

CBM-20A

Current Booster Module 20A Installation and maintenance

LEROY-SOMER[™]

Nidec
All for dreams

Current Booster Module 20A

**This manual concerns the alternator AVR which you have just purchased.
We wish to draw your attention to the contents of this maintenance manual.**

SAFETY MEASURES

Before using your machine for the first time, it is important to read the whole of this installation and maintenance manual.

All necessary operations and interventions on this machine must be performed by a qualified technician.

Our technical support service will be pleased to provide any additional information you may require.

The various operations described in this manual are accompanied by recommendations or symbols to alert the user to potential risks of accidents. It is vital that you understand and take notice of the following warning symbols.

WARNING

Warning symbol for an operation capable of damaging or destroying the machine or surrounding equipment.



Warning symbol for general danger to personnel.



Warning symbol for electrical danger to personnel.



All servicing or repair operations performed on the AVR should be undertaken by personnel trained in the commissioning, servicing and maintenance of electrical and mechanical components.

WARNING

This AVR can be incorporated in a EC-marked machine.

This manual is to be given to the end user.

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Share Capital: 32,239,235 €, RCS Angoulême 338 567 258.

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0. TERMS AND EXPRESSIONS

CT Current transformer, used as source of power in this case (“booster CTs”)

AVR Automatic voltage regulator

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1. GENERAL INSTRUCTIONS

1.1. Identity card

This current booster module has been designed and made by:

NIDEC - LEROY SOMER

Boulevard Marcelin LEROY

16000 ANGOULEME

France

Internal LEROY-SOMER reference: 40071747

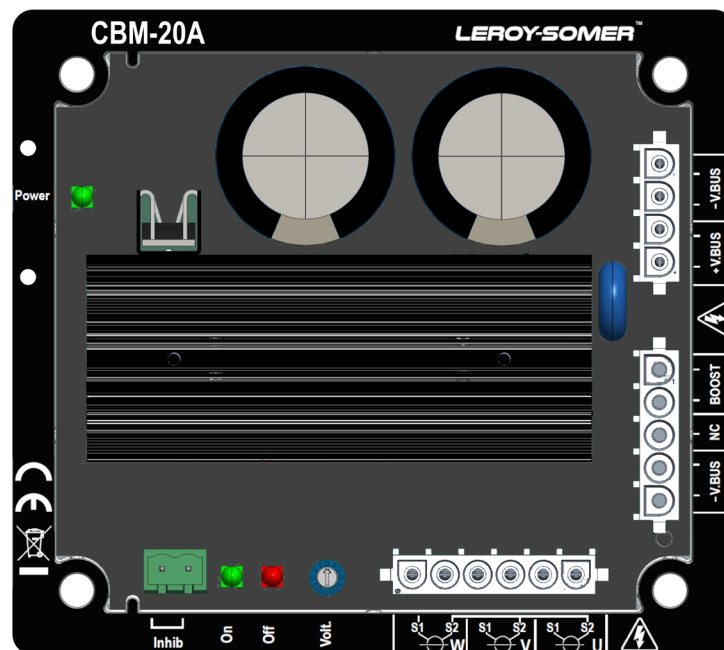
1.2. General overview

This manual describes the instructions for installation, use, setup, and maintenance of the Current Booster Module 20A.

The purpose of this module is to generate a DC power supply produced with one or three current transformers to feed the power stage of a D550 or a D700 automatic voltage regulator (AVR). The AVR will regulate the field current delivered to the generator.

This module is designed for mounting in a generator terminal box or a control cabinet. It must be installed in compliance with local protection and safety standards. This module embeds power components that request to be refreshed with natural convective air flow. Thus, the product must be placed with enough space around the heat sink in order to have sufficient cooling.

This module takes the form of a compact unit with a set of connectors, potentiometer, and LEDs on the front.



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It consists of several function blocks:

- A power bridge (that transforms the current from current transformers to DC power supply)
- A set of connectors
- A set of LEDs to indicate the running state of the module
- A potentiometer to set the voltage level delivered by the module
- An external input, available on a 2-pin connector, allows to inhibit the module action and to deliver a reduced voltage of 40VDC

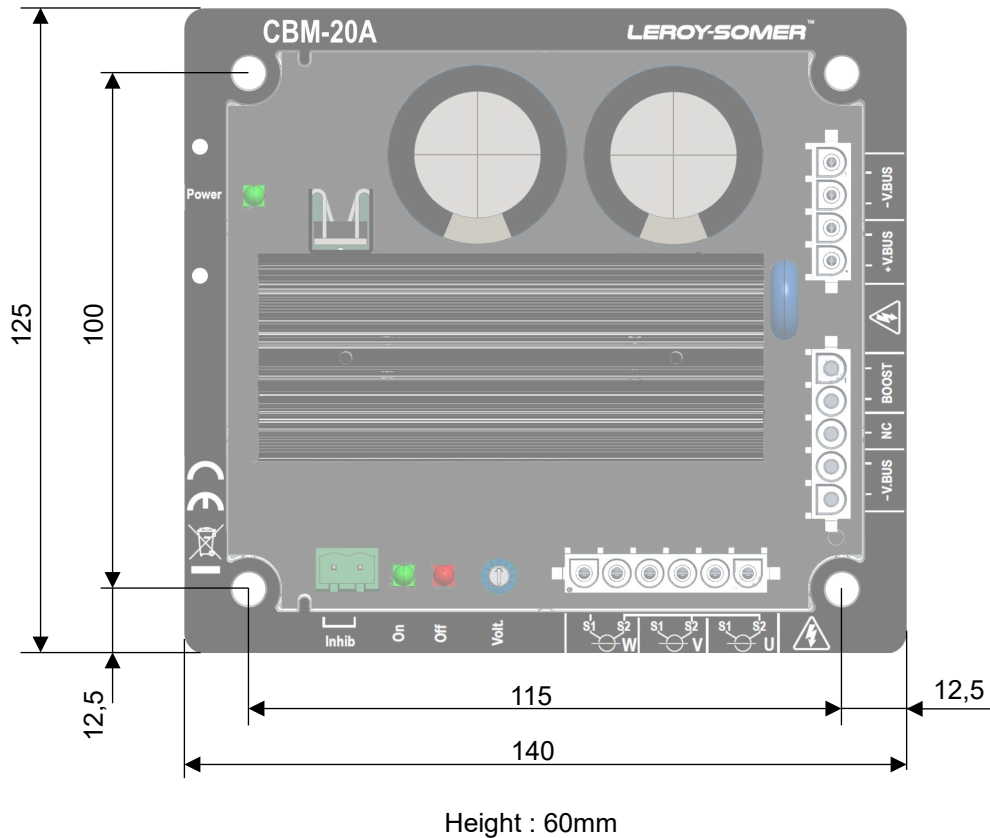
Note : this module cannot be the primary source of supply of the AVR. Its action is dependent to the current delivered by the booster CTs implemented in the generator. Another source of power supply must be wired on the AVR in order to deliver excitation when there is no load applied on the alternator.

1.3. Operating values

- **Booster Current transformers input:**
 - 1, 2 or 3 phases: 0 - 5A
 - Frequency: 30 – 400Hz
- **Power supply output:**
 - Continuous voltage: ~40 - 400VDC (level set by a potentiometer)
 - Current: 0 – 20A (10 seconds) according to CTs performances
- **Environment:** mounted in a cabinet or alternator terminal box
 - Operating conditions: ambient temperature from -40°C to +70°C, relative humidity less than 95%, non-condensing
 - Storage conditions: ambient temperature from -55°C to +85°C, relative humidity less than 95%, non-condensing
 - Vibration: 2.0 Hz to 25 Hz – amplitude ± 1.6 mm; 25 Hz to 100 Hz – acceleration ± 4.0 g
- **Weight:** 580g
- **Conformity to standards:**
 - Safety: IEC 61010-1 (CAT III, Pol. 2)

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- **Dimensions:**



The module must be mounted on a mechanical part on the terminal box or the cabinet with 4xM5 screws and the nominal screwing torque is 2.5 N.m.

When mounting the AVR and booster module in a cabinet, it must be positioned to allow air to circulate freely in the heatsink and around the product. For best cooling performance it is therefore recommended that the module must be mounted vertically at the base of the cabinet so that the heatsink is positioned vertically.

1.4. Safety devices and general warning symbols

It is essential to comply with the power connection diagrams recommended in this manual.

The current booster module includes devices which, in the event of problems, can deliver a voltage above 400VDC and damage the AVR connected. The generator itself can also become jammed for mechanical reasons. Finally, voltage fluctuations or power cuts may also cause the unit to stop.

The Current booster module is designed to be integrated in an installation or electrical machine and can under no circumstances be considered of a safety device.

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It is therefore the responsibility of the machine manufacturer, the designer of the installation or the user to take all necessary precautions to ensure that the system complies with current standards, and to provide any devices required to ensure the safety of the equipment and people (especially direct contact with connectors when the AVR is running).

NIDEC LEROY-SOMER declines all responsibility in the event of the above recommendations not being observed.

The various interventions described in this manual are accompanied by recommendations or symbols to alert the user to potential risks of accidents. It is vital that you understand and comply with the various warning symbols below:

- Throughout the manual, this symbol warns against consequences which may arise from inappropriate use of the AVR, since electrical risks may lead to material or physical damage as well as constituting a fire hazard.



- This symbol warns of Electrical danger to personnel:



1.5. General information

The current booster module may contain unprotected live parts, as well as hot surfaces, during operation. Unjustified removal of protection devices, incorrect use, faulty installation, or inappropriate operation could represent a serious risk to personnel and equipment.

For further information, consult technical support.

All work relating to transportation, installation, commissioning, and maintenance must be performed by experienced, qualified personnel (see IEC 364, CENELEC HD 384 or DIN VDE 0100, as well as national specifications for installation and accident prevention).

In these basic safety instructions, qualified personnel mean persons competent to install, mount, commission and operate the product and possessing the relevant qualifications.

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1.6. Use

Current booster module is a component designed for integration in installations or electrical machines.

When integrated in a machine, commissioning must not take place until it has been verified that the machine complies with directive 2006/42/EC (Machinery Directive). It is also necessary to comply with standard EN 60204, which stipulates that electrical actuators (which include voltage regulators) cannot be considered as circuit-breaking devices and certainly not as isolating switches.

The current booster module meets the requirements of the Low Voltage Directive 2014/35/EU. The harmonized standards of the DIN VDE 0160 series in connection with standard VDE 0660, part 500 and EN 60146/VDE 0558 are also applicable.

The technical characteristics and instructions concerning the connection conditions specified on the nameplate and in the documentation provided must be observed without fail.

1.7. Transportation and storage

All instructions concerning transportation, storage and correct handling must be observed.

The climatic conditions specified in this manual must be observed.

1.8. Installation

The installation and cooling of equipment must comply with the specifications in the documentation supplied with the product.

The current booster module must be protected against excessive stress. There must be no damage to parts and/or modification of the clearance between components during transportation and handling. Avoid touching the electronic components and any live parts.

The current booster module contains parts which are sensitive to electrostatic stress and may be easily damaged if handled incorrectly. Electrical components must not be exposed to mechanical damage or destruction (risks to health!). Consult technical support if you have any doubts concerning the product.

1.9. Electrical connections

When work is performed on current booster module which are powered up, national accident prevention specifications must be respected.

The electrical installation must comply with the relevant specifications (for example conductor cross-sections, protection via fused circuit-breaker, or/and connection of protective conductor). More detailed information is given in this manual.

Instructions for an installation which meets the requirements for electromagnetic compatibility, such as screening, earthing, presence of filters and correct insertion of cables and conductors, are also given in this manual. These instructions must be followed in all cases, even if the AVR carries the CE mark. Adherence to the limits given in the EMC legislation is the responsibility of the manufacturer of the installation or the machine.

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For EU application: Instrument transformers shall provide basic insulation according to the requirements of IEC 61869-1, "Instrument transformers – Part 1: General requirements" and IEC 61869-2, "Additional requirements for current transformers"

For US application: Instrument transformers shall provide basic insulation according to the requirements of IEEE C57.13, "Requirements for Instrument Transformers," and IEEE C57.13.2, "Conformance Test Procedure for Instrument Transformers."

1.10. Operation

Installations incorporating current booster module must be fitted with additional protection and monitoring devices as laid down in the current relevant safety regulations: law on technical equipment, accident prevention regulations, etc. Modifications to the current booster module using the potentiometer or the inhibition connector are permitted. Active parts of the device and live power connections must not be touched immediately after the current booster module is powered down, as the capacitors may still be charged. In view of this, the warnings fixed to the voltage regulators must be observed.

During operation, all doors and protective covers must be kept closed.

1.11. Service and maintenance

Refer to the manufacturer's documentation.

Our technical support service will be pleased to provide you with any additional information you may require.

This manual is to be given to the end user.

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2. MOUNTING AND CONNECTION INSTRUCTIONS

2.1. Layout of the space housing of the module

Dimension: see chapter 1.3 Operating values.

The product must be placed with enough space around the heat sink in order to have sufficient cooling.



When mounting the BOOSTER in a cabinet, it must be positioned to allow air to circulate freely in the heatsink and around the product. It is therefore recommended that the BOOSTER is mounted at the base of the cabinet in order that the heatsink will be positioned vertically.

Ventilation, cooling or even heating system may be needed to keep the BOOSTER within the environmental limits described earlier.

Note: If you wish to integrate components which do not comply with the above minimum prerequisites, please consult technical support.

2.2. Warning symbols for the installation

See section 1.4.



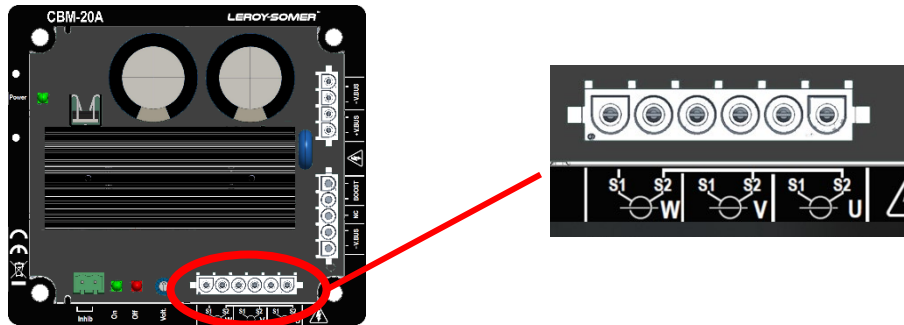
While the alternator is running, do not unplug any connectors or make any wiring modifications, as this may lead to electric shock and/or destruction of the module or the AVR and/or damage to the alternator.

2.3. Connections

The module must be connected to booster CTs and the AVR to perform its regulation function.

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- **Booster current transformers :**

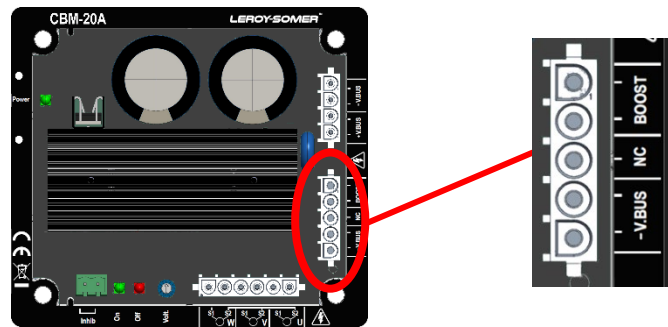


The booster CTs are mandatory to produce the voltage at the output of the module. It's possible to implement one, two or three CTs. The "S2" terminal is an internal common point for all of them. This "S2" can be referenced to the earth.

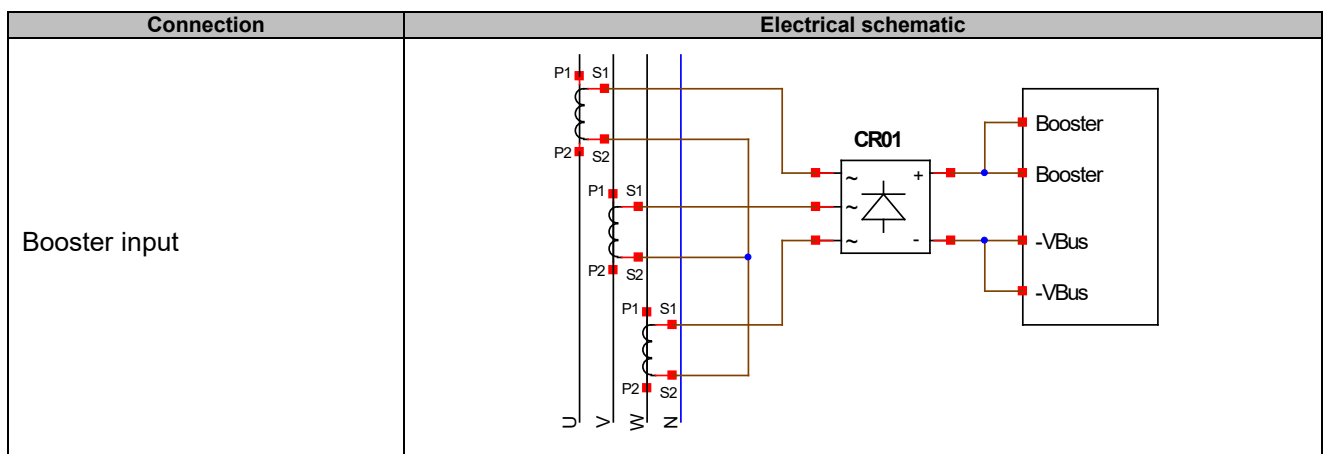
Connection	Electrical schematic	
1 phase		<p>Represented with a CT on phase "V", but it can be on phase "U" or "W".</p> <p>Careful: the wiring must be done between two "S1" terminals (S2 are only in start connection together).</p>
2 phases		<p>Represented with CTs on phase "U" and "V", but it can be on phase "U" and "W" or "V" and "W".</p>
3 phases		

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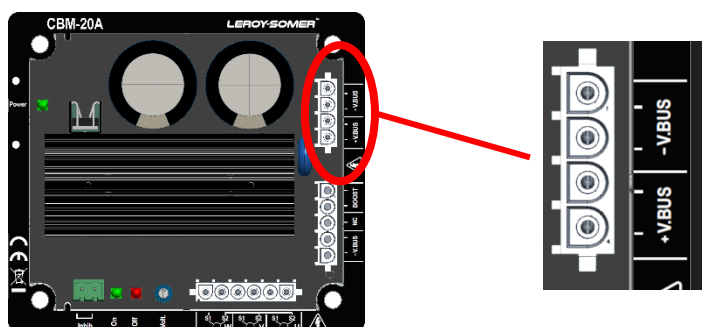
- -VBus / Boost voltage input



This connector can be used for generators already equipped with diode bridges (and eventually isolating CTs).



- -VBus / +VBus voltage output



This connector delivers the full voltage available at the output of the module. This voltage level is settable between 40VDC and 400VDC according to the position of the potentiometer.

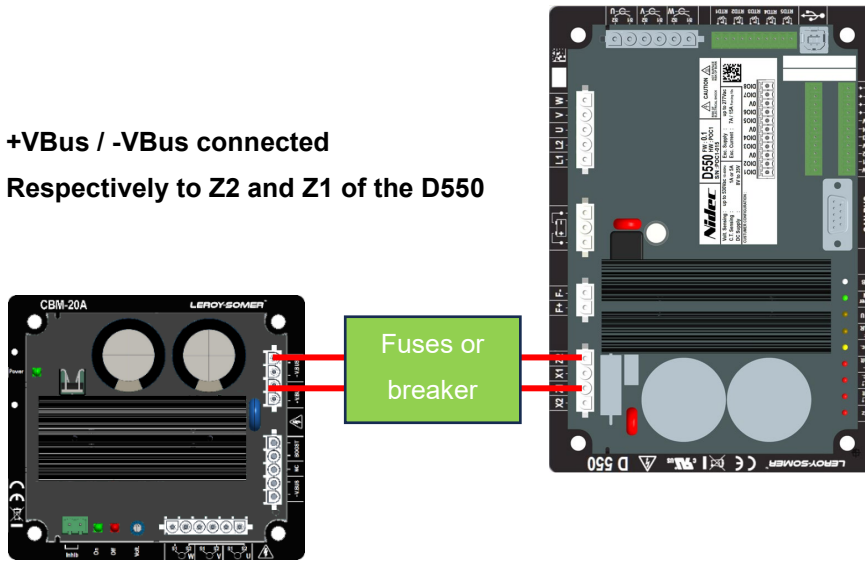
Contacts are doubled to deliver the 20A as each contact is sized for 10A.

To protect the AVR power input and the module, please refer to the AVR documentation. Below schematics are represented with a breaker.

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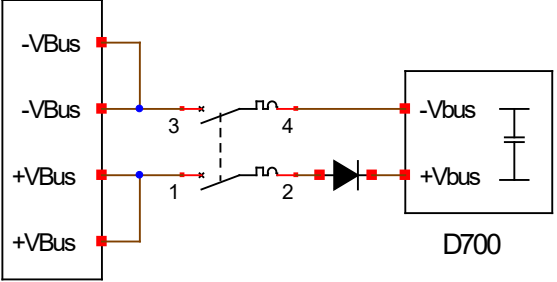
This connector can be wired directly at the power input of the AVR. Below an example with the D550:

**+VBus / -VBus connected
Respectively to Z2 and Z1 of the D550**

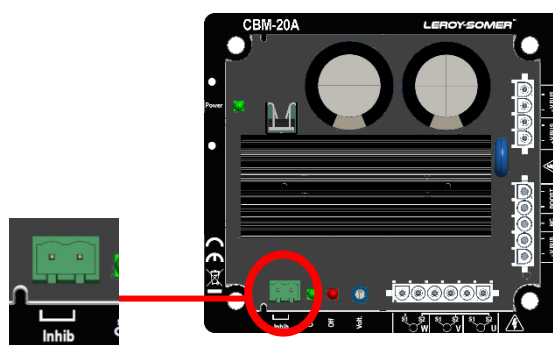


Connection	Electrical schematic	
<p>Booster module and D550</p>	<p>Booster module</p> <p>D550</p>	<p>Represented connected on “Z1” and “Z2” terminals but it can be either on “X1”, “X2”.</p>
<p>Booster module and D700</p>	<p>Booster module</p> <p>D700</p>	<p>Represented connected on “Z1” and “Z2” terminals but it can be either on “X1”, “X2”. Wires can be doubled as the D700 power stage input is 20A.</p>

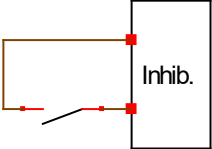
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Connection	Electrical schematic
	 <p data-bbox="576 600 751 629">Booster module</p> <p data-bbox="576 658 1401 687">The booster module can be also wired directly on the DC power input.</p>

- Inhibition contact



On this connector can be wired a dry contact with insulation 300V CAT II to reduce the voltage delivered by the module at 40VDC

Connection	Electrical schematic
Inhibition contact	

2.4. Wiring precautions

Maximum cross section of the wires for the connectors is 2.5mm².

The cable length must never exceed 100m. To ensure respect of standards IEC 61000-6-2, IEC 61000-6-4, IEC 60255-26, shielded cables are imperative in case of a D550 installed outside of the terminal box.

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To ensure that the booster current module will deliver the expected current, the total ohmic value of the power system cables must not exceed 5% of the exciter resistance, regardless of the cable length.

For information, the resistance at 20°C in milliohms by meter for copper cables is approximately:

Cross-section (mm ²)	Resistance (mΩ/m)
1.5	13.3
2.5	7.98
4	4.95
6	3.3
10	1.91

Example:

- Exciter resistance = 10 ohms
- Maximum cable resistance = 5% of 10 ohms = 0.5 ohms (2x0.25 ohms)
- Cross-section according to the distance between the AVR and generator would be:

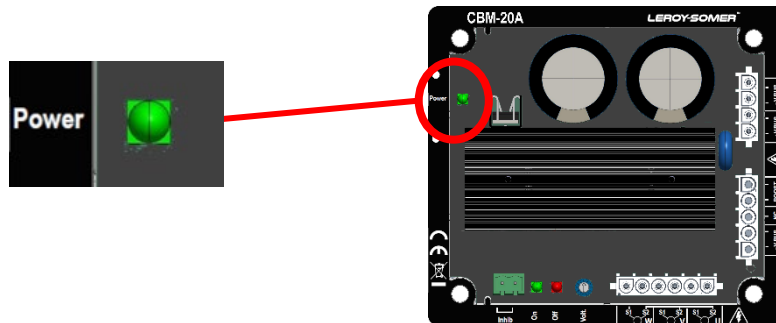
Distance (m)	Cross-section (mm ²)
30	2.5
50	4
75	6
100	10

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3. DESCRIPTION OF THE RUNNING

When the generator is running with load, the booster CTs will deliver current to the booster module.

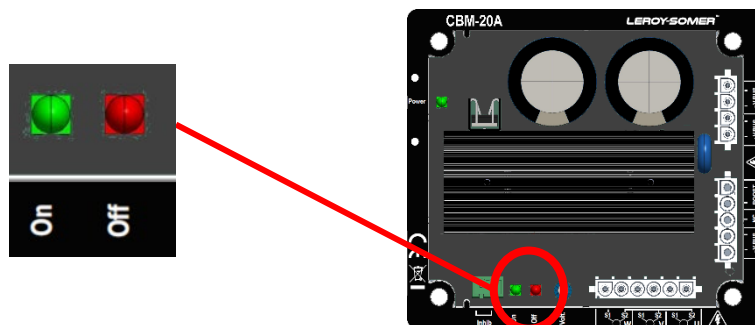
With this current, the module will create its own internal supply for electronic command circuits. When this supply is running correctly, the green "Power" LED is lit.



This internal supply allows to start the regulation loop to deliver at the output of the module the voltage expected.

Two LEDs indicate the behavior of the power module. They quickly blink during all the running according to the power required by the AVR and the excitation:

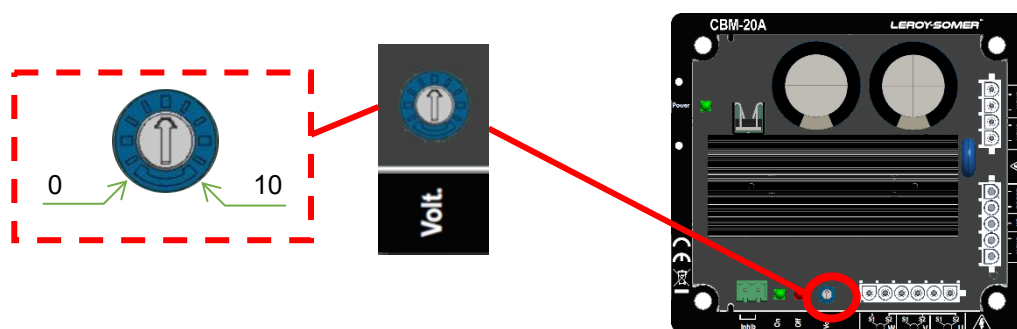
- Green "On" LED is lit when the booster CTs are shunted
- Red "Off" LED is lit when the booster CTs are used to charge the capacitors



The voltage level delivered by the module can be set by the potentiometer located on the product (with inhibit contact open):

- Position "0" of the potentiometer set the minimum of the voltage and correspond to about 150VDC
- Position "10" of the potentiometer set the maximum of the voltage. According to the booster CTs it can be more than 400VDC

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Take care to the output voltage setpoint of the module. If this voltage is too high, it could damage the module itself, the AVR, and then induce damages on the alternator.

A contact can be wired on "Inhib" connector to stop the voltage delivered by the module. This contact can be used to stop the excitation on the generator which have not a digital input to start/stop the excitation.

Note: This contact is not a safety contact.

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4. SETTINGS

4.1. Important reminder

The booster module cannot be the only source of power supply of the excitation (it's acting only if there is a load on the generator and then a current delivered by the booster CTs). Another source of power supply must ensure the excitation of the generator at no load.

4.2. Before starting

Before starting the settings, the value of the ceiling excitation voltage expected on the generator must be known: the output voltage setpoint must be higher than this value and lower than 400VDC. If the wires have been correctly sized, the loss in the cables between the module and the AVR can be neglected.

Example :

- Exciter resistance = 5 ohms
- Field current at ceiling (according to technical datasheet of the generator) = 12A
- Voltage setpoint must be higher than: $12 * 5 = 60\text{VDC}$

Note: Exciter resistance value must be estimated when the generator is at its heating temperature.

4.3. Setting steps



A multimeter is necessary to ensure correct settings.

- **Step 1:** Control the correct wiring between the module and the AVR
- **Step 2:** Set the potentiometer at "0"
- **Step 3:** Start the generator at its rated speed and excite it using the AVR at its rated voltage.
 - At no load, no current is delivered by the booster CTs, the "Power" LED of the module is switched off.
 - As soon as load is applied on the generator, booster CTs will deliver current, transformed by the module in a DC voltage.
- **Step 4:** Control with a multimeter on terminals "+VBus / -VBus" that the voltage is around 150VDC. The LEDs "on" and "off" are blinking according to the current delivered by the booster CTs and the voltage of the second source of excitation : If the voltage at the output "+VBus / -VBus" is lower (150VDC) than the other source of supply, the "On" LED (green) is more lit than the "Off" LED (red).
- **Step 5 :** Increase the position of potentiometer of the module to reach the expected value at "-VBus / +VBus" terminals. The LEDs "On" and "Off" are blinking.

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5. MAINTENANCE INSTRUCTIONS

5.1. Warning symbols for maintenance



See section safety chapter 1.4.

Preventive maintenance on the current booster module should be performed with the alternator stopped, and all power sources switched off and isolated.

5.2. Preventive maintenance instructions

During phases of alternator downtime for preventive maintenance, check that the wires are tight in the connectors, blow dry air through to get rid of any dust that may have settled on and around the module. Special care should be taken to ensure free circulation of air around the aluminum heatsink at the back of the device.

5.3. Anomalies and incidents

Several anomalies can occur on the module, which may result in it being replaced. These faults are listed in the table below.

ANOMALIES	CAUSES	REMEDIES	RESTARTING
No voltage at the output	Bad wiring of the booster CTs	Control the wiring and that connectors are correctly inserted	Restart the generator and control the output voltage
	Inhibit contact is closed	Open the contact	Control the output voltage
	Module power transistor short-circuited.	Replace the module.	Do the setting procedure in chapter "4 SETTINGS "
	Module internal power supply fault	Replace the module.	Do the setting procedure in chapter "4 SETTINGS "

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6. SPARE PARTS

References for the connectors to wire the module:

ROLE	DESCRIPTION	CODE
Current transformers input	Connector 6 pins 10A male	CNX 006 CO 009
Booster / -VBus input	Connector 5 pins 10A male	CNX 005 CO 049
-VBus / +VBus output	Connector 4 pins 10A male	CNX 005 CO 029
Contact	Pin (wire cross section 1.5mm ²)	CNX 002 NZ 006
Inhibit contact	Connector 2 pins male	40071675

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7. RECYCLING INSTRUCTIONS

NIDEC LEROY-SOMER is committed to minimizing the environmental impacts of its manufacturing operations and of its products throughout their life cycle. To this end, we operate an Environmental Management System (EMS) which is certified to the International Standard ISO 14001.

The current booster modules manufactured by NIDEC LEROY-SOMER have the potential to save energy and (through increased machine/process efficiency) reduce raw material consumption and scrap throughout their long working lifetime. In typical applications, these positive environmental effects far outweigh the negative impacts of product manufacture and end-of-life disposal.

Nevertheless, when the products eventually reach the end of their useful life, they must not be discarded but should instead be recycled by a specialist recycler of electronic equipment. Recyclers will find the products easy to dismantle into their major component parts for efficient recycling. Many parts snap together and can be separated without the use of tools, while other parts are secured with conventional fasteners. Virtually all parts of the product are suitable for recycling.

Product packaging is of good quality and can be re-used. Large products are packed in wooden crates; while smaller products come in strong cardboard cartons which themselves have high recycled fiber content. If not re-used, these containers can be recycled. Polythene, used on the protective film and bags for wrapping product, can be recycled in the same way. When you will be preparing to recycle or dispose of any product or packaging, please observe local legislation and best practice.

Service & Support

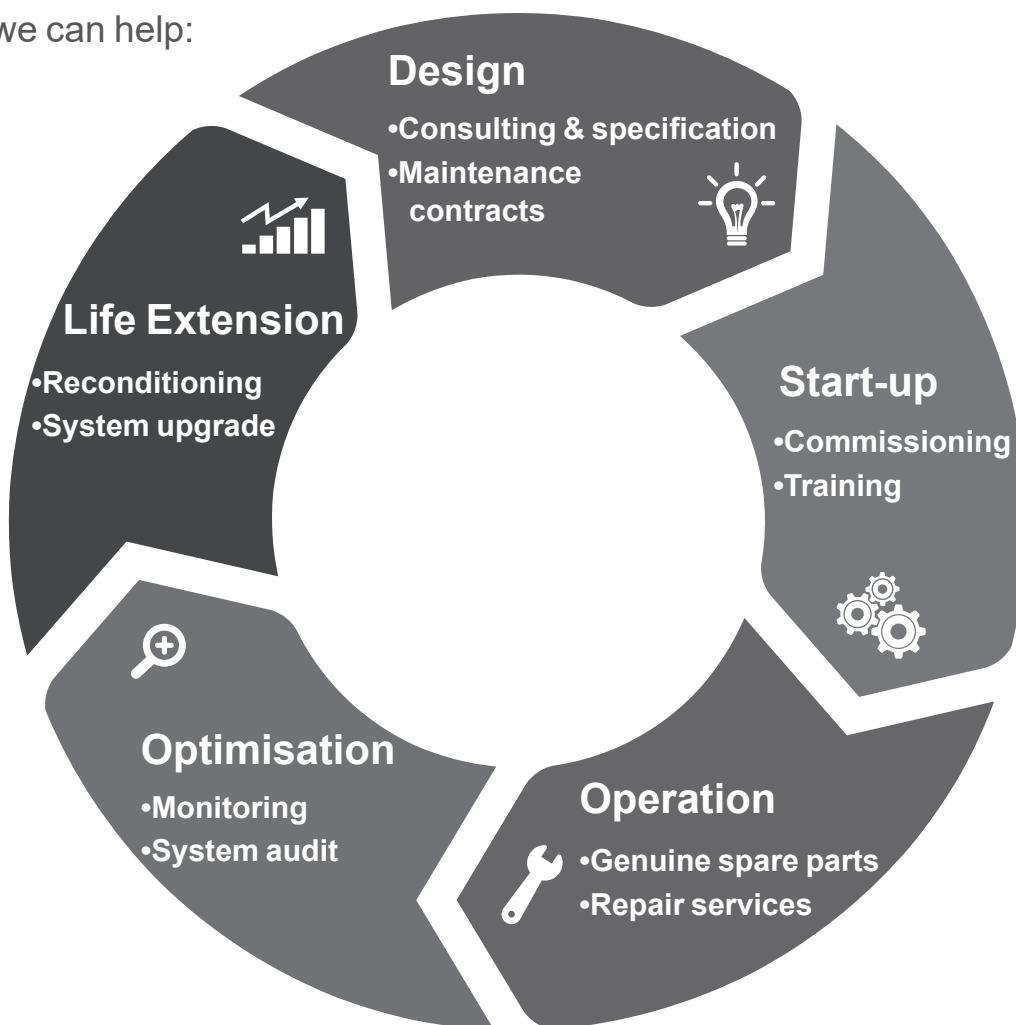
Our worldwide service network of over 80 facilities is at your service.

This local presence is our guarantee for fast and efficient repair, support and maintenance services.

Trust your alternator maintenance and support to electric power generation experts. Our field personnel are 100% qualified and fully trained to operate in all environments and on all machine types.

We have a deep understanding of alternator operation, providing the best value service to optimise your cost of ownership.

Where we can help:



Contact us:

Americas: +1 (507) 625 4011

EMEA: +33 238 609 908

Asia Pacific: +65 6250 8488

China: +86 591 8837 3010

India: +91 806 726 4867



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