

Product manual

Harmonic Filter RHF-Active

Nominal Current

15A, 35A, 55A, 100A

Nominal Voltage

380V – 480V (50Hz / 60Hz)



Marine



Oil & Gas



Water
Treatment



General
Industry



Data Center

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1. Important Information

1. Important Information

1.1 About the manual

These present operating instructions are the translation of the original instructions, which were composed in the official EU language German.

These operating instructions shall ensure safe operation of and with the filter module REVCON RHF-active. They contain security advices which must be observed and information which is necessary for an undisturbed operation of the units and for the exploitation of all advantages of the system.

All persons who work on and with the filter module REVCON RHF-Active must have accessible the operating instructions, or the equal chapters of the operating instructions for other with this option equipped REVCON products available. All persons must follow the relevant notes and designations.

The operating instructions must be complete and perfectly legible. Please read this manual carefully and follow all safety precautions before moving, installing, operating and servicing the RHF-Active Filter, if ignored, physical injury or death may occur, or damage may occur to the devices.

1.2 Terms and definitions

Filter module

For „Filter module REVCON RHF-Active“ the term „Filter module“ will be used.

Drive controller

For the frequency inverter which is used together with the power feedback unit in the following the term „Controller“ is used

Drive system

For a drive system with harmonic filter, power feedback units, controller and other components of the drive system in the following the term „Drive system“ is used.

1. Important Information

1.3 Type code

The type code is part of the name plate and contains important information about the active harmonic filter.

RHF –Active 100 – 400 – 50/60 – 20 – A

①	②	③	④	⑤	⑥	⑦
Code	Nr.		detaillied designation		Detailed signification	
Short form	①		Product designation		RHF:	Revcon Harmonic Filter
Product type	②		Product type		Active:	Active Harmonic Filter
Nominal current	③		Nominal current		100:	100Ampere
Voltage class	④		Voltage class		400:	400V
Mains frequency	⑤		Mains frequency		50/60:	50Hz and 60Hz
IP	⑥		IP degree of protection		20:	IP20
Version	⑦		-			-

1.4 Name plate



Serien-Nr. / Serial no.	191500224
Artikel-Nr. / Article no.	35000007
Typ / Type	RHF-Active 100-400-50/60-20-A
Spannung / Voltage	3 x 400 V AC / 50/60Hz
Optionen / Options	-
I RMS / MAX	100 A / 100 A
Gewicht / Weight	42 kg
Umgebungstemp. / Ambient Temp.	Max 40°C
Schutzart / Protection	IP 20
ELTROPLAN-REVCON GmbH	Made in Germany



1. Important Information

1.5 Legal regulations

Marking	Name plate	CE-marking	Manufacturer/Seller
	Filter modules REVCON® RHF-Active are clearly marked by the content of the nameplate	Conformable to EG directive "low-voltage"	ELTROPLAN-REVCON Edisonstraße 3 D-59199 Bönen
Intended use	<p>Filter module REVCON® RHF-Active</p> <ul style="list-style-type: none"> • only to use under the terms of this operating instructions and the required operational conditions • are components <ul style="list-style-type: none"> – to reduce the harmonic distortions of the electrical network by specific B6 rectifiers and inverters – to fit in a machine – to assembly with other components to a machine together • are electric equipment to assembly in a electrical enclosure or similar • locked up operations rooms • conform to the protection requirements of the EG directive "low-voltage " • are no machines in terms of the EG directive "machines" • are no household appliances, but components which are determined only for the further application in commercial use <p>Drive system with filter module REVCON® RHF-Active</p> <ul style="list-style-type: none"> • conform to the EG directive "Electromagnetic Compatibility", if they are installed by the specifications of the CE-typical drive control system • are applicable <ul style="list-style-type: none"> – in the public electrical network and closed electrical networks. – in the industrial sector and in living areas as well as in business units. <p>The responsibility for the compliancy of the EG directive with the machine application is one for the user.</p>		
Liability	<ul style="list-style-type: none"> • The indicated information, technical data and notes in this operating instruction were updated at the time of the printing. No demands for changing a delivered filter module can be asserted by the information, figures and descriptions of these operating instructions. • The represented process engineering notes in this operating instructions and circuit details are suggestions, which transferability on the respective application must be verified. For the suitability of the specified procedures and circuit suggestions accepts the ELTROPLAN-REVCON GmbH no guarantee. • The data in these operating instructions describe the characteristic of the products without ensuring them. • No Liability will be taken over for damages and malfunctions which result by: <ul style="list-style-type: none"> – disregard of the operating instructions – arbitrary changes on the filter module – operating errors – improper works on and with the inverter 		
Warranty	<ul style="list-style-type: none"> • Warranty conditions: Refer to the sales - and delivery conditions of the ELTROPLAN-REVCON GmbH. • Immediately announce guarantee claims after the discovery of defects or faults • The warranty expires in all cases, in which even no liability claims can be asserted. 		
Disposal	Material	Recycling	Disposal
	Metal	●	-
	Plastic	●	-
	PCB		●

2. Safety precautions

2.1 What this chapter contains

Please read this manual carefully and follow all safety precautions before moving, installing, operating and servicing the RHF-Active Filter, if ignored, physical injury or death may occur, or damage may occur to the devices.

If any physical injury, death, or damage to the devices occurs for ignoring to the safety precautions in the manual, our company will not be responsible for any damages and we are not legally bound in any manner.

2. Safety precautions

2.2 Safety definitions and warning symbols

All Safety definitions have a uniform layout:







- The pictogram shows the kind of danger
- The signal word characterizes the severeness of danger
- The note describes the danger and suggest how to avoid the danger.



Signal Word **Mot de signal**

Note

Noter

	Used Pictogram	Instruction	
Warning of personal injury Avertissement de blessure corporelle		Imminent danger by electricity <i>Danger imminent par l'électricité</i>	Danger! Danger! Warns of an immediate imminent danger. In case of disrespect, death or severe injury may happen. <i>Avertit d'un danger imminent immédiat. En cas de manque de respect, la mort ou des blessures graves peuvent survenir.</i>
		Warning of an imminent danger <i>Avertissement d'un danger imminent</i>	Warning Avertissement Warns of a possible, very dangerous situation. In case of disrespect, death or severe injury may happen. <i>Avertit d'une situation possible et très dangereuse. En cas de manque de respect, la mort ou des blessures graves peuvent survenir.</i>
		Dangerous Situation <i>Situation dangereuse</i>	Caution! Mise en garde! Warns of a possible, dangerous situation. In case of disrespect, minor injury may happen. <i>Avertit d'une situation possible et dangereuse. En cas de manque de respect, des blessures mineures peuvent survenir.</i>
		Warning of hot surface <i>Avertissement de surface chaude</i>	Warning! Avertissement Warns of touching of a hot surface. In case of disrespect, burnings may happen <i>Avertit de toucher une surface chaude. En cas de manque de respect, des brûlures peuvent survenir</i>
Warning of property damages Avertissement de dommages matériels		Harmful Situation <i>Situation préjudiciable</i>	Stop! Arrêter Warns of possible property damage. In case of disrespect, the system and it's environment may be damaged <i>Met en garde contre d'éventuels dommages matériels. En cas de non-respect, le système et son environnement peuvent être endommagés</i>
Useful information and hints for using Informations utiles et conseils d'utilisation		Information <i>Information</i>	Note! Noter! Marks a general, useful hint. If it is observed, usage of the system will be easier <i>Marque une indication générale et utile. S'il est observé, l'utilisation du système sera plus facile</i>



Safety and application notes for drive systems

(following Low Voltage Directive 2006/95/EG)

1. General

During operation, filter modules may have, according to their type of protection, live, bare, in some cases also movable or rotating parts as well as hot surfaces.

Non-authorized removal of required cover, inappropriate use, incorrect installation or operation, creates the risk of severe injury to persons or damage to material assets.

Further information can be obtained from the documentation.

All operations concerning transport, installation and commissioning as well as maintenance must be carried out by qualified, skilled personnel (IEC 364 and CENELEC HD 384 or DIN VDE 0100 and IEC-Report 664 or DIN VDE 0110 and national regulations for the preventions of accidents must be observed).

According to this basic safety information qualified skilled personnel are persons who are familiar with the erection, assembly, commissioning and operation of the product and who have the qualifications necessary for their occupation.

2. Application as directed

Filter modules are components which are designed for installation in electrical systems or machinery.

When installing in machines, commissioning of the filter module (i.e. the starting of operation as directed) is prohibited until it is proven, that the machine corresponds to the regulations of the EC Directive (2006/42/EG) (Machinery Directive); EN 60204 must be observed.

Commissioning (i.e. starting operation as directed) is only allowed when there is compliance with the EMC-Directive (2004/108/EG).

The filter modules meet the requirements of the Low-Voltage Directive (2006/95/EEC). The harmonized standards of the prEN 50178/DIN VDE 0160 series together with EN 60439-1/DIN VDE 0660 part 500 and EN 60146/DIN VDE 0558 are applicable for the power feedback unit. The technical data and information on the connection conditions must be obtained from the nameplate and the documentation and must be observed in all cases.

3. Transport, storage

Notes on transport, storage and appropriate handling must be observed. At non-observance any warranty expires. The filter module unit has to be protected from inadmissible stress. The transport is only valid in original packaging and in the thereon by pictograms marked transport position. In particular during transport and handling no components are allowed to be bent and / or isolating distances may not be altered. The modules are equipped with electrostatic sensitive devices, which may be damaged by improper handling. Therefore it has to be avoided to get in contact with electronic components. If electronic components are damaged mechanically the module must not be put into operation, as it cannot be ensured, that all relevant standards

This safety information must be kept!

4. Erection

The modules must be erected and cooled according to the regulations of the corresponding documentation.

The filter modules must be protected from inappropriate loads. Particularly during transport and handling, components must not be bent and / or isolating distances must not be changed. Touching of electronic components and contacts must be avoided.

Filter modules contain electro-statically sensitive components which can easily be damaged by inappropriate handling. Electrical components must not be damaged or destroyed mechanically (health risk are possible!).

5. Electrical Connection

When working on live filter modules, the valid national regulations for the prevention of accidents (e.g. VBG 4) must be observed. Before any installation or connection works, the plant has to be switched off and to be secured properly.

The electrical installation must be carried out according to the appropriate regulations (e.g. cable cross-sections, fuses, PE-connection). More detailed information is included in the documentation. When using the filter module with controllers without safe separation from the supply line (to VDE 0100) all control wiring has to be include in further protective measures (e.g. double insulated or shielded, grounded and insulated). Notes concerning the installation in compliance with EMC – such as screening, grounding, arrangement of filters and laying of cables – are included in the chapter installation of this documentation. These notes must be also observed in all cases for filter modules with the CE-mark. The compliance with the required limit values demanded by the EMC legislation is the responsibility of the manufacturer of the system or machine.

6. Operation

Systems where filter modules are installed, if applicable, have to be equipped with additional monitoring and protective devices according to the valid safety regulations e.g. law on technical tools, regulations for the prevention of accidents, etc.. After disconnecting the filter module the supply voltage, live parts of the filter module and power connections must not be touched immediately, because of possibly charged capacitors. For this, observe the corresponding labels on the drive controllers.

During operation, all covers and doors must be closed

7. Maintenance and service

The manufacturer's documentation must be observed.

The product-specific safety and application notes in these Operating Instructions must also be observed!!

2. Safety precautions

2.3 General safety information

- These safety regulations are not entitled to completeness. In case of questions please contact our technicians.
- When commissioning the filter module is compliant with the state of the art. The filter module generally allows safe operation.
- The statements of this manual describe the attributes of the products without guaranteeing them.
- The filter module unit may expose persons, the power feedback units itself and other material to danger, if
 - non-qualified personal works at and with the filter module
 - the filter module is used in opposite to its purpose.
- Filter modules have to be projected in a way, that they fulfil their function and don't expose persons to danger, if they are mounted correctly and are used in accordance with their purpose. This applies also for the interplay with the whole plant.
- The units, operational data and circuit details described in this manual have to be understood analogously and have to be checked for transferability to each application.
- Use the drive system only in flawless condition.
- Modifications of the filter modules without consultation of a REVCON[®]-technician are not allowed generally.
- The warranty given by us expires, if the unit is modified or (even partially) dismantled or if it is used in contradiction to our instructions.
- The constructor of the plant, who has to know the technical guidelines, bears the responsibility for the correct selection and arrangement of the electrical components.
- Putting into operation of the power feedback unit is only admissible at VDE-conform nets of electrical power supply. Non observance may damage the device!
- In accordance with the corresponding standards and guidelines the operation on even for a short time over-compensated networks ($\cos\varphi \leq 1$) respectively on un-choked compensation-units is not admissible. If this is done nevertheless, overvoltage will occur (caused by oscillating currents), which may damage all

2. Safety precautions

connected components, especially electronic units like controllers and filter modules.

Stop!



Undisturbed and safe operation of the filter module is possible only if the hints of this instruction are observed.

If they are not observed, in some cases malfunctions and damages may occur:

- Observe specified mains voltage.
- Power and control cables must be installed with distance (> 15cm)
- Use screened / twisted control wires. Connect screen to PE at both ends!
- Ensure good grounding of drive, motor and filter module. Connect the screen of power cables to ground extensive at both ends.(remove lacquer)!
- Observe star layout for grounding of cabinets and systems (AVOID ground loops!)
- The filter module is designed for fixed mounting and electrical connection. The ground wire must have a minimum cross section of 2,5mm² (depending of filter module size).

2. Safety precautions

2.4 Safety responsible persons

Operator

- The operator is any natural or legal person who is using the system or let someone use the system.
- The operator and / or the safety responsible person must take care for:
- all relevant rules , guidelines and laws must be observed
- only qualified personnel will work with and on the system
- the manual will be available for the personnel during working at the system.
- unqualified personnel will be forbidden to work on the system.

Qualified personal

Stop!

Qualified technical personnel are persons, who

- have appropriate training, knowledge and experience
- are informed about relevant specifications, standards and accident prevention regulations
- are trained in the installation and operation of relevant systems
- are able to recognize and avoid possible dangers

(Definition for qualified personnel in accordance to IEC 364)



2.5 Specification of wires and cables

- The used wires and cables must comply the relevant standards at place of installation and operation.
- Rules regarding minimum PE cross section must be observed in any case!

2.6 Rest danger

Danger!

ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

After switching of the mains supply all terminals may stay live for up to fifteen minutes!

Before touching, verify that no voltage is present.

Failure to comply will result in death or serious injury



Danger!

Electric shock, Interpretation ou Arc Flash

Pour L'entretien, débranchez toute l'alimentation électrique.

- Attendez 15 minutes. – Vérifiez qu'il n'y a pas de tension

Le défaut de le faire peut entraîner la mort ou des blessures graves.



3. Fast start

3.1 What this chapter contains

This chapter describes the basic guidelines for installation and commissioning of RHF-ACTIVE, which should be observed for fast and easy usage.

3.2 First check when unpacking

Please check the goods during and immediately after receipt on the following characteristics:

1	Please check the packaging for intactness and dryness. If this is not the case, immediately get in contact with the sender.
2	Please check if the type-code on the packaging matches the ordered product. If this is not the case, immediately get in contact with the sender.
3	Please check for any kind of moisture inside the packaging and for any kind of damages at the product. If this is not the case, immediately get in contact with the sender.
4	Please check if the type code on the packaging matches the data on the name plate. If this is not the case, immediately get in contact with the sender.
5	Please check if the packaging contains all accessories including manual. If this is not the case, immediately get in contact with the sender.

3.3 Suitability for the application

Please check if all current transformers and the the adjusted parameters asre suitable for the application before you start up the RHF-Active for the first time.

3.4 Environment conditions

Please check and consider the following environment conditions before starting the installation:

1	Check for the ambient temperature to be below 40°C. If it is higher, consider derating of 3%/K. This would mean that a RHF-Active 100A at 45°C must be loaded with not more than 85A. Operation above 50°C is not acceptable.
2	Check for the ambient temperature to be above -10°C. If it is lower, a heater must be installed. Hint: Ambient temperature means the temperature inside the cabinet with the RHF-Active.
3.	Check for the installation height to be below 1000m above sea level. If it is higher, consider derating of 1%/100m. This would mean that a RHF-Active 100A at 2000mC must be loaded with not more than 90A. Operation above 4000m is not acceptable.
4	Check for ambient moisture to be below 90%. If the moisture is higher, measures for reduction of moisture must be taken.
5	Check for no direct sunlight exposition of the RHF-Active and for no dust impact. If that could happen, countermeasures must be taken.

3. Fast start

3.5 Check of the installation

Perform this check AFTER installation but BEFORE first powering up:

1	Check the correct mounting and wiring of the current transformer (CT). The wiring used must comply with the requirements of components (CT, RHF-Active) and of place of installation.
3.	Check that power and controls wires are installed separately and that EMC guidelines are observed.
4	Check the grounding of the system and components for compliance with guidelines and requirements of the drives.
5	Check if the clearance between the components comply with the requirements of these instructions.
6	Check if the installation meets the requirements of these instructions. The RHF-Active must be mounted in an upright position.

3.6 Simplified commissioning

The REVCON RHF-ACTIVE is a largely automated product for reduction of harmonics.

Complete the simplified commissioning as described below BEFORE first usage:

1	Check all parameters of the monitoring system on your computer
2	Check the correct wiring of the current transformers
3	If several products are used in parallel, check for compliant adjustment of the parameters.

Hint: If the result of harmonic compensation is not satisfying, please check the parameters once again first, wiring (especially polarity) of the current transformers second. If everything is o.k. modify the phase angle of the system to achieve even better results.

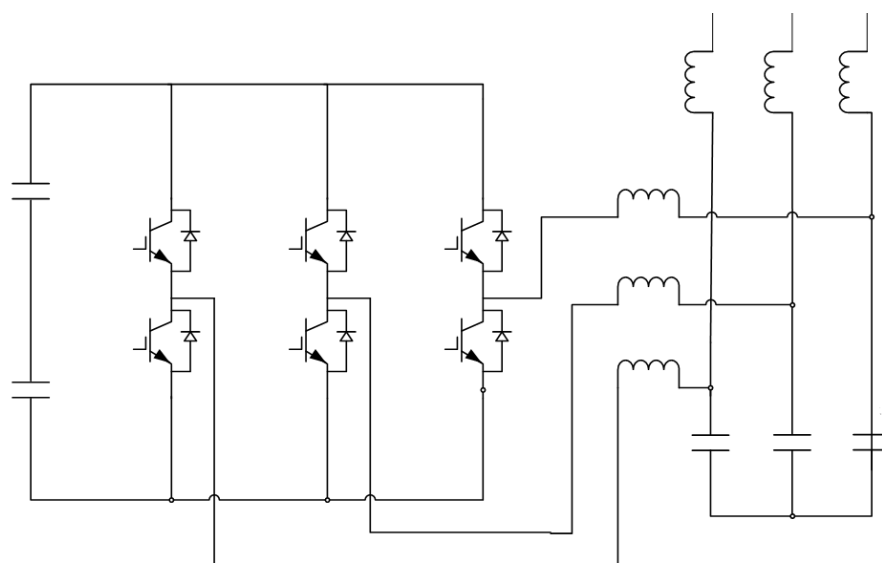
4. Product-Overview

4.1 What this chapter contains

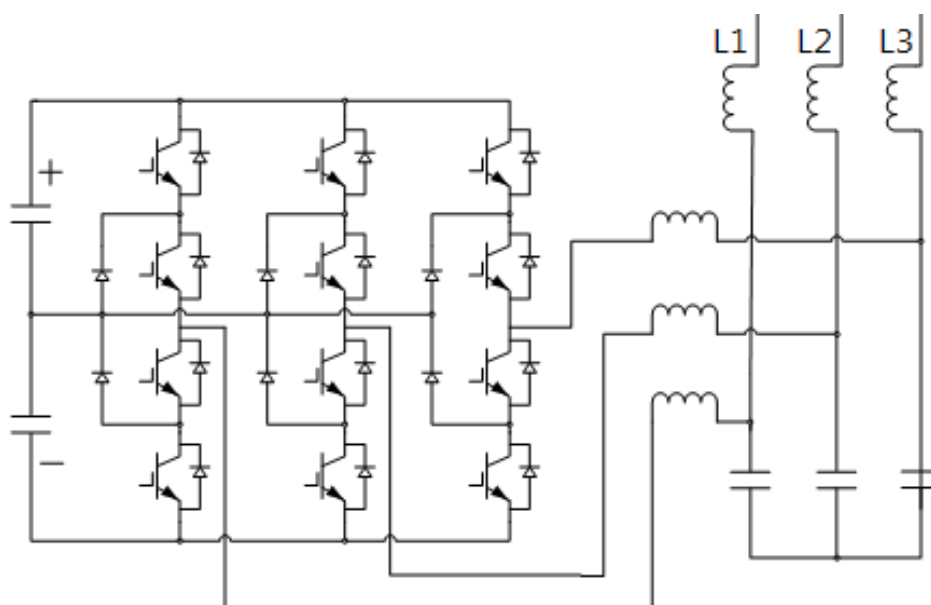
This chapter describes the function principle, the characteristics of the product and dimensions.

4.2 Function principle:

The following drawings show the principle, simplified setup for active harmonic filters.



Topology of RHF-Active 15-55A



Topology of RHF-Active 100A

4. Product-Overview

4.3 Product-characteristics

A) 15A

General Data	
Mains voltage	380-480V (+10% / -15%)
Network type	3 phase with/ without neutral 3P4W/3P3W
Nominal current	15 A
Colour	white
Electrical data	
Mains frequency	50Hz / 60Hz (±5Hz)
Harmonic compensation	1.-60. Harmonic
Response time	20µs
Full response time	5ms
Filter performance	>96%
Switching frequency	40kHz-60kHz, typical 50kHz
Technology	Advanced SIC
System topology	Two Level Topology
Function	Harmonic compensation, power factor correction, three phase balancing
User-Interface & Remote monitoring	
HMI	Not present / extern
Communication protocol	RS485
PC-Software	V3.2.3
Efficiency	
η	>99,4% at nominal load
Installation / Configuration	
Noise	<60db
Current transformer ratio	5/5~1000/5
Cooling	Forced air cooling
Air flow requirement	>105m³/h
Mounting	Wall mount
Parallel configuration	Unlimited
Extensions	Modules in parallel
Protection level	IP20
Cable entering	bottom
RFI level	class A
Environmental	
Ambient temperature	-10°C~40°C
Temperature-Derating	Derating above 40°C (3%/K)
Maximum temperature	50°C
Relative Humidity	5%~95% Class F without condensation
Altitude	below 1000m
Altitude Derating	above 1000m (5%/1000m to 4000m)
Weight, Dimensions	
Weight	8kg
Dimensions W*D*H[mm]	86*260*450
Certifications	
Certifications	CE,UL
Transport/Storage	
Ambient temperature (Transport)	-25°C~+70°C (following DIN EN 50178)
Ambient temperature (Storage)	-25°C~+55°C (following DIN EN 50178)

B) 35A

General Data	
Mains voltage	380-480V (+10% / -15%)
Network type	3 phase with/ without neutral 3P4W/3P3W
Nominal current	35 A
Colour	white
Electrical data	
Mains frequency	50Hz / 60Hz (±2Hz)
Harmonic compensation	1.-60. Harmonic
Response time	20µs
Full response time	5ms
Filter performance	>96%
Switching frequency	40kHz-60kHz, typical 50kHz
Technology	Advanced SIC
System topology	Two level topology
Function	Harmonic compensation, power factor correction, three phase balancing
User-Interface & Remote monitoring	
HMI	Not present / extern
Communication protocol	RS485
PC-Software	V3.2.3
Efficiency	
η	>99,3% at nominal load
Installation / Configuration	
Noise	<60db
Current transformer ratio	5/5~1000/5
Cooling	Forced air cooling
Air flow requirement	>160m³/h
Mounting	Wall mount
Parallel configuration	Unlimited
Extensions	Modules in parallel
Protection level	IP20
Cable entering	bottom
RFI level	class A
Environmental	
Ambient temperature	-10°C~40°C
Temperature-Derating	Derating above 40°C (3%/K)
Maximum temperature	50°C
Relative Humidity	5%~95% Class F without condensation
Altitude	below 1000m
Altitude Derating	above 1000m (5%/1000m to 4000m)
Weight, Dimensions	
Weight	16kg
Dimensions W*D*H(mm)	106*360*560
Certifications	
Certifications	CE,UL
Transport/Storage	
Ambient temperature (Transport)	-25°C~+70°C (following DIN EN 50178)
Ambient temperature (Storage)	-25°C~+55°C (following DIN EN 50178)

4. Product-Overview

C) 55A

General Data	
Mains voltage	380-480V (+10% / -15%)
Network type	3 phase with/ without neutral 3P4W/3P3W
Nominal current	55 A
Colour	White
Electrical data	
Mains frequency	50Hz / 60Hz (±5Hz)
Harmonic compensation	1.-60. Harmonics
Response time	20µs
Full response time	5ms
Filter performance	>96%
Switching frequency	40kHz-60kHz, typical 50kHz
Technology	Advanced SIC
System topology	Two level topology
Function	Harmonic compensation, power factor correction, three phase balancing
User-Interface & Remote monitoring	
HMI	Not present / extern
Communication protocol	RS485
PC-Software	V3.2.3
Efficiency	
η	>99,4% at nominal load
Installation / Configuration	
Noise	<60db
Current transformer ratio	5/5~1000/5
Cooling	Forced air cooling
Air flow requirement	>160m³/h
Mounting	Wall mount
Parallel configuration	Unlimited
Extensions	Modules in parallel
Protection level	IP20
Cable entering	bottom
RFI level	class A
Environmental	
Ambient temperature	-10°C~40°C
Temperature-Derating	Derating above 40°C (3%/K)
Maximum temperature	50°C
Relative Humidity	5%~95% Class F without condensation
Altitude	below 1000m
Altitude Derating	above 1000m (5%/1000m to 4000m)
Weight, Dimensions	
Weight	18kg
Dimensions W*D*H(mm)	106*360*560
Certifications	
Certifications	CE,UL
Transport/Storage	
Ambient temperature (Transport)	-25°C~+70°C (following DIN EN 50178)
Ambient temperature (Storage)	-25°C~+55°C (following DIN EN 50178)

D) 100A

General Data	
Mains voltage	380-415V (+10% / -15%)
Network type	3 phase with/ without neutral 3P4W/3P3W
Nominal current	75 / 100A
Colour	Grey
Electrical data	
Mains frequency	50Hz / 60Hz (± 5 Hz)
Harmonic compensation	1.-50. Harmonic
Response time	80 μ s
Full response time	10ms
Filter performance	>95%
Switching frequency	10kHz-20kHz, typical 15kHz
Technology	IGBT
System topology	Three level topology
Function	Harmonic compensation, power factor correction, three phase balancing
User-Interface & Remote monitoring	
HMI	Not present / extern
Communication protocol	RS485 / CAN
PC-Software	V3.2.3
Efficiency	
η	>97% at nominal load
Installation / Configuration	
Noise	<70db
Current transformer ratio	200/5~1500/5
Cooling	Forced air cooling
Air flow requirement	>540m ³ /h
Mounting	Wall mount
Parallel configuration	Unlimited
Extensions	Modules in parallel
Protection level	IP20
Cable entering	bottom
RFI level	class A
Environmental	
Ambient temperature	-10°C~40°C
Temperature-Derating	Derating above 40°C (3%/K)
Maximum temperature	50°C
Relative Humidity	5%~95% Class F without condensation
Altitude	below 1000m
Altitude Derating	above 1000m (5%/1000m to 4000m)
Weight, Dimensions	
Weight	42kg
Dimensions W*D*H(mm)	455*200*550
Certifications	
Certifications	CE
Transport/Storage	
Ambient temperature (Transport)	-25°C~+70°C (following DIN EN 50178)
Ambient temperature (Storage)	-25°C~+55°C (following DIN EN 50178)

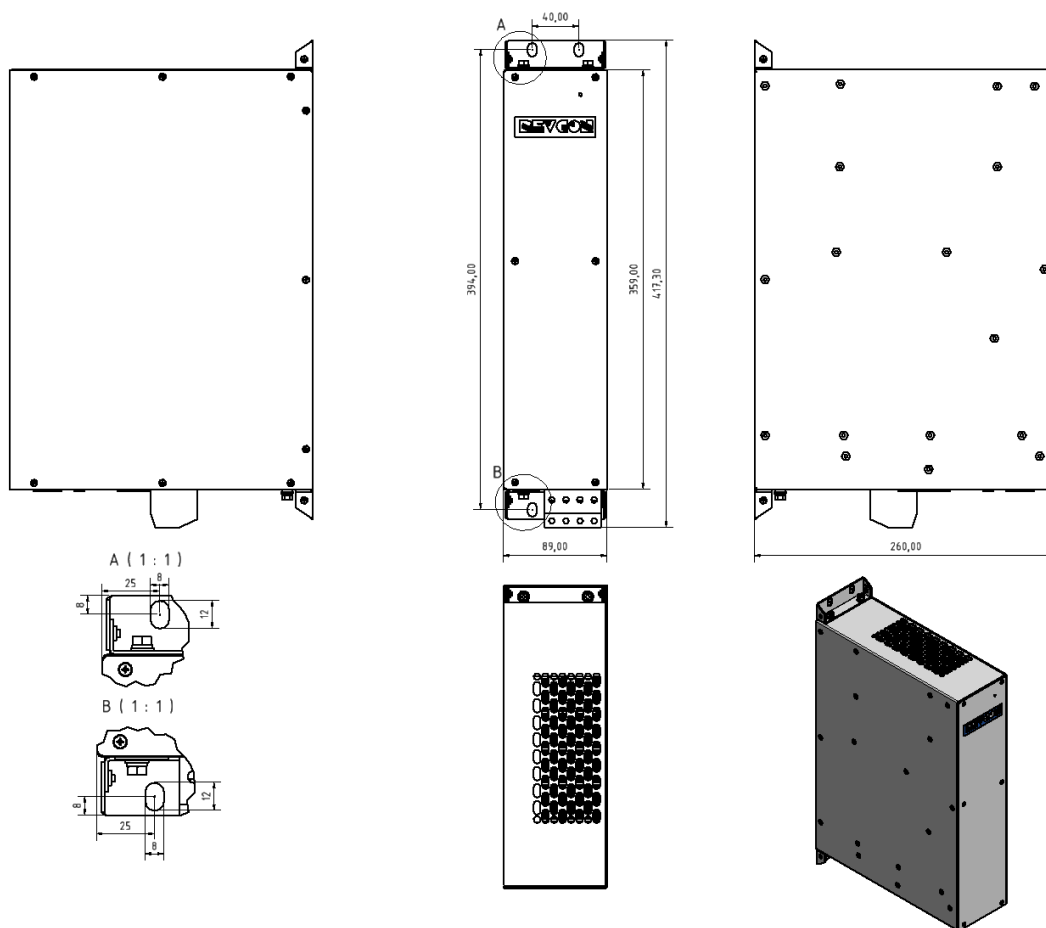
5. Installation instructions

5.1 What this chapter contains

This chapter describes mechanical and electrical installation.

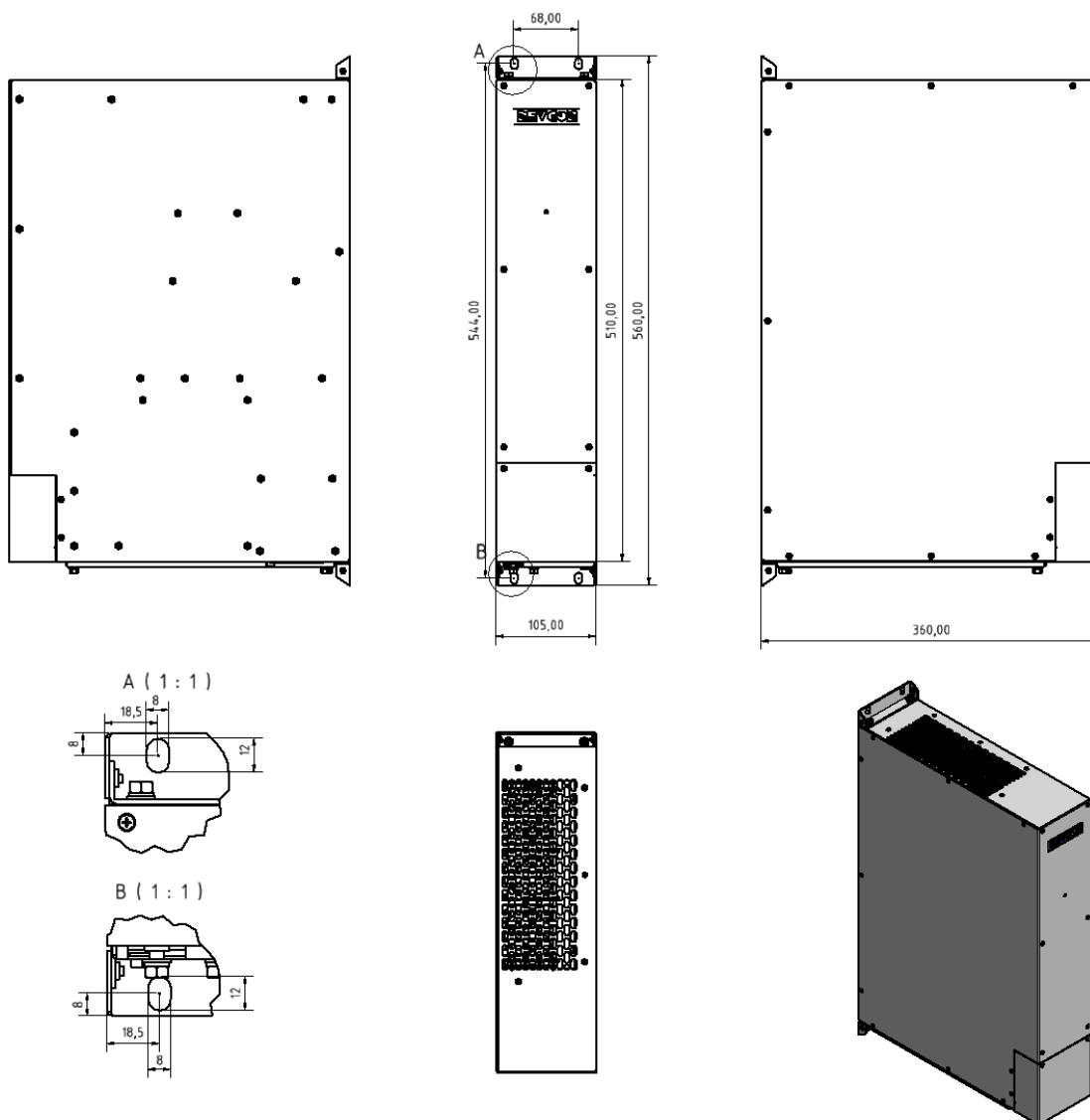
5.2 Mechanical drawings

A) 15A:



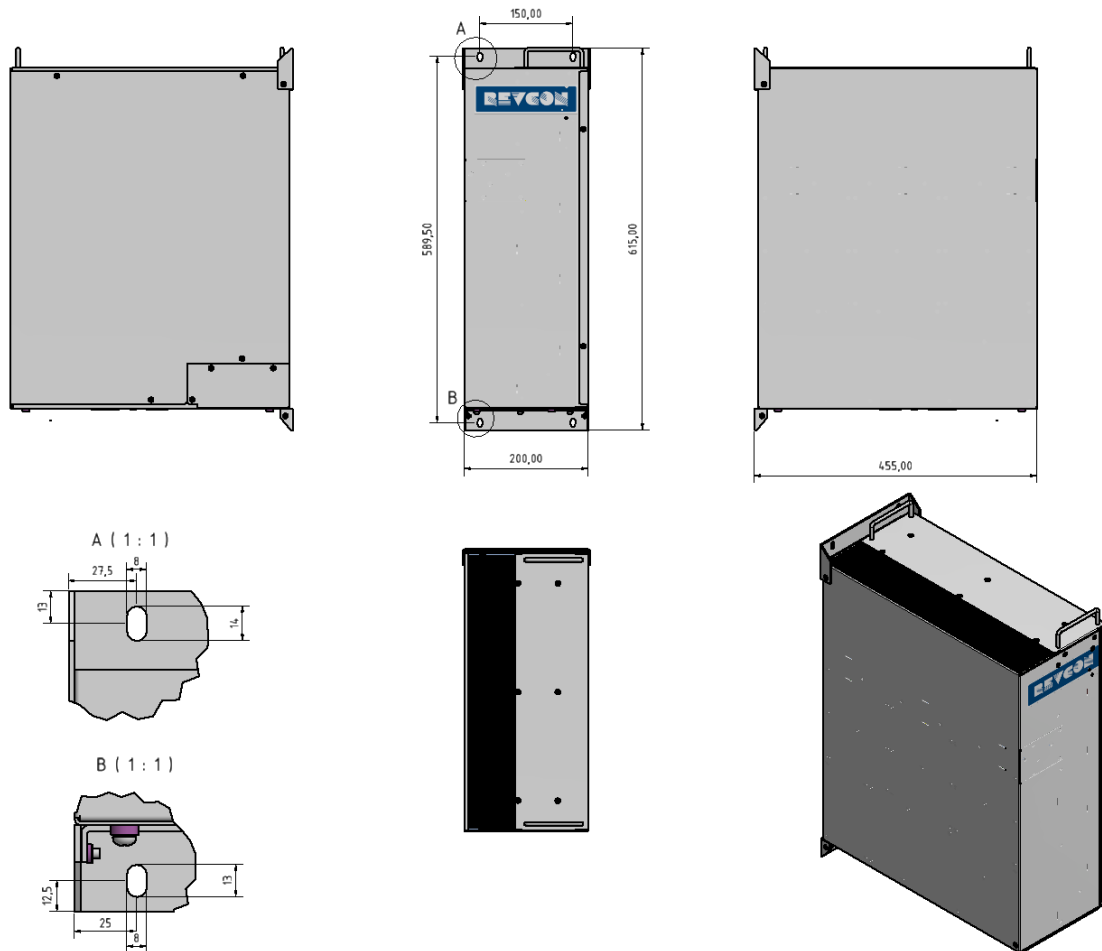
5. Installation instructions

B) 35A + C) 55A:



5. Installation instructions

D) 100A:



5.2.1 Mechanical installation

For safe and undisturbed operation, it is mandatory to follow those instructions for mechanical installation:

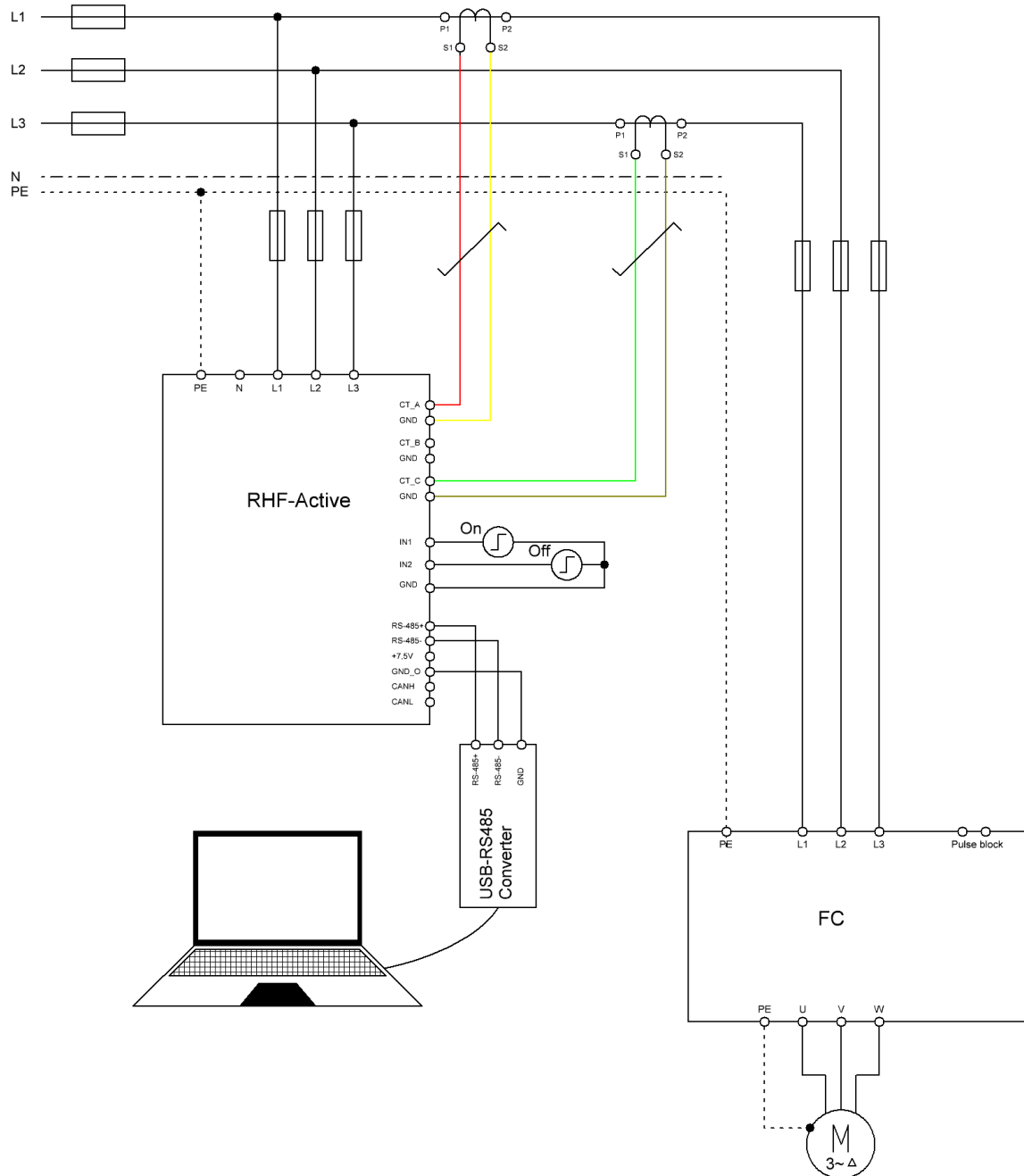
1. Clearance between RHF-Active and other components like chokes, cabinet walls, drives:
 $\geq 100\text{mm}$ in horizontal (left/right) and $\geq 100\text{mm}$ in vertical direction (bottom)
2. Clearance between RHF-Active and other RHF-Active:
 $\geq 10\text{mm}$ in horizontal (left/right) and $\geq 100\text{mm}$ in vertical direction (bottom)
3. Min. clearance in vertical direction (top):

RHF-Active 15A : 130mm	RHF-Active 35A : 180mm
RHF-Active 55A : 180mm	RHF-Active 100A : 230mm
4. Use screws with min. diameters

RHF-Active 15A : 6mm	RHF-Active 35A : 6mm
RHF-Active 55A : 6mm	RHF-Active 100A : 8mm

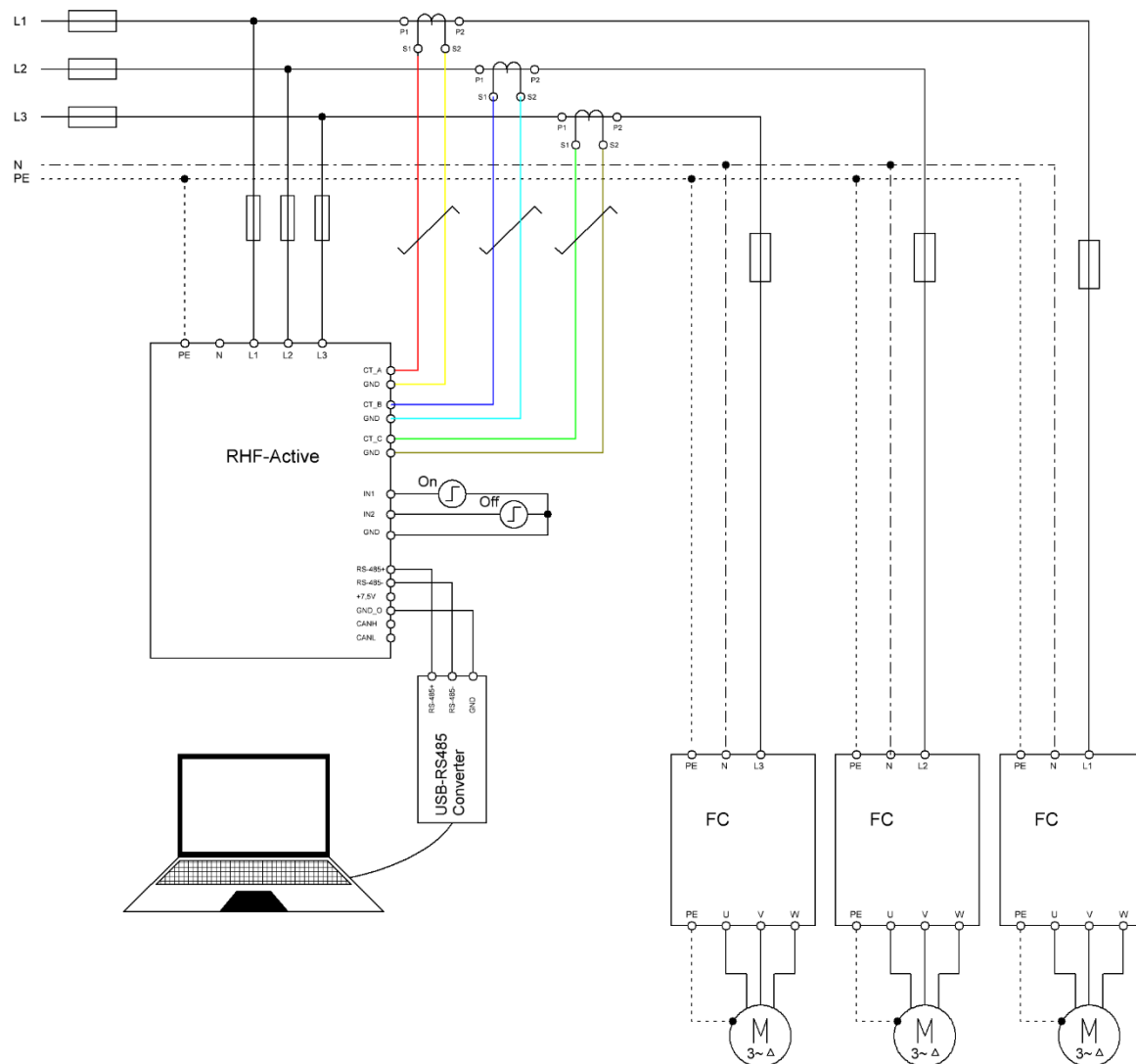
5.3 Electrical wiring 15A, 35A, 55A, 100A:

A) 3W3P



5. Installation instructions

B) 4W3P



Remarks:

Routing of wires: The wires between RHF-Active and current transformers must be twisted pair cables. A correct function is only possible if the wiring matches exact the diagram below. If wires are interchanged, the harmonics will not be reduced but amplified. To avoid interchanging of wires it is strongly recommended not to use any wire colour twice.

Wire cross section: The cross section of the wires has a significant influence on the quality of the control. Is the cross section too small in relation to the length of the wire, the resulting measurement will be too small to achieve a good control quality and good reduction of harmonics.

$$A = \frac{2 \times d \times v \times I^2 \times \rho}{S}$$

The following values needed to be known:

S = Power of the current transformer (typical 2,5VA)

d = Distance (length of cableway) between RHF-Active and current transformer

v = Twisting factor (typical 1,5)

I = secondary current of the current transformer (typical 5A)

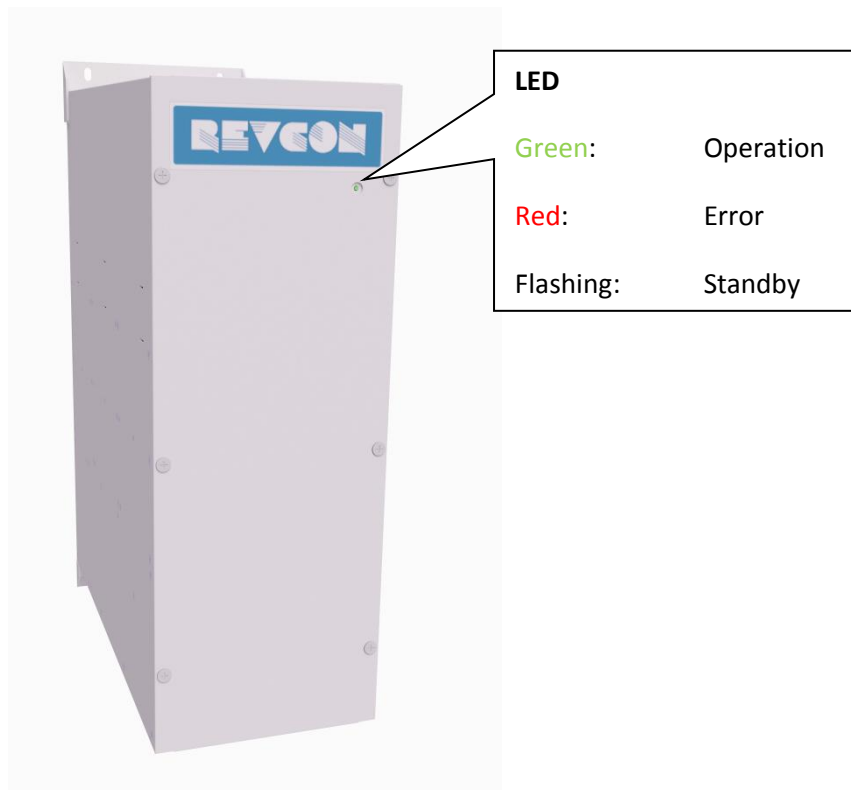
ρ = Rho = specific resistance of copper ($0,01786 \frac{\text{Ohm} \times \text{mm}^2}{\text{m}}$)

Example: $A = \frac{2 \times 2\text{m} \times 1,5 \times 5^2 \times 0,01786 \text{ Ohm} \times \text{mm}^2}{2,5\text{VA} \times \text{mm}^2} = 1,07\text{mm}^2$

Wiring type: A hybrid between 3W3P and 4W3P is not possible. At 3W3P (installation of two current transformers) the neutral must not be connected to the RHF-Active. It is mandatory that the physical installation must match the adjusted method in the software of the RHF-Active. If this is not observed, the reduction of harmonics is not optimal.

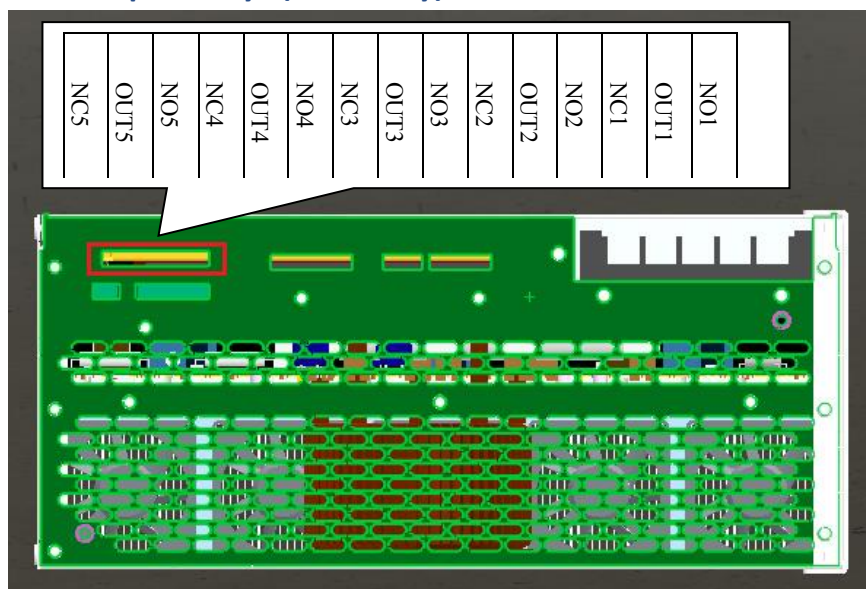
5. Installation instructions

5.3.1 LED status display



Green means normal operation , red means error, flashing means standby.

5.3.2 Output relays (100A only)

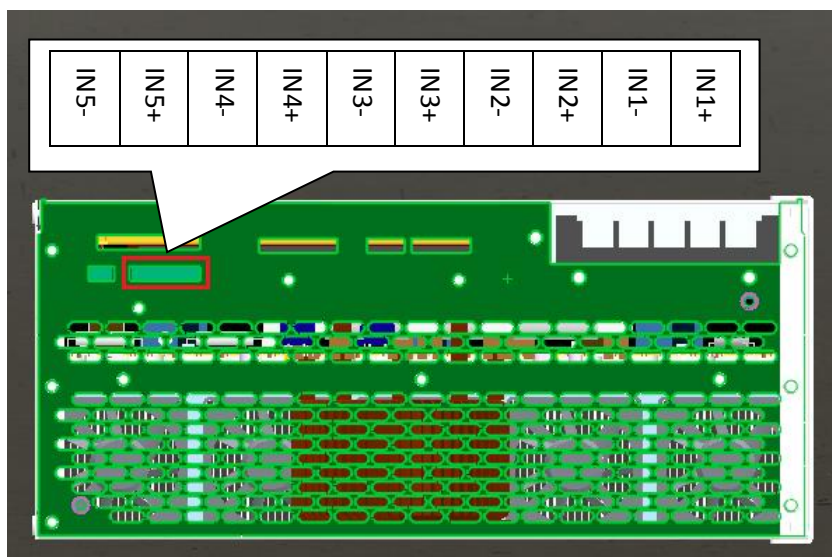


Terminal label	Function
Normal Open Contact	
NO1	Relay 1, Normal Open, DC, Capacity: 8A/250VAC
OUT1	
NO2	Relay 2, Normal Open, DC, Capacity: 8A/250VAC
OUT2	
NO3	Relay 3, Normal Open, DC, Capacity: 8A/250VAC
OUT3	
NO4	Relay 4, Normal Open, DC, Capacity: 8A/250VAC
OUT4	
NO5	Relay 5, Normal Open, DC, Capacity: 8A/250VAC
OUT5	
Normal Close Contact	
NC1	Relay 1, Normal Close, DC, Capacity: 8A/250VAC
OUT1	
NC2	Relay 2, Normal Close, DC, Capacity: 8A/250VAC
OUT2	
NC3	Relay 3, Normal Close, DC, Capacity: 8A/250VAC
OUT3	
NC4	Relay 4, Normal Close, DC, Capacity: 8A/250VAC
OUT4	
NC5	Relay 5, Normal Close, DC, Capacity: 8A/250VAC
OUT5	

5. Installation instructions

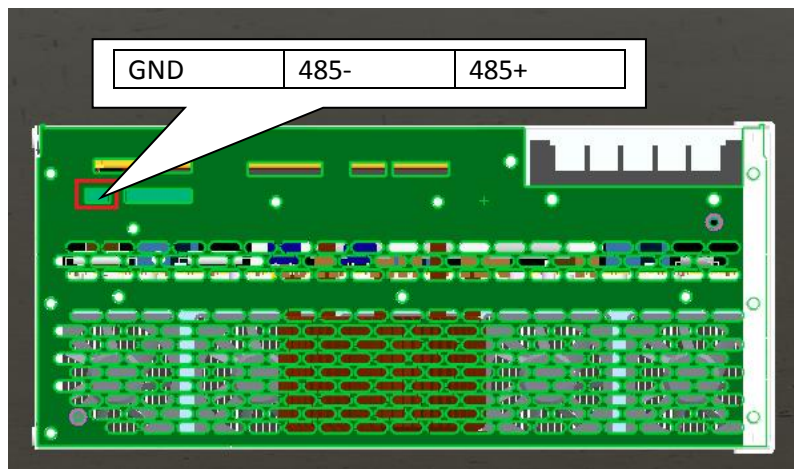
5.3.3 Input relays (100A only)

Function: Reserved for complex applications, IN1+ to IN5+ are DC+, IN1- to IN5- are DC-; It is recommended to use a DC-voltage of 10 ~ 24V DC.



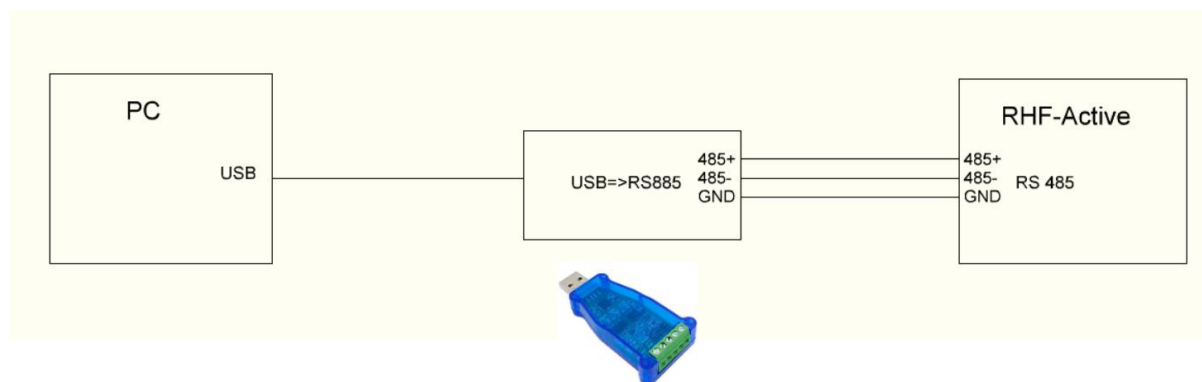
Terminal label	Function
IN1+	IN1+ for DC +, IN1- for DC-, recommended input voltage range: 10 ~ 24V DC
IN1-	
IN2+	IN2+ for DC +, IN2- for DC-, recommended input voltage range: 10 ~ 24V DC
IN2-	
IN3+	IN3+ for DC +, IN3- for DC-, recommended input voltage range: 10 ~ 24V DC
IN3-	
IN4+	IN4+ for DC +, IN4- for DC-, recommended input voltage range: 10 ~ 24V DC
IN4-	
IN5+	IN5+ for DC +, IN5- for DC-, recommended input voltage range: 10 ~ 24V DC
IN5-	

5.3.4 485 Communication (100A only)



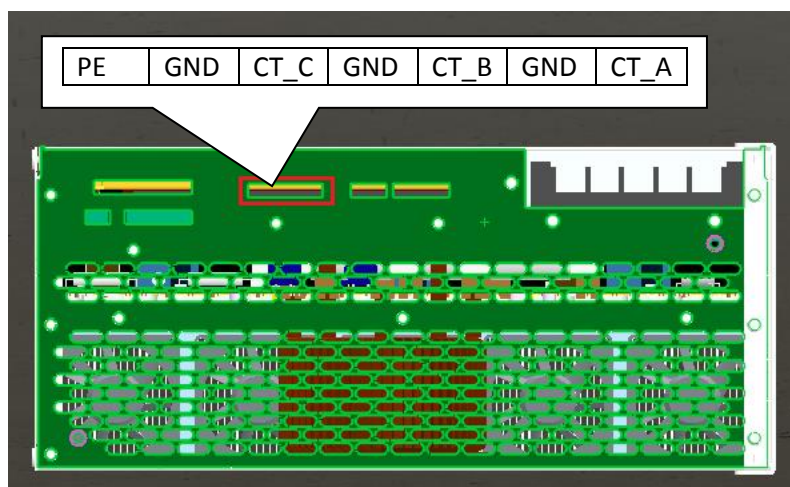
Terminal label	Function
485+	485 Interface for remote control by a computer. A standard-485-communication interface requires screened or twisted wires. If the wire length exceeds 1m, GND must be connected.
485-	
GND	

Wiring example:



5. Installation instructions

5.3.5 Current transformer wiring (all sizes)



Terminal label	Function / Terminal
CT_A	CT S1 in Phase A (L1)
GND	CT S2 in Phase A (L1.1)
CT_B	CT S1 in Phase B (L2)
GND	CT S2 in Phase B (L2.1)
CT_C	CT S1 in Phase C (L3)
GND	CT S2 in Phase C (L3.1)
PE	Protective wire / screening

Hint: To achieve best performance of RHF-active the pairs CT_A+GND, CT_B+GND and CT_C+GND should be twisted.

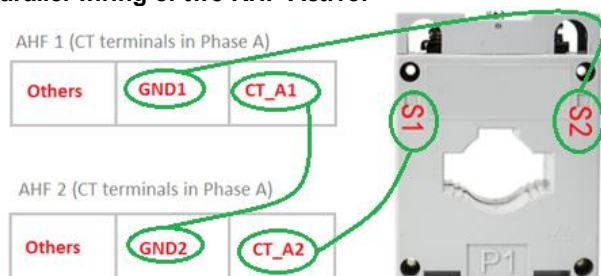
5.3.6 RHF-Active in parallel wiring

RHF-Active may be connected in parallel without limitation to achieve higher power ratings. It is necessary to adjust the related parameters in the software and do adopt the wiring of the current transformers.

Phase A (L1) is used for reference for the other phases.

Example Case 1:

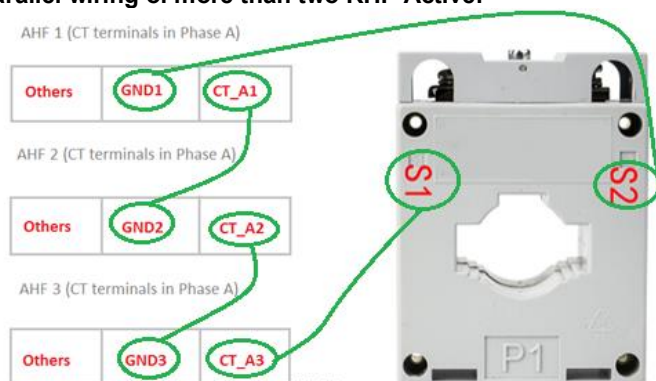
Parallel wiring of two RHF-Active:



Hint: Like the polarity of S1 and S2, the polarity of P1 and P2 is very important for the correct function. P1 must face to mains supply and P2 (on opposite side of current transformer) must face to the load.

Example Case 2:

Parallel wiring of more than two RHF-Active:



Hint: Like the polarity of S1 and S2, the polarity of P1 and P2 is very important for the correct function. P1 must face to mains supply and P2 (on opposite side of current transformer) must face to the load.

5.3.7 Selection of current transformers

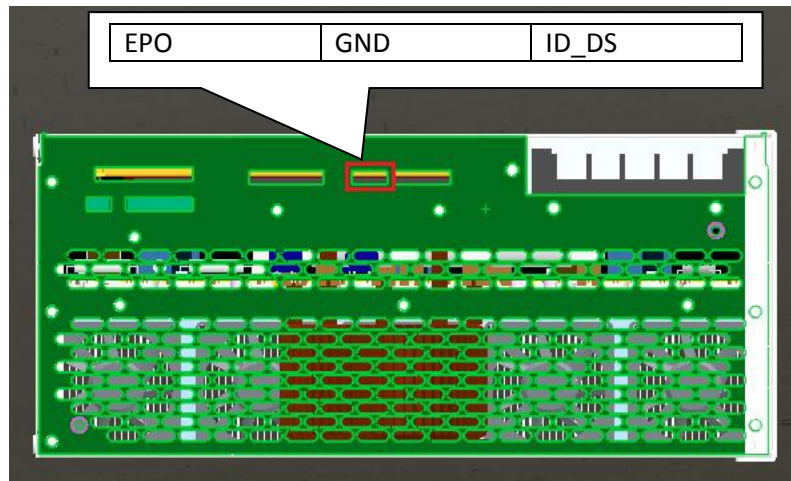
Selection of current transformers depends on the load current of the application. Applicable are current transformers in the range of 150:5 to 10000:5. The transfer ratio must be adjusted in the correlated parameter of the software. For optimal performance, the nominal current of the current transformer must not be much higher than the load current of the application (e.g. load current 95A => current transformer 100A)

5.3.8 Modification of wiring when using current transformers with high ratio

If there is no current transformer with optimal ratio available, at push through transformers the primary conductor may be lead through the transformer several times. Not only in this case it is very important to observe that the direction of energy flow in the conductor and the marked direction on the transformer match, For the same current like example of 5.3.4 a 300A transformer may be used if the conductor is turned three times through the transformer. In this case, the Software adjustment must be 100:5 and not 300:5. This method is not possible if current transformers without push through whole are used.

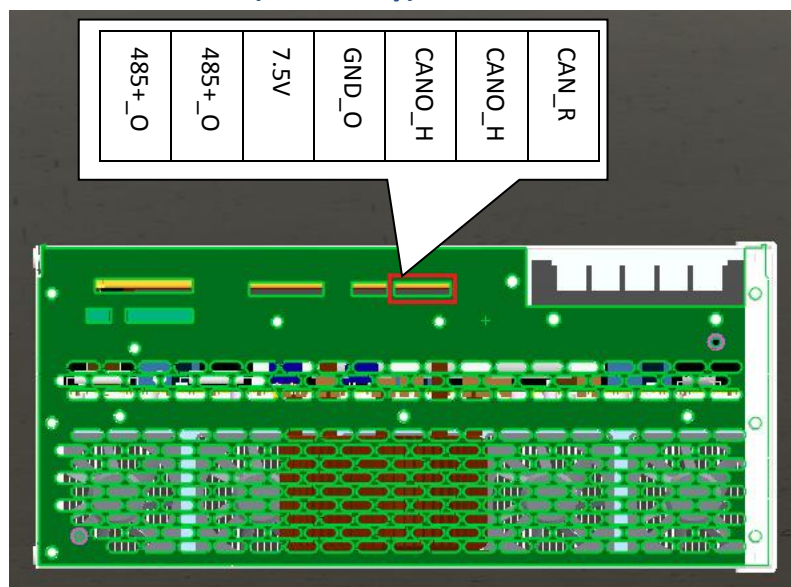
5. Installation instructions

5.3.9 EPO and RHF-Active ID (all sizes)



Terminal label	Function
EPO	EPO connection for usage as part of EMERGENCY OFF line. If the contact to be wired here is closed, the EMERGENCY OFF function is active.
GND	
ID_DS	Adjustment of the ID of the RHF-ACTIVE. This is required for correct software function if several modules are connected to the same interface of one computer

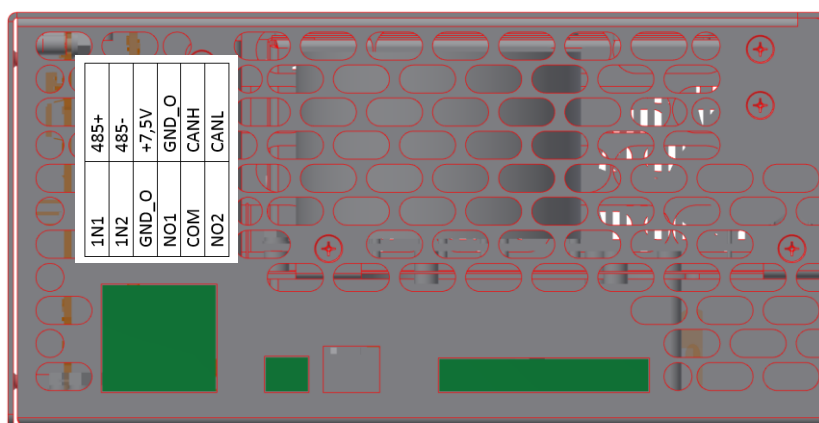
5.3.10 Reserved communication (100A only)



Terminal label	Function
485+ _O	Reserved 485 communication for extended connections
485- _O	
7.5V	Reserved 7.5V power supply for optional HMI, Not suitable for other loads
GND _O	
CANO _H	Reserved CAN communication for extended connections
CANO _L	

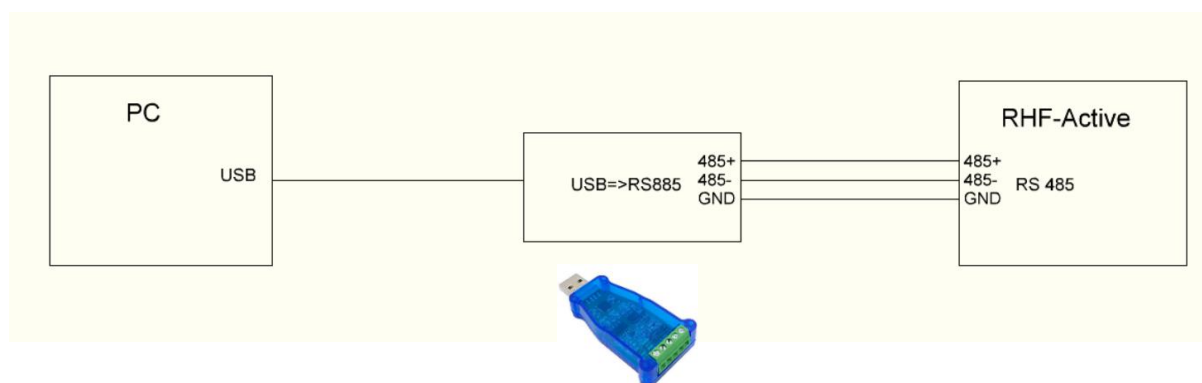
CAN_R	Reserved CAN communication. To improve communication, connect both terminals by a 120Ω resistor.
-------	--

5.3.11 Input and output interface (15-55A only)



Terminal label	Function
1N1	IN1+ for DC +, recommended input voltage range: 10 ~ 24V DC
1N2	IN2+ for DC +, recommended input voltage range: 10 ~ 24V DC
GND_O	Common ground for DC input
NO1	Relay 1, Normal Open, DC, capacity: 8A/250VAC
COM	Common ground for relay output
NO2	Relay 2, Normal Open, DC, capacity: 8A/250VAC
485+	485 Interface for remote control by a computer. A standard-485-communication interface requires screened or twisted wires. If the wire length exceeds 1m, GND must be connected.
485-	
+7,5V	-
GND_O	Common ground for communication 485 and CAN
CANH	CAN communication
CANL	

Wiring example RS 485:



6. Supervision- and control software

5.1 What this chapter contains

This chapter contains guidelines for using the supervision and control software. There are hints how to check the parameters before commissioning and how to optimize them during operation.

6.2 Introduction in the system

There are two versions of the software:

Software-Version	Suitable for
RHF-Active Configuration V3.2.2 SIC	RHF-Active 15, 35,55A
RHF-Active Configuration V2.0	RHF-Active 100A

6.2.1 Log In

After start the following dialog screen is shown:



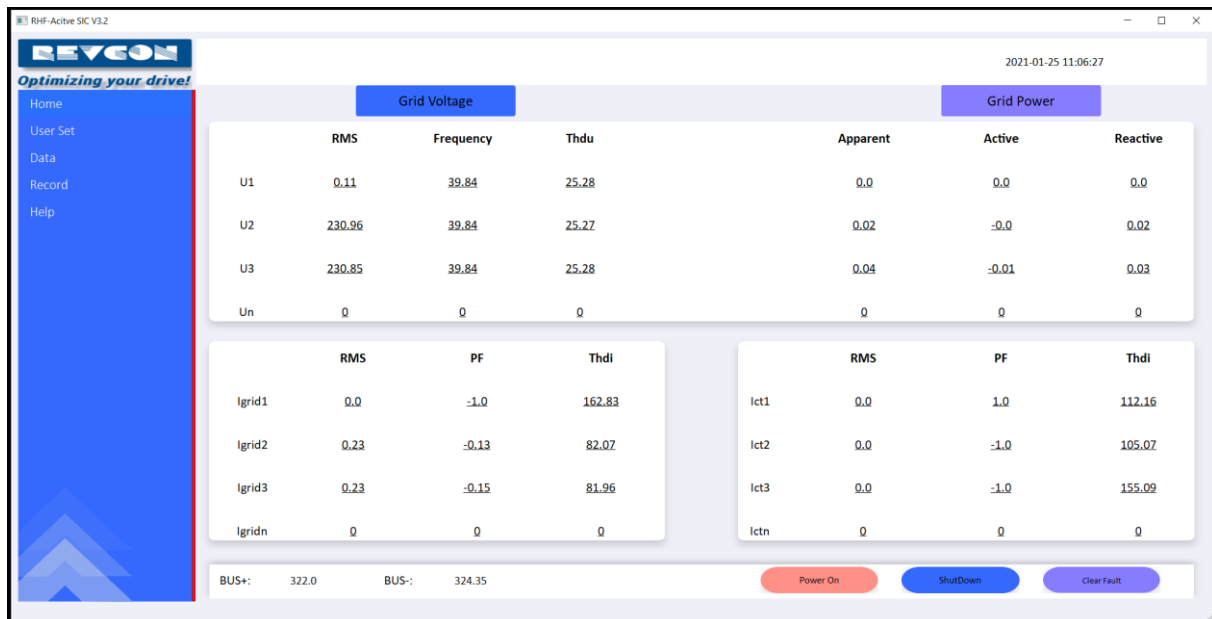
To log in use following data:

ID: 001

Password: 010101

6.2.2 Home

The home screen will be shown:



Home: Information concerning grid and load are shown. The three buttons at the bottom are used to start, stop and reset the RHF-Active.

User Set: All parameters can be read and modified.


DATA: Displays grid voltage and current (each RMS, frequency and THD of all active wires), load current (each RMS, frequency and THD of all active wires), power (each apparent, active, reactive and power factor), load current of the inverter (RMS, load rate, choke current) and the temperatures of the transistors

Record: Historical values of recorded data and warnings

Help: Shows easy hints.

Note!

The colour of the line beside the blue ribbon at the left shows connect status between PC and RHF-Active:

Red  => no connect

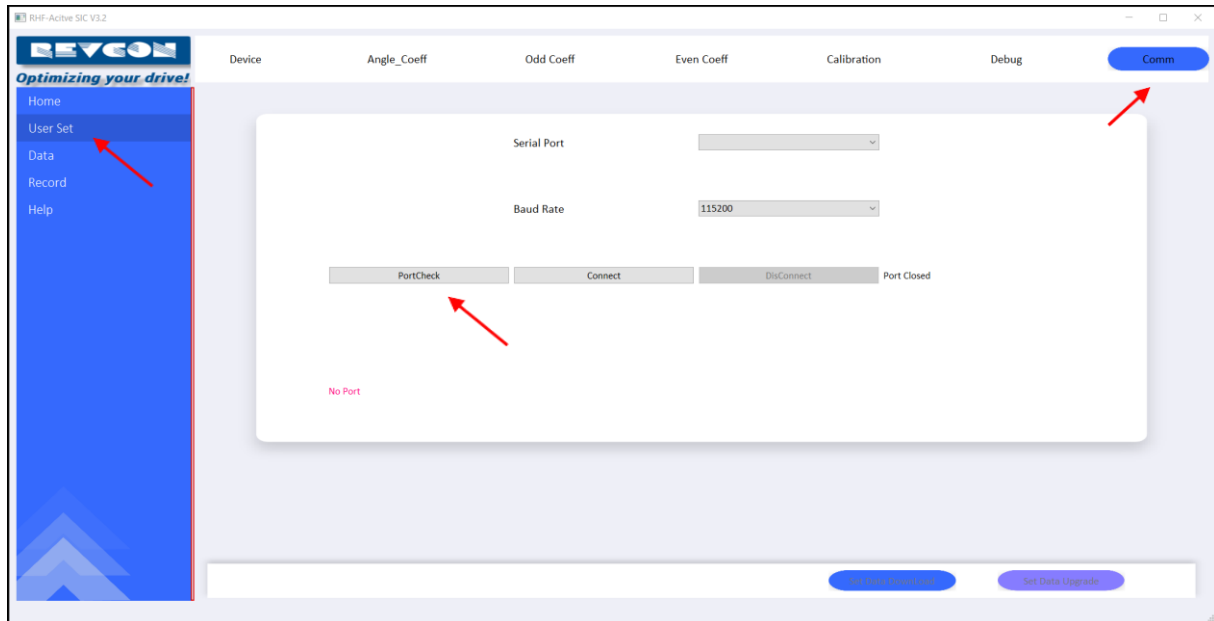
Green  => connect



6. Supervision- and control software

6.2.3 Initialize communication

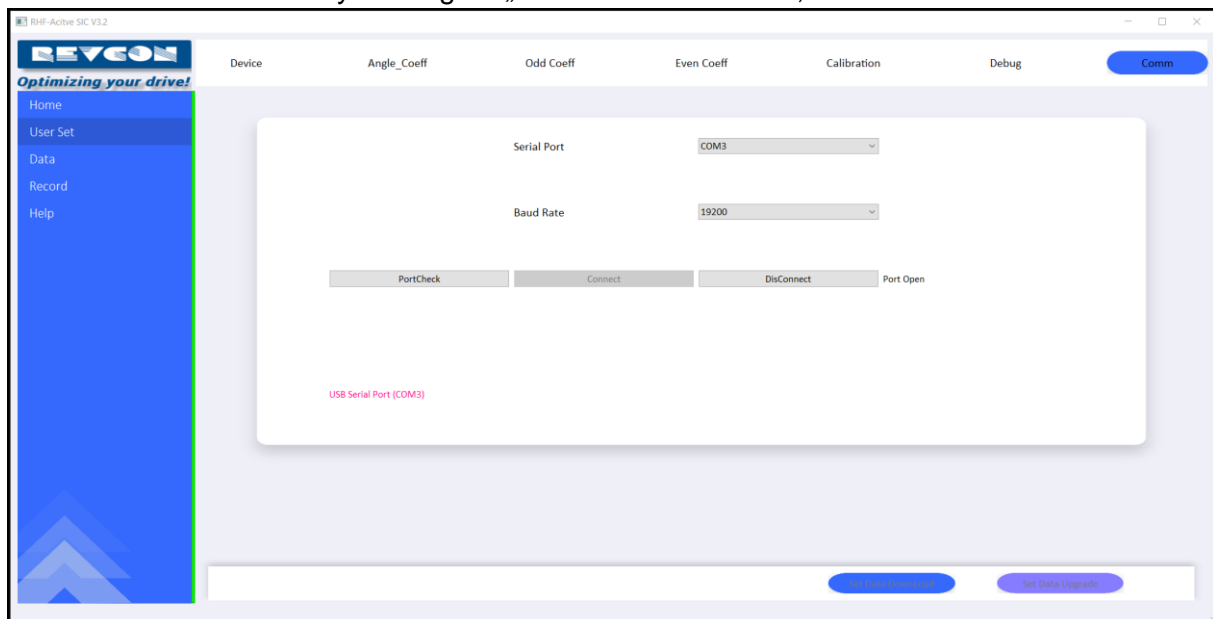
When computer and RHF-Active are connected the first time, it is necessary to set the communication parameters. Thereto click on „User Set“, then „Comm“ and start „PortCheck“:



The drop down list offers the available ports. Choose one of them.
Adjust the transmission speed in accordance to the list below:

Software-Version	Suitable for	Baud Rate
SiCAHF-3.2.1	RHF-Active 15-55A	19200
RHF-Active Configuration V2.0	RHF-Active 100A	115200

Initialize the connection by clicking on „Connect“. If succesful, the software will show this:



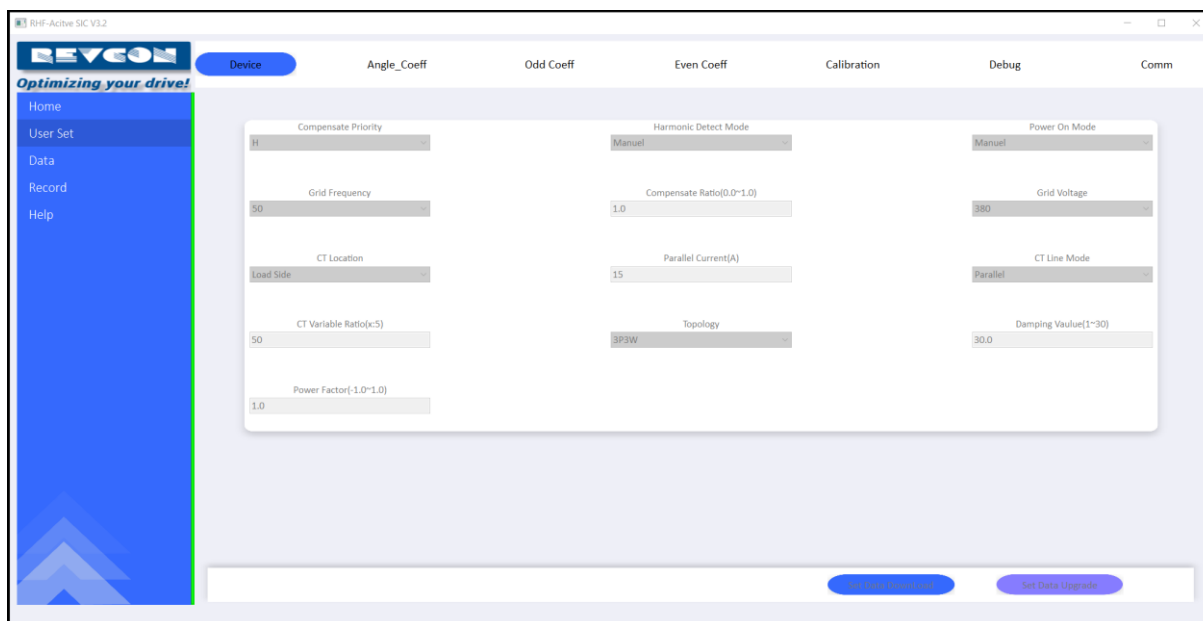
6.2.4 System configuration

Overall there are seven pages for adjustment of parameters.

Page	Content (Adjustment of...)
1	Module
2	Phase angle
3	Odd harmonics
4	Even harmonics
5	Sensor-calibration
6	Trouble shooting
7	communication

The description of page 7 „Communication“ is part of in chapter 6.2.3. All others can be found in the following:

6.2.4.1 Device



This page shows the following adjustments:

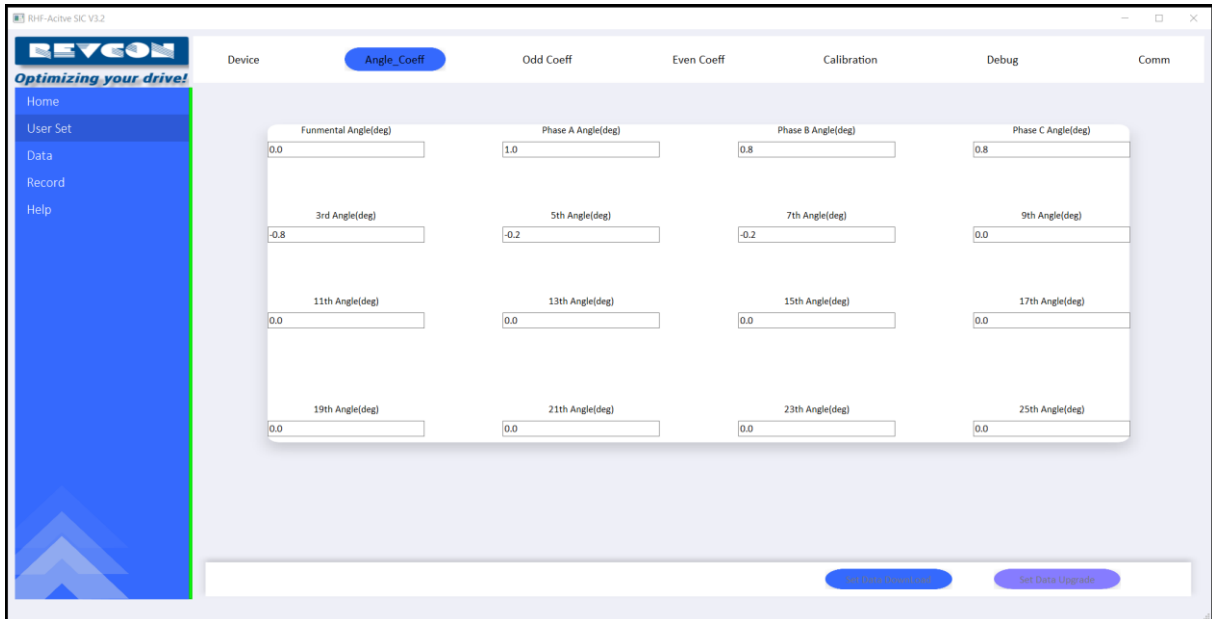
Nr.	Name	Description
1	Compensate priority	Mode of compensation: H: only Harmonic compensation HR: compensation of harmonics and reactive power, whereas harmonic compensation has priority. HRU: compensation of harmonics, reactive power and phase unbalance, whereas harmonic compensation has priority.
2	Grid Frequency	Adjustment to grid frequency: 50hz or 60hz
3	CT Location	Placing of current transformers. Load side (preferred) or grid side.
4	CT Variable Ratio	Ratio of current transformers, (typical XX: 5). XX must be written in here.
5	Power Factor	Set value for power factor if HR or HRU have been selected
6	Harmonic Detect Mode	Harmonic compensation algorithm: 1. Manual: The compensation rate must be adjusted manually. 2. Auto: The compensation rate is adjusted automatically. 3. Completely: the compensation rate is set to 1. Compensation includes reactive power. The default setting is „Manual
7	Compensate Ratio	Compensation rate: It is possible to adjust between 0.1-1.0 to reduce the compensation current. 1.0 means full compensation current
8	Parallel current	If several RHF-Active operate in parallel (at one set of current transformers), this cell expects the total current of all RHF-Active.
9	Topology	If three phases and three wires (L1, L2, L3) with two current transformers are used, select 3P3W If three phases and four wires (L1, L2, L3;N) with three current transformers are used, select 3P4W.
10	Power On mode	Power on status at voltage recovery. Auto: At voltage recovery module will start automatically

6. Supervision- and control software

		Manuel: At voltage recovery the start of the module must be initiated manually The default setting is „Manual
11	Grid Voltage	Grid voltage. The default setting is 380V (fits also for 400V).Alternatively 480V can be chosen.
12	CT Line Mode	Connection type of current transformers. Possible are series and parallel connection
13	Damp	Damping of the control. Admissible values are between 10 and 30. At symmetrical three phase load (3W3P) : 30. At single phase or unsymmetrical load (4W3P) : 10.

6. Supervision- and control software

6.2.4.2 Angle_Coeff



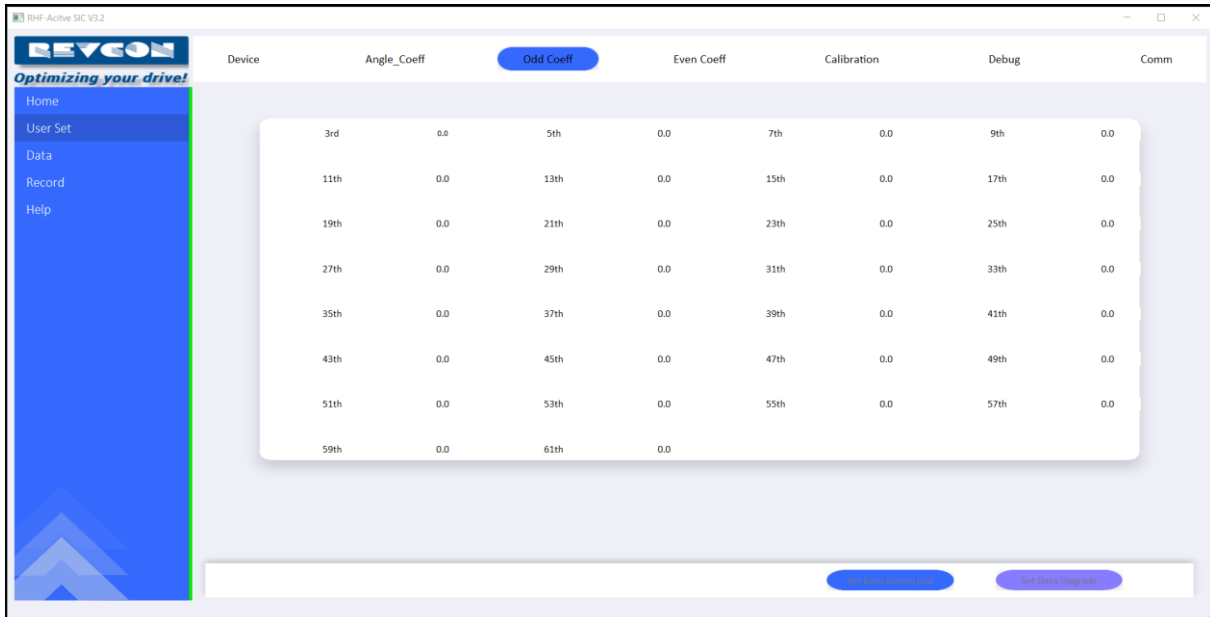
The angle coefficient of can compensate deviation of current transformers.

No.	Name	Description
1	Fundamental Angle	Set value range -99.99 to 99.99
2	Phase A Angle	Set value range -99.99 to 99.99
3	Phase B Angle	Set value range -99.99 to 99.99
4	Phase C Angle	Set value range -99.99 to 99.99
5	3 rd Angle	Set value range -99.99 to 99.99
6	5 th Angle	Set value range -99.99 to 99.99
7	7 th Angle	Set value range -99.99 to 99.99
8	9 th Angle	Set value range -99.99 to 99.99
9	11 th Angle	Set value range -99.99 to 99.99
10	13 rd Angle	Set value range -99.99 to 99.99
11	15 th Angle	Set value range -99.99 to 99.99
12	17 th Angle	Set value range -99.99 to 99.99
13	19 th Angle	Set value range -99.99 to 99.99
14	21 th Angle	Set value range -99.99 to 99.99
15	23 th Angle	Set value range -99.99 to 99.99
16	25 th Angle	Set value range -99.99 to 99.99

The default value is 0.

6. Supervision- and control software

6.2.4.3 Odd_Coeff



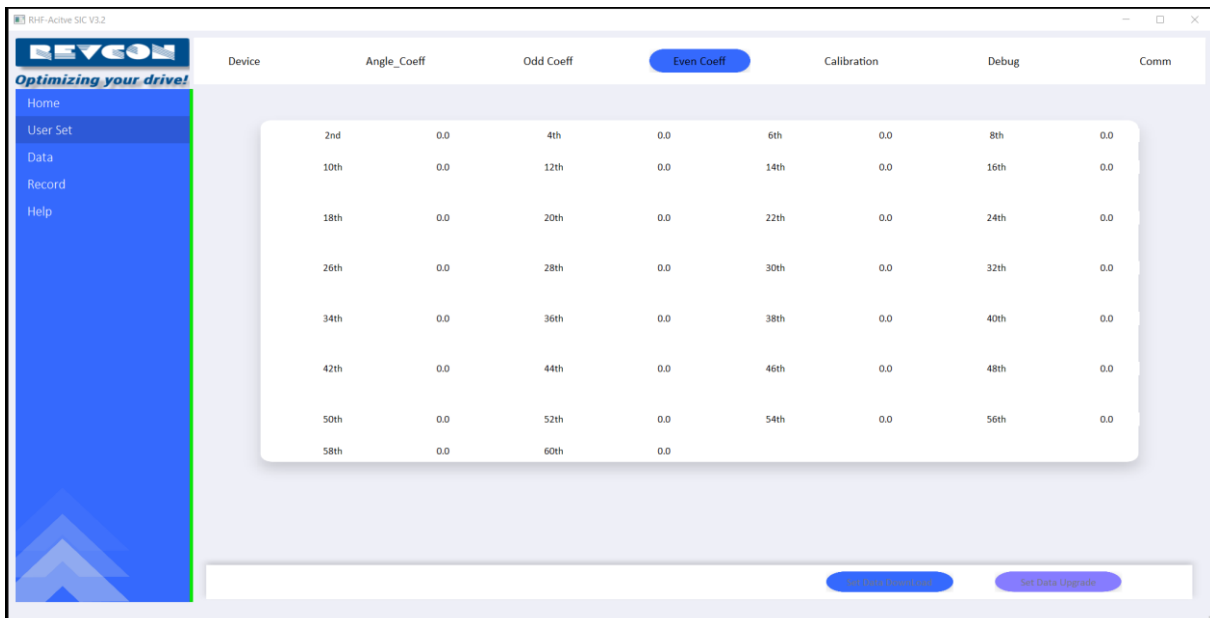
Order	Value	Order	Value	Order	Value	Order	Value
3rd	0.0	5th	0.0	7th	0.0	9th	0.0
11th	0.0	13th	0.0	15th	0.0	17th	0.0
19th	0.0	21th	0.0	23th	0.0	25th	0.0
27th	0.0	29th	0.0	31th	0.0	33th	0.0
35th	0.0	37th	0.0	39th	0.0	41th	0.0
43th	0.0	45th	0.0	47th	0.0	49th	0.0
51th	0.0	53th	0.0	55th	0.0	57th	0.0
59th	0.0	61th	0.0				

The odd coefficient can compensate characteristics of the grid on site:

No.	Name	Description
1-31	Compensation rate 1st – 59th	Set value range 0.01 to 1.0

The default value is 1.0.

6.2.4.4 Even_Coeff



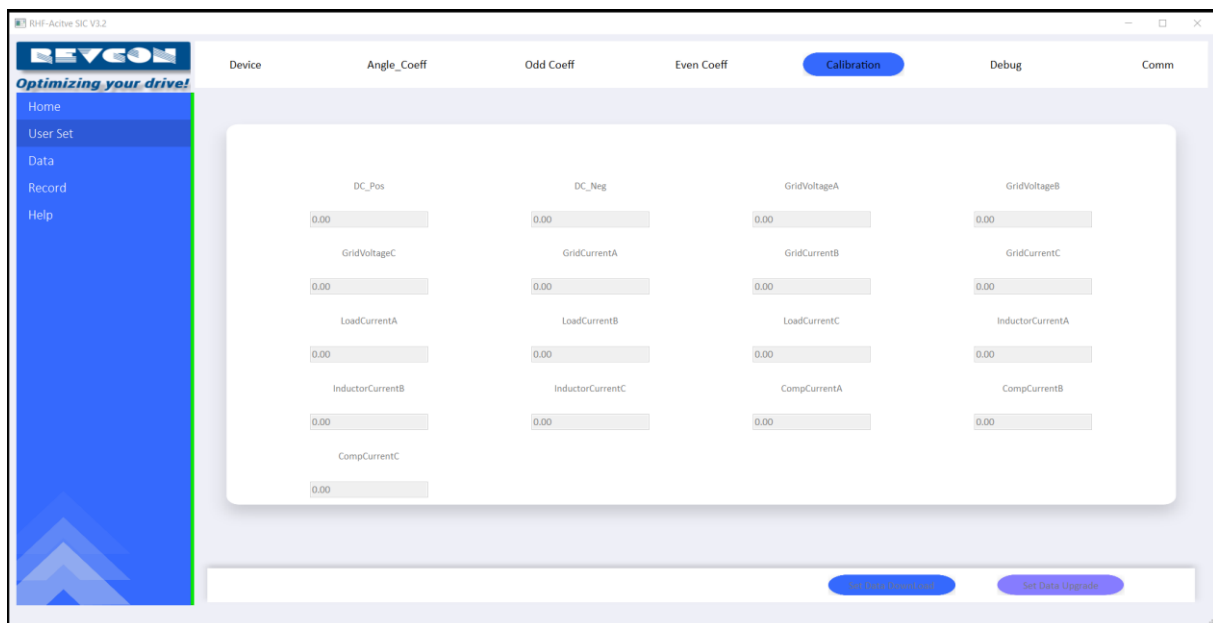
Order	Value	Order	Value	Order	Value	Order	Value
2nd	0.0	4th	0.0	6th	0.0	8th	0.0
10th	0.0	12th	0.0	14th	0.0	16th	0.0
18th	0.0	20th	0.0	22th	0.0	24th	0.0
26th	0.0	28th	0.0	30th	0.0	32th	0.0
34th	0.0	36th	0.0	38th	0.0	40th	0.0
42th	0.0	44th	0.0	46th	0.0	48th	0.0
50th	0.0	52th	0.0	54th	0.0	56th	0.0
58th	0.0	60th	0.0				

The even coefficient can compensate characteristics of the grid on site::

No.	Name	Description
1-30	Compensation rate 2nd – 60th	Set value range 0.01 to 1.0

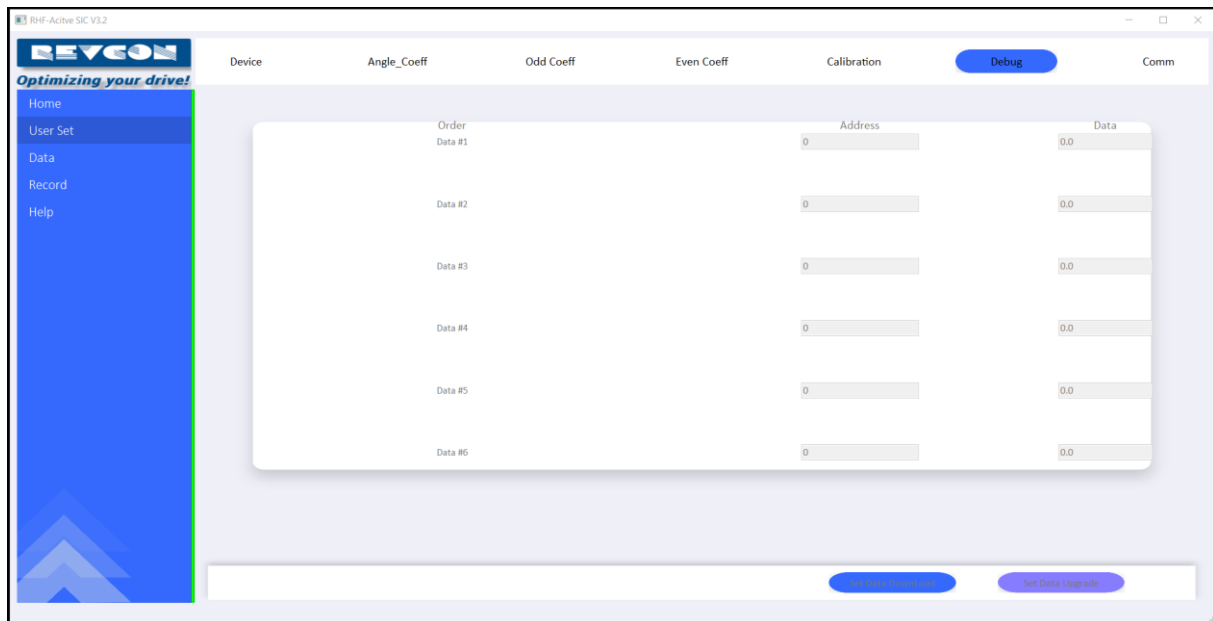
The default value is 1.0.

6.2.4.5 Calibration



This page defines the calibration of external and internal sensors (current and voltage transformers). This adjustment is done in factory and must not be changed without manufacturer's acknowledgment.

6.2.4.6 Debug



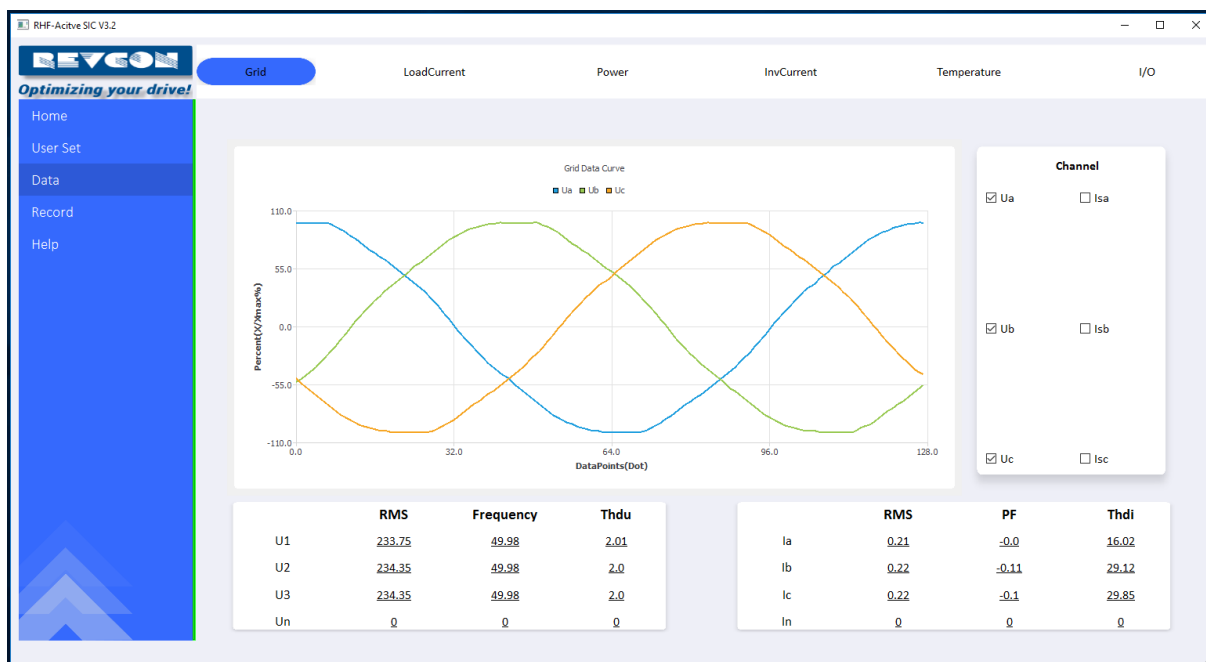
This page defines the internal variables of the RHF-Active (among other purposes for trouble shooting). This adjustment is done in factory and must not be changed without manufacturer's acknowledgment.

6.2.4.7 Communication Parameter

Refer to chapter 6.2.3.

6.2.5 Data

The “Data” pages show electrical values of the system. Based on the data from the “Home” page, also Voltage vs time and current vs. time are displayed.



6.2.6 Procedure to power on

1. Connect the RHF-Active with the PC
2. Adjust current transformer ratio, compensation rate, grid voltage, grid frequency etc. on pages „User Set”
3. Check that on page „Record” no errors or alarms are displayed. If there are, first clear the messages on page „Home“ by using „Clear Fault“ button.
4. Click at „Power on” on page „Home“.

7. Maintenance and check of hardware

7.1 What this chapter contains

This chapter contains instructions for predictive maintenance of the RHF-Active.

7.2 Periodicity of maintenance

When installed in an appropriate environment the RHF-Active required minimal maintenance. The recommended maintenance is listed below.

Check		Task	Method
Environment conditions		Check of ambient temperature, humidity, vibrations and for absence of dust, gas, oil mist and water drops	Optical check and measurment of the parameters
		Ensure that no tools or other potentially dangerous components have been placed nearby	Optical check
Voltage		Measure voltage in power and control circuits	Measurement with multimeter
Supply lines		Check of system and cabinet	Check for loosen screws
			Check of absence of sparks, damages, dark colour due to overheating or aging of isolation
			Ensure that no dust or dirt is present
Cooling system	Fan	Check for abnormal sound emission or vibrations	Optical check or estimation of operation time based on maintenance files
		Check for loosen screws	Fix screws
		Check of absence of dark colour due to overheating or aging	Optical check or estimation of operation time based on maintenance files
	Air duct	Check for debris in the cooling system	Optical check

8. Error description and repair

8. Error description and repair

8.1 What this chapter contains

This chapter describes known issues and their solving.

8.2 Typical errors and repairs

Error	cause	repair
RHF-Active wrong compensation (THDI rises)	Current transformer	Check wiring and polarity
	System settings	Check transformer ratio
RHF-Active insufficient compensation (THDI decreases but is higher than expected)	Phase angle	Setting the phase angle compensation with patience and carefully step by step, Trial and error iteration
	Low impedance	Low impedance of the connection result in very harmonic levels before compensation. It is highly recommended to install impedance as first counter measurement against harmonics (for Drives basically DC or AC chokes).
Error signal (red LED)	System settings	Check for first error than for second
No communication	Software settings	Improve baud rate and/or interface selection

9. Revcon

8.1 Revcon Product Overview

1. REVCON® RLD

Power feedback units for short time operation
(Crane systems, discontinuous centrifugal, etc.)

2. REVCON® RHD

Power feedback units for continuous operation
(Engine test beds, escalators, wind energy plants, elevators etc.)

3. REVCON® RFE

Power feed and feedback units for continuous operation
(Engine test beds, escalators, wind energy plants, elevators etc.)

4. REVCON® RSU

Step- up converter for the generation of a current controlled, high output voltage from a lower input DC voltage.

5. REVCON® RSD

Step- down converter for the generation of a decreased output voltage from a higher DC voltage (AC input is also possible).

- Voltage controlled: A free selectable output voltage in wide limits

The required output voltage can be adjusted by set-point (0 ... 10V)

- Current controlled: A lower output voltage that adjusts free in dependence of the load

The required output current can be adjusted by set-point (0 ... 10V)

6. REVCON® EDC

Power supply module for multiple motor applications (supply of multiple drive controllers) without generator- operation

7. REVCON® RHF-A/B

Revcon Passive Harmonic filter. Reduces the harmonic distortion of a drive to <5% or 10%

All products are available for 400V line voltage, the most also for 230V, 400V, 460V, 500V, 600V and 690V! According to the product power from 4 to 440kW can be transmitted, whereby the most products are appropriate for parallel connection, so that power ratings until the megawatt range can be achieved!

9.2 Revcon Contact

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