BRUSA

TECHNICAL DATA AND START-UP

NLG513

Translation of the original German operating instructions

BRUSA Elektronik AG
Neudorf 14
CH-9466 Sennwald
+41 81 758 19 00
info@brusa.biz

www.brusa.biz

LEGAL NOTICE

Publisher	BRUSA Elektronik AG Neudorf 14 CH-9466 Sennwald T +41 81 758 19- 00 Fax: +41 81 758 19 - 99 www.brusa.biz office@brusa.biz
Date of issue	09.01.2012

Updates	In light of the further technical development of our products, we reserve the right for technical changes. Any changes will be disclosed in the relevant manuals through the replacement of the relevant pages and/or a revision of the electronic data storage device.
Writer / Author	Holger Schmidt

REVISIONS

REVISION	DATE	NAME	CHANGE
01	30.01.2012	Holger Schmidt	Kap. 7.3 (Kühlsystem entlüften) entfernt, Kap. 7.3. (Spannung vorladen) neu. Inhalt Kap. 7 optimiert, kleinere textliche Korrekturen
02	10.03.2014	M.Tschumper	PON switched positive
03	19.07.2016	B.Graf	Kap. 5.1 „…R&D use only…“ text added
04	28.11.2016	A. Girod	Kap. 9. Warranty new; Kap. 10 Instructions regarding disposal new

VALIDITY

This manual is valid only for the following devices:

NLG513-U1-01A (water-cooled version)
NLG513-U1-02A (air-cooled version)

Decoding of the device designation is as follows:

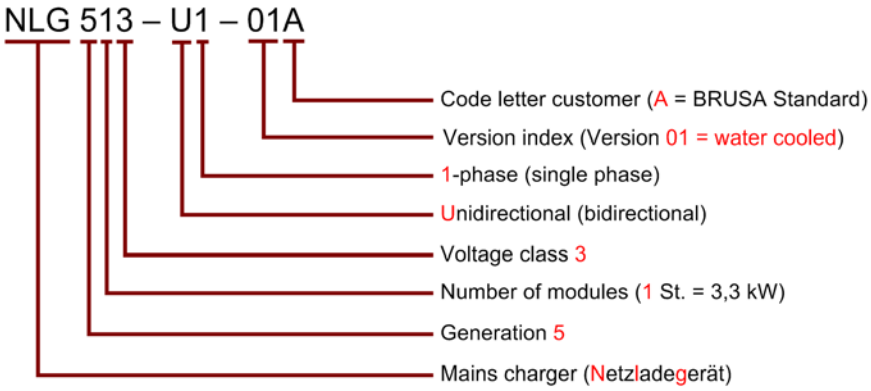


TABLE OF CONTENTS

1 Foreword

Dear customer!

With the BRUSA NLG5 charger you have obtained a very capable and versatile product. As this is a power electronics product with dangerous voltages and currents, specialist knowledge is required for dealing with it as well as operating it!

Read this manual - particularly the chapter *Safety and Warning Instructions* - carefully before you install the NLG5 charger or carry out any other work on it!

2 List of Abbreviations

Throughout this manual, some specific technical abbreviations are used. You will find an overview as well as their meaning in the following table:

ABBR.	MEANING	ABBR.	NAME
BMS	**B**attery **M**anagement **S**ystem	**HV**	**H**igh **V**oltage
CAN	**C**ontroller **A**rea **N**etwork	**IP**	Ingress Protection
CEE	**C**ommission for **E**lectrical **E**quipment	**NLG**	**N**etz**l**ade**g**erät (Mains Charger)
CP	**C**ontrol **P**ilot	**NTC**	**N**egative **T**emperature **C**oefficient
EMI	**E**lectro**m**agnetic **I**nterference	**PI**	**P**ower **I**ndicator
EMC	**E**lectro**m**agnetic **C**ompatibility	**PTC**	**P**ositive **T**emperature **C**oefficient
RCD	Residual Current Device	**VP**	**V**ehicle **P**ilot
GND	**G**rou**nd**		

3 Safety and Warning Instructions

In this chapter you will find safety instructions which apply to this device. These refer to assembly, start-up and running operation in the vehicle. Always read and observe these instructions in order to protect people's safety and lives and to avoid damage to the device!

3.1 Symbols and their meaning

Throughout this manual, several symbols are used. You will find an overview as well as their meaning in the following table:

PROHIBITION SYMBOLS

SYMBOL	MEANING	SYMBOL	MEANING
	General prohibition		Warning high voltage Touching forbidden
	Switching on forbidden		

WARNING SYMBOLS

SYMBOL	MEANING	SYMBOL	MEANING
	General hazard warning		Electromagnetic field warning
	Potentially explosive warning		Battery hazard warning
	Hot surface warning		High electrical voltage warning
	High pressure warning / fluid spurting out		Fire hazard warning

MANDATORY SIGNS

SYMBOL	MEANING	SYMBOL	MEANING
	Disconnect device from voltage		Disconnect device from mains

INFORMATION SIGNS

SYMBOL	MEANING	SYMBOL	MEANING
	Important information on avoiding possible damage to property		Important information

3.2 Safety instructions and danger levels

DANGER

This instruction warns against serious, irreversible risks of injury and in some cases death!

Avoid these dangers by observing these instructions!

WARNING

This instruction warns against serious, irreversible risks of injury!

Avoid these dangers by observing these instructions!

CAUTION

This instruction warns against serious, irreversible risks of injury!

Avoid these dangers by observing these instructions!

INSTRUCTION

This instruction warns against possible damages to property if the following instructions and work procedures are not observed.

INFORMATION

This type of instruction discloses important information for the reader.

3.3 Generally applicable safety measures

The following safety measures have been developed based on the knowledge of the manufacturer. They are not complete, they can be supplemented by local and/or country-specific safety instructions and guidelines for accident prevention!

The system integrator and/or distributor of the device must therefore supplement the present general safety instructions by country-specific and local guidelines.

3.3.1 Safety instructions for cooling water systems

WARNING
 **Spurting cooling fluid!** **Skin burning hazard!** Check the tightness of the cooling water system, particularly the pipes, screw joints and pressure tanks. Resolve recognisable leakages immediately!

3.3.2 Safety instructions for mechanical systems

DANGER
 **Potential explosion area!** **Danger to life!** Do not store any highly flammable materials or combustible fluids in the direct surroundings of the device! Sparks at the device connections can set these on fire and lead to explosions!

CAUTION
 **Hot surfaces!** **Burn hazard!** The device produces high temperatures when in operation! So always handle the device with care and caution!

3.3.3 Safety Instructions for Handling and Operation

INSTRUCTION
Damage to the HV Battery: ➢ Before the start of the first charging process ensure that the charging profile of the device is compatible with your HV battery! ➢ You must make sure that the voltage ranges of the device and the HV battery are identical! ➢ Only use compatible and high-quality cabling! For this we recommend our specially configured original BRUSA mains and charging cables.

INSTRUCTION
Damage to the Charger: ➢ Check while connecting the device that the mains voltage is within the permitted range (see chapter *6.1 Technical Data*)! ➢ A high cooling water temperature or ambient temperature reduces the life span! So take ongoing care to ensure sufficient cooling of the device! ➢ Do not place the device in direct sunlight and in close proximity to heat sources! ➢ Although if the device has high IP protection, you should avoid placing it in direct contact with water (rain, spurting water) if possible! ➢ Under no circumstances should you put a low-resistance connection between the HV contacts, the housing contacts and the LV contacts! This will lead to malfunctions and furthermore to the destruction of the device! ➢ Prevent any penetration of fluids into the device (e.g. during assembly work)! The penetration of fluids will lead to a short circuit and subsequent damage to the device! ➢ Under no circumstances should you operate the device if liquid is leaking in anywhere, contact BRUSA Elektronik AG immediately!

3.3.4 Safety Instructions for Electrical Systems

DANGER

High voltage!
Danger to life!

- Under no circumstances should you touch the HV wires or HV connections without ensuring that there is no voltage beforehand!
- The device may only be connected by a qualified electrician!
- Under no circumstances should you bypass or avoid security installations! Any malfunctions resulting from this could have life-threatening consequences!
- Never connect the device to a socket without a protective ground wire connection!
- A residual current device (RCD) must be used in the mains supply line!
- You must disconnect the mains connection immediately after charging has finished!

CAUTION

Overheating of the cables!
Fire hazard!

If using a cable reel, this can catch fire through heat accumulation!
You must completely unroll the cable rolls!

INSTRUCTION

Under no circumstances should the device be opened without authorisation! The opening of the device (housing sealed-up) leads directly to the forfeit of any guarantee and warranty rights!

INFORMATION

Adhere strictly to the following 5 safety rules when working on an HV grid:

- Disconnect system from power.
  - → Switch off the ignition.
  - → Remove service / maintenance plug and/or turn off main battery switch.
  - → Remove fuse.

- Ensure that the system does not reconnect.
  - → Keep ignition key safe to prevent unauthorised access.
  - → Keep service / maintenance plug safe to prevent unauthorised access and/or use lockable cover cap to ensure that the main battery switch does not reconnect.
- Check that it is not live with a suitable voltage tester (note voltage range!).
- Ground and short-circuit the system.
- Cover or seal off adjacent live parts.

3.4 Safety Installations / Power Limitations

3.4.1 Control Pilot (CP)

The control pilot is a safety installation which also increases the reliability of the charging process of an electric vehicle. It is absolutely necessary if the supply-side charging current exceeds 16 A. The CP signal is fed to the charger from the charging station via an additional contact in the mains plug and thereby transmits the maximum permitted current carrying capacity of the mains socket. Here, currents of 6 A - 32 A can be transmitted. The CP signal generator can also be integrated into an adapter cable for normal household sockets. In this case, this signal generator transmits a suitable current limitation so that the household socket is not overloaded.

The CP interface enables the bi-directional exchange of information between the charging station and the electric vehicle and it is standardised worldwide.

3.4.2 Overload Protection (Derating)

INSTRUCTION
Continuous operation at the temperature limit will inevitably lead to a higher level of wear of the components!

This security installation is the charger's self-protection. If the charger reaches a defined temperature threshold, this means a decrease in power (derating) to protect the charger from damage through overheating. The power will subsequently be reduced in proportion to the temperature increase until the temperature falls back within the target range.

Air-cooled chargers start to reduce the maximum power as soon as the ambient temperature is at +40°C. Water-cooled chargers can charge on full power up to a cooling water temperature of +60°C.

3.5 Requirements of the Start-up Personnel

All courses of action described in this manual may only be carried out by a qualified electrician! Specialist staff are defined as electricians who dispose of

- professional training,
- knowledge and experience in the field of electronics / electric mobility,
- as well as knowledge of relevant requirements and dangers

which they can display in practice. Furthermore, they must be able to assess the work assigned to them independently, detect possible dangers and establish necessary protection measures.

4 General

4.1 Content and scope of this manual

The present documentation gives an overview of all required working steps regarding the installation and operation of the charger and the necessary safety measures.

It contains technical data, application information and a basic description of the charger and its functions.

The operational and safety instructions provided are to be adhered to in order to ensure personal safety as well the ongoing optimum functioning of the charger. This is also a precondition to meet the warranty requirements of BRUSA Elektronik AG.

4.2 Scope of the Entire Documentation

INFORMATION
In order to successfully commission the charger, you need this manual and the software manual, and possibly further software. BRUSA will be happy to provide this so-called (documentation-) “customer package” by download links.

4.3 Scope of Delivery

	NAME	PIECES	ILLUSTRATION
1.	NLG513 charger (water-cooled) or	**1**	
	NLG513 charger (air-cooled)		
2.	M18 x 1.5 cooling water connection piece *	**2**	
3.	Protective cap for cooling water connection piece *	**2**	
4.	Software - *ChargeStar* on enclosed CD-ROM	**1**	---

* Only with the NLG513 charger (water-cooled)

4.4 Optional Scope of Delivery

INFORMATION
These accessories can be obtained optionally from BRUSA Elektronik AG.

	MEANING	TYPE	ILLUSTRATION
1.	23-pole control plug set, includes: *1 piece AMPSEAL 770680-1 control plug for wire diameter of 0.5 mm²* *23 pieces AMPSEAL 770854-1 crimp terminals* *4 pieces NTC* *1 piece 9-pole SUB-D* We recommend the use of the following crimping tool for the assembly: Tyco 58440-1	**MPAA208**	
2.	Mains cable (modular plug - input) 3 m	**11316**	
3.	Mains cable (modular plug - input) 10 m	**11663**	
4.	Battery cable (modular plug - output) 2 m	**11665**	
5.	Set of cooling water connection pieces - long (2 pieces incl. seals) *2 pieces M18 x 1.5 110 mm* *2 pieces rubber sealing ring Ø 16 mm*	**11857**	

4.5 EU Guidelines

This manual has been produced under application and consideration of the EC guidelines, national laws and harmonised standards (EN) valid at the time of production relevant to the product NLG5 charger .

4.6 Contact Information of the Manufacturer

BRUSA Elektronik AG
Neudorf 14
9466 Sennwald
Switzerland

Phone: +41 81 758 09 - 00
Fax: +41 81 758 09 - 99
Internet: www.brusa.biz
E-mail: support@brusa.biz

5 Use and Limits of the Product

5.1 Proper Use

The BRUSA NLG5 charger has been designed for the following uses. In the case of planned operations in other areas, please contact the company BRUSA Elektronik AG beforehand at the manufacturer address as given in chapter *4.6*.

- Universal charger for charging of various batteries e.g.
  - NiCd batteries
  - Pb batteries
  - Li-Ion batteries
- The user must ensure at all times during a charging process that the specific operational limits of the connected battery are never exceeded.
- The charger may only be operated within the limits given in chapter *5.2*.

INFORMATION
 This equipment is a custom built evaluation unit destined for professionals to be used solely at research and development facilities for such purposes.

5.2 Improper Use / Limits of the Product

The carrying out of applications which do not conform to the conditions and requirements stated in the technical documents and datasheets of the manufacturer is viewed as improper use.

The following limit values are set for the operation of the NLG5 charger . Operation outside these defined limits can lead to life-threatening situations and is therefore forbidden!

- Max. AC input voltage 265 V_{AC}
- DC output voltage range 0 - 520 V_{DC}
- Battery voltage range 200 – 520 V_{DC}
- Min. ambient temperature - 25°C
- Max. ambient temperature + 70°C
- Min. coolant temperature - 25°C
- Max. coolant temperature + 70°C
- Maximum pressure cooling water system 1.0 bar

INFORMATION
 The functioning of the charger can only be guaranteed if the given voltage range is observed! Batteries with differing loads will lead to malfunctioning of the charger!

6 About This Device

6.1 Technical Data

AC INPUT	NLG5 AIR-COOLED	NLG5 WATER-COOLED	UNIT
Min. input voltage	100	100	V
Max. input voltage	264	264	V
Min. input frequency	48	48	Hz
Max. input frequency	62	62	Hz
Max. input current ^{eff}	16	16	A
Max. input power (at input current ^{eff} = 16 A)	3.680	3.680	W
Power factor	> 0.99	> 0.99	---
Efficiency (P = $Pa1_{max}$)	93	93	%
X capacity	11.6	11.6	µF
Y capacity L1 → PE	44	44	nF
Y capacity N → PE	46.2	46.2	nF

DC OUTPUT	NLG5 AIR-COOLED	NLG5 WATER-COOLED	UNIT
Charging capacity	3.300	3.300	W
Voltage range	200 – 520	200 – 520	V
Charging voltage accuracy	± 1	± 1	%
Max. charging current	12.5	12.5	A
Charging current accuracy	± 2	± 2	%
Charging current ripple amplitude (100 %, fr = 2 fn (100 Hz)	12.5	12.5	A
X capacity	7.9	7.9	µF
Y capacity B^+(B^-) → PE	16.5	16.5	nF

THERMAL / COOLING SYSTEM	NLG5 AIR-COOLED	NLG5 WATER-COOLED	UNIT
Amount of coolant in device	---	~ 0.3	L
External diameter of cooling water connection pieces	---	15.2	mm
Minimum coolant temperature at inlet	---	- 25	°C
Maximum coolant temperature at inlet	---	+ 70	°C
Coolant pressure drop @ 5l/min, $T_{coolant}$ = 25°C (with a water to glycol mixture ratio of 50 / 50)	---	50	mbar
Maximum cooling system pressure	---	1.0	bar
Cooling water flowing rate	---	4 to 6	l/min
Ambient temperature range for storage	- 40 to + 85	- 40 to + 85	°C
Ambient temperature range in operation	- 25 to + 70	- 25 to + 70	°C
Device temperature range without reduced power (derating)	- 20 to + 40	- 20 to + 60	°C

BASIC MECHANICAL DATA	NLG5 AIR-COOLED	NLG5 WATER-COOLED	UNIT
Weight	6.3	6.2 *	kg
IP protection	IP54	IP65	---
Height	88	88	mm
Width	334	267	mm
Length (without modular plug)	250	250	mm

* without coolant

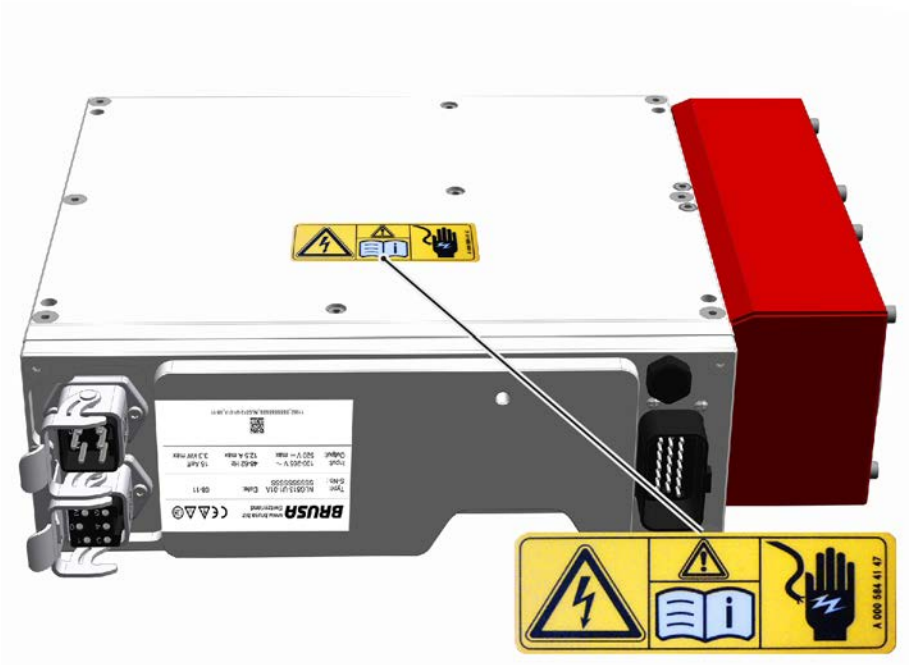
SAFETY AND PROTECTION FUNCTIONS	NLG5 AIR-COOLED	NLG5 WATER-COOLED	UNIT
Insulation testing (AC input / DC output)	2	2	kV
Power inlet over-voltage protection	264	264	V
Short-circuit protection	yes	yes	---
Open output protection	yes	yes	---
Internal over-temperature protection	yes	yes	---
Temperature sensor 1 (PT1000 @ 25°C)	1097	1097	Ω
Temperature sensor 2 and 3 (NTC @ 25°C)	33	33	kΩ
Min. insulation resistance (initial)	2	2	> GΩ

WIRING SYSTEM INTERFACE AUX	NLG5 AIR-COOLED	NLG5 WATER-COOLED	UNIT
Wiring system voltage	14	14	V
Max. wiring system voltage	30	30	V
Max. wiring system current	0.5	0.5	A
Wiring system close-circuit current (without terminal 15) @ U_{aux} = 12 V	230	230	uA
Wiring system no-load power (with terminal 15)	6	6	W

CAN INTERFACE	NLG5 AIR-COOLED	NLG5 WATER-COOLED	UNIT
CAN 2.0 b (11-bit identifier)	---	---	---
CAN baud rate (125 / 250 / 500 / 1000)	500 (default)	500 (default)	Kbit/s
Max. CAN input voltage (ESD protection)	+/- 24	+/- 24	V
CAN input capacity	64	64	pF
R_{diff} CANH - CANL	21	21	kΩ

6.2 Warnings on the Device

Warning signs are installed on the device to warn the operator of possible dangers. Should one of these warning signs be missing or become illegible due to wear and tear, it must be renewed immediately! To get an original label, please contact BRUSA support at the manufacturer address given in chapter *4.6* !



6.3 Technical Properties

- Covers a large battery voltage range (200 - 520 V_{DC})
- Scalable charging power of 3.3 kW – 20 kW (through linkage of several NLG5)
- Isolation between mains and HV battery by integrated HF transformer
- Compact and lightweight construction
- Vibration-resistant construction for mobile use
- Can be plugged into all connections
- Programmable charging profile via RS 232 and CAN
- Firmware updates via PC
- CAN interface integrated as standard
- Safety installation *Control Pilot* enables fast and efficient charging at correspondingly equipped power sockets
- Meets standard requirements (EMI, mains harmonics etc.)
- Passive HVIL (HV interlock)
- Precise and efficient charging power
- 2 digital inputs e.g. for external power control
- 4 digital outputs, 3 of which can be freely programmed for the driving of relays, LEDs or fans

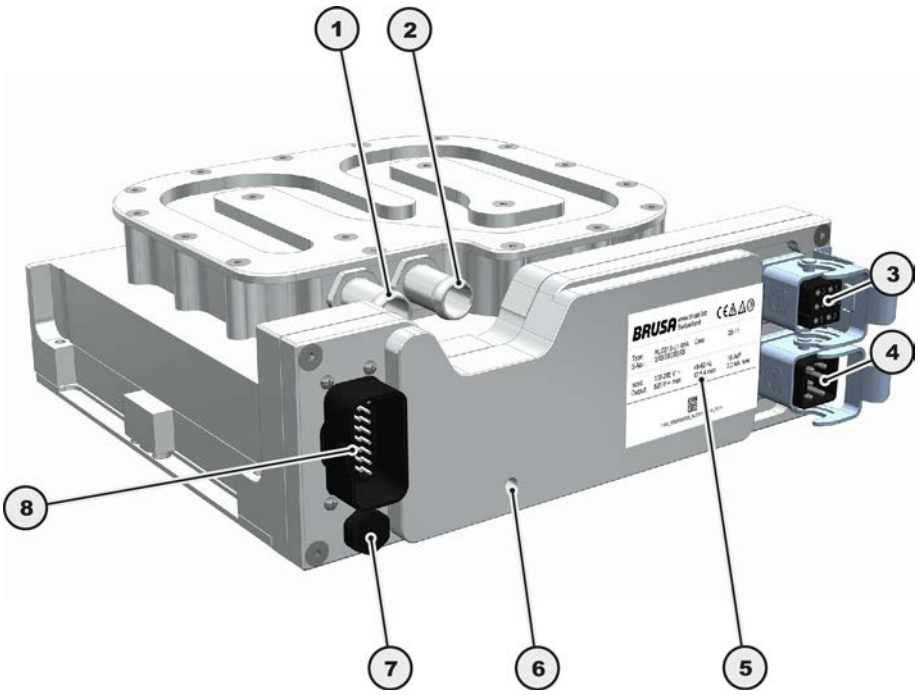
6.4 Basic function of the NLG5 charger

The NLG5 charger is generally designed for both stationary and mobile use. Due to its large output voltage range and the universal control mechanisms (automatically or via CAN) it is suitable for charging almost every type of HV battery. By linking several chargers, various charging power requirements can be met (from motorcycles, cars, delivery vehicles and buses to lorries). The maximum input current on 230 V / 240 V mains is 16 A and is thereby within the loading capacity limits for standardised mains installations with CEE sockets. If the mains loading capacity is lower, the charging power must be reduced correspondingly using the power limiters *Control Pilot* (*CP)* or *Power Indicator* (*PI)*.

With the NLG5 the emphasis was put on a compact and lightweight design to ensure that it can be used in almost all applications and installation locations. An integrated resonance circuit provides high efficiency and low EMI. The processor-driven charging algorithms ensure optimum and efficient results and contribute to a longer lifespan of the charger and the HV battery. The NLG5 is programmable and can therefore be adapted to individual customer wishes. With the provided software *ChargeStar*, individual charging profiles can be created and with these the charger can be adapted to the relevant operational environment.

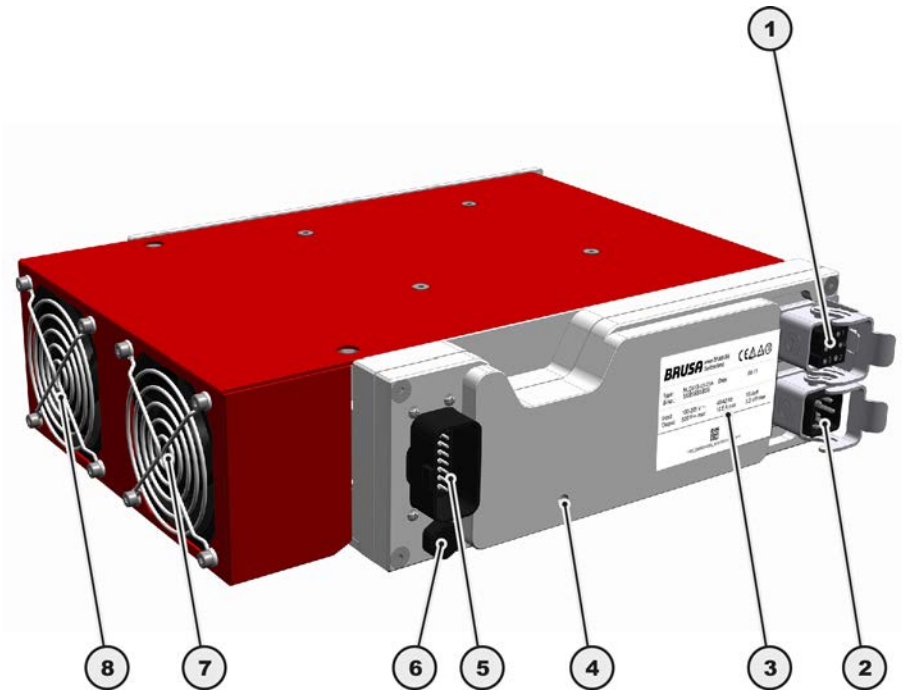
Intelligent safety installations always ensure the functioning and immediate reaction of the charger in case of a fault (e.g. over-voltage, short-circuits, overheating). The NLG5 charger is obtainable in both air- and water-cooled form. The water-cooled design is can be easily integrated into an available cooling circuit.

6.5 Overview of the Main Structural Components (Water-cooled NLG5)



1.	Cooling water inlet (Ø 15,2 mm)	**2.**	Cooling water outlet (Ø 15,2 mm)
3.	HV battery socket plug (output)	**4.**	Mains socket plug (input)
5.	Type plate	**6.**	Earth connection
7.	Pressure equalisation membrane	**8.**	Control plug

6.6 Overview of the Main Structural Components (Air-cooled NLG5)

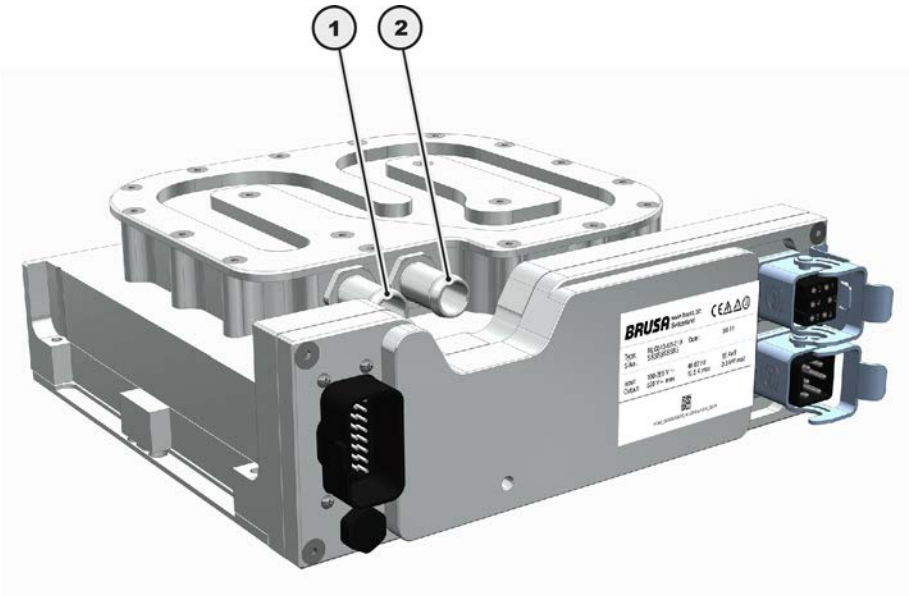


1.	HV battery socket plug (output)	**2.**	Mains socket plug (input)
3.	Type plate	**4.**	Earth connection
5.	Control plug	**6.**	Pressure equalisation membrane
7.	Fan module 1	**8.**	Fan module 2

6.7 Mechanical Connections

6.7.1 Cooling System

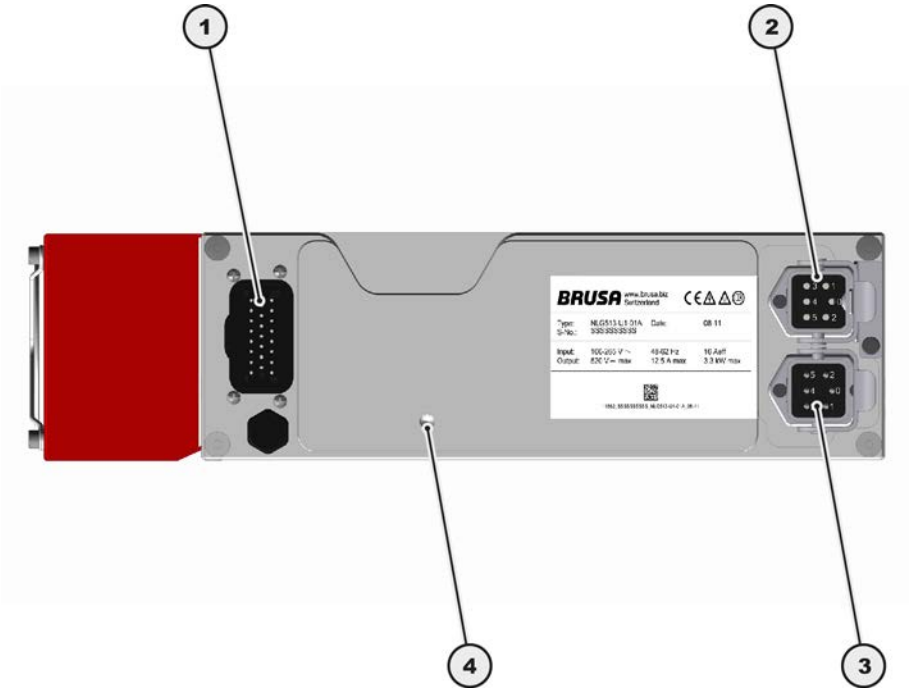
INSTRUCTION
Make sure that no air pockets are available in the cooling system! The vent can also be done by pressure- or vacuum-filling. Please note the maximum allowable system pressure! Air pockets in the cooling system can lead to overheating of the device!



1. Cooling water inlet connection (external Ø 16 mm) | **2.** Cooling water outlet connection (external Ø 16 mm)

6.8 Electrical Connections

INFORMATION
The electrical connections are the same for all model versions in terms of position and pin assignment.

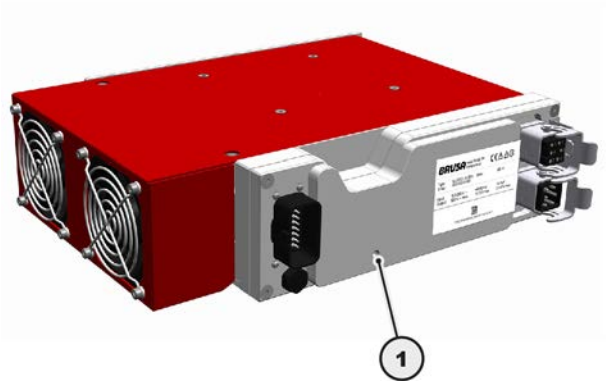


1.	23-pole control plug See chapter 6.8.4 *Pin Assignment Control Plug (Device-side)*	**2.**	Modular plug output See chapter 6.8.3 Pin Assignment Modular Plug Output (Device-side)
3.	Modular plug input See chapter 6.8.2 *Pin Assignment Modular Plug Input (Device-side)*	**4.**	Ground (GND) See chapter *6.8.1 Grounding Screw*

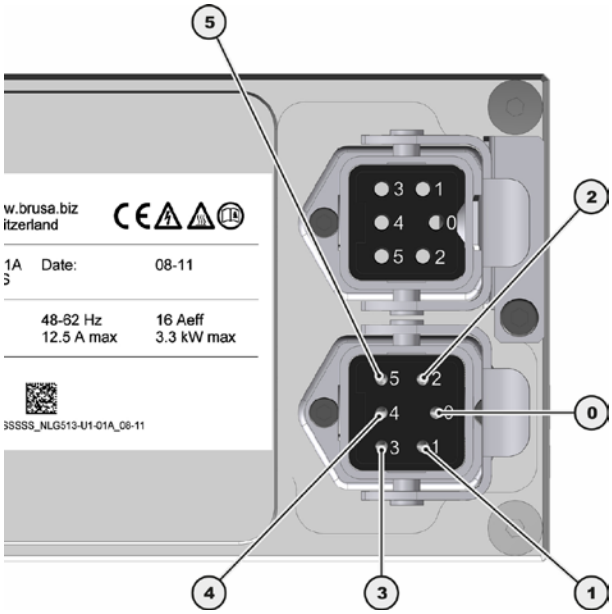
6.8.1 Grounding Screw

WARNING
Sparking! **Fire hazard!** Ensure that the earth connection is connected correctly! A loose ground circuit can lead to sparking and subsequent fires!

INFORMATION
➢ The grounding screw (1) must be connected with the ground of the vehicle. ➢ The cable diameter of the earth cable must correspond to the dimensions of the HV wiring. ➢ Torque of grounding screw (1) M6 x 10 = 15 Nm

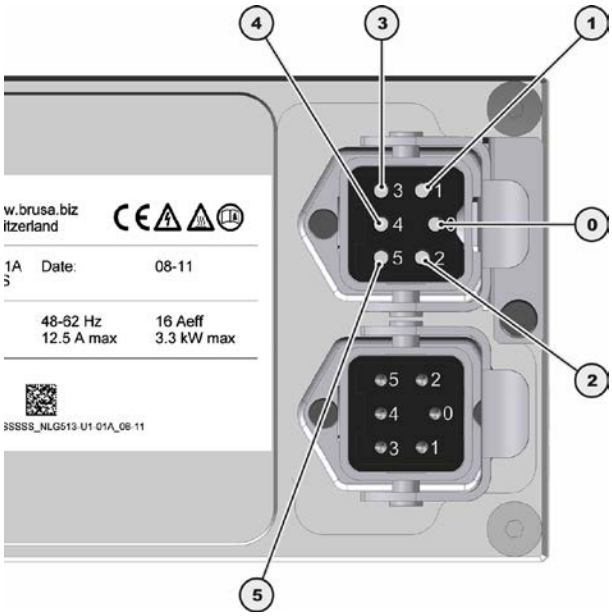


6.8.2 Pin Assignment Modular Plug Input (Device-side)



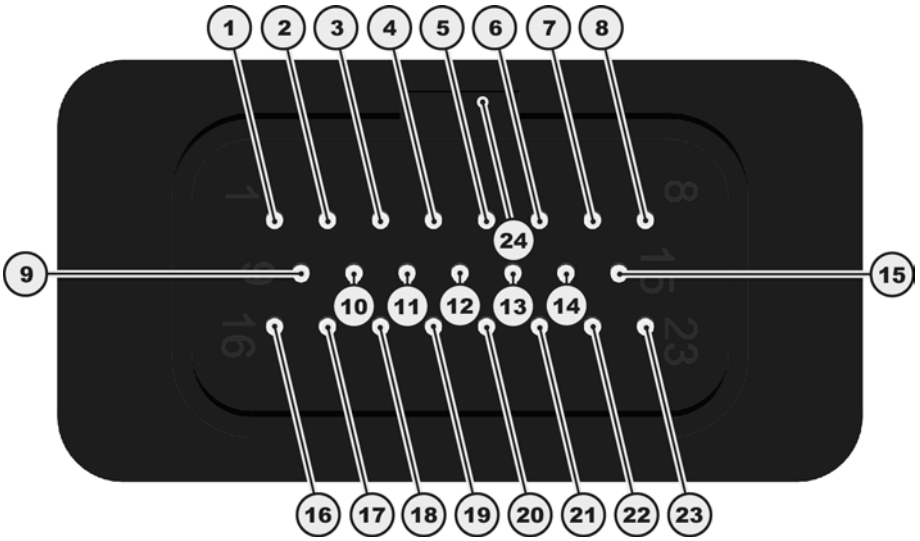
0	**Pin0 (PE)**	Protective grounding
1	**Pin1 (N1)**	Neutral conductor, power supply input
2	**Pin2**	Reserve
3	**Pin3 (L1)**	Input mains supply phase
4	**Pin4 (CP)**	Control pilot (CP)
5	**Pin5**	Reserve

6.8.3 Pin Assignment Modular Plug Output (Device-side)



0	**Pin0 *(PE)***	Protective grounding
1	**Pin1 *(B^-)***	Negative battery output
2	**Pin2**	Passive HV interlock (control plug pin 17 *IL2*)
3	**Pin3 *(B^+)***	Positive battery output
4	**Pin4 *(VP)***	Reserve
5	**Pin5**	Passive HV interlock (control plug pin 16 *IL1*)

6.8.4 Pin Assignment Control Plug (Device-side)

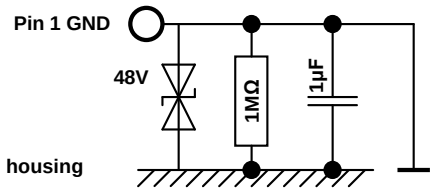


1.	**GND**	Earth (minus wiring system, terminal 31)	**2.**	**AUX**	+12 V (plus wiring system, terminal 30)
3.	**PON**	Power on (switched positive)	**4.**	**FLT**	Output 1 (fault, not ready)
5.	**DO2**	Output 2 (programmable)	**6.**	**DO3**	Output 3 (programmable)
7.	**DO4**	Output 4 (programmable)	**8.**	**PG1**	Ground signal 1 (for pins 20 - 23)
9.	**CNL**	CAN low	**10.**	**CNH**	CAN high
11.	**TXD**	RS232 transmit (9-pole D-Sub pin 2)	**12.**	**RXD**	RS232 receive (9-pole D-Sub pin 3)
13.	**PRO**	Enable firmware download	**14.**	**PG2**	Ground signal 2 (9-pole D-Sub pin 5)
15.	**PG3**	Ground signal 3 (reserve)	**16.**	**IL1**	HV interlock 1
17.	**IL2**	HV interlock 2	**18.**	**DI3**	Digital input 3 (ext. criterion 1)
19.	**DI4**	Digital input 4 (ext. criterion 2)	**20.**	**TS1**	Battery temperature sensor 1 input (PT1000)
21.	**TS2**	Battery temperature sensor 2 input (NTC 33K at 25 °C)	**22.**	**TS3**	Battery temperature sensor 3 input (NTC 33K at 25 °C)
23.	**PI**	Input for mains current limitation	**24.**	**---**	Plug locking device

6.8.4.1 Pin 1 GND

INFORMATION
If NLG5 control signals are connected with other vehicle components, then the connection to the vehicle's earth must take place at this pin.

Internal wiring

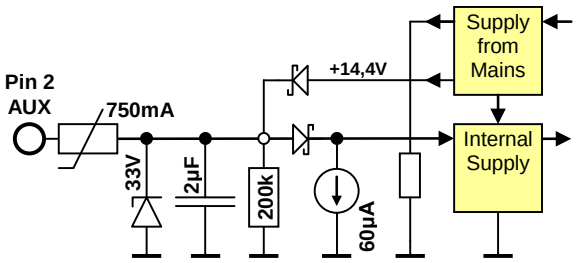


- Direct earth connection of the charger's control electronics.

6.8.4.2 Pin 2 AUX

INFORMATION
As soon as the power cord is connected, it supplies input / output ~ 14 V (max. 0.5 A). It then provides external signals and supports the on-board battery (12 V).

Internal wiring

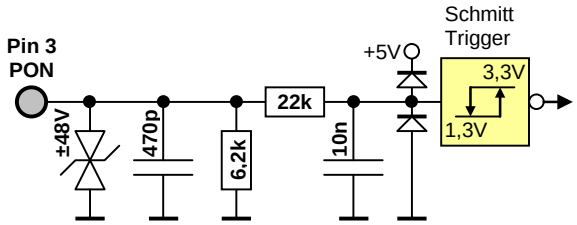


- When the power cord is connected, the device can be supplied from the 12 V vehicle electrical system via this input / output.

6.8.4.3 Pin 3 PON

INFORMATION
This pin is to be viewed as the main switch input. As soon as the input level is within the range of +5 V…32 V and the power cord is connected, the charging process will be activated in the *Automatic* mode.

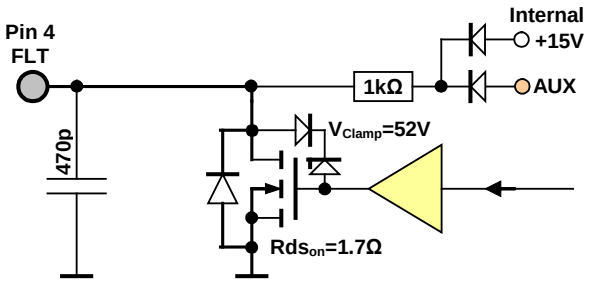
Internal wiring



- If no power cord is connected, the internal control unit can be activated via this pin (e.g. for programming a charging profile). For this pin 2 must be *AUX = high* (12 V voltage is applied).
- To activate the automatic charging process, pin 3 *PON* must be connected with pin 2 *AUX*.

6.8.4.4 Pin 4 FLT

Internal wiring

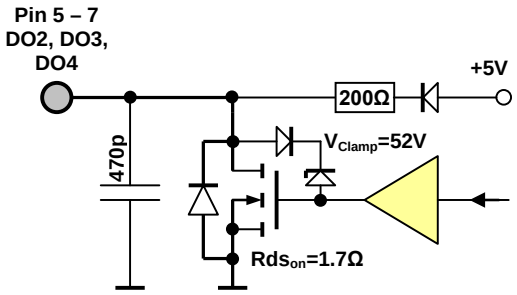


- This pin switches to ground *GND* and is short-circuit-proof (I = 400 mA).
- Pin 4 *FLT* is activated provided that no charging process is underway. So pin 4 *FLT = low* can be regarded as idle-mode or as a status signal for faults.

6.8.4.5 Pin 5 DO2, Pin 6 DO3, Pin 7 DO4

INFORMATION
These pins can be programmed by the customer and can be used for different purposes (e.g. driving of external LEDs for displaying the state of charge).

Internal wiring

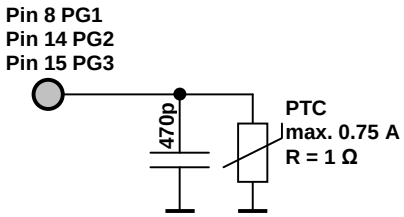


- These pins switch to ground *GND* and are short-circuit-proof (I = 400 mA).

6.8.4.6 Pin 8 PG1, Pin 14 PG2, Pin 15 PG3

INFORMATION
The additional earth connections are intended to simplify the external wiring.

Internal wiring



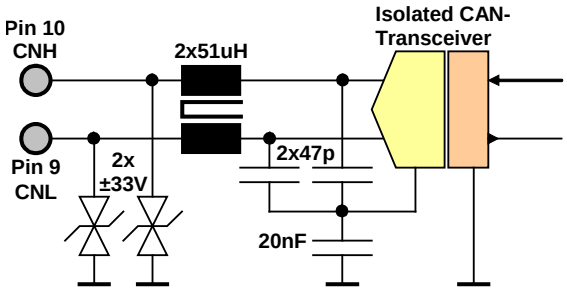
The pins 8, 14 and 15 are each connected with pin 1 *GND* via a reversible fuse (PTC) and are thereby protected.

The following allocation is recommended:

- Pin 8: Ground signal for pins 20 - 23
- Pin 14: 9-pole D-Sub: Pin 5
- Pin 15: Reserve

6.8.4.7 Pin 9 CNL, Pin 10 CNH

Internal wiring



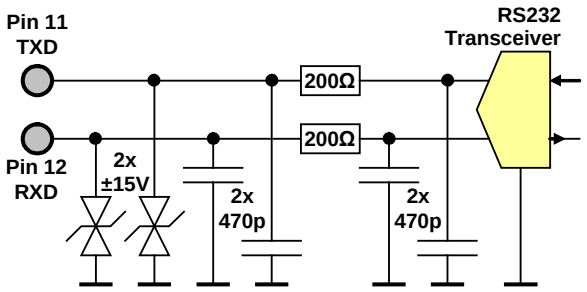
The CAN interface has the following features / possibilities:

- CAN 2.0 B, 500 kHz (default) - parameters can be set (125 / 250 / 500 / 1000 kBit/s).
- Both pins are electrically isolated from the ground *GND* (avoiding faults through potential shifts).
- Without termination resistor (no CAN termination).
- 6 messages in total can be transmitted via the CAN interface. You can find details on this in the *Software* manual.

6.8.4.8 Pin 11 TXD, Pin 12 RXD

INFORMATION
This interface is NOT intended for general use! It is designed for firmware updates, the programming of charging profiles and the monitoring or adapting of CAN parameters. Should you have any questions, please contact BRUSA support at the manufacturer address given in chapter 4.6 .

Internal wiring

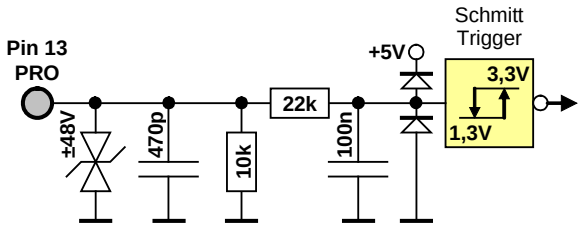


- The RS232 interface enables a direct, serial connection between the charger and a PC. Through the *ChargeStar* software, charging profiles can be programmed or CAN parameters can be adapted. See chapter *8.2 ChargeStar*
- The firmware for the microprocessor can be downloaded via this interface (provided by BRUSA). Pin 13 *PRO* must be *high* for this.
- The running operational data of the charger can be read / displayed via this interface.
  see chapter *8.1 HyperTerminal*

6.8.4.9 Pin 13 PRO

INFORMATION
This pin is only activated for the programming of a new firmware (pin 13 *PRO* = *high*). For this pin 3 *PON* must be *low*.

Internal wiring



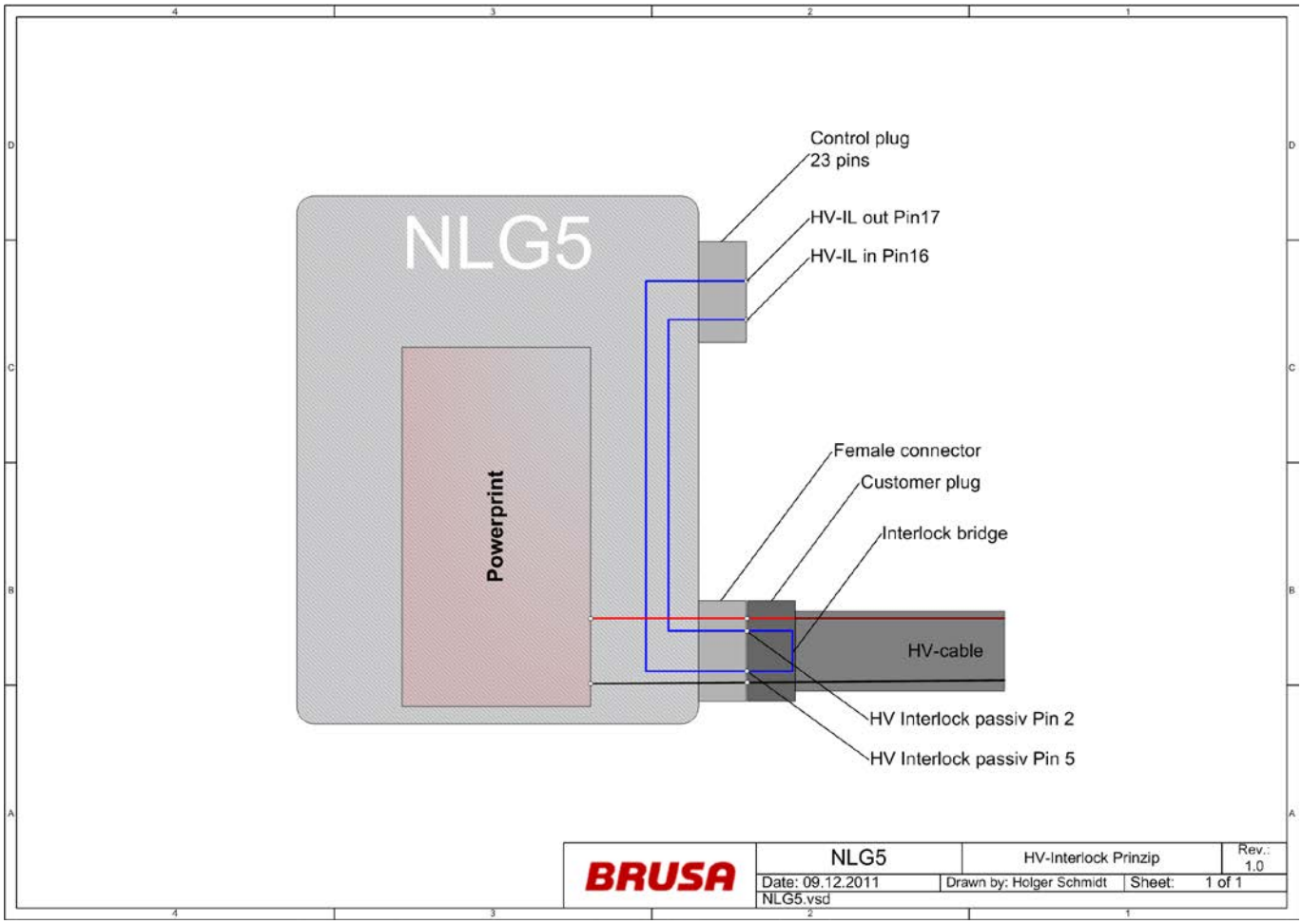
As soon as pin 13 *PRO* is *high*, the following processes are activated:

- The charging process is terminated (reset) if this is active.
- Pin 4 *FLT* is activated.
- The programming of the firmware can now be carried out via the serial interface.
  You can find details on this in the manual *NLG5_FW-Update.*

6.8.4.10 Pin 16 IL1, Pin 17 IL2

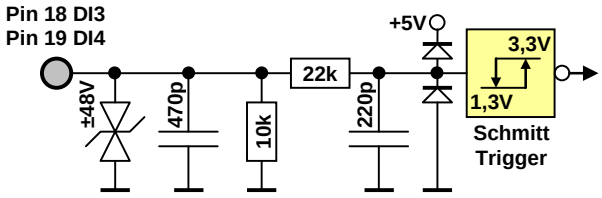
In order to be able to ensure a passive HV - DC-side interlock functionality, two interlock contacts are provided. The interlock circuit does not have to be wired up for the charger to function. In order to ensure safety we recommend that you activate this in all circumstances!

Block circuit diagram of the interlock circuit:



6.8.4.11 Pin 18 DI3, Pin 19 DI4

Internal wiring

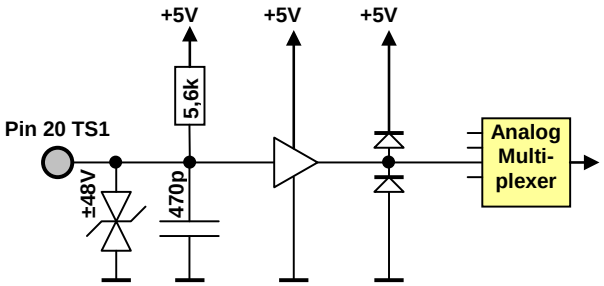


The following functions are carried out via the digital inputs:

- The charging profile can be governed via these inputs. The transition into the next charging stage can be activated by the input level (high / low or 0 / 1). This setting must be carried out correspondingly in the *ChargeStar* software.

6.8.4.12 Pin 20 TS1

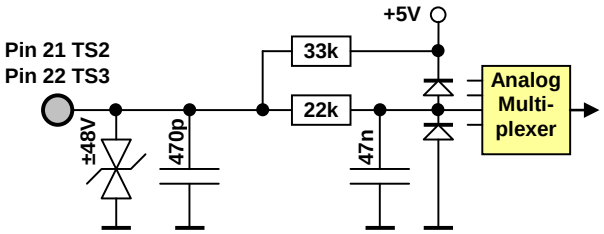
Internal wiring



- At pin 20 *TS1*, the charging socket temperature can be monitored through a PT1000 resistor. The NLG5 carries out the monitoring of the charging socket temperature automatically if the sensor is activated. The NLG5 disconnects the power flow at a temperature of > 60°C (I_act = 0). If the temperature falls back down to < 55°C, the output stage is enabled again (I_act = I_nom). The measuring tolerances which result in the PT1000 analysis will be taken into account accordingly for switch-off / -on thresholds.
  This function is not activated by default in the firmware and can be activated in the provided software *ChargeStar* using the function *temperature sensor 1*.

6.8.4.13 Pin 21 TS2, Pin 22 TS3

Internal wiring

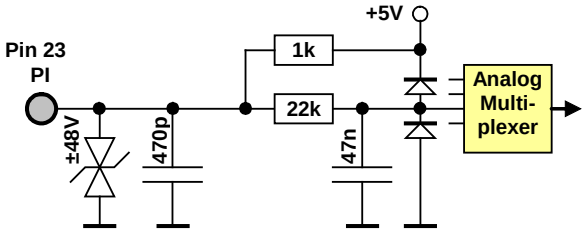


- At the pins 21 *TS2* and 22 *TS3*, the included temperature sensors (NTC with 33 kΩ at 25°C) can be connected. The temperature of the HV battery can be monitored and analysed with these temperature sensors.

INSTRUCTION
The number of connected temperature sensors must be configured in the included *ChargeStar* software. A temperature sensor which is not connected but configured leads to an error report and thereby shuts the charger down!

6.8.4.14 Pin 23 PI

Internal wiring



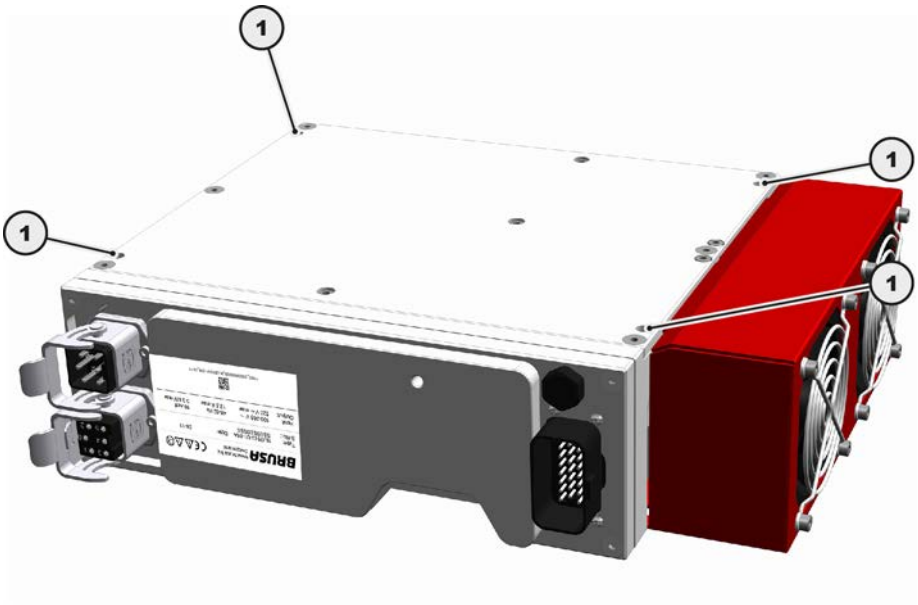
- Pin 23 *PI* reduces the maximum mains current. Reduction is necessary if the fuse protection of the power infrastructure is < 16 A.
- The reduction takes place through the connection of a resistor between pin 23 *PI* and ground *GND* (e.g. via pin 8 *PG1*).
- For details on this, see chapter *6.14.7 Power Indicator.*

6.9 Dimensions and Installation Information

For the installation of the charger, the following points must be strictly adhered to:

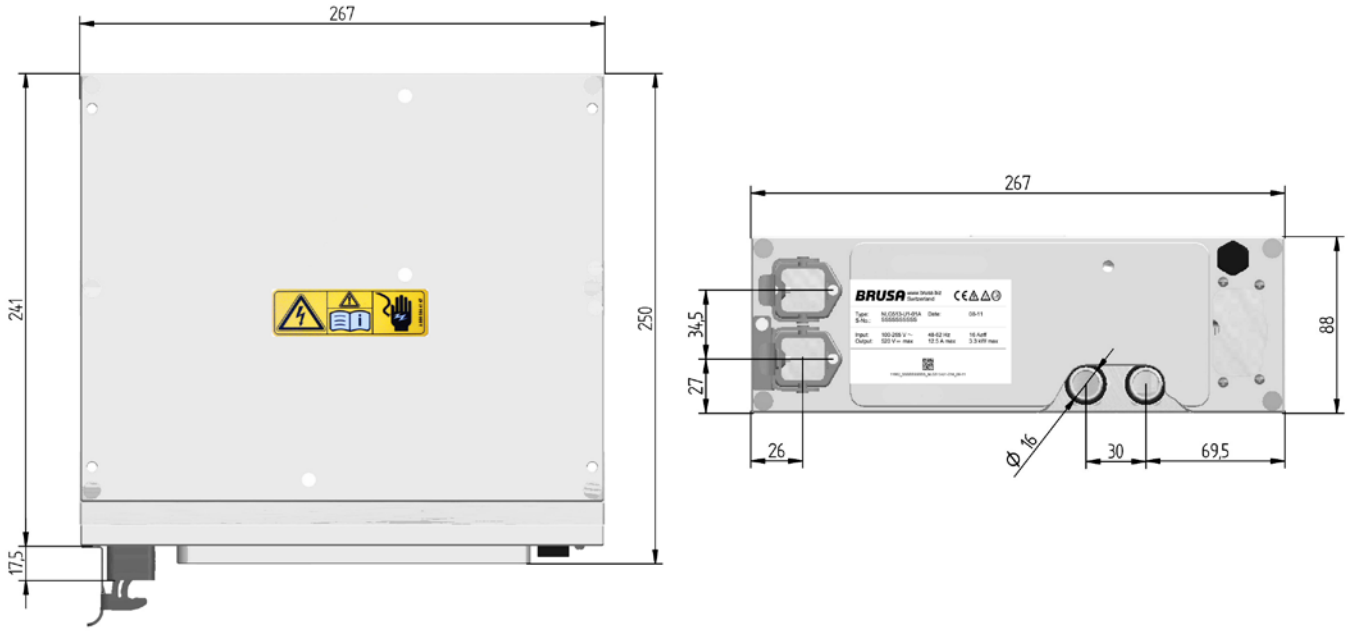
- Despite the IP protection provided, the charger should be installed in a dry location, protected from splashing water.
- The air-cooled version must be installed so that a constant fresh air supply is guaranteed. This has a direct influence on the power of the device (derating).
- The mechanical fixings must be arranged so that the device is fitted firmly and in a way that is as vibration-proof as possible.
- The cable feeds and cooling water pipes should have sufficient space for manoeuvre and may under no circumstances sit in contact with sharp-edged components.

6.9.1 Fixing Points

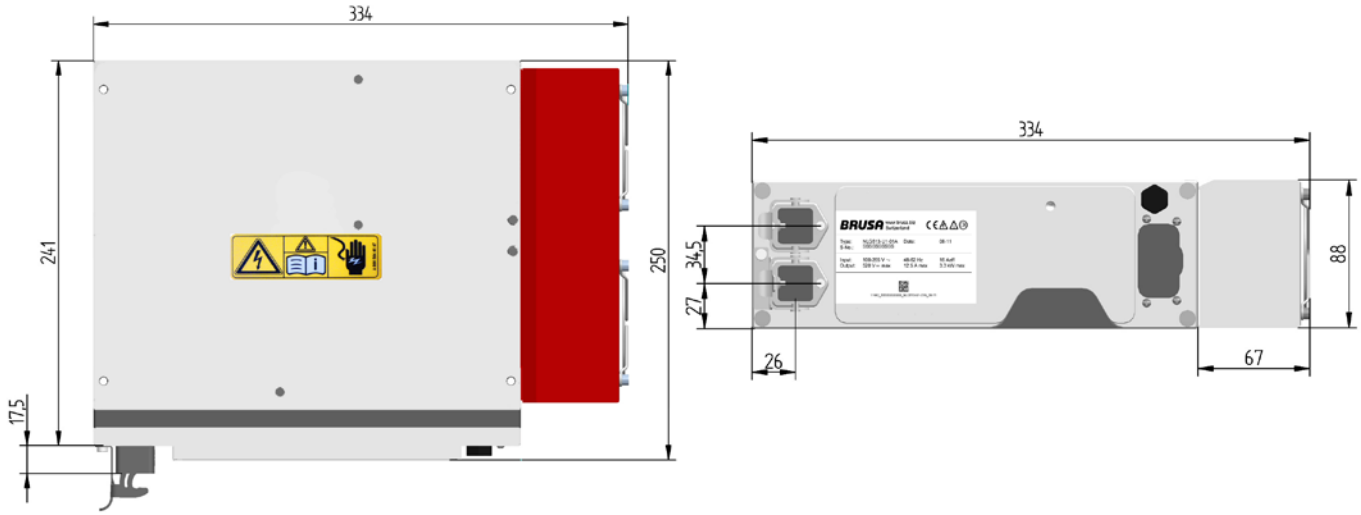


1. M6 through hole (thread depth 24 mm)
Min. screw-in depth = 20 mm
Torque = 10 Nm

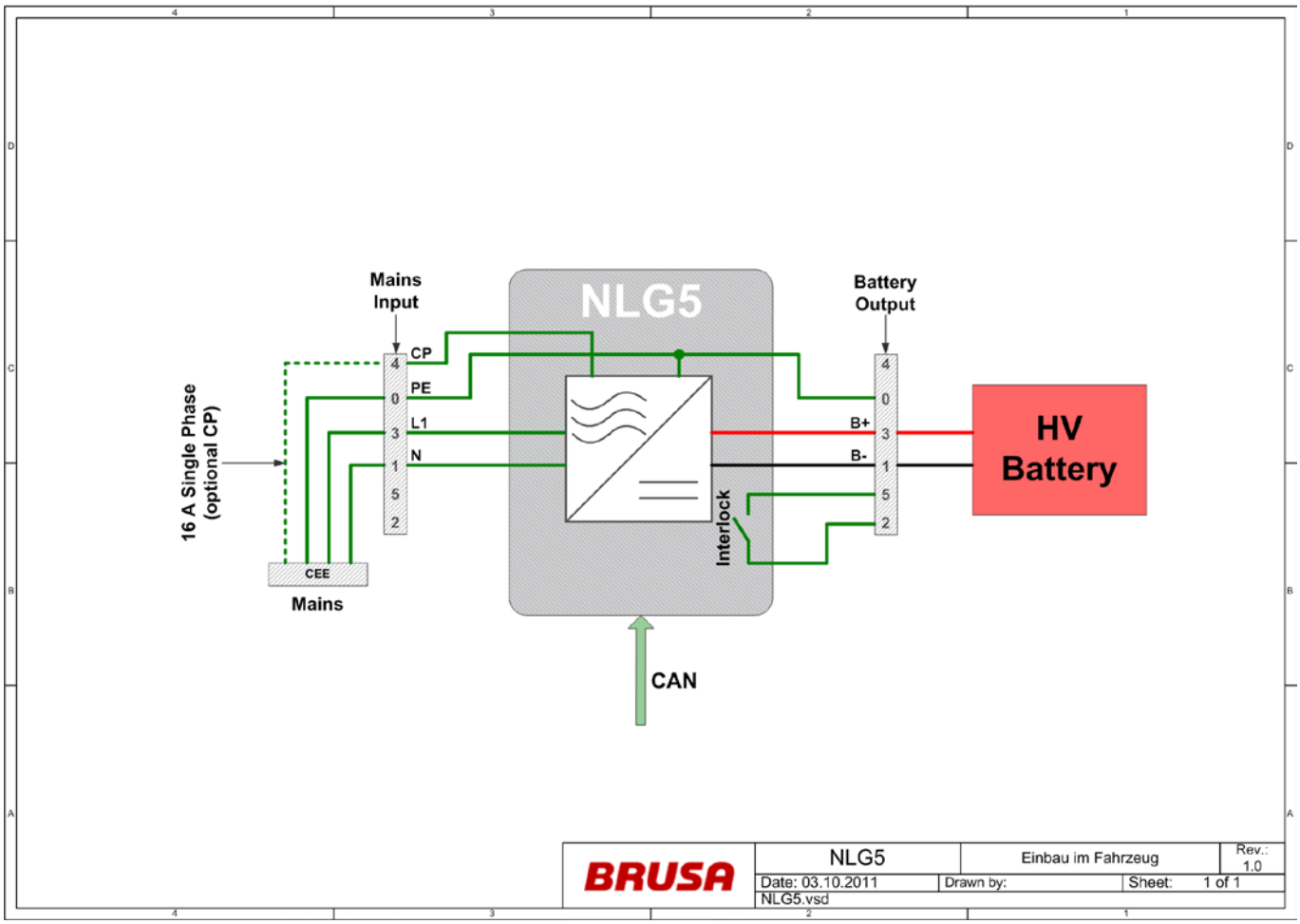
6.9.2 Dimensions (Water-cooled NLG5)



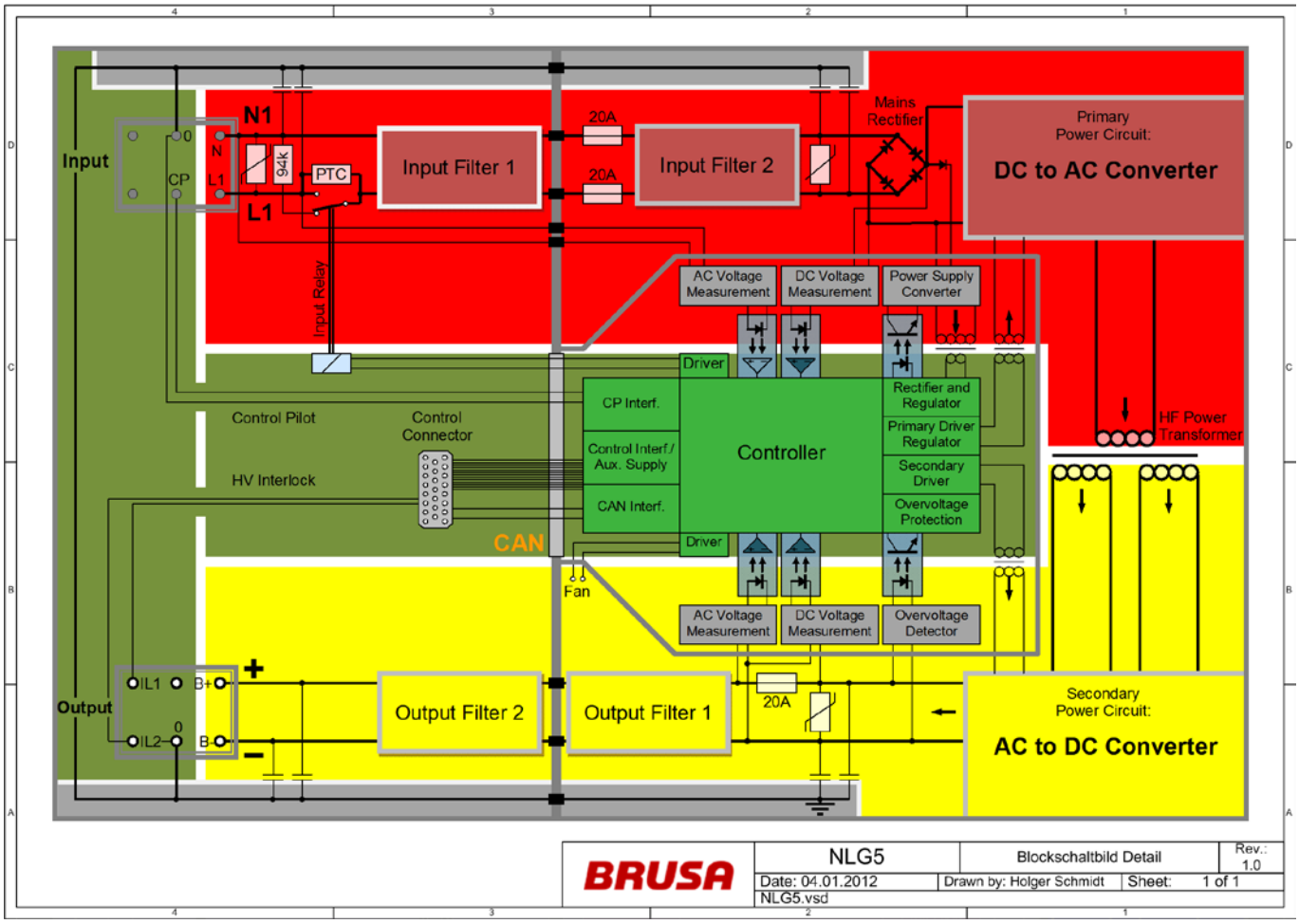
6.9.3 Dimensions (Air-cooled NLG 5)



6.10 Basic Principle for Installation into the Vehicle



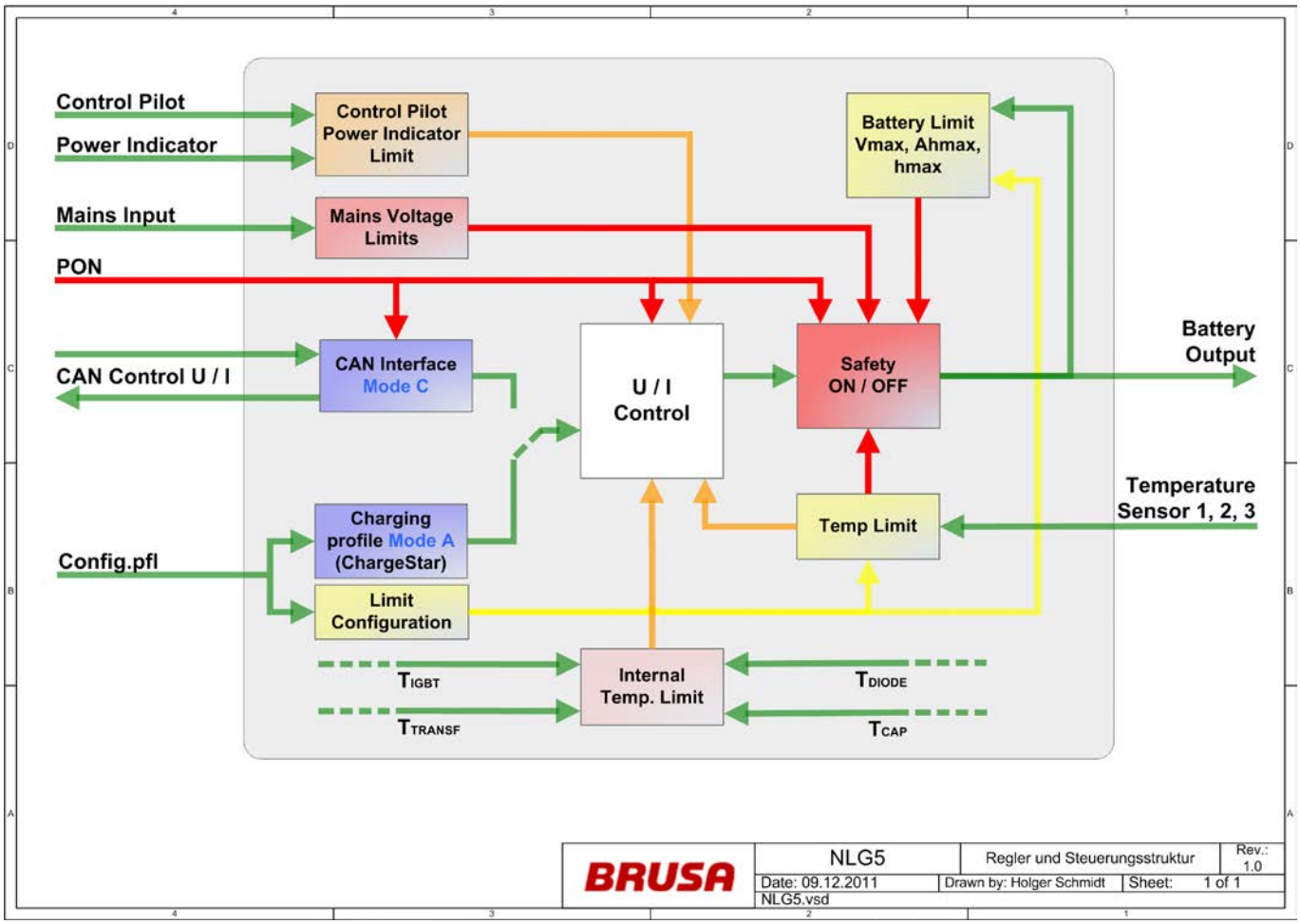
6.11 Block Circuit Diagram NLG5



6.12 Regulation and Control System

The following graph gives an overview of the way the different derating and shut-down installations of the charger work and how they are related.

- **Green = Signal**
- **Yellow = Configuration**
- **Orange = Power reduction**
- **Red = Shut down**

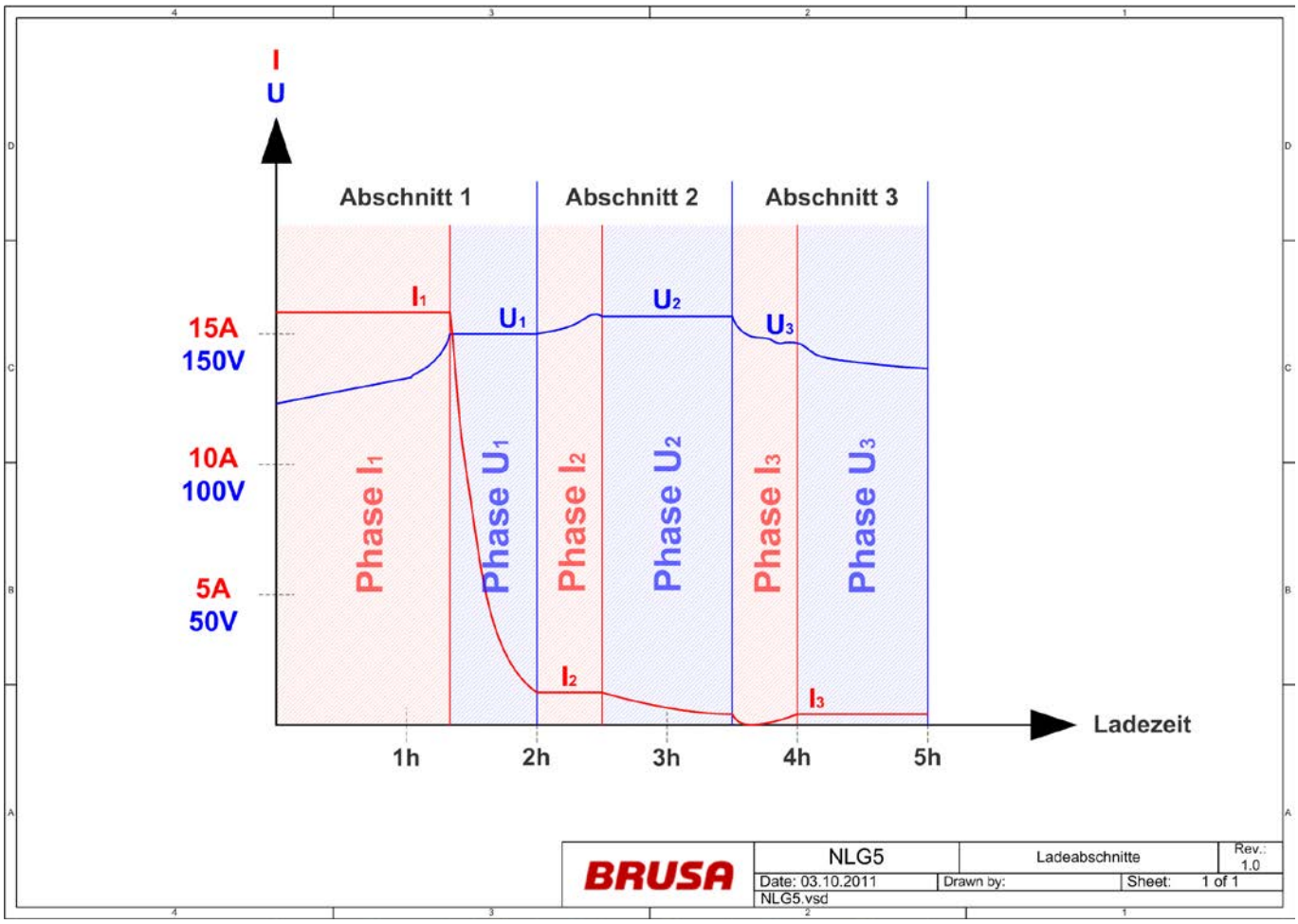


6.13 Modes of Operation

6.13.1 Mode A (Automatic)

In this mode, the charger charges the battery in conformity with a programmed charging profile. A charging profile consists in turn of several charging stages in which each charging follows its own I / U profile. The I / U profile in stage 1 is determined using the current level I_1 and the voltage level U_1. The I / U profile in stage 2 is determined using the current level I_2 and the voltage level U_2.

Transition to the next charging stage occurs automatically if specific criteria are met (e.g. falling below a defined charging current, charging of a specific charge quantity, the reaching of a fixed charging time etc.).



Charging example:

In stage 1 / phase I1, the battery is charged with a constant current I1 (if the voltage is < U1 and the charger provides this current). The transition to phase U1 occurs if the defined voltage U1 is reached. Now the voltage is constantly kept at U1 by reducing the charging current. This stage is referred to as *Main Charging.*

The transition into stage 2 can take place as early as phase I_1 or U_1 due to one or more conditions. In stage 2 the voltage level U_2 is usually larger and the current level I_2 is usually smaller than in stage 1. This stage is referred to as *Equalisation Charge*.

The transition to stage 3 then takes place when one or more requirements are fulfilled. In stage 3 both the voltage level U_3 and the current level I_3 are usually smaller than in stage 1. This stage is referred to as *Trickle Charging*.

Further information on the conditions (parameters) can be found in chapter *8.2.7 Charging Profile Parameters*

6.13.2 Mode C (CAN controlled)

In this mode, the charger is controlled by an external BMS via the CAN. During this the charger receives all the parameters from the BMS and adapts the charging voltage and charging current to the inputs/instructions. In this mode there is also the possibility of editing all basic settings (e.g. activation of external battery temperature sensors, absolute shut-down limit setting etc.) using the provided *ChargeStar* software.

The following main signals are transmitted via the CAN *:

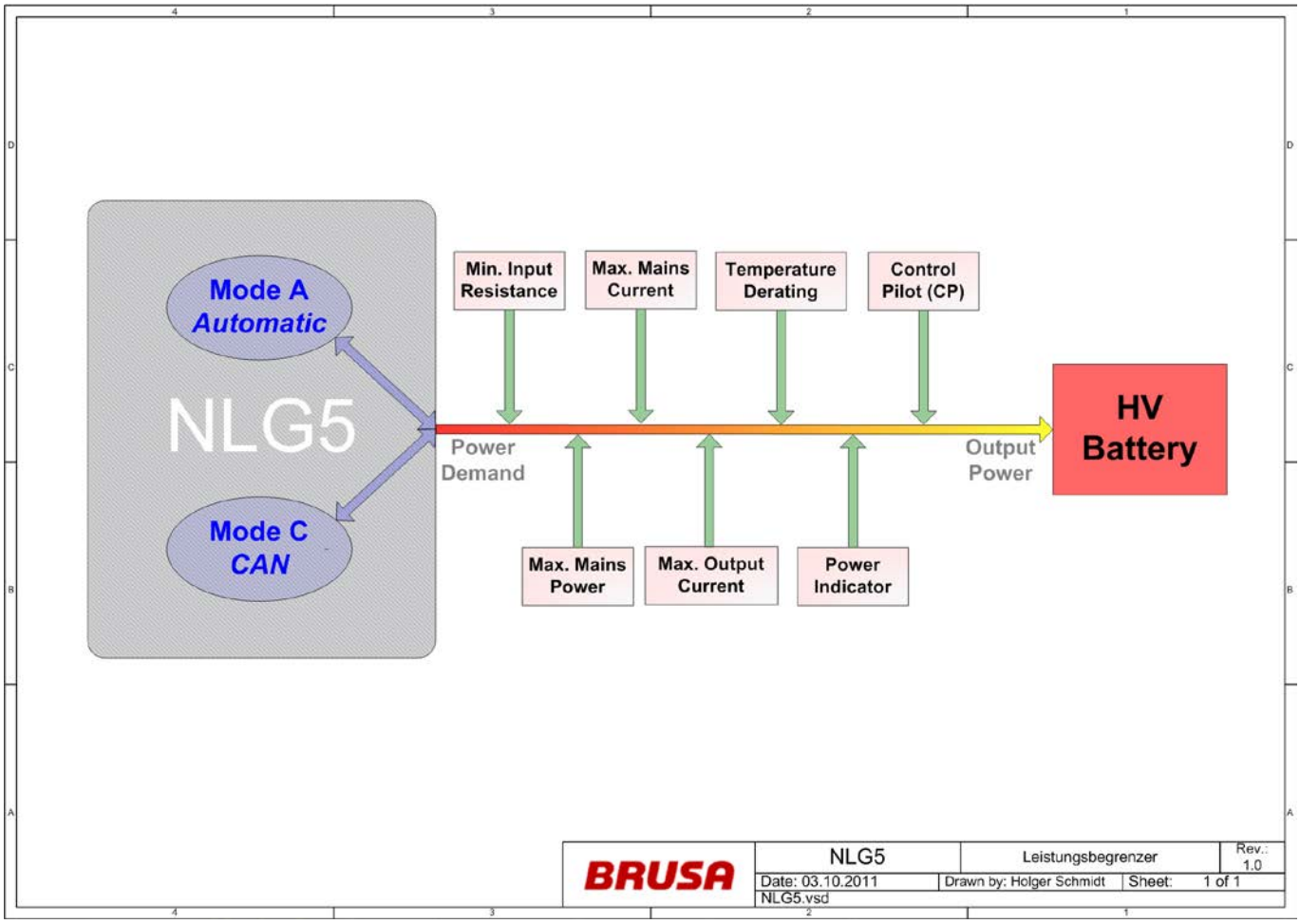
SIGNAL	DESCRIPTION	RX / TX	ID HEX	DLC BYTE	RATE (MS)
Control	I / U target value guidelines, control bits	**Rx**	618 h	7	100
Status	Status of the regulator and the limiter	**Tx**	610 h	4	100
Int. values	I / U current values of the NLG5	**Tx**	611 h	8	100
Ext. values	Current external values (CP etc.)	**Tx**	612 h	8	100
Temp.	Internal and external temperatures	**Tx**	613 h	8	1000
Errors	Fault causes and warnings	**Tx**	614 h	5	1000

***** You can find the complete CAN matrix in the *Software* manual.

6.14 Power Limitations

In order to permanently protect the NLG5 from overload damages, the charging power is automatically limited through different power limitations. Here checks are constantly made to see whether all operational values are within the permitted range. The charging power is thereby permanently reduced to the level which is permitted under consideration of the current power limitations. This way, depending on the mode of operation (mode A or C), the charging power which should be supplied by the module is produced.

The power limiters *Power Indicator* and *Control Pilot* are adjustable. All the others are permanently programmed in the device. The following graph gives an overview of the individual power limiters.



6.14.1 Min. Input Resistance

The charger acts like an ohmic load on the grid. On the surface this means a minimum input resistance of 13 ohms. At a mains voltage of </= 208 V, the input current is reduced to V/13. E.g. this means an input current of 11.5 A (150 V / 13 ohms = 11.5 A) at a mains voltage of 150 V.

6.14.2 Max. Mains Power

The charger constantly monitors the applied charging power and limits this to 3680 W. In a 230 V mains supply, this corresponds to a primary current of 16 A. During this, the maximum permitted mains connection current is ignored and the power limiters *Power Indicator* and *Control Pilot* are not considered.

The maximum mains power is country-specific and has a direct impact on the charging power. When mains power is low, the charging power also decreases as a result.

Examples:

- In Germany, the maximum mains power is 3680 W (230 V x 16 A = 3680 W) from the mains socket
- In Switzerland, the maximum mains power is 2990 W (230 V x 13 A = 2990 W) from the mains socket

6.14.3 Max. Mains Current

The charger limits the largest permitted mains current (primary current) to 16 A. This produces an input power of 3680 W on a 230 V mains supply.

6.14.4 Max. Output Current

The maximum output current (I_{max}) per charger is 12.5 A. If the battery voltage is larger than 260 V, the charging current is defined by the maximum mains power. At very low battery voltages (200 – 260 V), the charging power is limited by the maximum output current of 12.5 A.

6.14.5 Temperature Derating

You can find information on this in chapter *3.4.2 Overload Protection (Derating)*

6.14.6 Control Pilot

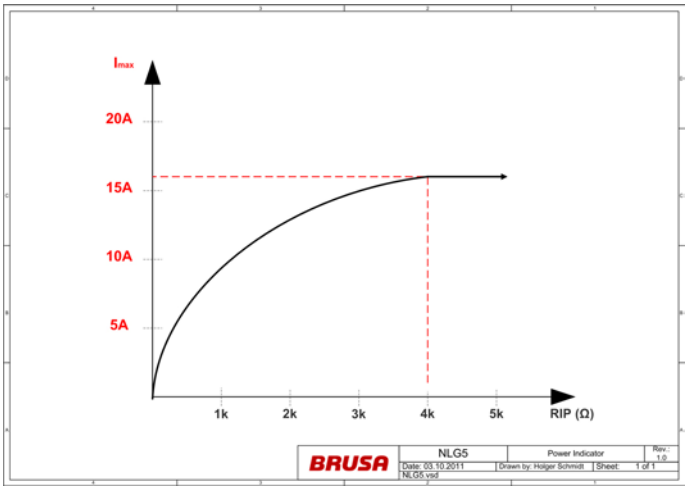
You can find information on this in chapter *3.4.1 Control Pilot (CP)*

6.14.7 Power Indicator

To limit the mains current manually, a potentiometer or a resistor can be connected between pins 23 and 8 of the control plug. The dependence of the maximum mains current In_{max} on the resistor R_{PI} is as follows:

$$In_{max} = 16A \quad \text{if } R_{PI} > 4k\Omega$$

$$In_{max} = 20A * \frac{R_{PI}}{R_{PI} + 1k\Omega} \quad \text{if } R_{PI} \leq 4k\Omega$$



The relation between the maximum mains current and the required resistance level can be seen in the following table.

Voltage relationship	$R_{Power\ indicator}$ (kΩ)	I_{AC} supply (A)	Voltage relationship	$R_{Power\ indicator}$ (kΩ)	I_{AC} supply (A)
0.00	0.000	0.0	0.45	0.818	9.0
0.05	0.053	1.0	0.50	1.000	10.0
0.10	0.111	2.0	0.55	1.222	11.0
0.15	0.176	3.0	0.60	1.500	12.0
0.20	0.250	4.0	0.65	1.857	13.0
0.25	0.333	5.0	0.70	2.333	14.0
0.30	0.429	6.0	0.75	3.000	15.0
0.35	0.538	7.0	0.80	4.000	16.0
0.40	0.667	8.0			

The most typically used current limits are obtained with the following resistors:

IN_{MAX} [A]	R_{PI}[KΩ]	R_{PI}(E24) [KΩ]
6	0,429	0,430
8	0,667	0,680
10	1,000	1,000
12	1,500	1,500
13	1,857	1,800
16	---	---

7 Installation / Start-up

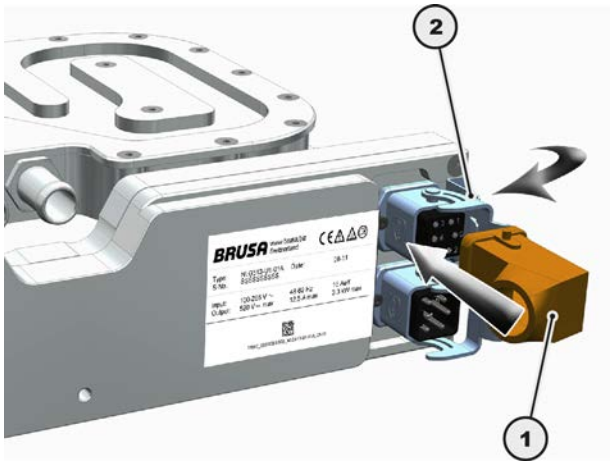
7.1 Installing and Connecting the Charger

DANGER
 **High voltage!** **Danger to life!** During the assembly of the charger, not adhering to the connection sequence can pose a danger to life through electric shock! Before starting work, make sure the absence of voltage in the HV-circuit! You must follow the given operating sequence! Under no circumstances should you carry this out in a careless or rash manner!

INSTRUCTION
 When connecting the battery cable to the HV battery, a precharging resistor must be used! Connecting without a precharging resistor can lead to very high current peaks which can in turn lead to damage to the charger!

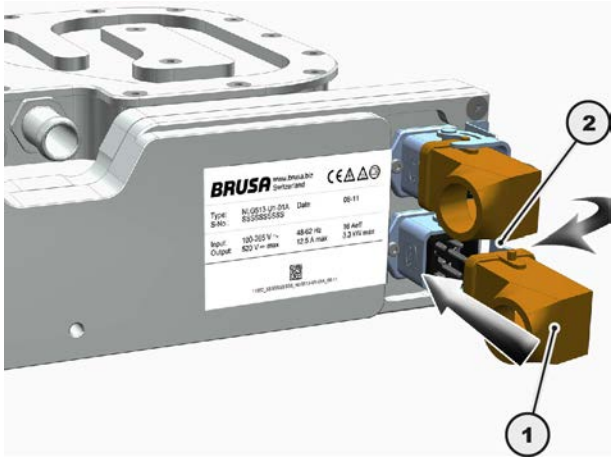
INFORMATION
 Visually check the packing material and the charger itself in particular for damages before installation. Each charger undergoes a strict quality and function test at BRUSA before distribution. However, we have no control over transportation routes which can sometimes take a long time and the shipping of our products.

PROCEDURE STEP	ILLUSTRATION / OTHER INFORMATION
1. Integrate the charger mechanically into the specified position.  Use the screws and torques stated, see chapter *6.9.1 Fixing Points*	---
2. Connect the cooling water pumps (only with the water-cooled version).  See chapter *6.7.1 Cooling System*	---
3. Ventilate the cooling water system.  Make sure that no air pockets are available in the cooling system!	
4. Make the ground connection between the charger and the vehicle.  See chapter *6.8.1 Grounding Screw*  As short a cable length as possible should be selected.	---
5. Build the *control plug* cable connections.  See chapter *6.8.4 Pin Assignment Control Plug (Device-side)*	---

PROCEDURE STEP	ILLUSTRATION / OTHER INFORMATION
6. Connect the *control plug* with the charger. Ensure that the control plug clicks into place and sits firmly.	---
7. Configure the charger. See chapter *7.2 Configuring the Charger / Assigning Charging Profiles*	---
8. Wire up the modular plug to the battery cable. See chapter *6.8.3 Pin Assignment Modular Plug Output (Device-side)*	---
9. Position the battery cable in the vehicle. Do not build any of the electrical connections yet!	---
10. Connect the battery cable (*output modular plug)* (1) with the charger. Close the locking clip (2).	

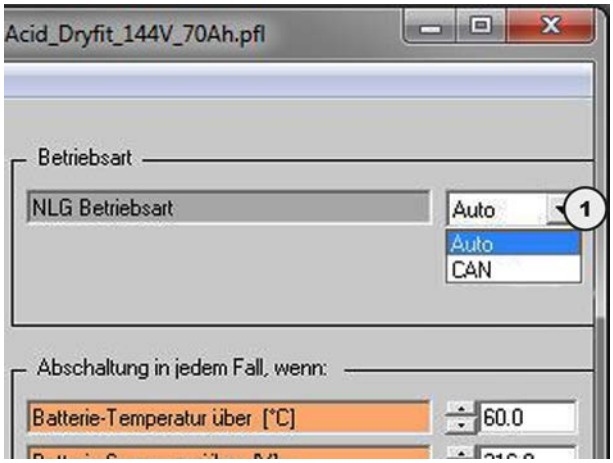
INSTRUCTION
Pay attention to the cable colours when connecting the battery cable to the HV battery! **Battery + = brown (when using the BRUSA KB51A battery cable)** **Battery - = blue (when using the BRUSA KB51A battery cable)** Incorrect polarity can lead to damages to the charger!

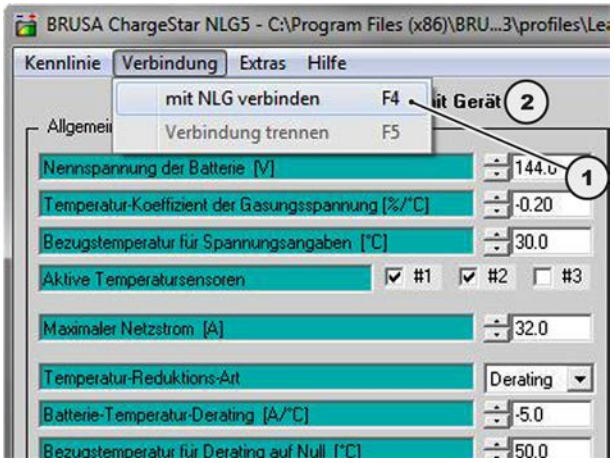
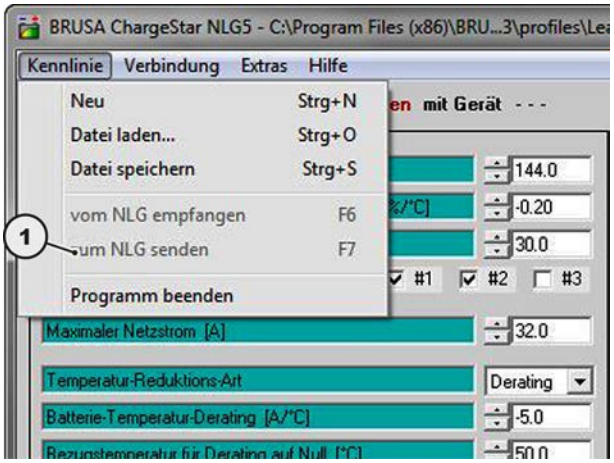
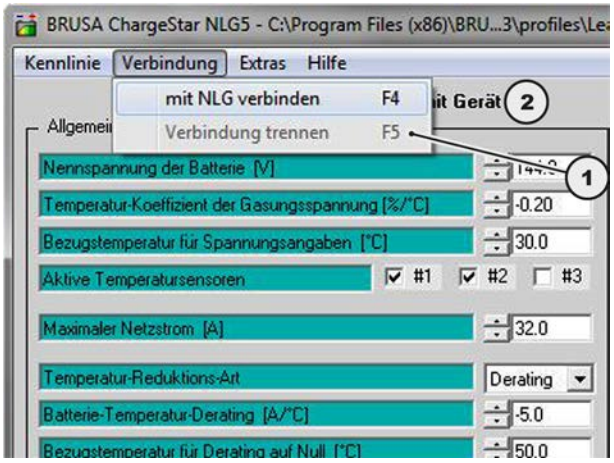
11. Connect the battery cable to the HV battery. Make sure, that the used battery has a Pre-charging contactor! For more information see chapter *7.3 Pre-charging Voltage* Connecting without pre-charging contactor can lead to voltage spikes and can damage the charger!	---

PROCEDURE STEP	ILLUSTRATION / OTHER INFORMATION
12. Connect the mains cable (*modular plug input)* (1) with the charger. Close the locking clip (2).	
13. Connect the charging cable to the charging socket of the vehicle.	---

7.2 Configuring the Charger / Assigning Charging Profiles

INFORMATION
The provided ChargeStar software functions using the following operating systems with 32-bit processors: ➢ Win2000 ➢ Win XP ➢ Win Vista

PROCEDURE STEP	ILLUSTRATION / OTHER INFORMATION
1. Ensure that all mechanical and electrical connections are connected with the charger.	---
2. Connect the charger with your PC (RS232 interface). See chapter *6.8.4.8 Pin 11 TXD, Pin 12 RXD*	---
3. Switch pin 2 *AUX* to *high* or connect the device to an external 12 V supply.	---
4. Make the connection to the charger. Then check the operational data of the charger. See chapter *8.1.1 Retrieving / Monitoring Operating Data from the Charger*	---
5. Install the provided *ChargeStar* software.	---
6. Start the *ChargeStar* software.	
7. Choose the desired mode of operation (1). See chapter *6.13 Modes of Operation*	
8. Choose the suitable charging profile for your battery. See chapter *8.2.1 Loading Charging Profiles from the Database* See chapter *8.2.2 Programming New Charging Profiles*	---

PROCEDURE STEP	ILLUSTRATION / OTHER INFORMATION
9. In the *Connection* menu, press *Connect with NLG* (1). The connection to the charger is being established. When the connection is active, the report *Connected with device* will appear in the field (2). Check the cable connections in case the connection cannot be established and repeat the procedure.	
10. In the *Profiles* menu, press *Send to NLG* (1). The charging profile is sent to the NLG.	
11. In the *Connection* menu, press *Disconnect* (1). The connection to the charger is now disconnected. When the connection is inactive, the report *Not connected with device* appears in the field (2).	
12. End the ChargeStar software.	---
13. Switch pin 2 *AUX* to low or disconnect the unit from the external 12 V supply. The charger has been switched off.	---

PROCEDURE STEP	ILLUSTRATION / OTHER INFORMATION
14. Disconnect the cable connection between the PC and the charger.	---

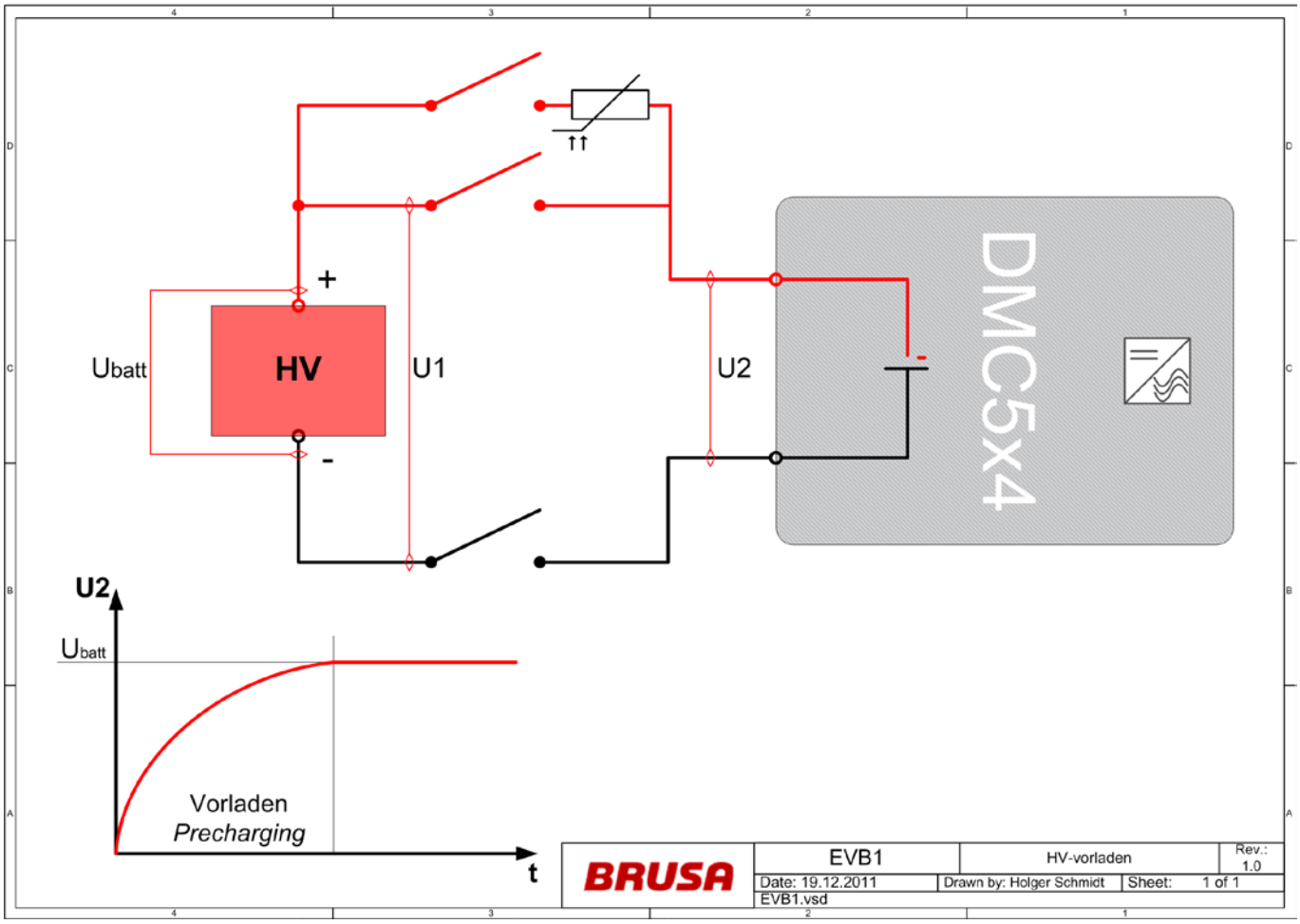
INFORMATION
 The charger is now configured and can be completely installed. For this perform the procedure steps in chapter *7.1 Installing and Connecting the Charger.* For further information on the adjustment parameters or the programming of charging profiles, read the following chapters.

7.3 Pre-charging Voltage

INFORMATION

The following operating principle applies to the BRUSA battery type EVB1:

- To avoid sparks when switching on, the connected loads are pre-charged with a 50 ohm PTC. For this process, three independent voltage measurements are used.
- The switching on of the battery (switching of the main contactors during pre-charging) is very easily heard and can therefore be used as a monitor.
- The pre-charging resistor is heated up by a succession of repeated (3-4 times) periods of pre-charging. If overheating occurs then further pre-charging is temporarily not possible. In this case, the pre-charging resistor must be cooled down over a particular period of time.



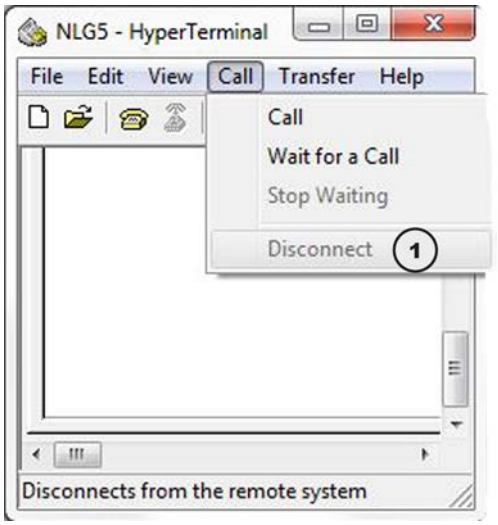
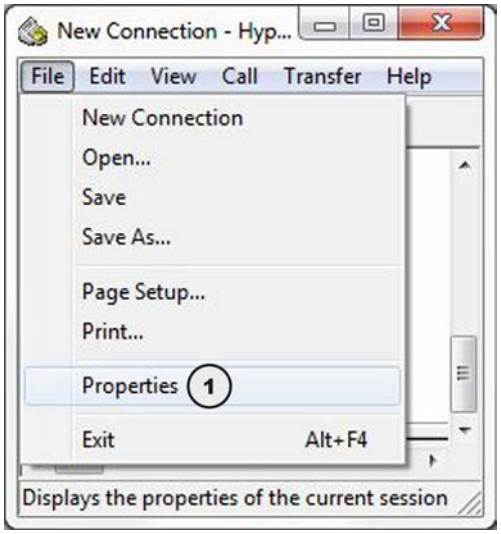
1.	Pre-charging contactor (1) closes. U1 must be at the same level as the sum of the cells (U_{batt}). There must be no current flowing.
2.	Main contactor (3) closes. U2 must rise to the same level as U1 within 5 s. Current < = 4 A. If the level is not reached, the CAN signal *BMS_Err_PreCharge* is emitted!
3.	Main contactor (2) closes.
4.	Pre-charging contactor (1) opens.

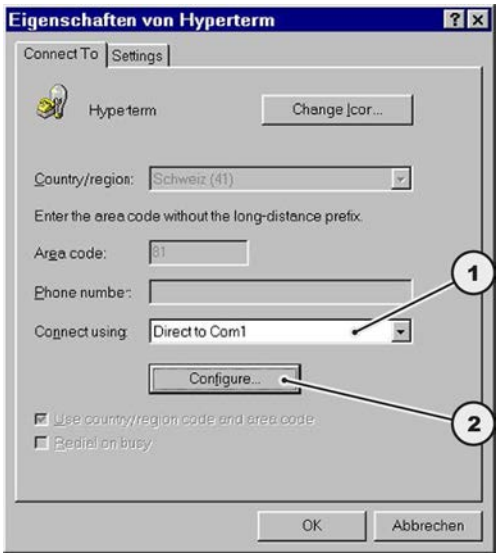
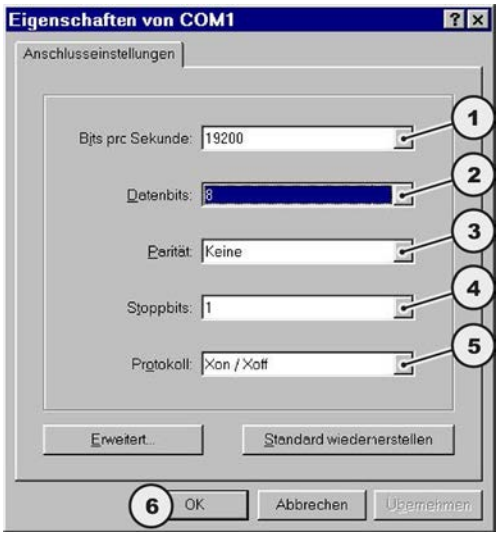
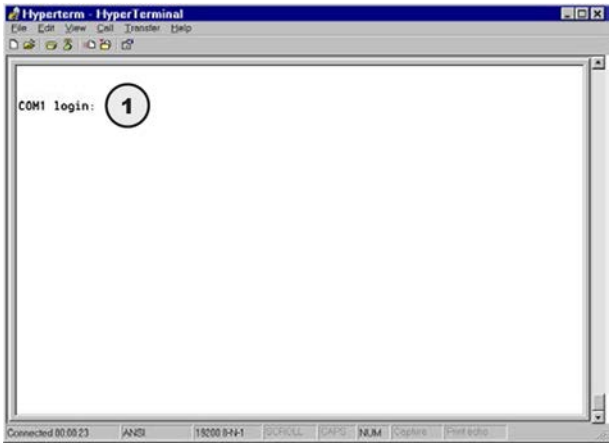
8 Handling and Operation

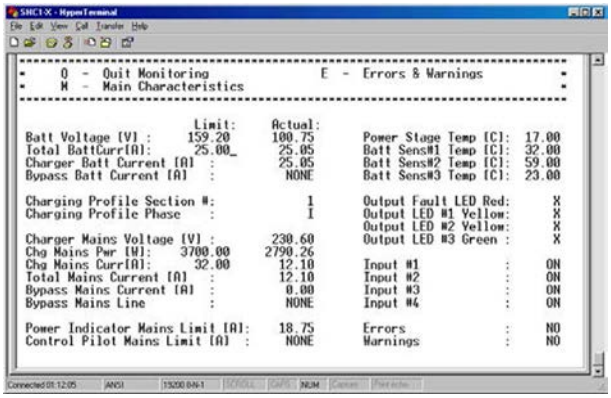
8.1 HyperTerminal

8.1.1 Retrieving / Monitoring Operating Data from the Charger

INFORMATION
To retrieve the operational data of the charger, you will need a terminal or a terminal programme. In the terminal, data which is transmitted from the charger via the serial interface (RS232) can be represented in text form. The following sequence is described using the example of the *HyperTerminal* software. *HyperTerminal* is integrated in most Windows versions as standard. Alternatively, this programme can be obtained directly from the manufacturer at the following address: *http://www.hilgraeve.com/htpe/index.html*

PROCEDURE STEP	ILLUSTRATION / OTHER INFORMATION
1. Start HyperTerminal.	---
2. Disconnect any existing connections if need be. To do this, in the *Call* menu, click on *Disconnect* (1).	
3. In the *File* menu, click on *Properties* (1). The dialogue box *Properties* is opened. The dialogue box *Properties* is opened by HyperTerminal.	

PROCEDURE STEP	ILLUSTRATION / OTHER INFORMATION
4. Set the connection *COM1* in the field (1). Then press the *Configure* button (2). The dialogue box *COM1 Properties* is opened.	
5. Set the limits as follows: (1) 19200 (2) 8 (3) None (4) 1 (5) Xon / Xoff Close the dialogue box by clicking the *OK* button (6).	
6. End HyperTerminal.	---
7. Connect the serial interface *COM1* of the PC with the serial connection of your charger (RS232).	---
8. Start HyperTerminal.	---
9. Enter the term *monitor* as a login in the text field (1). Confirm the entry by pressing the *Enter* button on your keypad.	

PROCEDURE STEP	ILLUSTRATION / OTHER INFORMATION
10. Now in the text field, the operational values of the NLG5 are displayed (*Main Characteristics* menu).	

INFORMATION

To retrieve current error and warning messages, press the *E* button on your keypad (*Errors & Warnings* menu).

To retrieve current status reports (e.g. serial number, date of manufacture, software version), press the *S* button on your keypad.

By pressing the *M* button, you go back to the *Main Characteristics* menu.

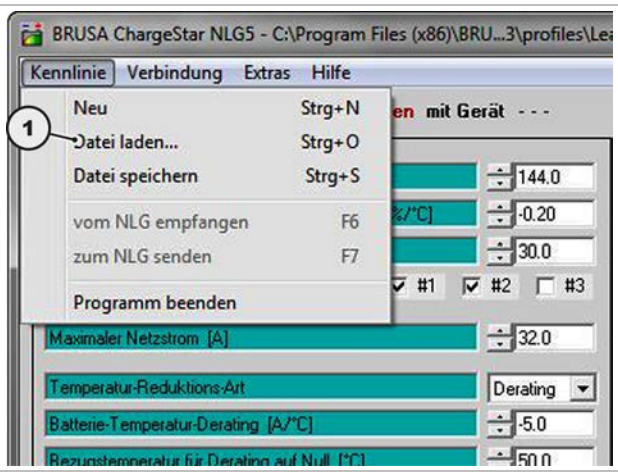
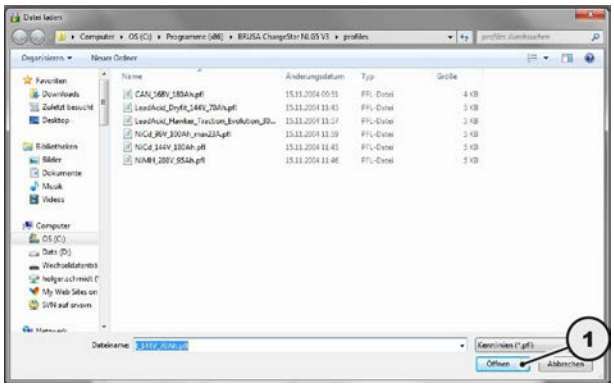
11. Press the *S* button on your keypad.	---
12. Check that the following status reports match the connected charger: ➢ Serial number ➢ Software version ➢ Date of manufacture	---
13. End the monitoring by pressing the *Q* button on your keypad.	---
14. End *HyperTerminal*.	---

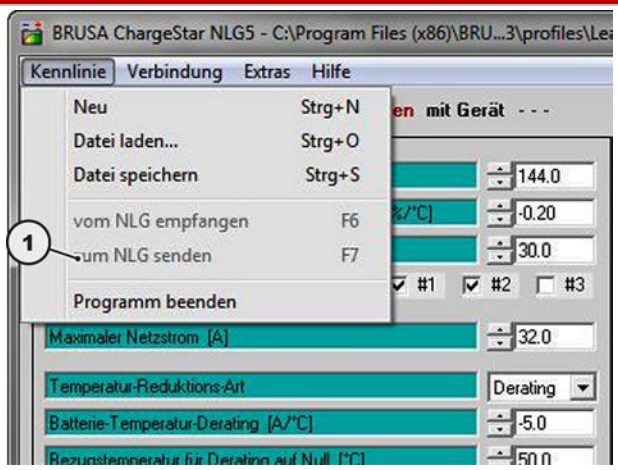
8.2 ChargeStar

INFORMATION
All functions and parameters available in ChargeStar are categorically and accurately explained in the *HELP function*. You can get to the *HELP function* using the menu *Help →ChargeStar Help* or by clicking the *F1* button on your keypad.

8.2.1 Loading Charging Profiles from the Database

INFORMATION
With the *ChargeStar* software, charging profiles configured by BRUSA are supplied which can be used as examples. These can be changed at any time. There is also the possibility of creating your own charging profiles. You can find details on this in chapter *8.2.2 Programming New Charging Profiles* The battery manufacturer must notify of or supply any charging profile suitable for the battery.

PROCEDURE STEP	ILLUSTRATION / OTHER INFORMATION
1. If you have not yet done so, start the *ChargeStar* software.	
2. In the *Profiles* menu, press *Load file* (1). The storage folder in explorer is opened (…BRUSA ChargeStar NLG5 V3\profiles).	
3. Choose the charging profile (.pfl) suitable for your HV battery. Press the Open button (1). The charging profile is adopted by ChargeStar.	

PROCEDURE STEP	ILLUSTRATION / OTHER INFORMATION
4. To transfer the charging profile to the charger, press *Send to NLG* in the *Profiles* menu. The charging profile is transferred to the NLG.	

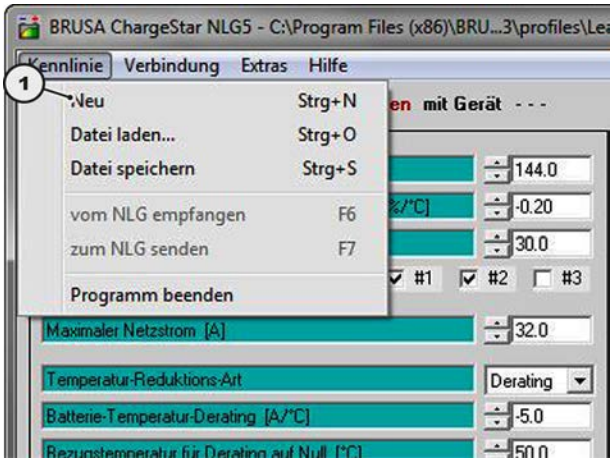
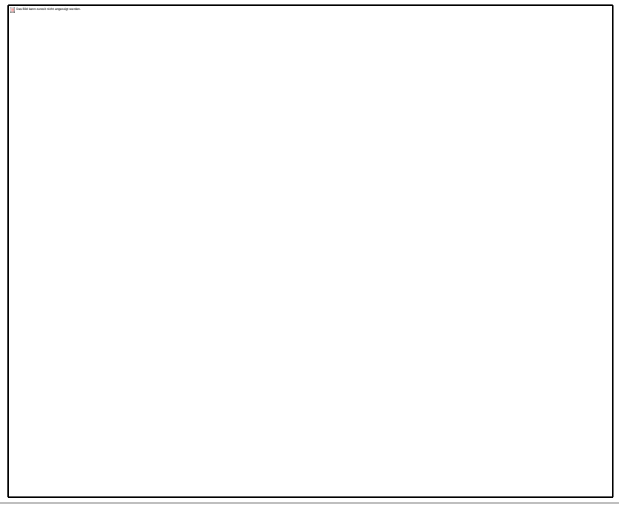
INFORMATION

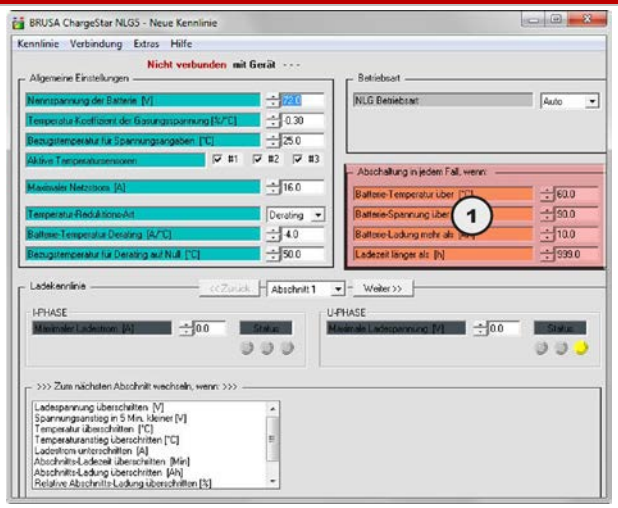
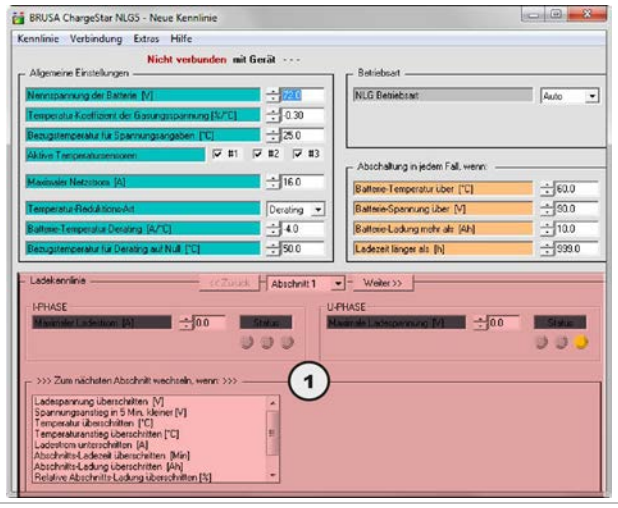
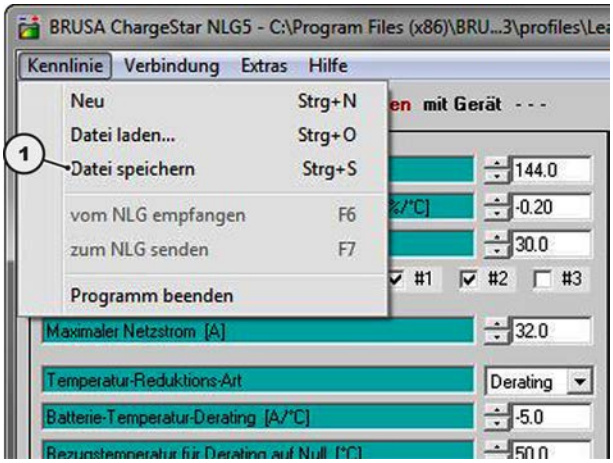
The charger must be restarted to adopt / activate the charging profile. After the reset, the charging profile is automatically active.

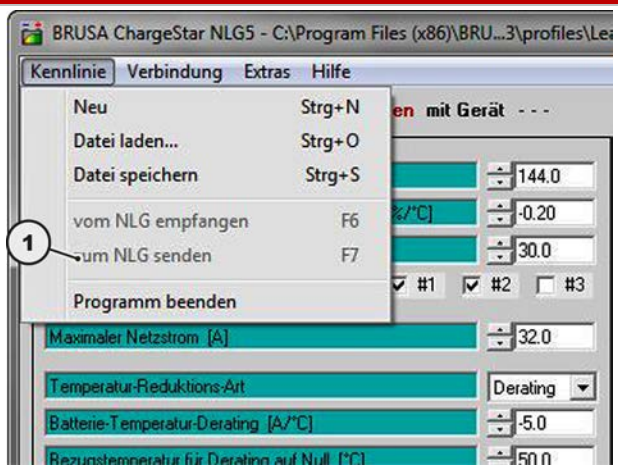
8.2.2 Programming New Charging Profiles

INSTRUCTION
The programming of a charging profile should only be carried out by experienced specialist personnel! Incorrectly defined parameters will lead to the malfunctioning of the charger and the connected HV battery! So in case of any questions or confusion, contact BRUSA Support at the manufacturer address given in chapter *4.6* !

INFORMATION
With ChargeStar you have the possibility of configuring existing charging profiles to fit in with your own requirements or even programming new charging profiles.

PROCEDURE STEP	ILLUSTRATION / OTHER INFORMATION
1. If you have not yet done so, start the *ChargeStar* software.	
2. In the *Profiles* menu, press *New* (1). To configure an existing charging profile, load the charging profile in question from the database. For this see chapter *8.2.1 Loading Charging Profiles from the Database*	
3. Enter the required values in the field (1). See chapter *8.2.7.1 General Parameters*	

PROCEDURE STEP	ILLUSTRATION / OTHER INFORMATION
4. Enter the required values in the field (1). See chapter *8.2.7.2 Shut-Down Parameters*	
5. Configure your charging profile in the field (1). See chapter *8.2.7.3 Parameters for Charging Profiles*	
6. To save the charging profile, press *Save file* (1) in the *Profiles* menu. Choose an appropriate name for the charging profile (.pfl) in the dialogue box which appears. Press the *Save* (1) button.	

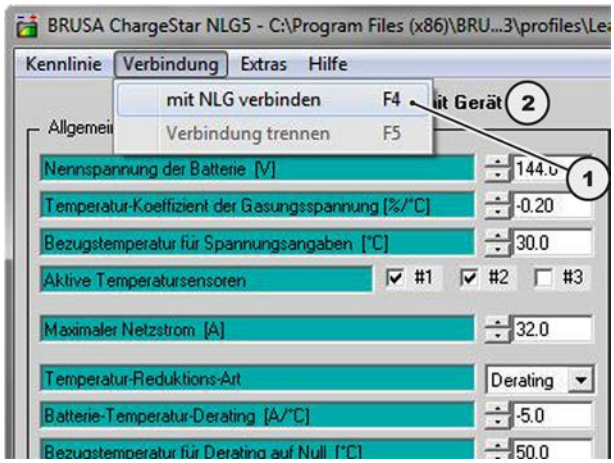
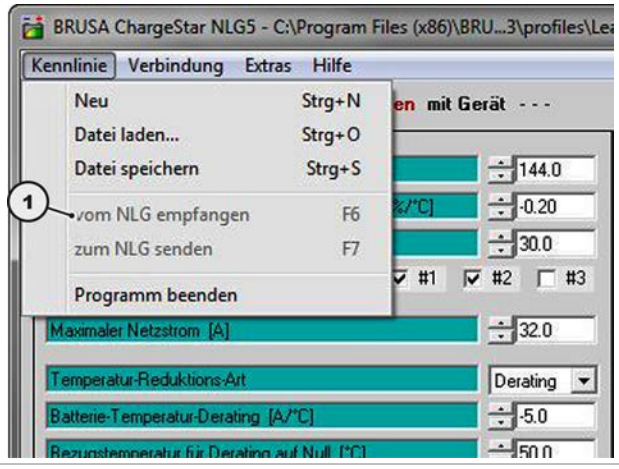
PROCEDURE STEP	ILLUSTRATION / OTHER INFORMATION
7. To transfer the charging profile to the charger, press *Send to NLG* in the *Profiles* menu. The charging profile is transferred to the NLG.	

INFORMATION

The charger must be restarted to adopt / activate the charging profile. After the reset, the charging profile is automatically active.

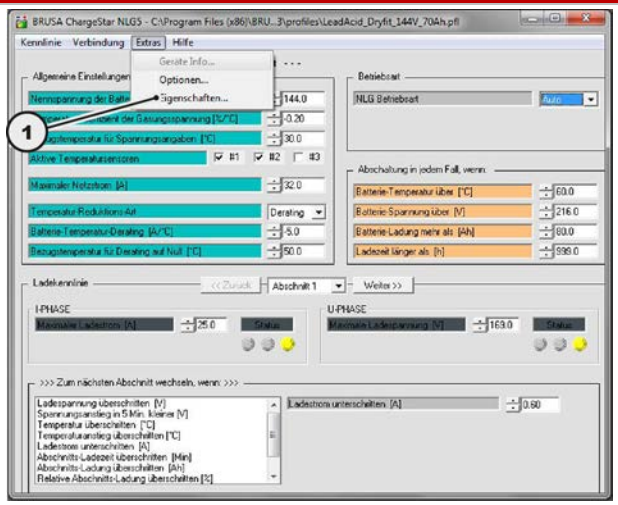
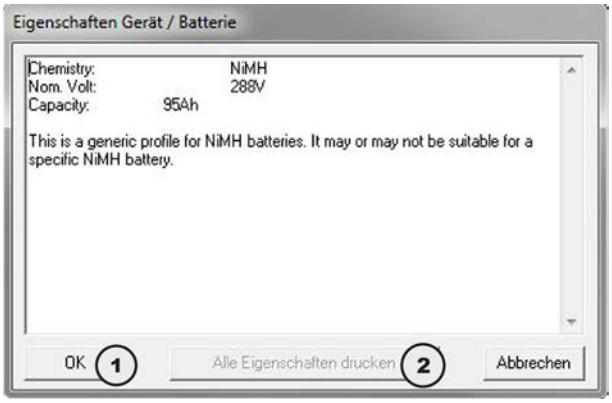
8.2.3 Retrieving Current Charging Profile from the Charger

INFORMATION
In order to determine which charging profile is currently installed on the charger, this can be called up at any time via ChargeStar.

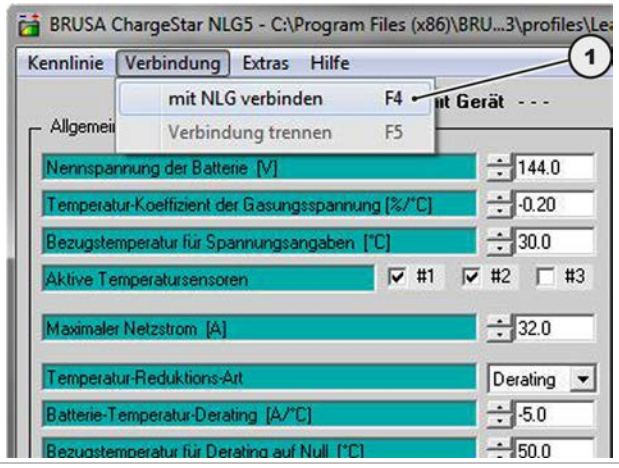
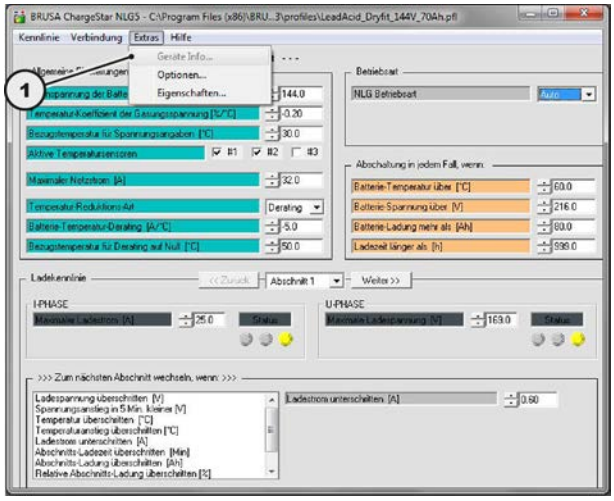
PROCEDURE STEP	ILLUSTRATION / OTHER INFORMATION
1. If you have not yet done so, start the *ChargeStar* software.	
2. In the *Connection* menu, press *Connect with NLG* (1). The connection to the charger is being established. When the connection is active, the report *Connected with device* will appear in the field (2).Check the cable connections in case the connection cannot be established and repeat the procedure.	
3. In the *Profiles* menu, press *Received from NLG* (1). The current charging profile is loaded into ChargeStar.	

8.2.4 Retrieving the Battery Properties of the Charging Profile

INFORMATION
Battery properties can be applied while programming a new charging profile and can be saved with the charging profile. Here, the battery types which can or may be charged with this charging profile can be precisely defined. By entering the battery properties, the charging profile can be allocated accordingly every time. The battery properties always relate to the charging profile which is currently loaded in ChargeStar!

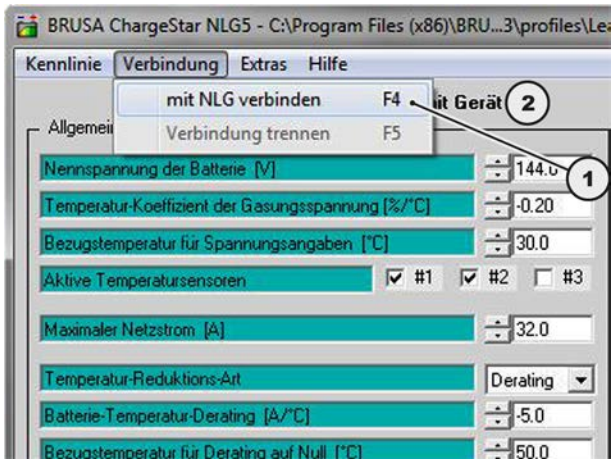
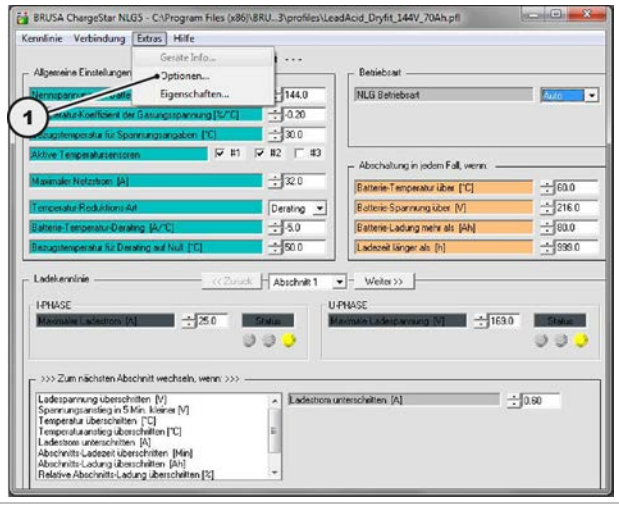
PROCEDURE STEP	ILLUSTRATION / OTHER INFORMATION
1. In the *Extras* menu, press *Properties* (1).	
2. The dialogue box *Properties Device / Battery* is opened. Check whether the given properties match the battery to be charged.	---
3. Press the *OK* button (1) to close the dialogue box. By pressing the button (2), the properties and the device information are fed to a printer. For this, the charger must be connected and the data link must be active.	

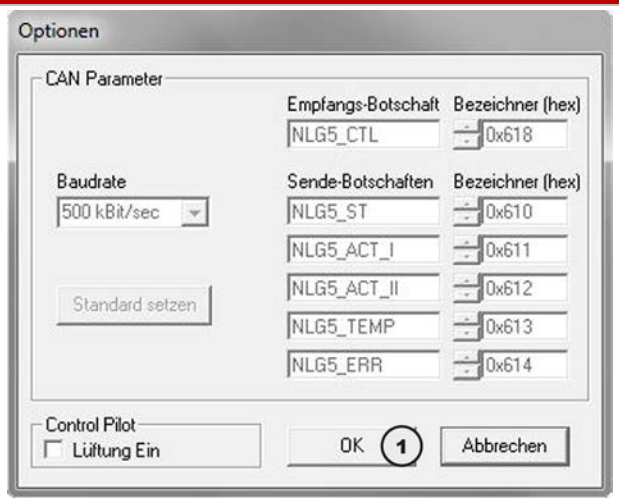
8.2.5 Retrieving Device Information from the Charger

PROCEDURE STEP	ILLUSTRATION / OTHER INFORMATION
1. If you have not yet done so, start the *ChargeStar* software.	
2. In the *Connection* menu, press *Connect with NLG* (1). The connection to the charger is being established. When the connection is active, the report *Connected with device* will appear in the field (2). If the communication cannot be established, check the cable connections.	
3. In the *Extras* menu, press *with device info* (1). The current device information of the connected charger is displayed.	

8.2.6 Changing the CAN Parameters (Options)

INFORMATION
In the dialogue box *Options*, the CAN parameters can be changed. The CAN parameters are set using the existing CAN matrix and should therefore only be changed by experienced specialist personnel!

PROCEDURE STEP	ILLUSTRATION / OTHER INFORMATION
1. If you have not yet done so, start the *ChargeStar* software.	
2. In the *Connection* menu, press *Connect with NLG* (1). The connection to the charger is being established. When the connection is active, the report *Connected with device* will appear in the field (2). Check the cable connections in case the connection cannot be established and repeat the procedure.	
3. In the *Extras* menu, press *Options* (1).	

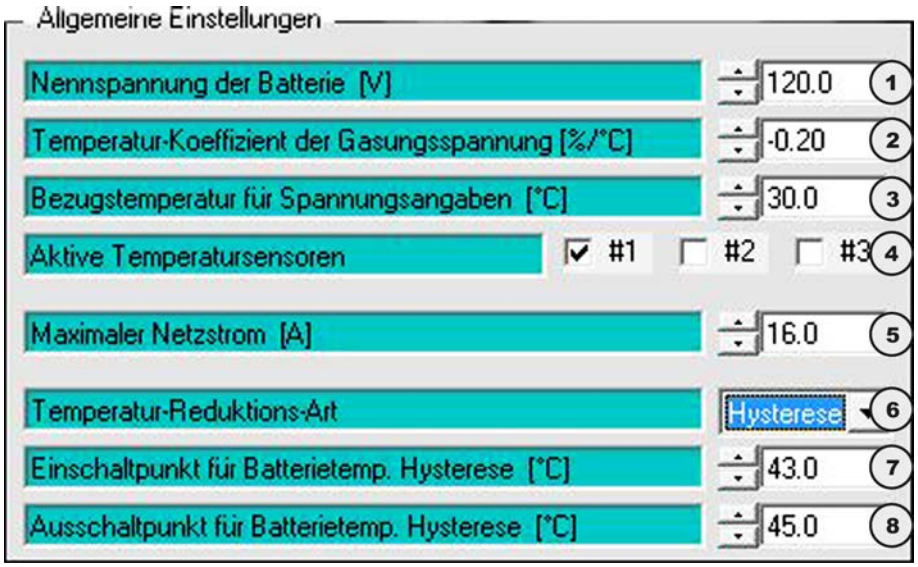
PROCEDURE STEP	ILLUSTRATION / OTHER INFORMATION
4. In the dialogue box *Options*, the different CAN parameters can now be changed. Press the *OK* button (1) to close the dialogue box. You can find details on the CAN matrix in the *Software* manual.	

8.2.7 Charging Profile Parameters

8.2.7.1 General Parameters

WARNING

Overheating!
Fire hazard!
There is a danger of the battery catching fire if the wrong parameters or limit values are entered!
Any adjustment values must be adopted from the connected battery's technical documentation or be given clearance by the manufacturer!



1.	Nominal voltage of the battery (V): Given nominal voltage of the connected battery (informative)	**2.**	Temperature coefficient of the gassing voltage (%/°C): Reduction (in percent) of the charging voltage on account of the difference between the battery temperature and the reference temperature.
3.	Reference temperature for voltage specifications (°C): Specification of the battery temperature from which the gassing voltage is reduced when the temperature is rising. From this battery temperature, the charger keeps the gassing voltage constant.	**4.**	Active temperature sensors 1, 2 and 3: If temperature sensors are connected, these must be activated accordingly by ticking the box.
5.	Maximum mains current (A): Specification of the maximum mains current which the charger can obtain.	**6.**	Temperature reduction type: **Hysteresis:** The charging process is terminated if the maximum battery temperature (8) is reached. The charging process is automatically continued if the lower temperature threshold (7) is reached.
7.	Switch-on point for battery temperature hysteresis (°C): Lower temperature threshold under which the charging process is activated once again.	**8.**	Switch-off point for battery temperature hysteresis (°C): Temperature threshold from which the charging process is deactivated.

8.2.7.2 Shut-Down Parameters

WARNING

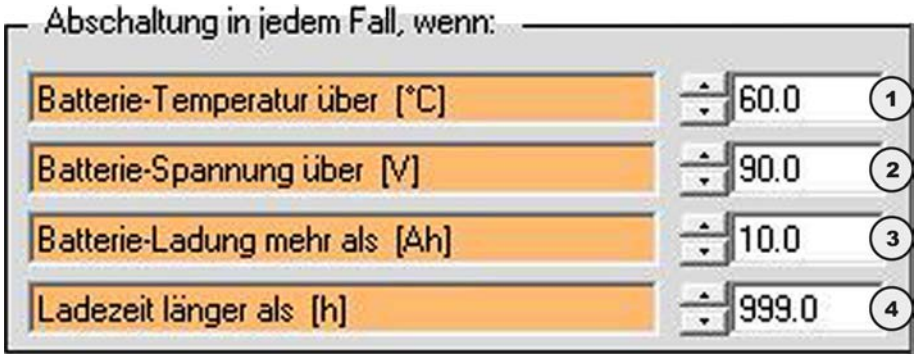
Overheating!
Fire hazard!

There is a danger of the battery catching fire if the wrong parameters or limit values are entered!

Any adjustment values must be adopted from the connected battery's technical documentation or be given clearance by the manufacturer!

INFORMATION

Shut-down parameters function as an additional safety installation. The charger is shut down for safety reasons anyway if one of these parameters is reached or surpassed.



1. Battery temperature over (°C):
Charger shuts down if the battery exceeds the given maximum temperature.

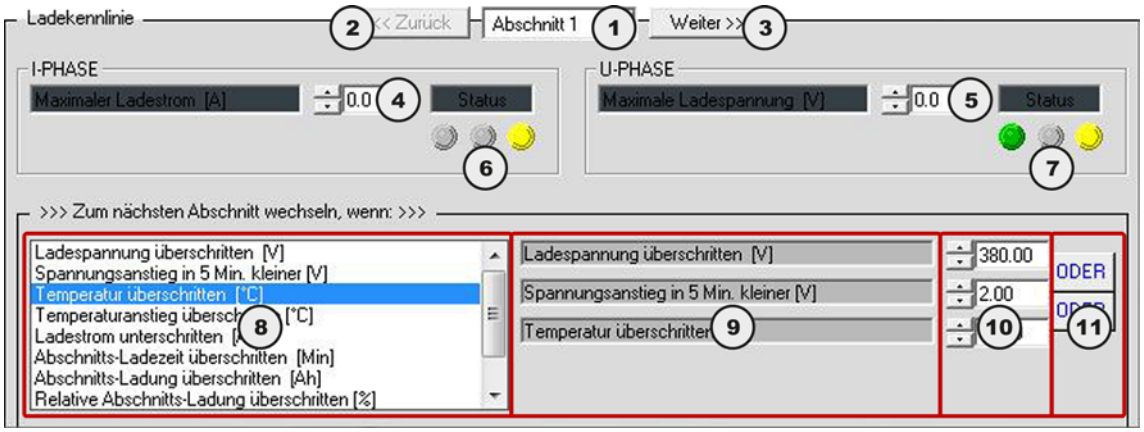
2. Battery voltage over (V):
Charger shuts down if the given maximum battery voltage is exceeded.

3. Battery charge more than (Ah):
Charger shuts down if the given capacity is charged.
(Entry *999* = never shut down)

4. Charging time longer than (h):
Charger shuts down if the given charging time is reached.
(Entry *999* = never shut down)

8.2.7.3 Parameters for Charging Profiles

A charging profile can be divided into up to 7 stages. Each stage is sub-divided into an I phase and a U phase in which the maximum charging current / maximum charging voltage must be determined. For each stage, one or more parameters can be set which must be reached in order for the transition into the following stage to take place. When using several parameters, they must be combined with AND / OR connectives. E.g. this means that if parameter 1 (charging current fallen below limit) OR (AND) parameter 2 (charging voltage fallen below limit) is reached, the transition into the next stage should take place. And this means that, as a result, if one or more parameters are reached during the charging process, a transition into the next stage will take place automatically.



1.	Selection field, stage (1 - 7)	**2.**	Back to last stage
3.	Forward to next stage	**4.**	Input field for maximum charging current, stage-specific
5.	Input field for maximum charging voltage, stage-specific	**6.**	Status selection, I phase: Here there is the option of creating a visual coding for the charging stage.
7.	Status selection, U phase: Here there is the option of creating a visual coding for the charging stage.	**8.**	Parameter selection list: Individual parameters can be adopted by double-clicking on the parameter list (9).
9.	Parameter list: Listing of the parameters selected for the stage. By double-clicking on a parameter, it can be removed from the parameter list again.	**10.**	Input fields
11.	AND / OR selection button		

9 Warranty and Guarantee

The warranty corresponds to the regulations in our currently valid general terms and conditions see under www.brusa.biz/en/support/terms-conditions.html.

10 Instructions regarding disposal

A basic requirement for the re-use and recycling of used electronic devices is the correct disposal.

With the implementation of the electric and electronic device regulation (ElektroG), since 24 March 2006, electronic devices may no longer be disposed of along with ordinary household waste but must be separately collected and recorded by a specialist services.

Disposal through a specialist service significantly helps to avoid dangers to people and nature. Therefore, in the case of disposal, we recommend contacting a recognised specialist disposal service.

11 Index