

### 8.1.3 Documentation

The following documentation shall be provided to the owner for each interfaced system and shall be kept on file by the installing dealer for future reference:

1. Interface diagram(s) in accordance with the examples contained herein, showing all interfaced units and connections between them. This diagram shall identify all interface modules and junction barrier strips included in the installation and shall include the name and location of each device or module. All diagrams shall be annotated with the vessel's name and date of installation.
2. Identification by device of all hardware input and output ports in use, including programming steps necessary to set the ports into the proper mode for operation.
3. Wire colors used.
4. A list of all barrier strips, T-connectors, and terminations that identifies their physical location aboard the vessel.
5. Intended data flow showing input and output ports.
6. Verification that interface testing was successfully completed.

### 8.2 NMEA 0183 Wiring Requirements

NMEA 0183 is a low-cost, low-capacity, single-transmitter/multi-receiver network for interconnecting marine electronic devices, also known as a "single talker/multiple listener" interface. This section identifies requirements and recommended practices for installing and connecting devices using the NMEA 0183 interface standard.

There are multiple versions of the NMEA 0183 specification in use in the marine industry. Prior to NMEA 0183 version 2.0, including NMEA 0180 and NMEA 0182, the hardware employed a single ended interface implemented with one signal wire and a common ground, based on EIA-232. All implementations from 2.0 and later employ a differential interface with two signal wires, based on EIA-422. Most remaining differences between versions are related to the content of the data sentences sent between devices.

**NOTE: Due to the difference between the single ended and differential interfaces implemented in EIA-232 and EIA-422, older versions of NMEA 0183 prior to version 2.0 cannot be connected to equipment supporting NMEA 0183 version 2.0 or higher without proper interface circuitry. Do not connect one of the signal wires of the differential interface to the common ground of the single ended interface!**

A high-speed version, NMEA 0183-HS also exists for devices that require greater bandwidth. Table 15 compares the data transmission characteristics of NMEA 0183

and NMEA 0183-HS, and identifies approximate aggregate throughput of each interface.

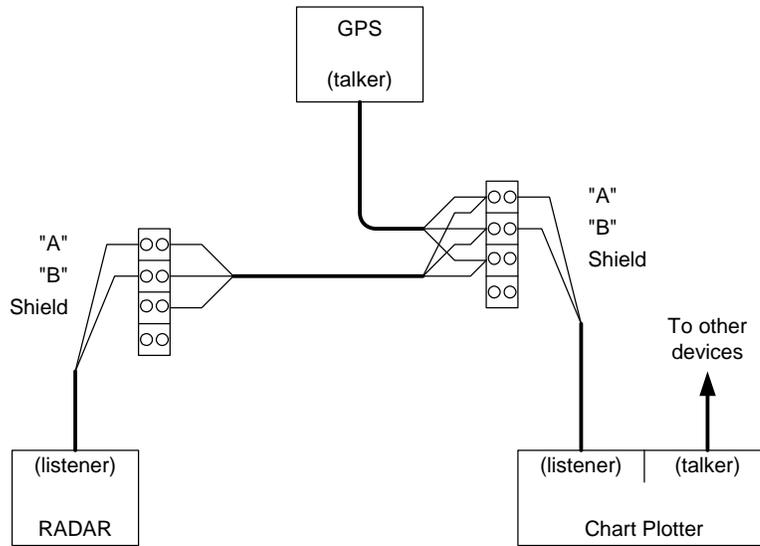
**Table 1: NMEA 0183 and NMEA 0183-HS Data Transmission Characteristics**

	<b>NMEA 0183</b>	<b>NMEA 0183-HS</b>
Baud Rate (bits/sec)	4,800	38,400
Data Bits	8 (d7 = 0)	8 (d7 = 0)
Parity	None	None
Stop Bits	One	One
Usable Throughput (char/sec)	450	3,600

NMEA 0183-HS implements the same sentences as NMEA 0183 and utilizes the same differential interface. Because of the different transmission rate, NMEA 0183-HS devices can not be interconnected to NMEA 0183 devices, but are connected similarly to NMEA 0183 with the only difference being that a third connection “C” is available at each interface to ensure that the common mode ground potential is the same at all drivers and receivers.

### 8.2.1 General Requirements

NMEA 0183 interfaces are based on a bus topology, where each device connects to the bus in accordance with whether they are a talker or a listener. There is only one talker on an NMEA bus, or interface circuit, and there may be multiple listeners, depending on the driving capability of the talker. Figure 13 illustrates an NMEA 0183 interface circuit and identifies the required connections.



**Figure 1: NMEA 0183 Interface Circuit**

Multiple interface circuits may be provided to accommodate vessels with more than one talker, but each circuit has only one talker and is independent and wired separately. Note that a single device that sends and receives data using NMEA 0183 may participate as a talker in one circuit and as a listener in another.

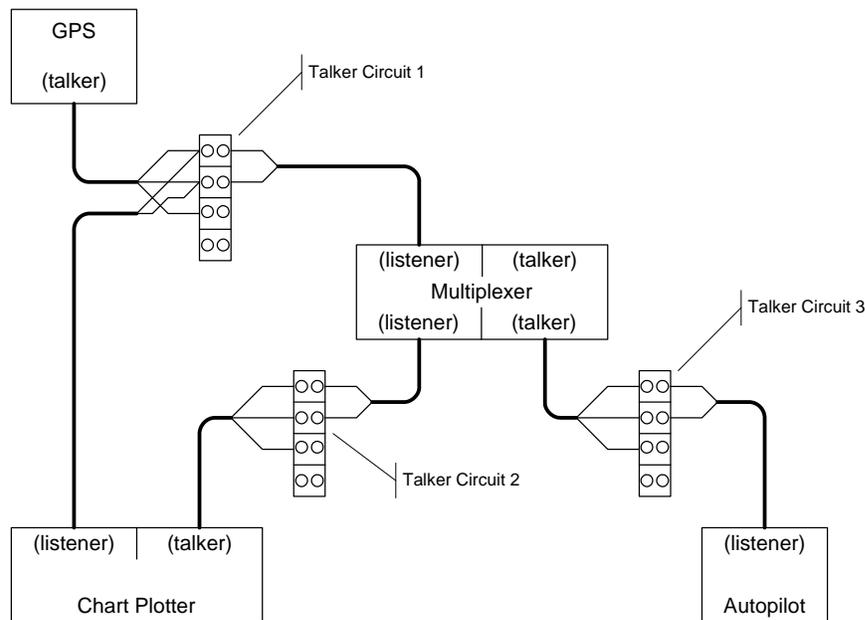
### 8.2.1.1 Talker Circuit

Each NMEA 0183 interface circuit shall have only one talker, and a maximum of 3 listeners. Where more than 3 listeners for a single talker is required, a signal expander shall be provided that amplifies the talker output to drive a greater number of listeners.

Older single ended devices may operate as a talker with a single differential listener by connecting the single ended talker signal to listener's "A" connection and connecting the listener's "B" connection to ground. Where more than one listener is desired, a signal expander that converts the single ended signal into a differential signal is recommended.

### 8.2.1.2 Multiple Talker Circuits

Where a single listener requires data from multiple talkers, a data multiplexer or combiner shall be provided as indicated in Figure 14. Data multiplexers buffer the input sentences from each talker, and provide a single data stream that may then be connected to multiple listeners. As shown in the figure, combining two talkers through a multiplexer results in a third talker circuit driven from the multiplexer.



**Figure 2: Combining Talkers for One Listener**

There is a practical limit to the number of talkers that can be combined based on the available bandwidth and the number of sentences that each talker transmits. Products are available that combine up to four talkers and replicate the combined output into four or more new talker circuits, each capable of supporting multiple listeners.

**NOTE:** At 4,800 bits per second the total available throughput is limited to 450 characters per second. When combining talkers, the installer shall ensure that the combined transmitted data made up of sentences from both talkers can be handled within the available bandwidth. The total bandwidth used can be computed by multiplying each transmitted sentence length for each talker by the sentence repetition rate, and summing the results.

## 8.2.2 Cable Requirements

Cabling and connections between equipment using NMEA 0183 shall be in accordance with the following paragraphs.

### 8.2.2.1 Maximum Operational Cable Length

Interface cables shall be kept as short as possible and shall not exceed 150 feet.

### 8.2.2.2 Cable Type

Interface cables, regardless of length, shall be composed of multi-conductor tinned shielded cable with a minimum 95 percent shielding. A twisted pair employing 22 AWG stranded wire shall be used for the NMEA 0183 data signals.

NMEA 0183-HS requires a third conductor, which is used to ensure that the common mode ground potential is the same at all drivers and receivers.

### 8.2.2.3 Connections

All interface cables shall be terminated at a common barrier strip for each interface circuit, in accordance with the requirements of Section 2, AC and DC Wiring. Additional barrier strips may be used to join interface extension cables to a manufacturer pigtail where it is impractical to route the pigtail directly to a common barrier strip.

### 8.2.2.4 Shielding

The interface cable shield shall be grounded only at the talker and shall be left unterminated at each listener. Shield continuity shall be maintained at all barrier strips.

### 8.2.2.5 Color-Coding

The NMEA 0183 standard does not establish specific color-codes for NMEA 0183 interface signals. Table 16 identifies signal color codes frequently used by manufacturers to identify and differentiate between NMEA 0183 Talker and Listener connections in supplied pigtails.

**Table 2: NMEA 0183 Signal Color Codes**

<b>Name</b>	<b>Color</b>	<b>Description</b>
Talker A	White	Data-H
Talker B	Brown	Data-L
Listener A	Yellow	Data-H
Listener B	Green	Data-L
NMEA 0183-HS C	Black	Ground
Shield	Bare	See Section 8.2.2.4

Color codes used by each device shall be confirmed by the installer using the manufacturer's documentation before equipment connections are made. When equipment pigtails cannot all be joined at the same barrier strip location and the NMEA 0183 network wiring is extended, the Talker color code should be used for cabling between barrier strips.

### 8.2.3 Power Requirements

Individual NMEA 0183 interface circuits are not powered separately from the connected devices; the devices themselves provide all transmission power. Accordingly, no over-current protection is required in circuit wiring used specifically for NMEA 0183 data transfer.

### 8.2.4 Interface between Versions, to NMEA 2000<sup>®</sup>, and to Other Devices

Connections between NMEA 0183 version 2.0 or later and NMEA 0180, 0182 and 0183 version 1.5 or lower shall only be made using buffers or transceivers that provide opto-isolation and voltage level shifts necessary to protect interface circuitry.

**NOTE: Equipment with multiple configurable ports as noted in 8.2.5 may be configured with one port in single ended mode (version 1.5 or earlier) and another port in differential mode (version 2.0 or later) in order to support a wide variety of interface requirements.**

Interfaces between NMEA 0183 or NMEA 0183-HS and an NMEA 2000<sup>®</sup> backbone must be provided using NMEA 2000<sup>®</sup> certified devices intended for that purpose.

Opto-isolation and voltage level shift may be required to interface devices designed to communicate using RS-232 with NMEA 0183 compatible devices. Refer to NMEA 0183 for specific details on opto-isolation requirements for connecting with non NMEA 0183 devices. Alternatively, Universal Serial Bus (USB) equipped multiplexers are available with software that provides virtual serial ports for communicating with PC based navigation and diagnostic software.

### 8.2.5 NMEA 0183 Setup

On installation completion, the equipment shall be initialized, and the talker and all listeners shall be set for the same data transfer format. Each piece of equipment shall be turned on, the interface data format shall be verified, and the specific interface port in use shall be activated and configured for the hardware connections in use.

**NOTE: High-end equipment may be provided with ports that can be configured as either single ended or differential outputs. Manufacturer instructions shall be followed to ensure that all interconnected ports are configured to use the same electrical interface.**