

Mounting a Mobile Computer or Cradle in a Vehicle

Overview

This document describes the requirements and considerations for mounting a mobile computer or cradle in a vehicle in order to ensure the safety of the end user and usability of the device, as well as minimizing damage to that device.

When driving a vehicle on a road, a mobile computer or the cradle mounted in that vehicle suffers the vibration and shock from the surface of the road at all times. If the device is not firmly secured and the vibration isolation mounts (known as “isolators”) are not properly installed, the device mechanism could be damaged, and the people in that vehicle could even get hurt.

Isolators are very predictable in how they will react to a given input—in this case, the movement of the vehicle. If given an erratic or inconsistent input, they will produce an erratic and inconsistent output.

For example, consider two people carrying a table with a stack of boxes on top of it. There would likely be no major issues until you ask those two people to jump up and down. In order for the boxes to stay stacked and not get knocked around, the two people would have to jump in unison, and also jump the same height. Relating the same principle to the mounting bracket for a device, if the isolators on the mounting bracket receive different inputs due to an uneven mounting scheme on the vehicle, the device would be treated like the stack of boxes on the table between the two people.

Isolators possess a limited input capability, just as the people jumping with the table can only help stabilize and protect the stacked boxes to a limit (by using their arms as shock absorbers) based on how high they jump. If the mounting surface is not stiff enough, it will bounce and excite the mounting bracket such that the input would be too high for the isolators to compensate for. Like a car driving over a deep pothole, the suspension has a limit and if exceeded, the car and all the occupants would suffer.

Generally, vibration isolation mounts should possess the following two requirements at a minimum:

- A mounting surface that is far stiffer than the vibration mount itself
- A consistent stiffness across the whole mounting surface

Mounting Methods

FIXED MOUNTING

The fixed mounting method involves the device being mounted directly to the surface of a vehicle, without isolation. Some devices are supplied with a mounting plate or bracket.

Mounting Plates and Brackets

An example of a mounting plate is shown in Figure 1:

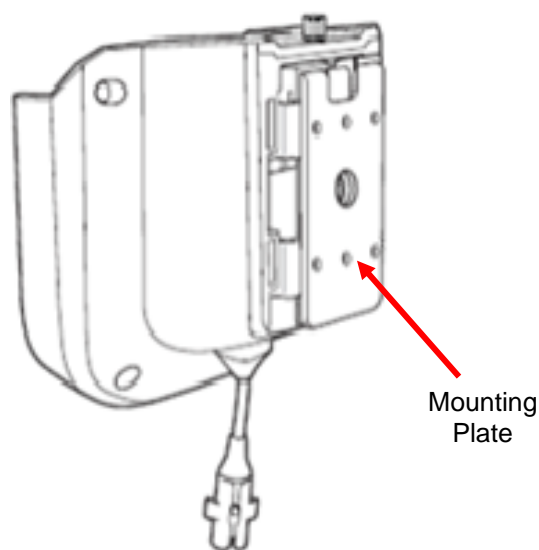


Figure 1: Mounting Plate Example

An example of a mounting bracket is shown in Figure 2:



Figure 2: Mounting Bracket Example

Direct Hardware vs. Suction Cup Mount

Many devices are mounted directly with hardware, but others are mounted via a suction cup.

Figure 3 displays an example of a direct hardware mount:

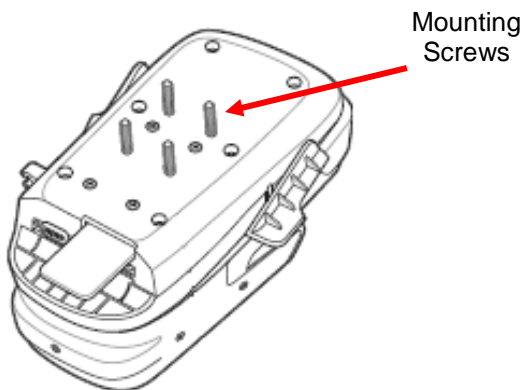


Figure 3: Direct Hardware Mount

Figure 4 illustrates a cradle mounted with a suction cup.

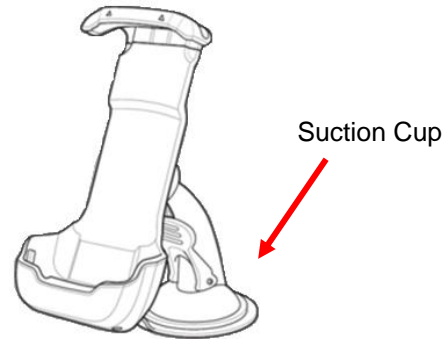


Figure 4: Suction Cup Mount Example

RAM MOUNTING

Many products are compatible with RAM mounting systems, which allow easy user adjustability when mounted to a vehicle, as opposed to fixed mount systems.

Although the use of a RAM mounting system can make the operation of a mobile computer more convenient, it can also amplify the shock and/or vibration levels from a vehicle to the mobile computer.

An example of a RAM mount is shown in Figure 5:

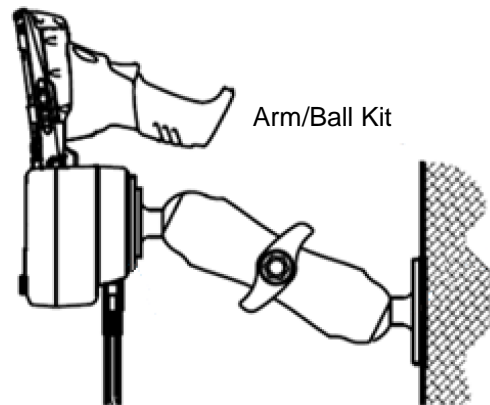


Figure 5: Example of RAM Mount

The components of the RAM mount system are as follows:

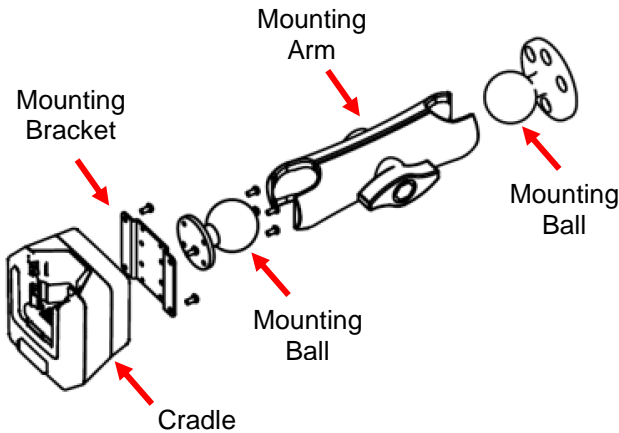


Figure 6: Components of a Sample RAM Mount System

Best Practices for Mounting a Device in a Vehicle

DOS

- ✓ When installing the device, ensure that the mounting bracket footprint is fully supported.
- ✓ Determine the best position for the device (the cradle or the mobile computer) and all the associated components. If a similar device was previously installed, check to see if the position it formerly occupied is suitable for the new device.
- ✓ Choose a surface that is flat for the entire span of the mount, and that provides adequate support and stiffness for the weight of the cradle and the mobile computer.
- ✓ For the suction cup type of mount, make sure the surface is free of dirt and oil. Clean the mounting surface with a glass cleaner and a clean lint-free cloth.
- ✓ **Note:** A suction cup mount is intended to be applied to flat glass or a smooth, flat plate securely mounted to the vehicle structure with adhesive, creating a mounting surface for the suction cup.

- ✓ Mount the device in a vertical position unless the Application Guide suggests an orientation of upside down or sideways.
- ✓ Check the specification of the product to determine if the device is intended to be used indoors or outdoors. For example, an “indoor” device should not be installed in fixed outdoor locations, or on a vehicle primarily operating outdoors, unless additional environmental protection is provided.
- ✓ Position the cradle or bracket on the mounting surface, and fasten the screws tightly using proper hardware rated for the loading, and include thread-locking features, such as lock washers or nylon insert lock nuts. Refer to the detailed instructions in the applicable Installation Guide.
- ✓ Check all nuts, bolts, and end clamps periodically and tighten them if required.

DON'TS

- ✗ Never mount a device on a wall that can be subject to impact or collision of greater than 40Gs (in accordance with testing standard SAE J1455 Section 4.10.3.5).
- ✗ Do not install a device on or near an airbag cover plate.
- ✗ Do not install a device in a location that affects vehicle safety or drivability. Check regulations for local use, such as the Department of Transportation (DOT) regulations.
- ✗ Do not install a standard, non-lift truck cradle on a lift truck or forklift, as the lift truck use case is far more severe with respect to shock and vibration inputs.
- ✗ Do not modify the brackets provided by the manufacturer. Any modification to supplied mountings could cause early failure of the unit/mountings.
- ✗ Do not extend RAM arms by connecting two or more RAM mounting arms together, as it will amplify the movement greatly and result in damage to the mobile computer and/or the cradle.

Post-Mounting Checklist

- ☑ Check that the mobile computer or cradle is positioned so that it does not obstruct the vehicle controls or the driver's view.
- ☑ Check the position of the device for user comfort over long periods.
- ☑ Ensure the filter box (if applicable) is not in a confined space where it may overheat.
- ☑ Check that any attached cables are routed so that they do not interfere with the user or other moving parts.
- ☑ If mounting a device on several forklifts, test the first installation for at least 30 minutes to ensure that the forklift cradle mounting has been done properly, and functions as needed, before installing on subsequent forklifts.
- ☑ Check the visibility of the mobile computer display and accessibility of the mobile computer keypad while seated in the forklift.

Examples of Improper Mounting

The following are examples of improper mounting techniques that resulted in device damage.

EXAMPLE #1

In this example, a handheld mobile computer in a vehicle cradle was mounted in an armored car.



Issue:

The mobile device fell out of the vehicle cradle due to impact shock when the truck door was slammed shut. The scan exit window on the device was broken when the mobile computer fell on objects below.

Root Cause:

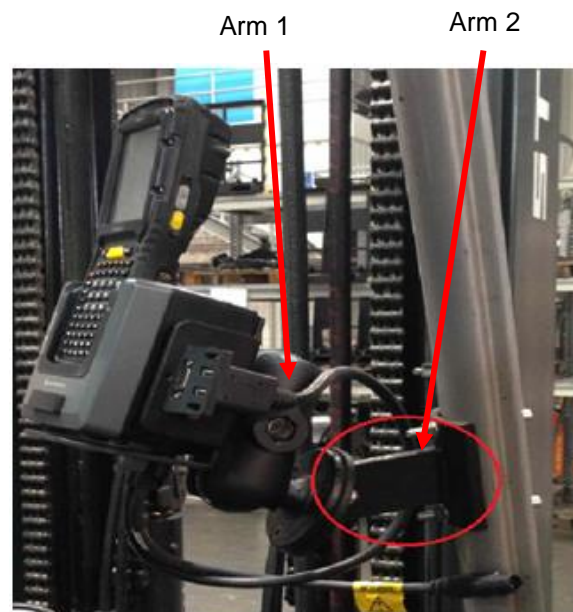
- The drivers slammed the doors forcefully, which can generate g-forces significantly higher than the design specifications of the cradle.
- Cradles were mounted horizontally, as opposed to vertically. The drivers removed the devices, in an improper orientation, resulting in a higher potential for drops.

Solution:

This customer rotated the mounting to a vertical position, and urged their drivers to not slam the heavy doors, but shut them more carefully.

EXAMPLE #2

In this example, a handheld mobile computer in a cradle was mounted to a forklift.



Issue:

Mobile computer popped out of the vehicle cradle during use.

Root Cause:

The mount to the forklift truck structure was unstable for the combined mass of the mobile computer, cradle, and RAM arm. The excessive movements that resulted caused the mobile computer to bounce in the cradle, resulting in the latching mechanism being worn out.

Solution:

A more robust mounting solution, using only one arm, was provided:



EXAMPLE #3

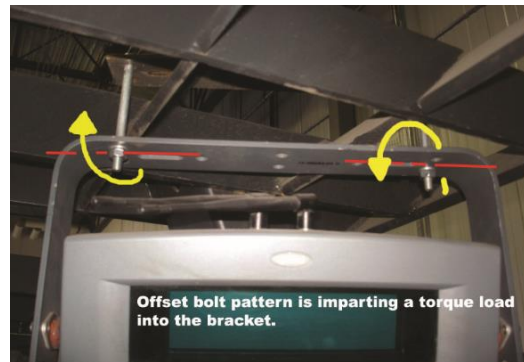
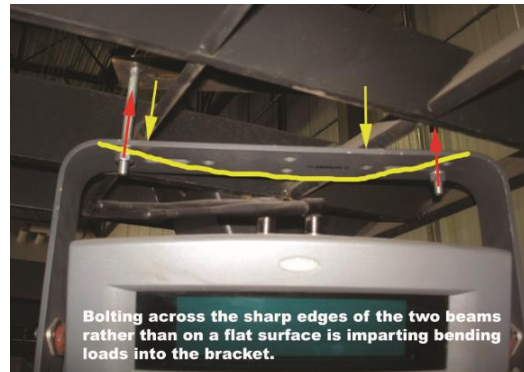
The final example shows the vehicle computer mounted to the overhead structure of a forklift.

Issue:

The vehicle computer mounting bracket was breaking.

Root Cause:

The customer incorrectly mounted the unsupported bracket across the forklift's cage. The top of the cage used angled crossbeams rather than a flat surface. The customer mounting tried to sandwich the angled beams. This resulted in high stresses in the bracket, which in turn caused the mounting brackets to bend, as well as crack where the bolt holes are located.



Solution:

A more robust mounting solution was provided, involving heavy gage steel plates clamped to the overhead cage with high-strength hardware. This provided the vehicle computer a bracket to which a flat support could be bolted, reducing the stresses that caused it to fail originally.



Bracket

Forklift's angled cross beams

