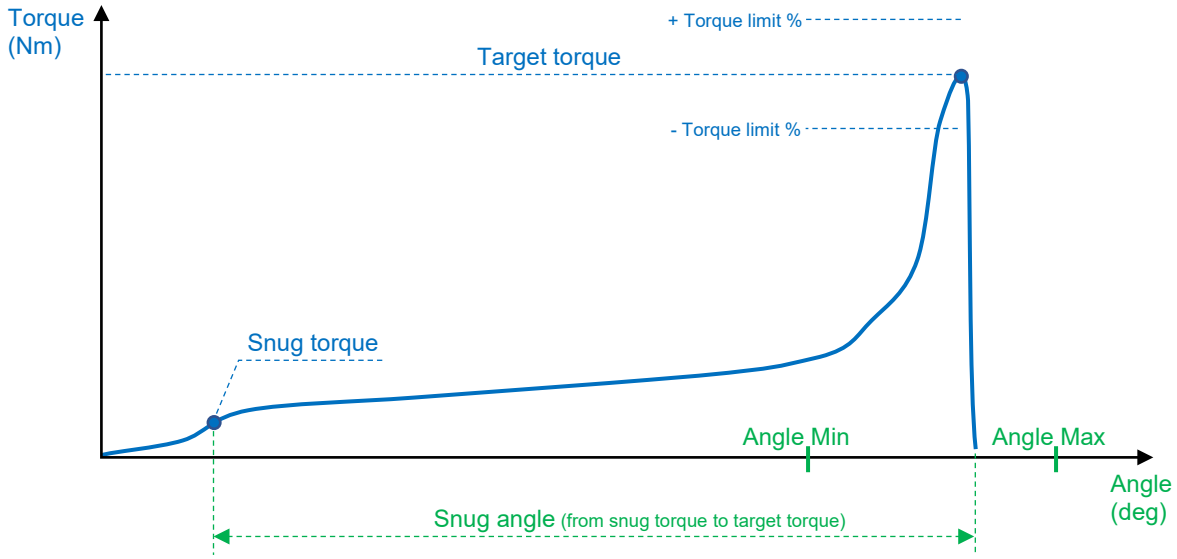


3. ADDENDUM – Programming Guide

3.1 Tightening strategy selection

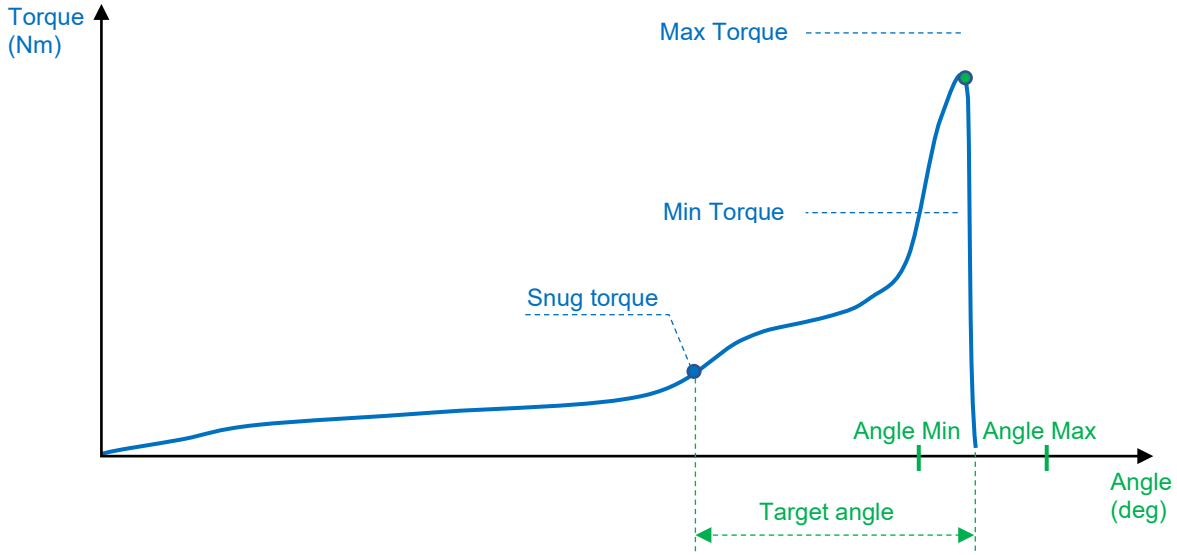
3.1.1 Torque Control / Angle Monitoring (TC/AM)

This strategy is used to tighten joints to target torque. Angle monitoring can be used to detect various tightening defects (cross-threading, thread stripping, not finished screw, wrong screw length, missing washer or other). Angle can be measured from the start of the tool or from the Snug Torque.



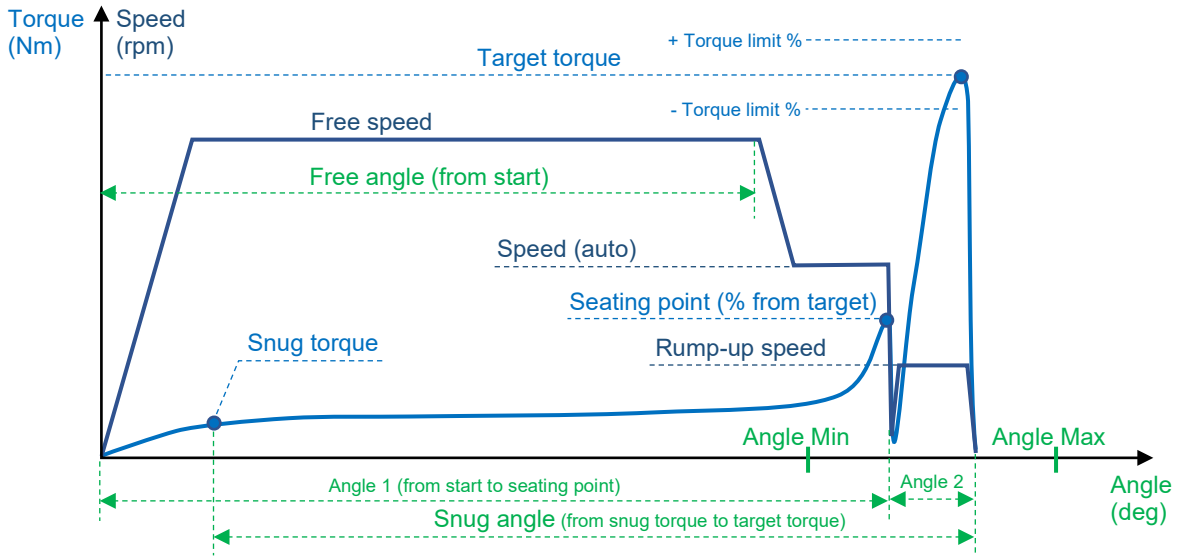
3.1.2 Angle Control / Torque Monitoring (AC/TM)

This strategy is used to tighten joints to target angle. Target angle is measured from the Snug torque. If Snug torque is equal to 0, then angle is measured from the moment the tool is started. Snug torque value and Target torque value have to be given by product design office. Torque monitoring can be used to avoid critical joint damage and to detect tightening defects.



3.2 Hard joint tightening

Typically represented by metric screws tightening without gaskets or spring washers. Torque is delivered very fast – it only takes about 30 degrees or less to reach the target torque once the torque starts rising.



Recommended settings:

Target torque and **Torque tolerance limit** are given by product design specification.

Speed value should be set automatically in case of hard joint (recommended for good precision). In order to do so, make sure that parameter “Auto Speed” is set to «YES».

Seating point has to be set to a relatively low value (20-40% of the target torque). Optimal value of the seating point is when Angle 2 is close to 30 deg. Use real time monitoring to check Angle 2.

Snug torque (starting point of angle control) is usually defined experimentally and depends on application needs. For example, for screw length detection, the snug torque should be as low as possible – 0 Nm or slightly above idle turning torque of the tool. To detect missing washer, gasket, etc, it’s necessary to compare curves of OK and NOK fastenings and select a snug point from which the angle to the target will be different.

Angle Min and **Angle Max** are also defined experimentally. It is necessary to do several test rundowns and monitor the Snug angle value. Then according to its variation, min and max values are defined.

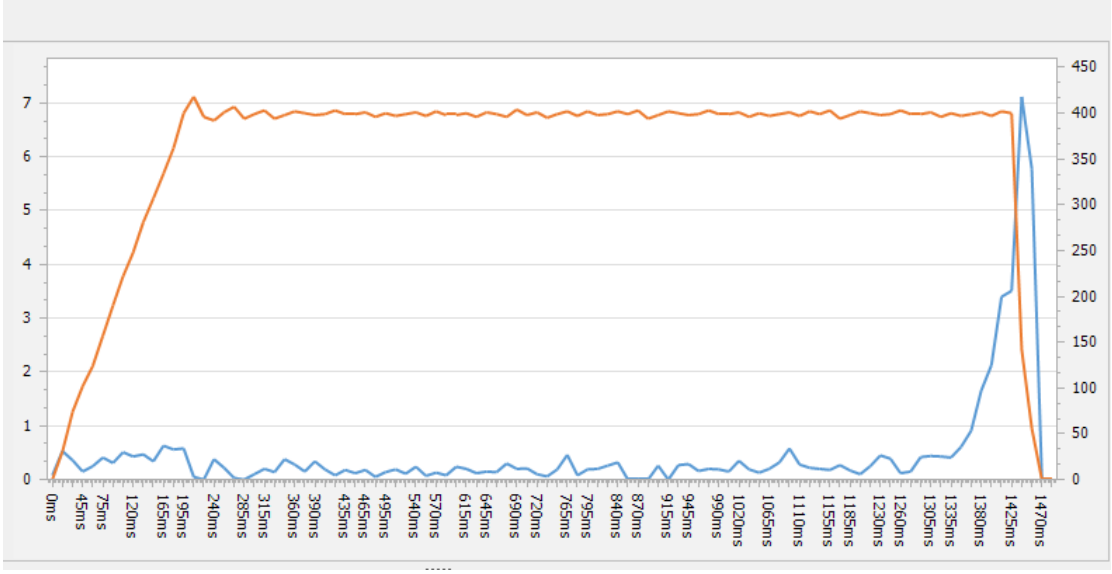
Free speed can be set to the max possible value to optimize production time.
Free angle has to be at least 360 deg less than Angle 1 to avoid torque overshooting.

Possible tightening issues

The main risk during hard joint tightening is torque overshoot. To avoid torque overshoot, it's necessary to monitor Angle 2 (between the Seating point and the Target). It has to be at least 30 degrees. Angle 2 can be increased by decreasing seating point value. If the seating point is already low and it's not possible increase Angle 2 by decreasing the seating point, then it is necessary to make sure that the speed before the seating point is less or equal to the Auto Speed ("Auto Speed" is set to «YES»).

Example:

Below you may see an example of the curve with a high risk of torque overshoot. Angle 2 is very low (7 degrees) and the speed is not decreased before the seating point.

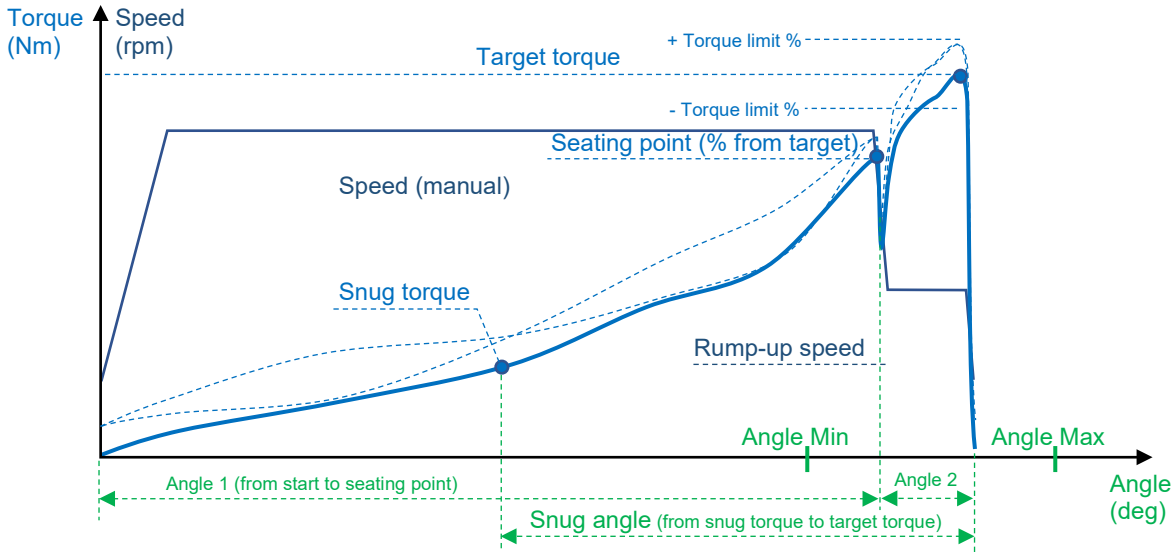


Possible solutions:

1. Decrease seating point to the beginning of torque rising process (approximately 1 Nm on the curve above – about 15% of the target). ATTENTION: if the seating point is too low, it can be wrongly detected in the beginning of the fastening due to thread imperfections etc.
2. Activate Auto Speed ("Auto Speed" is set to «YES») and use it in combination with Free Speed and Free Angle to optimize total fastening time. ATTENTION: Free angle has to be approximately 360 deg less than Angle 1.

3.3 Soft joint or tapping screw tightening

Typically represented by tapping screws tightening or metric screws with elastic washers, gaskets etc. Torque is delivered during relatively long time – it takes 720 degrees or more to reach the target torque once the torque starts rising.



Recommended settings:

Target torque and **Torque tolerance limit** are given by product design specification.

Speed can be set manually to a high value in case of soft joint. In order to do so, make sure that parameter A290 “Auto Speed” is set to «NO».

Seating point has to be set to a relatively high value (75-95% of the target torque). Optimal value of the seating point is when Angle 2 is close to 30 deg. Use real time monitoring to check Angle 2.

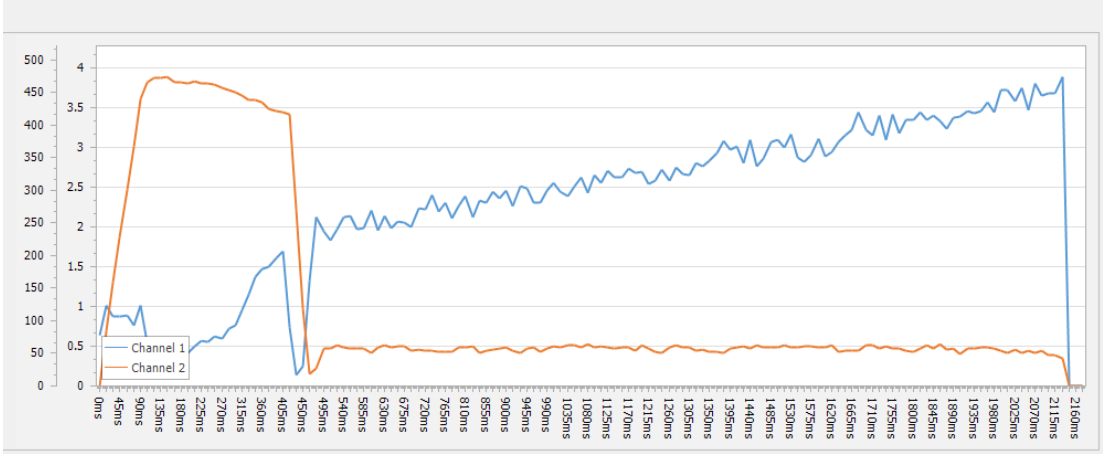
Snug torque (starting point of angle control) is usually defined experimentally and depends on application needs. It is advised to select a repeatable point on the curve (see above) from which the snug angle can be measured in a stable manner.

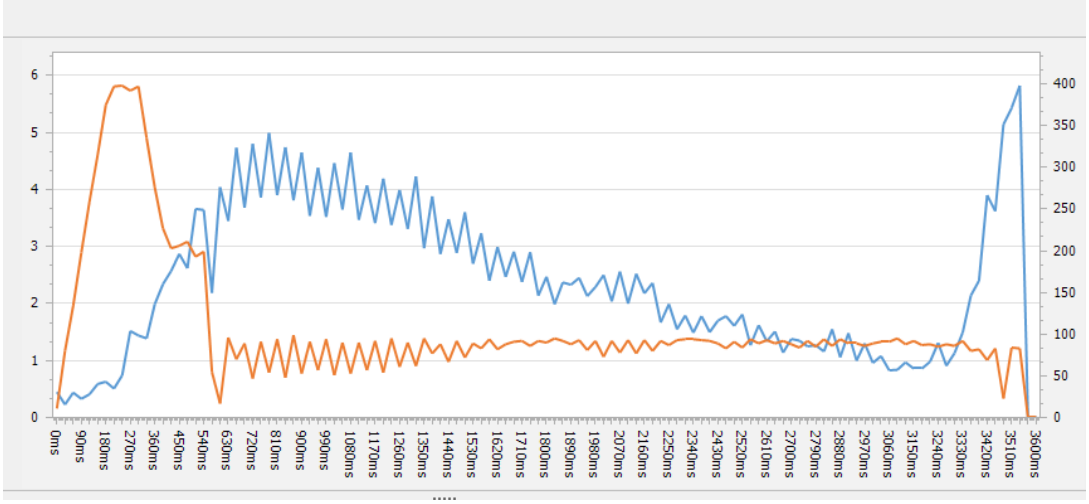
Angle Min and **Angle Max** are also defined experimentally. It is necessary to do several test rundowns and monitor the Snug angle value (it is shown on the LCD screen of MDC controller to the right from the target torque). Then according to its variation, min and max values are defined.

Free speed and **Free angle** can be used in case of high tapping torque. Setting is similar to hard joint condition.

Possible tightening issues

In some cases, it may happen that the seating point is prematurely detected and the tool slows down to the rump-up speed (see two sample curves below).





Possible solutions:

1. Increase the seating point to max but make sure that Angle 2 stays above 30 degrees.
2. Use Free speed and Free angle parameters. ATTENTION: During Free angle, the seating point is ignored, so make sure that Free angle is about 360 degrees less than Angle 1.
3. If the above doesn't help, it's possible to increase the Rump-up speed.
4. In case if tapping torque is close or higher than target torque, it is possible to divide the process into 2 steps and use a Muli Sequence A or B with 2 Fastening steps: 1st step with AC/TM strategy and high max torque value (target angle value in this case is same as Free angle for normal fastening), 2nd step with TC/AM strategy with relatively low speed to avoid torque overshoot.

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