

OPEN PROTOCOL

Communication Technical Guide

**mPro400GC and mPro400SG
Global Controllers**

Revision History

Revision Date	Revision Number	Name	Description
02/01/12	1.0	LFR	Based on original APEX Open Protocol document released 6-1-2011. Rev 1.0 revision was assigned document number AH2083PG.
02/10/12	2.0	LFR	Re-release based on a newer APEX document dated 10-6-2011. This document rev 2.0 was assigned a new document number AH2084PG. (AH2083PG had been originally assigned to a different document.) Rev 1.0 is now obsolete and replaced by this document Revision 2.0.
02/17/12	2.1	LFR	Corrected paragraph numbering in Table of Contents, Tables and Text.
05/30/12	2.2	SMK	Added Mid 0090-0093, 0130, fixed some formatting, added Appendix II, multiple Identifiers for MIDs 61, 65 revision 4
08/07/12	2.3	SMK	Updated MID 215 implementation
02/06/13	2.4	SMK	Updated Tightening Bits in MID0061
02/19/13	2.5	SMK	Final update of Tightening Bits in MID0061
02/27/13	2.6	SMK	Additional information about MID0061
03/04/13	2.7	SMK	Added Appenix III
03/26/13	2.8	SMK	Updated Torque Units supported.
04/10/13	2.9	SMK	Updated default PVT values for Seq32
09/10/13	2.10	SMK	Added Revisions 500 amd 998 to MID 61

Additional Reference Documents

Additional detailed explanation of the hardware and software related to this Application Guide is available from other Apex Tool Group documents, such as:

- mPro400GC Fastening Controller Programming Manual number PL12EN-1001(Hand Tools)
- mPro400SE Fastening Controller Programming Manual number P2044PA/EN-S168850 (Multiple Spindles)

OPEN PROTOCOL TECHNICAL GUIDE

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1. Available Messages

Table 1

MID	Description
0001	Communication start
0002	Communication start acknowledge
0003	Communication stop
0004	Command error
0005	Command accepted
0010	Application ID upload request
0011	Application ID upload reply
0012	Application data upload request
0013	Application data upload reply
0014	Application selected subscribe
0015	Application selected
0016	Application selected acknowledge
0017	Application selected unsubscribe
0018	Select Application
0019	Set Application batch size
0020	Reset Application batch counter
0021	Lock at batch done subscribe
0022	Lock at batch done upload
0023	Lock at batch done upload acknowledge
0024	Lock at batch done unsubscribe
0030	Linking Group ID upload request
0031	Linking Group ID upload reply
0032	Linking Group data upload request
0033	Linking Group data upload reply
0034	Linking Group info subscribe
0035	Linking Group info
0036	Linking Group info acknowledge
0037	Linking Group info unsubscribe
0038	Select Linking Group
0039	Linking Group 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
0074	Alarm Acknowledged on torque controller
0075	Alarm Acknowledged acknowledge
0076	Alarm Status
0077	Alarm Status acknowledge
0081	Time upload reply
0082	Set Time in the Torque Controller
0090	Multi-spindle status subscribe
0091	Multi-spindle status
0092	Multi-spindle status acknowledge
0093	Multi-spindle status unsubscribe
0100	Multi-spindle results subscribe
0101	Multi-spindle results
0102	Multi-spindle results acknowledge
0103	Multi-spindle results unsubscribe
0111	Display user text on graph
0113	Flash green LED on Tool
0127	Abort Linking Group
0128	Linking Group batch increment
0129	Linking Group batch decrement
0150	Identifier download request
0200	Set external controlled relays
0210	Status external monitored inputs subscribe
0211	Status external monitored inputs
0212	Status external monitored inputs acknowledge
0213	Status external monitored inputs unsubscribe
0214	IO device status request
0215	IO device status reply
0216	Relay function subscribe
0217	Relay function
0218	Relay function acknowledge
0219	Relay function unsubscribe
0220	Digital input function subscribe
0221	Digital input function
0222	Digital input function acknowledge
0223	Digital input function unsubscribe
9999	Keep alive message

2. FEP and Open Protocol Header

2.1 FEP Header

2.1.1 FEP 4.3 header

Header			
Length	MID	Spindle	Spare
4 bytes	4 bytes	2 bytes	10 bytes
20 bytes			

Length:

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:

The MID is four byte long and is specified by four ASCII digits ('0'...'9'). The MID describes how to interpret the sent telegram.

Spindle:

The number of the spindle. It is 2 byte long and is specified by four ASCII digits ('00'...'10'). It is used when multiple spindles are controlled from the same IP.

Spare:

Reserved space in the header for future use.

2.1.2 FEP 4.62 and 4.7 Header

Header				
Length	MID	Spindle	Rev	Spare
4 bytes	4 bytes	2 bytes	3 bytes	7 bytes
20 bytes				

Length:

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:

The MID is four byte long and is specified by four ASCII digits ('0'...'9'). The MID describes how to interpret the sent telegram.

Spindle:

The number of the spindle. It is 2 byte long and is specified by four ASCII digits ('00'...'10'). It is used when multiple spindles are controlled from the same IP.

Rev:

Revision number of the message to use.

Spare:

Reserved space in the header for future use.

2.2 Open Protocol Header

2.2.1 Open Protocol 3.0 Header

Header			
Length	MID	Rev	Spare
4 bytes	4 bytes	3 bytes	9 bytes
20 bytes			

Length:

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:

The MID is four byte long and is specified by four ASCII digits ('0'...'9'). The MID describes how to interpret the sent telegram.

Rev:

Revision number of the message to use.

Spare:

Reserved space in the header for future use.

2.2.2 Open Protocol 5.1 and 7.0 Header

Header				
Length	MID	Rev	No ack flag	Spare
4 bytes	4 bytes	3 bytes	1 bytes	8 bytes
20 bytes				

Length:

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:

The MID is four byte long and is specified by four ASCII digits ('0'...'9'). The MID describes how to interpret the sent telegram.

Rev:

Revision number of the message to use.

No ack flag:

ONLY FOR SUBSCRIPTION MIDs.

The No Ack Flag is used when setting a subscription. If the No Ack flag is not set in a subscription it means that the subscriber will acknowledge each "push" message sent by the controller (reliable mode). If set, the controller will only push out the information required without waiting for a receive acknowledgement from the subscriber (unreliable mode).

Spare:

Reserved space in the header for future use.

2.2.3 Open Protocol 10.0 and 10.3 Header

Header						
Length	MID	Rev	No ack flag	Station ID	Spindle ID	Spare
4 bytes	4 bytes	3 bytes	1 bytes	1 bytes	2 bytes	5 bytes
20 bytes						

Length:

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:

The MID is four byte long and is specified by four ASCII digits ('0'...'9'). The MID describes how to interpret the sent telegram.

Rev:

Revision number of the message to use.

No ack flag:

ONLY FOR SUBSCRIPTION MIDs.

The No Ack Flag is used when setting a subscription. If the No Ack flag is not set in a subscription it means that the subscriber will acknowledge each "push" message sent by the controller (reliable mode). If set, the controller will only push out the information required without waiting for a receive acknowledgement from the subscriber (unreliable mode).

Station ID:

The station the message is addressed to in the case of controller with multi-station configuration. The station ID is 1 byte long and is specified by one ASCII digit ('0'...'9'). One space is considered as station 1 (default value). Only available if not marked with N/A.

Spindle ID:

The spindle the message is addressed to in the case several spindles are connected to the same controller. The spindle ID is 2 bytes long and is specified by two ASCII digits ('0'...'9'). Two spaces are considered as spindle 1 (default value). Only available if not marked with N/A.

Spare:

Reserved space in the header for future use.

3. Communication

3.1 Communication telegram

3.1.1 Communication start (MID = 0001)

Header	Data Field	Message End
	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.

3.1.2 Communication start acknowledge (MID = 0002)

Header	Data Field	Message End
	<i>Data</i>	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 2

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').
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').
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).

Table 3

Additions for revision 2

Parameter	Id	Bytes	Comment
Supplier code	04	3	ATG (supplier code for Apex Tool Group) specified by three ASCII characters.

Table 4

Additions for revision 3

Parameter	Id	Bytes	Comment
Open Protocol version	05	19	Open Protocol version. 19 ASCII characters.
Controller software version	06	19	The software version is specified by 19 ASCII characters.
Tool software version	07	19	The software version is specified by 19 ASCII characters. Not Supported(default: All Spaces)

Possible answers No

Sent by the torque controller.

3.1.3 Communication stop (MID = 0003)

Header	Data Field	Message End
		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.

3.2 Request answer**3.2.1 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
	<i>MID</i>	<i>Error</i>	NUL (ASCII 0x0)
20 bytes	6 bytes		

MID Message Id of the request rejected.*Error* Error code ("00".."99"), two bytes. See Table 3.

Table 5

Error	Description
"00"	No Error
"01"	Invalid data.
"02"	Application number not present
"03"	Application cannot be set.
"04"	Application not running
"06"	VIN upload subscription already exists
"07"	VIN upload subscription does not exist
"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"	Application selection subscription already exists
"14"	Application selection subscription does not exist
"15"	Tightening Id requested not found
"16"	Connection rejected protocol busy
"17"	Linking Group number not present
"18"	Linking Group info subscription already exists
"19"	Linking Group info subscription does not exist
"20"	Linking Group cannot be set
"21"	Linking Group not running
"22"	Not possible to execute dynamic Linking Group request
"23"	Linking Group batch decrement failed
"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"	Linking Group line control info subscription already exists
"41"	Linking Group 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
"50"	Status "external monitored inputs" subscription already exists
"51"	Status "external monitored inputs" subscription does not exist
"52"	IO device not connected
"53"	Faulty IO device number
"59"	Tool currently in use
"60"	No histogram available
"70"	Calibration failed
"79"	Calibration failed
"80"	Audi emergency status subscription exists
"81"	Audi emergency status subscription does not exist
"82"	Automatic/Manual mode subscribe already exist
"83"	Automatic/Manual mode subscribe does not exist
"84"	The relay function subscription already exists
"85"	The relay function subscription does not exist
"86"	The selector socket info subscription already exist
"87"	The selector socket info subscription does not exist
"88"	The digin info subscription already exist
"89"	The digin info subscription does not exist
"90"	Lock at batch done subscription already exist
"91"	Lock at batch done subscription does not exist
"92"	Open protocol commands disabled
"93"	Open protocol commands disabled subscription already exists
"94"	Open protocol commands disabled subscription does not exist
"95"	Reject request, PowerMACS is in manual mode
"96"	Client already connected
"97"	MID revision unsupported
"98"	Controller internal request timeout
"99"	Unknown MID

Possible answers
Sent by

None
the torque controller.

3.2.2 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
	<i>MID</i>	NUL (ASCII 0x0)
20 bytes	4 bytes	

Possible answers None.

Sent by the torque controller.

3.3 Application telegrams

3.3.1 Application number upload request (MID = 0010)

Header	Data Field	Message End
	...	NUL (ASCII 0x0)
20 bytes	0 bytes	

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

Possible answers Application numbers upload reply (MID = 00011).

Sent by Station computer.

3.3.2 Application numbers upload reply (MID = 0011)

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

Header	Data Field		Message End
	<i>Number of valid Application</i>	...	NUL (ASCII 0x0)
20 bytes	3 bytes	3 bytes × Number of valid Application	

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

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

Possible answers No

Used by the torque controller

3.3.3 Application data upload request (MID = 0012)

Header	Data Field	Message End
	<i>Application Number</i>	NUL (ASCII 0x0)
20 bytes	3 bytes	

Request to upload a Application data from the torque controller.

Application Number Application number, is three byte long and is specified by three ASCII digits ('0'....'9')..

Possible answers "Application data upload reply (MID = 0013)"
or
"Command error (MID = 0003)"
"Application number not present "

Used by Station computer.

3.3.4 Application data upload reply (MID = 0013)

Header	Data Field	Message End
	<i>Data</i>	NUL (ASCII 0x0)
20 bytes	84 bytes	

Upload of Application data reply.

Table 6

Parameter	Id	Bytes	Comment
Application id	01	3 ASCII digits.	Range 0-250
Application name	02	25 ASCII character	Fill with SPC if Application Name size < 25
Rotation direction	03	1 ASCII digit	1. CW 2. CCW
Batch size	04	2 ASCII digit	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 degree.

Possible answers No

Sent by the torque controller

3.3.5 Application “selected” subscribe (MID = 0014)

Header	Data Field	Message End
		NUL (ASCII 0x0)
20 bytes	0 bytes	

A subscription for the Application selection. A message is sent to the station computer when a new Application is selected (Application selected MID = 0015).

Possible answers Command accepted (MID = 0005)
Or
Command Error (MID = 0004)
“Application selection subscription already exists”

Sent by Station computer.

3.3.6 Application selected (MID = 0015)

Header	Data Field		Message End
	<i>Application n Nbr</i>	<i>YYYY-MM-DD:HH:MM:SS Date of any settings change to Controller(one date for all apps)</i>	NUL (ASCII 0x0)
20 bytes	22 bytes		

A new Application is selected in the torque controller.
The telegram contains the number of the last Application selected as well as the date/time of the last change done in the Application settings.

Possible answers New Application selected Acknowledge (MID = 0016)

Sent by the torque controller.

3.3.7 Application selected acknowledge (MID = 0016)

Header	Data Field	Message End
		NUL (ASCII 0x0)
20 bytes	0 bytes	

Acknowledge for a New Application selected.

Possible answers No

Sent by Station computer.

3.3.8 Application “selected” unsubscribe (MID = 0017)

Header	Data Field	Message End
		NUL (ASCII 0x0)
20 bytes	0 bytes	

Reset the subscription for the Application selection.

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

Sent by Station computer.

3.3.9 Select Application (MID = 0018)

Header	Data Field	Message End
	<i>Application Number</i>	NUL (ASCII 0x0)
20 bytes	3 bytes	

Application Number Application number represented by 3 ASCII digits (range 000 to 999).

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

Sent by Station computer

3.3.10 Set Application batch size (MID = 0019)

Header	Data Field		Message End
	<i>Application Number</i>	<i>Batch size</i>	NUL (ASCII 0x0)
20 bytes	5 bytes		

This telegram gives the possibility to set the batch size of a Application in run time. This will set the maximum or required number of rundowns for the batch.

Application Number Application number represented by 3 ASCII digits (range 000 to 999).

Batch Size Size of the Application 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.

3.3.11 Reset Application batch size (MID = 0020)

Header	Data Field	Message End
	<i>Application Number</i>	NUL (ASCII 0x0)
20 bytes	3 bytes	

This telegram gives the possibility to reset the batch **accumulator** of the **running Application** in run time.

Application Number Application number represented by 3 ASCII digits (range 000 to 999).

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

Sent by Station computer.

3.3.12 *Lock at batch done subscribe* (MID = 0021)

Header	Data Field	Message End
		NUL (ASCII 0x0)
20 bytes	0 bytes	

Subscription for the “lock at batch done”. A message (Lock at batch done upload MID = 0022) is sent to the station computer each time the “lock at batch done” status is changed. An acceptance message (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)
“Lock at batch done subscription already exists”

Sent by Station computer.

3.3.13 *Lock at batch done Upload* (MID = 0022)

Header	Data Field	Message End
		NUL (ASCII 0x0)
20 bytes	1 bytes	

Upload the status of the “lock at batch done”. The data field consists of one ASCII digit: “1” if “lock at batch done” is true and “0” if false.

Possible answers Lock at batch done upload acknowledge (MID = 0023)

Sent by the torque controller.

3.3.14 *Lock at batch done Upload acknowledge* (MID = 0023)

Header	Data Field	Message End
		NUL (ASCII 0x0)
20 bytes	0 bytes	

Acknowledge to telegram “lock at batch done upload” (MID 0022).

Possible answers No

Sent by Station computer.

3.3.15 Lock at batch done unsubscribe (MID = 0024)

Header	Data Field	Message End
		NUL (ASCII 0x0)
20 bytes	0 bytes	

Unsubscribe the "lock at batch done".

Possible answers Command accepted (MID = 0005)
Or
Command Error (MID = 0004)
"Lock at batch done subscription does NOT exist"

Sent by Station computer.

3.4 Linking Group telegram

3.4.1 Linking Group numbers upload request (MID = 0030)

Header	Data Field	Message End
		NUL (ASCII 0x0)
20 bytes	0 bytes	

A request for all the valid Linking Group numbers of the PF3000. The result of this command will be the transmission of all the valid Linking Group numbers of the PF3000 (Linking Group numbers upload reply
MID = 0031)

Possible answers Linking Group numbers upload reply (MID = 0031).

Sent by Station computer.

3.4.2 Linking Group numbers upload reply (MID = 0031)

Header	Data Field		Message End
	<i>Number of valid Linking Group number</i>	...	NUL (ASCII 0x0)
20 bytes	2 bytes	2 bytes × Number of valid Linking Group	

The transmission of all the valid Linking Group numbers of the PF3000

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

Table 7

Revision 1

Parameter	Bytes	Comment
Number of Linking Groups	2 ASCII digits	Two ASCII digits, range 00-99.
Linking Group ID of each Linking Group present in the controller	2 ASCII digits * # of Linking Groups	Two ASCII digits for each Linking Group. Range: 00-99.

Table 8

Revision 2

Parameter	Bytes	Comment
Number of Linking Groups	4 ASCII digits	Four ASCII digits, range 0000-9999.
Linking Group ID of each Linking Group present in the controller	4 ASCII digits * # of Linking Groups	Four ASCII digits for each Linking Group. Range: 0000-9999.

Possible answers No

Sent by The torque controller.

3.4.3 Linking Group data upload request (MID = 0032)

Header	Data Field	Message End
	<i>Linking Group Number</i>	NUL (ASCII 0x0)
20 bytes	2 or 4 bytes	

Request to upload the data from a specific Linking Group from the PF3000.

Revision 1:

Linking Group Number Linking Group Number is two bytes long and is specified by two
Ascii digits ('0'....'9')

Revision 2

Linking Group Number Linking Group Number is four bytes long and is specified by four
Ascii digits ('0'....'9')

Possible answers “ Linking Group data upload “ (MID = 0033)”
or
“Command error (MID = 0003)
“Linking Group Number not present ”

Used by Station computer.

3.4.4 Linking Group data upload reply (MID = 0033)

Header	Data Field	Message End
	Linking Group data	NUL (ASCII 0x0)
20 bytes	71 + no of Applications in the Linking Group x 12 bytes.	

This message is sent as a reply to the **MID 0032 Linking Group data request**.

Possible answers None

Used by Controller

Table 9

Revision 1:

Parameter	Id	Bytes	Comment
Linking Group ID	01	2	The Linking Group ID is specified by two ASCII characters. Range: 00-99
Linking Group name	02	25	25 ASCII characters.
Forced order	03	1	One ASCII character: 0=free order, 1=forced order, 2=free and forced Not Supported(default:1)
Max time for first tightening	04	4	Four ASCII digits, range 0000-9999, Not Supported(default:0) 0000=not used
Max time to complete Linking Group	05	5	Five ASCII digits, range 00000-99999, Not Supported(default:0) 00000=not used
Linking Group batch mode/ batch count type	06	1	The Linking Group batch mode is the way to count the tightening in a Linking Group; only the OK or both OK and NOK. One ASCII character. 0=only the OK tightenings are counted 1=both the OK and NOK tightenings are counted Not Supported(default:0)
Lock at Linking Group done	07	1	One ASCII character: 0=No, 1=Yes Not Supported(default:0)
Use line control	08	1	One ASCII character: 0=No, 1=Yes Not Supported(default:0)
Repeat Linking Group	09	1	One ASCII character: 0=No, 1=Yes Not Supported(default:0)
Tool loosening	10	1	Tool loosening. One ASCII character. Not Supported(default:0) 0=Enable, 1=Disable, 2=Enable only on NOK tightening
Reserved	11	1	Reserved for Linking Group repair. One ASCII character. 0=E, 1=G Not Supported(default:0)
Number of Applications	12	2	The number of Applications in the Linking Group list, defined by two ASCII characters, range 00-99.
Linking Group list	13	N * 12	A list of Applications (N=value from parameter "Number of Applications", max 99). Each Application is defined by a number of parameters separated by ":" and terminated by ";" (12 bytes) according to: [Channel-ID]:[Type-ID]:[AutoValue]:[BatchSize]; Channel-ID = two ASCII characters, range 00-99 Type ID = Application ID or Multistage ID, three ASCII characters, range 000-999 Auto Value = One ASCII character, 1 or 0, 1=for Auto Next Not Supported(default:0) Change; BatchSize = Two ASCII characters, range 00-99 Not Supported(default:0) Example: 15:011:0:22;

Table 10
Revision 2:

Parameter	Id	Bytes	Comment
Linking Group ID	01	4	The Linking Group ID is specified by two ASCII characters. Range: 0000-9999
Linking Group name	02	25	25 ASCII characters.
Forced order	03	1	One ASCII character: 0=free order, 1=forced order, 2=free and forced Not Supported(default:1)
Max time for first tightening	04	4	Four ASCII digits, range 0000-9999, 0000=not used Not Supported(default:0)
Max time to complete Linking Group	05	5	Five ASCII digits, range 00000-99999, 00000=not used Not Supported(default:0)
Linking Group batch mode/ batch count type	06	1	The Linking Group batch mode is the way to count the tightening in a Linking Group; only the OK or both OK and NOK. One ASCII character. 0=only the OK tightenings are counted 1=both the OK and NOK tightenings are counted Not Supported(default:0)
Lock at Linking Group done	07	1	One ASCII character: 0=No, 1=Yes Not Supported(default:0)
Use line control	08	1	One ASCII character: 0=No, 1=Yes Not Supported(default:0)
Repeat Linking Group	09	1	One ASCII character: 0=No, 1=Yes Not Supported(default:0)
Tool loosening	10	1	Tool loosening. One ASCII character. 0=Enable, 1=Disable, 2=Enable only on NOK tightening Not Supported(default:0)
Reserved	11	1	Reserved for Linking Group repair. One ASCII character. 0=E, 1=G Not Supported(default:0)
Number of Applications	12	2	The number of Applications in the Linking Group list, defined by two ASCII characters, range 00-99.
Linking Group list	13	N * 12	A list of Applications (N=value from parameter "Number of Applications", max 99). Each Application is defined by a number of parameters separated by ":" and terminated by ";" (12 bytes) according to: [Channel-ID]:[Type-ID]:[AutoValue]:[BatchSize]; Channel-ID = two ASCII characters, range 00-99 Type ID = Application ID or Multistage ID, three ASCII characters, range 000-999 Auto Value = One ASCII character, 1 or 0, 1=for Auto Next Not Supported(default:0) Change; BatchSize = Two ASCII characters, range 00-99 Not Supported(default:0) Example: 15:011:0:22;

3.4.5 Linking Group Info/Selected subscribe (MID =0034)

Header	Data Field	Message End
		NUL (ASCII 0x0)
20 bytes	0 bytes	

A subscription for the Linking Group info. MID 0035 Linking Group info is sent to the integrator when a new Linking Group is selected and after each tightening performed during the Linking Group.

Possible answers Command accepted (MID = 0005)
Or
Command Error (MID = 0004)
Linking Group info subscription already exists

Sent by Station computer.

3.4.6 Linking Group/Selected Info (MID = 0035)

3.4.6.1 Linking Group Info Open Protocol Implementation

Header	Data Field	Message End
	<i>Linking Group Info</i>	NUL (ASCII 0x0)
20 bytes	42 bytes	

Info of selected Linking Group on the Torque controller

Possible answers Linking Group Info Acknowledge (MID = 0036)

Sent by Station computer

Table 11

Revision 1:

Parameter	Id	Bytes	Comment
Linking Group ID	01	2	The Linking Group ID is specified by two ASCII characters. Range: 00-99
Linking Group status	02	1	The Linking Group batch status is specified by one ASCII character. 0=Linking Group not completed, 1=Linking Group OK, 2=Linking Group NOK.
Linking Group batch mode	03	1	The Linking Group batch mode is the way to count the tightening in a Linking Group only the OK or both OK and NOK. One ASCII character 0= only the OK tightenings are counted 1= both the OK and NOK tightenings are counted Always set to '1'= both the OK and NOK tightenings are counted'
Linking Group batch size	04	4	This parameter gives the total number of tightening in the Linking Group. The Linking Group batch size is four bytes long. Four ASCII characters, range 0000-9999.
Linking Group batch counter	05	4	This parameter gives the current value of the Linking Group batch counter. The Linking Group is completed when the Linking Group batch counter is equal to the Linking Group batch size. The Linking Group batch counter is four bytes long. Four ASCII characters, range 0000-9999.
Time stamp	06	19	Time stamp for the Linking Group info. The time stamp is 19 bytes long and is specified by 19 ASCII characters YYYY-MM-DD:HH:MM:SS.

Table 12

Revision 2:

Parameter	Id	Bytes	Comment
Linking Group ID	01	4	The Linking Group ID is specified by two ASCII characters. Range: 0000-9999
Linking Group status	02	1	The Linking Group batch status is specified by one ASCII character. 0=Linking Group not completed, 1=Linking Group OK, 2=Linking Group NOK.
Linking Group batch mode	03	1	The Linking Group batch mode is the way to count the tightening in a Linking Group only the OK or both OK and NOK. One ASCII character 0= only the OK tightenings are counted 1= both the OK and NOK tightenings are counted
Linking Group batch size	04	4	This parameter gives the total number of tightening in the Linking Group. The Linking Group batch size is four bytes long. Four ASCII characters, range 0000-9999. Always set to '1'= both the OK and NOK tightenings are counted'
Linking Group batch counter	05	4	This parameter gives the current value of the Linking Group batch counter. The Linking Group is completed when the Linking Group batch counter is equal to the Linking Group batch size. The Linking Group batch counter is four bytes long. Four ASCII characters, range 0000-9999.
Time stamp	06	19	Time stamp for the Linking Group info. The time stamp is 19 bytes long and is specified by 19 ASCII characters YYYY-MM-DD:HH:MM:SS.

3.4.6.2 Linking Group Selected FEP Implementation

Header	Data Field	Message End
	<i>Linking Group Number</i>	NUL (ASCII 0x0)
20 bytes	2 bytes	

A new Linking Group is selected in the Torque controller.

Possible answers Linking Group selected Acknowledge (MID = 0036)

Sent by Station Station computer.

3.4.6 Linking Group Info/Selected acknowledge (MID = 0036)

Header	Data Field	Message End
		NUL (ASCII 0x0)
20 bytes	0 bytes	

Acknowledge for a Linking Group Info message.

Possible answers No

Sent by Station computer.

3.4.7 Linking Group Info/Selected unsubscribe (MID = 0037)

Header	Data Field	Message End
		NUL (ASCII 0x0)
20 bytes	0 bytes	

Reset the subscription for the Linking Group Info.

Possible answers Command accepted (MID = 0005)
Or
Command Error (MID = 0004)
Linking Group info subscription does not exist

Sent by Station computer

3.4.8 Select Linking Group (MID = 0038)

Header	Data Field	Message End
	<i>Linking Group Number</i>	NUL (ASCII 0x0)
20 bytes	2 or 4 bytes	

Revision 1:

Linking Group Number Linking Group Number is two bytes long and is specified by two
Ascii digits ('0'....'9')

Revision 2

Linking Group Number Linking Group Number is four bytes long and is specified by four
Ascii digits ('0'....'9')

Possible answers Command accepted (MID = 0005)
or
Command Error (MID = 0003)
("Linking Group cannot be set")
("Invalid data")

Sent by Integrator

3.4.9 Linking Group restart (MID = 0039)

Header	Data Field	Message End
	<i>Linking Group Number</i>	NUL (ASCII 0x0)
20 bytes	2 or 4 bytes	

Revision 1:

Linking Group Number Linking Group Number is two bytes long and is specified by two
Ascii digits ('0'....'9')

Revision 2

Linking Group Number Linking Group Number is two bytes long and is specified by four
Ascii digits ('0'....'9')

Possible answers Command accepted (MID = 0005)
or
Command Error (MID = 0003)
("Linking Group not running")
("Invalid data")

Sent by Integrator

3.4 Tool telegram

3.4.1 Tool data upload request (MID = 0040)

Header	Data Field	Message End
		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.

3.4.2 Tool data upload (MID = 0041)

3.4.2.1 Open Protocol Implementation

Header	Data Field	Message End
	<i>Data</i>	NUL (ASCII 0x0)
20 bytes	61 bytes	

Upload of tool data from the torque controller.

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

Table 13

Tool data, revision 1

Parameter	Id	Bytes	Comment
Tool serial number	01	14	The Tool serial number is specified by 14 ASCII characters Left justified.
Total number of tightening	02	10	The Total number of tightening is specified by 10 ASCII digits. Max 4294967295
Last calibration date	03	19	YYYY-MM-DD:HH:MM:SS Adjustment Date (year, Month) (Day = 1)(hour = minute = sec = 0)
Controller Serial Number	04	10	The controller serial number is specified by 10 ASCII characters

Table 14**Tool data, Additions for revision 2**

Parameter	Id	Bytes	Comment
Calibration value	05	6	The tool calibration value is multiplied by 100 and sent as an integer (2 decimals truncated). Six ASCII digits.
Last service date	06	19	YYYY-MM-DD:HH:MM:SS Service Date (year, Month) (Day = 1)(hour = minute = sec = 0) Blank if not available
Tightenings since service	07	10	The number of tightenings since last service is specified by 10 ASCII digits. Max 4294967295
Tool type	08	2	The tool type is specified by 2 ASCII digits: 01=S-tool, 02=DS-tool, 03=Ref. transducer, 04=ST-tool, 05=EPtool, 06=ETX-tool, 07=SL-tool, 08=DL-tool, 09=STB(offline), 10=STB(online), 11=QST-tool Not Supported(default: All Spaces)
Motor size	09	2	The motor size is specified by 2 ASCII digits, range 00-99.
Open end data	10	3	The open end data is specified by 3 ASCII digits. The first digit represents the "use open end": 1=true, 0=false. The second digit indicates the tightening direction: 0=CW, 1=CCW. The third digit indicates motor rotation: 0=normal, 1=inverted. Not Supported(default:0)
Controller software version	11	19	The software version is specified by 19 ASCII characters.

3.4.2.2 FEP Implementation

Header	Data Field	Message End
	<i>Data</i>	NUL (ASCII 0x0)
20 bytes	93 bytes	

Upload of tool data from the torque controller.

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

Table 15

Parameter	Id	Bytes	Comment
Tool serial number	01	14	The Tool serial number is specified by 14 ASCII characters Left justified.
Total number of tightening	02	10	The Total 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
Firmware Version 1	05	10	The controller firmware version, left justified. Software Version Number
Firmware Version 2	06	10	Auxiliary firmware version in the case there is a second firmware required Software Version Number
Future	07	20	Reserved for future (Blank)

3.4.3 Disable tool (MID = 0042)

Header	Data Field	Message End
		NUL (ASCII 0x0)
20 bytes	0 bytes	

Disable tool

Possible answers Command accepted (MID = 0005)

Sent by Station computer.

3.4.4 Enable tool (MID = 0043)

Header	Data Field	Message End
		NUL (ASCII 0x0)
20 bytes	0 bytes	

Enable tool

Possible answers Command accepted (MID = 0005)

Sent by Station computer.

3.5 VIN telegram

3.5.1 Vehicle Id Number download request (MID = 0050)

Header	Data Field	Message End
	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.

3.5.2 Vehicle Id Number upload subscribe (MID = 0051)

Header	Data Field	Message End
		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.

3.5.3 Vehicle Id Number upload (MID = 0052)

Header	Data Field	Message End
	VIN 25 ASCII characters	NUL (ASCII 0x0)
20 bytes	25 bytes	

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

Revision 2

Exceptions:

Identifier result part 2	Not Supported(default: All Spaces)
Identifier result part 3	Not Supported(default: All Spaces)
Identifier result part 4	Not Supported(default: All Spaces)

Possible answers Vehicle Id Number upload acknowledge (MID = 0053)

Sent by the torque controller

3.5.4 Vehicle Id Number upload acknowledge (MID = 0053)

Header	Data Field	Message End
		NUL (ASCII 0x0)
20 bytes	0 bytes	

Vehicle Id Number upload acknowledge.

Possible answers No

Sent by Station computer.

3.5.5 Vehicle Id Number upload unsubscribe (MID = 0054)

Header	Data Field	Message End
		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.

3.6 Tightening result telegram

3.6.1 Last tightening result data subscribe (MID = 0060)

Header	Data Field	Message End
		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.

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

Header	Data Field	Message End
	<i>Data</i>	NUL (ASCII 0x0)
20 bytes		

Upload last tightening result.

Table 16 Revision 1

Parameter	Id	Bytes	Comment
Cell ID	01	4	The cell ID is four bytes long and specified by four ASCII digits. Range: 0000-9999.
Channel ID	02	2	The channel ID is two bytes long and specified by two ASCII digits. Range: 00-99.
Torque controller Name	03	25	The controller name is 25 bytes long and is specified by 25 ASCII characters.
VIN Number	04	25	The VIN number is 25 bytes long and is specified by 25 ASCII characters.
Linking Group ID	05	2	The Linking Group ID is two bytes long and specified by two ASCII digits. Range: 00-99
Application ID	06	3	The Application ID is three bytes long and specified by three ASCII digits. Range: 000-999.
Batch size	07	4	This parameter gives the total number of tightening in the batch. The batch size is four bytes long and specified by four ASCII digits. Range: 0000-9999.
Batch counter	08	1	The batch counter information is four bytes long specifying and specified by four ASCII digits. Range: 0000-9999.
Tightening Status	09	1	The tightening status is one byte long and specified by one ASCII digit. 0=tightening NOK, 1=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 multiplied by 100 and sent as an integer (2 decimals truncated). It is six bytes long and is specified by six ASCII digits.
Torque Max limit	13	6	The torque max limit is multiplied by 100 and sent as an integer (2 decimals truncated). It is six bytes long and is specified by six ASCII digits.
Torque final target	14	6	The torque final target is multiplied by 100 and sent as an integer (2 decimals truncated). It is six bytes long and is specified by six ASCII digits.
Torque	15	6	The torque value is multiplied by 100 and sent as an integer (2 decimals truncated). It is six bytes long and is specified by six ASCII digits.
Angle Min	16	5	The angle min value in degrees. Each turn represents 360 degrees. It is five bytes long and specified by five ASCII digits. Range: 00000-99999.
Angle Max	17	5	The angle max value in degrees. Each turn represents 360 degrees. It is five bytes long and specified by five ASCII digits. Range: 00000-99999.
Final Angle Target	18	5	The target angle value in degrees. Each turn represents 360 degrees. It is five bytes long and specified by five ASCII digits. Range: 00000-99999.
Angle	19	5	The turning angle value in degrees. Each turn represents 360 degrees. It is five bytes long and specified by five ASCII digits. Range: 00000-99999.
Time stamp	20	19	Time stamp for each tightening. It is 19 bytes long and is specified by 19 ASCII characters (YYYY-MM-DD:HH:MM:SS).
Date/time of last change in Application settings	21	19	Time stamp for the last change in the current Application settings. It is 19 bytes 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. It is incremented after each tightening. 10 ASCII digits. Max 4294967295

Table 17 Revision 2

Parameter	Id	Bytes	Comment
Cell ID	01	4	The cell ID is four bytes long and specified by four ASCII digits. Range: 0000-9999.
Channel ID	02	2	The channel ID is two bytes long and specified by two ASCII digits. Range: 00-99.
Torque controller Name	03	25	The controller name is 25 bytes long and is specified by 25 ASCII characters.
VIN Number	04	25	The VIN number is 25 bytes long and is specified by 25 ASCII characters.
Linking Group ID	05	2	The Linking Group ID is two bytes long and specified by two ASCII digits. Range: 00-99
Application ID	06	3	The Application ID is three bytes long and specified by three ASCII digits. Range: 000-999.
Strategy	07	2	<div>The strategy currently run by the controller. It is two bytes long and specified by two ASCII digits. Range: 00-99.</div> <div>Supported:</div> <div><div>Torque Control01(Seq. 13,11,20)</div><div>Torque Control/Angle Mon02(Seq. 30,31)</div><div>Angle Control/Torque Mon04(Seq. 50,51)</div><div>Reverse Angle07(Seq. 41,46,48)</div><div>Torque Control/Angle Control (OR)11(Seq. 80)</div><div>Home Position13(Seq. 16)</div><div>Yield15(Seq. 63)</div><div>Yield/Torque Control19(Seq. 73,78)</div><div>No Strategy/Unsupported99</div></div>
Strategy options	08	5	<div>Five bytes long bit field</div> <div>Supported:</div> <div><div>Bit 0 Torque (Seq. 11,13,20,30,31,63,73,78,80)</div><div>Bit 1 Angle (Seq. 16,41,46,48,50,51,56,75,78,80)</div><div>Bit 3 PVT monitoring (Seq. 13)</div><div>Bit 4 PVT compensate (Seq. 32)</div></div>
Batch size	09	4	This parameter gives the total number of tightening in the batch. The batch size is four bytes long and specified by four ASCII digits. Range: 0000-9999.
Batch counter	10	1	The batch counter information is four bytes long specifying and specified by four ASCII digits. Range: 0000-9999.
Tightening Status	11	1	The tightening status is one byte long and specified by one ASCII digit. 0=tightening NOK, 1=tightening OK.
Batch status	12		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 Not Supported(default:1)
Current Monitoring Status	16	1	0=Low, 1=OK, 2=High Not Supported(default:1)
Selftap status	17	1	0=Low, 1=OK, 2=High Not Supported(default:1)
Prevail Torque monitoring status	18	1	0=Low, 1=OK, 2=High
Prevail Torque compensate status	19	1	0=Low, 1=OK, 2=High
Tightening error status	20	10	<div>Ten bytes long bit field.</div> <div>Tightening error bits show what went wrong with the tightening. See Appendix III for Corresponding Apex Controller Error codes.</div> <div>Supported:</div> <div><div>Bit 3 - Torque max shut off</div><div>Bit 4 - Angle max shut off</div><div>Bit 5 - Selftap torque max shut off</div><div>Bit 6 - Selftap torque min shut off</div><div>Bit 7 - Prevail torque max shut off</div><div>Bit 8 - Prevail torque min shut off</div></div>

			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 Bit 13 - Post view torque Angle too small Bit 14 - Trigger lost Bit 15 - Torque less than target Bit 17 - Multistage abort Bit 18 – Rehit (Seq. 31,51) Bit 20 - Current limit reached Bit 21 – End Time out shutoff Bit 23 - Disable drive Bit 31 - Yield nut off (Seq. 31,51) Bit 32 - Yield too few samples
Torque Min limit	21	6	The torque min limit is multiplied by 100 and sent as an integer (2 decimals truncated). It is six bytes long and is specified by six ASCII digits.
Torque Max limit	22	6	The torque max limit is multiplied by 100 and sent as an integer (2 decimals truncated). It is six bytes long and is specified by six ASCII digits.
Torque final target	23	6	The torque final target is multiplied by 100 and sent as an integer (2 decimals truncated). It is six bytes long and is specified by six ASCII digits.
Torque	24	6	The torque value is multiplied by 100 and sent as an integer (2 decimals truncated). It is six bytes long and is specified by six ASCII digits.
Angle Min	25	5	The angle min value in degrees. Each turn represents 360 degrees. It is five bytes long and specified by five ASCII digits. Range: 00000-99999.
Angle Max	26	5	The angle max value in degrees. Each turn represents 360 degrees. It is five bytes long and specified by five ASCII digits. Range: 00000-99999.
Final Angle Target	27	5	The target angle value in degrees. Each turn represents 360 degrees. It is five bytes long and specified by five ASCII digits. Range: 00000-99999.
Angle	28	5	The turning angle value in degrees. Each turn represents 360 degrees. It is five bytes long and specified by five ASCII digits. Range: 00000-99999.
Rundown angle Min	29	5	The tightening angle min value in degrees. Each turn represents 360 degrees. It is five bytes long and specified by five ASCII digits. Range: 00000-99999. Not Supported(default:0)
Rundown angle Max	30	5	The tightening angle max value in degrees. Each turn represents 360 degrees. It is five bytes long and specified by five ASCII digits. Range: 00000-99999. Not Supported(default:9999)
Rundown angle	31	5	The tightening angle value reached in degrees. Each turn represents 360 degrees. It is five bytes long and specified by five ASCII digits. Range: 00000-99999. Not Supported(default:0)
Current Monitoring Min	32	3	The current monitoring min limit in percent is three bytes long and is specified by three ASCII digits. Range: 000-999. Not Supported(default:0)
Current Monitoring Max	33	3	The current monitoring max limit in percent is three bytes long and is specified by three ASCII digits. Range: 000-999. Not Supported(default:150)
Current Monitoring Value	34	3	The current monitoring value in percent is three bytes long and is specified by three ASCII digits. Range: 000-999. Not Supported(default:0)
Self tap min	35	6	The selftap min limit is multiplied by 100 and sent as an integer (2 decimals truncated). It is six bytes long and specified by six ASCII digits. Not Supported(default: 000105)
Self tap max	36	6	The selftap max limit is multiplied by 100 and sent as an integer (2 decimals truncated). It is six bytes long and specified by six ASCII digits. Not Supported(default: 999900)
Self tap torque	37	6	The selftap torque is multiplied by 100 and sent as an integer (2 decimals truncated). It is six bytes long and specified by six ASCII digits. Not Supported(default:0)
Prevail torque monitoring min	38	6	The PVT min limit is multiplied by 100 and sent as an integer (2 decimals truncated). It is six bytes long and specified by six ASCII digits. (Only Seq 32 otherwise :1.05)
Prevail torque monitoring max	39	6	The PVT max limit is multiplied by 100 and sent as an integer (2 decimals truncated). It is six bytes long and specified by six ASCII digits. (Only Seq 32 otherwise :1.05)
Prevail torque	40	6	The prevail torque value is multiplied by 100 and sent as an integer (2 decimals truncated). The prevail torque is six bytes long and is specified by six ASCII digits. (Only Seq 32 otherwise :0)
Tightening ID	41	10	The tightening ID is a unique ID for each tightening result. It is incremented after each tightening. 10 ASCII digits. Max 4294967295
Linking Group sequence number	42	5	The tightening ID is a unique ID. It is incremented after each tightening. It is ten bytes long and specified by ten ASCII digits. Max 4294967295.

Sync tightening ID	43	5	The Linking Group sequence number is unique for each Linking Group. All tightenings performed in the same Linking Group are stamped with the same Linking Group sequence number. It is specified by five ASCII digits. Range: 00000-65535.
Tool serial number	44	14	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. It is specified by five ASCII digits. Range: 00000-65535.
Time stamp	45	19	Time stamp for each tightening. It is 19 bytes long and is specified by 19 ASCII characters (YYYY-MM-DD:HH:MM:SS).
Date/time of last change in Application settings	46	19	Time stamp for the last change in the current Application settings. It is 19 bytes long and is specified by 19 ASCII characters (YYYY-MM-DD:HH:MM:SS).

Exceptions for Revision 2:

Self Tap Max	Not Supported(default:999900)
Self Tap Torque	Not Supported(default:0)
Linking Group Sequence Number	Not Supported(default:0)
Sync Tightening ID	Not Supported(default:0)

Table 18, Additional revision 3

Parameter	Id	Bytes	Comment
Application Name	47	25	The Application name is 25 bytes long and is specified by 25 ASCII characters
Torque values Unit	48	1	The unit in which the torque values are sent. The torque values unit is one byte long and is specified by one ASCII digit. Nm = 1, FtLbs = 2, InLbs = 3
Result type	49	2	The result type is two bytes long and specified by two ASCII digits. Supported: Tightening 01 Loosening 02

Table 19, Additional revision 4

Parameter	Id	Bytes	Comment
Identifier result part 2	50	25	The identifier result part 2 is 25 bytes long and is specified by 25 ASCII characters.
Identifier result part 3	51	25	The identifier result part 2 is 25 bytes long and is specified by 25 ASCII characters.
Identifier result part 4	52	25	The identifier result part 2 is 25 bytes long and is specified by 25 ASCII characters.

Additional revision 5

Customer Tightening Error Code	Not Supported(default:0)
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Additional revision 6

Prevail Torque Compensate Value(ID: 54)	Supported (Only Seq 32 otherwise :0)
Tightening Error Status2	Not Supported(default:0)

Table 20, Trace Graph revision 500

Parameter	Id	Bytes	Comment
Graph Type	56	1	Type of Graph in Telegram, supported types: 0 = Torque over Angle(Default) 1 = Torque over Time 2 = Angle over Time
Torque Scale Factor	57	10	Decimal value Divide by 1000000
Angle Offset	58	6	Angle offset(Negative side of x axis)
Time Scale	59	4	Milliseconds between each reading(Mode 1 or 2)
Binary offset	60	10	Binary offset for trace as signed integer
Trace Length	61	4	Trace Length in Bytes Max 9000
Data Blob	62	9000	4500 signed 16bit integers of Torque/Angle Data(If trace over 4500 points, with be truncated to the Last 4500 values of the rundown)***

*** Float data is calculated with the following formula

Torque value = (dataBlob value – Binary Offset)/(Torque Scale Factor)

Table 21, Additional revision 998

Parameter	Id	Bytes	Comment
Number of stages in multistage	56	2	The total number of stages to be run for this tightening. It is two bytes long and specified by two ASCII digits.
Number of stage results	57	2	Number of run stages. It is two bytes long and specified by two ASCII digits. For each completed stage the final torque and the final angle are reported.
Stage result	58	11 x number of stage results	Byte 1-6: The stage torque value. The torque is multiplied by 100 and sent as an integer (2 decimals truncated). It is six bytes long and specified by six ASCII digits. Byte 7-11: The turning angle stage value in degrees. Each turn represents 360 degrees. It is five bytes long and specified by five ASCII digits. Range: 00000-99999.

Possible answers

Last tightening result Acknowledge (MID =0062)

Sent by

the torque controller

3.6.3 Last tightening result data acknowledge (MID = 0062)

Header	Data Field	Message End
		NUL (ASCII 0x0)
20 bytes	0 bytes	

Last tightening result data acknowledge.

Possible answers No

Sent by Station computer

3.6.4 Last tightening result data unsubscribe (MID = 0063)

Header	Data Field	Message End
		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.

3.6.5 Old tightening result upload request (MID = 0064)

Header	Data Field	Message End
	<i>Tightening Id</i>	NUL (ASCII 0x0)
20 bytes	10 bytes (Max 4294967295)	

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.

3.6.6 Old tightening result reply (MID = 0065)

Header	Data Field	Message End
	<i>Data</i>	NUL (ASCII 0x0)
20 bytes		

Old tightening upload.

3.6.6.1 Open Protocol Implementation

Table 20, MID 0065 revision 1

Parameter	Id	Bytes	Comment
Tightening ID	01	10	The tightening ID is a unique ID for each tightening result. It is incremented after each tightening. 10 ASCII digits. Max 4294967295
VIN Number	02	25	The VIN number is 25 bytes long and is specified by 25 ASCII characters.
Application ID	03	3	The Application ID is three bytes long and specified by three ASCII digits. Range: 000-999
Batch counter	04	4	The batch counter information is four bytes long and specified by four ASCII digits. Range: 0000-9999.
Tightening Status	05	1	The tightening status is one byte long and specified by one ASCII digit. 0=tightening NOK, 1=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 multiplied by 100 and sent as an integer (2 decimals truncated). It is six bytes long and is specified by six ASCII digits.
Angle	09	5	The turning angle value in degrees. Each turn represents 360 degrees. It is five bytes long and specified by five ASCII digits. Range: 00000-99999.
Time stamp	10	19	Time stamp for the tightening. It is 19 bytes 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. 0=batch NOK (batch not completed), 1=batch OK, 2=batch not used.

Table 21, MID 0065 revision 2

Parameter	Id	Bytes	Comment
Tightening ID	01	10	The tightening ID is a unique ID for each tightening result. It is incremented after each tightening. 10 ASCII digits. Max 4294967295
VIN Number	02	25	The VIN number is 25 bytes long and is specified by 25 ASCII characters.
Linking Group ID	03	4	The Linking Group ID is four bytes long and specified by four ASCII digits. Range: 0000-9999
Application ID	04	3	The Application ID (Application ID) is three bytes long and specified by three ASCII digits. Range: 000-999.
Strategy	05	2	<div>The strategy currently run by the controller. It is two bytes long and specified by two ASCII digits. Range: 00-99.</div> <div>Supported:</div> <div><div>Torque Control01</div><div>Torque Control/Angle Mon02</div><div>Angle Control/Torque Mon04</div><div>Reverse Angle07</div><div>Torque Control/Angle Control (OR)11</div><div>Home Position13</div><div>No Strategy99</div></div>
Strategy options	06	5	<div>Five bytes long bit field</div> <div>Supported:</div> <div><div>Bit 0 Torque</div><div>Bit 1 Angle</div><div>Bit 2 Batch</div></div>
Batch size	07	4	This parameter gives the total number of tightening in the batch. The batch size is four bytes long and specified by four ASCII digits. Range: 0000-9999.
Batch counter	08	4	The batch counter information is four bytes long specifying and specified by four ASCII digits. Range: 0000-9999.
Tightening Status	09	1	The tightening status is one byte long and is specified by one ASCII digit. 0=tightening NOK, 1=tightening OK.
Batch status	10	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	11	1	0=Low, 1=OK, 2=High
Angle status	12	1	0=Low, 1=OK, 2=High
Rundown angle status	13	1	0=Low, 1=OK, 2=High Not Supported(default:1)
Current Monitoring Status	14	1	0=Low, 1=OK, 2=High Not Supported(default:1)
Selftap status	15	1	0=Low, 1=OK, 2=High Not Supported(default:1)
Prevail Torque monitoring status	16	1	0=Low, 1=OK, 2=High Not Supported(default:1)
Prevail Torque compensate Status	17	1	0=Low, 1=OK, 2=High Not Supported(default:1)
Tightening error status	18	10	<div>Ten bytes long bit field.</div> <div>Tightening error bits show what went wrong with the tightening.</div> <div>Supported:</div> <div><div>Bit 3 Torque max shut off</div><div>Bit 4 Angle max shut off</div><div>Bit 15 Torque less than target</div></div>
Torque	19	6	The torque value is multiplied by 100 and sent as an integer (2 decimals truncated). It is six bytes long and is specified by six ASCII digits.
Angle	20	5	The turning angle value in degrees. Each turn represents 360 degrees. It is five bytes long and specified by five ASCII digits. Range: 00000-99999.
Rundown angle	21	5	The tightening angle value reached in degrees. Each turn represents 360 degrees. It is five bytes long and specified by five ASCII digits. Range: 00000-99999. Not Supported(default:0)

Current Monitoring Value	22	3	The current monitoring value in percent is three bytes long and is specified by three ASCII digits. Range: 000-999. Not Supported(default:0)
Selftap torque	23	6	The selftap torque is multiplied by 100 and sent as an integer (2 decimals truncated). It is six bytes long and specified by six ASCII digits. Not Supported(default:0)
Prevail torque	24	6	The prevail torque value is multiplied by 100 and sent as an integer (2 decimals truncated). The prevail torque is six bytes long and is specified by six ASCII digits. Not Supported(default:0)
Linking Group sequence number	25	5	The Linking Group sequence number is unique for each Linking Group. All tightenings performed in the same Linking Group are stamped with the same Linking Group sequence number. It is specified by five ASCII digits. Range: 00000-65535. Not Supported(default:0)
Sync tightening ID	26	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. It is specified by five ASCII digits. Range: 00000-65535. Not Supported(default:0)
Tool serial number	27	14	The Tool serial number is specified by 14 ASCII characters.
Time stamp	28	19	Time stamp for the tightening. It is 19 bytes long and is specified by 19 ASCII characters (YYYY-MM-DD:HH:MM:SS).

Table 22, Additional revision 3

Parameter	Id	Bytes	Comment
Torque values Unit	29	1	The unit in which the torque values are sent. The torque values unit is one byte long and is specified by one ASCII digit. Nm = 1, FtLbs = 2, InLbs = 3
Result type	30	2	The result type is two bytes long and specified by two ASCII digits. Supported: Tightening 01 Loosening 02

Table 23, Additional revision 4

Parameter	Id	Bytes	Comment
Identifier result part 2	31	25	The identifier result part 2 is 25 bytes long and is specified by 25 ASCII characters.
Identifier result part 3	32	25	The identifier result part 2 is 25 bytes long and is specified by 25 ASCII characters.
Identifier result part 4	33	25	The identifier result part 2 is 25 bytes long and is specified by 25 ASCII characters.

Additional revision 5

Customer Tightening Error Code Not Supported(default:0)

Additional revision 6

Prevail Torque Compensate Value Not Supported(default:0)

Tightening Error Status2 Not Supported(default:0)

3.6.6.2 FEP Implementation

Table 24, MID 0065

Parameter	Id	Bytes	Comment
Tightening ID	01	10	The tightening ID is a unique ID for each tightening result. It is incremented after each tightening. 10 ASCII digits. Max 4294967295
VIN Number	02	25	The VIN number is 25 bytes long and is specified by 25 ASCII characters.
Application ID	03	3	The Application ID is three bytes long and specified by three ASCII digits. Range: 000-999
Batch counter	04	4	The batch counter information is four bytes long and specified by four ASCII digits. Range: 0000-9999.
Tightening Status	05	1	The tightening status is one byte long and specified by one ASCII digit. 0=tightening NOK, 1=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 multiplied by 100 and sent as an integer (2 decimals truncated). It is six bytes long and is specified by six ASCII digits.
Angle	09	5	The turning angle value in degrees. Each turn represents 360 degrees. It is five bytes long and specified by five ASCII digits. Range: 00000-99999.
Time stamp	10	19	Time stamp for the tightening. It is 19 bytes 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. 0=batch NOK (batch not completed), 1=batch OK, 2=batch not used.

Possible answers No

Sent by the torque controller

3.7 Alarm telegram

3.7.1 Alarm subscribe (MID = 0070)

Header	Data Field	Message End
		NUL (ASCII 0x0)
20 bytes	0 bytes	

A subscription for the 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.

3.7.2 Alarm Upload reply (MID = 0071)

Header	Data Field	Message End
	<i>Data</i>	NUL (ASCII 0x0)
20 bytes	33 bytes	

Alarm upload.

Table 25

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 E851 Apex Error Codes(See Appendix)
Controller ready status	02	1	Controller ready status 1=OK, 0=NOK Not Supported(default:1)
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.

3.7.3 Alarm upload acknowledge (MID = 0072)

Header	Data Field	Message End
		NUL (ASCII 0x0)
20 bytes	0 bytes	

Alarm data acknowledge.

Possible answers No

Sent by Station computer

3.7.4 Alarm unsubscribe (MID = 0073)

Header	Data Field	Message End
		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.

3.7.5 Alarm acknowledged on torque controller (MID = 0074)

Header	Data Field	Message End
	<i>Error Code</i>	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.

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

Header	Data Field	Message End
		NUL (ASCII 0x0)
20 bytes	0 bytes	

Alarm acknowledged on torque controller acknowledgment.

Possible answers No

Sent by Station computer.

3.7.7 Alarm status (MID = 0076)

Header	Data Field	Message End
	<i>Data</i>	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 26

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. Example E851 <i>Apex Error Codes(See Appendix)</i>
Controller ready status	03	1	Controller ready status 1=OK, 0=NOK <i>Not Supported(default:1)</i>
Tool ready status	04	1	Tool ready status 1 OK 0 NOK
Time	05	19	YYYY-MM-DD:HH:MM:SS

Exceptions:

Controller ready status Not Supported(default:1)

Error code Apex Error Codes(See Appendix)

Possible answers Alarm status acknowledge (MID = 0077)

Sent by the torque controller.

3.7.8 Alarm status acknowledge (MID = 0077)

Header	Data Field	Message End
		NUL (ASCII 0x0)
20 bytes	0 bytes	

Alarm status acknowledge.

Possible answers No

Sent by the station computer

3.8 Time telegram

3.8.1 Read time upload request (MID = 0080)

Header	Data Field	Message End
		NUL (ASCII 0x0)
20 bytes	0 bytes	

Read time request.

Possible answers Time upload reply (MID = 0081)

Sent by the station computer.

3.8.2 Time upload reply (MID = 0081)

Header	Data Field	Message End
	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

3.8.3 Set Time in Torque Controller (MID = 0082)

Header	Data Field	Message End
	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.

3.9 Multi-spindle status messages

3.9.1 Multi-spindle status subscribe (MID = 0090)

Header	Data Field	Message End
		NUL (ASCII 0x0)
20 bytes	0 bytes	

A subscription for the multi-spindle status.

Possible answers Command accepted (MID = 0005) or
 Command error (MID = 0004), Controller is not a sync master/station
 controller, or Multi-spindle status subscription already exists

Sent by the station computer.

3.9.2 Multi-spindle status (MID = 0091)

Header	Data Field	Message End
	<i>Status data</i>	NUL (ASCII 0x0)
20 bytes	See table 27	

The multi-spindle status is sent after each sync tightening. The multiple status contains the common status of the multiple as well as the individual tightening status of each spindle.

Sent by the torque controller

Table 27 Multi-spindle status data (MID = 0091)

Parameter	Id	Bytes	Comment
Number of spindles	01	1	Number of spindles running in the multiple. The number of spindles is two bytes long and specified by 2 ASCII digits, range 02-10.
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, range 00000-65535.
Time stamp	03	19	Time stamp. 19 ASCII characters (YYYY-MM-DD:HH:MM:SS).
Sync overall status	04	1	The status of all the spindles. OK if the individual status of each spindle is OK, NOK if at least one spindle status is NOK. One ASCII digit 1=OK, 0=NOK.
Spindle status	05	5 × number of spindles.	Bytes 1-2: Spindle number in the same order as in the sync list. Range 01-99. Bytes 3-4: Channel ID of the spindle. Range 01-20 Byte 5: Individual overall status of the tightening of each spindle 0=NOK, 1=OK

3.9.3 Multi-spindle status acknowledge (MID = 0092)

Header	Data Field	Message End
		NUL (ASCII 0x0)
20 bytes	0 bytes	

Multi-spindle status acknowledge.

Sent by the station computer.

3.9.4 Multi spindle status unsubscribe (MID = 0093)

Header	Data Field	Message End
		NUL (ASCII 0x0)
20 bytes	0 bytes	

Reset the subscription for the multi spindle status.

Possible answers Command accepted (MID = 0005) or
 Command error (MID = 0004), Multi spindle status subscription does not exist

Sent by the station computer.

3.10 Multi-spindle result messages

3.10.1 Multi-spindle result subscribe (MID = 0100)

Header	Data Field	Message End
		NUL (ASCII 0x0)
20 bytes	0 bytes	

A subscription for the multi-spindle status.

Possible answers Command accepted (MID = 0005) or
Command error (MID = 0004), Controller is not a sync master/station
controller, or Multi-spindle result subscription already exists

Sent by the station computer.

3.10.2 Multi-spindle result (MID = 0101)

Header	Data Field	Message End
	<i>Result data</i>	NUL (ASCII 0x0)
20 bytes	See table 28	

The multi-spindle result is sent after each sync tightening. The multiple result contains the common status of the multiple as well as the individual tightening result (torque and angle) of each spindle.

Sent by the torque controller

Table 28 Multi-spindle result data (MID = 0101)

Parameter	Id	Bytes	Comment
Number of spindles	01	1	Number of spindles running in the multiple. The number of spindles is two bytes long and specified by 2 ASCII digits, range 02-10.
VIN Number	02	4	The VIN number is 25 bytes long and is specified by 25 ASCII characters.
Linking Group ID	03	2	The Linking Group ID is two bytes long and specified by two ASCII digits. Range: 00-99
Application ID	04	3	The Application ID is three bytes long and specified by three ASCII digits. Range: 000-999.
Batch size	05	4	This parameter gives the total number of tightening in the batch. The batch size is four bytes long and specified by four ASCII digits. Range: 0000-9999.
Batch counter	06	4	The batch counter information is four bytes long specifying and specified by four ASCII digits. Range: 0000-9999.
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). It is six bytes long and is specified by six ASCII digits.
Torque Max limit	09	6	The torque max limit is multiplied by 100 and sent as an integer (2 decimals truncated). It is six bytes long and is specified by six ASCII digits.
Torque final target	10	6	The torque final target is multiplied by 100 and sent as an integer (2 decimals truncated). It is six bytes long and is specified by six ASCII digits.
Angle Min	11	5	The angle min value in degrees. Each turn represents 360 degrees. It is five bytes long and specified by five ASCII digits. Range: 00000-99999.
Angle Max	12	5	The angle max value in degrees. Each turn represents 360 degrees. It is five bytes long and specified by five ASCII digits. Range: 00000-99999.
Final Angle Target	13	5	The target angle value in degrees. Each turn represents 360 degrees. It is five bytes long and specified by five ASCII digits. Range: 00000-99999.
Date/time of last change in parameter set settings	14	19	Time stamp for the last change in the current parameter set settings. It is 19 bytes long and is specified by 19 ASCII characters (YYYY-MM-DD:HH:MM:SS). Date of any settings change to controller (one date for all apps)
Time stamp	15	19	Time stamp. 19 ASCII characters (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, range 00000-65535.
Sync overall status	17	1	The status of all the spindles. OK if the individual status of each spindle is OK, NOK if at least one spindle status is NOK. One ASCII digit 1=OK, 0=NOK.
Spindle status	18	18 × number of spindles.	Bytes 1-2: Spindle number in the same order as in the sync list. Range 01-99. Bytes 3-4: Channel ID of the spindle. Range 01-20 Byte 5: Individual overall status of the tightening of each spindle 0=NOK, 1=OK Byte 6: Individual torque status of each spindle. 0=NOK, 1=OK Byte 7-12: The torque result of each spindle. The torque is multiplied by 100 and sent as an integer (2 decimals truncated). It is six bytes long and specified by six ASCII digits. Byte 13: Individual angle status of each spindle. 0=NOK, 1=OK Byte 14-18: The turning angle value in degrees for each spindle. Each turn represents 360 degrees. It is five bytes long and specified by five ASCII digits. Range: 00000-99999.

Torque variables transmitted in system configured torque units(Nm, FtLbs, InLbs). For any other configured torque unit is Nm used.

3.10.3 Multi-spindle result acknowledge (MID = 0102)

Header	Data Field	Message End
		NUL (ASCII 0x0)
20 bytes	0 bytes	

Multi-spindle result acknowledge.

Sent by the station computer.

3.10.4 Multi spindle result unsubscribe (MID = 0103)

Header	Data Field	Message End
		NUL (ASCII 0x0)
20 bytes	0 bytes	

Reset the subscription for the multi spindle result.

Possible answers Command accepted (MID = 0005) or
Command error (MID = 0004), Multi spindle result subscription does not exist

Sent by the station computer.

3.11 Additional Linking Group Telegrams

3.11.1 Abort Linking Group (MID = 0127)

Header	Data Field	Message End
		NUL (ASCII 0x0)
20 bytes	0 bytes	

Abort the current running Linking Group if there is one.

Possible answers Command accepted (MID = 0005)

Sent by the station computer.

3.11.2 Linking Group batch increment (MID = 0128)

Header	Data Field	Message End
		NUL (ASCII 0x0)
20 bytes	0 bytes	

Increment the Linking Group batch if there is a current running Linking Group.

Possible answers Command accepted (MID = 0005)

Sent by the station computer.

3.11.3 Linking Group batch decrement (MID = 0129)

Header	Data Field	Message End
		NUL (ASCII 0x0)
20 bytes	0 bytes	

Decrement the Linking Group batch if there is a current running Linking Group. Two revisions are available for this MID. The default revision or revision 1 does not contain any argument and always decrement the last tightening completed in a Linking Group. The revision 2 contains two parameters; the channel ID and Application ID to be decremented.

Possible answers Command accepted (MID = 0005)
 MID 0004 Command error, Linking Group batch decrement failed

Sent by the station computer.

Revision 1

No Data

Revision 2

Table 29

Parameter	Id	Bytes	Comment
Channel ID	01	1	The channel ID to be decremented. In case of a cell Linking Group each controller member has a unique channel ID.
Application ID	02	4	The Application ID to be decremented in the Linking Group.

3.11.4 Linking Group Off (MID = 0130)

Header	Data Field	Message End
	Linking Group Status	NUL (ASCII 0x0)
20 bytes	1 bytes	

Job off status is one byte long and specified by one
ASCII digit: 0 = set Job off, 1 = reset Job off

Possible answers Command accepted (MID = 0005)
 MID 0004 Command error, Linking Group batch decrement failed

Sent by the station computer.

3.12 VIN Telegram

3.12.1 Vehicle Id Number download request (MID = 0150)

Header	Data Field	Message End
	Identifier data	NUL (ASCII 0x0)
20 bytes	80 bytes	

Used by the integrator to send an identifier to the controller.
Currently only a 25 character Max VIN is supported.

Possible answers Command accepted (MID = 0005)
 or
 Command Error (MID = 0004)
 Identifier input source not granted

Sent by Station computer.

Open Protocol IO MIDs

3.13 IO Telegrams

3.13.1 Set externally controlled relays (MID = 0200)

Header	Data Field	Message End
	Relay Data	NUL (ASCII 0x0)
20 bytes	10 bytes	

By using this message the integrator can control 10 relays (externally control relays). The station can set, reset the relays or make them flashing.

Table 30

Parameter	Id	Bytes	Comment
Status relay 1	01	1	Set the status for relay 1. The relay status is one byte long and specified by 1 ASCII digit. Range 0-3. 0=Off (reset), 1=On (set, fast), 2=Flashing
Status relay 2	02	1	Set the status for relay 2. The relay status is one byte long and specified by 1 ASCII digit. Range 0-3. 0=Off (reset), 1=On (set, fast), 2=Flashing
Status relay 3	03	1	Set the status for relay 3. The relay status is one byte long and specified by 1 ASCII digit. Range 0-3. 0=Off (reset), 1=On (set, fast), 2=Flashing
Status relay 4	04	1	Set the status for relay 4. The relay status is one byte long and specified by 1 ASCII digit. Range 0-3. 0=Off (reset), 1=On (set, fast), 2=Flashing
Status relay 5	05	1	Set the status for relay 5. The relay status is one byte long and specified by 1 ASCII digit. Range 0-3. 0=Off (reset), 1=On (set, fast), 2=Flashing
Status relay 6	06	1	Set the status for relay 6. The relay status is one byte long and specified by 1 ASCII digit. Range 0-3. 0=Off (reset), 1=On (set, fast), 2=Flashing
Status relay 7	07	1	Set the status for relay 7. The relay status is one byte long and specified by 1 ASCII digit. Range 0-3. 0=Off (reset), 1=On (set, fast), 2=Flashing
Status relay 8	08	1	Set the status for relay 8. The relay status is one byte long and specified by 1 ASCII digit. Range 0-3. 0=Off (reset), 1=On (set, fast), 2=Flashing, 3=Keep current status
Status relay 9	09	1	Set the status for relay 9. The relay status is one byte long and specified by 1 ASCII digit. Range 0-3. 0=Off (reset), 1=On (set, fast), 2=Flashing
Status relay 10	10	1	Set the status for relay 10. The relay status is one byte long and specified by 1 ASCII digit. Range 0-3. 0=Off (reset), 1=On (set, fast), 2=Flashing

Possible answers Command accepted (MID = 0005)

Sent by Station computer.

3.13.2 Status externally monitored inputs subscribe (MID = 0210)

Header	Data Field	Message End
		NUL (ASCII 0x0)
20 bytes	0 bytes	

By using this message the integrator can set a subscription to monitor the status for the eight externally monitored digital inputs. After the subscription the station will receive a message every time the status of at least one of the inputs has changed.

Possible answers Command accepted (MID = 0005) or
 MID 0004 Command error,
 Status externally monitored inputs subscription already exists

Sent by Station computer.

3.13.3 Status externally monitored inputs (MID = 0211)

Header	Data Field	Message End
		NUL (ASCII 0x0)
20 bytes	8 bytes	

Status for the eight externally monitored digital inputs. This message is sent to the subscriber every time the status of at least one of the inputs has changed.

Table 31

Parameter	Id	Bytes	Comment
Status DIG/IN 1	01	1	The DIG/IN status is one byte long and specified by 1 ASCII digits. Range 0-1. 0=Off, 1=On
Status DIG/IN 2	02	1	The DIG/IN status is one byte long and specified by 1 ASCII digits. Range 0-1. 0=Off, 1=On
Status DIG/IN 3	03	1	The DIG/IN status is one byte long and specified by 1 ASCII digits. Range 0-1. 0=Off, 1=On
Status DIG/IN 4	04	1	The DIG/IN status is one byte long and specified by 1 ASCII digits. Range 0-1. 0=Off, 1=On
Status DIG/IN 5	05	1	The DIG/IN status is one byte long and specified by 1 ASCII digits. Range 0-1. 0=Off, 1=On
Status DIG/IN 6	06	1	The DIG/IN status is one byte long and specified by 1 ASCII digits. Range 0-1. 0=Off, 1=On
Status DIG/IN 7	07	1	The DIG/IN status is one byte long and specified by 1 ASCII digits. Range 0-1. 0=Off, 1=On
Status DIG/IN 8	08	1	The DIG/IN status is one byte long and specified by 1 ASCII digits. Range 0-1. 0=Off, 1=On

Possible answers Status externally monitored inputs acknowledge (MID = 0212)

Sent by Station computer.

3.13.4 Status externally monitored inputs acknowledge (MID = 0212)

Header	Data Field	Message End
		NUL (ASCII 0x0)
20 bytes	0 bytes	

Acknowledgement for the message status Externally monitored inputs upload.

Possible answers No

Sent by Station computer

3.13.5 Status externally monitored inputs unsubscribe (MID = 0213)

Header	Data Field	Message End
		NUL (ASCII 0x0)
20 bytes	0 bytes	

Reset the subscription for the Externally monitored inputs.

Possible answers Command accepted (MID = 0005)
Or
Command Error (MID = 0004)
Status externally monitored inputs subscription does not exist

Sent by Station computer.

3.13.6 IO device status request (MID = 0214)

Header	Data Field	Message End
		NUL (ASCII 0x0)
20 bytes	2 bytes	

Request for the status of the relays and digital inputs at a device, e.g. an I/O expander. The device is specified by a device number(See **Table 32**).

Possible answers Command accepted (MID = 0005)
Or
Command Error (MID = 0004)
Faulty IO device ID, or IO device not connected

Sent by Station computer.

3.13.7 IO device status reply (MID = 0215)

Header	Data Field	Message End
		NUL (ASCII 0x0)
20 bytes	72 – depend on # of relays bytes	

Relay and Input lists map to the physical IO(pins) on selected devices.

MID 0215 revision 1 should only be used to get the status of IO devices with max 8 relays/digital inputs.

MID 0215 revision 2 can be used to get the status of all types of IO devices with up to 32 relays/digital inputs. Both the relay and digital input lists will transmit a static list of 32 IO, with 0s for unused IO.

Possible answers No
Sent by Torque Controller

Table 32

Revision 1:

Parameter	Id	Bytes	Comment
IO device ID	01	2	The IO device ID specified with two ASCII characters. Range: 00-99. Supported Devices and associated addresses Primary: 0 IO expansion Bridge:1-32 (Arcnet Address: 101-132) Secondary: 50-65 (Arcnet Address: 1-16)
Relay list	02	32	A list of 8 relays for the current device ID. Each relay is specified by four bytes. Byte 1-3: Relay number, three ASCII characters, range 000-999 Byte 4: Relay status specified by one ASCII character;0=reset, 1=set.
Digital Input list	03	32	A list of 8 digital inputs for the current device ID. Each digital input is specified by four bytes. Byte 1-3: Digital input number, three ASCII characters, range 000-999 Byte 4: Digital input status specified by one ASCII character.0=Low, 1=High

Table 33

Revision 2:

Parameter	Id	Bytes	Comment
IO device ID	01	2	The IO device number specified with two ASCII characters. Range: 00-99. Supported Devices and associated addresses Primary: 0 IO expansion Bridge:1-32 (Arcnet Address: 101-132) Secondary: 50-65 (Arcnet Address: 1-16)
Number of relays	02	2	Number of relays present on the I/O-device.(Always: 32)
Relay list	03	128	A list of relays for the current device ID. Each relay is specified by four bytes. Byte 1-3: Relay number, three ASCII characters, range 000-999 Byte 4: Relay status specified by one ASCII character;0=reset, 1=set.
Number of Inputs	04	2	Number of Digital Inputs present on the I/O-device.(Always: 32)
Digital Input list	05	128	A list of digital inputs for the current device ID. Each digital input is specified by four bytes. Byte 1-3: Digital input number, three ASCII characters, range 000-999 Byte 4: Digital input status specified by one ASCII character. 0=Low, 1=High

Table 34 MID 0215 Relay number

Relay Number	Relay Function	Tracking Event	Comment
0	OFF		
1	OK		
2	NOK		
5	LOW TORQUE		
6	HIGH TORQUE		
7	LOW ANGLE		
8	HIGH ANGLE		
9	CYCLE COMPLETE		
12	LINKING GROUP OK	Yes	
13	LINKING GROUP NOK	Yes	
93	OPEN PROTOCOL->OUT 1		
94	OPEN PROTOCOL->OUT 2		
95	OPEN PROTOCOL->OUT 3		
96	OPEN PROTOCOL->OUT 4		
97	OPEN PROTOCOL->OUT 5		
98	OPEN PROTOCOL->OUT 6		
99	OPEN PROTOCOL->OUT 7		
100	OPEN PROTOCOL->OUT 8		
101	OPEN PROTOCOL->OUT 9		
102	OPEN PROTOCOL->OUT 10		

Table 35 MID 0215 Input number

Relay Number	Relay Function	Comment
0	OFF	
1	RESET LINKING	
2	TOOL ENABLE	
8	External TOOL START	
9	TOOL REVERSE	
68	IN-> OPEN PROTOCOL 1	
69	IN-> OPEN PROTOCOL 2	
70	IN-> OPEN PROTOCOL 3	
71	IN-> OPEN PROTOCOL 4	
72	IN-> OPEN PROTOCOL 5	
73	IN-> OPEN PROTOCOL 6	
74	IN-> OPEN PROTOCOL 7	
75	IN-> OPEN PROTOCOL 8	
86	REJECT RELEASE	
127	Tool Trigger	

3.13.8 Relay function subscribe (MID = 0216)

Header	Data Field	Message End
	Relay function number	NUL (ASCII 0x0)
20 bytes	3 bytes	

Subscribe for one single relay function. The data field consists of three ASCII digits, the relay number, which corresponds to the specific relay function. The relay numbers can be found in Table 34 above. At a subscription of a tracking event, **MID 0217 Relay function** immediately returns the current relay status to the subscriber.

MID 0216 can only subscribe for one single relay function at a time, but still, Open Protocol supports keeping several relay function subscriptions simultaneously.

Possible answers Command accepted (MID = 0005) or
 MID 0004 Command error,
 Relay function subscription already exists

Sent by Station computer.

3.13.9 Relay function (MID = 0217)

Header	Data Field	Message End
		NUL (ASCII 0x0)
20 bytes	8 bytes	

Upload of one specific relay function status, see Table 34.

For tracking event functions, **MID 0217 Relay function**, is sent each time the relay status is changed. For relay functions which are not tracking events, the upload is sent only when the relay is set high, i.e. the data field "Relay function status" will always be 1 for such functions.

Table 36

Parameter	Id	Bytes	Comment
Relay no	01	3	Three ASCII digits corresponding to a relay function. See Table 34 and add 0 before the number in the list.
Relay function status	02	1	One ASCII digit representing the relay function status: 1=active 0=not active

Possible answers MID 0218 Relay function acknowledge

Sent by Station computer.

3.13.10 Relay function acknowledge (MID = 0218)

Header	Data Field	Message End
		NUL (ASCII 0x0)
20 bytes	0 bytes	

Acknowledgement for the message Relay function upload.

Possible answers No

Sent by Station computer

3.13.11 Relay function unsubscribe (MID = 0219)

Header	Data Field	Message End
	Relay function number	NUL (ASCII 0x0)
20 bytes	3 bytes	

Unsubscribe for a single relay function. The data field consists of three ASCII digits, the relay number, which corresponds to the specific relay function.

Possible answers Command accepted (MID = 0005)
Or
Command Error (MID = 0004)
Relay function subscription does not exist

Sent by Station computer.

3.13.12 Digital input function subscribe (MID = 0220)

Header	Data Field	Message End
	Digital input function number	NUL (ASCII 0x0)
20 bytes	3 bytes	

Subscribe for one single digital input function. The data field consists of three ASCII digits, the digital input function number. The digital input function numbers can be found in Table 35 above. At a subscription of a tracking event, **MID 0221 Digital input function upload** immediately returns the current digital input function status to the subscriber.

MID 0220 can only subscribe for one single digital input function at a time, but still, Open Protocol supports keeping several digital input function subscriptions simultaneously.

Possible answers Command accepted (MID = 0005) or
MID 0004 Command error,
Digital input function subscription already exists

Sent by Station computer.

3.13.13 Digital input function (MID = 0221)

Header	Data Field	Message End
		NUL (ASCII 0x0)
20 bytes	8 bytes	

Upload of one specific Digital input function status, see Table 35.

For tracking event functions, **MID 0221 Digital input function**, is sent each time the digital input function's status (state) is changed. For digital input functions which are not tracking events, the upload is sent only when the digital input function is set high, i.e. the data field "Digital input function status" will always be 1 for such functions.

Table 37

Parameter	Id	Bytes	Comment
Digital input no	01	3	Three ASCII digits corresponding to a Digital input function. See Table 35 and add 0 before the number in the list.
Digital input function status	02	1	One ASCII digit representing the Digital input function status: 1=active 0=not active

Possible answers MID 0218 Digital input function acknowledge

Sent by Station computer.

3.13.14 Digital input function acknowledge (MID = 0222)

Header	Data Field	Message End
		NUL (ASCII 0x0)
20 bytes	0 bytes	

Acknowledgement for the message Digital input function upload.

Possible answers No

Sent by Station computer

3.13.15 Digital input function unsubscribe (MID = 0223)

Header	Data Field	Message End
	Digital input function number	NUL (ASCII 0x0)
20 bytes	3 bytes	

Unsubscribe for a single Digital input function. The data field consists of three ASCII digits, the Digital input number, which corresponds to the specific Digital input function.

Possible answers Command accepted (MID = 0005)
Or
Command Error (MID = 0004)
Digital input function subscription does not exist

Sent by Station computer.

4.1 Keep alive telegram

4.1.1 Keep alive message (MID = 9999)

Header	Data Field	Message End
		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 GLOBAL CONTROLLER since the last 15s, the GLOBAL CONTROLLER considers the connection as lost and close it.

In order to keep the communication alive the integrator must send a keep alive to the GLOBAL CONTROLLER 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.

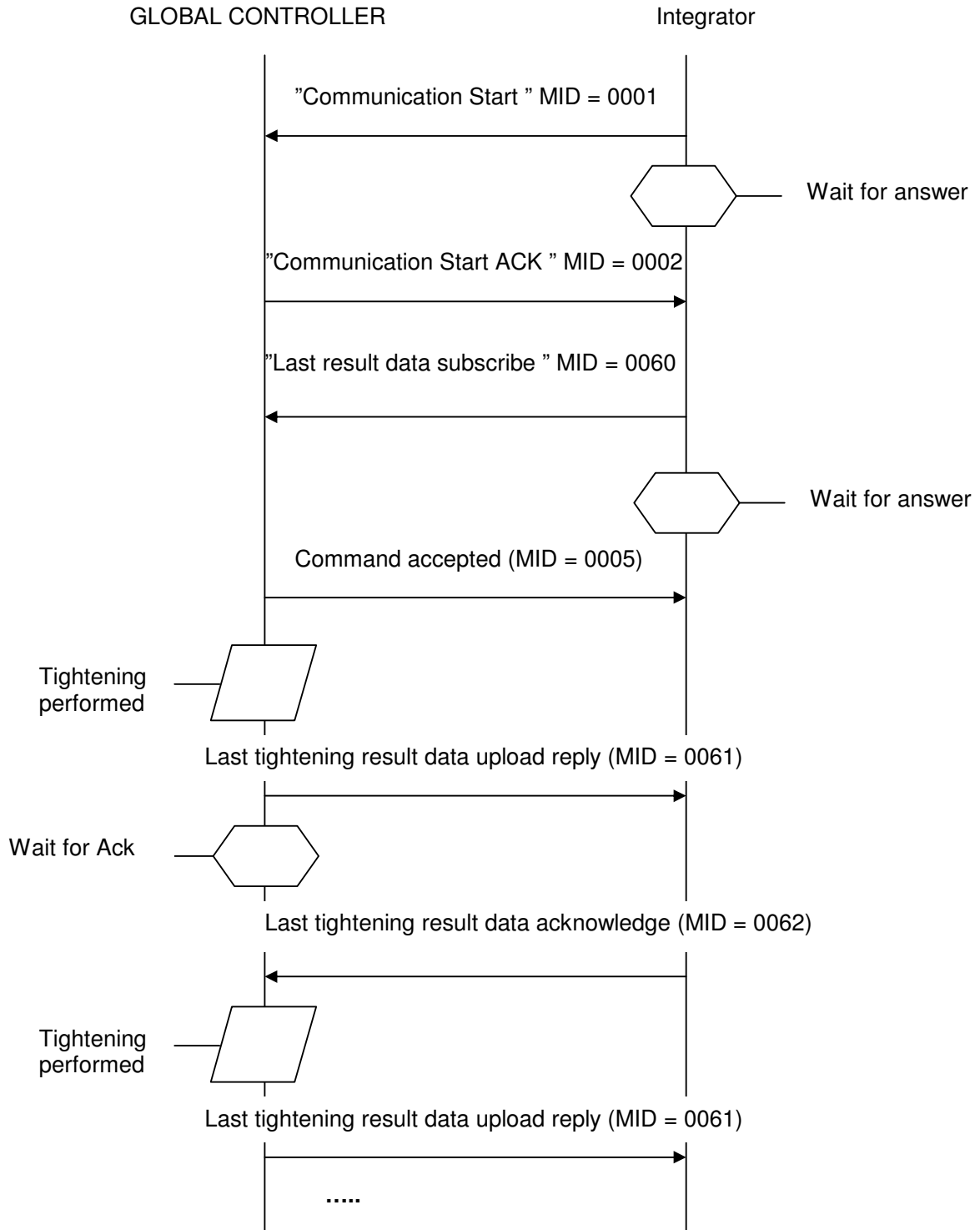
Possible answers Same message mirrored by the torque controller.

Sent by Station computer.

5. Communication flow chart example

The following chapter describes how the integrator should proceed to establish a session with the GLOBAL CONTROLLER and set its subscriptions.

5.1 Establish a connection and set result subscription

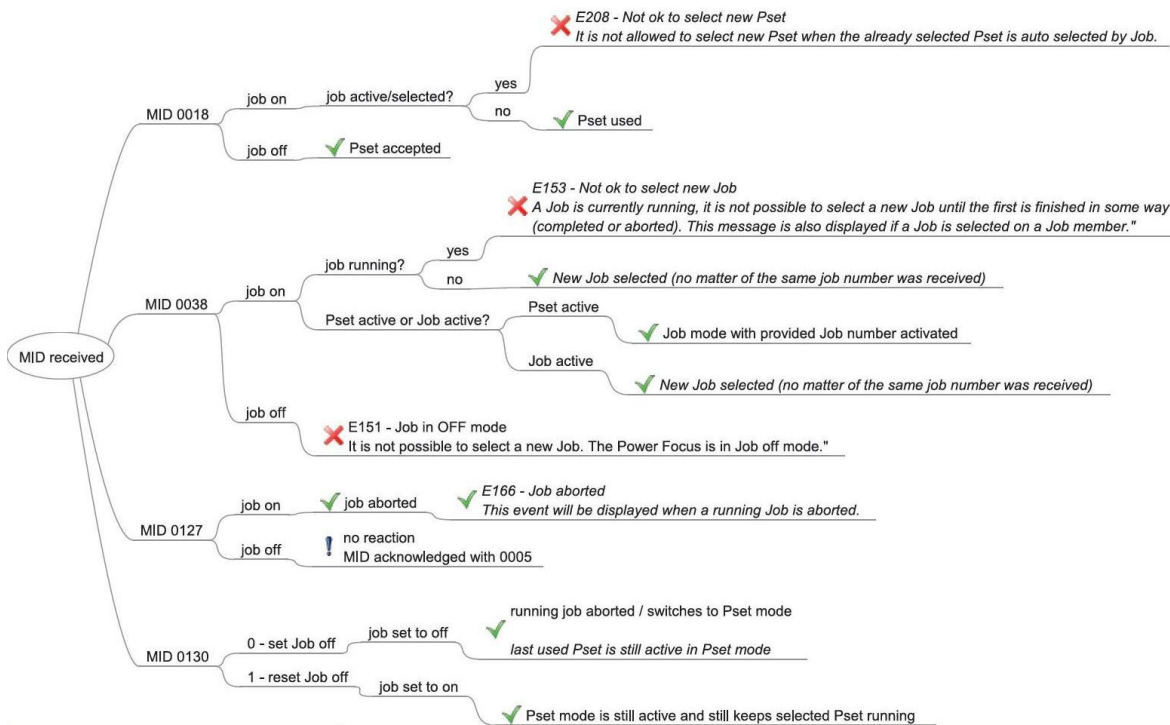


Appendix I: Apex Error Codes

Alarm Code	Alarm Description
E000	Alarm reporting active
E100	Intermediate circuit of the power section not supplied
E101	Motor cable defective
E102	Short-circuit in motor-circuit
E103	Motor temperature too high
E104	I2T monitoring
E105	Resolver error
E106	Intermediate circuit voltage too high
E107	Intermediate circuit voltage too low
E108	Not defined
E109	Not defined
E110	Temperature in the output section too high
E111	Start-up relay is does not open
E112	Main relay is does not open
E113	Undervoltage DC-DC converter
E114	Overvoltage DC-DC converter
E115	5 V supply in servo too low
E116	5 V supply in servo too high
E117	Driver supply of output section too low
E118	Offset of power supply too high
E119	Not defined
E120	5 V supply in measuring card too low
E121	5 V supply in measuring card too high
E122	DPR error
E123	FLASH error
E124	DPR - Communication to MB interrupted
E125	Start signal sequence faulty
E126	Not defined
E127	Not defined
E128	MOTID - error
E129	Mathematic error, illegal command etc.
E130	Measuring board not ready
E131	Not defined
E132	5 V out of tolerance
E133	+12 V out of tolerance
E134	-12 V out of tolerance
E135	not connected to network
E136	communication error with transducer 1
E137	communication error with transducer 2
E138	DPR test error
E139	communication error at COM1/2
E140	task cannot be created
E141	flash faulty
E142	not enough RAM storage available
E143	watchdog timer
E144	DPR test error
E145	ARCNET global error
E146	ARCNET reconfiguration
E147	MK initialization error
E148	Error in program processing
E149	Initialization error
E150	communication error

E151	ARCNET multiple address
E152	Order faulty
E153	Comm. echo problems
E154	Rundown error
E155	start problems
E156	no correct fastening stage program
E157	cancel
E158	evaluation problems
E159	ARCNET address wrong
E160	ARCNET address changed
E161	wrong configuration
E162	Servo type/-PS faulty
E163	test not allowed at present
E164	New Transducer 1
E165	New Transducer 2
E166	Transducer 1 absent
E167	Transducer 1 absent
E168	Transducer 1 error
E169	Transducer 1 offset error
E170	Transducer 1 calibration error
E171	Not defined
E172	Transducer 2 error
E173	Transducer 2 offset error
E174	Transducer 2 calibration error
E175	Not defined
E176	angle encoder 1 defective
E177	angle encoder 2 defective
E178	Not defined
E179	Not defined
E180	Transducer 1 not identified
E181	Transducer 2 not identified
E182	Not defined
E183	Not defined
E184	Transducer not correct
E185	Fieldbus communication error
E186	Not defined
E187	Not defined
E188	Not defined
E189	Not defined
E190	Not defined
E191	Transducer latchend
E192	24 volts nok
E193	temperature error
E194	IP error
E195	collection error

Appendix II: MID130 Flowchart



Appendix III: MID0061 Apex Tightening Error Bit codes

Open Protocol Tightening Error Bits	Apex Error
Bit 1 - Rundown angle max shut off	NA
Bit 2 - Rundown angle min shut off	NA
Bit 3 - Torque max shut off	MD>
Bit 4 - Angle max shut off	ANG>
Bit 5 - Selftap torque max shut off	MBO
Bit 6 - Selftap torque min shut off	MBU
Bit 7 - Prevail torque max shut off	P1M>, P2M> or MBO>
Bit 8 - Prevail torque min shut off	MBU<, P2M<
Bit 9 - Prevail torque compensate overflow	ME>, MST>
Bit 10 - Current monitoring max shut off	IREDD
Bit 11 - Post view torque min torque shut	MBU
Bit 12 - Post view torque max torque shut off	MBO
Bit 13 - Post view torque Angle too small	AW<
Bit 14 - Trigger lost	SA
Bit 15 - Torque less than target	TQ<
Bit 16 - Tool hot	NA
Bit 17 - Multistage abort	ABBR or taget stage = results target stage or ABL
Bit 18 - Rehit	BLOC
Bit 19 - DS measure failed	N/A
Bit 20 - Current limit reached	IP
Bit 21 - EndTime out shutoff	TMS>

Bit 22 - Remove fastener limit exceeded	NA
Bit 23 - Disable drive	FLT
Bit 24 - Transducer lost	N/A
Bit 25 - Transducer shorted	N/A
Bit 26 - Transducer corrupt	N/A
Bit 27 - Sync timeout	N/A
Bit 28 - Dynamic current monitoring min	NA
Bit 29 - Dynamic current monitoring max	NA
Bit 30 - Angle max monitor	NA
Bit 31 - Yield nut off	NBBR , NECK
Bit 32 - Yield too few samples	AW<