

## Professional Type Approved NMEA<sup>®</sup> 0183 Multiplexer Install/User Manual

## **Important Notices**

The device to which this manual relates complies with the Electromagnetic Compatibility requirements according to IEC 60945:2002-08, DNVGL-CG-0339:2019 & IACS UR E10 Rev7. The unit should always be used in conjunction with appropriately approved, shielded cable and connectors as per NMEA 0400 to ensure compliance. A declaration of conformity is available for download at [www.actisense.com](http://www.actisense.com).

If the device to which this manual relates is to be installed within five metres of a compass, please refer to the 'Compass Safe Distance' section in the 'Technical Specifications' table.

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The products described in this manual and the specifications thereof may be changed without prior notice. Active Research Ltd cannot accept any liability for differences between the product and this document. To check for updated information and specifications please check [www.actisense.com](http://www.actisense.com).

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## **Product Registration**

Please register your product via the online form at <https://actisense.com/product-registration>

Your product package includes a unit serial number. The serial number is six digits long and

can be found below the barcode on the label. Your registration will assist Actisense Support to link your product to your details, simplifying any future assistance you may require.

## **Product Guarantee**

All Actisense products are provided with a 5 year guarantee upon registration. To register your product, visit <https://actisense.com/product-registration>

If you suspect that the unit is faulty please refer to the Troubleshooting Section of the User Manual before contacting support.

It is a requirement of the guarantee that all installations of electronic equipment follow the NMEA 0400 specification. Any connection to a battery or power supply must meet the mandatory essential safety requirements that may be imposed by local regulatory agencies.

Actisense products are intended for use in a marine environment, primarily for below deck use. If a product is to be used in a more severe environment, such use may be considered misuse under the Active Research Ltd guarantee.

## **Product Disposal**

Please dispose of this product in accordance with the WEEE Directive. The product should be taken to a registered establishment for the disposal of electronic equipment.

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## **Introduction**

The PRO-NDC-1E multiplexer is designed to suit the majority of NMEA 0183 systems and provides a web-based configuration tool for setting the device to suit your requirements.

The web browser based configuration tool allows full customisation of the PRO-NDC-1E, and as it is web based it is compatible across all popular Operating Systems. The PRO-NDC-1 supports a direct Ethernet connection to a PC without the need for a specialised Ethernet crossover cable.

## **Installation Warnings**

All warnings and notices must be followed to ensure the correct operation of the PRO-NDC-1E. Incorrect installation may invalidate the guarantee.

It is highly recommended that all of the installation instructions are read before commencing the installation.

There are important warnings and notes throughout the manual that should be considered before the installation is attempted.

### **Warning 1: Accuracy**

The Actisense PRO-NDC-1E is designed to accurately transfer data from input to output. When the PRO-NDC-1E is in a Basic Mode no data integrity checking is performed, therefore any incomplete, inaccurate or corrupt data received on a PRO-NDC-1E input will be duplicated to the PRO-NDC-1E outputs. In contrast, PRO-NDC-1E Smart Modes do use the sentence checksum (if available) to remove incomplete and corrupted data, however, the accuracy of the data fields in a valid sentence still remains the responsibility of the NMEA Talker that generated the data.

### **Warning 2: Installation and Operation**

This product must be installed and operated in accordance with the instructions provided. Failure to do so could result in personal injury, damage to your boat and/or poor product performance.

### **Warning 3: Installation Code of Practice**

When wiring the power supply to the PRO-NDC-1E ensure the isolation switch is off. Wiring the PRO-NDC-1E while the connection is live may damage the PRO-NDC-1E and is in breach of the guarantee. Any connection to a battery or power supply must meet the mandatory safety requirements that may be imposed by local regulatory agencies. All wiring should be in accordance with the requirements of the NMEA 0400 installation specification.

### **Warning 4: Mounting Requirements**

Select a flat location to mount the PRO-NDC-1E. Mounting on a contoured surface may cause damage to the case.

Do not mount the PRO-NDC-1E while the device is powered, or the cable harness is connected.

Note that the connectors are pluggable for easy disconnection when mounting or removing the PRO-NDC-1E.

## **Software Updates**

The PRO-NDC-1E units have built-in firmware which is held in flash memory, allowing quick and easy upgrades using the latest Actisense Toolkit. It is highly recommended that the firmware is kept up to date in the PRO-NDC-1E.

The current PRO-NDC-1E firmware version can be viewed on the configuration tool 'Home' page, in the 'Main Application' section. Details of the latest PRO-NDC-1E firmware version can be viewed on the Actisense website's PRO-NDC-1E 'Downloads' page.

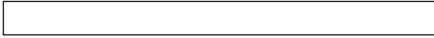
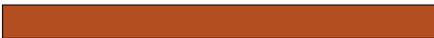
## Features

- Type-Approved (RINA)
- 5x Configurable Opto-isolated inputs.
- 2x Configurable ISO-Drive™ isolated outputs.
- 1x Bi-directional, configurable, isolated serial port.
- Automatic baud rate matching on inputs
- Advanced data filtering/routing.
- Free firmware updates making the device “future-proof”
- Diagnostic LED’s on all inputs and outputs.
- Bi-color status LED.
- Panel moutable.
- Using the configuration tool, each NMEA 0183 output can be configured to communicate at independent baud rates.
- Data statistics and load indication via web tool.
- Designed for 12 and 24 Volt supply.
- Pluggable connector system supports both screw and screwless terminals.
- Double Galvanic isolation between all inputs and outputs. Galvanic isolation to battery supply.

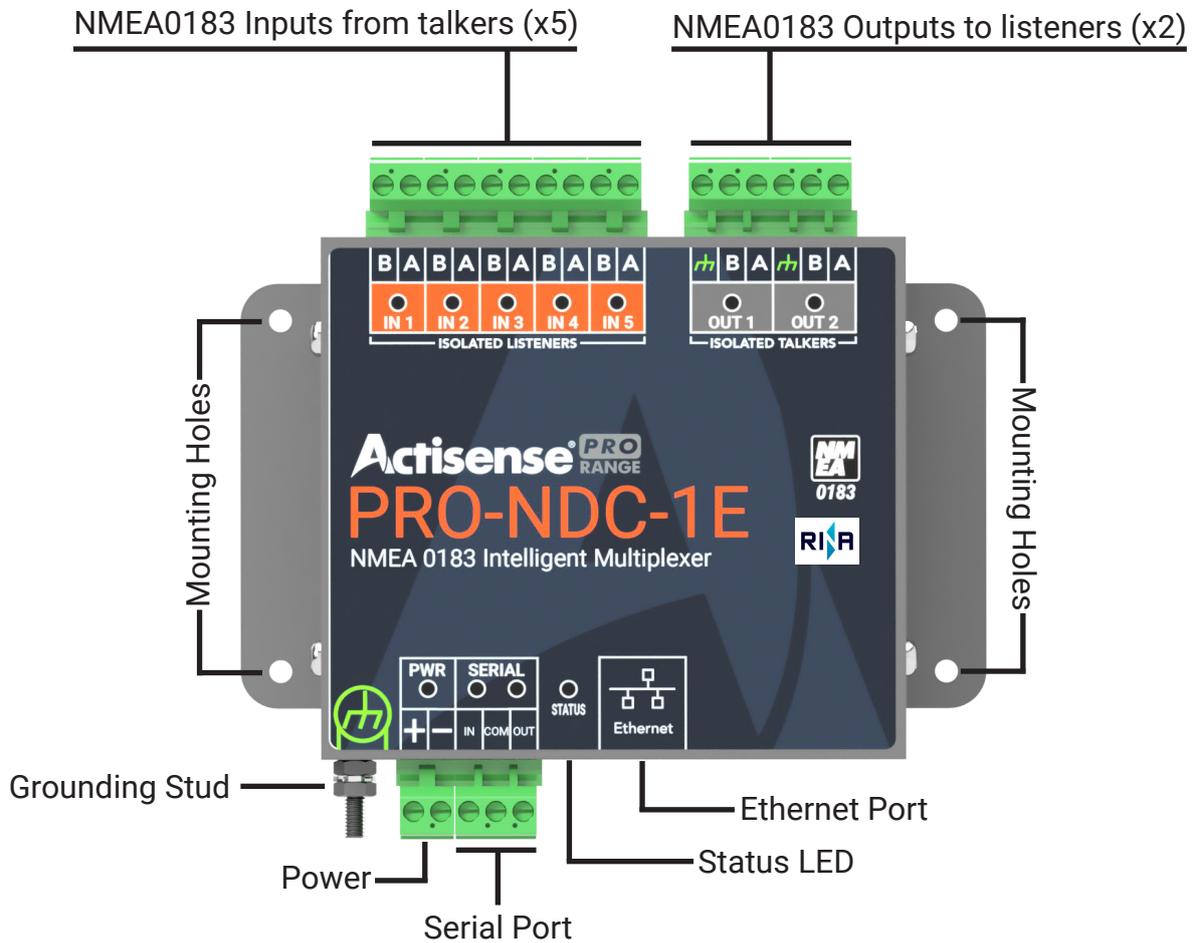
## NMEA wire colour coding

The wire colours used in this manual are in accordance with the NMEA 0183 specification (v.4.10, June 2014) and are for illustration purposes only. Please ensure you check the wiring colours given in the installation instructions for any devices you wish to interface with the PRO-MUX-2. Not all manufacturers follow this standard colour coding which can lead to confusion.

Currently, the specified NMEA0183 signal colour coding for individual wires is as follows:

- Talker A - White 
- Talker B - Brown 
  
- Listener A - Yellow 
- Listener B - Green 

## PRO-NDC-1E Overview



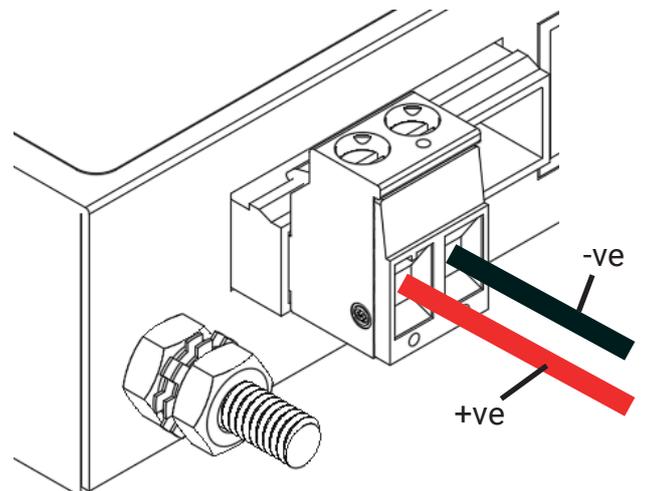
## PRO-NDC-1E Connections

### Terminals

The PRO-NDC-1E comes supplied with high quality 2-way and 3-way rising clamp connectors which are tightened with screws. Screwless spring-loaded connectors are also available as a optional extra and are available via your distributor.

### Power Supply Connections

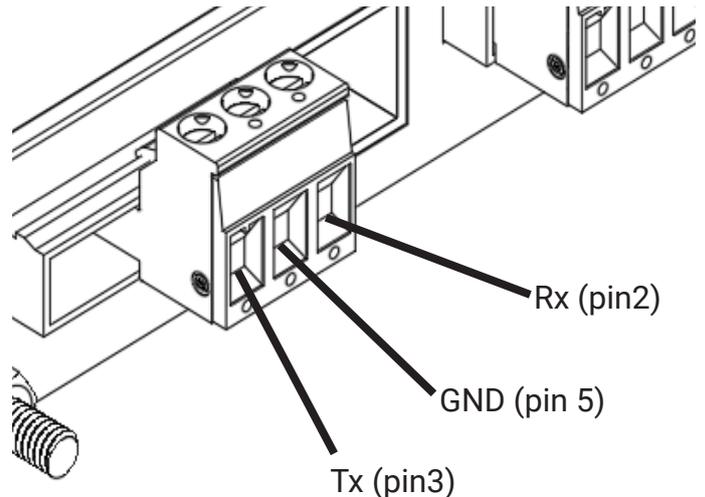
- The PRO-NDC-1E requires a power source providing between 10 to 35 Volts DC.
- The PRO-NDC-1E "+" terminal should be connected to the vessel power supply "+" terminal via the correctly rated fuse (in accordance with the NMEA 0400 installation standard).
- The PRO-NDC-1E "-" terminal should be connected to the vessels DC ground plate.
- The input supply connection has continuous reverse polarity and ESD protection.
- Red and Black wires are shown here as they are the most common designation for power and ground.



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## Standard Serial Port Connections

- The PRO-NDC-1E serial port connector allows a serial device/adaptor to be connected easily.
- The Standard RS-232 wiring designation is as shown below.
- Connect the **Tx** (pin 3) terminal **from** your serial device to the "IN" terminal
- Connect the **Rx** (pin 2) terminal **from** your serial device to the "OUT" terminal
- Connect the **GND** (pin 5) terminal **from** your serial device to the "COM" terminal



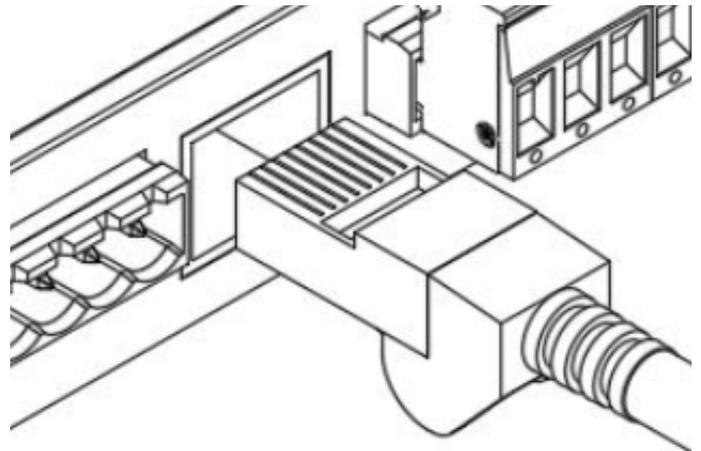
N.B Wire colours may vary between 3rd party cables/adapters (Pin numbers refer to a standard DB9 connector)

## USB - Serial Port Connections

- Should you require to connect your PRO-NDC-1 to a PC via a USB connection, Actisense have provided a way to achieve this using our **USBKIT-PRO (Universal Serial adaptor)** which contains a USB-SERIAL converter with the necessary Rx/Tx and GND connections.

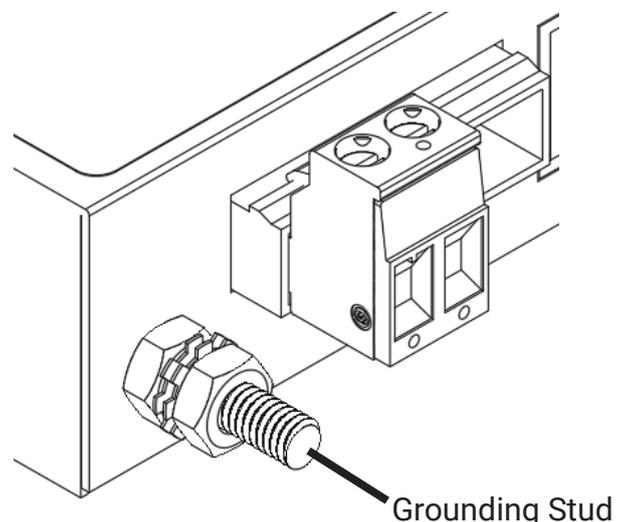
## Ethernet Connection

- An Ethernet port is provided as a means of correctly configuring your PRO-NDC-1E.
- Use either a standard Ethernet patch cable with an RJ45 plug to connect directly to a PC.
- Alternatively, the PRO-NDC-1E can be connected to an Ethernet switch.
- Insert the RJ45 plug into the PRO-NDC-1E "Ethernet" terminal until a click is heard. To remove the RJ45 plug, push down on the locking clip and gently pull the cable away from the "Ethernet" terminal.



## RF Ground Connection

- The PRO-NDC-1E must be properly grounded using the grounding stud provided.
- This connection should be made using a robust crimped connection if possible and routed back to the vessel's 'boat' ground.



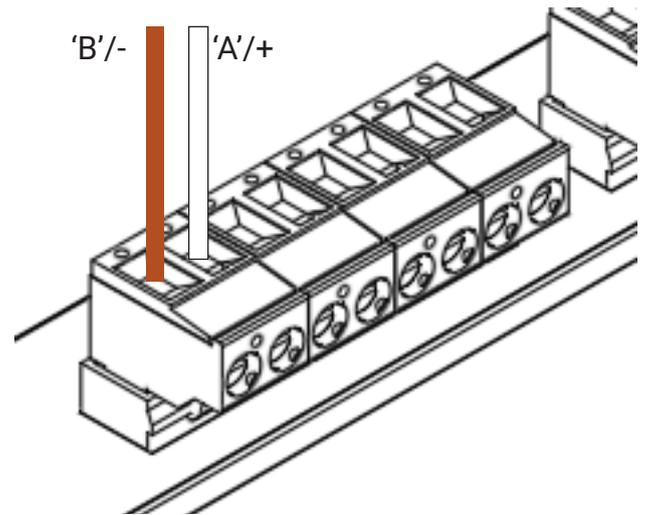
## NMEA 0183 Talker and Listener Designations

- The NMEA have updated the NMEA 0183 specifications to ensure a consistent naming convention is used for labelling ports. The designation follows the same rules as used for Rx and Tx labelling but uses the terminology “Talker” and “Listener” instead.
- The **Input / Receiving (Rx) port** will be labelled as a **LISTENER** port.
- The **Output / Transmitting(Tx) port** will be labelled as a **TALKER** port.

## NMEA “Talker” Input Connections

The PRO-NDC-1E has 5 input connections, labelled IN-1 to IN-5.

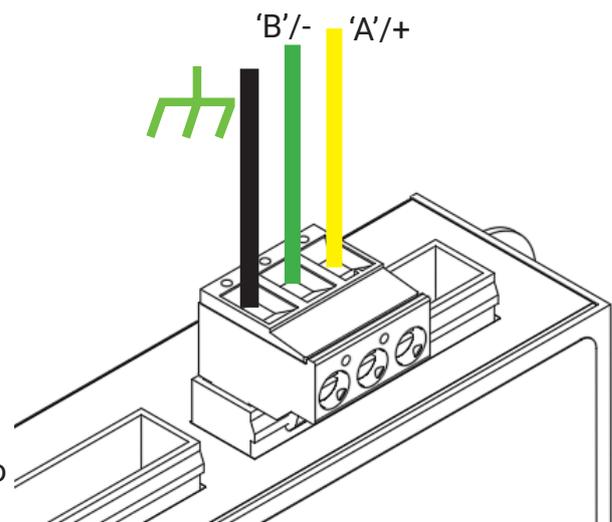
- Inputs are labelled ‘A’ and ‘B’ in line with the NMEA specification for labelling NMEA0183 signal pairs.
- If your “talker” follows the NMEA wire colour convention, the wires should be coloured as follows:
  - TALKER ‘A’/+ : WHITE 
  - TALKER ‘B’/- : BROWN 
- If your wire colours do not follow the NMEA convention, you will need to consult your device manual and find which wire colours correspond to ‘A’/+ and ‘B’/- and attach accordingly.
- If your “talker” device has only ‘A’ and ‘GND’ output wires, connect the ‘GND’ wire to ‘B’/-



## NMEA “Listener” Output Connections

The PRO-NDC-1E has 2 output connections, labelled OUT-1 & OUT-2.

- Outputs are labelled ‘A’ and ‘B’ in line with the NMEA specification for labelling NMEA0183 signal pairs.
- If your “listener” follows the NMEA wire colour convention, the wires should be coloured as follows:
  - LISTENER ‘A’/+ : YELLOW 
  - LISTENER ‘B’/- : GREEN 
- If your wire colours do not follow the NMEA convention, you will need to consult your device manual and find which wire colours correspond to ‘A’/+ and ‘B’/- and attach accordingly.
- The shield from each listener should be connected to the ‘GND’ connector on the output terminal.
- The RF ground stud should be connected to the vessels RF ground plate using a minimum conductor size of 8 AWG in accordance with the NMEA 0400 installation standard. Use a crimped connector to securely bond the RF wire.



# Type Approved NMEA Multiplexer - PRO-NDC-1E

## Web Browser Configuration

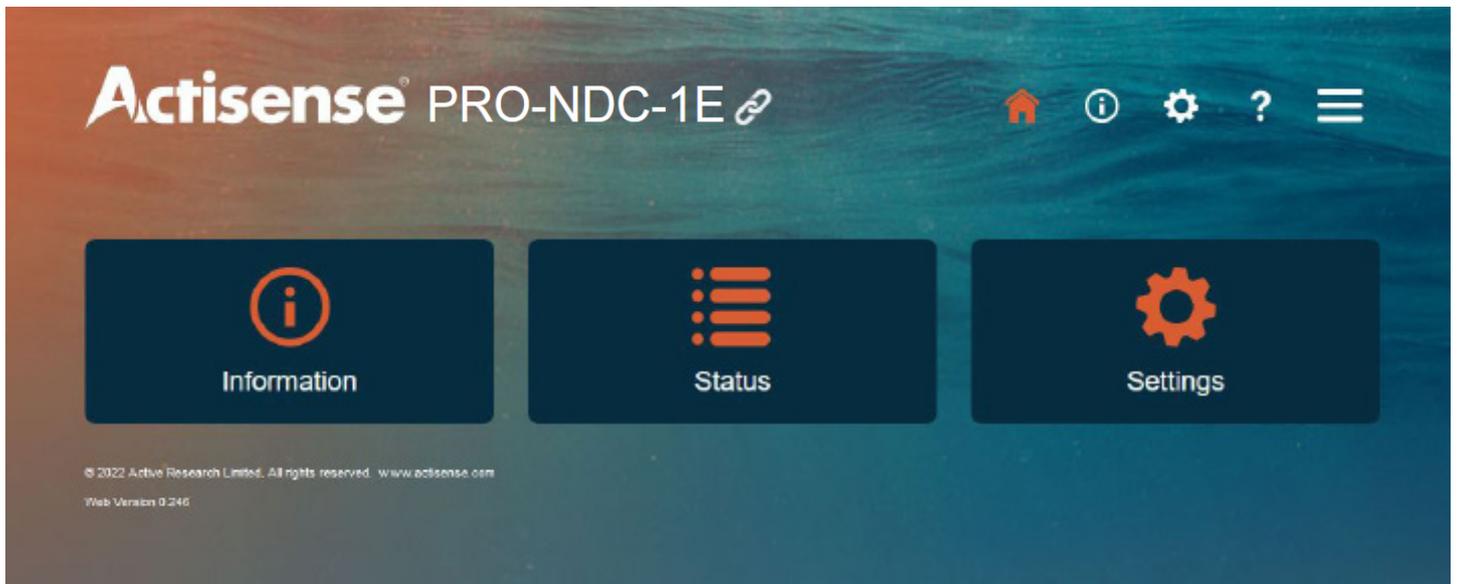
- The web-based configuration tool for the PRO-NDC-1E is built in, and can be accessed using the ethernet configuration port (see page 7).
- As it is web-based, the configuration tool is compatible with all popular web browsers and operating systems.
- NOTE: An internet connection is not required to access the configuration tool.

## Standard Ethernet Networks

- If the PRO-NDC-1E is connected to an ethernet network containing both DHCP and DNS servers, launch any of the popular web browsers.
- Replacing 'xxxxxx' with the serial number of your PRO-NDC-1E, type the following command into the address bar.

**http://prondc-xxxxxx**

- The following web-page will now be displayed allowing configuration of the PRO-NDC-1E
- Please see PRO-NDC-1E-2 Configuration manual for full details regarding set-up.



## Direct connection or basic ethernet networks

- If the PRO-NDC-1E is connected directly to a PC, or the ethernet network does not have a DHCP server, the PRO-NDC-1E will communicate using the auto-IP by default.
- A standard Ethernet cable can be used for the connection to your PC. The PRO-MUX-2 will automatically detect this. You do not require a cross-over cable.
- The auto-IP process can take up to 60 seconds to complete.
- The PC's 'Local Area Connection' must also be set-up to use auto-IP in order to communicate on this network. Most PC's are set-up to do this by default. If needed, instructions on how to do this using Windows 10 are detailed overleaf (other Windows operating systems will be similar).

### **NOTE: Administrator privileges are required to carry out these modifications.**

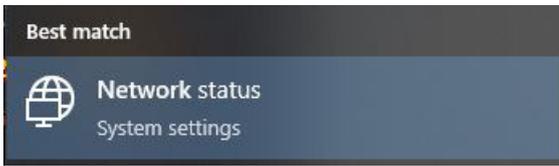
- Once the PC and PRO-NDC-1E are using the same IP address range, launch any popular web browser.
- Replacing 'xxxxxx' below with the serial number of your PRO-NDC-1E, type in the following command into the address bar.

**http://prondc-xxxxxx**

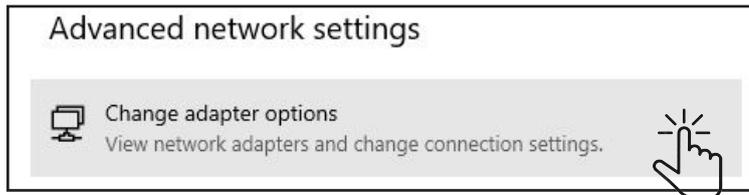
- The web-page shown above will now be displayed allowing configuration of the PRO-NDC-1E.

## Configuring 'Local Area Connection'

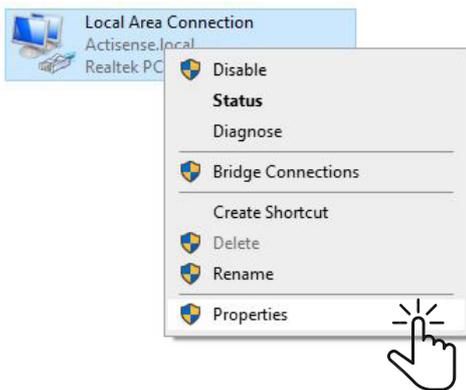
- Search for 'Network Status' on your PC and open the 'Network Status' menu



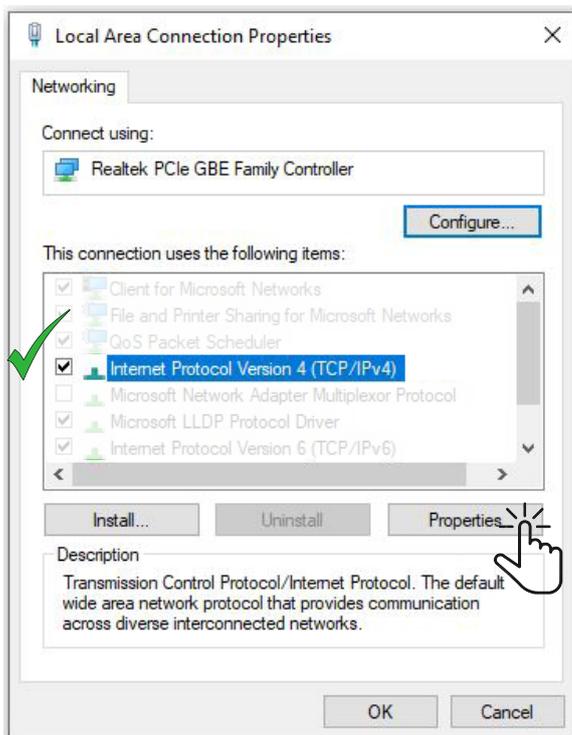
- In the 'Network Status' menu, under 'Advanced Network Settings', select 'Change Adapter Options'



- 'Right-click' on your 'Local Connection' and select 'Properties'

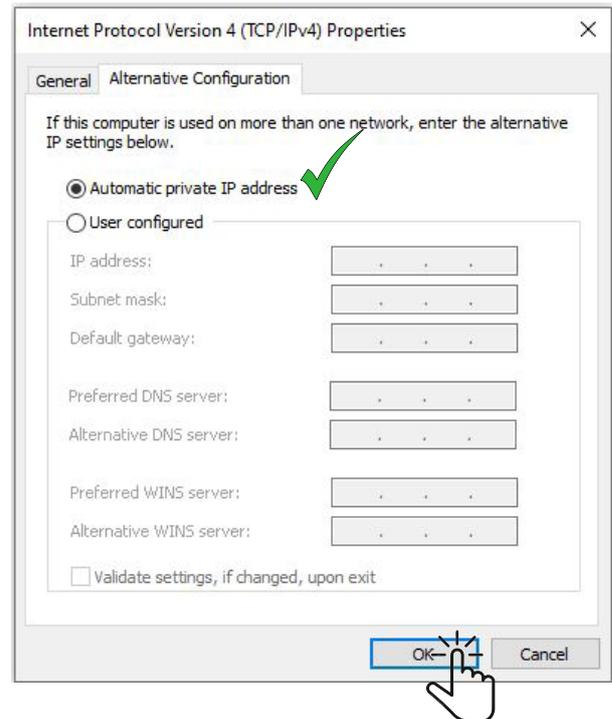
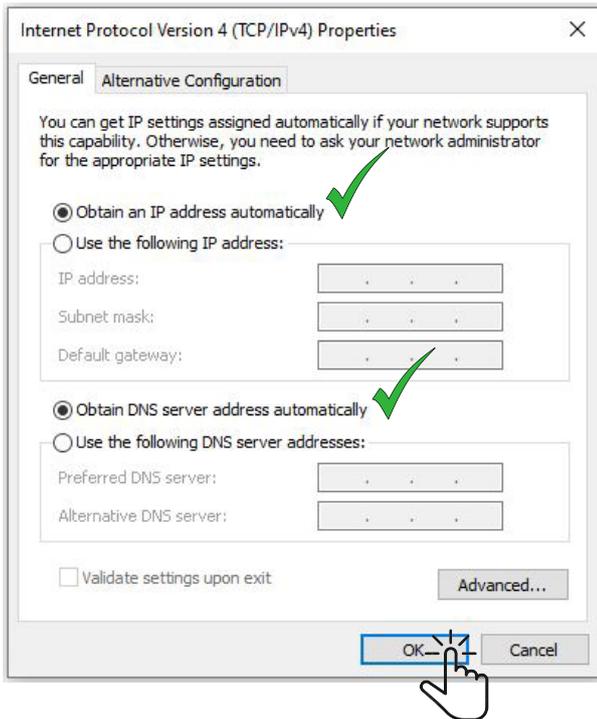


- Select 'Internet Protocol Version 4(TCP/IPv4)' and leave the box on the RHS checked.
- Click on 'Properties'



## Configuring 'Local Area Connection' (cont'd)

- Under the 'General' tab in 'Properties' make sure that:
  - **'Obtain an IP address automatically'** is selected.
  - **'Obtain DNS server address automatically'** is selected.
- Under the 'Alternate Configuration' tab make sure that:
  - **'Automatic private IP address'** is selected
- Click **'OK'** to accept these changes, and close the 'local connections window'



## Troubleshooting Guide

First level PRO-NDC-1E diagnostics / fault finding can be performed by observing the LED behaviour. The normal behaviour of the PRO-NDC-1E LEDs is described on the next page. If the LEDs are not behaving as expected, this will indicate a fault in either the device connected to the PRO-NDC-1E, the wiring/connections, or the PRO-NDC-1E itself.

Some common checks to perform on all terminals of the PRO-NDC-1E if the correct LED behaviour is not displayed:

- Connectors are fully inserted
- All pins of the connector are in the correct location (not overlapping into another port position)
- Wires are terminated firmly and correctly (check polarity)

LED	Colour	State	Description	User action
PWR	Blue	Pulsing	Indicates presence of power	None required
IN (INCLUDING 'SERIAL IN')	Green	Flashing	Data available on input indicated by LED.	No action required
	-	Off	No data available on this input or autobaud detection in progress (up to 20 seconds)	Check if connected Talker is sending data. If it is, review configuration.
OUT (INCLUDING 'SERIAL OUT')	Orange	Flashing/ solid	Flashes at a rate determined by baud rate and data length. If available bandwidth is nearly full, LED may appear solid instead of flashing	None required
STATUS	Red	Flashing / solid	Buffer Full – Overload condition, sentences are being dropped.	Use a web browser to review configuration and correct overload condition.
	Yellow	Flashing / solid	Warning, buffer is filling. Duplicate deletion is managing to maintain output capacity by deleting older copies of sentences	Review configuration to understand the required rates of sentences which is acceptable to any connected device
	Green	Flashing / solid	Normal operation. No data issues.	No action required
	-	Off	No data passing through outputs. Either no input data, or if IN LED is active it means all data is blocked.	Check if the connected Talker is sending data. If it is, review configuration.
Ethernet	Green	Flashing	Data activity on the Ethernet port	No action required
	Yellow	On	Indicates line speed at 100Mbps	No action required
		Off	Indicates line speed at 10Mbps	
	-	Off	No data available	Check that the Ethernet network is operational.
PWR and STATUS (combined)	Power = blue Status = red	Power = on (solid) Status = on (solid)	Critical HW Error. Both Power & Status LED's are solid	Return to manufacturer if this persists after a power reset

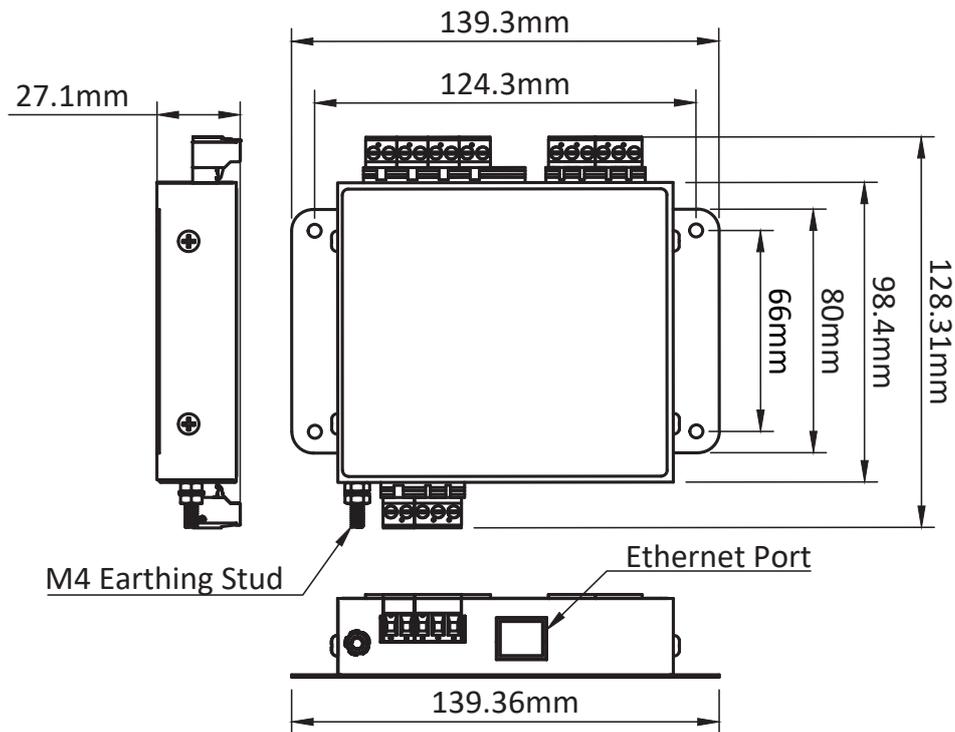
# Type Approved NMEA Multiplexer - PRO-NDC-1E

## Technical Specification

Power Supply	
Input supply voltage	10 to 35 V DC
Input supply current	150mA max @ 12V DC (all outputs @ full drive into 100 ohm loads)
Input protection	Continuous reverse polarity, transient overvoltage and ESD protection
Power indicator	LED, Blue - indicates unit is functioning correctly
Input Supply connector	Pluggable 2-way screw terminal, 5.08mm pitch (12 to 30 AWG)
NMEA 0183 Port - Listener & Talker	
Number of Listener / Input Ports	5 isolated NMEA 0183 Listeners
Number of Talker / Output Ports	2 isolated NMEA 0183 Talkers
Compatibility	Fully NMEA 0183, RS422 & RS232 compatible. RS485 Listener compatible
Speed / baud rate	4800 to 38400 bps
Talker Output Voltage Drive	$\geq 2.2V$ (differential) into 100 ohm
Talker Output Current Drive	20 mA maximum per output
Talker Output Protection	Short circuit and ESD
Talker Data Indicator	LED, Orange (Flashes with data rate)
Listener Input Voltage Tolerance	-15 V to +15 V continuous, -35 V to +35 V short term (< 1 second)
Listener Input Protection	Current limited, overdrive protection to 40 VDC and ESD protection
Listener Data Indicator	LED, Green (Flashes with data rate)
Connectors	Pluggable 2/3 way screw terminals, 5.08mm pitch (12 to 30 AWG)
Serial Port	
Compatibility	RS422 & RS232 compatible. RS485 Listener compatible
Speed / baud rate	115200 bps
Output voltage drive	$\geq 2.1V$ (differential) into 100 ohm
Output current drive	20 mA max.
Output protection	Short circuit and ESD
Input voltage tolerance	-15 V to +15 V continuous, -35 V to +35 V short term (< 1 second)
Input protection	Current limited, overdrive protection to 40 VDC and ESD protection
Data Indicators	LED's: Green = Receive, Orange = Transmit
Connectors	Pluggable 3-way screw terminals, 5.08mm pitch (12 to 30 AWG)
Ethernet Port	
Host interface	10/100BaseT, automatic polarity detection
Supported protocols	TCP/IP for configuration and firmware updating
	TCP/IP and UDP for NMEA 0183 comms
Connector	RJ45
Indicators	Green - Link, Yellow - 100 Mbps
Isolation	
NMEA 0183 Listener	Uses IsoDrive™, Hi-Pot tested to 1000V
NMEA 0183 Talker	Uses IsoDrive™, Hi-Pot tested to 1000V
Serial Port	Uses IsoDrive™, Hi-Pot tested to 1000V
Ethernet Port	2kv for 60s

Mechanical	
Housing Material	316 Stainless Steel
Dimensions	139mm (W) x 98mm (H) x 26mm (D)
Weight	360g
Mounting	Bulkhead mount or DIN rail mount (DIN kit 1)
Approvals and Certifications	
EMC	IEC 60945:2002-08, DNVGL-CG-0339:2019 & IACS UR E10 Rev7
Compass Safe Distance	300mm
Type Approval Certificate	RINA
Operating Temperature	-25 to +70°C
Storage Temperature	-40 to +85°C
Relative Humidity (RH)	95% @ 55°C
Environmental Protection	IP40
Guarantee	5 Years

## PRO-NDC-1E Dimensions



## Technical support and the returns procedure

All installation instructions and any warnings contained in this manual must be followed before contacting Actisense Technical Support. If the troubleshooting guide did not help resolve the problem and an error persists, please contact Actisense Technical Support to help trace the issue before considering the return of the product.

If the Actisense support engineer concludes that the PRO-NDC-1E unit should be returned to Actisense, a 'Return Merchandise Authorisation' (RMA) number will be issued by the support engineer.

The RMA number must be clearly visible on both the external packaging and any documentation returned with the product. Any returns sent without an RMA Number will incur a delay in being processed and a possible charge. Any cables originally supplied with the product are to be included in the returned box.



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