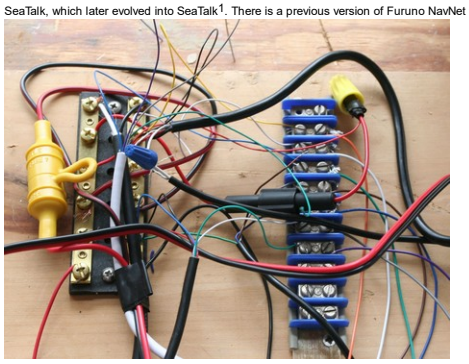
This web site is maintained by Christopher Young. I have no formal training in boat maintenance and am simply sharing my experience and advice. In 2014 I did an electronics refit of my 1979 Vagabond 47 sailboat named Raven. In doing research for this project I found that an online primer explaining the basics of marine networking did not exist. I created this website to share what I learned. If you have any questions or suggestions please email chris5977@gmail.com.

There are three main marine networking protocols

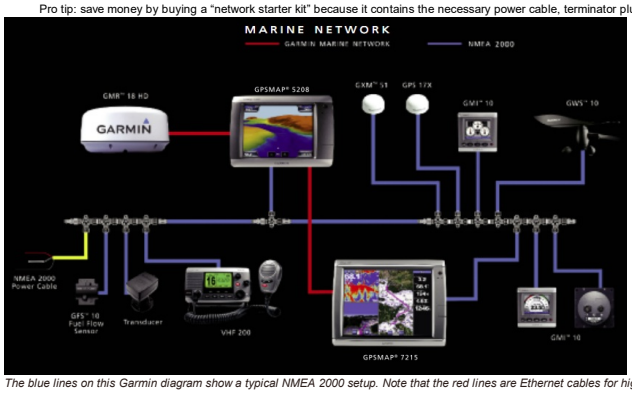
1. NMEA 0183 was established in 1992 and has a maximum data transfer rate of 4,800 bits per second. NMEA stands for National Marine Electronics Association. NMEA 183 often involved splicing bare wires between devices and you were severely limited to how many devices could be hooked up to each other. While some NMEA 183 devices may use plugs, there is no standard plug. RayMarine standardized their implementation of NMEA 183 with proprietary plugs called SeaTalk, which later evolved into SeaTalk[1]. There is a previous version of Furuno NavNet for NMEA 0183 which used proprietary cables with seven pin connectors. Despite all of the problems with NMEA 183 it is still manufactured.



2. NMEA 2000 was introduced in the year 2000 and has a maximum transfer rate of 250,000 bits per second. In order for a product to be N2k certified, it must use the same plug standard and networking protocol, called **DeviceNet**. Of the Big Four of marine electronics, Garmin and Navico use pure N2k. RayMarine and Furuno use proprietary variations discussed below. N2k allows the networking of up to 50 devices. After being connected, the different components sense each other and function with little or no setup. A N2k network consists of a backbone line and spurs. The following procedures must be followed in order for N2k to function:

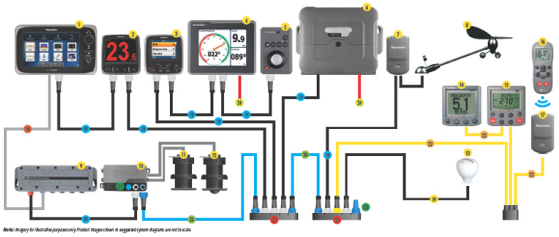
a. The backbone must have its own 12v power supply through one of the spurs.
b. A terminator plug must be placed on each of the two unused plugs at the ends of the backbone line. (See Item D for an exception)
c. Devices (such as VHF radios, chartplotters, wind instruments) must be attached to a spur and never directly to each other or the backbone. (See Item D for an exception)
d. Special terminator plugs that will convert each end of the backbone into spurs allows the addition of two extra devices on the network.
e. Devices must never be attached directly to each other. Everything must go through a spur attached to the backbone. Daisy chaining components is not permitted.

Pro tip: save money by buying a "network starter kit" because it contains the necessary power cable, terminator plugs and other items more affordably than if they were purchased individually.



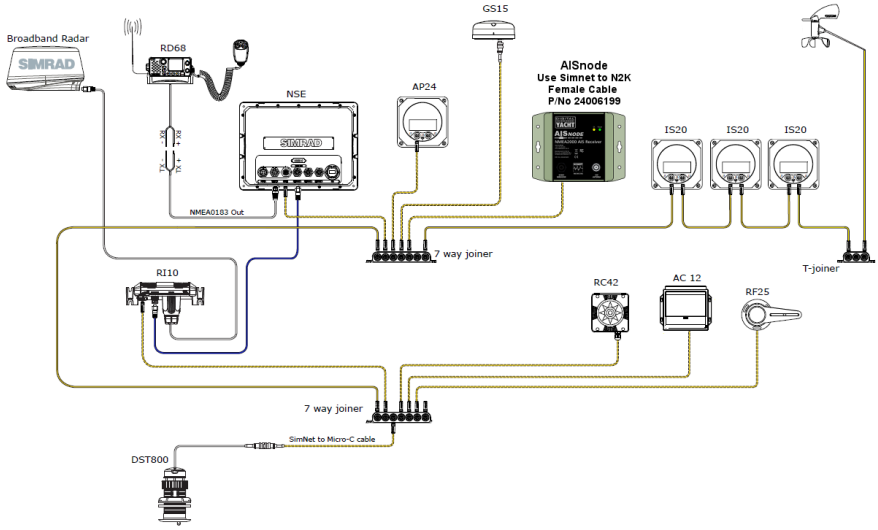
The blue lines on this Garmin diagram show a typical NMEA 2000 setup. Note that the red lines are Ethernet cables for high bandwidth data transfers.

SeaTalk^{ng} [New Generation] is a standard belonging to RayMarine using proprietary plugs. It is compatible with a pure N2k network by using adapters. SeaTalk allows for daisy chained components, therefore some devices have two SeaTalk^{ng} spur plugs. All of the other caveats regarding N2k (power to the backbone, backbone terminators, etc.) also apply to a SeaTalk^{ng} setup. It has backward compatibility with RayMarine's earlier NMEA 0183 devices.



This diagram shows a complex RayMarine setup. The black lines are SeaTalk^{ng} (N2k). The yellow lines represent SeaTalk[1] (NMEA 183). The gray line represents RayNet (Ethernet) connecting a chart plotter to a network switch.

SimNet is an obsolete standard belonging to Simrad using proprietary plugs but compatible with NMEA 2000. It is somewhat simpler to install than the aforementioned systems because it does not use a backbone. All components are simply plugged into a seven way hub. It allows for daisy chained components so some devices have two SimNet plugs. Starting in the year 2015, Simrad products will only use DeviceNet plugs, but Simrad continues to manufacture legacy products with SimNet. Simrad is owned by Navico, which also owns Lowrance and B&G. Navico is eliminating SimNet because it desires its products to be inter-operable. Many Navico products from its three brands are physically identical except for the label. However each brand's software is unique and focuses on a different type of boating. Lowrance is supposed to be for fishing, but really it is their budget brand for any boat. Simrad is marketed to sport fishing and powerboating but it is perfectly suitable for sailboat cruising as you can buy Simrad wind instruments. B&G is promoted as the brand for performance cruising and sailboat racing.



This diagram shows a SimNet setup. Note the seven way hubs.

Photo of the three most common NMEA 2000 based plugs

From left to right: DeviceNet, SeaTalk^{ng} and SimNet. Note that SeaTalk plugs are much smaller that DeviceNet. This makes cable routing easier. SimNet is even smaller.

- *DeviceNet uses a five wire cable. Cables can serve as a backbone or a spur. A DeviceNet cable is terminated with a male plug on one and a female plug on the other end.*
- *SeaTalk^{ng} has a blue six wire cable that serves as the backbone. The extra wire supports previous versions of SeaTalk which are based on NMEA 0183. The white cables are spurs and have five wires. The plugs are always female.*
- *Simnet uses a universal five wire cable and the plugs are always female.*

CAN bus is Furuno's implementation of N2k which allows for daisy chained instruments. They use a standard DeviceNet plug, but refer to them as Mini connector. The most significant difference with Furuno is that they have a Micro connector which is 14.5mm instead of 25mm, shown below.

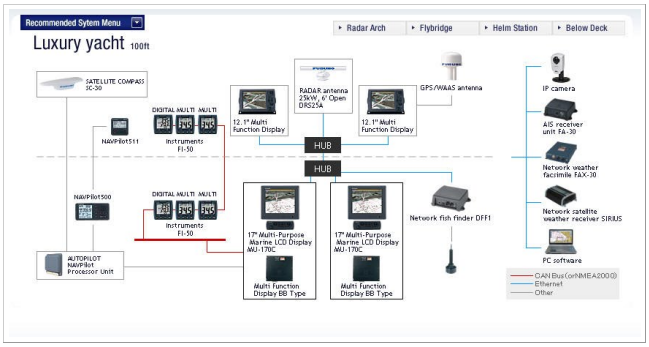
Fig.13 Female Micro connector

Fig.14 Male Micro connector

3. Ethernet Implementations use the standard Cat5 cables also used to network personal computers. This type of cable uses what looks like a large phone jack plug called RJ45 and has a data transfer rate of one gigabit, or 1,000,000,000 (one billion) bits, per second. Ethernet is 4,000 times faster than NMEA2000, which is too slow to transmit video. Ethernet is commonly used on boats to transmit radar data and video. Garmin calls its implementation of Ethernet **Garmin Marine Network.** It is simply Ethernet plugs with a rubber waterproof collar, show below.

SeaTalk[hs] (High Speed) is RayMarine's first generation system using computer Ethernet cables terminated with a waterproof collar around the plugs. RayMarine's current implementation called **RayNet** has proprietary screw plugs for high bandwidth devices such as video, sonar, infrared and radar data. Below is a RayNet to Ethernet adapter.

NavNet is an Ethernet implementation by Furuno. NMEA 2000 and NMEA 0183 devices can be used with NavNet with the proper adapter. PCs and standard Ethernet hubs can be integrated into the boat's network. NavNet allows for an unlimited number of devices on the network, making Furuno popular with large complex vessels. Modern Furuno equipment comes with DeviceNet plugs so you can do a standard N2k setup without using NavNet at all. You can also do a mix of NavNet and N2k.



OneNet is the future Ethernet standard being developed by NMEA. It is supposed to be backward compatible with NMEA 2000.

Comments

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