DCRM SERIES
- Modular housing
- 2 steps
- Settings by front potentiometers
- 3 LED indications.

DCRL SERIES (EXPANDABLE)
- Flush-mount housing:
  DCRL 3 - DCRL 5 (96x96mm/3.78x3.78")
  DCRL 8 (144x144mm/5.67x5.67")
- 3/5/8 steps, expandable with EXP series modules (step increment, digital outputs, communication ports, etc.)
- Backlit icon LCD
- Ethernet communication interface (only for DCRL 8)
- Alarm codes with scrolling texts, programmable in 6 languages (Italian, English, Spanish, French, German and Portuguese)
- Independent voltage measurement input
- Suitable for low and medium voltage systems
- Capacitor overload protection
- Internal panel temperature sensor
- Voltage and current harmonic-content measurement up to 15th order
- Front optical USB and Wi-Fi communication port for PC, smartphone and tablet connection
- Programmable alarms
- Protection via 2-level password to prevent all undesired access
- Compatible with **Synergy** supervision and energy management software, **Xpress** configuration and remote control software and with the **Sam1** application for Android/iOS.

DCRG SERIES (EXPANDABLE)
- Flush-mount housing: DCRG 8 - DCRG 8IND (144x144mm/5.67x5.67")
- 8 steps, expandable with EXP series modules (step increment, inputs and outputs, communication ports, GPRS/GSM modem, data memory, etc.) and with Master-Slave function
- 128x80 backlit graphic LCD, facilitating data reading even in poor lighting conditions and the display of system information clearly and intuitively
- Ethernet communication interface
- Texts in 10 languages: Italian, English, Spanish, French, German, Czech, Polish, Russian, Portuguese and one customisable
- Voltage measurement input independent of supply input
- Suitable for low and medium voltage systems
- Capacitor overload protection
- Internal panel temperature sensor
- Voltage and current harmonic-content measurement up to 31st order
- Suitable for dynamic power factor correction.
- Power factor correction by single phase (SPPFC)
- Capacitive reactive power factor correction (DCRG 8IND version)
- Front optical USB and Wi-Fi communication port for PC, smartphone and tablet connection
- Programmable alarms
- Protection via 2-level password to prevent all undesired access
- Calendar-clock with backup reserve energy.
- Logging of up to 250 events
- Compatible with **Synergy** supervision and energy management software, **Xpress** configuration and remote control software and with the **Sam1** application for Android/iOS.

THYRISTOR MODULES
- 30, 50, 100kvar
- Suitable for dynamic power factor correction
- Current flow zero-crossing controlled connection-disconnection
- Over-temperature protection
- Over-current protectional capacitor switching.

- Microprocessor supervision and control
- Accurate TRMS measurement circuit
- Automatic intelligent adjustment system
- Versions from 2 to 24 steps and up to 32 with Master-Slave function
- Versions with static outputs
- Versions for capacitive reactive power factor correction
- Use in cogeneration and medium-voltage systems
- USB, serial, Ethernet communication interfaces
- Modbus-RTU and ASCII communication protocols
- Thyristor modules for dynamic correction.

Lovato electric

	DCRL 3	DCRL 5	DCRL 8	DCRG 8 / DCRG 8IND
Steps	3 (up to 6 with EXP10 07)	5 (up to 8 with EXP10 07)	8 (up to 14 with EXP10 07)	8 (up to 18 relay outputs with EXP 1006 and EXP10 07) (up to 24 mixed relay and static outputs with EXP10 01)
ON FRONT/HOUSING				
Display	Backlit icon LCD			128x80 pixel backlit graphic LCD
Languages	6 (scrolling text of alarm codes only) Italian, English, Spanish, French, German, Portuguese			10 Italian, English, Spanish, French, German, Czech, Polish, Russian, Portuguese and 1 customisable
Dimensions	96x96mm/ 3.78x3.78"	96x96mm/ 3.78x3.78"	144x144mm/ 5.67x5.67"	144x144mm/ 5.67x5.67"
Protection rating	IP54	IP54	IP65	IP65
Expandable with EXP… modules	●			●
CONTROL/FUNCTIONS				
Automatic recognition of current flow direction	●			●
4-quadrant operation	●			●
Master-Slave function				●
Independent auxiliary supply input	●			●
Three-phase voltage control				●
Current inputs	1 (by 5A or 1A CTs)			3 (by 5A or 1A CTs)
Dynamic (FAST) power factor correction				● with EXP10 01 (maximum 16 static outputs)
Power factor correction by single phase				●
Possibility of connecting inductive steps				● (DCRG 8IND only)
Medium-voltage usage	●			●
Phase-neutral connection in three-phase systems	●			●
Analog inputs				● with EXP10 04
Analog outputs				● with EXP10 05
Input programmable as function or external temperature sensor				● with EXP10 04
USB communication interface	● with EXP10 10			● with EXP10 10
RS232 communication interface	● with EXP10 11			● with EXP10 11
Opto-isolated RS485 communication interface	● with EXP10 12			● with EXP10 12
Ethernet communication interface	● with EXP10 13 (only for DCRL 8)			● with EXP10 13 and web server function
Opto-isolated Profibus-DP interface				● with EXP10 14
GPRS/GSM modem				● with EXP10 15
Optical USB communication port on front	● with CX 01			● with CX 01
Optical Wi-Fi communication port on front	● with CX 02			● with CX 02
Fast setting of current transformer	●			●
Compatible with Xpress configuration and remote control software	●			●
Compatible with Synergy supervision and energy management software	●			●
Compatible with Sam1 App	●			●
Calendar-clock with backup reserve power				●
Data logging memory				● with EXP10 30
Event logging: alarms, setup changes, etc.				●
Customisable internal counters				●

|	DCRL 3	DCRL 5	DCRL 8	DCRG 8 / DCRG 8IND
MEASUREMENTS				
Rated measurement voltage		600VAC max		600VAC max
Measurement voltage range		50...720VAC		50...720VAC
Instantaneous cosφ (power factor displacement)		●		●
Instantaneous and average weekly power factor values		●		●
Voltage and current		●		●
Reactive power to reach set-point and total values		●		●
Capacitor overload		●		●
Electrical panel temperature		●		●
Maximum voltage and current value		●		●
Maximum capacitor overload value		●		●
Maximum panel temperature value		●		●
Maximum capacitor temperature value				● with EXP10 04 and EXP10 15
Active and apparent power value				●
Active, reactive, apparent energy				●
Current and voltage harmonic analysis		● up to 15th		● up to 31st
Var-measured value per step		●		●
Number of switches for each step		●		●
PROTECTIONS				
Voltage too high and too low		●		●
Current too high and too low		●		●
Over compensation (capacitors disconnected and cosφ higher than set-point)		●		●
Under compensation (capacitors connected and cosφ lower than set-point)		●		●
Capacitor overload		●		●
Capacitor overload on all 3 phases				●
Over temperature		●		●
Mains micro-breaking		●		●
Capacitor bank failure		●		●
Over maximum n° of switches		●		●
Over maximum harmonic distortion level limit		●		●
Programmable alarm property (enable, trip delay, relay energising, etc.)		●		●
Capacitor protection				● with EXP10 16
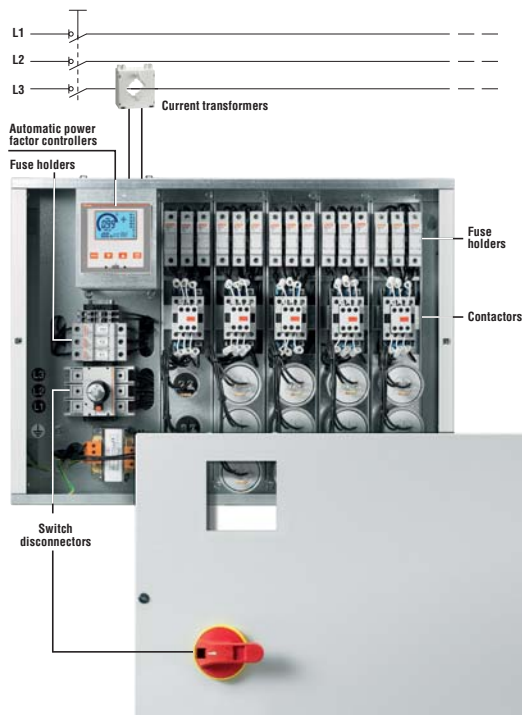
ESSENTIAL AND PERFORMANCE TOO!
DCRL 3 - DCRL 5

● **OPTICAL COMMUNICATION PORT**
The optical port on the front permits communication with PCs, smartphones and tablets through the USB and Wi-Fi standards for carrying out programming, diagnostics and data download without disconnecting power to the electrical panel.

IR

CX 01

CX 02
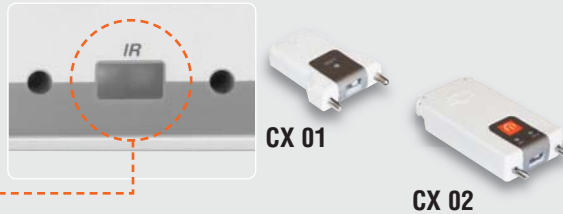
● **USER INTERFACE**
The backlit icon LCD ensures excellent legibility as well as the texts for the display of measurements and description of alarms. The 4 navigation buttons are for settings and functions.

● **AN EXPANSION SLOT FOR EXP… SERIES MODULES**

● **EXPANDABLE UP TO 8 STEPS**

● **COMPACT SIZE**
The space taken by the housing does not increase (96x96x73mm / 3.78x3.78x2.87") even with the expansion module fitted.

65 · 8.5
55

EXP 10...
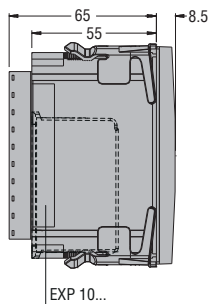
● **FIXING SYSTEM**
The system of **fixing with clips** is simple, with a press to click into place and push to ensure hold over time.
Correct application of the standard seal and clips in the panel ensures a front **IP54** protection degree.

CLICK!!

● **EXPANDABILITY**
Basic controller functionality can be extended easily using the EXP series expansion modules:
– digital outputs
– relay outputs to increase number of steps
– opto-isolated USB interface
– opto-isolated RS232 interface
– opto-isolated RS485 interface.

MAX 1

● **SOFTWARE COMPATIBILITY**
- **Sam1** Application for Android and iOS
- **Xpress** for configuration and remote control
- **Synergy** for supervision and energy management.

● CHARACTERISTICS OF THE DCRL SERIES

– **WIDE RANGE OF VOLTAGE MEASUREMENTS**
The wide measurement range between 50...720VAC L-L and between 50...415VAC L-N allows the controllers to be used in most applications.

– **SUITABLE FOR LOW- AND MEDIUM-VOLTAGE SYSTEMS**
The controllers can be used in medium-voltage systems thanks to the ability to set a voltage transformer ratio, obtaining measurements regarding the transformer primary value both for adjustment and for the display.

– **ALARM MESSAGES IN 6 LANGUAGES**
The alarm texts can be displayed in Italian, English, French, German, Portuguese and Spanish.

– **DEFECTIVE STEP**
The DCRL measures the percentage of residual power for each step, comparing it with the value set in the main menu.
The defective step alarm is generated if this value is below the set limit.

DCRL 8

● **USER INTERFACE**
The backlit icon LCD ensures excellent legibility as well as the texts for the display of measurements and description of alarms. The 5 navigation buttons are for settings and functions, while an LED indicates the alarms and the optical port for communication via USB and Wi-Fi.

● **EXPANDABLE UP TO 14 STEPS**

● **OPTICAL COMMUNICATION PORT**
The optical port on the front permits communication with PCs, smartphones and tablets through the USB and Wi-Fi standards for carrying out programming, diagnostics and data download without disconnecting power to the electrical panel.

● **TWO EXPANSION SLOTS FOR EXP... SERIES MODULES**

● **ETHERNET COMMUNICATION INTERFACE**
By using the expansion module with EXP 1013.

● **CUSTOMISATION**
An insert for labels customised with text, logos, codes, etc. is available, to be fixed onto the controller frames.

● **COMPACT SIZE**
Reduced profile and depth simplify installation of the power factor controller even in very compact electrical panels.
The total depth of the controller is 73mm (2.87") inside the panel with the expansion modules installed.

44 mm
9 mm

44
137
64.5
144
73
9
EXP 10...
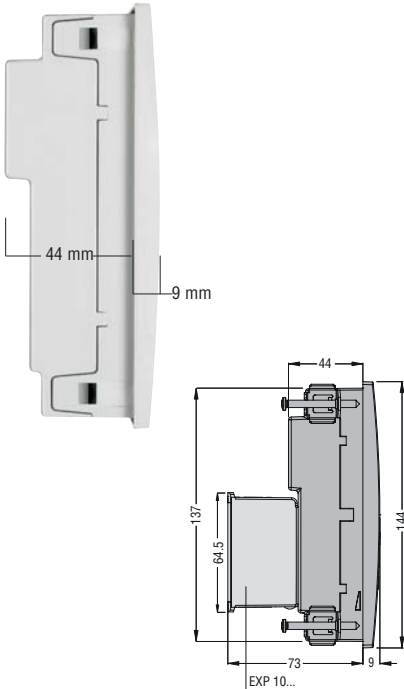
● **FIXING SYSTEM**
The fixing system **with metal screws** guarantees excellent, lasting hold over time.

● **HIGH PROTECTION RATING**
The front of the controller and seal have been designed to ensure a front protection rating of **IP65**.

● **EXPANDABILITY**
Basic controller functionality can be extended easily using the EXP series expansion modules:
– relay outputs to increase number of steps
– digital outputs
– opto-isolated RS232 interface
– opto-isolated RS485 interface
– opto-isolated ETHERNET interface.

MAX 2

● **SOFTWARE COMPATIBILITY**
- **Sam1** Application for Android and iOS
- **Xpress** for configuration and remote control
- **Synergy** for supervision and energy management.

● CHARACTERISTICS OF THE DCRL SERIES

– **5A OR 1A IN THE SAME CONTROLLER**
A parameter can enable the controller for use with a 5A or 1A secondary current transformer.

– **WHITE BACKLIT DISPLAY**
It can be programmed to flash during alarm conditions.

– **HARMONIC ANALYSIS**
It includes voltage and current THD measurements and single harmonic measurement up to the 15th order and they can be shown on the display.

– **MAINTENANCE INTERVALS**
There are 2 counters: one to count the operating hours for the steps and the other for the number of interventions of each step. An alarm threshold can be set for both counters.

– **BUILT-IN TEMPERATURE SENSOR**
The internal temperature of the controller is monitored constantly by the built-in sensor.
The user can program the thresholds to activate and stop the cooling fan and/or generate the temperature alarm.

THE SOLUTION FOR ALL APPLICATIONS!
DCRG 8

● BACKLIT GRAPHIC LCD
High-legibility 128x80 pixels, with adjustable brightness.

MAIN PAGE
+1.00 cosφ IND step
Set1 0.95I MAN 21.3°C
+0.00 kvar TOT %

DCRG8 POWER FACTOR CONTROLLER

● OPTICAL COMMUNICATION PORT
The optical port on the front permits communication with PCs, smartphones and tablets through the USB and Wi-Fi standards for carrying out programming, diagnostics and data download without disconnecting power to the electrical panel.
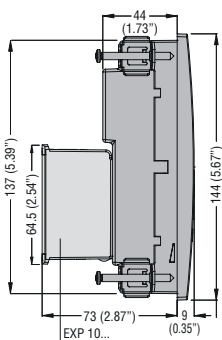
CX 01

CX 02
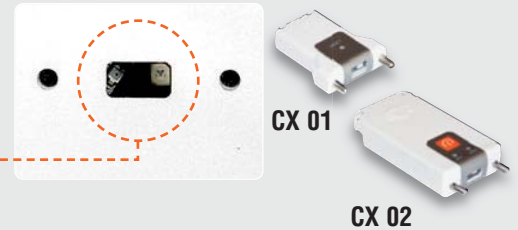
● CUSTOMISATION
There is a customisation slot available on the front panel for the description of the controller by adding texts, logos, codes, etc.

● COMPACT SIZE

Trim

44mm
1.73"

9mm
0.35"
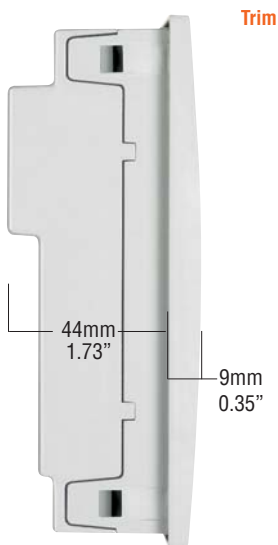
Frame profile and reduced total depth simplify installation of the controller also in very compact electric panels.

44 (1.73")
137 (5.39")
64.5 (2.54")
144 (5.67")
73 (2.87")
9 (0.35")
EXP 10...

● FIXING SYSTEM

The fixing system with **metal screws** guarantees excellent adhesion over time.

● HIGH PROTECTION DEGREE
The controller front and the rear seal have been designed to warrant an **IP54** protection degree.

● EXPANDABILITY

EXP 10 11 RS232 Interface
EXP 10 06
EXP 10 30 Data Memory with RTC
EXP 10 13 Ethernet Interface

MAX 4

Basic controller functionality can be extended easily using the EXP series expansion modules:
- Relay outputs to increase the number of steps
- Opto-isolated static outputs (also for dynamic correction)
- Capacitor protection
- Digital and analog inputs and outputs
- Expandable up to 24 mixed outputs
- Opto-isolated RS232 interface
- Opto-isolated RS485 interface
- Opto-isolated ETHERNET interface with web server function
- Opto-isolated Profibus-DP interface
- GPRS/GSM modem
- Data memory, calendar-clock with backup reserve power for data logging.

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● SUITABLE FOR POWER FACTOR CORRECTION USING CONTACTORS AND THYRISTOR MODULES

● INDEPENDENT POWER FACTOR CORRECTION FOR EACH SINGLE PHASE

● CAPACITIVE REACTIVE POWER FACTOR CORRECTION VIA INDUCTIVE STEP MANAGEMENT (WITH DCRG 8IND MODEL)

● SMS SENDING FOR ALARM CONDITIONS

● DATA SENDING BY EMAIL OR FTP SERVER

● WEB SERVER FOR DATA READING

● STREAMLINE DESIGN
The DCRG controller has an ergonomic design and, at the same time, particular care has been given to details.

● MASTER-SLAVE FUNCTION
The DCRG controller can control the outputs of other analog controllers in addition to its own steps. In this way, it offers a **Master-Slave** architecture. Up to 8 slaves can be controlled to create a system with a maximum of 32 steps.

Master

Slave 1

Slave 2

Slave 8

● WEB SERVER FUNCTION

By installing the **Ethernet** expansion module EXP10 13, the main measured values of the controller can be viewed by the most common web clients on the market compatible with Java, with no need to install any additional software on the PC.

● CAPACITOR PROTECTION
By adding the dedicated EXP10 16 expansion module, the DCRG controller can be equipped with additional capacitor protection functions. The module can measure the harmonic current values and the capacitor temperature on-site as well as detecting malfunction on any phase.

● 3 CURRENT INPUTS
- **Independent power factor correction** for each single phase
- Analysis of all electrical measurements in the system (multimeter).

● WIDE RANGE OF RATED VOLTAGE MEASUREMENTS
The wide measurement range between 100...600VAC allows the controller to be used in most applications.

● GSM/GPRS MODEM
With the EXP10 15 expansion module, the controller is equipped with a GSM/GPRS modem, which it automatically configures. This simplifies installation and wiring. Once a data-enabled SIM card is inserted, the controller can send alarm or event SMS and **e-mails** and data files can be transmitted to FTP servers.
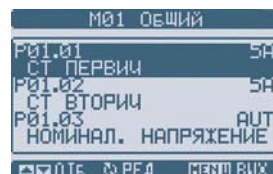
● 5A AND 1A BOTH ON THE SAME CONTROLLER
By configuring an specific parameter, the controller can be enabled for use with either a 5A or 1A secondary current transformer.

● GRAPHS AND TEXTS IN 10 LANGUAGES

Display of waveforms, graphs and texts in 10 languages: Italian, English, Spanish, French, German, Czech, Polish, Russian, Portuguese and one customisable.

● SUITABLE FOR MEDIUM-VOLTAGE SYSTEMS
The controller can be used in medium-voltage systems thanks to the ability to set a voltage transformer ratio, obtaining measurements regarding the transformer primary value both for adjustment and for the display.

● SUITABLE FOR DYNAMIC (FAST) POWER FACTOR CORRECTION
Thanks to the EXP10 01 expansion modules with static outputs, thyristor-based dynamic power factor correction systems can be created where the reactive load varies rapidly over time. By taking advantage of the built-in relay outputs as well, a mixed traditional (relay) and dynamic system can be obtained.

● INDEPENDENT POWER FACTOR CORRECTION FOR EACH SINGLE PHASE (SPPFC)
In highly unbalanced three-phase systems, power factor correction by single phase can be implemented. The DCRG controller can monitor the cosφ of each single phase and correct through the joint use of single- and three-phase capacitor banks.

● CAPACITIVE REACTIVE POWER FACTOR CORRECTION (DCRG 8IND).
The DCRG 8IND version can connect both capacitors and inductors to achieve the desired cosφ should it be necessary to correct the capacitive reactive power factor as well.

● SOFTWARE COMPATIBILITY
- **Sam1** Application for Android and iOS
- **Xpress** for configuration and remote control
- **Synergy** for supervision and energy management.

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DCRM series

DCRM 2

Order code	Steps	Auxiliary supply voltage	Qty per pkg	Wt
	no.	[V]	n°	[kg]
Single and three-phase low-voltage systems.				
DCRM 2	2	380...415VAC	1	0.284

General characteristics
The DCRM allows the reactive current of a system to be controlled.
It can correct to the best cosφ value possible, reducing the request for reactive current from the mains.
It can control the connection of two capacitor banks. Each one can be individually enabled and its power can be set through a dedicated trimmer.
It is also possible to adjust the time for connection and disconnection of the capacitors, thereby modifying the reaction speed of the system.
The controller can be used both in three- and single-phase wiring.

Operational characteristics
– Auxiliary supply voltage:
  • 380...415VAC standard
  • 220...240VAC and 440...480VAC on request
– Rated frequency: 50/60Hz
– 80...528VAC voltage measurement input
– Current measurement input:
  • By CT /5A
  • Measuring range: 0.1...6A
  • Measurement type: true root mean square (TRMS)
  • Automatic identification of CT connection polarity (straight / inverted)
– Relay outputs:
  • 2 relays (steps), each with 1 changeover contact
  • Rated current: 8A 250VAC (AC1)
  • Individual enablement of control of the two relays
– Modular DIN 43880 housing (3 modules)
– IEC degree of protection: IP40 on front (if placed in IP40 housing and/or electrical panel), IP20 terminals.

ADJUSTMENTS
"C/K Step 1"	C/K ratio step 1 (0.15...2)
"C/K Step 2"	C/K ratio step 2 (0.15...2)
"Connection delay"	Step connection delay 1...60s
"Disconnection delay"	Step disconnection delay 0.1...60s
"System configuration"	Single- or three-phase wiring selection.

INDICATIONS
– 1 green LED for power on and inhibition time
– 2 red LEDs for relay connection.

Certifications and compliance
Certifications obained: EAC; UL Listed, for USA and Canada (File E93601), as Auxliary Devices-Modular ampere monitoring relays (with 415VAC maximum only).
Compliant with standards: IEC/EN 60255-5, IEC/EN 61010-1, IEC/EN 61000-6-2, IEC/EN 61000-6-3, UL508, CSA C22.2 n°14.

DCRL series

DCRL 3 - DCRL 5

DCRL 8

EXP80 00

EXP 10…

Order code	Description	Qty per pkg	Wt
		n°	[kg]
Single and three-phase low and medium-voltage systems.			
DCRL 3	3 steps, expandable up to 6 steps, 100…440VAC	1	0.340
DCRL 5	5 steps, expandable up to 8 steps, 100…440VAC	1	0.340
DCRL 8	8 steps, expandable up to 14 steps, 100…440VAC	1	0.640
Accessory.			
EXP80 00	Plastic insert for customisation label (only for DCRL 8)	10	0.050

Order code	Description
EXPANSION MODULES. Additional steps.	
EXP10 06	2 relay outputs to increase number of power factor correction steps
EXP10 07	3 relay outputs to increase number of power factor correction steps
Inputs and outputs.	
EXP10 03	2 relay outputs 5A 250VAC
Communication ports.	
EXP10 10	Opto-isolated USB interface
EXP10 11	Opto-isolated RS232 interface
EXP10 12	Opto-isolated RS485 interface
EXP10 13	Opto-isolated ETHERNET interface (only for DCRL 8)

Snap-in fixing of EXP… expansion modules
DCRL 3 - DCRL 5 with 1 module

DCRL 8 with 2 modules

Backlit icon LCD

General characteristics
The DCRL series was developed with advanced functionality and produced with a dedicated ultra-compact housing. It combines modern front design with practical mounting and expandability (EXP… modules). Its main features are:
– Backlit icon LCD with excellent information display
– Alarm codes with scrolling texts, programmable in 6 languages (Italian, English, Spanish, French, German and Portuguese)
– Connection in single or three phase lines and co-generation systems with 4-quadrant operation
– Voltage measurement input independent of supply and which can be used in medium-voltage lines with VTs
– Drastic reduction in the number of switching operations
– Balanced use of steps with same power rating
– Measurement of reactive power installed for each step
– Capacitor over-current protection
– Panel over-temperature protection via internal sensor
– Accurate micro-breaking protection
– Vast choice of measurements available, including voltage and current THD with single harmonic analysis up to the 15th order.
– Wide voltage measurement range
– High accuracy of true root mean square (TRMS) measurements
– Front optical USB (CX 01 dongle) and Wi-Fi (CX 02 dongle) communication port for PC, smartphone and tablet connection
– Compatible with Ethernet communication modules EXP10 13 (only for DCRL 8)
– Compatible with Synergy supervision and energy management software, Xpress configuration and remote control software and with the Sam1 application for Android/iOS.
– Customisation with label on front (only for DCRL 8).

Operational characteristics
– Supply:
  • Auxiliary voltage: 100…440VAC
  • Frequency: 50/60Hz ±10%
– Voltage input:
  • Rated voltage: 600VAC L-L (346VAC L-N)
  • Frequency range: 45…65Hz
– Current input:
  • Single-phase connection
  • Rated current: 1A or 5A, configurable
– Measurements and control:
  • Power factor adjustment: 0.5ind.…0.5cap.
  • Voltage measurement range: 50…720VAC L-L; 50…415VAC L-N
  • Current measurement range: 0.025…1.2A for 1A full scale; 0.025…6A for 5A full scale
  • Type of voltage and current measurement: true root mean square (TRMS).
– Relay outputs (steps):
  • DRCL 3: 3 outputs
  • DCRL 5: 5 outputs
  • DCRL 8: 8 outputs
  • Contact arrangement: NO; the last is a changeover
  • Rated current: 5A 250VAC AC1
– Flush-mount housing:
  DCRL 3, DCRL 5 (96x96mm / 3.78x3.78"); DCRL 8 (144x144mm / 5.67x5.67")
– IEC degree of protection:
  DCRL 3, DCRL 5 IP54 and DCRL 8 IP65 on front; IP20 on terminals for all.

Certifications and compliance:
Certifications obtained: UL Listing for USA and Canada (cULus - File E93601), as Auxiliary Devices - Power factor controllers, EAC, RCM.
Compliant with standards: IEC/EN 61010-1, IEC/EN 61000-6-2, IEC/EN 61000-6-3, UL508, CSA C22.2 n°14.

Contactors for power factor correction
See section 2, page 2-14.

Software: Synergy, Xpress and Sam1
See section 27.

EXP expansion modules
See section 28.

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DCRG series

DCRG 8

EXP 10…

Order code	Description	Qty per pkg	Wt
	no.	n°	[kg]
DCRG 8	8 steps, expandable up to 24 steps, 100…440VAC	1	0.980
DCRG 8IND	8 steps, expandable up to 24 steps, 100…440VAC, for capacitive reactive power factor correction	1	0.980
Accessories.			
NTC 01	Remote temperature sensor, length 3m/3.3yd	1	0.150

Order code	Description
EXPANSION MODULES Additional steps.	
EXP10 06	2 relay outputs to increase number of power factor correction steps
EXP10 07	3 relay outputs to increase number of power factor correction steps
Inputs and outputs.	
EXP10 00	4 opto-isolated digital inputs
EXP10 01	4 opto-isolated static outputs to increase number of static steps
EXP10 02	2 digital inputs and 2 opto-isolated static outputs
EXP10 03	2 relay outputs 5A 250VAC
EXP10 04	2 PT100 opto-isolated analogue inputs, either 0/4...20mA, 0...10V or 0...±5V
EXP10 05	2 opto-isolated analogue inputs 0/4…20mA, 0…10V or 0…±5V
EXP10 08	2 opto-isolated digital inputs and 2 relay outputs 5A 250VAC
EXP10 16	Capacitor protection with 2 inputs for temperature measurement with NTC sensors and 2 three-phase measurement inputs
Communication ports.	
EXP10 10	Opto-isolated USB interface
EXP10 11	Opto-isolated RS232 interface
EXP10 12	Opto-isolated RS485 interface
EXP10 13	Opto-isolated ETHERNET interface with web server function
EXP10 14	Opto-isolated Profibus-DP interface
EXP10 15	GPRS/GSM modem❶, without antenna
Other functions.	
EXP10 30	Data memory, calendar-clock with backup reserve power for data logging

❶ For configuration via software, contact our Customer Service Office (Tel. +39 035 4282422; E-mail: service@LovatoElectric.com).

Maximum expandability DCRG 8 / DCRG 8IND

DCRG 8 / DCRG 8IND	EXP10 06	EXP10 07	EXP10 01	TOTAL STEPS	
Controller	Module with 2 relay outputs	Module with 3 relay outputs	Module with 4 static outputs		
Steps	no. of modules	no. of modules	no. of modules	Relay	Static
8	4 (2 steps)	–	–	16	–
8	2 (2 steps)	max. 2 (3 steps)	–	18	–
8	–	–	max. 4 (4 steps)	8	16

Snap-in fixing of 4 EXP… expansion modules
DCRG 8 / DCRG 8IND

General characteristics
The DCRG automatic power factor controller satisfies the technical requirements of modern electrical systems in industry.
It is designed to satisfy them, with the option of extending its functionality by using specific EXP series expansion modules. Mention should also be made of the optical communication port as standard, for programming the controller, diagnostics and data download.
The backlit graphic LCD facilitates data reading even in poor lighting conditions and permits the display of system information clearly and intuitively.
Its main features are:
– 128x80-pixel backlit graphic LCD with texts in 10 languages: Italian, English, Spanish, French, German, Czech, Polish, Russian, Portuguese and one customisable
– Connection in single and three-phase lines as well as three-phase lines with neutral control and cogeneration systems (4 quadrants)
– Capacitive reactive power factor correction (DCRG 8IND)
– Independent power factor correction for each single phase (SPPFC)
– Use with medium-voltage lines with VTs
– Capability for correct operation even in systems characterised by high harmonic content
– Drastic reduction in the number of switching operations
– Balanced use of steps with same power rating
– Measurement of reactive power installed for each step
– Recording of the number of connections for each step
– Capacitor over-current protection on all three phases
– Panel over-temperature protection via internal sensor and external sensor
– Accurate micro-breaking protection
– Current and voltage harmonic analysis
– Quick CT programming function
– USB (CX 01 dongle) and Wi-Fi (CX 02 dongle) communication port for PC, smartphone and tablet connection
– Modbus-RTU TCP and ASCII communication protocol
– Compatible with Synergy supervision and energy management software, Xpress configuration and remote control software and with the Sam1 application for Android/iOS
– Sending and reception of SMS, sending of e-mails with alarm diagnosis and data files, FTP Client function (with EXP10 15 module).

Operational characteristics
– Voltage measurement circuit:
  • Auxiliary supply voltage: 100...415VAC
  • Rated frequency: 50/60Hz (±10%)
– Current measurement circuit:
  • Single and three-phase input
  • Rated current: 5A (1A programmable)
– Measurements and control:
  • Power factor adjustment: 0.5ind....0.5cap.
  • Voltage measurement range: 50...720VAC
  • Current measurement range: 0.025...6A
  • Temperature measurement range: -30...+85°C
  • Capacitor overload current measurement range: 0...250%
  • Type of voltage and current measurement: true root mean square (TRMS).
– Relay outputs:
  • 7 each with NO contact and the last as changeover
  • Rated current: 5A 250VAC AC1
– Flush-mount housing (144x144mm / 5.67x5.67")
– IEC degree of protection: IP65 on front; IP20 on terminals.

Certifications and compliance
Certifications obtained: UL Listing for USA and Canada (cULus - File E93601), as Auxiliary Devices - Electronic power factor regulator, EAC, RCM (only for DCRG 8).
Compliant with standards: IEC/EN 61010-1, IEC/EN 61000-6-2, IEC/EN 61000-6-3, UL508, CSA C22.2 n°14.

Contactors for power factor correction
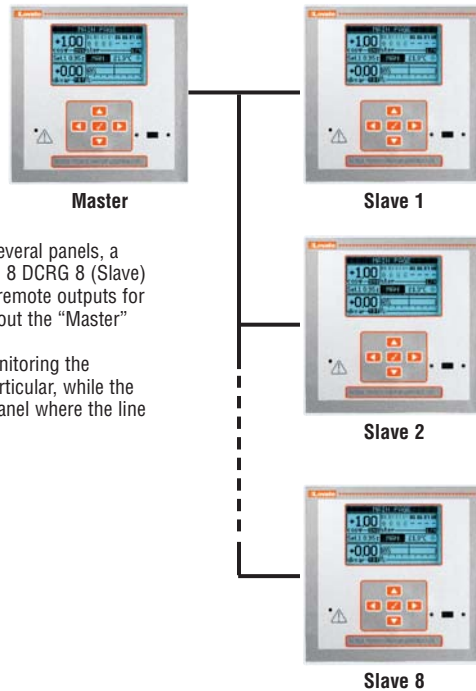See section 2, page 2-14.

Software: Synergy, Xpress and Sam1
See section 27.

EXP expansion modules
See section 28.

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24-10

"Master-Slave" power factor correction system with DCRG 8

Master

Slave 1

Slave 2

Slave 8

When the correction system is divided into several panels, a DCRG 8 (Master) controller can control up to 8 DCRG 8 (Slave) controllers. The "Slave" controllers serve as remote outputs for the connection of capacitor banks that carry out the "Master" controller's commands.
The single controllers are responsible for monitoring the electrical panel and the capacitor banks in particular, while the cosφ reading is centralised in the "Master" panel where the line arrives.
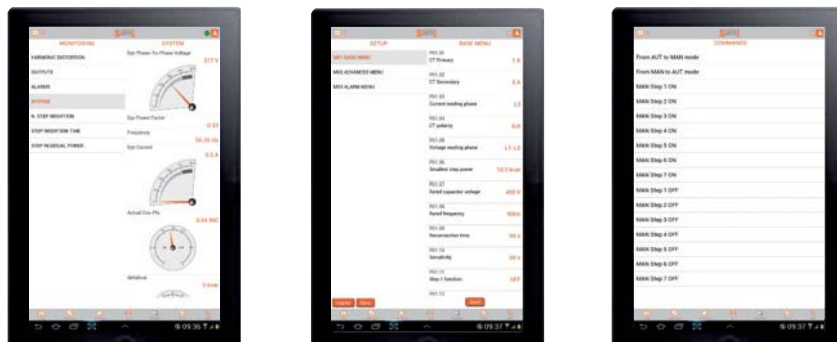
Software and APP

Xpress configuration and remote control software

Synergy Supervision and energy management software

Sam1 APP

General characteristics

By using the **Xpress** software, the quick setup of the controllers can be carried out via PC, avoiding parameter programming errors.
The parameter programming of a DCRL… or DCRG 8 controller can also be saved on PC and quickly loaded into another device requiring the same programming.
It permits the following operations:
– System operation monitoring:
  • Graphical and numerical display of measurements
  • Controller status
– Capacitor efficiency control
  • Current kvar measurement for each step
  • Counters for the number of connections for each step
  • Total hour counter for connection time for each individual step
  • Access all setup parameters
  • Saving / loading parameters
  • Highlighting of changed values
  • Resetting to default values.

The **Synergy** software permits remote control and supervision of the DCRL... and DCRG 8 controllers. See section 27 for details.
This software has structures and applications based on MS SQL relational databases, and the data can be consulted using the most popular browsers.
It is a highly versatile system, simultaneously accessible to a large number of users/workstations via intranets, VPN or Internet.

APP for smartphone and tablet

The **Sam1** application allows the user to program the controller, view alarms, send commands, read measurements, download statistical data and events and send retrieved data by e-mail. The connection is made by Wi-Fi with a smartphone or tablet using the CX 02 device.
It is iOS and Android compatible.
For details, consult section 27 or our Customer Service office; see contact details on inside front cover.

WiFi

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Accessories for DCRL and DCRG

51 C4

Order code	Description	Qty per pkg	Wt
		n°	[kg]
51 C2	Connection cable PC↔DCRL/DCRG+ EXP10 11 length 1.8m/2yd	1	0.090
51 C4	Connection cable PC↔converter 4 PX1, length 1.8m/2yd	1	0.147
51 C5	Connection cable DCRL/DCRG+ EXP1011↔Modem length 1.8m/2yd❶	1	0.111
51 C6	Connection cable DCRG+EXP10 11↔ converter 4 PX1, length 1.8m/2yd	1	0.102
51 C9	Connection cable PC↔Modem, length 1.8m/2yd	1	0.137
EXC CON 01	RS485/ Ethernet converter, 12...48VDC, including DIN rail fixing kit	1	0.400
4 PX1	RS232/RS485 converter drive, galvanically isolated, 220...240VAC (110...120VAC on request)❷	1	0.600
EXC M3G 01	RS485 Gateway/3G modem, 9.5…27VAC/9.5…35VDC, including antenna and programming cable	1	0.340

❶ Consult our Customer Service for modem details; see contact details on inside front cover.
❷ Opto-isolated RS232/RS485 analog modem, 38,400 Baud-rate maximum, automatic or manual TRANSMIT line supervision, 220...240VAC ±10% power supply (110...120VAC on request).

Communication devices

CX 01

CX 02

CX 03

Order code	Description	Qty per pkg	Wt
		n°	[kg]
CX 01	USB/optical dongle PC↔DCRL/DCRG, for programming, data download, diagnostics and updating firmware	1	0.090
CX 02	Wi-Fi connection device for PC↔DCRL/DCRG, for downloading data, programming, diagnostics and cloning	1	0.090
For DCRG8 type only.			
CX 03	GSM penta-band antenna (850/900/1800/1900/2100MHz) for EXP10 15 expansion.	1	0.090

General characteristics
Communication and connection devices to connect the DCRL and DCRG power factor controllers to personal computers, smartphones and tablets.

CX 01
This USB dongle, complete with cable, permits connection of the power factor controller with a PC without needing to disconnect the electrical panel supply, in order to:
– Program parameters
– Copy the settings to external units
– Download data and events
– Carry out diagnostics
– Update the firmware.
The PC identifies the connection as a standard USB.

CX 02
Via Wi-Fi connection, the power factor controllers can be viewed from PCs, smartphones and tablets without having to connect cables, in order to:
– Program parameters
– Download data and events
– Carry out diagnosis and cloning of the device.

CX 03
Compatible with major worldwide mobile phone networks, thanks to the use of 850/900/1800/1900/2100MHz frequencies.
IEC degree of protection: IP67.
Fixing hole Ø10mm (0.40").
Cable length 2.5m/2.73yd.

For dimensions, wiring diagrams and technical characteristics, consult the manuals available online in the Download section of the following website:
www.LovatoElectric.com

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DCTM3 400…

Order code	Step power	Qty per pkg	Wt
	[kvar]	n°	[kg]
DCTM3 400 030	Module for 30kvar step, 400...480VAC	1	4.300
DCTM3 400 050	Module for 50kvar step, 400...525VAC	1	4.300
DCTM3 400 100	Module for 100kvar step 400...525VAC	1	5.600

Power rating available depending on voltage

	DCTM3 400 030	DCTM3 400 050	DCTM3 400 100
Current Ie [A]	43A	72A	144A
Voltage [VAC]	Power [kvar]	Power [kvar]	Power [kvar]
400	30	50	100
440	33	55	110
480	36	60	120
525	—	66	131

General characteristics
– suitable for dynamic (fast) power factor correction
– connection at current flow zero-crossing
– capacitor over-current protection on connection
– over-temperature protection via built-in sensor.

Operational characteristics
– 30kvar, 50kvar and 100kvar steps
– Rated operating voltage:
  • 400...480VAC for DCTM3 400 030
  • 400...525VAC for DCTM3 400 050 and DCTM3 400 100
– Auxiliary fan supply voltage: 230VAC (only for DCTM3 400 100)
– Rated frequency: 50/60Hz
– Control circuit: 8...30VDC
– Controlled voltages: 2
– Forced ventilation: DCTM3 400 100 only
– Ambient conditions:
  • Operating temperature: -10...+45°C
  • Use at higher temperatures with power derating (see page 24-19)
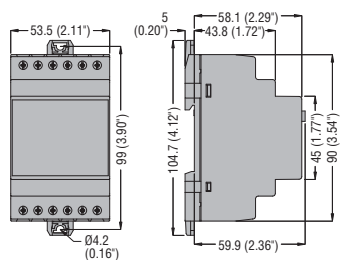– IEC degree of protection: IP10.

INDICATIONS
– Auxiliary power on
– Over-temperature alarm
– Trigger LED.

Compliance:
Compliant with standards: EN 50178.
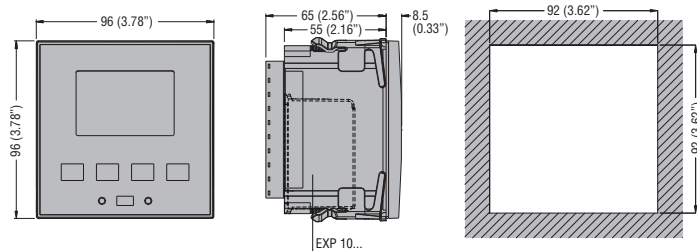
24

REACTIVE CURRENT CONTROL RELAY
DCRM 2

53.5 (2.11")
5 (0.20")
58.1 (2.29")
43.8 (1.72")
99 (3.90')
104.7 (4.12")
45 (1.77")
90 (3.54")
Ø4.2 (0.16")
59.9 (2.36")

AUTOMATIC POWER FACTOR CONTROLLERS
DCRL 3 - DCRL 5

Cutout

96 (3.78")
96 (3.78")
65 (2.56")
55 (2.16")
8.5 (0.33")
EXP 10...

92 (3.62")
92 (3.62")

DCRL 8 - DCRG 8...

Cutout

144 (5.67")
44 (1.73")
137 (5.39")
64.5 (2.54")
144 (5.67")
73 (2.87")
EXP 10...
9 (0.35")

138.5 (5.45")
138.5 (5.45")

THYRISTOR MODULES
DCTM3 400 030 - DCTM3 400 050

157 (6.18")
145 (5.71")
134 (5.27")
123 (4.84")
200 (7.87")
170 (6.69")
120 (4.72")
L1 C1
L3 C3

DCTM3 400 100

157 (6.18")
145 (5.71")
134 (5.27")
123 (4.84")
200 (7.87")
170 (6.69")
120 (4.72")
L1 C1
L3 C3
253 (9.96")
53 (2.09")
83 (3.27")
135 (5.31")

205 (8.07")
135 (5.31")
64 (2.52")
2.5 (0.10")
61 (2.40")
78 (3.07")
83 (3.27")
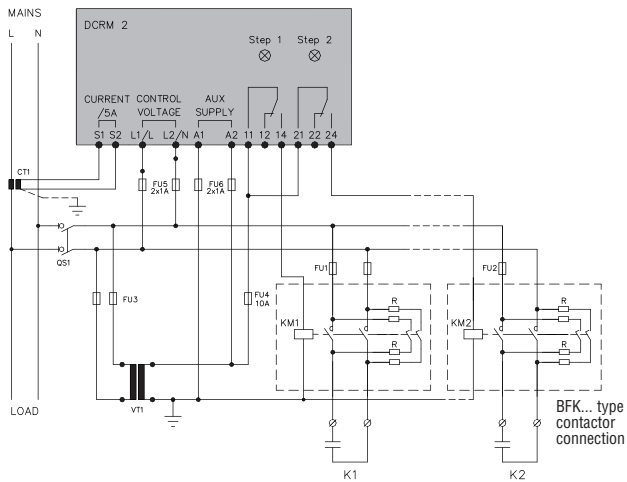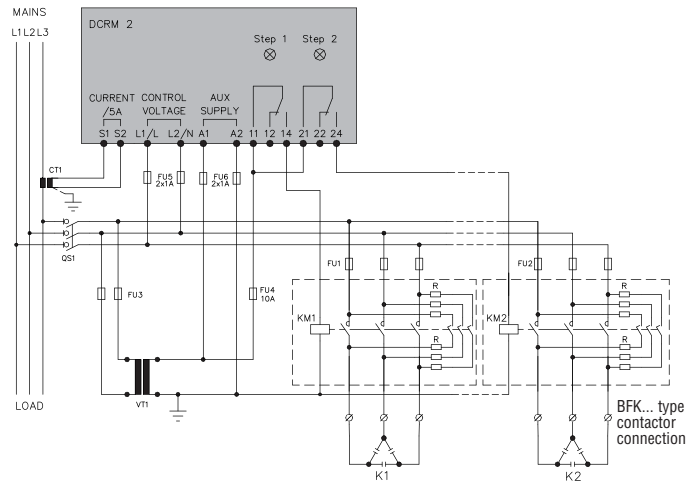5 (0.20")
103 (4.05")

24

REACTIVE CURRENT CONTROL RELAY
DCRM 2
Single-phase connection

Three-phase connection

IMPORTANT
a. For three-phase connection, the voltage measurement input must be connected between two phases; the line CT must be connected on the remaining phase.
b. The polarity of the current measurement input is irrelevant.

CAUTION! Always disconnect the power supply when operating on the terminals.

AUTOMATIC POWER FACTOR CONTROLLERS
DCRL… with BFK… type contactors

BFK... type contactor connection

IMPORTANT
a. For three-phase connection, the voltage measurement input must be connected between two phases; the line CT must be connected on the remaining phase.
b. The polarity of the current measurement input is irrelevant.

CAUTION! Always disconnect the power supply when operating on the terminals.

24

Automatic power factor controllers and thyristor modules
Wiring diagrams

AUTOMATIC POWER FACTOR CONTROLLERS
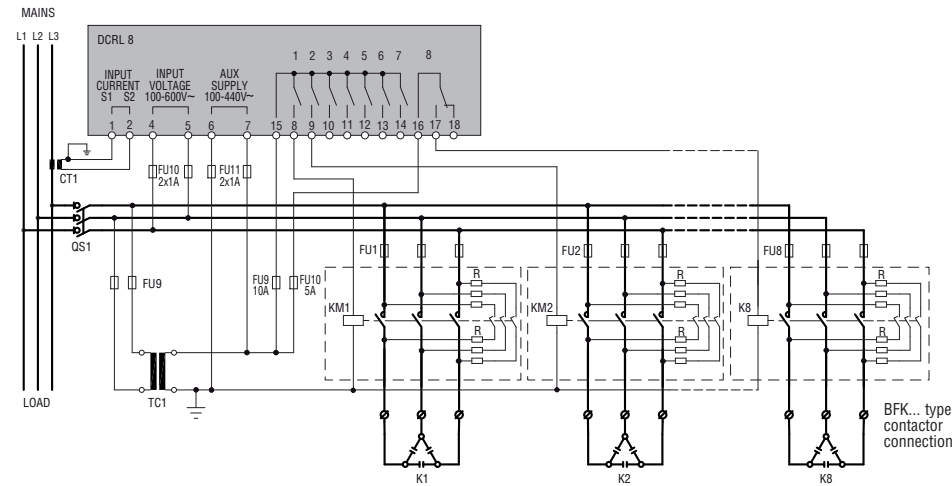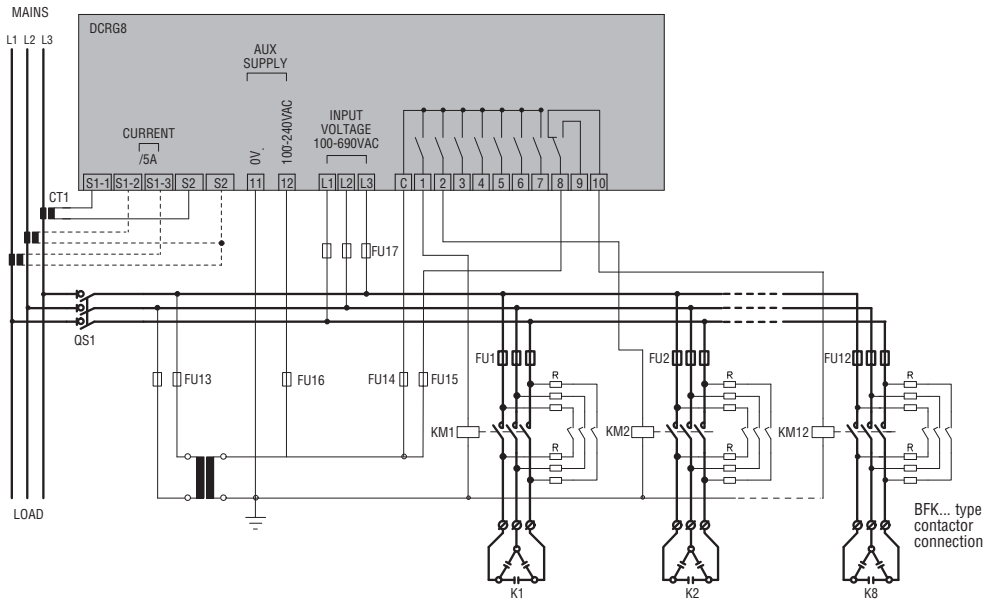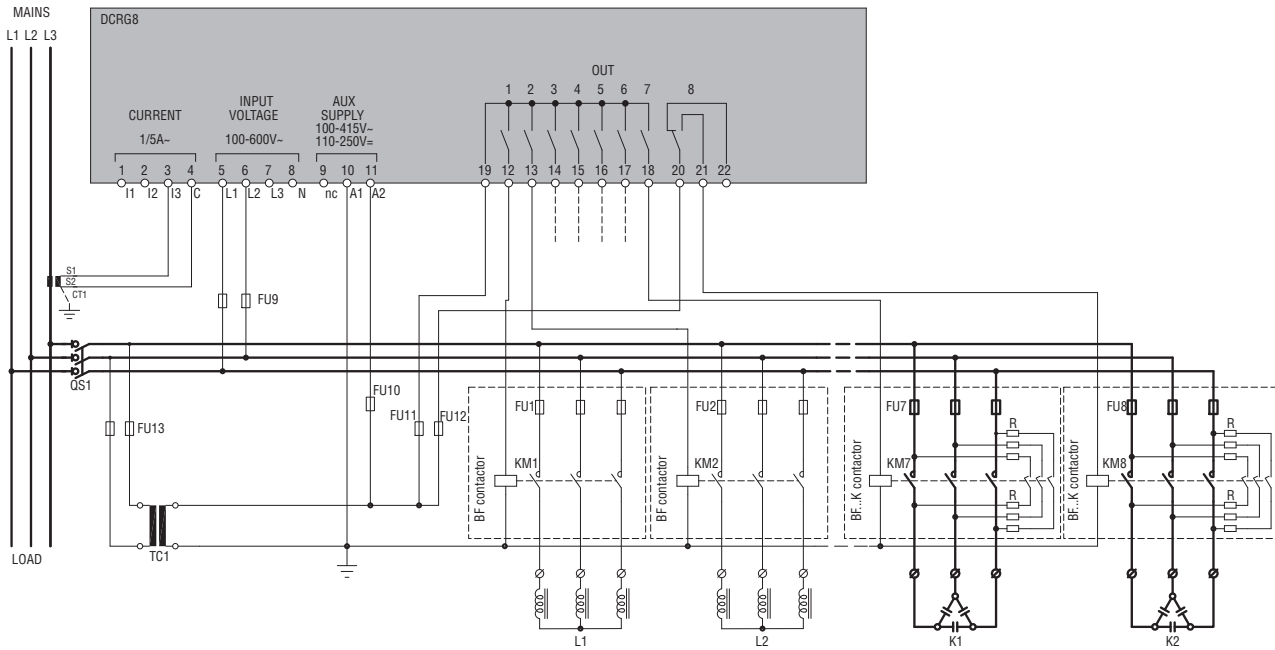**DCRG 8** with BF...K type contactors

IMPORTANT

a. For three-phase connection, the voltage measurement input must be connected between two phases; the line CT must be connected on the remaining phase.

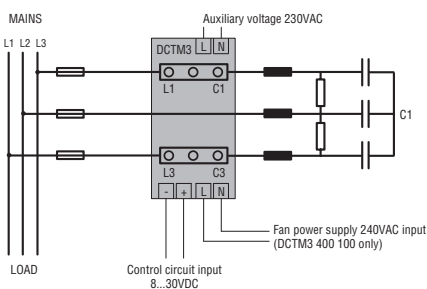b. The polarity of the current measurement input is irrelevant.

CAUTION! Always disconnect the power supply when operating on the terminals.

DCRG 8IND

THYRISTOR MODULES
DCTM3 400…

Automatic power factor controllers and thyristor modules
Technical characteristics
DCRM series reactive current control relay

Lovato electric

TYPE	DCRM 2
AUXILIARY SUPPLY CIRCUIT	
Rated auxiliary voltage (Us)	380...415VAC standard 220...240VAC and 440...480VAC on request❶
Operating range	0.85...1.1 Us
Rated frequency	50/60Hz ±5%
Maximum power consumption/dissipation	4.4VA / 2.4W
Micro-breaking immunity	≤17ms
No-voltage release	≥8ms
VOLTAGE INPUT	
Maximum rated voltage Ue	480VAC❶
Measuring range	80...528VAC
Frequency range	50 or 60Hz ±1% self configurable
Measurement input impedance	>1MΩ
Type of connection	L1-L2 or -N
CURRENT INPUT	
Type of connection	By current transformer (CT)
Rated current Ie	5A AC
Measurement range	0.1...6A
Type of input	Shunt supplied by external current transformer (low voltage). Max. 5A
Measurement method	True RMS value
Overload capacity	+20% Ie
Overload peak	10In for 1s
Dynamic limit	160A for 10ms
Burden	≤0.6W
ADJUSTMENTS	
C/K step 1 and 2	OFF / 0.15...2
Connection / disconnection	1...60s
System configuration	3-phase - 1-phase
RELAY OUTPUTS	
Number of relays	2 (each with 1 changeover)
Rated operational voltage	250VAC
Maximum switching voltage	400VAC
IEC conventional free air thermal current (Ith)	8A
IEC/EN 60947-5-1 and UL/CSA designation	B300
Electrical life with rated load	10^5 cycles
Mechanical life	30×10^6 cycles
INSULATION (input-output)	
Rated insulation voltage	480VAC
CONNECTIONS	
Maximum tightening torque	0.8Nm (7 lbin; 7-9 lbin according to UL/CSA)
Conductor section min....max.	0.2...4.0mm² (24...12 AWG; 18...12 AWG according to UL/CSA)
AMBIENT CONDITIONS	
Operating temperature	−20...+60°C
Storage temperature	−30...+80°C
HOUSING	
Material	Self-extinguishing polyamide

❶ UL/CSA certification obtained with 415VAC maximum.

Automatic power factor controllers and thyristor modules
Technical characteristics
DCRL... and DCRG series automatic power factor controllers

Lovato electric

TYPE	DCRL 3	DCRL 5	DCRL 8	DCRG 8 / DCRG 8IND
AUXILIARY SUPPLY CIRCUIT				
Rated supply voltage (Us)	100...440VAC			100...415VAC
Operating range	90...484VAC			90...456VAC
Rated frequency	50Hz; 60Hz			50Hz; 60Hz
Maximum power consumption	9.5VA		7VA	27VA
Maximum power dissipation (excluding power dissipation from the output contacts)	3.5W		2.5W	105W
VOLTAGE CIRCUIT				
Control voltage	100...600VAC L-L; 100...346VAC L-N			100...600VAC L-L; 100...346VAC L-N
Operating range	50...720VAC L-L; 50...415VAC L-N			50...720VAC L-L; 50...415VAC L-N
Frequency range	45...65Hz			46...65Hz; 360...440Hz
Immunity time for microbreaking	<25ms			35ms (110VAC) - 80ms (220...415VAC)
No-voltage relay release	≥8ms			≥8ms
CURRENT CIRCUIT				
Rated current Ie	Programmable 5A or 1A			
Operating range	0.025...6A for 5A full scale; 0.025...1.2A for 1A full scale			
Constant overload	1.2Ie			
Overload peak	50A for 1 second			
Power consumption	0.6VA			
MEASUREMENT DATA				
Type of voltage and current measurement	True RMS value			
Power factor adjustment	0.5ind....0.5cap.			
Type of temperature sensor type	Internal			Internal + PT100 with EXP10 04 + NTC with EXP10 16
Temperature measurement range	0...+212°C			0...+212°C
RELAY OUTPUTS				
Number of outputs	3/5/8 (up to 14 with EXP10 06 - EXP10 07)			8 (up to 18 with EXP10 06 - EXP10 07)
Contact arrangement	2/4/7 NO contacts + 1 changeover			7 NO contacts + 1 changeover
IEC rated current	5A 250V AC1			5A 250V AC1
Maximum current at common contact terminal	10A			
Maximum switching voltage	415VAC			
IEC/EN 60947-5-1 and UL/CSA designation	B300			
Electrical life with rated load	10^5 cycles			
Mechanical life	$30x10^6$ cycles			
STATIC OUTPUTS				
Number of outputs	—			4 or 8 with EXP10 01
INSULATION				
Rated insulation voltage Ui	600VAC			
Rated impulse withstand voltage Uimp	9.5kV			
Power frequency withstand voltage	5.2kV			
CONNECTIONS				
Type of terminal	Removable			
Conductor section min....max	0.2...2.5mm² (24...12 AWG; 18...12 AWG according to UL)			
AMBIENT CONDITIONS				
Operating temperature	-20...+60°C			-20...+70°C
Storage temperature	-30...+80°C			-30...+80°C
HOUSING				
Version	Flush-mount 96x96mm (3.78x3.78")		Flush-mount 144x144mm (5.67x5.67")	Flush-mount 144x144mm (5.67x5.67")
Material	Polycarbonate		Polycarbonate	Polycarbonate
IEC degree of protection	IP54		IP65	IP65

24

TYPE	DCTM3 400 30	DCTM3 400 50	DCTM3 400 100
VOLTAGE CIRCUIT			
Rated auxiliary voltage (Us)	400...480VAC ±10%	400...525VAC ±10%	400...525VAC ±10%
Rated current Ie	43A	72A	144A
Step power at 400 VAC	30kvar	50kvar	100kvar
Maximum inverse voltage	2200VAC	2800VAC	2800VAC
Number of controlled phases	2	2	2
Auxiliary voltage	230VAC ±10%	230VAC ±10%	230VAC ±10%
Fan supply	—	—	230VAC ±10%
Maximum power consumption	9VA		
Control circuit	8...30VDC (2mA at 12VDC)		
Over-temperature protection	Yes		
Cooling system	Natural	Natural	Forced ventilation
IEC degree of protection	IP10		
AMBIENT CONDITIONS			
Operating temperature	-10...+45°C (Ie<50A) -10...+50°C (Ie<48A) -10...+55°C (Ie<46A)	-10...+45°C (Ie<100A) -10...+50°C (Ie<90A) -10...+55°C (Ie<85A)	-10...+45°C (Ie<190A) -10...+50°C (Ie<180A) -10...+55°C(Ie<170A)
Storage temperature	-30...+80°C		
Altitude	1000 m with no derating; higher up derating 10%/1000m up to 4000m		
HOUSING			
Material	Metal		

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UCC28065DT L6564TD FAN4800ASMY FAN7930MX TDA4862G GEG TDA4863G L4984D NCP1612A1DR2G 415.98.9040 MP44014GS STCMB1 MP44011HS-LF PFS7328H PFS7329H UCC29910APWR UCC28517DWR UCC2818ADR DCRG8 BM1051F-GE2 NCP1654BD133R2G BM1050AF-GE2 BM1C001F-GE2 NCP1611BDR2G NCP1927DR2G UCC2818AQDRQ1 TDA4862GGEGXUMA2 L6561D013TR L6566B MP44010HS-LF-Z LT1509IN#PBF ICE2PCS02GXUMA1 NCP1622BECSNT1G NCP1632DR2G LT1248IS#PBF LT1509ISW#PBF STCMB1TR ICE3PCS03G ADP1048WARQZ-R7 UCC28050DR PFS7627H LT1248CN#PBF LT1248CS#PBF PFS7626H AL1788W6-7 PFS7628H R2A20132SP#W0 PFS7636H ICE3PCS02G L6382D5TR LT1249CN8#PBF