Navigation: Home =>Profil=>SeaTalk
Stand: 29.07.2017

SeaTalk Technical Reference Revision 3.23

General Information

SeaTalk is a simple interface for networking Raymarine/Autohelm marine equipment so that all devices of a ship can exchange and share their data. SeaTalk is a proprietary solution of Autohelm and **not** compatible with NMEA or CAN. Unfortunately Raymarine keeps the technical details of SeaTalk secret. To assist users who want to develop hard- or software to connect their devices to the SeaTalk bus these pages uncover some of the mysteries. Part 3 adds hints how to interface SeaTalk with a PC. The information is unsupported by Raymarine and was found by watching the bits travelling on the bus. Therefore the description is incomplete inaccurate and may even be wrong. Corrections and contributions are welcome.

Content

The technical description of the SeaTalk protocol is divided into three parts:

1. Part 1: How SeaTalk works
    a. Hardware-Interface describes the function of the three SeaTalk wires
    b. Serial Data Transmission describes the parameters of the asynchron serial port
    c. Composition of Messages describes the structure of datagrams
    d. Collision Management describes the arbitration between simultaneous talkers
    e. Data Coding describes common rules for coding numerical values
2. Part 2: Recognized Datagrams describes the SeaTalk messages and their meaning
3. Part 3: Processing SeaTalk Data with a PC
    a. Circuit example for an unidirectional SeaTalk => PC interface
    b. Circuit example for a bidrectonal SeaTalk <=> PC interface
    c. Simple SeaTalk monitoring utility for download
    d. SeaTrack: VisualBasic software for trip documentation
    e. SeaSigma: A small SeaTalk command generator for download

Revision History:

Rev 3.23: [July 2017] Commands 85 and 89 corrected thx Mindert Sprang and Hans Almquist
Rev 3.22: [May 2014] Command 53 corrected thx John Rind and Meindert Sprang
Rev 3.21: [March 2011] Time coding in command 54 clarified thx Tim Thornton
Rev 3.20: [January 2011] Some observations with Raystar 120 GPS included thx Tim Thornton
Rev 3.19: [August 2010] Command A2 revised thx Frank Wallenwein
Rev 3.18: [March 2009] Several commands edited and new commands 05 and 68 added thx Frank Wallenwein
Rev 3.17: [February 2009] Command A4 added thx Tord Lindner
Rev 3.16: [October 2008] Commands 65, 66, A8 and AB added thx Ray Holland
Rev 3.15: [June 2006] Command 61 added thx Ian Molesworth
Rev 3.14: [January 2006] Minor changes to commands 26, 01 and 6C thx Ian Molesworth
Rev 3.13: [December 2005] Additional bits found in command 26 by Pim Snoeks

Acknowledgement

Many thanks to

Knut Wiren, Finland
Mikael Wahlgren, Sweden (developed a PIC-based SeaTalk remote control)
Reiner Patommel, Danmark
Arnold de Maa, Holland
Wouter van Ooijen, Netherlands (developed a PIC-based SeaTalk protocol converter)
Jürgen Saniter, Germany (developed a SX-28 based SeaTalk remote control)
Harald Sammer, Scotland
Ales Janhar, Slovenija (developed the SeaSigma utility)
Jon Fick, USA (developed a PIC-based SeaTalk remote control)
Frank Wallenwein, **Germany** (NMEA <=> SeaTalk Bridge and several boat electronics projects)
Dave Martin, Great Britain
Horacio Martinez del Pezzo, Argentinia (developed an intelligent SeaTalk / NMEA multiplexer)
Pit Förster and Jochen Buttkereit, Germany (supplier of third party SeaTalk equipment for instance Brookhouse interfaces)
Louis Zammit Mangion, Malta (developed a PIC-based SeaTalk remote control)
Meindert Sprang, Netherlands (develops and manufactures NMEA/SeaTalk/Bluetooth/RS232-multiplexers)
Dennis Hambleton, Australia
Fernando MAS CADIZ, Spain
Ray Holland, Australia (developed a WakeUp Marine Alarm box)
Tord Lindner, Sweden and
Tim Thornton, United Kingdom (TeamSurv project for navigational data logging and Smartcom Software Ltd.)

who contributed valueable information for this page.

Return to Top of Page Part 1 Part 2 Part 3

SeaTalk Technical Reference Part 1: How SeaTalk works

Hardware-Interface

SeaTalk uses three wires, connected in parallel to all devices on the bus:

1. +12V Supply, red
2. GND Supply, grey
3. Data Serial Data, yellow: +12V=Idle/Mark=1, 0V=Space/Data=0, 4800 Baud, pullup circuit in each device, talker pulls down to 0V (wired OR). For connection to a RS232 receiver voltage levels must be inverted.

Serial Data Transmission

11 bits are transmitted for each character:

- 1 Start bit (0V)
- 8 Data Bits (least significant bit transmitted first)
- 1 Command bit, set on the first character of each datagram. Reflected in the parity bit of most UARTs. Not compatible with NMEA0183 but well suited for the multiprocessor communications mode of 8051-family microcontrollers (bit SM2 in SCON set).
- 1 Stop bit (+12V)

Composition of Messages

Each datagram contains between 3 and 18 characters:

1. Type of command (the only byte with the command-bit set)
2. Attribute Character, specifying the total length of the datagram in the least significant nibble:

   Most significant 4 bits: 0 or part of a data value
   Least significant 4 bits: Number of additional data bytes = n =>
   Total length of datagram = 3 + n characters
3. First, mandatory data byte
4. - 18. optional, additional data bytes

No datagrams or devices carry addresses. This eliminates the need for an initialization or arbitration phase on the bus. Events (such as a keystroke) are published as soon as they occure. Measured data is repeatedly transfered, typically about once per second. So the current values are always available to all devices on the bus and there is no need (and with the exception of command A4 no way) to request a particular information.

Collision Management

There is no master on the bus. Every device has equal rights and is allowed to talk as soon as it recognizes the bus to be idle (+12V for at least 10/4800 seconds). Low priority messages use a longer or randomly selected idle-bus-waiting-time. This allows messages from other devices with a higher priority to be transmitted first. The different waiting times of all devices make data collisions (two or more devices start

talking at exactly the same moment) very rare. Since each device also listens to its own transmission it will recognize when its message is garbled by a second talker. In this case it abandons the remaining characters of the datagram. It waits for the bus to become free again and then retransmits the whole message. For listeners this means that messages which are shorter than expected are invalid and have to be cancelled totally.

Data Coding

Some characters are repeated with all bits inverted for noise or transmission error detection. Example: 0xA2 is followed by 0x5D. The sum of both bytes must always be 0xFF. The listing below shows repeated bytes in small letters (example: ZZ zz).

Numerical values are transmitted binary coded and with least significant data first. Example: 0x13 0x57 means 0x5713 = 22291

Some values are put together by certain bits of a byte or nibble. The meaningful bits can be isolated by a bitwise AND operation (&). Example: (U & 0x3) filters the least significant two bits of U.

The "distance to destination" value (ZZZ in command 0x85) uses a scaling factor of 1/10 or 1/100 nm depending on the shift indicator bit (LSBit of Y).

Return to Top of Page Overview **Part 2** Part 3

SeaTalk Technical Reference Part 2:

Recognized Datagrams (in hexadecimal notation):

```
Com Att Dat Dat...

 00  02  YZ  XX XX  Depth below transducer: XXXX/10 feet
                     Flags in Y: Y&8 = 8: Anchor Alarm is active
                                 Y&4 = 4: Metric display units or
                                          Fathom display units if followed by
command 65
                                 Y&2 = 2: Used, unknown meaning
                     Flags in Z: Z&4 = 4: Transducer defective
                                 Z&2 = 2: Deep Alarm is active
                                 Z&1 = 1: Shallow Depth Alarm is active
                   Corresponding NMEA sentences: DPT, DBT

 01  05  XX XX XX XX XX XX  Equipment ID, sent at power on, reported examples:
 01  05  00 00 00 60 01 00  Course Computer 400G
 01  05  04 BA 20 28 01 00  ST60 Tridata
 01  05  70 99 10 28 01 00  ST60 Log
 01  05  F3 18 00 26 0F 06  ST80 Masterview
 01  05  FA 03 00 30 07 03  ST80 Maxi Display
 01  05  FF FF FF D0 00 00  Smart Controller Remote Control Handset

 05  03  0X  YY ZZ  PP   Engine RPM and PITCH:
                            X = 0: RPM & PITCH
                            X = 1: RPM & PITCH  starboard
                            X = 2: PRM & PITCH  port
                            YY*256+ZZ = RPM Value (signed value, example:
YYZZ=0x0110=272 RPM, YYZZ=0xfef0= -272 RPM)
                            PP = % Pitch (signed value -128%...+127%, example
0x03=3%, 0xFD= -3%)

 10  01  XX  YY  Apparent Wind Angle: XXYY/2 degrees right of bow
                Used for autopilots Vane Mode (WindTrim)
                Corresponding NMEA sentence: MWV

 11  01  XX  0Y  Apparent Wind Speed: (XX & 0x7F) + Y/10 Knots
                Units flag: XX&0x80=0    => Display value in Knots
                             XX&0x80=0x80 => Display value in Meter/Second
                Corresponding NMEA sentence: MWV

 20  01  XX  XX  Speed through water: XXXX/10 Knots
                Corresponding NMEA sentence: VHW

 21  02  XX  XX  0X  Trip Mileage: XXXXX/100 nautical miles

 22  02  XX  XX  00  Total Mileage: XXXX/10 nautical miles

 23  Z1  XX  YY  Water temperature (ST50): XX deg Celsius, YY deg Fahrenheit
                Flag Z&4: Sensor defective or not connected (Z=4)
                Corresponding NMEA sentence: MTW

 24  02  00  00  XX  Display units for Mileage & Speed
                     XX: 00=nm/knots, 06=sm/mph, 86=km/kmh

 25  Z4  XX  YY  UU  VV AW  Total & Trip Log
                     total= (XX+YY*256+Z* 4096)/ 10 [max=104857.5] nautical miles
                     trip = (UU+VV*256+W*65536)/100 [max=10485.75] nautical miles
```

```
 26  04  XX  XX  YY  YY DE  Speed through water:
                         XXXX/100 Knots, sensor 1, current speed, valid if D&4=4
                         YYYY/100 Knots, average speed (trip/time) if D&8=0
                                  or data from sensor 2 if D&8=8
                         E&1=1: Average speed calulation stopped
                         E&2=2: Display value in MPH
                         Corresponding NMEA sentence: VHW

 27  01  XX  XX  Water temperature: (XXXX-100)/10 deg Celsius
                  Corresponding NMEA sentence: MTW

 30  00  0X      Set lamp Intensity; X=0: L0, X=4: L1, X=8: L2, X=C: L3
                  (only sent once when setting the lamp intensity)

 36  00  01      Cancel MOB (Man Over Board) condition

 38  X1  YY  yy  Codelock data

 50  Z2  XX  YY  YY  LAT position: XX degrees, (YYYY & 0x7FFF)/100 minutes
                     MSB of Y = YYYY & 0x8000 = South if set, North if cleared
                     Z= 0xA or 0x0 (reported for Raystar 120 GPS), meaning unknown
                     Stable filtered position, for raw data use command 58
                     Corresponding NMEA sentences: RMC, GAA, GLL

 51  Z2  XX  YY  YY  LON position: XX degrees, (YYYY & 0x7FFF)/100 minutes
                      MSB of Y = YYYY & 0x8000 = East if set, West if cleared
                      Z= 0xA or 0x0 (reported for Raystar 120 GPS), meaning unknown
                     Stable filtered position, for raw data use command 58
                     Corresponding NMEA sentences: RMC, GAA, GLL

 52  01  XX  XX  Speed over Ground: XXXX/10 Knots
                  Corresponding NMEA sentences: RMC, VTG

 53  U0  VW      Course over Ground (COG) in degrees:
                  The two lower  bits of  U * 90 +
                     the six lower  bits of VW *  2 +
                     the two higher bits of  U /  2 =
                     (U & 0x3) * 90 + (VW & 0x3F) * 2 + (U & 0xC) / 8
                  The Magnetic Course may be offset by the Compass Variation (see
datagram 99) to get the Course Over Ground (COG).
                  Corresponding NMEA sentences: RMC, VTG

 54  T1  RS  HH  GMT-time: HH hours,
                           6 MSBits of RST = minutes = (RS & 0xFC) / 4
                           6 LSBits of RST = seconds =  ST & 0x3F
                  Corresponding NMEA sentences: RMC, GAA, BWR, BWC

 55  X1  YY  yy  TRACK keystroke on GPS unit
                  keycodes identical with autopilot (command 86)

 56  M1  DD  YY  Date: YY year, M month, DD day in month
                  Corresponding NMEA sentence: RMC

 57  S0  DD      Sat Info: S number of sats, DD horiz. dillution of position, if S=1
-> DD=0x94
                  Corresponding NMEA sentences: GGA, GSA

 58  Z5  LA XX YY LO QQ RR   LAT/LON
                  LA Degrees LAT, LO Degrees LON
                  minutes LAT = (XX*256+YY) / 1000
                  minutes LON = (QQ*256+RR) / 1000
                  Z&1: South (Z&1 = 0: North)
                  Z&2: East  (Z&2 = 0: West)
                  Raw unfiltered position, for filtered data use commands 50&51
                  Corresponding NMEA sentences: RMC, GAA, GLL

 59  22  SS MM XH  Set Count Down Timer
                   MM=Minutes ( 00..3B ) ( 00 .. 63 Min ), MSB:0 Count up start flag
```

```
                    SS=Seconds ( 00..3B ) ( 00 .. 59 Sec )
                    H=Houres  ( 0..9 )   ( 00 .. 09 Houres )
                    X= Counter Mode: 0 Count up and start if MSB of MM set
                                     4 Count down
                                     8 Count down and start
                    ( Example 59 22 3B 3B 49 -> Set Countdown Timer to 9.59:59 )
 59  22  0A 00 80  Sent by ST60 in countdown mode when counted down to 10 Seconds.

 61  03  03 00 00 00  Issued by E-80 multifunction display at initialization

 65  00  02      Select Fathom (feet/3.33) display units for depth display (see
command 00)

 66  00  XY      Wind alarm as indicated by flags in XY:
                   X&8 = 8: Apparent Wind angle low
                   X&4 = 4: Apparent Wind angle high
                   X&2 = 2: Apparent Wind speed low
                   X&1 = 1: Apparent Wind speed high
                   Y&8 = 8: True Wind angle low
                   Y&4 = 4: True Wind angle high
                   Y&2 = 2: True Wind speed low
                   Y&1 = 1: True Wind speed high (causes Wind-High-Alarm on ST40 Wind
Instrument)
                   XY  =00: End of wind alarm (only sent once)

 68  X1 01 00   Alarm acknowledgment keystroke (from ST80 Masterview)
 68  X1 03 00   Alarm acknowledgment keystroke (from ST80 Masterview)
 68  41 15 00   Alarm acknowledgment keystroke (from ST40 Wind Instrument)
                  X: 1=Shallow Shallow Water Alarm, 2=Deep Water Alarm, 3=Anchor
Alarm
                     4=True Wind High Alarm, 5=True Wind Low Alarm, 6=True Wind Angle
high
                     7=True Wind Angle low, 8=Apparent Wind high Alarm, 9=Apparent
Wind low Alarm
                     A=Apparent Wind Angle high, B=Apparent Wind Angle low

 6C  05  XX XX XX XX XX XX Second equipment-ID datagram (follows 01...), reported
examples:
 6C  05  04 BA 20 28 2D 2D ST60 Tridata
 6C  05  05 70 99 10 28 2D ST60 Log
 6C  05  F3 18 00 26 2D 2D ST80 Masterview

 6E  07  00  00 00 00 00 00 00 00 MOB (Man Over Board), (ST80), preceded
                 by a Waypoint 999 command: 82 A5 40 BF 92 6D 24 DB

 70  10  XY      Keystroke on Raymarine A25006 ST60 Maxiview Remote Control
                   X=0 => Single keypress; X=2 => Two keys pressed;
                   X=4 => Single key: Press,hold&release; X=6 => Two keys:
Press,hold&release
                   Y=0 => Key 1 "Depth"; Y=1 => Key 2 "Speed" or Keys 1+2;
                   Y=2 => Key 3 "HDG" or Keys 2+4; Y=3 => Key 4 "Wind" or Keys 1+3;
                   Y=4 => Keys 3+4 "Nav"

 80  00  0X      Set Lamp Intensity: X=0 off, X=4: 1, X=8: 2, X=C: 3

 81  01  00  00  Sent by course computer during setup when going past USER CAL.
 81  00  00      Sent by course computer immediately after above.

 82  05  XX  xx YY yy ZZ zz   Target waypoint name
                 XX+xx = YY+yy = ZZ+zz = FF (allows error detection)
                 Takes the last 4 chars of name, assumes upper case only
                 Char= ASCII-Char - 0x30
                 XX&0x3F: char1
                 (YY&0xF)*4+(XX&0xC0)/64: char2
                 (ZZ&0x3)*16+(YY&0xF0)/16: char3
                 (ZZ&0xFC)/4: char4
                 Corresponding NMEA sentences: RMB, APB, BWR, BWC
```

```
 83  07  XX  00  00  00  00  00  80  00  00  Sent by course computer.
                XX = 0 after clearing a failure condition, also sent once after
power-up.
                XX = 1 failure, auto release error. Repeated once per second.
                XX = 8 failure, drive stopped.

 84  U6  VW  XY 0Z 0M RR SS TT  Compass heading  Autopilot course and
                 Rudder position (see also command 9C)
                 Compass heading in degrees:
                   The two lower  bits of  U * 90 +
                   the six lower  bits of VW *  2 +
                   number of bits set in the two higher bits of U =
                   (U & 0x3)* 90 + (VW & 0x3F)* 2 + (U & 0xC ? (U & 0xC == 0xC ? 2 :
1): 0)
                 Turning direction:
                   Most significant bit of U = 1: Increasing heading, Ship turns
right
                   Most significant bit of U = 0: Decreasing heading, Ship turns
left
                 Autopilot course in degrees:
                   The two higher bits of  V * 90 + XY / 2
                 Z & 0x2 = 0 : Autopilot in Standby-Mode
                 Z & 0x2 = 2 : Autopilot in Auto-Mode
                 Z & 0x4 = 4 : Autopilot in Vane Mode (WindTrim), requires regular
"10" datagrams
                 Z & 0x8 = 8 : Autopilot in Track Mode
                 M: Alarms + audible beeps
                   M & 0x04 = 4 : Off course
                   M & 0x08 = 8 : Wind Shift
                 Rudder position: RR degrees (positive values steer right,
                   negative values steer left. Example: 0xFE = 2° left)
                 SS & 0x01 : when set, turns off heading display on 600R control.
                 SS & 0x02 : always on with 400G
                 SS & 0x08 : displays "NO DATA" on 600R
                 SS & 0x10 : displays "LARGE XTE" on 600R
                 SS & 0x80 : Displays "Auto Rel" on 600R
                 TT : Always 0x08 on 400G computer, always 0x05 on 150(G) computer

 85  X6  XX  VU ZW ZZ YF 00 yf   Navigation to waypoint information
                 Cross Track Error: XXX/100 nautical miles
                  Example: X-track error 2.61nm => 261 dec => 0x105 => X6XX=5_10
                 Bearing to destination: (U & 0x3) * 90° + WV / 2°
                  Example: GPS course 230°=180+50=2*90 + 0x64/2 => VUZW=42_6
                  U&8: U&8 = 8 -> Bearing is true, U&8 = 0 -> Bearing is magnetic
                 Distance to destination: Distance 0-9.99nm: ZZZ/100nm, Y & 1 = 1
                                          Distance >=10.0nm: ZZZ/10 nm, Y & 1 = 0
                 Direction to steer: if Y & 4 = 4 Steer right to correct error
                                     if Y & 4 = 0 Steer left  to correct error
                 Example: Distance = 5.13nm, steer left: 5.13*100 = 513 = 0x201 =>
ZW ZZ YF=1_ 20 1_
                          Distance = 51.3nm, steer left: 51.3*10  = 513 = 0x201 =>
ZW ZZ YF=1_ 20 0_
                 F contains four flags which indicate the available data fields:
                          Bit 0 (F & 1): XTE present
                          Bit 1 (F & 2): Bearing to destination present
                          Bit 2 (F & 4): Range to destination present
                          Bit 3 (F & 8): XTE >= 0.3nm
                      These bits are used to allow a correct translation from for
instance an RMB sentence which
                      contains only an XTE value, all other fields are empty. Since
SeaTalk has no special value
                      for a data field to indicate a "not present" state, these
flags are used to indicate the
                      presence of a value.
                  In case of a waypoint change, sentence 85, indicating the new
bearing and distance,
                  should be transmitted prior to sentence 82 (which indicates the
waypoint change).
                  Corresponding NMEA sentences: RMB, APB, BWR, BWC, XTE
```

```
86  X1  YY  yy  Keystroke
                 X=1: Sent by Z101 remote control to increment/decrement
                      course of autopilot
      11  05  FA     -1
      11  06  F9    -10
      11  07  F8     +1
      11  08  F7    +10
      11  20  DF     +1 &  -1
      11  21  DE     -1 & -10
      11  22  DD     +1 & +10
      11  28  D7    +10 & -10
      11  45  BA     -1        pressed longer than 1 second
      11  46  B9    -10        pressed longer than 1 second
      11  47  B8     +1        pressed longer than 1 second
      11  48  B7    +10        pressed longer than 1 second
      11  60  DF     +1 &  -1  pressed longer than 1 second
      11  61  9E     -1 & -10  pressed longer than 1 second
      11  62  9D     +1 & +10  pressed longer than 1 second
      11  64  9B    +10 & -10  pressed longer than 1 second (why not 11 68 97 ?)

                 Sent by autopilot (X=0: ST 1000+,  X=2: ST4000+ or ST600R)
      X1  01  FE    Auto
      X1  02  FD    Standby
      X1  03  FC    Track
      X1  04  FB    disp (in display mode or page in auto chapter = advance)
      X1  05  FA     -1 (in auto mode)
      X1  06  F9    -10 (in auto mode)
      X1  07  F8     +1 (in auto mode)
      X1  08  F7    +10 (in auto mode)
      X1  09  F6     -1 (in resp or rudder gain mode)
      X1  0A  F5     +1 (in resp or rudder gain mode)
      X1  21  DE     -1 & -10 (port tack, doesn´t work on ST600R?)
      X1  22  DD     +1 & +10 (stb tack)
      X1  23  DC    Standby & Auto (wind mode)
      X1  28  D7    +10 & -10 (in auto mode)
      X1  2E  D1     +1 & -1 (Response Display)
      X1  41  BE    Auto pressed longer
      X1  42  BD    Standby pressed longer
      X1  43  BC    Track pressed longer
      X1  44  BB    Disp pressed longer
      X1  45  BA     -1 pressed longer (in auto mode)
      X1  46  B9    -10 pressed longer (in auto mode)
      X1  47  B8     +1 pressed longer (in auto mode)
      X1  48  B7    +10 pressed longer (in auto mode)
      X1  63  9C    Standby & Auto pressed longer (previous wind angle)
      X1  68  97    +10 & -10 pressed longer (in auto mode)
      X1  6E  91     +1 & -1 pressed longer (Rudder Gain Display)
      X1  80  7F     -1 pressed (repeated 1x per second)
      X1  81  7E     +1 pressed (repeated 1x per second)
      X1  82  7D    -10 pressed (repeated 1x per second)
      X1  83  7C    +10 pressed (repeated 1x per second)
      X1  84  7B     +1, -1, +10 or -10 released

 87  00  0X        Set Response level
                  X=1  Response level 1: Automatic Deadband
                  X=2  Response level 2: Minimum Deadband

 88  03  WW  XX  YY  ZZ  Autopilot Parameter: Sent by AP every
                         second while in parameter setting mode.
                         (User or Dealer Calibration Mode)
                         WW Parameter Number
                         XX Current Setting
                         YY Max Parameter Value
                         ZZ Min Parameter Value
                         Known Paramters: Parameter (min-max) [default]
Number
                         rudder gain  (1-9) [2]
1
                         counter rudder (1-9) [2]
```

```
2
                        rudder limit  (10-40) [30]
3
                        turn rate limit  (1-30) [off]
4
                        speed  (4-60) [8]
5
                        off course limit  (15-40) [20]
6
                        auto trim  (0-4) [1]
7
                        power steer [Joy Stick] ON/OFF (not on new 400G)
9
                        drive type  (3,4,5) [3]
A
                        rudder damping  (1-9) [2]
B
                        variation: (full degrees)(-30 to +30) [0]
C
                        auto adapt: 0=Off,1=North,2=South [1]
D
                        auto adapt latitude (0-80) [0]
E
                        auto release (only for stern drive) ON/OFF
F
                        rudder alignment (-7 to +7) [0]
10
                        Wind Trim (Wind Response) (1-9) [5] (only for sail)
11
                        Response  (1-9) [5]
12
                        Boat type:1=displ,2=semi-displ,3=plan,4=stern,5=work,6=sail
13
                        Cal Lock:  0=OFF, 1=ON [0]
15
                        Auto Tack Angle (40-125) [100] (only for sail)
1d

 89  U2  VW  XY  2Z  Compass heading sent by ST40 compass instrument
                     (it is read as a compass heading by the ST1000(+) or ST2000(+)
autopilot)
                       Compass heading in degrees:
                         The two lower bits of  U  *  90   +
                         the six lower bits of VW  *   2   +
                         the two higher bits of U  /   2   =
                         (U & 0x3) * 90 + (VW & 0x3F) * 2 + (U & 0xC) / 8
                      Locked stear reference (only send by the ST40 compass):
                         The two higher bits of V * 90 + XY / 2
                       Z & 0x2 = 0 : St40 in Standby mode
                       Z & 0x2 = 2 : St40 in Locked stear mode
                     Corresponding NMEA sentences: HDM, HDG, HDT, VHW

 90  00  XX        Device Indentification
                   XX=02  sent by ST600R ~every 2 secs
                   XX=05  sent by type 150, 150G and 400G course computer
                   XX=A3  sent by NMEA <-> SeaTalk bridge ~every 10 secs

 91  00  0X        Set Rudder gain to X

 92  02  XX  YY  00 Set Autopilot Parameter: Sent by the remote head
                    (e.g. ST600R) to set a particular parameter.
                    XX Parameter Number (see 88)
                    YY Value to set to.

 93  00  00         Enter AP-Setup: Sent by course computer before
                    finally entering the dealer setup. It is repeated
                    once per second, and times out after ten seconds.
                    While this is being sent, command 86 X1 68 97 is
                    needed for final entry into Setup. (600R generates
```

```
                    this when –1 & +1 are pressed simultaneously in this
                    mode).

 95  U6  VW  XY 0Z 00 RR 00 0T  Replaces command 84 while autopilot is in value
setting mode
                  e.g. lamp intensity or response level

 99  00  XX        Compass variation sent by ST40 compass instrument
                     or ST1000, ST2000, ST4000+, E–80 every 10 seconds
                     but only if the variation is set on the instrument
                     Positive XX values: Variation West, Negative XX values:
Variation East
                     Examples (XX => variation): 00 => 0, 01 => –1 west, 02 => –2
west ...
                                                 FF => +1 east, FE => +2 east ...
                  Corresponding NMEA sentences: RMC, HDG

 9A  09  L11  L12  L13  L14  L21  L22  L23  00  00  00  Version String:
                  L11 means line 1 char 1. There are two lines, line 1
                  Can have 4 characters and line two can have 3
                  Characters. Char: "A"= 0x00, "B"= 0x01,……..
                  Char: "0"= 0x25, "1"= 0x26, …….
                  Some special characters are mapped to the range
                  Between alphas and numeric chars. It seems modulo
                  masked at 0x36, and wraps around from there.

 9C  U1  VW  RR    Compass heading and Rudder position (see also command 84)
                     Compass heading in degrees:
                       The two lower  bits of  U * 90 +
                       the six lower  bits of VW *  2 +
                       number of bits set in the two higher bits of U =
                       (U & 0x3)* 90 + (VW & 0x3F)* 2 + (U & 0xC ? (U & 0xC == 0xC ?
2 : 1): 0)
                     Turning direction:
                       Most significant bit of U = 1: Increasing heading, Ship turns
right
                       Most significant bit of U = 0: Decreasing heading, Ship turns
left
                     Rudder position: RR degrees (positive values steer right,
                       negative values steer left. Example: 0xFE = 2° left)
                     The rudder angle bar on the ST600R uses this record

 9E  FC  49  49 03 XX AA BB YY OO PP GG HH II JJ   Waypoint definition
                  XX: Degrees LAT, YY: Degrees LON
                  min&sec LAT= AA+(BB&0x1F)*256, BB&0x80 = 0: North, BB&0x80 = 0x80:
South
                  min&sec LON= OO+(PP&ßx1F)*256, PP&0x80 = 0: West,  PP&0x80 = 0x80:
East
                  GG HH II JJ: Last four characters of waypoint name

 A1  XD  49  49 GG HH II JJ C1 C2 C3 C4 C5 C6 C7 C8  Destination Waypoint Info
                  GG HH II JJ: Last four characters of waypoint name
                  C1...C8: Up to 8 characters of WP name, unused are 0
                  Longer names (> 8 chars) create an additional record:
                  X=0: single record (short name)
                  X=1: 1st record, more follows
                  X=3: last record
                  Corresponding NMEA sentences: RMB, APB, BWR, BWC

 A2  X4  00  WW XX YY ZZ Arrival Info
                  X&0x2=Arrival perpendicular passed, X&0x4=Arrival circle entered
                  WW,XX,YY,ZZ = Ascii char's of waypoint id.   (0..9,A..Z)
                                Takes the last 4 chars of name, assumes upper case
only
                  Corresponding NMEA sentences: APB, AAM

 A4  02  00  00 00 Broadcast query to identify all devices on the bus, issued e.g. by
C70 plotter
 A4  06  00  00 00 00 00 Termination of request for device identification, sent e.g.
```

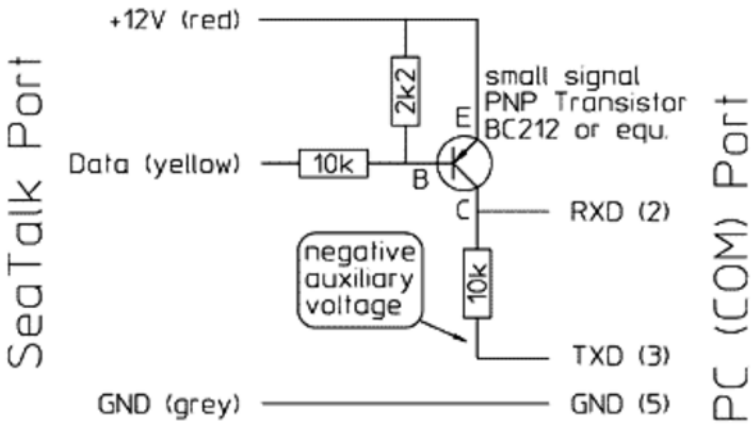
```
by C70 plotter
 A4  12  II  VV WW Device answers identification request
                      II: Unit ID (01=Depth, 02=Speed, 03=Multi, 04=Tridata,
05=Tridata repeater,
                                   06=Wind, 07=WMG, 08=Navdata GPS, 09=Maxview,
0A=Steering compas,
                                   0B=Wind Trim, 0C=Speed trim, 0D=Seatalk GPS,
0E=Seatalk radar ST50,
                                   0F=Rudder angle indicator, 10=ST30 wind, 11=ST30
bidata, 12=ST30 speed,
                                   13=ST30 depth, 14=LCD navcenter, 15=Apelco LCD
chartplotter,
                                   16=Analog speedtrim, 17=Analog depth, 18=ST30
compas,
                                   19=ST50 NMEA bridge, A8=ST80 Masterview)
                      VV: Main Software Version
                      WW: Minor Software Version

 A5                GPS and DGPS Info
 A5  57  QQ  HH ?? AA GG ZZ YY DD   GPS and DGPS Fix Info
                   Signal Quality= QQ&0xF, QQ&0x10: Signal Quality available flag
                   HDOP= HH&0x7C, HH&0x80: HDOP available flag
                   Antenna Height= AA
                   Number of Sats= (QQ&0xE0)/16+(HH&0x1), HH&0x2: NumSats available
flag
                   GeoSeperation= GG*16 (-2048....+2047 meters)
                   Differential age=(ZZ&0xE0)/2+(YY&0xF), YY&0x10: Diff. age
available flag
                   Differential Station ID=(YY&0xC0)*4+DD, YY&0x20: Diff.St.ID
available flag
                   Corresponding NMEA sentences: GGA, RMC, GSV, GLL, GGA
 A5  61  04  E2    , A5 8D ..., A5 98 ..., A5 B5 ..., A5 0C...  Unknown meaning
 A5  74  ID  ID ID ID ID   GPS Info: ID numbers of satellites
 A5  XD  NN  AA EE SS MM BB FF GG OO CC DD XX YY ZZ   GPS Info: Sat Position and
Signal
                   Data of up to three sattelites [1,2,3] per datagram
                   Satellite number: [1] NN&0xFE, [2] (MM&0x70)/2+(BB&0x7), [3]
CC&0x3F
                   Satellite azimuth:[1] AA*2+(EE&0x1), [2] (BB&0xF8)*2+(FF&0xF), [3]
(CC&0xC0)*2+DD&0x7F
                   Satellite elevation:[1] (EE&0xFE)/2, [2] (FF&0xF0)/2+GG&0x7, [3]
XX&0x7F
                   Satellite signal: [1] (SS&0xFE)/2, [2] (GG&0x80)/2+OO&0x3F, [3]
(YY&0xFC)/2+ZZ&0x1

                    It seems that there will be 4 sat info
                    datagrams generated, the first with X=0
                    carries the position and signal data of the
                    1st 3 satellites. The second also with X=0,
                    but NN&0x1 set and a length of 0x0C carries
                    the data of the next 2 satellites and then
                    the ID numbers of the 1st 4 sats. A datagram
                    like the 1st one, but with X=2 carries data
                    of 3 more sats [6,7,8]. It was not possible
                    to get more than 8 sats mapped to SeaTalk.
                    Finally a datagram with X=7 carries the next
                    5 ID numbers.

                   Corresponding NMEA sentences: GSV, GSA

 A7  09  86 000000000000000079 Unknown meaning, sent by Raystar 120 GPS

 A8  53  80 00 00 D3  Alarm ON  for Guard #1 or #2
 A8  43  80 00 00 C3  Alarm OFF for Guard #1 or #2
 AB  53  80 00 00 D3  Alarm ON  for Guard #1 or #2
 AB  43  80 00 00 C3  Alarm OFF for Guard #1 or #2
```

Return to Top of Page Overview Part 1 **Part 3**

SeaTalk Technical Reference Part 3: Processing SeaTalk Data with a PC

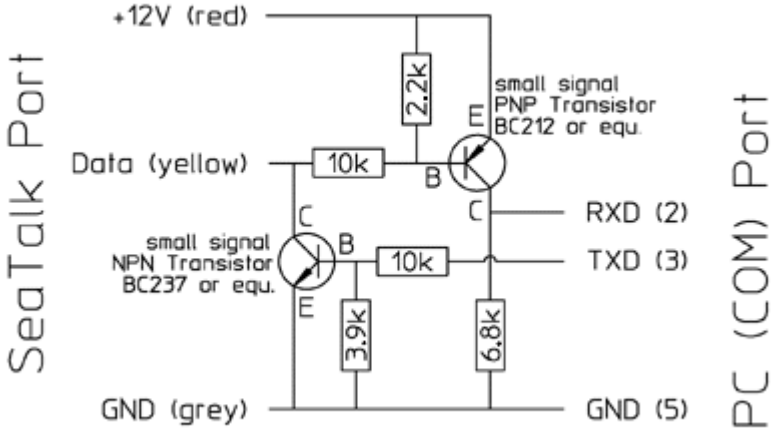
Unidirectional SeaTalk => RS232 Interface

This simple unidirectional interface circuit inverts the SeaTalk signal to make it readable by the PC serial port:



Bidirectional SeaTalk <=> RS232 Interface

For bidirectional communication the circuit has to be extended by a second transistor:



A PC-board may be obtained from Frank Wallenwein.

SeaTalk Monitor

The following piece of C-code gives an example of how to collect and process SeaTalk data. It monitors the SeaTalk bus and echoes the SeaTalk datagrams in hexadecimal notation to the screen.

```
#include <stdio.h>

/* Set Address of Serial Port: COM1=0x3F8, COM2=0x2F8 */
#define PORT 0x3F8

unsigned int collision_ctr,overrun_ctr;
char buffer[256],in_ptr,out_ptr,limit_ptr;
char line_status_reg,receiver_buf,byte_ctr;
char hex[]="0123456789ABCDEF";

main() {
  puts("SeaTalk Monitor Rev. 1.01    (c)2000 by Thomas Knauf\r\n");

 /* Serial Port Initialization */
 _outb(   0, PORT+1); /*IER Disable Interrupts */
 _outb(   1, PORT+2); /*FCR Enable Fifo */
 _outb(0x80, PORT+3); /*LCR Enable access to Divisor Latch */
 _outb(  24, PORT  ); /*DLL Set Baud Rate to 4800 LSB*/
 _outb(   0, PORT+1); /*DLM Baud Rate Divisor MSB */
 _outb(0x3B, PORT+3); /*LCR Stick Parity to 0, Enable Parity, 1 Stop bit, 8 bits/char
*/
 _outb(0x0F, PORT+4); /*MCR Disable LOOP Mode */
 _outb(   0, PORT+5); /*LSR Clear Error flags */

 while(1) { /* Continous data processing loop */
   if((line_status_reg= _inb(PORT+5)) & 1) { /* LSR New SeaTalk Data received ? */
     receiver_buf=_inb(PORT);  /* RBR Read SeaTalk Data Byte */
     if(line_status_reg & 2) overrun_ctr++; /* PC too slow, should not happen */
     if(line_status_reg & 4) { /* Parity bit set => Command Byte */
       if(byte_ctr) {          /* More characters expected => Collision */
         in_ptr=limit_ptr;     /* Discard last datagram, restart from beginning */
         collision_ctr++;      /* Count collision events */
       }
       buffer[in_ptr++]='\r';  /* Put new command on new line */
       buffer[in_ptr++]='\n';
       byte_ctr=255;           /* Undefined datagram length, wait for next character
*/
     } else
       if(byte_ctr==254)       /* Attribute byte ? */
         byte_ctr=(receiver_buf & 0xF) + 2; /* Read expected datagram length */
     if(byte_ctr) {            /* Process valid data bytes, should always be true */
       buffer[in_ptr++]=hex[receiver_buf >>  4]; /* Convert Data to hex */
       buffer[in_ptr++]=hex[receiver_buf & 0xF];
       buffer[in_ptr++]=' ';                     /* Seperate by space */
       if(! --byte_ctr) limit_ptr=in_ptr;        /* Complete datagram ready for
output */
     }
   } else
     if(out_ptr != limit_ptr)          /* Characters waiting for Output ? */
       putc(buffer[out_ptr++],stdout); /* Copy single character from buffer to screen
*/
     else if(scr_csts()) break;        /* Query keyboard, terminate if any key hit */
 }
 printf("\r\nSeatalk Collisions : %5u",collision_ctr);
 printf("\r\nUART Overrun Errors: %5u",overrun_ctr);
}
```

Compiled EXE-Files can be downloaded here as SEAMON1.EXE (using COM1:) or SEAMON2.EXE (using COM2:). They run in any MS-DOS environment. Redirecting the output logs data to a file (example: SEAMON1 > LOGFILE). Pressing any key terminates the program.

SeaTrack: Route documentation software

The SeaTrack software developed by Philip Beekman for reading editing combining displaying and saving trip routes is able to handle SeaTalk data directly. The author also describes how he solved the problem to handle the parity/command-bit interpetation within VisualBasic.

SeaSigma: A simple SeaTalk command generator

The file SeaSigma.zip contains a MS-Windows program which allows to generate SeaTalk commands and to send them via COM1: or COM2: to the SeaTalk bus. Since SeaSigma is a contribution of Ales Janhar I cannot give support or take any responsibility for this software.

Return to Top of Page Overview Part 1 Part 2

Reading SeaTalk data using Microsoft Communications Control in VisualBasic

On the website of Thomas Knauf (http://www.thomasknauf.de/seatalk.htm), the details of the SeaTalk protocol are discussed, and also the interface with a PC. Based on this information it is possible to read and process Seatalk input data in VisualBasic, using the Microsoft Communications Control. The advantage is obvious: we can directly interpret the SeaTalk input, and display the data on our Computer Navigation Centre. Below, we discuss how this is accomplished.

The practice of SeaTalk to set the parity bit, in order to signal a new datagram, is not the same as creating a parity condition in regular data transmission. Normally, the number of bits set in a byte is counted, and the parity bit is set to make the total bits even or odd (depending on the parity setting, see http://support.microsoft.com/default.aspx?scid=kb;en-us;52196 for an explanation). A further complication may be, that the after the parity event is raised by the Communications Control, when characters continue to be received, the parity event may be raised again. But if there is more than one character in the input buffer, it is not clear which character raised the parity condition.
As a workaround we will process the parity event as soon as it is raised, and then quickly process all remaining characters in the buffer, assuming these caused no parity. In my experience, this works quite well, creating less than a few percent wrong incorrect receptions.
The code example (**SeaTalkTest.vbp**) provided in attached zip file demonstrates this approach. It employs three key functions:

Public Function SetSeaTalkCom(myPort As Integer, myCom As MSComm) As Boolean

Opens the input port (**myPort**) using the Communications Control (**myCom**), with the proper settings:

.Settings = "4800,S,8,1"	4800 baud, Space, 8 data, and 1 stop bit.
.ParityReplace = ""	Parity will be detected by OnComm event, character will still be used
.InputMode = comInputModeBinary	Expect also Hex 00 characters, and process data as a binary array, not as a text string
.Handshaking = comNone	SeaTalk has no handshaking
.InputLen = 1	We will process 0ne character at a time
.RThreshold = 1	We will react when we get the character

Public Sub MSCommSeaTalkChar(myComm As MSComm, SeaTalkMode As Integer, mymsg As String, myMsgNum As Integer, Optional myInp As String)

Called by myComm_OnComm whenever a Communication event is raised on MsComm. It processes and stores the parity event, if received, and if called in a receive condition processes any characters available in the input buffer.

MyComm	the Communications Control we are using
SeaTalkMode	Public Const SeaTalkModeBoat = 1 (look at parity bit and parity algorithm) Public Const SeaTalkModeSim = 2 (only look at parity bit)
myMsg	will contain the message received, if a complete message was received
myMsgNum	will contain the SeaTalk message number of above
myInp	hex representation of any input bytes received will be appended to this string, if provided

Function DoSeaTalkMessage(b() As Byte) As String

When we have a full SeaTalk Message in our input buffer array (b()), we call this function to process

the message. It returns a legible string.

Notice
Although this code has demonstrated to work in my case (Pentium processor, Windows XP, three instruments on SeaTalk bus), no guarantees can be given. Also from time to time we detect improvements, which are implemented without notice. Any suggestions are welcome at : 'zee "@" pbeekman.com' (replace ' " ' by '@' for spam protection)

Downloads:
- seatalktestp.zip this documentation + vb project
- seatalktestc.zip complete setup package for executable
- seatalktestx.zip executable only

This page is available from: http://pbeekman.com/seatalk
Also take a look at look at http://pbeekman.com/seatrack.htm, which can be used to process seatalk input directly as well.

Thomas Knauf website on Seatalk: http://www.thomasknauf.de/seatalk.htm
Raymarine: http://raymarine.com
Microsoft knowledgebase on parity:http://support.microsoft.com/default.aspx?scid=kb;en-us;52196