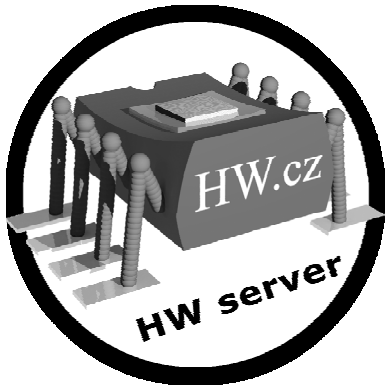
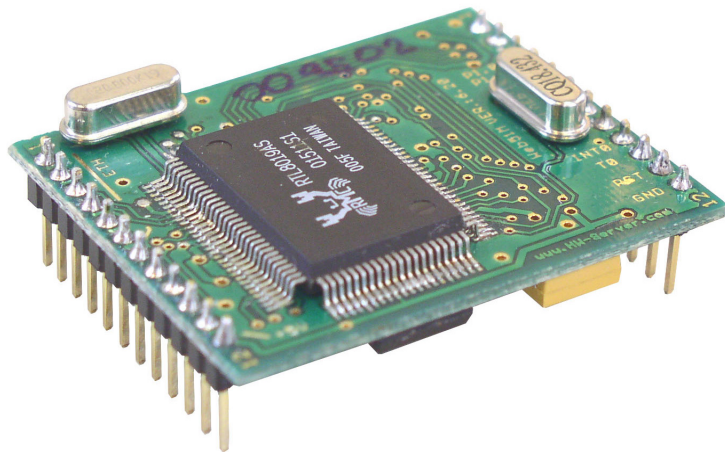




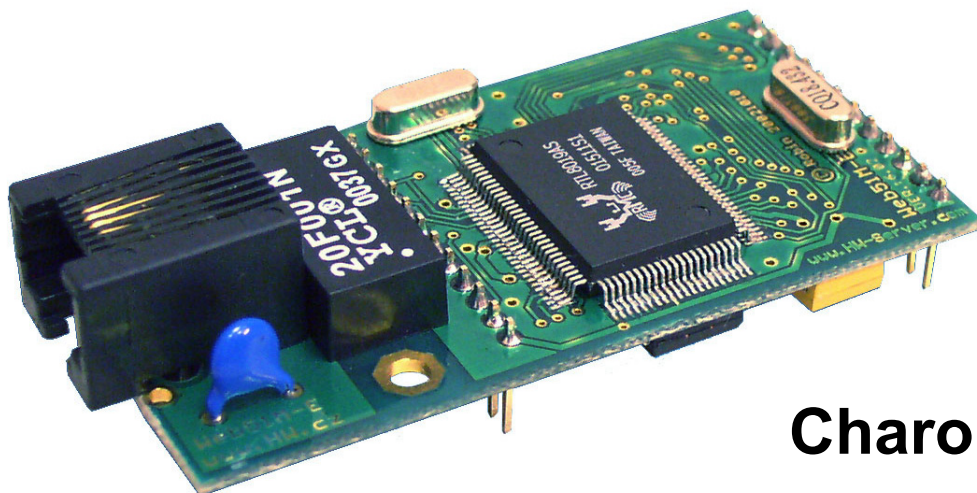
CHARON I

Web51 version 6.x (modul)

Charon is an embedded module that converts a serial line to Ethernet and supports 14 I/O pins. According to the software version, the module can just convert data from RS-232 to TCP/IP, control other appliances, extend connections (for instance) over the Ethernet, e-mail reports about current situation, control up to 64 other devices via SNMP, and more..

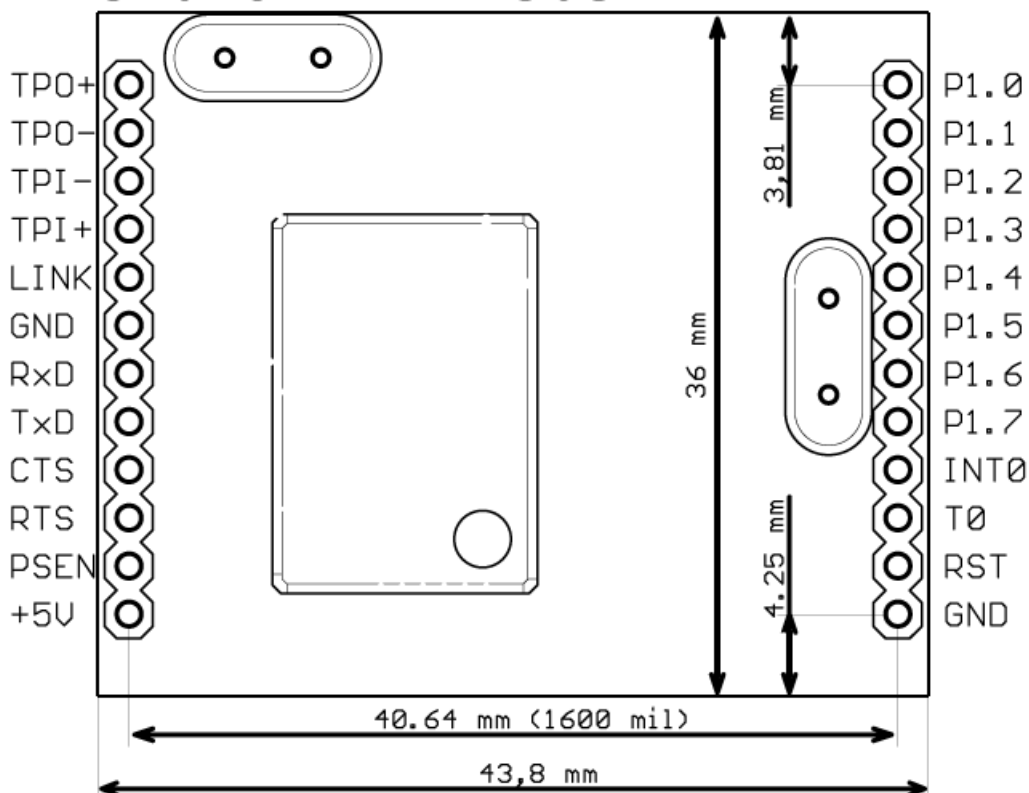


Charon



Charon E

Charon I - Web51



Charon I is available with the following firmware versions:

- **Ethernet - RS232/485 Converter**

Network interface - TCP/IP and UDP/IP protocols, remotely controlled 32kB buffer, support for NVT control according to RFC2217. Application can be configured over RS-232 (with a standard terminal), via UDP on a local segment, or remotely via secured TCP/IP.

Asynchronous interface – Support for serial line protocol autodetection. Full/half duplex mode, direction switching for RS485. Any speed from 0 to 115200 Bd, all settings of parity, stop bits, etc. Support for 9-bit data transfers.

Parallel outputs – The module contains 8 binary I/O pins that can be controlled directly via NVT according to RFC2217 extensions. It is possible to configure data transfer between two modules; these pins are then simply "connected" through the Ethernet. The application is fully compatible with the "boxed" version of the converter and is compatible with all existing communication libraries, ready-made subroutines, configuration software, solution examples, application notes, etc.

- **SNMP version**

Supports remote control of up to 64 binary inputs/outputs, serial RS232 line, etc. Includes SNMP specifications, a demo of a SNMP agent, and a wide range of related docs.

- **Empty (Raw) Version**

The module is shipped in programmable mode. You can develop your own application which can be based on the Web51 system. This version includes the **I/O Controller Lite** application for no additional charge. The module is programmed over RS232 using the available PSEN pin and the Atmel "Flip" software or the RD2 Flasher utility.

Hardware Description

Pin descriptions

PIN NAME	FUNCTION	I/O	optional
TPO+, TPO-	10Base -T Differential Outputs	OUT	-
TPI+, TPI-	10Base -T Differential Inputs	IN	-
LINK	10Base- T Link or RX Indicator	OUT	-
GND	GND for Ethernet shield	GND	-
RxD	P3-0 pin – Receive Data	IN	Module programming
TxD	P3-1 pin – Transmit Data	OUT	Module programming
CTS	P3-3 pin (INT1) - Clear to Send	IN	-
RTS	P3-5 pin (T1) - Request to Send	OUT	-
PSEN	Connect to GND and RESET for programming	IN	Module programming
+5V	Power +5V DC 15-80 mA	PWR	-
P1 (P1.0 .. P1.7)	Direct 8. bit port P1	I/O	-
INT0	P3-2 pin (INT0) - universal pin	I/O	-
T0	P3-4 pin (T1) – universal pin	I/O	*SETUP mode RS232-9600 8N1
RST	RESET module	I/O	-
GND	Main ground	GND	-

*For the **SETUP mode** with the configuration over RS232, connect TO pin to GND and reset module.

HW parameters

Parameters		Charon I – standard version	
Power supply	5V DC / 60 mA	I/O pins	14 = 4 (RS232) + 8 (P1) + 2
Dimension	44 x 35 x 12 mm (L x W x H)	RAM / EEPROM	32 KB / 2 KB (MCU internal)
Temperature	Operating: -5 – 50 °C	RTL8019 EEPROM	256B (93C46) – optionally
Ethernet	10BaseT - 802.3	MCU Xtal	18.432 MHz (X2 mode)
Serial port	TTL levels RxD,TxD,RTS,CTS	Power-on reset	YES – 10% tolerance
Programming	ISP over RS-232 (Atmel Flip SW)	WATCHDOG	MCU internal WD only

Added Value

- **An unique MAC** address is assigned to the module and specified on the label.
- All modules are burned-in for at least 24 hours.
- The module is shipped with a pre-configured firmware that can be removed or overwritten with a user application. In the Raw version, the I/O Controller lite application (released as a part of the Web51 project) is pre-loaded.
- The module is shipped with:
 - **LF1S022** - a RJ45 connector with integrated magnetic.
 - **Charon I - Web51 Development Board** (simple and inexpensive kit).
 - **Charon I & II Development Board** (Develop. board with peripherals for Ethernut Charon II as well).
- **Charon E** version (with the connector on the module) is shipped only upon request.

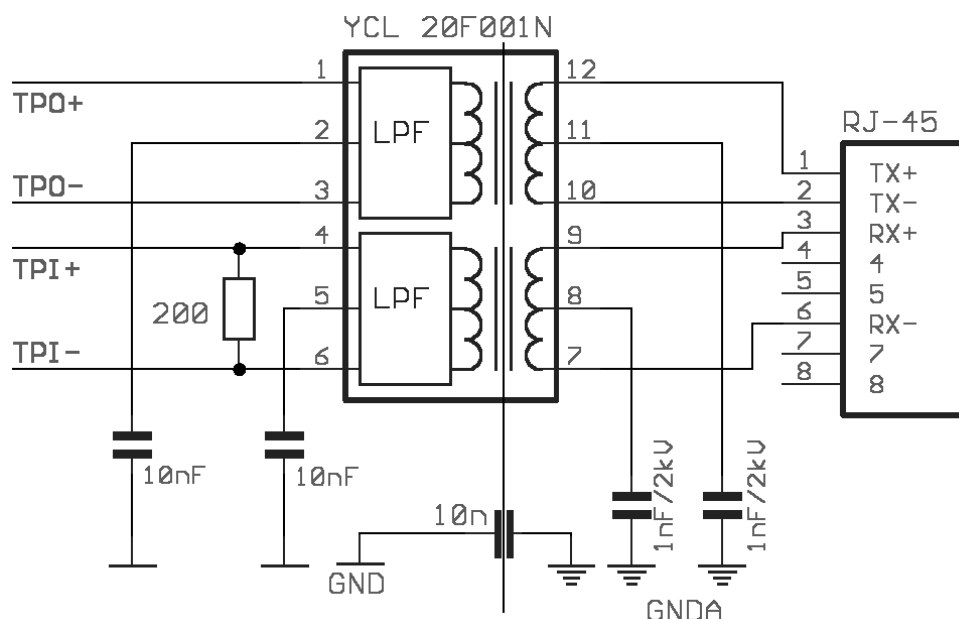
Connecting to the Ethernet

We recommend to connect the Ethernet outputs according to the following recommended diagram.

PLEASE PAY ATTENTION TO THE SEPARATION OF THE ETHERNET AND APPLICATION GROUNDS !

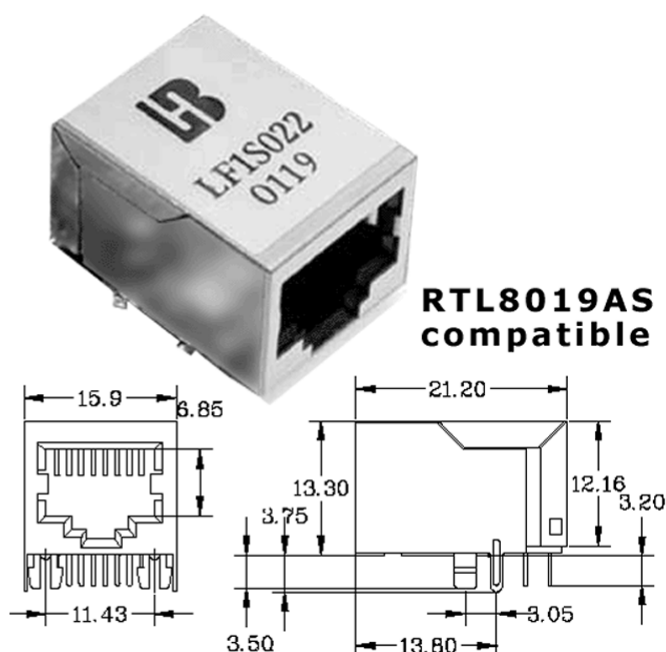
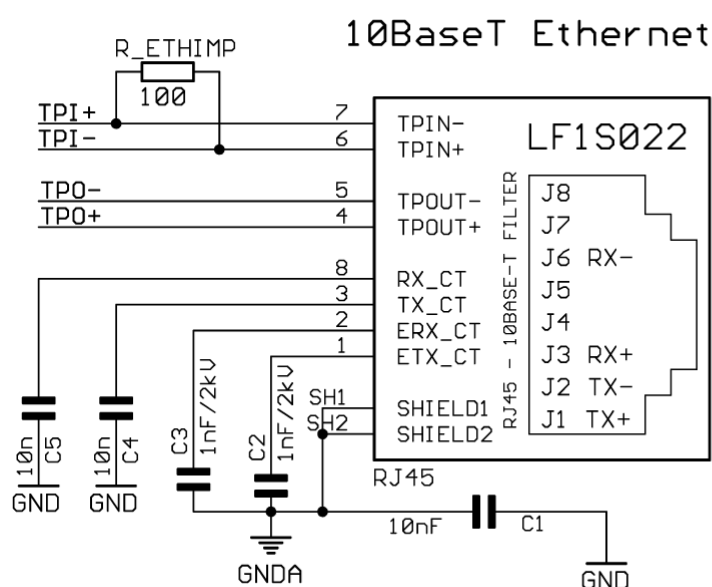
The resistor parallel to the TPI+ and TPI- pins needs to be as close to the module pins as possible. RTL8019 datasheet specifies 200 Ohms, which is probably a typo. However, in practice, it is an integer multiple of the impedance, both values work.

Recommended circuit with YCL 20F001N:



This circuit is a little better suited for industrial applications due to increased insulation strength, thanks to the standard packaging of the magnetic.

Use LF1S022 - a RJ45 connector with an integrated SMD magnetic.



Mechanical and electrical parameters, other functions

- **Power supply**

The module does not contain a voltage stabilizer. It requires +5V, maximum tolerance $\pm 10\%$. The consumption is between 30 to 80 mA and depends on the load connected to the outputs and the Ethernet interface.

- The module is **reset** with an internal CPU watchdog and a voltage resetting circuit on the module. The reset is active high.

The RST pin on the module is bidirectional. It can reset external circuitry upon a reset caused by MCU software or the voltage resetting circuit that is connected through a 3k3 resistor.

- **Application is programmed** into the module using the PSEN pin. If it is grounded upon reset, the internal loader is activated and the Atmel FLIP or our RD2 Flasher software can load a program into the module over RS232.

Atmel calls this ISP - In System Programming. It is not compatible with ISP for AVR and certain x51 processors that use the synchronous SPI interface. For Atmega128, the programming interface shares pins with its USART. However, don't let this confuse you - for T89C51RD2, you can simply ground PSEN, reset the MCU and load the new firmware over a standard asynchronous RS232 line.

- According to the RD2 manufacturer, the **I/O pins can sink up to 3.5 mA** and source up to 0.1 mA. For the Ethernet outputs, the maximum load depends on the magnetic, etc.
- **EMC of the module** depends on the components used. To reduce the chance of interference from external sources, we recommend to connect pull-up resistors of about 3k3 Ohms to all unused I/O pins. It is crucial to separate application and Ethernet grounds.

Typical symptoms of poor ground separation:

- A switching supply cannot be used.
- About 1-50% packet loss, the device works somewhat.
- A problem occurs after replacing an unshielded TP cable with a shielded one, resulting ground loop can even destroy the entire application.

- **Circuit diagram of the CHARON I** module is available in the appendix on the last page of this datasheet, or as a separate file at our web site.

The Charon modules development tools

Charon Development Kits are intended for embedding into the final application by the user. However, it is advantageous to use some kind of a development board to get oneself acquainted with the module so that the user can try all of the usual functions together.

The Development Kit contains:

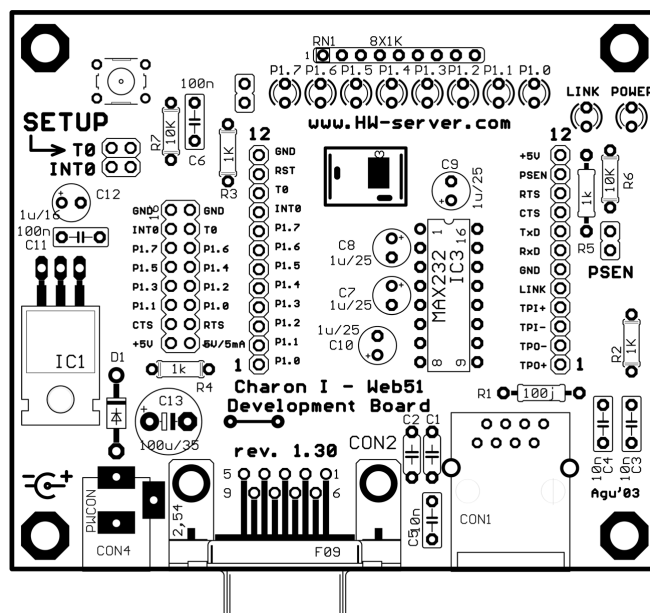
- Charon module with the "Ethernet - RS232/485 Converter" firmware
(This firmware can be erased and replaced with the I/O Controller Lite or a custom application).
- Development Board.
- Unique MAC address, pre-configured.
- RS232 cable for connecting to the PC.
- A crossed TP cable for connecting directly to a PC.
- Charon I datasheet + circuit diagram.
- Development kit datasheet with description of the connectors.
- Ethernet programming application note, description of NVT and TEA.
- Ethernet CD with the latest version of the Web51 development system and the required software.

Charon I - Development Kit Lite

Cheap, simple and concise version of the development kit. Extension pins are available on a PFL18 connector. The entire kit is designed with standard mount devices on a single-sided PCB to simplify user modifications.

The kit contains the following jumpers:

- **PSEN** – activates the programming mode after RESET, using Atmel FLIP or RD2 Flasher.
- **T0 / SETUP** – activates the SETUP mode of the application in Charon.
- (accessible via RS232 at 9600Bd, 8, N, 1)
- **INT0** – Currently unused.
- **LED ENABLE** – Disconnects power for 8 LEDs on P1. Necessary if you need to control something else with this port.

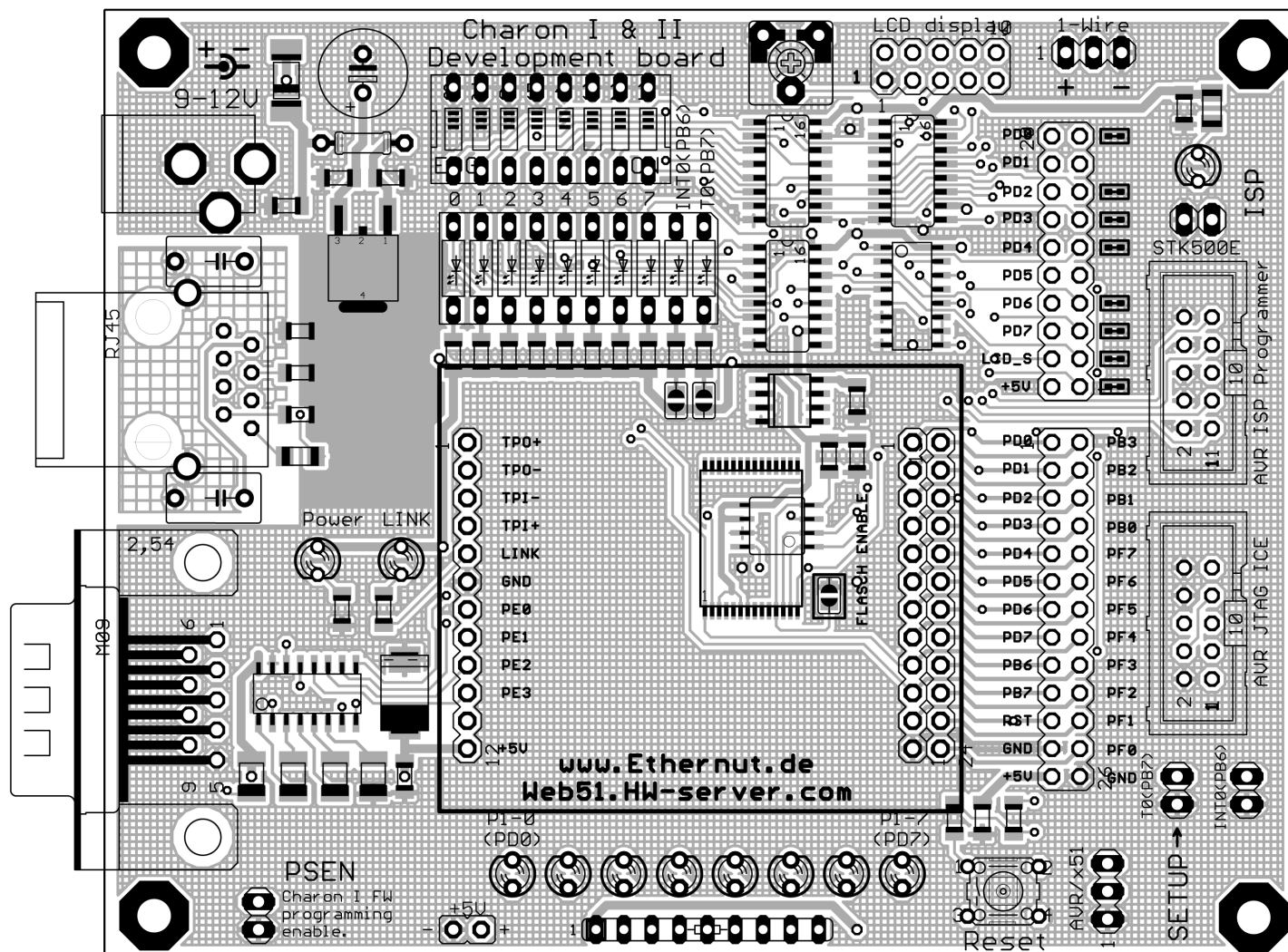


Serial line on this board is available on a 9-pin D-SUB-M connector, so a crossed "LapLink" cable (included) is necessary for connecting to a PC. However, the board itself can "simulate" a PC, which is advantageous for debugging applications.

Charon I & II Development board

The Charon I & II Development Board is a professional board in SMD technology, primarily intended for application development for the Charon II module. Charon II is pin-compatible with Charon I, hence the board can be used for both module versions.

Serial line on this board is available on a 9-pin D-SUB-M connector, so a crossed "LapLink" cable (included) is necessary for connecting to a PC. However, the board itself can "simulate" a PC, which is advantageous for debugging applications.



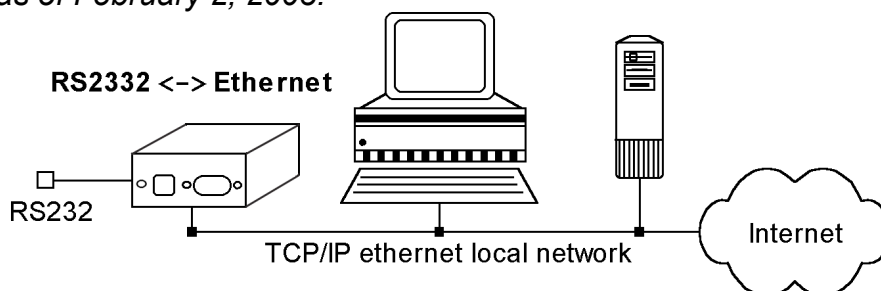
Important differences from the Development Kit Lite:

- Peripherals are connected to shift registers (8x IN, 8x OUT, 2x16 LCD)
- Support for Charon II with ATmega 128 that is based on the Ethernut technology.
- Support for Charon II application programming and debugging over JTAG.
- Support for programming the Charon II over SPI.
- Support for up to 16 Mbit SPI FLASH for Charon II.
- Board dimensions fit into the standard box of the Web51 system.

The development board again comes with complete accessories, listed on the previous page.

Software application "Ethernet - RS232 Converter"

Unless noted otherwise, the price of the module includes the software application of the serial line converter. Details about this SW application are available in a separate document that covers both the converter appliance and the software for the module. Here we list only the basic features of the version 2.2, valid as of February 2, 2003.



The "RS232-Ethernet Converter" application is fully customizable. It is possible to configure the Ethernet communication type (TCP server, TCP client, UDP, NVT support), serial line parameters and other options.

All options can be configured with the software described later or with any local RS232 terminal. For security reasons, remote configuration can be performed only with the supplied Ethernet_SETUP software; the configuration uses port 99 by default and is secured with the TEA encryption algorithm.

Communication types

Data communication, such as "Ethernet - RS232 line" or "Controlling I/O pins over the Ethernet", can use any port.

Three basic communication types are possible:

TCP server (passive mode)

After power up, the converter listens at the selected port and awaits client connection. After the client connects, data from the Ethernet are transmitted over the serial line, and vice versa. If the client is not connected and data are coming from the serial line, they are stored in a buffer (size is configurable) and sent immediately after the connection is established - unless the "clear buffer upon client connection" option is selected in the SETUP.

TCP client (active mode)

The converter behaves similarly to the previous case. However, a remote IP address is specified. Whenever data come from the serial line, the module actively tries to establish connection as a client and transmit the data. If it does not succeed, the data are stored in a buffer and transmitted upon establishing a connection, regardless whether as a client or a server. In this mode, two converters can "tunnel" a serial line over the Ethernet. In case of the Charon module or the I/O Controller, the parallel inputs and outputs can be "tunneled" over the Ethernet as well.

UDP

Ethernet data are expected on a specified port. When data come from the serial RS232 line, a packet is created according to specified conditions and sent to the specified IP address. In UDP transfer, acknowledges from the other side are not verified; the application itself should support recovery from a data loss. An advantage is a little faster response time which is useful especially for RS485 lines.

NVT (Network Virtual Terminal)

When using TCP/IP communication, the converter functions can be extended by NVT according to RFC2217 with a control data stream that can be used for example to change the transfer rate of the remote serial port, control inputs and outputs, or clear buffer. These control commands are included in the data stream and prefixed with the "FF" character (if it occurs in the normal data stream, it is doubled). Detailed NVT description is available in the "Programming Ethernet Applications" guide on our web site.

The PC software developer can use our library of demo subroutines for various programming languages. Development of controlling applications is covered in separate documents - see references.

How to begin

The Charon I module needs to be configured before embedding into the final application. The following method and special software can be used for the configuration. Or, if it is easier for you, you can switch the module into SETUP mode by driving the T0 pin low. If the module is operating and correctly connected to the serial port, SETUP mode is entered after reset and the module can be configured via any RS232 terminal. The setup uses the 9600 8N1 NONE mode.

Three main classes of options are configurable

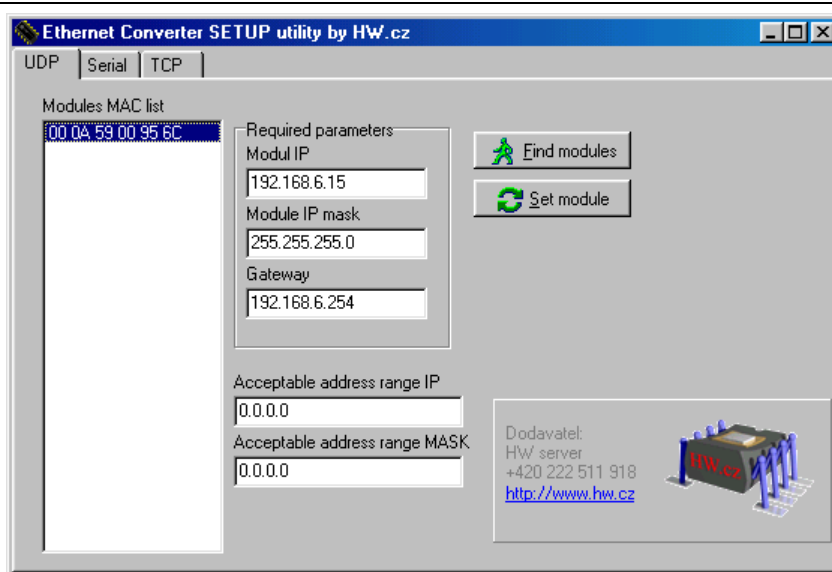
- Network configuration (IP, MASK, Gateway, ...)
- Serial RS232 line parameters (Baud rate, parity, 8/7-bit data, ...)
- Special parameters of the asynchronous channel (RS485 support, spaces in the data stream for slower devices, level of the unused RTS pin, ...)
- Internal data buffer options (transparent buffer, clear upon connection/disconnection, ...)
- NVT activation, port to use for NVT "Keep Connection" (prevents connection timeout)
- Security (16 bytes of the TEA key, remote configuration enable, ...)

Configuration menu is displayed by pressing Enter. Help is available for individual parameters; for example, sending the "I?" sequence prints out help for the "I" option that sets the IP address. The mentioned IP address is then set by issuing, for example, "I192.168.6.11"<enter>.

Configuration of module parameters

Module parameters (IP address, mask, gateway, serial port speed, etc.) can be configured with the software shown in the figure and available for download from our website. It is possible to configure the module in three ways:

- **Locally via a serial RS232 line**
(text menu - all options accessible)
- **Over the network using a UDP program for Windows.** Only the basic networking options are accessible, **access is limited to the local Ethernet segment only.**



- **Over the network using TCP** almost all options are accessible and the device can be located anywhere on the network; however, the netmask, GW and IP must be set in advance and cannot be changed in this mode. In addition, remote configuration over TCP/IP must be enabled with a special option accessible only in the RS232 SETUP.

Splitting a continuous data stream from RS232 into packets

The serial line presents a continuous data stream with low speed but fast response time. This is a problem for "request-response" protocols because the converter collects data from the serial line and then sends them to the Ethernet in a packet. It is therefore necessary to pay attention to the conditions that trigger the transmission of a packet. Charon supports triggering the transmission of a packet upon a defined pause in a continuous data stream coming from the serial line. In UDP mode, it is possible to define packet start and end with a 4-byte value and mask, and to specify certain number of characters before and after this sequence (to allow for checksums etc.). With a careful configuration, it is possible to shorten the response time of the device that is actually connected via the Ethernet network (even without detailed knowledge of the transfer protocol) significantly.

Wide range of serial line options

The serial RS232 line is used in a number of modifications. Thanks to a number of successful applications, our module is now configurable for a majority of the changeable serial line parameters.

- Any asynchronous data transfer rate from 50 to 115200 Bd.
- Support for 7 or 8-bit data transfer.
- Module supports 1 or 2 stop bits.
- Software or hardware flow control.
- All common parity options (none / odd / even / mark / space).
- Charon supports 9-bit data transfer as well.
- A subset of the mentioned parameters can be changed on the fly via NVT according to RFC2217.

Support for connecting a RS485 converter

The following parameters are useful for connecting a RS485 converter:

- Selectable polarity of transmit/receive switching using the RTS pin.
- "HW echo" confirms over the Ethernet the data that were sent to the RS485 line and read back. The remote side can be sure that the data were correctly sent to RS485, or repeat transmission after a timeout if necessary.
- "Tx Control HALF duplex" causes the module to delay sending data to the serial line until there are no more data coming from the line.

Direct control of the 8-bit port

In the "Programming Ethernet Applications" document, there are detailed NVT examples that demonstrate setting and reading of an input/output 8-bit port P1 on the Charon I module using simple sequences in the data stream. Available is a simple demo application for Win32 or VB source codes that can control LEDs connected to the P1 on the demo board.

Libraries of source codes:

To simplify support of Web51 and especially the Charon modules, we have included network communication protocols and examples of controlling devices in various programming languages on the Ethernet CD :

- **Control Web** – Access through a supplied Web51 component.
- **Delphi** – examples of using the Web51 component.
- **Borland C++ Builder** – The Web51 component itself and a demo application that uses a window interface for controlling inputs and outputs of the I/O Controller over the Ethernet.
- **Visual Basic** – examples of Ethernet communication using Telnet and http.

Programming of our Ethernet applications is covered by "Programming Ethernet Applications" - see references.

Using the converter in applications

From the point of view of an existing system, the module can be used very easily since it can be connected instead of the serial RS232 line. If needed, direct TTL outputs can be used, e.g. to indicate current communication activity, control a relay, etc. Thus, it is possible to develop a device that communicates over TCP/IP, USB or the standard RS232, depending on the module inside it.

Recommended literature and references

- **Programming Ethernet Applications (21 pages)**
Detailed ethernet application programming how-to. Documented examples of source codes supplied with our devices. Description of NVT and TEA algorithms.
- **Charon I - datasheet (12 pages)**
Datasheet for the Charon modules. Contains in particular the electrical parameters, connector descriptions, programming procedures, etc. Circuit diagram is available for download at our website.
Detailed informations for every application (for example the RS232-Ethernet Converter) is not part of this datasheet.
- **RS232 - Ethernet Converter**
 - Physical description of the "boxed" converter.
 - Detailed description of the "RS232-Ethernet Converter" application, also shipped in the Charon I modules.
- Web site of the HW Group concerning final products: www.HWgroup.cz
- For professionals and developers: Project Web51 - <http://Web51.HW.cz>

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