

Incubation temperature of the EmbryoScope™ time-lapse incubator

A stable and accurate controlled incubation temperature is of high importance for culturing human embryos for IVF. The temperature regulation in the EmbryoScope™ time-lapse incubator is a direct-heat regulation system, i.e. bench-top like temperature regulation system. A direct-heat temperature regulation provides a highly controlled and stable incubation temperature for embryo culture. Here we describe how we measured the temperature in the well of the EmbryoSlide® culture dish, to verify the culture temperature for the embryo. In addition, references to sections in the user manual for detailed description of external validation and calibration of the incubation temperature of the EmbryoScope time-lapse incubator are provided.

Temperature in the well of the EmbryoSlide culture dish

The slide holder provides the heating system of the EmbryoScope time-lapse incubator. The slide holder accurately regulates the incubation temperature from a heat-foil inlay that is mounted in the slide holder core.

Precise and accurate measurement of the temperature in the position where the embryo is located within the micro well of the EmbryoSlide culture dish requires a special purpose tool.

We have performed accurate temperature measurements using a precision micro sensor with a diameter of 0.7 mm and accuracy of ± 0.1 °C (*Micro YSI sensor probe MEAS 555, Technomed Europe*).

The micro sensor was placed in the EmbryoSlide culture dish less than 0.3 mm from the bottom of the micro well. The micro sensor was mounted in different wells of the dish, and temperature measurements were performed on all 6 positions of the slide holder, and on several different EmbryoScope time-lapse incubators.

For each temperature test, the YSI micro sensor temperature was continuously measured for 18-72 hours. The table below shows the results for the temperature in the micro well at a slide holder core temperatures of 37.2°C and of 37.1°C.

N	Slide holder core temperature (°C)	Micro YSI probe MEAS 555 avg temperature (°C (±S.D.))
35	37.2	37.09 (±0.06)
6	37.1	36.88 (±0.04)

Based on these experiments the temperature difference between the slide holder core and the bottom of the micro well where the embryo resides was estimated to be 0.2°C.

In conclusion, when external validation of the incubation temperature is performed the temperature measured directly in the slide holder core should be 0.2°C higher than the temperature set-point. For example, at a temperature set-point of 37.0°C, the slide holder core temperature should be 37.2°C as this setting will give a temperature in the bottom of the micro well of 37.0°C.

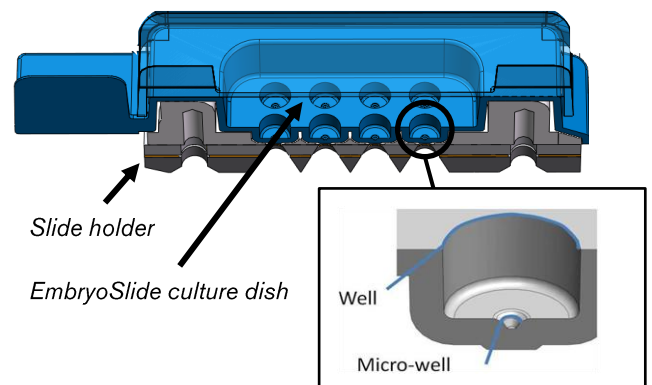


Figure 1: Image shows a cross section of the EmbryoSlide culture dish (blue) placed at the slide holder (grey) and an enlarged well with the central depression (micro well) where the embryo is placed.

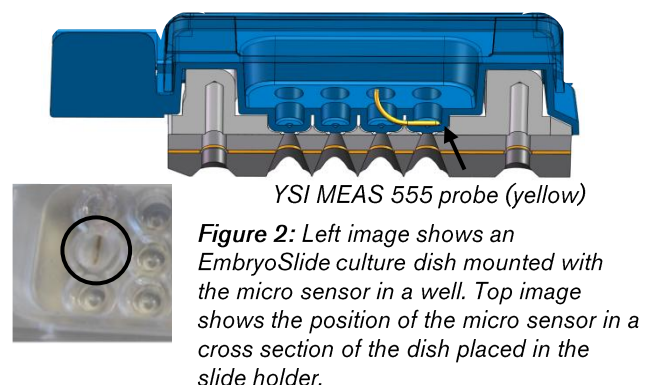


Figure 2: Left image shows an EmbryoSlide culture dish mounted with the micro sensor in a well. Top image shows the position of the micro sensor in a cross section of the dish placed in the slide holder.

Incubation temperature, external validation and calibration

For details on how to change the temperature set-point (SP) and to perform external validation and calibration please refer to the following sections of the EmbryoScope time-lapse system user manual:

- *Changing temperature set point*
- *Validate temperature*

External temperature validation is performed by measuring the temperature in the slide holder. The temperature is validated with a calibrated temperature sensor inserted into a hole in the slide holder. Any certified temperature sensor with proper sensor dimensions may be used according to the manufacturer's guidelines. However, the hole in the slide holder is designed specifically for use with a micro sensor (YSI 4611 probe) in combination with the YSI 4610 precision thermometer. The temperature probe must be completely inserted into the hole to ensure correct measurement of the core temperature of the slide holder.
- *Calibrate temperature*

Calibration of the temperature is performed in the menu of the incubator display. The temperature must be calibrated on the incubator display so the reading of the YSI from the slide holder core is $SP+0.2 \pm 0.05^{\circ}\text{C}$.

It is the user's responsibility to validate the performance of the EmbryoScope time-lapse incubator by doing regular quality control checks of the temperature and the gas concentrations.

