Spatial FOG Dual ETH Supplementary Reference Manual

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1 Revision History

Version	Date	Changes
1.2	10/09/2019	Section 4 Introduction updated Section 8.6 Communication Specifications updated Section 8.8 Electrical Specifications updated Section 11.8.6 GPIO Configuration updated Section 12.1 Communication updated Section 12.2 External Data updated Section 12.3 The GPIO and Auxiliary Ports updated
1.1	22/08/2019	Section 8.6 Communications Specifications updated Section 8.8 Electrical Specifications updated Section 8.10 Connector Pin-out updated for 13 pin connector Sections 11, 12 and 14 updated for Auxiliary and GPIO port changes.
1.0	22/03/2019	Initial release

Table 1: Revision history

2 Firmware Changelog

Refer to the Spatial FOG Dual Reference Manual.

3 Hardware Changelog

Refer to the Spatial FOG Dual Reference Manual.

4 Introduction

Spatial FOG Dual ETH is a variant of the Spatial FOG Dual that has an Ethernet interface instead of the primary RS422 port. It also has two modified GPIO ports that operate at RS422 voltage levels for input only.

This document details the differences between the standard Spatial FOG Dual and the Ethernet variant. Any information in this document supersedes the equivalent information in the same section of the Spatial FOG Dual Reference Manual. The structure has remained the same (with the addition of Section 14) to align the section numbers.

The Spatial FOG Dual Reference Manual can be downloaded from our website www.advancednavigation.com/product/spatial-fog-dual#documentation.

If you have any questions please contact support@advancednavigation.com.

5 Foundation Knowledge

Refer to the Spatial FOG Dual Reference Manual.

6 Evaluation Kit

An Evaluation Kit is not available for the Spatial FOG Dual ETH variant.

7 Part Numbers and Ordering Options

7.1 Evaluation Kit

An Evaluation Kit is not available for the Spatial FOG Dual ETH variant.

7.2 Standalone Unit

Part Number	Description	Notes
SPATIAL-FOG-DUAL-ETH	Spatial FOG Dual Ethernet Unit	Spatial FOG Dual Ethernet unit L1 GPS, GLONASS and SBAS DGNSS supported Raw satellite data output supported License required for RTK, L2, BeiDou and Galileo No cables included

Table 2: Standalone unit part numbers

8 Specifications

8.1 Mechanical Drawings

Refer to the Spatial FOG Dual Reference Manual.

8.2 Navigation Specifications

Refer to the Spatial FOG Dual Reference Manual.

8.3 Heading Accuracy

Refer to the Spatial FOG Dual Reference Manual.

8.4 Sensor Specifications

Refer to the Spatial FOG Dual Reference Manual.

8.5 GNSS Specifications

Refer to the Spatial FOG Dual Reference Manual.

8.6 Communication Specifications

Parameter	Value
Primary Interface	Ethernet TCP
Primary Protocol	AN Packet Protocol (ANPP)
Auxiliary Interface	RS232
Auxiliary Protocol	External data ANPP input & output Serial input & output
GPIO Interface	RS422
GPIO Protocol	Digital and frequency input only
Ethernet Speed	10Base-T or 100Base-Tx (auto sensing)
Auxiliary Speed	4800 to 2 M baud
GPIO Speed	4800 to 2 M baud

Table 3: Communication specifications

Note the GNSS Receiver port is not directly accessible.

8.7 Hardware Specifications

Refer to the Spatial FOG Dual Reference Manual.

8.8 Electrical Specifications

Parameter	Minimum	Typical	Maximum
Power Supply			
Input Supply Voltage	9 V		36 V
Input Protection Range	-40 V		100 V
RS422			
Rx Differential Threshold	-0.2 V		-0.05 V
RS232			
Tx Voltage Low		-5.4 V	-5 V
Tx Voltage High	5 V	5.4 V	
Tx Short Circuit Current			±60 mA
Rx Threshold Low	0.6 V	1.2 V	
Rx Threshold High		1.5 V	2.0 V
GNSS Antenna			
Active Antenna Supply Voltage	4.8 V		5 V
Antenna Supply Current			150 mA

Table 4: Electrical specifications

8.9 Power Consumption

Refer to the Spatial FOG Dual Reference Manual.

8.10 Connector Pin-out

Power supply and signal connections are made through a 13 pin Glenair Mighty Mouse connector. The part number for the connector on the unit is 801-011-07M8-13PA. The part number for the recommended cable connector is 801-007-16M8-13SA. The connector provides a reliable and rugged connection to Spatial FOG Dual ETH under demanding conditions and is rated to IP68 in the mated condition.

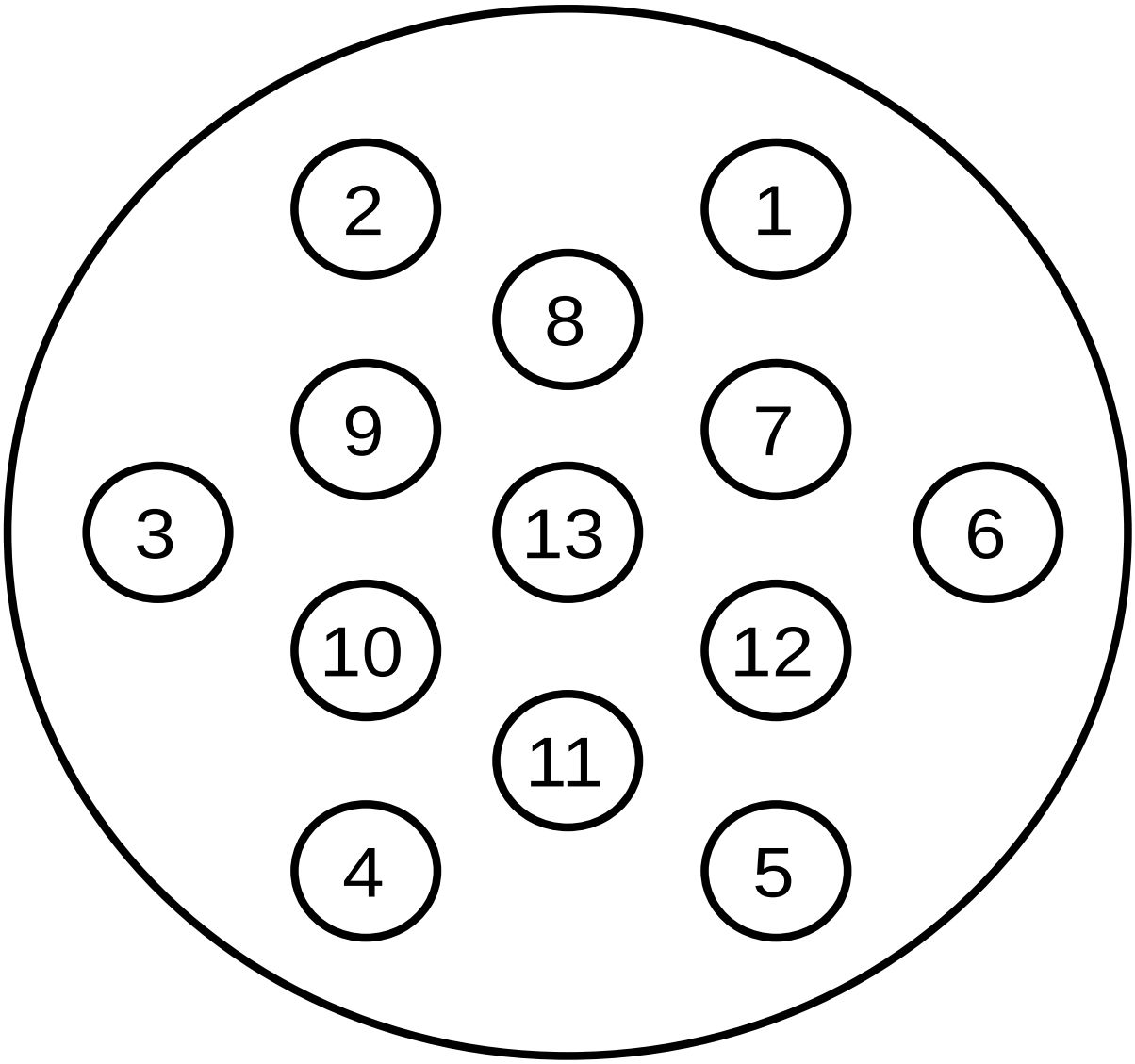

Illustration 1: View into the connector on the unit

Pin	Function
1	GPIO 2 -
2	Auxiliary RS232 Rx
3	Signal Ground
4	Power Ground
5	Power Supply
6	Ethernet Tx-
7	GPIO 2 +
8	GPIO 1 +
9	GPIO 1 -
10	Auxiliary RS232 Tx
11	Ethernet Rx+
12	Ethernet Rx-
13	Ethernet Tx+

Table 5: Pin allocation table

8.11 Spatial FOG Dual Evaluation Cable Harness

Advanced Navigation does not offer any pre-terminated evaluation cable harness for the Spatial FOG Dual ETH variant.

9 Installation

9.1 Installation Checklist

1. Securely mount the unit to the vehicle following the guidelines in section 9.2.
2. Mount the two GNSS antennas following the guidelines in section 9.5 and then connect the antenna cables between the antennas and the Spatial FOG Dual unit. If the two antennas are not installed in the standard configuration of primary front and secondary rear, the offset will need to be entered into the Dual Antenna dialogue in Spatial FOG Manager.
3. Connect your Ethernet cable to your router. Connect your Ethernet, power and optional GPIO cabling to Spatial FOG Dual.
4. The Spatial FOG Dual ETH is configured by default as a DHCP Client so it will automatically obtain an IP address from your router. Use the router interface to determine this IP address.
5. Open the Spatial FOG Manager software and select Network Connect under the Tools menu. Enter the IP address and set the port number to 16718. Click the Connect button.
6. If the unit is mounted in an alignment other than the standard alignment of X pointing forward and Z pointing down, this alignment offset will need to be entered into the Alignment Configuration dialogue in Spatial FOG Manager. Please see section 9.2.1 for more details.
7. Accurately measure the GNSS antenna offset from the centre of the Spatial FOG Dual unit to the central base of the antenna in the body co-ordinate frame (X positive forward and Z positive down) and enter these values into the Alignment Configuration dialogue in Spatial FOG Manager. Please see section 9.5 for more details. Please note that the body axes are always X positive forward and Z positive down irrespective of any alignment offset entered in the previous step.
8. Enter the vehicle type in the Filter Options dialogue in Spatial FOG Manager.
9. The system is now ready for use.

10 Operation

Refer to the Spatial FOG Dual Reference Manual.

11 Spatial FOG Manager

Refer to the Spatial FOG Dual Reference Manual.

11.1 Software Changelog

Refer to the Spatial FOG Dual Reference Manual.

11.2 System Requirements

Refer to the Spatial FOG Dual Reference Manual.

11.3 Installation

Refer to the Spatial FOG Dual Reference Manual.

11.4 Troubleshooting

Please contact support@advancednavigation.com if you are having issues.

11.5 Main View

Refer to the Spatial FOG Dual Reference Manual.

11.5.1 Serial Port

You cannot connect to the Spatial FOG Dual ETH variant using a serial port connection. Please see section 11.9.5 for information on connecting via the Ethernet interface.

11.6 Logging

Refer to the Spatial FOG Dual Reference Manual.

11.7 Views

Refer to the Spatial FOG Dual Reference Manual.

11.8 Configuration

Refer to the Spatial FOG Dual Reference Manual.

11.8.1 Configuration Export

Refer to the Spatial FOG Dual Reference Manual.

11.8.2 Filter Options

Refer to the Spatial FOG Dual Reference Manual.

11.8.3 Packet Rates

Refer to the Spatial FOG Dual Reference Manual.

11.8.4 Alignment Configuration

Refer to the Spatial FOG Dual Reference Manual.

11.8.5 Baud Rates

It is strongly recommended you do not modify the baud rates for the Primary port. The baud rate is pre-configured to communicate at 115200 bps directly with the Ethernet interface. If it is necessary to change this rate, it must also be changed on the Ethernet interface to match. Please contact support@advancednavigation.com before you make any changes.

Using Spatial FOG Manager you can modify the Auxiliary and GPIO port baud rates to suit your requirements.

When changing baud rates, some Microsoft Windows machines are unable to function at the higher baud rates. It is recommended to test the baud rate first with the permanent box unticked. This way, if it is not possible to communicate at the higher baud rate, a power cycle can be used to revert to the previous baud rate.

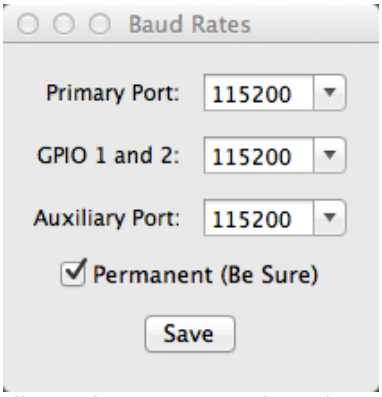

Illustration 2: Screenshot of Spatial FOG Manager baud rates dialogue

11.8.6 GPIO Configuration

This dialogue allows the user to select the input and output function of the GPIO and Auxiliary ports. These functions change dynamically and are effective immediately upon pressing save. Please note that the Auxiliary port operates at RS232 voltage levels whilst the GPIO ports 1 and 2 function at RS422 voltage levels. The internal hardware automatically reconfigures based upon the selected function. See section 12.4 for the list of available functions.

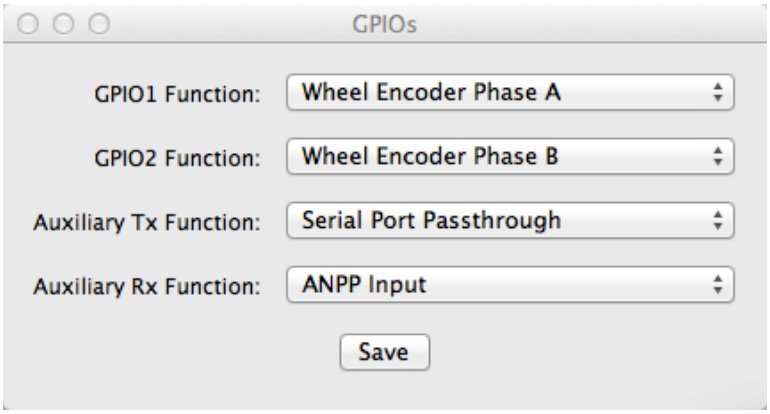

Illustration 3: Screenshot of Spatial FOG Manager GPIO configuration dialogue

Please contact support@advancednavigation.com before you make any changes, as this variant is only designed for GPIO ports 1 and 2 to function as inputs.

11.8.7 Odometer

Refer to the Spatial FOG Dual Reference Manual.

11.8.8 Reset

Refer to the Spatial FOG Dual Reference Manual.

11.8.9 Heave Offset

Refer to the Spatial FOG Dual Reference Manual.

11.8.10 GPIO Output

Refer to the Spatial FOG Dual Reference Manual.

11.9 Tools

Refer to the Spatial FOG Dual Reference Manual.

11.9.1 Terminal

Refer to the Spatial FOG Dual Reference Manual.

11.9.2 Firmware Update

Refer to the Spatial FOG Dual Reference Manual.

11.9.3 Log Converter

Refer to the Spatial FOG Dual Reference Manual.

11.9.4 NTRIP Client

Refer to the Spatial FOG Dual Reference Manual.

11.9.5 Network Connect

The Network Connect dialogue allows Spatial FOG Manager to make a connection to Spatial FOG Dual over a TCP/IP network. The Spatial FOG Dual ETH is configured by default as a DHCP Client so it will automatically obtain an IP address from your router. Use the router interface to determine this IP address.

Enter the IP address and set the port number to 16718. Click the Connect button.

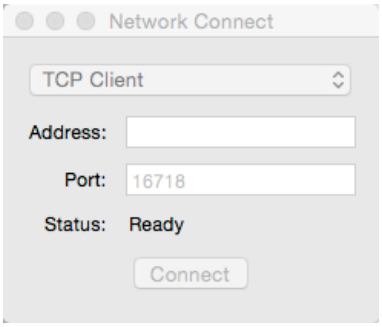

Illustration 4: Screenshot of Spatial FOG Manager network connect dialogue

See section 14.1 for information on changing the network settings.

12 Interfacing

12.1 Communication

Communication with the Spatial FOG Dual ETH Primary port is over an Ethernet connection interface using the Advanced Navigation Packet Protocol (ANPP). See section 13 for details on the Advanced Navigation Packet Protocol.

Communication with the Spatial FOG Dual ETH Auxiliary port is over a RS232 connection (1 start bit, 8 data bits, 1 stop bit and no parity).

Communication with the Spatial FOG Dual ETH GPIO ports 1 and 2 are over a RS422 connection (1 start bit, 8 data bits, 1 stop bit and no parity). Only inputs are supported with this variant.

12.1.1 Baud Rate

The default baud rate of the Spatial FOG Dual ETH GPIO ports and Auxiliary port is 115,200 baud. The baud rate can be set anywhere from 4800 to 2 M baud for the GPIO ports and the Auxiliary port, and can be modified using the Spatial FOG Manager software or the baud rate packet, see section 13.10.3. It is important to select a baud rate that is capable of carrying the amount of data that Spatial FOG Dual is set to send or receive. See packet rates in section 13.5 for more details on data output calculation. The data rate in bytes per second can be calculated by dividing the baud rate by 10. For example if the baud rate is 115200, then the data rate is 11520 bytes per second.

12.2 External Data

External sources of position, velocity and/or heading can be integrated into Spatial FOG Dual's filter solution. The data can be sent to Spatial FOG Dual in the ANPP format over the Primary or Auxiliary port, or through the Auxiliary port in a number of different formats. If using the ANPP, please use Table 6 below to find the relevant section. If using the Auxiliary ports, please see section 12.3.

Packet	Section
External Position and Velocity	13.9.25
External Position	13.9.26
External Velocity	13.9.27
External Body Velocity	13.9.28
External Heading	13.9.29
External Time	13.9.33
External Depth	13.9.34
External Odometer	13.9.43
External Air Data	13.9.44

Table 6: ANPP external data reference

12.3 The GPIO and Auxiliary Ports

In addition to the Primary port, Spatial FOG Dual ETH contains two general purpose input output ports (GPIO1 and GPIO2) and an Auxiliary port. These ports are multi function and can be used to extend Spatial FOG Dual with additional peripherals, sensors and data formats.

The GPIO port functions and Auxiliary port functions available are listed in section 12.4. The function of a GPIO port or the Auxiliary port can be changed at any time using the GPIO Configuration dialogue in Spatial FOG Manager (see section 11.8.6) or the GPIO Configuration Packet #188.

12.3.1 GPIO Pins Voltage Level

GPIO1 and GPIO2 function at RS422 levels.

12.3.2 GNSS Receiver Port

The GNSS Receiver port is not directly accessible. Access is via the GNSS Receiver Passthrough function on the Auxiliary port.

12.4 Dynamic Pin Functions

Function	Type	GPIOs	Auxiliary
Inactive	Tristate	All	Yes
1PPS Output	Digital Output		
GNSS Fix Output	Digital Output		
Odometer Input	Frequency Input	All	
Zero Velocity Input	Digital Input	All	
NMEA Input	Serial Receive	2	Receive
NMEA Output	Serial Transmit		Transmit
Novatel GNSS Input	Serial Receive	2	Receive
Topcon GNSS Input	Serial Receive	2	Receive
ANPP Input	Serial Receive	2	Receive
ANPP Output	Serial Transmit		Transmit
Disable GNSS	Digital Input	All	
Disable Pressure	Digital Input	All	
Set Zero Orientation Alignment	Digital Input	All	
System State Packet Trigger	Digital Input	All	
Raw Sensors Packet Trigger	Digital Input	All	
RTCM Differential GNSS Corrections Input	Serial Receive	2	Receive
Trimble GNSS Input	Serial Receive	2	Receive
u-blox GNSS Input	Serial Receive	2	Receive
Hemisphere GNSS Input	Serial Receive	2	Receive
Left Wheel Speed Sensor	Frequency Input	All	
Right Wheel Speed Sensor	Frequency Input	All	
1PPS Input	Digital Input	All	
Wheel Speed Sensor	Frequency Input	All	
Wheel Encoder Phase A	Frequency Input	All	
Wheel Encoder Phase B	Frequency Input	All	
Event 1 Input	Digital Input	All	
Event 2 Input	Digital Input	All	
GNSS Receiver Passthrough	Serial		Yes
TSS1 Output	Serial Transmit		Transmit
Simrad 1000 Output	Serial Transmit		Transmit
Simrad 3000 Output	Serial Transmit		Transmit

Serial Port Passthrough	Serial		Yes
Gimbal Encoder Phase A	Frequency Input	All	
Gimbal Encoder Phase B	Frequency Input	All	
Odometer Direction, Forward Low	Digital Input	All	
Odometer Direction, Forward High	Digital Input	All	

Table 7: GPIO pin functions

13 Advanced Navigation Packet Protocol

Refer to the Spatial FOG Dual Reference Manual.

14 The Ethernet Interface

The Ethernet interface is used to connect to the Primary port of the Spatial FOG Dual ETH via a TCP connection. This Ethernet interface can be configured using a web browser if your computer is on the same network as the Spatial FOG Dual ETH.

The Spatial FOG Dual ETH is configured by default as a DHCP Client so it will automatically obtain an IP address from your router when connected to the network. You can use your router interface to determine this IP address. Once you have the IP address you can use a web browser to display the Ethernet interface configuration screens.

Parameter	Value
Primary Port IP Address	Assigned by your router
Primary Port TCP Port Number	16718
Primary Port Ethernet Interface Channel Number	1

Table 8: TCP Port Connection Values

14.1 Network Settings

Using the Ethernet interface Network Settings page you can modify the network connection properties such as swapping to a fixed IP address.

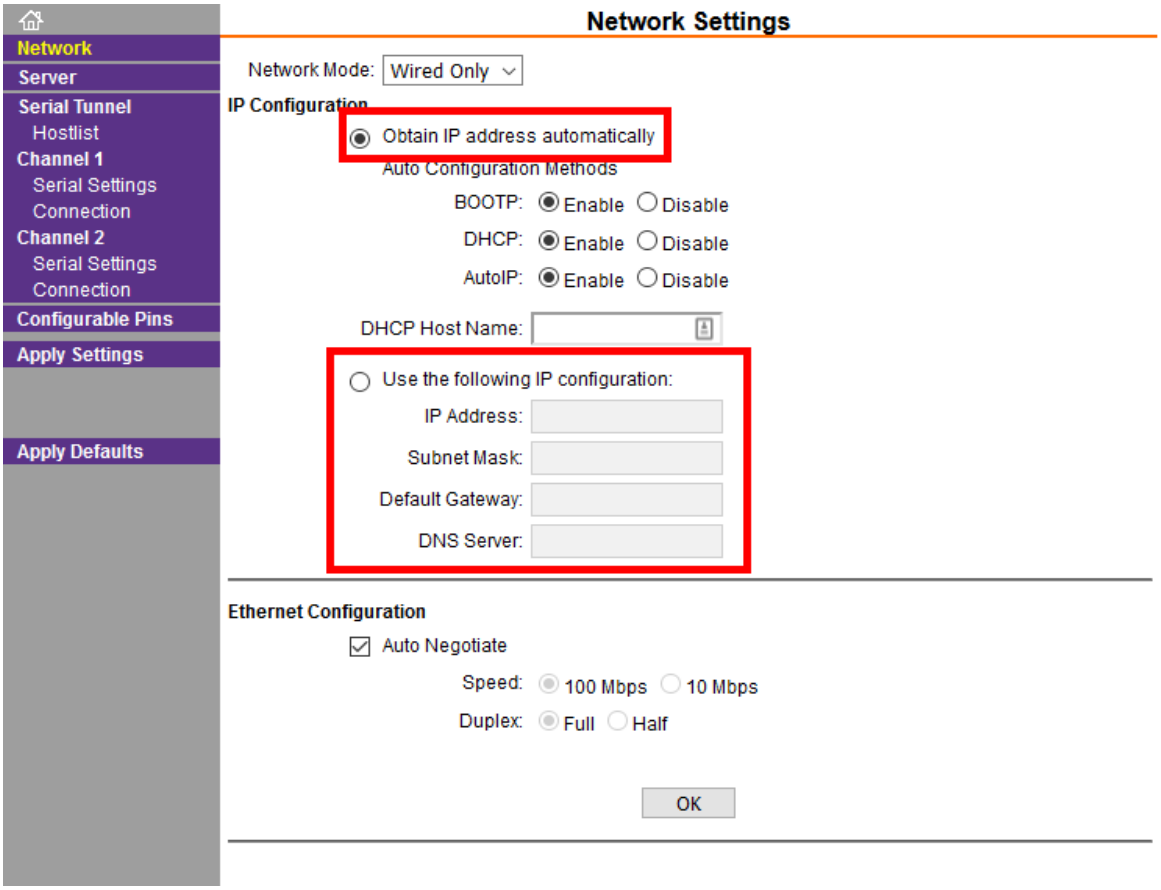

Illustration 5: Screenshot of Ethernet interface Network Settings page

Click OK when done.

WARNING: if using a fixed IP address you MUST remember the details you enter. If you reset the Ethernet interface back to its factory default settings using the Apply Defaults page, the IP Configuration settings you have set WILL NOT change.

14.2 Serial Settings

The Primary port is assigned to Channel 1 of the Ethernet interface. Using the Channel 1 Serial Settings pages you can modify the baud rate used to connect the Spatial FOG Dual to the internal Ethernet interface.

It is strongly recommended you do not modify the baud rates for Channel 1. These baud rates are pre-configured to communicate at 115200 bps directly with the Spatial FOG Dual. If it is necessary to change these rates, they must also be changed on the Spatial FOG Dual to match. Please contact support@advancednavigation.com before you make any changes.

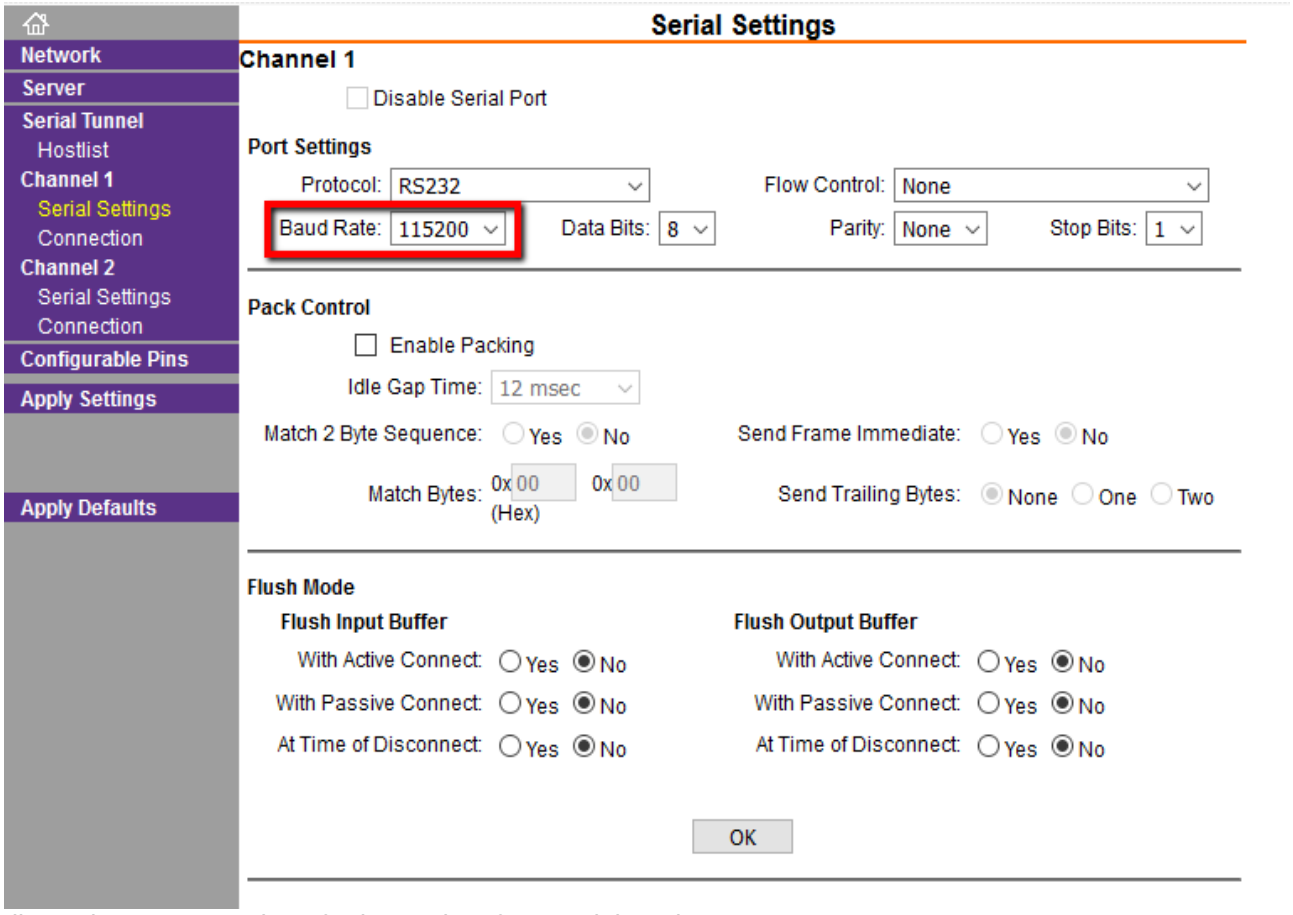

Illustration 6: Screenshot of Ethernet interface Serial Settings page

Click OK when done.

WARNING: if you reset the Ethernet interface back to its factory default settings using the Apply Defaults page, you will need to set the CPU Performance Mode on the Server Settings page to High, and then reset the Channel 1 and Channel 2 baud rates from the default values of 9600 baud to 115200.

14.3 Connection Settings

Using the Channel 1 Connection Settings page you can modify the TCP Port number. The default values are listed in Table 7.

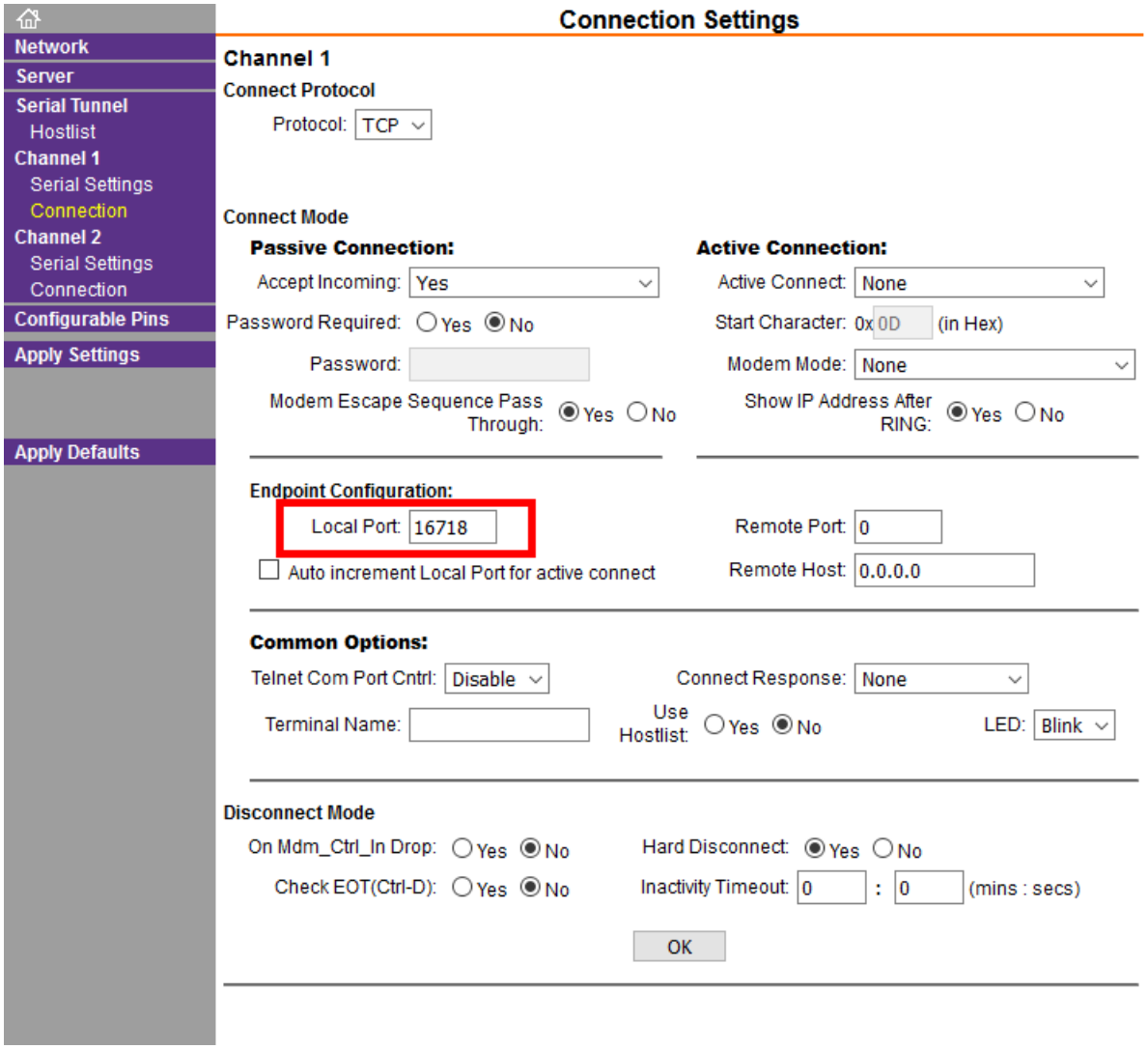

Illustration 7: Screenshot of Ethernet interface Connection Settings page

Click OK when done.

WARNING: if you reset the Ethernet interface back to its factory default settings using the Apply Defaults page, you will need to reset the Channel 1 and Channel 2 Local Port numbers from the default values of 10001 and 10002 to 16718 and 16719.

14.4 Saving Changes

After making any changes to the Ethernet interface settings, it is necessary to actually save the changes by using the Apply Settings page. The Ethernet interface will automatically reset after storing the changes. This should take less than a minute.

Whilst the changes are being saved you will see a status page:

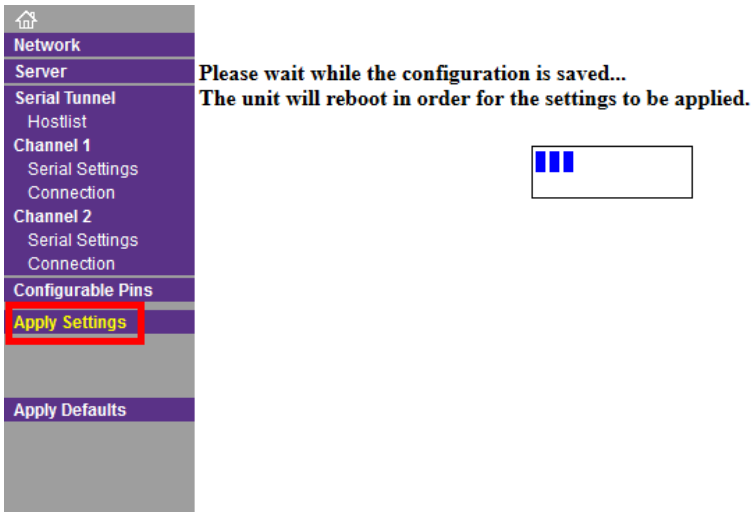

Illustration 8: Screenshot of Ethernet interface configuration settings saving page

NOTE: The OK buttons on the individual settings pages do need to be pressed after any change is made, but they DO NOT actually save the changes on the device.

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