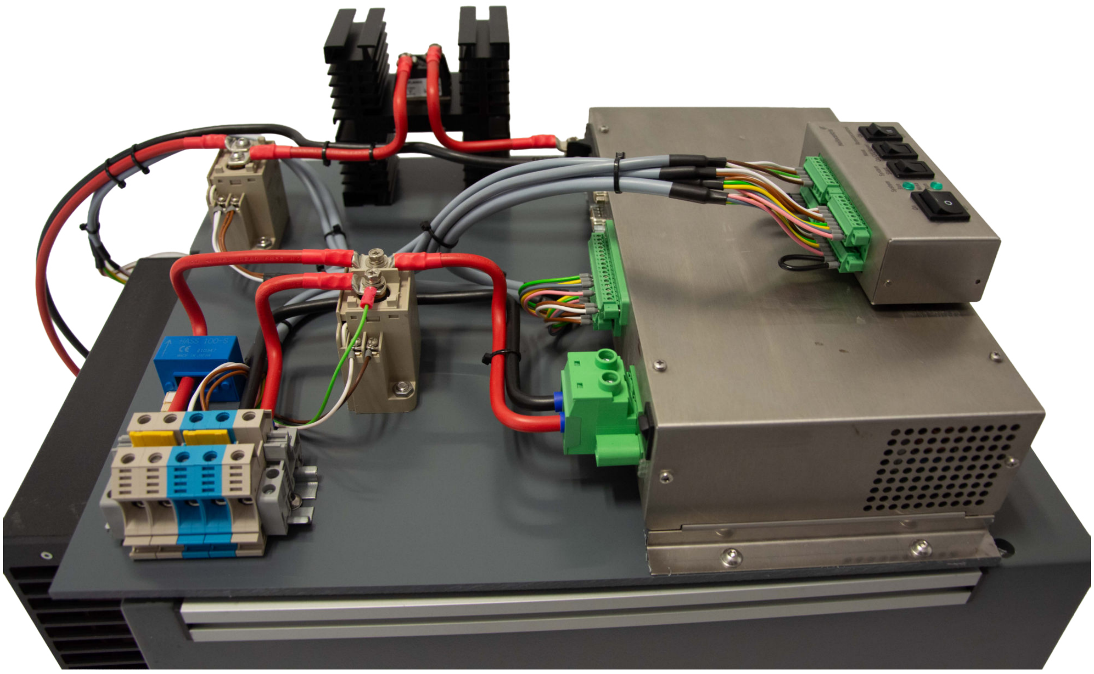
# NEXA® Integration System

Instruction Manual

NEXA® Integration System, Instruction Manual
Version 1.0
Juli 2026

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Heliocentris

# Nexa® 1200

Instruction Manual

ACADEMIA OFFERING

Nexa® 1200, Instruction Manual
Version 2.3
May 2014


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# Content

# 1 About This Document

If only the masculine or feminine form is used in parts of this manual, this is only used for readability and simplicity. Persons of the respective other gender are always included.

The operating manual is intended to help you use the product. It is structured as follows.

| | |
|---|---|
| Safety Instructions | In the safety chapter you will find information on the safe handling of the product. It is essential that you read and understand this chapter. |
| Components | This chapter includes background information about the product and its supplied components. |
| Getting Started | This chapter describes the scope of delivery and the necessary steps for initial startup of the product – from choosing a suitable installation location to connecting all required components. It is supplemented by the laminated assembly instructions. |
| Operation | The chapter provides instruction for the Operation of the product. |
| Software | The chapter describes the software and provides instructions for the software-supported use of the product. |
| Decommissioning | In the chapter Decommissioning the necessary steps for the disassembly product and the conditions for its packaging, storage and transport are described. |
| Troubleshooting | This chapter answers FAQ and deals with possible problems and their respective solutions. |
| Maintenance, Service | This chapter describes all necessary measures arising in the product life cycle, such as the maintenance, cleaning, service, warranty and disposal. |
| Integration | In this chapter Integration information is provided about the possibilities of integrating the product into different applications. |
| Technical Data | An overview of important Technical Data and the abbreviations used in this manual is provided at the end of the operating manual. |
| Index | The index at the end of the manual can be used for fast orientation in the manual. |

## 1.1 Notices and Symbols

### 1.1.1 Symbols

The following symbols and labels are used in this manual:

| Symbol or label | Meaning |
|---|---|
| ➔ | Instruction |

| Symbol or label | Meaning |
|---|---|
| ✓ | Aids or prerequisites that are required prior to an action |
| 1. | Instructions in a specific sequence |
| ⇨ | Result of an action |
| ●, - | List |
| SWITCH | Refers to a switch, key, button or icon |
| Reference to page x | Reference to further information |

Table 1-1 Symbols in the instruction manual

### 1.1.2 Warnings

The following warnings are used:

| | |
|---|---|
| **DANGER** | Warns of danger of death. |
| **WARNING** | Warns of dangers of serious injury. |
| **CAUTION** | Warns of dangers of injury. |
| **NOTICE** | Warns of property damage to the product. |

### 1.1.3 Tips

**TIP** Useful tips are marked this way:

## 1.2 Accompanying Documents

The following documents are supplied with the product in addition to the instruction manual:

- CD-ROM with:
  - *Electronic version of the manual*
  - *Software Nexa® RCS*
- Drivers for CAN-USB converter

# 2 Safety Instructions

In this chapter you will find information on the safe handling of the product. It is essential that you read and understand this chapter.

## 2.1 General Information on Safety & Responsibility

**Danger of injury due to improper use!**

Improper use of the product can result in serious injuries.

- ➔ Ensure that the manual is accessible at all times.
- ➔ Make sure you have read and understood this manual in its entirety.
- ➔ Comply with all safety instructions and warnings.
- ➔ Store the manual and other documentation in a safe place and pass them on to future owners of the product.
- ➔ Comply with all local regulations.
- ➔ Use only product components. Exception: if other aids are specified in the manual.

**Danger of death due to unauthorized modifications!**

Conversions and modifications to the product can result in general hazards (danger due to escaping hydrogen, danger of injury due to heavy parts, danger of death due to electric shock).

Alterations and a modification to the product void the warranty.

- ➔ Do not make conversions and modifications to the product or its individual components.
- ➔ Do not remove components (exception: air filter cartridge).

## 2.2 Approved Use

The product has been designed for:

- Analysis and test purposes
- Experimentation purposes
- Demonstration purposes
- Training purposes
- Research purposes
- R&D projects

The product is not intended for any other purpose; any other use is not approved.

The product may only be operated under supervision (for individual cases of exception, see Requirements for the Owner/Operator on page 9).

The use of the hydrogen supply, which is available as an accessory, is subject to special safety regulations and is intended only in combination with the product for the purposes listed above.

## 2.3 Non-approved Use

Do **not** use this product for:

- Generation of electricity and heat for other purposes than those stated above
- Operation beyond the technical specifications
- Operation beyond the approved operating environment
- Feeding generated energy into the power grid
- Unsupervised operation
- Operation in potentially explosive areas
- Installation in mobile applications
- If an inverter is used, do not feed the current into the electric power grid.
- Installation of the unit in a position other than horizontal.

Components or products delivered by or purchased from Heliocentris are not approved for use in aeronautics or aerospace applications (including models).

## 2.4 Hazards During Approved Use

For proper handling of all chemical or hazardous substances, it is necessary to exercise appropriate care; also make sure you have read and understood the relevant safety data sheets.

Hydrogen

Hydrogen itself is not a hazardous substance – its properties, however, can make it hazardous in interaction with other substances.

**Danger of injury due to explosion!**

Escaping hydrogen can ignite and burn the skin.

Escaping hydrogen can reduce the oxygen content and cause breathing difficulty.

➔ Do not inhale hydrogen.

➔ The lab must be equipped with a suitable ventilation system for the use of hydrogen.

- ➔ The lab must be equipped for hydrogen monitoring.
- ➔ Avoid heat in the vicinity of the system and the hydrogen source.
- ➔ No smoking, no naked flames.
- ➔ Comply with local safety regulations.
- ➔ Comply with regulations for handling of compressed hydrogen cylinders.
- ➔ In the case of escaping gas, keep away and keep inflammable materials away.
- ➔ Prevent electrostatic charges.
- ➔ Ensure proper installation of the hydrogen supply.
- ➔ Check the hydrogen lines and connectors regularly for leak tightness.
- ➔ Comply with local safety regulations.

Electricity

The unit poses no special electrical hazards as long as the following instructions are observed:

**Damage due to electricity!**

Excess voltage, short circuits and polarity reversal damage the unit.

- ➔ Use only the supply voltage specified on the rating plate.
- ➔ Do not short-circuit inputs and outputs.
- ➔ Do not reverse the polarity of inputs and outputs.
- ➔ Never use the system if any part of it has been immersed in water.

## 2.5 General Information on Operation

### 2.5.1 Requirements for the Owner/Operator

The owner/operator must ensure that the unit is accessible only to the persons defined in this manual (see Requirements for the User page 10).

The safety instructions and warnings listed in this instruction manual must be observed. The owner/operator is responsible for compliance with local safety regulations.

Furthermore, the owner/operator is responsible for:

- Proper installation of the hydrogen supply by a specialized company
- Regular checking of the hydrogen lines and connectors for leak tightness
- Unauthorized persons must be prevented, using corresponding measures, from installing, operating or maintaining the system. Installation, commissioning, shutdown and mainte-

nance of the hydrogen supply and filling the metal hydride canisters must be carried out by appropriately qualified personnel.

- Replacement and cleaning of filters if used under dirty operating conditions and/or impaired ventilation

The operator of the system must take sufficient precautions to prevent hydrogen being able to accumulate in enclosed or non-ventilated areas (e.g. installation of an exhaust air system and hydrogen warning system, etc.).

Unmanned operation of the system is possible if the overall design is integrated in a safety concept which conforms to local regulations. The overall design and the safety concept must be approved by the safety officer.

### 2.5.2 Requirements for the Location / Installation Location

The unit must be operated in a lab which complies with the local regulations (refer to Guidelines for Laboratories BGI 850-0e Working Safely in Laboratories – Basic Principles for Laboratories).

The following extinguishing agents must also be present:

Hydrogen

Hydrogen belongs to fire class C. It requires an ABC-extinguisher.

Metal hydride canister

Metal hydride belongs to fire class D. It requires a D-extinguisher. Never use a $CO_2$-extinguisher or water!

**Damage due to reactive gases and substances!**

The membrane of the fuel cell contains a catalyst which reacts with reactive gases and can ignite them.

➔ Operate the fuel cell only in rooms which contain no reactive gases and fluids.

➔ Ventilate the room sufficiently.

### 2.5.3 Requirements for the User

The product is intended as a laboratory system for use by trained qualified personnel in education and research. Its design does not correspond to that of a "consumer-oriented" product whose proper use is generally known and which is protected against operation errors or improper use. The product may be used by the following persons under the following conditions:

- Persons who can demonstrate proof of training in chemistry, physics, electronics, electrical engineering or comparable qualifications and who are familiar with the local regulations for safe handling of hydrogen and who have experience in working with hydrogen.

➔ Personnel must be familiar with and comply with the local applicable accident prevention and safety regulations.

There is an obligation of supervision during all training

- The fuel cell system must only be used by persons undergoing training when under the supervision of the instructor.
- The instructor must ensure proper handling and is obliged to point out possible dangers.

# 3 Components

Nexa® 1200 is a complete fuel cell unit which, with an output voltage between 16…40 $V_{DC}$ and a maximum output current of 60 A @ 5…25 °C, delivers a power output of 1200 W. The output voltage decreases with increasing power. The permissible current decreases with increasing ambient air temperature by 1 A / 1 ° C. An operation in freezing temperatures is not possible.

The Nexa® 1200 (also referred to as the unit) includes an air-cooled PEM fuel cell stack and the necessary peripheral components. It can be directly integrated in an application in various installation positions.

The unit converts the chemical energy of the hydrogen into electrical and thermal energy and water. The unit can be supplied with hydrogen by means of the lab supply with a downstream pressure reducer, an electrolyzer or metal hydride canisters. The cooling air flowing through the unit provides the oxygen required for the chemical reaction.

The unit can be controlled via the Nexa® 1200 Remote Control Software (RCS).

## 3.1 Nexa® 1200


Fig. 3-1 Nexa® 1200 front side

The plastic housing holds all the necessary components for the unit. Essentially, the unit consists of a PEM fuel cell stack (also referred to as the stack) and all important secondary components for operation of the unit, including the hydrogen components, air filter, controller, valves and sensors.

On the front there is a control panel with 3 LEDs and one button. The LEDs serve to indicate operating modes; the button is used to switch the unit on and off and to reset errors.

Fig. 3-2 Nexa® 1200 back side

On the back there is a connection panel with the connections for communication, control of external components and configuration of the unit.

Below the connection panel are the power outputs and the hydrogen supply.

Stack

The stack in the Nexa® 1200 is the FCgen™-1020ACS stack from Ballard Power Systems. It is an air-cooled PEM stack with 36 fuel cells and a power output of 1200°W.

Air supply

A fan provides the necessary reaction and cooling air through the housing to the stack. The housing not only holds the components, but also functions to guide the air.

Hydrogen component

The necessary hydrogen is conditioned by means of a hydrogen component to a pressure level that is adapted to the stack and supplied to the stack as flammable gas.

Controller

The controller regulates the operation of the stack, carries out the procedure for startup and shutdown, provides warnings and error messages and ensures safe operation at all times.

Via the CAN interface the controller provides the process data for monitoring and analysis to the PC and/or the Heliocentris control and visualization software “Remote Control System” (RCS).

### 3.1.1 Safety Concept

The unit can be used in an application as a standalone system or together with other modules. The unit features a 2-stage safety concept which is designed for both options.

- The unit features a fast shut-down function as part of a safety chain. External monitoring devices (such as a hydrogen sensor or oxygen sensor) can be integrated in this safety chain.
- In case a critical situation occurs (e.g. hydrogen leakage) the connected monitors open the safety chain and therefore switch the Nexa® 1200 to an intrinsically safe state.
- This safety chain operates independent of the unit's internal software controller and therefore ensures fast shutdown of the hydrogen supply.
- The 2nd stage of the safety device operates parallel to the first and uses the firmware to monitor the internal components to ensure compliance with specified threshold values.
- In case the threshold values are exceeded the unit switches to an error mode and can no longer be operated until the fault is eliminated.

### 3.1.2 Protection Concept

The Nexa® 1200 protects the stack and / or its operating environment against:

- overheating
- overvoltage
- overpressure
- overcurrent
- increased hydrogen concentration

## 3.2 Nexa® 1200 Startup Kit

In order to start, the unit needs an external power supply; for operation, a hydrogen supply, an external hydrogen valve and a load relay are also necessary.

The Nexa® 1200 Startup Kit consists of a connection and communication set and includes an external hydrogen valve, a load relay and the connecting lines.

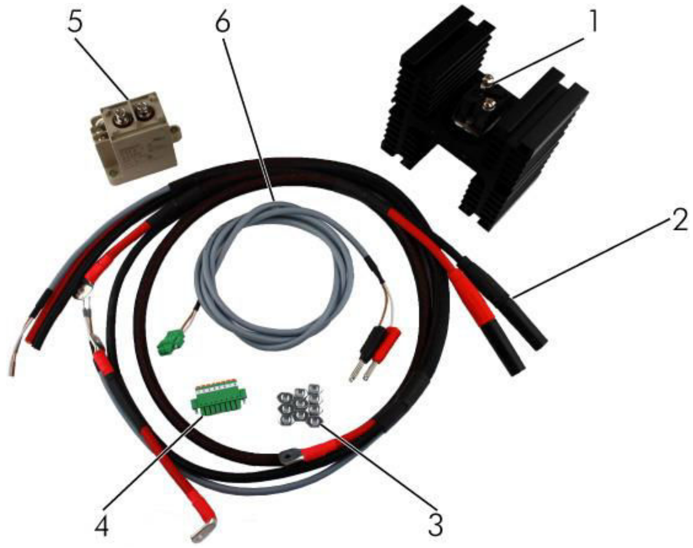



Fig. 3-3 Startup Kit connecting set

| | | | |
|---|---|---|---|
| 1 | Heat sink with reverse current diode | 2 | Pre-assembled power supply cable for battery, load and load relay |
| 3 | Sliding blocks | 4 | Plug for the *SAFETY CHAIN* connection) |
| 5 | Load relay | 6 | Plug connector for connecting the external power supply |

Fig. 3-4 Startup Kit connecting set: external hydrogen valve

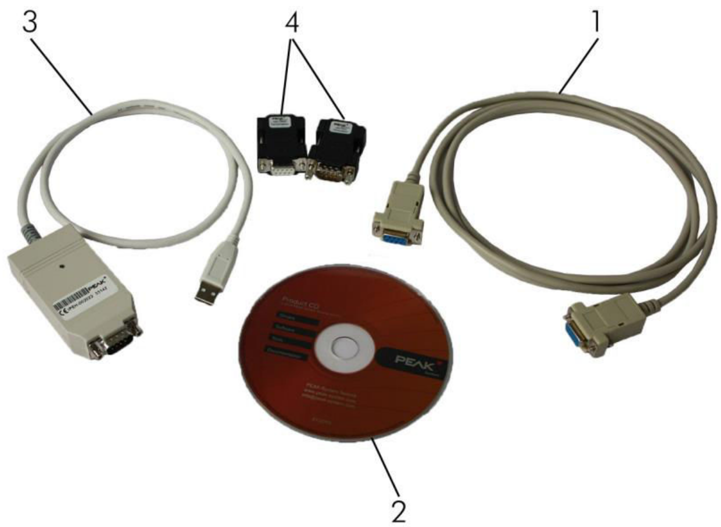



Fig. 3-5 Startup Kit communications set

| | | | |
|---|---|---|---|
| 1 | CAN cable | 2 | Driver CD |
| 3 | CAN-USB converter | 4 | Resistors |

### 3.2.1 External Power Supply

For the external power supply, either an AC adapter or a battery with a voltage of 9...36°VDC can be used.

A 3-pin plug connector for connecting the external power supply is included in the Startup Kit.

### 3.2.2 External Hydrogen Valve

The external hydrogen valve is an additional protective device between the hydrogen supply and the unit. It separates the unit from the hydrogen supply.

### 3.2.3 Load Connection

An external load can be connected to the unit.

A load relay prevents tapping of current if the unit is not in a suitable operating mode.

The reverse current diode mounted on a heat sink protects the unit against reverse current from the load to the unit.

During use of the reverse current diode, the heat sink enlarges the heat-emitting surface of this heat-producing component, therefore preventing the possibility of damage from overheating.

The load relay, a 6-pin plug connector, a heat sink with reverse current diode and power cable are included in the Startup Kit.

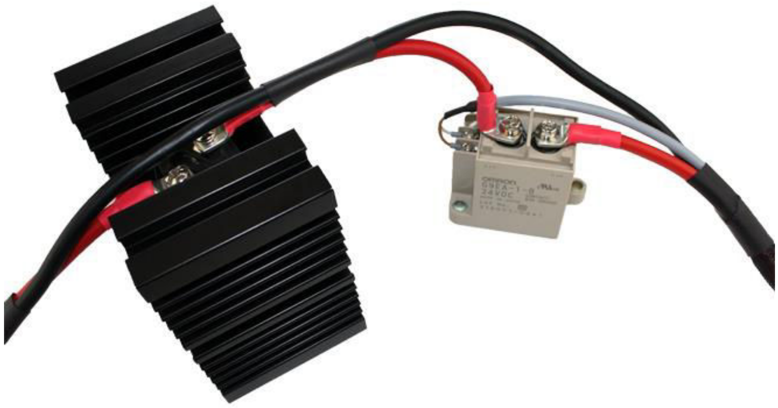


Fig. 3-6 Heat sink with mounted reverse current diode and connected load relay

### 3.2.4 Communication

For connecting a PC, the Startup Kit also includes a CAN-USB converter, CAN cable and 2 terminating resistors.

Fig. 3-7 CAN-USB converter, 2 terminating resistors and CAN cable

### 3.2.5 Nexa® Remote Control Software

The Nexa® RCS is monitoring and control software.

The abbreviation RCS stands for Remote Control Software. The Nexa® RCS serves as a control platform for the Nexa® 1200 and the connected Heliocentris components.

All relevant data can be checked, recorded and saved for further analysis, if necessary.

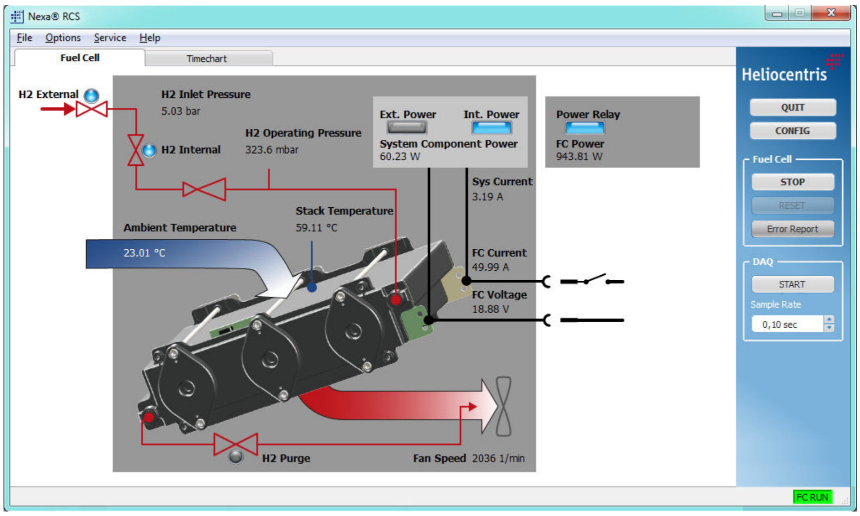



Fig. 3-8 Nexa® RCS – tab *FUEL CELL*

Communication between the Nexa® RCS and the Nexa® 1200 and the other components takes place via a CAN interface. Communication with electronic load takes place via RS232 cable delivered with electronic load.

The function of the software is to switch the units to the various operating modes and to visualize all relevant operating parameters. The operating parameters, e. g. fuel cell voltage and fuel cell current, can be saved.

The measured dates are displayed in tab *TIMECHART*.


Fig. 3-9 Nexa® RCS - tab *TIMECHART*

**TIP** The best performance of RCS will be reached by using Windows 7 or Windows 8. Using another operation system could cause a changeover in the parameters of the DC/DC converter. RCS is not compatible with Windows XP.

# 4 Getting Started

This chapter describes the scope of delivery and the necessary steps for initial startup of the Nexa® 1200 from choosing a suitable installation location to connecting all required components.

## 4.1 Scope of Delivery

| **Illustration** | **Designation** |
|---|---|
|   | Nexa® 1200 |
|  | Nexa® 1200 Startup Kit connection set<br>• 2-pin plug connector for connecting the external power supply<br>• Load relay<br>• Reverse current diode on heat sink<br>• Pre-assembled power supply cable for battery, load and load relay<br>• 8-pin plug for the *Safety Chain* connection<br>• 10 sliding blocks<br>• Pre-assembled solenoid valve with hydrogen hose and 6-pin plug connector for the connection of the solenoid valve and load relay |
|  | Nexa® 1200 Startup Kit communication set<br>• CAN-USB converter<br>• CAN cable<br>• 2 CAN terminating resistors)<br>• CD-ROM Nexa® Integration System<br>• CD-ROM PEAK System |

Table 4-1 Scope of delivery

## 4.2 Additional Supplemental Components

The following components are also recommended for connecting the unit – they are not included in the scope of delivery, but can be purchased from Heliocentris.

- Connecting set for hydrogen supply
- HydroKnowz™ hydrogen sensor

## 4.3 Installation Location

The unit must be operated in a lab which complies with the local regulations (see Requirements for the Location / Installation Location on page 10).

The installation location must also meet the following requirements:

- Hydrogen monitoring
- Frost-free
- Precautions against electrostatic charge have been taken
- Non-flammable or difficult to ignite surface (at least FV-1 according to IEC 60707 or better)
- Stable, level surface
- The unit may be operated at a maximum angle of inclination of 10 ° relative to the mounting plane
- Clean
- To prevent overheating of the unit, a minimum clearance of 20 cm must be maintained from walls or other equipment
- To ensure unobstructed air circulation the clearance at the air outlet must be at least 30 cm
- Do not install the unit in cabinets or facilities without sufficient ventilation
- Power connections must be present
- The back side must be accessible for making connections
- Minimum space requirement for installation:
  - *Unit needs 5 height unit (U) in a 19” rack system with 600 mm depth or*
  - *Approx. 50 x 60 cm*

## 4.4 Unpacking and Installation

The following section describes what to watch out for when unpacking and setting up the unit.

**CAUTION**

**Danger of injury due to heavy weight of the unit!**

If the unit falls, this can result in injuries from crushing. Material damage can also occur.

➔ Wear safety shoes.

➔ Have 2 persons unpack and set up the unit.

✓ Suitable installation location

✓ 2 persons

1. Grasp unit on profile side to lift it out of the packaging.
2. Check the unit for obvious transport damage to the packaging and to the product itself. In the event of damage, inform the shipping company and Heliocentris or your supplier about the damage immediately.
   - *If possible, document the damage with a camera.*
3. Compare the delivered items with the information in this instruction manual immediately after unpacking.
   - *(see page 21).*


Fig. 4-1 Set up the Nexa® 1200 horizontally

4. Set up unit at selected installation location.
   - *The unit must be set up horizontally*

**TIP**

Store packaging material for future storage or dispatch of the unit.

## 4.5 System Design

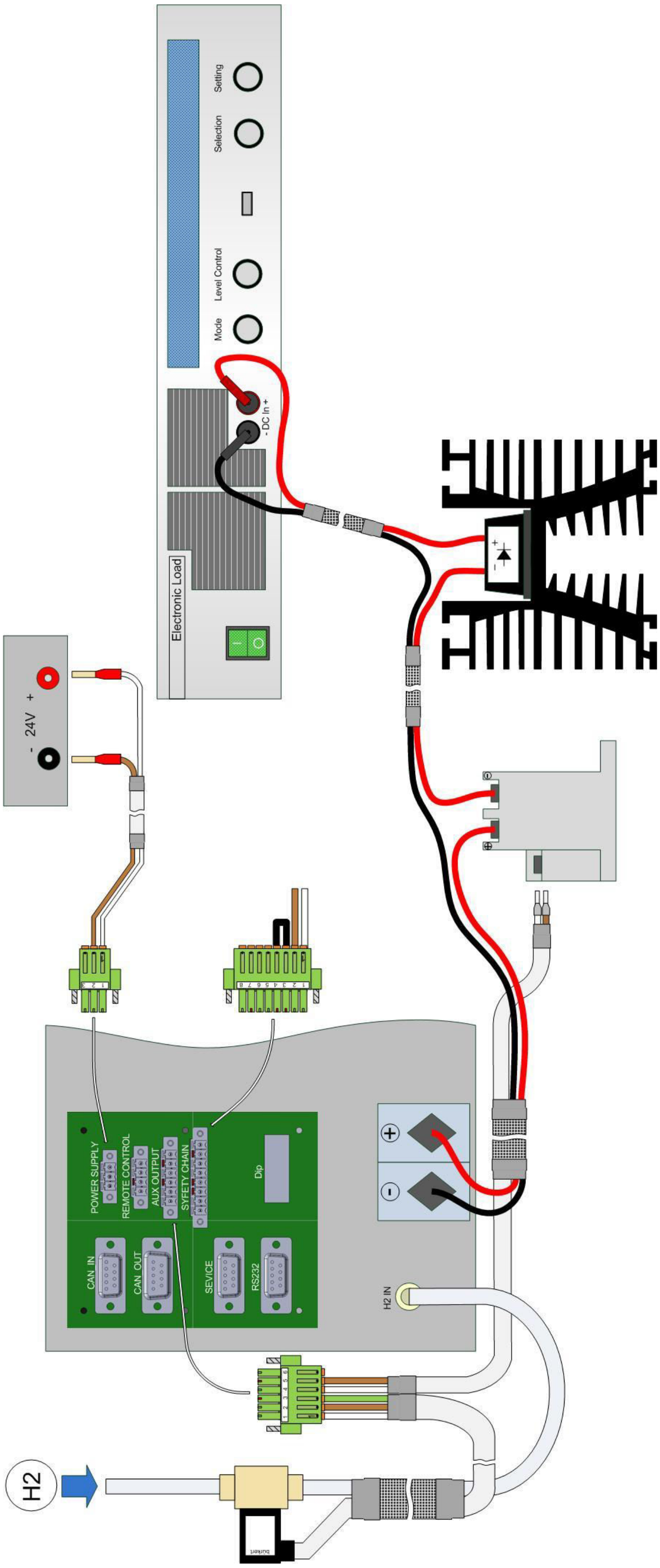



Fig. 4-2 Assembly instructions for the Nexa® 1200

### 4.5.1 How to Establish Electrical Connections and Communication

To get the unit ready for operation, connections must still be established for the electrical system, communication, safety devices and the hydrogen supply:

Connections and plugs are coded to prevent incorrect connection.

NOTICE

**Damage due to defective cables!**

Defective cables can cause a short circuit, resulting in damage to the unit.

➔ Check cables for intactness before use and reject defective cables.

## 4.6 How to Connect an External Load

An external load can be connected to the unit. For this purpose, the electronic loads (EL 2400 or EL 1500) of Heliocentris are suitable:

While the black (-) power cable is connected directly to the load, the red (+) power cable is routed through the load relay and the reverse current diode.

NOTICE

**Damage due to short circuits!**

Voltage can be present at the power output. If it is short-circuited this can damage the stack.

➔ Do not short-circuit the power output.

NOTICE

**Damage due to reverse current!**

Reverse current from the load to the unit can damage the fuel cell system.

➔ Install a reverse current diode between the unit's power outputs and the power inputs of the connected load.

Power output of the unit


Fig. 4-3

The power outputs are below the connection panel on the back of the unit. The power outputs are designed as screw terminals.

Proceed as follows to connect an external load to the unit:

- ✓ Pre-assembled power supply cable for battery, load and load relay
- ✓ The external load is switched off
- ✓ The device is off-circuit
- ✓ Flat-tip screwdriver

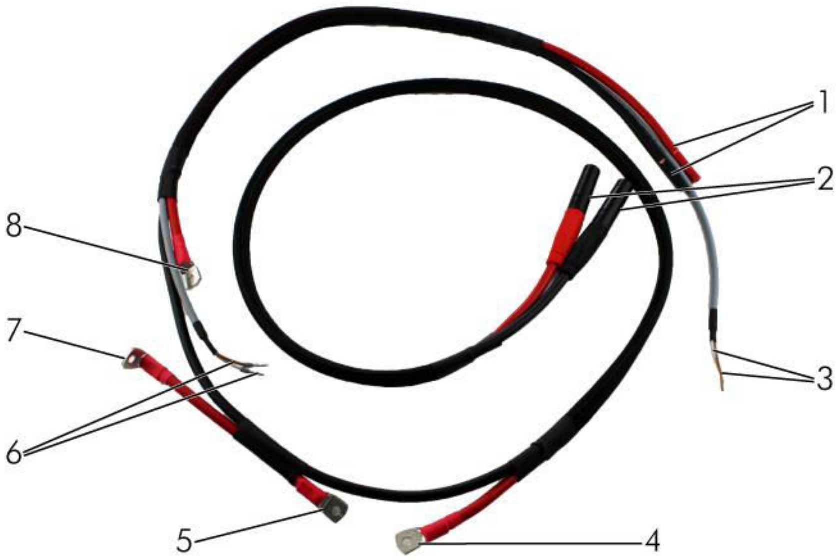



Fig. 4-4 Pre-assembled power cable

1. Loosen locking screws (1, Fig. 4-3) to open the power outputs (2, Fig. 4-3).
2. Insert the exposed end of the black power cable (1, Fig. 4-4) into the negative power output (-).
3. Insert the exposed end of red power cable (1, Fig. 4-4) into the positive power output (+).
4. Tighten the locking screws hand-tight.
5. Insert the black lab plug (2, Fig. 4-4) into the negative power input (-) of the load.

   ⇨ *The power cables are now connected to the power output.*

### 4.6.1 How to Connect the Load Relay

A load relay serves to switch off the load. It is connected between the unit's positive power output and the load. The load relay can be positioned anywhere near the unit.

Connect the load relay as follows:

- ✓ Load relay
- ✓ The pre-assembled power cable is connected to the load output of the unit

- ✓ Pre-assembled solenoid valve
- ✓ Philips-head screwdriver

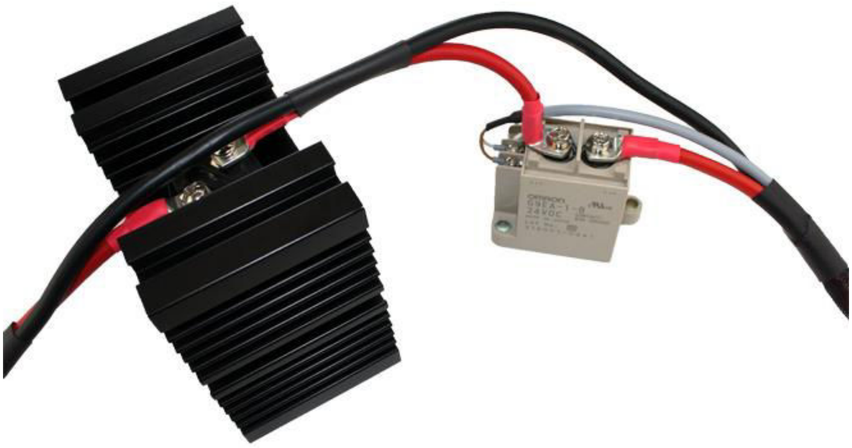


Fig. 4-5 Connect the load relay as follows

1. Connect the positive power cable coming from the unit (8, Fig. 4-4) to positive contact 1 (+) of the load relay.
2. Connect the angled side of the positive power cable (7, Fig. 4-4) to negative contact 2 (-) of the load relay.

   ⇨ *The power cable is connected to the load relay.*

Control of the load relay

For the control, the load relay is connected to the unit through the control of the solenoid valve by a two-wire cable.

Fig. 4-6

1. Plug the two wire cable (3, Fig. 4-4) to the fourth and fifth terminal of the solenoid valve plug connector (**Fig.** 4-6).
   - *Press the orange holding spring of the 5th terminal back towards the rear.*
   - *Insert the negative lead (brown) of the 2-wire cable.*
   - *Release orange holding spring.*
   - *Repeat steps with the positive lead (white) and the 4th terminal.*

Fig. 4-7

2. Loosen the screws of the contacts on the side of the load relay (**Fig.** 4-7).
3. Insert the white lead of the two-wire cable (6, Fig. 4-4) in Contact 8.
4. Insert the brown lead in Contact 7.
5. Insert plug connector of solenoid valve in *AUX OUTPUT* at Nexa® 1200.
6. Tighten screw hand-tight.

   ⇨ *Electrical connection to load relay is now established*

### 4.6.2 How to Connect the Reverse Current Diode

Without the use of a reverse current diode, the unit is not protected against reverse current from the load to the unit. The installation of the reverse current diode with a heat sink is absolutely necessary.

The heat sink enlarges the heat-emitting surface of the reverse current diode, therefore preventing the possibility of damage from overheating. The heat sink can be positioned anywhere near the unit as long as it can dissipate the heat efficiently.

NOTICE ! Damage from reverse current! Install a reverse current diode between the unit's power outputs and the power inputs of the connected load.

Connect the diode to the unit as follows:

- ✓ Heat sink with reverse current diode
- ✓ The pre-assembled power cable is connected to the load relay.

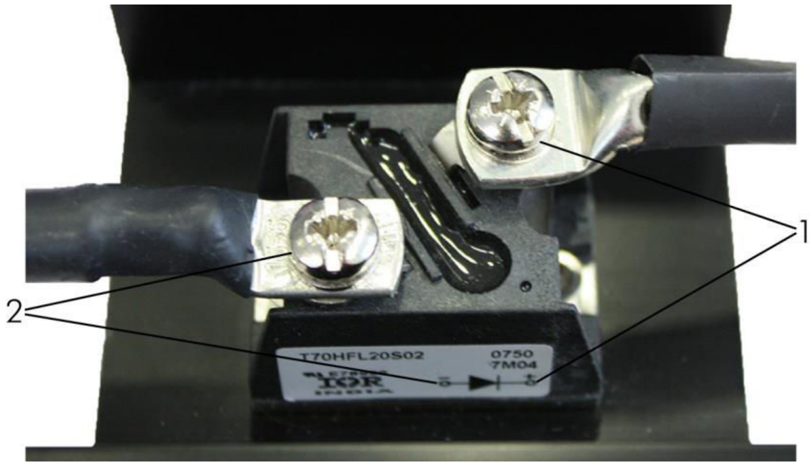



Fig. 4-8 Reverse current diode on heat sink

1 Positive contact 2 Negative contact

1. Loosen screw of negative contact (2) on the reverse current diode.
2. Place cable lug of the positive power cable (5, Fig. 4-4) coming from the load relay on the contact.
3. Tighten screw on contact hand-tight.
4. Loosen screw of positive contact (1) on the reverse current diode.
5. Place cable lug of the positive power cable (4, Fig. 4-4) to the load on the contact.
6. Tighten screw on contact.

   ⇨ *Reverse current diode is now connected.*

## 4.7 How to Install Safety Devices

### 4.7.1 How to Install the Safety Chain

**WARNING**

**Danger of injury due to hydrogen!**

Escaping hydrogen can ignite and cause severe burns to the body.

Escaping hydrogen can be hot and burn the skin.

Escaping hydrogen can reduce the oxygen concentration and cause respiratory difficulties.

➔ A safety chain must be installed.

The safety chain is based on a current loop. This allows every participant in the safety chain to detect or create an interruption. An interruption in the safety chain switches the system to an intrinsically safe state.

The following actions take place as soon as the safety chain is interrupted:

- All hydrogen valves of the unit are closed
- The connected load relay is disconnected
- The unit cannot be started

The electronic components of the safety chain can be integrated in an existing current loop, but they also have their own power source.

*NEXA® 1200* as a central safety controller

If the *NEXA® 1200* serves as the center of the safety equipment, various external monitoring devices (e.g. hydrogen and oxygen sensors) with potential-free switch output (relay contact) are integrated in the chain.

**How to connect the external $H_2$ sensor (not included in the scope of delivery)**

NOTICE ! If no external sensor / relay contact is used, a cable bridge must be used instead of the relay contact.

Connect the hydrogen sensor to the unit as follows:

- ✓ HydroKnowz™ hydrogen sensor
- ✓ Cable bridge
- ✓ Two-wire safety chain lead (0.5mm$^2$, flexible)
- ✓ Small flat-head screwdriver for holding spring

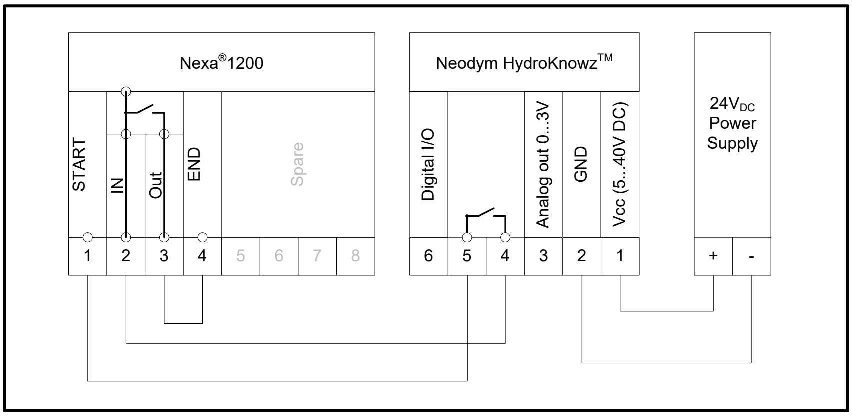



Fig. 4-9 Hydrogen sensor connection diagram

1. Plug cable bridge into the 3rd and 4th terminal in the SAFETY CHAIN connection on the Nexa® 1200.
2. Connect the 1st and 2nd terminal of the SAFETY CHAIN connection to the 5th and 4th contact of the hydrogen sensor.

   ⇨ *The hydrogen sensor is now connected*

For the allocation of the contacts, see Chapter Allocation of Plugs and Jacks on the Connection Panel page 79.

## 4.7.2 How to Connect the Equipotential Bonding Conductor

The equipotential bonding conductor eliminates electrical potential differences (voltages) between the devices of the system, the ground and conductive parts of third-party equipment. Connect the equipotential bonding conductor as follows:

- ✓ Equipotential bonding cable (not included in delivery)
- ✓ 10 mm open-end wrench (not included in delivery)

Fig. 4-10 Equipotential bonding

1. Loosen nut.
2. Place equipotential bonding cable on thread.
3. Tighten nut.
4. Fasten the other end of the equipotential bonding cable to a further Heliocentris product (e.g. a further Nexa® 1200 or Nexa® DC 1200) or to the rack system.

   ⇨ *Equipotential bonding is established.*

## 4.8 How to Connect the Hydrogen Supply

Hydrogen gas with a minimum purity of 4.0 (=99.99 %) is necessary for operation of the stack. The permissible hydrogen inlet pressure is 1…15 bar.

The unit can be supplied with hydrogen by means of all options, e.g. lab supply, metal hydride canister or electrolyzer which fulfill the above conditions.

**CAUTION**

**Danger of injury due to gas jet!**

The compressed hydrogen cylinder is pressurized. If the gas jet is directed at human beings, this can result in injuries.

➔ Do not direct the gas jet at human beings.


Fig. 4-11

The connection for the hydrogen supply is located on the back of the unit, to the left of the power connections.

The hydrogen valve is pre-assembled. It is equipped with a connecting cable and a hydrogen connection.

The load relay cables are already connected to the cables of the solenoid valve by means of a plug connector (see Control of the load relay on page 27). This plug connector is connected to the *AUX OUT* (1, **Fig.** 4-11) connection.


Fig. 4-12
Solenoid valve to Nexa® 1200

Connect the hydrogen supply as follows:

- ✓ Hydrogen supply
- ✓ Solenoid valve
- ✓ Hydrogen connection set (not included in scope of delivery), with quick coupling and consisting of
  - *Pressure reducer*
  - *Hydrogen hose*
- ✓ Hydrogen connecting set must be connected to hydrogen supply (see documentation for hydrogen connection set)
- ✓ Main valve of the hydrogen supply is closed

1. Push back the union nut on the hydrogen hose (**Fig.** 4-12, 2).
2. Insert the hydrogen hose in *$H_2$ IN* (**Fig.** 4-11, 2) as far as it will go.
3. Push the coupling ring forward.
4. Tighten hand-tight.
5. Tighten ⅛ to ¼ of a turn with the open-end wrench.

Solenoid valve to hydrogen connection set

6. Insert quick coupling plug of the pressure reducer from the hydrogen connection set into the quick coupling of the solenoid valve (**Fig.** 4-12, 1) until it locks into place.

   ⇨ *The hydrogen supply is now connected.*

Set pressure

➔ Set the hydrogen inlet pressure.

➔ The recommended hydrogen inlet pressure for optimal operation is between 3 and 8 bar.

Electrical connection of solenoid valve

Connect the solenoid valve as follows:

1. Insert plug connector (Fig. 4-12) in the *AUX OUT* (Fig. 4-11, 1) connection.
2. Tighten the locking screws hand-tight.

   ⇨ *The electrical connection of the solenoid valve and load relay is established.*

## 4.9 How to Connect the External Power Supply

**NOTICE**

**Damage due to incorrect connection!**

Connection of the external power supply to a different jack than *POWER SUPPLY* will short-circuit the unit.

➔ Connect the external power supply only to *POWER SUPPLY*.

AC adapter

Connect an AC adapter as the external power supply as follows:

✓ Power supply unit (12…36 V $_{DC}$)

✓ Power cable with plug connector


Fig. 4-13 Connect external power supply

1 Connection for power supply    2 Pre-assembled power supply cable

The startup kit includes a pre-assembled power supply cable with a plug connector in which the leads are already inserted into the terminal.

1. Connect an AC adapter with the power supply cable to the power supply.
2. Set the voltage (12…36 V $_{DC}$) at the power supply unit
3. Insert plug connector of the power supply cable (2) into the connection for the external power supply (*POWER SUPPLY*, 1).
4. Tighten the locking screws hand-tight.

NOTICE! Incorrect polarity can damage the unit! Check for correct polarity of the connection: + = red, - = black.

5. Insert lab plug of the power supply cable into the AC adapter.

   ⇨ *The external power supply with the AC adapter is now established.*

For the allocation of the contacts, see Chapter Allocation of Plugs and Jacks on the Connection Panel on page 79.

Battery

It is possible to provide the power supply with a battery (9...36 VDC). The battery cannot be charged by means of the unit.

## 4.10 How to Perform a Leak Test

For safe operation of the unit, it must be assembled so that there are absolutely no leaks.

The leak test should be conducted every time the hydrogen supply is connected.

- ✓ The unit is assembled
- ✓ Electrical connections are established
- ✓ Hydrogen supply is connected
- ✓ Set for $H_2$ leak monitoring (not included in the scope of delivery)

1. Remove contacts of the solenoid valve from the terminal (contact 1, 2 and 3 on AUX OUT) connection.
   - *Press the orange holding spring of the terminal toward the back.*
   - *Remove the lead.*
   - *Release orange holding spring.*
2. Connect solenoid valve cable to external power supply (AC adapter). The polarity of this connection is not important.
3. Switch on AC adapter with 0.4 A and 24 V to open solenoid valve.

   ⇨ *Opening the solenoid valve generates a clicking sound.*
4. Open valve from hydrogen supply (e.g. gas cylinder valve on the compressed gas cylinder).
5. Set the hydrogen inlet pressure.
6. Read the pressure.
7. Close the valve.
8. Wait 5 minutes.
9. Check the hydrogen primary pressure.
10. If the hydrogen primary pressure has not changed, the installation is leak proof.
11. If the hydrogen primary pressure has dropped, there is a leak in the installation.
12. Use the hand-held sensor and the leak test liquid to find the leak.

– *See the included operating manual for the personal gas warning unit and the instructions printed on the cylinder.*

Leak found:

13. Seal connection.
14. Repeat steps 1–7.

Leak eliminated

15. Switch off AC adapter.
16. Disconnect solenoid valve cable from the AC adapter.
17. Connect solenoid valve to unit

   – *Press the orange holding spring of the 2nd terminal of the plug connector back towards the rear.*
   – *Insert the negative lead (brown) of the 2-wire cable.*
   – *Release orange holding spring.*
   – *Repeat the preceding steps with the positive lead (white) and the 1st terminal.*

## 4.11 How to Establish Communication

**NOTICE**

**Damage due to incorrect interface cable!**

Incorrect interface cables can damage the unit.

➔ Use only connecting elements provided by Heliocentris.

The following data interfaces are connected to the unit.

- *CAN IN* (1): to PC
- *CAN OUT* (2): to a further Heliocentris product, e. g. Nexa® 1200 or Nexa® DC 1200

A CAN interface (3) is provided for service purposes.

The following data interfaces can optionally be connected to the unit:

- *RS232* (4)

The *RS232* interface can be enabled by Heliocentris if needed.

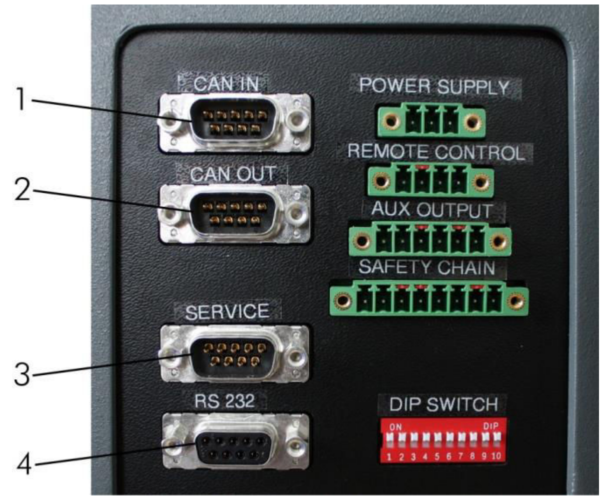



Fig. 4-14 Data interfaces

| | |
|---|---|
| 1 *CAN IN* (PC) | 2 *CAN OUT* (connection for further unit) |
| 3 *SERVICE* (CAN) | 4 *RS232* |

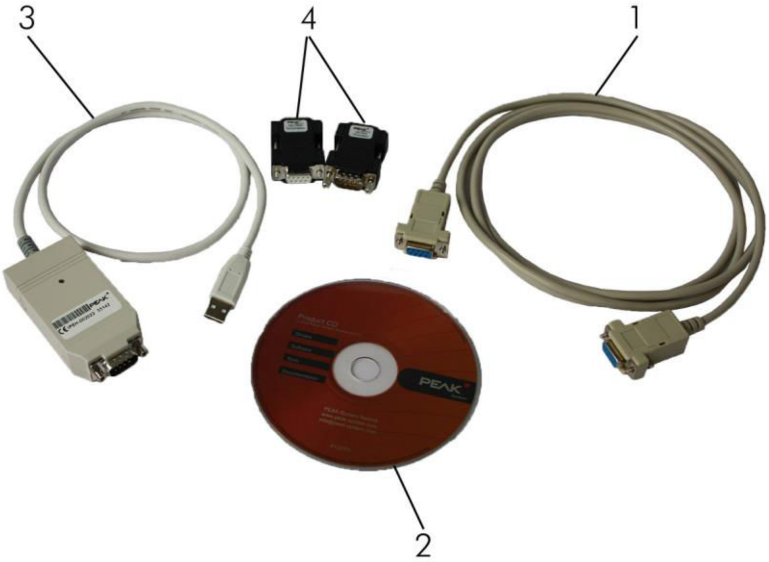



Fig. 4-15 Components for connection of PC and terminal connection of CAN-Bus

| | |
|---|---|
| 1 CAN cable | 2 Driver CD |
| 3 CAN-USB converter | 4 Resistors |

Fig. 4-16 Assembly instructions for establishing communication

### 4.11.1 How to Connect the Data Interface to the PC and Connect the CAN Bus to Terminals

Connect a PC as follows:

- ✓ PC (not included in delivery)
- ✓ CAN-USB converter
- ✓ CAN cable
- ✓ Terminating resistor
- ✓ Small flat-head screwdriver

PC connection

1. Insert jack of CAN cable in CAN IN of the unit.
2. Insert terminating resistor in jack of CAN cable.
3. Insert CAN-USB converter in terminating resistor.
4. Tighten all locking screws hand-tight.
5. Insert USB plug of the CAN-USB converter into the USB port of the PC.

   ⇨ *The unit is now connected to the PC.*

CAN-Bus terminal connection

The CAN-Bus must have a terminal connection if the unit is the last or only Heliocentris product connected to the bus. Establish the terminal connection as follows:


- ✓ Terminating resistor

1. Insert the terminating resistor into *CAN OUT*.
2. Tighten the locking screws hand-tight.

   ⇨ *The terminating resistor is now connected.*

### 4.11.2 How to Install the Software and Hardware Drivers

How to install the software and the hardware driver:

- ✓ System requirements

(see PC Requirements on page 85)

- ✓ CD-Rom Nexa® Integration System
- ✓ Sufficient rights for installation of the software
  - *Contact the administrator, if necessary*

1. Switch on PC and monitor.
2. Insert the CD-Rom Nexa® Integration System

The folder on the CD for the software installation is named SOFTWARE.

3. Open SOFTWARE\NEXA 1200\NEXARCS folder.
4. Double-click the file Nexa_RCS_2.2R1_Setup
5. Follow the instructions of the setup program for the Nexa® RCS.

   ⇨ *The program Nexa® RCS is installed.*

Install the PCAN-USB Driver

6. Follow the instructions of the setup program of the PCAN USB (software) driver.

   ⇨ *The PCAN USB (software) driver is installed.*
   ⇨ *Following the successful installation of the PCAN drivers, the red LED on the CAN-USB converter is blinking (The Nexa® 1200 must be switched on.)*

   ⇨ *The communication between the unit and the PC can now be established.*

# 5 Operation

The unit can be controlled via the Nexa® RCS software, buttons on the unit or remote control.

To start the unit and the software and to establish communication between the unit and the software, proceed as follows:

- Start unit
- Start software

The order is not important.

## 5.1 How to Start the Nexa® 1200

Proceed as follows to put the system into operation:

✓ The unit is mounted
  – *(see Unpacking and Installation on page 22)*

✓ Hydrogen supply is connected
  – *(see How to Connect the Hydrogen Supply on page 31)*

✓ Interfaces are connected
  – *(see How to Establish Communication page 34)*

✓ Hydrogen connection has been checked for leaks
  – *(see How to Perform a Leak Test on page 33)*

✓ Power supply (AC adapter or battery) is connected and switched on.

Start unit

Start the unit as follows:

➔ Press button.

Fig. 5-1 Button

Or (if software is already running)

➔ Click the START button in the FUEL CELL area.

⇨ *The unit is now switched on. The flush valve opens and flushes the unit. The fast blinking CAN-USB converter indicates the transfer of data to the PC.*

Initialization

The unit conducts the initialization, starting with the system test. The communication is initialized by the system.

Standby

After successful initialization and completion of the system test, the system automatically switches to *STANDBY* mode and also switches to internal power supply.

! TIP

If the unit continues to operate and communicate in the event of a faulty stack, for example as a result of insufficient hydrogen, it is recommended to leave the external power supply switched on while the unit is in operation. This maintains external communication when the unit switches to *ERROR* mode.

### 5.1.1 Information for the Commissioning:

The system can reach 50…60 % of the full capacity right after startup. To regenerate the system, a longer warm-up period may be necessary, depending on the past operation. The information provided here is based on experience; diverging values do not necessarily mean that the unit is defective.

The warm-up period depends on the temperature and the relative humidity during the storage period, the load and the characteristics of the BOP. The table below shows the foreseeable warm-up times with constant current load operation (65 A) and a minimum excess of oxygen of 20.

| Effect temperature | 80 % stack power | 100 % stack power |
|---|---|---|
| 20 | 0:20 | 1:35 |
| 0 | 1:00 | 2:51 |

Table 5-1 Foreseeable warm-up time of the Nexa® 1200 until the specified power is reached (minutes:seconds)

## 5.2 How to Start the Software

✓ PC and monitor are switched on

Start the software

Start the software as follows:

➔ In the Windows start menu, open > *PROGRAMS* > *NEXA® RCS*.

⇨ *The software starts.*

## 5.3 Operating Modes

The unit is in different modes during the course of operation.

| Designation | Description | Supply |
|---|---|---|
| *OFF* | The unit is not switched on and there is no external power supply present. Communication is not possible. The LEDs are off.<br>If the unit was switched from *RUN* or *ERROR* to *OFF*, | Without |

| Designation | Description | Supply |
|---|---|---|
| | the minimum quantity of hydrogen still remaining in the stack diffuses after a maximum period of 30 minutes. | |
| *STANDBY* | The unit is ready for operation. The start signal (button on the unit or Start button in software) switches the unit to *RUN* . The green LEDs blink in alternation. | External |
| *RUN* | Power can be tapped. The external load relay is actuated and closed. The unit is in normal operating mode. The green LEDs light up continuously.<br>Depending on the power output the fuel cell is flushed regularly in this operating mode; this is accompanied by an audible noise. | Internal |
| *ERROR* | The unit switches to an intrinsically safe state due to incorrect parameters. Red LED signals error. | External |

Table 5-2 User-related operating modes of the unit

### 5.3.1 Processes

Certain processes take place during the transition from one mode to the next:

| Designation | Description | Mode transition |
|---|---|---|
| Initializing | External power supply is established. The controller of the unit conducts the initialization. The communication is initialized and started by the system. Outputs controlled by the controller are set to defined values.<br>The system controller analyzes the sensor signals and initializes the variables required for operation.<br>This process is displayed in the software. | *OFF* → *STANDBY* |
| Fuel cell startup | The system controller starts the stack. This includes startup of the air and hydrogen supply. From this point onward all operating parameters, the operating pressure, fuel cell voltage, fuel cell current and temperatures are controlled constantly. As long as all operating parameters are within the defined ranges, the unit is remains switched to internal power supply.<br>As long as all operating parameters in internal power supply state are within the defined ranges, the unit is in *RUN* mode. | *STANDBY* → *RUN* |
| Fuel cell shutdown | The external input valve is closed, thus interrupting the hydrogen supply. If necessary, the stack is cooled to the defined temperature. The internal power supply is switched off. If a power supply is (still or again) present, the unit switches to *STANDBY*; otherwise it automatically switches to *OFF*. | *RUN* → *STANDBY* → *OFF* |

Table 5-3 Processes which take place during the transition from one mode to the next

## 5.3.2 LED Display of the Mode or Process

The LEDs on the front of the unit indicate the operating mode or current process of the unit.

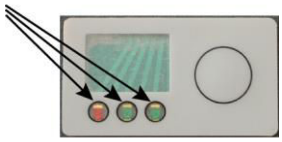


Fig. 5-2 LED display

| LED (from left to right) | | | Operating mode or process |
|---|---|---|---|
| Red | Green | Green | |
| o | o | o | Initializing (after application of an external power supply) |
| - | (o) | o | Standby, Fuel Cell Startup |
| - | o | o | Run |
| - | o | (o) | Fuel Cell Shutdown |
| o | - | o | Error |
| (o) | - | o | Critical error, e.g. in the safety chain |
| - | - | - | Unit has no external power supply |

Table 5-4 LED display of the mode or process

1 o LED lights up
2 (o) LED blinks
3 - LED off

## 5.3.3 Communication Status

The communication status is indicated at the CAN-USB converter.

Fig. 5-3 Status display at CAN-USB converter

| Status display | Meaning |
|---|---|
| Blinking fast | Data is being sent to PC |
| Blinking slow | Error in communication |
| No signal | No communication |

Table 5-5 Communication status

## 5.4 How to Reset an Error

The operating parameters are displayed in the software flow chart. If the parameters are not within the specified values, the unit switches to *ERROR* mode. Warnings and error messages are displayed (2).

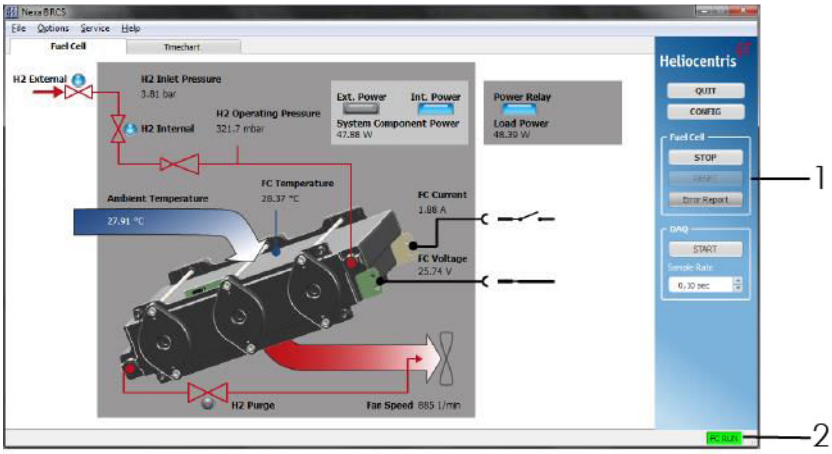



Fig. 5-4 Error

Troubleshooting

In case of shutdown due to an error, the unit is in a locked operating mode. After eliminating the cause of the error, the user must reset the error in order for the unit to operate.

**Reset error**

After eliminating the error, it has to be reset. Reset an error as follows:

In the software

➔ Click *RESET* button in *FUEL CELL* area (1).

➔ Click the *START* button in the *FUEL CELL* area.

⇨ *This switches the unit to the* STANDBY *mode after an error.*

Or

On the unit

➔ Press button.

⇨ *The unit can now be started again.*

➔ Press button one time briefly.

⇨ *This switches the unit to the* STANDBY *mode after an error.*

If the error is not completely eliminated, the unit will switch back to *ERROR* mode during the initialization.

## 5.5 How to Enable Power Output

If the system is in *STANDBY* mode and the operating mode status display (*OFF*) in the software is blinking, the power output can be enabled. It is recommended to first connect the load and set it to 0.

Proceed as follows to enable the power output:

✓ Power cables are connected

✓ Load relay is connected

- ✓ Reverse current diode is connected
- ✓ System is in *STANDBY* mode

Unit

1. Press button.

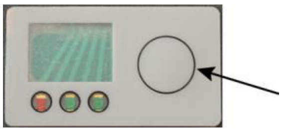


Fig. 5-5 Button

Or

Software

1. Click the *START* button in the *FUEL CELL* area.
2. Switch on load.
   - ⇨ *Load relay closes and power can be tapped.*

**TIP** If the software is closed, the most recently set power parameter is kept; in other words the loads draws power from the battery. Switch off the load manually.

## 5.6 How to Maintain the Hydrogen Supply

**TIP** Insufficient hydrogen supply results in shutdown of the unit and therefore shutdown of the load. Make sure that sufficient hydrogen is available at all times. The hydrogen inlet pressure during operation must be at least 1 bar. The recommended hydrogen inlet pressure is 3...12 bar.

If the pressure of the hydrogen supply is less than 1 bar, the hydrogen supply must be replaced. To do so, the unit must first be shut down.

- See How to Shut Down the Nexa® 1200 page 51.

# 6 Software

The function of the software is to switch to the various operating modes and to visualize all relevant operating parameters. The operating parameters, e.g. stack voltage and stack current, can be saved.

## 6.1 Software Views

The software has 2 different views: *FUEL CELL* flowchart and *TIMECHART*. The tab bar, control area and status display are the same in all views.

Each tab window contains the tab bar (1), the main view and the control area (2 – 4). It uses the in the right bottom corner in the bottom bar for error and status messages (5).

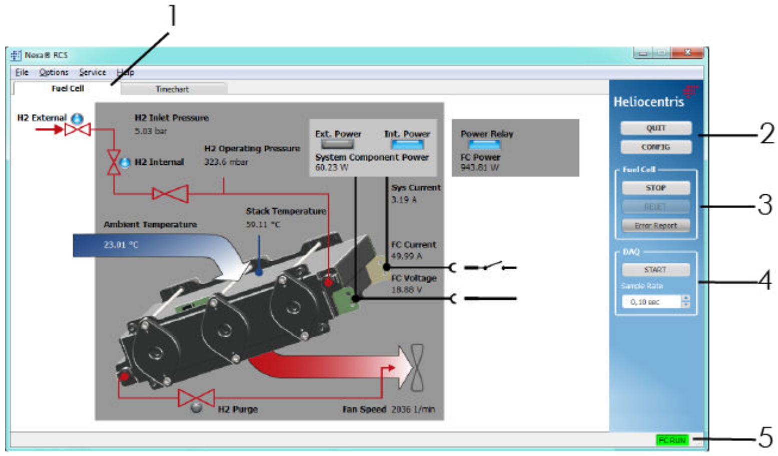



Fig. 6-1 Flowchart view

1 Navigation tabs
2 *QUIT* and *CONFIG* buttons
3 Fuel cell control
4 Data acquisition (DAQ) controls
5 Status display, error and warning messages

Status bar

In the status bar (5), the different status displays (standby, run, error) are shown in color highlighted fields:

| | **Background** | **Display** | **Operating Mode** |
|---|---|---|---|
| FC RUN | Green | RUN | active operating mode |
| FC SBY | Yellow | SBY | Standby |
| FC SBY | Yellow blinking | SBY | waiting mode |
| FC - | Grey | | No communication |
| FC ERR | Red | ERR | Error |
| FC TIM | Red | TIM | Timeout |

Table 6-1 Software status messages

Activate a view by clicking on the corresponding tab in the navigation tab bar (1).

Navigation

- *FUEL CELL*: Flowchart view
- *TIMECHART*: Timechart view

### 6.1.1 Controlling the Nexa® 1200

In the control frame on the right, you will find the control elements for controlling the Nexa® 1200:

*QUIT* — At the top of the control area you will find the *QUIT* button (2, fig. 6.1, which interrupts the connection to the unit and shuts down the software.

*CONFIG* — Beneath the *QUIT* button, you find the *CONFIG* button to open the *CONFIGURATION* dialog. The system configuration can be viewed and changed here.

*FUEL CELL* — Below the button *CONFIG* you find the *FUEL CELL* area, which includes the control buttons for controlling the device.

*START / STOP* — Click the *START* button to start the unit.

During operation, the text on the button changes to *STOP*. Click the *STOP* button to switch the unit to *STANDBY* mode.

*RESET* — Click the *RESET* button to reset existing error and warning messages.

*ERROR REPORT* — Click the *ERROR REPORT* button to create a service file, which can be sent to Heliocentris Service for error remedy. This file is saved in the directory *C:\USERS\PUBLIC\DOCUMENTS\HELIOCENTRIS\NEXA RCS*.

*DATA ACQUISITION* — Beneath the *FUEL CELL* area you will find the area for recording the data.

For further information on recording data, see 6.4 Acquiring Data on page 49.

## 6.1.2 Fuel Cell Flowchart

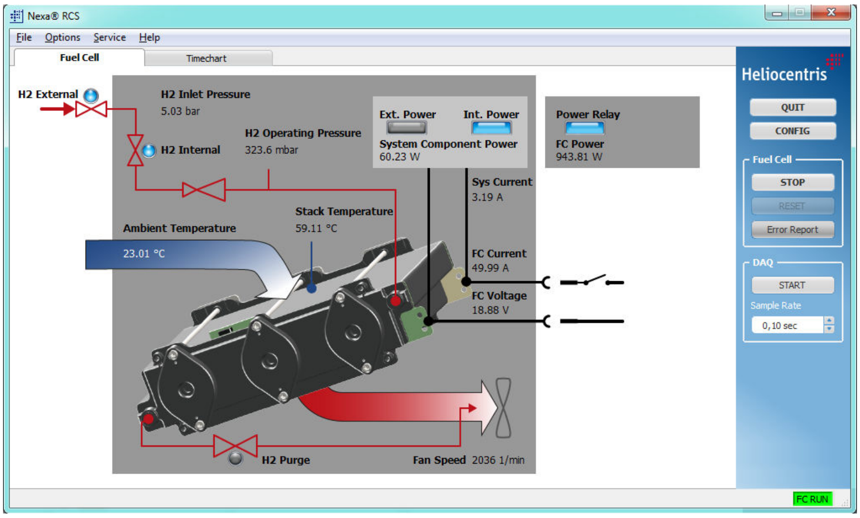



Fig. 6-2 Flowchart with displayed parameters

The *Fuel Cell* flowchart visualizes the Nexa® 1200 stack with all interfaces and the system boundaries.

The *Fuel Cell* view shows the individual values of the operating parameters and the states of valves and the load relay.

| **Area** | **Displayed parameters** | **Definition** | **Units / states** |
|---|---|---|---|
| Hydrogen supply | *H2 Inlet Pressure* | Inlet pressure | bar |
| | *H2 Internal* | Internal hydrogen valve | blue (active), grey (inactive) |
| | *H2 External* | External hydrogen valve | |
| | *H2 Operating Pressure* | Operating pressure | mbar |
| Air supply / cooling | *Ambient Temperature* | Ambient temperature | °C |
| | *Stack Temperature* | Fuel cell stack temperature | °C |
| | *Fan Speed* | Fan speed | l/min |
| Exhaust air | *H2 Purge* | Purge valve | blue (active), grey (inactive) |
| Output | *FC current* | Total power output | A |
| | *FC-Voltage* | | V |
| Power supply and consumption | *Ext. Power* | Power supply, external / internal | blue (active), grey (inactive) |
| | *Int. Power* | | |
| | *Sys. Current* | Self-consumption | W |
| Load | *Power Relay* | Load relay | grey (open) blue (closed), |
| | *FC Power* | Tapped power | W |

Table 6-2 Operating parameters displayed in the flow chart

### 6.1.3 Timechart view

Click the *TIMECHART* tab to activate the timechart view. On the left are toggle buttons for displaying/not displaying each parameter. In the main view, you see the timechart.

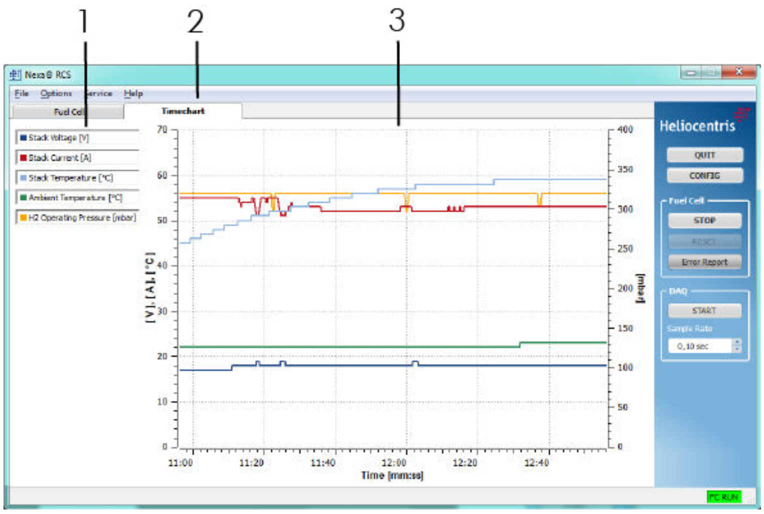



Fig. 6-3 Timechart view

1 Displayed parameters in respective display mode

2 *TIMECHART* tab

3 Time history of the individual parameters

This view visualizes the measured values and system data in time curves.

The scrolling x-axis simulates time. Simulated time is reset after 60 minutes. Scrolling back and forth through data is not possible.

The following parameters are displayed:

- *STACK VOLTAGE*
- *STACK CURRENT*
- *STACK TEMPERATURE*
- *AMBIENT TEMPERATURE*
- *H2 OPERATING PRESSURE*

Selecting parameters to be displayed

As default all parameters are activated. Deactivate parameters as follows:

➔ Click the parameter to deactivate it.

➔ Click deactivated parameters to activate them again.

## 6.2 How to Install the Software

Installation of the software is described in How to Install the Software and Hardware Drivers (see page 36).

## 6.3 How to Start the Software

The procedure for starting the software and establishing communication with the unit is described in How to Start the Software, page 40.

## 6.4 Acquiring Data

Acquired data can be saved. Proceed as follows to save the data:

✓ In Windows, a default program has to be determined to open files with a .csv extension (e. g. MS Excel, Windows Editor)

1. In the control frame area *DAQ*, click the field *SAMPLE RATE*.
2. Set the desired time interval for performing the recording (e.g. 30 s: a data set is recorded every 30 seconds).
   – *Possible interval ranges from 0,1 to 60 seconds with 0,1 seconds steps.*

   ⇨ *The button* START *is now active.*
3. Click the *START* button.

   ⇨ *The Data acquisition begins. During recording of data, the text on the button changes to* STOP.

   ⇨ *The acquired data is stored in* C:\USERS\PUBLIC\DOCUMENTS\HELIOCENTRIS\NEXA RCS\NEXA_RCS.CSV.

Stop Data acquisition

Proceed as follows to stop the recording:

1. Click the *STOP* button.

   ⇨ *The Data acquisition stops. The file Nexa_RCS.csv will be opened automatically.*

## 6.5 How to Uninstall the Software

To uninstall the software, use the integrated software management functions in the operating system.

1. In *START* > *CONTROL PANEL* open the *SOFTWARE* folder.

   ⇨ *The* SOFTWARE *dialog opens with a list of the installed software.*
2. Select *NEXA® RCS*.
3. Click the *REMOVE* button.

# 7 Decommissioning

## 7.1 How to Shut Down the Nexa® 1200

The following steps must be performed to shut down the unit:

- Switch off the unit
- Disconnect unit from the power supply
- Shut down the hydrogen supply

### 7.1.1 How to Switch off the Nexa® 1200

Proceed as follows to switch off the unit:

1. Switch off all consumers and loads.

   ➔ Unit: Use the button to switch off the unit.

   ⇨ *LED signals* SHUTDOWN*: middle LED blinks, right LED lights up green.*

Or

   ➔ Software: Use the *STOP* button to switch off the unit.

   ⇨ RUN *button blinks yellow.*

2. Close the software by clicking the *QUIT* button.
3. Shutdown the PC and switch off.

### 7.1.2 How to Disconnect the Nexa® 1200 from the Power Supply

✓ The unit is switched off

➔ Disconnect the power supply, i.e. physically disconnect the AC adapter from the power grid or disconnect the battery.

⇨ *The unit is now disconnected.*
⇨ *LED signals* OFF*: all LEDs are off.*

### 7.1.3 How to Shut Down the Hydrogen Supply

✓ The unit is switched off
✓ All LEDs are off
➔ Close main valve of the hydrogen supply

➔ If operating unit with a compressed hydrogen cylinder / metal hydride canister, store properly.

   – *See documentation for hydrogen supply*

⇨ *The hydrogen supply has been shut down*

## 7.2 Storage and Transportation of the Nexa® 1200

The following steps must be performed if the unit is to be stored or transported:

- Switch off unit
  - *(see How to Switch off the Nexa® 1200 page 51)*
- Disconnect unit from the power supply
  - *(see How to Disconnect the Nexa® 1200 from the Power Supply page 51)*
- Shut down the hydrogen supply
  - *(see How to Shut Down the Hydrogen Supply page 51)*
- Remove the hydrogen connections
- Shut down the external load
- Disconnect electrical contacts
- Disconnect data interfaces
- Pack components

### 7.2.1 How to Disassemble the Hydrogen Supply

✓ Open-end wrench
✓ Flat-tip screwdriver
✓ All LEDs are off

1. Loosen locking screws with flat-tip screwdriver.
2. Disconnect plug of the solenoid valve from the AUX OUT connection.

   ⇨ *The electrical connection of the load relay is now disconnected.*
3. Unscrew the coupling ring on the hydrogen connection of the unit.
4. Pull out the hydrogen hose.

⚠ CAUTION! The solenoid valve becomes hot during operation! Do not touch.

5. Push back the release ring on the quick coupling of the solenoid valve.
6. Pull out the quick coupling plug.

   ⇨ *The hydrogen supply has been shut down.*

⇨ *As soon as the solenoid valve has cooled and the contacts on the load relay have been disconnected, the solenoid valve can be packed.*

### 7.2.2 How to Shut Down the External Load

After switching off the power supply, a residual amount of hydrogen is still present in the stack. This causes the unit to remain in operation for a maximum duration of 1 minute, which also means that voltage is present at the unit's power output. Therefore, do not disconnect the power connection from the unit until the LEDs reliably indicate OFF mode, i.e. when all LEDs are off.

✓ Flat-head screwdriver
✓ Philips-head screwdriver

1. Loosen the locking screws on the top end of the power output.
2. Pull out the power cable.
3. Tighten the locking screws hand-tight.

Remove load relay

4. Loosen screws for the contacts on the load relay.
5. Remove the cable lugs of the positive power cable.
6. Remove the contacts of the load relay cable.
7. Tighten screws on contacts hand-tight.

   ⇨ *Load relay is now disconnected.*

Remove reverse current diode

8. Loosen screws for the contacts on the reverse current diode.
9. Remove the cable lugs of the positive power cable.
10. Tighten screws on contacts.

    ⇨ *Reverse current diode has now been disconnected.*

Disconnect communication

➔ Disconnect the RS232 cable from the Electronic Load and the PC connection.

### 7.2.3 How to Disconnect Electrical Contacts

The following electrical contacts must be disconnected:

- Power supply cable
- Equipotential bonding conductor

✓ 10 mm open-end wrench
✓ Flat-tip screwdriver

Power supply cable to adapter or battery

1. Loosen locking screws.
2. Pull out the plug from the POWER SUPPLY connection.
3. Pull out the lab plug from the adapter or disconnect from the battery.

   ⇨ *External power supply is now disconnected.*

Equipotential bonding conductor

4. Loosen nut with open-end wrench.
5. Disconnect equipotential bonding cable from the threads.
6. Tighten nut.

   ⇨ *Equipotential bonding is now disconnected.*

The following electrical contacts must optionally be disconnected:

- Monitoring device for the safety chain
- Load relay
- Remote control

✓ Small flat-head screwdriver

Monitoring device

1. Loosen locking screws of the SAFETY CHAIN connection with flat-head screwdriver.
2. Press the orange holding spring back towards the rear with the flat-head screwdriver.
3. Pull out the lead.
4. Release orange holding spring

Load relay

The load relay cable can remain in the plug connector of the solenoid valve for future use or it can be disconnected. Proceed as follows to disconnect the load relay contacts from the terminal:

5. Repeat steps 2 - 4 on contact 4 and 5 on the plug connector of the solenoid valve.

   ⇨ *The solenoid valve and load relay have now been shut down and can be packed.*

Remote control

6. Repeat steps 2 - 4 on the REMOTE CONTROL connection

   ⇨ *The remote control and monitoring device have now been shut down and can be packed.*

### 7.2.4 How to Disconnect Data Interfaces

✓ Small flat-head screwdriver
✓ Additional unit, peripheral devices and their power supply have been shut down

PC

1. Loosen locking screw of CAN cable.
2. Unplug the CAN cable.
3. Pull out the CAN-USB converter connection.
4. Pull out USB plug from the USB port of the PC.

   ⇨ *The data interface to the PC has been disconnected; the CAN-USB converter can be packed. The terminating resistor in* CAN IN *does not have to be disconnected.*

Additional unit

If no additional unit is connected, the *CAN OUT* is connected to a terminating resistor. This terminating resistor does not have to be disconnected.

Disconnect an additional unit from the data interface as follows:

1. Loosen locking screws from *CAN OUT* with a flat-head screwdriver.
2. Pull out the cable.
   ⇨ *The additional unit has now been shut down and can be packed.*

Peripheral devices

1. Loosen locking screws of the RS232 connection with flat-head screwdriver.
2. Pull out the cable.
   ⇨ *The peripheral device has now been shut down and can be packed.*

### 7.2.5 How to Pack and Store the Nexa® 1200


**CAUTION**

**Danger of injury due to falling!**

The unit is heavy and can cause injuries if it falls.

➔ Two people are needed to carry it.

Pack the unit in the original packaging material.

The unit should be stored in the temperature range from 3…30 °C.

### 7.2.6 Power Losses during Storage

Storage of the Nexa® over a longer period of time results in a reversible loss of power. Losses increase with the duration of the storage time and the level of the storage temperature to up to 70 mV per cell.

Storage at higher temperatures increases power losses during storage (see Power Losses during Storage). If the unit is stored at higher temperatures and for a longer period of time than specified in the Table 7-1, special start-up procedures are required (see Troubleshooting starting on page 57).

| Temperature range | Maximum storage duration |
|---|---|
| 3…30 °C | 2 years |
| 30…50 °C | 1 month |
| 50…70 °C | 3 days |

Table 7-1 Time limit for storage at higher temperatures

### 7.2.7 Transporting the Nexa® 1200

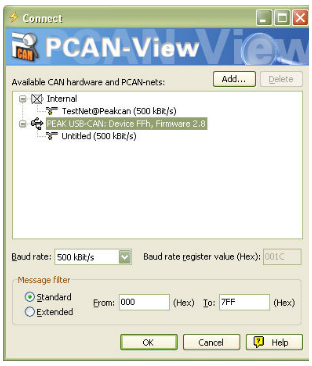
The unit can be transported as needed. During transport, the unit should not be exposed to freezing temperatures or excessive heat for extended periods. A temperature range of -40…+70 °C is possible for a short time.

The position of the unit during transport is not important. When packing the single components, they must be sufficiently padded to protect them against impact and fast acceleration.

# 8 Troubleshooting

## 8.1 FAQ

1. Where is the version of the Nexa® firmware to be found?
   - ➩ *Open the PCAN View USB program and view the messages of the Nexa® 1200.*
   - ➩ *In ID 010 you can read the version in the last 4 bytes.*
2. How do I open PCAN View USB?




   - ➔ Press the Windows START button.
   - ➔ Open ALL PROGRAMS > PCAN > PCAN VIEW USB.
   - ➔ Confirm the pre-set selection in the PCAN VIEW dialog with OK.
   - ➔ Check of the following CAN message and log of the value: it must be *01 00 07*.

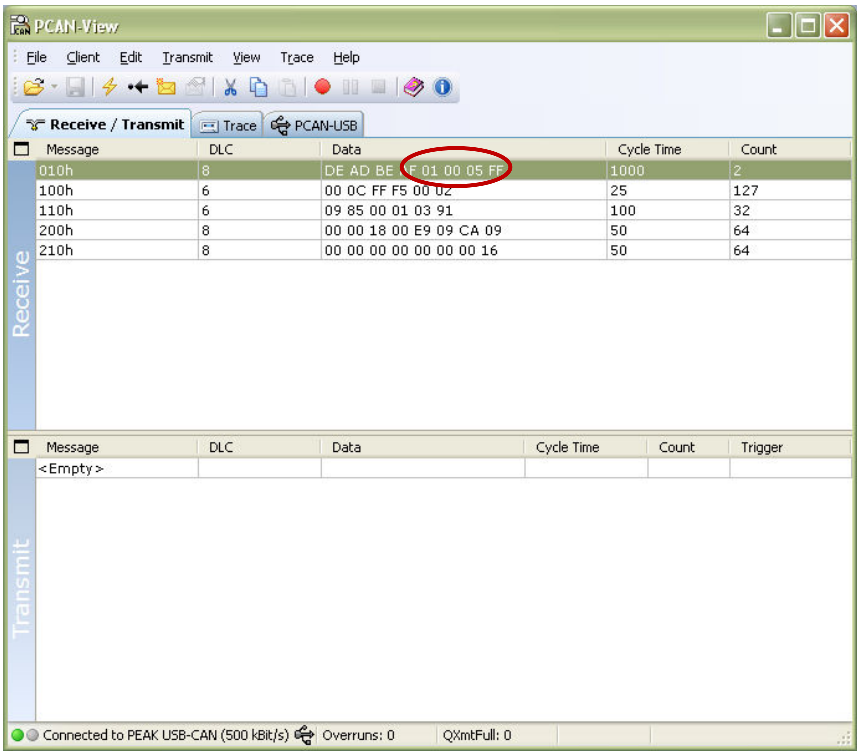



Fig. 8-1 PCAN View

3. How do I know if the firmware update has been properly executed?
   - ➩ *Check the firmware version after the update through the PCAN USB Monitor*

⇨ *During the firmware upload the LEDs of the Nexa® 1200 are out and only illuminate once you press the* START *button in the upload software.*

4. What must I take into consideration or think about for the operation of the fuel cell?

   ⇨ *Since the fuel cell involves an electrochemical energy conversion based on hydrogen and oxygen, the characteristic of a fuel cell is essentially based on the electrochemistry which takes place. The fuel cell can experience a reversible loss of power due to storage and appearances of aging. After extended periods of shutdown, depending on the environmental temperature, it may take from several minutes to hours (depending on the load current) until the fuel cell reaches the characteristics specified in the data sheet.*

   ⇨ *Irreversible power losses can result due to contamination of the environmental air, such as sulfur compounds.*

5. How do I check whether the CAN communication is functional?

   ⇨ *For this purpose, you can connect the PCAN USB adapter directly to the terminator of the CAN network and test the CAN Traffic using the PCAN USB monitor software.*

   ⇨ *Check the ID addresses of the Nexa® 1200 with the PCAN USB monitor software. With proper communication, the messages received must lie in the 100 and 200 range.*

   ⇨ *Check the wiring of the communications and whether the CAN is properly connected to the terminating resistors.*

   ⇨ *Check whether it uses a correct null modem cable incl. terminating resistors or CAN cable. Do not use a RS232 cable.*

6. How can you tell that the Nexa® 1200 is in standby mode?

   ⇨ *The right green LED illuminates.*

7. How can you tell that the Nexa® 1200 is started?

   ⇨ *The middle LED blinks while the right LED permanently lights up green.*

8. How can you tell that the Nexa® 1200 is in operation?

   ⇨ *The LEDS on the front side both illuminate green. In standby mode only the right LED; errors are signaled by a red LED.*

   ⇨ *On the Hybrid Extension Kit the* NEXA RUN *LED illuminates (only with integration of the Nexa® DC1200)*

   ⇨ *Measure the output voltage at the cage terminal of the Nexa® 1200.*

9. How can you tell that the Nexa® 1200 has just shut down?

   ⇨ *The right LED blinks while the middle LED permanently lights up green.*

10. Is it possible to save characteristics during operation of the system within the system without external software for later viewing?

    ⇨ *No. The internal memory is not intended for this purpose.*

11. Can an error memory be read out for Heliocentris Service?

   ⇨ *Yes. For this purpose, see Software Views on page 46.*

12. How can I provide the supply voltage to an external $H_2$ sensor from the unit?

   ⇨ *Connect the supply voltage of the external $H_2$ sensor to the Nexa® 1200 supply voltage.*

NOTICE ! The sensor must be designed for the supply voltage.

   ⇨ *With the use of the Hybrid Extension Kit, you can tap the supply voltage at the Hybrid Extension Kit. In the 24 V version this voltage corresponds to the battery voltage. In the 48 V version the voltage is fixed at 24 V.*

## 8.2 Behavior in the Event of an Error

With supply through a battery (hybridization) or in operation with an external mains adapter, a controlled overall system shut-off always takes place in the event of an error of the Nexa® Integration System.

Restart after an error

➔ Press and hold the SYSTEM START button until the green SYSTEM RUN LED illuminates.

With an additional external voltage supply errors which lead to a shut-off can be viewed and acknowledged with the Nexa® RCS or Nexa® DC1200 Control Software.

## 8.3 Errors and Troubleshooting

| Error / Error message | Possible cause | Solution |
|---|---|---|
| After the firmware update the LEDs on the front side do not light up. | You have to press START after the update | Press START |
| | | Carry out the update again. If this is still not successful, contact Heliocentris Service |
| No communication with Nexa® RCS PC software | The PCAN – USB dongle is connected to the wrong USB port | Connect the PCAN – USB dongle to the same USB port at which it was installed |
| | If the PCAN USB dongle is active and receives messages, the blink frequency of the red LED increases significantly. Blink frequency approx. 1 Hz | |
| | CAN hardware driver not installed after the RCS installation | Install the CAN hardware driver: The PCAN hardware driver can be found under ALL PROGRAMS → NEXA INSTALLER RC04 → PEAKOEMDRV (see p. 37 for further details) |

| Error / Error message | Possible cause | Solution |
|---|---|---|
| | Incorrect ID address of the Nexa® 1200 | Check the ID addresses of the Nexa® 1200 with the PCAN USB monitor software. They must always end with 0 so that they are recognized by the RCS. In the case of IDs ending with a 1 or 7 the DIP switches on the rear connection panel are in the wrong position. Set all DIP switches to the upward position and then disconnect the supply voltage. It is necessary to restart the controller in order to adopt the changes. Check the IDs in the PCAN USB monitor after all old messages have been deleted with the RESET button and only the most current messages are displayed |
| | Incorrect wiring of the communications or CAN Bus not terminated | Check the assembly and complete wiring on the basis of the assembly instructions |
| | Use of an incorrect null modem cable, CAN cable or an RS232 cable | Check whether a correct null modem cable incl. terminating resistors or a CAN cable is connected. Use of an RS232 cable is not permitted |
| The RCS software shows an error status (by using red font), but no error is displayed. | The safety electronics reacted faster to the triggering event than the software can react. There is a safety-relevant error present in the safety chain. The cause for this can only have been a short pulse (for example, how it can be called by turn-on current pulse). Due to the extremely fast triggering characteristics of the electronics hardware, this error was detected, but not registered by the software due to the inactivity of the firmware | Reset by pressing RESET |
| The Nexa® 1200 is currently in RUN mode, but not load can be tapped at the connected lines. | Incorrect installation direction of the reverse current diode | Check the assembly and complete wiring on the basis of the assembly instructions |
| | The load relay does not function | |
| | The Nexa® is not in RUN mode. No voltage can be measured at the cage terminals. There is a hardware error | Measure the output voltage at the cage terminals. If not, check whether both green LEDs on the front side illuminate. If this is not the case, contact Heliocentris Service |
| The Nexa® 1200 remains in standby mode with the error and the unit cannot be started. EMERGENCY STOP error message. | | Configure the system's Emergency STOP chain according to the instruction manual (see 29) |
| | | Check the external Emergency STOP chain |
| The Nexa® 1200 has a reproducible error on start or start purge | Too low hydrogen inlet pressure | Check whether sufficient hydrogen is present (recommended inlet pressure range 2...12 bar) |

| Error / Error message | Possible cause | Solution |
|---|---|---|
| System repeatedly goes into error status due to excessive inlet pressure > 15 bar. | Excessive inlet pressure > 15 bar | Reduce inlet pressure to the recommended pressure range of 2...12 bar |
| The Nexa® 1200 appears to go into error status on start purge | The power supply unit has too little power | Check whether the external power supply unit can provide at least 110 W. The use of the Nexa® 1200 power supply available from Heliocentris is recommended |
| The Nexa® 1200 goes into error status during the operation by the purge. | Too low hydrogen inlet pressure | Check whether sufficient hydrogen is present (recommended inlet pressure range 2... 12 bar) |
| | Metal hydride storage canisters cool down due to a high desorption rate and the pressure in the canisters falls below the minimum inlet pressure of the Nexa® 1200 | Check the temperature of the metal hydride canisters and whether their outlet valves may possible be icy |
| The valve fittings of the metal hydride canisters cool down drastically during operation | Due to repeated rinsing processes in short intervals (for example in a high power range of approx. 65 A every 30 seconds) the desorption rates of the metal hydride alloys lead to a lowering of the temperature (endothermic reaction) of the metal hydride, which can cause the icing of the outlet valves | Reduce the power or supplement the metal hydride canisters with additional canisters in order to prepare the hydrogen necessary for the rinsing processes. Volumetric flows of up to 140 Nl/min can arise during a rinsing process |
| The Nexa® 1200 repeatedly goes into error status due to an excessive stack temperature | Output too high | For this purpose, reduce the load current and/or the power removed from the unit.<br>• Maximum stack temperature: 65 °C<br>• Maximum supply air temperature: 35 °C<br>• Maximum stack current limited to 60 A in the range of 0…25 °C supply temperature<br>• Maximum stack current decreases by 1 A/°C starting at a supply air temperature of 25 °C<br>• In other words, the maximum stack current at 35 °C is 45 A |
| | Dirty filter | Check the filter of the system for visible soiling and replace if necessary (see p. 63) |
| | Blocked air outlet | The clearance at the air outlet must be 30 cm |
| The Nexa® 1200 repeatedly goes into error status due to too high stack current | Output too high | For this purpose, reduce the load current and/or the power removed from the unit. |

| Error / Error message | Possible cause | Solution |
|---|---|---|
| The Nexa® 1200 repeatedly goes into error status due to too low stack voltage | Output too high | • Maximum stack current limited to 60 A in the range of 0…25 °C supply temperature (usable at load output are 60 A @ 25 °C)<br>• Maximum stack current decreases by 1 A/°C starting at a supply air temperature of 25 °C<br>• In other words, the maximum stack current at 35 °C is 45 A (usable at load output are 60 A @ 25 °C) |
| | It is possible that the system has reached its end of life. There may be a variety of reasons for this | Contact Heliocentris Service |
| The hydrogen sensor continuously reports an excessive hydrogen concentration by a acoustic signals | Blocked air outlet | The clearance at the air outlet must be 30 cm |
| | Leak of the hydrogen supply | Contact Heliocentris Service |
| The hydrogen sensor is connected, but does not react | There is a hardware error | Contact Heliocentris Service |
| The LEDs of the Nexa® 1200 do not illuminate; operation using the software is possible | There is a hardware error | Contact Heliocentris Service |
| Nexa® 1200 goes into error status during a start with too low current | A voltage is present at the load output of the unit | Check the assembly and complete wiring on the basis of the assembly instructions |
| | Too high ext. voltage at the output terminals of the unit | Observe switching from external to internal supply voltage. If a negative output can be detected after the switch, there is a defect of the internal fuse of the electronics. Contact Heliocentris Service |
| The Nexa® 1200 assumes error status during the initial start after application of an external start-up supply. The error is not displayed in the RCS | Error in the automatic leak test during start-up | Open the error file ErrorLog.txt (button *ERROR REPORT*). With the value 32 in the *SE ERROR* column, proceed as follows:<br>• Check whether the input pressure is in the range 2…12 bar<br>• Check whether the solenoid valve is present and connected<br>• Check whether external, internal and purge valves are audibly perceptible<br>If the error is not eliminated, contact Heliocentris Service |
| | There is a hardware error | Contact Heliocentris Service |
| Nexa® 1200 repeatedly switches to error status during shutdown (*SYSTEM VOLTAGE TOO LOW* or *SYSTEM CURRENT TOO LOW*). The error can be reset, but recurs reproducibly | Problem with internal electronics | Check whether the error occurs together with switching of the external load relay or solenoid valve.<br>Contact Heliocentris Service |
| Nexa® 1200 switches to error status during switching of external relay or valves (*EMERGENCY STOP*) | The cutoff current peaks of the relays or valves created by Lenz's law cause unwanted emergency stop errors through the unit's supply voltage | Connect recovery diodes to the coils |

# 9 Maintenance, Service and Disposal

## 9.1 Maintenance

To ensure maximum performance of the unit and to prevent loss of efficiency, proceed as follows:

➔ Operate the unit regularly, at least once every month for half an hour at ca. 200 W.

**CAUTION**

**Danger of injury due to igniting hydrogen!**

As the result of damaged hydrogen hoses or leaky connections, hydrogen can escape and ignite.

➔ Close hydrogen supply

➔ Disconnect unit from power supply. Replace damaged hoses.

**NOTICE**

**Damage from short circuits!**

Short circuit due to damaged cables.

➔ Disconnect unit from power supply or battery. Replace damaged cables.

Inspect the condition of hoses and cables regularly and check connections for leaks and to make sure they are tightly connected:

Leaks

➔ Check hydrogen supply for leaks

– *(see How to Perform a Leak Test on page 33)*

### 9.1.1 How to Replace the Air filter

Occasion

A sufficient amount of reaction air required by the fuel cell cannot be supplied if the air filter is dirty.

Interval

Visually inspect the air filter regularly for dirt. In the event of a visible accumulation of dirt and each year, no later than after 1000 operating hours, it must be replaced. For this purpose, contact Heliocentris.

Implementation

The replacement can be carried out at any time. The system does not have to be shut down for this.


Replace the air filter as follows:

- ✓ Air filter for replacement
- ✓ Open-ended wrench / socket wrench

1. Loosen the two screws of the air filter cover on the fuel cell module.
   – *Keep the screws available for re-use.*
2. Remove the fan cover.
3. Remove the filter.
   ⇨ *The fuel cell stack is behind a protective grating. The temperature sensor protrudes out through the grating.*
4. Place the new air filter in front of the protective grating, making sure that the temperature sensor fits between the fins of the air filter.
5. Slide the air filter cover into the guide with the slot from below.
6. Fold the air filter cover upward and screw in place.

### 9.1.2 How to Replace the Internal $H_2$ Sensor

The $H_2$ has a two-year function guarantee After this time it should be replaced for safety purposes in the case of regular operation or after extended periods of shutdown.

How to replace the $H_2$ sensor:

Fig. 9-1

- ✓ $H_2$ sensor
- ✓ The unit is switched off
  – *(see How to Switch off the Nexa® 1200 page 51)*
- ✓ The device is de-energized
  – *(see How to Disconnect the Nexa® 1200 from the Power Supply page 51)*
- ✓ Open-end wrench
- ✓ Allen key

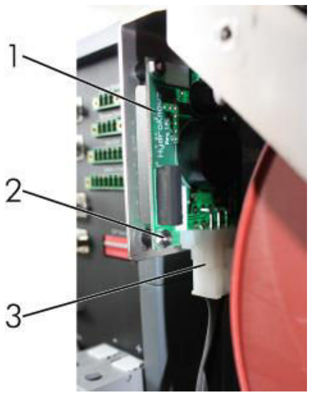



Fig. 9-2

1. Loosen the four screws of the fan cover (Fig. 9-1) on the rear side of the unit.
2. Remove the fan cover.
   ⇨ *The $H_2$ sensor (1) is located to the left of the fan, screwed onto the fan mount.*
3. Pull out the plug of the $H_2$ sensor (3).
4. Loosen the four screws (2) of the $H_2$ sensor on the fan mount.
   Put the screws aside for re-use.
5. Remove $H_2$ sensor
6. Screw on the replacement $H_2$ sensor on the fan mount.
7. Insert the plug in the $H_2$ sensor.

8. Re-mount and fasten the fan cover
   ⇨ *The $H_2$ sensor has been replaced.*

## 9.2 Cleaning

✓ Moist cloth

1. Disconnect unit from the power supply.
2. Clean the case with a slightly moist cloth.

## 9.3 Serial Number & Service

Each Nexa® 1200 has a serial number that is printed on the shipping carton (on the nameplate) and on the delivery note / invoice.

Please keep this serial number available so that the Heliocentris service team can easily and effectively help you.

If you experience problems with the unit, then please contact the manufacturer:

Heliocentris Academia International GmbH

Rudower Chaussee 30

12489 Berlin

Germany

Fon +49 (0)30 – 340601-600

Email: service@heliocentrisacademia.com

An employee from Heliocentris Customer Service will contact you and explain all further steps. If you return the unit for repair or replacement, you must ship the unit sufficiently secured and packaged.

Heliocentris is not responsible for damage which has been caused by improper packaging and / or improper shipment. You must bear the costs yourself for the shipment of units with expired warranty.

## 9.4 Disposal

### Unit

Never dispose of the system with household waste. In accordance with the the WEEE Directive 2012/19/EU, electronic equipment must be sent to the designated collection point for recycling.

### Batteries

Never dispose of batteries with household waste.

- ➔ Totally Discharge batteries.
- ➔ Seal battery poles with a strong piece of tape.
- ➔ Drop off used batteries at the designated collection point.

**Packaging material**

- ➔ If required, store packaging material for future storage of the system.
- ➔ Dispose of packaging material that is no longer needed in accordance with local laws and regulations.

## 9.5 Warranty

For the Nexa® 1200 incl. startup kit (article number 1911) Heliocentris provides a warranty of 1 year.

The warranty only covers defects which are present at the time of the handover of the product from the seller to the purchaser.

A warranty for specific characteristics (e.g. power and service life of the fuel cell) is not made.

With proper operation a minimum service life of 1500 hours can be expected, which is guaranteed by Heliocentris.

Warranty claims against Heliocentris cannot be made if:

- The customer has caused the damage by improper use or incorrect operation
- Unauthorized repairs or manipulations have been made to the product
- The customer has neglected his duty of supervision and has caused damage to third parties

The supplier is liable for damage caused during the delivery to the customer and provides replacement in the case of damage.

In the case of complaints and return of the product, the risk is borne by the customer who must provide proper and secure packaging.

# 10 Integration

## 10.1 How to Install the Nexa® in a Rack System

The unit can be integrated in a 19" rack system with a depth of 600 mm. In a 19" rack system, the unit is always installed horizontally.

The following components are also available for connecting the unit – they are not included in the scope of delivery, but can be purchased from Heliocentris.

- 19" mounting bracket
- 90° angled exhaust housing.
- For installation on the fan cover; conducts exhaust air to the rear

The unit can be mounted in a 19" rack system as in the following example:

- ✓ 19" rack system with a depth of 600 mm (not included in the scope of delivery)
- ✓ At least 4 sliding blocks
- ✓ M5 screws (not included in delivery)
- ✓ Wrench (not included in delivery)

Fig. 10-1 Insert sliding block in profile

1. Mount shelf / rails in rack system at the desired height.
   – *See mounting instructions of the rack system manufacturer.*
2. Insert sliding block with the rounded side facing downward into the profile of the unit.
3. Insert at least one sliding block on each corner.
4. Insert the unit in the rack system.

5. Tighten screws in the sliding block through the hole in the shelf / rail.

   ⇨ *The unit is now mounted.*

## 10.2 How to Connect an Additional Unit via CAN

An additional Heliocentris product, e. g. Nexa® 1200 or Nexa® DC 1200 can be connected to the *CAN OUT* interface. Connect an additional unit as follows:

- ✓ CAN cable
- ✓ The unit is switched off
- ✓ Small flat-head screwdriver
- ✓ Terminating resistor removed from *CAN OUT*

1. Insert the SUB-D jack of the CAN cable in CAN OUT (2 in Fig. 4-15).
2. Tighten the locking screws hand-tight.

   ⇨ *The additional unit is now connected*

CAN-Bus terminal connection


The CAN-Bus must have a terminal connection if the unit is the last Heliocentris product connected to the bus. Establish the terminal connection as follows:

- ✓ Terminating resistor

1. Insert the terminating resistor into *CAN OUT*.
2. Tighten the locking screws hand-tight.

   ⇨ *The terminating resistor is now connected.*

## 10.3 Consideration of Internal Frequencies

**NOTICE**

**Damage due to resonances in the Nexa® 1200!**

Integration of the unit in a setup where shocks and vibrations are likely to occur can cause resonances which will damage the unit.

➔ In case the unit is integrated in such a setup, take measures to prevent resonances.

Resonances are always found in the same frequency ranges, regardless of the point of measurement. The most critical range to evaluate is between 25 Hz and 60 Hz. Smaller fluctuations also occur in the ranges 300 Hz…360 Hz, 1225 Hz…1280 Hz and 1790 Hz…1820 Hz.

In order to isolate vibrations of the unit, the Konus 20 vibration damper made by STS Schwingungstechnik Schuster GmbH is used.

## 10.4 How to Change the Configuration of the Nexa® 1200

On the connection panel on the back of the unit there are DIP switches (1). The DIP switches can be used to change the configuration of the unit.

The basic setting for all DIP switches is ON.

When operating several units in one CAN Bus, they can be assigned different IDs by means of the DIP switch. 8 different IDs can be assigned.

**TIP** The supplied Nexa® RCS software is functional only for ID 0


Fig. 10-2 DIP switches on connection panel

For the allocation of the DIP switches, see Chapter Table 10-10 Allocation of the DIP switches page 81.

## 10.5 How to Check the Hydrogen Supply

The unit features an integrated leak and function test. This test is automatically conducted each time an external supply voltage is applied. The solenoid valve with the pre-configured hose length included in the connecting set is absolutely necessary, since it also functions as a redundant safety valve.

NOTICE! When integrating the unit, the length of the hydrogen hose from the unit to the solenoid valve must not exceed 2 m, since otherwise the integrated leak and function test cannot be conducted.

## 10.6 Protocol Definition of CAN Interface

This chapter contains the protocol definition of the CAN interface for the communication of the fuel cell system Nexa® 1200 with an external control unit.

The communication of the device is carried out through a CAN bus (Controller Area Network) without an advanced implementation of protocol, i.e. the useful information is directly embedded within the OSI-Layer 2 (data back-up layer). In order to denote the content of the messages an 11 bit identifier (base frame format) is used. The bus works with a speed of 500 kBaud.

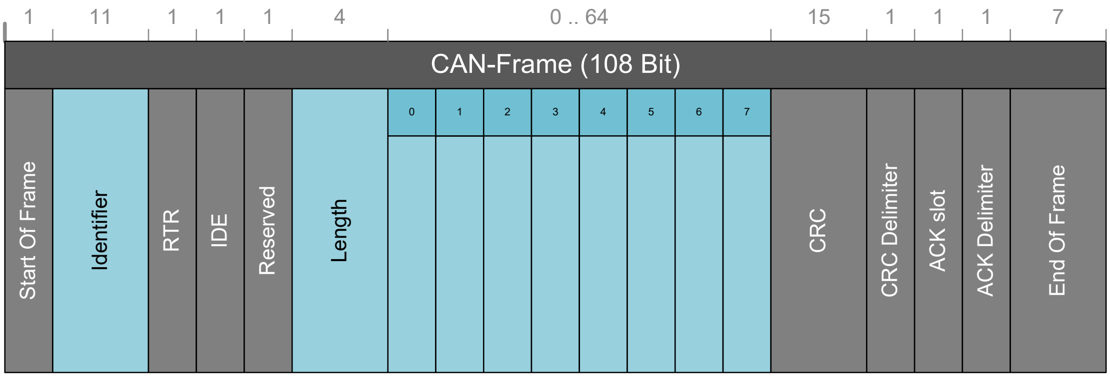



Fig. 10-3 CAN frame

Fig. 10-3 displays the content of a CAN message (frame) with the inscription of the corresponding identifier and its length. Tables 10-1 and 10-2 display which identifier is used for communication with the Nexa® 1200 fuel cell system and show its length (byte) and its transfer rate (T). An exact description of the message contents can be found in chapters 10.6.1 and 10.6.2.

| **Identifier** | **Length** | **T** | **Content** |
|---|---|---|---|
| 0x010 | 8 | 1s | Version number of the firmware |
| 0x100 | 6 | 25ms | Stack voltage and stack current<br>Self consumption of the system |
| 0x110 | 4 | 100ms | Stack temperature, H2 concentration in exhaust air and warnflags |
| 0x120 | variable | ACK | Response to 0x520 dependent on the parameter code in the 1. byte |
| 0x200 | 6 | 50ms | System pressure, system voltage, ambient temperature, mode |
| 0x210 | 6 | 50ms | Valve positions and fan rotation speed, fan control point and inlet pressure |
| 0x300 | 7 | - | Error flags (in the case of an error will only be transmitted once) |
| 0x330 | 8 | ACK / 25ms | Response to request 0x550. After a request several messages are sent in intervals of 25 ms in order to transmit the entire error memory. Provided for later |

| Identifier | Length | T | Content |
|---|---|---|---|
| | | | support by Heliocentris. |

Table 10-1 CAN message transferred from fuel cell system to external control

| Identifier | Length | T | Content |
|---|---|---|---|
| 0x500 | 2 | acycl. | System commands for control of the Nexa® 1200 (Start, Stop, Error Reset) |
| 0x520 | 8 | acycl. | Command for reading the stack operating time |
| 0x550 | 5 | acycl. | Request to dispatch the error log. Provided for later support by Heliocentris. |

Table 10-2 CAN message transferred from external control to fuel cell system

The following specified CAN IDs are reserved for further Heliocentris' components in the Controller and must not be used for integration by the integrator.

| Identifier | Length | T | Content |
|---|---|---|---|
| 0x130 | 1 to 8 | ACK | answer to request 0x560 |
| 0x220 | 1 to 8 | ACK | answer to request 0x530 |
| 0x240 | 1 to 8 | ACK | answer to request 0x540 |
| 0x310 | 1 to 8 | ACK | answer to request 0x500 |
| 0x320 | 1 to 8 | ACK | answer to request 0x510 |
| 0x700 | 1 to 8 | - | variable content: debug information |

Table 10-3 Reserved CAN messages transferred from the fuel cell system to external control

| Identifier | Length | T | Content |
|---|---|---|---|
| 0x510 | 8 | acycl. | reserved |
| 0x530 | 8 | acycl. | reserved |
| 0x540 | 8 | acycl. | reserved |
| 0x550 | 8 | acycl. | reserved |
| 0x560 | 8 | acycl. | reserved |

Table 10-4 Reserved CAN identifiers transferred from the external control to the fuel cell system

### 10.6.1 Message Definition of Incoming Messages

Description of CAN messages (request) which are sent from an external control unit to the Nexa® 1200 fuel cell system.

**Identifier 0x500**

The CAN message ID 0x500 transfers system commands to the control unit of the Nexa® 1200 (Start, Stop, Error Reset).

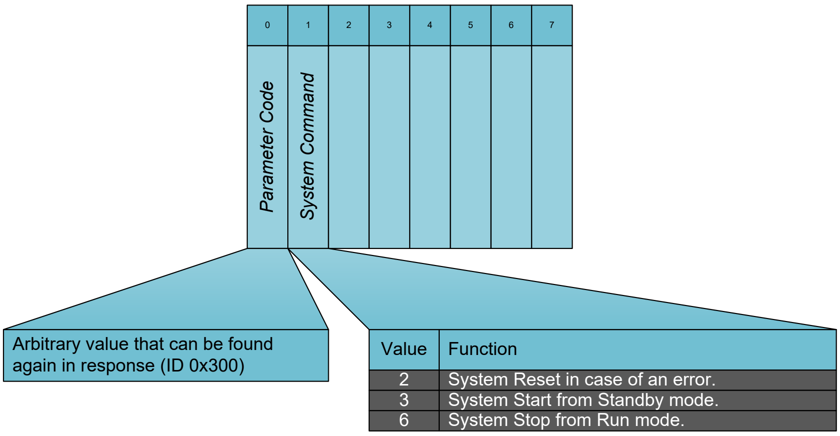



Fig. 10-4 Description of the frame 0x500

### Identifier 0x520

The stack operating time in the format hours, minutes, seconds is requested by the external control unit with CAN message ID 0x520 (Request); Nexa® 1200 responds to this message with CAN message ID 0x120.

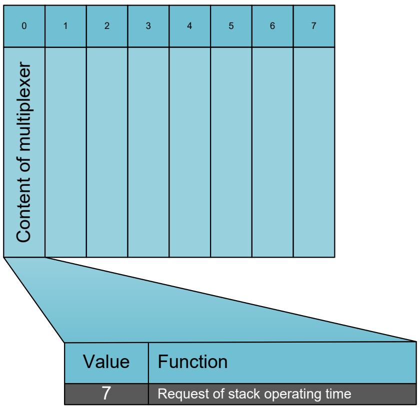



Fig. 10-5 Description of the frame 0x520

Length and content of this message are variable and depend on Byte0 multiplexer of the request (0x520). The multiplexer from 0x520 can be found again in Byte0 of the response. Values between 1…7 are valid, whereas exclusively value 7 is allowed to be used for the Integrator.

### Identifier 0x550

With the help of the Identifier 0x550, the external control unit requests the error log of the Nexa® 1200. It is possible that several controlling units request for the error log, or that during an existing transfer a new request is generated. In order to guarantee the allocation of the transferred data in accordance with a request, each request is furnished with a randomly generated request ID, which can then be found again in the corresponding response sequence. The request ID can thereby be displayed on a range of values between 1…255. Request IDs of the value 0 is ignored.

| Byte 0 | Byte 1 | Byte 2 | Byte 3 | Byte 4 |
|---|---|---|---|---|
| Request-ID | Command HB | Command LB | Frame # | Sequence # |
| ID, which can be found again in the response. Values between 1…255 are permitted. The message with the request ID "0" will be ignored | Commands 0 .. 3<br>0 request initialization (Command to dispatch a error frame.)<br>1 Resend all (break off the dispatch sequence with the stated request ID and start from the beginning.)<br>2 Resend frame (renewed dispatch of frames from byte 4 with the request-ID from byte 0)<br>3 Resend sequence (renewed dispatch of the sequence number from byte 4 of the frame out of byte 3 with the request from byte 0) | | # 0..N<br>States the frame that has to be sent by a frame-resend-command. | # 0..N<br>States the sequence number that has to be send by a resend-sequence-command. |

Table 10-5 Description of the data structure of frame 0x550

**TIP** Up to version V1.0.5 of the operational software of the fuel cell system the parallel processing of several connections is not yet supported.

## 10.6.2 Message Definition of Outgoing Messages

Description of messages sent from a fuel cell system to an external control unit.

### Identifier 0x100

The Frame with the identifier 0x100 is sent cyclically every 25ms. It transfers stack voltage, stack current and self consumption.

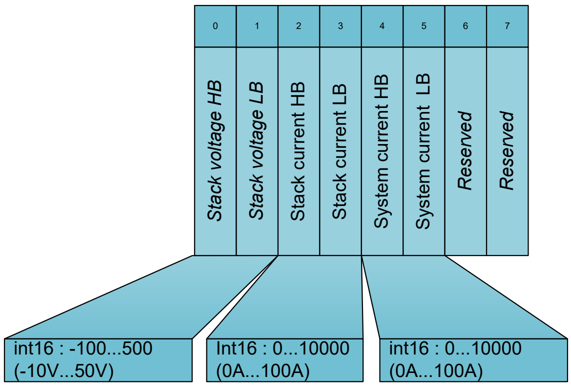



Fig. 10-6 Description of the frame 0x100

### Identifier 0x110

The Frame with the identifier 0x110 is sent cyclically every 100 ms. It transfers stack temperature, $H_2$ concentration and warning flags.

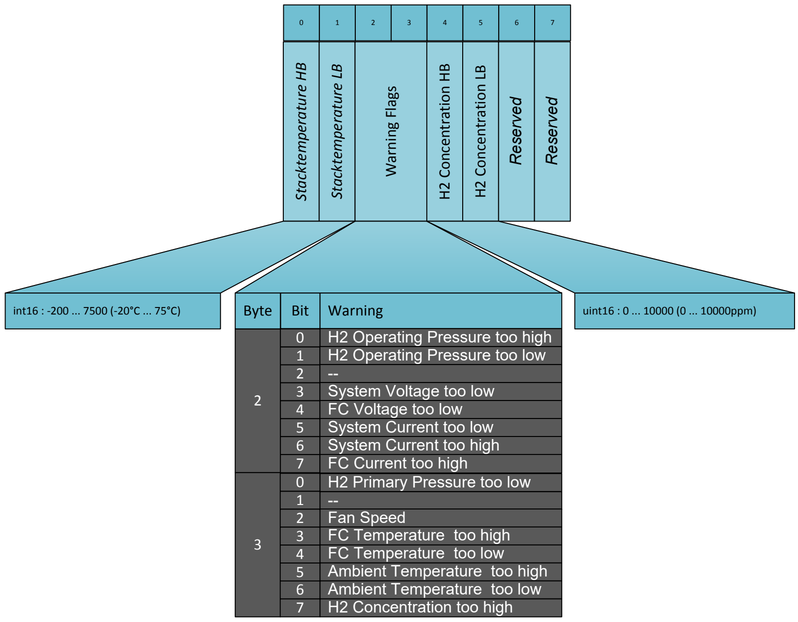



Fig. 10-7 Description of the frame 0x110

### Identifier 0x120

The frame with the identifier 0x120 is sent on request the ID 0x520.

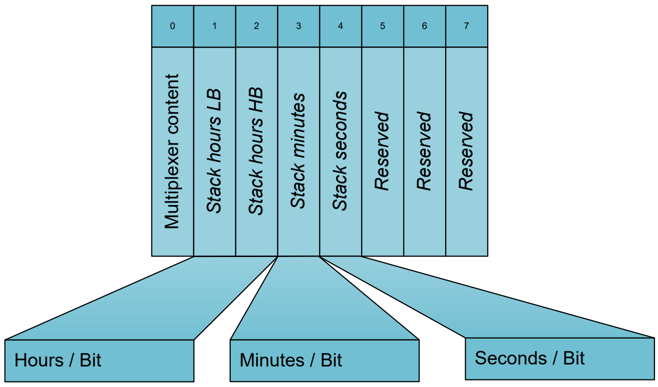



Fig. 10-8 Description of the content of frame 0x120

The message with the ID 0x120 will always be sent in response to the message 0x520. Length and content of this message is variable and dependent on Byte0 multiplexer of the request (0x520). The multiplexer from 0x520 can also be found in the Byte0 of the response. Valid are values between 1…7, whereas the integrator can only use the value 7.

| Byte0 Multi-tiplex plex-er | Byte1 | Byte2 | Byte3 | Byte4 | Byte5 | Byte6 | Byte7 |
|---|---|---|---|---|---|---|---|
| 1 | reserved | reserved | reserved | reserved | reserved | reserved | reserved |
| 2 | reserved | reserved | reserved | reserved | reserved | reserved | reserved |
| 3 | reserved | reserved | reserved | reserved | reserved | reserved | reserved |
| 4 | reserved | reserved | reserved | reserved | reserved | reserved | reserved |
| 5 | reserved | reserved | reserved | reserved | reserved | reserved | reserved |
| 6 | reserved | reserved | reserved | reserved | reserved | reserved | reserved |
| 7 | Stack hours (HB) | Stack hours (LB) | Stack minutes | Stack seconds | - | - | - |

Table 10-6 Description of the content of frame 0x120

## Identifier 0x200

The frame with the identifier 0x200 is sent cyclically every 50 ms. It transfers data about system pressure, system voltage, ambient temperature, and current mode.

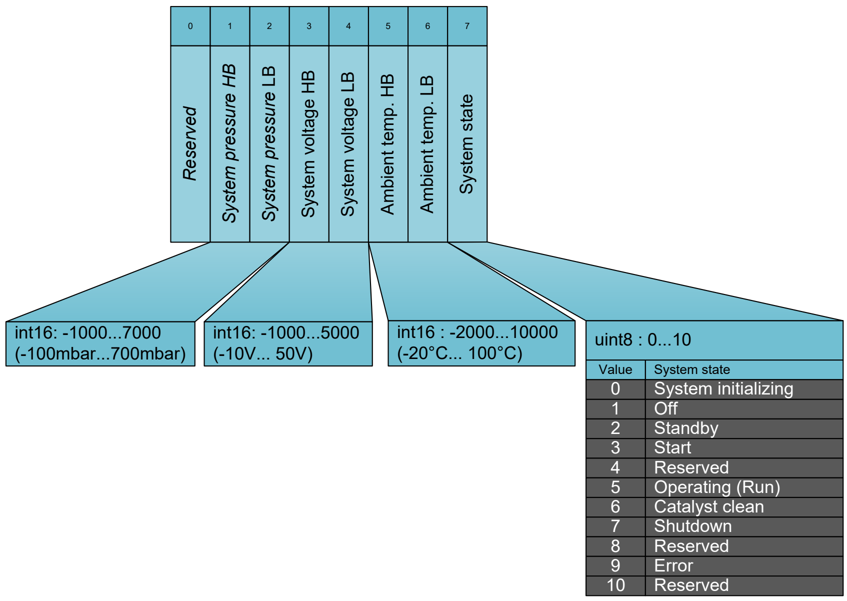



Fig. 10-9 Description of the frame 0x200

### Identifier 0x210

The frame with the identifier 0x210 is sent cyclically every 50 ms. It transfers data about valve positions, fan rotation speed, fan control point and inlet pressure.

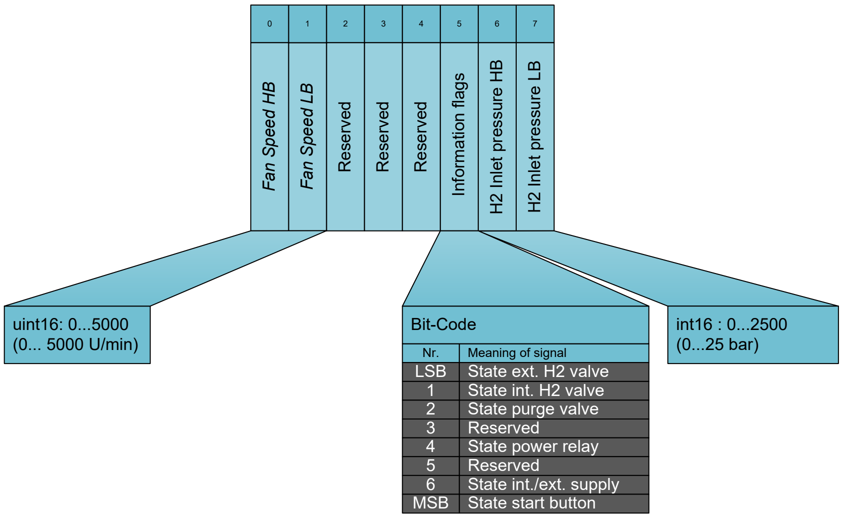
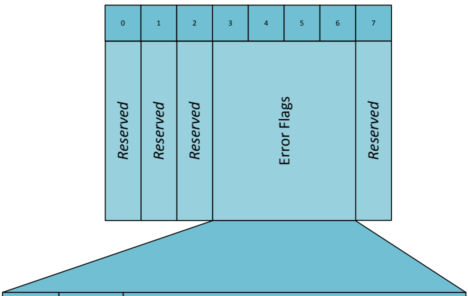



Fig. 10-10 Description of the Frame 0x210

## Identifier 0x300

The frame with the identifier 0x300 contains the error messages and is sent once an error appears.

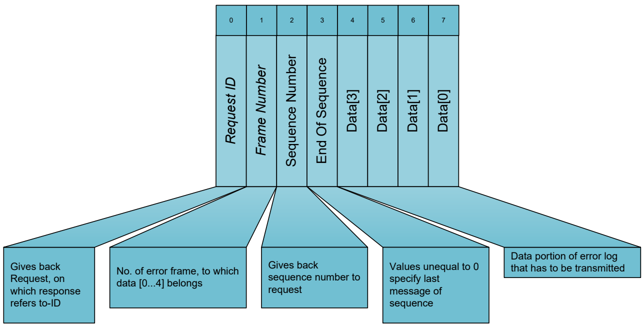



| Byte | Bit | Error |
|---|---|---|
| 3 | 0 | System Voltage too low |
| | 1 | System Voltage too high |
| | 2 | FC-Voltage too low |
| | 3 | FC-Voltage too high |
| | 4 | System Current too low |
| | 5 | System Current too high |
| | 6 | FC-Current too low |
| | 7 | FC-Current too high |
| 4 | 0 | Primary Pressure too low |
| | 1 | Primary Pressure too high |
| | 2 | Operating Pressure too low |
| | 3 | Operating Pressure too high |
| | 4 | - |
| | 5 | - |
| | 6 | - |
| | 7 | - |
| 5 | 0 | - |
| | 1 | Fan Speed |
| | 2 | FC-Temperature passed lower limit |
| | 3 | FC-Temperature exceded |
| | 4 | Ambient Temperature passed lower limit |
| | 5 | Ambient Temperature exceded |
| | 6 | H2 Sensor failed |
| | 7 | H2 Concentration too high |
| 6 | 0 | - |
| | 1 | - |
| | 2 | - |
| | 3 | - |
| | 4 | Emergency_Stop |
| | 5 | Emergency_Stop external cut off |
| | 6 | Emergency_Stop Overcurrent Safety Chain |
| | 7 | Emergency_Stop Sensorwerte |

Fig. 10-11 Description of the frame 0x300

## Identifier 0x330

The frame with the identifier 0x330 is sent after a request (0x550) every 25ms, until the entire error log is transmitted.




| Seq_ Num | Byte | Signalbedeutung | |
|---|---|---|---|
| 0 | 4 | SysHours | HB |
| | 5 | | LB |
| | 6 | SysMinutes | HB |
| | 7 | SysSeconds | LB |
| 1 | 4 | StackHours | HB |
| | 5 | | LB |
| | 6 | StackMinutes | HB |
| | 7 | StackSeconds | LB |
| 2 | 4 | StackVoltage | HB |
| | 5 | | LB |
| | 6 | StackCurrent | HB |
| | 7 | | LB |
| 3 | 4 | SysVoltage | HB |
| | 5 | | LB |
| | 6 | SysCurrent | HB |
| | 7 | | LB |
| 4 | 4 | StackTemp | HB |
| | 5 | | LB |
| | 6 | SysFanFreq | HB |
| | 7 | | LB |
| 5 | 4 | SysPressure | HB |
| | 5 | | LB |
| | 6 | PrimPressure | HB |
| | 7 | | LB |

| Seq_ Num | Byte | Signalbedeutung | |
|---|---|---|---|
| 6 | 4 | ErrFlags | - |
| | 5 | StackVoltageHistory[0] | HB |
| | 6 | | LB |
| | 7 | StackVoltageHistory[1] | HB |
| 7 | 4 | | LB |
| | 5 | StackVoltageHistory[2] | HB |
| | 6 | | LB |
| | 7 | StackVoltageHistory[3] | HB |
| 8 | 4 | | LB |
| | 5 | StackVoltageHistory[4] | HB |
| | 6 | | LB |
| | 7 | StackCurrentHistory[0] | HB |
| 9 | 4 | | LB |
| | 5 | StackCurrentHistory[1] | HB |
| | 6 | | LB |
| | 7 | StackCurrentHistory[2] | HB |
| 10 | 4 | | LB |
| | 5 | StackCurrentHistory[3] | HB |
| | 6 | | LB |
| | 7 | StackCurrentHistory[4] | HB |
| 11 | 4 | | LB |
| | 5 | SysVoltageHistory[0] | HB |
| | 6 | | LB |
| | 7 | SysVoltageHistory[1] | HB |
| 12 | 4 | | LB |
| | 5 | SysVoltageHistory[2] | HB |
| | 6 | | LB |
| | 7 | SysVoltageHistory[3] | HB |
| 13 | 4 | | LB |
| | 5 | SysVoltageHistory[4] | HB |
| | 6 | | LB |
| | 7 | SysCurrentHistory[0] | HB |
| 14 | 4 | | LB |
| | 5 | SysCurrentHistory[1] | HB |
| | 6 | | LB |
| | 7 | SysCurrentHistory[2] | HB |
| 15 | 4 | | LB |
| | 5 | SysCurrentHistory[3] | HB |
| | 6 | | LB |
| | 7 | SysCurrentHistory[4] | HB |
| 16 | 4 | | LB |
| | 5 | StackTempHistory[0] | HB |
| | 6 | | LB |
| | 7 | StackTempHistory[1] | HB |
| 17 | 4 | | LB |
| | 5 | StackTempHistory[2] | HB |
| | 6 | | LB |
| | 7 | StackTempHistory[3] | HB |

| Seq_ Num | Byte | Signalbedeutung | |
|---|---|---|---|
| 18 | 4 | StackTempHistory[3] | LB |
| | 5 | StackTempHistory[4] | HB |
| | 6 | | LB |
| | 7 | SysFanFreqHistory[0] | HB |
| 19 | 4 | | LB |
| | 5 | SysFanFreqHistory[1] | HB |
| | 6 | | LB |
| | 7 | SysFanFreqHistory[2] | HB |
| 20 | 4 | | LB |
| | 5 | SysFanFreqHistory[3] | HB |
| | 6 | | LB |
| | 7 | SysFanFreqHistory[4] | HB |
| 21 | 4 | | LB |
| | 5 | SysPressureHistory[0] | HB |
| | 6 | | LB |
| | 7 | SysPressureHistory[1] | HB |
| 22 | 4 | | LB |
| | 5 | SysPressureHistory[2] | HB |
| | 6 | | LB |
| | 7 | SysPressureHistory[3] | HB |
| 23 | 4 | | LB |
| | 5 | SysPressureHistory[4] | HB |
| | 6 | | LB |
| | 7 | PrimPressureHistory[0] | HB |
| 24 | 4 | | LB |
| | 5 | PrimPressureHistory[1] | HB |
| | 6 | | LB |
| | 7 | PrimPressureHistory[2] | HB |
| 25 | 4 | | LB |
| | 5 | PrimPressureHistory[3] | HB |
| | 6 | | LB |
| | 7 | PrimPressureHistory[4] | HB |
| 26 | 4 | | LB |
| | 5 | 0 | - |
| | 6 | | - |
| | 7 | | - |

Fig. 10-12 Description of the Frame 0x330

The portion of data that begins with Data[0], is written linearly into memory. The process of writing ends when the End Of Sequence Byte is unequal to 0. Fig. 10-13 gives an overview of how received data should be organized in the memory.

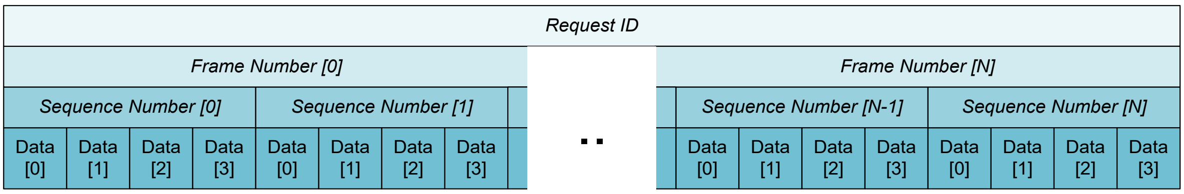



Fig. 10-13 Description of how the received data of the Error Log are organized in the memory

The enumeration of the Sequence Number begins in each frame at 0. In order to identify a certain data package, a Frame Number and Sequence Number are needed.

The received error protocol contains the following data and can be used in the following way. When an error appears (change in the error-state) all the information relevant to the system is secured in the form of an error frame in a non-volatile buffer memory. These error-frames will be placed in a non-blocking ring buffer memory.

- System time
- Stack operating time

- System parameters currently measured in case of an error
- SE (security electronics) error flags
- History of the system parameters of up to 5 seconds before the error had occured
- Storage of the error protocol in case of Controler voltage loss
- Storage and continuation of the error protocol after a firmware update

**Information Structure Error Frame**

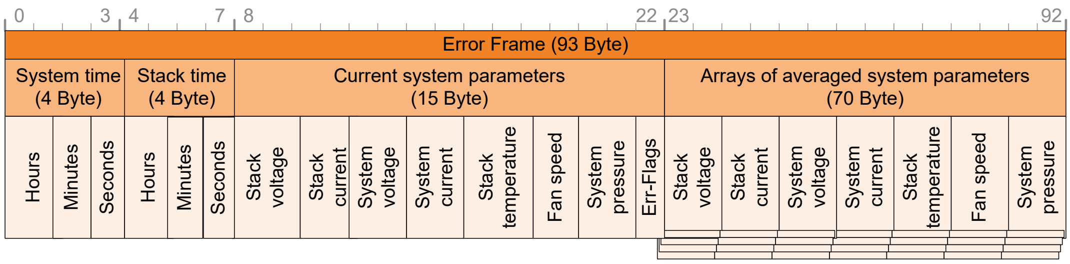



Fig. 10-14 Data structure of the error frame

How the error in the field *ERR-FLAG* has to be stored, can be gathered from the following table.

| Bit | Error-Flag | Description |
|---|---|---|
| 0 | SE-Error 1 | Emergency_stop sensorvalues |
| 1 | SE-Error 2 | Emergency_stop overcurrent Safety Chain |
| 2 | SE-Error 3 | Emergency_stop external cut off |
| 3 | SE-Error 4 | Emergency_stop actors |
| 4 | Timeout-Error | Keep-Alive-Timeout from the DC/DC converter |
| 5 | Leakage-Error | Error during leakage test |
| 6 | H2-ConcMax-Error | Maximum permitted $H_2$ concentration in the exhaust air channel exceeded |
| 7 | - | Reserved is always 0 |

Table 10-7 Error assignment in the field *ERR-FLAG* within an error frame

## 10.7 Allocation of Plugs and Jacks on the Connection Panel

### Plugs

| Plug | Pin | Signal | Specification |
|---|---|---|---|
| CAN IN | 2 | CAN_L | CAN |
| | 7 | CAN_H | CAN |
| | 1, 3-6, 8-9 | NC. | NC. |
| | Housing | Shield | Shield |

| Plug | Pin | Signal | Specification |
|---|---|---|---|
| CAN OUT | 2 | CAN_L | CAN |
| | 7 | CAN_H | CAN |
| | 1, 3-6, 8-9 | NC. | NC. |
| | Housing | Shield | Shield |
| Service | 2 | CAN_L | CAN |
| | 7 | CAN_H | CAN |
| | 1, 3-6, 8-9 | NC. | NC. |
| | Housing | Shield | Shield |

Table 10-8 Allocation of plugs CAN IN and CAN OUT

### Jacks

| Jack | Contact | Signal | Specification | Color of the line |
|---|---|---|---|---|
| RS232 | 2 | TxD | RS232 | |
| | 3 | RxD | RS232 | |
| | 5 | GND | RS232 | |
| | 1, 4, 6-9 | NC. | NC. | |
| | Housing | Shield | Shield | |
| Power Supply | 1 | VDC IN + | I / 9…36 $V_{DC}$ | White |
| | 2 | VDC IN - | I / GND | Brown |
| | 3 | Shield | Shield | Green |
| Remote Control | 1 | S1 / S2 | O / V+ | White |
| | 2 | | | |
| | 3 | S2 (Start / Stop) | I / V+ | White |
| | 4 | Shield | Shield | Green |
| Aux output | 1 | Valve + | O / V+ PWM | White |
| | 2 | Valve - | O / V- | Brown |
| | 3 | Shield | Shield | Green |
| | 4 | Relay + | O / V+ | White |
| | 5 | Relay - | O / V- | Brown |
| | 6 | Shield | Shield | Green |
| Safety chain | 1 | Output current of safety chain | O / CSC max. 20 mA | |
| | 2 | Safety chain input | I / CSCIN | |
| | 3 | Safety chain output | O / CSCOUT | |
| | 4 | Safety chain end / ground | I / CSCGND | Green |
| | 5-8 | NC. | NC. | |

Table 10-9 Allocation of jacks

### Switches

| DIP switch | Signal |
|---|---|
| 1 | NC |
| 2 | Address 1 (Address bit 0) |
| 3 | Address 2 (Address bit 1) |
| 4 | Address 3 (Address bit 2) |
| 5-8 | NC. |
| 9 | NC |
| 10 | NC |

Table 10-10 Allocation of the DIP switches

## 10.8 Data for the System Integration

| Designation | Specification |
|---|---|
| Current ramp | 1 A / Sec |

Table 10-11 Notes for the System Integration

# 11 Technical Data

## 11.1 Complete System

| Designation | Definition | Specification |
|---|---|---|
| Physical data | Dimensions (H x W x D) | 220 x 400 x 550 mm |
| | Weight | ca. 22 kg |
| | Protection type | IP22 |
| Power output | Output voltage | 16 ... 40 $V_{DC}$ |
| | Rated current | 60 $A_{DC}$ max. |
| | Rated output | 1200 W @ 5…25 °C |
| | Rated output | 1000 W @ 35 °C |
| Fuel | | $H_2$, hydrogen gas |
| | Minimum purity | 4.0 (= 99,99 %) |
| | Permissible inlet pressure | 1…15 bar |
| | Hydrogen consumption at 1200 W | 15 NL/min |
| Electrical supply | Min. input power | 110 $W_{DC}$ |
| | Power supply | 12…36 $V_{DC}$ |
| Oxidant | Oxygen | Atmospheric oxygen |
| | Volume flow rate | Max 335 $m^3$/h |
| | Oxygen concentration | Min 18% |
| | Ambient pressure | 700…1100 mbar |
| | Temperature | 5…35 °C |
| | Vaporous water content in exhaust gas at rated output | 550 g/h |
| Operating environment | Operating location | Inside of labs, dry |
| | Ambient temperature | 5…35 °C |
| | Relative humidity | 0…95 % , non-condensing |
| Storage | Ambient temperature | 3…30 °C |
| Transport | Ambient temperature | -40…+70 °C |
| German Electrical Electronic Equipment Act (ElektroG) | Law over the placing on the market, recycling and the environmentally-compatible disposal of electrical and electronic devices. | RoHS (Restriction of the use of certain Hazardous Substances) |
| | | WEEE Waste Electrical and Electronic Equipment) |

Table 11-1 Typical values with a unit which has been in operation for some time

| Parameter | | Specification | | Comment |
|---|---|---|---|---|
| Communications protocol | | Baud rate | 500 kBaud | |
| | | Identifier | 11 bit | |
| | | Protocol | Helio-centris | |
| | | Recom-mended converter | PEAK CAN USB | Required in combi-nation with Nexa® RCS |
| Data interface | CAN IN | SUB D9 Male | | If the unit is the last unit in the CAN bus, the CAN OUT connection must be terminally connect-ed with 120 Ohm. |
| | CAN OUT | SUB D9 Male | | |
| | Service | SUB D9 Male | | Only for Heliocen-tris Service |
| | RS 232 | SUB D9 Female | | Reserved for com-munication to pe-ripheral devices, |

Table 11-2 Specification for communication

## 11.2 Startup Kit

| Designation | Property | Specification |
|---|---|---|
| Connection of external power supply | | 3-pin 4mm plug con-nector |
| Connection of load relay and solenoid valve | | 6-pin plug connector |
| Reverse current diode with heat sink | Reverse voltage | 200 V |
| | Max. flow current | 70 A |
| Power cable | | 16 $mm^2$ lead, 6 mm safety plug (red / black) / 4 AWG, stripped length 24 mm |
| CAN-USB converter, CAN cable and 2 terminating resistors | | SUB-D extension 9-pin Bu/Bu 1.8m |
| | | CAN-USB opto-decoupled |
| | | CAN-Term |
| Load relay | Type | Relay Omron |
| | Coil voltage | 24 $V_{DC}$ |
| | Power consumption | < 6 W |
| | Control logic | NO, currentless open |
| External hydrogen valve | Nominal diameter | 1.5 mm |

| Designation | Property | Specification |
|---|---|---|
| | Pressure | 0…25 bar |
| | Connection | Parker quick coupling Q4 |
| | Coil voltage | 24 V |
| | Power consumption | < 8 W |
| | Control logic | NC, currentless closed |
| Hydrogen hose | Hose length | 2 m |
| | Hose diameter | 6 mm |
| Sliding blocks | | |

Table 11-3 Specification of startup kit components

## 11.3 Standards and Guidelines

The Nexa® 1200 complies with the following guidelines and standards:

Guidelines: EMC Directive 2004/108/EG

Product standards: EN 61326: 2006-10

Electrical measuring, control, regulating and lab devices - EMC requirements

Basic standards: Standards on Electromagnetic Compatibility (EMC):

- EN 61000-4-2: 2009-12
- EN 61000-4-3: 2008-06
- EN 61000-4-4: 2010-11
- EN 61000-4-5: 2007-06
- EN 61000-4-6: 2009-12
- EN 61000-4-7: 2009-12
- EN 61000-4-8: 2010-11
- EN 61000-4-11: 2005-02

The Nexa® 1200 is based on the following standards:

- IEC 62282-2: 2008-03

Fuel cell technologies - Part 2: Fuel cell modules

## 11.4 PC Requirements

| Description | Specifications |
|---|---|
| Operating system | Windows 7, Windows 8 |
| Processor | > Intel® Core™ 2 Duo CPU, 2 GHz |

| Description | Specifications |
|---|---|
| Ports | 2 free USB ports (USB 2.0) |
| RAM | > 2 GB |
| Hard disk space | >100 MB |
| Monitor resolution | 1024 x 768 pixels |

Table 11-4 Computer requirements

## 11.5 Hardware Requirements

| Description | Specifications |
|---|---|
| Nexa® firmware | Nexa Firmware 1.0.7 or higher |
| Nexa® DC1200 24/48 | Nexa Firmware 1.0.8 or higher |

Table 11-5 Hardware requirements

## 11.6 Safety Datasheet Hydrogen

The safety data sheet is available here: GESTIS Substance Database.

## 11.7 Abbreviations

| Abbreviation | Definition |
|---|---|
| A | Ampere (current) |
| ACK | Acknowledgement: Signal which indicates the reception or the process of data or commands |
| AWG | American Wire Gauge |
| BOP | Balance of Plant: Entirety of the mechanical and electrical components (humidifying, compressors, condensers, electrical drives, etc.) of the fuel cell system |
| CAN | Controller Area Network |
| DIP | DIP switches are small Dual Inline Package (DIP) switches for configuring and changing parameters |
| HB | High byte |
| ID | Identifier (also Identification) |
| LB | Low byte |
| NC. | Not connected |
| NO | Normally Open |
| LED | Light Emitting Diode |
| PEM fuel cell | Polymer Electrolyte Membrane fuel cell |
| RCS | Remote Control Software |
| SUB D | D shaped subminiature connector |
| U | Height unit (rack system) |
| UEG | Lower explosion limit |

| Abbreviation | Definition |
| --- | --- |
| V | Volt (voltage) |
| W | Watt (power) |

Table 11-6 Abbreviations

# Index

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# Nexa® DC1200-24 / -48

Instruction Manual

Nexa® DC1200 Instruction Manual
Version 2.2
October 2013


Rudower Chaussee 30
12489
Germany

# Content

# 1 About This Document

If only the masculine or feminine form is used in parts of this manual, this is only used for readability and simplicity. Persons of the respective other gender are always included.

The operating manual is intended to help you use the product. It is structured as follows.

Safety Instructions
In the safety chapter you will find information on the safe handling of the product. It is essential that you read and understand this chapter.

Components
This chapter includes background information about the product and its supplied components.

Getting Started
This chapter describes the scope of delivery and the necessary steps for initial startup of the product – from choosing a suitable installation location to connecting all required components. It is supplemented by the laminated assembly instructions.

Operation
The chapter provides instruction for the Operation of the product.

Decommissioning
In this chapter the necessary steps for the disassembly product and the conditions for its packaging, storage and transport are described.

Troubleshooting
This chapter answers FAQ and deals with possible problems and their respective solutions.

Maintenance and Service
This chapter describes all necessary measures arising in the product life cycle, such as the maintenance, cleaning, service, warranty and disposal.

Integration
In this chapter information is provided about the possibilities of integrating the product into different applications.

Index
The index at the end of the manual can be used for fast orientation in the manual.

## 1.1 Notices and Symbols

### 1.1.1 Symbols

The following symbols and labels are used in this manual:

| Symbol or label | Meaning |
|---|---|
| ➔ | Instruction |
| ✓ | Aids or prerequisites that are required prior to an action |
| 1. | Instructions in a specific sequence |
| ⇨ | Result of an action |
| ●, - | List |

| Symbol or label | Meaning |
|---|---|
| SWITCH | Refers to a switch, key, button or icon |
| Reference to page x | Reference to further information |

Table 1-1 Symbols in the Instruction Manual

### 1.1.2 Warnings

The following warnings are used:

| | |
|---|---|
| **WARNING** | ➔ Warns of dangers of serious injury. |

| | |
|---|---|
| **CAUTION** | ➔ Warns of dangers of injury. |

| | |
|---|---|
| **NOTICE** | ➔ Warns of damage to the product. |

### 1.1.3 Tips

Useful tips are identified as follows:

| | |
|---|---|
| **TIP** | Provides further tips. |

## 1.2 Accompanying Documents

The following documents are supplied with the product in addition to the instruction manual:

- CD-ROM with
  - *Nexa® DC1200 Control Software*
  - *All instruction manuals of the Nexa® Integration System*

# 2 Safety Instructions

In this chapter you will find information on the safe handling of the product. It is essential that you read and understand this chapter.

## 2.1 General Information on Safety & Responsibility

**Danger of injury due to improper use!**

Improper use of the product can result in serious injuries.

- ➔ Ensure that the manual is accessible at all times.
- ➔ Make sure you have read and understood this manual in its entirety.
- ➔ Comply with all safety instructions and warnings.
- ➔ Store the manual and other documentation in a safe place and pass them on to future owners of the product.
- ➔ Comply with all local regulations.
- ➔ Use only product components.
  Exception: if other aids are specified in the manual.

**Danger of injury due to unauthorized modifications!**

Conversions and modifications to the product can result in general hazards (danger of injury due to electric shock).

- ➔ Do not make conversions and modifications to product or its individual components.
- ➔ Do not remove components.

**Danger of injury due to fire!**

Short-circuiting the inputs and outputs can cause a fire.

- ➔ Do not short-circuit inputs and outputs.

**Danger of injury due to incorrect assembly and improper use of the Hybrid Extension Kit!**

Improper use can lead to personal injury and property damage.

- ➔ A hybridization of the DC/DC converter may only be performed by specialists in electrical and energy technology.
- ➔ Observe the operating manual of the battery manufacturer.

**Danger of injury due to improper use of the Nexa® DC1200 Control Software!**

Improper parameterization can result in damage to the batteries, which can explode as a result.

➔ Parameterization of the DC/DC converter may only be performed by specialists in electrical and energy technology.

➔ Observe the operating manual of the battery manufacturer.

## 2.2 Approved Use

The product has been designed for:

- Analysis and test purposes
- Experimentation purposes
- Demonstration purposes
- Training purposes
- Research purposes
- R&D projects

The product is not intended for any other purpose; any other use is not approved.

➔ The product must always be operated while under supervision.

## 2.3 Non-approved Use

Do **not** use this product for:

- Generation of electricity and heat for other purposes than those stated above
- Operation beyond the technical specifications and the approved operating environment
  – *See Technical Data on page 61*
- Feeding generated energy into the power grid
- Unsupervised operation
- Operation in potentially explosive areas

Components or products delivered by or purchased from Heliocentris are not approved for use in aeronautics or aerospace applications (including models).

## 2.4 Hazards during Approved Use

Electricity

The unit poses no special electrical hazards as long as the following instructions are observed:

- ➔ Use only the supply voltage specified on the rating plate.
- ➔ If an inverter is used, do not feed the current into the electric power grid.
- ➔ Do not short-circuit inputs and outputs.
- ➔ Do not reverse the polarity of inputs and outputs.
- ➔ Never use the system if any part of it has been immersed in water.

## 2.5 General Information on Operation

### 2.5.1 Requirements for the Owner/Operator

The owner/operator must ensure that the unit is accessible only to the persons defined in this manual (see Requirements for the User page 9).

The safety instructions and warnings listed in this instruction manual must be observed. The owner/operator is responsible for compliance with local safety regulations.

Furthermore, the owner/operator is responsible for:

- Unauthorized persons must be prevented, using corresponding measures, from installing, operating or maintaining the system. Installation, commissioning, shutdown and maintenance may be carried out only by appropriately qualified personnel.
- Replacement and cleaning of filters if used under dirty operating conditions and/or impaired ventilation

### 2.5.2 Requirements for the Location / Installation Location

The system must be operated in a lab which complies with the local regulations.

### 2.5.3 Requirements for the User

The product is intended as a laboratory system for use by trained qualified personnel in education and research. Its design does not correspond to that of a "consumer-oriented" product whose proper use is generally known and which is protected against operation errors or improper use. The product may be used by the following persons under the following conditions:

- Personnel who can demonstrate proof of training in chemistry, physics, electronics, electrical engineering or equivalent qualifications.
- ➔ Personnel must be familiar with and comply with the local applicable accident prevention and safety regulations.

There is an obligation of supervision during all training

- The product may be used by persons undergoing training only when under the supervision of the instructor.
- The instructor must ensure proper handling and is obliged to point out possible dangers.

# 3 Components

## 3.1 Nexa® DC1200 DC/DC Converter

The Nexa® DC1200 DC/DC converter is used to convert the electrical power output of the Nexa® 1200 fuel cell system.


Fig. 3-1 Nexa® DC1200 with 24 V

The DC/DC converter converts the unregulated, load-dependent output voltage of the Nexa® 1200 into a regulated, rated voltage of 24 V. This makes it possible for the output voltage to be used by typical DC consumers. The maximum load current is 55 A.

The Nexa® DC1200 (hereinafter referred to as the DC/DC converter) can be integrated in the Nexa® 1200 Integration System via a CAN Bus interface.

## 3.2 Nexa® DC1200 Hybrid Extension Kit

The Nexa® DC1200 Hybrid Extension Kit (hereinafter Hybrid Extension Kit) is a pre-assembled extension for connection to the Nexa® 1200 and Nexa® DC1200.


Fig. 3-2 Hybrid Extension Kit front side

It enables a significant expansion of the DC/DC converter's scope of function and thus the overall system consisting of the Nexa® 1200, the DC/DC converter and lead batteries.

In the process, the following functionalities are supported:

- A main switch for the system, which can be used to switch the Nexa® 1200 and DC/DC converter on and off
- Optical LED signals for the status of the overall system and the Nexa® 1200
- A load monitor disconnects connected batteries in the case of a malfunction of the load in order to prevent deep discharging or overcharging
- Remote operation enables the control of the overall system using the Nexa® 1200 OSC, which will be available soon
- Energy Saving mode disconnects the Nexa® 1200 from the power supply when it is not needed
- The DC/DC converter regulates to battery voltage and battery current or to converter output sizes using the current sensor
- The hybridization is supported by the battery monitor and automatic Battery Charging mode with and without Energy Saving mode as well as the automatic Nexa® 1200 Start / Stop and Error Reset

Provision of additional supply voltage of 24°V in the48°V version and corresponding battery voltage of the 24°V version:

- The connection and supply of additional components with a maximum of 30°W are possible

## 3.3 Nexa® DC1200 Control Software

The present Nexa® DC1200 Control Software (hereinafter Control Software) is designed for the parameterization and operation of the Nexa® DC1200. It enables an individualized adaptation and parameterization of your DC/DC converter with 24 V or 48 V for your system set-up, which exceeds most applications.

The PC-based software automatically recognizes which DC/DC converter is connected and adjusts to it. The following statuses can be displayed and the following parameters can be changed:

| **Function** |
|---|
| Display of system data of the DC/DC converter |
| Display of error and warning messages |
| Selection and parameterization of automatic battery charging mode |
| Selection of the current regulation of the DC/DC converter to converter output or battery current |
| Connection of an external current sensor and its use as a control variable for the battery charging |
| Change of parameters of the DC/DC converter |
| Operation of the DC/DC converter by means of RS232 communication REMOTE CONTROL switch on the Hybrid Extension Kit to ON |

| Function |
| --- |
| Display of the control unit of the DC/DC converter |
| Loading and saving of configurations |

Table 3-1 Scope of functions of the Control Software

## 3.4 Additional Supplementary Components

The following components are also necessary for connecting the unit – they are not included in the scope of delivery, but can be purchased from Heliocentris.

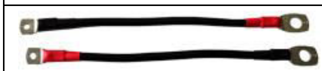
### 3.4.1 Lead batteries

The optional integrated lead batteries enable dynamic intermediate storage of the electrical energy. During operation of the Nexa® 1200 the DC converter charges the lead batteries with current (maximum 5.4 A as delivered).

# 4 Getting Started

This chapter describes the scope of delivery and the necessary steps for initial startup of the DC/DC converter

## 4.1 Scope of Delivery

| Illustration | Designation and quantity |
|---|---|
|  | Nexa® DC1200 |
|  | Nexa connecting cable set: 1 each black / red power cable with cable lug on one end and 6 mm lab plug |
|  | CAN cable |
|  | Pre-assembled power cable for battery connection with cable lug on one end and plug connectors includ-ing current sensor and voltage supply) |
|  | Fuse<br>Fuse link (only in the 24 V version) |
|  | 1 power cable set. with cable lugs on both ends (for fuse, only in the 24 V version)) |
|  | Nexa® DC1200 Hybrid Extension Kit |
|  | 1 connecting cable for Nexa® 1200 with 3-pin, 4-pin and 8-pin plug-in connectors and 2-wire cable |

| Illustration | Designation and quantity |
|---|---|
|  | 1 connecting cable for load relay and lead batteries with 3 ring cable lugs and 2-wire cable |
|  | 1 connecting cable for DC/DC converter with 16-pin plug connector |
|  | 1 plug connector with bridge (only in the 24 V version) |
|  | Load relay |
|  | 1 current sensor |
| | 2 long screws (for battery connection) |
| | CD-ROM with Nexa® DC1200 Control Software |
| **For the 48V version** | |
|  | Additional DC/DC converter (stepdown DC/DC converter) |

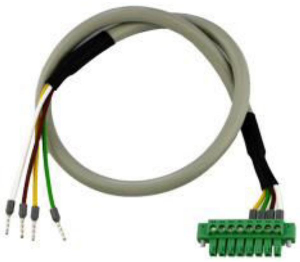
| Illustration | Designation and quantity |
|---|---|
|  | Power cable set with cable lugs on both ends (for fuse) |
|  | 1 power cable set with cable lugs on both ends (for batteries) |
|  | 1 connecting cable for stepdown converter with 4-wire cable |

Table 4-1 Scope of Delivery

**Further optional components available for Nexa® DC1200-24 and Nexa® DC1200-48**

| Illustration | Designation | Quantity 24 V / 48 V |
|---|---|---|
|  | Lead batteries | 2 / 4 |

Table 4-2 Further optional components available

## 4.2 Installation location

The installation location of the DC converter must be suitable for connection to the Nexa® 1200.

To ensure unobstructed air circulation the clearance at the air outlet on the side must be at least 30 cm.

## 4.3 Unpacking and Installation

The following section describes what to watch out for when unpacking and setting up the system.

- ✓ Suitable installation location

1. Check the system for obvious transport damage to the packaging and to the product itself. In the event of damage, inform the shipping company and Heliocentris or your supplier about the damage immediately.
   - *If possible, document the damage with a camera.*
2. Remove the DC/DC converter and other components from the box.
3. Remove packaging material and polystyrene elements.
4. Compare the delivered items with the information in this instruction manual immediately after unpacking. In case of discrepancies, notify Heliocentris or your vendor.
5. Set up system at selected installation location.
6. Store original packaging material for future storage or transport.

## 4.4 Assembly

The DC/DC converter can be mounted as needed. The sides are equipped with pre-drilled screw holes for horizontal mounting.

## 4.5 How to Set Up the Nexa® Integration System

The lead batteries are connected to the *BATTERY* power output of the DC/DC converter. The load relay must be interconnected. The lead batteries are optional components and are not included in the scope of delivery.

**CAUTION**

**Danger of injury due to explosion!**

Short-circuited batteries can explode.

➔ Do not short-circuit the battery.

### 4.5.1 How to Connect the Nexa® DC1200-24

Connection to Nexa® 1200

Connect the DC/DC converter, load relay and lead batteries to the Nexa® 1200 as follows:

✓ Nexa® 1200 is completely connected, without supply voltage connected and switched off

✓ 1 each black / red power cable with cable lug on one end and 6 mm lab plug (Nexa® connecting cable set)

✓ Power cable from the Nexa® 1200 Startup Kit

Connect load relay and lead batteries

✓ Hybrid Extension Kit

✓ Load relay

✓ 2 lead batteries

✓ Nexa® with cable lug on one end and 6 mm lab plug

- ✓ Pre-assembled power cable for battery connection
- ✓ Power cable set with cable lugs on both ends (fuse connection)
- ✓ Connecting cable for Nexa® 1200 with 3-pin, 4-pin and 8-pin plug-in connectors and 2-wire cable
- ✓ Connecting cable for DC/DC converter with 16-pin plug connector
- ✓ Connecting cable for load relay and lead batteries with 3 ring cable lugs and 2-wire cable
- ✓ Fuse link
- ✓ Fuse
- ✓ Plug connector with bridge
- ✓ Current sensor
- ✓ 2 long screws
- ✓ Socket wrench
- ✓ Philips-head screwdriver
- ✓ Screwdriver
- ✓ 8 mm open-end wrench
- ✓ DC/DC converter is switched off

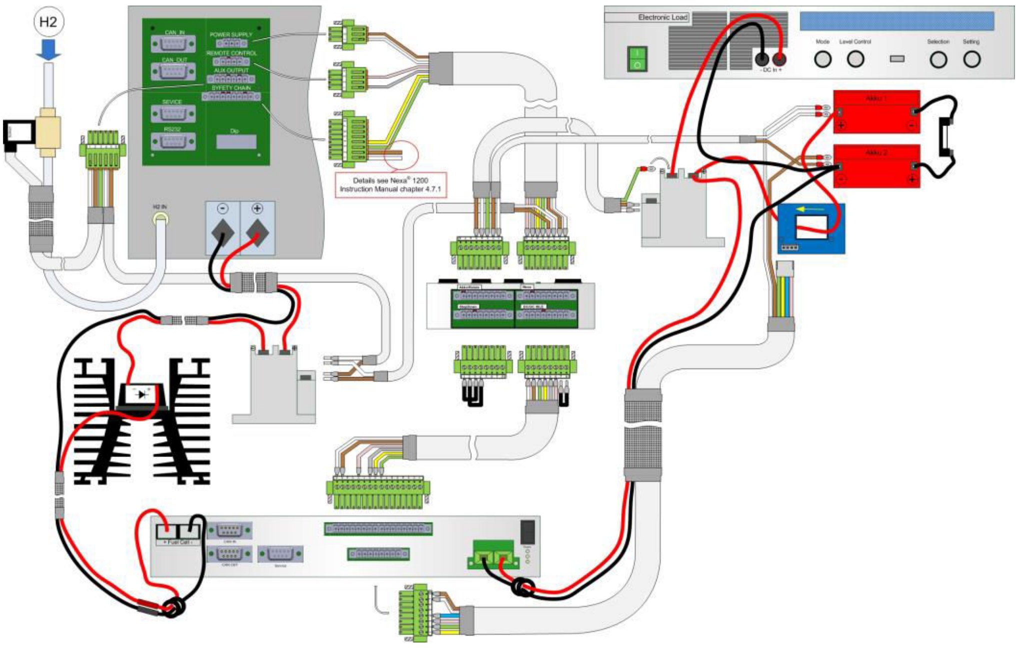
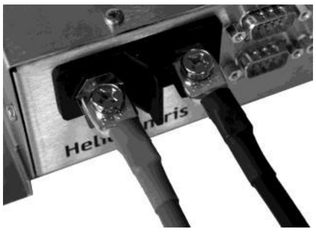



Fig. 4-1 Connecting diagram for Nexa® DC1200 with 24 V



1. Unscrew screws on negative power input of the DC/DC converter.
2. Place cable lug of the black power cable on the connection.
3. Screw tight.
4. Repeat steps 1 – 3 on positive power input with red power cable.

5. Connect the cable jack of the black power cable from the Nexa® 1200 to the lab plug of the power cable from the DC converter.
6. Connect the cable jack of the red power cable from the diode to the lab plug of the power cable from the DC/DC converter.

   ⇨ *The DC converter is now connected to the Nexa® 1200.*

Pre-assembled power cable

1. Connect the power output of the DC/DC converter (BATTERY) and the positive contact of the load relay using the red power cable.

NOTICE! The arrow of the current sensor must point in the direction of the load relay.

2. Connect the positive contact of the load relay and the positive pole of one lead battery using the short red power cable (including current sensor).
   - *Replace the original short screw with the long screw included in the scope of delivery.*

Mounting the fuse

NOTICE! Steps 3 - 10 apply only for the 24 V version of the DC/DC converter!

3. Open the fuse link.
4. Loosen nuts.
5. Place fuse on screws.
6. Place short power cable on screws.
7. Tighten using socket wrench.
8. Close the fuse link.
9. Connect one end of the power cable with fuse to the negative pole of the one lead battery
10. Connect the open end of the 2nd power cable to the positive pole of the other lead battery.

Pre-assembled power cable

11. Connect the power output of the DC/DC converter (BATTERY) and the negative pole of the lead battery using the black power cable.
    - *Replace the original short screw with the long screw included in the scope of delivery.*
12. Plug the 4-pin plug connector into the current sensor.
13. Connect the white lead of the 6-wire cable with ring cable lugs to the positive pole and the brown lead to the negative pole of each lead battery.

Connection of the load

14. Connect the red power cable of the load to the negative contact of the load relay.
15. Connect the black power cable of the load to the negative pole of the lead battery.

Connection of the Hybrid Extension Kit

The Hybrid Extension Kit is pre-assembled with coded connector plugs which cannot be connected incorrectly, since each plug fits only into one jack.

16. Plug in the 8-pin plug connectors of the 3 connecting cables into the connections on the Hybrid Extension Kit.

Connecting cable for Nexa® 1200

17. Use the 3 pre-assembled plug-in connectors to replace the following connections on the Nexa® 1200:

   - *With the 3-pin plug connector to the Power Supply connection*
   - *With the 4-pin plug connector to the Remote Control connection*

NOTICE! In the instruction manual for the Nexa® 1200 check the connection of the safety chain (see How to Install the Safety Chain).

   - *With the 8-pin plug connector to the Safety Chain connection.*

18. Connect the 2-wire lead with wire end ferrules to the load relay of the Nexa® 1200 parallel to the existing stranded wires (white to white and brown to brown)

Connecting cable for DC/DC converter

19. Plug the 16-pin plug connector into the Control connection on the DC/DC converter.

Connecting cable for load relay and lead batteries

20. Connect the 3-wire lead to the load relay as follows:

   - *Loosen the screws of the negative (-) contacts and of the contacts at the side (7 and 8)*
   - *Place the green lead with the ring cable lug on the negative contact 1 (-)*
   - *Connect the white lead with contact 8 brown lead with contact 7*
   - *Tighten screw of the contacts hand-tight*

21. Connect the 2-wire lead on the lead batteries as follows:

   - *Loosen the screw on the positive / negative pole of the lead battery*
   - *Place the white lead with the ring cable lug on the positive pole (+) and*
   - *place the brown lead with the ring cable lug on the negative pole (-)*
   - *Tighten screws hand-tight*

Pre-assembled power cable

22. Connect the 6-pin plug to Sens on the DC/DC converter.
23. Tighten the locking bolts.

Plug connector with bridge

24. Connect the bridge to the Stepdown connection on the Hybrid Extension Kit.
25. Connect the 2-pin battery plug to the output connection of the DC/DC converter Battery.

   ⇨ *The Nexa® DC1200 with 24 V is connected*

## 4.5.2 How to Connect the Nexa® DC1200-48

In the 48 V version of the DC/DC converter, 2 additional lead batteries and one additional DC/DC converter (stepdown converter) are needed.

The connection of the 48 V version of the DC/DC converter corresponds to that of the 24 V version with the exception of steps 3 - 10 and 24 and the additional following steps:

- ✓ Stepdown DC/DC converter
- ✓ 2 lead batteries
- ✓ Connecting cable for stepdown converter with 4-wire cable
- ✓ Power cable set with cable lugs on both ends (for batteries)
- ✓ Power cable set with cable lugs on both ends (for fuse)
- ✓ Fuse link
- ✓ Fuse
- ✓ Philips-head screwdriver
- ✓ 8 mm open-end wrench
- ✓ The Nexa® DC1200 with 24 V is connected
- ✓ DC/DC converter is switched off

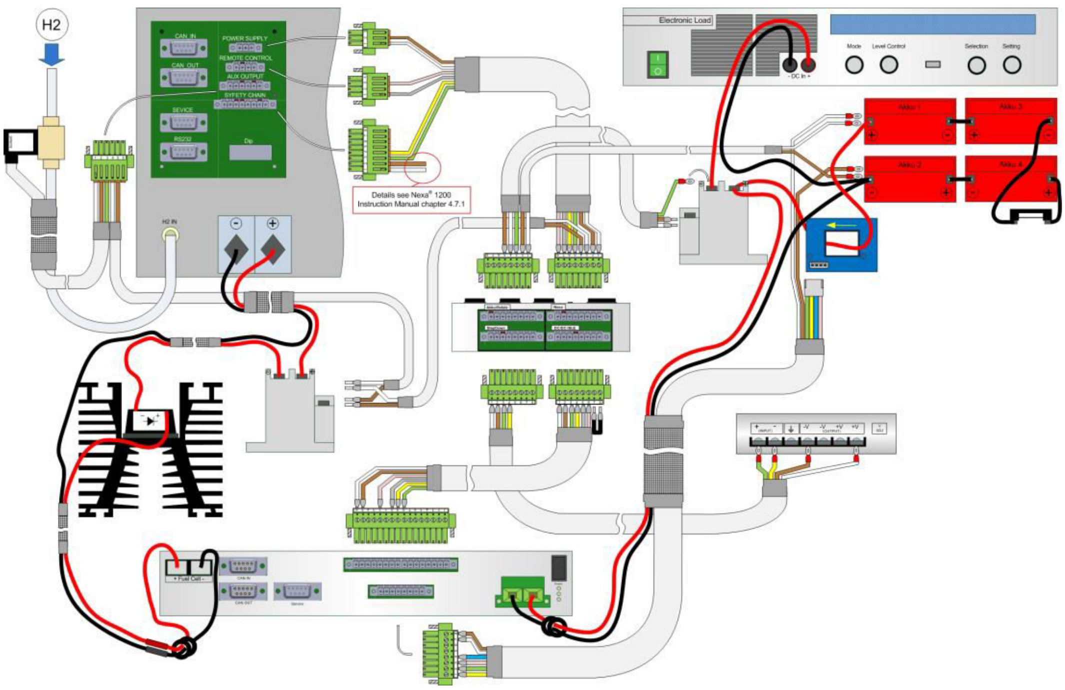



Fig. 4-2 Connecting diagram for Nexa® DC1200 with 48 V

**Power cable set for batteries**

To achieve a voltage of 48 V, the lead batteries must be connected in series as shown.

1. Connect the positive (+) pole of one lead battery with the negative pole () of an additional lead battery using 2 short power cables.

**Fuse**

2. Open the knurled nuts of the fuse.

3. Place short power cable on fuse screws.
   – *The current direction is not important.*
4. Tighten knurled screws hand-tight.
5. Connect the open ends of the power cables with the positive and negative pole of the additional lead batteries.

Stepdown DC/DC converter

6. Plug in the 8-pin plug connector of the connecting cable into the *STEPDOWN* connection on the Hybrid Extension Kit.
7. Connect the 4-wire lead to the stepdown DC/DC converter as shown.

## 4.6 How to Connect Data Interfaces

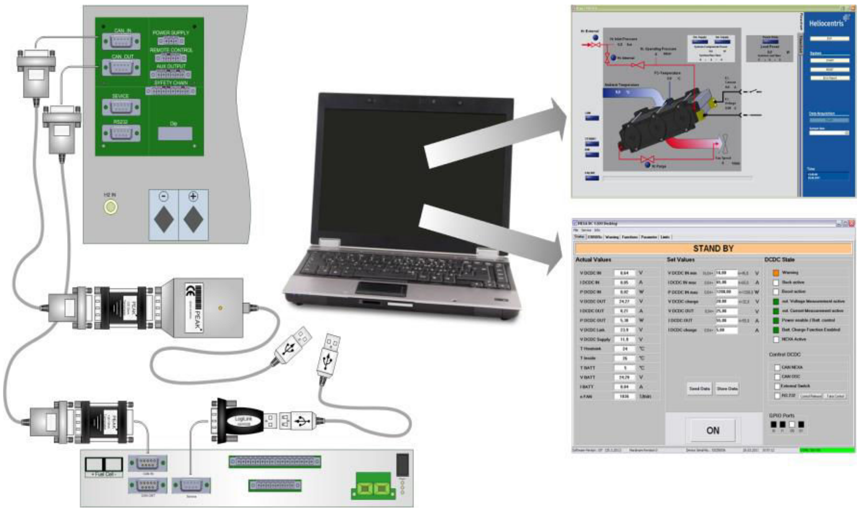


Fig. 4-3 How to connect data interfaces

### 4.6.1 How to Establish Communication for Automatic Battery Charger

The DC/DC converter is connected to the Nexa® 1200 by means of a CAN cable in order to use the functions of the automatic battery charger.

Connect the DC/DC converter as follows:

- ✓ CAN cable
- ✓ Nexa® 1200 is switched off
- ✓ DC/DC converter is switched off
- ✓ Hybrid Extension Kit is switched off
- ✓ Small Philips-head screwdriver

1. Remove terminating resistor at *CAN OUT* on the Nexa® 1200.
2. Insert the SUB-D plug of the CAN cable in *CAN OUT* on the Nexa® 1200.

3. Insert the terminating resistor in CAN IN on the DC/DC converter.
4. Insert the SUB-D plug of the CAN cable in the terminating resistor on the DC/DC converter.
5. Tighten all locking screws hand-tight.

   ⇨ *Communication for automatic battery charger is established.*

### 4.6.2 How to Establish Communication between the DC/DC Converter and the PC

✓ Nexa® DC1200 CD-ROM

✓ RS232 cable (not included in the scope of delivery)l

Start the software and establish communication as follows:

NOTICE! If the software is not started from the CD-ROM the file FTD2XX.DLL must be in the same directory as the file NEXA DC1200.EXE.

1. EXECUTE NEXA DC1200.EXE from the CD.

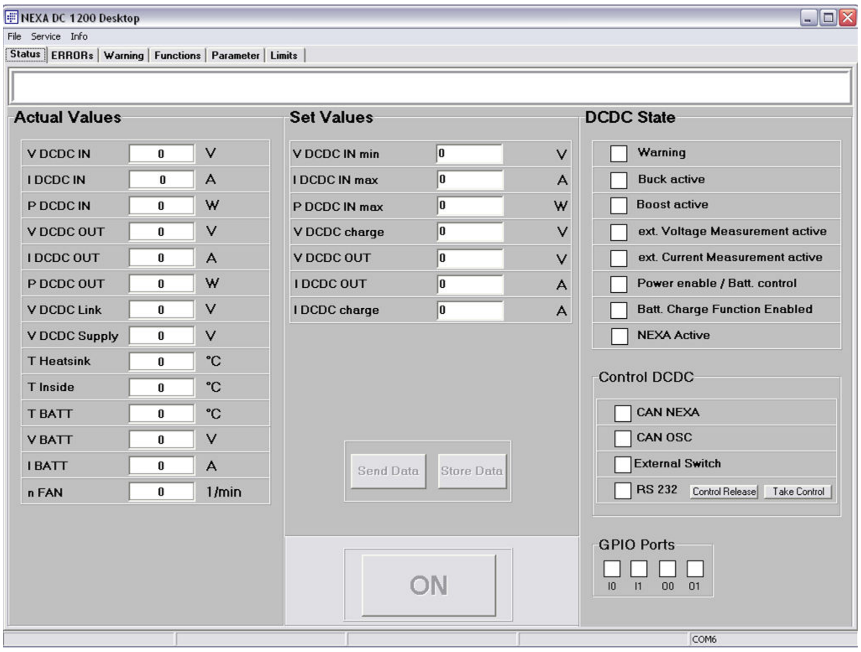



Fig. 4-4 The STATUS tab is defined as the start window of the application

2. Connect the service interface of the DC/DC converter and PC with the RS232 cable.
3. Select COM-PORT in the SERVICE menu.
4. Using your keyboard, enter the COM port of your PC in the SERIAL INTERFACE dialog.

**TIP** The designations of the communication interfaces are specified in the device manager of the operating system. The designations of the ports can be different for some computer configurations. Typical designations of the serial interfaces are "COM1", "COM2", etc.

If the designation of the COM port is above 10, change it to a single-digit number.

5. Select *SIO START* in the *SERVICE* menu

⇨ *The communication is established. The successful connection can be recognized by a green background in the COM-PORT XX ACTIVE field (see Status line on page 35).*

**TIP** If the *COM-PORT XX ACTIVE* field remains red, communication could not be established. Check your PC settings and then repeat steps 2 - 5.

## 4.7 Optional Modules of the Nexa® Integration System

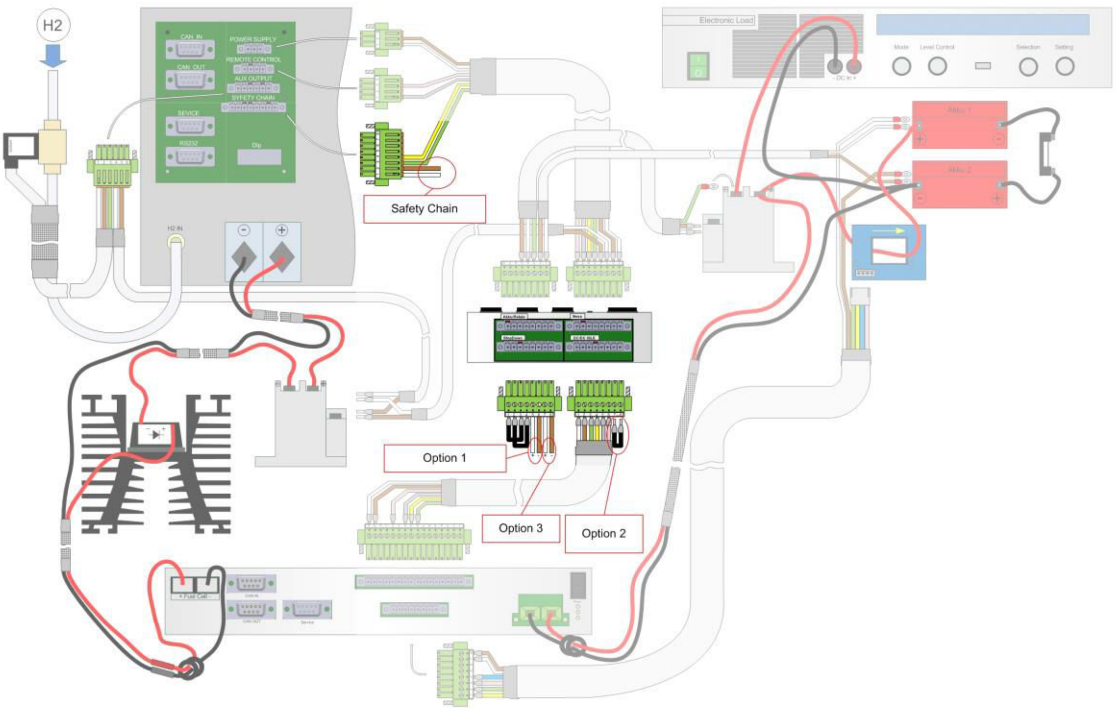



Fig. 4-5 Optional Modules of the Nexa® Integration System

Safety Chain

External safety sensors can be integrated in the safety chain. See instruction manual for the Nexa® 1200, how to Install the Safety Chain.

### 4.7.1 Option 1: External Power Supply

The overall system can be supplied with voltage of 24°V or 48°V with the AC adapter for the Nexa® 1200, depending on the DC/DC converter version. The AC adapter is connected to the Hybrid Extension Kit *STEPDOWN* connection. If performs the following functions:

- Voltage supply during system start
- Voltage supply during operation. In doing so, the overall system is still supplied with energy in the event of an error and does not switch off automatically. This allows you to display system errors via the software (supplied Nexa® RCS Software, Control Software or the optional OSC Software) if the software was started prior to the occurrence of the error.
- A firmware upload can also be carried out.

Connect the AC adapter to the Hybrid Extension Kit as follows:

✓ AC adapter for the Nexa® 1200

➔ Connect 2-wire AC adapter cable to 5th terminal (+) and 6th terminal (

### 4.7.2 Option 2: Energy saving mode

Also, an Energy Saving mode is also possible with the use of a cable bridge. This mode switches off the Nexa® 1200 completely if it is in Standby mode and is not in use. The energy requirement is reduced by the energy consumption of the Nexa® 1200. The Energy Saving mode can be established as follows:

✓ Cable bridge

➔ Remove the bridge on the *NEXA DC* connection on the Hybrid Extension Kit.

### 4.7.3 Option 3: Connect External Devices

External devices, such as an additional H2 sensor, can be connected. In the 48 V version and with corresponding battery voltage in the 24 V version they are supplied with an output voltage of 24 V and max. 30 W output power.

Connect an additional device to the Hybrid Extension Kit as follows:

✓ Additional device (not included in delivery)

✓ 2-wire cable (not included in delivery)

➔ Connect 2-wire AC adapter cable to 7th terminal (+) and 8th terminal (

# 5 Operation

## 5.1 DC/DC converter

The DC/DC converter, together with the Hybrid Extension Kit, can be operated through the supplied Nexa® DC1200 Control Software (hereinafter Control Software) or through the optional Nexa® OSC Software.

Standalone operation using the Hybrid Extension Kit without a PC is possible after parameterization through the Control Software.

**CAUTION**

**Danger of injury due to electric shock!**

The 48 V DC/DC converter can supply voltage of more than 60 V, resulting in shock hazard in case of contact.

➔ Avoid contact with the converter and the connections.

The LEDs on the front of the unit indicate the operating mode or current process of the unit.

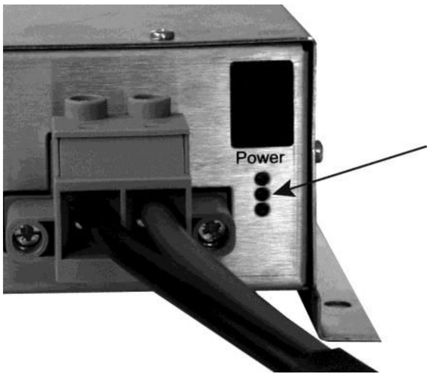



Fig. 5-1 LED display

| **LED** | | | **Operating mode** |
|---|---|---|---|
| **Red** | **Yellow** | **Green** | |
| (o) | – | – | Error |
| – | o | – | Standby |
| | (o) | | Battery charger active while DC/DC converter and Nexa® 1200 are in Standby mode: no power output from the DC/DC converter. In Energy-Saving mode the Nexa® 1200 is switched off and does not consume any energy. |
| – | – | (o) | Run, power output of the DC/DC converter is switched on. |
| | (o) | (o) | Battery charger active, recharging of batteries takes place, while DC/DC converter and Nexa® |

| LED | | | Operating mode |
|---|---|---|---|
| Red | Yellow | Green | |
| | | | 1200 are in Run mode: Power output of the DC/DC converter is switched on. |
| o | o | o | Update or operating system or controller crash, see Troubleshooting starting on page 45 |

Table 5-1 Signaling of the operating statuses of the DC/DC converter on the front side

1 o LED lights up    2 (o) LED blinks    3 – LED off

## 5.1.1 General Function of the DC/DC Converter:

The DC/DC converter makes it possible to regulate to its battery current (external current sensor) or to output current (internal current sensor). Additionally, the DC/DC converter is equipped with an automatic battery charger in connection with the Nexa® 1200 and a load monitor, which protects the batteries from total discharge. By integrating the external battery current measuring and regulation, the DC/DC converter can regulate the energy flows corresponding to the load demands and charge the batteries. The possibility of differentiating between battery and load current is especially important for the function of the DC/DC converter as a hybrid converter and not only as a battery charger.

All described functions

- Internal and external current sensor
- Regulation to output sizes
- Automatic Battery Chargers

can be individually adapted, activated or deactivated using the supplied Control Software (see Functions Tab on page 39).

Adaptation of the load monitoring and the output voltage range is possible only by Heliocentris Service.

In general, the DC/DC converter functions according to the following diagram.

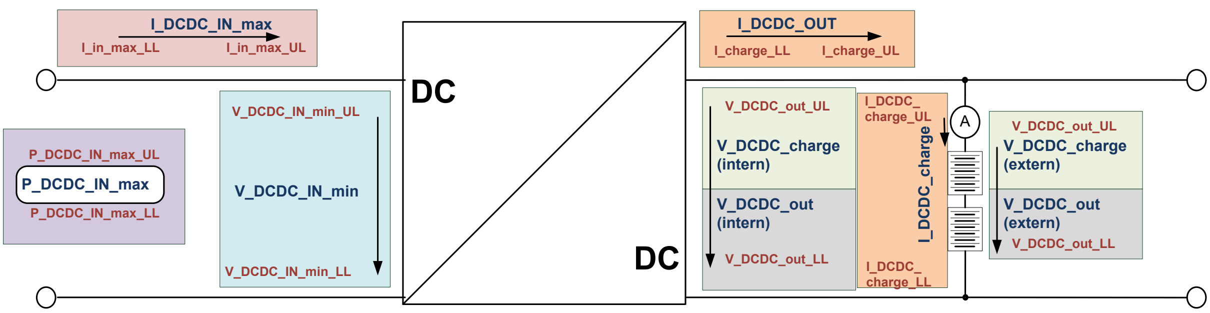



Fig. 5-2 Function of the DC/DC Converter

### 5.1.2 Battery Charging

Battery charging generally takes place with constant current charging with I_DCDC_charge until V_DCDC_Charge is reached. Afterwards, the battery current is reduced with a constant output voltage. If the current falls below a defined minimum output current (I_DCDC_out) of the DC/DC converter (I_DCDC_out < I_DCDC_Charge_min) the recharging time (t_charge) starts which concludes the battery charging.

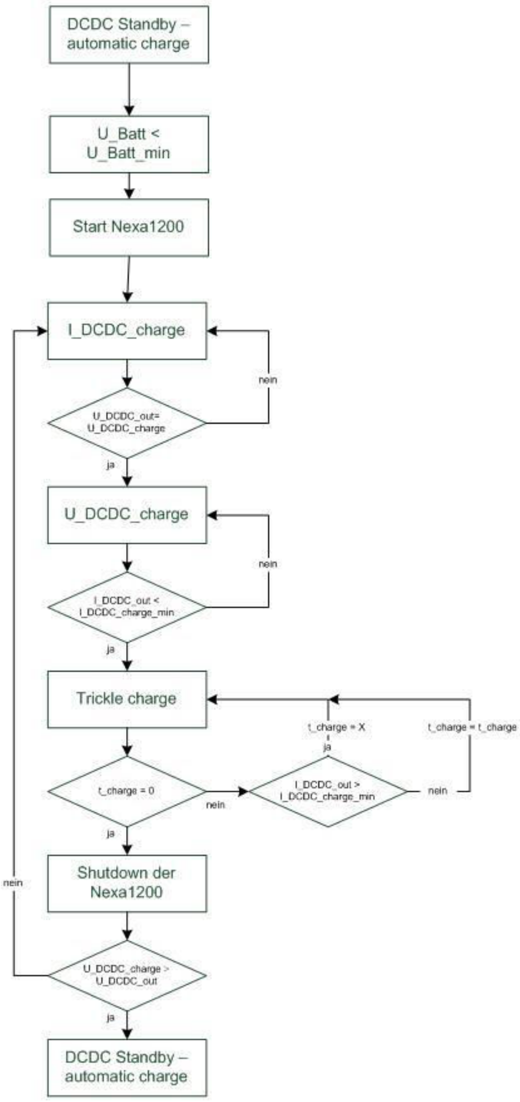
**TIP**

Please note that to switch off the automatic battery charging function the output current (I_DCDC_out) of the DC/DC converter must be lower than the minimum battery charging current (I_DCDC_Charge_min). This means that

- without a load, the battery current corresponds to the output current of the converter
- in hybrid operation with an additional load, the minimum battery charging current must be selected accordingly, since the output current of the DC/DC converter is based on the battery current and the current of the load switched parallel to the batteries

⇨ *On reaching a minimum battery voltage, the Nexa® 1200 is automatically activated and switches off again after the charging is completed.*

### 5.1.3 Automatic Battery Chargers




To properly take into account the energy flow from the DC/DC converter, especially as a hybrid converter, in the internal regulation, it is necessary to differentiate between load current and battery current. To regulate to the battery current (external current sensor), the current pre-assembled sensor provided in the scope of delivery of the DC/DC converter is required.

When the external current measuring is activated the charging current of the battery is used as an actual value for the regulation of the output current, independent of the load current. The battery charging current is regulated to the target value of I_DCDC_Charge. A load demand at the same time results in an output current of the DC/DC converter which is comprised of the load current and the battery charging current. As opposed to regulation to the internal sensor, the entire current range of the converter can be used, independent of the battery voltage.

The external measurement and regulation are based for example on the following diagram. The battery charging according to the above description likewise applies in case of an active battery charger.

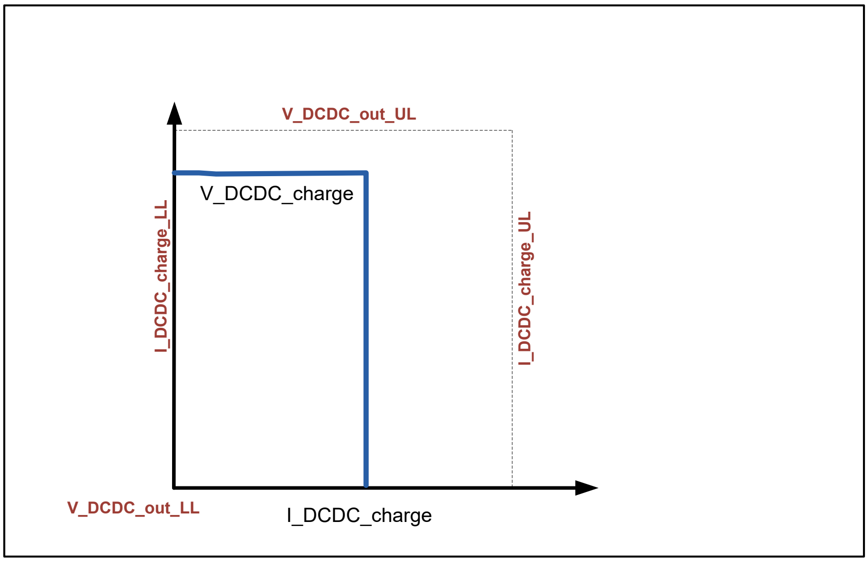



Fig. 5-3 Diagram (voltage over the battery / battery current) showing the behavior at the output of the DC/DC converter with battery current regulation and the condition I_DCDC_charge ≤ I_DCDC_out

- V_DCDC_charge has no effect on the battery current regulation
- The output current of the DC/DC converter can adjust freely from I_DCDC_charge to I_DCDC_out
- If regulated to I_DCDC_charge, the battery current adjusts itself freely

### 5.1.4 Regulation to the Internal Current Sensor

Regulation of the DC/DC converter to its output current and output voltage by means of the internal current sensor. Regulation takes place according to the following diagram. The output voltage and the output current of the DC/DC converter behave as follows:

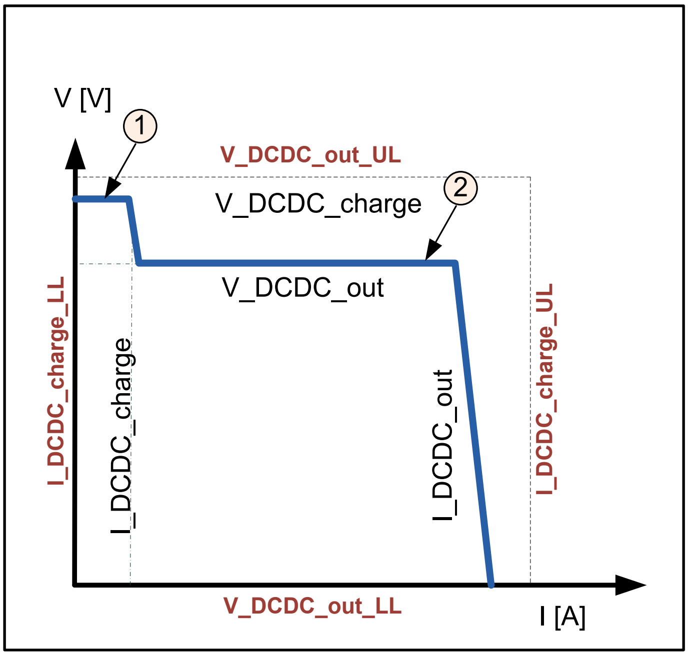



Fig. 5-4 Diagram showing the behavior at the output of the DC/DC converter

Without active battery charger

Until I_DCDC_charge is reached the output voltage of the converter V_DCDC_Charge remains constant; after I_DCDC_charge is passed the output voltage of the DC/DC converter is reduced to V_DCDC_out (1).

Larger current demands than I_DCDC_out lead to immediate breakdown of the output voltage of the DC/DC converter (2).

Active battery charger

For operation with batteries and an active battery charger, this has the following significance:

- Battery charging as described above
- If a load is demanded at the same time, the battery is first discharged. When V_DCDC_out is reached, the power output of the DC/DC converter is released and the DC/DC converter provides the power. The batteries can be charged only after removing the load demand.

**NOTICE**

**Damage due to excessive charging current!**

In case of regulation to the internal current sensor the batteries can contain a charging current that is greater than I_DCDC_charge.

➔ Parameterization of the DC/DC converter may only be performed by specialists in electrical and energy technology.

➔ Observe the operating manual of the battery manufacturer.

## 5.2 Hybridization of the Overall System

The DC/DC converter is delivered from the factory with the following parameterizations corresponding to the optional lead batteries:

- Load monitoring active
- Battery charger active
- External current and voltage measuring active

When configured with an automatic battery charger it operates according to this parameterization.

The DC/DC converter is switched on by means of the POWER switch. It is ready for operation as soon as voltage is supplied by the Hybrid Extension Kit.

## 5.3 Hybrid Extension Kit

The proper parameterization through the supplied Control Software or operation through the Nexa® OSC Software is prerequisite for the function of the overall system. The parameterization determines the function with which the overall system is represented. The following configurations of the overall system are possible with the Hybrid Extension Kit:

- Hybridization of the Overall System
  - *With automatic battery charger: automatic starting of the Nexa® 1200 for the recharging of batteries*
  - *Without automatic battery charger*
- Power supply of the overall system through a mains adapter

Operate the Hybrid Extension Kit as follows:

✓ The components of the overall system must be supplied with voltage

Main switch ON/OFF


Fig. 5-5 How to Use the Hybrid Extension Kit

1. Switch the main switch to ON in order to enable the system.

System start

2. Press and hold the SYSTEM START button until the green SYSTEM RUN LED illuminates.

⇨ *The system is ready for operation and assumes the load monitoring. The system has a locking mechanism through the load relay in order to switch off again in the event of a system error.*

Remote Control

In case of operation without OSC or Control-Software the *REMOTE CONTROL* switch can be used to switch the DC/DC converter to *RUN* and *STANDBY* mode. A corresponding signal takes place through the LEDs of the DC/DC converter.

➔ *REMOTE CONTROL* to *ON* switches the DC/DC converter to Standby mode (yellow LED lights up)

➔ Remote Control to Off switches the DC/DC converter to Run mode; depending on the parameterization of the DC/DC converter the yellow LED and / or the green LED blink

Define communication

Depending on how the DC/DC converter is to be operated the *REMOTE CONTROL* switch must be set to *ON* or *OFF*.

➔ Switch the *REMOTE CONTROL* switch to *ON* in order to operate the system using the Nexa® OSC or Control Software.

➔ Switch the *REMOTE CONTROL* switch to *OFF* in order to operate the system using the Hybrid Extension Kit and without a PC.

Switch the Nexa® 1200

➔ Press the *NEXA ON / OFF / RESET* button in order to start or stop the Nexa® 1200 or to acknowledge a pending error.

**TIP**

Please bear in mind that when switching off the Nexa® 1200 it can no longer provide energy to the DC/DC converter. This can lead to the undesired shut-off of the overall system. In automatic Battery Charging mode this assumes the function of the DC/DC converter.

How to switch the Hybrid Extension Kit

3. Switch off the load, if necessary.
4. Switch the main switch to *OFF* in order to switch off the Hybrid Extension Kit.

⇨ *The system will be switched off immediately.*

## 5.4 Control Software

### 5.4.1 Software Control Elements

Navigation

Navigation takes place through the horizontally arranged tabs:

- *STATUS*: Display and change of current values of the DC/DC converter
- *ERRORS*: The occurrence of an error is signaled by color
- *WARNING*: A current warning is signaled by color
- *FUNCTIONS*: Control and parameterization of automatic battery charging mode

The following functions are listed through the menu bar:

- *FILE*: File administration functions
  - *SAVE CONFIG FILE: Save current parameterization*
  - *LOAD CONFIG FILE: Load parameterization*
  - *EXIT: End program*

- *SERVICE*: Functions for commissioning
  - *Definition of the communication interface on the PC (COM PORT)*
  - *Establishing communication (SIO START)*
- *INFO*: Information about the program

Operating mode

In the horizontal field below the tab, the current operating mode of the DC/DC converter is indicated by text and color coding. The assignment of colors to modes of operation corresponds to that of the LEDs on the front side of the DC/DC converter.

| Color | Operating mode |
|---|---|
| White | No communication |
| Orange | Standby: No power output from the DC/DC converter |
| Green | Active: Power input of the DC/DC converter is switched on<br>Automatic Charge: Automatic battery charger is switched on, DC/DC converter assumes control of the Nexa®1200 and switches its load on as needed |
| Red | Error |

Table 5-2 Color coding of operating modes

Status line

The status line contains information on the

- Software version
- Hardware version (24 V or 48 V)
- Device serial number
- Date and time
- The status of the communication is indicated by color and text in the *COM PORT XX ACTIVE* field:

| Color | Text | Communication status |
|---|---|---|
| Green | Active | Communication established |
| Red | Error | Communication interrupted |

Table 5-3 Color and text coding of the communication status

### 5.4.2 Status Tab

The following is displayed and changed, if applicable, in the *STATUS* tab:

- Current values of the DC/DC converter
- Adjustable parameters
- Status messages
- Current control unit of the DC/DC converter
- Status of the digital GPIOs

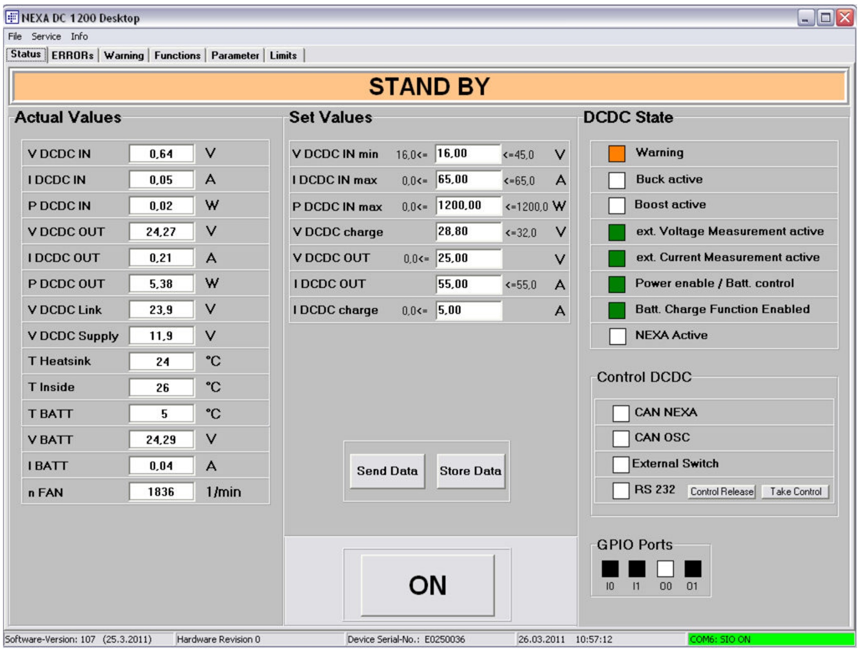



Fig. 5-6 STATUS tab in Standby mode

**Current values**

The current values of the DC/DC converter are displayed in the *ACTUAL VALUES* column. This data cannot be changed here. The respective current control parameter is shown with a green background.

**Change parameter**

The parameters which can be changed are shown in the *SET VALUES* column.

You can change the parameters as follows:

✓ Put the DC/DC converter in standby mode

1. Enter the values in the appropriate input fields.
2. Confirm changed values with the *SEND DATA* button.

   ⇨ *The parameterization is transmitted to the DC/DC converter.*

3. If the parameterization should be permanently defined, save it using the *STORE DATA* button.

**Status messages**

In the DCDC State column the respective Status of the DC/DC converter is signaled by color.

| Status message | Meaning | Signal |
|---|---|---|
| Warning | A warning is pending | Orange |
| Buck active | Step-down converter | Green |
| Boost active | Step-up converter | |
| Ext. Voltage Measurement active | External voltage measurement active | |
| Ext. Current Measurement active | External current measurement active | |
| Power enable / Batt control | Load monitoring / battery check | |

| Status message | Meaning | Signal |
|---|---|---|
| Batt. Charge Function Enabled | Battery monitoring is set | |
| Nexa active | Nexa® 1200 is running | |

Table 5-4 Status of the DC/DC converter

Control unit

The Control DCDC column shows the current control unit for the DC/DC converter.

| Control unit | DC/DC converter is controlled by | Signal |
|---|---|---|
| CAN NEXA | Nexa® 1200 through CAN | Green |
| CAN OSC | Nexa® OSC through CAN | |
| External Switch | Hybrid Extension Kit | |
| RS232 | RS232 communication | |

Table 5-5 Control unit of the DC/DC converter

RS232 communication

If the DC/DC converter should be controlled through RS232, proceed as follows:

1. Switch the *REMOTE CONTROL* switch on the Hybrid Extension Kit to *ON*.
2. Confirm the change by clicking on the *TAKE CONTROL* button.

   ⇨ *The DC/DC converter is controlled through RS232 communication until the communication is returned by the remote instance and then REMOTE CONTROL is switched to OFF.*

If the DC/DC converter should be controlled through the Hybrid Extension Kit or through the CAN (depending on what is attached), proceed as follows:

3. Release the communications connection again by clicking on the *CONTROL RELEASE* button.

During the RS232 control of the DC/DC converter the power output is released by clicking on the *ON* button.

During operation the text on the button changes to *OFF*. Click the *OFF* button to close the power output.

Status of the digital inputs and outputs

The status of the digital inputs and outputs is displayed under *GPIO PORT*.

### 5.4.3 Errors Tab

Pending errors are indicated by color in the *ERRORS* tab.

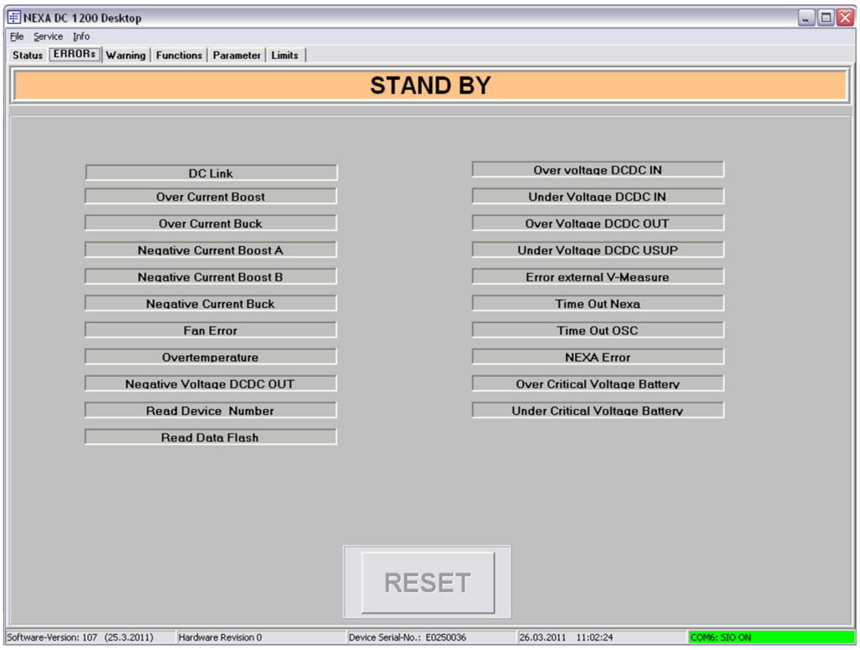



Fig. 5-7 Errors tab

For troubleshooting, see Errors and Troubleshooting starting on page 47.

Reset rectified errors by clicking on the RESET button.

### 5.4.4 Warning Tab

Warnings due to a problem which can lead to an error status are signaled by color in the WARNING tab.

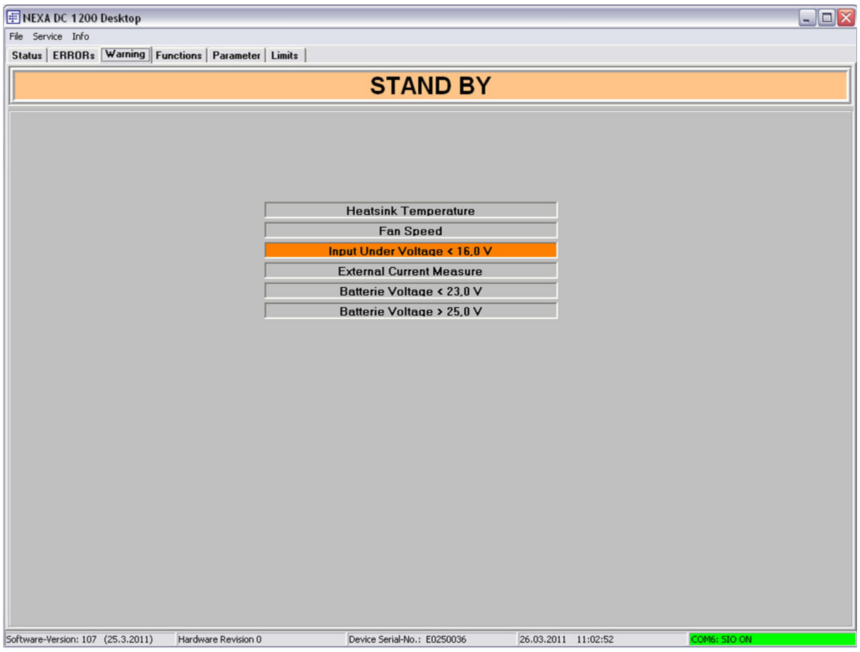



Fig. 5-8 WARNING TAB

## 5.4.5 Functions Tab

The automatic battery charger of the DC/DC converter is controlled and parameterized in the FUNCTIONS tab.

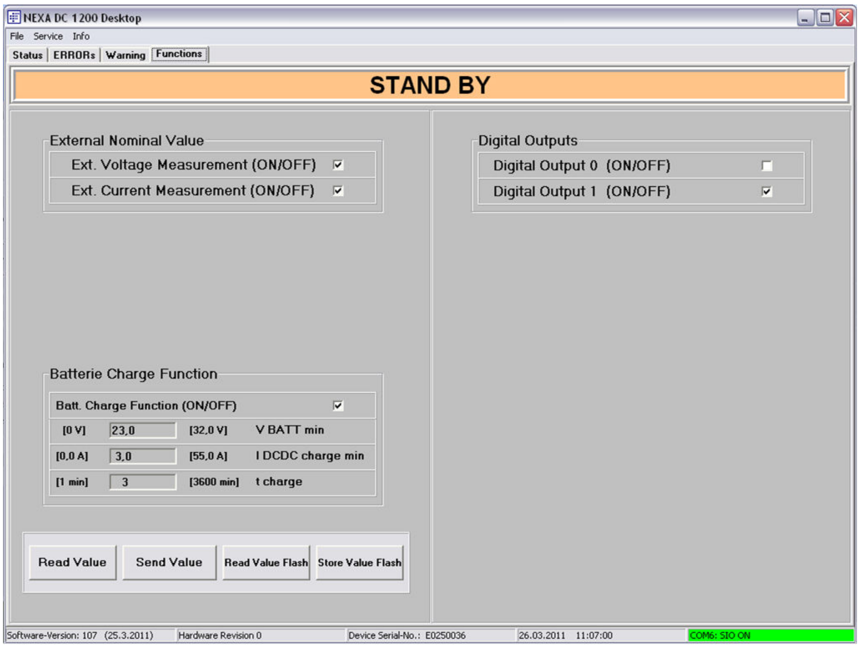



Fig. 5-9 FUNCTIONS TAB

The DC/DC converter makes it possible to regulate to its battery current (external current sensor) or to output current (internal current sensor). In addition, the battery voltage can be measured directly and utilized for the regulation. Regulation takes place by default to the external current sensor of the DC/DC converter.

How to regulate to the internal current sensor

In order to regulate to the output current of the DC/DC converter and not to the battery current, proceed as follows:

1. EXT. DEACTIVATE CURRENT MEASUREMENT under EXTERNAL NOMINAL VALUE.
2. EXT. DEACTIVATE VOLTAGE MEASUREMENT under EXTERNAL NOMINAL VALUE.

⇨ *The internal current measurement is activated.*

How to parameterize the automatic battery charger

You can adjust the following settings under BATTERY CHARGE FUNCTION:

| Function | Definition | Setting / Unit |
|---|---|---|
| BATT. CHARGE FUNCTION | Switch on battery charger | Activate / deactivate |
| V BATT MIN | The battery voltage level below which the recharging of the Nexa® 1200 is started | V |
| I DCDC CHARGE MIN | Minimum charge current below which the trickle charge begins<br>NOTICE! I_DCDC_out < I_DCDC_Charge_min. | A |
| T CHARGE | Recharging time in which the battery is charged before the Nexa® 1200 switches to Standby mode | min |

Table 5-6 How to parameterize the automatic battery charger

Please note that it is only possible to change data in standby mode. To change values, proceed as follows:

✓ DC/DC converter in standby mode

1. Enter values in the appropriate fields or mark the box.
2. Confirm the specification with the SEND DATA button
3. If the values should also permanently remain in the flash memory of the device and be used again on the next start-up, save them using the STORE DATA button

⇨ *The parameterization is transmitted to the DC/DC converter.*

The current values of the DC/DC converter and/or the flash memory are displayed with the READ and READ FLASH buttons.

# 6 Decommissioning

## 6.1 Shut Down the DC/DC Converter

The following steps must be performed to shut down the DC/DC converter:

- How to Switch off the DC/DC Converter
- How to Disconnect Connections of the DC/DC Converter
- How to Disconnect the Connections of the Lead Batteries
- How to Disconnect Connections of the Hybrid Extension Kit
- How to Remove the Connections of the Load Relay

### 6.1.1 How to Switch off the DC/DC Converter

Proceed as follows to switch off the DC/DC converter:

1. Switch off all consumers and loads.
2. Use the *POWER* switch to switch off the unit, the Hybrid Extension Kit and all external supply voltages.

   ⇨ *DC/DC converter is switched off.*

### 6.1.2 How to Disconnect Connections of the DC/DC Converter

Disconnect the connections from the DC/DC converter as follows:

✓ DC/DC converter is switched off

✓ Philips-head screwdriver

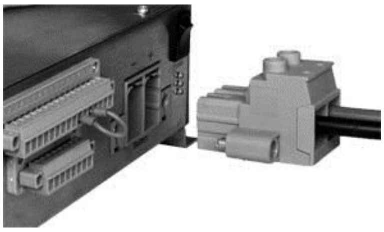


Fig. 6-1 Unplug plug from *BATTERY* connection

1. Loosen all locking screws.
2. Unplug plug from *BATTERY* connection.
3. Unplug all other plug connectors.

Disconnect DC/DC converter from Nexa® 1200:

4. Loosen locking screws on the power outputs of the Nexa® 1200.
5. Remove both power cables.
6. Tighten the locking screws hand-tight.

7. Unscrew screws on the *Fuel Cell* power output of the DC/DC converter.
8. Remove both power cables.
9. Tighten screws on power input.

   ⇨ *Connections from DC/DC converter are disconnected. The DC/DC converter can now be stored.*

### 6.1.3 How to Disconnect the Connections of the Lead Batteries

Disconnect the connections from the lead batteries as follows:

- ✓ Philips-head screwdriver
- ✓ 8 mm open-end wrench

1. Loosen the screw connection on the poles of the lead battery.
2. Remove the cable.
3. Reconnect screw connections.

   ⇨ *The connections are now disconnected from the lead batteries. They can now be stored.*

### 6.1.4 How to Disconnect Connections of the Hybrid Extension Kit

Disconnect the connections from the Hybrid Extension Kit as follows:

- ✓ Philips-head screwdriver

1. Loosen all locking screws on the Hybrid Extension Kit.
2. Pull off the plug connectors.

Connecting cable for Nexa® 1200

3. Loosen the locking screws of the following connections on the Nexa® 1200:
   - *Power Supply*
   - *Remote Control*
   - *Safety Chain*
4. Pull off the plug connectors.
5. Disconnect the 2-wire lead with wire end ferrules from the load relay of the Nexa® 1200.

   ⇨ *The connections are now disconnected from the Hybrid Extension Kit. It can be stored.*

### 6.1.5 How to Remove the Connections of the Load Relay

Disconnect the connections from the load relay as follows:

1. Loosen screws for the contacts on the load relay.
2. Remove leads and power cables.

3. Tighten screw of the contacts hand-tight

   ⇨ *The connections are now disconnected from the load relay. It can be stored.*

## 6.2 Store or Transport the Nexa® DC1200

The unit can be stored or transported as needed. During transport, the unit should not be exposed to freezing temperatures or excessive heat for extended periods.

The position of the unit during transport is not important. When packing the single components, they must be sufficiently padded to protect them against impact and fast acceleration.

# 7 Troubleshooting

## 7.1 FAQ

1. How can I check if the CAN communication is working?

   ⇨ *Connect the CAN-USB adapter (connected to the USB port of your PC) directly to the CAN network on the Nexa® 1200 or Nexa® DC1200 and check the CAN traffic using the CAN-USB monitor software (PCAN View).*
   ⇨ *Use the PCAN-USB monitor software to check the ID addresses of the Nexa® DC1200. If the communication is functioning properly the messages received must be in the 400 range.*
   ⇨ *Check the wiring of the communication and whether the CAN is properly connected to the terminating resistors.*
   ⇨ *Check whether you are using a null modem cable including terminating resistors or a CAN cable. Rule out the use of an RS232 cable.*

2. How do I determine the hardware and software version of my Nexa® DC1200?

   ⇨ *The status bar of the supplied Control Software displays the hardware version and the version number of the firmware currently installed on the converter. Properly functioning communication between the computer and the DC/DC converter is prerequisite.*

3. When is recharging or battery charging ended in general?

   ⇨ *You can discontinue battery charging at any time and switch the DC/DC converter to Standby mode.*

   – *If operated through RS232, switch the DC/DC converter to OFF by means of the connected Control Software.*
   – *If the Hybrid Extension Kit is used, switch the REMOTE CONTROL switch to ON. To reactivate the battery charger, switch the REMOTE CONTROL switch to OFF.*

   ⇨ *The DC/DC converter switches off after the output current (and not the battery current) has dropped below the value I_Charge_min for the duration of t_reload.*

4. Does the Nexa® 1200 switch to Standby mode after every successful battery charging?

   ⇨ *Yes, if the automatic battery charger is used.*
   ⇨ *No, without the automatic battery charger.*

5. How do I have to parameterize the DC/DC converter with active battery charger if I first wish to discharge the batteries before the Nexa® 1200 supplies energy?

⇨ *Set the V_Batt_min to the battery voltage to which the batteries are to be discharged. The automatic battery charger starts recharging the batteries only after the voltage drops below this level.*

6. How should I parameterize the DC/DC converter if I primarily use the energy from the fuel cell and the batteries are to be used only for peak loads.

   ⇨ *Use the battery current sensor for this. It always attempts to bring the batteries to the charging state that you specified with your parameterization. The load energy primarily supplies the fuel cell through the battery sensor.*

7. How do I activate energy-saving mode?

   ⇨ *The overview diagram included in the instruction manual shows a bridge which has to be disconnected for this function* *(see also Option 2: Energy saving mode, page 26).*

8. Is it possible to store the system characteristics in the unit without external software and retrieve them at a later time?

   ⇨ *No. The internal memory is not designed for this.*

9. Is it possible to retrieve data from an error memory for service purposes?

   ⇨ *No. The DC/DC converter itself has no internal error memory.*

10. Why does T_Batt display 500°C?

    ⇨ *The field is additionally grayed out. Both together symbolize that no temperature sensor is connected.*

11. Is the battery temperature integrated in the safety shut-off?

    ⇨ *No. Since different batteries can be connected to the converter, the temperature measurement was not included in the safety shut-off.*

12. How can the total output voltage range of the converter be used?

    ⇨ *This requires a parameterization that is outside of the intended use of the DC/DC converter with a connected battery. A corresponding parameterization is possible. To do this, please contact Heliocentris Service.*

13. Can I connect batteries other than those sold by Heliocentris?

    ⇨ *Yes; however, the converter is parameterized at the factory for the batteries available from Heliocentris and depicted in the instruction manual. For use of other batteries, a corresponding parameterization of the DC/DC converter in accordance with the specifications of the data sheet of the battery manufacturer is necessary.*

14. Can the output parameters (voltage, current and power) of the Nexa® 1200 fuel cell system be limited by the converter?

    ⇨ *Yes. The Nexa® 1200 can be limited by the parameters V_DCDC_IN / I_DCDC_IN and P_DCDC_IN.*

15. Is it possible to incorrectly connect the 8-pin plug connector on the Hybrid Extension Kit?
    - ⇨ *No, the coding precludes the possibility of incorrect connection. Each plug connector fits only one connection.*
16. Do I have to disconnect the communication by means of the CONTROL RELEASE button after parameterization of the DC/DC converter?
    - ⇨ *If you wish to operate the DC/DC converter by means of the Control Software, you do not have to disconnect the communication.*
    - ⇨ *However, for autarkic operation of the DC/DC converter, disconnection by means of the CONTROL RELEASE button is necessary.*

## 7.2 Behavior in the Event of an Error

With the use of the Hybrid Extension Kit, safety-oriented monitoring of the connected batteries can take place in order to prevent a deep discharge or overloading.

When the battery voltage falls below the critical level the connected load relay is opened and the system is put in a safe state.

With supply through a battery (hybridization) or in operation with an external mains adapter, a controlled overall system shut-off always takes place in the event of an error.

Restart after an error

➔ Press and hold the SYSTEM START button until the green SYSTEM RUN LED illuminates.

In case of additional external voltage supply, errors which lead to a shut-off can be viewed and acknowledged with the Nexa® 1200 RCS or Nexa® DC1200 Control Software.

## 7.3 Errors and Troubleshooting

<table>
<tr><th>Error / Error message</th><th>Possible cause</th><th>Solution</th></tr>
<tr><td rowspan="2">Red LED blinks</td><td>Units not connected correctly</td><td rowspan="2">Check connections and correct, if necessary</td></tr>
<tr><td>Polarity of outputs is reversed</td></tr>
<tr><td rowspan="2">After successful parameterization by means of the Control Software, the DC/DC converter cannot be operated without the Control Software</td><td rowspan="2">Operation of the DC/DC converter is possible only by means of the instance for which the corresponding flag lights up under “DCDC Control”. All controls by means of the other displayed possibilities are disabled.</td><td>Disconnect communication of the Control Software by means of the CONTROL RELEASE button in the STATUS tab.</td></tr>
<tr><td>SWITCH THE REMOTE CONTROL switch on the Hybrid Extension Kit from ON to OFF</td></tr>
</table>

| Error / Error message | Possible cause | Solution |
|---|---|---|
| DC/DC converter cannot be re-parameterized or started by means of the Control Software | | Switch *Remote Control* switch to ON and take control of the communication with the *Take Control* button under DCDC Control on the *Status* tab. |
| Control Software does not respond and cannot be shut down. | Control Software is hanging due to an error in the hardware's RS232 communication | Switch Hybrid Extension Kit to *Off* and reboot the PC |
| Control Software cannot establish communication to the DC/DC converter | Incorrect COM port | Select the correct COM port and activate the communication by means of “SIO Start” |
| | | Change the COM port to a number smaller than 10 in the properties of the COM port in the Hardware Manager |
| Control Software cannot establish communication to the DC/DC converter<br>Status window for communication in the lower right corner of the Control Software lights up green; however, the horizontal display field beneath the tab remains white. | If a USB-RS232 adapter is used, the cause could be a slow update rate of the input and transfer buffer of the RS232 interface or of the RS232 to USB converter. | This can be configured in the properties of the COM port in the Hardware Manager and also in the advanced connection settings: Reduce update rate of both buffer memory to the minimum value |
| When parameters are changed, this is indicated by a red font | The parameters are outside of the permissible limits | Change the parameters within the valid range |
| | | Restart after simultaneously changing several parameters, so that the limit ranges are adapted. The changes of permissible ranges are applied only after restarting the DC/DC converter |
| | | Specify parameters I_DCDC_out > I_DCDC_charge and V_DCDC_charge > V_out |
| The DC/DC converter does not retain the parameterized values after restarting the DC/DC converter | Pressing the *Send* button stores parameters only in cache memory, so they are not available after a restart | Parameters must be saved in Standby with the *Store* button |
| After stopping, the Nexa® 1200 reproducibly switches from battery charger to error status | Non-compatible Nexa® 1200 firmware | Contact Heliocentris Service |
| | Insufficient hydrogen inlet pressure | Check whether sufficient hydrogen is present (recommended inlet pressure range: 2...12 bar) |
| | | Attempt to identify the error with the supplied RCS software |
| DC/DC converter repeatedly switches to error status *Under Critical Voltage* | Battery voltage may be too low, i.e. outside of the permissible limits | Measure the battery voltage and check whether the batteries are totally discharged |

| Error / Error message | Possible cause | Solution |
|---|---|---|
| | Battery voltage measurement at the DC/DC converter is possibly negative | Check the setup of the DC/DC converter based on the setup instructions; measure battery voltage at the 16-pin plug of the DC/DC converter, terminal 5 (+) and 6(-). Between these terminals it has to be possible to measure the battery voltage with corre-sponding polarity. If not, connect these leads so that the polarity of the battery voltage at the DC/DC converter is correct |
| | In operation, the load current is too high and the U_Batt_min is too low, so that the DC/DC converter does not have enough time to start the Nexa 1200. Startup of the Nexa® 1200 lasts about 25 seconds | Change parameter |
| DC/DC converter repeatedly switches to error status EXT. VOLTAGE MEASUREMENT | Battery voltage measurement unit not connected correctly | Connect battery voltage meas-urement unit correctly according to the setup instructions |
| DC/DC converter repeatedly switches to error status due to fan error and cannot be reset | There is a hardware error | Contact Heliocentris Service |
| The Nexa® 1200 does not start in Battery Charging mode | Battery voltage still above the configured V-Batt Min | Change parameter |
| | CAN communication is not correctly set up | Set up CAN communication according to setup instructions |
| | The Nexa® 1200 receives no supply voltage through the Hybrid Extension Kit | Check bridge of the Energy Saving mode. If this is connected, check the supply voltage on the 3-pin connecting terminal of the Nexa® 1200. If you were not able to eliminate the error, please contact Heliocentris Service. |
| Battery charger is not switched off in hybrid operation when level falls below I_change and t_charge has expired | In general, the output current of the DC/DC converter, not the charging current of the batteries, is decisive for switching off the battery charging. Please remem-ber that the Hybrid Extension Kit has an approximate current consumption of 1.5 A and in Energy Saving mode approxi-mately 0.3 A | Change parameter |
| When the Nexa® 1200 load relay is switched on the DC/DC converter repro-ducibly switches to error status | | Contact Heliocentris Service |

| Error / Error message | Possible cause | Solution |
|---|---|---|
| Nexa® 1200 is functioning, but the LED Nexa RUN on the Hybrid Extension Kit does not indicate this | The connecting cable between the kit and the external load relay of the Nexa® 1200 was not connected or was connected incorrectly | Connect connecting cable correctly |
| Load relay on the batteries switches on and off periodically | | Check the setup and all wiring based on the setup instructions |
| | | Disconnect the load from the batteries and attempt to operate the setup without a load |
| | | Check whether the battery voltage at the DC/DC converter is correct |
| | The green cable with a ring cable lug is fastened on the battery side of the load relay | The green cable with a ring cable lug must be fastened on the load side of the load relay |
| When System Start is pressed, nothing happens; DC/DC converter LEDs do not light up | | Check the setup and all wiring based on the setup instructions |
| | | Switch main switch of the Hybrid Extension Kit to *ON* |
| | | Switch main switch of the DC/DC converter to *ON* (switch position down) |
| | | Check whether the polarity of the battery voltage at the DC/DC converter is correct |
| When System Start is pressed one can hear the load relay switching and after releasing the button the relay drops again | | Check the setup and all wiring based on the setup instructions |
| | The green cable with a ring cable lug is fastened on the battery side of the load relay | The green cable with a ring cable lug must be fastened on the load side of the load relay |
| When System Start is pressed one can hear the load relay switching back and forth | | Check whether the polarity of the battery voltage at the DC/DC converter is correct |
| | The green cable with a ring cable lug is fastened on the battery side of the load relay | The green cable with a ring cable lug must be fastened on the load side of the load relay |
| As soon as the main switch of the Hybrid Extension Kit is switched on the entire system switches to operating mode | There is a hardware error | Contact Heliocentris Service |
| All three LEDs on the DC/DC converter light up constantly | The DC/DC converter did not have sufficient time to start its controller properly | Switch off the DC/DC converter for at least 3 seconds and then switch it on again |

Table 7-1 Error messages and troubleshooting

# 8 Maintenance and Service

## 8.1 Maintenance

The unit is maintenance-free.

## 8.2 Cleaning

✓ Moist, lint-free cloth

1. Switch the DC/DC converter off circuit.
2. Clean the case with a slightly moist, lint-free cloth.

## 8.3 Service

If you experience problems with the system, then please

contact: Heliocentris Academia International GmbH

Rudower Chaussee 30

12489 Berlin

Germany

Phone: +49(0)30–340601-600

Email: service@heliocentrisacademia.com

An employee from Heliocentris Customer Service will contact you and explain all further steps. If you return the system for repair or replacement, you must ship the system sufficiently secured and packaged.

Heliocentris is not responsible for damage which has been caused by improper packaging and / or improper shipment. You must bear the costs yourself for the shipment of systems with expired warranty.

# 8.4 Disposal

## 8.4.1 Lead batteries

Never dispose of lead batteries with the household trash.

➔ Recycle lead batteries.

➔ Return used lead batteries to Heliocentris for disposal.

## 8.4.2 Unit

The unit is not registered for use in private households. Therefore, it may not be disposed of at the local recycling centers. Return the unit to Heliocentris for disposal.

## 8.4.3 Packaging Material

➔ Dispose of packaging material that is no longer needed in accordance with the local laws and regulations.

# 8.5 Warranty

Heliocentris guarantees the components of the unit for a period of 1 year.

The warranty only covers defects which are present at the time of the handover of the product from the seller to the purchaser.

A warranty for specific characteristics (e.g. power and service life of the fuel cell) is not made.

Warranty claims against Heliocentris cannot be made if:

- The customer has caused the damage by improper use or incorrect operation
- Unauthorized repairs or manipulations have been made to the product
- The customer has neglected his duty of supervision and has caused damage to third parties

The supplier is liable for damage caused during the delivery to the customer and provides replacement in the case of damage.

In the case of complaints and return of the product, the risk is borne by the customer who must provide proper and secure packaging.

# 9 Integration

## 9.1 Protocol Definition of the CAN-Interface

This chapter contains the protocol definition of the CAN interface for the communication of the DCDC Converter Nexa® DC1200 with an external control unit.

The communication of the device is carried out through a CAN bus (Controller Area Network) without an advanced implementation of protocol, i.e. the useful information is directly embedded within the OSI layer 2 (data back-up layer). In order to denote the content of the messages an 11bit identifier (Base Frame Format) is used. The bus works with a speed of 500 kBaud.

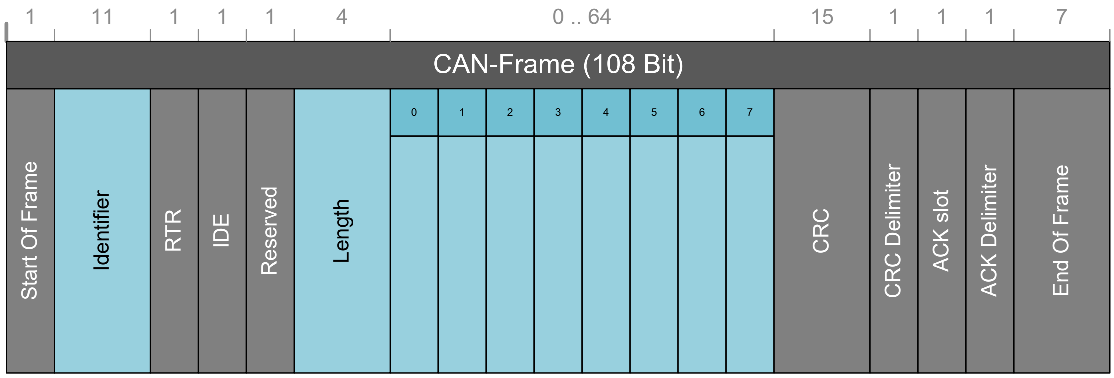



Fig. 9-1 CAN frame

Fig. 9-1 displays the content (frame) of a CAN message with the inscription of the corresponding identifiers (ID) and their length. Table 9-1 until Table 9-3 display which identifier is used for communication with the Nexa® DC1200 DC/DC converter, its length (measured in byte) and transfer rate (T). An exact description of the message contents can be found in Chapters 9.1.1 and 9.1.2.

| Identifier | Length | T | Content |
|---|---|---|---|
| 0x490 | 8 | 100ms | system commands for the control of the Nexa® DC1200 (start, stop, error reset) |

Table 9-1 CAN message, which is transmitted from the external control to the DC/DC converter

| Identifier | Length | T | Content |
|---|---|---|---|
| 0x400 | 8 | 25ms | input, and output voltage and input and output current |
| 0x410 | 8 | 100ms | status, error and warning notifications |
| 0x420 | 8 | 50ms | external sensors (current and voltage) as well as internal data |

| Identifier | Length | T | Content |
|---|---|---|---|
| 0x430 | 8 | 50ms | parameters und status notifications |

Table 9-2 CAN message, which is transmitted from the DC/DC converter to the external control.

| Identifier | Length | T | Content |
|---|---|---|---|
| 0x710 | 8 | 100ms | System Commands for automatic battery chargers, serves the control of the Fuel Cell System with the DC/DC converter (Start, Stop and Error-Reset) |

Table 9-3 CAN message, which is transmitted DC/DC converter to the Nexa® 1200 fuel cell system

**TIP** As soon as the DC/DC converter once receives the CAN message with ID 0x490 to start, it expects a heartbeat every 1000 msec from the external control. If it does not occur the DC/DC converter changes into error mode.

**TIP** The DC/DC converter can be operated via RS232, CAN or via digital input. The respective selected option blocks the other two options. Thus, if the converter is operated by an external control via CAN message 0x490 , then the RS232 interface and the digital input are ignored.

### 9.1.1 Message Definition of Incoming Messages

Description of CAN messages (request) which are sent from an external control unit to Nexa® DC1200.

**Identifier 0x490**

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| DCDC_Param. Nr. (X)_HB | DCDC_Param. Nr. (X)_LB | DCDC_PAR_(X)1_HB | DCDC_PAR_(X)1_LB | DCDC_PAR_(X)2_HB | DCDC_PAR_(X)2_LB | DCDC_PAR_(X)3_HB | DCDC_PAR_(X)3_LB |

Fig. 9-2 Description of the content of CAN message 0x490

The request ID 0x430 requests the CAN message with ID 0x430 from the DC/DC converter. Length and content of this message are variable and dependent on the byte0 multiplexer of the request (0x490). The multiplexer of 0x430 can also be found in the byte0 of the response.

| Status_No. (X) | Description | DCDC_P_(X)1 | DCDC_P_(X)2 | DCDC_P_(X)3 |
|---|---|---|---|---|
| 0x0001 | Standby | 0xAA55 | 0xAA55 | 0xAA55 |
| 0x0002 | tabu | 0xAA55 | 0xAA55 | 0xAA55 |

| Status_No. (X) | Description | DCDC_P_(X)1 | DCDC_P_(X)2 | DCDC_P_(X)3 |
|---|---|---|---|---|
| 0x0003 | tabu | 0xAA55 | 0xAA55 | 0xAA55 |
| 0x0004 | Active | 0xAA55 | 0xAA55 | 0xAA55 |
| 0x0005 | Reset | 0xAA55 | 0xAA55 | 0xAA55 |
| 0x0006 | Store Parameter | 0xAA55 | 0xAA55 | 0xAA55 |
| 0x0007 | Reserved | 0xAA55 | 0xAA55 | 0xAA55 |
| 0x0201 | Reserved | 0xAA55 | 0xAA55 | 0xAA55 |
| 0x0008 | External Voltagemeasurement active | 0xAA55 | 0xAA55 | 0xAA55 |
| 0x0009 | Internal Voltagemeasurement active | 0xAA55 | 0xAA55 | 0xAA55 |
| 0x000A | Reserved | 0xAA55 | 0xAA55 | 0xAA55 |
| 0x000B | Reserved | 0xAA55 | 0xAA55 | 0xAA55 |
| 0x0204 | Reserved | 0xAA55 | 0xAA55 | 0xAA55 |
| 0x0205 | Takeover of external control | 0xAA55 | 0xAA55 | 0xAA55 |
| 0x0206 | Reserved | 0xAA55 | 0xAA55 | 0xAA55 |
| 0x2A1 | External Currentmeasurememt active | 0xAA55 | 0xAA55 | 0xAA55 |
| 0x2A2 | Internal Currenmeasure-ment_Active | 0xAA55 | 0xAA55 | 0xAA55 |
| 0x301 | DC/DC-Standard-Operation | 0xAA55 | 0xAA55 | 0xAA55 |
| 0x302 | DC/DC-Auto-Batteryloadingprocess | 0xAA55 | 0xAA55 | 0xAA55 |
| 0x303 | Batterymonitoring_ON | 0xAA55 | 0xAA55 | 0xAA55 |
| 0x304 | Batterymonitoring_OFF | 0xAA55 | 0xAA55 | 0xAA55 |
| 0x0202 | Disable external control | 0xAA55 | 0xAA55 | 0xAA55 |
| 0x0203 | Reserved | 0xAA55 | 0xAA55 | 0xAA55 |
| 0x0100 | Reserved | 0xAA55 | 0xAA55 | 0xAA55 |
| 0x0010 | Send_Serialnumber | 0xAA55 | 0xAA55 | 0xAA55 |
| 0x0011 | Send_SW-Versionnumber | 0xAA55 | 0xAA55 | 0xAA55 |
| 0x0012 | Send_HW-Versionnumber | 0xAA55 | 0xAA55 | 0xAA55 |
| 0x002(X) | Reserved | DCDC_PAR_(X)1 | DCDC_PAR_(X)2 | DCDC_PAR_(X)3 |
| 0x003(X) | Reserved | DCDC_PAR_(X)1 | DCDC_PAR_(X)2 | DCDC_PAR_(X)3 |
| 0x004(X) | Send_Parameter (0x0001…0x0002) | 0xAA55 | 0xAA55 | 0xAA55 |
| 0x005(X) | Reserved | 0xAA55 | 0xAA55 | 0xAA55 |
| 0x006(X) | Reserved | 0xAA55 | 0xAA55 | 0xAA55 |
| 0x007(X) | Reserved | DCDC_PAR_(X)1 | DCDC_PAR_(X)2 | DCDC_PAR_(X)3 |
| 0x004(X) | Send_Parameter (0x0041…0x0042) | 0xAA55 | 0xAA55 | 0xAA55 |

Table 9-4 Description of the content of CAN message 0x490

### 9.1.2 Message Definition of Outgoing Messages

Description of CAN messages which are sent from the Nexa® DC1200 to an external control unit.

#### Identifier 0x400

With frame ID 0x400 data concerning input and output voltages and input and output currents is sent cyclically every 25ms.

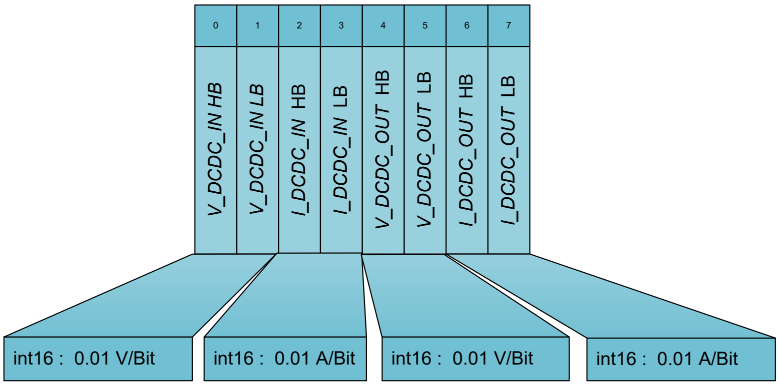



Fig. 9-3 Description of the content of CAN message 0x400

#### Identifier 0x410

With frame ID 0x410 status messages, error and warning messages are sent cyclically every 100 ms.


Fig. 9-4 Description of the content of CAN message 0x410

| Content | Bitfeld | Meaning | Content | Bitfeld | Meaning |
|---|---|---|---|---|---|
| Status regulator | 0 | Ucharge-Regulator active | Converter warning | 0 | Warning Heatsink Temperature |
| | 1 | Icharge-Regulator active | | 1 | Warning Fan Speed |
| | 2 | P_in-Regulator active | | 2 | Warning Ibatt-Measure |
| | 3 | I_in -Regulator active | | 3 | |
| | 4 | Ufc_min-Regulator active | | 4 | Warning Undervoltage U_in |
| | 5 | Uzk-Regulator active | | 5 | Warning Undervoltage U_out |
| | 6 | | | 6 | Warning Battery Voltage too low |
| | 7 | | | 7 | Warning Battery Voltage too high |

| Content | Bitfeld | Meaning | Content | Bitfeld | Meaning |
|---|---|---|---|---|---|
| Converter status | 0 | Buck active | Converter error 1 | 0 | DCDC Link |
| | 1 | Boost active | | 1 | Over Current Boost |
| | 2 | DCDC Error | | 2 | Over Current Buck |
| | 3 | Warning | | 3 | Negative Current Boost A |
| | 4 | DCDC Standby | | 4 | Negative Current Boost B |
| | 5 | Control via CAN | | 5 | Negative Current Buck |
| | 6 | Control via CAN-NEXA | | 6 | Fan Error |
| | 7 | Control via RS232 | | 7 | Overtemperature Heatsink |
| | 8 | Control via Digital IO | | 8 | Negative Voltage DCDC Out |
| | 9 | Converter active | | 9 | Read Device Number |
| | 10 | ext. Voltage Measurement active | | 10 | Read Data Flash |
| | 11 | int. Voltage Measurement active | | 11 | External Voltage Measuring |
| | 12 | Buffer Status | | 12 | Over Voltage DCDC OUT |
| | 13 | int. Current Measurement active | | 13 | NEXA Error |
| | 14 | ext. Current Measurement active | | 14 | Over Critical Battery Voltage |
| | 15 | Charge active | | 15 | Under Critical Battery Voltage |
| Converter error 2 | 16 | | Status DIGI I/O | 0 | DIGI-IN1 |
| | 17 | | | 1 | DIGI-IN2 |
| | 18 | | | 2 | DIGI-OUT1 |
| | 19 | | | 3 | DIGI-OUT2 |
| | 20 | | | 4 | |
| | 21 | | | 5 | |
| | 22 | | | 6 | |
| | 23 | | | 7 | |

Table 9-5 Description of the content of CAN message 0x410

### Identifier 0x420

With frame ID 0x410 data of external sensors and internal data is sent cyclically every 50ms.

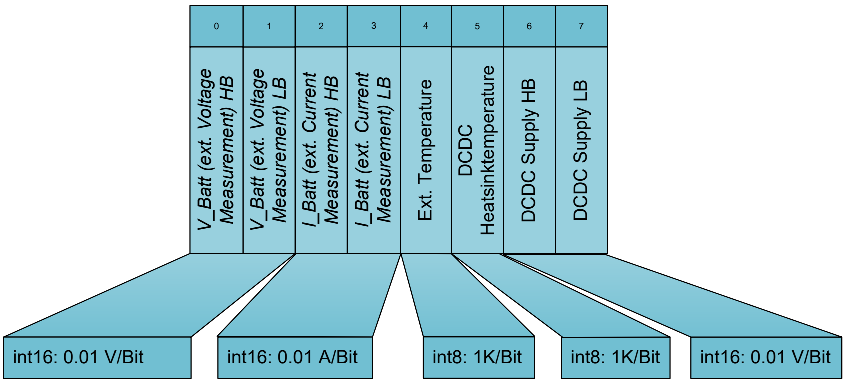



Fig. 9-5 Description of the content of CAN message 0x420

### Identifier 0x430

With frame ID 0x430 parameters and status messages are sent cyclically every 50 ms.

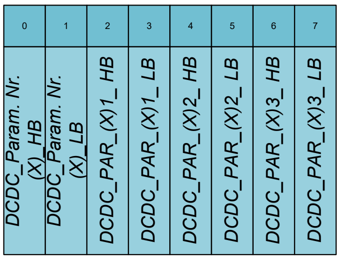



Fig. 9-6 Description of the content of CAN message 0x430

The CAN message with the ID 0x430 is always sent as a response to the request message ID 0x490. Length and content of this message is variable and dependent on the byte0 multiplexer of the request (0x490). The multiplexer of 0x430 can also be found in the byte0 of the response.

| DCDC_PARAM_No. (X) | DCDC_PAR_(X)1 | DCDC_PAR_(X)2 | DCDC_PAR_(X)3 |
|---|---|---|---|
| 0x0001 | DCDC_U_in_min | DCDC_I_in_max | DCDC_Pin_max |
| 0x0002 | DCDC_U_charge_max | DCDC_U_charge | reserved |
| 0x0003 | DCDC_I_charge | DCDC_I_charge_max | reserved |
| 0x0010 | 0x4953 = ASCII "IS" | Serial number Part1 | Serial number Part2 |
| 0x0011 | 0x4953 = ASCII "IS" | SW-Version number Part1 | SW-Version number Part2 |
| 0x0012 | 0x4953 = ASCII "IS" | HW-Version number Part1 | HW-Version number Part2 |
| 0x0031 | reserved | reserved | reserved |
| 0x0032 | reserved | reserved | reserved |
| 0x0033 | reserved | reserved | reserved |

| DCDC_PARAM_No. (X) | DCDC_PAR_(X)1 | DCDC_PAR_(X)2 | DCDC_PAR_(X)3 |
|---|---|---|---|
| 0x0034 | reserved | reserved | reserved |
| 0x003F | reserved | reserved | reserved |
| 0x00E1 | reserved | reserved | reserved |
| 0x00E2 | reserved | reserved | reserved |
| 0x00E3 | reserved | reserved | reserved |
| 0x00E4 | reserved | reserved | reserved |
| 0x00EF | reserved | reserved | reserved |
| 0x0041 | U_BATT_min | reserved | reserved |
| 0x0042 | I_charge_min | t_charge | |

Table 9-6 Description of the content of CAN message 0x430

### Identifier 0x710

During automatic battery charging function, cyclically every 100 ms the frame with identifier 0x710 sends a control signal (heartbeat) of the DC/DC converter to the Nexa® 1200 fuel cell system.

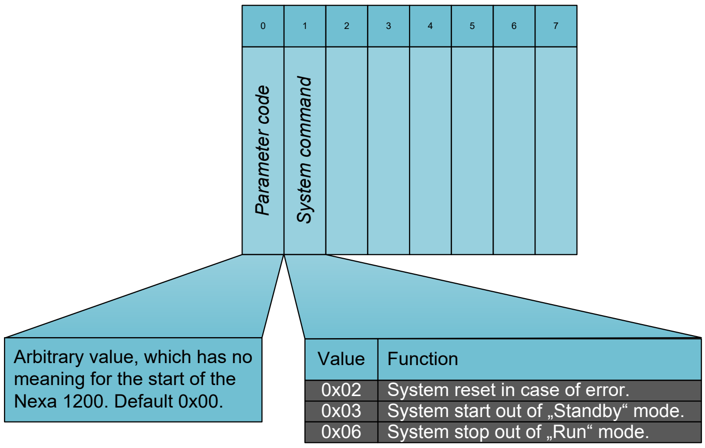



Fig. 9-7 Description of the content of CAN message 0x710

# 10 Technical Data

## 10.1 Nexa® DC1200

| Designation | | Specification |
|---|---|---|
| Dimensions | H x W x D | 80 x 320 x 170 mm |
| | Weight | 2.5 kg |
| | Maximum supply voltage | 50 V |
| Electrical power | Max. input power | 1500W |
| | Input voltage range | 16…45 V |
| Electric output of the DC/DC converter with 24 V | Max. output current | 55 A |
| | Rated output voltage | 24 V |
| | Output voltage range | 0...32 V |
| | Rated output current | 55A |
| | Efficiency | >95 % |
| Electric output of the DC/DC converter with 48 V | Max. output current | 27 A |
| | Rated output voltage | 48 V |
| | Output voltage range | 0...62 V |
| | Rated output current | 27 A |
| | Efficiency | >95% |
| Maximum output fluctuation | Max. output current fluctuation | 5% |
| | Maximum output voltage fluctuation | 1% |
| Operating environment | Operating location | Inside of labs, dry |
| | Ambient temperature | -10…55 °C |
| | Relative humidity, non-condensing | 0…95 % |
| Interfaces | | CAN |
| Electromagnetic compatibility | Interference emission and interference resistance (basic standards) | EN 61326<br>EN 55011 |

Table 10-1 Specifications of the DC/DC converter with 24 V and with 48 V

## 10.2 Lead Battery (optional)

Type WP18-12, lead battery (not included in delivery)

| Designation | Specification |
|---|---|
| Rated voltage | 12 V |

| Designation | | | Specification |
|---|---|---|---|
| Rated capacity (de-pendent on discharge current) | 20 h (0.9 A…10.5 V) | | 18 Ah |
| | 10 h (1.8 A…10.5 V) | | 18 Ah |
| | 5 h (3.06 A…10.2 V) | | 15.3 Ah |
| | 1 C (18 A…10.2 V) | | 8.1 Ah |
| | 3 C (54 A…9.6 V) | | 6.48 Ah |
| Maximum discharge current (30 seconds) | | | 360 A |
| Maximum discharge current (5 seconds) | | | 720 A |
| Operating temperature range | Charging | | 0…40 °C |
| | Discharging | | -15…50 °C |
| | Storage | | -15…40 °C |
| Charge retention at 20 °C | 1 month | | 92 % |
| | 3 months | | 90 % |
| | 6 months | | 80 % |
| Charging methods at 25 °C | Cycle | Charge voltage | 14.4…15.0 V |
| | | Max. charging current | 5.4 A |
| | Standby | Charging voltage (fluctuating) | 13.5…13.8 V |
| Service life | Cycle operation | 100 % discharge | 200 cycles |
| | | 80 % discharge | 225 cycles |
| | | 50 % discharge | 500 cycles |
| | Standby operation | | 3…5 years |
| Internal resistance at 1 KHz | | | 10 mΩ |
| Connection | | | F3 |
| Weight | | | 6.283 kg |

Table 10-2 Specifications of the lead batteries

## 10.3 Standards and Guidelines

The Nexa® DC1200 complies with the following guidelines and standards:

Guidelines: EMC Directive 2004/108/EG

Product standards: EN 61326: 2006-10

Electrical measuring, control, regulating and lab devices - EMC requirements

Basic standards: Standards on Electromagnetic Compatibility (EMC):

- EN 61000-4-2: 2009-12
- EN 61000-4-3: 2008-06
- EN 61000-4-4: 2010-11
- EN 61000-4-5: 2007-06

- EN 61000-4-6: 2009-12
- EN 61000-4-7: 2009-12
- EN 61000-4-8: 2010-11
- EN 61000-4-11: 2005-02

## 10.4 List of Parameters Used

| Parameter | Meaning |
|---|---|
| I_DCDC_Charge | Battery charging current |
| V_DCDC_Charge | Battery charging voltage |
| I_DCDC_out | Output current of the DC/DC converter |
| V_DCDC_out | Maximum output voltage of the DC/DC converter |
| I_DCDC_Charge_min | Minimum battery charging current |
| t_charge | Recharging time |
| U_Batt | Battery voltage |
| U_Batt_min | Minimum battery voltage |
| t_reload | Recharging time: used for starting the Nexa 1200 with automatic battery charging function |
| T_Batt | Battery temperature |
| V_DCDC_IN | Input voltage of the DC/DC con-verter |
| I_DCDC_IN | Input current of the DC/DC convert-er |
| P_DCDC_IN | Input power of the DC/DC converter |

Table 10-3 List of Parameters Used

# Index

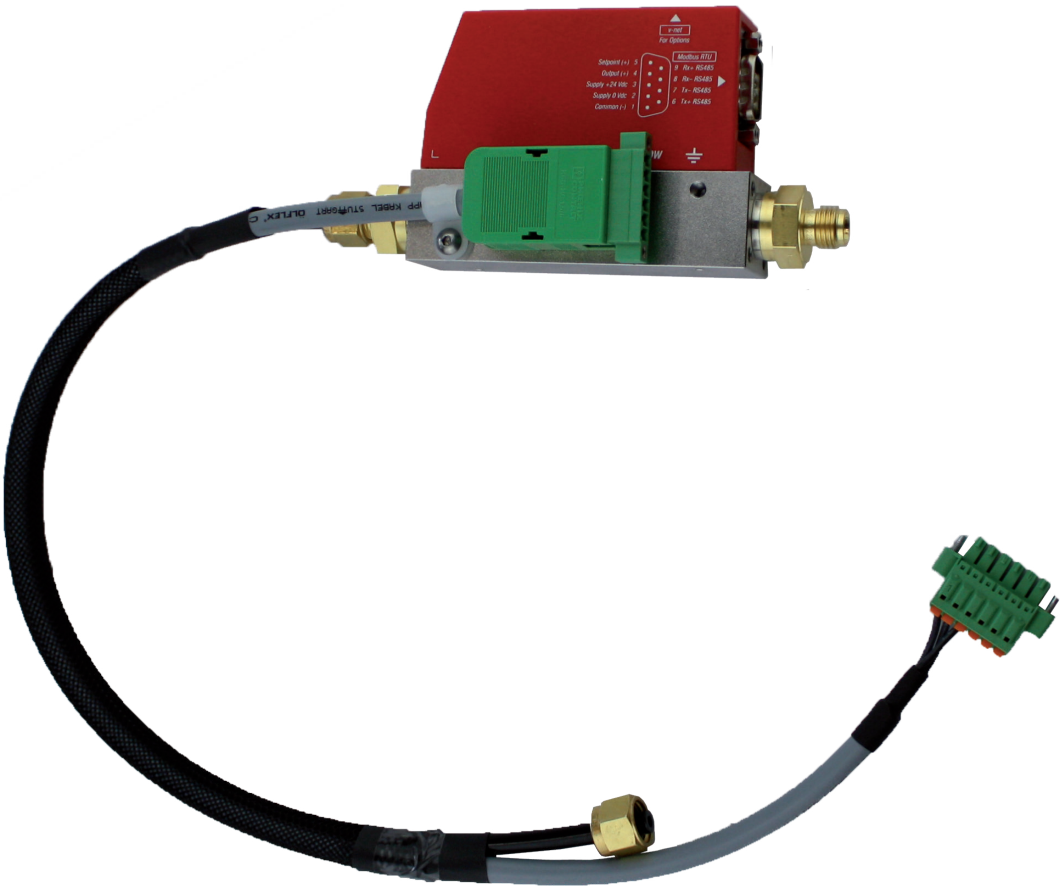
Heliocentris Academia International GmbH
Rudower Chaussee 30
12489 Berlin
Germany

http://www.heliocentrisacademia.com

Heliocentris

# $H_2$ Flow Meter for Nexa® 1200

Instruction Manual



H2 Flow Meter for Nexa® 1200, Instruction Manual
Version 1.0
May 2011


Rudower Chaussee 30
12489 Berlin
Germany

# Content

# 1 About This Document

The operating manual is intended to help you use the product. The index at the back of the manual can be used for fast orientation.

## 1.1 Notices and Symbols

### 1.1.1 Symbols

The following symbols and labels are used in this manual:

| Symbol or label | Meaning |
|---|---|
| ➔ | Instruction |
| ✓ | Aids or prerequisites that are required prior to an action |
| 1. | Instructions in a specific sequence |
| ⇨ | Result of an action |
| ●, - | List |
| *SWITCH* | Refers to a switch, key, button or icon |
| Reference to page x | Reference to further information |

Table 1-1 Symbols in the instruction manual

### 1.1.2 Warnings

The following warnings are used:

| | |
|---|---|
| **WARNING** | Warns of dangers of serious injury. |
| **CAUTION** | Warns of dangers of injury. |
| **NOTICE** | Warns of property damage to the product. |

### 1.1.3 Tips

| | |
|---|---|
| **TIP** | Tips are marked this way. |

## 1.2 Accompanying Documents

The following documents are supplied with the product in addition to the instruction manual:

- CD-ROM with:
  - *Electronic version of the instruction manual*
  - *Software GET RED-Y*

# 2 Safety Instructions

In this chapter you will find information on the safe handling of the product. It is essential that you read and understand this chapter.

## 2.1 General Information on Safety & Responsibility

**WARNING**

**Risk of injury due to improper use!**

Improper use of the product can result in serious injuries.

- ➔ Ensure that the manual is accessible at all times.
- ➔ Make sure you have read and under stood this manual in its entirety.
- ➔ Comply with all safety instructions and warnings.
- ➔ Store the manual and other documentation in a safe place and pass them on to future owners of the product.
- ➔ Comply with all local regulations.
- ➔ Use only product components.
- ➔ Exception: if other aids are specified in the manual.

**WARNING**

**Risk of injury in case of unauthorized modifications!**

Conversions and modifications to the product can result in general hazards (danger due to escaping hydrogen, fatal injury due to electric shock).

- ➔ Do not make conversions and modifications to product or its individual components.

## 2.2 Approved Use

The product was designed for connection to the Nexa® 1200.

The product is not intended for any other purpose; any other use is not approved.

- ➔ The product must always be operated while under supervision.

## 2.3 Non-approved Use

Do **not** use this product for:

- Operation beyond the technical specifications
- Operation beyond the approved operating environment
- Unsupervised operation
- Operation in potentially explosive areas

Components or products delivered by or purchased from Heliocentris are not approved for use in aeronautics or aerospace applications (including models).

## 2.4 Hazards during Approved Use

For proper handling of all chemical or hazardous substances, it is necessary to exercise appropriate care; also make sure you have read and understood the relevant safety data sheets.

Hydrogen

Hydrogen itself is not a hazardous substance – its properties, however, can make it hazardous in interaction with other substances.

**WARNING**

**Risk of injury due to hydrogen!**

Escaping hydrogen can ignite and cause severe burns to the body.

Escaping hydrogen can be hot and burn the skin.

Escaping hydrogen can reduce the oxygen concentration and cause respiratory difficulties.

- ➔ Do not inhale hydrogen.
- ➔ The lab must be equipped with a suitable ventilation system for the use of hydrogen.
- ➔ The lab must be equipped for hydrogen monitoring.
- ➔ Avoid heat in the vicinity of the system and the hydrogen source.
- ➔ No smoking, no naked flames.
- ➔ Comply with local safety regulations.
- ➔ Comply with regulations for handling of compressed hydrogen cylinders.
- ➔ In the case of escaping gas, keep away and keep inflammable materials away.
- ➔ Prevent electrostatic charges.
- ➔ Ensure proper installation of the hydrogen supply.
- ➔ Check the hydrogen lines and connectors regularly for leak tightness.

Electricity

The unit poses no special electrical hazards as long as the following instructions are observed:

- ➔ For the power supply, use only the AC adapter provided.
- ➔ Do not short-circuit inputs and outputs.
- ➔ Do not reverse the polarity of inputs and outputs.
- ➔ Never use the system if any part of it has been immersed in water.

## 2.5 General Information on Operation

### 2.5.1 Requirements for the Owner/Operator

The owner/operator must ensure that the unit is accessible only to the persons defined in this manual (see Requirements for the User page 8).

The safety instructions and warnings listed in this instruction manual must be observed. The owner/operator is responsible for compliance with local safety regulations.

Furthermore, the owner/operator is responsible for:

- Proper installation of the hydrogen supply by a specialized company
- Regular checking of the hydrogen lines and connectors for leak tightness
- Unauthorized persons must be prevented, using corresponding measures, from installing, operating or maintaining the system. Installation, commissioning, shutdown and maintenance of the hydrogen supply and filling the metal hydride canisters must be carried out by appropriately qualified personnel.

The operator of the system must take sufficient precautions to prevent hydrogen being able to accumulate in enclosed or non-ventilated areas (e.g. installation of an exhaust air system and hydrogen warning system, etc.).

### 2.5.2 Requirements for the Location / Installation Location

The system must be operated in a lab which complies with the local regulations.

### 2.5.3 Requirements for the User

The product is intended for use by trained qualified personnel in education and research. Its design does not correspond to that of a "consumer-oriented" product whose proper use is generally known and which is protected against operation errors or improper use. The product may be used by the following persons under the following conditions:

- Persons who can demonstrate proof of training in chemistry, physics, electronics, electrical engineering or comparable qualifications and who are familiar with the local regulations for safe handling of hydrogen and who have experience in working with hydrogen.
- Personnel must be familiar with and comply with the local applicable accident prevention and safety regulations.

There is an obligation of supervision during all training

- The product may be used by persons undergoing training only when under the supervision of the instructor.
- The instructor must ensure proper handling and is obliged to point out possible dangers.

# 3 Components

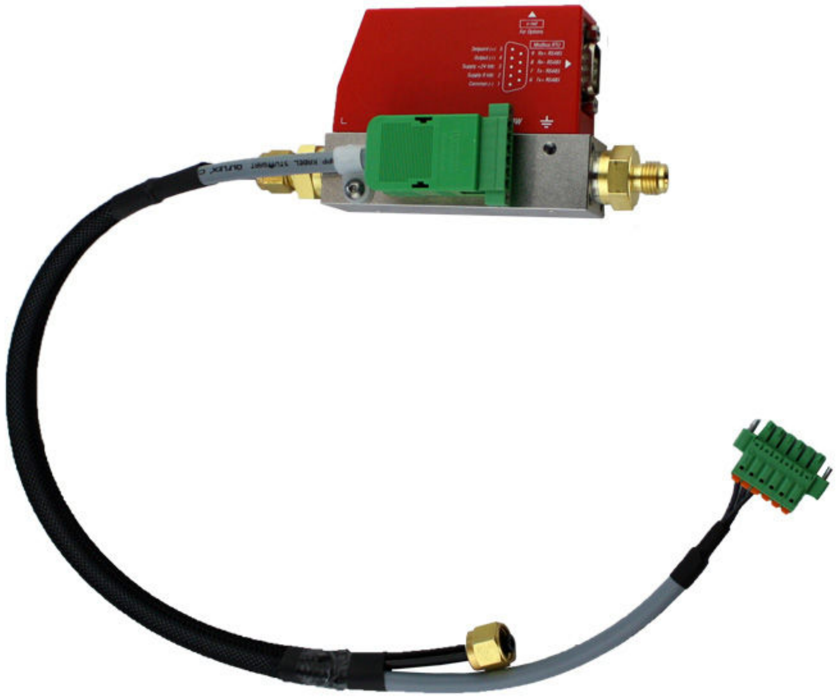


Fig. 3-1 Hydrogen flow meter

The hydrogen flow meter is pre-calibrated for hydrogen. It is connected between the Nexa® 1200 and the solenoid valve for exact measuring of the hydrogen consumption. It sends the measured flow rates, converted to standard data, to the PC. The *GET RED-Y* software is used for the data acquisition. The flow meter enables measurement of mass flow rates from 0…25 l/min. During hydrogen flushing of the Nexa® 1200, the flow meter reaches the end stop of its measuring range. In this case, the mass flow rate is significantly higher than the displayed value. During flushing, mass flow rates of up to 140 l/min can occur.

# 4 Getting Started

In this chapter you learn about the necessary steps for set-up of the flow meter.

## 4.1 Scope of Delivery

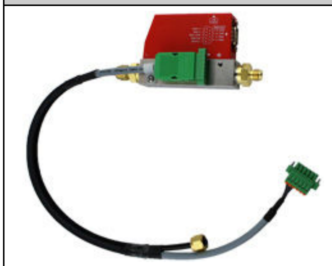
| Illustration | Designation |
|---|---|
|  | $H_2$ Flow Meter for Nexa® 1200 |
|  | USB communication cable: RS485-USB converter |
|  | AC adapter with exchangeable plugs  |
| | CD-Rom NEXA® INTEGRATION SYSTEM |

Table 4-1 Scope of delivery

## 4.2 Unpacking

The following section describes what to watch out for when unpacking the unit.

1. Check the unit for obvious transport damage to the packaging and to the product itself. In the event of damage, inform the shipping company and Heliocentris or your supplier about the damage immediately.
   - *If possible, document the damage with a camera.*
2. Compare the delivered items with the information in this instruction manual immediately after unpacking.

**TIP** Store packaging material for future storage or dispatch of the unit.

## 4.3 Connecting Flow Meter

The flow meter is connected between the hydrogen connection of the Nexa® 1200 and the external solenoid valve. The connection for the Nexa® 1200 hydrogen supply is located on the back of the unit, to the left of the power connections.

The flow meter is pre-assembled. It is equipped with a hydrogen connection, data interface and an extension for the solenoid valve connector.

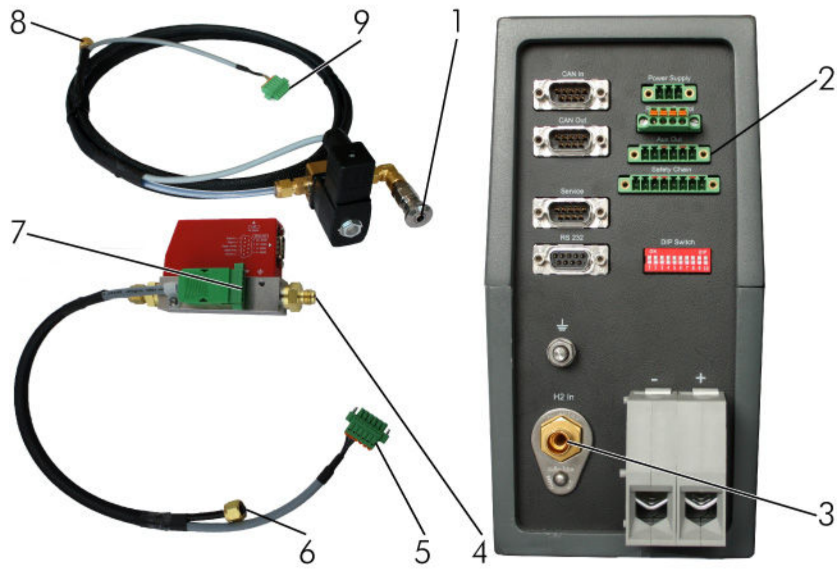



Fig. 4-1 Solenoid valve, flow meter and connection panel on Nexa® 1200

Connect the flow meter between the hydrogen connection of the Nexa® 1200 and the external solenoid valve as follows:

- ✓ Solenoid valve
- ✓ Flow meter
- ✓ Open-end wrench
- ✓ Main valve of the hydrogen supply is closed

Flow meter on Nexa® 1200 and solenoid valve

1. Push back the union nut on the hydrogen hose of the flow meter (6).
2. Insert hydrogen hose in the hydrogen connection of the Nexa® 1200 (3).
3. Push the union nut forward.
4. Tighten hand-tight.
5. Tighten $\frac{1}{8}$ to $\frac{1}{4}$ of a turn with the open-end wrench.
6. Push back the union nut on the hydrogen hose of the solenoid valve (8).

7. Connect with the hydrogen connection of the flow meter (4).
8. Push the union nut forward.
9. Tighten hand-tight.
10. Tighten ⅛ to ¼ of a turn with the open-end wrench.

Electrical connection of solenoid valve and flow meter

Connect the solenoid valve and flow meter as follows:

1. Insert plug connector of the flow meter (5) in the *AUX OUTPUT* (2) connection.
2. Insert plug connector of the solenoid valve (9) in the connection of the flow meter (7).
3. Tighten the locking screws hand-tight.
   - ⇨ *The electrical connection of the solenoid valve is complete.*
   - ⇨ *The quick coupling of the solenoid valve (1) is connected to the hydrogen supply.*

## 4.4 Connect Data Interface to PC

Connect the flow meter to a PC as follows:

- ✓ PC or OSC
- ✓ USB communication cable
- ✓ AC adapter

Fig. 4-2 Connect data interface to PC

1. Insert the converter of the communication cable into the RS485 connection of the flow meter.
2. Tighten the locking screws hand-tight.
3. Insert USB plug of the cable into the USB port of the PC.
4. Insert AC adapter cable into converter of the communication cable.
5. Connect the AC adapter to the power grid.
   - ⇨ *The unit is now connected to the PC.*

## 4.5 Installing the Software

Install the software as follows:

- ✓ System requirements
  - – *(see PC Requirements on page 23)*
- ✓ CD-Rom NEXA® INTEGRATION SYSTEM
- ✓ Sufficient rights for installation of the software
  - – *Contact the administrator, if necessary*

1. Switch on PC and monitor.
2. Insert CD-Rom NEXA® INTEGRATION SYSTEM.
3. Use the integrated *RUN* function in the Windows operating system.
   - – *In START > RUN select the GET RED-Y folder.*
4. Click the *OK* button.
5. Follow the instructions of the setup program.
   - ⇨ *The communication between the flow meter and the PC can now be established.*

### 4.5.1 Check for Leaks

For safe operation of the unit, it must be assembled so that there are absolutely no leaks.

The leak test should be conducted every time the hydrogen supply is connected.

- ✓ The unit is mounted
- ✓ Electrical connections are established
- ✓ Hydrogen supply is connected
- ✓ $H_2$ Detector with leak detection liquid (not included in the scope of delivery)

1. Remove the leads of the solenoid valve cable from the terminal (contact 1, 2 and 3).
   - – *Press the orange holding spring of the terminal toward the back.*
   - – *Remove the lead.*
   - – *Release orange holding spring.*
2. Connect leads (brown and white) of the solenoid valve cable to the external power supply (AC adapter). The polarity of this connection is not important.
3. Switch on AC adapter with 0.4 A and 24 V to open solenoid valve.
   - ⇨ *Opening the solenoid valve generates a clicking sound.*
4. Open valve from hydrogen supply (e.g. gas cylinder valve on the compressed gas cylinder).

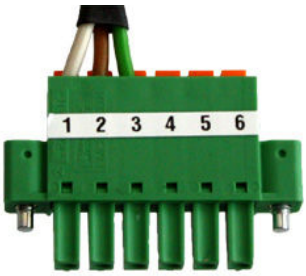
5. Set the hydrogen inlet pressure.
6. Read the pressure.
7. Close valve (e.g. gas cylinder valve on the compressed gas cylinder).
8. Wait 5 minutes.
9. Check the hydrogen inlet pressure.
10. If the hydrogen inlet pressure has not changed, the installation is leak proof.
11. If the hydrogen inlet pressure has dropped, there is a leak in the installation.
12. Use the $H_2$ Detector to find the leak.

Leak found:

13. Remove connections and re-install (see Connecting Flow Meter on page 12).
14. Repeat steps 4–9.

Leak eliminated

15. Switch off AC adapter.
16. Disconnect leads of the solenoid valve cable from the AC adapter.




17. Re-insert the leads in the terminal (contact 1, 2 and 3) as shown.
    - *Press the orange holding spring of the terminal toward the back.*
    - *Insert the lead.*
    - *Release orange holding spring.*

NOTICE ! If the leak persists, contact Heliocentris.

# 5 Operation

## 5.1 Acquisition of the Measured Data from the Flow Meter

The *Get Red-y software is used for the data acquisition*.

# 6 Decommissioning

- ✓ The unit is switched off
- ✓ All LEDs are off
- ✓ Main valve of the hydrogen supply must be closed.
- ✓ Solenoid valve must be disconnected from the hydrogen supply.
- ✓ Flat-head screwdriver
- ✓ Open-end wrench

Disconnect the flow meter as follows:

Disconnect data interface to PC

1. Disconnect AC adapter from power grid and communication cable.
2. Loosen locking screws of the communication cable.
3. Pull out the converter.
4. Pull out USB plug from the USB port of the PC.

   ⇨ *Data interface to PC is now disconnected.*

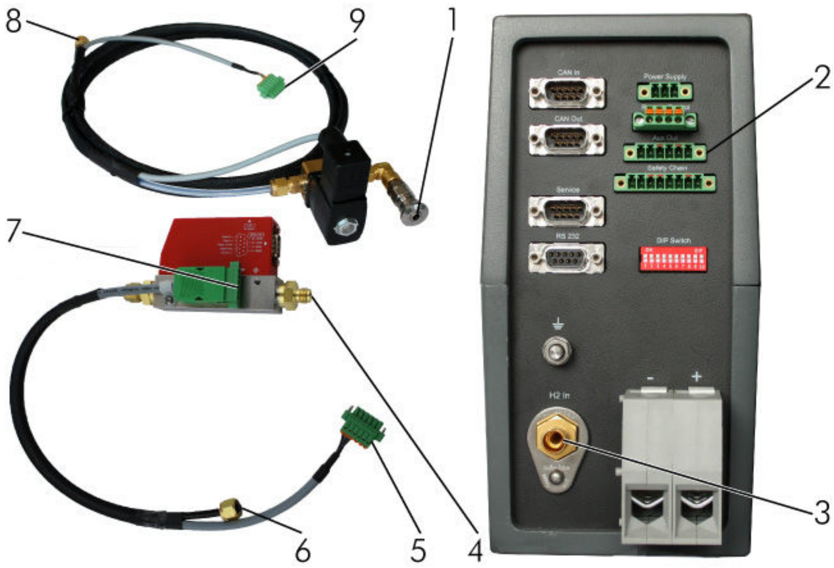



Fig. 6-1 Solenoid valve, flow meter and connection panel on Nexa® 1200

Disconnect electrical contacts from the flow meter and solenoid valve

5. Loosen locking screws with flat-head screwdriver.
6. Remove plug of the flow meter (5) from the AUX OUTPUT (2) connection.
7. Remove plug of the solenoid valve (9) from the connection on the flow meter (7).

Disconnect hydrogen connection

⚠ CAUTION The solenoid valve becomes hot during operation! Do not touch.

8. Loosen the union nut on the hydrogen hose of the solenoid valve (8).
9. Pull out hydrogen hose from the flow meter.
10. Loosen the union nut on the hydrogen connection of the flow meter (6).
11. Pull the hydrogen hose out of the Nexa® 1200 (3).

   ⇨ *The hydrogen supply has been shut down.*
   ⇨ *As soon as the solenoid valve has cooled, the solenoid valve and flow meter can be packed.*

## 6.1 Uninstalling the Software

To uninstall the software, use the integrated software management functions in the Windows operating system.

1. In *START > CONTROL PANEL* open the *SOFTWARE* folder.

   ⇨ *The SOFTWARE dialog opens with a list of the installed software.*

2. *SELECT GET RED-Y*.
3. Click the *REMOVE* button.

## 6.2 Disposal

### Unit

The unit is not registered for use in private households. Therefore, it may not be disposed of at the local recycling centers. Return the unit to Heliocentris for disposal.

### Packaging material

➔ Store packaging material for future storage of the unit.

➔ Dispose of packaging material that is no longer needed in accordance with local regulations.

# 7 Maintenance and Service

## 7.1 Maintenance

Inspect the condition of hoses and cables regularly and check connections for leaks and to make sure they are tightly connected:

Leaks

- ➔ Check hydrogen supply for leaks
  - (see *Check for Leaks* on page 14)

## 7.2 Cleaning

✓ Moist cloth

1. Disconnect unit from the power supply.
2. Clean the case with a slightly moist cloth.

**TIP** In case the unit is extremely dirty, use a mild detergent; never use chemical cleaners.

## 7.3 Service

If you experience problems with the unit, then please contact the manufacturer:

Heliocentris Academia International GmbH

Rudower Chaussee 30

12489 Berlin

Germany

Phone +49 (0)30 – 340601-600

Email:

service@heliocentrisacademia.com

An employee from Heliocentris Customer Service will contact you and explain all further steps. If you return the unit for repair or replacement, you must ship the unit sufficiently secured and packaged.

Heliocentris is not responsible for damage which has been caused by improper packaging and / or improper shipment. You must bear the costs yourself for the shipment of units with expired warranty.

## 7.4 Warranty

Heliocentris guarantees the flow meter for the Nexa® 1200 for a period of 1 year.

The warranty only covers defects which are present at the time of the handover of the product from the seller to the purchaser.

Warranty claims against Heliocentris cannot be made if:

- The customer has caused the damage by improper use or incorrect operation
- Unauthorized repairs or manipulations have been made to the product
- The customer has neglected his duty of supervision and has caused damage to third parties

The supplier is liable for damage caused during the delivery to the customer and provides replacement in the case of damage.

In the case of complaints and return of the product, the risk is borne by the customer who must provide proper and secure packaging.

# 8 Technical Data

| Property | Specification |
|---|---|
| Measuring range | 25 slpm (during hydrogen flushing the maximum mass flow rate that can be displayed is exceeded) |
| Connection | 2 x G1/4" |
| Seal | FKM |
| Housing | Stainless steel |
| Measuring precision | ±1.5 % of the final value |
| Reproducibility | ±0.2 % |
| Voltage | 24 (18…30) $V_{DC}$ |
| Operating pressure | 1…15 bar, recommended 1…5 bar |
| Temperature | 0…50 °C |
| Output signal | Analog 0…5 V, digital RS485 |

Table 8-1 Specifications of flow meter

## 8.1 PC Requirements

| Designation | Specification |
|---|---|
| Operating system | Windows 2000, Windows XP |

Table 8-2 PC hardware requirements

# Index

Heliocentris

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12489 Berlin
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Heliocentris

# Metal Hydride Canister 200l/800l

Instruction Manual

ACADEMIA OFFERING

200nl

800nl

Metal Hydride Canister 200nl/800nl, Instruction Manual
Version: 1.2
05/2026

Rudower Chaussee 30
12489 Berlin
Germany

# Table of Contents

# 1 About This Manual

The instruction manual is intended to help you use the product. It is structured as follows.

| | |
|---|---|
| Safety | In chapter safety instructions you will find information on the safe handling of the product. It is essential that you read and understand this chapter. |
| Components | This chapter presents the components of the product and their basic functions. |
| Getting started | This chapter describes the necessary steps for initial startup of the product. |
| Operation | The chapter provides instruction for the operation of the product. |
| Decommissioning | The necessary steps for the disassembly product and the conditions for its packaging, storage and transport are described in the chapter. |
| Troubleshooting | This chapter describes possible problems and their solution. |
| Maintenance and Service | This chapter describes all necessary measures arising in the product life cycle, such as the maintenance, cleaning, service, warranty and disposal. |
| Technical Data | An overview of important technical data is provided at the end of the instruction manual. |
| Appendix, Index | The abbreviations used in this manual are summarized in the appendix for a better overview and an index can be used for fast orientation. |

## 1.1 Notices and Symbols

### 1.1.1 Symbols

The following symbols and labels are used in this Instruction Manual:

| Symbol or label | Meaning |
|---|---|
| ▶ | Instruction |
| ✔ | Aids or prerequisites that are required prior to an action |
| 1. | Instructions in a specific sequence |
| ⇒ | Result of an action |
| •, – | List |
| ***Switch*** | Refers to a switch, key, button or icon |
| Reference to page x | Reference to further information |

Tab. 1-1Symbols in the instruction manual

### 1.1.2 Warnings

The following warnings are used:

CAUTION

Warns of dangers of injury.

NOTICE

Warns of physical damage to the product.

### 1.1.3 Tips

Useful tips are identified as follows:

Tip

Provides further tips.

## 1.2 Accompanying Documents

The following documents are supplied with the product in addition to the instruction manual:

- Safety data sheet
- Safety data sheet for transport according to UN3189 (after completion of inerting requirements, Shipping Metal Hydride Canister on page17)
- Instructions for using the MHS valve

# 2 Safety

This chapter describes the safe handling of the product. It is essential that you read and understand this chapter.

## 2.1 General Information on Safety & Responsibility

**Danger of injury due to improper use!**

Improper use of the product can result in serious injuries.

- ▶ Ensure that the manual is accessible at all times.
- ▶ Make sure you have read and understood this manual in its entirety.
- ▶ Comply with all safety instructions and warnings.
- ▶ Store the manual and other documentation in a safe place and pass them on to future owners of the product.
- ▶ Comply with all local regulations.
- ▶ Only use product components.
  Exception: if additional aids are specified in the manual.

**Danger of death due to unauthorized modifications!**

Conversions and modifications to the product can result in general hazards (danger due to escaping hydrogen, danger of injury due to heavy parts).

If unauthorized conversions or modifications are made to the product, the warranty becomes void.

- ▶ Do not make conversions and modifications to the product or its individual components.

## 2.2 Approved Use

The Metal Hydride Canisters are used to store pure gaseous hydrogen in a solid form and under a low pressure level. The stored hydrogen can be provided to a fuel cell system or other hydrogen consuming systems.

The Metal Hydride Canisters may only be operated in stationary use in Heliocentris products or in applications according to the technical data defined in the instruction manual. Heliocentris assumes no liability for improper handling of the canisters.

The product has been designed for:

- Analysis and test purposes
- Experimentation purposes

- Demonstration purposes
- Training purposes
- Research purposes

The product is not intended for any other purpose; any other use is not approved.

## 2.3 Hazards during Approved Use

**Escaping Hydrogen: Danger of death due to explosion!**

Hydrogen itself is not a hazardous substance – its properties, however, can make it hazardous in interaction with other substances.

Escaping hydrogen can ignite and burn the skin.
Escaping hydrogen can reduce the oxygen content and cause breathing difficulty.

- ▶ Do not inhale hydrogen.
- ▶ The lab must be equipped with a suitable ventilation system for the use of hydrogen.
- ▶ Incorporate the Metal Hydride Canister into the operational safety concept.
- ▶ The lab must be equipped for hydrogen monitoring.
- ▶ Avoid heat in the vicinity of the hydrogen source.
- ▶ No smoking, no naked flames.
- ▶ Comply with local safety regulations.
- ▶ Comply with regulations for handling of compressed hydrogen cylinders and metal hydride canisters.
- ▶ In the case of escaping gas, keep away and keep inflammable materials away.
- ▶ Prevent electrostatic charges.
- ▶ Ensure proper installation of the hydrogen supply.
- ▶ Check the hydrogen lines and connectors regularly for leak tightness.

Metal Hydride Canister

Metal Hydride Canister contains pyrophoric metal powder.
Metal hydride canister is under pressure. Pressure rises with increasing temperature. Unauthorized excess pressure.

- ▶ Keep away the Metal Hydride Canister from sources of ignition.
- ▶ Do not expose to sunlight, protect the canister from temperature above 55 °C.
- ▶ The maximum operating pressure of the canister must not be exceeded at any time.
- ▶ Do not open the Metal Hydride Canister. This can cause a metal fire.

- Do not remove the valve.
- Close valve after use.

## 2.4 Non-Approved Use

Do **not** use this product for:

- Operation beyond the technical specifications
- Operation beyond the approved operating environment
- Unsupervised operation
- Operation in potentially explosive areas

Components or products delivered by or purchased from Heliocentris are not approved for use in aeronautics or aerospace applications (including models).

For safety reasons, unauthorized modifications or changes to the Metal Hydride Canister are prohibited, since this can cause hydrogen leakage. The canisters may not be disassembled.

To refill the Metal Hydride Canister from a standard compressed hydrogen cylinder, use the connection kit only.

## 2.5 General Information on Operation

The Metal Hydride Canister is equipped with a pressure-sensitive relief valve with a rupture disk. This valve releases hydrogen Metal Hydride Canister in case of unexpected extreme operation or storage conditions e.g. open fire. The release conditions of this valve is specified under Technical Data on page 25. If the rupture disk has once been triggered, the Metal Hydride Canister cannot be used again.

### 2.5.1 Requirements for the Owner / Operator

The owner/operator must ensure that the unit is accessible only to the persons defined in this manual (see Requirements for the User on page 8).

The safety instructions and warnings listed in this manual must be observed. The owner/operator is responsible for compliance with local safety regulations.

Furthermore, the owner/operator is responsible for the following:

- Implementation of a risk analysis in the sense of national law and regulations concerning occupational health and safety
- Regular checking of the hydrogen lines and connectors for leak tightness
- Installation, commissioning, shutdown and maintenance of the hydrogen supply and filling the Metal Hydride Canister must be carried out by appropriately qualified personnel

- The operator of the product must take sufficient precautions to prevent hydrogen being able to accumulate in enclosed or non-ventilated areas (e.g. installation of an exhaust air system and hydrogen warning system, etc.)
- The tightness of the connections of the Metal Hydride Canister as well as the whole hydrogen system must be regularly examined for tightness. Regular examination of the hydrogen piping and connections for damages, deformations, bulges. If irregularities are detected, take Metal Hydride Canister out of operation and inform Heliocentris.
- For filling the Metal Hydride Canister, a connection kit must be used. Exceptions are use in applications where connections are present (pressure reduction, piping, quick release coupling interface) or in a fixed installation in which the Metal Hydride Canister itself is securely fixed.
- National regulations must be observed for the operation of Metal Hydride Canisters and the layout of hydrogen systems.

### 2.5.2 Requirements for the User

The product is intended for use under laboratory conditions by trained qualified personnel in education and research. Its design does not correspond to that of a "consumer-oriented" product whose proper use is generally known and which is protected against operation errors or improper use.The product may be used by the following persons under the following conditions:

Qualification

- Persons who can demonstrate proof of training in chemistry, physics, electronics, electrical engineering or comparable qualifications and who are familiar with the local regulations for safe handling of hydrogen and who have experience in working with hydrogen.
- Personnel must be familiar with and comply with the local applicable accident prevention and safety regulations.

There is an obligation of supervision during all training

- The fuel cell system must only be used by persons undergoing training when under the supervision of the instructor.
- The instructor must ensure proper handling and is obliged to point out possible dangers.

### 2.5.3 Requirements for the Installation Location

The product must be operated in a lab which complies with the local regulations (see Laboratory Guidelines BGI 850-0: Safe Work in Laboratories – Fundamentals and Guidance).

The following extinguishing agents must be on hand in case of fire:

Hydrogen: Hydrogen is in Fire Classification C. ABC extinguishing powder or a similar substance is required.

Metal Hydride Canister: Metal hydride is in Fire Classification D. D extinguishing powder is necessary. Never use $CO_2$ extinguishers or water!

# 3 Components

The Metal Hydride Canisters are used to store pure gaseous hydrogen in a solid form and under a low pressure level. The stored hydrogen can be provided to a fuel cell system or other hydrogen consuming systems.

The Metal Hydride Canister is filled with an AB2 type metal hydride alloy. The hydrogen pressure in the Metal Hydride Canister mainly depends on the temperature of the metal alloy.

The Metal Hydride Canister is equipped with a pressure-sensitive relief valve with a rupture disk. This valve releases hydrogen Metal Hydride Canister in case of unexpected extreme operation or storage conditions e.g. open fire. The release conditions of this valve is specified under Technical Data on page 25. Besides it has a stop valve and a gas outlet with quick-coupling.

Using the connection kit, Metal Hydride Canisters can be re-filled from commercial compressed hydrogen cylinders.


Fig. 3-1 Metal Hydride Canister

1 Canister
2 Thread for the handle (800 nl only)
3 Stop valve
4 Quick coupling

## 3.1 Optional Components

For filling and operating the Metal Hydride Canister, these components are available from Heliocentris:

- Connection kit
- Hydrogen generator
- Hydrogen detector

### 3.1.1 Hydrogen Connection Kit

Heliocentris offers various connection kits for filling Metal Hydride Canisters from a compressed hydrogen cylinder.

These connection sets guarantee:

- Correct connecting components
- Permissible hydrogen pressure

### 3.1.2 Hydrogen Generator

A hydrogen generator uses water to produce hydrogen and oxygen by means of electrolysis. The hydrogen can be used to fill the Metal Hydride Canisters.

A Heliocentris hydrogen generator ensures that the necessary connecting components are used and that the required parameters (hydrogen quality, pressure) are complied with.

### 3.1.3 Hydrogen Detector

The hydrogen detector can be attached to the belt with a clip and warns users in the event that the current concentration of hydrogen in the room air exceeds a specified value.

The device is equipped with a display and offers various acoustic and visual alarm levels. An included leak test liquid allows to easily identify leakage on fuel cell system, hoses or fittings.

# 4 Getting Started

This chapter describes the scope of delivery and the necessary steps for initial start-up of the Metal Hydride Canister from choosing a suitable installation location to connecting all required components.

## 4.1 Scope of Delivery

Fig.4-1Metal Hydride Canister 200 nl, 800 nl

## 4.2 Unpacking

The following section describes how to unpack the Metal Hydride Canister.

The Metal Hydride Canisters will be shipped separately from other components. For the transport the canisters are inert gas filled at 1...2 bar pressure to allow a transport under UN 3189 (transport as metal powder).

CAUTION

**Danger of injury due to high weight!**

Incorrect handling and weight that is disproportionately high for its size could cause the metal hydride canister to fall.

▶ Do not use fittings as a handle to remove from box.

1. Check for damage on the packaging and on the product itself.

- If applicable, document the damage using a camera and immediately inform the transport company and Heliocentris or your supplier.

CAUTION! If there is transport damage, do not use the Metal Hydride Canister.

2. Grasp the canister, not the fittings, when removing from box. Remove the Metal Hydride Canister 800 using the handle.
3. Remove handle of Metal Hydride Canister 800 only in the case of fixed installation.

Tip

Store packaging material for future storage or dispatch of the unit. It is always a good idea to copy the text on the packaging for future transport.

## 4.3 Filling the Metal Hydride Canister

The metal hydride canister should be filled with hydrogen:

- Before initial commissioning
- As soon as the ambient temperature becomes too low for the application

CAUTION

**Danger of injury due to improper use!**

Escaping hydrogen can ignite.

- Prevent electrostatic charges, and ensure good ventilation. No smoking or open flame.
- The cylinder is under pressure. Do not direct escaping gas towards personnel.
- Do not exceed 25 bar pressure when filling
- Metal Hydride Canisters may only be filled in the horizontal position if they are not mounted.
- Don't warm a fully filled canister.

NOTICE

**Danger of damage due to incorrect use!**

Dirt deposits (dust, chips, etc.) can damage hydrogen connections.

Hydrogen with a purity lower than 5.0 can irreversibly damage the Metal Hydride Canisters.

- Ensure clean connections. Wipe with dry cloth if necessary.
- Do not allow water, oil, air, or any substances other than pure hydrogen (or inert gas) to enter the Metal Hydride Canister.
- Hydrogen of purity 5.0 (99.999%) or higher is required.
- Contact Heliocentris as soon as possible for replacement of damaged connections.

The Metal Hydride Canister can be filled by different sources:

- Compressed hydrogen cylinder with pressure reducer
- Hydrogen generator
- Gas supply in laboratory with pressure reducer

Tip

When filling the Metal Hydride Canisters for the first time, it is not necessary to fill the metal hydride canister completely:

During the first discharge cycles the inert gas is being removed from the Metal Hydride Canister. Filling the Metal Hydride Canisters only partly, accelerates the discharge. The output of the fuel cell module will not be optimal as long as inert gas is in the system.

### 4.3.1 Filling with Compressed Gas Cylinder

The connection of a compressed hydrogen canister is only permissible with connecting components that ensure that the required parameters (pressure, temperature) are complied with (see Technical Data on page 25). We recommend a Heliocentris connection kit.

The filling procedure with a compressed hydrogen cylinder is as follows:

CAUTION

**Danger of injury due to overpressure in the Metal Hydride Canister!**

Injury and property damage to due to bursting of the canister.

▶ Do not set pressure higher than 25 bar.

▶ Do not heat canister.

▶ Do not cool tank down to lower than ambient temperature while filling.

Filling to saturation can take up to six hours, and the Metal Hydride Canister can only be partially filled. The Metal Hydride Canister is to be filled as follows:

✓ Compressed hydrogen cylinder

✓ Quick coupling plug

✓ Pressure reducer

✓ Connection lines purged

**Connecting pressure reducer**

1. Connect the quick coupling plug to the quick coupling of the Metal Hydride Canister, ensuring complete engagement of the quick coupling (click noise).
2. Open the stop valve of theMetal Hydride Canister.

NOTICE! Property damage due to triggering the rupture disk. Do not set pressure higher than 25 bar. Do not heat the tank or cool it to lower than the permissible operating temperature while filling.

3. Gradually increase operating pressure to 25 bar by turning the manual regulator of the cylinder's pressure reducer.

⇨ The Metal Hydride Canister heats up. Filling stops at approx. 50 °C.

Tip

During filling procedure the canister is heated by the exothermic reaction. Filling should begin at a canister temperature of 15 °C. Usually the temperature does not rise beyond 50 °C, because at a certain temperature the hydride formation stops and no further heat is generated.Cooling the tank during charging is not mandatory but would accelerate the charging procedure. Cooling can be realized by air ventilation or water bath. The Metal Hydride Canister must not be cooled down under approved operation temperature. By cooling with water bath it must be ensured that the valve armature is above water level.

⇨ Wait until the tank temperature has returned to the starting temperature. This indicates the charging operation is complete.

4. Close the main valve of the compressed gas cylinder.
5. Close the stop valve of the Metal Hydride Canister.
6. Disconnect the quick coupling plug from the quick coupling of the Metal Hydride Canister.

# 5 Operation

The desorption of hydrogen is the operational purpose of the Metal Hydride Canister. Safe desorption can be performed as follows:

CAUTION

**Danger of injury due to falling metal hydride canister!**

The metal hydride canister is very heavy and can cause injuries if it falls.

▶ Place the Metal Hydride Canister in a stable position and secure it against falling.

NOTICE

**Danger of damage to electronic devices due to condensate water!**

A high desorption rate can lead to the collection of condensate.

▶ Ensure sufficient distance between electronic devices and Metal Hydride Canister.

Desorption is to be prepared as follows:

✓ Hydrogen consumer (such as fuel cell)

✓ Quick coupling plug

1. Connect the Metal Hydride Canister to hydrogen consumer using quick coupling plug.
2. Open stop valve.

⇨ The Metal Hydride Canister supplies hydrogen consumer.

End desorption

3. Switch off hydrogen consumer.
4. Close stop valve on Metal Hydride Canister.
5. Remove quick coupling plug.

Tip

While the Metal Hydride Canister is delivering hydrogen (desorption), the canister temperature decreases and the canister pressure decreases correspondingly. To maintain constant hydrogen pressure, the metal hydride canister must be warmed. This can be achieved by allowing the waste heat of the fuel cell to flow around it. The temperature must in any case remain within the permissible range.

Tip

You should keep some pressure in the Metal Hydride Canister at all times. If the canister has little or no pressure and the canister becomes cooled, a negative pressure can develop, sucking air into the canister through the open valve. The low pressure will cause air to be drawn into the Metal Hydride Canister through the open valve.

# 6 Decommissioning

The necessary steps for the decommissioning of the Metal Hydride Canister, as well as the conditions for its packaging, storage and transport are described in this chapter .

## 6.1 Storing the Metal Hydride Canister

Metal Hydride Canister must be stored in a gas cylinder cabinet. The cabinet must fulfill the following conditions:

- Temperature range: -10 °C ... 40 °C
- Lockable

## 6.2 Shipping Metal Hydride Canister

For public transport, for the purpose of disposal of Metal Hydride Canisters or due to a complaint, pack the canisters in delivery condition and ship them in accordance with UN 3189. The shipper is responsible for the proper declaration and containment of dangerous goods.

Metal Hydride Canisters are transported internationally with inert gas filling with an absolute pressure < 2 bar as metal powder capable of self-heating in a box imprinted with UN 3189.

### 6.2.1 Preparing for Public Transport

The transport on public roads must be prepared as follows:

For public transport, the shipper must ensure that the Metal Hydride Canisters are emptied and superimposed with inert gas for transport in a carton with the imprint UN 3189.

The shipper is responsible for the proper declaration and containment of dangerous goods.

### 6.2.2 Emptying Metal Hydride Canister for Shipping

The following emptying device must be implemented for the emptying of the Metal Hydride Canister. Please contact Heliocentris Service for questions about the setup or the required components.

CAUTION

**Danger of injury due to explosion!**

Escaping hydrogen can ignite and cause burnings.

▶ Always ensure that there is sufficient ventilation of the room, a properly functioning exhaust system and hydrogen monitoring.

- ✓ Inert gas storage
- ✓ Pressure regulation valve
- ✓ Manometer
- ✓ 2 stop valves
- ✓ Vacuum pump
- ✓ Water bath
- ✓ Water bath heating, waterproof thermometer as necessary

- ▶ Set up emptying device without metal hydride canister
- ▶ Heat up water bath to 25...30°C

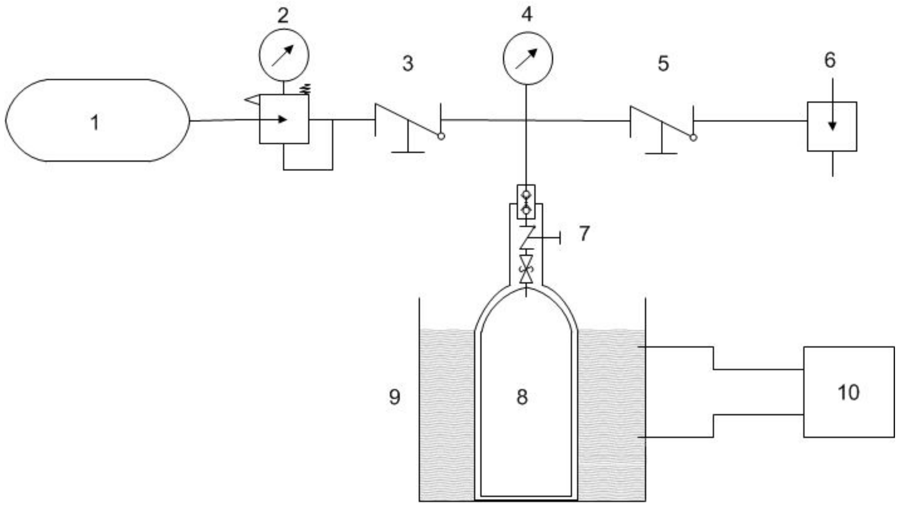


Fig. 6-1 Setup of emptying device

| | |
|---|---|
| 1 Inert gas canister | 2 Pressure control valve |
| 3 Stop valve on the inert gas line | 4 Manometer |
| 5 Stop valve on the vacuum pump line | 6 Vacuum pump |
| 7 Stop valve on Metal Hydride Canister | 8 Metal Hydride Canister |
| 9 Water bath | 10 Water bath heating |

The following steps must be performed to empty the canister:

- ✓ Vacuum pump and inert gas canister are disconnected yet
- ✓ All stop valves (3), (5), (7) are closed

1. Place the Metal Hydride Canister in the water bath so that the canister, but not the valve, is covered with water.
2. Connect the Metal Hydride Canister to the setup by means of the quick coupling.
3. Discharge the Metal Hydride Canister to a pressure of $p \geq 1$ bar:
   – Open the valves (5) and (7) and empty the Metal Hydride Canister.

Tip

By closing the valve (5) every 15 seconds, it is easier to obtain a more precise reading of the pressure on the manometer (4).

4. Close valves (5) and (7) as soon as manometer (4) displays a pressure $\geq$ 1 bar.

⇨ All valves are closed.

5. Connect the vacuum pump (6).
6. Increase the temperature of the water bath to 50° C.

NOTICE! The canister pressure must be continuously monitored on the manometer (4) during the heating / emptying in order to avoid exceeding the maximum pressure of the Metal Hydride Canister (25 bar).

7. For evacuation, open valve (5).
8. Start vacuum pump (6) and allow to run until manometer (4) displays a pressure of 0.1 bar.
9. Open Metal Hydride Canister stop valve (7) and evacuate storage.
10. Operate the vacuum pump for 1...3 hours until the manometer (4) shows an absolute pressure of 0.1 bar.
11. Close the valves (5) and (7) and shut off the vacuum pump (6).

⇨ The Metal Hydride Canister is now emptied.

⇨ The water bath is no longer needed.

### 6.2.3 Filling the Metal Hydride Canister with Inert Gas

After the completion of the emptying process as described above, the Metal Hydride Canister must be filled with inert gas for permissible transport.

CAUTION

**Danger of injury due to fire!**

Metal hydride powder reacting with oxygen can ignite. Purging the line with inert gas prevents a reaction with oxygen.

▶ Purging the line with inert gas.

Inert gases are gases that are sluggish in reaction; they include helium, neon, argon and xenon.The following steps are required for the filling:

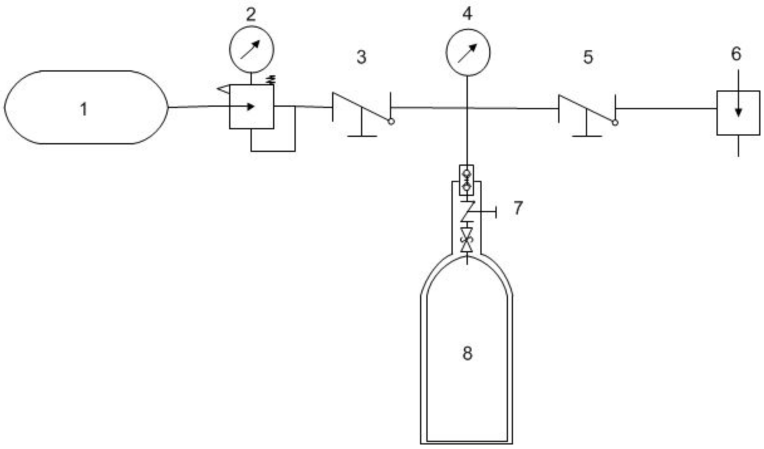

Fig. 6-2 Setup for inerting

| | | | |
|---|---|---|---|
| 1 | Inert gas storage | 2 | Pressure regulation valve |
| 3 | Stop valve on the inert gas line | 4 | Manometer |
| 5 | Stop valve on the vacuum pump line | 6 | Vacuum pump |
| 7 | Stop valve on Metal Hydride Canister | 8 | Metal Hydride Canister |

✓ The emptied Metal Hydride Canister has cooled down to room temperature

✓ All valves are closed

Purge the supply lines with inert gas and open the valves

1. Uncouple the quick coupling of Metal Hydride Canister (8) from the emptying device.
2. Remove Metal Hydride Canister.
3. Connect inert gas storage (1).
4. Set pressure regulation valve (2) until manometer (4) displays a pressure of < 2 bar.
5. Open valve (3).
6. Manually depress the quick coupling briefly to purge lines with inert gas.
7. Close the valve (3).

Fill the Metal Hydride Canister with inert gas for 20 seconds with an absolute pressure < 2 bar

8. Connect the Metal Hydride Canister (8) to the system.
9. Open the valves (3) and (7) for 20 seconds.
10. Close all valves.

⇨ The Metal Hydride Canister is now filled with helium and ready for transport in accordance with UN 3189.

# 7 Maintenance, Service, and Disposal

This chapter describes all necessary measures arising in the product life cycle, such as maintenance, cleaning, service, warranty, and disposal.

## 7.1 Maintenance

The Metal Hydride Canisters in Heliocentris systems fall under the exemption for recurrent testing according to the Pressure Equipment Directive (PED) 2014/68/EU (which supersedes the previous 97/23/EC):

- „The pressure device falls under Art. 3 Para. 3 of the PED on the basis of the specified operating data (pressure, volume) and is therefore not a system subject to monitoring in the sense of German Health and Safety at Work Regulations"

Assuming the permissible pressure is not exceeded, the Metal Hydride Canister is considered work equipment according to Art. 10 of the German national law and regulations concerning occupational health and safety (BetrSichV). The pressure vessel is therefore to be monitored by a qualified person determined by the operator at self-defined intervals.

Regular examination of the hydrogen piping and connections for damages, deformations, bulges. If irregularities are detected, take Metal Hydride Canister out of operation and inform Heliocentris.

The service life of metal hydride canisters is based on the degree of degradation accepted by the user. Therefore, it is the user's responsibility to determine how long the canisters are used.

## 7.2 Serial Number and Service

Every Metal Hydride Canister's serial number has been stamped onto it and can also be found on the packing box and the delivery order and the invoice.

Please keep in readiness this serial number so that the Heliocentris service can help you in the best possible way.

If you experience problems with the product, please contact the manufacturer:

Heliocentris Academia International GmbH

Rudower Chaussee 30

12489 Berlin

Germany

Phone +49 (0)30 – 340601-600

Email: service@heliocentrisacademia.com

An employee from Heliocentris customer service will contact you regarding your query.If you return the product for repair or replacement, you must ship it sufficiently secured and packaged (see Shipping Metal Hydride Canister on page 17.

Heliocentris is not responsible for damage that has been caused by improper packaging and/or improper handling during shipment. The customer is responsible for all related shipping charges for units whose warranties have expired.

## 7.3 Warranty

Heliocentris Academia Internationl GmbH assumes a warranty of 1 year for the product. The warranty period, according to the instruction manual, begins upon delivery as documented by the delivery order.

The warranty covers only defects which are present at the time of the handover of the product from the seller to the purchaser.

A warranty for specific characteristics is not given.

Warranty claims against Heliocentris Academia International GmbH cannot be made if:

- The customer has caused the damage by non-approved use or incorrect operation
- Unauthorized repairs or manipulations have been made to the product
- The customer has neglected his duty of supervision, and a third party has caused damage

The supplier is liable for damage caused during the delivery to the customer and provides replacement in the case of damage.

In the case of complaints and return of the product, the risk is borne by the customer, who must provide proper and secure packaging.

## 7.4 Cleaning

✓ Lint-free cloth, if necessary for heavy dirt moisten slightly.

▶ Clean the canister with a slightly moist cloth.

Tip

In case the unit is extremely dirty, use a mild detergent; never use chemical cleaners.

## 7.5 Disposal

Never dispose of metal hydride canisters with the household waste. The materials of the metal hydride are listed in the supplied material safety data sheet Metallic materials are generally recyclable.

Tip

For the disposal of Metal Hydride Canisters, Heliocentris recommends emptying the canister according to chapter Emptying Metal Hydride Canister for Shipping on page 17 and then flushing it with nitrogen.

The canisters in the depressurized state can be dropped off at a local collection center in accordance with local laws and regulations.

### Packaging material

- If required, store packaging material for future storage or transport of the system.
- Disposal of packaging material that is no longer needed in accordance with local laws and regulations.

# 8 Technical Data

| Designation | Definition | 200 | 800 |
|---|---|---|---|
| Rated capacity | max. | 200 nl | 800 nl |
| TN | Rated temperature | 20 °C | |
| PS | max. permissible pressure according to European Pressure Equipment Directive | 25 bar (362 psi) | |
| Coupling pressure | max. permissible coupling pressure of quick coupling | 17,2 bar (250 psi) | |
| Operating temperature | Discharging / filling | -5 °C...55 °C | |
| Thermalization temperature | During operation | 5 °C...50 °C | |
| Transport temperature | Filled with inert gas | -20°C...65 °C | |
| Hydrogen purity | | 5.0 (99.999 %) | |
| Pressure relief valve burst pressure | | 139 bar @ 60 °C | |
| Connection | for the quick coupling of the Metal Hydride Canister | Parker Q4CY Quick Coupling | |
| Total length | | 310 mm | 470 mm |
| Diameter | | 70 mm | 102 mm |
| Total weight | | 2.2 kg | 7.3 kg |
| Canister volume | | 0.5 l | 2.0 l |
| Desorption | recommended desorption rate | 1 Nl/min | 4 Nl/min |
| | recommended starting temperature | > 5 °C | |
| Absorption | Charge pressure | 1…25 bar | |
| | recommended starting temperature | ≤ 20 °C | |

Tab.8-1Technical specifications of the Metal Hydride Canister 200 and 800

## Abbreviations

| Abbreviation | Meaning |
|---|---|
| AB2 | Aluminum-bronze metal alloy |
| HW | Hardware |
| l | liter |
| PED | Pressure Equipment Directive |
| PS | max. allowable operating pressure according to PED |
| SL | Standard liter |
| TN | Nominal temperature |

Tab. 8-2Overview and explanation of the abbreviations

# Index

## W

Heliocentris

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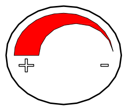
Rudower Chaussee 30, 12489 Berlin, Germany
T+ 49 (0) 30 340 601 600
service@heliocentrisacademia.com
www.heliocentrisacademia.com

# Important Note

Do not overtighten the knob

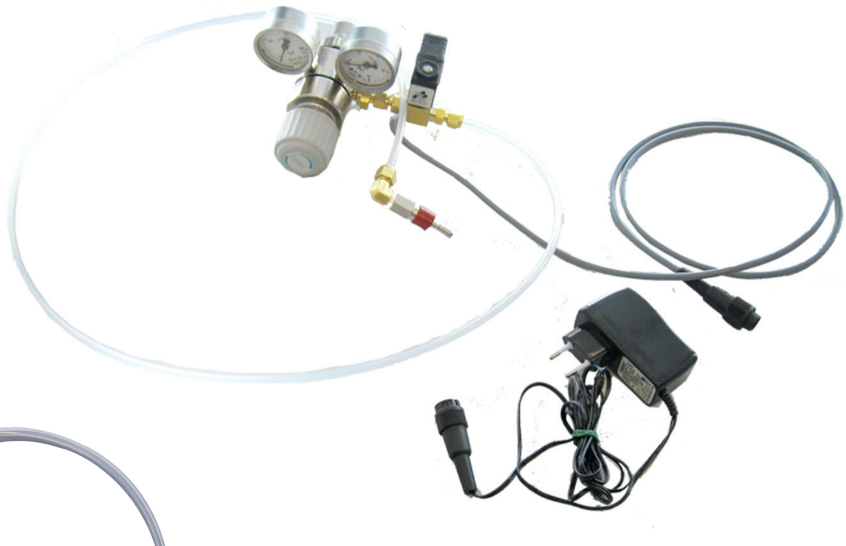


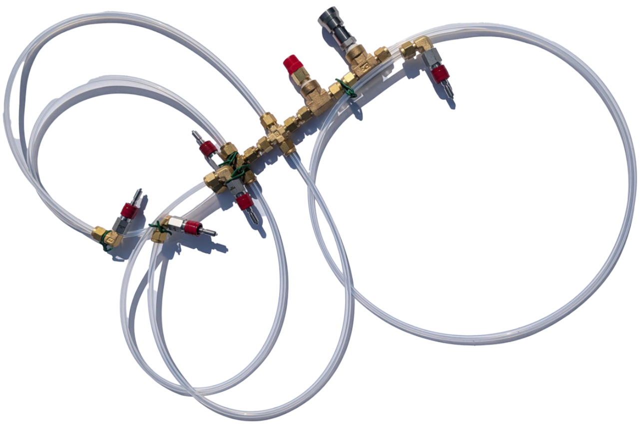

**!CLOCKWISE CLOSE!**

**!ANTI CLOCKWISE OPEN!**

# H2 Connection Set

Instruction Manual





H2 Connection Set, Instruction Manual
Version: 2.1
April 2026


Rudower Chaussee 30
12489 Berlin
Germany

# Contents

# 1 H2 Connection Set

The H2 Connection Set connects compressed hydrogen cylinder to:

- Fuel cells
- Metal hydride canisters
- Hydrogen storage modules by Heliocentris

Heliocentris offers accordingly different connection sets. These connection sets ensure:

- Correct connection components
- Permissible hydrogen pressure
- Safe hydrogen handling

## 1.1 About This Manual

If only the masculine or feminine form is used in parts of this manual, this is only used for readability and simplicity. Persons of the respective other gender are always included.

The instruction manual is intended to help you use the product. It is structured as follows.

| | |
|---|---|
| Safety | In the chapter "Safety" you will find information on the safe handling of the product. It is essential that you read and understand this chapter. |
| Components | This chapter presents the components of the product and their basic functions. |
| Getting started | This chapter describes the necessary steps for initial startup of the product. |
| Operation | The chapter provides instruction for the operation of the product. |
| Decommissioning | The necessary steps for the disassembly product and the conditions for its packaging, storage and transport are described in the chapter. |
| Troubleshooting | This chapter describes possible problems and their solution. |
| Maintenance and Service | This chapter describes all necessary measures arising in the product life cycle, such as the maintenance, cleaning, service, warranty and disposal. |
| Technical Data | An overview of important technical data is provided at the end of the instruction manual. |
| Appendix, Index | The abbreviations used in this manual are summarized in the appendix for a better overview and an index can be used for fast orientation. |

## 1.2 Notices and Symbols

### Symbols

The following symbols and labels are used in this manual:

| Symbol or label | Meaning |
|---|---|
| ▶ | Instruction |
| ✔ | Aids or prerequisites that are required prior to an action |
| 1. | Instructions in a specific sequence |
| ⇒ | Result of an action |
| •, – | List |
| *Switch* | Refers to a switch, key, button or icon |
| Reference to page x | Reference to further information |

Tab. 1-1 Symbols in the instruction manual

### Warnings

The following warnings are used:

| | |
|---|---|
| DANGER | Warns of dangers of fatal injury. |
| WARNING | Warns of dangers of serious injury. |
| CAUTION | Warns of dangers of injury. |
| NOTICE | Warns of physical damage to the product. |

### Tips

Useful tips are identified as follows:

| | |
|---|---|
| Tip | Provides further tips. |

# 2 Safety

In this chapter you will find information on the safe handling of the product. It is essential that you read and understand this chapter.

## 2.1 General Information on Safety & Responsibility

Improper use of the product can result in serious injuries.

**Danger of injury due to improper use!**

- ▶ Ensure that the manual is accessible at all times.
- ▶ Make sure you have read and understood this manual in its entirety.
- ▶ Comply with all safety instructions and warnings.
- ▶ Store the manual and other documentation in a safe place and pass them on to future owners of the product.
- ▶ Comply with all local regulations.
- ▶ Only use product components.
  Exception: if additional aids are specified in the manual.

**Danger of death due to unauthorized modifications!**

Conversions and modifications to the product can result in general hazards (danger due to escaping hydrogen, danger of injury due to heavy parts, danger of death due to electric shock).

Arbitrary modifications and changes of the product will void the warranty.

- ▶ Do not make conversions and modifications to the product or its individual components.
- ▶ Do not remove components (exception: see Maintenance on page 29.

## 2.2 Approved Use

The product has been designed for:

- Analysis and test purposes
- Experimentation purposes
- Demonstration purposes
- Training purposes
- Research purposes

The product is not intended for any other purpose; any other use is not approved.

The product must always be operated while under supervision.

The use of the hydrogen supply, which is available as an accessory, is subject to special safety regulations and is intended only in combination with the product for the purposes listed above.

## 2.3 Hazards during Approved Use

### Escaping Hydrogen: Danger of death due to explosion!

The system is built for continuous operation and it is continuously technically leak-tight. Besides, hydrogen itself is not a hazardous substance – its properties, however, can make it hazardous in interaction with other substances.

Escaping hydrogen can ignite and burn the skin.
Escaping hydrogen can reduce the oxygen content and cause breathing difficulty.

- ▶ Do not inhale hydrogen.
- ▶ The lab must be equipped with a suitable ventilation system for the use of hydrogen.
- ▶ Incorporate the unit, especially the vent line, into the operational safety concept.
- ▶ The lab must be equipped for hydrogen monitoring.
- ▶ Avoid heat in the vicinity of the system and the hydrogen source.
- ▶ No smoking, no naked flames.
- ▶ Comply with local safety regulations.
- ▶ Comply with regulations for handling of compressed hydrogen cylinders and metal hydride canisters.
- ▶ In the case of escaping gas, keep away and keep inflammable materials away.
- ▶ Prevent electrostatic charges.
- ▶ Ensure proper installation of the hydrogen supply.
- ▶ Check the hydrogen lines and connectors regularly for leak tightness.

## 2.4 Non-Approved Use

Do **not** use this product for:

- Operation beyond the technical specifications
- Operation beyond the approved operating environment
- Unsupervised operation
- Operation in potentially explosive areas

Components or products delivered by or purchased from Heliocentris are not approved for use in aeronautics or aerospace applications (including models).

# 2.5 General Information on Operation

## 2.5.1 Requirements for the Owner

The owner/operator must ensure that the unit is accessible only to the persons defined in this manual (see 2.5.3 ).

The safety instructions and warnings listed in this manual must be observed. The owner/operator is responsible for compliance with local safety regulations.

In the scope of a risk assessment (in accordance to national law and regulations concerning occupational health and safety), the operator must determine whether the occurrence of a potentially explosive atmosphere can be safely prevented. If this cannot be done, an explosion prevention document must be created.

Furthermore, the owner is responsible for the following:

- Implementation of a risk analysis in the sense of national law and regulations concerning occupational health and safety
- Proper installation of the hydrogen supply by a specialized company
- Regular checking of the hydrogen lines and connectors for leak tightness
- Unauthorized persons must be prevented, using corresponding measures, from installing, operating or maintaining the system. Installation, commissioning, shutdown and maintenance of the hydrogen supply and filling the metal hydride canisters must be carried out by appropriately qualified personnel
- The operator of the product must take sufficient precautions to prevent hydrogen being able to accumulate in enclosed or non-ventilated areas (e.g. installation of an exhaust air system and hydrogen warning system, etc.)
- National regulations must be observed for the operation of metal hydride canisters and the layout of hydrogen systems.

## 2.5.2 Requirements for the Installation Location

The system must be operated in a lab which complies with the local regulations (refer to Guidelines for Laboratories BGI 850-0e Working Safely in Laboratories – Basic Principles for Laboratories).

Hydrogen

The system location must meet the following requirements:

- The system must not be set up or operated in potentially explosive areas (EX zone).
- It must be included into a operation safety concept including an ex-protection document.
- Hydrogen monitoring or hydrogen sensors are present.
- Effective ventilation: The system may only be operated in rooms which have an air renewal rate of 10 / h in the event of an error. That means the entire air volume of the room must be replaced 10 times within one hour in the event of the escape of hydrogen.
- It must be marked that no source of ignition can be brought in here.
- Precautions against electrostatic charge have been taken
- Frost-free
- Clean
- The system may only be operated in rooms that don't contain any reactive gases and fluids.
- Non-flammable or difficult to ignite surface is used (FV-1 according to IEC 60707 or better)


- Hydrogen requires fire class C. Fire extinguisher class ABC (Powder)

Metal hydride canisters


Metal hydride requires fire class D. Fire extinguishers class D (Powder). Never try to use a $CO_2$ fire extinguisher or water!

### 2.5.3 Requirements for the User

The product is intended as a laboratory system for use by trained qualified personnel in education and research. Its design does not correspond to that of a "consumer-oriented" product whose proper use is generally known and which is protected against operation errors or improper use. The product may be used by the following persons under the following conditions:

Qualification

- Personnel must be familiar with and comply with the local applicable accident prevention and safety regulations.
- Persons with training in chemistry, physics, electronics, electrical engineering or comparable qualifications, who are familiar with the local regulations for safe handling of hydrogen, and who have experience in working with hydrogen.

Obligatory supervision

- The fuel cell system must only be used by persons undergoing training when under the supervision of the instructor.
- The instructor must ensure proper handling and is obliged to point out possible dangers.

## 2.6 System in Emergency

### Integration into a Safety Concept

The system needs to be incorporated into an operational safety concept. This depends on national laws, regulations and technical rules, compliance to which is solely the responsibility of the owner.

### Behavior on Hydrogen Warning Signal

If the hydrogen warning signal sounds in the room monitoring system, there should have already been an automatic emergency stop in the system onto which the connection set is used.

WARNING

**Danger of injury due to explosion!**

Escaping hydrogen can ignite in case of an accident, fire or great external heat.

Escaping hydrogen can reduce the oxygen content and cause breathing difficulty.

- ▶ Get all people into safety.
- ▶ Let escaping hydrogen burn off, do not extinguish burning hydrogen with extinguishing agents as this increases the risk of explosion.
- ▶ Notify the fire department and carry out the specified fire fighting actions for your laboratory.

CAUTION

**Danger of injury due to hydrogen ignition!**

Escaping hydrogen can ignite on any ignition source.

- ▶ Close hydrogen supply:
  - Internal hydrogen supply: close hand valves of the metal hydride canisters by turning them anti-clockwise.
  - External hydrogen supply: Close hydrogen cylinder or hydrogen supply. External hydrogen supply always requires a lab monitoring system, but this is in the responsibility of the owner.
- ▶ Disconnect system from power supply.
- ▶ Replace damaged hydrogen tubes.

# 3 Getting Started

This chapter describes the scope of delivery and the necessary steps for initial startup of the H2 Connection Set.

## 3.1 Installation Location

WARNING

**Danger of injury due to explosion!**

Escaping hydrogen can ignite.

Escaping hydrogen can reduce the oxygen concentration and cause respiratory difficulties.

- ▶ The H2 Connection Set is intended for installation in a room corresponding to local laboratory regulations, which must be integrated into an operational safety concept with Ex-protection documentation.
- ▶ Observe the additional safety instructions from Requirements for the Installation Location on page 9.

The installation location must meet the following requirements: see Requirements for the Installation Location on page 9

## 3.2 Scope of Delivery

The H2 Connection Sets consist of the following components

**15 bar H2 Connection Set supplying metal hydride canisters from 200 bar compressed hydrogen cyclinders**


Fig. 3-1 H2-Anschluss-Set, Article number K00-0631

Suitable for:

- Fuel Cell Trainer
- Heliocentris Metal hydride canister

Article number K00-0631
Cylinder thread variants:

- K00-0631BS
- K00-0631DIN
- K00-0631US

1 Pressure reducer with tube
2 Quick coupling
3 Cylinder holder

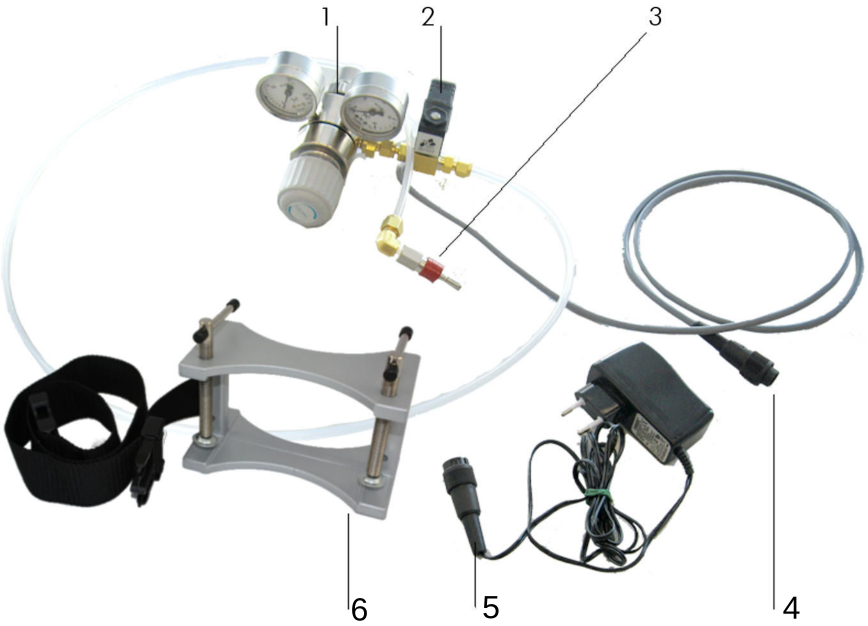
**15 bar H2 Connection Set supplying metal hydride canisters from 200 bar compressed hydrogen cyclinders (with solenoid valve)**

Suitable for:

- Hybrid Energy Lab-System
- Heliocentris Metal hydride canister
- Nexa® Integration System

Article number K00-0736
Cylinder thread variants:

- K00-0736-BS
- K00-0736-US
- K00-0736-DIN

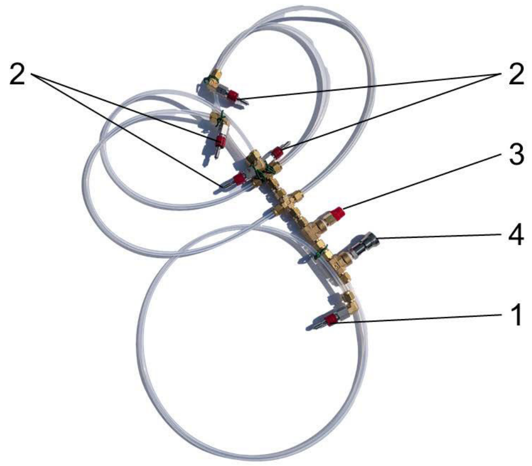



1 Pressure reducer with tube
2 2/2-ways solenoid valve
3 Quick coupling
4 Control cable solenoidvalve
5 Control cable + Poweradapter solenoidvalve
6 Cylinderholder

Fig. 3-2 H2-Anschluss-Set, Article number K00-0736

**H2 Connection Set supplying a Nexa® fuel cell from 1-4 metal hydride canisters**

Suitable for connecting up to 4 Heliocentris Metal hydride canister to the Nexa® 1200 fuel cell




1 Quick coupling to the solenoid valve of the Nexa
2 1-4 Quick couplings
3 Pressure relief valve
4 Quick coupling to HG

Fig. 3-3 H2-Anschluss-Set für 1-4 MHS, Article number K00-1502

## 3.3 Optional Components

### H2 Detector Set

The $H_2$ detection set is optionally available. It consists of a portable hydrogen warning device with acoustic and optic signals and leak detection fluid.

## 3.4 Unpacking and Assembling

1. Unpack the product.
2. Check the delivered product for visible shipping damage at the packaging and at the product.
   – If applicable
     - ▶ document the damage with a camera and
     - ▶ immediately inform the transport company and Heliocentris or your supplier about the damage.

CAUTION! Do not operate the H2 Connection Set in case of shipping damage.

3. Check the scope of delivery against the list in this instruction manual.

Tip

Store packaging material for future storage or shipping of the system.

4. Connect components as shown in the figures in chapter Scope of Delivery on page 13.

WARNING

**Danger of injury due to ignition of hydrogen!**

Escaping hydrogen can ignite and cause severe burnings of the body.
Escaping hydrogen can be hot and burn the skin.
Escaping hydrogen can decrease the oxygen concentration and cause difficulty breathing.

- ▶ Do not use any 3rd party adapters when connecting the set. Use the delivered parts only.
- ▶ Ensure that the connections fit properly.

# 4 Operation

The H2 Connection Set connects compressed hydrogen gas bottles (max. 200 bar) with:

- a fuel cell
- single metal hydrid canisters
- a Heliocentris hydrogen storage module

The chapter describes the connection of the different system sets.

## 4.1 Connect Hydrogen Cylinder to Metal Hydride Canister

These two $H_2$ connection sets connect a metal hydride canister with a compressed hydrogen cylinder. The $H_2$ connection sets differ:

- K00-0631 comes without solenoid valve
- K00-0736 includes a solenoid valve

The workflows differ only by the connection of the solenoid valve to the mains grid in step 13.

CAUTION

**Danger of injury due to overpressure in the metal hydride canister!**

Injury and property damage to due to bursting of the canister.

- ▶ Use allowed pressure only. Do not charge Heliocentris canisters with pressures higher than 25 bar.
- ▶ Use the allowed Heliocentris H2 Connection Set only.
- ▶ Do not heat canister.
- ▶ Do not cool canister down to lower than ambient temperature while filling.

CAUTION

**Danger of injury due to explosion!**

If the compressed hydrogen cylinder is damaged mechanically, e.g. by falling down, the adapter can tear off and hydrogen can leak out.

- ▶ Set compressed hydrogen cylinder in direct vicinity to the system, this way the hydrogen tube cannot be torn off by chance.
- ▶ Move and transport the compressed hydrogen cylinder only with the protective cap on.
- ▶ Do not kink or stretch the hydrogen tube.

NOTICE

**Danger of damage of the metal hydride canister due to low hydrogen purity!**

Hydrogen with a purity lower than 5.0 can irreversibly damage metal hydride canisters.

- ▶ Do not allow water, oil, air, or any substances other than pure hydrogen (or inert gas) to enter the metal hydride canister.
- ▶ Hydrogen of purity 5.0 (99.999%) or higher is required.

Connect the metal hydride canister as follows:

Prerequisites

- ✓ Compressed hydrogen cylinder (not in scope of delivery)
- ✓ H2 Connection Set 200 bar
- ✓ Metal hydride canister(s) is/are installed and open as described in the instruction manual Heliocentris Metal Hydride Canister
- ✓ Time: Filling can take up to 6 hours, depending on capacity and filling degree of the metal hydride canister.
- ✓ Wrench 30 mm (only needed for BS341 Nr. 4 / CGA350)

Prepare cylinder

1. Check the seal of the pressure reducer, in case of any damage replace with a new seal.


Fig. 4-1 Pressure reducer

| | | | |
|---|---|---|---|
| 1 | Inlet pressure gauge, inlet pressure from the compressed gas cylinder | 2 | Connection of the compressed gas cylinder with seal (not in image) |
| 3 | Outlet pressure gauge, outlet pressure from the metal hydride canister | 4 | Hand regulator |

2. Mount the compressed hydrogen cylinder onto a level and sturdy surface.
3. Fix the compressed hydrogen cylinder by using the supplied bottle holder to a suitable, sturdy object, for example a table.
4. Remove the protective cap from the compressed hydrogen cylinder, store the protective cap safely.
5. Ensure that the connections of compressed hydrogen cylinder and of pressure reducer are clean, if not, wipe them clean with a dry cloth.

Tip | Accessories for flammable gases are always lefthand threaded. In case of the H2 Connection Set the pressure reducer is lefthand threaded.

6. Close the hand regulator of the pressure reducer:
   Outlet pressure = 0 bar

Connect pressure reducer

7. DIN connection: Screw the union nut of the pressure reducer onto the cylinder connection and hand-tighten Beware the left-hand thread.
   Or
   BS or US connections: Screw the union nut of the pressure reducer onto the cylinder connection using a wrench.

CAUTION

**Danger of injury due to explosion!**

Escaping hydrogen can ignite and burn the skin.

▶ Perform leakage test before each operation.

NOTICE

**Damage by hydrogen overpressure!**

▶ Start with low inlet pressure 1…5 bar, then slowly increase by 1 bar per 10 seconds.

Leak tightness of connection set

8. Slowly open the cylinder valve until the inlet pressure gauge displays the same pressure as the cylinder gauge. Note of the pressure value.
9. Close cylinder valve.
10. Wait about 1 minute, checking the cylinder pressure.
    ⇨ The connection between cylinder and pressure reducer is tight if the cylinder pressure remains constant.

Caution

**Danger of injury by sparks!**

Contact of valves with metals can lead to sparking.

11. Empty the hydrogen train by shortly pressing in the valve pin of the quick coupling.
    ⇨ The connection is pressure-free.

Purge connection set

12. Open cylinder valve and turn clockwise the hand regulator of the pressure reducer, until the outlet pressure gauge displays a presssure of 1…15 bar (ideal operation pressure is 1…5 bar).
13. Connect the solenoid valve control cable (grey) with the mains adapter and plug the adapter into the power supply.
    ⇨ The solenoid valve opens.
14. Purge the hydrogen train by shortly pressing the valve pin of the quick coupling

⇨ The connection tube is purged with hydrogen and does not contain any other gases.

15. Insert the quick coupling of the connection set into the hydrogen inlet of the Heliocentris product, until it locks into place (click noise).
16. Open the hand regulator of the pressure reducer until the outlet pressure gauge displays a pressure of 15 bar.
17. Close the hand regulator.

Leak tightness of hydrogen train

For safe operation, all parts containing hydrogen must be absolutely tight.

18. Wait about 10 minutes.
19. Check the pressure at the outlet pressure gauge.
    - ⇨ The connection between connection set and system is tight if the pressure at the outlet pressure gauge remains constant.
    - ⇨ If he pressure at the outlet pressure gauge is decreasing then the hydrogen supply is leaking.

Tip

Systems with several metal hydride canisters: The inlet pressure at the hydrogen storage module will stabilise only after the pressures of all metal hydride canisters are the same.

In case of a leak:

20. Check all connections.
21. If the leak remains, see Performing Leakage Test on page 27.
22. If the leak remains, disconnect the hydrogen supply.
23. Contact Heliocentris.

In case of a tight system:

▶ Fill metal hydride canisters.

## 4.2 Connect Metal hydride Canisters to a Fuel Cell

The H2 Connection Set K00-1502 connects 1-4 metal hydride canisters to a Nexa® 1200 fuel cell.

Prerequisites

✓ H2 Connection Set 200 bar

✓ Metal hydride canister(s) is/are installed and open as described in the instruction manual Heliocentris Metal Hydride Canister

✓ Nexa® 1200 fuel cell is installed, see corresponding instruction manual, and is not running

Tip

Accessories for flammable gases are always lefthand threaded. In case of the H2 Connection Set the pressure reducer is lefthand threaded.

Connect

1. Insert the quick coupling (1) of the connection set into the quick coupling of the solenoid valve of the fuel cell until it locks into place (click noise).

2. Insert the quick couplings (2) of the connection set into the quick coupling of the metal hydride canisters, until they lock into place.

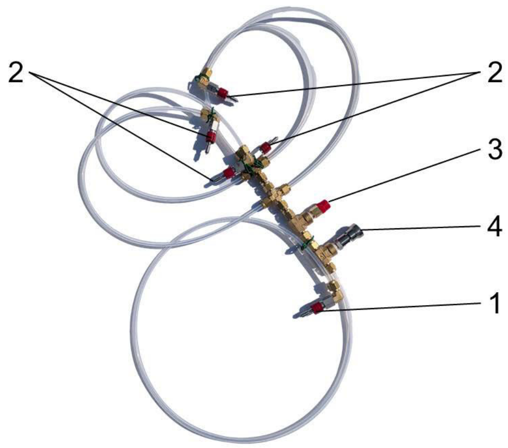



Fig. 4-2 H2 Filling & Connection Kit: 1 to 4 MHS to Fuel Cell (Nexa® 1200), article number K00-1502

1 Quick coupling to the solenoid valve of the fuel cell

2 1 - 4 Quick couplings to the metal hydride canisters

3 Pressure relief valve

4 Quick coupling to HG

Tip

The Nexa® 1200 fuel cell needs all 3 canisters for sufficient hydrogen supply.

▶ Always connect 3 metal hydride canisters.

Tip

Condensation on the surface of metal hydride canisters can occur when metalhydride canisters of different filling degrees are interconnected, while their gasvolumes and pressures equilibrate.

# 5 Decommissioning

The necessary steps for the decommissioning and disassembly of the H2 Connection Set, as well as the conditions for its packaging, storage and transport are described in this chapter .

## 5.1 Remove H2 Connection Sets 0631 / 0736

After each operation it is mandatory that the external hydrogen supply is disconnected and disassembled according to guidelines.

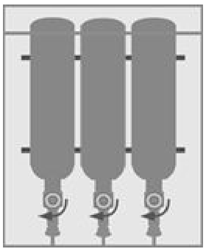
Prerequisites

✓ A fuel cell, if connected, is switched off and all LED lights are off.

Caution

| **Danger of injury by sparks!** |
| --- |
| Contact of valves with metals can lead to sparking. |

End filling



1. Check the hydrogen pressure at the pressure gauge at the front of the system. The pressure should be greater than 1 bar.
2. Close the stop valves of the metal hydride canisters of the system (either single MHS or in a hydrogen supply module) clockwise.
3. Close the valve of the compressed hydrogen cylinder anti-clockwise.
4. Disconnect the metal hydride canisters from the quick coupling:
   – Push back the release ring of the quick coupling.
   – Pull out the quick coupling.
5. Empty the hydrogen train by shortly pressing in the valve pin of the quick coupling.
   ⇨ The connection is pressure-free.
6. Check that both pressure gauges display 0 bar.
   – Check that the cylinder valve is closed properly and, if not, open the hand regulator of the pressure reducer again.

   CAUTION The solenoid valve is hot! Do not touch!
7. Disconnect the mains adapter from the solenoid valve control cable.
8. Close the hand regulator of the pressure reducer.

9. Check inlet pressure at the inlet pressure gauge. Target value is 0 bar.
   ⇨ If the cylinder is closed tightly, the pressure remains constant.

   The pressure reducer can only be removed if both pressure gauges display 0 bar.
10. Unscrew pressure reducer from the compressed hydrogen cylinder.

    The pressure seal can fall out of its seat, in this case, store them properly.
11. Cover the cylinder valve with protective cap.
12. Store the cylinder according to the guide lines.

## 5.2 Disconnect the H2 Connection Set K00-1502

After each operation it is mandatory that the external hydrogen supply is disconnected and disassembled according to guidelines.

Prerequisites

✓ A fuel cell, if connected, is switched off.

Caution

**Danger of injury by sparks!**

Contact of valves with metals can lead to sparking.

Disconnect H2 Connection Set

1. Close the stop valves of the metal hydride canisters of the system (either single MHS or in a hydrogen supply module) clockwise.
2. Disconnect the metal hydride canisters from the quick coupling:
   – Push back the release ring of the quick coupling.
   – Pull out the quick coupling.
3. Empty the hydrogen train by shortly pressing in the valve pin of the quick coupling.
   ⇨ The connection is pressure-free.

## 5.3 Storage

Tip

Store packaging material for future storage or shipping of the system.

If the system or individual modules are to be shipped

1. Decommission the system.
2. Pack the system properly:
   - Ship the system in its original packaging.
   - When packing the individual components, they must be sufficiently padded to protect them against impact and humidity.

## 5.4 Shipping

Notice

**Damage due incorrect shipping!**

Humidity and intrusion or deposits of of foreign objects can damage the H2 Connection Set system.

- Follow the instructions.
- Observe the shipping conditions, see Environmental Conditions on page 33.

During transport, the system should not be exposed to freezing temperatures or excessive heat for extended periods.

- Stay within a temperature range of +10…+70 °C.

# 6 Troubleshooting

**Fehler-Ursachen und ihre Behebung**

Fuel cell problems can originate in the hydrogen supply:

| **Problem** | **Possible Cause** | **Remedy** |
|---|---|---|
| No inlet pressure | Manual stop valve is closed. | Open manual stop valve of metal hydride canister. |
| | Quick coupling is not properly connected. | Ensure that quick coupling is locked into its place properly (click noise). |
| Low $H_2$ inlet pressure | No hydrogen | Ensure hydrogen supply. |
| Low $H_2$ pressure of fuel cell | Too low $H_2$ supply pressure | Ensure sufficient hydrogen supply |
| Fuel cell in error mode at start | Too low $H_2$ inlet pressure | Check whether sufficiently high $H_2$ pressure is available (recommended range of inlet pressure 1…15 bar). |
| Too high $H_2$ inlet pressure | Too high $H_2$ inlet pressure > 25 bar | Reduce the $H_2$ inlet pressure to the recommended range of 1…15 bar. |
| Too high $H_2$ stack pressure, repetitively | Possibly defective pressure reducer | Contact Heliocentris Service. |
| Irreparable leak | Defective H2 Connection Set | Contact your supplier. |

Tab. 6-1 Possible problems with the hydrogen supply, causes and remedies

## 6.1 Performing Leakage Test

The leakage test ensures the tightness of the hydrogen train. There are 2 different types of tests:

| **Test Type** | **To Perform** |
|---|---|
| **Leak-tightness test** (see Leak tightness of hydrogen train on page 20 ) | ▶ On installation<br>▶ and before each use |
| **Leakage test** | ▶ On installation<br>▶ and if the leak-tightness test shows a leak |

Prerequisites:

✓ Leak detection agent

✓ Wrench SW 8

✓ Screw driver 3.2 mm

✓ Clock: display accurate to the second

DANGER

**Danger of death due to explosion!**

Escaping hydrogen can ignite and burn the skin

▶ Under **no** circumstances use a potential ignition source (lighter, hot light bulb, ...) for the leak bubbles search.

WARNING

**Risk of injury from electric shock!**

The liquid leak detection agent can make an electrical connection between current carrying parts and the body.

▶ Apply leak detection agent only locally.

▶ Secure against drops by holding a cloth below the sprayed spot.

NOTICE

**Property damage by foreign matter in the fan!**

For example leak detection fluid will damage the fuel cell stack.

▶ Keep fan dry and tidy.

Tip

Scan the area with a LED lamp, when in poor lighting conditions. Lamp distance has to be at least 1 m.

Performing the leakage test

1. Place the entire hydrogen system under pressure 1…2 bar.
2. Apply leak detection agent evenly to all hydrogen junctions.
   – Avoid valve bodies and pressure relief valves!
   – Avoid electrical connections!
   – Take care to cover junctions completely.
3. Search all junctions for bubbles.
   ⇨ Leaks show immediately by bubbles in the agent.
   ⇨ The hydrogen train is considered technically tight if the leak detection agent does not show any bubbles within 3 minutes.
4. **Leakage test passed**:
   Submit test report in the lab book or archive at another suitable location.
   **Leakage test failed**:
   Document any detected leakage, take the system out of operation (see Decommissioning on page 23) and contact Heliocentris.
5. Remove excess leak detection agent with a dry, lint-free cloth.

# 7 Maintenance, Service and Disposal

## 7.1 Maintenance

All maintenance must be carried out by persons qualified for this work. In addition, the operator is responsible for ensuring that all maintenance is performed in accordance with the local occupational safety regulations.

Caution

**Danger of injury due to ignition of hydrogen!**

Hydrogen can escape through damaged hydrogen tubes or connections and ignite with the presence of an ignition source.

1. Close hydrogen supply.
2. Disconnect unit from power supply.
3. Replace damaged tubes.

| Interval | Component | Reason | Maintenance Task |
|---|---|---|---|
| Daily or on every operation | Hydrogen hydrogen piping and connections | Avoid performance loss | ▶ Leak tightness of hydrogen train on page 20 |
| Daily or on every operation | Hydrogen hydrogen piping and connections | Explosion protection | ▶ Check surface of tubes and cables<br>▶ Check tightness of connections<br>▶ If irregularities are detected, take metal hydride canisters out of operation |
| At least every 6 months | Hydrogen hydrogen piping and connections | Explosion protection | ▶ Check surface of tubes and cables for damages, deformations, bulges<br>▶ Check tightness of connections<br>▶ Do not use the H2 Connection Set if irregularities are detected. |
| Every 5 years | H2 Connection Set | Explosion protection | General overhaul<br>▶ Contact Heliocentris Service |

Tab. 7-1: Maintenance tasks and maintenance intervals

## 7.2 Cleaning

✓ Damp cleaning cloth

1. Clean the H2 Connection Set with a very slightly damp cleaning cloth.

## 7.3 Service

Each H2 Connection Set has a serial number printed on the shipping carton, on the nameplate and on the delivery note / invoice.

The module serial numbers are located on the back of the module on themodule nameplate.

Please keep this serial number to hand so that the Heliocentris service can help you in the best possible way.

If you experience problems with the product, please contact the manufacturer:

**Heliocentris Academia Internatiomnal GmbH**
Rudower Chaussee 30
12489 Berlin, Germany
T + 49 (0) 30 340 601 600
service@heliocentrisacademia.com
www.heliocentrisacademia.com

An employee from Heliocentris customer service will contact you regarding your query. If you return the product for repair or replacement, you must ship it sufficiently secured and packaged.

Heliocentris is not responsible for damage that has been caused by improper packaging and/or improper handling during shipment.
The customer is responsible for all related shipping charges for units whose warranties have expired.

## 7.4 Disposal

### H2 Connection Set

Never dispose of the product with household waste. In accordance with the WEEE Directive 2012/19/EU, electronic equipment must be sent to the designated collection point for recycling.

The respective national regulations must be observed for disposal. Disposal is normally the responsibility of the customer. Please contact Heliocentris services for any questions in this regard.

### Packaging material

- If required, store packaging material for future storage of the system.
- Disposal of packaging material that is no longer needed in accordance with local laws and regulations.

### Outside the European Union

Disposal of the system in accordance with local laws and regulations.

## 7.5 Warranty

Heliocentris guarantees the components of the system for one year after handover of the system.

The warranty only covers defects, which are present at the time of the handover of the product from the seller to the purchaser.

A guarantee of specific properties is not given.

Warranty claims against Heliocentris cannot be made if:

- The customer has caused the damage by improper use or incorrect operation
- Unauthorized repairs or manipulations have been made to the product
- The customer has neglected his duty of supervision and has caused damage to third parties

The supplier is liable for damage caused during the delivery to the customer and provides replacement in the case of damage.

In the case of complaints and return of the product, the risk is borne by the customer who must provide proper and secure packaging.

# 8 Technical Data

## 8.1 Environmental Conditions

| **Definition** | **Value** |
|---|---|
| Operation environment | |
| Location | Inside a laboratory, dry |
| Temperature | 5…35 °C |
| Relative humidity | 0…95%<br>Above dew point |
| Storage Conditions | |
| Storage temperature | 3…35 °C |
| Storage location | Free of dust<br>Effective ventilation<br>Free of reactive chemicals |

See also  auf Seite 1

## 8.2 System

### H2 Connection Set K00-0631 und K00-0736

| **Property** | **Value** |
|---|---|
| Media | Hydrogen |
| Pressure range | 0…200 bar |
| Operating temperature | 3…40 °C (37…104 °F) |
| Weight | 600 g |
| Pressure relief valve, max. pressure | 26 bar |
| Tubing length: transition piece for metal hydride canister | 60 cm |
| Tubing material | PFA |
| Quick coupling material | Stainless steel |
| Quick coupling connection | quick coupling Q4 |

### H2 Connection Set K00-1502

| **Property** | **Spezification** |
|---|---|
| Media | Hydrogen |
| Pressure range | 0…15 bar |
| Operating temperature | 3…40 °C (37…104 °F) |
| Weight | 600 g |

## 8 Technical Data

| Property | Spezification |
|---|---|
| Pressure relief valve, max. pressure | 16 bar |
| Tubing length: transition piece for Nexa® 1200 fuel cell | 110 cm |
| Tubing length: transition piece for metal hydride canister | 65 cm |
| Tubing material | PFA |
| Quick coupling material | Stainless steel |
| Quick coupling connection | quick coupling Q4 |

# 9 Appendix

## 9.1 Index (alphabetical)

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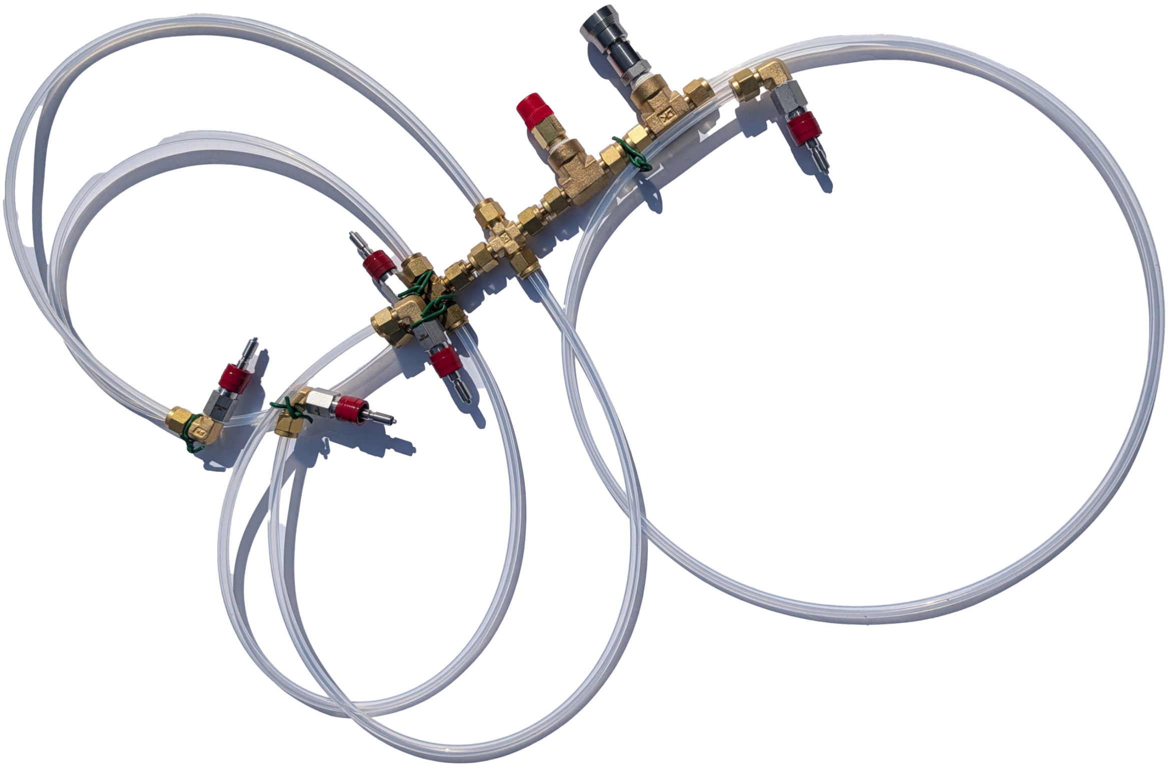
Heliocentris

# $H_2$ Filling & Connection Kit: 1 to 4 MHS to Fuel Cell (Nexa® 1200)

Instruction Manual



H2 Filling & Connection Kit: 1 to 4 MHS to Fuel Cell (Nexa® 1200), Instruction Manual
Version 2.1
April 2026


Rudower Chaussee 30
12489 Berlin
Germany

# 1 Content

# 2 About This Document

This document is intended to help you easily get your fuel cell stack running and set it up for further experiments.

## 2.1 Notices and Symbols

### 2.1.1 Symbols

The following symbols and labels are used in this manual:

| Symbol or label | Meaning |
|---|---|
| ➔ | Instruction |
| ✓ | Aids or prerequisites that are required prior to an action |
| 1. | Instructions in a specific sequence |
| ⇨ | Result of an action |
| ●, - | List |
| *SWITCH* | Refers to a switch, key, button or icon |
| Reference to page x | Reference to further information |

Table 2-1 Symbols in the instruction manual

### 2.1.2 Warnings

The following warnings are used:

| **WARNING** |
|---|
| Warns of dangers of serious injury. |

| **CAUTION** |
|---|
| Warns of dangers of injury. |

| **NOTICE** |
|---|
| Warns of physical damage to the product. |

### 2.1.3 Tips

Useful tips are identified as follows:

| TIP |
| --- |
| Provides further tips. |

## 2.2 Accompanying documents

The following documents are supplied with the product in addition to the instruction manual:

- USB-Stick with:
  - *Electronic version of the manual*

# 3 Safety Instructions

In this chapter you will find information on the safe handling of the product. It is essential that you read and understand this chapter.

## 3.1 General Information on Safety & Responsibility

**WARNING**

**Danger of injury due to improper use!**

Improper use of the product can result in serious injuries.

- ➔ Ensure that the manual is accessible at all times.
- ➔ Make sure you have read and understood this manual in its entirety.
- ➔ Comply with all safety instructions and warnings.
- ➔ Store the manual and other documentation in a safe place and pass them on to future owners of the product.
- ➔ Comply with all local regulations.
- ➔ Use only product components.
  Exception: if other aids are specified in the manual.

**WARNING**

**Danger of fatal injury in case of unauthorized modifications!**

Conversions and modifications to the product can result in general hazards (danger from escaping hydrogen).

- ➔ Do not make conversions and modifications to product or its individual components.
- ➔ Do not remove components.

### 3.1.1 Approved Use

The product has been designed to connect 1-4 Metal Hydride Canisters(Heliocentris version) to Nexa® 1200 or other Fuel Cell.

The product is not intended for any other purpose; any other use is not approved.

➔ The product must always be operated while under supervision.

The use of the hydrogen supply, which is available as an accessory, is subject to special safety regulations and is intended only in combination with the product for the purposes listed above.

## 3.2 Non-approved Use

**Do not** use this product for:

- Operation beyond the technical specifications
- Operation beyond the approved operating environment
- Unsupervised operation
- Operation in potentially explosive areas

Components or products delivered by or purchased from Heliocentris are not approved for use in aeronautics or aerospace applications (including models).

### 3.2.1 Hazards During Intended Use

For proper handling of all chemical or hazardous substances, it is necessary to exercise appropriate care; also make sure you have read and understood the relevant safety data sheets.

Hydrogen

Hydrogen itself is not a hazardous substance – its properties, however, can make it hazardous in interaction with other substances.

**WARNING**

**Danger of injury due to hydrogen!**

Escaping hydrogen can ignite and cause severe burns to the body.

Escaping hydrogen can be hot and burn the skin.

Escaping hydrogen can reduce the oxygen concentration and cause respiratory difficulties.

- ➔ Do not inhale hydrogen.
- ➔ The lab must be equipped with a suitable ventilation system for the use of hydrogen.
- ➔ The lab must be equipped for hydrogen monitoring.
- ➔ Avoid heat in the vicinity of the system and the hydrogen source.
- ➔ No smoking, no naked flames.
- ➔ Comply with local safety regulations.
- ➔ In the case of escaping gas, keep away and keep inflammable materials away.
- ➔ Prevent electrostatic charges.
- ➔ Ensure proper installation of the hydrogen supply.
- ➔ Check the hydrogen lines and connectors regularly for leak tightness.

## 3.3 General Information on Operation

### 3.3.1 Requirements for the Owner / Operator

The owner/operator must ensure that the unit is accessible only to the persons defined in this manual (see Requirements for the User page 8).

The safety instructions and warnings listed in this instruction manual must be observed. The owner/operator is responsible for compliance with local safety regulations.

Furthermore, the owner/operator is responsible for:

- Proper installation of the hydrogen supply by a specialized company
- Regular checking of the hydrogen lines and connectors for leak tightness
- Unauthorized persons must be prevented, using corresponding measures, from installing, operating or maintaining the product. Installation, commissioning,

shutdown and maintenance of the hydrogen supply and filling the metal hydride canisters must be carried out by appropriately qualified personnel.

The operator of the product must take sufficient precautions to prevent hydrogen being able to accumulate in enclosed or non-ventilated areas (e. g. installation of an exhaust air system and hydrogen warning system, etc.).

### 3.3.2 Requirements for the Installation Location

The product must be operated in a lab which complies with the local regulations. This particularly applies for the use and storage of the metal hydride canisters not included in the scope of delivery

### 3.3.3 Requirements for the User

The product is intended as a laboratory system for use by trained qualified personnel in education and research. Its design does not correspond to that of a "consumer-oriented" product whose proper use is generally known and which is protected against operation errors or improper use. The product may be used by the following persons under the following conditions:

➔ Personnel must be familiar with and comply with the local applicable accident prevention and safety regulations.

# 4 Components

With the Connection Kit 1-4 metal hydride canisters can be connected to the Nexa® 1200 or other Fuel Cell at the same time.

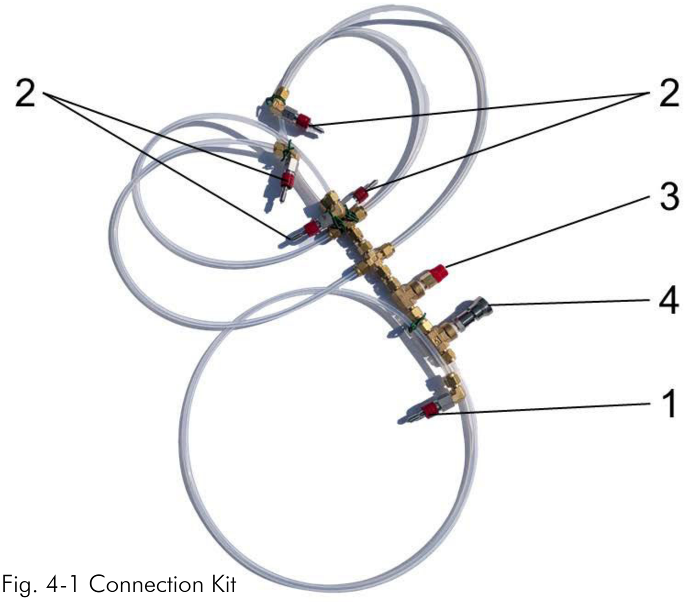



Fig. 4-1 Connection Kit

1 Quick coupling plug to solenoid valve of Nexa® 1200 or other Fuel Cell

2 Quick coupling plug to metal hydride canisters

3 Relief valve

4 Quick coupling to HG

# 5 Initial Steps

This chapter describes the scope of delivery and the necessary steps from mounting H2 Connection Kit to Nexa® 1200 or other Fuel Cell to connecting quick couplings with metal hydride canisters.

| WARNING |
|---|
| **Danger of injury due to hydrogen leakage!**<br>Escaping hydrogen can ignite and cause severe burns to the body.<br>Escaping hydrogen can be hot and burn the skin.<br>Escaping hydrogen can reduce the oxygen concentration and cause respiratory difficulties.<br>➔ Do not use any adapters when connecting the Connection Kit, only use the provided parts.<br>➔ Make sure connections mate. |

## 5.1 Scope of delivery

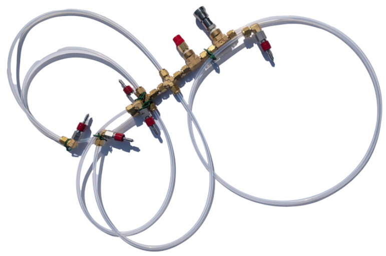
| Illustration | Designation |
|---|---|
|  | H2 Filling & Connection Kit:<br>1 to 4 MHS to Fuel Cell (Nexa® 1200) |

Table 5-1 Scope of delivery

## 5.2 Preliminaries

### 5.2.1 Installation Location

➔ Heed specifications for location requirements given in the instruction manual of the Nexa® 1200.

### 5.2.2 Unpacking

The following section describes what to watch out for when unpacking and setting up the unit:

1. Check for completeness.
2. Check the unit for obvious transport damage to the packaging and to the product itself. In the event of damage, inform the shipping company and Heliocentris or your supplier about the damage immediately.
   - *If possible, document the damage with a camera.*
3. Compare the delivered items with the information in this instruction manual immediately after unpacking.
4. Set up unit at selected installation location.

| **TIP** |
| --- |
| Store packaging material for future storage or dispatch of the unit. |

## 5.3 How to Connect the Connection Kit

Connecting the Connection Kit consists of the following steps:

- Connecting quick coupling to solenoid valve of Nexa® 1200
- Connecting quick couplings with the metal hydride canisters

### 5.3.1 How to Connect Quick Coupling to Solenoid Valve of Nexa® 1200

Connect the solenoid valve as follows:

➔ Insert quick coupling plug of connection kit into the quick coupling of the solenoid valve until it locks into place.

### 5.3.2 How to Connect Quick Couplings with Metal Hydride Canisters

✓ Nexa® 1200 set up, refer to respective Instruction Manual

✓ Metal hydride canisters installed safely and filled with hydrogen, refer to respective Instruction Manual

✓ Quick coupling connected with solenoid valve of Nexa® 1200

**TIP**

Always connect at least 3 metal hydride canisters. If fewer canisters are connected sufficient supply of the Nexa® 1200 is not given.

When several metal hydride canisters of different states of charge are interconnected they will equilibrate their gas volumes, which may lead to condensation on the surface of metal hydride canisters.

Connect the metal hydride canisters as follows:

➔ Insert quick coupling plugs of connection kit into the quick couplings of the metal hydride canisters until it locks into place.

### 5.3.3 How to Conduct Leakage Test

For safe operation of the unit it must be assembled absolutely leak-tight.

The leak test should be conducted every time the hydrogen supply is connected.

- ✓ Connection Kit installed
- ✓ Nexa® 1200 is not running
- ✓ H2 leakage test liquid (not included in the scope of delivery)

**TIP**

When leakage test liquid is applied to the relief valve wrong results may occur when the triggering pressure is reached at the relief valve and hydrogen is ejected.

Do not apply leakage test liquid to the relief valve.

➔ Use the leakage test liquid to find the leak.

– *See the instructions printed on the leakage test liquid.*

Leak found at Connection Kit:

➔ Contact Heliocentris.

# 6 Decommissioning

## 6.1 How to Disconnect the Connection Kit

Proceed as follows to disconnect the Connection Kit:

- ✓ Nexa® 1200 is switched off and all LEDs are off

1. Close stop valves at metal hydride canisters.
2. Push back the release rings on the quick couplings of the metal hydride canisters.
3. Pull out the quick coupling plug.

⚠ **CAUTION!** The solenoid valve becomes hot during operation! Do not touch.

4. Push back the release ring on the quick coupling of the solenoid valve.
5. Pull out the quick coupling plug.

## 6.2 Disposal

Dispose of the Connection Kit or single parts properly according to your statutory regulations.

# 7 Maintenance and Service

## 7.1 Maintenance

Inspection prior to every use:

- ➔ Examine for external damage and test function.

General overhaul every 6 years:

- ➔ Contact Heliocentris Service.

## 7.2 How to Clean the Connection Kit

- ✓ Moist cloth
- ➔ Clean Connection Kit with a slightly moist cloth.

## 7.3 Service

If you experience problems with the unit, then please contact the manufacturer:

Heliocentris Academia International GmbH

Rudower Chaussee 30

12489 Berlin

Germany

Phone +49(0)30–340601-624

Email: service@heliocentrisacademia.com

An employee from Heliocentris Customer Service will contact you and explain all further steps. If you return the unit for repair or replacement, you must ship the unit sufficiently secured and packaged.

Heliocentris is not responsible for damage which has been caused by improper packaging and / or improper shipment. You must bear the costs yourself for the shipment of units with expired warranty.

## 7.4 Warranty

For the H2 Filling & Connection Kit: 1 to 4 MHS to Fuel Cell (Nexa® 1200) Heliocentris provides a warranty of 1 year.

The warranty only covers defects which are present at the time of the handover of the product from the seller to the purchaser.

A warranty for specific characteristics (e.g. output and service life of the fuel cell) is not made.

Warranty claims against Heliocentris cannot be made if:

- The customer has caused the damage by improper use or incorrect operation.
- Unauthorized repairs or manipulations have been made to the product.
- The customer has neglected his duty of supervision and has caused damage to third parties.

The supplier is liable for damage caused during the delivery to the customer and provides replacement in the case of damage.

In the case of complaints and return of the product, the risk is borne by the customer who must provide proper and secure packaging.

# 8 Troubleshooting

## 8.1 Problems and their Remedies

| What's the trouble? | Possible cause? | Remedy! |
|---|---|---|
| No inlet pressure | Stop valve not open | Open stop valve at metal hydride canister |
| | Quick couplings not properly connected | Ensure complete engagement of the quick couplings (click noise) |
| Not possible to close off leak | Defective Connection Kit | Contact your supplier |

Table 8-1 Troubleshooting

# 9 Technical Data

## 9.1 Specifications

| **Characteristics** | **Value** |
|---|---|
| Media | Hydrogen |
| Pressure range | 0…15 bar |
| Operating temperature | 3…40°C |
| Weight | 600 g |
| Tubing length: Manifold–Nexa® 1200 | 110 cm |
| Tubing length: Manifold–Metal hydride canister | 65 cm |
| Material tubing | PFA |
| Material quick couplings | Stainless steel |
| Pressure relief valve, max. pressure | 16 bar |
| Specifications connections | |
| Quick coupling | quick coupling Q4 |

Table 9-1 Specifications Connection Kit

# Index

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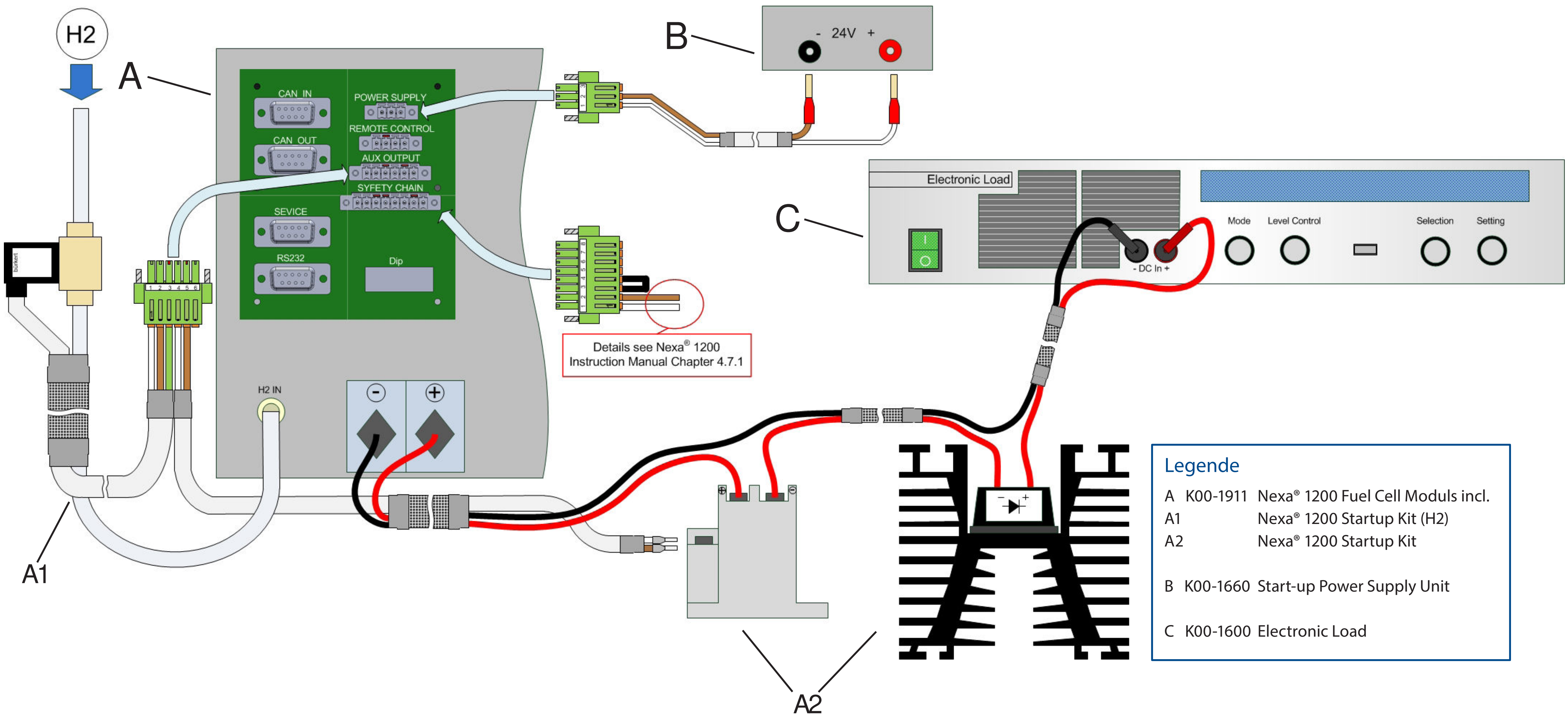
# Nexa® Integration System

Heliocentris




## Legende

A K00-1911 Nexa® 1200 Fuel Cell Moduls incl.
A1 Nexa® 1200 Startup Kit (H2)
A2 Nexa® 1200 Startup Kit

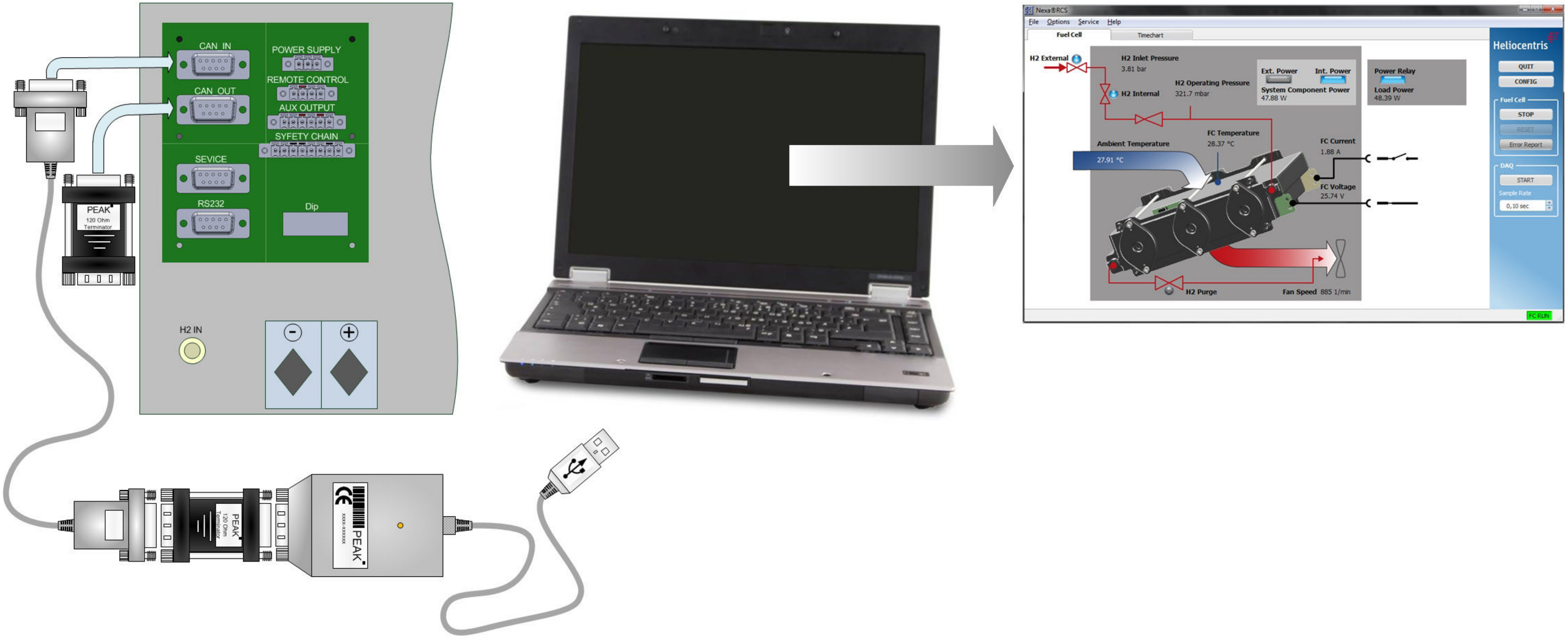
B K00-1660 Start-up Power Supply Unit

C K00-1600 Electronic Load

Refer to Nexa® 1200 and Nexa® DC1200 Instruction Manuals for more detailed information and information concerning your personal safety

# Nexa® Integration System - Communication via RCS

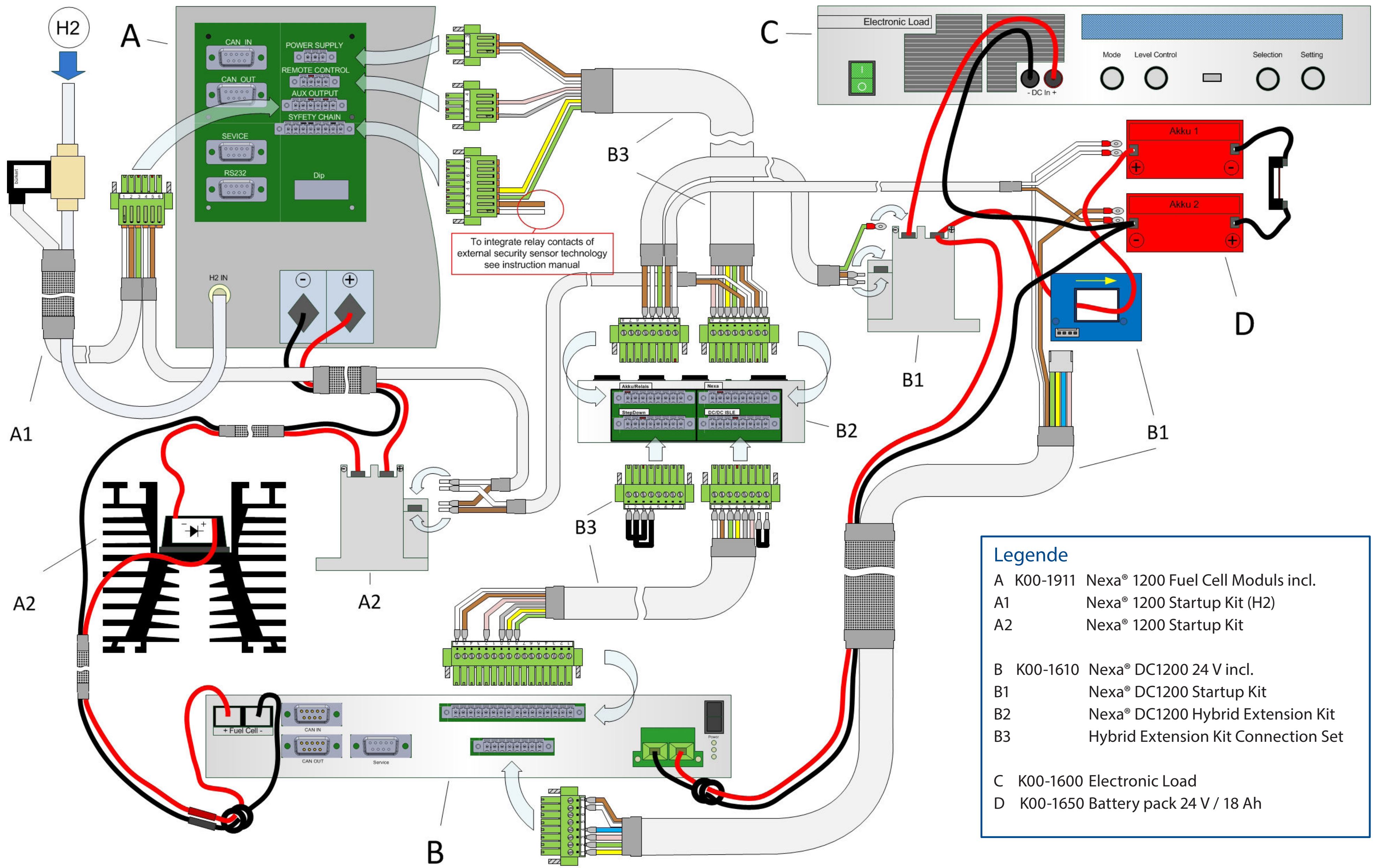
Heliocentris




Refer to Nexa® 1200 and Nexa® DC1200 Instruction Manuals for more detailed information and information concerning your personal safety

# Nexa® Integration System - Example with 24 V Version

Heliocentris



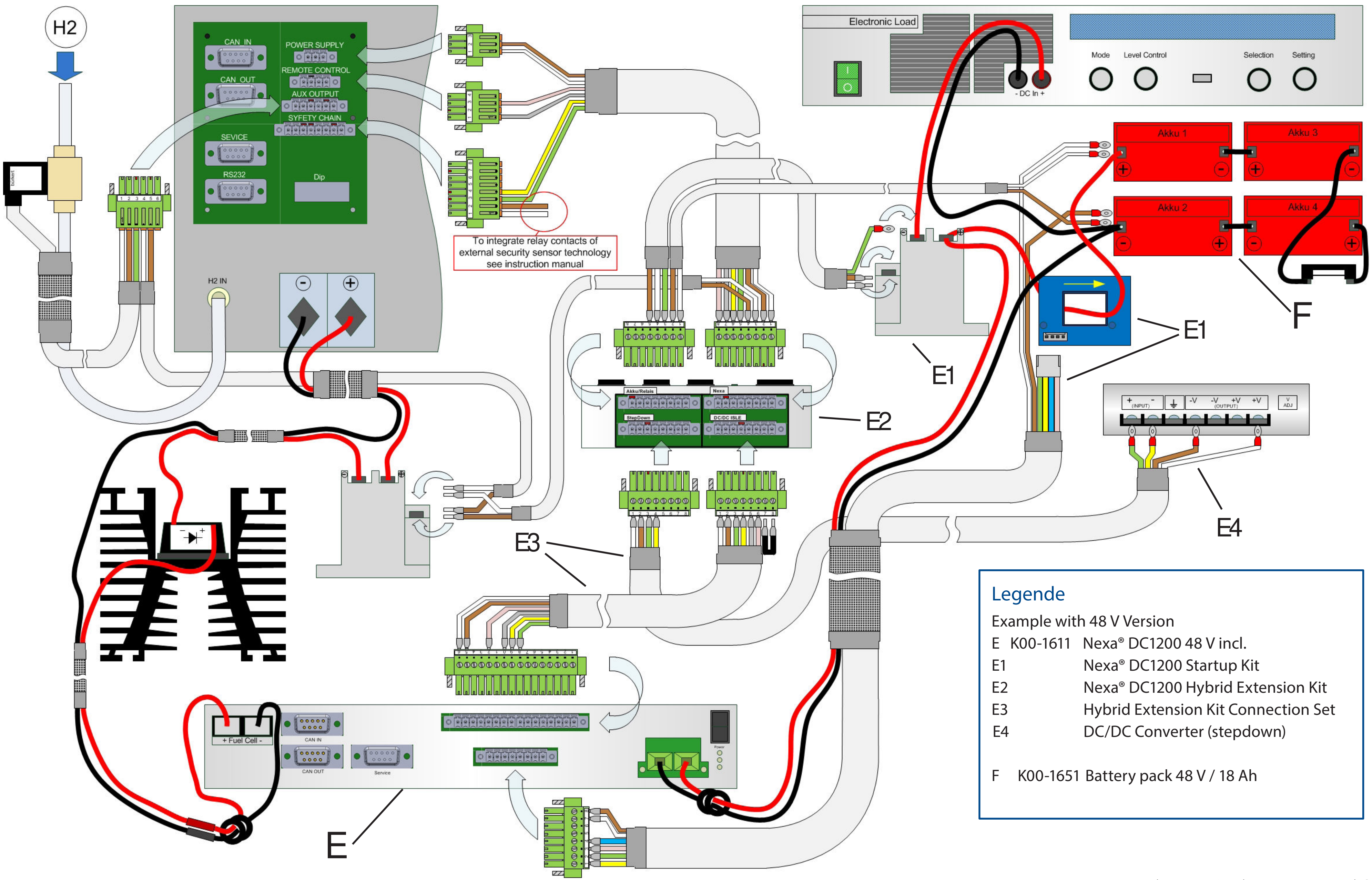

## Legende

| | | |
|---|---|---|
| A | K00-1911 | Nexa® 1200 Fuel Cell Moduls incl. |
| A1 | | Nexa® 1200 Startup Kit (H2) |
| A2 | | Nexa® 1200 Startup Kit |
| B | K00-1610 | Nexa® DC1200 24 V incl. |
| B1 | | Nexa® DC1200 Startup Kit |
| B2 | | Nexa® DC1200 Hybrid Extension Kit |
| B3 | | Hybrid Extension Kit Connection Set |
| C | K00-1600 | Electronic Load |
| D | K00-1650 | Battery pack 24 V / 18 Ah |

Refer to Nexa® 1200 and Nexa® DC1200 Instruction Manuals for more detailed information and information concerning your personal safety

# Nexa® Integration System - Example with 48 V Version

Heliocentris




## Legende

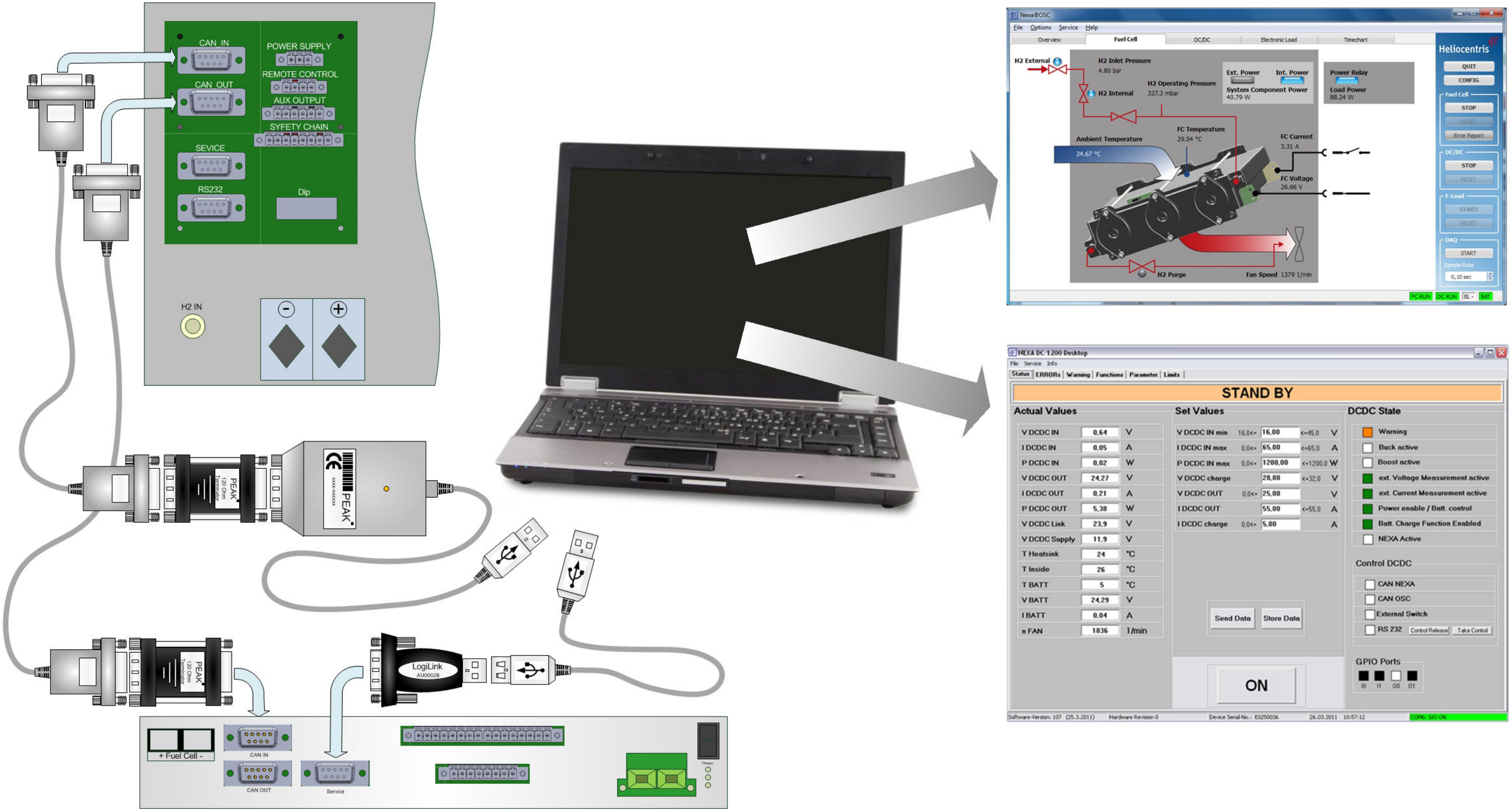
Example with 48 V Version

| | | |
|---|---|---|
| E | K00-1611 | Nexa® DC1200 48 V incl. |
| E1 | | Nexa® DC1200 Startup Kit |
| E2 | | Nexa® DC1200 Hybrid Extension Kit |
| E3 | | Hybrid Extension Kit Connection Set |
| E4 | | DC/DC Converter (stepdown) |
| F | K00-1651 | Battery pack 48 V / 18 Ah |

Refer to Nexa® 1200 and Nexa® DC1200 Instruction Manuals for more detailed information and information concerning your personal safety

# Nexa® Integration System - Communication via OSC

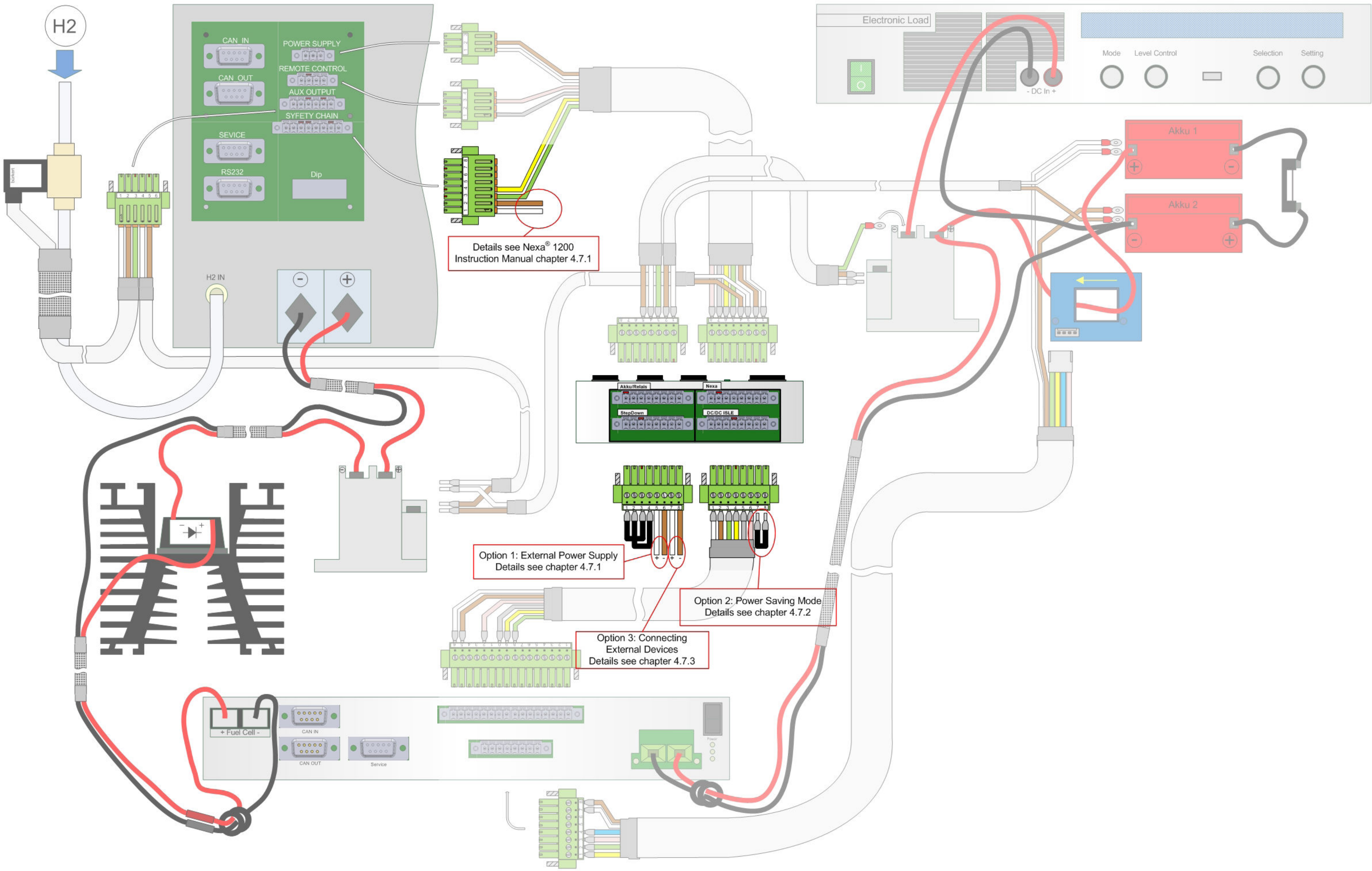
Heliocentris




Refer to Nexa® 1200 and Nexa® DC1200 Instruction Manuals for more detailed information and information concerning your personal safety

# Nexa® Integration System - Options

Heliocentris

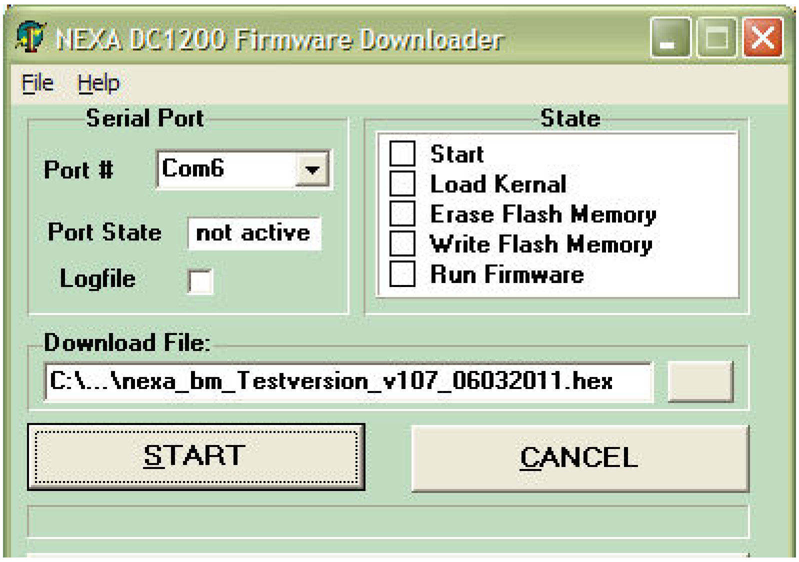



Refer to Nexa® 1200 and Nexa® DC1200 Instruction Manuals for more detailed information and information concerning your personal safety

Heliocentris

# Nexa® DC1200 Firmware Downloader

Instruction Manual



# Contents

# 1 Installing the Firmware Downloader

You have received a HEX file and a program for downloading the update, the Firmware Downloader, for the update of the Firmware of the Nexa® DC1200. First establish communication between the Nexa® DC1200 and the PC and then start the update as follows:

- ✓ RS232 cable (not included in the scope of delivery)

| **TIP** |
| --- |
| If there exists no RS232 interface you will need a RS232-USB converter. We recommend the AU0002B RS232-USB converter by. the company Logilink with a FTDI chip. The converter can also be purchased from Heliocentris. |


Abb. 1-1 Establish communication between Nexa® DC1200 and the PC

1. Connect the service interface of the Nexa® DC1200 to the PC.

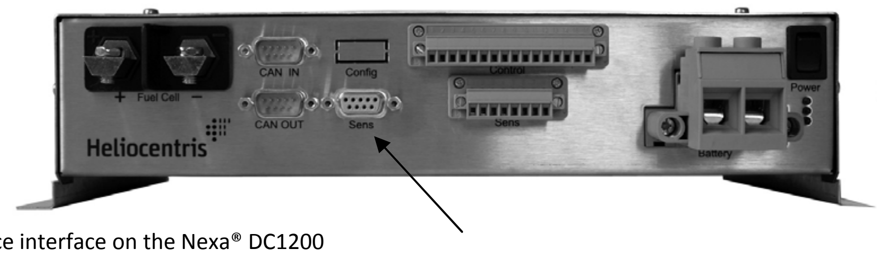



Abb. 1-2 Service interface on the Nexa® DC1200

2. Nexa DC 1200 Firmware Downloader.exe Executing the Nexa® DC1200 Firmware Downloader

⇨ *The start window of the Firmware Downloader opens up.*

# 2 Controls of the Firmware Downloader

After the installation is completed the start window of the Firmware Downloader opens up.

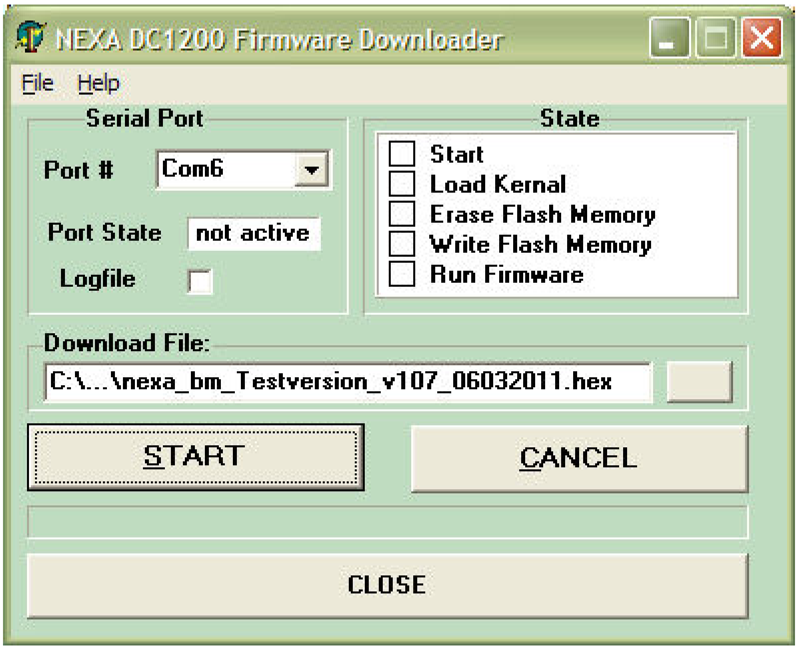



Abb. 2-1 Start window of the Firmware Downloader

| Window Element | Meaning |
|---|---|
| *Start* button | Starts the update on the DC/DC converter |
| *Cancel* button | Cancels the update on the DC/DC converter |
| *Close* button | Closes the Firmware Downloader |
| *File* menu | Contains the *Close* submenu for closing the Firmware Downloader |
| *Help* menu | Contains the *Info* submenu with the version number of the Firmware Downloader |
| *Serial Port* | *Port# :* drop-down field for selection of the COM port<br>*Port State*<br>*Logfile* check box: |
| *State* | Display of the update status when marked |
| *Download File* | Button for the selection of the HEX file |

# 3 Executing the Update of the Firmware

Define the settings as follows

- ✓ DC/DC converter is switched on

1. Select the COM port of the RS232 connection in the *PORT #* drop-down field.
2. Click the button in the Download File dialog.
   ⇨ OPEN FILE *dialog opens up.*
3. Select and open the HEX file.
4. Click the *START* button in the start window of the Firmware Downloader to start the update.
5. Follow the instructions of the installation wizard.
   ⇨ *Among other things you will be asked to switch off and then switch on the DC/DC converter. After you have switched it on all LEDs of the DC/DC converter must be illuminated.*
6. Complete the installation and start the program.
   ⇨ *After the completion of the update the DC/DC converter is ready for use again.*
7. Exit the firmware uploader by pressing the *CLOSE* button.

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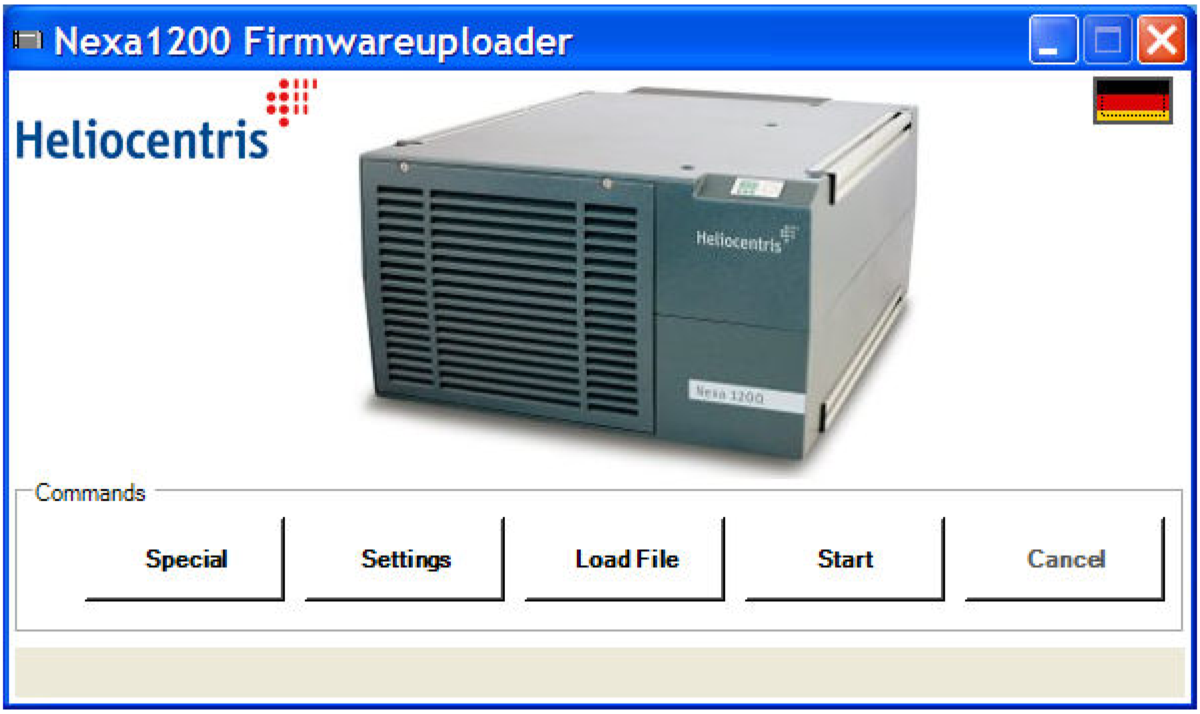
# Nexa® 1200 Firmware Uploader

Instruction Manual



# Contents

# 1 Installing the Firmware Uploader

For the update of the firmware of Nexa® 1200 you have received a HEX file and a program for uploading the update, the firmware uploader. First establish communication between Nexa® 1200 and the PC and then start the update as follows:

- ✓ CAN-USB converter
- ✓ 2 terminating resistors (from scope of delivery of Nexa® 1200)

1. Plug in the terminating resistor in the service interface of the Nexa® 1200.
2. Connect the terminating resistor and PC using the CAN-USB converter.

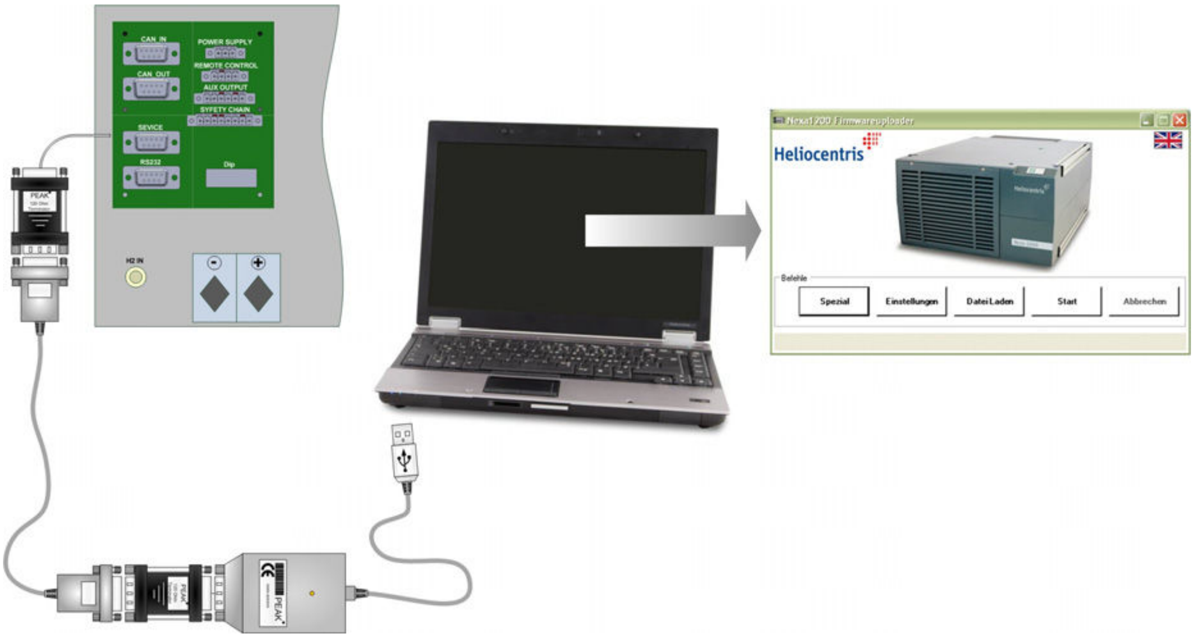
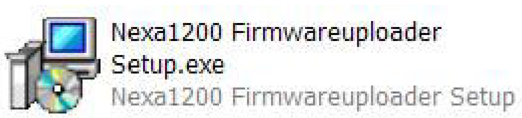



Fig. 1-1 Assembly instructions for establishing communication

3. 

Execute the Nexa® 1200 Firmware uploader

4. 

Select the installation language

5. Follow the instructions of the installation wizard.
6. Complete the installation and start the program.

# 2 Starting the Upload of the Update

After the installation is completed the start window of the firmware uploader opens.

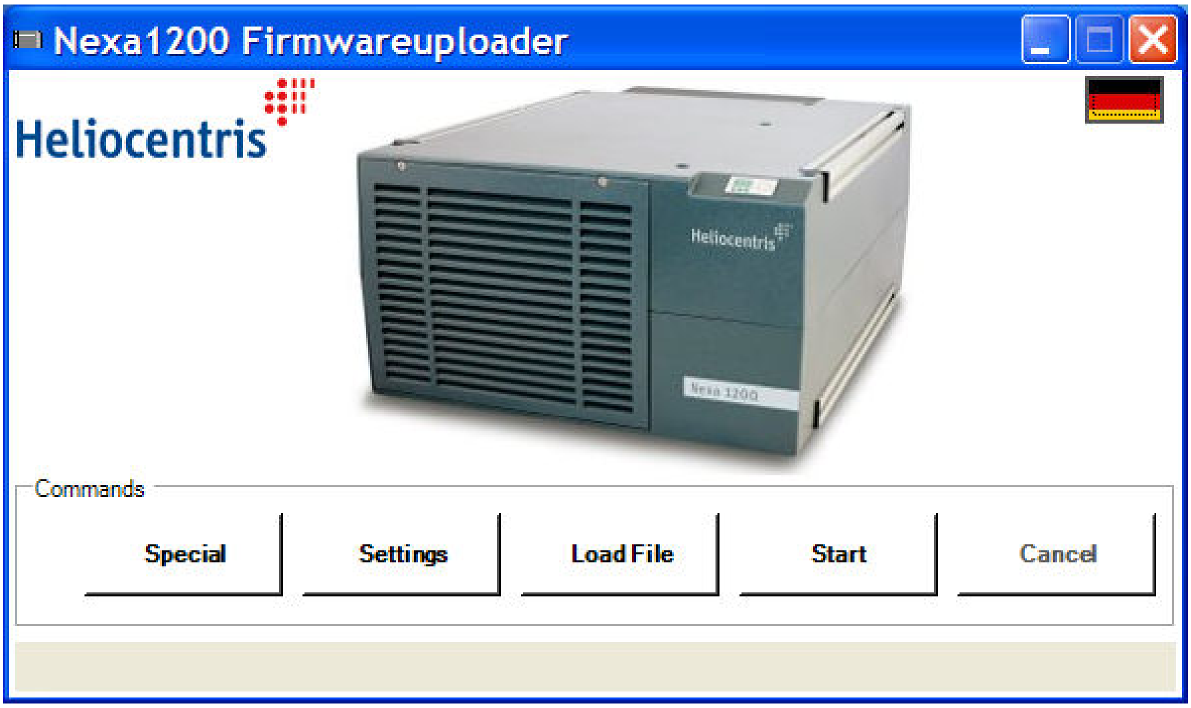



Fig. 2-1 Start window of the firmware uploader

| Window element | Meaning |
|---|---|
| Flag button | Select language: English / German |
| Settings button | Opens the *Settings* dialog with options for the communications interface |
| Load file button | Select the HEX file with firmware |
| Start button | Starts after successful update of the firmware on Nexa® 1200 |
| Cancel button | Cancels the loading process |
| Special button | Opens the *Special* dialog. This button is not needed for the update. |

**NOTICE!** Loss of functionality of the Nexa®1200 with improper use of the buttons! Do not use the *Special* dialog. Contact Heliocentris in the event of accidental misuse.

## 2.1 Defining the Settings of the Firmware Uploader

Define the settings as follows

1. In the start window of the firmware uploader, click on the *Settings* button.

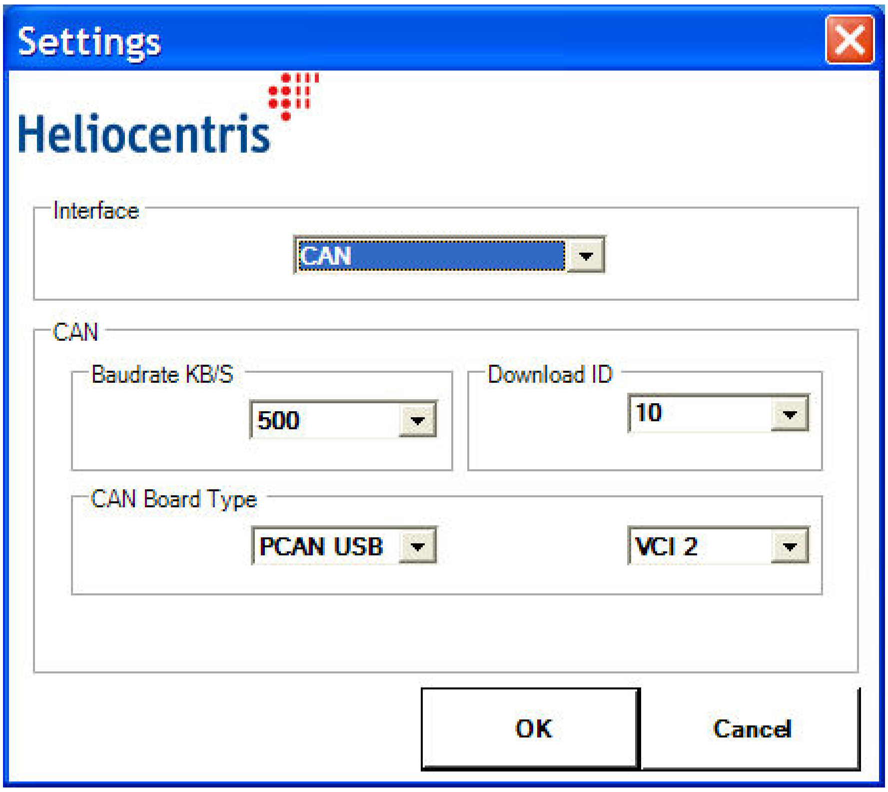



Fig. 2-2 The Settings dialog opens.

2. Select CAN in the drop-down field *Interface*.
3. Adopt the presettings and confirm with the *OK* button.
   ⇨ *The Settings dialog closes.*

## 2.2 Executing the Update of the Firmware

In order to execute the update, first upload and execute the HEX file on the Nexa® 1200.

✓ Nexa® 1200 is supplied with voltage.

1. In the start window of the firmware uploader, click on the *Load file* button.
2. Select the folder in which the HEX file is saved in the *Open* dialog.
3. Select and open the HEX file.
   ⇨ *The file is automatically uploaded. LEDs of the Nexa® 1200 are off. A progress bar is displayed, shows the progress and is closed after completion of upload.*
4. In the start window of the firmware uploader, click on the *Start* button.
   ⇨ *Nexa® 1200 is started and the update of the firmware is executed. The LEDs of the Nexa® 1200 illuminate again after the successful update.*

**NOTICE!** Damage due to incomplete update! You must click on the *Start* button. Contact Heliocentris in the event of accidental misuse.

5. End the firmware uploader by clicking on the close button  in the title bar.

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