CAS-GPS
IVU BASIC SYSTEMS INSTALLATION MANUAL

DOCU0085 rev Q

Digital Mining Technology
3-Co-Wyn Close, Fountaindale
NSW, 2258
Australia
www.wabteccorp.com

Wabtec CORPORATION

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)	DMc		19/11/2015
H	Doc No. added and other adjustments	NM, SW & MK		20/06/2016
J	SWR testing added, Network Configuration antenna location altered to Suit Self Test	NM		09/08/2016
K	Updates to CAM/RF Installations Chapter Ignition / Power signals added Page 25	NM		23/09/2016
L	Update Network Settings Image			05/10/2016
M	Updates to Interconnections – 4CAM/4RF			19/06/2019
N	Branding updates, PROD0179 wiring reference correction			16/09/2021
P	STEE0690 antenna washer assembly details added, dual IVU configuration removed			
Q	Updated WiFi, V2V & GNSS Antenna Gain	Rohan Kennedy	S Clifton	25/07/2022

Document Approval	
Creator(s):	CREATED: By P C Shivalingam at 12:10 pm, Jul 25, 2022
Reviewer(s):	
Approved:	

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 lading. If there are shortages or evidence of physical damage, notify Digital Mining Technology immediately.

Notify Digital Mining Technology within 7 days 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.

When preparing to ship the system, de-power for four, (4) days before transport.

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 °C to +85 °C
Storage Location:	dry low humidity location

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.

Installation

Installation should be in accordance with:

- Vehicle manufacturers instructions.
- National/local & site regulations relevant to the location of install.
- The installation procedures defined by Digital Mining Technology and only performed by authorised and qualified installers.

This radio transmitter IC: 8903A-PROD08422 & IC: 8903A-PROD08472 has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Cet émetteur radio IC : 8903A - PROD08422 & IC : 8903A - PROD08472 a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés ci-dessous avec le gain maximal admissible indiqué . types d'antennes non inclus dans cette liste , ayant un gain supérieur au gain maximum indiqué pour ce type , sont strictement interdits pour une utilisation avec cet appareil.

GE Part#	Relevant Product (x = any variant)	CAS-GPS Port	Nominal Impedance	Max. Gain	Operating Frequency
PROD0852	PROD084x-2	V2V	50 Ω	+3dBi	902-928MHz
PROD0874	PROD084x-1	V2V	50 Ω	+3dBi	821-896MHz
MISC0467 or PROD1222	PROD084x-x	GPS (Receive Only)	50 Ω	+17 to +50 dB	GPS: L1(1559 to 1610MHz), L2(1164 to 1215MHz) Galileo: E1 (1559 to 1610MHz), E5(1164 to 1215MHz) BDS: B1L (1559 to 1610MHz) GLONASS: G1 (1559 to 1610MHz),G2 (1215 to 1300MHz)
PROD0854	PROD0847-x	GSM / 3G	50 Ω	0dBi +1.7dBi +2.9dBi	700, 800, 850, 900, 1800, 1900, 2100, 2600 MHz
PROD0833	PROD084x-x	Wi - Fi	50 Ω	+3.0dBi	2400-2484MHz

Warning

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

Do not weld on ROPs!

Do not drill through ROPs!

Note:

It is solely the responsibility of the Installer to ensure the installation is compliant with the vehicle manufacturer's instructions, national/local statutory and site regulations.

Specialty Tools / Adhesives Required

- 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
- Heat gun
- Torx Security Bit – T25
- Metric Allen Key – 4mm
- Nutsert Tool – TOOL0253
- Deutsch pin removal Tool – TOOL0256

Specialty Tools / Adhesives Required

- 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 Metre tape measure
- Coaxial connector tightening tool, TOOL0264

In-Vehicle Unit (IVU)

PROD0842

PROD0847

Note: All IVUs have their “PRODXXXX” part number labelled on the flat underside of the housing.

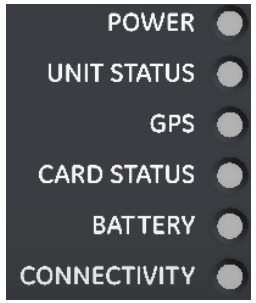
Input Power & Signal Connections

Serial number

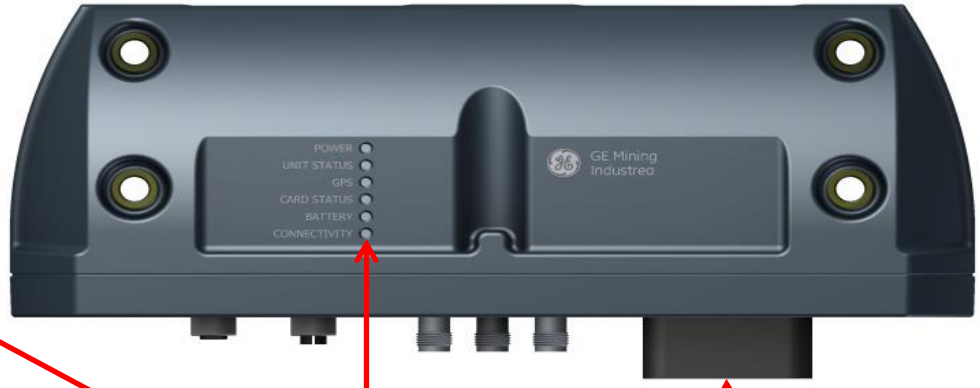
Hardware build letter code

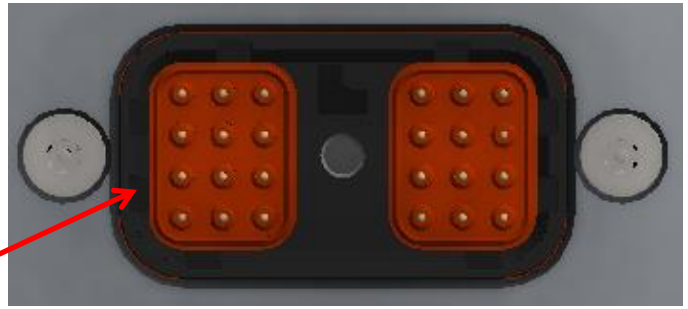
Service Panel	SIM Card
	USB Card
	Auxiliary USB
External Cables	LAN
	Display
RF Antenna	GPS Antenna
	GSM Antenna, (PROD0847 only)
	V2V Antenna
	WiFi/WAN Antenna

Input Power & Signal Connections



IVU





Status LEDs

24-Way Deutsch (Vehicle Electrical Connections)

Display

Power & Signal connector
(Shown with cover in place)

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
- It is easily accessible for servicing
- It is protected against rock fall and other damaging hazards
- It does not obstruct walkways, access or egress
- It is never left loose in the vehicle
- If mounting through a blind panel the supplied nutserts should be used to enable easy removal for servicing
- Remember to record the location and orientation of the IVU as this is critical for CAS-GPS functionality.

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.

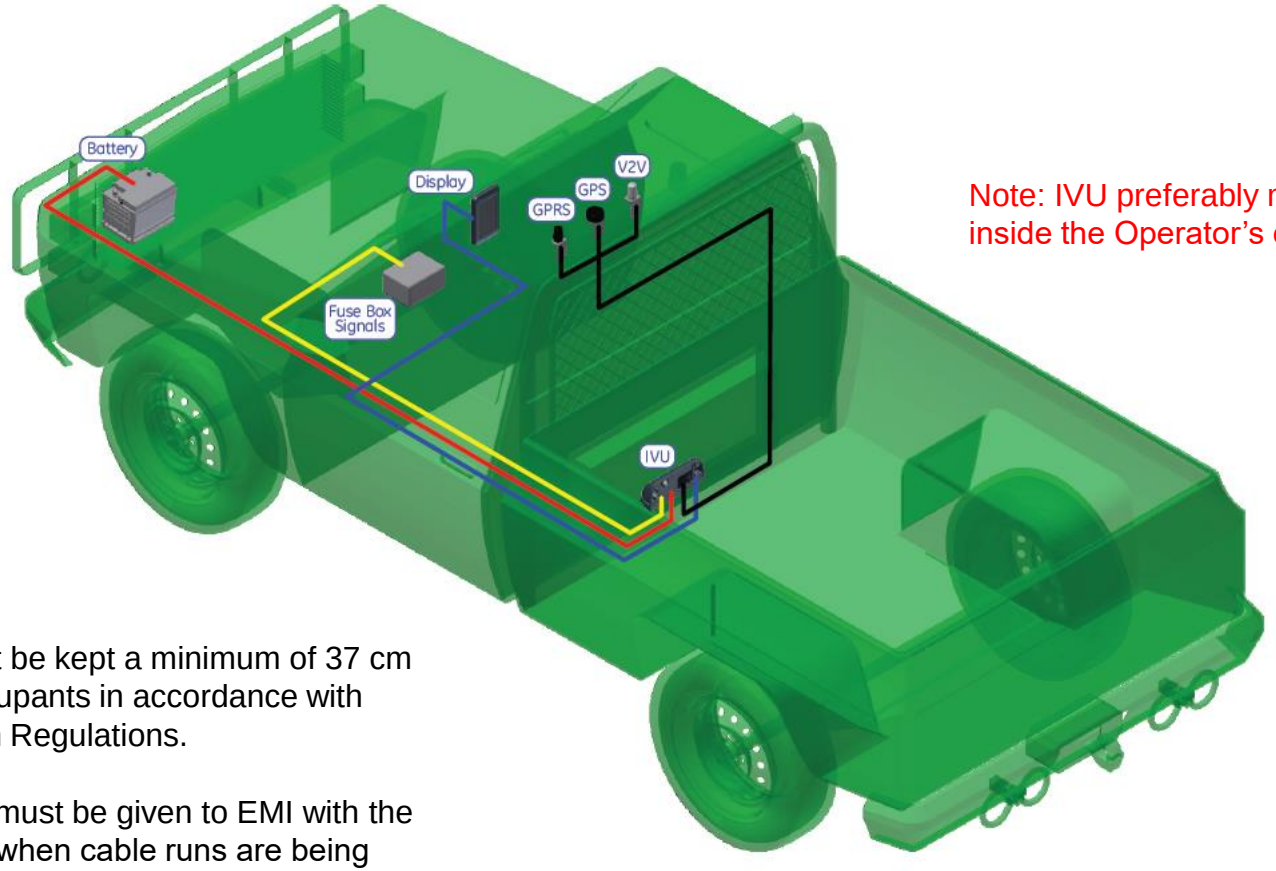
Ensure all stauff clamp assemblies are tightened and secured correctly.

Ensure Loctite 243 is used to secure all mounting fasteners, or alternatively Loctite 248 which is suitable for transporting by air as it is a paste.

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.
- Cabling must be kept away from air bags, fire extinguishers & suppression systems in accordance with local regulations.
- 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 to small.
- If mounting through a blind panel the supplied Nutserts should be used to enable easy removal for servicing.

Light Vehicle

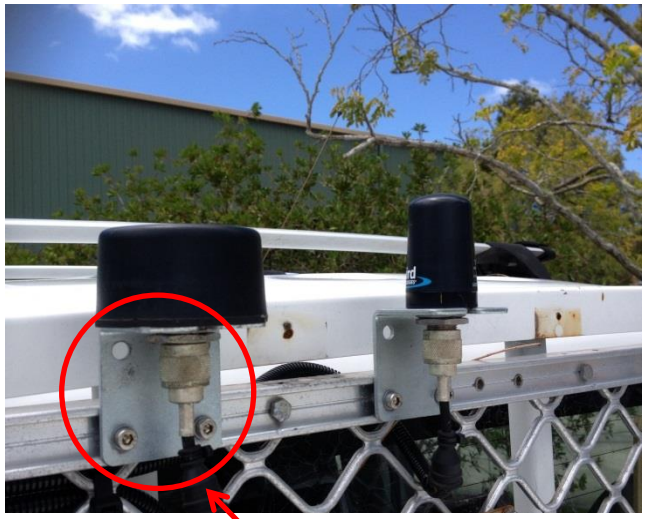


Note: IVU preferably mounted inside the Operator's cabin

Notes:

- Antennas must be kept a minimum of 37 cm away from occupants in accordance with MPE Radiation Regulations.
- Consideration must be given to EMI with the vehicle's ECU when cable runs are being planned in accordance with local regulations and vehicle manufacturers recommendations.

Light Vehicle



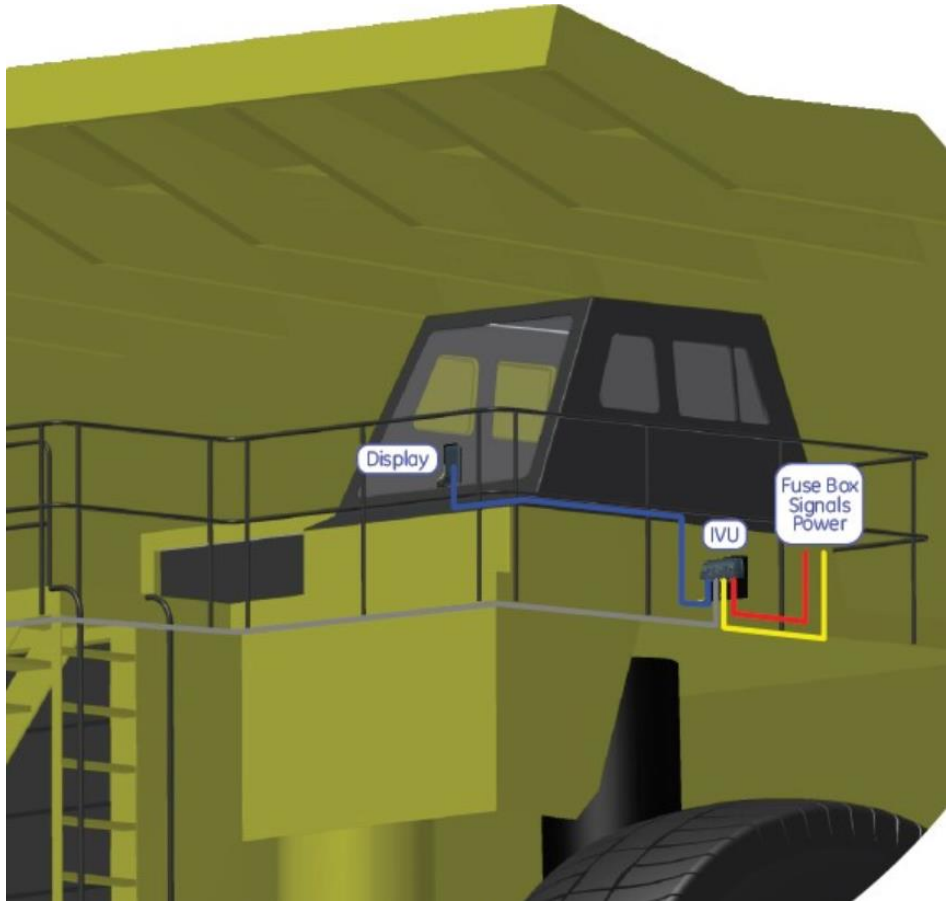
Bracket used here is ATOM0033

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

Haul Truck

Notes:

- Antennas must be kept a minimum 37 cm away from occupants in accordance with MPE Radiation Regulations.
- Consideration must be given to EMI with the vehicle's ECU when cable runs are being planned in accordance with local regulations.

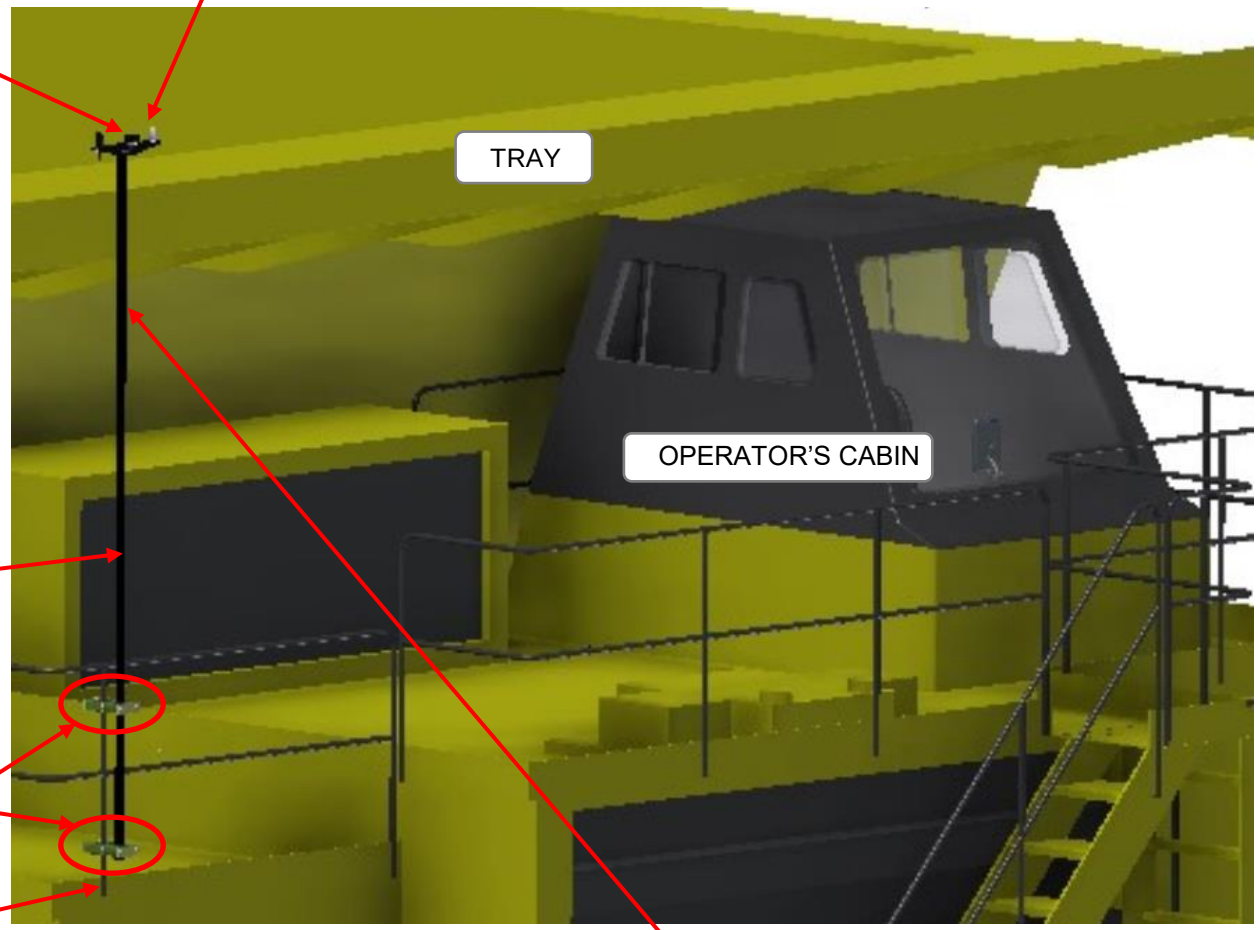


Note: IVU preferably mounted inside the Operator's cabin or the electrical compartment

Haul Truck

Antenna to protrude above the tray by 100mm.
Ensure the antennas will clear any working obstacles.
Standard fitment on opposite side of the vehicle from the operator's cabin.

Specific antennas deployed will depend on IVU type.



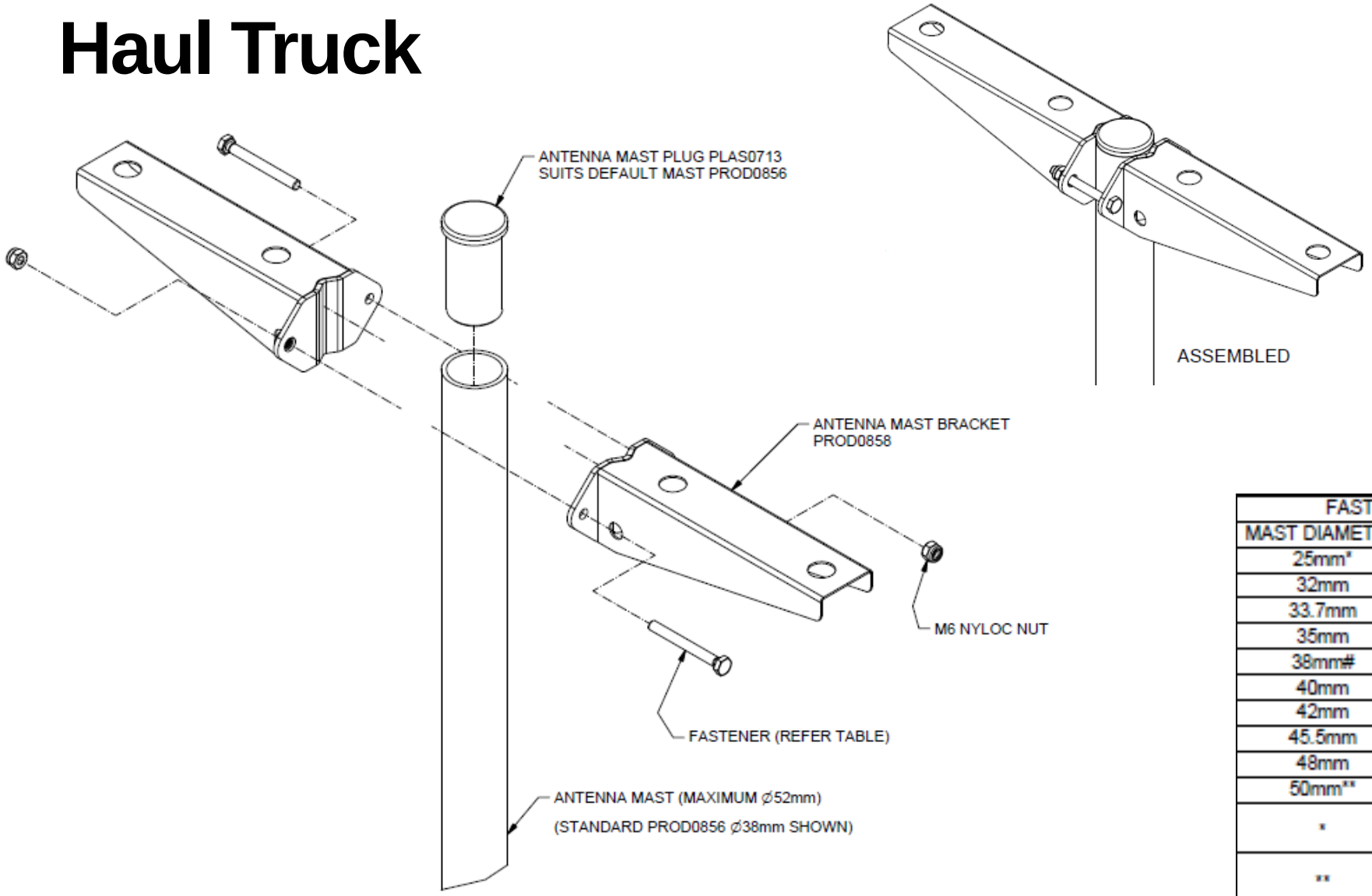
Adjust the mast length to suit the installation.
Standard length supplied = 3m

CLAMPING ASSEMBLIES

HAND RAIL SUPPORT POST

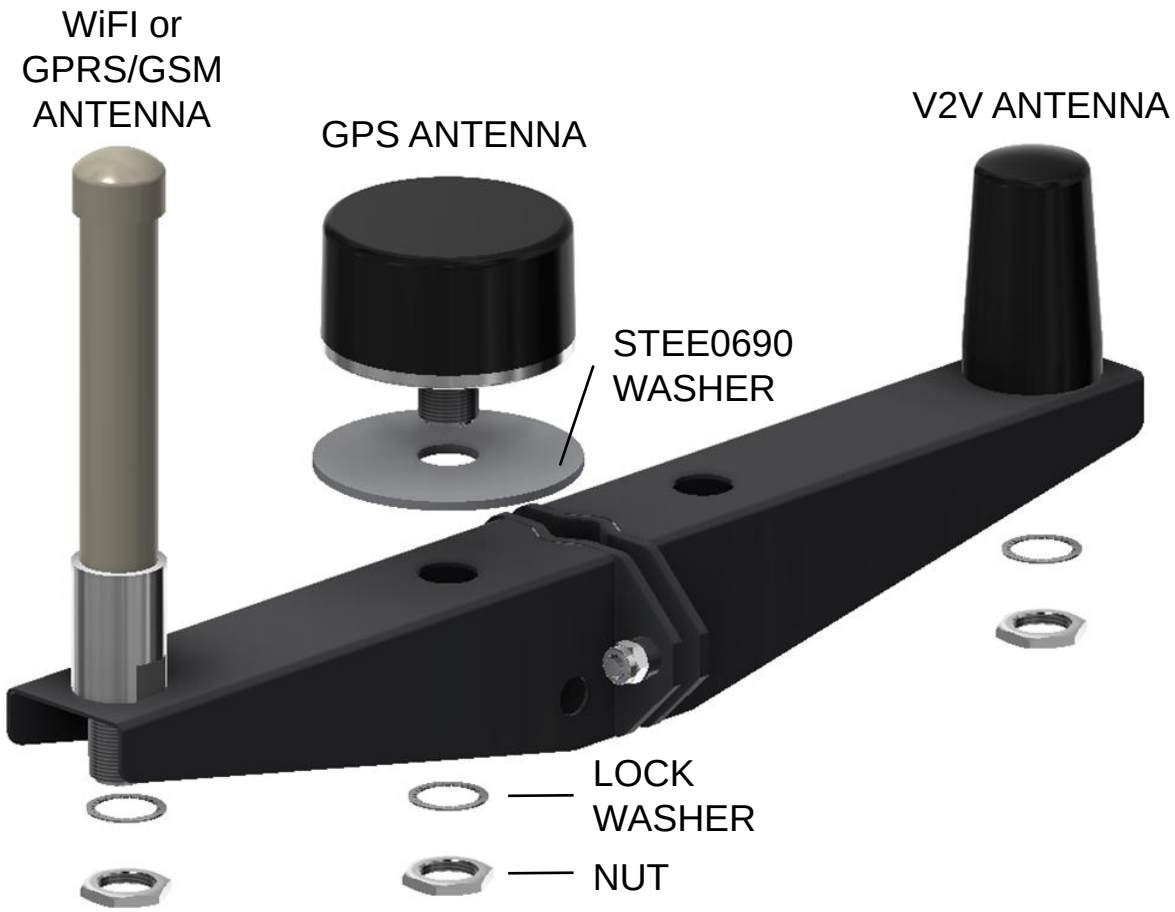
ANTENNA CABLE RUN TO IVU

Haul Truck



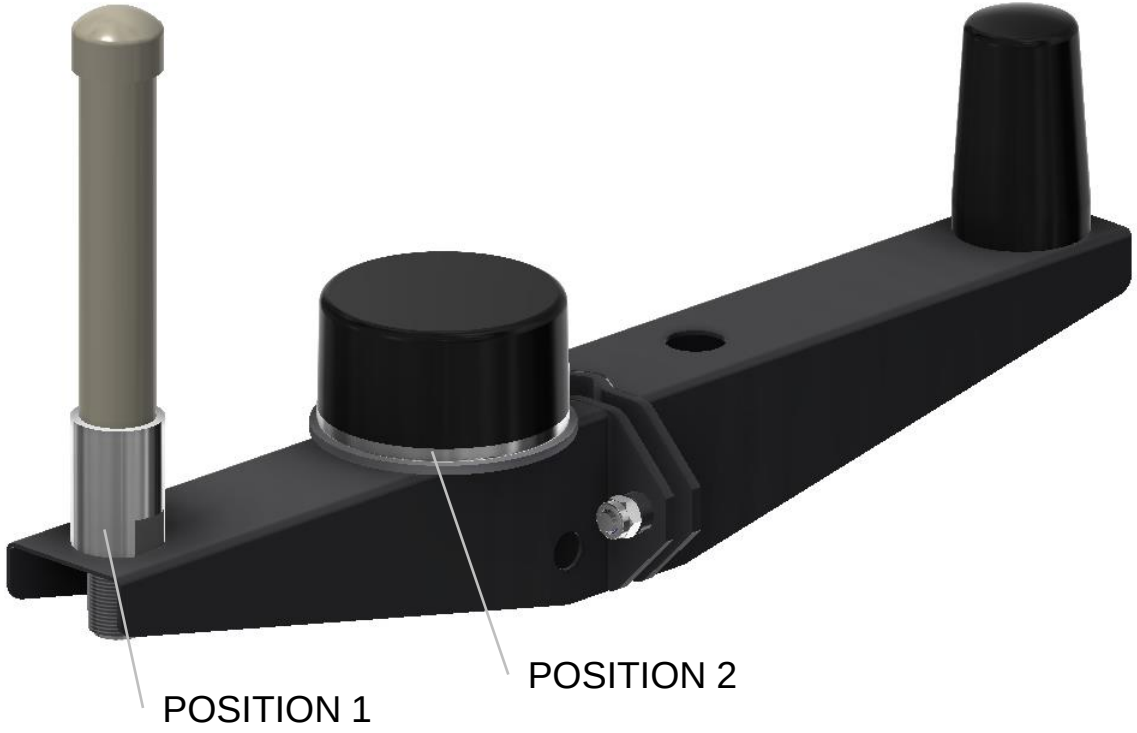
FASTENERS CROSS-REFERENCE	
MAST DIAMETER	RECOMMENDED FASTENER
25mm*	M6x40
32mm	M6x50
33.7mm	M6x50
35mm	M6x50
38mm#	M6x55
40mm	M6x60
42mm	M6x60
45.5mm	M6x60
48mm	M6x70
50mm**	M6x70
*	SIZE NOT SUITED TO STAUFF SIZE 6 MOUNTING SYSTEM
**	SIZE NOT SUITED TO STAUFF SIZE 6 RUBBER INSERTS
#	DEFAULT (PROD0856)

Haul Truck



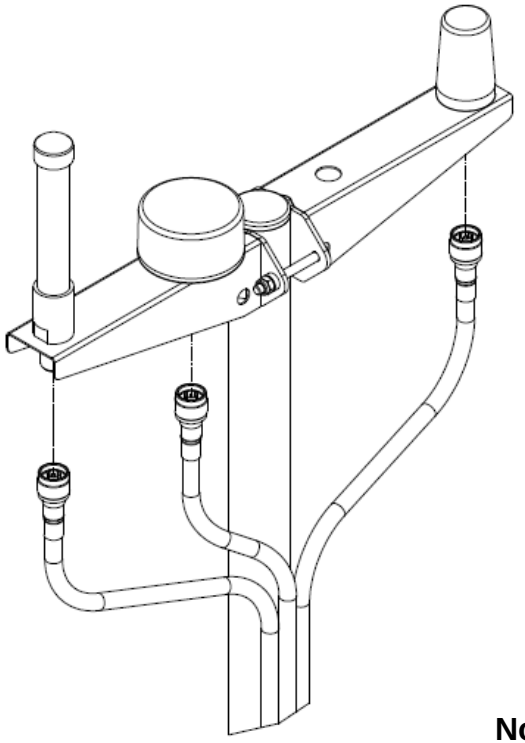
NOTE:

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

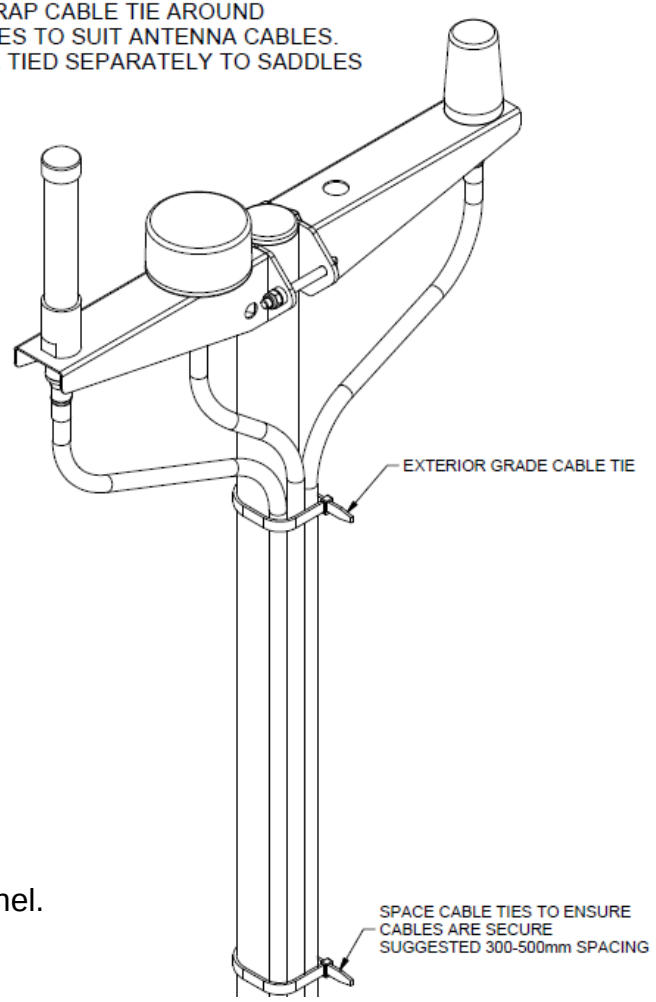


Note:
An extended depth socket spanner may be required to tighten the antenna fixing nuts within the bracket channel.

Haul Truck



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)



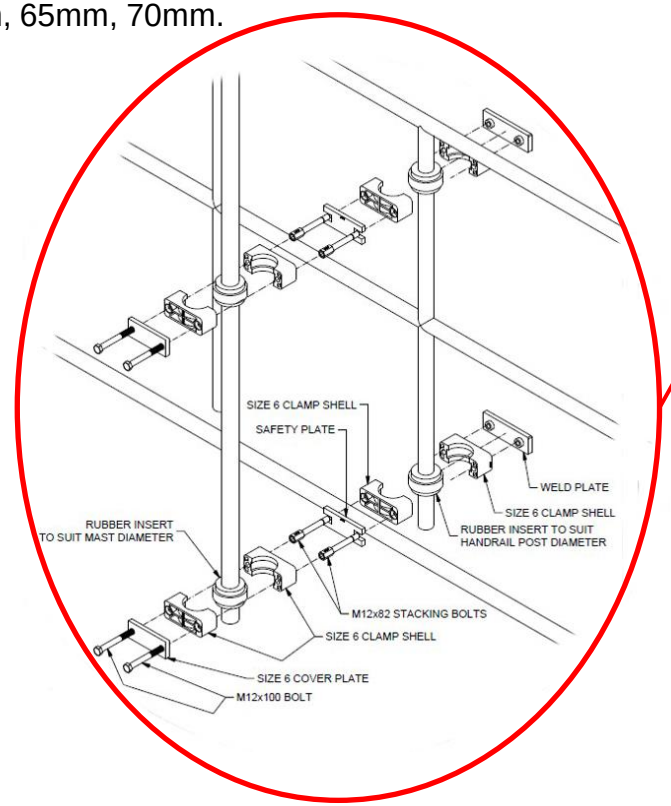
Note:
TOOL0264 is required to tighten the antenna coax within the bracket channel.

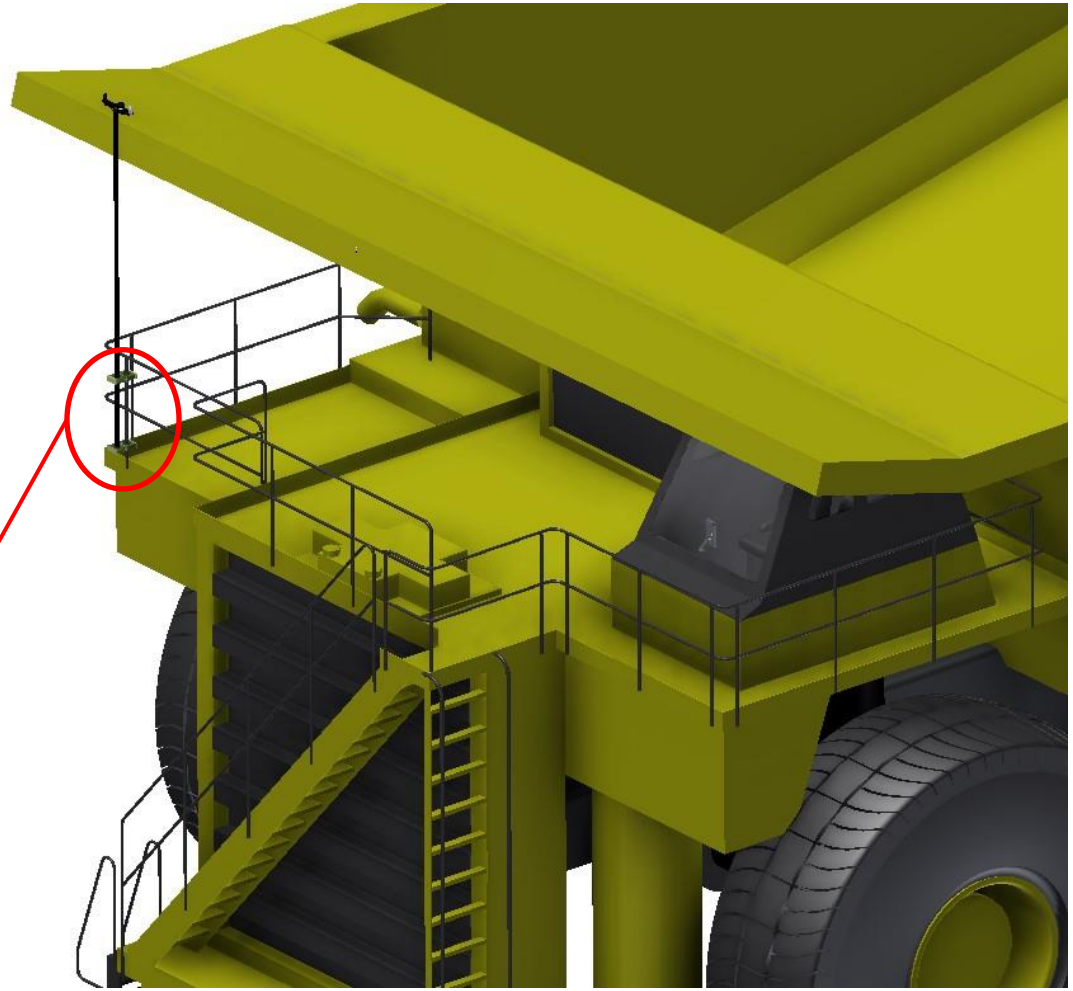
Haul Truck

Stauff clamp sizes used must be correctly chosen for the handrail tube size from the Size 6 heavy series Stauff clamping system

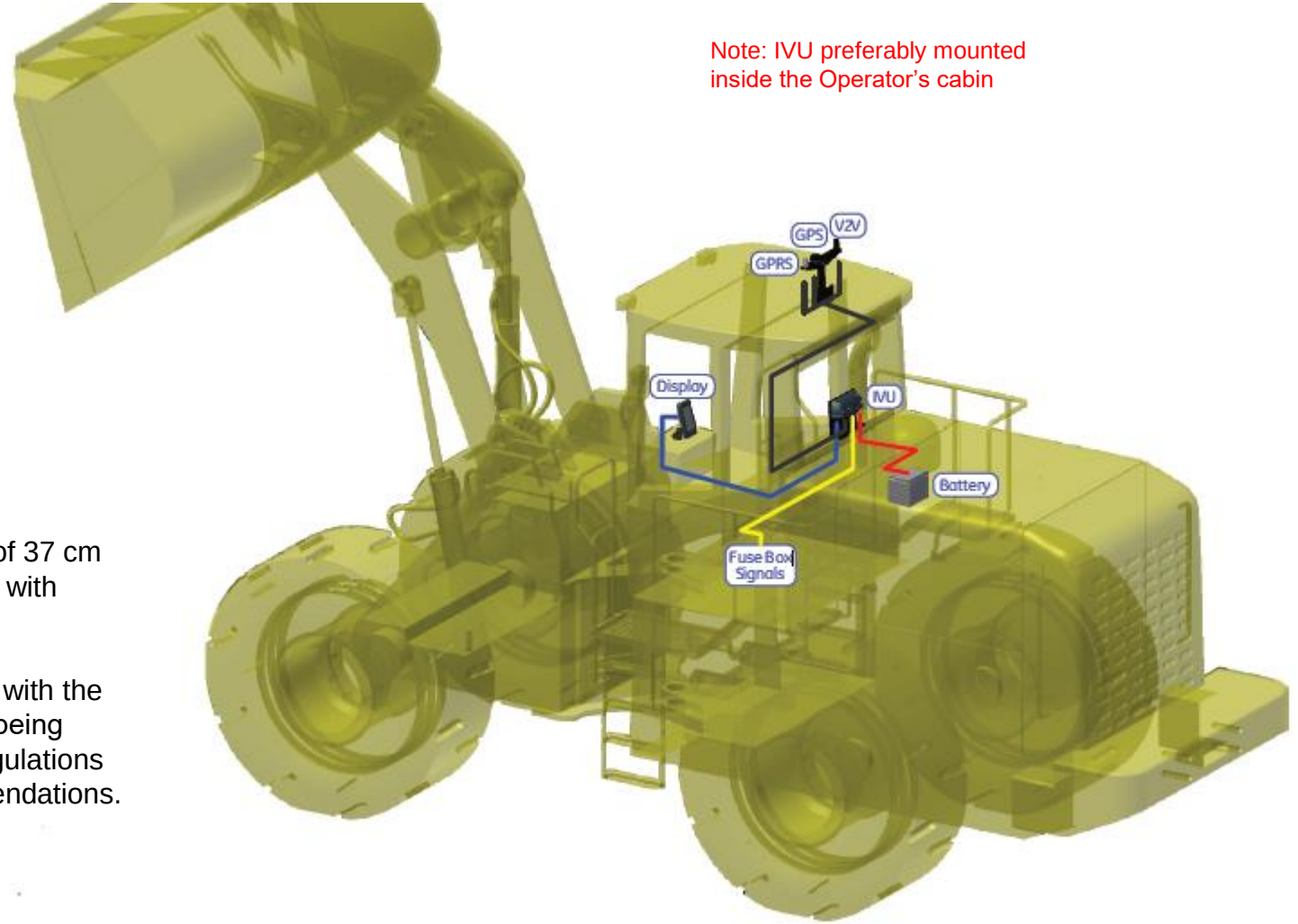
Available rubber inserts are:
32mm, 33.7mm, 35mm, 38.7mm, 40mm, 42mm, 45.5mm, 48mm, 51mm, 53.4mm, 56.4mm.

Available clamp bodies are:
38mm, 42mm, 44.5mm, 48.3mm, 50.8mm, 55mm, 57mm, 60.3mm, 60.5mm, 65mm, 70mm.





Heavy vehicle (excluding Haul Truck)



Note: IVU preferably mounted inside the Operator's cabin

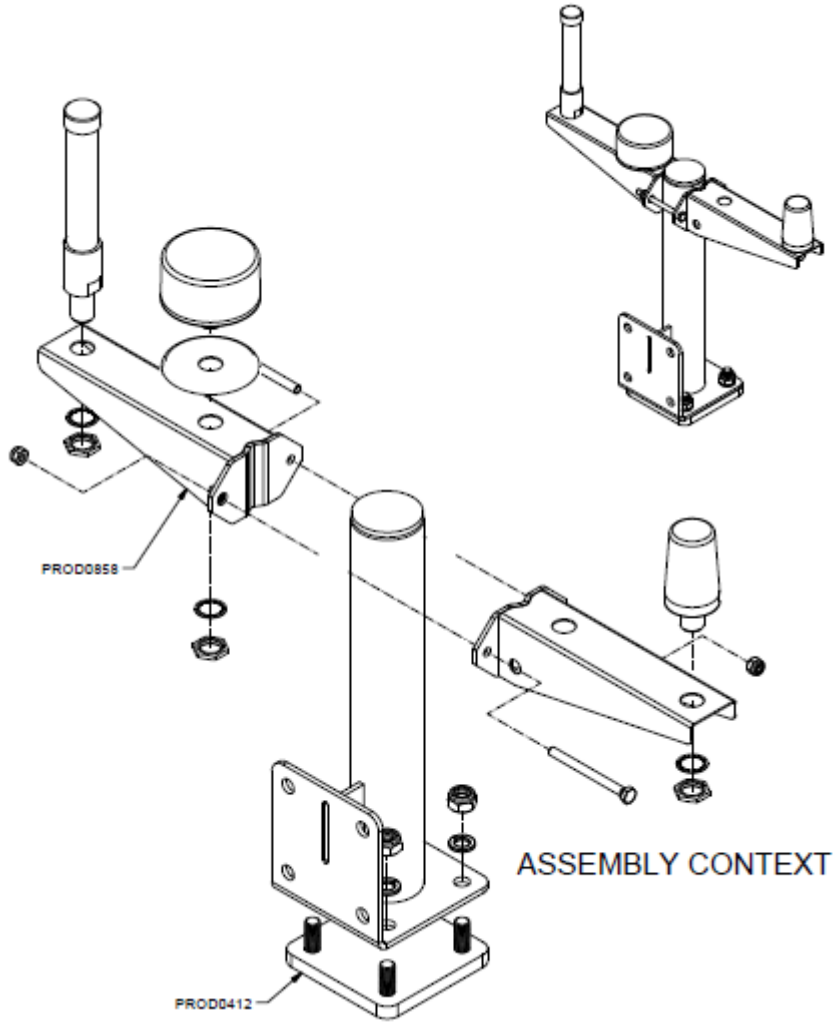
Notes:

- Antennas must be kept a minimum of 37 cm away from occupants in accordance with MPE Radiation Regulations.
- Consideration must be given to EMI with the vehicle's ECU when cable runs are being planned in accordance with local regulations and vehicle manufacturers recommendations.

Heavy vehicle (excluding Haul Truck)

Note:

An extended depth socket spanner may be required to tighten the antenna fixing nuts within the bracket channel.



Display Unit (PROD0839A)

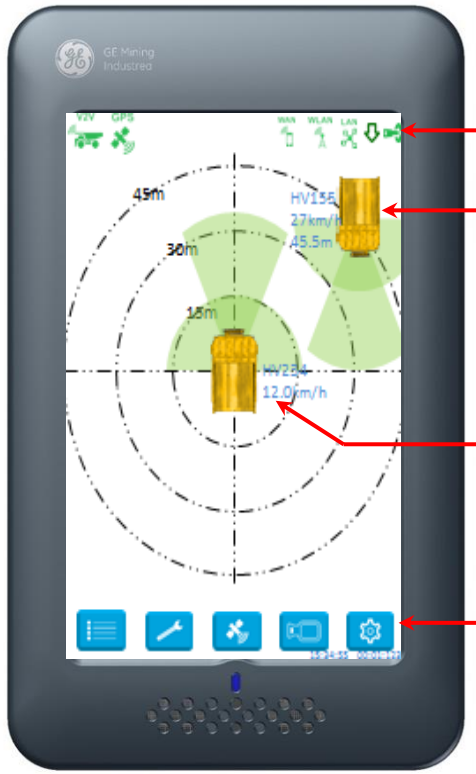
Display Unit (PROD0839A)

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 is compliant with vehicle manufacturer's instructions, national/local and site regulations.
- It does not to 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 Dashboard is not acceptable).
- The display of the installed equipment must never obscure nor obstruct instruments, vehicle controls or the swept area of the windscreen; neither should their operation distract or impede the driver.

Display Unit (PROD0839A)



Status Bar: Current status of system components

Approaching Vehicle: Vehicle ID, Speed Indicator and Distance

Your Vehicle: Vehicle ID and Speed Indicator

Special Functions Buttons: Menu, Configuration, GPS Data, Camera selection and Data

Display Unit (PROD0839A)

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

Display Unit (PROD0839A)

Connector: Electrical connection for power and signals

RAM Mount: Multi – axis adjustable mounting bracket

CAS-CAM/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.

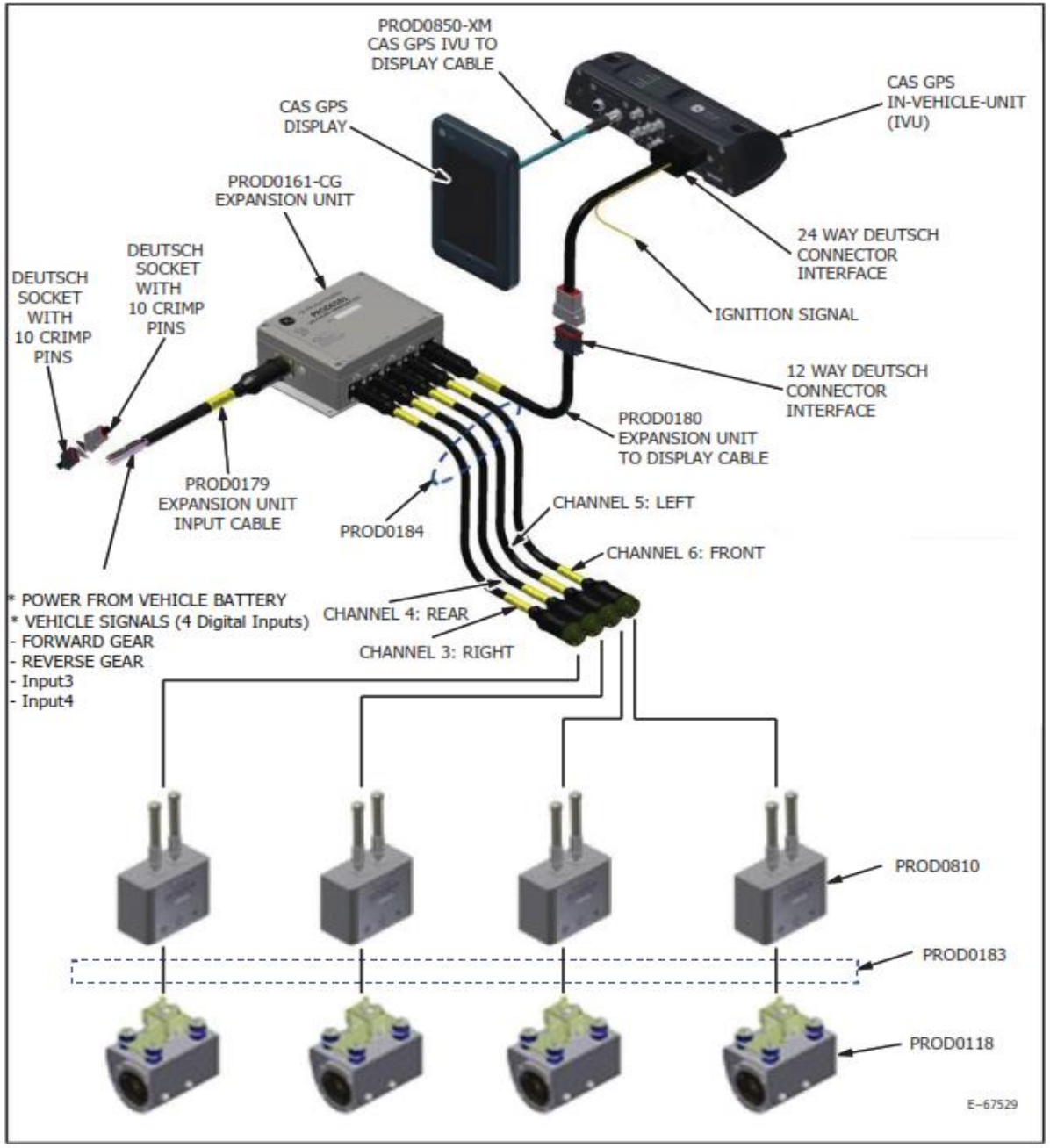
Upgrades

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.

Interconnections 4CAM/4RF

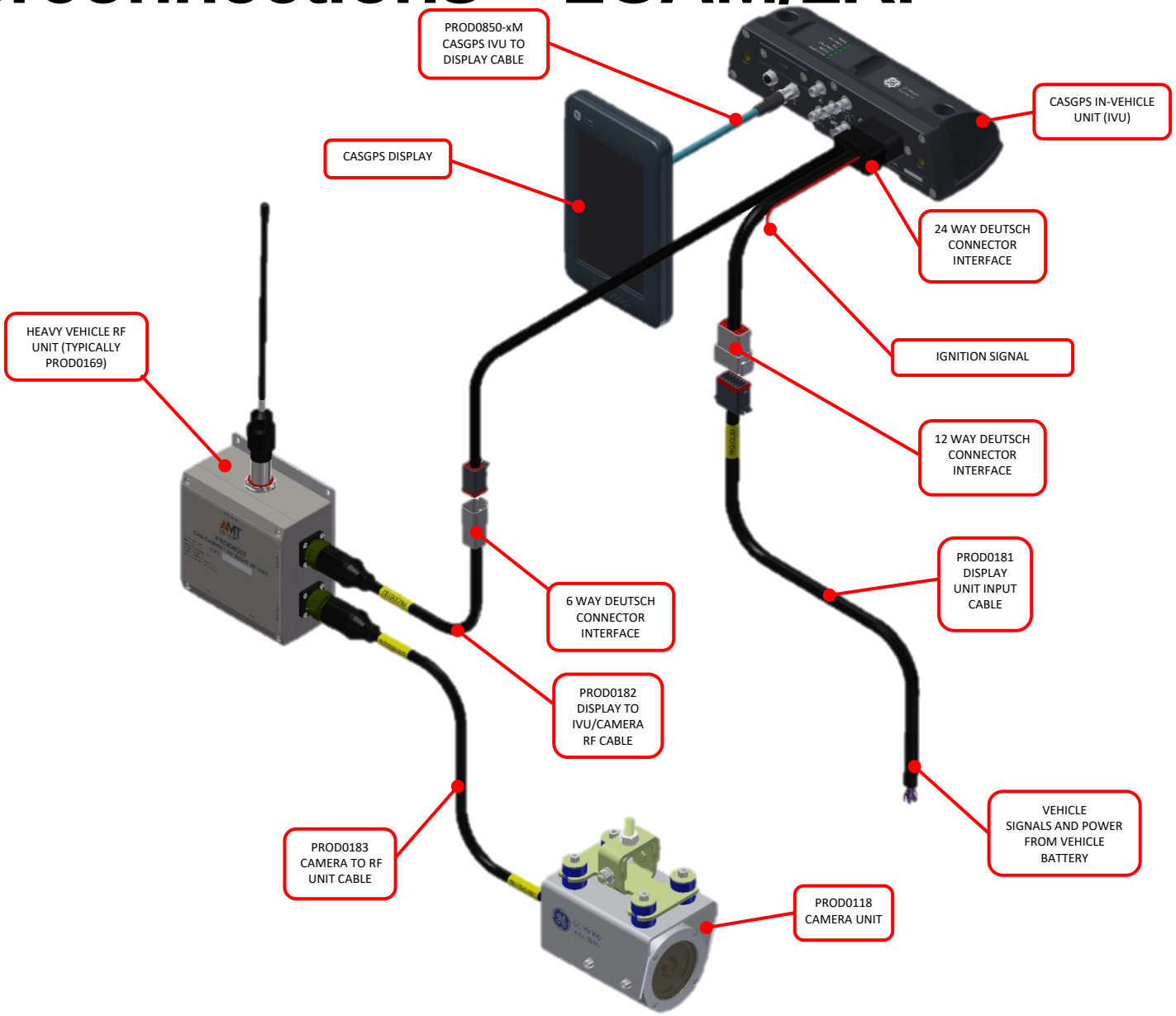


Interconnections – 4CAM/4RF

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
VOUT +	A	RED	1	PWR+ (Battery)	6
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
				Ignition (DI1)	4

Connections on PROD0179 – Expansion Unit inputs						
Signal	Wire Colour	Signal/Wire Marking	Deutsch Connector CONN0340	Deutsch Connector CONN0341	CABL0114 Wire colour	19- Way MILSPEC Connector
24VDC POWER (via 5A fuse)	RED	VIN+	1	1	Brown 18AWG	A
GND	BLACK	GND	2	2	Blue 18AWG	B
INPUT3	NC	IP3+	3	3	Green	G
GND	BLACK	IP3-	4	4	Yellow	H
INPUT4	NC	IP4+	5	5	White	J
GND	BLACK	IP4-	6	6	Blue	K
REVERSE GEAR (via fuse)	WHITE	REV DET+	7	7	Grey	C
GND	BLACK	REV DET-	8	8	Violet	D
NC	NC	NC	9	9	Orange	S
NC	NC	NC	10	10	Pink	T
FORWARD GEAR (via fuse)	YELLOW	FWD DET+	11	11	White/Black	E
GND	BLACK	FWD DET-	12	12	Pink/Black	F

Interconnections – 1CAM/1RF

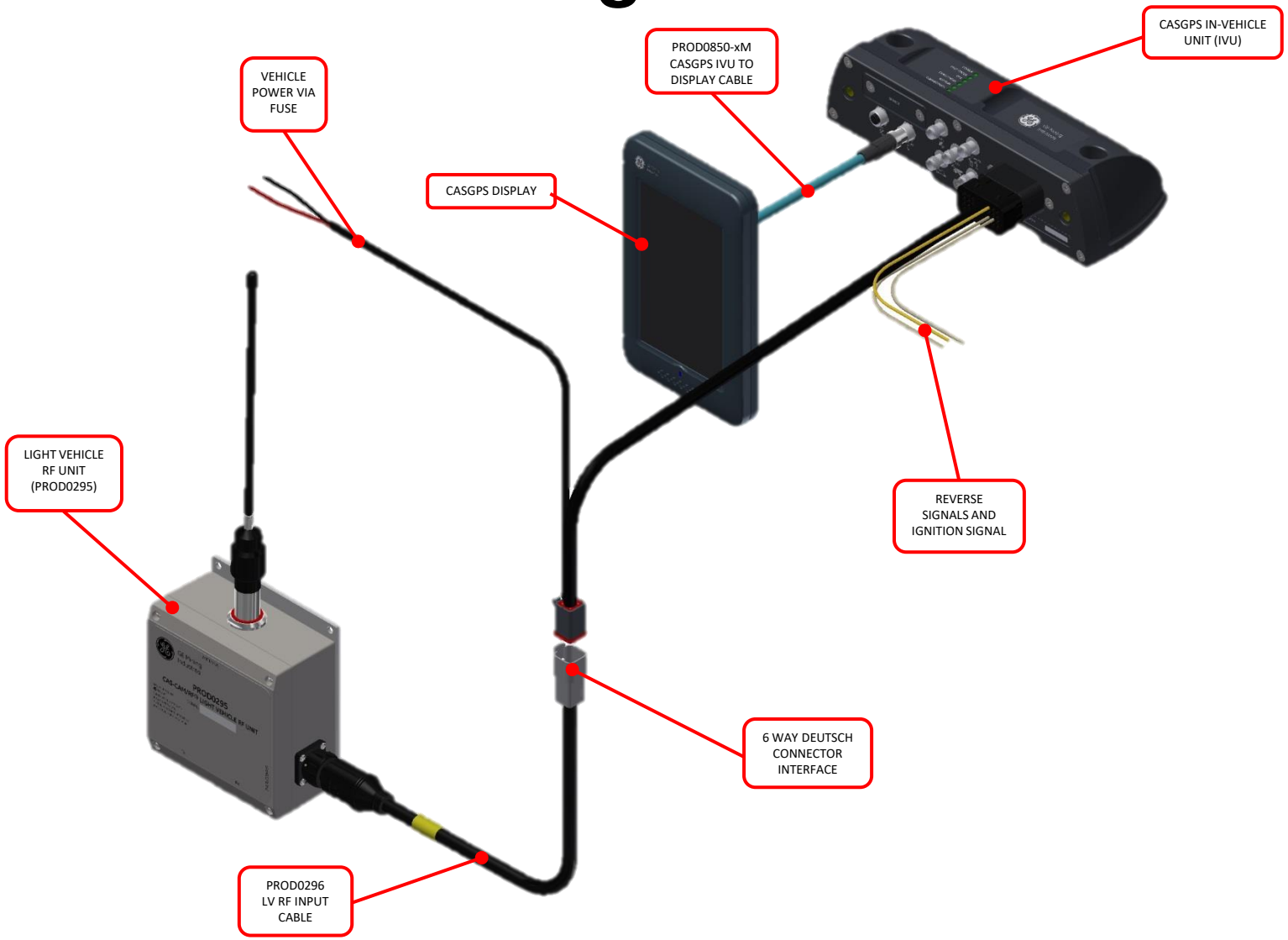


Interconnections – 1CAM/1RF

12 way Deutsch connector (PROD0181)		24 Way Deutsch Connector CASGPS IVU	
RED	1	PWR+ (Battery)	6
BLACK	2	GND	5
GREY	7	REV+ (DI3+)	16
VIOLET	8	REV- (DI3-)	17
WHITE/BLACK	11	FWD+ (DI4+)	22
PINK/BLACK	12	FWD- (DI4-)	23
ORANGE	9	BRAKE (DI2)	10
		Ignition (DI1)	4

Camera / RF Cable (PROD0182)			6 way Deutsch connector (PROD0182)	24 Way Deutsch Connector CASGPS IVU	
+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

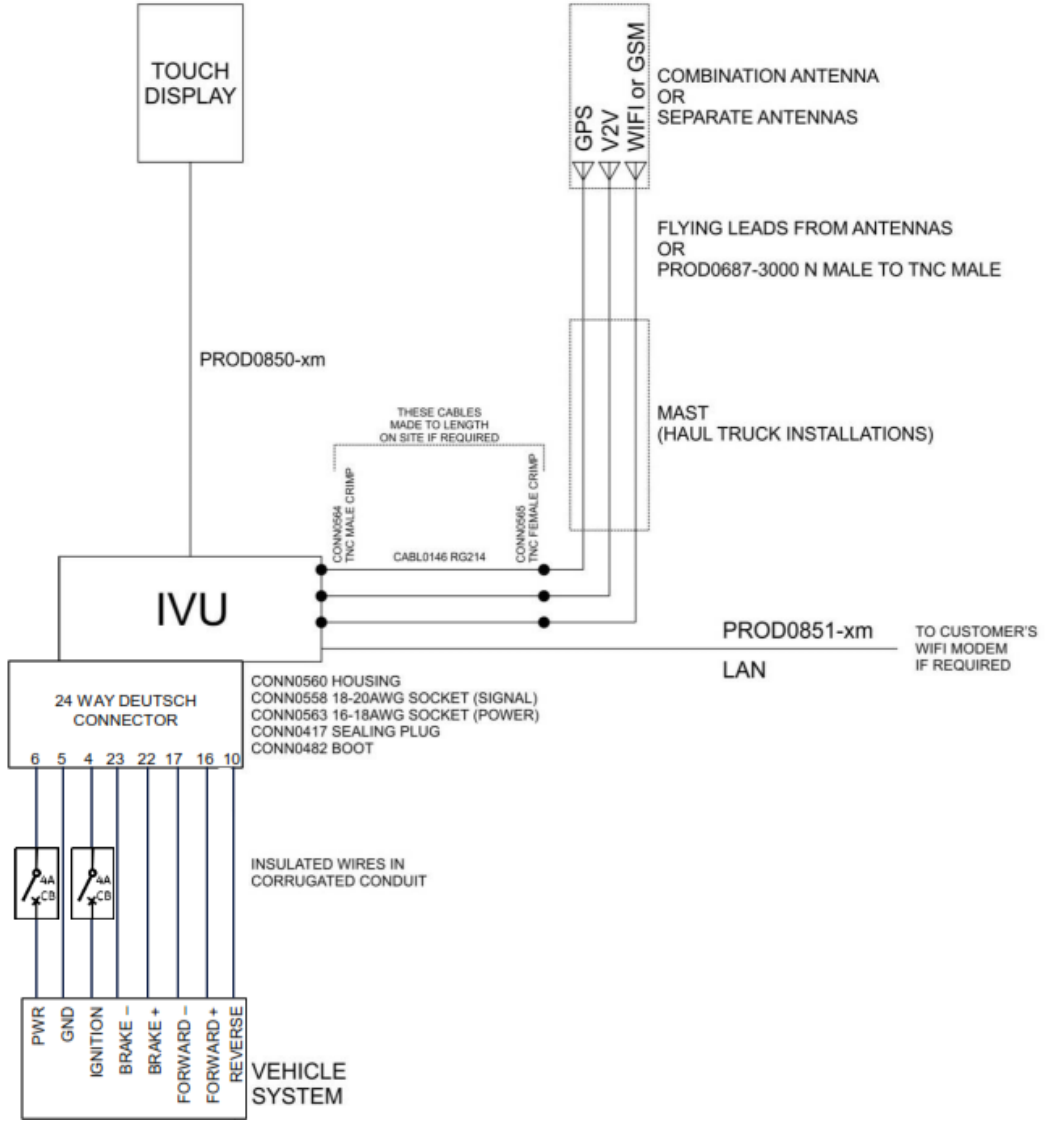
Interconnections – Light Vehicle



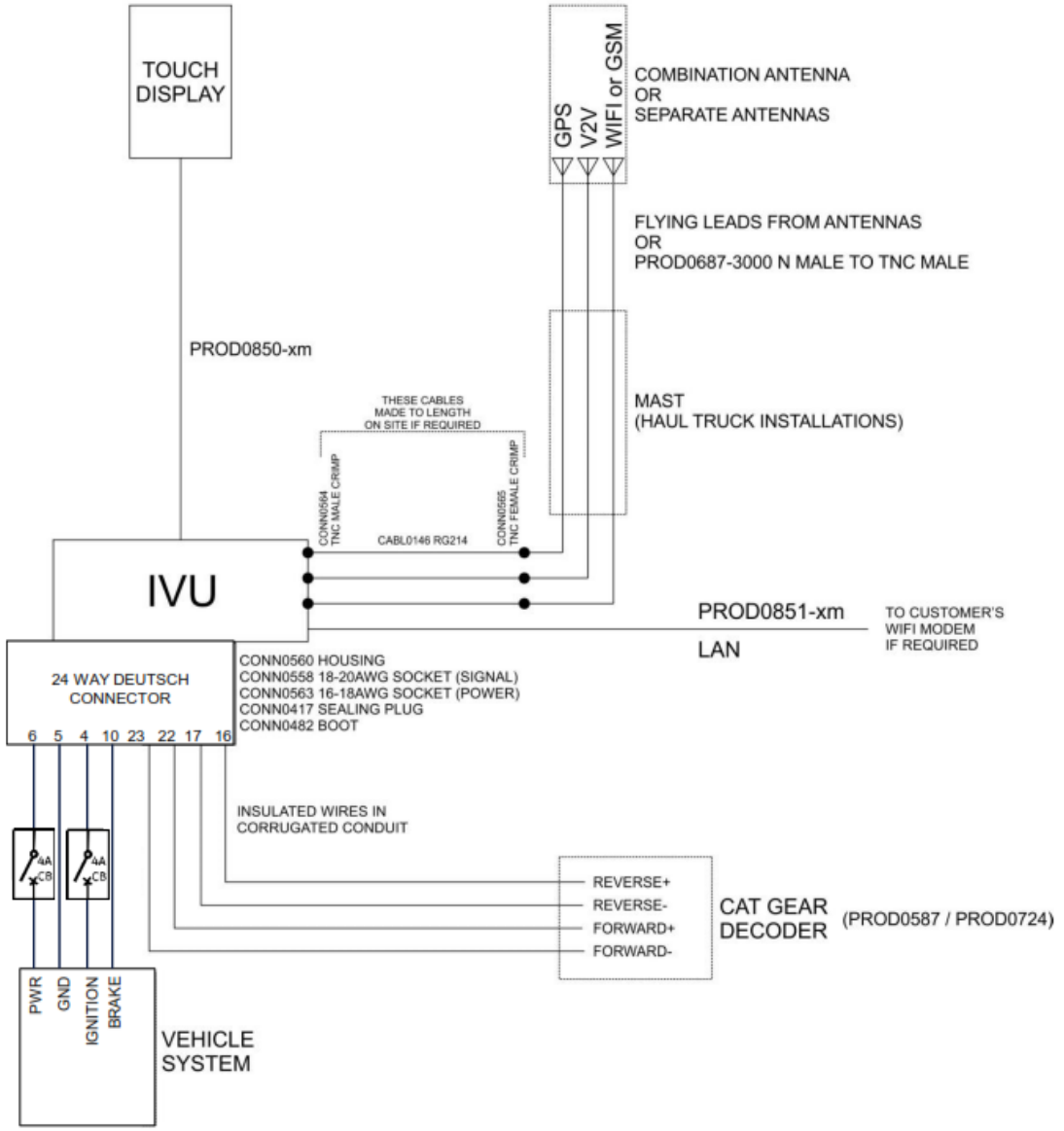
Interconnections – Light Vehicle

LV Power,		24 Way Deutsch connector CASGPS IVU		6 way Deutsch connector (PROD0296)	6 way Military connector RF Unit (PROD0296)	
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			
		Brake (DI2)	10			

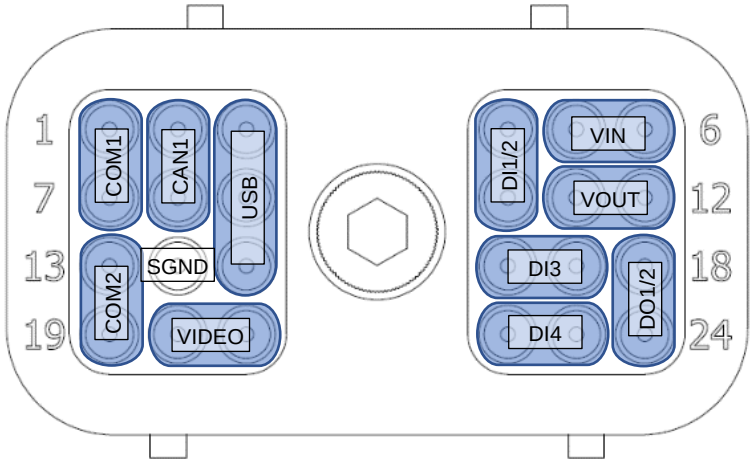
Input Power & Signal Connections – Basic CAS-GPS



Input Power & Signal Connections – Gear Decoder



Deutsch Connector



CONNECTIONS TO THE IVU ARE MADE USING DEUTSCH DRC26-24SA

Deutsch 24 pin	Wire Colour	Pin Designation	IVU Function	Heavy Vehicle CAS-GPS Signal	If CAS CAM RF or CAT GEAR decoder fitted	Subsystem/ Device
1		COM1	RS232 txd or RS485+	TXD		SmartCap or CASCAMRF LV
2		CAN	CAN High	CAN High		Self Test Node or LFM
3		USB5V	USB supply out	USB +5V		-
4	Yellow	DI1	Input 1+	Ignition +ve	Ignition +ve	Vehicle switched +ve supply
5	Black	GND	Ground	Ground	Ground	Vehicle –ve supply
6	Red	PWR	Input power +ve	Power in +	Input power +ve	Vehicle fused battery +ve
7		COM1	RS232 rxd or RS485-	Rxd in		SmartCap or CASCAMRF LV
8		CAN	CAN Low	CAN Low		Self Test Node or LFM
9		USBD	USBD-N	USBD-N		-
10	Blue	DI2	Input 2+	Reverse +ve	Brake +ve	Vehicle reverse +ve
11		GND	Ground	Ground		SmartCap or CASCAMRF LV
12		12Vo	+12V out	+ve supply out/enable		Self Test Node or LFM
13		COM2	RS232 txd or RS485+	RS485+		
14		SGND	Comms Ground	-ve supply		Self Test Node or LFM GND
15		USBD	USBD-P	USBD-P		-
16	Grey	DI3	Input 3+	Forward +ve	Reverse +ve	
17	Violet	DI3	Input 3-	Forward -ve	Reverse –ve	
18		DO1	Output +ve	DO1 +ve		
19		COM2	RS232 rxd or RS485-	RS485-		
20		VID	Video-	Video-		
21		VID	Video+	Video+		
22	White/Black	DI4	Input 4+	Brake +ve	Forward +ve	
23	Pink/Black	DI4	Input 4-	Brake -ve	Forward -ve	
24		DO2	DO2 +ve	Output 2+		

Input Power & Signal Connections

Input Power (Vin)

- Vin+ should be sourced after the isolator.

- **WARNING:**
  - The IVU remains powered for up to 14 hours after the input power has been Isolated.
- Input power / ignition pickup point must have inline short circuit protection, use supplied circuit breakers from installation kit.
  - 4A Resettable Circuit Breaker to be used on all vehicles for Ignition.
  - 4A Resettable Circuit Breaker to be used on all vehicles 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.

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 4 Amp 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.*

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
- Ethernet connections made to an IVU must be of a shielded construction

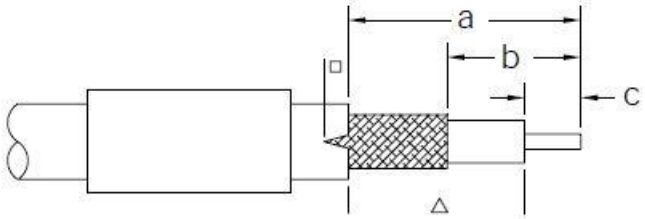
Antenna cable terminations

- 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.

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.

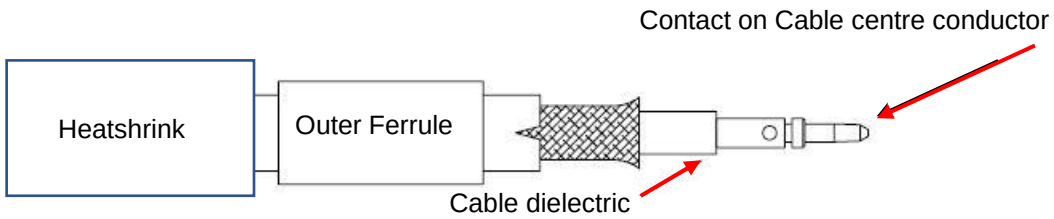


Cable Type	A (mm)	B (mm)	C (mm)
RG58 TNC	15.5	8	3.5
RG58 N	15.1	6.8	4
RG214 TNC	16.8	7.3	4.7
RG214 N	15.1	6.8	4

Antenna cable terminations

2. Slide heatshrink and 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.

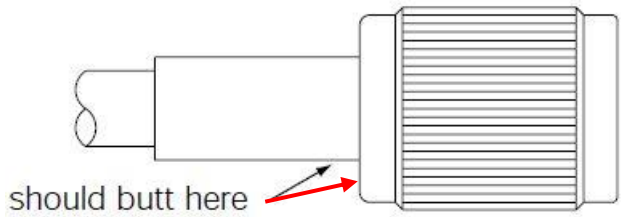


4. Place contact on cable centre conductor so that it butts against cable dielectric. Solder contact in place.

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.**

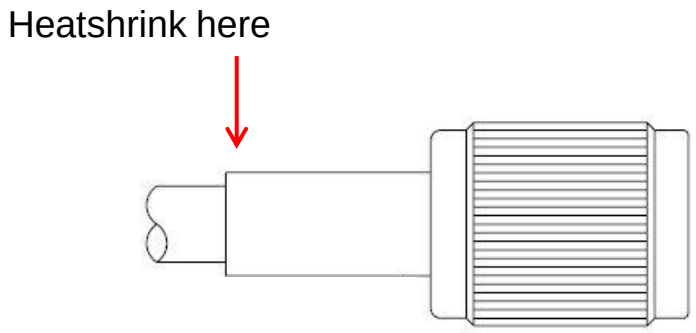
6. Slide outer ferrule over braid and up against connector body. Crimp outer ferrule using Die Set Cavity in table above.



Antenna cable terminations

7. Move the heatshrink up over the ferrule, and shrink into place using a heat gun

   This will aid in preventing moisture ingress to the termination.

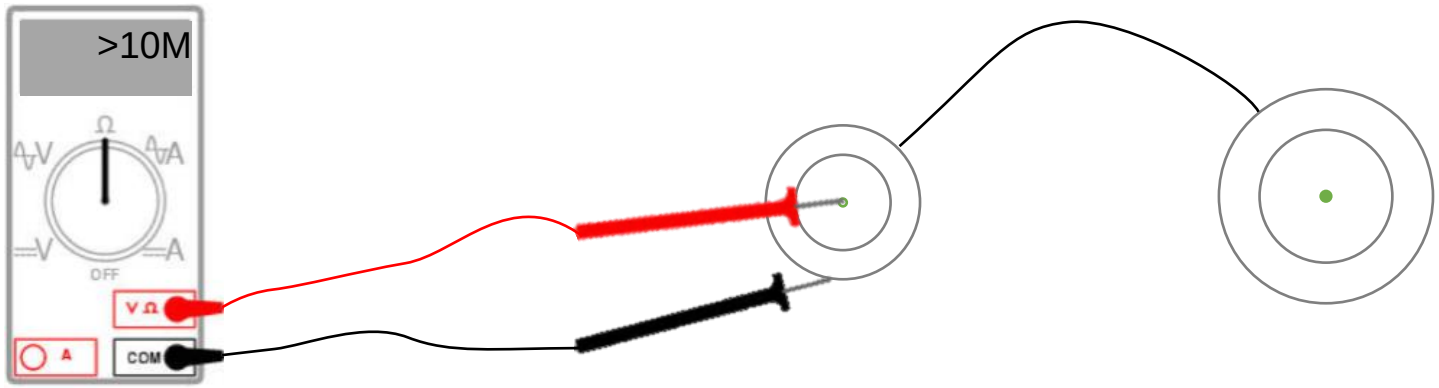


8. Repeat steps 1-7 for the other end of the cable.

Testing Antenna cable terminations

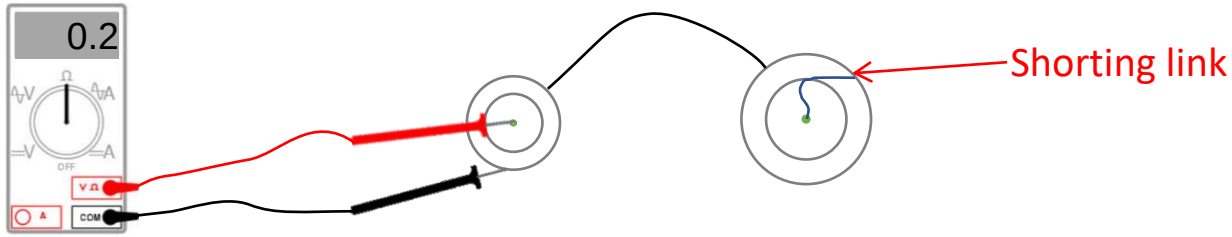
Test completed cable for continuity and short circuits by completing the following:

1. With both ends of the cable disconnected. Measure the resistance between the inner and outer conductors. Must be open circuit (>10MΩ)

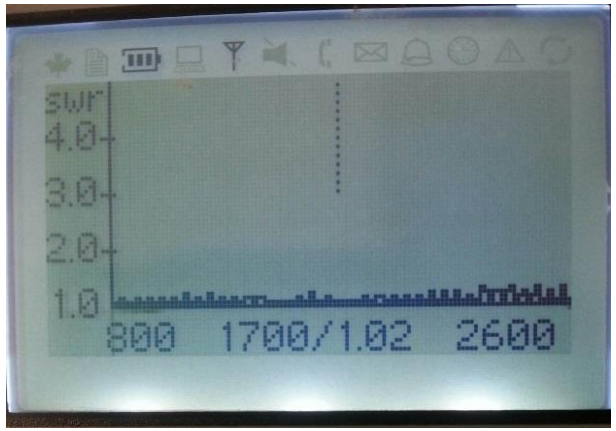


Testing Antenna cable terminations

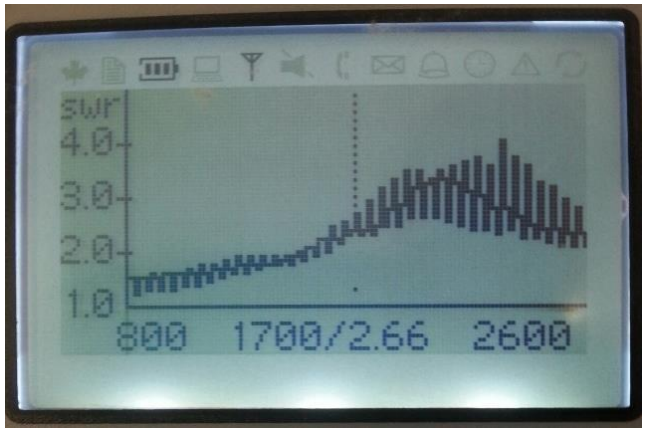
2. Short the inner to the outer conductor on one end of the cable.
3. Measure the resistance from the inner to the outer conductors on the opposite end. Must be low resistance (<1Ω).



4. If available, measure the SWR of the completed cable with a 50Ω dummy load installed in place of the antenna. SWR of cable should remain around 1 in the frequency range of 800MHz to 2.6GHz if terminations are good quality.
5. An SWR of 1.04 or higher should be corrected.



Good cable terminations



Poor cable terminations

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 self-amalgamating tape over the cable/antenna connection. This will prevent loosening and provide environmental protection
- Caution! Thread locking compounds are an electrically insulative material. If threads are covered with thread locker the antenna may not work! Ensure electrical conductivity after installation.

Configuration

The following pages instruct on the configuration process for CAS-GPS.

They are straight forward with no laptop being required.

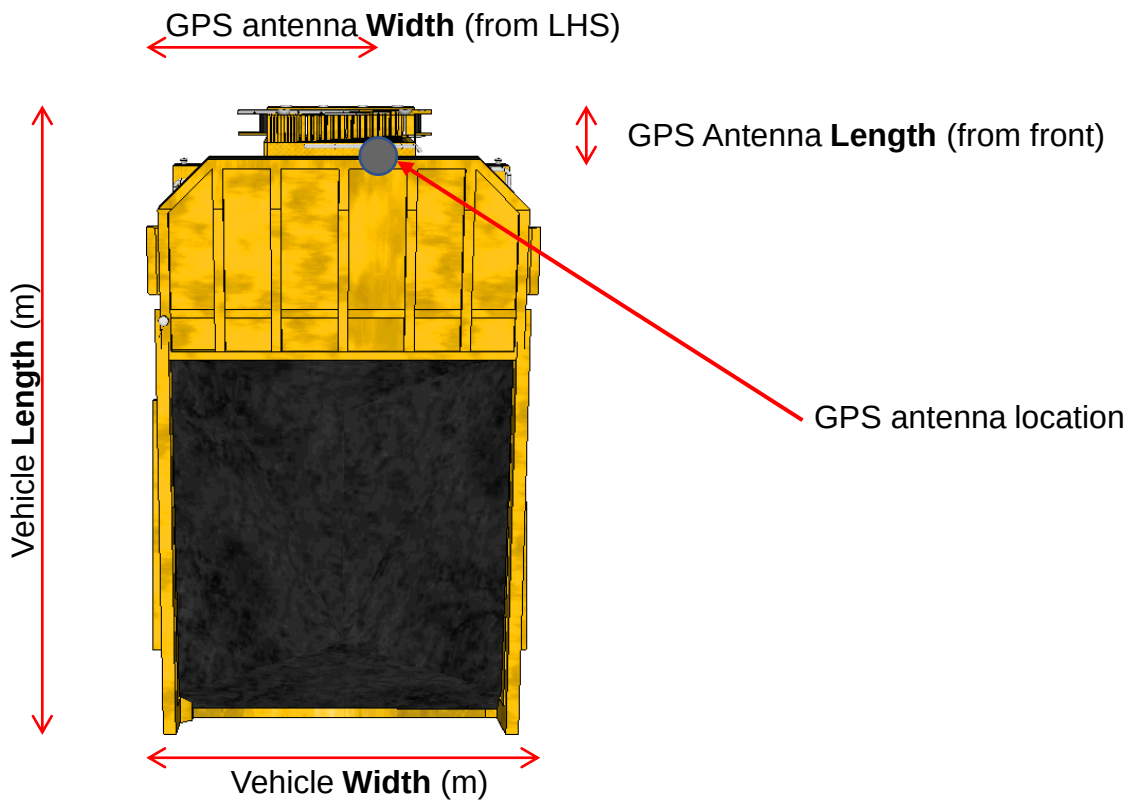
Configuration is programmed through the Graphic User Interface. (Display)

Note:
The Installer will need to obtain the site specific passcode from the Site Supervisor to complete the following process.

Configuration – Installation Measurements

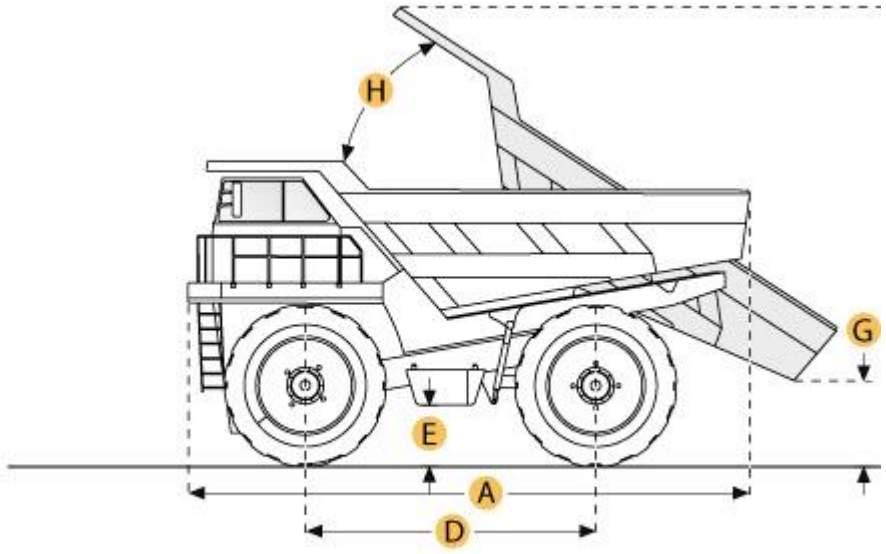
The measurements indicated here are the dimensions of the machine and GPS Antenna location.

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.

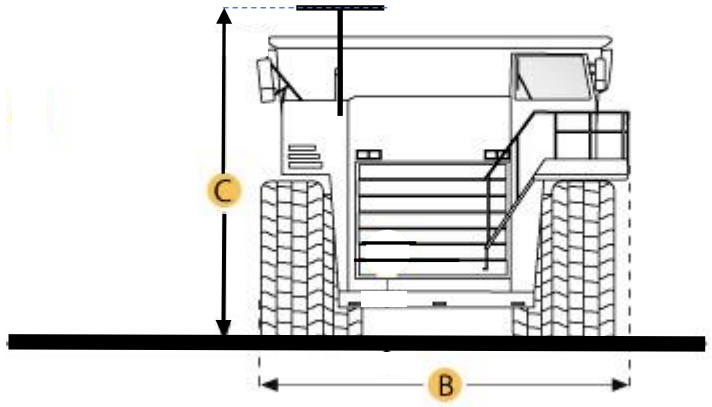


A = Truck Length

Configuration – Installation Measurements

Measurements shown here are an example of a Haul truck.

C = GPS antenna height

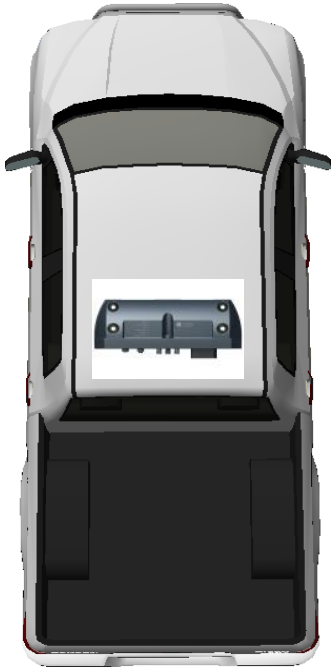


B = Truck Width

IVU Orientation

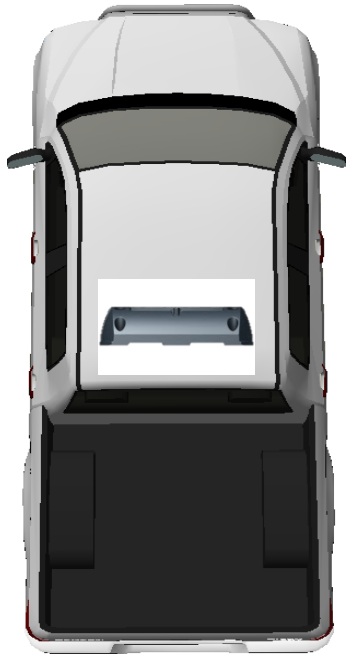
- The orientation of the IVU must be recorded so that the 3 axis accelerometer can be correctly calibrated
- The table (right) should be used to determine the orientation number of the installed IVU
- The orientation is referenced to the vehicle if viewed from above when travelling towards the top of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

IVU Orientation (examples)



Orientation Number 1

IVU mounted on the internal floor surface

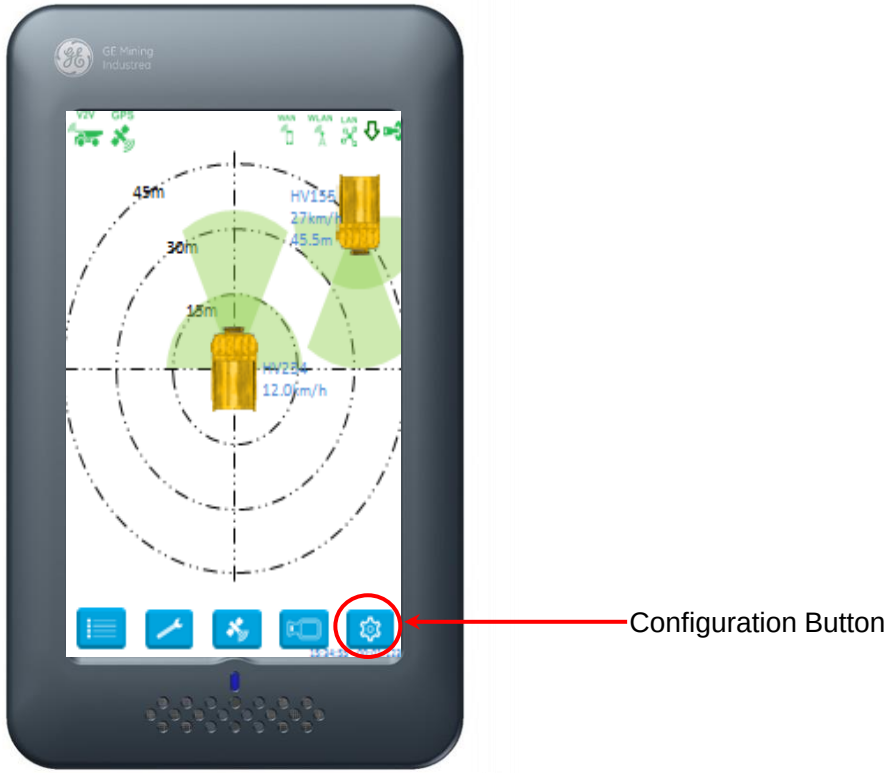


Orientation Number 7

IVU mounted inside cabin behind the rear seat

Configuration

Use the button at bottom of Display to access CAS-GPS CAS Installer window.



Configuration Setup

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

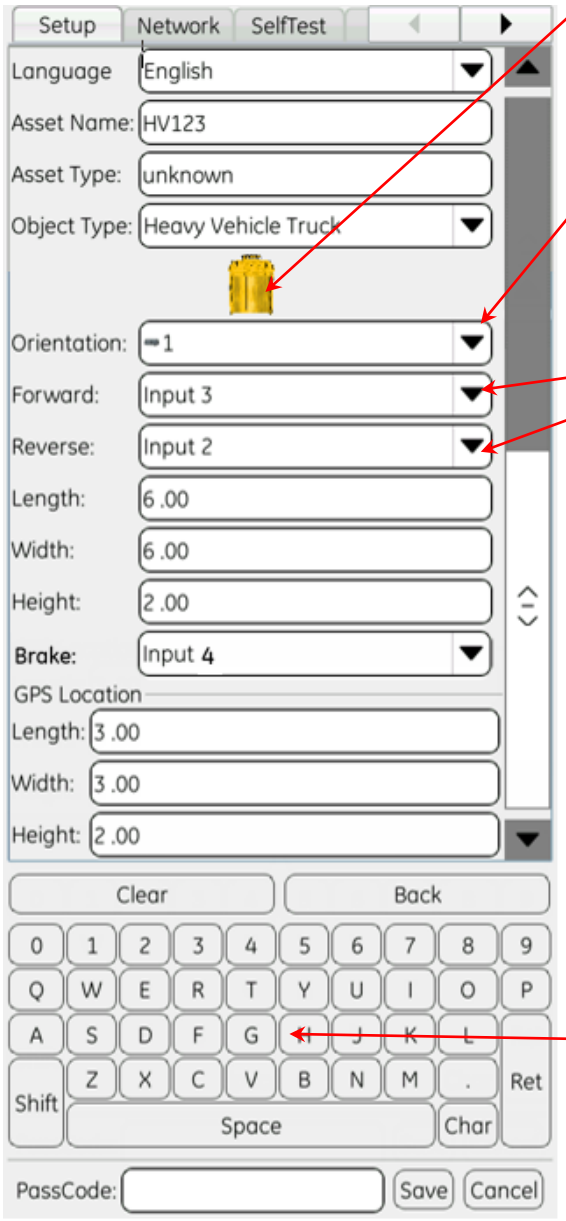
The **Asset type** provides a record of the make and model of the vehicle.

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.



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 previously in this manual.

Inputs – refer Deutsch Connector table on page 41

Keyboard

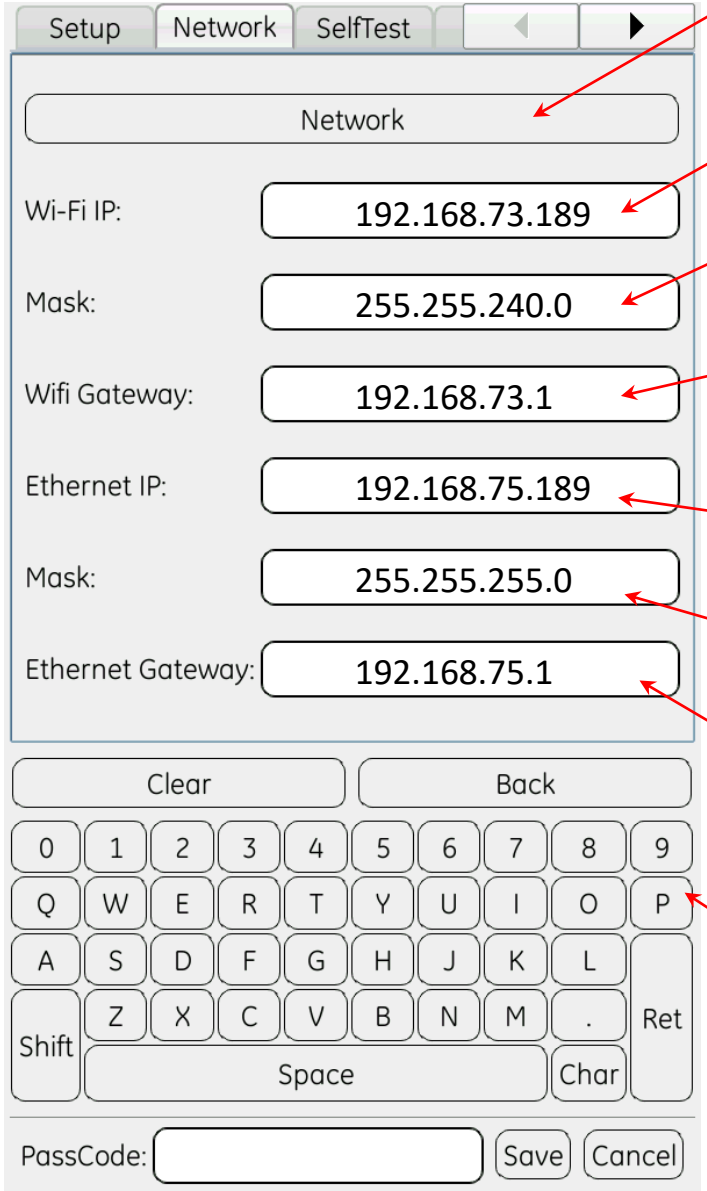
Network Configuration

Network Addresses are by default Dynamic until manually assigned in the Network Settings Page at which point they will be stored as static addresses.

Static Addressing must be assigned by your network administrator to avoid conflicts.

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.

Note:
Refer also DOCU0139 CASWeb User manual



The **Network** button shows connection status and settings

Wi-Fi IP: Enter the assigned Wi-Fi IP Address for the Vehicle

Wi-Fi MASK: Enter the assigned Wi-Fi MASK for the Vehicle

Wi-Fi GATEWAY: Enter the assigned Wi-Fi GATEWAY for the Vehicle

Ethernet IP: Enter the assigned Ethernet IP Address for the Vehicle

Ethernet MASK: Enter the assigned Ethernet MASK for the Vehicle

Ethernet GATEWAY: Enter the assigned Ethernet GATEWAY for the Vehicle

Keyboard

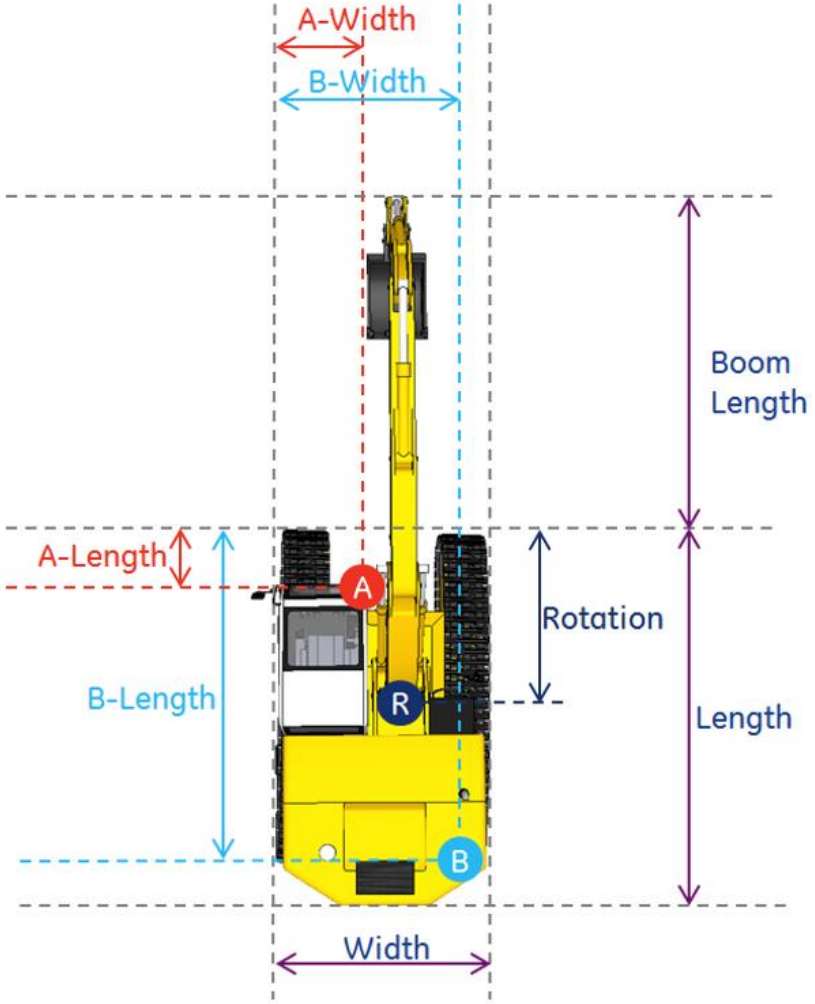
Shovel with Heading Overview

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

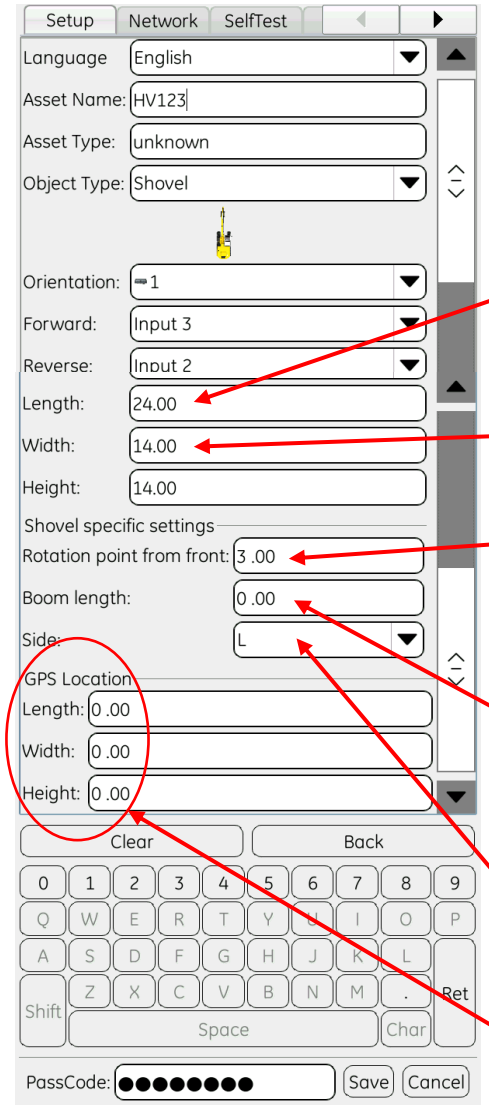
To provide the minimum error the antenna connected to the IVU and the node should be installed as far apart as possible on the machine.

The IVU's GPS antenna (A on diagram) should be located near the operator's cab. The node (B on diagram) should be located on the opposite side and to the rear of the Shovel.

This diagram is available in the "Help" tab.



Shovel IVU Configuration – Setup Tab



Configuration should only be completed once the IVU and node are installed and have power.

On the “Setup” tab the following items are significant for the IVU:

Length: The length of the body of the Shovel (not including the boom)

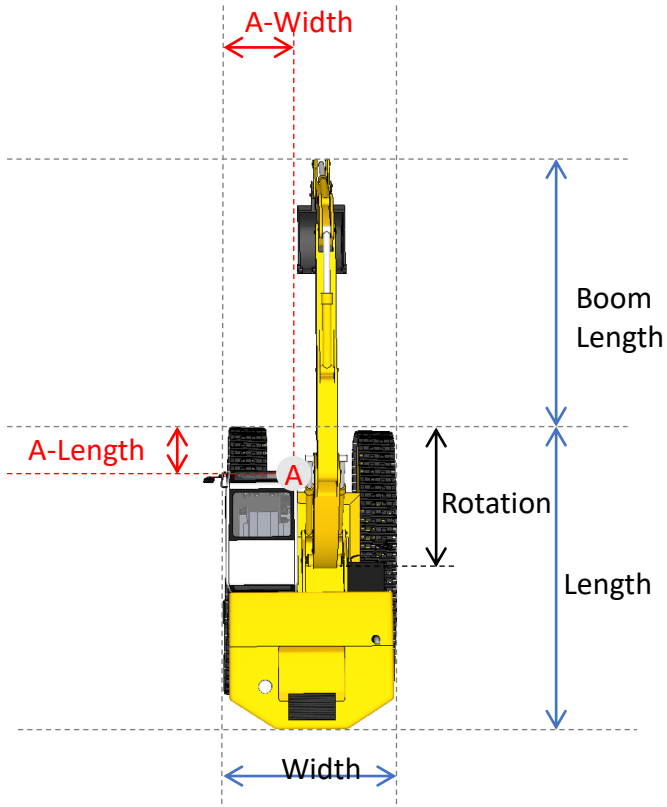
Width: The width of the body of the Shovel

Rotation point from front: is the distance from the front of the body to the center of the rotation point

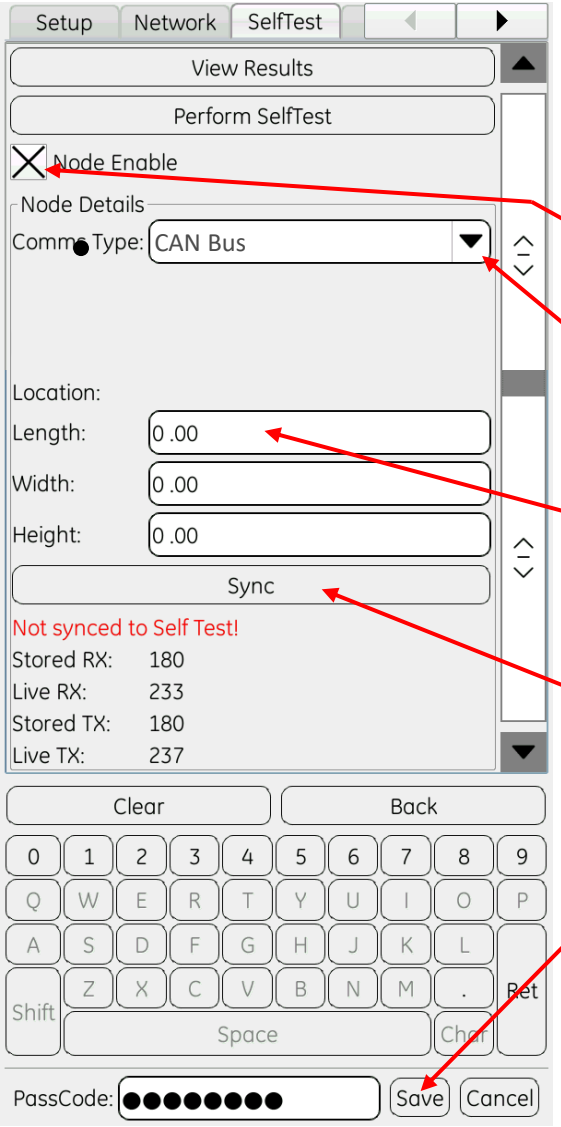
Boom length: The maximum length of the boom extending past the body (at maximum extension)

Side: Side of the body that the operator’s cabin is on

GPS Location: This is the location of the IVU’s GPS antenna (A) relative to the front left corner of the body. (Same as for any other vehicle)

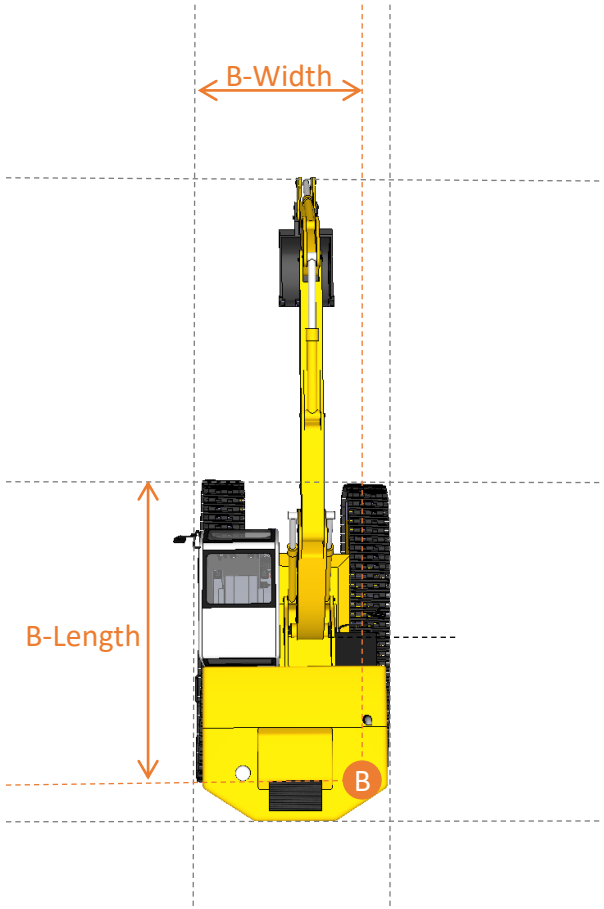


Shovel IVU Configuration – Self-Test Tab



On the “SelfTest” tab, settings in this tab relate to the node that will provide the second GPS signal:

- **Node Enable:** This box must be checked
- **Comms Type:** This should be set to “CAN Bus”. To change this box you must enter the passcode.
- **Location:** This is the location of the node GPS antenna (B) relative to the front left corner of the body.
- **Sync:** Press this button to synchronise the stored RX and TX values. This allows the IVU to continually test its V2V to ensure that the TX and RX signal strength does not vary significantly from the time of installation.
- **Save:** to finish press Save

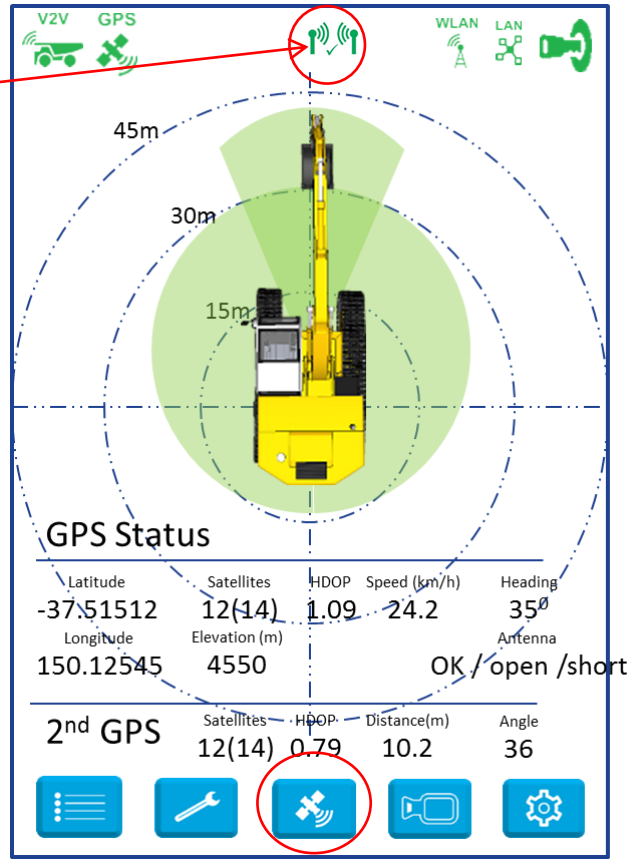


Node Installation

Refer to DOCU0088 *CAS-GPS SELF-TEST SUB-SYSTEM INSTALLATION MANUAL*

Shovel Heading Testing

The second status icon indicates the communication status to the node:



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 GPS information.

Shovel Heading Testing

The GPS icon 

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

If the GPS icon change to yellow, this indicates that the IVU no longer has a valid heading.

Potential causes:

- Loss of communication between IVU and node (will be indicated by the status icon ).
- Loss of GPS signal to IVU or node (indicated by poor HDOP reading >4).
- Poor GPS signal to IVU or node (indicated by poor HDOP reading >4).

Configuration & Install Record

On completion of the physical installation:

- Complete the Installation Checklist to ensure & record 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)

CAS-GPS 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-GPS 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)	
Self Test	
Mounting secure	
Cable run and connection secure	
Test self test unit as per engineering install document xxxxxx	
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	
GEAR DECODER	
Mounting is secure	
Cable run and connection secure	
Forward and Reverse ICON apear on the screen when in gear	
SmartCap App on GE-CAS	
Comms to Server indicator - see bottom left corner of SmartCap screen on GE Display	
Dock cards in Base - indicate 1,2 or 3 Cards in Base	
Procesor Card - Read sensor label from APP on Display and Sticker and confirm Sensor	
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	
All antennas minimum 35cm from nearest occupant's position?	
Self Test and Blue tooth is functional	
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 dimentions correctly configured and recorded on the ITP	
GPS location correctly configured and recorded on the ITP	
End to End Test	

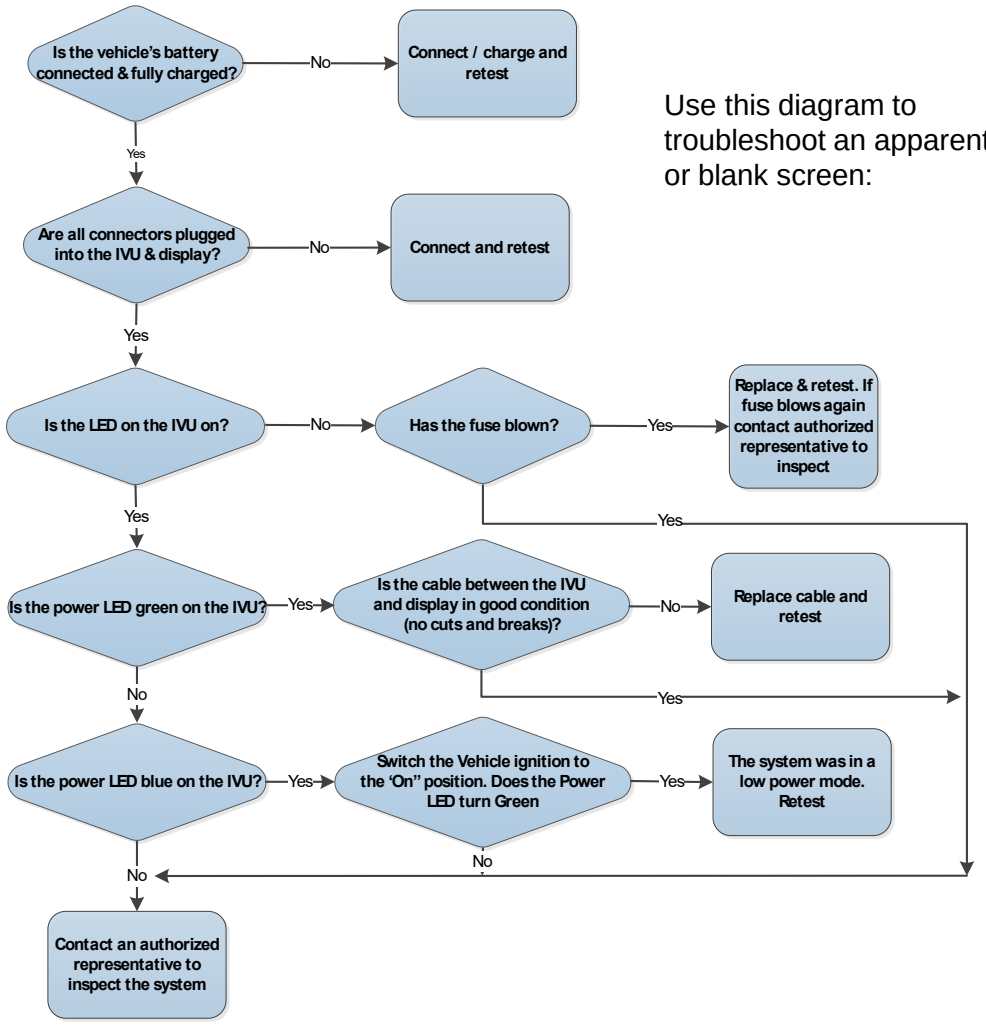
ITP NUMBER:	AMSA-XXXX-0000	**CAS GPS NEW INSTALL**			
Project:	CAS GPS AMSA	Site:		Date:	
Vehicle Type:		Call sign No		Owner:	
Vehicle Make & Model:		Vehicle ID		Installer	
System Number					
Installation Start Date and Time:				Total Hours:	
Installation Finish Date and Time:					
INSTALLATION TEAM					
Name		Position	JSA/Take 5 Completed	Signature	Hrs on Vehicle
IVU Serial #			**Display S #**		
CONFIGURATION ITEMS					
Self Test Serial #			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#			Self Test Distances		
Antenna safe distances, (35cm minimum)		GPS min dist from nearest occupant	cm	RF min distance from nearest occupant	cm
Supervisor Name:			**Supervisor Signature:**		
Additional Comments:					
Acceptance Date and Time:			**Recordable Delays**		
Client Representative Name:			**Client Rep Signature:**		
Client Comments:					
Delay details:					

Record Keeping

- Take photographs of the completed installation (for future reference and record of installation).

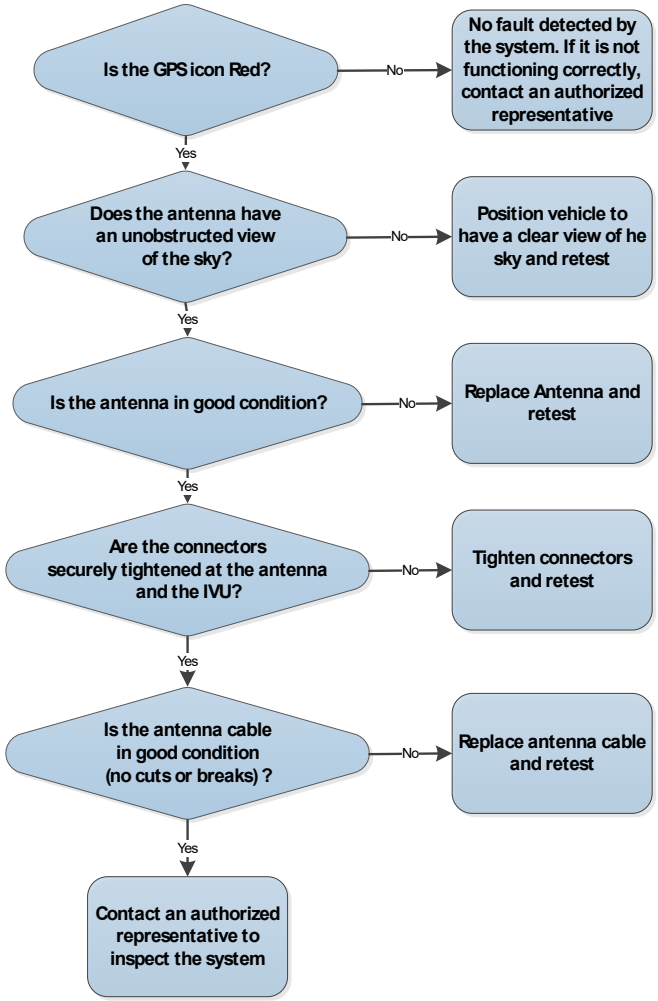
- Provide all completed installation records to the Site Supervisor.

Trouble Shooting - No power / Blank screen



Use this diagram to troubleshoot an apparent loss or blank screen:

Trouble Shooting – GPS problems



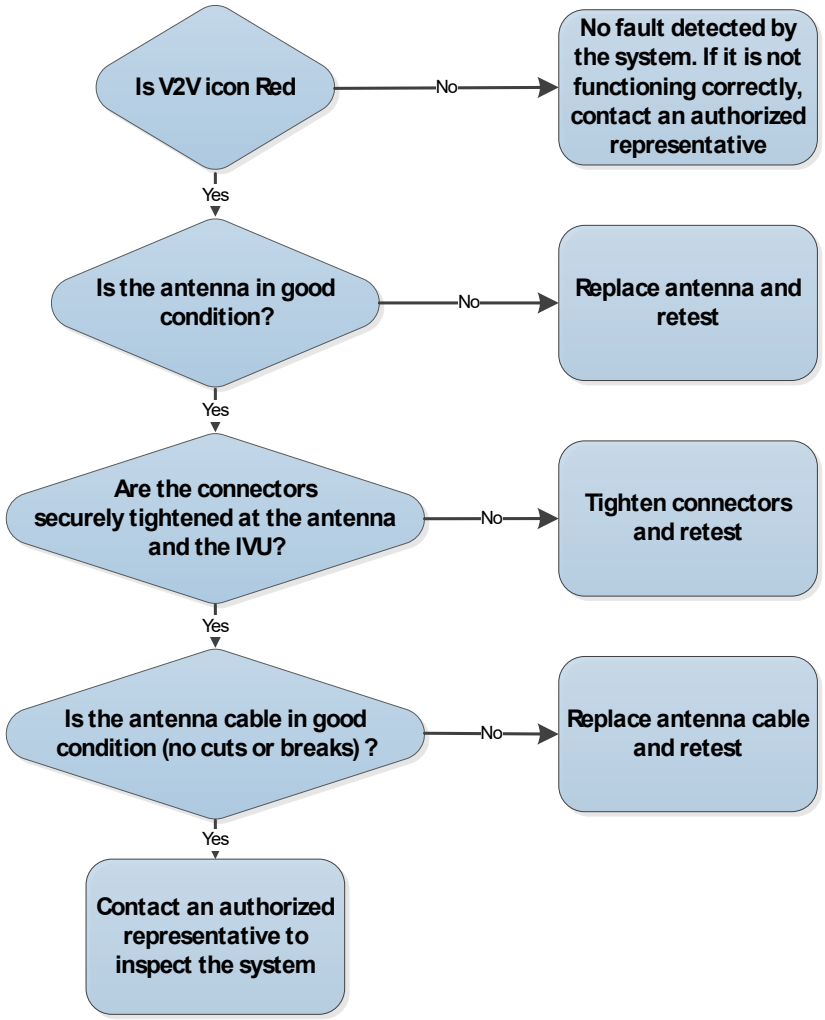
The GPS signal status is indicated by the colour of the GPS ICON at the top of the display.

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

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.

Service and Maintenance

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 recommencement of operations

Decommission

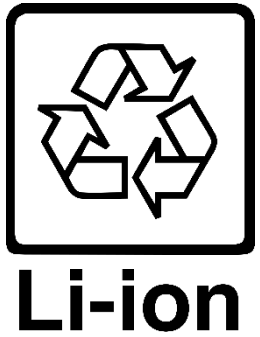
- Removal of the system should only be performed if authorised by the owner of the vehicle.
- Removal should only be performed by a qualified Auto Electrician.
- All system components and wiring should be removed.
- All vehicle wiring should be restored back to original condition.
- Dispose or store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

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.



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 Digital Mining Technology.
  A detailed risk assessment must be conducted.

Disclaimer

These materials are provided for information purposes only, "as is," without express or implied warranty of any kind.

WABTEC CORPORATION MAKES NO ANY EXPRESS OR IMPLIED WARRANTY OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE OR ANY OTHER EXPRESS OR IMPLIED WARRANTY REGARDING ANY PRODUCTS DESCRIBED IN THESE MATERIALS. TO THE MAXIMUM EXTENT PERMITTED BY LAW, WABTEC CORPORATION DISCLAIMS ANY AND ALL IMPLIED WARRANTIES THAT MIGHT OTHERWISE ARISE OR APPLY, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE.

WABTEC CORPORATION further makes no representation or warranty of accuracy of these materials and neither WABTEC CORPORATION will have no responsibility or liability for any error or omission in these materials.