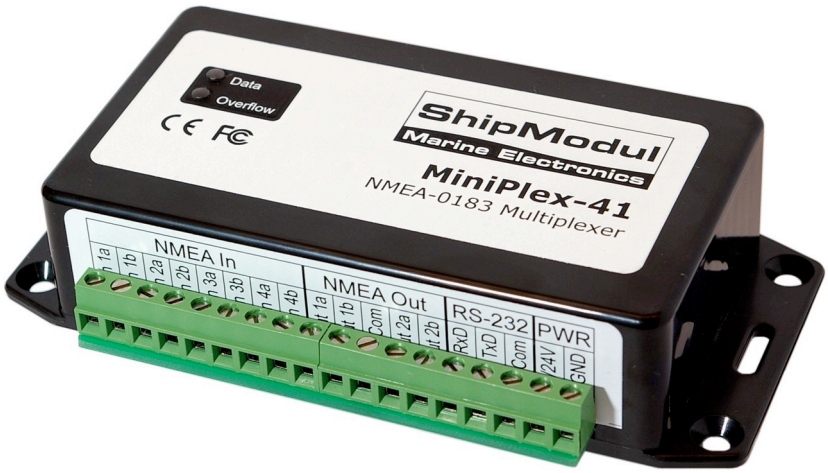
ShipModul
Marine Electronics

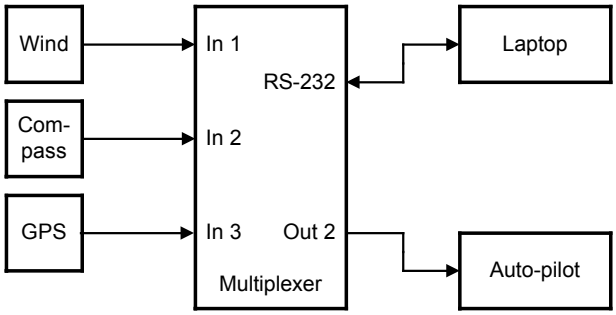
MiniPlex-41 NMEA-0183 multiplexer
Manual



MiniPlex-41, V2.0
Firmware V2.8.1
Art.no.: 101

Introduction

The MiniPlex-41 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) and one RS-232 port for connection with a computer. The multiplexer also offers a SeaTalk to NMEA translation in order to read data from Raymarine instruments like the ST40, ST50 and ST60 series.



Operation

The multiplexer reads NMEA sentences from the listener ports and stores them in a buffer, one for each input. The sentences are read from the buffers in a round robin fashion - one sentence at a time - giving each listener port equal priority. Each sentence is then sent to the talker ports and the RS-232 port.

The speed of the listener ports is fixed to 4800 Baud (= bits per second), which equals 480 characters per second. When all listener ports receive data at this rate, the buffers will not be emptied in time and an overflow situation occurs. The red LED indicates this situation. When a buffer is full, a partially received sentence will be discarded to ensure that the multiplexer only sends complete and valid NMEA sentences.

There are two ways to resolve this overflow situation:

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. Increase the speed of the RS-232 port on the multiplexer. 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, 'Out 1' and 'Out 2'. All received sentences from the listener ports are available on talker port 'Out 1'. Talker port 'Out 2' can be configured either to output all received sentences from the listener ports and the RS-232 port (Hub Mode), or only sentences from the RS-232 port (Server Mode). See the table below.

	NMEA In 1	NMEA In 2	NMEA In 3	NMEA In 4	RS-232 In
NMEA Out 1	H/S	H/S	H/S	H/S	-
NMEA Out 2	H	H	H	H	H/S
RS-232 Out	H/S	H/S	H/S	H/S	-

H: Hub mode, S: Server mode

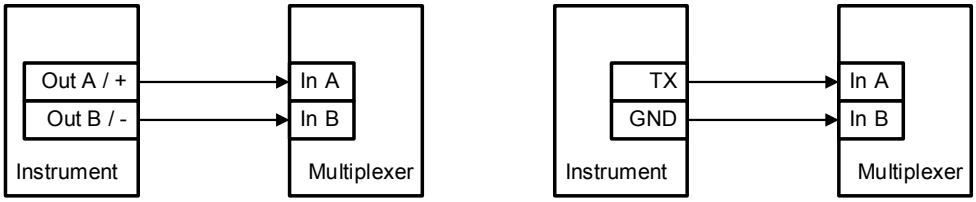
Connections

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 'b' terminal on the multiplexer with the ground of the instrument. The latter is often combined with the power supply ground.

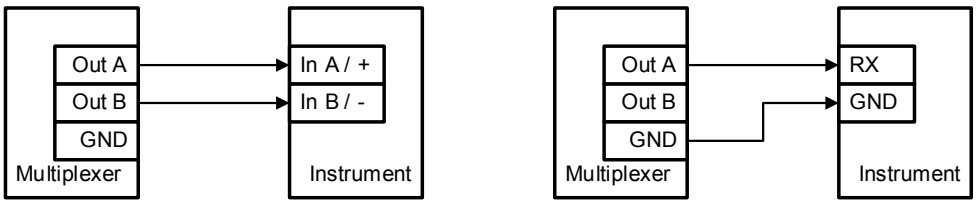


Differential Single-ended

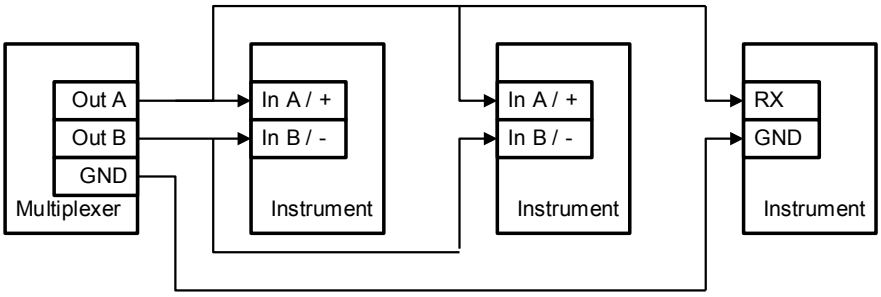
NMEA Talker Ports

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 'Com' terminal on the multiplexer with the instrument ground.



Differential Single-ended



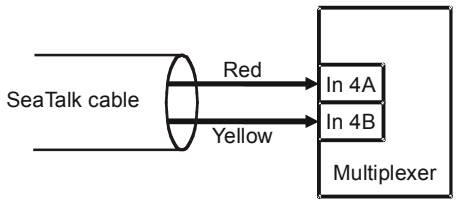
Multiple instruments

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 Input 4 can be switched to SeaTalk mode and should be connected as follows:

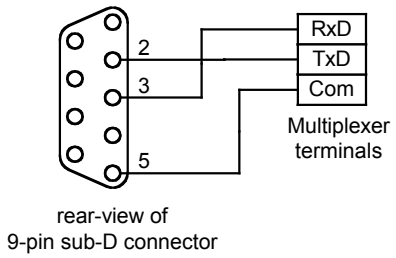


Connecting a SeaTalk network

The screen of the Seatalk cable is not connected to the multiplexer.

RS-232 Computer Port

The RS-232 port can be used to connect the multiplexer to a computer, as shown in the diagram below.



Power Supply

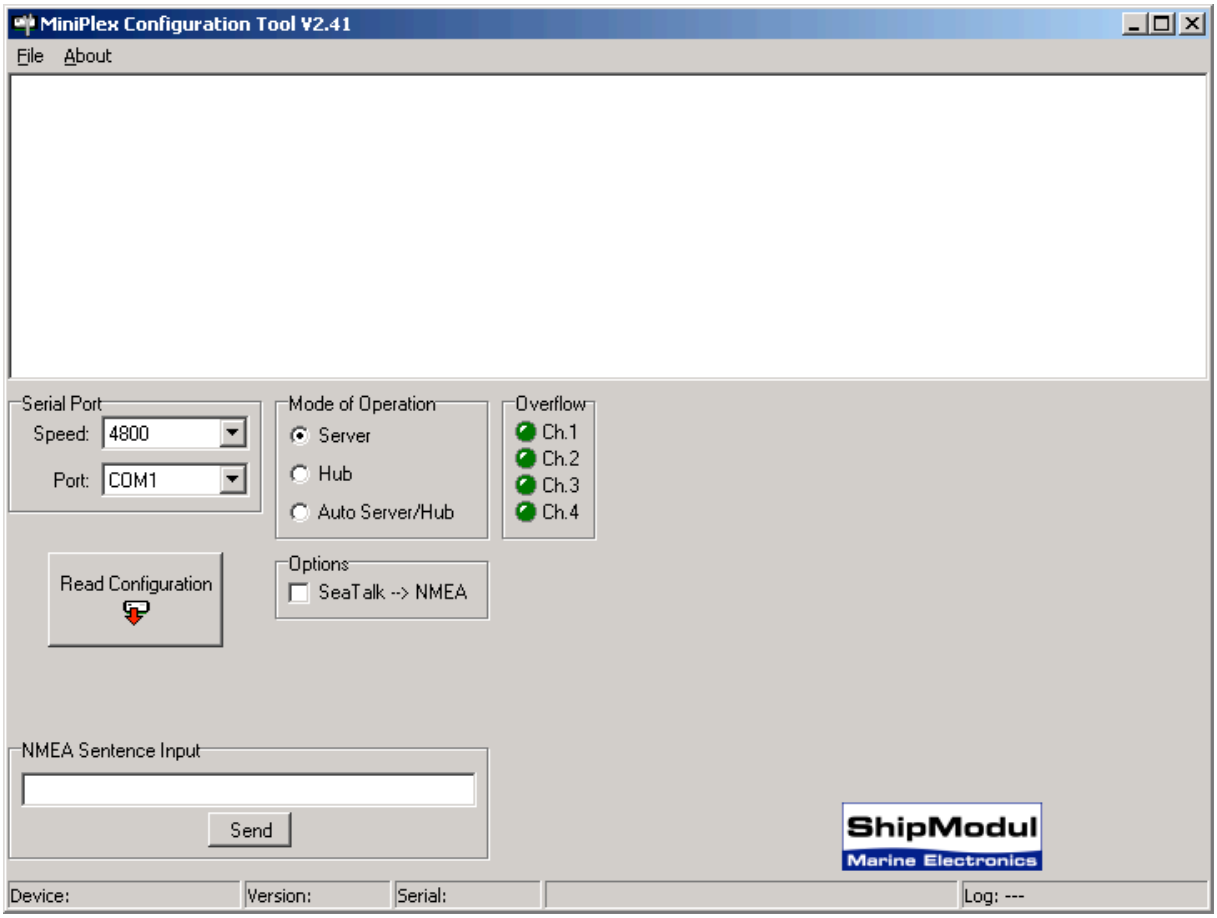
The multiplexer operates from a DC supply voltage from 8 to 35V and is protected against reversed polarity. It is recommended to connect the multiplexer to the same power source or circuit breaker as the ships instruments and/or computer.

Configuration

Various options can be configured on the multiplexer, using the supplied configuration program MPX-Config. 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 multiplexer is configured with proprietary NMEA sentences. MPX-Config sends these sentences to the multiplexer but they can also be issued with a terminal program. See the Technical Reference section for an overview 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. When selecting the baud rate, either choose 4800 (factory default) of 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 option is to try every possible setting from 4800 to 38400 baud, until NMEA data appears in the top window of MPX-Config. 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. Note that the Serial Port speed also affects the speed of NMEA Out1, since both ports run in parallel.

Read Configuration

Every time you start MPX-Config, it will request the current configuration from the multiplexer. When this is unsuccessful (various controls on the MPX-Config window are 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 and its serial number.

Mode of Operation

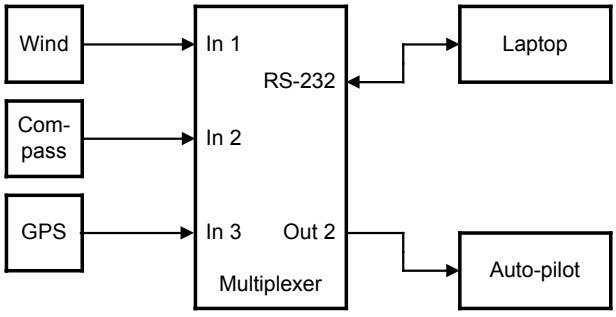
The multiplexer can operate in three different modes: Server, Hub and Automatic. Basically, these modes determine which NMEA data is available on NMEA Out2.

Server mode: In this mode, the combination of computer and multiplexer acts as an NMEA server. Incoming NMEA data from NMEA In1 to In4 is sent to the computer and NMEA Out1. NMEA Out2 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 In1 to In4 and the computer, is available on NMEA Out2.
This mode has one limitation: since the NMEA data is sent to the RS-232 port *and* NMEA Out2, the total throughput is limited by the speed of NMEA Out2, which is fixed to 4800 baud. Even when a higher baud rate is selected for the RS-232 port, the throughput will be 480 characters per second, the same as on NMEA Out2.

Auto mode: When Auto mode is selected, the multiplexer automatically switches between Hub- and Server mode, depending on the presence of computer generated data. When the computer sends NMEA data to the multiplexer (on the RS-232 interface), the multiplexer switches to Server mode. When no data is received on the RS-232 interface 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 set-up 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 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 in 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 Out1 is not affected by the mode setting. On this output, only NMEA data from the NMEA inputs is available. Since this output is connected in parallel with the RS-232 port, it will operate at the same speed as the RS-232 port. When the RS-232 port is set to 38400 baud, NMEA Out1 will also run at 38400 baud.

SeaTalk --> NMEA

To enable translation of SeaTalk into NMEA, check this option. Incoming SeaTalk data from Raymarine instruments like the ST40, ST50 or ST60 series is translated into NMEA sentences which other instruments or navigation software can use. Even Raymarine's own Raytech Navigator software works with NMEA only and needs some form of translation from SeaTalk into NMEA. See the Technical Reference section for an overview of the SeaTalk data that is translated into NMEA.

Overflow

The overflow indicators on the MPX-Config screen indicate which channel is causing the overflow. Running the multiplexer at a port speed of 19200 baud or higher will never result in overflow or long delays.

Manual NMEA input

MPX-Config allows manual entry of NMEA sentences for testing, configuration etc.
Type the desired NMEA sentence in the edit box below 'NMEA Sentence Input' and press the Send button or the enter key. Do not precede the NMEA sentence with a '$' as MPX-Config will do this for you. 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 RS-232 port. The LED only blinks on valid NMEA sentences that start with a '$' or '!' and end with CR/LF, 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. When a buffer is full, a partially received sentence will be discarded, to ensure that the multiplexer only passes complete and valid sentences.

There are several ways to resolve this overflow situation:

1. Configure the instruments on the listener ports to send less data or with greater intervals. Sometimes it is possible to disable non-relevant sentences.
2. Increase the speed of the talker port and the RS-232 port on the multiplexer. The maximum speed is 38400 Baud. From 19200 Baud and up (4 x 4800!) an overflow will never occur (except when in Hub Mode).
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 Out1, which is can be set to a higher high speed (see 2). In Hub mode, the high-speed ports must wait for every character to be transmitted over the low speed NMEA Out 2 port.

Both LED's will blink once when the power is applied to the multiplexer. When the red LED stays lit, a hardware error is found during execution of the self-test.

When SeaTalk translation is selected, the red LED will also blink when a data collision occurs on the SeaTalk bus or when the SeaTalk bus is not connected properly. An occasional blink during operation is normal; collisions do occur on the SeaTalk bus. However when constantly lit, there could be a short circuit on the SeaTalk bus or it could be miswired.

Mounting

The multiplexer is not waterproof. It should be mounted at a dry place, like behind the instrument panel, on a flat surface.

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
```

Proprietary NMEA commands

The multiplexer supports some NMEA commands through proprietary NMEA sentences. It also generates 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, 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,2.8.1,MiniPlex-41,10025943,0010*hh<CR><LF>

2.8.1:	software version number
MiniPlex-41:	product descriptor
10025943:	serial number
0010:	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 3: -42 model 4: Seatalk -> NMEA conversion 5: Sentence Frequency divisor supported 6: Firmware field-upgrade supported 7: AIS mode supported (BT models only)
hh:	checksum

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[*hh]<CR><LF>

b: baud rate selector: 0 = 4800 baud
1 = 9600 baud
2 = 19200 baud
3 = 38400 baud

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

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 mode must be changed, the command "$PSMDCF,,1" may be sent. The fields 'b' is left blank while the fields for 's' is omitted.
The 's' field will always return a 0 or 1 in response to a CFQ command.

CFQ – Request current configuration

This sentence requests the current configuration settings from the multiplexer.

$PSMDCFQ<CR><LF>

The multiplexer responds with a CF 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. To conserve bandwidth, this sentence has no checksum.

$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 (VWR)	Wind angle, (10 and 11 combined)
11	MWV (VWR)	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

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 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:	40 mA (70 mA max. with fully loaded talker ports).
Inputs:	4 x NMEA-183/RS-422, galvanically isolated. 1 input can be set to SeaTalk mode.
Input resistance:	>800 Ohm.
Outputs:	1 x RS-232, 2 x NMEA-183/RS-422.
Buffers:	5 buffers of 800 characters (4 x NMEA, 1 x RS-232).
NMEA Out1:	Combined data from NMEA inputs.
NMEA Out2:	Combined data from NMEA and RS-232 inputs (Hub mode) or data from RS-232 input only (Server mode).
Speed NMEA in:	4800 Baud.
Speed NMEA Out1/RS-232:	4800, 9600, 19200 or 38400 Baud.
Speed NMEA Out2:	4800 Baud.
Indicators:	Overflow and Data.
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

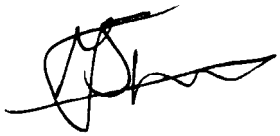
ShipModul MiniPlex-41

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

EN/IEC60945:2002 and EN/IEC61162-1:2000
FCC Title 47 CFR, Part 15 Class B

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

Assen, 11-06-2008 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.

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