Battery system wrench wireless Unit

WU-1 Open Protocol
Communication specifications
(Version 1.02.4)

1. Notes

This specifications explains about host controller communication method specification- Open Protcol compliant- to be mounted to battery system wrench wireless unit.

Even though it conforms to the Atlas Copco open protocol, neither the tightening result, the information content of status etc. nor operation agree with the controller made by Atlas Copco because the tightening method and the bolt number management method are different. Moreover, it is not the one corresponding to all the messages. (Please refer to the 3rd section for the correspondence messages.)

Only 1 tool can be used (1 tool specifications) with the WU-1 opening protocol specification.

Please check and understand the specifications deeply before usage.

2. Communication specification

2.1. Outline of communication

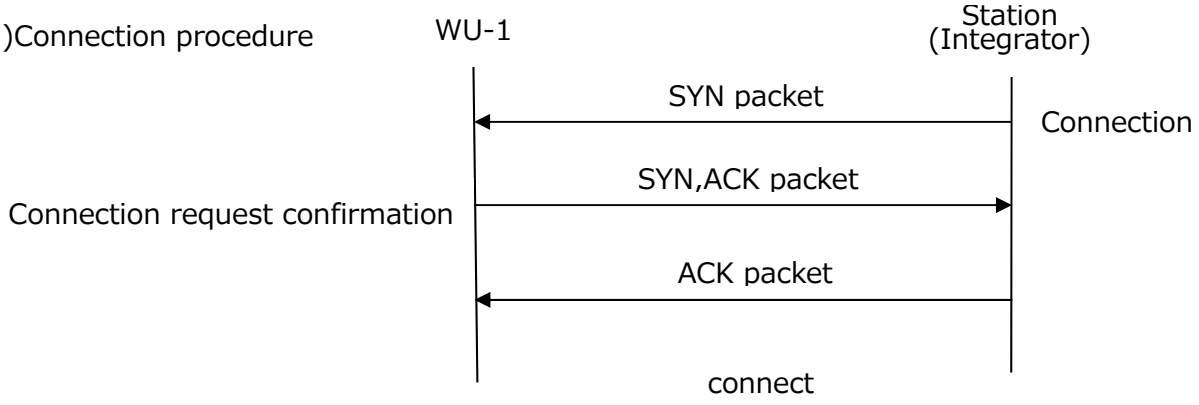
With the specifications, there is a part where the message of non-correspondence and the content of information are different though it basically conforms to the Atlas Copco document *1. Moreover, the open protocol communication with the serial is not supported. The correspondence message is listed in the 3rd section. Please refer to details of each message for the difference.

***1 Reference literature: 9836 4415 01 User manual release 10.3 Revision 1**

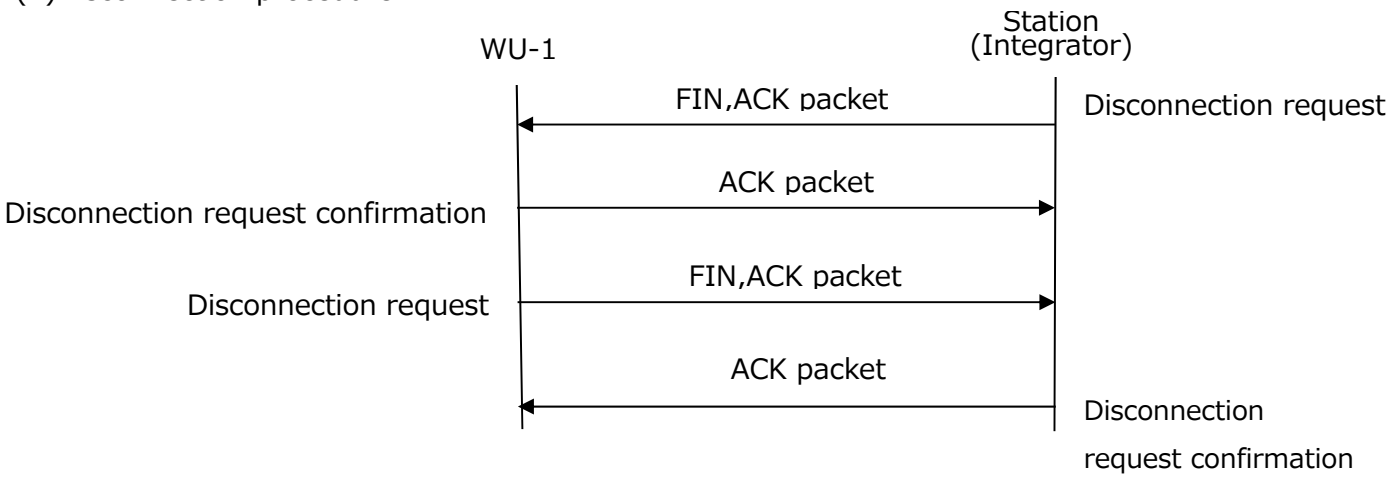
2.2. Ethernet Protocol (TCP/IP)

The connection request is transmitted from host computer (station) to WU-1, and communication is established when WU-1 accepts it. As for WU-1, the server and station become clients. This communication uses the TCP/IP protocol. Moreover, 4545 ports are used.

(1)Connection procedure



(2)Disconnection procedure



2.3. Structure of message

Header (20byte)			Data	End
Length	MessageID	Extension	····	NULL
4(byte)	4(byte)	12(byte) 3+1+1+2+5	Maximum 1004 (byte)	1(byte)

Length: The length of the entire message (End NULL is excluded) is specified by the byte number.

0000～1024(ASCII)

MessageID: ID that shows the message text is specified.

Data: Main body of message

(The structure is different depending on the content. Please refer to the section of each MessageID.)

End: NULL(0x00) It is assumed as the end of one byte message.

Extension:

Extension 12 (byte)

Revision	No Ack flag	Station ID	Spindle ID	Spare
3(byte)	1(byte)	1(byte)	2(byte)	5(byte)

Revison: Normally, 3 characters of space (‘0x20') or "001" (‘0x30','0x30','0x31') is specified. It might have two or more formats according to message ID. When either of which is specified, it is specified to this field.

No ack flag: Flag set: 1(‘0x31') and flag reset: Space (‘0x20') or 0(‘0x30')

It is effective only for subscription message. When the flag of this field is set, controller (WU-1) sends the following push message

without waiting for the reply for the acknowledgement of the message transmitted last time.

Station ID: No response. (Always space (‘0x20'))

Spindle ID: No response. (Always space (‘0x20'))

Spare: Five characters of space (‘0x20') are specified. (There is a possibility to be going to be extended in the future.)

2.4. Message Type

There are messages that include the following contents.

- Directive message (CMD):
  Message to direct operation. The communication begins, ends, and work group is switched or information is requested and etc.
- Subscribe (SUBSCR):
  It is a message to permit (prompt) those outputs when the message (push message) is output by the incident on the WU-1 side such as tightening data, etc.. Moreover, the subscribed message that has already been directed can be canceled by unsubscribing message. (In the next table, subscribe and unsubscribe are both categorized as SUBSCR.)

Example) Tightening result MID0061 is transmitted at any time by subscribe MID0060 when tightening is finished.
Tightening result automatic transmission is stopped from this state by subscribe MD0063.

- Response message (ACK):
  Message to confirm message was received.
- Answer message (ANSWR) against request:
  Answer to CMD message to demand information.
- Push message (PUSH):
  Message including the information transmitted from the WU-1 side when event occurs. Subscribe message beforehand
- Other messages (OTHER):
  Keep alive (Existence confirmation).

2.5. About push message, answer message, and subscribe

With the information transmission from WU-1, there are answer message (ANSWR) and push message (PUSH). When output of information is requested, the information against the request is answer message (ANSWR). Push message (PUSH) transmits the necessary information from WU-1 or the tool connected to the WU-1 such as tighgtening result at the time of tightening finish. However, push message is not something that transmits at the

occurrence of an event, and in order to have it transmit, it is necessary to request corresponding subscribe message (SUBSCR) beforehand.

For example, with the existing Yokota controllers, tightening result is output without fail at the time of tightening finish but in order to have it transmit tighening result (push message MID0061) at the time of tightening finish, it is necessary to direct the output of this push message by transmitting tightening result event transmission beginning (subscribe MID0060) beforehand. Moreover, it is necessary to transmit tightening result data reqest (0064CMD) to take out tightening result according to the timing on the station side. (The message reply against the request is tightening result data response (0061ANSWR).)

2.6. List of available MessageID

The following MessageID are prepared.

MessageID	Contents	Type	Direction
0001	Communication beginning Communication start	CMD	Station → WU-1
0002	Communication beginning response Communication start ack	ACK(0001)	WU-1 → Station
0003	Communication stop Communication stop	CMD	Station → WU-1
0004	Command refusal response Command error	ACK(nnnn)	WU-1 → Station
0005	Command receipt response Command accepted	ACK(nnnn)	WU-1 → Station
0010	Inquiry of available parameter set ID Parameter set numbers upload request	CMD	Station → WU-1
0011	Transmission of available arameter set ID Parameter set numbers upload reply [00350011 --- 004001002003004Null]	ANSWR	WU-1 → Station
0012	Parameter set data request (set value confirmation request of each work) Parameter set data upload request	CMD	Station → WU-1
0013	Parameter set data response (set value transmission of each work) Parameter set data upload reply << The format does not agree. >>	ANSWR	WU-1 → Station
0014	Parameter set selection notification beginning Parameter set “selected" subscribe	SUBSCR	Station → WU-1
0015	Parameter set selection notification Parameter set “selected" The date when the parameter set was rewritten last is returned.	PUSH	WU-1 → Station
0016	Parameter set selection notification response Parameter set “selected" acknowledge Acknowledge for a New Pset selected.	ACK(0015)	Station → WU-1
0017	Parameter set selection notification end Parameter set “selected" unsubscribe Reset the subscription for the Pset selection.	SUBSCR	Station → WU-1
0018	Selection and beginning on Work (parameter set) Select Parameter set	CMD	Station → WU-1
0020	Number of remaining bolt reset request Reset Parameter set batch counter	CMD	Station → WU-1
0021	Specified number completion (stop) notification beginning Lock at batch done subscribe	SUBSCR	Station → WU-1
0022	Specified number completion (stop) notification Lock at batch done upload Argument ASCII 0 or 1 (Relay status)	PUSH	WU-1 → Station
0023	Specified number completion (stop) notification response Lock at batch done upload acknowledge	ACK(0023)	Station → WU-1
0024	Specified number completion (stop) notification end Lock at batch done unsubscribe	SUBSCR	Station → WU-1
0030	Inquiry of available JOB ID Job ID upload request	CMD	Station → WU-1
0031	Transmission of available JOB ID	ANSWR	WU-1 → Station

	Job ID upload reply ※ Since there is no JOB function, JOB ID is replaced with work number		
0032	JOB data request (setting value confirmation request for each JOB ID) Job data upload request	CMD	Station → WU-1
0033	JOB data response (transmission of setting value for each JOB ID) Job data upload reply ※ Since there is no JOB function, JOB ID is replaced with work number	ANSWR	WU-1 → Station
0034	Job status notification start Job info subscribe	SUBSCR	Station → WU-1
0035	Job status notification (transmitted at the time of JOB selection and every tightening during JOB) Job info ※ Since there is no JOB function, JOB ID is replaced with work number	PUSH	WU-1 → Station
0036	JOB status notification response Job info acknowledge	ACK(0035)	Station → WU-1
0037	Job status notification end Job info unsubscribe	SUBSCR	Station → WU-1
0038	JOB selection and start Select Job ※ Since there is no JOB function, JOB ID is replaced with work number	CMD	Station → WU-1
0039	Job restart request Job Restart ※ Since there is no JOB function, JOB ID is replaced with work number	CMD	Station → WU-1
0040	Controller information request Tool data upload request	CMD	Station → WU-1
0041	Controller information response Tool data upload reply	ANSWR	WU-1 → Station
0042	Solenoid valve OFF Disable Tool	CMD	Station → WU-1
0043	Solenoid valve ON Enable Tool	CMD	Station → WU-1
0050	VIN number setting →in the transmission to 0150 (The length of Data Field is different). Vehicle Id Number download request	CMD	Station → WU-1
0051	VIN number notification beginning Vehicle Id Number upload subscribe	SUBSCR	Station → WU-1
0052	VIN number notification Vehicle Id Number upload	PUSH	WU-1 → Station
0053	VIN number notification response Vehicle Id Number upload acknowledge	ACK(0052)	Station → WU-1
0054	VIN number notification end Vehicle Id Number upload unsubscribe	SUBSCR	Station → WU-1
0060	Tightening result data event transmission beginning Last tightening result data subscribe	SUBSCR	Station → WU-1
0061	Tightening result data response Last tightening result data upload	PUSH	WU-1 → Station
0062	Tightening result data reception response Last tightening result data acknowledge	ACK(0061)	Station → WU-1
0063	Tightening result data event transmission end Last tightening result data unsubscribe	SUBSCR	Station → WU-1

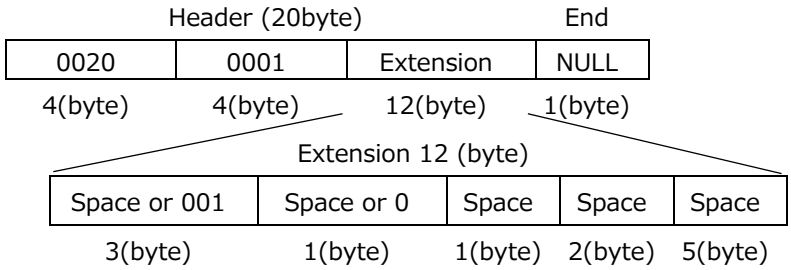
0064	Tightening result data request <The current spec. is for a specific customer> Old tightening result upload request	CMD	Station → WU-1
0065	Tightening result data Old tightening result reply	ANSWR	WU-1 → Station
0150	Car number setting Identifier download request	CMD	Station → WU-1
9999	Keepalive message Keep alive open protocol communication	OTHER	Station → WU-1 WU-1 → Station

2.7. The details of message.

2.7.1. Communication beginning and end

The communication between WU-1 and the station is begun by the communication beginning procedure. At power activation, after the connection by TCP/IP (), beginning of the communication is notified, and demanded from the station side by communication beginning command. If WU-1 is in the condition to begin communication, it answers communication begin response and communication begins. Until that time, transmission and reception of message is not possible.

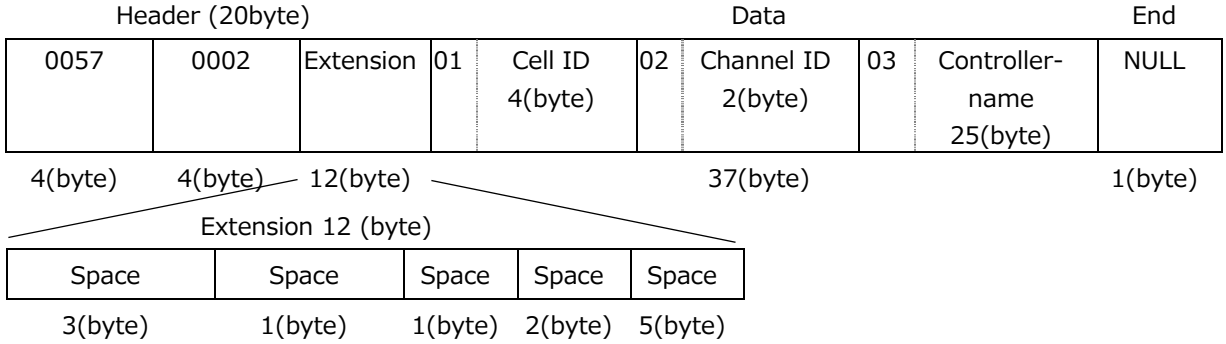
（1） Communication beginning (MID 0001, CMD, station → WU-1)



Revision must be space or 001 for the extension. Others must be spaces.

The station side notifies the start of communication and requests to enable communication. After receiving this message, if this message is received again without receiving coummnication stop message, command rejection (MID 0004 / error code Only 96 will be transmitted..

(2)Communication beginning response (MID 0002, ACK 0001, WU-1 → station)

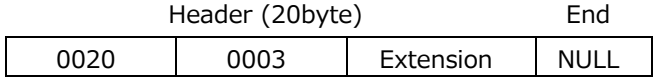


Extension has 12 byte space.

When communication beginning (0001) is received, WU-1 replies this message when it is possible to communicate. The data includes the following fixed character string.

Cell ID	“0000"
Channel ID	“00"
Controller-name	“ “(25 space bytes)

(3)Communication stop (MID 0003, CMD, station → WU-1)



4(byte)	4(byte)	12(byte)	1(byte)

Revision must be space or 001 for the extension. Others must be spaces.

This message is sent when communication ends from the station side. Upon receipt of this message, the status of the previous subscription and status of retransmission are reset. The same thing will be done in case connection is disconnected without this message.

2.7.2. Refusal of message and acceptance

When WU-1 receives a message, it transmits command reject (MID 0004), if it is a message not supported. If is the message that can be interpreted, it transmits acceptance (MID 0005) message or the message including corresponding informaiton in order to execute the operation. The accept message contains message ID of the received message.

(1)Command refusal (MID 0004, ACK(NAK) nnnn, WU-1 → station)

	Header (20byte)		Message ID	Error Code	End
0026	0004	Extension	****	99	NULL
4(byte)	4(byte)	12(byte)	4(byte)	2(byte)	1(byte)

Extension has 12 byte space.

When uncorrespondence command message is received, the received message ID is stored in the ID field of this message and it is replied. The error codes and conditons corresponding to MID are as follows.

Message ID	Error code	Condition
All	9 9	format error / unsupported command
0 0 0 1	9 6	Duplicate reception
0 0 1 2	0 2	work number other than 001 to 004
0 0 1 4	1 3	Duplicate reception
0 0 1 7	1 4	This message received without receiving MID 0014
0 0 1 8	0 3	Specify the work that exceeded work limit / work number other than 001 to 004
0 0 2 0	0 4	Work number different from the current work / other than 001 to 004
0 0 2 1	9 0	Duplicate reception
0 0 2 4	9 1	This message received without receiving MID0021
0 0 3 2	1 7	JOB（Work number）is other than 001～004
0 0 3 4	1 8	Duplicate reception of JOB (work number)
0 0 3 7	1 9	This message received without receiving MID0034
0 0 3 8	2 0	Specify JOB ID (work) that exceeded JOB (work) limit / other than

		001 to 004
0 0 3 9	2 1	JOB ID (work number) different from current JOB (work) / other than 001 to 004
0 0 5 1	0 6	Duplicate receiption
0 0 5 4	0 7	This message received without receiving MID0051
0 0 6 0	0 9	Duplicate reception
0 0 6 3	1 0	This message received without receiving MID0060
0 0 6 4	1 5	There is no tightening data corresponding to the tightening ID
All	9 7	Rev of Specified MID is not supported (when Rev space of extension is other than 001)

(2)Command acceptance (MID 0005, ACK nnnn, WU-1 → station)

Header (20byte)			Message ID	End
0024	0005	Extension	****	NULL
4(byte)	4(byte)	12(byte)	4(byte)	1(byte)

Extension has 12 byte space.

When command message is received, the received message ID is stored in the ID field of this message and it is replied.

When the following message is received and confirmed, this message is transmitted.

Message ID	Contents
0003	Communication stop
0014	Parameter set “selected" subscribe
0017	Parameter set “selected" unsubscribe
0018	Select parameter set
0020	Reset parameter set batch counter
0021	Lock at batch done subscribe
0024	Lock at batch done unsubscribe
0 0 3 4	Job info subscribe
0 0 3 7	Job info unsubscribe
0 0 3 8	Select Job
0 0 3 9	Job restart
0042	Disable tool
0043	Enable tool
0050	VIN download request
0051	VIN upload subscribe
0054	VIN upload unsubscribe
0060	Last tightening result data subscribe
0063	Last tightening result data unsubscribe
0150	Identifier download request

2.7.3. Confirmation, change, and bolt number reset of parameter set (PSET) ID

The Yokota controllers including WU-1 do not support the management method using JOB and parameter set (PSET). The memory of plural conditions or bolt management is done by a work group. However, the PSET in Open protocol can work as a work number because a work group is a set of setting values of a tightening condition.

(1)Inquiry of available parameter set ID(PSETID) (MID 0010, CMD, station→WU-1)

	Header (20byte)		End
0020	0010	Extension	NULL
4(byte)	4(byte)	12(byte)	1(byte)

Revision must be space or 001 for the extension. Others must be spaces.

By the message of this inquiry, WU-1 answers available work ID by available PSETID transmission (MID 0011) in the section that follows (2). Command acceptance (MID 0005) message is not transmitted.

(2) Available PSETID transmission (MID 0011, ANSWR 0010, WU-1 → station)

Header (20byte)			Data			End
0 0 2 6 0 0 2 9 0 0 3 2 0 0 3 5	0011	Extension	Effective number of work 3 (byte)	Effective work number 1 3(byte)	Effective work number n ------- 3(byte) X (n-1)	NULL
4(byte)	4(byte)	12(byte)		3 + 3 × n (byte)		1(byte)

Extension has 12 byte space.

When inquiry of available parameter set ID (PSETID) is received, available work number, that is the contents set in “work limitation” of the internal setting is answered in the following format. The message is as follows. The message is as follows.

Setting of limitation of number of work	Message text	
1:Only a	00260011	001001[Nul]
2:a,b	00290011	002001002[Nul]
3:a,b,c	00320011	003001002003[Nul]
4:a,b,c,d	00350011	004001002003004[Nul]

(3)Parameter set data request (MID 0012, CMD, station→WU-1)

Header (20byte)			Data (3byte)	End
0023	0012	Extension	001,002,003 or 004	NULL
4(byte)	4(byte)	12(byte)	3(byte)	1(byte)

The setting item of each work is inquired. The result is answered by MID 0013 but the format is a unique one. If the data is other than 001 to 004, only command rejection (MID 0004 / error code 02) is sent.

(4)Parameter set data response (MID 0013, ANSWR, WU-1→station)

Header (20byte)			Data (84byte)	End
0104	0013	Extension	Set value of each work	NULL
4(byte)	4(byte)	(byte)	84(byte)	1(byte)

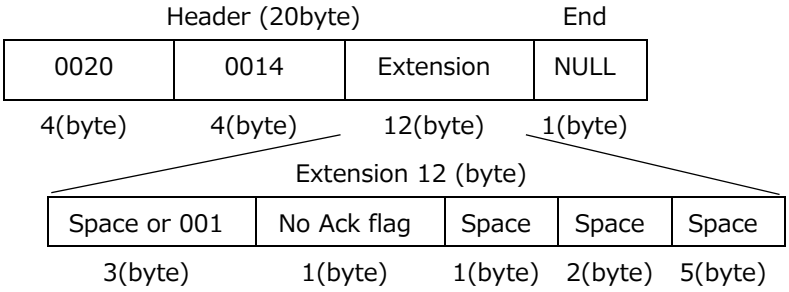
The setting item of each work is inquired. Data has the format listed below.

(PSET:001=Work A/002=Work B/003=Work C/004=Work D)

(MID 0013)The details of parameter set data

Parameter	ID	Byte	Explanation
(PSET)Number	01	3	Work number (“000"-"003")
PSET name	02	25	Space (0x20) buried
Direction of rotation	03	1	Always 1 (0x31)
Batch size	04	2	A set number is displayed ("01"-"99").
Lower limit torque	05	6	Lower limit torque set value (The value multiplied by 100 to the value)
Upper limit torque	06	6	Upper limit torque set point (The value multiplied by 100 to the value)
Target torque	07	6	Cutting torque set point (The value multiplied by 100 to the value)
Angle lower limit	08	5	Tightening angle lower limit setting value
Angle upper limit	09	5	Tightening angle upper limit setting value
Target angle	10	5	“00000"

(5) Parameter set selection notification start (MID 0014, SUBSCR, station→WU-1)



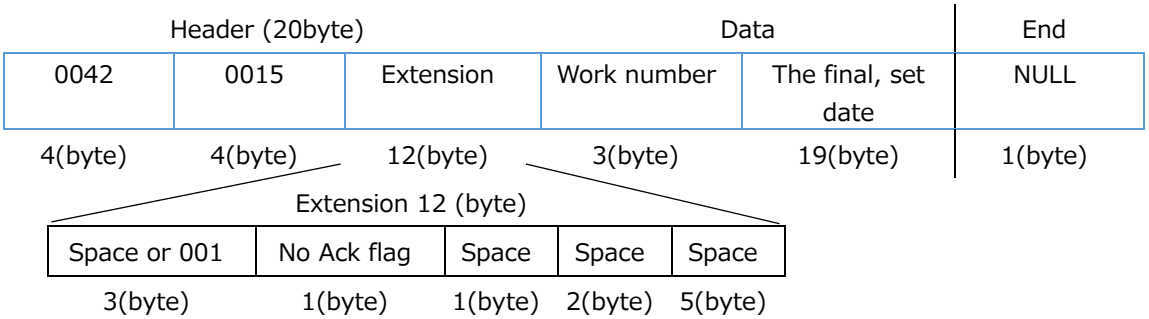
Revision must be space or 001 for the extension. Others must be spaces. Reference No Ack flag only.

When the work selection message reception or the input End, etc. and the work switch operation are done, WU-1 is set to transmit the parameter set data selection notification (MID 0015) in the following item, according to this inquiry message.

When No Ack flag is set to 1, the reception of response (MID 0016) is not waited after the parameter set data selection notification (MID 0015) is transmitted. (Retransmission is not made. It is transmitted if there is a change next.)

When duplicates are received, only command rejection (MID 0004 / error code 13) is sent.

(6) Notification of parameter set data selection (MID 0015, PUSH, WU-1→station)



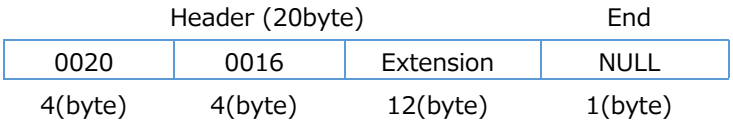
Extension has 12 byte space

The change in a work group is notified. It is specified by triple digit of ASCII character.

Work A:001/work B:002/work C:003/work D:004

When No Ack flag of parameter data selection notification beginning (MID 0014) is set to 1, the reception of response (MID 0016) is not waited after the parameter set data selection notification (MID 0015) is transmitted. (Retransmission is not made. It is transmitted if there is a change next.)

(7) Parameter set data response (MID 0016, ACK, station→WU-1)



Revision must be space or 001 for the extension.

It replies to notification of parameter set data (MID 0015).

(8)Parameter set selection notification end (MID 0017, SUBSCR, station→WU-1)

Header (20byte)			End
0020	0017	Extension	NULL
4(byte)	4(byte)	12(byte)	1(byte)

Revision must be space or 001 for the extension.

The state being notified at the change is released (Unscribe) by parameter set data selection notification beginning (MID 0014).

When receiving without receiving MID0014, only command rejection (MID 0004 / error code 14) is sent.

(9)Selection of work (0018) (MID 0018, CMD, station→WU-1)

Header (20byte)			Data	End
0023	0038	Extension	Work number	NULL
4(byte)	4(byte)	12(byte)	3(byte)	1(byte)

A work group is specified. The specified work is specified by the triple digit of ASCII characters as per the specification method in the above message 0015.

If the work number is other than 001 to 004 and exceeds the work restriction, command rejection (MID 0004 / error code 03) will only be transmitted.

(001 = work A / 002 = work B / 003 = work C / 004 = work D)

(10) Remaining bolt number reset request (MID 0020, CMD, station→WU-1)

Header (20byte)			Data	End
0023	0020	Extension	Work number	NULL
4(byte)	4(byte)	12(byte)	3(byte)	1(byte)

The bolt number of the bolt management of the work specified in the work number field is returned to the initial value. Nothing is done when specifying the work other than the work in operation now. The specified work is specified by the triple digit of ASCII characters as per the specification method in the above message 0015.

2.7.4. Bolt management message

(1) Beginniing of specified number completion notification (MID 0021, SUBSCR, station→WU-1)

Header (20byte)			End
0020	0021	Extension	NULL
4(byte)	4(byte)	12(byte)	1(byte)

Extension 12 (byte)

Space or 001	No Ack flag	Space	Space	Space

3(byte)	1(byte)	1(byte)	2(byte)	5(byte)

Revision must be space or 001 for the extension. Others must be spaces. Reference No Ack flag only.

According to this message of inquiry, WU-1 transmits notification of specified number completion (MID 0022) on completion of the specified number of boltsduring the bolt management.

When No Ack flag is set to 1, the reception of the response to specified number completion (MID 0022) is not waited after the notirication of specified number completion is transmitted. (Retransmission is not made. It is transmitted if there is a change next.)

In case of duplicate reception, only command rejection (MID 0004 / error code 90) is sent.

(2) Notification of Specified number completion (MID 0022, PUSH, WU-1→station)

	Header (20byte)		Data	End
0021	0022	Extension	1	NULL
4(byte)	4(byte)	12(byte)	1(byte)	1(byte)

During bolt management, notification of specified number completion (MID0022) is transmitted. When No Ack flag of notification of specified number completion (MID 0021) is set to 1, the reception of the specified number completion response (MID 0023) is not waited after the notification of specified number completion (MID 0022) is transmitted. (Retransmission is not made. It is transmitted if there is a change next.)

(3)The specified number completion response (MID 0023, ACK, station→WU-1)

	Header (20byte)		End
0020	0023	Extension	NULL
4(byte)	4(byte)	12(byte)	1(byte)

It replies to specified number completion (MID 0022).

(4) End of specified number completion notification (MID 0024, SUBSCR, station→WU-1)

	Header (20byte)		End
0020	0024	Extension	NULL
4(byte)	4(byte)	12(byte)	1(byte)

The state of the specified number completion notification (MID 0022) is released. When receiving without receiving MID 0021, only command rejection (MID 0004 / error code 91) is sent.

2.7.5

2．7．5．JOB confirmation · Status notification · Restart

Management method using JOB and parameter set (PSET) is not used for Yokota controllers including WU-1.

Storing multiple conditions and bolt number management are performed by work. However, as work is a set of setting values for tightening conditions, JOB in Open protocol is operated as a set of only one PSET (work number).

(JOB ID: 01 = work A / JOB ID: 02 = work B / JOB ID: 03 = work C / JOB ID: 04 = work D)

(Example 1) When tightening is required for one time with work A setting. Set the bolt number management of the tool to "OFF" and specify "01" for JOB ID.

(Example 2) When tightening is required for four times in a row with the setting of Work B

Set the bolt number management to "ON", and the tightening number of work B to "4" and specify "02" for JOB ID.

* When bolt number control is ON, next tightening will not be done until tightening OK is reached.

(As a result, NOK will not be replied)

(Example 3) When tightening is required for one time each with the setting of work A and work B, this cannot be specified by Yokota controllers. (Multiple works can not be specified)

（1）Inquiry of avaialble JOB ID（MID 0030, CMD, station→WU-1）

	Header(20byte)		End
0 0 2 0	0 0 3 0	Extension	NULL
4(byte)	4(byte)	12(byte)	1(byte)

Revision must be space or 001 for the extension. Others must be spaces.

According to this inquiry message, the WU − 1 returns an available work number by transmitting the JOB ID (MID0031) as specified in the following (2).

Command acceptance message (MID 0005) is not sent.

（2）Transmission of available JOB ID (MID 0031, ANSWR 0030, WU-1 → station ）

Header(20byte)			Data			End
0 0 2 4 0 0 2 6 0 0 2 8 0 0 3 0	0 0 3 1	Extension	A number of Effective work 2 (byte)	Effective work number 1 2(byte)	Effective work number n ------- 2(byte) X (n-1)	NULL
4(byte)	4(byte)	12(byte)		2 + 2 × n (byte)		1(byte)

Extension has 12 byte spaces.

Upon receiving an inquiry about an available JOB ID (MID 0030), the work number that can be used, that is, the contents set in the internal setting "WORK LIMIT" is replied in the following format.

Setting of work number limit	Message contents	
1 : a only	00240011	0101[Nul]
2 : a,b	00260011	020102[Nul]
3 : a,b,c	00280011	03010203[Nul]
4 : a,b,c,d	00300011	0401020304[Nul]

（3）JOB data request（MID 0032, CMD, station→WU-1）

Header (20byte)			Data (3byte)	End
0 0 2 2	0 0 3 2	Extension	01,02,03 or 04	NULL
4(byte)	4(byte)	12(byte)	2 (byte)	1(byte)

Revision must be space or 001 for the extension.　Others must be spaces.

It inquires about setting contents of each JOB (work). The result will be returned at MID 0033, but the format will be unique.

If JOB ID is other than 01 ~ 04, only command rejection (MID 0004 / error code 17) is transmitted.

（4）JOB data response（MID 0033, ANSWR, WU-1→station）

Header (20byte)			Data (85byte)	End
0105	0 0 3 3	Extension	Setting value of each work	NULL
4(byte)	4(byte)	12(byte)	85(byte)	1(byte)

Extension has 12 byte spaces.

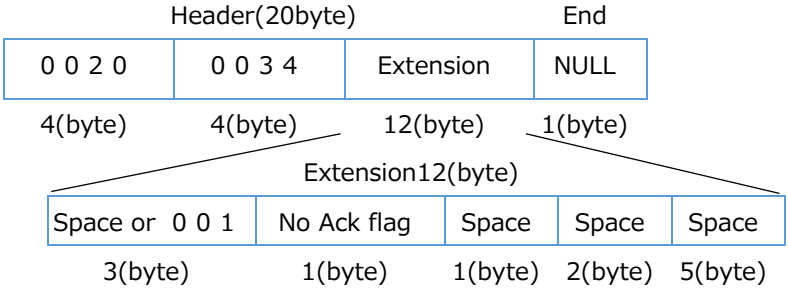
It transmits the setting contents of each JOB (work). The data has the following format.

(JOB ID: 01=work A / 02=work B / 03=work C / 04=work D)

(MID 0033) Parameter set data details

Parameter	ID	Byte	Explanation
JOB ID number	01	2	Work number (“01”～”04”)
JOB name	02	25	Space (0x20) filled
Forced order	03	1	Always 0 (0x30)
Max time for first tightening	04	4	Always 0 (0x30) × 4
Max time to complete Job	05	5	Always 0 (0x30) × 5
Job batch mode /bacth count	06	1	Always 0 (0x30)
Lock at Job done	07	1	Tool setting, operation after the finish of the bolt management not possible. NO： 0 (0x30) YES： 1 (0x31)
Use line control	08	1	Tool setting, Bolt management: No: 0 (0x30) Yes: 1 (0x31)
Repeat Job	09	1	Always 0 (0x30)
Tool loosening	10	3	Work setting Loosening permission： 0 (0x30) Prohibited： 1 (0x31) ※ “0 0 0”, ”0 0 1” due to 3 bytes
Reserved	11	1	Always 0 (0x30)
PSETID 数	12	2	Always 0 1(0x30, 0x31)
Job リスト	13	1 2	Always 00:000:0:xx; xx：ワーク設定 締め付け本数

(5) JOB status notification start（MID 0034, SUBSCR, station→WU-1）



Revision must be space or 001 for the extension. Others must be spaces. Refer to No Ack flag only.

By this notification start message, the WU-1 receives a JOB selection message or transmits JOB status notification (MID 0035) as specified in the following section when work switching operation by an input terminal etc. is done and also for each tightening during JOB.

When No Ack flag is set to 1, it does not wait to receive the JOB status notification response (MID 0036) after sending the JOB status notification (MID 0035). (No retransmit. Then, transmit if there are changes)

When duplicates are received, only command rejection (MID 0034 / error code 18) transmitted.

(6) JOB status notification (MID 0035, PUSH, WU-1→station)

	Header (20byte)		Data (43byte)	End
0 0 6 3	0 0 3 5	Extension	Info. per work	NULL
4(byte)	4(byte)	12(byte)	43(byte)	1(byte)

The extension part has 12byte spaces.

JOB (work) status is notified. The data is as per the following format.
(JOB ID:01=Work A / 02=Work B / 03=Work C / 04=Work D)

(MID 0035) Parameter set data details

Parameter	ID	Byte	Explantion
JOB ID number	01	2	Work number ("01"～"04")
JOB Status	02	1	Status of bol number management 0: Incomplete 1: OK completed 2: NOK completed * When bolt number management is OFF, 1 or 2 is returned at tightening completion.
JOB Batch mode	03	1	Always 1 (0x3 1)
JOB Batch size	04	4	Tightening bolt of work setting ※ 1 is returned when bolt number management is off.
JOB Batch counter	05	4	Tightening completion number
Time stamp	06	1 9	YYYY-MM-DD : HH:MM : SS

When the No Ack flag of the JOB status notification start (MID 0034) is set to 1, it does not wait to receive response (MID 0036) after transmitting the JOB status notification (MID 0035). (No retransmit. Then, transmit if there are changes next)

(7) JOB status notification response (MID 0036, ACK, station→WU-1)

	Header (20byte)		End
0 0 2 0	0 0 3 6	Extension	NULL
4(byte)	4(byte)	12(byte)	1(byte)

For the extension part, Revision must be space or 001. For others, it must be space.
It is returned against JOB status notification. (MID 0035)

(8) JOB status notification end (MID 0037, SUBSCR, station→WU-1)

	Header (20byte)		End
0 0 2 0	0 0 3 7	Extension	NULL
4(byte)	4(byte)	12(byte)	1(byte)

For the extension part, Revision must be space or 001. For others, it must be space.
By the start of JOB status notification (MID 0035), a state in which the JOB status is notified at the time of work switching or tightening is canceled. (Unsubscribe).

When receiving it without receiving MID 0034, only command rejection (MID 0004 / error code 19) is transmitted.

（9）JOB selection（0038） （MID 0038, CMD, station→WU-1）

	Header (20byte)		Data	End
0 0 2 2	0 0 3 8	Extension	JOB ID	NULL
4(byte)	4(byte)	12(byte)	2 (byte)	1(byte)

For the extension part, Revision must be space or 001. For others, it must be space.

Specify the work number for JOB ID. Specify the work number as 2 digit ASCII characters as specified in the message of 0035 above.

If the work number exceeds work restriction other than 01 to 04, only command rejection (MID 0004 / error code 20) is transmitted. (JOB ID: 01=work A / 02=work B / 03=work C / 04=work D)

（10）JOB restart request（MID 0039, CMD, station→WU-1）

	Header (20byte)		Data	End
0 0 2 2	0 0 3 9	Extension	JOB ID	NULL
4(byte)	4(byte)	12(byte)	2(byte)	1(byte)

For the extension part, Revision must be space or 001. For others, it must be space.

Specify the work number for JOB ID. As the work number is specified in the message of 0035 above, it is specified by the character 2 digit ASCII. The number of bolt number management of the specified work is reset to the initial value.

If anything other than the currently operating JOB (work) is specified, only command rejection (MID 0004 / error code 21) is transmitted. (JOB ID: 01=work A / 02=work B / 03=work C / 04=work D)

2.7.6. Controller information

(1) Controller information request (MID 0040, CMD, station→WU-1)

	Header (20byte)		End
0020	0040	Extension	NULL
4(byte)	4(byte)	12(byte)	1(byte)

Extension 12 (byte)

Space or 001	No Ack flag	Space	Space	Space
3(byte)	1(byte)	1(byte)	2(byte)	5(byte)

Controller information is acquired.

(2)Controller information response (MID 0041, ANSWR, WU-1→station)

Header (20byte)			ID	Data	ID	Data
0081	0041	Extension	01	Tool serial number	02	Tool number of tightening
4(byte)	4(byte)	12(byte)	2	14(byte)	2	10(byte)

ID	Data	ID	Data	End
03	Last Calibration date	04	Controller serial number	NULL
2	19(byte)	2	10(byte)	1(byte)

Only Revision=1 is effective. Each information that WU-1 manages is set to the following items. (At present, only setting of updated day and hour is possible.)

Justifying forward, the free area is filled with space.

Tool serial number: Space (6-7 digits)

Tool number of tightening: Space (5 digits)

Last Calibration date: Setting updated date (19 digits)

Controller serial number: Space (6 digits)

2.7.7. Tool operation

(1) Tool operation prohibition (MID 0042, CMD, station→WU-1)

Header (20byte)			End
0020	0042	Extension	NULL
4(byte)	4(byte)	12(byte)	1(byte)

Revision must be space or 001 for the extension.

According to this message, the solenoid valve is turned off in any circumstances according to the logic of the solenoid valve (N.O. or N.C).

(2) Tool operation permission (MID 0043, CMD, station→WU-1)

Header (20byte)			End
0020	0043	Extension	NULL
4(byte)	4(byte)	12(byte)	1(byte)

Revision must be space or 001 for the extension. Others must be spaces.

According to this message, solenoid valve is turned ON but if the solenoid valve has been turned off under other conditions (Waiting for start of bolt management and etc.), the solenoid valve is turned ON after the condition is deleted.

2.7.8. VIN number sending and receiving

(1) VIN number setting (MID 0050, CMD, station→WU-1)

	Header (20byte)		Data	End
0045	0150	Extension	VIN ID	NULL
4(byte)	4(byte)	12(byte)	MAX 25(byte)	1(byte)

The VIN number is notified from the station. The controller sets the VIN ID notified by this message to the VIN number field of tightening result data (0061). Until the next car number setting comes, the same VIN ID is set to the VIN number field. Moreover, when this message is not notified, the VIN number field is buried with space. (This message has the possibility to be integrated into the next item MID0150 thereafter.)

(2) ID setting (MID 0150, CMD, station→WU-1)

	Header (20byte)		Data	End
0021～0100	0150	Extension	VIN ID	NULL
4(byte)	4(byte)	12(byte)	MAX 80(byte)	1(byte)

The VIN number and other information are notified from PLC. The controller sets VIN ID notified by this message to the VIN number field of tightening result data (0061). Though the data field is based on variable length, the information after 26 bytes is disregarded by the controller. Until the next car number setting comes, the same VIN ID is set to the VIN number field. Moreover, when this message is not notified, the VIN number field is buried with space.

Though VIN ID consists of 80 bytes at a maximum, as the VIN number field of tightening data consists of 25 bytes only, the lower 25 bytes are reflected in the tightening result data when exceeding the 25 bytes. Moreover, when not coming up to 25 bytes, justifying forward and the remainder is buried with space.

(3)VIN number notification beginning (MID 0051, SUBSCR, station→WU-1)

	Header (20byte)		End
0020	0051	Extension	NULL
4(byte)	4(byte)	12(byte)	1(byte)

Extension 12 (byte)

Space or 001	No Ack flag	Space	Space	Space
3(byte)	1(byte)	1(byte)	2(byte)	5(byte)

According to the message of this inquiry, WU-1 is set to notify the set VIN number when the VIN number is set. When No Ack flag is set to 1, the reception of VIN number notification response (MID 0053) is not waited for after VIN number notification (MID 0052) is transmitted. (Retransmission is not made. It is transmitted if there is a change next.)

(4)VIN number notification (MID 0052, PUSH, WU-1→station)

Header (20byte)			Data		End
0047	0052	Extension	01	VIN number	NULL
4(byte)	4(byte)	12(byte)	2(byte)	25(byte)	1(byte)

WU-1 is set to notifiy the set VIN number is notified when the VIN number is set. When No Ack flag is set to 1, the reception of VIN number notification response (MID 0053) is not waited after VIN number notification (MID 0052) is transmitted. (Retransmission is not made. It is transmitted if there is a change next.)

(5)VIN number notification response (MID 0053, ACK, station→WU-1)

Header (20byte)			End
0020	0053	Extension	NULL
4(byte)	4(byte)	12(byte)	1(byte)

After VIN number notification (MID 0052) is received, transmission is made.

(6)VIN number notification end (MID 0054, SUBSCR, station→WU-1)

Header (20byte)			End
0020	0054	Extension	NULL
4(byte)	4(byte)	12(byte)	1(byte)

The state being notified for change by VIN number notification beginning (MID 0051) is released (Unsubscribe).

2.7.9. Tightening result transmission

(1) Tightening result data transmission beginning (MID 0060, SUBSCR, station→WU-1)

Header (20byte)			End
0020	0060	Extension	NULL
4(byte)	4(byte)	12(byte)	1(byte)

Extension 12 (byte)

Space or 001	No Ack flag	Space	Space	Space
3(byte)	1(byte)	1(byte)	2(byte)	5(byte)

Revision must be space or 001 for the extension. Reference No Ack flag only.

By this message, WU-1 is registered to transmit the tightening result data from WU-1 automatically when completing tightening.

When No Ack flag is set to 1, the reception of tightening result data reception response (0062) is not waited after tightening result data (0061) is transmitted. (Retransmission is not made. It is transmitted if there is a change next.)

(2) Tightening result data (MID 0061, PUSH, WU-1→station)

Header (20byte)			Data	End
0231	0061	Extension	Tightening data	NULL
4(byte)	4(byte)	12(byte)	211(byte)	1(byte)

When tightening is completed with the state in which tightening result data event transmission beginning (0060) has been registered, WU-1 transmits this tightening data message. Details of the tightening data (data) are as per the table below. Only the content in accordance with the item of revision1 corresponds to this data.

When No Ack flag is set to 1, the reception of tightening result data reception response (0062) is not waited after tightening result data (0061) is transmitted. (Retransmission is not made. It is transmitted if there is a change next.)

(MID 0061) Details of tightening data.

Parameter	ID	Byte	Explanation
Cell ID	01	4	Cell number (cluster number) "0000" always
Channel number	02	2	"00" always
Controller name	03	25	Space (0x20) buried
VIN number	04	25	The lower 25 bytes in the VIN number notified in car number setting (0150) are set. When not coming up to 25 bytes, Justifying forward, the remainder is filled with space.
JOB number	05	2	"00" always
(PSET) Number	06	3	Work number (“000"-"003")
Batch size	07	4	The setting number is displayed at bolt management ON. ("001"-"099"). "0000" always in case of bolt management OFF
Batch counter	08	4	Bolt number in work at bolt management ON. ("001"-"099") "0000" always in case of number management OFF
Tightening judgment	09	1	Total judgment (0:NOK 1:OK)
Torque judgment	10	1	Torque judgment (0:UNDER 1:OK 2:OVER) *With a castle nut, at secondarily tightening looseing is 1: OK (0 at tightening judgment: NG).
Angle judgment	11	1	Tightening angle judgment (0:UNDER,1:OK,2:OVER)
Lower limit torque	12	6	Lower limit torque setting value (The value multiplied by 100 to the value)
Torque upper limit	13	6	Upper limit torque setting value (The value multiplied by

			100 to the value)
Target torque	14	6	Target torque setting value (The value multiplied by 100 to the value)
Tightening torque	15	6	Tightening torque (The value multiplied by 100 to the value)
Angle lower limit	16	5	Tightening angle lower limit
Angle upper limit	17	5	Tightening angle upper limit
Target angle	18	5	“00000"
Tightening angle	19	5	Tightening angle
Time stamp	20	19	Tightening date (YYYY-MM-DD:HH:MM:SS)
Final setting change date	21	19	The Date when setting operation was last made (YYYY-MM-DD:HH:MM:SS)
Batch status	22	1	At bolt management ON, when the remaining bolt is other than 0="0", When the remaining bolt becomes 0 ="1" At bolt management OFF =“2" (Batch is not used.)
Tightening ID	23	10	Tightening ID

(3)Tightening result data reception response (MID 0062, ACK, station→WU-1)

	Header (20byte)		End
0020	0062	Extension	NULL
4(byte)	4(byte)	12(byte)	1(byte)

This message is transmitted to tightening result data (0061). When No Ack flag of the tightening result data transmission start message is not set to 1, if this message is not confirmed, WU-1 transmits tightening result data (0061) again. (3 times with the interval of 2 seconds) When No Ack flag is set to 1, the reception is not waited . (Retransmission is not made. It is transmitted if there is a change next.)

(4)Tightening result data transmission end (MID 0063, SUBSCR, station→WU-1)

	Header (20byte)		End
0020	0063	Extension	NULL
4(byte)	4(byte)	12(byte)	1(byte)

According to this message, the registration by tightening result data event transmission beginning (0060) is released. Subsequentlty, tightening result data is not transmitted automatically from the controller at tightening completion.

(5)Tightening result data request (MID 0064, CMD, station→WU-1)

Header (30byte)			Data	End
0030	0064	Extension	Tightening ID	NULL
4(byte)	4(byte)	12(byte)	10(byte)	1(byte)

Revision must be space or 001 for the extension.

The transmission of the past tightening result data shown in tightening ID is requested. In case there is nothing that matches the requested tightening ID, it returns a command rejection (error code: 15).

(6)Tightening result data (MID 0065, ANSWR, WU-1 → station)

Header (20byte)			Data	End
0 1 1 8	0 0 6 5	Extension	Tightening data	NULL
4(byte)	4(byte)	12(byte)	9 8 (byte)	1(byte)

Extension has 12byte space

When tightening result data request (0064) is received, WU-1 transmits this tightening data message. Details of the tightening data (data) are as per the table below. Only the content in accordance with the item of revision1 corresponds to this data.

(MID 0065)The details of tightening data

Parameter	ID	Byte	Explanation
Tightening ID	01	10	Tightening ID
VIN number	02	25	The lower 25 bytes in the VIN number notified in car number setting (0150) are set. When not coming up to 25 bytes, Justifying forward, the remainder is filled with space.
(PSET) Number	03	3	Work number (“000"-"003")
Batch counter	04	4	Bolt number in work at bolt management ON. ("001"-"099") "0000" always in case of number management OFF
Tightening judgment	05	1	Total judgment (0:NOK 1:OK)
Torque judgment	06	1	Torque judgment (0:UNDER 1:OK 2:OVER) *With a castle nut, at secondarily tightening looseing is 1: OK (0 at tightening judgment: NG).
Angle judgment	07	1	Tightening angle judgment (0:UNDER,1:OK,2:OVER)
Tightening torque	08	6	Tightening torque (The value multiplied by 100 to the value)
Tightening angle	09	5	Tightening angle
Time stamp	10	19	Tightening date (YYYY-MM-DD:HH:MM:SS)

Batch status	11	1	At bolt management ON, when the remaining bolt is other than 0="0", When the remaining bolt becomes 0 ="1" At bolt management OFF =“2" (Batch is not used.)

2.7.10. Keepalive (Existence confirmation) message

(1) Keepalive message (MID 9999,OTHER, station→WU-1,WU-1→station)

Header (20byte)			End
0020	9999	Extension	NULL
4(byte)	4(byte)	12(byte)	1(byte)

Revision must be space or 001 for the extension. Others must be spaces.

If communication message or this keep alive message from the station is lost for more than 15 seconds, the controller judges the connection was disconnected. Even when there is no need of transmitting a message, in order to keep the connection state, please transmit this message from the station. When this message is received, WU-1 transmits the message of the same content.

2.7.11. Handling of abnormal message

In each message notified from the station, abnormality (there is no termination, characters other than ASCII are detected in the middle of the message, data size inconsistency, etc.) is detected, the command rejection (MID 0004) is returned with error code 99.

3. Correspondence table for message ID

MessageID	Contents	Correspondence	Note
0001	Communication start	✓	
0002	Communication start ack	✓	
0003	Communication stop	✓	
0004	Command error	✓	
0005	Command accepted	✓	
0010	Parameter set numbers upload request	✓	
0011	Parameter set numbers upload reply	✓	It becomes 01-04. (4 work groups)
0012	Parameter set data upload request	✓	
0013	Parameter set data upload reply	✓	Parameter ID and the content become unique.
0014	Parameter set “selected" subscribe	✓	
0015	Parameter set “selected"	✓	
0016	Parameter set “selected" acknowledge	✓	
0017	Parameter set “selected" unsubscribe	✓	

0018	Select Parameter set	✓	It is assumed as work selection (start).
0019	Set Parameter set batch size	×	
0020	Reset Parameter set batch counter	✓	Number reset
0021	Lock at batch done subscribe	✓	
0022	Lock at batch done upload	✓	Bolt completion signal
0023	Lock at batch done upload acknowledge	✓	
0024	Lock at batch done unsubscribe	✓	
0025	Parameter user set download request	×	
0030	Job ID upload request	○	
0031	Job ID upload reply	○	
0032	Job data upload request	○	
0033	Job data upload reply	○	
0034	Job “info" subscribe	○	
0035	Job “info"	○	
0036	Job “info" acknowledge	○	
0037	Job “info" unsubscribe	○	
0038	Select Job	○	
0039	Job restart	○	
0040	Tool data upload request	△	
0041	Tool data upload reply	△	
0042	Disable Tool	✓	
0043	Enable Tool	✓	
0044	Disconnect tool	×	
0050	Vehicle Id Number download request	✓	
0051	Vehicle Id Number upload subscribe	✓	
0052	Vehicle Id Number upload	✓	
0053	Vehicle Id Number upload ack	✓	
0054	Vehicle Id Number upload unsubscribe	✓	
0060	Last tightening result data subscribe	✓	
0061	Last tightening result data upload	✓	Corresponding to Revision1 only
0062	Last tightening result data ack	✓	
0063	Last tightening result data unsubscribe	✓	
0064	Old tightening result upload request	✓	
0065	Old tightening result reply	✓	Corresponding to Revision1 only
0070	Alarm subscribe	×	
0071	Alarm Upload	×	

0072	Alarm Upload ack	×	
0073	Alarm Unsubscribe	×	
0074	Alarm Ack on torque controller	×	
0075	Alarm Acknowledged Ack	×	
0076	Alarm Status	×	
0077	Alarm Status acknowledge	×	
0078	Ack alarm remotely on torque controller	×	
0080	Read time upload request	×	
0081	Time upload reply	×	
0082	Set Time in the Torque Controller	×	
0090	Multi spindle status subscribe	×	
0091	Multi spindle status upload	×	
0092	Multi spindle status upload acknowledge	×	
0093	Multi spindle status unsubscribe	×	
0100	Multi spindle result subscribe	×	
0101	Multi spindle result upload	×	
0102	Multi spindle result upload acknowledge	×	
0103	Multi spindle result unsubscribe	×	
0110	Display user text on compact	×	
0111	Display user text on graph	×	
0113	Flash green light on tool	×	
0120	Job line control info subscribe	×	
0121	Job line control started	×	
0122	Job line control alert1	×	
0123	Job line control alert2	×	
0124	Job line control done	×	
0125	Job line control info acknowledge	×	
0126	Job line control info unsubscribe	×	
0127	Abort job	×	
0128	Job batch increment	×	
0129	Job batch decrement	×	
0130	Job off	×	
0150	Identifier download request	✓	The data after 26 bytes is disregarded
0151	Multiple Identifiers work order upload subscribe	×	
0152	Multiple Identifiers work order upload	×	
0153	Multiple Identifiers work order upload ack	×	

0154	Multiple Identifiers work order upload unsubscribe	×	
0155	Bypass Identifier	×	
0156	Reset latest Identifier	×	
0157	Reset all Identifier	×	
0200	Set “external controlled" relays	×	
0210	Status “external monitored inputs" subscribe	×	
0211	Status “external monitored inputs" upload	×	
0212	Status “external monitored inputs" upload ack	×	
0213	Status “external monitored inputs" unsubscribe	×	
0214	IO device status request	×	
0215	IO device status	×	
9999	Keep alive open protocol communication	✓	