

APN-048:
ALIGN[®] Family of Heading Solutions:
ALIGN[™] Heading and ALIGN Relative
Positioning[™]

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ALIGN Heading and ALIGN Relative Positioning

1 Overview

This application note provides an overview of NovAtel's ALIGN family of heading solutions, including the ALIGN Heading and ALIGN Relative Positioning models. Receiver hardware setup and software configurations are also discussed.

Heading information can be logged from NovAtel's OEM6® receivers at a maximum rate of 20 Hz, or at a maximum of 10 Hz on OEMV® receivers. The *Master* receiver position accuracy can be enhanced by adding L-Band corrections, SBAS tracking, or by adding an optional RTK static base station.

Please see section 3.1.2 for information regarding ALIGN use with SPAN INS.

2 ALIGN Models

There are two available ALIGN models:

ALIGN Heading provides angular heading and pitch measurements. The following logs are available from any free port:

Table 1: ALIGN Heading Logs

Logs	Description
MASTERPOS	Position of the ALIGN Master
HEADING	Heading and Pitch Angles
HEADING2	Heading and pitch angles with ROVERID
GPHDT	NMEA heading angle
ALIGNDOP	DOP of heading computation
HEADINGRATE	Rate of Change for ALIGN
HEADINGSATS	Satellites used in ALIGN

ALIGN Relative Positioning provides angular heading and pitch measurements, precise relative positioning measurements and relative baseline information with centimetre level accuracy. The following logs are available from any free port:

Table 2: ALIGN Relative Positioning Logs

Logs	Description
MASTERPOS	Absolute position of the ALIGN Master
ROVERPOS	Absolute position of the ALIGN Rover
ALIGNBSLNXYZ	ECEF vector between Rover and Master
ALIGNBSLBNENU	Easting, Northing, Altitude vector between Rover and Master
HEADING	Heading and pitch/yaw angles
HEADING2	Heading and pitch/yaw angles with ROVERID
GPHDT	NMEA heading angle
ALIGNDOP	DOP of heading computation
HEADINGRATE	Rate of change for ALIGN
HEADINGSATS	Satellites used in ALIGN

Complete explanation of logs can be found in the [OEM6 Firmware Reference Manual](#).

2.1 ALIGN Setup (For both models)

ALIGN functionality requires one receiver to operate as *Master* to send information to the *Rover*. The following are the requirements for both ALIGN models:

	ALIGN Heading	ALIGN Relative Positioning
Master	Any OEMV or OEM6 receiver model	Any OEMV or OEM6 receiver capable of outputting positions*
Rover	ALIGN Heading only ('Z') model	ALIGN Relative Positioning ('Y') model

Receiver features may be limited if basic Position Velocity Time (PVT) only models are used. See Appendix A for more information.

A typical ALIGN setup includes:

- One NovAtel OEM6 or NovAtel OEMV receiver running an ALIGN enabled receiver model and firmware version. This is the *Rover* receiver.
- One NovAtel OEM6 or NovAtel OEMV receiver. This is the *Master* receiver.
- Two GPS or GPS+GLONASS capable antennas.
- Data communication link between both receivers. Examples include a radio, modem or serial cable. It is recommended to set the communication rate to 230400 bits per second on both receivers.

* If using an ALIGN *Master* not capable of outputting a position (i.e: heading only model), ALIGNBSLNXYZ will be available but MASTERPOS, ROVERPOS, and ALIGNBSLNENU will not be.

There are two ways of initializing ALIGN:

- i. Plug and Play: ALIGNAUTOMATION command is used at the *Rover* receiver to setup ALIGN

For plug and play to work, the *Master* and *Rover* receivers must be running firmware versions OEM060100RN0000 or newer (for OEM6), or 3.900 or newer (for OEMV). A mix of OEM6 and OEMV receivers can be used provided their firmware versions meet these conditions.

- ii. Manual configuration: ALIGN commands are manually sent to the *Master* and *Rover* receivers

As of firmware version OEM060310RN0000, users have the option of using NOVATELX or RTCA message protocols when configuring ALIGN manually. NOVATELX is preferred because its messages are smaller in size, but is only available on OEM6 receivers with firmware version OEM060310RN0000 or newer. Both methods will be shown in this application note.

3 Use Cases

A variety of symbols are used in this application note to depict ALIGN output symbols. The meaning of each symbol is given below.

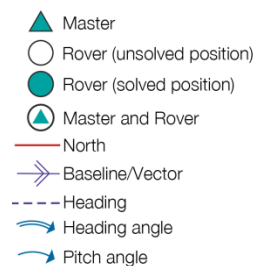


Figure 1: Use Case Legend

3.1 Use Case 1: Fixed Antenna Distance between Master and Rover Receivers on One Platform (ALIGN Heading)

This use case requires one *Master* and one *Rover* receiver. Figure 2 provides an example where the *Master* and *Rover* are located on the same vehicle, and the two antennas are located at a fixed distance from one another. Relative heading and pitch are computed with respect to the *Master* receiver.

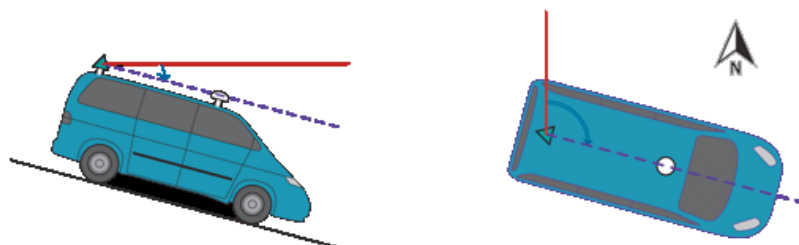


Figure 2: Heading from two receivers on one vehicle

There are two possible ways to set up ALIGN in this use case:

Plug and Play with Cable:

1. Connect COM2 of the *Rover* receiver to an available COM port on the *Master* receiver using a NULL modem cable.
2. Initiate ALIGN from the *Rover* receiver by entering the following command:
`ALIGNAUTOMATION ENABLE COM2 230400`
3. To access heading data, ALIGN logs can be logged at either the ALIGN *Master* or *Rover* receiver.

Manual Configuration with Cables:

1. Connect any COM port on the *Master* receiver (e.g. COM2) to any COM port on the *Rover* receiver (e.g. COM2) using a NULL modem cable.
2. Issue the following commands to the *Master* receiver:

NOVATELX (OEM6 only)	RTCA (OEM6 and OEMV)
MOVINGBASESTATION ENABLE SERIALCONFIG COM2 230400 N 8 1 N OFF ON LOG COM2 NOVATELXOBS ONTIME 0.1 LOG COM2 NOVATELXREF ONTIME 0.1	MOVINGBASESTATION ENABLE INTERFACEMODE COM2 NOVATEL RTCA OFF COM COM2 230400 N 8 1 N OFF ON LOG COM2 RTCAOBS3 ONTIME 0.1

SAVECONFIG	LOG COM2 RTCAREFEXT ONTIME 0.1 SAVECONFIG
------------	--

- Issue the following commands to the *Rover* receiver:

NOVATELX (OEM6 only)	RTCA (OEM6 and OEMV)
SERIALCONFIG COM2 230400 N 8 1 N OFF ON LOG COM2 HEADINGEXT2B ONNEW SAVECONFIG	INTERFACEMODE COM2 RTCA NOVATEL OFF COM COM2 230400 N 8 1 N OFF ON LOG COM2 HEADINGEXTB ONNEW SAVECONFIG

- To access heading data, ALIGN logs can be logged at either the ALIGN *Master* or *Rover* receiver.

Manual Configuration through Ethernet:

Many customers use Ethernet due to the fact that one physical connection provides three high speed ports. This section will go through the steps that are needed in order to setup ALIGN through Ethernet. Please note the ALIGNAUTOMATION command does not work with an Ethernet connection.

- Connect your computer to both *Master* and *Rover* receivers using null modem serial cables or USB cables.
- Establish a connection to both *Master* and *Rover* receivers using either NovAtel Connect or another terminal program such as Windows HyperTerminal. This connection is used to send the commands to the receivers.
- Establish an Ethernet connection on both *Master* and *Rover* receivers.

I. Dynamic IP Address Configuration

- Connect the Ethernet port of the *Master* and *Rover* receivers to the DHCCP server using two *patch* cables.
- Enable the Ethernet port by entering the following command on both the *Master* and *Rover* receivers:

ETHCONFIG ETHA AUTO AUTO AUTO NORMAL

- Obtain the IP address assigned to the *Master* receiver by the DHCP server through the command shown below. Make a note of the IP address returned with this log as it will be used later on. This is only done at the *Master*.

LOG IPSTATUS ONCE

- Confirm that DHCP is enabled by entering the following command. This is done at both the *Master* and *Rover* receivers.

LOG IPCONFIG ONCE

- Assign the TCP/IP port number by entering the command below. This is only done at the *Master*.

ICOMCONFIG ICOM1 TCP :3001

- Confirm the port number assigned to the *Master*'s ICOM1 by entering the following command at the *Master*.

LOG ICOMCONFIG ONCE

II. Static IP Address Configuration

- Connect the Ethernet port of the *Master* receiver with the Ethernet port of the *Rover* receiver using a *cross-over* cable.
- Enable the Ethernet port by entering the following command on both the *Master* and *Rover* receivers:

ETHCONFIG ETHA AUTO AUTO AUTO AUTO

- Assign the TCP/IP port number by entering the command below. This is done only at the *Master* receiver.

ICOMCONFIG ICOM1 TCP :3001

- Assign the receiver IP address, subnet mask, and default gateway of the *Master* by entering the following at the *Master* receiver:

IPCONFIG ETHA STATIC 192.168.74.10 255.255.255.0 192.168.74.1

- Assign the receiver IP address, subnet mask, and default gateway of the *Rover* by entering the following at the *Rover* receiver:

IPCONFIG ETHA STATIC 192.168.74.15 255.255.255.0 192.168.74.1

- Confirm TCP/IP configuration by entering the following command. This is done at both the *Master* and *Rover* receivers.

LOG IPCONFIG ONCE

4. Send the following commands to the *Master* receiver. Recall that manual ALIGN configuration can be done either through NOVATELX or RTCA message protocols.

NOVATELX (OEM6 only)	RTCA (OEM6 and OEMV)
MOVINGBASESTATION ENABLE LOG ICOM1 NOVATELXOBS ONTIME 0.1 LOG ICOM1 NOVATELXREF ONTIME 0.1 SAVECONFIG	MOVINGBASESTATION ENABLE INTERFACEMODE ICOM1 NOVATEL RTCA OFF LOG ICOM1 RTCAOBS3 ONTIME 0.1 LOG ICOM1 RTCAREFEXT ONTIME 0.1 SAVECONFIG

5. Send the following commands to the *Rover* receiver. Recall that manual ALIGN configuration can be done either through NOVATELX or RTCA message protocols.

NOVATELX (OEM6 only)	RTCA (OEM6 and OEMV)
ICOMCONFIG ICOM1 TCP <Master I.P address>:<Master port #> LOG ICOM1 HEADINGEXT2B ONNEW SAVECONFIG	ICOMCONFIG ICOM1 TCP <Master I.P address>:<Master port #> INTERFACEMODE ICOM1 RTCA NOVATEL OFF LOG ICOM1 HEADINGEXTB ONNEW SAVECONFIG

3.1.2 Using ALIGN with SPAN

Please ignore this section if you are not using ALIGN with SPAN INS.

ALIGN configuration when using SPAN is done automatically in the background provided both primary and secondary lever arm has been issued and that the ALIGN rover is connected to the SPAN receiver via serial COM ports. Please refer to the DUALANTENNAPORTCONFIG command in the SPAN firmware reference manual as it specifies the serial COM port from which the SPAN receiver expects connectivity with the ALIGN receiver.

There is one use case that requires further user input and that is if the SPAN and ALIGN rover receivers are connected via Ethernet. If so, please do as follows:

- i. Setup ALIGN manually using the static IP configuration shown in the previous section.
- ii. Send the following command at the rover: **SETROVERID DUAL**. Please note the field “DUAL” is case sensitive.

To confirm ALIGN is working and that the heading is being fed into SPAN:

- i. Send the LOG HEADING command in the SPAN receiver. If nothing is output then something is wrong with the ALIGN configuration.

- ii. Once the SPAN system is configured and has completed alignment (SPAN initialization), the log INSUPDATE can be used to confirm SPAN is using the ALIGN heading. If so, the last field should indicate ACTIVE/USED such as in the example below:

```
INSUPDATE SPECIAL 0 48.0 FINESTEERING 1701 156566.000 00004000 6f07 10883  
SINGLE 0 12 0 FALSE INACTIVE USED
```

Note that in order for the heading to be fed into the INS the following conditions must be met:

- a. SETROVERID is set to DUAL
- b. RTK status in HEADING log (third to last field) is set to RTK verified '01'

These conditions are important as it is entirely possible to be producing new HEADING logs but they are not being used by the INS filter. Confirmation is done through the LOG INSUPDATE message indicated earlier.

3.2 **Use Case 2: Master and Rover Receivers on Separate Moving Platforms**

This use case requires one *Master* and one *Rover* receiver. Figure illustrates the *Master* receiver on the vessel and the *Rover* receiver located on the fighter jet. Relative heading, pitch, baseline length, and *Rover* positions are computed with respect to the *Master* receiver.

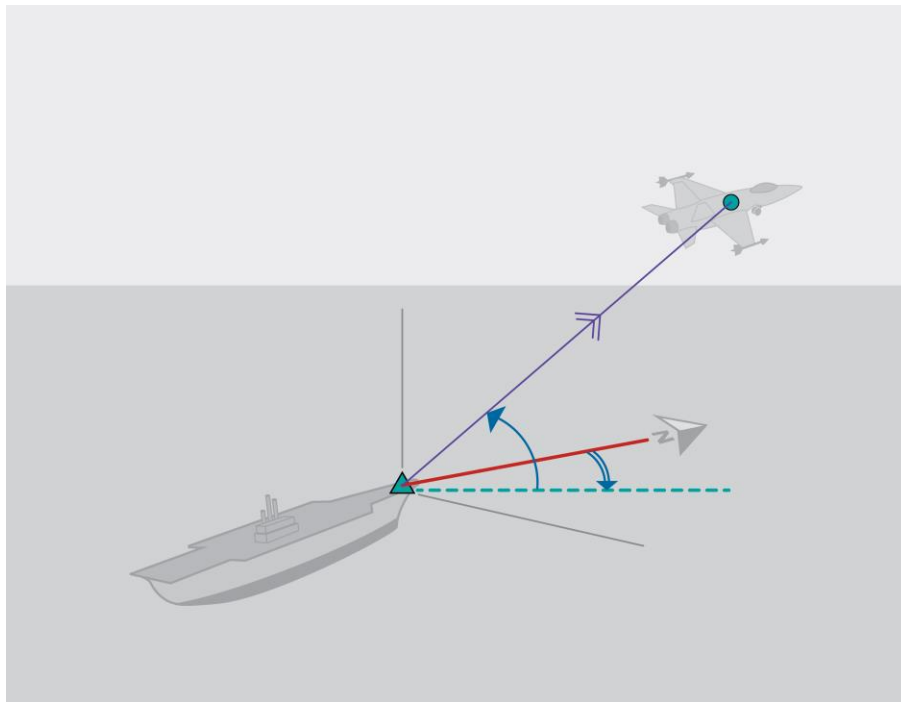


Figure 3: Heading from two receivers on separate platforms

There are two possible ways to set up this use case. One is to take advantage of ALIGN's plug and play functionality and another requires manual receiver configuration.

Plug and Play with Wireless Data Link:

1. Configure the wireless data links for two-way communication, using the same baud rate (i.e. 230400 bps).
2. Connect one wireless data link to an available COM port on the *Master* receiver.
3. Configure the *Master* receiver's COM port to communicate at the same baud rate as the wireless data link using the COM command:
`COM COM2 230400 N 8 1 N OFF ON`
4. Connect the other wireless data link to COM2 of the *Rover* receiver.
5. Initiate ALIGN from the *Rover* receiver by entering the following command:
`ALIGNAUTOMATION ENABLE COM2 230400`

Manual Configuration with Wireless Data Link:

1. Configure the wireless data links for two-way communication, using the same baud rate (230400 bps for this example).
2. Connect one wireless data link to an available COM port on the *Master* receiver (e.g. COM2).
3. Configure the *Master* receiver to output NOVATELX or RTCA corrections at the same baud rate as the wireless data link:

NOVATELX (OEM6 only)	RTCA (OEM6 and OEMV)
MOVINGBASESTATION ENABLE SERIALCONFIG COM2 230400 N 8 1 N OFF ON LOG COM2 NOVATELXOBS ONTIME 0.1 LOG COM2 NOVATELXREF ONTIME 0.1 SAVECONFIG	MOVINGBASESTATION ENABLE INTERFACEMODE COM2 NOVATEL RTCA OFF COM COM2 230400 N 8 1 N OFF ON LOG COM2 RTCAOBS3 ONTIME 0.1 LOG COM2 RTCAREFEXT ONTIME 0.1 SAVECONFIG

4. Connect the other wireless data link to an available COM port (e.g., COM2) on the *Rover* receiver.
5. Configure the COM port (COM2 in this example) of the *Rover* receiver to receive corrections and output heading information at the same baud rate as the wireless data link:

NOVATELX (OEM6 only)	RTCA (OEM6 and OEMV)
SERIALCONFIG COM2 230400 N 8 1 N OFF ON LOG COM2 HEADINGEXT2B ONNEW SAVECONFIG	INTERFACEMODE COM2 RTCA NOVATEL OFF COM COM2 230400 N 8 1 N OFF ON LOG COM2 HEADINGEXTB ONNEW SAVECONFIG

6. To access heading and relative positioning data, ALIGN logs can be logged at either the ALIGN *Master* or *Rover* receiver.

3.3 Use Case 3: Daisy-Chain ALIGN setup

This use case illustrates multiple *Master* and *Rover* receivers in a daisy chain type setup. There is one main *Master* receiver on one platform as a moving reference, with multiple *Rovers* setup on other platforms. Each *Rover* can act as the *Master* receiver for the next *Rover* receiver by transmitting ALIGN corrections to the next receiver.

Figure 4 illustrates the main *Master* receiver on a seismic research vessel. The *Rover* receivers are located on a series of buoys, with each *Rover* receiver acting as a *Master* for the next receiver. Relative heading and pitch are computed with respect to its linking *Master* receiver.

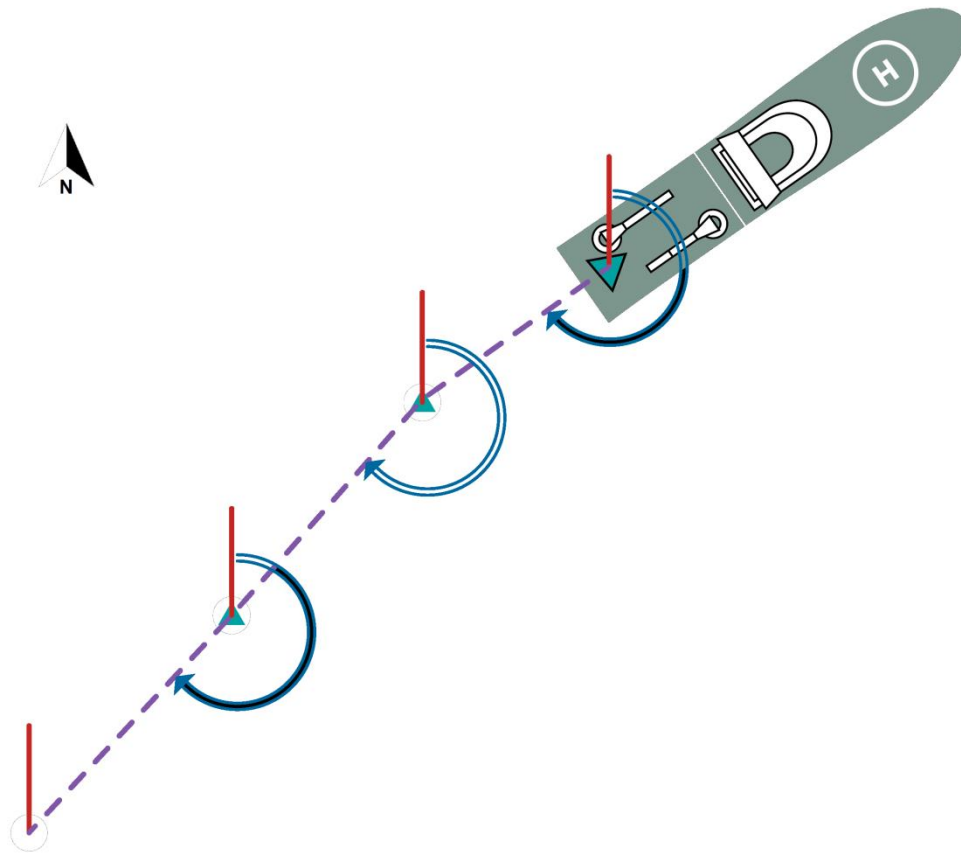


Figure 4: Use Case #3 – Daisy-Chain ALIGN setup

Plug and Play with Wireless Data Link:

1. Configure the wireless data links between each *Master* and *Rover* pair for two-way communication, using the same baud rate (230400 bps for this example).
2. Connect one wireless data link to an available COM port (e.g. COM2) on the first *Master* receiver.

3. Configure the *Master* receiver COM port to communicate at the same baud rate as the wireless data link using the COM command:
`COM COM2 230400`
4. Connect the other wireless data link to COM2 of the *Rover* receiver.
5. Initiate ALIGN by entering the following command to the *Rover* receiver:
`ALIGNAUTOMATION ENABLE COM2 230400 10 OFF`
6. Configure COM1 of the *Rover* receiver to send corrections to the next *Rover* receiver. Connect a wireless data link to COM1 and configure COM1 to communicate at the same baud rate as the wireless data link using the COM command:
`COM COM1 230400`
7. Connect the other wireless data link to COM2 of the next *Rover* receiver.
8. Repeat steps 5 to 7 using the appropriate COM ports until all receivers have been configured
9. To access heading and relative positioning data, ALIGN logs must be logged at each ALIGN *Rover*.

Manual Configuration with Wireless Data Link:

1. Configure the wireless data links between each *Master* and *Rover* pair for two-way communication, using the same baud rate (230400 bps for this example).
2. Connect one wireless data link to an available COM port (i.e., COM2) on the first *Master* receiver.
3. Configure the *Master* receiver COM port to output corrections at the same baud rate as the wireless data link:

NOVATELX (OEM6 only)	RTCA (OEM6 and OEMV)
MOVINGBASESTATION ENABLE SERIALCONFIG COM2 230400 N 8 1 N OFF ON LOG COM2 NOVATELXOBS ONTIME 0.1 LOG COM2 NOVATELXREF ONTIME 0.1 SAVECONFIG	MOVINGBASESTATION ENABLE INTERFACEMODE COM2 NOVATEL RTCA OFF COM COM2 230400 N 8 1 N OFF ON LOG COM2 RTCAOBS3 ONTIME 0.1 LOG COM2 RTCAREFEXT ONTIME 0.1 SAVECONFIG

4. Connect the other wireless data link to COM2 of the *Rover* receiver.

5. Configure COM2 of the *Rover* receiver to receive corrections at the same baud rate as the wireless data link:

NOVATELX (OEM6 only)	RTCA (OEM6 and OEMV)
SERIALCONFIG COM2 230400 N 8 1 N OFF ON SAVECONFIG	INTERFACEMODE COM2 RTCA NOVATEL OFF COM COM2 230400 N 8 1 N OFF ON SAVECONFIG

6. Configure COM1 of the *Rover* receiver to send corrections to the next *Rover* receiver. Connect a wireless data link to COM1.
7. Set the *Rover*'s COM1 to output corrections at the same baud rate as the wireless data link:

NOVATELX (OEM6 only)	RTCA (OEM6 and OEMV)
MOVINGBASESTATION ENABLE SERIALCONFIG COM2 230400 N 8 1 N OFF ON LOG COM1 NOVATELXOBS ONTIME 0.1 LOG COM1 NOVATELXREF ONTIME 0.1 SAVECONFIG	MOVINGBASESTATION ENABLE INTERFACEMODE COM1 NOVATEL RTCA OFF COM COM2 230400 N 8 1 N OFF ON LOG COM1 RTCAOBS3 ONTIME 0.1 LOG COM1 RTCAREFEXT ONTIME 0.1 SAVECONFIG

8. Configure COM2 of the next *Rover* receiver to receive corrections as described in steps 4 and 5.
9. Repeat steps 4 to 8 using the appropriate COM ports until all receivers have been configured
10. To access heading data, ALIGN logs must be logged at each ALIGN *Rover*.

3.4 Use Case #4: Single Master with Multiple Rovers ALIGN setup (ALIGN Relative Positioning)

This use case demonstrates one ALIGN *Master* and multiple *Rover* receivers. There is one main *Master* receiver set up on one platform as a moving reference, with multiple *Rovers* set up on other platforms.

Figure 4 illustrates the main *Master* receiver on a seismic research vessel. The *Rover* receivers are located on a series of buoys. Relative heading, pitch, baseline length and *Rover* positions are computed with respect to the *Master* receiver.

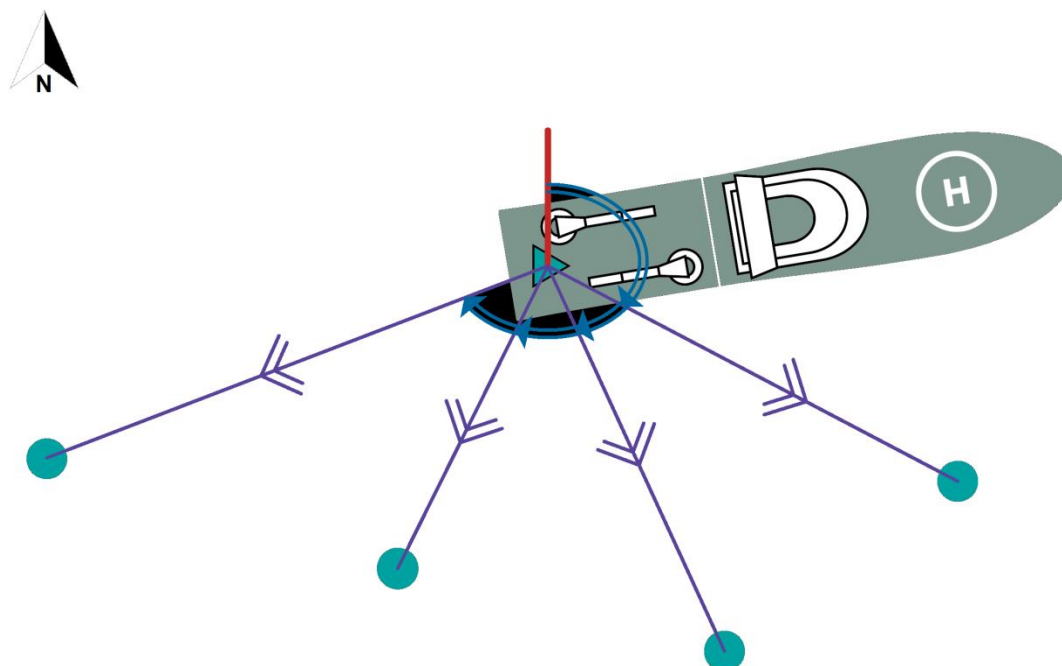


Figure 5: Single Master with Multiple Rovers ALIGN Setup

Manual Configuration with Wireless Data Link:

1. Configure the wireless data links for two-way communication, using the same baud rate (e.g. 230400 bps).
2. Connect one wireless data link to an available COM port on the *Master* receiver (e.g. COM2).
3. Configure the *Master* receiver to output corrections at the same baud rate as the wireless data link:

NOVATELX (OEM6 only)	RTCA (OEM6 and OEMV)
MOVINGBASESTATION ENABLE SERIALCONFIG COM2 230400 N 8 1 N OFF ON LOG COM2 NOVATELXOBS ONTIME 0.1 LOG COM2 NOVATELXREF ONTIME 0.1	MOVINGBASESTATION ENABLE INTERFACEMODE COM2 NOVATEL RTCA OFF COM COM2 230400 N 8 1 N OFF ON LOG COM2 RTCAOBS3 ONTIME 0.1

SAVECONFIG	LOG COM2 RTCAREFEXT ONTIME 0.1 SAVECONFIG
------------	--

- Connect the other wireless data link to an available COM port on the *Rover* receiver.
- Configure *Rover* receiver to receive corrections and output heading information at the same baud rate as the wireless data link:

NOVATELX (OEM6 only)	RTCA (OEM6 and OEMV)
SERIALCONFIG COM2 230400 N 8 1 N OFF ON LOG COM2 HEADINGEXT2B ONNEW SAVECONFIG	INTERFACEMODE COM2 RTCA NOVATEL OFF COM COM2 230400 N 8 1 N OFF ON LOG COM2 HEADINGEXTB ONNEW SAVECONFIG

- Repeat steps 4 and 5 until all *Rover* receivers are configured.
- To access heading and relative positioning data, ALIGN logs can be logged at each ALIGN *Rover*, or alternatively, data for all *Rovers* can be accessed at the *Master* receiver.

3.5 Use Case #5: Star Configuration

This case demonstrates one ALIGN *Master* setup between two *Rover* receivers. Only the *Master* receiver has to maintain a connection with the computer throughout data collection.

Figure 6 illustrates the *Master* receiver and *Rover1* receiver on a back of the truck and *Rover2* receiver on the front part of the truck. Relative heading, pitch, and rover positions are computed with respect to the *Master*.

In the example shown in Figure 7, *Rover1* is connected to the *Master* through COM1 while *Rover2* is connected to the *Master* through COM2. COM2 of *Rover1* and COM1 of *Rover2* are only used initially to setup the rovers through the computer. The *Master* receiver is connected to the computer via USB port (can also be Ethernet).

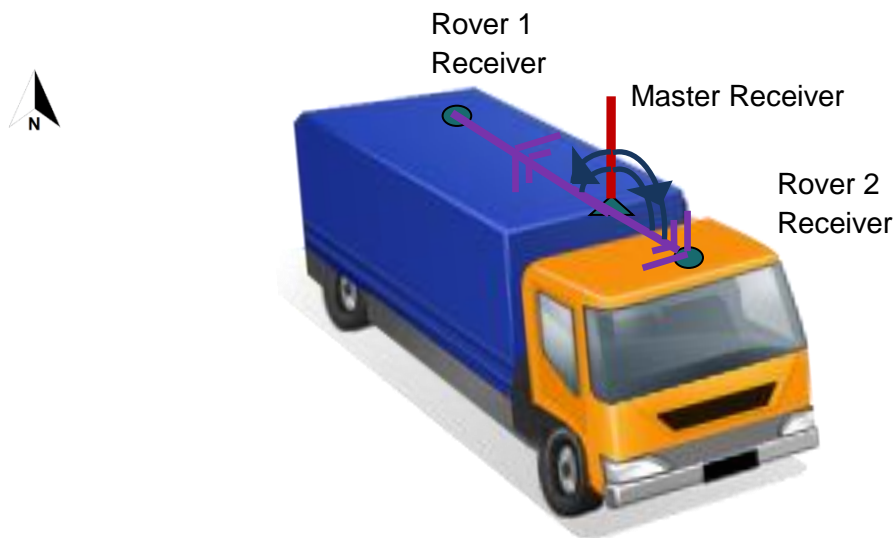


Figure 6: ALIGN Star Configuration Scenario

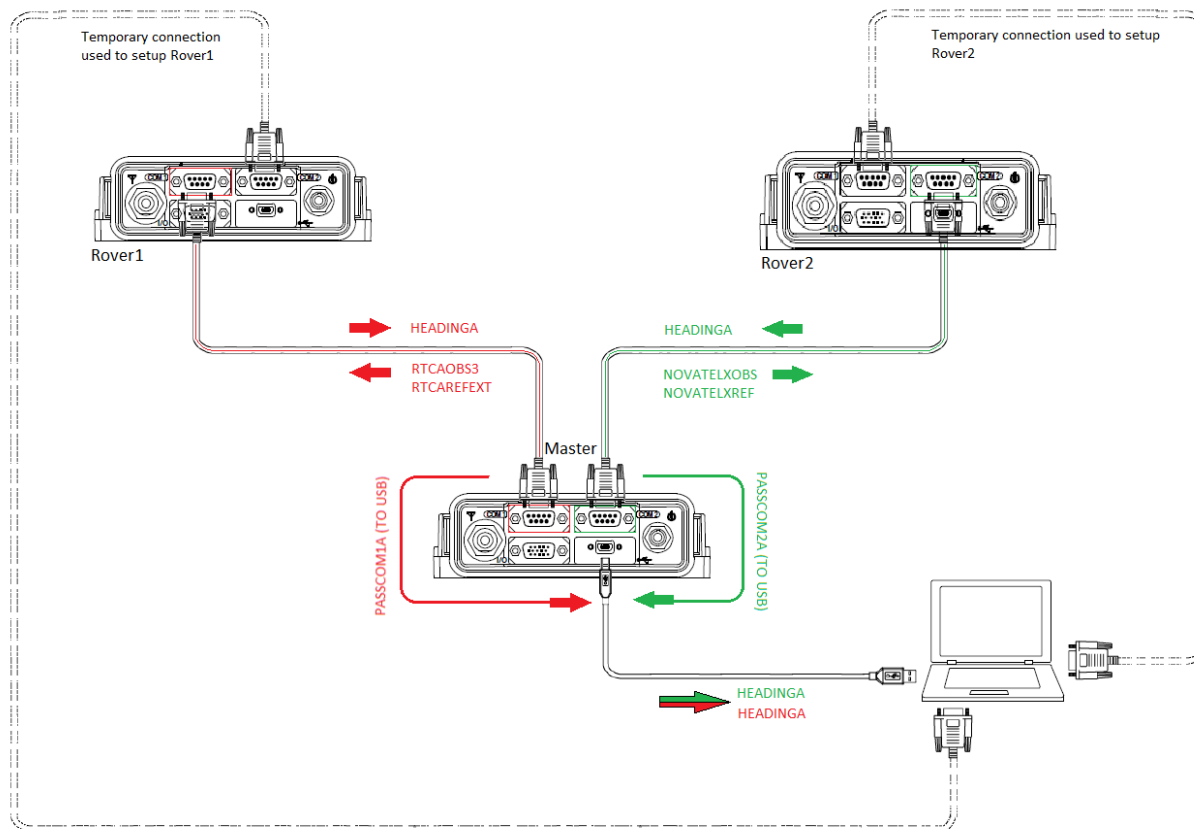


Figure 7: ALIGN Star Configuration Setup Example

Star Align Setup and Configuration:

This example is applicable for OEM 6 receivers.

1. Establish communication with the *Master* receiver (via USB port or Ethernet).
2. Establish communication with the *Rover1* receiver (via COM2).
3. Establish communication with the *Rover2* receiver (via COM1).
4. Connect the *Rover1* receiver to the *Master* receiver using COM 1 port.
5. Connect the *Rover2* receiver to the *Master* receiver using COM2 port.
6. Issue the following commands to the *Master*:

```
MOVINGBASESTATION ENABLE
INTERFACEMODE COM1 NOVATEL RTCA OFF
INTERFACEMODE COM2 NOVATEL NOVATELX OFF
COM COM1 230400 N 8 1 N OFF ON
COM COM2 230400 N 8 1 N OFF ON
LOG COM1 RTCAOBS3 ONTIME 0.1
```

```
LOG COM1 RTCAREFEXT ONTIME 0.1
LOG COM2NOVATELXOBS ONTIME 0.1
LOG COM2 NOVATELXREF ONTIME 0.1
SAVECONFIG
```

7. Issue the following commands to *Rover1*:

```
INTERFACEMODE COM1 RTCA NOVATEL OFF
COM COM1 230400 N 8 1 OFF ON
LOG COM1 HEADINGA ONCHANGED
SAVECONFIG
```

8. Issue the following commands to the *Master*. The heading from *Rover1* should be received at the computer at this point.

```
LOG PASSCOM1A ONCHANGED
SAVECONFIG
```

9. Issue the following commands to *Rover2*:

```
INTERFACEMODE COM2 NOVATELX NOVATEL OFF
COM COM2 230400 N 8 1 N OFF ON
LOG COM2 HEADINGA ONCHANGED
SAVECONFIG
```

10. Issue the following commands to the *Master*. The heading from *Rover2* should be received at the computer at this point.

```
LOG PASSCOM2A ONCHANGED
SAVECONFIG
```

A: Model Compatibility Chart ⁴

Master Receiver Model	Rover Receiver Model	Master <i>ALIGN</i> Logs	Rover <i>ALIGN</i> Logs
PVT Only Models (e.g. OEM615-G1S-00G-0T0, OEM628-D2S-00G-0T0)	Heading Only Models (e.g. OEM615-G2S-Z00-000, OEM628-D2S-Z00-00N)	MASTERPOS HEADING HEADING2 GPHDT	MASTERPOS HEADING HEADING2 GPHDT ALIGNDOP HEADINGRATE HEADINGSATS
PVT Only Models (e.g. OEM615-G1S-00G-0T0, OEM628-D2S-00G-0T0)	Relative Positioning Models (e.g. OEM615-P2S-Y0G-0T0, OEM628-D2S-Y0G-TTN)	MASTERPOS ROVERPOS HEADING HEADING2 GPHDT ALIGNBSLNXYZ ALIGNBSLNENU	MASTERPOS ROVERPOS HEADING HEADING2 GPHDT ALIGNBSLNXYZ ALIGNBSLNENU ALIGNDOP HEADINGRATE HEADINGSATS RANGE*
Heading Only Models (Daisy Chain Use Case) (e.g. OEM615-G2S-Z00-000, OEM628-D2S-Z00-00N)	Heading Only Models (e.g. OEM615-G2S-Z00-000, OEM628-D2S-Z00-00N)	HEADING HEADING2 GPHDT	HEADING, HEADING2, GPHDT, ALIGNDOP HEADINGRATE HEADINGSATS
Heading Only Models (Daisy Chain Use Case) (e.g. OEM615-G2S-Z00-000, OEM628-D2S-Z00-00N)	Relative Positioning Models (e.g. OEM615-P2S-Y0G-0T0, OEM628-D2S-Y0G-TTN)	HEADING HEADING2 GPHDT	HEADING HEADING2 GPHDT ALIGNBSLNXYZ ALIGNDOP HEADINGRATE RANGE* HEADINGSATS
Raw data Models (e.g. OEM615-G2S-BPR-TT0, OEM628-D2L-RPR-TTN, OEM638-G5J-B0R-TTN)	Heading Only Models (e.g. OEM615-G2S-Z00-000, OEM628-D2S-Z00-00N)	MASTERPOS HEADING HEADING2 GPHDT RANGE	MASTERPOS HEADING HEADING2 GPHDT ALIGNDOP HEADINGRATE HEADINGSATS
Raw data Models (e.g. OEM615-G2S-BPR-TT0, OEM628-D2L-RPR-TTN, OEM638-G5J-B0R-TTN)	Relative Positioning Models (e.g. OEM615-P2S-Y0G-0T0, OEM628-D2S-Y0G-TTN)	MASTERPOS HEADING HEADING2 GPHDT RANGE	MASTERPOS ROVERPOS HEADING HEADING2 GPHDT ALIGNBSLNXYZ ALIGNBSLNENU ALIGNDOP HEADINGRATE RANGE* HEADINGSATS

⁴ See Appendix B for link to receiver model configurations

* Available with raw data models

B: Receiver Model Configuration Descriptions

Refer to [NovAtel product model list](#) for complete list of ALIGN capable receivers and models. The last page of the model list document contains the possible receiver model configuration descriptions.

C: Dual Antenna Products

Dual antenna products such as the SPAN-SE-D, ProPak-6-D, OEM-617D, and FLEXPAK-6D are hardware preconfigured for ALIGN heading. No additional user input is required. Additional setup and equipment will be required if these systems are used in multiple platform applications (e.g. *daisy chain* use case, *master and rover on separate moving platform* use case, and *single master with multiple rovers* use case).

Final Points

If you require any further information regarding the topics covered within this application, contact:

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