

# Quick Start Guide

## NMEA0183 Listener

SER0058 - NMEA0183 Listener for Beijer PLC systems

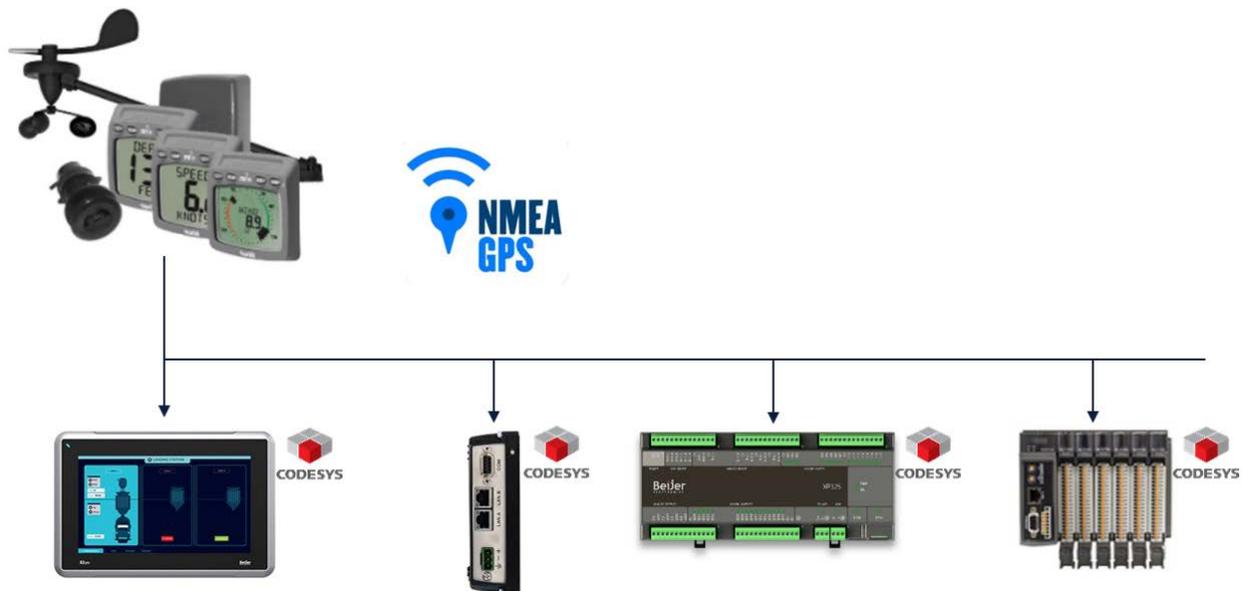


# 1. Function and area of use

This document explains how to install and setup the NMEA0183Listener smartobject in BCS Tools/Codesys using control systems from Beijer Electronics.

This guide requires the following steps to be completed:

- Set up the actual hardware.
  - X2 marine SC, X2 control, X2 extreme SC or BoX2 SC variants.
  - Nexto Xpress (XP-CPU) or Nexto Modular (NX-CPU)
- Download the smartobject and install into BCS Tools.
- Verify the setup using a testproject.



## 2. About this startup document

This quick start guide should not be considered as a complete manual. It is an aid to be able to start using our smartobject for the X2 control series and the Nexto plc.

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Use the following hardware, software, drivers and utilities in order to obtain a stable application:

### Software

- BCS Tools 3.33 or later <https://smartstore.beijerelectronics.com>

### Hardware

- X2 marine SC (X2 control, X2 extreme SC and Box2 SC can also be used).
- Nexto Xpress (XP) or Nexto modular (NX).
- Marine equipment with NMEA0183 protocol or a simulator.

### For further information refer to

- [Beijer Electronics knowledge database, HelpOnline](#)

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### 3. Table of Contents

1. Function and area of use.....	2
2. About this startup document.....	3
3. Table of Contents.....	4
4. The NMEA 0183 standard .....	5
4.1 Data link layer .....	5
4.2 Message structure .....	5
5. Prepare the hardware .....	7
5.1 X2 Marine SC / X2 control / X2 extreme SC / Box2 SC .....	7
5.2 BCS Nexto Compact (XP).....	8
5.3 BCS Nexto modular (NX).....	9
6. Configure the software .....	10
6.1 Add NMEA0183Listener.compiled-library to your project .....	10
6.2 Open testproject in BCS Tools.....	11
7. Description of the library .....	13
8. Supported NMEA messages.....	14
8.1 DBT .....	14
8.2 GGA.....	14
8.3 GLL.....	15
8.4 HDT .....	15
8.5 MWV .....	15
8.6 RMC .....	16
8.7 ROT .....	16
8.8 RSA.....	16
8.9 VHW.....	17
9. About Beijer Electronics .....	18
9.1 Contact us .....	18

## 4. The NMEA 0183 standard

NMEA 0183 is a combined electrical and data specification for communication between marine electronics such as echo sounder, sonars, anemometer, gyrocompass, autopilot, GPS receivers and many other types of instruments. It has been defined by, and is controlled by, the National Marine Electronics Association.

The electrical standard that is used is RS422, although most hardware with NMEA-0183 outputs are also able to drive a single RS232 port.

The NMEA 0183 standard uses a simple ASCII, serial communications protocol that defines how data are transmitted in a "sentence" from one "talker" to multiple "listeners" at a time.

### 4.1 Data link layer

The Serial configuration is 4800, N, 8, 1 with no handshake. The recommended interconnect wiring is a shielded twisted pair, with the shield grounded only at the talker. The standard does not specify the use of a particular connector.

**i** Note: The 0183-HS standard (HS = high speed) uses a 3-wire interface and a baud rate of 38400. This type of interface is not discussed here.

### 4.2 Message structure

All data is transmitted in the form of sentences. Data are printable ASCII characters (16#20 – 16#7E). Each sentence starts with a "\$" sign and ends with <CR><LF>.

The following characters are reserved:

ASCII	HEX	
<CR>	16#0D	Carrige return
<LF>	16#0A	Line feed, end delimiter
!	16#21	Start of encapsulation sentence delimiter
\$	16#24	Start delimiter
*	16#2A	Checksum delimiter
,	16#2C	Field delimiter
\	16#5C	TAG block delimiter
^	16#5E	Code delimiter for HEX representation
~	16#7E	Reserved

There are three basic kinds of sentences: talker sentences, proprietary sentences and query sentences. It is the talker sentences that are the scope of the NMEA0183Listener smartobject.

An example of a talker sentence is:

### GLL Geographic Position – Latitude/Longitude

1	2 3	4 5	6 7

\$--GLL,llll.ll,a,yyyyy.yy,a,hhmmss.ss,A\*hh<cr><lf>

- 1 - Latitude
- 2 - N or S (North or South)
- 3 - Longitude
- 4 - E or W (East or West)
- 5 - Time (UTC)
- 6 - Status A - Data Valid, V - Data Invalid
- 7 - Checksum

A sentence may contain up to 80 characters plus "\$" and CR/LF. If data for a field is not available, the field is omitted, but the delimiting commas are still sent, with no space between them. The checksum field consists of a "\*" and two hex digits representing the exclusive OR of all characters between, but not including, the "\$" and "\*".



Checksum is mandatory for the NMEA0182Listener smartobject.

## 5. Prepare the hardware

In this section we describe the hardware, connections and necessary configuration for the different systems we can run the solution on.

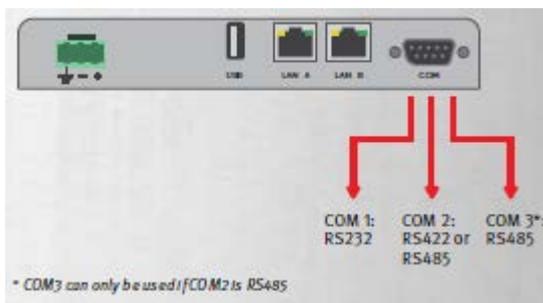
### 5.1 X2 Marine SC / X2 control / X2 extreme SC / Box2 SC

A X2 panel or Box2 from Beijer Electronics with Codesys PLC runtime included is delivered with the needed serial ports for the smartobject to run. The needed connections is 24Vdc power and a serial line for the NMEA0183 signal. RS422/RS485 is normally used, but RS232 can also be used in a point-point connection if the NMEA equipment permits. A network connection to one of the LAN ports is necessary for commissioning and program transfer.



#### 5.1.1 Connect serial port

COM1 (RS232) or COM2(RS422/RS485) or COM3 (RS485) can be used to receive the NMEA 0183 signal. The serial parameters are normally 4800, N, 8, 1.



X2 Pro X2 Control X2 Motion X2 Marine

Female DB-9	Pin	COM1 signal	COM2 signal	COM3 signal
	1	-	RS422 TX+/RS485 TX+/RX+	-
	2	RS232 RX	-	-
	3	RS232 TX	-	-
	4	-	RS422 RX+	RS485 TX+/RX+
	5	GND	GND	GND
	6	-	RS422 TX- / RS485 TX-/RX-	-
	7	RS232 RTS	-	-
	8	RS232 CTS	-	-
	9	-	RS422 RX-	RS485 TX-/RX-



Normally the NMEA 0183 signal is RS422, but it is also possible use RS485 since it is the same electrical levels and we use only 1 pair (RX).

## 5.2 BCS Nexto Compact (XP)

A compact PLC in the BCS XP-series with Codesys PLC runtime included is delivered with one serial RS485 port that can be used for NMEA 0183 purpose. The needed connections is 24Vdc power and a serial line for the NMEA0183 signal. A network connection to the LAN port is also necessary for commissioning and program transfer.



### 5.2.1 Connect serial port

COM1 (RS485) is used to receive the NMEA 0183 signal. The serial parameters are normally 4800, N, 8, 1.



Normally the NMEA 0183 signal is RS422, but in this case we can use RS485 also since it is the same electrical levels and we use only 1 pair (RX).

## 5.3 BCS Nexto modular (NX)

A modular PLC in the BCS XP-series with Codesys PLC runtime included is delivered with one, two or three serial ports (depending on the CPU) that can be used for NMEA 0183 purpose. The needed connections are 24Vdc power and a serial line for the NMEA0183 signal. RS422/RS485 is normally used, but RS232 can also be used in a point-point connection if the NMEA equipment permits. A network connection to one of the LAN ports is also necessary for commissioning and program transfer.



COM2 COM1

### Nexto Series

Type	Code	Communication Ports
CPUs	BCS-NX3003 *	1x Serial (RS-485) 1x Ethernet TCP/IP
	BCS-NX3004	1x Serial (RS-485/RS-422) 1x Ethernet TCP/IP
	BCS-NX3005	1x Serial (RS-485/RS-422) 1x Ethernet TCP/IP
	BCS-NX3010	2x Serial (RS-232 e RS-485/RS-422) 1x Ethernet TCP/IP
	BCS-NX3020	2x Serial (RS-232 e RS-485/RS-422) 2x Ethernet TCP/IP
	BCS-NX3030	2x Serial (RS-232 e RS-485/RS-422) 2x Ethernet TCP/IP

### 5.3.1 Connect serial port

COM1 or COM2 is used to receive the NMEA 0183 signal depending on the CPU type.

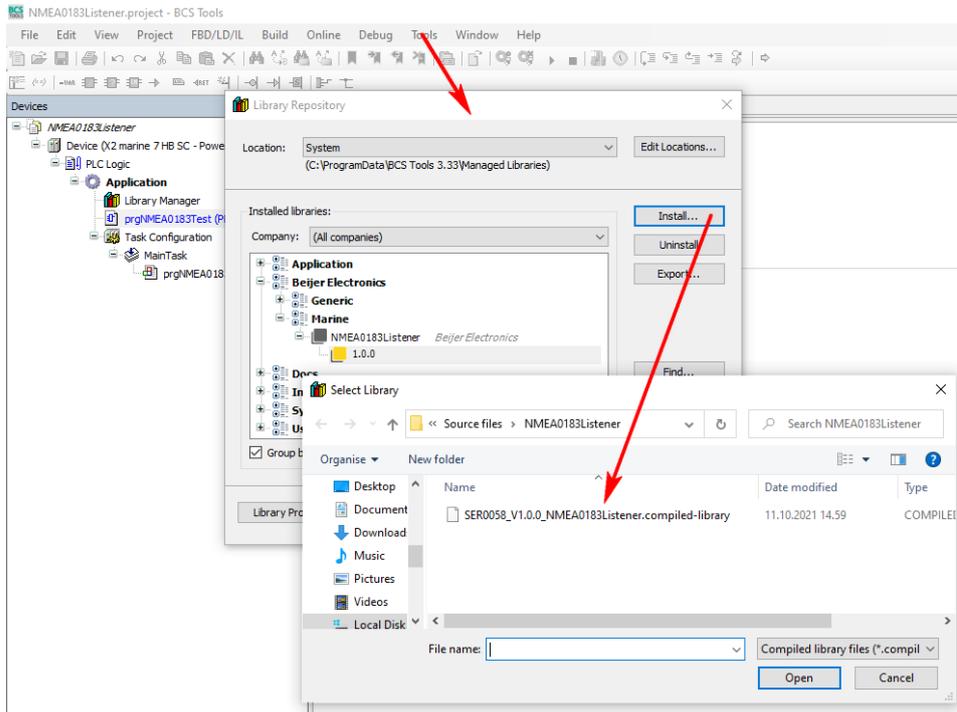


Normally the NMEA 0183 signal is RS422, but it is also possible to use RS485 since it is the same electrical levels and we use only 1 pair (RX).

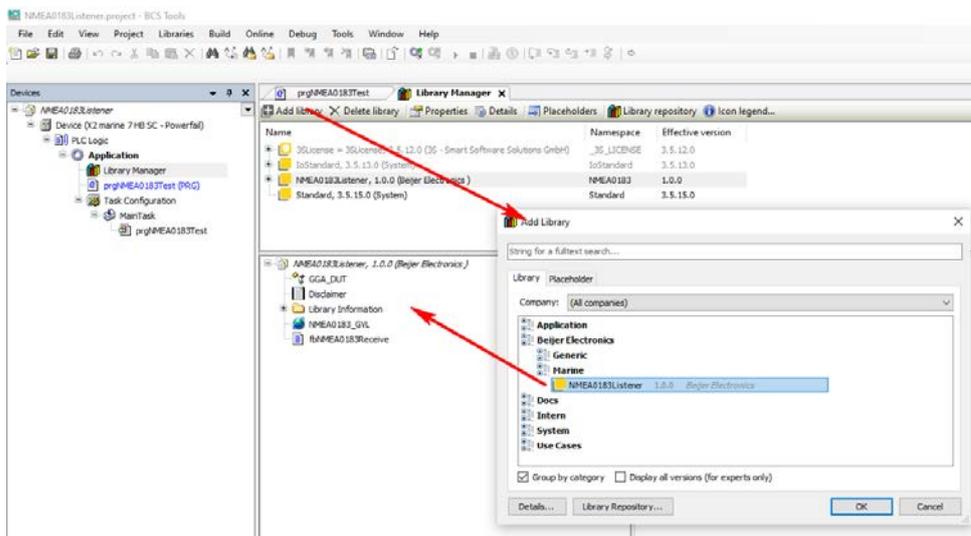
## 6. Configure the software

### 6.1 Add NMEA0183Listener.compiled-library to your project

Start BCS Tools and select Library Repository under the Tools menu. Install the compiled library ‘SER0058\_Vxxx\_NMEA0183ListenerXXXX.compiled-library’. There is one library for the X2-series and one for the Nexto-Series.



Open Library Manager in your project and add ‘NMEA0183Listener’.

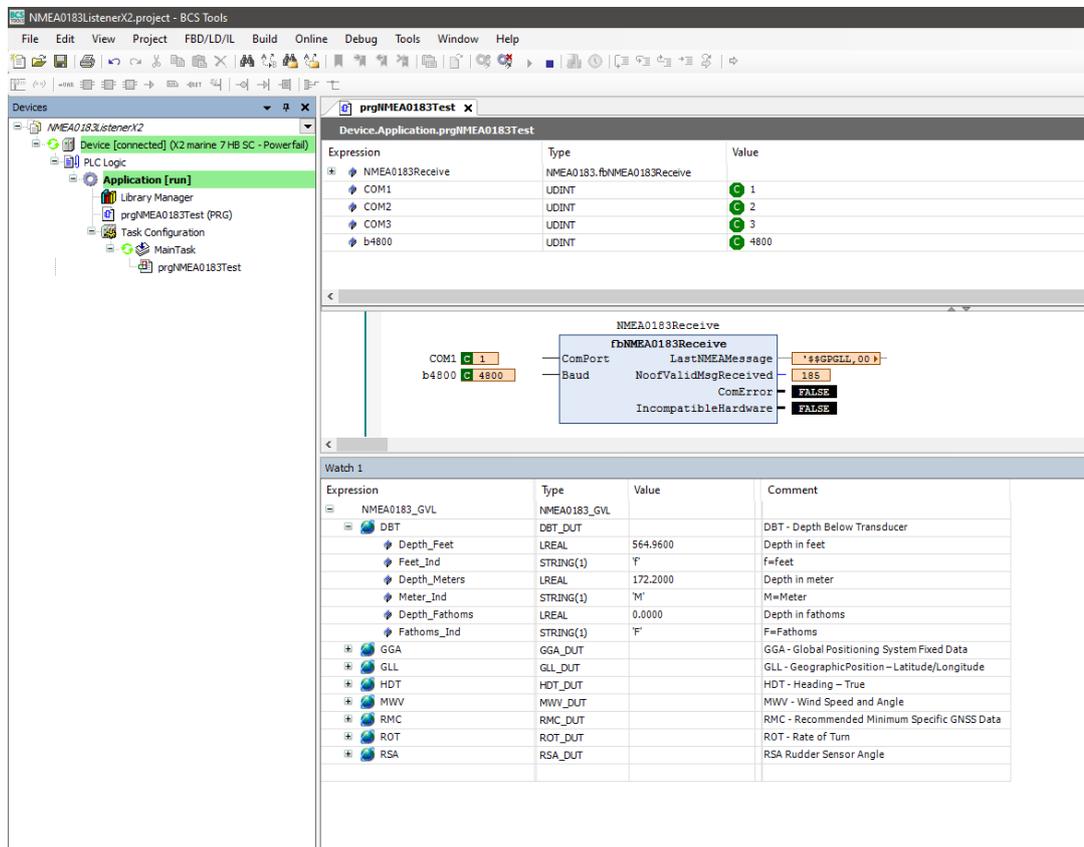


## 6.2 Open testproject in BCS Tools

In addition to the library file, two testproject is included to show the functionality. It is called NMEA0183ListenerX2.projectarchive for the X2-series and NMEA0183ListenerNexto.projectarchive for the Nexto-series. The functionality is the same.

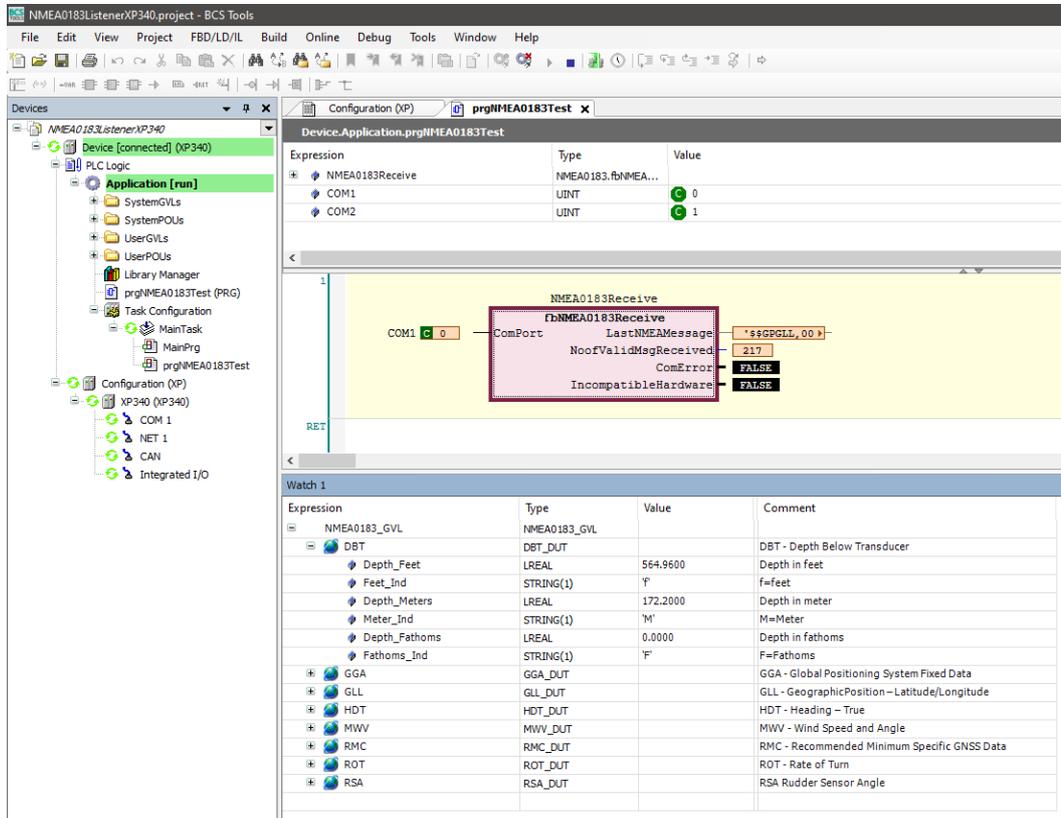
### 6.2.1 NMEA0183ListenerX2

The NMEA0183Receive function block is added in the project. In X2 the serial parameters are configured in the function block. It is possible to change the baudrate. The rest are fixed by the standard.

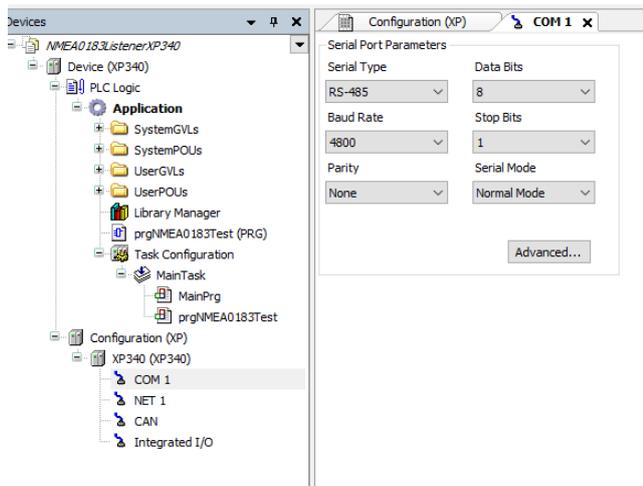


### 6.2.2 NMEA0183ListenerNexto

The NMEA0183Receive function block is added in the project. Note that the port numbers start with '0' in Nexto.



For the Nexto PLS's, the serial parameters are configured in device list.



## 7. Description of the library

The library consist of the 'fbNMEA0183Receive' function block, a struct for each message type and a global variable list with the decoded messages. See chapter 8 for details. The X2 version of the library have an additional setting for the baudrate.

The screenshot shows the Library Manager interface. The top pane lists installed libraries:

Name	Namespace	Effective version
3SLicense = 3SLicense, 3.5.12.0 (3S - Smart Software Solutions GmbH)	_3S_LICENSE	3.5.12.0
IoStandard, 3.5.13.0 (System)	IoStandard	3.5.13.0
<b>NMEA0183ListenerX2, 1.0.0 (Beijer Electronics)</b>	<b>NMEA0183</b>	<b>1.0.0</b>
Standard = Standard, 3.5.13.0 (System)	Standard	3.5.13.0

The bottom pane shows the documentation for the **FUNCTION\_BLOCK fbNMEA0183Receive**:

Name	Type	Inherited from	Address	Initial	Comment
<b>ComPort</b>	UDINT				Comport to use
<b>Baud</b>	UDINT				Baudrate, normally 4800. Nexto is set in configuration
<b>LastNMEAMessage</b>	STRING(255)				Output the last NMEA message received
<b>NoofValidMsgReceived</b>	WORD				Number of valid messages received
<b>ComError</b>	BOOL				Problem accessing comport
<b>IncompatibleHardware</b>	BOOL				Incompatible hardware is found

The screenshot shows the 'Inputs/Outputs' documentation for the **VAR\_GLOBAL NMEA0183\_GVL**:

Name	Type	Inherited from	Address	Initial	Comment
DBT	DBT_DUT				DBT - Depth Below Transducer
GGA	GGA_DUT				GGA - Global Positioning System Fixed Data
GLL	GLL_DUT				GLL - Geographic Position – Latitude/Longitude
HDT	HDT_DUT				HDT - Heading – True
MWV	MWV_DUT				MWV - Wind Speed and Angle
RMC	RMC_DUT				RMC - Recommended Minimum Specific GNSS Data
ROT	ROT_DUT				ROT - Rate of Turn
RSA	RSA_DUT				RSA Rudder Sensor Angle
VHW	VHW_DUT				VHW - Water Speed and Heading

## 8. Supported NMEA messages

The following NMEA messages is supported in this version.

### 8.1 DBT

DBT - Depth Below Transducer

Expression	Type	Value	Comment
 NMEA0183_GVL.DBT	DBT_DUT		DBT - Depth Below Transducer
 Depth_Feet	LREAL	564.9600	Depth in feet
 Feet_Ind	STRING(1)	'F'	f=feet
 Depth_Meters	LREAL	172.2000	Depth in meter
 Meter_Ind	STRING(1)	'M'	M=Meter
 Depth_Fathoms	LREAL	0.0000	Depth in fathoms
 Fathoms_Ind	STRING(1)	'F'	F=Fathoms

### 8.2 GGA

Global Positioning System Fix Data. Time, Position and fix related data for a GPS receiver.

Expression	Type	Value	Comment
 NMEA0183_GVL.GGA	GGA_DUT		GGA - Global Positioning System Fixed Data
 UTC_Hour	WORD	11	UTCHHmss.sss
 UTC_Minute	WORD	41	UTChhMMss.sss
 UTC_Second	REAL	38.0000	UTC hhmmSS.SSS
 Latitude_Degree	WORD	0	Latitude DDmm.mmmm
 Latitude_Minute	LREAL	1.2559	Latitude ddMM.MMMMM
 Latitude_NS	STRING(1)	'N'	N=North or S=South
 Longitude_Degree	WORD	0	Longitude DDDmm.mmmm
 Longitude_Minute	LREAL	0.0177	Longitude dddMM.MMMMM
 Longitude_EW	STRING(1)	'E'	E=East or W=West
 GPS_Quality	WORD	2	0=Fix not available, 1=G...SPS Mode, 2=Differenti...
 SatellitesUsed	WORD	8	Number of satellites used (0-12)
 HDOP	REAL	1.4000	Horizontal dilution of precision
 MSL_Altitude	REAL	0.0000	Mean Sea Level Altitude
 MSL_Units	STRING(1)	'M'	Mean Sea Level Units (Meters 'M')
 Geoid_Separation	REAL	0.0000	Geoid Separation
 Geoid_Units	STRING(1)	'M'	Geoid Separation Units (Meters 'M')
 AgeOfGPSData	REAL	5.0000	Age of differential GPS data, empty if not used
 DiffRefStationID	WORD	100	Differential reference station ID, 0000-1023

## 8.3 GLL

Geographic Position – Latitude/Longitude.

Expression	Type	Value	Comment
NMEA0183_GVL.GLL	GLL_DUT		GLL - GeographicPosition – Latitude/Longitude
Latitude_Degree	WORD	0	Latitude DDmm.mmmm
Latitude_Minute	LREAL	0.1499	Latitude ddMM.MMMM
Latitude_NS	STRING(1)	'N'	N=North or S=South
Longitude_Degree	WORD	0	Longitude DDDmm.mmmm
Longitude_Minute	LREAL	0.0039	Longitude dddMM.MMMMM
Longitude_EW	STRING(1)	'E'	E=East or W=West
UTC_Hour	WORD	13	UTCHHmss.sss
UTC_Minute	WORD	43	UTChhMMss.sss
UTC_Second	REAL	6.0000	UTC hhmmSS.SSS
Status	STRING(1)	'A'	A - Data Valid, V - Data Invalid
Mode	STRING(1)	'D'	A=Autonomous, D=DGP...R (Only present in N...

## 8.4 HDT

HDT - Heading – True.

Expression	Type	Value	Comment
NMEA0183_GVL.HDT	HDT_DUT		HDT - Heading – True
Heading_Degrees	LREAL	137.4000	Heading Degrees
Heading_True	STRING(1)	'T'	T=True

## 8.5 MWV

MWV - Wind Speed and Angle.

Expression	Type	Value	Comment
NMEA0183_GVL.MWV	MWV_DUT		MWV - Wind Speed and Angle
Wind_Angle	LREAL	124.3000	Wind Angle 0-360 degrees
Angle_Ref	STRING(1)	'T'	Reference R=Relative, T=True
Wind_Speed	LREAL	17.6000	Wind Speed
Speed_Units	STRING(1)	'K'	Wind Speed Units K/M/N
Status	STRING(1)	'A'	Status, 'A' = Data valid, 'V' = Data invalid

## 8.6 RMC

RMC - Recommended Minimum Specific GNSS Data.

Expression	Type	Value	Comment
 NMEA0183_GVL.RMC	RMC_DUT		RMC - Recommended Minimum Specific GNSS Data
 UTC_Hour	WORD	13	UTCHHmms.sss
 UTC_Minute	WORD	45	UTChhMMss.sss
 UTC_Second	REAL	48.0000	UTC hhmmSS.SSS
 Status	STRING(1)	'A'	Status, A = Active, V = Navigation receiver warning
 Latitude_Degree	WORD	0	Latitude DDmm.mmmm
 Latitude_Minute	LREAL	0.7421	Latitude ddMM.MMMM
 Latitude_NS	STRING(1)	'N'	N=North or S=South
 Longitude_Degree	WORD	0	Longitude DDDmm.mmmm
 Longitude_Minute	LREAL	0.0193	Longitude dddMM.MMMMM
 Longitude_EW	STRING(1)	'E'	E=East or W=West
 SpeedOverGnd	LREAL	13.1000	Speed over ground, knots
 CourseOverGnd	LREAL	1.5000	Course over ground , degrees True
 Date_dd	WORD	29	Date Day
 Date_mm	WORD	11	Date Month
 Date_yy	WORD	21	Date Year
 MagneticVar	LREAL	0.0000	Magnetic Variation, degrees
 MagneticVar_EW	STRING(1)	'E'	E=East or W=West

## 8.7 ROT

ROT - Rate of Turn.

Expression	Type	Value	Comment
 NMEA0183_GVL.ROT	ROT_DUT		ROT - Rate of Turn
 RateOfTurn	LREAL	29.0000	Rate of Turn, degrees/minutes
 Status	STRING(1)	'A'	A - Data Valid, V - Data Invalid

## 8.8 RSA

RSA - Rudder Sensor Angle.

Expression	Type	Value	Comment
 NMEA0183_GVL.RSA	RSA_DUT		RSA Rudder Sensor Angle
 RudderAngle_Star	LREAL	-44.0000	Starboard (or single) rud...sensor, "-" means Turn...
 RASStar_Status	STRING(1)	'A'	Status, A means data is valid
 RudderAngle_Port	LREAL	0.0000	Port rudder sensor
 RAPort_Status	STRING(1)	"	Status, A means data is valid

## 8.9 VHW

VHW – Water speed and Heading.

Expression	Type	Value	Comment
 NMEA0183_GVL.VHW	VHW_DUT		VHW - Water Speed and Heading
◆ Degrees_True	LREAL	0.0000	Degrees true
◆ True_Ind	STRING(1)	'T'	T=TRUE
◆ Degrees_Magnetic	LREAL	137.1900	Degrees magnetic
◆ Magnetic_Ind	STRING(1)	'M'	M=Magnetic
◆ WaterSpeed_Kn	LREAL	1.5000	Waterspeed in knots
◆ Kn_Ind	STRING(1)	'N'	N=Knots
◆ WaterSpeed_Kmh	LREAL	2.7800	Waterspeed in km/h
◆ Kmh_Ind	STRING(1)	'K'	K=Km/h

## 9. About Beijer Electronics

Beijer Electronics is a multinational, cross-industry innovator that connects people and technologies to optimize processes for business-critical applications. Our offer includes operator communication, automation solutions, digitalization, display solutions and support. As experts in user-friendly software, hardware and services for the Industrial Internet of Things, we empower you to meet your challenges through leading-edge solutions. Beijer Electronics is a Beijer Group company.

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