Connecting External Devices to Mx Systems

MARPORT

Contents

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History

V1	04/08/19	First release
V2	02/26/24	Removed topic about the display of Olex bathymetric data on Scala (feature no longer available).
V3	05/21/24	NMEA outputs from Scala: added Distance to Bottom from sensor (DFB) and added sentences sent by the clump sensor on multitrawl gears.

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Introduction and Presentation

Introduction

Marport Mx systems are able to receive data from external devices such as GPS, sonar, winch control system, compass or anemometer. These data can be displayed in Scala2 software. This can help you improving the system performance.

This guide explains how to connect specific equipment to Mx systems in order to receive data coming from external devices. The following equipment is documented in this manual:

- NPort Device Server: this device allows you to connect 8 serial devices to an Ethernet network. NMEA devices can be connected to the DB9 cable using an NMEA converter
- ShipModul Miniplex Multiplexer: you can use this multiplexer to simultaneously receive data coming from external devices using NMEA, and display them in Scala2.

Safety Guidelines

Important: To ensure proper and safe use of this equipment, carefully read and follow the instructions in this manual.

Installation

Installing ShipModul MiniPlex Multiplexer

You can use a ShipModul MiniPlex multiplexer to receive simultaneously NMEA data from devices such as GPS, compass or warp length sensor module and display them in Scala2.

Note: Product reference: ShipModul MiniPlex-3E-N2K if using NMEA2000 and NMEA0183 or Miniplex-3E if using only NMEA0183

Important: ShipModul multiplexer cannot read NMEA messages longer than the standard maximum length (82 characters), nor other format messages longer than 61 characters, nor Marelec messages. Use another multiplexer if this is your case.

Installing MPX-Config3

You need to download and install MPX-Config3 software to configure the MiniPlex multiplexer.

About this task

MPX-Config3 software enables you to change the settings of the MiniPlex multiplexer.

Procedure

1. To download MPX-Config3, go to: http://www.shipmodul.com/en/index.html. Then, click **Downloads** > **Utilities** > **MPX-Config3 for MiniPlex-3**.
2. From the **Downloads** folder, click the *.dmg file you downloaded.
3. From the MPX-Config3 window that appears, copy MPX-Config3 application and paste it in the **Applications** folder.

MPX-Config3 is installed on your computer and accessible via the Launchpad .

NMEA Multiplexer Cabling

You can connect ShipModul MiniPlex-3E-N2K or Miniplex-3E NMEA multiplexers in two different ways, depending on whether you have a network with DHCP server or not.

Wired Ethernet network

Connect the multiplexer according to the following schema if:

· You have an Ethernet switch
· You have a wired Ethernet network with a DHCP server

M3 and M5 systems:

M6 and M4 systems:

	Cable	Connected to
1	NMEA2000 device (only for Miniplex-3E-N2K)	NMEA2000 bus
2	NMEA2000 bus (only for Miniplex-3E-N2K)	Device outputting NMEA2000
3	NMEA0183 input bus (can be plugged into input 1 to 4)	Device outputting NMEA0183
4	NMEA 0183 output bus	Device receiving NMEA0183
5	Power cables	12V DC power supply
6	NMEA 0183 devices	NMEA 0183 output or input bus
7	Ethernet cable	Ethernet switch
8	Ethernet cable	Computer (Mac Pro: Ethernet port on the right)
9	Ethernet cable	Router

WiFi connection / No wired Ethernet network

Connect the multiplexer according to the following schema if:

- you connect to the internet via WiFi,
- or you do not have a wired Ethernet network.

M3 and M5 systems:

M6 and M4 systems:

	Cable	Connected to
1	NMEA2000 device (only for Miniplex-3E-N2K)	NMEA2000 bus
2	NMEA2000 bus (only for Miniplex-3E-N2K)	Device outputting NMEA2000
3	NMEA0183 input bus (can be plugged into input 1 to 4)	Device outputting NMEA0183
4	NMEA 0183 output bus	Device receiving NMEA0183
5	Power cables	12V DC power supply
6	NMEA 0183 devices	NMEA 0183 output or input bus
7	Ethernet cable	Computer (Mac Pro: Ethernet port on the right)

M4 system working with 2 Mac minis:
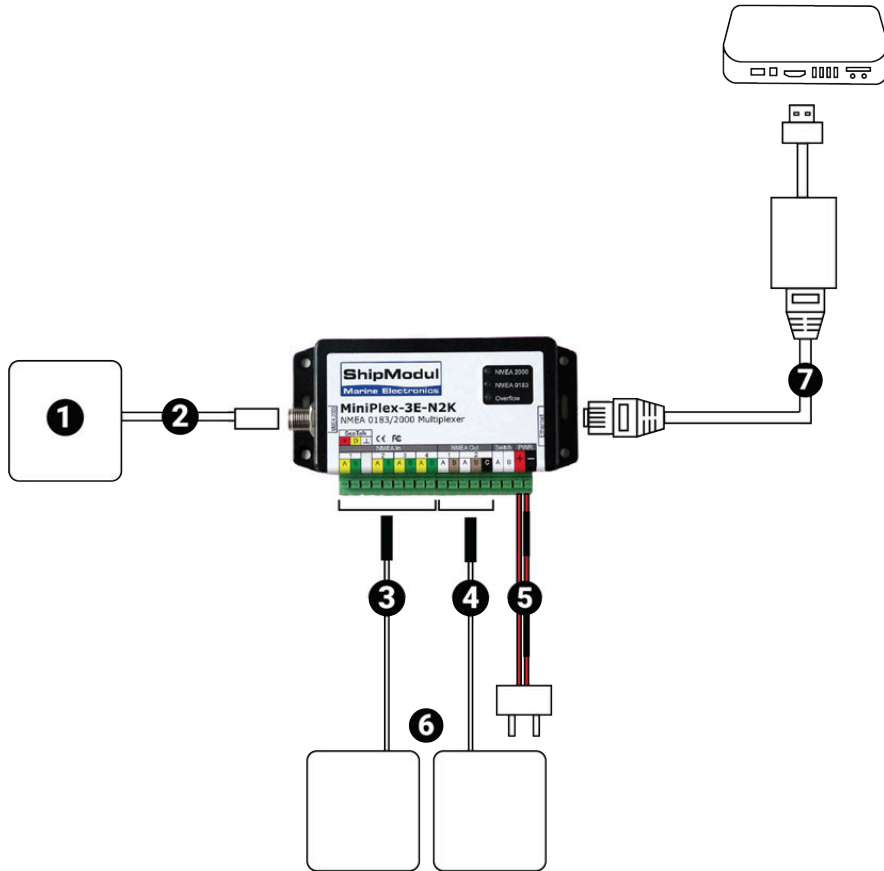

	Cable	Connected to
1	NMEA2000 device (only for Miniplex-3E-N2K)	NMEA2000 bus
2	NMEA2000 bus (only for Miniplex-3E-N2K)	Device outputting NMEA2000
3	NMEA0183 input bus (can be plugged into input 1 to 4)	Device outputting NMEA0183
4	NMEA 0183 output bus	Device receiving NMEA0183
5	Power cables	12V DC power supply
6	NMEA 0183 devices	NMEA 0183 output or input bus
7	Ethernet cable	Ethernet switch
8	Ethernet cable (Optional)	Router (Optional)
9	Ethernet cable + USB to Ethernet adaptor	Mac mini i7
10	Ethernet cable	Mac mini i5

Detecting the Multiplexer

You need to detect the multiplexer on the network to be able to use it. Wiring and configuration change according to your type of network installation.

- Scala2 must be closed.
- You can connect a device outputting NMEA data to the mutliplexer beforehand to see directly if the connection is working.
- If you have devices connected on different networks but no DHCP server, make sure that each device is on a different subnet. When adding a device on a new network, check that the third set of numbers of its IP address is different from other subnets: you can choose a number between 0 and 254. Avoid 192.168.**1** and do not use 192.168.**44**.

About this task

Follow the procedure corresponding to your network installation.

Wired Ethernet Network

About this task

Do this procedure if:

- You have a wired Ethernet network with a DHCP server (with or without an internet connection)
- The router, multiplexer and computer are connected to the same Ethernet switch.

Procedure

1. Connect the computer, multiplexer and router to the same Ethernet switch.
2. Power on the multiplexer.
3. Click **Apple Menu** > **System Preferences** > **Network**:
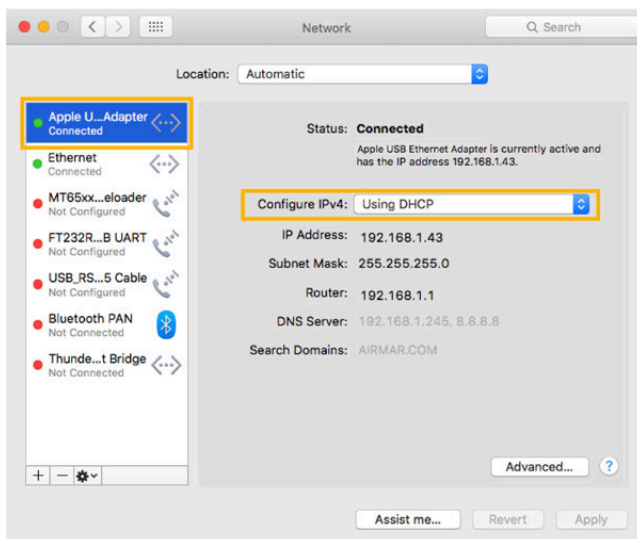
a) Check that the Ethernet network has a green LED and is configured as **Using DHCP**.
b) Check that Ethernet 2 (M6, M4)/the USB/Thunderbolt to Ethernet adapter (M3) is on top of the network list. If not, click the tooth wheel icon at the bottom of the list, select **Set Service Order** and drag Ethernet 2 (M6,M4)/USB/Thunderbolt to Ethernet (M3) adapter to the top.
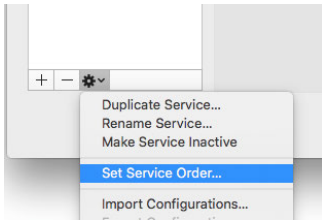
4. Open MPX-Config3 and click **Tools** > **MiniPlex-3E** > **Search** in the toolbar.
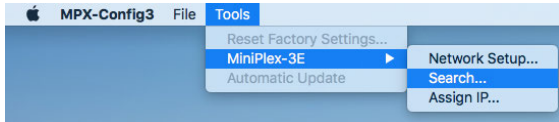
The MiniPlex is detected and displayed in the search results.
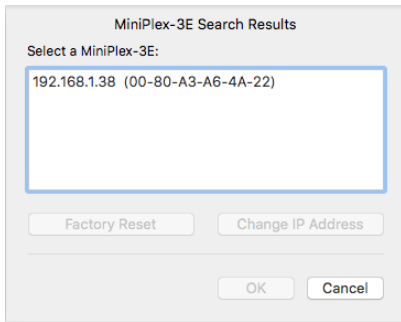
5. Select it and click **OK**.

The part **MiniPlex Connection** is automatically filled in.

6. In **MiniPlex Connection**, click **Connect**.

If you have connected and correctly configured the baud speed of the device outputting NMEA data, you should see incoming NMEA messages.

WiFi Connection / No Wired Ethernet Network

About this task

Do this procedure if:

· You have a wireless internet connection
· Or you have no wired Ethernet network

Procedure

1. If you are connected to a WiFi network, turn off the WiFi on your computer.
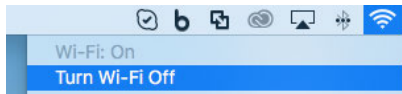
2. Connect the multiplexer to your computer (using a USB/Thunderbolt to Ethernet adapter for M3) and power on the multiplexer.

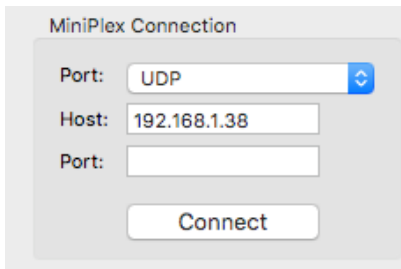3. Click **Apple Menu** > **System Preferences** > **Network**. From the network list, you can see Ethernet 2 (M6, M4)/the USB/Thunderbolt to Ethernet adapter (M3). Wait a few seconds until the LED becomes orange and until an IP address appears. Its IP address has been given automatically and randomly. You need to change it.
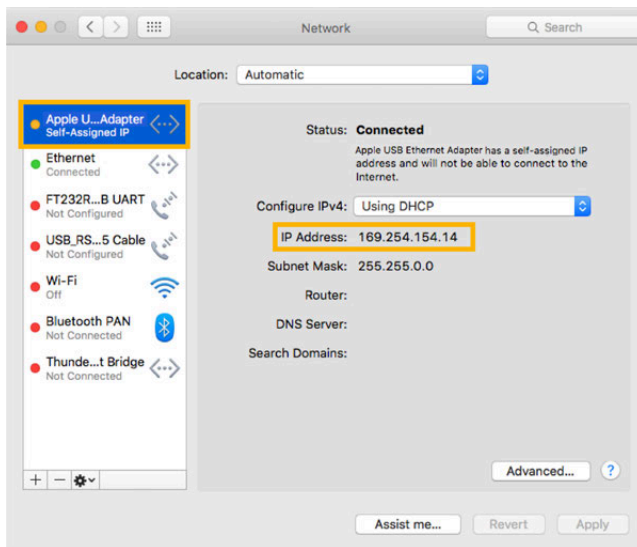
   a) Check that Ethernet 2 (M6, M4)/the USB/Thunderbolt to Ethernet adapter (M3) is on top of the network list. If not, click the tooth wheel icon at the bottom of the list, select **Set Service Order** and drag Ethernet 2 (M6,M4)/USB/Thunderbolt to Ethernet (M3) adapter to the top.
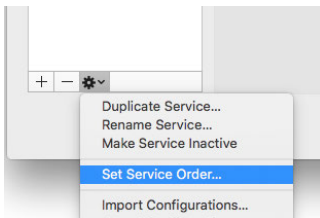
   b) In **Configure IPv4** menu, select **Manually**.
   c) In **IP Address**, enter a correct IP address, such as **192.168.70.1**. Make sure the third set of numbers is not used for another subnet.

d) In **Subnet Mask**, enter **255.255.255.0**.

e) In **Router**, enter the same numbers as for the IP address.
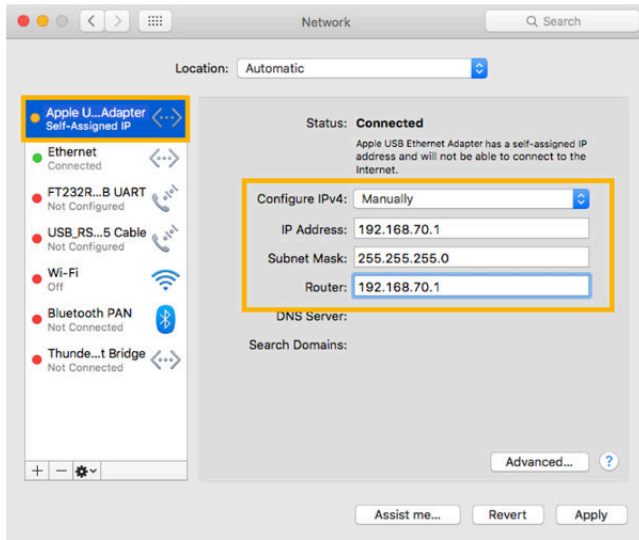
f) Click **Apply**.

4. Open MPX-Config3 and from the toolbar click **Tools** > **MiniPlex-3E** > **Search**.
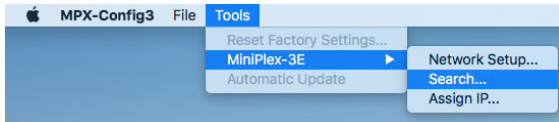
The multiplexer is displayed. Its IP address is also an auto-IP address that you need to change.
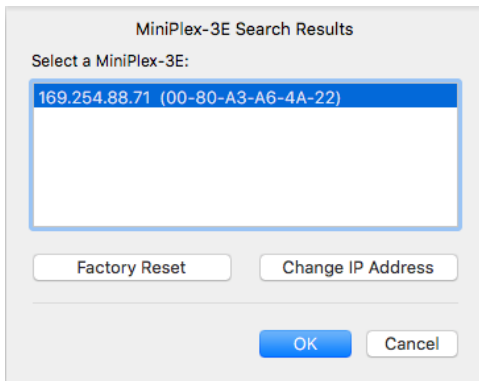
Trouble: If the multiplexer is not displayed: wait for a few seconds, then try again. It may take a few minutes to recognize the auto-assigned IP address.

Note: Do not change the IP address from this window. Follow the next steps to change the IP address.

5. Select the IP address then click **OK**.

6. Click **Tools** > **MiniPlex-35** > **Network Setup**.
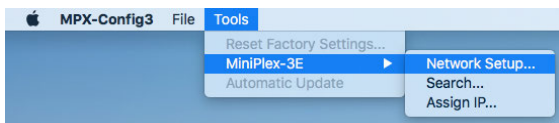
a) In **IP Address**, enter an IP address beginning by the same first 3 sets of numbers as in Ethernet 2 (M6, M4)/the USB to Ethernet adapter (M3) IP address, such as **192.168.70**.2.

b) In **Netmask**, enter **255.255.255.0**.

c) In **Gateway IP**, enter Ethernet 2 (M6, M4)/the USB to Ethernet adapter (M3) IP address: **192.168.70.1**.

d) Click **OK**.
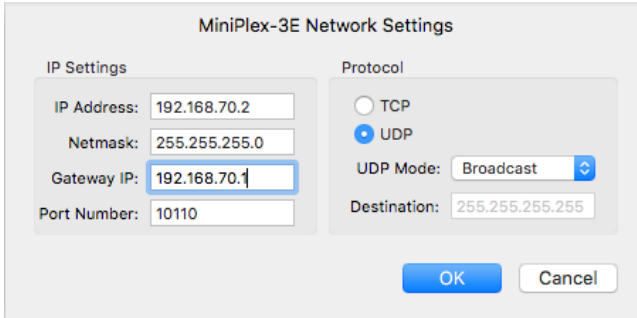
In **MiniPlex Connection**, the **Host** IP address is updated.
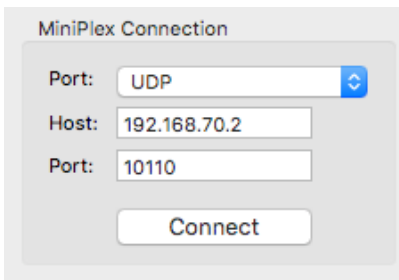
7. In **MiniPlex Connection**, click **Connect**.

If you have connected and correctly configured the baud speed of the device outputting NMEA data, you should see incoming NMEA messages.

Multiplexer with Defined IP address

About this task

Do this procedure if:

· The multiplexer has already been given an IP address.

Procedure

1. M3: Connect the multiplexer to the Ethernet switch or to the computer using the USB to Ethernet adapter. M6/M4: Connect the multiplexer to the computer or to the Ethernet switch.

2. Open MPX-Config3 and from the toolbar click **Tools** > **MiniPlex-3E** > **Search**.
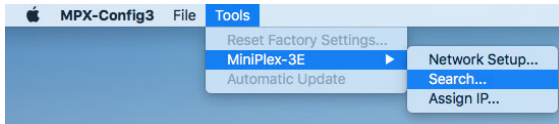
The multiplexer is displayed. You can see its IP address (192.168.70.2).
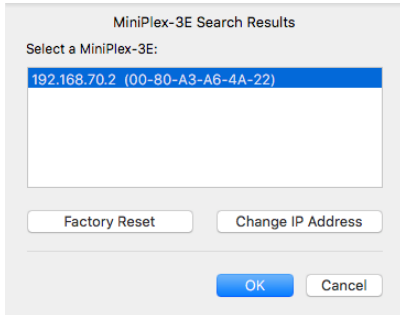
3. Click **Apple Menu** > **System Preferences** > **Network**.

4. Check that Ethernet 2 (M6, M4)/the USB/Thunderbolt to Ethernet adapter (M3) is on top of the network list. If not, click the tooth wheel icon at the bottom of the list, select **Set Service Order** and drag Ethernet 2 (M6,M4)/USB/Thunderbolt to Ethernet (M3) adapter to the top.
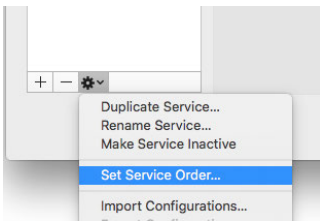

5. In the list of networks, click Ethernet 2 (M6, M4)/ USB/Thunderbolt to Ethernet adapter (M3):

   a) In **Configure IPv4**, select **Manually**.

   b) In **IP Address** enter an address belonging to the same subnet as the multiplexer.

For example, if the multiplexer IP address is 192.168.70.2, enter an IP address such as 192.168.70.4.

   a) In **Subnet Mask**, enter **255.255.255.0**.

   b) In **Router**, enter the same numbers as the IP address (in this example 192.168.70.4).
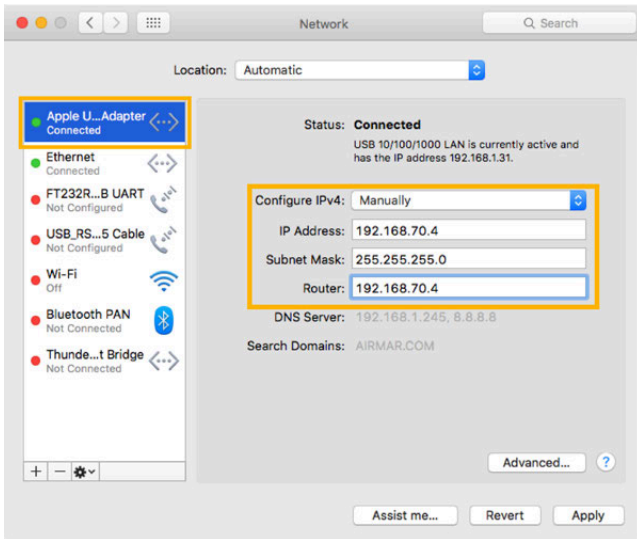
6. In MPX-Config3 toolbar, click **Tools** > **MiniPlex-35** > **Network Setup**.
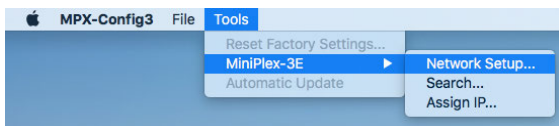
a) In Gateway IP, enter the IP address of Ethernet 2 (M6, M4)/ the USB/Thunderbolt to Ethernet adapter (M3) (in this example 192.168.70.4).
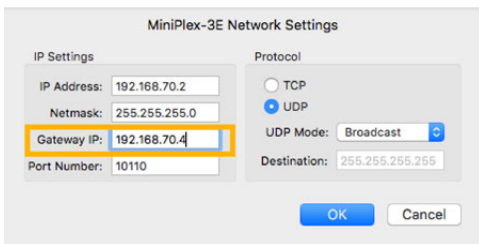
b) Click **OK**.

7. In **MiniPlex Connection**, click **Connect**.

If you have connected and correctly configured the baud speed of the device outputting NMEA data, you should see incoming NMEA messages.
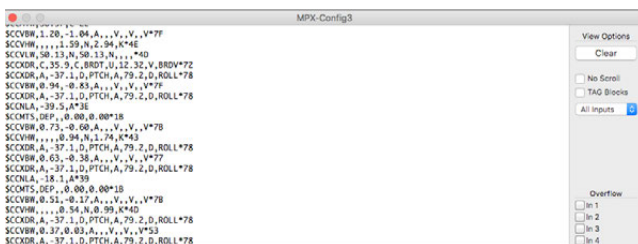

Multiplexer Not Detected

Before you begin

Make sure that your firewall does not block the multiplexer: in **Apple Menu** > **System Preferences** > **Security & Privacy** > **Firewall** check that your firewall is off.

The multiplexer might not be detected because of a wrong configuration of the network settings, such as a duplicate or illegal IP address. You need to assign a new IP address to the multiplexer.

Procedure

1. Click **Tools** > **MiniPlex-3E** > **Assign IP**.
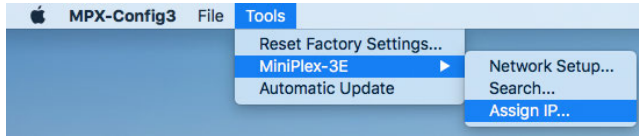
2. In **Assign IP Address** dialog box:

    a) Enter the MAC address of the multiplexer (see label on topside of multiplexer). Fields must be separated by dashes.

    b) Enter a valid IP address.

    c) Click **OK**.

    Wait for the update process to complete (approx. 10 sec.).

3. You can now have access to the multiplexer settings through **Network Settings** dialog box.

Configuring Inputs

You can configure the NMEA inputs of the multiplexer from MPX-Config3 software.

NMEA devices are connected to the multiplexer. See NMEA Multiplexer Cabling on page 8 for guidance.

> **Important:** Close Scala2 if open: MPX-Config3 software uses UDP channel to transmit and receive commands to the MiniPlex multiplexer. This channel needs to remain exclusive during the configuration of the multiplexer.

> **Important:** ShipModul multiplexer cannot read NMEA messages longer than the standard maximum length (82 characters), nor other format messages longer than 61 characters, nor Marelec messages. Use another multiplexer if this is your case.

You need to indicate the correct baud speed for each input so that the mulitplexer can extract data and diffuse it correctly through all outputs.

NMEA0183 Example

· Device 1 is a heading sensor with GPS at 4800 bauds.
· Device 2 is a warp length sensor module at 9600 bauds.

The multiplexer has to be set up the following way:

As it is, the multiplexer will not output NMEA messages to Output 1 or 2. Only UDP output on port 10110 will be done.

If Device 1 and Device 2 emit the same type of data (e.g. temperature, position), give them a talker ID like the following image, in order to distinguish data between the two of them when they are received by Scala2.
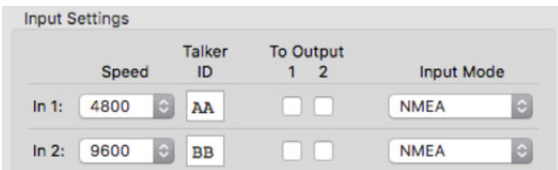
The console will output the following messages:

```
$BBVTG,148.29,T,,M,0.19,N,0.35,K,A*22
$BBHDG,342.49,0.00,E,1.59,W*6E
$AAGGA,103257.580,4744.462,N,00324.315,W,1,07,2.20,45.67,M,50.80,M,,*5D
$BBZDA,103335.180,07,10,2016,,*4C
$BBROT,-0.05,A*3E
$AARMC,103257.580,A,4744.462,N,00324.315,W,0.09,123.99,071016,1.59,W,A*29
$AAHDG,342.49,0.00,E,1.59,W*6E
$BBGLL,4744.462,N,00324.315,W,103334.580,A,A*56
$AAZDA,103256.180,07,10,2016,,*48
$BBGGA,103334.580,4744.462,N,00324.315,W,1,09,1.10,46.46,M,50.80,M,,*57
$BBRMC,103334.580,A,4744.462,N,00324.315,W,0.29,158.49,071016,1.59,W,A*2E
$AAGLL,4744.462,N,00324.315,W,103257.580,A,A*52
$AAROT,-0.05,A*3E
$AAVTG,55.99,T,,M,0.09,N,0.16,K,A*14
```

You can see the talker IDs AA and BB at the beginning of the NMEA sentences.

On the multiplexer, the LED NMEA0183 blinks green.

NMEA2000 Example

Device 3 is a WeatherStation WX220 from Airmar on NMEA 2000.

The multiplexer has to be set up the following way:
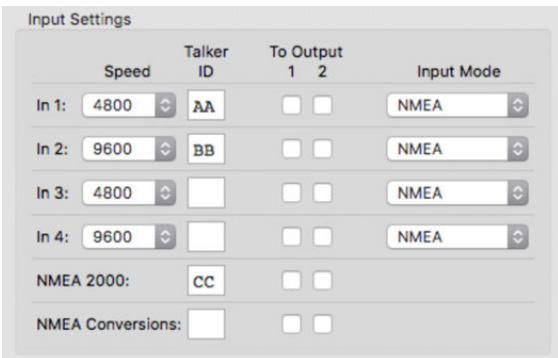
The console will output the following messages:

```
$BBROT,2.81,A*1D
$AAHDG,342.49,0.00,E,1.59,W*6E
$CCHDG,342.58,0.00,E,1.59,W*6E
$CCGLL,4744.458,N,00324.312,W,092805.720,A,A*50
$CCGGA,092805.720,4744.458,N,00324.312,W,1,10,0.90,27.45,M,50.80,M,,*54
$CCRMC,092805.720,A,4744.458,N,00324.312,W,0.19,150.19,071016,1.59,W,A*26
$BBHDG,342.49,0.00,E,1.59,W*6E
$BBVTG,11.69,T,,M,0.09,N,0.16,K,A*1B
$AAZDA,103308.180,07,10,2016,,*42
$CCMWV,256.99,R,0.58,N,A*31
$AAROT,3.95,A*19
$CCVTG,106.59,T,,M,0.09,N,0.16,K,A*2F
$BBGLL,4744.462,N,00324.315,W,103307.580,A,A*56
$BBGGA,103307.580,4744.462,N,00324.315,W,1,07,2.20,45.74,M,50.80,M,,*5B
$CCMDA,29.82,I,1.010,B,25.40,C,,,,,,,,,,,,,,*2C
$BBRMC,103307.580,A,4744.462,N,00324.315,W,0.09,167.49,071016,1.59,W,A*20
$AAGLL,4744.462,N,00324.315,W,103307.580,A,A*56
$CCZDA,092806.320,12,10,2016,,*42
$AAGGA,103307.580,4744.462,N,00324.315,W,1,07,2.20,45.74,M,50.80,M,,*5B
$CCROT,-35.63,A*08
$BBZDA,103307.180,07,10,2016,,*4D
```

NMEA sentences from this device all begin by $CC.

On the multiplexer, the LED NMEA2000 blinks green.

Other formats

If your device outputs messages in other formats than NMEA, for example Rapp Marine or non-standard NMEA messages beginning by @: select **Plain Text** in **Input Mode**.
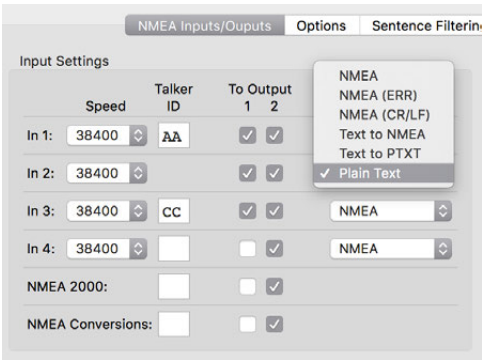
If you do not select **Plain Text**, messages will not be received by the multiplexer.

Note: Messages in plain text longer than 61 characters will not be received by the multiplexer.

Configuring Scala2

You need to configure Scala2 software to receive and display the NMEA data received on the multiplexer.

About this task

Important: You cannot use Scala2 and configure the multiplexer on MPX-Config3 at the same time: MPX-Config3 software uses UDP channel to transmit and receive commands to the MiniPlex multiplexer. This channel needs to remain exclusive during the configuration of the multiplexer.

Procedure

1. Open Scala2.
2. From the top left corner of the screen, click **Menu** ▤ > **Settings**.
3. In the control panels, click **NMEA Inputs** > **Add Input**.
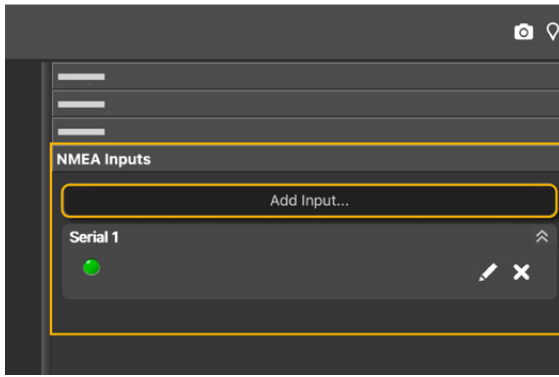
4. Select **UDP** and enter `10110` as port.
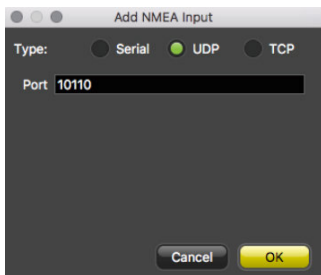
5. Click **OK**.

6. Check the activity of data received in the **NMEA Inputs** control panel.
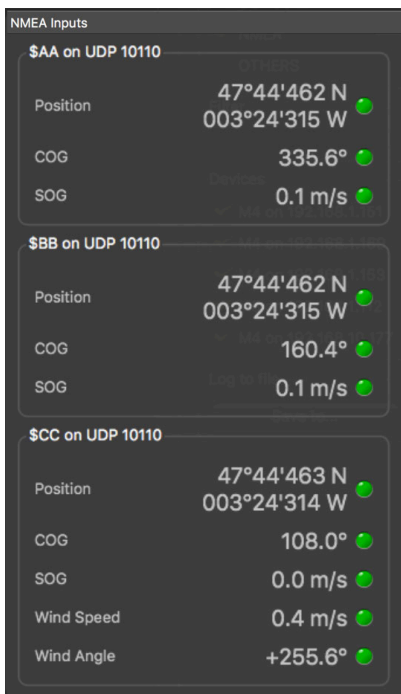
If you gave talker IDs to the devices you configured on MPX-Config3, you can see that each device is identified by its talker ID (AA, BB and CC).

Note: You need to give talker IDs to devices sending the same type of data, so that Scala2 can distinguish them.

Installing NPort Device Server

You can use NPort Device Server to connect serial devices to your Ethernet network.

Note: NMEA devices can be connected to a DB9 cable using an NMEA converter.

Note: Product reference: Moxa Nport 5650-8-DT

NPort Device Server Cabling

Connect the NPort device server to the system according to the following cabling.
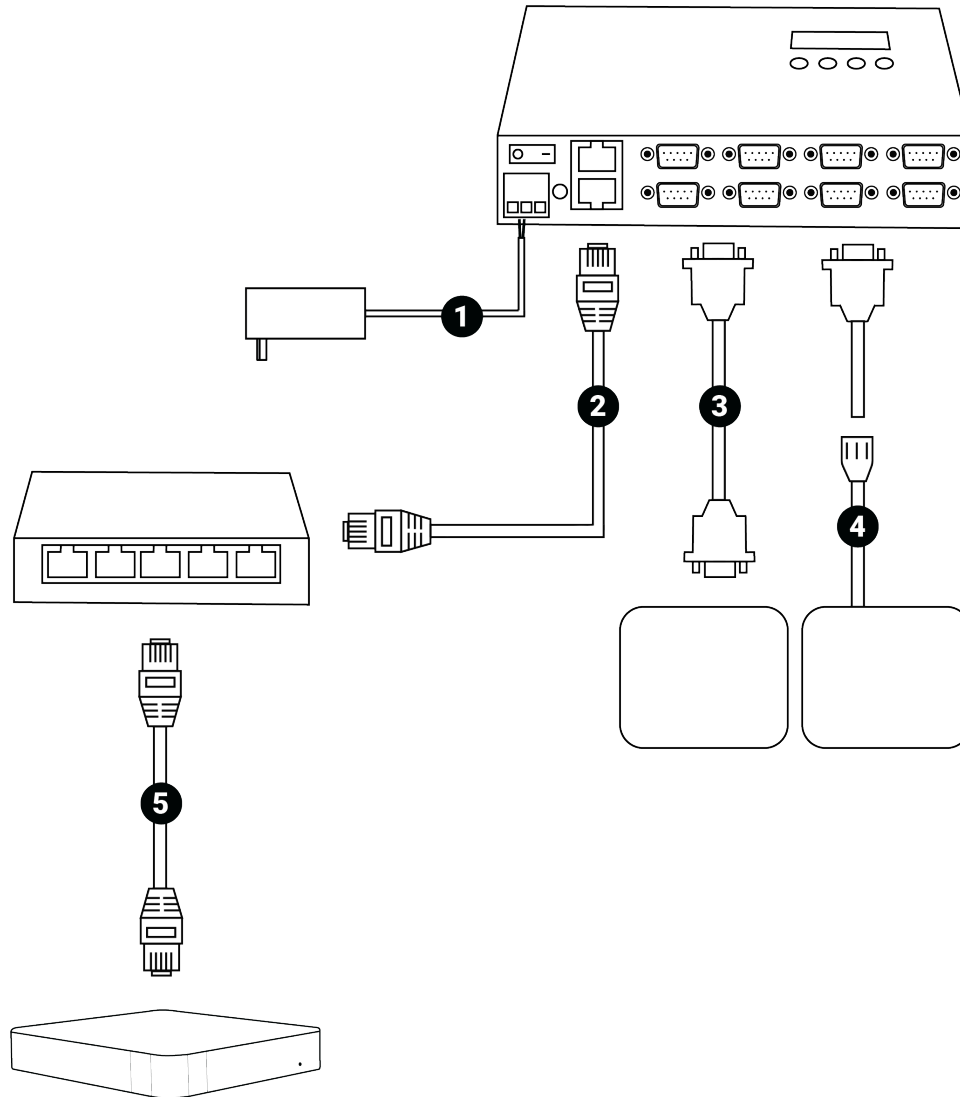
	Cable	Connected to
1	Power cable	12V DC power supply
2	Ethernet cable	Ethernet switch
3	DB9 connector	Device using DB9 connector or NMEA converter

	Cable	Connected to
4	NMEA converter	Connect device outputting NMEA 0183 or 2000 to DB9 cable
5	Ethernet cable	Computer (Mac mini or Mac Pro, according to Mx system)

Configuring the NPort Device Server

You need to configure the NPort Device Server so that it can broadcast to the network to which the computer is connected.

Procedure

1. If you want the NPort Device Server to broadcast to the computer network, you need to change the default IP address of the NPort Device Server and give it an IP address that is on the same subnet as the computer network. To do this, use the LCD panel and buttons on the box to change the IP address of the device.
For example, if your Ethernet network begins by `192.168.1.xxx`, enter an address such as `192.168.1.174`.

2. Open a web browser and enter the new IP address of the NPort device in the address bar. Enter the password `moxa`.

   NPort's web console opens.

   Trouble: If the web console does not open, it means the computer is not on the same network subnet as the NPort device. Check the IP address displayed on the box and check that the computer's network is on the same subnet as the NPort device. If not, repeat the previous steps.

3. Click **Network Settings**, then enter the following settings:

   a) In **IP address** enter `192.168.1.174` (as configured on the device).
   b) In **Netmask** enter `255.255.255.0`.
   c) In IP configuration, select **Static**.
   d) Click **Submit**, then **Home**.

   Serial Settings OK!

   Warning! The changes will take affect until Save/Restart the NPort.

   You can Save/Restart NPort now or Save/Restart NPort until all other settings configured.

   Back   Save/Restart   Home
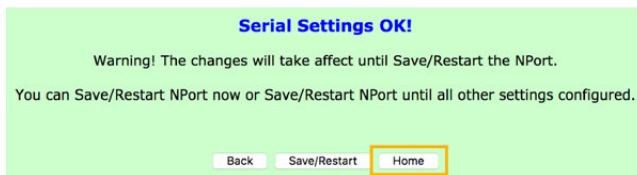
   Note: **Do not** click **Back** or your changes will not be saved.

4. Go to **Serial Settings** > **Port 1** to configure the port settings. For example, you can enter the following settings for a device using NMEA:

   a) In **Port alias**, enter a port name to differentiate the ports. You can for example enter P1 for the first port, then P2, P3 etc.

   b) **Baud rate**: 4800

   c) **Data bits**: 8.

   d) **Stop bits**: 1.

   e) **Interface**: RS-422.

   f) Click **Submit**, then **Home**.
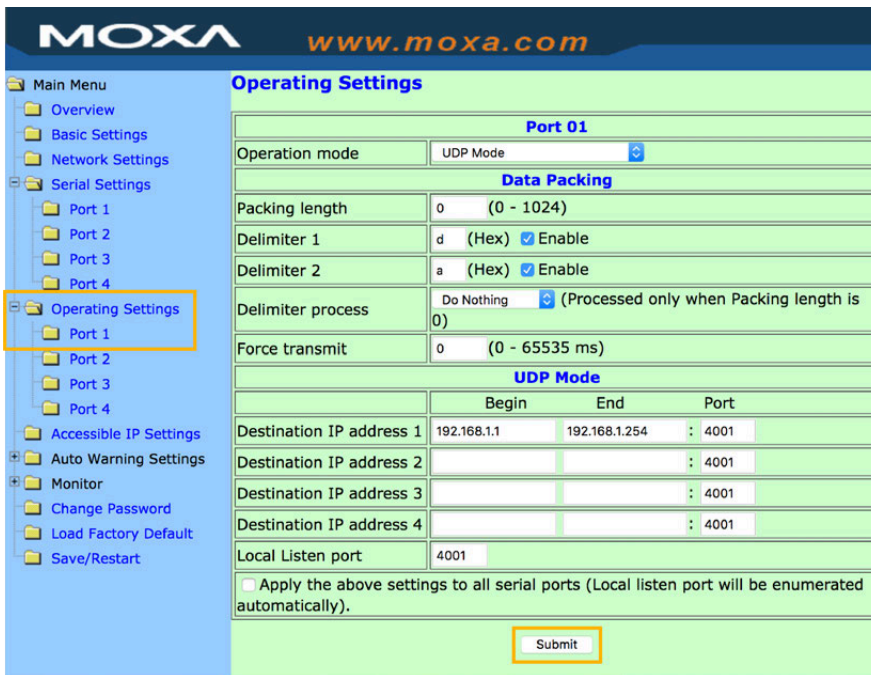
5. Go to **Operating Settings** > **Port 1**. Enter the following settings for each port being used:

    a) **Operation mode**: UDP.

    b) **Packing length**: 0

    c) **Delimiter 1**: enter d and select **Enable**.

    d) **Delimiter 2**: enter a and select **Enable**.

    e) **Delimiter process**: **Do Nothing**.

    f) **Force transmit**: 0.

    g) **Destination IP address 1**: enter `192.168.1.1` in **Begin** and `192.168.1.254` in **End**. Enter a port number in **Port**, such as `4001`. Enter other port numbers for the other ports, such as `4002`, `4003` etc.

    > **Note:** This field corresponds to the network to which NPort sends data. The beginning and end of IP addresses entered here allows the NPort device to broadcast to all devices connected to this network.

    h) Click **Submit**, then **Home**.

6. When you have finished configuring all the ports, click **Save/Restart** on the left menu, then **Submit**.

Configuring Inputs in Scala2

You need to add to Scala2 the UDP port corresponding to the NPort device server to be able to receive transmitted data.

1. Open Scala2.
2. In the control panels, click > ., then select **UDP** and enter a port number as configured in NPort's web console (4001, 4002...).
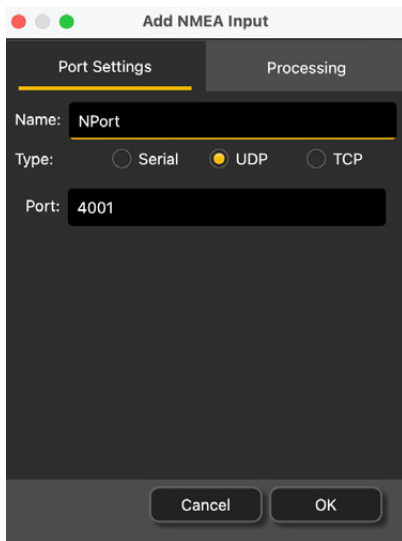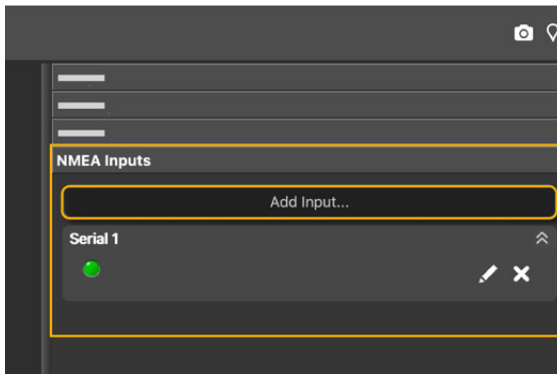
Data are received and displayed in Scala2:

In this example, two devices are connected: to Port 1 (4001) and Port 2 (4002). You can check in **Menu** ≡ > **Messages** (**Expert Mode**) the details of data being received.

Appendix

Compatible Incoming NMEA Sentences

Scala2 can decode and use the following types of NMEA sentences coming from external devices (GPS, winch system, sounder...).

NMEA 0183 Standard Sentences

Symbol (*) indicates which parts of the sentence Scala2 uses.

NMEA Sentence	Format	First compliant version of Scala

GGA – Global Positioning System Fix Data	`$--GGA,hhmmss.ss,aaaa.aa,b,cccc.cc,d,e,ff,g.g,h.h,`
	`M,i.i,M,j.j,kkkk*hh<CR><LF>`
	
	1. `$--`: Talker identifier*
	2. GGA: Sentence formatter*
	3. hhmmss.ss: UTC of position*
	4. aaaaa.aa, b: Latitude North/South (N/S)*
	5. cccc.cc, d: Longitude East/West (E/W)*
	6. e: GPS quality indicator
	7. ff: Number of satellites in use (00-12)
	8. g.g: Horizontal dilution of precision
	9. h.h, M: Antenna altitude above/below mean sea level (geoid), meters*
	10. i.i, M: Geoidal separation, meters
	11. j.j: Age of differential GPS data
	12. kkkk: Differential reference station ID
	13. *hh: Checksum*
		1.0.0.0

GLL – Geographic Position – Latt/Long	`$--GLL,`
	`aaaa.aa,L,bbbbb.bb,L,hhmmss.ss,C,d*hh<CR><LF>`
	
	1. `$--`: Talker identifier*
	2. GLL: Sentence formatter*
	3. aaaa.aa,L: Latitude North/South (N/S)*
	4. bbbbb.bb,L: Longitude East/West (E/W)*
	5. hhmmss.ss: UTC of position*
	6. C: status (A= data valid / V: data not valid)*
	7. d: Mode indicator
	8. *hh: Checksum*
		1.2.6.0

NMEA Sentence	Format	First compliant version of Scala

GNS – GNSS Fix Data	`$--GNS,hhmmss.ss,aaa.aa,L,bbbbb.bb,L,c--c,`
	`dd,e.e,f.f,g.g,h.h,i.i,a*hh<CR><LF>`
	
	1. `$--`: Talker identifier*
	2. GNS: Sentence formatter*
	3. hhmmss.ss: UTC of position*
	4. aaaa.aa,L: Latitude North/South (N/S)*
	5. bbbbb.bb,L: Longitude East/West (E/W)*
	6. `c--c`: Mode indicator
	7. dd: Total number of satellites in use (00-99)
	8. e.e: Horizontal dilution of precision
	9. f.f: Antenna altitude above/below mean sea level (geoid), in meters*
	10. g.g: Geoidal separation, meters
	11. h.h: Age of differential data
	12. i.i: Differential reference station ID
	13. *hh: Checksum*
		1.0.0.0

HDG – Heading, Deviation & Variation	`$--HDG,a.a,b.b,M,c.c,M*hh<CR><LF>` 1. `$--`: Talker identifier* 2. HDG: Sentence formatter* 3. a.a: Sensor magnetic heading (degrees)* 4. b.b,M: Magnetic deviation (degrees), Easterly/Westerly (E/W)* 5. c.c,M: Magnetic variation (degrees), Easterly/Westerly (E/W)* 6. *hh: Checksum*	1.0.0.0
HDT – Heading, True	`$--HDT,a.a,T*hh<CR><LF>` 1. `$--`: Talker identifier* 2. HDT: Sentence formatter* 3. a.a,T: Heading (degrees) True* 4. *hh: Checksum*	1.0.0.0

NMEA Sentence	Format	First compliant version of Scala
RMC – Recommended Minimum Navigation Information	`$--RMC,aaaaaa,A,bbbb.bbb,B,ccccc.ccc,C,ddd.d,eee.e,` `ffffff,ggg.g,G,H*hh<CR><LF>` 1. `$--`: Talker identifier* 2. RMC: sentence formatter* 3. aaaaaa: Time (UTC)* 4. A: Status, A = data valid, V = navigation receiver warning* 5. bbbb.bbb, B: Latitude, N/S* 6. ccccc.ccc, C: Longitude, E/W* 7. ddd.d: Speed over ground (knots)* 8. eee.e: Course Over Ground (degrees True)* 9. ffffff: Date: ddmmyy* 10. ggg.g, G: Magnetic variation (degrees E/W)* 11. H: mode indicator: A=Autonomous, D=Differential, E=Estimated, M=Manual input, S=Simulator, N=data not valid (sentence is not accepted if mode indicator = N)* 12. *hh: Checksum*	2.2.2.0
VHW – Water Speed and Heading	`$--VHW,a.a,T,b.b,M,c.c,N,d.d,K*hh<CR><LF>` 1. `$--`: Talker identifier* 2. VHW: Sentence formatter* 3. a.a,T: Heading, degrees True* 4. b.b,M: Heading, degrees Magnetic* 5. c.c,N: Speed, knots* 6. d.d,K: Speed, km/hr 7. *hh: Checksum*	1.4.0.0
VTG – Course Over Ground and Ground Speed	`$--VTG,a.a,T,b.b,M,c.c,N,d.d,K*hh<CR><LF>` 1. `$--`: Talker identifier* 2. VTG: Sentence formatter* 3. a.a,T: Course over ground, degrees, True* 4. b.b,M: Course over ground, degrees, Magnetic 5. c.c,N: Speed over ground, knots* 6. d.d,K: Speed over ground, km/hr* 7. *hh: Checksum*	1.3.3.0

Proprietary Sentences

Symbol (*) indicates which parts of the sentence Scala2 uses.

Sentence	Format	First compliant version of Scala2
ATW – Naust Marine winch control system	`$NMATW,aaaaaa,bbbbbb,cccccc,dddddd,eeeeee,ffffff,` `ggggg,hhhhh,iiiii,jjjjj,kkkkk,lllll,mm:mm*hh` `<CR><LF>` $NMATW: Talker identifier + sentence formatter* a. Winch starboard tension (kg)* b. Winch port tension (kg)* c. Winch middle tension (kg)* d. Winch starboard length (meter or feet)* e. Winch port length (meter or feet)* f. Winch middle length (meter or feet)* g. RPM starboard h. RPM port i. RPM middle j. Line speed starboard (meter or feet/min) k. Line speed port (meter or feet/min) l. Line speed middle (meter or feet/min) m. Towing time (meter or feet/min)	1.2.0.0
FEC – Furuno attitude message	`$PFEC,GPatt,aaa.a,bb.b,cc.c,*hh<CR><LF>` 1. $PFEC: Talker identifier + sentence formatter* 2. GPatt: Global positioning attitude, sentence formatter 3. aaa.a: Heading true* 4. bb.b: Pitch* 5. cc.c: Roll* 6. *hh: Checksum*	1.0.5.0
KW – Karmoy Winch	`$KWIN,a,b.b,T,c.c,M,d.d,rpm*hh<CR><LF>` 1. $KWIN: Talker identifier + sentence formatter* 2. a: Winch 0 = Stbd / Trawl 1 = Port Trawl Winch 3. b.b, T: Tensions (tons) 4. c.c, M: Length (meters) 5. d.d, rpm: Speed (rpm)	1.6.25.0

Sentence	Format	First compliant version of Scala2
MA DD – Marelec winch length and tension	`# MA DD dd/mm/yy hh:mm:ss LB aaaam LS bbbbm LM ccccm TB ddddK TS eeeeK TM ffffK gg<CR><LF>` 1. # MA DD: talker identifier* 2. dd/mm/yy: date 3. hh:mm:ss: time 4. LB aaaam: Shooted length portside in meters* 5. LS bbbbm: Shooted length starboard in meters* 6. LM ccccm: Shooted length center in meters* 7. TB ddddK: Tension of portside in kg* 8. TS eeeeK: Tension of starboard in kg* 9. TM ffffK: Tension of center in kg* 10. gg: system in 00 = MANUAL (stop), 10 = auto shooting, 20 = auto fishing, 30 = auto hauling, 40 = slow tension alarm without propeller reduction, 41 = slow tension alarm with propeller reduction, 50 = fast tension alarm without propeller reduction, 51 = fast tension alarm with propeller reduction*	1.2.0.0
MPT TXOR – Marport, transducer orientation	**$PMPT,TXOR,aa.a,bb.b,cc.c,d*hh** · **$PMPT**: talker identifier + sentence formatter. · **TXOR**: Transducer Orientation · **aa.a**: pitch* · **bb.b**: roll* · **cc.c**: yaw* · **s:** V = valid / N = not valid*	2.0.0.0

NAV – Ifremer proprietary sentence	`$NANAV,04/09/`
	`yy,hhmmss.sss,NASYC,N,48,22.92315,W,004,28.90527,`
	`D,00.0,WG84,04/09/13, 13:05:37.000,`
	`COU,346.08,-00.22,+00.13,+00.00,+00052.172,000,0000`
		1.0.0.0

IFM – Ifremer versatile sentence	`$PIFM,EU,MES,dd/mm/yy,hh:hh:ss.sss,TRFUN,`
	`±a,bb,ccccc,dddd,e.e,f,ggggg,hhhh,i.i,j,<CR><LF>`
	
	1. $PIFM: Talker identifier + sentence formatter*
	2. OCGYR: pitch, roll, heading
	3. TRFUN: winch lengths (starboard, port) and winch tensions (starboard, port)
		1.0.0.0

Sentence	Format	First compliant version of Scala2
SYN – Winch Syncro 2020, winch length and tension	`$WMSYN,aaa.a,m,bbb.b,m,ccc.c,m,ddd.d,m,ee.e,t,ff.f,t,gg.g,t,hh.h,t,0.5,r,0.7,r,1.6,s,2.0,s,0,0,1,0,0,45.5,c,33.0,p,32.8,p*31` 1. $WMSYN: Talker identifier + sentence formatter* 2. aaa.a: winch starboard length in meters* 3. bbb.b: winch inner starboard length in meters* 4. ccc.c: winch inner port length in meters* 5. ddd.d: winch port length in meters* 6. ee.e: winch starboard tension in tons* 7. ff.f: winch inner starboard tension in tons* 8. gg.g: winch inner port tension in tons* 9. hh.h: winch port tension in tons* 10. Other strings are not used.	1.0.0.0
	`$WMSYN,aaa.a,c,bbb.b,c,ccc.c,c,dd.d,t,ee.e,t,ff.f,t*hh<CR><LF>` 1. $WMSYN: Talker identifier + sentence formatter* 2. aaa.a,l: Starboard wire length (m=meter)* 3. bbb.b,l: Mid wire length (m=meter)* 4. ccc.c,l: port wire length (m=meter)* 5. dd.d,t: Starboard wire tension, tons* 6. ee.e,t: Mid wire tension, tons* 7. ff.f,t: Port wire tension, tons*	1.6.19.0
TAWWL – RappHydema, PTS Pentagon warp length	`@TAWWL,a,M,b,M,c,M*hh<CR><LF>` See below. M = meter	1.4.4.0
	`@TAWWL,x,y,z*hh<CR><LF>` 1. @TAWWL: Talker identifier + sentence formatter* 2. a: Starboard winch length* 3. b: Port winch length* 4. c: Middle winch length*	1.6.19.0
TAWWT – RappHydema, PTS Pentagon warp tension	`@TAWWT,a.a,T,b.b,T,c.c,T*hh<CR><LF>` See below. T = tons	1.4.4.0
	`@TAWWT,a.a,b.b,c.c*hh<CR><LF>` 1. @TAWWT: Talker identifier + sentence formatter* 2. a.a: Starboard winch tension* 3. b.b: Port winch tension* 4. c.c : Middle winch tension*	1.6.19.0

Sentence	Format	First compliant version of Scala2
WCT – Warp length and tension (Silecmar)	`$SIWCT,aaa,bbb,ccc,d.d,e.e,f.f*hh<CR><LF>` 1. $SIWCT: Talker identifier + sentence formatter* 2. aaa: Port winch cable, meters* 3. bbb: Starboard winch cable, meters* 4. ccc: Clump winch cable, meters* 5. d.d: Tension in the port winch, tons* 6. e.e: Tension in the starboard winch, tons* 7. f.f: Tension in the clump winch, tons* 8. *hh: Checksum*	1.2.6.0

WIDA1 – Kongsberg warp length (single to triple trawls)	`$WIDA1,aa,bbbb,cc,0,dd,eeee,ff,1,g,h,i,2,k,l,m,3`
	`*hh<CR><LF>`
	1. $WIDA1: Talker identifier + sentence formatter*
	2. aa: port wire tension, tons*
	3. bbbb: port wire out, meters*
	4. cc: port wirespeed, m/min
	5. 0: port*
	6. dd: starboard wire tension, tons*
	7. eeee: starboard wire out, meters*
	8. ff: starboard wirespeed, m/min
	9. 1: starboard*
	10. g: port mid wire tension, tons*
	11. h: port mid wire out, meters*
	12. i: port mid wirespeed, m/min
	13. 2: port mid*
	14. k: stb mid wire tension, tons*
	15. l: stb mid wire out, meters*
	16. m: stb mid wirespeed, m/min
	17. 3: starboard mid*
	18. *hh: Checksum*
		2.2.2.0

Sentence	Format	First compliant version of Scala2
WIDA2 – Kongsberg warp length (quad and penta trawls)	`$WIDA2,aa,bbbb,cc,4,dd,eeee,ff,5 *hh<CR><LF>` **1.** $WIDA2: Talker identifier + sentence formatter* **2.** aa: center port wire tension, tons* **3.** bbbb: center port wire out, meters* **4.** cc: center port wirespeed, m/min **5.** 4: center port* **6.** dd: center stb wire tension, tons* **7.** eeee: center stb wire out, meters* **8.** ff: center stb wirespeed, m/min **9.** 5: Center stb* **10.** *hh: Checksum*	2.12.1.0
WLP – Scantrol winch length (port)	`$SCWLP,a.a,M,b.b,M*hh<CR><LF>` **1.** $SCWLP: Talker identifier + sentence formatter* **2.** a.a,M: paid out wire in meters* **3.** b.b,M: wirespeed in meters/sec., positive when paying out wire **4.** *hh: Checksum*	1.0.6.0
WLS – Scantrol winch length (starboard)	`$SCWLS,a.a,M,b.b,M*hh<CR><LF>` **1.** $SCWLS: Talker identifier + sentence formatter* **2.** a.a,M: paid out wire in meters* **3.** b.b,M: wirespeed in meters/sec., positive when paying out wire **4.** *hh: Checksum*	1.0.6.0
WLC – Scantrol winch length (clump)	`$SCWLC,a.a,M,b.b,M*hh<CR><LF>` **1.** $SCWLC: Talker identifier + sentence formatter* **2.** a.a,M: paid out wire in meters* **3.** b.b,M: wirespeed in meters/sec., positive when paying out wire **4.** *hh: Checksum*	1.0.6.0
WLD – Scantrol winch length (triple trawl – port clump)	`$SCWLD,a.a,T*hh<CR><LF>` **1.** $SCWLD: Talker identifier + sentence formatter* **2.** a.a,M: paid out wire in meters* **3.** b.b,M: wirespeed in meters/sec., positive when paying out wire **4.** *hh: Checksum*	2.0.0.0

Sentence	Format	First compliant version of Scala2
WLE – Scantrol winch length (quad trawl – center clump)	`$SCWLE,a.a,T*hh<CR><LF>` 1. $SCWLE: Talker identifier + sentence formatter* 2. a.a,M: paid out wire in meters* 3. b.b,M: wirespeed in meters/sec., positive when paying out wire 4. *hh: Checksum*	2.0.0.0
WTP – Scantrol winch tension (port)	`$SCWTP,a.a,T*hh<CR><LF>` 1. $SCWTP: Talker identifier + sentence formatter* 2. a.a,T: tension in tons* 3. *hh: Checksum*	1.0.6.0
WTS – Scantrol winch tension (starboard)	`$SCWTS,a.a,T*hh<CR><LF>` 1. $SCWTS: Talker identifier + sentence formatter* 2. a.a,T: tension in tons* 3. *hh: Checksum*	1.0.6.0
WTC – Scantrol winch tension (clump)	`$SCWTC,a.a,T*hh<CR><LF>` 1. $SCWTC: Talker identifier + sentence formatter* 2. a.a,T: tension in tons* 3. *hh: Checksum*	1.0.6.0
WTD – Scantrol winch tension (triple trawl – port clump)	`$SCWTD,a.a,T*hh<CR><LF>` 1. $SCWTD: Talker identifier + sentence formatter* 2. a.a,T: tension in tons* 3. *hh: Checksum*	2.0.0.0
WTE – Scantrol winch tension (quad trawl – center clump)	`$SCWTD,a.a,T*hh<CR><LF>` 1. $SCWTD: Talker identifier + sentence formatter* 2. a.a,T: tension in tons* 3. *hh: Checksum*	2.0.0.0

NMEA Outputs from Scala2

Scala2 outputs data in the following formats.

Marport's proprietary sentence

Scala2 uses the following sentence to output sensor data:

$MPMSD, X, YY, ZZZ, TTT, u, VV.VVV*<chk>

1. **$MP**: Talker identifier
2. **MSD**: Sentence formatter (Marport Sensor Data)

3. **X, YY, ZZZ**: location of the emitting sensor on the trawl gear
4. **TTT**: type of sensor data
5. **u**: acronym of the unit
6. **VV.VVV**: decimal value
7. ***<chk>**: checksum. The checksum is a security measure to ensure that the sentence is transmitted accurately. The checksum follows the NMEA specifications (IEC 61162-1 Ed.4).

The following sections give more details about the contents of the sentence.

Sensor location

X, YY, ZZZ specifies the location of the emitting sensor on the trawl gear.

- **X**: 1 or 2 letters indicating on which gear the sensor is installed. This is useful only for twin, triple, quad and penta trawl gears.
- **YY**: 2 letters indicating the part of the gear where the sensor is installed.
- **ZZZ**: numerical code that is a Marport sensor node identifier related to the Mx receiver configuration. It is used in Scala2 to position the sensors in the 3D views.

Type of gear	Gear position	X
Single		T
Twin trawl	Starboard	ST
Twin trawl	Port	PT
Triple trawl	Starboard	ST
Triple trawl	Middle	MT
Triple trawl	Port	PT
Quad trawl	Starboard	ST
Quad trawl	Inner starboard	NT
Quad trawl	Inner port	MT
Quad trawl	Port	PT
Penta trawl	Starboard	ST
Penta trawl	Inner starboard	LT
Penta trawl	Middle	NT
Penta trawl	Inner port	MT
Penta trawl	Port	PT
Unknown		<Empty>

Trawl gear part	YY
Port Door	PD

Trawl gear part	YY
Starboard Door	SD
Port Wing	PW
Starboard Wing	SW
Headrope	HR
Footrope	FR
Body	BO
Cod-end	CE

Clumps in twin or triple gears are coded as a starboard door of the trawl:

Clump	X, YY	Description
Twin trawl	PT, SD	Port trawl, starboard door
Triple trawl, starboard clump	MT, SD	Middle trawl, starboard door
Triple trawl, port clump	PT, SD	Port trawl, starboard door
Quad trawl, starboard clump	NT, SD	Inner starboard trawl, starboard door
Quad trawl, middle clump	MT, SD	Inner port trawl, starboard door
Quad trawl, port clump	PT, SD	Port trawl, starboard door
Penta trawl, starboard clump	LT, SD	Inner starboard trawl, starboard door
Penta trawl, inner starboard clump	NT, SD	Middle trawl, starboard door
Penta trawl, inner port clump	MT, SD	Inner port trawl, starboard door
Penta trawl, port clump	PT, SD	Port trawl, starboard door

Sensor data types and values

TTT, u, VV.VVV contains the type, unit and value of sensor data.

- **TTT**: 3 letter code corresponding to the type of data.
- **u**: acronym of the unit.
- **VV.VVV**: decimal value.

Data type	TTT	Unit	u	Description
Depth	DPT	meters	m	Depth of sensor (distance from surface)
Catch	CAT	%		Currently 0 (sensor OFF) or 100 (sensor ON), unit field is empty

Data type	TTT	Unit	u	Description
Pitch	PIT	degrees	d	From –90 to 90
Roll	ROL	degrees	d	From –180 to 180
Temperature	TMP	Celsius degrees	c	
Spread starboard	XST	meters	m	Distance between the master spread sensor and the slave. If the field is empty, it means "slave lost".
Spread clump	XC1			
Spread port	XPT			
Battery	BAT	%		From 0 to 100. Unit field is empty.
Speed along	SPL	m/s	ms	
Speed across	SPX	m/s	ms	
Distance to bottom	DTB	meters	m	Distance from the sensor to the sea floor
Distance to bottom from sensor	DFB	meters	m	Distance from the sensor to the sea floor (sensor data)*
Opening	OPN	meters	m	Distance from the headrope to the footrope or from the top to the bottom of the trawl body
Clearance	CLR	meters	m	Distance from the footrope or the bottom of the trawl body to the sea floor
Slant Distance	SLD	meters	m	Distance from the sensor to the hydrophone
Relative Bearing	RBR	degrees	d	Angle from the ownship to the sensor relative to ownship heading
True Bearing	TBR	degrees	d	Angle from the ownship to the sensor relative to True North

*DFB: If value remains equal to the sensor maximum range, it means the bottom is not detected.

Type of gear	X, YY, ZZZ, TTT	
Single	T,PD,23,XST	Distance between doors
Twin trawl	PT,PD,23,XST	Distance between doors
	PT,PD,23,XC1	Distance between port door and clump

Type of gear	X, YY, ZZZ, TTT	
	PT,SD,26,XST	Distance between clump and starboard
Triple trawl	PT,PD,23,XST	Distance between port door and starboard door
	PT,PD,23,XC1	Distance between port door and port clump
	PT,PD,23,XC2	Distance between port door and starboard clump
	PT,SD,26,XC2	Distance between port clump and starboard clump
	MT,SD,123,XST	Distance between starboard clump and starboard door
Quad trawl	PT,PD,23,XST	Distance between port door and starboard door
	PT,PD,23,XC1	Distance between port door and starboard clump
	PT,PD,23,XC2	Distance between port door and middle clump
	PT,PD,23,XC3	Distance between port door and port clump
	PT,SD,26,XC2	Distance between port clump and middle clump
	MT,SD,123,XC3	Distance between middle clump and starboard clump
	NT,SD,223,XST	Distance between starboard clump and starboard door
Penta trawl	PT,PD,23,XST	Distance between port door and starboard door
	PT,PD,23,XC1	Distance between port door and starboard clump
	PT,PD,23,XC2	Distance between port door and inner starboard clump
	PT,PD,23,XC3	Distance between port door and inner port clump
	PT,PD,23,XC4	Distance between port door and port clump

Type of gear	X, YY, ZZZ, TTT	
	PT,SD,26,XC2	Distance between port clump and inner port clump
	MT,SD,123,XC3	Distance between inner port clump and inner starboard clump
	NT,SD,223,XC4	Distance between inner starboard and starboard clump
	LT,SD,323,XST	Distance between starboard clump and starboard door

Positioning sentences

Scala2 can output NMEA data for trawl door positioning with the following sentences:

- $PSIMS (Olex)
- $PTSAL (MaxSea version 12 and SeaPix)
- $PMPT (TimeZero)
- $IIGLL (MaxSea version 12, single position sentence)
- $IITPT (Simrad, single position sentence)

These are examples of PSMIS, PTSAL and IITPT sentences:

$PSIMSn,aaa,M,bbb,M,ccc.c,T,ddd.d,M, hhmmss*hh<cr><lf>

- **$PSIMS**: talker identifier + sentence formatter
- **n**: 1 = Spread1 (port trawl door when Twin Rig) / 2 = Spread2 (starboard trawl door when Twin Rig).
- **aaa,M**: slant range to sensor, in meters (filtered values, no decimals).
- **bbb,M**: horizontal range to sensor, in meters (unfiltered values, no decimals). Transmits null fields if depth-sensor is not activated (will calculate horizontal range with manual set depth).
- **ccc.c,T**: true bearing (deg.rel.north) to sensor. Requires gyro input for reliable data.
- **ddd.d,M**: spread measurement in meters (door to door or door to clump). Transmits null fields if invalid values. Filtered values if sensor's filter is on.
- **hhmmss**: time of transmission (time of Spread interrogation). Requires ZDA input from GPS for accurate timestamp.
- ***hh**: checksum

$PTSAL,aaa.a,bbb.b,ccc.c, ddd.d,eee.e,fff.f*hh <cr><lf>

- **$PTSAL**: talker identifier + sentence formatter
- **aaa.a**: horizontal range in meters to sensor 1
- **bbb.b**: horizontal range in meters to sensor 2
- **ccc.c**: bearing to sensor 1 relative to stern line
- **ddd.d**: bearing to sensor 2 relative to stern line
- **eee.e**: depth in meters of sensor 1
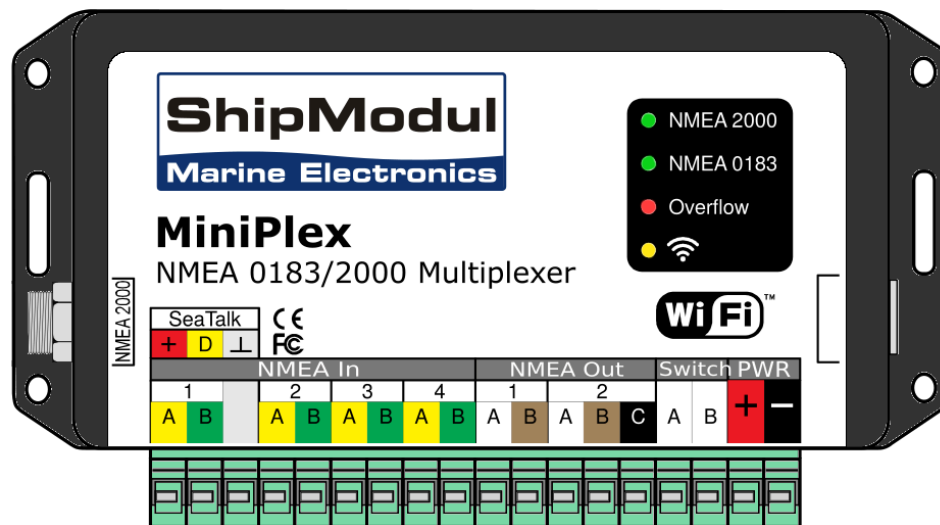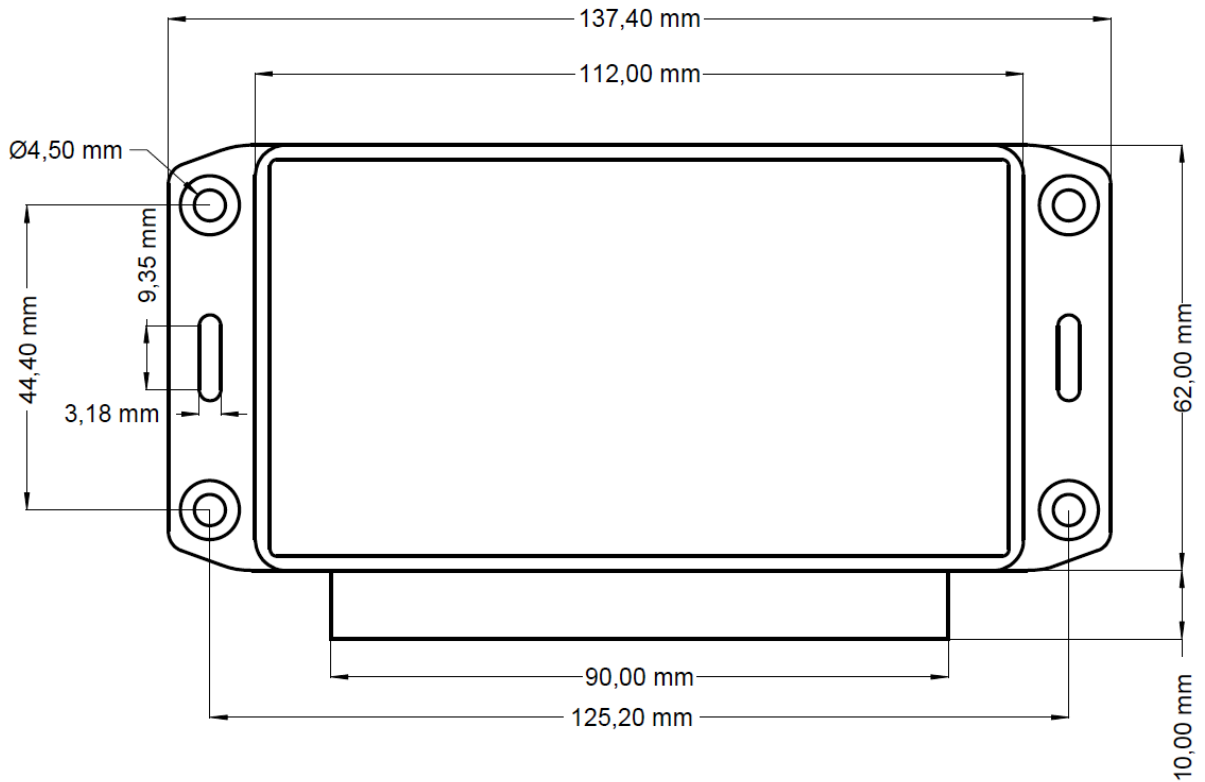- **fff.f**: depth in meters of sensor 2

- ***hh**: checksum

$PMPT,POS,AA,bbb.b,M,ccc.c,T, ddd.d,M,eee.e,M,hhmmss*<chk><cr><lf>
- **$PMPT**: talker identifier + sentence formatter
- **POS**: position
- **AA**: 2 letters code that specifies the part of the gear (SD = starboard door / PD = port door / CL = clump on twin trawl / SC = starboard clump on triple trawl / PC = Port Clump on triple trawl).
- **bbb.b,M**: horizontal distance in meters
- **ccc.c,T**: true bearing (deg.rel.north) to sensor
- **ddd.d,M**: depth below surface distance in meters
- **eee.e,M**: distance to bottom in meters if available, or empty
- **hhmmss**: time of data (hour-minutes-seconds)
- ***hh**: checksum

@IITPT,aaa,M,bbb,P,ccc.c,M<cr><lf>
- **@IITPT**: talker identifier + sentence formatter. (TPT = Trawl position true vessel)
- **aaa,M**: horizontal range in meters to the target (0 – 4000 m). Requires an active depth sensor on the trawl or manual set depth, if not the slant range will be presented.
- **bbb,P**: true bearing to the target (i.e. relative to north). Requires gyro input for reliable data.
- **ccc.c,M** is the depth in meters of trawl below the surface (0 –2000 m). Requires an active depth sensor on the trawl or manual set depth, if not the depth field will be empty

ShipModul MiniPlex NMEA Multiplexer Dimensions

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