

# K190. 4 Channel Temperature Monitor & Controller

This kit is an 'extension' of our popular K145 Temperature Logger kit. Like K145 it features four (4) temperature inputs using the DS1820 digital sensor. We have also added four (4) relays to provide output control.

Commands for reading temperatures or controlling relays are sent via the RS232 interface using simple text strings.

The kit can be controlled by a simple terminal or communications program (such as Hyperterminal) or via the free Windows application (see below).

FEATURES	
<b>Operating Voltage</b>	12VDC (nominal) 2.5mm DC jack, center positive
<b>Operating Current</b>	30mA (no relays operated) 120mA (all relays operated)
<b>Inputs</b>	4 x DS1820 or DS18B20 Digital Temperature Sensors
<b>Outputs</b>	4 x SPDT relays, dry contacts
<b>Connectors</b>	2.5mm DC power jack DB9 female connector (RS232) 4 x 3-way pluggable screw terminals for relay contacts 4 x 3-way pluggable screw terminals for temperature sensors
<b>Visual Indicators</b>	<b>POWER LED</b> <b>DATA LED</b> - OFF when idle ON while processing commands
<b>Case size</b>	13cm (W) x 10cm (D) x 3cm (H) (5.1" x 4" x 1.3")

## KIT ASSEMBLY

Before starting, check the components supplied in the kit against the parts list.

It is recommended that components be inserted and soldered in the following order:

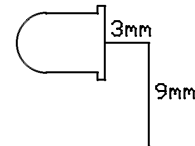
1. All the resistors
2. Diodes D1 & D2. Match up the bar on the diodes with the bar on the overlay. **Note:** When installing D2 use the two outer holes. The 'middle' hole is actually a pin through – do not use that.
3. All the 100nF mono capacitors
4. The crystal and 27pF ceramic capacitors
5. All the IC sockets
6. Resistor network RP1. The 'dot' at one end is to the right towards the 'K190' PCB designation.
7. The 78L05 regulator and 2-pin header J1
8. The 12 way connectors X3 & X4. Make sure they are sitting right down flat on the PCB before soldering.
9. 7805 voltage regulator. Measure and bend the leads at 90 degrees and fit to the PCB. Fix to the PCB using the supplied 3mm nut and bolt before soldering.
10. Electrolytic capacitors C2, C4 and C6. These are polarized - the positive lead is marked on the overlay, the negative is marked on the body of the capacitor.

**NOTE:** Capacitor C6 is laid down flat on the PCB. Bend the leads at 90 degrees close to the body using needle nose pliers before inserting. Make sure

11. DC power jack X2 and DB9 connector X1
12. The four (4) relays
13. **Pre-test.** Do not insert any ICs into their sockets yet. Connect a 12VDC supply the DC jack X2 and measure the voltage across pin 20 (+) and pin 10 (-) of IC1. It should read approximately 5 volts.  
If OK then remove power and insert the ICs. Take care not to bend any of the IC pins when doing so.
14. **Now comes assembly of the front panel.** Start by inserting a LED clip into each hole, pushing it in from the front. Now insert a LED into each clip **from the rear**. The LED should "click" into place.

The long LED lead is the positive lead – the flat edge on the LED body indicates the negative lead. This flat edge is indicated on the PCB overlay.

Turn the LEDs in the clip so that the long lead is to the left (as viewed from the front). **This is very important so make sure it is right.** Now bend the leads down at right angles, about 3mm from the LED body, as shown below. Use a pair of long nose pliers to hold the leads while bending. Cut the leads off to a length of about 9mm from the bend.



15. **We are now going to fit the assembled PCB into the plastic case.** Before that check all your work carefully. Look for unsoldered joints and any solder bridges or splashes that may be shorting out adjacent pins.

Fit the front panel to the PCB. Be sure that the LED leads are inserted into their matching holes on the PCB. This can be a bit awkward – you may need to use long nose pliers to position the leads into the holes.

Now fit the rear panel and, while holding the panels in place, slowly position the PCB into the base of the plastic case. Make sure the front and rear panels slide into the slots provided. Secure the PCB to the case using the self-tapping screws then solder the LED leads **from the top of the PCB.**

Leave off the lid until after the next section - **TESTING.**

## TESTING

1. Insert the shorting plug on header J1. This sets the communications rate to 9600 baud.
2. Connect the kit to a PC serial port using a straight-through 9-way cable. The cable should have a male DB9 connector at one end and a female DB9 connector at the other.

# K190. 4 Channel Temperature Monitor & Controller

3. Connect a 12VDC supply to the kit – the POWER LED should be **on** and the DATA LED **off**.
4. On the PC start a terminal or communications program. Most Windows PCs (up to XP) have a program called ‘Hyperterminal’ which can be found under ‘Start – Programs – Accessories – Communications’.
5. Configure the selected COM port for 9600 baud, 8 data bits, 1 stop bit, no parity, no handshaking.
6. Enable connection to the COM port. Some programs such as Hyperterminal require this step.
7. Press the ‘Enter’ key – the kit will respond with a ‘?’ character.
8. If all is well, press the ‘?’ key. The kit will respond with a banner message which includes the firmware version.

If steps 7 and 8 did not work then proceed to the next section.

## TROUBLESHOOTING

Most faults are due to assembly or soldering errors. Verify that you have the right components in the right place.

Inspect your work carefully under a bright light. The solder joints should have a ‘shiny’ look about them. Check that there are no solder bridges between adjacent pads.

Check that no IC pins are bent up under the body of the ICs. This can sometimes happen when inserting ICs into sockets.

Is the POWER LED on? If not then check that diode D1 is inserted correctly. Also the DC power plug should be center positive.

Does the DATA LED blink on when you press the ‘Enter’ key? If not then this indicates a problem with the microcontroller IC1. The microcontroller turns this LED on in software. Either the microcontroller is not running, there is a comms problem (see below) or there was a programming error at the factory.

Have you inserted the link on J1? Have you configured the other comms parameters correctly? Have you enabled the program to connect to the selected COM port?

If the hardware assembly seems OK and the 5V test was OK (as described in the **ASSEMBLY** section) then there could be a communication problem between the kit and the PC.

Are you using a straight-through serial cable rather than a crossover cable? **You must use a straight-through cable.** You can test your cable – pin 2 at each end should be connected to each other. Same for pin 3.

If the cable is OK then we can test the communications link. Plug the cable into the PC serial port and short pins 2 and 3 together at the other end (not connected to kit). Run

your comms program and press some keys on the keyboard. They should appear on the screen. If not then there is a problem with either the cable itself or the comms program configuration.

## KIT OPERATION AND COMMANDS

The kit is controlled via the serial port using a set of simple text commands. The serial communication rate can be set to either 2400 or 9600 baud via jumper J1.

Commands are not terminated by an ‘enter’ key – they are processed character by character as they are received. This means the kit will immediately abort the command if an incorrect or invalid character is received.

The kit will output a response to **all** commands. In the case of an invalid or incorrect command the response will be a ‘?’ character to indicate an error condition.

### **The kit also features a two second command timeout.**

This means that once a valid command sequence is started, each subsequent character must be received within 2 seconds of the previous one. If not the command sequence will be aborted and the kit will output a ‘?’ character. This helps to prevent a command ‘lock up’ if the kit receives a spurious character.

### **Note:**

- Commands can be in upper or lower case.
- Each character received is echoed back.
- Relays are numbered 1 to 4. Relay number ‘0’ (zero) indicates **all** relays.
- Temperature sensors are numbered 1 to 4. Sensor number ‘0’ (zero) indicates **all** sensors.

### **? – Prints banner and firmware version number**

### **Nx – Turn ON relay ‘x’ (where x = 0,1,2,3,4)**

Eg. N3 – turn on relay 3  
N0 – turn on **all** relays

### **Fx – Turn OFF relay ‘x’ (where x = 0,1,2,3,4)**

Eg. F3 – turn off relay 3  
F0 – turn off **all** relays

**Note:** The ‘N’ and ‘F’ commands do not need to return any data so the kit will output a ‘#’ character to indicate that the command executed correctly.

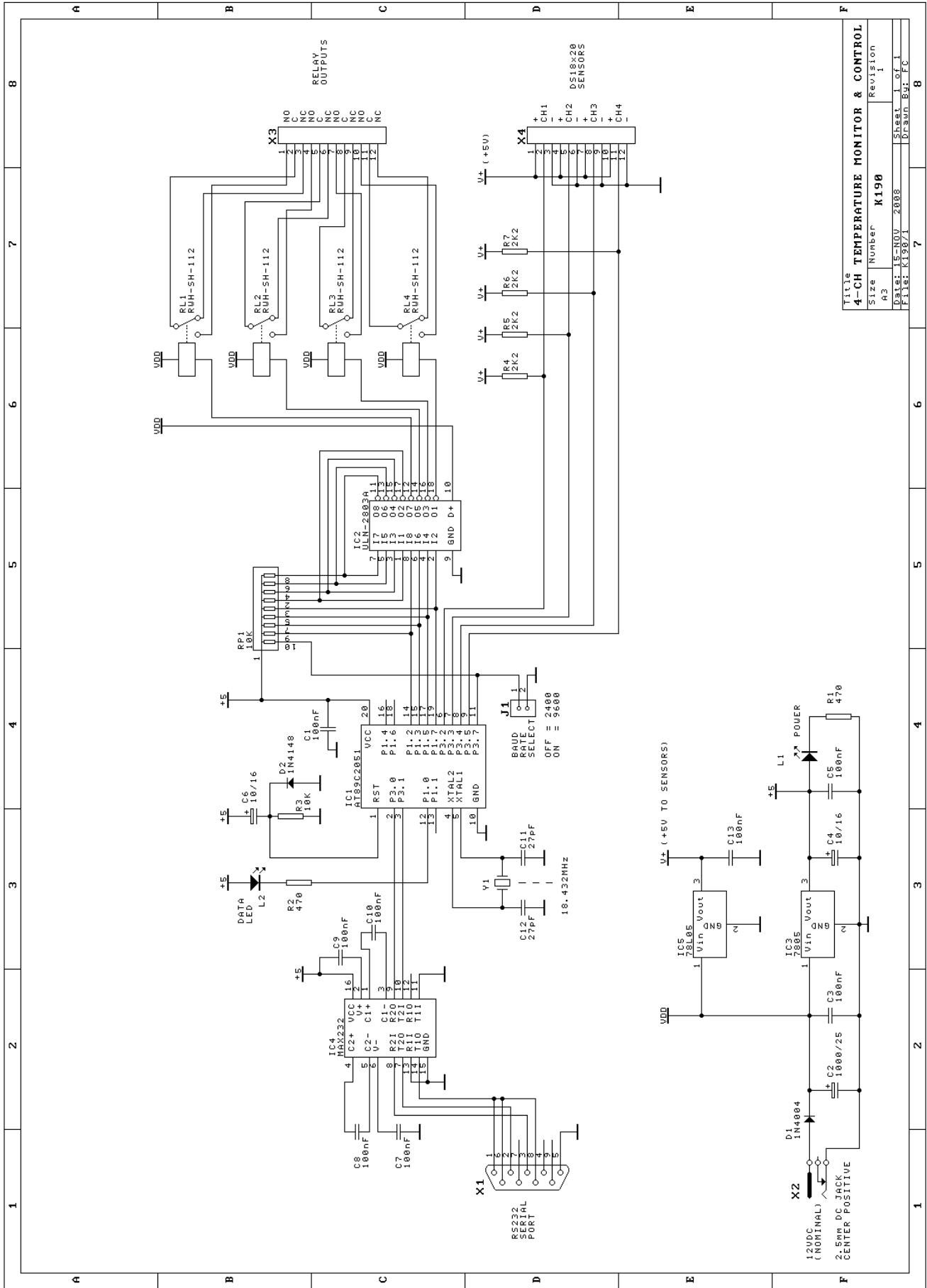
### **Sx – Get status of relay ‘x’ (where x = 0,1,2,3,4)**

Eg. S3 – returns the status of relay 3  
S0 – returns the status of **all** relays

Returns ‘1’ if operated – ‘0’ if released



# K190. 4 Channel Temperature Monitor & Controller



Title		4-CH TEMPERATURE MONITOR & CONTROL	
Size	Number	Revision	
A3	K190	1	
Date:	15-NOV-2008	Sheet	1 of 1
File:	K190/1	Drawn	By: FC