EPP-Adapter

High-Speed Modem Interface

BayCom

Hardware Documentation

Introduction

The current trend towards increasing data transmission speed on amateur radio has been boosted by the introduction of a number af high-bandwidth user access frequencies in Germany, operated in the 70cm band. Baudrates in the range of hundreds of kilobits per second, which seemed to be far from reality just a few years ago, will be daily routine not too far in the future. New applications fields, like digital voice transmission or HTML-based document presentation, integrating text, sound and graphics are becoming possible.

Of course the existence of appropriate radios and modems is an important prerequisite for a wide acceptance of the new high speed nodes. Two german amateurs, DL8AAU and DL2ZBN have developed a robust transceiver concept, which allows data transmission up to 105kbit/s in the 70cm broadband channels. These transceivers are wide spread in Germany and have proved to be very reliable. But also on the digital side, some action was necessary. The standard equipment, either consisting of a TNC2, a serial modem or a parallel port interface, show their performance limits already at speeds of approximately 19.2 kbit/s. Currently, only a few expensive PCs or slotcards are available for data rates of 76.8kbit/s or above. Thus, we present a new modem adapter for the enhanced parallel port (EPP) of modern PCs. Together with a suitable FSK modem, a powerful concept for interfacing a high speed radio to the PC is now available.

When evaluating a suitable interface in the PC architecture, the standard RS-232 interface was excluded from the beginning, due to their natural limits at about 100kbit/s. The new Universal Serial Bus (USB) is not yet wide spread enough and pretty complicated in its implementation. Ethernet and SCSI were to costly for a practical implementation.

But almost every new PC features an extension of the traditional parallel port, the Enhanced Parallel Port (EPP), which is an efficient and powerful alternative to the interfaces given above. The EPP interface not only allows an 8 bit wide bidirectional data transmission, but also supports a handshake mechanism for the transfer of input and output data. Data rates of several 100 kbyte/s are possible. Thus, the interface is well suited for high performance AX.25 communication. Because there is no real-time capability of modern PCs (this means, that the reaction times on a data request from the modem are not predictable), a buffer is required between the modem and the PC. The PC writes data with maximum speed into this buffer, which is read serially by the PC. For the receiver side, data are clocked into the buffer with the regenerated receive clock. When the buffer is almost full, the data can be read into the PC via the EPP interface. Thus, the EPP adapter is a buffering connection between the modem, usually a modified standard FSK modem for high bitrates, and the PC with its EPP interface.

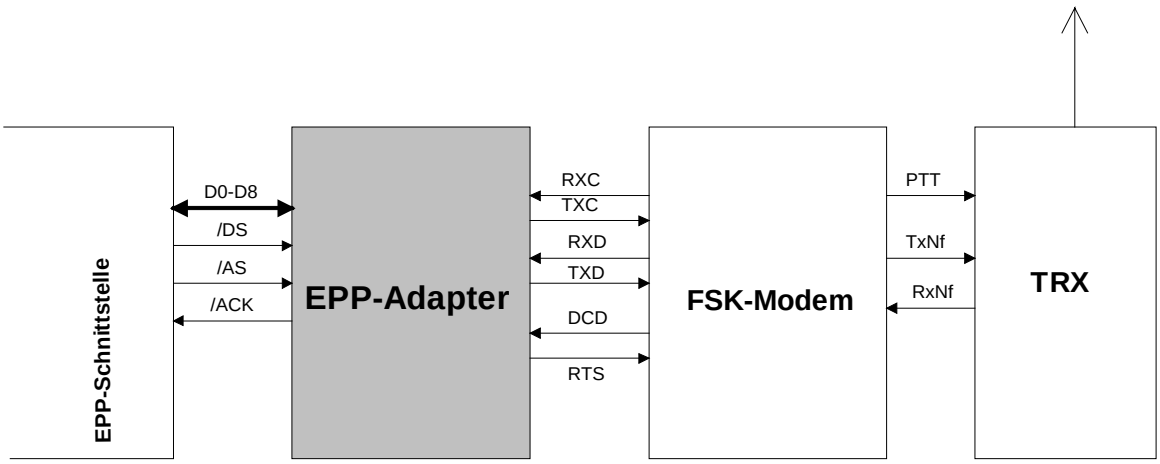


Bild 1: EPP-adapter as connection between FSK modem and PC.

Table 1 shows an overview of the EPP port lines in comparison with the conventional parallel port lines. As can be seen, there are significant differences in the function of the lines. The EPP port allows transfer of either addresses or data. The unit connected to the EPP interface can trigger a PC interrupt. All signals with an exception of the bidirectional data lines are active low.
The maximum data transmission bandwidth is mainly limited by the processing power of the PC connected. In first trials, a 486/66 processor showed its limits at approximately 100kbit/s, a Pentium 166 achieved 750kbit/s. Full duplex operation is possible, but available data rate decreases will be only half of these values.

Pin DB25	**LPT-Signal**	**EPP-Signal**	**EPP-Function**	**In / Out**
2-9	Data Bit 0-7	**Data Bit 0-7**	Data In-Out (8bit parallel)	I/O
14	/AutoFeed	**/DataStrobe**	PC initiates "Data read/write"	O
17	/SelectInput	**/AddrStrobe**	PC initiates "Command read/write"	O
1	/Strobe	**/Write**	L= Write, H= Read	O
11	Busy	**/Wait**	Handshake from peripheral device	I
10	/ACK	**/IRQ**	Interrupt from peripheral device	I
16	/Initialize	**/Reset**	PC resets peripheral device	O
12	PE		User defined input	I
13	Select		User defined input	I
15	/Error		User defined input	I

Table 1: Signals of conventional parallel port and EPP port

EPP adapter schematics

Fig. 1 at the center page of this manual shows the schematics of the EPP adapter. The connection to the PC interface is done via St1 at the left side of the sheet. The external FSK modem is connected via St2, bottom right. Core of the schematics are two integrated FIFO ICs by IDT. Next to a 2048 word @ 8 bit FIFO, these circuits also integrate a parallel to serial converter (72131) at the output and a serial to parallel converter (72132) at the input. Parallel inputs and outputs of the FIFOs are

connected to the EPP data bus via a 74ALS245 buffer. The serial FIFO interfaces lead directly to the modem connector and are controlled by the transmission and receiver clocks. The PTT line of the modem interface (RTS) is held low as long as data are in the transmitter FIFO (controlled via empty flag of TX-FIFO IUC2).
Via the EPP command mode, a data register IC7 can be written and another can be read (IC10). The write data register IC7 is used to reset the FIFOs and also controls two LEDs (CON / STA signal). Three other bits in this register control a programmable timer, generating a cyclic interrupt from the the transmission clock (IC8, IC9 and /IRQ line of the EPP port). The read register IC10 gives access to the actual status flags of the FIFOs and also the DCD and CTS lines of the modem. Thus, the control software is able to monitor the current status of all buffers on the circuitry.
A power supply with a conventional 7805 regulator supplies the whole board with 5V DC power.

Assembly

Fig. 2 shows the assembly plan of the modem, to be assembled on a double sided PCB with a size of 80*100mm. Together with the additional DF9IC modem, the assembly fits exactly into one of the usual eurocard size cases. The modem is connected to the EPP adapter via a 20p. flat cable. Power supply and EPP connection are then accessible via the back side of the case, the AF output via the front side.
Table 2 shows the EPP adapter part list. The listed IC types have to be exactly the technology listed, otherwise timing problems may occur. All ICs should be put on sockets. Assembly starts with the few passive components (resistors, capacitors, sockets), then the active components are assembled. The voltage regulator needs a small heat sink, especially, when the modem is supplied via the EPP adapter.

Part list

R1 R2 R3 R4 R5 R6 R7 R8	10k 1k 1k 1k 1k 470 Ohm 470 Ohm 470 Ohm	IC1 IC2 IC3 IC4 IC5 IC6 IC7 IC8 IC9 IC10 IC11	IDT 72132 IDT 72131 74HCT138 74ALS132 74HC14 74ALS245 74HCT273 74HCT251 74HCT4040 74ALS541 7805
C1 C2 C3 C4 C5 C6 C7 C8 C9 C10 C11 C12 C13 C14	1uF Tantalum 470uF 20V, RM 5mm 100nF 100nF 47pF 47pF 100nF 100nF 100nF 1uF Tantalum 1uF Tantalum 1uF Tantalum 1uF Tantalum 100nF	D1 D2 D3 D4 D5 D6	LED yellow LED green LED yellow LED green B40C800 1N4148
St1 St2 St3	SUB-D 90°, 25p, male AC-Connector Pinhead 2*10p. Optional: Two pinhead connectors 20p. + 2cm flat cable 20p. as connection to DF9IC-modem	2* 3* 3* 2*	IC-Socket 28p IC-Socket 20p IC-Socket 16p IC-Socket 14p PCB EPP Heat sink TO220

Schematic see extra Diagram

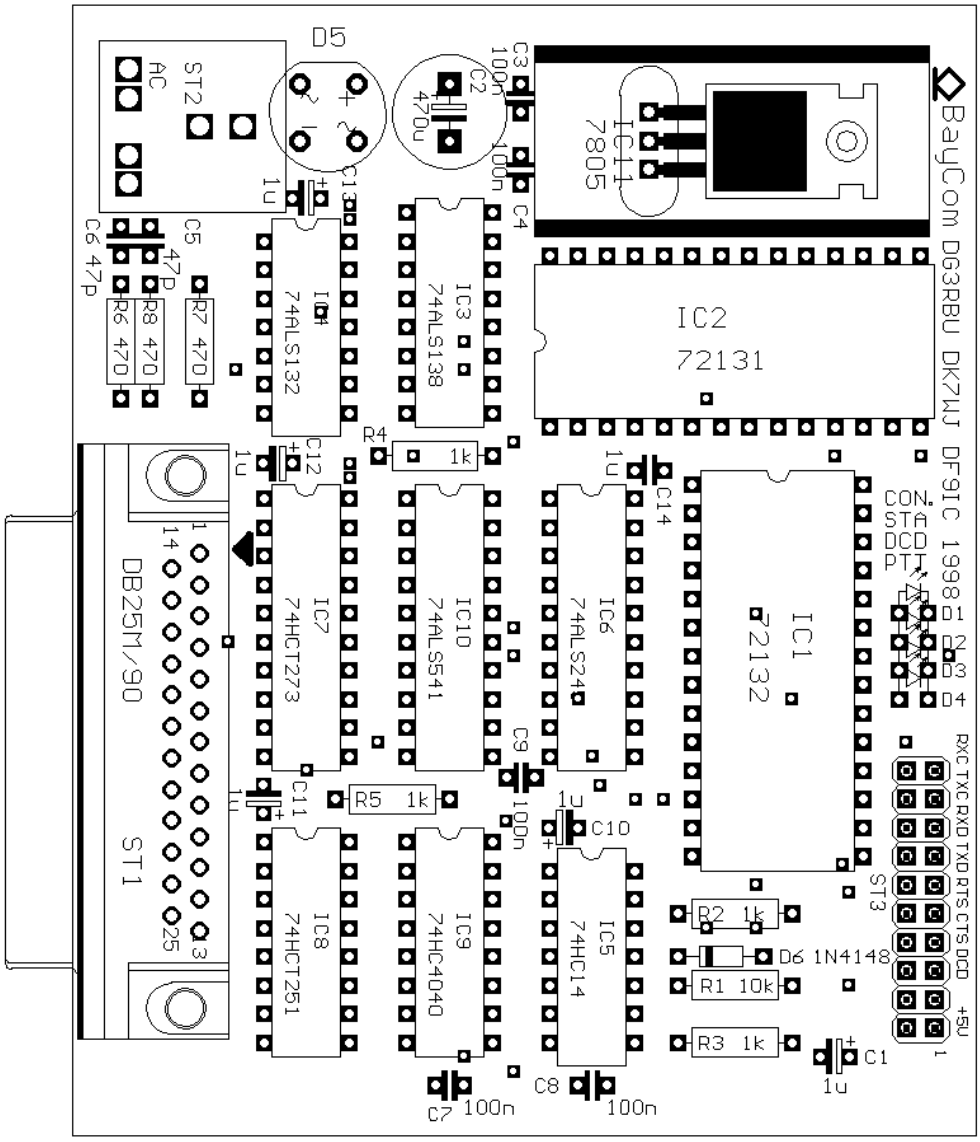
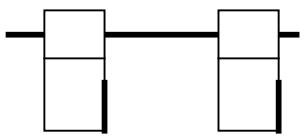


Fig 2: Assembly plan EPP adapter

Connecting the EPP adapter

When the assembly is finished, the adapter is connected to the DF9IC modem. A short 1:1 flat cable can be connected. The following figure shows a side view of the required cable. The Connector notches have to be on the same side for each connector.

Usually, the modem power is supplied via the connector cable from the EPP adapter.



DF9IC-Modem EPP-Adapter

If this is not desired, the corresponding wires should be cut.

DF9IC modem connector layout:

Pin	Signal	Pin	Signal
P1	+5V	P2	GND
P3	+5V	P4	GND
P5	/RES	P6	GND
P7	/DCD	P8	GND
P9	/CTS	P10	GND
P11	/RTS	P12	GND
P13	TXD	P14	GND
P15	RXD	P16	GND
P17	TXC	P18	GND
P19	RXC	P20	GND

Tabelle 2: Layout of the DF9IC modem disconnect header

The EPP adapter power supply is connected to AC jack St2. AC or DC between 8 and 14V can be used, the power consumption is 300mA including the DF9IC modem. The connection to the EPP PC port is made via a standard printer port cable (25 pin parallel port cable). Because of the critical timing the cable should not exceed 3m in length. For the connector layout, refer to table 1.

Getting Started

We describe the first steps using the PC FlexNet software included with the kit. It is used with a DOS operating system or in the DOS mode of Win95. For other drivers, refer to the driver documentation.

1. Determine the I/O address of the EPP interface in your computer and an appropriate interrupt. This is not necessary when using the default adresses (378h = EPP1, 278h = EPP2). Make sure, that the interface is configured as EPP, not SPP or ECP (usually done via jumpers or via BIOS setup for onboard-interfaces)
2. Install the FlexNet software by copying all files on disk, including subdirectories into an appropriate directory of your hard disk. The actual version of the software is available via the internet (at http://dl0td.afthd.th-darmstadt.de/~flexnet/index.html).
3. Connect the modem to the PC, which should be switched off. Switch on the PC and power up the modem.
4. Start the FlexNet software by typing the following commands printed in `Courier:`

```
FLEXNET 20     (starts Flexnet)
EPP 1          (loads EPP-driver)
               (for EPP-Port LPT1, otherwise appropriate Port-Nummer 1-4. For
               customized address EPP /p=<port address>
               /i=<Interrupt>
FLEX           (concludes loading of drivers)
FSET MODE 0 76800
```

(Choose mode for EPP,
other baudrates as required)

`BCT` Start terminal (here the BayCom BCT terminal).

For full duplex operation (concurrent sending and receiving) an additional `d` can be added when setting the mode. The bitrate is principally controlled by the modem, but an appropriate setting with the mode command is necessary to initialize the timers in the software.
After entering BCT, the usual three-screen BayCom terminal screen will appear. By entering an connect command (`:C <Call>`)or sending some unproto packets from the monitor screen (enter with F10-key), the modem function can be tested. If the PTT LED on the EPP adapter or on the modem is switched on, the principal function of the EPP adapter is given.
There are four LEDs in total on the EPP adapter. The PTT-LED signals an active transmitter, the DCD-LED shows an active channel. Connect is switched on, as soon as a connection is established. The STA LED signals data within the FIFOs.
For further information on the software, please refer to the software manual provided with the Flexnet software package.

Troubleshooting

Some tips, if you should run into problems while setting up the EPP adapter:

- Check all solderings on the PCB and the correct assembly of all components.
- Check your interface cable. All 25 connector pins must be connected 1:1.
- Make sure, that there is a true EPP interface in your computer and that it is configured into EPP mode. SPP or ECP mode is not possible!
- Check the correct connection of the FSK modem. Transmission and Receive clock must be provided by the modem and must have simple baudrate frequency.
- Check that the TTL families given in the part list are used. IC 4, 6 8 and 10 must be 74ALS...!

Enjoy high speed packet with the EPP adapter!

The BayCom team

BayCom

Service Information

Ordering Information

Please contact BayCom if you need any informations about our kits and assembled units. All BayCom equipment is available with comprehensive english manual.

Order information:

8700	EPP-Adapter, kit incl. FlexNet Treiber
8800	EPP-Aadpter, assembled, incl. FlexNet Treiber
8701	EPP-Adapter, PCB
8702	I/O-card with EPP-Interface for PC-ISA-Bus
8703	220V power adapter for the EPP adapter + modem
8704	Centronics-Cable for EPP interface, 2m
8705	ALU case for EPP adapter + modem

Technical support and repair service

We offer a repairs service for all original BayCom kits. This service cannot be offered for free, but we will try to minimize cost where we can. As long as the repair cost do not exceed 50% of the kit price, we will do the repair without contacting you before. If there is a major damage, we will contact you and inform you about the cost to be expected. Please send your equipment to the BayCom address or contact us via telephone, FAX or e-mail. We will also answer all your questions.

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