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Personal Protective Equipment (PPE)

*Head Protection:* Hard hats

*Eye Protection:* Safety glasses

*Foot Protection:* Work shoes with slip-resistant and puncture-resistant soles and steel-toes

*Hand Protection:* Gloves that fit snugly

http://www.osha.gov
The **Global Positioning System (GPS)** is a space-based global navigation satellite system (GNSS) that provides reliable location and time information in all weather and at all times and anywhere on or near the Earth whenever there is an unobstructed line of sight to at least four or more GPS satellites. As a national resource, it is maintained by the United States government and is freely accessible by anyone with a GPS receiver.

GPS was created and realized by the U.S. Department of Defense (USDOD) and was originally run with 24 satellites. It was established in 1973 to overcome the limitations of previous navigation systems. The first original satellite was launched in 1989, and the 24th satellite was launched in 1994. “Selective Availability” was implemented initially, where the highest quality signal was reserved for military use and the signal available for civilian use was intentionally degraded. On May 2, 2000 "Selective Availability" was discontinued as a result of an executive order, allowing users to receive a non-degraded signal globally. This improved the precision of civilian GPS from 100 meters (about 300 feet) to 20 meters (about 65 feet). Additional satellites were launched over the years to replace older ones.

A GPS receiver uses the messages it collects from the satellites to determine the transit time of each message and calculates the distance to each satellite. Although, signals from three satellites may seem to be enough to compute global position, even a very small clock error multiplied by the “speed of light” with which message is delivered — results in a large positional error. Consequently receivers use four or more satellites to calculate for the receiver’s location and time. The messages from satellites also carry a very accurate time stamp. About eight satellites are visible from any point on the ground at any one time. *(source Wikipedia)*

The GPS signal is a line-of-sight signal so it is imperative that the GPS antenna has a clear view of the sky. All GPS tracking systems depend upon a well placed and functioning antenna. Some conditions that negatively affect the GPS signal reception include driving between tall buildings, deep valleys, forests, mountain regions, underground parking or tunnels or being indoors.
Navman Wireless Fleet Tracking

Global Positioning Satellites

Qube Fleet

Qtanium Fleet

Cellular Network

Navman Wireless Operations Center

Customer PC
Recommended Installation Practices

Review installation manual to become familiar with all installation procedures and electrical wiring requirements prior to starting the installation. This installation guide has been prepared to provide you with details necessary to complete the Qtanium installation.

Use of proper tools and testing equipment is required. Never use a grounding style test light. Use only a Digital Multi Meter (DMM) to test wires in the vehicle. It is strongly recommended that one of the battery post cables is disconnected prior to making wire connections.

It is critical to ensure that all connections are done using marine grade sealable heat shrink connectors that are described in this guide. Do not use regular butt connectors, crimp connectors or any other means to connect wires. Failing to ensure proper connection method may result in warranty being voided and damage to the device and/or equipment.

Be sure that all wiring is protected from heat sources and sharp edges and is routed in such a manner that it will not get damaged or pinched when all components and trim are fully installed. Run new wiring along factory harnesses and secure with quality cable ties. Be sure to leave a “service loop” near the Qtanium, enough slack in the wiring to allow working room and strain relief.

Determine the best possible mounting location, make sure the Qtanium will be securely attached and will not obstruct any serviceable areas. The Qtanium must be mounted using self-tapping screws or nuts and bolts. Optional high power magnets may also be used. When selecting a mounting location consider the length of the power harness and proximity to all connection points. The Qtanium and its wiring must be mounted free from all moving parts.

Follow all construction site safety measures and installation guidelines outlined in this manual, as well as those set forth by the industry and the government.
Recommended Tools and Supplies

**Tools:**
- Wire Cutters
- Wire Strippers
- Small Utility Knife
- Crimping Tool for Insulated Connectors
- Digital Multimeter
- Power Drill
- Quality Drill Bit Set
- Butane Blow Torch

**Supplies:**
- Marine Grade/Assorted:
  - Heat Shrink Ring Terminals
  - Heat Shrink Butt Connectors
- Heavy Duty Cable Zip-Ties
- Split Loom Tubing (1/4”)
- Coax Seal Tape
- Quality Electrical Tape
- Tamper-Evident Sealant
- ATC Blade Fuses (3A)
- Weatherproof ATC Fuse Holders
- Silicone Sealant

*Do not use any Nylon or Vinyl Connectors!*

[Click here for Wire Crimper article]
Qtanium Hardware

Qtanium 5-pin 4-wire Power Harness:

- **Red** – Constant 12/24V*
- **Pink** – Run Signal*
- **Black** – Ground
- **Orange** - Auxiliary Battery**

* Must be fused (3A) at the source

**All unused ports must be covered with end-caps. All unused wires must be individually isolated.
Isolated Power Supply Unit (IPS)
(*IPS unit is required in installations on assets with ground master battery disconnect switch)

IPS Wiring Harness:
- **Red** – Battery +12/24V (IN)
- **Yellow** – +12V (to QTANiUM)
- **Blue** – Chassis Ground
- **Black** – Battery Negative

*Note: On assets with **ground master battery disconnect switch**, the Qtanium must be isolated from the equipment’s chassis using the Isolated Power Supply unit (IPS). Installing the Qtanium into this type of equipment, without an IPS unit, may create an alternate path from vehicle’s chassis to the negative battery post (through the Qtanium), effectively bypassing the master disconnect switch. In order to avoid this condition, the Qtanium must be installed in conjunction with an IPS unit.
Isolated Power Supply Unit (IPS)

(*IPS unit is required in installations on assets with ground master battery disconnect switch)

IPS unit plug-n-play
(coming spring 2012)

(to power harness)

(to Qtanium)

(to uninterrupted ground)
1. Only marine grade connectors should be used for all connections. Choose either the insulated marine type butt connectors or the non-insulated butt connectors and the adhesive-lined dual-wall heat shrink tubing. These types of connections provide maximum weatherproof protection against the elements.

2. Use an appropriate crimping tool to make a solid crimp. Make sure the crimper used does not damage the heat shrink insulation. Apply heat (lighter or butane torch) to shrink the insulation and melt the adhesive.

Note: Use extreme caution not to allow non-insulated areas of stripper or other tools to simultaneously contact exposed wiring and the vehicle chassis.
Optional Magnet Mounting

1. When attaching the optional magnet mounts to the Qtanium, do not overtighten. Applying excessive force may cause the magnet’s stem to break off. Locknuts are optional. Remove rubber covers from magnets prior to installation.

2. Mounting holes are threaded for M6*1.0 bolts.
Installation Work Flow/Check List

1. **Verify** you have all the necessary parts and supplies to complete the installation.
2. **Inspect** the equipment and **identify** if Isolated Power Supply (IPS unit) will be required.
3. **Inspect** the equipment and **identify** an appropriate mounting location for the Qtanium.
4. **Identify** an appropriate mounting method: screws/bolts or high-power magnets.
5. **Identify** an appropriate location for antenna and **mount** the antenna.
6. **Identify** the location to connect the Qtanium’s chassis Ground (*and IPS unit chassis ground)*.
7. **Identify** the location to connect the Qtanium’s Power (to vehicle or IPS unit).
8. If IPS is required, **identify** the location to connect IPS’s Power and un-switched Ground.
9. **Identify** the location to connect to the “run-signal”: R-terminal or oil pressure switch.
10. **Disable** the asset by turning the battery switch off or disconnect a post on battery.
11. **Route** the Qtanium’s power harness; **connect** Power, Ground and R-terminal wires.
12. **Attach** both antenna connectors to the Qtanium. **Mount** the Qtanium.
13. **Attach** the power harness to the Qtanium.
14. **Turn on** battery switch and/or reconnect battery post.
15. **Remove** the yellow shipping plug.
16. **Make** any optional connections (sensors, M-Nav, etc). **Attach** end caps to unused ports.
17. **Perform** the Live Test using Online AVL2 software.
18. **Apply** tamper-evident seal.
Mounting the Qtanium

1. Inspect the equipment to determine best possible location to mount the Qtanium. Mount away from any moving parts or linkages and away from any high heat sources. Although, the Qtanium is ruggedized, it is recommended to be mounted to an interior wall of the asset and near power source. If available, mount inside a lockable storage compartment. On smaller equipment, an alternate place to consider is inside the cab, above the headliner.

2. Next, determine the best way of attaching the Qtanium. Approved methods include self-drilling screws or nut & bolt. Qtanium must be attached at all 4 corners. Optional magnet-mounts are available. *Do not use cable ties to secure the Qtanium.*

**IMPORTANT NOTICE:** Ensure that any holes drilled for the installation will not weaken the structure or compromise the safety of the equipment or its occupants. If in doubt, consult the equipment manufacturer.
Selecting Appropriate Install Method

Types of Battery Disconnect Circuits/Qtanium Connections

**Without Battery Disconnect Switch**
- to Vehicle
- Vehicle Chassis

**Positive Side Battery Disconnect Switch**
- to Vehicle
- *The switch can be manual or electronic

**Negative Side Battery Disconnect Switch**
- *requires Isolated Power Supply Unit (IPS)
- Vehicle Chassis
- *The switch can be manual or electronic
Assets Without Battery Disconnect Switch

Without Battery Disconnect Switch

to Vehicle

Vehicle Chassis
Follow the above diagram when installing on assets without battery disconnect. Obtain power and ground at the asset’s battery or alternator.
Assets With Positive Battery Disconnect Switch

Positive Side Battery Disconnect Switch

to Vehicle

*The switch can be manual or electronic
1. This is an example of Constant Power and Ground connections on equipment with a positive side battery disconnect switch.

2. In order for the Qtanium to receive power at all times, you must connect Qtanium’s red wire to the battery side (hot side) of the positive disconnect switch or to the battery post. Insert inline weatherproof fuse-holder with a 3A fuse. Do not connect power at the alternator.

3. Ground the black wire to vehicle’s chassis.
Assets With Negative Side Battery Disconnect Switch

*This installation requires Isolated Power Supply unit (IPS)

Vehicle Chassis

*The switch can be manual or electronic

Negative Side Battery Disconnect Switch

*requires Isolated Power Supply Unit (IPS)
Assets With Negative Side Battery Disconnect Switch

*This installation requires Isolated Power Supply unit (IPS)*

*Note: On assets with ground master battery disconnect switch, the Qtanium must be isolated from the equipment’s chassis using the Isolated Power Supply unit (IPS). Installing the Qtanium into this type of equipment, without an IPS unit, may create an alternate path from vehicle’s chassis to the negative battery post (through the Qtanium), effectively bypassing the master disconnect switch. In order to avoid this condition, the Qtanium must be installed in conjunction with an IPS unit.*

Follow the above diagram to add IPS unit to the installation on assets with the ground battery disconnect switch. See next page for description.
1. When installing on assets with the negative side battery disconnect switch Isolated Power Supply unit (IPS) must be used.

2. At Isolated Power Supply (IPS): Red is a constant power input, Black is constant ground, Yellow is a power output to Qtanium, Blue is a chassis ground (switched ground). Connect Qtanium’s Red wire to the IPS’s Yellow and Qtanium’s Black to chassis ground.

**Attention:** Installing the Qtanium into this type of equipment, without an IPS unit, may create an alternate path from vehicle’s chassis to the negative battery post (through the Qtanium), effectively bypassing the master disconnect switch. On assets with **ground master battery disconnect switch**, the Qtanium must be isolated from the equipment’s chassis using the Isolated Power Supply unit (IPS).
Engine Run Signal

1. R-terminal at the alternator or the hour meter will be ideal place to make this connection. If the R-terminal is not available/accessible, engine oil pressure switch or fuel pump circuit can be used, also.

2. Identify the R-terminal: the correct wire/terminal will have 12 or 24 volts present only when the engine is running. Use Volt Meter to test for the terminal that goes “hot” when engine is started.

3. On some equipment, the R-terminal may not be utilized by the vehicle (bare stud on alternator), you may need to add an R-terminal connector (see Figure 2).

4. Connect the Qtanium’s pink wire here. Insert a 3-Amp inline fuse and use a weather-proof fuse holder.

   Note: It is not recommended connecting to the vehicle’s ignition wires. Using the ignition wire can result in inaccurate engine hours calculation because the ignition can sometimes be left on without the engine running.
1. When choosing a mounting location for the antenna, consider places, where it will be least likely to get damaged by debris or moving parts. Ideal location will have a clear view of the sky. For best performance, mount on a horizontal (+/-30°), clean surface. Attach the antenna utilizing the built-in magnet and securing with a bead of silicone. Antenna will work through windshield glass, dashboard plastic and vinyl, and fiberglass materials.

2. Secure antenna harness along the way using cable ties. Screw on antenna connectors hand-tight, apply Coax-Seal®, a moldable plastic sealant, to protect the RF fittings from moisture and corrosion (optional).

3. Do not mount the GPS antenna under any metal surface. The cable impedance is matched to the pre-determined length, so do not shorten or extend it. Avoid making sharp bends in the cable or winding excess cable into small, tight loops. Wind excess cable into large “8” shapes.

Attention: Connect both antenna connectors to the Qtanium before connecting power harness.
If applicable, route and connect M-Nav or MDT cable from the Qtanium to the dashboard, in driver’s reach. Use the supplied suction cup or the optional dash mount bracket to secure the device in place.

*Note: In order to utilize the messaging feature of the M-Nav760 and the Qube, please, ensure that the mini USB cable is plugged into the jack on the cradle, and not on the body of M-Nav760. Also, verify the switch on the back of M-Nav760 is in ON position. Never remove the micro SD memory card – it contains map data.*
The Qtanium is capable of monitoring multiple vehicle sensors thru ConEx sensor inputs. PTO’s, oil pressure, air restriction sensors, etc can be connected. Sensor settings are configured thru AVL2 software. Both positive and negative trigger inputs are accepted.

See following pages for different sensor configurations.
Digital Inputs
These inputs are either ON or OFF. Polarity is not important but must be noted for the correct configuration to be sent to the asset thru Online AVL2.
Digital inputs can be configured to be either Active High or Active Low. The Yellow, Green, Blue, and Purple wire inputs on the optional 6-pin harness can be configured as digital inputs.

*For any analogue sensors, an adaptor must be fitted to convert to a digital on/off signal.

**Active High Configuration**
An Active High input requires a sourcing input of +12 / 24 V.

**Active Low Configuration**
An Active Low input requires a ground switching input; that is, a circuit that goes open or closed to earth when activated.
Digital Output
This output has an ‘open collector’ transistor-type arrangement.
This output is controlled by the dispatcher thru Online AVL2 software.
This output will pull low with a maximum current of 250mA when activated.
It has an over current tripped protection. If tripped, the output must be changed to OFF or have a power cycle to reset the current trip.
Only the Green wire can be configured as a digital output. This feature is commonly used to prevent unauthorized starting of the equipment or to activate a dash-mounted light to signal the operator.
Qtanium Power Up Procedure

When the installation is complete, perform the following steps in order they are listed to bring the device online promptly:

1. Attach both antenna cables to the Qtanium,
2. Insert fuses into fuse holders and plug in the power harness,
3. Remove the yellow shipping plug,
4. Start the engine, allow up to 5 minutes to initiate AVL reporting,
5. Connect optional harnesses: ConEx, MDT, etc
6. Perform Live Test outlined on next page
Now, perform the Live Test procedure outlined below. This will act as the installation verification and troubleshooting,

a) Establish/verify communication between Online AVL2 and the device,

b) Verify/record asset’s name and calibrate engine hours in Online AVL2 software,

c) Toggle the battery disconnect switch and verify this does not affect Qtanium’s power supply (except when connected to “cold” side of negative battery disconnect).  *If this creates “power up” and “disconnect” events in Online AVL2, check wiring,*

d) Turn ignition key on, do not start engine. Verify this does not register as “engine running” in Online AVL2.  *To collect engine hours, rewire to the R_terminal at the alternator,*

e) Start the engine. Verify Online AVL2 shows “engine running”.  *If Online AVL2 does not register an “ignition on” event, check your connections on the pink wire,*

f) While engine running, check “Satellites” column in Online AVL2, 5 or more satellites are required.  *If the number of satellites is low, move the vehicle to an open to sky area and/or select a different location for mounting the antenna,*

g) Send and receive text message from the M-Nav (mobile data terminal) (if applicable),

h) Verify/configure sensor activity in AVL2 for any sensors connected to ConEx inputs (if applicable)
### Live Test Procedure with Online AVL2 (cont.)

#### Highlighted Vehicle

- **Initial Power Up Events**
- **Query Button Response**
- **ConEx Sensor Activity**
- **Satellites Column**
- **Percent of GPS Error**

### Vehicle Activity - Qube 3-2

<table>
<thead>
<tr>
<th>Event Description</th>
<th>Time</th>
<th>Speed</th>
<th>Trip</th>
<th>HDOP</th>
<th>Satellites</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal Battery Charging</td>
<td>9:30 AM</td>
<td>0 mi/h</td>
<td>0 mi</td>
<td>1.40</td>
<td>11</td>
<td>[Navman], 1601-1699 Willow Rd, Glenview, IL</td>
</tr>
<tr>
<td>Idle</td>
<td>9:33 AM</td>
<td>0 mi/h</td>
<td>0 mi</td>
<td>0.90</td>
<td>9</td>
<td>[Navman], 1601-1699 Willow Rd, Glenview, IL</td>
</tr>
<tr>
<td>Bed Down</td>
<td>9:35 AM</td>
<td>0 mi/h</td>
<td>0 mi</td>
<td>0.90</td>
<td>9</td>
<td>[Navman], 1601-1699 Willow Rd, Glenview, IL</td>
</tr>
<tr>
<td>Bed Up</td>
<td>9:35 AM</td>
<td>0 mi/h</td>
<td>0 mi</td>
<td>0.90</td>
<td>9</td>
<td>[Navman], 1601-1699 Willow Rd, Glenview, IL</td>
</tr>
<tr>
<td>Internal Battery Charging Complete</td>
<td>9:34 AM</td>
<td>0 mi/h</td>
<td>0 mi</td>
<td>0.90</td>
<td>9</td>
<td>[Navman], 1601-1699 Willow Rd, Glenview, IL</td>
</tr>
<tr>
<td>Work</td>
<td>9:34 AM</td>
<td>0 mi/h</td>
<td>0 mi</td>
<td>0.90</td>
<td>9</td>
<td>[Navman], 1601-1699 Willow Rd, Glenview, IL</td>
</tr>
<tr>
<td>Timed Update</td>
<td>9:33 AM</td>
<td>0 mi/h</td>
<td>0 mi</td>
<td>1.70</td>
<td>6</td>
<td>[Navman], 1601-1699 Willow Rd, Glenview, IL</td>
</tr>
<tr>
<td>Query</td>
<td>9:28 AM</td>
<td>0 mi/h</td>
<td>0 mi</td>
<td>1.60</td>
<td>6</td>
<td>[Navman], 1601-1699 Willow Rd, Glenview, IL</td>
</tr>
<tr>
<td>Timed Update</td>
<td>9:25 AM</td>
<td>0 mi/h</td>
<td>0 mi</td>
<td>1.60</td>
<td>6</td>
<td>[Navman], 1601-1699 Willow Rd, Glenview, IL</td>
</tr>
<tr>
<td>Internal Battery Charging</td>
<td>9:15 AM</td>
<td>0 mi/h</td>
<td>0 mi</td>
<td>99.90</td>
<td>0</td>
<td>[Navman], 1601-1699 Willow Rd, Glenview, IL</td>
</tr>
<tr>
<td>Power Up</td>
<td>9:14 AM</td>
<td>0 mi/h</td>
<td>0 mi</td>
<td>99.90</td>
<td>0</td>
<td>[Navman], 1601-1699 Willow Rd, Glenview, IL</td>
</tr>
<tr>
<td>Unknown</td>
<td>9:14 AM</td>
<td>0 mi/h</td>
<td>0 mi</td>
<td>99.90</td>
<td>0</td>
<td>[Navman], 1601-1699 Willow Rd, Glenview, IL</td>
</tr>
<tr>
<td>Ignition On</td>
<td>9:14 AM</td>
<td>0 mi/h</td>
<td>0 mi</td>
<td>99.90</td>
<td>0</td>
<td>[Navman], 1601-1699 Willow Rd, Glenview, IL</td>
</tr>
</tbody>
</table>
1. Attach end caps to all unused ports on the Qtanium,

2. Apply Tamper Evident Seal liquid (inspector’s lacquer) to all fuse holders, the ground screw and to all Qtanium connectors/end caps.

3. Complete the installation by securing all wires with zip-ties, away from any moving parts, heat sources or sharp metal edges.

4. Reconnect any of the asset’s connectors that were unplugged during disassembly and replace all trim panels.
The yellow shipping plug can be used to **Cold Reset** the Qtanium

1. Verify both antenna connectors are attached to Qtanium
2. Insert yellow shipping plug into RJ45 port
   (unplug any other device from RJ45 port)
3. Remove Power
   (unplug power connector or pull power fuse)
4. Wait 30 seconds
   (allow device to power down)
5. Reconnect Power
   (plug in power connector or insert power fuse)
6. Remove shipping plug from RJ45 port
   (reconnect any other device or port cap to RJ45)
7. Start the engine
   (allow time for device to reboot: 1-5 min)
Troubleshooting the Installation (cont.)

**Power Harness Connector**
This is the connector-end view of the power harness.
When troubleshooting, use Volt meter to verify power, R-terminal/ignition and ground at the pins in the connector.
- RED – Power
- PNK – Run Signal
- BLK – Ground
- ORG – AUX Out

**Optional ConEx Connector**
This is the connector-end view of the ConEx harness.
When troubleshooting, use Volt meter to verify all sensor inputs at the connector.
- YLW – Sensor#1
- PPL – Sensor#4
- GRN – Sensor#2
- BLK – Ground Ref
- BLU – Sensor#3
- WHT – 3V+ Ref
Overview Diagram: Qtanium, IPS and Sensors

NOTES:
1. Connections to OEM sensors may NOT indicate the correct state when the Ignition Switch is in the OFF position.
2. DO NOT connect Converter Positive Output to any OEM wiring.
Dimensions and Specifications

**Physical**
- Weight: 3.26 lbs (1.48 kg)
- Packed Weight (Box): 4.18 lbs (1.90 kg)
- Case Material: Extruded Aluminum
- End Caps: Die cast Aluminum

**Power Supply**
- Nominal operating voltage: 12 or 24 V asset supplies
- Minimum operating voltage: 9 V
- Maximum operating voltage: 30 V

**Current Consumption at 13.8 V (27.6 V)**
- Sleep State: <1 mA (<3 mA)
- Awake, modem ON: 50 mA (25 mA)
- Awake, average transmit event once every minute: 100 mA (50 mA)
- Peak transmit current: 200 mA (100 mA)
- Battery charging: additional 170 mA (90 mA)

**Digital Inputs**
- Input Voltage LOW: <1.0 V when configured Active High
- Input Voltage HIGH: >5.0 V when configured Active High
- Input Voltage LOW: <0.2 V or grounded when configured Active Low
- Input Voltage HIGH: >0.5 V or not connected when configured Active Low
- Absolute Maximum Voltage: 30 V (independent of supply)

**Digital Output**
- Maximum sink current 250 mA (over current protection / shut-off)

**Analog Input**
- Voltage Range: 0 to 5 V DC
- ADC Resolution: 10 bit (4.88 mV / step)
- Absolute Maximum Voltage: 30 V (independent of supply)

**Ignition Input**
- Absolute Maximum Voltage: 30 V (independent of supply)

**Environmental**
- Storage Temperature: -40 to +185°F (-40 to +85°C)
- Operational Temperature: -4 to +158°F (-20 to +70°C)
- IP Rating: IP-67
Questions?  Troubleshooting?  Suggestions?

**Technical Support Department:**
Monday – Friday
7am – 7pm
(Central Standard Time)

e-mail:  us.support@navmanwireless.com
*Toll Free:*  866-527-9896  *(option #3)*
*Local:*  847-832-6950  *(option #3)*

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