

**MINI-MAX/51-E**  
**Single Board Computer**  
**WEB SERVER**

**Quick Start Guide**

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MM51E WEB server Quick Start Guide. No part of this work may be reproduced in any manner  
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Thank you for your purchase of the MINI-MAX/51-E Single Board Computer. This document describes how to build MINI-MAX/51-E World's Ethernet WEB server. BiPOM Electronics designed the "mm51et.lib" Micro-C library for you to support full TCP/IP stack. CS8900 (Ethernet controller), ARP, IP, ICMP, and TCP layers will allow you to build many modern network applications easily. BiPOM Electronics provides an open source of the test WEB server as an example. MINI-MAX/51-E WEB server supports PING, TELNET (port 23) and HTTP (port 80) services. MINI-MAX/51-E TCP/IP stack includes TCP engine. The engine supports the sliding windows, re-transmission and automatic closing of unused TCP connection.

*Note. MINI-MAX/51-E TCP/IP stack can support 6 TCP/IP connections at the same time. MINI-MAX/51-E WEB server has been designed as a very reliable embedded network application. To protect WEB server against hacker's attack the current TCP connection will be closed if there is no activity on this connection within 30 seconds.*

## **Ethernet basics**

Ethernet boards communicate using the MAC-addressing. A node on an Ethernet network requires 6 bytes to define its address. A node address of 0xFFFFFFFF (that is, 6 bytes of 0xFF) broadcasts the packet to all nodes on the destination network.

*Note. A unique Ethernet MAC-address is factory-programmed into each MINI-MAX/51-E. The MAC-address is written to IC7, AT24C04A (please see MINI-MAX/51-E manual).*

When installing a Network card, Windows installs a default set of Clients and protocols, which includes the TCP/IP protocol. Figure 1 shows where you can find installed Network protocols.

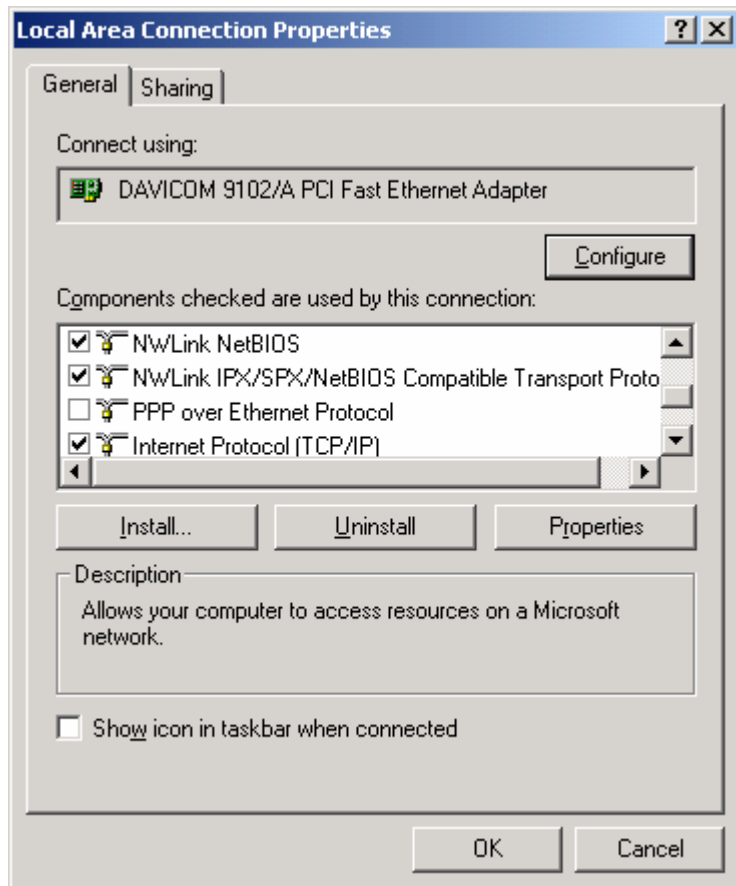


Figure 1.

## Software Setup

Please download and install the latest release of the 8051 Development System from <http://www.bipom.com/8051dev.php> Development software components include Micro-IDE, Micro C Compiler, simulator and debugger.

**Micro-IDE** is a Windows based Integrated Development Environment for micro-controller systems application development. Micro-IDE integrates essential components of software development including

- Multi File Editor with C and Assembly language syntax coloring
- Integration with toolkits including command line compilers, assemblers and linkers
- Project Manager
- Tools: Terminal program, Calculator, ASCII Chart
- Download Capability to target micro-controller boards including MINI-MAX/51-E
- Microcontroller simulator to simulate program execution without having the actual hardware

**Micro C Compiler** is powerful C compiler package for the 8051. Micro C includes all tools and utilities you need to develop 'C' and 'ASM' code for the 8051/52 family of processors.

## Hardware Setup

Your PC should already be connected to your Ethernet hub. The included Ethernet cable cannot be used to connect the MM51E board directly to the PC. For that, you must use an Ethernet cable designed for hub-to-hub communications, commonly referred to as an X cable.

*Note. You can use a BiPOM Electronics Ethernet cross cable (Part#: ECC-1) to connect MINI-MAX/51-E directly to a PC's network card.*

- 1) Connect one end of Ethernet cable to Ethernet port of MINI-MAX/51-E (J6)
- 2) Connect other end of Ethernet cable to the hub
- 3) Connect one end of serial cable to an available serial (COM) port on your PC
- 4) Connect the other end of serial cable to MINI-MAX/51-E serial (COM) port (J2)
- 5) Connect the 6VDC Adapter to the MINI-MAX/51-E power connector (J5)

## Testing the Hardware

BiPOM Electronics provides all the necessary software to test the hardware.

**MM51E comes set from the factory as IPX server.**

It means you need to download the WEB server code to the MINI-MAX/51-E board

- 1) Run Micro-IDE;
- 2) Open WEB project (Project->Open Project menu option) under  
..\MicroC\BipomLib\MM51E\Servers\WEB\_SERVER;
- 3) WEB server has been designed for HOST with IP 65.71.108.27.  
Of course, you need to change IP address for your needs

```
/* Set our IP address */
```

```
OurIP[0] = 65;
```

```
OurIP[1] = 71;
```

```
OurIP[2] = 108;
```

```
OurIP[3] = 27;
```

WEB server uses HOST with IP 65.71.108.30 as GATE.

You need to change IP address of GATE also

```
/* Set Gate address */
```

```
GateIP[0] = 65;
```

```
GateIP[1] = 71;
```

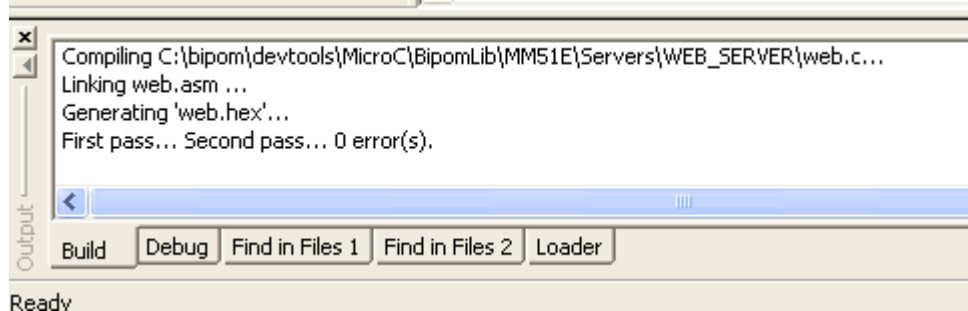
```
GateIP[2] = 108;
```

```
GateIP[3] = 30;
```

*Note. You can test MINI-MAX/51-E WEB server on local network. Current implementation*

of WEB server uses 255.255.255.0 subnet mask. For example, if your PC has IP 192.168.0.1 on local network ( or even you have one PC) you can assign IP address for MINI-MAX/51-E as 192.168.0.2. IP address of GATE does not matter in this case.

- 4) Press "Build All" icon button on toolbar of Micro-IDE.  
Check Output\Build window.



If you have no success message like "0 error(s)" please check all your corrections of C source and try to re-build again.

- 5) Download WEB server to the MM51E board ("Download" icon button)  
*Figure 2 shows DOWNLOAD PROCESS.*

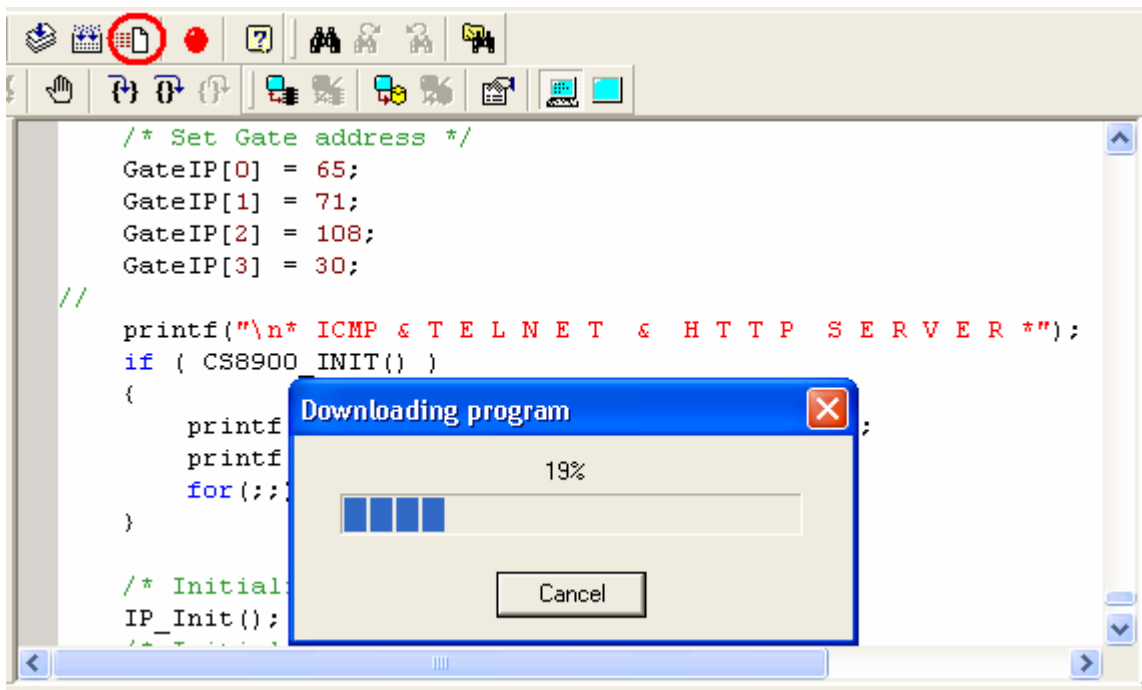


Figure 2

- 6) Connect Terminal Window and put board in RUN mode (change "Set Mode" button to GREEN LIGHT). Figure 3 shows RUN mode of MINI-MAX/51-E board.  
You will be see welcome message of WEB server.

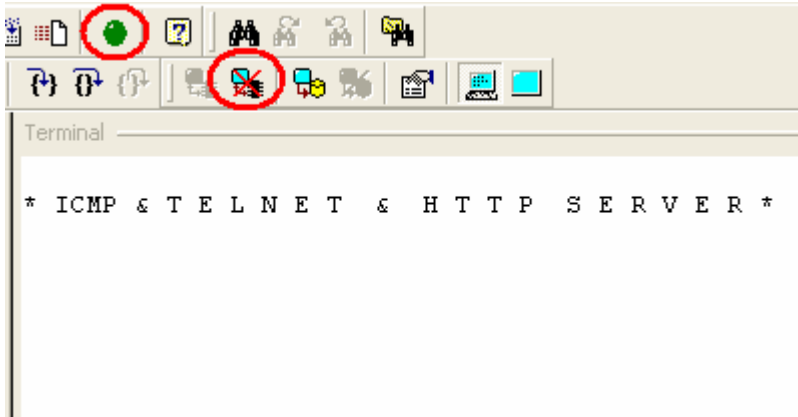


Figure 3

- 7) To check IP routing please try to “ping” the board as first step ( ping.exe 65.71.108.27 )  
Figure 4 shows stable connection between PC HOST and MINI-MAX/51-E board.  
*Note. Do not forget to type your IP address instead of 65.71.108.27*  
*Note. If you have lots of network traffic you can define a large timeout using “-w” option.*

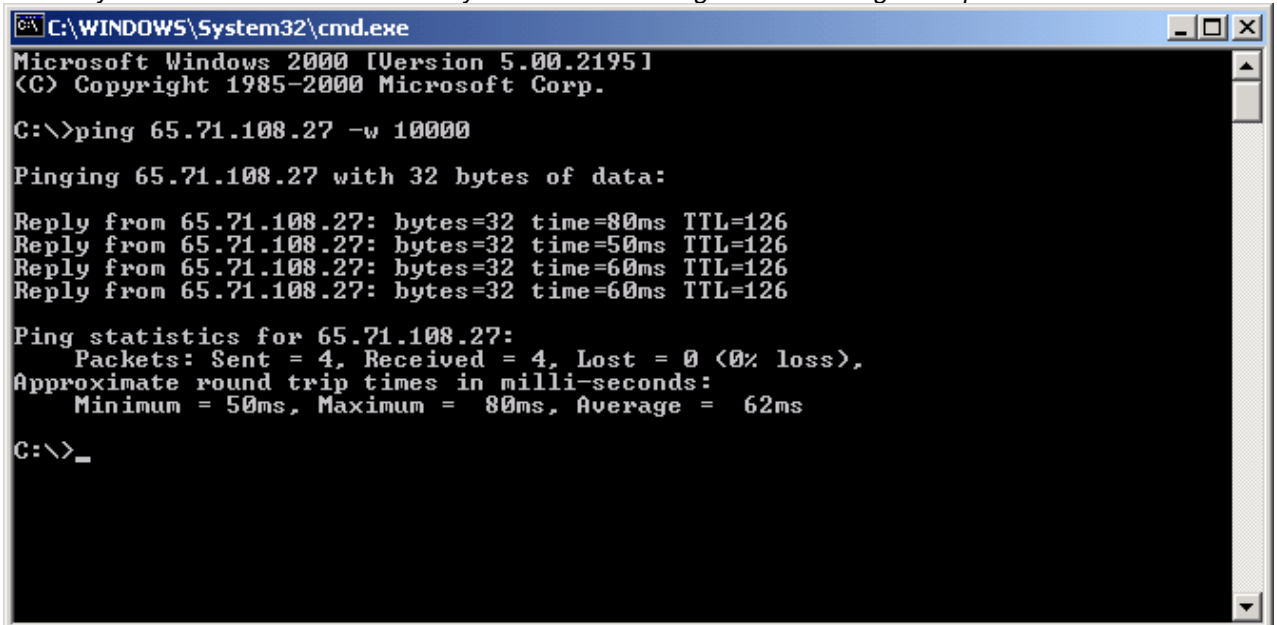


Figure 4

- 8) Now you can run an Internet WEB browser (for example, IE6.0). Type <http://65.71.108.27/> on command line of Internet Explorer and press “Enter” button of your keyboard.  
Figure 5 shows downloaded WEB page of MINI-MAX/51-E WEB server.  
*Note. Do not forget to type your IP address instead of 65.71.108.27*



Figure 5

9) If you have Training TB-1 board from BiPOM Electronics ( [http://www.bipom.com/periph\\_boards.php](http://www.bipom.com/periph_boards.php) ) you can install TB-1 to Expansion connector on top of MINI-MAX/51-E board.

*Note. MINI-MAX/51-E is a MINI-MAX/51-C compatible single board computer with the ATMEL T89C51RD2 chip and a built-in Ethernet controller.*



**TB-1:** TB-1 Training Board allows performing various experiments with the [MINI-MAX/51-C](#) or other 8051 compatible boards. TB-1 has programmable traffic lights, 4-channel, 8-bit analog inputs, buzzer, switch inputs, and counter/timer inputs to test the interrupts.

[Technical manual](#)

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Figure 6

By pressing “LightOn” or “LightOff” buttons you will be able to interact with the board. It will affect the RED LED on TB-1.

10) Click the “Monitoring” link. You will open a new WEB page of the MINI-MAX/51E server

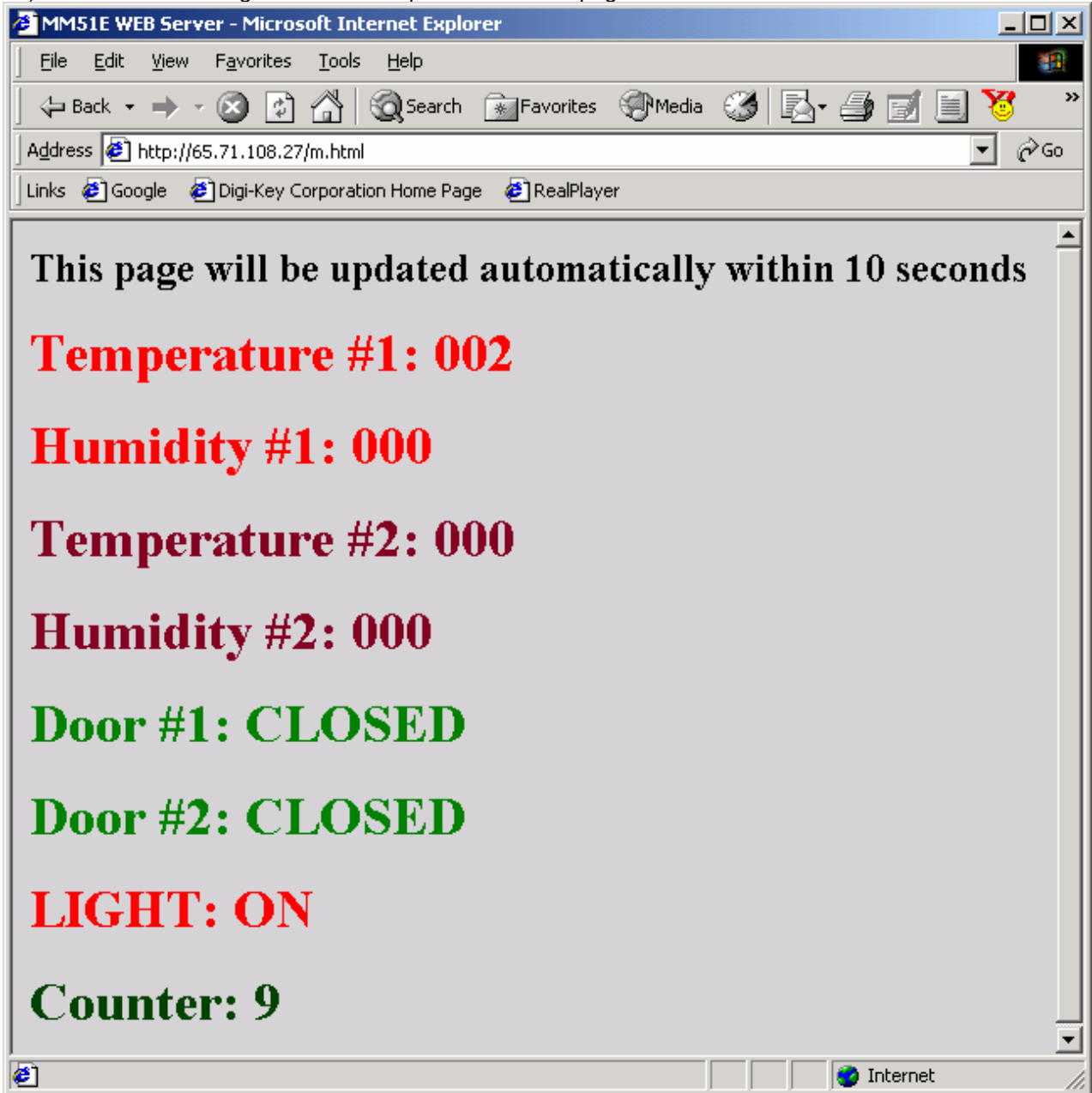


Figure 7

- Temperature #1 shows the value of analog channel #1 of TB-1 board.
- Humidity #1 shows the value of analog channel #2 of TB-1 board.
- Temperature #2 shows the value of analog channel #3 of TB-1 board.
- Humidity #2 shows the value of analog channel #3 of TB-1 board.
- Door #1 shows the current state of switching push button #1 of TB-1 board.
- Door #2 shows the current state of switching push button #2 of TB-1 board.
- LIGHT shows the current state of the RED LED.

*Note. MINI-MAX/51-E WEB server uses special Java script, that updates the current WEB page automatically within 10 seconds. You can press switching button #1 on TB-1 board. Within 10 seconds you will see updated WEB page. It will have “Door #1: Opened” message.*

11) MINI-MAX/51E WEB server also supports TELNET service. Run TELNET utility and open new TCP connection to host with IP 65.71.108.27.

Note. Do not forget to type your IP address instead of 65.71.108.27

```

Telnet 65.71.108.27
f - MM51E (rev 1.02) TELNET SERVER: LED OFF -
n - MM51E (rev 1.02) TELNET SERVER: LED ON -
f - MM51E (rev 1.02) TELNET SERVER: LED OFF -
a - MM51E (rev 1.02) TELNET SERVER: UNKNOWN COMMAND
Available commands:
N - LED ON
F - LED OFF
gHTTP/1.1 200 OK
Cache-control: no-cache
Connection: Keep-Alive
Content-Length: 000
@0895
Content-Type: text/html
<HTML>
  <HEAD>
    <TITLE>MM51E WEB Server</TITLE>
  </HEAD>
  <BODY BGCOLOR="#FFFFFF">
    <H1><I
MG SRC= photo.jpg></H1>
    <TABLE height=18 cellSpacing=0 cellPadding=0 width=734 bo
rder=0>
      <TBODY>
        <TR>
          <TD width=625 height=0><STRONG><FONT face=Arial color=#000080
size=6>BiPOM
            Electronics,Inc.</FONT></STRONG><FONT face=Arial><BR></FONT><FONT
            fac
            e=Uerdana size=2><STRONG>Your One Source for Micro-controller Systems
            and Compone
            nts</STRONG></FONT></TD>
        </TR></TBODY></TABLE>
      <b><p><font color="#FF0000" size="5
">
        <H1><marquee width="388" height="26" bgcolor="#FFFFFF"> MM51E WEB SERVER </mar
quee></H1>
        <H1><font color="#004000">VISITOR: 00000902</H1>
          <hr>
          <form method="subm
it" action="Light">
            <input type="submit" name="Submit" value="LightOn">
            <input typ
e="submit" name="Submit" value="LightOff">
          </form>
          <H1><font color="#808080">LIGHT
:
            OFF</H1>
            <H1><a href="m.html">Monitoring</a></H1>
          </BODY>
        </HTML>
n - MM51E (
rev 1.02) TELNET SERVER: LED ON -
n - MM51E (rev 1.02) TELNET SERVER: LED ON -
f - MM51E (rev 1.02) TELNET SERVER: LED OFF -
a - MM51E (rev 1.02) TELNET SERVER: UNKNOWN COMMAND
Available commands:
N - LED ON
F - LED OFF
n - MM51E (rev 1.02) TELNET SERVER: LED ON -
f - MM51E (rev 1.02) TELNET SERVER: LED OFF -

```

Figure 8

Telnet service of MINI-MAX/51-E WEB server supports 2 public commands:

- "n" – turn RED LED on ;
- "f" – turn RED LED off.

Also, Telnet service supports a hide command ( "g"). It shows WEB page in HTML form.

On any another command Telnet will send

<command> - MM51E ( rev 1.02) TELNET SERVER: UNKNOWN COMMAND

Available commands:

N - LED ON



## **How can you build your own WEB server?**

It is very easy! BiPOM Electronics provides all sources of the WEB server.

WEB project is available under MicroC\BipomLib\MM51E\Servers\WEB\_SERVER. This project is very simple because most of the code has already been implemented for you inside the "mm51et.lib" library.

This simple command line of the Linker (Project->Settings->Linker) has been pre-configured to allow you to use full TCP/IP stack:

```
{TOOLKITDIR}\slink {OBJFILES} l={TOOLKITDIR}\lib51 i=mm51et.lib -q {TMPFILE}
```

For low-level access to the networking hardware on the MINI-MAX/51-E:

CS8900 project is available under MicroC\BipomLib\MM51E\CS8900

ARP project is available under MicroC\BipomLib\MM51E\ARP

ICMP project is available under MicroC\BipomLib\MM51E\ICMP

IP project is available under MicroC\BipomLib\MM51E\IP

TCP project is available under MicroC\BipomLib\MM51E\TCP

For low-level access to built-in hardware on the MINI-MAX/51-E:

I2CT (I2C library) project is available under C:\bipom\devtools\MicroC\BipomLib\I2C\Tiny

ExMem (XRAM library) project is available under C:\bipom\devtools\MicroC\BipomLib\MM51E\ExMem

All projects are sources of the TCP/IP stack, which is supported by "mm51et.lib" library. You can see how it works and adapt for your needs.

## **How can you put dynamically changed data inside of your HTML code?**

Let's research how MINI-MAX/51-E can do it.

For example, do you notice that the color of the "LIGHT OFF" message is gray and "LIGHT ON" message is red?

```
'<H1><font color=^TAG:LF1">LIGHT: ^TAG:LT1</H1>'
```

We have 2 tags inside of this HTML line:

^TAG:LF1 – color of message;

^TAG:LT1 - "ON" or "OFF" string.

How can TCP engine handle these tags?

The TCP engine envelopes HTML code in TCP packets and sends them through TCP connection.

When the TCP engine reaches the "^TAG:LF1" tag it will call the GetTag function

( prototype: register UBYTE\* HTTP\_GetTag(const UBYTE\* pt) ).

"pt" points to "^TAG:LF1". You should decode the name of this tag and handle it

```
if (STRING_STRCMP(tag,"LF1")==SUCCESS)
```

```
  /*#808080
```

```
  if( P1 & 8 )
```

```
  {
```

```
    tag[0] = "";
```

```
    tag[1] = '#';
```

```
    tag[2] = '8';
```

```
    tag[3] = '0';
```

```
    tag[4] = '8';
```

```
    tag[5] = '0';
```

```
    tag[6] = '8';
```

```
    tag[7] = '0';
```

```
  }
```

```
  else
```

```
  { tag[0] = "";
```

```
    tag[1] = '#';
```

```
tag[2] = 'F';  
tag[3] = 'F';  
tag[4] = '0';  
tag[5] = '0';  
tag[6] = '0';  
tag[7] = '0';  
}
```

GetTag returns a pointer to “tag” char array. It can contain “#808080” (RED color) in case of LED ON or “#FF0000” (GRAY color) in case of LED OFF. TCP engine will replace 8 symbols of “^TAG:LF1” with 8 chars from “tag” array inside of HTML code.

TCP engine will handle “^TAG:LT1” tag in the same way.

As a result Internet browser will get a different string depending a state of RED LED:

- '<H1><font color="#808080">LIGHT: ON </H1>'
- '<H1><font color="#FF0000">LIGHT: OFF </H1>'

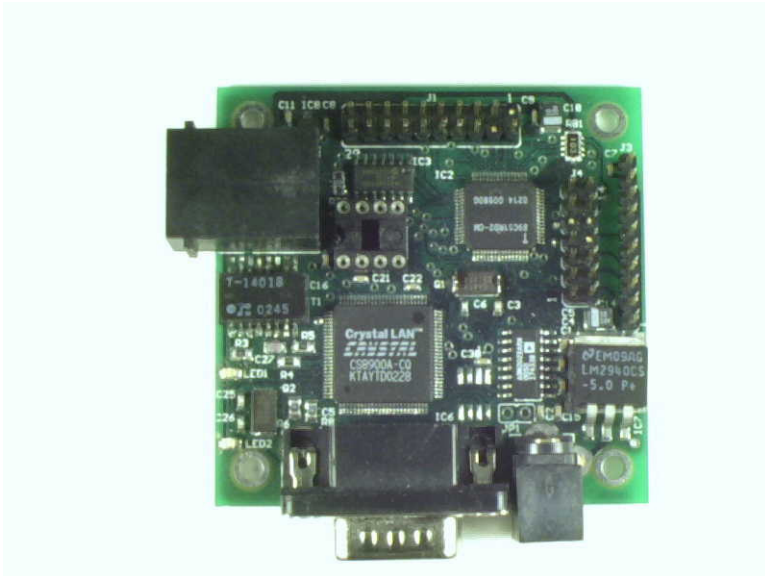


Figure 9. MINI-MAX/51-E board ( rev 1.02)