



When to select a Limit, versus an Alarm Controller (or a temperature controller)

In Watlow catalogs, brochures and web pages there is a category of controllers listed as “Limits and Alarms”. It is not always clear to everyone when to use these controllers or which type of controller to use. This document is an attempt to clear up some of these issues.

Even though limits and alarm controllers are put together in our documentation, in terms of application, **there is no relationship between a limit controller and an alarm controller**. The primary purpose of each is completely different. They are together in the catalog simply to highlight the fact that they are not PID controllers. Now lets define what is each controller’s purpose.

Limit Controller

The primary purpose of a limit controller is to act as part of a redundant control system that prevents runaway conditions in the event the primary control system fails. It’s job may be to prevent an over temperature condition, an under temperature condition, or sometimes both conditions. A controller designated as a limit controller means that it meets approval agency standards for a limit purpose. Underwriter’s Laboratories (UL) and Factory Mutual (FM) are two approval agencies that Limit controllers are typically submitted to for approval.

Circumstances such as the application, industry standards, regulations, and local laws will determine whether a Limit controller is needed as well as which agency approvals or features are required. In general, use a limit controller as part of a redundant control system any time a failure of the main control system could result in a hazardous condition. See Watlow Over/under temperature protection bulletin for more details.

In order to obtain agency approvals, additional restrictions on the controller are implemented that do not apply to PID controllers. These restrictions often make a limit controller unsuitable for alternate applications that might at first glance seem appropriate. Here are a couple of the most significant limitations imposed on limit controllers:

- **Once the controller trips on a limit condition, it must stay tripped until the temperature has dropped back into the safe region and the reset button is pressed or power is removed from the limit.** Unlike an alarm output, this output is always latching and cannot be programmed otherwise. This means this controller will not work for control, such as ON/OFF controller because once the output deactivates it does reactivate again. Limit controllers are available with “Auto Reset on Power Loss”, but this refers to how the controller responds when it is initially powered up. It always must be manually reset to recover from its limit condition.
- **The limit output must be a mechanical relay. It cannot be a solid state relay or a Switched DC control signal.** To obtain a non-latching alarm function with a limit controller, order a secondary output, if available. For alarm only applications, the limits’s primary output would still have to be a mechanical relay output, which means extra money for an output that is not utilized. A better solution for a single loop alarm only controller would be a low cost PID controller with an alarm output option.
- **The limit trip point is not readily available for casual adjustment by operators of the equipment.** Lets say you do find an application where a controller that goes up to temperature and then shuts off until reset is appropriate. The next consideration about a limit controller, is that the set point is intentional made less convenient to access. This is because of the important job that limit controllers perform. Again a low cost PID controller might be a better solution for alarms. By using a deviation alarm, the trip points are readily adjustable.

Watlow’s limit controllers that are presently available are; Series L, Series SD Limit, Series 94, Series 97, and the TLM multi-loop limit.

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Alarm Controller

Watlow manufactures one controller, the CAS200 alarm scanner that falls under the category of an alarm controller. An alarm controller is a controller that doesn't control a process but instead provides additional or auxiliary information about the process. It provides the information either through alarm outputs or a serial interface. Temperature measurements from various locations from within the process, or a signal that indicates to the main control system that a particular area of the system is within the desired temperature range are available. The CAS200 does not meet the special criteria of a limit controller that was listed above:

- **CAS200 outputs are Switched DC signals used to control solid state relays.** Limits require mechanical relay outputs.
- **CAS200 Outputs can be programmed as latching or non-latching.** Limits must have latching outputs.

The CAS200 is a 16-channel controller with up to 34 outputs available.

When to consider a Low Cost PID Controller?

There are many applications that one might try to fit to a Limit controller or an alarm controller that is best performed by a low cost PID controller. It more directly meets the application it at a lower cost. All current Watlow PID controllers have the capability to disable PID control and operate in an ON/OFF control mode with hysteresis. Available options for alarm outputs are flexible in programming. Here are some ideas for using a PID controller for some very basic applications:

- **Product Protection from a cost standpoint.** It's desired to stop a process if the temperature gets out of range because being out of temperature range increases the amount of reject product. However, to use a latched limit causes the system to shutdown unnecessarily for extended periods of time until someone can reset the system. A redundant controller using ON/OFF temperature controller or an alarm output will stop the process when it deviates out of range, yet allow it to recover automatically if temperature returns to normal. This system may also be in addition to the limit control system but is not considered part of a safety system. It would trip at temperatures that reduce the efficiency of the process, not at temperatures that are considered hazardous. (Caution: See Watlow's over/under temperature control bulletin.)
- **Notification.** It's desired to add the ability to trigger a light or warning buzzer to an existing system. Adding a PID controller with an alarm output to the system could perform this function. With the Series SD controller, the primary output can be configured as an alarm. Other controllers could use a secondary output for the alarm. (The primary output is ordered as a "No Charge" Switch DC output.) The alarm output would then allow utilization of such features as alarm silencing. Alarm silencing will allow the alarm to be disabled during startup, so that the alarm doesn't activate until process value is achieved and then deviates from a normal process range.



Engineering Bulletin

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Over/Undertemperature Protection

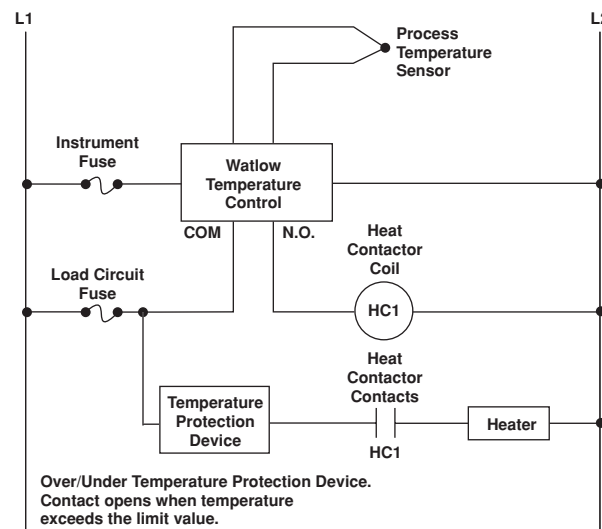
Failure of components in a temperature control loop, such as the sensor, heater control relay, or main temperature control, can result in damage to a product in process, a meltdown of a heater, and/or a damaging fire.

To protect against this possibility, over/undertemperature protection must be provided to interrupt or remove power from the heater circuit. A “thermal fuse line” at the heater, or a “mechanical thermostwitch” at the heater are examples of recommended over/under temperature protection. For precise, repeatable limit protection, an “electronic limit control” may be used. We recommend the temperature protection device have UL, CSA, or FM approval, and be applied in the classification for which it was tested and approved. An example of a single phase wiring line diagram appears below.



WARNING

Install high or low temperature control protection in systems where an overtemperature or undertemperature fault condition could present a fire hazard or other hazard. Failure to install temperature control protection where a potential hazard exists could result in damage to equipment and property, and injury to personnel.



Further information is available from Watlow Controls; ask for application assistance.

Disclaimer of Warranty

This document is a presentation of a general overview and statement of the safety-related need for and method of applying “over/undertemperature protection.” Because of the diversity of conditions and hazards under which control products may be applied and because of the differences in components and methods of their installation, **no representation or warranty of any kind, express or implied, is hereby made**, that the limit control protection discussed and presented herein will be effective in any particular application or set of circumstances, or that additional or different precautions will not be reasonably necessary for a particular application. We will be pleased to consult with any customer regarding a specific application upon written request.

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Watlow Controls

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Limit Controls from Watlow

Series L — LV / LF Limit

- Open board, potted case, DIN-rail mount or panel mount 1/8 DIN square package styles
- Fixed or push-to-set adjustable set point operation
- High or low limit with auto or manual reset on power loss
- Remote reset capability
- Celsius or Fahrenheit indication (factory selectable)
- Sensor break protection to de-energize system for safety
- Operating environment:
 - 0 to 70°C (32 to 158°F)
 - 0 to 90% RH, non-condensing
- Agency approvals:
 - Series LF (potted version only)
 - UL 991 recognized temperature limit for cooking industry
 - Series LV and Series LF (including potted version)
 - UL 873 recognized temperature regulator
 - ANSI Z21.23 Gas appliance thermostat approval
 - FM Class 3545 temperature limit switches



Series 97 — 1/16 DIN Limit

- Programmable messages to display user programmed limit and safe message
- Microprocessor-based for accurate set point settings and quick output response
- Remote reset capability
- Four outputs for high/low limit, alarms, communication, retransmit requirements
- Software and hardware lockouts for high security
- Aesthetic match of Series 96 temperature controller
- Operating environment:
 - 0 to 65°C, 32 to 149°F
 - 0 to 90% RH, non-condensing
- NEMA 4X, 12, IP65 case makes the control water and corrosion resistant
- Agency approvals: FM, CE, NEMA 4X, 12, and IP65



Series SD — Family of Limit Controllers

- Available in a 1/32, 1/16, 1/8 (horizontal or vertical) or 1/4 DIN package
- Up to three outputs (two on 1/32 DIN model) provide high and low limit/alarm capacity
- Lockout functions for increased security
- Flexible high/low alarm output notifies of trouble with flashing display message
- Programmable dual display default shows actual, limit, blank or alarm default display information
- Aesthetic match for Series SD, 96 and F4 PID controllers
- Operating environment:
 - -18 to 65°C (0 to 149°F)
 - 0 to 90% RH, non-condensing
- Agency approvals: FM, CE, NEMA 4X, 12, IP65, and NSF



TLM Series — Multi-Channel Limit Monitor

- Eight channel monitoring in a single compact package
- Multiple sensor types (one sensor type per TLM)
- Selectable limit set points for each channel. TLM-8P has field adjustable limit set points.
- Sub-panel mounting
- Flexible interlocks
- Self-test diagnostics
- Latching alarms
- Operating environment:
 - 0 to 60°C (32 to 140°F)
 - 0 to 90% RH, non-condensing
- Agency approvals: FM, CE, UL listed, C-UL listed



**TOTAL
CUSTOMER
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3 Year Warranty



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