

## KC LV Motor Protection Relay

### INSTALLATION AND SETTING UP PROCEDURE

#### 1. Protection Features

- Overload (for both cyclic and sustained overload conditions)
- Running stall / jam
- Single phasing / unbalance
- Stall protection
- Undercurrent / load loss linked to a timed auto restarting configuration if desired
- Phase rotation
- Overvoltage
- Undervoltage

#### 2. Description of Operation

Overload protection is provided against cyclic and sustained overloads. Pre-loading with thermal memory, utilising accurate hot and cold thermal curve characteristics to IEC 255-8 provides this protection. The thermal IDMT curve is Class 15 cold and Class 5 hot. This curve will provide adequate protection in the event of a motor stall, both during starting and running conditions.

Should the motor load exceed the thermal capacity allowed by the thermal IDMT curve (Class 15 cold and Class 5 hot curve), the motor overload LED indicator will be illuminated, the relay healthy indicator switched off and the main trip relay de-energised to stop the motor.

The same motor overload LED can be used to read the actual load current being drawn by the motor during normal running conditions. This is achieved by pressing and holding the control panel-mounted reset pushbutton, while trimming back the maximum load current dial, until the motor overload LED switches on. The calibration on the maximum load current dial where this occurs, is the actual load current being drawn by the motor.

In the event of a motor overload trip, the entire thermal capacity of the motor has been utilised. If auto reset has been selected the motor overload LED will flash at a one second rate until the thermal capacity has integrated to 33%. At this point the overload LED will switch off and the relay healthy LED will switch on to indicate that the motor can be returned to service. The relay will reset to a Class 5 hot curve. It is important to note that the KC series of motor protection relays will limit the auto reset sequence to 3 per hour. Once this duty cycle is exceeded the auto reset will revert to manual reset.

## KC LV MOTOR PROTECTION RELAY

If manual reset is selected the motor overload LED will remain on until the control panel-mounted reset button is pressed. If the reset pushbutton is pressed and the thermal capacity has not integrated to 33% the auto reset sequence is initiated. If the thermal capacity has integrated to >33%, then the overload LED will switch off, the relay healthy LED will switch on, and the main trip relay will be re-energised and the motor returned to service.

In order to limit any possible damage that could occur to driven components attached to the motor output shaft in the way of impact torque, the KC range of relays will disrupt the supply to the motor in 1 second if the motor full load current peaks above 3 times the "MAX LOAD CURRENT AMPS" setting dial once the starting inrush current is completed. Thus providing effective running stall or jam protection. (An example may be a rag stuck in an impeller).

Phase unbalance protection is provided independent of motor load. In the event of the three line currents becoming unbalanced by more than 30% a 5 second trip delay is initiated. After tripping, the phase unbalance LED will be illuminated, the relay healthy indicator switched off, and the main trip relay de-energised to stop the motor.

Should the motor load current, during normal operation, drop below the minimum load % MLC dial setting, while still being >10% of the maximum load current dial value for the full 10 second period, the minimum load LED will be illuminated, the relay healthy indicator switched off and the main trip relay de-energised to stop the motor. If, during the 10 second trip time period, the motor load current increases above minimum load % MLC dial setting, and then once more drops below the minimum load % MLC dial setting value, a new 10 second trip delay period is initiated. Linked to the minimum load protection feature is a user-selectable minimum load restart timer dial which may be set to manual start or auto start after 10 seconds, 5 minutes, 10 minutes, 20 minutes, 30 minutes, 45 minutes, 1 hour, 3 hours OR 6 hours delay. The facility permits the KC relay to restart the protected motor automatically through the re-start contact present on terminals 11-13 which should be wired in parallel with the start circuit. The facility is ideal in sump pump applications and could eliminate the need for probes. NOTE THAT THE AUTO/MANUAL TOGGLE SWITCH SELECTOR HAS NO BEARING ON THE MINIMUM LOAD FUNCTION.

Phase rotation protection will be operative provided terminals 19, 20 and 21 have been connected in the phase sequence red, white and blue as indicated on the label. The phase rotation LED will extinguish as soon as the sequence is correct. Incorrect phase rotation will result in the phase rotation LED being illuminated, the relay healthy indicator switched off, and the main trip relay de-energised. This will prevent motor operation with incorrect phase sequence and resultant damage to driven equipment. Once the phase rotation has been corrected the phase rotation LED will be switched off, the relay healthy LED switched on, and the main trip relay re-energised. This will then allow the motor to be started.

In the event of an overvoltage condition where the main circuit voltage becomes greater than 115 % of the rated supply, a 10 second trip delay is initiated. After this, the phase rotation LED is illuminated and pulsed at a 75% duty over a 4 second period, the relay healthy LED is switched off, and the main trip relay de-energised. Once the main circuit voltage level reduces to below 115%, the flashing phase rotation LED will switch off, the relay healthy LED is switched on, and the main trip relay re-energised. This will then allow the motor to be started. This is subject to terminals 19, 20 and 21 being connected.

In the event of an undervoltage condition where the main circuit voltage becomes less than 90% of the rated supply, a 10 second trip delay is initiated. After this, the phase rotation LED is illuminated and pulsed at a 25% duty over a 4 second period, the relay healthy LED is switched off, and the main trip relay de-energised. Once the main circuit voltage level increases to above 90% the flashing phase rotation LED is switched off, the relay healthy LED is switched on and the main trip relay re-energised. This will then allow the motor to be started. This is all subject to terminals 19, 20 and 21 being connected.

Descriptive LED indications have been provided for ease of fault diagnosis and information. The following red LED trip indicators with clear descriptive fault conditions have been mounted on the control panel to assist maintenance personnel in determining the exact cause of a trip.

- \* Motor Overload
- \* Phase Unbalance
- \* Min Load
- \* Phase Rotation/Over & Undervoltage

A green LED indicating relay healthy status.

### 3. Information required for Initial Settings

This user-friendly relay requires only that you set the motor full load current on the "Max Load Current Amp" dial to coincide with the protected motor's full load capability. Prior knowledge of the no load current value of the protected motor, if known, will be useful. However it is not necessary as a procedure will be outlined below to determine this value. If the motor is to be auto re-started in accordance with the under current protection features described earlier, you will need to know the time period required for re-starting the motor after an under load trip condition.

**Note:** This relay has a fixed cold thermal curve of 15 seconds which integrates to a 5 second curve as the motor reaches its full thermal capacity. Use of this product on large motors designed for cold thermal curves in excess of 15 seconds will result in over protection of the motor.

### 4. Setting up Procedure

Ensure that the selected KC relay does in fact cover the full load current range of the protected motor. Note that the models KC 1; KC 5; KC 10 and KC 25 do not require any additional current transformers. The relay MUST be installed in the MAIN CIRCUIT of the starter. Being compact in design the built-in single-turn feed-through primary winding transformers permit the main circuit cable conductors of up to 7 mm to pass through the protection relay. In the case of the models KC 50; KC 100 and KC 200 interposing current transformers of 50:5; 100:5 and 200:5 respectively are required. The secondary winding of these interposing current transformers are then wired through the single-turn feed-through primary winding transformers at the rear of the relay.

CARE SHOULD BE OBSERVED IN ENSURING THAT THE POLARITY OF THE CURRENT TRANSFORMERS IS THE SAME FOR EACH PHASE AND THAT THE DIRECTION OF CURRENT FLOW FROM THE SECONDARY SIDE OF THE TRANSFORMERS IS UNIFORM FOR ALL PHASES. If this is not done, nuisance unbalance trips will occur.

The KC range of relays require an auxiliary supply voltage of either 110 OR 220 Volt a.c to be connected to terminals 17 and 18 OR 16 and 18 as appropriate. In addition and in order to activate ALL voltage sensitive protection features each main phase must be connected to terminals 19, 20 and 21 in the sequence red, white and blue as depicted on the relay label. The nominal supply voltage will be auto detected by the relay. For this reason we recommend the insertion of a 2 Amp fuse on each line to afford some protection to possible high surge voltages. The phase rotation LED will extinguish the moment the rotation is correct. The measurements of these phase voltages will automatically incorporate phase rotation, overvoltage and undervoltage protection features.

Connect the N.C contact in series with your trip circuit, (usually the main contactor holding coil) and, if required the N.O contact can be used for signalling or control purposes. Terminals 9 and 10 AS WELL AS terminals 7 and 8 respectively will refer.

Proceed to set the motor full load current on the "MAX LOAD CURRENT AMPS" dial.

Approximate (unless you already know) the percentage drop in load the fully loaded motor will experience during a no load condition and set that % value on the "MIN LOAD % MLC AMPS" dial.

Select either auto OR manual reset in respect of the overload trip thermal lock out period.

If it is required that the relay re-start the motor after an underload trip condition connect terminals 11 and 13 in parallel with the start circuit and set the appropriate time delay on the "MINIMUM LOAD RE-START" dial to suit your own particular application.

The motor protection relay is now ready.

Tip:

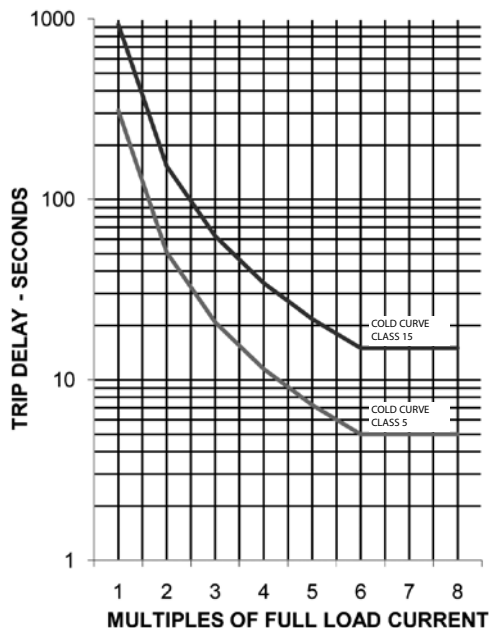
Applicable once the motor is running. When using the KC motor protection relay on an application where the motor load is relatively constant it may be a good idea to set the "Maximum Load Current Amps" dial to coincide with the actual mechanical load being drawn by the motor. This can be achieved by holding in the reset button while at the same time slowly turning counter clockwise on the "MAXIMUM LOAD CURRENT AMPS" dial until the red "Overload" LED lights up. When this point is reached, you will have established the actual load current being drawn by the protected motor. Now, while still holding down the reset button gently turn the "Maximum Load Current" 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.

In a similar fashion, if the motor is run under no load, while consistently pressing the reset button on the control panel it is possible to accurately determine the % drop in load. This is achieved by setting the "MIN LOAD % MLC AMPS" dial to the minimum value and then rotating the setting knob slowly clockwise until the MIN LOAD LED lights up. Leave this as a final setting.

## 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

Class	: Class 1
Rating	: 0,1 VA
Frequency response	: 40 – 66 Hz

OVERLOAD TRIP DELAY CURVES

Cold  
T TRIP = 15 (35,49) Ln  $\left[ \frac{(I/I_e)^2 - (I_p/I_e)^2}{((I/I_e)^2 - 1)} \right]$

Hot  
T TRIP = 5 (35,49) Ln  $\left[ \frac{(I/I_e)^2 - (I_p/I_e)^2}{((I/I_e)^2 - 1)} \right]$

Accuracy: ± 5% 1,2 X I<sub>e</sub> to 6 X I<sub>e</sub>  
              ± 10% 1.01 X I<sub>e</sub> to 1,2 X I<sub>e</sub>

UNBALANCE / SINGLE PHASING SETTING

Level setting	: > 30% I <sub>e</sub> (motor full load)
Trip delay	: 5s

FAULT INDICATION

Operation	: Latch on trip
Resetting fault indication	: Latch

ENVIRONMENTAL SPECIFICATIONS

Reference standards IEC 255  
Isolation N/O contact  
1 kV for 1 minute To IEC 255-5 C  
Isolation separate contacts  
1 kV for 1 minute To IEC 255-5 C  
Impulse withstand  
5 kV To IEC 255-4 EIII  
High frequency  
IEC 255-4 C III

MAXIMUM LOAD CURRENT SETTING

Level setting accuracy	: ± 2%
Linearity	: ± 2%
Repeatability	: ± 1%
Detection level	: ± 2%
Calibration	: Amps

OVERLOAD THERMAL LOCK-OUT TIME TO RECOVER  
33% CAPACITY

T reset = Curve [2.33 (35,49 x 2) 15 log  
(100/70)] – Motor running

T reset = Curve [2.33 (35,49 x 4) 15 log  
(100/70)] – Motor standstill

MAIN TRIP RELAY

Current rating	: 5 Amps 220 Volt a.c
Configuration	: 1n/o + 1n/c
Terminals	: n/c 7 and 8 : n/o 9 and 10

UNDERLOAD DETECTION

Range	: 10 to 100% of maximum load setting dial
Trip delay	: 10 seconds

RESTART TIMER

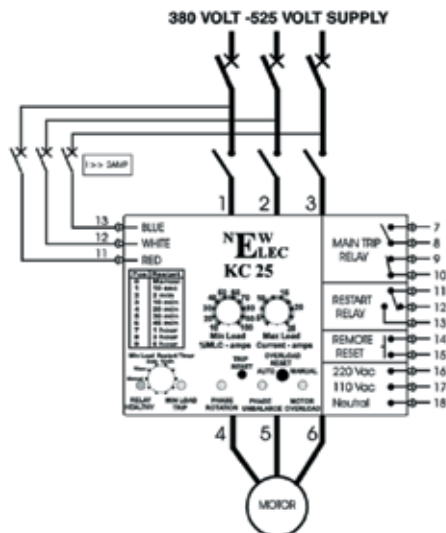
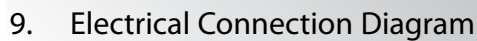
User-selectable range: Manual only, 10s,  
2 min, 10 min, 20 min, 30 min, 45 min, 1 hr, 3 hrs OR  
6 hrs delay.

RUNNING STALL PROTECTION

Detection level: 300% of maximum load dial  
setting with a 1s trip delay

AUTO RESET LIMITER

Auto reset limited to only 3 times per hour



## 10. Ordering Information

Model or relay type	Current setting range	Interposing secondary current transformer ratio where required
KC 1	0,1 to 1 Amp	Not required
KC 5	0,5 to 5 Amp	Not required
KC 10	1 to 10 Amp	Not required
KC 25	2,5 to 25 Amp	Not required
KC 50	5 to 50 Amp	50:5 Class 1 2,5 VA
KC 100	10 to 100 Amp	100:5 Class 1 2,5 VA
KC 200	25 to 200 Amp	200:5 Class 1 2,5 VA

### Ordering examples for the various models

#### Example 1:

Protection for 3 kW 380 Volt three-phase motor

Motor full load 6,5 Amp

Suggestion: KC10/STD

\* KC10/380V - 525V

\* If 380/525 Volt control is desired

#### Example 2:

Protection for 132 kW 525 Volt four-pole, three-phase motor

Motor Full Load 175 Amp

KC200/STD/200:5

\* KC200/380-525/200:5

\* If 380/525 Volt control is desired

# NEW ELEC

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