

instructions for

QUESTEMP^oI

Personal Heat Stress Monitor

56-013
5/91

INSTRUCTION MANUAL FOR
QUESTEMP^oI
PERSONAL TEMPERATURE MONITOR

TABLE OF CONTENTS

I.	INTRODUCTION.....	2
II.	FUNCTIONS.....	3
III.	CALIBRATION.....	4
IV.	EAR SENSOR INSERTION.....	5
V.	EAR SENSOR REMOVAL.....	6
VI.	E.A.R.® PLUG CARE.....	7
VII.	OPERATION SEQUENCE.....	7
VIII.	INDICATORS AND ACTION.....	8
IX.	SPECIFICATIONS.....	9
X.	SERVICE AND WARRANTY.....	10

I. INTRODUCTION

QUESTEMPOI is an easy to use, personal heat stress indicator which monitors the human body's temperature via the ear canal. By calibrating directly to the individual's mouth (oral) temperature, the monitor will have a direct representation of that individual's body temperature.

The QUESTEMPOI personal monitor is intended to be a part of a well managed heat stress program. It is an alerting device which warns the user that their body temperature has risen above the "safe" level and that action should soon be taken to allow the body to cool. The device will provide ample warning before the user is in danger of serious heat illness. The QUESTEMPOI monitor acts as an aid and does not replace the individuals own feelings and judgement.

The hypothalamus, located at the base of the brain, is the body's temperature controller. The ear canal borders the hypothalamus and once it is isolated from the outside environment, it will track the body's core temperature with a given constant differential for each individual. A small sensor is placed in the ear canal, via an E.A.R.® earplug, which will monitor the change in the body's temperature and set off an audible alarm when the level reaches a predetermined "safe" limit. That level has been determined to be 38°C by the WORLD HEALTH ORGANIZATION and has been accepted by the ACGIH, NIOSH, and the International Organization for Standardization. As the temperature rises above 38°C, the risk of heat related problems occurring increases.

Many people who work in hot or humid areas, particularly those enclosed in protective suits, are in danger of overheating and becoming heat stressed. Heat stress can occur when the body's cooling system can not keep up with the heat induced by the activity or environment of the worker. Some symptoms of overheating are dizziness, exhaustion, heat cramps, dehydration, heat collapse, or even heat stroke which can be very damaging or fatal. Also, people who become overheated are typically less alert than they would ordinarily be and thus there are many other potentially dangerous situations they could find themselves in. Workers in steel mills, asbestos cleaning, power plants, heavy machine operators, etc... are examples of people who may often find themselves in environments posing a risk for heat related illnesses.

II. FUNCTIONS

The QUESTEMPOI utilizes a miniature sensor which can easily and comfortably be placed in even the smallest ear canal via an E.A.R.® foam earplug.

QUESTEMPOI consists of a belt or pocket worn electronic assembly with a thin flexible cable leading up to a small ear mold which contains the sensor and a small speaker for an audible alert. The sensing device protrudes from the ear mold and a disposable E.A.R.® foam earplug slides over the sensor providing a comfortable vehicle for inserting and maintaining the sensor. The speaker and ear mold remain just outside of the ear to completely avoid any possible damage or injury to the ear canal.

The unit assembly contains two switches and four LED indicators. The switches select ON/OFF and RUN/CALibrate/TEST. The four LED's indicate ALARM, COLD, LOW BATTERY, and CALibrate.

SWITCHES

ON/OFF - Controls the power to the entire unit. This switch must be turned ON for operation in any of the modes RUN, CALibrate, or TEST.

RUN/CALibrate/TEST - Sets the operational mode of the unit. RUN is the mode for normal operation. Switch to CALibrate for calibration of the unit to the individual user. TEST activates both the audible and visual alarms to ensure that they are working properly.

LED INDICATORS

ALARM - The red LED blinks on and off (approximately once per second) when the temperature in the ear canal surpasses the body calibrated equivalency of 38°C.

COLD - Indicates that the sensor is reading well below normal body temperature and that the sensor is not in place or is possibly damaged.

LOW BATTERY - Indicates that the battery should be changed as soon as possible. The unit can continue to operate in the RUN mode for a minimum of eight hours after this indicator has turned on.

CALibrate - Used for setting the personal temperature alerting point based on the individual's oral to ear differential. (See section III on CALIBRATION.)

AUDIBLE ALARM

Along with the red LED, the speaker located in the ear assembly will pulse on and off (approximately once per second) when the temperature in the ear canal surpasses the body calibrated equivalency of 38°C.

The typical frequency of the alarm speaker is 3000 hertz. If the speaker is too loud or if the 3000 hertz tone is undesirable, the speaker's output may be modified. By switching the unit to TEST, removing the back cover, and turning the screw dial located on the left hand side of the middle of the circuit board, the frequency and loudness are altered.

III. CALIBRATION

Environmental temperature conditions cause a temperature gradient within an individual's physical structure, including the ear canal. It is the presence of this gradient that is being accounted for in calibration. Calibration must take place in the environment that the work will be performed in. If the ambient temperature later changes by greater than 5.5°C (10°F) then the QUESTEMP°I should be recalibrated or else an early alarm condition could occur.

Calibration should be performed with each use to account for effects of physiological changes or differences in the placement of the ear sensor within the ear canal.

To calibrate the personal monitor, the individual's differential between the ear and mouth temperatures is determined and subtracted from the 38° Celsius heat stress reference. The QUESTEMP°I is calibrated by taking an oral temperature with the QUESTEMP° CALPROBE I Oral Temperature Probe, which taken under proper conditions, is a good representation of the body's temperature. [When taking an oral temperature, the person should be rested and should not have had anything to eat or drink in the past 15 minutes. The probe should be kept under the tongue with the mouth closed while the person breathes through their nose.]

Although typical oral to ear temperature differentials can be found over a fairly large range, each individual's differential will remain relatively constant provided that the ambient temperature remains reasonably stable. By calibrating the monitor for the individual's temperature differential, the result is a very strong correlation with that person's body temperature. The equation for calibration is:

$$38 - (\text{ORAL} - \text{EAR}) = \text{ALARM LEVEL } (^\circ\text{C}).$$

Calibration is accomplished by the following procedure.

- 1) Insert the E.A.R.® plug, with the ear sensor, into the ear canal.
- 2) Switch the unit ON.
- 3) Flip the mode switch to CALibrate.
- 4) Plug the oral thermometer into the jack on the front of the unit.
- 5) Place the oral thermometer under the tongue.
- 6) Wait five minutes for the ear and mouth sensors to completely stabilize.
- 7) Turn the CAL pot (located just below the CAL LED) with a screwdriver until the CALibrate LED turns on. Because the calibration dial has a full range of roughly 15 turns, the first time you calibrate it may take many turns in either direction before getting the LED to come on. After the initial calibration, it should only take small adjustments to recalibrate.

The unit is now calibrated for the individual's body temperature. Disconnect the oral thermometer, flip the mode switch to RUN, and use the unit throughout the workday.

IV. EAR SENSOR INSERTION

- 1) Roll the disposable yellow E.A.R.® foam ear plug, containing a black protruding tube, back and forth with the fingers until it forms a small crease-free cylinder. See Figures 1 and 2.



Figure 1.



Figure 2.

2) Using only light pressure to keep the E.A.R.® plug rolled tight, gently slide it over the sensor of the ear mold assembly. The black tube should slide into the ear mold leaving only the yellow foam plug visible. The sensor should fill the black tube of the E.A.R.® plug with the tip lying flush with, or just inside of, the outer end of the tube.

3) With the E.A.R.® plug still rolled tight, hold on to the blue ear mold and quickly insert the rolled up plug into the ear canal and hold it in place until it expands. The yellow portion of the earplug should be completely contained within the ear canal without any danger of hurting the inner ear. Fitting is easier if the outer ear is pulled outward and upwards during insertion as shown in Figure 3. Once the plug has expanded, pushing or twisting will not improve its fit therefore, if the initial fit is inadequate, remove the plug and repeat the process.

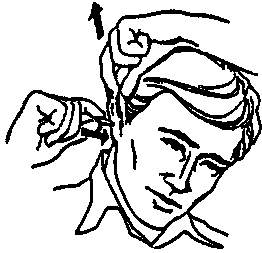


Figure 3.

4) Maneuver the ear hanger over the ear. The ear hanger will help to hold the assembly in place throughout the day.

(This procedure may feel awkward at first but it will become very easy with continued usages.)

A properly fit E.A.R.® plug will be comfortable and should hold snug and secure in the ear canal. It also provides good noise attenuation for those who would typically use hearing protection.

V. EAR SENSOR REMOVAL

To remove the ear assembly after use, simply grab the blue ear mold, slide the ear hanger off of the ear, and pull the assembly out from the ear. If the E.A.R.® plug separates from the assembly and remains in the ear canal, then simply grab hold of it by the black tube and pull it out.

The E.A.R.® earplug can easily be removed from the assembly by holding the tip of the plug and sliding it off. Do not squeeze the middle of the plug to remove or the sensor may be damaged.

Use care when removing or handling the ear sensor assembly. Do not remove

by pulling on the cable and always be careful when handling the temperature sensor because it can be damaged if mishandled.

VI. E.A.R.® PLUG CARE

The E.A.R.® foam earplugs can be washed with soap and water and reused or they can simply be thrown away and replaced. (Remove the E.A.R.® plug from the blue ear mold prior to washing.)

If the black tube separates from the yellow foam or if the plug does not slide properly over the temperature sensor, discard the plug and try another.

VII. OPERATION SEQUENCE

- 1) Insert the ear sensor assembly as described in Section IV.
- 2) Turn the QUESTEMP[®] ON. [When located in environments where the temperature is greater than 38°C (100°F), the sensor should be placed in the ear canal prior to turning the unit ON or the sensor will detect the hot temperature and trigger the alarm.]
- 3) Calibrate the unit following the guidelines in Section III on CALIBRATION.
- 4) Be sure the unit is turned ON and is in the RUN mode.
- 5) If your situation requires it, attach the front cover.
- 6) Clip the QUESTEMP[®] housing to your belt or pocket and wear it throughout the work day or as needed.

VIII. INDICATORS AND ACTION

ALARM - If the alarm activates, indicating a body temperature greater than 38°C, take appropriate measures to allow the body to cool itself and properly regulate its temperature. Lowering the work load, moving into a cooler environment, and drinking cool liquids are all methods to help cool the body and avoid heat related injuries.

Note that the alarm is latched on when the body temperature hits 38°C and the unit must be turned OFF to stop it.

COLD - The cold LED will be on when the unit reads a temperature below any typical ear canal temperature (less than 32°C). This could indicate that the sensor has fallen out of the ear canal or that it has possibly been damaged.

LOW BATTERY - If this indicator comes on, replace the battery as soon as possible. With the COLD indicator on, the QUESTEMP[®]I can continue to operate for a minimum of 8 hours.

To preserve battery life, be sure to turn the unit OFF when not in use. [Because the COLD LED may come on after the sensor is removed, the power drain from the battery would be drastically increased if the unit is left ON when not in use.]

IX. SPECIFICATIONS

ACCURACY

The QUESTEMP[®]I has an electronic accuracy of better than +/-0.1°C over the temperature range of 32°C to 40°C.

The QUESTEMP[®] CALPROBE I Oral Temperature Probe calibrators are interchangeable between units and have an accuracy of better than 0.05°C over the temperature range of 30°C to 40°C.

BATTERY LIFE

Using one 9-volt alkaline (NEDA 1604 or NEDA 1604A) battery, the QUESTEMP[®]I, under normal daily usage, should last approximately 4 months. It will also continue to operate for a minimum of 8 hours after the LOW BATTERY indicator comes on.

WORKING TEMPERATURE RANGE

Both the oral probe and aural sensor are meant to operate at body temperature in the range of 32°C to 40°C. The unit itself has an operating temperature range of 0°C to 70°C.

STORAGE

If the unit is to be stored for prolonged periods, the battery should be removed.

OPERATING HUMIDITY

Operate between 0% - 95% humidity (non-condensing).

SIZE

2.5 x 5.1 x 1.0 inches (64 x 130 x 25mm)

WEIGHT

Housing: 10 ounces (283 grams)
Ear Sensor Assembly: 0.15 ounces (4.2 grams)

CONSTRUCTION

The electronics are housed in a rugged cast aluminum case. The ear mold is constructed from an FDA approved GEON.

QUEST SERVICE POLICY

The Quest product you have purchased is one of the finest acoustic instruments available. It is backed by our full one year warranty which seeks complete customer satisfaction. This is your assurance that you can expect prompt courteous service for your equipment from the entire Quest service organization.

Should your Quest equipment need to be returned for repair or recalibration, please contact the Service Department at (800)245-0779 (USA) or Fax (262)567-4047 for a Return Authorization Number. The RA number is valid for 30 days, and must be shown on the shipping label and purchase order/cover letter. If you are unable to return instruments in that time call for a new RA number. Send it prepaid and properly packed in the original shipping carton directly to Quest Technologies, 1060 Corporate Center Drive, Oconomowoc, WI 53066 U.S.A.

Repair or replacement work done under warranty will be performed free of charge, and the instrument will be returned to you prepaid. Your copy or a photocopy of the Quest Registration Card will serve as proof of warranty should the factory require this information.

If for any reason you should find it necessary to contact the factory regarding service or shipping damage, please direct your calls or letters to the attention of the Service Manager, Quest Technologies, (262) 567-9157 or (800) 245-0779. Office hours are from 7 AM to 6 PM (Central Standard Time) Monday through Friday.

For service or recalibration outside the U.S.A., please contact your local Quest Dealer or fax Quest U.S.A. at 1-262-567-4047.