

A constant process temperature under different loads

Introduction

The specified process temperature during soldering must be kept within the specified boundaries.

Different loads in the machine ask for a different thermal demand. Due to the regulation of the elements concerned it is possible to keep the settings within their specified limits during a variation of the machine load.

Solderpot

The temperature of the solderpot is maintained constant at its set temperature within its specified limits. Since the solder is continuously pumped around as the waves are running, there is a good homogenisation of the temperature. If there is a high-energy demand, like during continuous production, the elements will be switched on more frequently and during a longer period to keep the temperature constant. If once in a while a board is soldered this frequency and also the on time will automatically reduce. This due to the fact that there is in the case that once in a while a board is soldered, less thermal loss from the solder in the solderpot. So the solder in the pot will keep in this case its set temperature for a longer time before it cools down below its set point.

The correct power supply is finally established by a PID process regulator that is set to keep the temperature of the solderpot as constant as possible to its set point.

Conclusion: As long as the elements are not switched on continuously and the pumps are running, the solder in the pot will keep its set temperature within the specified limits as can be permanently controlled on the monitor.

If the pumps are switched off for a longer period it is advised to start the pumps well before the first board must be soldered. This is necessary to homogenise the solder in the pot, so that the temperature in the solder will be the same in the wave as in the solderpot.

Note: It is remarkable that in a static solderpot temperature differences at different positions can be more than 5 degrees Centigrade. One should expect that metal will have a perfect thermal conductivity, this is however not the case for a 'dead' solderpot where the solder is not mixed well. As soon as the solder is pumped around however the solder temperature will homogenise quickly. It may take some time however to get the pot at its set temperature after this homogenisation.

Preheating

The story for the preheater system is more or less the same as for the solderpot. The principle is that the output (temperature) of each preheater module is monitored and kept constant within its specified limits.

The load (amount of boards soldered) is in that case not of main importance on the final preheating effect.

Depending on the amount of energy that is absorbed by the boards that pass these units the temperature of the monitoring element in the preheating unit will change.

As soon as the lower limit setting is reached it will start to put in more energy until the upper limit is reached. As long as the heating elements are not switched on constantly, which is by the way never the case in normal operation, this system will do its job for each separate preheating unit, with the exception for the quartz preheater.

The quartz preheater uses mainly short wave IR-radiation energy, which reacts almost as fast as light. Therefore there is no need for a separate temperature control on these elements. Just a controlled setting of the power output will work well in this case. The conveyor tracking system will normally activate the quartz heater, so that it is only active when a board passes this unit.

The boundaries and the settings for each preheater unit can be set in the preheater menu.

The variations in the preheater output can be monitored with the View Trends option.

The temperature on the board itself depends not only on the preheater setting, but also on the conveyor speed, type of board, the amount of flux that is applied, the measuring position, etc.

One should measure always on the same position under the same conditions for a given board, to be able to set the preheaters at their demanded setting for that specific board.

Reflow oven

For each section in the reflow oven the thermal settings should be kept within its specified limits, independent of the load of the machine.

Also in this case the use of PID process regulators makes this possible for the temperature of each section. However the real temperature on a specific component has to be monitored on the board itself.

Important is to use an oven setting where the maximum temperature of the smallest component will be below the damaging temperature, while at the same time the melting conditions of the solderpaste at the 'heaviest' component will be sufficient to provide a sound joint. This means that for the best process the 'band width' of the profile for a given board should be as small as possible during the actual soldering.

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