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NCR

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Location: Controller Firmware
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Subject: NCR PRINTER PROPOSAL FOR SCSI-2

Attached is a copy of the "NCR Printer Proposal for SCSI - 2" to be presented at the July 13-15, 1987 working group in Irvine, California.

TJ/k1

Attachments

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OVERVIEW OF NCR PRINTER PROPOSAL FOR SCSI-2

1. REQUEST SENSE COMMAND

- Printer-related Additional Sense Code Definitions

2. COPY COMMAND

- Printer-related COPY function codes and segment descriptors

3. MODE SENSE and MODE SELECT COMMANDS

- Parameter List Header
- Parallel (Dataproducts- and Centronics-type) Printer Interface parameter page definitions
- Serial Printer Interface parameter page definition

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REQUEST SENSE Command

The REQUEST SENSE Extended Sense Data format remains as previously defined - with the addition of the Additional Sense Code Qualifier.

Extended Sense Data									
Bit	7	6	5	4	3	2	1	0	
Byte(s)									
8-11	Command-specific Information Bytes								
12	Additional Sense Code								
13	Additional Sense Code Qualifier								
14	FRU Failed								
15	FPV	C/D	VU	VU	BPV	Bit Pointer			
16	Field Pointer (MSB)								
17	Field Pointer (LSB)								
18-N	Vendor Unique								

The Additional Sense Code (Qualifier) fields for Printer Devices are defined on the following page.

Additional Sense Codes for Printer Devices

Byte		Description	Related Sense Keys (others may apply)
12	13		
00	00	No additional sense information	
01	00	No printer interface verify (printer device not present)	NO SENSE
03	00	Printer-detected parity error	HARDWARE ERROR
04	00	Printer not ready	HARDWARE ERROR
05	00	Printer off-line	NOT READY
06	00	No Top-of-Form (TOF) detected	NOT READY
08	00	Paper movement failure	HARDWARE ERROR
08	01	Slew failure	HARDWARE ERROR
08	02	Paper jam	
09	00	Printer Fault	
10	00	Tape/Electronic Vertical Forms Unit (TVFU/EVFU) not ready	HARDWARE ERROR
1B	00	Synchronous transfer error	NOT READY
20	00	Invalid command operation code	HARDWARE ERROR
20	01	Illegal function for device type	ILLEGAL REQUEST
20	02	Unsupported function	
21	00	Invalid byte transfer length	ILLEGAL REQUEST
22	00	Invalid function for device type	ILLEGAL REQUEST
24	00	Illegal CDB field	ILLEGAL REQUEST
24	02	Reserved bit/field set	ILLEGAL REQUEST
25	00	Invalid Logical Unit Number (LUN)	ILLEGAL REQUEST
26	00	Invalid parameter list field	ILLEGAL REQUEST
29	00	Power-on / bus reset occurred	UNIT ATTENTION
2A	00	MODE SELECT parameters changed	UNIT ATTENTION
31	00	FORMAT failed	HARDWARE ERROR
3A	00	Out of paper	MEDIUM ERROR
3B	00	Paper position error	MEDIUM ERROR or HARDWARE ERROR
3B	01	Failed to sense Bottom-of-Form (BOF)	
3B	02	Failed to sense Top-of-Form (TOF)	
42	00	Power-on diagnostic failure	
43	00	Message Reject Error	HARDWARE ERROR
44	00	Internal controller SCSI failure	ABORTED COMMAND
45	00	Select/Reselect failure	HARDWARE ERROR
46	00	Unsuccessful soft reset	HARDWARE ERROR
47	00	SCSI parity error	HARDWARE ERROR ABORTED COMMAND or RECOVERED ERROR or HARDWARE ERROR
48	00	Initiator detected error	ABORTED COMMAND or RECOVERED ERROR or HARDWARE ERROR
49	00	Inappropriate/Illegal message	ABORTED COMMAND
60	00	Target status error on COPY command	ABORTED COMMAND
70	00	Self-test failed	COPY ABORTED HARDWARE ERROR

COPY Command

Define additional COPY function codes as follows:

COPY function code:

04h	Direct access to printer
05h	Sequential access to printer

Segment Descriptor for COPY Function Code 04h

Function Code 04h									
Bit	7	6	5	4	3	2	1	0	
Byte(s)									
0	Source Address			Resvd	Cat	Source LUN			
1	Destination Address			Reserved		Destination LUN			
2,3	Direct-Access Device Block Length						(MSB first)		
4-7	Direct-Access Device Number of Blocks						(MSB first)		
8-11	Direct-Access Device Logical Block Address						(MSB first)		

Segment Descriptor for COPY Function Code 05h

spec for CDP Function Code 05h								
Bit	7	6	5	4	3	2	1	0
Byte(s)								
0	Source Address			Resvd	Cat	Source LUN		
1	Destination Address			Reserved		Destination LUN		
2,3	Reserved							
4,5	Source Block Length					(MSB first)		
6,7	Reserved							
8-11	Source Number of Blocks (MSB first)							

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MODE SELECT / MODE SENSE Commands

After a MODE SELECT command is successfully completed, a UNIT ATTENTION condition for the Logical Unit will begin for all other initiators (if the MODE SELECT changed any parameters from their previous values. (If none changed, the UNIT ATTENTION condition will not begin.) The UNIT ATTENTION condition is described in 6.1.3 of the SCSI-2 Working Draft Proposal.

Parameter List Header									
Bit	7	6	5	4	3	2	1	0	
Byte(s)									
0	Reserved (MODE SELECT) or Sense Data Length (MODE SENSE)								
1	Reserved								
2	Resvd	Buffered Mode				Reserved			
3	Reserved								

The SCSI-2 Working Draft Proposal describes the Parameter List Header.

In most cases, the printer options/parameters described herein are not available to a controller via the printer/controller interface. These parameters provide a means for printer options to be communicated to the controller via the host system(s), or for the controller to report its parameter assumptions to the host. It will be incumbent upon the user or installer to verify that the printer and controller options agree or are compatible for proper operation.

The Page Codes for the following page definitions are to be assigned.

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PARALLEL PRINTER INTERFACE PARAMETERS (Page Code h)

The following page includes parameters pertaining to both Dataproducts and Centronics type parallel interface printers. This was done since both interface types emulate the other to some degree. Combining the parameters then, requires only one page to be defined. The appropriate parameters to specific applications can be determined by issuing a MODE SENSE (Changeable Parameters) command.

Bit	7	6	5	4	3	2	1	0
Byte(s)								
0	Page Code (h)							
1	Page Length (0Eh)							
2	EVFU	Reserved			Band Identification			
3	Reserved			Slew Limit				
4	VCBS	VCBP	Slew Mode	Reserved	SCTE	AFC		
5	Parity Select	PIPC	Reserved					
6	Max. Line Length - MSB							
7	Max. Line Length - LSB							
8	EVFU Format Start Character							
9	EVFU Format Stop Character							
10	Line Slew Options			Form Slew Options				
11	Data Termination Options			Reserved			Autofd	
12	BUSY Signal Options							
13	ACK Signal Options							
14	Reserved							
15	Reserved							

Parallel Printer Interface Parameters - cont'd.

EVFU indicates if a Tape/Electronic Vertical Forms Unit is present. (MODE SENSE command only - RESERVED in the MODE SELECT command.)

The Band Identification provides band information. (MODE SENSE command only - RESERVED in the MODE SELECT command.)

Band I.D. Definition:

0000b	The Band I.D. is invalid.
1XXXb	Band I.D. bits 2-0 (which are controller and/or printer-specific) are valid.

The Slew Limit specifies the maximum line count accepted by the EVFU for SLEW AND PRINT line skip commands. A 00h value will specify the target's default value is to be selected (in the MODE SELECT command).

VCBS (VFU Control Bit Select) indicates the VFU control bit selected. The selected bit indicates VFU channel/line skip commands, depending on its state (selected by VCBP). VCBS = 0/1 = bit 4/6.

VCBS	VFU Control Byte	Function of Control Bit (C)
	7 6 5 4 3 2 1 0	
0	0 E E C N N N N	Advance (EE)NNNN lines (C = line skip)
	0 0 0 C N N N N	Skip to VFU channel NNNN (C = VFU channel)
1	0 C E E N N N N	Advance (EE)NNNN lines (C = line skip)
	0 C 0 0 N N N N	Skip to VFU channel NNNN (C = VFU channel)

VCBP (VFU Control Bit Polarity) indicates the state of the VFU control bit for VFU channel or line skip (paper motion control) commands.

VCBP = 0:	Logic true control bit indicates a line skip command.
	Logic false control bit indicates a VFU channel command.
VCBP = 1:	Logic true control bit indicates a VFU channel command.
	Logic false control bit indicates a line skip command.

SCTE = 0/1 indicates the printer's Step Count Truncate Enable option is disabled/enabled to truncate line skip commands to stop at the top of the next form.

AFC = 0/1 indicates the printer does not/does support ASCII Form Control characters.

Parallel Printer Interface Parameters - cont'd.

The **Slew Mode** options specify the printer's support mode for SLEW AND PRINT line skip commands:

Slew Mode	Definition
00b	Select controller's default mode.
01b	Line skip commands are supported without host/controller intervention. The host and/or controller need not issue an EVFU Format function. (The printer EVFU READY = TRUE will not be required.)
10b	Intervention is required for line skip command support. The initiator must first issue the necessary FORMAT data (Printer interface EVFU READY = TRUE will be required.)
11b	Intervention is required for line skip command support. The initiator must first issue the necessary FORMAT data or the controller may send a START/STOP format sequence to enable the EVFU Line Counter-only mode of operation.

Parity Select controls/indicates printer interface parity checking:

Parity Select	Definition
00b	Default (Controller-specific)
01b	No parity checking
10b	Even Parity
11b	Odd Parity

86 PIPC = 0/1 indicates the Paper Instruction (is not/is) included in Parity Checking by the printer.

The **Maximum Line Length** will specify/indicate the maximum byte count per line to be accepted in the SLEW AND PRINT command. A value of 0000h will specify the controller's default value.

The **EVFU Start/Stop Code** bytes will specify/indicate the codes used by the controller, if the Slew Mode option is set to 11b. The controller's default START and STOP codes will be specified if these bytes are set to 00h in the MODE SELECT parameters.

Parallel Printer Interface Parameters - cont'd.

Line Slew Options will specify/indicate the controller's implementation of line slewing for support of SLEW AND PRINT (Line Skip) commands for Centronics-type printers.

Code	Form Slew Option
0000b	Controller's Default
0001b	No implementation. (SLEW AND PRINT commands will be Illegal Requests for Centronics-type printers.)
0010b	0Dh (Carriage Return)
0100b	0Ah (Line Feed)
0110b	0Dh,0Ah (Carriage Return, Line Feed)

Form Slew Options specify/indicate the controller's implementation of form slewing for support of the SLEW AND PRINT (Line Skip) command.

Code	Line Slew Option
0000b	Controller's Default
0001b	No implementation. (SLEW AND PRINT commands will be Illegal Requests for Centronics-type printers.)
0010b	0Dh (Carriage Return)
1000b	0Ch (Form Feed)
1010b	0Dh,0Ch (Carriage Return, Form Feed)

Data Termination Options specify/indicate the controller implementation of data termination for support of the FLUSH BUFFER command. Used for printers which require data termination to print data in their buffer.

Code	Data Termination Option
0000b	Controller's Default
0001b	No implementation. (Data termination must be provided by the initiator.)
0010b	0Dh (Carriage Return)
0100b	0Ah (Line Feed)
0110b	0Dh,0Ah (Carriage Return, Line Feed)
1000b	0Ch (Form Feed)
1010b	0Dh,0Ch (Carriage Return, Form Feed)

The **Autofd** option will disable/enable (0/1) the controller driving the printer interface Auto Line Feed line.

Parallel Printer Interface Parameters - cont'd.

BUSY Signal Options:

Bit	Option
7	0 - select defaults for bits 0-6 (which are ignored) 1 = bits 0-6 valid
6	0/1 = BUSY (does not/does) reflect Paper Out
5	0/1 = BUSY (does not/does) reflect Printer Fault
4	0/1 = BUSY (does not/does) reflect Online/Local status
3	Reserved, must be set to 0
2	0/1 = BUSY (does not/does) reflect full print buffer
1	0/1 = BUSY (does not/does) reflect ACK
0	0/1 = BUSY active low/high

ACK Signal Options:

Bit	Option
7	0 = select defaults for bits 0-6 (which are ignored) 1 = bits 0-6 valid
6	0/1 = ACK (does not/does) reflect Paper Out
5	0/1 = ACK (does not/does) reflect Printer Fault
4	0/1 = ACK (does not/does) reflect Online/Local status
3	Reserved, must be set to 0
2	Reserved, must be set to 0
1	Reserved, must be set to 0
0	Reserved, must be set to 0

SERIAL INTERFACE PARAMETERS (Page Code h)

The following page defines parameters for RS232-interface printers.

Bit	7	6	5	4	3	2	1	0
Byte(s)								
0	Page Code (h)							
1	Page Length (06h)							
2	Reserved							
3	Reserved				Baud Rate Select			
4	Reserved		Stop Bit Length					
5	Parity Select		Reserved		Bits per Character			
6	RTS	Rsvd	CTS	Reserved		Ready/Busy Protocol		
7	Reserved							

Baud Rate Selection is specified as follows:

Code	Baud Rate	Code	Baud Rate
00000b	Default	10000b	reserved
00001b	50	10001b	75
00010b	110	10010b	110
00011b	134.5	10011b	134.5
00100b	200	10100b	150
00101b	300	10101b	300
00110b	600	10110b	600
00111b	1200	10111b	1200
01000b	1050	11000b	2000
01001b	2400	11001b	2400
01010b	4800	11010b	4800
01011b	7200	11011b	1800
01100b	9600	11100b	9600
01101b	38400	11101b	19200
01110b	reserved	11110b	reserved
01111b	reserved	11111b	reserved

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Serial Interface Parameters - cont'd.

Stop Bit Length is specified as follows:

Code	Stop Bit Length
000000b	Default
XXXXXXb	All non-zero values are interpreted as n-16ths bits.

Parity Select controls parity selection as follows:

Parity Select	Parity Mode:	5-7-bit	8-bit
000b		Default	Default
001b		None	None
100b		Mark	None
101b		Space	None
110b		Odd	Odd
111b		Even	Even

Bits per Character are specified as follows:

Code	Bits per Character
000b	Default (Controller-Specific)
001b	5 bits per character
010b	6 bits per character
011b	7 bits per character
100b	8 bits per character

RTS provides a Request-To-Send timing option:

- 0 = high after power-on
- 1 = RTS follows DTR

CTS provides a Clear-To-Send control option:

- 0 = CTS not used
- 1 = Delay transmission till CTS asserted

Ready/Busy Protocol

Code	Definition
000b	Default
001b	XON/XOFF
010b	ETX/ACK
011b	Busy on DTR
100b	BUSY Pin(s)