

CMC electronics

Smart Antenna RS232

P/N 100-601903-XXX



Installation Manual

930-600015-000

Revision F June 2001

CMC Electronics Inc.

(formerly BAE SYSTEMS CANADA and Canadian Marconi Company)

GPS OEM Product Group

600 Dr. Frederik Philips Boulevard

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Introduction

The CMC Electronics Inc. Smart Antenna is a self-contained, high-performance GPS position sensor that accepts DGPS correction signals to further enhance accuracy. The sensor provides highly accurate position and speed data for a variety of applications.

Features

- 12 parallel channels — “all in view” tracking
- 9 – 36 volts DC power (1.8 watts) rated for SAE 1455 heavy duty truck power system
- –30°C to +75°C operating temperature range standard
- Fully automatic operation
- <1 m circular error probability (CEP), DGPS
- <16 m circular error probability (CEP), no DGPS, without SA
- Can be supplied with the Superstar Timing Engine for 50 nSec. accuracy of 1PPS output
- WAAS version uses the STAR*WAAS receiver

Interconnections

All connections are made through a single 7-conductor cable (supplied with development kits, otherwise available as an option).

Output data

The Smart Antenna is shipped with the following protocol: Proprietary binary at 9600 baud, Message 20, at 1 Hz. It can be user-programmed to output additional binary messages or to output NMEA 0183 Version 2.0 sentence types GGA, GSA, GSV, RMC, VTG, ZDA, GLL, and proprietary messages. Baud rates are user-selectable from 300 to 19,200.

The Smart Antenna also outputs a one-millisecond time-mark pulse once per second.¹ This output is open-drain with a 120-Ohm series resistor. The current capability is 50mA.

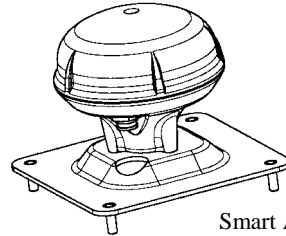
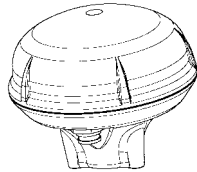
Input data

The default format is the binary protocol at 9600 baud. On Port 1 the Smart antenna can accept NMEA or binary messages for altitude, position, date and time. On Port 2, it can receive RTCM DGPS message types 1, 2, 3, 9, and 16 in SC-104 format.¹

¹ Applicable to certain Smart Antenna configurations only. Refer to section on Connector Pin Assignments.

System Components

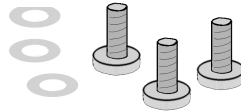
Standard-mount
Smart Antenna



Smart Antenna with
optional mounting plate
adapter

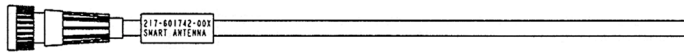
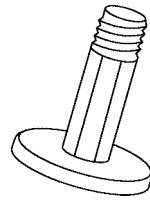


Mounting adapter – 1 inch
male threads to 5/8 inch
female threads

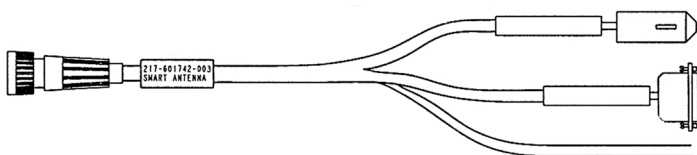


3 mounting screws and washers
supplied.

Optional magnetic-mount adapter
P/N 270-990146-890



P/N 217-601742-001 5 meters
P/N 217-601742-002 15 meters



+12 Volts Input Lighter plug
DB-9 Female

P/N 217-601742-003 5 meters
P/N 217-601742-004 15 meters

Locating the antenna

On land vehicles, mount the antenna high enough to provide an unobstructed view of the sky in all directions. The receiver uses satellites that can be as low as the horizon. Do not let anything block the antenna from the sky. Ensure the bottom of the antenna is at least five inches above the surface it is mounted on for easy cable connection.

If it is not possible to obtain a completely clear view of the horizon, a blockage of the lower 25 degrees of up to half of the horizon is acceptable in most cases.

For marine applications, mount the antenna below the radiation plane of INMARSAT or radar antennas, and away from any other high-power transmitting antennas. On sailboats, mount the antenna low on the vessel, since side-to-side antenna motion caused by vessel rolling may degrade Speed-Over-Ground (SOG) and Course-Over-Ground (COG) readings.

Do . . .

- Plan the installation carefully, following the guidelines above
- For land-based applications, mount the antenna high and away from objects
- For marine applications, mount the antenna low and away from objects

Don't . . .

- Block the antenna from any part of the sky
- Run the antenna cable near radio transmitters or transmitter antenna cables
- Pinch the antenna cable in window or door jambs
- Run cables where they may interfere with any controls or pedals

By default, the Smart Antenna uses satellites above 4.5 degrees of elevation. It can be programmed to use other cut-off angles, as low as zero degrees (all in view).

Mounting the Smart Antenna

The Smart Antenna is normally mounted using its industry-standard 1"-14 UNS threads onto an antenna mast or mounting adapter. Available mounting options include a 5.75-inch square mounting plate and a magnetic mount.

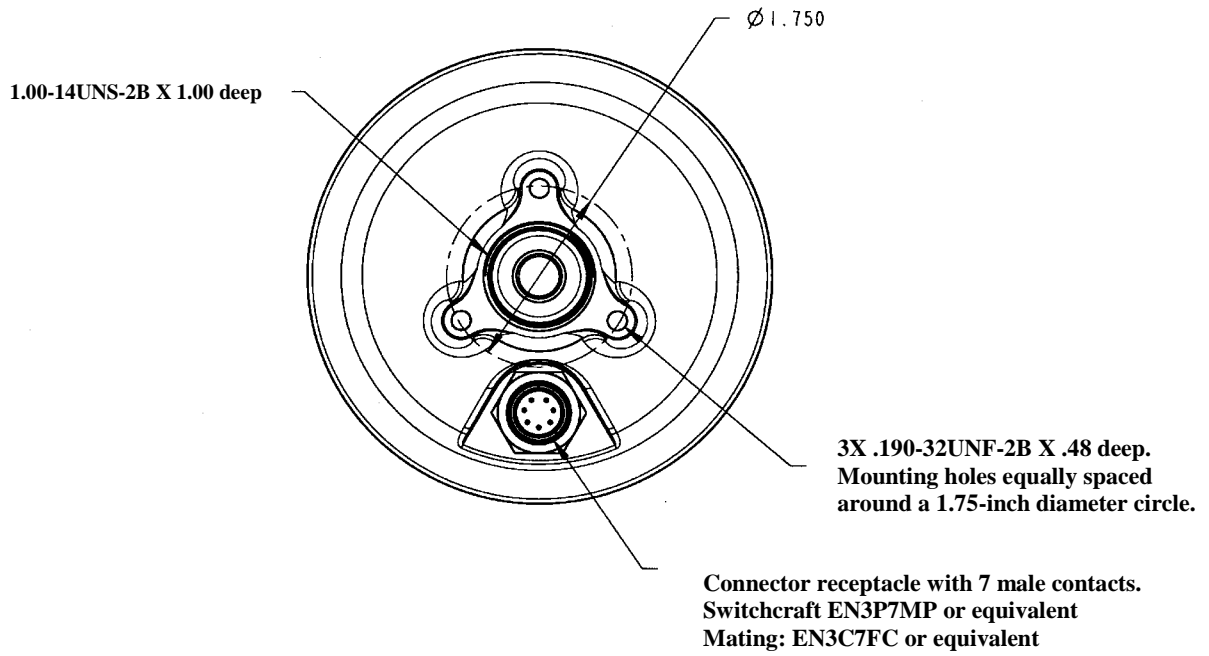
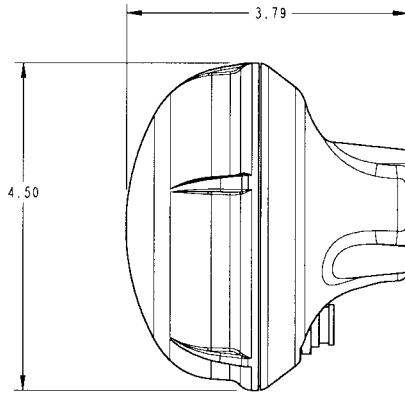
Method 1: Using the 1"-14 threads, mount the antenna onto a standard antenna mast or mounting adapter.

Method 2: Using three 10-32 UNF screws, mount the antenna on a flat surface with three holes on a 1.75-inch diameter circle as shown on page 5.

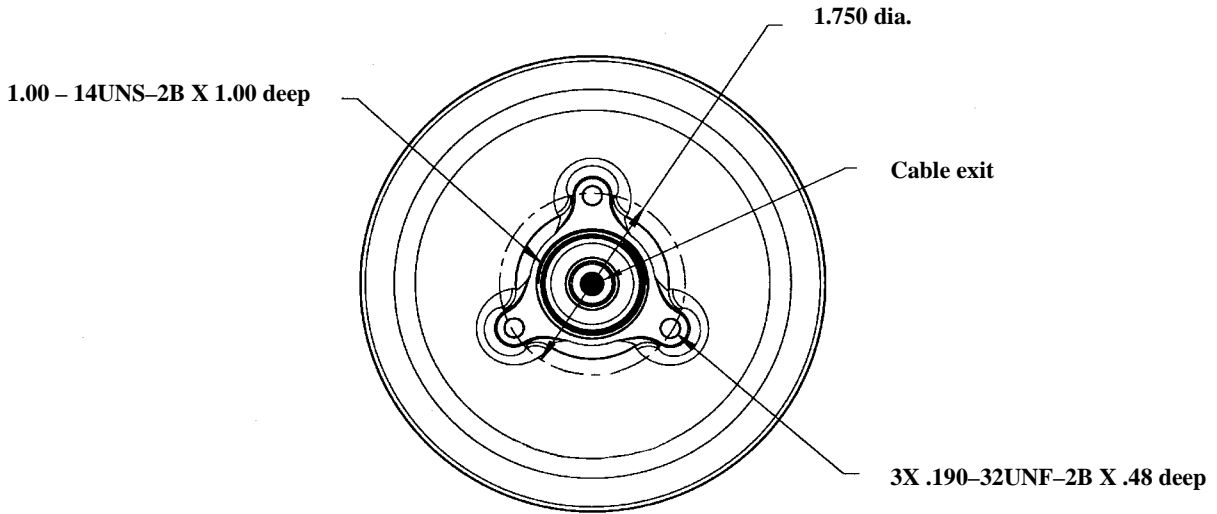
Method 3: Using the optional mounting plate adapter and four mounting screws, mount the antenna on a flat surface as shown on page 6.

Method 4: Using the optional magnetic mount, thread the antenna onto the mount and position the mount on a flat surface on top of the vehicle.

Smart antenna for mounting on mast or using three mounting holes in base.



Smart Antenna is also available with cable exiting from central mounting hole, instead of using the connector shown in the previous figure.



Making the connections

Two cable types are available for connecting the Smart Antenna:

P/N 217-601742-001 (5 meters) and 217-601743-002 (15 meters) provide an unterminated cable end for connecting directly to other equipment. See color coding of wires in Connector Pin Assignments section of this manual.

P/N 217-601742-003 (5 meters) and 217-601742-004 (15 meters) use separate connectors for DC power from a cigarette lighter plug, a DB-9 connector for the primary data signals and unterminated wires for auxiliary signals.

DB-9 connector pinout:

Pin #	Signal	Signal Direction
pin 2	TX1 (yellow)	To host computer receive port.
pin 3	RX1 (orange)	From host computer transmit port
pin 5	GND (violet)	

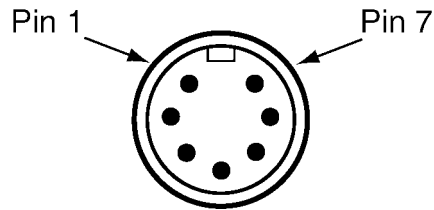
When installing the cable, use a tie-wrap near the antenna to hold the weight of the cable so that the connector is not stressed by the cable weight. If the cable is supplied by the customer, ensure the connector is waterproof (for example, connector and cable molded as one unit). A piece of sleeving covering the two connector halves will help assure a long-lived reliable installation.

The following connector variations are available:

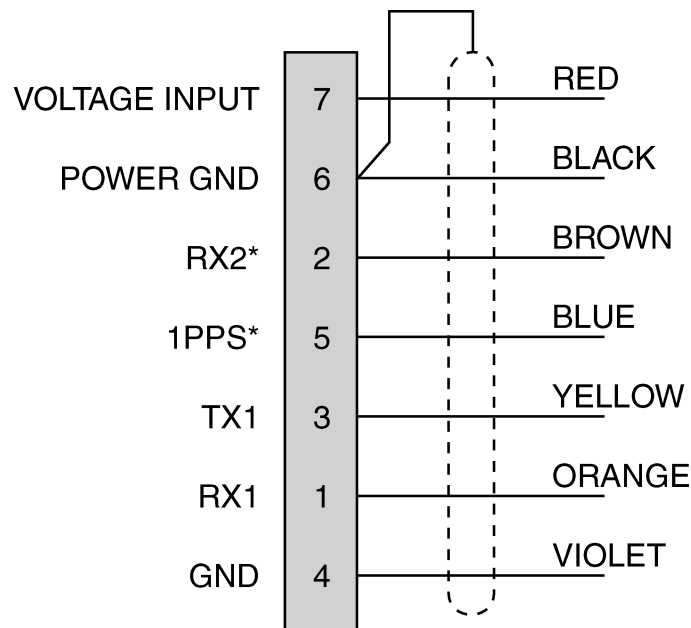
Connector Manufacturer	Installed on the Smart Antenna	Recommended mating connector
Switchcraft	7-pin male EN3P7MP	7-contact female EN3C7FC
ConXall	7281-7PG-300	6282-7SG-3XX

Connector Pin Assignments

Pin numbers and signals for the 7-pin connector are shown below. The most popular model (p/n 100-601903-002) has the following pinouts :



Smart Antenna connector view
from outside of unit



*Alternate signal assignments on these pins (such as TX2 and an external battery connection for memory backup) are available as variations. Please contact CMC Electronics Inc. for latest options. Add -050 to variation number (-xxx) listed below to order Smart Antenna with green enclosure.

The following Smart Antenna configurations are available :

Part Number	Smart Antenna Configuration
100-601903-001	Smart Antenna with RX2 input (pin 2)
100-601903-002	Smart Antenna with RX2 input (pin 2) & 1PPS output (pin 5)
100-601903-003	Smart Antenna with RX2 input (pin 2) & external Memory backup input (pin 5)
100-601903-004	Smart Antenna with 1PPS output (pin 5) & external Memory backup input (pin 2)
100-601903-005	Smart Antenna with RX2 input (pin 2) & TX2 output (pin 5)

Detailed Specifications

12-PARALLEL TRACKING CHANNELS, "ALL-IN-VIEW" OEM UNIT

GENERAL CHARACTERISTICS

L1 Frequency	1,575.42 MHz
Coarse Acquisition	C/A code (1.023 MHz chip rate), code & carrier phase tracking
Sensitivity	-143 dBm (antenna input level)
DGPS Software	Standard

PERFORMANCE CHARACTERISTICS

Velocity	1852 km/h (514 m/sec)
Acceleration	4 Gs (39.2 m/sec ²) Jerk: 2 m/sec ³
Position Accuracy	<1 m circular error probability (CEP), DGPS <16 m circular error probability (CEP), without SA imposed <40 m circular error probability (CEP), with SA imposed
Time to First Fix	Hot start: 15 sec typical, with current almanac, position, time & ephemeris Warm start: 45 sec typical, with current almanac, position, & time Cold start: 2 min typical, with no almanac, no position, & no time
Re-acquisition Time	<1 sec typical to re-acquire (5-sec. obscuration) <3 sec typical to re-acquire (60-min. obscuration)

INTERFACE CHARACTERISTICS

Prime Power	9 to 36 VDC (12V & 24V System) SAE 1455 Heavy Duty Truck Power System. 1.8 watts typical at 14V Reverse Polarity protected and SAE1455 Load Dump protected
Serial Communications	RS-232 asynchronous data ports; Main port IN/OUT plus DGPS INPUT 9,600 baud standard (both ports user-selectable from 300 to 19,200 baud) RS-422/485 version also available

Input Messages

NMEA/Binary Set altitude, position, date & time selectable output messages & rates

DGPS (RTCM SC-104) Message types 1, 2, 3, 9, 16

Output Messages

Tx 1: NMEA GGA, GSA, GSV, RMC, VTG, ZDA, GLL plus proprietary messages

or Binary All data available on NMEA messages plus, ephemeris, channel assignments, self-test result (BIT), plus others

Time Mark Output

1 pulse/sec, aligned with GPS time

(± 200 ns, typical in absolute mode)

(± 50 ns typical, in relative mode), with SA imposed

PHYSICAL CHARACTERISTICS

Dimensions 4.5" dia. x 3.6" H (115mm Dia. x 90mm H)

Weight 1.2 lb maximum not including cable (0.55 Kg)

Mounting 1-14 UNS threads x 1" deep and/or 3 x 10-32 UNF screws

Cable (normal installation) 22 Ga conductors foil shielded cable, environmentally sealed

Connectors Equipment: Weathertight, Switchcraft EN3P7MP or equivalent

Cable: Weathertight, Switchcraft EN3C7FC or equivalent

ENVIRONMENTAL CHARACTERISTICS

Operating Temperature -30 to +75°C (standard)

-40 to +85°C (optional extended temperature range components)

Storage Temperature -55 to +90°C

Humidity SAE J1455/4.2 Procedure I/II

Waterproof Fully sealed unit. Meets MIL-STD 810E method 512.3 (Equivalent to 6-foot, 30-minutes submersion)

Shock MIL-STD 810E Method 506.4, Procedure I, IV

Vibration MIL-STD 810E Method 514.4 Category 8

Salt spray MIL-STD 810E Method 509.3 (48 hours)

Chemical resistance Antenna material is compatible with chemicals encountered in heavy-duty trucks industry

Sand and Dust MIL-STD 810E method 510.3

ESD IEC 1000-4-2 level 2 (-8KV to +8KV)

EMI	FCC Class B, European CE, 89/EEC EN55022 class B, EN50082-1
Transient Protection	SAE J1455 4.11.2 typical vehicle transient voltage characteristics power lines (600 watts, 1 msec)
Ultraviolet Light Protection	ASTM G53-88
Altitude	-10,000 ft to 40,000 ft (-3,000 m to 12,000 m)

OPTIONAL FEATURES

Hardware mounting	Standard: 1-14 UNS pipe (minimum of 6 inches long) Plate adapter and 4 screws Magnetic mount
Cable	Mating cable (5 meters with DB-9 and power lead)
Development kit	Includes cable plus power adapter for PC interfacing. See part number in the section "Obtaining accessories and development kits" of this manual.

APPLICATION NOTES

AN001	Updating Receiver Firmware
AN002	Battery Connection on the Allstar Receiver
AN003	Measurements Usage
AN004	Waypoint Navigation
AN005	Superstar Timing Engine
AN006	WAAS

Troubleshooting

The Smart Antenna does not require a system checkout. If installed according to the instructions, the Smart Antenna will function properly.

If . . .	Then . . .
Satellite signals are often lost; or the Smart Antenna works while traveling in one direction, but not the opposite.	The antenna may be partially shielded by metallic objects. Note: Signals may be lost when under bridges and trees and when shielded by buildings.
Smart Antenna works with engine off or running slowly, but not at operating speed.	Check or relocate ground strap. Try an alternator filter on the alternator, or a noise suppressor on the DC power line to the sensor. Try connecting the Smart Antenna power leads directly to the battery.
Smart Antenna does not output any data	Follow the steps indicated below.

Checking output data

Connect the Smart Antenna to a PC running CMC Electronics GPS Monitor software. Select the proper Comm port on your PC, and click on Binary Mode (or NMEA Mode, if previously configured for NMEA Mode). Next click on Force ALLSTAR to Binary 9600 BPS. These commands reset the Smart Antenna to a known, well-defined state. Then select the desired messages in Binary mode, or switch to NMEA format and select the required messages.

If there is still no output data, disconnect power to the Smart Antenna, and perform the following test:

1. Set the GPS monitor software to the appropriate Comm port, at 9600 baud.
2. Open the Windows -> TERMINAL window. (maximize the terminal window)
3. Apply power to the Smart Antenna.
4. Watch for the following to be displayed in the terminal window:

```
SUPERSTAR
169-614175-xxx      (BOOT S/W Part Number)
D0
PCPB: XXXXXXXXXXXX
GO
```

```
<CMC,Part Nb:169-614174-xxx, CB=0x3F SHP  
                                     (Operational S/W Part Number)  
  
Go to CMC Binary @ 9600 baud  
In CMC Binary @ 9600 baud  
I>
```

If this data is not displayed, verify the interconnections and power source.

If you have followed the troubleshooting steps above, and are still experiencing difficulties, please refer problem to Technical Support listed in the back of this manual.

GPS terminology

baud rate The speed at which data is output from the Smart Antenna—normally set to 9600 baud.

beacon A radio transmitter operated by the U.S. Coast Guard that supplies differential corrections to GPS receivers.

differential corrections Data sent via radio signals to improve the accuracy of GPS receivers. Primary sources include: AM Coast Guard beacon; FM signals from local broadcast stations (such as subscription services offered by DCI and Accqpoint); satellite signals (such as subscription services offered by Racal and OMNISTAR) ; and DGPS Base station.

DGPS Differential GPS—the technique of correcting basic GPS position data to increase its accuracy from 100 meters to 1–2 meters.

geometry The number and location of satellites overhead, determining the GPS accuracy available at any given time.

GPS Global Positioning System—the satellites and receivers that enable position and speed to be determined anywhere on earth with great accuracy.

NMEA National Marine Electronics Association—the industry group that has established standards for exchanging data between electronic navigation equipment. “NMEA 0183” is the standard that’s currently in wide use. It specifies the format for “sentences” containing specific types of data.

satellite An object orbiting the earth. GPS satellites are controlled by ground stations, and transmit signals that can be used to calculate position and speed.

sentence A group of data in one of several formats defined by the National Marine Electronics Association.

WAAS (Wide Area Augmentation System) A new source of DGPS corrections originated by the FAA and transmitted at the same frequency as the GPS signal.

Contacting CMC Electronics Inc.

For sales or service information on this product, contact CMC Electronics Inc. by telephone, fax, or e-mail as follows :

Postal Address:

CMC Electronics Inc.
GPS OEM Group, BOX 17
600 Dr.Frederik-Philips Boulevard
St.Laurent, QC, CANADA H4M 2S9

Web Site :

<http://www.cmcelectronics.ca> (formerly <http://www.baesystems-canada.com>)

Marketing / Sales :

Tel: 514-748-3070
Fax: 514-748-3017
E-mail: gpsmarketing@cmcelectronics.ca

Contracts / Purchase Orders / Shipment Status

Tel: 514-748-3000 Ext.4491 or 4943
Fax: 514-748-3017
E-mail: gpscontract@cmcelectronics.ca

Technical Support :

Tel: 514-748-3050 North America Toll-free : 1-888-262-6060
Fax: 514-748-3024
E-mail: gpshelp@cmcelectronics.ca

FTP Site:

<ftp.cmcelectronics.ca>

Obtaining accessories and development kits

For available accessories and development kits (p/n 241-601153-000), please send your request by e-mail to

gpsmarketing@cmcelectronics.ca

Returning the unit for service

Before returning a unit to CMC Electronics Inc. for repair, contact the factory for instructions and a Returned Materials Authorization (RMA) number. Shipments without a proper RMA number will not be accepted.

930-600015-000 Rev. F