Cleaning Consultancy Delft bv.
Haagweg 125-B
NL-2612CR Delft The Netherlands
Phone : +31 15 2158676
Bank : ABN Amro
IBAN : NL07ABNA0550105379
BIC : ABNANL2A
VAT : NL0093.29.328.B01
www.ccd.eu / info@ccd.eu

TEMPERATURE MEASURING WITH TRM2000	IN-TRM-T-UK 1/3

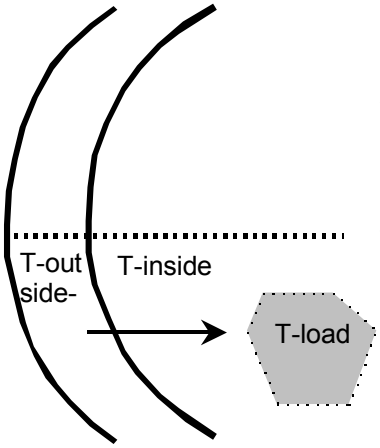
This important information gives a more detailed view of the principles behind measuring temperature inside machines and especially inside loads like laundry. Based on these principles the TRM2000 measuring module was optimised, thus giving the most optimal configuration to measure temperature in these processes. Also guidelines for use will be given.

PROCESSES ARE DYNAMICAL

Every product that is heated or cooled will eventually reach the temperature of its environment, providing the time is long enough. In practice however processes are dynamic and changes in environmental temperature are rapid. The product that is led through a dynamic process will be heated or cooled, but almost never reaches the temperature of its environment. The slower the heat transfer properties of the machine and load, the greater the difference in temperature between product and machine settings will be. Because all chemical and physical action has to take place at the product level, only the end result of the process, the product temperature, is of main interest. This is why the TRM2000 was developed. The TRM2000 makes it possible to get an accurate estimate of the temperature of the product.

In an industrial continuous batch washer the heat transfer is influenced by process factors, machine and load characteristics.

process factors	temperature setting, time, water level, mechanical action/movement, amount of load
machine characteristics	mechanical action, size of openings, construction
load characteristics	size and material type



This schematic figure gives the direction of the heat transfer in a continuous batch washer.

When heating: $T_{outside}$, T_{inside}, T_{load}. When cooling the differences reverse.

Measurements have shown that these differences can easily vary up to 10-15 °C.

Since these combination of factors and characteristics are of high interest and importance for an optimal washing process the temperature profile of the load itself must be measured regularly.

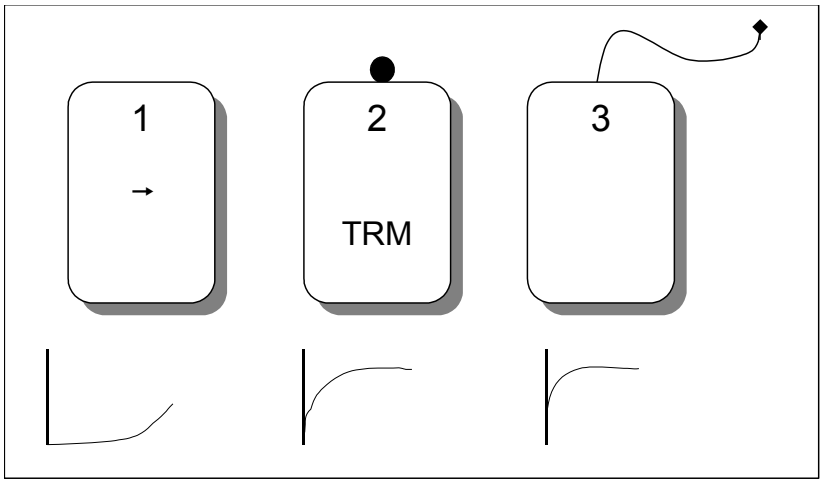
Registered at Chamber of Commerce, no. 272.31.287
Terms of delivery deposited at Chamber of Commerce Haaglanden, no. 804

Cleaning Consultancy Delft bv.
Haagweg 125-B
NL-2612CR Delft The Netherlands
Phone : +31 15 2158676
Bank : ABN Amro
IBAN : NL07ABNA0550105379
BIC : ABNANL2A
VAT : NL0093.29.328.B01
www.ccd.eu / info@ccd.eu

PRINCIPLES OF TEMPERATURE MEASUREMENT

Three basic sensor configurations of temperature measurement can be used. These will be described and also an explanation will be given of the right choice for measuring temperature inside a load/machine.

figure: schematic drawing of three configurations



1 sensor inside the temperature module
When the sensor is placed inside the module, the sensor will measure the temperature of the inside of the module itself. This is heated due to the process, but the heating and cooling time is too slow to perform accurate measurements.

2 sensor on the surface of the temperature module
This is the optimal configuration for temperature measurements inside processes. The configuration is rigid and the sensor will indicate the temperature of the environment, providing there is mechanical action. The module will also be heated, but this influence will only be noticed when there is no movement of the water around the module. As can be observed with the TRM2000, the sensor is fitted in a chamber that must be flushed with water continuously. In other words, the measurements are correct in processes with mechanical action or processes were the water can flow freely around the sensor. The influence of the temperature of the module can be observed after a short and warm process. When the module is left outside the process in a normal room, the temperature of the sensor will first slowly rise due to the higher temperature of the module and afterwards the temperature will drop even more slowly due to cooling of the module until the room temperature.

3 external, separate sensor
This configuration is normally used and gives the most accurate measurements without influence of the module. It is not applicable for measuring inside processes, because this configuration will not survive the process.

Registered at Chamber of Commerce, no. 272.31.287
Terms of delivery deposited at Chamber of Commerce Haaglanden, no. 804

Cleaning Consultancy Delft bv.
Haagweg 125-B
NL-2612CR Delft The Netherlands
Phone : +31 15 2158676
Bank : ABN Amro
IBAN : NL07ABNA0550105379
BIC : ABNANL2A
VAT : NL0093.29.328.B01
www.ccd.eu / info@ccd.eu

The selected configuration and construction of the TRM2000 is carefully chosen and thoroughly tested. It has proven to be the best solution for measuring temperature inside the load of a machine.

GUIDELINES FOR USE

Given this information the following guidelines can be given for using the TRM2000

- use the TRM2000 in processes with mechanical action or flowing water
- the sensor is optimised for measuring in water or other fluids
- measurements in air can be performed, but not in situations were temperatures change rapidly. This can only be measured with sensors external form the module
- it is not possible to check the TRM2000 in a waterbath and compare the measurements with another (standard) temperature sensor. Special calibration procedures are required
- for a representative measurement and for protection of the TRM2000, the module must be placed inside a piece of laundry like a towel.

CONCLUSION

The TRM2000 is ideal for measuring temperature inside processes providing the sensor is flushed with the fluid that is used in the process. Values will be very accurate, but cannot easily be compared with (standard) temperature sensors.

Registered at Chamber of Commerce, no. 272.31.287
Terms of delivery deposited at Chamber of Commerce Haaglanden, no. 804