Open Protocol Manual

Rev 14 October 2013

ASG™ PRECISION FASTENING

<Contents>

1. Introduction

This specification document describes specifications of ASG EH2 Series X-PAQ™ corresponding to Atlas PF3000 open protocol.

X-PAQ™ contains functions of Atlas open protocol Revision 1, but does not contain functions limited to Atlas PF3000 (although those are described on the specification document.)

2. Protocol

2.1 TCP/IP

The protocol used is TCP/IP. The port used for the communication is 4545.

The torque controller can accepts up to 5 connections at a time.

2.2 Serial ASCII protocol

Use X-PAQ™ COM1. This function becomes effective when the setting of "1.SCANER SEL" in "S06:ID SELECT" is OFF and the dip switch 1 - 3 is turning on.

When running serial communication, all the messages exchanged between the X-PAQ™ and the station computer are the same as for Ethernet communication BUT must be encapsulated between STX (ASCII 0x02) and ETX (ASCII 0x03).

Furthermore all the messages sent from the station computer to the X-PAQ™ must be stamped with a tag before the STX character. The tag is constituted with 4 ASCII characters following each other : BEL (ASCII 0x07) HT (ASCII 0x09) BEL (ASCII 0x07) HT (ASCII 0x09).

2.3 Message structure

All information sent over the communication links is ASCII format.

A message consists of three parts, header, data field and message end. The sections below describe each part in greater details.

Header				Data Field	Message End
Length	MID	Rev	Spare	….	NUL (ASCII 0x0)
20 bytes				Max 1004 bytes	

2.4 Header

The header contains 20 bytes.

Table 1

Part	Bytes	Comment
Length	4	The header always contains the length of the telegram. The length is four ASCII digits long ('0'…'9') specifying a range of 0000 to 9999. The length is the length of the header plus the data field exclusive the NULL termination.
MID	4	The MID is four byte long and is specified by four ASCII digits ('0'…'9'). The MID describes how to interpret the sent telegram.
Revision	3	The revision of the MID is specified by three ASCII digits ('0'…'9'). The MID revision is unique per MID and is used in case where several versions are available for the same MID. Using the revision number the station computer can subscribe or ask for different versions of the same MID. By default the MID revision number is three spaces (revision 1 of the MID). So, if the station computer is interested in the initial revision (revision 1) of the MID, it can send three spaces as MID revision or 001.
Spare	9	Reserved space in the header for future use.

Special Note:

The Length and MID are padded on the left with zeroes (ASCII 0x30).

2.5 Data Field

The specific data format depends on the actual command.

Data Field ASCII data representing the data.
The data contains a list of parameters.

Each parameter is represented with the following structure (if nothing else is mentioned):

Id	Parameter Value

Id Parameter id ("00"..."99"), length two bytes.
The parameter id is padded on the left with the ASCII characters '0'.

Parameter Value
Parameter value is defined by parameter selection (fixed number of bytes).

If the Parameter value is only specified by ASCII digits the parameter value is padded on the left with the ASCII characters '0'.

If the Parameter value is specified by ASCII characters (taken between 0x20 and 0x7F Hex), the parameter value is padded on the right with space <SPC> (ASCII character 0x20 Hex).

Special Notes:

All the parameters of the data field should be sent.
The data field of each message is subject to future modifications, new parameters may be added and by the way the length of the data field could increase.

2.6 Message End

All the telegrams are NULL terminated. The NULL termination is not included in the message length.

3. Communication

3.1 Available Message

MID	Description
0001	Communication start
0002	Communication start acknowledge
0003	Communication stop
0004	Command error
0005	Command accepted
0010	Parameter set numbers upload request
0011	Parameter set numbers upload reply
0012	Parameter set data upload request
0013	Parameter set data upload reply
0014	Parameter set “selected” subscribe
0015	Parameter set “selected”
0016	Parameter set “selected” acknowledge
0017	Parameter set “selected” unsubscribe
0018	Select Parameter set
0019	Set Parameter set batch size
0020	Reset Parameter set batch size
0030	Job numbers upload request
0031	Job numbers 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
0050	Vehicle Id Number download request
0051	Vehicle Id Number upload subscribe
0052	Vehicle Id Number upload
0053	Vehicle Id Number upload acknowledge
0054	Vehicle Id Number upload unsubscribe
0060	Last tightening result data subscribe
0061	Last tightening result data upload
0062	Last tightening result data acknowledge
0063	Last tightening result data unsubscribe
0064	Old tightening result upload request
0065	Old tightening result reply
0070	Alarm subscribe
0071	Alarm Upload
0072	Alarm Upload acknowledge
0073	Alarm Unsubscribe

MID	Description
0074	Alarm Acknowledged on torque controller
0075	Alarm Acknowledged Ack
0076	Alarm Status
0077	Alarm Status acknowledge
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
9999	Keep alive message

3.2 Communication telegram

3.2.1 Communication start (MID = 0001)

Header				Data Field	Message End
0020	0001	Rev	Spare	….	NUL (ASCII 0x0)
20 bytes				0 bytes	

Enables the command link. The torque controller will not respond to any other commands before this. The torque controller answers with a command error “Already connected” if the link has already been enabled.

Possible answers	Communication start acknowledge (MID = 0002) Command Error (MID = 0004) “Client already connected”
Sent by	Station computer.

3.2.2 Communication start acknowledge (MID = 0002)

Header				Data Field	Message End
0057	0002	Rev	Spare	*Data*	NUL (ASCII 0x0)
20 bytes				37 bytes	

When accepting the communication the torque controller sends as reply, a Communication start acknowledge. This message contains some basic information about the torque controller which accept the connection (cluster number, channel number, torque controller Name)

Table 7 MID 0002 Revision 1

Parameter	Id	Bytes	Comment	X-PAQ™
Cell Id	01	4	The cell number (cluster number). is four byte long specifying a range of 0000 to 9999 and is specified by four ASCII digits ('0'….'9').	"0000"
Channel Id	02	2	The channel Id is two byte long specifying a range of 00 to 20 and is specified by two ASCII digits ('0'….'9').	"00"
Controller Name	03	25	The torque controller name is 25 byte long and is specified by 25 ASCII characters taken between 0x20 and 0x7F Hex. (X25).	

Possible answers No
Sent by the torque controller.

Example:

Header				Data Field	Message End
0057	0002	Rev	Spare	010000020003controller1	NUL (ASCII 0x0)
20 bytes				37 bytes	

3.2.3 Communication stop (MID = 0003)

Header				Data Field	Message End
0020	0003	Rev	Spare	…	NUL (ASCII 0x0)
20 bytes				0 bytes	

Disables the command link. The torque controller will stop to respond to any commands (except for "Communication start" MID = 0001) after receiving this command.

Possible answers Command accepted (MID = 0005).
Sent by Station computer.

3.3 Request answer

3.3.1 Command error (MID = 0004)

This message is used by the torque controller when a request for one reason could not have been performed. The data field contains the message Id of the telegram request that failed as well as an error code.

Header				Data Field		Message End
0026	0004	Rev	Spare	*MID*	*Error*	NUL (ASCII 0x0)
20 bytes				6 bytes		

MID *Message Id of the request rejected.*
Error *Error code ("00"..."99"), two bytes. See Table 9.*

Table 9

Error	Original Text
“01”	Invalid data.
“02”	Pset number not present
“03”	Pset can not be set.
“04”	Pset not running
“06”	VIN upload subscription already exists
“07”	VIN upload subscription does not exists
“08”	VIN input source not granted
“09”	Last tightening result subscription already exists
“10”	Last tightening result subscription does not exist
“11”	Alarm subscription already exists
“12”	Alarm subscription does not exist
“13”	Parameter set selection subscription already exists
“14”	Parameter set selection subscription does not exist
“15”	Tightening Id requested not found
“16”	Connection rejected protocol busy
“17”	Job number not present
“18”	Job info subscription already exists
“19”	Job info subscription does not exist
“20”	Job can not be set
“21”	Job not running
“30”	Controller is not a sync Master
“31”	Multi spindle status subscription already exists
“32”	Multi spindle status subscription does not exist
“33”	Multi spindle result subscription already exists
“34”	Multi spindle result subscription does not exist
“40”	Job line control info subscription already exists
“41”	Job line control info subscription does not exist
“42”	Identifier input source not granted
“43”	Multiple identifiers work order subscription already exists
“44”	Multiple identifiers work order subscription does not exist
“58”	No alarm present
“59”	Tool currently in use
“96”	Client already connected
“97”	MID revision unsupported
“98”	Controller internal request timeout
“99”	Unknown MID

Possible answers None.
Sent by the torque controller.

Example:

The request Select Pset (MID = 0018) failed, the Pset number was not present in the torque controller.

Header				Data Field	Message End
0026	0004	Rev	Spare	001802	NUL (ASCII 0x0)
20 bytes				6 bytes	

3.3.2 Command accepted (MID = 0005)

This message is used by the torque controller to confirm that the last request sent by the station computer was accepted. The data field contains the MID of the request accepted.

Header				Data Field	Message End
0024	0005	Rev	Spare	*MID*	NUL (ASCII 0x0)
20 bytes				4 bytes	

Possible answers None.
Sent by the torque controller.

Example:

The request Select Pset (MID = 0018) is accepted.

Header				Data Field	Message End
0024	0004	Rev	Spare	0018	NUL (ASCII 0x0)
20 bytes				4 bytes	

3.4 Parameter set telegrams

3.4.1 Parameter set number upload request (MID = 0010)

Header				Data Field	Message End
0020	0010	Rev	Spare	…	NUL (ASCII 0x0)
20 bytes				0 bytes	

A request for all the valid Parameter set number of the torque controller. The result of this command will be the transmission of all the valid Pset number of the torque controller (Parameter set numbers upload reply MID = 0011)

Possible answers Parameter set numbers upload reply (MID = 00011).
Sent by Station computer.

3.4.2 Parameter set numbers upload reply (MID = 0011)

The transmission of all the valid Pset numbers of the torque controller. The data field contains the number of valid pset currently present in the torque controller, and the number of each Pset present.

Header				**Data Field**		**Message End**
Length	0011	Rev	Spare	*Nbr of valid channel*	…	NUL (ASCII 0x0)
20 bytes				3 bytes	3 bytes × Number of valid Pset	

Nbr of valid Pset : number of pset present in the torque controller specified by 3 bytes(max 999).

Each Pset number is three byte long and is specified by three ASCII digits ('0'….'9').

Possible answers No
Used by the torque controller.

Example :
Pset 1 and 2 are presents in the torque controller

Header				**Data Field**		**Message End**
0029	0011	Rev	Spare	002	001002	NUL (ASCII 0x0)
29 bytes				3 bytes	6 bytes	

3.4.3 Parameter set data upload request (MID = 0012)

Header				**Data Field**	**Message End**
0023	0012	Rev	Spare	*Pset Number*	NUL (ASCII 0x0)
20 bytes				3 bytes	

Request to upload a parameter set data from the torque controller.

Channel Number Parameter set number, is three byte long and is specified by three ASCII digits ('0'….'9')..

Possible answers Parameter set data upload reply (MID = 0013)
or
Command error (MID = 0003)
"Channel number not present "
Used by Station computer.

Example :
Upload Channel data request for Channel number 1.

Header				Data Field	Message End
0023	0012	Rev	Spare	001	NUL (ASCII 0x0)
20 bytes				3 bytes	

3.4.4 Parameter set data upload reply (MID = 0013)

Header				Data Field	Message End
0104	0013	Rev	Spare	*Data*	NUL (ASCII 0x0)
20 bytes				84 bytes	

Upload of parameter set data reply.

Table 10

Parameter	Id	Bytes	Comment
Channel id	01	3 ASCII digits	Range 1-99
Channel name	02	25 ASCII character	Fill with SPC if Channel Name size < 25
Rotation direction	03	1 ASCII digits	1. CW 2. CCW
Batch size	04	2 ASCII digits	Range 0-99
Torque min	05	6 ASCII digits	The torque min limit is multiplied by 100 and sent as an integer (2 decimals truncated).
Torque max	06	6 ASCII digits	The torque max limit is multiplied by 100 and sent as an integer (2 decimals truncated).
Torque final target	07	6 ASCII digits	The torque final target is multiplied by 100 and sent as an integer (2 decimals truncated).
Angle min	08	5 ASCII digits	The angle min value has a specified range between 0 and 99999.
Angle max	09	5 ASCII digits	The angle max value is five byte long and is specified by five ASCII digits ('0'….'9').
Final Angle Target	10	5 ASCII digits	The target angle has a specified range between 0 and 99999. The target angle is specified in degrees.

Possible answers No
Sent by the torque controller

Example :
Upload Channel data for Channel number 1.

Header				Data Field	Message End
0104	0013	Rev	Spare	0100102pset1 03104030500120006001500070014000800360090072010004 80	NUL (ASCII 0x0)
20 bytes				84 bytes	

3.4.5 Parameter set “selected” subscribe (MID = 0014)

Header				Data Field	Message End
0020	0014	Rev	Spare		NUL (ASCII 0x0)
20 bytes				0 bytes	

A subscription for the Pset selection. A message (Parameter set selected MID = 0015) is sent to the station computer each time a new Pset is selected. Note that the message as well is sent after the answer (Command accepted MID = 0005) is sent, as an immediate response to the subscribe message.

Possible answers Command accepted (MID = 0005)
Or
Command Error (MID = 0004)
“Parameter set selection subscription already exists”
Sent by Station computer

3.4.6 Parameter set selected (MID = 0015)

Header				Data Field		Message End
0042	0015	Rev	Spare	*Pset Nbr*	*YYYY-MM-DD:HH:MM:SS Date of last change in Pset setting*	NUL (ASCII 0x0)
20 bytes				22 bytes		

A new Channel is selected in the torque controller.
The telegram contains the number of the last Channel selected as well as the date/time of the last change done in the Channel settings. This message is also sent as an immediate response to the subscription for the Channel selection (MID = 0014).

Possible answers New Channel selected Acknowledge (MID = 0016)
Sent by the torque controller.

Example:

Header				Data Field		Message End
0042	0015	Rev	Spare	001	2001-06-30:20:34:12	NUL (ASCII 0x0)
20 bytes				22 bytes		

3.4.7 Parameter set selected acknowledge (MID = 0016)

Header				Data Field	Message End
0020	0016	Rev	Spare		NUL (ASCII 0x0)
20 bytes				0 bytes	

Acknowledge for a New Channel selected.

Possible answers No
Sent by Station computer.

3.4.8 Parameter set “selected” unsubscribe (MID = 0017)

Header				Data Field	Message End
0020	0017	Rev	Spare		NUL (ASCII 0x0)
20 bytes				0 bytes	

Reset the subscription for the Channel selection.

Possible answers Command accepted (MID = 0005)
Or
Command Error (MID = 0004)
“Parameter set selection subscription does not exist”

Sent by Station computer.

3.4.9 Select Parameter set (MID = 0018)

Header				Data Field	Message End
0023	0018	Rev	Spare	*Pset Number*	NUL (ASCII 0x0)
20 bytes				3 bytes	

Pset Number Parameter set number represented by 3 ASCII digits (range 000 to 999).

Possible answers Command accepted (MID = 0005)
or
Command Error (MID = 0003)
“pset cannot be set”

Sent by Station computer

3.4.10 Set Parameter Set batch size (MID = 0019)

Header				Data Field		Message End
0025	0019	Rev	Spare	*Channel Number*	*Batch size*	NUL (ASCII 0x0)
20 bytes				5 bytes		

This telegram gives the possibility to set the batch size of a parameter set in run time.

Channel Number Parameter set number represented by 3 ASCII digits (range 000 to 999).

Batch Size Size of the parameter set batch represented by 2 ASCII digits (range 00-99)

Possible answers Command accepted (MID = 0005)
Or
Command Error (MID = 0004)
“Invalid data”

Sent by Station computer.

3.4.11 Reset Parameter Set batch size (MID = 0020)

Header				Data Field	Message End
0023	0020	Rev	Spare	*Channel Number*	NUL (ASCII 0x0)
20 bytes				3 bytes	

This telegram gives the possibility to reset the batch counter of the running parameter set in run time.

Channel Number Parameter set number represented by 3 ASCII digits (range 000 to 999).

Possible answers Command accepted (MID = 0005)
Or
Command Error (MID = 0004)
"Invalid data"
"Pset not running"

Sent by Station computer.

3.5 Job telegram

3.5.1 Job numbers upload request (MID = 0030)

Header				Data Field	Message End
0020	0030	Rev	Spare		NUL (ASCII 0x0)
20 bytes				0 bytes	

A request for all the valid Job numbers of the X-PAQ™. The result of this command will be the transmission of all the valid Job numbers of the X-PAQ™ (Job numbers upload reply MID = 0031)

Possible answers Job numbers upload reply (MID = 0031).

Sent by Station computer.

3.5.2 Job numbers upload reply (MID = 0031)

Header				Data Field		Message End
Length	0031	Rev	Spare	*Nbr of valid Job number*	…	NUL (ASCII 0x0)
20 bytes				2 bytes	2 bytes × Number of valid Job	

The transmission of all the valid Job numbers of the X-PAQ™.

Each Job number is two bytes long and is specified by three Ascii digits ('0'….'9'). Range ('00'…'99').

Possible answers No

Sent by The torque controller.

Example :

Job 1 and 2 are present in the X-PAQ™

Header				Data Field		Message End
26	0031	Rev	Spare	*02*	*0102*	NUL (ASCII 0x0)
20 bytes				2 bytes	2 bytes × Number of valid Job	

3.5.3 Job data upload request (MID = 0032)

Header				Data Field	Message End
0022	0032	Rev	Spare	*Job Nbr*	NUL (ASCII 0x0)
20 bytes				2 bytes	

Request to upload the data from a specific Job from the X-PAQ™.

Job Nbr Job Nbr is two bytes long and is specified by two Ascii digits ('0'….'9')

Possible answers "Job data upload " (MID = 0033)"
or
"Command error (MID = 0003)
"Job Nbr not present "

Used by Station computer.

Example :

Header				Data Field	Message End
0022	0032	Rev	Spare	01	NUL (ASCII 0x0)
20 bytes				2 bytes	

3.5.4 Job data upload reply (MID = 0033)

Header				Data Field	Message End
	0033	Rev	Spare	*Data*	NUL (ASCII 0x0)
20 bytes				83 + no of Pset x 12 bytes	

The job data reply is sent as a reply to the Job data request (MID = 0032).

Table 11

Parameter	Id	Bytes	Comment
Job number	01	2	The job number (JobId) is specified by two ASCII characters. Range 0-99
Job name	02	25	Job name
Forced order	03	1	One ASCII character 0 . free order 1 . forced order 2 . free and forced
Max time for first tightening	04	4	0-9999 seconds defined by four ASCII characters 0 = not used
Max time to complete job	05	5	0-99999 seconds defined by five ASCII characters 0 = not used
Job batch mode/batch Count type	06	1	The job batch mode is the way to count the bolt in a job; only the OK or both OK and NOK. One ASCII character 0 -> only the OK bolts are counted 1 -> both the OK and NOK bolts are counted
Lock at job done	07	1	One ASCII character 0 . No 1 . Yes
Use line control	08	1	One ASCII character 0 . No 1 . Yes
Repeat job	09	1	One ASCII character 0 . No 1 . Yes
Tool loosening	10	1	Tool loosening. One ASCII character. 0 . Enable 1 . Disable 2 . Enable only on NOK tightening
Reserved	11	1	Reserved for job repair. One ASCII character. 0 . E 1 . G
Number of psets	12	2	The number of psets in the job list, defined by two ASCII characters
Job list	13	N x 12	A list with up to 30 Psets where each Pset is defined by a number of parameters separated by ":" and terminated by ";" (12 bytes) according to: [PF-id]:[Type-ID]:[AutoValue]:[BatchSize]; PF-id = ChannelID, 0-99, two ASCII characters For X-PAQ™, 00 fixed. Type ID = Pset ID or Multistage ID, three ASCII characters For X-PAQ™, 0 fixed. Auto Value = 1 or 0, 1 for Auto Next Change, one ASCII character BatchSize = 0-99, two ASCII characters Ex: 15:011:0:22;

Possible answers	No
Sent by	The torque controller.

3.5.5 Job “info” subscribe (MID =0034)

Header				Data Field	Message End
0020	0034	Rev	Spare		NUL (ASCII 0x0)
20 bytes				0 bytes	

A subscription for the Job “info”. A message is sent to the station computer when a new Job is selected (Job “info” MID = 0035)) and after each rundown performed during the job.

Possible answers	Command accepted (MID = 0005) Or Command Error (MID = 0004) “Job info subscription already exists”
Sent by	Station computer.

3.5.6 Job “info” (MID = 0035)

Header				Data Field	Message End
0063	0035	Rev	Spare	*Data*	NUL (ASCII 0x0)
20 bytes				43 bytes	

The job info subscriber will receive a job info telegram after a job has been selected and after each rundown performed in the job (if all the tightening are counted) or after each OK rundown (if only the OK tightening are counted) see job below batch mode. The job info consists of the number of the currently running job, the job status, the job batch mode, the job batch size and the job batch counter.
Data ASCII data representing the parameter set data.

Data	ASCII data representing the parameter set data. The data contains a list of parameters.

Table 12

Parameter	Id	Bytes	Comment
Job number	01	2	The job number is specified by 2 ASCII characters Range 0-99
Job status	02	1	The job batch status is specified by one ASCII character. 0 job batch not completed / 1 job batch OK / 2 job batch NOK.
Job batch mode	03	1	The job batch mode is the way to count the bolt in a job only the OK or both OK and NOK. The job batch mode is specified by one ASCII character 0 -> only the OK bolts are counted 1 -> both the OK and NOK bolts are counted
Job batch size	04	4	This parameter gives the total number of tightening in the job. The job batch size is four byte long specifying a range of 0000 to 9999.
Job batch counter	05	4	This parameter gives the current value of the number of OK rundowns already performed in the job. The job batch size is four byte long specifying a range of 0000 to 9999.
Time stamp	06	19	Time stamp for the job info sent to the control station. The time stamp is 19 byte long and is specified by 19 ASCII characters (YYYY-MM-DD:HH:MM:SS).

Possible answers Job info Acknowledge (MID = 0036)
Sent by The torque controller

Example:

Header				Data Field	Message End
0039	0035	Rev	Spare	0101020030040012050012 062001-12-01:20:12:45	NUL (ASCII 0x0)
20 bytes				43 bytes	

3.5.7 Job “info” acknowledge (MID = 0036)

Header				Data Field	Message End
0020	0036	Rev	Spare		NUL (ASCII 0x0)
20 bytes				0 bytes	

Acknowledge for a Job “info”.

Possible answers No
Sent by Station computer.

3.5.8 Job “info” unsubscribe (MID = 0037)

Header				Data Field	Message End
0020	0037	Rev	Spare		NUL (ASCII 0x0)
20 bytes				0 bytes	

Reset the subscription for the Job info telegram.

Possible answers Command accepted (MID = 0005)
Or
Command Error (MID = 0004)
“Job “info” subscription does not exist”

Sent by Station compute

3.5.9 Select Job in X-PAQ™ (MID = 0038)

Header				Data Field	Message End
0022	0038	Rev	Spare	*Job Number*	NUL (ASCII 0x0)
20 bytes				2 bytes	

Job number Job number represented by 2 Ascii digits (range 00 to 99).

Possible answers Command accepted (MID = 0005)
or
Command Error (MID = 0003)
(“Job cannot be set”)
(“Invalid data”)

Sent by Integrator

3.5.10 Job restart (MID = 0039)

Header				Data Field	Message End
0022	0039	Rev	Spare	*Job Number*	NUL (ASCII 0x0)
20 bytes				2 bytes	

Job number Job number represented by 2 Ascii digits (range 00 to 99).

Possible answers Command accepted (MID = 0005)
or
Command Error (MID = 0003)
(“Job not running”)
(“Invalid data”)

Sent by Integrator

Example:

Header				Data Field	Message End
0022	0039	Rev	Spare	01	NUL (ASCII 0x0)
20 bytes				2 bytes	

3.6 Tool telegram

3.6.1 Tool data upload request (MID = 0040)

Header				Data Field	Message End
0020	0040	Rev	Spare		NUL (ASCII 0x0)
20 bytes				0 bytes	

A request for some data stored in the tool. The result of this command will be the transmission of the tool data (Tool data upload reply MID = 0028)

Possible answers Tool data upload reply (MID = 0041).
Sent by Station computer.

3.6.2 Tool data upload (MID = 0041)

Header				Data Field	Message End
0081	0041	Rev	Spare	*Data*	NUL (ASCII 0x0)
20 bytes				61 bytes	

Upload of tool data from the torque controller.

Data ASCII data representing the parameter set data.
The data contains a list of parameters.

Table 13

Parameter	Id	Bytes	Comment
Tool serial number	01	14	The Tool serial number is specified by 14 ASCII characters
Tool number of tightening	02	10	The Tool number of tightening is specified by 10 ASCII digits. Max 4294967295
Last calibration date	03	19	YYYY-MM-DD:HH:MM:SS
Controller Serial Number	04	10	The controller serial number is specified by 10 ASCII characters

Example:

Header				Data Field	Message End
0081	0041	Rev	Spare	01C341212 02548796 032001-05-07:13:24:5404670919	NUL (ASCII 0x0)
20 bytes				61 bytes	

3.6.3 Disable tool (MID = 0042)

Header				Data Field	Message End
0020	0042	Rev	Spare		NUL (ASCII 0x0)
20 bytes				0 bytes	

Disable tool

Possible answers Command accepted (MID = 0005)
Sent by Station computer.

3.6.4 Enable tool (MID = 0043)

Header				Data Field	Message End
0020	0043	Rev	Spare		NUL (ASCII 0x0)
20 bytes				0 bytes	

Enable tool

Possible answers Command accepted (MID = 0005)
Sent by Station computer.

3.6.5 Disconnect tool request (MID = 0044)

Header				Data Field	Message End
0020	0044	Rev	Spare		NUL (ASCII 0x0)
20 bytes				0 bytes	

This command is sent by the station computer in order to request the possibility to unmount the tool on the torque controller. The command will be rejected if the tool is currently used.
When the command is accepted the worker can loosen the tool and replace it (hot swap).=> For X-PAQ™, no replacement

Possible answers Command accepted (MID = 0005)
Command error (MID = 0004)
"Tool currently in use"
Sent by Station computer.

3.7 VIN telegram

3.7.1 Vehicle Id Number download request (MID = 0050)

Header				Data Field	Message End
0045	0050	Rev	Spare	*VIN*	NUL (ASCII 0x0)
20 bytes				25 bytes	

Used by the station computer to send a VIN number to the torque controller.

The VIN number is represented by max 25 ASCII characters. If the VIN number length is lower than 25 characters, the VIN number field is filled with space SPC

Possible answers Command accepted (MID = 0005)
or
Command Error (MID = 0003)
"VIN input source not granted"
Sent by Station computer.

3.7.2 Vehicle Id Number upload subscribe (MID = 0051)

Header				Data Field	Message End
0020	0051	Rev	Spare		NUL (ASCII 0x0)
20 bytes				0 bytes	

This telegram is used by the station computer to set subscription for the barcode received by the torque controller independently of the input source (serial, Ethernet, field bus…). The result of this command will be the transmission of all the barcode received by the torque controller to the subscriber independently of the input source.

Possible answers Command accepted (MID = 0005)
Or
Command Error (MID = 0004)
"VIN upload subscription already exists"
Sent by Station computer.

3.7.3 Vehicle Id Number upload (MID = 0052)

Header				Data Field	Message End
0045	0052	Rev	Spare	*VIN* *25 ASCII characters*	NUL (ASCII 0x0)
20 bytes				25 bytes	

Transmission of the last barcode received by the torque controller to the subscriber.

Possible answers Vehicle Id Number upload acknowledge (MID = 0053)
Sent by the torque controller

3.7.4 Vehicle Id Number upload acknowledge (MID = 0053)

Header				Data Field	Message End
0020	0053	Rev	Spare		NUL (ASCII 0x0)
20 bytes				0 bytes	

Vehicle Id Number upload acknowledge.

Possible answers No
Sent by Station computer.

3.7.5 Vehicle Id Number upload unsubscribe (MID = 0054)

Header				Data Field	Message End
0020	0054	Rev	Spare		NUL (ASCII 0x0)
20 bytes				0 bytes	

Reset the subscription for the barcode (VIN) received by the torque controller.

Possible answers Command accepted (MID = 0005)
Or Command Error (MID = 0004)
"VIN upload subscription does not exists"
Sent by Station computer.

3.8 Tightening result telegram

3.8.1 Last tightening result data subscribe (MID = 0060)

Header				Data Field	Message End
0020	0060	Rev	Spare		NUL (ASCII 0x0)
20 bytes				0 bytes	

Set the subscription for the rundowns result. The result of this command will be the transmission of the rundown result after the tightening is performed (push function)

Possible answers Command accepted (MID = 0005)
Or
Command Error (MID = 0004)
"Last tightening result subscription already exists"
"MID revision not supported"

Sent by Station computer.

3.8.2 Last tightening result data upload reply (MID = 0061)

Header				Data Field	Message End
0231	0061	Rev	Spare	*Data*	NUL (ASCII 0x0)
20 bytes					

Upload last tightening result. Five revisions are available for this MID.
The five revision are presented in the following tables.

Table 14, MID 0061 revision 1
Table 15, MID 0061 revision 2
Table 16, MID 0061 revision 3
Table 17, MID 0061 revision 900
Table 18, MID 0061 revision 901

The length of MID 61 revision 1 is 231 byte (211 byte of data + 20 byte header)
The length of MID 61 revision 2 is 385 byte (365 byte of data + 20 byte header)
The length of MID 61 revision 3 is 419 byte (399 byte of data + 20 byte header)
The length of MID 61 revision 900 is 387 byte (367 byte of data + 20 byte header)
The length of MID 61 revision 901 is 411 byte (391 byte of data + 20 byte header)

Table 14、MID0061 Revision 1

Parameter	Id	Bytes	Comment
Cell Id	01	4	The cell number (cluster number) is four byte long specifying a range of 0000 to 9999 and is specified by four ASCII digits ('0'….'9'). => For X-PAQ™, 0001 fixed.
Channel Id	02	2	The channel Id is two byte long specifying a range of 00 to 20 and is specified by two ASCII digits ('0'….'9').=> For X-PAQ™, 01 fixed.
Torque controller Name	03	25	The torque controller name is 25 byte long and is specified by 25 ASCII characters taken between 0x20 and 0x7F Hex.
VIN Number	04	25	The VIN number is 25 byte long and is specified by 25 ASCII characters taken between 0x20 and 0x7F Hex.
Job Number	05	2	This is the job number that is currently run (JobId), this information is sent with each tightening result. The job number is two bytes long specifying a range of 00 to 99 and is specified by two ASCII digits ('0'….'9').
Pset number	06	3	This is the pset number that is run (psetId), this information is sent with each tightening result. The pset number is three byte long specifying a range of 000 to 999 and is specified by three ASCII digits ('0'….'9').
Batch Size	07	4	This parameter gives the total number of tightening in the batch. The batch size is four byte long specifying a range of 0000 to 9999.
Batch counter	08	4	This is the batch counter, this information is sent with each tightening result. The batch counter number is four byte long specifying a range of 0000 to 9999 and is specified by four ASCII digits ('0'….'9').
Tightening Status	09	1	The tightening status is one byte long and is specified by one ASCII digit ('0' or '1'). Zero corresponds to tightening NOK, one corresponds to tightening OK.
Torque status	10	1	0. Low / 1. OK / 2 .High
Angle status	11	1	0. Low / 1. OK / 2 .High
Torque Min limit	12	6	The torque min limit is sent with each tightening result. The torque min limit is multiplied by 100 and sent as an integer (2 decimals truncated). The torque min limit is six byte long and is specified by six ASCII digits ('0'….'9').
Torque Max limit	13	6	The torque max limit is sent with each tightening result. The torque max limit is multiplied by 100 and sent as an integer (2 decimals truncated). The torque max limit is six byte long and is specified by six ASCII digits ('0'….'9', '.').
Torque final target	14	6	The torque final target is sent with each tightening result. The torque final target is multiplied by 100 and sent as an integer (2 decimals truncated). The torque final target is six byte long and is specified by six ASCII digits ('0'….'9', '.').
Torque	15	6	The torque value is sent with each tightening result. The torque is multiplied by 100 and sent as an integer (2 decimals truncated). The torque is six byte long and is specified by six ASCII digits ('0'….'9', '.').
Angle Min	16	5	The angle min value in degrees is sent with each tightening result, each turn represents 360 degrees. The angle min value has a specified range between 0 and 99999. The angle min value is five byte long and is specified by five ASCII digits ('0'….'9').
Angle Max	17	5	The angle max value in degrees is sent with each tightening result, each turn represents 360 degrees. The angle max value has a specified range between 0 and 99999. The angle max value is five byte long and is specified by five ASCII digits ('0'….'9')
Final Angle Target	18	5	The target angle value in degrees is sent with each tightening result, each turn represents 360 degrees. The target angle has a specified range between 0 and 99999. The target angle is five byte long and is specified by five ASCII digits ('0'….'9').
Angle	19	5	The turning angle value in degrees is sent with each tightening result, each turn represents 360 degrees. The turning angle has a specified range between 0 and 99999. The turning angle is five byte long and is specified by five ASCII digits ('0'….'9').

Parameter	Id	Bytes	Comment
Time stamp	20	19	Time stamp for each tightening sent to the control station. The time stamp is 19 byte long and is specified by 19 ASCII characters (YYYY-MM-DD:HH:MM:SS).
Date/time of last change in Pset settings	21	19	Time stamp for the last change in the current pset settings. The time stamp is 19 byte long and is specified by 19 ASCII characters (YYYY-MM-DD:HH:MM:SS).
Batch status	22	1	The batch status is specified by one ASCII character. 0 batch NOK (batch not completed) / 1 batch OK / 2 batch not used.
Tightening Id	23	10	The tightening Id is a unique Id for each tightening result. The tightening Id is incremented after each rundown. 10 ASCII digits. Max 4294967295

Table 15、MID0061 Revision 2

Parameter	Id	Bytes	Comment
Cell Id	01	4	The cell number (cluster number) is four byte long specifying a range of 0000 to 9999 and is specified by four ASCII digits ('0'….'9'). => For X-PAQ™, 0000 fixed.
Channel Id	02	2	The channel Id is two byte long specifying a range of 00 to 20 and is specified by two ASCII digits ('0'….'9').=> For X-PAQ™, 00 fixed.
Torque controller Name	03	25	The torque controller name is 25 byte long and is specified by 25 ASCII characters taken between 0x20 and 0x7F Hex.
VIN Number	04	25	The VIN number is 25 byte long and is specified by 25 ASCII characters taken between 0x20 and 0x7F Hex.
Job Number	05	4	This is the job number that is currently run (JobId), this information is sent with each tightening result. The job number is two bytes long specifying a range of 0 to 9999 and is specified by two ASCII digits ('0'….'9').
Pset number	06	3	This is the pset number that is run (psetId), this information is sent with each tightening result. The pset number is three byte long specifying a range of 000 to 999 and is specified by three ASCII digits ('0'….'9').
Strategy	07	2	The strategy currently run by the torque controller. The strategy is two bytes long specifying a range of 00 to 99 and is specified by two ASCII digits ('0'….'9'). The corresponding strategies are： 1. Torque control 2. Torque control / angle monitoring 3. Torque control / angle control AND 4. Angle control / torque monitoring ~~5. DS control~~ ~~6. DS control torque monitoring~~ 7. Reverse angle ~~8. Reverse torque~~ ~~9. Click wrench~~ ~~10. Rotate spindle forward~~ 11. Torque control angle control OR ~~12. Rotate spindle reverse~~ ~~99. No strategy~~

Parameter	Id	Bytes	Comment
Strategy Option	08	5	Bit 0 (value 1) Torque Bit 1 (value 2) Angle Bit 2 (value 4) Batch Bit 3 (value 8) PVT Monitoring Bit 4 (value 16) PVT Compensate Bit 5 (value 32) Selftap Bit 6 (value 64) Rundown Bit 7 (value 128) CM ~~Bit 8 (value 256) DS control~~ ~~Bit 9 (value 512) Click Wrench~~ ~~Bit 10 (value 1024) RBW Monitoring~~
Batch Size	09	4	This parameter gives the total number of tightening in the batch. The batch size is four byte long specifying a range of 0000 to 9999.
Batch counter	10	4	This is the batch counter, this information is sent with each tightening result. The batch counter number is four byte long specifying a range of 0000 to 9999 and is specified by four ASCII digits ('0'….'9').
Tightening Status	11	1	The tightening status is one byte long and is specified by one ASCII digit ('0' or '1'). Zero corresponds to tightening NOK, one corresponds to tightening OK.
Batch Status	12	1	The batch status is specified by one ASCII character. 0 batch NOK (batch not completed) / 1 batch OK / 2 batch not used.
Torque status	13	1	0. Low / 1. OK / 2 .High
Angle status	14	1	0. Low / 1. OK / 2 .High
Rundown angle status	15	1	0. Low / 1. OK / 2 .High
Current monitoring status	16	1	0. Low / 1. OK / 2 .High
Self tap status	17	1	0. Low / 1. OK / 2 .High
Prevailing torque monitoring status	18	1	0. Low / 1. OK / 2 .High
Prevailing torque compensate status	19	1	0. Low / 1. OK / 2 .High
Tightening error status	20	10	Bit field, Tightening error bits shows what went wrong with the tightening. Bit 1 Rundown angle max shut off Bit 2 Rundown angle min shut off Bit 3 Torque max shut off Bit 4 Angle max shut off Bit 5 Selftap torque max shut off Bit 6 Selftap torque min shut off Bit 7 Prevail torque max shut off Bit 8 Prevail torque min shut off Bit 9 Prevail torque compensate overflow Bit 10 Current monitoring max shut off ~~Bit 11 Post view torque min torque shut off~~ ~~Bit 12 Post view torque max torque shut off~~

Parameter	Id	Bytes	Comment
			~~Bit 13 Post view torque Angle too small~~ ~~Bit 14 Trigger Lost~~ ~~Bit 15 Torque Less Than Target~~ ~~Bit 16 Tool Hot~~ ~~Bit 17 Multistage Abort~~ ~~Bit 18 Rehit~~ ~~Bit 19 DS Measure Failed~~ Bit 20 Current Limit Reached Bit 21 EndTime out Shutoff ~~Bit 22 Remove fastener limit exceeded~~ ~~Bit 23 Disable drive~~ Bit 24-32 Reserved
Torque Min limit	21	6	The torque min limit is sent with each tightening result. The torque min limit is multiplied by 100 and sent as an integer (2 decimals truncated). The torque min limit is six byte long and is specified by six ASCII digits ('0'….'9').
Torque Max limit	22	6	The torque max limit is sent with each tightening result. The torque max limit is multiplied by 100 and sent as an integer (2 decimals truncated). The torque max limit is six byte long and is specified by six ASCII digits ('0'….'9').
Torque final target	23	6	The torque final target is sent with each tightening result. The torque final target is multiplied by 100 and sent as an integer (2 decimals truncated). The torque final target is six byte long and is specified by six ASCII digits ('0'….'9').
Torque	24	6	The torque value is sent with each tightening result. The torque is multiplied by 100 and sent as an integer (2 decimals truncated). The torque is six byte long and is specified by six ASCII digits ('0'….'9').
Angle Min	25	5	The angle min value in degrees is sent with each tightening result, each turn represents 360 degrees. The angle min value has a specified range between 0 and 99999. The angle min value is five byte long and is specified by five ASCII digits ('0'….'9').
Angle Max	26	5	The angle max value in degrees is sent with each tightening result, each turn represents 360 degrees. The angle max value has a specified range between 0 and 99999. The angle max value is five byte long and is specified by five ASCII digits ('0'….'9').
Final Angle Target	27	5	The target angle value in degrees is sent with each tightening result, each turn represents 360 degrees. The target angle has a specified range between 0 and 99999. The target angle is five byte long and is specified by five ASCII digits ('0'….'9').
Angle	28	5	The turning angle value in degrees is sent with each tightening result, each turn represents 360 degrees. The turning angle has a specified range between 0 and 99999. The turning angle is five byte long and is specified by five ASCII digits ('0'….'9').
Rundown angle Min	29	5	The rundown angle min value in degrees is sent with each tightening result, each turn represents 360 degrees. The rundown angle min value has a specified range between 0 and 99999. The rundown angle min value is five byte long and is specified by five ASCII digits ('0'….'9').
Rundown angle Max	30	5	The rundown angle max value in degrees is sent with each tightening result, each turn represents 360 degrees. The angle max value has a specified range between 0 and 99999. The rundown angle max value is five byte long and is specified by five ASCII digits ('0'….'9').
Rundown angle	31	5	The rundown angle value reached in degrees is sent with each tightening result, each turn represents 360 degrees. The turning angle has a specified range between 0 and 99999. The turning angle is five byte long and is specified by five ASCII digits ('0'….'9').

Parameter	Id	Bytes	Comment
Current Monitoring Min	32	3	The current monitoring min limit in percent is sent with each tightening result. The current monitoring min limit has a specified range between 0 and 999. The current monitoring Min limit is three byte long and is specified by three ASCII digits ('0'….'9').
Current Monitoring Max	33	3	The current monitoring max limit in percent is sent with each tightening result. The current monitoring max limit has a specified range between 0 and 999. The current monitoring Max limit is three byte long and is specified by three ASCII digits ('0'….'9').
Current Monitoring Value	34	3	The current monitoring value in percent is sent with each tightening result. The current monitoring value has a specified range between 0 and 999. The current monitoring value is three byte long and is specified by three ASCII digits ('0'….'9').
Self tap Min	35	6	The self tap min limit is sent with each tightening result. The self tap min limit is multiplied by 100 and sent as an integer (2 decimals truncated). The self tap min limit is six byte long and is specified by six ASCII digits ('0'….'9').
Self tap Max	36	6	The self tap max limit is sent with each tightening result. The self tap max limit is multiplied by 100 and sent as an integer (2 decimals truncated). The self tap max limit is six byte long and is specified by six ASCII digits ('0'….'9').
Self tap torque	37	6	The self tap torque is sent with each tightening result. The self tap torque is multiplied by 100 and sent as an integer (2 decimals truncated). The torque is six byte long and is specified by six ASCII digits ('0'….'9').
Prevailing torque monitoring min	38	6	The PVT min limit is sent with each tightening result. The PVT min limit is multiplied by 100 and sent as an integer (2 decimals truncated). The PVT min limit is six byte long and is specified by six ASCII digits ('0'….'9').
Prevailing torque monitoring max	39	6	The PVT max limit is sent with each tightening result. The PVT max limit is multiplied by 100 and sent as an integer (2 decimals truncated). The PVT max limit is six byte long and is specified by six ASCII digits ('0'….'9').
Prevail Torque	40	6	The prevail torque value is sent with each tightening result. The prevail torque is multiplied by 100 and sent as an integer (2 decimals truncated). The prevail torque is six byte long and is specified by six ASCII digits ('0'….'9').
Tightening Id	41	10	The tightening Id is a unique Id for each tightening result. The tightening Id is incremented after each rundown. 10 ASCII digits. Max 4294967295
Job Sequence Number	42	5	The job sequence number is unique for each job. All tightenings performed in the same job are stamped with the same job sequence number. The job sequence number is specified by five ASCII digits ('0'….'9'). Range 0-65535
Sync tightening ID	43	5	The sync tightening Id is a unique Id for each sync tightening result. Each individual result of each spindle is stamped with this Id.The tightening Id is incremented after each sync tightening. 5 ASCII digits. Max 65535.=> For X-PAQ™, no ID stamped.
Tool Serial Number	44	14	The Tool serial number is specified by 14 ASCII characters
Time stamp	45	19	Time stamp for each tightening sent to the control station. The time stamp is 19 byte long and is specified by 19 ASCII characters (YYYY-MM-DD:HH:MM:SS).
Date/time of last change in Pset settings	46	19	Time stamp for the last change in the current pset settings. The time stamp is 19 byte long and is specified by 19 ASCII characters (YYYY-MM-DD:HH:MM:SS).

Table 16、MID0061 Revision 3

Same as revision 2 but extended with fields 47, 48 and 49 see below：

Parameter	Id	Bytes	Comment
Parameter Set Name	47	25	The parameter set name is 25 byte long and is specified by 25 ASCII characters taken between 0x20 and 0x7F Hex.
Torque Value Unit	48	1	The unit in which the torque values are sent. The torque values unit is one byte long specifying a range of 0 to 9 and is specified by two ASCII digits ('0'….'9'). 1. Nm 2. Lbf.ft 3. Kpm
Result Type	49	2	The result type is the type the telegram result define as below 1. tightening 2. loosening 3. Batch Increment 4. Batch decrement 5. Bypass pset result 6. Abort job result 7. sync tightening

Table 17、MID0061 Revision900

Parameter	Id	Bytes	Comment
Cell Id	01	4	The cell number (cluster number) is four byte long specifying a range of 0000 to 9999 and is specified by four ASCII digits ('0'….'9'). .=> For X-PAQ™, 0000 fixed.
Channel Id	02	2	The channel Id is two byte long specifying a range of 00 to 20 and is specified by two ASCII digits ('0'….'9').=> For X-PAQ™, 00 fixed.
Torque controller Name	03	25	The torque controller name is 25 byte long and is specified by 25 ASCII characters taken between 0x20 and 0x7F Hex.
VIN Number	04	25	The VIN number is 25 byte long and is specified by 25 ASCII characters taken between 0x20 and 0x7F Hex.
Job Number	05	2	This is the job number that is currently run (JobId), this information is sent with each tightening result. The job number is two bytes long specifying a range of 0 to 99 and is specified by two ASCII digits ('0'….'9').
Channel number	06	3	This is the Channel number that is run (psetId), this information is sent with each tightening result. The Channel number is three byte long specifying a range of 000 to 999 and is specified by three ASCII digits ('0'….'9').
Batch Size	07	4	This parameter gives the total number of tightening in the batch. The batch size is four byte long specifying a range of 0000 to 9999.
Batch counter	08	4	This is the batch counter, this information is sent with each tightening result. The batch counter number is four byte long specifying a range of 0000 to 9999 and is specified by four ASCII digits ('0'….'9').
Tightening Status	09	1	The tightening status is one byte long and is specified by one ASCII digit ('0' or '1'). Zero corresponds to tightening NOK, one corresponds to tightening OK.
Torque status	10	1	0. Low / 1. OK / 2 .High
Angle status	11	1	0. Low / 1. OK / 2 .High
Torque Min limit	12	6	The torque min limit is sent with each tightening result. The torque min limit is multiplied by 100 and sent as an integer (2 decimals truncated). The torque min limit is six byte long and is specified by six ASCII digits ('0'….'9').
Torque Max limit	13	6	The torque max limit is sent with each tightening result. The torque max limit is multiplied by 100 and sent as an integer (2 decimals truncated). The torque max limit is six byte long and is specified by six ASCII digits ('0'….'9').
Torque final target	14	6	The torque final target is sent with each tightening result. The torque final target is multiplied by 100 and sent as an integer (2 decimals truncated). The torque final target is six byte long and is specified by six ASCII digits ('0'….'9').
Torque	15	6	The torque value is sent with each tightening result. The torque is multiplied by 100 and sent as an integer (2 decimals truncated). The torque is six byte long and is specified by six ASCII digits('0'….'9').
Angle Min	16	5	The angle min value in degrees is sent with each tightening result, each turn represents 360.0 degrees. The angle is multiplied by 10 and sent as an integer (1 decimals truncated). The angle min value has a specified range between 0 and 9999.9. The angle min value is five byte long and is specified by five ASCII digits ('0'….'9').
Angle Max	17	5	The angle max value in degrees is sent with each tightening result, each turn represents 360.0 degrees. The angle is multiplied by 10 and sent as an integer (1 decimals truncated). The angle max value has a specified range between 0 and 9999.9. The angle max value is five byte long and is specified by five ASCII digits ('0'….'9').
Final Angle Target	18	5	The angle target value in degrees is sent with each tightening result, each turn represents 360.0 degrees. The angle is multiplied by 10 and sent as an integer (1 decimals truncated). The angle target value has a specified range between 0 and 9999.9. The angle target value is five byte long and is specified by five ASCII digits ('0'….'9').

Parameter	Id	Bytes	Comment
Angle	19	5	The turning angle value in degrees is sent with each tightening result, each turn represents 360.0 degrees. The angle is multiplied by 10 and sent as an integer (1 decimals truncated). The turning angle has a specified range between 0 and 9999.9. The turning angle is five byte long and is specified by five ASCII digits (‘0’….’9’).
Time stamp	20	19	Time stamp for each tightening sent to the control station. The time stamp is 19 byte long and is specified by 19 ASCII characters (YYYY-MM-DD:HH:MM:SS).
Date/time of last change in Pset settings	21	19	Time stamp for the last change in the current pset settings. The time stamp is 19 byte long and is specified by 19 ASCII characters (YYYY-MM-DD:HH:MM:SS).
Batch status	22	1	The batch status is specified by one ASCII character. 0 batch NOK (batch not completed) / 1 batch OK / 2 batch not used.
Tightening Id	23	10	The tightening Id is a unique Id for each tightening result. The tightening Id is incremented after each rundown. 10 ASCII digits. Max 4294967295
Torque Value Unit	24	1	The unit in which the torque values are sent. The torque values unit is one byte long specifying a range of 0 to 9 and is specified by two ASCII digits (‘0’….’9’). 0:Nm 1:Kgm 2:ftlbs
Code Address	25	2	Code Address(S02 SYS SETUP=>1.CODE ADR). Number 1 is master address code.
Step	26	2	Job step number.
JOB Result	27	1	JOB total judge result.0:Total OK,1:Total NOK,3:Reject,4:Un-completing,5:Un-operating
Peak Torque	28	6	The peak torque value is sent with each tightening result. The torque is multiplied by 100 and sent as an integer (2 decimals truncated). The torque is six byte long and is specified by six ASCII digits ('0'….'9').
Seat Torque	29	6	The seat torque value is sent with each tightening result. The torque is multiplied by 100 and sent as an integer (2 decimals truncated). The torque is six byte long and is specified by six ASCII digits ('0'….'9').
Monitor Torque	30	6	The monitor torque value is sent with each tightening result. The torque is multiplied by 100 and sent as an integer (2 decimals truncated). The torque is six byte long and is specified by six ASCII digits ('0'….'9').
Final Monitor Torque	31	6	The final monitor torque value is sent with each tightening result. The torque is multiplied by 100 and sent as an integer (2 decimals truncated). The torque is six byte long and is specified by six ASCII digits ('0'….'9').
Angle Start Torque	32	6	The angle start torque value is sent with each tightening result. The torque is multiplied by 100 and sent as an integer (2 decimals truncated). The torque is six byte long and is specified by six ASCII digits ('0'….'9').
Self Tap Torque	33	6	The self tap torque value is sent with each tightening result. The torque is multiplied by 100 and sent as an integer (2 decimals truncated). The torque is six byte long and is specified by six ASCII digits ('0'….'9').
Compensate Torque	34	6	The compensate torque value is sent with each tightening result. The torque is multiplied by 100 and sent as an integer (2 decimals truncated). The torque is six byte long and is specified by six ASCII digits ('0'….'9').
Rundown Angle	35	6	The rundown angle value in degrees is sent with each tightening result, each turn represents 360.0 degrees. The angle is multiplied by 10 and sent as an integer (1 decimals truncated). The rundown angle has a specified range between 0 and 99999.9. The turning angle is five six long and is specified by six ASCII digits ('0'….'9').
Section Current Monitor	36	4	The section current monitor value is sent with each tightening result. The current monitor is multiplied by 10 and sent as an integer(1 decimals truncated)The current monitor has a specified range between 0 and 100.0%. The current monitor is four byte long and is specified by four ASCII digits ('0'….'9').

Parameter	Id	Bytes	Comment
Final Current Monitor	37	4	The final current monitor value is sent with each tightening result. The current monitor is multiplied by 10 and sent as an integer (1 decimals truncated) The current monitor has a specified range between 0 and 100.0%. The current monitor is four byte long and is specified by four ASCII digits ('0'….'9').
Rundown Time	38	4	The rundown time is sent with each tightening result. The rundown time is multiplied by 10 and sent as an integer (1 decimals truncated) The rundown time has a specified range between 0 and 999.9sec. The rundown time is four byte long and is specified by four ASCII digits ('0'….'9').
Final Time	39	4	The final time is sent with each tightening result. The final time is multiplied by 10 and sent as an integer (1 decimals truncated) The final time has a specified range between 0 and 999.9sec. The final time is four byte long and is specified by four ASCII digits ('0'….'9').
Total Time	40	4	The total time is sent with each tightening result. The total time is multiplied by 10 and sent as an integer (1 decimals truncated) The total time has a specified range between 0 and 999.9sec. The total time is four byte long and is specified by four ASCII digits ('0'….'9').
Peak Torque Min Limit	41	6	The peak torque min limit is sent with each tightening result. The peak torque min limit is multiplied by 100 and sent as an integer (2 decimals truncated). The peak torque min limit is six byte long and is specified by six ASCII digits ('0'….'9').
Peak Torque Max Limit	42	6	The peak torque max limit is sent with each tightening result. The peak torque max limit is multiplied by 100 and sent as an integer (2 decimals truncated). The peak torque max limit is six byte long and is specified by six ASCII digits ('0'….'9').
System Error Number	43	3	System Error Number.
Judge1	44	8	HEX-ASCII "00000000"～"FFFFFFFF"。 Tightening judge 1.
Judge2	45	8	HEX-ASCII "00000000"～"FFFFFFFF"。 Tightening judge 2.
Channel Status	46	1	The channel status is specified by ASCII of one digit a bytes long. (0 or 1.)It is shown that 0 usually shows the channel, and one is multichannel.
Torque Curve Count	47	2	The torque curve count is specified by ASCII of one digit a bytes long. The number of acquired torque curves is shown (0-8).

Note 1) For torques, Nm and ftlbs are multiplied by 100 and sent, Kgm is multiplies by 1000 and sent, and inlbls is multiplied by 10 and sent.

Note 2) For fastening judg1 and 2, please refer to Appendix.

Table 18、MID0061 Revision 901

Same as revision 900 but extended with fields 48, 49 and 50 see below：

Parameter	Id	Bytes	Comment
Position Data X	48	6	X axsis coordinate data of tightened position.
Position Data Y	49	6	Y axsis coordinate data of tightened position.
Position Data Z	50	6	Z axsis coordinate data of tightened position.

Possible answers Last tightening result Acknowledge (MID =0062)

Sent by the torque controller

Example revision 1:

Header				Data Field	Message End
0231	0061	Rev	Spare	*010001020103air bag 04* *0500060030700000800000901001111200084013001400140012001 5* *0007391600000170999918000001900000202001-06-02:09:54:09212* *001-05-29:12:34:3322123345675*	NUL (ASCII 0x0)
20 bytes				211 bytes	

3.8.3 Last tightening result data acknowledge (MID = 0062)

Header				Data Field	Message End
0020	0062	Rev	Spare		NUL (ASCII 0x0)
20 bytes				0 bytes	

Last tightening result data acknowledge.

Possible answers No
Sent by Station computer

3.8.4 Last tightening result data unsubscribe (MID = 0063)

Header				Data Field	Message End
0020	0063	Rev	Spare		NUL (ASCII 0x0)
20 bytes				0 bytes	

Reset the last tightening result subscription for the rundowns result.

Possible answers Command accepted (MID = 0005)
Or
Command Error
" Last tightening result subscription does not exist"
Sent by Station computer.

3.8.5 Old tightening result upload request (MID = 0064)

Header				Data Field	Message End
0030	0064	Rev	Spare	*Tightening Id*	NUL (ASCII 0x0)
20 bytes				10 bytes	

This telegram is a request to upload a special rundown result from the torque controller. The result wanted is specified by its unique Id (tightening Id). This telegram can be useful after a failure of the network in order to retrieve the missing result during the communication interruption (the station computer can see the missing results by always comparing the last tightening ids of the two last received rundowns packets (parameter 23 in the result telegram).
Requesting tightening Id zero is the same as requesting the latest rundown performed.

Possible answers Old tightening result reply (MID = 0065)
Or
Command Error
"Tightening Id requested not found"
"MID revision not supported"

Sent by Station computer.

3.8.6 Old tightening result reply (MID = 0065)

Header				Data Field	Message End
	0065	Rev	Spare	*Data*	NUL (ASCII 0x0)
20 bytes					

Old tightening upload.

Table 18、MID0065 Revision 1

Parameter	Id	Bytes	Comment
Tightening Id	01	10	The tightening Id is a unique Id for each tightening result. The tightening Id is incremented after each rundown. 10 ASCII digits. Max 4294967295
VIN Number	02	25	The VIN number is 25 byte long and is specified by 25 ASCII characters taken between 0x20 and 0x7F Hex.
Pset number	03	3	This is the pset number that is run (psetId), this information is sent with each tightening result. The pset number is three byte long specifying a range of 000 to 999 and is specified by three ASCII digits ('0'….'9').
Batch counter	04	4	This is the batch counter, this information is sent with each tightening result. The batch counter number is four byte long specifying a range of 0000 to 9999 and is specified by four ASCII digits ('0'….'9').
Tightening Status	05	1	The tightening status is one byte long and is specified by one ASCII digit ('0' or '1'). Zero corresponds to tightening NOK, one corresponds to tightening OK.
Torque status	06	1	0. Low / 1. OK / 2 .High
Angle status	07	1	0. Low / 1. OK / 2 .High
Torque	08	6	The torque value is sent with each tightening result. The torque is multiplied by 100 and sent as an integer (2 decimals truncated). The torque is six byte long and is specified by six ASCII digits ('0'….'9').
Angle	09	5	The turning angle value in degrees is sent with each tightening result, each turn represents 360 degrees. The turning angle has a specified range between 0 and 99999. The turning angle is five byte long and is specified by five ASCII digits ('0'….'9')
Time stamp	10	19	Time stamp for each tightening sent to the control station. The time stamp is 19 byte long and is specified by 19 ASCII characters (YYYY-MM-DD:HH:MM:SS).
Batch status	11	1	The batch status is specified by one ASCII character. SPC current batch not completed / 0 batch NOK / 1 batch OK / 2 batch not used.

Possible answers No
Sent by the torque controller

Example revision 1:

Header				Data Field	Message End
0231	0065	Rev	Spare	*01456789 02air bag* *030010400205006007008001467090004 6* *102001-04-22:14:54:34142112*	NUL (ASCII 0x0)
20 bytes				bytes	

3.9 Alarm telegram

3.9.1 Alarm subscribe (MID = 0070)

Header				Data Field	Message End
0020	0070	Rev	Spare		NUL (ASCII 0x0)
20 bytes				0 bytes	

A subscription for the alarm that can pop up on the torque controller

Possible answers Command accepted (MID = 0005)
Or
Command Error
"Alarm subscription already exists"
Sent by Station computer.

3.9.2 Alarm upload reply (MID = 0071)

Header				Data Field	Message End
0053	0071	Rev	Spare	*Data*	NUL (ASCII 0x0)
20 bytes				33 bytes	

Alarm upload.

Table 20

Parameter	Id	Bytes	Comment
Error code	01	4	The error code is specified by 4 ASCII characters / The error code begins with E and is followed by three digits. Example E141
Controller ready status	02	1	Controller ready status 1 OK 0 NOK
Tool ready status	03	1	Tool ready status 1 OK 0 NOK
Time	04	19	YYYY-MM-DD:HH:MM:SS

Possible answers No
Sent by the torque controller.

Example:

Header				Data Field	Message End
0043	0071	Rev	Spare	*01E4040210310420001-06-02:10:14:26*	NUL (ASCII 0x0)
20 bytes				23 bytes	

3.9.3 Alarm upload acknowledge (MID = 0072)

Header				Data Field	Message End
0020	0072	Rev	Spare		NUL (ASCII 0x0)
20 bytes				0 bytes	

Alarm data acknowledge.

Possible answers No
Sent by Station computer

3.9.4 Alarm unsubscribe (MID = 0073)

Header				Data Field	Message End
0020	0073	Rev	Spare		NUL (ASCII 0x0)
20 bytes				0 bytes	

Reset the subscription for the torque controller alarms.

Possible answers Command accepted (MID = 0005)
Or
Command Error
"Alarm subscription does not exist"
Sent by Station computer.

3.9.5 Alarm acknowledged on torque controller (MID = 0074)

Header				Data Field	Message End
0020	0074	Rev	Spare	*Error Code*	NUL (ASCII 0x0)
20 bytes				4 bytes	

This telegram is sent by the torque controller to inform the station computer that the current alarm has been acknowledged.

Possible answers Alarm acknowledged on torque controller ack (MID = 0075)
Sent by Torque controller.

Example:

Header				Data Field	Message End
0020	0074	Rev	Spare	*E141*	NUL (ASCII 0x0)
20 bytes				4 bytes	

3.9.6 Alarm acknowledged on torque controller ack (MID = 0075)

Header				Data Field	Message End
0020	0075	Rev	Spare		NUL (ASCII 0x0)
20 bytes				0 bytes	

Alarm acknowledged on torque controller acknowledgment.

Possible answers No
Sent by Station computer.

3.9.7 Alarm status (MID = 0076)

Header				Data Field	Message End
0056	0076	Rev	Spare	*Data*	NUL (ASCII 0x0)
20 bytes				36 bytes	

The alarm status is sent after an accepted subscription for the torque controller alarms.
The aim of the alarm status is to eventually inform the station computer that an alarm is currently active on the controller at connection.

Table 21

Parameter	Id	Bytes	Comment
Alarm Status	01	1	0 if no alarm is active / 1 if an alarm is currently active
Error code	02	4	The error code is specified by 4 ASCII characters. The error code begins with E and is followed by three digits.
Controller ready status	03	1	Controller ready status 1 OK 0 NOK
Tool ready status	04	1	Tool ready status 1 OK 0 NOK
Time	05	19	YYYY-MM-DD:HH:MM:SS

Possible answers Alarm status acknowledge (MID = 0077)
Sent by the torque controller.

Example:

Header				Data Field	Message End
0056	0076	Rev	Spare	*01102E404031041052001-06-02:10:14:26*	NUL (ASCII 0x0)
20 bytes				23 bytes	

3.9.8 Alarm status acknowledge (MID = 0077)

Header				Data Field	Message End
0020	0077	Rev	Spare		NUL (ASCII 0x0)
20 bytes				0 bytes	

Alarm status acknowledge.

Possible answers No
Sent by the station computer.

3.10 Time telegram

3.10.1 Read time upload request (MID = 0080)

Header				Data Field	Message End
0020	0080	Rev	Spare		NUL (ASCII 0x0)
20 bytes				0 bytes	

Read time request.

Possible answers Time upload reply (MID = 0081)
Sent by the station computer.

3.10.2 Time upload reply (MID = 0081)

Header				Data Field	Message End
0039	0081	Rev	Spare	*YYYY-MM-DD:HH:MM:SS*	NUL (ASCII 0x0)
20 bytes				19 bytes	

Time upload reply from the torque controller.

Possible answers No
Sent by the torque controller

3.10.3 Set Time in Torque Controller (MID = 0082)

Header				Data Field	Message End
0039	0082	Rev	Spare	*YYYY-MM-DD:HH:MM:SS*	NUL (ASCII 0x0)
20 bytes				19 bytes	

Set the time in the torque controller.

Possible answers Command accepted (MID = 0005)
Sent by the station computer.

3.11 Multi spindle status telegram

3.11.1 Multi spindle status subscribe (MID = 0090)

Header				Data Field	Message End
0020	0090	Rev	Spare		NUL (ASCII 0x0)
20 bytes				0 bytes	

A subscription for the multi spindle status (synch application). The subscription can only be addressed to a sync Master.

Possible answers Command accepted (MID = 0005)
Or
Command Error
"Controller is not a sync Master"
"Multi spindle status subscription already exists"
Sent by Station computer.

3.11.2 Multi spindle status upload (MID = 0091)

Header				Data Field	Message End
	0091	Rev	Spare	*Data*	NUL (ASCII 0x0)
20 bytes				37 + 5 × number of spindles Bytes	

The multi spindle status is sent from the "sync master" to the station computer after each sync tightening. The multiple status contains the common status of the multiple as well as the individual status of each spindle (in the sync list order)

Table 22

Parameter	Id	Bytes	Comment	
Number of spindles	01	2	Number of spindles running in the multiple, a maximum of 10 spindles can be synchronized . The number of spindles is two bytes long and specified by 2 ASCII digits range 2-10.	
Sync tightening Id	02	5	The sync tightening Id is a unique Id for each sync tightening result. Each individual result of each spindle is stamped with this Id. The tightening Id is incremented after each sync tightening. 5 ASCII digits. Max 65 535.	
Time	03	19	YYYY-MM-DD:HH:MM:SS	
Sync overall status	04	1	The common status of all the spindles OK if the individual status of each spindle is OK, NOK if at least one spindle status is NOK. The sync overall status is specified by one ASCII digit 1 = OK, 0 = NOK.	
Spindle status	05	5 × Number of spindles	Bytes 1-2	The first two bytes specify the spindle number range 01-10 (same order as in the sync list)
			Bytes 3-4	The next two bytes (three and four) are the channel Id of the spindle range 01 to 20
			Byte 5	The fifth byte is the individual overall status of the rundown of each spindle 0 = NOK / 1 = OK

Possible answers Multi spindle status acknowledge (MID = 0092)
Sent by the torque controller.

Example:

Multiple status for two spindles. Common status OK, spindle 1 OK, spindle 2 OK.

Header				Data Field	Message End
0067	0091	Rev	Spare	*0102020001203200 1-06-02:10:14:26041050120102041*	NUL (ASCII 0x0)
20 bytes				47 bytes	

3.11.3 Multi spindle status upload acknowledge (MID = 0092)

Header				Data Field	Message End
0020	0092	Rev	Spare		NUL (ASCII 0x0)
20 bytes				0 bytes	

Multi spindle status acknowledge.

Possible answers No
Sent by the station computer.

3.11.4 Multi spindle status unsubscribe (MID = 0093)

Header				Data Field	Message End
0020	0093	Rev	Spare		NUL (ASCII 0x0)
20 bytes				0 bytes	

Reset the subscription for the multi spindle status.

Possible answers Command accepted (MID = 0005)
Or
Command Error
"Multi spindle status subscription does not exist"

Sent by Station computer.

3.12 Multi spindle result telegram

3.12.1 Multi spindle result subscribe (MID = 0100)

Header				Data Field	Message End
0020	0100	Rev	Spare		NUL (ASCII 0x0)
20 bytes				0 bytes	

A subscription for the multi spindle status (synch application). The subscription can only be addressed to a sync Master.

Possible answers Command accepted (MID = 0005)
Or
Command Error
"Controller is not a sync Master"
"Multi spindle result subscription already exists"

Sent by Station computer.

3.12.2 Multi spindle result upload (MID = 0101)

Header				Data Field	Message End
	0101	Rev	Spare	*Data*	NUL (ASCII 0x0)
20 bytes				154 + 18 × number of spindles bytes	

The multi spindle result is sent from the "sync master" to the station computer after each sync tightening. The multiple spindle result contains the common status of the multiple as well as the tightening result of each spindle (torque and angle) of each spindle (in the sync list order).

Table 23

Parameter	Id	Bytes	Comment	
Number of spindles	01	2	Number of spindles running in the multiple, a maximum of 10 spindles can be synchronized . The number of spindles is two bytes long and specified by 2 ASCII digits range 2-10.	
VIN Number	02	25	The VIN number is 25 byte long and is specified by 25 ASCII characters taken between 0x20 and 0x7F Hex.	
Job Number	03	2	This is the job number that is currently run (JobId). The job number is two bytes long specifying a range of 00 to 99 and is specified by two ASCII digits ('0'….'9').	
Pset number	04	3	This is the pset number that is run (psetId). The pset number is three byte long specifying a range of 000 to 999 and is specified by three ASCII digits ('0'….'9').	
Batch Size	05	4	This parameter gives the total number of tightening in the batch. The batch size is four byte long specifying a range of 0000 to 9999.	
Batch counter	06	4	The batch counter number is four byte long specifying a range of 0000 to 9999 and is specified by four ASCII digits ('0'….'9').	
Batch status	07	1	The batch status is specified by one ASCII character. 0 batch NOK (batch not completed) / 1 batch OK / 2 batch not used.	
Torque Min limit	08	6	The torque min limit is multiplied by 100 and sent as an integer (2 decimals truncated). The torque min limit is six byte long and is specified by six ASCII digits ('0'….'9').	
Torque Max limit	09	6	The torque max limit is multiplied by 100 and sent as an integer (2 decimals truncated). The torque max limit is six byte long and is specified by six ASCII digits ('0'….'9').	
Torque final target	10	6	The torque final target is multiplied by 100 and sent as an integer (2 decimals truncated). The torque final target is six byte long and is specified by six ASCII digits ('0'….'9').	
Angle Min	11	5	The angle min value in degrees, each turn represents 360 degrees. The angle min value has a specified range between 0 and 99999. The angle min value is five byte long and is specified by five ASCII digits ('0'….'9').	
Angle Max	12	5	The angle max value in degrees each turn represents 360 degrees. The angle max value has a specified range between 0 and 99999. The angle max value is five byte long and is specified by five ASCII digits ('0'….'9').	
Final Angle Target	13	5	The target angle value in degrees each turn represents 360 degrees. The target angle has a specified range between 0 and 99999. The target angle is five byte long and is specified by five ASCII digits ('0'….'9').	
Date/time of last change in Pset settings	14	19	Time stamp for for the last change in the current pset settings. The time stamp is 19 byte long and is specified by 19 ASCII characters (YYYY-MM-DD:HH:MM:SS).	
Time	15	19	YYYY-MM-DD:HH:MM:SS	
Sync tightening Id	16	5	The sync tightening Id is a unique Id for each sync tightening result. Each individual result of each spindle is stamped with this Id. The tightening Id is incremented after each sync tightening. 5 ASCII digits. Max 65535.	
Sync overall status	17	1	The common status of all the spindles OK if the individual status of each spindle is OK, NOK if at least one spindle status is NOK. The sync overall status is specified by one ASCII digit 1 = OK, 0 = NOK.	
Spindle status	18	18 × Number	Bytes 1-2	The first two bytes specify the spindle number range 01-10 (same order as in the sync list)
			Bytes 3-4	channel Id of the spindle range 01 to 20

Parameter	Id	Bytes	Comment	
		of spindles	Byte 5	Individual overall status of the rundown of each spindle 0= NOK / 1=OK
			Byte 6	Individual torque status of each spindle 0. Low / 1. OK / 2 .High
			Bytes 7-12	The torque result of each spindle. The torque is multiplied by 100 and sent as an integer (2 decimals truncated). The torque is six byte long and is specified by six ASCII digits ('0'….'9').
			Byte 13	Individual angle status of each spindle 0. Low / 1. OK / 2 .High
			Byte 14-18	The turning angle value in degrees is sent for each spindle, each turn represents 360 degrees. The turning angle has a specified range between 0 and 99999. The turning angle is five byte long and is specified by five ASCII digits ('0'….'9').

Possible answers Multi spindle result acknowledge (MID = 0102)
Sent by the torque controller.

3.12.3 Multi spindle result upload acknowledge (MID = 0102)

Header				Data Field	Message End
0020	0102	Rev	Spare		NUL (ASCII 0x0)
20 bytes				0 bytes	

Multi spindle result acknowledge.

Possible answers No
Sent by the station computer.

3.12.4 Multi spindle result unsubscribe (MID = 0103)

Header				Data Field	Message End
0020	0093	Rev	Spare		NUL (ASCII 0x0)
20 bytes				0 bytes	

Reset the subscription for the multi spindle status.

Possible answers Command accepted (MID = 0005)
Or
Command Error
"Multi spindle result subscription does not exist"
Sent by Station computer.

3.13 Job telegram advanced

3.13.1 Abort Job (MID = 0127)

Header				Data Field	Message End
0020	0127	Rev	Spare		NUL (ASCII 0x0)
20 bytes				0 bytes	

Abort the current running job if there is one.

Possible answers Command accepted (MID = 0005)
Sent by Station computer.

3.17 Keep alive telegram

3.17.1 Keep alive message (MID = 9999)

Header				Data Field	Message End
0020	9999	Rev	Spare		NUL (ASCII 0x0)
20 bytes				0 bytes	

The station computer sends a keep alive to the torque controller
The torque controller should only mirror and return the received keep alive to the station computer.
The torque controller has a communication timeout equal to 15s i.e. if no message has been exchanged between the integrator and the X-PAQ™ since the last 15s, the X-PAQ™ considers the connection as lost and close it.
In order to keep the communication alive the integrator must send a keep alive to the X-PAQ™ with a time interval lower than 15s.

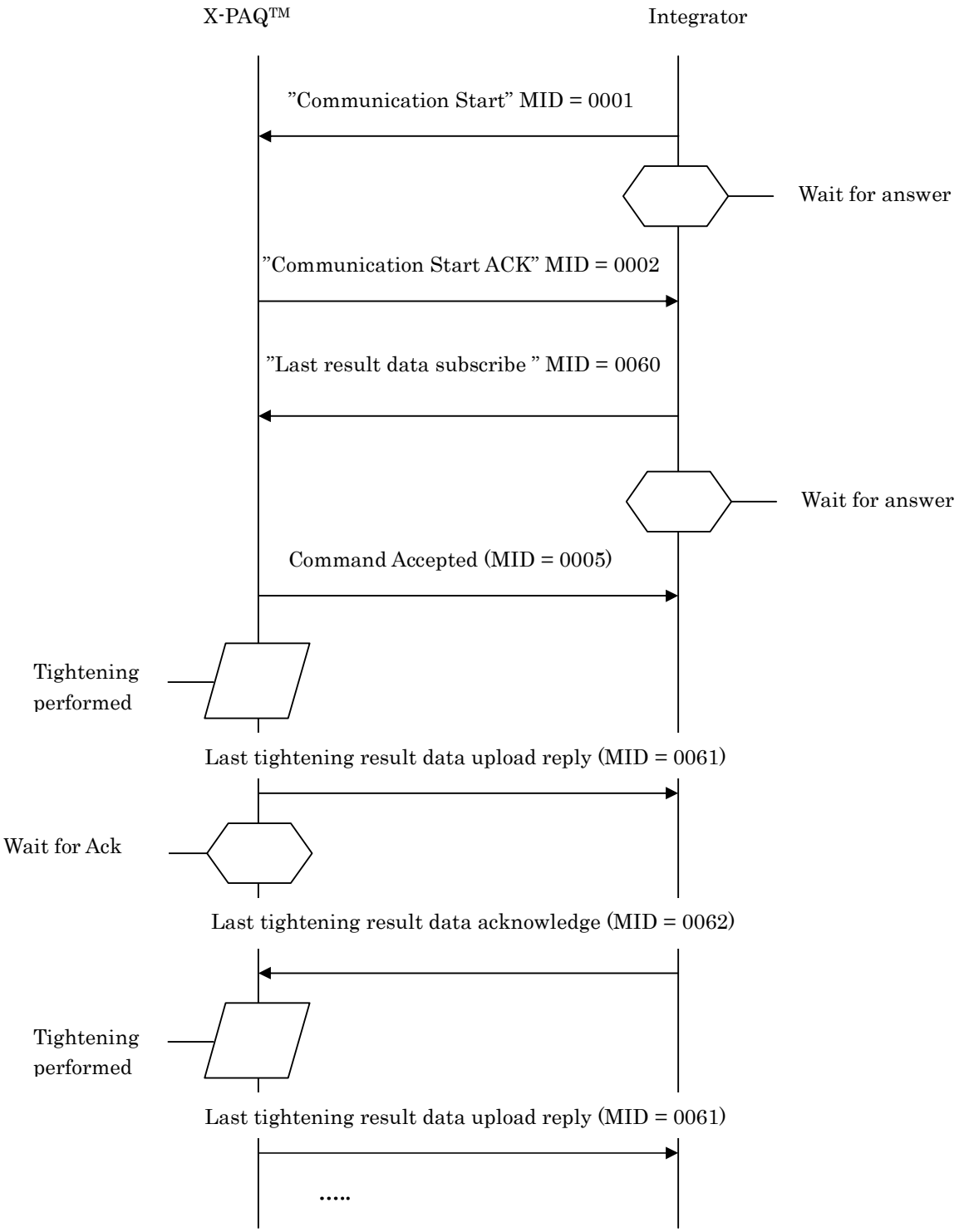
Notice:
An inactivity timeout is suggested to integrator i.e. if no message has been exchanged (sent or received) during the last 10s, send a keep alive.

Possible answers Same message mirrored by the torque controller.
Sent by Station computer.

4. Communication flow chart example

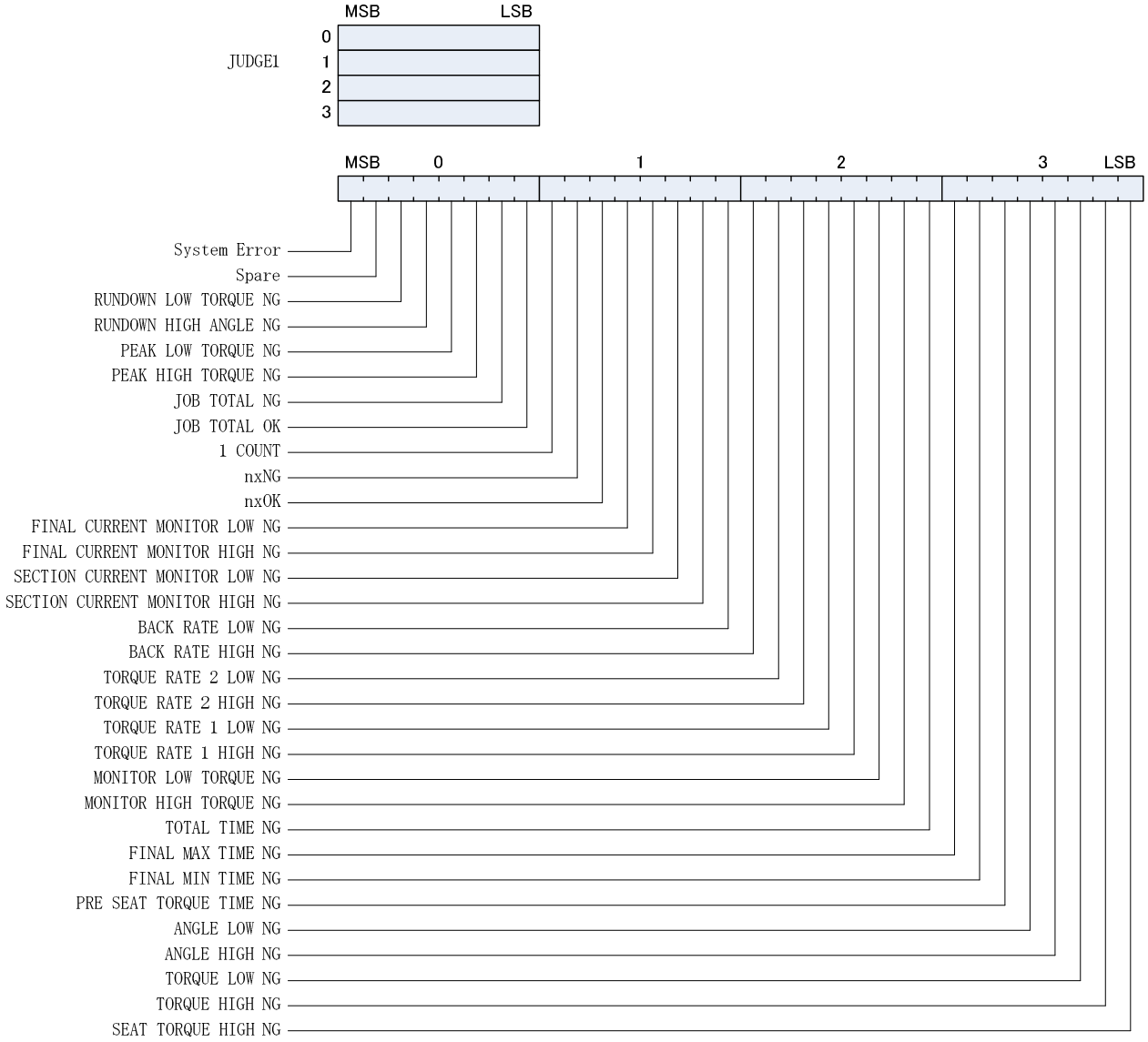
The following chapter describes how the integrator should proceed to establish a session with the X-PAQ™ and set its subscriptions.

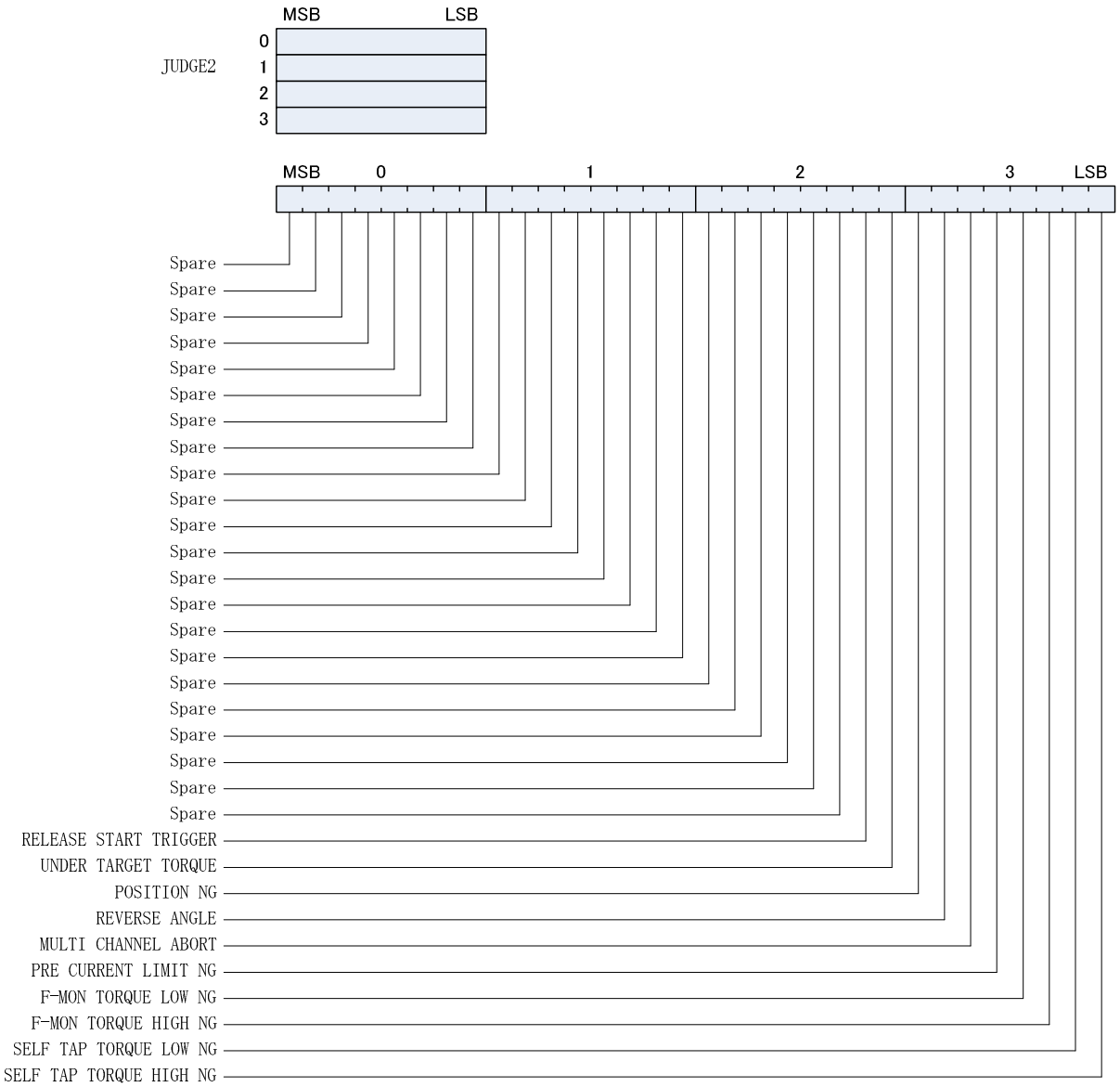
4.1 Establish a connection and set result subscription



Appendix

Fastening judge 1 and 2 are bit allocation and are allocated as shown below.




MSB
LSB
JUDGE2
0
1
2
3
MSB
0
1
2
3
LSB
Spare
Spare
Spare
Spare
Spare
Spare
Spare
Spare
Spare
Spare
Spare
Spare
Spare
Spare
Spare
Spare
Spare
Spare
Spare
Spare
Spare
Spare
RELEASE START TRIGGER
UNDER TARGET TORQUE
POSITION NG
REVERSE ANGLE
MULTI CHANNEL ABORT
PRE CURRENT LIMIT NG
F-MON TORQUE LOW NG
F-MON TORQUE HIGH NG
SELF TAP TORQUE LOW NG
SELF TAP TORQUE HIGH NG