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DYNAMIC POWER FACTOR CONTROLLER AND THYRISTOR MODULES

GB Frequently asked questions (FAQ)

DCRG8F
DCTL

CE

1) Which are the main differences between DCRG8F and DCRG8?

Characteristic	DCRG8F	DCRG8
Application	DCRG8F is dedicated to dynamic power factor correction (F = Fast), which is characterized by the insertion of capacitors via thyristor modules thanks to their very high switching speed (order of milliseconds), fundamental for the fast correction of the rapid variations of the power factor generated by non-linear loads such as welding machines, presses, cranes, mixers, automation robots, etc.	DCRG8 is dedicated to traditional power factor correction, with the connection of capacitors via electromechanical contactors, which requires much longer reaction times (typically 60s due to the discharge time of the capacitors). DCRG8 can command thyristor modules only if equipped with the optional EXP1001 expansion module (4 static outputs).
Type of built-in outputs	DCRG8F integrates 8 **static** outputs (transistor), necessary for the command of thyristor modules thanks to their very short reaction times and the huge number of switching operations that can guarantee.	DCRG8 integrates 8 **relay** outputs for the command of electromechanical contactors.
Ratings of the static outputs	The built-in static outputs of DCRG8F have a maximum capacity of 120mA, increased capacity to allow the connection (in case of necessity) of several thyristor modules in parallel to the same output of DCRG8F.	The optional static outputs of DCRG8 (EXP1001 module) have a capacity of 55mA.
Use with DCTL thyristor modules	DCRG8F can command thyristor modules DCTL series via static outputs (typical wiring) or via RS485 bus (innovative wiring) with the possibility to monitor from the display of the DCRG8F the status and measures of each DCTL thyristor module.	DCRG8 can command thyristor modules but only via static outputs, with the addition of the optional EXP1001 module (4 static outputs), while is not possible the connection via RS485 bus (the advantages of this type of wiring are explained in the following questions).
Master-slave function	DCRG8F doesn't integrate the master-slave function (rather unusual on dynamic	DCRG8 integrates the master-slave function.

	PFC systems, where the number of static steps is typically smaller than the number of standard steps of a traditional PFC system). In its place, DCRG8F integrates the function for the command of DCTL thyristor modules via RS485 bus with the possibility to monitor from the display the status and measures of each DCTL.	
EXP1016 capacitor protection expansion module	The expansion modules compatible with DCRG8F are exactly the same of DCRG8, except for the EXP1016 capacitor protection module (2 current inputs for the measure of capacitor current + 2 inputs for temperature measurement with NTC sensors), which is not compatible with DCRG8F but also not necessary, because the protection of the capacitors is directly done by the DCTL thyristor modules that, thanks to the presence of integrated current transformers, they can monitor the electrical measures of the capacitor banks and protect them with protection thresholds configurable on the DCTL, without need to delegate the protection to the DCRG8F controller.	DCRG8 is compatible with EXP1016 capacitor protection expansion module.

2) How many DCTL thyristor modules can be commanded with DCRG8F?
   With the connection via static outputs (typical wiring) it is possible command up to 24 thyristor modules with the configuration DCRG8F (8 built-in static outputs) + 4 x EXP1001 expansion modules (4 static outputs on each module).
   With the connection via RS485 bus it is possible to connect up to 32 DCTL thyristor modules.

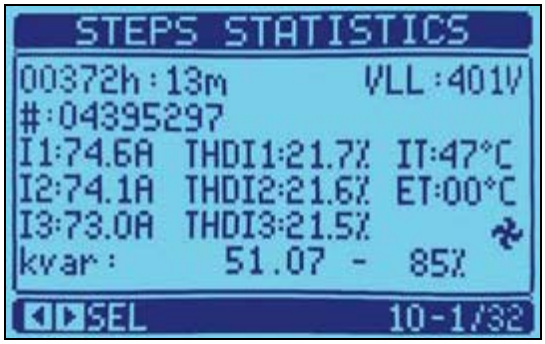
3) Is it possible to realize a mixed dynamic PFC system with DCRG8F with some DCTL commanded via static outputs and other DCTL commanded via RS485?
   Yes, because the command source (static output of DCRG8F or RS485 bus) of each step is independently configurable. The total number of DCTL that can be managed from DCRG8F remains anyway 32.

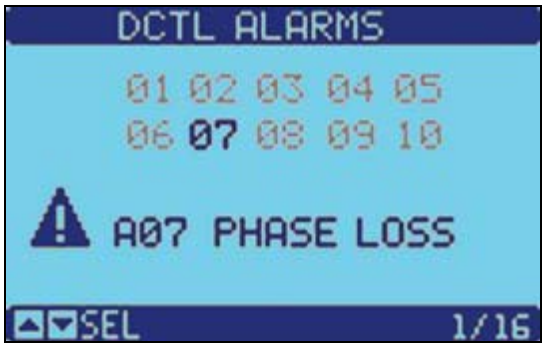
4) Is it possible to realize a mixed dynamic (fast, with thyristor modules) and traditional (with contactors) PFC system with DCRG8F?
   Yes, it is possible to add on the DCRG8F expansion modules with relay outputs EXP1006 (2 relay outputs) and EXP1007 (3 relay outputs) for the steps dedicated to the command of contactors.
   Each step of the DCRG8F controller can be individually configured for the command of thyristor modules (fast) or contactors.

5) Which is the maximum expandability in terms of steps outputs (static or relay) for DCRG8F?
See table below.

		EXP10 01 4 static outputs	EXP10 06 2 relay outputs	EXP10 07 3 relay outputs	TOTAL STEPS	
Regulator	Built-in steps (static outputs)	No. of modules	No. of modules	No. of modules	Static	Relay
DCRG8F	8	Max 4 (4 steps)	-	-	24	-
	8	-	2 (2 steps)	Max 2 (3 steps)	8	10
	8	-	4 (2 steps)	-	8	8

6) Which are the advantages of the connection of DCTL thyristor modules via RS485 bus compared to the connection via static outputs?
The command via RS485 bus allows to monitor from the display of DCRG8F controller the status (e.g. active alarms) and the measures of each DCTL thyristor module (residual power of capacitor bank, switching number, operating time, voltage, three-phase currents, THDI, heatsink temperature, capacitors temperature, etc.).





The connection via RS485 bus allows also a simple and linear wiring, realized with a standard twisted pair cable for the connection in series of the terminals A-B of the DCRG8F and the DCTL.
Differently, the command via static outputs requires to connect each static output of the DCRG8F controller to the respective input of each DCTL thyristor module (which requires more time and it is less orderly).

7) What do I need to connect the DCRG8F controller to the DCTL thyristor modules via RS485 bus?
To command the DCTL thyristor modules via RS485 bus is necessary to add:
- the optional EXP1012 module (RS485 port) on the DCRG8F controller
- the optional EXC1042 card (RS485 port) on each DCTL thyristor module

Note. In this configuration the EXP1012 mounted on DCRG8F controller is dedicated for the command of DCTL thyristor modules and cannot be used for other functions (e.g. the connection to a supervision system). If necessary to connect the DCRG8F controller to a supervision system (e.g. a PC) is necessary to add an additional EXP communication module to the DCRG8F, at choice between the available options (Ethernet, USB, RS232, RS485, Profibus, GPRS/GSM modem).

8) Can DCRG8F command thyristor modules different from DCTL series?
Yes, but in this case the command can be done only via static outputs, not via RS485 bus.

9) What is the difference between DCTLA 400… and DCTLA 480… thyristor modules?
The DCTLA 400 version has a rated operating voltage of 400VAC, while the DCTLA 480 version has a larger range of rated operating voltage from 400 to 480VAC. Moreover the DCTLA 400 version doesn't have the cULus approval, while DCTLA 480 yes.

10) Can DCTLA 690 version be always used in systems with rated voltage 690VAC?
It can be used up to 690VAC for installations which meet the IEC standards.
For installations comply with the cULus standard DCTLA 690 can be used with a rated voltage up to 600VAC max.

11) Does it exists a tolerance on the rated operating voltage value declared for the DCTL?
Yes, there is a tolerance of 10% of the rated voltage.
For example for DCTLA 400: rated voltage 400VAC, maximum operating voltage 400VAC+10% = 440VAC.

12) Which is the most important feature of DCTL compared to the thyristor modules of competitors?
The presence of built-in current transformers, which allows to measure the current which flows in the capacitors and to detect any abnormal conditions by signaling the problem and protecting the capacitor bank.
In addition to the three-phase currents, DCTL monitor electrical measures like voltages, harmonics (THDI), residual power of the capacitor bank, current asymmetry, heatsink temperature, capacitors temperature, number of insertions and working hours.
Moreover it is possible to configure customizable protection thresholds and dedicated alarms associated to each monitored measure, function which allows to best protect the capacitor bank and the thyristor module itself.

DCTL thyristor modules also offer several important advantages related to the hardware and functionalities. For more information see the brochure DYNAMIC POWER FACTOR CORRECTION.

13) DCTL thyristor modules offers advanced programming modes (NFC and optical port for the connection to PC/App). Compared to competitors thyristor modules, which requires only the cabling, may DCTL require a longer time for the putting into service? Is it always necessary to program the DCTL thyristor module to make it work?
No. The factory settings of DCTL thyristor modules makes them ready for immediate use without necessity of any programming, if used with standard functions. The possibility to program the parameters offers a significant advantage because it allows to perfectly fit the characteristics of the thyristor modules to the system where are installed (capacitor bank + eventual de-tuning reactors) and to protect it thanks to the settings of customizable protection thresholds.

14) Which is the smaller step of the capacitor bank controllable from the DCTL?
DCTL thyristor modules can switch steps with power from the 50% to the 100% of the rated power of the module.

Example: with a DCTL 30kvar it is possible to command a step from 15kvar (50%) to 30kvar (100%).

15) In case of active alarm, how can I recognize the type of the alarm?

On the front of the DCTL thyristor module it is present a FAULT LED which signals the presence of an active alarm.

In case of alarm the FAULT LED is flashing and the number of flashes identifies the type of the alarm.

For example: 1 flash = A01 alarm (heatsink overtemperature), 2 flashes = A02 alarm (capacitors overtemperature), etc.. The description of the alarms codes is explained in the technical manual of DCTL (I580 instruction).

In addition, if the DCTL is connected to the DCRG8F controller via RS485 bus, it is possible to see on the display of the DCRG8F controller the code and the description of the active alarm.

16) Which is the function of the relay output on DCTL thyristor modules?

The relay output (with changeover contact) integrated on DCTL thyristor modules can be programmed for one of the following functions:

- *signaling of global alarm*: the relay output switches in case of active alarm. The type of active alarm can be identified by the number of flashes of the FAULT LED on the front (see question 15). This feature is very useful to make diagnostic and for the remote signaling of an unusual condition on the system, for example to signal a problem on the plant (e.g. voltages or currents too high) or on the thyristor module (e.g. short circuited SCR) or to check if the built-in fan does not work or is jammed.
- *Command of an external fan*: in this case the relay output switches in case of overtemperature and can be used for the command of an additional external fan.

17) How the DCTL receive the switching command from the PFC controller? Do they offer any advantages compared to the other thyristor modules present on the market?

The switching command of DCTL can be done in three different ways:

- 8…30VDC voltage signal applied to the static outputs of the PFC controller: this type of command is the most common used and makes DCTL compatible with any kind of dynamic automatic power factor regulator present on the market. To use this mode the static output (powered at 8…30VDC) of DCRG8F controller has to be connected to the terminals CONTROL +/- of the DCTL.
- Digital input (free-voltage contact): compared to the previous solution, in this case the static output of the controller is not connected to any voltage source, but is directly connected to the built-in digital input of DCTL (self-supplied by its control unit). This solution allows to avoid the installation of a power supply with output 12-24VDC (typically used to provide voltage to the static outputs of the regulator), with consequent saving of cost and space inside the panel. To use this mode the static output (free of voltage) of the DCRG8F controller has to be connected directly to the terminals IN1-C (digital input) of the DCTL.
- Via RS485 bus from DCRG8F controller: in this case, instead of connect the static outputs of the DCRG8F controller, the DCTL are connected on the serial RS485 bus (it requires optional accessories, see question 7) obtaining a simpler and linear wiring, with the advantage of monitor the measures of each DCTL from the display of DCRG8F controller.

18) How can I select the switching command mode of the DCTL?

If DCTL are commanded via the static outputs of the PFC controller is enough to follow the wiring diagram shown on the technical manual without configure anything on the PFC controller or on the DCTL regarding the switching mode:

- If you want to command the DCTL via 8…30VDC signal, connect the static output (with voltage) of DCRG8F to the input CONTROL +/- of the DCTL;
- If you want to command the DCTL via digital input connect the static output (free of voltage) of the DCRG8F to the digital input IN1-C of the DCTL;

The two command inputs CONTROL +/- and IN1-C work with OR logic (which means that the DCTL is activated when at least one of the two sources is present), but obviously each DCTL must have only one command mode.

If the DCTL are commanded via RS485 bus (optional), in this case is necessary to configure on the DCRG8F controller the respective step as “Static-485”. This condition automatically disable the functioning of the inputs CONTROL +/- and IN1-C of the DCTL. For more information see the technical manual of DCRG8F controller, instruction I564.

19) Which is the value of the temperature threshold that activates the built-in fans?

DCTL thyristor modules integrate one or two cooling fans (code depending) to ensure a correct ventilation. The fans are automatically activated when the heatsink temperature of the DCTL (measured with a built-in probe) rises above the threshold of 50°C, then the fans are stopped when the temperature decreases under the reset threshold of 40°C.

Moreover, when the fans are not active, the DCTL performs periodical tests to check the correct functioning of the fans. The control logic of the fans, in addition to the measure of the temperature, it monitors the status of the fans with an analog measure of the supply current, which allows to recognize automatically a failure (fan not connected or jammed).

20) What is the meaning of the three LEDs on the front of the DCTL?

Each DCTL thyristor module has three LEDs on the front:

- POWER (green): flashing, it signals the presence of the auxiliary power supply (the flashing represents the “heartbeat” of the thyristor module). If turned off, indicates the absence of auxiliary power supply.
- ON (green): if turned on, it signals the activation of the switching command of the DCTL module; if turned off, it means that the DCTL switching command is not active.
- FAULT (red): turned off when there are no active alarms, flashing in case of global alarm active. The number of flashes identifies the type of alarm (e.g. 1 flash = A01 alarm – heatsink overtemperature, 2 flashes = A02 alarm – capacitors overtemperature, etc..).

21) Which is the function of the NTC input of the DCTL thyristor modules? Is it mandatory to wire it?

The NTC input is dedicated for the connection of an external temperature probe code NTC01. This probe allows to measure (in addition to the heatsink temperature, measured with a sensor integrated inside the DCTL) the temperature directly in the area of installation of the capacitors, useful when the capacitors are installed far away from the thyristor modules.

The connection of the NTC01 probe is optional and on the DCTL it is possible to program a protection threshold associated to this temperature with a dedicated alarm (A02). If not used, don’t connect anything to the NTC input of DCTL.

22) Which parameters can be configured on the DCTL thyristor modules?

Through the LOVATO NFC App or the frontal IR optical port (via Xpress software or LOVATO SAM1 App), it is possible to configure:

- The rated values of the capacitor bank: rated power (which can be set between the 50% and 100% of the rated power of DCTL), rated voltage and rated current. The default values of these parameters are set to the rated values of the DCTL, the possibility to adjust them allows to perfectly fit the module to the characteristics of the capacitor bank and to protect the capacitors as best as possible (for example, it may happens to install capacitors with rated voltage 480V but which are used at 400V, so the rated reactive power is different, or it is very common to install de-tuning reactors in series to the capacitors, which significantly affect the value of the rated current, etc…).
- The protection thresholds: it is possible to set the values of the protection thresholds to protect the capacitor bank and the thyristor module itself in case of overcurrent, overvoltage, internal (heatsink) or external (capacitors) overtemperature, THDI and current asymmetry. It is also possible to monitor the real residual power of the capacitor bank and signal with an alarm when this power decreases under a programmable threshold (for example due to the ageing and wear of the capacitors).
- The password: it is possible to configure a 4 digits numeric password to protect the access to the settings to unauthorized personnel.
- The function of the built-in relay output: it is possible to configure the function of the relay output for alarm signaling or for the command of an external fan (in addition to the built-in fans) in case of overtemperature.

23) In case of active alarm, the command of the DCTL thyristor modules is it always interrupted?

Not always, it depends on the type of alarm. Critical alarms such as overvoltages, overcurrents, overtemperatures, current asymmetry or THDI too high, cause the stop of the DCTL. The other alarms, like a fan failure or a residual power too low, which are not so critical, are signaled but they don't cause the stop of the thyristor module.

24) In addition to the programmable protection thresholds, are there other thresholds not configurable dedicated for the auto-protection of the thyristor module?

Yes, it is present a current protection (that cannot be disabled) fixed at the 180% of the maximum admissible current of the thyristor module. Moreover many of the configurable protection thresholds are already limited to values which don't compromise the functioning of the thyristor module, for example the overtemperature alarm (that cannot be disabled) can be set at maximum to 85°C, which is the maximum operating temperature of the thyristors of the DCTL.