

# CR-5P User Manual

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# **Table of Contents**

Table of Figures	v
Applicability of This Manual	vi
Warnings and Safety	vi
GeoSIG Cybersecurity Recommendations	vii
Symbols and Abbreviations	viii
1. Introduction	1
<ul> <li>2. Incoming Inspection</li> <li>2.1. Damage during Shipment</li> <li>2.2. Warranty</li> </ul>	2 2 2
<ul> <li>3. Description</li></ul>	3 4 4 4 4 5 5
<ul> <li>3.3.2. Connectors.</li> <li>3.4. Recorder Module (RHDx).</li> <li>3.4.1. LED's.</li> <li>3.4.2. Connectors.</li> <li>3.5. External DC Power Supply.</li> <li>3.6. Storage.</li> </ul>	5 6 7 7
<ul> <li>4. Installation</li></ul>	8 8 8 8 8 8 9 9 9 9 9
<ul> <li>4.2.5. Completing the Installation</li> <li>4.3. Cabling</li> <li>4.3.1. Power</li> <li>4.3.2. Communication</li> <li>4.4. First Start Up</li> <li>4.4.1. Start Up of the COM Module</li> <li>4.4.2. Start Up of the RHDx Module</li> </ul>	10 10 10 11 12 12 13

4.4.3. Start Up of the PAD Module	14
5. Configuring Parameters Putting in Operation	16
5.1. Quick Setup	16
5.1.1. Login to the RHDx module	16
5.1.2. Add new PAD Module	18
5.1.3. Enable the Data Stream Recording	18
5.1.4. Add new COM Module	19
5.2. Data Streaming to Remote Computer	20
5.2.1. RHDx Settings	20
5.2.2. Remote Computer Settings	21
5.3. Data Access on the Remote Computer	22
6. Advanced Network Settings	24
6.1. Introduction	24
6.2. IP Change of the PAD or COM module	24
6.3. Adjustment of the CRP Manager	26
7. Functional Description	27
7.1. Signal Conditioning	27
7.1.1. Digital Signal Filtering	27
7.2. Triggering	28
7.3. Clock	28
7.3.1. GPS Option	28
7.3.2. Synchronisation	28
8. Troubleshooting and Maintenance	
8.1.1. Power	29
8.1.2. Real Time Clock RTC	29
8.1.3. Data Streaming	29
8.1.4. COM module reset every couple of hours	29
8.1.5. RHDx module reset every couple of hours	
8.2. Maintenance	30

# **Table of Figures**

Figure 1. CR-5P Housing	3
Figure 2. CR-5P System overview using a computer as CCU (left) or a recorder module RHDx (right	)3
Figure 3. PAD module, front view	4
Figure 4. PAD module, rear view (three or nine connectors)	4
Figure 5. COM module, front view	5
Figure 6. COM module, rear view	5
Figure 7. RHDx module, front view	6
Figure 8. RHDx module, rear view	6
Figure 9. Example of powering a CR-5P system	10
Figure 10. Example of networking a CR-5P system	11
Figure 11: IP change on the laptop	16
Figure 12: GeoDAS running inside the RHDx module	17
Figure 13: Watchdogs settings of the COM module	19
Figure 14. Disconnect from Remote Desktop Connection	19
Figure 15. Data forwarding over Network	20
Figure 16. Network Links	21
Figure 17. Map a network drive	22
Figure 18. Map of the data folder from the RHDx module	23
Figure 19: IP change on the laptop	24
Figure 20. Change X-Port network settings	25
Figure 21. Change the IP in the CRP Manager	26
Figure 22. Default settings for the internal watchdog	30

# Applicability of This Manual

**W** This manual is applicable to the Firmware versions listed below:

Firmware VersionRemarkV40.00.01 and upInitial release

## Warnings and Safety



STATIC ELECTRICITY

The Instrument contains CMOS devices and when serviced, care must be taken to prevent damage due to static electricity. This is very important to ensure long term reliability of the unit.

## **INSIDE THE INSTRUMENT (MAINTENANCE)**

Under normal circumstances, there is no need to remove any of the printed circuit board covers inside the Instrument. The racks themselves can be removed and exchanged by user without posing a threat to device, provided the power supply is switched off or all cables are disconnected.

The rack covers, from the other hand, should be removed by trained personnel only. Moreover untrained access may lead to serious damage to the Instrument, as well as may void the warranty.

Especially the rack cover should never be removed without first contacting GeoSIG or your local representative.

Before removing any of the racks, always:

- 1. Flip all power switches to "OFF" (PAD, COM and RHDx module if applicable)
- 2. Disconnect the power supply
- 3. Make sure that the blue On/Off LED indicator is OFF

## **IFE** BATTERY LIFE

Although supplied through an AC/DC adapter from the mains, the instrument is optionally shipped with the batteries to provide the backup power supply. If the system is not in use, the batteries should be disconnected. If connected, the batteries are attached using the crocodile clamps; the red cable on "+", the black cable on "-" poles of the battery.

*Note: The battery lifetime can drastically change depending on operating conditions. Strong discharge of the main battery must be avoided.* 

# **GeoSIG Cybersecurity Recommendations**

GeoSIG instruments, as described in their documentation, have built-in security and safety features against unauthorised access or use. However, ultimately it is the user's responsibility to ensure the safe and secure usage of our instruments based on their actual implementation. No factory delivered solution can fit each and every possible scenario. The user is advised herein that once you connect a device to a network, you are also connecting that network to that device. It is the responsibility of the user to take appropriate precautions so that all devices should be adequately hardened, such as with individual strong passwords, and should have their traffic monitored and managed via appropriate security features, such as firewalls. Also, noncritical devices should be segmented away from networks that contain sensitive information.

Compliance with a well-defined security procedure helps protect not only an individual device, but also other devices connected through the network. Such procedure would be intended to prevent exploitation of an individual device's resources by unauthorized individuals, including the use of such device to attack other systems on the network or the Internet.

The following recommendations can be considered in establishing such a security procedure:

## 1. Physical access restriction

All devices must be restricted from unauthorised physical access and a well-defined physical access procedure shall be utilised.

## 2. No Unattended Console Sessions

Except for the devices which are physically secured, no unattended console sessions shall be left running.

## 3. No Unattended Network Sessions

No unattended user interface sessions shall be left running towards any device accessed through its network interface.

## 4. Use of a Firewall

For a network that has any connection to the outside world, a hardware firewall must be running and configured to block all inbound traffic that is not explicitly required for the intended use of the network and the connected devices. The user can also consider limiting outbound traffic.

Any communication ports that are required for the operation must be protected.

## 5. No Unnecessary Services or Ports

If a service or port is not necessary for the intended purpose or operation of the device, that service must not be running and the port must be closed. (e.g. if seedlink server is running, but not used, turn it off)

## 6. Use of authentication

Network and console device access must require authentication by means of strong and individualised passwords per device (no passe-partout passwords).

Wireless access must require strong encryption to associate (such as WPA2), or some other strong mechanism to keep casual users near the access point from using it to get full access to the network. WEP or MAC address restrictions do not meet this requirement.

## 7. Password complexity and security

When passwords are used, they must meet the specifications similar to below:

All default passwords must be changed at time of initial access or latest at deployment into service.

Passwords MUST:

contain eight characters or more

contain characters from AT LEAST two of the following three character classes:

```
Alphabetic (e.g., a-z, A-Z)
Numeric (i.e. 0-9)
Punctuation and other characters (e.g., !@#$%^&*()_+|~-=\`{}[]:";'<>?,./)
```

## 8. Privileged Accounts

Privileged and super-user accounts (Administrator, root, etc.) must not be used for non-administrator activities. A secure mechanism to escalate privileges with a standard account is acceptable to meet this requirement. Network services must run under accounts assigned the minimum necessary privileges.

## 9. No Unencrypted Authentication

All network-based authentication must be strongly encrypted. In particular, insecure services such as Telnet, FTP, SNMP, POP, and IMAP must not be used or must be replaced by their encrypted equivalents.

## 10. Software / Firmware updates

Networked devices must only run software/firmware that are updated according to supplier's guidelines. A periodical check of any available updates from the supplier must be sought.

Please contact GeoSIG Ltd if you require any further advice or clarification.

## **Symbols and Abbreviations**

CR-5P	Portable Central Recording System
CMOS	Complementary Metal Oxide Semiconductor
VDC	DC Voltage
VAC	AC Voltage
PC	IBM <sup>©</sup> compatible Personal Computer
SPS	Samples Per Second
Vpp	Volts peak to peak
PAD	Portable A/D converter
COM	Communication module
RHDx	Recorder module

# 1. Introduction

Dear Valued GeoSIG Customer, thank you for purchasing this product.

These Instruments have been optimised to meet the requirements of the majority of customers out of the box and may have even be delivered tailored to your needs. In any case, to be able to get the most out of our product, please carefully study this manual, its appendices and referenced manuals, as well as any other documents delivered with it.

This is a reliable and easy to use device, and at the same time a sophisticated product, which requires care, attention and know-how in configuring, installing, operating and maintenance.

The Portable Central Recorder (in further text CR-5P) is a 24 bit portable seismic system suitable for centralised data acquisition and recording. The CR-5P is designed for both temporary and permanent setups such as bridges, tunnels, and tall buildings. It is easy to use and provides user with a possibility to easily reinstall the system and acquire the seismic data from numerous measurement points. The CR-5P nodes can be easily interconnected to obtain a synchronised network for data acquisition from remote and distant points.

Several types of externally mounted sensors can be used with the instrument, like seismometers, geophones, accelerometers, anemometers or other sensors with single-ended or differential outputs.

The signals such as temperature are considered slow-changing and the chosen sampling rate might be the minimum one (typically a few samples per second suffice). The accelerometers, on the other side, generate the signals of a wider bandwidth and as such require higher sampling rate (typically 50 SPS or higher depending on the required bandwidth, i.e. type of the events observed at the specific site).

The CR-5P collects and records the data, which can later be downloaded and analysed on a remote PC running the dedicated software package GeoDAS. Recorded data include the sensor data, clock/timing information and instrument configuration information.

Frequency response (bandwidth) depends on the chosen low-pass filter and the sampling rate. Typical attenuation at 99% of the Nyquist frequency is >120dB.

During normal operation the instrument continuously amplifies, filters and converts sensor inputs to 24 bit digital form and passes these to the recorder module (RHDx). The recording parameters can be set by remote with a common laptop from anywhere inside the network. The recorded data can then be downloaded over the network and analysed with the GeoDAS software package. Instead of the recorder module (RHDx) an existing computer system can be used as well.

Trigger algorithms include STA/LTA ratio triggering and level triggering. The STA/LTA ratio trigger computes the short term and long term signal averages.

A CR-5P node is comprised of one or more portable digitiser modules (PAD) and an optional communication module (COM). The PAD module further contains up to three triaxial digitisers giving the PAD possibility to acquire data from up to nine channels. The triaxial digitisers from each PAD are further connected via Ethernet cable and the COM module to a recorder module (RHDx) or another computer working as central control unit CCU.

The PAD digitisers are typically configured from the CCU itself or if using a RHDx, from a laptop anywhere in the network. Besides configuration, this connection facilitates data acquisition and performs a complete sensors test as well via the menu driven software **GeoDAS**.

GeoSIG continuously improves and enhances capabilities of all products. There may be several other connectivity, hardware or software options for the Instrument, which are not covered in this manual. Refer to separate documentation from GeoSIG about available options.



# 2. Incoming Inspection

All Instruments are carefully inspected both electrically and mechanically before they leave the factory. Please check if all received items correspond to the packing list and your order confirmation. In case of discrepancies please contact GeoSIG or your local representative immediately.

## 2.1. Damage during Shipment

If requested at the time of order, all instruments can be insured prior to the shipment. If you receive damaged equipment and shipping insurance was previously arranged you should:

- Report the damage to your shipper immediately
- Inform GeoSIG or your local representative immediately
- Keep all packaging and shipping documents



## 2.2. Warranty

GeoSIG Ltd (hereafter GeoSIG) warrants hardware and software products against defects in materials, workmanship and design for the defined period in the relevant contract or offer, starting from date of shipment and 5 years parts and maintenance support commitment. If GeoSIG receives notice of such defects during the warranty period, GeoSIG shall at its option either repair (at factory) or replace free of charge hardware and software products that prove to be defective. If GeoSIG is unable, within a reasonable time to repair or replace any instrument to a condition as warranted, buyer shall be entitled to a refund of the purchase price upon return of the instrument to GeoSIG. 50 % of freight charges on shipments of warranty repairs or replacements will be borne by GeoSIG (normally one way freight).

## Limitation of Warranty:

The foregoing guarantee shall not apply to defects resulting from:

- Improper or inadequate maintenance by buyer
- Buyer supplied software or interfacing
- Unauthorised modification or misuse
- Operation and storage outside of the environmental specifications of the instrument

or

• Improper preparation and maintenance of site.

# 3. Description

## 3.1. Housing

The CR-5P is comprised of 19" rack units (PADs and optional COM or RHDx) housed in a portable case with handles and lids. Information regarding the instrument's date of manufacturing, serial number, etc. is contained on the ID label on the outside of the housing.



Figure 1. CR-5P Housing



Figure 2. CR-5P System overview using a computer as CCU (left) or a recorder module RHDx (right)

## 3.2. Portable A/D Module (PAD)



Figure 4. PAD module, rear view (three or nine connectors)

## 3.2.1. LED's

## N (Network)

These red LEDs indicate that the digitiser is transmitting the data. The LED "A" refers to the first, "B" to the second, and "C" to the third digitiser. The digitisers transmit data at different time intervals, which is indicated by non-simultaneous LED illumination.

## Status

These green LEDs continuously illuminate as the corresponding channels are enabled. Otherwise, the LEDs are off. The first LED from the left of the first row corresponds to the channel 1 of the digitiser "A"; the second LED from the left of the first row corresponds to the channel 2 of the digitiser "A", and so on.

## On/Off

This blue LED is continuously illuminated when the unit is switched on. Otherwise, the LED is off.

## 3.2.2. Connectors

The PAD has typically three connectors on the front side and five at the back. Optional configuration that relies on the uniaxial sensor connection utilises 11 connectors on the back side.

## 3.2.2.1. Sync Connectors

The front side sync connectors are used for synchronisation and optional GPS connection. SYN *in* is used as the synchronisation input (SYNC output of the previous unit or GPS) while SYN *out* is used as the synchronisation output.

## 3.2.2.2. Power

The connectors on the rear left hand side are used as power input and power output. In other words, each PAD is supplied from the previous one, the main power supply, the COM or the RHDx module. But at the same time it provides power on its output connector for the optional cascading. Through this seven-pin connector the PAD is supplied with 12 VDC power. Alternatively, external batteries for powering the instrument may be connected here.

#### 3.2.2.3. Sensor Connectors

The connectors A1, B1, and C1 respectively are triaxial connectors. The optional connectors in between labelled as (A2, A3, B2, B3, C2, and C3) are used when each axis utilises one connection, and is available per customer's specific request.

The SENSOR connector is a 12 pin connector, which is used to connect external sensor(s) to the Instrument. It carries the output signals from the sensor(s) and the test signals from the Instrument. The SENSOR connector provides +12 VDC power to the sensor(s).

Different types of sensors with following sensor voltage output ranges are supported:

- 2.5 VDC ± 2.5 VDC
- 0 ± 10 VDC (20 Vpp)
- 0 ± 2.5 VDC (5 Vpp) differential
- 0 ± 10 VDC (2.0 Vpp) differential

## 3.2.2.4. Ethernet Connectors

The ETH connector is used to attach the PAD to a RHDx module or a COM module that provides the connection path toward the CCU.

## 3.2.2.5. 🕀 Earthing Screw

This is a screw to be used for proper grounding of the chassis. When used, it has to be securely connected to a reliable Earth connection.

## 3.3. Communication Module (COM)



Figure 6. COM module, rear view

## 3.3.1. LED's

## On/Off

This blue LED is continuously illuminated when the unit switched on. Otherwise, the LED is off.

## 3.3.2. Connectors

There are six designated ETH connectors on the front side and one ETH connector at the back side. The number of PAD units attached to a COM module can be expanded and is available upon special request. In that case, the back side can contain up to five more ETH connectors.

## 3.3.2.1. Ethernet Connectors (Front)

The centrally located ETH connector (labelled as *ETH out*) is a designated ETH connector for the CCU connection (laptop, PC or RHDx). The remaining ETH connectors (*ETH1 – ETH7*) are used for the PAD

modules connection. There is no correlation between the physical location of the specific PAD module and the connector relative position.

## 3.3.2.2. Ethernet Connector (Rear)

These connectors are used only for PADs and represent just a continued connector array of the PAD connectors located at the front.

## 3.3.2.3. 🖶 Earthing Screw

This is a screw to be used for proper grounding of the chassis. It has to be securely connected to a reliable Earth connection.

## 3.3.2.4. Power

The connectors on the rear on the left hand side are used as power input and power output. In other words, each COM module provides power supply for the first PAD in the array. Through this seven-pin connector the PAD is supplied with 12VDC power. Alternatively, external batteries for powering the instrument may be connected here.

## 3.4. Recorder Module (RHDx)

The recorder module has the same functionality as the COM module but additionally the possibility to record the data streams from all connected PAD's to a internal hard disk drive



## Figure 7. RHDx module, front view

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	^

Figure 8. RHDx module, rear view

## 3.4.1. LED's

## On/Off

This blue LED is continuously illuminated when the unit switched on. Otherwise, the LED is off.

## Status CPU

This green LED shows if the internal computer is switched on and running.

## Status HDD

If the internal computer access to the hard disk drive, this green LED lights up. Therefore during normal operation this LED should be illuminated from time to time.

## 3.4.2. Connectors

There are six designated ETH connectors on the front side and the power connector on the back.

## 3.4.2.1. Ethernet Connectors (Front)

The centrally located ETH connector (labelled as *ETH out*) is a designated ETH connector for the laptop, which is used for configuration and data download. The remaining ETH connectors (*ETH1 – ETH7*) are used for the PAD or COM modules connection. There is no correlation between the physical location of the specific PAD or COM module and the connector relative position.

## 3.4.2.2. 🖶 Earthing Screw

This is a screw to be used for proper grounding of the chassis. It has to be securely connected to a reliable Earth connection.

## 3.4.2.3. Power

The connectors on the rear on the left hand side are used as power input and power output. In other words, each RHDx module can provide power supply for the first PAD or COM in the array. Through this seven-pin connector the RHDx is supplied with 12 VDC power. Alternatively, external batteries for powering the instrument may be connected here.

## 3.5. External DC Power Supply

An external 12 VDC power supply is connected to the POWER connector of the RHDx module. The power is further distributed to the PAD modules by cascading the power supply cables.

## 3.6. Storage

When not in use, the Instrument should be stored at the room temperature in a dry location. Note that the real time clock continues operation even when the main switch is in the OFF position. The real time clock is maintained by a lithium battery.

## 4. Installation

This section lists the procedures involved in installation, configuration and operation the Instrument. The procedures will be outlined as steps to be performed in the field or in house prior to deploying the instrument in the field.

## 4.1. Site Selection

## 4.1.1. Environmental Considerations

The choice of an installation site for is similar in most respects to that of a regular continuous recording seismic station.

Although the Instrument is housed in a solid case, it is certainly best if a location can be arranged for the unit, which is free from direct sunlight, precipitation, the dangers of falling materials in the event of a severe earthquake and the risk of tampering or vandalism if the unit is to be left unattended. Furthermore, the installation site must not be affected by the weather condition such as ice, rain, or snow.

Additionally, the user should select a site with a provision for 115 / 230 VAC power if the unit is supplied from batteries and will be left in place for a long period of time (more than 3 days). Although this is not necessary for the operation of the device, it does preclude concerns about battery charging.

In case of event triggered recording, any cultural or environmental sources of noise and vibration around the selected site should be noted, which may cause false triggers of the recording mechanism. These will have to be considered when setting the trigger parameters within the GeoDAS software package.

## 4.1.2. Power Supply Considerations

The Instrument is powered from a 12 VDC external power supply or optionally from the backup battery (if available) at the time of the power outage. A solar panel instead of a power supply can be used as well, ask GeoSIG for more detail specifications.

- If the supply in the field is from a 115 / 230 VAC, you need to connect the VAC cable from the external power supply to the power source only. The VAC source must consist of Phase, Neutral and Protection Earth.
- If the supply will be exclusively from the battery, it is necessary to charge the battery sufficiently • beforehand. Make sure to have at least 24 hours of uninterrupted charging prior to leaving the Instrument in the field. The configuration of the instrument, of course, may be performed while the charger is connected to the Instrument.

The best approach to the deployment of the Instrument is to use the battery along with the AC/DC adapter at the remote site. In the lab, the Instrument can be checked and configured for the correct time, trigger and other relevant settings. It may then be carried to the remote site (with the power switch in the "OFF" position to avoid electrical shocks) and then connected to the VAC power through the AC/DC adapter. After switching it "ON", the Instrument runs with the pre-configured parameters. This reduces the amount of time needed to configure in the field; an important consideration in the case of an adverse condition.

## 4.2. Installation



IF Many times the locations of seismic equipment are highly exposed to electrical disturbances caused by lightning or by the industrial environment. It may sometimes be necessary to use additional surge protectors for the equipment. Contact GeoSIG or your local representative for more information.

## 4.2.1. Supply Voltage Selection

In case that the Instrument is powered from an AC/DC converter, ensure that the right voltage is selected 115 VAC / 60 Hz or 230 VAC / 50 Hz.

## 4.2.2. Requirements for the Instrument Installation

Since the instrument is portable and it collects the data from the remote sensors there are no special requirements in terms of foundation and mechanical stability. Typically, the only limitation is the area required for cable running toward the CR-5P housing and the housing itself.

Minimum surface area (footprint) and height requirements for the 4 HU CR-5P housing are as follows:

 $H300 \times W550 \times D600 \text{ mm}$ 

Please note that the height is limited by the number of rack modules in the housing thus possibly reducing the height requirements.

## 4.2.3. Mounting the Instrument

The following are the typical items needed for installation:

- Instrument (CR-5P)
- Power cable with an external 12 VDC AC/DC adapter
- Sync cable between the PAD modules and/or GPS module (if available)
- Ethernet Cables for PAD COM connection
- Ethernet Cable for the connection to the RHDx or the central control unit
- This Manual and its Appendices
- Set of Tools
- Laptop PC with GeoDAS installed, to check or configure the Instrument
- Any accessories or peripheral equipment for the Instrument and their manuals, such as external sensor, GPS, external modem, etc.

Typically follow these steps for a successful installation:

- The Instrument can be mounted in any convenient position at the location that complies with the basic requirements outlined in the previous section.
- Ensure that all cables, especially the sensor cables, have enough space around the housing to be connected to the PAD module.
- Ensure that all PADs have power and sync cables connected to it. Sync cables are cascaded from one PAD to another. The power cables are cascaded from the COM module first then to nearest PAD, then to the second PAD in the array and so on.
- Depending on the location it may be necessary to earth the Instrument properly. Therefore connect the ⊕ (Earthing Screw) of the Instrument via a copper wire of minimum 1.5 mm<sup>2</sup> to a proper earth contact.

It is strongly recommended to have a proper Earthing.

## 4.2.4. Optional Interconnection

In case that the CR-5P nodes are to be interconnected to achieve the time synchronisation, ensure with GeoSIG or your representative at the time of order that the cable length is sufficient for the particular installation. This also applies to the situation when the PAD modules are remotely located in different housing.

## 4.2.5. Completing the Installation



Fix the remaining cables, so that they may not influence the sensor signal by knocking or vibrating at the sensor.

IF Do not leave any unpowered device connected to the Instrument.

After verifying that the physical installation is done properly, the Instrument can now be started and put in operation as described in the following sections.

IF Do not touch the sensors and leave the installation site as quietly as possible.

## 4.3. Cabling

## 4.3.1. Power

The first module of each node is powered by battery and/or an external power supply, connected to 230 VAC. The power supply works as a battery charger at the same time and therefore guarantees maximum of autonomy in case of a power loss. A solar panel instead of a power supply can be used as well, ask GeoSIG for more detail specifications. Each module is powered by a connection to the power connector *12V in* at the rear side of the module. The subsequent module will be powered by connecting its *12V in* to the power connector labelled as *12V out* of the previous module.



Figure 9. Example of powering a CR-5P system

## 4.3.2. Communication

For full functionality of the CR-5P system, all PAD modules must be synchronised. This is done by connecting the *SYN in* connector on the front side of each module either to a GPS, or to the *SYN out* of the previous PAD.

The PAD with a connected GPS works as a timing master; all modules connected to its SYN out have exactly the same time, even if the GPS fails.

The measured data will be streamed by each PAD either to the RHDx module, or to another PC in the network, working as CCU. Therefore each PAD must be connected by a Ethernet LAN cable (via COM module) to the RHDx or CCU computer.

		GPS	GPS
PAD		PAD 0 0000 00000 00000	
PAD		PAD PAD BILL PAD	
PAD			
COM			
	Ethernet Cable (max 100 m)	□ • • • (2003) - <b>GesSG</b>	
	Synchronisation Expansion Cable (max 1'000 m)	PAD	
	GPS Cable (max 70 m)		

Figure 10. Example of networking a CR-5P system

Every module has it IP. The IP is written on the front label and by default the IP's are organised as can be seen below:

Out of factory, the IP's are 192.168.10.xxx

The <i>xxx</i> is	011 020	for RHDx modules
	021 030	reserved for the watchdogs inside the RHDx modules
	031 050	for COM modules
	051 127	for PAD modules

For any change in the network topology see chapter 0.

## 4.4. First Start Up

## 4.4.1. Start Up of the COM Module

Follow the procedure below for every start up of the module. The white boxes are ACTIONS the user has to do; the grey boxes are DECISIONS, which affect the further process.



## 4.4.2. Start Up of the RHDx Module

Follow the procedure below for every start up of the module. The white boxes are ACTIONS the user has to do; the grey boxes are DECISIONS, which affect the further process.



## 4.4.3. Start Up of the PAD Module

Each PAD module can either be powered by another PAD module, or by a power supply and/or battery. For the start up of the module please select the according procedure 4.4.3.1 or 4.4.3.2.

4.4.3.1. PAD is powered from the 12V out connector of another PAD, COM or RHDx module



4.4.3.2. PAD is powered by an external power supply and/or battery







You can now configure the operation parameters, start data acquisition or leave the Instrument for operation with the actual configuration as described in the following sections.

# 5. Configuring Parameters Putting in Operation

For configuration and data acquisition a PC running GeoDAS has to be used.



For the installation and usage of GeoDAS refer to the GeoDAS Manual, which explains the use of the software in full details.

The typical procedure to be followed is to connect the Ethernet cable from the PC to the COM module of the Instrument and follow the steps described in the GeoDAS Manual to configure or perform following functions:

- Communication with the Instrument. ٠
- Verifying the operation of the Instrument and its sensor via Analog Signals. .
- Setting Date and Time (if GPS is no available).
- Saving and/or Loading Configuration.
- Setting Recording parameters.

## 5.1. Quick Setup

Perform the following steps to have a basic running system within a few minutes. Make sure that all modules are properly working and interconnected as described in chapter 4. Basic knowledge of Windows XP and GeoDAS are assumed.

## 5.1.1. Login to the RHDx module

This step is only needed if using a RHDx module for data acquisition. Skip this step if you are using a computer with GeoDAS as a CCU.

- Connect a laptop to the ETH out of the RHDx. Use a standard Ethernet cable.
- Set the IP of the laptop to 192.168.10.1, Subnet mask 255.255.255.0 .
  - Start → Settings → Network Connections 0
  - Double-click Local Area Connections → Properties → Internet Protocol (TCP/IP) 0
  - Press OK 0

🗼 Local Area Connection Status	Image: Second Area Connection Properties         Image: Second Area Connection Properties	Internet Protocol (TCP/IP) Properties
General Support	General Advanced	General
Connection	Connect using:	You can get IP settings assigned automatically if your network supports
Status: Connec	d Broadcom NetXtreme Gigabit Etheme Configure	the appropriate IP settings.
Duration: 2 days Ub:56 Speed: 100.0 Mb	This connection uses the following items:	C Obtain an IP address automatically
	Gos Packet Scheduler      Gos Packet Scheduler      Solution Advanced Server Program Driver      Solution Schemet Protocol (TCP/IP)      Solution Schemet Protocol (TCP/IP)	© Uge the following IP address:         192.168.10.1           IP address:         255.255.0
Sent - Receiv	d Install Uninstall Properties	Default gateway:
Packets: 2'842'667   3'004'	Transmission Control Protocol/Internet Protocol. The default wide area network protocol that provides communication across diverse interconnected networks.	Preferred DNS server:
Properties Disable	Show icon in notification area when connected  Notify me when this connection has limited or no connectivity	Atyanced
2	se OK Cancel	OK Cancel

Figure 11: IP change on the laptop

- Open Remote Desktop
  - Start → Programs → Accessories → Communications → Remote Desktop Connection
  - *Computer:* 192.168.10.xx \*1
  - User name: CR5PRHDx
  - Password: login003
  - o Then click Connect



Now you are working on the PC inside the RHDx module. The GeoDAS window appears.

GeoSIG Data Acquisition S	lystem	9		192.168.10.10	)		- 8 ×			_ 6 ×
File Edit View Analyse Set	tings Tools Window Help									
		المعالييا بالساخط								
										(DIX
Station and Stream	Format Bl	ock Time GPS status	Loct Data (	Trigger	DC Officet	Amplitude	Start Time	Filer	Size	Comment
E V Local Streams		OCK THILE   OF 5 STATUS	LUST Data I	muuci	De onset	Ambiliouc	Jan Inne	11165	JIZC	- conuncilit
E TSTOD	3 ch 24 bit 200	No Lock	Unknown	OFF	000	000	01.01.1601	6086	1.3 GB	
Ch_01	24 bit 200 sps	No Lock	Unknown	OFF	0	0	01.01.1601	2051	450.2 MB	
- Ch 03	24 bit 200 sps	No Lock	Unknown	OFF	0	ő	01.01.1601	2017	459.2 MB	
- R. TST02	3 ch 24 bit 200	No Lock	Unknown	OFF	000	000	01.01.1601	3975	1.3 GB	
Ch 07	24 bit 200 sps	No Lock	Unknown	OFF	0	0	01.01.1601	1323	458.9 MB	
- 📇 Ch_08	24 bit 200 sps	No Lock	Unknown	OFF	0	0	01.01.1601	1327	459.3 MB	
📇 Ch_09	24 bit 200 sps	No Lock	Unknown	OFF	0	0	01.01.1601	1325	458.9 MB	
E TSTO1	3 ch 24 bit 200	No Lock	Unknown	OFF	000	000	01.01.1601	3079	1.3 GB	
Ch_04	24 bit 200 sps	No Lock	Unknown	OFF	0	0	01.01.1601	1020	459.0 MB	
Ch_05	24 bit 200 sps	No Lock	Unknown	OFF	0	0	01.01.1601	1029	459.1 MB	
	24 bit 200 sps	NO LOCK	Unknown	UFF	U	U	01.01.1601	1030	460.3 MB	
1										
1										
1										
1										
Data Stream Monitor										
									1 second -	
+2.9										
-65-008										
-2.9										Station: TST00 (Ch_01)
+2.4										
-66000										
-2.4										Station: TSTDD (Ch_02)
+1.9										
-65-008										Station: TST00 (Ch. 03)
+1.0										
										s
-1.6										Station: TST01 (Ch_06)
+1.3										
-6E-008										
-1.3										Station: TST01 (Ch_05)
E CooDAS Longon				mivi Beco	ial Communication	Channels				
E Geooxa Logger			EI.		an communication	renamels				
25.03.2007 13:41:40 GeoDAS An	plication started. Current version is	2.19k		Port	Baud o	r IP   Owner	Calls In/Out SMS In	VOut   Logins	Errors St	atus
25.09.2007 13.41:40 GeoDAS Ho	ome directory: C:\GeoDAS_DATA				1152	20 ×15	neynes ney	ising U	0 K0	COlter
25 09 2007 13 41 40 Remote net	work links are disabled									
25.09.2007 13:41:40 Strong Mond	ion List View has been introlised									
25 09 2007 13 41 40 WRNs No s	lations configured									
25.09.2007 13 41 40 WRINE SM F	Manager: No stations contigured									
25.03.2007 13.41:40 Network even	enr trigger: Disabled (U of 3 datastre	eamsj								
• • • • • • • • • • • • • • • • • • •				· //						

Figure 12: GeoDAS running inside the RHDx module

**Don't** change any settings without proper study of the manual. Wrong handling can result in a malfunction of the whole system.

<sup>&</sup>lt;sup>\*1</sup> The *xx* stands for any number from 11 to 20. Please look at the label of the RHDx module and type the correct IP address

## 5.1.2. Add new PAD Module

0

- Open in the tab GeoDAS Settings → Channels of Digitisers...
  - Name:
  - Type: GeoSIG D183 Digitizer

XXX \*1

- Press Add/Modify
- Local COM or USB Port: COMxxx \*2
- Sampling Rate: 200
- Baudrate: 115'200
- Time Source External SYNC Signal
- Select proper Full Scale and Unit \*3
- Press Add/Modify
- o Press OK

Now the data stream	of the selected PAF	) appears in the v	window Stations	DataStream

A blue arrow 🚢 next to the channel shows, that data packets are received with no errors

## 5.1.3. Enable the Data Stream Recording

- Open in the GeoDAS the tab Settings → Data Streams...
  - Keep all active streams of data (...):
  - Maximum length of data chunk (...):
  - Delete oldest data if disk free (...):
  - Remove data files older than:
  - Press OK
  - o Restart GeoDAS



nfiguration targ	lot	This Computer	2	-
Parameters of D	Xigitizer			
Name (three-lef	ter code)	TST 💌	Add/Modif	y Remove
Type G	eoSIG D183 Digiti	izer 💌	Sampling rat	e 200 💌
C Local COM	or USB port	COM1: 💌	Baud rate	115200 -
C Remote hos	t IP address and	port	TCP:192.1	68.0.1:12345
🗖 Data packel	s are forwarded	to a remote compu	ter	Setup
Time source	External S	YNC Signal	-	
Configured Cha	nnels			
Configured Cha	nnels	Full Scale	Unit	HW Channel
Configured Cha Station ▼ TST00	nnels Stream Ch_01	Full Scale 2.22222	Unit 0	HW Channel Unit A, Ch 1
Configured Cha Station V TST00 V TST00	nnels Stream Ch_01 Ch_02	Full Scale 2.22222 2.22222	Unit 0 0	HW Channel Unit A, Ch 1 Unit A, Ch 2
Station V TST00 V TST00 V TST00 V TST00	nnels Stream Ch_01 Ch_02 Ch_03	Full Scale 2.22222 2.22222 2.22222	Unit J G G G	HW Channel Unit A, Ch 1 Unit A, Ch 2 Unit A, Ch 3
Station V TST00 V TST00 V TST00 V TST00 V TST01 V TST01 V TST01	nnels Ch_01 Ch_02 Ch_03 Ch_04 Ch_04	Full Scale 2.22222 2.22222 2.22222 2.22222 2.22222	Unit U G G G G	HW Channel Unit A, Ch 1 Unit A, Ch 2 Unit A, Ch 3 Unit B, Ch 1
Configured Cha Station V TST00 V TST00 V TST00 V TST01 V TST01 V TST01 V TST01	nnels Ch_01 Ch_02 Ch_03 Ch_04 Ch_04 Ch_05 Ch_05	Full Scale 2.22222 2.22222 2.22222 2.22222 2.22222 2.22222 2.22222 2.22222	Unit 0 9 9 9	HW Channel Unit A, Ch 1 Unit A, Ch 2 Unit A, Ch 3 Unit B, Ch 1 Unit B, Ch 1 Unit B, Ch 2
Configured Cha Station V TST00 V TST00 V TST00 V TST01 V TST01 V TST01 V TST01 V TST01 V TST01	nnels Ch_01 Ch_02 Ch_03 Ch_03 Ch_04 Ch_05 Ch_06 Ch_06	Full Scale 2.22222 2.22222 2.22222 2.22222 2.22222 2.22222 2.22222 2.22222 2.22222 2.22222 2.22222	Unit 0 9 9 9 9	HW Channel Unit A, Ch 1 Unit A, Ch 2 Unit A, Ch 3 Unit B, Ch 1 Unit B, Ch 1 Unit B, Ch 2 Unit B, Ch 3
Station           V TST00           V TST00           V TST00           V TST00           V TST01           V TST01           V TST01           V TST01           V TST01           V TST02           V TST02           V TST02	nnels Ch_01 Ch_02 Ch_03 Ch_04 Ch_04 Ch_05 Ch_06 Ch_06 Ch_07 Ch_09	Full Scale 2.22222 2.22222 2.22222 2.22222 2.22222 2.22222 2.22222 2.22222 2.22222 2.22222 2.22222 2.22222	Unit 0 0 9 9 9 9	HW Channel Unit A, Ch 1 Unit A, Ch 2 Unit A, Ch 3 Unit B, Ch 1 Unit B, Ch 1 Unit B, Ch 2 Unit B, Ch 3 Unit C, Ch 1
Station           V TST00           V TST00           V TST00           V TST01           V TST01           V TST02           V TST02           V TST02           V TST02           V TST02	Stream Ch_01 Ch_02 Ch_03 Ch_04 Ch_05 Ch_06 Ch_07 Ch_06 Ch_07 Ch_08	Full Scale 2.22222 2.22222 2.22222 2.22222 2.22222 2.22222 2.22222 2.22222 2.22222 2.22222 2.22222 2.22222 2.22222	Unit 0 0 9 9 9 9 9 9 9 9	HW Channel Unit A, Ch 1 Unit A, Ch 2 Unit B, Ch 1 Unit B, Ch 1 Unit B, Ch 1 Unit B, Ch 3 Unit C, Ch 1 Unit C, Ch 1 Unit C, Ch 2
Station           V TST00           V TST00           V TST00           V TST01           V TST01           V TST01           V TST01           V TST02           V TST02           V TST02           V TST02	Ch_01 Ch_02 Ch_03 Ch_04 Ch_05 Ch_06 Ch_06 Ch_06 Ch_07 Ch_08 Ch_09	Full Scale 2.22222 2.22222 2.22222 2.22222 2.22222 2.22222 2.22222 2.22222 2.22222 2.22222 2.22222 2.22222	Unit G G G G G G G G G G G G G	HW Channel Unit A, Ch 1 Unit A, Ch 2 Unit A, Ch 3 Unit B, Ch 1 Unit B, Ch 2 Unit B, Ch 2 Unit C, Ch 1 Unit C, Ch 2 Unit C, Ch 3
Station           V TST00           V TST00           V TST00           V TST01           V TST01           V TST01           V TST02           V TST02           V TST02           V TST02           V TST02	Stream           Ch_01           Ch_02           Ch_03           Ch_05           Ch_06           Ch_07           Ch_08           Ch_09           It parameters pro	Full Scale 2.22222 2.22222 2.22222 2.22222 2.22222 2.22222 2.22222 2.22222 2.22222 2.22222 2.22222 2.22222 2.22222 2.22222 2.22222	Unit 0 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	HW Channel Unit A, Ch 1 Unit A, Ch 2 Unit A, Ch 2 Unit B, Ch 1 Unit B, Ch 1 Unit B, Ch 3 Unit C, Ch 1 Unit C, Ch 3
Station           V TST00           V TST00           V TST00           V TST00           V TST01           V TST01           V TST01           V TST02           V TST02           V TST02           V TST02           V TST02           V TST02           V TST02	Stream           Ch_01           Ch_02           Ch_03           Ch_04           Ch_05           Ch_06           Ch_07           Ch_08           Ch_09           al parameters pro	Full Scole 2.72222 2.22222 2.22222 2.22222 2.22222 2.22222 2.22222 2.22222 2.22222 2.22222 2.22222 2.22222 2.22222 2.22222 2.22222 2.22222 2.22222 2.22222	Unit 0 0 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	HW Channel Unit A, Ch 1 Unit A, Ch 2 Unit B, Ch 2 Unit B, Ch 2 Unit B, Ch 2 Unit B, Ch 3 Unit C, Ch 1 Unit C, Ch 3

30 minutes
1000 MByte

2

2

168 hours

<sup>&</sup>lt;sup>\*1</sup> The xxx stands for any arbitrary 3-character name of the desired PAD module.

<sup>&</sup>lt;sup>\*2</sup> The xxx stands for any number between 051 and 127 and correlates to the last three digits of the IP of the PAD, which is written on the front side of the PAD module (e.g. 192.168.10.115  $\rightarrow$  COM115)

<sup>&</sup>lt;sup>\*3</sup> The *Full Scale* settings depends on the sensor type, please check manual for details.

## 5.1.4. Add new COM Module

For the supervision all COM modules must be added to the GeoDAS too, otherwise the COM modules will restart a couple of times per day.

- Open in the GeoDAS the tab Settings → Watchdogs...
  - Name: xxx \*1
  - Port: COMxx \*2
  - o Baud rate: 115200
  - Press Add Watchdog
  - o Change all values as seen in Figure 13
  - o Press Apply
  - Press Save and Exit

Main Parameters and General Information	Configuration target This Computer
Name WD 💌 Type GeoSIG Watchdog 💌	Time Parameters
Port COM100:      Baud rate 115200	Time parameters define delays between two events indicated below for each delay. Use the format HH:MM:SS to set them
Firmware V_99.5 Counter of restarts 0	Low supply voltage - System shutdown
Monitoring of Voltages Power Control	Supply voltage recovery - System startup 30:00
Thresholds Good Low 🔽 Main Output	No supervised communication - Error declaration 15
12 V Supply 11.973 10.491 🔽 Power Output 1	No supervised communication - First system reset 1:00
24 V Supply 23.946 20.982 🔽 Power Output 2	No supervised communication - Next system resets 6:00:00
Actual supply voltage 11.388 🔽 Power Output 3	System power off time during resets 5
Restarts on low voltage 0 Power Output 4	System startup - Start of the communication supervision 1:00
Monitoring of Communication	
🔽 Data from DCE/ETH 📄 Data from DTE 🔽 GeoDAS activity	Add Watchdog Reset Counterts Read
Number of restarts on communication timeouts 4	Remove Watchdog Default Settings Apply
☐ Watchdog timeout counter is reset by a critical GeoDAS routine	Sample Requester Save and Exit Cancel

Figure 13: Watchdogs settings of the COM module

There is already a watchdog with the name RHD configured. Do not delete or change this watchdog! Otherwise the RHDx module will restart couple of times per day.

## 5.1.4.1. Disconnect from RHDx Module

After the setup, the laptop can be disconnected

• Move the mouse to the upper end of the screen and press the X

System	9	192.168.10.10	- (×)	
attings Tools Window	w Help			

Figure 14. Disconnect from Remote Desktop Connection

<sup>&</sup>lt;sup>\*1</sup> The xxx stands for any arbitrary 3-character name of the desired COM module.

<sup>&</sup>lt;sup>\*2</sup> The xx stands for any number between 31 and 50 and correlates to the last three digits of the IP of the COM, which is written on the front side of the COM module (e.g. 192.168.10.45  $\rightarrow$  COM45)

## 5.2. Data Streaming to Remote Computer

## 5.2.1. RHDx Settings

The following settings must be done on the RHDx module after login over Remote Desktop

- Open GeoDAS
- Click Settings → Network Links...
- Put in the following data on the left side of the window (see
  - Enable network links with the remote applications:
  - o Network name:
  - o IP Address:
  - Accept request from the remote clients at port:
  - Support functions of a remote node:
  - Click OK
- Restart GeoDAS

Network Links			×
Enable network links with the remote applications		Remote application	
Local settings of this application		Network name	
Network name	CR5P	Password	
Password		IP Address	
IP Address	Default	Connect through the port	1024
Accept requests from the remote clients at port	1024	Connection timeout, sec	40
C Accept requests from the configured applications	only	Inactivity timeout, sec	600
Support functions of a remote node	Options	🔲 Remote node	Options
Support broadcasting of datagrams, port	1025		Monitor
Launch the application	_ Options of the Remo	ote Node	×
	The followings options	s are granted to the remote clients:	
Configured remote applications	Monitoring SOH of	f the configured stations	
Na Link Parameters Conn.TO Inac	tiv 🔲 Downloading ever	nt and ringbuffer files	
	🗌 Requests for stati	istics of communication	-
	🔽 Real time data str	eaming	e
	🔽 Remote configura	tion	
		ОК	Cancel

Figure 15. Data forwarding over Network

Workstation Default

Enabled

- Enabled, 1024
- Enabled: Real time data streaming
  - Remote configuration

## 5.2.2. Remote Computer Settings

The following settings must be done on the computer, where you want to receive the data streams

- Open GeoDAS
- Click Settings → Network Links...
- Put in the following data (see Figure 16)
  - Enable network links with the remote applications: Enabled
  - Local settings of this application, Network name:
  - Local settings of this application, IP Address:
  - Remote application, Network name:
  - Remote application, IP Adress:
  - Remote application, Connect through the port:
  - Remote application, Connection timeout, sec:
  - Remote application, Inactivity timeout, sec:
  - Remote application, Remote node
- Workstation Default CR-5P 192.168.10.xx\*1 1024 40 600 Enabled: - Real time data streaming - Remote configuration Enabled

- Permanent monitoring:
- Click Add, then OK
- Restart GeoDAS

Ne	twork Links									×
F	Enable netwo	ork links with the remote appli	cations			– Remote app	ication			
Г	- Local settings	of this application			-	Network nam	ne	CR5P		
	Network name	•	Wo	rkstation		Password				
	Password					IP Address		192, 168.	200.146	
	IP Address		Def	fault		Connect thre	ough the port		1024	
	Accept red	quests from the remote clients	at port	10240		Connection	imeout, sec		40	
	Accept red	quests from the configured ap	plications only			Inactivity tin	neout, sec		600	
	🔲 Support fu	inctions of a remote node		Options		Remote :	node	Op	otions	
	Support b	roadcasting of datagrams, po	rt	10241		Permane	nt monitoring	M	nitor	
	Launch the	e application				🔲 Packet m	ode	Se	ttings	
L										
Γ	- Configured re	mote applications							<u>A</u> dd	
	Name	Link Parameters	Conn.TO	Inactivity TO		Node	Monitor			-
	SAAS	TCP 212.254.29.34:10246	120	600		Yes	Yes		<u>R</u> emove	
	CR 5P	TCP 192.168.10.11:1024	40	600		Yes	No			
									Update	
				Options of the Remo	te Noo	le	×			
				Options below enable	the cor	responding functiona	lity		ОК	
				Monitoring SOH of	the co	nfigured stations				
	1			Downloading even	it and ri	ngbuffer files			Cancel	
L				Requests for statis	stics of	communication				_
				Real time data stre	eaming					
				Remote configurat	tion					
				Options may not work	if they	are not granted by t	he server			
				Query Options		OK	Cancel			
				1						

Figure 16. Network Links

<sup>&</sup>lt;sup>\*1</sup> The *xx* stands for any number from 11 to 20. Please look at the label of the RHDx module and type the correct IP address

- In the window *Remote Nodes and Applications* a new station *CR5P* appears.
- In the window Stations: Data Streams the network CR5P will all channels appears

GeoSIG Data Acquisition	System										_ 8 ×
File Edit View Analyse Se	File Edit View Analyse Settings Tools Window Help										
- <b>R</b>											
											1-1-1
TRemote Nodes and App	plications										
Net Name Lin	k Parameters Last Restart L	ast Heartbeat Net	t Modules Connec	tions Free Memory	PhysMemory, Kb	VirMemory, Kb	HDD Space, Mb	In/Out Rate, Kb/s	System Flags	Status	
SAAS TCP 212	2.254.29.34:10246 28.05 10:56	14:16:30	2 1	69%	147952 of 490992	2011936 of 2097024	66044 of 76308	0.0/0.0	Not supported	OnLine	
CR5P 10P 192	2, 168, 10, 11; 1024 13; 43; 18	14:16:30	2 2	32%	34/048 OT 5153/6	Taalals 01 50al054	33939.01.38146	0.0/0.0	Not supported	UnLine	
11											
11											
11											
Stations: Data Streams	5										<u>- 0 ×</u>
Stations: Data Streams	Format	Block Time	GPS status	Lost Data (%)	Trigger	DC Offset	Amplitude	Start '	Time	Files	
Stations: Data Streams Station and Stream	Format	Block Time	GPS status	Lost Data (%)	Trigger	DC Offset	Amplitude	Start	Time	Files	
Station and Streams Station and Stream Local Streams CR5P CR5P	Format	Block Time	GPS status	Lost Data (%)	Trigger	DC Offset	Amplitude	Start '	Time	Files	
Stations: Data Streams       Station and Stream       B→ ↓ Local Streams       B→ ↓ CRSP       B→ ↓ AD 100	Format 3 ch 32 bit 200 sps	Block Time	GPS status No Lock	Lost Data (%)	Trigger IIII	DC Offset 42 352 39	Amplitude		Time	Files 5203	
Stations: Data Streams Station and Stream Station and Stream CRSP CRSP CRSP CRSP Ch_100 Ch_201	Format 3 ch 32 bit 200 sps 32 bit 200 sps	Block Time	GPS status No Lock No Lock	Lost Data (%) 0 0	Trigger INI INI	DC Offset	Amplitude 19 22 20 19	01.01.2000 01.01.2000	Time	Files 5203 1735	
Station and Streams Station and Stream CRSP C	3 ch 32 bit 200 sps 32 bit 200 sps 32 bit 200 sps 32 bit 200 sps	Block Time 21:13:49 21:13:49 21:13:49 21:13:49	GPS status No Lock No Lock No Lock No Lock	Lost Data (%)	Trigger INI INI INI INI	DC Offset 42 352 39 42 352	Amplitude 19 22 20 19 22	01.01.2000 01.01.2000 01.01.2000 01.01.2000	Time 0 06:02:00 0 06:05:00 0 06:02:00 0 00:05:00 0 00:02:00 0 0 00:02:00 0 0 00:02:00 0 00 0 00:02:00 0 00:00 0 00:00 0 00:00 0 00:00 0 00:00 0 00:00 0 00:00 0 00:00 0 00:00 0 00:00 0 00:00 0 00:00 0 00:00 0 00:00 0 00:00 0 00:00 00:00 00:00 0 00:00 00:00 0 00:00 0 00:00 0 00:00 0 00:00 0 00:00 0 00:00 0 00:00 0 00:00 0 00:00 0 00:00 0 00:00 0 00:00 0 00:00 0 00:00 00:00 0 00:00 0 00:00 00:00 0 00:00 0 00:00 00:00 0 00:00 0 00:00 00:00 0 00:00 0 00:00 00:00 0 00:00 0 00:00 00:00 0 00:00 0 00:00 00:00 0 00:00 0 00:00 00:00 0 00:00 0 00:00 00:00 0 00:00 0 00:00 00:00 00:00 00:00 00:00 00:00 00:00 00:00 00:00 00:00 00:00 00:00 00:00 00:00 00:00 00:00 00:00 00:000 00:00 00:000 00:00 00:00 00:00 00:000 00:0000 00:00	Files 5203 1735 1734	
Station and Streams Station and Streams Build Local Streams CRSP AD 100 AD 100 AD 100 CRSP AD 100 AD	5 Format 3 ch 32 bit 200 sps 32 bit 200 sps 32 bit 200 sps 32 bit 200 sps	Elock Time 21:13:49 21:13:49 21:13:49 21:13:49	GPS status No Lock No Lock No Lock No Lock	Lost Data (%) 0 0 0 0	Trigger INI INI INI INI INI	DC Offset 42 352 39 42 352 39 42 352 39	Amplitude 19 22 20 19 22 20	01.01.2000 01.01.2000 01.01.2000 01.01.2000 Invi	Time 0.06:02:00 0.06:05:00 0.06:05:00 0.06:02:00 alid	Files 5203 1735 1734 1734	
Stations: Data Streams Station and Stream Deal Streams CRSP CR	3 ch 32 bit 200 sps 32 bit 200 sps 32 bit 200 sps 32 bit 200 sps 32 bit 200 sps 3 ch 32 bit 200 sps	Block Time 21:13:49 21:13:49 21:13:49 21:13:49 21:13:49	GPS status No Lock No Lock No Lock No Lock No Lock	0 0 0 0 0 0 0 0	Trigger INI INI INI INI OFF	DC Offset 42 352 39 42 352 39 0 0 0	Amplitude 19 22 20 19 22 22 20 8 8 9	01.01.2000 01.01.2000 01.01.2000 01.01.2000 Inva Inva	Time 006:02:00 006:05:00 006:02:00 alid alid	Files 5203 1735 1734 1734 5325	
Stations: Data Streams           Station and Stream           ⊕ ↓ coal Streams	5 Format 3 ch 32 bit 200 sps 32 bit 200 sps 32 bit 200 sps 32 bit 200 sps 3 ch 32 bit 200 sps 3 ch 32 bit 200 sps	Block Time 21:13:49 21:13:49 21:13:49 21:13:49 21:13:49 21:13:49	GPS status No Lock No Lock No Lock No Lock No Lock No Lock	Lost Data (%) 0 0 0 0 0 0 0	Trigger INI INI INI INI OFF OFF	DC Offset 42 352 39 42 3552 39 0 0 0 0 0	Amplitude 19 22 20 19 22 20 8 8 9 8	01.01.2000 01.01.2000 01.01.2000 01.01.2000 Inva Inva Inva	Time 0.06:02:00 0.06:02:00 0.06:02:00 alid alid alid	Files 5203 1735 1734 1734 5325 1697	
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• For display of the streams make a right-click on the cannel and press Data Monitor

For more details see GeoDAS User Manual

## 5.3. Data Access on the Remote Computer

The following steps must be done on the computer, where you normally download and analyse the data.

- Open Windows Explorer
- Click Tools → Map Network Drive...

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Ele Edit View Favor	rites Tools Help						11
G Back • 🕥 - 💋	Map Network Drive Disconnect Network Drive Synchronize						T 🗗 Go Link
Foldere	Eolder Ontions	×	Name +	Size	Type	Date Modified	
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H My Documents			Config.Msi		File Folder	27.09.2007 14:32	
E My Computer mann			CPQSYSTEM		File Folder	29.08.2007 13:08	
I for Local Dick (C)			CDocuments and Settings		File Folder	14.03.2006 13:32	
COLUMN TE AN	us.		C eDrawings		File Folder	27.03.2006 09:58	
Confector	13		Firmware		File Folder	30.04.2007 09:03	
			Flexim		File Folder	28.03.2006 08:38	
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E Contenengo			MATLAB7		File Folder	23.01.2007 10:22	
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GS Templat			COrCAD_Data		File Folder	03.03.2006 16:29	
			C PIC		File Folder	31.07.2007 14:22	
			Profiles		File Folder	18.09.2007 13:50	
El Modulie			Profiles_old		File Folder	10.11.2006 15:02	
			Program Files		File Folder	26.07.2007 15:55	
	a		Programme		File Folder	24.05.2006 14:36	
Co Duction			RECYCLER		File Folder	21.03.2006 17:00	
Drafiles ald			SEISLOG		File Folder	31.03.2006 12:31	
Promes_old			🗀 sj677		File Folder	26.03.2007 11:38	
El Co Program Pile			Surfer6.04		File Folder	25.07.2007 14:36	

Figure 17. Map a network drive

• Map the drive to the Folder: \\192.168.10.xx\GeoDAS\_DATA \*1



Figure 18. Map of the data folder from the RHDx module

- Click Finish
- A new drive appears under *My Computer*

From now on all data can be easily copied from this new drive. No login to the RHDx module is needed.

<sup>&</sup>lt;sup>\*1</sup> The xx stands for any number between 10 and 49 and correlates to the last two digits of the IP of the RHDx, which is written on the front side of the RHDx module (e.g. 192.168.10.16  $\rightarrow$  COM16)

# 6. Advanced Network Settings

## 6.1. Introduction

The CPR Manager on the RHDx module or the CCU computer creates a virtual Com-port.

# All modules are preconfigured for easy and convenient handling and operation. A change in the network topology needs a structured action and good knowledge in networking

There are different modules, which must be adjusted in case of a change of the network topology.

Name	Location	Description
X-Port	PAD / COM	The X-Port is the interface from the module to the LAN
CPR Manager	RHDx or CCU computer	The CPR Manager redirects the virtual Com-port to the correct IP (of the PAD or COM)
GeoDAS	RHDx or CCU computer	Data acquisition. For this, the correct Com- ports must be selected.

A change in one of these three places always affects the two others.

## 6.2. IP Change of the PAD or COM module

- Set the IP of the laptop in the same range as all the other modules (by factory default use IP **192.168.10.1 and** Subnet mask **255.255.255.0** for the laptop)
  - Start → Settings → Network Connections
  - Double-click Local Area Connections  $\rightarrow$  Properties  $\rightarrow$  Internet Protocol (TCP/IP)
  - Press OK

🗼 Local Area Connection Status	<u>?×</u>	📕 Local Area Connection Properties	Internet Protocol (TCP/IP) Properties
General Support		General Advanced	General
Connection		Connect using:	You can get IP settings assigned automatically if your network supports
Status:	Connected	Broadcom NetXtreme Gigabit Etheme Configure	the appropriate IP settings.
Duration:	2 days 06:56:43		
Speed:	100.0 Mbps	This connection uses the following items:	C Obtain an IP address automatically
		🗹 📮 QoS Packet Scheduler 📃	□ ● Use the following IP address:     □
		Broadcom Advanced Server Program Driver	IP address: 192, 168, 10, 1
		✓ Totemet Protocol (TCP/IP)	
Activity			Subret mask. 200.200.200.0
2.64769	514	handen in the state of the stat	Default gateway:
Sent	Received		C OLL DIS
		Description	<ul> <li>ugtan DNS server address automatically</li> </ul>
Packets: 2'842'667	3/004/584	Iransmission Control Protocol/Internet Protocol. The default wide area network protocol that provides communication.	• Use the following DNS server addresses:
	1	across diverse interconnected networks.	Prefemed DNS server:
			Alternate DNS server:
		Show icon in notification area when connected	
Properties Disable		<ul> <li>Notify me when this connection has influed of no connectivity</li> </ul>	Advanced
$\leq$			
	Close	OK Cancel	OK Cancel

Figure 19: IP change on the laptop

- Connect a laptop the PAD either ...
  - ... directly by connecting a Ethernet <u>cross</u>-cable from the laptop to the ETH connector on the PAD
  - $\circ$   $\ldots$  over the network, by connecting the laptop to a COM or PAD module using a standard Ethernet cable.
- Open a standard web browser as Internet Explorer or Firefox

- Problems have been seen during configuration of the Lantronix by using Google Chrome Browser: Saving of the configuration was not possible (tested with version 20.0.1132.57). Therefore Google Chrome browser shall not be used.
- As Address type // and the IP address of the PAD (e.g. //192.168.10.105), then press Enter
- As soon as the login windows appears, press Enter (Blank Username and Password, both are not set by default)

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Address Address http://192.16	8.10.30/secure/tx_conf.htm
Google G-	💽 Go 🆗 🧭 🌑 🗲 🛛 🏠 🖌 😭 Bookmarks 🕶 🥸 No popups 🛛 👯 Check 👻 🔨 AutoLink 👻 🔚 AutoFill 🔒 Send to
LANTRO	Firmware Version: V6.1.0.0 MAC Address: 00-20-4A-93-B6-6F
<u>ය</u>	Network Settings
Network	
Serial Tunnel Hostlist Channel 1 Serial Settings Connection Email Trigger 1 Trigger 3 Configurable Pins Apply Settings Apply Factory Defaults	IP Configuration C Obtain IP address automatically Auto Configuration Methods BOOTP:  Enable DHCP:  Enable DHCP:  Enable DHCP:  Enable DHCP Host Name: DHCP Host Name: IP Address: I92.168.10.30 Subnet Mask: 255.255.255.0 Default Gateway: 0.0.0.0
	Ethe net Configuration Auto Negotiate Speed: @ 100 Mbps @ 10 Mbps Dupler: @ Full @ Half OK

Figure 20. Change X-Port network settings

- Click Network and adjust your settings
- Press OK
- Click Apply Settings
- Close Browser



For more detail documentation, please see: <u>http://www.lantronix.com/pdf/XPort\_UG.pdf</u>

## 6.3. Adjustment of the CRP Manager

With the CRP Manager the virtual Com ports on the computer can be linked to the desired IP address of the X-Port inside the PAD or COM module

- Open CPR Manager: Start  $\rightarrow$  Programs  $\rightarrow$  Lantronix  $\rightarrow$  CPR 4.1  $\rightarrow$  CPR Manager
- Click on the COM port on the left side you want to use.
- Change the IP setting
- Click OK
- Click Com Port  $\rightarrow$  Save Settings

All Com Ports (252)		Com Foit List Gene	ral l'ests			19	~ ~ ~
E. Com 1 - 22		Com Port	IP Address	TCP Port	Com Status	Network Status	2217
		Lom I [Inaccessible]				<u>.</u>	
uons							
neral Derauk Com Foit							
			Com Status: Clos	ed			
			Network Status: Disc	connected			
Reset to Defaults	Cancel Edits						
I✓ Buffer Writes (Keep cl	ecked for better writ	te performance )	7 🛨 Connection Ti	meout (in second	s)		
Server Reconnect			Timeout Reconnect	0 ÷ Re	connect Limit (C	) = forever)	
T No Net Close							
Listen Mode	Normal - port clos	ed after disconnect	TCP Pa	urt 🛛	Add To F	irewall	
TCP KeepAlive	720000 🕂 Kee	epAlive Time (msec)	1000 🛨 KeepAlive I	nterval (msec)			
E BEC 2217 DTB (In):	Tie DTR to DCD,	DSR always active	-				
(TruPort) Tu Freebu	CDD Transmit Drd	flas Davahu					
i x cinply	CITI Hanshie Da	arei Emply					
Service Host	TCP Port	WARNING! If the	Host is on the other	side of a rout	er or a remol	e firewall,	
1		then UDP ports 30	718, 43282 and 432	B3 may need t	o be added t	o the	
2		these UDP ports a	re not excluded	ience trouble	opening this	com port ir	
3							
	_	Also, some legacy	device servers responses to a device server of	and on UVP pe	ort 43283. If ause is the F	you are	
		this machine is blo	cking this port. Pres	s the 'Add Rx	Port' button	to add this	
	_	port to the Firewall	. If the button capt	ion reads 'Rer	nove Rx Port	then the	
5		- port has alleady be		ic removed by	pressing the	Datton.	
6							
5 6 7			Add Rx Port 1	ne Firewall is tu	rned OFF		

Figure 21. Change the IP in the CRP Manager

For more detail documentation, please see: http://www.lantronix.com/pdf/Com-Port-Redirector\_QS.pdf

# 7. Functional Description

This section discusses some of the technical details of how the Instrument works. Input signal filtering, digitising, and time accounting are among the functions described.

## 7.1. Signal Conditioning

Electrical signals from seismic sensors connected to the Instrument are range-adjusted in preparation for conversion to digital form and are filtered to prevent aliasing effects. The signals are next sampled and digitised, and then digitally filtered under software control to further reduce noise. Then these data are used for triggering and recording within the GeoDAS software package.

The Instrument accepts signals from sensors within the sensor voltage output ranges as follows:

- 2.5 VDC ± 2.5 VDC
- 0 ± 10 VDC (20 Vpp)
- 0 ± 2.5 VDC (5 Vpp) differential
- 0 ± 10 VDC (2.0 Vpp) differential

The Digital Values (DV) for Analog Input Voltages (AIV) are summarised in the following table:

Analog Input V [V]	Voltage AIV	Digital Value DV [Bit]		
Minimum input	0.0	-(2 <sup>23</sup> – 1) x 90% = -7549746		
Zero input	2.5	0		
Maximum input	5.0	2 <sup>23</sup> x 90% = 7549746		

In CR-5P Instruments each signal channel has a low-pass 120 Hz 4th-order Butterworth analog filter with the attenuation of 48dB at 500Hz. The sensor input signal passes through this filter prior to being sampled and converted to digital form. This filter removes signal energy at frequencies above one-half the input sampling rate (1000 Hz) so that these higher frequencies are not aliased by the sampling process. The signal level above 400 Hz at the output of the analog filter is at least 120 dB below the input level. For different sampling rates, anti-aliasing is achieved by the software means (equi-ripple FIR filter structures with the linear phase) with a -3dB point above 80% of the Nyquist rate.

## 7.1.1. Digital Signal Filtering

The anti-aliasing low-pass filter is automatically applied by the sigma-delta A/D converter based on the selected data output rate.

The amplified and filtered analog signals are sampled at a rate of 1000 SPS per channel and converted by a delt-sigma AD converter to 24 Bit digital data values. Since the Instrument allows recording with output sample rates of 50, 100, 200, and 250 SPS the data has to be further decimated digitally.

The sampling rate is common to all three channels digitised by one digitiser, i.e. the sampling rate cannot be individually set for a specific channel.

Please note that the selectable sampling rate is available from the firmware revision 1 and up.

The digitised data still contains signal energy at frequencies of up to 500 Hz, which has to be filtered digitally for all sample rates except 1000 SPS. At the Nyquist frequency (half the decimated sample rate) the signal is at least 120 dB below the input level due the combined effect of the 120 Hz analog filter and the digital filter.

Since data are digitised and stored in the 24 Bit resolution, signals above the Nyquist frequency, even full-scale signals, do not affect the final stored data values at all.

## 7.2. Triggering

The CR-5P Instrument does not have any data storage capability. It acts as a digitiser by simply forwarding the data to the remote host. The recording itself is performed by the GeoDAS software package on the PC side. For more information about the possibility of triggering or to record the data, please consult the GeoDAS manual.

## 7.3. Clock

The Instrument has a complete, self-contained time-keeping system. This clock keeps track of days, hours, minutes and seconds. The instrument has the ability to synchronise the clock automatically with an encoded external time signal, typically from a GPS. The clock operates from the internal battery and runs regardless whether the Main Switch is at ON or OFF position.

## 7.3.1. GPS Option

The GPS (Global Positioning System) is originally used for navigation. It contains several satellites, which orbit the earth in a distance of about 20 000 km. The signals transmitted by the satellites are used to get the position; minimum 4 satellites have to be received by the GPS receiver to find its exact position. The transmitted signals contain also precise time information, which is used to update the internal clock of the Instrument.

## 7.3.2. Synchronisation

Beside the GPS, the PADs can be synchronised with another PAD or the CCU. The CR-5P nodes have to be interconnected with the sync cable to provide the time synchronisation. The most accurate method is to connect a GPS module to every node. In case that there is limited sky visibility, at least one unit should be equipped with a GPS module and the other units can be consequently synchronised by the node having the GPS module attached to it.

When the relative accuracy and synchronisation are not of a primary interest or if the sky visibility is poor throughout the entire installation site, all nodes can be individually synchronised (remotely from a CCU, one by one). This type of synchronisation provides the lowest accuracy.

Please note that the selectable sampling rate is available from the firmware revision 1 and up.

## 8. Troubleshooting and Maintenance

This section describes troubleshooting procedures using the self-testing features of the Instrument if configured via GeoDAS and the maintenance needed to be done.

## 8.1.1. Power

In case that the ON/OFF LED is not lit the probable cause of it is one of the following:

- The cable connection to the mains. Check that 12VDC is available on the output of AC/DC converter.
- Ensure that the main switch in the COM module is ON. The PAD modules are sequentially supplied from their own COM module within a node.
- Check that the fuse in the COM module is not blown.

## 8.1.2. Real Time Clock RTC

In case that the reported time does not correspond to the real time, the probable cause of this is one of the following:

- The GPS module is not attached. Check if GPS is connected and functioning properly. Ensure that there is reasonable sky visibility for clear satellites signal reception.
- The node being synchronised by another node is not attached. Check the Sync cable connection.
- In case that the problem is not resolved using the previous methods please consult the GeoSIG or you representative.

## 8.1.3. Data Streaming

In case that there is no data available on the PC:

- Check that GeoDAS is configured properly. Please consult the GeoDAS manual for further details.
- Ensure that the Ethernet cable (Labelled as 'ETH Out' on the COM module) is plugged in and connected to the PC.
- Ensure that all PAD modules are properly connected to their own COM modules with the Ethernet cables and that all PAD modules are powered on.
- If the previous methods do not resolve the problem try replacing the connection cables.
- For further troubleshooting please consult GeoSIG or your representative.

## 8.1.4. COM module reset every couple of hours

- Check that the COM module is connected to the RHDx module, or the computer working as CCU.
- Check that the watchdog of the COM module is add in the GeoDAS of the RHDx module or the CCU computer (see chapter 5.1.4)

## 8.1.5. RHDx module reset every couple of hours

- Login to the CR-5PRHDx over Remote Desktop and click Settings  $\rightarrow$  Watchdogs... in GeoDAS
- Check if the Watchdog RHD has the settings as shown in Figure 22. Default settings for the internal watchdog. If the watchdog RHD is not present, add it.

Watchdog Configuration		
Main Parameters and General Information		Configuration target This Computer
Name RHD 💌	Type GeoSIG Watchdog 💌	Time Parameters
Port COM21: 💌	Baud rate 115200	Time parameters define delays between two events indicated below for each delay. Use the format HH:MM:SS to set them
Firmware V_3.3	Counter of restarts 0	Low supply voltage - System shutdown 5:00
Monitoring of Voltages ———	Power Control	Supply voltage recovery - System startup 30:00
Thresholds Good	Low 🔽 Main Output	No supervised communication - Error declaration 15
12 V Supply 11.973	10.491 Ver Power Output 1	No supervised communication - First system reset 2:00
24 V Supply 23.946	20.982 Power Output 2	No supervised communication - Next system resets 6:00:00
Actual supply voltage	12.363 Ver Power Output 3	System power off time during resets 5
Restarts on low voltage	0 Power Output 4	System startup - Start of the communication supervision 5:00
Data from DCE/ETH Data from DTE GeoDAS activity		
Number of restarts on communication timeouts 0		Remove Watchdog Default Settings Apply
Watchdog timeout counter	r is reset by a critical GeoDAS routine	Sample Requester Save and Exit Cancel

Figure 22. Default settings for the internal watchdog

## 8.2. Maintenance

The Instrument has been designed in a way that it requires a minimum of maintenance. If the following procedures are performed frequently, the instrument will last for many years:

- The periodic test indicates any irregularity as soon as it occurs. Therefore it is recommended, to check the recorded sensor test at least **once a year**. Compare the signals of the 3 channels with older records. There should not be a distinctive change.
- The function of a sensor with DC response (capacitive, piezo-resistive and FB sensors) can be checked by inclining the sensor in every axis. An inclination of 90° causes an acceleration of 1.0 g, 30° an acceleration of 0.5 g and 14.7° an acceleration of 0.25 g. Check this value for every channel. This check should be performed **annually.**
- The function of the sensor can be checked frequently with a tilt table. For testing the sensor has to be installed onto the tilt table. The whole range of ± 1g has to be checked with the table. Every axis shall be performed. The output signal has to be compared with the calibration values given by the manufacturer.

A sensor without AC response needs to be checked by using a shaking table. The period of this check depends on the used sensor type. For detailed information refer to the data sheet of your sensor.

- The voltage of the optional battery and the charging voltage of the charger shall be measured **annually**. Disconnect the AC power to measure the battery voltage, keep the Instrument switched on. The voltage should be between 11.8 and 13.2 VDC, depending on its charge. Reconnect the AC power cable, switch off the Instrument and disconnect the battery, measure the voltage on the battery cables. The voltage should be 13.8  $\pm$  0.3 VDC.
- The physical condition of the Instrument and the sensor should be checked **annually**. Make sure every cable and connector is in good condition and plugged in properly.
- The optional battery should be replaced every **3 years**. After replacement, adjust the date of installation and the date of the next replacement into the Instrument via GeoDAS.
- The backup battery should be replaced every **5 years**. After replacement, adjust the date of installation and the date of the next replacement into the Instrument via GeoDAS.