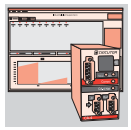
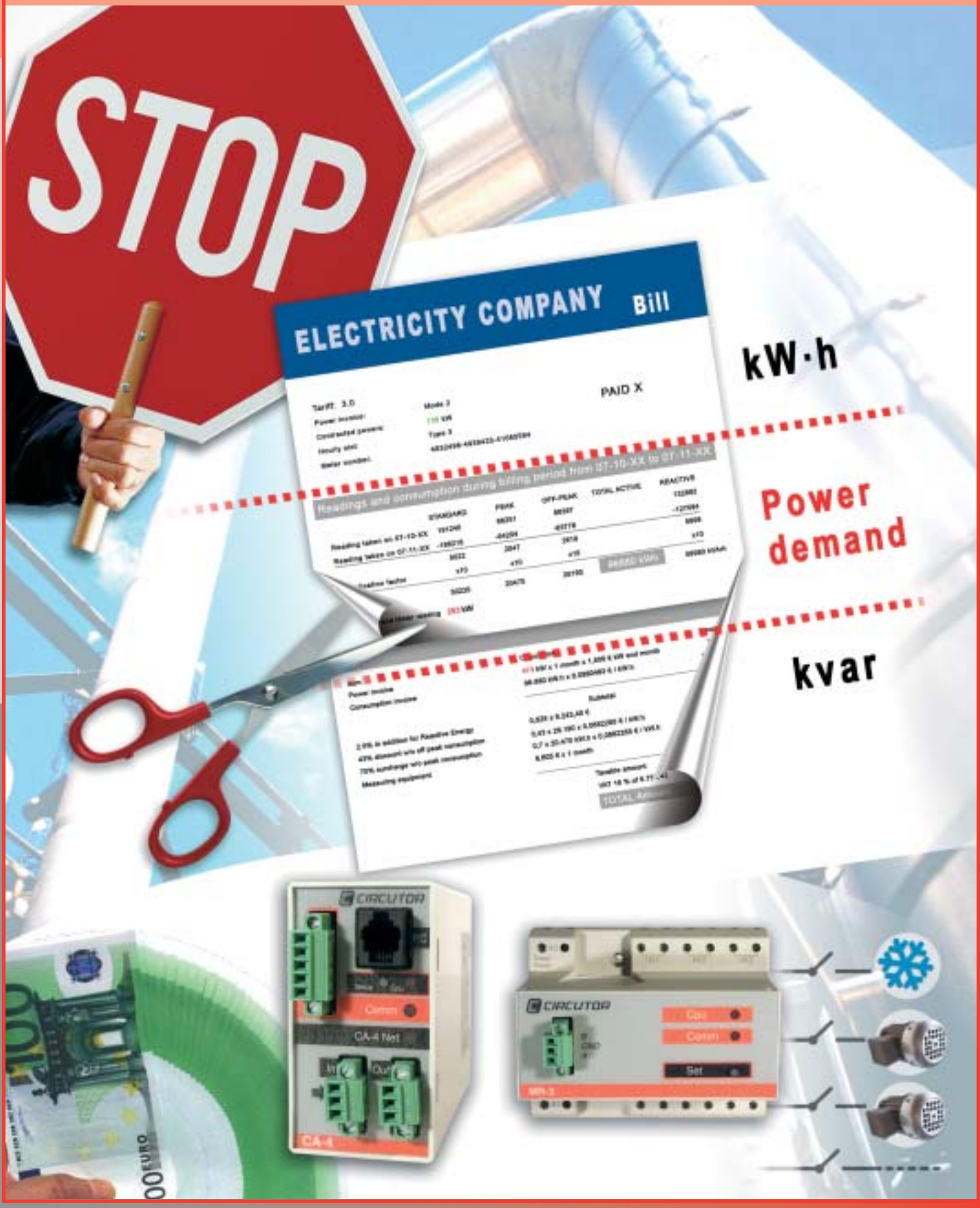
CIRCUTOR

Maximum demand control systems

M 6

M.6.01 GB





Maximum Demand Control

- There are three terms that appear on the majority of electric company bills:
- Active energy consumption (kWh)
- Reactive energy consumption (kvarh)
- Maximum Demand

Traditionally, utility companies have concentrated their energy saving efforts on two items:

- Reduction of Kilowatt Hour consumption
- Improving the electrical system's Power Factor

There is a third item to consider when reducing the amount of the electric company bill, proper kW Demand management which aloows:

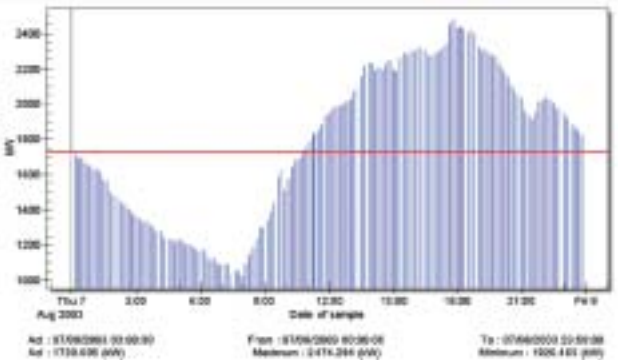
- The reduction of the contracted power
- Adjusting to the new kW limit
- Avoiding kW Demand limit penalties

WHAT IS MAXIMUM DEMAND?

Maximum Demand is the power consumed over a predetermined period of time, which is usually between 8 – 30 minutes.

The most common period of time, in the majority of countries, is 15 minutes.

This power is calculated and billed by a kW demand meter, which records the highest kW value in one 15 minute period, over a month's time.



CALCULATING MAXIMUM DEMAND

There are several different ways to calculate Maximum Demand:

• Fixed Demand (Block Demand)
The utility company sends a signal to synchronize the start of the Maximum Demand period.

- **Rolling demand**

In a 15 minute window, the last kW value in the current window is used as the first kW value in the next 15 minute window. The kW value is updated every second.

- **Time Synchronization window**

This type of demand is a Fixed Demand. The utility company sends a signal at the start of the day to synchronize the start of the first period. The meter, using its own internal clock, synchronizes each period thereafter until, at the end of the day, the utility company send a signal to reset the meter's clock to match the utility's clock.

- **Thermal demand**

This demand is calculated by a bimetallic, analog kW demand meter or an electronic version of a bimetallic kW demand meter.

HOW DOES THIS EFFECT YOU BILL?

This example shows how excess power consumption effects the electric company bill:

Contracted power: 136 kW

kW Demand meter reading: 253 kW

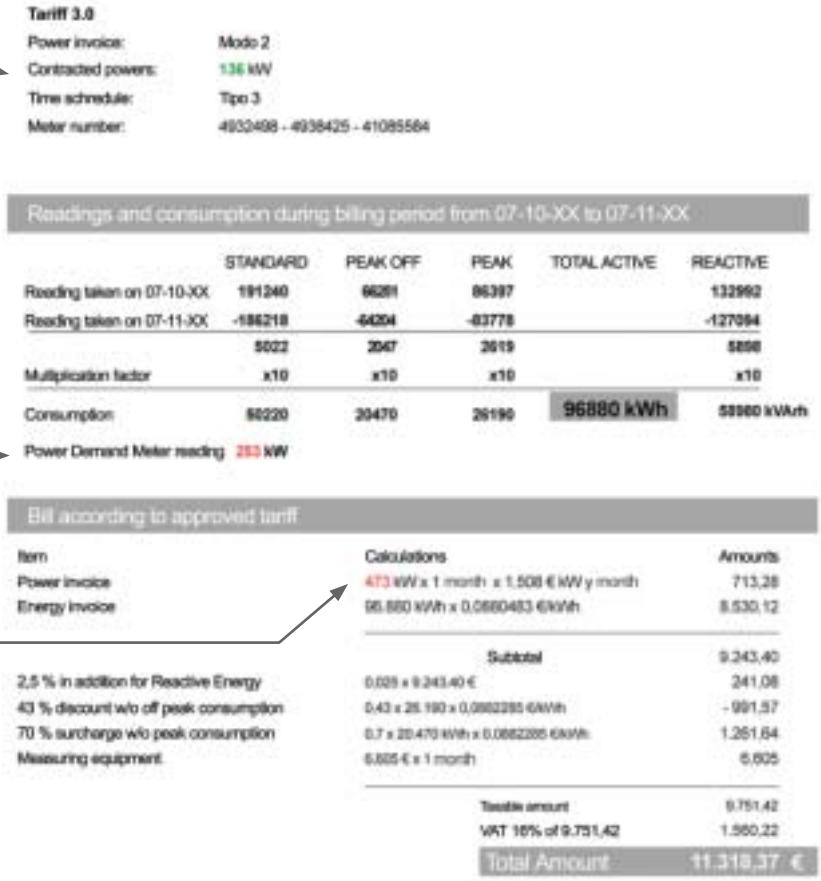
Maximum demand calculated without surcharge*:
136 kW x 1.05 = 142.80 kW

Excess power consumed *:
253 kW - 142.80 kW = 110.2 kW

kW penalty *:
110.2 kW x 2 = 220.4 kW

Total kW to be billed:
220.4 kW + 253 kW = 473.4 kW

Proper management of kW powerconsumption would not have allowed 136 kW to be exceeded and 205.1 € would have been charged instead of 713.28 €.
71.25 % LESS!



Tariff 3.0

Power invoice:	Modo 2
Contracted powers:	136 kW
Time schredule:	Tipo 3
Meter number:	4932498 - 4938425 - 41085584

Readings and consumption during billing period from 07-10-XX to 07-11-XX

	STANDARD	PEAK OFF	PEAK	TOTAL ACTIVE	REACTIVE
Reading taken on 07-10-XX	191240	66281	86397		132992
Reading taken on 07-11-XX	-186218	-64204	-83778		-127084
	5022	2047	2619		5898
Multiplication factor	x10	x10	x10		x10
Consumption	50220	20470	26190	96880 kWh	58980 kVArh
Power Demand Meter reading: 253 kW					

Bill according to approved tariff

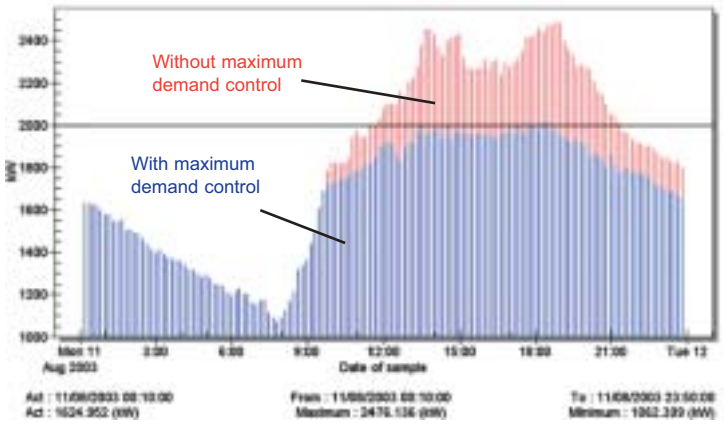
Item	Calculations	Amounts
Power invoice	473 kW x 1 month x 1.508 € kW y month	713,28
Energy invoice	96.880 kWh x 0.0880483 €/kWh	8.530,12
	Subtotal	9.243,40
2,5 % in addition for Reactive Energy	0.025 x 9.243,40 €	241,08
43 % discount w/o off peak consumption	0.43 x 26.190 x 0,0882285 €/kWh	- 991,57
70 % surcharge w/o peak consumption	0.7 x 20.470 kWh x 0,0882285 €/kWh	1.261,64
Measuring equipment	6.605 € x 1 month	6,605
	Taxable amount	9.751,42
	VAT 16% of 9.751,42	1.560,22
	Total Amount	11.310,37 €

* In other countries, the formulas used in calculating kW penalties are different and may even be more rigid.

HOW TO CONTROL MAXIMUM DEMAND?

The purpose of controlling the demand is, not to exceed the contracted maximum demand limit. One way to do this is to shed non-critical loads.

Possible loads to be disconnected:
- Lights
- Compressors
- Air conditioners
- Pumps
- Fans and extractors
- Packaging machinery
- Shredders
- Others...



Generally, all those machines which do not affect the main production process or which are not essential.

In addition to controlling kW demand, the following equipment is suitable for processes which have large variations in kW demand and low loading factors, such as companies in the smelting, mining, automobile, textile, paper industries, etc.

Equipment to Control Maximum Demand

CIRCUTOR, SA offers all the necessary equipment for optimum energy / demand management.

The following equipment measures instantaneous power and automatically calculates
and determines if and when the kW demand will exceed the limit set forth by the utility
company. This is done by reliably disconnecting and reconnecting non-critical loads
using relays which are built into the equipment.

The CVM - R8 CPP and the CA - 4 can also be programmed with different Tariffs (Time of Use periods) to shed loads within different contracted limits.

METHOD OF OPERATION

There are two methods used to avoid excess Maximum Demand:

- **Preventive**

The Preventive method is suitable for those companies who do not want to allow the automatic connection or disconnection of loads.
This system operates using visual or audible alarms indicating that the kW demand limt is going to be exceeded and that an operator should manually disconnect certain loads.

- **Predictive**

The predictive method is most often used.
The unit predicts what is going to happen, based on the load at the end of the current period and optimises the loads in order to have as many loads connected without exceeding the maximum demand limit, which is preset in the unit.
This method of control is used when calculating demand using the fixed or synchronised demand methods.

			
Type	**DH96 CPP**	**CVM-R8 CPP**	**CPP-BT / CPP-CT**
Number of loads controlled	4	17 (2)	128
Company impulse input	•	•	•
System operation	Any	Fixed demand	Rolling or fixed demand
Method of operation	Preventive or predictive	Predictive	Preventive or predictive
Software used	Easy Comm	--	Power C
Communications	RS-232 or RS-485 (1)	--	RS-232
Page	5	7	8

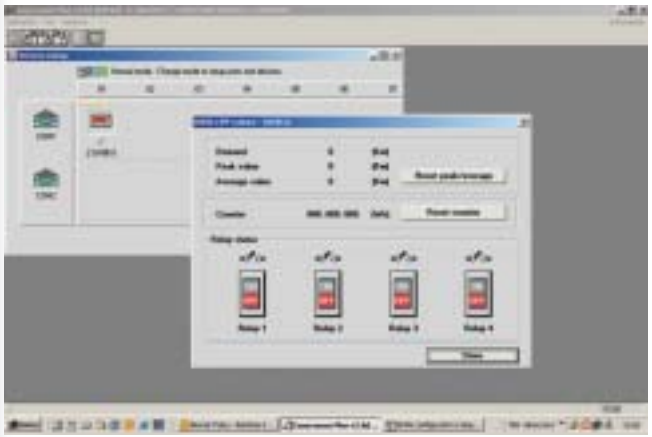
(1) DH96 CPP-RS (2) With CVM-R10 extension module

DH96 CPP

- Control up to four loads or groups of loads using contactors
- Minimal response time to disconnect / connect loads
- Connects to the utility meter's isolated pulse output. Can also connect to any of our measuring devices when a utility pulse is not available.
- Calculates Maximum Demand using either the Rolling, Fixed (Block) Synchronization or Thermal demand methods.
- Prioritizes the loads to be disconnected when reaching the maximum demand limit.
- Comes with software, when ordered with communications, to trend from 1 – 60 minute records of both consumption and relay change of states (opening and closing of relays).
- Substantial recording and control capabilities housed in a stand-alone unit priced for a short-term return on investment.
- Select between Preventive or Predictive demand control in the same unit.

Type	Code
DH96 CPP	**M54031**

SOFTWARE



Features

Power supply circuit	115 / 230 V (-15 % / +20 %)
Consumption	4 V•A (without card) 7 V•A (with card)
Frequency	45 ... 65 Hz
Input circuit	
Accuracy on reading	0,5% ±1 dig
Resolution	10 bits
Overvoltage (permanent / for 10 s)	1,2 U_n / 2 U_n
Current overload (permanent / for 10 s)	1,2 I_n / 5 I_n
Measurement margin	2 ...120%
Nº. of conversions per cycle	32
Display	7 x 14 mm segments, red
Digits	4
Display refresh	< 1s
Decimal point	Programmable
Range excess indicator	" - - - - "

Innsulation	Between input, measurement and optional output card
Test voltatge	3 kV , 50 HZ , 1 min
Impulse test	4 kV (1,2 / 50 µs)
Output relays	1 single contact
Insulating voltage	750 V contact-contact 2 000 V contact-coil
Thermal current (I_{th})	5 A
Maximum operating power	750 V·A
Mechanical life	2 x 10^7 operations
Electrical life	30 000 operations at 5 A and 250 V
Digital inputs	2 inputs, potential free contacts (20 mA-24 V d.c.)
Environmental conditions	
Storage temperature	- 40 ºC / +70 ºC
Operating temperature	-10 ºC / +65 ºC
Assembly features	
Casing material	ABS V0, anthracite grey
Protection grade	Casing and terminals: IP 20 / Front: IP 54
Weight	550 g
Standards	IEC 1010, IEC 348, IEC 664, VDE 0110, VDE 0435

ACCESSORIES

Converters (see M.5 catalogue)

CVM-R8 CPP

- Control up to seventeen loads or groups of loads using contactors
- Minimal response time to disconnect / connect loads
- Connects to the utility meter's isolated pulse output. Can also connect to any of our measuring devices when a utility pulse is not available.
- Calculates Maximum Demand using Fixed (Block) demand method.
- Prioritizes the loads to be disconnected when reaching the maximum demand limit.
- Utilizes load connection offsets to prevent tripping of circuits due to motor start up curves.
- Alarm indication in the event of synchronization signal loss.
- Predictive demand control.
- There are three additional inputs used to select tariffs and to control the loads associated with those tariffs.

Type	Code
CVM-R8 CPP	**M60311**

Fixed demand
The CVM - R8 CPP is connected to the synchronization pulse generated from the utility company's demand.
When the CVM-R8 CPP receives the pulse it ends one demand period and starts the next demand period.

Measurement by impulse
Measurement of consumed energy (kWh), during each demand period, is calculated by counting KYZ pulses from the utilty meter.
If a utility pulse is not available then connect the CVM-R8 CPP to any of our measuring devices that elicit a pulse.

Features

Power supply circuit	
Voltage	Single-phase 220 V a.c. (+10 % / -15 %)
Frequency	50 ... 60 Hz
consumption	7 V·A
Output relay features	
Number of relays	8
Insulating voltage (U_i)	270 V a.c. / 125 V d.c.
Thermal current (I_{th})	3 A
A. C. 11 I_e / U_e	2 A / 250 V a.c.
D. C. 11 I_e / U_e	2 A / 30 V d.c.
Maximum operating power	750 V·A a.c. - 90 W d.c.
Mechanical life	2 x 10^7 operations
Electrical life	2 x 10^5 operations (at full loading)
Digital inputs	6 6 inputs, potential free contacts (20 mA - 24 V d.c.)
Analogue inputs	2 entradas de 0 ... 2 V d.c.

Display	
Alphanumeric display with 1 x 8 characters (50 x 15 mm)	
Environmental conditions	
Operating temperature	-10 ºC / +65 ºC
Assembly features	
Casing type	Modular self-extinguishing plastic
Connection	Metal terminals with "posidriv"
Screws	Mounting DIN 46277 (EN 50022) rail coupling (Screw mounting option)
Front of the box	Lexan front
Protection	Built in relay: IP 41: IP 41 Terminals: IP 20
Dimensions	140 x 70 x 110 mm (8 modules)
Safety	Category II (EN 61010)
Standards	IEC 255, IEC 348, UNE 21 136, IEC 664, VDE 0110, UL 94

CA-4 / MR-3

- **Minimal response time to disconnect / connect loads**
- **Connects to the utility meter's isolated pulse output. Can also connect to any of our measuring devices when a utility pulse is not available.**
- **Calculates Maximum Demand using either the Rolling, Fixed (Block) demand methods.**
- **Using the PS12 DC auxiliary power supply allows for the connection of mid voltage loads to the unit.**
- **Unit can be tested by a simulated program in order to prevent unwanted operations.**
- **Prioritizes the loads to be disconnected when reaching the maximum demand limit.**
- **Substantial control capabilities housed in stand-alone unit(s) priced for a short-term return on investment.**

Type	code
CA-4 4 (load controller + software)	**M60411**
MR-3 3 (expansion 3 lines)	**M60412**
CPP-B: Basic power control kit (3 loads) 1 CA-4 Controller 1 PS-12 DC Supplier 1 Power control software already installed casing (280 x 280 x 150)	**M60421**

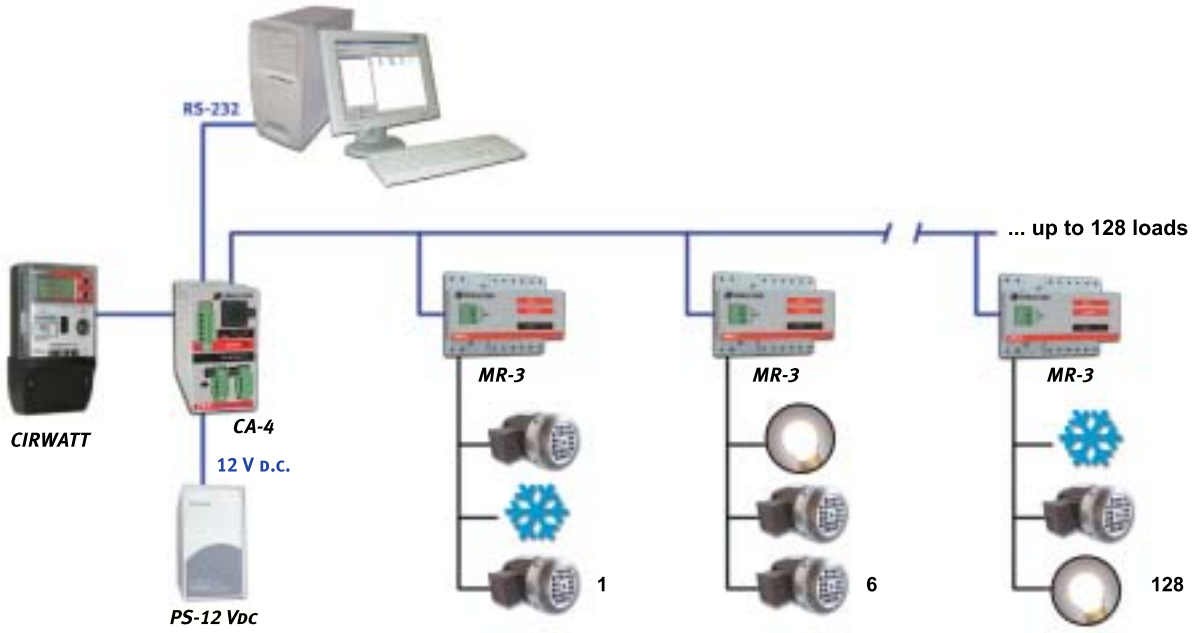
LOAD CONTROL

- • Control up to one hundred twenty eight (128) loads or groups of loads using
- contactors
- • Prioritizes the loads to be disconnected when reaching the maximum demand limit.
- • Option to create groups of loads having the same priority of connection and
- disconnection: FIFO or LIFO.
- • Status identification of each controlled load, defined as: Active, Inactive, Forced
- active and Forced inactive. For example: By programming the load to "Forced
- inactive" the load can be repaired without the fear of having the load energized
- during the repair.

MODULAR SYSTEM

- • Modular design which can be added to in order to handle the number of loads to be
- controlled. Modules can be installed near each load in order to simplify wiring and
- improve response time.It has a modular system which allows the load connection/disconnection to be near to the loads

themselves, to simplify cabling, to reduce cabling distances and to improve response time

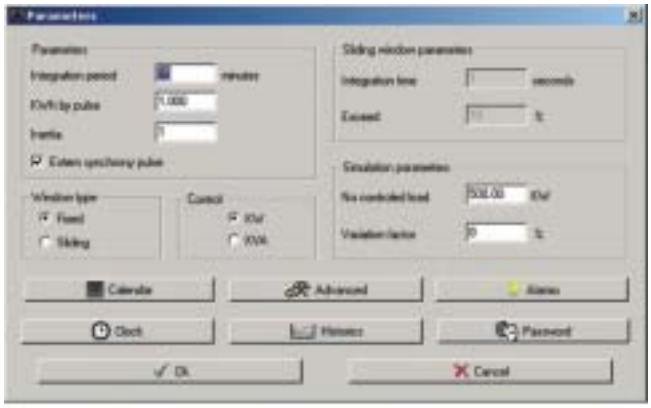


SOFTWARE

- Software is able to display the state of each relay as well as record and date stamp each relay's change of state.
- Ability to program the software with a two year contracted power calendar. Programming to include hours in the day, type of day (weekday, weekend, holiday), etc.
- Software has load calendars, which can be programmed for each controlled load. Calendars can be programmed not only to automatically start and stop each load, but control the kW demand as well. It does this by knowing, in advance, the priority of each load, which loads are operating, what the kW demand limit is so it can determine which loads can be connected and which loads can be disconnected.

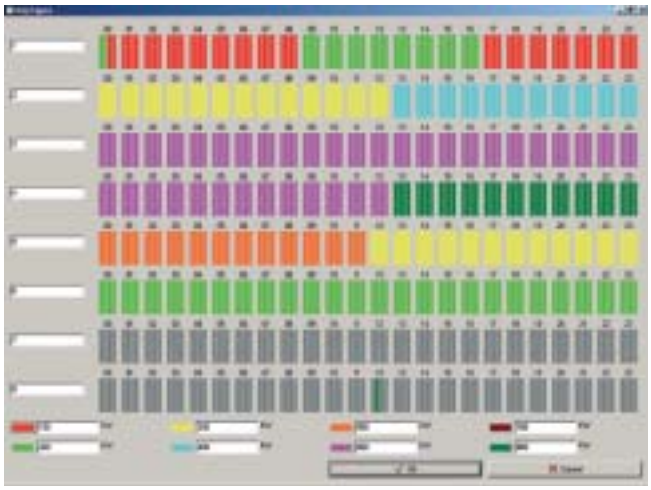
First, the user defines the basic parameters for the power control, such as: type of window, integration period, etc.

The type of calendar under contract, to be carried out, is assigned along with the TOU periods of each day to which the tariffs will be applied by the utility company. The software supports up to 8 tariffs in 8 different TOU periods in each day.



Assigning basic parameters

Assigning calendar

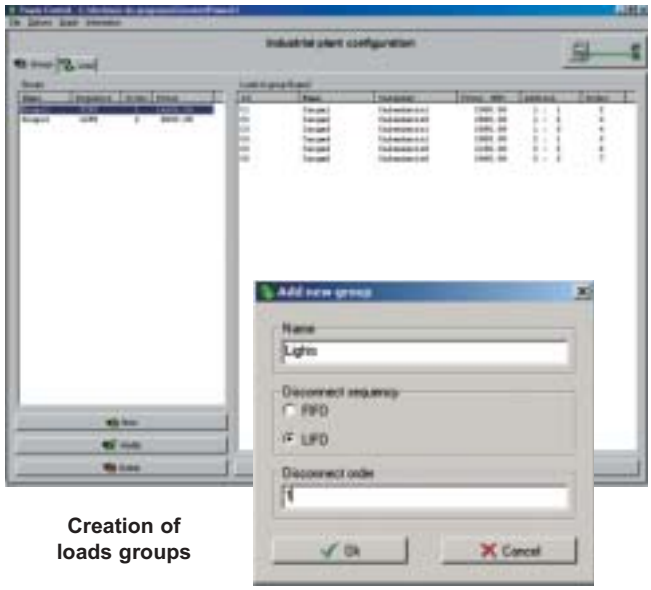


Assigning tariff

Second, the groups of loads are defi ned, as well as the order of disconnection of each load, within the group (FIFO or LIFO) and the order of disconnection of the group as related to the other groups defined in the software.

These groups are created according to the installation (for example: groups of compressors or lights, etc.). Then, each group is assigned to the corresponding loads from any MR3 or the CA4. Loads in each group are limitless.

The disconnection order for the power consumed, by each load, including the total power per group, is shown at all times with information showing if it is a FIFO or LIFO sequence.



Creation of loads groups

SOFTWARE

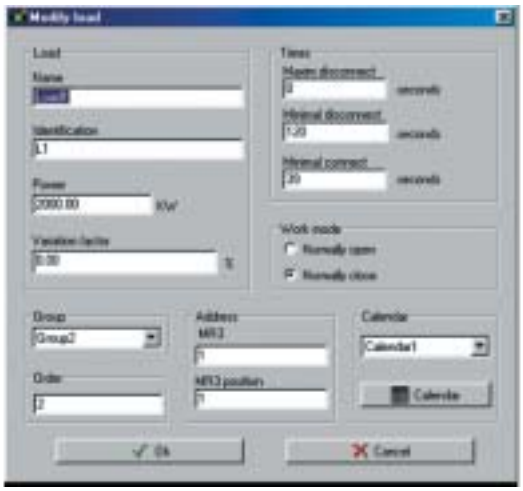
Once the groups have been created, it is necessary to program each load's controlling relay. It is also possible to create a specifi c calendar for each load.

NOTE: For personell safety, it is possible to force any load (machine) to remain disconnected (locked out) for a certain period of time without the option to reconnect it.

A calendar schedule, of up to two years, can be programmed due to the large memory capacity of the CA-4.

List of loads

Calendar schedule



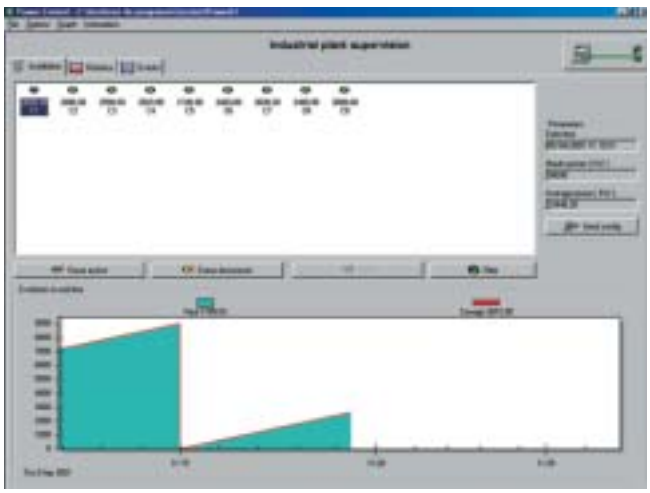
New load

When all parameters have been defined, a simulation may be created to check the proper operation of the system and make any final corrections.

After opening the software, Power Control displays the status of each load, in real time. The user can then choose to manually change the staus of each load or let the software oversee the system.

The loads' status remains clearly defined because the display lights indicate the current status:

- Green light: Load active
- Red light: Load disconnected
- Yellow light: Load inactive



Monitoring in real time

Features CA 4

Power supply circuit	24 V d.c. (± 25 %)
Consumption	500 mA
Output relays	4 relays
Insulating voltage	1 000 V contact-contact 4 000 V contact-coil
Thermal current (I_{th})	3 A
Maximum operating power	1 500 V·A
Mechanical life	3 x 10^7 operations
Electrical life	350 operations / hour (at full loading)
Digital inputs	4 inputs free of potential (10 mA - 24 V d.c.)

Environmental conditions	
Operating temperature	-10 ºC / +65 ºC
Assembly features	
Mounting	DIN 46277 (EN 50022) rail coupling
Front of the box	Lexan front
Safety	Category I (EN 61010)
Standards	EN 50082-1, EN 50082-2, EN 61000-3-2, EN 61000-3-3, EN 61010-1

Features MR3

Power supply circuit	24 V d.c.
Consumption	65 mA
Output relays	3 relays of 10 A / 250 V a.c.
Digital inputs	3 polarised inputs

Communications	RS-485
Environmental conditions	
Operating temperature	-10 ºC / +65 ºC

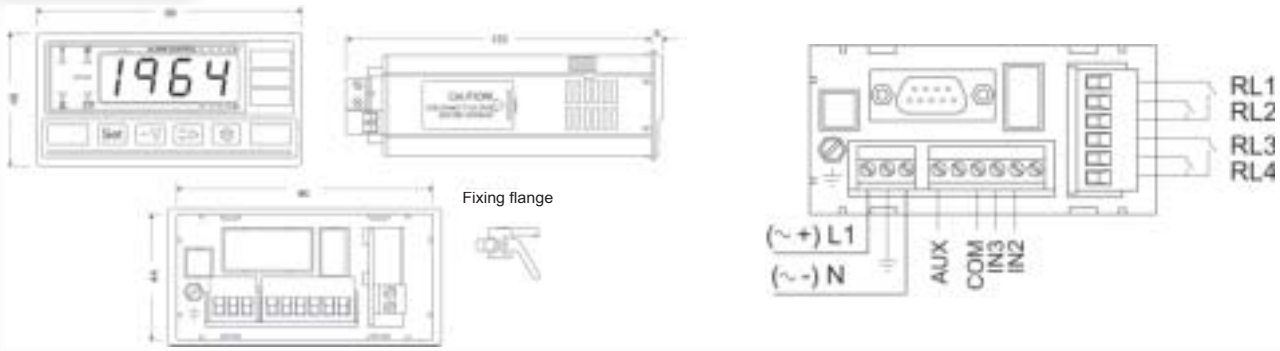
ACCESSORIES

Converters
(see M.5 catalogue)

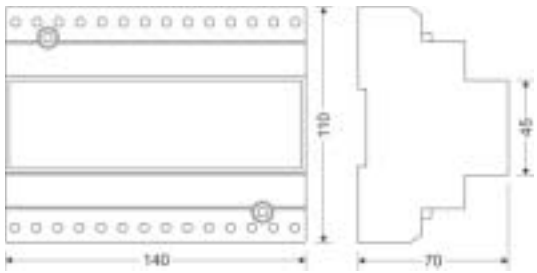
Direct power source PS-12-V DC.
M60413

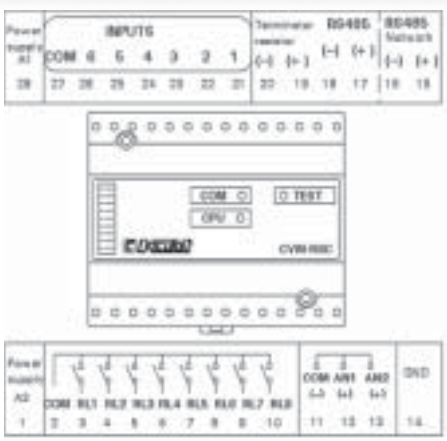
Dimensions / Connections

DH96 CPP

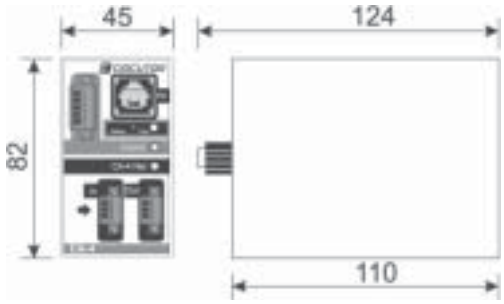


CVM-R8 CPP





CA-4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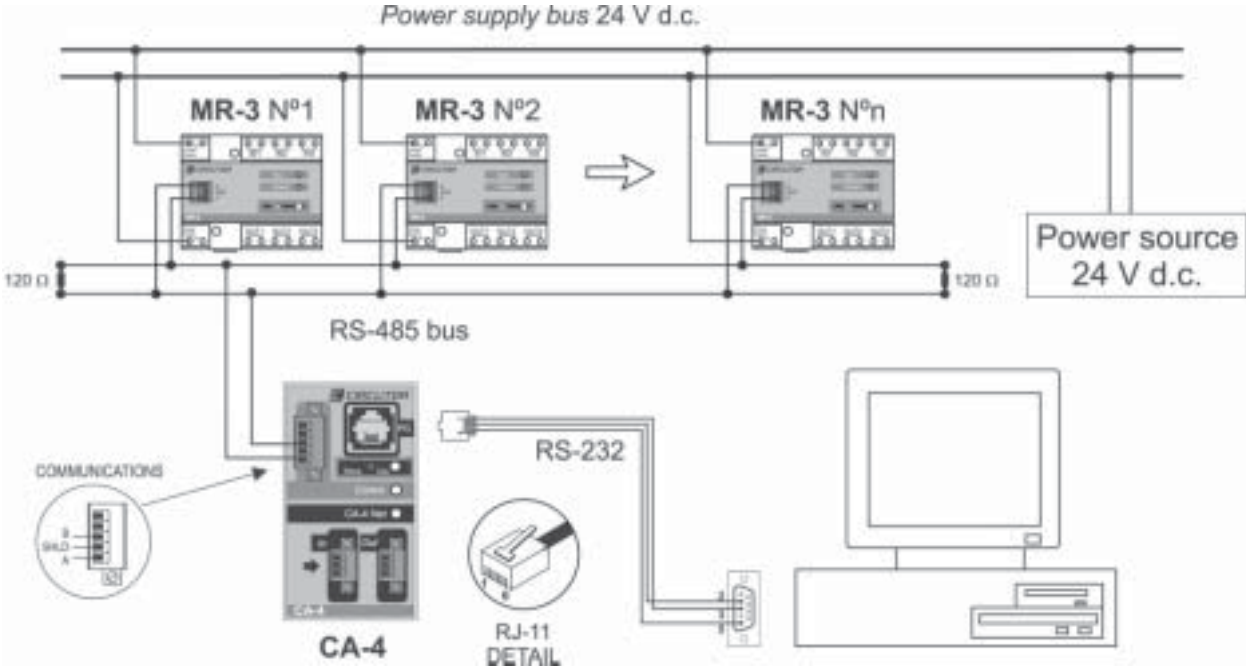
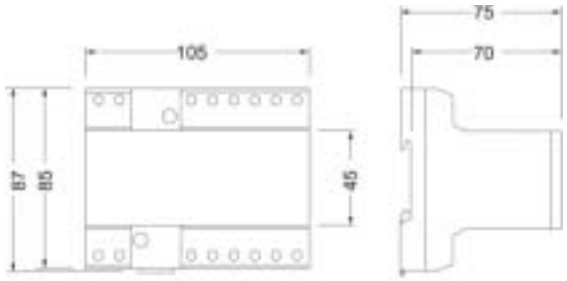
124
82
110


Power supply bus 24 V d.c.
MR-3 Nº1
MR-3 Nº2
MR-3 Nºn
Power source
24 V d.c.
120 Ω
120 Ω
RS-485 bus
COMMUNICATIONS
RS-232
CA-4
RJ-11
DETAIL

MR-3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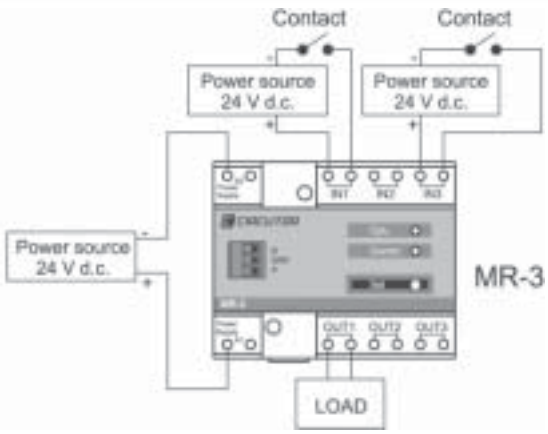
85
45


Contact
Contact
Power source
24 V d.c.
Power source
24 V d.c.
Power source
24 V d.c.
MR-3
LOAD