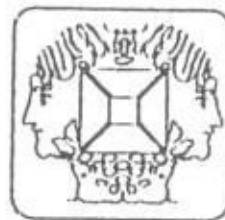


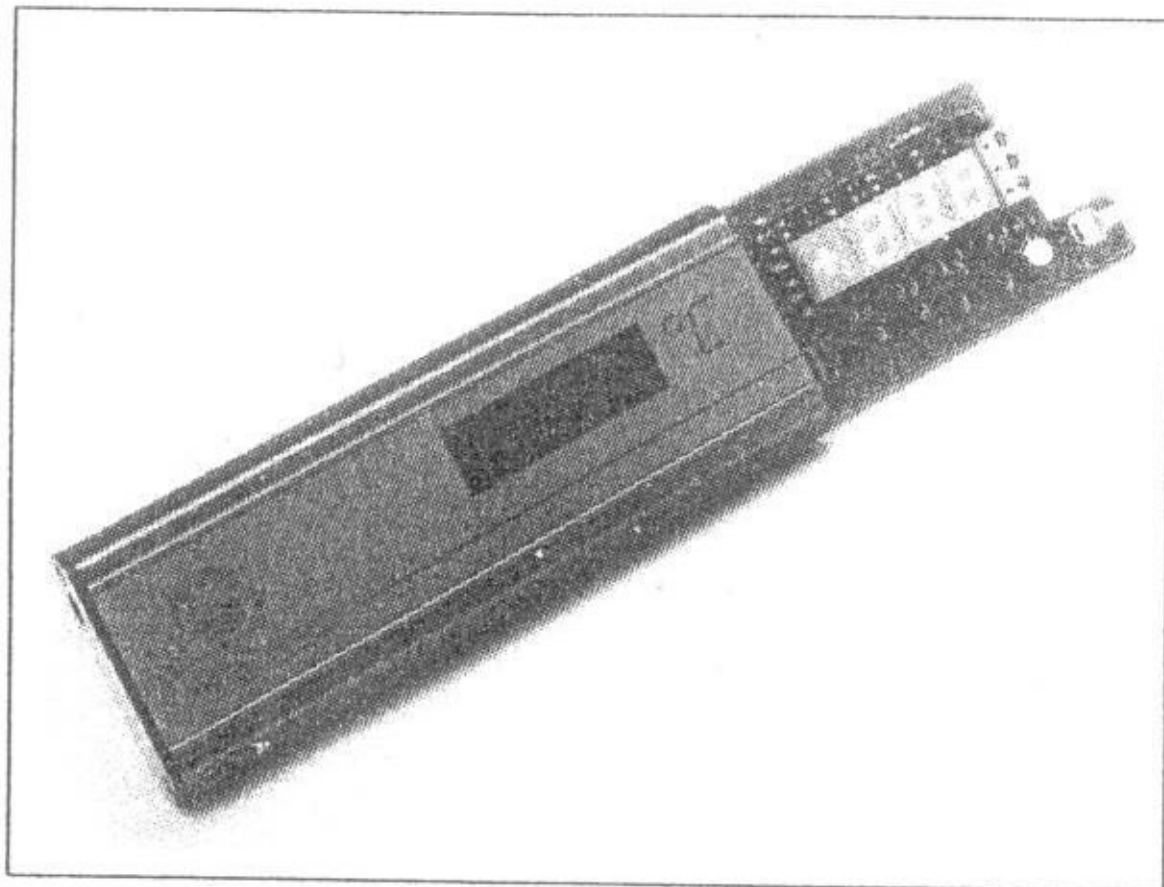
velleman-**kit**

HIGH-Q



DIGITAL THERMOMETER / SENSOR K6003

- Microprocessor technology
- Minimum and maximum temperature memory
- Temperature range: -50° to +150°
- Pulse-width modulation: 200usec/°C (0°C=10msec.)
- Output: 15mA current loop for K6000 or K6002
- Adjustable to degrees Fahrenheit
- Display: 3 1/2 digits (0.1° display accuracy)
- Supply voltage: 12 to 15VDC / 150mA
- Dimensions (W x H x D): 144 x 50 x 22 mm



DIGITAL THERMOMETER / SENSOR

Although this kit was especially designed to operate in conjunction with our controllers K6000, K6010 or K6002, it is also very well suited for use as a conventional thermometer.

The digital display gives the following consecutive information:

1. The present temperature
2. The minimum temperature
3. The maximum temperature.

When a "reset" key is pressed the highest and lowest temperatures measured are stored and, if necessary, adjusted.

A wonderful aluminium house is supplied with the kit, to allow the thermometer/sensor to be mounted on a wall.

For use in conjunction with our controllers a pulse-width modulated output is provided. The advantage of this system lies in the fact that the distance between the sensor and the controller is irrelevant and that noise will not interfere with the transfer signal.

TECHNICAL SPECIFICATIONS

Microprocessor technology

Minimum and maximum temperature

Temperature range of the sensor: -50° to $+150^{\circ}$

Pulse-width modulation: $200\mu\text{sec}/^{\circ}\text{C}$ ($0^{\circ}\text{C} = 10\text{msec.}$)

Linearity from -10° to $+50^{\circ}$: better than 0.5%

Full scale: better than 2%

Output: 15mA current loop

Adjustable to degrees Fahrenheit

Display: 3 ½ digits (0.1° display accuracy)

Supply voltage: 12 to 15VDC / 150mA

Dimensions (W x H x D): 144 x 50 x 22 mm

Modifications reserved

ASSEMBLY

ATTENTION: Before mounting the components onto the print, first try to slide the print into the house (see Fig. 2.1). Sometimes the edge of the print may have to be sanded off using fine sanding paper.

CAUTION:

CAREFULLY MOUNT ALL COMPONENTS AS CLOSE TO THE PRINT AS POSSIBLE, TO MAKE FULL USE OF THE AVAILABLE SPACE INSIDE THE HOUSE.

Mount the jumpers marked with J onto the print. Attention: the jumpers underneath the IC sockets DY1 to DY4 must come as close to the print as possible.

Mount the following resistors:

- R1, 240K, metal film (red, yellow, black, orange)
(If the thermometer is to display degrees Fahrenheit use a 560K type (green, blue, black, orange) for R1)
- R3, 3K, metal film (orange, black, black, brown)
- R4, 4K7 metal film (yellow, purple, black, brown)
- R5, 10K metal film (brown, black, black, red)
- R6, 1K8 metal film (brown, grey, black, brown)
- R8 and R17, 10K (brown, black, orange)
- R19, 1K8 (brown, grey, red)
- R33, 560 ohm (green, blue, brown)
- R34, 82 ohm 1/2W (grey, red, black)

Mount the following diodes: (Watch the polarity!)

D1, small signal diode of the 1N4148 series

D2, diode of the 1N4000 series

ZD1, 8.2V zener diode of 1.3W

ZD2, 5.1V zener diode

Mount the IC sockets for IC1 to IC4, also mount the sockets for the displays DY1 to DY4. Note: mount the latter with the stud towards the edge of the print and in such a way that the sockets

come against the print, in spite of the underlying jumpers (if necessary, cut away part of the socket with a sharp knife).

Mount the capacitors:

- C1 and C2, 470pF ceramic (sometimes marked as 470 or 471)
- C3, 470nF MKM (sometimes marked as u47)
- C7 and C8, 18pF ceramic

Mount the following resistors in an upright position:

NOTE: Respect the information on the print, so that the body of the resistors is within the largest circle.

- R2, 18K metal film (brown, grey, black, red)
- R7, 1K8 metal film (brown, grey, black, brown)
- R9 to R16 and R18, 10K (brown, black, orange)
- R20 to R23, 1K8 (brown, grey, red)
- R24, 220 ohm (red, red, brown)
- R25, 2K2 (red, red, red)
- R26 to R32, 1K5 (brown, green, red)

Mount the multi-turn trimmer potentiometers:

- RV1, 1K (OFFSET: zero setting of the sensor)
- RV2, 200K (ZERO: zero degrees calibration)
- RV3, 5K (GAIN: max. temperature calibration)

Mount the transistors:

T1 to T4, type BC557

T5 to T9, type BC547

Mount the electrolytic capacitors: (AGAINST the print)

C4 to C6 and C9, 10 μ F. Watch the polarity!

C10, 220 μ F. Watch the polarity!

Mount the two print pins for the sensor connection (marked SENS).

Mount the push button SW1 (carefully against the print).

Mount the three-pole screw connector J1.

Mount the 7-segment displays DY1 to DY3 in their socket, in such a way that the decimal point is closest to the transistors T1 to T3. Mount the +/- display DY4 in a similar fashion.

Put the ICs in their sockets:

IC1, 3160 type with the stud towards the edge of the print.

IC2, 3524 type with the stud towards R4.

IC3, VK6003 or PIC16C54 with the stud towards R8.

IC4, 2003, 2203 or equivalent type with the stud towards the edge of the print.

Mount the crystal X1 (4.19MHz): (see Fig. 1.0)

Mount it in such a way that it lies against IC2; only then solder the connections.

TEST AND CALIBRATION

The sensor must be calibrated by submersion in melting ice water; moreover, the sensor must be at a certain distance from the display (to protect the sensor against the heat dissipation of the display). As a result, the sensor must be prepared as follows:

- Cut two 9.5cm pieces of the supplied copper wire, see Fig. 1.1.
- Using a knife, remove the varnish of both pieces of wire over some 3mm from the ends and tin the ends.
- Cut the connections of the KTY10 sensor at 3mm. see fig. 1.2
- Solder both copper wires to the sensor type KTY10, and twist the wires see Fig. 1.3 .
- Cut off a piece of shrinking tube with a length equal to 8cm.
- Slide the shrinking tube over the copper wires and OVER the sensor see fig. 1.4 .
- heat the shrinking tube using a hair dryer or, better still, using a paint stripper.

The sensor is now ready for use.

Connect the sensor to the points marked SENS on the print using a piece of wire (+/- 50cm). The polarity is of no importance.

Connect a DIGITAL voltmeter between the two connection wires of R2 and R7.

Connect a direct current of 12V to 15VDC / 150mA between + and - of connector J1.

Normally a random temperature will appear in the display. If "Err" appears, this means that the sensor is short-circuited or not connected.

After about 5 minutes the display will automatically show the lowest temperature (LOW) and then the highest temperature (HIGH) for about 1 sec. Then the current temperature (CURRENT) is displayed for about 20 seconds. Even after pressing the reset button it will take 5 minutes before the minimum and maximum temperatures are displayed.

IMPORTANT: Let the circuit "warm up" for about half an hour before carrying out any adjustments!

NOTE: Avoid touching the circuit with your hand during the adjustment procedure, since this might produce hum on the output, which would result in a very unstable display.

Fill a glass with ice cubes and let them melt slightly, until ice water is obtained.

Submerge the sensor in the melting ice water (0°C/32°F). Make sure that the sensor connecting wires do not contact the water. It is recommended to stir the ice water for a more accurate result.

Adjust the OFFSET trimmer potentiometer RV1 until the meter indicates 0V (if necessary, set the meter to a more sensitive range). Do not forget to wait a while until the display becomes stable.

THIS ADJUSTMENT IS VERY IMPORTANT, SO BE VERY CAREFUL!

Then adjust the ZERO trimmer potentiometer RV2 (sensor still in the ice water) until the sensor display shows 0°C or 32°F. Wait

until the display becomes stable. This concludes the adjustment procedure for the minimum temperature.

For the maximum temperature and if the thermometer is to be used to measure room temperatures, it is advisable to adjust the thermometer to the body temperature. This maximum temperature is then calibrated using the GAIN trimmer potentiometer. It is recommended to check the temperature in the position of the sensor using a clinical thermometer.

If a higher accuracy above 40°C is required, the sensor should be calibrated in a known heat source, e.g. boiling water (100°C).

NOTE: When adjustments are made in degrees Fahrenheit, the maximum temperature is 150°F.

REPEAT THE ENTIRE ADJUSTMENT PROCEDURE AT LEAST ONE MORE TIME!

FINAL CONNECTION

1. Connecting the sensor:

- Remove the piece of wire from the sensor and from the print.
- Solder the free connections of the sensor to the sensor print pins marked SENS. Make sure that later the connections will not contact the lid of the house.

2. Mounting and connection:

- Cut all connections as short as possible (especially of the screw connector and the print pins). Try to slide the print in the house, to check if any components are mounted too high on the print (if necessary, make the necessary corrections).
- Attach the front film to the house (note the position of the window).

- See K6000 manual for the connection and the necessary wiring.
- Mount the house against a wall using the supplied plug (drill 6mm hole) and screw. The recess on the right of the house is used to pass the wiring. Do not mount the thermometer too close to the heat source and make sure that the sensor is protected from direct sunlight.
- Slide the print in the house from left to right (see Fig. 2.1).
- Slide the print a little through the right hand side, to allow for the connection of the wiring.
- Slide a lid over the sensor on the left hand side and secure the lid using two screws.
- Push the print against the left hand side lid and then also mount the right hand side lid.

IMPORTANT: Fold the sensor connection as illustrated in Fig. 2.2

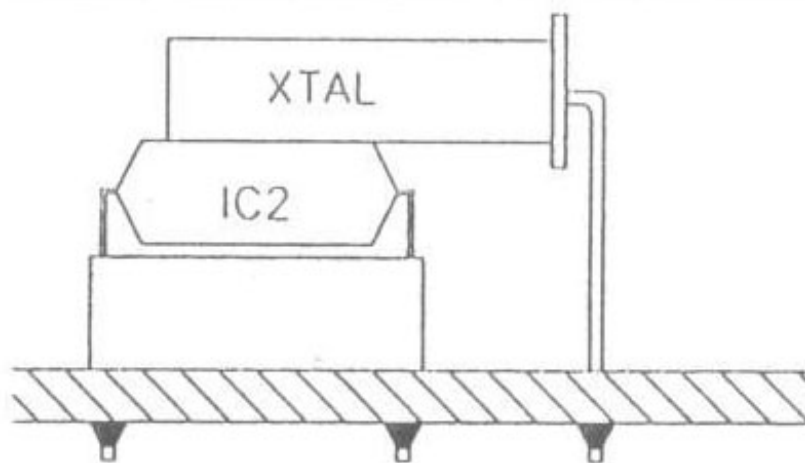


FIG.1.0

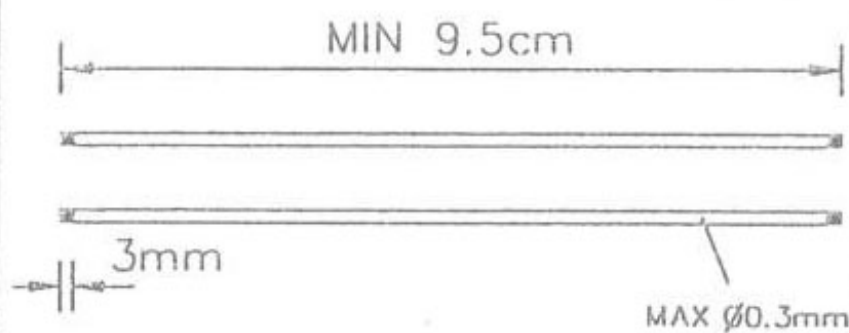


FIG.1.1

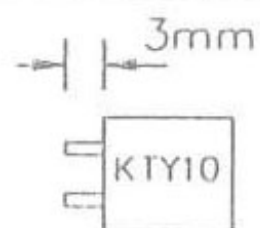


FIG.1.2

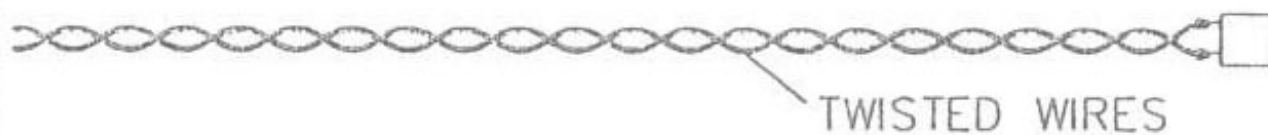


FIG.1.3

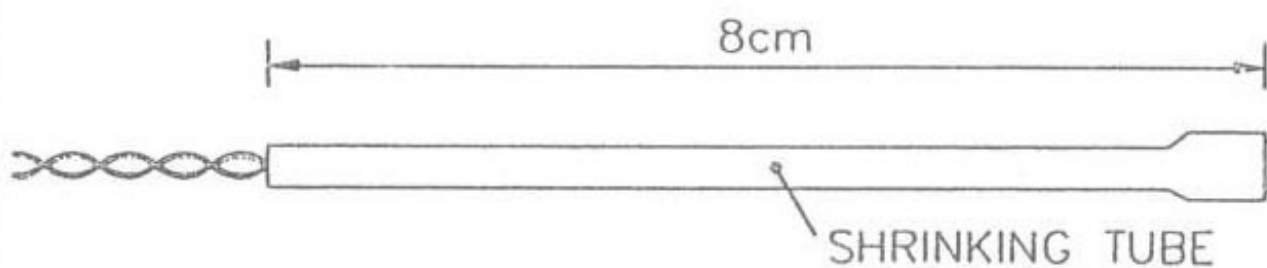


FIG.1.4

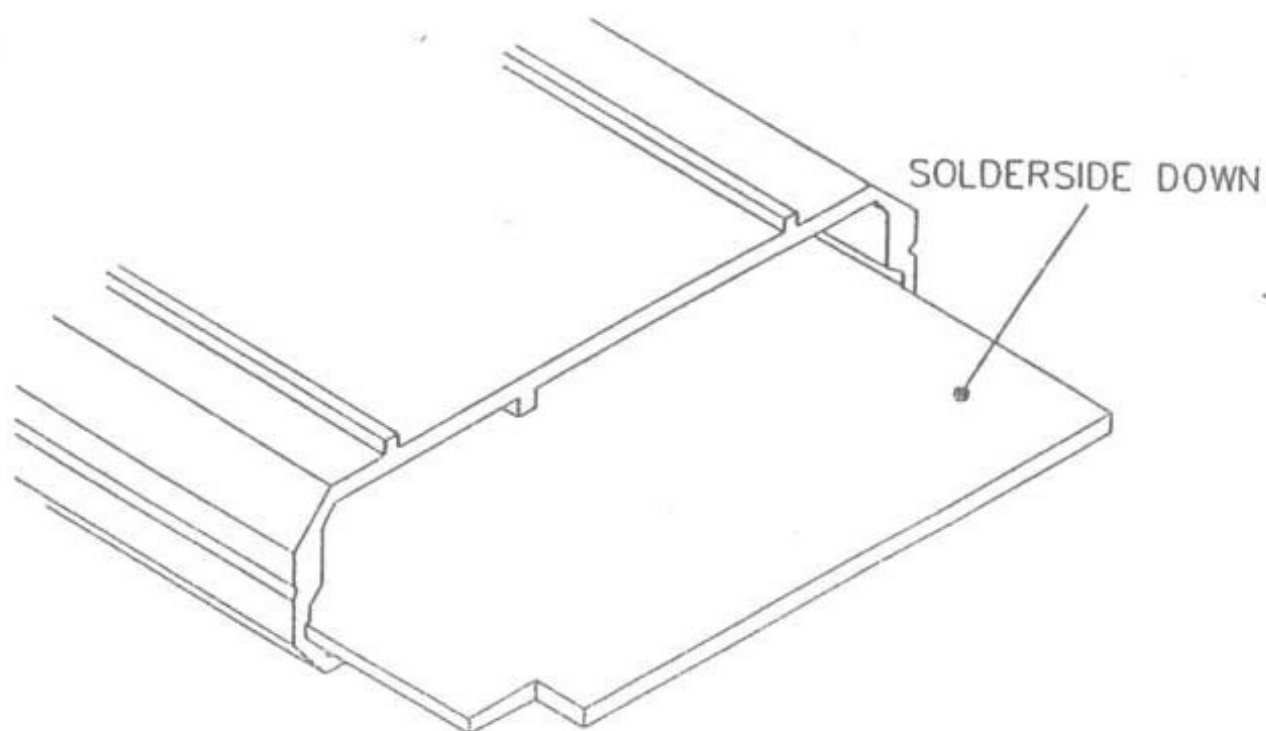


FIG:2.1

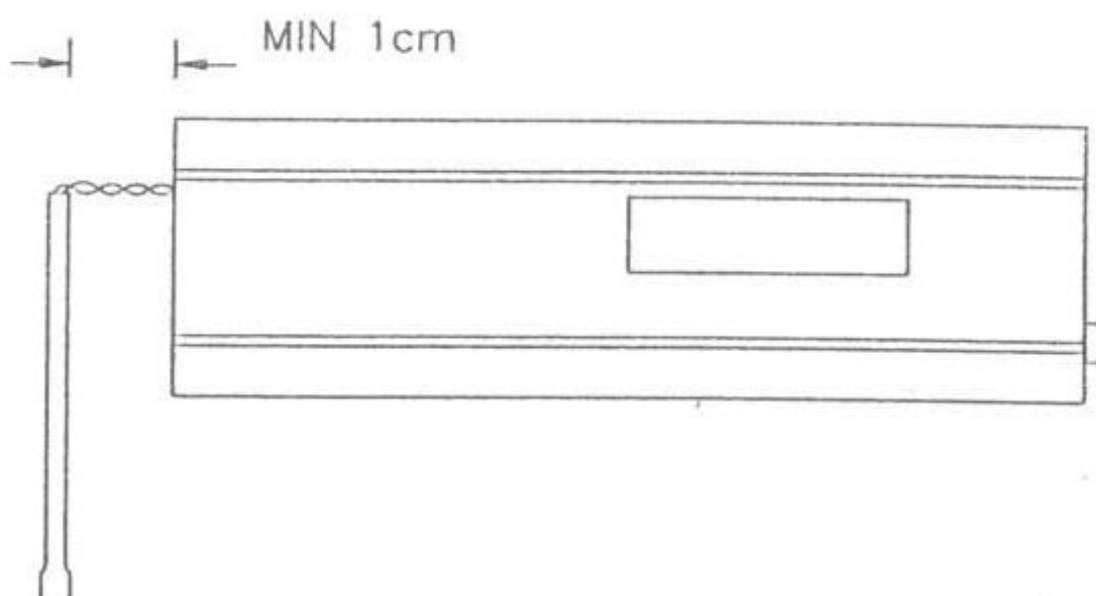


FIG.2.2

