GRADEMETRIX™ SCRAPER
INSTALLATION GUIDE
Revision: A2

Additional information, documentation, and software can be found at:
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Table of Contents

Chapter 1: Getting Started

Overview

Introduction

Chapter 1 provides you with the information and proper tooling needed to begin a GradeMetrix Scraper installation.

It is recommended for only an experienced service technician perform the installation and configuration of the Hemisphere GradeMetrix system.

Contents

Getting Started

Introduction

This section lists the tools required, preparation, and power setup necessary to prepare your machine for the GradeMetrix scraper system installation.

Tools List

Tools list

A variety of tools are needed to properly set up and install your GradeMetrix Scraper system.

Review the following list and locate these required tools prior to beginning installation:

- ☐ Slotted screwdriver
- ☐ Phillips screwdriver
- ☐ Adjustable wrench
- ☐ ½” & 3/8” ratchet set
- ☐ Inch sockets
- ☐ Metric sockets
- ☐ Cable tie cutters
- ☐ Allen wrench set (inch)
- ☐ Allen wrench set (metric)
- ☐ Torx wrench
- ☐ Wire stripper / Crimp tool
- ☐ GNSS base/rover
- ☐ Open wheel measuring tape
- ☐ Cable ties
- ☐ Split tube or other cable protection
- ☐ Electrical Tape
- ☐ Heat Shrink
- ☐ Electrical terminals i.e., spade, ring etc.
- ☐ Thread locker (Loctite Blue)
- ☐ Nickel anti-seize grease or similar
- ☐ Cold Gal and Machine-color paint if welding

Preparing for Installation

Prepare for installation

To prepare for a scraper installation place the scraper on a flat surface.

Locate a clean source of power and a safe mounting location for the control box. Check to ensure the IronOne/IronTwo control box and sensors have power. The GMS-1 sensors are powered through the IronOne/IronTwo and receiver.

Important: The IronOne/IronTwo must receive 9 – 36 VDC of input power from the machine (most machines should provide 24 V directly from the battery). **Ground to the machine chassis. Do not ground to the negative terminal of the battery.**

Note: The IronOne or IronTwo must be installed so the operator can see the screen. Use care not to place the IronOne or IronTwo in a location that might compromise visibility or block an exit from the cab.

Safety Information and Warnings

Safety information and warnings

Refer to the safety manual for proper operation and safety precautions. Store this guide and all related safety information with related machine manuals for future reference.

Prior to installing and operating GradeMetrix, read and follow all safety precautions as outlined in this manual.

Review and adhere to the follow safety warnings:

- Before you begin working on the machine, use the machine's master switch to disconnect power to the machine.
- A human operator is required to manually maintain a safe operating speed.
- GradeMetrix is a grade reference tool and is not designed to replace the machine's operator. **Do NOT allow a driver to operate without safety instructions. Avoid obstacles to prevent human, machine, and property injury.**

Important: The safety warnings contained in this manual are intended as guidelines and are not meant to be a complete list of potential hazards.

What's Included in Your Kit

Kit contents

Your GradeMetrix kit contains the parts listed in Table 1-1, Installation Kit Contents.

Table 1-1: Installation Kit Contents

Part Number	Description	Qty
752-0030-10	HGNSS VR1000 Receiver	1
752-0041-10	A46 ANTENNA, HGNSS	1
051-0415-10	Cable, RG 213, N-Type, Male, with Caps, 25ft	2
051-0419-10	CBL,VR1000 Excav Rcvr I/O,23to12pin,0.5m	1
051-0420-10	CBL,VR1000 Excav Chassis,12to2X6Pin,5m	1
710-0237-10	KIT, BULKHEAD, N-TYPE QTY 1, M12-5PIN	1
051-0425-30	Cable, M12 CAN M/F Sensor, 5m	1
051-0425-40	Cable, M12 CAN M/F Sensor, 10m	2
710-0217-10	KIT, GMS-1 SENSOR MOUNT, WITH COVER	1
750-5019-10	SENSOR,GMS-1,DUAL AXIS,VER,M12-5PIN,M-F	1
150-0018-000	ANT,450-470MHZ,3DB-MEG,3.4",BLK/WHT	1
150-0053-10	IronX BT_Wifi Antenna	1
150-0054-10	IronX Cellular Antenna	1
478-0022-10	MAGNET BASE, 3.25" DIA, CHROME, UHF ANT, 12' CABLE, TNC	1
710-0148-10	IronX Flush Mount Kit	1
710-0149-10	IronX U-Mount Kit	1
710-0161-10	KIT, MOUNTING MAGNETS, VR1000	1
710-0223-10	KIT, BT/WIFI ANTENNA WITH ADAPTER	1
710-0231-10	GradeMetrix Consumables Kit, VR1000	1
750-0245-10	CAN TERMINATION RESISTOR, M12(F)	1
400-1105-10	N-Type, Coupler	1

Continued on next page

What's Included in Your Kit, Continued

Kit contents, continued

Table 1-1: Installation Kit Contents

Note: You must add either an IronOne or an IronTwo kit to your GradeMetrix Scraper kit.

980-7008-10	**IronTwo Terminal Kit, NA & EMEA**	**Qty**
050-0022-01	CBL,ADO,POWER	1
050-0046-20	CBL, ADO, PWR ADAPT, GRADEMETRIX	1
051-0426-10	HGNSS IronTwo Bulkhead Cable	1
752-0040-10	IronTwo Terminal	1

980-7009-10	**IronTwo Terminal Kit, APAC**	**Qty**
050-0022-01	CBL,ADO,POWER	1
050-0046-20	CBL, ADO, PWR ADAPT, GRADEMETRIX	1
051-0426-10	HGNSS IronTwo Bulkhead Cable	1
752-0040-20	IronTwo Terminal, APAC	1

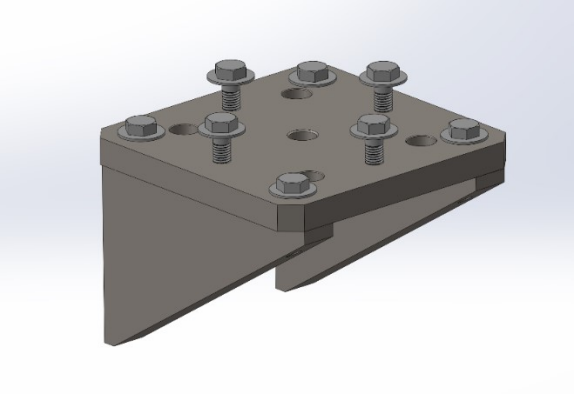
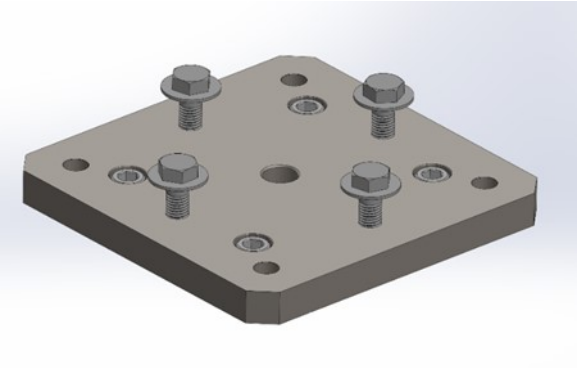
980-7007-10	**IronOne Terminal Kit**	**Qty**
051-0408-10	HGNSS IronOne Bulkhead Cable	1
054-0182-11	HGNSS IronOne Power Cable	1
752-0036-10	IronOne Terminal	1

Continued on next page

What's Included in Your Kit, Continued

Optional Accessories

Table 1-2: Option Accessories

Part Number	Description
710-0247-10	KIT, MOUNTING BRACKET, R/A, 1.4M MAST 
710-0246-10	

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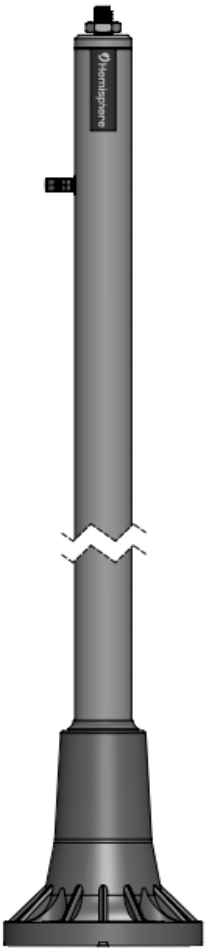
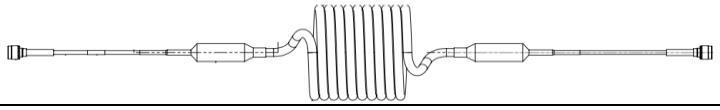
What's Included in Your Kit, Continued

Kit contents, continued

Part Number	Description
710-0239-10	KIT, 1.4 METER MAST 
720-0087-10	CBL ASSY, RF, N(M)-N(M), COILED, 15FT 

NOTE: Due to manufacturing processes outside of HGNSS purview, the installer may be required to adapt the GradeMetrix kit to your individual system.

Machine Inspection Checklist

Machine Inspection Checklist

To ensure peak performance, GradeMetrix should be installed only after a thorough machine inspection has been conducted.

To avoid bodily and machine injury, follow the machine inspection checklist below:

- Park the machine on a clean and level surface.
- Turn off the machine and remove +power from the batteries.
- Lower all implements to the ground.
- Apply the parking brake and chock wheels if necessary.
- Inspect any drilling and/or cutting sites to ensure no electrical wiring damage will be incurred.
- Periodically re-measure the blade width at the tips to adjust accuracy due to blade wear.

Chapter 2: GMS-1 Sensor Installation

Overview

Introduction

The scraper uses one GMS-1 sensor. This sensor provides the pitch and roll values of the cutting edge so that accurate calculations can be done from the GNSS antenna to the cutting edge – allowing GradeMetrix to provide an accurate cut/fill.

Contents

GMS-1 Sensor Installation

Sensors

Your GradeMetrix Scraper kit comes with a GMS-1 sensor (P/N: 750-5019-10). The sensor will be mounted to the outside of the scraper.

Important: It is crucial to choose a safe welding location for the sensor.

Continued on next page

GMS-1 Sensor Installation, Continued

Brackets

The GMS-1 sensors include a base bracket (P/N: 602-1194-10) that can be welded to the machine. This bracket has two welding holes, so the bracket can be welded to the machine and hide the weld. **Prior to welding, disconnect the control box and switch off the master ground disconnect.** Refer to Figure 2-1 bracket dimensions.

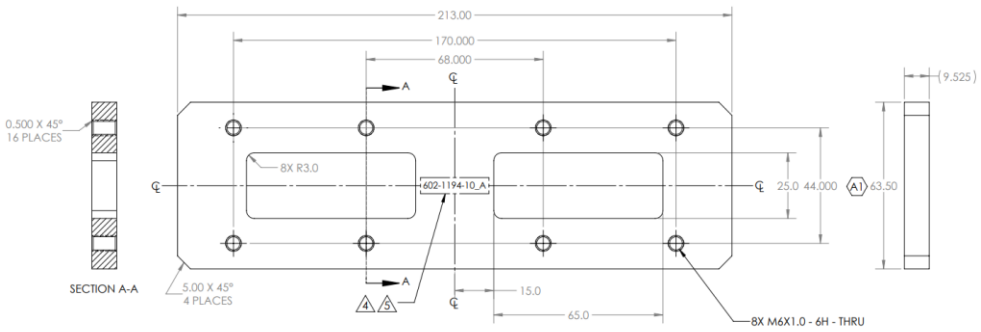


Figure 2-1: Bracket dimensions

Strain relief wings are also included. Screw the strain relief wing onto the bracket with the provided 14mm M6x1mm screws. The CAN cable can be zip-tied to the strain relief wing.

Figure 2-2 shows the drawing of P/N: 602-1196-10 strain relief wing.

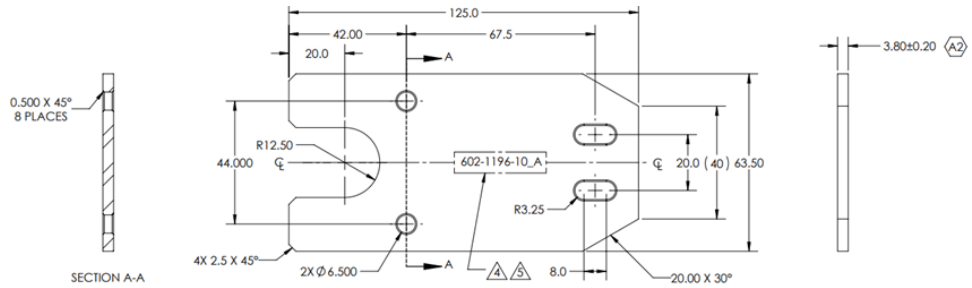


Figure 2-2: P/N: 602-1196-10 strain relief wing

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GMS-1 Sensor Installation, Continued

Brackets, continued

After the base bracket has been welded onto the machine, the GMS-1 sensor can be bolted onto the bracket with the provided 20mm M6x1mm screws.

One strain relief plate and one spacer (P/N: 602-1197-10) is included for the blade. The spacer can be attached to the base bracket on the opposite side of the strain relief wing using the provided 14mm M6x1mm screws. See the following example.

A cover is added to the sensor bracket for protection.

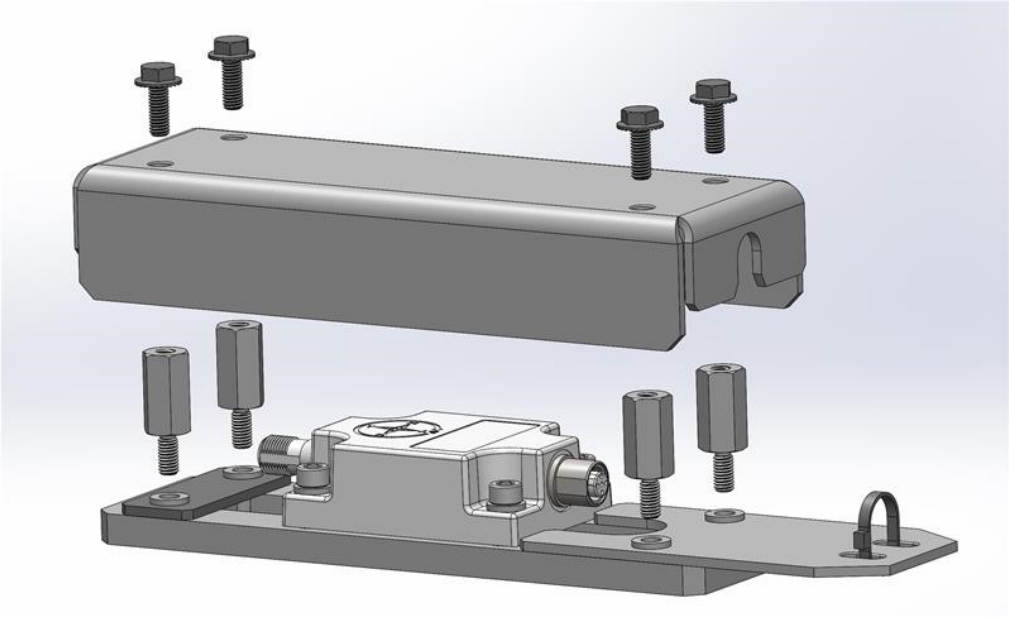


Figure 2-3: Strain Relief Plate and Spacer

Continued on next page

GMS-1 Sensor Installation, Continued

Sensor Placement

Place the sensor on the outside of the can.

Important: Ensure the antenna and sensor are on the same plane. When the can is raised, the antenna should raise with the can.

The LED light can be placed facing left, right, up, or down. Take care to square the sensor so the LED faces one of these locations.

The image below shows a red line along the antenna mast axis. The blue line shows the plane that the sensor is installed on. When the can is pitched or rolled, the antenna and sensor will be pitched or rolled along the same angle.

Figure 2-4: Antenna and Sensor

Continued on next page

Sensor Placement, continued

The image below shows a closer image of the sensor.

Figure 2-5: Sensor placement

The sensor shown above, is mounted to the outside of the can.

Chapter 3: Installing the Sensor Junction Box

Overview

Introduction

This chapter provides the information to install the sensor junction box in your scraper.

Contents

Install the Junction Box

Steps to install the junction box

For a pull pan scraper, the tractor towing the scraper can disconnect from the pan. Since the GradeMetrix system requires components be installed on both the tractor (IronOne or IronTwo control box and VR1000 GNSS receiver) and on the pan (GMS-1 sensor and A46 antenna), there must be an easy way to disconnect the system.

The GradeMetrix Scraper system comes with a junction box.

A CAN cable runs from the IronOne or IronTwo (inside of the cab) to the junction box and from the junction box to the GMS-1 sensor. Additionally, a GNSS antenna cable runs from the VR1000 to the junction box and from the junction box to the A46 antenna.

The junction box must be installed near the point where the tractor attaches to the pan. It can be installed on either the pan or on the tractor.

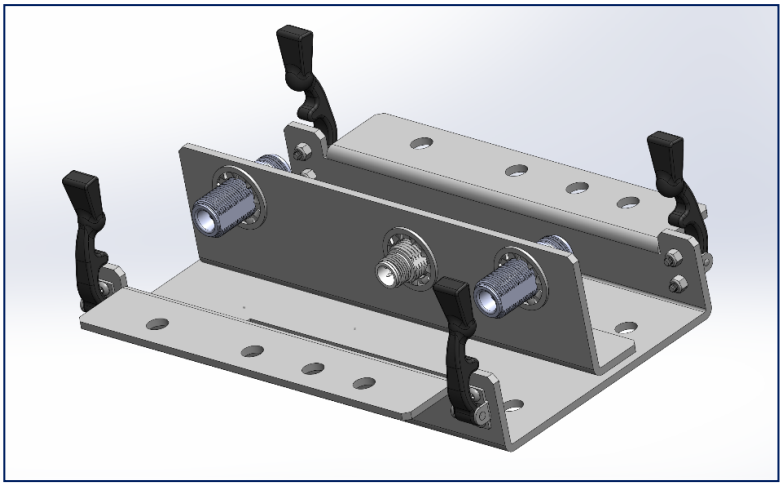
Continued on next page

Install the Junction Box, Continued

Steps to install the junction box, continued

To install the junction box, follow the steps as detailed in Table 3-1: Install Sensor Junction Box.

Table 3-1: Install Sensor Junction Box

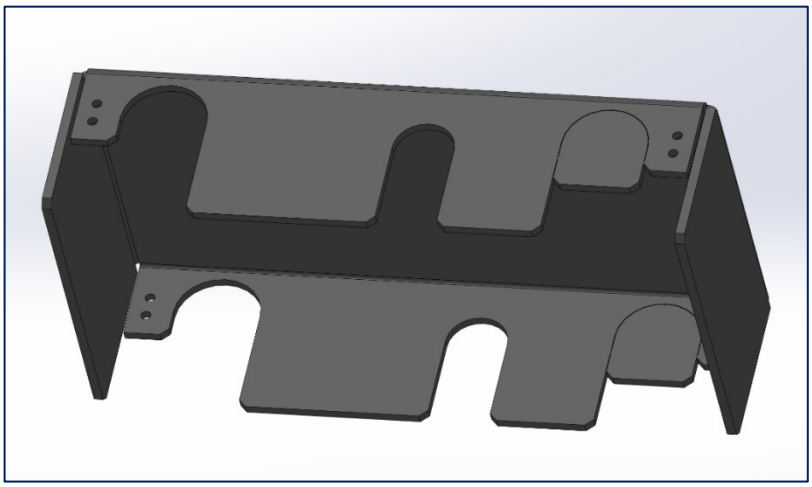
Step	Action
1	The junction box is a base plate that can be welded onto the machine. The junction box will have one 5-pin M12 bulkhead connector for the CAN cable and either one or two N-Type connectors for the GNSS antennas. Most systems come with a single GNSS antenna, and the secondary antenna is optional.  **Figure 3-1: Junction Box**

Continued on next page

Install the Junction Box, Continued

Steps to install the junction box, continued

Table 3-1: Install Sensor Junction Box (continued)

Step	Action
2	In the photo below, the junction box is securely welded to the machine near the point where the tractor can disconnect from the pan. Paint the junction box to help protect it from rust. **Prior to welding, disconnect the control box and switch off the master ground disconnect.**  **Figure 3-2: Junction Box Installed**
3	A cover is provided to place over the junction box. If you are using two GNSS antennas, you can punch out the additional slot on the cover.  **Figure 3-3: Junction Box Cover**

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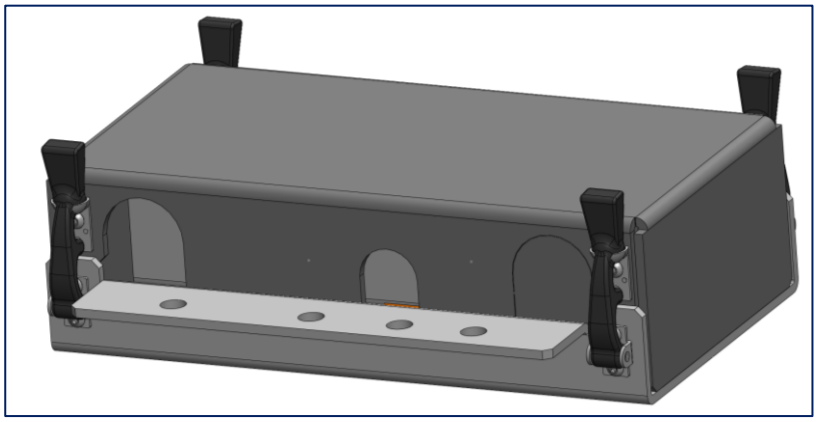
Install the Junction Box, Continued

Steps to install the junction box, continued

Table 3-1: Install Sensor Junction Box (continued)

Step	Action
4	The junction box has four rubber hooks for attaching the cover.  **Figure 3-4: Junction Box with Cover**
5	The junction box should be placed in a protected area when possible.  **Figure 3-5: Junction Box Installed**

Chapter 4: Install the VR1000 Receiver

Overview

Introduction

A VR1000 receiver is used for position. This section describes how to install the VR1000 onto the scraper.

Contents

Install the VR1000 Receiver

Install the VR1000 (Magnets)

The first step is to install the VR1000 magnet kit (P/N: 710-0161-10) onto the VR1000, so the VR1000 can be secured in a safe location on the scraper.

Use the M5x0.8mm screws to attach the magnets to the VR1000.

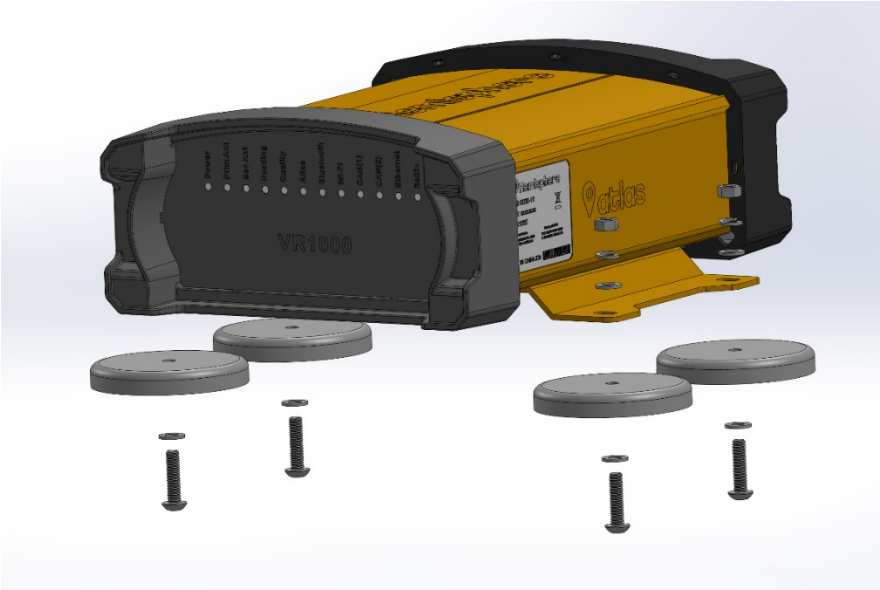


Figure 4-1: VR1000 with magnets

The VR1000 will look as shown:

Figure 4-2: VR1000 with magnets attached

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Mount the corrections radio antenna

Mount the radio antenna at the highest point and secure with mounting bolts or a mag mount.

Note 1: The mounting location for the RTK antenna can typically be located on top of the cab using a magnet mounted antenna.

Note 2: If receiving RTK over NTRIP, a UHF radio antenna is not necessary.

Figure 4-3: Radio antenna

Continued on next page

Install the VR1000 Receiver, Continued

Mount the VR1000

Mount the VR1000 in the battery compartment, the engine compartment, or behind the seat. Ensure the VR1000 is mounted far from any heat sources. The GradeMetrix Scraper Installation Kit contains magnetic mounts that allow the VR1000 to be mounted in a convenient location.

Carefully run the cables into the cab. The default GradeMetrix Scraper comes with one A46 antenna, although there is an option to purchase a second A46 antenna. This would require installing an additional Rf cable (as shown in the photo below).

Note: Run the power and communication cable into the cab to connect to the IronOne/IronTwo cable. Run the UHF antenna to the roof of the machine.

Figure 4-4: Mounted VR1000

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Install the VR1000 Receiver, Continued

Running Cables

The VR1000 has a short, 50cm cable that connects to the 23-pin connector on the VR1000 (P/N: 051-0419-10).

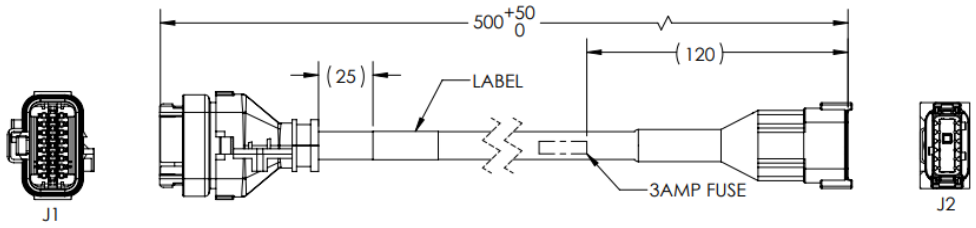

Figure 4-5: VR1000 Cable, P/N: 051-0419-10

Connect the J2 connector of P/N: 051-0419-10 to the J1 connector of the 5m VR1000 cable (P/N: 051-0420-10) that runs to the IronOne or IronTwo control box.

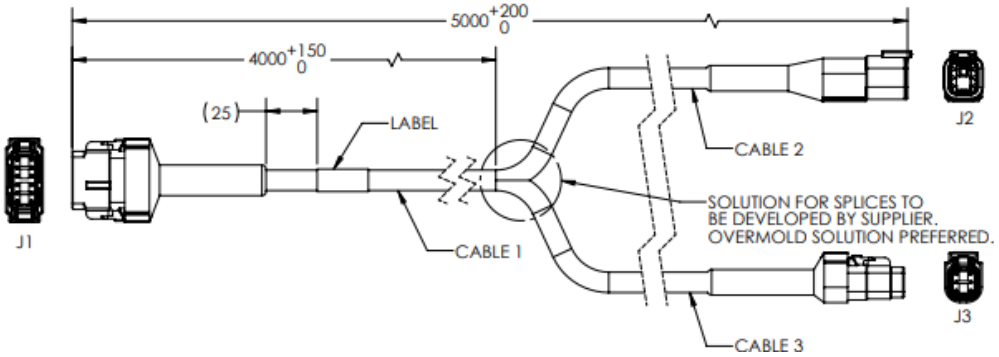

Figure 4-6: VR1000 Cable, P/N: 051-0420-10

The 5m cable must be run safely to the inside of the cab, where the IronOne or IronTwo is installed. The J2 connector of cable (P/N: 051-0420-10) connects to the IronOne or IronTwo cable and provides both power and communication to the VR1000 (see Installing the IronOne or IronTwo). The J3 connector can be used for an external RTK correction source. See Appendix C for further details on pinouts.

Chapter 5: Install the VR1000 Antenna

Overview

Introduction

Chapter 5 provides all the information you need to install the VR1000 antenna and antenna mast.

Contents

Install the Mast

Steps to install the A46 antenna mast

The A46 antenna is installed onto a mast. The mast is provided as an optional accessory (Part Number: 710-0239-10). The mast is a 1.4m (4.6ft) tall mount for the A46 GNSS antenna. The dimensions of the mast base are shown below. Several adapter plates are available for purchase. All dimensions are in millimeters. Note: do not torque more than 15 lbs.-ft/20 Nm.

Note: When bolting the mast down, make sure to use a thread locker (Loctite Blue) to secure the base to the mounting plate. Place grease on the 5/8”-11 thread that the A46 antenna mounts to.

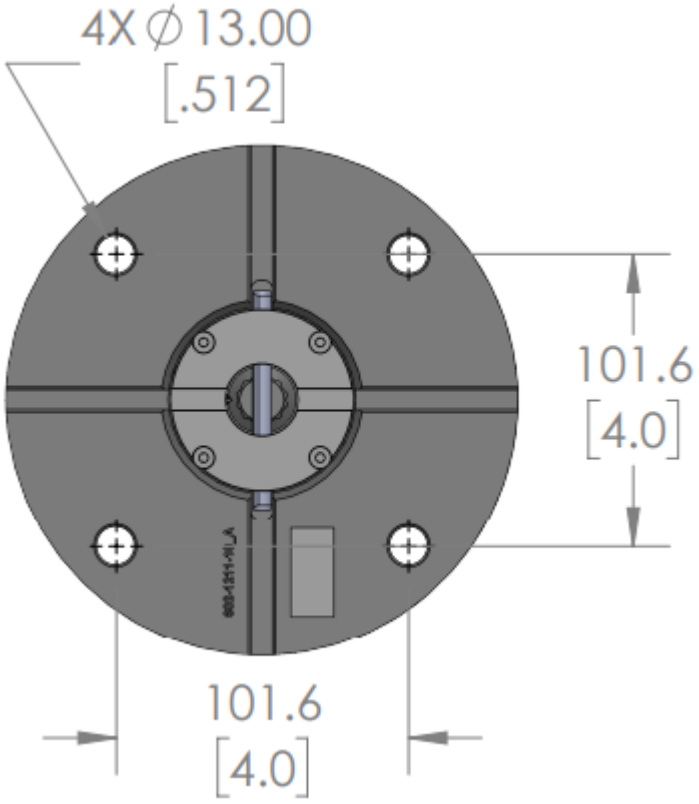

Figure 5-1: Antenna Mast Base

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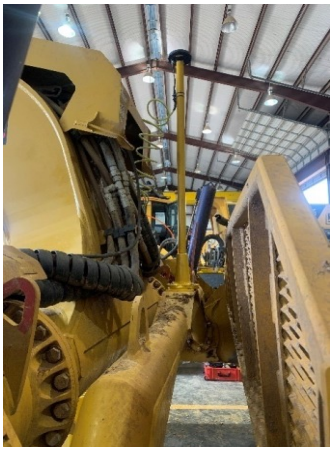
Install the Mast, Continued

Steps to install the A46 antenna mast, continued

To install the A46 antenna mast, follow the steps as detailed in Table 5-1.

Table 5-1: Install A46 antenna mast

Step	Action
1	If the A46 antenna mast is not mounted over the cutting edge of the scraper you can enter the offsets into the software. It is important that it is mounted to part of the can, so when the cutting edge is raised, the antenna is also raised to be on the same articulation The antenna should move with the cutting edge. Refer to Installing the sensor.  

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Install the Mast, Continued

Steps to install the A46 antenna mast, continued

Table 5-1: Install A46 antenna mast (continued)

Step	Action
2	The A46 antenna screws onto the 5/8” thread at the top of the mast. A coil cable is available as an optional accessory (Part Number 720-0087-10). 

Chapter 6: Installing the IronOne or IronTwo Control Box

Overview

Introduction

This chapter provides information necessary to install the IronOne or IronTwo to your GradeMetrix scraper.

Contents

IronOne/Iron Two Display Installation

Install the IronOne or IronTwo

The GradeMetrix Scraper Installation Kit comes with the following components:

- IronOne (P/N: 752-0036-10) or IronTwo (P/N: 752-0040-10 or P/N: 752-0040-20)
- IronOne Power Cable (P/N: 710-0210-10) or IronTwo Power Cable (P/N: 050-0022-01 and P/N: 050-0046-01)
- IronOne/IronTwo U-Mount Kit (P/N: 710-0149-10)
- IronOne/IronTwo Flush Mount Kit (P/N: 710-0148-10)

To install the components, you must have:

- Philips Screwdriver
- Nut driver

The IronOne/IronTwo control panel console (P/N: 752-0036-10) and mounting assembly (the RAM mount included in the GradeMetrix Scraper Installation Kit) should be installed inside of the cab in a location the gives the operator a clear view.

Figure 6-1: IronTwo control box-mounting option #1

Continued on next page

Install the IronOne or IronTwo, continued

Figure 6-2: IronOne control box-mounting option #2

Note: Individual machines may differ, and some customization may be necessary to complete any portion of this installation. Installers may wish to mount the IronOne /IronTwo in a different location than shown, or with custom built brackets.

Continued on next page

Install the IronOne or IronTwo, continued

Follow these steps to install the control box to your machine:

Table 6-1: Install IronOne or IronTwo control box

Step	Action
1	Attach the 1.5” RAM ball to the rear of the IronOne or IronTwo using the included bolts.
2	Install the 1.5” RAM base mount to an unobstructed location in the cab for console mounting. **Note:** The RAM swivel mount can be used to adjust the location and viewing angle of the console.
3	Using the IronOne/IronTwo U-Mount Kit (P/N: 710-0149-10), mount the IronOne/IronTwo to the window rails at the right-side of machine cab.
4	Ensure adequate cable slack is provided, so the IronOne/IronTwo can swivel on the RAM mount without putting stress on the cables.

The IronOne or IronTwo power cable runs power to the console.

IMPORTANT!
The main power cable (IronOne P/N: 054-0182-10 and IronTwo P/N: 050-0022-01, P/N: 050-0046-01 connected) leads should be installed to system power (9-36 +VDC and chassis ground).

Do NOT ground to the negative terminal of the battery; always ground to the machine chassis.

The IronTwo power cable comes with an ignition wire (orange) that can be connected to the switch power. If connected to the switch power, the IronTwo will automatically be turned on after receiving power. Switch power should have 12v or 24v (depending on machine voltage) when the ignition is keyed on and have 0v when ignition is keyed off. If you do not want to use switch power, connect the ignition to the constant machine voltage power.

Continued on next page

Install the IronOne or IronTwo, continued

The IronOne/IronTwo bulkhead adapter cable harness (P/N: 054-0182-11 and P/N: 051-0426-10) must be installed and routed along the interior side of the cab. Install harness cables away from sharp edges and other areas that could damage cables. The cable provides the following connections for the installation:

- **Serial (1)** – 6-pin Deutsch Connector -Connects to the GNSS receiver.
- **CAN (1**) – M12 Connector -Connects to the CAN axial sensors for monitoring boom, stick, and bucket movement.

Note: When installing cables, ensure you leave enough slack behind the IronOne /IronTwo so the display screen may be moved in any direction and will not place any stress on the cabling.

Continued on next page

IronOne/Iron Two Display Installation, Continued

IronOne cable schematic

The diagrams below show the cable schematics for P/N: 051-0408-10 (IronOne) and P/N: 051-0426-10 (IronTwo). The J1 connector plugs into the IronOne/IronTwo. The J2 connector connects a CAN cable. The J3 connector connects to the VR1000 cable.

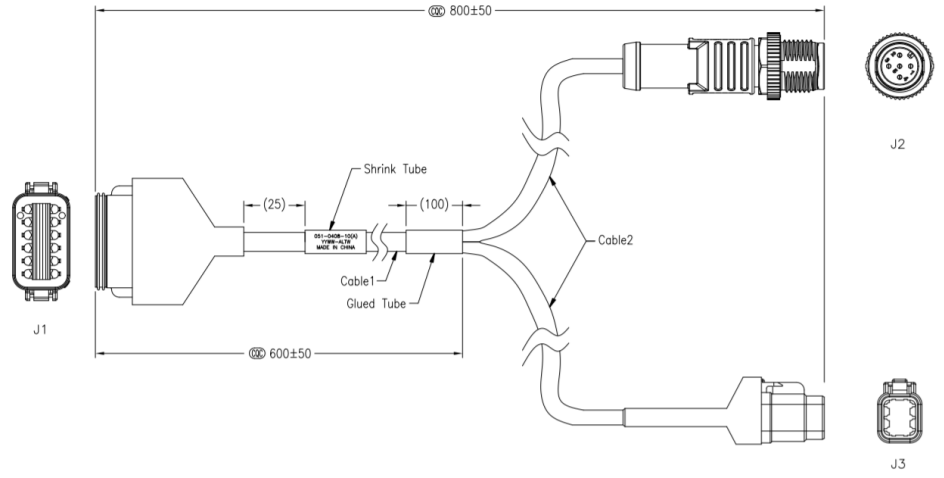


Figure 6-3: Cable schematic for P/N: 051-0408-10 (IronOne)

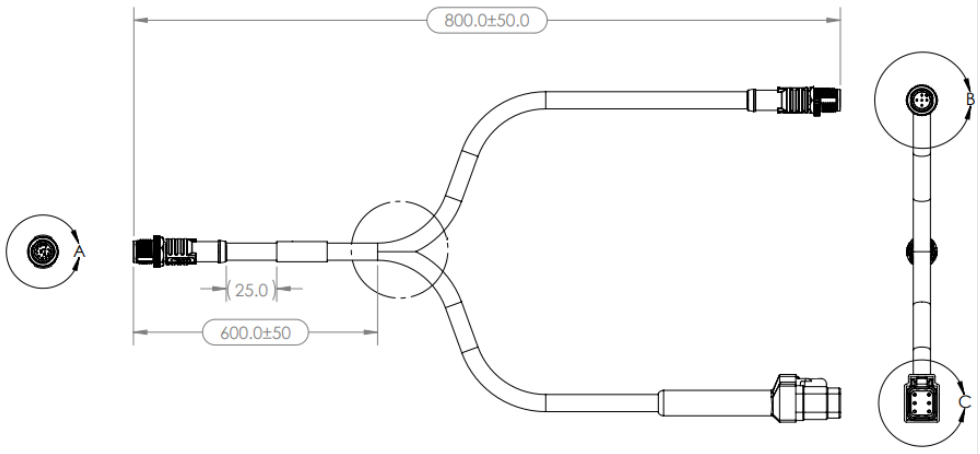


Figure 6-4: Cable schematic for P/N: 051-0426-10 (IronTwo)

Chapter 7: GradeMetrix System

Overview

Introduction

This chapter provides information necessary to use the GradeMetrix System to measure and setup your equipment.

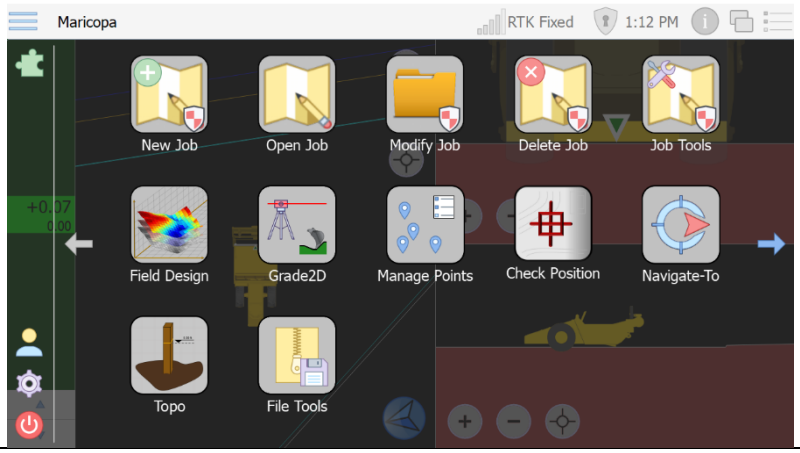
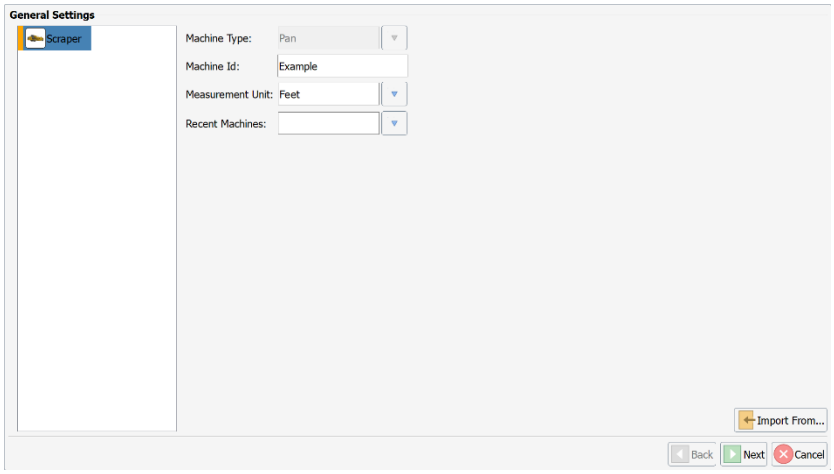
Contents

Measure and Set Up Equipment

Steps to measure and set up equipment

To measure and setup your equipment, log in as administrator, and follow the steps as detailed in Table 7-1: Measure and Set Up Equipment.

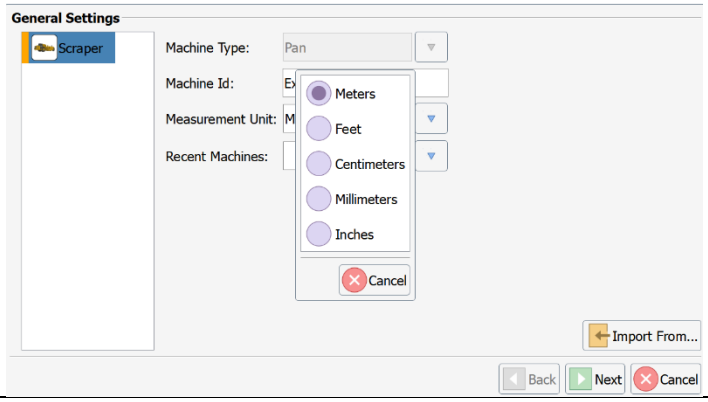
Table 7-1: Measure and Set Up Equipment

Step	Action
1	Select **Equipment Setup**. 
2	Select **Scraper** in the **General Settings** screen. 
3	Select **Machine Type**.

Continued on next page

Steps to measure and set up equipment, continued

Table 7-1: Measure and Set Up Equipment (continued)

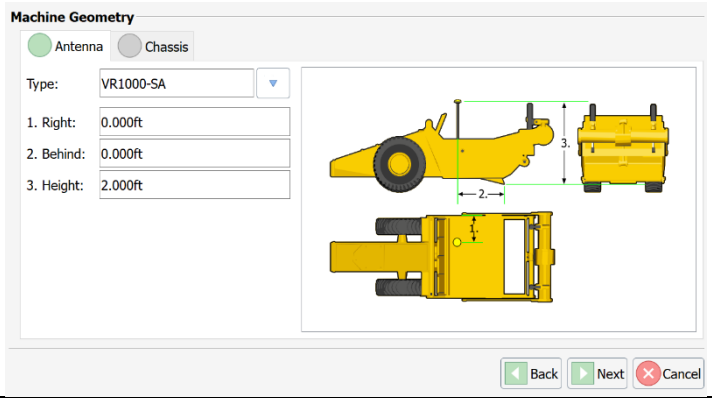
Step	Action
4	Assign a **Machine ID**. **Note:** Your Machine ID should be a unique identifier that will identify this specific machine to your company.
5	Select the unit of measure. Click **NEXT**. 

Continued on next page

Measure and Set Up Equipment, Continued

Steps to measure and set up equipment, continued

Table 7-1: Measure and Set Up Equipment (continued)

Step	Action
6	Follow the screen directions for measuring the machine. The first dropdown box –**Type** – references the GNSS option for the scraper. **Important! Scraper kits use either a VR1000 or a VR1000 SA. This is a critical setting.** Select **VR1000** if you are using two A46 antennas. Select **VR1000 SA** if you are using one A46 antenna. If you select VR1000 but only have one A46 antenna installed, the system will not provide cut/fill because the VR1000 detects only one antenna. When installing the antenna, keep the mast vertical, so to be measured to the right and from behind to the bottom of the mast. The antenna height to the cutting edge should not change when moving up or down, as they move together as one single piece. 

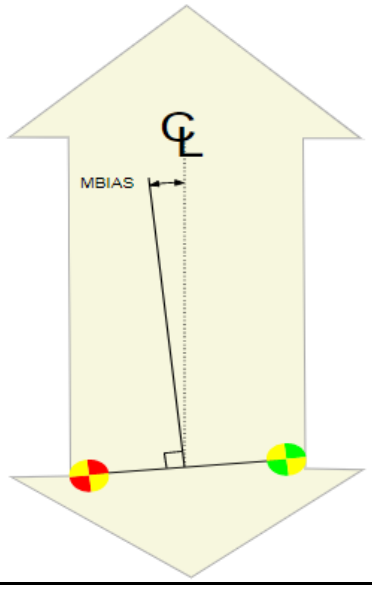
Continued on next page

Steps to measure and set up equipment, continued

Table 7-2: Configure machine measure

Step	Action
1	On the **Antenna** tab, select the type of antenna and receiver you are using.

Field	Description
Pitch orientation	This option is not used when operating a scraper.
Roll orientation	Roll orientation displays if you are using a dual antenna setup. Roll orientation implies that the antennas are perpendicular to the centerline of the machine.
MBias	MBias displays if you are using a dual antenna setup. MBias is the angle between the vector created from the primary to secondary antennas and the centerline of the machine. If using a roll orientation, this vector is offset by 90 degrees.

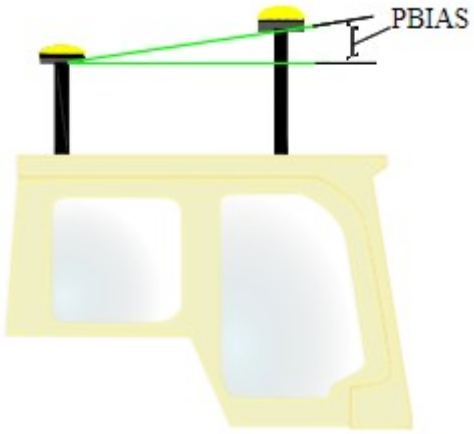


Continued on next page

Steps to measure and set up equipment, continued

Table 7-2: Configure machine measure (continued)

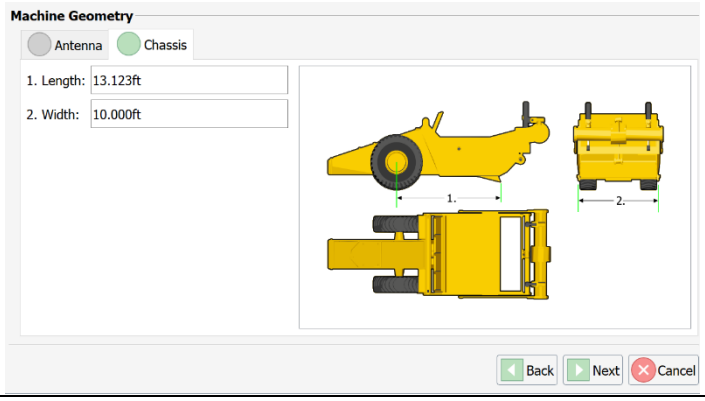
Step	Action
2	

Field	Description
PBias	This option displays if you are using a dual antenna setup. This is the angle created between the vector from the primary to secondary antenna and the machine's chassis. 
Right	The distance of the primary antenna from the left side of the machine.
Behind	The distance from the primary antenna to the cutting edge. If the antenna is in front of the cutting edge, this value will be **negative**. If the antenna is behind the cutting edge, this value will be positive.
Height	The height of the antenna above the cutting edge**.**

Continued on next page

Steps to measure and set up equipment, continued

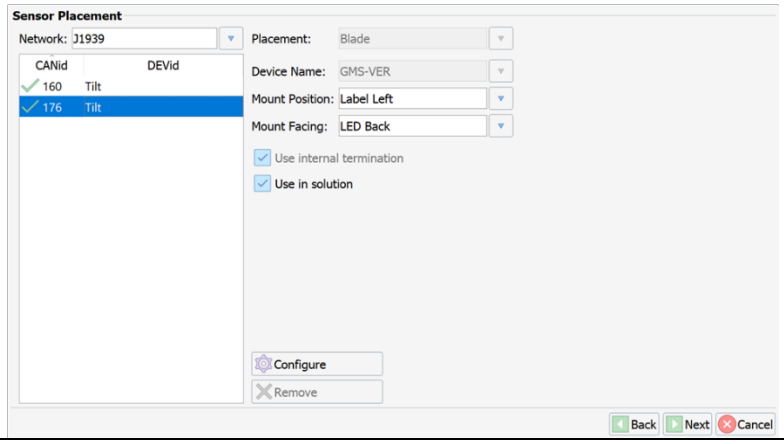
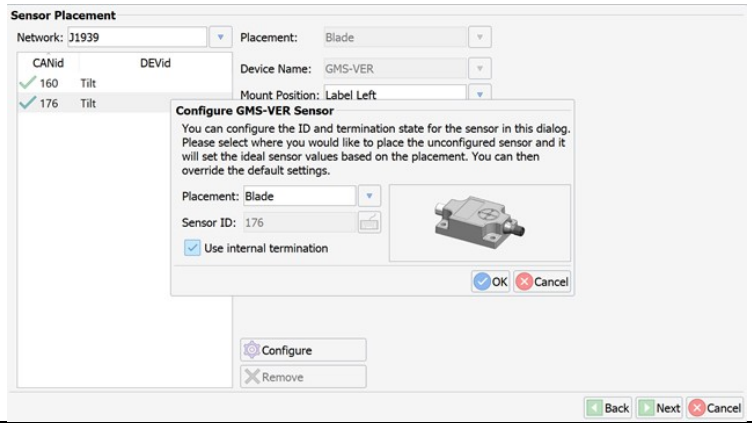
Table 7-2: Configure machine measure (continued)

Step	Action
3	Click the **Chassis** tab. Type the body length, width, and height per the diagram below. The blade width is defined by the chassis width. Body length and height are for graphical purposes and should be accurate to within +/- 1m. 

Steps to measure and set up equipment, continued

After clicking **Next** in the screen above, you will see the **Sensor Placement** screen.

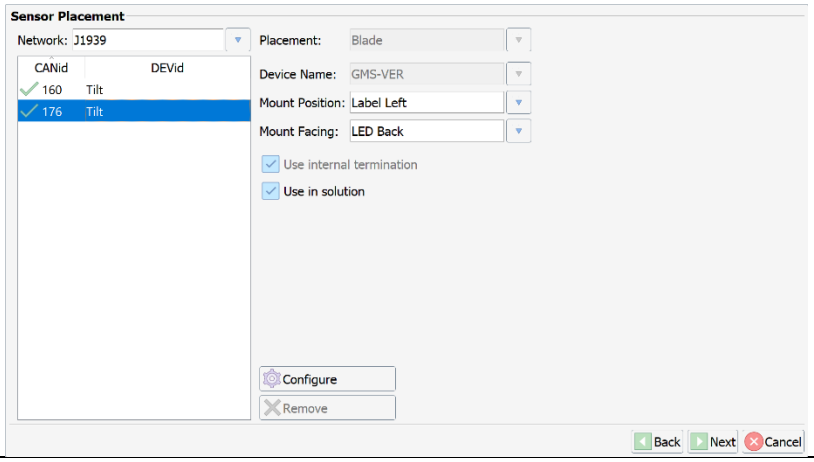
Table 7-3: Set up sensor

Step	Action
1	Click **Sensor Network**. Set **Network** to **J1939**. 
2	The sensor is unconfigured. Click the sensor name and click **Configure**. A dialogue window displays. Click the dropdown box next to **Placement**. Click **Chassis**. Click **Use internal termination**. Click **OK**. 

Continued on next page

Steps to measure and set up equipment, continued, continued

Table 7-3: Set up sensor (continued)

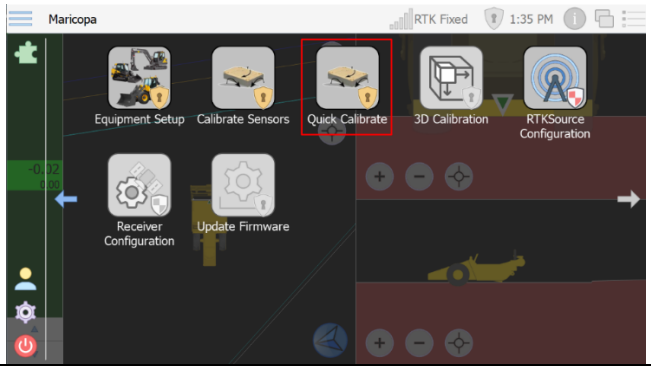
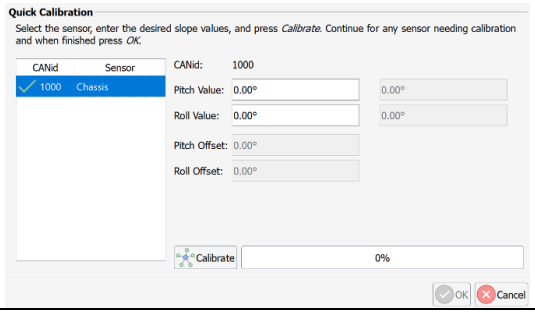
Step	Action
3	Set up the orientation of the sensor. **Mount Position** refers to the direction of the label. **If ...** / **Then ...** the label is facing forward → Set to **Label Forward** The label is facing toward the cab → Set to **Label Back** 
4	Click **FINISH**.

Calibrate System

Calibrate system

To calibrate the system, follow the steps as detailed in Table 6-4: Calibrate System. Use this method to calibrate all the sensors using GradeMetrix.

Table 7-4: Calibrate System

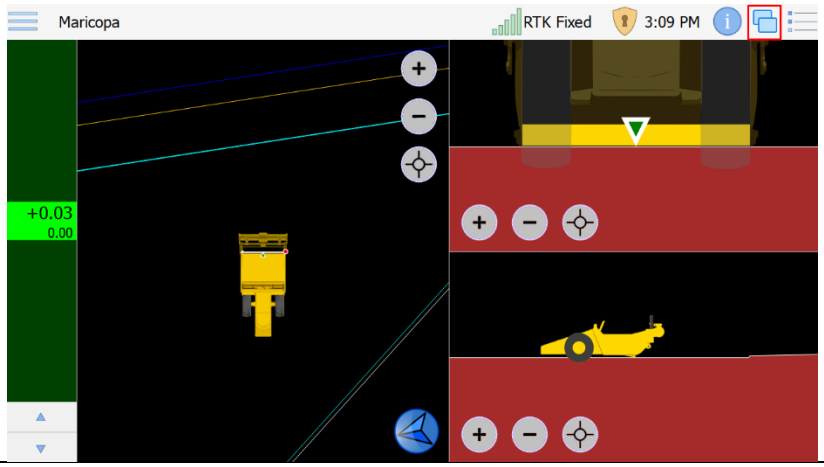
Step	Action
1	Click **Quick Calibrate** and follow instructions. It is recommended to use a firm, flat surface during the calibration process. 
2	The cross slope of the blade needs to be 0. If you cannot get the cross slope at 0, use a smart level to measure the cross slope. Raise or lower the blade until the antenna mast is plumb. It is important that when entering primary antenna offsets, you measure while the machine is in this position. Click **Calibrate**. Click **OK**. 

Verify Machine Accuracy

Verify machine accuracy

To verify the accuracy of the machine, follow the steps as detailed in Table 7-5: Verify Machine Accuracy.

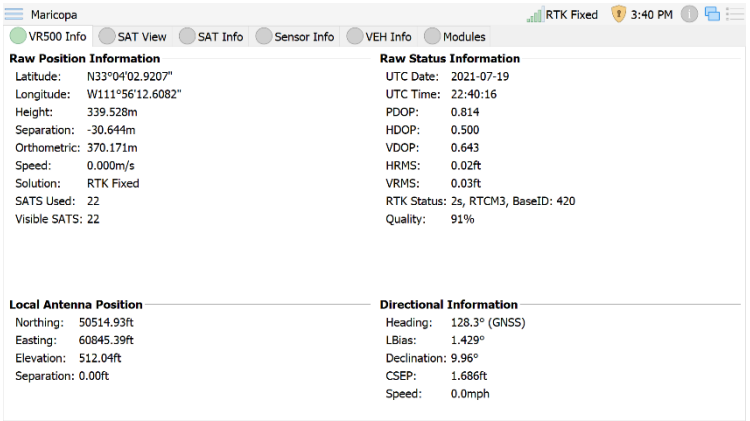
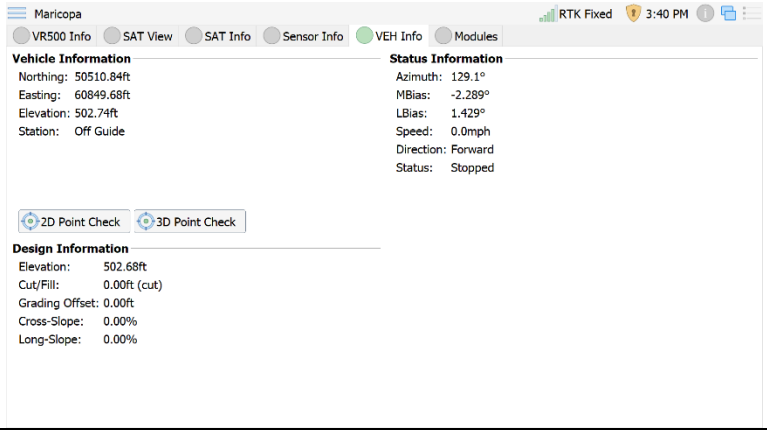
Table 7-5: Verify Machine Accuracy

Step	Action
1	**Warning: if using a VR1000 with a single antenna (VR1000 SA), you must move the machine before checking accuracy, since course over ground is used to determine machine azimuth.** From the main operational screen, select the “folder” icon in the upper-right corner of the screen. 

Continued on next page

Verify machine accuracy, continued

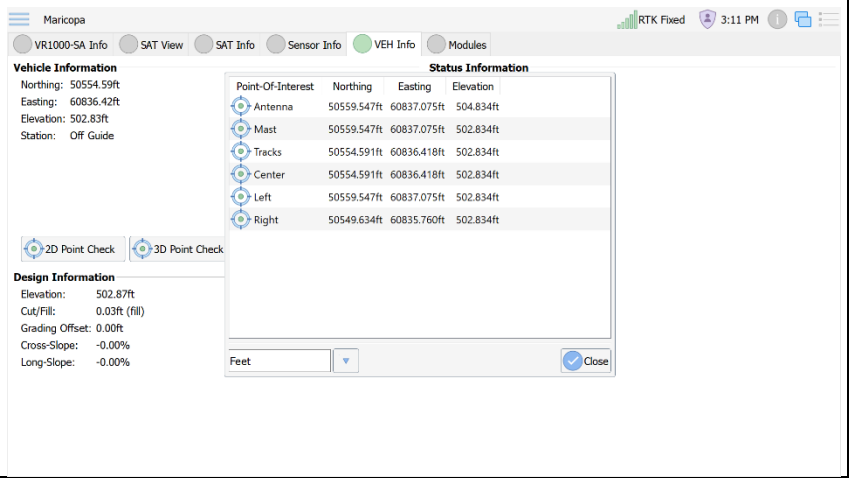
Table 7-5: Verify Machine Accuracy (continued)

Step	Action
2	Verify you have an **RTK Fixed** solution before proceeding. 
3	Select the **VEH (Vehicle)** tab to verify the blade accuracy. 

Continued on next page

Verify machine accuracy, continued

Table 7-5: Verify Machine Accuracy (continued)

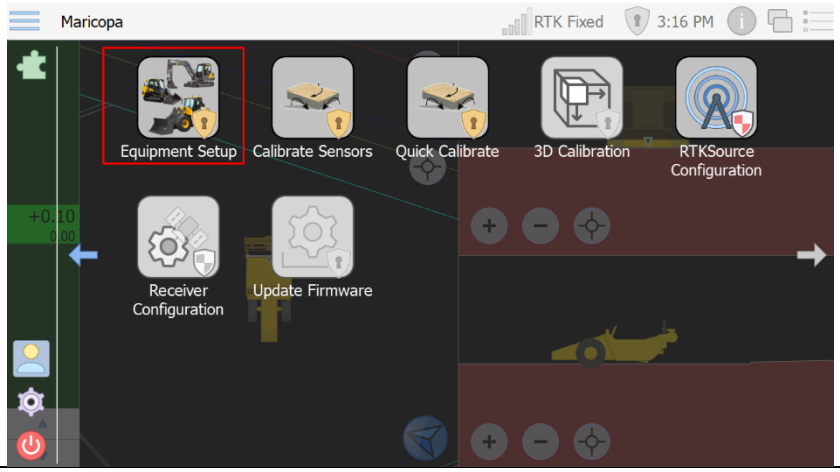
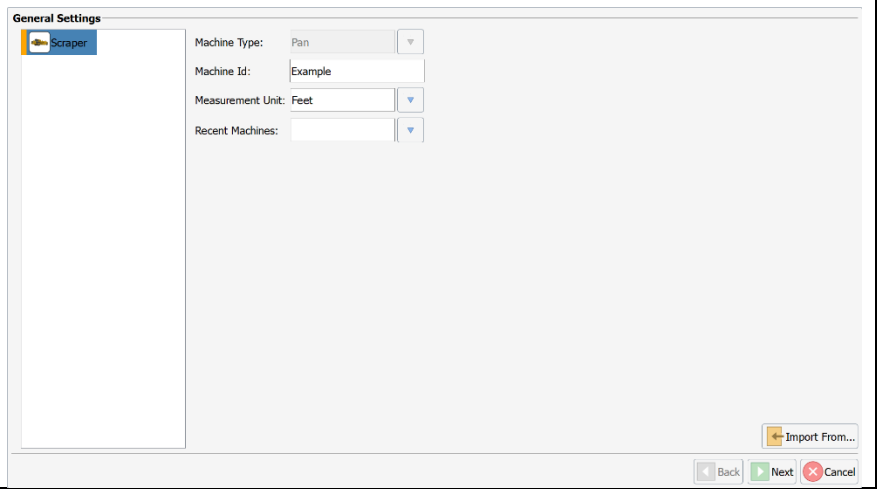
Step	Action
4	Select **3D Point Check** to check the accuracy at multiple locations. Use a rover to verify accuracy at left and right of cutting edge. 

Save Machine Settings

Save Machine Settings

To save the settings for your machine, use the following steps.

Table 7-6: Save Machine Settings

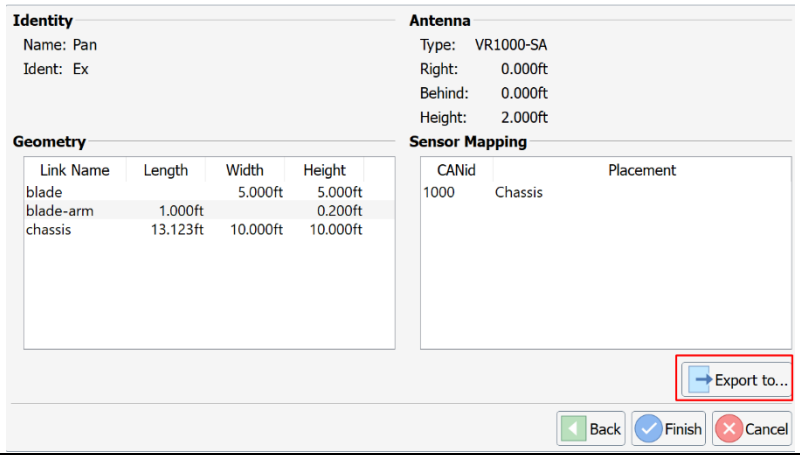
Step	Action
1	To save your machine settings, go to **Equipment Setup.** 
2	Click **Next**. 

Continued on next page

Save Machine Settings, Continued

Save Machine Settings, continued

Table 7-6: Save Machine Settings (continued)

Step	Action
3	Click **Next** until the final screen displays. Click **Export to…** and save the machine settings to a USB thumb drive. 

Appendix A: Troubleshooting

Overview

Introduction

Appendix A provides troubleshooting for the scraper installation.

Note: It is important to review each category in detail to eliminate it as a problem.

Contents

Troubleshooting

Troubleshooting **Table A-1: Troubleshooting**

Issue	Possible Solution
Incorrect Position	First, check a control point with the machine and the survey rover. If the horizontal or vertical position is off, first consider if it is off by a consistent amount throughout the jobsite, or if the position bust varies throughout the job. If it is consistent, consider the following: • Check your machine measurements/offsets. If any of these are incorrect, your projected position will be off. • Bad localization. Make sure that all points in your localization file have low residuals and/or that the correct coordinate system is selected (this can make a significant difference). If there is an inconsistent position bust, check: • Sensor mounting was incorrectly selected and/or the sensor was not calibrated. This is evident if your position is correct when flat, but not if you are on a slope. • If the position at the GPS antenna is correct, but the position bust worsens as you approach the cutting edge, it may be a heading offset error. • If using a single antenna solution, you need to move the machine before checking accuracy, since course-over-ground is used for machine azimuth calculation. Once you move the machine several meters, you no longer need to move the machine since the last valid course-over-ground will be locked in. This must be forward movement (not driving in reverse).

Continued on next page

Troubleshooting, continued

Table A-1: Troubleshooting (continued)

Issue	Possible Solution
No GPS Position	First, check to see if the VR1000 is powered on. There are LED lights underneath the receiver. If the receiver is not powered, disconnect the cable and use a multimeter to verify it is receiving power and ground. Check the monitor screen and sky plots to see if there is any data from the receiver. If there is no data, but the receiver is powered, there could be a bad serial connection / mismatched baud rate.
No RTK	1. If using a base station onsite (versus an NTRIP service), first check to verify the base station is turned on. 2. If the base station is turned on and sending RTK out over UHF, check to see if the Tx (or TD on some radios) light is flashing once per second. 3. Verify that the other rovers on the job site are receiving RTK corrections, if available. 4. If it is flashing once per second, check to verify the settings (frequency, bandwidth, forward error corrections, modulation, and protocol) at the base match that of the rover. 5. Check to see if the UHF light at the rover is blinking once per second. If it is, refer to #3. 6. The receiver may be out of UHF range. Install the radio antenna (if using a VR1000). You may need to install repeaters. See if the RTK corrections work when the machine is closer to the base station. 7. If using NTRIP, check cellular connectivity. One option is to exit GradeMetrix and verify you can go to a website via the browser.

Continued on next page

Troubleshooting, continued

Table A-1: Troubleshooting (continued)

Issue	Possible Solution
IronOne/IronTwo Will Not Power On	1. Check to verify the power cable is connected to machine power. The positive should go to a reliable, clean power source and ground to the chassis of the machine. 2. Disconnect the cable and refer to the pinout to see if 12V or 24V (depending on machine) is going into the IronTwo by using a multi-meter. If the multimeter reads 12V or 24V, then power is confirmed, and the IronTwo may need to be serviced. If you do not have any power, then check your power source, ground, and all fuses.

Appendix B: Technical Specifications

Overview

Introduction

Appendix B contains the technical specifications for the VR1000 GNSS receiver, the IronTwo control box, and the GMS-1 sensor.

Contents

VR1000 GNSS Receiver

VR1000 GNSS receiver

Table B-1: VR1000 GNSS Receiver

Item	Specification
Receiver Type	GNSS Position & Heading RTK Receiver
Signals Received	GPS, GLONASS, BeiDou, Galileo, QZSS, NavIC (IRNSS) and Atlas®
Channels	1059
GPS Sensitivity	-142 dBm
SBAS Tracking	3-channel, parallel tracking
Update Rate	10 Hz standard, 20 Hz optional
Timing (PPS) Accuracy	20 ns
Rate of Turn	100°/s maximum
Cold Start	40 s (no almanac or RTC)
Warm Start	20 s typical (almanac and RTC)
Hot Start	5 s typical (almanac, RTC, and position)
Heading Fix	10 s typical (Hot Start)
Antenna Input Impedance	50 Ω
Maximum Speed	1,850 mph (999 kts)
Maximum Altitude	18,288 m (60,000 ft)
Differential Options	SBAS, Atlas (L-band), RTK

Continued on next page

VR1000 accuracy

Table B-2: VR1000 Accuracy

Item	Specification	
Positioning	**RMS (67%)**	**2DRMS (95%)**
Autonomous, no SA: [2]	**1.2 m**	**2.5 m**
SBAS: [2]	**0.25 m**	**0.5 m**
Atlas: [2,3]	**0.04 m**	**0.08 m**
RTK: [1]	**10 mm + 1 ppm**	**20 mm + 2 ppm**
Heading (RMS)	< 0.2° @ 0.5 m antenna separation < 0.1° @ 1.0 m antenna separation < 0.05° @ 2.0 m antenna separation < 0.02° @ 5.0 m antenna separation < 0.01° @ 10.0 m antenna separation	
Pitch/Roll (RMS)	1°	
Heave (RMS)	30 cm (DGPS)[3], 10 cm (RTK)[3]	

VR1000 communications

Table B-3: VR1000 Communications

Item	Specification
Ports	1x full-duplex RS-232/RS-422, 1x full-duplex RS232, 2x CAN, 1x Ethernet
Baud Rates	4800 - 115200
Radio Interfaces	Bluetooth 2.0 (Class 2), Wi-Fi 2.4 GHz, UHF (400 MHz)
Correction I/O Protocol	Hemisphere GNSS proprietary ROX format RTCM v2.3, RTCM v3.2, CMR[5], CMR+[5]
Data I/O Protocol	NMEA 0183, Hemisphere GNSS binary
Timing Output	PPS, CMOS, active high, rising edge sync, 10kΩ, 10 pF load
Event Marker Input	CMOS, active low, falling edge sync, 10 kΩ, 10pF load

Continued on next page

VR1000 power

Table B-4: VR1000 Power

Item	Specification
Input Voltage	9-36 VDC
Power Consumption	10.8W Maximum (All signals and L-band)
Current Consumption	1.2A Maximum
Power Isolation	No
Reverse Polarity Protection	Yes

VR1000 environmental

Table B-5: VR1000 Environmental

Item	Specification
Operating Temperature	-40°C to +70°C (-40°F to +158°F)
Storage Temperature	-40°C to +85°C (-40°F to +185°F)
Humidity	95% non-condensing
Mechanical Shock	50G, 11ms half sine pulse (MIL-STD-810G w/ Change 1 Method 516.7 Procedure 1)
Vibration	7.7 Grms (MIL-STD-810G w/Change 1 Method 514.7 Category 24)
EMC	CE ISO14982/EN13309/ISO13766/IEC60945), Radio Equipment Directive 2014/53/EU, E-Mark, RCM
Enclosure	IP69K

Continued on next page

VR1000 L-band receiver

Table B-6: VR1000 L-band receiver

Item	Specification
Receiver Type	Single Channel
Channels	1530 to 1560 MHz
Sensitivity	-140 dBm
Channel Spacing	5 kHz
Satellite Selection	Manual or Automatic
Reacquisition Time	15 sec (typical)

VR1000 aiding devices

Table B-7: VR1000 Aiding devices

Item	Specification
Gyro	Provides smooth heading, fast heading reacquisition and reliable < 0.5° per min heading for periods up to 3 min. when loss of GNSS has occurred.[4]
Tilt Sensors	Provide pitch/roll data and assist in fast start-up and reacquisition of heading solution.

VR1000 mechanical

Table B-8: VR1000 Mechanical

Item	Specification
Dimensions No Plate	23.2 L x 16.5 W x 7.9 H (cm) 9.1 L x 6.5 W x 3.1 H (in)
Dimensions with Plate	23.2 L x 21.4 W x 8.3 H (cm) 9.1 L x 8.4 W x 3.3 H (in)
Status Indications (LED)	Power, Primary Antenna, Secondary Antenna, Heading, Quality, Atlas, Bluetooth, Wi-Fi, CAN1, CAN2, Ethernet, Radio
Power/Data Connector	23-pin multi-purpose

Continued on next page

VR1000 footnote references	[1]Depends on multipath environment, number of satellites in view, satellite geometry, no SA, and ionospheric activity [2]Depends on multipath environment, number of satellites in view, WAAS coverage and satellite geometry [3]Requires a subscription [4]Depends on multipath environment, number of satellites in view, satellite geometry, baseline length (for differential services), and ionospheric activity [5]CMR and CMR+ do not cover proprietary messages outside of the typical standard

IronOne

IronOne system

Table B-9: IronOne System

Item	Specification
Processor	Intel Atom dual-core CPU E3825 @ 1.33 GHz
Storage	SSD 32GB, RAM 2GB
Operating System	Windows 10

IronOne mechanical

Table B-10: IronOne Mechanical

Item	Specification
Dimensions	22.9 L x 16.9 W x 5.2 H (cm) 9.0 L x 6.6 W x 2.0 H (in)
Weight	1.38 kg (3.04 lbs.)
Mount	Adjustable 1.5” RAM ball mount

IronOne environmental

Table B-11: IronOne Environmental

Item	Specification
Operating Temperature	-20°C to +70°C (-4°F to 158°F)
Storage Temperature	-40°C to +85°C (-40°F to 185°F)
Operating Humidity	30% ~ 95% (Relative Humidity)
Storage Humidity	45% ~ 80% (Relative Humidity)
Enclosure	IP67
Vibration	EP455 5.15

IronOne power

Table B-12: IronOne Power

Item	Specification
Input Voltage	7 - 36 VDC
Power Consumption	36 W
Current Consumption	3.0 A @ 12 VDC

IronOne screen

Table B-13: IronOne Screen

Item	Specification
Display Type	8” TFT-LCD capacitive touchscreen
Size	192.8 mm × 116.9 mm (7.59” × 4.6”)
Resolution	1280 × 720, 16:9
Luminance	750 nit

IronOne input

Table B-14: IronOne Input

Item	Specification
Power Button	1× mechanical waterproof button
Function Button	2× mechanical waterproof button
Ignition Input	Yes

Continued on next page

IronOne communication

Table B-15: IronOne Communication

Item	Specification
Serial Port	1x RS232×1, 1x RS422/RS485/RS232 (software controlled)
Camera Interface	2× CVBS
USB	1× USB 2.0
Ethernet	10/100
Wi-Fi	IEEE 802.11b/g/n
Cellular	4G LTE
Data I/O Protocol	NMEA 0183

IronOne sensor and multimedia

Table B-16: IronOne Sensor and multimedia

Specification
1x 2W Buzzer
1x Headphone Jack

IronTwo

IronTwo system

Table B-17: System

Item	Specification
Processor	Intel® Celeron N3350
Storage	SSD 64GB, RAM 4GB
Operating System	Windows 10

IronTwo mechanical

Table B-18: Mechanical

Item	Specification
Dimensions	263.28 W x 171 H x 35.7 D (mm) 10.4 W x 6.7 H x 1.4 D (in)
Weight	1.38 kg (3.04 lbs)
Mount	Adjustable 1.5” RAM ball mount

IronTwo environmental

Table B-19: Environmental

Item	Specification
Operating Temperature	-20°C to +60°C (-4°F to 140°F)
Operating Humidity	30% ~ 90% (non-condensing)
Enclosure	IP65

Continued on next page

IronTwo, Continued

IronTwo power

Table B-20: Power

Item	Specification
Input Voltage	9 - 36 VDC

IronTwo screen

Table B-21: Screen

Item	Specification
Display Type	10.1” TFT edge-to-edge projective capacitive multi-touch screen
Size	192.8 mm × 116.9 mm (7.59” × 4.6”)
Resolution	1920 × 1200, 800:1
Luminance	700 cd/m

IronTwo communication

Table B-22: Communication

Item	Specification
Serial Port	2 x RS232
CANBUS	2 × CANBUS
USB	2 × USB 2.0
Ethernet	2x 10/100 LAN
Wi-Fi	IEEE 802.11a/b/g/n/ac
Cellular	4G LTE
Bluetooth	Bluetooth 4.1

GMS-1 Sensor

GMS-1 sensor measurement range

Table B-23: Measurement range

Item	Specification
Pitch	± 180°
Roll	± 85°

GMS-1 sensor accuracy

Table B-24: Sensor accuracy

Item	Specification
Absolute Accuracy	±0.30°
Resolution	±0.01°
Repeatability	±0.05°
Refresh Rate	20 Hz
Base Sensor Cycle	5ms
Hysteresis	±0.05°

GMS-1 sensor electrical

Table B-25: Electrical

Item	Specification
Supply Voltage	9 – 30 VDC
Current	≤ 65mA @ 10 VDC
EMC Emittance	DIN EN 61000-6-4
EMC Immunity	DIN EN 61000-6-2

Continued on next page

GMS-1 Sensor, Continued

GMS-1 sensor pin-outs

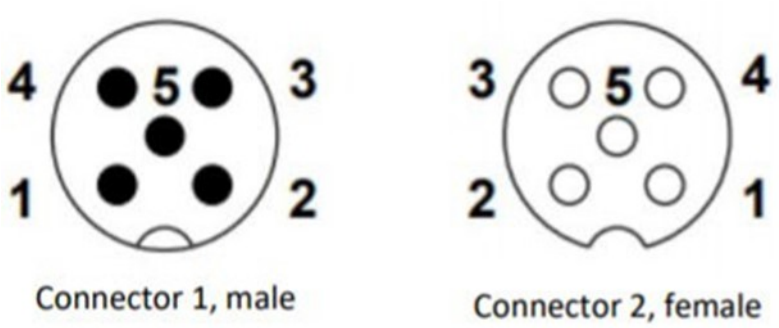


Figure B-1: GMS-1 Sensor pin-out

Table B-26: GMS-1 Sensor pin-out

Signal	Connector	Pin Number
Power Supply	Connector 1	2
GND	Connector 1	3
CAN High	Connector 1	4
CAN Low	Connector 1	5
CAN GND	Connector 1	1
Power Supply	Connector 2	2
GND	Connector 2	3
CAN High	Connector 2	4
CAN Low	Connector 2	5
CAN GND	Connector 2	1

Appendix C: Cable Pin-Outs

Overview

Introduction

Appendix C contains the cable pin-outs used for installation of the VR1000 and IronTwo.

Contents

VR1000 Cables

P/N: 051-0419-10

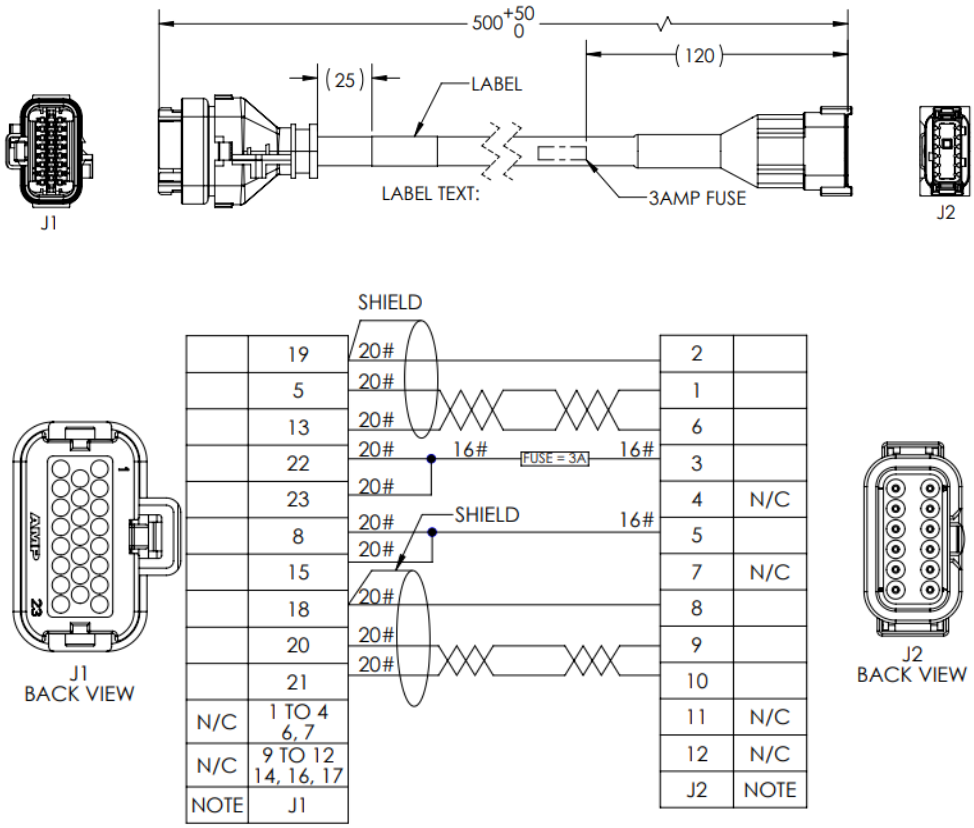


Figure C-1: P/N: 051-0419-10

Table C-1: P/N: 051-0419-10 Pin-Outs

J1	J2	Signal
5	1	VR1000 Port A RS232 Rx
8	5	Power Ground
13	6	VR1000 Port A RS232 Tx
15	5	Power Ground
18	8	Signal Ground
19	2	Signal Ground
20	9	VR1000 Port B RS232 Tx
21	10	VR1000 Port B RS232 Rx
22	3	Power Positive
23	3	Power Positive

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VR1000 Cables, Continued

P/N: 051-0420-10

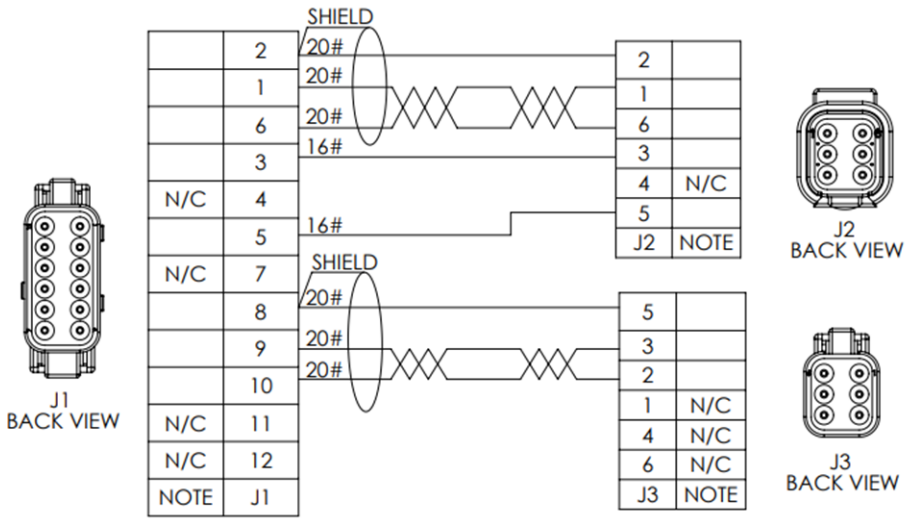

Figure C-2: P/N: 051-0420-10

Table C-2: P/N: 051-0420-10 Pin-Outs

J1	J2	J3	Signal
1	1	NC	VR1000 Port A RS232 Rx
2	2	NC	Signal Ground
3	3	NC	Power Positive
5	5	NC	Power Ground
6	6	NC	VR1000 Port A RS232 Tx
8	NC	5	Signal Ground
9	NC	3	VR1000 Port B RS232 Tx
10	NC	2	VR1000 Port B RS232 Tx

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VR1000 Cables, Continued

P/N: 051-0477-10

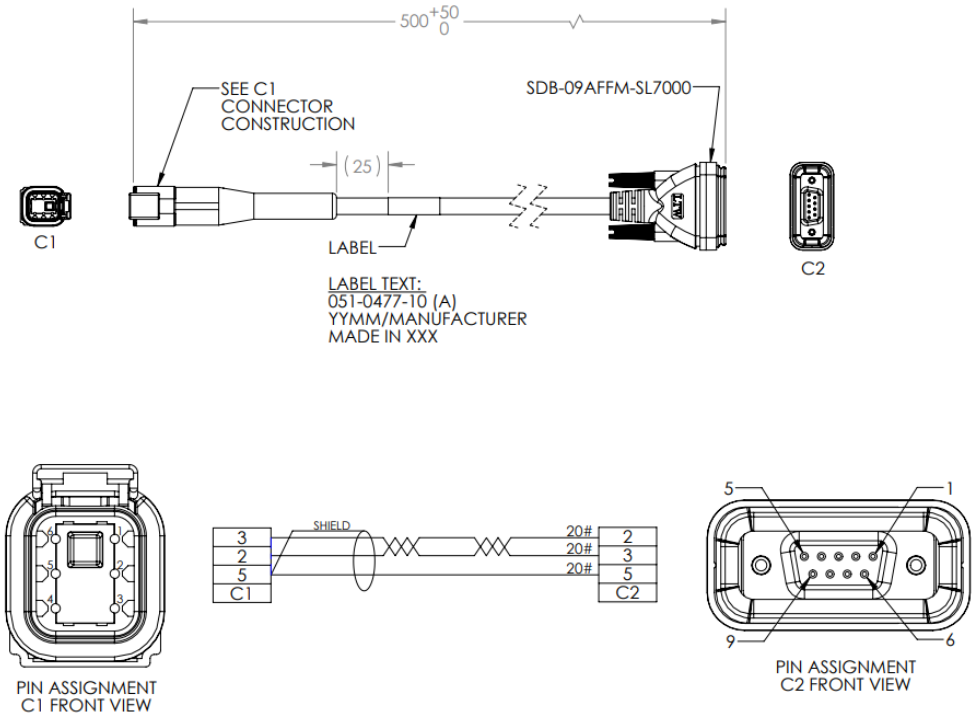

Figure C-3: P/N: 051-0477-10

Table C-3: P/N: 051-0477-10

C1	C2	Signal
2	2	VR1000 Port B RS232 Rx
3	3	VR1000 Port B RS232 Tx
5	5	Signal Ground

VR1000 Installation Schematic

VR1000 Installation Schematic

Table C-4: Scraper Schematic-R232 and Power, IronOne -VR1000

051-0408-10 J1 (IronOne)	051-0408-10 J3	051-0420-10 J1	051-0419-10 J1	VR1000
2	1	1	5	VR1000 Rx (IronOne RS232 Tx)
3	6	6	13	VR1000 Tx (IronOne RS232 Rx)
5	2	2	19	Signal Ground
10	5	5	15	Power Ground
11	3	3	23	12V+ Out

Table C-5: Scraper Schematic-R232 and Power, IronTwo -VR1000

051-0426-10 J1 (IronTwo)	051-0426-10 J3	051-0420-10 J1	051-0419-10 J1	VR1000
3	6	6	13	VR1000 Tx (IronTwo RS232 Rx)
4	1	1	5	VR1000 Rx (IronTwo RS232 Tx)
7	2	2	19	Signal Ground
10	3	3	22/23	Power+
12	5	5	8/15	Power Ground

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