ThermoScan®

One Second Ear Thermometer

Model: PRO 3000

Service Manual

Part Number 501671A

Refer to the Pro 3000 Operator's Manual for warranty information.

The information and specifications contained within this service manual are subject to change without notification.

Printed in the U.S.A.

ThermoScan

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Chapter 1
General Information

1.1 Introduction

This technical manual contains information for maintaining the Braun ThermoScan® Pro 3000 NA Thermometer – Type 6014.

This manual is not intended to support in-field repair but to provide information and reference only.

Refer to the Operator's Manual for complete information regarding the setup and operation of the thermometer.

The thermometer must not be disassembled as the warranty will be voided and calibration and accuracy may be affected. The only user service functions currently available are window cleaning, battery replacement, and accuracy verification with a Braun ThermoScan Infrared Temperature Reference - Model No. BB 3200.

Any attempt to service the thermometer by anyone other than an authorized Braun ThermoScan service representative may invalidate the warranty.

1.2 Principle of Operation

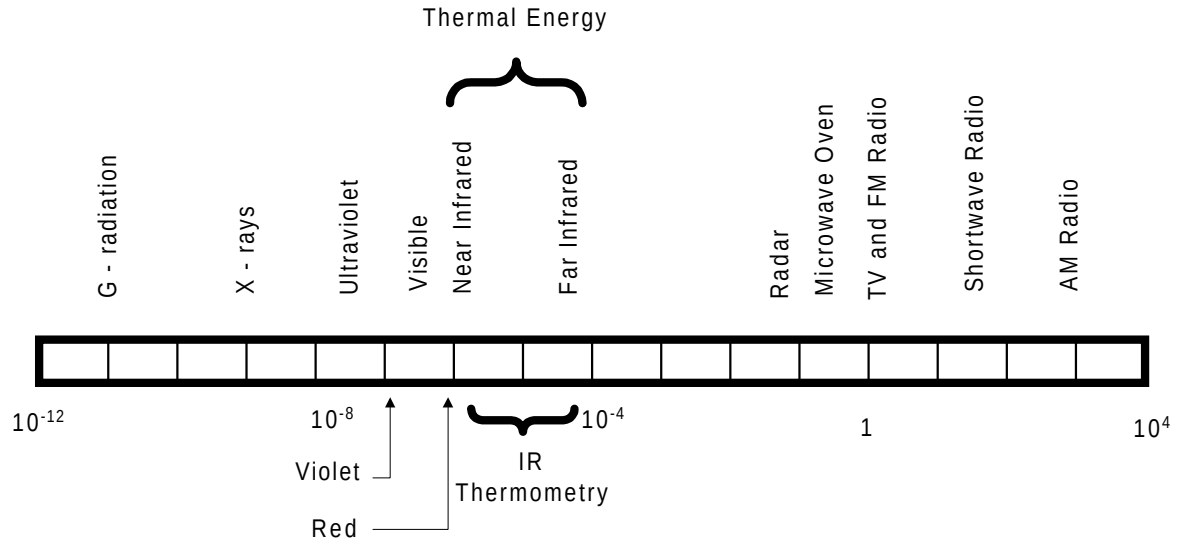
1.2.1 Infrared Energy

The Pro 3000 One Second Ear Thermometer operation is based on the detection of thermal (infrared) energy. Any material object emanates electromagnetic waves from its surface. Everything around us, and we ourselves, are sources of electromagnetic energy. The cooler the object, the lower the frequency of the electromagnetic waves and the less energy they carry. The hotter the object, the shorter the wavelength and the more energy the waves carry. Thus, the intensity of electromagnetic energy represents the temperature of the object from which it emanated.

The energy emanated from surrounding objects and from our bodies carries relatively low energy and is absolutely harmless. Its wavelength range (4 microns and longer) is situated beyond the longest waves we can see (red) and carries energy below that of red. (Refer to Figure 1-1 “Electromagnetic Spectrum".) That is why this energy is called infrared (meaning - below red). This energy is just another type of light well beyond the capabilities of our eye. While we cannot see infrared light, we can feel it with our skin. The heat we feel at a distance from a warm stove is caused by infrared energy. As any other electromagnetic energy, infrared propagates with the speed of light. Infrared energy emitted from the tympanic membrane and surrounding tissues provides an excellent

measurement of the body's temperature because the tympanic membrane shares its blood supply with the hypothalamus, the area of the brain that regulates body temperature.

Figure 1-1 *Electromagnetic Spectrum*



1.2.2 How the Pro 3000 Works

Operation of the thermometer is based on the detection and measurement of thermal, infrared energy that is naturally radiated from the human body. Any material object with a temperature above absolute zero emanates thermal electromagnetic waves from its surface.

Special instruments are needed to measure infrared energy. A thermographic camera converts thermal images from the infrared spectral range into the visible spectral range so we can see them. The thermometer works in a similar way, as these thermal images are related to the temperature of an object. By measuring the infrared energy from the tympanic membrane and surrounding tissue, the thermometer can calculate the temperature of these surfaces and display it as actual ear temperature.

1.3 Features

The Pro 3000 Thermometer takes fast, accurate, and safe temperatures in one second. Use this table to view the thermometer's features.

Table 1-1 *Thermometer Features*

	Pro 3000 NA
Expected Min. Number of Temperatures within Life-span	100,000
Measurement Time	1 second
Accuracy	ASTM over ambient temperature range at 50°F - 104°F (10°C - 40°C)
Ambient Temperature Range	50°F - 104°F (10°C - 40°C)
Displayed Temperature Range	68°F- 108°F (20°C - 42.2°C)
Time Between Readings	2 seconds
Battery Type and Expected Life	2 x CR2032 (Lithium) 5,000 temps (6 months heavy use)
Display Mode	“EAR” in °C or °F
Probe Window	Hard Window
Disposable Probe Cover	Yes
Probe Cover Ejector	Yes
Probe Cover Detector	Yes
Beep	1 second after activation button is depressed. Also, indicates error conditions
Shock Resistant Cover	Yes

1.4 Construction

The thermometer is housed in a shock resistant case. The case is constructed with a main housing and a front panel which are snapped together and secured by two screws. The shell houses a double-sided PCB with an opto-mechanical assembly attached to its upper portion. The assembly is a prefabricated device which contains the thermopile sensor, ambient temperature sensor, the gold barrel, and the speculum. Both sensors are mounted in the same housing and close to each other. This ensures a good thermal coupling and mechanically stability. Disassembly of the device must be avoided as it may result in a misalignment of optical components and loss of calibration. The battery compartment is located under a door near the bottom of the instrument

1.5 Infrared Temperature Reference

To verify the accuracy of infrared tympanic thermometers, a precision infrared source which simulates the infrared characteristics of the human ear canal is required. One near-ideal infrared source is an instrument known as a "blackbody" due to the total "blackness" of its cavity at normal room temperatures. A "blackbody" is a good "artificial ear" because it is capable of maintaining stable temperature settings and, like the human ear, has high emissivity.

The BB 3200 (120V and 230V) Infrared Temperature References are cavity-type blackbodies specially designed for ThermoScan Thermometers. The BB 3200 has a 104°F (40°C) temperature setting. The typical emissivity of the instrument is 0.990 ± 0.002.

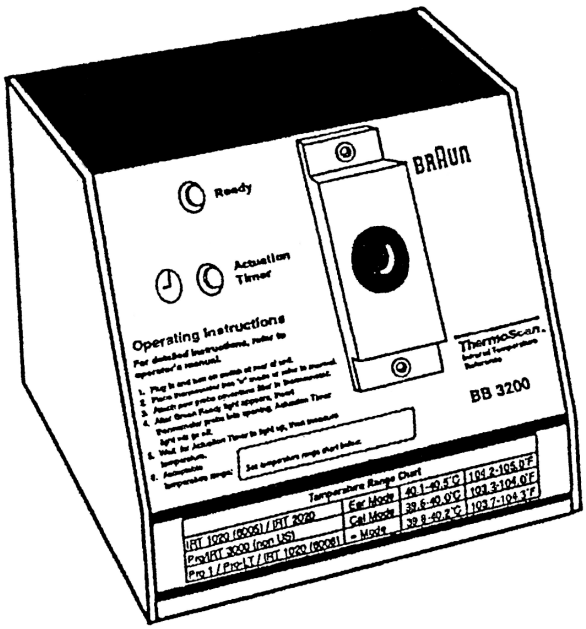
1.6 Specifications

Accuracy Meets American Society for Testing and Materials (ASTM) Standard E1965-98	96.8°F – 102.2°F …….± 0.4°F 36°C – 39°C …….± 0.2°C Outside this range: ……..±0.5°F (±0.3°C)
Automatic "Power Down":	30 seconds if no temperature taken
Battery Life:	5,000 temperatures (6 months heavy use)
Battery Type:	2 x CR2032 (Lithium) (Nominal capacity of battery is 170mA)
Case:	Durable, lightweight, plastic
Dimension:	6.4" x 1.7" x 1.2" (16.3 cm x 4.4 cm x 3.1 cm)
Measurement Time:	1 second
Min. Time Between Readings:	2 seconds
Relative Humidity: Storage, Shipping, and Operating	Up to 95% relative humidity, non-condensing
Resolution:	0.1°F or °C
Shock Resistance:	Withstands 1 meter drop
Temperature Range:	Patient: 68°F to 108°F (20°C to 42.2°C) Ambient: 50°F to 104°F (10°C to 40°C) Storage: -4°F to 122°F (-20°C to 50°C)
Weight: (without batteries)	3.5 ounces (100 grams)

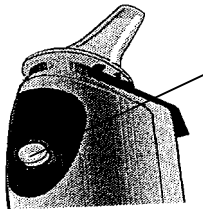
1.7 Accessories

Figure 1-2 *Pro 3000 Base (shown with thermometer and probe covers, not included)*

Figure 1-3 *Infrared Temperature Reference*
Model No. BB 3200 (120V & 230V)

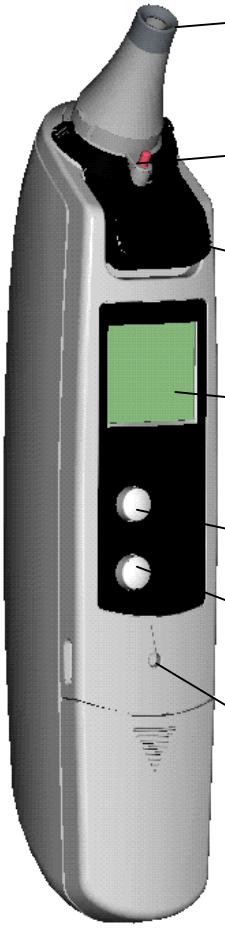


1.8 Controls and Display



Activation Button

Takes a temperature reading after a new probe cover is installed and the button is depressed until a beep tone is heard



Probe Window

Provides protection for the sensitive components of the optical pathway while allowing heat waves to pass through.

Probe Cover Detect Switch

Detects probe cover before allowing to take a temperature and powers up the unit after change of probe cover.

Probe Cover Eject Button

Ejects used probe covers.

LCD Display

Displays patient temperature, user messages and error messages.

Light Button

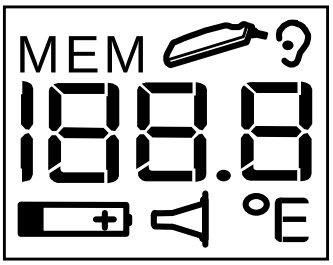
Activates the display light.

On/Mem Button

Powers up the thermometer and also allows the user to enter the memory mode.

Battery Door Lock

To prevent children from accessing the batteries.



LCD (All segments shown)

Table 1-2 Common Abbreviations

A/D	analog to digital
ADC	analog to digital converter
ASIC	application specific integrated circuit
°C	degrees Celsius
cm	centimeter
COB	chip on board
DC	direct current
EEPROM	electrically erasable programmable read only memory
°F	degrees Fahrenheit
Hz	hertz
I	current
in	inch
IR	infrared
kHz	kilo hertz
LCD	liquid crystal display
LED	light emitting diode
µA	micro ampere
µm	micro meter
µP	microprocessor
mA	milli ampere
ms	milli second
PCB	printed circuit board
V	volt

Chapter 2
Functional Description

2.1 Introduction

The Pro 3000 One Second Ear Thermometer is comprised of the essential components depicted in the simplified block-diagrams of Figure 2-1 “Pro 3000 Sensor Unit” and Figure 2-2 “Pro 3000 Electrical Diagram.” The sensor unit of the thermometer includes a gold plated wave guide which is called the barrel, the outer end of which is covered by a protective probe window and the sanitary disposable probe cover. The other end of the wave guide is placed near the sensor window.

Signals from both sensors are multiplexed in the Analog Multiplexer Circuit and are converted into digital form in the integrating A/D converter. The signal from the A/D converter is fed into the microprocessor (μP) which calculates the temperature of the target (patient) and sends it to the LCD. The “Ear” mode (“=Oral” on ThermoScan Pro-1 thermometer) is calculated by adding a clinically documented offset temperature to the measured temperature adjusted for variations in ambient conditions.

The thermometer is designed to operate correctly only when specially designed probe covers are attached. The unit is calibrated for use with a probe cover installed.

During the measurement, the probe is positioned in the ear canal using standard otoscopic technique to get a direct view of the tympanic membrane. To take a temperature, the operator depresses the activation button to activate the activation switch. The switch initializes a data acquisition cycle through the μP.

The infrared radiation emanated from the tympanic membrane passes on to the thermopile detector. The detector converts heat flow into electric voltage (V), which is digitized in the A/D converter.

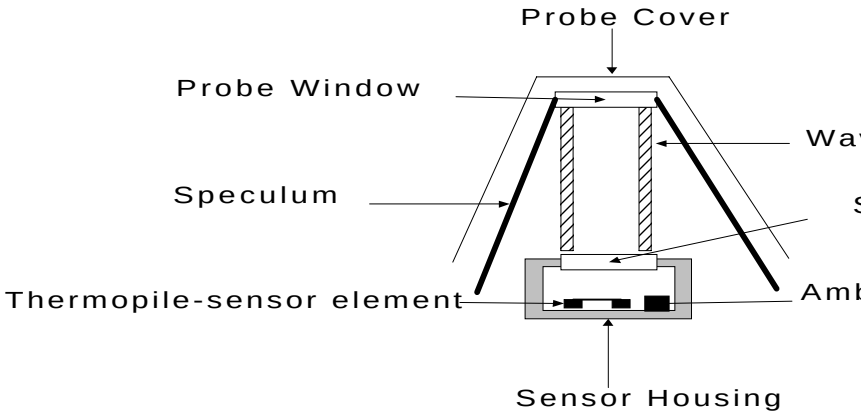
The microprocessor performs many auxiliary functions, such as self-diagnostics and battery check, etc.

2.2 Sensor Unit

The thermometer is a precision optoelectronic instrument which operates in the far infrared spectral range. During its operation, it collects infrared radiation from the tympanic membrane and surrounding tissues, converts it into electric signals, processes the signals, calculates and displays the patient temperature. Because calculating precise temperature is directly related to precise measurement of infrared radiation, the front-end optical components of the thermometer are critical for its accuracy.

There are six essential components in the sensor unit: the Probe Cover, the Probe Window, the Wave-guide (Barrel), the Sensor Window, the Infrared Sensor, and the Ambient Sensor.

Figure 2-1 *Pro 3000 Sensor Unit*



2.2.1 Probe Cover

The Probe Cover is a low cost disposable polypropylene resin shield which is placed over the probe to protect patients from cross-contamination and ensure cleanliness of the front window. The cover is fabricated of a polymer film whose chemical structure is optimized for the best thermal and optical performance in the far infrared spectral range. After a temperature measurement, the probe cover usually becomes soiled with cerumen (ear wax), either in the form of loose debris or as a "stain" which can affect subsequent readings. Therefore, to assure high accuracy and sanitary practice, a **new** probe cover **must** be used every time a temperature is taken, even on the same patient.

2.2.2 Probe Window

The probe window is made of silicon. **It is essential to keep the probe window clean and free of any dirt, including fingerprints.** Refer to section 3.2.2 for specific cleaning instructions. **To protect the probe window, always keep the thermometer in the storage cover when it is not in use.** The probe window must be protected against physical damage. Nicks, cracks, scratches or chips may affect transparency and accuracy. **The unit must be returned to an authorized Braun ThermoScan Service Center for service/exchange.**

2.2.3 Wave Guide (Barrel)

The Barrel is an optical wave guide which is fabricated of copper whose thermal properties are optimized for the instrument's operation. The barrel is a hollow tube which is highly polished inside. To form a tubular infrared mirror, it is given a layer of optical quality gold. The inside of the barrel must be absolutely clean to assure accurate temperature measurements. The front window is permanently attached to the barrel and cannot be removed. The barrel must be protected against any physical damage. Nicks, dents or bends may affect the accuracy. **The unit must be returned to an authorized Braun ThermoScan Service Center for service/exchange.**

2.2.4 Sensor Window

The Sensor Window is an infrared filter and has the capability to transmit only radiation with wavelengths above 5 μm. The window is positioned behind the barrel and can not be accessed without disassembling the thermometer. **The unit must be returned to an authorized Braun ThermoScan Service Center for service/exchange.**

2.2.5 Infrared Sensor

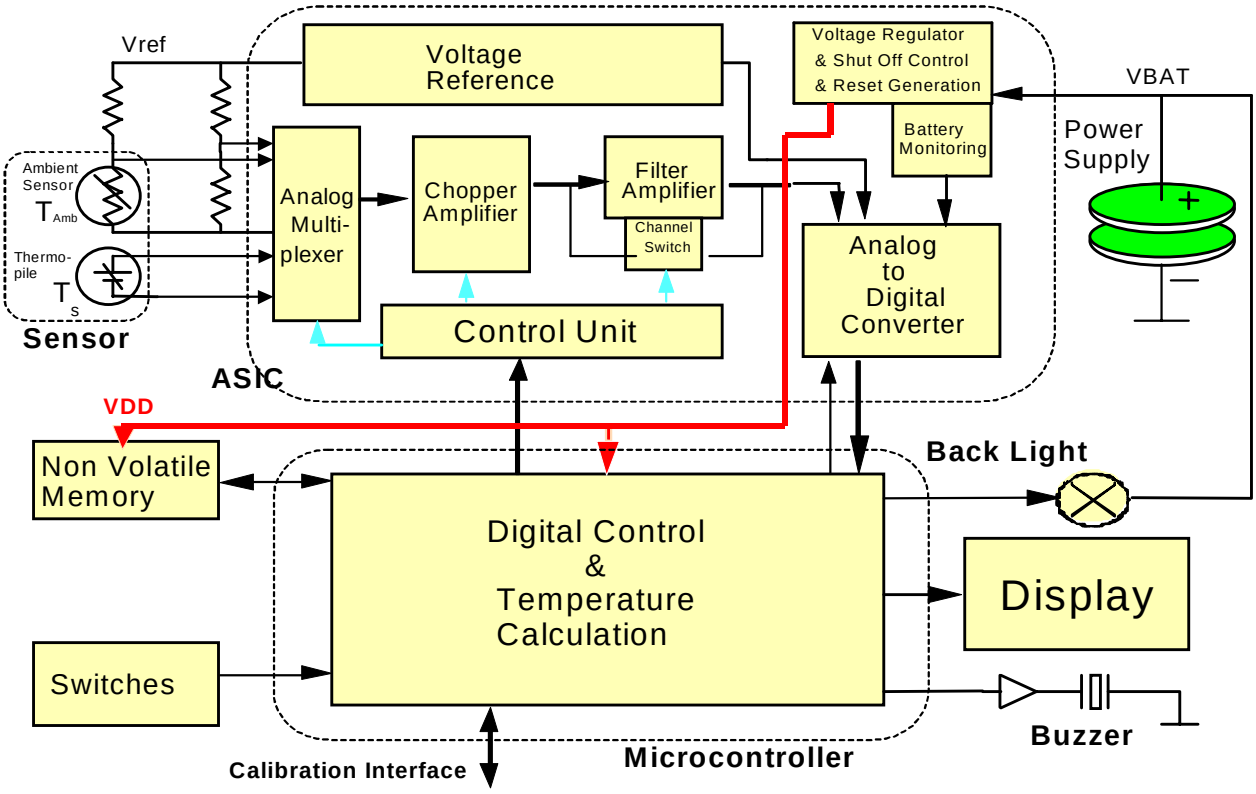
The infrared sensor is a silicon micromachined thermopile sensor. This sensor provides an output voltage which is proportional to the intensity of the radiation impinging onto the sensor element.

2.2.6 Ambient Temperature Sensor

Close to the infrared sensor the ambient sensor element, a spreading resistance sensor, is mounted. For further explanation see 2.3.2.

2.3 Electronic Circuits

Figure 2-2 *Pro 3000 Block Diagram*



2.3.1 Power Supply

The thermometer is powered by two lithium batteries (CR 2032). The battery life of the system is designed to achieve at least 5,000 measurements during six months before reaching the low battery voltage limit under the following conditions:

- Nominal battery capacity of 170 mA
- 30 seconds power off time
- Probe cover mounted during storage

2.3.2 Sensors

The thermopile and an ambient temperature sensors are needed to measure the absolute temperature of an object (target). Both are mounted in the same housing and are close to each other which ensures a

good thermal coupling and mechanical stability. The thermopile outputs a polarized DC voltage, which depends on the difference between the target temperature and the thermopile temperature itself.

The sensor and the barrel are optically adjusted. Any repositioning of these components requires an adjustment of the instrument. **The unit must be returned to an authorized Braun ThermoScan Service Center for service/exchange.**

2.3.3 Application Specific Integrated Circuit (ASIC)

2.3.3.1 Battery Monitoring Circuit

The battery voltage is monitored through this circuit during the unit power up sequence, during activation of the display backlight and immediately after each temperature reading.

2.3.3.2 Voltage Regulator and Shut Off Control

The voltage regulator supplies a stable operating voltage for all electrical components of the unit, except for the buzzer and the backlight LED. The output voltage is approximately 4.0V ±10%. A shut off control circuit is functionally combined with the regulator and will shut off all the components when the battery voltage drops below a certain limit. The shut off feature is to prevent the thermometer from operating outside of the specified voltage range in case of installing almost discharged batteries.

2.3.3.3 Power-On Reset

A Power-On Reset signal is provided to ensure that the microprocessor will be initiated in a known logical state upon power-up. This signal is generated when batteries are inserted or when the shut off control circuit is activated.

2.3.3.4 Analog Multiplexer

The analog multiplexer connects different input signals to the amplifier. This is controlled by the microprocessor.

2.3.3.5 Amplifier

Small sensor output signals need to be amplified by a low noise, high input resistance amplifier. This performance is accomplished by using a chopper technique in combination with an instrumentation amplifier in the first stage. A second amplifier stage provides amplifier and filter function in combination. The filter suppresses the voltage spikes which are parasitically generated by the previous chopper demodulator. The second amplifier provides a switchable gain factor correlated to the selected input channel.

2.3.3.6 Voltage Reference

The voltage reference supplies a precision voltage to both the Analog to Digital Converter (ADC) and the resistor bridge.

2.3.3.7 Analog To Digital Converter (ADC)

The analog-to-digital converter provides at least 13 bits of resolution at a conversion time of 100ms maximum. Its operation is based on the basis of the charge balancing principle. The ADC requires a clock signal with a frequency of approximately 200 kHz.

2.3.3.8 Control Unit

The Control Unit provides the means to control the particular functional blocks of the ASIC. This circuit accommodates frequency dividers, for example, to provide the ADC and the chopper modulator and demodulator with the appropriate clock frequency. It decodes the binary coded channel selection signals and controls the multiplexer and gain factor switches.

2.3.4 Microcontroller

The Samsung KS57C2408A is a single-chip, masked 4-bit microprocessor. Distinctive features of the microprocessor are described as follows:

- Package: 80 pin chip on board
- Memory size: 512 X 4 bit RAM
  8192 X 8 bit ROM (program)
- Single operating power supply: 2.7V to 6V
- LCD controller driver (possible 98 segments)

The microcontroller's tasks are as follows:

- Provide status on the specified LCD
- Monitor switch inputs
- Communicate with calibration equipment
- Interface a non volatile memory
- Provide the ASIC clock and control signals
- Process data in the temperature algorithm and display that data on the LCD as a numerical temperature reading in degrees Celsius or Fahrenheit.

2.3.5 Non Volatile Memory

A non volatile memory is used for permanent storage of calibration and serial number information, and temporary storage of temperatures or other features.

2.3.6 Switches

There are four (4) switches in the Pro 3000 thermometer.

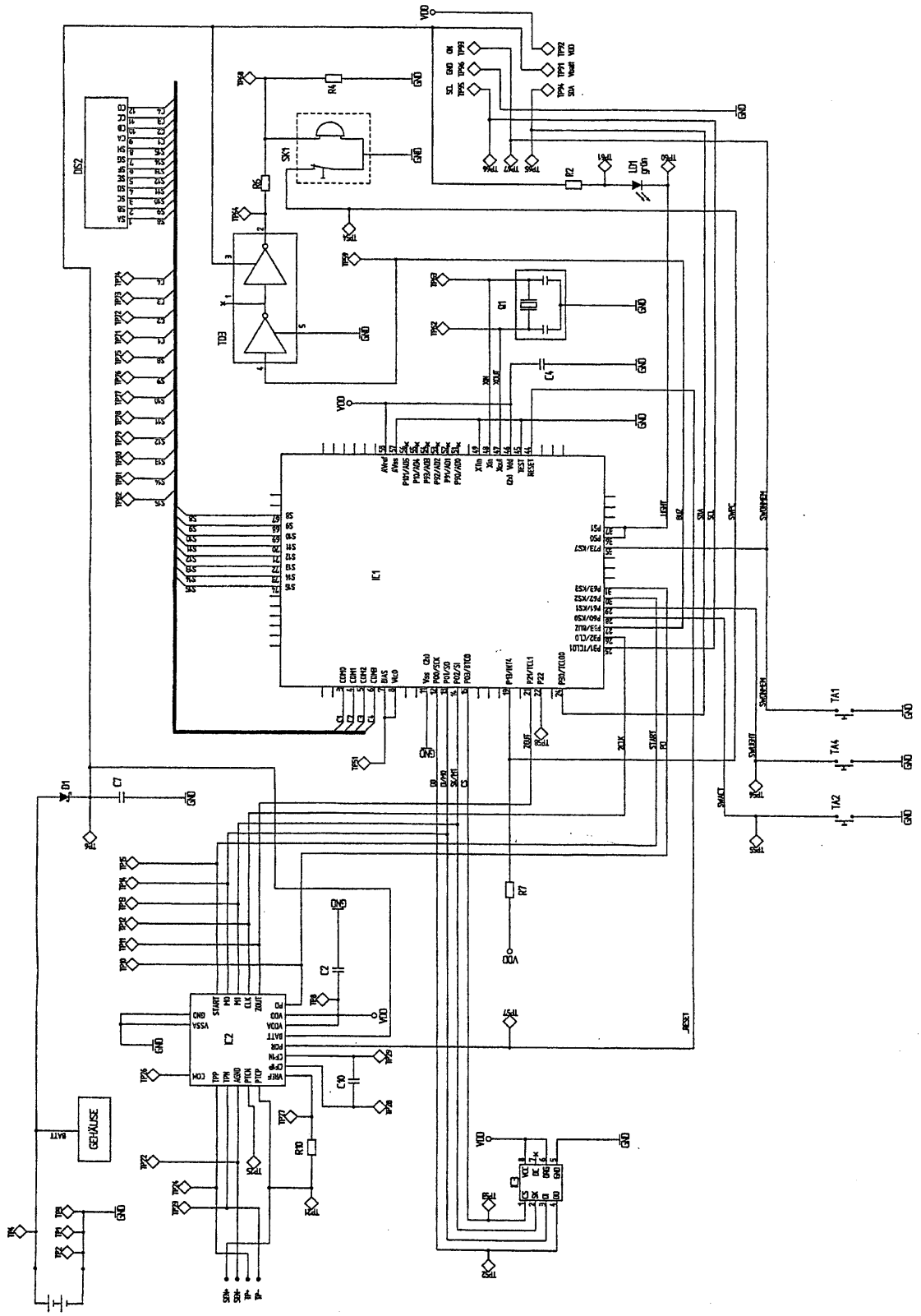
1. ON/MEM switch (SW1) has functions to power up the thermometer and to enter the memory mode.

2. ACTIVATION switch (SW2) has functions to initialize a measurement cycle upon activation. An additional function of the switch is to control the "CAL" test mode. This test mode allows thermometer to take a temperature in the Infrared Temperature Reference without a probe cover installed.

3. PROBE COVER DETECT switch (SW3) has functions to power up the thermometer and to detect the installation of the probe cover over probe window of the thermometer.

4. LIGHT switch (SW4) controls backlights for the LCD display and is disabled by the microcontroller during actual temperature taking to ensure stable power supply for temperature measurement.

Figure 2-3 *Pro 3000 Schematic*



Chapter 3
Preventive Maintenance

3.1 Introduction

Servicing of the thermometer in the field is not authorized except user service functions, i.e. window cleaning, battery replacement, and accuracy verification with a Braun ThermoScan Infrared Temperature Reference - Model No. BB 3200. **Contact Braun ThermoScan or authorized service center for other service.**

3.2 Cleaning

3.2.1 Thermometer

The Pro 3000 cannot safely withstand environmental factors beyond the limits as specified in section 1.6 “Specifications." **Do not autoclave or immerse thermometer.**

The plastic case may be cleaned with a soft cloth dampened with alcohol or mild detergent and warm water. **Do not use solvent or other corrosive agents for cleaning.** Avoid wiping the instrument in a manner that could result in moisture getting into the thermometer. Always keep water and moisture away from the thermometer interior.

Battery contacts must be kept clean of flux, dust, oxides and other soiling coatings which may affect electrical conductivity. If contacts become dirty, they may be cleaned with electronic cleaning liquids without Freon content. Freon may damage the external plastic parts. "Contact Re-Nu" MS-230 from Miller-Stephenson, or equivalent is recommended.

3.2.2 Probe Window

If the probe window becomes dirty, gently wipe its surface with a cotton swab slightly moistened with alcohol and immediately wipe dry with a clean cotton swab.

After wet cleaning of the probe window, allow at least 5 minutes drying time before taking temperatures. Any liquid applied to the probe window will lower its temperature due to evaporation and propagation along the outside walls of the wave guide. Avoid touching the probe window except when cleaning is required.

Never use Clorox®, Bleach, Betadine®, Iodine, or any colored liquids as they may penetrate the probe window surface and reduce transparency and impact accuracy.

If the probe window is damaged, **the unit must be returned to Braun ThermoScan or an authorized service center for service/exchange.**

3.3 Inspection Guidelines for Users

Refer to the Operator's Manual for complete operating instructions prior to taking temperatures with the Pro 3000. If you have questions, call Braun ThermoScan's Customer Support department at 1-800-327-7226 in North America or contact Braun outside North America.

3.3.1 Every Use

Visual inspection should be performed by the end user (nurse, medical assistant) each time the thermometer is used. Check the probe window for any dirt or damage. Clean, if necessary, as detailed in section 3.2.2 "Probe Window."

Note: To assure a high level of accuracy, it is very important to keep the probe window clean, dry, and undamaged at all times.

3.3.2 Battery Change Message

The batteries should be changed when the "battery" symbol first appears. When the batteries are removed, check the contacts. If they appear dirty, clean as specified in section 3.2.1. Replace batteries as directed in the Operator's Manual.

3.4 Inspection Guidelines for the Biomedical Department

3.4.1 Laboratory Accuracy

Laboratory accuracy should be verified whenever the clinical accuracy of the thermometer is questioned. Use the Model BB 3200 Infrared Temperature Reference to verify laboratory accuracy after visual inspection, cleaning the probe window and attention to proper technique is addressed.

If the hospital has a BB 3200, the biomedical department should establish a routine schedule for verifying laboratory accuracy. This can be monthly, quarterly, semiannually or annually depending on the policies of the department.

When using the Infrared Temperature Reference, the thermometer must be checked in the Calibration Check Mode (represented by the "CAL" mode.) This mode sets the thermometer to display the actual temperature of the Infrared Temperature Reference without the addition of any offset. The range of acceptable readings are 103.3°F to 104.0°F or 39.6°C to 40.0°C.

To enter the “Calibration Check Mode”, perform the following steps:

1. Wait until the thermometer is in Standby mode (screen is blank.)
2. Press down and hold the Activation button (do not release until step 4!)
3. Press the ON/Mem button.
4. “CAL” will be displayed on the LCD after the self check sequence with a 1Hz flashing rate.
5. Release both buttons.
6. Install probe cover then use the thermometer as usual.

   Note: “CAL” will be displayed flashing with 1 Hz, even if a temperature has been taken. Pro 3000 will automatically exit Calibration Check mode when unit enters Standby mode which is about 4 minutes.

The BB 3200 Infrared Temperature Reference should be returned to Braun ThermoScan’s Technical Service Center for calibration as specified in the BB 3200 Operator’s Manual, or sooner if a problem is suspected. Refer to return policy as stated in the Operator’s Manual.

3.4.2 Adjustment

Adjustment of a thermometer is necessary only if the Infrared Temperature Reference readings demonstrate out of range readings.

Adjustment of the thermometer is accomplished through special hardware and software. The unit contains no internal adjustments. All adjustments or other servicing of thermometers and the Infrared Temperature Reference must be performed by an authorized Braun ThermoScan Service Center.

3.5 Service/Technical Inquiries (United States and Canada)

Should service be required during or after the warranty period, call Braun ThermoScan's Technical Service Center at (800) 327-7226 to obtain an Authorization number. Repackage the thermometer carefully in its original box or any sturdy carton with enough packing material to prevent damage. Include a note describing the problem, Authorization number, return address, and telephone number. For your protection, we also suggest that you ship your package in a traceable and insured manner.

Send the instrument, postage prepaid, to:

Braun ThermoScan Inc.

Attention.: Auth. # _____ (Authorization Number)

10421 Pacific Center Court
San Diego, CA 92121-4339
U.S.A.

Answers to questions regarding operation of the Braun ThermoScan Pro 3000 Thermometer may be obtained by calling us toll free at:

(800) EAR-SCAN
(800) 327- 7226

Monday-Friday 6:30 A.M. to 5:00 P.M. Pacific Time
www.braun.com

Other than United States and Canada: Contact your regional Braun ThermoScan authorized service center.

Chapter 4
Troubleshooting

4.1 Introduction

Refer to the Braun ThermoScan Warranty before servicing the thermometer. Any attempt to service a Braun ThermoScan thermometer by anyone other than an authorized Braun ThermoScan service representative may invalidate the warranty. **Should service be required during or after the warranty period, contact your Braun ThermoScan Technical Service Center. See Section 3.5 "Service/Technical Inquiries (United States and Canada)".**

4.2 Possible Malfunctions

Functional problems with the thermometer may be separated into three groups depending on the complexity and specialized test equipment and tools required for their corrections:

- may be corrected by the end user
- may be corrected by a Biomedical Department
- may be corrected at an authorized ThermoScan Service Center only

Most of the problems which may be corrected by the end user are covered in the Operator's Manual. The list below embraces problems which require professional qualifications of a biomedical technician or engineer to correct.

Before doing a more thorough diagnostic of a possible malfunction, check the Troubleshooting Section in the Operator's Manual for the existence of a simple solution.

Table 4-1 *Troubleshooting*

SYMPTOMS	POSSIBLE PROBLEMS AND CORRECTION
In "EAR" mode, the Pro 3000 has a tendency to repeatedly display lower or higher temperatures than those measured by glass mercury or electronic oral/rectal thermometers.	• Make sure that glass mercury or electronic oral/thermometer is properly calibrated before using it for comparison. • Use electronic oral thermometers in the "monitor" mode only. • Make sure that oral and rectal thermometers are used strictly according to the manufacturer's recommendations. Oral and rectal temperatures are often less accurate representatives of core temperature, hence Pro 3000 readings may differ from them, however, tympanic readings are a better indicator of core temperature. However, if a large difference persists for various febrile and afebrile patients, the Pro 3000 thermometer accuracy must be verified. • The Pro 3000 must be operated according to the Operator's manual. If patient is under one year of age pull the ear pinna straight back as done in standard otoscope exams. For children over one year of age and adults, the ear pinna should be pulled both up and back. Use only Braun ThermoScan probe covers. Use of any other covers may result in inaccurate readings. • Probe window must be clean, undamaged and intact. The front window should be cleaned according to the cleaning procedure outlined in Section 3.2 "Cleaning" of this manual. If front window is damaged, unit must be returned for service/exchange. • Patient's ear canal must not be obstructed or contain excessive cerumen and must be dry. Taking temperatures shortly after washing ears or taking a shower may result in lower readings. • Thermometer should not be subject to thermal transients, such as draft from an air conditioner. • Check the Pro 3000 thermometer reading with the Infrared Temperature Reference Model No. BB 3200 if calibration is in question. Make sure that the BB 3200 functions properly according to its Operator's Manual. If the Pro 3000 readings are outside the range indicated on the temperature reference blackbody BB3200, check the probe window and integrity of the probe cover used. Clean the probe window, change the probe cover and re-measure the temperature in the BB 3200. • If the problem persists return unit for service/exchange.
After a new probe cover is installed, and temperature is taken in a normal way, the display indicates ERR message.	• The thermometer's internal temperature is outside the ambient operating range or not stable because of environmental change. More time is required at a constant ambient temperature to stabilize the thermometer.

- If the problem persists return unit for service/exchange.

Table 4-1 Troubleshooting (Cont.)

SYMPTOMS	POSSIBLE PROBLEMS AND CORRECTION
Fresh batteries were installed but the instrument display either stays blank or indicates "CHANGE BATTERY."	• One or more of the new batteries may be defective. Check voltage of each battery. Each fresh battery must read 3.0V. • Battery contacts may be corroded or otherwise damaged. Clean the contact. • One or more batteries may be inserted in reverse. Check battery for correct polarity. • If the problem persists return unit for service/exchange.
Batteries discharge quickly or do not last for at least 5,000 readings.	• One or more of the new batteries may be defective. Check voltage of each battery. Each fresh battery must read at least 3.0V. • The Backlight switch is damaged and keeps the light on continuously. Unit must be returned for service/exchange. • The probe cover was not installed during storage. Always store the thermometer with probe cover in place.
All segments flash for 30 seconds, which cannot be cleared by loading new probe cover.	• The flashing display indicates an internal error (e.g. if the thermometer has experienced electrical shock). Remove and replace batteries to correct this failure mode. Accuracy of thermometer is not affected. • If problem persists return unit for service/exchange.