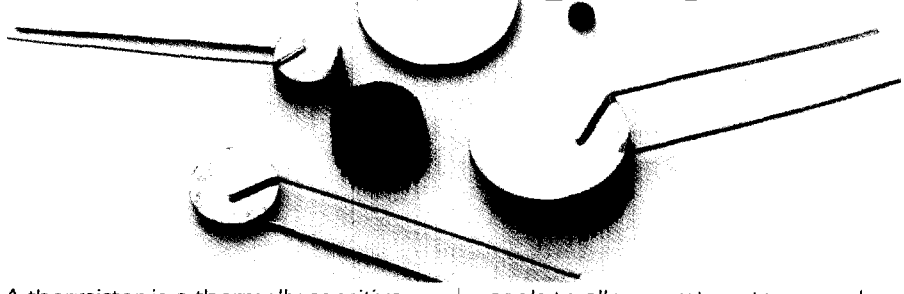
PTC SWITCHING THERMISTORS



Application and design considerations for ceramic positive temperature coefficient thermistors

A thermistor is a thermally sensitive resistor—a device whose resistance changes significantly and predictably with temperature. The resistance of a PTC (Positive Temperature Coefficient) thermistor increases as temperature increases. This increase in resistance is so abrupt and predictable that the PTC thermistor can function as an electronic switch.

PTC Benefits

The PTC offers many advantages over other switching devices. Under ordinary conditions, the PTCs service life is unlimited, its switching action is infinitely repeatable, and a PTC is not susceptible to any hysteresis. With no moving parts to wear out, the PTC provides long-term stability at a very low cost. The PTC provides several circuit functions in one package, so the savings in parts cost, board space, and labor are significant.

Current Limiting

A natural use of the PTC switching thermistor is for overload protection where the PTC acts as a self-resetting circuit breaker. A current limiting circuit (see Figure 1) is typically designed so that, under normal circuit conditions, the PTCs internal temperature is just below its transition temperature. When excessive current begins to flow through the circuit, the PTC quickly self-heats past its transition temperature, causing its resistance to increase dramatically. This results in an immediate shutdown of the circuit. When the excessive current is removed, the PTC cools to allow a return to normal conditions.

Fluids Sensing

A self-heating PTC dissipates significantly more heat in a liquid or in an air stream than it does in still air. The PTC fluid-sensing circuit detects the cooling caused by the presence of the fluid as an increase in the power required to maintain a steady temperature. Figure 2 shows typical airflow and liquid-level sensing circuits. The series relay shown in the Liquid Detection circuit is possible only when the change in resistance is large enough to operate the relay.

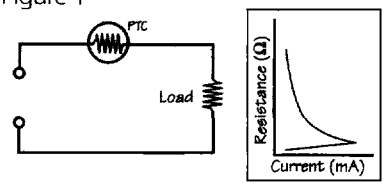
Time Delay

The PTC, used as a time delay device, can provide high reliability with low maintenance because of its lack of mechanical contacts. The time delay circuit, shown in Figure 3, is typical of a number of time delay applications. The current flowing through the PTC is sufficient to cause it to self-heat past its transition temperature, switch to a high resistance and de-energize the circuit. The predictability in self-heating characteristics of the PTC makes for a reliable time delay circuit. It is important that the PTC has the opportunity to cool between operations, otherwise the time delay will be shortened.

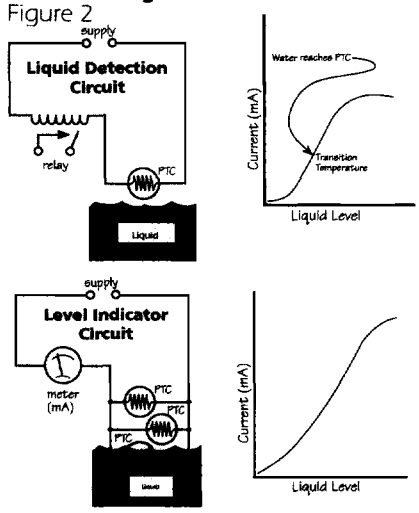
Overcharge Protector

A PTC can be used to protect rechargeable batteries from being overcharged. As shown in Figure 4, the PTC is thermally coupled to the ni-cad batteries. As the batteries reach their charging capacity, they heat up. This causes the PTC to heat up, switch to high resistance, and cut off the current to the batteries.

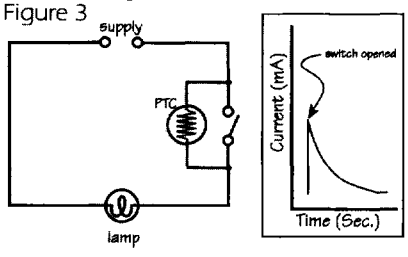
Current Limiting Circuit
Figure 1



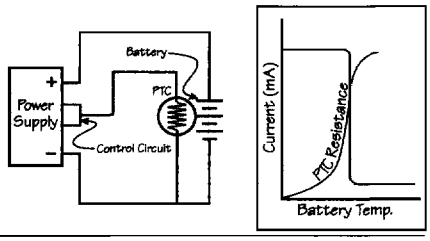
Fluids Sensing Circuits
Figure 2



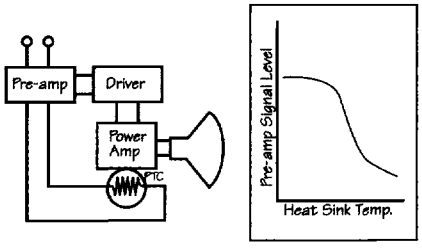
Time Delay Circuit
Figure 3



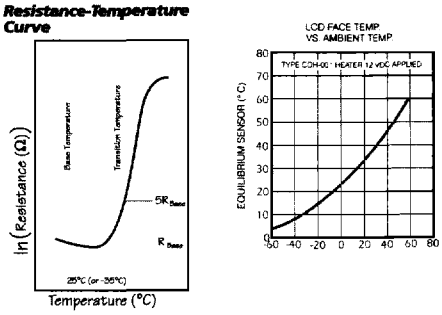
Battery Over-Charge Protection

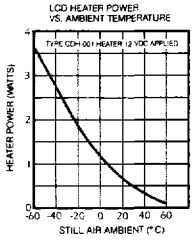


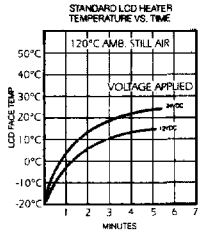
Over-Temperature Protection

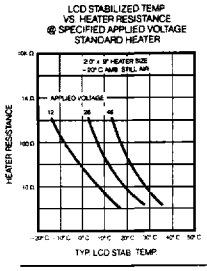


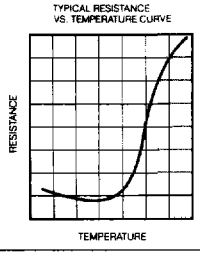
Resistance-Temperature Curve

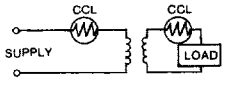




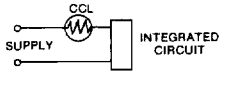




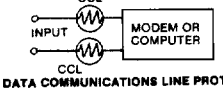




OVER-LOAD PROTECTION



OVER-CURRENT PROTECTION



DATA COMMUNICATIONS LINE PROTECTOR

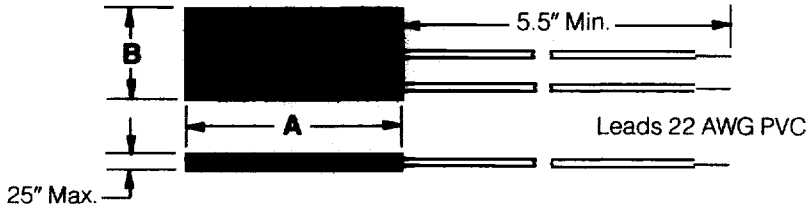
Self-Regulating Heater

A PTC thermistor can be used as an effective, low-cost heater, because it combines the functions of heater and thermostat in a single device. PTC heaters are self-regulating because they switch to a very high resistance as the temperature reaches a prescribed limit. The high resistance of the PTC shuts off the circuit, allowing it to cool.

When the temperature returns below the transition temperature, current resumes and the PTC again functions as a heater. PTC devices are especially well suited for LCD heaters in portable instruments. In this application, the PTC circuit can be designed to produce heat at cold temperatures and limit heating at normal or high temperatures. This feature conserves battery usage by virtually eliminating current drain at normal operating temperatures.

Important Notice

The user must determine the suitability of the thermistor for the application and assumes all risk and liability associated therewith.



ORDER NUMBER	SIZE (INCHES) DIM "A"	DIM "B"	NOMINAL R @ -35°C	MINIMUM R @ 50°C
CDH00102	1.50	.50	10.0 ohms	3,000 ohms
CDH00104	1.50	1.50	5.0 ohms	1,500 ohms
CDH00105	2.00	.65	10.0 ohms	3,000 ohms
CDH00106	1.98	.68	50.0 ohms	15,000 ohms
CDH00108	2.70	1.10	5.0 ohms	1,500 ohms
CDH00111	2.80	.50	9.5 ohms	2,850 ohms
CDH00112	2.00	.90	10.0 ohms	3,000 ohms
CDH00114	2.00	.60	22.0 ohms	1,500 ohms
CDH00115	1.74	.29	15.0 ohms	4,500 ohms
CDH00117	2.60	1.50	5.0 ohms	1,500 ohms
CDH00119	2.40	.70	50.0 ohms	10,000 ohms
CDH00121	2.00	.90	22.0 ohms	800 ohms
CDH00301	3.60	.90	2.5 ohms	750 ohms
CDH00302	3.60	.70	2.5 ohms	750 ohms
CDH00303	4.00	1.50	2.5 ohms	750 ohms
CDH00304	2.20	.38	7.5 ohms	2,250 ohms
CDH00305	3.60	1.10	5.0 ohms	1,500 ohms
CDH00306	3.60	1.50	2.5 ohms	750 ohms
CDH00307	5.40	1.50	2.5 ohms	750 ohms
CDH00308	3.60	1.10	85.0 ohms	15,000 ohms
CDH00309	3.60	1.10	11.0 ohms	400 ohms
CDH00310	5.00	3.00	2.5 ohms	750 ohms
CDH00311	3.60	.50	5.0 ohms	1,500 ohms
CDH00400	7.50	.56	3.3 ohms	750 ohms
CDH00404	5.85	.70	3.3 ohms	750 ohms
CDH00407	7.50	1.50	3.3 ohm	750 ohms

Other sizes available — give us a call

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