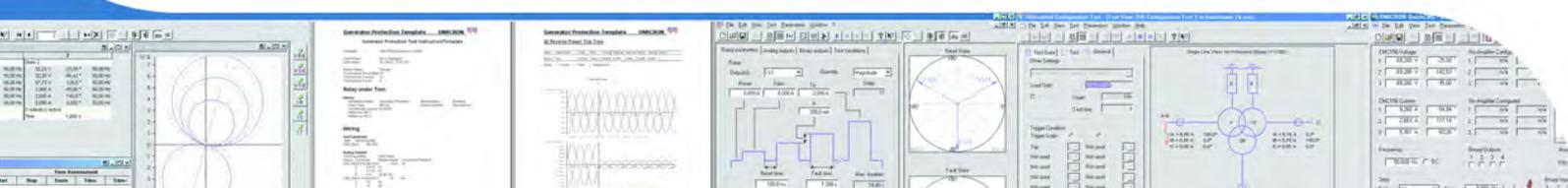


OMICRON

Reference Manual

CMGPS

Synchronization Unit



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The product information, specifications, and technical data embodied in this manual represent the technical status at the time of writing and are subject to change without prior notice.

We have done our best to ensure that the information given in this manual is useful, accurate and entirely reliable. However, OMICRON electronics does not assume responsibility for any inaccuracies which may be present.

The user is responsible for every application that makes use of an OMICRON product.

OMICRON electronics translates this manual from the source language English into a number of other languages. Any translation of this manual is done for local requirements, and in the event of a dispute between the English and a non-English version, the English version of this manual shall govern.

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Preface

The purpose of this reference manual is to familiarize users with the *CMGPS* synchronization unit and to show how to properly use it in various application areas.

The reference manual contains important tips on how to use the *CMGPS* synchronization unit safely, properly, and efficiently. Its purpose is to help you avoid danger, repair costs, and down time as well as to help maintain the reliability and life of the *CMGPS* synchronization unit.

This reference manual is to be supplemented by existing national safety standards for accident prevention and environmental protection.

The reference manual should always be available at the site where the *CMGPS* synchronization unit is used. It should be read by all personnel operating the synchronization unit.

Note: The OMICRON *Test Universe* software also installs a PDF version of this reference manual. It can directly be opened by a mouse-click from the help topic "User Manuals". The *Test Universe* Help can be launched by clicking **Help** on the *Start Page*.

In addition to the reference manual and the applicable safety regulations in the country and at the site of operation, the usual technical procedures for safe and competent work should be heeded.

Note: This reference manual describes the *CMGPS* synchronization unit hardware - that is, the physical device. In order to get familiar with the software for controlling and configuring the *CMGPS* synchronization unit, please refer to the software manuals and/or the OMICRON *Test Universe* Help.

Safety Requirements



Before operating the *CMGPS*, carefully read the following safety instructions.

Only operate the *CMGPS* after you have read this manual and fully understood the instructions herein.

The *CMGPS* may only be operated by trained personnel. Any maloperation can result in damage to property or persons.

Principles, Designated Use

- The *CMGPS* should only be used when in a technically sound condition. Its use should be in accordance with the safety regulations for the specific job site and application. Always be aware of the dangers of the high voltages and currents associated with this equipment. Pay attention to the information provided in the reference manual and the software documentation.
- The *CMGPS* is exclusively intended for the application areas specified in section 1, "Designated Use" on page 9. The manufacturer/distributors are not liable for damage resulting from unintended usage. The user alone assumes all responsibility and risk.
- The instructions provided in this reference manual and the associated software manuals are considered part of the rules governing proper usage.
- Do not open the *CMGPS* or remove any of its housing components.

Orderly Practices and Procedures

- The reference manual (or its "electronic PDF pendant", which is installed to your computer with the OMICRON *Test Universe* software) should always be available on site where the *CMGPS* is used.



Note: The OMICRON *Test Universe* software also installs a PDF version of this reference manual. It can directly be opened by a mouse-click from the help topic "User Manuals". The *Test Universe* Help can be launched by clicking **Help** on the *Start Page*.

- Personnel assigned to using the *CMGPS* must have read this reference manual and fully understood the instructions herein.
- Do not carry out any modifications, extensions or adaptations at the *CMGPS*.

Operator Qualifications

- Testing with the *CMGPS* should only be carried out by authorized and qualified personnel.
- Personnel receiving training, instruction, direction, or education on the *CMGPS* should remain under the constant supervision of an experienced operator while working with the equipment.

Safe Operation Procedures

- The *CMGPS* is to be set into operation in accordance with the information provided in section 4 "Operating the *CMGPS*".
- The *CMGPS* must not be opened! If the device is opened, no guarantee claims can be made.
- Do **not** position the antenna of the *CMGPS* in an exposed location **above the lightning rod** or in other locations endangered by lightning. Make sure that the position of the lightning rod is higher than that of the antenna in any case.
When installing the *CMGPS*, observe the general rules for lightning protection complying with the industrial standard.
In addition to that, do **not** position the antenna within a control cabinet in the vicinity of **flashover-endangered spots**.
- The *CMGPS* must not be used in connection with devices with an operating voltage that exceeds 250 V r.m.s. (for further details refer to section 6.8 "Insulation Coordination").
- The electric equipment of the *CMGPS* is to be regularly checked. Any fault such as loose connections or defective cables is to be immediately repaired.
- If work has to be carried out on components connected to the mains supply, a second person is required who presses, in case of emergency, the emergency stop and/or the main push button with overvoltage release.

1 Designated Use

The *CMGPS* is designed to either

- control **one** OMICRON CMC test set at a predetermined point in time (triggering the starting point of a test process) or
- to synchronize the starting point of a test process of **two** or **more** OMICRON CMC test sets.

by means of the GPS signal with world-wide reception.

The test set is controlled:

- via the **ext. Interf.** input¹ at the rear of the CMC test set
or
- via a binary input on the front of the CMC test set.

Using the *CMGPS* for other purposes than those described above is not considered the designated use.

The *CMGPS*'s specifications have been determined in the course of a project to develop a **mobile** synchronization unit for CMC test sets. The *CMGPS* may **not** be installed **stationary**.

Any other use of the *CMGPS* is only permitted after OMICRON electronics has expressly agreed to it.

Observance of the operating instructions and compliance with the precautions outlined therein is part of the defined use.

1. Refer also to section 3.3.3 "ext. Interf."

2 Introduction

2.1 What is GPS?

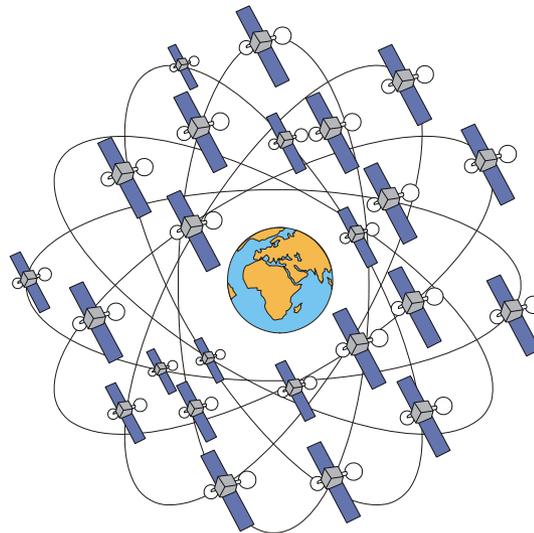
The Global Positioning System (GPS) is one of two satellite navigation systems covering the whole earth. It was developed in 1978 by the US Department of Defence to replace TRANSIT, the first US satellite navigation system, and was initially designed to develop the defence ability of the USA.

The second system currently being used is the GLObal NAVigation Satellite System (GLONASS), operated by Russia. The system was completed in 1995.

Technical Principles

GPS navigation is based on the principle of determining the distance between a certain location on the earth to the NAVSTAR satellites revolving around the earth on six different orbits twice a day. Their orientation in relation to the equator is approx. 55 °.

Figure 2-1:
The NAVSTAR
satellites on their orbits



The satellites are continuously sending encoded position and time information in a frequency range of approx. 1500 MHz.

Special GPS receivers (passive receivers) receive these signals and determine their exact position in the system of earth co-ordinates by means of the signal code as well as measurement of the time span between receiving the signals.

At the same time, the GPS receiver's clock is synchronized to the atomic clocks aboard the GPS satellites.

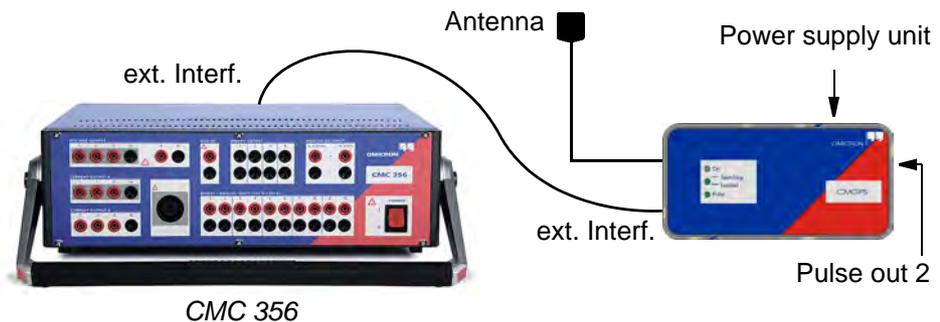
2.2 Purpose of the CMGPS

CMGPS is a system extension which allows for controlling (triggering) a CMC test set at a precisely defined moment via the GPS¹ satellite signal with world-wide reception (see also section "Technical Principles").

Based on this innovative test method by using two or more CMGPS extension units, two or more CMC test sets can be started simultaneously with a synchronization error of the CMGPS output of $< 1 \mu\text{s}^2$. There may be any distance between these test sets to be synchronized (see also section 5 "Synchronizing Two or More CMC Test Sets").

By utilizing the GPS signal it is thus possible to ensure identical trigger time of test processes of several independently operating test units, regardless of the distance between them.

Figure 2-2:
CMGPS connected to
CMC 356 test set



1. **Global Positioning System**
2. Depends on the accuracy set by means of the software (please also refer to chapter 5.1 "Standard Accuracy Mode").

3 Construction and Functioning

3.1 Components

The *CMGPS* consists of the following components:

Figure 3-1:
Synchronization unit
CMGPS



Article number VEHZ3000

Figure 3-2:
Power supply unit
100 - 240 V_{AC}/18 V_{DC}
incl. plug-in adapter for
country-specific wall
outlets



Figure 3-3:
Connection cable
CMGPS ext. Interf. ↔
CMC test set

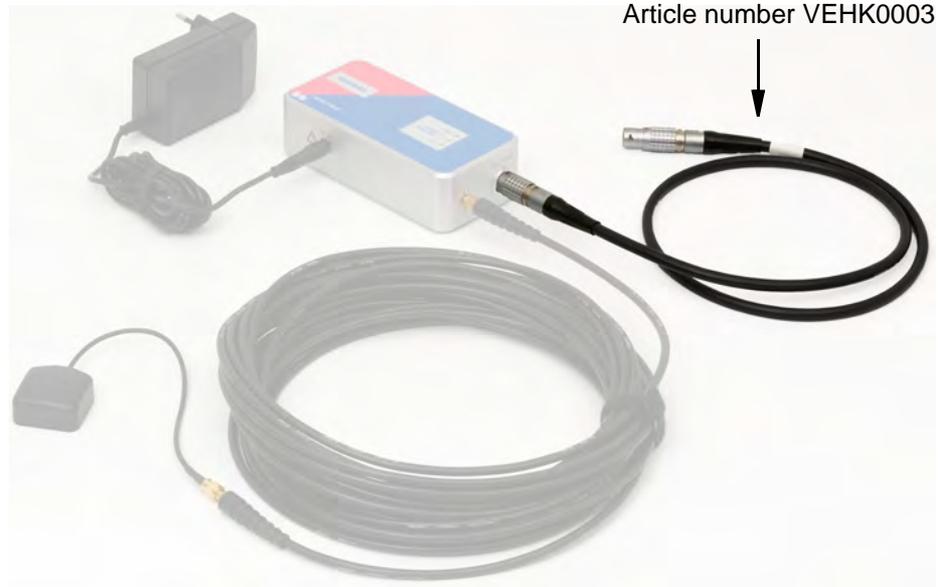


Figure 3-4:
Active antenna



Figure 3-5:
15 m (50 ft) RG58
coaxial cable with SMA
connector (extension
cable for antenna)



Article number VEHK3002

For cases that may require an extension of the antenna cable, an optional set of 2 x 20 m (2 x 60 ft) cables is available from OMICRON.

Figure 3-6:
CMGPS connected to
antenna via 2 x 20 m
(2 x 60 ft) extension
cables.

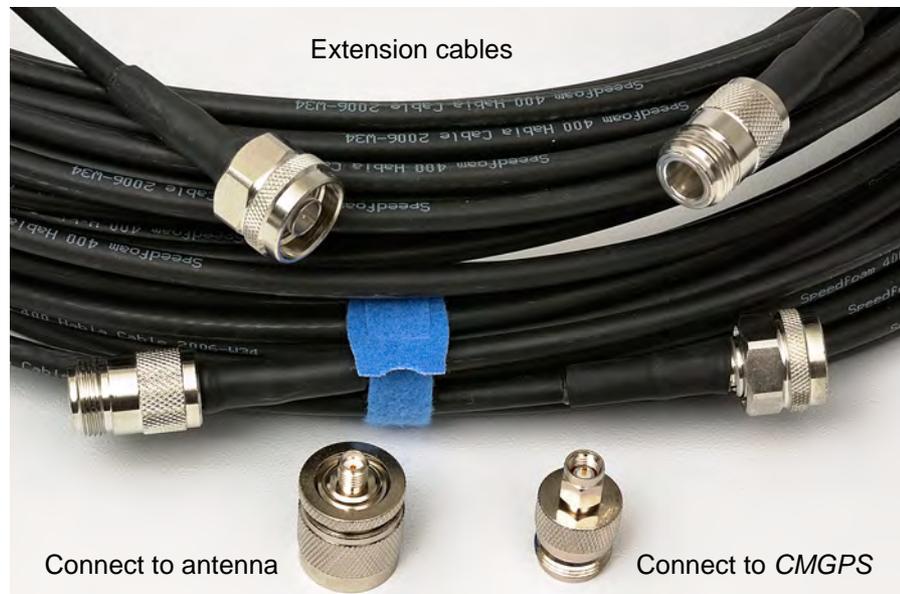
2 extension cables + SMA adapter (see also figure 3-7).

Article number VEHZ3003

Note: when connecting
VEHZ3003, VEHK3002
shown in figure 3-5
cannot be used
anymore.



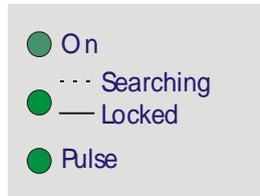
Figure 3-7:
SMA adapter to connect
the extension cables to
CMGPS and antenna



- Protecting cap for antenna input (no illustration)
- Carrying bag for CMGPS (no illustration)
- User manual (no illustration)

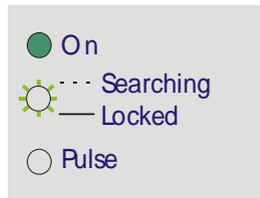
3.2 LED Status Display

1. The power supply is applied to the CMGPS



All 3 LEDs are lit for about 30 seconds; the GPS receiver is initialized.

2. After the initialization of the CMGPS



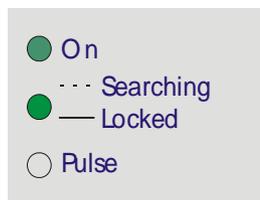
LED "ON" is lit.

LED "Searching/Locked" flashes. The receiver does not yet receive enough strong satellite signals in order to put out the synchronization pulse.



Typically, after a time period of max. 5 minutes this status is succeeded by the condition "CMGPS ready for operation" (refer to the following item)¹. If this should not be the case, refer to section 7 "Faults, Possible Causes, Remedies".

3. CMGPS is ready for operation

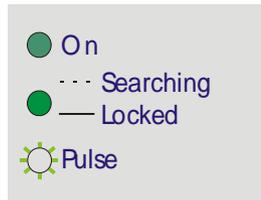


LED "ON" is lit.

LED "Searching/Locked" is lit. The receiver acquires the necessary number of satellite signals of sufficient strength and can therefore put out the synchronization pulse with the unit accuracy.

1. This time may increase to up to 20 minutes in cases where the *CMGPS* was either relocated by several hundred kilometers since the last time it was in use or out of operation for more than 6 months.

Synchronization pulse



LED "ON" is lit.

LED "Searching/Locked" is lit.

LED "Pulse" is lit for approx. 500 ms during the output of the synchronization pulse at the outputs Pulse out 1 and/or Pulse out 2.

Other LED conditions as those described above indicate faults and are outlined in section 7 "Faults, Possible Causes, Remedies" on page 41.

3.3 Connections and Interfaces

3.3.1 DC in Power Supply

Power supply is applied to the *CMGPS* by means of a power supply unit 100-240 V_{AC}/18 V_{DC}, which is equipped with an adapter for the various country-specific wall outlets (see figure 3-2 on page 13).

The connector of this power supply unit is reverse polarity protected.

Figure 3-8:
Power supply input
DC in



Most of the up-to-date CMC test sets (e.g., *CMC 256*, *CMC 256plus*, *CMC 353*, *CMC 356* or *CMC 850*) provide power supply to the *CMGPS* via the connection cable to the **ext. Interf.**. Therefore, in conjunction with one of these test sets, the power supply unit is not needed.

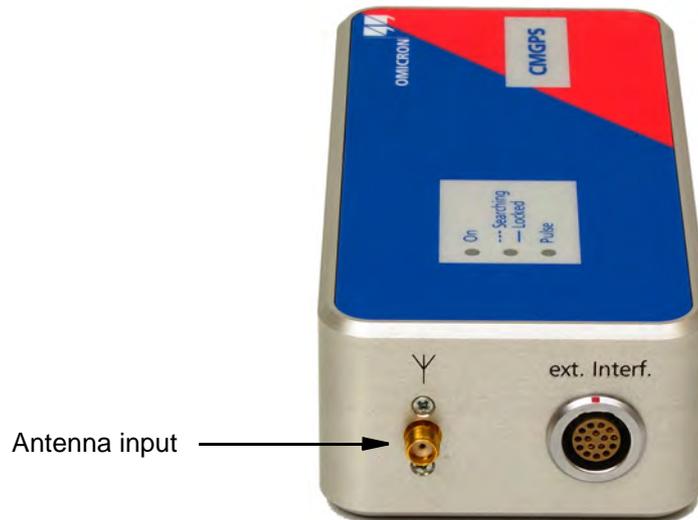
In conjunction with the *CMIRIG-B* interface unit, use the above mentioned power supply unit to power the *CMGPS*.

Note that using such a separate power supply unit keeps the *CMGPS* in "locked" mode when the CMC test set is switched off.

3.3.2 Antenna Input

CMGPS uses an active antenna (see figure 3-4 on page 14).

Figure 3-9:
Antenna input of the
CMGPS



The antenna is connected to the antenna input of the *CMGPS* (SMA socket) by means of the RG58 coaxial extension cable (see figure 3-5 on page 15).

This extension cable also serves as power supply cable for the antenna of the *CMGPS*.

Note: The coaxial extension cable supplied with *CMGPS* has a length of 15 m (45 ft.) If that is not sufficient, there is an optional extension set of 2 × 20 m (2 × 60 ft.) with SMA adapters available for a total extension of 40 m (120 ft.). Refer to figure 3-6 on page 15 for a view. For ordering information please refer to table 8-1 on page 43.

When applying the optional 2 × 20 m (2 × 60 ft.) extension set, the original 15 m (45 ft.) extension cable cannot be used anymore.

3.3.3 ext. Interf.

The **ext. Interf.** (Pulse out 1) is the communication interface between the *CMGPS* and the CMC test set.

Figure 3-10:
Communication
interface **ext. Interf.**



Communication interface to connect *CMGPS* to the CMC test set's **ext. Interf.**

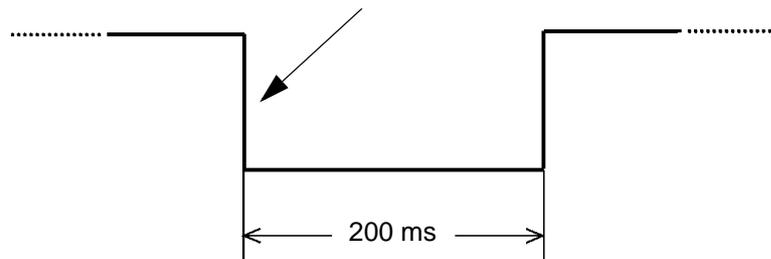
At this interface, the *CMGPS* is connected to the CMC test set by means of the supplied connection cable (see figure 3-3 on page 14).

This interface serves to

- configure the *CMGPS* via software (e.g., the synchronization time)
- send the "Pulse out 1" synchronization pulse to the CMC test set.

Standardized factory setting of the synchronization pulse is **200 ms** output **once per minute**.

The falling edge of this signal represents the synchronization point of time.



Note: This output is only to be used together with an OMICRON CMC test set. Do not use this output for other devices or other applications.

3.3.4 Pulse out 2 Interface

The **Pulse out 2** interface is represented by two safety banana sockets.

Figure 3-11:
The **Pulse out 2**
interface



Via these banana sockets, the synchronization pulse of the *CMGPS* can be picked up potential-free by means of an internal opto-electronic coupler (see also section 6.6 "Pulse Out 2 Interface" on page 38).

It is put out following the standardized factory setting simultaneously to the synchronization pulse at the **ext. Interf.** connector.

Standardized factory setting of the synchronization pulse is **200 ms** output **once per minute**.

This interface has been especially designed for the synchronization of a CMC test set **without** an integrated **ext. Interf.** connector.

In order to be able to trigger these CMC test sets by means of the GPS signal, the *CMGPS* synchronization signal from the **Pulse out 2** interface may be connected to one of the CMC's binary inputs (see also documentation of the test set and/or software).

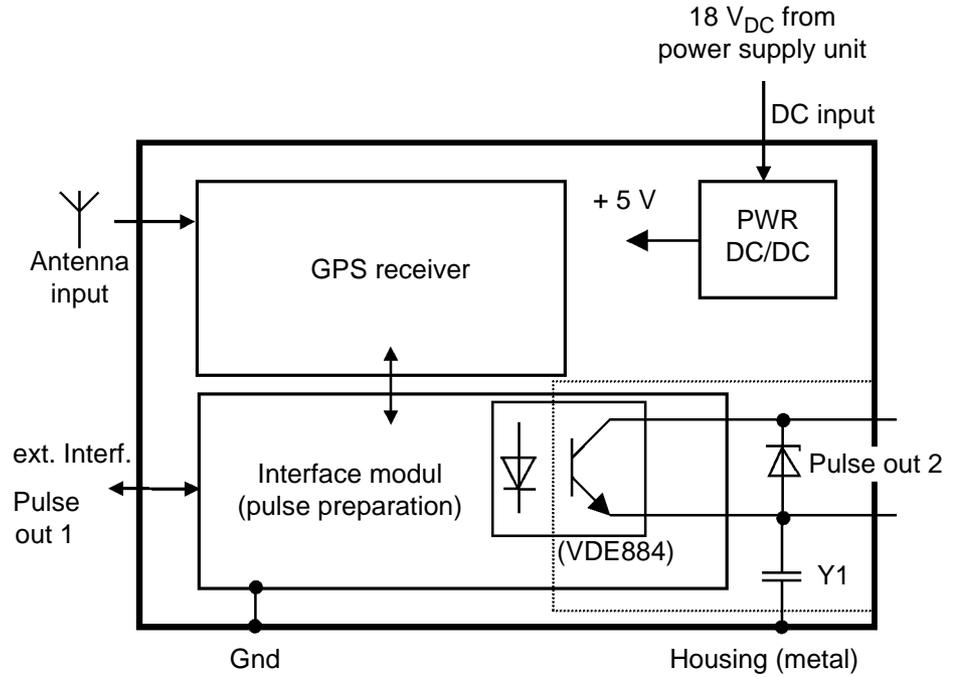
By means of the **Pulse out 2** interface, the *CMGPS* can also be utilized as "standalone" synchronization unit **without** being connected to a CMC test set.



At present, the *Test Universe* software supports the configuration of a pulse output only. Therefore, the **Pulse out 2** is synchronous to **Pulse out 1**.

3.3.5 Block Diagram of the CMGPS

Figure 3-12:
Block diagram of
the CMGPS



4 Operating the CMGPS

Please check for the availability of all components prior to operating *CMGPS*. For a detailed list of the components please refer to the packaging list.

Standard scope of supply comprises:

- *CMGPS* synchronization unit
- antenna
- antenna extension cable
- connection cable *CMGPS* ↔ CMC
- power supply unit 100 - 240 V_{AC}/18 V_{DC}
- *CMGPS* user manual.



The instructions for operating the *CMGPS* are based on the precondition that the CMC test set has been operated in accordance with its manual and is ready for use.

Operating the *CMGPS* is as follows:

- Connect the extension cable of the antenna to the *CMGPS*.
- Connect the antenna to the extension cable. Place the antenna at a suitable position that provides sufficient open sky.



Do **not** position the antenna of the *CMGPS* in an exposed position **above the lightning rod** or at another location endangered by lightning.

In addition, do **not** position the antenna within a control cabinet in the vicinity of **flashover-endangered spots**.

4.1 Connecting the CMGPS to a CMC Test Set

Figure 4-1:
CMGPS communication
interface **ext. Interf.**



1. Connect the **ext. Interf.** of the *CMGPS* to the **ext. Interf.** input at the rear of the CMC test set by means of the supplied connection cable VEHK0003 (shown in figure 3-3).

Figure 4-2:
Power supply unit
100 - 240 V_{AC}/18 V_{DC}
incl. plug-in adapter for
country-specific wall
outlets



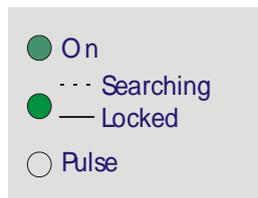
2. Plug in the DC adapter of the 100-240 V_{AC}/18 V_{DC} power supply unit to the **DC in** power supply input of the *CMGPS*.
3. Connect the power supply unit to a wall outlet.

Note: The power supply unit is not needed with up-to-date test sets such as *CMC 256*, *CMC 256plus*, *CMC 353*, *CMC 356* and *CMC 850*. In conjunction with the *CMIRIG-B* interface unit, use the above mentioned power supply unit to power the *CMGPS*.

1. Section 3.2 "LED Status Display" on page 17 describes the state of the LED signalization during the activation and initialization of the *CMGPS*.

The following explanations are based on successful initialization and on the fact that the *CMGPS* locked itself to the GPS signal.

The state of the LEDs of the *CMGPS* should then be as follows:



LED "ON" is lit.

LED "Searching/Locked" is lit.

2. The synchronization pulse of **200 ms** is sent in regular intervals of 1 minute (synchronization on falling edge). Every synchronization pulse sent is indicated by the "Pulse" LED that lights up for 500 ms.
3. This synchronization pulse can now be used as trigger pulse for starting one or several test processes. The required settings are determined by software parameters (see respective software documentation and/or on-line help).



Typically, the *CMGPS* is ready for operation max. 10 minutes after the power supply has been applied to it. If this should not be the case, refer to section 7 "Faults, Possible Causes, Remedies" on page 41.

4.2 Connecting the CMGPS to a CMC 56

Earlier versions of the *CMC 56* test set do not have an **ext. Interf.** connector at their rear side. If you have such a test set, connect the *CMGPS* to a binary input instead.

Figure 4-3:
The **Pulse out 2**
interface



Use two suitable cables with banana plugs and connect the **Pulse out 2** interface ("+" and "-") to a binary input of the *CMC 56*.

Make sure the polarity of the connection cables is correct.

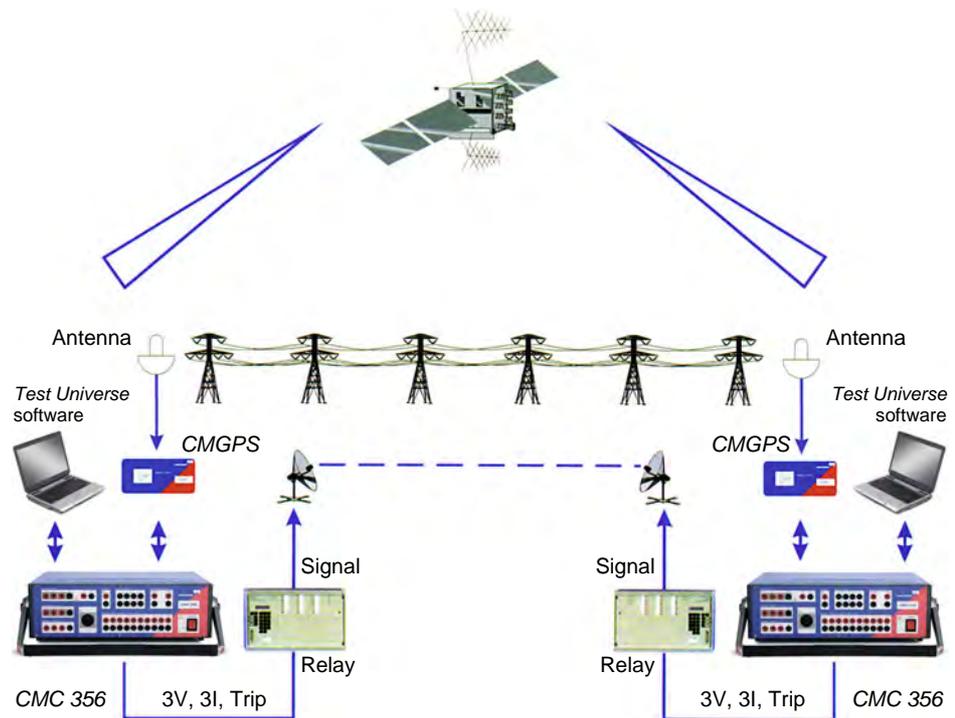
5 Synchronizing Two or More CMC Test Sets

Figure 5-1 shows a typical field application of the *CMGPS* synchronization unit:

Power transmission lines are usually protected by means of distance or differential relays. Line differential relays require a signal link for comparing currents' amplitudes or phases at both ends of the line. Distance relays are quite often equipped with signal links in order to enable instantaneous tripping at 100 % of the protected line segment.

Here, two *CMGPS* synchronization units trigger two CMC test sets to start a test at the exact same point of time. Since the GPS signal is available worldwide, the physical distance between these test sets is thereby of no relevance ("end to end" testing).

Figure 5-1:
Example: Testing a
power transmission
line's protection system
with two
GPS-synchronized
CMC test sets



The synchronization accuracy depends on the settings made at the **Time Trigger Configuration** window of the *Test Universe* software. *Test Universe* differentiates between standard and enhanced accuracy. See the following chapters.

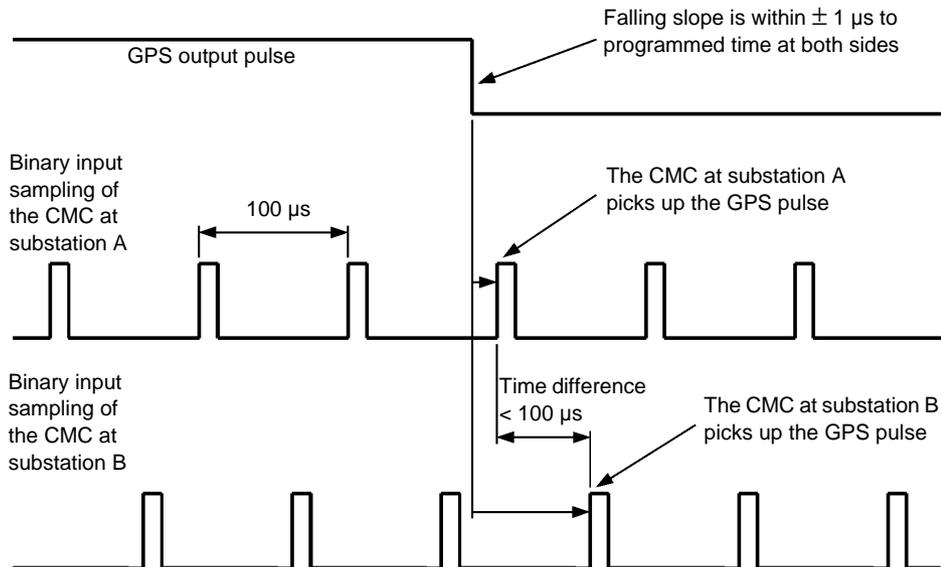
5.1 Standard Accuracy Mode

If such a protection scheme is to be reliably tested, it has to be tested **as a complete system**, i.e. the relays on both sides of the transmission line, the signal link and the functional interaction of all the components have to be tested.

Using two CMC test sets — one at the beginning of the transmission line and one at the end — performs this function. The two devices are synchronized by means of a *CMGPS*.

After the *CMGPS* synchronization units have received signals from a sufficient number of satellites, they can determine the exact time.

Figure 5-2:
Timing Relationship
when using *CMGPS*
and multiple CMC test
sets



The GPS output pulse is issued at the same time ($\pm 1 \mu\text{s}^1$) from the GPS receivers in both substations. The test sets have a $100 \mu\text{s}$ sampling rate for reading the status of the binary inputs, which also applies to the external input for the GPS output signal. The timing of the binary input sampling is not synchronized between the two test sets. Due to this, a time difference of up to $100 \mu\text{s}$ can appear between the pickup of the GPS pulse by the two test sets. This can result in an equivalent phase difference of a maximum of 1.8° at 50 Hz or a maximum of 2.16° at 60 Hz.

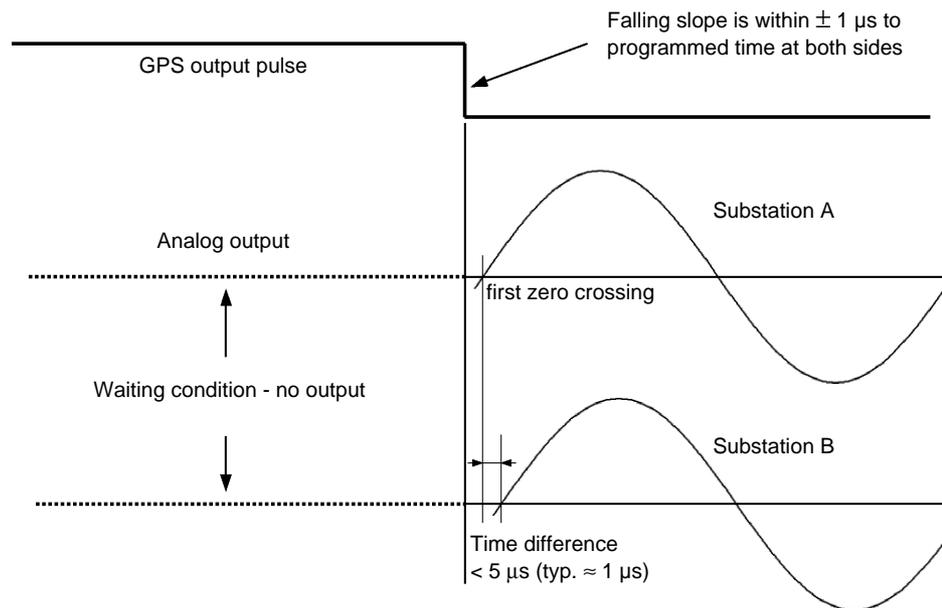
1. Depending on set accuracy (configuration in software)

5.2 Enhanced Accuracy Mode

For applications with very high requirements of synchronization accuracy, the enhanced accuracy mode is provided. In this mode, the start of a test sequence can be synchronized with a timing error of less than $5 \mu\text{s}$. Typically this error is in range of only $1 \mu\text{s}$ ¹.

When using this mode, there is a special behaviour of the test equipment, which has to be considered. The test set enters a type of wait condition some milliseconds prior to the expected occurrence of the GPS pulse. During this wait, there is no output of signals.

Figure 5-3:
Behaviour of the
Enhanced Accuracy
Mode



Other restrictions with the enhanced accuracy mode are:

- It applies to the test sets *CMC 256*, *CMC 256plus*, *CMC 353*, *CMC 356* and *CMC 850*, only.
- Supported by a selected range of test modules only (e.g., *State Sequencer*)
- The specified precision refers to the first state (start state) of a sequence
- Concurrent operation of the *EnerLyzer* is not supported.



Note that the $5 \mu\text{s}$ accuracy is restricted to the **test start** only. It does not apply to actions triggered by the following GPS pulses².

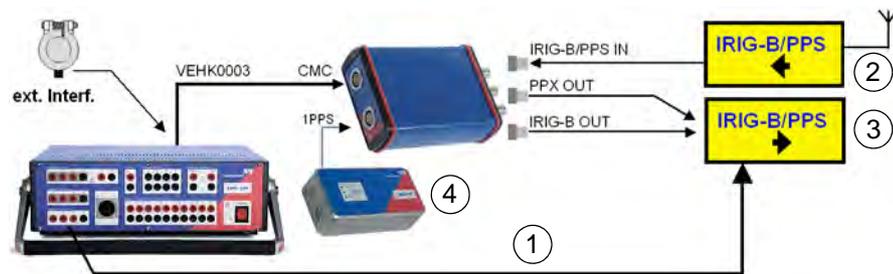
1. Error corresponds to amplifier output signals (voltage/current) of *CMGPS*-synchronized test sets at configured GPS trigger event.
2. Together with the *CMIRIG-B* extension box, CMC outputs can be resynchronized with each 1PPS *CMGPS* pulse.

5.3 Using CMGPS in Conjunction with CMIRIG-B

Via the *CMIRIG-B* interface unit you can connect devices to CMC test sets that either transmit or receive the IRIG-B time reference signal (DC level shift protocol B00x). That way, two or more CMC test sets are synchronized. Furthermore, an optional *CMGPS* synchronization unit can be integrated into the test setup to serve as source of the synchronization moment or 1PPS signal, respectively. The CMC test set decodes (when receiving) or encodes (when transmitting) the IRIG-B protocol. The IRIG-B protocol extensions required by standard IEEE C37.118 are supported as well.

The most significant functional enhancement of those *Test Universe* test modules supporting the IRIG-B time reference is the starting and synchronizing of CMC test set states (signal output) with high accuracy synchronous to the IRIG-B¹ time reference or PPS/PPX² signal, respectively; for example for PMU synchrophasor tests.

Figure 5-4:
Typical test setup with
CMIRIG-B
(not true to scale)



- ① Test signals (e.g., 3 x current, 3 x voltage).
- ② IRIG-B/PPS source, e.g. GPS receiver with IRIG-B output.
- ③ IRIG-B/PPS receiver, e.g. protection relay, PMU.
- ④ Optional *CMGPS* synchronization unit (depends on the application).

Requirements:

- A *CMC 256* test set with Ethernet ports (**not** with PAR-1 option), a *CMC 256plus*, *CMC 353*, *CMC 356* or a *CMC 850* test set.
- IRIG-B source or receiver with 5 V/TTL level; demodulated; DC level shift protocol (B00x).
- In conjunction with the *CMIRIG-B* interface unit, use the 100-240 V_{AC}/18 V_{DC} power supply unit to power the *CMGPS*.

1. IRIG stands for Inter Range Instrumentation Group and represents a serial time code format.
2. PPS: pulses per second. PPX: programmable PPS signal (pulse rate, e.g., 1 pulse per minute or one pulse per 10 seconds)

CMIRIG-B timing specifications

Figure 5-5:
CMIRIG-B timing in
detail

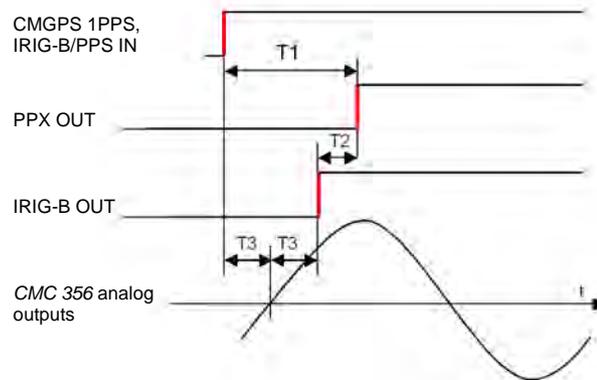


Table 5-1:
Timing specifications

Timing specifications	
T1 (delay time PPS source to PPX OUT)	< 1 μ s typ., 1.5 μ s max.
T2 (time skew PPX OUT to IRIG-B OUT)	< \pm 0.1 μ s typ., \pm 0.5 μ s max.
T3 (time error of time reference source to analog outputs) ¹	
- Current outputs	\pm 5 μ s typ., \pm 20 μ s guar.
- Voltage outputs	\pm 1 μ s typ., \pm 5 μ s guar.

1. Valid for CMC 356 output frequencies < 100Hz and re-synchronized analog output signals.



For basic information about the IRIG time codes standard, please refer to the *CMIRIG-B Reference Manual* or the *Test Universe Help*. Detailed information about the IRIG-B standard can be found, for example, in the IRIG SERIAL TIME CODE FORMATS publication at the url <https://wsmrc2vger.wsmr.army.mil/rcc/manuals/200-04/index.html>.



For detailed information about the OMICRON *CMIRIG-B* interface unit please refer to the *CMIRIG-B Reference Manual*.



Detailed information about how to configure the *Test Universe* software component **Time Trigger Configuration**  for the use of *CMIRIG-B* with or without *CMGPS* can be found in the *CMIRIG-B Reference Manual* and in the *Test Universe Help*, topics **Time Trigger Configuration** and **Hardware Configuration (IRIG-B & GPS)** tab).

6 Technical Data

Guaranteed Features: The technical specifications indicated in this chapter are valid for 1 year from date of delivery.

6.1 CMGPS in General

Table 6-1:
General technical
specifications of the
CMGPS

CMGPS in general	
Dimensions (w x h x d)	140 x 70 x 40 mm (5.5 x 2.25 x 1.6 in)
Housing	Metal, front panel with foil coating
Weight	440 g (0.88 lb)
Ambient temperature	0 ... 50 °C (32 ... 122 °F)
Storage and transport	-25 ... +70 °C (-13 ... +158 °F)
Humidity range	5 ... 95 % relative humidity; non-condensing

6.2 GPS Receiver

Table 6-2:
Technical specifications
GPS receiver

GPS receiver	
Number of SV ¹	12 (satellites)
TTFF (time to first fix) ²	Typ. 5 minutes (for a set accuracy of < ±1 μs) Typ. 3 minutes (for a set accuracy of < ±10 μs)
Position fault	< 5 m (16.4 ft) [1 σ]
Identification antenna status	OK, short circuit, defective

1. SV = "space vehicle". Max. number of satellites the receiver can use to determine position or time. The satellites providing the highest signal quality are considered. In general, the receiver only needs 4 - 5 satellites to determine position and time — depending on the signal quality.
2. TTFF = Time span the CMGPS needs to receive a sufficient number of satellite signals after switching on (to be "locked" to the signals). The higher the synchronization accuracy set via software (optimum: abs. error < ± 1 μs), the longer the time span will be.

6.3 Power Supply

Table 6-3:
Power supply

Power supply unit	
Supply voltage	100 - 240 V _{AC}
Power supply unit	
Rated current input	
Rated current input	400 mA
Frequency	50/60 Hz
• nominal freq.:	
• admissible range:	
• admissible range:	47 - 63 Hz
Output voltage	18 V _{DC}
Rated current output	840 mA

Power supply CMGPS	
Nominal supply voltage CMGPS	18 V _{DC} / 150 mA
Admissible range of power supply voltage	+8 V _{DC} ... +30 V _{DC}
Power consumption	2.5 W
Connection	Reverse polarity protected
Protection class	II

6.4 Antenna

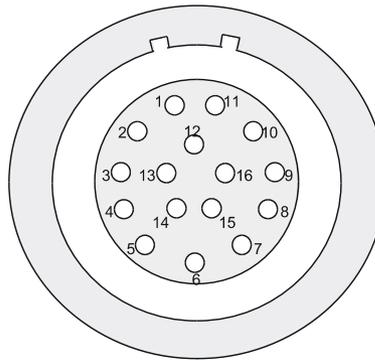
Table 6-4:
Antenna

Antenna	
Antenna	Active
Connection of device	Coaxial (SMA socket)
Connection of antenna	Screw-on type (SMA plug)
Antenna extension cable	RG58 50 Ω coaxial cable, 15 m (45 ft.) (approx. 1 dB/m or 0.3 dB/ft) ¹

1. There is an optional extension set of 2 x 20 m (2 x 60 ft.) with SMA adapters available for a total extension of 40 m (120 ft.); refer to Table 8-1: "Ordering information for the CMGPS synchronization (set)" on page 43.

6.5 ext. Interf.

Figure 6-1:
16-pole LEMO™ socket
ext. Interf.



This interface serves to connect the *CMGPS* to the CMC test set by means of the supplied connection cable VEHK0003 (see figure 3-3 on page 14).

Table 6-5:
Technical data
ext. Interf. (output
Pulse out 1)

ext. Interf. (output Pulse out 1)	
Type	CMOS output
Accuracy	Absolute error < $\pm 1 \mu\text{s}$ ¹
Pulse length	200 ms
Pulse rate	Configurable in steps of 1 second (1 s ... 65535 s)
Polarity of synchronization signal	Configurable to descending or ascending edge
First synchronization point of time	Programmable

1. Accuracy of *CMGPS*. The synchronization of test sets depends on the accuracy set in the *Test Universe* software. Also refer to chapters 5.1 "Standard Accuracy Mode" and 5.2 "Enhanced Accuracy Mode"



The synchronization pulse is only put out if the *CMGPS* is able to meet the accuracy configured by the software.

6.6 Pulse Out 2 Interface

Figure 6-2:
Pulse out 2 interface

At this interface the synchronization pulse of the CMGPS can be picked up potential free via an internal opto-electronic coupler (open collector). At present, the *Test Universe* software supports the configuration of a pulse output only. Therefore, **Pulse out 2** is synchronous to **Pulse out 1**.



Figure 6-3:
Block diagram of the
Pulse out 2 interface

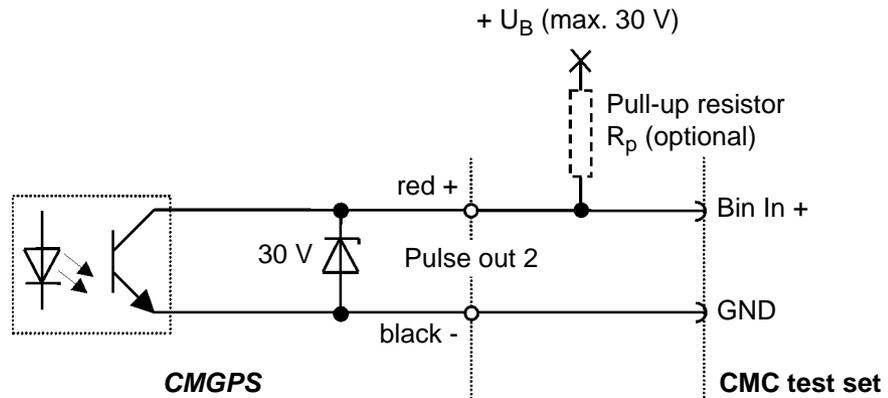


Table 6-6:
Technical specifications
Pulse out 2 interface

Interface Pulse out 2	
Type	Output by optoelectronic coupler (open collector)
Accuracy	Absolute error $\pm 5 \mu\text{s}$ ¹
Pulse length	200 ms
Pulse rate	Configurable in steps of 1 s (1 s ... 65535 s)
Polarity of synch. signal	Configurable to falling or rising edge
First synchronization point of time	Programmable
Specifications of the open collector output transistor:	
• I_{Cmax}	5 mA
• U_{CEmax}	30 V (red socket +, black socket -)

1. Depending on accuracy set in the *Test Universe* software



The synchronization pulse is only put out if the CMGPS is able to meet the accuracy configured by the software.

6.7 CE Conformity, Electromagnetic Compatibility

Table 6-7:
Electromagnetic
Compatibility

CE Conformity	
The product adheres to the specifications of the guidelines of the council of the European Community for meeting the requirements of the member states regarding the electromagnetic compatibility (EMC) Directive 2004/108/EC and the low voltage Directive 2006/95/EC.	
Electromagnetic Compatibility (EMC)	
Emission	
Europe	EN 61326-1; EN 61000-6-4; EN 61000-3-2/3
International	IEC 61326-1; IEC 61000-6-4; IEC 61000-3-2/3
USA	FCC Subpart B of Part 15 Class A
Immunity	
Europe	EN 61326-1; EN 61000-6-2; EN 61000-4-2/3/4/5/6/11
International	IEC 61326-1; IEC 61000-6-2; IEC 61000-4-2/3/4/5/6/11

6.8 Insulation Coordination

Table 6-8:
Insulation coordination

Insulation coordination	
Insulation of Pulse out 2 interface with regard to housing and/or ext. Interf.	Complies with EN 61010-1 and EN 60950-1
Max. operating voltage	250 V _{AC}
Test voltage	3000 V _{AC}
Air gap	> 5 mm (0.2 in)
Creep path	> 6 mm (0.24 in)

6.9 Safety Standards, Certificates

Table 6-9:
Safety Standards,
Certificates

Certified Safety Standards	
Europe	EN 61010-1 Insulation of Pulse out 2 interface with regard to housing and/or ext. Interf. complies with EN 60950-1.
International	IEC 61010-1
USA	UL 61010-1
Canada	CAN/CSA-C22.2 No 61010-1-04
Certificate	 <p>Manufactured under an ISO9001 registered system.</p>

7 Faults, Possible Causes, Remedies

Table 7-1:
Faults, possible causes
and elimination - I

Fault	Possible cause	Remedy
CMGPS without power, LED "ON" is off.	Power supply unit defective.	Check output voltage of the power supply unit by means of a voltmeter (nominal value: 18 V _{DC}).
	Malfunction of the CMGPS.	Please contact the OMICRON Technical Support (see "Contact Information / Technical Support" on page 45).

Table 7-2:
Faults, possible causes
and elimination - II

Fault	Possible cause	Remedy
Both LEDs "Searching/Locked" and "Pulse" are off, LED "ON" is lit	Antenna not connected	Check connection.
	Cable connection antenna ↔ CMGPS defective.	Check screwed fittings and contact quality of the coaxial cable at each connection.
	Malfunction of hardware.	Read out the fault description via software. For information how to do that, start the <i>Test Universe</i> Help from the OMICRON <i>Start Page</i> (or any test module) and navigate to the table of contents entry --- Start Page ---. Click OMICRON Start Page and scroll down to the subheader Support . There you'll find Diagnosis & Calibration .
	Antenna defective.	Please contact the OMICRON Technical Support (see "Contact Information / Technical Support" on page 45).

Table 7-3:
Faults, possible causes
and elimination - III

Fault	Possible cause	Remedy
LED "Searching/Locked" has been flashing for approx. 20 minutes, CMGPS cannot be successfully locked to the GPS signal (TTFF considerably exceeded).	Cable connection antenna ↔ CMGPS defective.	Check screwed fittings and contact quality of the coaxial cable at each connection.
	Position of antenna inappropriate.	Place antenna in a more exposed location that provides sufficient open sky.
	Antenna or antenna cable defective.	Replace defective component.
	Malfunction of the CMGPS.	Please contact the OMICRON Technical Support (see "Contact Information / Technical Support" on page 45).

Table 7-4:
Faults, possible causes
and elimination - IV

Fault	Possible cause	Remedy
LED "Searching/Locked" is lit, CMGPS is locked to the GPS signal, but there is no synchronization pulse.	Timing parameter for putting out the synchronization pulse is set wrong or too long.	Check the settings by means of the software. If necessary change settings.
	Malfunction of the CMGPS.	Please contact the OMICRON Technical Support (see "Contact Information / Technical Support" on page 45).

8 Appendix

8.1 Ordering Information

Table 8-1:
Ordering information for
the *CMGPS*
synchronization (set)

CMGPS synchronization unit	Part no.
CMGPS synchronization unit set , consisting of <ul style="list-style-type: none"> – <i>CMGPS</i> synchronization unit (see figure 3-1 on page 13) – power supply unit 100 - 240 V_{AC}/18 V_{DC} , incl. plug-in adapter for various country-specific wall outlets – active antenna – 15 m (50 ft) antenna cable – 16-pole LEMO connection cable <i>CMGPS</i> ↔ CMC test set – carrying bag 	VEHZ3000

Table 8-2:
Ordering information for
individual or optional
components

Individual and optional components	Part no.
Power supply unit 100 - 240 V _{AC} /18 V _{DC} , incl. plug-in adapter for various country-specific wall outlets (see figure 3-2 on page 13)	VEHZ1103
Active antenna (see figure 3-4 on page 14)	VEHZ3001
Cables: <ul style="list-style-type: none"> – 16-pole LEMO connection cable <i>CMGPS</i> ↔ CMC test set (see figure 3-3 on page 14) – 15 m (50 ft) antenna cable (see figure 3-5 on page 15) – 2 × 20 m (2 × 60 ft) antenna extension cable and SMA adapter for an extension of 40 m (see figure 3-6 on page 15). Note: when connecting VEHZ3003, VEHK3002 cannot be used anymore.	VEHK0003 VEHK3002 VEHZ3003
Reference manual for <i>CMGPS</i>	VESD0200
<i>CMGPS</i> carrying bag	VEHP0020
<i>CMIRIG-B</i> interface unit with all accessories	VEHZ1150
<i>CMIRIG-B</i> interface unit without accessories	VEHZ1151
Connection cable <i>CMIRIG-B</i> ↔ CMC test set	VEHK0003
<i>CMIRIG-B</i> Reference Manual	VESD1150

8.2 Cleaning

To clean the *CMGPS*, use a cloth dampened with isopropanol alcohol or water. Prior to cleaning, always unplug the *CMGPS* from the mains and disconnect *CMGPS* from the CMC test set.

Contact Information / Technical Support

North and South America

OMICRON electronics Corp. USA

12 Greenway Plaza, Suite 1510

Houston, TX 77046, USA

Phone: +1 713 830-4660 or 1 800 OMICRON

E-Mail: techsupport@omicronusa.com

Web: <http://www.omicronusa.com>

Asia, Pacific

OMICRON electronics Asia Ltd.

Suite 2006, 20/F, Tower 2

The Gateway, Harbour City

Kowloon, Hong Kong S.A.R.

Phone: +852 2634 0377

E-Mail: support@asia.omicron.at

Web: <http://www.omicron.at>

Europe, Africa, Middle East

OMICRON electronics GmbH

Oberes Ried 1

6833 Klaus, Austria

Phone: +43 5523 507-333

E-Mail: support@omicron.at

Web: <http://www.omicron.at>

For addresses of OMICRON offices with customer service centers, regional sales offices or offices for training, consulting and commissioning, please see the **Contact** section of our Web site <http://www.omicron.at>.

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