



# Configuring the SPAN-SE for HYPACK Integration

Application Note

## **Configuring the SPAN-SE for HYPACK Integration**

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### **1 Overview**

This application note describes how to configure and communicate with a NovAtel SPAN-SE receiver for use with HYPACK software. The processes for setting up a logging profile to interface with HYPACK and using the NovAtel SPAN-SE drivers in HYPACK and HYSWEEP for real-time data collection will be described.

### **2 Required Hardware**

The following hardware is required to setup a SPAN-SE receiver to interface with HYPACK 2013 software:

- User supplied computer with an available Ethernet, serial and/or USB port
- SPAN-SE receiver with a Heave model (including cables)
- NovAtel IMU (Inertial Measurement Unit) with cables
- Power supply
- All or one of the following for communications:
  - USB cable
  - USB-to-serial adaptor
  - CAT5 Ethernet cable
  - RS-232 straight through cable
- Two (2) GNSS antennas
- Two (2) standard 5 metre 50 ohm TNC-to-TNC antenna cables

### 3 SPAN-SE Configuration

#### 3.1 System Alignment Procedure

1. Make all necessary power and IMU cable connections. Ensure that the DB9 connector on the IMU cable is securely connected to the IMU port on the yellow I/O cable. If using an IMU-CPT, pin 35 on the IMU cable must be connected to EVENT-IN 4 of the yellow I/O cable.
2. Power the unit and connect to your SPAN-SE via USB, Ethernet, or serial port (COM1 is recommended) with either NovAtel Connect or another terminal program such as Windows HyperTerminal. For more information on receiver communication, refer to our online video tutorial *Communicating with the Receiver* found at <http://www.novatel.com/support/knowledge-and-learning/video-tutorials-and-tech-presentations/>.
3. Issue the SETIMUTYPE command to specify the type of IMU being used (see *Appendix A: SPAN Commands and Logs*).

```
SETIMUTYPE IMU_KVH_COTS
```

4. Enter the lever arm from the IMU to the primary antenna (the primary antenna is connected to the connector labeled *GPS 1*) using the SETIMUTOANTOFFSET command (see *Appendix A: SPAN Commands and Logs*).

```
SETIMUTOANTOFFSET 0.54 0.32 1.20 0.03 0.03 0.05
```

5. Enter the lever arm from the IMU to the secondary antenna (the secondary antenna is connected to the connector labeled *GPS 2*) using the SETIMUTOANTOFFSET2 command (see *Appendix A: SPAN Commands and Logs*).

```
SETIMUTOANTOFFSET2 0.54 0.32 1.20 0.03 0.03 0.05
```

The alignment occurs after the receiver establishes communication with the IMU and computes a fixed integer, verified heading solution. The INS Status field changes to `INS_ALIGNMENT_COMPLETE` and will then reach `INS_SOLUTION_GOOD` after some vehicle dynamics.

**Note:** The receiver will echo with an <OK acknowledgement for each command entered.

### 3.2 SPAN-SE Ethernet Connection

The SPAN-SE receiver has a unique Media Access Control (MAC) address, hard coded into flash, and user-configurable IP information. There are four ports available for Ethernet: Ports 3000, 3001, 3002 and 3003. These ports are used to access ICOM1, ICOM2, ICOM3 and ICOM4 respectively. Each port can be used for either Transmission Control Protocol (TCP) or User Datagram Protocol (UDP) traffic, but not simultaneously.

The SPAN-SE uses a static IP address. There is no Dynamic Host Configuration Protocol (DHCP) support on the SPAN-SE.

An FTP port is available for transfer of data files from the data logging SD Card.

The receiver is shipped with the following default configuration:

- Default IP: 192.168.0.10
- Default mask: 255.255.255.0
- Default Gateway: 192.168.0.1

The MAC address is available to through the MAC log.

#### 3.2.1 Configuring for TCP or UDP Operation

Each SPAN-SE Ethernet port can be configured for either TCP or UDP. The default configuration of the Ethernet ports is for TCP operation. To configure the Ethernet ports for UDP operation, see the ICOMCONFIG command in *Appendix A: SPAN Commands and Logs*.

#### 3.2.2 Configuring the Ethernet Connection Settings

Use the IPCONFIG command, see *Appendix A: SPAN Commands and Logs*, to set the static IP address, the subnet mask and the gateway. An example of the IPCONFIG command is:

```
IPCONFIG ETHA STATIC 10.1.100.25 255.255.255.0 10.1.100.1
```

#### 3.2.3 Configuring Log Requests Destined for the Ethernet Port

The COM port identifier for the Ethernet port is ICOM1 in ASCII or 23 in binary. A sample log request for the Ethernet port is:

```
LOG ICOM1 RANGECPMB ONTIME 1
```

### 3.2.4 Connecting to the Ethernet Port

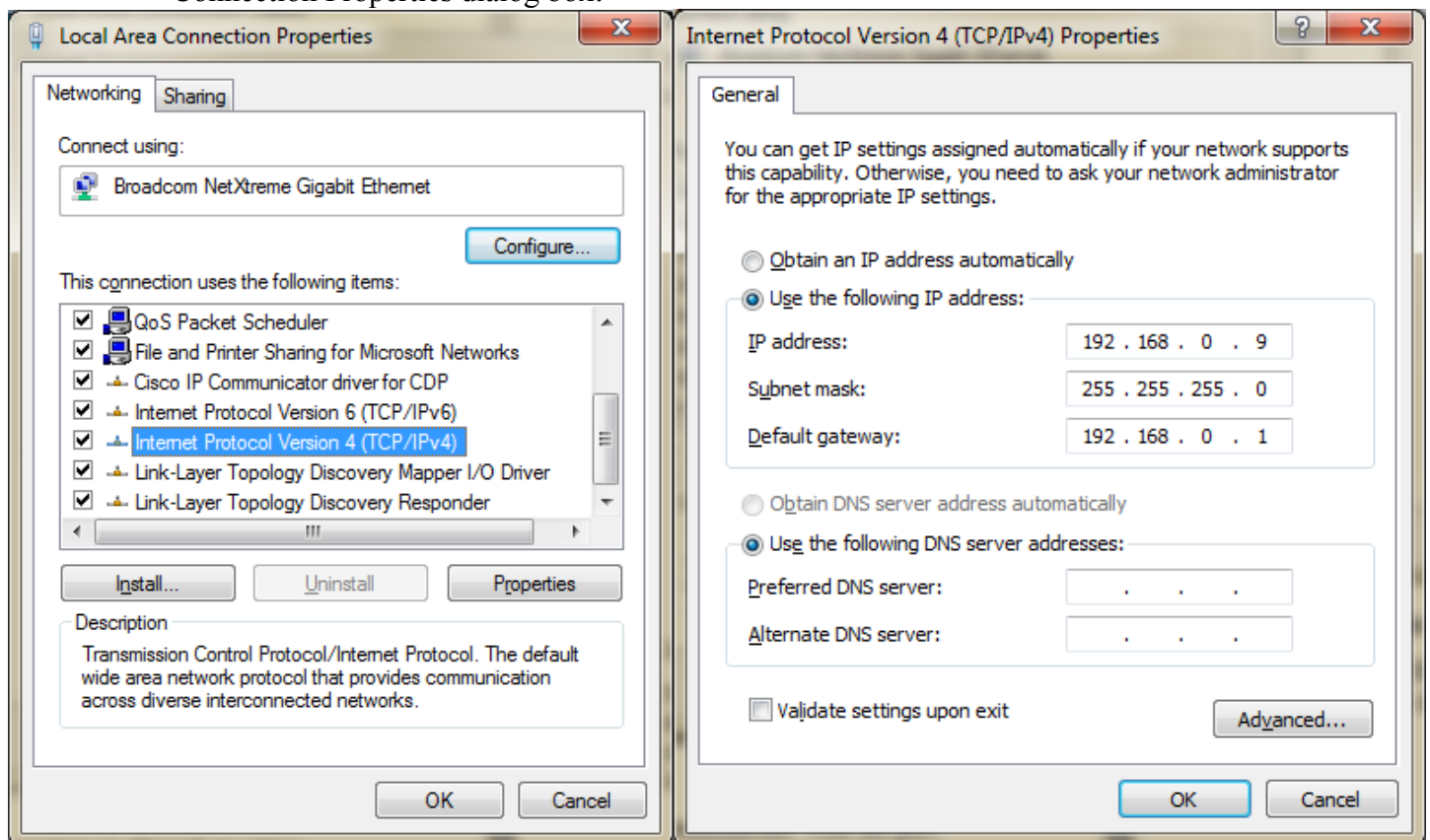
If the port is configured in TCP mode, only one connection to the receiver is allowed at a time. Data automatically streams to the IP address that connects to the port.

Because UDP is a connectionless protocol, multiple end-points could communicate with the port at one time from multiple IP addresses. Data streams to the last IP address to communicate with the receiver.

For details on the FTP functionality of the Ethernet port, see the *SPAN-SE User Manual*.

To connect the SPAN-SE directly to the computer's Ethernet port (not through a network), follow these steps:

1. Connect the computer's Ethernet port to the SPAN-SE Ethernet port using a shielded Ethernet cross-over cable.
2. Set the static IP address on the computer to the following settings in the Local Area Connection Properties dialog box:



**Note:** The last octet of the IP address can be any number from 1 to 255 inclusive except for 10, which is the last value in the SPAN-SE default IP address. In the above example, we have used 9 for the last octet.

### 3.3 Setting up the SPAN-SE Logging Profile

The SPAN-SE receiver has four COM ports, a USB port and four Ethernet ports available for logging and data collection.

**Table 1: COM Port Identifiers**

Binary	ASCII	Description
1	COM1	COM Port 1 (yellow I/O cable)
2	COM2	COM Port 2 (yellow I/O cable)
3	COM3	COM Port 3 (green I/O cable)
13	USB1	USB Device
19	COM4	COM Port 4 (green I/O cable)
23	ICOM1	10/100 Ethernet 1
24	ICOM2	10/100 Ethernet 2
25	ICOM3	10/100 Ethernet 3
29	ICOM4	10/100 Ethernet 4

#### 3.3.1 HYPACK LOGS

Send the following commands to set up a logging profile for HYPACK Survey. Logging can be done on any of the available ports. See *Table 1: COM Port Identifiers*. COM1 will be used to illustrate the logging commands<sup>1</sup>. A SAVECONFIG command is issued at the end of each logging profile to save all settings and logs to the receiver's NVM.

```
COM COM1 115200
LOG COM1 BESTPOSA ONTIME 1
LOG COM1 INSPVAA ONTIME 0.05
LOG COM1 TIMEA ONTIME 1
LOG COM1 HEAVEA ONNEW
SAVECONFIG2
```

---

<sup>1</sup> Always connect to a different port than you are logging to. For example, connect on USB to send commands to log on COM1.

<sup>2</sup> When using NovAtel Connect software, close all graphical windows before issuing a SAVECONFIG command

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### 3.3.2 HYSWEEP LOGS

Send the following commands to set up a logging profile for HYSWEEP Survey. Logging must be done on a network port (see *Table 1: COM Port Identifiers*). The IPCONFIG command is used to set the IP address used on the SPAN-SE (see *Appendix A: SPAN Commands and Logs*). ICOM1 will be used to illustrate the logging commands.

```
IPCONFIG ETHA STATIC <IP> <MASK> <GATEWAY>
LOG ICOM1 HEAVEA ONNEW
LOG ICOM1 INSPVAA ONTIME 0.05
SAVECONFIG3
```

**Note:** Logging rates are user configurable with the exception of the HEAVEA log. This message is available at approximately 10 Hz and must be logged with the ONNEW trigger.

The periods available when you use the ONTIME trigger are 0.005 (200Hz), 0.01 (100Hz), 0.02 (50 Hz), 0.05, 0.1, 0.2, 0.25, 0.5, 1, 2, 3, 5, 10, 15, 20, 30 or 60 seconds. BESTPOSA logs are available at <1, 1 and 5 Hz only.

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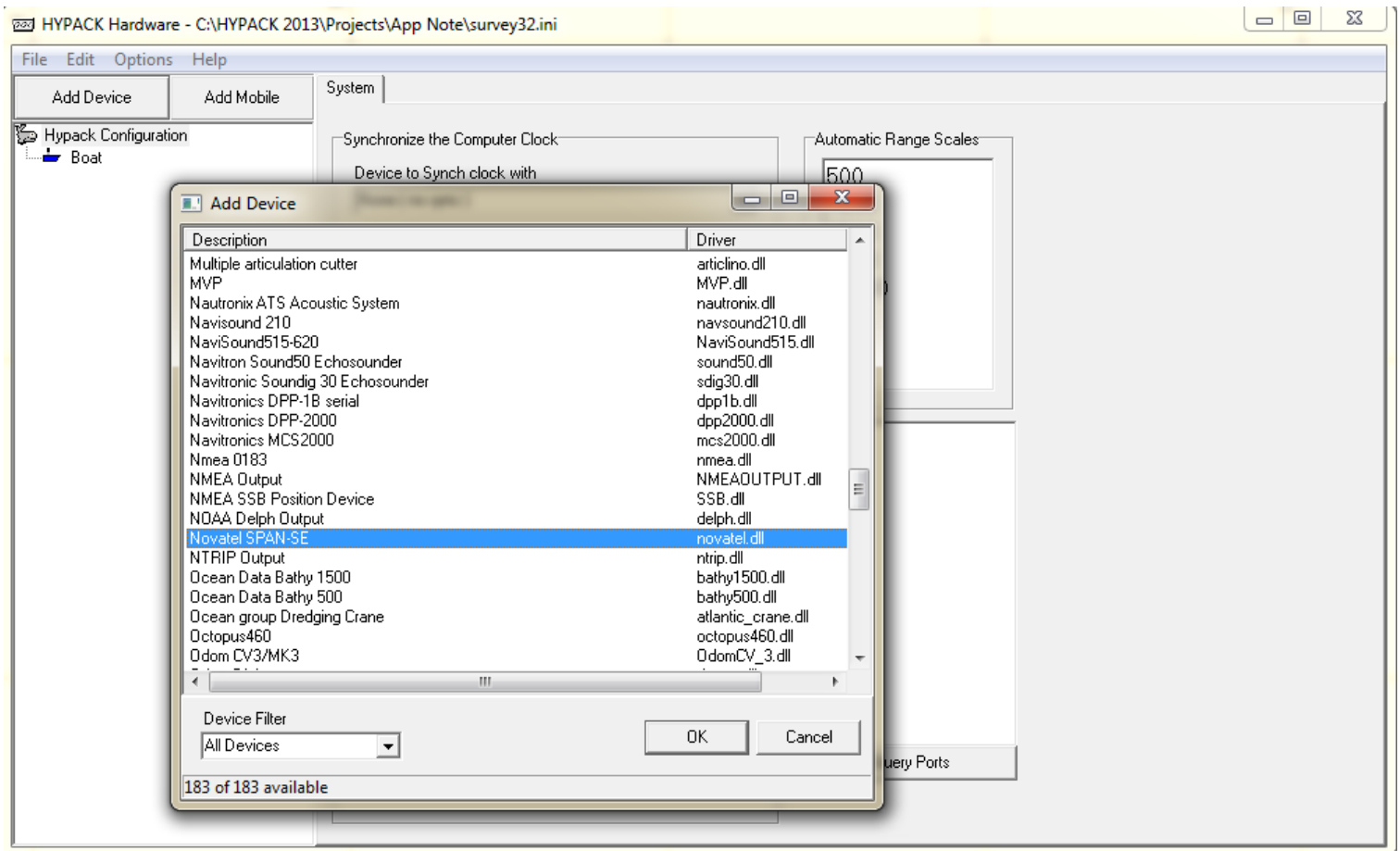
<sup>3</sup> When using NovAtel Connect software, close all graphical windows before issuing a SAVECONFIG command



## 4 Establishing Communications in HYPACK

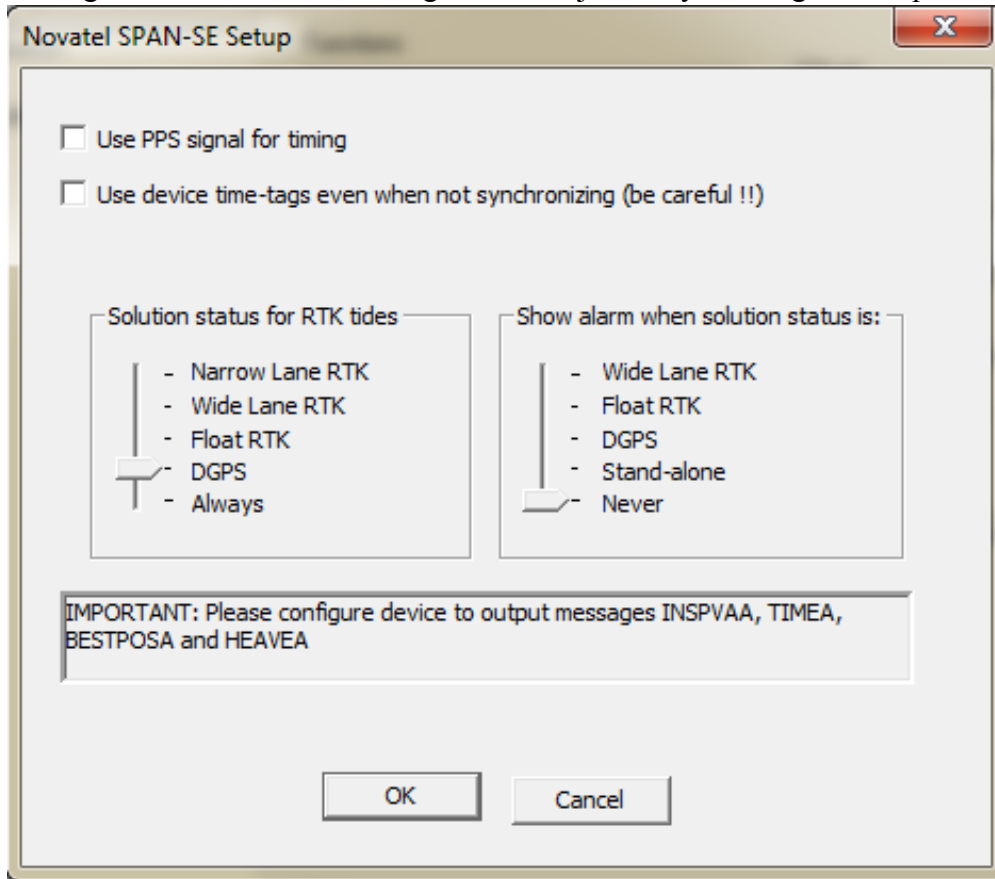
### 4.1 HYPACK Hardware

1. Add the NovAtel SPAN-SE system (novatel.dll) to the device list. Ensure that you have downloaded all the latest updates from the HYPACK website to have access to the NovAtel device. Current releases from HYPACK can be found at the following link: <http://support.hypack.com/support/index.php?/Knowledgebase/List/Index/24/downloads>.



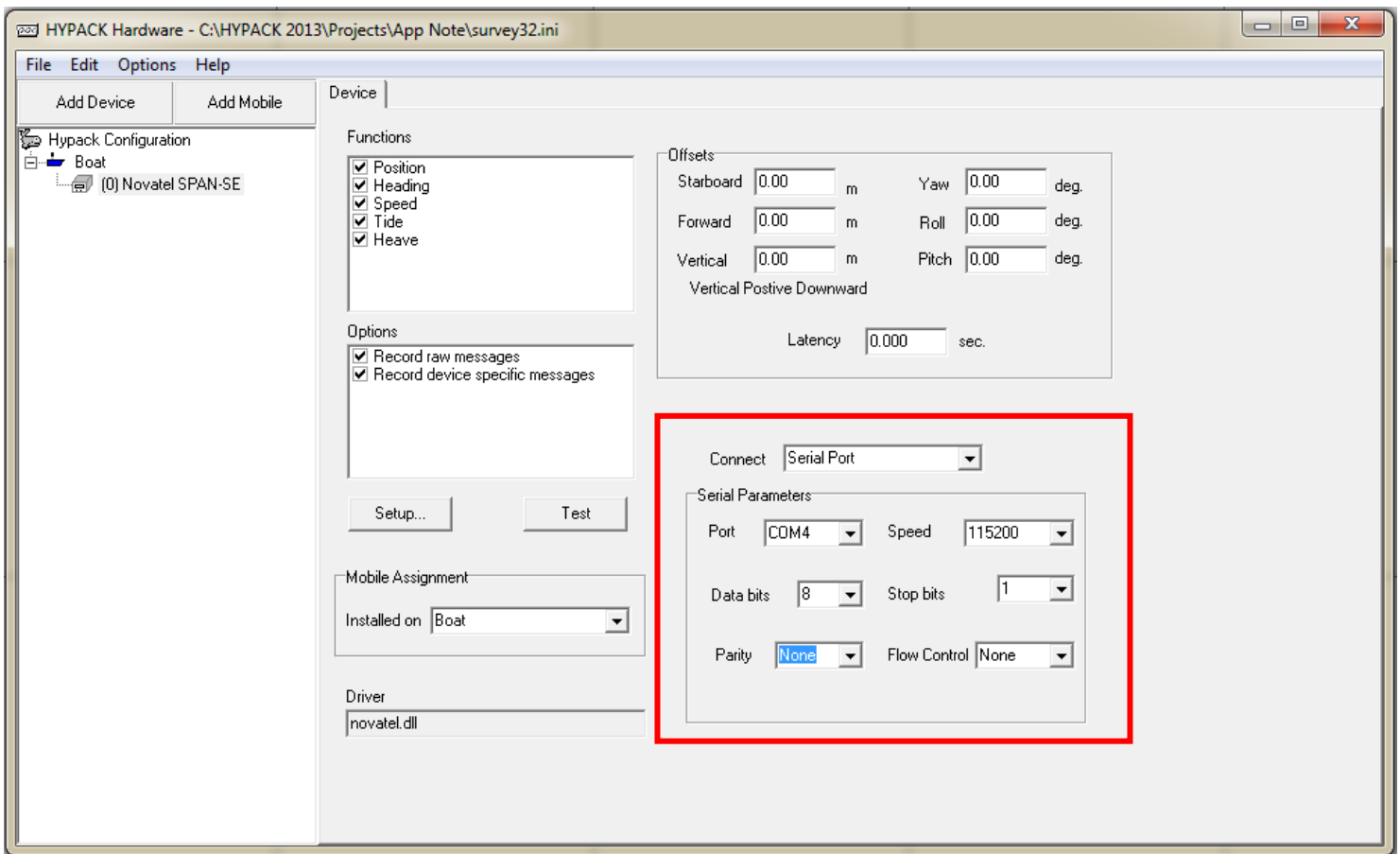
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2. Timing and solution status settings can be adjusted by clicking on Setup...



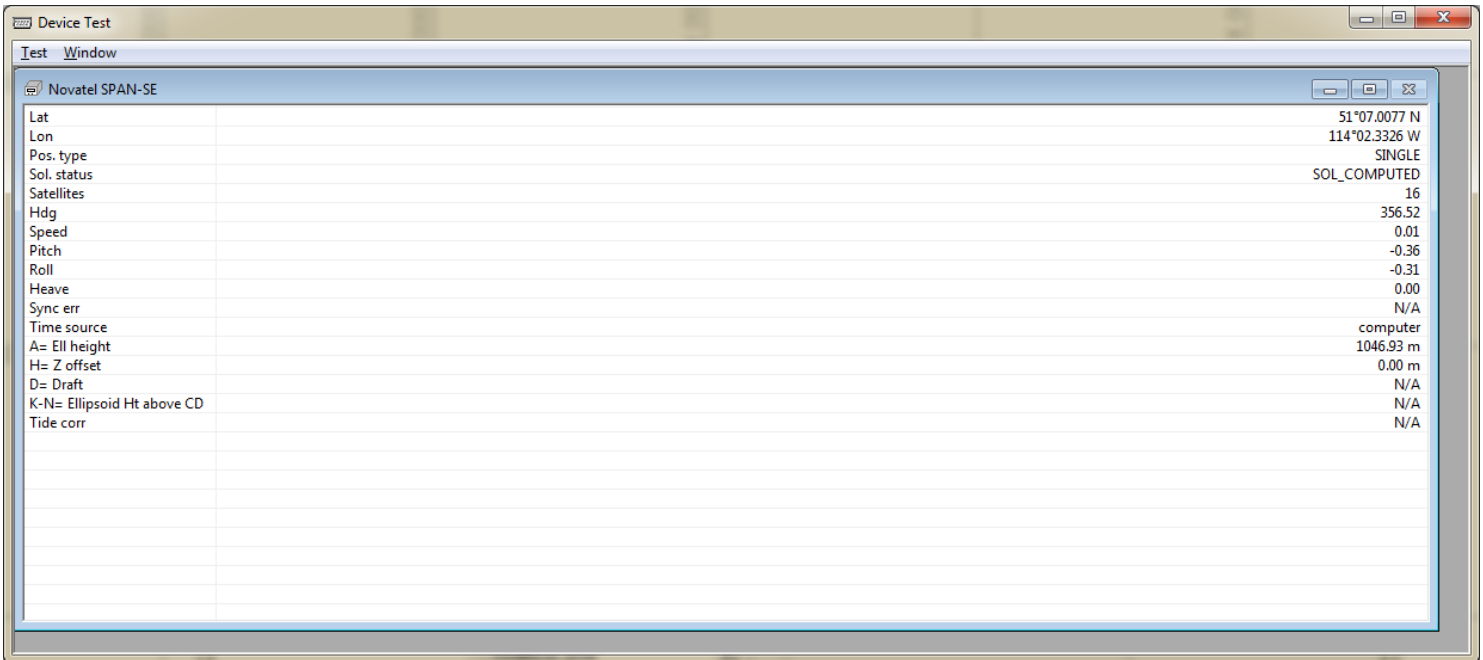
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3. Establish communication to the receiver using the Connect menu in HYPACK Hardware. The COM port selected refers to the computer COM port to which the receiver is connected.



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3. Test HYPACK communications with the SPAN system. Values in the Device Test window will be updating reasonably if the system is working correctly.



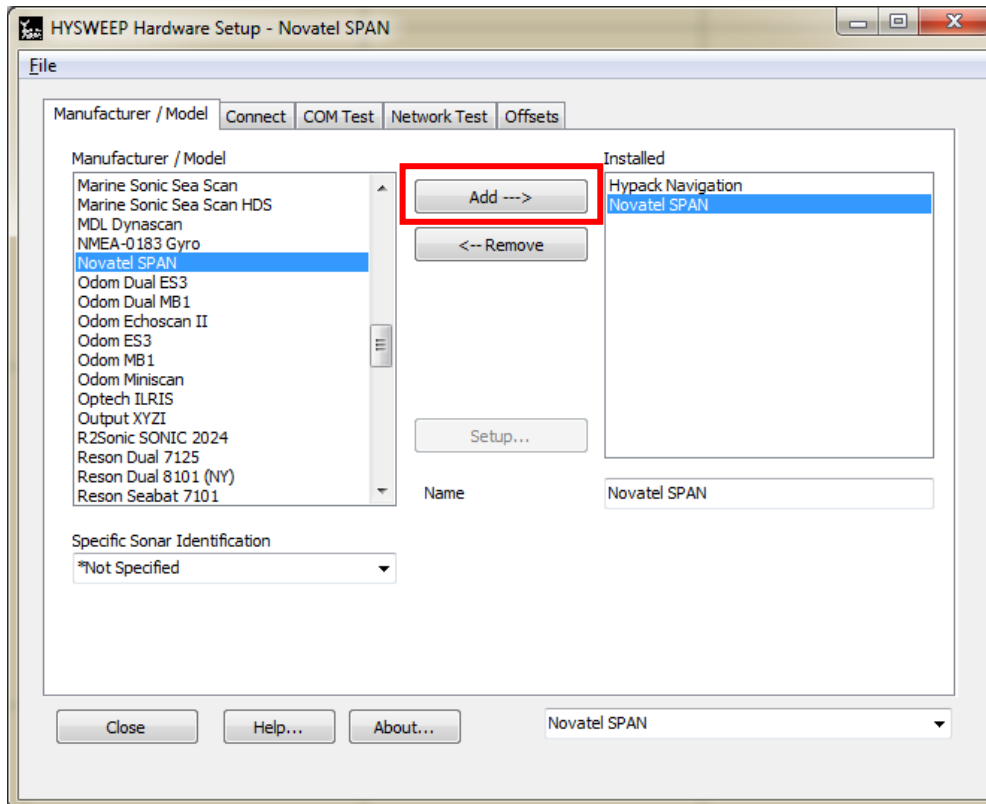
The screenshot shows a window titled "Device Test" with a sub-window "Novatel SPAN-SE". It displays a list of parameters and their corresponding values:

Parameter	Value
Lat	51°07.0077 N
Lon	114°02.3326 W
Pos. type	SINGLE
Sol. status	SOL_COMPUTED
Satellites	16
Hdg	356.52
Speed	0.01
Pitch	-0.36
Roll	-0.31
Heave	0.00
Sync err	N/A
Time source	computer
A= Ell height	1046.93 m
H= Z offset	0.00 m
D= Draft	N/A
K-N= Ellipsoid Ht above CD	N/A
Tide corr	N/A

4. Close and save your HYPACK Hardware.

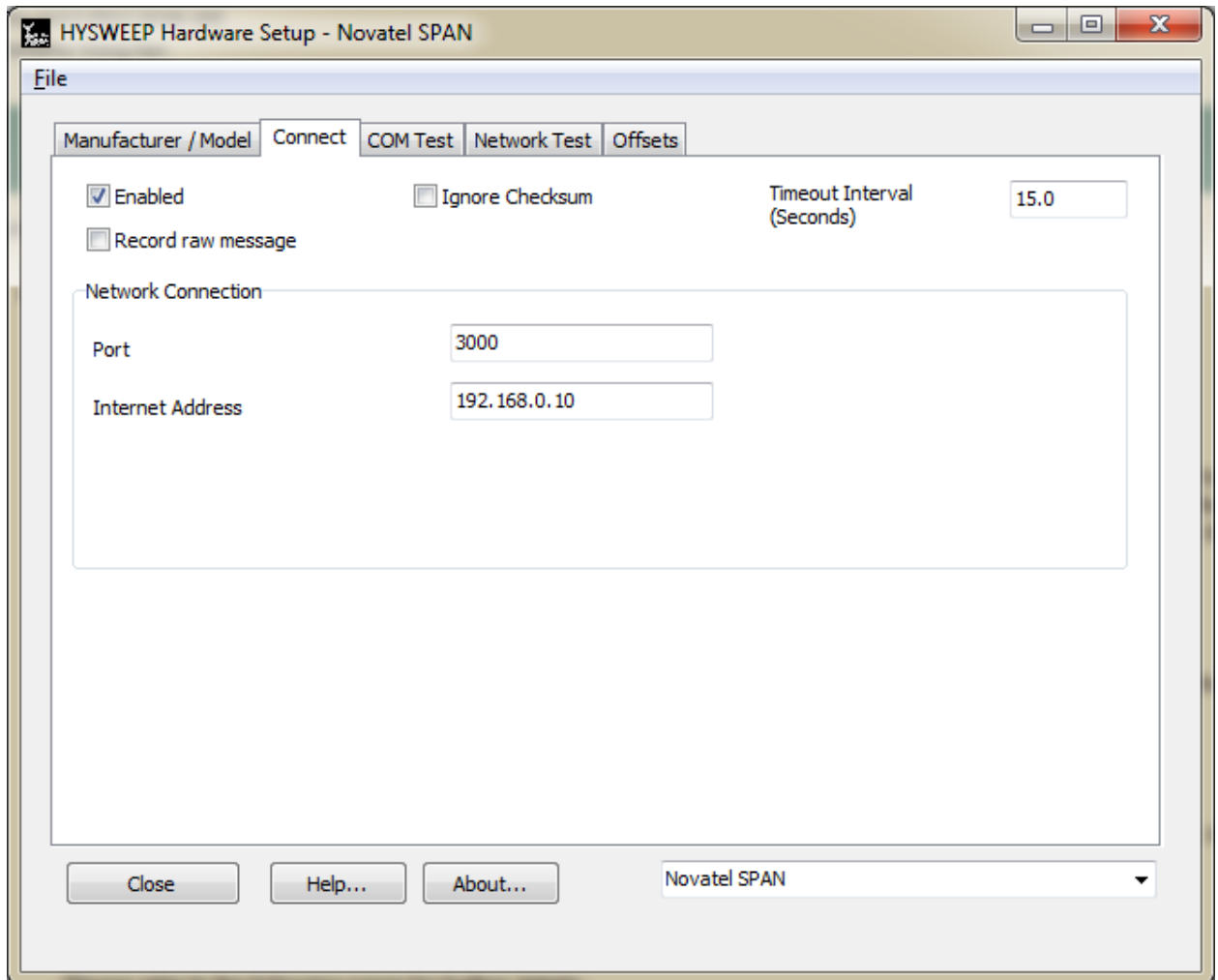
### 4.2 HYSWEEP Hardware

1. Add the NovAtel SPAN system to the list of installed hardware.



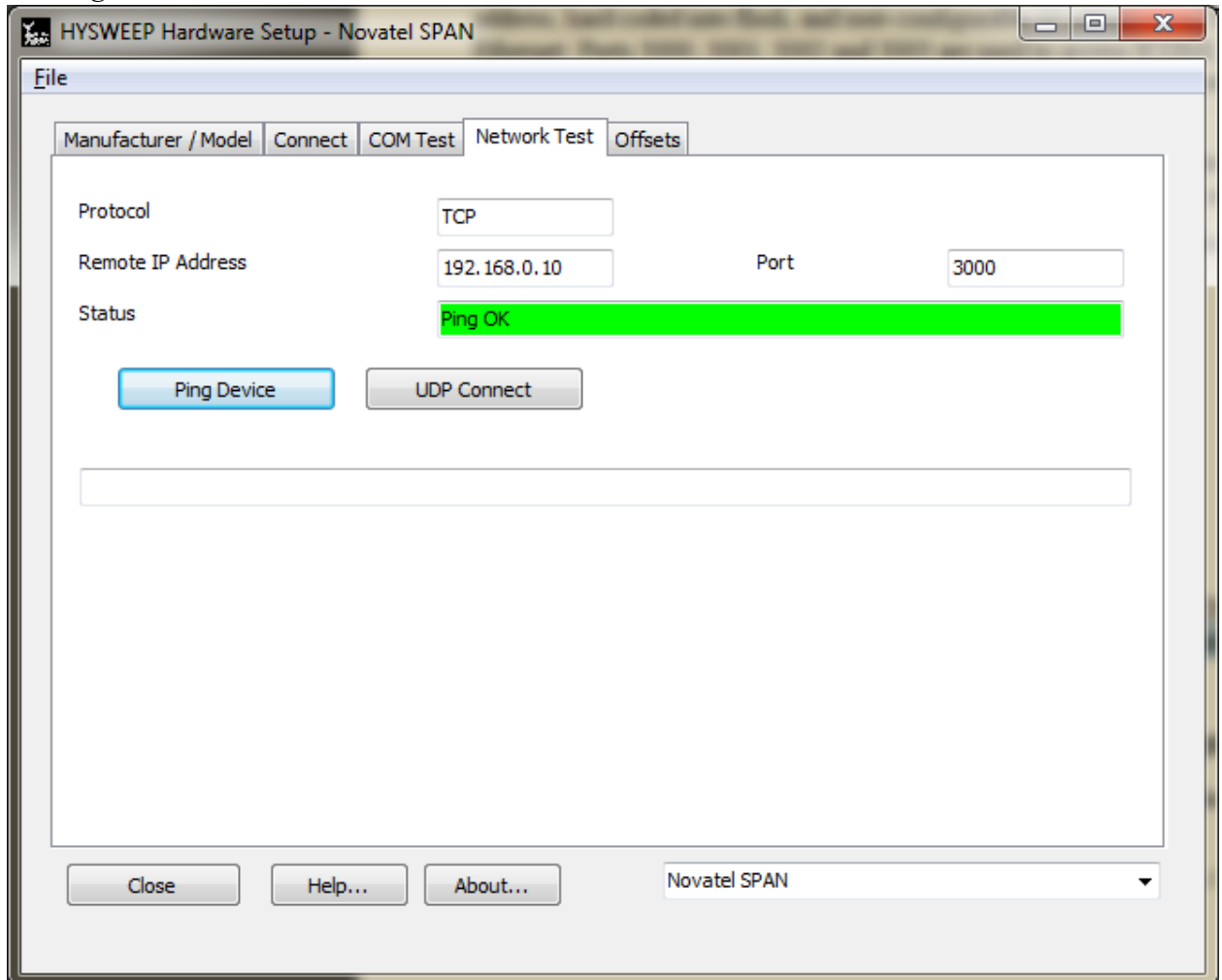
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2. Set the Network Connection settings. The ICOM1, ICOM2, ICOM3, and ICOM4 port numbers on the SPAN-SE are defaulted to 3000, 3001, 3002, and 3003 respectively. Port numbers can be configured using the ICOMCONFIG command (see *Appendix A: SPAN Commands and Logs*).



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- Complete a Network Test to ensure the receiver is recognized. The default configuration of the Ethernet ports is for TCP operation (recommended). To configure the Ethernet ports for UDP operation, see the ICOMCONFIG command in *Appendix A: SPAN Commands and Logs*.



- Exit HYSWEEP Hardware and save changes to HYSWEEP.ini.
- The configuration process is complete. Position, attitude and heave information are now available from the SPAN system in HYPACK Survey and HYPWEEP Survey.

### 5 Enabling PPS Output on the SPAN-SE

The PPS output is available on any of the four EVENT-OUT lines located on the yellow I/O cable. Send the following commands to the receiver to enable the PPS output on EVENT-OUT 1:

```
EVENTOUTCONTROL MARK1 ENABLE  
SAVECONFIG
```

## A. SPAN Commands and Logs

### A.1 SETIMUTYPE Command

The SETIMUTYPE command is used to specify the type of IMU connected to the receiver. The IMU type can be saved using the SAVECONFIG command.

**Message ID:** 569

**Abbreviated ASCII Syntax:**

```
SETIMUTYPE switch
```

**Abbreviated ASCII Examples:**

```
SETIMUTYPE IMU_KVH_COTS
```

Field	Field Type	ASCII Value	Binary Value	Data Description	Format	Binary Bytes	Binary Offset
1	Log Header	-	-	This field contains the command name or the message header depending on whether the command is abbreviated ASCII, ASCII or binary, respectively	-	H	0
2	Switch	See Table 2: IMU Type		IMU Type	Enum	4	H

**Table 2: IMU Type**

Binary	ASCII	Description
0	IMU_UNKNOWN	Unknown IMU type (default)
1	IMU_HG1700_AG11	Honeywell HG1700 AG11/AG58
2-3	Reserved	
4	IMU_HG1700_AG17	Honeywell HG1700 AG17/AG62
5	IMU_HG1900_CA29	Honeywell HG1900 CA29
6, 7	Reserved	
8	IMU_LN200	Litton LN-200 (200 Hz model)
9	IMU_LN200_400HZ Litton	LN-200 (400 Hz model)
10	Reserved	
11	IMU_HG1700_AG58	Honeywell HG1700 AG58
12	IMU_HG1700_AG62	Honeywell HG1700 AG62
13	IMU_IMAR_FSAS	iMAR iIMU-FSAS
14-15	Reserved	
16	IMU_KVH_COTS	IMU-CPT
17, 18	Reserved	
19	IMU_LITEF_LCI1	NG Litef LCI 1 IMU
20	IMU_HG1930_AA99	Honeywell HG1930 AA99

### A.2 SETIMUTOANTOFFSET Command

It is recommended that you mount the IMU as close as possible to the GNSS antenna, particularly in the horizontal plane. This command is used to enter the offset between the IMU and the GNSS antenna. The measurement should be done as accurately as possible, preferably to within millimetres especially for RTK operation. The x, y and z fields represent the vector from the IMU to the antenna phase center in the IMU enclosure frame. The a, b and c fields allow you to enter any possible errors in your measurements. If you think that your 'x' offset measurement is out by a centimetre for example, enter 0.01 in the 'a' field. The X (pitch), Y (roll) and Z (azimuth) directions of the inertial frame are clearly marked on the IMU. This command must be entered before or during the INS alignment mode (not after) or the INS will reset and require alignment again.

**Message ID:** 383

**Abbreviated ASCII Syntax:**

```
SETIMUTOANTOFFSET x y z [a] [b] [c]
```

**Abbreviated ASCII Example:**

```
SETIMUTOANTOFFSET 0.54 0.32 1.20 0.03 0.03 0.05
```

Field	Field Type	ASCII Value	Binary Value	Description	Binary Format	Binary Bytes	Binary Offset
1	header	-	-	This field contains the command name or the message header depending on whether the command is abbreviated ASCII, ASCII or binary, respectively	-	H	0
2	x	±100		x offset (m)	Double	8	H
3	y	±100		y offset (m)	Double	8	H+8
4	z	±100		z offset (m)	Double	8	H+16
5	a	0 to +10		Uncertainty in x (m). Default is 10% of the x offset to a minimum of 0.01 m	Double	8	H+24
6	b	0 to +10		Uncertainty in y (m). Default is 10% of the x offset to a minimum of 0.01 m	Double	8	H+32
7	c	0 to +10		Uncertainty in z (m). Default is 10% of the x offset to a minimum of 0.01 m	Double	8	H+40



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### A.3 SETIMUTOANTOFFSET2 Command

Set the lever arm for the GPS2 antenna. Preferably, the GPS1 antenna will be set up behind the IMU forward axis and the GPS2 antenna will be set up ahead of the IMU forward axis. Entering both lever arms will automatically compute the angular offset between the ALIGN antennas and the IMU axes.

The format of this command is identical to the SETIMUTOANTOFFSET command.

**Message ID:** 1205

**Abbreviated ASCII Syntax:**

```
SETIMUTOANTOFFSET2 x y z [a] [b] [c]
```

**Abbreviated ASCII Example:**

```
SETIMUTOANTOFFSET2 0.54 0.32 1.20 0.03 0.03 0.05
```

Field	Field Type	ASCII Value	Binary Value	Description	Binary Format	Binary Bytes	Binary Offset
1	header	-	-	This field contains the command name or the message header depending on whether the command is abbreviated ASCII, ASCII or binary, respectively	-	H	0
2	x	±100		x offset (m)	Double	8	H
3	y	±100		y offset (m)	Double	8	H+8
4	z	±100		z offset (m)	Double	8	H+16
5	a	0 to +10		Uncertainty in x (m). Default is 10% of the x offset to a minimum of 0.01 m	Double	8	H+24
6	b	0 to +10		Uncertainty in y (m). Default is 10% of the x offset to a minimum of 0.01 m	Double	8	H+32
7	c	0 to +10		Uncertainty in z (m). Default is 10% of the x offset to a minimum of 0.01 m	Double	8	H+40

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### A.4 ICOMCONFIG Command

The SPAN-SE has a 10/100 RJ-45 Ethernet port, which has a MAC address hard coded into flash and user-configurable IP information. Each port can be used for both TCP and UDP traffic but not simultaneously. You must configure the system for either UDP or TCP communication. The default is TCP.

You can also use this command to program a destination or peer IP. When using UDP, the destination or peer IP allows SPAN to start sending data to the remote peer without waiting to receive data first (by sending something first, SPAN then gains knowledge of the remote IP). This command is saved using the SAVECONFIG command.

To configure only the ICOM transport protocol, use the ICOMCONFIG command with a port name and its one non-optional parameter.

**Message ID:** 1248

#### Abbreviated ASCII Syntax:

```
ICOMCONFIG Port IPProtocol [ULPort] [IPAddress] [Interface]
```

#### Factory Default:

```
ICOMCONFIG ICOM1 TCP :3000
ICOMCONFIG ICOM2 TCP :3001
ICOMCONFIG ICOM2 TCP :3002
ICOMCONFIG ICOM3 TCP :3003
```

#### Abbreviated ASCII Examples:

```
ICOMCONFIG ICOM2 TCP 3001 192.168.1.25
```

**Note:** The SPAN-SE does not currently use the ULPort parameter. A dummy value (e.g., 0) must be entered but is ignored by the firmware. Default TCP port numbers persist for each ICOM port.

Field	Field Type	ASCII Value	Binary Value	Data Description	Format	Binary Bytes	Binary Offset
1	header	-	-	This field contains the command name or the message header depending on whether the command is abbreviated ASCII, ASCII or binary, respectively	-	H	0
2	Port	See Table 2: IMU Type		Name of the port (default = THISPORT)	Enum	4	H
3	IP Protocol	DISABLE	0	Not Used	Enum	4	H+4
		TCP	1	Transport Control Protocol (default)			
		UDP	2	User Datagram Protocol	Enum	4	H+8
4	ULPort			Not used	Enum	4	H+12
5	IPAddress			Peer IP Address	Enum	4	H+16

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Field	Field Type	ASCII Value	Binary Value	Data Description	Format	Binary Bytes	Binary Offset
6	Interface	ALL	1	The Ethernet adaptor to use. SPAN-SE can currently only use ETHA	Enum	4	H+20
		EHTA (default)	2				
		ETHB	3				

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### A.5 IPCONFIG Command

Use this command to configure Internet Protocol (IP) information

**Message ID:** 1243

#### Abbreviated ASCII Syntax:

```
IPCONFIG Interface Mode IP Mask Gateway
```

#### Factory Default:

```
IPCONFIG ETHA STATIC
```

#### Abbreviated ASCII Examples:

```
IPCONFIG ETHA STATIC 10.1.100.25 255.255.255.0 10.1.100.1
```

Field #	Field Type	ASCII Value	Binary Value	Data Description	Format	Binary Bytes	Binary Offset
1	Header	-	-	This field contains the command name or the message header depending on whether the command is abbreviated ASCII, ASCII or binary, respectively	-	H	0
2	Interface			Physical interface. SPANSE can currently only use ETHA	Ulong	4	H
3	Mode	DHCP	1	Automatic IP address assignment	Ulong	4	H+4
		STATIC	2	Manual IP address assignment			
4	IP			IP Address	Enum	4	H+8
5	Mask			Subnet mask	Enum	4	H+12
6	Gateway			IP Gateway	Enum	4	H+16

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### A.6 IPSTATUS Log

Use this log to display settings for all Ethernet ports. If DHCP is used to configure IP addresses, this command displays automatically obtained dynamic addresses.

**Message ID:** 1289

**Log Type:** Asynch

**Recommended Input:**

```
LOG IPSTATUS
```

**ASCII Example:**

```
#IPSTATUSA,USB1,0,98.0,FINESTEERING,1635,320781.983,00000001  
,0000,394;1,ETHA,192.168.0.10,255.255.255.0,192.168.0.1*2854  
b03a
```

Field #	Field Type	Data Description	Format	Binary Bytes	Binary Offset
1	Log Header	Log header	-	H	0
2	Interface	Always ETHA	Enum	4	H
3	IPAddress	Ethernet IP Address	Ulong	4	H+4
4	NetMask	Network Mask	Ulong	4	H+8
5	Gateway	Network Gateway	Ulong	4	H+12
6	xxxx	32-bit CRC (ASCII, Binary and Short Binary only)	Hex	4	H+16
7	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

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### A.7 EVENTOUTCONTROL Command

This command controls up to three Event-Out output triggers.

**Note:** The EVENTOUTCONTROL MARK1 ENABLE POSITIVE 10000000 24000000 command will generate a 4 Hz signal. The signal is held high for 10 ms during each cycle and the leading edge of the high signal is aligned to the 1PPS.

**Message ID:** 613

**Abbreviated ASCII Syntax:**

```
EVENTOUTCONTROL mark switch [polarity] [active period] [non-
active period]
```

**Abbreviated ASCII Examples:**

```
EVENTOUTCONTROL MARK3 ENABLE
```

Field #	Field Type	ASCII Value	Binary Value	Description	Binary Format	Binary Bytes	Binary Offset
1	Header	-	-	This field contains the command name or the message header depending on whether the command is abbreviated ASCII, ASCII or binary, respectively	-	H	0
2	mark	MARK1	0	Choose which Event-Out mark to use	Enum	4	H
		MARK2	1				
		MARK3	2				
3	switch	DISABLE	0	Disables Event output	Enum	4	H+4
		ENABLE	1				
4	polarity	NEGATIVE	0	Negative polarity (default)	Enum	4	H+8
		POSITIVE	1	Positive polarity			
5	active period	default: 500 000 000 minimum: 25 maximum: 999 999 975		Active period of the Event Out signal in nanoseconds.	Ulong	4	H+12
6	not-active period	default: 500 000 000 minimum: 25 maximum: 999 999 975		Not-active period of the Event Out signal in nanoseconds.	Ulong	4	H+16