

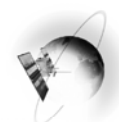
AEM3000 DCU

AVL & Data Logging System



System overview & Installation Guide

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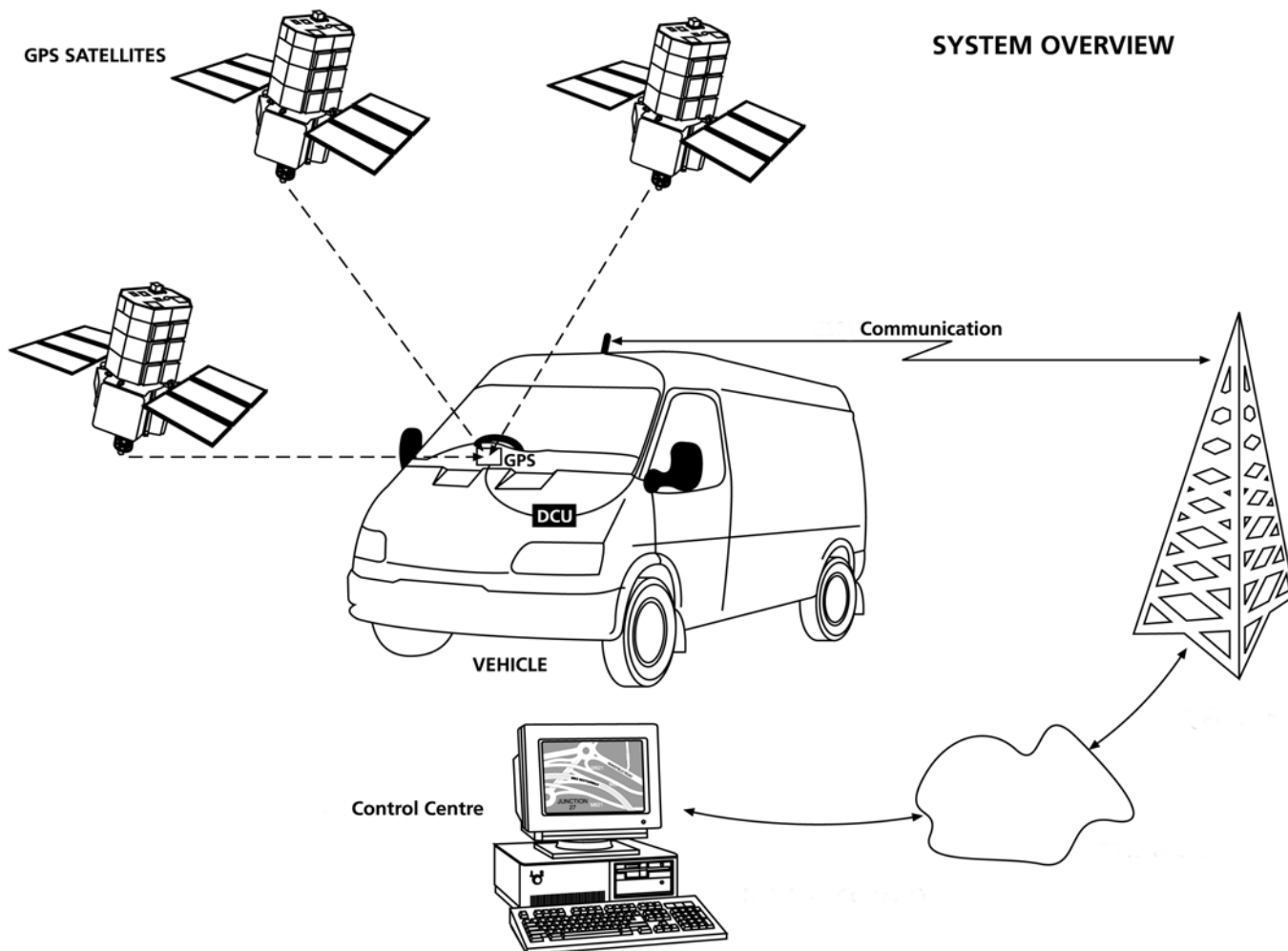


1. OPERATION

1.1 Maptrack System Overview

The Maptrack system brings together satellite based global positioning technology, microprocessor control, low power radio and international GSM communication infrastructure to achieve wide area communication, vehicle location, telematics and communication services.

1.1.1 OPERATION OVERVIEW



1.2 System Overview

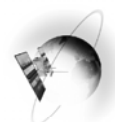
The AEM3000 is an electronic data collection and transmission device, incorporating GPS tracking and GSM communication technologies.

Whilst the vehicle is in use, geographical and operational data is continually monitored and recorded within the DCU (data collection unit) memory. Up to 8 weeks of operational data can be held within the DCU. If the memory capacity is reached before the data is downloaded, the oldest records will be lost as new records are recorded.

Recorded data may be downloaded for processing by the base computer in the following ways;

- bulk download of all held data via the GSM data channel
- snap shot of current 'live' data via the GSM SMS network.
- bulk download of held data via the low power radio interface upon return to base.

Interrogation of the DCU is possible anywhere that benefits from GSM network coverage (subject to roaming agreements with GSM networks).



1.3 System Operation

The Maptrack in-vehicle system consists of the DCU (data collection unit), GPS and GSM antennae. Only power and ignition connections are made to the vehicle electrical system.

When an ignition signal is present at the DCU the system records a start event and activates the GPS receiver, the vehicles geographical position, velocity and distance travelled are then continually recorded within the DCU until the ignition signal is removed, at which time a stop event is recorded, the DCU then performs any outstanding tasks before powering down the GPS receiver and GSM transceiver.

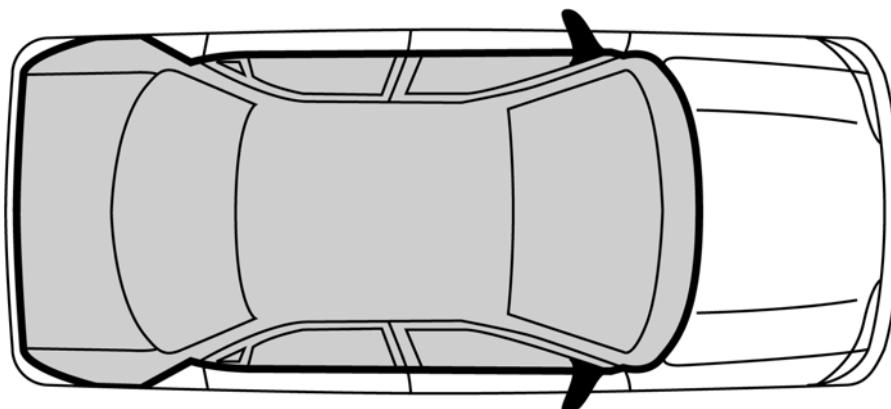
The DCU will stay in this power save mode until either the ignition is turned on or a command is received from the monitoring bureau to reactivate.

1.4 Component Layout

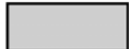
The following equipment positioning guides are for reference only and are not intended to be exhaustive. Actual optimum positions will change depending upon type of vehicle being fitted.

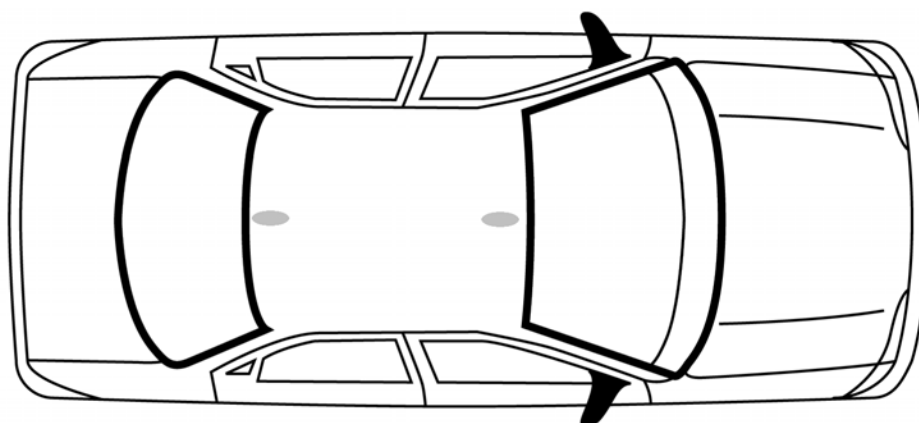
1.4.1 DCU POSITION GUIDE (within vehicle)

DCU Assembly Fitting Zones 



1.4.2 TRI-BAND AERIAL POSITION GUIDE (roof of vehicle)

Antenna Fitting Zones 



SAFETY PRECAUTIONS

2.1 General Safety

It is the installation engineers' responsibility to assess all potential risks before commencing work on the host vehicle and be fully conversant with all vehicle operating procedures and workshop practices. The following points are for guidance only and are not intended to be exhaustive:

- 2.1.1 never work under a vehicle, which is supported solely by jacks.
- 2.1.2 the vehicle should always be left out of gear.
- 2.1.3 never perform any tasks, which would jeopardise your own or the operational safety of the vehicle.
- 2.1.4 always remove and replace vehicle trim with correct tools and in line with manufacturers instructions.
- 2.1.5 take extreme caution not to damage or disrupt air bag or supplementary restraint systems (SRS).
- 2.1.6 if additional mountings are required, these should be drilled within the vehicle manufacturers guidelines.
- 2.1.7 never operate the system with damaged unapproved parts.

2.2 Electrical Safety

It is the installation engineer's responsibility to assess all potential risks before commencing work on the host vehicle and be fully conversant with all auto electrical procedures and workshop practices. The following points are for guidance only and are not intended to be all-inclusive:

- 2.2.1 it is advisable to disconnect the vehicle battery prior to making any electrical connections.
- 2.2.2 never attempt to test any electrical circuits using a test lamp.
- 2.2.3 remove or cover any jewellery if it is necessary to work on live electrical systems.
- 2.2.4 never tamper with or disconnect the air bag or SRS electrical harness.
- 2.2.5 refer to the vehicle manufacturer's instructions when making supplementary electrical connections.
- 2.2.6 use a high impedance multi-meter with both voltage and resistance ranges for testing electrical circuits.
- 2.2.7 always fuse supplementary power connections at source to protect against electrical fire if damaged.
- 2.2.8 take extreme care not to trap or damage any cables when replacing the vehicle trim.
- 2.2.9 check that vehicle electronic equipment is adequately shielded from RF energy before fitting the DCU or GSM antenna in the direct vicinity of any electronic control or management systems.

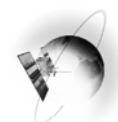
2.3 Safety Standards

The AEM3000 DCU and associated equipment has been fully EMC tested to VCA recommendations in accordance with European Directive 95/54/EC, Annex 7 & 8 (emissions).

The cellular modem contained within the DCU complies with all applicable RF safety standards and recommendations for the protection of public exposure to RF electromagnetic energy as defined by directives of the European Community.

As the AEM3000 DCU contains a cellular radio modem it should not be fitted or used within any potentially explosive atmospheres, within any vehicle powered by liquefied petroleum gas or governed by petrochemical regulations without additional operational safety precautions being taken.

3. GENERAL INSTALLATION

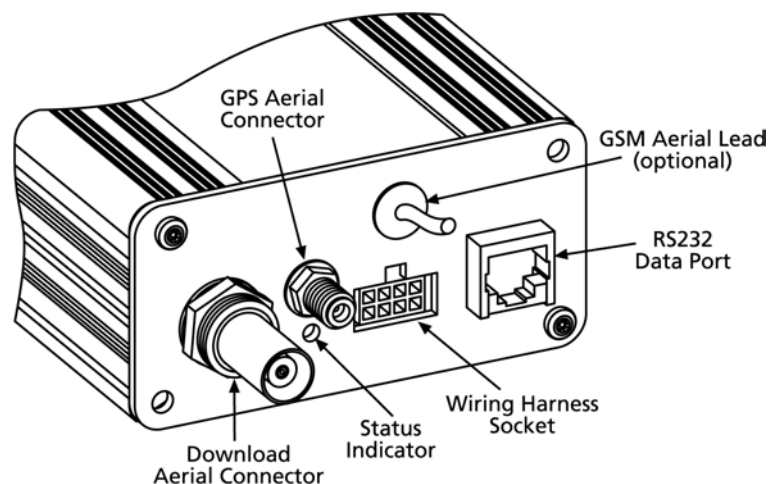


The manufacturer cannot accept responsibility for any operational failure of vehicle systems or consequential loss resulting from failure to comply with recognised workshop practices, installation guidelines or vehicle manufacturers recommendations.

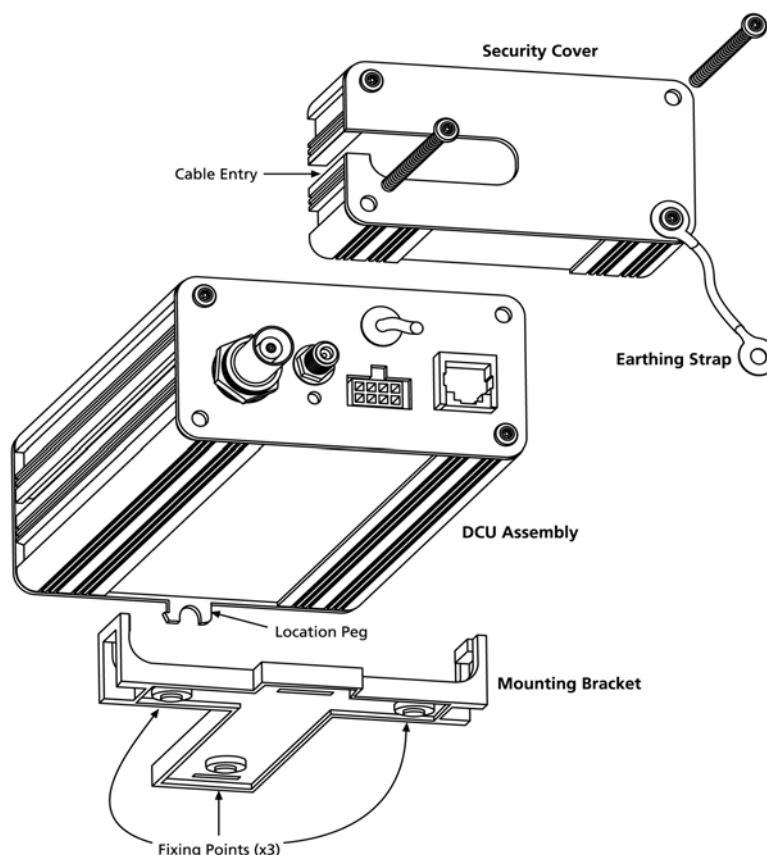
3.1 Mechanical Assembly

The following diagrams show the general mechanical configuration of the DCU, refer to the relevant detailed instructions for the recommended fitting and assembly procedures.

3.1.1 DCU BULKHEAD LAYOUT



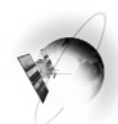
4.1.14 DCU GENERAL ASSEMBLY



3.2 DCU

The heart of the Maptrack system is the DCU (data collection unit). It is essential that this and all other system components are securely fixed and very well concealed.

Installation



The actual position of the DCU and indeed the antennae should be varied to reduce the opportunity of discovery. Ideally the termination end of the DCU should be directly adjacent to an existing vehicle wiring loom, providing easier concealment of system wiring.

Please note that the AEM3000 DCU is not waterproof and should only be fitted within an environmentally protected area of the vehicle.

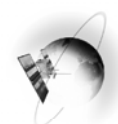
The following recommended procedure should be followed;

- 3.2.1 conduct pre installation tests.
- 3.2.2 select installation position, be sure to leave sufficient room for the tamper protection cover.
- 3.2.3 secure fixing bracket using three No 8 x 3/4 inch self-tapping screws (provided in fixing kit).
- 3.2.4 ensure that vehicle electrical supply is isolated and made safe.
- 3.2.5 make electrical connections and fit antennae as detailed in sections 3.1 & 3.4.
- 3.2.6 route cables to DCU fixing position and conceal by looming in with existing vehicle wiring.
- 3.2.7 screw the GPS aerial plug onto the SMA bulkhead socket at the DCU (see section 3.1.1)
- 3.2.8 screw the GSM aerial plug onto the FME free cable socket at the DCU (see section 3.1.1)
- 3.2.9 screw the LPR aerial plug onto the BNC bulkhead socket at the DCU (see section 3.1.1)
- 3.2.10 plug the power harness into the DCU, ensuring that the retaining clip is fully located.
- 3.2.11 reconnect vehicle electrical supply.
- 3.2.12 perform all system tests as described in section 4.1.
- 3.2.13 secure auxiliary fuse covers in place using cable ties provided.
- 3.2.14 pass the protection cover over cables and secure in place using the security screws provided.
- 3.2.15 tidy and protect remaining cables.
- 3.2.16 replace vehicle trim etc. and ensure that all accessories / settings are returned to their original state.
- 3.2.17 conduct post installation test.

3.3 Electrical Wiring

All connection must be wrapped and soldered. Crimped connections are not suitable.

3.3.1 NEGATIVE POWER SUPPLY (GND) - Black Wire



Always connect directly to a dedicated earth point within the vehicle electrical system.

Never connect to any other electrical earth or drill and strap any part of the vehicle body, as build up in contact resistance may cause supply voltage problems, resulting in erratic operation of the DCU.

3.3.2 POSITIVE POWER SUPPLY (+VE) - Red Wire

Connect to a continuous +12 to +24 volt DC supply. This should be taken from the secondary side of the main distribution fuse from the vehicle battery, and should not share a fused supply to any other equipment. This line should be fused at source to provide protection against shorting of the wiring harness, (DCU is internally fused).

To avoid mis-operation ensure that the power is not interrupted when the engine is being started.

3.3.3 IGNITION SENSE INPUT - Blue Wire

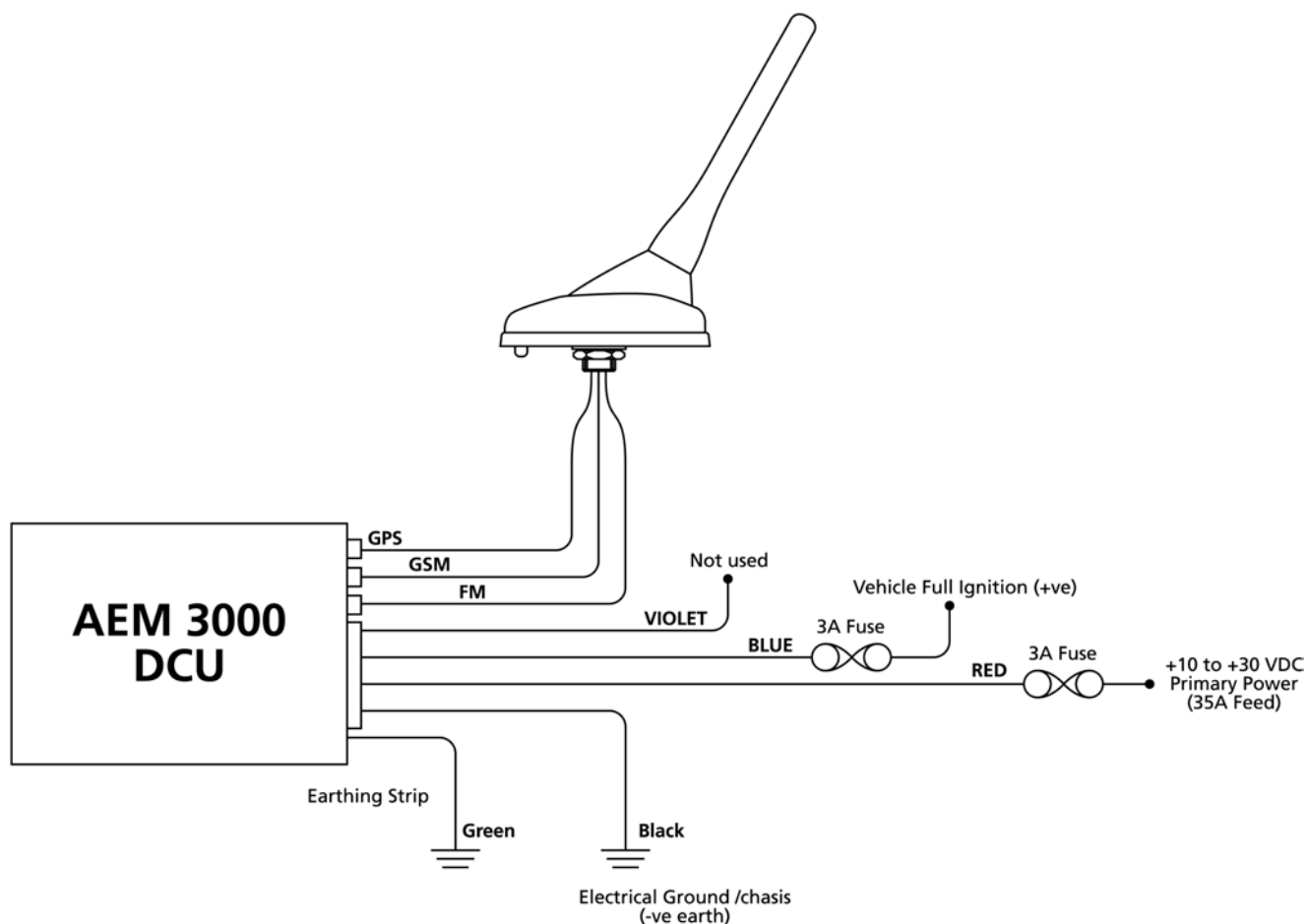
Connect to an ignition signal which goes positive (+10 to +30 volt DC) when the engine is running, and is removed or goes to ground when the engine stops.

The auxiliary ignition feed is not suitable as this may result in the false operation of the DCU

3.3.4 SECONDARY EARTHING - Black Wire

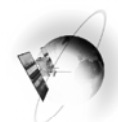
To comply with EMC requirements, the earth strap provided must be terminated to an electrically tested chassis ground in the direct vicinity of the DCU.

3.3.5 ELECTRICAL WIRING DIAGRAM

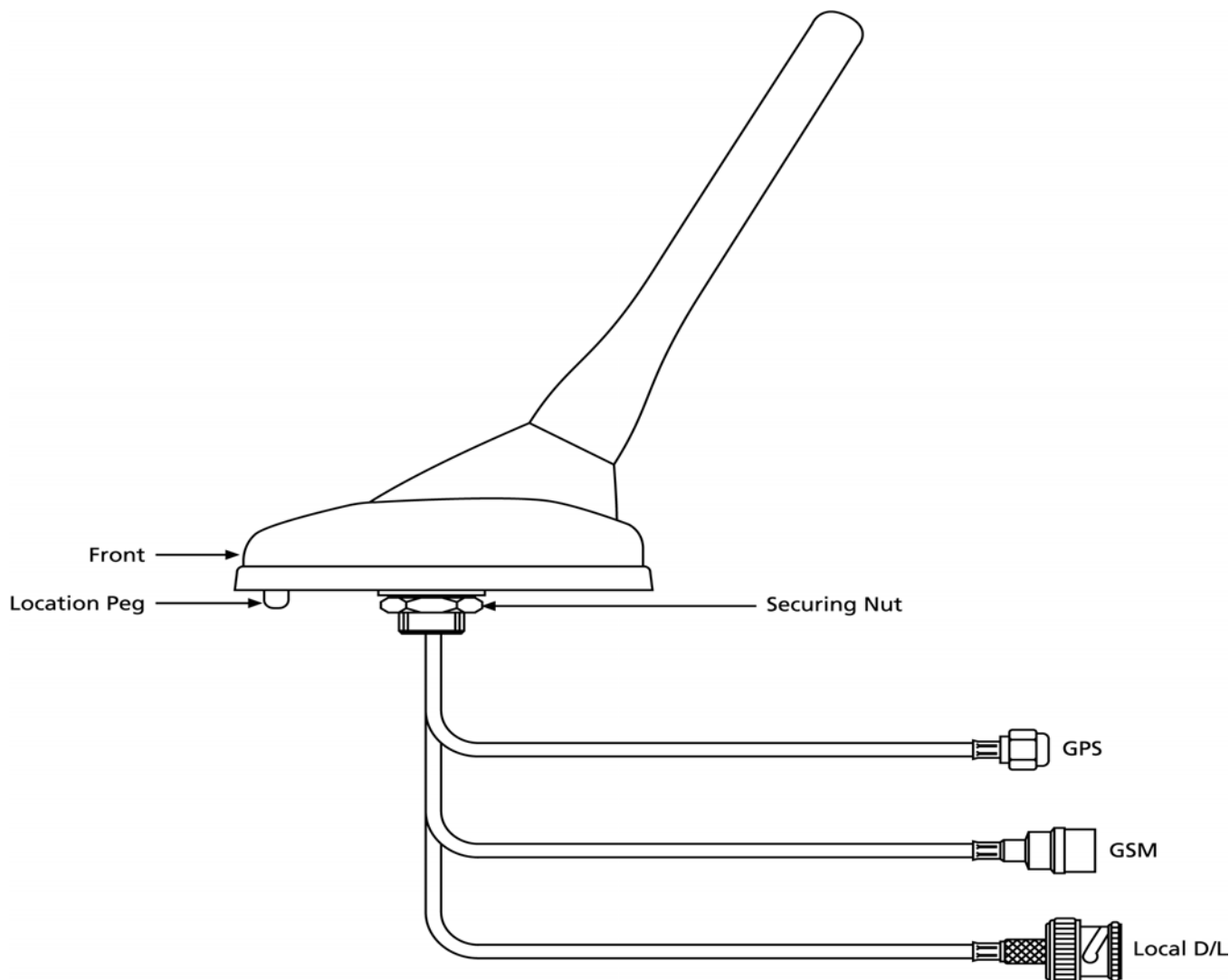


3.4 Antenna Fitting

3.4.1 GENERAL CONSIDERATIONS



Radio signals can be affected by metal structures or electrical systems; therefore it is essential that the antennae element(s) is located away from sources of electrical or mechanical interference. Take care not to route either antenna cable near any sensitive electrical systems or controls.



3.4.2 GPS ANTENNA

It is essential that when the antenna be fitted the following considerations are observed;

- view of the sky must be as wide as possible
- field of view must not be obscured by any metallic substance
- top of antenna must point towards field of view
- navigation must be tested rigorously to ensure optimum performance under operational conditions.

3.4.5 GSM ANTENNA ELEMENT

The GSM antenna should be fitted observing the following guidelines;

- fit the GSM antenna as far away from vehicle management and control systems as possible.
- the GSM antenna should be fitted in such a way that it is not shielded by metallic surfaces.
- once fitted, cut the antenna lead to length and terminate using the FME plug provided.

3.4.6 LOW POWER RADIO ANTENNA ELEMENT

The low power radio contained within the AEM3000 DCU is designed to comply with FCC directive part 15, as such only aerials approved and supplied by Minorplanet may be used in conjunction with this product. It is forbidden to use any antennae other than those verified and approved by Minorplanet.

4. COMMISSIONING

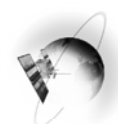
Once all cables are terminated and aerial leads connected, the system should be tested for correct functional operation, visual indication of operating status is provided, (see 3.1.1).

4.1 Test Procedure

The following operational tests should be conducted outdoors with an unobstructed view of the sky and in an area of known GSM coverage.

- 4.1.1 ensure that antenna is securely fitted and cables connected to the DCU.
- 4.1.2 fit the harness protection fuses into their holders and close fuse holder caps (do not secure).
- 4.1.3 turn the vehicle ignition to the full on position (ignition input signal +VE).
- 4.1.4 plug power harness into DCU, the status indicator should immediately flash Green and Red.
- 4.1.5 wait 30 seconds for the DCU to initialise and run its internal diagnostic test.
- 4.1.6 the status indicator should now show Amber. This indicates ignition on, but no GPS navigation.
- 4.1.7 wait for the status indicator to turn Green (upto 3 min. max). This indicates correct GPS navigation.
- 4.1.8 after approx. 1 min. the status indicator will start to flash every 10 sec. This confirms GSM operation.
- 4.1.9 turn the vehicle ignition off; the status indicator will turn Red to indicate that the DCU is shutting down.
- 4.1.14 after 20 sec. the status indicator will flash to indicate that the DCU is in download mode.
- 4.1.15 the DCU will now attempt to initiate a LPR download for a period of 2 minutes, after which time the DCU will fully shut down. During the LPR download period a radio download test may be conducted.
- 4.1.11 turn the vehicle ignition on again, the status indicator will turn Amber and then Green when navigating.
- 4.1.12 call technical help desk to confirm installation and request remote test.
- 4.1.13 when the DCU receives a GSM message, the status indicator will flash rapidly (if ignition on).
- 4.1.14 upon completion of the remote test the technical help desk will confirm correct operational status.

4.2 Trouble Shooting



ALL DCU assemblies are 100% factory tested prior to despatch, in the unlikely event of the system does not appear to function correctly, please refer to the following guide to help diagnose any potential errors made upon installation:

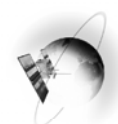
4.2.1 FAULT FINDING GUIDE

FAULT	REASON	ACTION
Status indicator fails to illuminate.	No power connected to DCU.	Check fuses and supply wiring
Status indicator flashes when power is connected but then stays off.	Ignition signal is not present at DCU	Check ignition line fuse and wiring to vehicle ignition line
DCU 'live' test only works when vehicle ignition is on.	DCU power & ignition wiring is reversed.	Check power / ignition wiring and correct fault.
Status indicator stays Amber after 5 min. from power up. (ignition on)	GPS navigation is not achievable under current conditions.	Ensure that GPS aerial has a wide view, without metallic obstruction.
No GPS navigation (no metallic obstructions, wide field of view)	Antenna orientation or position is not allowing full satellite comm.	Reorientate aerial within 30 deg. of horizontal for best performance.
Status indicator does not flash (amber or green light only).	GSM communication is not able to initialised correctly.	Check for good signal strength and reposition GSM aerial.
No GSM initialisation after 10 min. (signal strength aerial OK)	Network registration failed or SIM card not active.	Check GSM aerial installation and reposition if necessary.
DCU appears to work correctly but will not shut down with ignition off.	Ignition sense wiring connected to permanent +ve voltage.	Check wiring and if necessary correct fault.
DCU reinitialises (indicator flashes red/green) when engine is started.	Power is being temporarily removed upon starting of the vehicle.	Rewire DCU power to a permanent uninterruptible power source.
System operates correctly until after the vehicle immobiliser is operated.	Some immobilisers isolate auxiliary power circuits for safety reasons.	Rewire DCU power to a permanent uninterruptible power source.
System only works when vehicle door(s) are open.	DCU power has been taken from +ve switched interior light circuit.	Rewire DCU power to a permanent uninterruptible power source.
Status indicator repeatedly flashes spasmodically and will not stabilise.	GSM modem has failed to initialise correctly.	Power down system, check GSM aerial & power level then re-power.

If it is not possible to identify the actual cause of a fault by following the above guide, make a note of the status of the DCU, any fault symptoms along with the make, model and year of vehicle. With this information please call the technical help desk who will be pleased to provide additional assistance if required.

5. TECHNICAL SPECIFICATION

Due to continuous product development, aspects of the following specification may be changed without notice and solely at the discretion of the manufacturer.



5.1 Mechanical Specification (DCU)

Size (mm)	:	82 w x 40 H x 140 L (170 inc. tamper cover).
Weight	:	480 grams.
Material	:	Aluminium main body, polycarbonate rear end cover.

5.2 Electrical Specification

Supply Voltage	:	10.80 to 31 volts DC.
Current @ 12V	:	400 mA Maximum.
	:	210 mA Typical.
	:	60 mA Power save (Ave).
Current @ 24V	:	260 mA Maximum.
	:	130 mA Typical.
	:	50 mA Power save (Ave).
Ignition Sense	:	8 to 31 volts DC.
Protection	:	3 Amp line protection fuses (2 off) supplied.
GSM modem	:	ETSI full type approved, 890-960 MHz 2 Watt (max) Transceiver.
GPS receiver	:	12 parallel channels, GPS rollover & Y2K compliant.
LPR Transceiver	:	902.75MHz max 1 mW @ 3M, FCC xxxxx part 15 compliant
Operating Temp	:	-20 to +50 degrees centigrade.
EMC	:	Tested to meet European directive 95/54/EC (emissions)

5.3 GPS Antenna Specification

Technology	:	1575.42 MHz, 5 volt active ceramic patch (ground plane dependent).
Cable	:	4 metre, type 174 (50 Ohm coaxial).
Connector	:	SMA free cable plug

5.4 GSM Antenna Specification

Technology	:	890 - 960 MHz, ground plane independent.
Cable	:	4 metre, type 174 (50 Ohm coaxial).
Connector	:	FME free cable plug

5.5 LPR Antenna Specification

Technology	:	900-928 MHz, ground plane dependant.
Cable	:	4 metre, type 174 (50 Ohm coaxial).
Connector	:	BNC free cable plug

F.C.C.CAUTION: THIS DEVICE COMPLIES WITH PART 15 OF THE FCCRULES. OPERATION IS SUBJECT TO THEFOLLOWING TWO CONDITIONS: (1) THIS DEVICE MAY NOT CAUSE HARMFULINTERFERENCE,

AND (2) THIS DEVICE MUST ACCEPT ANY INTERFERENCE RECEIVED, INCLUDING INTERFERENCE THAT MAY CAUSE UNDESIRABLE OPERATION. **NOTE:** NO CHANGES OR MODIFICATIONS MAY BE MADE TO THE UNITS. ANY CHANGES MADE TO THE UNITS WILL VOID THE USER'S AUTHORITY TO OPERATE THE EQUIPMENT.