

# Four Loop Temperature Controller

## Four Loop Temperature Controller Module F4-4LTC <--->



### Overview

The F4-4LTC combines the features of four single loop temperature controllers into one inexpensive module. The module has four asynchronous, configurable PID loops, with built-in temperature inputs and control outputs so that precision temperature control is maintained, even while the PLC is in program mode. This module can control temperatures up to  $\pm 3276.7^{\circ}\text{C}/^{\circ}\text{F}$  and accepts either thermocouple or RTD inputs. By simply changing a jumper setting, you can choose the one that is best suited for your application. In addition, both versions have solid-state relay outputs for heater or chiller control.

### Operation

The temperature is read directly into the F4-4LTC with the on-board RTD or thermocouple inputs. If the temperature is not at the target value (setpoint), then the control outputs are automatically activated. The F4-4LTC also provides automatic tuning of the control loops, so the module can easily adapt to changing temperature and process conditions. And since the F4-4LTC is an intelligent DL405 module, you can easily use simple ladder logic in a DL405 CPU for ramp and soak setpoint changes.

Minimal setup ladder logic is required in the CPU, and since the floating point calculations are performed in the temperature controller, there is little effect on the CPU scan time. The temperature controller also provides alarm and diagnostic capabilities by monitoring Low Alarm, High Alarm, Deviation Alarm, Heater Burn-out, and broken transmitter conditions.

All information from the F4-4LTC can be mapped directly into the DL405 CPU memory. As a result, information is freely accessible through the CPU for coordinated control, operator interface usage, or data collection.

The operating characteristics for each loop are programmed into a user-defined block of V-memory in the DL405 CPU. The temperature controller accesses this memory area to determine the operating parameters for each loop. Each loop that is enabled requires 24 V-memory locations. Since all loop parameters are stored in V-memory, any device capable of reading and writing DL405 V-memory can be used to configure or monitor loops. The temperature controller reads/writes data within the CPU. This data includes:

#### Read continually

- Mode word
- Temperature setpoint

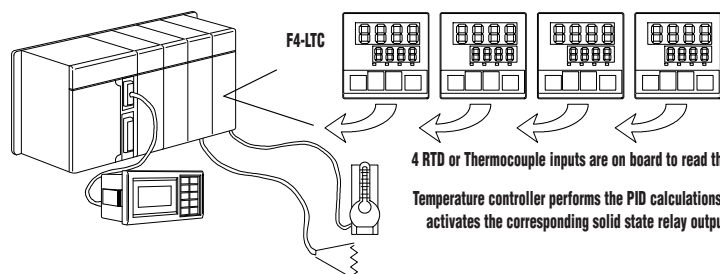
#### Written after loop update

- Output (0.0-100.0% or 0-4095)
- Alarm word
- Process temperature

#### Read setup/write after auto tune

- Gain
- Reset, Integral time (0-999.9s)
- Rate, Derivative time (0-999.9s)

**Combines four single loop controllers into one module.**



#### Read for setup

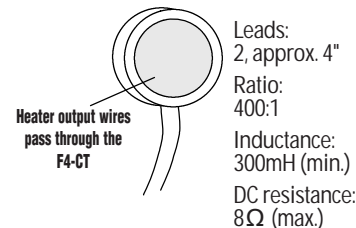
- Temperature Low Alarm
- Temperature High Alarm
- Temperature Deviation Alarm
- Alarm Deadband
- Setpoint Low Limit
- Setpoint High Limit
- Input Type (for Thermocouple)
- PID Control Period
- On/Off Hysteresis

#### RTD or thermocouple inputs

The F4-4LTC can accept either RTD or Thermocouple inputs. See the specifications table on the following page.

#### Current transformer

The F4-CT detects the presence of current flow and is very useful in detecting heater burnout conditions. One F4-CT is included with the 4-loop Temperature Controller Module. The F4-4LTC has four inputs that can be used with these current transformers:



- PLC Overview
- DL05/06 PLC
- DL105 PLC
- DL205 PLC
- DL305 PLC
- DL405 PLC**
- Field I/O
- Software
- C-more HMIs
- Other HMI
- AC Drives
- Motors
- Steppers/Servos
- Motor Controls
- Proximity Sensors
- Photo Sensors
- Limit Switches
- Encoders
- Current Sensors
- Pushbuttons/Lights
- Process
- Relays/Timers
- Comm.
- TB's & Wiring
- Power
- Circuit Protection
- Enclosures
- Appendix
- Part Index

# Four Loop Temperature Controller

| General Specifications        |   |
|-------------------------------|---|
| <b>Module Type</b>            | CoProcessor, Intelligent  |
| <b>Number of Loops</b>        | Four maximum  |
| <b>Modules per CPU</b>        | Eight maximum, CPU base, any slot                                   |
| <b>I/O Points Required</b>    | None  |
| <b>V Memory Required</b>      | 24V-memory locations per loop                                       |
| <b>Input Type</b>             | RTD or Thermocouple   |
| <b>Controller Output</b>      | Open collector, high-current solid state relays, 5-26.4VDC @ 0.15A  |
| <b>Converter Type</b>         | Charge Balancing, 24-bit  |
| <b>Notch Filter</b>           | >100dB at 50Hz and 60Hz<br>(f <sub>-3db</sub> =13.1Hz)              |
| <b>Common Mode Rejection</b>  | 90dB minimum at DC, 150dB minimum at 50Hz and 60Hz                  |
| <b>Sampling Rate</b>          | Selectable per module<br>800ms (10Hz filter)<br>160ms (50Hz filter) |
| <b>Current Transformer</b>    | 0.5A to 50A sense range   |
| <b>Minimum Output On Time</b> | 300ms to sense heater current                                       |
| <b>Operating Environment</b>  | 0°C to 60°C (32°F to 140°F)<br>5-95% humidity (non-condensing)      |
| <b>Power Requirements</b>     | 280mA at +5VDC, (base power)<br>75mA at +24VDC external ±10%        |
| <b>Manufacturer</b>           | FACTS Engineering   |

| Thermocouple Specifications   |  |
|-------------------------------|--|
| <b>Temperature Ranges</b>     | J, -190/760 °C (-310/1400 °F)<br>E, -210/1000 °C (-346/1832 °F)<br>K, -150/1372 °C (-238/2502 °F)<br>R, 65/1768 °C (149/3214 °F)<br>S, 65/1768 °C (149/3214 °F)<br>T, -230/400 °C (-382/752 °F)<br>B, 529/1820 °C (984/3308 °F)<br>N, -70/1300 °C (-94/2372 °F)<br>C, 65/2320 °C (149/4208 °F) |
| <b>Input Fault Protection</b> | 60Vrms or 50 VDC max   |
| <b>Cold Junction</b>          | Automatic compensation   |
| <b>Input Impedance</b>        | 20MΩ DC  |
| <b>Resolution</b>             | ±0.1°C (relative accuracy)   |
| <b>Maximum Inaccuracy</b>     | ±3°C exc. thermocouple error   |
| RTD Specifications            |  |
| <b>Temperature Ranges</b>     | PT100 -200/850 °C (-328/1562 °F)<br>PT1000 -200/595°C (-328/1103 °F)<br>jPT100 -35/450°C (-36/842 °F)<br>10Ω -200/260°C (328/500 °F)<br>25Ω -200/260°C (328/500 °F)  |
| <b>Input Fault Protection</b> | 50VDC maximum  |
| <b>RTD Excitation Current</b> | 200µA  |
| <b>Resolution</b>             | ±0.1°C   |
| <b>Maximum Inaccuracy</b>     | ±1°C   |

| Loop Specifications         |   |
|-----------------------------|---|
| <b>Loop Operating Modes</b> | PID control - computes and controls the outputs based on the PID parameters stored in V memory. If auto tuning is enabled, the module uses PID parameters calculated during the auto tuning process. ON/OFF Control - the outputs turn on, then off based on only the Process Temperature, Setpoint On/Off Hysteresis, and control type (heating or cooling). |
| <b>PID Control Period</b>   | Specifies the sample rate and the time period the output is applied to (0.5 to 99.9 seconds)  |
| <b>Limit SP</b>             | Specify a high and low limit for allowable setpoint changes   |
| <b>Scaling</b>              | Automatically converts temperature to engineering units   |
| <b>Gain</b>                 | Specify proportional gain of 0.0 to 6553.5. Gain may also be determined automatically by using the auto tuning feature.   |
| <b>Reset</b>                | Specify reset time of 0 to 65535 seconds. Reset may also be determined automatically by using the auto tuning feature.  |
| <b>Anti-windup</b>          | Stops the reset action when the PID output reaches 0 or 100%. Bias is automatically adjusted when the process temperature begins to respond.  |
| <b>Rate</b>                 | Specify the derivative time, 0 to 65535 seconds. Rate may also be determined automatically by using the Auto Tuning feature.  |
| Alarm Specifications        |   |
| <b>Deadband</b>             | Specifies the temperature deadband on alarms. The alarm will remain active while the temperature is outside the alarm limit minus the deadband.   |
| <b>Temperature High</b>     | Temperature has risen above the programmed limit.   |
| <b>Temperature Low</b>      | Temperature has fallen below the programmed limit.  |
| <b>Deviation</b>            | A Y output or CR may be activated when the high or low temperature is further from the Setpoint than the programmed deviation limit.  |
| <b>Broken Transmitter</b>   | This alarm is turned on when the RTD or Thermocouple is burned out or missing.  |