

Universal IMU Controller

QUICK START GUIDE

GM-14915134

Rev 2

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This guide provides the basic information needed to set up and use your new NovAtel® Universal IMU Controller (UIC). For more detailed information on the installation and operation of your UIC, download the [SPAN on OEM6 User Manual](#) from www.novatel.com or refer to the OEM7 Documentation available at docs.novatel.com/OEM7.

BOX CONTENTS

In addition to this *Quick Start Guide*, the following is provided with your UIC:

- 1 UIC to IMU interface cable

ADDITIONAL EQUIPMENT REQUIRED

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

- A SPAN® enabled OEM6® or OEM7 receiver
- An IMU (see the *IMU Type* column in *Table 1, CONNECTIMU Commands* on page 5)
- A 10-34 VDC power supply
- A power supply for the receiver



OEM7 Receivers

A separate power supply is required for OEM7 receivers.

OEM615, OEM617 and OEM628

A separate power supply is required for OEM615, OEM617 and OEM628 receivers.

OEM638, FlexPak6 and ProPak6

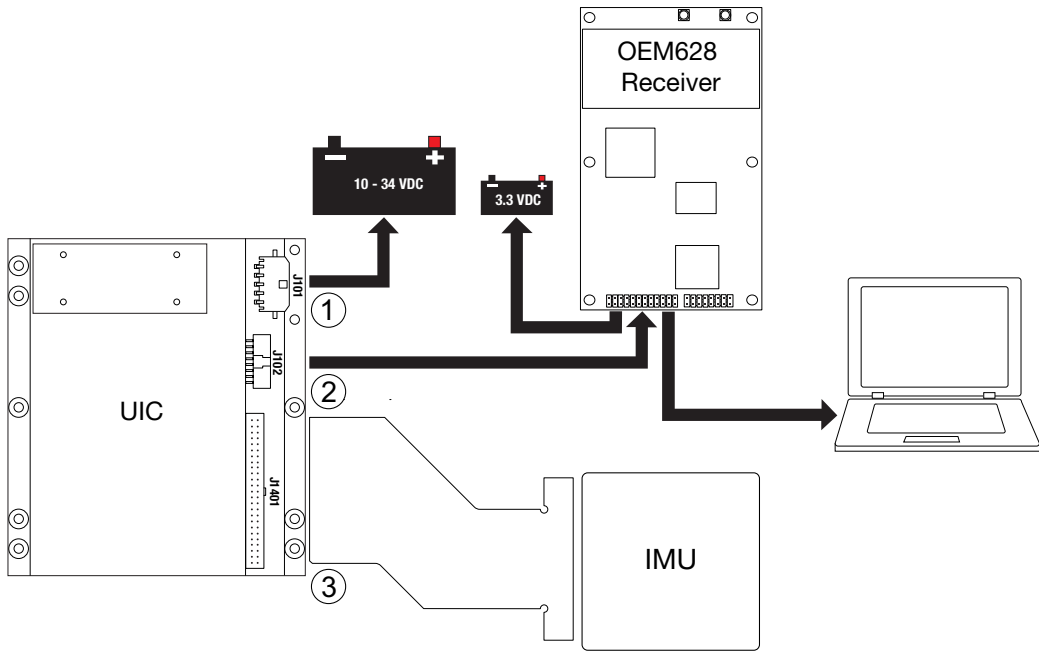
The same power supply can be used for the UIC and the OEM638, FlexPak6 or ProPak6 receiver if the power supply provides +10 to +34 V DC and can provide enough power for both devices.

For information about receiver power supply requirements, refer to the Technical Specifications appendix for the receiver in the [OEM6 Family Installation and Operation User Manual](#) (OM-20000128) or the [ProPak6 User Manual](#) (OM-20000148). These user manuals are available from our website at www.novatel.com.

- A wiring harness to provide power to the J101 connector on the UIC (10-34 VDC)
- A wiring harness to connect the receiver and customer equipment to the J102 connector on the UIC
- A wiring harness to provide power and external connections to the receiver
- Screws and standoffs to mount the UIC
- A quality, dual-frequency GNSS antenna such as the 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
- Antenna cable(s)
- A Windows® based computer

INSTALL THE UIC

The UIC, IMU and receiver are mounted separately.




Ref	Connector	Part Number	Mating Connector	Description
1	J101	43650-0513 (Molex)	43645-0500 (Molex)	Connects to the UIC power supply (user supplied cable)
2	J102	98464-G61-16LF (FCI)	90311-016LF (FCI)	Connects the UIC serial port to the receiver (user supplied cable)
3	J1401	LTMM-125-02-L-D (Samtec)	SQT-125-01-L-D (Samtec)	Connects to the IMU (NovAtel supplied cable)

Connection	J101 Pin (UIC)
Power input (UIC)	1
Power input (UIC)	2
Power return (UIC)	3
Power return (UIC)	4
Chassis ground	5


Connection*	J102 Pin (UIC)	P1500 Pin (OEM628)	P1802 Pin (OEM729)
RS-422 Serial Data (UIC to Receiver)	A1	20	20
RS-422 Serial Data (UIC to Receiver)	A2	17	17
RS-422 Serial Data (UIC to Receiver)	A3	18	18
RS-422 Serial Data (UIC to Receiver)	A4	15	15
3.3 VDC		2, 5, 6	2, 5, 6
Ground	B8	1, 23, 24	1, 23, 24
RS-232 RXD (Receiver to Computer)		14	14
RS-232 TXD (Receiver to Computer)		16	16

*Other OEM6 and OEM7 receivers require an interface circuit between the UIC and receiver. Refer to the [SPAN on OEM6 User Manual](#) or OEM7 Documentation (docs.novatel.com/OEM7) more information.


Complete the following steps to connect and power your UIC.


 Ensure all Electrostatic Discharge (ESD) measures are in place, in particular, use a ground strap before exposing or handling any electronic items, including the UIC, receiver and IMU. Take care to prevent damaging the UIC, receiver or IMU. For more information about ESD practices, see the [OEM6 Family Installation and Operation User Manual](#) or the OEM7 Documentation (docs.novatel.com/OEM7).

1. 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, see the [SPAN on OEM6 User Manual](#), the OEM7 Documentation (docs.novatel.com/OEM7) or the documentation that came with the IMU.

2. Install the receiver in a secure enclosure to reduce environmental exposure and RF interference. See the [OEM6 Family Installation and Operation User Manual](#) or OEM7 Documentation (docs.novatel.com/OEM7) for information about installing and connecting the receiver.
3. Install the UIC in a secure enclosure to reduce environmental exposure and RF interference. If there is sufficient space, the UIC can reside in the same enclosure as the receiver. Use M3 pan head stainless steel screws to secure the UIC to its mounting location. See the [SPAN on OEM6 User Manual](#) or the OEM7 Documentation (docs.novatel.com/OEM7) for the UIC dimensions.

 Ensure the UIC is mounted close enough to the IMU so the interface cable can reach both devices.

 Ensure the mounting location provides at least 5 mm of clearance below the board to allow for components on the bottom of the UIC.
Ensure all standoffs are properly installed and the mounting location for the UIC is flat.
The amount of board deflection (bow and twist) must not exceed 0.75%. For example, on the UIC which is 100 mm long and 113 mm wide, the deflection along the length must not exceed 0.75 mm and the deflection along the width must not exceed 0.85 mm.

4. Attach the screw kit to the IMU to UIC interface cable (OEM-IMU-ISA100C only).
5. Connect the IMU to UIC interface cable to the IMU.
6. Connect the IMU to UIC interface cable to the IMU connector (J1401) on the UIC.
7. Using a customer supplied wiring harness, connect the UIC serial port to a serial port on the receiver. See the [SPAN on OEM6 User Manual](#) or OEM7 Documentation (docs.novatel.com/OEM7) for pin out information for the communications connector (J102).

 The serial port on the UIC uses RS-422 levels.
To connect the UIC to devices that use other signals levels, such as an LVTTTL COM port on the GNSS receiver, an interface circuit that converts to and from RS-422 must be used.

OEM719 OEM7700	<ul style="list-style-type: none"> • All of the COM ports on these receivers use LVCMOS levels. An interface circuit that converts to and from RS-422 levels is required for all COM ports.
OEM729	<ul style="list-style-type: none"> • COM1 on the OEM729 receiver can use RS-232 levels (default) or RS-422 levels. To use COM1 for connection to the UIC, configure the COM1 port to use RS-422 levels. Refer to the OEM7 Documentation (docs.novatel.com/OEM7) for information about changing COM1 to RS-422 levels. • COM2 and COM3 on the OEM729 receiver use LVCMOS levels. To use COM2 or COM3 for connection to the UIC serial port, an interface circuit that converts to and from RS-422 levels is required.
OEM615 OEM617	<ul style="list-style-type: none"> • All of the COM ports on these receivers use LVTTTL levels. An interface circuit that converts to and from RS-422 levels is required for all COM ports.
OEM628	<ul style="list-style-type: none"> • COM1 on the OEM628 receiver can use RS-232 levels (default) or RS-422 levels. To use COM1 for connection to the UIC, configure the COM1 port to use RS-422 levels. Refer to the OEM6 Family Installation and Operation User Manual for information about changing COM1 to RS-422 levels. • COM2 and COM3 on the OEM628 receiver use LVTTTL levels. To use COM2 or COM3 for connection to the UIC serial port, an interface circuit that converts to and from RS-422 levels is required.
OEM638	<ul style="list-style-type: none"> • 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 COM6 for connection to the UIC serial port. To use COM6, the port must be changed to RS-422 levels. Refer to the OEM6 Family Installation and Operation User Manual for information about changing COM6 to RS-422 levels.



For information about the OEM6 receiver card connectors and pin-outs, refer to the [OEM6 Family Installation and Operation User Manual](#).

For information about the OEM7 receiver card connectors and pin-outs, refer to the OEM7 Documentation (docs.novatel.com/OEM7).

8. Using a customer supplied wiring harness, connect a +10 to +34 VDC power supply to the power connector (J101) on the UIC.
See the [SPAN on OEM6 User Manual](#) or the OEM7 Documentation (docs.novatel.com/OEM7) for pin out information for the power connector.
9. Using a customer supplied wiring harness, connect a power supply to the receiver.
See the [OEM6 Family Installation and Operation User Manual](#) or OEM7 Documentation (docs.novatel.com/OEM7) for information about connecting power to the receiver.
10. Connect a computer (for monitoring and configuration) to receiver.
Refer to the [OEM6 Family Installation and Operation User Manual](#) or OEM7 Documentation (docs.novatel.com/OEM7) for information about connecting data communications equipment to the receiver.

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/info/documents/809.

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 | 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 enabled receiver is connected to from the Port drop down list.
6. If this is a serial connection, select **115200** from the **Baud Rate** drop down list.
7. If this is a serial connection, clear the **Use hardware handshaking** check box.
8. Click the **OK** button to save the new connection.
9. Select the SPAN receiver from the Available Device Connections area of the Open Connection window.
10. Click the **Open** button to open SPAN receiver communications.
11. As NovAtel Connect establishes the communication session, a progress box is displayed.



Detailed instructions for using NovAtel Connect are available from within the Help within the software.

CONFIGURE THE SPAN SYSTEM

Follow these steps to enable INS as part of the SPAN system using software commands:

1. Establish a connection to the receiver.
Refer to the [OEM6 Family Installation and Operation User Manual](http://docs.novatel.com/OEM6) or OEM7 Documentation (docs.novatel.com/OEM7) for information about connecting to the receiver and entering commands.



A GNSS antenna must be connected and tracking satellites for operation.

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

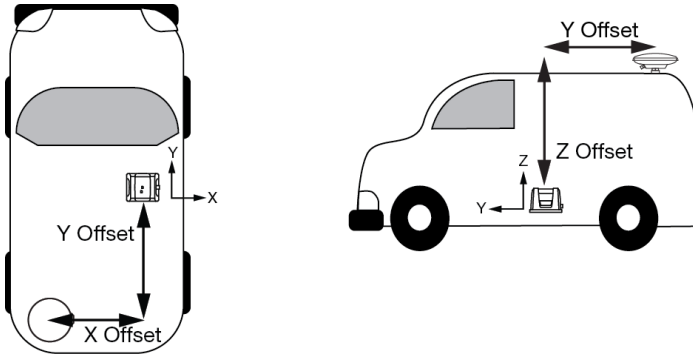
Table 1: CONNECTIMU Commands

IMU Type	CONNECTIMU command
HG1900 CA50	CONNECTIMU COMx IMU_HG1900_CA50
IMU-ISA-100C	CONNECTIMU COMx IMU_ISA100C
IMU-μIMU	CONNECTIMU COMx IMU_LITEF_MICROIMU
LN-200	CONNECTIMU COMx IMU_LN200

Basic configuration of the SPAN system is now complete. The inertial filter starts once the GNSS solution is solved and the IMU is connected.

- 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]`



This example assumes a default mounting configuration with a -X offset, -Y offset and +Z offset.

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.

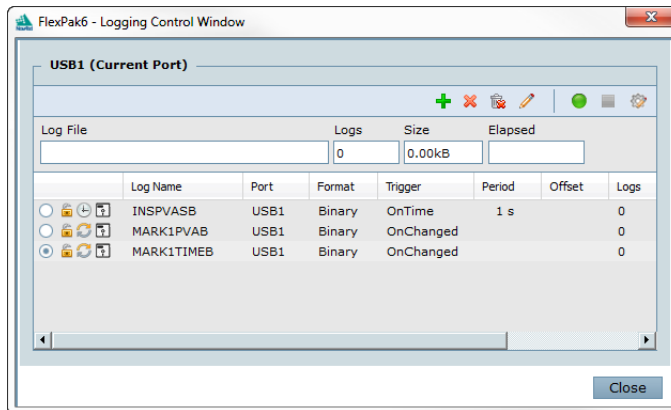
- Perform a kinematic alignment.

See the [SPAN on OEM6 User Manual](#) or OEM7 Documentation (docs.novatel.com/OEM7) 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 after 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 statuses may be observed:

Table 2: Inertial Solution Status

Binary	ASCII	Description
0	INS_INACTIVE	IMU logs are present, but the alignment routine has not started; INS is inactive.
1	INS_ALIGNING	INS is in alignment mode.
2	INS_HIGH_VARIANCE	The INS solution is still being computed but the azimuth solution uncertainty has exceeded 2 degrees. 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.
3	INS_SOLUTION_GOOD	The INS filter is in navigation mode and the INS solution is good.
6	INS_SOLUTION_FREE	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.
7	INS_ALIGNMENT_COMPLETE	The INS filter is in navigation mode, but not enough vehicle dynamics have been experienced for the system to be within specifications.
8	DETERMINING_ORIENTATION	INS is determining the IMU axis aligned with gravity.
9	WAITING_INITIALPOS	The INS filter has determined the IMU orientation and is awaiting an initial position estimate to begin the alignment process.

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
 - IMUTOANTOFFSETS onchanged
 - VEHICLEBODYROTATION 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



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