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Bluetooth Communications Protocol Document

Document relating to Bluetooth connectivity with BMS Torque Devices.

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Description

Bluetooth Connection

When using a Bluetooth 2.0 connection it is assumed that the connection will be made using a Bluetooth serial port. The PC and the torque wrench can be paired using the password 1234. No password is used for 4.0 Bluetooth communications.

The Bluetooth identification of the torque device is named using BMS PCFE software. This number will appear as "BT ID" on the device info screen of the wrench.

Message Format

Data is transmitted using the ASCII character set. Each message is structured as follows;

1. "\$PT"
2. Message acronym
3. Message contents following the structures described in section 2.
4. A checksum indicator i.e. asterisk
5. A checksum of the message¹
6. Carriage Return (0x0D) and Line Feed (0x0A)

Example

\$PTRQT, Test Count, "Text field JOB ID", subtest count, T.Nom, T.Min, T.Max, Amin, A.Max, T.Ref, justMove angle, Units, Measurement Mode*FF

Header	Command	Message contents	Checksum Indicator	CheckSum	End of message
\$PT	RQT,	Test Count, "Text field JOB ID", subtest count, T.Nom, T.Min, T.Max, Amin, A.Max, T.Ref, justMove angle, Units, Measurement Mode	*	FF	\n\r

Note 1:

The checksum is calculated by performing an XOR calculation on all message characters converted to ASCII hexadecimal values between the symbols \$ and *.

For example; \$PTRQS,1,0,0

Character	P	T	R	Q	S	,	1	,	0	,	0	Result
Hexadecimal value	50	54	52	51	53	2C	31	2C	30	2C	30	49

50 Xor 54 Xor 52 Xor 51 Xor 53 Xor 2C Xor 31 Xor 2C Xor 30 Xor 2C Xor 30 = 49

Single fastener operation

This method of protocol usage is recommended for automated systems where a subsequent job is automatically sent to the wrench after receipt of the current result. Messages/Tightening's are sent and received on a one-by-one basis until a Job is complete.

Operation:

1. Within the application the operator defines a tightening parameter and sends the request to the wrench.
2. The operator proceeds to tighten a stud.
3. When the tightening is complete a result message is sent to the Application.
4. The Application can then proceed to send the next Tightening parameter if required.

Multi-fastener operation

This method of protocol usage is recommended for one off jobs with multiple tightening's with the same parameters. The results transmit in a batch only after the final Tightening of the sequence is complete. The maximum number of tightening's that a wrench can process for one job is 9.

Operation:

1. Within the application the operator defines the tightening parameters and the number of tightening's in a Job.
2. The operator proceeds to tighten the fastenings.
3. When all fastenings are tightened a single results message is sent to the application.

Connection overview

The wrench continuously outputs a Status Message (S) at a 1 second interval once the Bluetooth connection is established.

Messages Overview

1. Status Message

Message	Received from wrench: While No Test in Progress: \$PTRQS,0,0,0 While Test in Progress: \$PTRQS,T,N,M T= Test Index (Reference index for current job, managed by application) N = Number of the fastening being tightened (1 to M) M = Number of fastenings to be tightened (1 to 9)
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2. Device information

This message provides information on the device currently connected.

Message	Sent to Wrench: \$PTINF*CS Received from wrench: \$PTINF, Bluetooth ID #, Product #, Transducer #, Firmware #, Units when calibrated, Date of calibration, Current torque counter value, Validation status #, Battery level, Date of last validation, Current Date, Lifetime torque counter value * CS
Example	Application: \$PTINF*CS Wrench: \$PTINF,BT123456,SB1234,TR123456,1.1.1.1,Nm,2018-01-25,256,4,3,2018-05-13, 2018-06-13,97321*FF

Notes

Current Date

This is stored to wrench at initial calibration using PCFE. Current Date is accessible from the wrench using the INF message to allow for verification of system time. To update the current date, use the CFG message or manually set the date on the wrench.

Lifetime torque counter value

This is a value from the wrench counter which is set during factory calibration. This value is stored on the wrench transducer and cannot be overwritten. This value is a hexadecimal number.

Battery Indicator

Battery Level	Indication
1	Battery low
2	Battery half full
3	Battery three quarters full
4	Battery full

Validation status

Status message value	Indication
1	Wrench validated
2	Wrench over-torqued. Transducer recalibration or replacement required
3	Wrench needs validation
4	Wrench needs Calibration

3. CFG

This message sends configuration information to the wrench.

Message	Sent to Wrench: \$PTCFG, Current date & time (YYYY-MM-DDTHH:MM:SS), New torque counter limit (<100,000), Date of last validation (YYYY-MM-DD)*CS Received from wrench: \$PTCFG*CS
Example	Application: \$PTCFG,2018-06-13T23:59:59,20000,2018-05-13*FF Wrench: \$PTCFG*FF

Notes

Date of last validation

The date of validation is simply an indicator which gives the user the option to record a successful validation of the wrench versus a Torque tester.

4. Send a Click-Torque message

This message sends a tightening job that activates the Click-Torque (1st peak) mode on the wrench.

Message	Sent to Wrench:
Description	\$PTRQT, Test Index (Reference index for current job), "Text field JOB ID", Number of fastenings (1-9), T.Nom, T.Min, T.Max,,, Units, Measurement Mode* CS Received from wrench: RX :\$PTRQR, YYYY-MM-DDTHH:MM:SS, Test Index, Transducer #, Click-Torque result(s), Installed Torque result(s),T.Nom, T.Min, T.Max, Units, Measurement Mode * CS
Example	Application: \$PTRQT,21,"Wheel stud",1,20,10,30,,,Nm,click*FF Wrench: \$PTRQR,2018-01-01T23:59:59,21,tr123456,28.6,30.6,,20,10,30,Nm,click*FF

5. Send an Installed-Torque message

This message sends a tightening job that activates the Installed-Torque (2nd peak) mode on the wrench.

Message	Sent to Wrench:
Description	\$PTRQT, Test Index, "Text field JOB ID", Number of fastenings (1-9), T.Nom, T.Min, T.Max, Amin, A.Max, Units, Measurement Mode, T.Ref* CS Received from wrench: RX :\$PTRQR, YYYY-MM-DDTHH:MM:SS, Test Index, Transducer #, Installed Torque Result(s), ,Peak Angle, T.Nom, T.Min, T.Max, Units, Measurement mode * CS
Example	Application: \$PTRQT,21,"Wheel stud",21,20,10,30, 30,40,Nm,Instal,5*FF Wrench: \$PTRQR,2018-01-01T23:59:59,21,tr123456,30.6,, 26.5,20,10,30,Nm, Instal*FF

Notes

Units

The two options for units are 'lbft' for foot pounds and 'Nm' for Newton metres.

T.Ref

This is the Torque value at which time the Angle will start to count

6. Send a WheelTorque message

This message sends a tightening job that activates the WheelTorque mode on the wrench.

Message	Sent to Wrench:
Description	\$PTRQT, Test index, "Text field JOB ID", Number of fastenings (1-9), T.Nom, T.Min, T.Max, Amin, A.Max, Units * CS Received from wrench: RX :\$PTRQR, YYYY-MM-DDTHH:MM:SS, Test index, Transducer #,Peak Torque result(s), peak angle result(s), JustMove result(s), T.Nom, T.Min, T.Max, Units * CS
Example	Application: \$PTRQT,21," Wheel stud",1,20,10,30,10,40,Nm *FF Wrench: \$PTRQR,2018-01-01T23:59:59,21,tr123456,28.6,30.6,25.3,20,10,30,Nm*FF

7. Lock device

This message locks the wrench and prevents keypad usage.

Message Description	Sent to Wrench: \$PTLOC, "Text field to display on wrench OLED"*CS Received from wrench: RX :\$PTLOC*CS
Example	Application: \$PTLOC, "Refer to manual"*FF Wrench: \$PTLOC*FF

8. Unlock device

This message unlocks the wrench

Message	Sent to Wrench:
Description	\$PTULOC*CS Received from wrench: RX :\$PTULOC*CS
Example	Application: \$PTULOC*FF Wrench: \$PTULOC*FF

9. Abort current task

This message aborts the current task showing on the wrench.

Message	Sent to Wrench:
Description	\$PTRQA*CS Received from wrench: RX :\$PTRQA*CS
Example	Application: \$PTRQA*FF

10. Request date and time

Message	Sent to Wrench:
Description	\$PTDTM*CS Received from wrench: RX :\$PTDTM,YYYY-MM-DDTHH:MM:SS*CS
Example	Application: \$PTDTM, *FF Wrench: \$PTDTM, 2019-06-19T23:56:12*FF

General Notes:

1. Protocol Date & Time Format

YYYY-MM-DDTHH:MM:SS

or

YYYY-MM-DD

2. Unit format

lbft, Nm

3. Calibration

The calibration date will be stored on the transducer and the date of calibration will only change once a physical calibration is carried out.

4. Device Info Screen

a. Torque Counter

There are two torque counters;

- The Current Torque Counter will display on Device Info screen. This counts from the most recent PCFE calibration. This resets to zero after each calibration.
- The second torque counter – Lifespan torque counter is stored on the transducer at the initial calibration. Once it is enabled it cannot be overwritten. **This will not display on the Device info screen.**

b. Last Calibration - This is the date of last PCFE activated calibration.

c. Last Validation – This is set using the CFG command for information purposes.

5. Abbreviations

a. T.Min = Torque Minimum

b. T.Nom = Torque Nominal (Torque target)

c. T.Max = Torque Maximum

d. A.Min = Angle Minimum

e. A.Max = Angle Maximum

f. T.Ref = Torque Reference (Torque value from which angle starts counting)