

# EM200 Ethernet Module



The EM200 is an Ethernet Module for onboard installation. Module hardware includes one 100BaseT Ethernet port (standard Ethernet magnetics are **NOT integrated** into the Module), one serial port (CMOS-level) with a number of additional general-purpose I/O lines, and an internal processor, whose firmware acts as a bridge between the Ethernet and serial ports. Ethernet "side" of the Module connects directly to a standard Ethernet magnetics circuit (such as YCL-PH163112) or RJ45 connector with integrated magnetics. Serial "side" interfaces directly to the serial port pins of most microcontrollers, microprocessors, UARTs, etc.

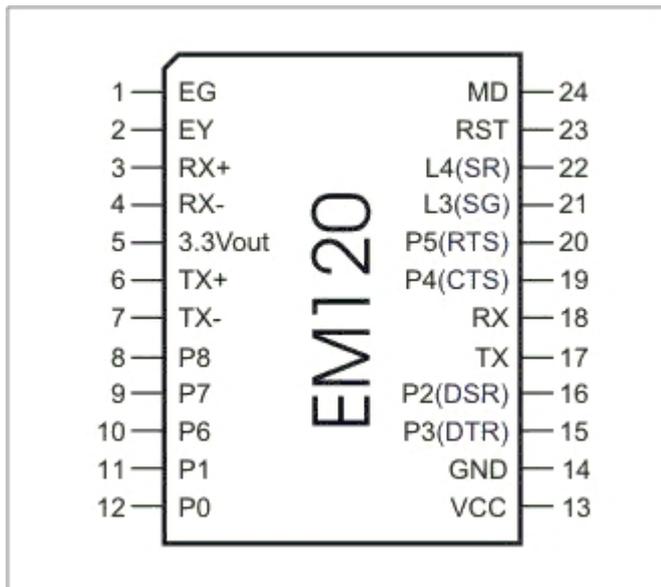
From the hardware standpoint, the EM200 can be viewed as a universal platform suitable for running a variety of network and serial communications-related applications. It is the application firmware, not hardware that gives the EM200 most of its functionality.

The [Application firmware](#) EM200 is supplied with, currently in its 3rd generation ("Release3"), turns the EM200 into a Serial Device Server used to connect serial devices to the Ethernet (TCP/IP) networks.

The application firmware of the EM200 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 EM200. The Monitor 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 EM200's operation is defined by its firmware the major part of the EM200's functional description can be found in the [Device Server Application Firmware Manual](#). This *EM200 Ethernet Module Manual* focuses on the hardware portion of the EM200.

## I/O pin assignment and pin functions



Click on the pin in the diagram above or one of the links provided below to learn more about EM200's I/O pins:

- [Ethernet port lines](#)
- [Serial port and general-purpose I/O lines](#)
- [LED lines](#)
- [Power, reset, and mode selection lines](#)

### Ethernet port lines

<b>#6</b>	<b>TX+</b>	Output	Positive line of the differential output signal pair
<b>#7</b>	<b>TX-</b>	Output	Negative line of the differential output signal pair
<b>#3</b>	<b>RX+</b>	Input	Positive line of the differential input signal pair
<b>#4</b>	<b>RX-</b>	Input	Negative line of the differential input signal pair
<b>#5</b>	<b>3.3V</b>	Output	"Clean" 3.3V power for magnetics circuitry

Ethernet port of the EM200 is of 100BaseT type. Onboard electronics of the EM200 do not include Ethernet magnetics, so magnetic circuitry must be connected externally. You can use either a standalone magnetics part (such as YCL-PH163112) or RJ45 connector with integrated magnetics.

It is important to make the PCB wire connections between the Ethernet port pins of the EM200 and external magnetics circuitry as short as possible. Making the wires too long may cause the noise level generated by your PCB surpass the maximum radiated emission limits stipulated by FCC and CE regulations. Additionally, longer Ethernet lines on the PCB will make your board more susceptible to the damage from the ESD (electrostatic discharge).

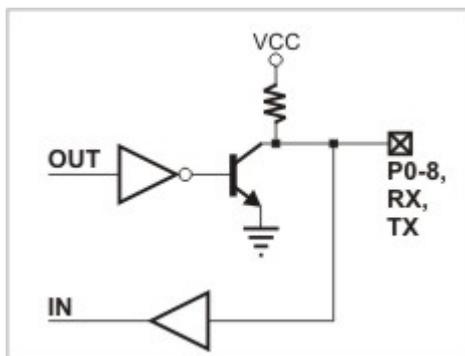
## Serial port and general-purpose I/O lines

#8	P8	Input/output	General-purpose input/output line
#9	P7	Input/output	General-purpose input/output line
#10	P6	Input/output	General-purpose input/output line
#11	P1	Input/output	General-purpose input/output line
#12	P0	Input/output	General-purpose input/output line
#15	P3 (DTR)	Input/output (output)	General-purpose input/output line Data terminal ready output
#16	P2 (DSR)	Input/output (input)	General-purpose input/output line Data set ready input
#17	TX		Serial transmit line
#18	RX		Serial receive line
#19	P4 (CTS/SEL)	Input/output (input)	General-purpose input/output line Clear to send input Full-/half-duplex selection input
#20	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 EM200 features a serial port (RX, TX lines) and several general-purpose I/O lines (P0-P8). 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 EM200'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 EM200 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 EM200 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 EM200 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 EM200 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 EM200 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.

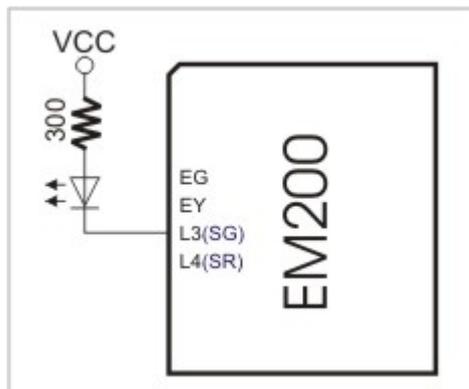
\* Such as MAX232 for RS232, MAX485 for RS485, etc.

## LED lines

#1	EG	Output	Green Ethernet status LED
#2	EY	Output	Yellow Ethernet status LED
#21	L3 (SG)	Output	LED output 3, <a href="#">Green status LED</a>
#22	L4 (SR)	Output	LED output 4, <a href="#">Red status LED</a>

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

The EM200 has four LED control lines. All lines have the same internal structure and the LEDs should be connected to these lines as shown on the schematic diagram below. Maximum load for each line is 10mA.



EG and EY lines reflect the status of the Ethernet port. The EG LED is switched on whenever a live Ethernet connection is detected by the EM200's Ethernet port. The EG LED is momentarily switched off whenever the EM200 receives a network packet. The EY shows whether current Ethernet link is of 10BaseT type (EY off) or 100BaseT (EY on).

SG and SR lines are under firmware control and 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.](#)

## Power, reset, and mode selection lines

#13	VCC		Positive power input, 5V nominal, +/- 5%, app. <b>220mA</b>
#14	GND		Ground
#23	RST	Input	Reset, active high
#24	MD (MD)	Input	Mode selection pin

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

The EM200 should be powered from a stabilized DS power supply with output nominal voltage of 5V (+/- 5% tolerance). Current consumption of the EM200 is approximately 220mA (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.

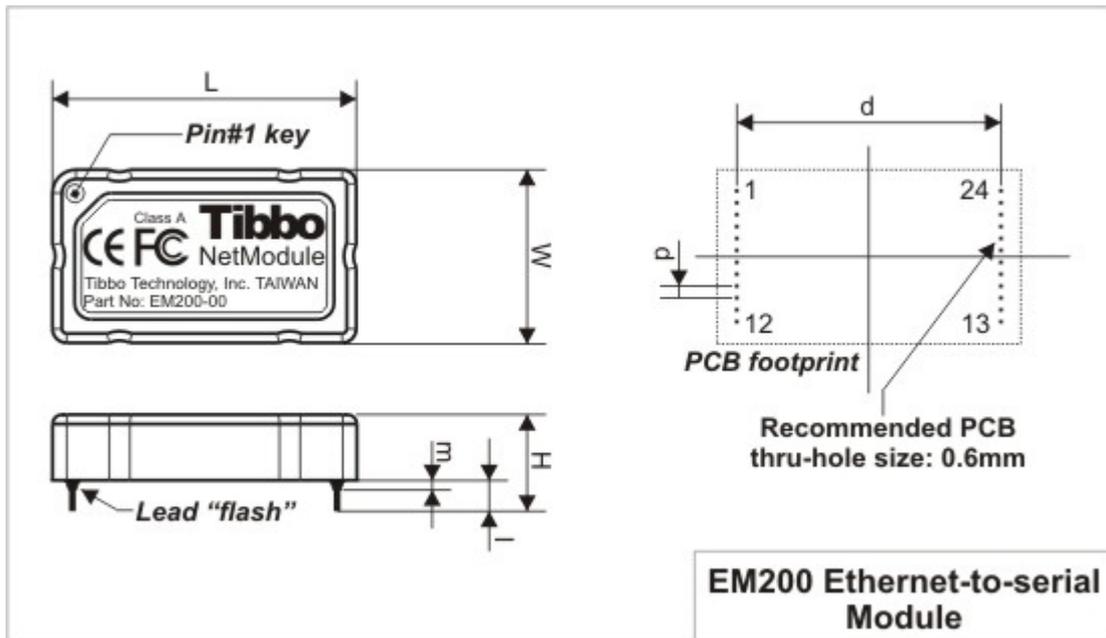
If the EM200 is used to serve as a communications co-processor in a larger system that has its own CPU it is also OK to control the RST line of the EM200 through a general-purpose I/O pin of the "host" microcontroller. I/O pins of many microcontrollers default to HIGH after the powerup and this means that the reset will be applied to the EM200 at the same time when the host microcontroller is reset. All the host microcontroller has to do is release the EM200 from reset at an appropriate time by switching the state of the I/O line to LOW.

The MD line of the EM200 is used to select the operating mode of the EM200 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 EM200 powers up it verifies the state of the MD input. If the MD input is at HIGH the EM200 proceeds to verifying and running the application firmware loaded into its internal FLASH memory. If the MD input is at LOW the EM200 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 EM200 enter the serial programming mode. For more information see [serial programming](#).

When the EM200 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 EM200.

## Mechanical dimensions



<b>L</b>	Max.	32.1	Module length
<b>W</b>	Max.	18.5	Module width
<b>H</b>	Max.	7.3	Module height
<b>I</b>	Min.	2.2	Lead length
<b>m</b>	Max.	0.5	Lead "flash"
<b>d</b>	Aver.	28.0	Distance between lead rows
<b>p</b>	Aver.	1.27	Pin pitch

All dimensions are in millimeters

## Specifications and EM200 modifications

The EM200 has one submodel in circulation- EM200-00.

Device specifications are presented in the table below.

Parameter	EM200-00
Ethernet interface	10/100BaseT Ethernet, magnetics <b>not</b> built-in
Serial interface and I/O lines	CMOS-level; TX, RX, and 9 additional I/O lines with RTS, CTS, DTR, DSR implemented in <a href="#">application firmware</a>
<a href="#">Routing buffers</a> size	12Kbytes x 2*
Maximum load current of I/O lines	10mA
Power requirements	DC 5V, +/- 5%, app. 220mA
Device temperature during operation	+55 degrees C** (in 100BaseT mode)
Operating temperature	-10 to +70 degrees C
Operating relative humidity	10-90%
Mechanical dimensions (excl. leads)	App. 32.1x18.5x7.3mm
Packing	Plastic tray, 50 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*