

GVC Level 1A General Functional Overview

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Time Measurement

The communications controller keeps track of two basic time elements in seconds. The time the engine has been running and the time the key is on.

Key-On Time

The total key-on time is represented in seconds and accumulated in Meter 4. It represents the total time the communications controller is in full power mode with power supplied from the ignition key. Key-on time is not reported to the host, but only available by direct connection with the remote communications controller and reading Meter 4.

Engine Running Time

The total engine running time is represented in seconds and accumulated in Meter 0. It represents the total time the communications controller is in full power mode (key-on) and the engine is running. Engine running time is reported with a standard position report provided during communications controller check-in.

Engine Hour Check-in Interval

The total time the engine has run since the last confirmed communication controller check-in is saved in Meter 1. A confirmed check-in may be due the polling of the machine or a scheduled check-in. If the engine hour interval has exceeded a predetermined threshold a check-in occurs and the counter is set to zero to repeat the process.

Engine Hour Log Interval

This is a trigger point in seconds that once reached the current position and total engine running time are saved to flash for latter reading during a check-in. It allows positions and hours to be saved on a defined engine hour interval to be reported when a check-in occurs. This function is disabled in the GVC Level 1A release.

Power Operation / Modes

The GVC Level 1A communications controller has 4 power modes used. They are as follows:

Full On

In full on or full power mode the GPS is powered up and doing position fixes, the cellular system is powered and capable of either checking in or being contacted (polled). All I/O are monitored continuously.

Ears On

In ears on power mode the GPS is not powered, but the cellular system is power in a minimum state and capable of either checking in or being contacted (polled). All I/O are monitored on a 5-second basis to reduce power consumption. Ears on time is configurable in seconds

Power Save

In power save mode the GPS is not powered and the cellular system is not powered. The FCP (Function Control Processor) wakes on a 5-second interval to do a house keeping check I/O and

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check if a schedule must be executed. If a scheduled check-in is required the communications controller will power-up perform the check-in and then return to power save mode. This sequence is repeated until the retry configuration has been met. Power save time is only established if key-on and engine running are seen prior to key off. Power save time is configurable in seconds.

Off

In the off mode the communications controller consumes no battery power. This mode is entered with the key on only and no engine running signal and then the key is turned off, or when the power save time has expired.

The following table describes the power consumption within the different modes of operation. This information is duplicated from the power management section and describes the maximum power reserve consumption (AmpHr) once a Key-On and Engine-Running event occur.

Power reserve consumption

(during Power Save from Key-Off)

Power save mode – Ears On (8 hours)

Power save mode – Sleep (70 hours)

Failed check-in attempts – (1 min - 12 total)

Total

60 mA	0.48 AmpHr
6 mA	0. AmpHr
500 mA	0.10 AmpHr
	1.00 AmpHr

Check-in Processing

The communications controller performs 3 types of check-ins. When communications are established to the host an ID and reason code for the check-in are sent. Currently 3 reason codes are used. The reason codes are a binary mask that may contain multiple reasons if a prior check-in attempt was unsuccessful. The default Level 1A Configuration will be no scheduled check-in with an engine hour interval check-in.

Scheduled Check-in (reason code 0x0001)

A scheduled check-in is based on a time schedule entered into the communications controller. In the GVC L1A application one time on each day of the week is set-up to execute a check-in. Each day of the week may be individually enabled or disabled. The actual time set in the controller to check-in is randomized over a 2-hour interval. Due to highly accurate GPS clock this is required to prevent over loading at the communications server. The scheduled-in check-in may also be disabled.

Polled Check-in (reason code 0x0002)

A polled check-in occurs when the unit is dialed from the host. Under this check-in the communications controller position and engine meter reading are read. After directly reading the current values the data stored in flash is downloaded from the unit.

Engine Hour Interval Check-in (reason code 0x1000)

An engine hour interval check-in is based on the engine hour operation reaching an accumulated threshold and that no confirmed check-in has occurred. This type of check-in is based on engine running time accumulation. For example the vehicle could report for every 8 hours of operation. Please refer to the operating time metering above.

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Synchronize Plug Pull Check-in (reason code 0x2000)

A synchronize plug pull check-in is manually initiated by pulling the diagnostic plug and re-inserting it. This check-in is used for the synchronization of engine hours and/or diagnostics purposes. When used to calibrate vehicle hours the current engine hours and a time/date stamp of the event must be recorded. From this record a calibration valued may then later be configured at the host, via the web interface. A paper form (Deere Trak Installation Record) is inserted into the installation kit to aid in this set-up.

Retry Configurations

The retry configuration controls how a failed check-in attempt is retried. The retry configuration for check-ins is explained below.

Data Logging to Flash

The communications controller uses a process of saving information to flash memory on an event and then the information is downloaded during a check-in. This process preserves data integrity during power failures. Also with date/time stamping of data on the communication controller this preserves a vehicle time reference basis, even when the data is transmitted much later in time.

GPS Position/Velocity and Total Engine Running

Based on the check-in events both a GPS position/velocity and total engine running time records are written to flash (location – Flash 0). The information in each report is summarized below:

GPS Position/Velocity Record

Current GPS information

Date/time, GPSStatus, GPSErrorCode

Last know GPS fix information

TimeOfFix, EastVelocity, NorthVelocity, UpVelocity, Latitude, Longitude, Altitude, VelocityScaling, FixType, NumSys, UtcOffset

Engine Running Meter

Meter Id=0, OperationMode, MeterValue, MeterThreshold

Cellular Diagnostic Information

The communication controller is configured to process diagnostic operations before and after each phone call attempt. The pre and post-connection action will be processed with each outgoing call attempt and stored in on board unit diagnostic Flash (Area 5). In this area GPS Position/Velocity, Cellular Status, FCP (Function Controller Processor) Status, General Hardware Status are stored prior to the call. After the call a Connection Log Status is stored. The diagnostic flash area saves the last 51 check-in call attempts. The diagnostic data when the unit is paged is not saved. Diagnostic LEDs

Diagnostic LEDs

On the system two diagnostic LEDs are provided. One LED provides diagnostic on availability of cellular service and positively verifies a device checked in to the host communication services. The second LED provides diagnostics for both engine running and GPS positioning.

Cellular LED

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The following table describes the operation of the Cellular LED. Please pay particular attention of the sequence of operation followed in the table.

Cellular LED

Cellular Service Availability Check

- Vehicle Key-Off
- Vehicle Key-On (0 to 7 seconds)
- Vehicle Key-On (15 seconds to "Service Available")
- Vehicle Key-On ("Service Available") – steady state

Synchronization Check – "Service Available"

- Vehicle Key-On "Sync Plug and re-insert" => start check in
- Vehicle Key-On (start check-in to communicating with host)
- Vehicle Key-On communicating with host
- Vehicle Key-On ("Service Available") – steady state

State

Off
On
Off
On
On
On
Off
On

Engine Running/GPS Positioning LED

The following table describes the operation of the Engine Running/GPS LED. Please pay particular attention of the sequence of operation followed in the table. The logic driving the LED is Engine Running or GPS Positioning.

Engine Running/GPS Positioning LED

Cellular Service Availability Check

- Vehicle Key-Off
- Vehicle Key-On (0 to 5 seconds)
- Vehicle Key-On (5 seconds to "GPS Positioning")
- Vehicle Key-On ("GPS Positioning") – steady state

Synchronization Check – "GSP Input Signal Disabled"

- Vehicle Key-On / Engine Running-Off
- Vehicle Key-On / Engine Running-On

State

Off
On
Off
On
Off
On

Communication Connection Parameters

Retry Configuration

1	Number of retries on each system for a single connection attempt
56	Delay between each retry in seconds
2	Total number of multiple retries
60	Delay between multiple retries in minutes

Retry configuration establishes the communications controller attempt retry sequence for completing a check-in event. The communications controller will attempt up to 6 calls for each check-in request. The retry sequence is defined as 2 attempts separated by 56 seconds, wait 60 minutes, 2 more attempts separated by 56 seconds, wait 60 minutes and a final 2 attempts separated by 56 seconds.

Automatic Redial

Automatic redial controls how the communications controller responds when contacted by the communications server. Under the current configuration the unit will answer and respond accordingly to properly formatted query and configuration messages. This allows the

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communication controller to be configured and/or re-programmed over-the-air. Upon receiving a page the unit immediately answers to minimize airtime.

Diagnostic Operation

The communication controller is configured to process diagnostic operations before and after each phone call attempt. The pre and post-connection action will be processed with each out going call attempt and stored in on board unit diagnostic Flash (Area 5). In this area GPS Position/Velocity, Cellular Status, FCP (Function Controller Processor) Status, General Hardware Status are stored prior to the call. After the call a Connection Log Status is stored. The diagnostic flash area saves the last 51 check-in call attempts. The diagnostic data when the unit is paged is not saved.

During cellular operation the GPS is turned off to maximize available transmit power, reducing current draw. Just prior to the call the GPS position is saved and reported during the check-In.

Miscellaneous Configurations

A continuous communications handshake occurs when the unit is on the air. If a handshake time-out occurs of over 25 seconds the link is declared inactive and shutdown. If a handshake is present, but no command packets are processed within 120 seconds the communications channel is also declared inactive and shutdown.

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NAM Configuration

ID

The Communications Controller Asset ID is set equivalent to the ESN of the AMPS cellular module minus the leading byte. This assignment will be permanent and unique for each device produced.

Description

Within the Communications Controller the Description field is used for identification of the software loaded into the unit. There are other methods to obtain this information, but this provides a single string to identify the software loaded into the unit.

Example: GVC1A009*0316*020*043*040*100*1400*002 (50 Chars Max)

GVC Configuration Level	GVC1A009
CVDM Application Firmware	0.31.6
CVDM Boot Firmware	0.2.0
Hitachi Firmware	0.4.3
Boot Firmware	0.4.0
GPS System Firmware	1.0.0
GPS Signal Firmware	1.40.0
SID Table	002

Dial String

An 800 number is entered into the unit as the number to dial for a check-in to occur. Regardless of the setting of this number a communications controller serviced by the WIN4 network will always dial the 800 number provide by WIN4 configuration.

GPS Parameters

The GPS within the communications controller is configure to not power the GPS system while making a cellular connection or when waking up to perform a scheduled event. The position that is saved and reported when waking up to perform a scheduled event is based on the position last seen during full power mode (Key-On). This conserves power during scheduled check-ins and assumes the vehicle has not moved unless a Key-On event occurs.

Power Management

The communications controller voltage management is described below. When looking at this table it is important to remember the power supply is designed to support an external battery if required. The Asset voltage represents voltage supplied to the unit. The Battery voltage represents voltage supplied to an intermediary point through a charger (where an external battery is attached). The charger output is controlled based on the battery voltage and temperature when present. In the Level 1A no external battery is present and the temperature thermistor is internally to the unit and set at 10K. In this configuration the controller charger outputs a nominal 14volts.

Battery voltage levels (Volts)

Low voltage off (8-12)

10.8

Asset voltage levels (Volts)

Low voltage off (8-24)

9.1

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Low voltage on (8-14)	12.0	Low voltage on (8-28)	9.5
Low voltage warning (8-14)	11.2	Low voltage warning (8-28)	9.5
Max voltage off (15-20)	16.2		
Max voltage on (10-20)	15.0	☐ Full On Power	

The communications controller power off monitor sets the interval at which the FCP checks and verifies voltage levels. The communications controller power save monitor sets the interval at which the FCP wakes and does house keeping duties in regards to scheduled events, external I/O, etc..

Power monitor

Power Save monitor status update interval (2-63)	5.00	Seconds
Power Off monitor status update interval (2-63)	5.00	Seconds

The following table describes the power consumption within the different modes of operation. This information is duplicated in the power management section, describing the maximum power consumption in AmpHr once a Key-On and Engine-Running event occur and then the vehicle is turned off.

Power reserve consumption (during Power Save)

Power save mode – Ears On (8 hours)	60 mA	0.48 AmpHr
Power save mode – Sleep (70 hours)	6 mA	0.42 AmpHr
Failed check-in attempts – (1 min - 12 total)	500 mA	0.10 AmpHr
Total		1.00 AmpHr

SID Table

The SID Table configuration is only used with the WIN4 service. The WIN4 Service utilizes a prioritization for the selection of either the A-side or B-side carrier. A unique feature of the service is that it is allowed to use both A/B-side carriers within the same service area based on availability of signal.