MT4100X-UG001

MT 4100

User Guide

Version 1.3

NOVATEL WIRELESS

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NOVATEL WIRELESS TRADEMARKS AND SERVICE MARKS

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Introduction

Description

Novatel Wireless' MT 4100 keeps you connected to your assets. It is more than just a communication device, it is a full-featured telematics solution designed to optimize your mobile resources and improve your company's bottom line. MT 4100 offers two serial interfaces, 1-wire driver ID support, multiple GPIO, polygon geo-fencing, driver behavior reporting, and an optional backup battery. MT 4100 includes optional routing and optimization with Garmin® Fleet Management Interface (FMI)—a key part of today's most useful, versatile, and cost-efficient fleet management solutions.

When you add N4A™ Communications and Management platform to your MT 4100 (shown here), you can provision, monitor, and reconfigure the MT 4100 remotely from almost anywhere in the world.

The MT 4100 has a printed label on the top side of the device. The following figure shows a sample label with the type of information it includes.

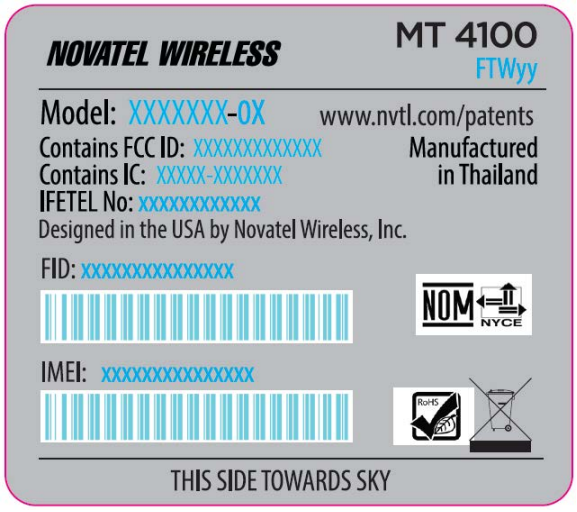

Figure 1-1: MT 4100 Label

Technical Specifications

General

Name:	MT 4100
Models:	RTT2201, UMT2202, UMT2203
Approvals:	FCC, CE, RoHS, Industry Canada
Housing:	Rugged textured plastic enclosure UL94-Vo fire
Weight:	Without Battery: 71.8 grams With Battery: 81 grams
Dimensions:	82 x 52 x 26.4 mm
Battery:	Rechargeable lithium-ion battery (230 mAh)
Recharge Temperature Range	0 to +45° C
Operating Voltage:	9 - 32 VDC operational for 12 V & 24 V systems

Radio Technology

Downlink/Uplink	
- CDMA:	153 Kbps
- GPRS:	80 Kbps, 40 Kbps
- EDGE:	237 Kbps,118 Kbps
- WCDMA Release 99:	384 Kbps, 384 Kbps
- HSDPA Release 5:	3.6 Mbps, 3.6 Mbps
Cellular Technology:	1xRTT (CDMA2000) or HSDPA (UMTS 3G)
	1xRTT (CDMA): 850/1900
	HSDPA (UMTS): 850/1900 (Bands V, II) (NA) or 900/2100 (Bands VIII, I) (ROW)
GSM/GPRS/EDGE Fallback:	850/1900 Mhz Fallback (NA) 900/1800 Mhz Fallback (ROW)

Packet Data

Packet Data	IS-95, IS-2000
SMS Functionality	
- HSDPA SMS:	Text, PDU, MO/MT, Cell Broadcast
- CDMA SMS:	Text, MO/MT

Environmental

Operating Temperature:	Battery version: -20° C to 60° C Non battery version: -30° C to 85° C
Storage Temperature:	-40° C to 85° C
Humidity:	Battery version: Up to 89% non-condensing Non-battery version: Up to 95% non-condensing
Vibration Stability:	In accordance with SAE J1211

Components

GPS Protocols:	NMEA, Binary
Buffered GPS Message Feature:	Yes
Accelerometer:	3-axis digital
SIM Access:	Internal (HSDPA models only)
Cellular Antenna:	Internal
GPS Antenna:	Internal
Serial Data I/O:	(2) RS-232 (RX, TX, CTS, RTS) (RX, TX on 2nd)
I/O Connector:	22-pin Molex (3) digital outputs (2) analog inputs (0-16 V, 0-32 V) (5) digital inputs 1-wire interface (Driver ID) Ignition Sense
Garmin® FMI:	Optional, Version 2.6 with integrated safe mode and speed limit alerts
LEDs:	Power (green), Cellular (green), GPS (red)
Analog To Digital Converter (ADC1):	10 bit, 0-16 V input range, +/- 1%, 40 V max, scaling 0.0156 per bit (16 VDC/1023)
Analog To Digital Converter (ADC2):	ADC2: 10 bit, 0-32 V input range, +/- 1%, 40 V max scaling 0.0312 per bit (32 VDC/1023)

Protocols

Host Protocols:	AT commands, UDP API, FOTA
Internal Protocols:	UDP API, TCP API
API Control/Status:	AT commands, UDP API, TCP API, AT commands over SMS

Part Numbers

RTT2201-00	CDMA 1xRTT w/ Backup Battery
RTT2201-01	CDMA 1xRTT w/o Backup Battery
UMT2202-00	ROW (HSDPA Version with Battery)
UMT2202-01	ROW (HSDPA Version without Battery)
UMT2203-00	NA (HSDPA Version with Battery)
UMT2203-01	NA (HSDPA Version without Battery)
BRK4100	Mounting bracket
CAB2448-01	Power, ground, ignition cable
CAB2200-02	Power and full I/O integration/development cable

Document References

MT4100R-AT144	MT 4100 R AT Command Reference
MT4100U-AT144	MT 4100 U AT Command Reference
ENF0000AN003	Accelerometer Guide Application Note
ENF0000AN009	Low Power Sleep Mode Application Note
ENF0000AN002	FOTA Application Note
ENF0000CB001	API Reference
ENF0000XG001	GFMI Technical Guide
ENF0000AN014	Access the Novatel Wireless Test Server Application Note
ENF0000AN010	MT Decoding NMEA Messages Application Note
ENF0000AN018	1-Wire Interface Application Note

Certifications

FCC:	Yes
CE:	Yes
RoHS Compliant:	Yes
Industry Canada:	Yes

Additional Features

FOTA (Firmware Over-the-Air) I/O control
Binary reporting
Timed reporting

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Features and Functions

GPS

GPS functions include:

- NMEA protocol (to update all data points)
- Novatel Wireless Binary Packets
- Buffered GPS message feature
- Geo-fencing (helps secure devices within a defined location)
- Virtual odometer (uses GPS technology to track devices)

GPS Measurements

Dimension	Measurement
Time to first fix - Cold Start @ -130 dBm with 20 m accuracy	< 60 sec
Time to first fix - Hot Start @-130 dBm with 20 m accuracy	≤ 3 sec
Time to first fix - Reacquisition @-130 dBm with 20 m accuracy	< 3 sec
Acquisition Sensitivity with 50 m accuracy	< -140 dBm
Tracking sensitivity with < 50 m accuracy	< -157 dBm
Tracking sensitivity with > 50 m accuracy	-162 dBm
Accuracy, R 95%, Clear view of the sky, 24 hours	< 15 meters

For more information on NMEA and Binary Packets, see Novatel Wireless document *MT Decoding NMEA Messages Application Note* (ENF0000AN010).

For more information on Virtual Odometer, see Novatel Wireless document *API Reference* (ENF0000AN010).

Power

The MT 4100 accepts 9-32 VDC, minimum 2 amps input power. This allows the device to be used on both 12 V and 24 V vehicles per SAE specifications, including protection for jump-starting 24 V vehicles.

Pins 17 and 18 on the 22-Pin IO connector are the power input and pins 6 and 7 are ground.

All power and ground pins must be connected.

Power Consumption

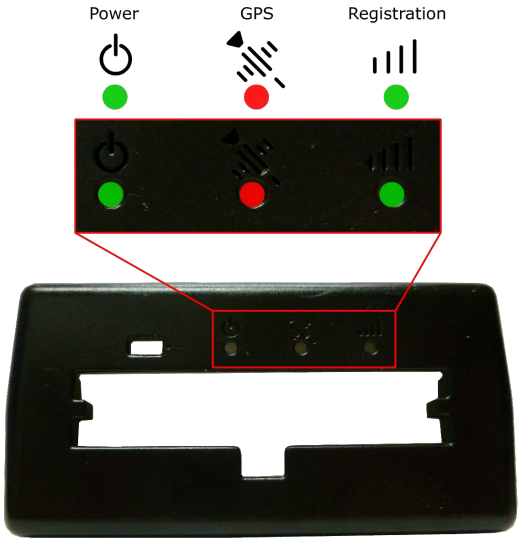
Mode	Current	GPS
CDMA BC0 - 800 MHz	< 66 mA @ 14.2 V	GPS off; lowest current consumption while still being able to contact the device
CDMA BC1 - 1900 MHz	< 63 mA @ 14.2 V	GPS on
Idle (GPS on)	< 54 mA @14.2 V	Registered
Idle (GPS off)	< 33 mA @14.2 V	Registered
Low Power Sleep Mode	<1.3 mA @14.2 V	GPS off

Bench Testing / Programming

WARNING! After performing a firmware upgrade the device will respond that the firmware load is complete. However, power must remain applied to the device for approximately two minutes after the firmware upgrade completion message is received. This allows time for the upgrade to be applied to the auxiliary processor. The user can confirm it is safe to remove power by sending the AT$OBDVER? command. If the upgrade is still processing, the device will respond with an error. If the upgrade is complete, the device will respond with the current software version.

LEDs

The MT 4100 includes LEDs to indicate Power, GPS, and Registration status. The following image shows the location of each LED.

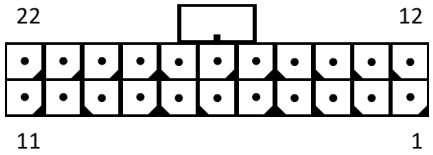


The LEDs are described in the following table.

MT 4100 LEDs	
PWR:	This LED indicates power to the GPS module. LED is on ~1 second after powered on and the GPS module is operational. This LED is off when powered off or when the MT 4100 enters Low-Power Sleep mode. Note: If you disable the GPS module, you must apply power for this LED to turn on.
GPS:	You can configure this LED to display registration, GPS fix status, or other user functions. By default, this LED indicates GPS fix status. The LED remains off when it receives invalid GPS data. The LED remains on when it receives valid GPS data.
Registration:	You can configure this LED to display registration or other user functions. By default, this LED indicates network registration status. If this LED stays off, this indicates that the device is not attempting to register to the network. If the LED blinks, it indicates that the device is trying to connect to the network. If the LED is always on, this indicates that the device has connected to the network.

22-Pin I/O Connector

The MT 4100 has a 22-pin I/O connector. The following image shows the pin layout.

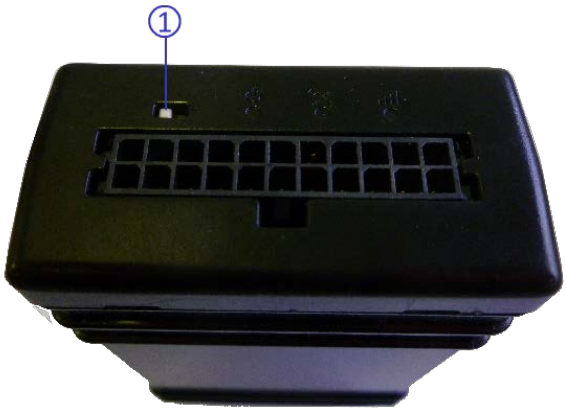


The 22-Pin I/O Connector provides the following functionality:

Pin #	User Name	Description
1	Digital Input #5	Digital Input #5 (GPI12)
2	Digital Input #4	Digital Input #4 (GPI11)
3	1-Wire	1-Wire® Interface / Note: Maximum voltage on this pin is 3.3 VDC
4	ADC In #2	Analog-to-Digital Input, 0 – 32 VDC
5	ADC In #1	Analog-to-Digital Input, 0 – 16 VDC
6	Ground	System Ground
7	Ground	System Ground; Connector has longer pin for MFBL
8	Digital Input #2	Digital Input #2 (GPI9)
9	Digital Input #1	Digital Input #1 (GPI1)
10	RS-232 CTS1	RS-232 CTS1 Out / Note: Output only. Input voltages should not be applied.
11	Ignition Sense	Vehicle Ignition Sense
12	RS-232 TX2	RS-232 TX2 In / Note: -25 VDC to 25 VDC
13	RS-232 RX2	RS-232 RX Out / Note: Output only. Input voltages should not be applied.
14	Digital Output 1	Output, High-Current Sink, Low-Current Source, Latched (GPO2)
15	Digital Output 2	Output, High-Current Sink, Low-Current Source, Latched (GPO5)
16	Digital Output 3	Output, High-Current Sink, Latched (GPO3)
17	Power In	Vehicle Power from 12 or 24 V Vehicles
18	Power In	Vehicle Power from 12 or 24 V Vehicles
19	Digital Input #3	Digital Input #3 (GPI10)
20	RS-232 RTS1	RS-232 RTS1 In / Note: -25 VDC to 25 VDC
21	RS-232 TX1	RS-232 TX1 In / Note: -25 VDC to 25 VDC
22	RS-232 RX1	RS-232 RX1 Out / Note: Output only. Input voltages should not be applied.

Battery Disconnect Switch

Use the MT 4100 Battery Disconnection Switch to remove battery power from the device (battery models only). Move the switch toward the dot to place the battery in the **ON** position. Move the switch away from the dot to place the battery in the **OFF** position. The following figure shows the MT 4100 Battery Disconnection Switch in the **OFF** position.



You must place the Battery Disconnection Switch in the **ON** position before using the optional backup battery for programming or operating the MT 4100.

WARNING! If the Battery Disconnection Switch remains in the **ON** position with no external power applied for an extended period of time, then the battery may significantly lose its charging capability.

WARNING! Before connecting to any auxiliary I/O device, you must apply power to the MT 4100 by moving the Battery Power Switch to the **ON** position. Failure to apply power to the MT 4100 before connecting auxiliary devices may result in damage to the attached I/O device.

NOTE: Move the Battery Disconnection Switch to the **OFF** position when transporting the device by air.

Low-Power Sleep Mode

In Low-Power Sleep Mode (LPS), all modem/GPS activity stops; this allows extreme power savings. The auxiliary processor efficiently monitors system inputs based on the configuration assigned and will exit LPS mode when needed. The current draw during LPS is:

< 1.5 mA @ 12 V

You can configure the MT 4100 to exit Low-Power Sleep Mode when:

- Ignition detected
- Motion detected
- Input triggered
- Elapsed-time expired

For more details, see Novatel Wireless document *Power Saving Techniques Application Note* (ENF0000AN015).

Accelerometer

The MT 4100 has two, three-axis digital accelerometers that provide the following features:

- Motion alert (towing alert)
- Driver behavior reporting
    - Rapid acceleration
    - Harsh braking
- Configurable thresholds
    - Range settings
    - Mode (Normal, Sleep, Wakeup)
    - Wakeup pause (20 to 2560 msec)
    - Sample Rate (0 to 25 per second)
    - Filter Coefficient and Filter Bandwidth
    - Device Orientation Setup

For more information, please refer to Novatel Wireless document *Accelerometer Guide Application Note* (ENF0000AN003).

1-Wire® Interface

The MT 4100 includes a 1-Wire® interface that enables the device to communicate with the following accessories:

- An iButton® receiver to allow for Driver ID (iButton® and receiver not included)
- Up to two 1-Wire Temperature Sensors

For more information, see the Novatel Wireless document *1-Wire Application Note* (ENF0000AN018).

WARNING! The maximum permissible voltage to the 1-Wire® interface is 3.3 Volts DC. Voltage in excess of this limit will damage the device.

Device Check-In

The device check-in feature provides connectivity to "configuration-only" servers. The device performs a “check-in" to these servers periodically for configuration updates. A check-in is similar to a wake-up message. The server then configures the device using AT commands after establishing a UDP connection.

This feature has AT$CHKIN command available and requires Novatel Wireless CMS software version 3.1 or higher. For more information, see *MT 4100 R AT Command Reference* (MT4100R-AT144) or *MT 4100 U AT Command Reference* (MT4100U-AT144).

Garmin Fleet Management Interface (GFMI)

NOTE: The Garmin Fleet Management Interface (GFMI) feature is available for separate purchase. Contact your Novatel Wireless sales representative for information.

GFMI provides the MT 4100 with a Wireless Network back-end to allow the Garmin Portable Navigation Device (PND) to communicate with a server.

Garmin has defined and published the GFMI Control Specification. The GFMI defines the message protocol that the PND supports over the 9600 baud serial line. If a device has GFMI enabled, the MT 4100 will support this protocol and transmit and receive requests back to the server.

For more information, see Novatel Wireless document *GFMI Technical Guide* (ENF0000XG001).

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Installation

SIM Installation

NOTE: The SIM installation section applies only to models UMT 2202 and UMT 2203.

The MT 4100 UMT versions include an onboard SIM carrier supporting 1.8/3V SIM cards. This section applies only to a version with a SIM. There is no external access to the SIM.

NOTE: You must obtain a SIM card from your network service provider. The operator must provision the SIM card for data. Without the SIM installed, the MT 4100 modem cannot communicate with the network.

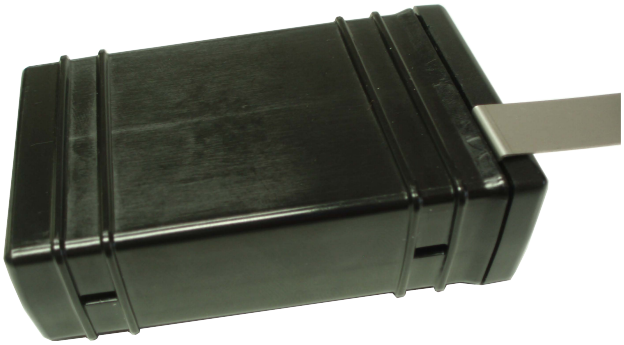
NOTE: To prevent damaging the device, use the Metal Lever (Novatel Wireless part number K1T2418) when opening the MT 4100.

WARNING! Use proper Electrostatic Discharge precautions when handling the open device.

To install a SIM into the MT 4100:

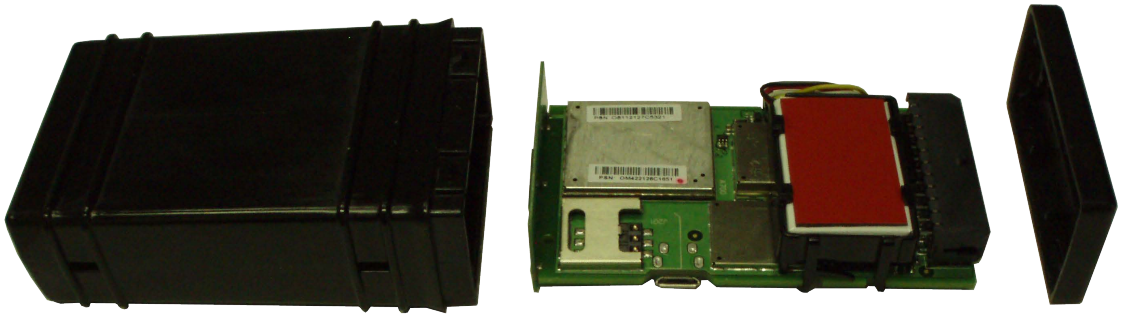
1. Locate the retainer snaps on the top of the device.

2. Insert the curved foot of the Metal Lever into the gap between the lid and the body next to the retainer snaps on both sides of the device.

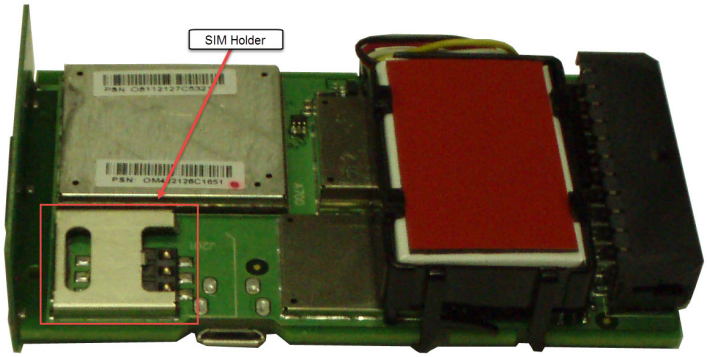


3. Gently apply pressure upwards on the lever until the lid unsnaps.

4. Carefully remove the cover from the device.



5. Insert the SIM into the SIM holder of the MT 4100.

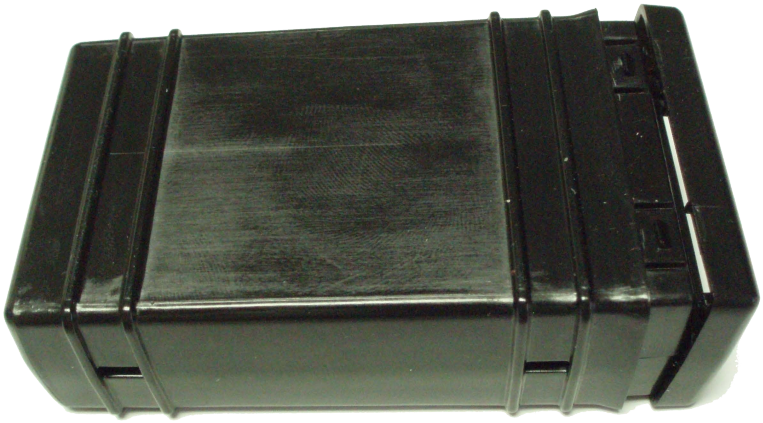


CAUTION! Always take care to protect the SIM.

6. Place the MT 4100 cover onto the base so that the LED symbols on the cover align with the LED placement inside the device.

CAUTION! Take care not to disconnect the battery connector on devices with a backup battery.

7. Carefully press the lid against the base until it snaps in place.



Device Installation

There are several considerations for mounting and installing the MT 4100 device such as determining the mounting location within the vehicle, the type of mounting method to use, and best device position and orientation. This section covers each of these considerations and includes installation steps along with precautions and guidelines.

Precautions and Guidelines

As you determine the mounting location and prepare to install the device, be sure to heed the following precautions and guidelines:

- Use a qualified Automotive Electronics Installer to perform the installation.
- Perform a basic vehicle functionality check before starting the installation.
- Mount all components properly or attach to the vehicle in a way that does not interfere with the normal operation of the vehicle.
- Never mount the MT 4100 in the engine compartment, directly on top of the AM/FM radio, by any moving parts, or in a location that would be exposed to the elements.
- Choose a location where metal or cable bundles do not shield the device.
- Do not mount the device near or in the path of the vehicle's airbag.
- Route all device cabling away from vehicle components where it could cause RF interference, such as radio, speakers and speaker wires, and GPS.
- Choose a location where the device can be positioned so that the correct side has the best unobstructed path to the sky (see label instructions).
- Protect cabling through the vehicle chassis against spurs and nicks.
- Do not mount the device where any excessive heat is generated by the vehicle or vehicle components.
- Solder all splice connections to ensure optimum reliability.
- Make all I/O connections prior to connecting the device to vehicle power.

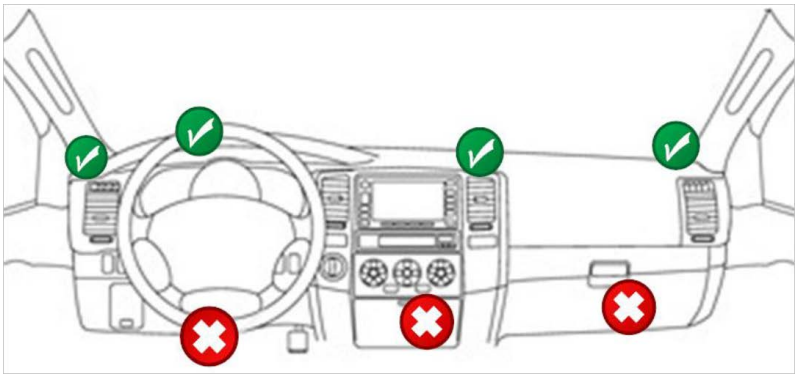
WARNING! If the device is already connected to vehicle power, remove the in-line fuse on the MAIN POWER (+V) wire of the device power cable before connecting any of the IO.

- For added security as an indicator against tampering, use torque/tamper seal on Molex, ground and fuse connections.

Mounting Locations

When mounting the device, the Novatel Wireless label side must be facing up or out with an unobstructed view of the sky. (See instructions on the device label.)

Select the best location for mounting the device within the vehicle, such as one of the following locations:



- Above the air vents
- Above the steering wheel
- Above the instrument cluster
- Above the glove box

NOTE: Avoid locations identified with a red X.

CAUTION! Both the cellular and GPS antennas are internal to the device. Therefore, it is critical to get the device mounted as high on the dashboard as possible with minimal obstructions above it.

Mounting Methods

Mounting Bracket Used

The preferred method for mounting and securing the MT 4100 inside a vehicle is to use the recommended Mounting Bracket Assembly (BRK4100). The bracket allows for mounting the device so that the label location conforms to the installation location. The following image shows the device inserted into the bracket.

The bracket can be installed using two #6 screws (preferred method) or with double-sided tape.

CAUTION! If double-sided tape is used (or another method not described in this guide), note the following precautions.

- Excessive force in the middle of the device may cause damage to the device.
- If using rigid mounting hardware, apply pressure only to the ends of the device.
- Limit the mounting pressure only to the amount needed to secure the device.

Mounting Bracket Not Used

If a mounting bracket is not used, you can mount the device using cable ties by fastening it directly to the vehicle. The MT 4100 case includes molded channels, as shown in the following image, to help secure it to a stable structure or wire bundle. The recommended cable tie size is 0.19" wide (4.75 mm).

Device Orientation

The MT 4100 has an accelerometer auto-calibration procedure that orients the device to the vehicle's direction of travel.

NOTE: For the accelerometer to operate properly, you must mount the MT 4100 securely. The accelerometer may report inaccurate results if you mount the device to cable runs or other structures that may shift the device's orientation.

For more information, see Novatel Wireless document *Accelerometer Guide Application Note* (ENF0000AN003).

Mounting and Installing the Device

Prior to performing the installation, ensure that each of the following prerequisites have been met.

- Engage the services of a qualified Automotive Electronic Installer.
- Read the entire *MT 4100 User Guide*.
- Perform a basic vehicle functionality check and note any pre-existing issues.
- Obtain the required cables to connect the device to the vehicle. See the Accessories section for more information.

WARNING! While performing these steps, do not apply excessive force to the retention legs or snap feature prior to inserting the device as this may deform the mounting bracket.

To mount and install the device:

1. In the chosen location, secure mounting bracket to the mounting surface using one of the following methods:
   - Two (2) # 6 screws (preferred method)
   - Double-sided tape
2. After securely attaching the mounting bracket, snap the device into the bracket with the connector end at the mount opening.

   NOTE: You can insert the device with the label side up or down. Position the device so that the label side has the best unobstructed path to the sky. See notation on the device label.
3. Connect the device to the power source.

4

Network Test Procedure

Test Preparation

Use the following instructions to configure the Novatel Wireless modem to communicate with the Novatel Wireless test server using UDP.

Before you begin, consider the following points:

- Most configurations are Mobile Originate only.
- A mobile modem initiates a conversation with a remote server before it can talk to the modem.
- IP addresses are dynamically assigned and can change.
- Some IP addresses are NAT and are non-routable.

Use the following configuration commands and settings to address these points:

- Modem ID/name = “My_MT_TEST”
- Remote Server address = http://apitest.nvtl.com/UDPAPP/
- Remote Server IP port = 1721

Ensure the device is powered up and connected to the computer. Use a tool like Hyperterminal or similar to communicate with the device.

Verifying Communications with the Computer

To verify communications with the computer:

- Send the following commands to the device:

AT Command	Command Action
AT	The modem should respond with OK.
ATE1	Use ATE1 if the modem doesn't respond to AT
ATI	The modem should respond with Novatel Wireless Inc
AT&F	Reset the modem to factory defaults
AT&W	Write current configuration to memory. The modem is now ready to be configured using Step 2.
AT$RESET	Reset the modem

Configuring the Modem to Access the GPRS Network

NOTE: GPRS Registration Information, which includes the APN (Access Point Name), Username, and Password (if applicable), should come from the service provider of the SIM.

Example:

```
APN = isp.cingular or public IP
Username (If necessary) Username = ISP@CINGULARGPRS.COM
Password (If necessary) Password = CINGULAR1
```

To configure the modem to access the GPRS network:

- Program the GPRS registration information into the device using the following commands.

AT Command	Command Action
AT+CGDCONT=1,"IP","<APN>"	Inform the modem of the proper APN
AT%CGPCO=1,"<user>,<pwd>",0	Inform the modem of the user and password
AT$AREG=2	Enable auto GPRS registration
AT&W	Write current configuration to memory
AT$RESET	Reset the modem

Checking the Device Connection to the Cellular Network

Once the device is power cycled in the previous step, use the following commands to check that the device can connect to the cellular network.

To check if the device can connect to the cellular network:

- Send the following commands to the device:

AT Command	Command Action

`AT+CREG?`
`+CREG: 0,1`
`+CREG: 0,5`
	Verify GSM status :
	• GSM registered to home network
	• GSM registered roaming

`AT%CGREG?`
`%CGREG: 0,1`
`%CGREG: 0,5`
	Verify GPRS status:
	• GPRS registered to home network
	• GPRS registered roaming

`AT$NETIP?`	Verify GPRS activation: • If the response is non-zero, then everything is working
`AT$CGEER`	If AT$NETIP returns all zeros: • No PDP reject cause (Everything should be working OK) • Requested service option not subscribed (APN is incorrect or SIM has not been enabled for data mode.) • User authentication failed (username/password is wrong)

Configuring the Modem to Talk to the Test Server

Giving the modem a unique name using AT$MDMID and by combining with a wakeup message allows the server to associate a Public IP address with a specific modem and enables the server to send commands to the modem.

This step uses the following sample information:

- Modem ID/name = “My_MT_Test”
- Remote Server IP address = http://apitest.nvtl.com/UDPAPP/
- Remote Server IP port = 1721

To configure the modem to talk to the Novatel Wireless Test Server:

- Program the device to communicate with the Novatel Wireless Test server using the following commands.

AT Command	Command Action
`AT$MDMID=”My_MT_Test”`	Give the modem a unique name.
`AT$FRIEND=1,1,”apitest.nvtl.com”`	Configure the modem to talk with a specific server.
`AT$UDPAPI=,1721`	Configure the port number to be used by the modem.
`AT$WAKEUP=1,1`	Enable wakeup to be sent to the server every 60 seconds.
`AT&W`	

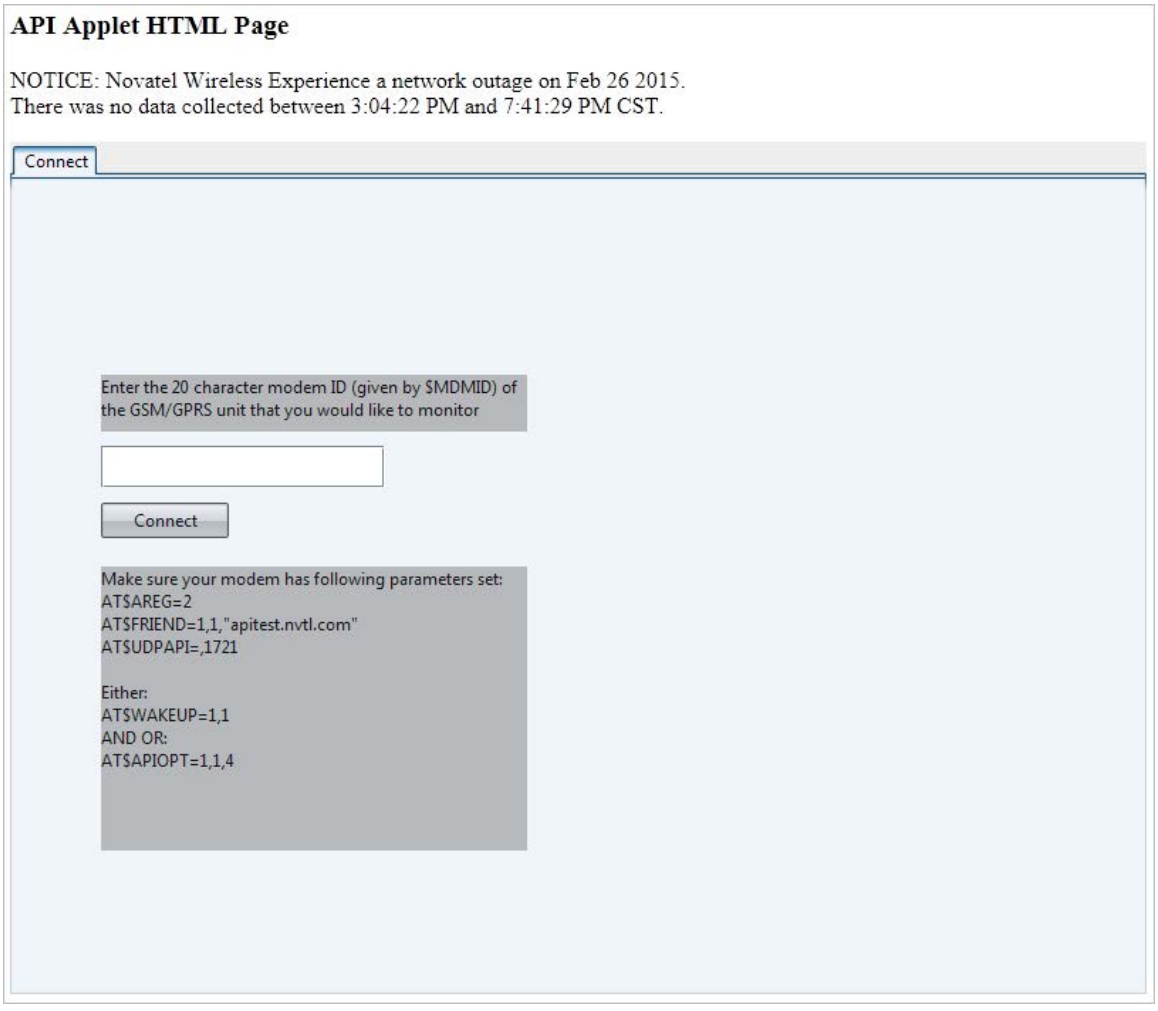
Verifying Server Connectivity

For the following tests, ensure that you have Java Runtime installed on your computer. To install Java Runtime, please visit the Java website at http://www.java.com/en/download/manual.jsp.

1. Start a web browser and navigate to the following URL:

   http://apitest.nvtl.com/udpapp/

   The API Applet HTML page opens.



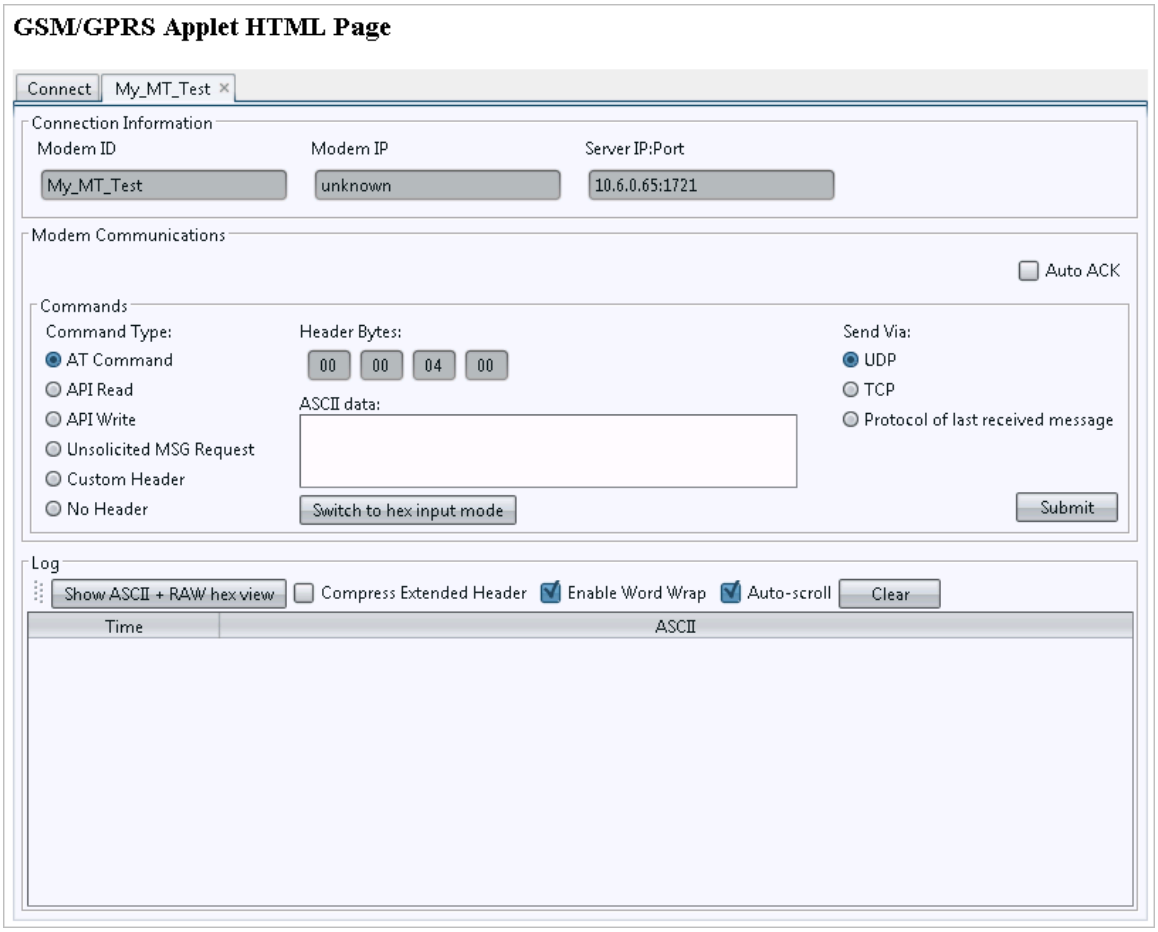
2. In Port, enter the Server port.

   NOTE: This example uses 1721, as defined in AT$UDPAPI=,1721.

3. In Modem ID (MDMID) command, enter the GSM/GPRS unit to monitor.

4. Click **Connect**.

The GSM/GPRS Applet HTML page opens.



5. Click the tab with the modem name (My_MT_Test).

   Within approximately 60 seconds you should see a wakeup message in the window.

   NOTE: Clicking the **Clear** button erases the contents from the (ASCII Data) window.

6. Enter the following command in the Command/Data text box: `ATI`
7. Click **Submit**.
8. Verify that you see the modem response: `Novatel Wireless, Inc.` If so, you have successfully configured the modem to talk with the server.

5

Accessories

Metal Lever

Use the Metal Lever to open the device.

For more information, see the SIM Installation section.

Mounting Bracket

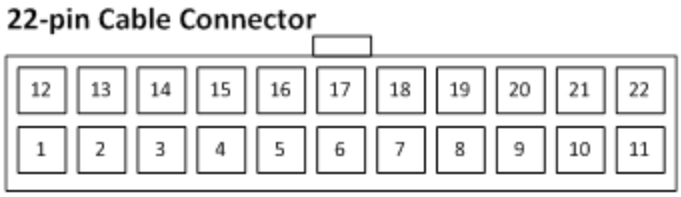
Use the Mounting Bracket to securely mount the device.

For more information, see the Device Installation section.

Cables

WARNING! The I/O connector on this MT product is not hot-pluggable. To ensure proper operation apply power to the MT product before you connect to any auxiliary I/O device, otherwise your target I/O device could be damaged.

The cable accessories for the MT 4100 are: CAB2448-01 and CAB2200-02. Both cables interface to the MT 4100 using the serial connector as shown below.



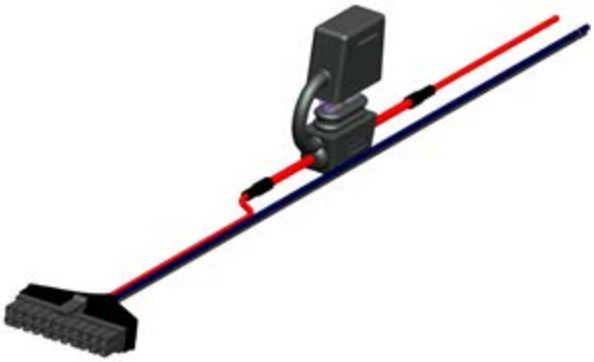
Molex Connector 43025-2200 and pins (43030-0008)

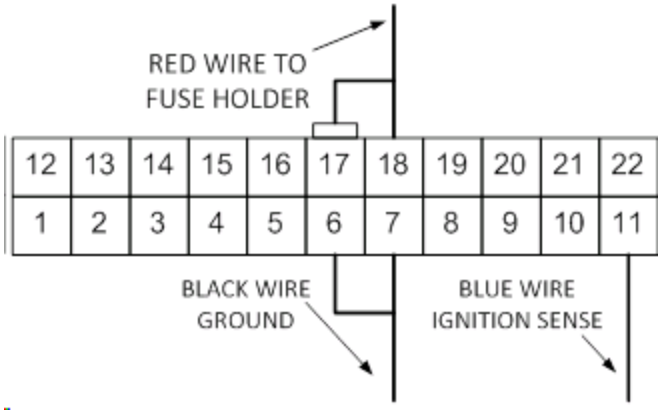
Note – this is the view of the connector on the cable accessory

For more information, see the 22-Pin I/O Connector section.

Power Cable

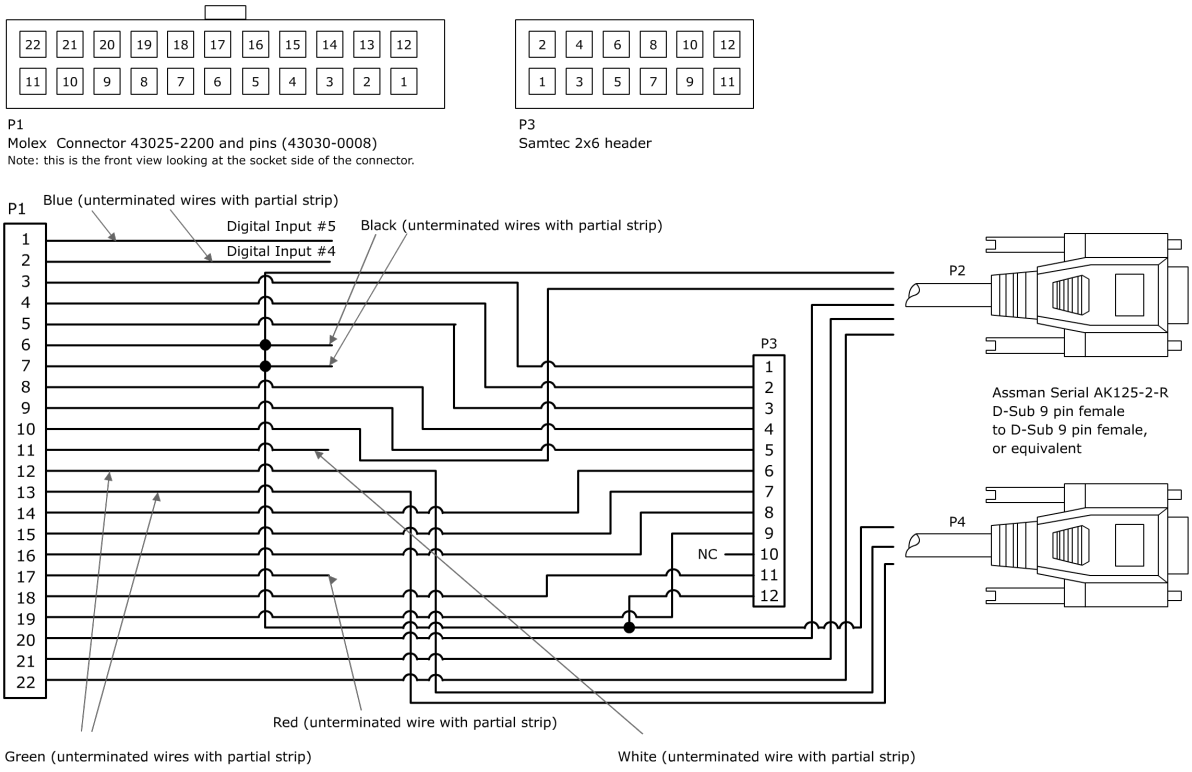
The power cable for the MT 4100 (CAB2448-01) includes a fuse and ignition sense.





Integration and Development Cable

The MT 4100 uses the Integration and Development Cable (CAB2200-02) to program and test the device. It contains two RS232 9-pin interfaces (P2 and P4), an I/O connector, two power cables, two ground cables, and an ignition sense cable.



Cable Wiring Guides

Serial to P2 DB9 Wiring Guide

Connector	DB9	Wire Color
6/7 Ground	5 Ground	Yellow
22 Rx	2 RXD	Brown
10 CTS	8 CTS	Purple
20 RTS	7 RTS	Blue
21 Tx	3 TXD	Red

Serial to P4 DB9 Wiring Guide

Connector	DB9	Wire Color
6/7 Ground	5 Ground	Yellow
13 RX2DOUT	2 RXD2	Brown
12 TX2DIN	3 TXD2	Red

Pin to I/O Header Wiring Guide

Connector	I/O Header	Function
3	1	1- Wire I/F
4	2	ADC In #2
5	3	ADC In #1
8	4	Digital Input #2
9	5	Digital Input #1
14	6	Digital Output #2
15	7	Digital Output #1
16	8	Digital Output #3
19	9	Digital Input #3
NC	10	No Connect
18	11	Power
6,7	12	Ground

22-Pin I/O Connector Parameters

Pin #	User Name	Parameter Condition	Variable	Min	Nom	Max	Units
1	Digital Input #5	Pull-up/Pull-down (Ref. 3.3 V/GND)			47		kΩ
		Minimum-Maximum High input threshold	V_{IH}	3.0		7.0	Vdc
		Maximum Low input threshold	V_{IL}			0.39	Vdc
		Input range	V_{IN}	0.0		32.0	Vdc
		Absolute Max Input without damage	V_{MAX}			36	Vdc
2	Digital Input #4	Pull-up/Pull-down (Ref. 3.3 V/GND)			47		kΩ
		Minimum-Maximum High input threshold	V_{IH}	3.0		7.0	Vdc
		Maximum Low input threshold	V_{IL}			0.39	Vdc
		Input range	V_{IN}	0.0		32.0	Vdc
		Absolute Max Input without damage	V_{MAX}			36	Vdc
3	1-Wire	1-Wire Input High	V_{IH}	1.9			Vdc
		1-Wire Input Low	V_{IL}			0.9	Vdc
		1-Wire Weak Pull-Up R	R_{WPU}	1000		1675	Ω
		1-Wire Output Low @ 4 mA load	V_{OL}			0.4	Vdc
4	ADC In #2	Measurement range, 10 bit (0 to 1023) VREF Tolerance ±6% VREF Load Reg ±2 LSB	V_{IN}	0.0		32.0	Vdc
		Absolute Max Input	V_{MAX}			36.0	Vdc
5	ADC In #1	Measurement range, 10 bit (0 to 1023) VREF Tolerance ±6% VREF Load Reg ±2 LSB	V_{IN}	0.0		16.0	Vdc
		Absolute Max Input	V_{MAX}			36	
6	Ground						
7	Ground						
8	Digital Input #2	Pull-up/Pull-down (Ref. 3.3 V/GND)			47		kΩ
		Minimum-Maximum High input threshold	V_{IH}	3.0		7.0	Vdc
		Maximum Low input threshold	V_{IL}			0.39	Vdc
		Input range	V_{IN}	0.0		32.0	Vdc
		Absolute Max Input without damage	V_{MAX}			36	Vdc
9	Digital Input #1	Pull-up/Pull-down (Ref. 3.3 V/GND)			47		kΩ
		Minimum-Maximum High input threshold	V_{IH}	3.0		7.0	Vdc
		Maximum Low input threshold	V_{IL}			0.39	Vdc
		Input range	V_{IN}	0.0		32.0	Vdc
		Absolute Max Input without damage	V_{MAX}			36	Vdc

Pin #	User Name	Parameter Condition	Variable	Min	Nom	Max	Units
10	RS-232 CTS1	Input RangeOut / Note: Output only. Input voltages should not be applied.		-25		25	Vdc
11	Ignition Sense						
12	RS-232 TX2	Input RangeOut / Note: Output only. Input voltages should not be applied.		-25		25	Vdc
13	RS-232 RX2	Input RangeOut / Note: Output only. Input voltages should not be applied.		-25		25	Vdc
14	Digital Output 1	High Output (no sourcing capability)	V_{OH}			32.0	V
		Low Output, max ISINK = -1.1 A	V_{OL}	0.0		0.55	V
		Absolute Max Voltage without damage	V_{MAX}			36	Vdc
15	Digital Output 2	High Output, no load	V_{OHNL}			4.2	V
		High Output, ISOURCE = 10 mA	V_{OH}		3.0		V
		Low Output, max ISINK = -1.1 A	V_{OL}	0.0		0.55	V
		Sink Resistance	R_{DSON}		250	500	mΩ
		Output state during system reset			3.0	4.2	V
		Absolute Max Voltage without damage	V_{MAX}			36	Vdc
16	Digital Output 3	High Output, no load	V_{OHNL}			4.2	V
		High Output, ISOURCE = 10 mA	V_{OH}		3.0		V
		Low Output, max ISINK = -1.1 A	V_{OL}	0.0		0.55	V
		Sink Resistance	R_{DSON}		250	500	mΩ
		Output state during system reset			3.0	4.2	V
		Absolute Max Voltage without damage	V_{MAX}			36	Vdc
17	Power In						
18	Power In						
19	Digital Input #3	Pull-up/Pull-down (Ref. 3.3 V/GND)			47		kΩ
		Minimum-Maximum High input threshold	V_{IH}	3.0		7.0	Vdc
		Maximum Low input threshold	V_{IL}			0.39	Vdc
		Input range	V_{IN}	0.0		32.0	Vdc
20	RS-232 CTS1	Input RangeOut / Note: Output only. Input voltages should not be applied.		-25		25	Vdc
21	RS-232 CTS1	Input RangeOut / Note: Output only. Input voltages should not be applied.		-25		25	Vdc
22	RS-232 CTS1	Input RangeOut / Note:Output only. Input voltages should not be applied.		-25		25	Vdc

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Compliance and Regulatory

General Disclaimer

TERMS OF USE OF NEW MATERIALS - PLEASE READ CAREFULLY

From time to time, Novatel Wireless, in its sole discretion, may make available for download on its website (www.novatelwireless.com), or may transmit via mail or email, updates or upgrades to, or new releases of, the firmware, software or documentation for its products (collectively, 'New Materials'). Use of such New Materials is subject to the terms and conditions set forth below, and may be subject to additional terms and conditions as set forth in Novatel Wireless's Technical Support Policy (posted on its website) and/or any written agreement between the user and Novatel Wireless.

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IN NO EVENT WILL NOVATEL WIRELESS BE RESPONSIBLE FOR ANY INCIDENTAL, INDIRECT, CONSEQUENTIAL OR SPECIAL DAMAGES AS A RESULT OF THE USE OF ANY NEW MATERIALS. NOVATEL WIRELESS'S MAXIMUM LIABILITY FOR ANY CLAIM BASED ON THE NEW MATERIALS SHALL NOT EXCEED FIFTY U.S. DOLLARS ($50).

Version Verification

Please ensure you have the latest version of this document by downloading it from www.novatelwireless.com

Warranty Information

This warranty applies to (a) products sold directly by Novatel Wireless, unless a different warranty is specified in a written agreement between Novatel Wireless and the purchaser; and (b) products sold to end users through a distributor authorized by Novatel Wireless, but only where the authorized distributor does not provide a separate warranty on such products, and Novatel Wireless has agreed to provide this warranty to such end users. If you purchased the product from an authorized distributor, please check whether this warranty from Novatel Wireless, or a separate warranty from the distributor, applies to your purchase. This warranty does not apply to any (i) accessories or batteries for the products; or (ii) demonstration samples or prototypes of the products. Unless otherwise provided in a written agreement between Novatel Wireless and the purchaser, all such accessories, batteries, samples or prototypes are provided by Novatel Wireless AS IS without any warranty of any kind.

Novatel Wireless warrants to the original purchaser of the product from Novatel Wireless or its authorized distributor (as applicable) that, for a period of one (1) year from the date of shipment of the product from Novatel Wireless, the product hardware will be substantially free from defects in material or workmanship under normal operation, and the product firmware will perform substantially in accordance with the product documentation provided by Novatel Wireless. Novatel Wireless does not warrant that (a) the product hardware or firmware will meet the purchaser's requirements; (b) the operation of the product hardware or firmware will be uninterrupted or error-free; or (c) the product, when integrated in, or combined with, other products or software not supplied by Novatel Wireless, will continue to perform substantially in accordance with the product documentation. This limited warranty is for the benefit of the original purchaser, and is not transferable.

During the warranty period, Novatel Wireless, at its expense and in its sole discretion, will repair the product, or replace the product with a corresponding or equivalent product, if it is determined to have a covered defect, provided that the purchaser first notifies Novatel Wireless (directly or through its authorized distributor from which the product was purchased) of any such defect, furnishes Novatel Wireless with a proof of purchase (if required), requests and obtains a return merchandize authorization (RMA) number from Novatel Wireless, and returns the product under that RMA to Novatel Wireless (or, at Novatel Wireless's option, to its authorized distributor), with the shipping charges being prepaid by purchaser. If, upon reasonable examination of the returned product, Novatel Wireless does not substantiate the defect claimed by purchaser, or determines that the defect is not covered under this limited warranty, Novatel Wireless will not be required to repair or replace the product, but may instead reship the product to the purchaser (or, at Novatel Wireless's option, to its authorized distributor where the product can be made available to purchaser), in which case the purchaser shall be responsible for paying Novatel Wireless's cost for reshipping the product to purchaser (or to Novatel Wireless's authorized distributor), and Novatel Wireless's usual charges for unpacking, testing, and repacking the product for reshipment to purchaser (or to Novatel Wireless's authorized distributor). Purchaser shall bear the risk of loss or damage in transit to any product returned by purchaser to Novatel Wireless, or any returned product not found to be defective or covered under this warranty, and reshipped by Novatel Wireless to purchaser (or to Novatel Wireless's authorized distributor). In the event Novatel Wireless repairs or replaces a defective product covered by this limited warranty, the repaired or replacement product will be covered under this limited warranty for the remainder of the original

warranty period on the defective product, or a period of ninety (90) days, whichever is longer. If Novatel Wireless is unable to repair or replace a defective product covered by this limited warranty, Novatel Wireless will provide to purchaser a credit or a refund (at Novatel Wireless's option) of the original purchase price (excluding taxes and shipping charges). Any returned and replaced product, or any product for which Novatel Wireless has furnished a credit or a refund, becomes the property of Novatel Wireless.

Novatel Wireless shall not have any obligation to provide any firmware bug fixes, upgrades or new releases except as may be necessary to correct any covered defect of which purchaser notifies Novatel Wireless in writing during the warranty period. Novatel Wireless, from time to time and in its sole discretion, may make available for download on its website (www.nvtl.com), or may provide via email, certain firmware bug fixes, upgrades or new releases for the product. Download and use of any such bug fixes, upgrades or new releases is subject to all of the applicable terms and conditions of Novatel Wireless's technical support policy as posted and updated on its website. Novatel Wireless shall have no obligation under this limited warranty for (a) normal wear and tear; (b) the cost of procurement of substitute products; or (c) any defect that is (i) discovered by purchaser during the warranty period but for which purchaser does not request an RMA number from Novatel Wireless, as required above, until after the end of the warranty period, (ii) caused by any accident, misuse, abuse, improper installation, handling or testing, or unauthorized repair or modification of the product, (iii) caused by use of any materials not supplied by Novatel Wireless, or by use of the product other than in accordance with its documentation, or (iv) the result of electrostatic discharge, electrical surge, fire, flood or similar causes. The purchaser (or its customers, as applicable) shall be solely responsible for the proper configuration, testing and verification of the Novatel Wireless product prior to deployment in the field, and for ensuring that any end user product or system into which the Novatel Wireless product is integrated or incorporated operates as intended and meets the requirements of purchaser (or its customers). Novatel Wireless shall have no responsibility whatsoever for the integration, configuration, testing, verification, installation, upgrade, support or maintenance of any such end user product or system, or for any liabilities, damages, costs or expenses associated therewith.

NOVATEL WIRELESS'S SOLE RESPONSIBILITY AND PURCHASER'S SOLE REMEDY UNDER THIS LIMITED WARRANTY SHALL BE FOR NOVATEL WIRELESS TO REPAIR OR REPLACE THE PRODUCT (OR IF REPAIR OR REPLACEMENT IS NOT POSSIBLE, PROVIDE A CREDIT OR REFUND OF THE PURCHASE PRICE) AS PROVIDED ABOVE. NOVATEL WIRELESS EXPRESSLY DISCLAIMS ALL OTHER WARRANTIES OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF NON-INFRINGEMENT, MERCHANTABILITY, SATISFACTORY PERFORMANCE AND FITNESS FOR A PARTICULAR PURPOSE. IN NO EVENT SHALL NOVATEL WIRELESS BE LIABLE FOR ANY INDIRECT, SPECIAL, EXEMPLARY, INCIDENTAL OR CONSEQUENTIAL DAMAGES (INCLUDING WITHOUT LIMITATION LOSS OR INTERRUPTION OF USE, DATA, REVENUES OR PROFITS) RESULTING FROM A BREACH OF THIS WARRANTY OR BASED ON ANY OTHER LEGAL THEORY, EVEN IF NOVATEL WIRELESS HAS BEEN ADVISED OF THE POSSIBILITY OR LIKELIHOOD OF SUCH DAMAGES.

Some jurisdictions may require a longer warranty period than specified above and, accordingly, for products sold in those jurisdictions the applicable warranty period shall be extended as required under the laws of those jurisdictions. Furthermore, some jurisdictions may not allow the disclaimer of implied warranties or the exclusion or limitation of incidental or consequential damages, so the above disclaimer, limitation or exclusion may not apply to products sold in those jurisdictions. This limited

warranty gives the purchaser specific legal rights and the purchaser may have other legal rights that vary from jurisdiction to jurisdiction. This limited warranty shall be governed by the laws of the State of Texas, United States of America, without regard to conflict of laws principles. This limited warranty shall not be governed in any respect by the United Nations Convention on Contracts for the International Sale of Goods.

Regulatory Compliance

FCC

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits pursuant to Part 15 Subpart B. FCC Part 22 & Part 24 is covered by the "modular approval" process for the embedded wireless module. This approach, described by FCC Public Notice DA 00-131407 released June 26, 2000, is intended to afford relief to equipment manufacturers by eliminating the requirement for obtaining a new equipment authorization for the same transmitter when installed in a new device.

These limits are designed to provide reasonable protection against harmful interference in an appropriate installation. This equipment generates, uses, and can radiate radio frequency energy and, if not used in accordance with instructions, can cause harmful radiation to radio communication. However, there is no guarantee that interference will not occur in a particular installation.

RF EXPOSURE

Your device is a radio transmitter and receiver. It is designed and manufactured not to exceed the emissions limits for exposure to radio frequency (RF) energy set by the Federal Communications Commission (FCC) of the U.S. Government. These limits are part of comprehensive guidelines and establish permitted levels of RF energy for the general population. These guidelines are based on the safety standards previously set by the U.S. and international standards bodies. The standards include a substantial safety margin designed to assure the safety of all persons, regardless of age and health.

The exposure standard for wireless RF devices, such as the device, employs a unit of measurement known as the Specific Absorption Rate, or SAR. The SAR limit set by the FCC is 1.6W/kg. SAR values at or below that limit are considered safe for the general public.

Before a wireless RF device is made available for sale to the Public, it must be tested and certified to the FCC that it does not exceed the SAR limits established by the FCC. Tests for SAR are conducted using the positions and locations (e.g., at the ear or worn on the body) as required by the FCC for each device model.

In order to use this device without additional FCC certification approvals, the installation must meet the following conditions:

For the transmitter to meet the MPE categorical exclusion requirements of 2.1091, the ERP must be less than 1.5 watts for personnel separation distance of at least 20 cm (7.9 in). Therefore, the maximum antenna gain cannot exceed +3.3dBi. If greater than 1.5 watts exists, then additional testing and FCC approval is required.

R&TTE CE

This device has been fully tested and complies with the requirements of EN301 489-1, EN301 489-3, EN301 489-7, EN60950-1, IEC60950-1, EN62311, and EN300 440-2. Compliance to EN301 511 has been demonstrated through testing performed on this device and the embedded wireless module. RF exposure levels are below the recommended levels at distances of 6.7 cm between the antenna and user.

Novatel Wireless hereby declares that this device is in compliance with the essential requirements and other provisions of the Directive 1999/5/EC.

A full copy of the declaration of conformity can be found at http://documentation.nvtl.com.

Industry Canada

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this

device must accept any interference, including interference that may cause undesired operation of the device.

Cet appareil est conforme aux normes d'Industrie Canada exempts de license(s) RSS. Son fonctionnement est soumis aux deux conditions suivantes : (1) cet appareil ne doit pas provoquer d'interférences, et (2) cet appareil doit accepter toute interférence, y compris les interférences pouvant provoquer un fonctionnement indésirable de l'appareil.

ROHS COMPLIANCE

This device has been designed to comply with the European Union Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (RoHS) Directive (2002/95/EC), effective since July 1, 2006.

DISCLAIMER

The information and instructions contained within this publication comply with all FCC, GCF, PTCRB, R&TTE, IMEI and other applicable codes that are in effect at the time of publication. Novatel Wireless disclaims all responsibility for any act or omissions, or for breach of law, code or regulation, including local or state codes, performed by a third party. Novatel Wireless strongly recommends that all installations, hookups, transmissions, etc., be performed by persons who are experienced in the fields of radio frequency technologies. Novatel Wireless acknowledges that the installation, setup and transmission guidelines contained within this publication are guidelines, and that each installation may have variables outside of the guidelines contained herein. Said variables must be taken into consideration when installing or using the product, and Novatel Wireless shall not be responsible for installations or transmissions that fall outside of the parameters set forth in this publication.

Battery Information and Safety Requirements

Failure to comply with all of the following precautions could:

- Cause personal injury or property damage
- Cause abnormal chemical reactions which would make the battery overheat, smoke, distort, leak, or catch on fire
- Destroy internal protections built into the battery
- Shorten battery life
- Reduce battery performance

Precautions

- Read this entire manual and the label on the exterior of the battery.
- Keep the battery away from sources of excessive heat such as fire, stoves, or direct sunlight.
- Keep the battery away from sources of high voltage or static discharge.
- Do not use or store the battery with other batteries or where it could touch metal.
- Do not put the battery into a microwave oven.
- Do not allow the battery to be crushed.
- Keep the battery away from children.
- Do not drop the battery.
- Do not allow anything to touch any of the battery contacts
- Do not connect two or more of the contacts.
- Do not disassemble, destroy, or attempt reassembly of the battery.
- Do not place or leave the battery in a damp or wet environment.
- Do not allow water to touch the battery.
- Do not wrap the battery with conductive material.
- Properly dispose of the battery.
- Do not incinerate or burn the battery.
- Do not leave or discard the battery where it could get wet or become submerged in water.
- Do not damage the battery.

- Do not weld or solder anything to the battery, the attached wires, or the connector.
- Do not use this battery in any device other than supplied.
- Use of this battery in other devices could result in unsafe conditions.
- Risk of explosion if battery is replaced by an incorrect type.
- Do not touch a leaking battery or materials that may have leaked from a battery. Do not allow it to touch your skin or clothes. If touched, immediately rinse affected areas thoroughly with water. Leaked materials may cause skin irritation. Seek medical attention if irritation persists. If it contacts your eyes, do not rub your eyes. Rinse the eyes thoroughly with water, and see a doctor immediately.