

**Accuracy Study for the Welch Allyn®  
Model 692/690 SureTemp® Plus  
Oral, Adult Axillary, and Rectal Thermometer**

**WelchAllyn®**



## Accuracy Study for the Welch Allyn® Model 692/690 SureTemp® Plus Oral, Adult Axillary, and Rectal Thermometer

### Summary:

*Clinical accuracy studies were performed using the SureTemp® Plus in the oral, adult axillary (18 years and older), and rectal modes. Over 220 temperature measurements were obtained from over 8 clinical sites. Thirty percent of all data represent fevers. Temperatures ranged from 93.7° F (34.27° C) to 105.0° F (40.55° C). Subjects ranged in age from 7 months to 87 years. Accuracy results for each site (oral, adult axillary, and rectal) are listed below. For the combined data, the average error is -0.05° F (-0.027° C) with a Standard Deviation of 0.355° F (0.197° C) (Table 1).*

### Definitions:

**Monitor Mode Temperature:** Monitor mode is a function of an electronic thermometer used to monitor a temperature reading until it reaches the thermal steady state. The thermal steady state for oral and rectal temperatures is reached in approximately three minutes. The thermal steady state for axillary temperatures is reached in approximately five minutes.

**Predicted Temperatures:** Predicted temperatures are from any thermometer that renders a temperature reading before the steady state is achieved. Predictive thermometers reduce the time required for measurement by predicting what the temperature would be if the probe were left in the site until steady state is reached.

**Fever:** For the purposes of this study, fever is defined as any temperature equal to or greater than 100.0° F (37.77° C).

**Data set:** A data set is defined as a predicted temperature followed by a three-minute (oral and rectal) or a five-minute (axillary) monitor mode reference temperature.

### Overview:

Normal body temperature in a healthy person is a range that fluctuates throughout the day. Body temperature can vary as much as 1° F to 2° F (0.5° C to 1.0° C) over a twenty-four hour period. Body temperature is

lowest in the morning (2-4 am) while resting and warmest in the afternoon (4-6 pm) while active. Body temperature is regulated by the hypothalamus, which continually adjusts temperature to stay within a set range of normal in the absence of illness (Table 2). Fever is defined as a temperature above an individual's range of normal.

Fever has always been recognized as an indication of illness. Today, in every clinical setting, the primary purpose for taking a patient's temperature is to screen for fever and to follow its course. Timely, accurate temperature measurement has always been an essential part of patient assessment.

Thermometer technology has changed over recent years. Temperature taking is FAST and clinicians must rely on a thermometer's accuracy to make important and informed decisions for patient care.

The purpose of this clinical paper is to summarize the studies performed to demonstrate the accuracy of the Welch Allyn® SureTemp Plus thermometer in the oral, adult axillary, and rectal predictive modes.

### Materials and Methods:

Six critical care nurses, trained on the use of the SureTemp Plus, collected the data. All thermometers and probes were tested for accuracy before and after the study in a stirred water bath at three different temperatures as per ASTM testing standards.

Over 220 data sets were collected, with 30% of all data defined as febrile. For each subject, an initial oral, adult axillary, or rectal temperature was taken in the predict mode. Once the temperature was recorded, the probe was left in place and the thermometer was switched to the monitor mode for three minutes (oral and rectal) or five minutes (adult axillary) to establish a reference temperature. A direct comparison was then made between each predicted temperature and the corresponding reference temperature for each data set.

### Data Analysis:

Data were analyzed by comparing each subject's predicted temperature to the corresponding three or five-minute monitor mode reference temperature.

## Results:

### Oral Data

Oral temperatures ranged from 97.1° F (36.16° C) to 102.6° F (39.22° C). The total number of data sets were 91, with 27 of those being febrile. Subjects ranged in age from 11 years to 87 years. The average error was -0.03° F (-0.016° C) with a Standard Deviation of 0.358° F (0.198° C).

### Adult Axillary Data (18 years and older)

Adult Axillary temperatures ranged from 93.7° F (34.27° C) to 105.0° F (40.55° C). The total number of data sets were 92, with 29 of those being febrile. Subjects ranged in age from 18 years to 85 years. An equal number of adult axillary data sets were collected from three age groups: 18 years to 30 years, 31 years to 60 years, and 65+ years. The average error was -0.10° F (-0.055° C) with a Standard Deviation of 0.373° F (0.207° C).

### Rectal Data

Rectal temperatures ranged from 97.1° F (36.16° C) to 102.9° F (39.38° C). The total number of data sets were 40, with 12 of those being febrile. Subjects ranged in age from 7 months to 79 years. The average error was 0.01° F (0.005° C) with a Standard Deviation of 0.290° F (0.160° C).

## Conclusion:

Statistically, analyses show no clinically significant differences between the predicted temperatures and the monitor mode reference temperatures from the SureTemp Plus in the oral, adult axillary, and rectal modes. The researchers of this study support the use of this thermometer in today's fast-paced clinical setting. The accuracy and speed of the device provides clinicians with an added level of confidence when assessing and caring for their patients.

**SureTemp® Plus Monitor Mode  
Temperature vs. Predicted Temperature  
Oral, Adult Axillary, and Rectal Modes**

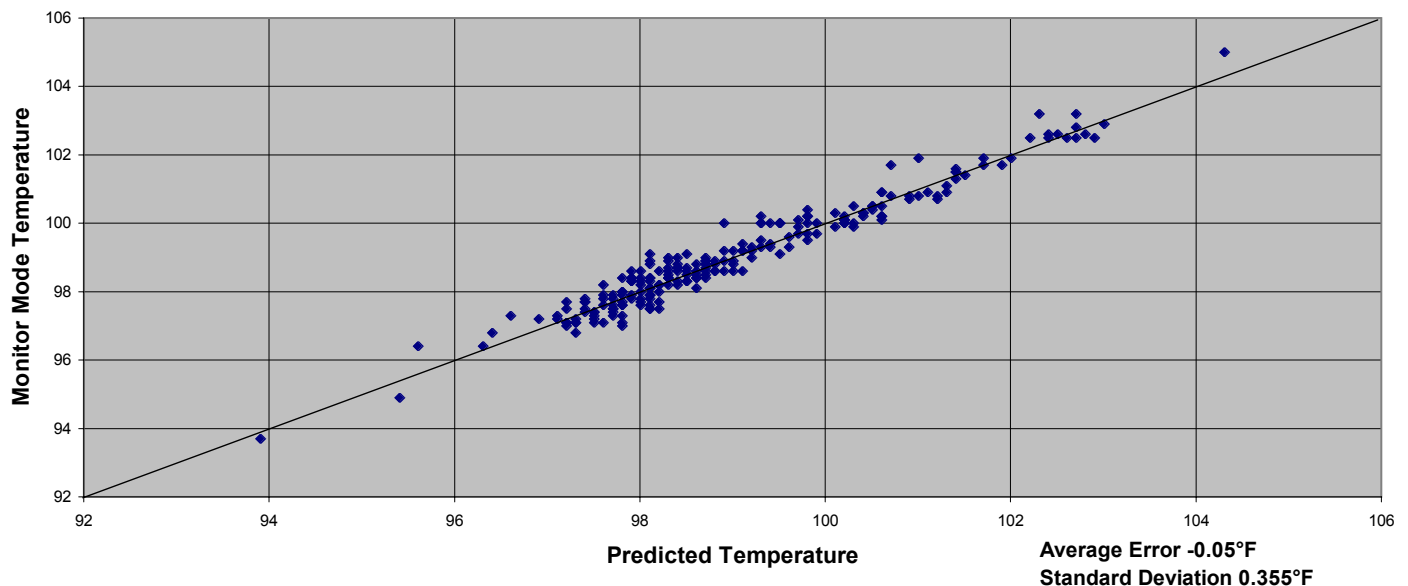


Table 1

## Normal Body Temperature Ranges

°F	0 - 2 years	3 - 10 years	11- 65 years	> 65 years
Oral	—	95.9 — 99.5	97.6 — 99.6	96.4 — 98.5
Rectal	97.9 — 100.4	97.9 — 100.4	98.6 — 100.6	97.1 — 99.2
Axillary	94.5 — 99.1	96.6 — 98.0	95.3 — 98.4	96.0 — 97.4
Ear	97.5 — 100.4	97.0 — 100.0	96.6 — 99.7	96.4 — 99.5
Core	97.5 — 100.0	97.5 — 100.0	98.2 — 100.2	96.6 — 98.8

*Table 2*

Normal body temperature is a range. This table shows that normal temperatures vary by site. Therefore, readings from different sites, even if taken at the same time, should not be directly compared.

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