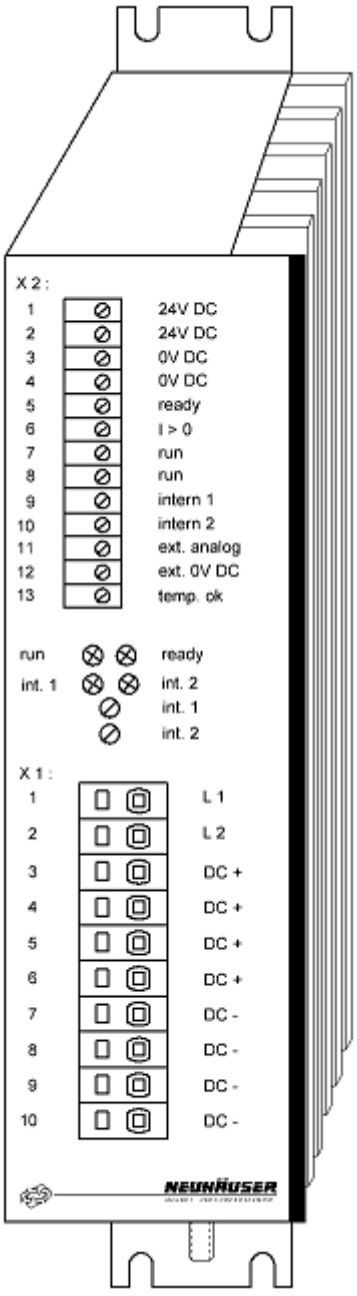
Operating instructions

Current rectifiers
NHCR10-2 and NHCR30-2
13.08.2024



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1. General instructions

The operating instructions apply to the NHCR10-2 and NHCR30-2 devices.

Purpose of the document

The purpose of the operating instructions is to familiarise employees from the following target groups

- Project planning
- Assembly
- Installation
- Commissioning
- Maintenance

with the device.

The operating instructions must always be kept at hand and in a legible condition near to the device.
Storage of the operating instructions in the control cabinet is not allowed.

It must be ensured that all people working with the device read the instructions completely.

Warranty and liability:

Our 'General Terms and Conditions of Sales and Delivery' apply as a matter of principle. These have been available to the user at the latest since the conclusion of the contract. Warranty and liability claims in the case of personal injuries and material damages are excluded if they are due to one or more of the following causes:

- use of the device other than for its intended purpose
- improper assembly, commissioning, operation or maintenance of the device
- failure to adhere to the instructions in the operating manual
- unauthorised structural changes to the device
- inadequate monitoring of the devices that are subject to wear
- repairs not carried out properly
- catastrophes due to the influence of foreign bodies and force majeure.

2. Safety instructions

2.1 Use of the current rectifier

The current rectifier is intended for installation in a stationary control cabinet; in particular, its use is prohibited in potentially explosive atmospheres or in environments containing aggressive media (oils, acids, solvents).

The framework conditions such as protection class, connection requirements and other technical data can be taken from the section entitled "Technical Data".

Work may be carried out on this device only by qualified electricians, taking into account these operating instructions.
Applicable standards such as DIN VDE 0100, DIN VDE 0110, IEC 664, IEC 364 and CENELEC HD 384 and the respective national accident prevention regulations must be observed.

It must be ensured that no damaged devices are installed or put into operation.

The current rectifier may be used only for supplying magnetic systems with a direct current.
The electrical load at the output must have a inductivity >130mH.
Liability claims for defects and liability claims for material defects are excluded for other cases of use.

The current rectifier may not be used for safety functions!

2.2 Warning notes

The notes are structured as follows:

2.2.1 Danger

Danger

Direct danger that can lead to death or serious injuries.

Example: deadly danger due to live parts when opening the device

2.2.2 Warning

Warning

Possible danger that can lead to slight to serious injuries.

Example: deadly danger due to live parts if the device is damaged

2.2.3 Caution

Caution

Possible situation that can lead to damage to the device

Example: incorrect connection of analog signals

2.2.4 Note

Note

Useful note

Example: set the DIP switch of the device before installation because the housing cover has to be opened to do this.

2.3 Operation

The supply voltage may be applied only if the housing is closed.

Danger

Deadly danger due to live parts

Work on the wiring may be carried out only if the supply voltage is switched off.

The following procedure must be complied with if the front panel is removed:

- Switch off the supply voltages
- Remove the terminal strip X2
- Disconnect the wires to the terminal strip X1

The output voltage of the current rectifier is not isolated from the mains voltage. A high potential to earth is possible even at a low output voltage.

Since the state of the LEDs is no indication of freedom from voltage, the freedom from voltage must be checked at the power terminals.

Warning

Risk of being burnt by hot surface

The temperature of the device housing can reach more than 60 degrees.

3. Project planning

3.1 Description of the device

The NHCR current rectifiers are intended for the activation of magnetic systems.

The compact "booksize" format allows a high packing density in the control cabinet. EMC problems are greatly reduced by the analogue circuit design.

The power section consists of a rectifier bridge with downstream IGBT and a freewheeling diode. Together with a filter, this prevents switch-off voltage peaks through the magnetic systems.

The control part is protected by an internal fine-wire slow-blow fuse rated at 500 mA.

The NHCR30 device is additionally equipped with an external fan and a heat sink temperature monitor.

Due to the IP20 protection class, the devices should be installed in a closed control cabinet. The ambient air must be free from electrically conductive dust particles and chemically aggressive vapours. Vibrations can destroy the device.
It is for use in Pollution Degree 2 Enviroment only.

3.2 Design of the current rectifier

The current rectifier is designed for a supply voltage of 210 to 530 V AC. The device can be operated with a frequency of 50 or 60 Hz (set by DIP switch)

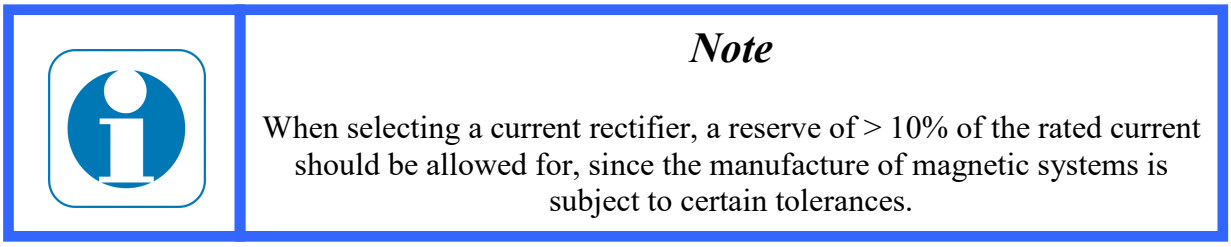
The magnetic systems to be activated are connected in parallel.
Make sure that the rated DC voltages of the magnetic systems are the same.

Example:

Magnetic system 1: 120 V DC; 1 A DC; 120 Ohm
Magnetic system 2: 120 V DC; 2 A DC; 60 Ohm
Magnetic system 3: 180 V DC; 1 A DC; 180 Ohm

Magnetic systems 1 and 2 can be connected together to one current rectifier; magnetic system 3 must be activated by its own current rectifier.

The current rectifier must be able to supply a current that is higher than the sum of the rated currents of the connected magnetic systems.



In addition, it must be taken into account that the DC voltage at the output cannot be higher than the supply voltage.

Caution

Overheating of the magnetic systems leads to damage to the systems.

Also, the temperature contacts of the magnetic systems must be evaluated. The current rectifier must be switched off if the temperature monitoring of the magnetic systems is triggered.

If a connected magnetic system fails, it must be disconnected and the current of the current rectifier must be adjusted.

If fuses are to be used between the current rectifier and the magnetic system, they must meet the following requirements:

- the fuse must be designed for a DC voltage equal to the supply voltage
- it must be ensured that the current rectifier is switched off if a fuse blows

Warning

Possible danger due to voltage peaks during switching operations

If contactors are to be used between the current rectifier and the magnetic system for selecting the magnetic systems to be switched, they must meet the following requirements:

- the contactors must be able to switch a DC voltage equal to the supply voltage of the current rectifier; the rated current is determined by the upstream fuse
- the contactors may only be switched when the current rectifier is disabled

3.3 Connection of the current rectifier to the mains supply

The current rectifier is connected to the mains by two phases.
The current rectifier must be protected by ultra-fast semiconductor fuses with full-range protection (operating class gR).

Current rectifiers	**Input current**	**Output current**	**Semiconductor fuse ultra-fast**	**Recommended connection cross-section**	**Power dissipation**
NHCR10-2	8A AC	10 A DC	15 A	1.5 mm² AWG 15	40 W
NHCR30-2	24A AC	30 A DC	32 A	6 mm² AWG 9	100 W

Example of semiconductor fuses:

Fuse holder: Siemens Sitor 14 x 51; 600 V AC, up to 50 A, 2-p. Order no. 3NC1 492

For NHCR10-2:
Fuse cartridge Siemens Sitor 14 x 51 10 A Order no. 3NC1410-0MK

For NHCR30-2:
Fuse cartridge Siemens Sitor 14 x 51 32 A Order no. 3NC1432-0MK

According to the respective regional regulations, a circuit breaker must additionally be provided upstream of the semiconductor fuses
(circuit breaker, motor protection switch, etc.).

3.3.1 Special features USA

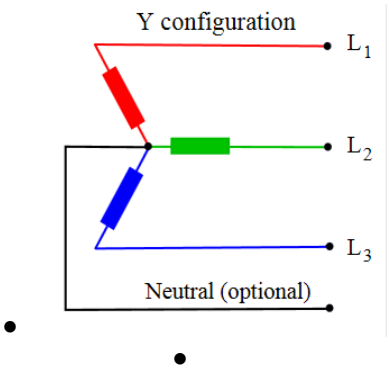
According to the respective regional regulations, a circuit breaker must additionally be provided upstream of the semiconductor fuses (brench circuit protection)
(circuit breaker, motor protection switch, etc.).

Example of ClassCC fuses USA:

Fuse holder :	Siemens	Class CC ; 600VAC,30A	Order no.: 3NW7523-0HG
For NHCR10-2:			
Fuse catridge:	Siemens	Class CC 12A	Order no.: 3NW3120-0HG
For NHCR30-2:			
S-einsatz	Siemens	ClassCC 30 A	Order no.: 3NW3300-0HG

3.3.2 Special features CSA

According to the respective regional regulations, a surge-protection device must additionally be provided upstream of the semiconductor fuses ; rated for phase-to-ground (WYE) , sytem voltage not above 300V (Overvoltage Category III); max. Voltage peak 4kV.



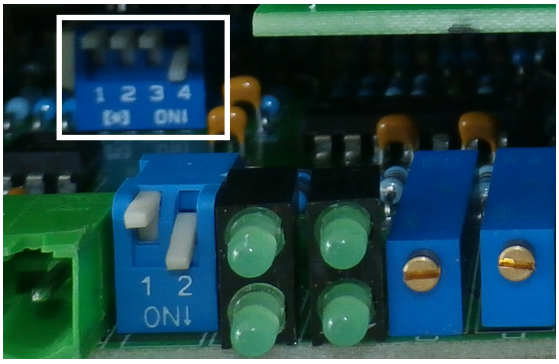
3.4 Connection of power circuit X1

The configuration of terminal X1 for the power connections is as follows:

Terminal strip	Terminal number	Label	Meaning
X 1	1	L 1	Supply AC phase 1
X 1	2	L 2	Supply AC phase 2
X 1	3	DC+	1st output DC positive
X 1	4	DC+	2nd output DC positive
X 1	5	DC+	3rd output DC positive
X 1	6	DC+	4th output DC positive
X 1	7	DC-	1st output DC negative
X 1	8	DC-	2nd output DC negative
X 1	9	DC-	3rd output DC negative
X 1	10	DC-	4th output DC negative

Terminals 3, 4, 5 and 6 are connected to each other.
Terminals 7, 8, 9 and 10 are connected to each other.

The frequency of the supply voltage is set on a switch block with four DIP switches. The switch block is accessible after removing the front panel.

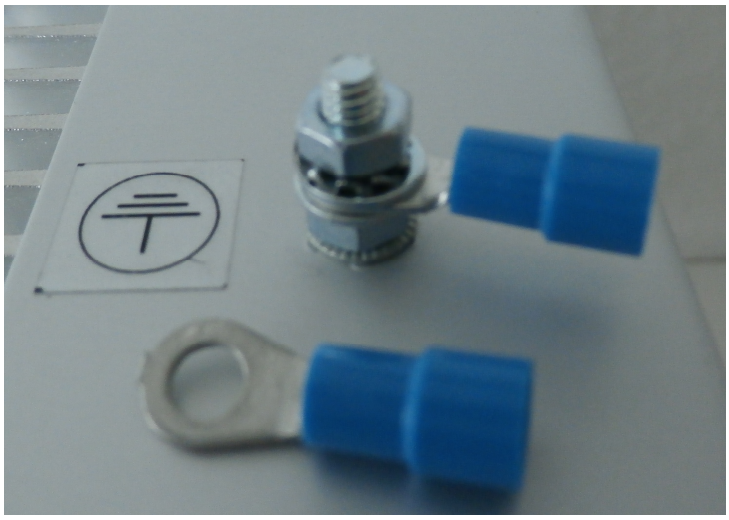


The picture shows the factory settings

DIP switches 1, 2 and 3 must always be set to "Off".

Supply voltage 50 Hz: DIP switch 4 "ON"
Supply voltage 60 Hz: DIP switch 2: "OFF"

The earth is connected via an M4 threaded bolt on the underside of the appliance.
The earth wire must be designed for the maximum earth leakage current of the voltage source, which is limited by the upstream fuses.



Example:
Solderless terminals 1,5-2,5mm² Klauke A-Nr.6304
Solderless terminals 4,5-6mm² Klauke A-Nr.6504

Terminal strip X1 consists of push-in spring-loaded terminals.

The following wire cross-sections are possible:

Type of conductor	Minimum cross-section	Maximum cross-section	NHCR10-2	NHCR30-2
rigid	0.2 mm²	10 mm²	1,5mm²-6mm²	6mm²
flexible	0.2 mm²	6 mm²	1,5mm²-6mm²	6mm²
flexible with wire end ferrule without plastic sleeve	0.2 mm²	6 mm²		
flexible with wire end ferrule with plastic sleeve	0.2 mm²	4 mm²		
2 conductors with same cross-section with TWIN-AEH with plastic sleeve	0.25mm²	1.5mm²		
Conductor cross-section AWG	24	8	16-8	10-8

Only cooper conductors for a temperature > 75 degrees ; stripping length 15 mm

Core colour according to EN 60204 for main power AC/DC: black

3.5 Connection of control circuit X2

The configuration of terminal strip X2 for the control connections is as follows:

Terminal strip	Terminal number	Label	Meaning
X 2	1	24 V DC	Control circuit supply 24 V DC
X 2	2	24 V DC	Control circuit supply 24 V DC
X 2	3	0 V DC	Control circuit supply 0 V DC
X 2	4	0 V DC	Control circuit supply 0 V DC
X 2	5	ready	DO ready signal
X 2	6	I > 0	DO output current > 0
X 2	7	run	DI enablement of the current rectifier
X 2	8	run	DI enablement of the current rectifier
X 2	9	intern 1	DI internal setpoint value 1
X 2	10	intern 2	DI internal setpoint value 2
X 2	11	ext analog	AI analog setpoint value
X 2	12	ext 0 VDC	Reference potential analog value X2:11
X 2	13	temp.o.k.	DO static converter temperature o.k.

DI: digital input of the current rectifier 24 V DC ref. X2:3 current consumption 5 mA
DO: digital output of the current rectifier 24 V DC ref. X2:3 max 30 mA load capacity
AI: analog input of the current rectifier

Terminal strip X2 consists of screw terminals

The following wire cross-sections are possible:

Type of conductor	minimum cross-section	maximum cross section
rigid	0.2 mm²	4 mm²
flexible	0.2 mm²	2.5 mm²
flexible with wire end ferrule	0.25 mm²	2.5 mm²
Conductor cross-section AWG	24	10
Tightening torque	0.6 Nm	0.6 Nm

Only cooper conductors for a temperature > 75 degrees ; stripping length 7 mm

Core colour according to EN 60204 for DC control current: dark blue
Recommended core colour for X2:11/12: white

Explanation of Terminal X2:1-4 "24 V DC control circuit supply"

The external supply voltage for the control circuit is connected here.

Power consumption, NHCR10: approx. 150 mA
Power consumption, NHCR30: approx. 300 mA
maximum pre-fuse 4 A

Explanation of Terminal X2:5: "ready" and "ready" LED

The output is on when
- the power supply is present
- the electronics supply is present
- the internal electronic voltages are present
- the heat sink temperature is lower than 70 degrees.

Explanation of Terminal X2:6: "I>0"

The output is on when the output current reaches the setpoint value.

Explanation of Terminal X2:7 and X2:8 "run"

The current rectifier is enabled with this input; i.e. the output current is switched with this input.
The current setpoint values must be present beforehand.

Explanation of Terminal X2:9 and X2:10: "internal setpoint values"

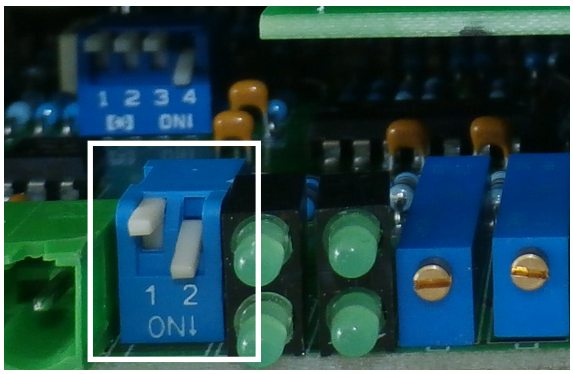
If the digital input "Internal setpoint value 1" is present, then the current set by potentiometer "int.1" is output.
The procedure is the same for setpoint 2.

If both inputs for the internal setpoint values are present, then the adjusted currents add up; it must be ensured that the sum of the currents does not exceed the rated device current.
If the internal setpoint values are used, there must be no signal present at the "analog setpoint value" Terminal X2:11.

Explanation of Terminal X2:11: "analog setpoint value"

Voltage setpoint value: 0 -10 V : Input impedance 100 KOhm
Current setpoint value 0 - 20mA: Input impedance 100 Ohm

The switchover is set on a switch block with two DIP switches. The switch block is accessible after removing the front panel.



The picture shows the factory settings

Voltage setpoint value 0 - 10 V:	DIP switch 1: off	DIP switch 2: on
Current setpoint value 0-20 mA:	DIP switch 1: on	DIP switch 2: off

The reference potential 0 V DC for analog inputs must be applied to Terminal X2:12.

If the analog setpoint value is used, there must be no connection to Terminals X2:9 and X2:10 for the internal setpoint values.

Explanation of Terminal X2:13: "temp. o.k."

The output is on if the heat sink temperature is lower than 70 degrees.
If this output drops, the device switches off after approx. 2 minutes (not ready).
If the temperature is within the permissible range again, the output switches on again without a reset.

Note

Loop-through of signals when using several current rectifiers

Terminals 1/2; 3/4 and 7/8 are connected to each other, so that the supply voltage and the enable signal for the current rectifier can be looped through.

3.6 Potentiometers

The two potentiometers have the following meaning:

Potentiometer	Meaning
intern 1	Setting of the internal setpoint value 1
intern 2	Setting of the internal setpoint value 2

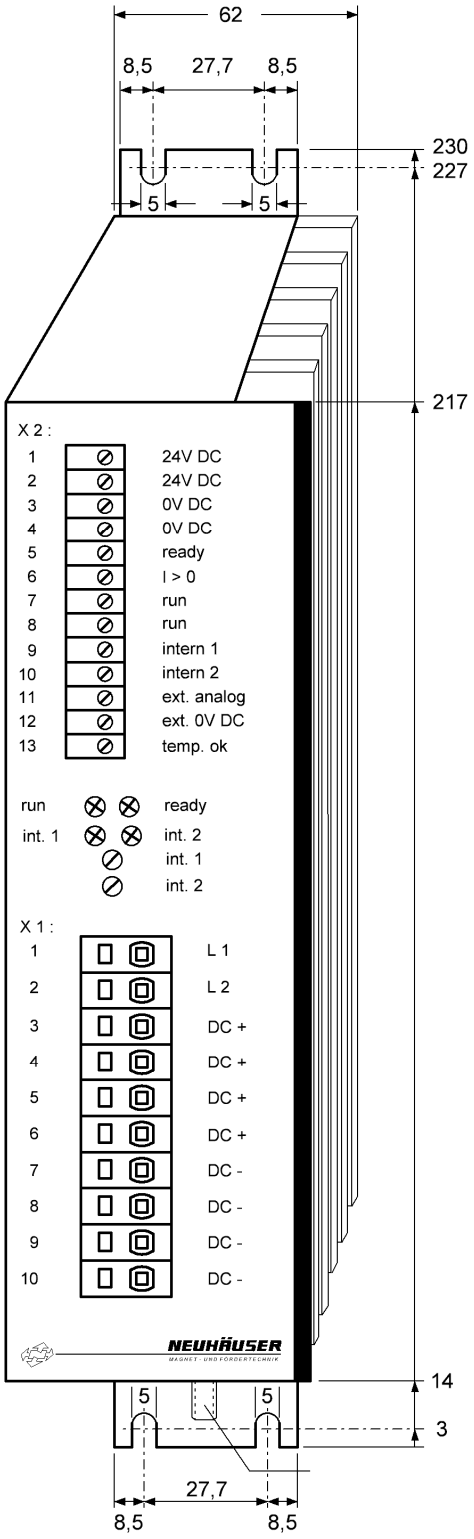
The potentiometers are 19-turn spindle trimmers. They can set the current from 0 to the rated current of the device (clockwise stop).

3.7 Display LEDs

The display LEDs have the following meaning

LED	Meaning
ready	Ready signal of the current rectifier
run	Current rectifier enabled; the output current is on
intern 1	Internal setpoint value 1 activated
intern 2	Internal setpoint value 2 activated

4. Mechanical installation



Device depth 230 mm

The static converter is secured with four screws directly on the mounting plate.

Warning

Overheating of the current rectifier

To ensure unhindered ventilation of the current rectifier, the following must be complied with:

- the current rectifier may be installed in a vertical position only
- a distance of > 100 mm is to be maintained to other structures above and below.

2The maintenance of a lateral distance to neighbouring current rectifiers doesn't make sense. The devices should be placed side by side like books. This improves the airflow through the heat sink.

Note

It is a good idea to set the DIP switches before installation since the front panel has to be removed for this

The dimensions apply to all device types; the NHCR30 current rectifier has an additional fan on the underside.

5. Electrical installation

Danger

Risk of electric shock.

Work may only be carried out on the device after it has been switched off.

The safety instructions in section 2 are to be observed without fail

Warning

Incorrect connections will lead to damage to the device

5.1 Installation of main circuit terminal strip X1

Terminal strip X1 consists of push-in spring-loaded terminals.

The following wire cross-sections are possible:

Type of conductor	minimum cross-section	maximum cross section
rigid	0.2 mm²	10 mm²
flexible	0.2 mm²	6 mm²
flexible with wire end ferrule without plastic sleeve	0.2 mm²	6 mm²
flexible with wire end ferrule with plastic sleeve	0.2 mm²	4 mm²
2 conductors with same cross-section with TWIN-AEH with plastic sleeve	0.25 mm²	1.5 mm²
Conductor cross-section AWG	24	8

The wiring with flexible wires with wire end ferrules is recommended

Stripping length 15 mm

Core colour according to EN 60204 for main power AC/DC: black

5.2 Installation of control circuit terminal strip X2

Terminal strip X2 consists of screw terminals

The following wire cross-sections are possible:

Type of conductor	minimum cross-section	maximum cross section
rigid	0.2 mm²	4 mm²
flexible	0.2 mm²	2.5 mm²
flexible with wire end ferrule	0.25 mm²	2.5 mm²
Conductor cross-section AWG	24	10
Tightening torque	0.6 Nm	0.6 Nm

The wiring with flexible wires with wire end ferrules is recommended

Stripping length 7 mm

Core colour according to EN 60204 for DC control current: dark blue
Recommended core colour for X2:11/12: white

Caution

Malfunction of the current rectifier due to cable interference

All wires to the terminal strip X2 should be screened. The screen should have a large area and must be connected to the protective earth wire and the controller ground.
The screen for the analog signals (Terminal X2:11/12) is earthed at one end only.

The cables must not be laid parallel to the main power line.

Note

Terminal strip X2 is pluggable to facilitate wiring.

6. Commissioning

Commissioning may be carried out only by technical personnel, taking into account these operating instructions.
In particular, your attention is drawn to the safety instructions in section 2.

The following points must be checked first of all:

- correct setting of the frequency of the supply voltage
  Dip switch block with 4 switches – see section 3.4

- correct setting of the setpoint value
  Dip switch block with 2 switches – see section 3.5

Caution

Incorrect setting of the DIP switches can lead to damage to the device

- is the supply voltage within the specified range (see technical data)?
- is the control circuit supply within the specified range (see technical data)?
- when using the external setpoint value, check whether the project-planned setpoint value is present at terminals X2:11/12
- when using the internal setpoint values, the potentiometers must be turned to the anticlockwise stop
- are the project-planned magnetic systems connected and are the temperature contacts of the magnetic system correctly evaluated?

6.1 Use of the external setpoint value

After applying the supply voltage and enabling the current rectifier, the output current must be checked.

If no current clamp for DC is available, the DC voltage at the output terminals can be measured instead; in this case, however, the voltage loss due to the cable has to be taken into account. It should also be noted that the resistance of the magnetic system in the heated state can be up to 30% higher than in the normal state.

6.2 Use of the internal setpoint values

After applying the supply voltage and enabling the current rectifier, the output current must be adjusted.

To do this the output current is checked and the current gradually increased by turning the respective potentiometer.

7. Diagnosis

7.1 Diagnostic LEDs

LED ready	LED run	LED int.1	LED int.2	
off	x	x	x	Device not ready: - Check the supply voltage (X1;1 /X1:2) - Check the control voltage (X2;1 /X2:3) - is terminal strip X2 plugged in correctly? - Allow the device to cool down to below 50 °C - check internal fuse
on	x	x	x	Device is ready
on	x	on	off	Internal setpoint value 1 selected
on	x	off	on	Internal setpoint value 2 selected
on	x	on	on	Sum of internal setpoint value 1 + internal setpoint value 2 selected
on	on	x	x	Device is ready and in run mode. Preselected output current is present

7.2 Diagnosis of digital outputs

X2:5 ready	X2:6 I>0	X2:13 temp.ok.	
low	x	high	Device not ready: - Check the supply voltage (X1;1 /X1:2) - check internal fuse
low	x	low	Device not ready: - Check the supply voltage (X1;1 /X1:2) - Check the control voltage (X2;1 /X2:3) - is terminal strip X2 plugged in correctly? - Allow the device to cool down to below 50 °C - check internal fuse
high	x	low	Device not ready because the temperature monitoring has tripped - Allow the device to cool down to below 50 °C - check internal fuse
high	low	high	No output current flows; - the setpoint value must be checked - the connected magnetic system must be checked

If the fan in the NHCR30 device is not running, check the internal fuse and that control voltage is present.

8. Maintenance, storage and disposal

Maintenance

The current rectifier must be checked regularly to ascertain whether it is damaged.
(Visual inspection every 2 months)

All cables must be checked for tightness after transporting or moving the control cabinet in which the current rectifier is installed.

The fan attached to the NHCR30-2 current rectifier must be replaced at the latest after 60,000 hours.

Storage

The technical data must be observed when storing the current rectifier.

Disposal

If the device is to be disposed of, then the front panel, the heat sink and the cover of the housing of the electronic boards are to be separated and disposed of as scrap metal.

The electronic boards with the plug connectors are to be disposed of as electrical scrap.

9. Contacts at the manufacturer

Manufacturer

Neuhäuser Magnet- und Fördertechnik
Scharnhorstrasse 11-16
44532 Luenen
Germany
www.neuhaeuser.com

Sales contact

Mr Kalpein
Phone: 02036 949 130
Email: kalpein@neuhaeuser.com

Technical contact

Mr Lakenbrink
Phone: 02036 949 115
Email: lakenbrink@neuhaeuser.com

Mr Zuncke
Phone: 02036 949 216
Email: zuncke@neuhaeuser.com

10. Technical data

Environmental conditions

	NHCR10-2	NHCR30-2
Ambient temperature - storage	-10 °C to 60 °C	-10 °C to 60 °C
Ambient temperature - operation	0 °C to 40 °C	0 °C to 40 °C
Relative humidity (condensation not permitted)	95 %	95 %
Maximum installation altitude, rated operation	1000 m	1000 m
Derating above 1000 m up to 2000 m	1% / 100 m	1% / 100 m
Protection class	IP 20	IP 20

Dimensions and weight

	NHCR10-2	NHCR30-2
Device width	63 mm	63 mm
Device height	230 mm	230 mm
Device depth	230 mm	230 mm
Weight	1.9 kg	1,9 kg

Power unit – rated values

	NHCR10-2	NHCR30-2
Pre-fuse, input circuit	15 A ultra-fast (semiconductor protection)	32 A ultra-fast (semiconductor protection)
AC input voltage	210 V to 530 V	210 V to 530 V
Input frequency	50 Hz or 60 Hz	50 Hz or 60 Hz
AC input current	10 A	24 A
DC output voltage	<input voltage; max.400VDC	< input voltage; max.400VDC
DC output current	10 A	30 A
Duty cycle in relation to one second	100 %	70 %
Connectable conductor cross-section (see section 3.4)	6 mm² / AWG 8	6 mm² / AWG 8
Power dissipation	40 W	100 W

Control unit – rated values

	NHCR10-2	NHCR30-2
DC input voltage	24 V DC (±10%)	24 V DC (±10%)
DC input current	approx. 150 mA	approx. 300 mA
Control circuit pre-fuse	max. 4 A	max. 4 A
Conductor cross section (see section 3.5)	max. 2.5 mm² / AWG 10 min. 0.25 mm² / AWG 24	max. 2.5 mm² / AWG 10 min. 0.25 mm² / AWG 24
Load capacity of the digital outputs	max. 30 mA	max. 30 mA
Current consumption of the digital inputs	5 mA	5 mA
Internal fine-wire fuses F1 and F2	500 mA slow-blow; 5x20 mm	500 mA slow-blow; 5x20 mm

Current rectifier NHCR30-2 - fan

Rated voltage range	24 V DC (±10%)
Power consumption	2.9 W
Speed of rotation	6850 rpm
Volumetric flow rate	56 m³/h
Ambient temperature - operation	-20 °C to 70 °C
Lifetime L10 at 40 °C	60,000 hours
Dimensions	60 x 60 x 25 mm
Manufacturer / type	ebm-pabst / 614 NHH

Appendix 1 Modification GEI3 to NHCR

Current rectifier GEI3					Current rectifier NHCR			
Terminal strip	**Terminal number**	**Label**	**Meaning**		**Terminal strip**	**Terminal number**	**Label**	**Meaning**
X 1	1	+	Output DC positive	->	X 1	3 - 6	DC+	Output DC positive
X 1	2	-	Output DC negative	->	X 1	7-10	DC-	Output DC negative
X 1	3	L1	Supply AC phase 1	->	X 1	1	L 1	Supply AC phase 1
X 1	4	L2	Supply AC phase 2	->	X 1	2	L 2	Supply AC phase 2
X 1	5	L	Supply Electronic 230 VAC					-
X 1	6	N	Supply Electronic 0 VAC					-

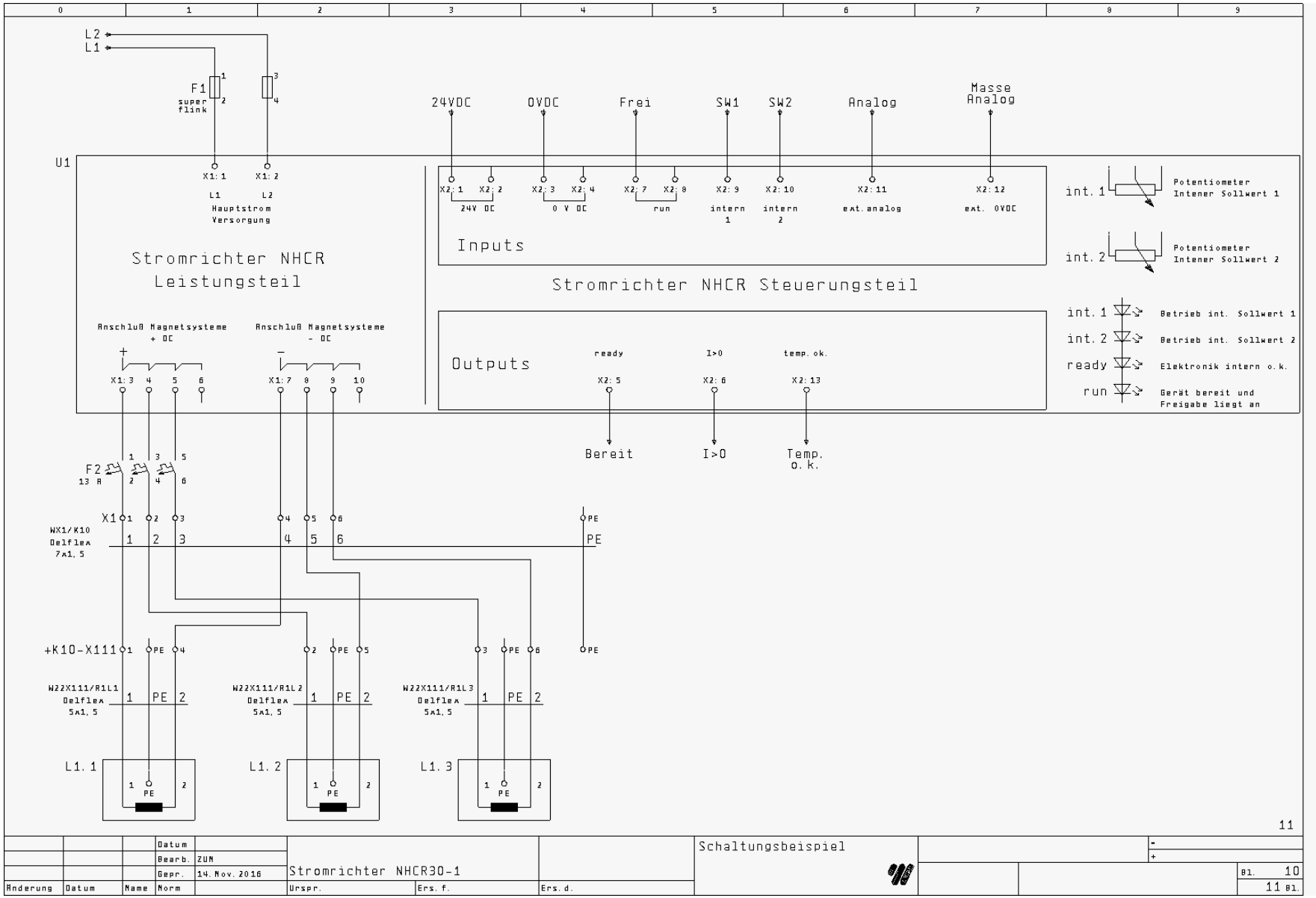
Current rectifier GEI3					Current rectifier NHCR			
Terminal strip	**Terminal number**	**Label**	**Meaning**		**Terminal strip**	**Terminal number**	**Label**	**Meaning**
X 2	1	+24V	Aux. voltage 24VDC					-
X 2	2	+15V	Aux. voltage 15VDC					-
X 2	3	0 V	Aux. voltage 0VDC					-
X 2	4	-15V	Aux. voltage -15VDC					-
X 2	5	In=10V	Output actual value					-
X 2	6	Bereit	DO ready signal	->	X 2	5	ready	DO ready signal
X 2	7	Freigabe	DI enablement	->	X 2	7-8	run	DI enablementr
X 3	1	SW 1	DI internal setpoint 1	->	X 2	9	intern 1	DI internal setpoint value 1
X 3	2	SW 2	DI internal setpoint 2	->	X 2	10	intern 2	DI internal setpoint value 2
X 3	3	0 V	OV DC	->	X 2	3-4	0V DC	Supply 24 V DC
X 3	4	SW ext.	AI analog setpoint value 0 -10V	->	X 2	11	ext.analog	AI analog setpoint value 0-10V / 0-20mA
X 3	5	I>0	DO output current > 0	->	X 2	6	I>0	DO output current > 0
					X 2	1-2	24V DC	Supply 24 V DC
					X 2	12	ext.0V DC	Reference potential analog value X2:11
					X 2	13	temp.ok	DO static converter temperature o.k.

Appendix 2 Modification GEI4 to NHCR

Current rectifier GEI4					Current rectifier NHCR			
Terminal strip	**Terminal number**	**Label**	**Meaning**		**Terminal strip**	**Terminal number**	**Label**	**Meaning**
X 1	1	L 1	Supply AC phase 1	->	X 1	1	L 1	Supply AC phase 1
X 1	2	L 2	Supply AC phase 2	->	X 1	2	L 2	Supply AC phase 2
X 1	3-6	DC+	Output DC positive	->	X 1	3-6	DC+	Output DC positive
X 1	7-10	DC-	Output DC negative	->	X 1	7-10	DC-	Output DC negative

Current rectifier GEI4					Current rectifier NHCR			
Terminal strip	**Terminal number**	**Label**	**Meaning**		**Terminal strip**	**Terminal number**	**Label**	**Meaning**
X 2	1-2	+24 V	Control circuit supply 24 V DC	->	X 2	1-2	24 V DC	Control circuit supply 24 V DC
X 2	3-4	0 V	Control circuit supply 0 V DC	->	X 2	3-4	0 V DC	Control circuit supply 0 V DC
X 2	5	Bereit	DO ready signal	->	X 2	5	ready	DO ready signal
X 2	6	I >	DO output current > 0	->	X 2	6	I > 0	DO output current > 0
X 2	7-8	Freigabe	DI enablement of the current rectifier	->	X 2	7-8	run	DI enablement of the current rectifier
X 2	9	SW 1	DI internal setpoint value 1	->	X 2	9	intern 1	DI internal setpoint value 1
X 2	10	SW 2	DI internal setpoint value 2	->	X 2	10	intern 2	DI internal setpoint value 2
X 2	11	SW ext.	AI analog setpoint value	->	X 2	11	ext analog	AI analog setpoint value
X 2	12	0 V	Reference potential analog value X2:11	->	X 2	12	ext 0 VDC	Reference potential analog value X2:11
X 2	13	In=10V	DO static converter temperature o.k.		X 2	13	temp.o.k.	DO static converter temperature o.k.

Appendix 3 Sample circuit diagram, German



Appendix 4 Sample circuit diagram, English