USB
SeaTalk <-> NMEA
C o n v e r t e r

Installation and Operation

Manual

Hardware Version : V 3.5
with galvanic isolation
Software Version : V 1.70

April 2014

Contents

Credits / Warning / Disclaimer

The protocol converter is a
RESEARCH PROJECT.

It is used for research on data communication, computer communication and data conversion on computers used on board boats.

Hard- and Software are still under development and have NOT been fully tested. Malfunctions of the protocol converter and of any connected device are possible at any time.

Never use this product as your only source of navigation data. Always apply “good seamanship” by using proper charts, keeping lookout and cross check electronic data with other sources.

The protocol converter could cause damage to connected devices.

Liability **cannot** be accepted for any damages, personal injuries or malfunctions caused by the converter.

There are no Seatalk technical specifications available from the manufacturer. I have used the Technical Reference of the Seatalk protocol, compiled by Thomas Knauf GmbH.
See http://www.thomas-knauf.de/seatalk.htm .Thank you to Thomas Knauf for his work.

Do not use for navigation

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An operating GSM mobile phone should not be placed within 2m of an
unshielded Seatalk/NMEA Bridge because of interference from the phone's
radio transmissions. If a phone is brought closer than this 2m distance, the
bridge may stop operating or data may become corrupted.
( Thank's John Blaiklock for testing )
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Function overview

The converter interconnects two different data communication systems – SeaTalk[1] and NMEA.

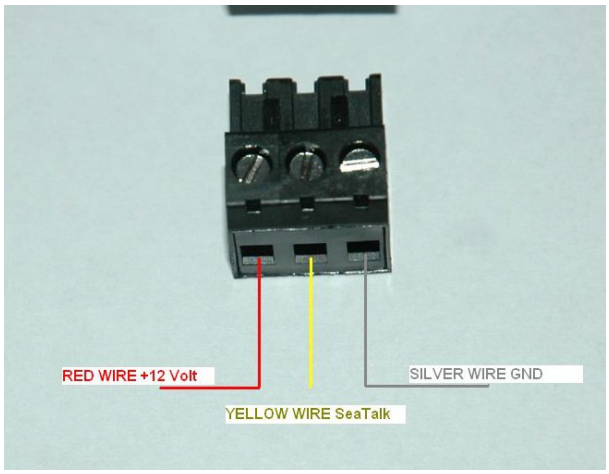
- Information from the SeaTalk bus is transformed into NMEA Data and sent to the USB port of the boat computer.
- Information from navigation software in NMEA format is transformed into SeaTalk data and sent to the SeaTalk bus.

Installation

The USB-SeaTalk NMEA bridge comes with two connectors.

A USB Plug Connect the USB plug to your computer, using the supplied extension cable	A SeaTalk Terminal Connect a SeaTalk Instrument to the SeaTalk terminal as shown below

The SeaTalk plug has a 3 pin detachable screw terminal.
Connect the SeaTalk terminal to one of your SeaTalk instruments.



Make sure, that cables are connected as shown above. A wrong connection could damage the converter or other devices on the SeaTalk Bus.

The SeaTalk Port is galvanic isolated from the USB port. The SeaTalk-NMEA-Link gets it's operating power from the USB port - not from the SeaTalk Port.

USB plug connections tend to be unstable. Please use the supplied extension cable between your computer and the SeaTalk-Nmea-Bridge. Do not plug the SeaTalk-Nmea-Bridge directly into a USB Port of your computer. Otherwise you will have a very unstable electrical and mechanical connection. This can cause frequent loss of data and can even mechanically damage the printed circuit board in the device or in your computer. Please make sure, that all USB cables are firmly connected.

[1] SeaTalk is Reg. Trademark of Raymarine Inc.

Driver installation.

Depending on your operation system it might be necessary to install a driver software. The bridge uses a standard FTDI USB Serial Converter.

Linux :

A normal LINUX system does not need any driver installation. It will recognise the USB chip and connect it to port /dev/ttyUSB0. If you already have another USB-Serial converter connected to your system, the bridge will be connected to /dev/ttyUSB1 or /dev/ttyUSB2 etc. . To find out which port has been assigned, open a console window and type "tail /var/log/messages". You should see something like

usb 2-2: new full speed USB device using uhci_hcd and address 29

usb 2-2: configuration #1 chosen from 1 choice

ftdi_sio 2-2:1.0: FTDI USB Serial Device converter detected

usb 2-2: FTDI USB Serial Device converter now attached to ttyUSB0

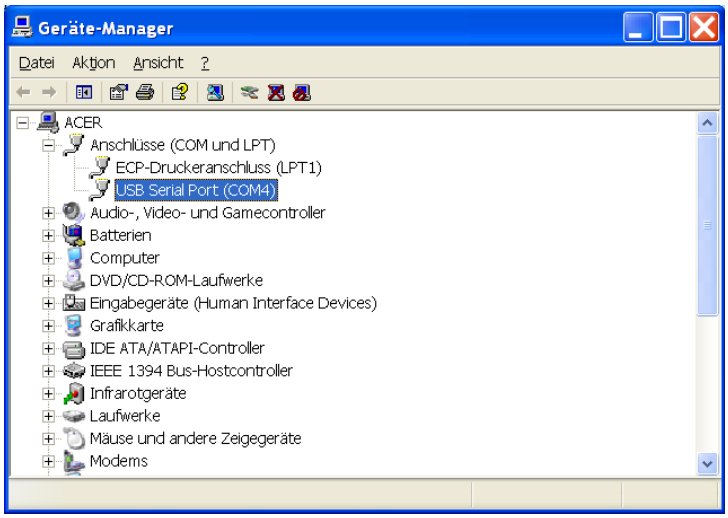
In this example, the SeaTalk Nmea Bridge has been attached to /dev/ttyUSB0

Windows:

On a Windows System it will be necessary to install driver software. If you already have used a FTDI USB Serial Converter on your system, this driver may already be installed. The driver software can be found on the CD in subdirectory /DRIVERS.

Com Port assignment

Windows automatically assigns a virtual COM port to the SeaTalk NMEA Bridge.
You can use the Windows System Manager to find out which COM Port has been assigned.
In the Device Manager you'll find "Ports – COM & LPT ".



Here Windows has assigned COM4 to the SeaTalk NMEA Bridge.

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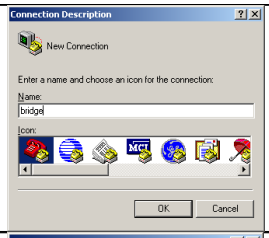
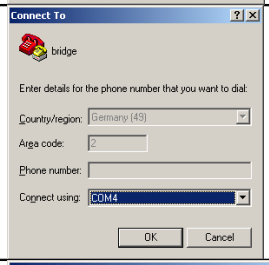
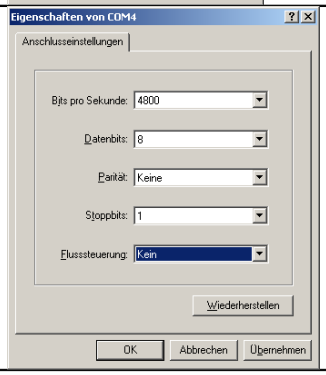
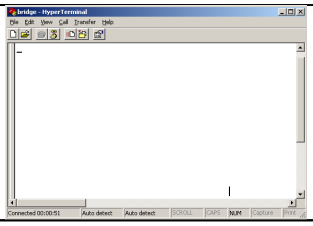
Initial startup

Once the drivers are installed, it's time for a first test and to adjust the device to your needs.

- For our first tests and configuration, we don't want to be distracted by incoming SeaTalk Data. Therefore - Unplug the SeaTalk port.
- Connect the device to the USB port of your computer.
- Find out which port has been assigned by the operating system. (See above)
- Open a terminal program.(For example hyperterm for Windows, minicom for Linux)
- Set the terminal program to the assigned port (Windows - COM1:, COM2 ... Linux /dev/ttyUSB0, /dev/ttyUSB1 .....)
  Set the terminal program to: 8 Bit, No Partiy, 1 Stop-Bit, 4800 Baud, No Handshake.
  Please make sure, that you terminal software is set to send CR/LF when you press the ENTER Key.
  Here is an example for Windows Hyperterm:

Start Hyperterm. It will ask for a connection name. Just type in anything.		
Select the communications port.		
Choose : 4800 Baud 8 Data bits No Parity 1 Stop bit No Flow Control ... and press OK		

You will see an empty terminal screen. In the status bar, Hyperterm will show “Connected”.	
Type : $SWVERSION in capital letters and press ENTER. While you type $SWVERSION, you will **not** see what you type. The bridge does not echo what you type. After you pressed the ENTER key, the bridge will display it’s software version string.	Type : $SWVERSION  Bridge responds : SeaTalk<->Nmea Converter VER,1.62 $STVER,1.62
If the bridge does not respond, press ENTER and try again. The terminal program might have sent some modem initialisation strings on start-up.	

Once communication is established, you can set the configuration as needed.
See chapter “Configuration settings” on page 14

SeaTalk and NMEA Data

NMEA Input

The SeaTalk NMEA Bridge reads and writes NMEA Data to/from the USB Port.
Processing of incoming NMEA data starts, when a complete NMEA sentence has been received ($xxxxx,.....<CR><LF>) from the boat computer

If the received sentence contains a checksum, this checksum is used to check for communication errors. If the checksum does not match the sentence, the received NMEA sentence is discarded.
If the sentence does not contain a checksum, the sentence is always regarded as valid.

After complete reception and checksum verification of the sentence, the data are processed and translated into SeaTalk

At this time the following NMEA sentences can be received:

$xxRMC	Speed over Ground, course over ground, latitude, longitude, time, date
$xxRMB	Waypoint Name, XTE, distance & bearing to waypoint, arrival info etc.
$xxAPB $xxBWC	Waypoint Name, XTE, distance & bearing to waypoint,arrival info etc
$xxWPL	Waypoint location
$xxVHW	Speed through water
$xxDBT	Depth below transducer
$xxDPT	Depth below keel
$xxMTW	Water temperature
$xxVLW	Total / Trip mileage
$xxMWV	Wind angle wind speed
$xxVWR	Relative wind speed and angle
$xxHDM	Heading magnetic
$xxHDG	“ “
$xxGLL	Position
$xxZDA	Date & time
$STALK	Special SeaTalk datagram
$SNBSE	Board configuration
$SWVERSION	Display Software version

NMEA Output

The converter continuously checks for new incoming SeaTalk data.
Incoming SeaTalk data is converted to NMEA Data and transferred to the NMEA-USB Port.

The following NMEA sentences can be sent :

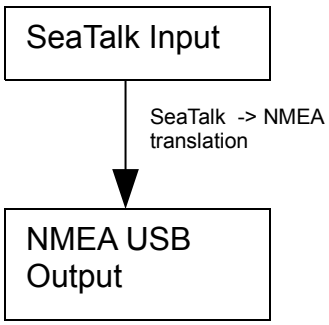
$IIDBT	Depth below transducer
$IIDPT	Optional $IIDPT can be sent instead of $IIDBT
$IIVHW	Speed t. Water
$IIMTW	Water Temperature
$IIVLW	Total / Trip Mileage
$IIMWV	Wind angle & Wind speed (app & true)
$IIHDM	Compass heading
$IIRMC	Speed over ground, Course over ground, Latitude, Longitude, UTC time, Date
$IIGLL	Optional an additional $IIGLL sentence can be sent for position information
$IIRSA	Rudder Position
$STALK	special SeaTalk datagram
$SNBSE	special system configuration datagram

SeaTalk Input

When a SeaTalk datagram was received the system checks if this datagram is known and should be processed. When the datagram is known, all datagram parameters are extracted and stored.
Any unknown datagram is ignored.
(Exception: $STALK is sent even for unknown datagrams)

At this time the following SeaTalk datagram's can be received.

00 Depth
10 Wind angle
11 Wind speed
20 Speed through water
21 Trip mileage
22 Total mileage
23 Water temperature
25 Total & trip mileage
26 Speed through water
27 Water temperature
30 Display illumination
50 Latitude
51 Longitude
52 Speed over ground
53 Course over ground
54 UTC time
56 Date
84 Compass heading
89 Compass ST40 heading
9C Compass Heading & Rudder position



SeaTalk Output

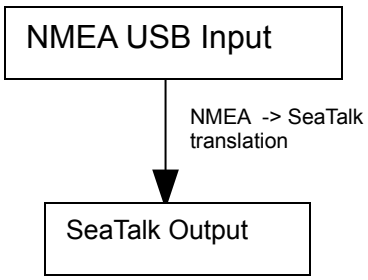
The converter periodically checks if any new data has arrived from NMEA, that needs to be sent to SeaTalk. New data is written to the SeaTalk bus only if the bus is not in use by any other instrument. If the bus is in use, the converter waits for a while, and tries again.

Collision detection
With SeaTalk it can happen, that two instruments try to send data at the same time. This may causes a data collision on the SeaTalk bus. In this case, the SeaTalk NMEA Bridge immediately stops sending the current datagram.

To detect data collision, every single bit sent out to the SeaTalk bus is read back again and checked for successful transmission. If the transmission was corrupted, this transmission is stopped immediately. This single datagram will be discarded.
When the bus becomes free again, the transmission will be started again.
The lost datagram will be repeated on the next update from NMEA data.

At this time the following SeaTalk datagrams can be sent

00 Depth
10 app. Wind angle
11 app. Wind speed
25 Total & Trip mileage
27 Water temperature
30 Display illumination
50 Latitude
51 Longitude
52 Speed over ground
53 Course over ground
54 Time
56 Date
82 Target waypoint name
85 Navigation to waypoint Data
89 Compass ST40 heading
A2 Waypoint arrival Info
20 Speed through water
(see “Configuration settings” Item 14)



Same type of Data on NMEA & SeaTalk

Information available from like instruments on both Busses (SeaTalk & NMEA) are not converted.

Example:

We have a depth sounder on the SeaTalk Bus and another depth sounder on the NMEA bus.
So, on both sides depth information is available.
In this case no depth information in transferred from one bus to the other.

If depth information is not updated within 30 sec. on one bus, sending to the other bus is activated again. So - If one device should break, we have an automatic switch-over to the remaining functioning device.

Some navigation software echos all received NMEA sentences back to the SeaTalk-NMEA-Link. In this case, the SeaTalk-NMEA-Link would stop translating data from/to SeaTalk, because it would find every information as already available on the NMEA side.

See item #25 on page 17 for SeaTalk-NMEA-Link configuration settings.

The $STALK sentence

The converter can process a special NMEA-like sentence.
With this special sentence any SeaTalk command can be sent to SeaTalk.

$STALK,cc,p1,p2..,pn*xx

cc = SeaTalk Command
p1 = Parameter1
p2 = Parameter 2
..
*xx = NMEA checksum (optional) .

This special sentence will also be sent to the NMEA Bus (USB) for every received SeaTalk datagram – regardless as to whether it was recognised and processed or not.
For every received SeaTalk datagram,

Transmission of the $STALK sentence is switch on by default and should be switched off if not really needed. It causes unnecessary additional load on the NMEA Bus.
It is switched on by default

Example :

$STALK,30,00,0C - Switch ON illumination on SeaTalk instruments.
$STALK,30,00,00 - Switch OFF illumination on SeaTalk instruments.

Configuration settings

The SeaTalk NMEA converter can be configured to meet the users requirements.

The configuration is made by sending a NMEA-like sentence. The settings are stored in an EEProm.

The configuration sentence is:

$SNBSE,address,data<CR><LF>

(SNBSE = **S**eatalk **NMEA B**ridge **S**et **E**eprom)
Most configuration settings a read only, when the bridge gets switched on. So when you make changes to the configuration, you need to disconnect/reconnect it from the USB port in order to activate the changes.

How to set the configuration :

Connect the bridge to a PC.
Open a terminal program (i.e. hypertern) and set it to 4800 Baud, 8 Bit, no parity, no handshake. Please make sure, that the terminal program sends <CR><LF> when pressing ENTER. A command in recognized only after the bridge receives <CR><LF>

If there are SeaTalk instruments connected, you will see data coming in.

Type " $xxx " and press Enter

The bridge responds with " $xxx ". When you receive the $xxx, connection to your bridge is ok. If $xxx does not appear after you pressed ENTER, check connection, setting of Com-Port, Baud rate etc.
You will not see the characters on your screen as you type them. The bridge will only respond after you pressed ENTER.

Example 1 :

In this example, we configure the bridge, so that every incoming SeaTalk sentence will be sent to the PC as $STALK,xx,yy sentence.

In your terminal program type $SNBSE,0,1 Enter (capital letters)

The bridge will respond $SNBSE,0,0.001

Next time you switch the bridge on, it will send every incoming SeaTalk sentence to the PC as a $STALK,xx,yy,zz … sentence.

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Example 2 :

In this example, we configure the bridge, so that it only translates data from SeaTalk to NMEA – but does not send anything to the SeaTalk Bus.

In your terminal program type	$SNBSE,16,0 Enter
The bridge will respond	$SNBSE,16,0.000

Next time you switch the bridge on, it will not send anything to the SeaTalk Bus but it will only listen for SeaTalk data and translate them to NMEA.

Addresses and descriptions for $SNBSE Sentence

Address	Data
0	1 = Send out every incoming SeaTalk datagram as "$STALK....." to NMEA 0 = Do not generate $STALK,xx,yy sentence for each incoming SeaTalk datagram If you don't really need this function – better switch if OFF. It causes additional load on the NMEA Bus.
1	Set NMEA Port Baud rate 3 = 1200 Baud 4 = 2400 Baud 5 = 4800 Baud (Default) 6 = 9600 Baud 7 = 19200 Baud 8 = 38400 Baud any other value defaults to 4800 baud. Baud rate is changed at next start of the converter **Warning :** **The baud rate selected is also the baud rate used for any further configuration.** **If your configuration program cannot handle the selected baud rate, the only way to reconfigure the device is loading new Software which resets all settings to default values.**
2+3	Prefix for generated NMEA Sentence - Character 1+2 Every NMEA Sentence generated from the system begins with this two letters Default = "II" (Integrated Instrumentation) WARNING You have to enter the ASCII Value of the character, not the character itself. Example : To set character 1 to "I" and character 2 to "A" $SNBSE,2,73 (Character "I" is a 73 in ascii) $SNBSE,3,65 (Character "A" is a 65 in ascii) See Ascii Table below
4	1= Echo every incoming NMEA Sentence 0 = Do not echo incoming NMEA sentences
5	N.A:
6	1 = Send $IIVHW Sentence when new Data from SeaTalk arrives 0 = Do not send $IIVHW Sentence
7	1 = Send $IIHDM Sentence when new Data from SeaTalk arrives 0 = Do not send $IIHDM Sentence
8	1 = Send $IIMWV Sentence when new Data from SeaTalk arrives 0 = Do not send $IIMWV Sentence
9	1 = Send $IIDBT Sentence when new Data from SeaTalk arrives 0 = Do not send $IIDBT Sentence
10	1 = Send $IIMTW Sentence when new Data from SeaTalk arrives 0 = Do not send $IIMTW Sentence
11	1 = Send $IIVLW Sentence when new Data from SeaTalk arrives 0 = Do not send $IIVLW Sentence
12	Not used with USB SeaTalk NMEA Link
13	Not used with USB SeaTalk NMEA Link

14	0 = Speed over Ground from NMEA input is sent to SeaTalk bus as Speed over Ground **and** as Speed through Water (Needed for ST60 Wind instrument, that does not recognise Speed Over Ground) 1 = Normal operation. No special SOG => STW handling) (default) (See Webpage www.gadgetPool.de for more on this special ST60 Wind function.
15	0 = Only SeaTalk sentences known to the system are echoed as $STALK,xxx,yyy 1 = Every incoming SeaTalk datagram is sent to NMEA as "$STALK,xxx,yyy – no matter if the system can interpret the SeaTalk data or not. **Only valid if Address "0" is switch on.**
16	0 = Don't send any data to the SeaTalk Port. SeaTalk Port is READ-ONLY
17	0 = Display wind speed in knots. 1= Display wind speed in m/s
18	0 = Don't send SOG to SeaTalk 1 = Send SOG to SeaTalk
19	0 = Don't send Position to SeaTalk 1= Send Position to SeaTalk
20	0 = Display depth on SeaTalk instrument in feet, 1 = display in meters
21	Currently not used
22	0=send only RMC Sentence for Position 1=send GLL and RMC Sentence for Position
23	23+24 Offset of depth transducer. In mm (+- 1000th Meter) If this value is set to -1, the bridge will send DBT NMEA Sentence and no offset will be used. If this value is set to something between -32000 to 32000, the bridge will produce DPT sentences including the offset.
25	0 = if the same type of data is available on SeaTalk and NMEA, stop translating of this type of data . 1 = translate data from SeaTalk to NMEA even if already received from NMEA 2= translate from NMEA to SeaTalk, even if this type of data is already received from SeaTalk. **Needed if the PC Software echoes incoming NMEA Data to NMEA Port.** **Example :** **The bridge receives position data from SeaTalk from a SeaTalk GPS** **-> It sends the position data as NMEA to the PC** **-> The PC echoes position back to the bridge,** **The bridge receives position data on it's NMEA Port.** **In this case, Bridge would receive position data on it's SeaTalk port and on it's NMEA Port. It would stop translating any new arriving position data from the SeaTalk GPS because it "thinks" there are already position data available on the NMEA side.**

26	0=don't send RSA Sentence 1=send RSA Sentence for Rudder angle
27	Currently not used
28	0 = Don't send Waypoint autopilot data to SeaTalk 1 = Send Waypoint autopilot data to SeaTalk (default)
33	Calculate TRUE Wind data and send as $IIMWV Sentence 0 = don't calculate true wind. Dont send true wind data to NMEA. 1 = calculate true wind from app wind and **speed through water**. Send true wind data to NMEA. 2 = calculate true wind from app wind and **speed over ground**. Send true wind data to NMEA.

Reading actual configuration settings:

In your terminal program, enter

$SNBSE,address Enter

(Example : $SNBSE,0 Enter)

The bridge will respond „ $SNBSE,0,0.001„
- Parameter 0 is currently set to 1 -

(Example : $SNBSE,1 Enter)

The bridge will respond „ $SNBSE,0,0.005„
- Parameter 1 is currently set to 5 -

Software update

The Software can be updated by using the built in Bootstrap-Loader function.

If you find anything missing in the Software, if you should find any software errors or if you have new ideas – just sent a mail to FWallenwein@gadgetPool.de

I can send new / revised software by E-Mail and you can update the controller software yourself.

Bootstrap method advantages:
No Hardware programmer needed.
Just a PC Software is needed. (Provided with every bridge on CD)
Latest Software versions can be found at http://www.gadgetPool.de

Bootstrap Loader

- Disconnect bridge from USB and from SeaTalk Bus.
- Connect the SeaTalk NMEA Bridge to your PC (plug in USB connector)
- Open a terminal program (i.e. Hyperterm),
  select your serial port and set it to 4800 Baud, 8 Bit, no parity, no handshake.

Enter :

$SWUPDATE 

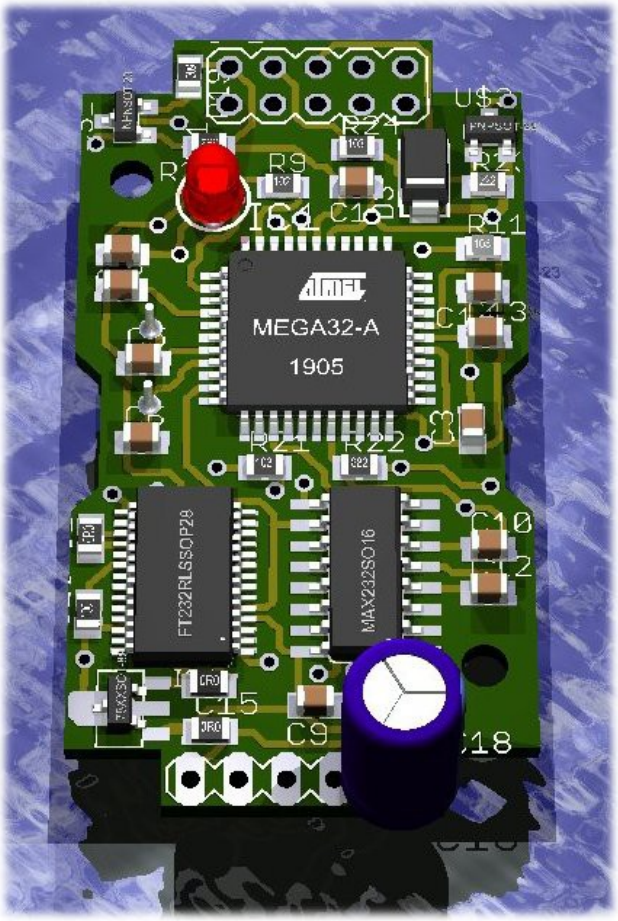
The Bridge will respond with :

$SWUPDATE
Software Update Function will start in 40 sec.
.....

Exit the terminal program.
Immediately start “Megaload” - the supplied bootstrap software - on the PC.
Open the program image file you would like to program into the bridge. (xxx.hex)
Open the eeprom image file you would like to program into the bridge.
(xxx.eep)
Select **9600 Baud**
Select your serial port in bootstrap software
Wait until the 40 sec. have passed.
The Bootstrap Software finds the SeaTalk NMEA Bridge and flashes the new software.

Warning:
Always select a proper image file. If a file not suitable for the bridge is selected (like a text file, an image file for a different device, or anything else) the bridge software will be reprogrammed with this wrong data and the bridge will not be working anymore!!

PCB Layout



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SeaTalk & NMEA conversion Table

Function	SeaTalk ID	NMEA	Stalk -> NMEA	NMEA->Stalk
Depth	0	DBT	X	X
Speed t. water	20	VHW	X	X (See SNBSE,14)
Speed t. water	26	VHW	X	
Trip mileage	21	VLW	X	
Total mileage	22	VLW	X	
Water temperature	23	MTW	X	
Water temperature	27	MTW	X	X
Total / Trip mileage	25	VLW	X	X
Wind angle	10	MWV VWR	X	X X
Wind speed	11	MWV VWR	X	X
Compass	84	HDM (VHW)	X	
Compass ST40	89	HDM	X	X
Speed over ground	52	RMC	X	X
Course over ground	53	RMC	X	X
Compass heading and Rudder position	9C	HDM/ RSA	X	
Latitude	51	RMC	X	X
Latitude	51	GLL		X
Longitude	50	RMC	X	X
Longitude	50	GLL		X
UTC time	54	RMC	X	X
UTC time	54	ZDA		X
# of sats	57	GGA		X
Date	56	RMC	X	X
Date	56	ZDA		X
Target waypoint name	82	RMB APB		X

Navigation to waypoint Data	85	RMB APB		X
Special NM->ST	any	$STALK	X	X
Special config.	-	$SNBSE		

News and Info on the web.

If you have any question or suggestions – there is a SeaTalk NMEA Bridge forum on our web page. http://www.gadgetPool.de

Errata

ASCII Table

Upper case letters

Character	ASCII Value
A	65
B	66
C	67
D	68
E	69
F	70
G	71
H	72
I	73
J	74
K	75
L	76
M	77
N	78
O	79
P	80
Q	81
R	82
S	83
T	84
U	85
V	86
W	87
X	88
Y	89
Z	90

Lower case letters

a	97
b	98
c	99
……..	
x	120
y	121
z	122

Digits

0	48	6	54
1	49	7	55
2	50	8	56
3	51	9	57
4	52		
5	53		

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