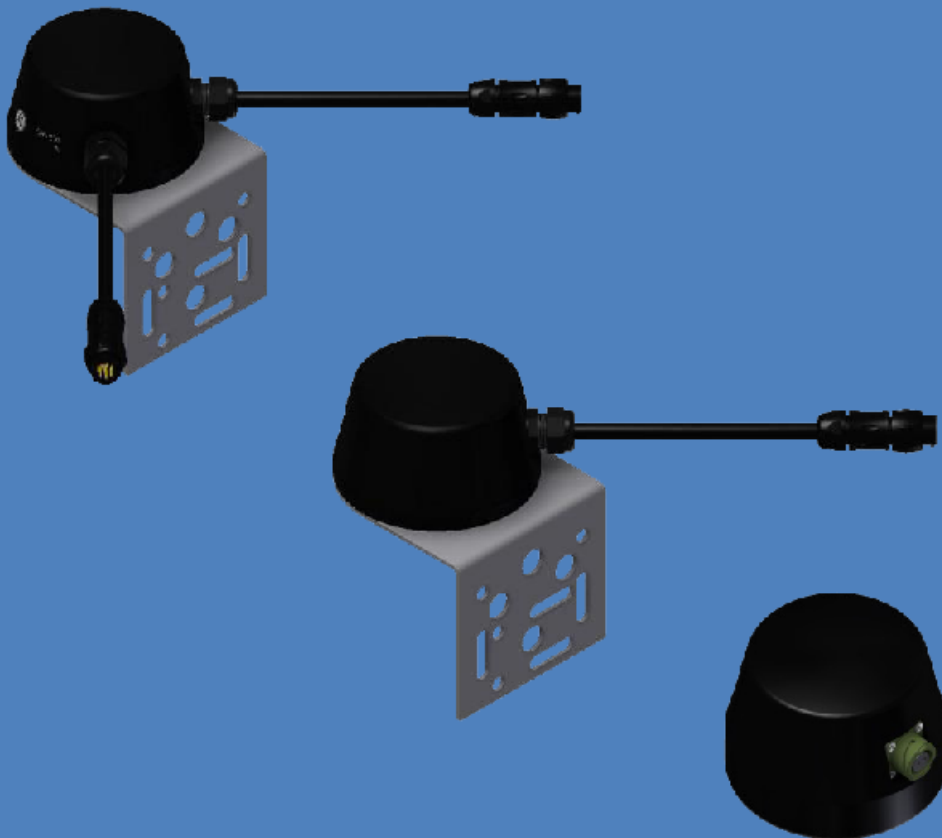


CAS GPS Node

PROD1052



User Manual

Rev A

DOCU0097

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imagination at work

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Document Revision

REV	DESCRIPTION	Author	Review	Approval	Date
A	Initial Release	APT			

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1 Warnings



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



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. Interaction include 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.



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.



Do not weld on ROPs!



Do not drill through ROPs!

2 Company Details

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3 Scope

CAS GPS Node User Manual

This user manual covers the following variants of the CAS GPS Node system:

PROD1052-LRx	Light Vehicle Fixed Expandable Installation Node
PROD1052-LFx	Light Vehicle Fixed Installation Node
PROD1052-LPx	Light Vehicle Portable Node (Bluetooth®)
PROD1052-BGx	Boomgate Node
PROD1052-STx	Self Test Node

3.1 CAS-GPS NODE VARIANTS

The CAS-GPS Node family of products are available in region / customer specific configurations for compliance with local radio regulations.

PROD1052-LRx

Suffix '1' includes 868MHz V2V radio. (South Africa)

Suffix '2' includes 920MHz V2V radio. (Au, US, CAN, Brazil, Indonesia)

Suffix '3' customer specific configuration for V2V radio

3.2 Abbreviations

Abbreviation	Meaning
IVU	In Vehicle Unit
GPS	Global Positioning System
CAS	Collision Avoidance System
LAN	Local Area Network
Wi-Fi	Wireless Communication Medium
GSM	Global System for Mobile Communications
OEM	Original Equipment Manufacture
V2V	Vehicle to Vehicle
RF	Radio Frequency
PDA	Personnel Digital Assistant

3.3 Definitions

Term	Definition
"system"	Refers to the assembled and installed operational elements which together perform the desired functionality.
"system components"	Refers to the individual single elements which when assembled together at the point of installation form the "system". Each of these elements has a unique part number.

4 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 GE Mining immediately.

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

5 Storage

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

All equipment should be stored indoors protected from the elements in a cool dry area. If storing on the ground, ensure that the storage area is not an area where water will collect.

All equipment which contains batteries, must be placed in "Transit Mode" prior to storage. This mode disables the battery.

6 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.

7 Installation

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

8 Test & Commission

At installation time, the system must be checked against the installation test procedure (ITP) to verify the system is correctly installed and functioning as required. After passing its final installation test, the system is then ready for use after which inbuilt self-diagnostic testing combined with daily user monitoring ensures that any faults can be acted upon.

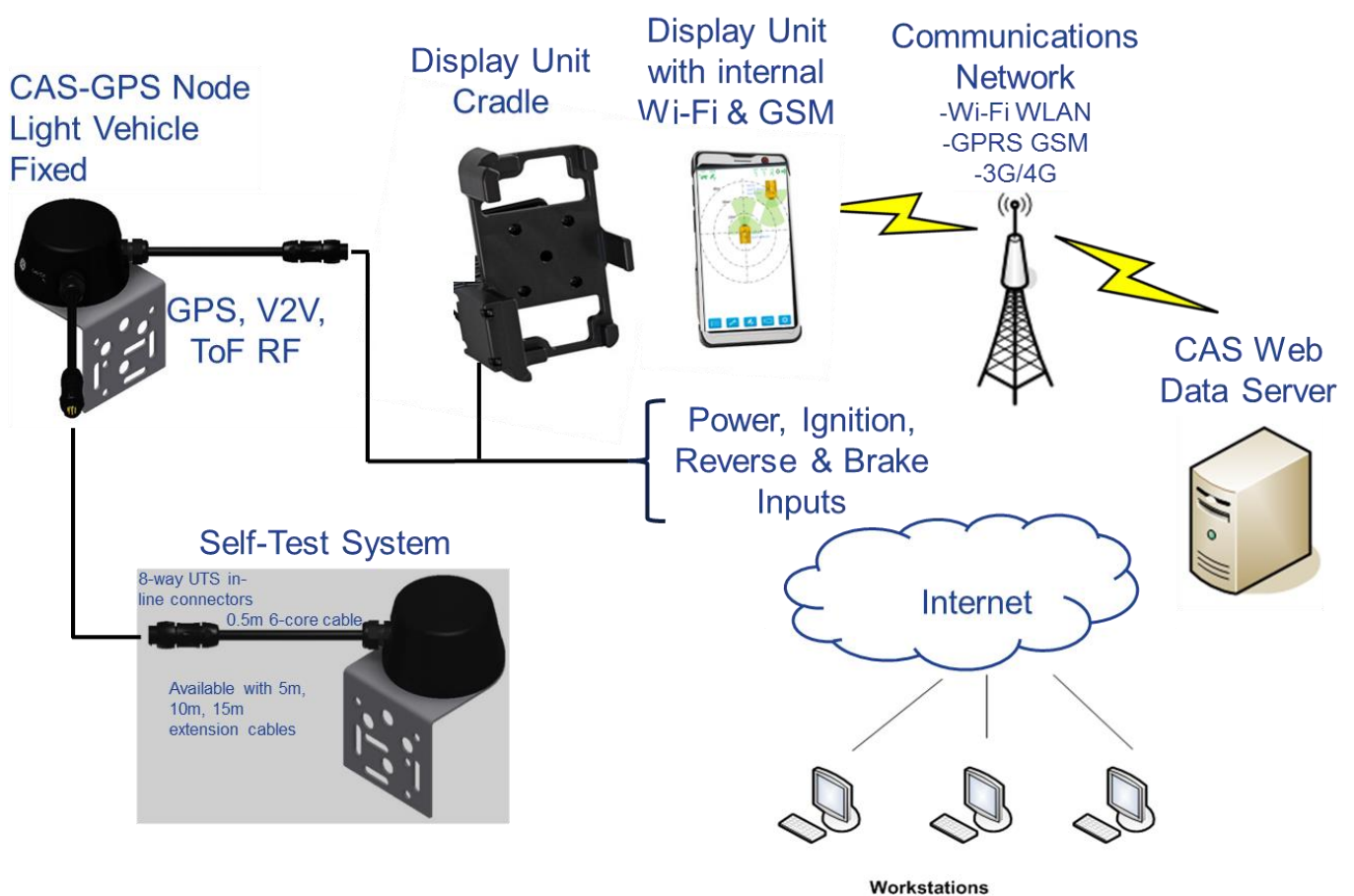
9 Operation

9.1 Principle of Operation

The CAS-GPS Intelligent multi-purpose node comprises of a high performance GPS receiver, Vehicle to Vehicle (V2V) radio transceiver, high accuracy Ranging RF transceiver, CAN bus, RS-232 / RS-485 communications, Digital Input (2) / Output (1), Bluetooth® wireless technology and internal battery that is available in the following configurations:

1. **Light Vehicle roof unit (fixed configuration)** – unit communicates with the Display Unit in the Operator’s cabin via a fixed cable using RS232 communications. The roof unit is powered from the vehicle battery which also serves to charge the optional internal back-up battery.
2. **Light Vehicle roof unit (portable configuration)** – magnetic base unit which communicates with the Display Unit in the Operator’s cabin via Bluetooth® wireless technology. The roof unit is battery powered. Suited to Light Vehicle portable installations deployed on a daily basis.
3. **Light Vehicle Fixed Expandable Installation Node** – same operation as “Light Vehicle roof unit (fixed configuration)” with the addition of extra connections for downstream use of Light Vehicle Fixed Node unit for additional accuracy.
4. **Self-Test** – fixed unit that enables automatic real-time functional health monitoring of a primary CAS-GPS/RF system on a vehicle without the requirement for a remote Test Station or operator interaction. Communicates with the In-Vehicle-Unit (IVU) or Light Vehicle Display Unit. Suited to Light or Heavy vehicle installations.
5. **Boomgate** – unit which communicates with machines via V2V radio and operates a boomgate via contacts.

Typical Light Vehicle Topology



9.2 Positional Tracking

The system uses the latest precision point GPS technology which gives accurate location-based tracking.



For the GPS to work accurately the Node must have clear line of sight to the sky. Obstructions such as machine structure, work roof or deep pit may affect the accuracy or operation of the GPS.

9.3 Connectivity

The Node communicates in the following ways:-

- with the In Vehicle Unit (IVU) via CANBUS + RS485
- with the light vehicle PDA via Bluetooth® (Portable) or RS232 (Fixed)
- other vehicles and nodes via RF radio
- Physical Devices via Inputs and Outputs

9.4 Key Components

9.4.1 PDA Cradle

The PDA Cradle securely holds the PDA for use in the vehicle.



9.4.1.1 Fixed Installation of PDA Cradle in Vehicle

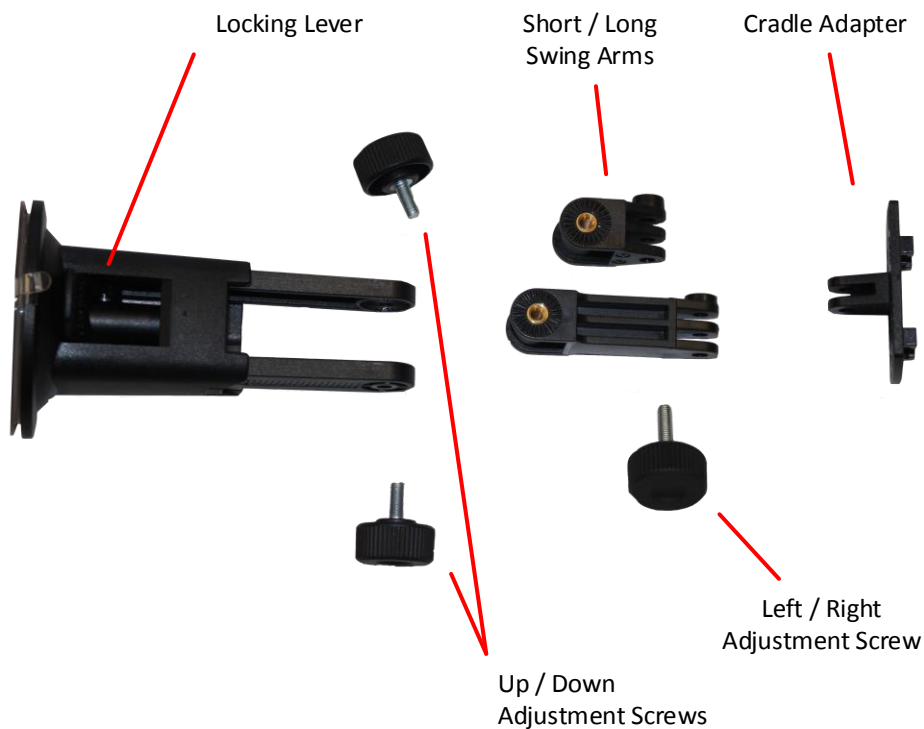


The PDA Fixed Cradle must only be installed by an authorised person.

See Installation manual for detailed instructions.

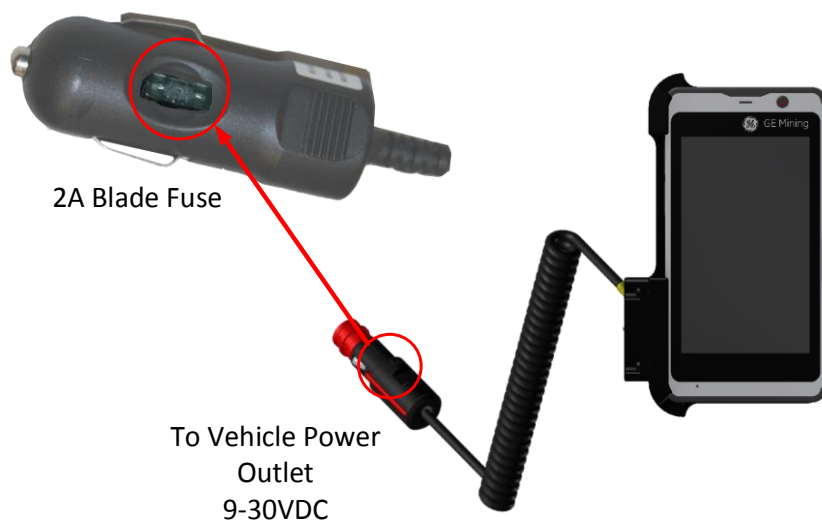
9.4.1.2 Suction Cup Installation of PDA Cradle In Vehicle

- Clean the mounting surface thoroughly. Ensure that the surface is completely dry and free of any dirt or residue. For best results use rubbing alcohol or similar to clean the surface prior to installation.
- Determine placement of your suction cup by using the cradle as a guide.
- Once satisfied with the location for the suction cup, remove the cradle from the suction cup and push the suction cup into place – the suction cup should hold in this position without any weight on it.
- Ensure the rotational alignment is correct.
- Push the locking lever towards the mounting surface to secure in place.
- Adjust the Up/Down and Left/Right Alignment of the cradle by releasing the adjustment screws and moving the cradle with your hand.
- Ensure all adjustment screws are tight prior to fitting the PDA to the cradle.



9.4.1.3 Charge Cable for Portable Installation

The charge cable for the Portable Cradle is fixed to the cradle and needs to be plugged into a power outlet in the Light Vehicle. There is a 2A replaceable fuse in the plug to protect the system.



9.4.1.4 Cable Connections for Fixed Installation



The PDA Fixed Cradle must only be installed by an authorised person.

See Installation manual for detailed instructions.

9.4.2 Node

9.4.2.1 Fixed Node

The CAS-GPS NODE Light Vehicle Fixed unit comprises of a high performance GPS receiver and on-board digital radios for ranging measurements, Bluetooth® wireless technology and point to multipoint communication.

The unit is powered from 12 – 24VDC vehicle derived power supply and features 2 x digital inputs for control signals & 1 x RS232 communication port for primary communication to the in-cab GE Personal Digital Assistant (PDA) running the CAS-GPS application software or communication to a PROD1052-LRx node to provide an on-board system functional test.

This roof mounted unit optionally features an internal battery back-up for continuous operation during a vehicles powered down state.

Bluetooth® wireless technology provides a secondary communication link to the in-cab PDA to allow for real time situational awareness of the CAS-GPS enabled fleet.

When used for connection to a PDA, the Light Vehicle Fixed Node requires control signals for reverse and brake to be routed to the digital inputs for complete system functionality.

9.4.2.1.1 Fixed Node Installation



The CAS GPS Node must only be installed by an authorised person.

See Installation manual for detailed instructions.

9.4.2.2 Portable Node

The CAS-GPS NODE Portable Light Vehicle unit comprises of a high performance GPS receiver and on-board digital radios for ranging measurements, Bluetooth® wireless technology and point to multipoint communication.

The unit is charged from a 12 – 24VDC power supply and features magnetic mounts for quick installation on visiting site vehicles, allowing full functional situational awareness integration with the existing CAS-GPS enabled fleet.

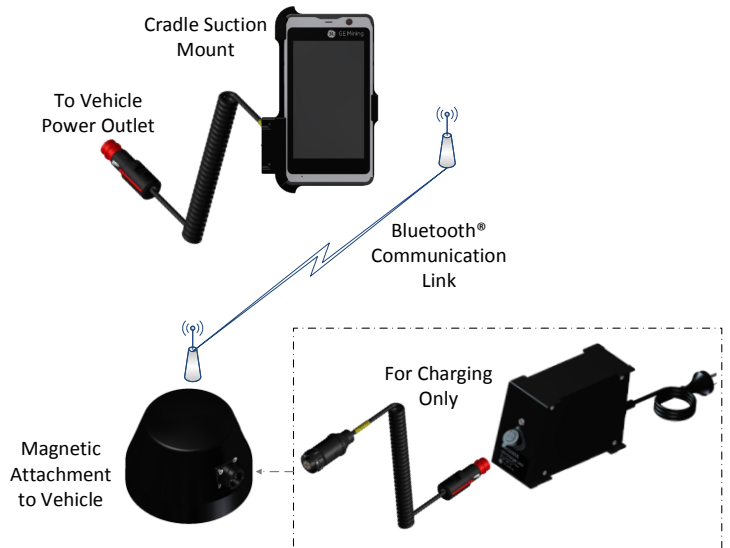
This roof mounted unit features an internal rechargeable battery for continuous operation for 24 hours without the need for cabling.

Bluetooth® wireless technology provides a primary communication link to the in-cab PDA to allow for real time situational awareness of the CAS-GPS enabled fleet.

9.4.2.2.1 Portable Node Installation

The Portable Node is attached to the vehicle using a magnetic base. The Node must be installed on the vehicle such that:-

- It has a flat smooth and clear surface to fix to
- It does not protrude from the vehicle or in a position where it may be damaged
- It does not obstruct the driver's view
- It has a clear line of sight to the sky
- It is a minimum of 300mm away from any other communication antenna
- Magnets should be kept clean from dust for maximum effect.
- It is mounted in a position so that all 3 magnets are positively attached to a ferromagnetic vehicle surface



Avoid harsh braking whilst in use to minimize the chance of the node becoming dislodged in a dangerous manner.

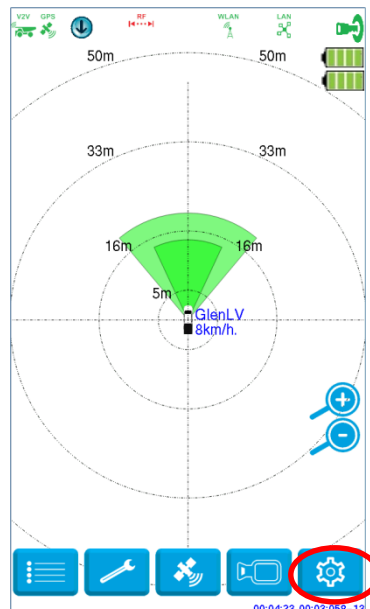


For the GPS to work accurately the Node must have clear line of sight to the sky. Obstructions such as machine structure, work roof or deep pit may affect the accuracy or operation of the GPS.

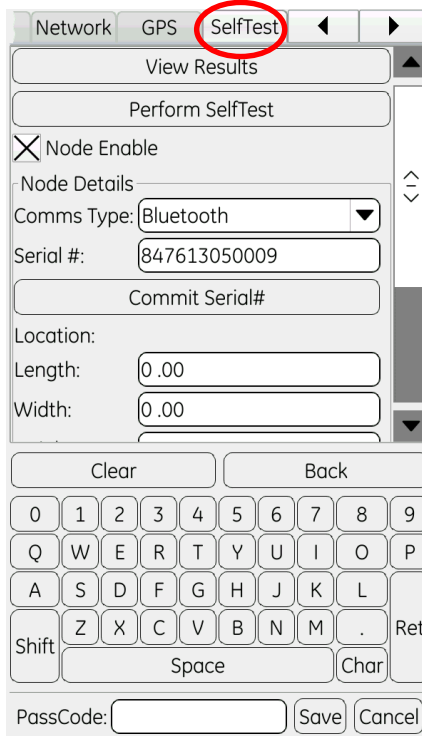
9.4.2.3 Bluetooth® connection setup

When using the Portable Node and PDA the Bluetooth® connection needs to be setup or confirmed each use. To setup the Bluetooth® connection:-

On the main screen of the PDA press on the Settings Button



Select the Self Test Setup Screen



Enter the Node ID Number from the barcode on the Node and select 'Commit Serial#'



Scroll down the page and enter the Location details then select Sync

Network GPS SelfTest ◀ ▶

Commit Serial#

Location:

Length:

Width:

Height:

Stored RX: 206

Live RX: 205

Stored TX: 208

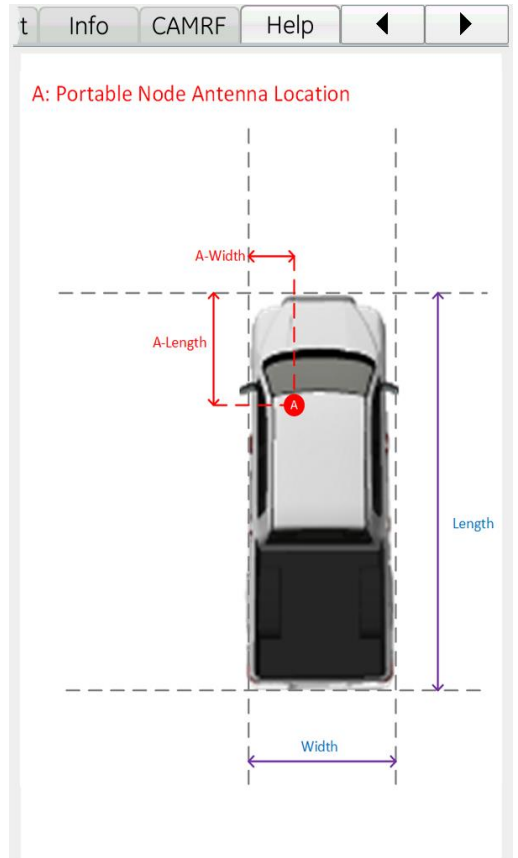
Live TX: 206

Sync

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	.	Ret
Space								Char	

PassCode: Save Cancel

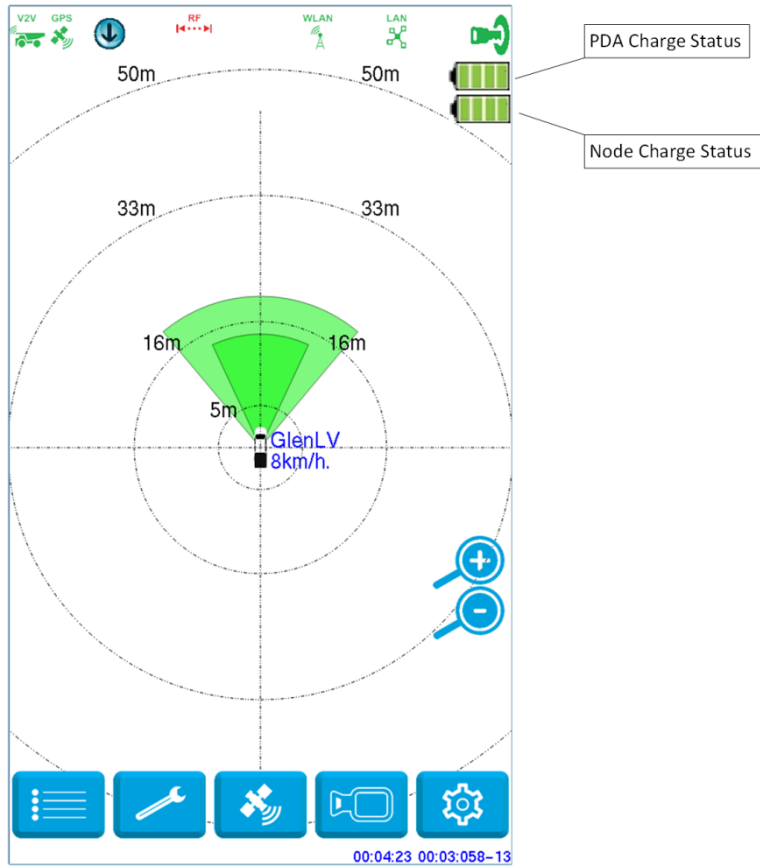


9.4.2.4 *Portable Node Charging*

The Portable Light Vehicle Node battery is charged using the specially designed charging station. This charging station takes care of the battery and takes approximately 6 hours to charge the battery completely.

Battery charge status of the Node can be checked on the PDA Screen.

PDA Screen Image for Charge status



9.4.2.5 Charging Warnings



Only use charge cables provided.



Charging can be plugged into a normal vehicle accessory power outlet.
Charging can be carried out during operation.
Do not pass charging cable through vehicle doors or windows.



Do not use damaged power cords or plugs.
Do not bend or damage the power cord.
Do not touch the power cord with wet hands, or disconnect the charger by pulling the cord.
Do not Short-Circuit the Charger or the Battery.
Do not drop or cause impact to the charger or battery.
Do not charge the battery with chargers that are not approved by the manufacturer.



Incompatible batteries and chargers can cause serious injuries or damage to your device.



Do not handle a damaged or leaking lithium Ion battery.
Handle and dispose of batteries and chargers with care.
Never crush or puncture the battery. Avoid exposing the battery to high external pressure, which can lead to an internal short circuit and overheating.



The CAS-GPS Nodes contain no user serviceable parts.
Batteries should be replaced every 2 years by a suitably qualified and trained technician.
Only replace batteries with OEM supplied parts.



Never dispose of batteries or devices in a fire.
Follow all local regulations when disposing of used batteries or devices.
Never place batteries or devices on or in heating devices, such as microwave ovens, stoves, radiators, or in an engine bay.



Avoid exposing your device and batteries to very cold or very hot temperatures.
Extreme temperatures can cause the deformation of the device and reduce the charging capacity and life of your device and batteries.

9.4.2.6 Using the PDA Display

On Vehicle Start-up

Immediately after starting the vehicle and before putting it into motion, perform a quick check of the Display's status bar. Check that none of the icons are Red, if so your CAS GPS system is not functioning correctly and its operation cannot be assured!



If any of the CAS Icons are red the system may not be operating correctly.



On Startup, the GPS will assume you are facing 'North' until a heading has been established by forward movement.



If a nearby vehicle's beams are overlapping your vehicles beam an audible alarm will be sounded. Only when your vehicle is stationary may you silence the alarm by touching anywhere on the screen.

Vehicle in Motion

When your vehicle is moving you can operate using your normal safe operating procedures. The Display will sound an alarm to gain your attention if there is another vehicle that is getting too close. A quick glance at the display will show the location, type, ID, heading and speed of other vehicles.



You cannot silence the alarm whilst your vehicle is in motion.

9.4.3 Boomgate Node

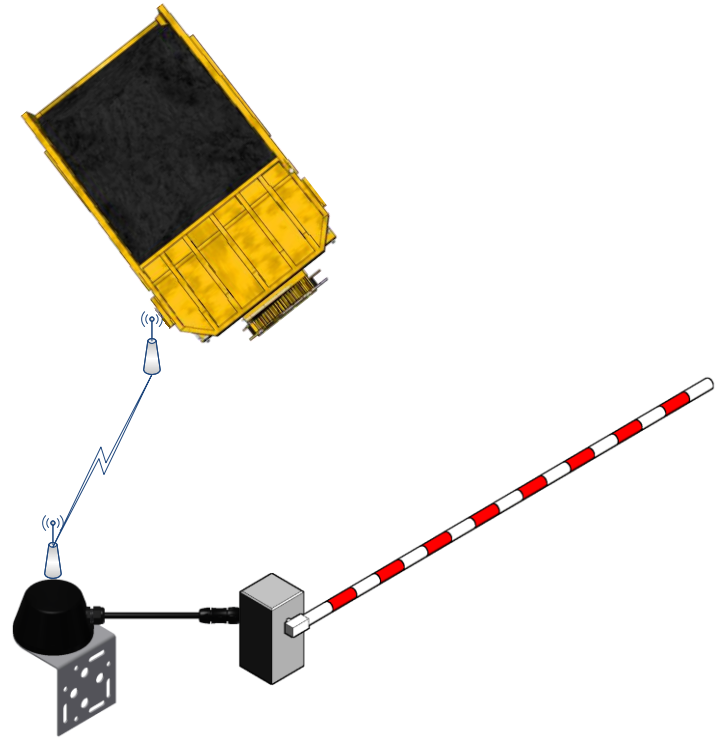
The CAS-GPS NODE Boomgate access control comprises of a high performance GPS receiver and on-board digital radios for ranging measurements, Bluetooth® wireless technology and point to multipoint communication.

The unit accepts power from a 12 – 24VDC power supply and features 2 digital inputs & 1 digitally controlled output.

The digital output is active with either a GPS derived position of approaching CAS-GPS enabled fleet or RF Ranging proximity detection within a configurable activation area.

The digital output is a current limited push/pull switch supplying voltage from the unit's source supply.

The Boomgate access control digital output can be connected to any device that may require control signaling based on CAS-GPS fleet proximity.



9.4.3.1 Boomgate Node Installation



The CAS GPS Node must only be installed by an authorised person.

See Installation manual for detailed instructions.

9.4.4 Light Vehicle Node

9.4.5 Light Vehicle Expandable Node

The CAS-GPS NODE Light Vehicle Fixed Expandable unit comprises of a high performance GPS receiver and on-board digital radios for ranging measurements, Bluetooth® wireless technology and point to multipoint communication.

The unit is powered from an 12 – 24VDC vehicle derived power supply and features 2 x digital inputs for control signals, 1 x RS232 communication port for primary communication to the in-cab GE Personal Digital Assistant running the CAS-GPS application software & 1 x RS232 communication port for primary communication to an PROD1052-LFx Node used for system self-test functionality or for connection to an existing CAS/CAM/RF legacy product range.

This roof mounted unit optionally features an internal battery back-up for continuous operation during a vehicles powered down state.

Bluetooth® wireless technology provides a secondary communication link to the in-cab PDA to allow for real time situational awareness of the CAS-GPS enabled fleet.

The Light Vehicle Fixed Expandable Node requires control signals for reverse and brake to be routed to the digital inputs for complete system functionality.

9.4.5.1 Light Node Installation



The CAS GPS Node must only be installed by an authorised person.

See Installation manual for detailed instructions.

9.4.6 Self-Test Node

The CAS-GPS NODE Self-Test unit comprises of a high performance GPS receiver and on-board digital radios for ranging measurements and point to multipoint communication.

The unit accepts power from the CAS-GPS In Vehicle Unit (IVU) as installed on heavy and medium site vehicles.

The Self-Test unit enables automatic real-time functional health monitoring of a primary CAS-GPS/RF system on a vehicle without the requirement for a remote 'test station' or operator interaction.

The self-test GPS receiver and V2V radio also functions as a backup redundancy to the primary GPS and V2V link.

The self-test GPS can be linked to the primary GPS to provide accurate heading for rotational or slow moving machines (e.g. shovels).

Communication is via a dedicated CAN Bus connection between the CAS-GPS IVU and CAS-GPS NODE.

9.4.6.1 Self Test Node Installation



The CAS GPS Node must only be installed by an authorised person.

See Installation manual for detailed instructions.

10 Service, Maintenance & Disposal

10.1 Equipment Service

10.1.1 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 cradle.
- Check the mounting bracket is secure – finger tighten only if loose.

10.1.2 System

- Check visually that all Nodes are in good condition and the cables (where applicable) are securely 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.

10.1.3 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 (whichever occurs first).

10.1.4 Equipment Maintenance

If the system is not functioning as expected and a fault cannot be resolved, please contact your nearest authorised representative.



It is essential that no attempt be made to repair the equipment (other than replacement of system components). Opening equipment enclosures should never be attempted and will void any warranty and could compromise the safe operation of the system.

11 Decommissioning

- Removal of the system should only be performed if authorised by the owner of the vehicle.
- Removal should be performed by a qualified person.
- 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.

12 Disposal

The electronic equipment discussed in this manual must not be treated as general waste. 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 waste handling of this product.

The system should be disposed of in accordance with local regulations. The electronics of CAS GPS are ROHS compliant.



The system contains a Lithium Ion Battery and should be disposed of in accordance with local regulations.

13 Authorised Representatives

13.1 Brazil



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M.G. 31710-400, Brazil
P: +55 31 3311 7200
F: +55 31 3311 7205
Email: brasil@joyglobal.com
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Germiston 1614
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F: +27 11 453 2141
www.probebattery.co.za

13.3 Indonesia



PT Intecs Teknikatama Industri
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F: +62 21 729 3352
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13.4 Canada



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P: +1 905-858-5100
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13.5 North America



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Pennsylvania, 16531, US
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F: 480 264-6402
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13.6 Australia



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F: +612 4389 2355
www.getransportation.com

14 Warranty Terms

Equipment and Parts:

15 months from delivery, or 12 months from when system is placed in service (whichever occurs first). Modifications to this product without written consent from the manufacturer or its designated authorised representatives will void all warranty obligations.

15 Regulatory Information

Warning: Modifications to this product without written consent from the manufacturer or its designated authorised representatives could void the user's authority to operate the equipment

15.1 DECLARATION OF CONFORMITY WITH FCC RULES FOR ELECTROMAGNETIC COMPATIBILITY

We, GE Mining, Industrea Mining Technology, of 3 Co-Wyn Close, Fountaindale, NSW, 2258, Australia declare under our sole responsibility the products:

CAS-GPS Node

YIY-PROD1052LP2

YIY-PROD1052LR2

YIY-PROD1052LF2

YIY-PROD1052ST2

YIY-PROD1052BG2

to which this declaration relates:

Complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:
(1) This device may not cause harmful interference, and (2) This device must accept any interference received, including interference that may cause undesired operation.

15.1.1 FCC Interference Statement for Class B devices.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

15.1.2 Federal Communication Commission (FCC) - Radiation Exposure Statement

To comply with FCC RF exposure limits for general population / uncontrolled exposure, the antennas used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

15.2 INDUSTRY CANADA Compliant

This Class B digital apparatus complies with Canadian ICES-003. Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

15.2.1 Concerning Radio Transmitters

This device complies with Industry Canada's licence-exempt RSSs.

Operation is subject to the following two conditions:

- (1) This device may not cause interference; and
- (2) This device must accept any interference, including that may cause undesired operation of the device.

15.2.2 Industry Canada - Radiation Exposure Statement

To comply with Industry Canada RF exposure limits for general population / uncontrolled exposure, the antennas used for this transmitter must be installed to provide a separation distance of 20cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

15.2.3 Industrie Canada – Déclaration sur l'exposition aux radiations

Afin de respecter les limites d'exposition pour l'ensemble de la population/l'exposition non contrôlée de la FCC/IC RF, les antennes utilisées pour cet émetteur doivent être installées de manière à offrir une distance de séparation minimum de 20 cm les personnes et ne doivent pas être utilisées en conjonction avec d'autres antennes ou émetteurs.

15.2.4 Conforme aux normes d'INDUSTRIE CANADA

Cet appareil numérique de classe B est conforme à la norme canadienne ICES-003. Les changements ou les modifications non approuvés expressément par la partie responsable de la conformité pourraient annuler l'autorisation de l'utilisateur de faire fonctionner l'équipement.

15.2.5 Au sujet des émetteurs radio

Ce dispositif est conforme à la partie 15 des règles de la Federal Communications Commission (FCC) des États-Unis et d'Industrie Canada (IC) exempts de licence RSS norme(s).

Son fonctionnement est assujéti aux deux conditions suivantes:

- (1) Ce dispositif ne doit pas provoquer de brouillage préjudiciable, et
- (2) il doit accepter tout brouillage reçu, y compris le brouillage pouvant entraîner un mauvais fonctionnement.

15.3 Australian Radio Communications Equipment - Radiation Exposure Statement

The equipment complies with the Radiocommunications (Electromagnetic Radiation – Human Exposure) Standard 2014 for General Public Exposure, Non-Aware User, for a Compliance Level 2 Radiocommunications Equipment, when the minimum safety distance of 20cm is adhered to, and shall bear the RCM.

15.4 Anatel Resolution 506 Statement

This equipment operates in a secondary manner, that is, does not have the right of protection against prejudicial interference, even from stations of the same type, and nor can they cause interference to systems operating in a primary manner.