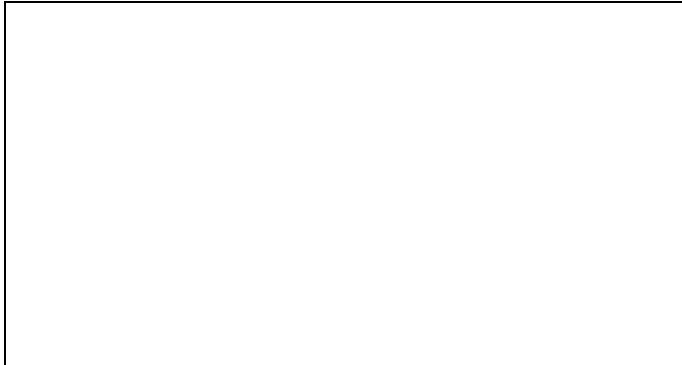




ENGLISH

Automatic Power Factor Controller “CRL 8 – CRL 12”

INSTRUCTIONS MANUAL



**WARNING!**

- Carefully read the manual before the installation or use.
  - This equipment is to be installed by qualified personnel, complying to current standards, to avoid damages or safety hazards.
- Before any maintenance operation on the device, remove all the voltages from measuring and supply inputs and short-circuit the CT input terminals.
  - Products illustrated herein are subject to alteration and changes without prior notice.
  - Technical data and descriptions in the documentation are accurate, to the best of our knowledge, but no liabilities for errors, omissions or contingencies arising there from are accepted.
  - A circuit breaker must be included in the electrical installation of the building. It must be installed close by the equipment and within easy reach of the operator. It must be marked as the disconnecting device of the equipment: IEC /EN 61010-1 § 6.11.2.1.
  - Clean the instrument with a soft dry cloth; do not use abrasives, liquid detergents or solvents.

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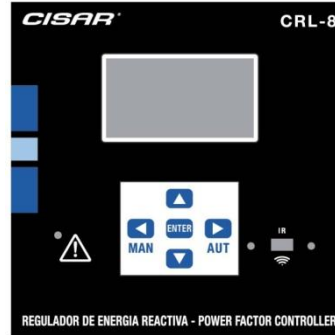
**Introduction**

The CRL8-12 automatic power factor control unit has been designed to offer state-of-the-art functions for power factor compensation applications. Built with dedicated components and extremely compact, the CRL8-12 combines the modern design of the front panel with practical installation and the possibility of expansion from the rear, where two EXP series modules can be slotted. The LCD screen provides a clear and intuitive user interface.

**Description**

- Automatic power factor controller.
- Flush-mount, standard 144x144mm housing.
- Backlit LCD icon screen.
- Versions:
  - CRL8 with 8 relays, expandable to 14 max.
- 5 navigation keys for function and settings.
- Alarm messages in 6 languages (English, Italian, French, Spanish, Portuguese, German).
- Expansion bus with 2 slot for EXP series expansion modules:
  - RS232, RS485, USB, Ethernet communications interface.
  - Additional relay outputs.

- High accuracy TRMS measurements.
- Wide selection of electrical measures, including voltage and current THD with harmonic analysis up to 15<sup>th</sup> order.
- Voltage input separated from power supply, suitable for VT connection in medium voltage applications.
- Wide-range power supply (100-440VAC).
- Front optical programming interface: galvanically isolated, high speed, waterproof, USB and WiFi dongle compatible.
- Programming from front panel, from PC or from tablet/smartphone.
- 2-level password protection for settings.
- Backup copy of original commissioning settings.
- Built-in temperature sensor.
- Tool-less panel mount.



#### Front keyboard

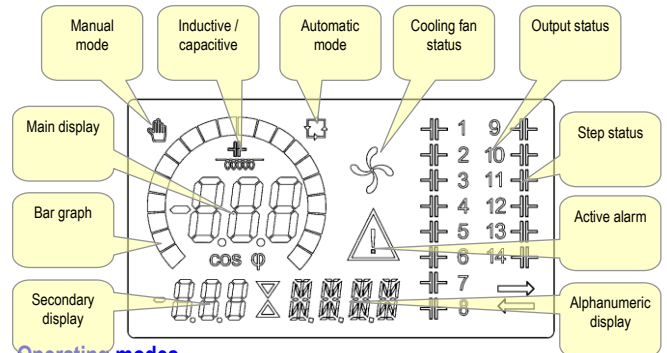
**MODE Key** – Used to select among available measurements. Used also to access programming menus.

**▲ and ▼ keys** – Used to set values and to select steps.

**MAN key** – Used to select operating manual mode.

**AUT key** – Used to select operating automatic mode.

#### Display indications

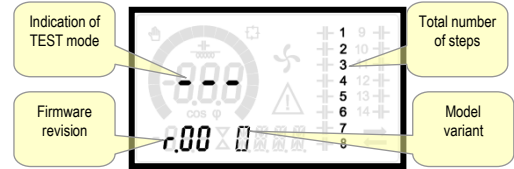


#### Operating modes

There are three possible operating modes, listed below:

##### TEST Mode

- When the unit is brand new and has never been programmed, it automatically enters in TEST mode that allows the installer to manually activate the individual relay outputs, so you can verify the correct wiring of the panel.
- The TEST mode is indicated by three dashes --- shown on the main display.
- The activation and deactivation of the outputs is done directly by pushing ▲ and ▼ buttons, but without considering the reconnection time.
- The TEST mode is automatically left after the parameter programming is done (see *Parameter setting* chapter).

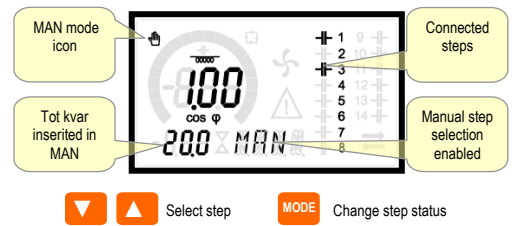


**MAN and AUT Modes**

- The icons AUT and MAN indicate the operating mode automatic or manual.
- For manual mode, press the **MAN** button for 1 sec in a row.
- For automatic mode, press the **AUT** button for 1 sec in a row.
- The operating mode remains stored even after removing and reapplying the power supply voltage.

**MAN Mode**

- When the unit is in manual mode, you can select one of the steps and manually connected or disconnect it.
- In addition to the specific icon, the alphanumeric display shows **MAN** in order to highlight the manual mode condition. Press **MODE** to view the other measurements as usual.
- While the display shows **MAN**, it is possible to select the step to be switched on or off. To select a step, use the **▲** or **▼** buttons. The selected step will flash quickly.
- Press **MODE** to activate or deactivate the selected step.
- If the selected step has not yet exhausted the reconnection time, the **MAN** icon will flash to indicate that the transaction has been accepted and will be conducted as soon as possible.
- Manual configuration of the steps is maintained even when the power supply voltage is removed. When the power returns, the original state of the steps is restored.



**AUT Mode**

- In automatic mode, the controller calculates the optimum configuration of capacitor steps in order to reach the set  $\cos \varphi$ .
- The selection criteria takes into account many variables such as: the power of each step, the number of operations, the total time of use, the reconnection time, etc.
- The controller displays the imminent connection or disconnection of the steps with the flashing of their identification number (left). The flashing can last in cases in which the insertion of a step is not possible due to the reconnection time (discharge time of the capacitor).
- The device initiates automatic corrections when there is an average reactive power request (delta-kvar) higher than 50% of the smallest step, and the measured  $\cos\phi$  is different from the setpoint.

**Measures**

- The CRL8 provides a set of measurements displayed on the alphanumeric display, in conjunction with the current  $\cos\phi$  that is always displayed on the main display.
- Press the **MODE** key to scroll through the measures in rotation.
- After 30 seconds without pressing any buttons, the display automatically returns to the default measurement defined by P.47.
- If P.47 is set on the ROT, then the measures rotate automatically every 5 seconds.
- At the bottom of the list of measures it is possible to set the setpoint of the  $\cos\phi$ , acting on the same value set with P.19.

Below is a table with the measurements displayed.

Measure	Icon	Description
Delta-kvar	$\Delta KVAR$	Kvars needed to reach the cosphi setpoint. If delta-kvar is positive capacitors need to be inserted, if negative to be disconnected.
	$KVAR$	Total kvar of the plant.
	$\Delta STEP$	Number of equivalent steps.
<b>MODE</b>		
Voltage	$V$	RMS voltage of the plant current.
	$V HI$	Maximum peak of measure.
<b>MODE</b>		
Current	$A$	RMS current of the plant voltage.
	$A HI$	Maximum peak of measure.
<b>MODE</b>		
Weekly PF	$WPF$	Weekly average power factor.
	$PF$	Instantaneous total power factor.
<b>MODE</b>		
Cap. current	$\%C.CU$	Calculated capacitor current, in % of their nominal.
	$\%C.HI$	Maximum peak of measure.
<b>MODE</b>		
Temperature	$^{\circ}C$ $^{\circ}F$	Temperature of internal sensor.
	$^{\circ}CHI$ $^{\circ}FHI$	Maximum peak of measure.
<b>MODE</b>		
Voltage THD	$THDV$	Total harmonic distortion % (THD) of plant voltage.
	$VHD2...$ $...VHT5$	% voltage harmonic content from 2.nd up to 15.th order.
<b>MODE</b>		
Current THD	$THDI$	Total harmonic distortion % (THD) of plant current.
	$IHD2...$ $...IHT5$	% Current harmonic content from 2.nd up to 15.th order.
<b>MODE</b>		
Cosphi setpoint		$IND CAP$ Setting of desired cosphi setpoint (same as P.19).
<b>MODE</b>		
Step power		$\%$ Step residual power, as a percentage of the set rated power.
<b>MODE</b>		
Step counter		$OPC$ Operation counter of the step.
<b>MODE</b>		
Step hours		$H$ Hour meter of the step insertion.

These measures are shown only if the *Step trimming* function is enabled (P.25=ON) and the advanced password is enabled and entered.

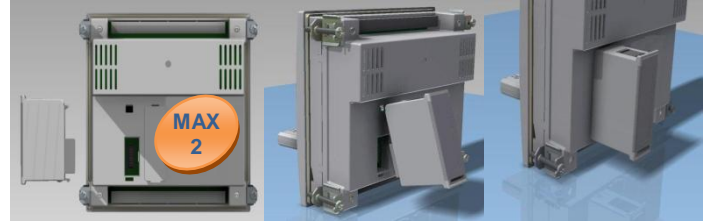
**Keypad lock**

- A function to exclude all modification to operating parameters can be enabled; measurement viewing is still provided in any case.
- To lock and unlock the keypad, press and keep **MODE** key pressed. Then press the key three times and the key twice and after that release **MODE**.
- The display will show *LCK* when the keypad is locked and *UNL* when it is unlocked.
- When the lock is enabled, it is not possible to make the following operations:
  - Operation between automatic and manual mode
  - Access to set-up menus
  - Change of cosphi set-point
- By attempting to conduct the above operations, the display will view *LCK* to indicate the locked keypad state.

**Expandability**

- Thanks to expansion bus, the CRL8 can be expanded with two EXP... series modules.
- The supported EXP modules can be grouped in the following categories:
  - additional steps
  - communication modules
  - digital I/O modules
- To insert an expansion module:
  - remove the power supply to CRL8.
  - remove the protecting cover of the expansion slot.
  - insert the upper hook of the module into the fixing hole on the top of the expansion slot.
  - rotate down the module body, inserting the connector on the bus.
  - push until the bottom clip snaps into its housing.

**Expansion mounting**



- When the CRL8 is powered on, it automatically recognises the EXP module that have been mounted.
- The expansion modules provide additional resources that can be used through the dedicated setup menus.
- The setup menus related to the expansions are always accessible, even if the expansion modules are not physically fitted.
- The following table indicates which models of expansion modules are supported:

MODULE TYPE	CODE	FUNCTION
ADDITIONAL STEPS	EXP 10 06	2 STEP RELAYS
	EXP 10 07	3 STEP RELAYS
DIGITAL I/O	EXP 10 03	2 RELAY C/O
COMMUNICATION	EXP 10 10	USB
	EXP 10 11	RS-232
	EXP 10 12	RS-485
	EXP 10 13	ETHERNET

**IR programming port**

- The parameters of the CRL8 can be configured through the front optical port, using the IR-USB code CX01 programming dongle, or with the IR-WiFi code CX02 dongle.
- This programming port has the following advantages:
  - You can configure and service the CRL8 without access to the rear of the device or having to open the electrical panel.
  - It is galvanically isolated from the internal circuits of the CRL8, guaranteeing the greatest safety for the operator.
  - High speed data transfer.
  - IP54 front panel protection.
  - Limits the possibility of unauthorized access with device config, since it is necessary to have the CX01 or CX02 dongles.
- Simply hold the CX.. dongle up to the front panel, connecting the plugs to the relevant connectors, and the device will be acknowledged as shown by the LINK LED on the programming dongle flashing green.



USB programming dongle code CX01.  
WiFi programming dongle code CX02

**Parameter setting with PC, tablet or smartphone**

- **PC:** You can use the *Xpress* or *Synergy* software to transfer (previously programmed) set-up parameters from the CRL8 to the hard drive of the PC and vice versa.
- **Tablet/Smartphone:** Using the dedicated application CISAR Sam1, available for Android and iOS operative systems together with the CX02 dongle, it is possible to program the parameters in a very easy and innovative way.

**Parameter setting (setup) from front panel**

To access the programming menu (setup) :

- To enter parameter programming the unit must be in **TEST** mode (first programming) or in **MAN** mode.
- From the normal measurement display, press **MODE** for 3 seconds to recall the main menu. **SET** is displayed on the main display.
- If you have set the password (P.21 = ON) instead of **SET** the display shows **PAS** (password entry request). Set the numeric password using **▲ ▼** and then press **AUT** to move to next digit.
- If the password is correct the unit will show **OK U** or **OK R** depending on the entered password is user or the advanced level. The password can be defined with parameters P.22 and P.23. Factory default is 001 and 002 respectively.
- If the entered password is wrong the unit will show **ERR**.
- After having entered the password, the access is enabled until the unit is re-initialized or for 2 minutes without pressing any key.
- After having entered the password, repeat the procedure to access the parameter setting.
- Press **▲ ▼** to select the desired submenu (**BAS**→**ADV**→**ALA** ... ) that is shown on the alphanumeric display.



- The following table lists the available submenus:

Cod	Description
<b>BAS</b>	Access to Base menu
<b>ADV</b>	Access to Advanced menu
<b>ALA</b>	Access to Alarm menu
<b>FUN</b>	Access to Ethernet menu
<b>CMD</b>	Access to Command menu
<b>CUS</b>	Access to Custom menu
<b>SAVE</b>	Exits saving modifications
<b>EXIT</b>	Exits without saving (cancel)

- Press **AUT** to access the submenu.
- When you are in a submenu, the main display shows the code of the selected parameter (eg **P.01** ), while the numeric/alphanumeric displays at the bottom of the screen show the parameter value and / or description.
- Press **AUT** to advance in the selection of items (such as scroll through parameters P.01 → P02 → P03... ), or press **MAN** to go back to the previous parameter.
- While a parameter is selected, with **▲ ▼** you can increase/decrease its value.



- Once you reach the last parameter of the menu, by pressing **AUT** once more will return you to the submenu selection.
- Using **▲ ▼** select **SAVE** to save the changes or **EXIT** to cancel.



- Alternatively, from within the programming, holding **AUT** for three seconds will save the changes and exit directly.
- If the user does not press any key for more than 2 minutes, the system leaves the setup automatically and goes back to normal viewing without saving the changes done on parameters (like EXIT).
- N.B.: a backup copy of the setup data (settings that can be modified using the keyboard) can be saved in the eeprom memory of the CRL8. This data can be restored when necessary in the work memory. The data backup 'copy' and 'restore' commands can be found in the Commands menu.

**Rapid CT set-up**

- When the CT value is not known and only used at the moment of the installation, the P.01 parameter for CT primary can remain set at OFF while all the others can be programmed.
- In this case, during the system installation and once the controller is powered up, the display will show a flashing **CT** (Current Transformer). By pressing **▲ ▼** the CT primary can be set directly.
- Once programmed, press **AUT** to confirm. The unit will store the setting into P.01, and directly restart in automatic mode.



**Parameter table**

- Below are listed all the programming parameters in tabular form. For each parameter are indicated the possible setting range and factory default, as well as a brief explanation of the function of the parameter. The description of the parameter shown on the display can in some cases be different from what is reported in the table because of the reduced number of characters available. The parameter code can be used however as a reference.
- **Note:** the parameters shown in the table with a shaded background are essential to the operation of the system, thus they represent the minimum programming required for operation.

**BASE MENU**

COD	DESCRIPTION	ACC	UoM	DEF	RANGE
P.01	CT primary	Usr	A	OFF	OFF / 1...10.000
P.02	CT secondary	Usr	A	5	1 / 5
P.03	CT read phase	Usr		L3	L1 L2 L3
P.04	CT wiring polarity	Usr		Aut	Aut Dir Inv
P.05	Voltage read phase	Usr		L1-L2	L1-L2 L2-L3 L3-L1 L1-N L2-N L3-N
P.06	Smallest step power	Usr	Kvar	1.00	0.10 ... 10000
P.07	Rated capacitor voltage	Usr	V	400V	50 ... 50000
P.08	Nominal frequency	Usr	Hz	Aut	Aut 50Hz 60Hz Var

P.09	Reconnection time	Adv	sec	60	1 ... 30000
P.10	Sensitivity	Usr	sec	60	1 ... 1000
P.11	Step 1 function	Usr		OFF	OFF 1...32 ON NOA NCA FAN MAN AUT A01...A13
P.12	Step 2 function	Usr		OFF	=
P.13	Step 3 function	Usr		OFF	=
P.14	Step 4 function	Usr		OFF	=
P.15	Step 5 function	Usr		OFF	=
P.16	Step 6 function	Usr		OFF	=
P.17	Step 7 function	Usr		OFF	=
P.18	Step 8 function	Usr		OFF	=
P.19	Cos-phi setpoint	Usr		0.95 IND	0.50 Ind – 0.50 Cap
P.20	Alarm messages language	Usr		ENG	ENG ITA FRA SPA POR DEU

**P.01** – The value of the primary current transformer. Example: with CT 800/5 set 800. If set to OFF, after the power-up the device will prompt you to set the CT and allow direct access to this parameter.

**P.02** – Value of the secondary of the current transformers. Example: with CT 800/5 set 5.

**P.03** – It defines on which phase the device reads the current signal. The wiring of current inputs must match the value set for this parameter. Supports all possible combinations of parameter P.05.

**P.04** – Reading the connection polarity of the CT.

**AUT** = Polarity is automatically detected at power up. Can only be used when working with only one CT and when the system has no generator device.

**Dir** = Automatic detection disabled. Direct connection.

**Inv** = Automatic detection disabled. Reverse wiring (crossover).

**P.05** – Defines on which and on how many phases the device reads the voltage signal. The wiring of voltage inputs must match the setting for this parameter. Supports all possible combinations of parameter P.03.

**P.06** – Value in kvar of the smallest step installed (equivalent to the step weight 1). Rated power of the capacitor bank provided at the rated voltage specified in P.07 and referred to the total of the three capacitors for three-phase applications.

**P.07** – Rated plate capacitor, which is delivered in specified power P.06. If the capacitors are used to a voltage different (lower) than nominal, the resulting power is automatically recalculated by the device.

**P.08** - Working frequency of the system:  
**Aut** = automatic selection between 50 and 60 Hz at power on.  
**50Hz** = fixed to 50 Hz.  
**60Hz** = fixed to 60 Hz.  
**Var** = variable, measured continuously and adjusted.

**P.09** - Minimum time that must elapse between the disconnection of one step and the subsequent reconnection both in MAN or AUT mode. During this time the number of the step on the main page is blinking.

**P.10** – Connection sensitivity. This parameter sets the speed of reaction of the controller. With small values of P.10 the regulation is fast (more accurate around the setpoint but with more step switchings). With high values instead we'll have slower reactions of the regulation, with fewer switchings of the steps. The delay time of the reaction is inversely proportional to the request of steps to reach the setpoint: waiting time = (sensitivity / number of steps required).

**Example:** setting the sensitivity to 60s, if you request the insertion of one step of weight 1 are expected 60s (60/1 = 60). If instead serve a total of 4 steps will be expected 15s (60/4 = 15).

**P11 ... P18** – Function of output relays 1 ... 8:  
**OFF** = Not used.  
**1 .. 32** = Weight of the step. This relay drives a bank of capacitors which power is n times (n = 1...32) the smallest power defined with parameter P.06.  
**ON** = Always on.  
**NOA** = Alarm normally de-energized. The relay is energized when any alarm with the *Global alarm* property arises.  
**NCA** = Alarm normally energized. The relay is de-energized when any alarm with the *Global alarm* property arises.  
**FAN** = The relay controls the cooling fan.  
**MAN** = Relay is energized when device is in MAN mode.  
**AUT** = Relay is energized when device is in AUT mode.  
**A01 ... A13** = The relay is energized when the alarm specified is active.

**P.19** – Setpoint (target value) of the cosphi. Used for standard applications.

**P.20** – Language of scrolling alarm messages.



**ADVANCED MENU**

COD	DESCRIPTION	ACC	UoM	DEF	RANGE
P.21	Password enable	Adv		OFF	OFF ON
P.22	User password	Usr		001	0-999
P.23	Advanced password	Adv		002	0-999
P.24	Wiring type	Usr		3PH	3PH three-phase 1PH single-phase
P.25	Step trimming	Usr		OFF	ON Enabled OFF Disabled
P.26	Setpoint clearance +	Usr		0.00	0 – 0.10
P.27	Setpoint clearance -	Usr		0.00	0 – 0.10
P.28	Step insertion mode	Usr		STD	STD Standard Lin Linear
P.29	Cogeneration cosφ setpoint	Usr		OFF	OFF / 0.50 IND – 0.50 CAP
P.30	Disconnection sensitivity	Usr	sec	OFF	OFF / 1 – 600
P.31	Step disconnection passing in MAN	Usr		OFF	OFF Disabled ON Enabled
P.32	Capacitor current overload alarm threshold	Adv	%	125	OFF / 100...150
P.33	Capacitor overload immediate disconnection threshold	Adv	%	150	OFF / 100.. 200
P.34	VT primary	Usr	V	OFF	OFF / 50-50000
P.35	VT secondary	Usr	V	100	50-500
P.36	Temperature unit of measure	Usr		°C	°C °Celsius °F °Fahrenheit
P.37	Fan start temperature	Adv	°	55	0...212
P.38	Fan stop temperature	Adv	°	50	0...212
P.39	Temperature alarm threshold	Adv	°	60	0...212
P.40	Step failure alarm threshold	Adv	%	OFF	OFF / 25...100
P.41	Maximum voltage alarm threshold	Adv	%	120	OFF / 90...150
P.42	Minimum voltage alarm threshold	Adv	%	OFF	OFF / 60..110

P.43	THD V alarm threshold	Adv	%	OFF	OFF / 1..250
P.44	THD I alarm threshold	Adv	%	OFF	OFF / 1..250
P.45	Hours maintenance interval	Adv	h	9000	OFF/1...30000
P.46	Bar-graph function	Usr		Kvar ins/tot Kvar att/nom	Kvar ins/tot Corr att/nom Delta kvar att/tot
P.47	Default auxiliary measure	Usr		Delta kvar	Deltakvar V A Week TPF Cap. Current Temp THDV THDI ROT
P.48	Backlight flashing on alarm	Usr		OFF	OFF ON
P.49	Serial node address	Usr		01	01-255
P.50	Serial speed	Usr	bps	9.6k	1.2k 2.4k 4.8k 9.6k 19.2k 38.4k
P.51	Data format	Usr		8 bit – n	8 bit, no parity 8 bit, odd 8bit, even 7 bit, odd 7 bit, even
P.52	Stop bits	Usr		1	1-2
P.53	Protocol	Usr		Modbus RTU	Modbus RTU Modbus ASCII Modbus TCP
P.54	Number of switchings for maintenance	Adv	kcnt	OFF	OFF / 1-60

P.55	Step 9 function	Usr		OFF	OFF 1...32 ON NOA NCA FAN MAN AUT A01...A13
P.56	Step 10 function	Usr		OFF	=
P.57	Step 11 function	Usr		OFF	=
P.58	Step 12 function	Usr		OFF	=
P.59	Step 13 function	Usr		OFF	=
P.60	Step 14 function	Usr		OFF	=

**P.21** – If set to OFF, password management is disabled and anyone has access to the settings and commands menu.

**P.22** – With P.21 enabled, this is the value to specify for activating user level access. See Password access chapter.

**P.23** – As for P.22, with reference to Advanced level access.

**P.24** – Number of phases of the power correction panel.

**P.25** - Enables the measurement of the actual power of the step, performed each time they are switched in. The measure is calculated, as the current measurement is referred to the whole load of the plant. The measured power of the steps is adjusted (trimmed) after each switching and is displayed on the step life statistic page. When this function is enabled, a 15 sec pause is inserted between the switching of one step and the following, necessary to measure the reactive power variation.

**P.26 – P.27** - Tolerance around the setpoint. When the cosphi is within the range delimited by these parameters, in AUT mode the device does not connect / disconnect steps even if the delta-kvar is greater than the smallest step.

Note: + means 'towards inductive', while - means 'towards capacitive'.

- Selecting mode of steps insertion.

**Standard mode** – Normal operation with free selection of the steps

**Linear mode** – the steps are connected in progression from left towards right only following the step number and according to the LIFO (Last In First Out) logic. The controller will not connect a step when the system steps are of different ratings and by connecting the next step, the set-point value would be exceeded.

**P.29** - Setpoint used when the system is generating active power to the supplier (with negative active power / power factor).

**P.30** - Disconnection sensitivity. Same as the previous parameter but related to disconnection. If set to OFF the disconnection has the same reaction time of connection set with the previous parameter.

**P.31** - If set to ON, when switching from AUT mode to MAN mode, steps are disconnected in sequence.

**P.32** – Trip threshold for the capacitors overload protection (alarm A08), that will arise after a integral delay time, inversely proportional to the value of the overload.

**Note:** You can use this protection only if the capacitors are not equipped with filtering devices such as inductors or similar.

**P.33** - Threshold beyond which the integral delay for tripping of the overload alarm is zeroed, causing the immediate intervention of the A08 alarm.

**P.34 – P.35** – Data of VTs eventually used in the wiring diagrams.

**P.36** – Unit of measure for temperature.

**P.37 – P.38** - Start and stop temperature for the cooling fan of the panel, expressed in the unit set by P.36. The cooling fan is started when the temperature is >= to P.37 and it is stopped when it is < than P.38.

**P.39** - Threshold for generation of alarm A08 Panel temperature too high .

**P.40** - Percentage threshold of the residual power of the steps, compared with the original power programmed in general menu. Below this threshold the alarm A10 step failure is generated.

**P.41** - Maximum voltage alarm threshold, referred to the rated voltage set with P.07, beyond which the alarm A06 Voltage too high is generated.

**P.42** - Undervoltage alarm threshold, referred to the rated voltage set with P.07, below which the alarm A05 voltage too low is generated.

**P.43** - Maximum plant voltage THD alarm threshold, beyond which the alarm A10 THDV too high is generated.

**P.44** – Maximum plant current THD alarm threshold beyond which the alarm A05 voltage too low is generated.

**P.45** – Maintenance interval in hours. When it is elapsed, the alarm A12 maintenance interval will be generated. The hour count increments as long as the device is powered.

**P.46** – Function of the semi-circular bar-graph.

**Kvar ins/tot:** The bar graph represents the amount of kvar actually inserted, with reference to the total reactive power installed in the panel.

**Curr act/nom:** Percentage of actual plant current with reference to the maximum current of the CT.

**Delta kvar:** bar graph with central zero. It represents the positive/negative delta-kvar needed to reach the setpoint, compared to the total kvar installed.

**P.47** – Default measure shown on the secondary display. Setting the parameter to ROT, the different measures will be shown with a sequential rotation.

**P.48** – If set to ON, the display backlight flashes in presence of one or more active alarms.

**P.49** – Serial (node) address of the communication protocol.

**P.50** – Communication port transmission speed.

**P.51** – Data format. 7 bit settings can only be used for ASCII protocol.

P.52 – Stop bit number.  
 P.53 – Select communication protocol.  
 P.54 - Defines the number of step switchings (considering the step that has the highest count) beyond which the maintenance alarm A12 is generated. This parameter should be used as an alternative to P.45. If both P45 and P.54 are set to a value other than OFF, then P.45 has priority.  
 P.55 ... P60 – Function of output relays 9...14. See description of parameter

**ALARM MENU**

COD	DESCRIPTION	ACC	UoM	DEF	RANGE
P.61	A01 Alarm enable	Adv		ALA	OFF ON ALA DISC A+D
P.62	A01 alarm delay	Adv		15	0-240
P.63	A01 delay uom	Adv		min	Min Sec
...	....	...	...	...	...
P.97	A13 Alarm enable	Adv		ALA	OFF ON ALA DISC A+D
P.98	A13 alarm delay	Adv		120	0-240
P.99	A13 delay uom	Adv		sec	Min Sec

P.61 - Enable alarm A01 and defines the behavior of the controller when the alarm is active:

OFF – Alarm disabled

ON – Alarm enabled, only visual

ALA – Alarm enabled, global alarm relay energized (if set)

DISC – Alarm enabled, logoff step if the controller is in automatic mode

A + D = Alarm relay energized and disconnection of the steps if the controller is in automatic mode.

**Note: when you access the parameters P61, P.64, P67, etc., the auxiliary display shows the relative alarm code.**

P.62 - Delay alarm A01.

P.63 - Unit of delay alarm A01.

P.64 – Like P.61 for alarm A02.

P.65 – Like P.62 for alarm A02.

P.66 – Like P.63 for alarm A02.

...

P.97 – Like P.61 for alarm A13.

P.98 – Like P.62 for alarm A13.

P.99 – Like P.63 for alarm A13.

**Alarms**

- When an alarm is generated , the display will show an alarm icon, the code and the description of the alarm in the language selected.
- If the navigation keys in the pages are pressed, the scrolling message showing the alarm indications will disappear momentarily, to reappear again after 30 seconds.
- Alarms are automatically resetted as soon as the alarm conditions that have generated them disappear.
- In the case of one or more alarms, the behaviour of the CRL8 depends on the *properties* settings of the active alarms.

**Alarm description**

COD	ALARM	DESCRIPTION
-----	-------	-------------

A01	Undercompensation	In automatic mode, all the available steps are connected but the cosphi is still more inductive than the setpoint.
A02	Overcompensation	In automatic mode, all the steps are disconnected but the cosphi is still more capacitive than the setpoint.
A03	Current too low	The current flowing in the current inputs is lower than minimum measuring range. This condition can occur normally if the plant has no load.
A04	Current too high	The current flowing in the current inputs is lower than minimum measuring range.
A05	Voltage too low	The measured voltage is lower than the threshold set with P.42.
A06	Voltage too high	The measured voltage is higher than the threshold set with P.41.
A07	Capacitor current overload	The calculated capacitor current overload is higher than threshold set with P.32 and P.33. After the alarm conditions have disappeared, the alarm message remains shown for the following 5 min or until the user presses a key on the front.
A08	Temperature too high	The panel temperature is higher than threshold set with P.39.
A09	No-Voltage release	A no-voltage release has occurred on the line voltage inputs, lasting more than 8ms.
A10	Voltage THD too high	The THD of the plant voltage is higher than the threshold set with P.43.
A11	Current THD too high	The THD of the plant current is higher than the threshold set with P.44.
A12	Maintenance requested	The maintenance interval set with either P.45 or P.54 has elapsed. To reset the alarm see command menu.
A13	Step failure	The residual power of one or more steps is lower than minimum threshold set with P.40.

**Default alarm properties**

Cod.	Description	Enable	Alarm relay	Disconnection	Delay
A01	Undercompensation	•	•		15 min
A02	Overcompensation	•			120 s
A03	Current too low	•		•	5 s
A04	Current too high	•			120 s
A05	Voltage too low	•	•		5 s
A06	Voltage too high	•	•		15 min
A07	Capacitor current overload	•	•	•	180 s
A08	Temperature too high	•	•	•	30 s
A09	No-Voltage release	•		•	0 s
A10	Voltage THD too high	•	•	•	120 s
A11	Current THD too high	•	•	•	120 s
A12	Maintenance requested	•			0s
A13	Step failure	•	•		0s

**Notes:** The A12 alarm is generated by the thresholds defined in P.45 and P.54 parameters. If the maintenance alarm is generated by exceeding the number of hours in the description will be present the indication HR, if it's generated by exceeding the number of operations will be present the indication CN.

**FUNCTION MENU**

COD	DESCRIPTION	ACC	UoM	DEF	RANGE
F.01	IP address	Usr		192. 168.1.1	IP1.IP2.IP3.IP4 IP1 0...255 IP2 0...255 IP3 0...255 IP4 0...255
F.02	Subnet mask	Usr		0.0.0.0	SUB1.SUB2.SUB3.SUB4 SUB1 0...255 SUB2 0...255 SUB3 0...255 SUB4 0...255
F.03	IP port	Usr		1001	0...9999
F.04	Client/server	Usr		Server	Client/server
F.05	Remote IP address	Usr		0.0.0.0	IP1.IP2.IP3.IP4 IP1 0...255 IP2 0...255 IP3 0...255 IP4 0...255
F.06	Remote IP port	Usr		1001	0...9999
F.07	IP gateway address	Usr		0.0.0.0	GW1.GW2.GW3.GW4 GW1 GW2 GW3 GW4

F.01...F.03 – TCP-IP coordinates for Ethernet interface application.

F.04 – Enabling TCP-IP connection. **Server** = Awaits connections from a remote client. **Client** = Establishes a connection to the remote server

F.05...F.07 – Coordinates for the connection to the remote server when F.04 is set to client.

**Commands menu**

- The commands menu allows executing some occasional operations like reading peaks resetting, counters clearing, alarms reset, etc.
- If the Advanced level password has been entered, then the commands menu allows executing the automatic operations useful for the device configuration.
- The following table lists the functions available in the commands menu, divided by the access level required.
- With controller in MAN mode, press the **MODE** button for 5 seconds.
- Press **▲** to select **CMD**.
- Press **AUT** to access the *Commands menu*.
- Select the desired command with **MAN** or **AUT**.
- Press and hold for three seconds **▲** if you want to execute the selected command. CRL8 shows **OKP** with a countdown.
- If you press and hold **▲** until the end of the countdown the command is executed, while if you release the key before the end, the command is canceled.
- To quit command menu press and hold **AUT** button.

COD	COMMAND	ACCESS LEVEL	DESCRIPTION
C01	RESET MAINTENANCE	Advanced	Reset maintenance service interval.
C02	RESET STEP COUNT	Advanced	Reset step operation counters.
C03	RESET STEP TRIMMING	Advanced	Reload originally programmed power into step trimming.
C04	RESET STEP HOURS	Advanced	Reset step operation hour meters.
C05	RESET MAX VALUES	Advanced	Reset maximum peak values.
C06	RESET WEEKLY TPF	Advanced	Resets weekly total power factor history.
C07	SETUP TO DEFAULT	Advanced	Resets setup programming to factory default.
C08	SETUP BACKUP	Advanced	Makes a backup copy of user setup parameters settings.
C09	SETUP RESTORE	Advanced	Reloads setup parameters with the backup of user settings.

Notes:

- The maintenance alarm A12 (maintenance hours alarm) generated by the parameter P.45 is resetted with C01 command.
- The maintenance alarm A12 (maintenance operations alarm), generated by the parameter P.54, is reset before executing the C01 command and then the C02 command.

**CX02 dongle usage**

- The CX02 dongle offers WiFi Access point capability for connection to PC, tablet or smartphones. In addition to this function it also offer the

possibility to store and transfer a block of data from/to the CRL8.

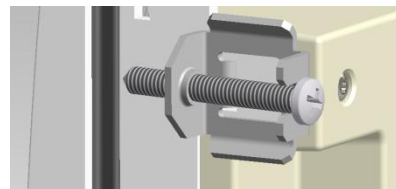
- Insert the interface CX02 into the IR port of CRL8 on the front plate.
- Switch CX02 on by pressing the button for 2 sec.
- Wait until the *LINK* LED becomes orange flashing.
- Press 3 times consecutively and fast the dongle button.
- At this point the display of the CRL8 shows the first of the 6 possible commands (D1...D6).
- Press ▲ ▼ to select the desired command.
- Press *AUT* to execute the selected command. The unit will prompt for a confirmation (*OK?*). Press once again *AUT* to confirm or *MODE* to cancel.
- The following table lists the possible commands:

COD	COMMAND	DESCRIPTION
D1	SETUP DEVICE → CX02	Copies Setup settings from CRL8 to CX02.
D2	SETUP CX02 → DEVICE	Copies Setup settings from CX02 to CRL8.
D3	CLONE DEVICE → CX02	Copies Setup settings and working data from CRL8 to CX02.
D4	CLONE CX02 → DEVICE	Copies Setup settings and working data from CX02 to CRL8.
D5	INFO DATA CX02	Shows information about data stored into CX02.
D6	EXIT	Exits from dongle menu.

- For additional details see CX02 operating manual.

### Installation

- CRL8 is designed for flush-mount installation. With proper mounting and using dedicated gasket, it guarantees IP54 front protection.
- From inside the panel, for each four of the fixing clips, position the clip in one of the two sliding guide, then press on the clip corner until the second guide snaps in.
- From inside the panel, for each four of the fixing clips, position the clip in its square hole on the housing side, then move it backwards in order to position the hook.
- Repeat the same operation for the four clips.
- Tighten the fixing screw with a maximum torque of 0,5Nm.
- In case it is necessary to dismount the system, repeat the steps in opposite order.



- For the electrical connection see the wiring diagrams in the dedicated chapter and the requirements reported in the technical characteristics table.

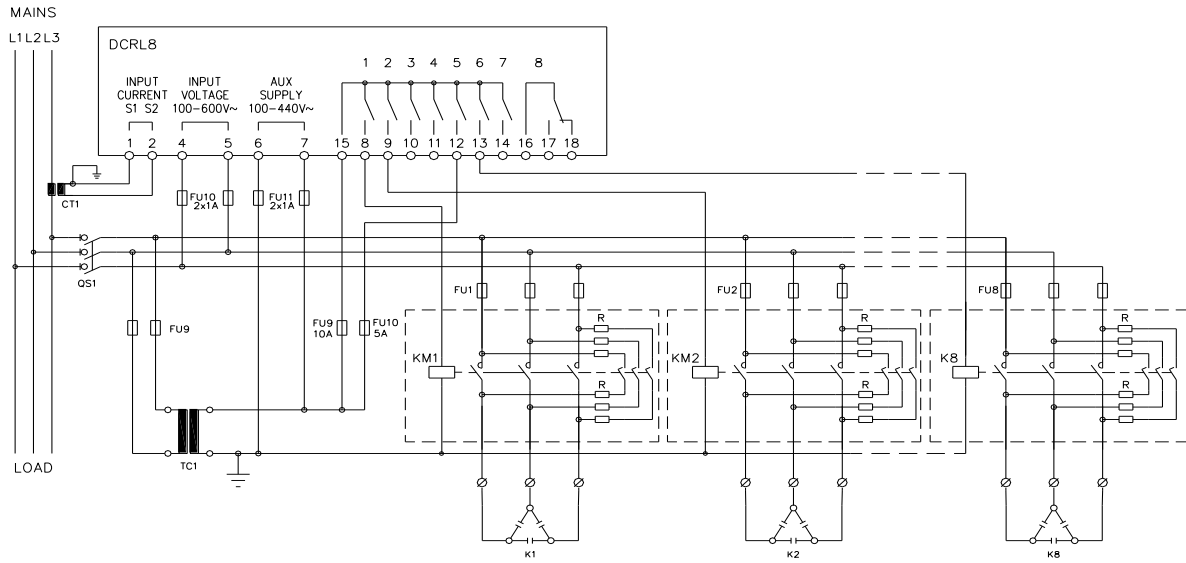
Wiring diagrams



WARNING!

Disconnect the line and the supply when operating on terminals.

Standard Three-phase wiring



THREE-PHASE STANDARD CONNECTION (default)

Default wiring configuration for standard applications.

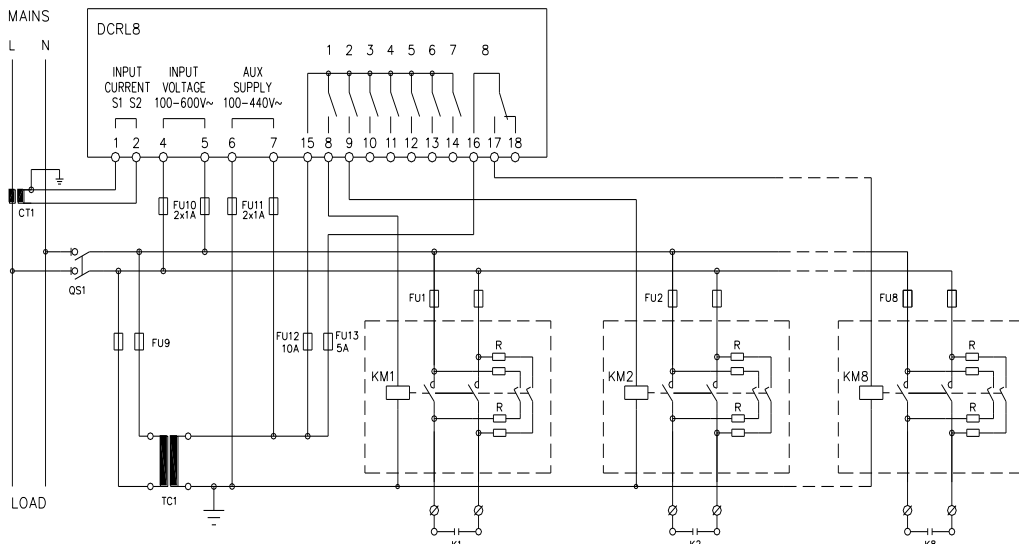
Voltage measure	1 ph-to-ph voltage reading L1-L2
Current measure	L3 phase
Phase angle offset	Between V (L1-L2) and I (L3) ⇒ 90°
Capacitor overload current measure	1 reading calculated on L1-L2
Parameter setting	P.03 = L3 P.05 = L1-L2 P.24 = 3PH

NOTES



- For three-phase connection, the voltage input must be connected phase to phase; the current transformer must be connected on the remaining phase.
- The polarity of the current/voltage input is indifferent.

Single-phase wiring



SINGLE-PHASE CONNECTION

Wiring configuration for single-phase applications

Voltage measure	1 phase voltage reading L1-N
Current measure	L1 phase
Phase angle offset	Between V (L1-N) and I (L1) ⇒ 0°
Capacitor overload current measure	1 reading calculated on L1-N
Parameter setting	P.03 = L1 P.05 = L1-N P.24 = 1PH

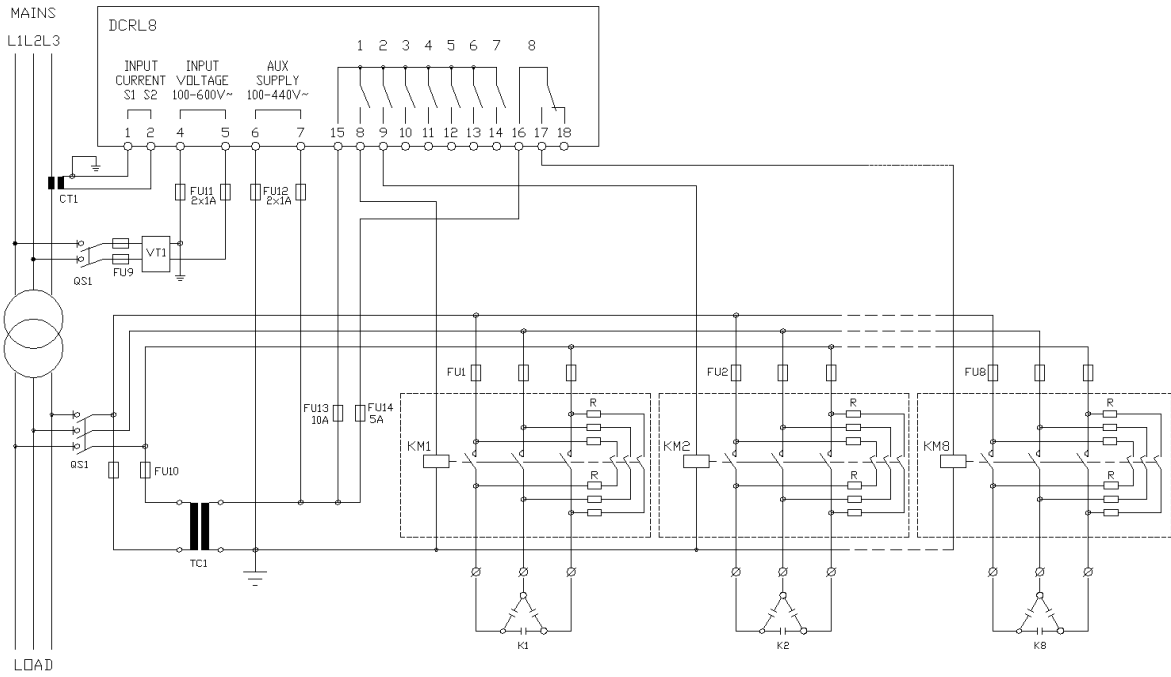
NOTES

NOTA



**IMPORTANT!**  
The polarity of the current/voltage input is irrelevant.

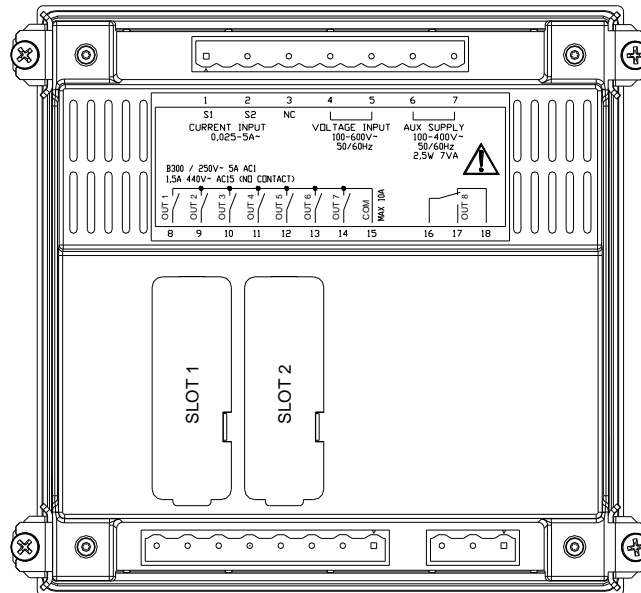
**MV wiring**



**Configuration with MV measurement and correction**

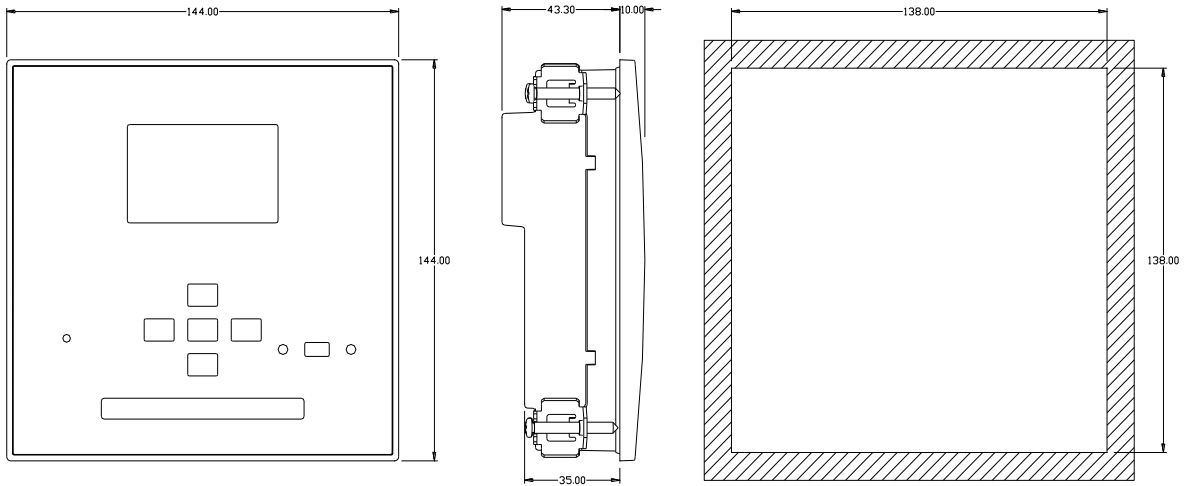
Voltage measure	3 ph-to-ph voltage reading L1-L2, L2-L3, L3-L1 on MV side	
Current measure	L1-L2-L3 phase	
Phase angle offset	90°	
Capacitor overload current measure	disabled	
Parameter setting	P.03 = L3	P.34 = VT primary
	P.05 = L1-L2	P35 = VT secondary
	P.24 = 3PH	

**Terminals position**





**Mechanical dimensions and panel cutout (mm)**



**Technical characteristics**

<b>Supply</b>		
Rated voltage U <sub>s</sub> ●		100 - 440V~ 110 - 250V=
Operating voltage range		90 - 484V~ 93,5 - 300V=
Frequency		45 - 66Hz
Power consumption/dissipation		2.5W – 7VA
No-voltage release		>= 8ms
Immunity time for microbreakings		<= 25ms
Recommended fuses		F1A (fast)
<b>Voltage inputs</b>		
Maximum rated voltage U <sub>e</sub>		600V~
Measuring range		50...720V
Frequency range		45...65Hz
Measuring method		True RMS
Measuring input impedance		> 15MΩ
Accuracy of measurement		1% ±0,5 digit
Recommended fuses		F1A (fast)
<b>Current inputs</b>		
Rated current I <sub>e</sub>		1A~ or 5A~
Measuring range		For 5A scale: 0.025 - 6A~ For 1A scale: 0.025 – 1.2A~
Type of input		Shunt supplied by an external current transformer (low voltage). Max. 5A
Measuring method		True RMS
Overload capacity		+20% I <sub>e</sub>
Overload peak		50A for 1 second
Accuracy of measurement		± 1% (0,1...1,2In) ±0,5 digit
Power consumption		<0.6VA
<b>Measuring accuracy</b>		
Line voltage		±0.5% f.s. ±1digit
<b>Relay output OUT 1 - 7</b>		
Contact type		7 x 1 NO + contact common
UL Rating		B300, 5A 250V~ 30V= 1A Pilot Duty, 1.5A 440V~ Pilot Duty
Max rated voltage		440V~
Rated current		AC1-5A 250V~ AC15-1,5A 440V~
Maximum current at contact common		10A
Mechanical / electrical endurance		1x10 <sup>7</sup> / 1x10 <sup>5</sup> ops
<b>Relay output OUT 8</b>		
Contact type		1 changeover
UL Rating		B300, 5A 250V~ 30V= 1A Pilot Duty, 1.5A 440V~ Pilot Duty
Max rated voltage		440V~
Rated current		AC1-5A 250V~ AC15-1,5A 440V~
Mechanical / electrical endurance		1x10 <sup>7</sup> / 1x10 <sup>5</sup> ops
<b>Insulation voltage</b>		
Rated insulation voltage U <sub>i</sub>		600V~
Rated impulse withstand voltage U <sub>imp</sub>		9.5kV
Power frequency withstand voltage		5,2kV
<b>Ambient operating conditions</b>		
Operating temperature		-20 - +60°C
Storage temperature		-30 - +80°C
Relative humidity		<80% (IEC/EN 60068-2-78)
Maximum pollution degree		2
Overvoltage category		3
Measurement category		III
Climatic sequence		Z/ABDM (IEC/EN 60068-2-61)
Shock resistance		15g (IEC/EN 60068-2-27)
Vibration resistance		0.7g (IEC/EN 60068-2-6)
<b>Connections</b>		

Technical manual power factor controller "CLL8 – CRL12"

		Terminal type	Plug-in / removable
		Cable cross section (min... max)	0.2...2.5 mm <sup>2</sup> (24... 12 AWG)
		UL Rating	0,75...2.5 mm <sup>2</sup> (18...12 AWG)
		Cable cross section (min... max)	
		Tightening torque	0.56 Nm (5 LBin)
		<b>Housing</b>	
		Version	Flush mount
		Material	Polycarbonate
		Degree of protection	IP54 on front with gasket - IP20 terminals
		Weight	640g
		<b>Certifications and compliance</b>	
		cULus	Pending
		Reference standards	IEC/EN 61010-1, IEC/EN 61000-6-2 IEC/ EN 61000-6-4 UL508 and CSA C22.2-N°14
		UL Marking	Use 60°C/75°C copper (CU) conductor only AWG Range: 18 - 12 AWG stranded or solid Field Wiring Terminals Tightening Torque: 4.5lb.in Flat panel mounting on a Type 1 enclosure
		<b>ⓘ Auxiliary supply connected to a line with a phase-neutral voltage ≤300V</b>	
		<b>Manual revision history</b>	
		<b>Rev</b>	<b>Date</b>
		<b>Notes</b>	
		00	12/18/2014
			First release

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