

DCREG

AC/DC Converter for
DC Motors and Electromagnet Applications

DCREG4.350 Model



(picture is for illustration purposes only)

The devices of the DCREG series, manufactured in Italy by Enertronica Santerno, are AC/DC converters implementing fully digital control system. The DCREG converters fit:

- the armature and field supply of direct current motors to enable the speed or torque control. The DCREG4 operates in four quadrants, while the DCREG2 operates in two quadrants.
- The DCREG devices can be used to supply and regulate voltage for very inductive loads, such as electromagnets.

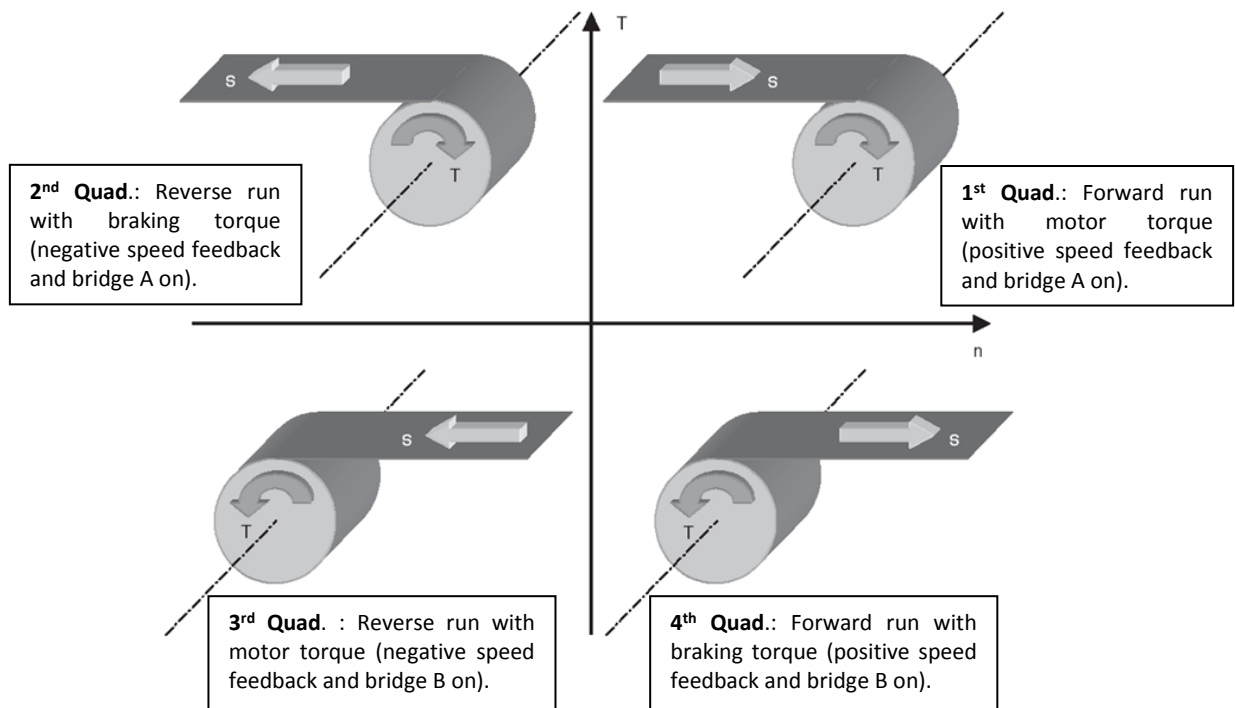
HIGHLIGHTS

- Product ratings ranging from 10A to 4500A (2.4 kW ~ 3200kW)
- Wide range of supply voltage levels, from 200VAC to 690VAC, 3ph, 50-60Hz
- DCREG2: Unidirectional, regenerative, 2-quadrant
- DCREG4: Bidirectional, regenerative, 4-quadrant
- Easy commissioning thanks to:
 - Self-calibration of current and speed
 - Self-calibration of field
 - Insensitivity to phase sequence
- Overload up to 150% In for 60s
- Field regulator, economy and field boost functionality
- Predictive control, increases the dynamic response of the motor
- Feedback from tacho generator, from encoder and armature
- Automatic switching of the armature feedback in the event of breakdown of tachometer/encoder (safer operation)
- Integrated control for magnet feeding applications
- Control of step current limit or hyperbolic current limit
- High accuracy level of $\pm 0.1\%$ of rated speed following:
 - Load variations up to 100% of the rated torque.
 - Root mean square variations of the supply voltage of +10/-15% (or higher, depending on each case) with respect to the rated value.
 - Temperature variations of $\pm 10^{\circ}\text{C}$.
- Integrated multimeter
- Speed multiramps, "S" ramps, double speed loop regulator, JOG Control, 7 programmable speed levels
- RS485 serial communication interface (optional)
- Degree of protection: IP00 (IP20 with optional protections)
- In compliance with EMC EN61800-3/IEC1800-3 second environment (industrial environment) with no auxiliary filters.
- Global standard compliance: CE, UL (up to DCREGX.350 model), EAC
- Thorough manufacture with first class materials, fully Made in Italy

DCREG – General description

Operating features

- DCREG4: operation and total reversibility in the four quadrants: may operate as a motor or a brake towards both directions of rotation. Speed or torque control system.
 - DCREG2: operation as a motor in the 1st quadrant with speed or torque control system. May operate as a brake in the 2nd quadrant with speed or torque control system.
- In both drive versions, each quadrant may be individually enabled or disabled. Possibility of operation with constant available maximum torque / power through an internal field regulator.



Control

- With feedback double loop, inner adjustment for the current control and external adjustment for the voltage / speed control.
- Two micro controllers: one of them is designed to perform the current loop and offers the possibility to choose between a PI-type regulator or a predictive algorithm to achieve a more dynamic response.
- Adaptive speed regulator and automatically variable parameters according to the speed error.
- DCREG2 and DCREG4 converters can be used to supply very inductive loads, such as electromagnets. Application problems due to this type of load - that can be compared to an ohmic resistance series connected to a very strong inductance - have been solved by a control algorithm specially developed for DCREG converters.

Supply - Control section

From 380...500Vac single-phase alternating voltage (or 200...240Vac on request), taken directly from the power supply three-phase voltage, not necessarily in phase with it. Alternatively, with 24Vdc direct voltage, with no hardware adjustment.

Supply - Armature section

From three-phase alternate mains or a 10...440Vac, 500Vac, 600Vac or 690Vac generator unit. Frequency is 50/60Hz. Phase sequence insensitiveness of power phases.

Supply - Field regulator

From 200...500Vac single-phase alternate voltage. Supply frequency is 50/60 Hz.

Air –cooling

Natural with vertical airflow up to DCREG.40, forced ventilation from the DCREG.70 version on. Possibility of THROUGH PANEL assembly for all sizes.

DCREG – Input/Output signals**Analog I/Os**

- N. 4 Ref. $\pm$ inputs (10VDC) including 2 configurable 0-20mA (13bit) inputs
Possibility of application of Bias, Gain, Polarity, Reverse operators. Minimum speed function available by request.
- N. 4 configurable analogue outputs including 2 configurable 0-20mA (12bit) outputs
Possibility of application of Bias, Gain, Polarity operators. *V Out* voltage signal proportional to the motor running speed. *I Out* current signal proportional to the supplied armature current (double polarity or positive single polarity only).

Digital I/Os

- N. 8 digital inputs including N.6 fully configurable inputs
All inputs are optoinsulated and PLC-controllable by way of PNP static outputs.
- N. 5 configurable relay digital outputs
The following functions may be programmed for the digital outputs: energizing delay, de-energizing delay, positive or negative logic, hysteresis.

Other signals

- Encoder inputs: Line Drive 5VDC-15VDC, Push-Pull, NPN, NPN Open Collector, 5VDC-24VDC, maximum frequency: 102.4kHz
- Tacho generator input
- Isolated 24VDC output (200mA) for digital inputs or encoder
- Isolated 5VDC output (160mA) for encoder
- Isolated $\pm$ 10VDC output (10mA) for potentiometer

Main features				
Model	DCREG4.350			
Size	1			
Integrated EMC filter	Compliance with EMC EN61800-3 2nd environment, EN55011 gr.2 class A (industrial environment) with no auxiliary filters. (additional filters on request)			
Degree of protection	IP00			
Operating temperature range	0 ÷ 50°C			
Max. operating temperature without derating ⁽¹⁾	40°C			
Storage temperature range	-20 ÷ 60 °C			
Max. operating altitude ⁽²⁾	2000 m a.s.l.			
Input Ratings				
Input frequency	50/60 Hz (±20%)			
Supply voltage – Control section	380...500 Vac single-phase (-20%, +10%) or 24 Vdc (-10%, +15%)			
Max. Supply voltage – Armature section ⁽³⁾	440Vac / 500Vac / 600Vac / 690Vac			
Supply voltage – Field section	200..500Vac			
Output Ratings				
Armature output voltage (depends on the input supply voltage)	Input 440Vac 460 Vdc max	Input 500Vac 520 Vdc max	Input 600Vac 630 Vdc max	Input 690Vac 720 Vdc max
Armature nominal current (I _{ARM NOM})	350 A			
Field output voltage	425 Vdc max (500 Vin)			
Field nominal current ⁽⁴⁾	15 A			
Motor current for overload (I _{MOT})	350 A			
Overload percentage (k factor)	Up to 150%			

NOTE

⁽¹⁾ Apply 2% derating of the rated current per degree over the max. operating temperature but not exceeding 50°C.

⁽²⁾ Up to 1000m without derating, apply derating of the rated current by 1% every 100m up to 2000m. Above 2000m up to 4000m only on request.

⁽³⁾ Armature supply voltage must be specified when ordering the equipment.

⁽⁴⁾ By request, Enertronica Santerno can provide drives of any size with a field rated current different than the standard value.

Dimensions and weight	
Converter dimensions (WxHxD)	214x440x264 mm
Converter weight	19 kg
Additional information	
Dissipated power at rated current	1050 W
Display	Optional
Maximum value for relative humidity	90% non-condensing
Cooling system	Forced air-cooling
Communication	Optional RS232/RS485 interface Other protocols available on request

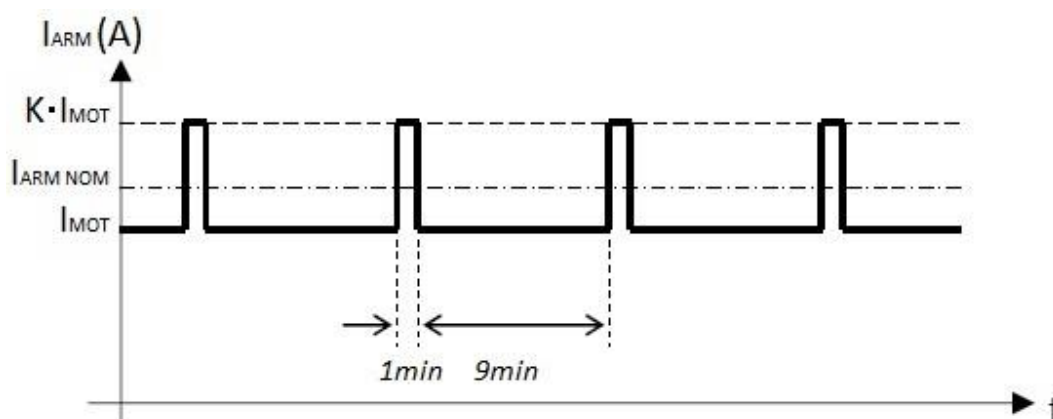
DCREG – Overload capacity

The DCREG also allows setting timeout overlimits (1 min every 10 min) up to 150 % of the converter rated current. It can be performed with a 1:10 duty-cycle.

Repetitive overload cycle:

$$\begin{aligned}
 I &= k \cdot I_{MOT} && \text{for 1m} \\
 I &= I_{MOT} && \text{for 9m @ } T = 40^{\circ}\text{C (room temperature)}
 \end{aligned}$$

available after operating at a motor current lower than or equal to the armature nominal current $I_{ARM\ NOM}$ for a period sufficient for temperature stabilization.



DCREG Main Options

The following options are available for DCREG converters:

Display/Keypad Kit

Display/keypad including a 32-character, backlit LCD display, featuring 8 keys and 8 indicator LEDs.

Display /Keypad Remoting Kit

Remote keyboard operation kit (5 metres).

RS232/RS485 interface

The DCREG may be supplied with a MODBUS protocol according to RS232-C standard and RS485 standard

Communications boards

Additional communication boards are available: Profibus DP, DeviceNet, InterBus, CANopen, ControlNet, Ethernet+IT, Lonworks. Other buses available on request.

IP20 Protection kit

A special IP20 kit is supplied to protect the terminals block/bars.

Input three – phase Inductors

Three-phase inductors can be installed on the supply line to obtain the following benefits:

- limit input current peaks on the input circuit of the converter and value di/dt value
- reduce supply harmonic current
- increase power factor and the duration of line capacitors inside the converter

EMC Input Filters

The converters of the DCREG series are in compliance with EMC EN61800-3 second environment, EN55011 gr.2 class A (industrial environment) with no auxiliary filters.

If required, the DCREG can be equipped with an EMC filter in compliance with EN EMC EN61800-3 first environment or EN55011 gr.1 class A or B.

Clamping Unit for Magnet Feeding applications

The clamping unit CU400 protects the DCREG when it is subject to dangerous overvoltage conditions generated when the current conduction mesh of the magnet unexpectedly opens. Power is cut by CU400, which avoids dangerous overvoltage conditions.

The energy stored into the magnet is “absorbed” and stored in an RC-type clamping circuit, where overvoltage is limited by a capacitor and is dissipated by a resistor.

The configuration above is typically required for electromagnets installed on bridge cranes.

Heatsink Segregation kit (THROUGH-PANEL ASSEMBLY)

This kit allows segregating the air flow cooling the power section in order to avoid dissipating power related to converter losses inside the converter case. The converters available for through-panel assembly are from size 1 to 2A.

Custom Cabinet

Santerno offers a custom solution in cabinet that can integrate all the required options.