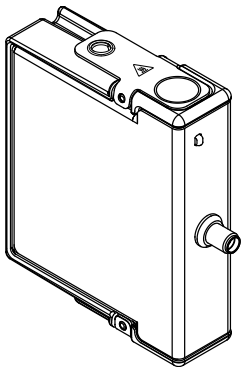


GETTING STARTED GUIDE

NI 9467

C Series GPS Synchronization Module



This document explains how to connect to the NI 9467.



Note Before you begin, complete the software and hardware installation procedures in your chassis documentation.



Note The guidelines in this document are specific to the NI 9467. The other components in the system might not meet the same safety ratings. Refer to the documentation for each component in the system to determine the safety and EMC ratings for the entire system.

Safety Guidelines

Operate the NI 9467 only as described in this document.



Caution Do not operate the NI 9467 in a manner not specified in this document. Product misuse can result in a hazard. You can compromise the safety protection built into the product if the product is damaged in any way. If the product is damaged, return it to NI for repair.

Safety Guidelines for Hazardous Locations

The NI 9467 is suitable for use in Class I, Division 2, Groups A, B, C, D, T4 hazardous locations; Class I, Zone 2, AEx nA IIC T4 and Ex nA IIC T4 hazardous locations; and nonhazardous locations only. Follow these guidelines if you are installing the NI 9467 in a potentially explosive environment. Not following these guidelines may result in serious injury or death.



Caution Do not disconnect I/O-side wires or connectors unless power has been switched off or the area is known to be nonhazardous.



Caution Do not remove modules unless power has been switched off or the area is known to be nonhazardous.



Caution Substitution of components may impair suitability for Class I, Division 2.




Caution For Division 2 and Zone 2 applications, install the system in an enclosure rated to at least IP54 as defined by IEC/EN 60079-15.



Caution For Division 2 and Zone 2 applications, install a protection device between the external power supply and the Vsup pin. The device must prevent the Vsup-to-COM voltage from exceeding 50 V if there is a transient overvoltage condition.

Special Conditions for Hazardous Locations Use in Europe and Internationally

The NI 9467 has been evaluated as Ex nA IIC T4 Gc equipment under DEMKO Certificate No. 07 ATEX 0626664X and is IECEx UL 14.0089X certified. Each NI 9467 is marked  II 3G and is suitable for use in Zone 2 hazardous locations, in ambient temperatures of $-40\text{ }^{\circ}\text{C} \leq T_a \leq 70\text{ }^{\circ}\text{C}$. If you are using the NI 9467 in Gas Group IIC hazardous locations, you must use the device in an NI chassis that has been evaluated as Ex nC IIC T4, Ex IIC T4, Ex nA IIC T4, or Ex nL IIC T4 equipment.



Caution You must make sure that transient disturbances do not exceed 140% of the rated voltage.



Caution The system shall only be used in an area of not more than Pollution Degree 2, as defined in IEC 60664-1.



Caution The system shall be mounted in an ATEX/IECEX-certified enclosure with a minimum ingress protection rating of at least IP54 as defined in IEC/EN 60079-15.



Caution The enclosure must have a door or cover accessible only by the use of a tool.

Electromagnetic Compatibility Guidelines

This product was tested and complies with the regulatory requirements and limits for electromagnetic compatibility (EMC) stated in the product specifications. These requirements and limits provide reasonable protection against harmful interference when the product is operated in the intended operational electromagnetic environment.

This product is intended for use in industrial locations. However, harmful interference may occur in some installations, when the product is connected to a peripheral device or test object, or if the product is used in residential or commercial areas. To minimize interference with radio and television reception and prevent unacceptable performance degradation, install and use this product in strict accordance with the instructions in the product documentation.

Furthermore, any changes or modifications to the product not expressly approved by National Instruments could void your authority to operate it under your local regulatory rules.



Caution To ensure the specified EMC performance, operate this product only with shielded cables and accessories.

Special Conditions for Marine Applications

Some products are Lloyd's Register (LR) Type Approved for marine (shipboard) applications. To verify Lloyd's Register certification for a product, visit ni.com/certification and search for the LR certificate, or look for the Lloyd's Register mark on the product.



Caution In order to meet the EMC requirements for marine applications, install the product in a shielded enclosure with shielded and/or filtered power and input/output ports. In addition, take precautions when designing, selecting, and installing measurement probes and cables to ensure that the desired EMC performance is attained.

NI 9467 Overview

The NI 9467 is a stationary GPS timing module for C Series platforms. It provides accurate timing and geographic location information to the C Series host, which enables synchronization of C Series systems.

Start-Up Behavior

At start-up, the NI 9467 automatically begins determining its location through a process known as self-survey. During the self-survey, the module computes a location fix every second and averages the locations at the end to obtain a more accurate location. After the self-survey, the NI 9467 no longer computes new location fixes; it uses its known location and satellite signals to generate accurate timing signals.

Like all GPS receivers, the NI 9467 requires GPS satellite ephemeris and almanac data to compute accurate time and location. The ephemeris is detailed orbital information about each satellite (where each satellite is expected to be at a given time). The almanac data describes the general health of each satellite

(for example, the receiver must not use signals from satellites marked as unhealthy) and contains coarse orbit information. The GPS satellites broadcast the ephemeris and almanac data every 30 seconds. Therefore, it usually takes approximately 30 seconds for it to receive the ephemeris and almanac data and start computing location and timing fixes.

Status LED

The NI 9467 has a front panel LED to indicate status. The following table describes the meaning of each LED pattern.

Conditions	LED State
Normal operation	Solid green
Performing survey	Blinking green
Not enough or no satellites	Blinking yellow
Antenna error (no antenna or over-current)	Solid yellow
Unconfigured	Off



Note Although the module may not detect the presence of very low-power GPS antennas, it can still function correctly. Note that the LED and software may report antenna error under these conditions, and if the current consumed is close to the detection threshold the LED may flicker. Refer to the *Specifications* section for more details.

Connecting the NI 9467

The NI 9467 has one SMA female connector on its front panel for a GPS active antenna. The connector provides a DC voltage to power the antenna and also serves as input for the GPS RF signal.

Installing the Antenna



Caution National Instruments recommends using a lightning arrester in line with the GPS antenna installation to protect the NI 9467 and the C Series system from possible damage and operators from injury in the event of lightning.

The embedded GPS receiver in the NI 9467 requires signals from several satellites to compute accurate timing and location. The more satellites available to the receiver, the more accurately it can determine time and location. Therefore, the antenna location should be such that it receives signals from the greatest number of satellites possible. As the number of satellites visible to the antenna decreases, the synchronization performance may also decrease. Choose the antenna location so that the antenna has a clear view of the sky. There is no strict definition for a clear view of the sky, but a suitable guideline is that the GPS antenna should have a straight line of sight to the sky in all directions (360°) down to an imaginary line making a 30° angle with the ground. Locations far from trees and tall buildings that could block or reflect GPS satellite signals are best.

Maximum Cable Length

Maximum cable length depends on the GPS antenna gain and the cable's loss per unit of distance. National Instruments recommends a GPS signal strength of between -135 dBm and -120 dBm at the NI 9467 SMA input. GPS signal strength on the Earth's surface is typically -130 dBm. Targeting a signal strength

of -125 dBm at the SMA input, you can compute the maximum cable length as:

$$\text{Max_cable_loss} = -130 \text{ dBm} + \text{antenna_gain} - (-125 \text{ dBm})$$

$$\text{Max_cable_length} = \text{Max_cable_loss} / \\ (\text{loss_per_unit_of_distance})$$

For example, if you use an active antenna with gain of 28 dB and RG-58 cable, which has a rated loss at 1.5 GHz of about 0.8 dB/m (24.5 dB/100 ft), the maximum cable length you could use is:

$$\text{Max_cable_loss} = -130 \text{ dBm} + 28 \text{ dB} - (-125 \text{ dBm}) = 23 \text{ dB}$$

$$\text{Max_cable_length} = 23 \text{ dB} / (0.8 \text{ dB/m}) \approx 29 \text{ m}$$

Sleep Mode

This module supports a low-power sleep mode. Support for sleep mode at the system level depends on the chassis the module is plugged into. Refer to the chassis manual for information about support for sleep mode. If the chassis supports sleep mode, refer to the software help for information about enabling sleep mode. Visit ni.com/info and enter `cseriesdoc` for information about C Series documentation.

Typically, when a system is in sleep mode, you cannot communicate with the modules. In sleep mode, the system consumes minimal power and may dissipate less heat than it does in normal mode. Refer to the *Specifications* section for more information about power consumption and thermal dissipation.

Notice that when the NI 9467 is in sleep mode, the GPS receiver is not powered and stops tracking satellites. When the module exits sleep mode and power to the GPS receiver is restored, the module goes through the normal power-up process, which includes the ephemeris/almanac data acquisition and self-survey process. Therefore, it can take approximately 30 seconds before usable timing and location signaling can be generated. Refer to *Start-Up Behavior* for more information.

NI 9467 Specifications

The following specifications are typical for the range $-40\text{ }^{\circ}\text{C}$ to $70\text{ }^{\circ}\text{C}$ unless otherwise noted.

General Characteristics

Signal type	L1 frequency; GPS C/A code
Datum	WGS-84
RF GPS signal frequency	1575.42 MHz
Recommended signal strength at SMA ¹	-135 dBm to -120 dBm
Max RF power at input	3 dBm
Input impedance	50 Ω , nominal
MTBF	2,234,702 h at 25 °C; Bellcore Issue 2, Method 1, Case 3, Limited Part Stress Method
PPS accuracy ²	± 100 ns, > 99% typical

¹ Higher signal strength might saturate the receiver and degrade performance.

² For the best timing accuracy performance, ensure that the GPS antenna has a clear view of the sky. Refer to the *Antenna Installation* section for more details.

GPS Antenna Connector Characteristics

GPS antenna connector type	SMA female
DC voltage output for active antenna	+5 V \pm 10%
Max. current output	30 mA
Minimum current for antenna presence detection	6 mA typical, 9.5 mA max
Over-voltage protection	\pm 30 VDC

Power Requirements

Power consumption from chassis	
Active mode	150 mA max
Sleep mode	1 mA
Thermal dissipation (at 70 °C)	
Active mode	550 mW max
Sleep mode	5 mW

Physical Characteristics

To clean the module, wipe it with a dry towel.

Weight	141 g (4.5 oz)
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Environmental

Refer to the manual for the chassis you are using for more information about meeting these specifications.

Operating temperature (IEC 60068-2-1, IEC 60068-2-2)	-40 °C to 70 °C
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Storage temperature (IEC 60068-2-1, IEC 60068-2-2)	-40 °C to 85 °C
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Ingress protection	IP40
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Operating humidity (IEC 60068-2-78)	10% RH to 90% RH, noncondensing
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Storage humidity (IEC 60068-2-78)	5% RH to 95% RH, noncondensing
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Pollution Degree	2
Maximum altitude	5,000 m

Indoor use only.

Shock and Vibration

To meet these specifications, you must panel mount the system.

Operating vibration

Random (IEC 60068-2-64)	5 g _{rms} , 10 Hz to 500 Hz
Sinusoidal (IEC 60068-2-6)	5 g, 10 Hz to 500 Hz
Operating shock (IEC 60068-2-27)	30 g, 11 ms half sine; 50 g, 3 ms half sine; 18 shocks at 6 orientations

Safety and Hazardous Locations Standards



Note The NI 9467 module does not provide electrical isolation.

This product is designed to meet the requirements of the following electrical equipment safety standards for measurement, control, and laboratory use:

- IEC 61010-1, EN 61010-1
- UL 61010-1, CSA 61010-1
- EN 60079-0:2012, EN 60079-15:2010
- IEC 60079-0: Ed 6, IEC 60079-15; Ed 4
- UL 60079-0; Ed 5, UL 60079-15; Ed 3
- CSA 60079-0:2011, CSA 60079-15:2012



Note For UL and other safety certifications, refer to the product label or the *Online Product Certification* section.

Hazardous Locations

U.S. (UL)	Class I, Division 2, Groups A, B, C, D, T4; Class I, Zone 2, AEx nA IIC T4
Canada (C-UL)	Class I, Division 2, Groups A, B, C, D, T4; Class I, Zone 2, Ex nA IIC T4
Europe (DEMKO)	Ex nA IIC T4 Gc

Electromagnetic Compatibility

This product meets the requirements of the following EMC standards for electrical equipment for measurement, control, and laboratory use:

- EN 61326-1 (IEC 61326-1): Class A emissions; Industrial immunity
- EN 55011 (CISPR 11): Group 1, Class A emissions
- AS/NZS CISPR 11: Group 1, Class A emissions
- FCC 47 CFR Part 15B: Class A emissions
- ICES-001: Class A emissions



Note In the United States (per FCC 47 CFR), Class A equipment is intended for use in commercial, light-industrial, and heavy-industrial locations. In Europe, Canada, Australia and New Zealand (per CISPR 11) Class A equipment is intended for use only in heavy-industrial locations.



Note Group 1 equipment (per CISPR 11) is any industrial, scientific, or medical equipment that does not intentionally generate radio frequency energy for the treatment of material or inspection/analysis purposes.



Note For EMC declarations and certifications, and additional information, refer to the [Online Product Certification](#) section.

CE Compliance

This product meets the essential requirements of applicable European Directives, as follows:

- 2014/35/EU; Low-Voltage Directive (safety)
- 2014/30/EU; Electromagnetic Compatibility Directive (EMC)
- 94/9/EC; Potentially Explosive Atmospheres (ATEX)

Online Product Certification

Refer to the product Declaration of Conformity (DoC) for additional regulatory compliance information. To obtain product certifications and the DoC for this product, visit ni.com/certification, search by model number or product line, and click the appropriate link in the Certification column.

Environmental Management

NI is committed to designing and manufacturing products in an environmentally responsible manner. NI recognizes that eliminating certain hazardous substances from our products is beneficial to the environment and to NI customers.

For additional environmental information, refer to the *Minimize Our Environmental Impact* web page at ni.com/environment. This page contains the environmental regulations and directives with which NI complies, as well as other environmental information not included in this document.

Waste Electrical and Electronic Equipment (WEEE)



EU Customers At the end of the product life cycle, all NI products must be disposed of according to local laws and regulations. For more information about how to recycle NI products in your region, visit ni.com/environment/weee.

电子信息产品污染控制管理办法（中国 RoHS）



中国客户 National Instruments 符合中国电子信息产品中限制使用某些有害物质指令 (RoHS)。关于 National Instruments 中国 RoHS 合规性信息，请登录 ni.com/environment/rohs_china。(For information about China RoHS compliance, go to ni.com/environment/rohs_china.)

Worldwide Support and Services

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Visit ni.com/services for NI Factory Installation Services, repairs, extended warranty, and other services.

Visit ni.com/register to register your NI product. Product registration facilitates technical support and ensures that you receive important information updates from NI.

A Declaration of Conformity (DoC) is our claim of compliance with the Council of the European Communities using the manufacturer's declaration of conformity. This system affords the user protection for electromagnetic compatibility (EMC) and product safety. You can obtain the DoC for your product by visiting ni.com/certification. If your product supports calibration, you can obtain the calibration certificate for your product at ni.com/calibration.

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