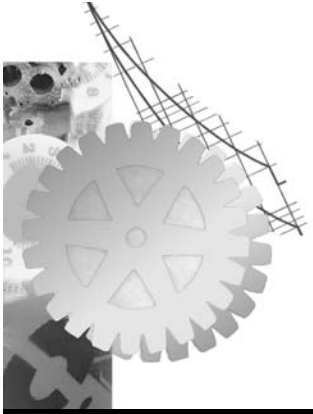


MOTOR PROTECTION & CONTROL TECHNOLOGY

NI LV Motor Protection Relay

INSTALLATION AND SETTING UP PROCEDURE

1. Protection Features

- Overload (for both cyclic and sustained overload conditions)
- Phase unbalance / single phasing
- Stall
- Earth leakage protection

2. Description of Operation

The NI Series motor protection relay is modular in design. The relay may be flush door-mounted or on the chassis inside the cubicle together with the currrent transformer module block. Alternatively, a transformer module block may be mounted directly on the rear of the relay so as to facilitate mounting of the complete unit directly onto a chasis plate. Yet another option is to use 3 separate ring current transformers instead of the NewElec current transformer module block. The NI relay is available for the following current ranges:

Models	Current Range	Suggested CTs		Alternative CTs
NI 050	5 to 55 Amp	NewElec CTMB 50:1CBCT		Ring CTs 50:1
NI 200	20 to 220 Amp	NewElec CTMB 200:1CBCT		Ring CTs 200:1
NI 500	50 to 550 Amp	Ring CTs 500:1		
NI 100	Any desired range	Any of the above	**OR**	Choose to suit

Note: CTs having a 5 Amp secondary can also be used with a matching relay.
5 VA Class 1 current transformers are adequate.

The NI 100 is percentage calibrated from 10 to 110 % of the CT ratio used. To understand this better let us take a practical example. Assume that the motor requiring protection has a full load rating of 322 Amp. If one were to use 400:1 ring current transformers, the motor full load setting would be:

$$\frac{322 \quad X \quad 100}{400} = 80\%$$

The **overload** level is adjusted on the 'MOTOR FULL LOAD CURRENT – AMPS' dial for the Ampere calibrated units OR the 'MOTOR FULL LOAD CURRENT - % CT' dial in the case of the percentage calibrated model. The overload **trip delay curve** is selected on the 'OVERLOAD CURVE 6 X I fl – SECONDS' dial which is user-selectable from 2,5 to 32,5 seconds. The latter setting must coincide with the safe cold stall time of the protected motor. The resultant hot curve will reduce to 33 % of the cold curve selection. It is very important that the cold curve selected is not in excess of the safe cold stall time of the protected motor.

The actual load current is the greatest value measured on the three line currents. Its value is compared with the value set on the 'MOTOR FULL LOAD CURRENT' dial. If less than 'Maximum Load Current' the motor 'Thermal Capacity' is integrated to increase to the value determined by the % motor preload value. If the actual load current is greater than the 'MOTOR FULL LOAD CURRENT' setting, a trip delay proportional to the 'Overload Level' is initiated, to reduce the thermal capacity to zero. After this time the 'Main Trip Relay' will be operated and the 'Overload' LED indicator turned on together with the 'Thermal Lock Out' LED. The 'Thermal Capacity' will recover at a rate corresponding to 2 x motor heating time constant for a stationary motor and 1 x motor heating time constant for a running motor. If the auto/manual selector switch is set to MANUAL and the RESET button is pressed, the relay will not reset until 33% thermal capacity has been regained. A visual indication of the thermal capacity is provided on the relay face in the way of an **LED bar graph**. As soon as the THERMAL LOCK OUT LED extinguishes, a manual reset will be tolerated by the relay. At this point the main trip relay will re-energise and the OVERLOAD LED indication will switch off. If the auto/manual selector is in the AUTO mode, the main trip relay will be re-energised as soon as the thermal capacity is greater than 33 %.

The actual load current level of the motor in service can be measured by turning the 'MOTOR FULL LOAD CURRENT- AMPS' dial counter clockwise from the initial motor full load setting until the green **'I actual > I fl' LED illuminates**. This is situated directly below the thermal LED bar graph.

A test button is situated on the relay control panel which, when held down, will simulate 6 X the full load current on the selected **thermal trip delay curve** from cold. In other words, if you have selected a 15 seconds cold thermal curve, an overload trip would be triggered after holding the test button down for 15 seconds.

Single phasing protection for light as well as a fully loaded motor during starting and running conditions.

Unbalance condition exists when the three line currents become unbalanced by more than 30% from each other. The unbalance value is measured as the greatest deviation from the average divided by the average. On detection of an unbalance condition a 5 second trip delay is initiated after which the 'Unbalance' LED indication is turned on and the main trip relay is de-energised. Before the motor can be restarted the 'Reset' pushbutton must be pressed to clear the 'Unbalance' LED indication and re-energise the main trip relay.

Earth leakage protection is provided with a fixed sensitivity of 250 mA and a 100 milli second trip delay. The sensing is achieved by means of the built-in core if using the NewElec orange currrent transformer module block OR by means of a separate core balance current transformer if one is installed. In any event NewElec recommends the installation of a separate core balance CT in all protection applications where the motor kW exceeds 75 kW. In order to prevent the main contactor from opening on a potentially high energy fault current a totally separate potential free changeover contact has been allocated (terminals 16, 17 and 18) for the purpose of interrupting current flow to the motor by means of a shunt mechanism being fitted to the back up ACB. In the event of an earth leakage current being detected the earth leakage trip relay will be energised and the 'Earth leakage' LED will be illuminated and latched until the local or remote 'RESET' button is actuated.

A control panel-mounted local reset button is mounted on the relay face.

Descriptive red LED indications have been provided for ease of fault diagnosis and information. These are:

* Overload trip
* Thermal lock out
* Unbalance trip
* Earth leakage

The green LED designates that the internal circuits are functioning correctly.

3. Information required for Initial Settings

This user-friendly relay requires only that you set the motor full load current on the 'MAXIMUM LOAD CURRENT' setting dial to coincide with the protected motor's full load capability. You will also need to know the safe cold stall time for the protected motor. As a guideline, you may refer to the Useful Information section on our CD ROM / Website, under the Typical Three-Phase Induction Motors Performance Data section.

Note: This relay is equipped with user-selectable cold thermal curves ranging from 2,5 to 32,5 seconds. As such it is possible to more exactly match the thermal limitations of the protected motor and in so doing permit the protected motor to work at it's full capacity. However, selecting a cold thermal curve which is in excess of the thermal capacity of the protected motor is dangerous and will result in the motor being inadequately protected. The converse is also true. Therefore DO ENSURE TO SELECT THE CORRECT THERMAL CURVE.

4. Setting up Procedure

- Ensure that the selected NI relay does in fact cover the full load current range of the protected motor and that the secondary current from the current transformers match the selected current input requirements of the relay. Note that the model NI 100 is percentage calibrated. The relay MUST be installed in the MAIN CIRCUIT of the starter. CARE SHOULD BE OBSERVED IN ENSURING THAT THE POLARITY OF THE CURRENT TRANSFORMERS ARE THE SAME FOR EACH PHASE AND THAT THE DIRECTION OF CURRENT FLOW FROM THE SECONDARY SIDE OF THE TRANSFORMERS ARE UNIFORM FOR ALL PHASES. If this is not done, nuisance unbalance trips will occur. Terminal 1 is the star point connection and terminals 2 to 4 inclusive must be wired to the corresponding secondary outputs of the transformers.

- Connect the auxiliary supply of either 110 OR 220 Volt a.c to terminals 13 and 14 OR 13 and 15 as appropriate.

- The main trip contact is made up of one separate potential free changeover contact. Terminals 19 to 21 inclusive refer. Connect the main trip wiring through terminals 20 and 21 which is in the N.C state with the auxiliary supply present. Note here that the NI relay is FAIL SAFE so that the change- over contacts will de-energise on loss of the auxiliary power supply.

- The earth leakage trip potential free changeover contact constitutes terminals 16 to 18 inclusive. The shunt trip mechanism of the back-up ACB should be wired to terminals 17 and 18 so that the relay will energise the back-up ACB through its shunt trip mechanism in order to disrupt the supply to the motor in the event of an earth leakge current being detected by the relay.

- Proceed to set the motor full load current on the 'MOTOR FULL LOAD CURRENT - AMPS' dial.

- Proceed to set the required cold thermal curve on the 'OVERLOAD CURVE 6 X I fl SECONDS' dial.

- Set the auto/ manual reset toggle switch in accordance with your preference.

The motor protection relay is now ready.

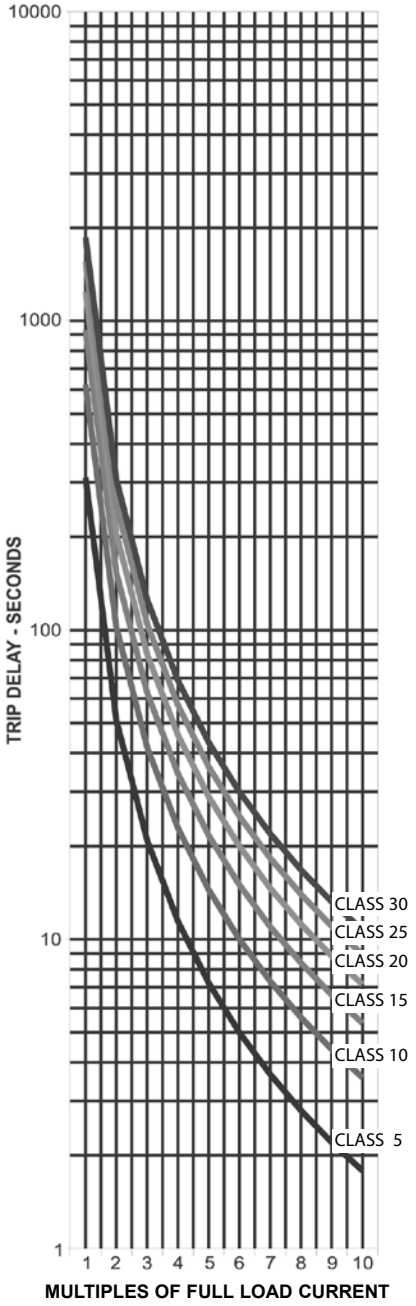
Tip:

Applicable once the motor is running. When using the NI motor protection relay on an application where the motor load is relatively constant it may be a good idea to set the 'MOTOR FULL LOAD CURRENT' dial to coincide with the actual mechanical load being drawn by the motor. This can be achieved by turning counter -clockwise on the dial until the green 'I actual > I fl ' LED illuminates. When this point is reached, you will have established the actual load current being drawn by the protected motor. Now turn the dial clockwise until the 'overload' LED extinguishes and leave as a final setting. The result of this setting-up method will enhance the protection to the motor in that frequent overload trips would signal possible bearing degradation which would translate as extra abnormal load to the motor in overcoming additional frictional forces.

5. Adding or Removing Features on Site

No additional features can be set OR disabled on site.

6. Thermal Trip Curves



7. Specifications

INPUT CURRENT

From NewElec CTMB xxx/1/CBCT
or separate suitably rated ring C.Ts

SECONDARY RATING

1 Amp (5 Amp on request)

NOMINAL OUTPUT

2,5 VA

ACCURACY CLASS

5 P 10 at 0,1 VA

OUTPUT RELAY

Contacts	: 2 x Changeover
Rating	: 6 Amp at 250 Volt
Isolation	: 2 kV between circuits : 1 kV across n.o contacts
Auxiliary supply	: 110 or 220 Volt a.c
Operating range	: 85 to 120% of specified voltage
Burden	: 3 VA
Frequency range	: 45 to 65 Hz
Operating temp	: -10° to + 50°C

ISOLATION

2 kV between all separate circuits to IEC 255-5 Appendix A.

1 kV across n.o contacts in accordance to IEC 255-5 Appendix A

OVERLOAD RESET DELAY

Two stage thermal memory matched to overload curve selection

IMPULSE WITHSTAND

Transient 5 kV to IEC 255-5 Appendix D

HIGH FREQUENCY DISTURBANCE

1 MHz modulated
400 Hz 1 kV to IEC 255-8
Appendix E (Class III)

OVERLOAD WITHSTAND RATINGS

10 x rated current	: Continuous
100 x rated current	: 1s
Burden	: <0,1 VA
Current setting range	: 10 to 110% In
Calibration	: Amperes R.M.S
Response	: Filtered peak value output 3 phase rectifier
Current detection level	: 102% of set value (Ie)
Current operation level	: 104% of set value (Ie)
Repeatability	: 1% of detection level
Current setting accuracy	: ± 3% of rated current
Overload curve accuracy	: ± 5% 120% Ie to 800% Ie : ± 10% 105% Ie to 119% Ie

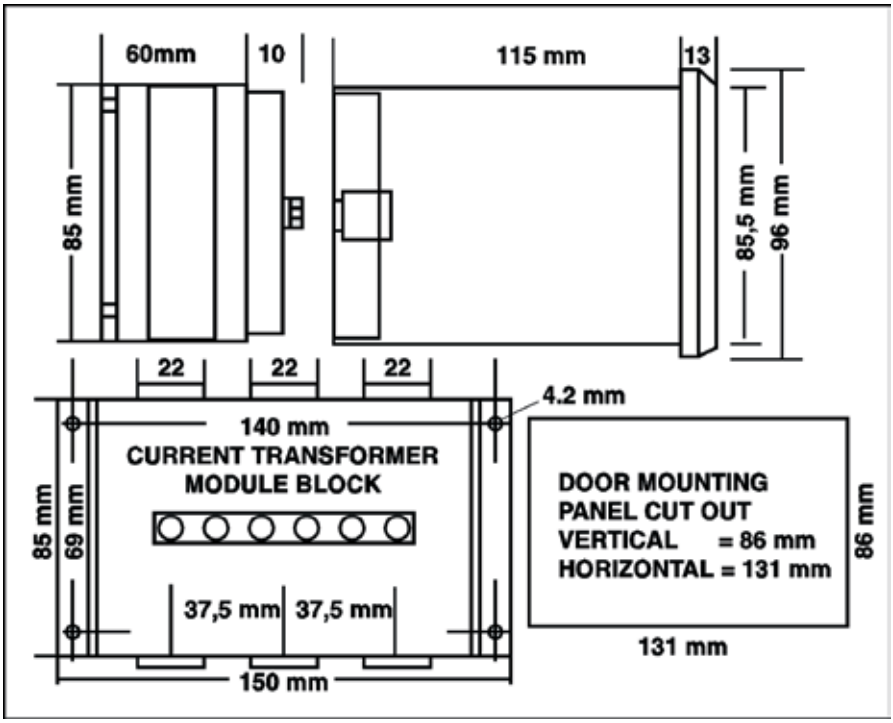
EARTH LEAKAGE

Level	: 250mA
Trip Delay	: 100ms
Operation	: Back trip to circuit breaker

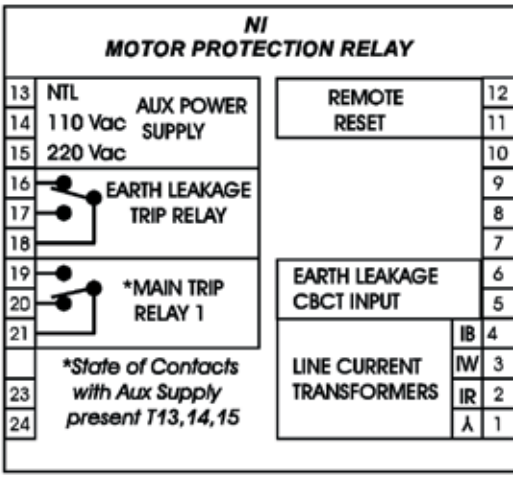
UNBALANCE

Level (I_2)	: 30% I_{act}
Trip Delay	: 5s
Operation	: Block I_{act} < 20% Ie

8. Dimensional Diagram



9. Electrical Connection Diagram



10. Ordering Information

MODEL	CURRENT RANGE	CURRENT TRANSFORMER SECONDARY	MOUNTING CONFIGURATION	S = User selectable
NI	050 = 5 to 55 Amp	1 AMP or 5 AMP	F = flush door mounting	110 or 220V AC auxiliary
	200 = 20 to 220 Amp		C = chassis mounting	
	500 = 50 to 550 Amp		M = current transformer module mounted	
	100 = % calibration			

EXAMPLE: NI/ 200/ 1/ F/ S

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MOTOR PROTECTION & CONTROL TECHNOLOGY

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