This guide provides the basic information needed to set up and use your new NovAtel® MEMS Interface Card (MIC). For more detailed information on the installation and operation of your MIC, download the SPAN on OEM6 User Manual from our web site at www.novatel.com.

BOX CONTENTS
In addition to this Quick Start Guide, the following is provided with your MIC:

- 1 MIC to IMU interface cable
- 1 IMU mounting PCB (Printed Circuit Board)
  (a PCB is not included with the OEM-IMU-STIM300)
- Screws and standoffs for mounting the MIC

ADDITIONAL EQUIPMENT REQUIRED
The additional equipment listed below is required for a typical setup:

- An OEM615 receiver

The MIC supports all OEM6® family receiver cards for communications. The OEM615 is the only OEM6 family receiver card that can be directly integrated and powered by the MIC.

- An IMU (see the IMU Type column in Table 1, CONNECTIMU Commands on page 9)
- A 10-30 VDC power supply

If the MIC is installed in a standalone configuration, a separate power supply is required for the OEM6 family receiver. For information about the power supply requirements, refer to the Technical Specification appendix for the receiver card in the OEM6 Family Installation and Operation User Manual. This user manual is available from our website at www.novatel.com.

- A wiring harness to provide power to the P101 connector on the MIC (10-30 VDC).
- A wiring harness to connect the customers equipment to the P301 connector on the MIC.
- A quality, dual-frequency GNSS antenna such as the GNSS-502 or GNSS-802. See the NovAtel website (www.novatel.com/products/gnss-antennas/) for information on a variety of quality antennas available to meet your form factor and performance needs.
- An antenna cable
- A Windows® based computer
**IMU SETUPS**

**Figure 1: MIC to OEM-IMU-ADIS-16488 (OEM Cable Kit: 01019007)**

**Figure 2: MIC to OEM-IMU-HG1700 (OEM Cable Kit: 01018868)**

**Figure 3: MIC to OEM-IMU-HG1900 (OEM Cable Kit: 01018871)**

**Figure 4: MIC to OEM-IMU-HG1930 (OEM Cable Kit: 01018869)**
INSTALL THE MIC IN A STACK UP CONFIGURATION

In a stack up configuration, the MIC is connected directly to an OEM615 receiver. Power and communications connections to the receiver are made through the MIC.

Ref | Connector | Part Number | Mating Connector | Description
--- | --- | --- | --- | ---
1 | P101 | 43650-0313 (Molex) | 43645-0300 (Molex) | Connects to the power supply (user supplied cable)
2 | J101 | MCX-J-P-H-ST-SM1 (Samtec) | M1051-110 (ShinA Telecom) | Connects to the GNSS antenna (user supplied cable)
3 | P301 | 501571-3007 (Molex) | 501189-3010 (Molex) | Connects to COM and USB ports LVTTL (not 5 V tolerant) (user supplied cable)
Complete the following steps to connect and power your MIC and OEM615.

1. Attach the IMU mounting PCB to the IMU. Ensure all the pins on the header are aligned with the holes on the mating connector.

   An IMU mounting PCB is not used with the STIM300 IMU.

2. Mount the IMU and antenna securely to a vehicle. For the simplest operation, align the Y-axis of the IMU with the forward axis (direction of travel) of the vehicle. Ensure the Z-axis is pointing up. Ensure that the GNSS antenna and IMU cannot move relative to each other. The distance and relative direction between them must be fixed.

   For center of navigation diagrams of the ADIS and STIM300 IMUs, see the SPAN on OEM6 User Manual available from our web site at www.novatel.com.

   For center of navigation diagrams of the HG1700, HG1900 and HG1930 IMUs, contact NovAtel Customer Support. See Questions or Comments on page 12 for contact information.

3. Use the standoffs supplied with the MIC to mount the OEM615 receiver in a secure enclosure to reduce environmental exposure and RF interference. See the OEM6 Family Installation and Operation User Manual for information about mounting printed circuit boards.

   The part number for the recommended standoffs is RAF-M21073005AL7 (Irwin Industrial). If alternate standoffs are selected, use equivalent parts with a minimum height of 12 mm.
4. Connect the antenna cable to the antenna jack (J101) on the OEM615. The antenna cable must have a right angle MCX connector on the end that connects to the OEM615.

5. Align the OEM615 mating connector (J301) on the MIC with the 20-pin header (P1101) on the OEM615. Make sure all of the pins on the header are aligned with the holes in the mating connector. Press down on the MIC to seat the connector on the header.

6. Use the four screws supplied with MIC to secure the MIC to the OEM615.

7. Connect the IMU-to-MIC interface cable to the IMU.

8. Connect the IMU-to-MIC interface cable to the IMU connector on the MIC.
   - Use the 10-pin locking connector (P701) for the ADIS IMU.
   - Use the 20-pin locking connector (P601) for the HG1700, HG1900, HG1930 or STIM300 IMU.

9. Using a customer supplied wiring harness, connect a +10 to +30 VDC power supply to the power connector (P101) on the MIC. This connection provides power to the MIC and the OEM615. See the SPAN on OEM6 User Manual for pin out information for the power connector.

10. Using a customer supplied wiring harness, connect the communications connector (P301) to the user system. In a stack up configuration, the P301 connector provides connections for the: MIC serial port, OEM615 serial port (COM2), USB port, Event1 trigger, Event2 trigger, 1 Pulse Per Second (PPS) output, Variable Frequency (VARF) output, Reset Input and Position Valid output. See the SPAN on OEM6 User Manual for pin out information for the communications connector.

11. Skip to Install the PC Utilities on page 8.
INSTALL THE MIC IN A STANDALONE CONFIGURATION

In a standalone configuration, the MIC and OEM6 receiver are mounted separately.

<table>
<thead>
<tr>
<th>Ref</th>
<th>Connector</th>
<th>Part Number</th>
<th>Mating Connector</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>P101</td>
<td>43650-0313 (Molex)</td>
<td>43645-0300 (Molex)</td>
<td>Connects to the MIC power supply (user supplied cable)</td>
</tr>
<tr>
<td>2</td>
<td>P601</td>
<td>53780-2070 (Molex)</td>
<td>51146-2000 (Molex)</td>
<td>Connects to HG1700, HG1900, HG1930 and STIM300 IMUs (NovAtel supplied cable)</td>
</tr>
<tr>
<td>3</td>
<td>P701</td>
<td>53780-1070 (Molex)</td>
<td>51146-1000 (Molex)</td>
<td>Connects to ADIS IMUs (NovAtel supplied cable)</td>
</tr>
<tr>
<td>4</td>
<td>P301</td>
<td>501571-3007 (Molex)</td>
<td>501189-3010 (Molex)</td>
<td>Connects the MIC serial port to the OEM6 receiver (user supplied cable)</td>
</tr>
<tr>
<td>5</td>
<td>J301</td>
<td>ASP-163577-01 (Samtec)</td>
<td>N/A</td>
<td>This connector is not used in a standalone configuration.</td>
</tr>
</tbody>
</table>

**OEM628 Recommendations**

- Use COM1 for connection to a computer. COM1 uses RS-232 levels and can be connected to a computer without additional interface circuitry.
- Use COM2 for connection to the MIC serial port. Both the MIC serial port and COM2 use LVTTL levels and can be connected without additional interface circuitry.

**OEM638 Recommendations**

- Use COM1 or COM2 for connection to a computer. COM1 and COM2 use RS-232 levels and can be connected to a computer without additional interface circuitry.
- Use COM3 for connection to the MIC serial port. This COM port and the MIC serial port use LVTTL levels and can be connected without additional interface circuitry.
For information about the OEM6 receiver card connectors and pin-outs, refer to the OEM6 Family Installation and Operation User Manual.

Complete the following steps to connect and power your MIC.

1. Attach the IMU mounting PCB to the IMU. Ensure all the pins on the header are aligned with the holes on the mating connector.

An IMU mounting PCB is not used with the STIM300 IMU.

2. Mount the IMU and antenna securely to a vehicle. For the simplest operation, align the Y-axis of the IMU with the forward axis (direction of travel) of the vehicle. Ensure the Z-axis is pointing up. Ensure that the GNSS antenna and IMU cannot move relative to each other. The distance and relative direction between them must be fixed.

For center of navigation diagrams of the ADIS and STIM300 IMUs, see the SPAN on OEM6 User Manual available from our web site at www.novatel.com.

For center of navigation diagrams of the HG1700, HG1900 and HG1930 IMUs, contact NovAtel Customer Support. See Questions or Comments on page 12 for contact information.

3. Install the OEM6 receiver in a secure enclosure to reduce environmental exposure and RF interference. See the OEM6 Family Installation and Operation User Manual for information about installing and connecting an OEM6 receiver.

4. Use the four screws supplied with the MIC to secure the MIC to its mounting location. See the SPAN on OEM6 User Manual for the MIC dimensions.

Ensure all standoffs are properly installed and the mounting location for the MIC is level. The amount of board deflection (bow and twist) must not exceed 0.75%. For example, on the MIC which is 75 mm long and 46 mm wide, the deflection along the length must not exceed 0.56 mm and the deflection along the width must not exceed 0.34 mm.

5. Connect the IMU-to-MIC interface cable to the IMU.

6. Connect the IMU-to-MIC interface cable to the IMU connector on the MIC.
   - Use the 10-pin locking connector (P701) for the ADIS IMU.
   - Use the 20-pin locking connector (P601) for the HG1700, HG1900, HG1930 IMU or STIM300.

7. Using a customer supplied wiring harness, connect a +10 to +30 VDC power supply to the power connector (P101) on the MIC. See the SPAN on OEM6 User Manual for pin out information for the power connector.
8. Using a customer supplied wiring harness, connect a power supply to the OEM6 family receiver. See the [OEM6 Family Installation and Operation User Manual](#) for information about connecting power to an OEM6 family receiver.

9. Using a customer supplied wiring harness, connect the MIC serial port to a serial port on the OEM6 receiver. See the [SPAN on OEM6 User Manual](#) for pin out information for the communications connector.

All signal I/O with the exception of the USB port are at LVTTL levels. To connect the MIC to devices that use other signals levels, such as a computer with an RS-232 serial port, an interface circuit that converts to and from LVTTL must be used.

10. Skip to Install the PC Utilities on page 8.

**INSTALL THE PC UTILITIES**

1. Install the NovAtel Connect™ PC Utilities and USB drivers.

   To access and download the most current version of the NovAtel Connect PC Utilities and USB drivers, go to the Support page of the NovAtel web site at [www.novatel.com/support/search/items/PC%20Software](#).

**Establishing a New Receiver Connection**

The first time you open a serial port to communicate with the receiver, complete the following:

1. Launch NovAtel Connect from the Start menu folder specified during the installation process. The default location is Start | All Programs | NovAtel Connect.
2. Select New Connection from the Welcome window.
3. Enter a name for the Connection.
4. Select Serial or USB from the Type list.
5. Select the computer port that the SPAN system is connected to from the Port drop down list.
Follow these steps to enable INS as part of the SPAN system using software commands:

1. Establish a connection to the OEM6 receiver.
   Refer to the receiver Quick Start Guide for information about connecting to the receiver and entering commands.

2. Issue the `CONNECTIMU` command to specify the type of IMU and the receiver port connected to the IMU.

<table>
<thead>
<tr>
<th>IMU Type</th>
<th>CONNECTIMU command</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADIS-16488</td>
<td>CONNECTIMU COMxa IMU_ADIS16488</td>
</tr>
<tr>
<td>HG1700 AG11</td>
<td>CONNECTIMU COMxa IMU_HG1700_AG11</td>
</tr>
<tr>
<td>HG1700 AG17</td>
<td>CONNECTIMU COMxa IMU_HG1700_AG17</td>
</tr>
<tr>
<td>HG1700 AG58</td>
<td>CONNECTIMU COMxa IMU_HG1700_AG58</td>
</tr>
<tr>
<td>HG1700 AG62</td>
<td>CONNECTIMU COMxa IMU_HG1700_AG62</td>
</tr>
<tr>
<td>HG1900 CA50</td>
<td>CONNECTIMU COMxa IMU_HG1900_CA50</td>
</tr>
<tr>
<td>HG1930 CA50</td>
<td>CONNECTIMU COMxa IMU_HG1930_CA50</td>
</tr>
<tr>
<td>STIM300</td>
<td>CONNECTIMU COMxa IMU_STIM300</td>
</tr>
</tbody>
</table>

   a. If you are using the OEM615+MIC board stack, you must use COM1.

Basic configuration of the SPAN system is now complete. The inertial filter starts once the GNSS solution is solved and the IMU is connected.
3. Enter the distance from the IMU to the GNSS antenna using the SETIMUTOANTOFFSET command. The X (pitch), Y (roll) and Z (azimuth) directions are clearly marked on the IMU enclosure. The SETIMUTOANTOFFSET parameters are (where the standard deviation fields are optional):

\[ x\_offset \ y\_offset \ z\_offset \ [x\_stdev] \ [y\_stdev] \ [z\_stdev] \]

A typical RTK GNSS solution is accurate to a few centimetres. For the integrated GNSS/INS system to have this level of accuracy, the offset must be measured to within a centimetre.

4. Perform a kinematic alignment.
See the SPAN on OEM6 User Manual for more information.

LOG SPAN DATA
Navigation data (position, velocity, attitude) is available from the system as ASCII or binary logs.
Data can be collected through NovAtel Connect using the Logging Control Window, or sent out the receiver COM port to user supplied data collection software.

The figure shows the recommended logs for optimal real-time performance.
OPERATE THE SPAN SYSTEM

The system is ready to go once it is powered and the INS and GNSS are configured using the previously shown commands.

Observe the status of the system in the NovAtel Connect INS Window or in the status field of any of the INS solution logs (for example INSPOS, INSVEL, INSATT and INSPVA).

INS data is available once there is a good GNSS solution. Therefore, an antenna must be connected for the system to function.

If performing a static alignment, allow the system to be stationary for at least 1 minute after the GNSS solution is computed for its initial system alignment. If performing a kinematic alignment, move the vehicle forward at a speed faster than 5 m/s. The following status stages may be observed:

Table 2: Inertial Solution Status

<table>
<thead>
<tr>
<th>Binary</th>
<th>ASCII</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>INS_INACTIVE</td>
<td>IMU logs are present, but the alignment routine has not started; INS is inactive.</td>
</tr>
<tr>
<td>1</td>
<td>INS_ALIGNING</td>
<td>INS is in alignment mode.</td>
</tr>
<tr>
<td>2</td>
<td>INS_HIGH_VARIANCE</td>
<td>The INS solution is still being computed but the azimuth solution uncertainty has exceed the threshold. The default threshold is 2 degrees for most IMUs. The solution is still valid but you should monitor the solution uncertainty in the INSCOV log. You may encounter this state during times when the GNSS, used to aid the INS, is absent.</td>
</tr>
<tr>
<td>3</td>
<td>INS_SOLUTION_GOOD</td>
<td>The INS filter is in navigation mode and the INS solution is good.</td>
</tr>
<tr>
<td>6</td>
<td>INS_SOLUTION_FREE</td>
<td>The INS filter is in navigation mode and the GNSS solution is suspected to be in error. This may be due to multipath or limited satellite visibility. The inertial filter has rejected the GNSS position and is waiting for the solution quality to improve.</td>
</tr>
<tr>
<td>7</td>
<td>INS_ALIGNMENT_COMPLETE</td>
<td>The INS filter is in navigation mode, but not enough vehicle dynamics have been experienced for the system to be within specifications.</td>
</tr>
<tr>
<td>8</td>
<td>DETERMINING_ORIENTATION</td>
<td>INS is determining the IMU axis aligned with gravity.</td>
</tr>
<tr>
<td>9</td>
<td>WAITING_INITIALPOS</td>
<td>The INS filter has determined the IMU orientation and is awaiting an initial position estimate to begin the alignment process.</td>
</tr>
</tbody>
</table>
POST-PROCESS DATA

Post-processing requires collection of simultaneous data from the base and rover stations. This includes accurate coordinates of the base station and accurate measurement of the IMU to antenna separation.

Collect the following data for post-processing:

- From the base station
  - RANGECMPB ontime 1
  - RAWEPHEMB onchanged
  - GLOEPHEMERISB onchanged (if using GLONASS)

- From the rover station(s)
  - RANGECMPB ontime 1
  - RAWEPHEMB onchanged
  - GLOEPHEMERISB onchanged (if using GLONASS)
  - RAWIMUSXB onnew
  - IMUTOANTOFFSETSB onchanged
  - VEHICLEBODYROTATIONB onchanged

SPAN system output is compatible with Inertial Explorer® post-processing software from the Waypoint® Products Group, NovAtel Inc. Visit our website at www.novatel.com/products/software/ for details.

QUESTIONS OR COMMENTS

If you have any questions or comments regarding your SPAN system, contact NovAtel Customer Service using one of these methods

Log a Case and Search Knowledge:

- Website: www.novatel.com/support

Log a Case, Search Knowledge and View Your Case History: (login required)

- Web Portal: https://novatelsupport.force.com/community/login

Email:

- support@novatel.com

Telephone:

- U.S. and Canada: 1-800-NOVATEL (1-800-668-2835)
- International: +1-403-295-4900