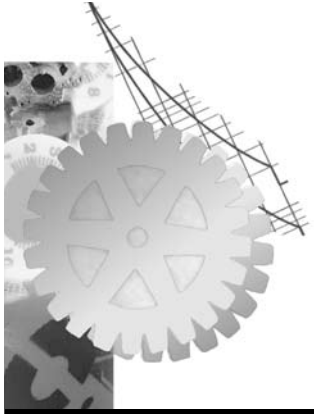


NEW ELEC
MOTOR PROTECTION & CONTROL TECHNOLOGY

100 - 103 M Series
Motor Protection Relays

INSTALLATION AND SETTING UP PROCEDURE

1. Protection Features

- Overloading (for both cyclic and sustained overload conditions)
- Start stall
- Unbalanced phases OR phase loss
- Short-circuit protection with user-selectable thresholds)

2. Description of Operation

This chassis-mounted series of motor protection relays constitutes a 12-pin base into which the protection relay plugs into. It is popular for use inside gate-end boxes, underground coal cutting machinery and transformer protection cubicles. Three red latched LEDs are provided on the front control panel to assist maintenance personnel in fault diagnosis. These are, from top to bottom, UNBALANCE, OVERLOAD and SHORT CIRCUIT fault indications. A green RELAY HEALTHY LED is provided for indication that there are no faults present and that the relay is operative while a yellow COOL DELAY LED is lit during the cooling cycle after an overload trip which serves to indicate that the motor may not be brought back into service as it is cooling down. A LED THERMAL BAR graph has been fitted to the front of the control panel which depicts the heat build-up and cooling rate in the motor as a result of excessive start attempts and sustained or cyclic overloading of the motor.

When the entire LED bar graph is lit, the relay will trip the motor on overload. A control panel-mounted toggle switch permits the user to select an automatic reset after an overload trip OR if preferred, a manual reset only. The third dial from the top allows the selection of a suitable thermal trip delay curve based on the known starting time required by the motor. It is labelled START TIME SECONDS and may be adjusted for a period ranging from 2 to 10 seconds. For example, if the protected motor requires 5 seconds to accelerate to speed, a six second curve would be adequate and will protect the motor against start stall. A lower setting would result in the relay tripping the motor before it actually accelerated to full speed.

The bottom setting dial is labelled SHORT CIRCUIT LEVEL X I fl. The latter is used to set the short circuit detection threshold for the protected machine/cables as a multiple of motor full load current setting. In order to prevent the main contactor from opening under such potentially destructive conditions, the protection relay has been fitted with a N.O contact across terminals 5 and 6 which will energise and close so as to open a back-up circuit breaker by means of a shunt trip mechanism in 100 milliseconds following the detection of such a fault.

100 TO 103 M SERIES MOTOR PROTECTION RELAYS

This particular series of motor protection relays is available as Amp calibrated models up to and including 360 Amp and also as percentage calibration. Thus, the models available are:

To be used with:

100M	is calibrated 10 to 120 %	xxx: 1 current transformers
101M	is calibrated 10 to 120 Amp	100: 1 current transformers
102M	is calibrated 20 to 240 Amp	200: 1 current transformers
103M	is calibrated 30 to 360 Amp	300: 1 current transformers

In addition, any of the above relays may be ordered for auxiliary supplies of 12, 110 OR 220 Volt a.c. and designed for matching thermal envelopes for motors capable of 6, 12, 18 OR 120 starts per hour.

The overload setting is adjusted by means of the two top dials both under the label MOTOR CURRENT – Amps or MOTOR CURRENT - % setting dials. The top larger dial is the coarse setting parameter calibrated in 10 % steps of the model range while the smaller dial underneath is the vernier setting. The (+) label between the two dials signifies that the full load setting is the sum of both dial settings. The thermal IDMT curve is a selectable curve set between 2 to 10 seconds at 6 times motor full load current and 200 seconds at 1,01 times motor full load for sustained overloading conditions. Refer to the thermal curves later in this instruction. In the eventuality of an overload trip the relay healthy LED will extinguish and the main trip contact comprising of a N.O and a N.C contact will de-energise and latch so as to disrupt the supply to the motor through the main contactor. At this point, the overload LED will illuminate together with the cool delay LED. If the user has selected auto reset, the cool delay LED will extinguish after an appropriate cooling cycle which will coincide with the number of starts per hour for which the motor and protection relay have been designed. The overload trip LED will extinguish and the main trip contact will energise so that the motor may be brought back into service. If in the manual reset mode, pressing the control panel-mounted reset button will cause the overload trip LED to extinguish but the main trip contact will remain latched until the cooling period has lapsed and the cool delay LED has extinguished. At this point the control panel-mounted pushbutton will need to be pressed again so that the main trip contact can energise and in a like manner, the motor may be brought back to service.

The relay consistently monitors the thermal capacity used by the motor. The thermal protection envelope for the protected motor is affected by the user-selected setting on the "Motor Current-Amps" dials, the maximum starts per hour and the maximum start time for which the relay has been designed. During normal running operations the motor load is consistently monitored and compared with the maximum load setting dials. The thermal memory stores all overload values and this value increases with magnitude and duration of overload conditions. If an overload condition is removed before the relay is able to trip and another overload condition is applied to the motor at a later stage, the actual tripping time of the relay would be a function of the cumulative effect of the second overload condition and the contents of the thermal memory from the first overload condition. The thermal memory is decayed at one of two rates depending on whether the motor, while in an overload condition, is still running and gaining some benefit from its cooling fan OR whether it has stopped running. Repetitive or consecutive starts of the protected motor will only be permitted by the relay for as long as these occur within the constraints of the selected thermal envelope. Once this boundary is exceeded, either by repetitive starts OR by cyclic overloading patterns, the relay will trip the motor on overload. Whenever this occurs, it is only possible to bring the motor back into service once the cooling off period is completed.

Phase unbalance and phase loss protection is provided by the relay. Unbalanced load conditions exist when the three line currents (irrespective of actual motor load) become unbalanced by more than the factory preset of 20% between phases of motor full load current. On detection of a phase unbalance OR phase loss condition, a 4 second trip delay will be initiated. The condition must persist for the entire trip delay period for the trip delay timer not to reset. On expiry of the trip delay period, the main trip relay will de-energise so as to disrupt the supply to the motor, the unbalance LED will illuminate and the trip LED will illuminate. Once the fault condition has been addressed the motor may be brought back to service by pressing the reset pushbutton which will reset the main trip contact and cause the unbalance trip LED to extinguish.

Short circuit protection, either phase to phase OR phase to earth will be detected by the relay once a fault current equal to or above the user selected detection threshold (range is 7,5 to 12 times motor full load setting) on the SHORT CIRCUIT LEVEL X I fl dial is trespassed and will cause the protection relay to energize the auxiliary N.O contact present across terminals 5 & 6 and latch. The trip delay upon detection of such fault is 100 milli seconds. Should the protection relay still detect current flow to the motor after a 2 second delay, the main trip contact will trip and latch.

The state of the main trip contacts indicated in the circuit diagram are shown with the auxiliary supply power present on terminals 11 and 12. The configuration is such as to render the protection relay fail safe in the eventuality of the disruption of the power supply from the protection relay which would then trip the protected motor.

3. Information required for Initial Settings

This user friendly relay requires the following inputs so as to render the required protection:

1. You must know the motor full load current of the protected motor.

2. You will need to know the motor acceleration time to get to full speed in the range 2 to 10 seconds.

3. You will be required to decide on the short circuit protection detection threshold in multiples of motor full load current.

4. In the case of a percentage calibrated relay the % full load setting is calculated as:

$$\frac{\text{Motor Full Load X 100}}{\text{CT ratio}} = \text{X \%}$$

4. Setting up Procedure

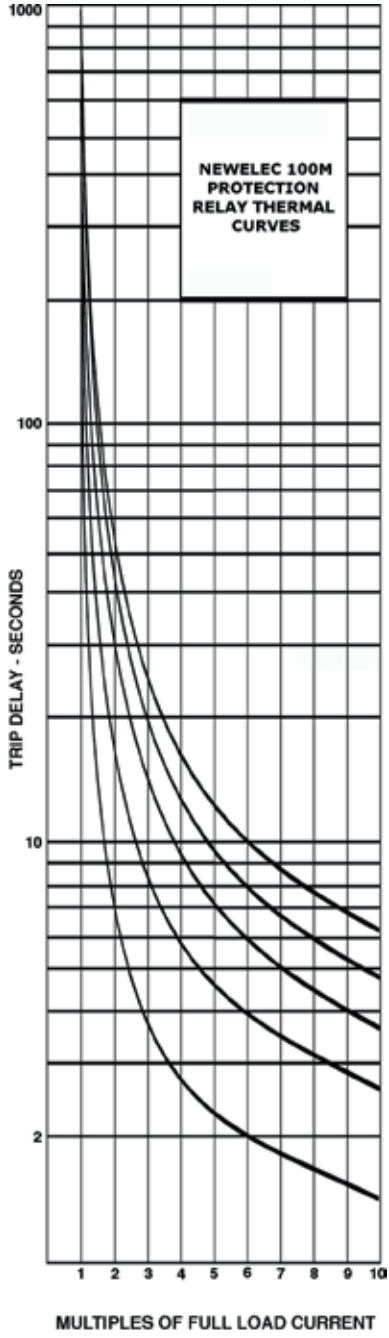
- Ensure that the wiring and connections to the relay are in accordance with the schematic connection diagram in this documentation.
- Ensure that the start per hour capability of the motor match the protection relay design parameter.
- Ensure that the correct current transformers with a 1 Amp secondary have been connected to the relay and check for polarity parity.
- Ensure that the auxiliary trip contact has been correctly wired to the shunt mechanism of the back up circuit breaker.
- Set the maximum motor load, select the appropriate thermal trip curve (2 to 10 seconds) and set the short circuit detection threshold for the application under consideration.
- Apply power to terminals 11 and 12.

The motor may now be started.

5. Adding or Removing Features on Site

No additional features can be set OR disabled on site.

6. Thermal Trip Curves



7. Specifications

INPUT CONVERTER

Overload capacity	: 6 X In 5 Min : 12 X In 30s
Frequency response	: 42 to 66 Hz

CONTROL SUPPLY

12, 110 OR 220 Volt a.c	: 90 to 115% of specified voltage

SHORT CIRCUIT SENSOR

Tripping level	: 7,5 to 12 X Ie
Accuracy	: ± 8%
Back tripping relay trip delay	: 100ms
Main tripping relay trip delay	: 2s

MAXIMUM UNBALANCE SENSOR

Maximum level setting	: 20% of Ie (Motor full load)
Trip delay	: 4 seconds

MAXIMUM LOAD CURRENT SENSOR

Level setting accuracy	: ± 4%
Linearity	: ± 4%
Repeatability	: ± 1%
Detection level	: ± 1%
Calibration	: Optional, Amp or % of In
Range	: 10 to 120% In

OVERLOAD TRIP DELAY CURVES

Accuracy	: ± 5 % 1,2 to 10 X Ie : ± 10 % 1,01 to 1,2 X Ie

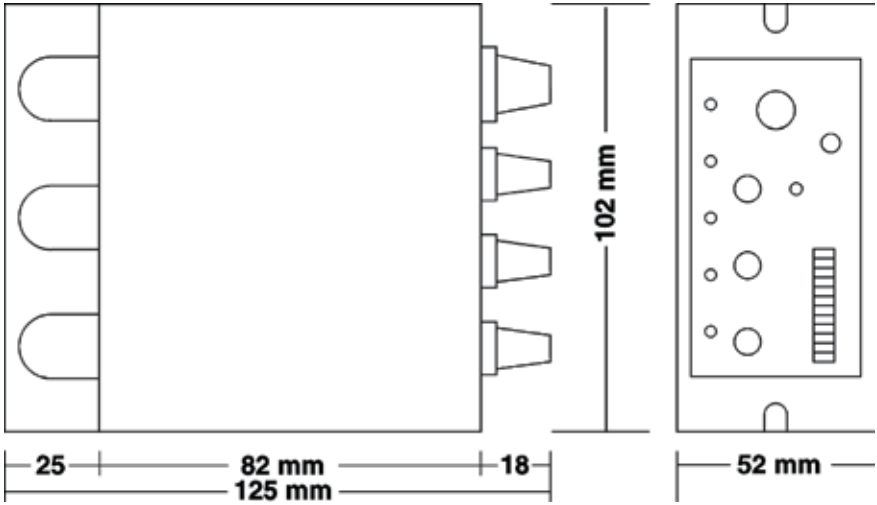
OVERLOAD THERMAL LOCK OUT TIMES

6 Starts per hour	: 10 minutes
12 Starts per hour	: 5 minutes
18 Starts per hour	: 3,5 minutes
120 Starts per hour	: 30 seconds
Accuracy	: ± 5%

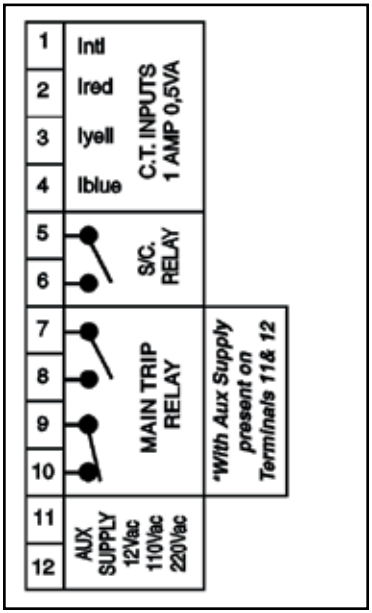
MAIN TRIP RELAY AND SHORT CIRCUIT BACK TRIPPING RELAY

Current rating	: 5 Amp at 220 Volt a.c
Configuration	: 2 Form C (CM n.o n.c)
Insulation coil to contacts	: 2 kV 1 minute
Insulation across open contacts	: 1 kV 1 minute
Insulation between separate contacts	: 2 kV 1 minute

8. Dimensional Diagram



9. Electrical Connection Diagram



10. Ordering Information

Example: 103 MC 012 18 starts/hour

C.T. Ratio	Setting Range	Code
xxx:1	10 - 120%	0
100:1	10 - 120A	1
200:1	20 - 240A	2
300:1	30 - 360A	3

Code	Control Supply
012	12 Vac
110	110 Vac
220	220 Vac

Code	Thermal Lock out
6	10 Min.
12	5 Min.
18	3 Min. 30s
120	30s

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