Actisense®
Connect without limits

Professional Type Approved
NMEA® 0183 Buffer
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.**

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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Technical Accuracy

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Product Registration

Please register your product via the online form at **www.actisense.com/support/prodreg.**

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 3 year guarantee as standard. To activate the 5-year guarantee offered with this product please complete product registration either online at **www.actisense.com/support/prodreg** or by completing and returning the warranty card supplied in the box with the product.

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.

Contents Page

Introduction

The PRO-BUF-2 is designed to suit the majority of NMEA 0183 systems and ready to go 'out of the box' by simply hard-wiring the two mode inputs as required. The manually configurable basic modes of operation include variations of buffer modes, Autoswitch modes, and combine modes. For all other configurations, leaving the mode inputs floating selects the 'User Configuration Mode'.

The web browser based configuration tool allows full customisation of the PRO-BUF-2, and as the configuration tool is web based it is compatible across all popular Operating Systems.

The PRO-BUF-2 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-BUF-2. 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-BUF-2 is designed to accurately transfer data from input to output. When the PRO-BUF-2 is in a Basic Mode no data integrity checking is performed, therefore any incomplete, inaccurate or corrupt data received on a PRO-BUF-2 input will be duplicated to the PRO-BUF-2 outputs. In contrast, PRO-BUF-2 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-BUF-2 ensure the isolation switch is off. Wiring the PRO-BUF-2 while the connection is live may damage the PRO-BUF-2 and is in breach of the guarantee. Any connection to a battery or power supply must meet the mandatory essential 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-BUF-2. Mounting on a contoured surface may cause damage to the case.
Do not mount the PRO-BUF-2 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-BUF-2.

Software Updates

The PRO-BUF-2 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-BUF-2.

The PRO-BUF-2 firmware version can be viewed on the PRO-BUF-2 Configuration Tool 'Home' page, in the 'Main Application' section. Details of the latest PRO-BUF-2 firmware version released can be viewed on the Actisense website's PRO-BUF-2 'Downloads' page, for the Actisense Toolkit download.

Features

- 2 x NMEA 0183 OPTO-isolated inputs
- 12 x NMEA 0183 ISO-Drive™ isolated outputs
- 1 x bi-directional and fully isolated serial port
- 1 x Ethernet port
- 1 x Alarm output (N/O and N/C contacts)
- Pre-defined modes of operation
- Automatic Baud Rate maching on inputs
- 'User Configuration Mode' available when mode inputs are not hard-wired
- Easily configurable via any standard web browser
- Supports direct connection to PC using standard Ethernet cable
- Using the configuration tool, each NMEA 0183 output can be configured to communicate at an independent baud rate
- 2 Virtual Autoswitch modules
- Advanced Data Filtering and Routing
- Data statistics and load indication via web tool
- Diagnostic LEDs (power, data in/out & alarm)
- 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
- The PRO-BUF-2 firmware can be easily upgraded to offer new features as they become available, making it 'future proof'

Before getting started

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 in the installation instructions for the devices you wish to interface to the PRO-BUF-2.

Terminals

The PRO-BUF-2 comes with 2-way and 3-way screw connectors. Screwless terminals are available as an accessory.

PRO-BUF-2 connectors are pluggable, meaning they can be easily removed for quick and simple wire installation without the need to unmount the PRO-BUF-2 from its installed location.

Screw Connector
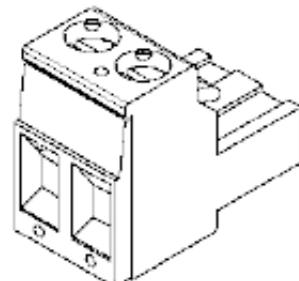
2-way
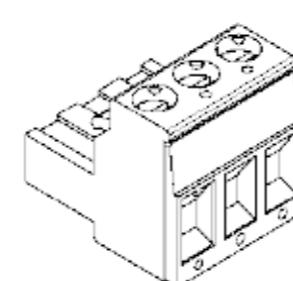
3-way

Screwless Connector (Supplied as an accessory)

Open the clamp inside the screwless connector by pressing down on the orange button with a small (2mm) flat headed screwdriver. This will allow the wire to be inserted. For best connections do not twist the wire strands.

Release the orange button to lower the clamp on to the wire strands for a secure termination.
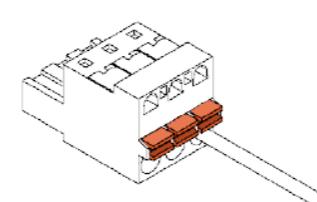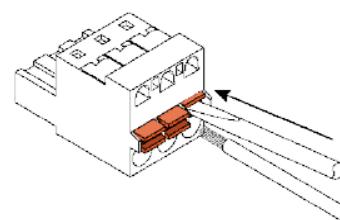

Power Supply Connection

The PRO-BUF-2 requires a power source providing between 10 and 35 Volts DC.

The PRO-BUF-2 '+' terminal should be connected to the vessel power supply '+' terminal via the correctly rated fuse (in accordance with NMEA 0400).

The PRO-BUF-2 '-' terminal should be connected to the vessels DC ground plate.

The input supply connection has continuous reverse polarity and ESD protection.
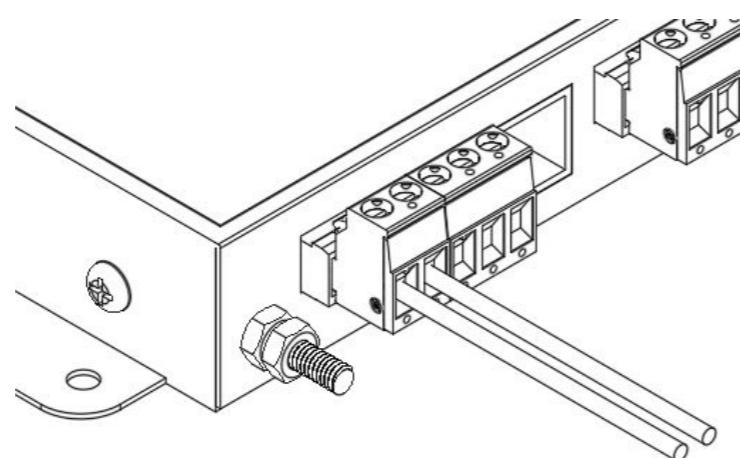
NMEA 0183 Talker and Listener Designations

The NMEA have updated the NMEA 0183 specification 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 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. When a port is labelled 'Listener' it is an input and when it is labelled 'Talker' it is an output.

Connecting to NMEA Devices

The 'A/+' and 'B/-' of the NMEA 0183 device should be matched to the 'A' and 'B' on the PRO-BUF-2. If the NMEA 0183 device has a ground (GND) wire (and no 'B/-' wire), simply connect this to 'B' on the PRO-BUF-2.

RF Ground Connection

The shield from each Listener should be connected to the terminal on the PRO-BUF-2 'Isolated Talkers' ports. All terminals are connected internally and form a common bonding point at the RF ground stud.

The RF ground stud should be connected to the vessels RF ground plate using a minimum conductor size of 8 AWG in accordance with NMEA 0400.
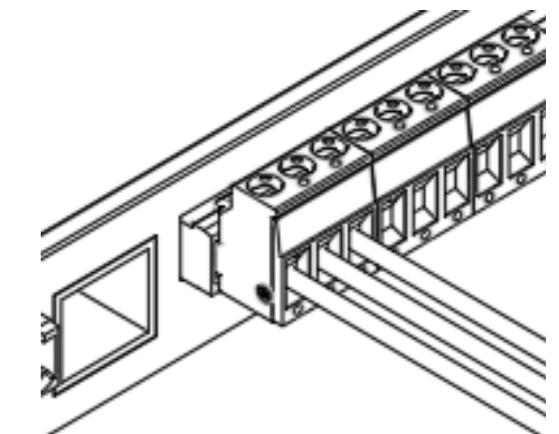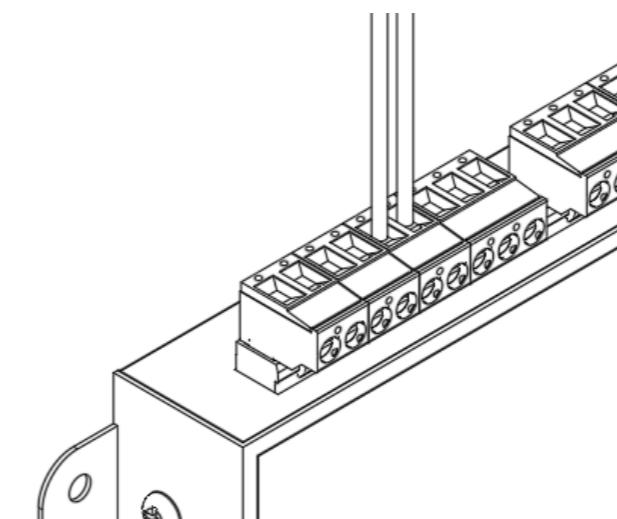
Serial port connection

Standard RS232 Wiring

RS232 Cable:	PRO-BUF-2:
TX (pin 3)	'IN'
RX (pin 2)	'OUT'
GND (pin 5)	'COM'

Null Modem Wiring

| Null Modem Cable:	PRO-BUF-2:
TX (pin 2)	'IN'
RX (pin 3)	'OUT'
GND (pin 5)	'COM'
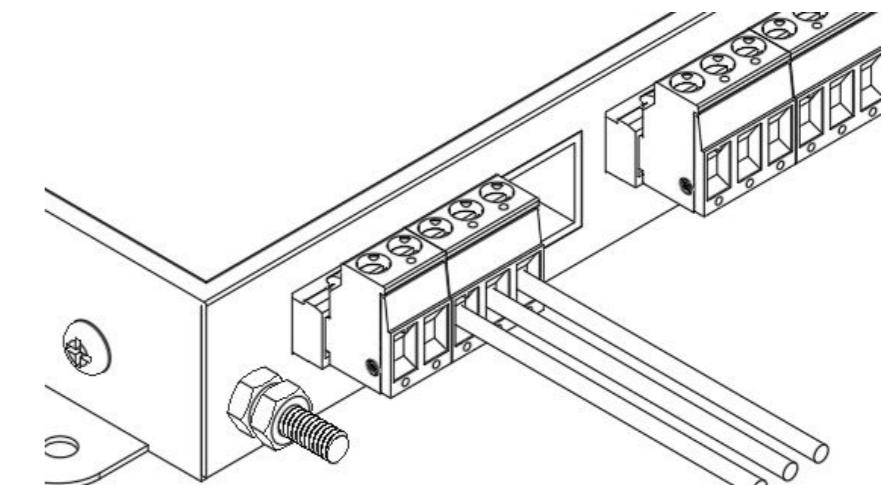
*Serial port can be connected safely to a USB port on a PC using the USBKIT-PRO supplied as an accessory

Ethernet

Either a standard Ethernet patch or crossover cable with an RJ45 plug can be used for a direct connection to a PC/laptop, or the PRO-BUF-2 can be connected to an Ethernet network switch.

Insert the RJ45 plug in to the PRO-BUF-2 'Ethernet' terminal until a click is heard. To remove the RJ45 plug, push down on the locking clip and pull the cable away from the 'Ethernet' terminal.
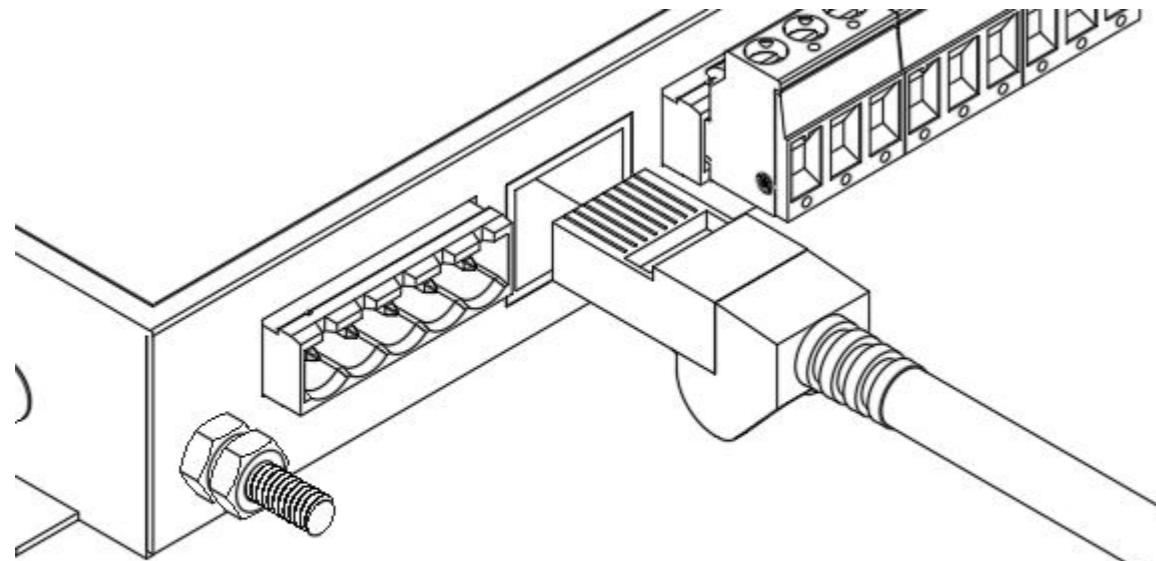
Alarm

Connect to an Alarm input, indicator or equipment as required.
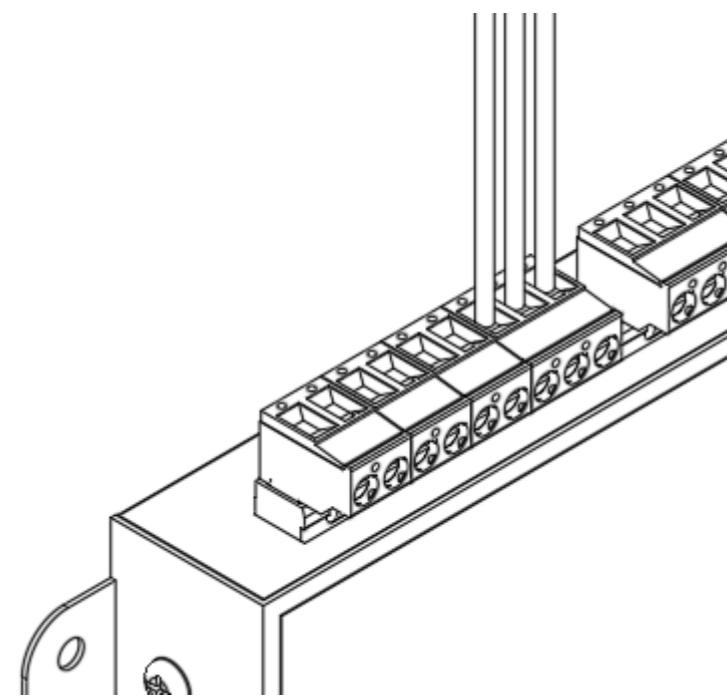
DIN Rail Mounting

Install the DIN rail in the desired location.

Attach the PRO-BUF-2 to the DIN rail as shown in the diagrams below.

Ensure the PRO-BUF-2 sits flush against the DIN kit clips, and that the rail clips are securely fastened to the DIN Rail.*
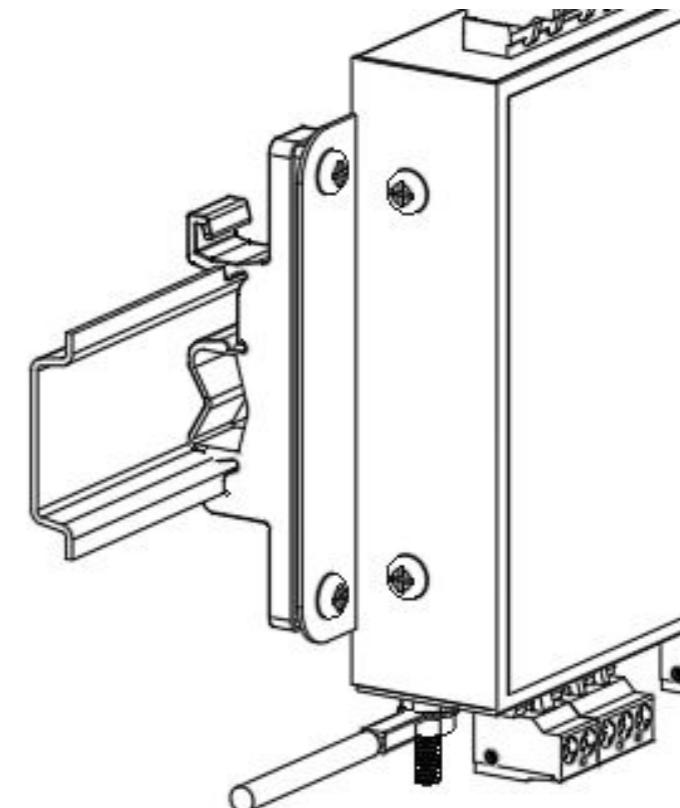
* Please note, the Actisense DIN-KIT-1 is an accessory, and is not supplied with the PRO-BUF-2.

Bulkhead Mounting

Actisense recommends the PRO-BUF-2 is installed to a bulkhead using the 2 screw holes located on either side of the device to ensure a secure mount.

Strain Relief Bracket

The Actisense Strain Relief bracket is sold as an accessory and can be used to secure loose cables for a neat installation..
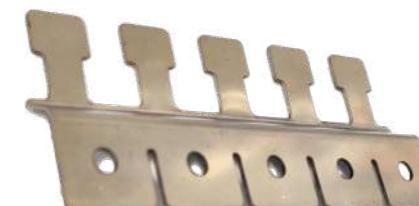
Operating Modes

The PRO-BUF-2 can be configured manually using the 'Mode' pins (also referred to as 'hard-wiring') or user configured via the Configuration Tool. Manually configuring the PRO-BUF-2 takes priority over any user configuration. The factory default setting is 'Buffer 3' for the User Defined Modes.

Hard-wiring the operating modes

For a list of modes and how to set them up, refer to the 'Mode Table' sheet included with the PRO-BUF-2 or available from the PRO-BUF-2 'Downloads' page on the Actisense website. Connect the mode pins on the device to the Power input as indicated in the tabe below:

"-" = connect to "PWR -"		"+" = connect to "PWR +"			
N/C = No Connection i.e. leave floating		LED will pause for two seconds at the end of the sequence before continuing to flash again.			
Mode Name	**Description**	**Pin 1**	**Pin 2**	**LED**	
Buffer 1	Input 1 → Output 1-12	-	N/C	1 Flash	BasicModes
	Inputs Autobaud, Output baud rates follow input				
Buffer 2	Input 2 → Output 1-12	+	N/C	2 Flashes	
	Inputs Autobaud, Output baud rates follow input				
Buffer 3	Input 1 → Output 1-6, Input 2 → Output 7-12	N/C	-	3 Flashes	
	Inputs Autobaud, Output baud rates follow inputs				
Autoswitch	Smart Autoswitch Input 1 OR 2 → Output 1-12	-	-	4 Flashes	SmartModes
	Inputs Autobaud				
	Output baud rates follow Input 1 baud rate				
	2000ms Switch delay				
Combine 1	Combine, Input 1 AND 2 → Output 1-12	N/C	+	5 Flashes	
	Inputs Autobaud, Output baud rates follow Input 1				
Combine 2	Combine, Input 1 AND 2 → Output 1-12	+	+	6 Flashes	
	Inputs Autobaud, Output 1 to 6 baud rates follow Input 1, Output 7 to 12 baud rates follow Input 2				
User Mode 1	If unit is configured, selects User Mode 1 If there is no User Mode 1 setup, will be factory default	-	+	7 Flashes	
User Mode 2	If unit is configured, selects User Mode 2 If there is no user mode 2 setup, will be factory default	+	-	8 Flashes	
User Defined Mode	PC / Remote Config*	N/C	N/C	Pulsing	

Web Browser Configuration

The Configuration Tool for the PRO-BUF-2 is built-in and can be accessed via the Ethernet connection.
As the Configuration Tool is web based it 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-BUF-2 is connected to an Ethernet network containing both DHCP and DNS servers, launch any popular web browser and enter '//probuf-xxxxxx' into the address bar (replacing 'xxxxxx' with the product's serial number).

Direct connections or basic Ethernet networks

If the PRO-BUF-2 is connected directly to a PC (or the Ethernet network does not have a DHCP server), the PRO-BUF-2 will communicate using auto-IP by default. The auto-IP process can take up to 60 seconds to complete.

The PC's "Local Area Connection" must also be setup to use auto-IP in order to communicate on this network. Most PCs are set to do this by default. If needed, instructions for how to do this using Windows 10 are detailed below (other Windows Operating Systems will be similar). Administrator privileges are required to carry out these instructions in full.

Now that the PC and PRO-BUF-2 are using the same IP address range, launch any popular web browser and enter '//probuf-xxxxxx' in to the address bar (replacing 'xxxxxx' with the actual product's serial number).

1. Search for 'Network Status' and open the 'Network Status' menu
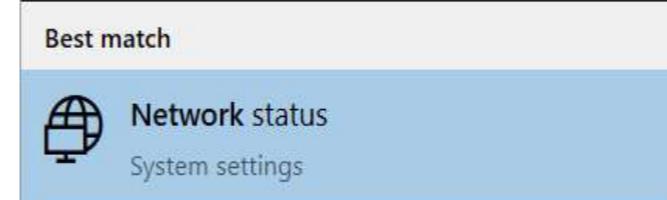
2. In the 'Network Status' menu, under Advanced network settings, select 'Change Adapter Options'
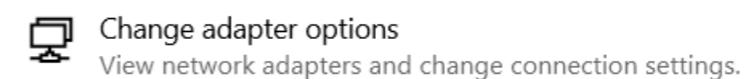

3. Right click on your Local Connection and select 'Properties'
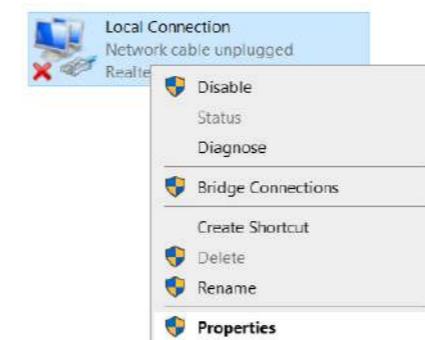
4. Select 'Internet Protocol Version 4 (TCP/IPv4)', but DO NOT uncheck the box.
Click on 'Properties'
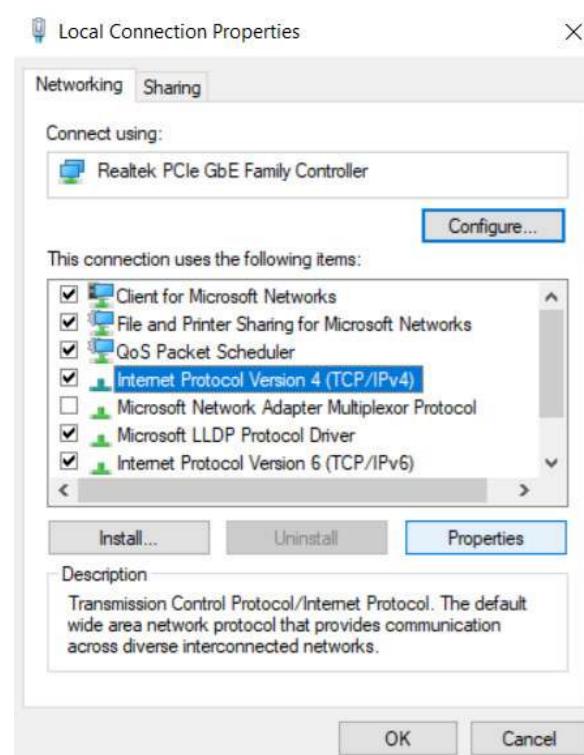
5. Under the 'General' tab in 'Properties', ensure that 'Obtain IP address Automatically' and 'Obtain DNS server address manually' are both selected.

6. In the 'Alternate Configuration' tab, ensure 'Automatic Private IP Address' is selected.
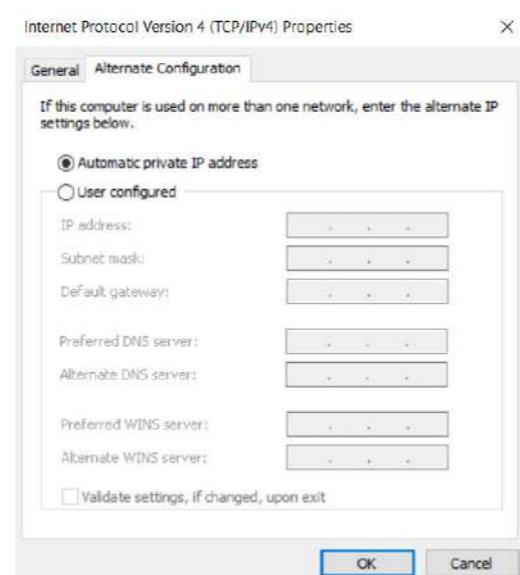
7. Accept these changes by clicking 'OK' and then close the Local Connection Windows

Web Browser Configuration

The default page displayed is the PRO-BUF-2 Configuration Tool 'Home' page. We strongly suggest bookmarking the 'Home' page in your web browser to allow quick and easy future access.
To access any of the PRO-BUF-2 setup pages, the user is required to log-in. This prevents unauthorised user access from modifying the PRO-BUF-2 configuration. The log-in is "admin" for username and "admin" for password.

All modifications to the PRO-BUF-2 settings, including any user defined 'User Modes' are automatically saved inside the PRO-BUF-2.

Troubleshooting Guide

First level PRO-BUF-2 diagnostics / fault finding can be performed by observing the LED behavior. The normal behavior of the PRO-BUF-2 LEDs is described below. If the LEDs are not behaving as expected, this will indicate a fault in either the device connected to the PRO-BUF-2, the wiring/connections, or the PRO-BUF-2 itself.

LED and Behaviour	If LED is not lit, or different behaviour than expected
Power (Blue 'PWR') LED Pulses blue to indicate presence of power. During power-on, this LED will flash rapidly (5 times per second) for 2 seconds to indicate that the Bootloader is active.	• Ensure that the power terminal plug is correctly located and seated. • Ensure that the wires are securely connected to the plug. • Ensure that positive power and ground wires have been connected with the correct polarity. • Ensure that any external power fuse has not blown and that the external power isolation switch is closed. • Ensure that the power supply meets the Voltage and Current requirements as defined in the Specifications.
Listener (Green 'IN') LEDs In Basic Modes, this LED will flash on receipt of any data (at a rate determined by baud rate and data load). In Smart Modes, this LED will flash when valid data is received (at a rate determined by baud rate and data load).	• Ensure that the PRO-BUF-2 has power, refer to "Power (Blue 'PWR') LED" above. • Ensure that the (NMEA Talker) device connected to this input is powered and is configured to output data. • Ensure that the plug is correctly located and the wires are securely connected to the plug, with the correct polarity. • Ensure that two data wires are connected to the PRO-BUF-2 Listener terminals. If the (NMEA Talker) device does not have a 'negative' data connection/wire, connect its ground to the 'B/-' on the PRO-BUF-2 Listener terminal instead. • If the (NMEA Talker) device is sending data at 38400 baud or less, the PRO-BUF-2 will automatically match that baud rate by default. Check that this default setting has not been changed to a 'Manual' baud rate instead.
Talker (Amber 'OUT') LEDs Flashes on transmit of data (at a rate determined by baud rate and data load).	• Ensure that the PRO-BUF-2 has power, refer to "Power (Blue 'PWR') LED" above. • Ensure that the plug is correctly located and the wires are securely connected to the plug, with the correct polarity. • Ensure that two data wires are connected to the PRO-BUF-2 Talker terminals. If the (NMEA Listener) device does not have a 'negative' data connection/wire, connect its ground to the 'B/-' on the PRO-BUF-2 Talker terminal instead. • Ensure that the corresponding Listener (Green) LED is lit, indicating that data is being received. Refer to the 'Mode Table' sheet included with the PRO-BUF-2 or available from the PRO-BUF-2 'Downloads' page on the Actisense website.

LED and Behaviour	If LED is not lit, or different behaviour than expected
Serial Talker (Amber 'OUT') LED & Listener (Green 'IN') LED As described above for 'Talker Out' and 'Listener In' LEDs.	As described above for 'Talker Out' and 'Listener In' LEDs.
Ethernet (Green & Amber 'ETHERNET') LEDs Green LED flashes to indicate data activity. Yellow LED indicates line speed: off = 10 Mbps, on = 100 Mbps. Determined by the Ethernet switch/PC connected – will be 100 Mbps by default.	• Ensure that the Ethernet cable is connected to an Ethernet switch or a PC. • Ensure the PC/Ethernet switch is powered and operating normally.
Status LED Green flashing / solid LED indicates device is operating correctly	• If LED is not lit, ensure that the PRO-BUF-2 has power, refer to Power (Blue 'PWR') LED above. • Yellow LED indicates the buffer is filling, but duplication deletion is managing to keep load under max capacity. • Red LED indicates buffer is in overload condition, where too much data is being received, causing sentences to be dropped. • Review web configuration of device to understand where the overloads are happening, and correct overload condition by adjusting configuration.
Alarm (Red 'Alarm') LED Indicates whether the alarm condition has been triggered. • LED will light if Alarm condition has been met.	
Mode LED (Green 'Mode') Pulsing, or the number of flashes equates to the Mode number. Refer to the 'Mode Table' sheet included with the PRO-BUF-2 or available from the PRO-BUF-2 'Downloads' page on the Actisense website. • If the LED is pulsing, this indicates a User Defined Mode has been selected • If the LED is flashing, the number of flashes indicates the operating mode number selected according to the Mode Pins. (refer to Mode Table).	

Technical Support and 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-BUF-2 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.

Technical Specification

Power Supply	
Input Supply Voltage	10 to 35 V DC
Input Supply Current	325mA 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	2 isolated NMEA 0183 Listeners
Number of Talker / Output Ports	12 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	>= 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 at 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 to indicate valid input)
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	4800 to 115200 bps
Output Voltage Drive	>= 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
Indicators	Green = Link/Activity, Yellow = 100 Mbps
Connector	RJ45

Isolation	
NMEA 0183 Listener	OPTO-Isolated, Hi-Pot tested to 1000V
NMEA 0183 Talker	Uses IsoDrive™, Hi-Pot tested to 1000V
Serial Port	Uses IsoDrive™, Hi-Pot tested to 1000V
Alarm Relay	Hi-Pot tested to 1000V
Ethernet Port	2kV for 60s

Mode Inputs	
Input Voltage Range	0 to 35V DC
Protection	Transient overvoltage and ESD protection
Connectors	Pluggable 2-way screw terminals, 5.08mm pitch (12 to 30 AWG)

Alarm Output	
Contacts	Common, Normally Open and Normally Closed
Alarm Indicator	LED, Red indicates a valid alarm condition
Contact Ratings	35VAC / 50VDC
Connectors	Pluggable 3-way screw terminals, 5.08mm pitch (12 to 30 AWG)

Mechanical	
Housing Material	316 Stainless Steel
Dimensions	210mm (W) x 128mm (H) x 27mm (D)
Weight	530g
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	750mm
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

All specifications are taken with reference to an ambient temperature of 25°C unless otherwise specified.

Part Number	Description
PRO-BUF-2	2 OPTO input, 12 ISO-Drive outputs professional Type Approved Buffer
	Accessory Description
DIN-KIT-1	Kit of 2 clips & 4 screws. Use with top hat (EN 50 022) or G section (EN 50 035) rails
A-CONPACK-PBUF2	Pluggable Screwless Terminal pack for PRO-BUF-2
SRB-90	Kit of 2 x 90mm Stainless Steel Strain Relief Brackets
USBKIT-PRO	USB To Serial Adapter for use with PRO range products

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