

# Proper NMEA 2000 Installation

## IBEX 2012 Session 813

Part I

Physical Installation

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Pete Braffitt, Gemeco

# Overview

- What is NMEA 2000?
- What are its physical characteristics and limits?
- What makes a good NMEA 2000 network?
- What makes a good NMEA 2000 network fail?

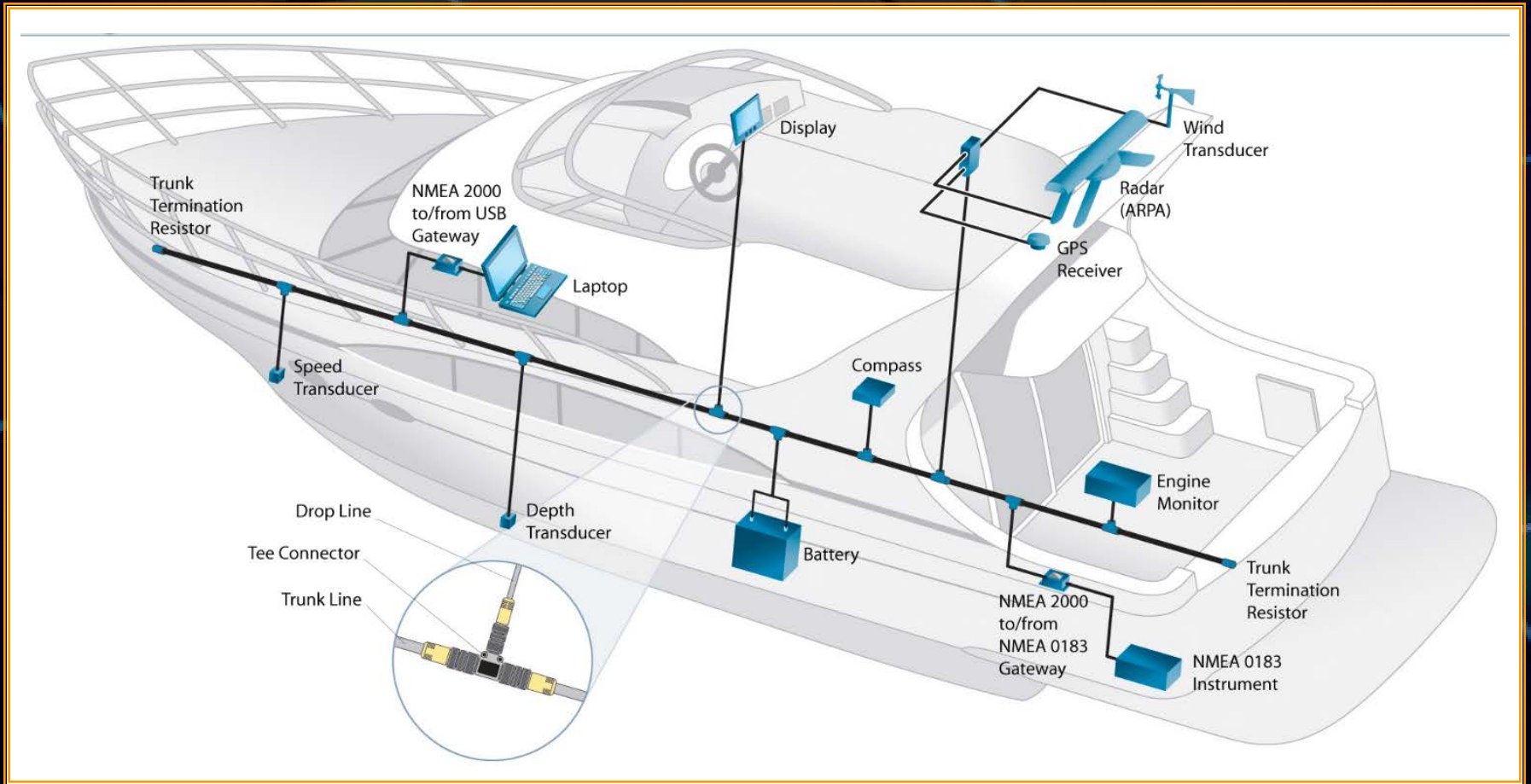
# NMEA 2000

- Marine specific network for navigation, control, and monitoring
- CAN based, similar to J1939
- Uses industrial quality cabling originally developed for DeviceNET
- Certified products, based on standard certification tool

# NMEA 2000 Certification

- First certification program applicable to recreational marine electronic products
- Over 400 products certified to date
- Purpose: ensure products communicate cooperatively (plug and play)
- Based on common certification tool
- Cabling components are also approved

# NMEA 2000



# Typical Tee

**MALE  
Backbone  
Connection**



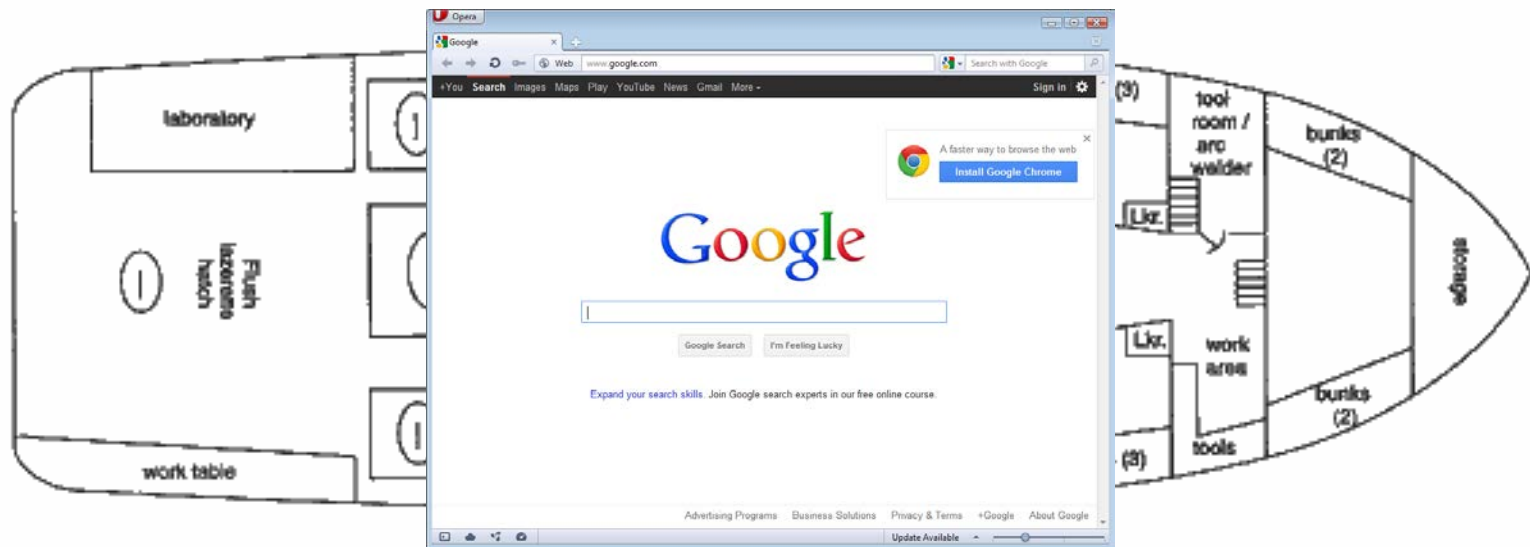
**FEMALE  
Backbone  
Connection**

**Drop Connection to device (FEMALE)- Accepts drop cable.**

# NMEA 2000

- Single backbone cable snakes throughout the vessel
- No active network infrastructure to fail
- Standardized message structure and format
  - both generic and system specific messages
- Links vessel systems together
  - engines, navigation, power distribution, water & waste, etc.

# NMEA 2000 = Vessel Database





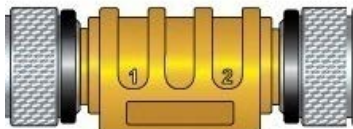
# What can you do with NMEA 2000?



# Physical Construction

- Building Blocks
- Characteristics
- Power Availability
- Other considerations

# NMEA 2000 Building Blocks



Power Tee(s)

Tee Connectors



Termination Resistors



Backbone & Drop Cables

# NMEA 2000 Building Blocks



Mini to Micro  
Adapter



Field Installable  
Connectors

Mini Backbone  
w/ Micro Drop



Gender  
Changer



# NMEA 2000 Characteristics

## Overall:

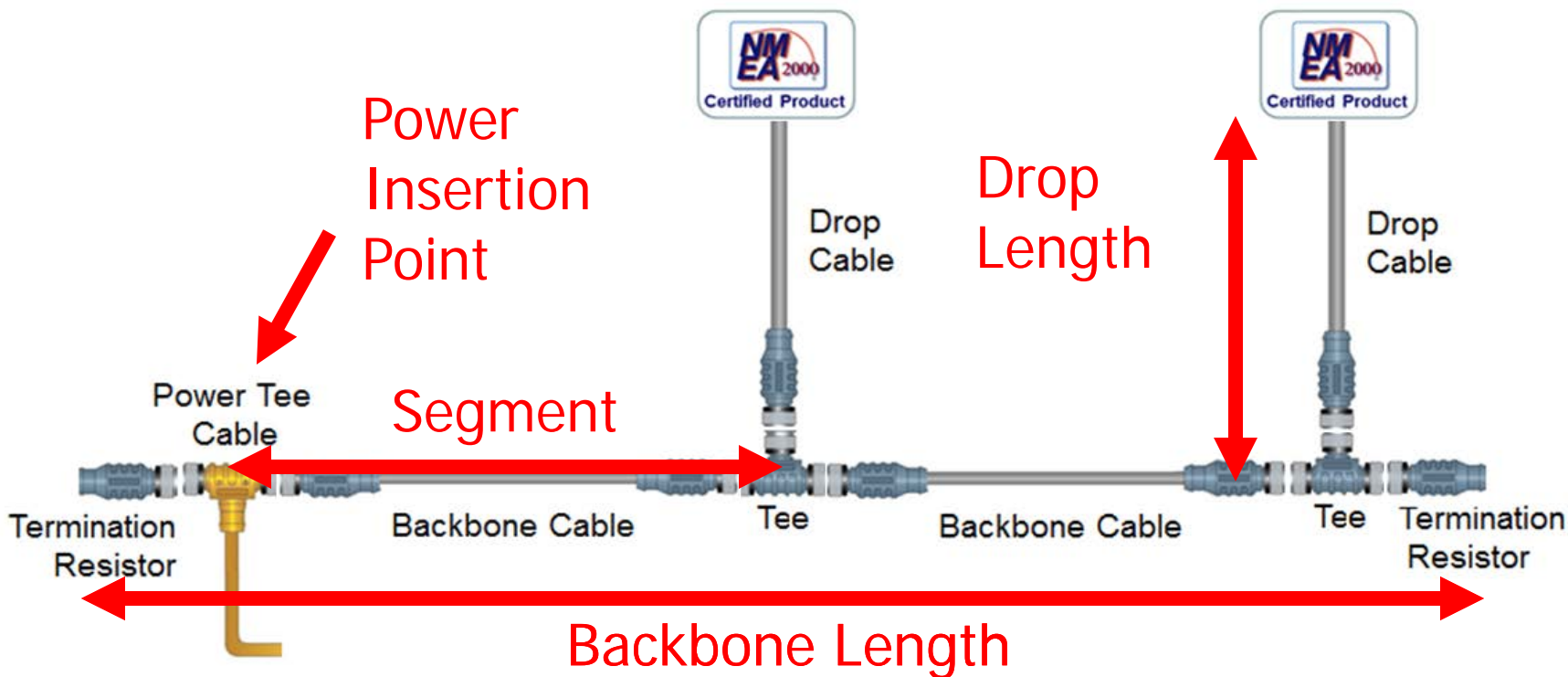
- Capacity - 250K bits-per-second
- Interface operating range - 9 to 15 volts
- Logical network identities - 252
- Minimum node separation - 0 meters
- Maximum bridged backbones - 10

# NMEA 2000 Characteristics

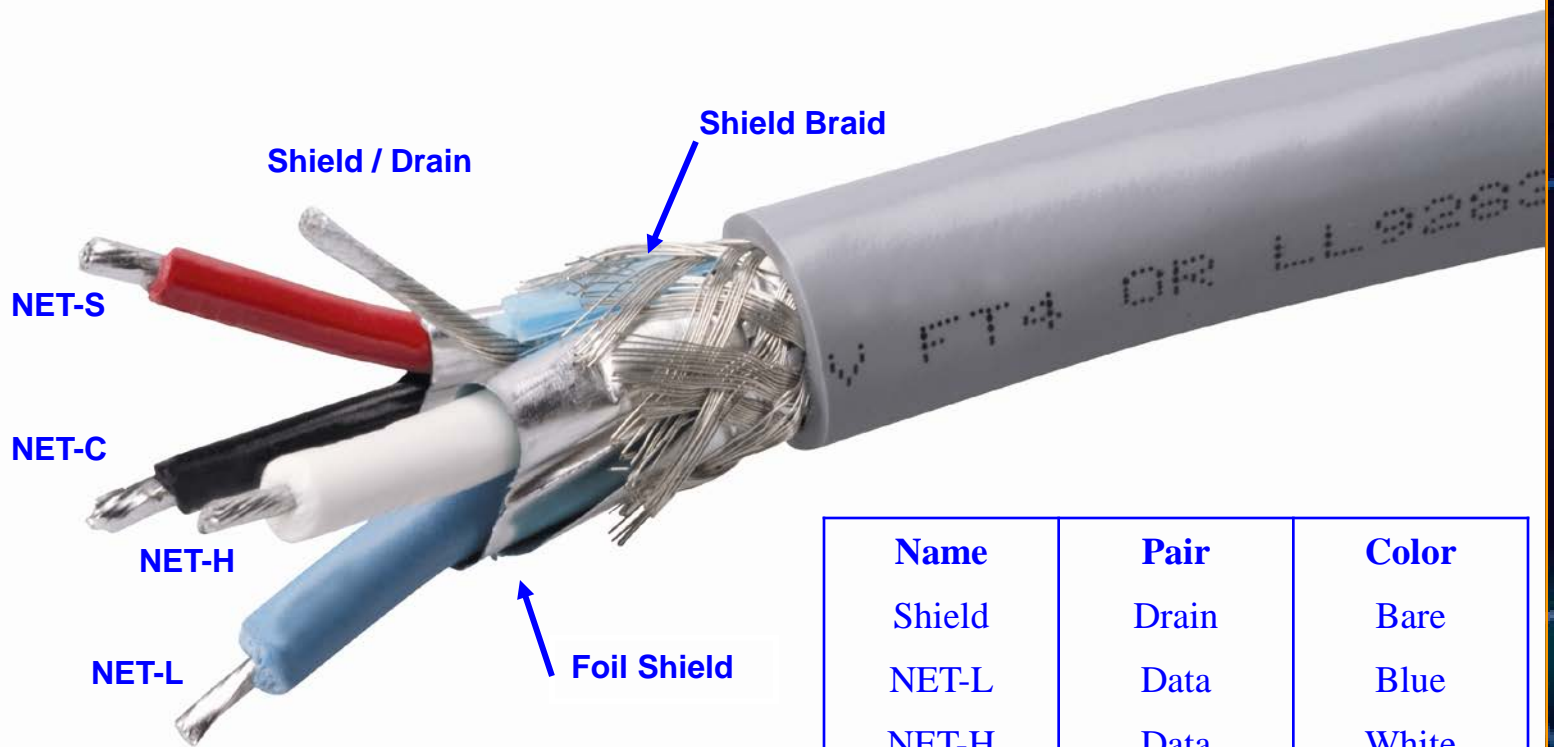
## Each backbone:

- Length - 200 meters
  - 100 meters when using light cable
- Connected products - 50
- Drop cable
  - 6 meters per drop
  - 78 meters total of all drops
- Power - limited by cable size and the number of power insertion points

# NMEA 2000 Terminology



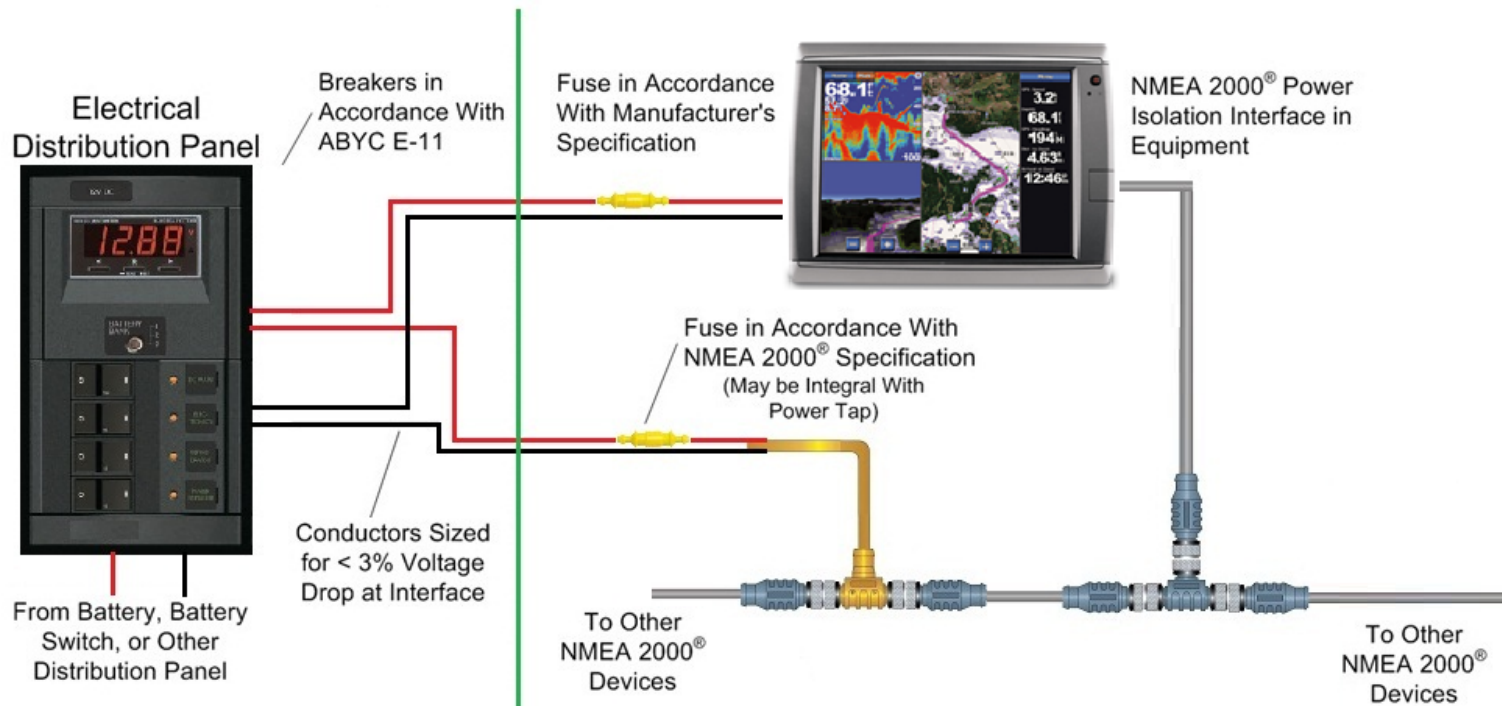
# Cable Construction



Name	Pair	Color
Shield	Drain	Bare
NET-L	Data	Blue
NET-H	Data	White
NET-C	Power -	Black
NET-S	Power +	Red



# Product Power Sources



ABYC E-11 | NMEA 2000®

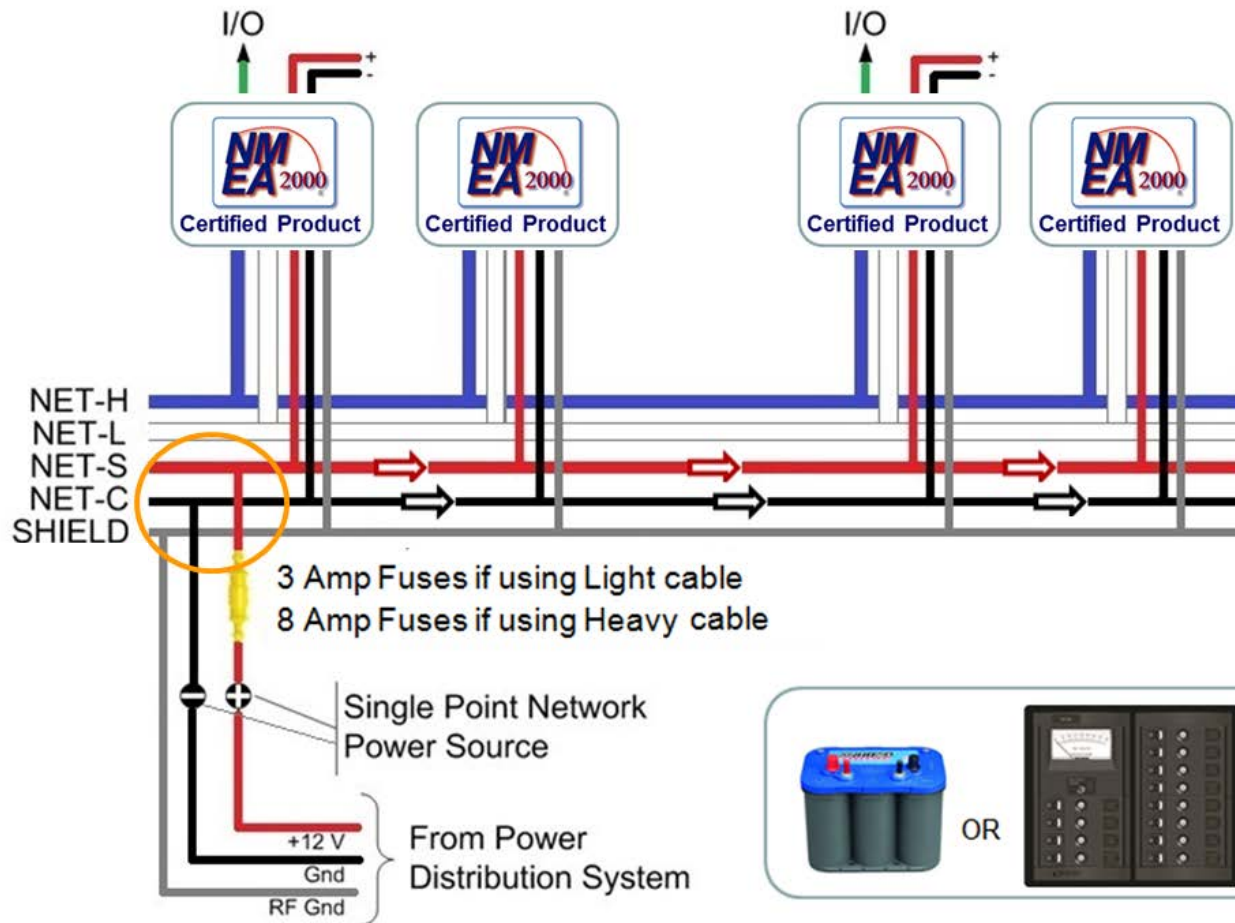
Power Distribution Communications Interface

# Cable Types

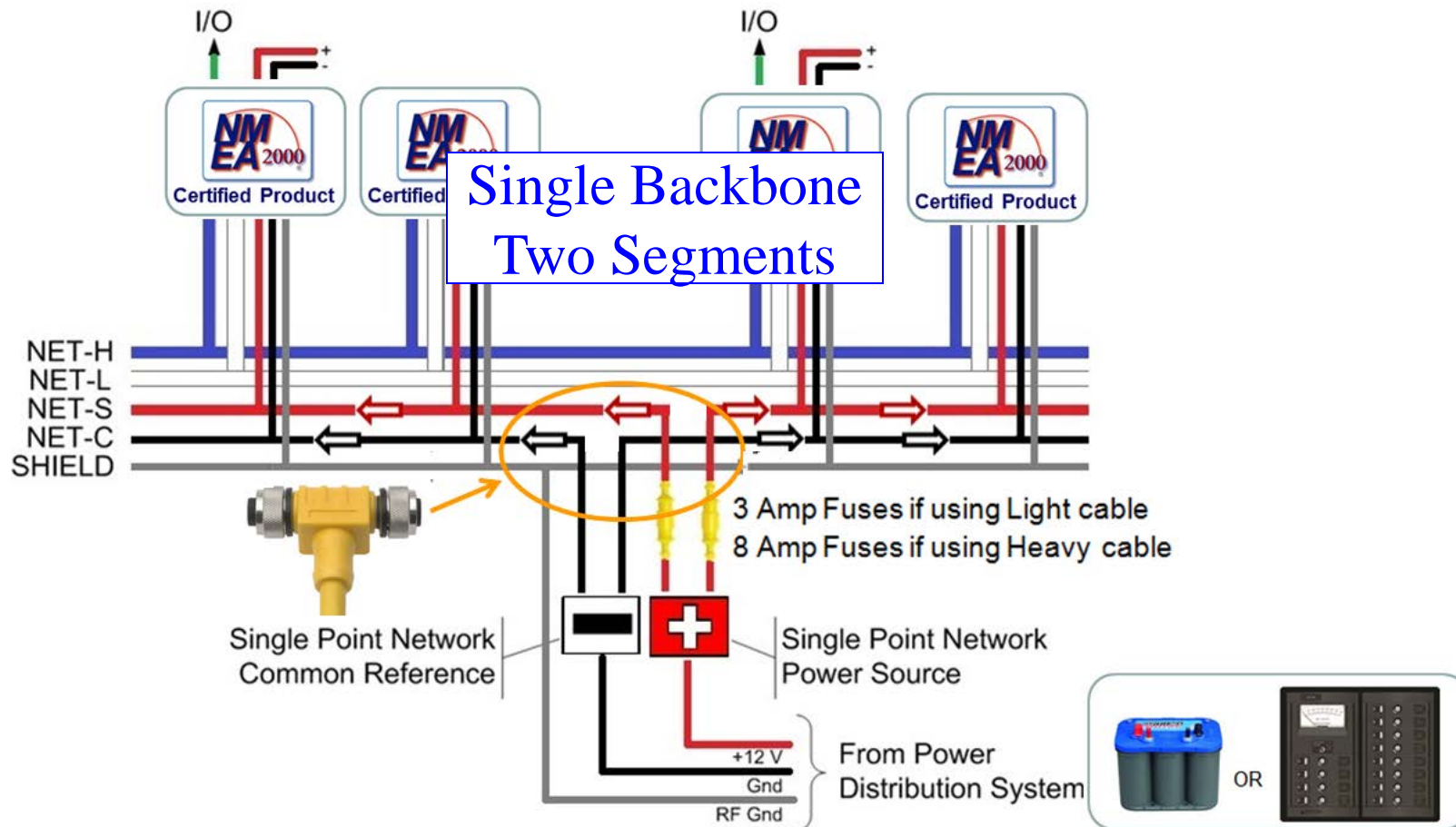
Style	Light	Mid	Heavy
Connectors	Micro	Micro/Mini	Mini
Max Length	100 meters	200 meters	200 meters
Capacity	3 amp*	4/8 amp*	8* amp
Signal Wire Gage	24 AWG	20 AWG	18 AWG
Power Wire Gage	22 AWG	16 AWG	16AWG

\* Maximum power per backbone segment

# NMEA 2000 Backbone



# NMEA 2000 Backbone



# Power Sources

- Battery (nominally 12.0 VDC)
  - Allowed voltage drop = 1.5 VDC
- Typical power supply (13.8 VDC)
  - Allowed voltage drop = 3.0 VDC
- Maximum power supply (15 VDC)
  - Maximum allowed voltage drop = 5.0 VDC

# Other Considerations

- Products may be added to or removed from the backbone while operational
- No daisy-chaining ensures backbone remains intact when removing equipment
- Two terminators required, one at each end of the backbone

# Making the Right Selections



# Network Design Drivers

- Network power distribution
  - Segment voltage drop limit
  - Add power insertions points as needed
- Network topology
  - Keep it pure



# Network Voltage Drop

- Straightforward application of Ohm's Law

$$E = I \times R$$

where

E = voltage drop

I = circuit current

R = wire resistance

# Network Voltage Drop

- Wire resistance

$$R = 2 \times \text{Length} \times \text{Power Pair Resistance} / 100$$

- Network current

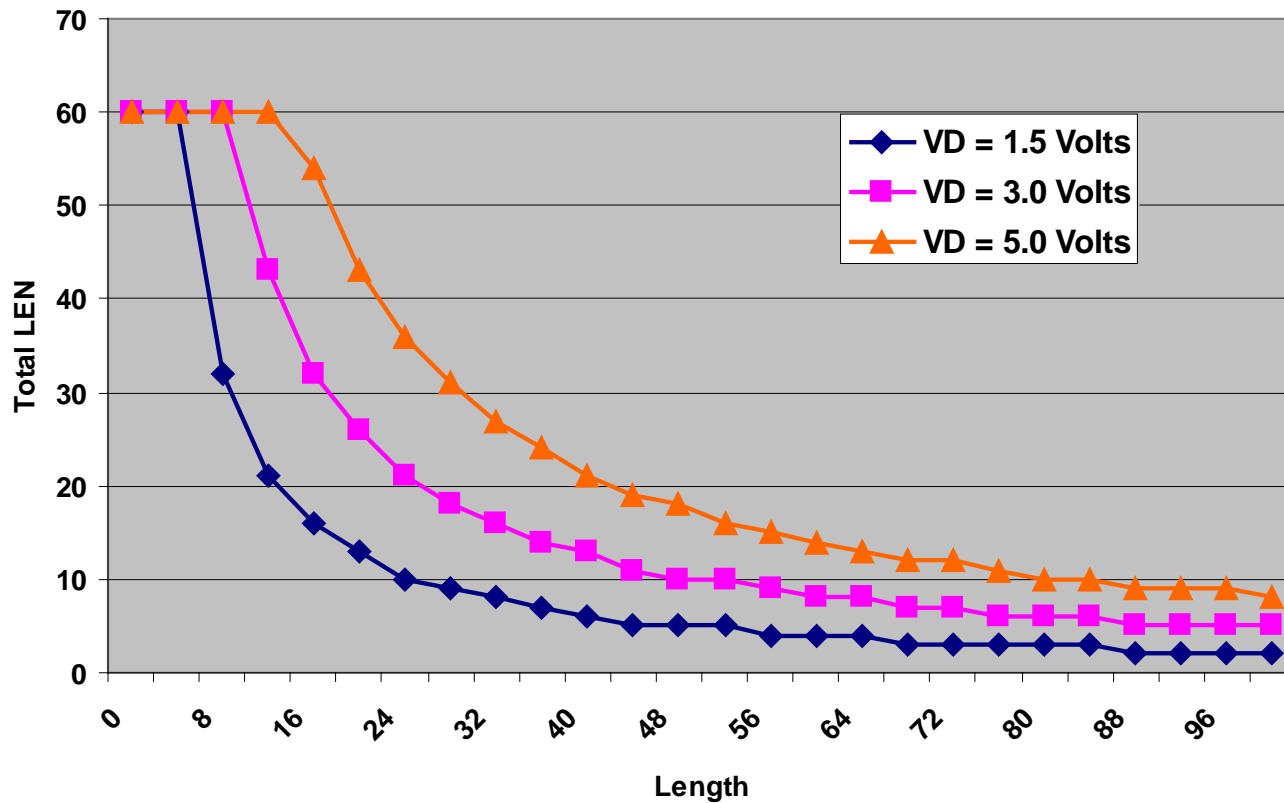
$$I = \text{LEN} \times 0.050 \text{ amp}$$

- All together

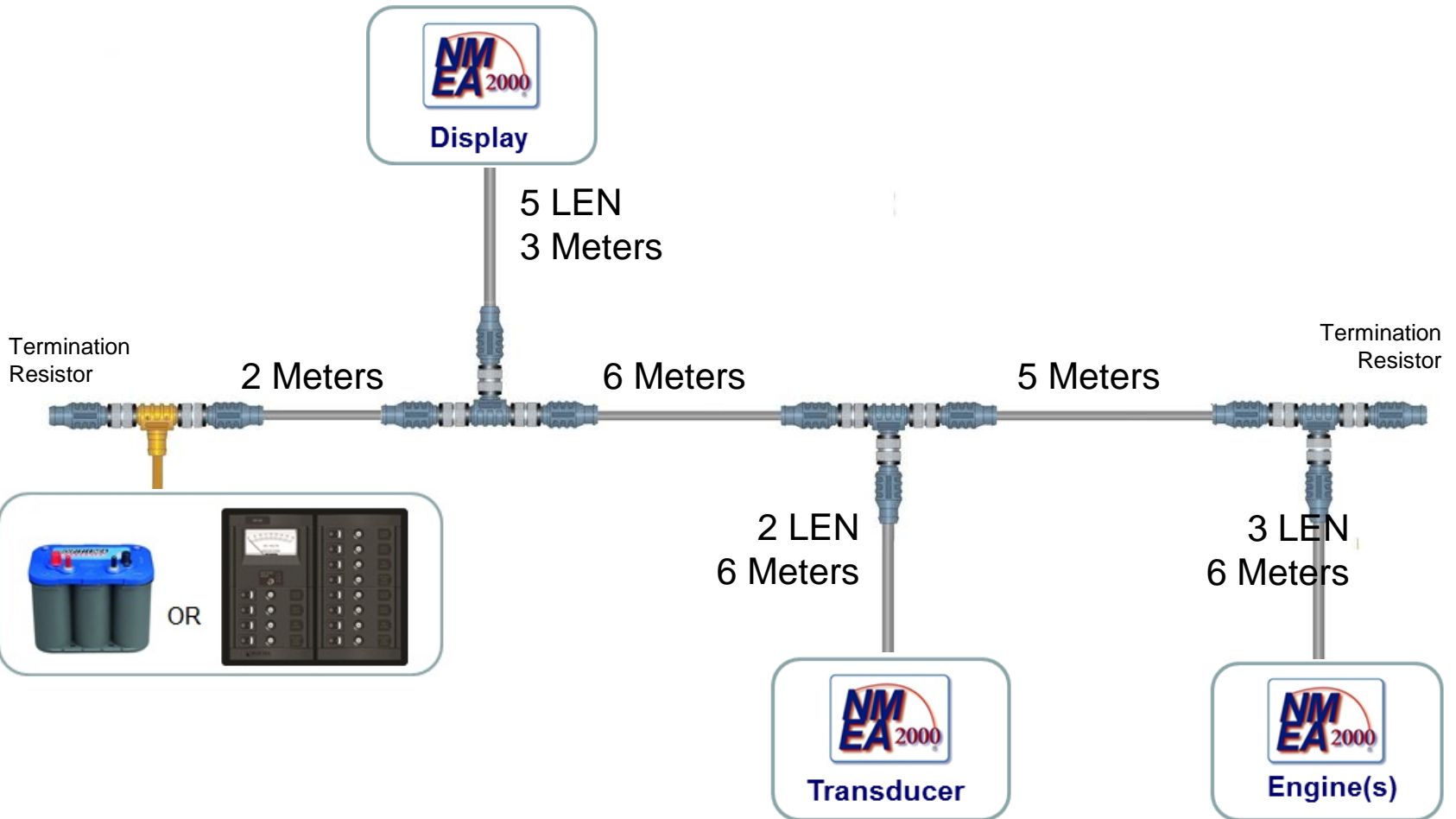
$$E = 0.1 \times \text{LEN} \times L \times 0.057 \text{ (Light)}$$

$$E = 0.1 \times \text{LEN} \times L \times 0.016 \text{ (Mid/ Heavy)}$$

# Estimated Length - Light



# Example Network



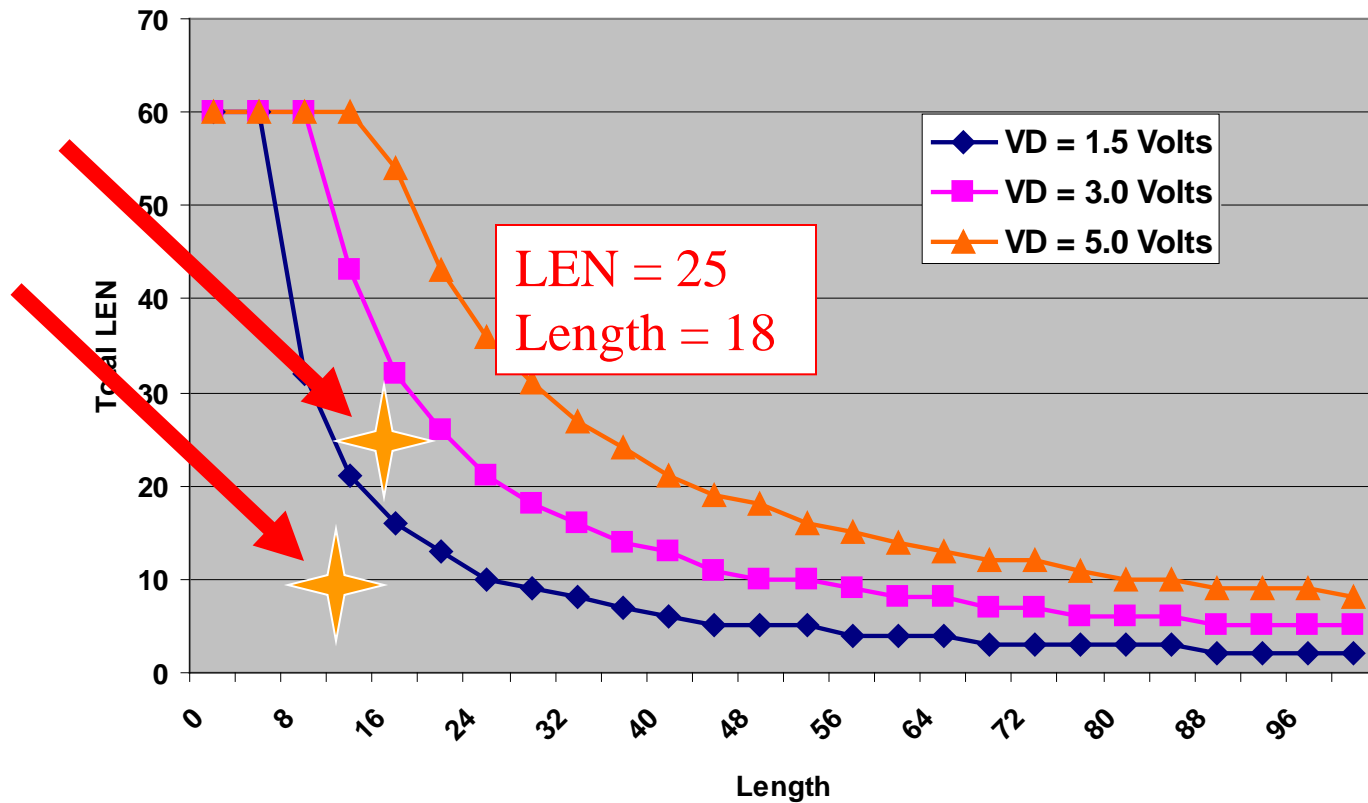
# Example Summary

- Total load = 10 LEN
- Backbone length = 13 meters
- Using light cable
  - Power pair resistance = 0.057  $\Omega$ /meter

$$E = 0.1 \times 10 \times 13 \times 0.057$$

$$E = 0.74 \text{ Volts}$$

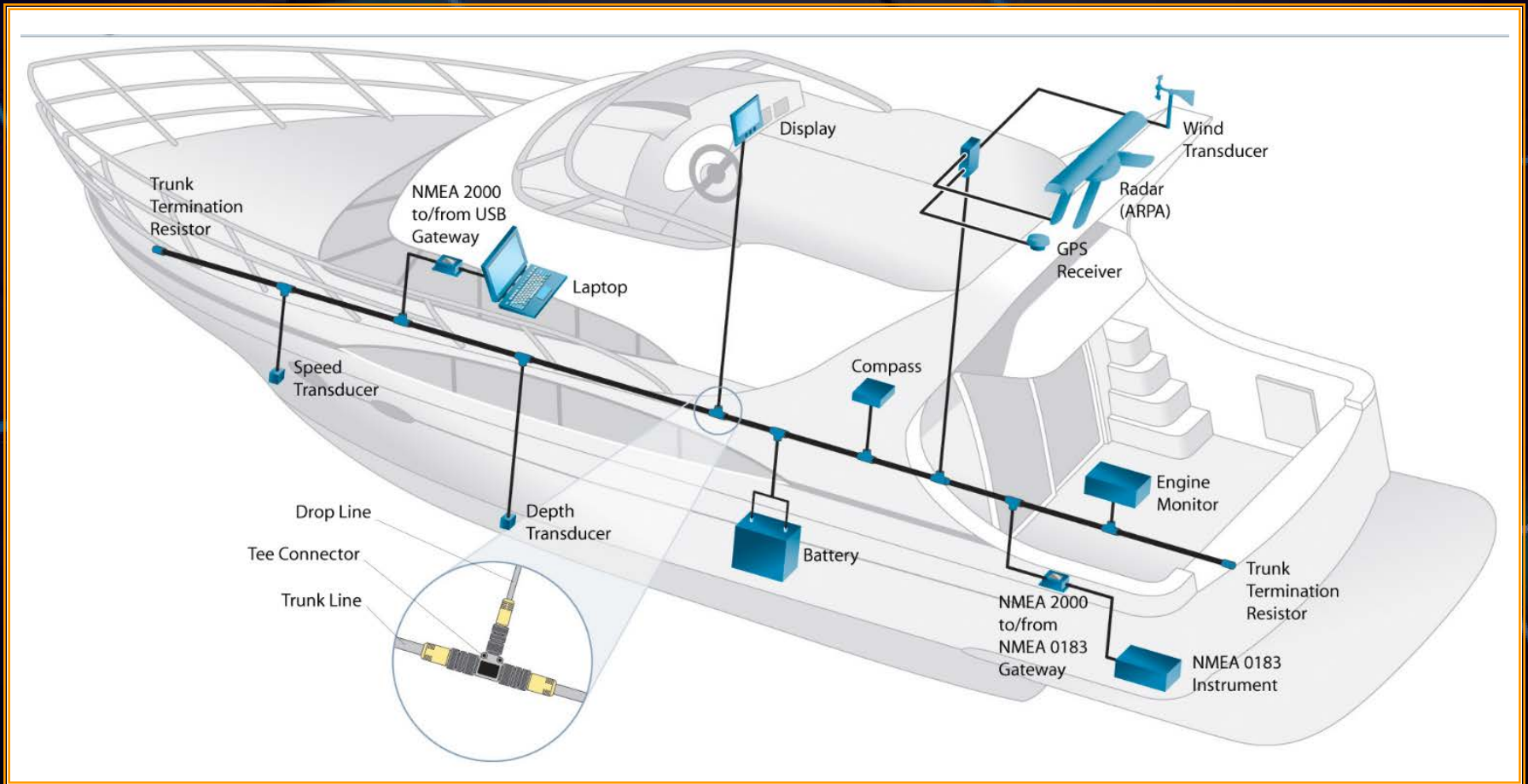
# Estimated Length - Light



# Network Layout

- ‘Trunk and Drop’ Topology
- Determine location for each product
- Determine path for trunk/backbone that:
  - Passes within 6 meters of each product
  - Total of all drops  $< 78$  meters
- Determine number and location of power insertion points

# Network Layout





# Layout Issues

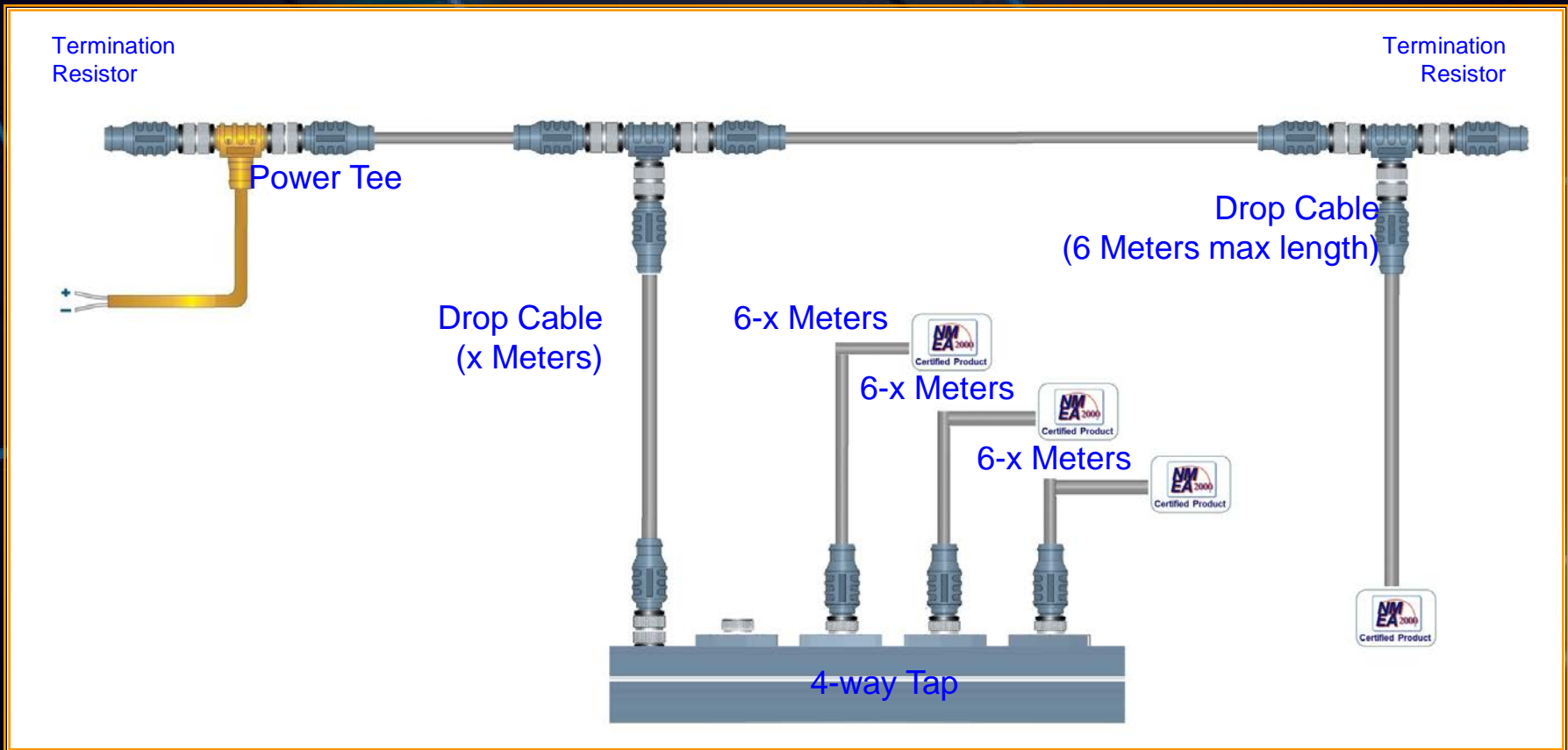
- Multiple connections in confined spaces
- Sailboat masts & powerboat towers
- Gateways to other protocols
- Multiple backbone configurations

# Multiple Connections in Confined Spaces



- Multi-tap tee is used just like multiple tees
- Multi-drop splitter has some limitations

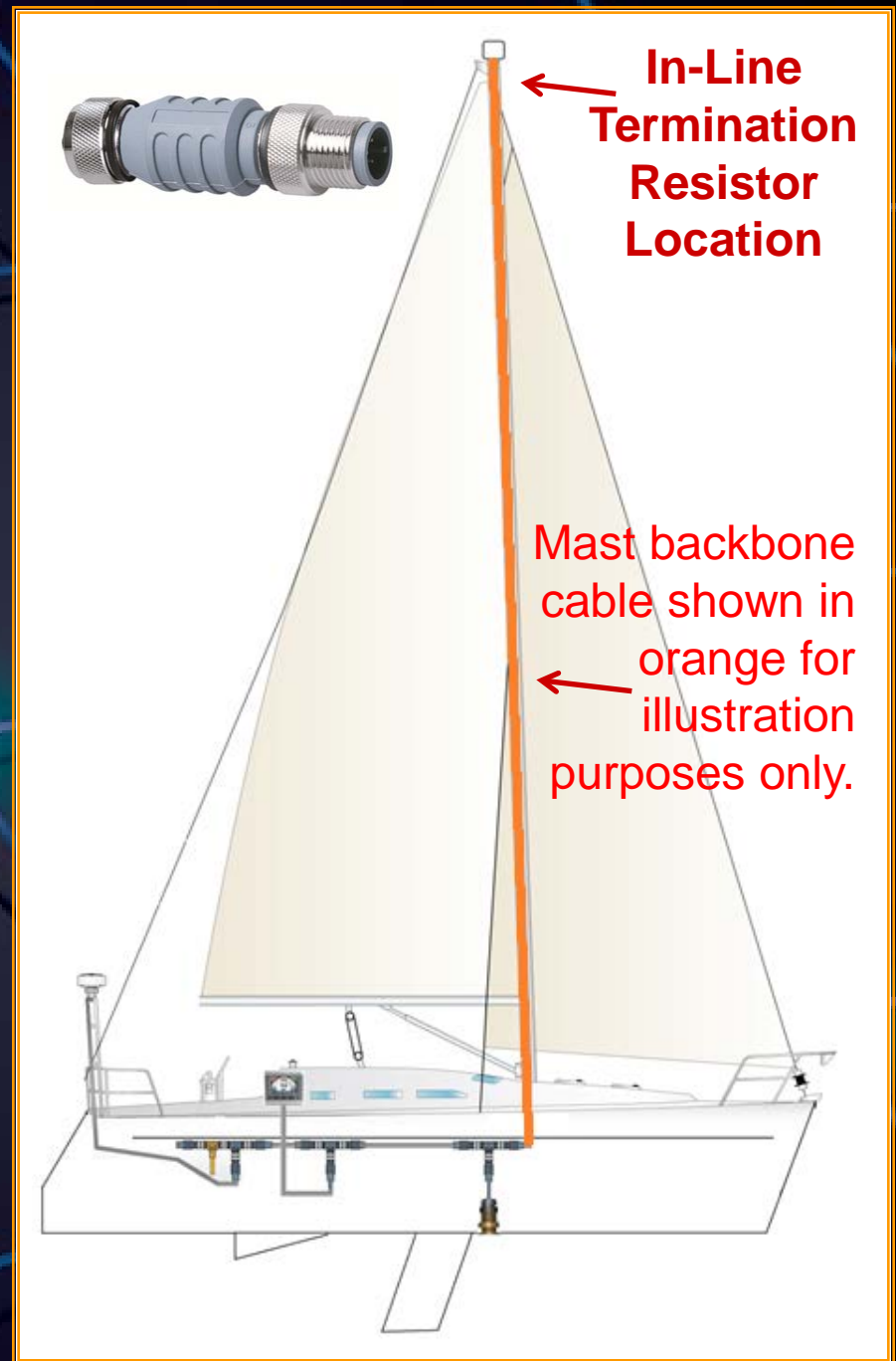
# Multi-tap Drop



**Max length of each drop must be reduced by the length of the drop cable between the Tee and the multi-tap**

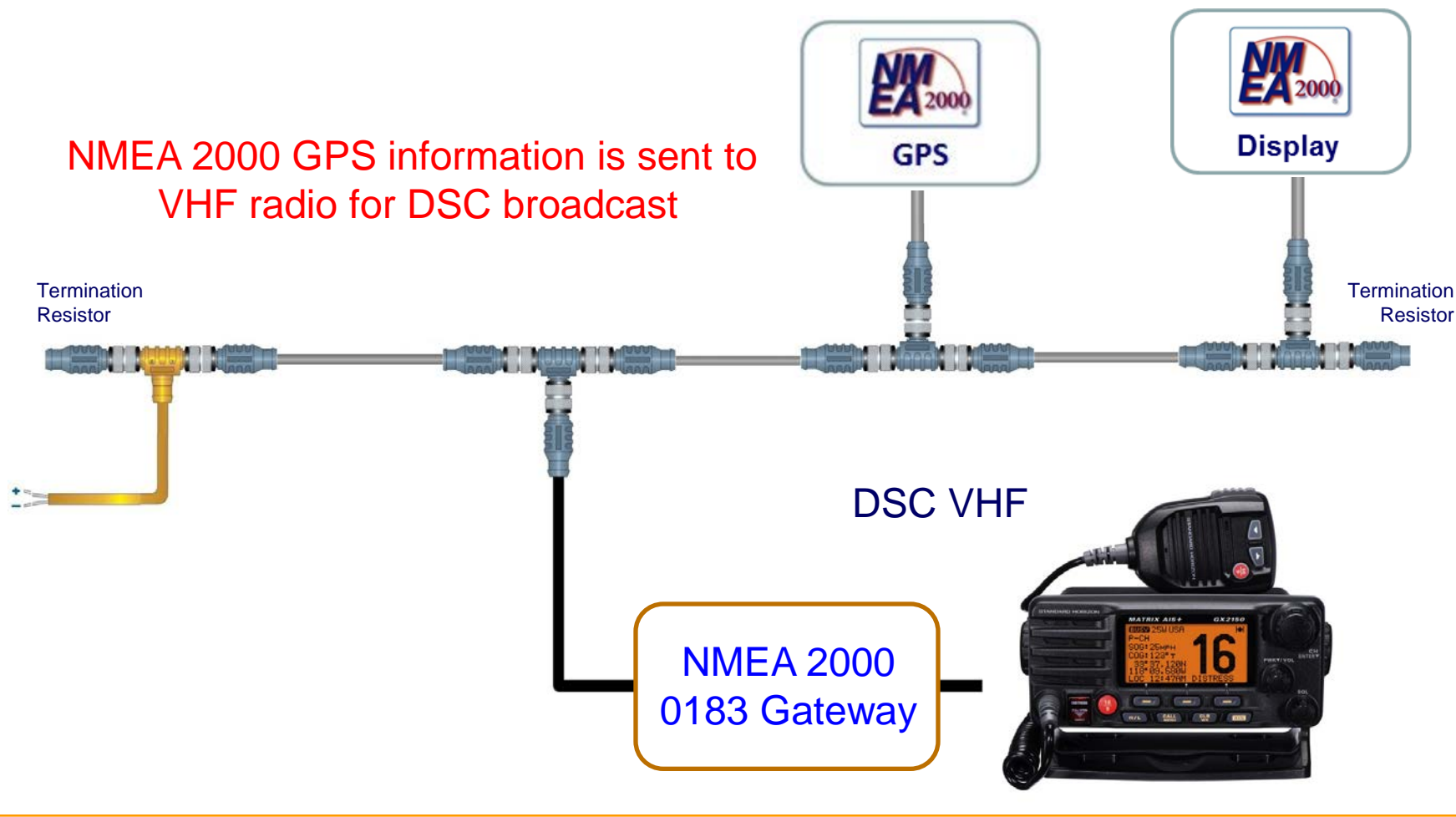
# Sailboat Masts

- Most masts are greater than 6 Meters
- Backbone termination at the top of the mast
- In-Line termination resistors are used
- Must be within 6 meters of last device
- Some manufacturers have a built-in termination resistors on cables  $> 6$  meters



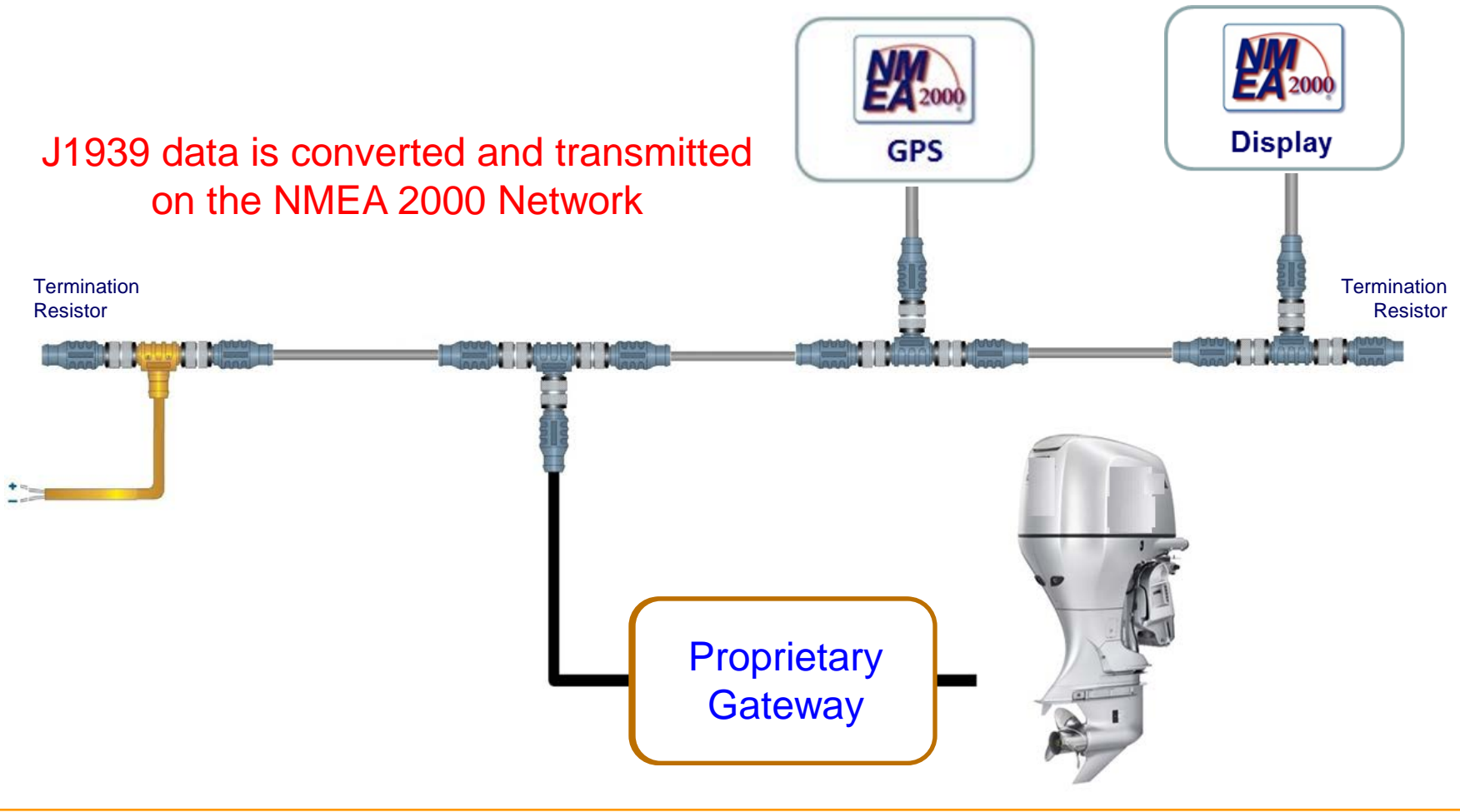
# Gateways

NMEA 2000 GPS information is sent to VHF radio for DSC broadcast



# Gateways

J1939 data is converted and transmitted on the NMEA 2000 Network



# NMEA 2000 Network Bridge

- Connect two networks
- > 50 nodes
- Backbone > 200 meters
- Drops > 78 meters

## Useful For:

- Separate mast backbone from main
- Separate critical equipment
- Port/stbd redundancy

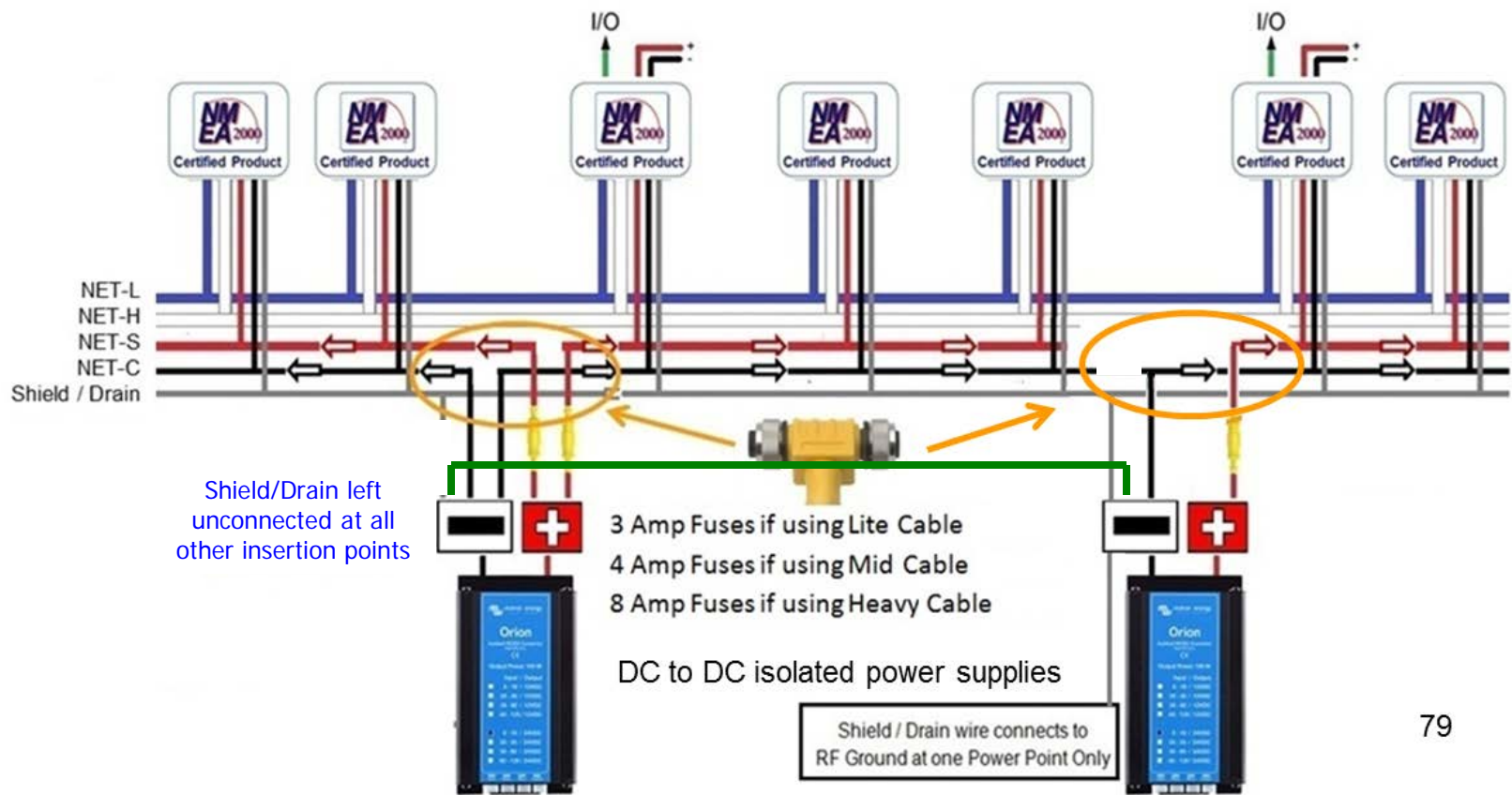


# Power Insertion

- How many insertion points?
- Common reference point
- Connect shield to RF ground only once
- Each leg has only one power source – consecutive legs not connected
  - Risk of harmonics between power supplies
  - Risk of cumulative voltage drop exceeding common mode offset limits



# Power Insertion



# Power Insertion Building Blocks



# Testing



# Testing Checklist

- ✓ Loose connections
- ✓ Voltage fluctuations & data errors
  - Voltage consistent and  $> 9$  VDC at all tees
- ✓ Correct termination
  - Approximately  $60 \Omega$  across data pair when power off
- ✓ No sustained error rate

# Testing Checklist

- ✓ 50 connected products or less
- ✓ Drops 6 meters or less
- ✓ Total drops 78 meters or less
- ✓ Network 200 meters or less
- ✓ All power tap leads powered

# Plug and Play Limitation

- Layout and power planning rules result in products communicating non-destructively
- Product configuration ensures data displayed is data intended
- Manufacturer configurability may vary
- New Label and Configuration messages will unify methods in use

# Acknowledgements and Contact Information

Photos courtesy of Airmar, Actisense, Garmin, LTW,  
Maretron, Moxel, Turck

Diagrams courtesy NMEA

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MYSTIC VALLEY COMMUNICATIONS LLC

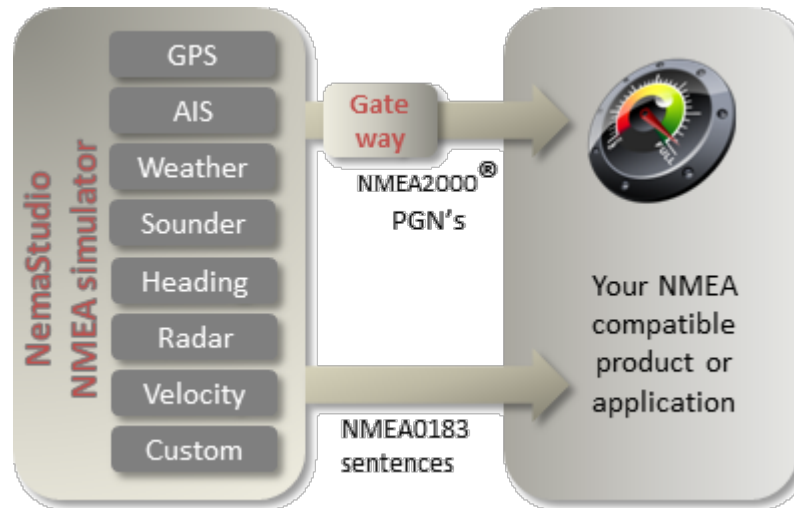
<http://www.nmea2000solutions.com>

# NMEA Software Utilities

## Actisense®

## Maretron®

## SailSoft





# Actisense NMEA Reader



- The Actisense NMEA Reader is a great utility for testing and evaluating a NMEA 0183 or NMEA 2000™ system.
- The program is free to download from the Actisense web site and will work great with a compatible serial or USB adapter.
- This software will allow the user to view real time data flow and buffer rates.
- Certain Actisense gateways can be programmed by this software such as the NGW-1 and NGT-1.
- Manufacturer and LEN numbers can be obtained from this software for certain NMEA 2000™ devices.

# Actisense NMEA Reader



- The Actisense NGT-1-USB is a great product to deliver NMEA 2000™ data directly into the PC for use with the NMEA Reader Software.

# Actisense NMEA Reader

The screenshot shows the Actisense NMEA Reader application window. The title bar reads "NMEA Reader - [COM3: Actisense NGT]". The menu bar includes "File", "Edit", "View", "Window", and "Help". Below the menu bar, there are icons for refresh, stop, and save, followed by a dropdown menu showing "COM3: Actisense NGT" and a baud rate dropdown set to "115200".

The main area contains a table with the following columns: Line, PGN, SRC, DST, Name, Time, Interval, and Data. The table lists 43 rows of NMEA sentences, including various types such as Meteorological Station Data, Environmental Parameters, Wind Data, GNSS Sats in View, GNSS DOPs, Time & Date, GNSS Position Data, COG & SOG, Rapid Update, Position, Rapid Update, Fluid Level, Magnetic Variation, Attitude, Rate of Turn, Vessel Heading, Rudder, Configuration Information, Product Information, System Time, and ISO Address Claim.

Line	PGN	SRC	DST	Name	Time	Interval	Data
1	130944	36	255	Manu. Proprietary fast-packet non-address...	09:39:27:446	9.77	87 98 FF 0E 00 01 01 00 ...
2	130323	36	255	Meteorological Station Data	09:39:31:519	1.62	F0 FF FF FF FF FF FF FF ...
3	130311	36	255	Environmental Parameters	09:39:31:525	0.87	0A C1 69 73 FF 7F FC 03
4	130306	36	255	Wind Data	09:39:32:018	0.42	16 FF FF FF FF F8 FF FF
5	129540	36	255	GNSS Sats in View	09:39:31:555	1.63	FF FF 00
6	129539	36	255	GNSS DOPs	09:39:31:524	1.62	FF FB FF 7F FF 7F FF 7F
7	129033	36	255	Time & Date	09:39:31:517	1.62	FF FF FF FF FF FF FF 7F
8	129029	36	255	GNSS Position Data	09:39:31:538	1.63	FF FF FF FF FF FF FF FF ...
9	129026	36	255	COG & SOG, Rapid Update	09:39:31:523	1.62	FF FF FF FF FF FF FF FF
10	129025	36	255	Position, Rapid Update	09:39:31:520	1.62	FF FF FF 7F FF FF FF 7F
11	127505	10	255	Fluid Level	09:39:33:462	2.52	00 44 48 DE 93 00 00 FF
12	127505	12	255	Fluid Level	09:39:34:041	2.50	50 FC 53 FF FF FF FF FF
13	127505	13	255	Fluid Level	09:39:34:040	2.50	10 FC 53 FF FF FF FF FF
14	127258	36	255	Magnetic Variation	09:39:31:518	1.62	05 F5 CC 3C FF 7F FF FF
15	127257	36	255	Attitude	09:39:31:519	1.62	05 FF 7F FF 7F FF 7F FF
16	127251	36	255	Rate of Turn	09:39:31:916	0.10	34 FF FF FF 7F FF FF FF
17	127250	36	255	Vessel Heading	09:39:31:916	0.10	FF FF FF FF 7F FF 7F FF
18	127245	11	255	Rudder	09:39:35:861	0.10	00 F8 FF 7F 29 E1 FF FF
19	126998	2	255	Configuration Information	09:35:04:409		02 01 02 01 2D 01 41 63 ...
20	126998	3	255	Configuration Information	09:35:03:519		02 01 02 01 2D 01 41 63 ...
21	126998	4	255	Configuration Information	09:35:05:279		02 01 02 01 2D 01 41 63 ...
22	126998	36	255	Configuration Information	09:35:46:557		02 01 02 01 26 01 41 69 ...
23	126996	2	255	Product Information	09:35:04:190		14 05 27 6E 4E 4D 45 41 ...
24	126996	3	255	Product Information	09:35:03:320		14 05 27 6E 4E 4D 45 41 ...
25	126996	4	255	Product Information	09:35:05:059		14 05 27 6E 4E 4D 45 41 ...
26	126996	5	255	Product Information	09:35:09:980		B0 04 12 09 44 65 63 6B ...
27	126996	7	255	Product Information	09:35:14:020		B0 04 38 4D 50 61 6E 65 ...
28	126996	8	255	Product Information	09:35:05:941		B0 04 38 4D 50 61 6E 65 ...
29	126996	9	255	Product Information	09:35:18:052		B0 04 38 4D 50 61 6E 65 ...
30	126996	10	255	Product Information	09:35:21:990		14 05 FA 20 46 75 65 6C ...
31	126996	11	255	Product Information	09:35:26:030		B0 04 7C 1E 52 75 64 64 ...
32	126996	12	255	Product Information	09:35:30:061		B0 04 78 6D 57 61 74 65 ...
33	126996	13	255	Product Information	09:35:34:112		B0 04 78 6D 57 61 74 65 ...
34	126996	36	255	Product Information	09:35:46:241		BA 04 7B 22 50 42 32 30 ...
35	126992	36	255	System Time	09:39:31:516	1.62	FF F0 FF FF FF FF FF FF
36	60928	2	255	ISO Address Claim	09:35:00:478		CD B0 21 22 00 82 32 C0
37	60928	3	255	ISO Address Claim	09:35:00:477		E1 B0 21 22 00 82 32 C0
38	60928	4	255	ISO Address Claim	09:35:00:479		E3 B0 21 22 00 82 32 C0
39	60928	5	255	ISO Address Claim	09:35:00:480		58 02 21 14 00 D2 64 C0
40	60928	6	255	ISO Address Claim	09:35:00:621		22 A4 21 14 00 A0 A0 C0
41	60928	7	255	ISO Address Claim	09:35:00:481		17 00 24 14 00 A0 A0 C0
42	60928	8	255	ISO Address Claim	09:35:00:480		69 80 24 14 00 A0 A0 C0
43	60928	9	255	ISO Address Claim	09:35:00:481		38 00 25 14 00 A0 A0 C0

At the bottom of the window, there are navigation buttons for "Data View", "Network View", and "Hardware Config". The status bar at the very bottom shows "COM 3 115200 Open Transfer Receive All".

- The NMEA Reader is a good utility to read what sentences are located on the network.
- The data shown includes the specific PGN, Sentence Name, Transmit Interval and the actual data itself.

# Actisense NMEA Reader

Line	PGN	SRC	DST	Name	Time	Interval	Data
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10	129025	36	255	Position, Rapid Update	09:39:31:520	1.62	FF FF FF 7F FF FF FF 7F
11	127505	10	255	Fluid Level	09:39:33:462	2.52	00 44 48 DE 93 00 00 FF
12	127505	12	255	Fluid Level	09:39:34:041	2.50	50 FC 53 FF FF FF FF FF
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- The top selected item shows the com port, description and baud rate of the available NMEA 0183 or NMEA 2000™ Device.

# Actisense NMEA Reader

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The main area contains a table with the following columns: Line, PGN, SRC, DST, Name, Time, Interval, and Data. The "Interval" column is circled in red. The table lists various NMEA sentences such as "Manu. Proprietary fast-packet non-address...", "Meteorological Station Data", "Environmental Parameters", "Wind Data", "GNSS Sats in View", "GNSS DOPs", "Time & Date", "GNSS Position Data", "COG & SOG, Rapid Update", "Position, Rapid Update", "Fluid Level", "Magnetic Variation", "Attitude", "Rate of Turn", "Vessel Heading", "Rudder", "Configuration Information", "Product Information", and "ISO Address Claim".

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5	129540	36	255	GNSS Sats in View	09:39:31:555	1.63	FF FF 00
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13	127505	13	255	Fluid Level	09:39:34:040	2.50	10 FC 53 FF FF FF FF FF
14	127258	36	255	Magnetic Variation	09:39:31:518	1.62	05 F5 CC 3C FF 7F FF FF
15	127257	36	255	Attitude	09:39:31:519	1.62	05 FF 7F FF 7F FF 7F FF
16	127251	36	255	Rate of Turn	09:39:31:916	0.10	34 FF FF FF 7F FF FF FF
17	127250	36	255	Vessel Heading	09:39:31:916	0.10	FF FF FF FF 7F FF 7F FF
18	127245	11	255	Rudder	09:39:35:861	0.10	00 F8 FF 7F 29 E1 FF FF
19	126998	2	255	Configuration Information	09:35:04:409		02 01 02 01 2D 01 41 63 ...
20	126998	3	255	Configuration Information	09:35:03:519		02 01 02 01 2D 01 41 63 ...
21	126998	4	255	Configuration Information	09:35:05:279		02 01 02 01 2D 01 41 63 ...
22	126998	36	255	Configuration Information	09:35:46:557		02 01 02 01 26 01 41 69 ...
23	126996	2	255	Product Information	09:35:04:190		14 05 27 6E 4E 4D 45 41 ...
24	126996	3	255	Product Information	09:35:03:320		14 05 27 6E 4E 4D 45 41 ...
25	126996	4	255	Product Information	09:35:05:059		14 05 27 6E 4E 4D 45 41 ...
26	126996	5	255	Product Information	09:35:09:980		B0 04 12 09 44 65 63 6B ...
27	126996	7	255	Product Information	09:35:14:020		B0 04 38 4D 50 61 6E 65 ...
28	126996	8	255	Product Information	09:35:05:941		B0 04 38 4D 50 61 6E 65 ...
29	126996	9	255	Product Information	09:35:18:052		B0 04 38 4D 50 61 6E 65 ...
30	126996	10	255	Product Information	09:35:21:990		14 05 FA 20 46 75 65 6C ...
31	126996	11	255	Product Information	09:35:26:030		B0 04 7C 1E 52 75 64 64 ...
32	126996	12	255	Product Information	09:35:30:061		B0 04 78 6D 57 61 74 65 ...
33	126996	13	255	Product Information	09:35:34:112		B0 04 78 6D 57 61 74 65 ...
34	126996	36	255	Product Information	09:35:46:241		BA 04 7B 22 50 42 32 30 ...
35	126992	36	255	System Time	09:39:31:516	1.62	FF F0 FF FF FF FF FF FF
36	60928	2	255	ISO Address Claim	09:35:00:478		CD B0 21 22 00 82 32 C0
37	60928	3	255	ISO Address Claim	09:35:00:477		E1 B0 21 22 00 82 32 C0
38	60928	4	255	ISO Address Claim	09:35:00:479		E3 B0 21 22 00 82 32 C0
39	60928	5	255	ISO Address Claim	09:35:00:480		58 02 21 14 00 D2 64 C0
40	60928	6	255	ISO Address Claim	09:35:00:621		22 A4 21 14 00 A0 A0 C0
41	60928	7	255	ISO Address Claim	09:35:00:481		17 00 24 14 00 A0 A0 C0
42	60928	8	255	ISO Address Claim	09:35:00:480		69 80 24 14 00 A0 A0 C0
43	60928	9	255	ISO Address Claim	09:35:00:481		38 00 25 14 00 A0 A0 C0

- The interval shows how often the data is being sent from the device. This allows the user to know how fast a sender is transmitting.

# Actisense NMEA Reader

The screenshot shows the Actisense NMEA Reader software interface. At the top, there are two progress bars: "NMEA 2000 Bus Load (0%)" and "PC Receive Load (2%)". The main display area shows the following details for NMEA 2000 PGN: 130944 (0x1FF80):

- Name: Manu. Proprietary fast-packet non-addressed
- Source = 36, Destination = 255
- Priority = 7, Length = 32
- Number Of Fields = 4
- Field 1: NMEA 2000 Manufacturer Code = 135
- Field 2: Reserved field
- Field 3: Industry Group = 4
- Field 4: Manufacturer defined field(s) = [FF.0E.00.01.01.00.02.00.03.00.08.00.09.00.0A.00.0B.FF.0C.00.0D.80.0E.80.0F.80.10.80.11.80]

At the bottom of the window, there are navigation buttons: "Details", "Properties", and "Log".

- Pictured here are the details of each individual data PGN.
- This will list what data is present on the specific device as well as what makes up the sentence structure.
- Also located on this page is the NMEA 2000™ Bus Load as well as the PC Load through the Gateway.

# Actisense NMEA Reader

NMEA 2000 PGN: 130944 (0x1FF80)  
Name: Manu. Proprietary fast-packet non-addressed  
Source = 36, Destination = 255  
Priority = 7, Length = 32  
Number Of Fields = 4  
Field 1: NMEA 2000 Manufacturer Code = 135  
Field 2: Reserved field  
Field 3: Industry Group = 4  
Field 4: Manufacturer defined field(s) = [FF.0E.00.01.01.00.02.00.03.00.08.00.09.00.0A.00.0B.FF.0C.00.0D.80.0E.80.0F.80.10.80.11.80]

- The bus load can be used to check how many devices on the network.
- If the NMEA 2000™ network is not functioning correctly it could be due to excess load or a defective sender.
- The NMEA 0183 version allows for the same reading.

# Actisense NMEA Reader

The screenshot displays the Actisense NMEA Reader application window. The main window title is "NMEA Reader - [COM3: Actisense NGT]". The interface includes a menu bar (File, Edit, View, Window, Help) and a toolbar with icons for file operations. The main display area is divided into two panes. The left pane shows a table of received NMEA packets, and the right pane shows a detailed view of the selected packet.

Line	PGN	SRC	DST	Name	Time	Interval	Data
1	130944	36	255	Manu. Proprietary fast-packet non-address...	09:39:27:446	9.77	87 98 FF 0E 00 01 01 00 ...
2	130323	36	255	Meteorological Station Data	09:39:31:519	1.62	F0 FF FF FF FF FF FF FF ...
3	130311	36	255	Environmental Parameters	09:39:31:525	0.87	0A C1 69 73 FF 7F FC 03
4	130306	36	255	Wind Data	09:39:32:018	0.42	16 FF FF FF FF F8 FF FF
5	129540	36	255	GNSS Sats in View	09:39:31:555	1.63	FF FF 00
6	129539	36	255	GNSS DOPs	09:39:31:524	1.62	FF FB FF 7F FF 7F FF 7F
7	129033	36	255	Time & Date	09:39:31:517	1.62	FF FF FF FF FF FF FF 7F
8	129029	36	255	GNSS Position Data	09:39:31:538	1.63	FF FF FF FF FF FF FF FF ...
9	129026	36	255	COG & SOG, Rapid Update	09:39:31:523	1.62	FF FF FF FF FF FF FF FF
10	129025	36	255	Position, Rapid Update	09:39:31:520	1.62	FF FF FF 7F FF FF FF 7F
11	127505	10	255	Fluid Level	09:39:33:462	2.52	00 44 48 DE 93 00 00 FF
12	127505	12	255	Fluid Level	09:39:34:041	2.50	50 FC 53 FF FF FF FF FF
13	127505	13	255	Fluid Level	09:39:34:040	2.50	10 FC 53 FF FF FF FF FF
14	127258	36	255	Magnetic Variation	09:39:31:510	1.62	05 F5 CC 3C FF 7F FF FF
15	127257	36	255	Attitude	09:39:31:519	1.62	05 FF 7F FF 7F FF 7F FF
16	127251	36	255	Rate of Turn	09:39:31:916	0.10	34 FF FF FF 7F FF FF FF
17	127250	36	255	Vessel Heading	09:39:31:916	0.10	FF FF FF FF 7F FF 7F FF
18	127245	11	255	Rudder	09:39:35:861	0.10	00 F8 FF 7F 29 E1 FF FF
19	126998	2	255	Configuration Information	09:35:04:409		02 01 02 01 2D 01 41 63 ...
20	126998	3	255	Configuration Information	09:35:03:519		02 01 02 01 2D 01 41 63 ...
21	126998	4	255	Configuration Information	09:35:05:279		02 01 02 01 2D 01 41 63 ...
22	126998	36	255	Configuration Information	09:35:46:557		02 01 02 01 26 01 41 69 ...
23	126996	2	255	Product Information	09:35:04:190		14 05 27 6E 4E 4D 45 41 ...
24	126996	3	255	Product Information	09:35:03:320		14 05 27 6E 4E 4D 45 41 ...
25	126996	4	255	Product Information	09:35:05:059		14 05 27 6E 4E 4D 45 41 ...
26	126996	5	255	Product Information	09:35:09:980		B0 04 12 09 44 65 63 68 ...
27	126996	7	255	Product Information	09:35:14:020		B0 04 38 4D 50 61 6E 65 ...
28	126996	8	255	Product Information	09:35:05:941		B0 04 38 4D 50 61 6E 65 ...
29	126996	9	255	Product Information	09:35:18:052		B0 04 38 4D 50 61 6E 65 ...
30	126996	10	255	Product Information	09:35:21:990		14 05 FA 20 46 75 65 6C ...
31	126996	11	255	Product Information	09:35:26:030		B0 04 7C 1E 52 75 64 64 ...
32	126996	12	255	Product Information	09:35:30:061		B0 04 78 6D 57 61 74 65 ...
33	126996	13	255	Product Information	09:35:34:112		B0 04 78 6D 57 61 74 65 ...
34	126996	36	255	Product Information	09:35:46:241		BA 04 7B 22 50 42 32 30 ...
35	126992	36	255	System Time	09:39:31:516	1.62	FF F0 FF FF FF FF FF FF
36	60928	2	255	ISO Address Claim	09:35:00:478		CD B0 21 22 00 82 32 C0
37	60928	3	255	ISO Address Claim	09:35:00:477		E1 B0 21 22 00 82 32 C0
38	60928	4	255	ISO Address Claim	09:35:00:479		E3 B0 21 22 00 82 32 C0
39	60928	5	255	ISO Address Claim	09:35:00:480		58 02 21 14 00 D2 64 C0
40	60928	6	255	ISO Address Claim	09:35:00:621		22 A4 21 14 00 A0 A0 C0
41	60928	7	255	ISO Address Claim	09:35:00:481		17 00 24 14 00 A0 A0 C0
42	60928	8	255	ISO Address Claim	09:35:00:480		69 80 24 14 00 A0 A0 C0
43	60928	9	255	ISO Address Claim	09:35:00:481		38 00 25 14 00 A0 A0 C0

The right pane displays the details for the selected packet (Line 1):

NMEA 2000 PGN: 130944 (0x1FF80)  
Name: Manu. Proprietary fast-packet non-addressed  
Source = 36, Destination = 255  
Priority = 7, Length = 32  
Number Of Fields = 4  
Field 1: NMEA 2000 Manufacturer Code = 135  
Field 2: Reserved field  
Field 3: Industry Group = 4  
Field 4: Manufacturer defined field(s) = [FF:0E:00:01:01:00:02:00:03:00:08:00:09:00:0A:00:0B:FF:0C:00:0D:0E:80:0F:80:10:80:11:80]

At the bottom of the window, there are navigation tabs: "Data View" (selected), "Network View", and "Hardware Config". The status bar at the very bottom shows "COM3 115200 Open Transfer Receive All".



# Actisense NMEA Reader

The screenshot shows the Actisense NMEA Reader software interface. The window title is "NMEA Reader - [COM3: Actisense NGT]". The menu bar includes "File", "Edit", "View", "Window", and "Help". The status bar shows "COM3: Actisense NGT" and "115200". The main area displays a table with the following columns: SRC, Manufacturer, Device Function, Serial Num, D. Instance, and Firmware. The table contains 14 rows of data, with the last row (SRC 36) highlighted in blue. The "D. Instance" column is circled in red. At the bottom of the window, there are three tabs: "Data View", "Network View", and "Hardware Config". The "Network View" tab is selected and circled in red.

SRC	Manufacturer	Device Function	Serial Num	D. Instance	Firmware
0	Airmar	Gateway (130)	101094	0	1.090, 2.190
2	Actisense	Gateway (130)	ID: 110797	0	1.100, 2.180
3	Actisense	Gateway (130)	ID: 110817	0	1.100, 2.176
4	Actisense	Gateway (130)	ID: 110819	0	1.100, 2.176
5	Offshore Systems UK	Gauge Small (210)	0066136 ...	0	V1.01 ...
6	Offshore Systems UK	General Purpose Displays (...)		0	
7	Offshore Systems UK	General Purpose Displays (...)	0262167 ...	0	V1.01 ...
8	Offshore Systems UK	General Purpose Displays (...)	0295017 ...	0	V1.01 ...
9	Offshore Systems UK	General Purpose Displays (...)	0327736 ...	0	V1.01 ...
10	Offshore Systems UK	Transducer/general (190)	0001704 ...	0	V4.14 ...
11	Offshore Systems UK	Transducer/general (190)	0109536 ...	0	V1.00 ...
12	Offshore Systems UK	Transducer/general (190)	0131800 ...	0	V4.12 ...
13	Offshore Systems UK	Transducer/general (190)	0131801 ...	0	V4.12 ...
36	Airmar	Weather Instruments (180)	1641966	0	1.009, 1.611, ...

- This item shows which instance is assigned to the device allowing for the user to match it on the display.
- Also pictured are the serial number and function which can be helpful for identification of the device.

# Actisense NMEA Reader

The screenshot displays the Actisense NMEA Reader software interface. The window title is "NMEA Reader - [COM3: Actisense NGT]". The interface is divided into several sections:

- Device being configured:** Local NGT
- TX PGN Enable List:** A list of PGNs with checkboxes. Enabled: 4/30. Buttons: "Update from hardware", "Apply defaults to hardware".
- RX PGN Enable List:** A list of PGNs with checkboxes. Enabled: 31/35. Buttons: "Update from hardware", "Apply defaults to hardware".
- Port Config:** Serial Baud Rate (115200), ARL P-Codes (ARL P-codes permanently disabled). Button: "Apply".
- Log:** A table showing the sequence of actions and their results.

Line	Time	Action	Result	Error
0	09:34:59	Update Operating Mode	Passed	
1	09:34:59	Change Operating Mode	Passed	
2	09:34:59	Get Lists Params	Passed	
3	09:35:00	Download Rx PGN Enable List	Passed	
4	09:35:00	Download Tx PGN Enable List	Passed	
5	09:35:00	Get Port P Code	Passed	
6	09:35:00	Get Port Baudrate	Passed	
7	09:35:00	Get Hardware Baudrate	Passed	
8	09:35:01	Update CAN Name	Passed	
9	09:35:01	Requesting Address Claim Info	Passed	
10	09:35:01	Get Lists Params	Passed	
11	09:35:01	Download Rx PGN Enable List	Passed	
12	09:35:01	Download Tx PGN Enable List	Passed	
13	09:35:02	Get Port P Code	Passed	
14	09:35:02	Get Port Baudrate	Passed	
15	09:35:02	Get Hardware Baudrate	Passed	
16	09:35:02	Update Product Information	Passed	
17	09:35:03	Update Configuration Information	Passed	
18	09:35:03	Update Configuration Information	Passed	
19	09:35:03	Update Configuration Information	Passed	
20	09:35:04	Update Product Information (remote device)	Passed	
21	09:35:04	Update Configuration Information (remote device)	Passed	
22	09:35:05	Update Product Information (remote device)	Passed	
23	09:35:05	Update Configuration Information (remote device)	Passed	
24	09:35:05	Update Product Information (remote device)	Passed	
25	09:35:06	Update Configuration Information (remote device)	Passed	
26	09:35:06	Update Product Information (remote device)	Passed	
27	09:35:07	Update Configuration Information (remote device)	Timeout	
28	09:35:08	Update Configuration Information (remote device)	Timeout	
29	09:35:10	Update Product Information (remote device)	Passed	
30	09:35:11	Update Configuration Information (remote device)	Timeout	
31	09:35:12	Update Configuration Information (remote device)	Timeout	
32	09:35:14	Update Product Information (remote device)	Passed	
33	09:35:15	Update Configuration Information (remote device)	Timeout	
34	09:35:16	Update Configuration Information (remote device)	Timeout	
35	09:35:18	Update Product Information (remote device)	Passed	
36	09:35:19	Update Configuration Information (remote device)	Timeout	
37	09:35:20	Update Configuration Information (remote device)	Timeout	
38	09:35:22	Update Product Information (remote device)	Passed	
39	09:35:23	Update Configuration Information (remote device)	Timeout	
40	09:35:24	Update Configuration Information (remote device)	Timeout	
41	09:35:26	Update Product Information (remote device)	Passed	
42	09:35:27	Update Configuration Information (remote device)	Timeout	

At the bottom of the window, the "Hardware Config" tab is selected and circled in red. The "Log" button in the bottom right corner is also circled in red.

# Sail Soft NEMA Studio



- The Sail Soft program will allow data to be sent from a PC via NMEA 0183 on a user selected Com Port.
- This will allow for testing of displays or networks by sending out select amounts of data which is controlled through the software.
- The data that is being transmitted via NMEA 0183 can then be converted to NMEA 2000™ using either an NGW-1, AT-10 or any other NMEA approved device.

# Sail Soft NEMA Studio



- The Actisense NGW-1 is a great way to convert the data sent from the Sail Soft program into a NMEA 2000™ Format. It can also send AIS information into a Bus with the proper Firmware update provided from the Actisense website.

# Sail Soft NEMA Studio

The screenshot displays the Sail Soft NEMA Studio software interface. The main window is titled "GPS1" and contains several control panels:

- Settings:** Includes fields for Tag, Latitude (00° 00.58779' S), Longitude (000° 00.80902' W), Course (0), Velocity (0.0), and Altitude (0).
- UTC Date/Time:** Shows 9/20/2012 at 3:48:35 PM with an offset of 0.0 hours and magnetic variation of 0.0 W.
- PDOP/HDOP/VDOP:** All values are 0.0.
- Satellites used (GSA):** A grid showing satellite status for WAAS, with 12 satellites active.
- GPS for quality:** Options for GPS, D/GPS (selected), and No Fix.
- Exec mode:** Options for Normal (selected), Auto, and Navigate.
- Auto/Navigate:** Includes Bearing, Range, XTE, and Steer controls, with checkboxes for Track Back and Loop.
- Port:** Set to COM1, 4800.8.None.One.
- Pos.Update:** 1.0 second.
- Transmit:** 1.00 second.
- NMEA 0183 sentences:** A list of sentences with checkboxes, including \$GPGLL, \$GPRMC, \$GPVTG, \$GPZDA, \$GPGGA, \$GPGSA, \$GPGSV, \$GPXTE, \$GPRMB, \$GPDTM, and Status(AV).
- Buttons:** Stop and Start buttons.

On the right side, there are two panels:

- NMEA Object Explorer:** Lists available objects: AIS, Custom, GPS, Heading, Radar, Sounder, Velocity, and Weather.
- Object Control Center:** Contains sliders for Altitude (meters), Course (degrees), Velocity (knots), and Rudder (angle in deg), all currently set to 0.0.

At the bottom, the **I/O Port Monitor** shows a stream of NMEA sentences:

```
GPS1 on COM1: #GPGLL,0000.58779,S,000000.80902,W,154831.12,A,A*68
GPS1 on COM1: #GPGLL,0000.58779,S,000000.80902,W,154832.14,A,A*6D
GPS1 on COM1: #GPGLL,0000.58779,S,000000.80902,W,154833.15,A,A*6D
GPS1 on COM1: #GPGLL,0000.58779,S,000000.80902,W,154834.17,A,A*68
GPS1 on COM1: #GPGLL,0000.58779,S,000000.80902,W,154835.18,A,A*64
GPS1 on COM1: #GPGLL,0000.58779,S,000000.80902,W,154836.20,A,A*6E
GPS1 on COM1: #GPGLL,0000.58779,S,000000.80902,W,154837.21,A,A*6E
GPS1 on COM1: #GPGLL,0000.58779,S,000000.80902,W,154838.22,A,A*62
```

At the bottom left, the status bar shows "Sentences waiting in output buffer: 0 bytes: 0".

# Sail Soft NEMA Studio

The screenshot displays the Sail Soft NEMA Studio software interface. The main window is titled "GPS1 General Settings" and is divided into two tabs: "Program settings" and "NMEA settings". The "NMEA settings" tab is active, showing various configuration options for NMEA data output.

**Program settings**

- NMEA 0183 Version:  Version 2.20,  Version 2.30/3.01
- Default Magn. Var.: Degrees, 0.0,  East,  West
- Default UTC Offset +/-: Hours, 0.0
- Distance Unit:  Nautical Miles,  Kilometers

**SGPGGA Extensions for Differential GPS Data**

- Age of differential GPS Data (seconds): 0
- Differential Reference Station ID: 0

**GPS Position Accuracy**

- The number of decimal positions of the Lat and Lon in the \$GPGLL, \$GPRMC and \$GPGGA sentences: 5

**SGPDTM Datum reference data**

- Local Datum Code: WB4, Lat. Offset: 0, N
- Subdivision Code: , Lon. Offset: 0, E
- Ref. Datum Code: WB4, Alt. Offset: 0

**UTC Date/Time handling in GPS**

- Realistic UTC Date/Time
- User-tweaked UTC Date/Time

**Object Control Center**

- Altitude (meters): 0
- Course (degrees): 0
- Velocity (knots): 0.0
- Rudder (angle in deg.): 0

**Serial Port Monitor**

```
GPS1 on COM1: $GPGLL,0000.58779,S,000000.80902,W,154943.12,A,A*6C
GPS1 on COM1: $GPGLL,0000.58779,S,000000.80902,W,154944.13,A,A*6A
GPS1 on COM1: $GPGLL,0000.58779,S,000000.80902,W,154945.15,A,A*6D
GPS1 on COM1: $GPGLL,0000.58779,S,000000.80902,W,154946.16,A,A*6D
GPS1 on COM1: $GPGLL,0000.58779,S,000000.80902,W,154947.18,A,A*62
GPS1 on COM1: $GPGLL,0000.58779,S,000000.80902,W,154948.19,A,A*6C
GPS1 on COM1: $GPGLL,0000.58779,S,000000.80902,W,154949.20,A,A*67
GPS1 on COM1: $GPGLL,0000.58779,S,000000.80902,W,154950.22,A,A*6D
```

Sentences waiting in output buffer: 0 Bytes: 0

# Sail Soft NEMA Studio

The screenshot displays the Sail Soft NEMA Studio application window. The main menu includes File, Edit, View, Settings, and Help. The status bar at the top left shows "Logging is OFF" and "Textfile:".

The "Communications Settings" window is open, showing a table of serial ports found in the system:

PortName	BaudRate	DataBits	Parity	StopBits	N2000Dev	Status
COM1	4800	8	None	One		GPS1
COM5	9600	8	None	One		Not used
COM3	9600	8	None	One		Not used
COM4	9600	8	None	One		Not used
COM6	9600	8	None	One		Not used

Below the table is a "Reset all" button and an important note: "(IMPORTANT: use this button only after you have added or removed any serial ports from your system. You will also need to reload all open objects because NemaStudio will close them before performing this operation. Note that all port parameters will be reset to their default Windows settings. It is good practice to also review the port setting for each object after the reset.)"

The "UDP settings" section includes fields for Remote IP address (127.0.0.1), Local Port (1100), and Remote Port (1100), along with a checkbox for "Use RTS/CTS Handshaking" and an "Apply settings" button.

The "NMEA Object Explorer" on the right lists available objects: AIS, Custom, GPS, Heading, Radar, Sounder, Velocity, and Weather.

The "Object Control Center" on the right features sliders for Altitude (meters), Course (degrees), Velocity (knots), and Rudder (angle in deg.), each with a numerical display and a spin button.

The "I/O Port Monitor" at the bottom shows a stream of NMEA sentences from COM1, such as: "#GPGLL,0000.58779,S,00000.80902,W,154905.60,A,A\*6B".

The status bar at the bottom left indicates "Sentences waiting in output buffer: 0 Bytes: 0".

# Maretron N2KAnalyzer

# ***Maretron***<sup>®</sup>

- The Maretron N2KAnalyzer Software is free to download from the Maretron Web site and offers many valuable options for network evaluation and testing.
- The N2KAnalyzer requires the use of a Maretron USB100 Gateway to properly connect to a NMEA 2000™ system.
- Maretron's software will allow a user to assign device instances to components directly.
- The software also shows software version, manufacturer, serial numbers and much more data specific to a sensor.



# Maretron N2KAnalyzer

USB100 Gateway



- The Maretron USB100 Gateway will allow the NMEA 2000™ network to be accessed by the N2KAnalyzer to show what devices are attached. The Gateway will also allow devices to be programmed for instances and queried for transmitted and received PGN's.

# Maretron N2KAnalyzer

## N2KAnalyzer Software Device Page

Expand	Node Address	Manufacturer	Mfg Model ID	Mfg Serial Number	Source	Unique Instance	Label	Current Software	Available Software	Installation Description #1	Installation Description #2
	99	Sanshin Indu...				1			-		
	98	Sanshin Indu...	6AW8591A00			0		10006AW-00_ENG_86_P02	-		
	97	Sanshin Indu...	6AW8591A00			0		10006AW-00_ENG_86_P02	-		
	96	Sanshin Indu...	6AW8591A00			0		10006AW-00_ENG_86_P02	-		
	41	Sanshin Indu...	TELEFLEX	YG2790900023		0		SW0208Rev1	-		
	B0	Maretron	DCM100	1400531		0	Pilot House B...	1.0.4	-		
	28	Maretron	IPG100	1620099		0		3.4.6	-		
	9A	Sanshin Indu...				2			-		
	23	Airmar	PB200 Weath...	2238344		0		1.601,1.611,1.001,1.611,000	-		
	9A	Sanshin Indu...				1			-		
	98	Sanshin Indu...	6AW8591A00			1		10006AW-00_ENG_86_P02	-		

- The Main Device page will show what devices are connected to the Network and the specific information of that device.

# Maretron N2KAnalyzer

## N2KAnalyzer Software Device Page

Expand	Node Address	Manufacturer	Mfg Model ID	Mfg Serial Number	Source	Unique Instance	Label	Current Software	Available Software	Installation Description #1	Installation Description #2
	99	Sanshin Indu...				1			-		
	98	Sanshin Indu...	6AW8591A00			0		10006AW-00_ENG_86_P02	-		
	97	Sanshin Indu...	6AW8591A00			0		10006AW-00_ENG_86_P02	-		
	96	Sanshin Indu...	6AW8591A00			0		10006AW-00_ENG_86_P02	-		
	41	Sanshin Indu...	TELEFLEX	YG2790900023		0		SW0208Rev1	-		
	B0	Maretron	DCM100	1400531		0	Pilot House B...	1.0.4	-		
	28	Maretron	IPG100	1620099		0		3.4.6	-		
	9A	Sanshin Indu...				2			-		
	23	Airmar	PB200 Weath...	2238344		0		1.601,1.611,1.001,1.611,000	-		
	9A	Sanshin Indu...				1			-		
	98	Sanshin Indu...	6AW8591A00			1		10006AW-00_ENG_86_P02	-		

- The unique instance tab allows for the user to view and assign specific instances to a sender if there are multiple versions of the same unit on the network.

# Maretron N2KAnalyzer

The screenshot displays the Maretron N2KAnalyzer interface. At the top is a standard Windows-style toolbar with icons for file operations and help. Below the toolbar is a table listing various N2K devices. The table has columns for Expand, Node Address, Manufacturer, Mfg Model ID, Mfg Serial Number, Source, Unique Instance, Label, Current Software, Available Software, Installation Description #1, and Installation Description #2. A modal dialog box titled 'Device Instance Properties' is open over the table, showing details for a selected device (NA: 0x1A (26), Model: DSM250, S/N: 1300100, Device Class: Instrumentation/general systems (80)). The 'Device Instance' field in the dialog is set to 0. The table row for the selected device (Node Address 1A, Manufacturer Maretron, Model DSM250, Serial 1300100) is highlighted in blue. The status bar at the bottom indicates 'Connected to NMEA 2000 Network', 'COM5', and 'NUM'.

Expand	Node Address	Manufacturer	Mfg Model ID	Mfg Serial Number	Source	Unique Instance	Label	Current Software	Available Software	Installation Description #1	Installation Description #2
	08	Simrad	NR8 iGPS	001649#		0		01000_E ...	-		
	12	Simrad	NR8 MFD	001649#		0		01000_E ...	-		
	1B	Garmin	GMI10	3829486641							
	1E	DNA Group, I...	Powergate 20...	Serial# 1							
	-	Airmar	PB200 Weath...	2262798							
	24	Airmar	DST200	2254145							
	23	Airmar	H2183	2260237							
	1A	Maretron	DSM250	1300100				1.4.15.3			
	0A	#481	SeaSmart An...	130942							
	03	#481	SeaSmart N...	126154							
	01	Actisense	NMEA 2000<...	121609						Demo for NMEA E...	
	00	Actisense	NMEA 2000 P...	120828		0		1.100, 2...	-	Supplied by Geme...	
	04	Faria Instrum...				0			-		
	52	Maretron	USB100	1160678		0		1.8.3	1.8.3		
	CC	Westerbeke ...	RC20	2247		0		52749.A.8	-		
	71	Maretron	TLA100	1260116				1.6.12	1.6.15		
	7A	Beyond Meas...	Fish Display 1...	396-B23085		0		1.53	-		
	32	Beyond Meas...	FishGate 100	396-A0001012		0		1.2.1	-		

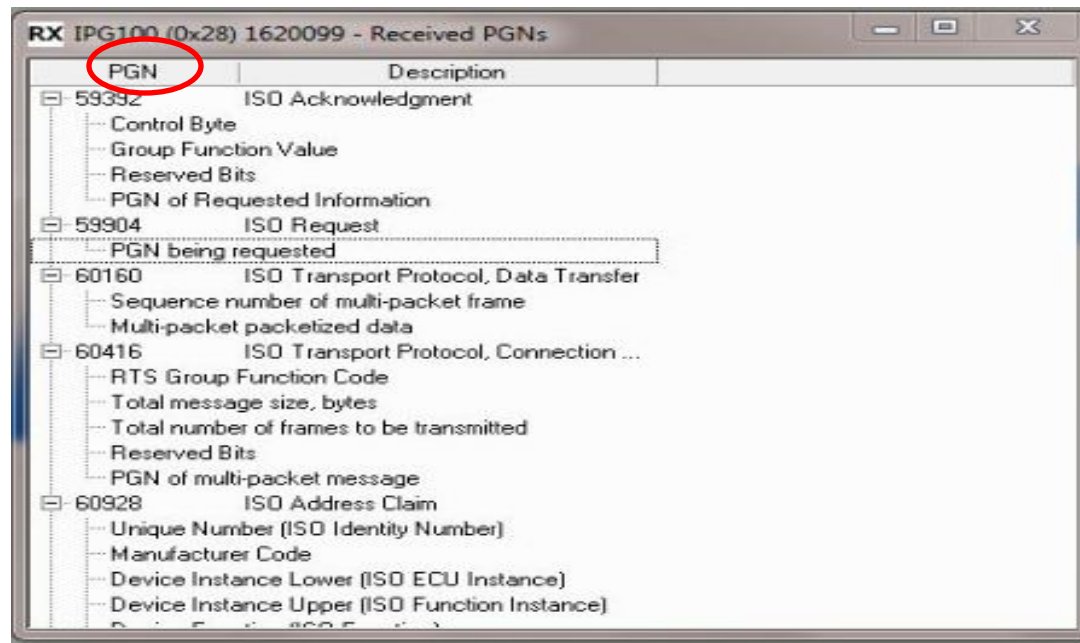
- The Instancing tool is as simple as setting the number for any applicable device.

# Maretron N2KAnalyzer

## N2KAnalyzer Software Properties Page

Expand	Node Address	Manufacturer	Mfg Model ID	Mfg Serial Number	Source	Unique Instance	Label	Current Software	Available Software	Device Function	System Instance	NMEA 2000 Version	NMEA 2000 Certification Level	LEN
	99	Sanshin Indu...				1			-	Engine Controller	0	65.535	-	255
	98	Sanshin Indu...	6AW8591A00			0		10006AW-00_ENG_86_P02	-	Engine Controller	0	1.111	-	0
	97	Sanshin Indu...	6AW8591A00			0		10006AW-00_ENG_86_P02	-	Engine Controller	0	1.111	-	0
	96	Sanshin Indu...	6AW8591A00			0		10006AW-00_ENG_86_P02	-	Engine Controller	0	1.111	-	0
	41	Sanshin Indu...	TELEFLEX	YG2790900023		0		SW0208Rev1	-	Engine Gateway	0	1.111	B	4
	80	Maretron	DCM100	1400531		0	Pilot House Batteries	1.0.4	-	General Sensor Box	0	1.210	A	1
	28	Maretron	IPG100	1620099		0		3.4.6	-	Gateway	0	1.301	A	3
	9A	Sanshin Indu...				2			-	Engine Controller	0	65.535	-	255
	23	Airmer	PB200 Weath...	2238344		0		1.601.1.611.1.001.1.611.000	-	Weather Instruments	0	1.210	B	13
	9A	Sanshin Indu...				1			-	Engine Controller	0	65.535	-	255
	98	Sanshin Indu...	6AW8591A00			1		10006AW-00_ENG_86_P02	-	Engine Controller	0	1.111	-	0

The PGN Page shows all transmitted and received sentences to ensure proper operation.



RX IPG100 (0x28) 1620099 - Received PGNs

PGN	Description
59392	ISO Acknowledgment
Control Byte	
Group Function Value	
Reserved Bits	
PGN of Requested Information	
59904	ISO Request
PGN being requested	
60160	ISO Transport Protocol, Data Transfer
Sequence number of multi-packet frame	
Multi-packet packetized data	
60416	ISO Transport Protocol, Connection ...
RTS Group Function Code	
Total message size, bytes	
Total number of frames to be transmitted	
Reserved Bits	
PGN of multi-packet message	
60928	ISO Address Claim
Unique Number (ISO Identity Number)	
Manufacturer Code	
Device Instance Lower (ISO ECU Instance)	
Device Instance Upper (ISO Function Instance)	

# Maretron N2KAnalyzer

## N2KAnalyzer Software Properties Page

Expand	Node Address	Manufacturer	Mfg Model ID	Mfg Serial Number	Source	Unique Instance	Label	Current Software	Available Software	Device Function	System Instance	NMEA 2000 Version	NMEA 2000 Certification Level	LEN
	99	Sanshin Indu...				1			-	Engine Controller	0	65.535	-	255
	98	Sanshin Indu...	6AW8591A00			0		10006AW-00_ENG_86_P02	-	Engine Controller	0	1.111	-	0
	97	Sanshin Indu...	6AW8591A00			0		10006AW-00_ENG_86_P02	-	Engine Controller	0	1.111	-	0
	96	Sanshin Indu...	6AW8591A00			0		10006AW-00_ENG_86_P02	-	Engine Controller	0	1.111	-	0
	41	Sanshin Indu...	TELEFLEX	YG2790900023		0		SW0208Rev1	-	Engine Gateway	0	1.111	B	4
	80	Maretron	DCM100	1400531		0	Pilot House Batteries	1.0.4	-	General Sensor Box	0	1.210	A	1
	28	Maretron	IPG100	1620099		0		3.4.6	-	Gateway	0	1.301	A	3
	9A	Sanshin Indu...				2			-	Engine Controller	0	65.535	-	255
	23	Airmar	PB200 Weath...	2238344		0		1.601,1.611,1.001,1.611,000	-	Weather Instruments	0	1.210	B	13
	9A	Sanshin Indu...				1			-	Engine Controller	0	65.535	-	255
	98	Sanshin Indu...	6AW8591A00			1		10006AW-00_ENG_86_P02	-	Engine Controller	0	1.111	-	0

The Received PGN Page shows the specifics of what data is being sent and specifics of that data.

**RX IPG100 (0x28) 1620099 - Received PGNs**

PGN	Description
59392	ISO Acknowledgment
Control Byte	
Group Function Value	
Reserved Bits	
PGN of Requested Information	
59904	ISO Request
PGN being requested	
60160	ISO Transport Protocol, Data Transfer
Sequence number of multi-packet frame	
Multi-packet packetized data	
60416	ISO Transport Protocol, Connection ...
RTS Group Function Code	
Total message size, bytes	
Total number of frames to be transmitted	
Reserved Bits	
PGN of multi-packet message	
60928	ISO Address Claim
Unique Number (ISO Identity Number)	
Manufacturer Code	
Device Instance Lower (ISO ECU Instance)	
Device Instance Upper (ISO Function Instance)	

# Maretron N2KAnalyzer

## N2KAnalyzer Software Properties Page

File Setup Analyze Update Configure Web Help

**TX DST200 (0x24) 2254145 - Transmitted PGNs**

Clear

Time	PGN	Description
146216...	60928	ISO Address Claim
146222...	65408	Unknown (65408)
146222...	65409	Unknown (65409)
146222...	65410	Unknown (65410)
62541.88	126208	NMEA - Read Fields - group function
90103.72	126208	NMEA - Read Fields - group function
63998.56	126464	PGN List - Received PGN's group function
63998.58	126464	PGN List - Received PGN's group function
90103.72	126720	Moritz DCR Channel Lock Status
146217...	126996	Product Information
62514.07	126998	Configuration Information
146222...	128259	Speed, Water referenced
146222...	128267	Water Depth
Destination: Global		
SID: -		
Water Depth, Transducer: - ft		
Offset: 0.000000 ft		
Reserved Bits: 255		
146222...	128275	Distance Log
146222...	130311	Environmental Parameters

Frequency	Label	Current Software	Available Software	Installation Description #1	Installation Description #2
		01000_E ...	-		
		01000_E ...	-		
		3.50	-		
		1.0 Mod A	-		
		1.601,1.6...	-		
		1.004,1.0...	-		
		1.201,1.2...	-		
		1.4.15.3	1.4.15.3		
		1.100, 2....	-		
		1.100, 2....	-		
		1.100, 2....	-	Demo for NMEA E...	
		1.100, 2....	-	Supplied by Geme...	
		1.8.3	1.8.3		
		52749.A.8	-		
		1.6.12	1.6.15		
		1.53	-		

CC	Westerbeke ...	RC20	2247	0
71	Maretron	TLA100	1260116	
7A	Beyond Meas...	Fish Display 1...	396-B23085	0

The transmitted PGN Page will allow for the user to view the live data coming from a sensor which will show if it is actually transmitting and if the data is correct.

# Maretron N2KAnalyzer

## N2KAnalyzer Software Properties Page

N2KAnalyzer also offers the ability to simulate a DSM250 display through the software to view live data as well as change settings just as if a live display were onboard.

The screenshot displays the N2KAnalyzer software interface. On the left, a simulated Maretron DSM250 display is shown with a menu of options: Alert Setup..., Alert Status..., Configuration..., Display Settings..., Favorite Screens Mode: Manual, Favorite Screens Setup..., and Units... The display also features physical buttons for Power, Back, Scroll Up, Scroll Down, and Enter, along with a directional pad and a power button.

On the right, a table lists software properties. The table has columns for Label, Current Software, Available Software, Installation Description #1, and Installation Description #2. A blue arrow points from the 'Favorite Screens Mode: Manual' option on the display to the '1.415.3' entry in the 'Current Software' column of the table.

Label	Current Software	Available Software	Installation Description #1	Installation Description #2
	01000_E ...	-		
	01000_E ...	-		
	3.50	-		
	1.0 Mod A	-		
	1.601,1.6...	-		
	1.004,1.0...	-		
	1.201,1.2...	-		
	1.415.3	1.415.3		
	1.100, 2....	-		
	1.100, 2....	-		
	1.100, 2....	-	Demo for NMEA E...	
	1.100, 2....	-	Supplied by Geme...	
	-	-		
	1.8.3	1.8.3		
	52749.A.8	-		
71	Maretron	TLA100	1260116	
7A	Beyond Meas...	Fish Display 1...	396-B23085	0
32	Beyond Meas...	FishGate 100	396-A0001012	0

At the bottom of the software window, a status bar indicates: Connected to NMEA 2000 Network, COM5, and NUM.



# Maretron N2KBuilder

## **N2KBUILDER NMEA 2000™ NETWORK DESIGN SOFTWARE**

- Maretron's unique N2KBuilder program allows dealers and installers to design and test networks before any cable is pulled through the vessel.
- The software will calculate voltage drop, connector gender, and cable lengths as well as allow the use of custom parameters to meet most design needs.
- When used properly, a configuration file can be generated to create a bill of material that will include all Maretron parts used in the build that makes ordering parts much more efficient.

# Maretron N2KBuilder

The screenshot displays the N2KBuilder software interface. The window title is "N2KBuilder™ - New file". The menu bar includes "File", "Edit", "Tools", and "About".

**Design Rule Checks:**

- Terminators / Branches OK
- No Loops OK
- Power OK
- Number Nodes OK
- Length OK
- Currents OK
- Voltages OK
- Common Mode Voltages OK

**Component Library Area:**

- Engine/Vessel Monitoring
- Gateways/Tools
- Adaptors/Adapter Cables
- Miscellaneous
- Mini Cable Components
- Mid/Micro Cable Components
- Displays/Alarms
- Navigation Instruments

**Screen Control Area:**

- Zoom In
- Zoom Out
- Zoom Reset

**Display Details:**

- Cable Lengths
- Plug Gender
- Show Handles
- Backbone(s)

**Design / Drawing Area:**

**Title:**

Created:		Date:	
Checked:		Date:	
Approved:		Date:	
Revision:		Date:	

**Maretron**

N2KBuilder™ - NMEA 2000 Network Builder  
Version: 4.0.20080717.4

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# Maretron N2KBuilder

**Design Rule Checks**

- ✓ Terminators / Branches OK
- ✓ No Loops OK
- ✓ Power OK
- ✓ Number Nodes OK
- ✓ Cable Lengths OK
- ✓ Trunk Length OK
- ✓ Branch Length OK
- ✓ Cumulative Branch Length OK
- ✓ Currents OK
- ✗ Voltages OK
- ✓ Common Mode Voltages OK

**Show On Drawing**

Zoom In

Zoom Out

Zoom Extents

Display Details

Cable Lengths

Currents

**Voltages**

Plug Gender

Show Handles

Backbone(s)

Mini Cable Components	Mid/Micro Cable Components	Displays/Alarms	Navigation Instruments
Engine/Vessel Monitoring	Gateways/Tools	Adaptors/Adapter Cables	Miscellaneous

?

Text

Picture

Maretron


Title: Tutorial 3

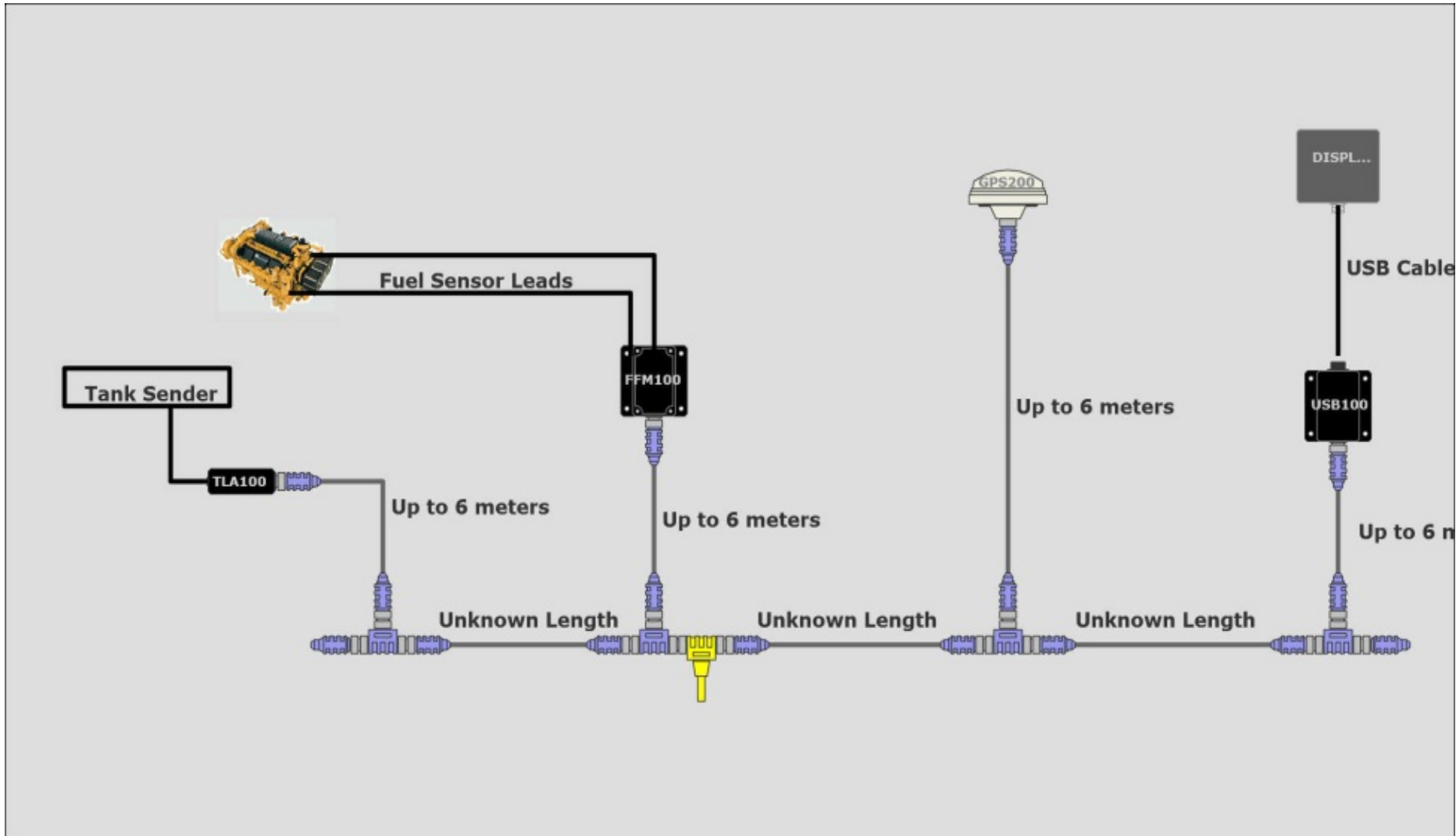
Drawn:		Date:	
Checked:		Date:	
Approved:		Date:	
Revision:		Date:	

Maretron

N2KBuilder™ - NMEA 2000 Network Builder  
Version 4.0.00007.00

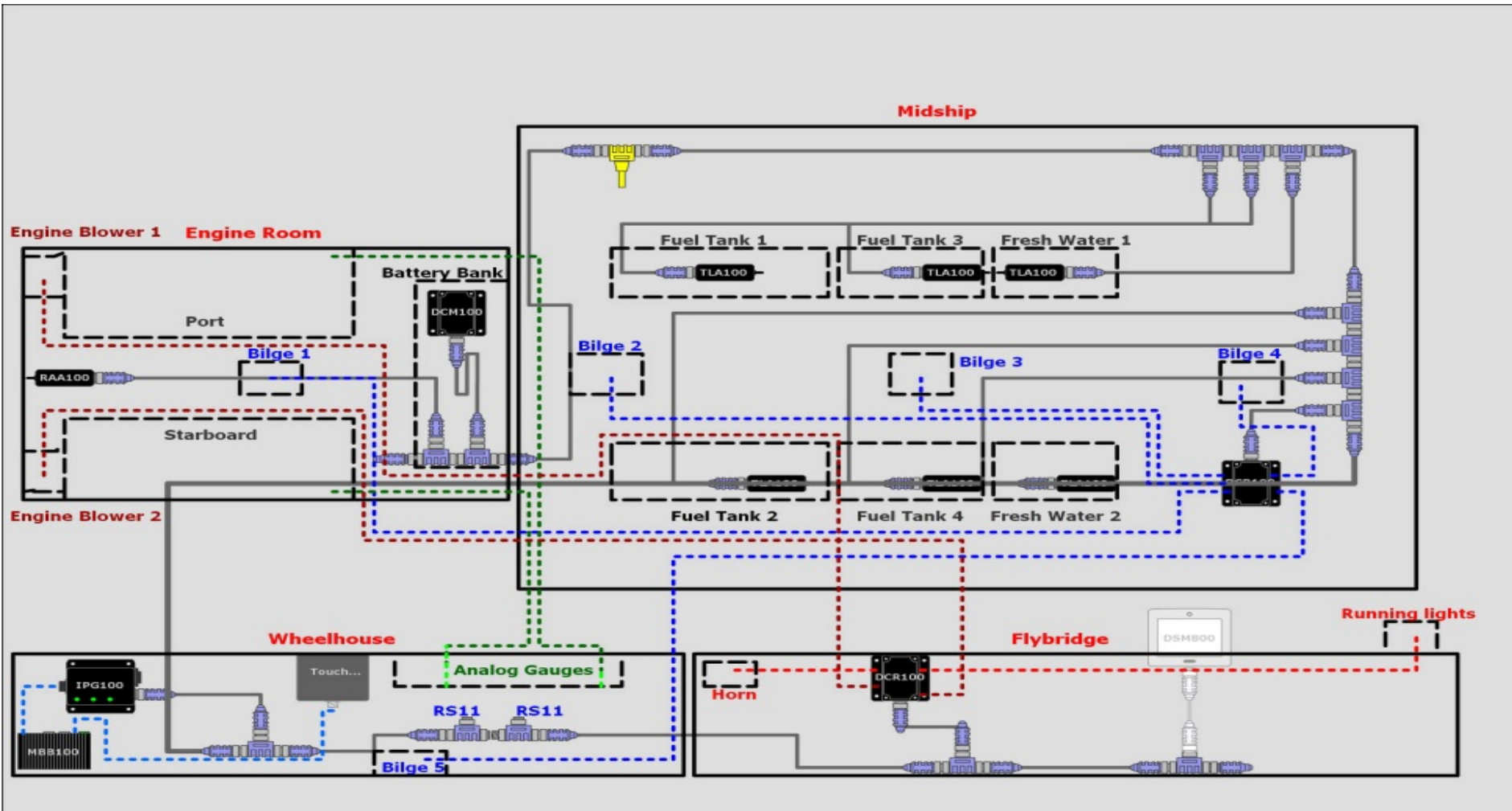
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# Maretron N2KBuilder



- This build file shows a system where the end user supplies specifics to be used to generate a complete network. It is a useful program to start a system and explain to customers not familiar with NMEA 2000™ how the parts are utilized.

# Maretron N2KBuilder



- Attached is a detailed view of how the system can be used to partition specific sections of a vessel and show possible connection and integration points. The more detailed a customer's requirements are, the more data can be added to the builder file. This also helps generate a very specific BOM to give an accurate estimate of what parts will be required as well as total component cost.

# Maretron N2KBuilder

Bill of Materials Report for C:\Documents and Settings\zfoyd\l\Desktop\N2K Builder Files\Marine tech 2.n2b

Manufacturer	PartNumber	Description	Quantity
Maretron		Micro Double Ended Cordset - M to F - ?m Gray	18
Maretron	CF-SPWR05-CF	Micro/Mid 5m Power Tap Tee	1
Maretron	CM-CF-CF	Micro Tee	14
Maretron	DCM100-01	Direct Current Monitor	1
Maretron	DCR100-01	DC Relay	2
Maretron	IPG100-01	Internet Protocol Gateway	1
Maretron	MBB100	Black Box Vessel Monitoring and Control	1
Maretron	RAA100-01	Rudder Angle Adapter	1
Maretron	TLA100-01	Tank Level Adapter	6
Maretron	TR-CM	Micro Termination Resistor Male	2

- The Bill of Materials that is generated from the Builder file is an excellent way to control cost of the build as well as to generate equipment costs for a job.

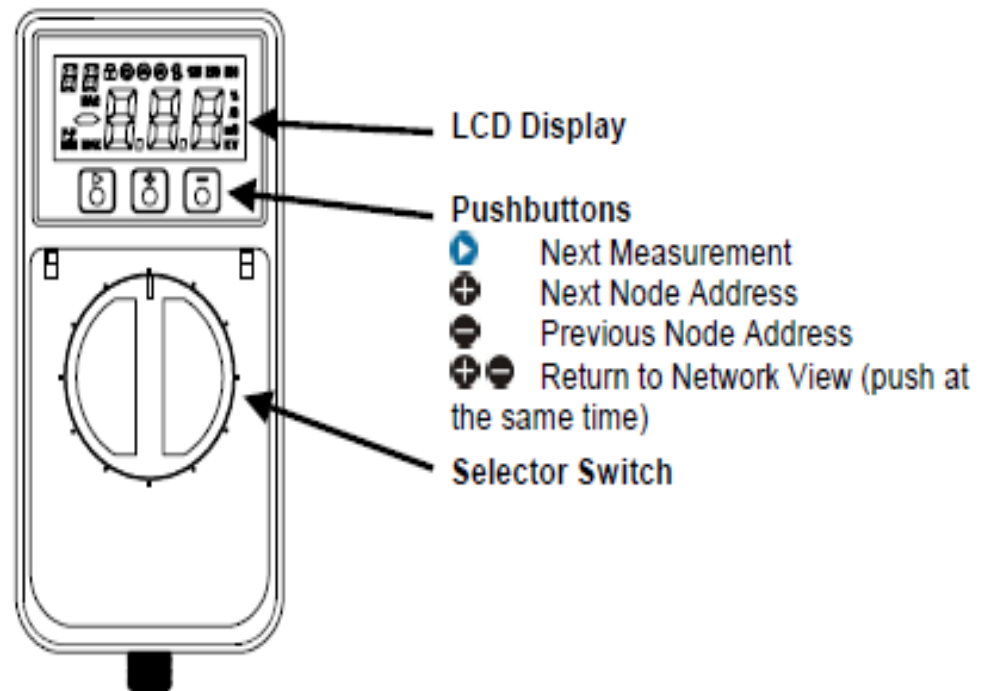
# Maretron N2KMeter



- The N2KMeter has the capability to test the physical aspects of a network.
- Faults that can be detected by the N2KMeter include:
  - Opens and Shorts
  - Incorrect Topology
  - Bad Nodes
  - Bad Termination
  - Improper Shield Connection
  - Intermittent Problems
  - Excessive Scan Rate
  - Common Mode Voltage

# Maretron N2KMeter

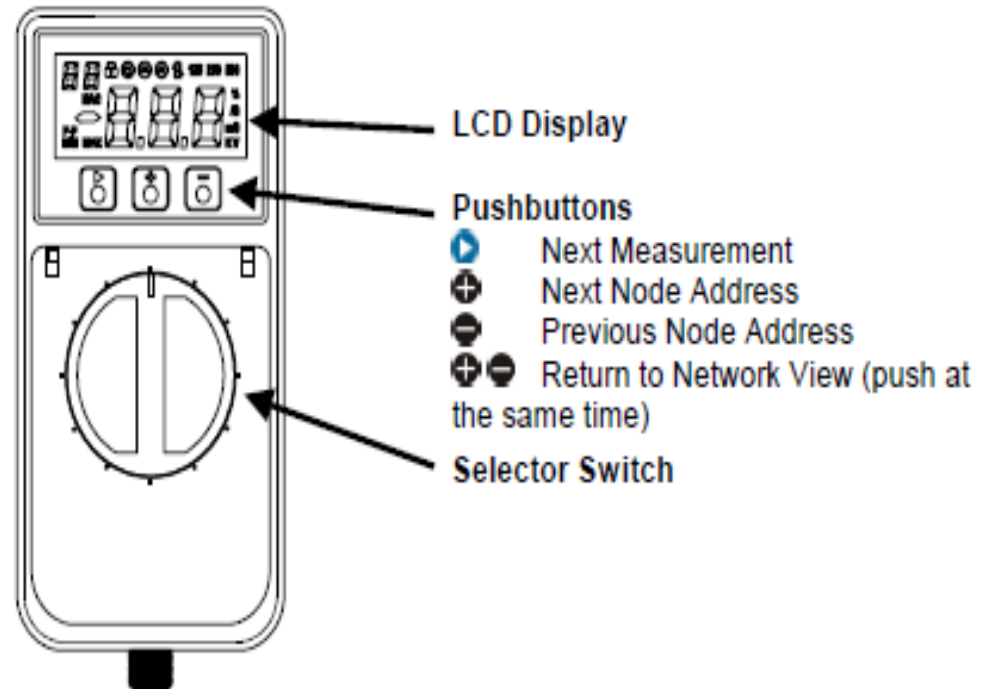
- The meter offers the ability to use an Auto-Search tool that will allow the dealer to locate faults.
- It works by examining all measurements and then pinpointing any that exceed or are close to specified limits.
- The N2KMeter tracks network data transmission errors in real-time and lets you know if the error rate is acceptable, marginal or unacceptable with the use of a simple signal interface.









# Maretron N2KMeter

- The automated error detection of the N2KMeter allows the user to view issues on the backbone live.
- The technician will be able to determine if the error was an isolated event or if it is recurring which would indicate a problem on the NMEA 2000™ network.
- The error detection will scroll numerically as issues arise from the time it is connected to a node.



# Maretron N2KMeter

- Any error rate greater than zero is undesirable (although your network may still function since CAN automatically retransmits after errors).
- An error rate greater than 10/s indicates a problem that should be investigated.
- The N2KMeter uses unique technology to accurately determine which node was attempting to transmit when a bus error occurs.

Display	What it means
	Real-time error rate of 14 errors/second
	Minimum bus error rate on whole network since N2KMeter was connected to the network or reset.
	Maximum bus error rate on the whole network since N2KMeter was connected or reset.
	Incremental error count on the entire network since the N2KMeter was connected or reset.