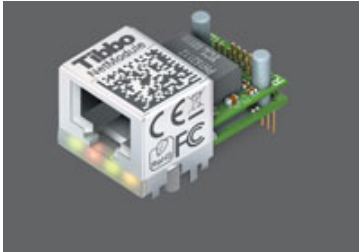


EM202 Ethernet-to-serial Module



The EM202 is a "RJ45 form factor" Ethernet Module for onboard installation. Module hardware includes one 100BaseT Ethernet port (standard Ethernet magnetics and RJ45 connector are integrated in the EM202*), one serial port (CMOS-level), and an internal processor, whose firmware acts as a bridge between the Ethernet and serial ports. Standard Ethernet cable plugs directly into the RJ45 connector on the network "side" of the Module. Serial "side" interfaces directly to the serial port pins of most microcontrollers, microprocessors, UARTs, etc.

From the hardware standpoint, the EM202 can be viewed as a universal platform suitable for running a variety of network and serial communications-related applications. It is the application firmware, not the hardware that gives the EM202 most of its functionality.

The [Application firmware](#) EM202 is supplied with, currently in its 3rd generation ("Release3"), turns the EM202 into a Serial Device Server used to connect serial devices to the Ethernet (TCP/IP) networks.

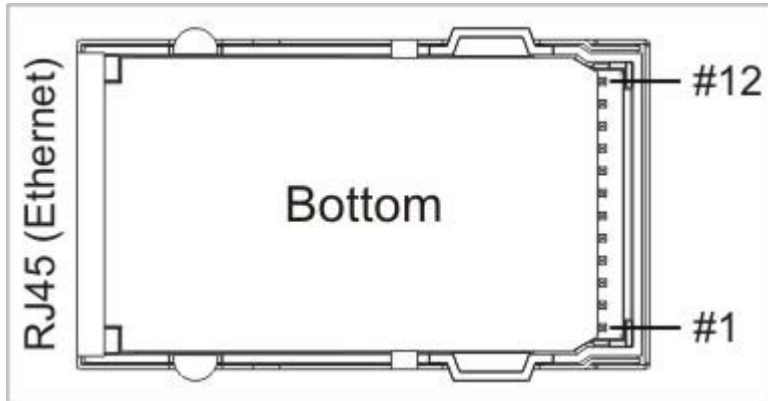
The application firmware of the EM202 can be upgraded through the module's serial port or Ethernet port. Serial upgrades are facilitated by a so-called [Monitor](#)- a fixed "service" firmware inside the EM202. The Monitor itself cannot be upgraded. Network upgrades rely on the application firmware itself- there is a self upgrade algorithm that will be detailed later.

Since most of the EM202's operation is defined by its firmware the major part of the EM202's functional description can be found in the [Device Server Application Firmware Manual](#). This *EM202 Ethernet Module Manual* focuses on the hardware portion of the EM202.

**Or, to put it another way, the electronics of the EM202 are built into RJ45 connector.*

I/O pin assignment and pin functions

EM202 pin assignment is shown below.



#1	MD (MD)	Input	Mode selection pin
#2	RST	Input	Reset, active high
#3	P3 (DTR)	Input/output (output)	General-purpose input/output line Data terminal ready output
#4	P2 (DSR)	Input/output (input)	General-purpose input/output line Data set ready input
#5	L3 (SG)	Output (output)	LED output 3 (Green status LED)
#6	L4 (SR)	Output (output)	LED output 4 (Red status LED)
#7	VCC		Positive power input, 5V nominal, +/- 5%, app. 220mA
#8	GND		Ground
#9	RX	Input	Serial receive line
#10	TX	Output	Serial transmit line
#11	P4 (CTS/SEL)	Input/output (input)	General-purpose input/output line Clear to send input Full-/half-duplex selection input
#12	P5 (RTS/DIR)	Input/output (output)	General-purpose input/output line Request to send output (full-duplex mode) Data direction control output (half-duplex mode)

Line functions defined by the [application firmware](#) are shown in **blue**

Click on one of the links provided below to learn more about EM202's I/O pins:

- [Serial port lines](#)
- [LED lines](#)
- [Power, reset, and mode selection lines](#)

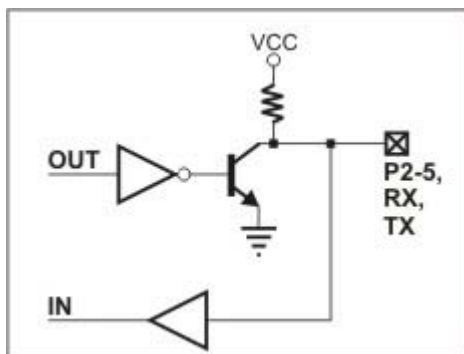
Serial port and general-purpose I/O lines

#3	P3 (DTR)	Input/output (output)	General-purpose input/output line Data terminal ready output
#4	P2 (DSR)	Input/output (input)	General-purpose input/output line Data set ready input
#9	RX		Serial receive line
#10	TX		Serial transmit line
#11	P4 (CTS/SEL)	Input/output (input)	General-purpose input/output line Clear to send input Full-/half-duplex selection input
#12	P5 (RTS/DIR)	Input/output (output)	General-purpose input/output line Request to send output (full-duplex mode) Data direction control output (half-duplex mode)

Line functions defined by the [application firmware](#) are shown in **blue**

The EM202 features a serial port (RX, TX lines) and several general-purpose I/O lines (P2*-P5). All of the above lines are of CMOS type. From the hardware point of view, all general-purpose I/O lines can serve as inputs or outputs. Maximum load current for all CMOS lines is 10mA.

Simplified structure of EM202's I/O lines is shown on the circuit diagram below. All lines are "quasi-bidirectional" and can be viewed as open collector outputs with weak pull-up resistor. There is no explicit direction control. To "measure" an external signal applied to a pin the OUT line must first be set to HIGH. It is OK to drive the pin LOW externally when the pin outputs HIGH internally.



The [application firmware](#) of the EM202 maps certain serial port functions onto the general-purpose I/O pins- these functions are shown in blue in the table at the top of this topic. For example, P5 is a universal input/output but the application firmware can be set to turn this line into the RTS output of the serial port. Therefore, depending on your application you can view P5 as a general-purpose I/O line or specific control line of the serial port (RTS).

Being of CMOS type, the serial port and I/O lines of the EM202 can be connected directly to the serial port pins and I/O lines of most microcontrollers, microprocessors, etc. An interface IC** must be added to the EM202 externally if you want to connect the module to a "true" serial port (for example, COM port of the PC).

Logical signals on the serial port lines of the EM202 are active LOW. TX and RX lines are high when idle, start bit is LOW, stop bit is HIGH; LOW on CTS and RTS lines means "transmission allowed" and HIGH means "transmission not allowed". This is standard for CMOS-level serial ports and is exactly opposite to the signalling on the RS232 cables. Logical signals on the EM202 are inverted because standard interface

ICs** invert the signals internally too.

As explained earlier, actual functionality of the I/O lines is firmware-dependent. See [serial port and serial communications](#) for details.

* *There are no lines P0 and P1. Line names were selected for naming compatibility with the [EM100](#)*

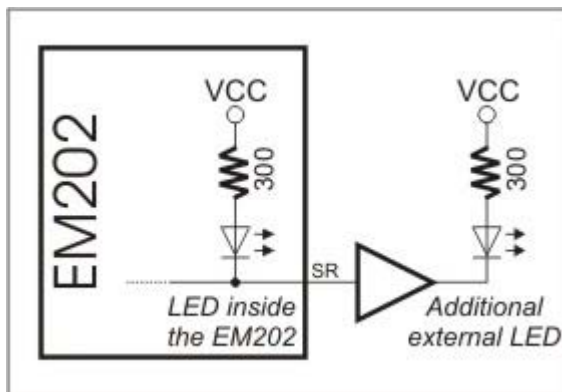
** *Such as MAX232 for RS232, MAX485 for RS485, etc.*

LED lines

#5	L3* (SG)	Output	LED output 3, Green status LED
#6	L4* (SR)	Output	LED output 4, Red status LED

Line functions defined by the [application firmware](#) are shown in **blue**

The EM202 has two LED control lines. Both lines have the same internal structure. Each line drives one [internal LED](#) (see figure below). If you want to connect an external LEDs as well you may do so but we recommend using a TTL buffer element to reduce the load on the I/O line of the EM202's internal microcontroller. Maximum load for each line without the buffer is 2mA.



The firmware of the EM202 uses L3 and L4 as "status LEDs" which display various status information depending on what firmware is running at the moment. Follow the links below to learn more about the behaviour of these LEDs under different conditions:

- [SR/SG behavior in the monitor firmware.](#)
- [SR/SG behavior in the application firmware.](#)

* *There are no lines L1 and L2. Line names were selected for naming compatibility with the [EM100](#)*

Power, reset, and mode selection lines

#7	VCC		Positive power input, 5V nominal, +/- 5%, app. 230mA
#8	GND		Ground
#2	RST	Input	Reset, active high
#1	MD (MD)	Input	Mode selection pin

Line functions defined by the [application firmware](#) are shown in **blue**

The EM202 should be powered from a stabilized DS power supply with output nominal voltage of 5V (+/- 5% tolerance). Current consumption of the EM202 is approximately 230mA (in 100BaseT mode).

Proper external reset is a must! Reset pulse should be an active HIGH. We strongly advise against using low-cost RC-networks and other unreliable methods of generating reset pulse. Reset should be applied for as long as the power supply voltage is below 4.6V. We recommend using a dedicated reset IC with brownout detection, such as MAX810. Reset pulse length should be no less than 50ms, counting from the moment the power supply voltage exceeds 4.6V.

If the EM202 is used to serve as a communications co-processor in a larger system that has its own CPU it is also OK to control the RST line of the EM202 through a general-purpose I/O pin of the "host" microcontroller. I/O pins of many microcontrollers default to HIGH after the powerup and this means that the reset will be applied to the EM202 at the same time when the host microcontroller is reset. All the host microcontroller has to do is release the EM202 from reset at an appropriate time by switching the state of the I/O line to LOW.

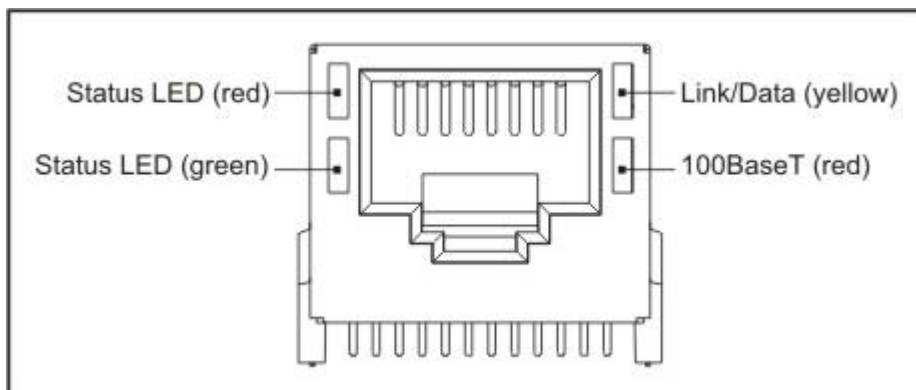
The MD line of the EM202 is used to select the operating mode of the EM202 and/or its application firmware. The reason why the pin name is shown as MD(**MD**) is because the functionality of this pin is in part hardwired and in part depends on the [application firmware](#):

- **Hardwired functionality.** When the EM202 powers up it verifies the state of the MD input. If the MD input is at HIGH the EM202 proceeds to verifying and running the application firmware loaded into its internal FLASH memory. If the MD input is at LOW the EM202 enters the serial upgrade mode. For more information see [Monitor](#).
- **Application firmware-dependent functionality.** When the [application firmware](#) is already running the MD line is typically used to make the EM202 enter the serial programming mode. For more information see [serial programming](#).

When the EM202 is used as a co-processor in a host system the MD line can be also controlled by the host microcontroller. Ability to control both the RST and DS lines allows the host microcontroller to switch between the operating modes of the EM202.

Built-in LEDs₂

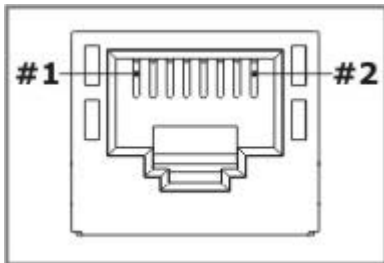
The EM202 features four built-in LEDs (shown on figure below) that are placed on the front of the device, next to the RJ45 connector.



LEDs have the following function:

- **Status LED** (red) is internally connected to the [L4\(SR\) LED control line](#).
- **Status LED** (green) is internally connected to the [L3\(SG\) LED control line](#).
- **Link/Data LED** (green) is turned on when "live" Ethernet cable is plugged into the Module. The LED is temporarily switched off whenever an Ethernet packet is received.
- **100BaseT LED** (yellow) is turned on when the EM202 links with the hub at 100Mb. The LED is off when the link is established at 10Mb.

Built-in RJ45 Ethernet connector

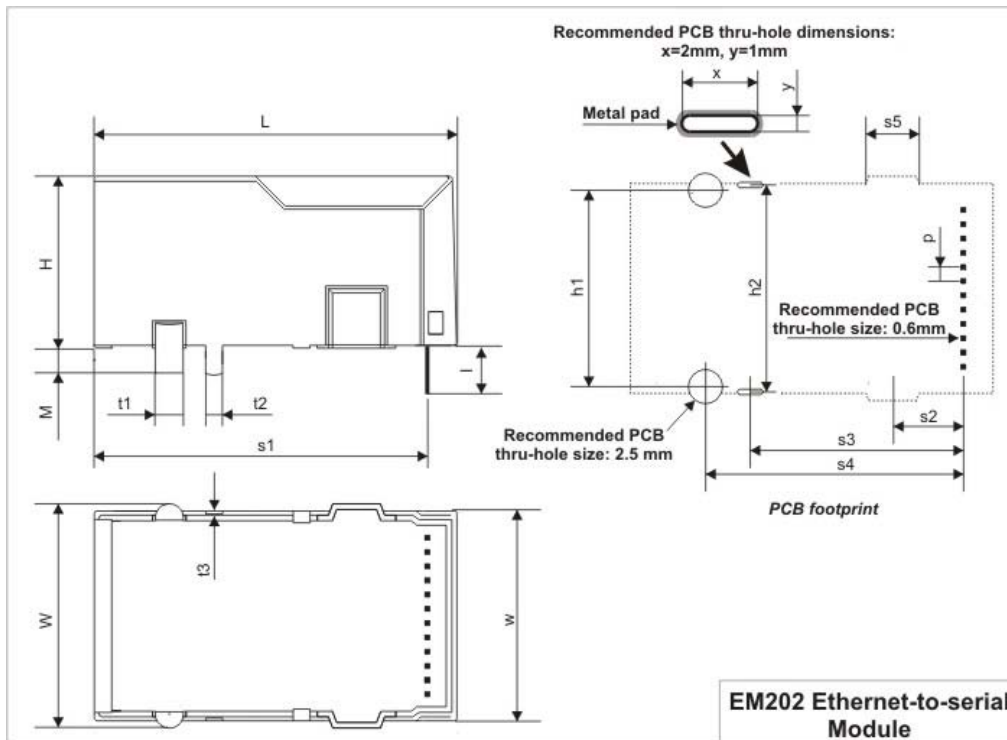


Ethernet port of the EM202 is of 10/100BaseT type (auto-switching).

Connector is of RJ45 type, pin assignment is as follows:

#1	TX+
#2	TX-
#3	RX+
#4	<No connection>
#5	<No connection>
#6	RX-
#7	<No connection>
#8	<No connection>

Mechanical dimensions



L	Max.	32.3	Module length
W	Max.	20.0	Module width including mounting holders
w	Max.	19.0	Module width excluding mounting holders
H	Max.	16.0	Module height
I	Min.	4.5	Lead length
M	Min.	1.9	Height of mounting holders and solder pins
t1	Aver.	2.45	Mounting holder diameter
t2	Aver.	1.5	Solder pin width
t3	Aver.	0.25	Solder pin thickness
p	Aver.	1.27	Pin pitch
s1	Aver.	29.7	Distance from device "face" to the leads
s2	Aver.	6.3	Distance from leads to the center of "pockets"
s3	Aver.	19.0	Distance from leads to the mounting solder pins
s4	Aver.	23.0	Distance from leads to the mounting holders
s5	Max.	5.0	"Pocket" length
h1	Aver.	17.5	Distance between center lines of mounting holders
h2	Aver.	18.5	Distance between center lines of mounting solder pins

All dimensions are in millimeters

Specifications and EM202 modifications

The EM202 has one submodel in circulation- EM202-00.

Device specifications are presented in the table below.

Parameter	EM202-00
Ethernet interface	10/100BaseT Ethernet, standard magnetics and RJ45 connector built-in
Serial interface and I/O lines	CMOS-level; TX, RX, and 4 additional I/O lines with RTS, CTS, DTR, DSR implemented in application firmware
Routing buffers size	12Kbytes x 2*
Maximum load current of I/O lines	10mA
Power requirements	DC 5V, +/- 5%, app. 230 mA (in 100BaseT mode)
Device temperature during operation	+40 degrees C** (in 100BaseT mode)
Operating temperature	-10 to +70 degrees C
Operating relative humidity	10-90%
Mechanical dimensions (excl. leads)	App. 32.5x19x15.5mm
Packing	Plastic tray, 30 modules/tray

* *Maximum possible buffer size. Actual size may be smaller depending on how much RAM is "consumed" by the firmware*

** *As measured on top of the device*

Ethernet-to-serial Boards

This part of documentation describes Ethernet-to-serial Boards supplied by Tibbo. These boards can be used for convenient evaluation and testing of Tibbo [Ethernet-to-serial Modules](#). At the same time, some boards are also suitable for use in production devices as "faster implementation" alternatives to Modules.

The following Boards are currently manufactured:

- [EM100-EV Evaluation Board](#)
- [EM120/EM200-EV Evaluation Board](#)
- [EM202-EV Ethernet-to-RS232 Board](#)

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