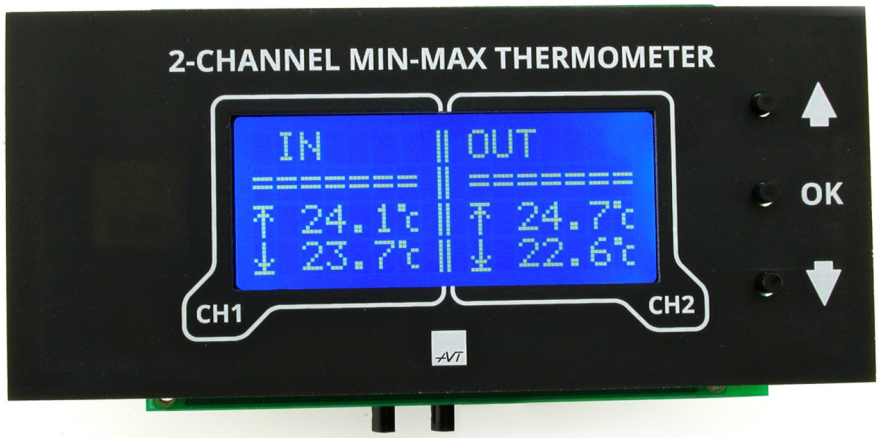
2-channel MIN-MAX thermometer with alarm

PDF DOWNLOAD

AVT 1999



ASSEMBLY DIFFICULTY

The thermometer is used to monitor the temperature at two points using temperature sensors of the DS18B20 type with a 1-Wire interface.
A normal temperature range can be declared for each sensor, and an audible alarm will indicate when it is exceeded. The thermometer has a minimum and maximum value memory with the possibility of resetting it at any time. Additional feature of the thermometer is the ability to assign an individual name to each of the two measuring points.

Specifications

- temperature measurement range of the sensor is -55°C to +125°C,
- accuracy of measurement: ±0.5°C (from -10°C to +85°C), ±2°C (from -55°C to +125°C)
- reading resolution: 0.1°C over the entire measuring range
- power supply: 7-12 VDC
- board dimensions: 97×62 mm

Circuit description

A schematic diagram of the thermometer is shown in Figure 1. Its operation is controlled by a US1 microcontroller (ATmega8) clocked by an internal RC oscillator. The thermometer must be supplied with 7...12 V DC fed to the "ZAS 12V" connector. Power source can be any DC power supply with a current capacity of 150 mA or more. D1 diode provides protection against incorrect polarity of the supply voltage. US2 stabiliser provides the +5 V voltage, and capacitors C1...C4 ensure that this voltage is properly filtered.
The measured temperature is shown on an easy-to-read 4-line x 16-character LCD display. Due to the multi-character display, it is possible to display all parameters simultaneously, both during normal operation, i.e. reading the measured temperatures, and during alarms. Temperature display is updated every 2 seconds. The display backlight is controlled via T1 transistor. While, its contrast is adjusted using the PR1 potentiometer. The S1...S3 buttons are used to enter settings and configure the thermometer. A buzzer controlled by T2 transistor sounds an alarm signal. Each of the DS18B20 sensors is connected to a separate microcontroller pin (PD6 and PD7). This solution ensures that the sensors are ready for operation as soon as they are connected and powered up, eliminating the need to search for them on the bus and register their serial numbers.

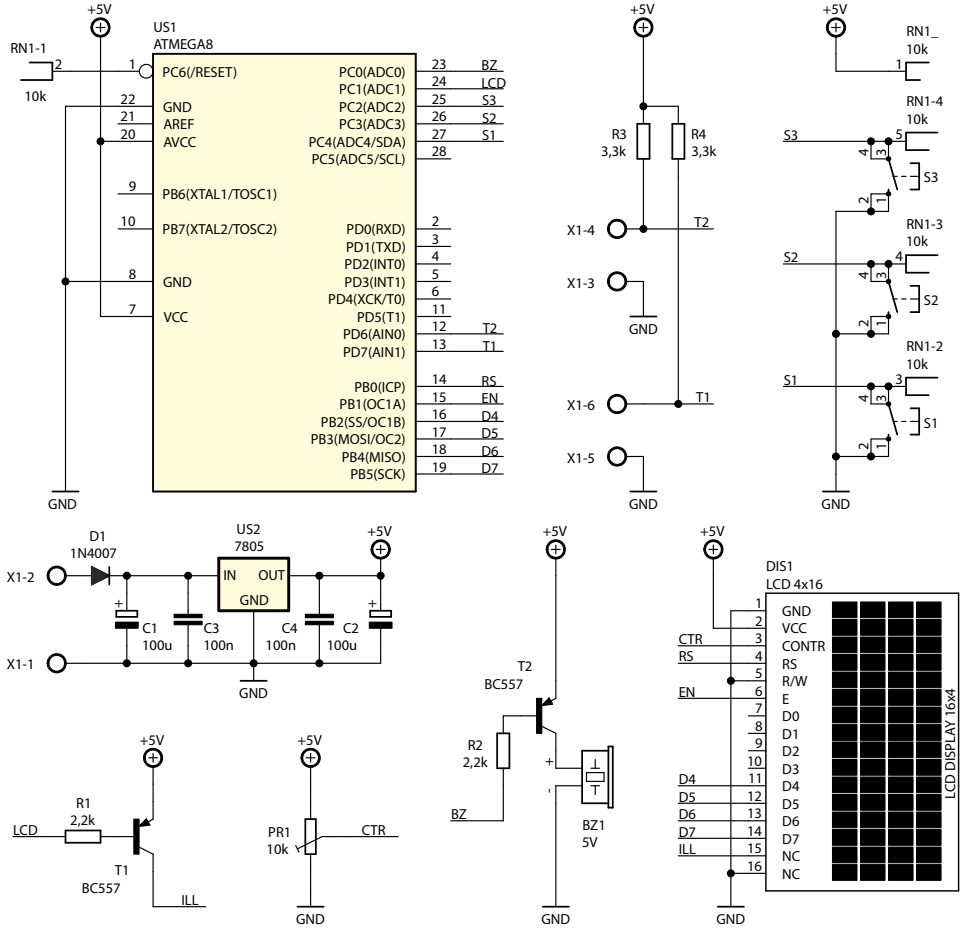


Figure 1. Schematic diagram of the MIN/MAX thermometer

Mounting and start-up

The thermometer was mounted on a 62 mm x 97 mm double-sided PCB. Its mounting diagram is shown in Figure 2. We mount the thermometer in a typical manner, except for the LCD display that must be 6 mm away from the board, and the buttons, which must be soldered on the print side. Mounting of these components is shown in Photo 3. When properly mounted, the circuit will not require any start-up steps and, once the sensors are connected, it can start operating immediately. Connect the temperature sensors to the PCB by connecting their outer leads to the point marked " -" , and the middle lead to the point marked DQ. The thermometer manufacturer guarantees correct operation of the sensor with 30m cables, which was confirmed during testing. If you will only be measuring air temperature, it is sufficient to screen the sensors from any weather conditions or mechanical damage with heat shrink tubing. When measuring the temperature of liquids, take care to reliably protect the sensor and its contacts from moisture. The easiest way to do this is to use DS18B20 chips factory mounted on wires and sealed in special stainless steel sleeves additionally flooded with epoxy resin. Once the sensors are connected to the board, connect the power supply and adjust the display contrast using PR1 potentiometer. The display will show the default measurement channel names and the currently read temperature. If only one sensor is connected, no value will be displayed in place, where the temperature would normally be seen. Scrolling names of the measurement channels on the display indicate the operation of the thermometer.

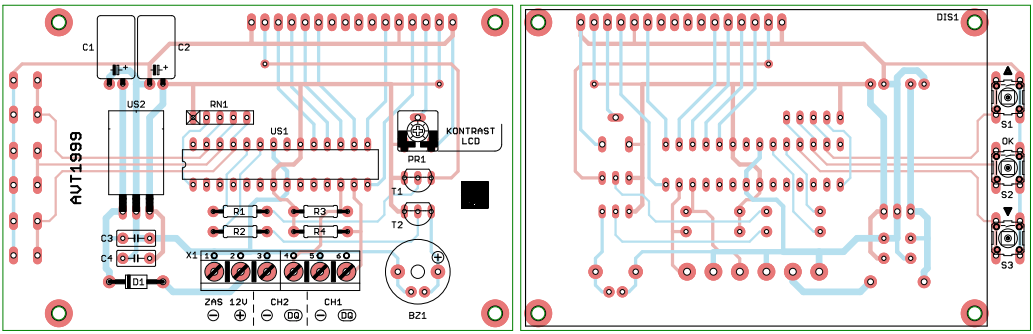


Figure 2. Mounting diagram for MIN/MAX thermometer

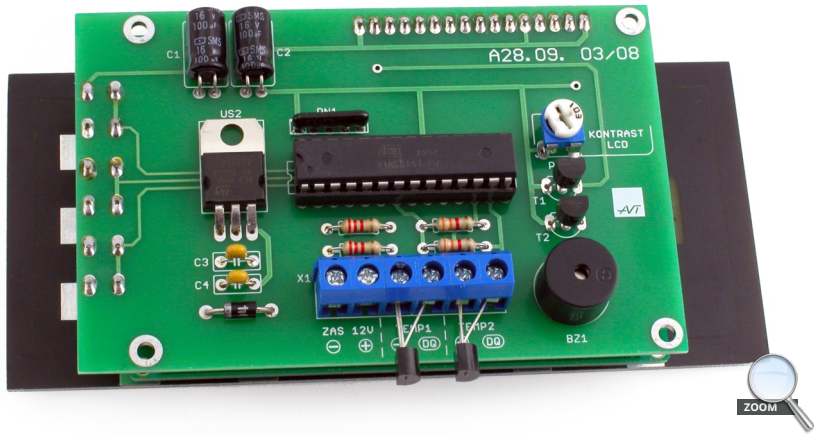


Photo 2. Mounting of push buttons and display

Operation

Control of the device is simple and intuitive and it is carried out using three buttons S1(▲up), S2 (**OK** - confirm/next) and S3 (▼down).
Figure 4 shows the subsequent user interface screens. To name the measurement channel, press button ▼, the cursor appears in the first line and now, confirming the selection with **OK**, the New Name screen appears. Now, using buttons ▲ and ▼ , select the first character. By confirming the selection with the **OK** button, move on to the next character. If the field is to be left blank, press **OK** and continue until you return to the home screen. Similarly, give name to the second measurement channel. To switch from the home screen to the screen for viewing the minimum and maximum temperature values, press **OK**. In addition, in this window, by moving the cursor to the selected temperature with buttons ▲ or ▼ and using the **OK** button, the selected temperature value can be deleted. After this operation, the thermometer will return to its home screen. To set the alarm temperature, select the relevant screen from the home screen and use buttons ▲ or ▼ to position the cursor on the appropriate line. By confirming your selection with the **OK** button, the cursor as an arrow < will change to the square bracket symbol]. From this point on, buttons ▲ or ▼ can be used to set the temperature value at which the alarm is to be triggered. The temperature setting value has been limited to one degree Celsius. Once the settings have been confirmed with the **OK** button, the set values will be stored in memory and the thermometer will return to displaying the current temperatures read from the sensors. When an exceeding of the set temperature is detected on the measuring channel, an intermittent acoustic signal will sound and the text **!ALARM!** will appear below the temperature value.

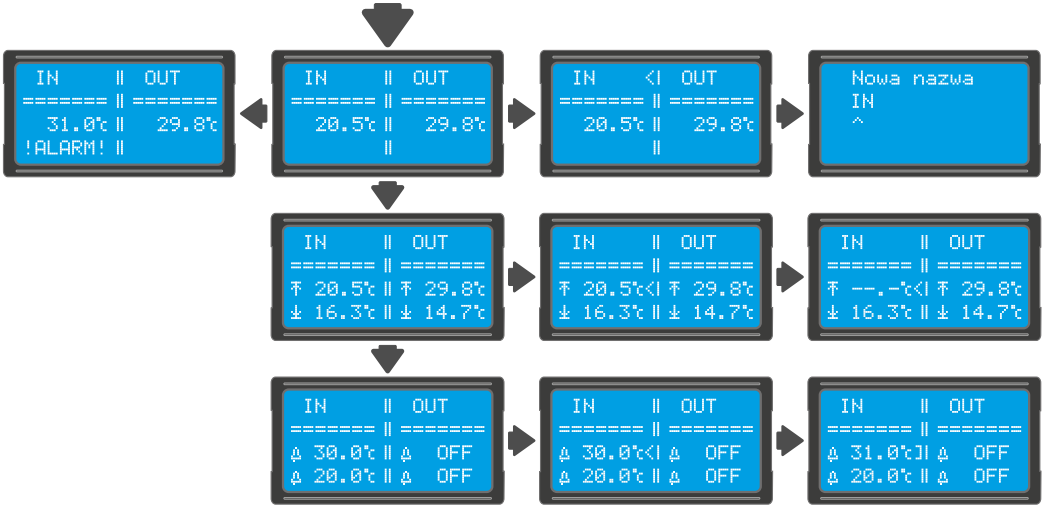


Figure 4. User interface screens

List of components

Resistors:

R1, R2: .....2.2 kΩ (red-red-red-gold)
R3, R4: .....3.3 kΩ (orange-orange-red-gold)
RN1: .....ladder 4×10 kΩ
PR1:.....mounting potentiometer 10 kΩ

Capacitors:

C1, C2: .....100 uF
C3, C4: .....100 nF

Semiconductors:

D1:.....1N4007
US1:.....ATmega8
US2:.....7805
T1, T2:.....BC557

Other:

DIS1: .....4×16 LCD display
BZ1:.....3 V or 5 V buzzer
S1-S3:.....button with 17.5 mm pin
X1: ..... 3×ARK2/500 or 2×ARK3/500
16-pin goldpin strip

Begin mounting by soldering the components onto the board in order of size from smallest to largest, paying attention to their polarity. Photographs of the assembled set may be helpful. To access the high-resolution images, use links and download the PDF.

PDF DOWNLOAD

AVT SPV Sp. z o.o.

Leszczynowa 11 Street,
03-197 Warsaw, Poland
https://sklep.avt.pl/

This symbol means do not dispose of your product with your other household waste. Instead, you should protect human health and the environment by handing over your waste equipment to a designated collection point for the recycling of waste electrical and electronic equipment.