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EPSON

Universal Interface-compatible

For TM Series Printers

Serial Universal Board for RS-232 Interface	UB-S01
Serial Universal Board for RS-485 Interface	UB-S02
Parallel Universal Board for IEEE 1284 Interface	UB-P01

Specifications

STANDARD	
Rev. No.	C
Notes	

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REVISION SHEET

The table below indicates which pages in this specification have been revised.
Before reading this specification, be sure you have the correct version of each page.

Revisions		Design Section			Sheet Rev. No.					
Rev.	Document	WRT	CHK	APL	Sheet	Rev.	Sheet	Rev.	Sheet	Rev.
A	Enactment	K,Ebina	--	Y.Inoda	I	C	18	B		
B	Change	Imaizumi	Inakoshi	--	II	C	19	B		
C	Change				III	C	20	B		
							21	B		
							22	B		
							23	B		
					0	C	24	B		
					1	B	25	B		
					2	B	26	B		
					3	B	27	B		
					4	B	28	B		
					5	B	29	B		
					6	B	30	B		
					7	B				
					8	B				
					9	B				
					10	B				
					11	B				
					12	B				
					13	B				
					14	B				
					15	B				
					16	B				
					17	B				

Universal Interface-compatible For TM Series Printers Interface Board Specification (STANDARD)	Cover	Rev. Sheet	Scope	General Descriptions	Table of Contents	Contents	Appendix	Total
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REVISION SHEET

REV.	SHEET	CHANGED CONTENTS
B	I	Overview • When the parallel universal board ….. cannot be used. (added)
C	I	Confidential Agreement (added)
	II	Table of Contents is moved to page III.
	III	Table of Contents is moved from page II.
	0	0. GENERAL SPECIFICATIONS (added)

TITLE

Universal Interface-compatible For TM Series Printers

Interface Board Specification

(STANDARD)

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Overview

These universal interface-compatible interface boards for the TM Series printers are an option intended solely for use with universal interface-compatible TM Series printers. These optional boards are designed to make a variety of interfaces compatible with the TM Series printers simply by replacing the existing interface board.

- Each board supports one of the following interfaces:
  1) EIA/TIA RS-232 interface
  2) IEEE 1284 [*1] interface (nibble/byte modes only)
     (*1) Copyright 1994 by the Institute of Electrical and Electronic Engineers, Inc.
  3) EIA/TIA RS-485 interface
- The boards can be replaced easily.
  * The interface boards require only two screws for installation.
- When the parallel universal board is used, the DM connector on the TM series printer cannot be used.

For information on the TM Series printers for which these boards are designed, contact your sales representative.

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Table of Contents

0. GENERAL SPECIFICATIONS

0.1 Applied Standards

0.1.1 Serial Universal Board for RS-232 Interface UB-S01

EMC is tested using the EPSON TM series printers with the EPSON PS-170 power supply.

1) Europe — CE marking:
- Directive 89/336/EEC
  - EN55022 Class B
  - EN55024
    - IEC61000-4-2
    - IEC61000-4-3
    - IEC61000-4-4
    - IEC61000-4-5
    - IEC61000-4-6
    - IEC61000-4-11

2) North America: EMI FCC/ICES-003 Class A

3) Japan: EMI VCCI Class A

4) Oceania: EMC AS/NZS 3548 Class B

0.1.2 Serial Universal Board for RS-485 Interface UB-S02

EMC is tested using the EPSON TM series printers with the EPSON PS-170 power supply.

1) Europe — CE marking:
- Directive 89/336/EEC
  - EN55022 Class B
  - EN55024
    - IEC61000-4-2
    - IEC61000-4-3
    - IEC61000-4-4
    - IEC61000-4-5
    - IEC61000-4-6
    - IEC61000-4-11

2) North America: EMI FCC/ICES-003 Class A

3) Japan: EMI VCCI Class A

4) Oceania: EMC AS/NZS 3548 Class B

1. Serial Universal Board for RS-232 Interface UB-S01

1.1 Electrical Specifications

1.1.1 Communications Specifications

Data transfer format: Bit serial
Synchronization method: Asynchronous (start-stop synchronization method)
Flow control: According to the settings of the TM Series printer (selection of DTR/DSR control and XON/XOFF control)
*The flow control method is set through DIP switches on the TM Series printer in question. The choices indicated in parentheses above are typical choices that are supported by the TM Series printers.
Signal levels:

MARK	=	-3V to -15V	logical "1" or OFF
SPACE	=	+3V to +15V	logical "0" or ON

Data format:
Data length: According to the settings of the TM Series printer (7 bits/8 bits)
Stop bit: According to the settings of the TM Series printer (1 bit or more)
Baud rate: According to the settings of the TM Series printer (2400 to 19200)
Parity: According to the settings of the TM Series printer (Odd, even, none)
*The data format is set through DIP switches on the TM Series printer in question. The choices indicated in parentheses above are typical choices or a typical range of choices that are supported by the TM Series printers.

1.1.2 Assignment of Signals to the Pins of the RS-232 Interface Connector and a Description of Their Functions

Table 1-1 RS-232 Interface Signal Table

Pin No.	Signal Name	Signal Direction	Function
1	FG	-	Protective ground.
2	TXD	Output	Transmit data.
3	RXD	Input	Receive data.
4	RTS	Output	Either of the following settings can be selected through the setting of a DIP switch on the TM Series printer: (1) Same as DTR signal (pin 20) (2) Logical product of the customer display DTR signal and the printer DTR signal (The SPACE state when both are in the SPACE state) Note that some models of the TM Series do not permit setting (2).
6	DSR	Input	This signal indicates whether the host is ready to receive data. The SPACE state indicates that the host is ready to receive data, while the MARK state indicates that the host is not ready to receive. (1) When DTR/DSR control is selected, the state of this signal is checked before data is transmitted (except when transmitting data by means of GS ENQ, DLE EOT, GS a). (2) When XON/XOFF control is selected, the status of this signal is not checked.

			In addition, with some of the TM Series printers, this signal can be used as a reset signal for the printer. If this signal is set for use as a reset signal for the TM Series printer, the printer is reset by inputting a MARK signal with a pulse width of at least 1ms.
7	SG	-	Signal ground
20	DTR	Output	(1) When DTR/DSR control is selected This signal indicates whether the TM Series printer is BUSY or READY. The SPACE state indicates that the TM Series printer is READY, while the MARK space indicates that the TM Series printer is BUSY. The conditions for the BUSY state can be switched through the DIP switch setting. The printer enters the BUSY (MARK) state under the following conditions:

Conditions under which the printer goes offline (BUSY or MARK) when DTR/DSR control is selected		State of DIP switch used to switch the BUSY conditions	
		ON	OFF
Offline conditions	1) The interval from a reset initiated either by the power being turned on or through the interface, until the printer is ready for communications after mechanism initialization	BUSY	BUSY
	2) During the self-test	BUSY	BUSY
	3) When the cover is open	----	BUSY
	4) When the paper feed switch is being used to execute a paper feed	----	BUSY
	5) When printing was halted because the printer was out of paper	----	BUSY
	6) When an error has occurred	----	BUSY
	7) When the receive buffer is full (*1)	BUSY	BUSY

(2) When XON/XOFF control is selected
This signal indicates whether the printer is connected correctly and is ready to receive data from the host computer. The SPACE state indicates that the printer is connected correctly and is ready to receive data from the host.
When XON/XOFF control is selected, this signal is always in the SPACE state, except for the cases indicated below.

Conditions under which the printer DTR signal is output in the MARK state when XON/XOFF control is selected
1) The interval from when the power is turned on until the printer is ready for communications after mechanism initialization
2) During the self-test

25	INIT	Input	This signal can be used as a reset signal for TM Series printers by setting a DIP switch on the printer.. If this signal is set for use as a reset signal for the TM Series printer, the signal is in the MARK state normally; the printer is reset by inputting a SPACE signal with a pulse width of at least 1ms.

*1 * The receive buffer full state differs for different models of the TM Series printers. For a definition of the receive buffer full state, refer to the specifications for the specific TM Series printer model in question.
* The data that is received is ignored once there are 0 bytes of free space in the receive buffer.

1.1.3 XON/XOFF Transmission Timing

When XON/XOFF control is selected through the DIP switch on the TM Series printer, the TM Series printer sends XON or XOFF to the host computer according to the timing shown in Table 1-2.
It is essential to note that in some models of the TM Series, the timing by which XON or XOFF is transmitted differs according to the setting of the DIP switch on the TM Series printer that sets the offline conditions. For details on the offline condition setting DIP switch, refer to the specifications for the specific TM Series printer model in question.

Table 1-2 Timing for Transmitting XON/XOFF

Printer status		State of offline condition setting DIP switch	
		ON	OFF
[XON transmission]	(1) When first going online after a reset due to the power being turned on or a reset initiated through the interface	Send	Send
	(2) When the "receive buffer full" state is released	Send	Send
	(3) When switching from offline to online	----	Send
	(4) When recovering from a recoverable error in response to a command	----	Send
[XOFF transmission]	(5) When the "receive buffer full" state is in effect	Send	Send
	(6) When switching from online to offline	----	Send

Reference : * The XON code is <11>H; the XOFF code is <13>H.
* XON is never sent when the receive buffer is full, even in the case of (3) above.
* XOFF is never sent when the receive buffer is full, even in the case of (6) above.

1.1.4 Notes on Resetting the Printer through the RS-232 Interface

1.1.4.1 Reset Overview

In a TM Series printer equipped with this RS-232 interface board, the printer can be reset through the RS-232 interface by switching a DIP switch on the TM Series printer.

1.1.4.2 Reset Signal Details

When resetting a TM Series printer through the RS-232 interface, the signal is supplied to either pin 6 or pin 25, according to the setting of the DIP switch on the TM Series printer.

(For details, refer to the section on DIP switches in the specifications for the TM Series printer model in question.)

Table 1-3 Settings for Signal Input to the TM Series Printer

Signal line	Reset condition
Pin 6 (DSR)	MARK level input
Pin 25 (INIT)	SPACE or TTL-HIGH level input

When the printer is reset, the condition indicated in Table 1-3 and the electrical characteristics indicated in Table 1-4 must be satisfied.

Table 1-4 Electrical Characteristics of Reset Signal

Characteristic			
		Prescribed value	
DC characteristics	Symbol	Pin 6 (DSR)	Pin 25 (INIT)
Input high voltage	V IH	+3V ~ +15V	+2V ~ +15V
Input low voltage	V IL	-15V ~ -3V	-15V ~ +0.8V
Input high current	I IH	5mA (MAX)	1mA (MAX)
Input low current	I IL	-5.3mA (MAX)	-2mA (MAX)
Input impedance	R IN	3KΩ (MIN)	
AC characteristics			
Characteristic	Symbol	Prescribed value	
Reset minimum pulse width	TRS	1msec (MIN)	

• Reset signal timing when using pin 6 (DSR)

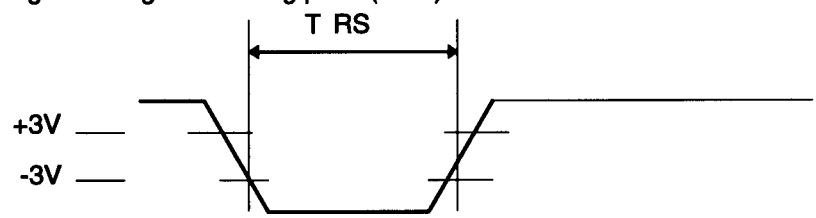

Fig. 1-1 Reset Timing Waveform for Pin 6 (DSR)

• Reset signal timing when using pin 25 (INIT)

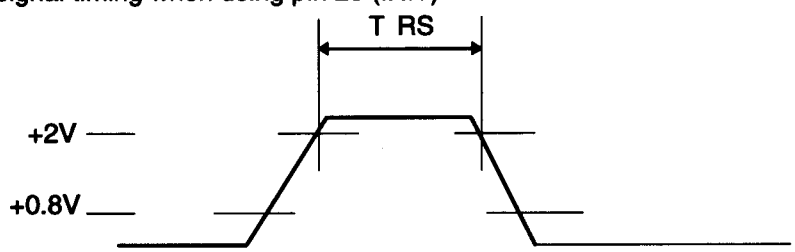

Fig. 1-2 Reset Timing Waveform for Pin 25 (INIT)

Notes:

• Operation is not guaranteed if a signal that does not satisfy the conditions indicated in Tables 1-3 and 1-4 and in Figs. 1-1 and 1-2 is input. Even if a TTL signal is input to pin 25 (INIT), the above characteristics must still be satisfied.
Note that, as indicated in the DC characteristics portion of Table 1-4, the input characteristics of pin 6 (DSR) are outside of the TTL operation range, so pin 6 cannot be controlled through TTL output.

• If the DIP switch on the TM Series printer that sets DSR for use as the reset signal is set to ON and pin 6 (DSR) is open, or if the DIP switch that sets INIT for use as the reset signal is set to ON and pin 25 (INIT) is open, the printer will still function. Note that if both DIP switches are ON and one of the pins is open, the open pin will have no effect on the operation of the printer.

1.2 Mechanical Specifications

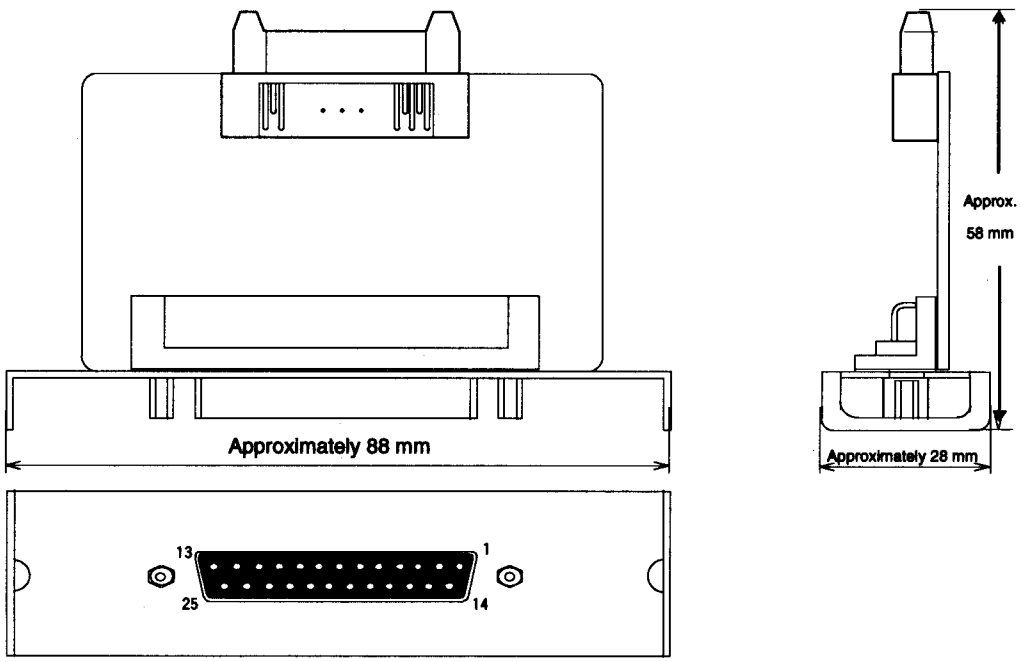

Fig. 1-3 External View of the RS-232 Interface Board

Connector on printer: Dsub 25-pin connector (female)

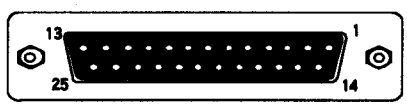

Fig. 1-4 RS-232 Interface Connector

2. Serial Universal Board for RS-485 Interface UB-S02

2.1 Electrical Specifications

2.1.1 Communications Specifications

Data transfer format: Bit serial
Synchronization method: Asynchronous (start-stop synchronization method)
Flow control: According to the settings of the TM Series printer (selection of DTR/DSR control and XON/XOFF control)

*The flow control method is set through DIP switches on the TM Series printer in question. The choices indicated in parentheses above are typical choices that are supported by the TM Series printers.

Signal levels:
2.0V to 5.0V logical "1"
0.0V to 0.8V logical "0"

Data format:
Data length: According to the settings of the TM Series printer (7 bits/8 bits)
Stop bit: According to the settings of the TM Series printer (1 bit or more)
Baud rate: According to the settings of the TM Series printer (2400 to 19200)
Parity: According to the settings of the TM Series printer (Odd, even, none)

*The data format is set through DIP switches on the TM Series printer in question. The choices indicated in parentheses above are typical choices or a typical range of choices that are supported by the TM Series printers.

Regarding signal level notation:
DR1 > DR2 CS1 > CS2: Indicates that:
.....Channel 1 is high.
.....Channel 2 is low.
DR1 < DR2 CS1 < CS2: Indicates that:
.....Channel 2 is high.
.....Channel 1 is low.

Table 2-1 List of Signal Levels and Communication Control Functions

CS1	CS2	Function
H	L	Communication is available
L	H	Communication is not available

* If the electric potential of CS1 is higher than that of CS2, the TM Series printer is deemed ready for communications (the host side is ready to receive). If the electric potential of CS1 is lower than that of CS2, the TM Series printer is deemed not ready for communications (the host side is ready to receive).

DR1	DR2	FUNC
H	L	Communication is available
L	H	Communication is not available

* If the electric potential of DR1 is higher than that of DR2, it indicates that the TM Series printer is ready for communications (data receive is possible). If the electric potential of DR1 is lower than that of DR2, it indicates that the TM Series printer is not ready for communications (data receive is not possible).

2.1.2 Assignment of Signals to the Pins of the RS-485 Interface Connector and a Description of Their Functions

Table 2-2 RS-485 Interface Connector Signal Table

<table>
<tr><th>Pin No.</th><th>Signal Name</th><th>Signal Direction</th><th>Function</th></tr>
<tr><td>1</td><td>FG</td><td>-</td><td>Protective ground.</td></tr>
<tr><td>2
3</td><td>SD1
SD2</td><td>Output</td><td>Transmit data.</td></tr>
<tr><td>4
5</td><td>RD1
RD2</td><td>Input</td><td>Receive data.</td></tr>
<tr><td>7</td><td>SG</td><td>-</td><td>Signal ground.</td></tr>
<tr><td>8
9</td><td>DR1
DR2</td><td>Output</td><td>(1) When DTR/DSR control is selected
This signal indicates whether the printer is BUSY or READY. DR1 > DR2 indicates that the printer is READY, while DR1 < DR2 indicates that the printer is BUSY. Note that the conditions for the BUSY state can be switched through the setting of the online condition DIP switch on the TM Series printer. When DTR/DSR control is selected, the printer enters the BUSY (DR1 < DR2) state under the following conditions:
<table>
<tr><th colspan="2" rowspan="2">Conditions under which the printer goes offline (BUSY or DR1 < DR2) when DTR/DSR control is selected</th><th colspan="2">State of DIP switch used to set the offline conditions</th></tr>
<tr><th>ON</th><th>OFF</th></tr>
<tr><td rowspan="7">Offline conditions</td><td>1) The interval from a reset initiated either by the power being turned on or through the interface, until the printer is ready for communications after mechanism initialization</td><td>BUSY</td><td>BUSY</td></tr>
<tr><td>2) During the self-test</td><td>BUSY</td><td>BUSY</td></tr>
<tr><td>3) When the cover is open</td><td>----</td><td>BUSY</td></tr>
<tr><td>4) When the paper feed switch is being used to execute a paper feed</td><td>----</td><td>BUSY</td></tr>
<tr><td>5) When printing was halted because the printer was out of paper</td><td>----</td><td>BUSY</td></tr>
<tr><td>6) When an error has occurred</td><td>----</td><td>BUSY</td></tr>
<tr><td>7) When the receive buffer is full (*1)</td><td>BUSY</td><td>BUSY</td></tr>
</table>
(2) When XON/XOFF control is selected
This signal indicates whether the printer is connected correctly and is ready to receive data from the host computer.
The DR1 > DR2 state (the READY state) indicates that the printer is connected correctly and is ready to receive data from the host.</td></tr>
</table>

			When XON/XOFF control is selected, this signal is always in the DR1 > DR2 state, except for the cases indicated below. Conditions under which the printer is offline (BUSY or DR1 < DR2) when XON/XOFF control is selected 1) The interval from when the power is turned on until the printer is ready for communications after mechanism initialization 2) During the self-test
10 11	CS1 CS2	Input	This signal indicates to the TM Series printer whether the host computer is ready to receive data. The CS1 > CS2 state indicates that the host computer is ready to receive data, while the CS1 < CS2 state indicates that the host is not ready to receive. (1) When DTR/DSR control is selected, the state of this signal is checked; data is transmitted only if the state is READY (except when transmitting data by means of GS ENQ, DLE EOT, GS a). (2) When XON/XOFF control is selected, the data is transmitted without regard for the status of this signal.

*1 * The receive buffer full state differs for different models of the TM Series printers. For a definition of the receive buffer full state, refer to the specifications for the specific TM Series printer model in question.
* The data that is received is ignored once there are 0 bytes of free space in the receive buffer.

2.1.3 XON/XOFF Transmission Timing

When XON/XOFF control is selected through the DIP switch on the TM Series printer, the TM Series printer sends XON or XOFF to the host computer according to the timing shown in Table 2-3.

It is essential to note that in some models of the TM Series, the timing by which XON or XOFF is transmitted differs according to the setting of the DIP switch on the TM Series printer that sets the offline conditions. For details on the offline condition setting DIP switch, refer to the specifications for the specific TM Series printer model in question.

Table 2-3 Timing for Transmitting XON/XOFF

Printer status		State of offline condition setting DIP switch	
		ON	OFF
[XON transmission]	(1) When first going online after a reset due to the power being turned on or a reset initiated through the interface	Send	Send
	(2) When the "receive buffer full" state is released	Send	Send
	(3) When switching from offline to online	----	Send
	(4) When recovering from a recoverable error in response to a command	----	Send
[XOFF transmission]	(5) When the "receive buffer full" state is in effect	Send	Send
	(6) When switching from online to offline	----	Send

Reference: * The XON code is <11>H; the XOFF code is <13>H.
* XON is never sent when the receive buffer is full, even in the case of (3) above.
* XOFF is never sent when the receive buffer is full, even in the case of (6) above.

2.1.4 Data Format When Using the RS-485

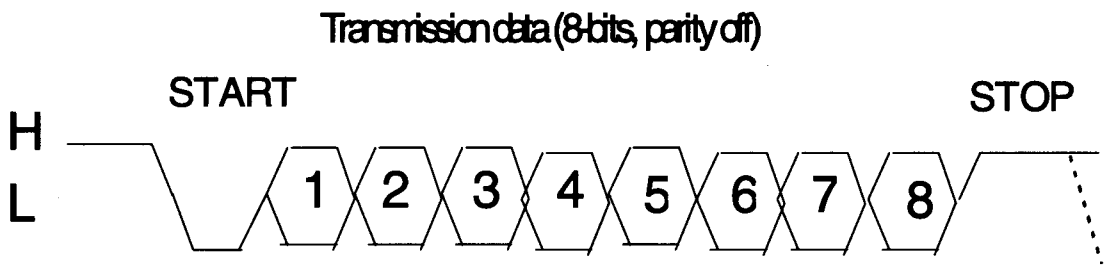

Fig. 2-1 RS-485 Communications Data Format

The transfer data format used with the RS-485 interface is shown in Fig. 2-1.

In Fig. 2-3, "H" represents:
<Printer transmission data> SD1 < SD2
<Printer receive data> RD1 < RD2

and "L" represents:
<Printer transmission data> SD1 > SD2
<Printer receive data> RD1 > RD2

The transmission data is H = 1, L = 0.

Note that this format is the format that is used when an RS-232 UART is connected to an RS-485 driver.

Table 2-4 Printer Receive Data Level Table

RD1	RD2	Read Data
H	L	Receiving data line is low level
L	H	Receiving data line is high level

Table 2-5 Printer Transmission Data Level Table

SD1	SD2	Send Data
H	L	Sending data line is low level
L	H	Sending data line is high level

2.2 Mechanical Specifications

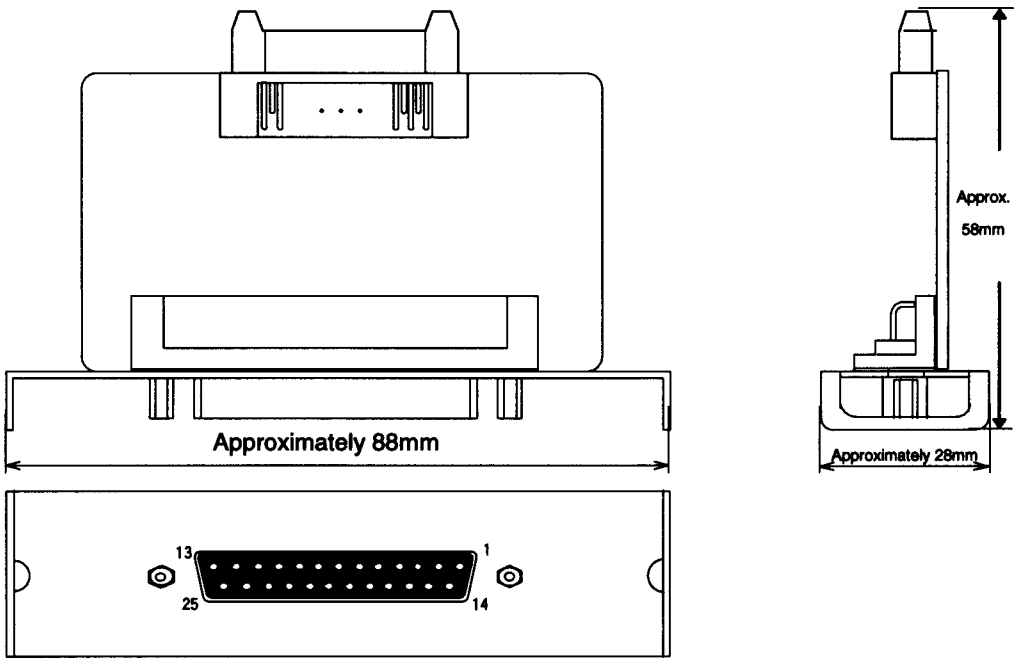

Fig. 2-2 External View of the RS-485 Interface Board

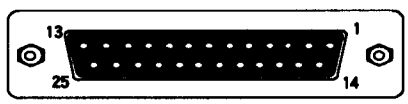

Fig. 2-3 RS-485 Interface Connector

3. Parallel Universal Board for 1284 Interface UB-P01 (IEEE 1284-1994*1 - conforming interface)

3.1 Electrical Specifications

3.1.1 Communications Specifications

Data transfer format : 8-bit parallel
Synchronization method : Synchronized with externally supplied nStrobe signal
Flow control : According to nAck signal and Busy signal
Signal levels : TTL-compatible
Connector : 57RE-40360-830B (DDK) or equivalent (1284 Type B)
Reverse communications (TM Series printer -> Host computer)
: Nibble and byte mode

3.1.2 Reverse Mode (Printer -> Host Communications)

Either nibble mode or byte mode is used to transfer status data from a TM Series printer equipped with a 1284 interface board to the host computer.
Nibble/byte mode transfers are defined for asynchronous transfers of data controlled by the host computer from the TM Series printer to the host computer.
In a nibble mode data transfer, existing control lines are used to transfer data four bits (a "nibble") at a time. In byte mode, the eight data lines (bits) are used for bi-directional transfer. In either case, simultaneous execution with compatibility mode is not possible; in such a case, half-duplex communications result. For details, refer to Appendix A.

Note that the 1284 nibble/byte modes are subject to change without notice.

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3.1.3 Interface Connector Pin Assignments in Each Mode

Table 3-1 Table of TM Series Printer Interface Connector Pin Assignments

Pin	Source	Compatibility Mode	Nibble Mode	Byte Mode
1	Host	nStrobe	HostClk	HostClk
2	Host/Ptr	Data0(LSB)	Data0(LSB)	Data0(LSB)
3	Host/Ptr	Data1	Data1	Data1
4	Host/Ptr	Data2	Data2	Data2
5	Host/Ptr	Data3	Data3	Data3
6	Host/Ptr	Data4	Data4	Data4
7	Host/Ptr	Data5	Data5	Data5
8	Host/Ptr	Data6	Data6	Data6
9	Host/Ptr	Data7(MSB)	Data7(MSB)	Data7(MSB)
10	Printer	nAck	PtrClk	PtrClk
11	Printer	Busy	PtrBusy/Data3,7	PtrBusy
12	Printer	Perror	AckDataReq/Data2,6	AckDataReq
13	Printer	Select	Xflag/Data1,5	Xflag
14	Host	nAutoFd	HostBusy	HostBusy
15		NC	ND	ND
16		GND	GND	GND
17		FG	FG	FG

Pin	Source	Compatibility Mode	Nibble Mode	Byte Mode
18	Printer	Logic-H	Logic-H	Logic-H
19		GND	GND	GND
20		GND	GND	GND
21		GND	GND	GND
22		GND	GND	GND
23		GND	GND	GND
24		GND	GND	GND
25		GND	GND	GND
26		GND	GND	GND
27		GND	GND	GND
28		GND	GND	GND
29		GND	GND	GND
30		GND	GND	GND
31	Host	nInit	nInit	nInit
32	Printer	nFault	nDataAvail/Data0,4	nDataAvail
33		GND	ND	ND
34	Printer	DK_STATUS	ND	ND
35	Printer	+5V	ND	ND
36	Host	nSelectIn	1284-Active	1284-Active

Note 1: A signal name that begins with "n" is an active low signal. If the host computer lacks even one of the above signal lines, bi-directional communications are not possible.

Note 2: Each signal line in the interface must be implemented using a twisted pair wire, and the return side must be connected to the signal ground level.

Note 3: The interface requirements all use TTL level as a reference point, and must satisfy the characteristics shown in item 3.1.4. The rise and fall time of each signal should be 0.5µsec or less.

Note 4: Do not ignore a nAck signal or a Busy signal and attempt to transfer data. If either type of signal is ignored, the data will be lost. (Data transfers to the printer must either check the nAck signal or must be performed when the Busy signal is low.)

Note 5: The interface cable must be as short as possible.

* NC: No connect ND: Not defined

3.1.4 Electrical Characteristics

Table 3-2 DC Characteristics (Except for logic-H and +5V signals)

Characteristic	Symbol	Prescribed value		Conditions
		Min	Max	
Output high voltage	V_{OH}	*2.4V	5.5V	*I OH = 0.32mA
Output low voltage	V_{OL}	-0.5V	*0.4V	*I OL = -12mA
Output high current	I_{OH}	0.32mA	-	V OH=2.4V
Output low current	I_{OL}	-12mA	-	V OL=0.4V
Input high voltage	V_{IH}	20V	-	
Input low voltage	V_{IL}	-	0.8V	
Input high current	I_{IH}	-	-0.32mA	V IH = 2.0V
Input low current	I_{IL}	-	12mA	V IL = 0.8V

Table 3-3 Logic-H Signal Transmitting Side Characteristics

Characteristic	Symbol	Prescribed value		Conditions
		Min	Max	
Output high voltage	V OH	3.0V	5.5V	
Output low voltage	V OL	-	2.0V	Power off

Table 3-4 +5V Signal Transmitting Side Characteristics

Characteristic	Symbol	Prescribed value		Conditions
		Min	Max	
Output high voltage	V OH	*2.4V	5.5V	*I OH = 0.32mA
Output low voltage	V OL	-	- **	Power off
Output high current	I OH	-	0.32mA	V OH=2.4V
Output low current	I OL	- **	-	Power off

**When the power is off, V OL and I OL are not guaranteed.

3.1.5 Data Receive Timing (Compatibility Mode)

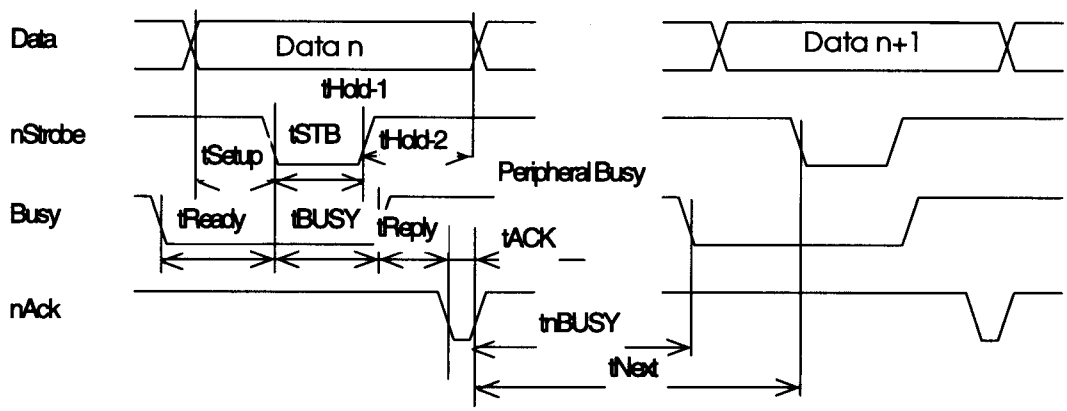


Fig. 3-1 Compatibility Mode Timing

Table 3-5 List of Prescribed Timing Values for Fig. 3-1

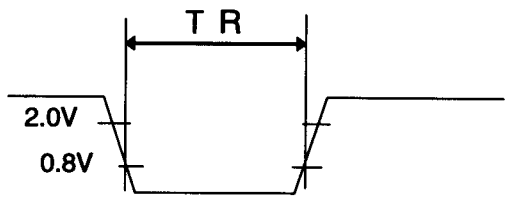
Characteristic	Symbol	Prescribed value	
		Min [ns]	Max [ns]
Data hold time (host)	tHold-1	-	500
Data hold time (printer)	tHold-2	-	-
Data setup time	tSetup	-	500
STROBE pulse width	tSTB	-	500
READY cycle idle time	tReady	-	-
BUSY output delay time	tBUSY	0	500
Data processing time	tReply	0	∞
ACKNLG pulse width	tACK	500	10 μ sec
BUSY release time	tnBUSY	0	∞
ACK cycle idle time	tNext	-	0

*The printer latches data at the falling edge of nStrobe.

3.1.6 Notes on Using an Interface Signal to Reset the Printer

With this interface board, by setting a DIP switch on the TM Series printer, it is **necessary** to use the nInit signal (pin 31) of the 1284 interface to reset the printer.

The DIP switch in question on the TM Series printer is the DIP switch that is used to set INIT reset (pin 25 reset) when using the RS-232 interface. For details on the DIP switches on the TM Series printers, refer to the TM Series printer specifications.
Note that reset via the nInit signal is valid only when the SelectIn (1284-Active) signal is low. In addition, the reset signal timing requirements shown in Fig. 3-2 must be satisfied.



*Minimum reset pulse width TR: 50μs (min.)

Fig. 3-2 Reset Signal Timing

Make sure that the DIP switches of 25 pin reset (or INIT signal) and 6 pin reset are set to on.

3.1.7 Receiving Status Information from the Printer through the Bi-directional Parallel Interface

It is possible to send information on the status of the TM Series printer to the host computer by using the bi-directional communications function in IEEE P1284 nibble/byte mode when using the bi-directional parallel interface board.

When an IBM-PC/AT or a compatible system is used as the host computer, it is not possible to send a data receive interrupt to the MPU when using a parallel interface, unlike the case when an RS-232 serial interface is used. Therefore, the following points must be noted.

(1)The printer's internal transmission buffer is 100 bytes. Any status information (excluding ASB status information) in excess of 100 bytes is lost. In order to avoid losing any of the status data that is to be sent, it is necessary to establish the receive state (reverse mode) in the host computer side.

* ASB: Automatic Status Back
  This function reports changes in the status of the TM Series printer. For details, refer to the TM Series printer specifications.

(2) When using ASB, it is best to use the waiting-for-receive state (reverse idle mode) as the normal mode for the host computer. If reverse idle mode cannot be used as the normal mode, then it is best to constantly look for data by setting the host computer side to reverse mode at suitable, regular intervals.

(3) When using ASB, the ASB status is given priority ahead of other status information in reverse mode. In addition, any ASB status information that is accumulated between the last time the ASB status information was sent and when the newest ASB status information is sent is grouped into a single batch of ASB status information (indicating that there were changes) and is then sent, followed by the newest ASB status information.

Example: The ASB status in the normal (standby) state is as follows:

Status 1	Status 2	Status 3	Status 4
0000 0000	0000 0000	0000 0000	0000 0000

In this state, if near end, cover open, and then cover closed is detected, the following data is accumulated:

	Status 1	Status 2	Status 3	Status 4	
(1)	0000 0000	0000 0000	0000 0000	0000 0000	Near end detection
(2)	0010 1000	0000 0000	0000 0011	0000 0000	Cover open
(3)	0000 0000	0000 0000	0000 0011	0000 0000	Cover closed

The ASB status is then received. The ASB status information that is actually sent is as follows (1 + 2 + 3):

ASB ((1)+(2)+(3))

Status 1	Status 2	Status 3	Status 4
0010 1000	0000 0000	0000 0011	0000 0000

+

and then the final ASB (3):

Status 1	Status 2	Status 3	Status 4
0000 0000	0000 0000	0000 0011	0000 0000

for a total of eight bytes sent.

3.2 Mechanical Specifications

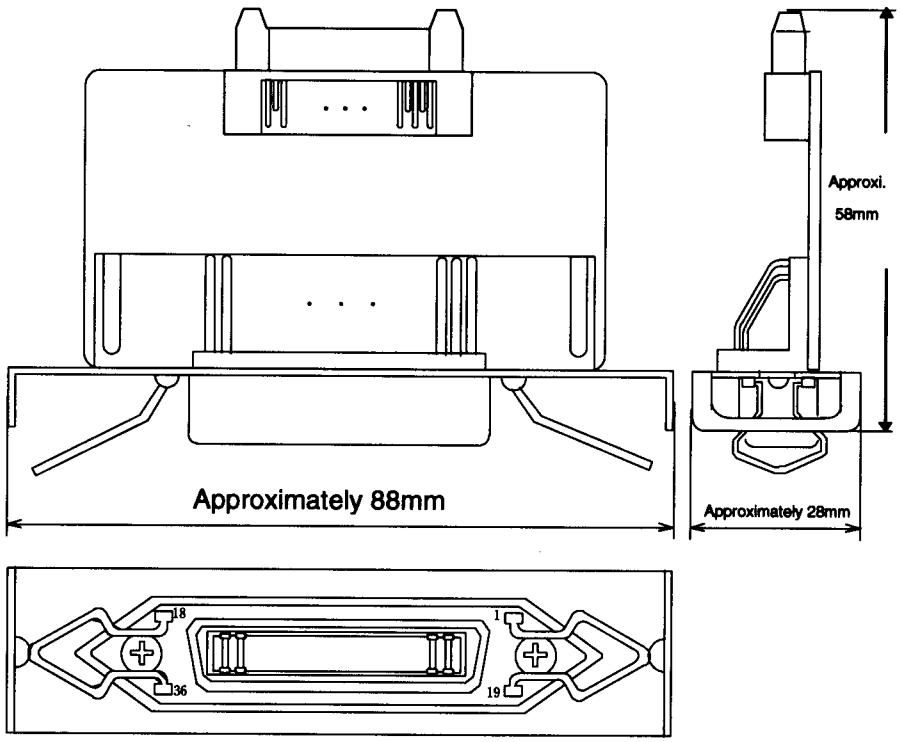


Fig. 3-3 External View of the Parallel Interface Board

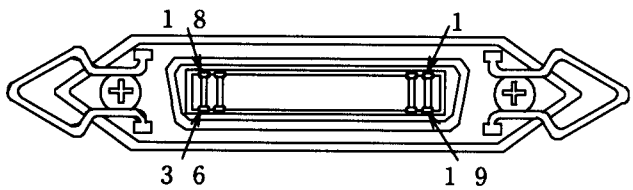


Fig. 3-4 External Front View of Parallel Interface Connector

*The connector used on this interface board is equivalent to a 1284-B.

4. (Appendix A) Bi-directional Parallel Interface

4.1 Overview

When the parallel interface specifications are used, the interface on this printer conforms with a level-1 device in IEEE 1284, and for communications modes this printer supports each mode indicated in J.1.1.

4.2 1284 Parallel Interface Communications Modes

The parallel interface implemented by this product supports the three communications modes indicated below. When the power is turned on or when a reset is executed the initial mode that is set is compatibility mode.

- Compatibility Mode
  In this mode, communications are handled in units of bytes in the direction of the printer from the host. Normal data receive is performed in this mode. In addition, the transition to all other modes is made from compatibility mode.

- Nibble Mode
  In this mode, communications are handled in units of four bits in the direction of the host from the printer. Data transmissions from the printer are performed using the status signal lines. In this mode, it is necessary to send two consecutive "nibbles" of four bits in order to send one byte of data.

- Byte Mode
  In this mode, communications are handled in units of bytes in the direction of the host from the printer. Data transmissions from the printer are performed using the eight data signal lines (8 bits). Byte mode requires that the host computer have a function for switching the signal direction on the eight data signal lines. When communications flow from the host to the printer, that is called "forward mode;" when communications flow from the printer to the host, that is called "reverse mode."

4.3 Interface Operation Phases

Interface operations in each communications mode consist of several phases. In addition, there are separate phases for mode initialization and mode transition. In some cases, the name and function of interface signals differs for each mode and phase.

Fig. 4-1 shows a phase diagram for the 1284 interface, and Table 4-1 describes the interface phases.

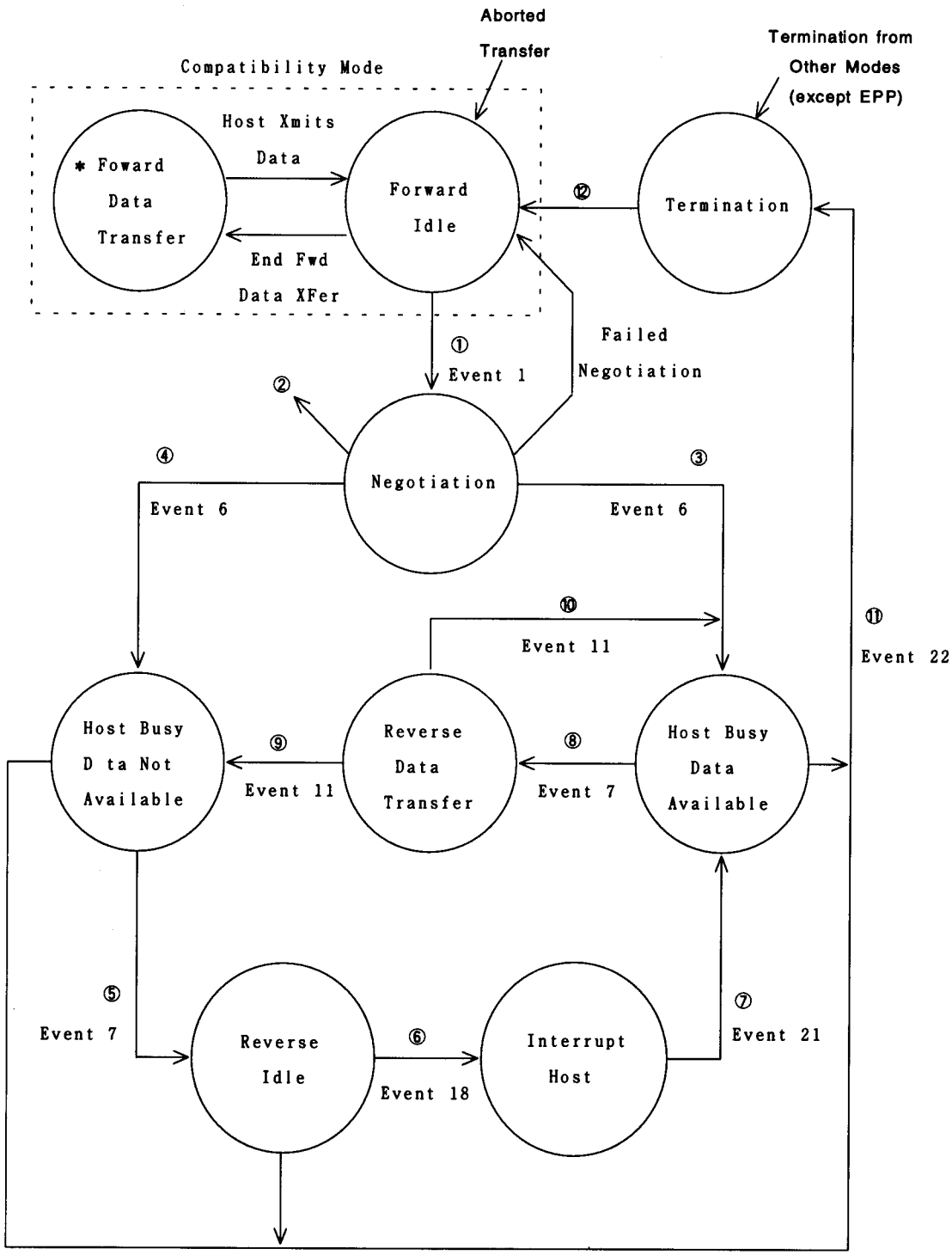


Fig. 4-1 Interface Phase Transition Diagram

Table 4-1 Description of the Phases in Fig. 4-1

Phase No.	Description of Phase	SIGNAL STATUS
①	Host Requests Reverse Transfer.	
②	Successful Negotiation to Another Mode.	
③	Perpheral Has Data To Send.	nDataAvail=Low
④	Perpheral Has No Data To Send.	nDataAvail=High
⑤	Host Goes To Idle.	HostBusy =Low
⑥	Perpheral Has New Data.	
⑦	Perpheral Has Data Send.	
⑧	Host Requests Data Byte.	
⑨	Host Receives Data Byte. Peripheral Has No More Data To Send.	nDataAvail=High
⑩	Host Receives Data Byte. Peripheral Has More Data.	nDataAvail=Low
⑪	Host Requests Termination.	
⑫	Interface Returns To The Compatible Mode	

*When data is not being received, the phase changes to forward idle phase.

4.4 Phases in Compatibility Mode

- Compatibility mode forward data transfer phase: This is the phase in which data is received from the host computer. The host and the printer control the flow of data through the nStrobe, nAck, and Busy signals. The host must not start up the negotiation phase in order to shift to another phase until the interface returns to the compatibility mode forward idle phase.
- Compatibility mode forward idle phase: In this phase, the interface is in compatibility mode and data communications are not in progress. The host can initiate data communications in compatibility mode and can start up the negotiation phase in order to shift to another mode.

4.5 Phases in Nibble Mode and Byte Mode

- Reverse data transfer phase: Data communications from the printer to the host.
- Reverse "host busy, data available" phase: State in which the printer has transmission data.
- Reverse "host busy, data not available" phase: State in which the printer has no more transmission data.
- Reverse idle phase: State in which data communications are not in progress. In this state, the host is waiting for data from the printer. If the printer sends transmission data, the phase changes to reverse interrupt phase.
- Reverse interrupt phase: This phase is used to notify the host that the printer has sent out transmission data in the reverse idle phase. In this phase, the host can shift to the termination phase.

4.6 Other Phases

- Initialization phase: Initialization phase when the power is turned on or a hardware reset is executed.
- Negotiation phase: Phase used to shift from compatibility mode to other modes.
- Power-on phase: Device initialization phase when the power is turned on.
- Termination phase: Phase used to return to compatibility mode from the nibble and byte modes.

4.7 1284 Interface Operation

4.7.1 Power On

In this interface, checking the Logic-H signal makes it possible to detect that the printer power has just been turned on. After the power has been turned on and the Logic-H signal has been set high (3.0V or higher), all signals become valid within 500ms.

4.7.2 Hardware Reset

With these printers, the nInit signal can be used to force a reset. However, this signal is invalid in the following cases, and low level pulses on this signal are ignored:

- When the 1284-active (Select-In) signal is high
- When there is a function for enabling/disabling hardware resets by a DIP switch on the printer and the DIP switch is set to disable hardware resets

When resetting the printer through the nInit signal line, the signal must conform with the timing shown in Fig. 4-2.

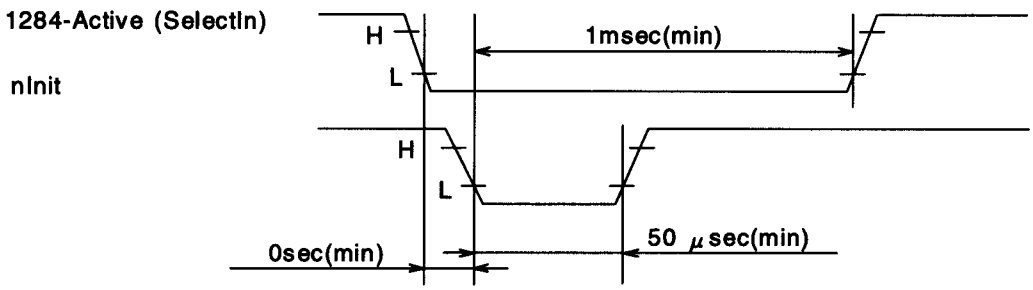


Fig. 4-2 Timing of Resets Using the nInit Signal

4.7.3 Compatibility Mode

4.7.3.1 Overview

Compatibility Mode is compatible with Centronics interfaces, which are commonly used in conventional PCs. Compatibility mode is the initial mode that is set after the power is turned on or a reset is executed.

This is the mode that is normally used to receive data from the host.

The data communications procedure is summarized below:

- The host confirms that the printer is ready to receive data, and outputs the data and strobe signals.
- Once the printer detects the strobe signal from the host, it sets the Busy signal high and commences data receive processing.
- Once the printer completes data receive processing, it outputs a low pulse on the nAck signal, and sets the Busy signal low.

4.7.3.2 Flow Control Timing

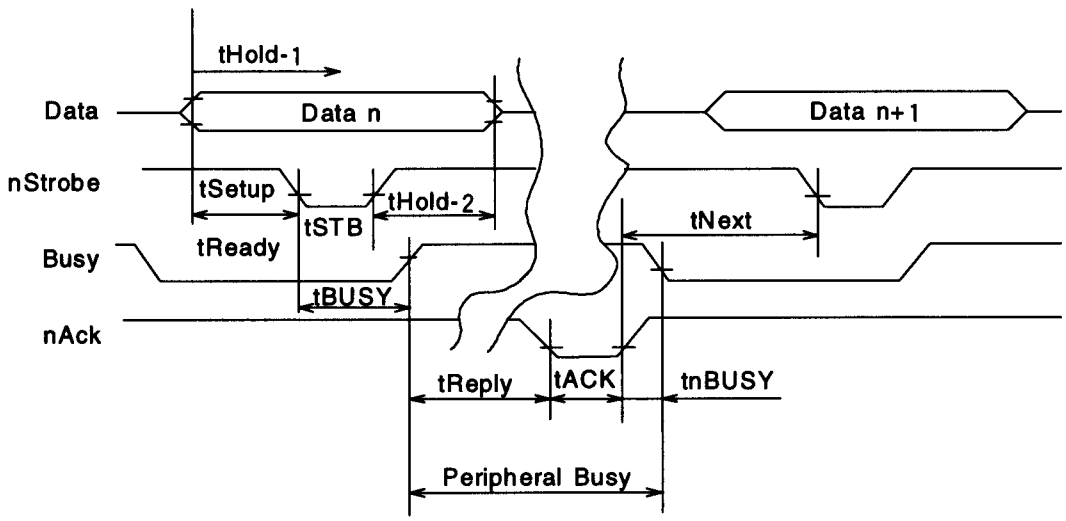


Fig. 4-3 Compatibility Mode Communications Timing

Table 4-2 Compatibility Mode Communications Timing Definitions

Characteristic	Symbol	Required of printer Prescribed values for printer section		Required of host Prescribed values for host section	
		Minimum (ns)	Maximum (ns)	Minimum (ns)	Maximum (ns)
Data hold time (host)	tHold-1	-	500	-	-
Data hold time (printer)	tHold-2	-	-	750	-
Data setup time	tSetup	-	500	750	-
STROBE pulse width	tSTB	-	500	750	500 µs
READY cycle idle time	tREADY	-	-	0	∞
BUSY output delay time	tBUSY	0	500	-	-
Data processing time	tREPLY	0	∞	-	-
ACKNLG pulse width	tACK	500	10 µs	-	-
BUSY release time	tnBUSY	0	∞	-	-
ACK cycle idle time	tNext	-	0	0	∞

*The printer latches data at the falling edge of nStrobe.

4.7.4 Negotiation

4.7.4.1 Overview

Normally, the printer starts up in compatibility mode and in this state the interface functions as a standard Centronics interface. When switching to nibble or byte mode, negotiation is conducted in response to a request from the host. The flow of negotiation is described below.

1) The host enters the negotiation phase by setting the 1284-Active signal high.

↓

2) The printer responds to the host as to whether it can execute the requested mode.

3) The negotiation phase ends, and the communications phase begins.

4.7.4.2 Negotiation Procedure

The negotiation procedure is as follows:

1) In 1284 communication mode, the host and printer default mode is compatibility mode. Compatibility mode continues until the host recognizes that the connected device is a 1284-compatible device.
2) In order to initiate negotiation, the host sets the communications mode request bit on the data bus. (event 0)
3) The host sets 1284-Active (nSelectIn) high and sets HostBusy (nAutoFd) low. (event 1)
4) The printer responds to the request by setting PtrClk (nAck) low, nDataAvail (nFault) high, Xflag (Select) high, and AckDataReq (PError) high. (event 2)
5) The host sets HostClk (nStrobe) low, and as a result the printer latches the communications mode request bit. (event 3)
6) The host sets HostClk (nStrobe) and HostBusy (nAutoFd) high. (event 4)
7) When there is data in the printer that is to be sent to the host, the printer sets AckDataReq (PError) low, and nDataAvail (nFault) low, and sets Xflag (Select) to a value that corresponds to the communications mode. (event 5)

   Xflag: Nibble mode low
   Byte mode high

8) The printer sets PtrCLk (nAck) high, indicating that the other status lines can be read. (event 6)
9) When there is data in the printer that is to be sent to the host, the host either shifts to the "host busy, data available" phase, or else shifts to the termination phase and then returns to compatibility mode.
10) When there is no data in the printer that is to be sent to the host, the host either shifts to the "host busy, data not available" phase, or else shifts to the termination phase and then returns to compatibility mode.
11) If the printer does not support the communications mode requested by the host, the Xflag (Select) is set as follows:

   Nibble mode requested : High
   Byte mode requested : Low

4.7.4.3 Notes

1) The rising edge of the 1284-Active signal triggers the start of the negotiation phase.
2) The general rule regarding the start of negotiation from compatibility mode is after output of the nAck pulse after the rising edge of nStrobe. If the rising edge of 1284-Active is detected after the rising edge of nStrobe but before or during nAck output, then processing shifts immediately to the negotiation phase. In this case, the nAck pulse is not output when processing returns to compatibility mode after termination.
3) Negotiation is possible from the compatibility mode busy state or error state. In this case, processing does not return to the original busy state or error state after termination; instead, the printer state after the completion of termination is restored.
4) If the printer does not support the communications mode requested by the host, the host must shift to the termination phase and return to compatibility mode.

Table 4-3 1284 Communications Mode Request Bit Definitions

bit	Definition	Valid BitValues (76543210)	HexCode	Xflag Support value	Xflag Printer value
7	Request Extensibility Link	10000000	80H	High	Low
6	Request EPP Mode	01000000	40H	High	Low
5	Request ECP Mode with RLE	00110000	30H	High	Low
4	Request ECP Mode	00010000	10H	High	Low
3	Reserve	00001000	08H	High	Low
2	Request Device ID;Return Data Using				
	Nibble Mode Rev Channel Transfer	00000100	04H	High	High
	Byte Mode Rev Channel Transfer	00000101	05H	High	High
	ECP Mode Transfer without RLE	00010100	14H	High	Low
	ECP Mode Transfer with RLE	00110100	34H	High	Low
1	Reserve	00000010	02H	High	Low
0	Byte Mode Reverse Channel Transfer	00000001	01H	High	High
non	Nibble Mode Reverse Channel Transfer	00000000	00H	Low	Low
	Illegal Contradictory Request	Except Above	Except Above		Low

*This interface board supports nibble and byte modes only. The Xflag becomes a negative value in response to requests for ECP mode or EPP mode.

4.7.5 Data Communications from the Printer to the Host

4.7.5.1 Nibble Mode

The procedure for printer to host transfers is described below. Note that the procedure starts from step 1 when processing shifted from the negotiation phase to the "host busy, data available" phase. When processing shifted from the negotiation phase to the "host busy, data not available" phase, the procedure starts from step 9.

1) After negotiation for nibble mode ends, the host sets HostBusy (nAutoFd) low in order to indicate that it is ready to receive data from the printer. (event 7)
2) The printer sets the least significant four bits on the reverse channel data line, and sets the PtrClk (nAck) low. (event 8, event 9)
3) The host latches the data at event 9 and then sets HostBusy (nAutoFd) high to indicate that it received the data. (event 10)
4) The printer sets PtrClk (nAck) high, terminating the process of transferring the first nibble. (event 11)
5) The most significant four bits are transferred by repeating steps 1 to 3 and then continuing with the next step below.
6) After the host sets HostBusy (nAutoFd) high (event 10), having received the data, the printer must set the four status lines as shown below. (event 13)
   - PtrBusy (Busy): Return to the forward mode state.
   - nDataAvail (nFault): Set low if there is any data to be transmitted.
   - AckDataReq (PError): Same as nDataAvail (nFault)
   - Xflag (Select): Set the current mode state; in other words, set low.
7) Next, the printer sets PtrClk (nAck) high. (event 11)
8) After event 11, the host uses the signals (set by the printer in event 13) to check whether there is still any data to be transferred from the printer to the host or whether transfer from the host to the printer is now possible, and decides the state accordingly.

9) Once the transfer of one byte (two nibbles) is complete, and there is no more data to be transferred from the printer, the host selects the following three states:
   1. Terminates and then returns to compatibility mode.
   2. Remains in the "host busy, data not available" phase.
   3. Sets HostBusy (nAutoFd) low (event 7) and shifts to Reverse idle phase.
10) If there is data from the printer, the host selects the following three states:
   1. Sets HostBusy (nAutoFd) low, indicating that the host is ready to receive data.
   2. Remains in the "host busy, data available" phase.
   3. Terminates and then returns to compatibility mode.
11) If the host sets HostBusy (nAutoFd) low from the "host busy, data available" phase, the printer repeats the procedure, starting from step 2.
12) If the printer sends transmission data from the reverse idle phase, the printer sets PtrClk low in order to request an interrupt from the host computer. (event 18)
13) The printer then sets PtrClk high. (event 19)
14) The host responds to the interrupt request from the printer by setting HostBusy (nAutoFd) high. (event 20)
15) Afterwards, the printer sets AckDataReq (PError) low in response to the host computer, and then shifts to the "host busy, data available" phase. (event 21)

4.7.5.2 Byte Mode

The procedure for printer to host transfers is described below. Note that the procedure starts from step 1 when processing shifted from the negotiation phase to the "host busy, data available" phase. When processing shifted from the negotiation phase to the "host busy, data not available" phase, the procedure starts from step 9.

1) After negotiation for byte mode ends, the host sets the data lines to high impedance and sets HostBusy (nAutoFd) low (event 7) in order to indicate that it is ready to receive data from the printer. (event 14, event 7)
2) The printer sets the communications data on the data lines. (event 15)
3) The printer sets PtrClk (nAck) low. (event 9)
4) The host latches the data at event 9 and then sets HostBusy (nAutoFd) high to indicate that it received the data. (event 10)
5) After step 4, the printer must set the status lines as shown below. (event 13)
   - PtrBusy (Busy) : Return to the forward channel state.
   - nDataAvail (nFault) : Set low if there is any data to be transmitted.
   - AckDataReq (PError) : Same as nDataAvail (nFault)
   - Xflag (Select) : Set the last negotiation state; in other words, set low.
6) Next, the printer sets PtrClk (nAck) high and terminates the byte handshake. (event 11)
7) The host sets HostClk (nStrobe) low and then high to indicate that receive processing was performed. (event 16, event 17)
8) Event 10 and event 16 may occur simultaneously, and event 7 and event 17 may also occur simultaneously. (If HostBusy and HostClk share the same line, for example.)
9) Once the transfer of one byte is complete, the printer informs the host whether there is any more data to be transferred. If there is no more data to be transferred from the printer, the host selects the following three states:
   1. Terminates and then returns to compatibility mode.
   2. Remains in the "host busy, data not available" phase.
   3. Sets HostBusy (nAutoFd) low and shifts to Reverse idle phase. (event 7)

10) If there is data from the printer, the host selects the following three states:
1. Sets HostBusy (nAutoFd) low, indicating that the host is ready to receive data.
2. Remains in the "host busy, data available" phase.
3. Terminates and then returns to compatibility mode.

The procedure for starting transfer from the reverse idle phase is the same as in nibble mode.

4.7.6 Device ID

The device ID is a character string that is used to identify the type of device connected to the interface. These printers return a device ID similar to the one shown below in response to a device ID request from the host computer.

<00>H<31>H MFG : EPSON; CMD : ESC/POS; MDL : TM-P1.00; CLS : PRINTER;
(The semicolons are included in the character strings.)

The first two bytes of the device ID show the length of the device ID data as a whole (unit: bytes), including those two bytes themselves. For details on the method for requesting the device ID, refer to the section on negotiation. The host must receive a device ID character string of the length indicated by the first two bytes. In addition, the termination operation may not be executed until the entire device ID character string has been received.

* If the termination operation is executed before the entire device ID character string is received, the printer discards the remaining character string. The next time the device ID is requested, the printer sends the entire ID, starting from the beginning.

After the host has completely received an ID of the length indicated by the first two bytes, the termination operation must be executed once. Even if there is transmission data on the printer side (Data Available), it is necessary to execute the termination operation. If the receive operation is performed without executing the termination operation, the printer status is sent.

4.7.7 Termination

"Termination" is the processing that returns the mode to compatibility mode from nibble mode or byte mode. When performing the termination operation, make the following settings:

1284-Active (nSelectIn) -> low
HostBusy (nAutoFd) -> High (event 22)

There are two termination methods:

(1) Termination by means of flow control between the host and the printer
(2) Immediate termination

Method (1), when shifting from reverse mode to compatibility mode, assuming event 22 was performed after the interface was enabled (1284-Active: high):

1) The printer responds to 1284-Active by setting PtrBusy (Busy) and nDataAvail (nFault) high. (event 23)
2) The printer then inverts Xflag (Select) and sets PtrClk (nAck) low. (event 24)
3) The host sets HostBusy (nAutoFd) low. (event 25)
4) The printer returns nDataAvail (nFault), Xflag (Select), and AckDataReq (PError) to their compatibility mode states, and then sets PtrClk (nAck) high. (event 26, event 27)

5) The host ends termination flow control by setting HostBusy (nAutoFd) high and then returning the interface to compatibility mode idle phase. (event 28)
6) The printer changes PtrBusy (Busy) so that it can receive data from the host.

In method 2, if the interface is disabled (1284-Active: low) without executing event 22, the printer performs the termination operation immediately. In this event, the data is not guaranteed, and the printer switches the data lines from output to input within 1µs.
In the reverse idle phase, the printer can notify the host that it has data that is to be transferred to the host. This can happen simultaneously with the termination operation so that the host can shift from idle phase to compatibility mode. When the printer has data that is to be transferred, the interrupt phase indicated by events 8 and 9 begins. In this case, if 1284-Active (nSelectIn) goes low before HostBusy (nAutoFd) changes from high to low, the printer decides that the host has shifted to the termination phase, and then performs flow control.

4.7.8 Interface Operation Timing Chart

4.7.8.1 Nibble Mode Negotiation And Transfer

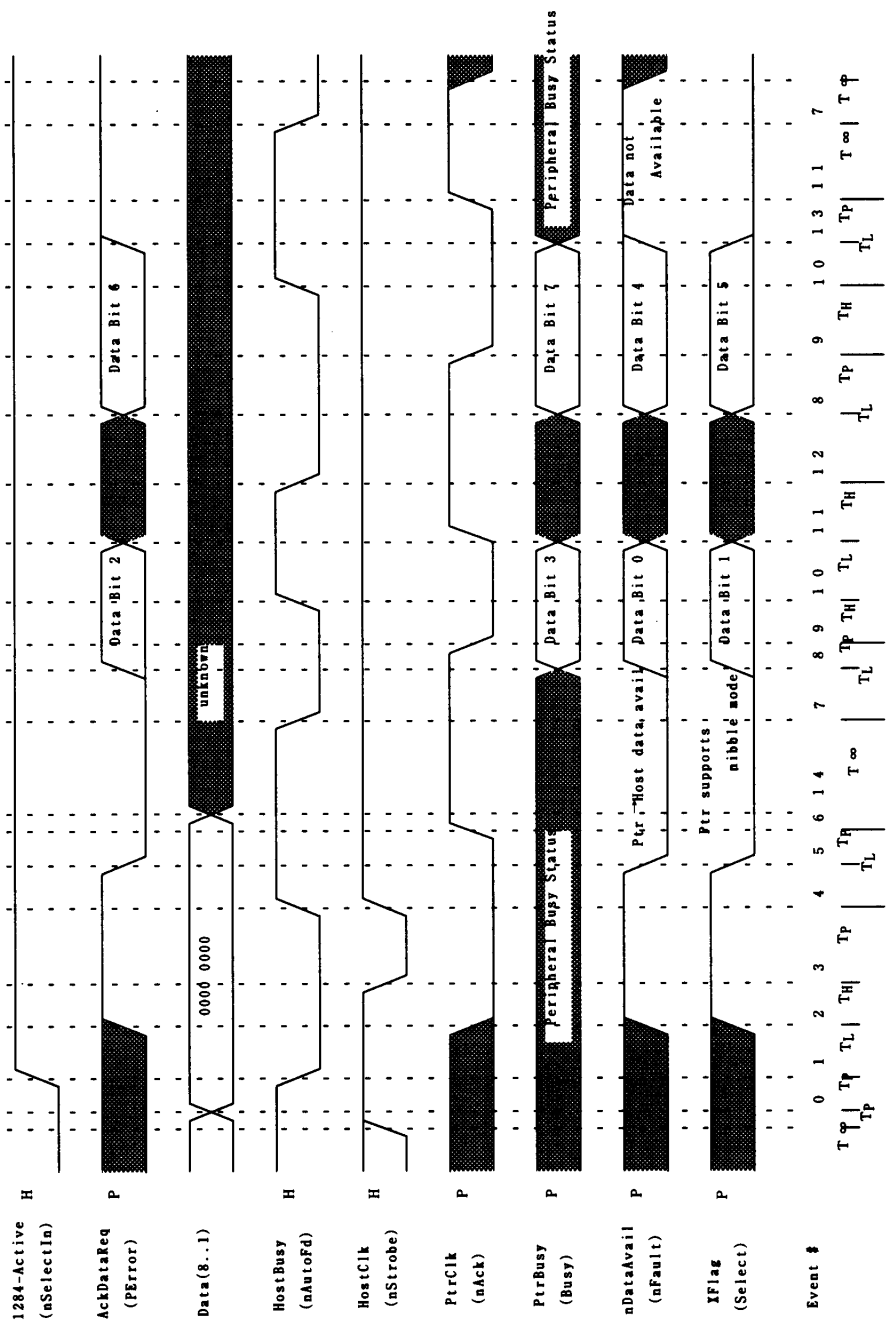


Fig. 4-4 Nibble Mode Negotiation And Transfer

4.7.8.2 Byte Mode Negotiation And Termination

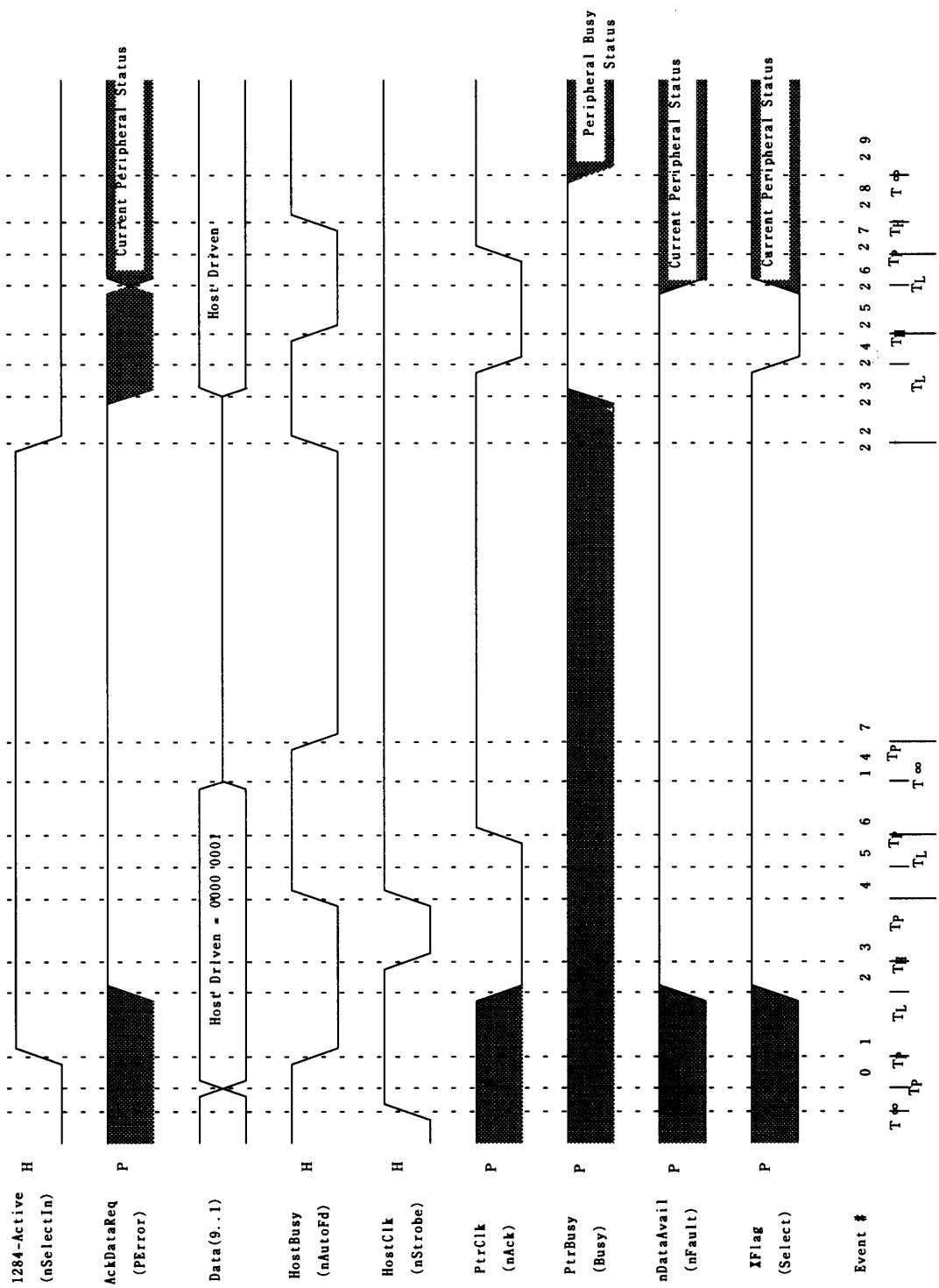
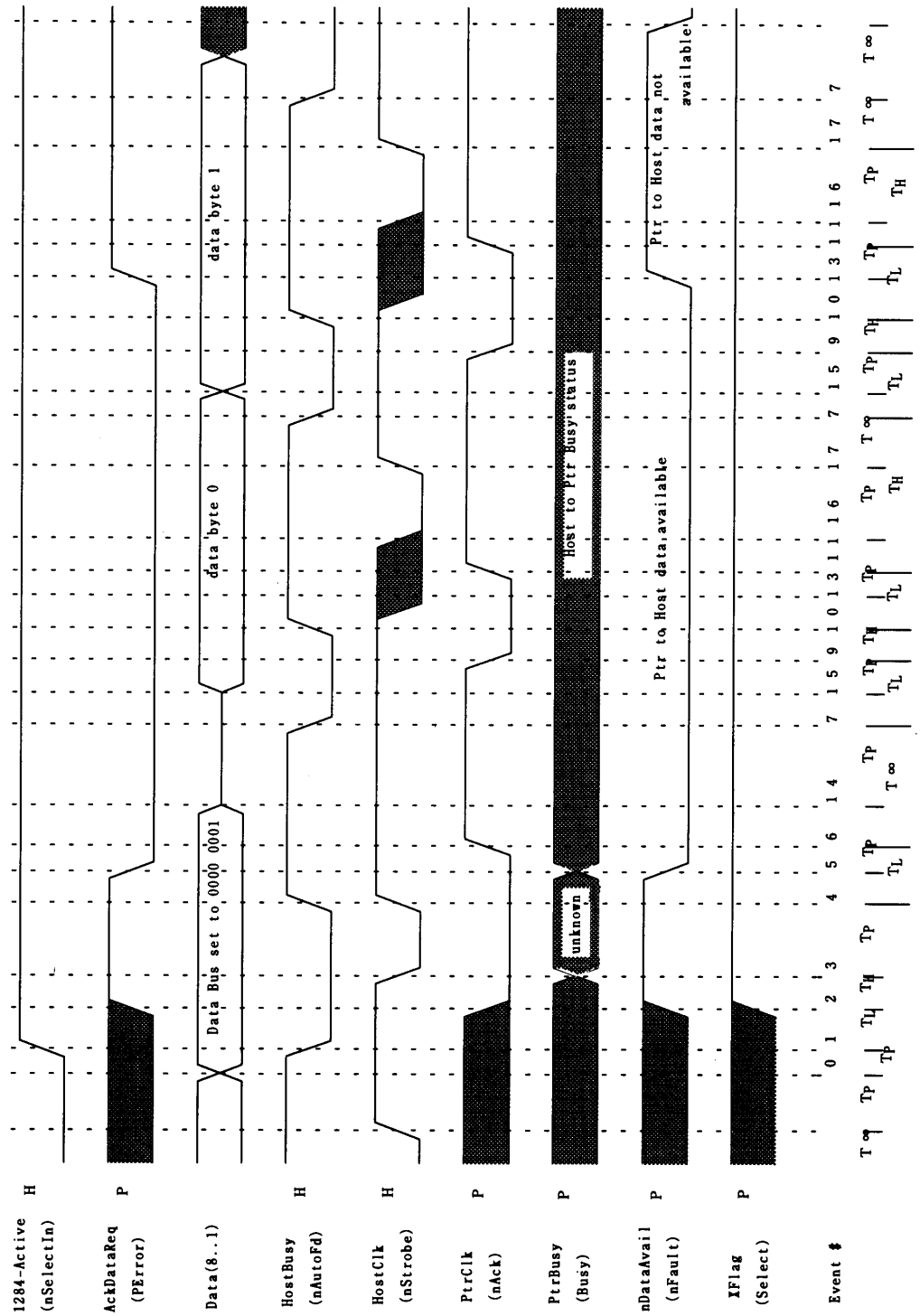


Fig. 4-5 Byte Mode Negotiation And Termination

4.7.8.3 Byte Mode Negotiation And Transfer



4-6 Byte Mode Negotiation And Transfer

4.7.8.4 Nibble Mode Transfer And Termination

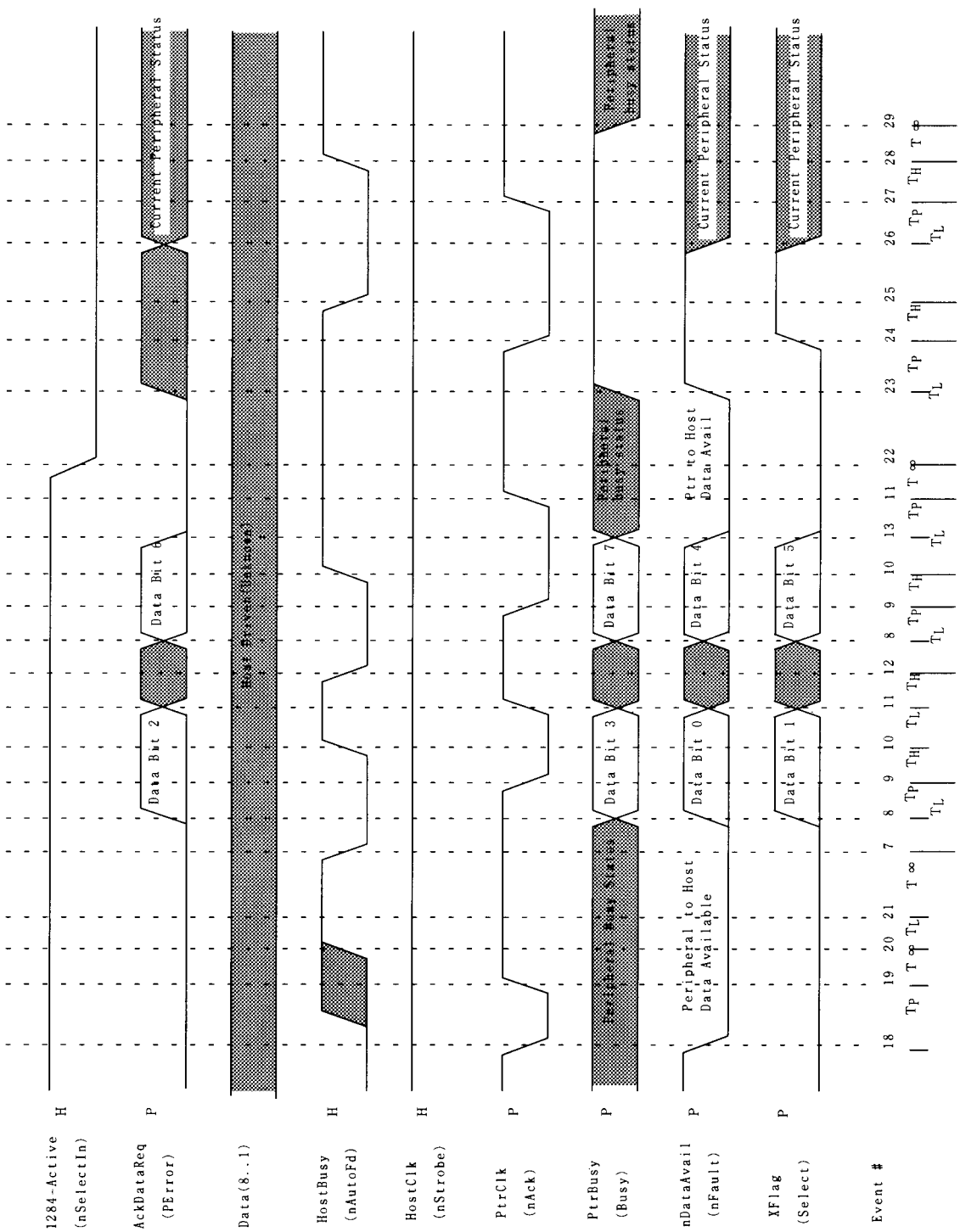


Fig. 4-7 Nibble Mode Transfer And Termination

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4.7.8.5 Nibble Mode Interrupt And Transfer

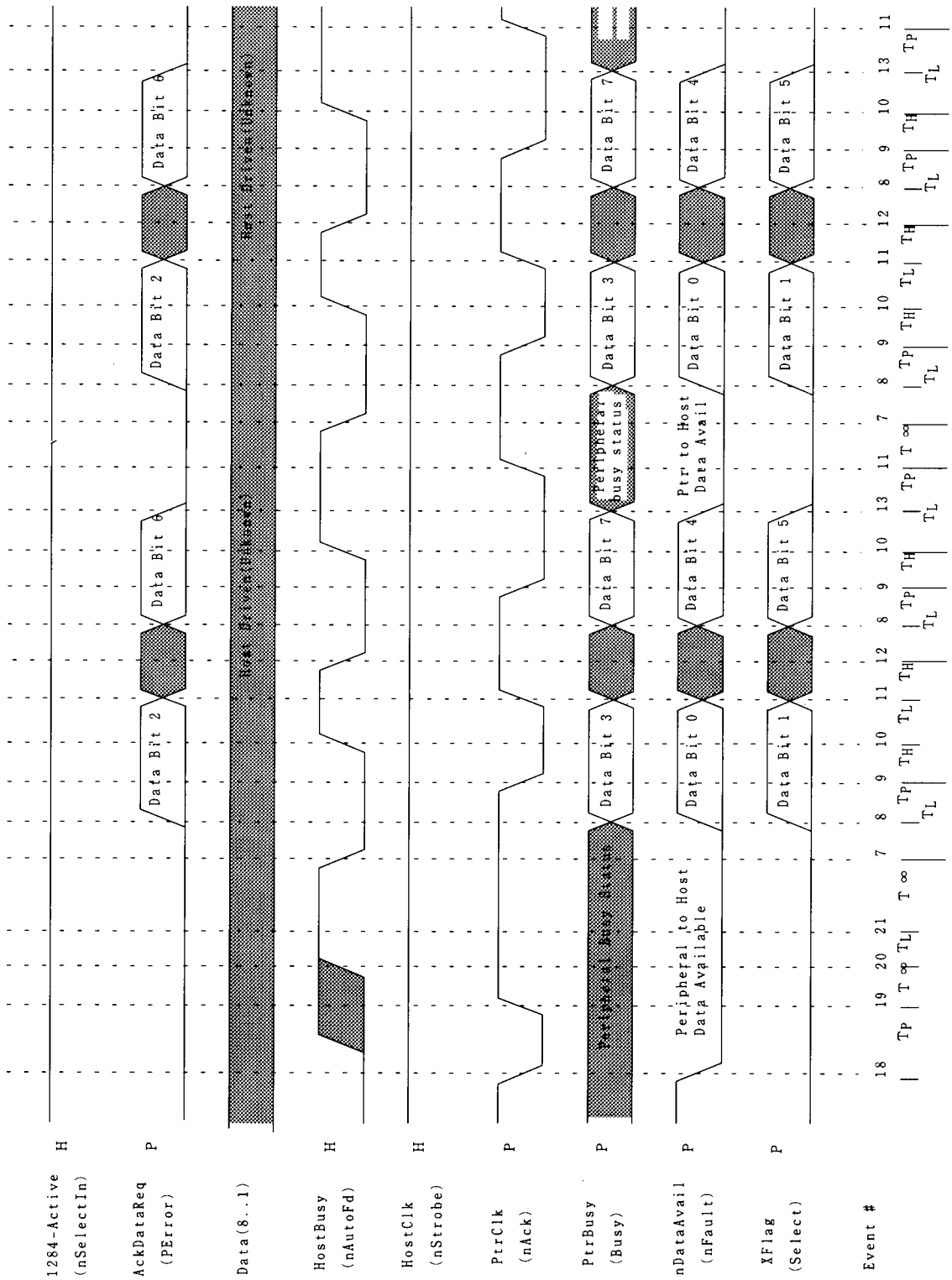

Fig. 4-8 Nibble Mode Interrupt And Transfer

4.7.8.6 Failed Negotiation

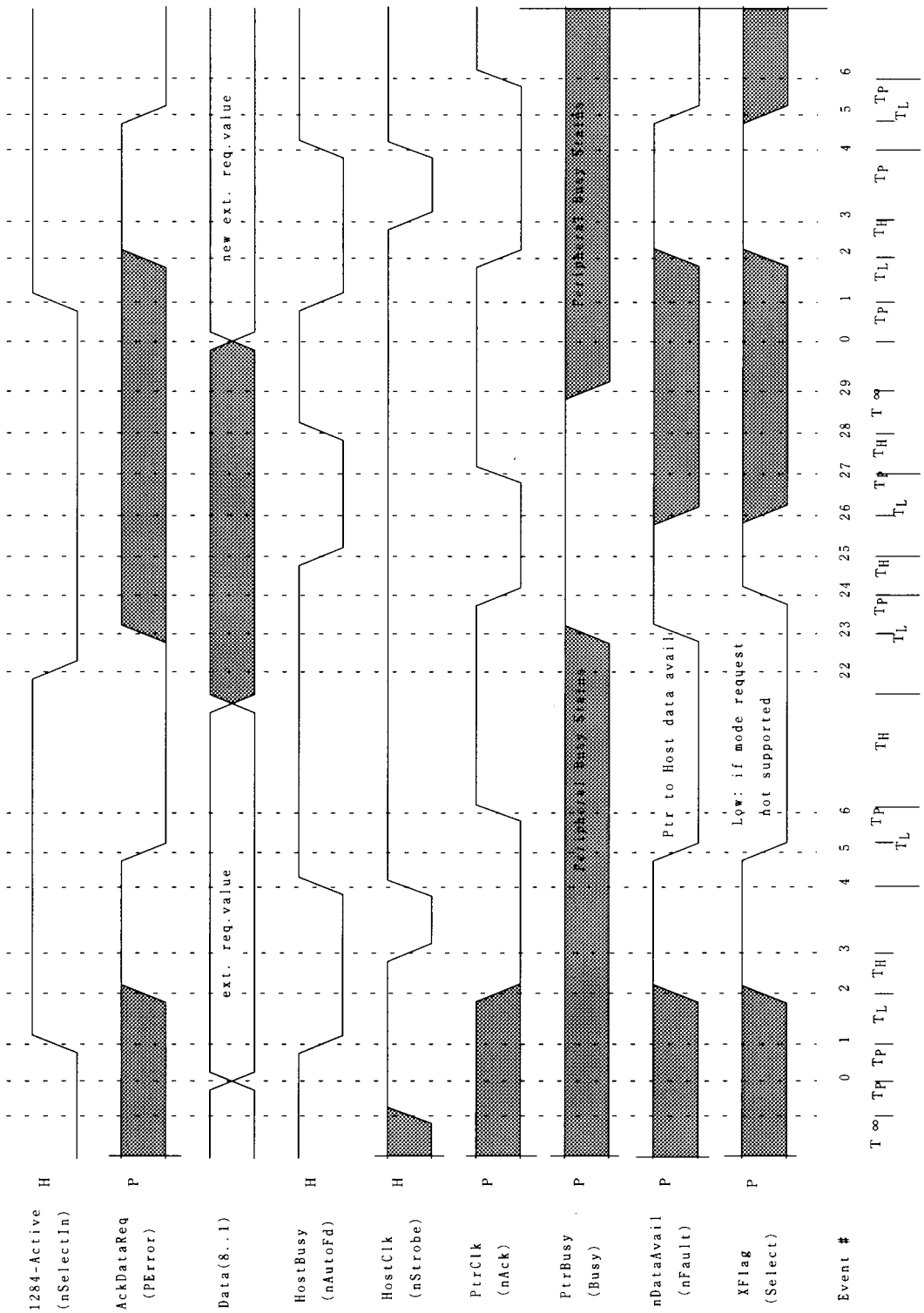

Fig. 4-9 Failed Negotiation

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