



**Overcurrent Protection** 

**Protection, Metering and Communications** 



## Description

The equipment of the **CPI** family consists of protective relays, designed with digital technology of the latest generation, which incorporate overcurrent protection functions (directional and non-directional), metering and communications in the following versions:

- Two or three phase overcurrent (2 or 3×50/51)
- Three phase and neutral overcurrent (3×50/51+50N/51N)
- Neutral overcurrent (directional) (67N)
- Isolated neutral overcurrent (67NA)

Optionally, they may incorporate voltage functions in the following versions:

- Three-phase overcurrent and single-phase maximum or minimum voltage unit (3×50/51+(1×59/1×27N)\*)
- Three-phase overcurrent and single-phase residual voltage unit (3×50/51+1×59N)
- Two-phase and neutral and singlephase maximum or minimum voltage unit

(2×50/51+1×50N/51N+(1×59/1×27)\*)

• Two-phase and neutral overcurrent and single-phase residual voltage unit (2×50/51+1×50N/51N+1×59N) \* Selectable in the equipment

Each relay can be used either individually or integrated in a system with other types of protections (MXI, TPI, FGI or others). Local and remote communications are available inevery case.

When the relays are part of an integrated protection and control system, the connection to the remote center is made through the communications subsystem of each terminal. This subsystem is responsible for the external coupling functions.

### **Application**

The **CPI** relays are applicable in all of those circuits (feeders, machines, transformers, etc.) where protection against overloads and short-circuits (between phases and to ground) is required.

In systems with isolated neutral  $(67 N_{A})$ , where high sensitive protection for faults to ground is needed, one directional protection unit is also recommended. The directional neutral protection can be installed either as independent protection or as support in distance schemes.



## Functions

In addition to the protection functions above described, they incorporate, as standard, the following ones:

- 4 selectable curves (3 Inverse and 1 of Definite Time)
- Optical alarm indication: 7 LED's (6 configurable)
- Tripping outputs (1 switched contact plus another configurable a/b)
- 2 configurable digital inputs
- Programmable logic auxiliary outputs (3 switched contacts)
- Local and remote\* communications interface
- Voltage and current measurements (according to models)
- (\*) Optional

Optional functions (applied to model #CPI-B-S)

- Breaker failure unit
- Open phase unit
- Zero sequence sensitive unit
- Breaker control functions (open/close)

Event recording and Fault Reporting

- Current data recording (history)
- Fault reporting

## **Human-Machine Interface**

Man-machine communication can be done in two different modes:

#### • LOCALLY, through:

**1. Push button.** When the equipment has its cover on, access to it can be made through one push button. Pressing it, the information is displayed in a circular motion, showing the following features:

Last trip data

- Measurements (referred to the primary side)
  - Last trip information and LED's
    reset

**2. Key board.** Removing the cover, user has access to the entire keyboard, 3 keys ( $\uparrow$ ,  $\downarrow$  and **Enter**). Through the  $\uparrow$ ,  $\downarrow$  keys, access is allowed to the corresponding submenus, for example:

Configuration	Settings	Information
Communications	General	Measurements
Inputs and outputs	Protection	Last trip
configuration		data

**3. Display.** LCD type with one row of 4 characters.

**4. PC.** Connected to a serial port, placed in the front of the equipment.

• **REMOTELY (optional)**, through a serial communications port in the rear of the equipment. RS232 or Optical Fiber (glass or plastic) are the two available options.







Screen from the *erecom* communications program for PC





### Communications

The communications program **CPI** relays, and other equipment, either **locally** (via front port) or **remotely** (via serial port). This program covers every user need regarding programming, setting, operations, event recording, reporting, measuring data, etc..

The program is protected against unauthorized users by means of **passwords**.

wich runs in Windows<sup>TM</sup>, is user friendly and requires buttons or keys to open the various sub-menus.

Each sub-menu contains one or several dialog windows which, in each case, ask user to either introduce data or select certain predetermined values.

The communication through the local port implies necessarily an automatic switch to **local mode**. Thus, remote access is inhibited. Configuration of the remote serial port and the programmable I/O, can only be carried out in **local mode**.



Examples of screens from the Examples of screens from the

### Modularity

The **CPI** protective relays are mounted in standard 1/7 19"rack metallic housing (horizontal construction is also available), all are 6 RU high and painted in graphite color. They are designed for panel installation. Additionally, CPI equipment can be part of a system with other type of protections (**FGI**, **TPI** and/or **MXI**).

In this case, housings would be 1/2 or 1 19" rack. All equipment is protected with a transparent sealable cover.

Terminal blocks are placed in the rear of the equipment and admit wires of a cross section up to 4 mm<sup>2</sup> (11 AWG) for voltage and/or current circuits and 2.5 mm<sup>2</sup> (13 AWG) for the rest of the circuits.

System incorporating protective relays and 3IRD terminal in a 19" rack



### **Protection Settings**

General Settings	
Transformer ratio VT	1–3000
Transformer ratio CT	1–4000

#### Overcurrent protection (non directional) (50/51+50N/51N)

Time Unit I>	Phases: (0.2–2.4) In / Neutral: (0.04–0.48) In
Instantaneous unit I>>	Phases: (0.1-30) In / Neutral: (0.1-12) In

#### Overcurrent protection (directional) ( $67N_A$ )

Time unit I>	(0.04–0.48) I <sub>n</sub>
Instantaneous unit I>>	(0.1–12) I <sub>n</sub>
Polarizing voltage	110 V, 50 Hz
Polarizing voltage	120 V, 60 Hz

The characteristic angle (which corresponds to the maximum torque) can be adjusted between 15° and 85°, both leading the polarizing voltage. This directional characteristic is ±90° around the maximum torque line.

#### Directional zero sequence overcurrent protection (67N<sub>A</sub>)

Low current (I <sub>b</sub> )	(0.005 – 0.5) A
High current (I <sub>a</sub> )	(1 – 3) I <sub>b</sub>
Low voltage (U <sub>b</sub> )	(0.5 – 6) V
High voltage (U <sub>a</sub> )	(6 – 60) V
Time 1st trip	(0.05 – 10) s
Switching time to instantaneous	(0.05 – 100) s

Characteristic angle: Current lagging voltage 90°

#### Characteristics I/t

Type of curve (phase/neutral)	Inv., Very Inv., Extr. Inv., Definite Time
Time multiplier	0.05-1
Time (definite time)	(0.05–100) s
Time (instantaneous)	(0.00–100) s

### Voltage protection Setting Range

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#### **General settings**

	-
Transformer ratio	1-4000
Over voltage function	YES/NO
Under voltage function	YES/NO
Under / Over function	YES/NO

### Over voltage residual (1x59N)

Pick-up unit U>	(0.02—0.5) U <sub>n</sub>
Time (definite time) t>	(0—100) s

#### Single-phase under / over voltage unit

- <b>J</b>	
Pick-up U	(0.1—1.5) U <sub>n</sub>
Instantaneous U	(0.1—2.5) U <sub>n</sub>
Time (definite time) t	(0—100)s
Unity curve U<	V/t
Unity curve U>	V/t

### **Setting ranges** for the optional functions (model #CPI-B-S)

#### Zero sequence sensitive unit

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Pickup	(0.02-0.48) In
Time delay	(0.05-300) s

#### Breaker failure unit

Reset phase/ground	(0.02-2.4) In
Time delay	(0.05-0.70) s

#### Open phase unit

Pickup	(0.05-0.4) l <sub>2</sub> /l <sub>1</sub>
Time delay	(0.05-300) s





## **Technical Characteristics**

Auxiliary voltage	(Uaux)*	
24-48 Vdc (± 20	%)	
110-250 Vdc (± 2	0 %)	
110-250 Vac Vdc (±	: 20 %)	
230 Vac (± 20 9	%)	
Power Drain: 7	W	
Selectable according to models		
Current inpu	uts	
Rated current (In)	1A or 5A	
Thermal withstand capability	4 In (continuously)	
	50 In (during 3 s)	
	100 In (during 1 s)	
Dynamic limit	240 In	
Burdens	< 0.1 VA (In = 1A)	
	< 0.2 VA (In = 5A)	
Voltage inpu	its	
Rated values (IIn)	110 V 50Hz	
Nated Values (On)	120 V 60Hz	
Thermal canability (continuous)	2xLin (nhases)	
Thermal canability (for 10 s)	3 6xUn (zero seguence	
Digital inpu	ts	
Input voltage range*	24-250 Vdc (± 20 %)	
	110-250 Vdc (± 20 %	
	230 Vac (± 20 %)	
Consumption	< 10 mA	
* Range according to model		
Tripping outp	outs	
Switching capability	2500 W	
Breaking capability	250 W / 1250 VA*	
Switching voltage	250 Vdc	
I Continuous	5 A	
I short duration	10 A during 0.5 s	
Auxiliary out	outs	
Switching capability	2000 W	
Breaking capability	200W / 1000 VA*	
Switching voltage	250 Vdc	

Switching voltage

I continuous

I short duration

\* With a resistive load

3 A

8 A during 4 s

## Dimensions



## **Model Selection**

	Selection		
Vertical		3	
Horizontal		8	
Tionzontai		•	
	Functions		
3 x 50/51		A	
3 × 50/51 + 50N/51	1N	В	
50N/51N		C	
67N		D	
67NA		E	
3x50/51+(1x59/1x2	27)*	G	
3x50/51+1x59N		H	
2×50/51+50N/51N	+(1x59/1x27)*	K	
2x50/51+50N/51+1	1x59N	L	
	Rated Current		
L(g) = 5A L(N) = 1	Δ	1	
$I_{n}(\sigma) = 5A, I_{n}(N) = 1$	5A	2	
$I_{n}(\omega) = 5A, I_{n}(N) = 2$	OmA	3	
· <u>n(</u> , , , , , <u>, , , , , , , , , , , , , , </u>			
	Options		
Basic Model		В	
Special Model		S	
Power	Digital		
Supply*	Inputs*		
24-48 Vdc	24-48 Vdc	1	
110-125 Vdc	24-125 Vdc	2	
220-250 Vdc	48-250 Vdc	3	
230 Vac	230 Vac	4	
(*) ± 20 %			
	Rated Voltage		
–/50 Hz		0	
110 and 110 $\sqrt{3}$ V <sub>a</sub>	<sub>c</sub> / 50 Hz	1	
–/60 Hz		2	
120 and 120 $\sqrt{3}$ V <sub>a</sub>	<sub>c</sub> / 60 Hz	3	
	Communications		
Local RS232		1	
Local RS232 / Rei	mote F.O. plastic	2	
Local RS232 / Rei	mote O.F. glass (SMA)	3	EXAMPLE: Model 3CPLR2R-2020000DR
Local RS232 / Rei	mote O.F. glass (ST)	4	Overcurrent three-phase and neutral rated current: 5 & auxiliary
	Type of Enclosure		voltage: 125 $V_{dc}$ /50 Hz; Communication by O.F. (plastic)
6U x 1/7 19" Pac	k	D	vertical construction
As part of a syste	em in a full 19" Rack	V	
no part or a syste		,	Revision

# Standards and Type Tests

	IEC-	255-5	
Between Circuits and Grou	nd	2 kV, 5	0/60 Hz for 1 minute
Between Independent Circ	uits	2 kV, 5	60/60 Hz for 1 minute
Impulse Test	IEC-	255-5	
		5 kV; 1	.2/50 μs; 0.5 J
1 MHz Disturbance Test			
IEC-255-22-1 Class III			0.511/
Common Mode			2.5 kV
Differential Mode	. <b>T</b> (		1.0 KV
Fast Transient Disturbance	e l'est		
IEC-255-22-4 Class IV			41-1/ 400/
Dedicted Electromerustic	Field F	l'aturk a	4 KV ±10%
Radiated Electromagnetic	riela L	isturba	lice lest
Amplitude Meduleted			10 \//m
Ruleo Modulated	_		10 V/III
Fuise Modulated	ct		IU V/M
Electrostatic Discharge Te	:51		
120-200-220-2 GId55 III			9 kV + 100/
Radio Frequency Emissivi EN 55011	ty		
Radio Frequency Emissivi EN 55011	ty		
Radio Frequency Emissivi EN 55011 Temperature	ty IEC-	255-6	
Radio Frequency Emissivi EN 55011 Temperature Operatino Rance	ty IEC-	255-6 -10° C	to +55° C
Radio Frequency Emissivi EN 55011 Temperature Operating Range Storage Range	ty IEC-	255-6 -10° C -25° C	to +55° C to +70° C
Radio Frequency Emissivi EN 55011 Temperature Operating Range Storage Range Humidity	ty IEC-	255-6 -10° C -25° C 95% (r	to +55° C to +70° C ion condensing)
Radio Frequency Emissivi EN 55011 Temperature Operating Range Storage Range Humidity	ty IEC-	255-6 -10° C -25° C 95% (r	to +55° C to +70° C ion condensing)
Radio Frequency Emissivi EN 55011 Temperature Operating Range Storage Range Humidity Power Supply Ripple	IEC-	255-6 -10° C -25° C 95% (r	to +55° C to +70° C ton condensing)
Radio Frequency Emissivi EN 55011 Temperature Operating Range Storage Range Humidity Power Supply Ripple IEC-255-11	IEC-	255-6 -10º C -25º C 95% (r	to +55° C to +70° C ion condensing)
Radio Frequency Emissivi EN 55011 Temperature Operating Range Storage Range Humidity Power Supply Ripple IEC-255-11	IEC-	255-6 -10° C -25° C 95% (r	to +55° C to +70° C ion condensing) < 20%
Radio Frequency Emissivi EN 55011 Temperature Operating Range Storage Range Humidity Power Supply Ripple IEC-255-11	IEC-	255-6 -10° C -25° C 95% (r	to +55° C to +70° C ion condensing) < 20%
Radio Frequency Emissivi EN 55011 Temperature Operating Range Storage Range Humidity Power Supply Ripple IEC-255-11 Vibration Test (sinusoidal)	IEC-	255-6 -10° C -25° C 95% (r 255-21-	to +55° C to +70° C ion condensing) < 20%
Radio Frequency Emissivi EN 55011 Temperature Operating Range Storage Range Humidity Power Supply Ripple IEC-255-11 Vibration Test (sinusoidal) Shock and Bump Test	ty IEC- IEC IEC	255-6 -10° C -25° C 95% (r 255-21-2 255-21-2	to +55° C to +70° C ion condensing) < 20% I Class I 2 Class I
Radio Frequency Emissivi EN 55011 Temperature Operating Range Storage Range Humidity Power Supply Ripple IEC-255-11 Vibration Test (sinusoidal) Shock and Bump Test	IEC-	255-6 -10° C -25° C 95% (r 255-21-2 255-21-2	to +55° C to +70° C ion condensing) < 20% I Class I 2 Class I
Radio Frequency Emissivi EN 55011 Temperature Operating Range Storage Range Humidity Power Supply Ripple IEC-255-11 Vibration Test (sinusoidal) Shock and Bump Test PI terminals comply with the EEC ompability	IEC- IEC- IEC IEC 89/336 s	255-6 -10° C -25° C 95% (r 255-21- 255-21-2 255-21-2 andard of	to +55° C to +70° C ion condensing) < 20% I Class I 2 Class I 2 Class I
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Radio Frequency Emissivi EN 55011 Temperature Operating Range Storage Range Humidity Power Supply Ripple IEC-255-11 Vibration Test (sinusoidal) Shock and Bump Test PI terminals comply with the EEC ompability	ty IEC- IEC 89/336 s <sup>-</sup>	255-6 -10° C -25° C 95% (r 255-21-2 255-21-2 andard of	to +55° C to +70° C ion condensing) < 20% I Class I 2 Class I 2 class I
Radio Frequency Emissivi EN 55011 Temperature Operating Range Storage Range Humidity Power Supply Ripple IEC-255-11 Vibration Test (sinusoidal) Shock and Bump Test Power Supply with the EEC compability	IEC- IEC IEC 89/336 s	255-6 -10° C -25° C 95% (r 255-21-2 255-21-2 andard of	to +55° C to +70° C ion condensing) < 20% I Class I 2 Class I i electromagnetic
Radio Frequency Emissivi EN 55011 Temperature Operating Range Storage Range Humidity Power Supply Ripple IEC-255-11 Vibration Test (sinusoidal) Shock and Bump Test Piterminals comply with the EEC ompability	ty IEC- IEC IEC 89/336 s	255-6 -10° C -25° C 95% (r 255-21-2 255-21-2 andard of	to +55° C to +70° C ion condensing) < 20% I Class I 2 Class I 2 electromagnetic



### Generic Block Diagram





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