



Aplicaciones y Tecnología, S.A.



# MXI

**Motor/Generator Protection**  
Protection, Metering and Communications

## Description

The **MXI** is an equipment, designed with the latest digital technology, for protecting motors and generators. It incorporates protection, metering and communication functions. Protection functions include the following:

- Undercurrent (37)**
- Current unbalance (46)**
- Thermal overload (49)**
- Short-circuits (50)**
- Faults to ground (51N)**
- Rotor blocked (51RB)**
- Excessive number of pick-ups (66)**

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

In industrial facilities when a motor fails and needs to be fixed or replaced the down time is very often prohibitive.

An appropriate protection system has a positive impact in the correct operation of motors, their useful life and the "Quality of Service". The protection system should act only in the presence of real danger and avoid unnecessary breakdowns.

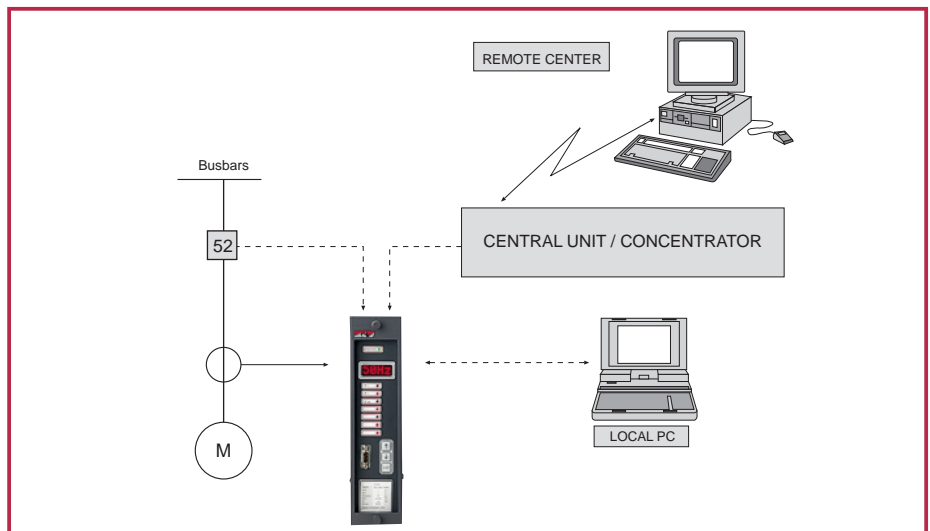
Based on recent surveys, the most common failures in motors/generators causing serious damage are the following:

- **Thermal overloads**
- **Aging of insulation in windings or associated circuits**
- **Phase reversal**
- **Phase unbalance**
- **Mechanical failure**

The selection of the appropriate protection requires a precise knowledge

of the main characteristics of the machine such as the rated power, current pickup values, pickup time, maximum permissible time in blocked position, heating and cooling constants, number of permissible successive pickups, etc.

**MXI** relays are applicable to those installations requiring reliable protection for HV and MV motors and small and medium power generators.



## Functions

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

- **Optical alarm indication: 7 LED's (6 configurable)**
- **Tripping outputs (1 switched contact plus another one configurable a/b)**
- **2 configurable digital inputs**
- **Local and remote\* communication interface**
- **Programmable logic of auxiliary outputs (3 switched contacts)**
- **Metering: current, sequential currents and value of the thermal status**
- **Event recording and Fault Reporting**

\* Optional

## Man-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 scrolled down, showing the following features:

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

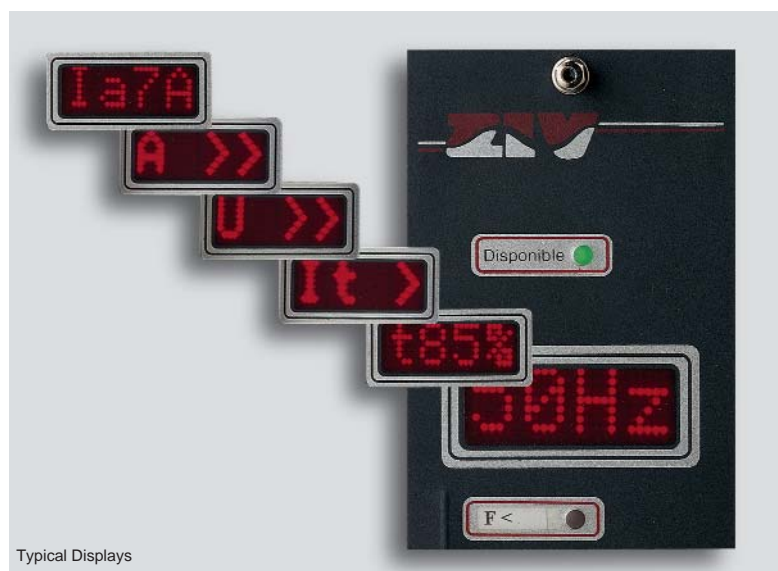
**2. Key board.** Removing the cover, user has access to the entire keyboard, 3 keys (/ , and **Enter**). Through the (/ . ) keys, access is allowed to the corresponding submenus, for example:

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

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

**4. PC.** Connected to a serial communications 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  communications program for PC





## Communications

The communications program enables the dialogue with **MXI** 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, metering data, etc.. The program is protected against unauthorized users by means of passwords.

**vercom**, which runs in **Windows™**, is user friendly and requires buttons or keys to open the various submenus.

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

The communications 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 **vercom**

## Modularity

The **MXI** 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, **MXI** equipment can be part of a system with other type of protections ((**CPI**, **FGI** and/or **FGI**)).

In this case, housings would be 1/2 or 1 full 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 current circuits and 2.5 mm<sup>2</sup> (13 AWG) for the rest of the circuits.



System made of protective relay and 2IRD terminals in one 19" rack.

\* **WINDOWS™** is a registered trademark of **Microsoft Corporation** in the United States of America and other Countries

# Protection setting ranges

General settings	
Transformer ratio CT	1-3.000

Thermal image unit (49)	
Pick-up $I_l >$	1.5 – 10 A
Heating constant (curve)	$t_c = 1 - 100 \text{ min}$
Cooling constant (curve)	$t_c = (1 - 10) t_c$
Negative sequence (overvalue)	$K = 1 - 0$
Thermal alarm	$Q_a = 50 - 100\%$
Thermal restoration	$Q_r = 30 - 90\%$

Unbalance Unit (46)	
Definite time	
Pick-up $I_2 >$	$(1 - 8) I_l$
Time $t >$	$0 - 100 \text{ s}$
Inverse time	
Initial curve value:	$(0.1 - 1) I_l$
Time Delay	$0 - 100 \text{ s}$

Under current unit (37)	
Pick-up $I_l >$	$(0.2 - 0.9) I_l$
Time $t <$	$0.05 - 100 \text{ s}$

Protection against faults between phases ( $I_f$ ) (50)	
Pick-up $I_f >$	$(0.5 - 12) I_l$
Time Delay $t >$	$100 \text{ s}$

Protection against faults to ground ( $I_g$ ) (51N)	
Pick-up $I_g >$	$(0.04 - 0.48) I_{n0}^*$
Time Delay $t >$	$0 - 100 \text{ s}$

Blocked motor unit (51RB)	
Pick-up $I_{RB} >$	$(1 - 12) I_l$
Time Delay $t >$	$0 - 100 \text{ s}$

# of pick-ups control unit (66)	
Number of permissible pick-up	1 to 15
Time window	1 – 120 min
Pick-up current $I_{arr}$	1 – 75
Pick-up time $t_{arr}$	0.3 – 80 s
min. time the output is active	5 – 100 min

\* (0.8 - 10 mA) for mod. 3MXI-A3B  
(0.2 - 2.4 mA) for mod 3MXI-A2B  
Note: all terminals are geared with a setting to enable / disable the unit.



Rear view of the relay.

## Technical characteristics

### Auxiliary voltage ( $U_{aux}$ )\*

24-48 V<sub>ac</sub> ( $\pm 20\%$ )

110-125 V<sub>ac</sub> ( $\pm 20\%$ )

220-250 V<sub>ac</sub> ( $\pm 20\%$ )

230 V<sub>ac</sub> ( $\pm 20\%$ )

Power drain: 7 W

\* Selectable according to models

### Current inputs

Rated current ( $I_n$ )	1 or 5 A
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### Thermal withstand capability

4 $I_n$	Continuously
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50 $I_n$	During 3 s
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100 $I_n$	During 1 s
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Dynamic limit	240 $I_n$
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### Burdens

$I_n = 1$ A	< 0.1 VA
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$I_n = 5$ A	< 0.2 VA
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### Voltage inputs

Rated value ( $U_n$ )	110 V at 50 Hz
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Rated value ( $U_n$ )	120 V at 60 Hz
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Thermal capability (continuous)	$2 \times U_n$ (phase)
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Thermal capability (for 10 s)	$3.6 \times U_n$ (zero seq.)
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### Digital inputs

#### Input voltage range

24-250 $\pm 20\%$	$V_{dc}^*$
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110-250 $\pm 20\%$	$V_{dc/lac}$
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230 $\pm 20\%$	$V_{ac}$
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Current drain	< 10 mA
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\* Range according to models

### Tripping outputs

Switching capability	2500 W
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Breaking capability	250 W/1250 VA*
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Switching voltage	250 V <sub>cc</sub>
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I continuous	5 A
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I short duration	10 A during 0.5 s
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### Auxiliary outputs

Switching capability	2000 W
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Breaking capability	200 W/1000 VA*
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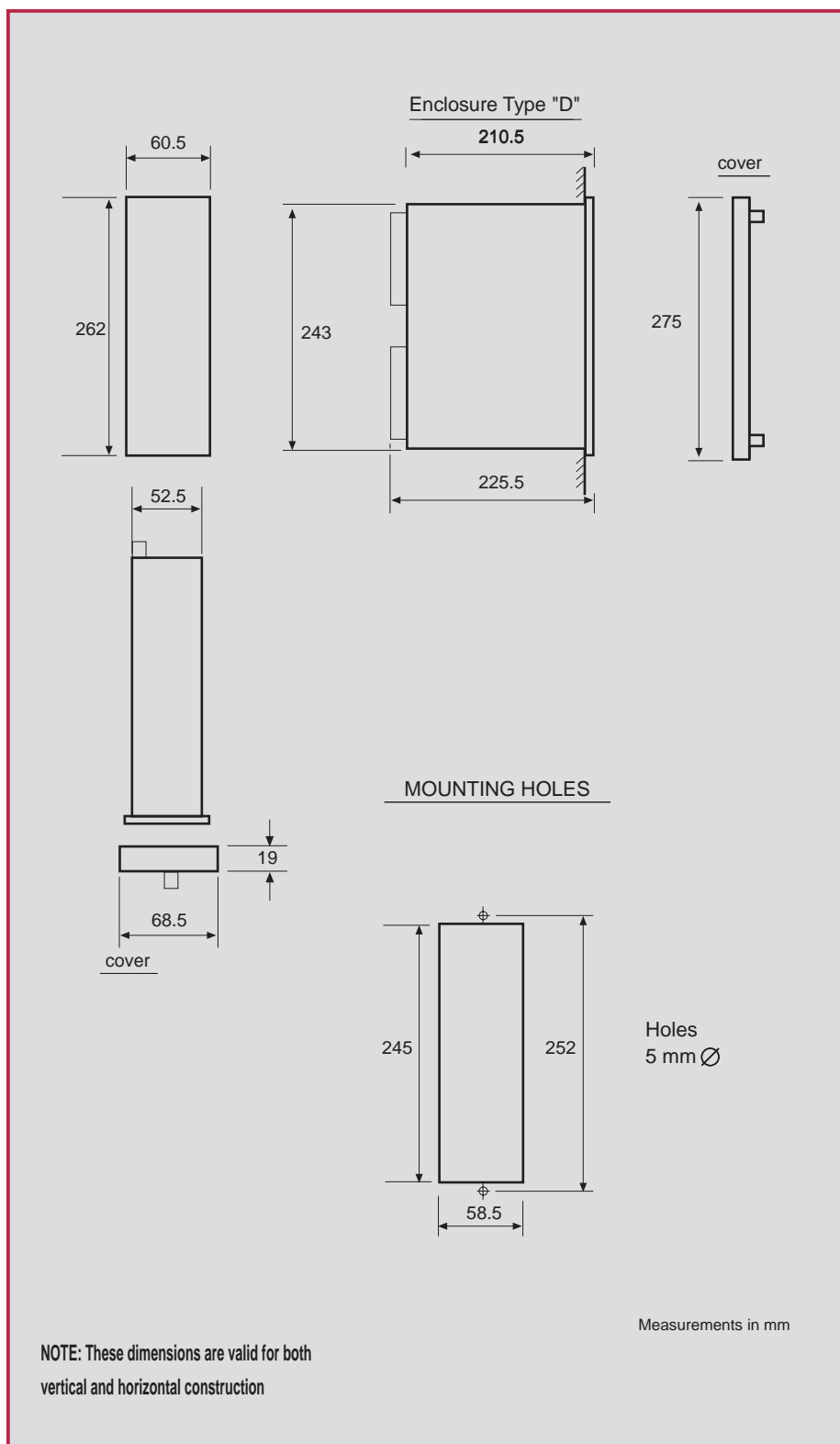
Switching voltage	250 V <sub>cc</sub>
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I continuous	3 A
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I short duration	8 A en 4 s
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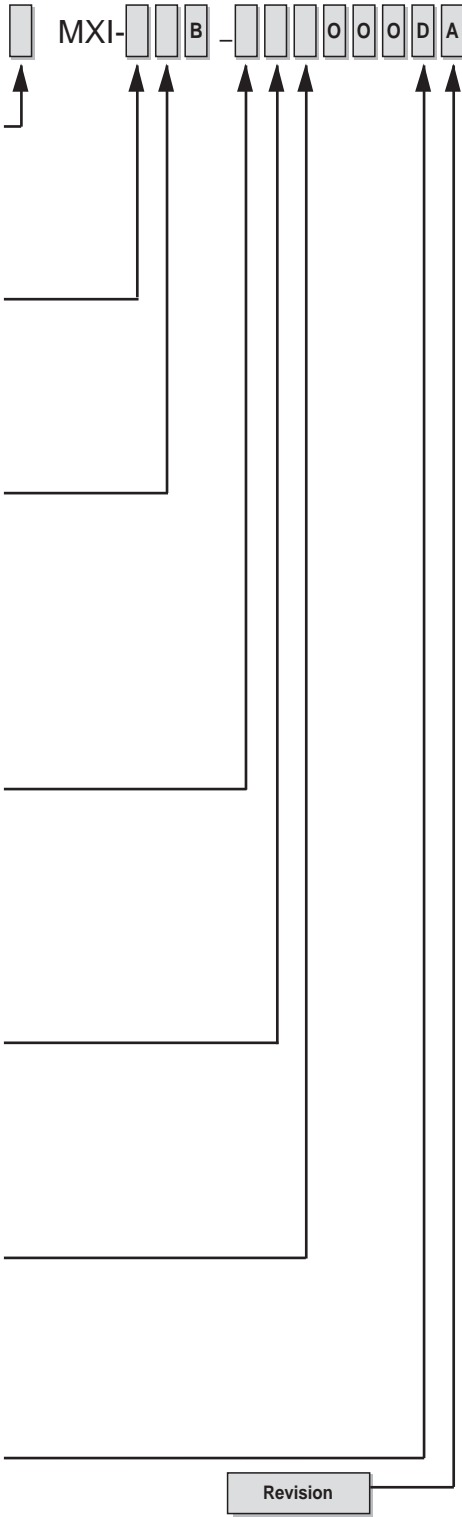
\* With a resistive load

## Dimensions



## Model selection

SELECTION		
Vertical		3
Horizontal		8
FUNCTIONS		
37 + 46 + 49 + 50 + 51N + 51RB + 66		A
RATED CURRENT		
$I_n(\emptyset) = 5A, I_n(N) = 1A$		1
$I_n(\emptyset) = 5A, I_o(N) = 5A$		2
$I_n(\emptyset) = 5A, I_n(N) = 20mA$		3
AUXILIARY VOLTAGE		
POWER* SUPPLY	DIGITAL INPUTS	
24–48 V <sub>dc</sub>	24–48 V <sub>dc</sub>	1
110–120 V <sub>dc</sub>	24–125 V <sub>dc</sub>	2
220–250 V <sub>dc</sub>	48–250V <sub>dc</sub>	3
230 V <sub>ac</sub>	230 V <sub>ac</sub>	4
* ± 20%		
FREQUENCY		
50 Hz		0
60 Hz		2
COMMUNICATIONS		
Local RS232		1
Local RS232 / Remote F.O. plastic		2
Local RS232 / Remote F.O. glass (SMA)		3
Local RS232 / Remote F.O. glass (ST)		4
TYPE OF ENCLOSURE		
6 U x1/7 19"-rack		D
As part of a System in a full 19" Rack		V



EXAMPLE: Model 3MXI-A2B-2020000DA

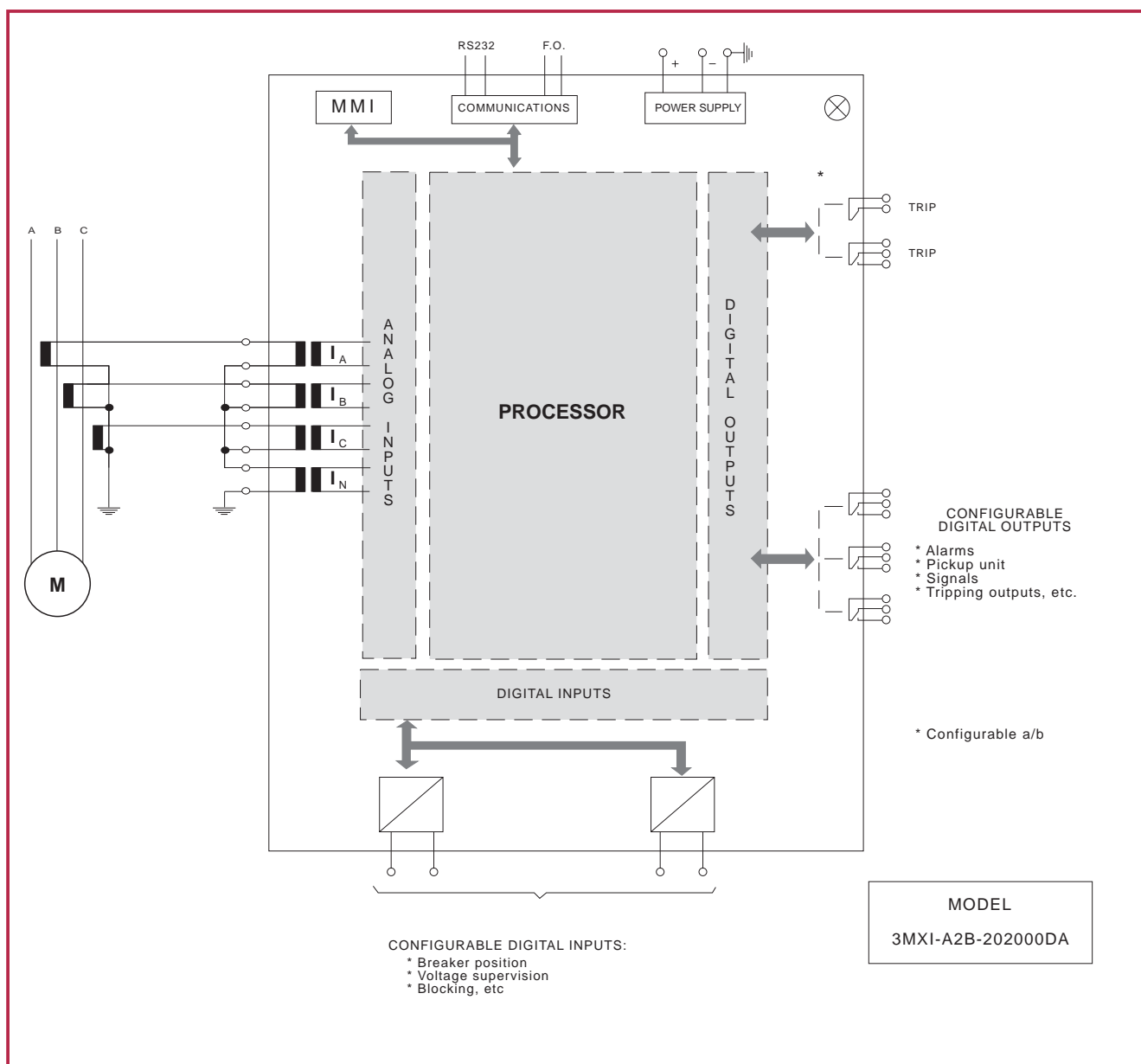
Under current, current unbalance, short-circuits, rotor blocked, excessive number of pick-ups  
In = 5 A, 120 Vcc/50 Hz  
Communications by O.F. (plastic)

## Standards and type tests

This equipment satisfies and exceeds the requirements of IEC-255 in its maximum class for all the values indicated below.

Insulation test (IEC-255-5)	
Between circuits and earth	2 kV to 50 Hz 1 min
Between independent circuits	2 kV to 50 Hz 1 min
Impulse test (IEC 255-5)	
5 kV, 1,2/50 $\mu$ s, 0.5 J	
1 MHz disturbances (IEC 255-22-4 Class III)	
Common mode	2.5 kV
Differential mode	1 kV
Fast transients (IEC 255-22-1 Class IV)	
4 kV ± 10%	
Electrostatic discharges (IEC 255-22-2 Class III)	
8 kV ± 10%	
Temperature (IEC-255-6)	
Operating range	-40°C to +80°C
Storage range	-40°C to +80°C
Humidity	95% (non condensing)
Alternating component (ripple) (IEC 255-11)	
Ripple should always be less than 20%	
Radio frequency emissivity IEC-41B (5) 80	
Degree of protection provided by the enclosure IP 51 for the metallic enclosure, IEC-529	
Susceptibility to radiated electromagnetic fields IEC-5-22-3 Class III	
10 V/m	

## Connections diagram



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