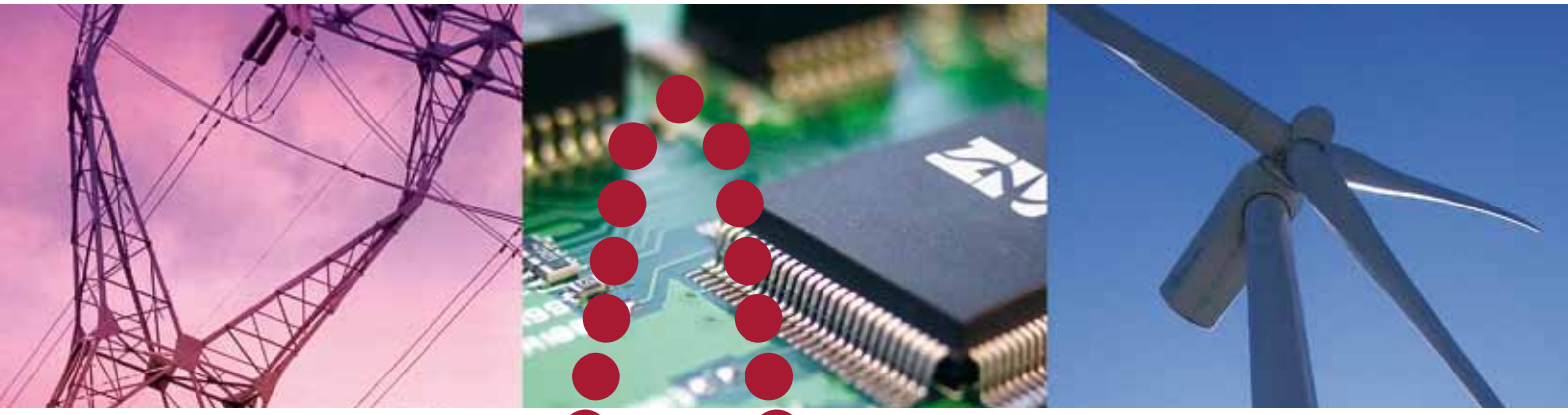
grid automation



#CPI

Overcurrent Protection

Instructions Manual

BCPI1101Av01

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Spain

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1. Description

The **#CPI** protection relay is designed for overcurrent protection in electrical networks using state-of-the-art digital technology.

#CPI terminals are designed for application on circuits (feeders, transformers, motors, etc…) where overcurrent protection for phase-to-phase faults, and ground faults is required.

For isolated ground systems where a high sensitivity ground protection is required, the application of directional overcurrent ($67N_I$) is recommended.

Note: This instruction manual covers the models **#CPI-A**, **#CPI-B**, and **#CPI-C**. Other **CPI** models have separate instruction manuals.

1.1 Functions

Functions included in the terminals are model dependent as listed in Section 1.3. This instruction manual covers both series (**3CPI** and **8CPI**), since their functionality is identical.

1.1.1 Phase Overcurrent Protection (3x50/51). #CPI-A Models

Includes three phase overcurrent protection units. The three phases share the same settings. Each phase unit includes two independent protection elements; one time delayed element, and one instantaneous element with a definite time setting.

The time delay elements are provided with five characteristics: **Inverse**, **Very Inverse**, **Extremely Inverse**, **Definite Time**, and **User** defined. Time delayed and instantaneous elements can be disabled via settings. **#CPI-A** models also include information on pickup and trip for each phase instantaneous and time delayed elements.

1.1.2 Phase and Ground Overcurrent Protection (3x50/51 + 50N/51N). #CPI-B Models

Includes three phase and ground overcurrent protection units. The three phases share the same settings while the ground unit has independent settings. Each unit includes two independent protection elements; one time delayed element, and one instantaneous element with a definite time setting.

The time delayed elements are provided with five characteristics: **Inverse**, **Very Inverse**, **Extremely Inverse**, **Definite Time**, and **User** defined. Time delay and instantaneous elements can be disabled via settings. **#CPI-B** models also include information on pickup and trip for each phase and ground instantaneous and time delayed elements.

1.1.3 Ground Overcurrent Protection (50N/51N). #CPI-C Models

Includes ground overcurrent protection unit. The ground unit includes two independent protection elements; one time delayed element, and one instantaneous element with a definite time setting.

The time delayed element is provided with five characteristics: **Inverse**, **Very Inverse**, **Extremely Inverse**, **Definite Time**, and **User** defined. Time delayed and instantaneous elements can be disabled via setting. **#CPI-C** models also include information on pickup and trip for both the instantaneous and the time delayed elements.

Note: ground units of the #CPI-*-***010** models don't trip.**

1.2 Common Functions to all Models

- **LED Targets**

Terminal unit front panel indication consists of eight LED's. Seven of the LED's are user definable. The eighth LED is assigned to indicate the terminal unit is "**Ready**" (powered up, self-test OK). A list of available LED signals is defined in Chapter 6.

- **Status Contact Inputs**

The terminal unit has two status contact inputs, both are configurable. A list of available inputs is defined in Chapter 6.

- **Auxiliary Contact Outputs**

There are three auxiliary contact outputs, two of which are configurable. Auxiliary Output **AUX-3**, which corresponds to terminal unit "**In Service**" (powered up, self-test OK), is not programmable. A list of available outputs is defined in Chapter 6.

- **Local Information (display)**

Display of:

- Events:
  - Last relay operation (tripped element)
  - Status contact input status
  - Auxiliary contact output status
  - Protection element status

- Metering:
  - Current

- **Self-Test Program**

A continuously running diagnostic self-test program verifies the correct operation of the terminal unit and alerts the user of potential problems.

1.3 Model Selection

	CPI											
1		2	3	4	5	6	7	8	9	10	11	12

1	**Selection**				
	3	Vertical Format		**8**	Horizontal Format
2	**Functions**				
	A	3x50/51			
	B	3x50/51 + 50N/51N			
	C	50N/51N			
3	**Rated Current**				
	1	If = 5A / In = 1A		**4**	If = 5A / Ins = 1A
	2	If = 5A / In = 5A		**5**	If = 1A / In = 1A
	3	If = 5A / In = 20mA			
4	**Options**				
	B	Basic Model		**G**	[In > 0.2 - 2.4A; In>> 0.1 - 30A]
	E	[In > 0.1 – 1.2A; In>> 0.1 - 30A]			
5	**Supply Rated Voltage**				
		Power Supply	Digital Inputs		Power Supply / Digital Inputs
	1	24 - 48 Vdc	24 - 48 Vdc	**3**	220 - 250 Vdc / 48 - 250 Vdc
	2	110 - 125 Vdc	24 - 125 Vdc	**4**	220 Vac / 220 Vac
6	**Frequency / Language**				
	0	50 Hz / Spanish		**E**	60 Hz / Portuguese
	2	60 Hz / English		**G**	50 Hz / French
	A	50 Hz / English		**J**	50 Hz / Portuguese
	C	60 Hz / Spanish			
7	**Communications**				
	1	RS232 + RS232		**4**	RS232 + Glass FO (ST)
	2	RS232 + Plastic FO 1mm		**5**	RS232 + RS485
	3	RS232 + Glass FO (SMA)			
8	**0**	Standard		**1**	RS232 Remote (only if COMMUNICATIONS option= 1)
9	**Special Models**				
	00	Basic Model		**15**	Optional Ground Range: (0.1-1.2) x In
	03	Special DIs [Activation Ranges + Detection Times]		**20**	IN>: (0.01-0.5 x In) ; IN>>: (0.01-6 x In)
	04	Special DIs [Activation Ranges]		**40**	IN>: 1-20A ; IN>>: 0.5-150A
	10	Phase Trip (*)			If>: 1-20A ; If>>: 0.5-150A
10	**Enclosure**				
	D	6U x 1/7 of 19" Rack		**V**	6U x 1 19” Rack
11	**Communications Protocol**				
	A	Prot. NO PROCOME + Without Ctrl.		**E**	Prot. NO PROCOME + Ctrl. DNP3 and PROCOME
	B	Prot. NO PROCOME + Ctrl. PROCOME		**F**	Prot. NO PROCOME + Ctrl. MODBUS and PROCOME

- **Functions**

50	Phase instantaneous Overcurrent
51	Phase Time Overcurrent (Inverse / Fixed)
50N	Ground Instantaneous Overcurrent
51N	Ground Time Overcurrent (Inverse / Fixed)

2. Technical Data

2.1 Power Supply Voltage

Selectable range depending on model:	**24-48 Vdc (±20%)** **110-125 Vdc (±20%)** **220-250 Vdc (±20%)** **220 Vac (±20%)**

Note: In case of power supply failure, a maximum interruption of 100 ms is allowed for 110Vdc input.

2.2 Power Supply Burden

Quiescent	**7 W**
Maximum	**20 W**

2.3 Current Analog Inputs

Rated Value	**In = 5 A** (phase & ground) **In = 1 A** (phase & ground) **In = 0.020 A** (special ground)
Thermal Withstand Capability	**4 In** (continuously) **50 In** (for 3 s) **100 In** (for 1 s)
Dynamic Limit (Dynamic Load Capacity)	**240 In**
Current Circuit Burden	**In = 5 A < 0.2 VA** **In = 1 A < 0.05 VA** **In = 0.020 A < 0.002 VA**

2.4 Measurement Accuracy

Internal Measure Accuracy	**< 5 %**
Display Measure Accuracy	**< 5 %** or **20mA** (whichever is greater)

2.5 Time Measurement Accuracy

Definite and Inverse Time Characteristic (IEC 255)	**E = 5 %** or **25 ms** (whichever is greater)

2.6 Repeatability

Operating Time	**2 %** or **25 ms** (whichever is greater)

2.7 Status Contact Inputs

Two electrically separate, user programmable status contact inputs.

Status Contact Input Voltage Range (selectable range depending on model)	**24 - 48 Vdc ±20%** **24 - 125 Vdc ±20%** **48 - 250 Vdc ±20%** **220 Vac ±20%**
Current Drain	**< 5 mA**

#CPI-*-***003** Model**

Status Contact Input Voltage Range	**30 - 48 Vdc ±20%** **70 - 125 Vdc ±20%** **120 - 220 Vdc ±20%**
Current Drain	**48 Vcc → 10.4 mA** **125 Vcc → 6.4 mA** **220 Vcc → 4.5 mA**

2.8 Trip Outputs and AUX-1

Two trip contacts internally configurable as NO or NC.
AUX-1 Form C switch (SPDT) internally configurable as NO and/or NC.

I DC maximum limit (with resistive load)	**30 A** (1 s)
I DC continuous service (with resistive load)	**8 A**
I short duration	**10A** (max. with a duty cycle of 10%)
Close	**2500 W**
Breaking capability (with resistive load)	**150 W** - max. 8 A - (48 Vdc) **55 W** (80 Vdc - 250 Vdc) **1250 VA**
Break (L/R = 0.04 s)	**120 W** at 125 Vdc
Switching voltage	**250 Vdc**
Momentary close time trip contacts remain closed	**100 ms**

2.9 Auxiliary Contact Outputs (AUX-2 and AUX-3)

Electrically separate Form C (SPDT) auxiliary contact outputs NO or NC.

I DC maximum limit (with resistive load)	**5 A** (30 s)
I DC continuous service (with resistive load)	**3 A**
I short duration	**8A** (max. with a duty cycle of 10%)
Close	**2000 W**
Breaking capability (with resistive load)	**75 W** - max. 3 A - (48 Vdc)
	40 W (80 Vdc - 250 Vdc)
	1000 VA
Break (L/R = 0.04 s)	**20 W** at 125 Vdc
Switching voltage	**250 Vdc**

2.10 Communications Link

Glass Fiber Optics

Type	**Multimode**
Wavelength	**820 nm**
Connector	**ST**
Transmitter Minimum Power:	
50/125 Fiber	**- 20 dBm**
62.5/125 Fiber	**- 17 dBm**
100/140 Fiber	**- 7 dBm**
Receiver Sensitivity	**- 25.4 dBm**

Plastic Fiber Optics (1 mm)

Wavelength	**660 nm**
Transmitter Minimum Power	**- 16 dBm**
Receiver Sensitivity	**- 39 dBm**

RS232C Port Signals

Terminal unit DB-9 (9-pin) connectors	**Pin 5 - GND**
	Pin 2 - RXD
	Pin 3 - TXD

3. Standards and Type Test

The equipment satisfies the requirements of IEC-255 (EN 21-136) at the maximum class for the values indicated below.

3.1 Insulation

Insulation Test (Dielectric Strength)	*IEC-60255-5*
Between all circuit terminals and ground	**2 kV**, **50 Hz**, for 1 min
Between all circuit terminals	**2 kV**, **50 Hz**, for 1min
Voltage Impulse Test	*IEC-60255-5*
Common mode (analog inputs, DIs, AOs and PS)	**5 kV**; **1.2/50 μs**; **0.5 J**

3.2 Electromagnetic Compatibility

1 MHz Burst Test	*IEC-60255-22-1 Class III*
Common mode	**2.5kV**
Differential mode	**2.5kV**
Fast Transient Disturbance Test	*IEC-60255-22-4 Class IV (IEC 61000-4-4)* **4 kV ±10 %**
Radiated Electromagnetic Field Disturbance	*IEC 61000-4-3 Class III*
Amplitude modulated	**10 V/m**
Pulse modulated	**10 V/m**
Conducted Electromagnetic Field Disturbance	*IEC 61000-4-6 Class III*
Amplitude modulated	**10 V**
Electrostatic Discharge	*IEC 60255-22-2 Class IV (IEC 61000-4-2)*
On contacts	**±8 kV ±10 %**

Radio Frequency Emissivity	*EN55022* (Radiated) *EN55011* (Conducted)

3.3 Environmental Test

Temperature	*IEC 60255-6*
Operating range	From **-10º C** to **+ 55º C**
Storage range	From **-25º C** to **+ 70º C**
Humidity	**95 %** (non-condensing)

3.4 Power Supply

Power Supply Interference and Ripple	*IEC 60255-11* **< 20 %**

3.5 Mechanical Test

Vibration (sinusoidal)	*IEC-60255-21-1 Class I*
Mechanical Shock and Bump Test	*IEC-60255-21-2 Class I*

The models comply with the EEC 89/336 standard of electromagnetic compatibility.

4. Physical Architecture

4.1 General

#CPI protection terminals consist of a circuit board with the following functions:

- Power Supply
- Central Processing Unit
- Analog Input Transformers
- Contact Inputs and Outputs

Depending on the terminal settings, contact inputs / outputs may be used or remain as spare signals.

Figures 4.1 and 4.2 show terminal unit front panels for **3CPI** series and **8CPI** series respectively. Dimensions of the front panels are specified at the end if this instruction manual.

Keypad, alphanumeric display, LED targets, and local communications port are located on the front panel.

The rear panel contains terminal connectors as shown in Figures 4.3 and 4.4. There are two terminal connector groups, one corresponds to transformer secondary analog inputs (from 1 to 10 terminal connectors), and the other corresponds to power supply input and contact inputs and outputs (from 11 to 30 terminal connectors).

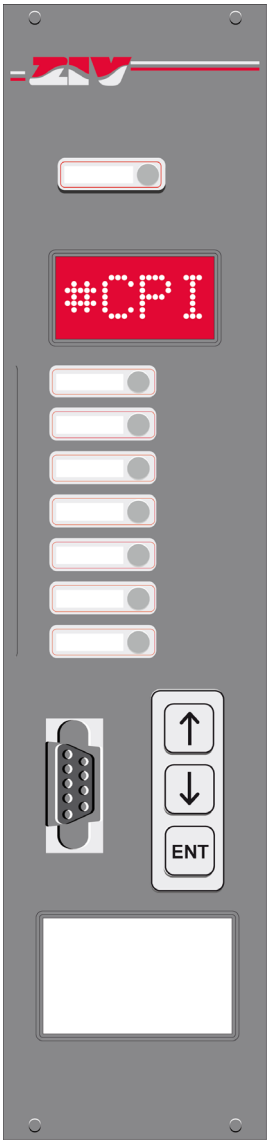


Figure 4.1: 3CPI Front View.

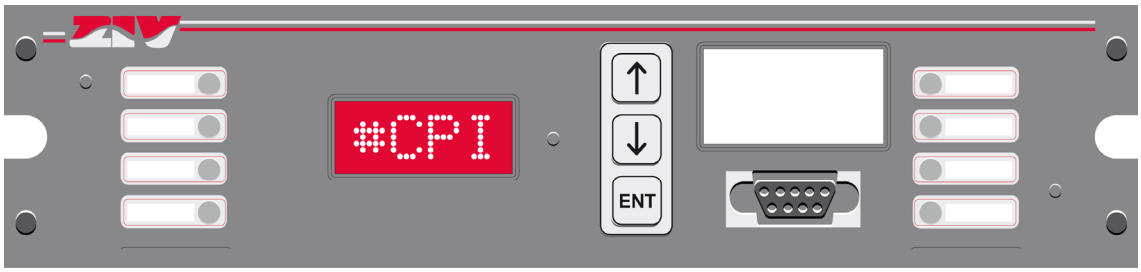


Figure 4.2: 8CPI Front View.

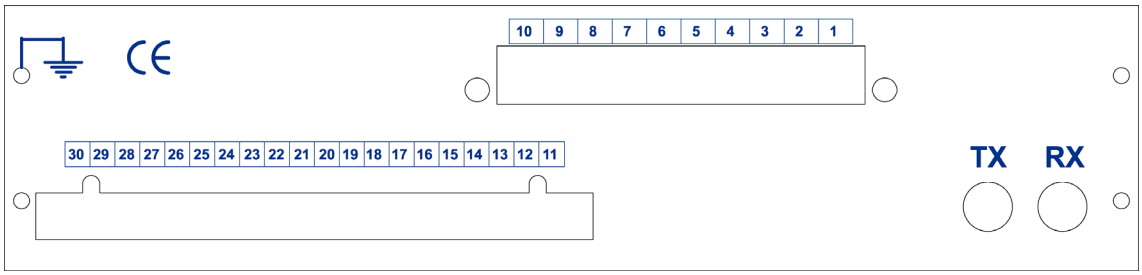


Figure 4.3: 8CPI Rear View.

4.2 Dimensions

#CPI protection terminal case dimensions are 1/7 of a 19" rack wide, and 6 standard rack units high (10½"). **3CPI** terminals are vertical mount units, and **8CPI** terminals are horizontal mount units. The equipment is intended to be installed either semi-flush mounted on panels or inside a 19" rack. The **#CPI** is equipped with a transparent cover which can be sealed for security purposes. The enclosure color is graphite.

Note: 8CPI models are designed to be mounted on 1 Rack wide x 2U high adapter element. Dimension drawings for this adapter are given at the end of this instruction manual.

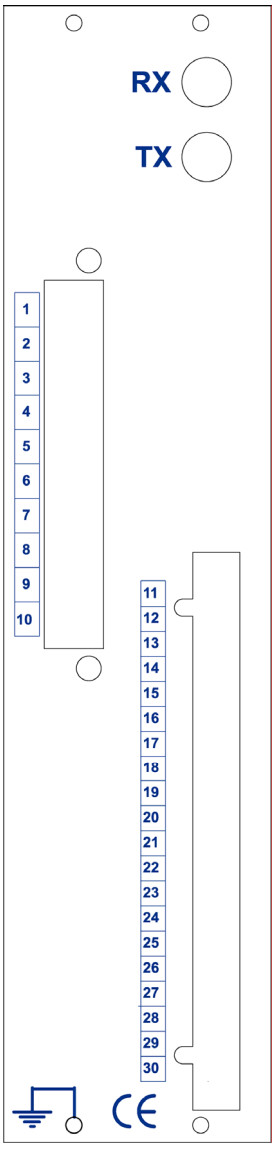


Figure 4.4: 3CPI Rear View.

4.3 Connection Elements

4.3.1 Terminal Connectors

Terminal connectors are permanently attached to the rear edge of the printed circuit board to facilitate external wiring and are arranged in rows or columns depending on the model.

- One row or column of 10 terminal connectors for transformer secondary inputs.
- One row or column of 20 terminal connectors for power supply input and contact inputs and outputs.

Voltage analog input terminals accept up to #11 AWG wire. The remaining circuit terminals permit wire up to #14 AWG. Communications connectors are provided on both front and rear equipment panels.

4.3.2 Removing Printed Circuit Boards (Non Self-Shorting)

The equipment has been designed to enable removal of the printed circuit board. The printed circuit board is attached to the case using self-tapping screws. These screws must be removed before the board is withdrawn. It is also necessary to remove the screws on the terminal connectors.

4.3.3 Internal Wiring

The equipment uses traditional printed circuit board connections and internal buses to minimize internal wiring.

5. Settings

5.1 Configuration Settings

Communications (Local Port RS232C)	
Setting	**Range**
Terminal Address	Not sensitive - enter any number
Baud Rate	4800 Baud
Stop Bits	1
Parity	1 (even)

Communications (Remote Port)	
Setting	**Range**
Terminal Address	0 to 254
Baud Rate	300 to 19200 bauds(1)
Stop Bits	1 or 2
Parity	1 (parity) or 0 (no parity)
MODBUS Protocol (2)	YES / NO (3)

(1) Maximum baud rate for RS-232: 9600 bauds.
(2) Depending on the model.
(3) With NO setting answers Procome Protocol.

Communications (HMI)		
Setting	**Range**	**By Default**
Frontal Port Parity (affects to local port)	0 or 1	1
Time Out (affects to local and remote port)	0 to 1000 ms	100 ms

Language	
Setting	**Range**
Language (1)	Spanish English Portuguese

(1) Accord to software version.

Frequency	
Setting	**Range**
Frequency (1)	50 / 60 Hz

(1) Accord to software versión.

5.2 General Settings

General Settings		
Setting	**Range**	**Step**
Phase CT Ratio (#CPI-A/B)	1-3000	1
Ground CT Ratio (#CPI-B/C)	1-3000	1
Event masking	only via communications	

5.3 Protection Elements Settings

Phase Time Overcurrent Element (#CPI-A/B)		
Setting	**Range**	**Step**
Enable	YES/NO	
Pickup	(0.2-2.4) In	0.01 A
Time Curve	Definite time Inverse Very Inverse Extr. Inverse	
Time Dial	0.05-1	0.01
Definite Time Delay	0.05-100s	0.01 s

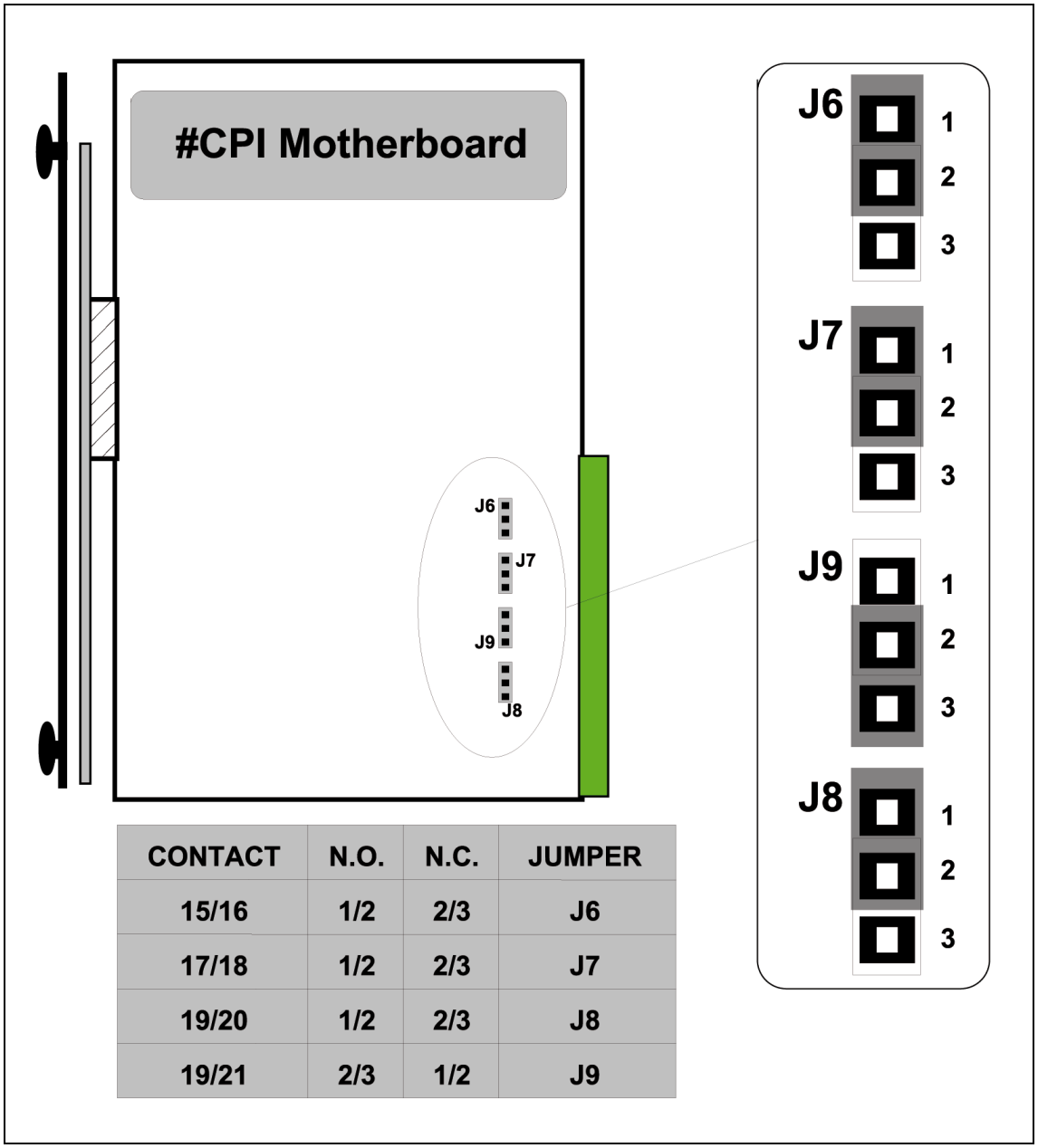
Phase Instantaneous Overcurrent Element (#CPI-A/B)		
Setting	**Range**	**Step**
Enable	YES/NO	
Pickup	(0.1-30) In	0.01 A
Time Delay	0-100s	0.01 s

Ground Time Overcurrent Element (#CPI-B/C)		
Setting	**Range**	**Step**
Enable	YES/NO	
Pickup	(0.04-0.48) In	0.01 A
Time Curve	Definite Time Inverse Very Inverse Extr. Inverse	
Time Dial	0.05-1	0.01
Definite Time Delay	0.05-100s	0.01 s
20 mA Ground Time Overcurrent Unit	0.16 to 2 mA	0.01 mA
Sensitive Ground Time Overcurrent Unit	0.01 to 0.24 A	0.01A
Optional Ground Unit (only #CPI-B)	(0.1-1.2) In	0.01A

Ground Instantaneous Overcurrent Element (#CPI-B/C)		
Setting	**Range**	**Step**
Enable	YES/NO	
Pickup (standard)	(0.1-12) In	0.01 A
Time Delay	0-100s	0.01 s
20 mA Ground Instantaneous Overcurrent Unit	0.16 to 4.8 mA	0.01 mA
Sensitive Ground Instantaneous Overcurrent Unit	0.05 to 3 A	0.01 A
Optional Ground Unit (only #CPI-B)	(0.1-30) In	0.01 A
Optional Ground Unit (only #CPI-C*G)	(0.02-6) In	0.01 A

5.4 Digital Inputs, Auxiliary Outputs and LED Targets

Digital Inputs, Auxiliary Outputs and LED Targets Configuration
The ***ZiverCom***® communications program allows a user to redefine or reallocate the Auxiliary outputs via the local communication port. It is also possible to configure auxiliary outputs as NO or NC contacts, by changing the internal jumpers as indicated in figure 5-1.



CONTACT	N.O.	N.C.	JUMPER
15/16	1/2	2/3	J6
17/18	1/2	2/3	J7
19/20	1/2	2/3	J8
19/21	2/3	1/2	J9

Figure 5.1: Internal Jumpers.

6. Description of Operation

6.1 Overcurrent Units

#CPI-A terminals provide Three-Phase Instantaneous and Time Overcurrent protection. **#CPI-B** terminals provide Three-Phase and Ground Instantaneous and Time Overcurrent protection. **#CPI-C** terminals provide Ground Instantaneous and Time Overcurrent protection.

Note: ground units of the #CPI-*-***010** models don't trip.**

Each of these overcurrent protection functions consists of an Instantaneous and a Time Overcurrent measuring element. The Instantaneous measuring element is also equipped with an adjustable timer that can be enabled or disabled. Instantaneous and Time Overcurrent element settings are made for Phase and Ground functions. Consequently, all three phases share the same Phase Instantaneous and Phase Time Overcurrent settings. The following parameters are adjustable for each of the setting groups:

- **Enable**
- **Pickup**
- **Definite Time Delay**

6.1.1 Time Elements

The Time Overcurrent element continuously processes the RMS value of current analog input **I** based on averaging a full cycle of samples. Pickup takes place when the measured value exceeds 1.05 times the pickup setting, and reset occurs at the pickup setting.

The time element integrates a measured value above pickup by incrementing a counter in the integrator module using an amount proportional to the input current RMS value. When the counter reaches the operate threshold, the Time Overcurrent element initiates a trip. When the measured value drops below the pickup setting, the incrementing value is removed, causing a rapid reset of the integrator module to its initial condition with the counter at zero. Any new measured value above pickup must then start the integration interval from zero.

Three inverse time curves (Inverse, Very Inverse and Extremely Inverse), one definite time delay and one user defined time curve can be selected. The user defined curve is loaded into the Terminal Unit front RS232 port through the ***ZiverCom***© communications program. Time-current characteristic curves have two independent settings: curve family, and time dial.

6.1.1.a Time/Current Characteristics

Figures 6.1, 6.2 and 6.3 show the pre-programmed time/current characteristic curves provided with the **#CPI** Terminal Unit.

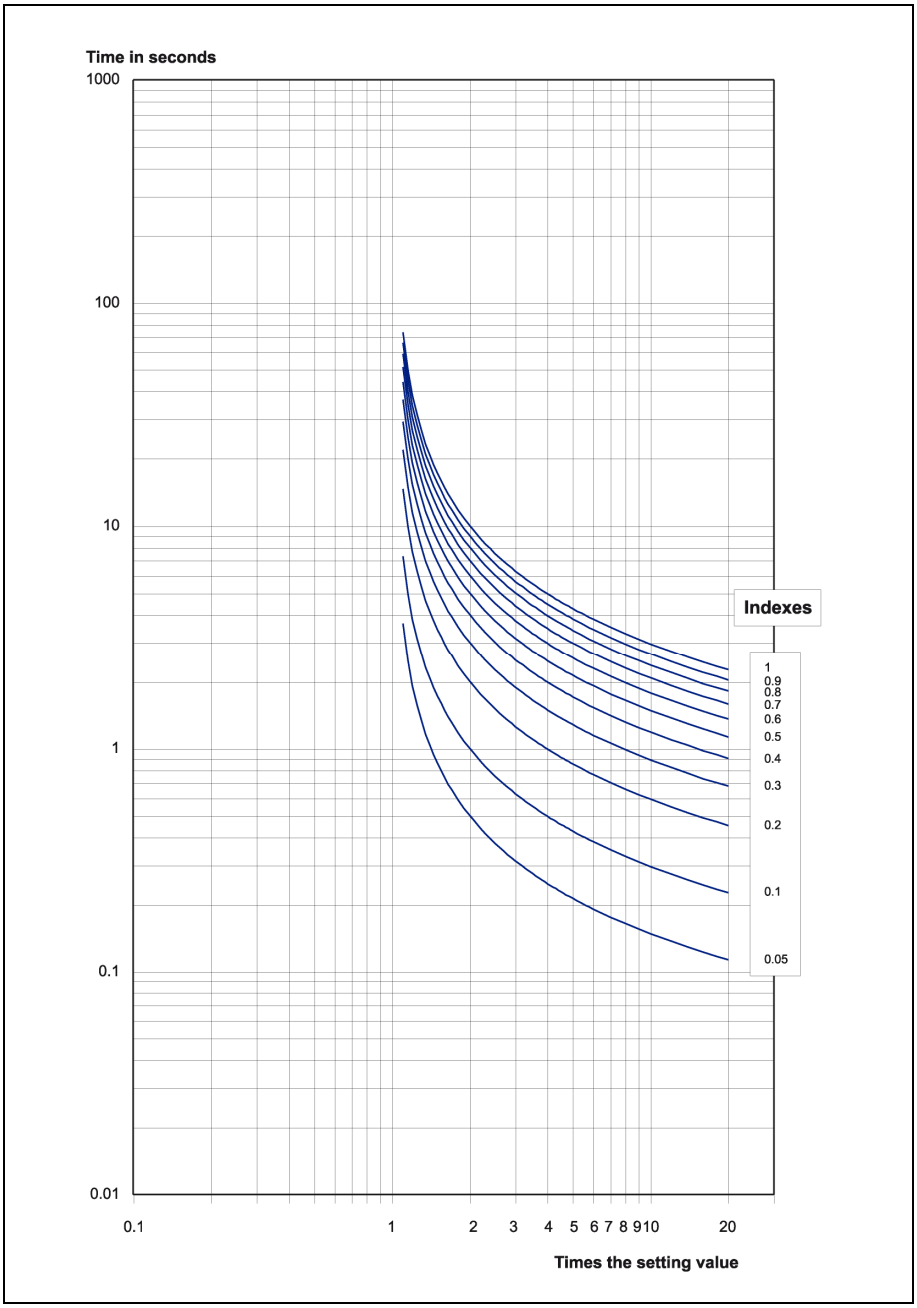


Figure 6.1: Inverse Time/Current Characteristic.

$$t = \frac{0.14}{I_S^{0.02} - 1}$$

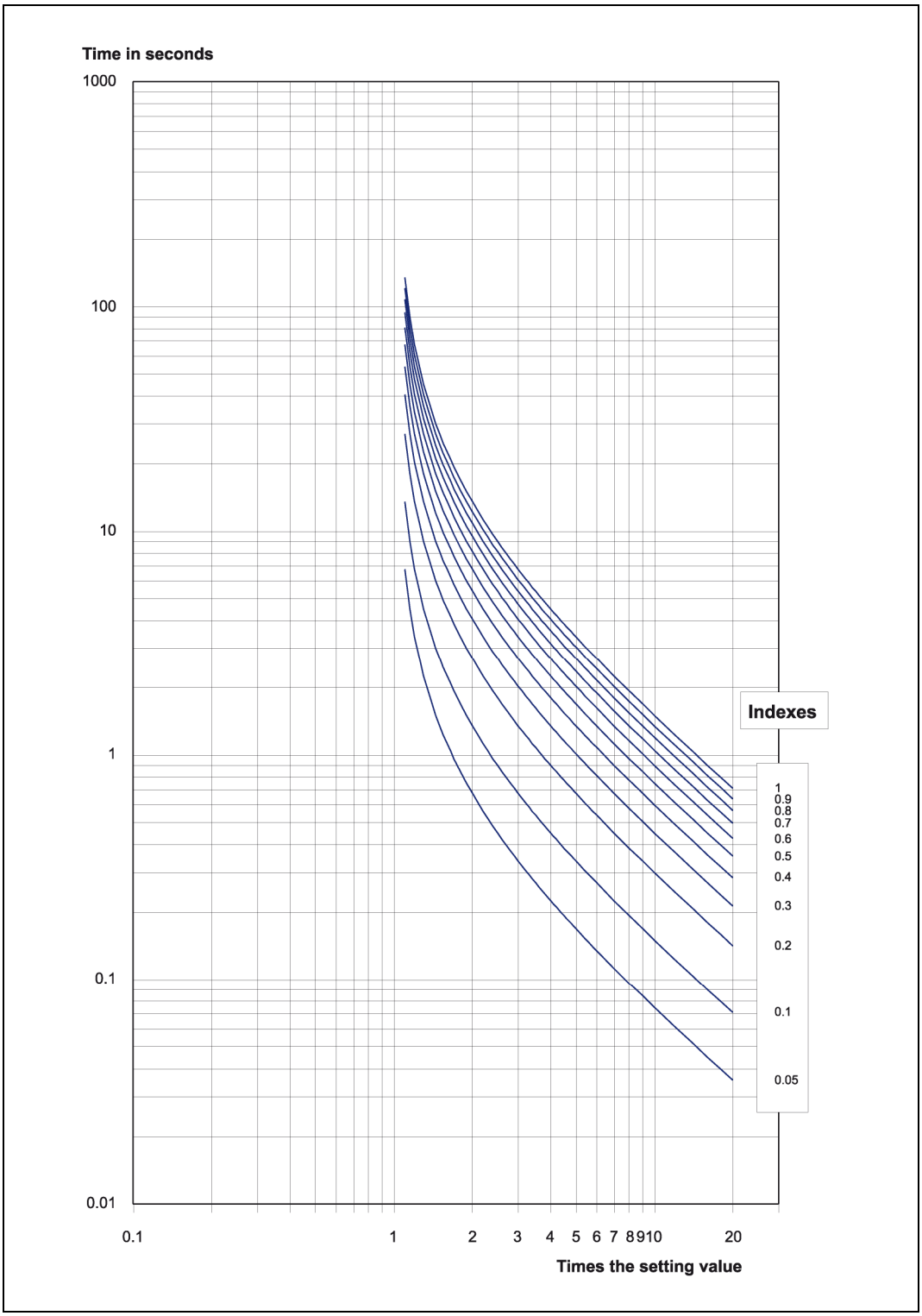


Figure 6.2: Very Inverse Time/Current Characteristic.

$$t = \frac{13.5}{I_S - 1}$$

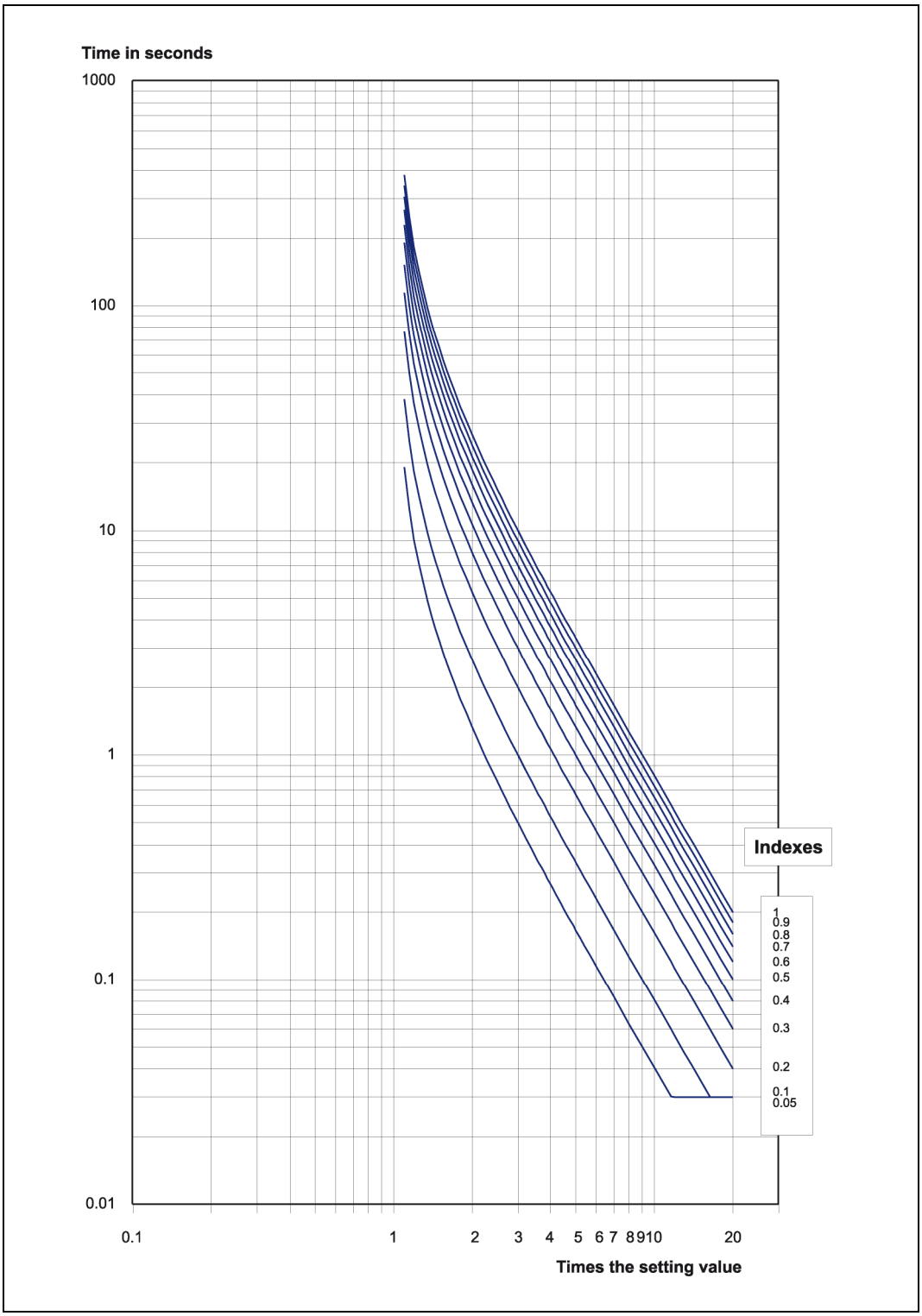


Figure 6.3: Extremely Inverse Time/Current Characteristic.

$$t = \frac{80}{I_S^{\,2} - 1}$$

6.1.2 Overcurrent Unit Block Diagram

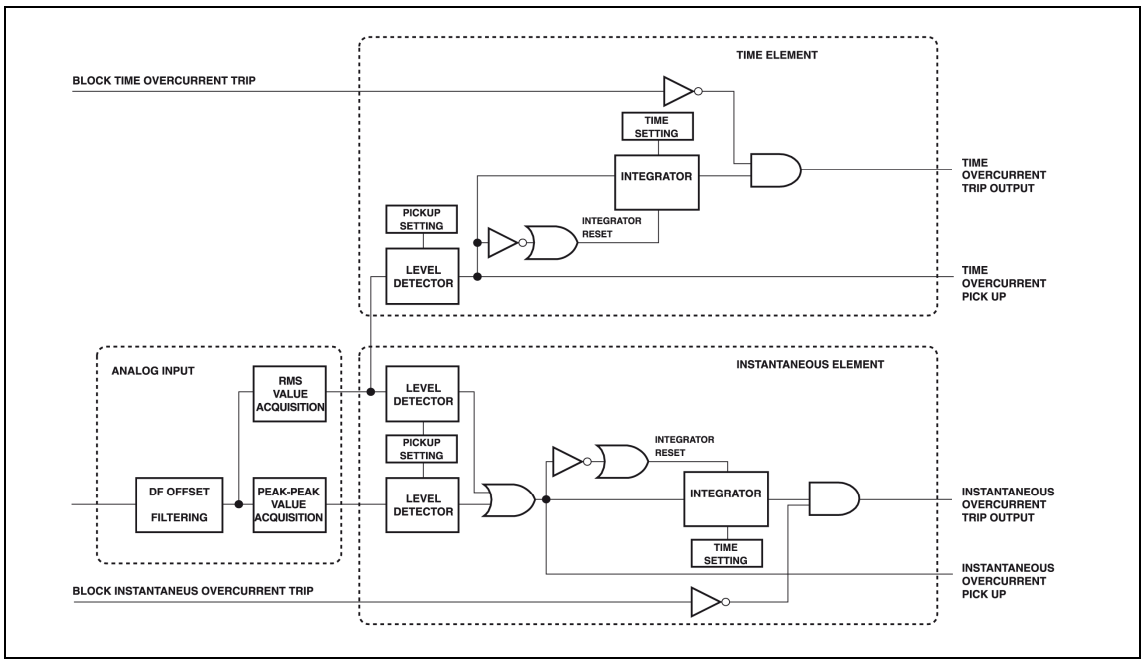


Figure 6.4: Overcurrent Unit Block Diagram.

6.1.3 Instantaneous Elements

The instantaneous elements respond using two different current measuring criteria, one for RMS values and the other for peak-to-peak values. For RMS current values, operation takes place whenever the measured value exceeds 1.05 times the pickup setting. For peak-to-peak current values, operation occurs whenever there are two consecutive samples, whose value exceeds 2.1 times the peak value of the pickup setting. The RMS level detector and the peak-to-peak level detector will reset whenever the measured value is below the pickup setting.

Filtering out the DC offset component in combination with the application of these two instantaneous measurement methods results in low transient overreach without adversely affecting tripping speed.

The combined output of these measuring elements is equipped with an adjustable timer that enables delay of the instantaneous trip.

6.2 General Settings

6.2.1 Transformer Ratio

The transformer ratio settings (phase and/or ground, depending on model) only affect to the analog values displayed on the HMI. A transformer ratio setting of 1 will display the secondary values of the CTs. A setting equivalent to the CT transformation ratio will display the primary values of the system.

6.2.2 Event Masking

It is possible to mask unneeded events or those events without importance for the study of protection behavior. Event masking can be done only through ***ZiverCom***© communications software.

6.3 Event Recording

Protection functions that are monitored by the **Sequence of Events** feature are listed in Table 6-1.

Table 6-1: Events

Function	Event	oct.	bit	#CPI-A	#CPI-B	#CPI-C
Overcurrent Elements Activation [0C]	Phase A Time Overcurrent Pickup	1	1	✓	✓	
	Phase B Time Overcurrent Pickup	1	2	✓	✓	
	Phase C Time Overcurrent Pickup	1	3	✓	✓	
	Ground Time Overcurrent Pickup	1	4		✓	✓
	Phase A Instantaneous Overcurrent Pickup	1	5	✓	✓	
	Phase B Instantaneous Overcurrent Pickup	1	6	✓	✓	
	Phase C Instantaneous Overcurrent Pickup	1	7	✓	✓	
	Ground Instantaneous Overcurrent Pickup	1	8		✓	✓
	Phase A Time Overcurrent Trip Output Active	2	1	✓	✓	
	Phase B Time Overcurrent Trip Output Active	2	2	✓	✓	
	Phase C Time Overcurrent Trip Output Active	2	3	✓	✓	
	Ground Time Overcurrent Trip Output Active	2	4		✓	✓
	Phase A Instantaneous Trip Output Active	2	5	✓	✓	
	Phase B Instantaneous Trip Output Active	2	6	✓	✓	
	Phase C Instantaneous Trip Output Active	2	7	✓	✓	
	Ground Instantaneous Trip Output Active	2	8		✓	✓

Table 6-1: Events						
Function	**Event**	**oct.**	**bit**	**#CPI-A**	**#CPI-B**	**#CPI-C**
Overcurrent Elements Reset and Deactivation [10]	Phase A Time Overcurrent Reset	1	1	✓	✓	
	Phase B Time Overcurrent Reset	1	2	✓	✓	
	Phase C Time Overcurrent Reset	1	3	✓	✓	
	Ground Time Overcurrent Reset	1	4		✓	✓
	Phase A Instantaneous Overcurrent Reset	1	5	✓	✓	
	Phase B Instantaneous Overcurrent Reset	1	6	✓	✓	
	Phase C Instantaneous Overcurrent Reset	1	7	✓	✓	
	Ground Instantaneous Overcurrent Reset	1	8		✓	✓
	Phase A Time Overcurrent Trip Output Deactivated	2	1	✓	✓	
	Phase B Time Overcurrent Trip Output Deactivated	2	2	✓	✓	
	Phase C Time Overcurrent Trip Output Deactivated	2	3	✓	✓	
	Ground Time Overcurrent Trip Output Deactivated	2	4		✓	✓
	Phase A Instantaneous Trip Output Deactivated	2	5	✓	✓	
	Phase B Instantaneous Trip Output Deactivated	2	6	✓	✓	
	Phase C Instantaneous Trip Output Deactivated	2	7	✓	✓	
	Ground Instantaneous Trip Output Deactivated	2	8		✓	✓
Initialization [13]:	Power up	1	8	✓	✓	✓
	Change Of Settings Initialization	1	7	✓	✓	✓
Inputs [06]:	Status Contact Input IN-2 Active	1	2	✓	✓	✓
	Status Contact Input IN-1 Active	1	1	✓	✓	✓
	Status Contact Input IN-2 Deactivated	2	2	✓	✓	✓
	Status Contact Input IN-1 Deactivated	2	1	✓	✓	✓
	Status Contact Input IN-2 Disabled	3	2	✓	✓	✓
	Status Contact Input IN-1 Disabled	3	1	✓	✓	✓
Commands [05]:	Trip Blocked Due to Setting Disagreement	1	2	✓	✓	✓
	Breaker Open Command	1	8	✓	✓	✓
HMI [09]:	Local Mode (Keypad and Display)	1	5	✓	✓	✓
	Remote Mode (Rear Port)	1	6	✓	✓	✓
	Local Mode (Front Port)	1	7	✓	✓	✓

- **Event Recorder Management**

The event record capacity is one hundred (100) events. The Event Recorder structure is a FIFO stack. Once the full capacity is reached, a new event overwrites the oldest event. The following information is stored in each event register:

- **Phase and ground currents (depending on model) measured at the moment the event was generated**
- **Event date and time and event description**

The management of the event recorder is optimized so that simultaneous operations generated by the same event occupy a single position in the event memory. For example, the simultaneous occurrence of the Phase A and the Ground Time Overcurrent Pickups are recorded in the same memory position. However, if the occurrences were not simultaneous, two separate events would be generated. Simultaneous events are defined as those operations that occur within a 1 ms interval, which is the resolution time of the recorder.

Important: There is the option of masking those events that the user considers unnecessary for the analysis of relay operations. Since the capacity of the relay is 100 events, the recording of unnecessary data may erase important information.

- **Records retrieval**

ZiverCom© communications software allows the user to retrieve the information recorded by the unit. Information is decoded for user friendly presentation. Information is presented in table format with a record per table entry.

6.4 Contact Inputs, Outputs & LED Targets

#CPI terminal units are provided with programmable inputs and outputs enabling user configuration of flexible logic designs. The following paragraphs contain a description of the programming structure to configure protection inputs, outputs and signaling. Factory default settings may be modified using the ***ZiverCom***© software program.

6.4.1 Status Contact Inputs

The terminal unit metering elements, and logic functions use the Logic Input Signals listed in Table 6-2 below. Any of these Logic Input Signals can be assigned to one of the two Status Contact Inputs of the terminal unit. The closure of a contact will thereby activate those Logic Input Signals assigned to it. Several different Logic Input Signals can be assigned to one Status Contact Input, but a given Logic Input Signal can only be assigned to one Status Contact Input.

Table 6-2: Status Contact Inputs

No.	Name	Description	#CPI-A	#CPI-B	#CPI-C
6	EPT	External Protection Trip	✓	✓	✓
7	BP_TOC_PH	Bypass Time Phase Time Overcurrent	✓	✓	
8	BP_TOC_N	Bypass Time Ground Time Overcurrent		✓	✓
9	BLK_IOC_PH	Block Phase Instantaneous Overcurrent Trip	✓	✓	
10	BLK_IOC_N	Block Ground Instantaneous Overcurrent Trip		✓	✓
11	BLK_TOC_PH	Block Phase Time Overcurrent Trip	✓	✓	
12	BLK_TOC_N	Block Ground Time Overcurrent Trip		✓	✓

Note: Depending on the model, each unit have available the signals indicated by the check mark.

Users can easily program different input settings using the local RS232 communications port and the ***ZiverCom***© software, or can request this to be completed by the manufacturer.

- **Input Properties**

Input **EPT** blocks trips from every element, provided that it is active before trip is generated.

Inputs **BP_TOC_PH** and/or **BP_TOC_N** change the phase and ground time units into instantaneous units when the input is active before the unit pickup. When the input becomes active after the pickup has occurred, the time delay is bypassed and a trip command is issued.

BLK_IOC_PH, **BLK_IOC_N**, **BLK_TOC_PH**, and **BLK_TOC_N** block the trip output for the corresponding units. When the input becomes active after the trip has occurred, the trip contact will reset.

6.4.2 Auxiliary Contact and Trip Outputs

- **Auxiliary Contact Outputs**

#CPI units are provided with three auxiliary contact outputs. Two of these contacts (AUX-1 and AUX-2) are programmable. Auxiliary Contact Output (AUX-3), which corresponds to **Relay in Service**, is not programmable. Auxiliary contacts location and configuration procedure is outlined in chapter 4 of this manual.

Terminal unit metering elements and logic functions generate a series of Logic Output Signals during terminal unit operation. Each of these signals has either a "True" or "False" value and this status can be used as an input to either of the combinational logic gates shown in Figure 6.5.

Two logic gates are available in each cell (one **"OR"** gate and one **"AND"** gate). Each gate accepts up to eight Logic Output Signals. The output of these two gates is operated by a selectable second gate. The desired final **"AND"** or **"OR"** output from the logic cell can then be connected to any one of the two programmable Auxiliary Contact Outputs (AUX-1 and AUX-2) available in the terminal unit. There are two output modes, pulsed or without pulse.

- **Without Pulses**: Setting the pulse timer to "0", the output contact remains active as long as the forcing function is present.
- **With Pulses**: Once the forcing function activates the output, the contact remains active during the time set independent of the length of the forcing function.

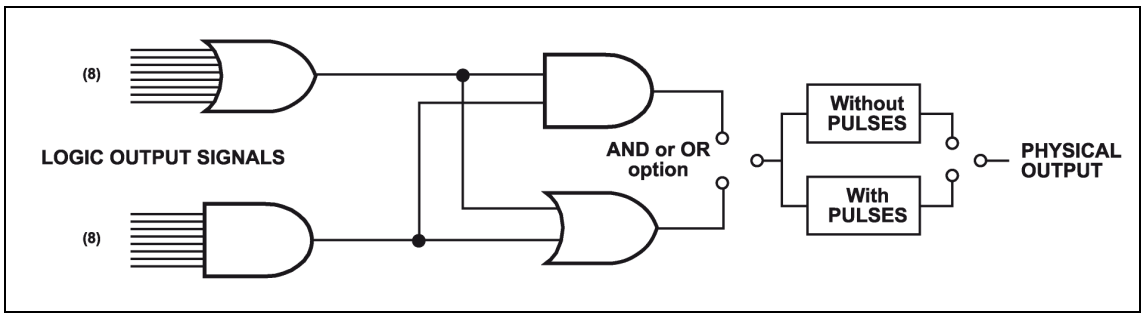


Figure 6.5: Auxiliary Contact Output Logic Cell Block Diagram.

Table 6-3: Auxiliary Contact Outputs					
No.	**Name**	**Description**	**#CPI-A**	**#CPI-B**	**#CPI-C**
1	TOCT_A	Phase A Time Overcurrent Trip Output Active	✓	✓	
2	TOCT_B	Phase B Time Overcurrent Trip Output Active	✓	✓	
3	TOCT_C	Phase C Time Overcurrent Trip Output Active	✓	✓	
4	TOCT_N	Ground Time Overcurrent Trip Output Active		✓	✓
5	IOCT_A	Phase A Instantaneous Trip Output Active	✓	✓	
6	IOCT_B	Phase B Instantaneous Trip Output Active	✓	✓	
7	IOCT_C	Phase C Instantaneous Trip Output Active	✓	✓	
8	IOCT_N	Ground Instantaneous Trip Output Active		✓	✓
9	TOCP_A	Phase A Time Overcurrent Pickup	✓	✓	
10	TOCP_B	Phase B Time Overcurrent Pickup	✓	✓	
11	TOCP_C	Phase C Time Overcurrent Pickup	✓	✓	
12	TOCP_N	Ground Time Overcurrent Pickup		✓	✓
13	IOCP_A	Phase A Instantaneous Overcurrent Pickup	✓	✓	
14	IOCP_B	Phase B Instantaneous Overcurrent Pickup	✓	✓	
15	IOCP_C	Phase C Instantaneous Overcurrent Pickup	✓	✓	
16	IOCP_N	Ground Instantaneous Overcurrent Pickup		✓	✓
44	ALARM_PRO	Protection Module Alarm	✓	✓	✓
54	OPEN	Opening Command	✓	✓	✓
56	DISP	Protection Trip Active	✓	✓	✓
98	ALARMAERR	Error Module Alarm	✓	✓	✓
99	IN_1	Physical Input 1	✓	✓	✓
100	IN_2	Physical Input 2	✓	✓	✓

- **Trip Output**

#CPI models are provided with two trip output relays, each with two contacts. These contacts are internally configurable to NO or NC. Trip contacts correspond to terminal connectors 15-16 and 17-18. Trip outputs location and configuration procedure is outlined in chapter 4 of this manual.

6.4.3 LED Targets

CPI terminals are provided with eight optical indicators (**LEDs**) located on the front panel. Seven of the **LEDs** are user definable. The eighth **LED** is always assigned to indicate the terminal unit is **"Ready"** (powered up, self-test OK).

The logic cell structure, shown in the block diagram of Figure 6.6, permits the user to create combinational logic equations for the **LED** Target Outputs. To configure **LED** Target Outputs, Logic Output Signals are assigned to a **LED** Target Output. The available Logic Output Signals are shown in Table 6-3.

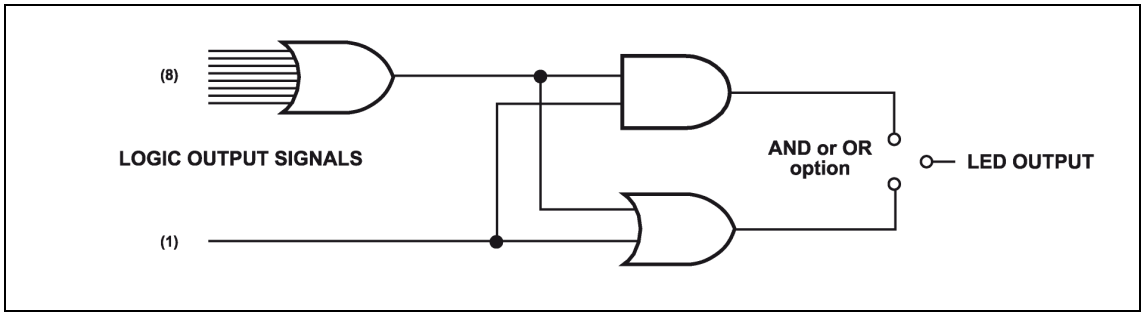


Figure 6.6: LED Target Output Logic Cell Block Diagram.

Each **LED** can be defined as latched or unlatched. If an **LED** is latched it will remain illuminated until reset, even after a condition has disappeared. The **LED** reset function is accomplished via the keypad ↓ (see Chapter 7: Alphanumeric Keypad and Display).

The latching function resides in the volatile memory section of the microprocessor. A power supply loss will cause any latched **LED** to be reset.

Each **LED** can be assigned to any Logic Output Signal listed in Table 6-3.

6.5 Communications

6.5.1 Communications Settings

Communications settings are listed in Chapter 5 (Settings) and include **Terminal Unit Address**, **Baud Rate**, **Stop Bits**, and **Parity**.

6.5.2 Communications Types

#CPI Terminals contain two communications ports. The local port located on the front panel is an RS232 DB-9 port with fixed settings. The remote port is optional, and can be glass fiber optics, 1mm plastic fiber optics, RS232 or RS485 type. Technical data relative to these ports is listed in Chapter 2 (Technical Data).

6.5.3 Communicating with the Unit

Communications with the unit through the communication ports is achieved using the ***ZiverCom***© software application. This software is designed to connect with units of the **#CPI** family, allowing operations such as programming, settings configuration, event recording, activity reports, etc.

It is also possible using **PROCOME**, **DNP3.0** or **MOD-BUS** protocol (according to model), to communicate with equipment to request control and metering changes and to execute commands.

Remote port communication settings can be modified only via the HMI. Local port communication settings are fix to 4800 baud, 1 stop bit and adjustable parity, as listed in Chapter 5.

#CPI models are provided with two communication controllers. This enable simultaneous communications via both ports.

ZiverCom© is password protected to provide access only to authorized personnel. ***ZiverCom***© is a user-friendly, Windows™ based software tool. The software allows easy navigation of and access to available settings and actions through a series of intuitive menus and graphical user interfaces.

Terminal unit status information can be accessed either in local or remote mode. The following data can be retrieved:

- Metering data
- Settings
- Contact inputs
- Auxiliary outputs & LED targets
- Event records
- Contact inputs/outputs status
- Protection element status
- Last trip information
- Time and Date

7. Alphanumeric Display and Keypad

7.1 Alphanumeric Display and Keypad

The dot matrix display has four characters, each one being a 7 x 5 dot matrix. It provides information on terminal unit alarms, settings, metering, status, etc. The default screen displays model identification (**#CPI**) as shown in Figure 7.1.

Figure 7.1: Alphanumeric Display.

The **#CPI** keypad consists of 3 keys (see Figure 7.2). This keypad is associated with the information on the Alphanumeric Display. Only one key is accessible (the ↓ key) when the cover is installed on the equipment.

Starting from the default screen, the Local Interface has two possible operation modes. One mode operates using only a single key (when the cover is installed), and the other takes advantage of the complete keypad.

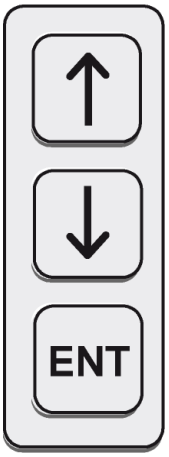


Figure 7.2: Keypad.

7.2 Keys, Functions and Operation Modes

- **Option Selection**

Using the selection keys (↑↓) is possible to scroll through the different options on the display. The **ENT** key is used to confirm a selection.

To scroll through different settings use the ↓ key. Once the desired setting is found, use the **ENT** to select it. The setting value will be displayed. If these setting value needs to be changed, press the **ENT** key a second time and the setting value will blink.

- **Change of Settings (Range)**

For settings with a numeric value (inside a range) the procedure is as follows: The first digit in the setting will blink. Pressing the ↑ key is possible to scroll through the different values for that digit. Once the selection is made, press the ↓ key to set it and the next digit will blink. Repeat the procedure until the setting value is completed.

For digits where no changes are desired, press the ↓ key to skip to the next digit. Once every digit has been adjusted press the **ENT** key to set the value and the screen will show the setting identifier. Proceed to the next setting by pressing the ↓ key.

The system does not allow to exceed the range for a given setting. When setting a value out of range, the value resets to zero and the blinking cursor is placed on the first digit.

- **Change of Settings (Options)**

For settings with preset options, it is possible to scroll through the different values using the ↑ and ↓ keys. Once the selection is displayed, press the ENT key to set the value and the screen will show the setting identifier. Proceed to the next setting by pressing the ↓ key.

- **Exit Menus or Settings**

After an operation has been performed (selection, change of settings, viewing information, etc.) move to the previous level in the menu by pressing the ↑ key.7.3.

7.3 Screen Sequence using a Single Key

From the default screen, press the ↓ key to access the following screen sequence:

- Phase and ground current metering (depending on model).
- Last relay trips since last reset.
- Reset trip information.
- Reset LEDs.

Figure 7.3 shows the sequence after a trip has occurred. Figure 7.4 sequence starts without trip indication. The white areas shown in both Figures depict screen groups dependent on the **#CPI** model, with different content for each model. The shaded areas depict screen common for each model. The screen mnemonics are explained in the following paragraphs.

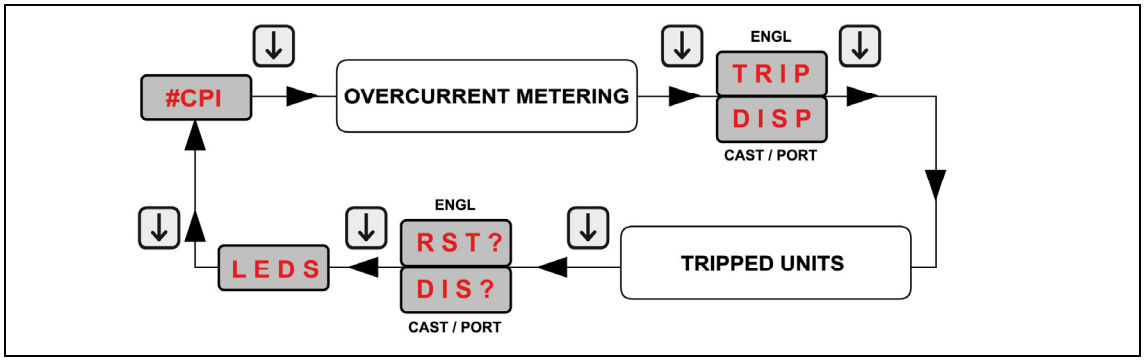


Figure 7.3: General Screen Sequence using the ↓ Key (with Trip Indication).

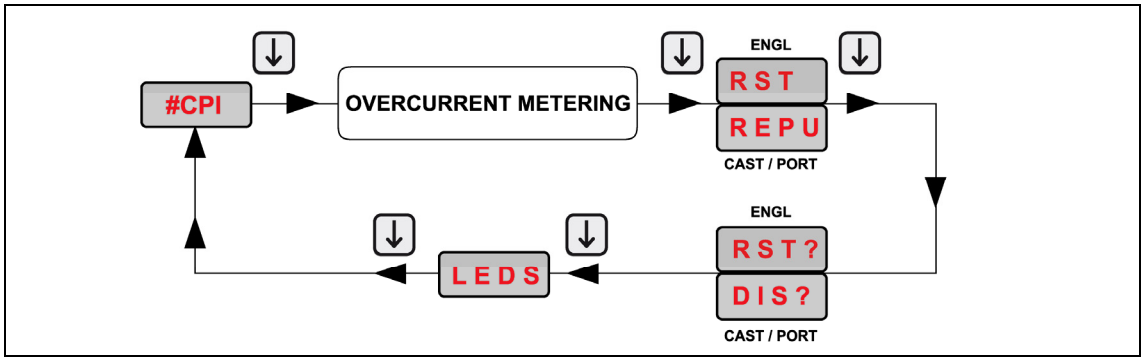


Figure 7.4: General Screen Sequence using the ↓ Key (without Trip Indication).

The screen mnemonics included in Figures 7.3 and 7.4 are explained in the following paragraphs.

TRIP DISP	Screen indicating a protection trip.
RST? DIS?	Trip Indication Reset. Once the trip conditions have been removed, it is possible to reset the trip indication by pressing and holding the ↓ key for more than two (2) seconds.
LEDS	It is possible to reset the trip indication by pressing and holding the ↓ key for more than two (2) seconds.

The following Figures depict the screen groups including metering and trip indications. These sequences are model dependent, corresponding to the white areas in Figure 7.3.

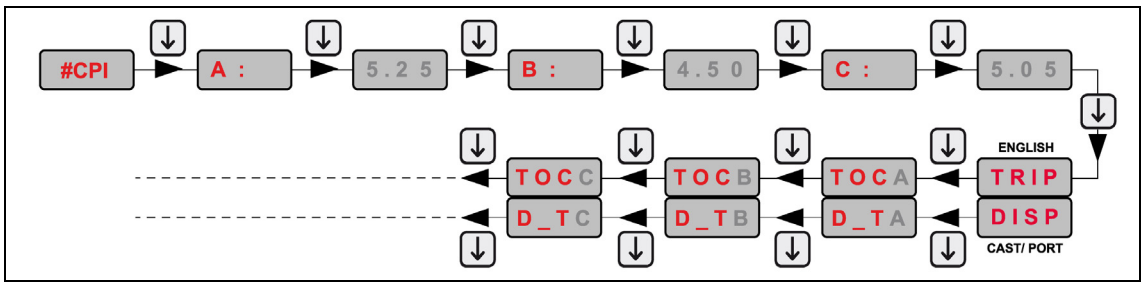


Figure 7.5: Metering Elements and Trip Information Screen Sequence. #CPI-A Model.

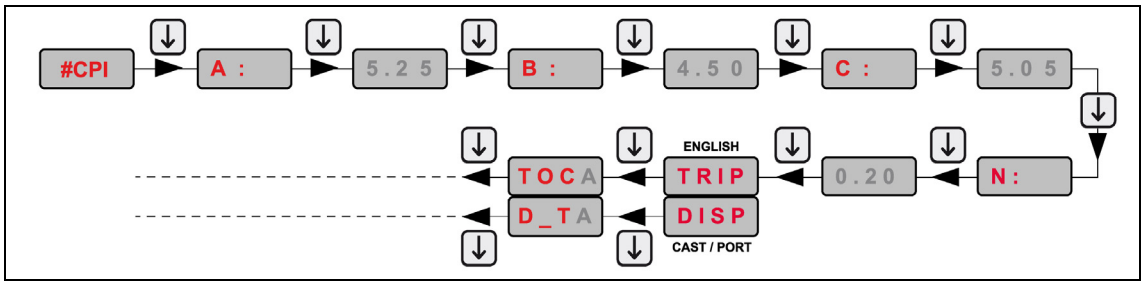


Figure 7.6: Metering Elements and Trip Information Screen Sequence. #CPI-B Model.

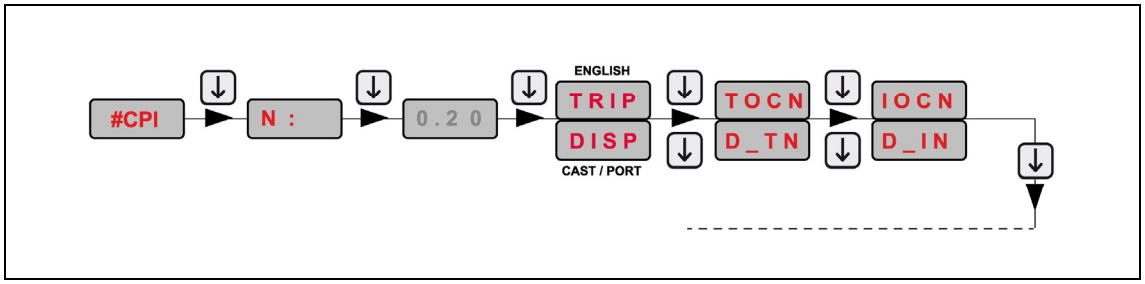


Figure 7.7: Metering Elements and Trip Information Screen Sequence. #CPI-C Model.

The screen mnemonics included in Figures 7.5, 7.6 and 7.7 are explained in the following paragraphs.

A:	Indicates that the value displayed in the next screen corresponds to the real time measurement of the current circulating on Phase A.
B:	Indicates that the value displayed in the next screen corresponds to the real time measurement of the current circulating on Phase B.
C:	Indicates that the value displayed in the next screen corresponds to the real time measurement of the current circulating on Phase C.
N:	Indicates that the value displayed in the next screen corresponds to the real time measurement of the ground current.
0.00	Measured value in Amps, indicating primary values (according to the CT ratio set in the relay). The value correspond to the phase or ground, as indicated in the previous screen.
TRIP DISP	Indicates that a protection trip has occurred, and has not been acknowledged. Following to these screen are the indication of the elements issuing the trip command.
TOC X DT_X	Indicates a Time Overcurrent trip by element X. Depending on the **#CPI** model, X can take the value A, B, C, or N.
IOC X DI_X	Indicates an Instantaneous Overcurrent trip by element X. Depending on the **#CPI** model, X can take the value A, B, C, or N.

Always that a protection trip command is issued, the relay will display the **TRIP** (or **DISP**) indication, followed by the tripped elements. If more than an element is under trip conditions, the screens shown will **not** be in chronological sequence.

These screens will be displayed always that a protection trip command is issued. Once the trip conditions are eliminated, the screens will remain until reset from the **RST?** (or **DIS?**)screen. Once the indications are reset, screens **TRIP** (or **DISP**), **TOC X** (or **DT_X**), and **IOC X** (or **DI_X**) are replaced by **RST** (or **REPU**).

7.4 Screen Sequence using the Complete Keypad

From the default screen (see Figure 7.1), there are a series of screen sequences. Using the selection keys (↑↓) and the **ENT** key is possible to access the following options:

- **Settings**
  - general
  - protection
- **Information**
  - contact input status
  - contact output status
  - protection elements status
  - selected language
  - frequency
- **Configuration**
  - communications
  - language
  - frequency

For a global display of the screen sequence and the keys used to move forward in the sequence, below is a table describing the process.

- **General Settings: HMI Access**

SETT	**GNRL**	**PCT:**
INFO	PRO	**NCT:**
CNFG		

- **Protection Settings: HMI Access**

SETT	GNRL	**TOCP**	**ENBL**
INFO	**PRO**	TOCN	**PKUP**
CNFG		IOCP	**CURV**
		IOCN	**DIAL**
			TIME

SETT	GNRL	TOCP	**ENBL**
INFO	**PRO**	**TOCN**	**PKUP**
CNFG		IOCP	**CURV**
		IOCN	**DIAL**
			TIME

SETT	GNRL	TOCP	
INFO	**PRO**	TOCN	**ENBL**
CNFG		**IOCP**	**PKUP**
		IOCN	**TIME**

SETT	GNRL	TOCP	
INFO	**PRO**	TOCN	**ENBL**
CNFG		IOCP	**PKUP**
		IOCN	**TIME**

- **Information Menu: HMI Access**

SETT	**D_IN**
INFO	**DOUT**
CNFG	**PKUP**
	LANG
	FREQ

- **Configuration Menu: HMI Access**

SETT		**ADDR**
INFO	**COMN**	**RATE**
CNFG	LANG	**STOP**
	FREQ	**PARI**
		MODB
		FPAR
		TOUT

SETT		
INFO	COMN	**ENGL**
CNFG	**LANG**	**PORT**
	FREQ	**SPAN**

SETT		
INFO	COMN	
CNFG	LANG	**50Hz**
	FREQ	**60Hz**

8. Receiving Tests

8.1 General

Improper handling of electrical equipment is extremely dangerous, therefore, only skilled and qualified personnel familiar with appropriate safety procedures and precautions should work with this equipment. Damage to equipment and injury to personnel can result when proper safety precautions are not followed. The following general safety precautions are provided as a reminder:

- High magnitude voltages are present in auxiliary supply and measuring circuits **even after equipment has been disconnected**.
- Equipment should be solidly grounded before handling or operating.
- Under no circumstances should the operating limits of the equipment be exceeded (auxiliary voltage, current, etc.).
- The auxiliary supply voltage (AC or DC) should be disconnected from the equipment before extracting or inserting any module, otherwise damage may result.

The number, the type and the specific characteristics of the acceptance tests for the **#CPI** units are detailed in the following table.

#CPI	Preliminary inspection
	Insulation test
	Current measuring test
	Phase and Ground Units Test
	Status contact inputs & LED targets test
	Communications test

8.1.1 Accuracy

The results obtained in electrical testing greatly depend on the accuracy of the measuring instruments and test source signals (auxiliary voltage, and measurement voltages). Therefore, verification of the information specified in the Technical Data section of this manual can only reasonably be achieved using test equipment under normal reference conditions and with the tolerances indicated in the UNE 21-136 and IEC 255 standards, in addition to using precision instruments.

It is extremely important that there be no distortion (<2%) in the test source signals as harmonics can affect internal measuring of the equipment. For example, distortions will affect this unit, made up of non-linear elements, differently from an AC ammeter, because the measurement is made differently in both cases.

It must be emphasized that the accuracy of the test will depend on the instruments used for measuring as well as the source signals used. Therefore, tests performed with secondary equipment should focus on operation verification and not on measuring accuracy.

8.2 Preliminary Inspection

The following equipment aspects should be examined:

- The unit is in good physical condition, mechanical parts are securely attached and no assembly screws are missing.
- The unit model number and specifications agree with the equipment order.

8.3 Insulation Test

While testing for insulation of switchgear and external wiring, is recommended to disconnect the terminal unit to avoid damage, since insulation testing has been performed by the manufacturer. The following paragraphs describe common mode and transverse mode insulation tests.

- **Common Mode**

With no wires connected to the unit, wire all the rear connection terminals together except for number 10, number 30, and the ground terminal. With external wiring connected, disconnect terminals 28, 29, 30, and the ground terminal. Apply 2,000 Vac for 1 minute between interconnected terminals and metal case.

- **Transverse Mode**

Divide the terminals into terminal groups according to Table 8-1. Apply 2000 VAC for 1 minute between pairs of terminal groups.

Table 8-1: Insulation Test (Transverse Mode)

#CPI-A	#CPI-B	#CPI-C
1-2	1-2	---
3-4	3-4	---
5-6	5-6	---
---	7-8	7-8
11-12-13-14	11-12-13-14	11-12-13-14
15-16-17-18	15-16-17-18	15-16-17-18
19-20-21-22-23-24-25-26-27	19-20-21-22-23-24-25-26-27	19-20-21-22-23-24-25-26-27
28-29	28-29	28-29

High voltage may be present after testing due to internal capacitors. Gradually, reduce test voltage to zero, before removing the test probes.

8.4 Current Measuring Test

To avoid trips while performing this test, protection elements must be disabled and the test current should not be interrupted by the breaker. Apply the a.c. current values indicated in table 8-2 to the Phase and Ground Current Analog Inputs – terminal connectors are model dependent.

Table 8-2: Current Measuring Test	
Applied Current	Measured Value
X Aac	X ± 5% Aac

Note: for high current values, apply test current for the shortest time possible. Do not exceed 8 seconds for 20 A input current.

8.5 Phase and Ground Units Test

It is recommended to test each unit individually. Disable every unit but the unit to be tested.

- **Pickup and Reset**

Adjust the desired settings in the terminal unit, and apply current to the corresponding analog input. To verify pickup and reset values, set the display to the Information - Pickup menu. Auxiliary outputs can also be programmed to verify element pickup and reset.

Table 8-3: Phase and Ground Units Test				
Setting	**Pickup**		**Reset**	
	Maximum	Minimum	Maximum	Minimum
X	1.10 x X	1 x X	1.05 x X	0.95 x X

- **Operating Times**

Operating times can be verified monitoring the trip outputs (terminals 15-16 and 17-18).

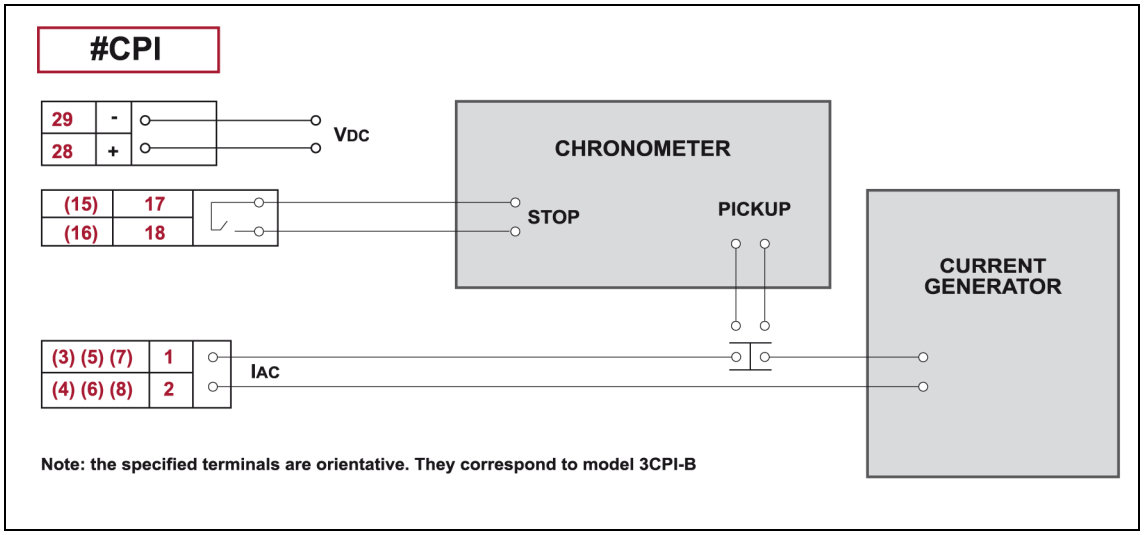


Figure 8.1: Operating Time Test Setup.

Fixed Time or Instantaneous

Apply a current value 20% over the pickup setting. Operating time should be the time setting ±5% or ±25 ms (whichever is greater). Note that minimum operating speed for instantaneous operation averages 30 ms.

Inverse Time

For a given curve, operation time depends on the time dial setting and the applied current (refer to chapter 6 for time/current characteristic curves). Tolerance is ±5% of the current value.

8.6 Contact Inputs, Auxiliary Outputs and LED Targets Test

Connect the equipment to a suitable power supply (rated Vdc) through terminal connectors 28 (+) and 29 (-). Ready **LED** will illuminate.

Apply rated voltage to the contact input connectors 11(+) – 12(-) and 13(+) – 14(-). Select from the information menu the inputs status screens (refer to Chapter 7 Operator Interface) and verify that both signals are ON. Disconnect the test probes and verify that both signals are OFF.

To test auxiliary outputs, the forcing function to activate the output depends on how the outputs are configured. A straight forward test is to program the outputs to activate when the physical inputs are energized. In this fashion the inputs test doubles as the output operation test.

Press the 🡻 key to scroll through the screen sequence until the screen LEDS is reached. Then, press the 🡻 key for 2 seconds and verify that all the LEDs illuminate. Release the 🡻 key and verify that all the LEDs turn off.

8.7 Communication Test

Connect the equipment to a suitable power supply (rated Vdc) through terminal connectors 28 (+) and 29 (-). Ready LED will illuminate. Test will be performed through local communications port, allocated on front panel. This port has fixed settings as follows:

Baud Rate	4800 bauds
Stop Bits	1
Parity	1 (even)

Connect to the terminal unit through the local communications port using a DB9 (9-pin) serial connection wire. Synchronize time using the ***ZiverCom***© software program. Disconnect the communications wire and disconnect the terminal unit power supply and wait for two minutes. Afterwards, connect the power supply and connect to the terminal unit through the remote communications port. Activate the cyclical mode in the ***ZiverCom***© software program and verify that time actualizes properly.

8.8 Installation

8.8.1 Location

The location where the terminal unit is to be installed should meet the following minimum conditions to ensure correct operation, long service life, and ease of installation and maintenance:

- Absence of dust
- Absence of dampness
- Absence of vibration
- Adequate lighting
- Easy access
- Horizontal or vertical mounting

Mounting should be in accordance with the external connections scheme.

8.8.2 Connection

Terminal number 30 should be solidly grounded to ensure disturbance filtering circuits operate properly. The wire used for grounding these terminals should be stranded 14 AWG. Ground wire length should be minimized and should not exceed 12”.

A. Protection Communications Protocol PROCOME 3.0

Model-specific documentation with protection communications protocol PROCOME 3.0

A.1 Settings

A.1.1 Configuration Settings

Communications (HMI)	
Setting	**Range**
Communications password enable	YES / NO
Communications password timeout	1 - 1440 min
Communications password	8 characters

Settings for establishing communication through the remote port.

A.2 Description of Operation

A.2.1 Event Record

Table A-1: Event Record			
Function	**Event**	**Oct.**	**Byte**
33750	Measurement annotation	1	1

A.2.2 Inputs

There exists the possibility of the physical inputs functioning with inverse logic, assigning one or a set of them to a digital input or to its negated.

A.2.3 Communicating with the Unit

Using the PROCOME profile, it is possible to communicate with the unit to request control changes and to execute orders. In this case, the distance to the fault calculated by the locator is transmitted as one more measurement.

A.3 Alphanumeric Keypad and Display

A.3.1 Communications

Selecting the communications option brings up a menu composed of the settings: Terminal Address, Baud Rate, Stop Bits, Parity, Frontal Port Parity, Communications Timeout, Communications Password Enable and Communications Password Timeout.

- **Communications Password Enable, Communications Password Timeout and Communications Password**

P_CL The setting of **Communications Password Enable** makes it possible to enable the password access function to establish communication with the unit via the rear port: YES means enabling the permission and NO, disabling.

T_CL The setting of **Communications Password Timeout** allows establishing a period of time for activating a lockout of communication with the unit (whenever communication is via the rear port): if the set time elapses with no activity taking place in the communications program, the system locks itself in this state. Consequently, it will be necessary to restart the communication.

The last setting of the communications group, **Communications Password**, makes it possible to establish a specific password to access communication with the unit through the rear port (only through ***ZiverCom***© communications program. This password must have 8 characters, which will be entered using the numerical keys and the key corresponding to a dot.

A.3.2 Accessing the Information

The variations in the settings menus described in the preceding sections are reflected in the information menus, with the same layout shown. Note that the information menu only allows viewing the established settings and does not allow modifying them.

B. DNP 3.0 Communications Protocol

Model-specific documentation with communications PROTOCOL DNP 3.0

B.1 Physical Architecture

Figures B.1 and B.2 shows de options for the **CPI** models (vertical and horizontal mounting).

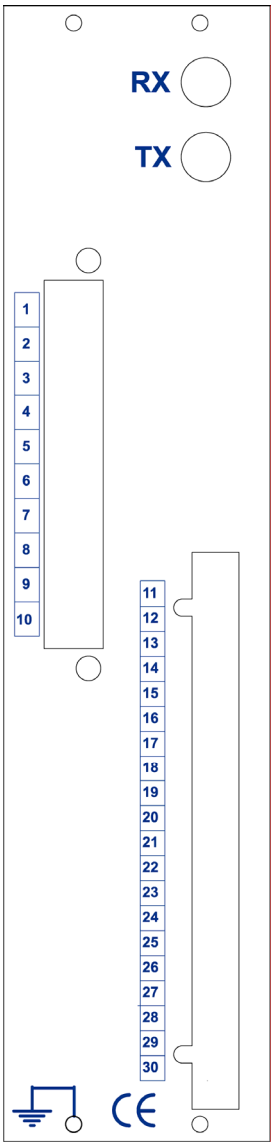


Figure B.1: 3CPI Rear View.

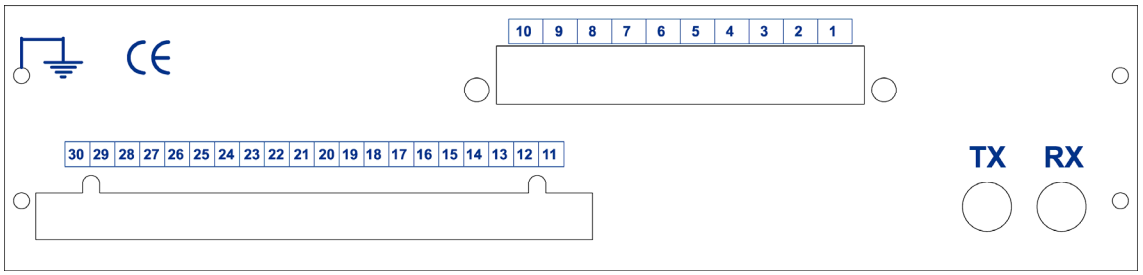


Figure B.2: 8CPI Rear View.

B.2 Settings

DNP 3.0 Protocol		
Setting	**Range**	**Step**
MTU Address (Master equipment number)	0 - 65534	1
RTU Address (Slave equipment number	0 - 65534	1
Enable Unsolicited Reporting)	0 - 1	
Timeout N7	50 - 65535 ms	1 ms
Time Grouping Unsolicited	100 - 65535 ms	1 ms
N7 Retries Number	0 - 3	1
Pre-Transmission Time	0 - 65535 ms	1 ms
Echo Control Enable	0 - 1	
N2 Retries Number	0 - 32	1
Fixed Delay	0 - 32767 ms	1 ms
Max. Random Delay	0 - 32767 ms	1 ms

Metering Changes Settings		
Setting	**Range**	**Step**
Settings independents for metering changes from 0 to 5 % Change Metering	0.00 - 100 %	0.01 %

B.3 Description of Operation

B.3.1 DNP 3.0 Protocol

The models with the option DNP 3.0 communication protocol present the following configuration settings:

- **DNP Configuration Settings**

The DNP 3.0 protocol configuration settings incorporate the definition of the **RTU** and **MTU** address (number of slave equipment and number of master equipment); the activation or deactivation of **Unsolicited**, the setting of **Timeout N7**, which fixes the time out to receive confirmation from the master asked by the slave with CON bit set to 1, the number of new attempts which can be applied when waiting for confirmation from the master, if it does not arrive repeatedly within the time fixed by the **Timeout N7**, the setting for the **Pre-Transmission Time** setting, time which generates the number of warning characters, and the one of **Echo Control**, i.e. the activation or deactivation of the transmission echo.

Note: Pre-Transmission Time and Echo Control settings are used to have various equipments connected to a concentrator type 4CCY and working in multi-master mode.

- **Metering Changes (Deadband Values)**

Analog metering bands (according to equipment and model) can be set. The setting represents the percentage over the maximum value of the measure, that will be taken as reference to test if there is an analogical change to record. In other word, a change will be recorded if the difference in the analogical measures is greater than the set percentage.

If it is adjusted to 100%, analogical changes in this measure will not be recorded, which is then understood as being in a deactivated state.

B.3.2 Communications

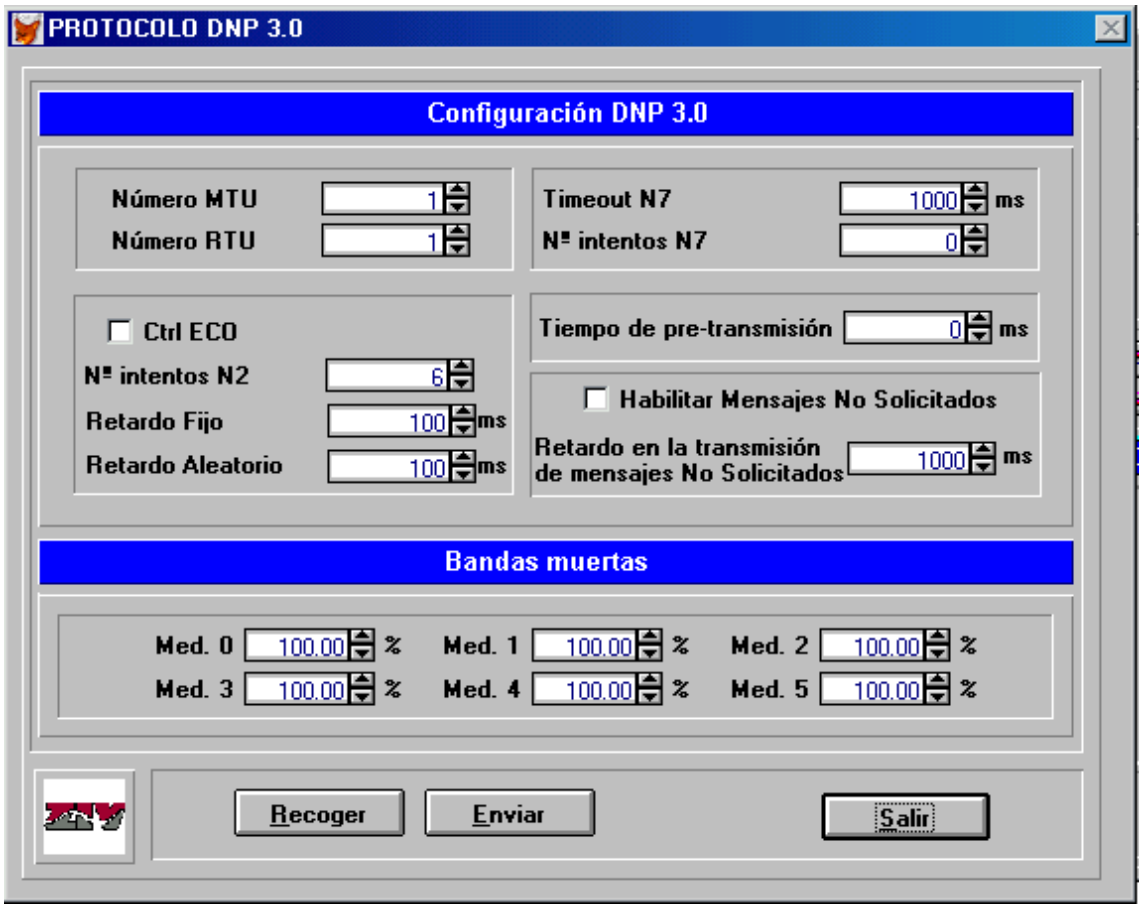
B.3.2.a Communication with the Equipment

The **CPI** models have a frontal and a rear communications port.

B.4 Alphanumeric Keypad and Display

The settings of the communications protocol DNP3 are not adjustable locally from the relay itself. They can only be changed by using the communications program ***Zivercom***®.

B.4.1 DNP 3.0 Settings Menu (*Zivercom*®)



C. MODBUS RTU Documentation. Address Map

Documentation specific to the models with the MODBUS RTU communication profile

C.1 Preliminary Information

This document is intended as a reference on the implementation of the MODBUS RTU Protocol in the **#CPI**.

This document describes the MODBUS map of addresses (inputs, outputs, metering registers and commands) and their equivalent in the **#CPI**.

The functions implemented are as follows:

ModBus Function	Description
01	Reading of Outputs (Read Coil Status)
02	Reading of Inputs (Read Input Status)
04	Reading of Metering Registers (Read Input Registers)
05	Commands (Force Single Coil)

Any other function non-included in the table above will be considered illegal and the exception code 01 (Illegal function) will be returned as a reply.

C.2 Reading of Outputs (Read Coil Status)

- **Range of Modbus Addresses for the #CPI**

The Output Modbus addresses assigned to the **#CPI** are as follows:

Addresses	Description
0200H..02FFH	Outputs Status

- **Map of Modbus Addresses for the #CPI**

The Output Modbus addresses assigned to the **#CPI** are as follows:

Addresses	Description
0200H	AUX-1 Status
0201H	AUX-2 Status

Assigned addresses are fixed and their content is variable (it depends on the configuration selected by the end-user for each relay).

The remaining addresses of the range will be considered as illegal and the exception code 02 (Illegal Data Address) will be returned as a reply.

C.3 Reading of Inputs (Read Input Status)

- **Range of Modbus Addresses for the #CPI**

The Input Modbus addresses assigned to the **#CPI** are as follows:

Addresses	Description
0000..00FFH	Inputs Stauts

- **Map of Modbus Addresses for the #CPI**

The Input Modbus addresses assigned to the **#CPI** are as follows:

Addresses	Description
0000H	INPUT-1 Status
0001H	INPUT-2 Status

Assigned addresses are fixed, their content being variable (it depends on the configuration selected by the end-user for each relay).

The remaining addresses of the range will be considered as illegal and the exception code 02 (Illegal Data Address) will be returned as a reply.

C.4 Reading of Metering Register (Read Input Registers)

- **Range of Modbus Addresses for the #CPI**

The Modbus addresses for the Metering Input Registers assigned to the **#CPI** are as follows:

Addresses	Description
2000H..201FH	Metering Value

- **Map of Modbus Addresses for the #CPI**

The Modbus addresses for the Metering Input Registers assigned to the **#CPI-A/B** are as follows:

Addresses	Description
2000H	Phase A Overcurrent Metering
2001H	Phase B Overcurrent Metering
2002H	Phase C Overcurrent Metering

The Modbus addresses for the Metering Input Registers assigned to the **#CPI-C** are as follows:

Addresses	Description
2000H	Ground Overcurrent Metering

The rest of addresses of the range will be considered as illegal and the exception code 02 (Illegal Data Address) will be returned as a reply.

C.5 Commands (Force Single Coil)

- **Range of Modbus Addresses for the #CPI**

The range of Modbus addresses for commands in the **#CPI** is as follows:

Addresses	Description
00200..02FFH	Commands

D. Schemes and Drawings

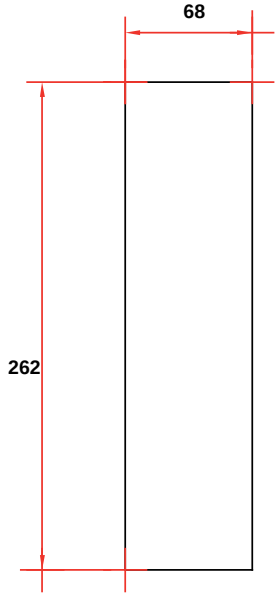
Dimension and Drill Hole Schemes

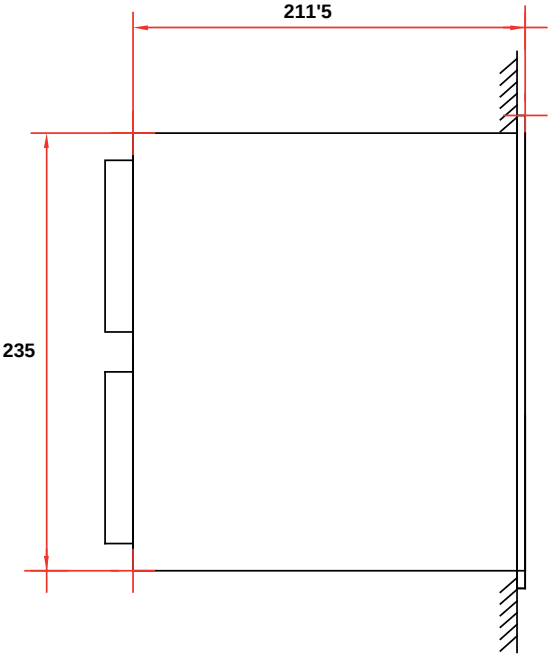
3CPI	>>4BF0100/0016
Adapter board to 19”x 2U / 8CPI	>>4BF0100/0026

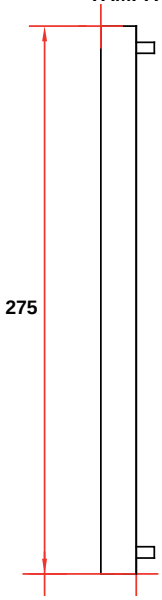
External Connection Schemes

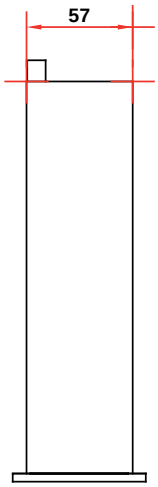
CPI-A	>>3RX0131/0034 (Generic)
CPI-B	>>3RX0131/0035 (Generic)
CPI-C	>>3RX0131/0036 (Generic)

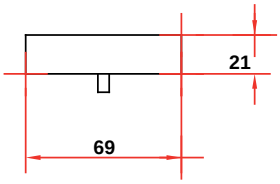
CAJA TIPO "D"
ENCLOSURE TYPE "D"
CAIXA TIPO "D"











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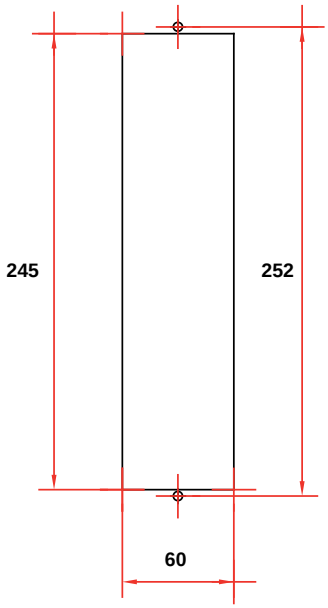
FRONT COVER
TAMPA



TALADROS 5mm
5mm DRILLING
FUROS 5mm

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8		9		10	
11		12		13	
14		15		16	

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TÍTULO: DIMENSIONES Y TALADRADO

PROYECTO: CAJA TIPO "D" 6U 1/7RACK

Rev. 0
Rev. 1 14/9/98
Rev. 2 14/2/02

NÚMERO: 4BF0100/0016

	Fecha	Nombre
Dibujado	3/5/96	J.C.S.
Aprobado	3/5/96	R.O.

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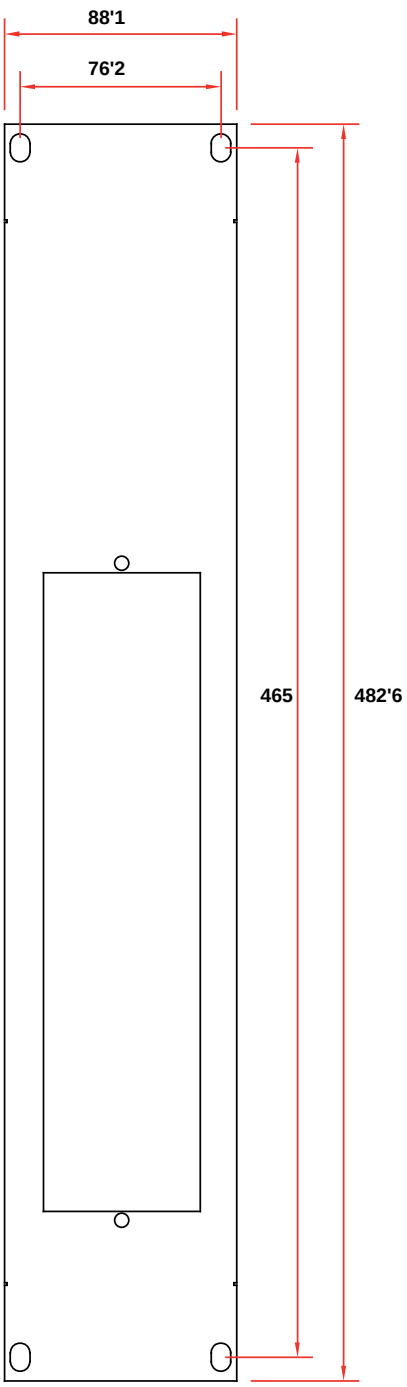

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14		15		16	

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TÍTULO: PLACA ADAPTACION A 19``X 2U

PROYECTO: RELE INDUSTRIAL

Rev. 0
Rev. 14/2/02

NÚMERO: 4BF0100/0026

	Fecha	Nombre
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Aprobado	29/4/99	R.O.

Hoja: 1

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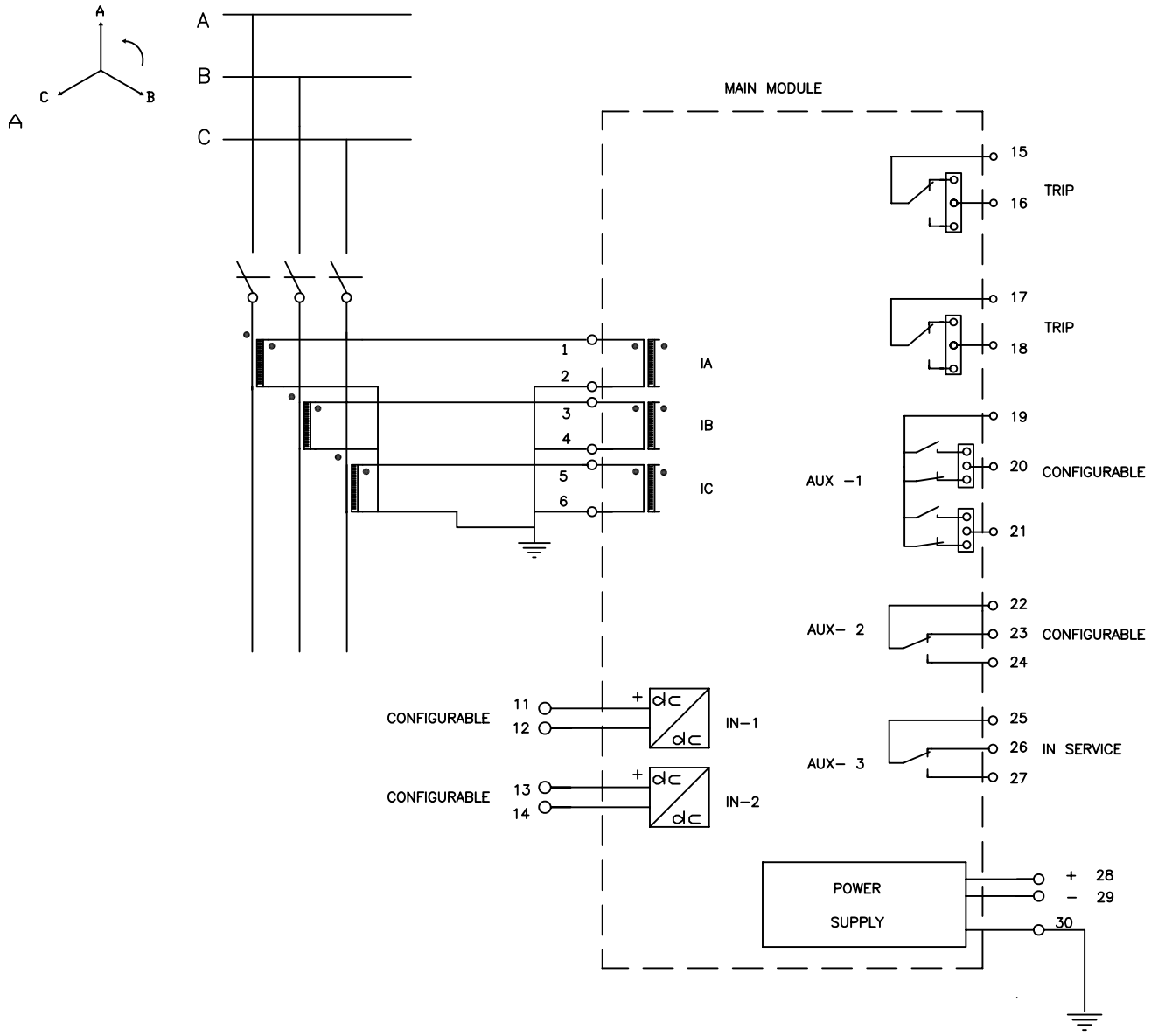

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Z I V Aplicaciones y Tecnologia S.A.

TITLE: EXTERNAL CONNECTIONS 3/8CPI–A

PROJECT: OVERCURRENT PROTECTION

Rev.0

NUMBER: 3RX0131/0034

	Date	Name
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Approved	15/04/03	J.M.Y.

Sheet: 1

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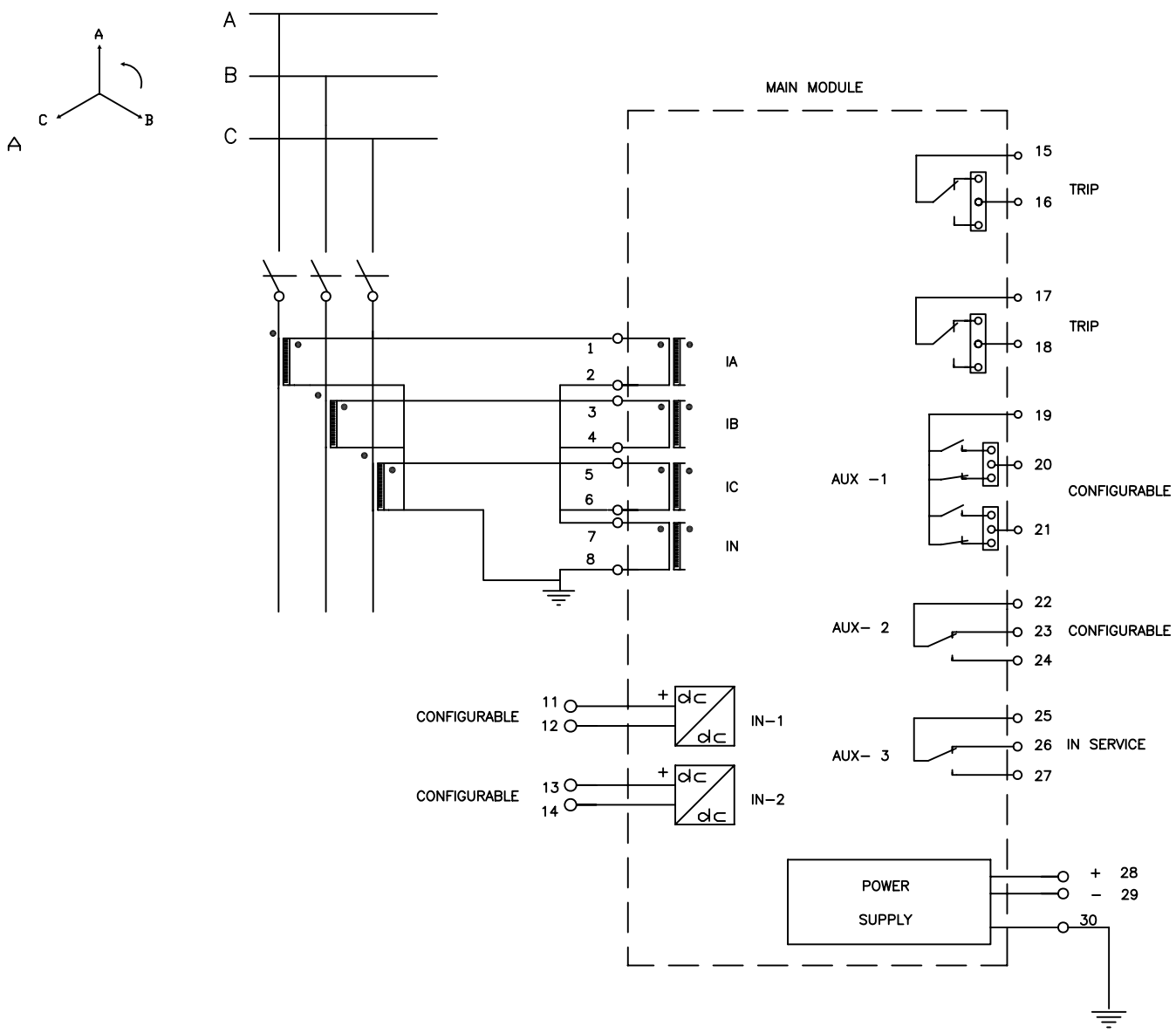

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Z I V Aplicaciones y Tecnologia S.A.

TITLE: EXTERNAL CONNECTIONS 3/8CPI–B

PROJECT: OVERCURRENT PROTECTION

Rev. 0

NUMBER: 3RX0131/0035

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Approved	15/04/03	J.M.Y.

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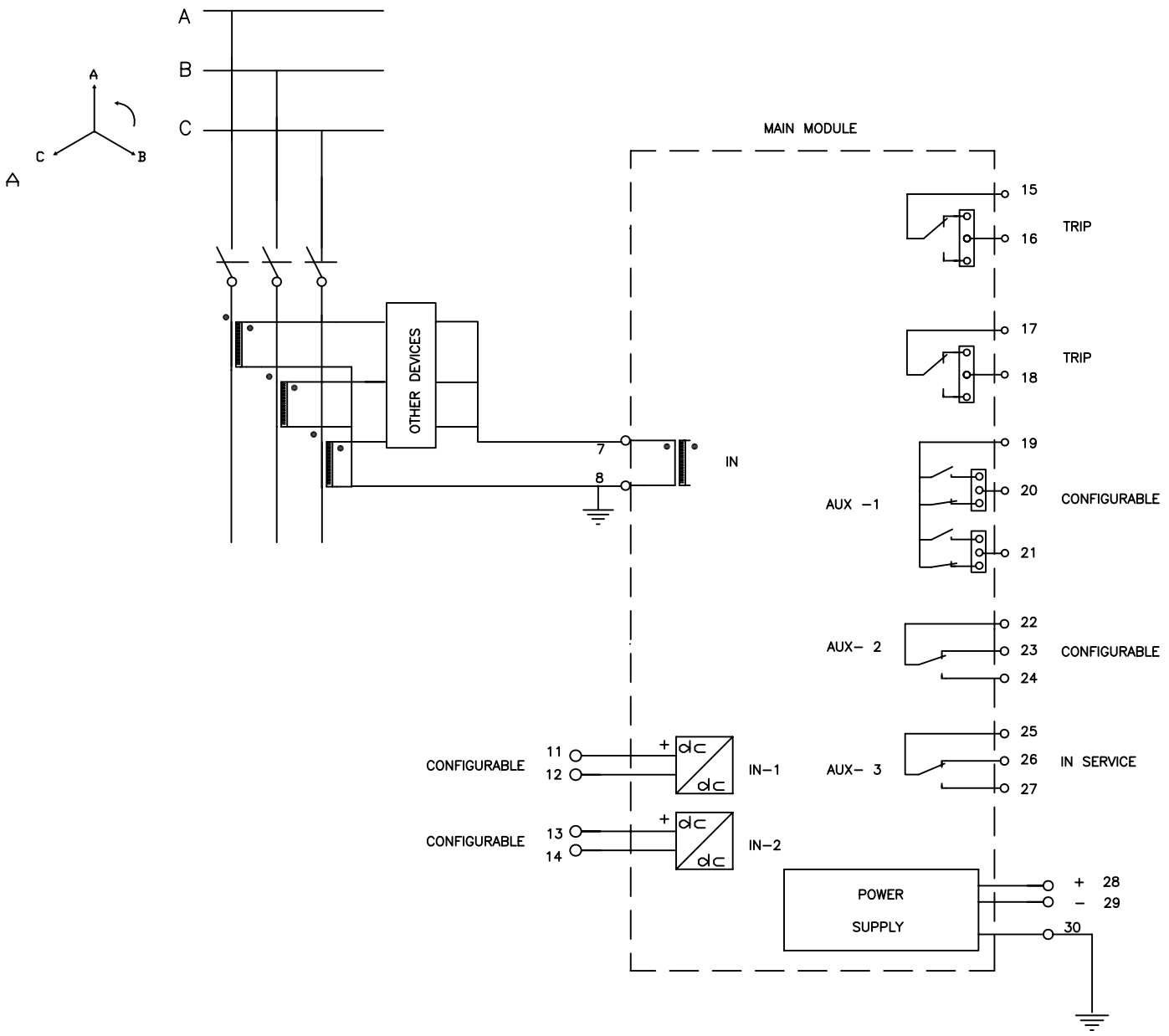

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Z I V Aplicaciones y Tecnologia S.A.

TITLE: EXTERNAL CONNECTIONS 3/8CPI–C

PROJECT: OVERCURRENT PROTECTION

Rev.0

NUMBER: 3RX0131/0036

	Date	Name
Drawn	15/04/03	J.C.S.
Approved	15/04/03	J.M.Y.

Sheet: 1

Continued on Sheed:

E. List of Illustrations and Tables

E.1 List of Figures

E.2 List of Tables

F. Warranty

ZIV GRID AUTOMATION, S.L.
Standard Product Warranty

All new products sold to customers are warranted against defects in design, materials, and workmanship for a period of ten (**10**) years from the time of delivery (at the moment the product leaves ZIV GRID AUTOMATION premises, as indicated in the shipping documents). Customer is responsible of notifying ZIV GRID AUTOMATION of any faulty conditions as soon as they are detected. If it is determined that the new product defect is covered by the warranty, ZIV GRID AUTOMATION will repair, or substitute the product at its own discretion to the customer at no charge.

ZIV GRID AUTOMATION may, at its own discretion, require the customer to ship the unit back to the factory for diagnosis before making a determination as to whether it is covered by this warranty. Shipping costs to the ZIV GRID AUTOMATION factory (including but not limited to, freight, insurance, customs fees and taxes, and any other expenses) will be the responsibility of the customer. All expenses related to the shipment of the repaired or replacement units back to the customer will be borne by ZIV GRID AUTOMATION.

Customers are responsible for all expenses related to the shipment of defective units back to ZIV GRID AUTOMATION when it is determined that such units are not covered under this warranty or that the fault is not ZIV GRID AUTOMATION´s responsibility. Units repaired by ZIV GRID AUTOMATION are warranted against defects in materials, and manufacturing for a period of one (1) year from the time of delivery (at the moment the product leaves ZIV GRID AUTOMATION premises, as indicated by the shipping documents), or for the remaining of the original warranty, whichever is greater.

ZIV GRID AUTOMATION warranty does not cover: 1) improper installation, connection, operation, maintenance, and/or storage, 2) minor defects not interfering with the operation of the product, possible indemnities, misuse or improper usage, 3) abnormal or unusual operating conditions or application outside the specifications for the product, 4) application in any way different from that for which the products were designed, 5) repairs or alterations performed by individuals other than ZIV GRID AUTOMATION employees or an authorised representative.

Limitations:

1) Equipment or products provided but not manufactured by ZIV GRID AUTOMATION. Such products may be covered by a warranty issued by the corresponding manufacturer.
2) Software: ZIV GRID AUTOMATION warrants that the licensed Software corresponds with the specifications included in the instruction manuals provided with the units, or with the specifications agreed with the end-customer. ZIV GRID AUTOMATION sole and entire liability, and customer exclusive remedy, with respect to any claims relating to the Software shall be to provide a new set of diskettes free of charge.
3) In the case that a bank guarantee or similar instrument be required to back up the warranty period, such warranty period, and only for these purposes, will be of a maximum of twelve (12) months from the time of delivery (at the moment the product leaves ZIV GRID AUTOMATION premises, as indicated in the shipping documents).

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