FAFNIR

VISY-Quick Communication Protocol

Rev.	Protocol Version	Modification	VI Version	Date	Name
0	1.00	First release	2.0.1	2000-03-29	Willmer
1	1.10	New commands – date and time (3.2 ... 3.5) New commands – alarms (6.2, 6.3) New commands – history (7.1 ... 7.5)	2.0.2	2000-07-07	Willmer
2	1.11	New command – tank status (6.4)	2.0.8	2001-03-26	Willmer
3	1.12	New high-resolution commands (chapter 8)	3.0.1	2002-04-18	Willmer
4	1.13	New wireless commands (chapter 9) New probe status values (chapter 6.1) for wireless operation	3.0.1	2006-05-03	Willmer
5	1.14	Tank 0 adressing (chapter 10)	3.1.3	2006-09-06	Willmer
6	1.15	Added waves/waveless description to tank status (chapter 6.4) New command - Type of VISY-Stick (chapter 4.5) New discrete temperatur sensor commands (chapter 8.4.2 - 8.4.5)	3.1.4	2006-11-06	Willmer
7	1.16	Added new commands: Tank diameter (chapter 4.6), Water volume (chapter 5.7)	3.1.5	2007-07-24	Willmer
8	1.17	New environmental sensor commands (chapter 10.x) Added status 2 and product alarm to interstitial sensor (chapter 10.1) Added pressure/vacuum leak prevention/detection data (chapter 11.x) Added oil separator data (chapter 12.x)	4.0.1	2009-01-19	Willmer
9	1.18	New chapter 4.7 - Tank Chart New chapter 14 - Extensible commands New chapter 15 - Miscellaneous commands Added new probe status 12 (chapter 6.1, 10.1, 10.2, 10.3) Chapter 4.1 modified Added floating point format description to chapter 2 Added chapter 3.1.2 - Version of device	4.0.2	2009-09-03	Willmer
10	1.19	New chapters 5.8 - 5.11 - Density measuring values	4.0.4	2009-10-13	Willmer
11	1.20	Chapter 11.1 - 11.4: Added new leak detection alarm flag "liquid detected"	4.0.5	2009-11-11	Willmer
12	1.21	Added modified commands which support levels of more than 10 meters to chapter 5.5, 5.6, 8.4.3, 8.5, 8.6 Added description of tank chart volume unit to chapter 4.7.4 and 4.7.5 Added tank chart volume unit/resolution commands (chapter 4.7.6 and 4.7.7) Added chapters 6.5 and 6.6 - Density alarms Added chapter 14.4: Extensible density measurement values Added density values to extensible history (chapter 14.3) Added chapter 4.8: Product code	4.0.7	2010-11-08	Willmer
13	1.22	Added new alarm and functional flags for pressure/vacuum leak detection/prevention. (chapter 11.1, 11.2, 11.3, 11.4)	4.0.9	2011-12-16	Ritter
14	1.23	Added commands to read out all available data for pressure/vacuum leak detection/prevention (chapter 11.1.2, 11.2.2, 11.3.2, 11.4.2)	4.1.2	2012-04-25	Ritter
15	1.24	Added chapters 3.6 and 3.7 – Century Added chapter 3.8 – Serial number of device Added chapter 7.6 – Type of delivery Added type of delivery to extensible delivery history (chapter 14.3)	4.1.3	2013-02-21	Ritter
16	1.25	Added chapter 3.9 – General system functionality	4.1.3	2013-02-26	Ritter
17	1.26	Modified chapter 3.9 – General system functionality, added pressure sensor monitoring (bit B) Added chapter 3.10 – Serial number of probes Added chapter 4.9 – Product quality Added chapter 5.13 – Mass Added status 8 to chapter 6.1 – Status of probe Added chapter 8.7 – Mass (high resolution) Added chapter 10.4 – Pressure sensor VPS Modified chapter 14.2 – Extensible ATG measurement values, added mass (bit E) Modified chapter 14.3 – Extensible delivery history, added mass (bit A)	4.1.6	2014-12-16	Ritter
18	1.27	Added chapter 15.3 - Status of input device inputs	4.1.7	2015-03-17	Ritter
19	1.28	Modified chapter 3.9 – General system functionality, added sludge sensor monitoring (bit C) Modified chapter 3.10 – Serial number of probes, added sludge	4.1.9	2016-04-13	Ritter

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		sensor monitoring (bit 9) Added chapter 10.5 – Sludge sensor VISY-Sludge Added chapter 15.4 – ATG tank inventory data			
20	1.29	Modified chapter 3.9 – General system functionality, added general in tank measurement via Slave ATG (bit D) Added chapter 3.11 – VI-4 Communication Interface Modifierd Chapter 10.5 – Sludge sensor VISY-Sludge, added wireless data Modified 4.9 – Product quality, index 98 is now a predefined product quality	4.2.3	2019-04-05	Ritter
21	1.30	Modified chapter 3.9 – General system functionality, added VISY-Stick Temp (bit E) Modified chapter 3.10 – Serial number of probes, added VISY-Stick Temp (bit A) Added chapter 5.14 – Mass of LPG in the vapour phase Added chapter 5.15 – Mass of LPG in the liquid phase Added chapter 5.16 – Liquid equivalent volume of LPG in the vapour phase	4.2.4	2019-12-18	Ritter
22	1.31	Modified chapter 4.7 – Tank charts, now two different types of tank charts can be used Remamed chapter 4.7.1 – Maximum number of tank chart entries supported by the VI-4 board Added comment in chapter 4.7.4 – Read tank chart entry Added comment in chapter 4.7.5 – Write tank chart entry Added chapter 4.7.8 – Maximum number of tank chart entries per tank Added chapter 4.7.9 – Read tank chart type Added chapter 4.7.10 – Write tank chart type	4.2.6	2020-03-09	Ritter
23	1.32	Modified chapter 14.3 – Extensible delivery history, added bit B, product density (not temperature compensated)	4.3.0	2021-07-05	Ritter

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1 - Interface

Modulation:	RS232 or RS485
Signals:	RxD, TxD (no hardware handshake)
Mode:	Asynchronous, halfduplex
Baudrate:	9600bps
Start-bits:	1
Data-bits:	8
Stop-bits:	1
Parity:	-

Timing conditions:

The VISY-Command replies to incoming host commands. If the time between the characters of a host command exceeds 2 seconds, the VISY-Command will dismiss the command and clears the internal receive buffer.

The response time (start of reply) of the VISY-Command is usually 100ms to 200ms. In individual cases (e.g. simultaneous host and configuration communication) the response time can reach 600ms. Therefore, a timeout of 1000ms is recommended at the host side before repeating a command in case of no answer.

2 - Abbreviations and formats

2.1 - Abbreviations

cr - Carriage Return (ASCII 13_{dec})

cs - Checksum
The checksum is attached to the reply message. It starts with the character "**:**" (ASCII 58_{dec}) followed by the three-character checksum. The value range of the checksum is 1 – 255. The value 0 is illegal. The representation of the checksum is decimal.

To calculate the checksum all characters of the reply message including the "**:**" have to be added. Example: Sum = Q + ... + : = 81_{dec} + ... + 58_{dec}.

The checksum can now be calculated by repeatedly substracting 255 from the sum until the value is in the range of 1 – 255.

Note: This calculation is <u>not</u> the modulo 255 function which has a value range of 0 – 254.

hh - Index of history. At this protocol version 1 - 10, 1 = latest entry, 10 = oldest entry.

i..i - Integer value with fixed field width. Value is right-justified in the field. Leading zeros are replaced by spaces (ASCII 32_{dec}). Example: 17 in a field of *i i i i* is *sp sp* 1 7 (not 0 0 1 7).

lf - Line feed (ASCII 10_{dec})

sp - Space (ASCII 32_{dec})

s..s - String. Number of characters can vary.

tt - Number of tank (1...16). Always 2 characters, 1 – 9 with leading space (ASCII 32dec). Tank 0 (*tt* = *sp* 0) command delivers the data of all active tanks since protocol version 1.14.

2.2 - ASCII 4-byte floating point format

Some of the newer commands of this protocol are using the ASCII 4-byte floating point format which uses eight ASCII characters to transfer a 4-byte (single precision) floating point number. Each of these characters ('0'-'9', 'A'-'F') represents a nibble (4 bit) of the 4-byte floating point number:

ASCII character	#1	#2	#3	#4	#5	#6	#7	#8
Floating point nibble	#1	#2	#3	#4	#5	#6	#7	#8
Floating point byte	#1		#2		#3		#4	
Binary	SEEE EEEE		EMMM MMMM		MMMM MMMM		MMMM MMMM	

S - Sign bit. 0 = positive, 1 = negative
E...E - 2's exponent value biased by 127_{Dec} / $7F_{hex}$. Can be determined by subtracting 127 from E...E and raising 2 from the resulting power.
M...M - 23-bit mantissa. Can be determined by dividing M...M by 2^{23} (8,388,608) and adding 1.0.

The value can be calculated by multiplying the exponent by the mantissa and considering the sign (positive or negative).

Example:

ASCII character	'4' $_{hex}$	'2' $_{hex}$	'C' $_{hex}$	'7' $_{hex}$	'F' $_{hex}$	'A' $_{hex}$	'E' $_{hex}$	'1' $_{hex}$
Floating point nibble	4_{dec}	2_{dec}	12_{dec}	7_{dec}	15_{dec}	10_{dec}	14_{dec}	1_{dec}
Floating point byte	66_{dec}		199_{dec}		250_{dec}		225_{dec}	
Binary	0100 0010		1100 0111		1111 1010		1110 0001	

$42C7FAE1_{hex}$ = $0100\ 0010\ 1100\ 0111\ 1111\ 1010\ 1110\ 0001_{bin}$

S = 0 = positive
E = $1000\ 0101_{bin}$ = 133_{dec}
M = $100\ 0111\ 1111\ 1010\ 1110\ 0001_{bin}$ = $4,717,281_{dec}$

Exponent = $2^{(133-127)}$ = 2^6 = 64
Mantissa = 1.0 + (4,717,281 / 8,388,608) = 1.56234372
Value = +64 x 1.56234372 = +99.99

Convention: 00 00 00 00 = 0.0

3 - Common commands

3.1.1 - Version of protocol

Command: Q V E *cr lf*
Reply: Q V E $ *i i i* : *cs cs cs cr lf*

Comment: *i i i* = 104 means version 1.04.

Command available since protocol version 1.00.

3.1.2 - Version of device

Command: Q V D *cr lf*
Reply: Q V D $ *s s s s s s s s s s s s s s s s* $ v v v . v v v . v v v . v v v : *cs cs cs cr lf*

Comment:
s..s = Left adjusted 16 character string which describes the connected device (e.g. "VI-4 ...", "VISY-Monitor ..."). The string is filled up with spaces to the right.
v v v.. = 4-segment firmware/software version number with leading zeros in each segment (004.000.002.255). The last segment indicates whether it is a released or a beta firmware/software: A release is always marked by a value of 255. A value of 0 - 254 indicates a beta version which should be used temporarily and for testing only.

Command available since protocol version 1.18.

3.2 - Read date of VISY-Command system clock

Command: Q D R *cr lf*
Reply: Q D R $ *i i i i i i* : *cs cs cs cr lf*

Comment: *i i i i i i* = Y Y M M D D.
Examples: *sp sp sp* 2 0 3 = February 3rd, 2000, *sp* 2 0 7 1 5 = July 15th, 2002

Command available since protocol version 1.10.

3.3 - Write date to VISY-Command system clock

Command: Q D W $ *i i i i i i* : *cs cs cs cr lf*
Reply: Q D W $ *i i i i i i* : *cs cs cs cr lf*

Comment: *i i i i i i* = Y Y M M D D.
Examples: *sp sp sp* 2 0 3 = February 3rd, 2000, *sp* 2 0 7 1 5 = July 15th, 2002

Command available since protocol version 1.10.

3.4 - Read time of VISY-Command system clock

Command: Q C R *cr lf*
Reply: Q C R $ *i i i i i i* : *cs cs cs cr lf*

Comment: *i i i i i i* = H H M M S S.
Examples: *sp sp sp* 2 0 3 = 00:02:03, 2 2 0 7 1 5 = 22:07:15

Command available since protocol version 1.10.

3.5 - Write time to VISY-Command system clock

Command: Q C W $ *i i i i i i* : *cs cs cs cr lf*
Reply: Q C W $ *i i i i i i* : *cs cs cs cr lf*

Comment: *i i i i i i* = H H M M S S.
Examples: *sp sp sp* 2 0 3 = 00:02:03, 2 2 0 7 1 5 = 22:07:15

Command available since protocol version 1.10.

3.6 - Read century of VISY-Command system clock

Command: Q H R *cr lf*
Reply: Q H R $ *i i* : *cs cs cs cr lf*

Comment: *i i* = C C.
Examples: 2 0 = 20YY, 2 *5* = 25YY (with YY = year from date commands)

The century is a 2-digit value in the range of 20 to 26. It represents the upper 2 digits of the 4-digit year. To calculate the current 4-digit year the 2-digit century has to be combined with the 2-digit year included in the date commands (see chapters 3.2 and 3.3). The century has been implemented to allow the correct indication of the 4-digit year (e.g. on delivery reports) in countries that use the Buddhist calendar instead of the Gregorian calendar.

Command available since protocol version 1.24.

3.7 - Write century to VISY-Command system clock

Command: Q H W $ *i i* : *cs cs cs cr lf*
Reply: Q H W $ *i i* : *cs cs cs cr lf*

Comment: *i i* = C C.
Examples: *2 0 = 20YY, 2 5 = 25YY (with YY = year from date commands)*

Command available since protocol version 1.24.

3.8 - Serial number of device

Command: Q S N *cr lf*
Reply: Q S N $ *i i i i i i i* : *cs cs cs cr lf*

Comment: *i i i i i i i* = sp sp 1 4 9 7 3 means serial number 14973.

Command available since protocol version 1.24.

3.9 - General system functionality

Comment: This command allows to read out the general functionality the VISY-Command system offers according to the current configuration. The structure of the command and reply follows the definitions as described in chapter 14 - Extensible commands, with one exception: this command is not tank related, it always returns information for all 16 possible tanks.

Command: Q S F *& d d d d d cr lf*

d d d d d :
Bit 0 : General in tank measurements (e.g. product level, product volume ect.)
Bit 1 : In tank product density measurements
Bit 2 : In tank sump density measurements
Bit 3 : Interstitial space monitoring
Bit 4 : Manhole sump monitoring
Bit 5 : Dispenser sump monitoring
Bit 6 : Leak detection tank
Bit 7 : Leak detection product line
Bit 8 : Leak detection filling line
Bit 9 : Leak detection manhole sump
Bit A : Oil separator monitoring
Bit B : Pressure sensor monitoring (e.g. VPS-V, VPS-L)
Bit C : Sludge sensor monitoring (e.g. VISY-Sludge)
Bit D : General in tank measurements via Slave ATG

Bit E : Discrete temperature sensor monitoring (e.g. VISY-Stick Temp)
Bit F : Not yet defined. Requesting non-defined data (&F) will cause an error message.

Example: Q S F & *sp sp sp* 7 1 *cr lf* (71_{dec} = 0000 0000 0100 0111_{bin})

Read out for which tanks the following system functionalities are currently configured in the VISY-Command system:

- Bit 0 = 1 → General in tank measurements
- Bit 1 = 1 → In tank product density measurements
- Bit 2 = 1 → In tank sump density measurements
- Bit 6 = 1 → Leak detection tank

Reply: Q S F *& x* $ functionality x flags & y $ functionality y flags ... & z $ functionality z flags : cs cs cs *cr lf*

Comment: functionality flags - 0 - 65535, bit orientated, bit 0 -> tank 1, bit 15 -> tank 16.

Example: Q S F & *sp sp sp* 7 1 *cr lf*

Q S F & 0 $ sp sp 1 2 7 & 1 $ sp sp sp 6 3 & 2 $ sp sp sp 1 2 & 6 $ sp sp sp 6 3 : sp 7 4 *cr lf*

The following functionalities that have been requested are currently configured in the VISY-Command system:

- General in tank measurements for tanks: 1, 2, 3, 4, 5, 6, 7
- In tank product density measurements for tanks: 1, 2, 3, 4, 5, 6
- In tank sump density measurements for tanks: 3, 4
- Leak detection tank for tanks: 1, 2, 3, 4, 5, 6

Command available since protocol version 1.25 with bit 0 to A supported.
Bit B supported since protocol version 1.26.
Bit C supported since protocol version 1.28.
Bit D supported since protocol version 1.29.
Bit E supported since protocol version 1.30.

3.10 - Serial numbers of probes

Comment: This command allows to read out the serial numbers of the various probe types that can be connected to the VISY-Command. Only serial numbers of configured probes are returned. The structure of the command and reply follows the definitions as described in chapter 14 - Extensible commands.

Command: Q S P *t t & d d d d d cr lf*

d d d d d :
Bit 0 : General in tank measurements (e.g. VISY-Stick, VISY-Stick Advanced)
Bit 1 : Interstitial space monitoring (e.g. VISY-Stick Interstitial, VISY-Reed Interstitial)
Bit 2 : Manhole sump monitoring (e.g. VISY-Stick Manhole Sump, VISY-Reed Manhole Sump)
Bit 3 : Dispenser sump monitoring (e.g. VISY-Stick Dispenser Sump, VISY-Reed Dispenser Sump)
Bit 4 : Leak detection product line
Bit 5 : Leak detection tank
Bit 6 : Leak detection filling line
Bit 7 : Leak detection manhole sump
Bit 8 : Pressure sensor monitoring (e.g. VPS-V, VPS-L)
Bit 9 : Sludge sensor monitoring (e.g. VISY-Sludge)

Bit A : Discrete temperature sensor monitoring (e.g. VISY-Stick Temp)
Bit B ...
Bit F : Not yet defined. Requesting non-defined data (&B - &F) will cause an error message.

Example: Q S P *t t & sp sp sp sp 3 cr lf* (3_{dec} = 0000 0000 0000 0011_{bin})

Read out the serial numbers for sensors used for in tank measurements and interstitial space monitoring that are currently configured in the VISY-Command system:

- Bit 0 = 1 → General in tank measurements
- Bit 1 = 1 → Interstitial space monitoring

Reply: Q S P *t t & x* $ serial number probe type x & y $ serial number probe type y ... & z $ serial number probe type z : cs cs cs *cr lf*

Comment: serial numbers - i i i i i i i, e.g. sp sp 6 7 4 3 0 means serial number 67430.

Example: Q S P *sp 5 & sp sp sp sp 3 cr lf*

Q S P *sp 5 & 0* $ sp sp 6 2 7 3 5 *& 1* $ sp sp 5 0 3 1 1 : 2 5 3 *cr lf*

The following probe type serial numbers that have been requested for tank 5 are currently configured in the VISY-Command system:

- General in tank measurements: 62735
- Interstitial space monitoring: 50311

Reply string in case of no probes configured: Q S P t t : cs cs cs *cr lf*

Command available since protocol version 1.26 with bit 0 to 8 supported.
Bit 9 supported since protocol version 1.28.
Bit A supported since protocol version 1.30.

3.11 - VI-4 Communication Interface

Command: Q I F *cr lf*
Reply: Q I F $ *i* : *cs cs cs cr lf*

Comment: *i* = 0…1
0 = VISY-Quick communication via Service Interface
1 = VISY-Quick communication via Host Interface

Command available since protocol version 1.29.

4 - Requesting of static tank parameters

4.1 - Product designation

Command: Q P N *t t cr lf*
Reply: Q P N *t t* $ *s s s s s s s s s s s s s s s s* : *cs cs cs cr lf*

Comment: *s .. s* = String, 16 characters, left adjusted filled up with spaces (ASCII 32_{dec}) to the right. The string can contain bytes like ASCII control characters in case of a product designation written via a 16-bit character set (e.g. Chinese). Therefore, you should deal with the string as a 16-byte array without any expectation to find only ASCII characters in it.

Command available since protocol version 1.00 with variable string length (up to 16 characters).
Since protocol version 1.18 the string length is fixed to 16 characters to avoid problems with 16-bit character sets.

4.2 - Tank capacity

Command: Q V 1 *t t cr lf*
Reply: Q V 1 *t t* $ *i i i i i i i i i* : *cs cs cs cr lf*

Comment: *i i i i i i i i i* = Capacity in litres, Resolution 0.1 litre.
Example: *i i i i i i i i i* = *sp sp sp sp* 4 5 6 1 4 = 4561.4 litres

Command available since protocol version 1.00.

4.3 - Max. permissible volume of tank

Command: Q V 2 *t t cr lf*
Reply: Q V 2 *t t* $ *i i i i i i i i i* : *cs cs cs cr lf*

Comment: *i i i i i i i i i* = Max. permissible volume (e.g. 95% of capacity) in litres, Resolution 0.1 litre.
Example: *i i i i i i i i i* = *sp sp sp sp* 4 5 6 1 4 = 4561.4 litres

Command available since protocol version 1.00.

4.4 - Reference temperature

Command: Q T R *t t cr lf*
Reply: Q T R *t t* $ *i i i i* : *cs cs cs cr lf*

Comment: *i i i i* = Reference temperature, resolution 0.1°C, always signed, 0 is +0.
Example: *i i i i* = *sp* + 7 4 = 7.4°C
i i i i = *sp sp* – 1 = -0.1°C
If the reference temperature is –19.9°C the temperature compensation is disabled. All compensated volume values (like reference volume and history entries) will be uncompensated then.

Command available since protocol version 1.00.

4.5 - Type of VISY-Stick

Command: Q S T *t t cr lf*
Reply: Q S T *t t* $ *i i* : *cs cs cs cr lf*

Comment: *i i* = Type of VISY-Stick:
0 = Unknown.
1 = VISY-Stick Basic
(Resolution: 0.1 mm, 0.1 °C, 1 litre. Integral temperature sensor.)
2 = VISY-Stick Standard
(Resolution: 0.001 mm, 0.001 °C, 0.001 litre. Integral temperature sensor.)
3 = VISY-Stick Advanced
(Resolution: 0.001 mm, 0.001 °C, 0.001 litre. Discrete temperature sensors.)
>3 = Future types of VISY-Stick.

Command available since protocol version 1.15.

4.6 - Tank diameter

Command: Q D I *t t cr lf*
Reply: Q D I *t t* $ *i i i i i* : *cs cs cs cr lf*

Comment: *i i i i i* = Diameter in millimetres, Resolution 1 mm.
Example: *i i i i i* = 4 5 6 1 4 = 45614 millimetres.

Command available since protocol version 1.16.

4.7 - Tank charts

From firmware V 4.2.6.255 onwarts the VI-4 board supports two different tank chart types.

<u>Tank chart of type 1 (old type), available from VI-4 firmware V4.0.0.255</u>

Tank chart with a maximum of 128 value pairs consisting of level and associated volume.

The first pair of values of a tank chart of type 1 must always correspond to a level of 0 mm. Correspondingly, 0 liters or 0.0 m^3 or a known remaining volume (possibly caused by an inclined position of the tank) must be specified. The last pair of values must always correspond to the nominal volume (and not the permissible filling volume) of the tank. Accordingly, the tank diameter or the tank height must be specified as the associated level.

<u>Tank chart of type 2 (new type), available from VI-4 firmware V4.2.6.255</u>

Tank chart with a maximum of 2200 volume values and a fixed increment of 10 mm for the level.

The first volume value of a tank chart of type 2 must always correspond to a level of 10 mm. All other volume values follow the fixed level increment of 10 mm. The last volume value must always correspond to the nominal volume (and not the permissible filling volume) of the tank. Accordingly, the tank diameter or tank height (in the fixed 10 mm grid) must be specified as the associated level.

NOTES:
If the desired tank chart type is different from the currently configured tank chart type, then the new tank chart type must be set before the tank chart is actually transferred.

To be backwards compatible the default tank chart type is type 1 (the old type existing since VI-4 firmware V4.0.0.255). So, if the tank chart type 1 was used in the past and is to be used in the future, there is no need to change the tank chart type.

4.7.1 - Maximum number of tank chart entries supported by the VI-4 board

Command: Q C M *cr lf*
Reply: Q C M $ *i i i i* : *cs cs cs cr lf*

Comment: *i i i i* = Maximum number of tank chart entries (rows).
VI-4 firmware V4.2.5 (or lower): up to 128 tank chart entries.
VI-4 firmware V4.2.6 (or higher): up to 2200 tank chart entries.
To read out the maximum number of tank chart entries for an individual tank that depends on the tank chart type configured for the tank use command QCMtt described in chapter 4.7.8.

Command available since protocol version 1.18.

4.7.2 - Read actual number of tank chart entries

Command: Q C N R *t t cr lf*
Reply: Q C N R *t t* $ *i i i i* : *cs cs cs cr lf*

Comment: *i i i i* = Current number of used tank chart entries.
Note: Command does not support tank 0 addressing.

Command available since protocol version 1.18.

4.7.3 - Write actual number of tank chart entries

Command: Q C N W *t t* $ *i i i i* : *cs cs cs cr lf*
Reply: Q C N W *t t* $ *i i i i* : *cs cs cs cr lf*

Comment: *i i i i* = Current number of used tank chart entries. Must be set to 0 before writing tank chart entries (see 4.7.5) or tank chart volume unit / resolution (see 4.7.7). Due to accuracy reasons the minimum number of entries is 10. Writing a value of 1 to 9 will cause an error message. Writing a value of 0 will deactivate the tank chart (all volume measurement values are 0). Writing a new actual number of tank chart entries is only possible if the actual number has been cleared before (old tank chart must be deactivated by writing actual number = 0). Furthermore, the value must not exceed the max. number of tank chart entries (see 4.7.1). Writing a new actual number of tank chart entries starts an internal validity check of the tank chart. In case of an invalid tank chart an error message will be replied.
Note: Command does not support tank 0 addressing.

Command available since protocol version 1.18.

4.7.4 - Read tank chart entry

Command: Q C E R *t t* $ *i i i i cr lf*
Reply: Q C E R *t t* $ *i i i i* $ *l l l l l* $ *v v v v v v v* : *cs cs cs cr lf*

Comment: *i i i i* = Index (row) of tank chart entry, range 1 - max. number of entries (see 4.7.1).
l l l l l = Level in millimetres, resolution 1 mm.
v v v v v v v = Volume, range 0 - 999999, unit litres or m³, res. 1 litre or 0.1 m³
Example: *v v v v v v v* = *sp sp sp* 3 1 7 2 = 3172 litres or 317.2 m³ (see 4.7.6).
Notes: Command does not support tank 0 addressing. If the tank chart has a high number of entries (with tank chart type 2 a maximum of 2200 entries is possible) then it makes sense to read the tank chart in small portions to be able to use other commands inbetween.

Command available since protocol version 1.18.
Range of value limited to 999999 and variable unit (see 4.7.6/7) since protocol version 1.21.

4.7.5 - Write tank chart entry

Command: Q C E W *t t* $ *i i i i* $ *l l l l l* $ *v v v v v v v* : *cs cs cs cr lf*

Reply: Q C E W *t t* $ *i i i i* $ *l l l l l* $ *v v v v v v v* : *cs cs cs cr lf*

Comment: *i i i i* = Index (row) of tank chart entry, range 1 - max. number of entries (see 4.7.1).
l l l l l = Level in millimetres, resolution 1 mm.
v v v v v v v = Volume, range 0 - 999999, unit litres or m³, res. 1 litre or 0.1 m³
Example: *v v v v v v v* = *sp sp sp* 3 1 7 2 = 3172 litres or 317.2 m³ (see 4.7.6).

Before using this command, the actual number of tank chart entries (see 4.7.3) must be set to 0 to deactivate the current tanks chart and stop any volume calculations during the transmission of the chart. The entries must be sent sorted in ascending order (index, levels, volume). After writing all tank chart entries the actual number of entries (see 4.7.3) must be set to the number of transmitted entries to activate the new tank chart and enable volume calculations for this tank. The reply is not a simple copy of the command: Reply level and volume are written and read back from non-volatile memory.

Notes: Command does not support tank 0 addressing. If the tank chart has a high number of entries (with tank chart type 2 a maximum of 2200 entries is possible) then it makes sense to write the tank chart in small portions to be able to use other commands inbetween.

Command available since protocol version 1.18.
Range of value limited to 999999 and variable unit (see 4.7.6/7) since protocol version 1.21.

4.7.6 - Read tank chart volume unit and resolution

Command: Q C V R *t t cr lf*
Reply: Q C V R *t t* $ *i i i* : *cs cs cs cr lfJa*

Comment: *i i i* = Unit and resolution of tank chart volume entries.
= 0: Unit litre, resolution 1 litre (factory default).
= 1: Unit m³, resolution 0.1 m³.
> 1: for future options.

Volume measurement values (e.g. chapter 5.1 - 5.3) will be in no way affected by the volume unit of the tank chart.

Note: Command does not support tank 0 addressing.

Command available since protocol version 1.21.

4.7.7 - Write tank chart volume unit and resolution

Command: Q C V W *t t* $ *i i i* : *cs cs cs cr lf*
Reply: Q C V W *t t* $ *i i i* : *cs cs cs cr lf*

Comment: *i i i* = Unit and resolution of tank chart volume entries.
= 0: Unit litre, resolution 1 litre.
= 1: Unit m³, resolution 0.1 m³.
> 1: for future options.

Volume measurement values (e.g. chapter 5.1 - 5.3) will be in no way affected by the volume unit and resolution of the tank chart. Unit / resolution can be written only if the tank chart is deactivated (number of tank chart entries = 0, see 4.7.3), otherwise an error message will be replied. The reply is not a simple copy of the command: Unit/resolution value is written and read back from non-volatile memory.

Note: Command does not support tank 0 addressing.

Command available since protocol version 1.21.

4.7.8 - Maximum number of tank chart entries per tank

Command: Q C M t t *cr lf*
Reply: Q C M t t $ *i i i i* : *cs cs cs cr lf*

Comment: *i i i i* = Maximum number of tank chart entries (rows) per tank.

Command available since protocol version 1.31.

4.7.9 - Read tank chart type

Command: Q C T R *t t cr lf*
Reply: Q C T R *t t* $ *i* : *cs cs cs cr lf*

Comment: *i* = Current tank chart type 0…2 (default: 1).
i = 0 – No tank chart available.
i = 1 – Old tank chart format with a maximum of 128 value pairs consisting of level and volume.
i = 2 – New tank chart format with a constant step size of 10 mm for the level and a maximum of 2200 values for the volume.
Note: Command does not support tank 0 addressing.

Command available since protocol version 1.31.

4.7.10 - Write tank chart type

Command: Q C T W *t t* $ *i* : *cs cs cs cr lf*
Reply: Q C T W *t t* $ *i* : *cs cs cs cr lf*

Comment: *i* = *T*ank chart type
i = 0 – No tank chart available.
i = 1 – Old tank chart format with a maximum of 128 value pairs consisting of level and volume.
i = 2 – New tank chart format with a constant step size of 10 mm for the level and a maximum of 2200 values for the volume.
In case of an invalid tank chart type an error message will be replied.
Note: Command does not support tank 0 addressing.

Command available since protocol version 1.31.

4.8 - Product code

Command: Q P C *t t cr lf*
Reply: Q P C *t t* $ *i i i* : *cs cs cs cr lf*

Comment: *i i i* = Numerical code for unique product identification. Value depends on company or site specific requirements. Range: 0 - 254, 0 = No code assigned.

Command available since protocol version 1.16.

4.9 - Product quality

Command:	Q P Q t t cr lf
Reply when product quality is 0 to 98:	Q P Q t t $ i i : cs cs cs cr lf
Reply when product quality is 99:	Q P Q t t $ i i $ d d d d d $ t t t t t : cs cs cs cr lf

Comment:

i i	-	Index for the product quality: 0 = unknown/not defined 1 to 14 = predefined product qualities 15 to 97 = free for future predefined product qualities 98 = predefined product quality 99 = freely configured product quality
d d d d d	-	Product density at 15 °C, resolution 0.1 g/l
t t t t t	-	Product thermal expansion coefficient, resolution 10^{-7}/k

The product density at 15 °C and the product thermal expansion coefficient will only be included in the reply if the index for the product quality is 99.

Examples:

d d d d d = sp 7 4 3 0	➔ Product density at 15 °C = 743.0 g/l
t t t t t = 1 2 7 8 4	➔ Product thermal expansion coefficient = 1.2784 * 10^{-3}/k

Command available since protocol version 1.26.

5 - Requesting of variable measuring values

5.1 - Product volume

Command: Q V 3 *t t cr lf*
Reply: Q V 3 *t t* $ *i i i i i i i i i* : *cs cs cs cr lf*

Comment: *i i i i i i i i i* = Volume in litres, Resolution 0.1 litre.
Example: *i i i i i i i i i* = *sp sp sp sp* 4 5 6 1 4 = 4561.4 litres

Command available since protocol version 1.00.

5.2 - Ullage

Command: Q V 4 *t t cr lf*
Reply: Q V 4 *t t* $ *i i i i i i i i i* : *cs cs cs cr lf*

Comment: *i i i i i i i i i* = Ullage (spare volume) in litres, resolution 0.1 litre.
Example: *i i i i i i i i i* = *sp sp sp sp* 4 5 6 1 4 = 4561.4 litres

Command available since protocol version 1.00.

5.3 - Reference volume

Command: Q V 5 *t t cr lf*
Reply: Q V 5 *t t* $ *i i i i i i i i i* : *cs cs cs cr lf*

Comment: *i i i i i i i i i* = Reference volume (current volume compensated to reference temperature) in litres, Resolution 0.1 litre.
Example: *i i i i i i i i i* = *sp sp sp sp* 4 5 6 1 4 = 4561.4 litres

Command available since protocol version 1.00.

5.4 - Temperature of product

Command: Q T P *t t cr lf*
Reply: Q T P *t t* $ *i i i i* : *cs cs cs cr lf*

Comment: *i i i i* = Temperature of product, resolution 0.1°C, always signed, 0 is +0.
Example: *i i i i* = *sp* + 7 4 = 7.4°C
i i i i = *sp sp* – 1 = -0.1°C

Command available since protocol version 1.00.

5.5 - Level of product

Command: Q L P *t t cr lf*
Reply: Q L P *t t* $ *i i i i i* : *cs cs cs cr lf*

Comment: *i i i i i* = Level of product, resolution 0.1mm.
Example: *sp* 9 3 7 1 = 937.1mm

Command available since protocol version 1.00.

Since protocol version 1.21 the VISY-X system supports also large storage tanks with a height of more than 10 meters. The old QLP command is limited to 9999.9 mm. There is a modified command available which supports levels of more than 10 meters:

Command: Q L p *t t cr lf*
Reply: Q L p *t t* $ *i i i i i i* : *cs cs cs cr lf*

Comment: *i i i i i i* = Level of product, resolution 0.1mm.
Example: 1 2 4 5 3 7 = 12453.7mm

Command available since protocol version 1.21.

5.6 - Level of water

Command: Q L W *t t cr lf*
Reply: Q L W *t t* $ *i i i i i* : *cs cs cs cr lf*

Comment: *i i i i i* = Level of water, resolution 0.1mm
Example: *sp sp* 8 0 5 = 80.5mm

Command available since protocol version 1.00.

Since protocol version 1.21 the VISY-X system supports also large storage tanks with a height of more than 10 meters. The old QLW command is limited to 9999.9 mm. There is a modified command available which supports levels of more than 10 meters:

Command: Q L w *t t cr lf*
Reply: Q L w *t t* $ *i i i i i i* : *cs cs cs cr lf*

Comment: *i i i i i i* = Level of water, resolution 0.1mm.
Example: 1 0 0 8 2 4 = 10082.4mm

Command available since protocol version 1.21.

5.7 - Water volume

Command: Q V W *t t cr lf*
Reply: Q V W *t t* $ *i i i i i i i i i* : *cs cs cs cr lf*

Comment: *i i i i i i i i i* = Volume in litres, Resolution 0.1 litre.
Example: *i i i i i i i i i* = *sp sp sp sp* 4 5 6 1 4 = 4561.4 litres

Command available since protocol version 1.16.

WARNING: Water volume, as well as water level, should be used only for the purpose of alarm indication. Do not use water volume for reconciliation or product volume calculations (e.g. product volume = current volume - water volume). Due to harsh environmental conditions at the tank bottom (e.g. mud, undefined interface layer between water and product, streaming, etc) the water measurement is less accurate than the product measurement. Furthermore, there are additional inaccuracies in the water level to volume calculation since the water at the tank bottom is always out of the tank calibrating range.

5.8 - Measured sump density

Command: Q D M S *t t cr lf*
Reply: Q D M S *t t* $ *i i i i i* : *cs cs cs cr lf*

Comment: *i i i i i* = Measured sump density, resolution 0.1 g/l.
Example: *sp* 8 7 3 1 = 873.1 g/l
This value is available only if the water float of a VISY-Stick has been replaced by a density measurement unit which is mounted in the sump, directly above the tank bottom, otherwise it is always 0.0 g/l. Water level and volume are not available (always 0.0) if a sump density measurement unit is mounted.

Command available since protocol version 1.19.

5.9 - Reference sump density

Command: Q D R S *t t cr lf*
Reply: Q D R S *t t* $ *i i i i i* : *cs cs cs cr lf*

Comment: *i i i i i* = Calculated temperature compensated sump density at tank reference temperature (chapter 4.4), resolution 0.1 g/l.
Example: *sp* 8 5 2 7 = 852.7 g/l

Command available since protocol version 1.19.

5.10 - Measured product density

Command: Q D M P *t t cr lf*
Reply: Q D M P *t t* $ *i i i i i* : *cs cs cs cr lf*

Comment: *i i i i i* = Measured average product density, resolution 0.1 g/l.
Example: *sp* 8 7 3 1 = 873.1 g/l
This value is available only if the VISY-Stick has been equipped with a density measurement unit which is mounted above the tank sump, otherwise it is always 0.0 g/l.

Command available since protocol version 1.19.

5.11 - Reference product density

Command: Q D R P *t t cr lf*
Reply: Q D R P *t t* $ *i i i i i* : *cs cs cs cr lf*

Comment: *i i i i i* = Calculated temperature compensated product density at tank reference temperature (chapter 4.4), resolution 0.1 g/l.
Example: *sp* 8 5 2 7 = 852.7 g/l

Command available since protocol version 1.19.

5.12 - Density measurement temperature

Command: Q D T B *t t cr lf*
Reply: Q D T B *t t* $ *i i i i i i* : *cs cs cs cr lf*

Comment: *i i i i i i* = Temperature at density measurement, resolution 0.001°C, always signed, 0 is +0.
Example: *sp* + 7 4 0 3 = 7.403°C
This value is available only if at least one density measurement unity (sump, product or both) is mounted on the probe, otherwise it is always 0.0.

Command available since protocol version 1.19.

5.13 - Mass

Command: Q M P *t t cr lf*
Reply: Q M P *t t* $ *i i i i i i i i i* : *cs cs cs cr lf*

Comment: *i i i i i i i i i* = Mass in kg, Resolution 0.1 kg.
Example: sp sp sp 2 6 1 4 9 5 = 26149.5 kg
If the product quality LPG is configured then the mass is the sum of the mass in the liquid phase and the mass of the vapour phase.

Command available since protocol version 1.26.

5.14 - Mass of LPG in the vapour phase

Command: Q M V *t t cr lf*
Reply: Q M V *t t* $ *i i i i i i i i i* : *cs cs cs cr lf*

Comment: *i i i i i i i i i* = Mass in kg, Resolution 0.1 kg.
Example: sp sp sp sp sp 1 7 4 9 =174.9 kg

Command available since protocol version 1.30.

5.15 - Mass of LPG in the liquid phase

Command: Q M L *t t cr lf*
Reply: Q M L *t t* $ *i i i i i i i i i* : *cs cs cs cr lf*

Comment: *i i i i i i i i i* = Mass in kg, Resolution 0.1 kg.
Example: sp sp sp 2 6 1 4 9 5 = 26149.5 kg

Command available since protocol version 1.30.

5.16 - Liquid equivalent volume of LPG in the vapour phase

Command: Q L E *t t cr lf*
Reply: Q L E *t t* $ *i i i i i i i i i* : *cs cs cs cr lf*

Comment: *i i i i i i i i i* = Volume in litres, Resolution 0.1 litre.
Example: *i i i i i i i i i* = *sp sp sp sp sp sp* 8 1 4 = 81.4 litres

Command available since protocol version 1.30.

6 - Requesting of status and alarms

6.1 - Status of probe

Command: Q P S *t t cr lf*
Reply: Q P S *t t* $ *i i* : *cs cs cs cr lf*

Comment: *i i* = 0…99, currently used:

0	-	Probe ok.
1	-	Probe reports internal error.
5	-	Probe reports temperature measuring error.
6	-	Probe reports level measuring error.
7	-	Probe reports reduced measuring accuracy.
8	-	Wireless receiver reports checksum error in probe data received from transmitter (in wireless operation mode only).
9	-	Wireless transmitter reports missing probe response (in wireless operation mode only).
10	-	Probe communication error between VISY-Command and probe.
11	-	No response from probe or wireless transmitter.
12	-	Incompatible probe data (communication and checksum ok but probe data does not match).
13	-	Waiting for first incoming wireless data (after power-on or reset in wireless operation mode only).
99	-	Probe not configured.

Command available since protocol version 1.00.

6.2 - Alarm product

Command: Q A P *t t cr lf*
Reply: Q A P *t t* $ *i* : *cs cs cs cr lf*

Comment: *i* = 0…9, currently used:

0	-	No alarm.
1	-	Low Low alarm.
2	-	Low alarm.
3	-	High alarm.
4	-	High High alarm.

Command available since protocol version 1.10.

6.3 - Alarm water

Command: Q A W *t t cr lf*
Reply: Q A W *t t* $ *i* : *cs cs cs cr lf*

Comment: *i* = 0…9, currently used:

0	-	No alarm.
1	-	High alarm.
2	-	High High Alarm.

Command available since protocol version 1.10.

6.4 - Tank status

Command: Q T S *t t cr lf*
Reply: Q T S *t t* $ *i* : *cs cs cs cr lf*

Comment: *i* = 0…9, currently used:

0	-	No delivery in progress and no waves on product surface.
1	-	Delivery in progress or waves on product surface.

Command available since protocol version 1.11.

6.5 - Alarm sump density

Command: Q A D S *t t cr lf*
Reply: Q A D S *t t* $ *i* : *cs cs cs cr lf*

Comment: *i* = 0...9, currently used:

0	-	No alarm.
2	-	Low alarm.
3	-	High Alarm.

Command available since protocol version 1.21.

6.6 - Alarm product density

Command: Q A D P *t t cr lf*
Reply: Q A D P *t t* $ *i* : *cs cs cs cr lf*

Comment: *i* = 0...9, currently used:

0	-	No alarm.
2	-	Low alarm.
3	-	High Alarm.

Command available since protocol version 1.21.

7 - Requesting of delivery history entries

All volume values of the history are scaled to the reference temperature. To get unscaled values the reference temperature must be set to -19.9°C. This can only be done by the VISY-Setup system configuration.

VISY-Command supports five history entries for each tank:

Entry (*h h*) 1 = Latest entry ... Entry (*h h*) 5 = Oldest entry

Note: The history entries of the VISY-Command are volatile up to protocol version 1.17 (VISY-Command firmware V 4.01). They will be deleted on a power-on reset. Since protocol version 1.18 (VISY-Command firmware 4.02) history entries are non-volatile and extended history data are available (see chapter 14.3).

7.1 - Start of delivery

Command: Q H *t t* A *h h cr lf*
Reply: Q H *t t* A *h h* $ *Date* $ *Time* : *cs cs cs cr lf*

Comment: Date = *i i i i i i* = Y Y M M D D
Time = *i i i i i i* = H H M M S S
(same format like in chapter 3.2 - 3.5)

Command available since protocol version 1.10.

7.2 - End of delivery

Command: Q H *t t* B *h h cr lf*
Reply: Q H *t t* B *h h* $ *Date* $ *Time* : *cs cs cs cr lf*

Comment: Date = *i i i i i i* = Y Y M M D D
Time = *i i i i i i* = H H M M S S
(same format like in chapter 3.2 - 3.5)

Command available since protocol version 1.10.

7.3 - Delivered volume

Command: Q H *t t* C *h h cr lf*
Reply: Q H *t t* C *h h* $ *i i i i i i i i i* : *cs cs cs cr lf*

Comment: *i i i i i i i i i* = Delivered volume in litres, scaled to ref. Temperature, Resolution 0.1 litre.
Example: *i i i i i i i i i* = *sp sp sp sp* 4 5 6 1 4 = 4561.4 litres

Command available since protocol version 1.10.

7.4 - Volume before delivery

Command: Q H *t t* D *h h cr lf*
Reply: Q H *t t* D *h h* $ *i i i i i i i i i* : *cs cs cs cr lf*

Comment: *i i i i i i i i i* = Volume at start of delivery, scaled to ref. Temperature, Resolution 0.1 litre.
Example: *i i i i i i i i i* = *sp sp sp sp* 4 5 6 1 4 = 4561.4 litres

Command available since protocol version 1.10.

7.5 - Volume after delivery

Command: Q H *t t* E *h h cr lf*
Reply: Q H *t t* E *h h* $ *i i i i i i i i i* : *cs cs cs cr lf*

Comment: *i i i i i i i i i* = Volume at end of delivery, scaled to ref. Temperature, Resolution 0.1 litre.
Example: *i i i i i i i i i* = *sp sp sp sp* 4 5 6 1 4 = 4561.4 litres

Command available since protocol version 1.10.

7.6 - Type of delivery

Command: Q H *t t F h h cr lf*
Reply: Q H *t t F h h* $ *i* : *cs cs cs cr lf*

Comment: *i* = 0...1, type of delivery, currently used:
- 0 - Real delivery
- 1 - Virtual delivery

Real delivery: The complete delivery occurred under control of VISY-Command. VISY-Command was switched on during the complete delivery.

Virtual delivery: During the delivery VISY-Command was not on or only partly on. After VISY-Command was switched on an increased volume was detected. A delivery was calculated out of the difference between the increased volume and the last volume stored before VISY-Command was switched off.

Command available since protocol version 1.24.

8 - High resolution values

The high-resolution measuring values offer a resolution of 0.001mm, 0.001 litre and 0.001 °C. They can be used for external leak detection purposes by a superior application. High resolution values are available for level of product, level of water, temperature of product, current volume, reference volume.

8.1 - Product volume

Command: H V 3 *t t cr lf*
Reply: H V 3 *t t* $ *i i i i i i i i i i i* : *cs cs cs cr lf*

Comment: *i i i i i i i i i i i* = Volume in litres, Resolution 0.001 litre.
Example: *i i i i i i i i i i i* = sp sp sp sp 1 5 4 5 6 1 4 = 1545.614 litres.

Command available since protocol version 1.12.

8.2 - Ullage

Command: H V 4 *t t cr lf*
Reply: H V 4 *t t* $ *i i i i i i i i i i i* : *cs cs cs cr lf*

Comment: *i i i i i i i i i i i* = Ullage (spare volume) in litres, resolution 0.001 litre.
Example: *i i i i i i i i i i i* = *sp sp sp sp* 4 2 8 5 6 1 4 = 4285.614 litres

Command available since protocol version 1.12.

8.3 - Reference volume

Command: H V 5 *t t cr lf*
Reply: H V 5 *t t* $ *i i i i i i i i i i i* : *cs cs cs cr lf*

Comment: *i i i i i i i i i i i* = Reference volume (current volume scaled to reference temperature) in litres, Resolution 0.001 litre.
Example: *i i i i i i i i i i i* = *sp sp sp sp* 4 5 6 1 7 7 4 = 4561.774 litres

Command available since protocol version 1.12.

8.4 - Temperature of product

8.4.1 - Average temperature

Command: H T P *t t cr lf*
Reply: H T P *t t* $ *i i i i i i* : *cs cs cs cr lf*

Comment: *i i i i i i* = Average temperature of product, resolution 0.001°C, always signed, 0 is +0.
Example: *i i i i i i* = *sp* + 7 4 0 3 = 7.403°C
i i i i i i = *sp sp* - 1 8 2 = -0.182°C

Command available since protocol version 1.12.

8.4.2 - Number of discrete temperature sensors

Command: H T N *t t cr lf*
Reply: H T N *t t* $ *i* : *cs cs cs cr lf*

Comment: *i* = Number of discrete temperature sensors (VISY-Stick Advanced).
0 = No discrete sensors (VISY-Stick Basic or VISY-Stick Standard).

Command available since protocol version 1.15.

8.4.3 - Height of discrete temperature sensors

Command: H T *t t* H *n cr lf*
Reply: H T *t t* H *n* $ *i i i i* : *cs cs cs cr lf*

Comment: *n* = Index of discrete temperature sensor (1 to number of sensors, chapter 8.4.2)
i i i i = Height of discrete temperature sensor #*n*, resolution 1 mm. The height means the height of the sensor in the tank. It includes the fitting offset of the VISY-Stick Advanced. Non-available heights (e.g. VISY-Stick Basic / Standard) are transmitted as 0 millimetres.

Command available since protocol version 1.15.

Since protocol version 1.21 the VISY-X system supports also large storage tanks with a height of more than 10 meters. The old HT*tt*H command is limited to 9999 mm. There is a modified command available which supports levels of more than 10 meters:

Command: H T *t t* h *n cr lf*
Reply: H T *t t* h *n* $ *i i i i i* : *cs cs cs cr lf*

Comment: *n* = Index of discrete temperature sensor (1 to number of sensors, chapter 8.4.2)
i i i i i = Height of discrete temperature sensor #*n*, resolution 1 mm. The height means the height of the sensor in the tank. It includes the fitting offset of the VISY-Stick Advanced. Non-available heights (e.g. VISY-Stick Basic / Standard) are transmitted as 0 millimetres.

Command available since protocol version 1.21.

8.4.4 - Volume of discrete temperature sensors

Command: H T *t t* V *n cr lf*
Reply: H T *t t* V *n* $ *i i i i i i i i* : *cs cs cs cr lf*

Comment: *n* = Index of discrete temperature sensor (1 to number of sensors, chapter 8.4.2)
i i i i i i i i = Tank chart calculated volume corresponding to the height of the discrete temperature sensor #*n*, resolution 1 litre. Non-available volumes (e.g. no tank chart) will be transmitted as 0 litres.

Command available since protocol version 1.15.

8.4.5 - Temperature of discrete temperature sensors

Command: H T *t t* T *n cr lf*
Reply: H T *t t* T *n* $ *i i i i i i* : *cs cs cs cr lf*

Comment: *n* = Index of discrete temperature sensor (1 to number of sensors, chapter 8.4.2)
i i i i i i = Temperature of discrete sensor, resolution 0.001°C, always signed, 0 is +0.
Example: *i i i i i i* = *sp* + 7 4 0 3 = 7.403°C
i i i i i i = *sp sp* – 1 8 2 = -0.182°C
Non-available discrete temperatures (e.g. VISY-Stick Basic / Standard) will be transmitted as 0.000 °C.

Command available since protocol version 1.15.

8.5 - Level of product

Command: H L P *t t cr lf*
Reply: H L P *t t* $ *i i i i i i i* : *cs cs cs cr lf*

Comment: *i i i i i i i* = Level of product, resolution 0.001mm.
Example: *sp* 2 4 9 3 7 1 = 249.371mm

Command available since protocol version 1.12.

Since protocol version 1.21 the VISY-X system supports also large storage tanks with a height of more than 10 meters. The old HLP command is limited to 9999.999 mm. There is a modified command available which supports levels of more than 10 meters:

Command: H L p *t t cr lf*
Reply: H L p *t t* $ *i i i i i i i i* : *cs cs cs cr lf*

Comment: *i i i i i i i i* = Level of product, resolution 0.001mm.
Example: 1 2 4 5 3 6 8 2 = 12453.682mm

Command available since protocol version 1.21.

8.6 - Level of water

Command: H L W *t t cr lf*
Reply: H L W *t t* $ *i i i i i i i* : *cs cs cs cr lf*

Comment: *i i i i i i i* = Level of water, resolution 0.001mm
Example: *sp sp* 8 0 5 2 1 = 80.521mm

Command available since protocol version 1.12.

Since protocol version 1.21 the VISY-X system supports also large storage tanks with a height of more than 10 meters. The old HLW command is limited to 9999.999 mm. There is a modified command available which supports levels of more than 10 meters:

Command: H L w *t t cr lf*
Reply: H L w *t t* $ *i i i i i i i i* : *cs cs cs cr lf*

Comment: *i i i i i i i i* = Level of product, resolution 0.001mm.
Example: 1 0 0 8 2 4 2 1 = 10082.421mm

Command available since protocol version 1.21.

8.7 - Mass

Command: H M P *t t cr lf*
Reply: H M P *t t* $ *i i i i i i i i i i i i* : *cs cs cs cr lf*

Comment: *i i i i i i i i i i i* = Mass in kg, Resolution 0.001 kg.
Example: *sp sp sp* 2 6 1 4 9 4 7 2 = 26149.472 kg

Command available since protocol version 1.26.

9 - Wireless operation

If the VISY-Command is working in wireless mode, some additional measurement values become available. Histories are not supported in wireless mode (all history values = 0).

9.1 - Wireless operation mode

Command: Q W M *cr lf*
Reply: Q W M $ *i* : *cs cs cs cr lf*

Comment: *i* = 0…1
0 = Regular operation mode
1 = Wireless operation mode

Command available since protocol version 1.13.

9.2 - Battery voltage

Command: Q W B *t t cr lf*
Reply: Q W B *t t* $ *i* : *cs cs cs cr lf*

Comment: Battery voltage of VISY-Stick, *i* = 0...5
0 = unknown (e.g. after reset until first data received or in regular operation mode)
1...5 = Very low (battery replacement required) ... very high.

Command available since protocol version 1.13.

9.3 - Field strength

Command: Q W F *t t cr lf*
Reply: Q W F *t t* $ *i* : *cs cs cs cr lf*

Comment: Field strength of latest data reception, *i* = 0...5
0 = unknown (e.g. after reset until first data received or in regular operation mode)
1...5 = Very low ... very high.

Command available since protocol version 1.13.

9.4 - Age of tank data

Command: Q W A *t t cr lf*
Reply: Q W A *t t* $ *i i i i i i* : *cs cs cs cr lf*

Comment: Elapsed seconds since last data reception, *i* = -1...999999
-1 = unknown (e.g. after reset until first data received or in regular operation mode)
0...999999 = Elapsed time in seconds.

Remains on 999999 in case of exceeding range. The probe status (chapter 6.1) will be set to 11 (no probe response) by the VISY-Command if the age of data exceeds a limit of 1 - 99 hours which can be configured in the VISY-Command.

The age of data is primarily of interest in wireless operation mode, but it can be also used in regular operation mode to check whether the data are up to date. In regular operation mode, the age of data should be always below 10 seconds.

Command available since protocol version 1.13.

10 - Environmental sensor data

10.1 - Interstitial space

Command: Q E b *t t cr lf*
Reply: Q E b *t t* $ *a a a a a a* $ *st st* $ *l l l l l* $ *la* $ *pa* : *cs cs cs cr lf*

Comment:

a a a a a a	-	Age of data (latest sensor data transmission) in seconds.
st st	-	Status: 0 = Ok 1 = Internal probe error. 2 = Mounting error. 10 = Communication error between VISY-Command and probe. 11 = No response from probe. 12 = Incompatible probe data (communication and checksum ok but probe data does not match). 99 = Probe not configured.
l l l l l	-	Level of interstitial (brine) liquid. Resolution 0.1 mm.
la	-	0 = No level alarm. - 2 = Low level alarm. - 3 = High level alarm. - Currently no other level alarms defined.
pa	-	0 = No product alarm. - 1 = Product alarm (fuel detected in interstitial space).

Command available since protocol version 1.17.

10.2 - Manway sump

Command: Q E c *t t cr lf*
Reply: Q E c *t t* $ *a a a a a a* $ *st st* $ *l l l l l* $ *la* $ *pa* : *cs cs cs cr lf*

Comment:

a a a a a a	-	Age of data (latest sensor data transmission) in seconds.
st st	-	Status: 0 = Ok 1 = Internal probe error. 2 = Mounting error. 10 = Communication error between VISY-Command and probe. 11 = No response from probe. 12 = Incompatible probe data (communication and checksum ok but probe data does not match). 99 = Probe not configured.
l l l l l	-	Level of liquid. Resolution 0.1 mm.
la	-	0 = No level alarm. - 3 = High level alarm. - 4 = High High level alarm. - Currently no other level alarms defined.
pa	-	0 = No product alarm. - 1 = Product alarm (fuel detected in manway sump).

Command available since protocol version 1.17.

10.3 - Dispenser sump

Command: Q E d *t t cr lf*
Reply: Q E d *t t* $ *di di* $*a a a a a a* $ *st st* $ *l l l l l* $ *la* $ *pa* : *cs cs cs cr lf*

Comment:

di di - Optional dispenser ID, range 1-99, default: 0 = no ID assigned
a a a a a a - Age of data (latest sensor data transmission) in seconds.
st st - Status:
0 = Ok
1 = Internal probe error.
2 = Mounting error.
10 = Communication error between VISY-Command and probe.
11 = No response from probe.
12 = Incompatible probe data (communication and checksum ok but probe data does not match).
99 = Probe not configured.
l l l l l - Level of liquid. Resolution 0.1 mm.
la - 0 = No level alarm.
- 3 = High alarm.
- 4 = High High alarm.
- Currently no other level alarms defined.
pa - 0 = No product alarm.
- 1 = Product alarm (fuel detected in dispenser sump).

Command available since protocol version 1.17.

10.4 - Pressure sensor VPS

Command: Q E p t t cr lf
Reply: Q E p t t $ a a a a a a $ st st $ ti ti $ p p p p p p p p p $ t t t t $ pa : cs cs cs cr lf

Comment:

a a a a a a - Age of data (latest sensor data transmission) in seconds.
st st - Status:
0 = Ok
1 = Internal probe error.
10 = Communication error between VISY-Command and probe.
11 = No response from probe.
12 = Incompatible probe data (communication and checksum ok but probe data does not match).
99 = Probe not configured.
ti ti - Type indicator:
0 = unknown
1 = VPS-V
2 = VPS-L
3…99 = unknown (free for future types)
p p p p p p p p p - Pressure, Resolution 1 µbar (0.1 Pa), always signed, 0 is +0.
t t t t - Temperature, resolution 0.1 °C, always signed, 0 is +0
pa - Pressure alarm:
0 = No pressure alarm.
1 = Pressure alarm low low.
2 = Pressure alarm low.
3 = Pressure alarm high.
4 = Pressure alarm high high.

Command available since protocol version 1.26.

10.5 - Sludge sensor VISY-Sludge

Command: Q E s t t cr lf
Reply: Q E s t t $ a a a a a a $ st st $ m m m m m $ d d d d d d $ t t t t : cs cs cs cr lf

Comment:

a a a a a a	-	Age of data (latest sensor data transmission) in seconds.
st st	-	Status: 0 = Ok 1 = Internal probe error. 10 = Communication error between VISY-Command and probe. 11 = No response from probe. 12 = Incompatible probe data (communication and checksum ok but probe data does not match). 99 = Probe not configured.
mmmmm	-	maximum Distance, resolution 1 mm
d d d d d d	-	Distance, resolution 0.1 mm
t t t t	-	Temperature, resolution 0.1 °C, always signed, 0 is +0

Command available since protocol version 1.28.

Command: Q X s t t cr lf
Reply: Q X s t t $ a a a a a a $ st st $ m m m m m $ d d d d d d $ t t t t $ b $ f: cs cs cs cr lf

Comment:

a a a a a a	-	Age of data (latest sensor data transmission) in seconds.
st st	-	Status: 0 = Ok 1 = Internal probe error. 10 = Communication error between VISY-Command and probe. 11 = No response from probe. 12 = Incompatible probe data (communication and checksum ok but probe data does not match). 99 = Probe not configured.
mmmmm	-	maximum Distance, resolution 1 mm
d d d d d d	-	Distance, resolution 0.1 mm
t t t t	-	Temperature, resolution 0.1 °C, always signed, 0 is +0
b	-	Battery
f	-	Fieldstrength

Command available since protocol version 1.29.

11 - Pressure/vacuum leak detection/prevention

11.1 - Tank leak detection/prevention

11.1.1 - Tank leak detection/prevention alarm and functional flags

Command: Q E t a a *t t cr lf*
Reply: Q E t a a *t t* $ *al al al al al* : *cs cs cs cr lf*

Comment: *al al al al al* - 0 - 65535, bit orientated,
bit = 0 -> no alarm / inactive, bit = 1 -> alarm / active.

Bit 0 = System error. [A]
Bit 1 = P/V request (used for switching on/off P/V source). [F]
Bit 2 = P/V loss (P/V alarm threshold exceeded). [A]
Bit 3 = Liquid detected. [A]
Bit 4 = Product detected. [A]
Bit 5 = No P/V build up. [A]
Bit 6 = P/V source active. [F]
Bit 7 = Solenoid valve open. [F]
Bit 8 = Overpressure. [A]
Bit 9 ... 14 = Not yet defined.
Bit 15 = System/sensor available/configured if bit = 1.
System/sensor not available/configured if bit = 0. [F]

[A] = Alarm flag.
[F] = Functional flag.

Command available since protocol version 1.17.
Bit 4 - 8 supported since protocol version 1.22.

11.1.2 - Tank leak detection/prevention data

Command: Q E t a d *t t cr lf*
Reply: Q E t a d *t t* $ *a a a a a a* $ *st st* $ *cp cp cp cp cp* $ *ap ap ap ap ap* $ *ti ti*
$ *al al al al al* : *cs cs cs cr lf*

Comment:	*a a a a a a*	-	Age of data (latest sensor data transmission) in seconds.
	st st	-	Status: 0 = Ok 1 = Internal probe error. 10 = Communication error between VISY-Command and probe. 11 = No response from probe. 12 = Incompatible probe data (communication and checksum ok but probe data does not match). 99 = Probe not configured.
	cp cp cp cp cp	-	Current pressure, resolution 1 mbar, always signed, 0 is +0.
	ap ap ap ap ap	-	Alarm pressure, resolution 1 mbar, always signed, 0 is +0.
	ti ti	-	Tightness indicator, range 0 (totally tight) – 10 (totally untight).
	al al al al al	-	Alarm and functional flags (format described in chapter 11.1.1).

Command available since protocol version 1.23.

11.2 - Product line leak detection/prevention

11.2.1 - Product line leak detection/prevention alarm and functional flags

Command: Q E p l a *t t cr lf*
Reply: Q E p l a *t t* $ *al al al al al* : *cs cs cs cr lf*

Comment: *al al al al al* - 0 - 65535, bit orientated,
bit = 0 -> no alarm / inactive, bit = 1 -> alarm / active.

Bit 0 = System error. [A]
Bit 1 = P/V request (used for switching on/off P/V source). [F]
Bit 2 = P/V loss (P/V alarm threshold exceeded). [A]
Bit 3 = Liquid detected. [A]
Bit 4 = Product detected. [A]
Bit 5 = No P/V build up. [A]
Bit 6 = P/V source active. [F]
Bit 7 = Solenoid valve open. [F]
Bit 8 = Overpressure. [A]
Bit 9 ... 14 = Not yet defined.
Bit 15 = System/sensor available/configured if bit = 1.
System/sensor not available/configured if bit = 0. [F]

[A] = Alarm flag.
[F] = Functional flag.

Command available since protocol version 1.17.
Bit 4 - 8 supported since protocol version 1.22.

11.2.2 - Product line leak detection/prevention data

Command: Q E p l d *t t cr lf*
Reply: Q E p l d *t t* $ *a a a a a a* $ *st st* $ *cp cp cp cp cp* $ *ap ap ap ap ap*
$ *ti ti* $ *al al al al al* : *cs cs cs cr lf*

Comment:

a a a a a a	-	Age of data (latest sensor data transmission) in seconds.
st st	-	Status: 0 = Ok 1 = Internal probe error. 10 = Communication error between VISY-Command and probe. 11 = No response from probe. 12 = Incompatible probe data (communication and checksum ok but probe data does not match). 99 = Probe not configured.
cp cp cp cp cp	-	Current pressure, resolution 1 mbar, always signed, 0 is +0.
ap ap ap ap ap	-	Alarm pressure, resolution 1 mbar, always signed, 0 is +0.
ti ti	-	Tightness indicator, range 0 (totally tight) – 10 (totally untight).
al al al al al	-	Alarm and functional flags (format described in chapter 11.2.1).

Command available since protocol version 1.23.

11.3 - Filling line leak detection/prevention

11.3.1 - Filling line leak detection/prevention alarm and functional flags

Command: Q E f l a *t t cr lf*
Reply: Q E f l a *t t* $ *al al al al al* : *cs cs cs cr lf*

Comment: *al al al al al* - 0 - 65535, bit orientated,
bit = 0 -> no alarm / inactive, bit = 1 -> alarm / active.

Bit 0 = System error. [A]
Bit 1 = P/V request (used for switching on/off P/V source). [F]
Bit 2 = P/V loss (P/V alarm threshold exceeded). [A]
Bit 3 = Liquid detected. [A]
Bit 4 = Product detected. [A]
Bit 5 = No P/V build up. [A]
Bit 6 = P/V source active. [F]
Bit 7 = Solenoid valve open. [F]
Bit 8 = Overpressure. [A]
Bit 9 ... 14 = Not yet defined.
Bit 15 = System/sensor available/configured if bit = 1.
System/sensor not available/configured if bit = 0. [F]

[A] = Alarm flag.
[F] = Functional flag.

Command available since protocol version 1.17.
Bit 4 - 8 supported since protocol version 1.22.

11.3.2 - Filling line leak detection/prevention data

Command: Q E f l d *t t cr lf*
Reply: Q E f l d *t t* $ *a a a a a a* $ *st st* $ *cp cp cp cp cp* $ *ap ap ap ap ap* $ *ti ti*
$ *al al al al al* : *cs cs cs cr lf*

Comment:

a a a a a a	-	Age of data (latest sensor data transmission) in seconds.
st st	-	Status: 0 = Ok 1 = Internal probe error. 10 = Communication error between VISY-Command and probe. 11 = No response from probe. 12 = Incompatible probe data (communication and checksum ok but probe data does not match). 99 = Probe not configured.
cp cp cp cp cp	-	Current pressure, resolution 1 mbar, always signed, 0 is +0.
ap ap ap ap ap	-	Alarm pressure, resolution 1 mbar, always signed, 0 is +0.
ti ti	-	Tightness indicator, range 0 (totally tight) – 10 (totally untight).
al al al al al	-	Alarm and functional flags (format described in chapter 11.3.1).

Command available since protocol version 1.23.

11.4 - Manhole leak detection/prevention

11.4.1 - Manhole leak detection/prevention alarm and functional flags

Command: Q E m h a *t t cr lf*
Reply: Q E m h a *t t* $ *al al al al al* : *cs cs cs cr lf*

Comment: *al al al al al* - 0 - 65535, bit orientated,
bit = 0 -> no alarm / inactive, bit = 1 -> alarm / active.

Bit 0 = System error. [A]
Bit 1 = P/V request (used for switching on/off P/V source). [F]
Bit 2 = P/V loss (P/V alarm threshold exceeded). [A]
Bit 3 = Liquid detected. [A]
Bit 4 = Product detected. [A]
Bit 5 = No P/V build up. [A]
Bit 6 = P/V source active. [F]
Bit 7 = Solenoid valve open. [F]
Bit 8 = Overpressure. [A]
Bit 9 ... 14 = Not yet defined.
Bit 15 = System/sensor available/configured if bit = 1.
System/sensor not available/configured if bit = 0. [F]

[A] = Alarm flag.
[F] = Functional flag.

Command available since protocol version 1.17.
Bit 4 - 8 supported since protocol version 1.22.

11.4.2 - Manhole leak detection/prevention data

Command: Q E m h d *t t cr lf*
Reply: Q E m h d *t t* $ *a a a a a a* $ *st st* $ *cp cp cp cp cp* $ *ap ap ap ap ap* $ *ti ti*
$ *al al al al al* : *cs cs cs cr lf*

Comment:

a a a a a a	-	Age of data (latest sensor data transmission) in seconds.
st st	-	Status: 0 = Ok 1 = Internal probe error. 10 = Communication error between VISY-Command and probe. 11 = No response from probe. 12 = Incompatible probe data (communication and checksum ok but probe data does not match). 99 = Probe not configured.
cp cp cp cp cp	-	Current pressure, resolution 1 mbar, always signed, 0 is +0.
ap ap ap ap ap	-	Alarm pressure, resolution 1 mbar, always signed, 0 is +0.
ti ti	-	Tightness indicator, range 0 (totally tight) – 10 (totally untight).
al al al al al	-	Alarm and functional flags (format described in chapter 11.4.1).

Command available since protocol version 1.23.

12 - Oil separator data

12.1 - Oil separator alarm flags

Command: Q E o s a *t t cr lf*
Reply: Q E o s a *t t* $ *al al al al al* : *cs cs cs cr lf*

Comment: *al al al al al* - 0 - 65535, bit orientated, bit = 0 -> no alarm, bit = 1 -> alarm.
Bit 0 = System error.
Bit 1 = Overfill.
Bit 2 = Oil layer thickness.
Bit 3 ... 14 = Not yet defined.
Bit 15 = Alarms available/configured if bit = 1.
No alarms available/configured if bit = 0.

Command available since protocol version 1.17.

13 - Tank 0 addressing

Usually a tank is addressed by its number (*tt = 1...16*) in the transmitted command string. Since protocol version 1.14 (see chapter 3.1 - Version of protocol) it is possible to address tank 0 to get the data of all active tanks in a single reply string. 'Active' tank means each configured tank, even tanks in error status.

Basic format of a single tank reply string:

'Command' 'tank number' **$** 'data' **:** 'checksum'

Example: Q L P *sp* 1 $ 1 3 7 5 8 : 1 0 8 *cr lf*

In a tank 0 reply string the '*tank number $ tank data*' segments are separated by '**=**' (ASCII 61dec).

Basic format of a tank 0 reply string:

'Command' **=** 'tank number 1' **$** 'data' **=** 'tank number 2' **$** 'data' ... **=** 'tank number x' **$** 'data' **:** 'checksum'

Example - product level (command string Q L P *sp* 0 *cr lf*):

Q L P **=** *sp* 1 **$** 1 3 7 5 8 **=** *sp* 3 **$** 1 4 3 3 9 **=** *sp* 4 **$** 1 1 0 6 4 **=** 1 3 **$** *sp* 7 4 1 2 **:** *sp sp* 5 *cr lf*

Tanks 1, 3, 4 and 13 are active. Product levels are 1375.8mm, 1433.9 mm, 1106.4 mm, 741.2 mm.

Reply string in case of no tanks active: Q L P : *sp* 4 0 *cr lf*

Example - history, latest delivered volume (command string: Q H *sp* 0 C *sp* 1 *cr lf*):

Q H = *sp* 1 C *sp* 1 $ *sp sp sp sp* 7 5 2 1 8 = *sp* 3 C *sp* 1$ *sp sp sp sp* 4 9 3 3 6 : *sp* 8 3 *cr lf*

Tanks 1 and 3 are active. Latest delivery volume of tank 1 was 7521.8 litres. Latest delivery volume of tank 3 was 4933.6 litres.

Reply string in case of no tanks active: Q H : 2 1 1 *cr lf*

Example - height of discrete temperature sensors #1 (command string: H T *sp* 0 H 1 *cr lf*):

H T **=** *sp* 1 H 1 **$** *sp* 2 2 0 **=** *sp* 3 H 1 **$** *sp* 2 1 0 **=** *sp* 4 H 1 **$** *sp* 2 2 0 **:** *sp* 8 9

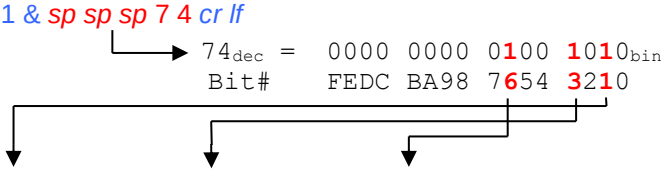
Tanks 1, 3 and 4 are active. Heights of discrete temperature sensors #1 are 220 mm, 210 mm and 220 mm.

14 - Extensible commands

The extensible commands allow to get several predetermined reply data in a common reply. Tank 0 addressing is not possible for the extensible commands. The desired reply data can be determined by a '&' character (ASCII 38_{dec}) followed by the command parameter *d d d d d* (Range 1 - 65535) which represents 16 bits. Each of these bits represents a specific tank parameter or measuring value. If the corresponding bit is set to 1 in the *d d d d d* parameter, the parameter / value will appear in the reply. In the reply the parameters / values are marked by a prefixed "& Bit number" ($0\text{-}F_{hex}$).

Example: command *t t* & *d d d d d cr lf*

X Y Z *sp* 1 & *sp sp sp* 7 4 *cr lf*



reply *t t* & 1 $ parameter & 3 $ parameter & 6 $ parameter : *cs cs cs cr lf*

14.1 - Extensible static tank parameters

Command: Q S X *t t & d d d d d cr lf*

d d d d d :

Bit 0 : Product designation (left adjusted 16 character string, see also chapter 4.1)(1)
Bit 1 : Capacity of tank (4-byte floating point, chapter 2.2)
Bit 2 : Max. permissible volume of tank (4-byte floating point, chapter 2.2)
Bit 3 : Reference temperature of tank (4-byte floating point, chapter 2.2)
Bit 4 : Type of VISY-Stick (formatted as described in chapter 4.5)
Bit 5 : Tank diameter (4-byte floating point, chapter 2.2)
Bit 6 ...
Bit F : Not yet defined. Requesting non-defined data (&6 - &F) will cause an error message.

Reply: Q S X *t t & x* $ parameter x & y $ parameter y ... & z $ parameter z : cs cs cs *cr lf*

Example: Q S X *sp* 3 & *sp sp sp* 4 2 *cr lf*

Q S X sp 3 & 1 $ 4 6 E A 6 0 0 0 & 3 $ 4 1 7 0 0 0 0 & 5 $ 4 5 1 C 4 0 0 0 : 2 3 4 *cr lf*

Reply consists of tank capacity 30000 litres, reference temperature +15.0 °C, tank diameter 2500 mm.

(1): String can contain bytes like ASCII control characters in case of a product designation written via a 16-bit character set (e.g. Chinese). Therefore, you should deal with the string as a 16-byte character array, possibly with ASCII control characters inside.

Command available since protocol version 1.18.

14.2 - Extensible ATG measurement values

Command: Q A X *t t & d d d d d cr lf*

d d d d d :

Bit 0 : Age of data (formatted as described in chapter 9.4)
Bit 1 : Probe status (formatted as described in chapter 6.1)
Bit 2 : Product volume. Unit: Litre (4-byte floating point, chapter 2.2)
Bit 3 : Ullage (4-byte floating point, chapter 2.2)
Bit 4 : Reference volume (4-byte floating point, chapter 2.2)
Bit 5 : Product temperature (4-byte floating point, chapter 2.2)
Bit 6 : Product level (4-byte floating point, chapter 2.2)
Bit 7 : Water level (4-byte floating point, chapter 2.2)
Bit 8 : Product alarm (formatted as described in chapter 6.2)
Bit 9 : Water alarm (formatted as described in chapter 6.3)
Bit A : Tank status (formatted as described in chapter 6.4)
Bit B : Battery voltage, wireless (formatted as described in chapter 9.2)
Bit C : Field strength, wireless (formatted as described in chapter 9.3)
Bit D : Water volume (4-byte floating point, chapter 2.2)
Bit E : Mass (4-byte floating point, chapter 2.2)
Bit F : Not yet defined. Requesting non-defined data (&F) will cause an error message.

Reply: Q A X *t t & x* $ parameter x & y $ parameter y ... & z $ parameter z : cs cs cs *cr lf*

Example: Q A X *sp* 7 *& sp sp* 3 9 0 *cr lf*

Q S X sp 7 & 1 $ *sp* 0 & 2 $ 4 6 3 2 F D E D & 7 $ 4 2 7 7 5 2 3 E & 8 $ 0 : 1 4 5 *cr lf*

Reply consists of probe status 0, product volume 11455.481 litres, water level 61.830 mm, no product alarms.

Command available since protocol version 1.18 with bit 0 to D supported. Bit E supported since protocol version 1.26.

14.3 - Extensible delivery history

The reply to the extensible history command is a little different from the other extensible replies since it consists of records instead of single values. At the current protocol version 1.18 a history of the latest 10 (command parameter *h h* = 1-10) deliveries is available. Tank 0 addressing is not available for this command.

The desired reply data are determined by the command parameter *d d d d*. It is a numerical unsigned integer value (16 bit) in the range of 1 to 65535. Each of the 16 Bits represents a specific record of history data:

Bit 0 : Delivery ID
Bit 1 : Start date / time, stop date / time
Bit 2 : Start volume, stop volume, delivered volume
Bit 3 : Start volume tc (temperature compensated), stop volume tc, delivered volume tc
Bit 4 : Start temperature, stop temperature, temperature change
Bit 5 : Start product level, stop product level, product level change
Bit 6 : Start water level, stop water level, water level change
Bit 7 : Start reference sump density, stop reference sump density, change in reference sump density
Bit 8 : Start reference product density, stop reference product density, change in reference product density
Bit 9 : Type of delivery
Bit A : Start mass, stop mass, delivered mass
Bit B : Start product density, stop product density, change in product density
Bit C ... F: Not yet defined. Requesting non-defined records (&B - &F) will cause an error message.

Command: Q H *t t* X *h h* & *d d d d cr lf* bit .....6.....3..1..
Example: Q H *sp* 3 X *sp* 1 & *sp sp sp* 7 4 *cr lf* (74_{dec} = 0000 0000 0100 1010_{bin})
Requests tank 3 latest delivery (*h h* = 1) records: Date/Time, volume tc, water level.

Reply:

The reply will consist of command, tank number (*t t*) and history number *(h h)* followed by the desired history records which are separated by & + bit number$_{hex}$ (0-F):

Q H *t t* X *h h* & *b* record 1 & *b* record 2 ... & b record n : *cs cs cs cr lf*

Overview of records:

& 0 : $ *i i i i i*. Delivery ID. Range 1 - 65535. Incremented by 1 each delivery. Switches back to 1 after 65535. 0 = No delivery available.

& 1 : $ *i i i i i i* $ *i i i i i i* $ *i i i i i i* $ *i i i i i i*. Start date, start time, stop date, stop time formatted as described in chapter 3.2/3.4.

& 2 : $ *f f f f f f f f* $ *f f f f f f f f* $ *f f f f f f f f*. Start volume, stop volume, delivered volume. Unit: Litre. Floating point format as described in chapter 2.2.

& 3 : $ *f f f f f f f f* $ *f f f f f f f f* $ *f f f f f f f f*. Temperature compensated start volume, stop volume, delivered volume. Unit: Litre. Floating point format as described in chapter 2.2.

& 4 : $ *f f f f f f f f* $ *f f f f f f f f* $ *f f f f f f f f*. Start temperature, stop temperature, change in temperature. Unit: Degree centigrade. Floating point format as described in chapter 2.2.

& 5 : $ *f f f f f f f f* $ *f f f f f f f f* $ *f f f f f f f f*. Start product level, stop product level, change in product level. Unit: Millimetre. Floating point format as described in chapter 2.2.

& 6 : $ *f f f f f f f f* $ *f f f f f f f f* $ *f f f f f f f f*. Start water level, stop water level, change in water level. Unit: Millimetre. Floating point format as described in chapter 2.2.

& 7 : $ *f f f f f f f f* $ *f f f f f f f f* $ *f f f f f f f f*. Temperature compensated start sump density, stop sump density, change in sump density. Unit: g/l. Floating point format as described in chapter 2.2.

& 8 : $ *f f f f f f f f* $ *f f f f f f f f* $ *f f f f f f f f*. Temperature compensated start product density, stop product density, change in product density. Unit: g/l. Floating point format as described in chapter 2.2.

& 9 : $ i. Type of delivery, 0 – Real delivery, 1 – Virtual delivery, see chapter 7.6 for a complete description.

& A : $ *f f f f f f f f* $ *f f f f f f f f* $ *f f f f f f f f*. Start mass, stop mass, delivered mass. Unit: kg.

Floating point format as described in chapter 2.2.

& B : $ *f f f f f f f f* $ *f f f f f f f f* $ *f f f f f f f f*. None temperature compensated start product density, stop product density, change in product density. Unit: g/l. Floating point format as described in chapter 2.2.

& C ...& F: Not yet defined. Requesting non-defined records (&B - &F) will cause an error message.

Command available since protocol version 1.18 with bit 0 - 6 supported. Bit 7, 8 supported since version 1.21. Bit 9 supported since version 1.24. Bit A supported since version 1.26. Bit B supported since version 1.32.

14.4 - Extensible density measurement values

Command: Q B X *t t & d d d d d cr lf*

d d d d d :

Bit 0 : Age of data (formatted as described in chapter 9.4)
Bit 1 : Probe status (formatted as described in chapter 6.1)
Bit 2 : Measured sump density. Unit: g/l (4-byte floating point, chapter 2.2)
Bit 3 : Reference sump density. Unit: g/l (4-byte floating point, chapter 2.2)
Bit 4 : Sump density alarm (formatted as described in chapter 6.5)
Bit 5 : Measured product density. Unit: g/l (4-byte floating point, chapter 2.2)
Bit 6 : Reference product density. Unit: g/l (4-byte floating point, chapter 2.2)
Bit 7 : Product density alarm (formatted as described in chapter 6.6)
Bit 8 : Density measurement temperature. Unit: Degree centigrade (4-byte floating point, chapter 2.2)
Bit 9 : ...
Bit F : Not yet defined. Requesting non-defined data (&9 - &F) will cause an error message.

Reply: Q B X *t t & x* $ parameter x & y $ parameter y ... & z $ parameter z : cs cs cs *cr lf*

Command available since protocol version 1.21 with bit 0-8 supported.

15 - Miscellaneous commands

15.1 - Status of input device

Command: Q I S *t t cr lf*
Reply: Q I S *t t* $ *i i* : *cs cs cs cr lf*

Comment: *t t* = 1 - 8, number of input device

i i = 0 - 99, currently used:
- 0 - Input device ok.
- 1 - Input device reports internal error.
- 10 - Communication error between VISY-Command and input device.
- 11 - No response from input device.
- 99 - Input device not configured / not existing.

The VISY-X system can be equipped with input devices (VISY-Input ...). The inputs are internally linked to alarms (e.g. oil separator, see chapter 12). With this command, it can be checked whether input devices are connected and whether they are working well.

Command available since protocol version 1.18

15.2 - Status of output device

Command: Q O S *t t cr lf*
Reply: Q O S *t t* $ *i i* : *cs cs cs cr lf*

Comment: *t t* = 1 - 8, number of output device

i i = 0 - 99, currently used:
- 0 - Output device ok.
- 1 - Output device reports internal error.
- 10 - Communication error between VISY-Command and output device.
- 11 - No response from output device.
- 99 - Output device not configured / not existing.

The VISY-X system can be equipped with output devices (VISY-Output ...). The outputs are internally linked to alarm events. With this command, it can be checked whether output devices are connected and whether they are working well.

Command available since protocol version 1.18

15.3 - Status of input device inputs

Command: Q I I *t t cr lf*
Reply: Q I I *t t* $ *i i i i i* : *cs cs cs cr lf*

Comment: *t t* = 1 - 8, number of input device

i i i i i = 0 - 65535, status of inputs, bit orientated
Bit 0: Status of input 1
.
Bit 7: Status of input 8
Bit 8...15: Not yet defined, returned as 0

bit = 0 -> input deactivated (contact open or voltage level low)
bit = 1 -> input activated (contact closed or voltage level high)

NOTE: When the status of the input device is not equal to 0 the status of all inputs will be returned as 0 (deactivated).

Command available since protocol version 1.27

15.4 - ATG tank inventory data

Command: Q T I *t t cr lf*

Reply: Q T I *t t* $ *C C Y Y M M D D* $ *H H M M S S* $ *f f f f f f f f* $ *f f f f f f f f* $ *f f f f f f f f*
$ *f f f f f f f f* $ *f f f f f f f f* $ *f f f f f f f f* $ *f f f f f f f f* $ *f f f f f f f f* $ *f f f f f f f f* $ *f f f f f f f f*
$ *f f f f f f f f* $ *f f f f f f f f* $ *f f f f f f f f* $ *f f f f f f f f* : *cs cs cs cr lf*

Comments:

The tank inventory data starts with a time stamp made up of the following values:

1. **Date of VISY-Command system clock (C C Y Y M M D D)**
   Format: century (CC, 2 digits), year (YY, 2 digits), month (MM, 2 digits), day (DD, 2 digits)
   Example: 2 0 1 6 0 2 2 2 = February, 22rd, 2016

2. **Time of VISY-Command system clock (H H M M S S)**
   Format: hour (HH, 2 digits), minute (MM, 2 digits), seconds (SS, 2 digits)
   Examples: sp sp sp 2 0 3 = 00:02:03, 2 2 0 7 1 5 = 22:07:15

The time stamp is followed by the measurement values of the tank inventory data formatted in 4-byte floating point format (see chapter 2.2).

The measurement values are arranged in the following order:

3. **Gross Observed Volume (G.O.V)**
   The Gross Observed Volume is the Total Observed Volume at current temperature corrected for the volume of free water at the bottom of the tank.
   Unit: litre

4. **Gross Standard Volume (G.S.V)**
   The Gross Standard Volume is the Gross Observed Volume corrected to the reference temperature.
   Unit: litre

5. **Ullage**
   The Ullage is the empty volume up to the maximum permissible volume (e.g. 97% of capacity) that the tank can safely hold taking temperature effects into account.
   Unit: litre

6. **Liquid level**
   Unit: mm

7. **Water level**
   Unit: mm

8. **Average product temperature**
   Unit: °C

9. **Temperature of discrete temperature sensor 1**
   This is the temperature sensor with the lowest position (closest to the bottom of the tank).
   If no discrete temperature sensor exists, the returned value will be 0.
   Unit: °C

10. **Temperature of discrete temperature sensor 2**
    If no discrete temperature sensor exists, the returned value will be 0.
    Unit: °C

11. **Temperature of discrete temperature sensor 3**
    If no discrete temperature sensor exists, the returned value will be 0.
    Unit: °C

12. **Temperature of discrete temperature sensor 4**
    If no discrete temperature sensor exists, the returned value will be 0.
    Unit: °C

13. **Temperature of discrete temperature sensor 5**
    This is the temperature sensor with the highest position (closest to the top of the tank).
    If no discrete temperature sensor exists, the returned value will be 0.
    Unit: °C

14. **Water volume**
    Unit: litre

15. **Measured product density**
    The measured product density is the density of the product measured at current temperature.
    If no density measurement module is installed on the probe the returned value will be 0.
    Unit: g/l

16. **Reference product density**
    The reference product density is the measured product density corrected to the reference temperature.
    If no density measurement module is installed on the probe the returned value will be 0.
    Unit: g/l

Notes:

The command H T N t t cr lf - number of discrete temperature sensors - can be used to check how many discrete temperature sensors are existing in the probe of the tank (see chapter 8.4.2).

The command Q S F & d d d d d cr lf - general system functionality - can be used to check if the probe of the tank is equipped with a configured product density measurement module (see chapter 3.9).

This command does not support tank 0 addressing.

Command available since protocol version 1.28.

16 - Error message

If VISY-Command receives a faulty command, the message
E R R O R *cr lf*
will be replied.