Desoutter Protocol

CVIxII – Release 4.2A and higher
CVI3 – Release 1.6.9.x and higher

Release date: 18/07/2016

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1. Change description

The following table describes the changes from one version of the specification to the next one:

Status	Release	Date	Description
Official	13	11/09/2012	**1st official release of the documentation**
Official	14	12/12/2012	Add Ncm and InOzf units in MID 7413
Official	15	04/04/2013	MID 0041 rev 5 updated
Official	16	30/09/2013	MID 7414 rev 1 fix doc issue : use parameters 10, not 11
Draft	17-1	25/04/2014	Add of MID 7418, 7419, 7420, 7421, 7422, 7423, 7424, 7425
Draft	17-2	18/07/2014	Official add of MID 7427, 7428, 7429
Draft	17-3	23/10/2014	Length corrected for MID 7418, 7419, 7427, 7428 and 7429
Draft	17-4	15/12/2014	Removed error case “Pset is already selected” for MID 7415. Document format modifications
Draft	17-5	06/03/2015	Precise Desoutter curves decoding
Official	17	22/04/2015	Add CVI3 info for Cycle/Pset settings R/W commands. Document format modifications
Official	18	14/10/2015	ELRT & ERPHT tools can’t have their cycle read or modified.
Official	19	27/01/2016	Correction on curves decoding method.
Official	20	13/06/2016	Update synthesis table
Official	21	27/01/2016	Correction on curves decoding method.

2. Goal of the document

This document specifies the Desoutter protocol used to manage communication over ethernet between CVIxII or CVI3 tightening controllers and any external device, such as PLC, industrial PC, server, etc.

This protocol is an enhancement of the existing Open Protocol.
Specific commands (MIDs) are integrated in CVI controllers.
Both Open Protocol & Desoutter protocol are using the same communication port and mechanism.

Please refer to Open Protocol documentation for detailed information about communication structure, messages formats (headers, etc).

3. CVIxII - Detailed tightening results

MID 7400: CVIxII – System event (Reserved)

Direction: *CVIxII Controller → Integrator*

Sent by the CVIxII controller every time a cycle has been modified.
No acknowledgement needed.

MID 7402: CVIxII - Cycle & phases results subscribe

Direction: *Integrator → CVIxII controller*

Header				Data Field	Message End
0020	7402	Rev	Spare		NULL (ASCII 0x00)
20 bytes				0 bytes	

This command is used to subscribe to the tightening results, from the controller.
The controller will then start to send phases results (MID 7404) and cycle results (MID 7406) event telegrams after every tightening.

Possible answers:

- Command accepted (MID 0005 with 7402 in data field).
- Command error (MID 0004 with error code 71: “Subscription already exists”).

Notes: This subscription is related to both events: MID 7404 and MID 7406, which contains all the data related to phases & cycles tightening results.
It is not possible to only receive phase’s results or cycle results.

MID 7403: CVIxII - Cycle & phases results unsubscribe

Direction: *Integrator → CVIxII Controller*

Header				Data Field	Message End
0020	7403	Rev	Spare		NULL (ASCII 0x00)
20 bytes				0 bytes	

This command is used to stop receiving phases and cycle results from the controller.

Possible answers:

- Command accepted (MID 0005 with 7403 in data field).
- Command error (MID 0004 with error 72: “Subscription does not exist”).

MID 7404: CVIxII - Phase result data

Direction: *CVIxII Controller → Integrator*

Header				Data Field	Message End
0277	7404	Rev	Spare	Data *(See next table)*	NULL (ASCII 0x00)
20 bytes				257 bytes	

This event telegram contains the tightening results for the phase that has just been completed.

The allocation of the variables in the data field is shown in the below table:

Parameter	Field Id	Nb Bytes	Description
Spindle number	01	2	01, etc.
Cycle number	02	3	001, 002, etc.
Phase number	03	2	01, 02, etc.
Phase name	04	2	Following names are defined for the phase names. Please notice that the upper/lower case has to be considered "S" = search sequence "D" = rundown speed "F" = final speed "R" = run reverse "V" = act on NOK "J" = jump "T" = prevailing torque "W"= synchronization waiting "d" = angle rundown " " (space character) = empty phase
Method name	05	2	This field indicates the tightening strategy used during the phase. It is coded as following: 0 -> Torque only 1 -> Torque + Angle 2 -> Torque + Angle + Torque Rate 3 -> Angle + Torque 4 -> Angle + Torque + Torque rate 5 -> Torque + Current 6-> Torque + Angle + Current
M-	06	6	xxxxxx value * 100 min. torque (lower limit)
M+	07	6	xxxxxx value * 100 max. torque (upper limit)
M_O	08	6	xxxxxx value * 100 torque safety limit
M_S	09	6	xxxxxx value * 100 angle threshold
M_A	10	6	xxxxxx value * 100 target torque
M_I	11	6	xxxxxx value * 100 measured torque
W-	12	6	xxxxxx value * 10 min. angle (lower limit)
W+	13	6	xxxxxx value * 10 max. angle (upper limit)
W_O	14	6	xxxxxx value * 10 safety angle
W_A	15	6	xxxxxx value * 10 target angle
W_I	16	6	xxxxxx value * 10 measured angle (phase)
t-	17	6	Reserved
t+	18	6	Reserved
t_A	19	6	Reserved
t_I	20	6	Reserved
n	21	6	xxxxxx Speed in %
-	22	6	Reserved
-	23	6	Reserved
-	24	2	Reserved
-	25	6	Reserved
-	26	6	Reserved
CurveIndex1	27	4	xxxx Index of the first point of the curve corresponding to this phase (1-500) Value has the range 1001 to 1500 in case of buffer overrun
CurveIndex2	28	4	xxxx Index of the last point of the curve corresponding to this phase (1-500) Value has the range 1001 to 1500 in case of buffer overrun
-	29	6	Reserved
-	30	6	Reserved
-	31	6	Reserved
-	32	6	Reserved
-	33	6	Reserved
-	34	6	Reserved
Report	35	10	status (see next table)

Phase "Report" field:

It's possible to get the phase status in the "Report" field of MID 7404.
This 10 ASCII characters of the "Report" field are the representation of a 32bits bit field:

Position	Name	Length (bits)	Mask	Description
28 ... 31	Tightening type	4	0xF0000000	0 -> Torque only 1 -> Torque + Angle 2 -> Torque + Angle + Torque Rate 3 -> Angle + Torque 4 -> Angle + Torque + Torque rate 5 -> Torque + Current 6-> Torque + Angle + Current
26 .. 27	Unused	2	0x0C000000	N / A
25	Not Finished	1	0x02000000	Spindle didn't finish the cycle
24	Synchronisation	1	0x01000000	SYN error
23	External stop	1	0x00800000	Cycle finishes due to external stop input
22	Time out	1	0x00400000	Information showing time (max) reached
21	Imax	1	0x00200000	Information showing Imax has been reached
20	Trigger	1	0x00100000	Trigger released before end of cycle
19	Slave error	1	0x00080000	N / A
18	Group	1	0x00040000	N / A
17	Prog	1	0x00020000	Program error (bad cycle parameters)
16	SPI	1	0x00010000	Connection with tool is faulty
15	Flex	1	0x00008000	Connection with FPGA is faulty
14	Thermal contact	1	0x00004000	Tool is overheaten
13	Surgeguard	1	0x00002000	Surge guard is faulty
12	Overcurrent	1	0x00001000	An overcurrent error has occured
11	Accelaration rate	1	0x00000800	Error during acceleration phase
10	C1/C2	1	0x00000400	N / A
09	MMAX	1	0x00000200	Monitoring over top limit
08	Mmin	1	0x00000100	Monitoring under low limit
07	TMAX	1	0x00000080	Time over top limit
06	Tmin	1	0x00000040	Time under low limit
05	RMAX	1	0x00000020	Torque Rate over top limit
04	Rmin	1	0x00000010	Torque Rate under low limit
03	AMAX	1	0x00000008	Angle over top limit
02	Amin	1	0x00000004	Angle under low limit
01	TMAX	1	0x00000002	Torque over top limit
00	Tmin	1	0x00000001	Torque under low limit

Example: if the start trigger is released before the end of cycle, bit 20 'trigger' will be set

Notes:

- The curves are stored in a circular buffer. This means, if 500 points are stored for a curve, a new point will overwrite the oldest point of this curve. There is an over-run of the curve buffer, if the tightening duration is higher than the duration that has been set in the menu Parameters>Curves of the controller. The whole curve is sampled and displayed if the curve duration is higher than the tightening duration. A value between 1001 and 1500 for the CurveIndex1, indicates an over-run of the buffer, so the curves for the beginning of the tightening are not available. There is a maximum of 500 points stored.

- The results of the measurements are in the data field with the following Ids:
  - 11: tightening torque (M_I)
  - 16: tightening angle (W_I)
  - 20: tightening time (t_I)
  - 35: result status

MID 7405: CVIxII - Phase result data acknowledge

Direction *Integrator → CVIxII Controller*

Header				Data Field	Message End
0020	7405	Rev	Spare		NULL (ASCII 0x00)
20 bytes				0 bytes	

This telegram must be sent by the integrator to acknowledge the results of a phase (MID 7404) that has just been received.

MID 7406: CVIxII - Cycle result data

Direction: *CVIxII Controller→ Integrator*

Header				Data Field	Message End
0140	7406	Rev	Spare	Data *(See next table)*	NULL (ASCII 0x00)
20 bytes				120 bytes	

This event telegram contains the tightening results for the cycle that has just been completed.

The allocation of the variables in the data field is shown in the below table:

Parameter	Id	Bytes	Description
Spindle number	01	2	01, etc.
Cycle number	02	3	001, 002, etc.
VIN number	03	25	The VIN number is 25 byte long and is specified by 25 ASCII characters taken between 0x20 and 0x7F Hex.
Time stamp	04	19	Time stamp for each tightening sent to the control station. The time stamp is 19 byte long and is specified by 19 ASCII characters (YYYY-MM-DD:HH:MM:SS).
Spindle name	05	11	Name of the spindle (ex. ERAL1.5-70)
Spindle serial number	06	11	Serial number of the spindle
Tool total Count	07	10	It's the total number of tightenings of the tool
Tool partial count	08	10	It's the partial number of tightenings of the tool
Batch size	09	3	Batch size of the considered cycle
Batch count	10	3	Batch count (number of OK tightenings)

MID 7407: CVIxII - Cycle result data acknowledge

Direction: *CVIxII Controller → Integrator*

Header				Data Field	Message End
0020	7407	Rev	Spare		NULL (ASCII 0x00)
20 bytes				0 bytes	

This telegram must be sent by the integrator to acknowledge the result of a cycle (MID 7406) that has just been received.

4. Curves (CVIxII & CVI3)

It is possible to get curves (graphs) information after every tightening using Desoutter protocol.

Each curves are filled with measurement points for the defined cycle time.
CVIxII controllers handle up to 500 points per curve.
CVI3 controllers handle up to 2000 points per curve. (FW min 1.6.6.x)

Note: For CVIxII controller, the limits between the different phases of a cycle are transferred in the phase result telegram (MID7404) using 2 markers, CurveIndex1 and CurveIndex2, indicating the number of first sample and the number of the last sample. It's then possible for the integrator to display markers for each phase when building the curve.

MID 7408: Last tightening curve data subscribe

Direction *Integrator → Controller*

Header							Data Field	Message End
0020	7408	Rev	No Ack flag	Station ID	Spindle ID	Spare		NULL (ASCII 0x00)
20 bytes							0 bytes	

This command is used to subscribe to the last tightening curve from the controller.
The controller will then start to send curves information (MID 7408) event telegrams after every tightening.

Possible answers:

- Command accepted (MID 0005 with 7408 in data field).
- Command error (MID 0004 with error code 71: "Subscription already exists").

Note: Each tightening curve is split in several 7408 frames.

MID 7409: Last tightening curve data unsubscribe

Direction: *Integrator → Controller*

Header							Data Field	Message End
0020	7409	Rev	No Ack flag	Station ID	Spindle ID	Spare		NULL (ASCII 0x00)
20 bytes							0 bytes	

This command is used to stop receiving last tightening curve from the controller.

Possible answers:

- Command accepted (MID 0005 with 7409 in data field).
- Command error (MID 0004 with error 72: “Subscription does not exist”).

MID 7410: Last tightening curve data

Direction: *Controller → Integrator*

Header							Data Field	Message End
91 + N bytes	7410	Rev	No Ack flag	Station ID	Spindle ID	Spare	Data *(See next table)*	NULL (ASCII 0x00)
20 bytes							71 + N bytes	

Parameter	Bytes	Description
Tool number	01-02	01
	03-04	Tool number (01, 02, ... ,51, 52, …)
Pset number	05-06	02
	07-09	Pset/Cycle number (001, 002, … , 250).
Time Coefficient	10-11	03
	12-25	Time coefficient to be applied to each curve point
Torque Coefficient	26-27	04
	28-41	Torque coefficient to be applied to each torque value
Angle Coefficient	42-43	05
	44-57	Angle coefficient to be applied to each angle value
Nb measurement Points	58-59	06
	60-63	Total number of points in the curve (xxxx)
Nb Telegrams (frames)	64-65	07
	66-67	Total number of curve telegrams (MID7410) for this curve (xx)
Id Telegram (frame)	68-69	08
	70-71	Current curve telegram number (xx)
Curve Data	72-..	Curve Raw Data: (raw bytes values formatted in big endian). A frame can contain up to 125 curve points of torque & angle. *see detailed explanation below*

Curve raw data explanation:
Before being transferred, the curve raw data (torque & angle values) are encoded by the controller. This is due to the fact that Open protocol is an ASCII protocol and 'null values' (0x00) can't be transmitted or it will disrupt the communication ('null value' 0x00 is used to delimitate the "message end" of a frame).

The CVI controller encodes the curve raw data (torque & angle values) by adding +1 to each byte and modifying the possible 0x00 & 0xFF bytes values by 0xFFFE & 0xFFFF.

Each frame can contains up to 125 torque & angle values.
Torque values are defined in a 2 bytes ('ushort').
Angle values are defined in a 4 bytes ('ulong').

The size of curve raw data can be 750 bytes long (125*(2+4)) + extra bytes because of the encoding of the 0x00 & 0xFF values (0xFFFE & 0xFFFF).

Curve raw data decoding procedure:
- Analyze every byte to find any 0xFFFE and replace them by 0x00.
- Analyze every byte to find any 0xFFFF and replace them by 0xFF.
- Remove - 1 to each byte. For value = 0x00, applying -1 generates an overflow, so the result is 0xFF.
- Swap group of bytes for torque (2 bytes) & angle (4 bytes) values.
  Torque : AB CD => CD AB
  Angle: AB CD 12 34 => 34 12 CD AB

Swap example:
4A005D1A00004A005D1A00005B00…
Swap Torque & Angle bytes:
004A00001A5D004A00001A5D005B…

MID 7411: Last tightening curve data acknowledge

Direction: *Integrator → Controller*

Header							Data Field	Message End
0020	7411	Rev	No Ack flag	Station ID	Spindle ID	Spare		NULL (ASCII 0x00)
20 bytes							0 bytes	

This telegram must be sent by the integrator to acknowledge the tightening curve data (MID 7410) that has just been received.

5. Cycle/Pset parameters modification

It is possible to modify parameters (torque, angle, speed, etc) of an existing cycle/Pset using Desoutter protocol.

Note: it is not possible to modify the cycle/Pset structure (add or remove phases/steps, change its type, etc).

The following table shows which parameters are accessible for each type of phase/step:

Phase/Step Parameters	**Search sequence**	**Final speed / Tightening : A + T mon.**	**Final speed / Tightening : T + A mon.**	**Final speed / Tightening : Torque only**	**Final speed / Tightening : T + A + T. rate**	**Final speed / Tightening : A + T + T. rate**	**Final speed / Tightening : T + C mon.**	**Final speed / Tightening : T + A + C mon.**	**Run Reverse / Loosening : A + T mon.**	**Run Reverse / Loosening : T + A mon.**	**Run Reverse / Loosening : Torque only**	**Rundown speed**	**Action on NOK**	**Prevailing Torque - Forward**	**Prevailing Torque - Backward**	**Jump / Synchro**	**Seating Detection**	**Post Seating Detection**
CVIxII	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
CVI3 *(fw 1.6.9.x min)*		x	x		x	x		x	x	x			x	x	x	x	x	
Phase type *(read only)*	x	x	x	x	x	x	x	x	x	x	x	x				x	x	x
Tightening strategy type *(read only)*		x	x	x	x	x	x	x	x	x	x							
Min torque		x	x	x	x	x	x	x	x	x	x			x	x		x	x
Max torque		x	x	x	x	x	x	x	x	x	x			x	x		x	x
Target torque			x	x	x		x			x	x	x			x			
Angle Threshold		x	x		x	x		x	x	x				x	x		x	
Min angle		x	x		x	x		x	x	x		x					x	x
Max angle		x	x		x	x		x	x	x							x	x
Target angle or Back Angle 2 (prev.)		x				x		x	x					x	x			
Safety/Abort torque		x				x		x	x	x	x			x			x	x
Safety/Abort angle			x		x					x					x		x	x
Direction /Rotation	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x			
Interphase time /Post step delay	x	x	x	x	x	x	x	x	x	x	x	x		x	x			
Speed	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x			
Rotation type	x												x	x	x			
Stop : time / angle or Back Angle 1 (prev.)	x												x	x	x			
Number of rotations	x																	
End slope(Nm/°)																	x	
Delay (°)																	x	
Number of samples																	x	
Gradient torque																		x
Gradient angle																		x

MID 7412: Cycle/Pset - Phase/Step parameters request

Direction: *Integrator → Controller*

Header							Data Field	Message End
0029	7412	Rev	No Ack flag	Station ID	Spindle ID	Spare	Data *(See next table)*	NULL (ASCII 0x00)
20 bytes							9 bytes	

Parameter	Bytes	Description
Cycle/Pset number	1-2	01
	3-5	Cycle/Pset number 3 ASCII digits. Max 999
Phase/Step number	6-7	02
	8-9	Phase/Step number 2 ASCII digits. Max 99

This command is used to read (get) a cycle/Pset - phase/step parameters in the controller.
Note: This command can't be used with ELRT pulse tools and ERPHT tools.

Possible answers:

- Parameters data (MID 7413)
- Command error (MID 0004 with error code 02: "Parameter set ID not present").

MID 7413: Cycle/Pset - Phase/Step parameters data

Direction: *Controller → Integrator*

Header							Data Field	Message End
0283	7413	Rev	No Ack flag	Station ID	Spindle ID	Spare	Data *(See next table)*	NULL (ASCII 0x00)
20 bytes							263 bytes	

This event telegram contains the cycle/Pset X - phase/step X settings stored in the controller.

The data field contains the following parameters:

Revision 1:

Parameter	Field Id	Nb Bytes	Description
Spindle/Tool number	01	2	01 to 99
Cycle/Pset number	02	3	001, 002, … to 250
Phase/Step number	03	2	01, 02, … to 40
Phase/Step type	04	2	Phase/Step type codes: "S " = Search sequence "D " = Rundown speed "F " = Final speed / Tightening

			“R ” = Run reverse / Loosening “V ” = Action on NOK “J ” = Jump “T ” = Prevailing Torque / Prevailing “W ”= Synchronization Waiting / Synchro “d ” = angle rundown “ “ (2 space characters) = empty phase/step (end step)
Tightening strategy type	05	2	This field indicates the tightening strategy applied. “0 “ = Torque only (CVIxII) “1 “ = Torque + Angle “2 “ = Torque + Angle + Torque Rate "3 " = Angle + Torque "4 " = Angle + Torque + Torque rate "5 " = Torque + Current (CVIxII) "6 " = Torque + Angle + Current “??" or " " = not applicable
Min. torque	06	6	Min. torque (value * 100)
Max. torque	07	6	Max. torque (value * 100)
Safety/Abort torque	08	6	Safety/Abort torque (value * 100)
Angle threshold	09	6	Angle threshold (value * 100)
Target torque	10	6	Target torque (value * 100)
-	11	6	Reserved
Min. angle	12	6	Min. angle (value * 10)
Max. angle	13	6	Max. angle (value * 10)
Safety/Abort angle	14	6	Safety/Abort angle (value * 10)
Target angle Back Angle 2 (Prevailing Backward) End Angle (Prevailing Forward)	15	6	Target angle (value * 10)
-	16	6	Reserved
-	17	6	Reserved
-	18	6	Reserved
Interphase time/Post step delay	19	6	Interphase time/Post step delay (in milliseconds)
-	20	6	reserved
Speed / Downshift speed	21	6	Speed/Downshift speed in %
-	22	6	Reserved
-	23	6	Reserved
-	24	2	Reserved
-	25	6	Reserved
-	26	6	Reserved
Curve Index 1 (CVIxII)	27	4	Curve index start of phase point
Curve Index 2 (CVIxII)	28	4	Curve index end of phase point
-	29	6	Reserved
-	30	6	Reserved
-	31	6	Reserved
Direction/Rotation direction	32	2	“CW” = Clockwise rotation of the motor “CC” = counter clockwise rotation of the motor “AL” = alternate rotation direction of the motor (search sequence only)
Rotation type (CVIxII search sequence, Action on nok and Prevailing only)	33	1	“A” = angle “T” = time (CVIxII)
Rotation time/angle Run reverse angle (Action on NOK) Back Angle 1 (Prevailing Backward) Start Angle (Prevailing Forward)	34	3	Time or angle depending on parameter 33 Angle range: 000-999° (accuracy 1°) Time range: 00.0-99.9 sec. (accuracy 0.1 sec.)
Number of rotations	35	1	search sequence number of rotations
Torque Unit	36	4	“Nm ” = Newton meter “FtLb” = Foot pound “InLb” = Inch pound “Kgm ” = Kilogram meter “Kgcm”= Kilogram centimeter
Cycle/Pset last modification date	37	19	YYYY-MM-DD:HH:MM:SS

Revision 2:

Parameter	Field Id	Nb Bytes	Description
Spindle/Tool number	01	2	01 to 99
Cycle/Pset number	02	3	001, 002, … to 250
Phase/Step number	03	2	01, 02, … to 40
Phase/Step type	04	2	Phase/Step type codes: ”S ” = Search sequence “D ” = Rundown speed “F ” = Final speed / Tightening “R ” = Run reverse / Loosening “V ” = Action on NOK “J ” = Jump “T ” = Prevailing Torque / Prevailing “W ”= Synchronization Waiting / Synchro “d ” = angle rundown **“s ” = seating detection** **“p ” = post seating detection (CVIxII)** “ “ (2 space characters) = empty phase/step (end step)
Tightening strategy type	05	2	This field indicates the tightening strategy applied. “0 “ = Torque only “1 “ = Torque + Angle “2 “ = Torque + Angle + Torque Rate "3 " = Angle + Torque "4 " = Angle + Torque + Torque rate "5 " = Torque + Current "6 " = Torque + Angle + Current6 -> Torque + Angle + Current **“7 “ = Seating detection** **“8 “ = Post seating detection (CVIxII)** “??"or " " = not applicable
Min. torque	06	6	Min. torque (value * 100)
Max. torque	07	6	Max. torque (value * 100)
Safety/Abort torque	08	6	Safety/Abort torque (value * 100)
Angle threshold	09	6	Angle threshold (value * 100)
Target torque	10	6	Target torque (value * 100)
-	11	6	reserved
Min. angle	12	6	Min. angle (value * 10)
Max. angle	13	6	Max. angle (value * 10)
Safety/Abort angle	14	6	Safety/Abort angle (value * 10)
Target angle Back Angle 2 (Prevailing Backward) End Angle (Prevailing Forward)	15	6	Target angle (value * 10)
-	16	6	Reserved
-	17	6	Reserved
-	18	6	Reserved
Interphase time/Post step delay	19	6	Interphase time/Post step delay (in milliseconds)
-	20	6	Reserved
Speed / Downshift speed	21	6	Speed/Downshift speed in %
Target torque rate	22	6	Seating detection : Target torque rate (value * 10000)
Angle delay	23	6	Seating detection : Angle delay (value * 10)
Nbr of samples for T.rate calc. / Angular sample	24	2	Seating detection : Nbr of samples for Torque rate calculation (range 00-64)
Gradient torque (CVIxII)	25	6	Post seating detection : Gradient torque (value * 100)
Gradient angle (CVIxII)	26	6	Post seating detection : Gradient angle (value * 10)
Curve Index 1 (CVIxII)	27	4	Curve index start of phase point
Curve Index 2 (CVIxII)	28	4	Curve index end of phase point
-	29	6	Reserved
-	30	6	Reserved

-	31	6	Reserved
Direction/Rotation direction	32	2	“CW” = Clockwise rotation of the motor “CC” = counter clockwise rotation of the motor “AL” = alternate rotation direction of the motor (search sequence only)
Rotation type (CVIxII search sequence, Action on nok and Prevailing only)	33	1	“A” = angle “T” = time (CVIxII)
Rotation time/angle Run reverse angle (Action on NOK) Back Angle 1 (Prevailing Backward) Start Angle (Prevailing Forward)	34	3	Time or angle depending on parameter 33 Angle range: 000-999° (accuracy 1°) Time range: 00.0-99.9 sec. (accuracy 0.1 sec.)
Number of rotations	35	1	1 ASCII character
Torque Unit	36	4	"Nm " = Newton-metre "FtLb" = Foot-pound "InLb" = Inch-pound "Kgm " = Kilogram-metre "Kgcm"= Kilogram-centimeter "**Ncm** " = Newton-centimeter “**InOz**” = Inch-ounce
Cycle/Pset last modification date	37	19	YYYY-MM-DD:HH:MM:SS

MID 7414: Change Cycle/Pset - Phase/Step parameters

Direction *Integrator → Controller*

Header							**Data Field**	**Message End**
0256	7414	Rev	No Ack flag	Station ID	Spindle ID	Spare	Data *(See next table)*	NULL (ASCII 0x00)
20 bytes							236 bytes	

This command is used to write (set) a cycle/Pset – phase/step parameters in the controller.

The data field contains the following parameters to set in the server:

Possible answers:

- Command accepted (MID 0005) with 7414 in data field.
- Command error (MID 0004 with error code 02: “Parameter set ID not present”).
- Command error (MID 0004 with error code 03: “Parameter set can’t be set”).

Note: For CVIxII, only cycles with up to 6 phases can be modified.
This command can’t be used with ELRT pulse tools and ERPHT tools.

Revision 1:

Parameter	Field Id	Nb Bytes	Description
Spindle/Tool number	01	2	01 to 99
Cycle/Pset number	02	3	001, 002, … to 250
Phase/Step number	03	2	01, 02, … to 40
Phase/Step type *(Read only parameter)*	04	2	Phase/Step type codes: ”S ” = Search sequence “D ” = Rundown speed “F ” = Final speed / Tightening “R ” = Run reverse / Loosening “V ” = Action on NOK “J ” = Jump “T ” = Prevailing Torque / Prevailing “W ”= Synchronization Waiting / Synchro “d ” = angle rundown “ “ 2 spaces (not checked by the firmware).
Tightening strategy type *(Read only parameter)*	05	2	This field indicates the tightening strategy applied. “0 “ = Torque only “1 “ = Torque + Angle “2 “ = Torque + Angle + Torque Rate "3 " = Angle + Torque "4 " = Angle + Torque + Torque rate "5 " = Torque + Current "6 " = Torque + Angle + Current6 -> Torque + Angle + Current “??"or " " = not applicable “ “ 2 spaces (not checked by the firmware).
Min. torque	06	6	Min. torque (value * 100)
Max. torque	07	6	Max. torque (value * 100)
Safety/Abort torque	08	6	Safety/Abort torque (value * 100)
Angle threshold	09	6	Angle threshold (value * 100)
Target torque	10	6	Target torque (value * 100)
-	11	6	reserved
Min. angle	12	6	Min. angle (value * 10)
Max. angle	13	6	Max. angle (value * 10)
Safety/Abort angle	14	6	Safety/Abort angle (value * 10)
Target angle Back Angle 2 (Prevailing Backward) End Angle (Prevailing Forward)	15	6	Target angle (value * 10)
-	16	6	Reserved (spaces)
-	17	6	Reserved (spaces)
-	18	6	Reserved (spaces)
Interphase time/Post step delay	19	6	Interphase time/Post step delay (in milliseconds)
-	20	6	Reserved (spaces)
Speed / Downshift speed	21	6	Speed/Downshift speed in %
-	22	6	Reserved (spaces)
-	23	6	Reserved (spaces)
-	24	2	Reserved (spaces)
-	25	6	Reserved (spaces)
-	26	6	Reserved (spaces)
Curve Index 1 (CVIxII)	27	4	Curve index start of phase point
Curve Index 2 (CVIxII)	28	4	Curve index end of phase point
-	29	6	Reserved (spaces)
-	30	6	Reserved (spaces)
-	31	6	Reserved (spaces)
Direction/Rotation direction	32	2	“CW” = Clockwise rotation of the motor “CC” = counter clockwise rotation of the motor “AL” = alternate rotation direction of the motor (search sequence only)

Rotation type (CVIxII search sequence, Action on nok and Prevailing only)	33	1	“A” = angle “T” = time (CVIxII)
Rotation time/angle Run reverse angle (Action on NOK) Back Angle 1 (Prevailing Backward) Start Angle (Prevailing Forward)	34	3	Time or angle depending on parameter 33 Angle range: 000-999° (accuracy 1°) Time range: 00.0-99.9 sec. (accuracy 0.1 sec.)
Number of rotations	35	1	1 ASCII character

Revision 2:

Parameter	Field Id	Nb Bytes	Description
Spindle/Tool number	01	2	01 to 99 Read only parameter
Cycle/Pset number	02	3	001, 002, … to 250 Read only parameter
Phase/Step number	03	2	01, 02, … to 40 Read only parameter
Phase/Step type *(Read only parameter)*	04	2	Phase/Step type codes: ”S ” = Search sequence “D ” = Rundown speed “F ” = Final speed / Tightening “R ” = Run reverse / Loosening “V ” = Action on NOK “J ” = Jump “T ” = Prevailing Torque / Prevailing “W ”= Synchronization Waiting / Synchro “d ” = angle rundown **“s ” = seating detection** **“p ” = post seating detection** “ “ 2 spaces (not checked by the firmware).
Tightening strategy type *(Read only parameter)*	05	2	This field indicates the tightening strategy applied. “0 “ = Torque only “1 “ = Torque + Angle “2 “ = Torque + Angle + Torque Rate "3 " = Angle + Torque "4 " = Angle + Torque + Torque rate "5 " = Torque + Current "6 " = Torque + Angle + Current6 -> Torque + Angle + Current **“7 “ = Seating detection** **“8 “ = Post seating detection** “??"or " " = not applicable “ “ 2 spaces (not checked by the firmware).
Min. torque	06	6	Min. torque (value * 100)
Max. torque	07	6	Max. torque (value * 100)
Safety/Abort torque	08	6	Safety/Abort torque (value * 100)
Angle threshold	09	6	Angle threshold (value * 100)
Target torque	10	6	Target torque (value * 100)
-	11	6	reserved
Min. angle	12	6	Min. angle (value * 10)
Max. angle	13	6	Max. angle (value * 10)
Safety/Abort angle	14	6	Safety/Abort angle (value * 10)
Target angle Back Angle 2 (Prevailing Backward) End Angle (Prevailing Forward)	15	6	Target angle (value * 10)
-	16	6	Reserved (spaces)
-	17	6	Reserved (spaces)
-	18	6	Reserved (spaces)
Interphase time/Post step delay	19	6	Interphase time/Post step delay (in milliseconds)
-	20	6	Reserved (spaces)
Speed / Downshift speed	21	6	Speed/Downshift speed in %
Target torque rate	22	6	Seating detection : Target torque rate (value * 10000)
Angle delay	23	6	Seating detection : Angle delay (value * 10)
Nbr of samples for T.rate calc.	24	2	Seating detection : Nbr of samples for Torque rate calculation (range 00-64)
Gradient torque	25	6	Post seating detection : Gradient torque (value * 100)
Gradient angle	26	6	Post seating detection : Gradient angle (value * 10)
Curve Index 1 (CVIxII)	27	4	Curve index start of phase point
Curve Index 2 (CVIxII)	28	4	Curve index end of phase point
-	29	6	Reserved (spaces)
-	30	6	Reserved (spaces)
-	31	6	Reserved (spaces)

Direction/Rotation direction	32	2	“CW” = Clockwise rotation of the motor “CC” = counter clockwise rotation of the motor “AL” = alternate rotation direction of the motor (search sequence only)
Rotation type (CVIxII search sequence, Action on nok and Prevailing only)	33	1	“A” = angle “T” = time (CVIxII)
Rotation time/angle Run reverse angle (Action on NOK) Back Angle 1 (Prevailing Backward) Start Angle (Prevailing Forward)	34	3	Time or angle depending on parameter 33 Angle range: 000-999° (accuracy 1°) Time range: 00.0-99.9 sec. (accuracy 0.1 sec.)
Number of rotations	35	1	1 ASCII character

6. PSET selection & cordless tools

MID 7418: Select PSET within time frame (ExBCom tool)

Direction *Integrator → CVI3 Controller*

Header							Data Field	Message End
0029	7418	Rev	No Ack flag	Station ID	Spindle ID	Spare	Data *(See next table)*	NULL (ASCII 0x00)
20 bytes							9 bytes	

This command is used to select a PSET in a given time frame.
This command is mostly used for cordless tools (ExBCom) to prevent WiFi lag issues.

Parameter	Bytes	Description
Pset number	01-02	01
	03-05	Pset number : 001, 002, etc.
Time frame	06-07	02
	08-09	Time frame 01 to 99 (x 100ms)

Possible answers

- If Pset has been selected in the cordless tool within time frame (MID7419)
- If cordless tool response time is greater than defined time.
  Command error (MID 0004 with error code 79: “Command failed”).
- If Pset does not exist:
  Command error (MID 0004 with error code 02: “Parameter set ID not present”).
- If Pset selection source is not set to Open protocol :
  Command error (MID 0004 with error code 03: “Parameter set cannot be set”).

.

MID 7419: PSET selected within time frame

Direction *CVI3 Controller → Integrator*

Header							Data Field	Message End
0098	7419	Rev	No Ack flag	Station ID	Spindle ID	Spare	Data *(See next table)*	NULL (ASCII 0x00)
20 bytes							78 bytes	

This command is sent by the controller when PSET has been selected within the given time frame from MID 7418.

Parameter	Bytes	Description
Pset number	01-02	01
	03-05	001, 002, etc.
Time stamp	06-07	02
	08-27	YYYY-MM-DD:HH:MM:SS
Removable accessory name	28-30	03
	31-80	50 characters

7. Get information data from controller or tool

Information Table: controller & tool information:

Information number	Information description	Data 1	Data 2	Data 3
001	Tool battery pack level	0-100%	-	-
002	Controller battery pack level	0-100%	-	-

MID 7420: Information data subscribe

Direction *Integrator → CVI3 Controller*

Header							Data Field	Message End
0025	7420	Rev	No Ack flag	Station ID	Spindle ID	Spare	Data *(See next table)*	NULL (ASCII 0x00)
20 bytes							5 bytes	

Parameter	Bytes	Description
Information number	01-02	01
	03-05	Information number (001, 002, etc). (*See Info table*)

This command is used to subscribe to an information from the controller or tool.
At subscription, MID 7421 is returned by the controller with the actual data information.

Possible answers:

- Command accepted (MID 0005, with 7420 in data field)
- Command error (MID 0004 with error code 71: “Subscription already exists)
- Command error (MID 0004 with error code 79: “Command failed”) in case information number doesn’t exist.

MID 7421: Information data change event

Direction *CVI3 Controller → Integrator*

Header							Data Field	Message End
29 + N bytes	7421	Rev	No Ack flag	Station ID	Spindle ID	Spare	Data *(See next table)*	NULL (ASCII 0x00)
20 bytes							9 + (N x 12 bytes)	

Parameter	Bytes	Comment
Information number	01-02	01
	03-05	001, 002, etc. (*See Info table*)
Number of Parameters	06-07	02
	08-09	Number of parameters of the information
Information data 1	10-11	03
	12-21	Data 1 value (10 characters) Ex : “ 52”.
Information data x	22-…	0#
	…-…	Data x value (10 characters)

This command is returned by the controller if a subscription (MID7420) has been accepted. The information can contains one or several data. In that case the information data length depends on number of data.

MID 7422: Information data change acknowledge

Direction *Integrator → CVI3 Controller*

Header							Data Field	Message End
0020	7422	Rev	No Ack flag	Station ID	Spindle ID	Spare		NULL (ASCII 0x00)
20 bytes							0 bytes	

This telegram must be sent by the integrator to acknowledge to the controller when the information data change event (MID 7421) has been successfully received.

MID 7423: Information data change unsubscribe

Direction *Integrator → CVI3 Controller*

Header							Data Field	Message End
0025	7423	Rev	No Ack flag	Station ID	Spindle ID	Spare	Data *(See next table)*	NULL (ASCII 0x00)
20 bytes							5 bytes	

Parameter	Bytes	Description
Information number	01-02	01
	03-05	Information number (001, 002, etc). (*See Info table*)

This command is used to stop receiving information data change event from the controller.

Possible answers:

- Command accepted (MID 0005, with 7423 in data field).
- Command error (MID 0004 with error code 72: “Subscription does not exist”.
- Command error (MID 0004 with error code 79: “Command failed in case information number doesn’t exist.

MID 7424: Information data request

Direction *Integrator → CVI3 Controller*

Header							Data Field	Message End
0025	7424	Rev	No Ack flag	Station ID	Spindle ID	Spare	Data *(See next table)*	NULL (ASCII 0x00)
20 bytes							5 bytes	

Parameter	Bytes	Description
Information number	01-02	01
	03-05	Information number (001, 002, etc). (*See Info table*)

This command is used to get an information data from the controller or tool.

MID 7425: Information data reply

Direction *CVI3 Controller → Integrator*

Header							Data Field	Message End
29 + N bytes	7425	Rev	No Ack flag	Station ID	Spindle ID	Spare	Data *(See next table)*	NULL (ASCII 0x00)
20 bytes							9 + (N x 12 bytes)	

Parameter	Bytes	Description
Information number	01-02	01
	03-05	001, 002, etc. (*See Info table*)
Number of Parameters	06-07	02
	08-09	Number of parameters of the information
Information data 1	10-11	03
	12-21	Data 1 value (10 characters) Ex : “ 52”.
Information data x	22-…	0#
	…-…	Data x value (10 characters)

This command is returned by the controller if a request (MID7440) has been accepted.
The information can contains one or several data. In that case the information data length depends on number of data.

8. File transfer

MID 7427: Transfer file (Pset settings)

Direction *Integrator → CVI3 Controller*

Header							Data Field	Message End
37 + N bytes	7427	Rev	No Ack flag	Station ID	Spindle ID	Spare	Data *(See next table)*	NULL (ASCII 0x00)
20 bytes							17 + N bytes	

This command is sent by the client to write a Pset or a Removable accessory file in the controller.

Parameter	Bytes	Description
File type	01-02	01
	03-05	001: Pset file (*.dex file exported from CVI Config). 002: Removable accessory file *(not available)*
Nb of parts	06-07	02
	08-10	001, 002, etc.
Part Id	11-12	03
	13-15	001, 002, etc.
File part	16-17	04
	18-…	N < Max Size (9970)

Possible answers

- Command accepted (MID 0005, with 7427 in data field).
- Command error (MID 0004 with error code 79: “Command failed) in case of error on file type, number or parts, part id or invalid data.

9. Synthesis

MID	Description	CVIxII	CVI3
7400	*System event (Reserved)*	4.2A	N/A
7402	Cycle & phases results subscribe	4.2A	N/A
7403	Cycle & phases results unsubscribe	4.2A	N/A
7404	Phase result data	4.2A	N/A
7405	Phase result data acknowledge	4.2A	N/A
7406	Cycle result data	4.2A	N/A
7407	Cycle result data acknowledge	4.2A	N/A
7408	Last tightening curve subscribe	4.2A	1.6.6.x
7409	Last tightening curve unsubscribe	4.2A	1.6.6.x
7410	Last tightening curve data	4.2A	1.6.6.x
7411	Last tightening curve acknowledge	4.2A	1.6.6.x
7412	Cycle/Pset parameters request	4.2A	1.6.9.x
7413	Cycle/Pset parameters data	4.2A	1.6.9.x
7414	Change Cycle/Pset parameters	4.2A	1.6.9.x
7418	Select Pset within time frame	N/A	1.6.6.x
7419	Pset selected within time frame	N/A	1.6.6.x
7420	Information data change subscribe	N/A	1.6.6.x
7421	Information data change event	N/A	1.6.6.x
7422	Information data change acknowledge	N/A	1.6.6.x
7423	Information data change unsubscribe	N/A	1.6.6.x
7424	Information data request	N/A	1.6.6.x
7425	Information data reply	N/A	1.6.6.x
7427	Transfer file (Pset settings)	N/A	1.6.6.x