10 PARALLEL PRINTER PORTS

ETRAX 100 contains two parallel printer ports. They are multiplexed on the same pins as other interface applications, see Chapter 5, 5.1.2 The DMA Channels on page 47. Both ports have the same behavior.

The parallel ports can be used either through register access or by using internal DMA. Each port has its own set of registers. The ports can be configured to communicate with printers using various parallel printer protocols, including:

- IBM XT/AT compatible Centronics
- IBM PS/2 compatible Centronics
- Hewlett Packard Fast Mode
- Fastbyte protocol
- Bitronics, compatible with IEEE 1284 and HP Boise specifications (modes byte, nibble and ECP).

10.1 CONFIGURATION

The operation mode is set in the internal parallel port configuration registers. The basic operation modes supported are:

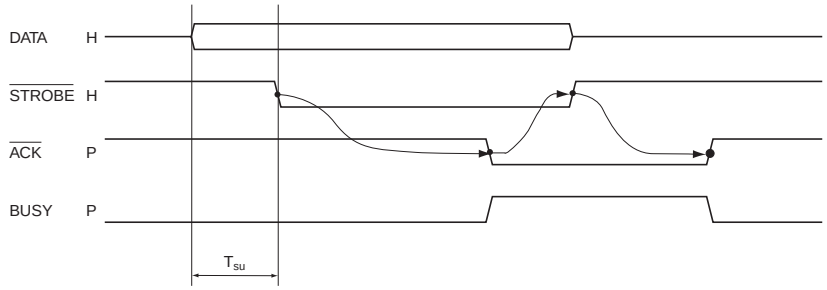
- Fastbyte protocol
- IEEE-1284 Compatibility mode, same as Centronics mode
- IEEE-1284 Nibble mode
- IEEE-1284 Byte mode
- IEEE-1284 ECP mode, forward and reverse
- Manual mode

10.1.1 Fastbyte

In the Fastbyte mode, the strobe remains active until the printer sends an acknowledge $\overline{ACK}$. Setup time T_{su} is configurable. The T_{su} is controlled by an internal register in the same way as for Centronics mode.

The handshaking is a straightforward four phase.

Data is present on the bus until $\overline{STROBE}$ goes high.



H = Host
P = Peripheral
T_{su} can be set between 20 ns and 4.98 μsec in steps of 160 ns.

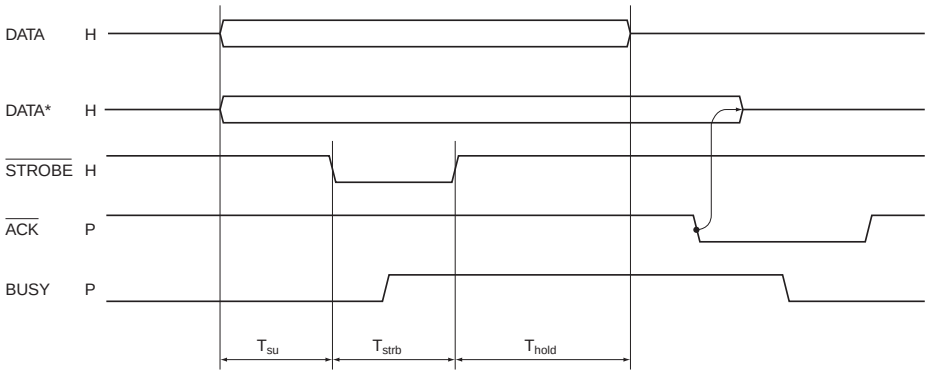
Figure 10-1 Fastbyte mode timing

10.1.2 IEEE-1284 Compatibility mode

The IEEE-1284 compatibility mode, used in ETRAX 100, is the same as Centronics mode.

The strobe is generated a given time (setup time) after the output data appears on the bus, see Figure 10-2 below. The data setup time T_{su}, the strobe time T_{strb} and the data hold time T_{hold} are set individually for each port in internal registers. Each time can be set between 20 ns and 4.98 µs in steps of 160 ns.

The host can be configured to wait for or ignore printer acknowledge. If the host waits for an acknowledge, data will remain on the bus until $\overline{ACK}$ goes low or T_{hold} has elapsed, whichever happens last. An acknowledge from the printer is thus needed before new data can be put on the bus. If the host ignores the printer acknowledge, only the BUSY signal will be monitored.



* if the oe_ack bit is set
H = Host
P = Peripheral
T_{su}, T_{strb} and T_{hold} can be set between 20 ns and 4.98 µsec in steps of 160 ns.

Figure 10-2 Centronics mode timing

10.1.3 IEEE-1284 Nibble Mode

This mode is used for reading data from a peripheral unit. The peripheral requests attention from the host generates an interrupt. This is shown in the left part of the timing diagram. Once the host is available the transfer of data begins, one nibble at the time, using straightforward four phase handshaking. The data bus is not used.

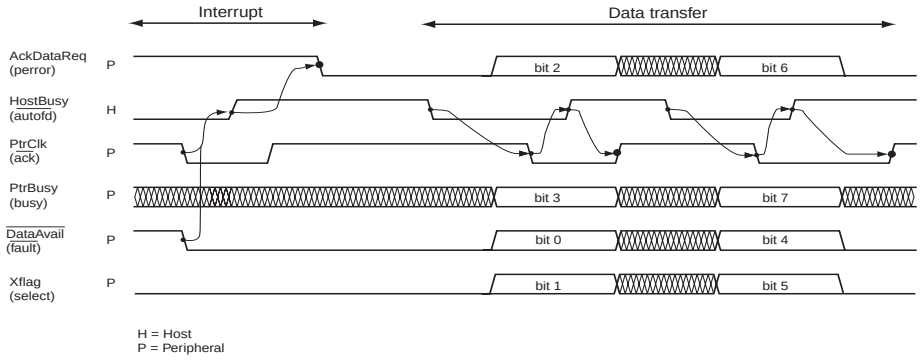


Figure 10-3 Nibble mode timing

Note: The startup mode for the IEEE 1284 is the compatibility mode. In order to switch to another mode a negotiation face is needed. Since this negotiation face is not supported in ETRAX 100 the manual mode must be used to set this up in software.

10.1.4 IEEE-1284 Byte Mode

This mode is used for reading data from a peripheral unit. The procedure is similar to Nibble mode, but all the bits in one byte is transferred simultaneously on the data bus.

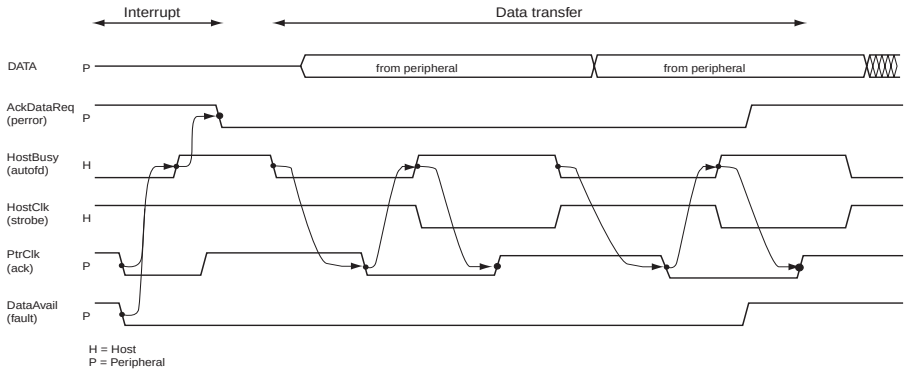


Figure 10-4 Byte mode timing

Note: The startup mode for the IEEE 1284 is the compatibility mode. In order to switch to another mode a negotiation face is needed. Since this negotiation face is not supported in ETRAX 100 the manual mode must be used to set this up in software.

10.1.5 IEEE-1284 ECP Mode (Forward and Reverse)

The ECP mode is used for fast data transfer to and from a peripheral unit, up to 6 MByte/s. In the timing diagram below, transfer of data in the forward mode is shown followed by transfer of data in the reverse mode.

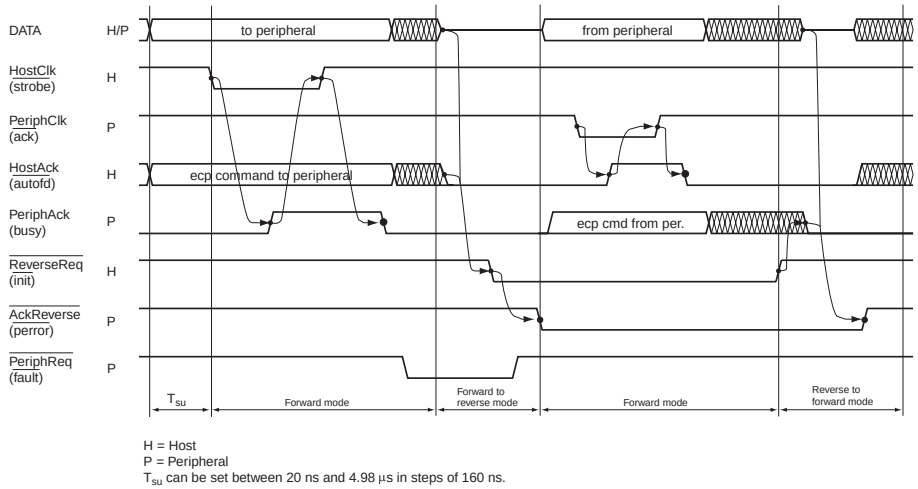


Figure 10-5 ECP mode timing

Note: The startup mode for the IEEE 1284 is the compatibility mode. In order to switch to another mode a negotiation face is needed. Since this negotiation face is not supported in ETRAX 100 the manual mode must be used to set this up in software.

ECP reverse mode is also used when ETRAX 100 is bootstrapped by loading a bootstrap program via parallel port 0, see Chapter 4, Bootstrap Methods on page 43.

10.1.6 Manual Mode

In manual mode, the strobe has to be generated by the software. Manual mode gives full software control of the port pins, allowing for implementations of printer protocols not built-in in the ETRAX 100. All signals are read/written by software through registers.

10.2 ECP COMMANDS

ECP commands are supported in both directions. Run length encoding (RLE) is generally handled by hardware, but can be handled by software if necessary. Channel address requires software interaction.

10.3 PARALLEL PORT INTERRUPTS

The parallel port can generate four interrupts:

1. Peripheral interrupt
   In nibble, byte and both ECP modes, there are several possibilities for the peripheral to get the host's attention through signal sequences on the parallel port. These sequences are detected and can generate a peripheral interrupt, if enabled.
2. ECP command interrupt
   Upon reception of a command in ECP reverse mode, an interrupt can be generated.
3. Data available interrupt
   An interrupt can be generated when data is available on the parallel port.
4. Ready interrupt
   When a byte has been sent an interrupt can be generated.