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Sparton Navigation Modules

Programmer's Quick Start Guide

Version 2.0

Applicable to Sparton GEDC-6, DC-4 and AHRS-8.



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5612 Johnson Lake Rd • DeLeon Springs, FL • 32130
800.824.0682 • 386.985.4631

www.sparton.com/ne • www.spartonnavex.com

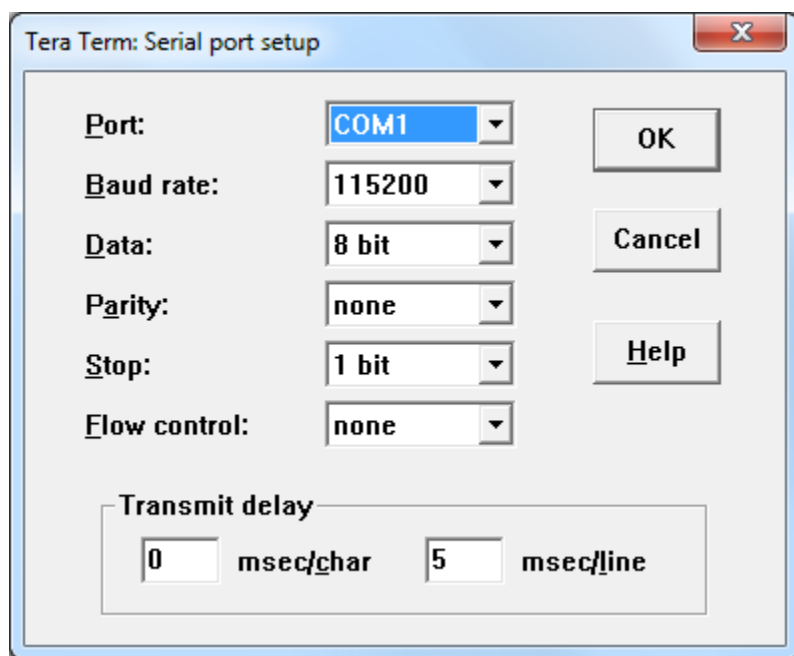
Programmer's Quick Start

This document is intended to provide examples of each of the protocols that are supported by the Navigation Module (NavMod). It is assumed that the instructions in the NDS-1 Quick Start Guide have been followed except that the NDS-1 Host Application is not needed here. The NDS-1 Host Application needs to be closed or disconnected as it uses the same COM port that is needed for the terminal emulator below.

The documents referenced in this Quick Start may be found at: <https://thedigitalcompass.com/technical-support/downloads/>

See the *Troubleshooting* section at the end of the *Software Interface User's Manual* if problems are encountered while following this Quick Start.

Connect a terminal emulator (such as Tera Term Pro, available free on the web) to the Navigation Module's (NavMod) user port with the following settings shown below. Control of DTR/DSR and RTS/CTS is not needed.



The screenshot shows the 'Tera Term: Serial port setup' dialog box. It contains the following settings:

- Port: COM1
- Baud rate: 115200
- Data: 8 bit
- Parity: none
- Stop: 1 bit
- Flow control: none
- Transmit delay: 0 msec/char, 5 msec/line

Buttons for OK, Cancel, and Help are visible on the right side of the dialog.

In the terminal emulator, hit the "Enter" key and there should be an "OK" response.

The NavMod supports 4 protocols where two are binary and two are ASCII. The binary protocols are Legacy Binary and RFS (Remote Function Select) and the ASCII protocols are NMEA and NorthTek. **Reference:** *Protocol Introduction* section in the *Software Interface Users Manual*.

This Quick Start provides examples of the different ways to get magnetic heading (yaw).

NorthTek Protocol

Reference: *NorthTek* section in the *Software Interface Users Manual*.

Note that NorthTek is a programming language based on ANSI Forth. With this, the user has a lot of control in how the NavMod outputs its data. The “reset” command can be useful if the NavMod is put in an erroneous state during user development of NorthTek scripts. NorthTek lines are terminated with a carriage return.

NorthTek Display Command Word “di.”

Reference: *Displaying Database Elements* section in the *Software Interface Users Manual*

Reference: *Internal Database Identifier Operations* section in the *NorthTek System Programming Manual* for similar command words.

The “di.” command can be used to display any of the variables listed in any of the long list of available variables (**reference:** the *Variable Summary Table* and the *Variable Detailed Descriptions* table in the *Software Interface User’s Manual*). NorthTek is case sensitive.

Enter:

```
yaw di.
```

Response example:

```
yaw = 215.102310  
OK
```

NorthTek Streaming Sensor Data Functions

Reference: *Streaming Sensor Data* section in the *Software Interface Users Manual*.

A set of functions have been created that output comma separated (and sometimes ‘:’ separated) data suitable for input to analysis tools such as Microsoft® Excel®, MATLAB® and Mathematica®. Terminal emulators usually supply a logging capability which can be used to capture the data.

Enter:

```
1 compass.p
```

Response example (repeats):

```
C,17324883, 2.45, -0.12, 214.26
```

The letter 'C' identifies the data set, the next number is the timestamp (milliseconds), followed by pitch, roll and yaw respectively (degrees).

Notation such as <ctrl-s> below represents pressing the control key and the s key at the same time.

To stop the data streaming, enter:

```
<ctrl-s>
0 compass.p
<ctrl-q>
```

The <ctrl-s> causes the streaming to pause so you can enter the next command. The <ctrl-s> is not necessary but it makes it easier to see what is being typed. The <ctrl-q> unpauses which allows streaming due to future commands.

Custom Combination Print Streaming (AHRS-8 user port only)

Reference: *Custom Combination Print Streaming* section in the *Software Interface Users Manual*.

This capability allows the user to select a custom combination of the most commonly desired data. In this example, suppose we want to have time, temperature and yaw and we want the data displayed every 10th time the yaw is computed.

First, we select what we want to display (see printmask below). This is Forth, so each item gets pushed on the stack and functions such as "or" operate on the top 2 items on the stack and put the result on the stack. The "set" puts the result of the 2 "or"s into the variable "printmask". The "drop" is needed to clear the status result of the "set" off of the stack. **Reference:** *NPL Basics* section in the *NorthTek System Programming Manual*

Enter:

```
printmask
time_trigger  yaw_trigger  or  temp_trigger  or  set  drop
```

Select the display rate (every 10 "triggers" specified by printtrigger below):

```
printmodulus  10 set  drop
```

Select the display rate trigger (in this case, an update of yaw is set to be a trigger):

```
printtrigger  yaw_trigger  set  drop
```

Response example (repeats):

```
P: ,18754028,y,218.71,T,34.69
```

In the above response, the “P:” identifies the type of output. It is followed by the timestamp (milliseconds since power up), the ‘y’ identifies that the next number is yaw (degrees) and the ‘T’ identifies that the next number is the temperature (Celsius).

To stop the streaming output, enter:

```
<ctrl-s>  
printmask 0 set drop  
printmodulus 0 set drop  
printtrigger 0 set drop  
<ctrl-q>
```

Note that if we print high rate data at a slower baud rate, it may not be possible to output all of the data due to the serial communication bandwidth limitations. In this case, entire lines of data will be dropped to ensure that the lines that do get output are complete. The data will still be computed at the normal rate within the NavMod.

NMEA

Reference: *NMEA* section in the *Software Interface Users Manual* for an introduction.

The acronym NMEA is used here to represent NMEA 0183 which is a communication standard for marine electronic devices. This standard is defined by the National Marine Electronics Association.

NMEA Set-up

Turn on key stroke “local echo” using a terminal emulator **OR** issue the command (once per session) :

```
nmeaecho 1 set drop
```

Also set the terminal emulator to transmit a carriage return and line feed (i.e. <cr><lf> or hex 0d0a) upon hitting enter **OR** some terminal emulators like Tera Term will do so if you type <ctrl-j>.

Standard NMEA command (\$xxHDM):

There is a 5 second timeout on entering each character in a NMEA command.

To get heading using the standard NMEA command, enter:

```
$xxHDM
```

Response example:

```
$HCHDM,300.4,M*2E
```

The 2E is the checksum and the 'M' indicates magnetic heading. **Reference:** *NMEA* section in the *Software Interface Users Manual* for details on interpreting the response and for other NMEA protocol commands.

To get repeated values every 0.1 seconds, enter the command:

```
$xxHDM,RPT=0.1
```

To pause the output, enter:

```
<ctrl-s>
```

Enter any NMEA command to cancel the repeat, for example:

```
$xxHDM
```

Enter a <ctrl-q>. If you forget to enter the <ctrl-q>, then the next streaming command won't output.

Sparton Custom NMEA command:

A NMEA command has been created that allows access to almost any of a long list of available NavMod variables (**reference:** the *Variable Summary Table* and the *Variable Detailed Descriptions* table in the *Software Interface User's Manual*). For our magnetic heading example, the corresponding variable name is "yaw" (RPT can be applied to this one as well).

```
$PSRFS,yaw,get
```

Response example:

```
$PSRFS,yaw,286.672424*38
```

Legacy Binary

Reference: *Legacy Binary* section in the *Software Interface Users Manual*.

Legacy binary is intended to be backward compatible with the Sparton SP300X compasses when the DC4/6/AHRS8 is being used as a retrofit in an existing system.. As a result, this protocol does not have access to any of the newer data such as the gyro data.

Since it is a binary protocol, a terminal emulator that can send binary may be used or a custom interface program may be used to send the binary message.

Legacy Binary uses a header byte (0xA4) and a termination byte (0xA0). The 0x indicates the following 2 digits are in hexadecimal form (i.e. don't send the 0x part). There is no checksum.

In this example, 0x09 is the identifier for magnetic heading.

Send (3 Bytes without the commas):

0xA4, 0x09, 0xA0

Response (5 Bytes without the commas):

0xA4, 0x09, <Heading as a 16-bit signed integer>, 0xA0

Heading (degrees) = (16-bit Heading value)*360/4096

Heading Range = 0.0 to +359.9

RFS

RFS is a flexible binary interface but is not practical to type in by hand. It can be customized to efficiently provide just the data needed in a repeating binary message using “BitField”s (packed structures) and the “position” variable.

For an RFS example and an introduction, reference the *RFS* section in the *Software Interface Users Manual* for an introduction and an example.

See the document titled *Remote Function Select (RFS) Protocol Suite – Interface Design Description* for a more complete description.