Professional NMEA 0183 Intelligent Buffer
PRO-BUF-1
User Manual

Important Notices

The device to which this manual relates complies with the Electromagnetic Compatibility requirements according to EN60945. 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

To the best of our knowledge the information contained in this document was correct at the time it was produced. Active Research Ltd cannot accept liability for any inaccuracies or omissions.

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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

Introduction

The PRO-BUF-1 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-1, and as the configuration tool is web based it is compatible across all popular Operating Systems. The PRO-BUF-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-BUF-1. 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-1 is designed to accurately transfer data from input to output. When the PRO-BUF-1 is in a Basic Mode no data integrity checking is performed, therefore any incomplete, inaccurate or corrupt data received on a PRO-BUF-1 input will be duplicated to the PRO-BUF-1 outputs. In contrast, PRO-BUF-1 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-1 ensure the isolation switch is off. Wiring the PRO-BUF-1 while the connection is live may damage the PRO-BUF-1 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-1. Mounting on a contoured surface may cause damage to the case. Do not mount the PRO-BUF-1 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-1.

Software Updates

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

The PRO-BUF-1 firmware version can be viewed on the PRO-BUF-1 Configuration Tool 'Home' page, in the 'Main Application' section. Details of the latest PRO-BUF-1 firmware version released can be viewed on the Actisense website's PRO-BUF-1 'Downloads' page, for the Actisense Toolkit or ActiPatch 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). Operates on failure of primary input in Autoswitch mode

- Pre-defined modes of operation

- Each NMEA 0183 input automatically matches the Talker's baud rate when in one of the basic modes of operation (4800 or 38400)

- '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

- 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-1 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-1.
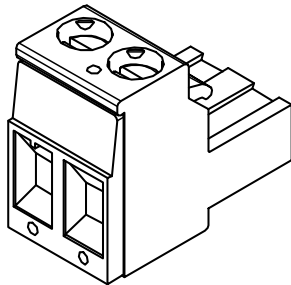
Terminals

The PRO-BUF-1 comes with two main choices for its 2-way and 3-way connectors: 'screw' (-R) or 'screwless ' (-S).
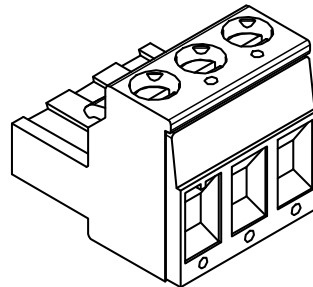
PRO-BUF-1 connectors are pluggable, meaning they can be easily removed for quick and simple wire installation without the need to unmount the PRO-BUF-1 from its installed location.
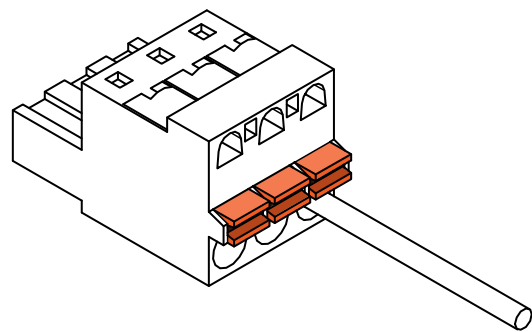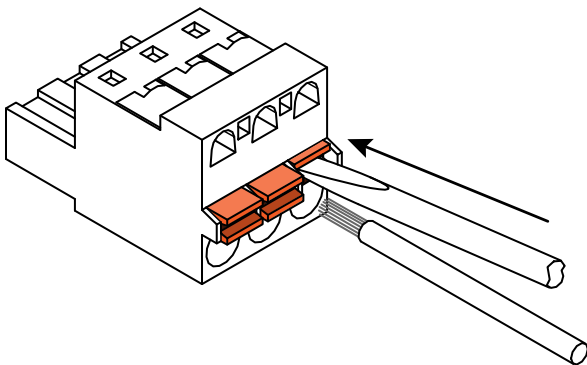
Screw Connector

2-way:

3-way:

Screwless Connector

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.

Connections

Power Supply

The PRO-BUF-1 requires a power source providing between 10 and 35 Volts DC.

The PRO-BUF-1 '+' terminal should be connected to the vessel power supply '+' terminal via the correctly rated fuse (in accordance with NMEA 0400).

The PRO-BUF-1 '-' terminal should be connected to the vessels DC ground plate.

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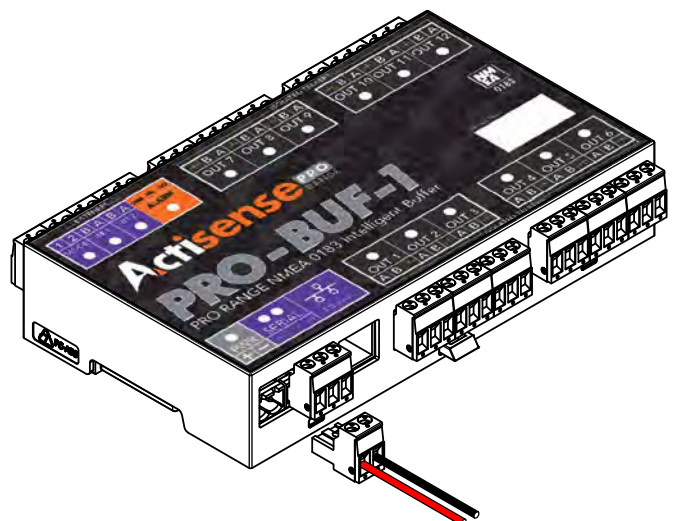
NMEA 0183 Talker and Listener Designations

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-1. If the NMEA 0183 device has a ground (GND) wire (and no 'B/-' wire), simply connect this to 'B' on the PRO-BUF-1.
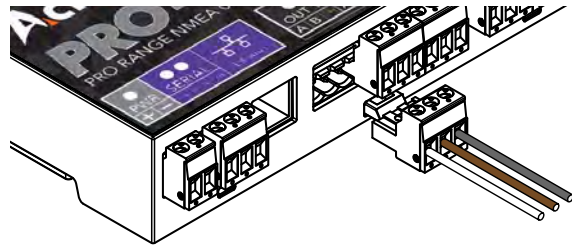
OPTO Inputs

Connect the NMEA 0183 Talker to the PRO-BUF-1 Listener terminals as shown in the diagram.
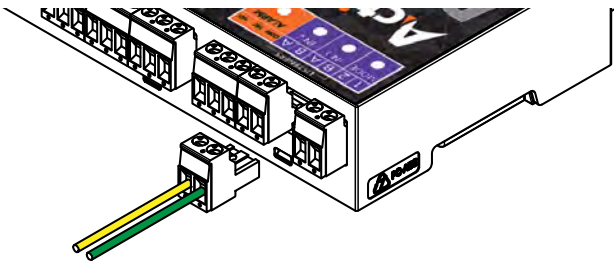

ISO-Drive Outputs

Connect the NMEA 0183 Listener to the PRO-BUF-1 Talker terminals as shown in the diagram. Connect the shield/drain wire of each Listener to the ⏚ terminal.

RF Ground Connection

The shield from each Listener should be connected to the ⏚ terminal on the PRO-BUF-1 '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 (10mm2) in accordance with NMEA 0400, (in version 3.1, this is in section 3.2).
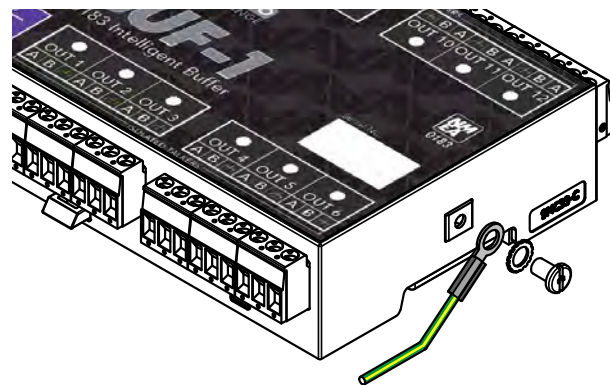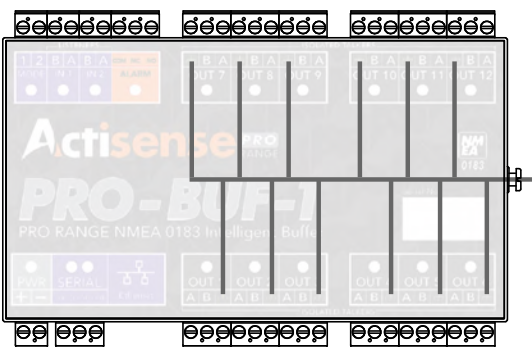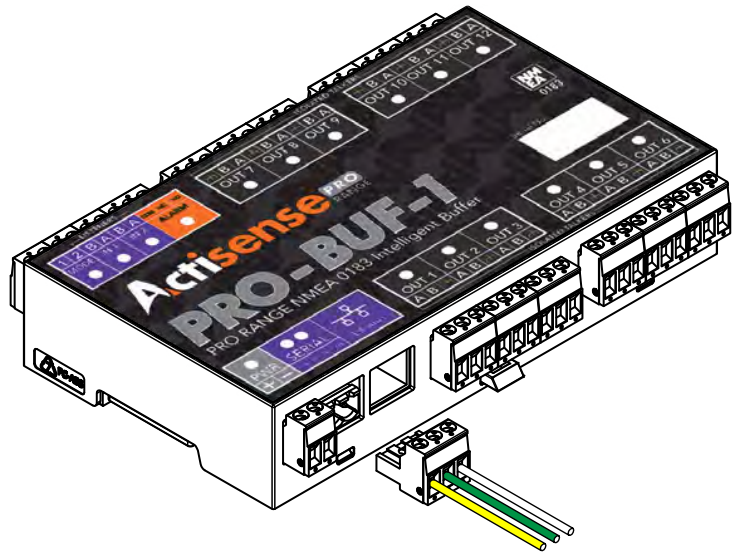
Serial

The connections for a standard RS232 cable are:

RS232 Cable:	PRO-BUF-1:
TX (pin 3)	'IN'
RX (pin 2)	'OUT'
GND (pin 5)	'COM'

The connections for a null modem cable are:

| Null Modem Cable:	PRO-BUF-1:
TX (pin 2)	'IN'
RX (pin 3)	'OUT'
GND (pin 5)	'COM'

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-1 can be connected to an Ethernet network switch.

Insert the RJ45 plug in to the PRO-BUF-1 '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.

Note: Transferring NMEA 0183 data via Ethernet is a feature planned for a future firmware release. Currently the Ethernet connection is used to configure the PRO-BUF-1 and create 'User Modes' (via the Configuration Tool), and update the PRO-BUF-1's firmware.
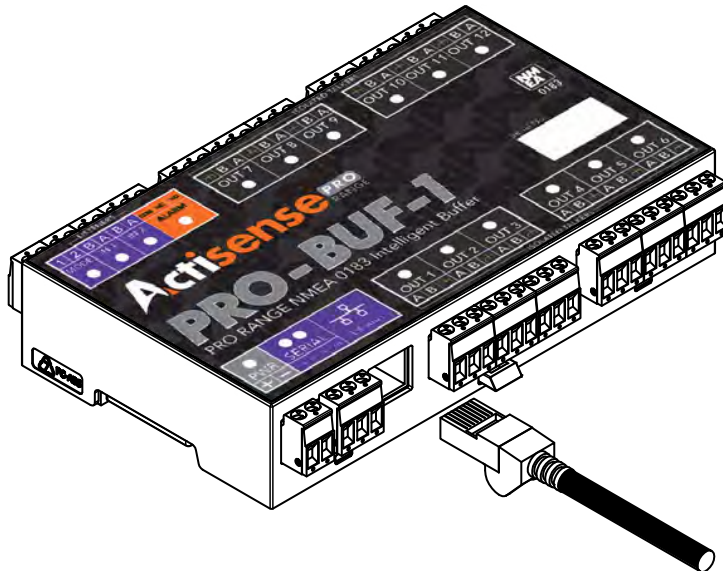
Alarm

Connect to an Alarm input, indicator or monitoring equipment as required. Currently this feature is not available but will become active through a firmware update for the Autoswitch modes initially.
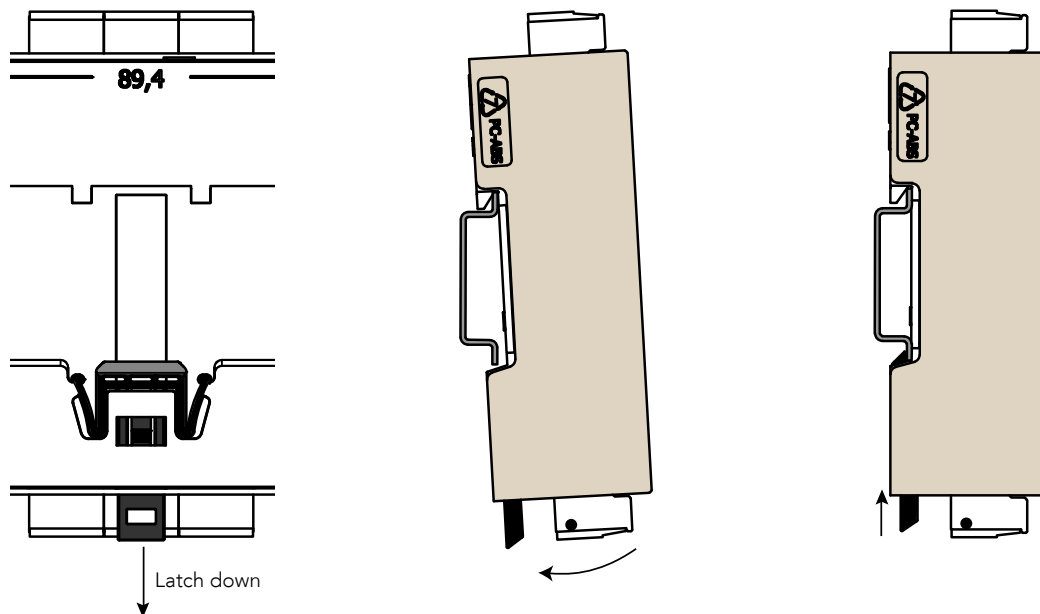
Mounting the PRO-BUF-1

DIN Rail Mounting

Install the DIN rail in the desired location.

Fully retract the black securing latch in to the down position.

Attach the PRO-BUF-1 to the DIN rail as shown in the diagrams below.

Ensure the PRO-BUF-1 sits flush against the DIN rail, then push the securing latch back in to position to hold the PRO-BUF-1 in place.

Bulkhead Mounting
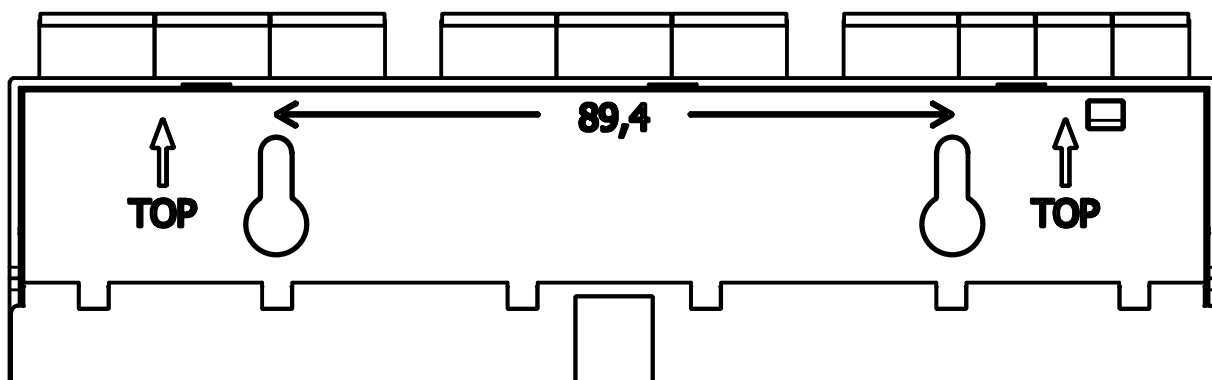
Actisense recommends the PRO-BUF-1 is installed using the DIN rail supplied for the most secure installation. However, the PRO-BUF-1 can be secured to a bulkhead using the two screw catches on the reverse of the PRO-BUF-1 shown in the diagram below.

Two screws must be used 89.4mm apart and horizontally aligned.

The above diagram is actual size if document is printed out at 100% onto A4.
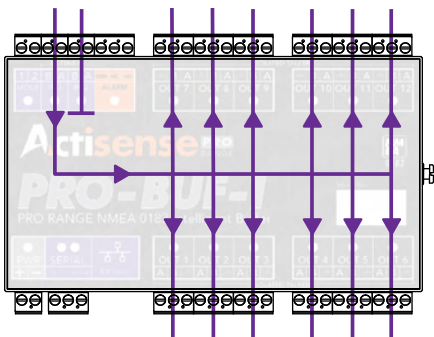
Operating Modes

The PRO-BUF-1 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-1 takes priority over any user configuration. The factory default setting of the PRO-BUF-1 is 'Buffer Mode 3'.
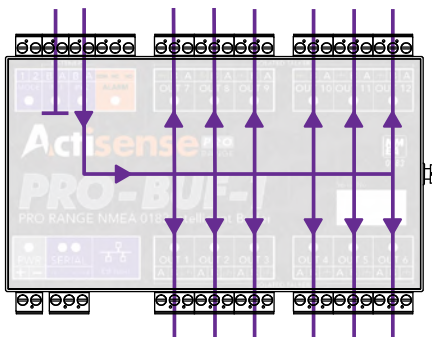
Hard-wiring the operating modes
For a list of modes and how to set them up, refer to the 'Mode Table' sheet included with the PRO-BUF-1 or available from the PRO-BUF-1 'Downloads' page on the Actisense website.
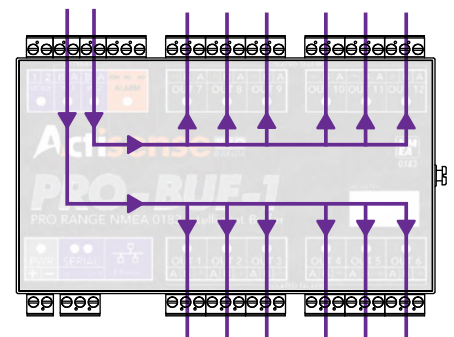
System Block Diagrams

Buffer Mode 1

Buffer Mode 2

Buffer Mode 3

Autoswitch Mode 1/2
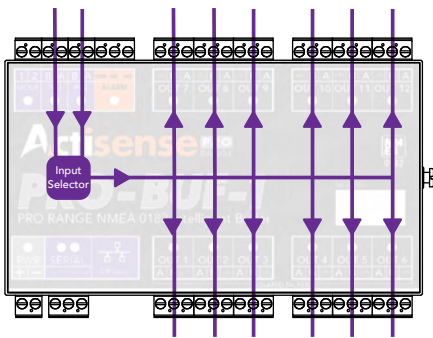
Combine Mode 1/2
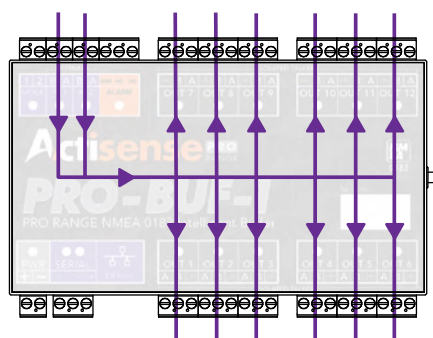
See the 'Mode Table' for the operating differences between Autoswitch Mode 1 & 2 and Combine Mode 1 & 2.

Web Browser Configuration Tool

The Configuration Tool for the PRO-BUF-1 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.
An internet connection is not required to access the Configuration Tool.

Standard Ethernet networks

If the PRO-BUF-1 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 actual product's serial number).

Direct connections or basic Ethernet networks

If the PRO-BUF-1 is connected directly to a PC (or the Ethernet network does not have a DHCP server), the PRO-BUF-1 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 7 are detailed below (other Windows Operating Systems will be similar). Administrator privileges are required to carry out these instructions in full:

1. Launch the 'Start' menu and type 'Network and Sharing Center' in the search bar.
    Select 'Network and Sharing Center'.
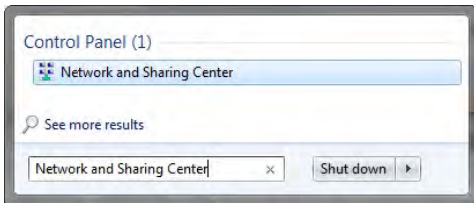
2. In the 'Network and Sharing Center' window, select 'Change adapter settings'.
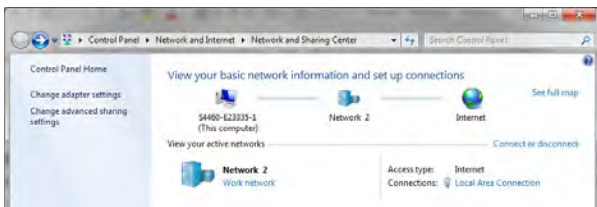
3. Right click on 'Local Area Connection' and select 'Properties'.
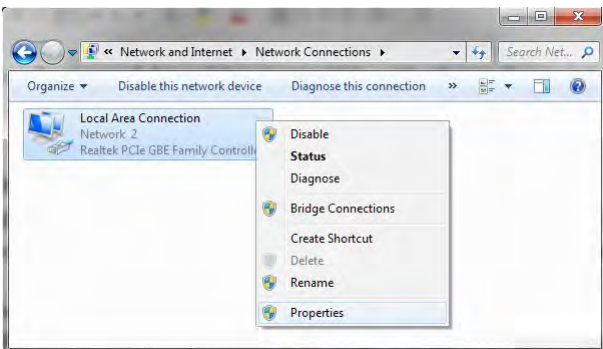
4. Select 'Internet Protocol Version 4 (TCP/IPv4)' but DO NOT untick the box. Then Select 'Properties'.
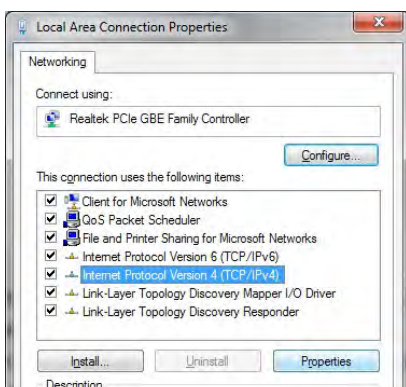
5. Under the 'General' tab heading, ensure 'Obtain an IP address automatically' and 'Obtain DNS server address automatically' are selected.
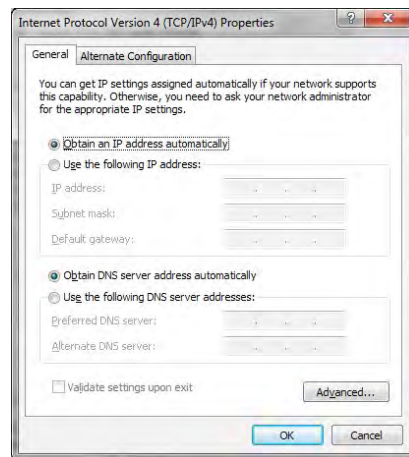
6. Under the 'Alternate Configuration' tab heading, ensure 'Automatic private IP address' is selected.
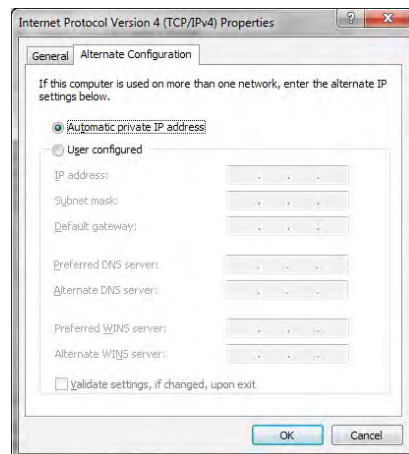
7. Accept these changes by selecting 'OK'.

8. Close the 'Local Area Connection Properties' window.

Now that the PC and PRO-BUF-1 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).

Configuration Tool

The default page displayed is the PRO-BUF-1 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-1 setup pages, the user is required to log-in. This prevents unauthorised user access from modifying the PRO-BUF-1 configuration. The factory default log-in is "admin" for username and "admin" for password. A future firmware update will allow individual username and password log-ins to be remembered and used.

All modifications to the PRO-BUF-1 settings, including any user defined 'User Modes' are automatically saved inside the PRO-BUF-1.

Troubleshooting Guide

First level PRO-BUF-1 diagnostics / fault finding can be performed by observing the LED behavior. The normal behavior of the PRO-BUF-1 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-1, the wiring/connections, or the PRO-BUF-1 itself.

LEDs

Name of LED and its Behaviour	If LED does not light
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-1 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-1 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-1 Listener terminal instead. • If the (NMEA Talker) device is sending data at 38400 baud or less, the PRO-BUF-1 will automatically match that baud rate by default. Check that this default setting has not been changed to a 'Manual' baud rate instead.

Name of LED and its Behaviour	If LED does not light
Talker (Amber 'OUT') LEDs Flashes on transmit of data (at a rate determined by baud rate and data load).	• Ensure that the PRO-BUF-1 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-1 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-1 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-1 or available from the PRO-BUF-1 'Downloads' page on the Actisense website. • For PC connections, the Actisense NMEA Reader application can be used to view if any data is present on a Talker output. NMEA Reader is included on the CD and the latest version available from the PRO-BUF-1 'Downloads' page. **Note:** If a software application other than NMEA Reader is used to view NMEA data, if required, define its COM port settings to no parity, 1 stop bit, 8 data bits and no flow control. These settings refer to the software application COM port settings and not the OS settings (such as those in Windows Device Manager).
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 on/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.
Alarm (Red 'Alarm') LED Indicates whether the alarm condition has been triggered.	• Currently this feature is not available but will become active through a firmware update.
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-1 or available from the PRO-BUF-1 'Downloads' page on the Actisense website.	

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-BUF-1 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.

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
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
Electrical isolation	2500 V input to ground, 1500 V output to ground using ISO-Drive™
Speed / baud rate	4800 to 38400 bps
Talker output voltage drive	>= 2.1V (differential) into 100 ohm
Talker output current drive	20 mA maximum per output
Talker output protection	Short circuit and ESD
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)
Talker data indicator	LED, Orange (Flashes at data rate)
Serial Port	
Number of input ports	1 isolated input
Number of output ports	1 isolated output
Compatibility	RS422 & RS232 compatible. RS485 Listener compatible
Electrical isolation	2500 V input to ground 1500 V output to ground using ISO-Drive™
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
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
Electrical isolation	2kV
Indicators	Green - Link, Yellow - 100 Mbps
Mode Inputs	
Input voltage range	0 to 35V DC
Protection	Transient overvoltage and ESD protection
Alarm Output	
Contacts	Normally open and normally closed
Electrical isolation	1000V between power supply and contacts
Alarm indicator	LED, red indicates a valid alarm condition

Mechanical	
Housing material	Polycarbonate / ABS blend
Flame retardancy	UL94 - V0
Dimensions	See diagram below
Weight	250g
Mounting	DIN rail mount (35mm top hat rail EN 50 022)
Compass safe distance	TBD
Wiring terminals	Pluggable 2/3 way screw or screwless connectors, 5mm pitch, 12 to 30 AWG
Approvals and Certifications	
EMC	IEC 60945 (sections 9 & 10)
CE	2004/108/EC
Type approval	DNV planned
Environmental protection	IP44
Operating temperature	-20°C to +70°C
Storage temperature	-40°C to +85°C
Relative Humidity (RH)	0 - 80% RH
Guarantee	5 years

Product Dimensions.
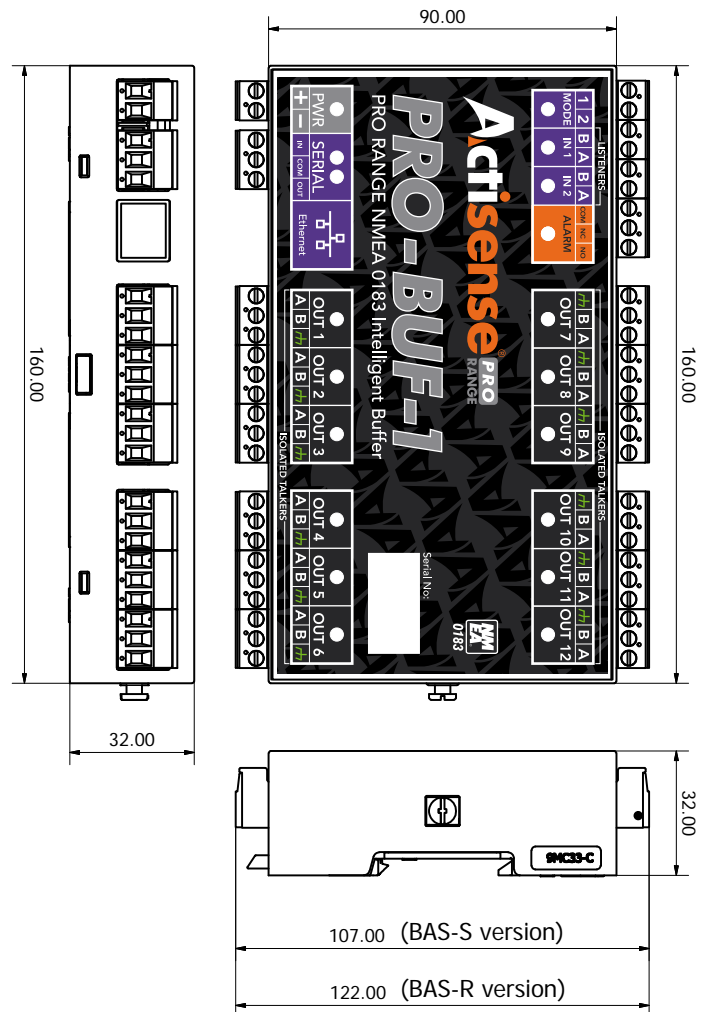
Product Code	Description
PRO-BUF-1-BAS-R	Standard configuration with pluggable screw terminals
PRO-BUF-1-BAS-S	Standard configuration with pluggable screwless terminals

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