ShipModul
Marine Electronics

# MiniPlex-2BT NMEA-0183 multiplexer
Manual

Bluetooth™
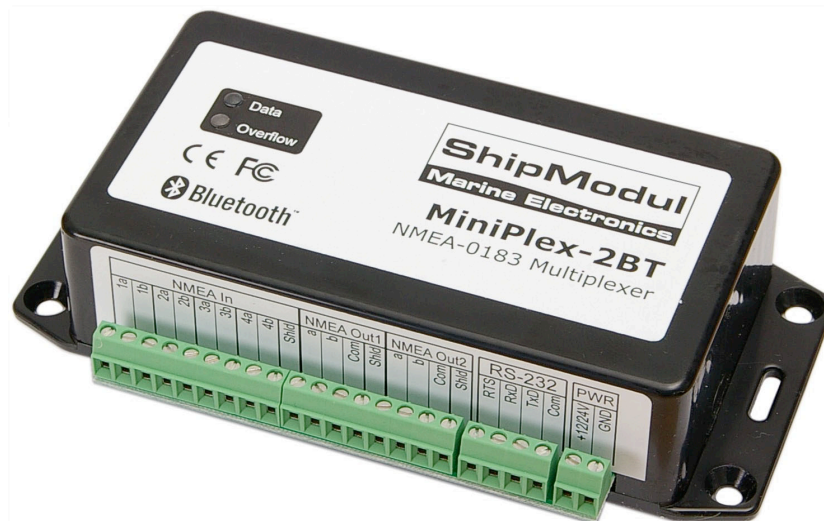
Introduction

The MiniPlex-2BT is a four-channel NMEA multiplexer, enabling the connection of multiple NMEA-0183 instruments to each other and a computer. Available are four NMEA inputs (*listener*-ports), two NMEA outputs (*talker*-ports), a serial port (RS-232) and a Bluetooth interface for a wireless connection with a computer, PDA or smartphone. The multiplexer offers many features for manipulating incoming NMEA data like sentence filtering, real time mode, talker ID modification and SeaTalk to NMEA translation in order to read data from Raymarine instruments like the ST40, ST50 and ST60 series.

Operation

The multiplexer receives NMEA sentences on the listener ports and forwards them to one or more talker ports, the serial port and the Bluetooth interface with equal priority. When NMEA sentences are received simultaneously, they are stored and transmitted sequentially. This basic function allows data of several instruments to be combined into one integral stream of data, to be sent to other navigation equipment and/or a computer. One input of the multiplexer (In 4) can be set to SeaTalk mode. The multiplexer will then translate SeaTalk$^®$ data from a Raymarine$^®$ network into NMEA sentences.
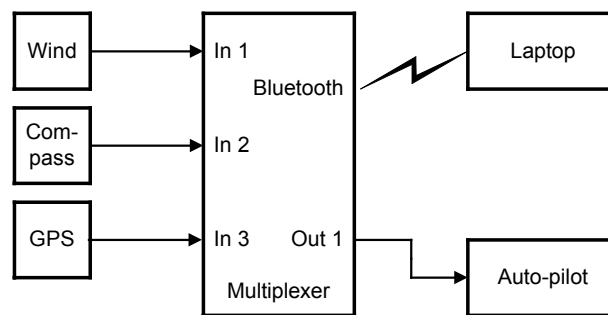
The picture above shows a typical configuration where data from a wind instrument, a compass and a GPS are combined and forwarded to a laptop. Data that is returned from the laptop to the multiplexer is sent to an autopilot.

The operating mode of the multiplexer determines which information goes where. In **Server** mode, the data from wind, compass and GPS are only sent to the laptop. The autopilot on **Out 1** only receives route and track data from the laptop. In **Hub** mode however, the multiplexer combines the data from wind, compass and GPS with the data received from the laptop and sends it to the autopilot on **Out 1**. This way the autopilot also has access to the wind, compass and GPS data. See 'Mode of Operation' for more details.

Overflow

Depending on the configuration of the multiplexer, NMEA sentences are sent to one or more talker ports with different communication speeds. A situation could arise where more data is received than can be transmitted because of certain speed settings on some of the listener or talker ports. Such a situation leads to an overflow of data in some of the internal buffers of the multiplexer. When an NMEA sentence is being received while a buffer is full, this sentence is discarded completely to ensure only complete NMEA sentences are stored and forwarded. This event is indicated by the red LED, which will blink briefly when a sentence is discarded.

A couple of occasional blinks of the red LED each second means that some sentences are discarded but most of them will be passed without problems. Such a situation is totally acceptable and would practically mean that for instance one depth, wind or position update is missed.

When the red LED is blinking severely or stays on almost continuously, it is advisable to investigate which instrument leads to this overflow. The **MPX-Config** utility will show on which input the overflow occurs. One typical situation could be where a fluxgate compass sending 10 heading sentences per second or more is continuously filling up the buffer. This leads to a situation where the heading information output by the multiplexer is 20 seconds old. Such a situation could be

resolved by either using the **Sentence Filter** to reduce the frequency of the fluxgate's NMEA sentences or to enable **Real Time** mode for the input the fluxgate is connected to.

Some general rules are applicable for reducing overflow situations. A simple rule of thumb is that an overflow can never occur if the speed of an output is equal or higher than the combined speeds of all applicable inputs. For example: if the multiplexer is in **Server** mode and all four inputs are set to 4800 baud, the minimum output speed equals 4 x 4800 = 19200 baud. This rule is only a hard rule when the input bandwidth is fully utilized i.e. an instrument is sending data continuously. This is never the case. Generally an instrument only sends one or more sentences per second, resulting in a much lower bandwidth. It could be perfectly feasible to have an installation where four instruments are connected to the multiplexer, while running all in- and outputs on 4800 baud without a single overflow.

There are several ways to resolve overflow situations:

1. Configure the instruments on the listener ports to send less data or with greater intervals. It is often possible to disable non-relevant sentences.

2. Many instruments do not allow selection of NMEA sentences to be output. In this case, use the NMEA sentence filter of the multiplexer to block unwanted sentences. Unwanted sentences are discarded immediately and do not occupy buffer space or bandwidth.

3. Set the operation mode of the multiplexer to **Server** mode (factory default). This mode only sends incoming data to the computer and to **NMEA Out 2**, which is factory set to high speed (38400 baud). In **Hub** mode, the high-speed ports must wait for every character to be transmitted over any low speed ports.

4. Increase the speed of the **Out 2** port on the multiplexer, especially when this port is not used. The maximum speed is 38400 baud. From 19200 baud and up (4 x 4800!) an overflow will never occur, except when the multiplexer is set to **Hub** Mode.

The multiplexer has two talker ports, **NMEA Out 1** and **NMEA Out 2**. All received sentences from the listener ports are available on talker port **NMEA Out 2**. Talker port **NMEA Out 1** can be configured to output either all received sentences from the listener ports, the serial port and the Bluetooth port (**Hub** mode), or sentences from the serial port and the Bluetooth port only (**Server** mode). See the table below.

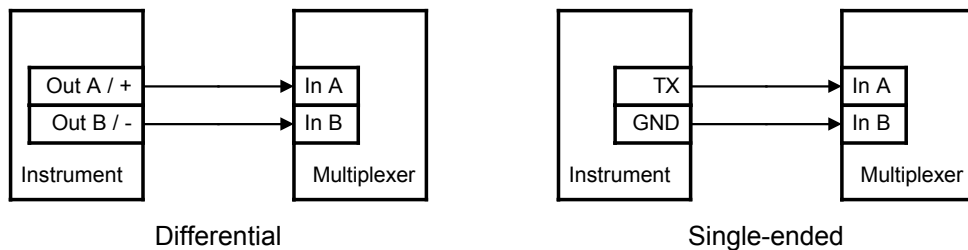|	NMEA In 1	NMEA In 2	NMEA In 3	NMEA In 4	Bluetooth In	Serial In
NMEA Out 1	H	H	H	H	H/S	H/S
NMEA Out 2	H/S	H/S	H/S	H/S	-	-
Bluetooth Out	H/S	H/S	H/S	H/S	-	H
Serial Out	H/S	H/S	H/S	H/S	H	-

H: Hub mode, S: Server mode

Connections

NMEA Listener Ports

The multiplexer has four listener ports, **In 1** to **In 4**. Each listener port should be connected to one instrument only. These inputs are galvanically isolated from the multiplexer, as specified in the NMEA-0183 standard.

Connect the **a** and **b** terminals of the listener port on the multiplexer to the **a** and **b** terminals of the talker port on the instrument. Other designations used are for instance **Data+** and **Data-**, **TX+** and **TX-** , **Out+** and **Out−** or **ve+** and **ve-**.
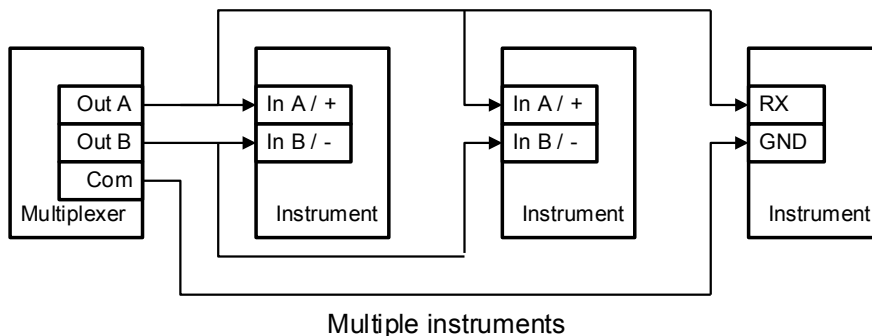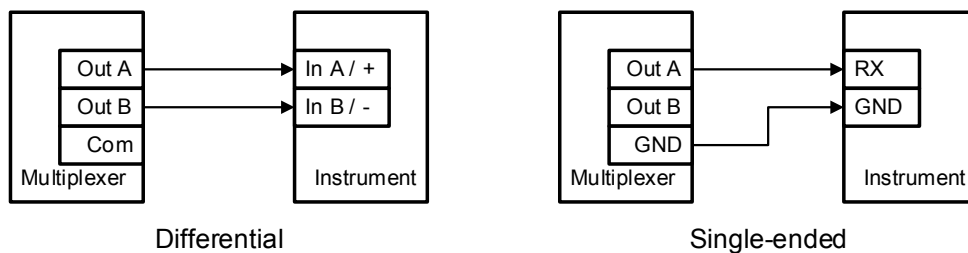
Some instruments have single ended talker ports, with only one data terminal. Connect this terminal to the **a** terminal on the multiplexer, and connect the ground of the instrument to the **b** terminal on the multiplexer. The instrument's data ground is often combined with its power supply ground.

```
┌─────────────────┐          ┌─────────────────┐     ┌─────────────────┐          ┌─────────────────┐
│  ┌──────────┐   │          │  ┌──────┐       │     │  ┌──────┐       │          │  ┌──────┐       │
│  │ Out A / +│───┼─────────►│  │ In A │       │     │  │  TX  │───────┼─────────►│  │ In A │       │
│  │ Out B / -│───┼─────────►│  │ In B │       │     │  │ GND  │───────┼─────────►│  │ In B │       │
│  └──────────┘   │          │  └──────┘       │     │  └──────┘       │          │  └──────┘       │
│  Instrument     │          │    Multiplexer  │     │  Instrument     │          │    Multiplexer  │
└─────────────────┘          └─────────────────┘     └─────────────────┘          └─────────────────┘
```

<center>Differential   Single-ended</center>

NMEA Talker Ports

Both talker ports can be connected to up to four instruments. Connect the **a** and **b** terminals of the talker port on the multiplexer to the **a** and **b** terminals of the listener port(s) on the instrument(s). Other designations used are for instance **Data+** and **Data-**, **TX+** and **TX-** , **Out+** and **Out−** or **ve+** and **ve-**.

Some instruments have single ended listener ports, with only one data terminal. Connect this terminal to the 'a' terminal on the multiplexer, and leave the 'b' terminal on the multiplexer unconnected. Connect the ground of the instrument to the **Com** terminal on the multiplexer. The instrument's data ground is often combined with its power supply ground.

```
┌─────────────────┐          ┌─────────────────┐     ┌─────────────────┐          ┌─────────────────┐
│  ┌──────────┐   │          │  ┌──────────┐   │     │  ┌──────┐       │          │  ┌──────┐       │
│  │  Out A   │───┼─────────►│  │ In A / + │   │     │  │ Out A│───────┼─────────►│  │  RX  │       │
│  │  Out B   │───┼─────────►│  │ In B / - │   │     │  │ Out B│       │          │  │ GND  │       │
│  │  Com     │   │          │  └──────────┘   │     │  │ GND  │───────┼─────────►│  └──────┘       │
│  └──────────┘   │          │                 │     │  └──────┘       │          │                 │
│  Multiplexer    │          │    Instrument   │     │  Multiplexer    │          │    Instrument   │
└─────────────────┘          └─────────────────┘     └─────────────────┘          └─────────────────┘
```

<center>Differential   Single-ended</center>

<center>Multiple instruments</center>

<center>4</center>

The shield terminals (**Shld**) can be connected to the screen/shield of the cable if present. This should always be done on one end of the cable only, preferable on the talker side.

SeaTalk

SeaTalk® is a proprietary protocol developed by Raymarine®. This protocol is used for communication between Raymarine navigation instruments like the ST40, ST50 and ST60 series. To be able to use these instruments with commonly available navigation programs or to feed their data into other non-Raymarine instruments, the SeaTalk data needs to be translated into NMEA. Even Raymarine's own navigation software, Raytech Navigator, needs this translation.

The multiplexer can be connected to a SeaTalk network. It will translate all SeaTalk data required for navigation into NMEA sentences. **NMEA In 4** can be switched to SeaTalk mode and should be connected as follows:
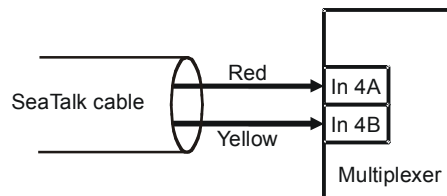
Connecting a SeaTalk network

The screen of the SeaTalk cable is not connected to the multiplexer.
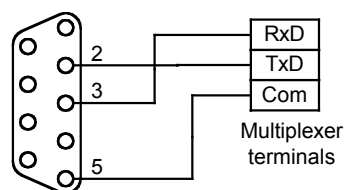
Bluetooth

The MiniPlex-2BT communicates with a computer or PDA through its Bluetooth interface, allowing the computer/PDA to receive all incoming NMEA data. The computer/PDA can also send data back to the multiplexer to control an autopilot connected to NMEA Out 1.

The Bluetooth interface uses the 'Serial Profile', which means that on the computer/PDA, this connection is presented as a standard COM port. Such a COM port can be opened by any application. To setup a connection, the MiniPlex-2BT must be paired to your computer/PDA. Pairing is a process that makes a Bluetooth device known to a computer and vice versa, by their unique address. Pairing is initiated on the computer or PDA by issuing the appropriate commands on the respective devices. Mostly this will be something like 'Find Bluetooth Devices'. This operation will show a list of Bluetooth devices in the near surroundings that have responded to the computer's/PDA's inquiry scan. The multiplexer will be listed as 'MiniPlex-2BT'. Select this entry and enter the required passkey when asked. The passkey of the multiplexer is '0000' (four zeros). Follow the directions on the screen to finish the pairing process and assigning it to a COM port. This COM port will now be assigned to the MiniPlex-2BT. Sometimes, two COM ports are assigned to the multiplexer, one for outgoing connections and one for incoming connections. The port for outgoing connections must be used.

Data that is sent over the Bluetooth connection to the multiplexer will appear at **NMEA Out 1** but also at the serial port of the multiplexer when set to Hub-mode.

RS-232 Serial Port

The RS-232 serial port can be used to connect the multiplexer to a computer, as shown in the diagram below. The serial port is bi-directional: the multiplexer sends NMEA data to the computer and the computer can also send NMEA data back to the multiplexer. This data is available on **NMEA Out 1**.

rear-view of
9-pin sub-D connector

When the multiplexer is set to Hub mode, this data will also be available on the Bluetooth port.

The serial port behaves in exactly the same way as the Bluetooth port. All received NMEA data is available on both the serial port and the Bluetooth port. If data is sent to the serial port in Hub-mode, it will not only be sent to NMEA Out 1 but also to the Bluetooth port.

This allows a PDA to be used as a wireless repeater for navigation information generated by the software on the computer.

The serial port is galvanically isolated from the multiplexer to prevent ground loops and excessive currents that could otherwise destroy the multiplexer or the serial port of the connected computer.

The serial port is set to 38400 baud when shipped. It can however be set to any speed in the range from 4800 to 38400 baud using the MPX-Config utility.

Power Supply

The multiplexer must be powered from an externally supplied DC voltage from 8 to 35V. The power supply connection is protected against reversed polarity.

Configuration

Various options can be configured on the multiplexer, using the configuration program **MPX-Config** that can be found on the accompanying CD. There is no installation procedure for this utility, just start it from the CD or copy it to a suitable folder on the hard disk of your computer.

The top part of **MPX-Config** shows the NMEA sentences that are received by the multiplexer. The bottom part shows the configuration controls.

The **File** menu allows you to store the configuration settings of the multiplexer to a file or load the configuration from a file. This file format is similar to the Windows INI file format, allowing editing the files with a text editor. See the Technical Reference section for an example of a configuration file. Use the **Log** options from the **File** menu to store received NMEA sentences to a log file for trouble-shooting purposes.

The multiplexer is configured with proprietary NMEA sentences. **MPX-Config** sends these sentences to the multiplexer when you change an item on the screen but they can also be issued with a terminal program. See the Technical Reference section for a complete reference of the supported proprietary sentences.

All configuration settings are stored in the multiplexer's non-volatile memory. These settings are retained without power supply.
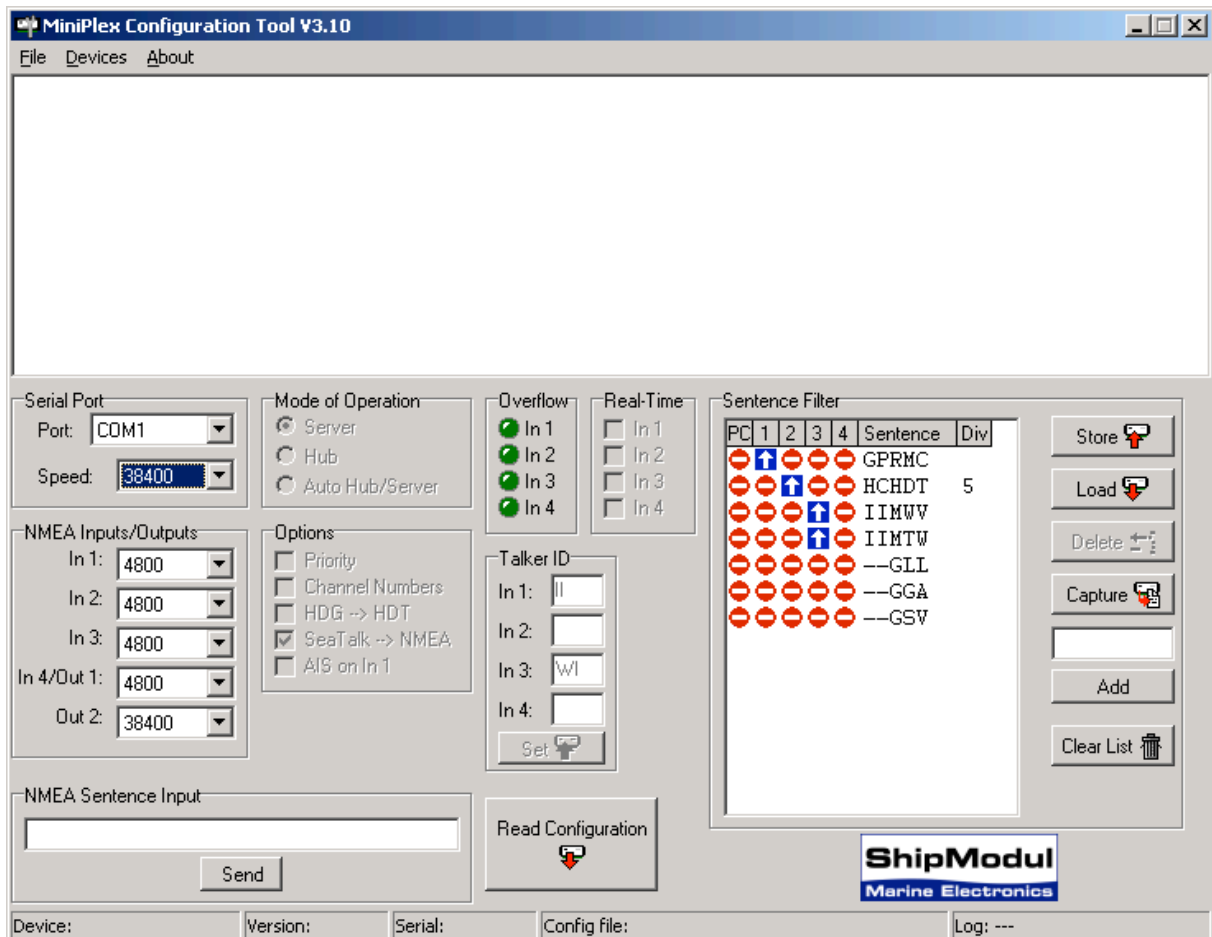
Screenshot of MPX-Config

Serial Port

Before being able to configure the multiplexer, select the serial port to which the multiplexer is connected or the serial port assigned by the Bluetooth pairing process. When choosing a 'real' serial port, set the baudrate to 38400 (factory default) or choose **Automatic** to let **MPX-Config** detect the communication speed of the multiplexer automatically. This may take a few seconds,

especially when instruments are sending data to the multiplexer. When a 'Multiplexer does not respond' - message appears, disconnect or shut down the connected instruments. Another way is to try every possible setting from 4800 to 38400 baud, until NMEA data appears in the top window of **MPX-Config** when the **Read Configuration** button is pressed.

When the right baud rate has been found, the multiplexer will follow any change you make: when you set MPX-Config to 38400 baud, the multiplexer will also be set to this value in order to stay 'synchronized' with MPX-Config. If you exit MPX-Config, the settings will be saved.

When the Bluetooth port is selected, the speed setting has no relevance and will show 'Automatic' and will be disabled once the configuration has been retrieved from the multiplexer.

NMEA Inputs/Outputs

This section allows you to set the speed of the NMEA inputs and outputs. The settings range from 4800 to 38400 baud. Please note that **In 4** and **Out 1** share the same speed setting. **Out 1** is generally used to control an autopilot and should be left at 4800 baud for this purpose. The same goes for **In 4**, which should be left at 4800 baud when SeaTalk translation is enabled.

Care should be taken when selecting other speeds than 4800 baud with respect to possible buffer overflows. See paragraph 'Overflow' for more information.
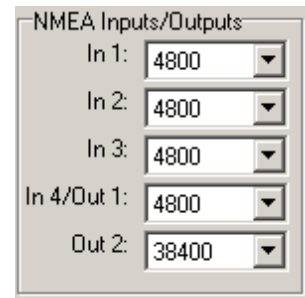
Read Configuration

Every time you start **MPX-Config**, it will retrieve the current configuration from the multiplexer. When this is unsuccessful (various controls on the MPX-Config window stay greyed), you can manually request the current configuration with this button.

The status line on the bottom of the **MPX-Config** window will show the name of the multiplexer, the internal software version, the serial number and the optionally loaded configuration file.

Options

Various options can be enabled on the multiplexer by checking one of the checkboxes shown on the right.

Priority
This option assigns a priority to incoming NMEA data, based on the input it is received. The serial port input has the highest priority, followed by **NMEA In 1**, **In 2**, **In 3** and **In 4** in descending order. If for instance two GPS receivers are connected to input 1 and 2 and both GPS receivers output GPRMC sentences, only those from the GPS on input 1 are passed. This feature can be useful to set up a second GPS as a backup for the main GPS.
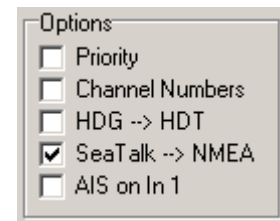
The multiplexer only uses the sentence formatter (the 'RMC' part) for comparison - the talker ID (the 'GP' part) is ignored.

Another useful application of Priority is when a GPS and an AIS transponder are connected to the multiplexer. An AIS transponder also outputs sentences from its internal GPS. A navigation program now receives GPS data from two sources that might differ in position due to GPS inaccuracy. This will lead to navigation errors. With the GPS connected to input 1 and the AIS transponder to input 2, the NMEA data from the GPS is passed while similar NMEA sentences (e.g. GPRMC) from the AIS transponder are blocked. When the GPS fails, a timeout mechanism ensures that after 10 seconds the NMEA data from the AIS transponder is passed through the multiplexer.

Please note that the priority mechanism only blocks similar sentences. AIS sentences that are not present on the GPS input are passed.

The following example shows what is passed and what not. The left column in the table shows sentences from the GPS and the right column sentences from the AIS transponder. The sentence that is greyed in the table is blocked by the priority mechanism. The table shows that only the RMC sentence from the AIS transponder is blocked.

The priority mechanism can store up to 50 sentence types to determine their priority. A time-out on mechanism ensures that

GPS (In 1)	AIS (In 2)
GPRMC	GPRMC
GPGGA	AIVDM

sentence types on lower priority inputs are passed again when their counterparts on higher priority inputs are no longer received.

Channel Numbers

This option inserts channel number information in the NMEA stream that is output by the multiplexer. Each NMEA sentence that is output on the serial port is preceded by the proprietary NMEA sentence '$PSMDCN' to indicate on which NMEA input the following sentence was received. The following example shows that the IIGGA sentence was received on input 1, the GPGGA sentence on input 2, the IIGLL sentence on input 1 and the HEHDT sentence on input 3.

```
$PSMDCN,1*1A
$IIGGA,143357.999,5301.0061,N,00635.5479,E,1,06,1.9,90.0,M,,,,0000*2E
$PSMDCN,2*19
$GPGGA,143357.999,5301.0061,N,00635.5479,E,1,06,1.9,90.0,M,,,,0000*39
$PSMDCN,1*1A
$IIGLL,5301.0061,N,00635.5479,E,143357.999,A*22
$PSMDCN,3*18
$HEHDT,67.0,T*1E
```

Channel numbers allow distinguishing between similar data from different instruments, like two depth sounders on the same boat.

HDG -> HDT

This option converts an HDG sentence (magnetic heading) into an HDT sentence (true heading). If the HDG sentence contains a magnetic variation, it is used to calculate the true heading from the magnetic heading in the HDG sentence, otherwise the magnetic heading value is just copied. This option can be used when a device like a Voyage Data Recorder needs a true heading from a gyrocompass while only a fluxgate compass is available.

SeaTalk -> NMEA

To enable translation of SeaTalk® into NMEA, check this option. SeaTalk is a proprietary protocol developed by Raymarine® and it is used for communication between Raymarine navigation instruments like the ST40, ST50 and ST60 series. To be able to use these instruments with commonly available navigation programs or to feed their data into non-Raymarine instruments, the SeaTalk data needs to be translated into NMEA. See the Technical Reference section for an overview of the SeaTalk data that is translated into NMEA.

AIS on In 1

This option enables AIS mode for input 1, to be able to connect an AIS receiver or transponder to the multiplexer. It sets the speed of In 1 to 38400 baud and it prevents data received on **In 1** to be sent to **Out 1** when the multiplexer is in **Hub** or **Auto** mode.

It is very well possible to connect an AIS receiver or transponder to any input and set that input to 38400 baud, but this requires the multiplexer to be set to Server mode to prevent the AIS data from being sent to **Out 1**, the port that is generally used to control an autopilot at 4800 baud.

Mode of Operation

The multiplexer can operate in three different modes: **Server**, **Hub** and **Auto Hub/Server**. Basically, these modes determine which NMEA data is available on **NMEA Out 1**.
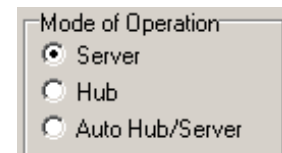

Server mode: In this mode, the combination of computer and multiplexer acts as an NMEA server. Incoming NMEA data from **NMEA In 1** to **In 4** is sent to the computer and **NMEA Out 2**. **NMEA Out 1** only outputs data received from the computer.

Hub mode: In **Hub** mode, the multiplexer acts as a hub where all NMEA data comes together and is sent out again. All incoming NMEA data from **NMEA In 1** to **In 4** and the computer is available on **NMEA Out 1**.
This mode has one limitation: since the NMEA data is sent to multiple outputs on the multiplexer, the total throughput is limited by the speed of the slowest output. This may cause buffer overflows.

Auto mode: When **Auto Hub/Server** mode is selected, the multiplexer automatically switches between **Hub** and **Server** mode, depending on the presence of computer generated data. When the multiplexer receives NMEA data from the computer, it

switches to **Server** mode. When no data is received from the computer for more than 10 seconds, the multiplexer will switch to **Hub** mode.

Auto mode is very useful when sailing alternately with our without a laptop. Consider a typical setup as shown below:
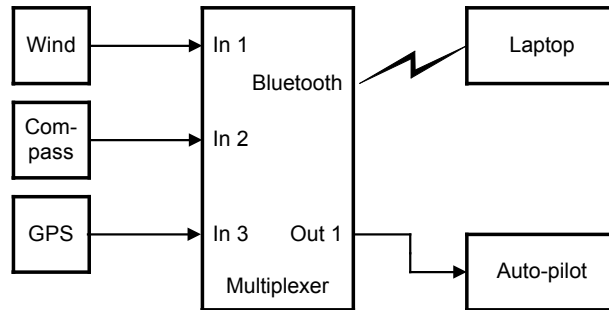
When the laptop is connected, it will receive all information from the instruments and the running navigation software is able to calculate the course to steer and drive the autopilot accordingly. Because the laptop is sending NMEA data, the multiplexer operates in **Server** mode and the autopilot on **NMEA Out 1** will therefore receive information from the laptop only.

When the laptop is not connected or the navigation software is not sending any data, the multiplexer switches to **Hub** mode and sends all data from the instruments directly to the autopilot. This way, the autopilot will receive course information directly from the GPS.

NMEA Out 2 is not affected by the mode setting. On this output, only NMEA data from the NMEA inputs is available.

Real-Time

The Real-Time option bypasses the buffer on a specific channel. In normal operation, all incoming NMEA sentences are stored in a buffer, one for each channel, which hold several seconds of NMEA data. In situations with heavy NMEA traffic, these buffers can be filled up quite rapidly until an overflow occurs (red LED blinks).

Normally an overflow situation does not pose an immediate problem, it only means that every now and then an incoming NMEA sentence is discarded because there is no room left in the buffer.

However, when a fluxgate or gyrocompass is connected, which sends it's heading 10 or 20 times per second, the corresponding input buffer on the multiplexer is filled up constantly. Together with NMEA data from other instruments, the total amount of data passing through the multiplexer gets so high that almost all used inputs are in constant overflow, resulting in an unacceptable delay of information of up to 20 seconds. This makes it impossible for an autopilot to steer on a compass heading.

By enabling the Real-Time option on the channel that is connected to the gyro or fluxgate compass, the buffer on that channel is bypassed and the NMEA data from the compass is passed through the multiplexer without delay. Some NMEA sentences will be discarded when the multiplexer is servicing another channel but this is far less of a problem than having a 20 second delay in the heading information.

The overflow indicators on the **MPX-Config** screen can also be used to determine which channel is causing the overflow. The LED corresponding to the compass channel will be lit almost continuously. See the section 'Overflow' for ways to prevent overflow situations.
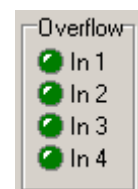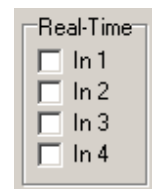
Talker ID

The multiplexer allows you to change the talker ID of incoming sentences, the first two characters of an NMEA sentence that determine which instrument (talker) the sentence is originating from. Enter the desired talker ID in the edit box of the desired channel and press the Set button to send the setting to the multiplexer. Pressing the **Read Configuration** button will read the Talker ID settings from the multiplexer. To clear a talker ID, simply clear the edit box(es) and press the **Set** button. Please note that any combination of two characters can be used as talker ID, including spaces. Therefore, make sure you clear the edit box and not fill it with spaces if you want to clear a talker ID.
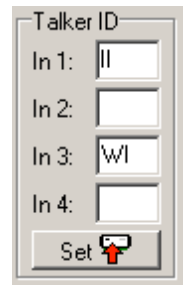
With the setting as shown on the right, any NMEA sentence received on input 1 will get talker ID 'II'. Thus a GPRMC sentence from a GPS will be changed into IIRMC.

This feature can be useful when similar sensors are connected to the multiplexer and the software must be able to distinguish between the data from these sensors. A catamaran for instance could have a depth sensor in each hull, sending similar sentences to the navigation software.

Sentence Filter

The sentence filter is a powerful feature that allows you to specify exactly which NMEA sentence may be received on any channel, including the serial port. Up to 50 rules can be entered, either manually or by capturing the NMEA sentences received by the multiplexer.

Each filter rule consists of the address field of an NMEA sentence (2 characters for the talker ID and 3 characters for the sentence formatter like 'GPRMC') and an indicator for each channel (Inputs 1 to 4 and the PC). Wildcards are allowed in the sentence formatter by using the '-' character. The indicator can be toggled between a pass sign (🔼) and a block sign (⛔) by clicking on it. This determines whether that specific sentence will be passed or blocked by the multiplexer.

Whenever the multiplexer receives an NMEA sentence, the filter list is traversed until a match is found. The order of filter entries is exactly the same as shown in **MPX-Config**. When a match is found, the input on which the sentence was received is checked against the input settings in this rule to determine whether the sentence may be passed or not.

When no match is found, the received sentence is passed. This means that all sentences for which no rule exist, are passed through the multiplexer.

Example 1

The first step is to fill the list with NMEA sentences to be filtered. This can be done automatically by pressing the **Capture** button. All controls will be disabled during capture and the **Capture** button changes to **Stop**.

Leave the capture mode running for approximately 10 seconds. By that time, all connected instruments will have sent NMEA sentences. Press **Stop** to end the capture mode.

To make sure all sentences are captured properly, no Talker ID's may be set for the input channels.

After the capture process, the list may look like the example on the right: the list shows received sentences GLL and RMC on input 1 and HEHDT on input 2 (GLL and RMC would have been preceded by GP but more on that later).
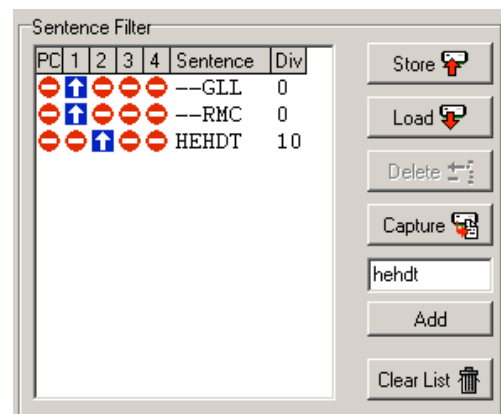
If for instance the GGA and GLL sentences have to be blocked, simply click on the pass signs of both sentences to change them into a block sign. Pressing the **Store** button sends the list to the multiplexer. Now the filter is operational. Please note that the multiplexer will suspend its operation for a few seconds while storing the list in non-volatile memory.

As can be seen in the picture, the GLL and RMC sentences contain two dashes ('--') to indicate a wildcard. This means that the first two characters are not used in the comparison with received data. In this case, the filter processes anything that has a sentence formatter of GLL or RMC. When a list is captured, you can click on a sentence with the cursor and edit the characters of that list

entry. Thus a captured sequence with 'GPRMC' and 'GPGLL' can be changed into '--RMC' and '--GLL'. A useful purpose for wildcards is to block proprietary sentences from a device by entering 'P----' in the filter list. This will block any sentence that starts with a 'P'.

The optional number in the last column is a divisor factor. By default, this number is 0, which means that every occurrence of that sentence is passed. To lower the frequency of a sentence, a number between 2 and 99 can be entered. For instance, if a fluxgate compass is sending 10 sentences per second, and the multiplexer or a connected device is suffering from an overflow, you can enter a 5 in the divisor column. The effect is that every fifth sentence will be passed while all others are blocked. This brings the sentence frequency down from 10 to 2 sentences per second.

Example 2

As mentioned before, all sentences are passed for which no rule exists. It can be desired however to reverse this operation: when no rule exists, a sentence is blocked on all inputs. This behaviour can be achieved by adding an all wildcard entry to the end of the list with all inputs blocked. This entry acts as a 'catch-all' rule. When no match is found in the list, this last rule will always match a sentence and causes it to be blocked. The picture shows such a list.
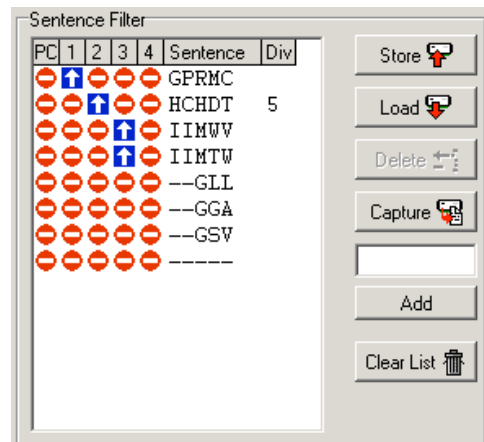
Managing the list

The filter list is managed in **MPX-Config** and can be stored to or retrieved from the multiplexer. Clicking on a traffic sign toggles it between a pass sign (⬆) and a block sign (⊖), which determines whether that specific sentence will be passed or blocked on that input. Each column represents an input of the multiplexer, including the input from the computer (PC). The following management functions are available:

Store — Stores the filter list from **MPX-Config** in the multiplexer. Any existing filter rules in the multiplexer are overwritten with the ones in the list. Note that the multiplexer will suspend its operation for a few seconds while storing the list in non-volatile memory.

Load — Loads the filter list from the multiplexer into **MPX-Config**. The loaded filter rules are added to any existing rules in the list. If you do not want this, clear the list by pressing the **Clear List** button first.

Delete — Delete a filter rule from the list in **MPX-Config**. Select the filter rule to be deleted by clicking on the formatter (e.g. 'RMC') and press the **Delete** button.

Capture — Enables capture mode. The filter list will be filled automatically with the NMEA sentences that are received by the multiplexer. For this function to work properly, it is necessary that any **Talker ID** settings be cleared first. Otherwise, the list will be filled with modified sentences instead of the originals.

Add — Add a filter rule. Type the desired sentence address into the edit box above the **Add** button and press **Add** or the enter key. This will enter a new filter rule with all channels blocked (⊖). The input is case-insensitive; every entered sentence formatter will be converted into uppercase. The input must contain 5 characters, including wildcards.

Clear List — This button clears the filter list in **MPX-Config** (not the multiplexer!). To clear the list in the multiplexer, press the **Store** button after clearing the list in **MPX-Config**.

Manual NMEA input

MPX-Config allows manual entry of NMEA sentences for testing, configuration etc. Type the desired NMEA sentence in the edit box as shown on the right and press the **Send** button or the enter key. Preceding the NMEA sentence with a '$' is optional. **MPX-Config** will add a '$' if necessary. The input is case sensitive, so whatever you type will be sent literally to the multiplexer. Since all NMEA commands are uppercase, you have to enter them as uppercase.
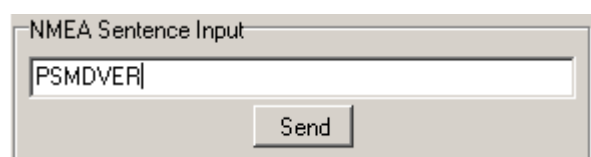
Indicators

The multiplexer has two LED's. The green LED indicates the reception of valid NMEA data on the listener ports or the serial port. The LED only blinks on valid NMEA sentences that start with a '$' or '!' and end with a CR and LF character, thus indicating a proper connection and polarity of the connected instrument. In case of a reverse polarity, the green LED will not blink.

The red LED indicates a buffer overflow, in case more data is coming in than can be transmitted. See section 'Overflow' for options to resolve this situation.

Mounting

The multiplexer is not waterproof. It should be mounted at a dry place, like behind the instrument panel, on a flat surface. Do not mount the multiplexer in a metal enclosure or behind a metal panel, as this obstructs the radio waves used for the Bluetooth connection.

Technical Reference

MPX-Config Registry keys

The serial port settings of **MPX-Config** are stored in the Windows registry, using the following keys:

```
HKEY_CURRENT_USER\Software\CustomWare\MPXConfig\BaudRate
HKEY_CURRENT_USER\Software\CustomWare\MPXConfig\SerialPort
```

MPX-Config INI file format

The configuration file format of **MPX-Config** resembles the standard Windows INI file format and is readable text.. Below is an example with has all possible options listed. The example corresponds with the settings shown on the **MPX-Config** screenshot on page 7.

```
[Configuration]
Priority=0
Channel Numbers=0
HDG Translation=0
AIS Mode=0
SeaTalk=1
Mode=0
RealTime Ch.1=0
RealTime Ch.2=0
RealTime Ch.3=0
RealTime Ch.4=0
Talker ID1=II
Talker ID2=
Talker ID3=WI
Talker ID4=
Baud In1=0
Baud In2=0
Baud In3=0
Baud In4/Out1=0
Baud Out2=3
[Filter]
GPRMC=01000,0
HCHDT=00100,5
IIMWV=00010,0
IIMTW=00010,0
--GLL=00000,0
--GGA=00000,0
--GSV=00000,0
```

Proprietary NMEA commands

The multiplexer supports some NMEA commands through proprietary NMEA sentences. They also generate certain proprietary NMEA sentences in some modes of operation or as a response to NMEA commands.

All commands have the following format:

$PSMDxx

$P: Start of a proprietary command. Dictated by the NMEA standard.
SMD: ShipModul manufacturer's mnemonic.
xx: Two- or three-character command code.

For ease of manual configuration, the commands issued to the multiplexer do not require a checksum. Sentences output by the multiplexer always contain a checksum. Sentences output by the multiplexer always contain a checksum denoted with '*hh' in the descriptions below.

Command reference

VER – Get Version

Retrieves version information from the multiplexer. The multiplexer responds with the following version sentence:

$PSMDVER,2.10,MiniPlex-2BT,10025943,8082*hh<CR><LF>

2.10:   software version number
MiniPlex-2BT: product descriptor
10025943:   serial number
8002:   multiplexer capabilities. This is a 4 digit, 16-bit field represented as a hexadecimal number. Each bit identifies a capability of the multiplexer. The following bits are defined:
                2-0: Interface type, 0 = serial, 1 = USB, 2 = Bluetooth
                15: 3rd generation multiplexer

hh: checksum

CN - Channel Number indicator

This sentence precedes an NMEA sentence to indicate through which input channel the sentence was received.

$PSMDCN,x*hh<CR><LF>

x: channel number 1,2,3 or 4.
hh: checksum

Example: $PSMDCN,1*1A<CR><LF>

CF – Configuration

This sentence sets the configuration of the multiplexer. The same sentence is sent by the multiplexer in response to a CFQ sentence.

Command: $PSMDCF,b,m,s,p,n,rrrr,h,a[*hh]<CR><LF>

b: baudrate selector: 0 = 4800 baud
                                    1 = 9600 baud
                                    2 = 19200 baud
                                    3 = 38400 baud
                                    9 = toggle checksum mode [1]

m: mode selector: 0 = Server mode
                                    1 = Hub mode
                                    2 = Auto mode

s: Seatalk translation: 0 = off
                                    1 = on
                                    2 = dump all unknown Seatalk datagrams (PSMDST,xx,xx,…)
                                    3 = dump all Seatalk datagrams
                                    4 = toggle generated wind sentence between VWR and MWV

p: Channel priority: 1 = on, 0 = off

n: Channel numbers: 1 = on, 0 = off

r: Real-time mode: 1 = on, 0 = off. Four digits, one digit per channel, numbered from 1 to 4

h: Heading translation: 1 = on, 0 = off

a: AIS mode: 1 = on, 0 = off

hh: optional checksum

When sending this command to the multiplexer, it is not necessary to specify every field when only one configuration parameter has to be changed. Fields preceding the one to be changed can be left blank. Fields after the one to be changed may be omitted. When for example only the channel priority must be changed, the command '$PSMDCF,,,,1' may be sent. The fields 'b', 'm' and 's' are left blank while the fields for 'n' and 'rrrr' are omitted.
The 's' field will always return a 0 or 1 in response to a CFQ command.

1) Normally the multiplexer blocks sentences that contain a checksum error. Toggling the checksum mode lets the multiplexer pass sentences with a checksum error unprocessed. The response of the CFQ command shows in which mode the multiplexer is configured: when a checksum is added, the multiplexer is in normal mode and blocks erroneous sentences. When the CF response shows no checksum, the multiplexer passes erroneous sentences.

CFQ – Request current configuration

This sentence requests the current configuration settings from the multiplexer.

$PSMDCFQ<CR><LF>

The multiplexer responds with a CF sentence. When the response contains a checksum, the multiplexer is in normal mode and blocks erroneous sentences. When the CF response shows no checksum, the multiplexer passes erroneous sentences.

SP – Speed

This sentence sets the baud rate of the NMEA inputs and outputs.

$PSMDSP,a,b,c,d,e[*hh]<CR><LF>

The following fields are defined for setting the various ports:

a: NMEA In 1
b: NMEA In 2
c: NMEA In 3
d: NMEA In 4/Out 1
e: NMEA Out 2

Each field accepts the following value:

0 = 4800 baud
1 = 9600 baud
2 = 19200 baud
3 = 38400 baud

SPQ – Request Speed

Request the baud rate settings of the NMEA inputs and outputs.

$PSMDSPQ<CR><LF>

The multiplexer responds with a $PSDMSP sentence.

FL – Filter

This sentence specifies a filter rule which is applied on every incoming NMEA sentence. Sentences for which a rule is specified, will only be transferred if the input on which they are received matches the input specified in the filter rule.
Filter rules are specified by the formatter part of the NMEA address field, for instance the 'GPRMC' part of a GPS '$GPRMC' sentence. For each filter rule, the inputs to be passed can be specified. Sentences for which no rule exists are passed unrestricted.

$PSMDFL,ccccc,xxxxx,[dd][*hh]<CR><LF>

ccccc: Sentence formatter of the filter rule (e.g. 'GPRMC', 'IIMWV', etc). This field may contain wildcard characters ('-'). For instance, 'GP---' will apply to all sentences starting with 'GP'. Similarly, '--MWV' will apply to all sentences ending on 'MWV' regardless of the talker ID. One filter rule with all wildcards and all inputs blocked is allowed to let the multiplexer block all sentences for which no rule exists. When an all-wildcard rule is entered, the multiplexer will not accept subsequent filter rules.
          Example: $PSMDFL,-----,00000<CR><LF>

xxxxx: Inputs to pass. Each 'x' represents an input to assign to this rule, numbered from 0 to 4, where input 0 is the computer interface and 1 to 4 represent NMEA inputs 1 to 4. A '1' means to pass, a '0' means to block. When all x'es are '1', the filter rule is removed.

dd: Optional divisor factor (0..99). The frequency of a sentence is divided by this number to reduce the number of sentences over time. If for instance a divisor of 6 is specified for a sentence, only every 6th sentence is passed. This can be used to reduce the output of a high-speed heading sensor.

hh: Optional checksum

A FL sentence without any parameters will erase all rules.

Example: $PSMDFL,GPRMC,10011<CR><LF>

This sentence specifies a rule for all sentences that have the 'GPRMC' sentence formatter. When this rule is applied, only 'GPRMC' sentences on inputs 0 (the computer), 3 and 4 are passed.

FLQ – Request filter list

This sentence requests the filter list from the multiplexer. The multiplexer responds by sending FL sentences, one for each list entry. An empty FL sentence denotes the end of the list.

Example:

```
$PSMDFL,GPRMC,10011,0*hh<CR><LF>
$PSMDFL,GPGGA,10001,0*hh<CR><LF>
$PSMDFL,--VWT,01000,5*hh<CR><LF>
$PSMDFL,GPGSV,00001*hh<CR><LF>
$PSMDFL,*hh<CR><LF>
```

The sentences may not be dumped as one contiguous block. In case of heavy NMEA traffic, they may be interspersed with other NMEA sentences.

ID – Talker ID

Enables a Talker ID to be set for a specific channel. If the talker ID is set for a specific channel, the original talker ID in the sentences received on that channel is replaced by the specified one before sending the sentence to the computer.

$PSMDID,aa,bb,cc,dd[*hh]<CR><LF>

aa: Talker ID for channel 1
bb: Talker ID for channel 2
cc: Talker ID for channel 3
dd: Talker ID for channel 4
hh: optional checksum

An empty field clears the ID and disables the translation for that specific channel. Sending a PSMDID sentence without any fields clears all ID's.

IDQ – Request talker ID's

Requests the Talker ID settings. The multiplexer responds with an ID sentence.

OV – Overflow

In case of a buffer overflow (blinking red LED on the multiplexer), an overflow sentence is output, to indicate on which input buffer the overflow occurred:

$PSMDOV,x<CR><LF>

x: Binary field. The first four bits indicate on which input buffer the overflow occurred.

Translated Seatalk datagrams

When the Seatalk translation is enabled, the following datagrams are translated into NMEA sentences:

SeaTalk	NMEA	Description
00	DBT	Depth below transducer
10	MWV	Wind angle, (10 and 11 combined)
11	MWV	Wind speed, (10 and 11 combined)
20	VHW	Speed through water
21	VLW	Trip mileage (21 and 22 combined)
22	VLW	Total mileage (21 and 22 combined)
23	MTW	Water temperature
25	VLW	Total and Trip mileage
26	VHW	Speed through water
27	MTW	Water temperature
50	---	Latitude, value stored
51	---	Longitude, value stored
52	---	Speed over ground, value stored
53	RMC	Course over ground. RMC sentence is generated from stored values from 5x datagrams.
54	---	GMT time, value stored
56	---	Date, value stored
58	---	Lat/Long, values stored
84	HDG	Magnetic heading, including variation (99)
89	HDG	Magnetic heading, including variation (99)
99	---	Magnetic variation, value stored
9C	HDG	Magnetic heading, including variation (99)

As appears from the table, not all datagrams result in an NMEA sentence. Some datagrams are only used to retrieve a certain value to be combined into one NMEA sentence.

When the Seatalk translation is enabled with with option 2 (the 's' parameter in the CF sentence is 2), unlisted datagrams are translated into a proprietary NMEA sentence with the following format:

$PSMDST,aa,bb,cc,dd…*hh<CR><LF>

aa,bb,cc,dd… represent the hexadecimal value of the bytes from the received Seatalk datagram.

Technical Specifications

Supply voltage:	8 – 35 V$_{DC}$, protected against reversed polarity.
Current consumption:	100 mA (150 mA max. with fully loaded talker ports and active Bluetooth connection).
Inputs:	4 x NMEA-183/RS-422, galvanically isolated. Input 4 can be set to SeaTalk mode.
Input resistance:	>800 Ohm.
Outputs:	1 x RS-232, galvanically isolated. 2 x NMEA-183/RS-422 1 x Bluetooth
Buffers:	6 buffers of 800 characters (4 x NMEA, 1 x Bluetooth, 1 x RS-232).
Filter list size:	50 sentence types
Priority list size:	50 sentence types
NMEA Out 1:	Combined data from NMEA inputs, Bluetooth and serial port (**Hub** mode) or from Bluetooth and serial port only (**Server** mode)
NMEA Out 2:	Combined data from NMEA inputs.
Speed NMEA In 1-3:	4800 - 38400 baud.
Speed NMEA In 4/Out 1:	4800 - 38400 baud.
Speed NMEA Out 2:	4800 - 38400 baud.
Speed serial port:	4800 - 38400 baud.
Speed Bluetooth:	38400 baud.
Indicators:	Overflow and Data.
Bluetooth range:	100 meters / 300 feet.
Bluetooth Device Name:	"MiniPlex-2BT"
Bluetooth Pass Key (PIN):	"0000"
Bluetooth transceiver:	Type: TDK TRBLU20-00100, Class 1 device. FCC ID: PI4-TDK-BTISM. Canada: 1931-TDK-BTISM.
Dimensions:	138 x 72 x 33 mm.
Housing:	Flame retardant ABS.

Declaration of Conformity

We,

CustomWare
Borgstee 27b
9403 TS Assen
The Netherlands
Tel.: +31 592 375700
Fax: +31 592 375550

Declare under our sole responsibility that the product
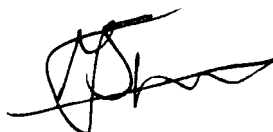
ShipModul MiniPlex-2BT

to which this declaration relates is in conformity with the following specifications:

EN/IEC60945:2002 and EN/IEC61162-1:2000
EN300328 and EN301489
FCC Title 47 CFR, Part 15, FCC ID: PI4-TDK-BTISM

The product herewith complies with the requirements of the EMC Directive 89/336/EEC and carries the CE-marking accordingly.

Assen, 1-7-2010   M. Sprang

This device complies with Part 15 of the FCC Rules. Operation is subject to the following conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

CE 0700   FC

ShipModul / CustomWare
Borgstee 27b
9403 TS Assen
The Netherlands

Tel.:   +31 592 375700
Fax: +31 592 375550

web: www.shipmodul.com
e-mail: mail@shipmodul.com