

CAS GPS

Collision Avoidance System

Installation
Manual

Rev G1



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Document Control

REV	DESCRIPTION	Review	Approval	Date
E	Added shovel heading			19/11/2014
F	Fixed inconsistent pinouts on 24way connector			27/03/2015
G	Added Compliant Antenna Information (Page 6)	D.Mc		19/11/2015



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Transport

All possible precautions are taken to protect the equipment against damage or losses during shipment, however before accepting delivery, check all items against the packing list or bill of loading. If there are shortages or evidence of physical damage, notify GE Mining immediately.

Notify GE Mining within 7 days (maximum) in case of shortages or discrepancies, according to the packing list. This will help ensure a speedy resolution to any perceived problems. Keep a record of all claims and correspondence. Photos are recommended.

Where practicable do not remove protective covers prior to installation unless there are indications of damage. Boxes opened for inspection and inventory should be carefully repacked to ensure protection of the contents or else the parts should be packaged and stored in a safe place. Examine all packing boxes, wrappings and covers for items attached to them, especially if the wrappings are to be discarded.



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Storage

Where the equipment is not to be installed immediately, proper storage is important to ensure protection of equipment and validity of warranty.

Storage Temperature: -30 deg C to +85 deg C

Storage Location: dry low humidity location



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Unpacking of Equipment

The method of packing used will depend on the size and quantity of equipment.

Take care when unpacking the equipment to avoid damage to the equipment and ensure the use of correct manual handling techniques.



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Installation

Installation should be in accordance with the installation procedures defined by GE Mining and only performed by authorised and qualified installers.

This device has been designed to operate with the antennas listed below, and having a maximum gain listed. Antennas not included in this list or having a gain greater than those listed are strictly prohibited for use with this device. The required antenna impedance is 50ohms.

GE Part#	Relevant Product (x = any variant)	CAS-GPS Port	Nominal Impedance	Gain	Operating Frequency
PROD0852	PROD084x-2	V2V	50 Ω	+4dBi	902-928MHz
PROD0874	PROD084x-1	V2V	50 Ω	+4dBi	821-896MHz
PROD0853	PROD084x-x	GPS (Receive Only)	50 Ω	+26dBi	1574.42-1576.42MHz
PROD0854	PROD0843-x, PROD0847-x	GSM / 3G	50 Ω	0dBi +1.7dBi +2.9dBi	698-960MHz 1710-1990MHz 2100-2700MHz
PROD0833	PROD0842-x, PROD0847-x	Wi - Fi	50 Ω	<+5.0dBi	2400-2484MHz



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WARNING:

Consult with the client to confirm all equipment mounting locations and power connections!



Do not weld on ROPs!



Do not drill through ROPs!



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Specialty Tools Required / Adhesives



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Specialty Tools Required / Adhesives

- Coax Crimpers – Tool0112 & Tool0254 for RG 58/214
- Coax Cable Stripper – Tool0113 for RG 58/59
- Coax Cable Stripper – For RG 214
- Soldering Iron – Butane
- Torx Security Bit – T25
- Metric Allen Key – 4mm
- Nutsert Tool – Tool0253
- Deutsch pin removal Tool – Tool0256

Specialty Tools Required / Adhesives

- Deutsch pin Crimping Tool – Tool0068 or Tool0101 / Tool0102
- Digital Multi-Meter
- Hole Saws: 20mm – 25mm
- Self Amalgamating Tape – Plas0684
- Loctite 243 – Chem0002
- Loctite 248 – Chem0044
- 30 Meter tape measure

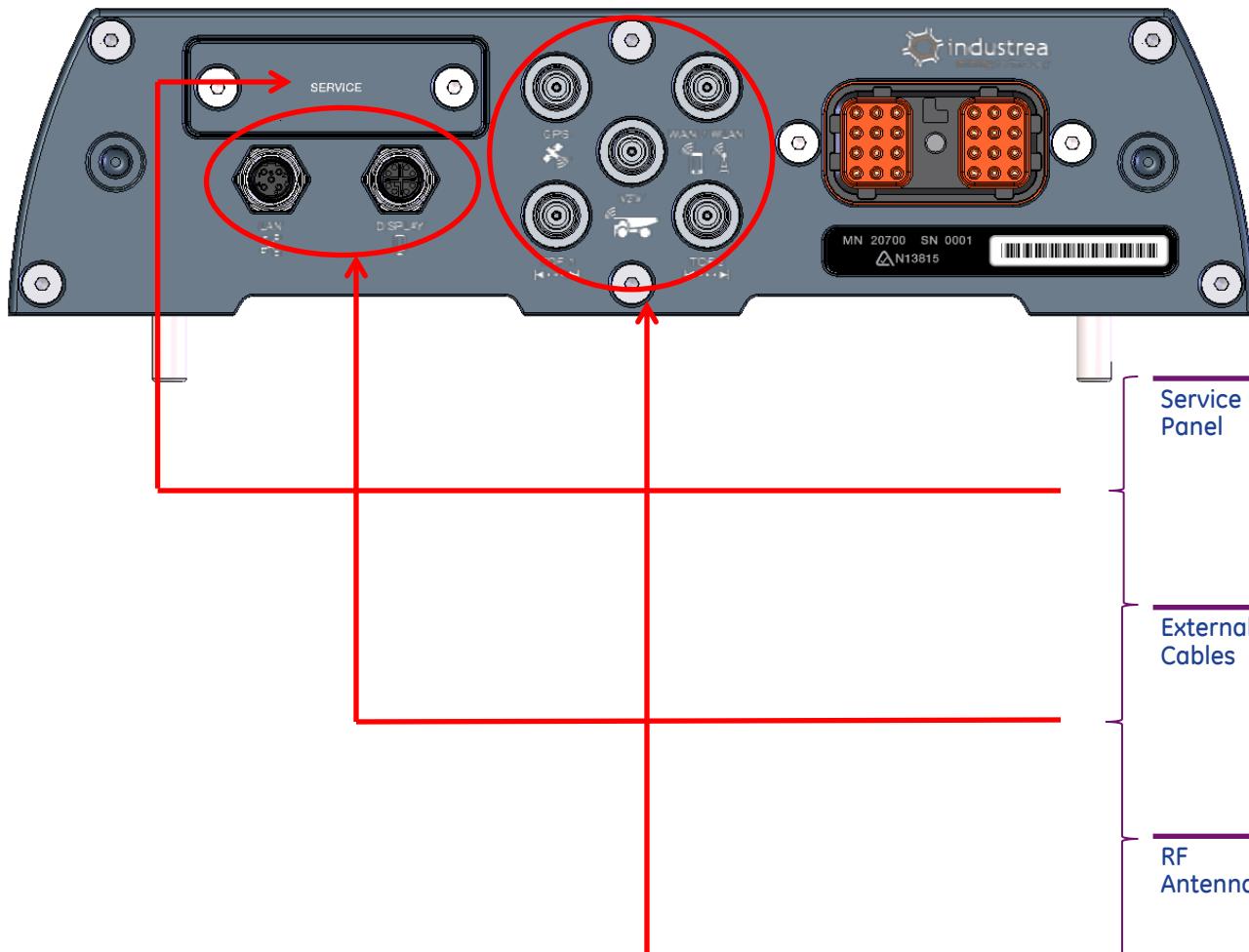


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In Vehicle Unit (IVU) (PROD0842)



Input Power & Signal Connections



Service Panel

SIM Card

USB Card

Auxiliary USB

External Cables

LAN

Display

RF Antenna

GPS Antenna

TOF1 Antenna

V2V Antenna

WiFi/WAN Antenna

TOF2 Antenna



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Input Power & Signal Connections



IVU Mounting

The IVU should be mounted such that:

- The Preferred IVU mounting location is inside the cabin / electrical compartment (this will assist with future expansion)
- It is in the preferred location for that vehicle type
- The units location is easily accessible for servicing
- It is protected against rock fall and other damaging hazards
- Not to obstruct walkways, access or egress
- If mounting through a blind panel the supplied Nutserts should be used to enable easy removal for servicing
- Remember to record the orientation of the IVU as this is critical for the Calibration of the 3 Axis Accelerometer. Refer to pages 60-61 of this manual.



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Mounting Locations & Cable Runs

The following diagrams show the preferred mounting locations and cable paths for each vehicle type. Ensure the hardware supplied in the kit is being utilised.

Ensure there is a clear line of sight from all directions for the Antennas. It is a recommendation on all Haul trucks the Antennas are to protrude above the Tray by 100mm, by doing this it creates a clear line of sight for the Antennas on all vehicles. Keep in mind any working obstacles.

Ensure the correct size Stauff Clamp is used and matched to the specific handrail for that machine and antenna mounting post diameter. Regular clamp bodies are available in the following sizes: 38mm, 42mm, 44.5mm, 48.3mm, 50.8mm, 55mm, 57mm, 60.3mm, 60.5mm, and 70mm.

Stauff Clamp Rubber inserts are also available in all kits to maintain the correct clamping on all Hand rail sizes and Antenna mounting post. Rubber inserts are available in the following sizes: 32mm, 33.7mm, 35mm, 38.7mm, 40mm, 42mm, 45.5mm, 48mm, 51mm, 53.4mm, 56.4mm

Ensure all stauff clamp assemblies are tightened and secured correctly.

Ensure Loctite 243 is used to secure all Antenna mounting fasteners, or the equivalent to this is Loctite 248. Loctite 248 (perfect for transporting by air as it is a paste).



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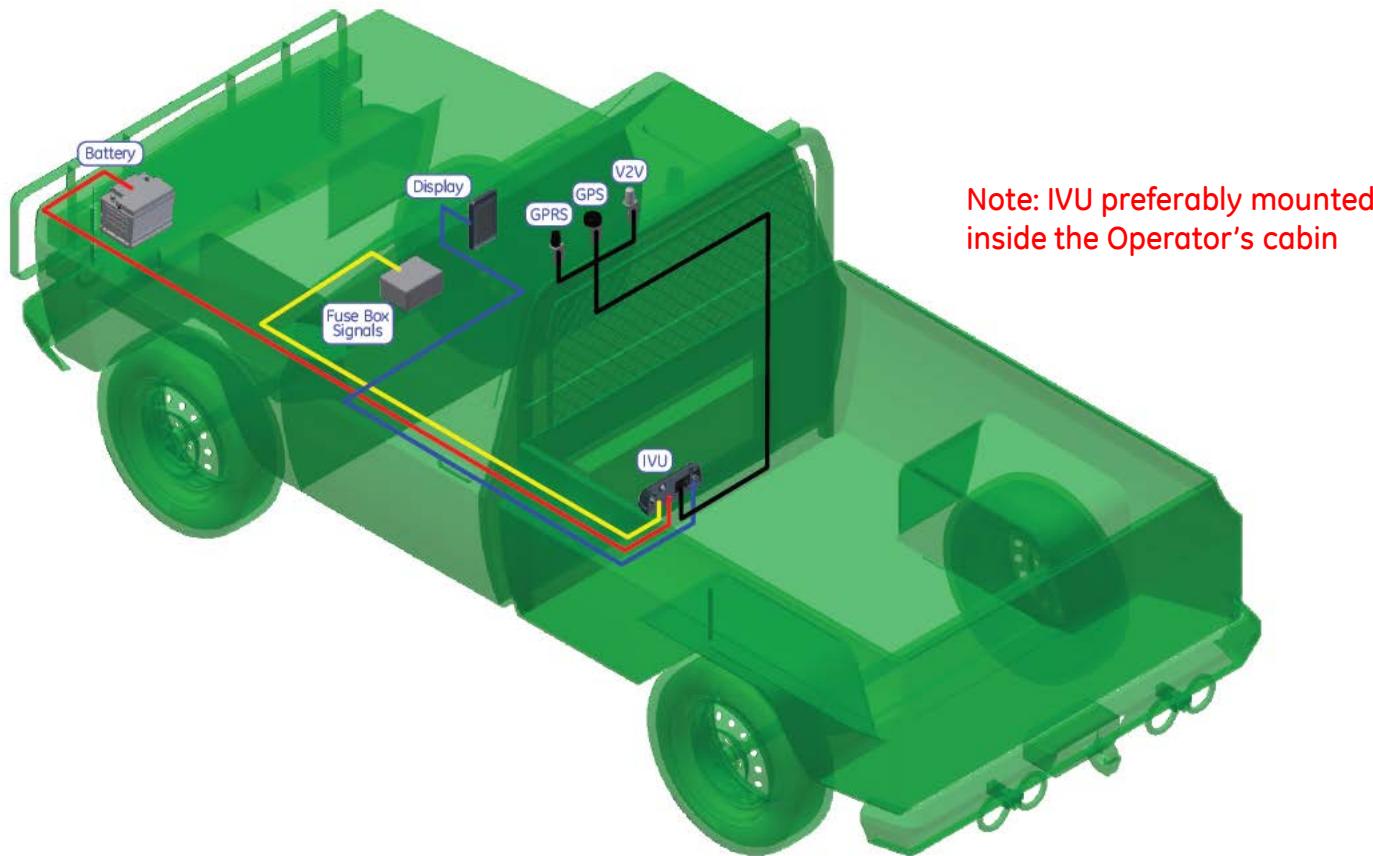
Mounting Locations & Cable Runs

- Follow existing cable runs where possible
- All cables to be secured using P-Clamps where possible
- Cable ties should be used as a last resort where there is no provision for P-Clamps
Ensure cable ties are cut flush to avoid sharp edges
- Cables should be secured at a minimum every 300mm
- Avoid running cables near hot spots and pinch points
- Glands should be used on cables running through bulkheads
- It is recommended that a service loop be created on all the Antenna Coax Cables
this will especially aid in servicing of the system. i.e. Break in termination at either end of the Coax cables.
- Service loops are acceptable in the Coax and Display cables. Ensure if a service loop is placed in the Coax Antenna cable that it is placed in a position that it is not going to create a hazard, also ensure the service loop radius is not too small.
- If mounting through a blind panel the supplied Nutserts should be used to enable easy removal for servicing



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Light Vehicle



Light Vehicle

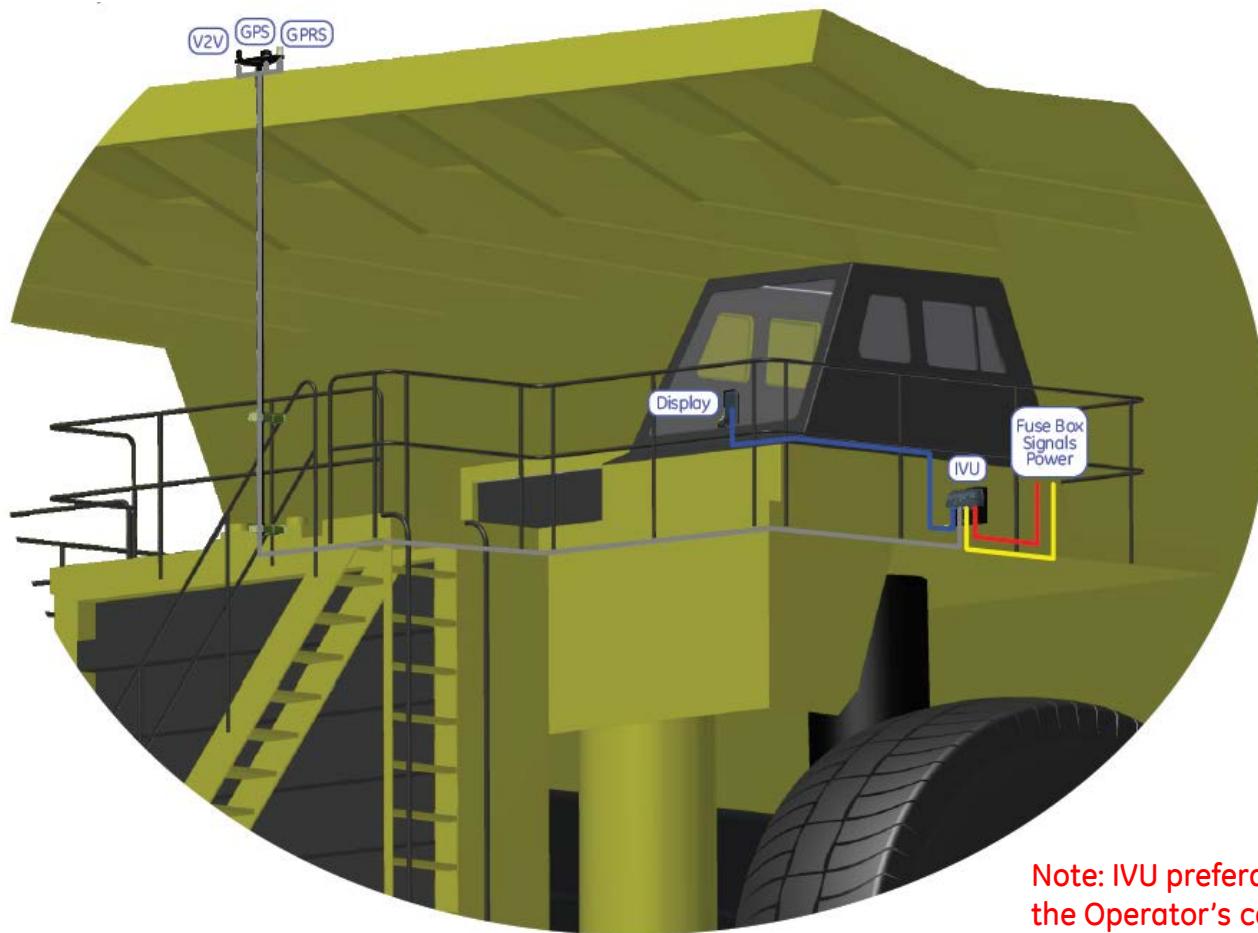


Bracket used here is the ATOM0033



Note: Antenna Spacing between V2V and GPRS should be a minimum of 300mm.

Haul Truck



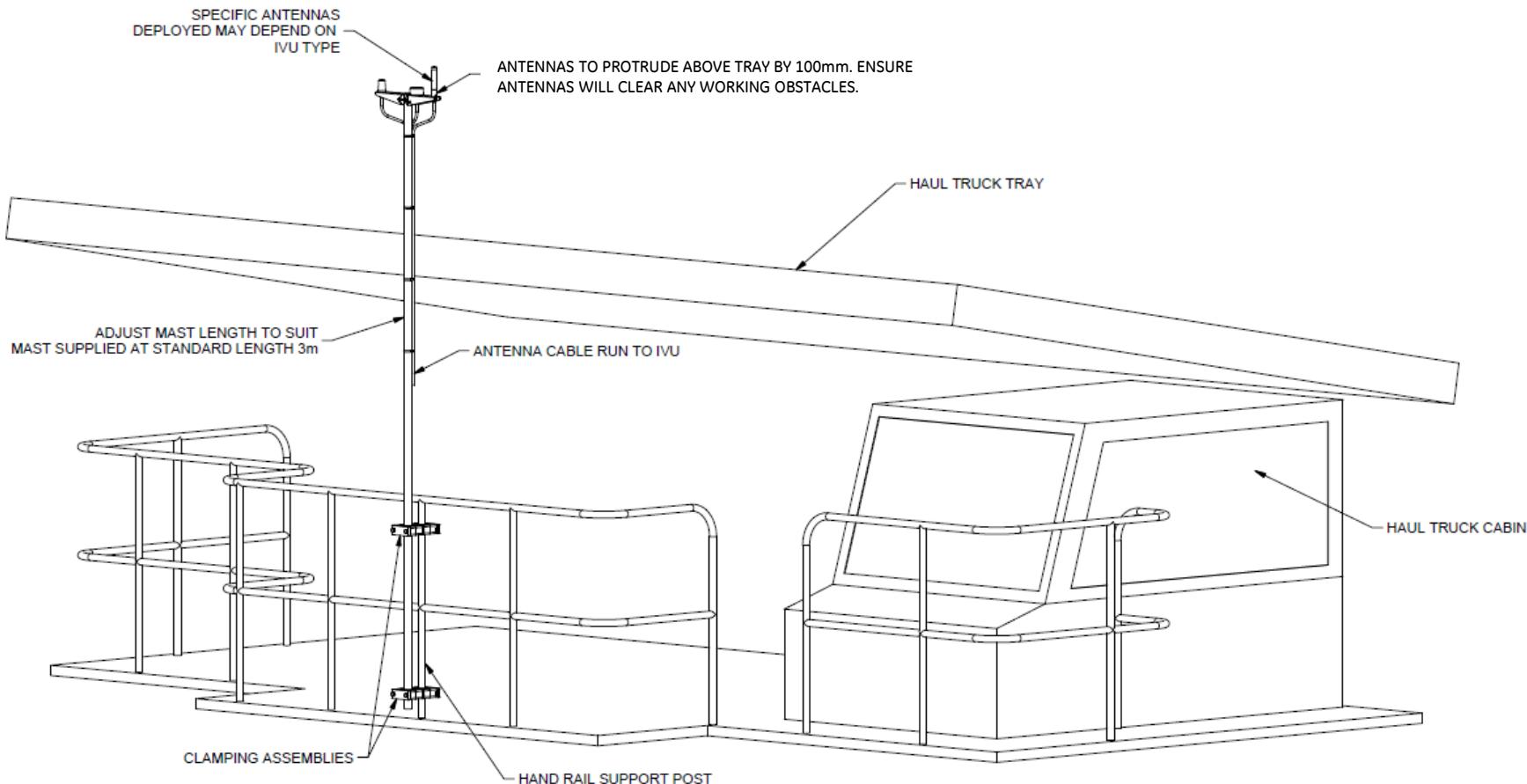
Note: IVU preferably mounted inside the Operator's cabin or the electrical compartment



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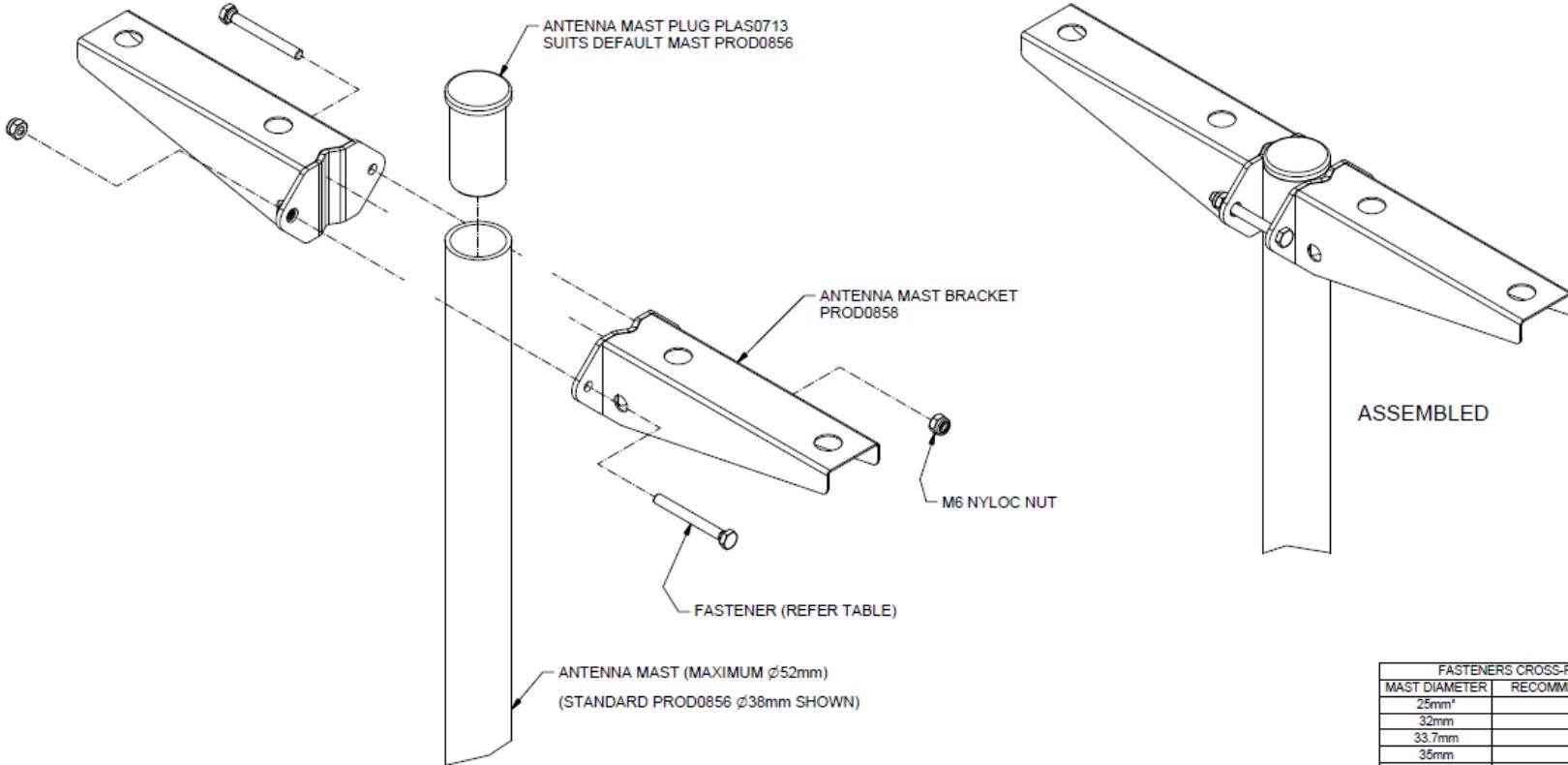
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Haul Truck

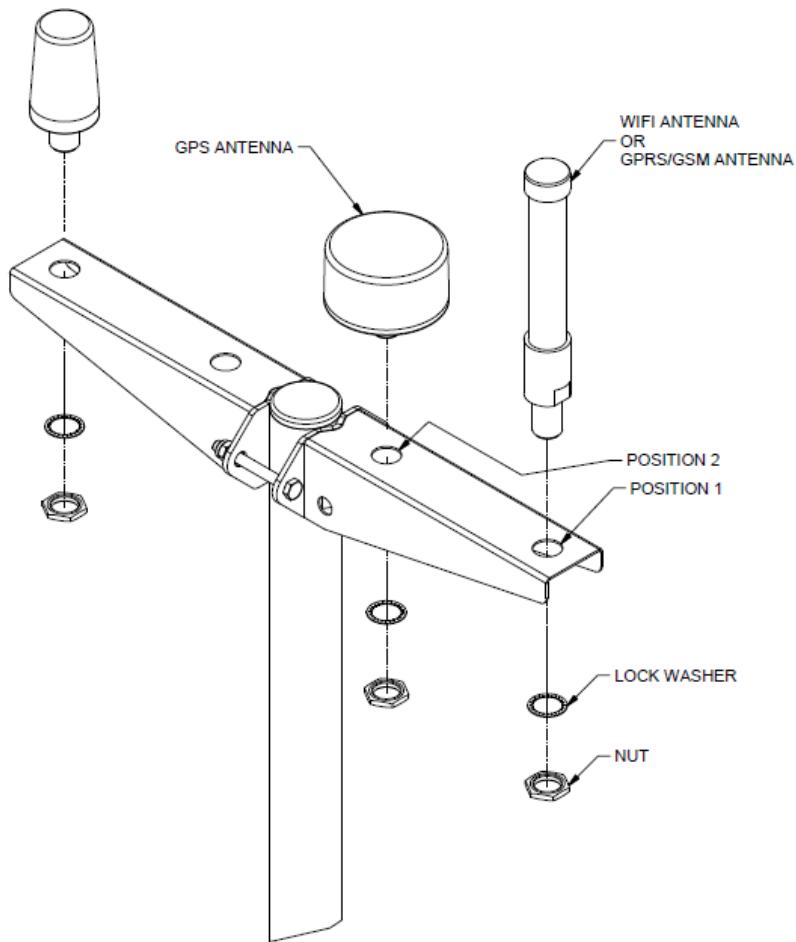


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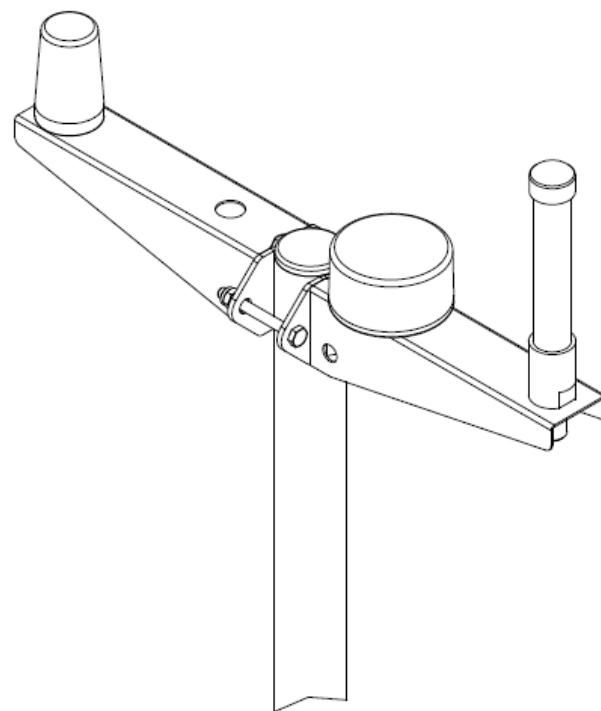


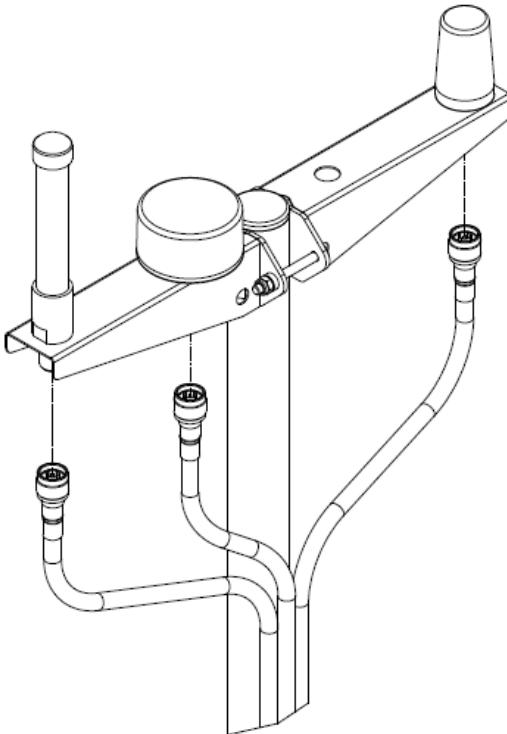
MAST DIAMETER	RECOMMENDED FASTENER
25mm*	M6x40
32mm	M6x50
33.7mm	M6x50
35mm	M6x50
38mm#	M6x55
40mm	M6x60
42mm	M6x60
45.5mm	M6x60
48mm	M6x70
50mm**	M6x70
*	SIZE NOT SUITED TO STAUFF SIZE 6 MOUNTING SYSTEM
**	SIZE NOT SUITED TO STAUFF SIZE 6 RUBBER INSERTS
#	DEFAULT (PROD0856)



NOTE:

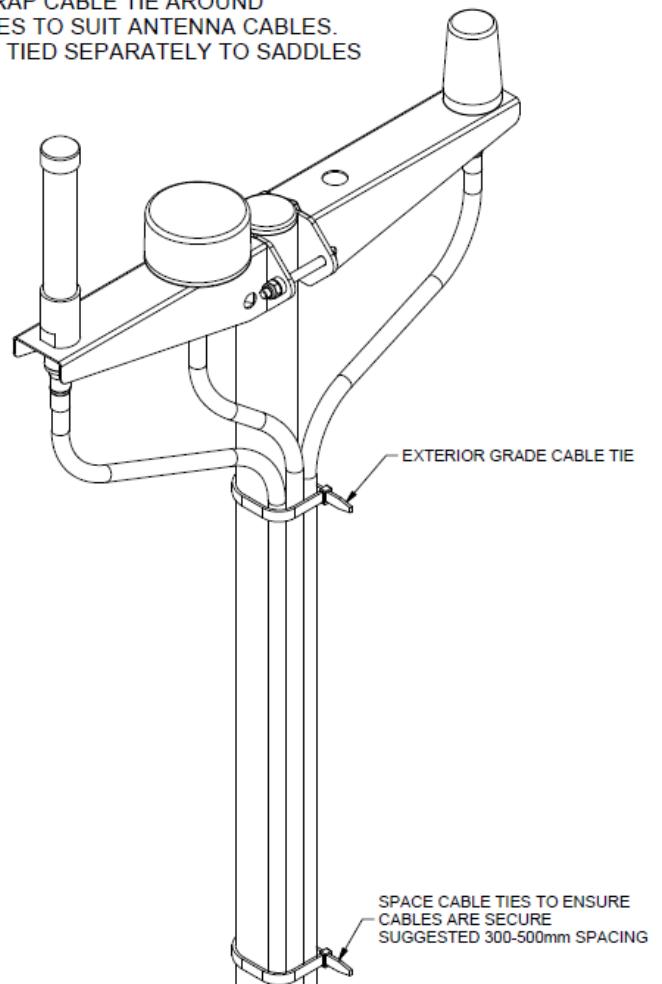
1. WHERE NO WIFI OR GPRS ANTENNA IS DEPLOYED,
MOUNT GPS ANTENNA AT POSITION 1
2. SECURE NUTS WITH LOCTITE 243



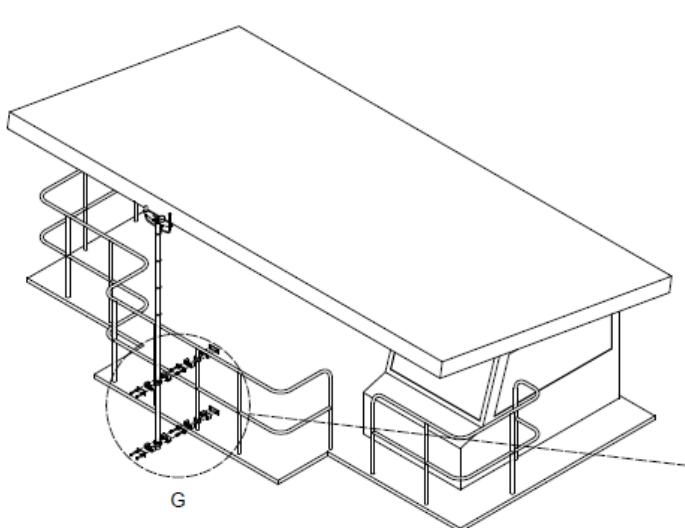


NOTE:

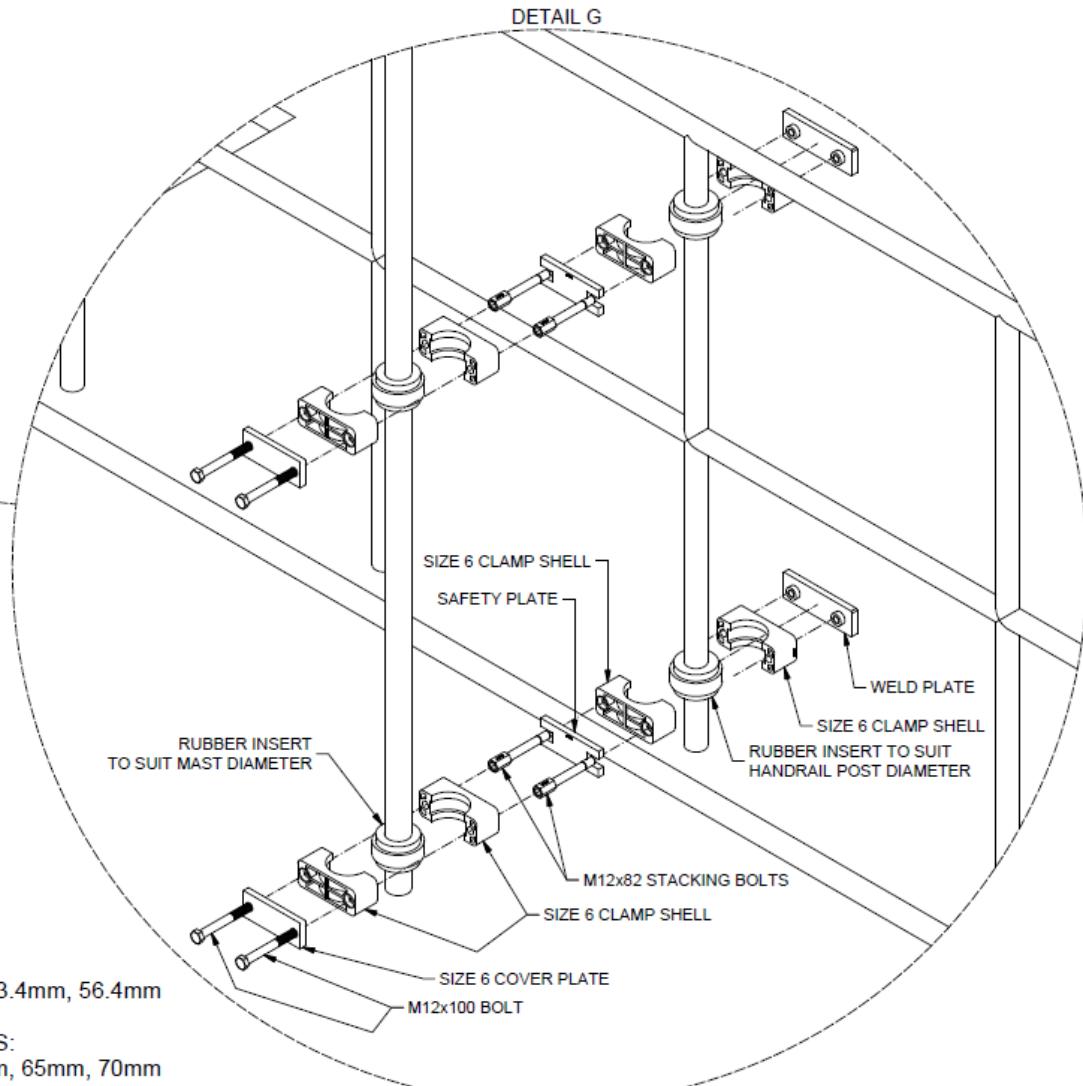
PREFERRED METHOD IS TO WRAP CABLE TIE AROUND
MAST INCORPORATING SADDLES TO SUIT ANTENNA CABLES.
ANTENNA CABLES THEN TO BE TIED SEPARATELY TO SADDLES
(NOT DEPICTED HERE)



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Stauff Clamp Sizes chosen to suit Handrail sizes.



NOTE:

SIZE 6 HEAVY SERIES STAUFF CLAMPING SYSTEM

RUBBER INSERTS ARE AVAILABLE IN THE FOLLOWING SIZES:

32mm, 33.7mm, 35mm, 38.7mm, 40mm, 42mm, 45.5mm, 48mm, 51mm, 53.4mm, 56.4mm

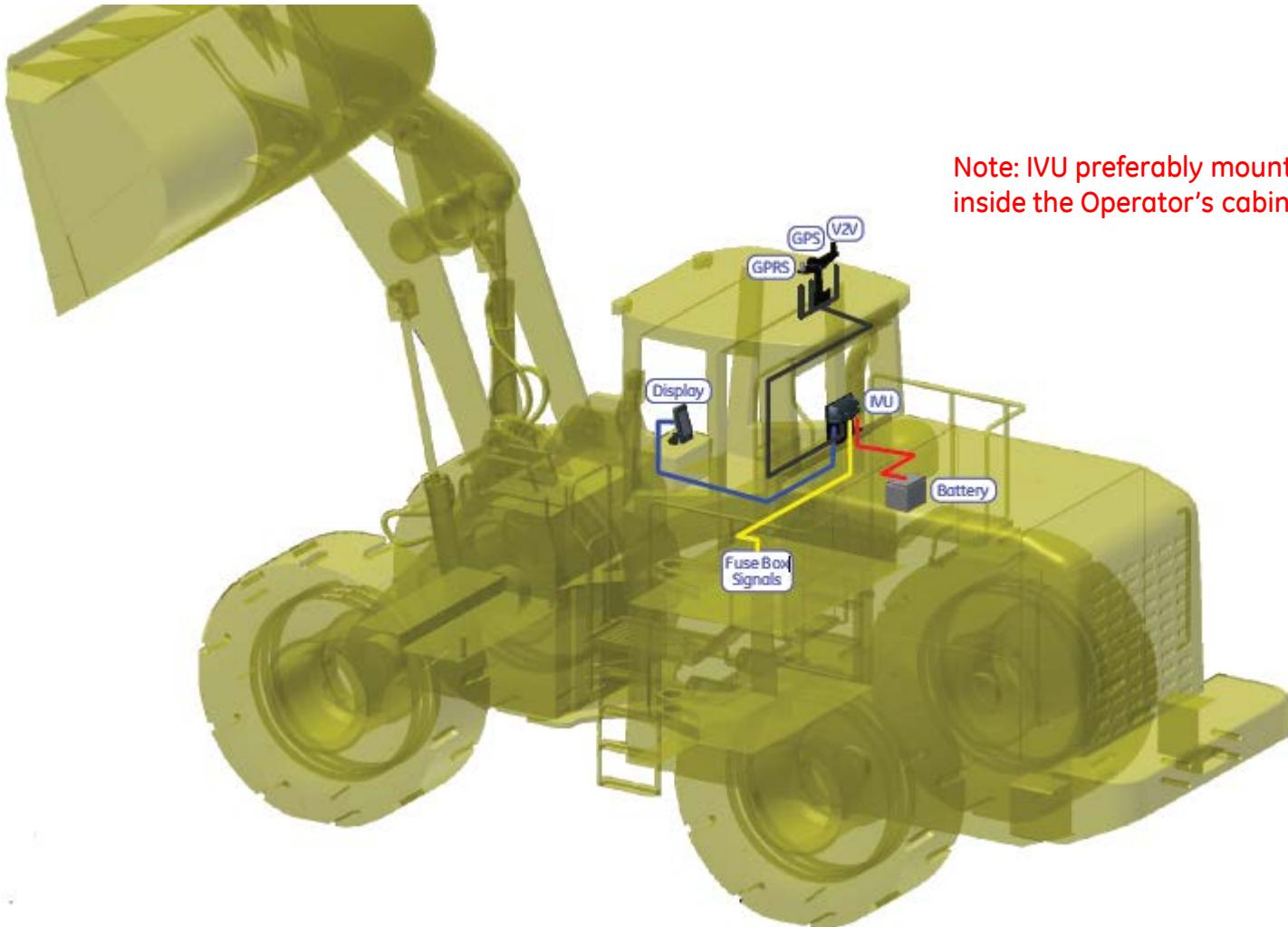
REGULAR CLAMP BODIES ARE AVAILABLE IN THE FOLLOWING SIZES:

38mm, 42mm, 44.5mm, 48.3mm, 50.8mm, 55mm, 57mm, 60.3mm, 60.5mm, 65mm, 70mm



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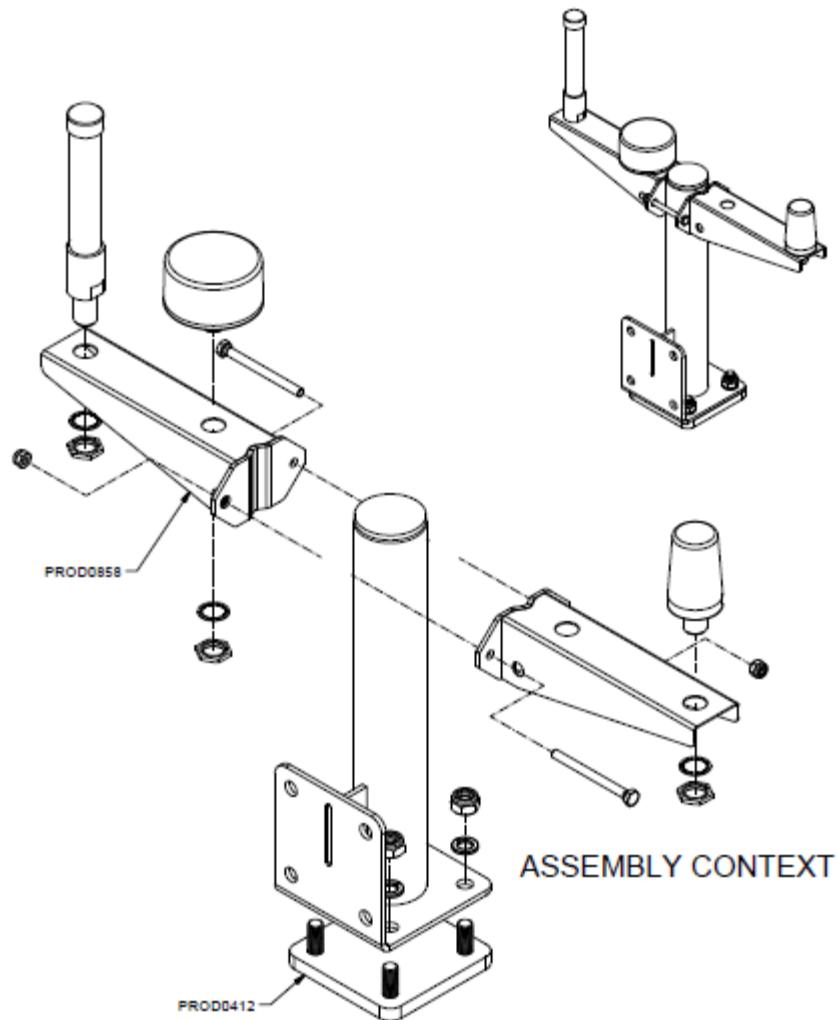
Heavy vehicle (excluding Haul Truck)



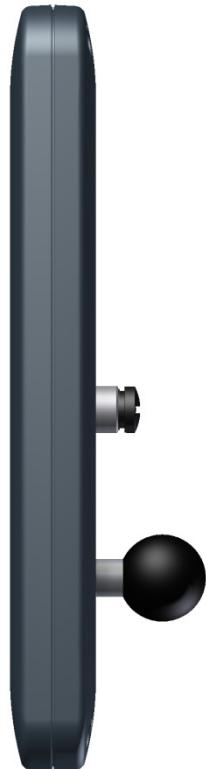
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Heavy vehicle (excluding Haul Truck)



Display Unit (PROD0839)



Display Unit (PROD0839)

The client should be consulted to ensure Display Unit is mounted in a mutually agreed position.

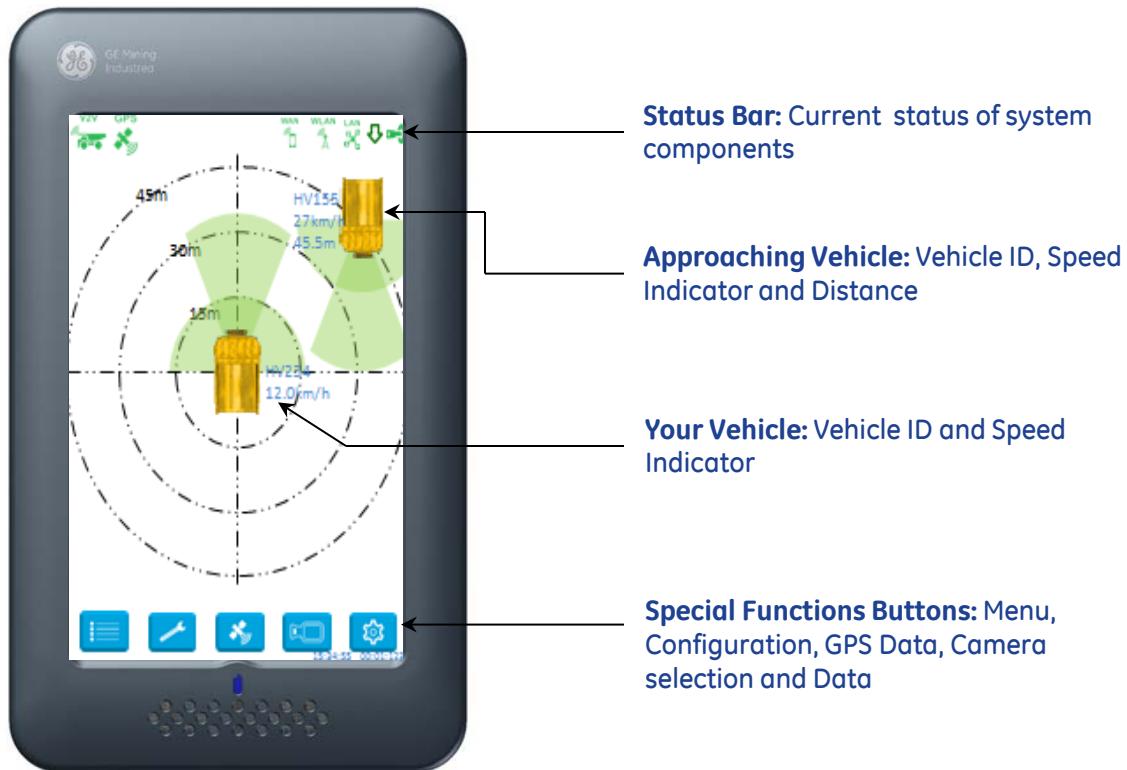
The Display Unit should be mounted such that:

- It does not create any additional blind spots
- The machine operator can easily reach the screen
- Located within the field of view of the operator
- It is not a hazard when operator is entering / exiting the machine cabin
- It has appropriate support so as not to damage any part of the machine
- Cable routes are carefully considered
- All machines of the same type have the screen located in the same place
- Mounting provides sufficient support for the Display (self tapping screws into the Dash board is not acceptable)



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Display Unit (PROD0839)



Display Unit (PROD0839)

Screen: 7" High Brightness LCD Touch Screen with auto dimming for all lighting conditions

Audio: Voice and tone output

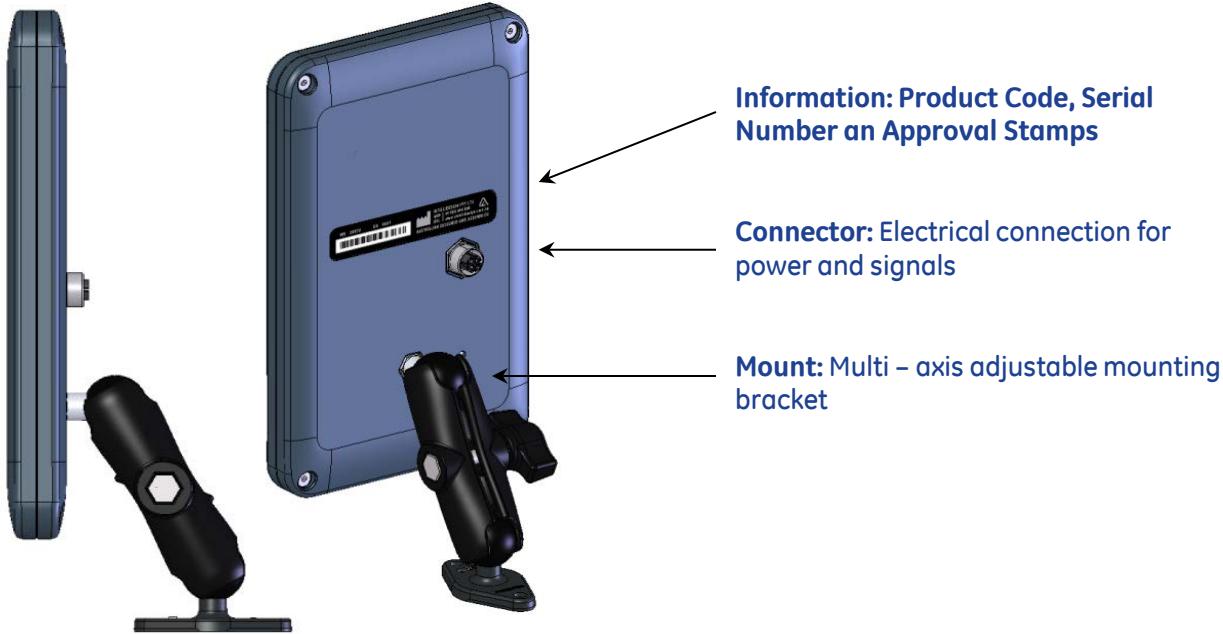
Sensors: Light sensor for automatic screen dimming

LED: LED output for system status indication



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Display Unit (PROD0839)



RF Installations



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RF Installations

This section describes the interconnections between the CASCAM/RF system and CAS GPS system.

Refer to the CASCAM/RF installation documentation for the camera and RF installation procedure.



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Upgrades

If upgrading a previous CASCAM/RF installation the installed CASCAM/RF Display (PROD0119) will be removed and replaced with the CAS GPS Display.

All cables may be reused (provided they are in a serviceable condition). Some power input requirements may change depending on the requested functionality of the system. In this case modifications may need to be made to the existing connections.

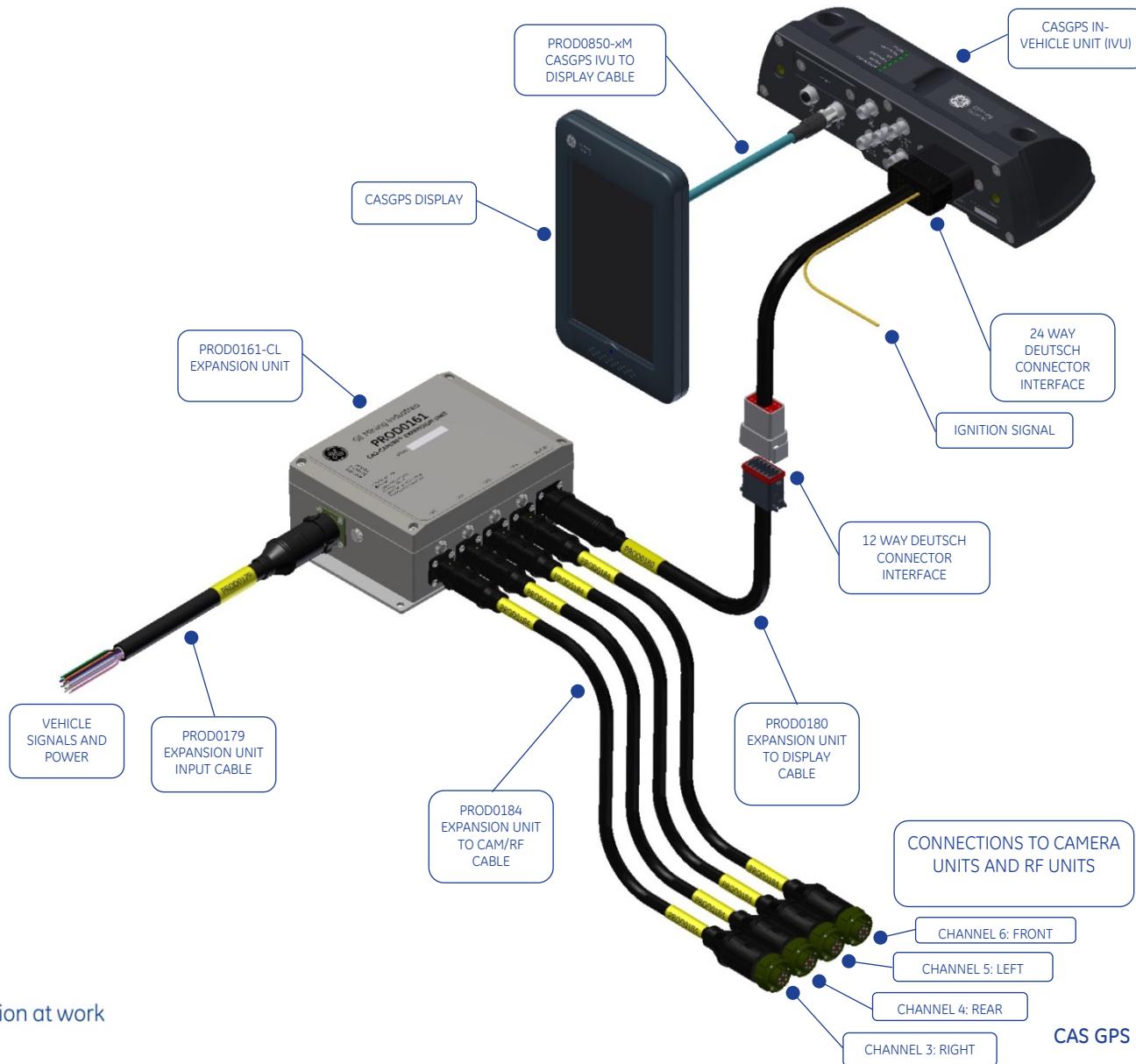
A full system health check should be completed before upgrade works start! Any repair work to the existing installation may need to be charged back to the customer.



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Interconnections - 4CAM/4RF



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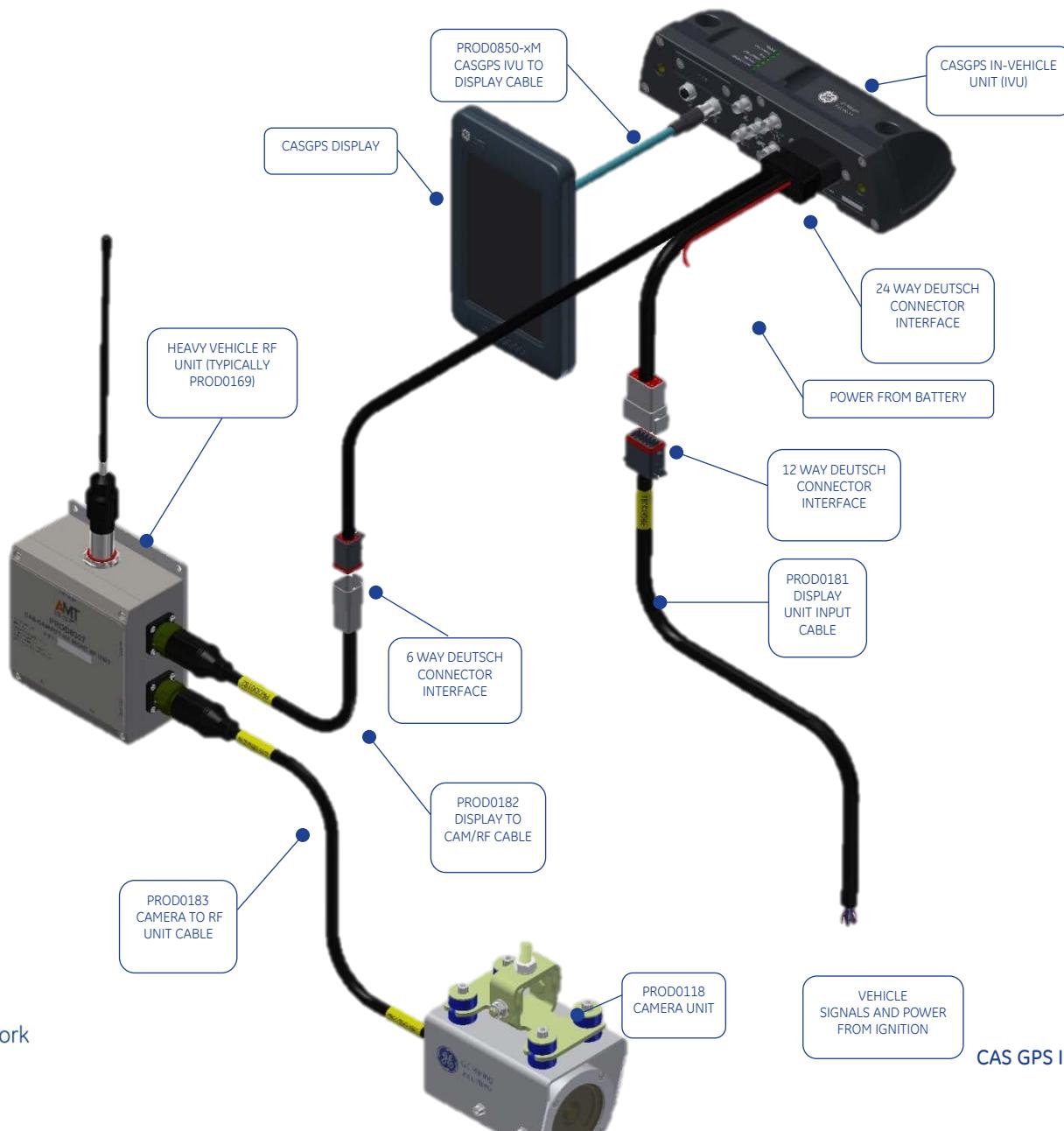
Interconnections – 4CAM/4RF

Expansion Unit "DISPLAY" output 12 way military connector			12 way Deutsch connector on PROD0180 cable	24 way Deutsch connector at IVU	
Reference	Pin	Colour	Pin	Reference	Pin
Vin +	A	RED	1	Ignition (DI1)	4
GND	B	BLACK	2	GND	5
CAMEX+	C	GREEN	3	Video+	21
CAMEX-	D	YELLOW	4	Video-	20
RS485+	E	WHITE	5	RS485+	13
RS485-	F	BLUE	6	RS485-	19
REV+	H	GREY	7	REV+ (DI3+)	16
REV-	J	VIOLET	8	REV- (DI3-)	17
FWD+	M	WHITE/BLACK	11	FWD+ (DI4+)	22
FWD-	N	PINK/BLACK	12	FWD- (DI4-)	23
				PWR+ (Battery)	6



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Interconnections - 1CAM/1RF



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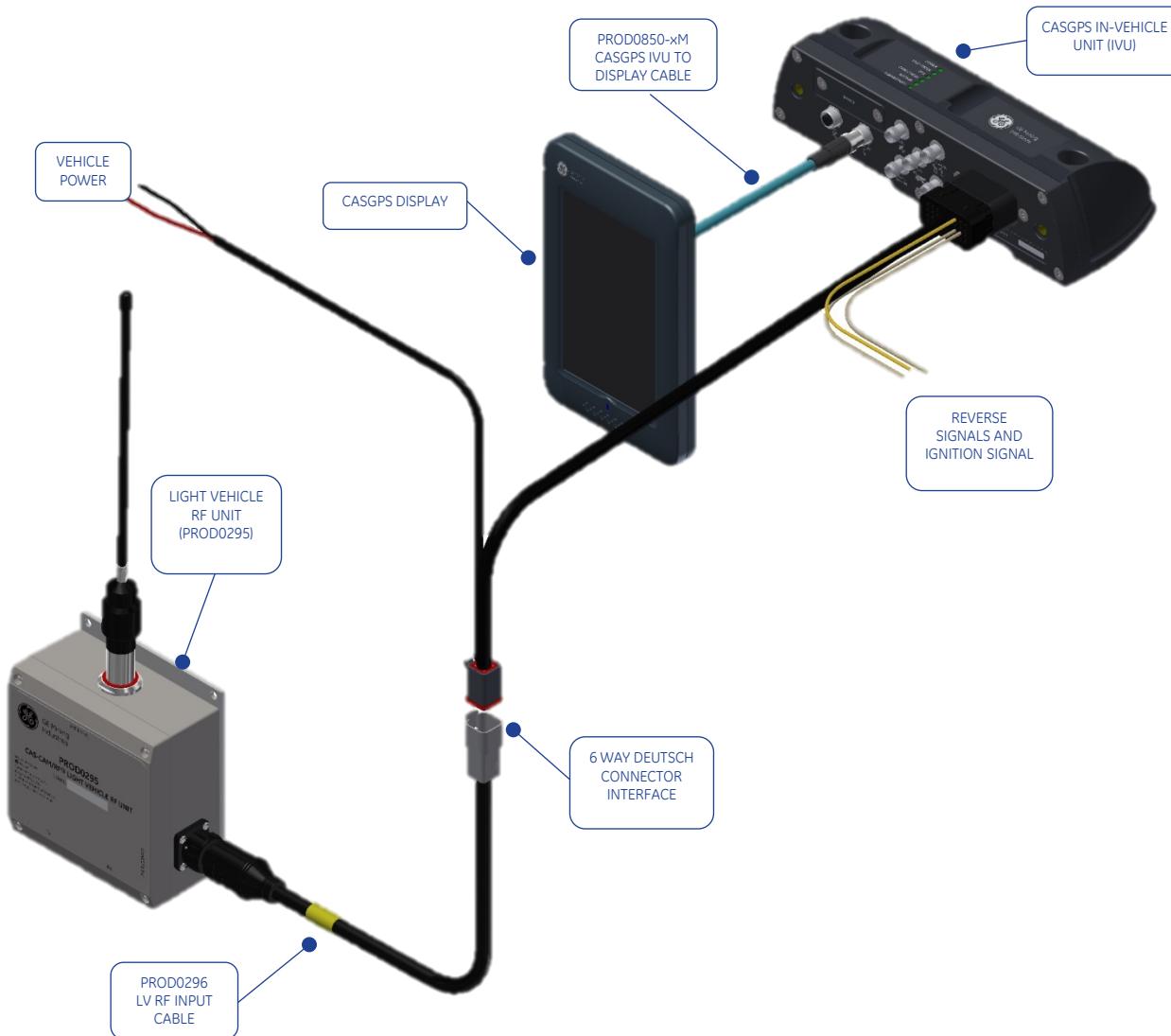
Interconnections – 1CAM/1RF

Display Input Cable (PROD0181)				24 Way Deutsch Connector CASGPS IVU	
Reference	Pin	Colour	Deutsch (12 way)	Reference	Pin
Vin +		RED	1	Ignition (DI1)	4
GND		BLACK	2	GND	5
REV +		WHITE	7	REV+ (DI3+)	16
REV -		BLACK	8	REV- (DI3-)	17
FWD +		YELLOW	11	FWD+ (DI4+)	22
FWD -		BLACK	12	FWD- (DI4-)	23
				PWR+ (Battery)	6
Display to Camera/RF Cable (PROD0182)			Deutsch (6 way)		
+12V	A	RED	1	+12V	12
GND	B	BLACK	2	GND	11
VID+	C	GREEN	3	Video+	21
VID-	D	YELLOW	4	Video-	20
RS485+	E	WHITE	5	RS485+	13
RS485-	F	BLUE	6	RS485-	19



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Interconnections - LV



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Interconnections - LV

LV Power		CASGPS IVU (24 way)		Deutsch (6 way)		RF Unit	
Pin	Colour	Reference	Pin	Pin	Reference	Colour	
PWR+	RED	PWR+	6	1	Vin	RED	
GND	BLACK	GND	5	2	GND	BLACK	
				3	+12	BROWN	
				4	BUZZER	BLUE	
		COM1 RX	7	5	RS232 TX	GREEN	
		COM1 TX	1	6	RS232 RX	YELLOW	
		REV+ (DI3+)	16				
		REV- (DI3-)	17				
		Ignition (DI1)	4				



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Input Power & Signal Connections

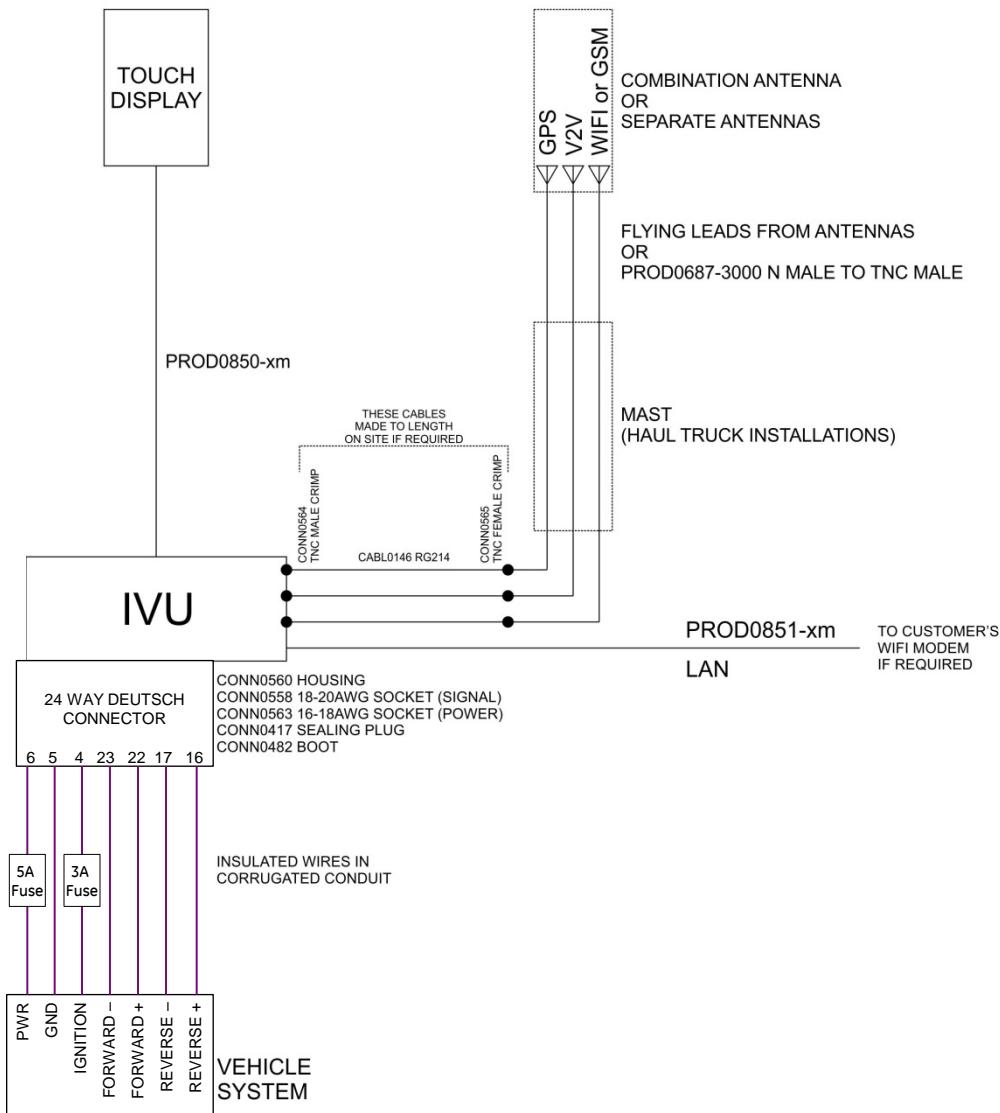


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WIRING SCHEMATIC

BASIC CAS LITE

GE Mining
Industria
Mining Technology



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CAS Lite

Collision Avoidance System

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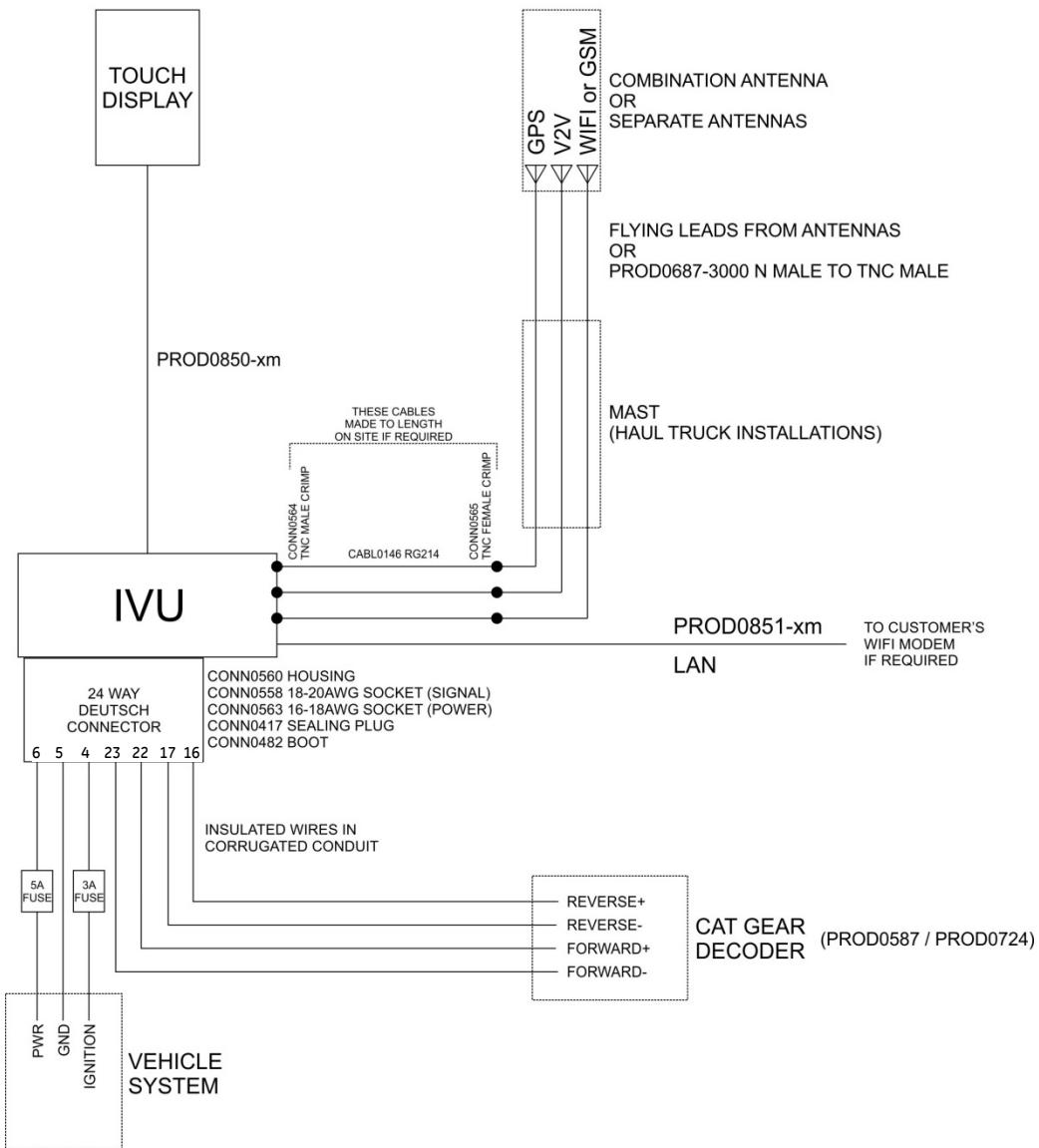
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Revision C

WIRING SCHEMATIC

CAS LITE WITH CAT GEAR DECODER

GE Mining
Industria
Mining Technology



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CAS Lite

Collision Avoidance System

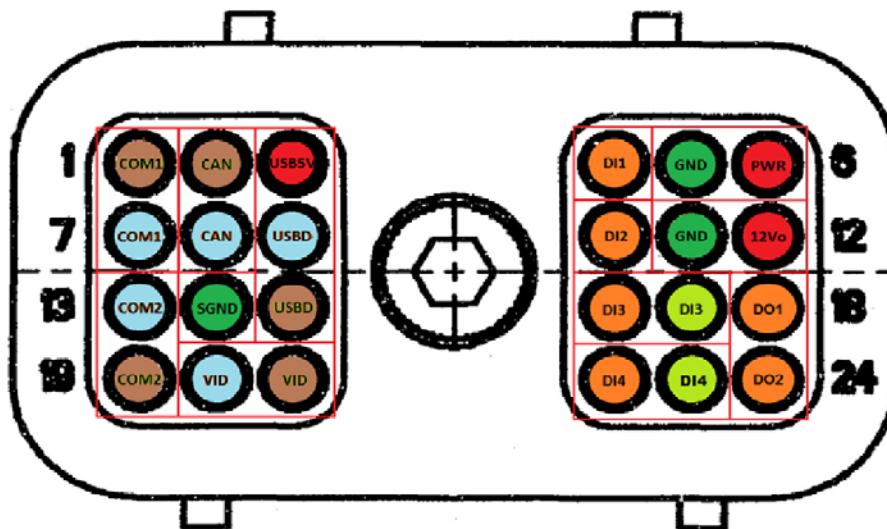
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Revision C

Deutsch Connector

24 Pin Deutsch Connector	Wire Colour	Basic Signal Wiring	CAT Gear Decoder Signal Wiring
6	Red	Input Power +ve (Fused Battery)	Input Power +ve (Fused Battery)
5	Black	Ground	Ground
4	Yellow	Ignition +ve (Key Switch) (Ground Referenced)	Ignition +ve (Key Switch)
16	Grey	Reverse +ve	Reverse +ve
17	Violet	Reverse -ve	Reverse -ve
22	White / Black	Forward +ve	Forward +ve
23	Pink / Black	Forward -ve	Forward -ve



Input Power & Signal Connections

Input Power (Vin)

- Vin+ should be sourced after the isolator
- **WARNING:**
 - The IVU remains powered for up to 14hrs after the input power has been Isolated
- Input power / ignition pickup point must have inline short circuit protection, use supplied fuse holders and fuses from installation kit.
 - 5A blade fuse on VIN+ located as close as possible to the power source for LV
 - 3A Resettable Circuit Breaker to be used on all HV for Ignition
 - 5A Resettable Circuit Breaker to be used on all HV for VIN+
 - Fuse location should be accessible for servicing and be clearly labelled using the supplied labels from kit and located if possible on or close to the existing fuse panel. Fuse label is identified by 'CAS'
 - Direct battery power should be used with independent fuse
 - Do not use other electrical circuit power supplies



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Input Power & Signal Connections

Ground

Ground pickup point is the vehicle chassis. A ring terminal on a designated grounding point should be used.

Ignition Signal

Vehicle ignition should be protected by an independent 3Amp fuse. Although the system does not draw operating current from this source, the vehicle's circuit should be protected against inadvertent shorts.

Basic Reverse & Forward Signals

Unless using a CAT Gear Decoder (see below) the reverse signal should be obtained from the vehicle's reverse buzzer or alternatively the reverse lights. The forward signal may be wired from a suitable forward gear indicator, with the forward negative signal is tied to ground. Pickup should be made on the output side of the relays.

CAT Gear Decoder Reverse & Forward Signals (PROD0587 CAT B,C & D or PROD0724 CAT E & F)

For vehicles using the CAT Gear Decoder, Reverse and Forward signals should be obtained directly from the decoders outputs observing the correct polarity when connecting to the IVU. *Basic Reverse & Forward Signal wiring is not required when using the Reverse & Forward Signals from the CAT Gear Decoder.*



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General Wiring Principles

- Blanking plugs or caps are supplied and **must** be in place for all unused connectors i.e. 24 way Deutsch Connector on the IVU for example
- All cable joins/splices should be **soldered** and heat shrink insulation applied
- All wires are to be labelled i.e. IGN, VIN+, GND, REV using the supplied labels
- **DO NOT** use clamp type splice devices to tee into vehicle wiring
- Crimp type ring terminals should be used for all terminal blocks
- All wiring should be run in the supplied flexible conduit along with the boot ends also supplied in the kit



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Antenna cable terminations



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Antenna cable terminations

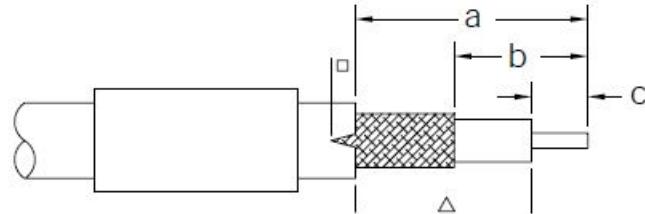
- You need to have received the proper training before attempting to terminate antenna cables
- Antenna cable terminations are one of the most critical components of the system



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Antenna cable terminations

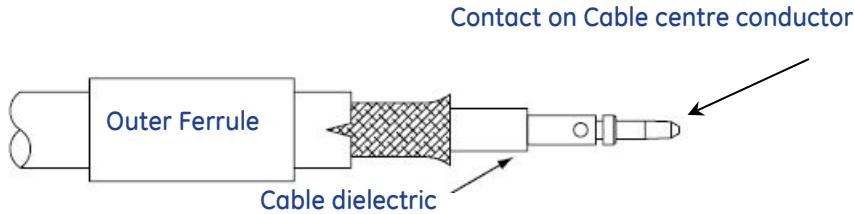
1. Strip cable jacket, braid, and dielectric to dimensions in the table below for the appropriate cable and connector. All cuts are to be sharp and square. Important: Do not nick braid, dielectric, and centre conductor.



Cable Type	A (mm)	B (mm)	C (mm)
RG58 TNC	15.5	8	3.5
RG58 N	15.1	6.8	4
RG214 TNC	16.8	7.3	4.7
RG214 N	15.1	6.8	4

Antenna cable terminations

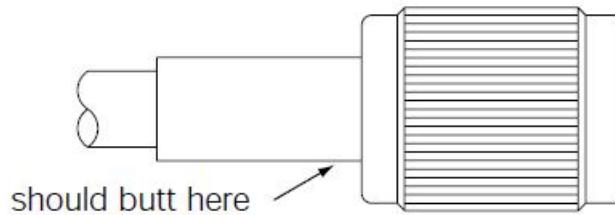
2. Slide outer ferrule onto cable as shown
3. Flare slightly end of cable braid as shown to facilitate insertion of inner ferrule.
Important: Do not comb out braid.



4. Place contact on cable centre conductor so that it butts against cable dielectric.
Solder contact in place.

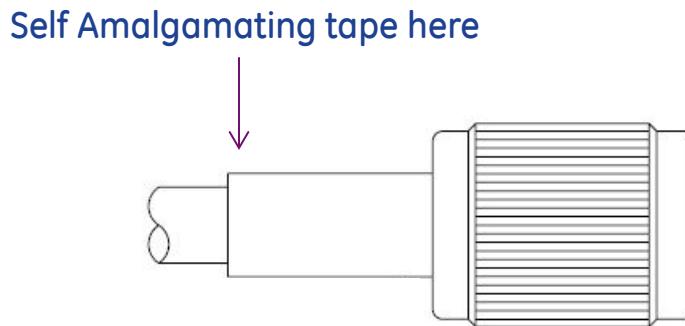
Antenna cable terminations

5. Install cable assembly into body assembly so that inner ferrule portion slides under braid. Push cable assembly forward until contact snaps into place in insulator. **The tip of the centre contact should be level with the face of the connector.**
6. Slide outer ferrule over braid and up against connector body. Crimp outer ferrule using Die Set Cavity in table above.



Antenna cable terminations

7. Apply Self Amalgamating tape to Co – ax Termination this will aid in keeping out any moisture that may get into the Co – ax Termination.

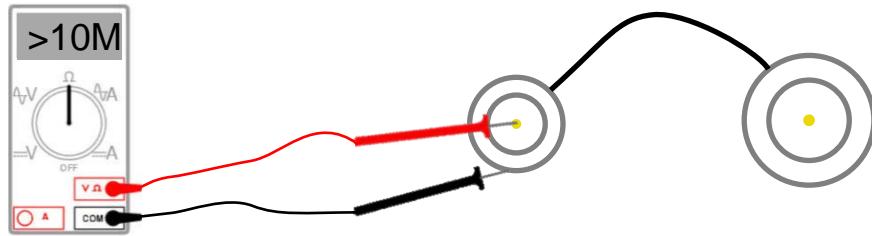


8. Repeat steps 1-7 for the other end of the cable

Testing Antenna cable terminations

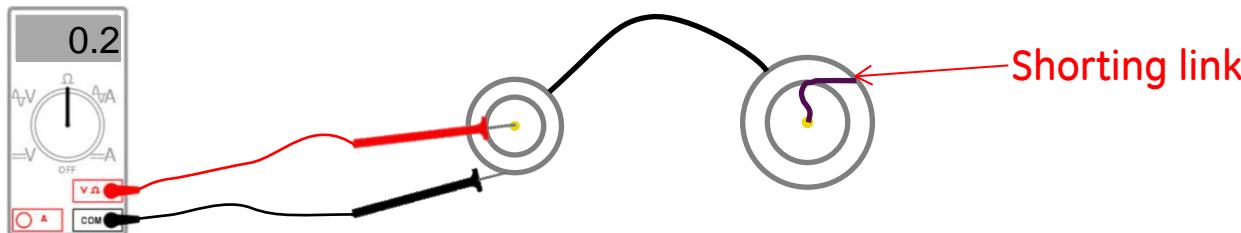
Test completed cable for continuity and short circuits by completing the following:

- With both ends of the cable disconnected. Measure the resistance between the inner and outer conductors. Must be open circuit ($>10M\Omega$)



Testing Antenna cable terminations

- B. Short the inner to the outer conductor on one end of the cable
- C. Measure the resistance from the inner to the outer conductors on the opposite end. Must be low resistance ($<1\Omega$).



- D. If available, measure the VSWR of the completed cable

Antenna Cable Connection Security

- Antenna cable connection points can be prone to loosening with cable movement
- Tighten antenna cable connections with adequate force to prevent loosening
- Apply a small amount Loctite 243 or 248 thread locker to prevent unwanted loosening
- **Caution!** Thread locking compounds are an electrically isolative material. If all threads are covered with thread locker the antenna may not work! Ensure electrical conductivity after installation.



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Configuration

The following pages refer to the configuration process for CAS GPS.

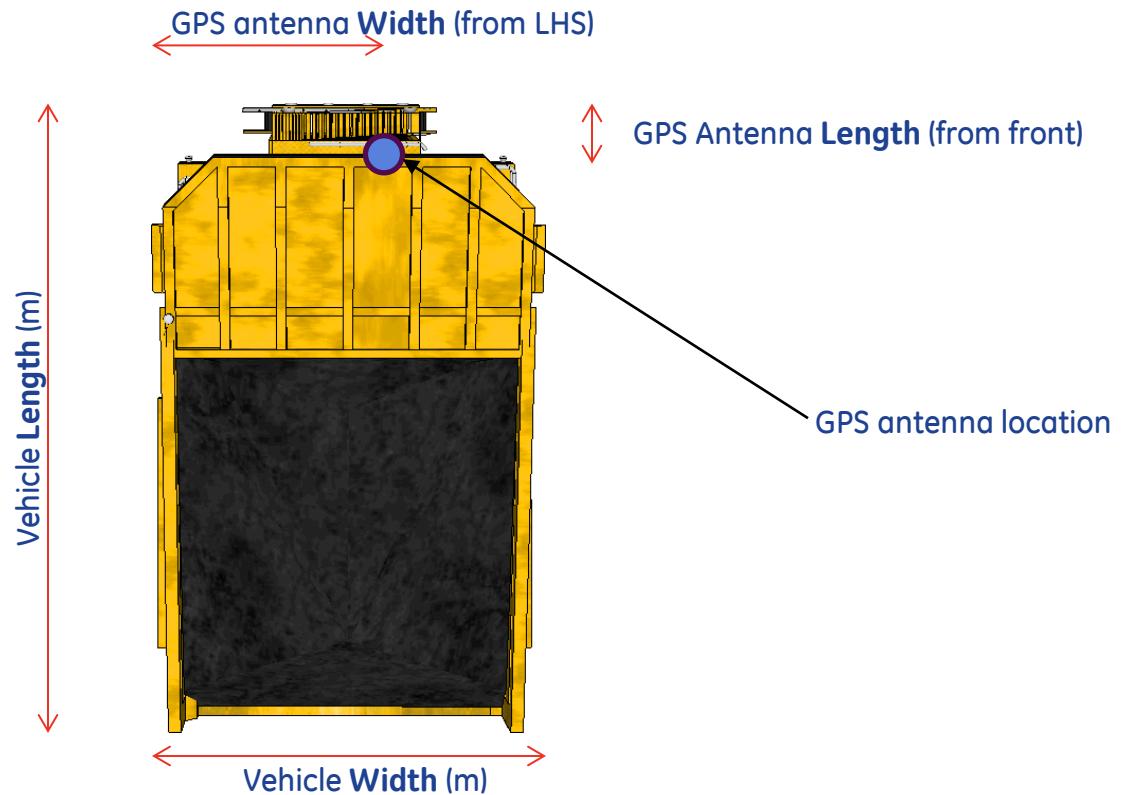
Easy and straight forward no laptop required.

Conveniently programmed through the Graphic User Interface. (Display)



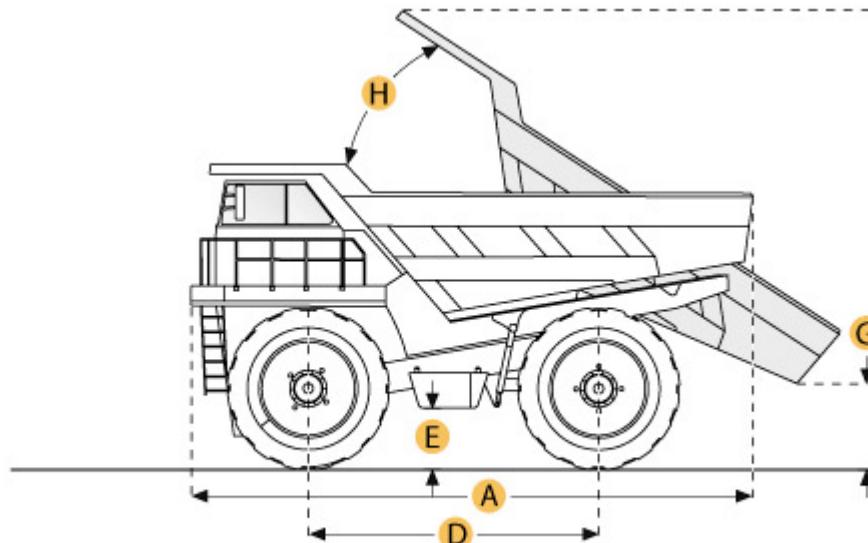
Configuration – Installation Measurements

The following measurements are the dimensions of the machine and GPS Antenna location. These measurements are crucial for the GPS to perform correctly and accurately.



Configuration – Installation Measurements

Measurements shown here are an example of a Haul truck.

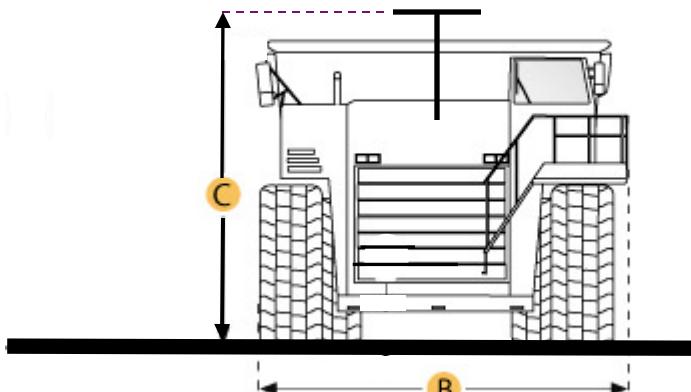


A = Truck Length

Configuration – Installation Measurements

Measurements shown here are an example
of a Haul truck.

C = GPS antenna height



B = Truck Width

IVU Orientation

- The orientation of the IVU must be recorded so that the 3 axis accelerometer can be correctly calibrated
- The table (right) should be used to determine the orientation number of the installed IVU
- The orientation is referenced to the vehicle if viewed from above when travelling towards the top of the page (as shown by the vehicle diagram)



1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	16
17	18	19	20
21	22	23	24



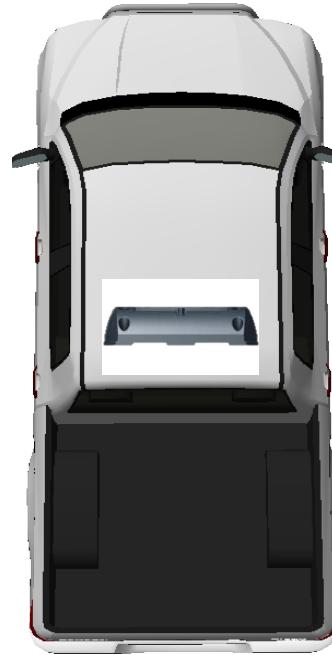
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IVU Orientation (Examples)



Orientation
Number 1

IVU mounted on
the roof

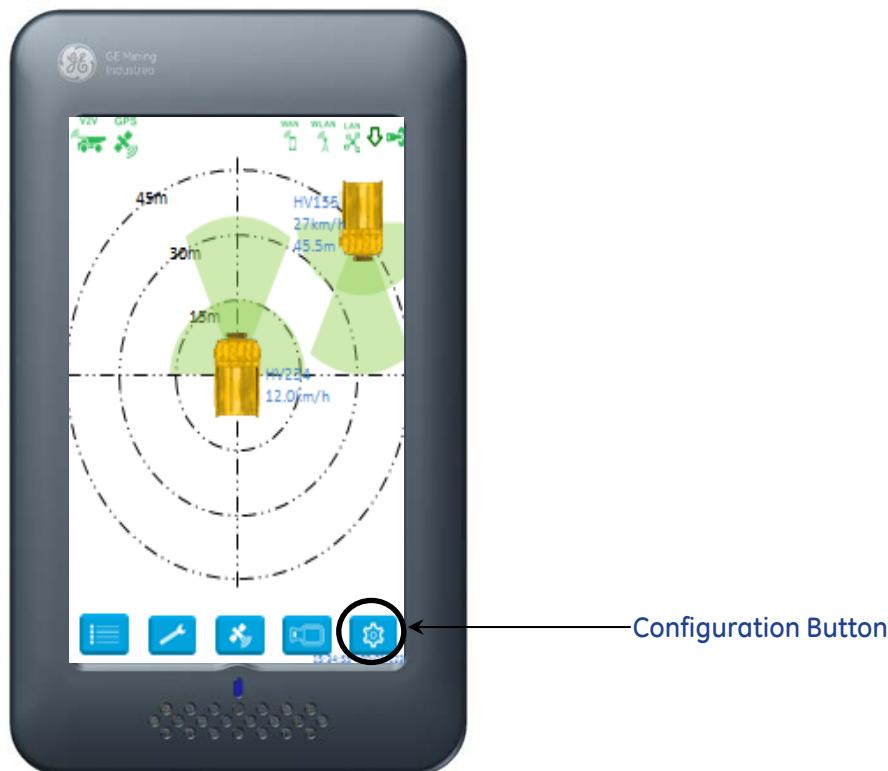


Orientation
Number 7

IVU mounted
inside cabin
behind the rear
seat

Configuration

Use the  button at bottom of Display to access CAS GPS
CASInstaller window



Configuration

Enter the **Asset Name** (usually the vehicle's ID) using the Keyboard below

The **Asset type** is not critical but provides a record of the make and model of the vehicle.

Select the **Object type** by clicking on the object type drop down box and select the correct vehicle for the installation.

Once the **object type** is selected it automatically populates the typical dimensions for the particular vehicle type.

Ensure the location of the **GPS Antenna (Length, Width and Height)** is correct for the install

When completed enter the passcode before pressing **Save** button on the lower right hand side of the screen, this configuration is now stored and system is now ready to use.

CASGPS
Vehicle Configuration

Wi-Fi IP: 192.168.1.5 Network:

Asset Name: HV1234

Asset Type: CAT793

Object Type: Heavy Vehicle Truck

Orientation: 1

Forward: Input 3

Reverse: Input 2

Length(m): 10.00 Width(m): 10.00 Height(m): 10.00

GPS Antenna

Length(m): 10.00 Width(m): 10.00 Height(m): 10.00

Clear	Back								
0	1	2	3	4	5	6	7	8	9
Q	W	E	R	T	Y	U	I	O	P
A	S	D	F	G	H	J	K	L	
Shift	Z	X	C	V	B	N	M	.	Ent
Space									Char

PassCode: Save Cancel

This ICON will change once the **Object Type** has been chosen

Record the **IVU orientation** here.
Click on the Orientation drop down box and select from the list of numbers which refer to the table listed on page 39 of this manual.

Key Board



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Shovel with Heading

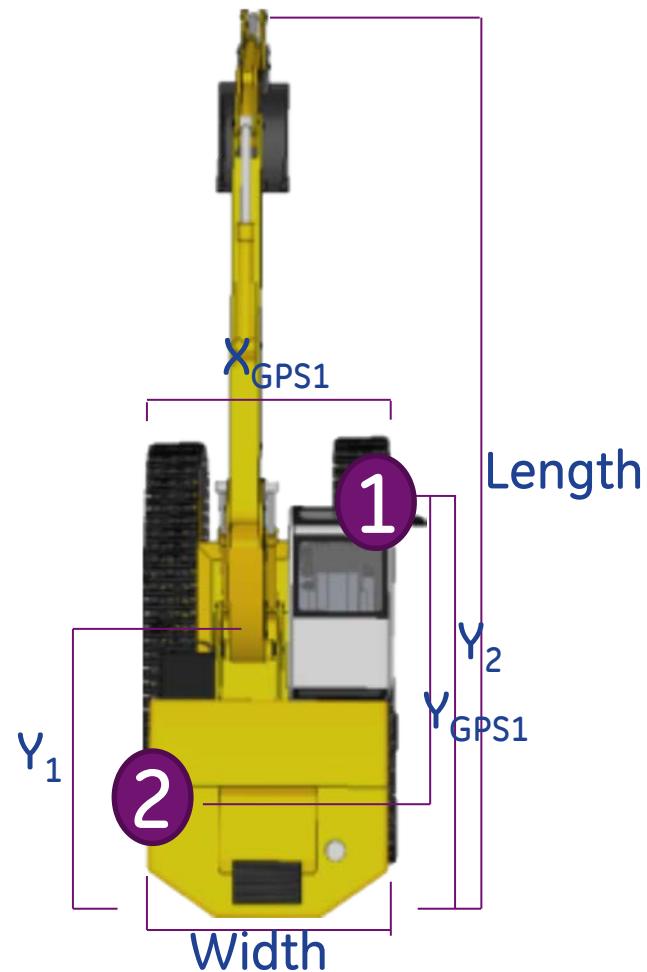
Shovel with Heading Overview

The difficulty with rotating equipment such as shovels is that the heading cannot be determined by 1 normal GPS receiver. To overcome this a secondary IVU can be installed to provide another position from which a heading can be determined.

To provide the minimum error the 2 IVU antenna's should be installed as far apart as possible on the machine.

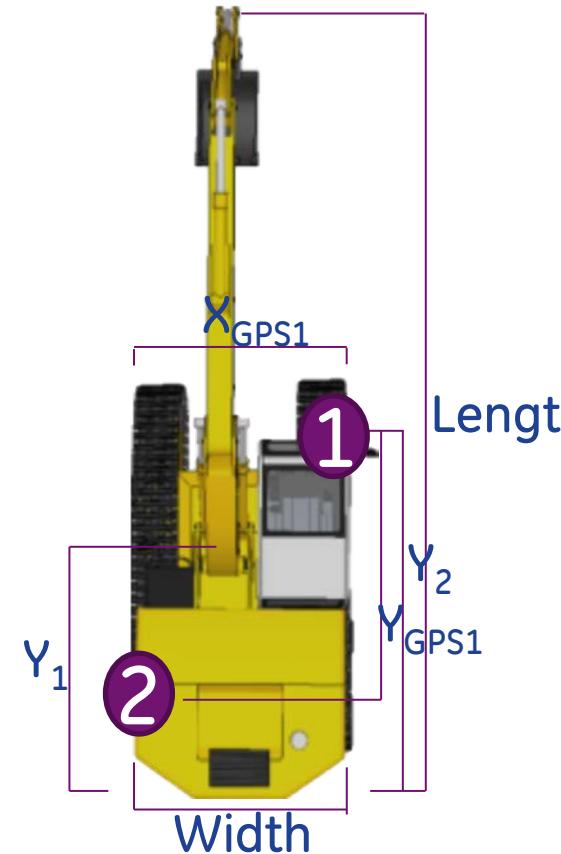
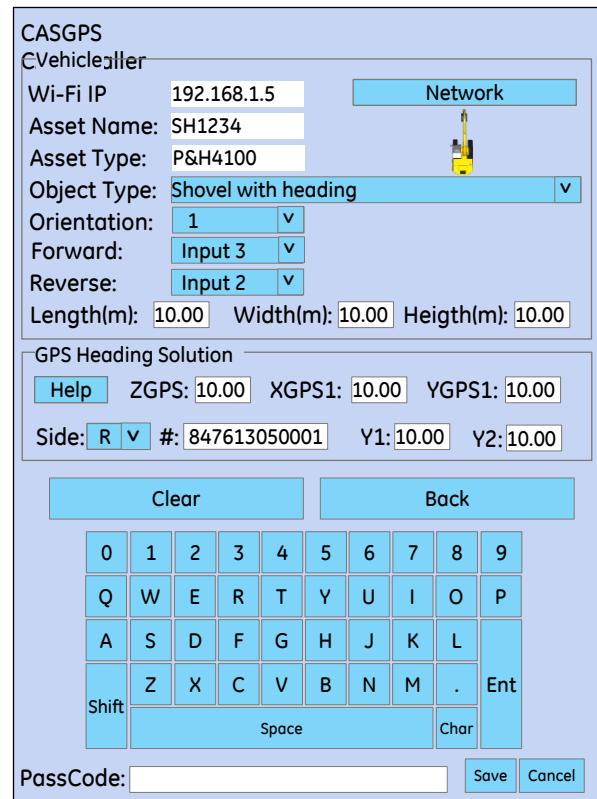
The primary IVU (1 on diagram) should be located near the operators cab. The secondary IVU (2 on diagram) should be located on the opposite side and to the rear of the Shovel.

The primary IVU (1) is installed exactly the same as a normal Shovel installation (with the exception of configuration).



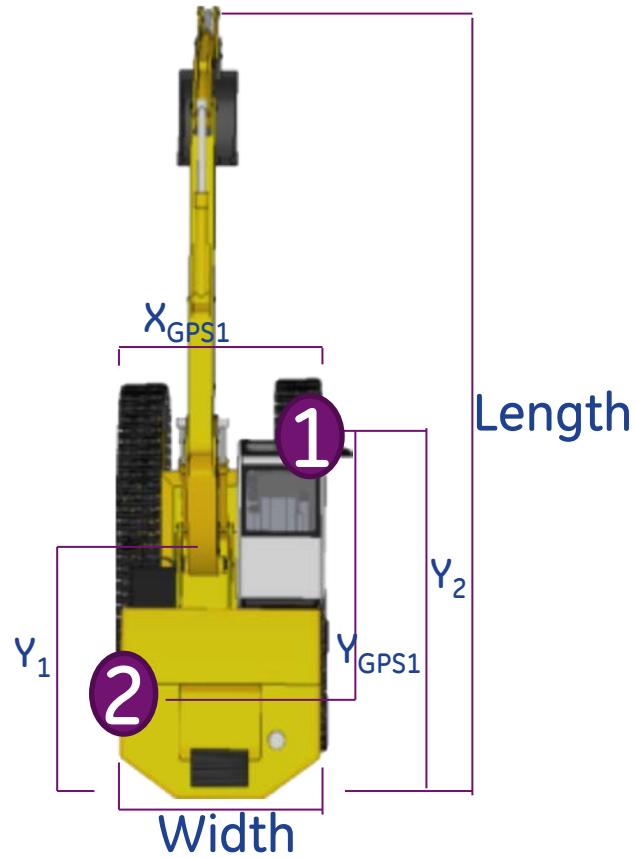
Primary IVU Configuration

- Configure the vehicle section as normal
- Help** button opens a window describing the required measurements
- ZGPS** is the height of the Primary GPS antenna
- XGPS1** is the horizontal distance between the primary and secondary antennas
- YGPS1** is the vertical distance between the primary and secondary antennas
- Side** indicates the location of the operators cabin (Left or Right side of the boom)
- # is the serial number of the secondary IVU
- Y1** is the distance from the rear of the shovel to the center of rotation
- Y2** is the length of the body of the shovel (excluding the boom)

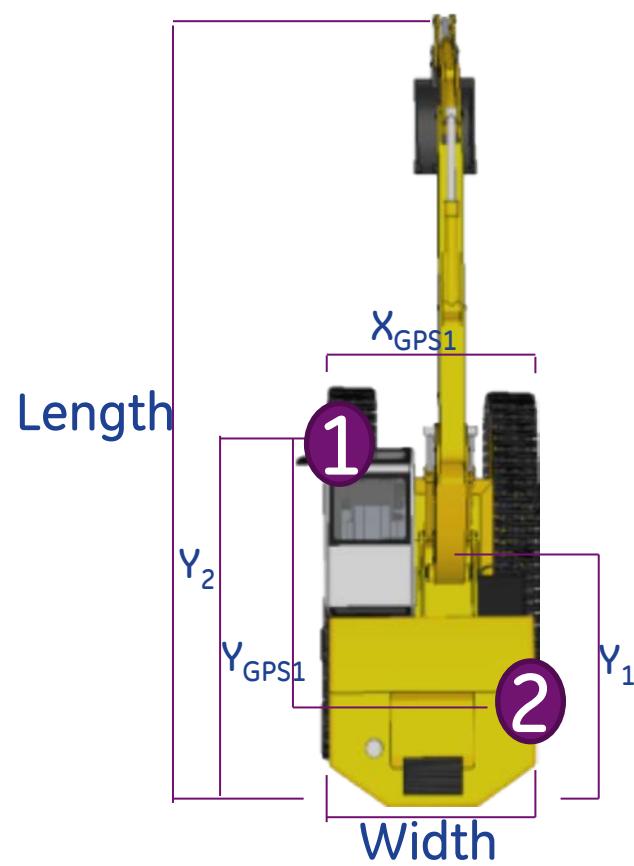


Primary IVU Configuration

Right Hand Side Cab



Left Hand Side Cab



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Secondary IVU Installation

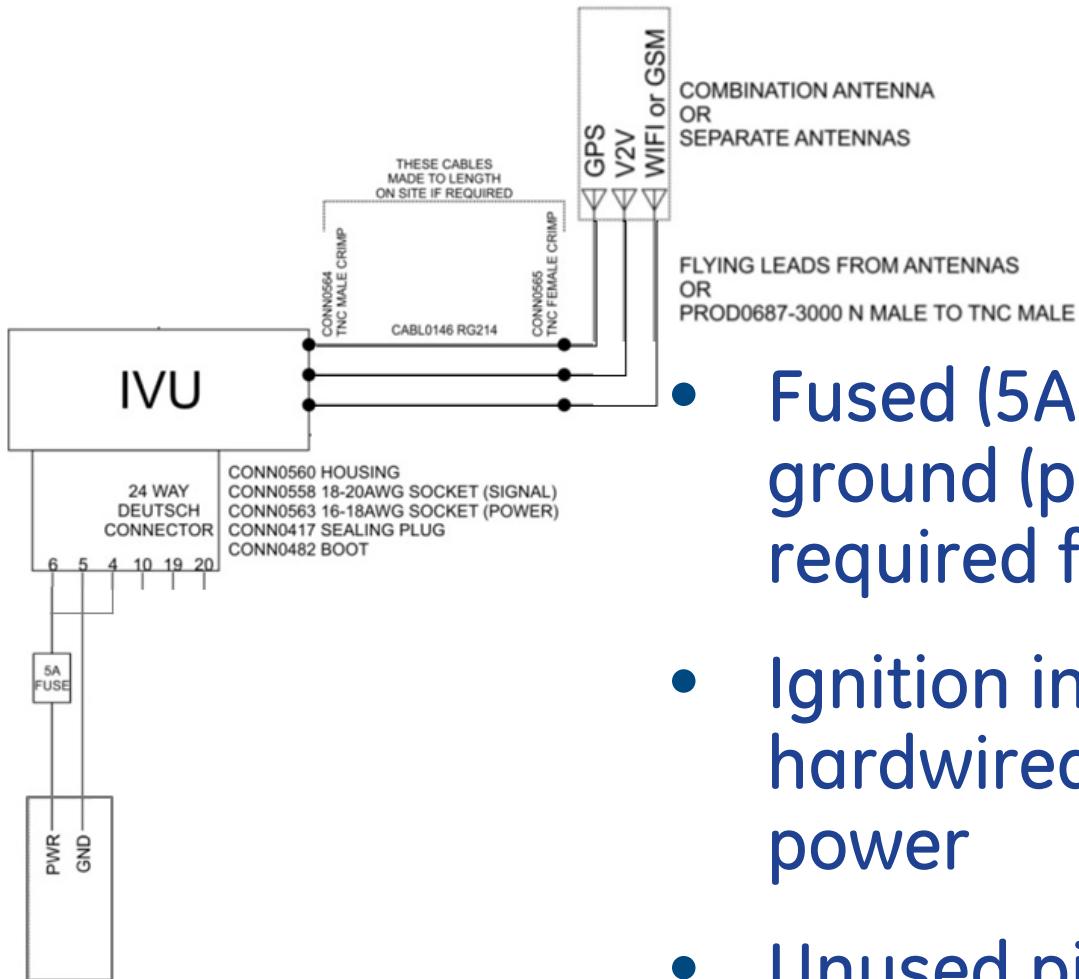
Key points:

- Secondary IVU GPS antenna to be located as far away as practical from the primary GPS antenna
- IVU needs to be configured via the Display interface prior to installation
- The IVU is installed without Display
- Install sealing caps on all unused ports



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Secondary IVU Wiring



- Fused (5A) power (pin 6) and ground (pin 5) are the only signals required for the secondary IVU
- Ignition input (pin 4) should be hardwired to the fused input power
- Unused pins sealed with sealing plugs



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Secondary IVU Configuration

- Set the **Asset Name** to be the same as the primary IVU
- Object type should be set to **Other Heading**
- **Orientation, Forward and Reverse** are not used.
- The **Length, Width and Height** by default will be set to 0.00 and should be left as zero.

The screenshot shows the CASGPS C:VehicleEditor configuration interface. At the top, it displays 'CASGPS' and 'C:VehicleEditor'. Below that, there are several configuration fields:

- Wi-Fi IP: [redacted] Network: [redacted]
- Asset Name: SH1234
- Asset Type: Heading unit
- Object Type: Other Heading
- Orientation: 1
- Forward: Input 3
- Reverse: Input 2
- Length(m): 0.00 Width(m): 0.00 Height(m): 0.00

Below these fields is a numeric keypad and function key layout:

0	1	2	3	4	5	6	7	8	9
Q	W	E	R	T	Y	U	I	O	P
A	S	D	F	G	H	J	K	L	
Shift	Z	X	C	V	B	N	M	.	Ent

At the bottom, there are buttons for 'Clear', 'Back', 'Space', 'Char', 'Save', and 'Cancel', and a 'PassCode:' input field.

Shovel Heading Testing

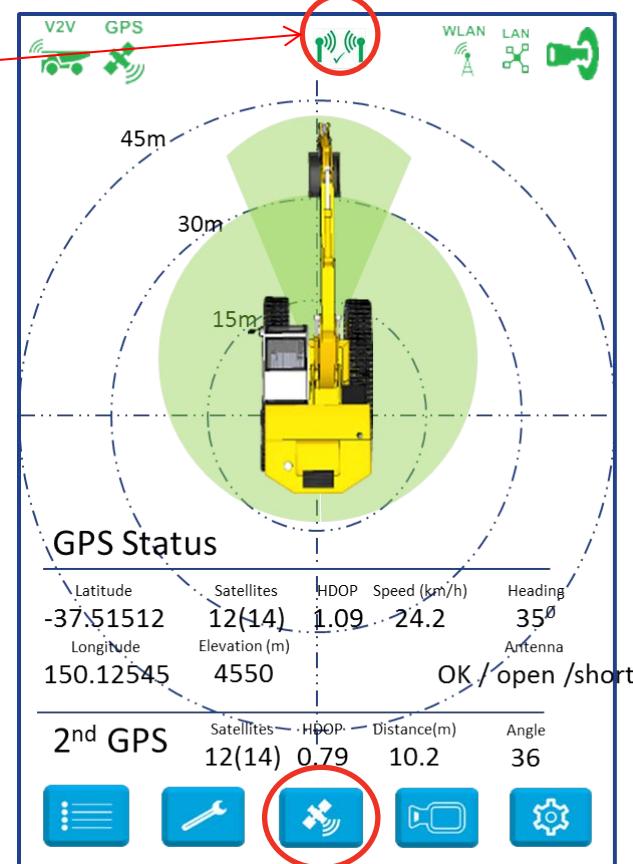
The secondary IVU status icon indicates the communication status to the secondary IVU:

 Green indicates good

 Yellow indicates warning, no message received in the last 5 seconds

 Red indicates error, no message received in the last 5 minutes

Pressing the  button displays the primary and secondary IVU's GPS information.



Shovel Heading Testing

The GPS icon  should always be green when a Shovel with Heading is correctly installed and operating.

Should the GPS icon change to yellow, this indicates that the primary IVU no longer has a valid heading. Potential causes:

- Loss of communication between primary and secondary IVU's (will be indicated by the Secondary IVU status icon 
- Loss of GPS signal to primary and/or secondary IVU (indicated by poor HDOP reading >4)
- Poor GPS signal to primary and/or secondary IVU (indicated by poor HDOP reading >4)

Configuration & Install Record

On completion of the physical installation:

- Complete the **Installation Checklist** to ensure that the system is installed correctly and is operating as expected.
- Complete the **Installation Record** carefully filling in all of the required details (including – orientation, GPS location, vehicle size, vehicle ID)

GE Mining Industries	
CAS Lite Installation Checklist	
Item	Checked
GPS	
Status indicator is yellow (no heading) or green (heading determined)	
Vehicle speed indicates 0km/h (N/A km/h indicates a problem)	
V2V	
Status indicator is yellow (when no other CAS Lite unit is in range)	
Transmitter icon is green (when Test Station is in range)	
Test Station icon, ID and distance is displayed on the screen	
IVU/GSM	
Status indicator goes Green indicating connection to the server (may take a few minutes)	
Display elements	
The vehicle icon is correctly set	
The vehicle icon is correct for the vehicle type	
Light sensor function - cover the light sensor and observe the screen change from white to black background	
Tearing off the screen silences the alarm generated from either a near by vehicle or the Test Station	
Correct UTC Time is displayed in the bottom RMS and is updating	
The blue display led is flashing (approximately once per second)	
Input signals	
The reverse icon appears only when the vehicle is put into reverse	
The ignition icon is green only when the ignition is on, otherwise yellow	
IVU	
All cable connectors securely connected	
All blanking plugs/caps in place on unused connectors (LAN, Deutsch, Antennas)	
Power LED Green when input voltage present	
Other Physical	
Antenna's securely mounted	
Antenna cables securely mounted at antenna	
IP Clamps used in preference to cable ties	
Configuration	
Vehicle ID correctly configured and recorded on the ITP	
Vehicle Type correctly configured and recorded on the ITP	
IVU Orientation recorded on the ITP	
Network settings correctly configured and IP address recorded (if required)	
Vehicle dimensions correctly configured and recorded on the ITP	
GPS location correctly configured and recorded on the ITP	

GE Mining Industries				
ITP NUMBER:				
Project:	Site:	Date:		
Vehicle Type:	Call sign No.:	Owner:		
Vehicle Make & Model:	Vehicle ID, Plant Number:	Installer licence number:		
System type:	CASLite			
Installation Start Date and Time:		Total Hours:		
Installation Finish Date and Time:				
INSTALLATION TEAM				
Name	Position	DA & Take S Completed	Signature	Mrs on Vehicle
IVU Serial #		Display Serial #		
CONFIGURATION ITEMS				
Vehicle ID	Vehicle Type #			
(P) Address	GPS Height (m)			
GPS Distance from C.D (m)	GPS Distance from C.D (m)			
Vehicle Width (m)	Vehicle Length (m)			
IVU Orientation#				
Supervisor Name:	Supervisor Signature:			
Additional Comments:				
Acceptance Date and Time:	Recordable Delays			
Client Representative Name:	Client Representative Signature:			
Client Comments:				
Delay details:				

Configuration & Install Record

CAS GPS CHECKLIST:

GE Mining Industrea		CAS Lite Installation Checklist	Item	Checked
GPS				
Status indicator is yellow (no heading) or green (heading determined)				
Vehicle speed indicates 0km/h (N/A km/h indicates a problem)				
V2V				
Status indicator is yellow (when no other CAS Lite unit is in range)				
Status indicator is green (when Test Station is in range)				
Test Station icon, ID and distance is displayed on the screen				
WiFi/GSM				
Status indicator goes Green indicating connection to the server (may take a few minutes)				
Display elements				
The vehicle ID is correctly set				
The vehicle icon is correct for the vehicle type				
Light sensor function - cover the light sensor and observe the screen change from white to black background				
Touching the screen silences the alarm generated from either a near by vehicle or the Test Station				
Correct UTC Time is displayed in the bottom RHS and is updating				
The blue display led is flashing (approximately once per second)				
Input signals				
The reverse icon appears only when the vehicle is put into reverse				
The ignition icon is green only when the ignition is on, otherwise yellow				
IVU				
All cable connectors securely connected				
All blanking plugs/caps in place on unused connectors (LAN, Deutsch, Antennas)				
Power LED Green when input voltage present				
Other Physical				
Antenna's securely mounted				
Antenna cables securely mounted at antenna				
P Clamps used in preference to cable ties				
Configuration				
Vehicle ID correctly configured and recorded on the ITP				
Vehicle Type correctly configured and recorded on the ITP				
IVU Orientation recorded on the ITP				
Network settings correctly configured and IP address recorded (if required)				
Vehicle dimensions correctly configured and recorded on the ITP				
GPS location correctly configured and recorded on the ITP				



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Configuration & Install Record

CAS GPS ITP:

GE Mining Industrea				
ITP NUMBER:		Site:	Date:	
Project:		Call sign No.:	Owner:	
Vehicle Type:		Vehicle ID, Plant Number:	Installer licence number:	
Vehicle Make & Model:				
System type:	CASLite			
Installation Start Date and Time:		Total Hours:		
Installation Finish Date and Time:				
INSTALLATION TEAM				
Name	Position	JSA & Take 5 Completed	Signature	Hrs on Vehicle
CONFIGURATION ITEMS				
Vehicle ID		Vehicle Type #		
IP Address		GPS Height (m)		
GPS Distance From LHS (m)		GPS Distance From Front (m)		
Vehicle Width (m)		Vehicle Length (m)		
IVU Orientation#				
Supervisor Name:		Supervisor Signature:		
Additional Comments:				
Acceptance Date and Time:		Recordable Delays		
Client Representative Name:		Client Representative Signature:		
Client Comments:				
Delay details:				



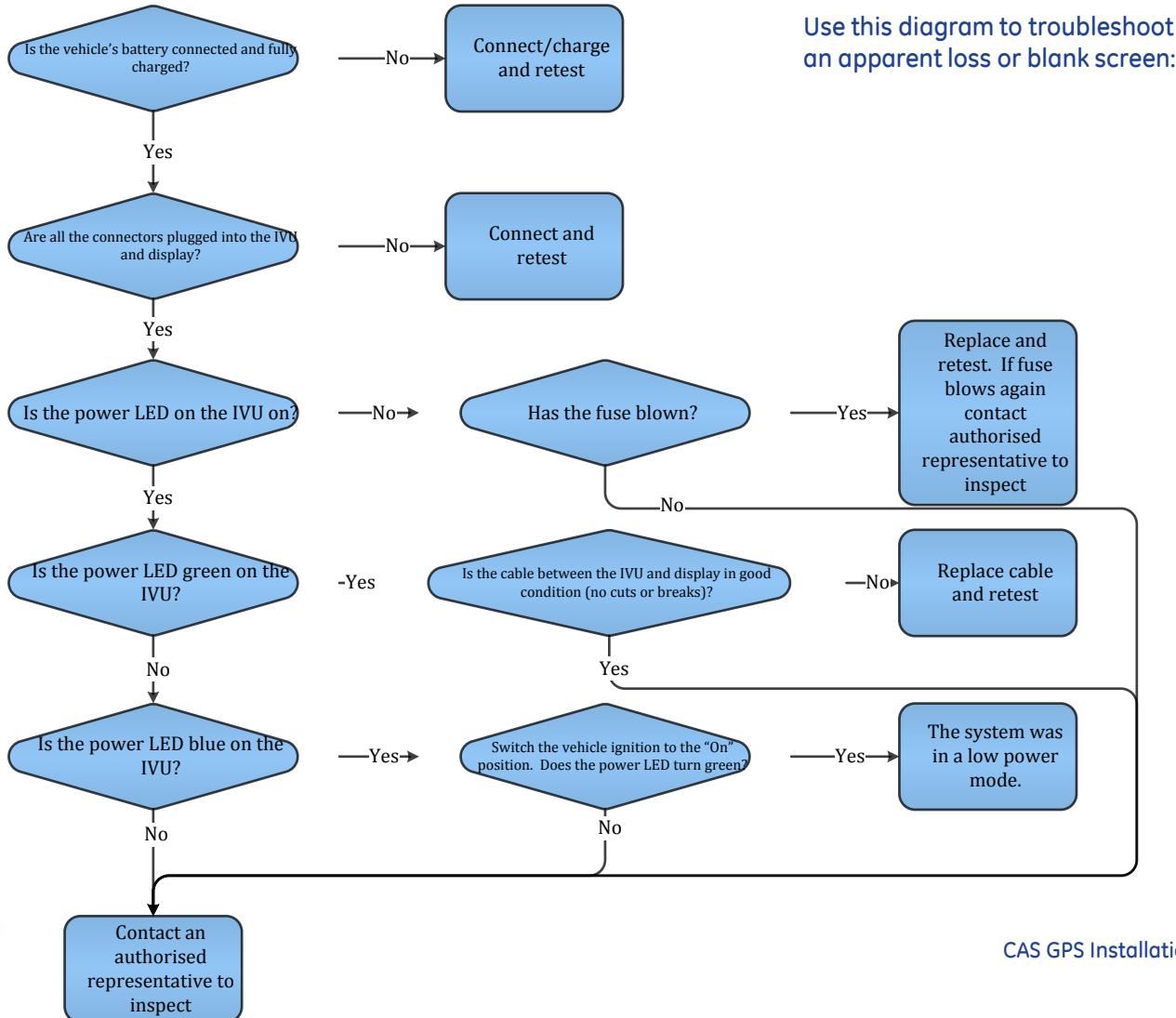
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Record Keeping

- Take photographs of the completed installation (for future reference and record of installation)
- File all documentation appropriately

Trouble Shooting

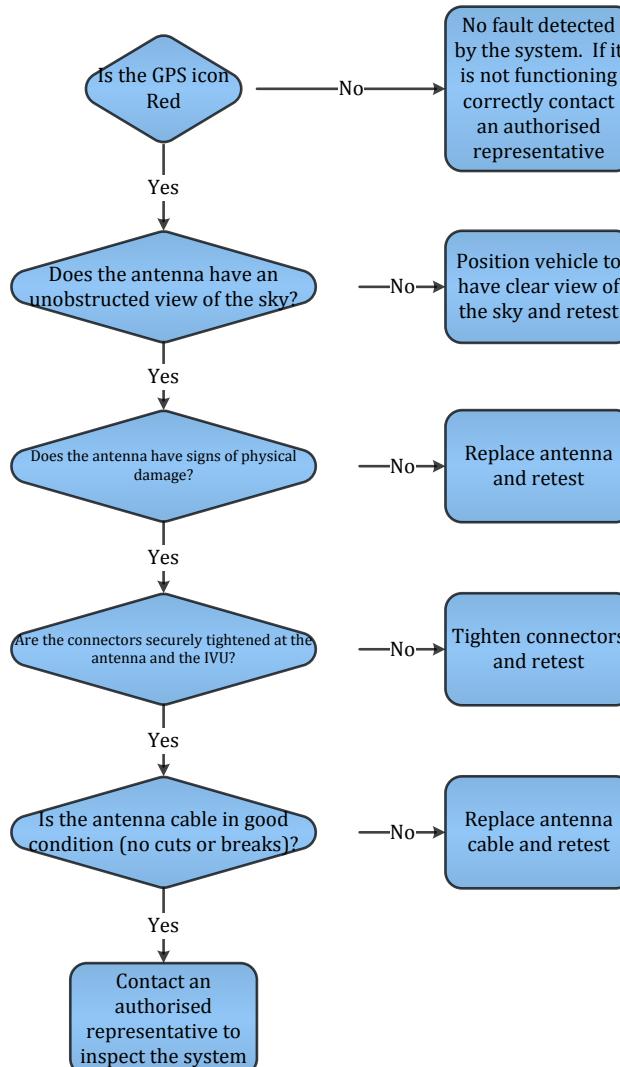
No power / Blank screen



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Trouble Shooting

GPS Problems



The GPS signal status is indicated by the colour of the  ICON at the top of the display.

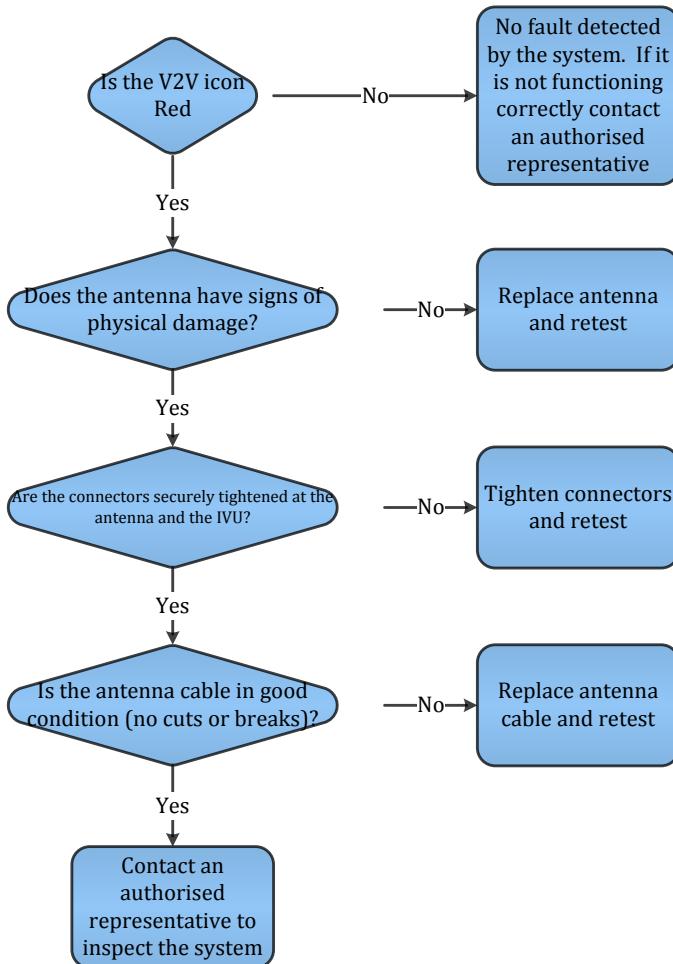
Green: position and heading – no faults

Yellow: position fix but no heading – no faults

Red: No GPS signal or GPS error – fault or no signal

Trouble Shooting

V2V Problems



The Vehicle to Vehicle communication is indicated by the colour of the  ICON at the top of the display.

Green: Communicating with other vehicles – no faults

Yellow: No other vehicles in range – no faults

Red: Radio error – fault or error detected



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Service and Maintenance

Scheduled System Servicing

- It is recommended that the system undergo preventative scheduled maintenance and inspections. These should be carried out by trained and authorised personnel every 6 months or 1500hrs (which ever occurs first)

Software Updates

- Software updates are automatically pushed out to all IVU'S connected to the CAS server and will be scheduled with the end-user.

Equipment Maintenance

- If the system is not functioning as expected, refer to the Troubleshooting section. If a fault cannot be resolved please contact your nearest authorised representative.



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Service and Maintenance

■ Equipment Service

■ Display Unit

- Clean screen surface with a clean dry soft cloth – **Do Not** use solvents or cleaners on the screen surface
- Check for physical damage to screen surface
- Check the cable connector is securely connected at the rear of the screen – finger tighten only if loose
- Check the mounting bracket is secure – finger tighten only if loose

■ System

- Check visually that all antennas are in good condition and the antenna cables are connected
- Check visually that no cables are loose or damaged
- Verify that the system is working correctly prior to starting the vehicle and during operations



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Decommission

- Removal of the system should only performed if authorised by the owner of the vehicle
- Removal should only be performed by a qualified Auto Electrician
- All system components and wiring should be removed
- All vehicle wiring should be restored back to original condition
- Dispose or store removed system in accordance with this manual



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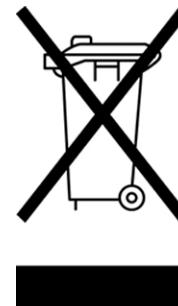
Disposal

The electronic equipment discussed in this manual must not be treated as general waste or disposed of into landfill.

By ensuring that this product is disposed of correctly, you will be helping to prevent potentially negative consequences for the environment and human health which could otherwise be caused by incorrect disposal of this product.

The IVU unit contains a Lithium Ion battery and should be disposed of in accordance with local regulations.

The electronic equipment is RoHS compliant 2002/95/EC (Lead Free).



Disclaimer

- The CAS product is a driver's aid and should not be relied upon as the primary means of reducing the risks of high potential interactions between Heavy Vehicles, Light Vehicles, infrastructure and personnel.
- GPS based proximity detection may not operate when satellites are not fully visible in the sky (e.g. in a deep mining pit near a high-wall or under a workshop roof). Consideration should be given to supplementing GPS with RF proximity detection and visual aids using cameras.
- Alarm logic should be determined via site specific risk assessment based on the end-users specified high risk interactions.
- The CAS product does not take control of the vehicle although can provide inhibit signals to prevent movement from a stationary position – implementation will require approval from the vehicle OEM, vehicle owner and GE and a detailed risk assessment conducted.



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