

Technical Article

Developing Software for the CN3 Integrated GPS Receiver

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Introduction

The Intermec CN3 includes an integrated GPS receiver and antenna as an optional feature. The receiver can report horizontal position to a range of approximately 3 meters. This technical paper provides information for developers interested in developing software that makes use of the CN3 integrated GPS receiver.

An Overview of GPS Technology

This section provides an introductory, high-level description of GPS technology. A basic understanding of GPS technology will be helpful as you develop applications that make use of GPS data. You can find additional GPS technical resources on the web that describe the technology in greater detail.

What is GPS?

The Global Positioning System (GPS) is a satellite-based navigation system owned and operated by the US Department of Defense. The system consists of a constellation of at least 24 satellites in orbit about 12,000 miles above Earth. Although initially created for military use, satellites also transmit signals for free, worldwide civilian and commercial use. A GPS receiver's job is to locate three or more of the satellites in this system, figure out the distance to each, and use this information to calculate its own location on Earth.

How GPS works

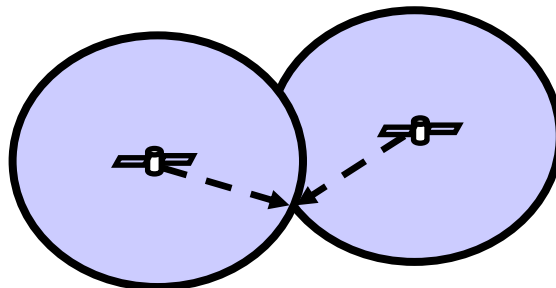
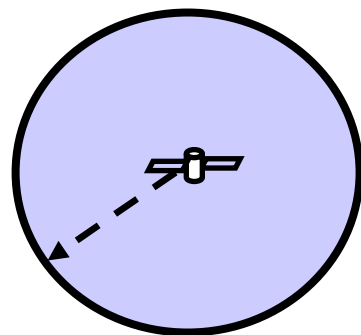
GPS is an outdoor technology requiring the GPS receiver to “see” satellites. Indoor coverage varies widely, and GPS may not work indoors.

STEP #1: GPS satellites broadcast precise time and location information (ephemeris data) which is picked up by a GPS receiver.

Ephemeris data includes orbital parameters used by the GPS receiver to calculate precise satellite position and velocity. “Ephemeris” is an astronomical term meaning: “a table listing the spatial coordinates of celestial bodies and spacecraft as a function of time.”

STEP #2: The GPS receiver determines the distance to each satellite.

Satellite signals travel at a known speed. By comparing signal transmission time to signal reception time, the time required for the GPS signal to travel from the satellite can be measured. Speed and time information are used to calculate

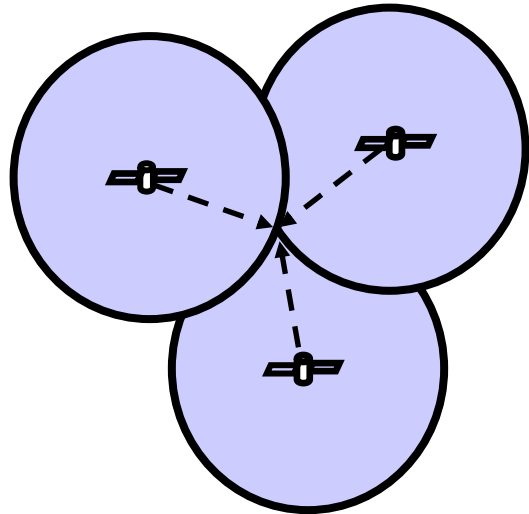


the distance to the satellite.

STEP #3: The GPS receiver uses the distance between itself and 3 or more satellites to “trilaterate” its position.

“Trilateration” is a method of determining the relative positions of objects using the geometry of triangles.

Satellite orbits are arranged so that at least 5 satellites should be in view from any point on Earth. Knowing the distance between a GPS receiver and at least 3 satellite signals provides a 2-dimensional position (latitude and longitude). Knowing the distance between a GPS receiver and 4 satellite signals provides a 3-dimensional position which also includes altitude.



GPS Terminology

- **Signal Strength** - Measured in decibel-hertz (dB-Hz). A signal strength of 28 or better needed for good signal
- **Time to First Fix (TTFF)** - Time required for receiver to establish a position “fix”, i.e., latitude, longitude, altitude
- **Horizontal Dilution of Precision (HDOP)** - Measure of how much satellite geometry affects position estimate. Default (no fix) = 50; values < 6 acceptable

Developing Applications that use GPS

NMEA Support

Satellite signals transmit data in strings. The format of these strings is defined by the National Marine Electronics Association (NMEA) 0183 Interface Standard.

After receiving satellite signals, the CN3’s internal GPS receiver delivers NMEA strings. GPS devices may have the ability to generate proprietary “binary” streams, but these are not supported by Intermec at this time.

Use the Microsoft GPS Intermediate Driver (GPSID)

Direct access from your application code to the GPS receiver in the CN3 is not recommended and is **NOT SUPPORTED**.

Your application must interface to the CN3 integrated GPS receiver via Microsoft’s GPS Intermediate Driver (GPSID) which resides on the CN3. The GPSID provides a layer of abstraction between your application and the CN3 GPS Receiver. This protects your code from hardware revisions to the CN3’s

GPS Receiver, and ideally, enables you to write code that is likely to work with other GPS Receivers besides the one integrated into the CN3. Additional benefits of using the the GPSID include:

1. Allows multiple applications to simultaneously access the GPS data stream
2. Access to GPS data through a friendly API that doesn't require your application to understand and parse NMEA syntax.
3. Provides power management for the GPS receiver. GPS power is correctly managed based on system power model and application access to the GPSID.
4. Over time, Intermec may add additional GPS features. Some features will ONLY be available through use of the GPSID.

A drawback of the GPSID is that it is possible to put the GPS receiver in a non-standard mode that causes GPS data to be returned in a proprietary (binary) format. When this occurs, applications expecting to receive standard GPS data will be "broken".

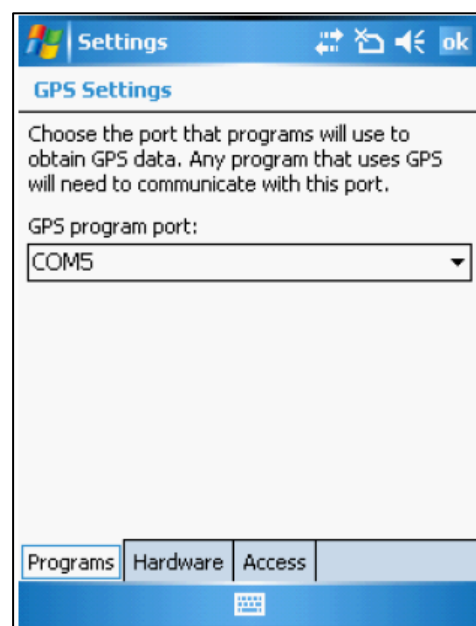
APIs for the GPSID are defined in the "GPS Intermediate Driver Reference" included in the Microsoft Windows Mobile 5.0 SDK. That documentation is available on Microsoft's MSDN site at this link:

<http://msdn2.microsoft.com/en-us/library/ms850332.aspx>

Configuring GPSID options in the CN3

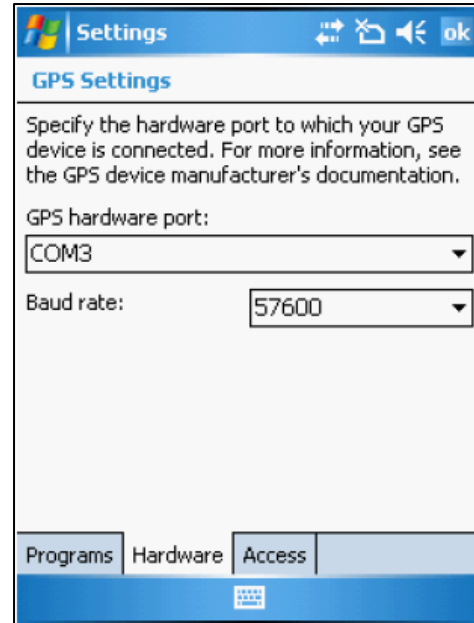
The CN3 includes a GPS control panel applet that allows you to configure GPSID settings by using the touch-screen. The applet is accessible by selecting **Start** | **Settings** | **System** (tab) | **GPS**. The applet contains 3 tabs:

1. **Programs** tab
The first tab allows you to assign the GPSID to an unused port. This is the port that applications will use to get GPS data from GPSID. COM2 is recommended for CN3, but this may need to be changed if another application has been installed using COM2.



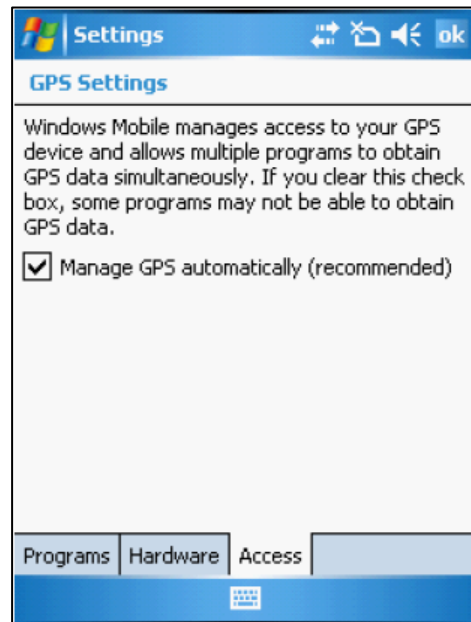
2. **Hardware** tab

The second tab tells GPSID where the GPS data originates. For the internal GPS receiver in a CN3 this must be set to COM3, 57600 baud. Information on how to configure the system for other GPS receivers is beyond the scope of this document.



3. **Access** tab

The third tab allows you to enable/disable GPSID. Select the "Manage GPS automatically" check box.



Improving GPS Performance with Extended Ephemeris Data

The CN3 Integrated GPS Receiver comes with online access to Extended Ephemeris data that minimizes the amount of time it takes the CN3 to acquire a fix, providing a faster Time-To-First-Fix (TTFF). Extended Ephemeris data eliminates the need to obtain precise data directly from the satellite by replacing the ephemeris data broadcast by satellites with a calculated extended ephemeris (EE) data file that predicts a week's worth of ephemerides (location data from GPS satellites).

How Extended Ephemeris Data Works

A GPS Receiver needs to know where each GPS satellite is with a very high degree of accuracy. Each satellite broadcasts its precise location once every 30 seconds, and the receiver must collect this data from every satellite it needs for a fix. If anything interrupts the signal while receiving this data, such as driving by a building or under a tree that momentarily blocks the signal, the receiver has to wait another 30 seconds until the information is broadcast again.

Using EE data, fixes can be obtained and maintained in areas with weaker satellite signals and/or fewer visible satellites such as areas of dense foliage or urban canyons (areas with tall buildings). A small EE data file must be updated weekly to maintain the benefits of EE data.

	Broadcast Ephemeris	Extended Ephemeris
Download time	30 sec	1-2 sec
Lifetime of Data Validity	2 hours (typical)	7 days
How Dynamic?	Sensitive to Obstruction	Robust
# Satellite signals >28dB	4 or more	1

Source: SiRF Technology

Using Extended Ephemeris Data with the CN3

Requirements for Using Extended Ephemeris Data include:

- Your application must interface with the GPS Receiver via the Microsoft GPS Intermediate Driver (GPSID).
- Extended Ephemeris (EE) data is valid for 7 days. You are responsible for updating the EE data stored on your CN3 every 7 days. Update EE data using the synchronization or file transfer method of your choice. EE file

updates are available for download from Intermec. Select one of the following options:

- Download updates from Intermec's ftp site at:
ftp://epsfiles.intermec.com/eps_files/SWFiles/SiRF3.ee
- Download updates from Intermec's web site at
www.intermec.com/swdownloads. Select "CN3" and download the "GPS Extended Ephemeris Data" update. Access the download directly via this URL:
http://www.intermec.com/eprise/main/GSS/Service/Content/Downloads/Show_DownloadSearchResults?Product=CMPTRCN3
- The EE file named "SiRF3.ee" must be loaded in the following location:
 \Program Files\Intermec\GPS\SiRF3\EE

If the downloaded file contains leading digits, be sure to strip those from the front of the file name so that the file is named "SiRF3.ee". The system detects and uses new EE files automatically. If the EE data is not regularly maintained the system will stop using extended ephemeris data and your time-to-first-fix (TTFF) will increase.

Your application can get information about the usage of extended ephemeris data:

- Your application can query the status of the ephemeris data at:

```
[HKEY_LOCAL_MACHINE\SOFTWARE\Intermec\GPS\Internal\SiRF3]
"EEStatus"=dword:
    0x00000000 = EE not being used
    0x00000001 = EE file current
    0x00000002 = EE file out of date
```

- The beginning date of the currently loaded ephemeris file is recorded here:

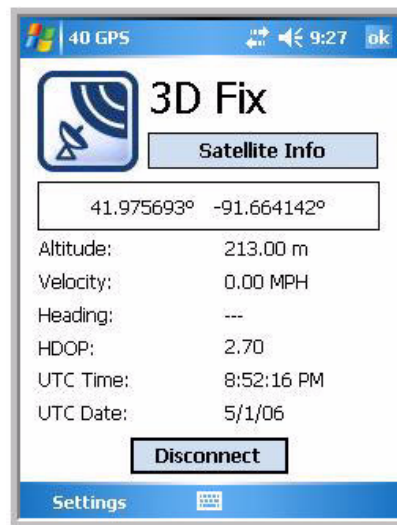
```
[HKEY_LOCAL_MACHINE\SOFTWARE\Intermec\GPS\Internal\SiRF3]
"EETimeStamp"="(Date String)" Time stamp for the beginning of
the time frame wherein this ee file is valid.
```


Software that demonstrates GPS capabilities of the CN3

There are several software demos available from Intermec that show the capabilities of the CN3 integrated GPS receiver. Demonstration software mentioned in this section is available for download from www.intermec.com/swdownloads, select "CN3".

CN3 Features Demo from Intermec

The CN3 Features demo includes a GPS option which enables you to get a fix on your current location. View location details such as latitude, longitude, altitude and velocity.



GPS Tracker Demo from Intermec

GPS Tracker is a “breadcrumbing” demo from Intermec for use on the CN3. “Breadcrumbing” tracks an object’s movement over a period of time. The demo captures position fixes periodically and uploads them to an Intermec web site. The data lives for 24 hours and is plotted on a personal Virtual Earth web page. The demo requires wireless internet connectivity.

