Central GPS Manual

Central GPS Manual

Revision History

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Rev	Date	Author	Description
1.0	November 23, 2001	J. Hills	Initial release.

Approval: _____

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1 Introduction

The Central GPS is used to acquire and distribute a GPS clock signal for time stamping data at remotes, and as input for a central time server, in Nanometrics Callisto networks.

Please read carefully the appropriate sections of this manual before storing, installing, or operating the Central GPS. If you need technical support, please submit your request by e-mail or fax. Please include a full explanation of the problem and supporting data, to help us direct your request to the most knowledgeable person for reply.

E-mail:	support@nanometrics.ca
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2 Organization of this manual

This manual includes both reference and procedural information. Reference information is contained in Chapter 4, "Technical description", and in the appendixes. Procedural information is contained in Chapter 5, "User guide".

Please read carefully the sections on "Handling and storage precautions" before installing or using the Central GPS.

The information in this manual is divided into these chapters:

Chapter	Contents
1. Introduction	Introduction, and support contact information
2. Organization of this manual	An overview of the manual contents
3. Unpacking and post-delivery inspection	Important information on inspecting the shipment and handling the equipment
4. Technical description	An overview of Central GPS features and specifications
5. User guide	Procedures for installing, operating and maintaining Central GPS
Appendix A	Connector pinouts
Appendix B	Specifications
Appendix C	Cable drawings

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3 Unpacking and post-delivery inspection

This chapter provides information on how to check the completeness of the shipment and the condition of the shipped items prior to installing the equipment, instructions on what to do if there are any problems with the shipment, and lists some precautions for handling and storage of the Central GPS. The information in this section is supplemental and should be used in conjunction with system warranty information.

Unpacking the shipment

Inspect the shipment packaging to ensure the equipment has not been exposed to excessive moisture. Open the shipment and check the contents for completeness against the packing slip. Visually inspect the equipment for any damage that may have occurred in transit. If there are any problems with the shipment, please contact Nanometrics Support.

There is an as-shipped sheet containing specific configuration information for each Central GPS unit shipped with the system.

Handling and storage precautions

The Central GPS should not be stored or operated in an environment with a temperature below 10 degrees Celsius or above 30 degrees Celsius, or with non-condensing humidity greater than 95%. Ensure that the heat ventilation holes in the case are not blocked while the Central GPS is operating. Switch the power off before connecting or disconnecting the GPS antenna cable or the power cable. Power specifications are included in Appendix B.

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4 Technical description

This chapter provides a brief overview of the Central GPS, including its function in a terrestrial data network, and the function of the two main modules.

Operational description

The Central GPS is used to acquire and distribute the GPS clock signal for time stamping data at remote station Europa digitisers. It can be used in data acquisition networks that provide an extra serial channel for the GPS data. Typically, these are systems that use a fiber optic network.

The Central GPS has two outputs to the remote station digitisers: GPS data, and a 1 Hz signal synchronized to the start of the second. Both outputs are transmitted on an RS232 physical layer. Each Europa digitiser processes the GPS data received from the central site and, if sanity checks are successful, synchronizes its internal time to GPS time. The internal time is used to time stamp the data.

The Central GPS also processes the GPS signal locally, synchronizes its internal time to GPS time if sanity checks are successful, and provides time information to the Network Time Protocol (NTP) server. It runs an NTP time server software module to provide time service, on port 123, to any IP network element running an NTP client.

A network would typically use two Central GPS units connected in a master-slave configuration. That is, if the master GPS loses lock to the GPS satellites or is powered down, the slave GPS will take over if it has lock to GPS satellites. The slave GPS reverts to standby operation as soon as the master gains lock to GPS satellites. This process is fully automatic provided that the two units are interconnected with a GPS timing distribution cable (see Appendix C for the cable connection diagram). This feature is not yet released. Nanometrics has designed a GPS splitter unit that can serve up to 20 remote station units. Typically, two splitters can be connected to a master/slave Central GPS pair.

To facilitate easy troubleshooting and monitoring, the internal communications controller generates comprehensive and detailed state-of-health (SOH) information. The SOH information can be recorded by the NAQSServer software if NAQSServer has been configured to have a station for each Central GPS serial number. The Central GPS can be monitored and configured using the Libra User Interface. Refer to the Libra User Interface manual for information on configuring the Central GPS.

A typical application of the Central GPS is shown in Figure 1.

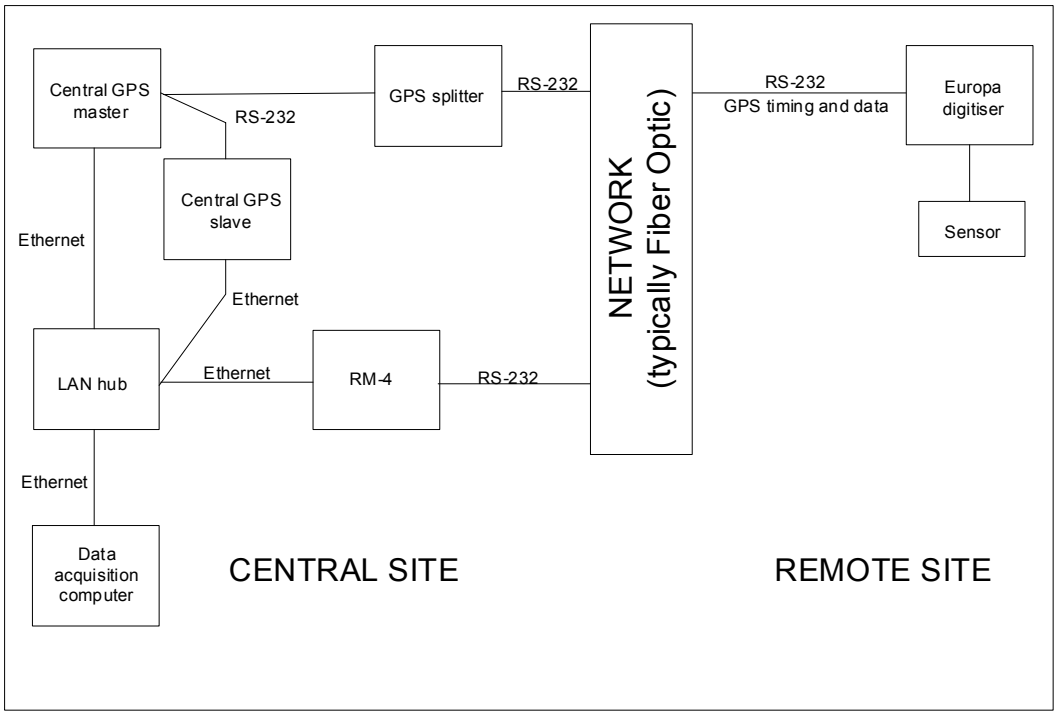

Figure 1: Example of Central GPS in a Callisto fiber optic network

Hardware description

The Central GPS contains two main modules: A GPS engine, and a communications controller.

The eight-channel GPS engine is capable of tracking eight satellites. It has two outputs to the communications controller module: GPS clock data, and a 1 Hz signal, synchronized to the start of the second. The GPS data and the 1 Hz signal both use an RS232 physical layer. The GPS engine is powered by the communications controller board.

The communications controller passes both signals to the telemetry system on an RS232 physical layer (SOH COMMS connector).

5 User guide

This chapter contains procedural information for installing, operating, and troubleshooting the Central GPS. Please read the section on handling and storage precautions before installing or operating the Central GPS.

Handling and storage precautions

The Central GPS should not be stored or operated in an environment with a temperature below 10 degrees Celsius or above 30 degrees Celsius, or with non-condensing humidity greater than 95%. Ensure that the heat ventilation holes in the case are not blocked while the Central GPS is operating. Switch the power off before connecting or disconnecting the GPS antenna cable or the power cable. Power specifications are included in Appendix B.

Installing the Central GPS

1. Place the Central GPS unit in the equipment rack slot.

   The Central GPS dimensions are 58 mm x 307 mm x 284 mm. It is typically installed in a 19-inch equipment rack, using 2U of rack space.

2. Connect the GPS antenna cable, data cables, and power cable to the appropriate connectors indicated on the rear panel.

   Connector pinouts and installation drawings are included in the appendixes.

3. Switch the unit on, wait five minutes to allow the GPS to gain lock from a cold start, and then test the installation.

Testing the installation

Single Central GPS unit

1. Test the GPS:
   a. Run the Libra User Interface on a computer connected to the same IP network as the Central GPS.
   b. Log on to the Central GPS using the correct IP address, user name, and password; these can be found on the as-shipped sheet. The IP address of the computer should be from the same subnet as the Central GPS address or have IP routing to it.
   c. Confirm that the GPS tracks satellites on its channels, and that the internal clock is fine-locked to the GPS time.

2. Test direct communication between the Central GPS and a remote unit prior to connecting the remote through the telemetry system:
    a. Connect a Europa to the Central GPS.
    b. Run the Libra User Interface on a computer connected to the same IP network as the Europa.
    c. Log on to the Central GPS using the correct IP address, user name, and password; these can be found on the as-shipped sheet. The IP address of the computer should be from the same subnet as the Central GPS address or have IP routing to it.
    d. Confirm that the GPS tracks satellites on its channels, and that the internal clock is fine-locked to the GPS time.
3. Test the time server function:
    a. Run an NTP time client on the computer. Ensure that the time client is configured for the IP address of the Central GPS.
    b. Confirm that the system time is synchronized to UTC.

Master/slave pair of Central GPS units

1. Conduct the same installation tests as for a single Central GPS unit, described above.
2. Test the automatic backup:
    a. Switch the power off for the master unit.
    b. Conduct the same installation tests as for a single Central GPS unit.
    c. Switch the power on for the master unit, and confirm that the master Central GPS unit resumes proper operation.
    d. Obscure the master unit antenna.
    e. Conduct the same installation tests as for a single Central GPS unit.
    f. Restore the master unit antenna, and confirm that the master Central GPS unit resumes proper operation.

Operating and maintaining the Central GPS

Once the Central GPS is installed and operating, it does not require scheduled maintenance. Its operation can be monitored using the information in the Libra User Interface Operation tab GPS panels.

Servicing the Central GPS

Firmware upgrades can be done on-site. Servicing a unit requires troubleshooting to the main assembly level, and returning the unit to Nanometrics for repair if necessary.

To upgrade the communications controller firmware

The Libra User Interface manual describes the procedure for upgrading the communications controller firmware.

To troubleshoot the Central GPS

Troubleshoot the Central GPS to the main assembly level. Most problems with the Central GPS are a result of the antenna not having a clear line-of-sight to the GPS satellites. If the GPS does not lock within 15 minutes of power-on from a cold start, if it frequently loses lock, or if the signal is noisy, try repositioning the antenna to a more favourable location.

1. Check all cable connections, and ensure that the antenna is not carrying the weight of the antenna cable (if it is, secure the cable with a few tie wraps near the antenna).
2. Check the GPS reception:
    a. Log on to the Europa with the Libra User Interface program, and go to the Operation Tab > GPS/Satellite panel.
    b. Check whether satellites are being tracked, and examine the signal strength values. The signal strength from the satellites, indicated by the signal-to-noise ratio (S/N), should be greater than 38.
3. Reposition the antenna to a better location. For best reception the GPS antenna should have an unobstructed line-of-sight of the sky above the 30 degree elevation circle.

To repair the Central GPS

The Central GPS assembly does not contain user-serviceable hardware, except for the fuse in the communications controller PCB power supply. If there is a hardware problem other than the main fuse, return the unit to Nanometrics for repair. Please include a description of the problem, if possible.

Replacing the main fuse

1. Disconnect all of the cables, remove the unit from the equipment rack, and remove the enclosure top.
2. Remove the plastic plug in the end of the fuse bracket on the communications controller PCB to access the fuse (GMA fast-blow; 15A, 250V) for replacement.
3. Replace the enclosure top, and reinstall the Central GPS unit as described in the section "Installing the Central GPS".

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Appendix A: Connector pinouts

SOH1

Pin	Signal name
A	+5V
B	SOH1
C	GND

SOH COMMS

Pin	Signal name
A	GND
K	GPS_Tx
H	GPS_1 Hz
N	Locked slave - feature not yet released
M	Locked master - feature not yet released
P	+3V - feature not yet released
U	GND - feature not yet released

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Appendix B: Specifications

Central GPS

Description

This clock generates the GPS signals for transmission to the remote sites.

Included Parts

Central GPS clock

Mains power cable

GPS antenna kit

Optional:

- GPS splitter
- GPS splitter mains power cable
- Central GPS to splitter data cable

Specifications

Interface

Signal inputs:	GPS RF In		
Signal outputs:	1 Hz signal, RS-232 level		
	GPS data, RS-232 level		
Data connections:	RJ-45	Ethernet	IP
	19 pin MIL circular	RS232	GPS; 1 Hz
RF connections:	TNC connector		
Power:	10W		
Voltage:	110/220 VAC		

Environmental

Environment:	meets indoor/office specification
Housing:	19” rack mount tray, 2U high
Dimensions:	58 mm x 307 mm x 284 mm
Weight:	3.9 kg

Notes

1. The C-GPS is mounted in the equipment rack.
2. The supply voltage must meet the Mains Power Requirements.

Environmental Specification

Office environmental specification

Humidity	0 to 95% non-condensing
Temperature	10 to 30 degrees Celsius
Storage temperature	10 to 30 degrees Celsius

Unprotected outdoor environmental specification

Humidity	0 to 100% condensing
Temperature	-40 to 60 degrees Celsius
Storage temperature	-40 to 60 degrees Celsius

Mains Power Requirements

Specifications

220 VAC single phase power source for loads 0-100%

Voltage	220 VAC_{rms} ± 5%
Frequency	50 Hz ± 2% true sine wave
Power factor	>0.95
Crest factor	the PSU should be able to handle a load that results in a CF up to 3
Total harmonic distortion	<2%
Surges	Surges higher than the voltage specified above should not appear under any operating conditions.
Transients/spikes	Transients/spikes higher than the voltage specified above should not appear under any operating conditions.
Brownout/sags	Brownout/sags below the voltage specified above should not appear under any operating conditions.

110 VAC single phase power source for loads 0-100%

Voltage	110 VAC_{rms} ± 5%
Frequency	60 Hz ± 2% true sine wave
Power factor	>0.95
Crest factor	the PSU should be able to handle a load that results in a CF up to 3
Total harmonic distortion	<2%
Surges	Surges higher than the voltage specified above should not appear under any operating conditions.

Transients/spikes	Transients/spikes higher than the voltage specified above should not appear under any operating conditions.
Brownout/sags	Brownout/sags below the voltage specified above should not appear under any operating conditions.

Notes

1. The crest factor is the ratio of peak voltage to rms value.
2. Harmonic distortion is the distortion of the sine wave due to effects of harmonics in voltage and current waveforms.
3. Power factor is the effect due to current having harmonics or not in phase with voltage.

GPS Antenna Kit

Description

This is a GPS antenna with a mounting bracket and cable.

Included Parts

GPS antenna

Mounting bracket

GPS cable

2 U-bolts

Specifications

GPS antenna

Prime power:	+5 VDC (±10%) (supplied by Callisto digitizer)
Power consumption:	22 mA, 0.11W (nominal)
Output impedance:	50Ω
Frequency:	L1 (1575 MHz)
Gain:	35 dB (nominal)
Noise:	2.75 dB (nominal)
Azimuth coverage:	360° (omni-directional)
Elevation coverage:	0° to 90° elevation (hemispherical)

Physical Characteristics

Dimensions:	77.3 mm x 74.6 mm
Enclosure:	Textured, light gray plastic
Antenna weight:	0.1 kg
Connector:	F-type
Environment:	meets unprotected outdoor specification

Mounting bracket

Size:	86.4 mm x 86.4 mm x 25.4 mm
Mounting:	U-bolts for 50 mm pipe

GPS cable

Cable diameter:	6 mm
Bend radius:	250 mm
Typical length:	15m
Maximum length:	20m
Connector, Callisto end:	TNC
TNC connector diameter:	16 mm
Connector, antenna end:	F-Type
F-Type connector diameter:	13 mm

Notes

1. See drawing 13007 for physical characteristics (indicates a bullet roofmount type antenna).
2. The GPS antenna can be mounted directly to a pipe. This pipe must be threaded using a 3/4-14 NPT (national pipe thread), and 17 mm long on 26.7 mm OD pipe.

Appendix C: Cable drawings

Central site GPS timing distribution cable

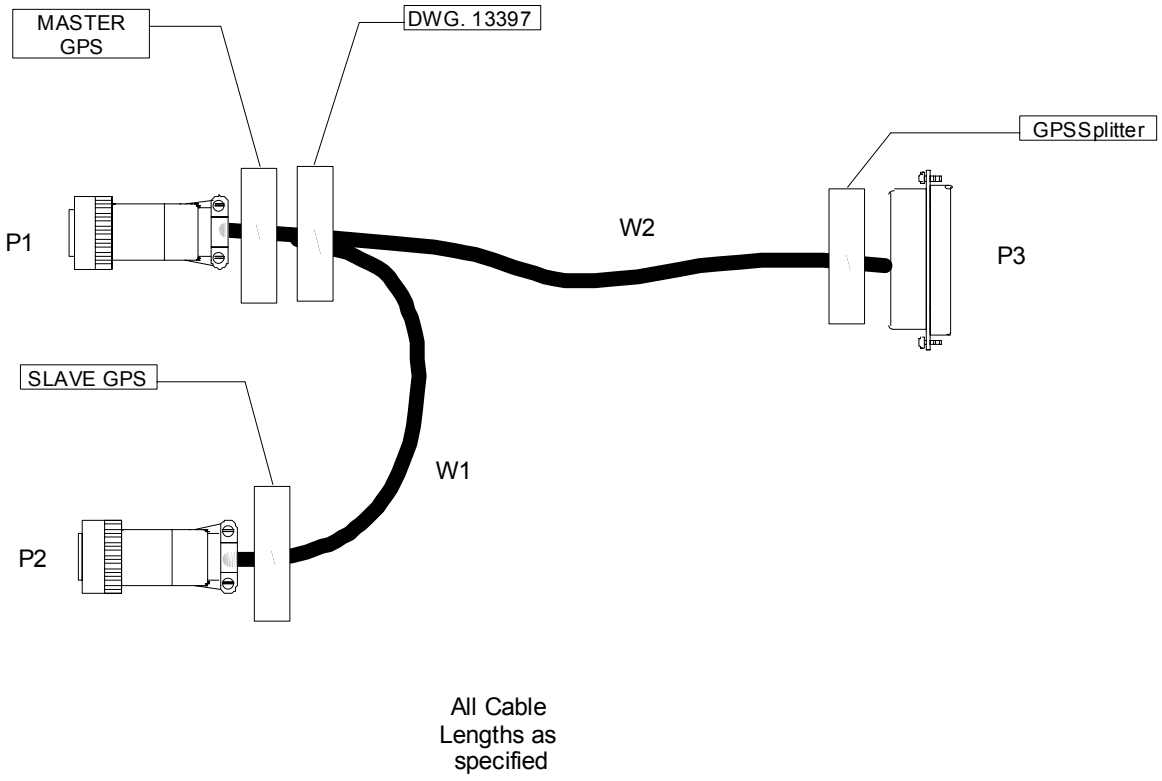

Figure 1: Cable Assembly

From			To			Wire (Belden)				
Conn.	**Pin**	**Name**	**Conn**	**Pin**	**Name**	**Part**	**Colour**	**AWG**	**Type**	**Len**
P1	A	GND	P2	A	GND	W1	BLK	24	9536	12”
P1	K	TX GPS	P3	2	TX GPS	W2	RED	22	8443	20”
P1	K	TX GPS	P2	K	TX GPS	W1	BLU	24	9536	12”
P1	H	Tx 1Hz	P3	1	Tx 1Hz	W2	BLK	22	8443	20”
P1	H	Tx 1Hz	P2	H	Tx 1Hz	W1	GRN	24	9536	12”
P1	P	+3V	P2	J	NC	W1	RED	24	9536	12”
P1	N	Locked Slave	P2	M	Locked Slave	W1	BRN	24	9536	12”
P1	M	Locked Master	P2	N	Locked Master	W1	WHT	24	9536	12”
P1	A	GND	P3	5	GND	W2	GRN	22	8443	20”

Table 1: Wiring List

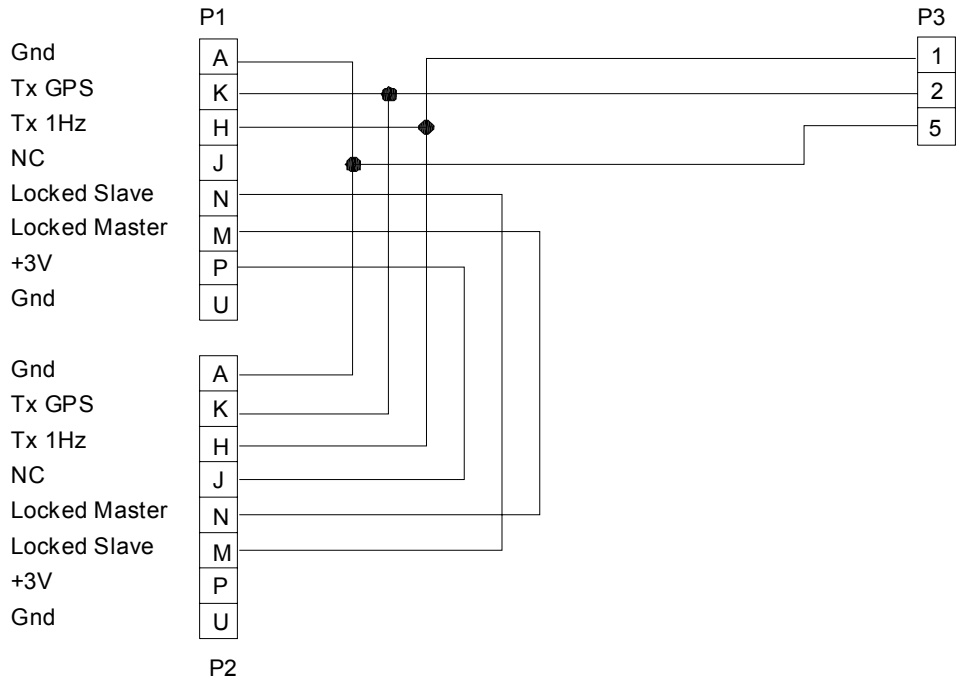

Figure 2: Wiring Diagram