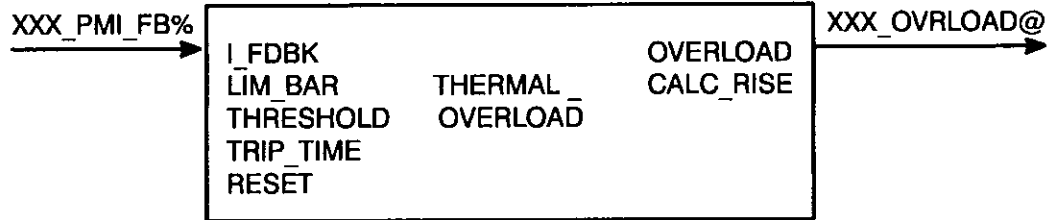


# 36.0 THERMAL OVERLOAD

This function can be used in UDC Control Block tasks only. It cannot be used in AutoMax Control Block tasks.



## Function

This block is used to create a model of the temperature in a device such as a single motor or Power Module controlled by a Distributed Power System drive and to turn on an alarm when an overload condition exists. The block calculates a rise in temperature based on current feedback. When operating above 100%, if the rise in temperature exceeds the programmed limit, the OVERLOAD output will turn on. After the overload condition is detected, the rise in temperature must return to the 100% condition before the drive will be allowed to turn on again.

Note that this block is required in all UDC Control Block tasks, unless motor thermal overload protection is provided by a hardware device.

## Program Statement

```
CALL THERMAL_OVERLOAD( I_FDBK = xxx_pmi_fb%,           &
    LIM_BAR = lim_bar%,                                 &
    THRESHOLD = threshold%,                             &
    TRIP_TIME = trip_time%,                             &
    RESET = reset@,                                     &
    OVERLOAD = xxx_ovrload@,                             &
    CALC_RISE = calc_rise% )
```

## Inputs

I\_FDBK =

This variable is the current feedback as sampled by the PMI (Power Module Interface), register 211/1211 in the UDC dual port for AC drives, and 207/1207 for DC drives. It is scaled so 4095 counts is the maximum current that will be produced. This variable must be defined as a common integer. Recall that there must be no duplicate common variable names in an AutoMax rack; each instance of this variable name in a rack must be customized. The suggested name of the variable is XXX\_PMI\_FB%, with XXX used for UDC slot and drive designation, for example: S12A\_PMI\_FB% might be used for the current feedback value returned by the PMI connected to port A of the UDC in slot 12.

## LIM\_BAR=

This variable is the maximum current limit for the motor in percent. The value used for LIM\_BAR must be the same value entered for the Motor Overload Ratio during drive parameter configuration. It defines what percent of motor current is expressed by 4095 counts. For example, if LIM\_BAR is 150, then 100% motor current is 2730 counts. If LIM\_BAR is 200, then 100% motor current is 2047 counts. This variable may be programmed as an integer variable, an integer constant, or it may be omitted, in which case it defaults to a value of 150. Legal values range from a low of 115 to a high of 400. If the value is outside this range, it will be limited to this range and an error will be logged. The value must be greater than the value of THRESHOLD or an error will be logged.

## THRESHOLD =

This variable determines the threshold of current at which the overload output is turned on. For example, if threshold is set to 114, then an overload will be detected when steady state current reaches 115%. This variable may be programmed as an integer variable or an integer constant, or it may be omitted, in which case it defaults to a value of 114. Legal values range from a low of 110 to a high of 124. If the value is outside this range, it will be limited to this range and an error will be logged. The value must be less than the value of LIM\_BAR or an error will be logged.

## TRIP\_TIME =

This variable is the trip time in seconds. If I\_FDBK is at steady state 100%, and then stepped to LIM\_BAR, the OVERLOAD output will turn on in TRIP\_TIME seconds. This variable may be programmed as an integer variable or an integer constant, or it may be omitted, in which case it defaults to a value of 60. Legal values range from a low of 10 to a high of 120. If the value is outside this range, it will be limited to this range and an error will be logged.

## RESET=

This variable is the reset input. When this input is turned on, the OVERLOAD output is turned off, and CALC\_RISE is set to zero. This parameter is intended only for test purposes and should not be used in application tasks controlling real applications. If this variable is programmed, it must be specified as a boolean.

## Outputs

### OVERLOAD =

This variable is a boolean that will be turned on when an overload is detected. This boolean must be programmed in a Ladder Logic task to turn off the drive when the bit turns on. It must be defined as a common boolean. Recall that there must be no duplicate common variable names in an AutoMax rack; each instance of this variable name in a rack must be customized. The suggested name of the variable is XXX\_OVRLOAD@, with XXX used for UDC slot and drive designation, for example: S07B\_PMI\_FB% might be used for the bit that will turn off the drive connected to port B on the UDC module in slot 7.

CALC\_RISE =

This variable displays the calculated rise in temperature. The calculation squares I\_FDBK, scales it, and then applies a low pass filter to introduce a time delay. For example, when I\_FDBK is at steady state 100%, if I\_FDBK is then stepped to 110%, CALC\_RISE will reach a steady state value of 1210, (N%\*\*2/10). With THRESHOLD at 114%, the trip point will be 1300. If I\_FDBK remains less than 114%, CALC\_RISE will remain less than 1300 and OVERLOAD will not turn on.

If this variable is programmed, it must be defined as an integer.

## 36.1 Setup Calculations and Block Equations

The following setup calculations are performed internally by the Thermal Overload function based on the parameters entered.

$$Wlg = \frac{\ln[(LIM\_BAR^{**2} - 100^{**2}) / (LIM\_BAR^{**2} - THRESHOLD^{**2})]}{TRIP\_TIME \text{ (sec.)}}$$

$$SCALE = (4095 / LIM\_BAR)^{**2} * 10$$

IF OVERLOAD = TRUE THEN

LIMIT = 1000

ELSE

LIMIT = THRESHOLD\*\*2 / 10

END\_IF

$$CALC\_RISE = \frac{(I\_FDBK^{**2})}{SCALE} * \frac{1}{(1 + s / \omega lg)}$$

IF RISE% > LIMIT THEN

OVERLOAD = TRUE

ELSE

OVERLOAD = FALSE

END\_IF

## 36.2 Special Notes

1. UL 508C section 56.1.3 specifies that when subjected to 200% of rated full load motor current, the overload protection must trip in at least eight (8) minutes. Because TRIP\_TIME is calibrated from 100% to current limit, and TRIP\_TIME from zero to current limit is approximately four times longer, the maximum trip time that is allowed is 2 minutes (120 seconds). To meet UL listing requirements, any value for TRIP\_TIME greater than 120 seconds is limited to 120 seconds.
2. The National Electric Code (430-32; 1993) requires that thermal overloads protecting motors having a 1.0 service factor trip at load currents no greater than 115% of full load. To meet NEC, the THRESHOLD block parameter has a default value of 114%. If your motor has a service factor greater than 1.0, you may use a value up to 124.