

INTERNATIONAL STANDARD

ISO/IEC 9316-2

First edition
2000-06

Information technology – Small computer system interface-2 (SCSI-2) –

Part 2: Common Access Method (CAM) Transport and SCSI interface module

© ISO/IEC 2000

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from the publisher.

ISO/IEC Copyright Office • Case postale 56 • CH-1211 Genève 20 • Switzerland



PRICE CODE XA

For price, see current catalogue

CONTENTS

	Page
FOREWORD	6
INTRODUCTION	7
Clause	
1 Scope.....	9
2 Conformance.....	9
3 Normative references	10
4 Definitions	10
5 Conventions	11
6 General description	12
6.1 General.....	12
6.2 Environment.....	12
6.3 Peripheral driver functions.....	13
6.4 XPT functions.....	14
6.5 SIM functions	14
7 Background	14
7.1 General	14
7.2 Software.....	14
7.3 CAM (Common Access Method).....	14
7.4 OSD (Operating System Dependencies).....	15
7.5 Architectural considerations	15
8 Principles of operation.....	16
8.1 Accessing the XPT	16
8.2 Initialization.....	17
8.3 CCB completion	17
8.3.1 Completion of immediate CCB.....	17
8.3.2 Completion of queued CCB	17
8.4 SCSI request queues	18
8.4.1 The logical unit and the peripheral driver.....	18
8.4.2 SIM queuing.....	18
8.5 SIM handling of SCSI resets.....	20
8.6 Asynchronous event callback	21
8.7 Autosense	23
8.8 Loadable modules	24
9 OSD (operating system dependent) operation	25
9.1 UNIVOS operating system.....	25
9.1.1 Initialization	25
9.1.2 Accessing the XPT	26
9.1.3 Callback on completion.....	26
9.1.4 Pointer definition in the UNIVOS environment.....	26
9.1.5 Request mapping information	27
9.1.6 XPT interface	27
9.1.7 SIM interface.....	28
9.2 LANOS.....	28
9.2.1 Initialization.....	28
9.2.2 SIM and peripheral driver unloading	29
9.2.3 Accessing the XPT	30
9.2.4 Hardware registration.....	30
9.2.5 Miscellaneous	30

Clause	Page
9.3 DOS (disk operating system)	31
9.3.1 Initialization	31
9.3.2 Accessing the XPT	32
9.3.3 Callback on completion	33
9.3.4 Asynchronous event callbacks	33
9.3.5 Pointer definition	34
10 CAM control blocks	34
10.1 CCB header fields	36
10.1.1 Address of this CCB	36
10.1.2 CAM control block length	36
10.1.3 XPT function code	36
10.1.4 CAM status	36
10.1.5 Connect ID	39
10.1.6 CAM flags	39
10.2 Function codes	39
10.2.1 NOP	39
10.2.2 Get device type	40
10.2.3 Path inquiry	41
10.2.4 Release SIM queue	43
10.2.5 Scan SCSI bus	44
10.2.6 Scan logical unit	45
10.2.7 Set asynchronous callback	45
10.2.8 Set device type	46
10.3 SCSI control functions	47
10.3.1 Abort SCSI command	47
10.3.2 Reset SCSI bus	48
10.3.3 Reset SCSI device	49
10.3.4 Terminate I/O process	49
11 CAM control block to request I/O	51
11.1 Field descriptions for CAM control blocks to request I/O	51
11.1.1 Autosense Residual Length	51
11.1.2 Callback on completion	51
11.1.3 CAM flags	51
11.1.4 CDB	55
11.1.5 CDB length	55
11.1.6 Data transfer length	55
11.1.7 Function code	55
11.1.8 Initiator ID	55
11.1.9 Message buffer length (target-only)	55
11.1.10 Message buffer pointer (target-only)	55
11.1.11 Next CCB pointer	56
11.1.12 Number of scatter/gather entries	56
11.1.13 Peripheral driver pointer	56
11.1.14 Private data	56
11.1.15 Request mapping information	56
11.1.16 Residual length	56
11.1.17 SCSI status	56
11.1.18 Sense info buffer length	56

Clause	Page
11.1.19 Sense info buffer pointer	56
11.1.20 SG list/data buffer pointer	56
11.1.21 Tag ID	56
11.1.22 Tagged queue action.....	57
11.1.23 Timeout value	57
11.1.24 VU field	57
11.2 Execute SCSI I/O	57
11.3 Command linking (optional)	59
11.4 Target mode overview	61
11.5 Phase-Cognizant Mode	62
11.5.1 Enable LUN for phase cognizant mode.....	62
11.5.2 I/O process creation for phase cognizant mode	65
11.5.3 Continuation and completion of an I/O process for phase cognizant mode	66
11.5.4 Non-transparent event handling for phase cognizant mode.....	67
11.5.5 EXECUTE TARGET I/O CCB.....	69
11.6 Host Target Mode.....	71
11.6.1 Host Target Mode functionality not specified	71
11.6.2 Host Target Mode messages	71
11.6.3 Use of the IMMEDIATE NOTIFY CCB.....	72
11.6.4 IMMEDIATE NOTIFY CCB.....	79
11.6.5 NOTIFY ACKNOWLEDGE CCB.....	81
11.6.6 Enable target mode LUN for Host Target Mode	81
11.6.7 ENABLE LUN CCB for Host Target Mode	84
11.6.8 ACCEPT TARGET I/O and CONTINUE TARGET I/O CCB operation	85
11.6.9 ACCEPT TARGET I/O CCB	91
11.6.10 CONTINUE TARGET I/O CCB.....	92
11.6.11 Disable of a Host Target Mode LUN	94
11.6.12 Exception conditions	94
11.6.13 CDB reception on a non enabled LUN	96
11.6.14 Retrieving unused ACCEPT TARGET I/O CCBs from the SIM	96
12 HBA engines	96
13 Engine inquiry	97
13.1 Execute engine (optional).....	98
Annex A (informative) Physical/logical translation in 80x86 environment.....	100
Annex B (informative) Target peripheral driver example.....	105
Annex C (informative) UNIVOS OSD data structures.....	107
Figure 1 – CAM environment model	13
Figure 2 – CAM layers	29

	Page
Table 1 – Asynchronous event callback opcode data requirements	23
Table 2 – CAM control block header	34
Table 3 – Support of SCSI messages.....	35
Table 4 – XPT function codes	36
Table 5 – CAM status	37
Table 6 – NOP CCB.....	40
Table 7 – Get device type CCB.....	40
Table 8 – PATH INQUIRY CCB – Part 1 of 2.....	41
Table 9 – Release SIM queue.....	44
Table 10 – SCAN SCSI BUS CCB.....	44
Table 11 – SCAN LOGICAL UNIT CCB.....	45
Table 12 – SET ASYNCHRONOUS CALLBACK CCB.....	46
Table 13 – SET DEVICE TYPE CCB.....	46
Table 14 – ABORT SCSI COMMAND CCB.....	48
Table 15 – RESET SCSI BUS CCB.....	48
Table 16 – RESET SCSI DEVICE CCB	49
Table 17 – TERMINATE I/O PROCESS CCB	50
Table 18 – CAM flags – Part 1 of 2	52
Table 19 – Scatter Gather List	53
Table 20 – EXECUTE SCSI I/O REQUEST CCB.....	58
Table 21 – ENABLE LUN CCB for phase cognizant mode.....	63
Table 22 – CCB List.....	63
Table 23 – EXECUTE TARGET I/O CCB.....	70
Table 24 – IMMEDIATE NOTIFY CCB.....	80
Table 25 – NOTIFY ACKNOWLEDGE CCB	81
Table 26 – ENABLE LUN CCB for Host Target Mode	84
Table 27 – ACCEPT TARGET I/O CCB.....	91
Table 28 – CONTINUE TARGET I/O CCB	93
Table 29 – ENGINE INQUIRY CCB.....	97
Table 30 – EXECUTE ENGINE REQUEST CCB.....	98

INFORMATION TECHNOLOGY – SMALL COMPUTER SYSTEM INTERFACE–2 (SCSI-2) –

Part 2: Common Access Method (CAM) Transport and SCSI interface module

FOREWORD

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

International Standard ISO/IEC 9316-2 was prepared by subcommittee 25: Interconnection of information technology equipment, of ISO/IEC joint technical committee 1: Information technology.

Annexes A, B and C are for information only.

INTRODUCTION

SCSI provides a diverse range of peripherals for attachment to a wide range of computing equipment. Some system manufacturers have developed approaches for SCSI attachment which are widely followed, increasing the applications available for the attachment of SCSI peripherals. In markets where no standard method of attachment exists, however, variations between third party sellers have made it nearly impossible for end users to attach more than one SCSI peripheral to one host bus adapter.

In an effort to broaden the application base for SCSI peripherals, an ad hoc industry group of companies representing system integrators, controllers, peripherals, and semiconductors decided to address the issues involved. That effort has evolved into this International Standard.

INFORMATION TECHNOLOGY – SMALL COMPUTER SYSTEM INTERFACE-2 (SCSI-2) –

Part 2: Common Access Method (CAM) Transport and SCSI interface module

1 Scope

This International Standard defines the Common Access Method (CAM) for the Small Computer Systems Interface (SCSI).

The purpose of this International Standard is to define a method whereby multiple environments may adopt a common procedure for the support of SCSI devices.

The CAM provides a structured method for supporting peripherals with the software (e.g. device driver) and hardware (e.g., host bus adapter) associated with any computer.

2 Conformance

An implementation claiming conformance to the transport layer (XPT) for a specified operating system and language environment shall:

- provide all the mandatory XPT functions and services specified in this International Standard;
- correctly interoperate with any conforming SCSI Interface Module (SIM) for the specified environment;
- provide the necessary interface specifications that a conforming SIM requires to interface with the XPT.

An implementation claiming conformance to the SIM for a specified operating system and language environment shall:

- provide all the mandatory SIM functions and services specified in this International Standard;
- correctly interoperate with any conforming XPT for the specified environment;
- provide the necessary interface specifications that a conforming XPT requires to interface with SIMs.

A conforming implementation shall execute all function codes as required by this International Standard, and in response to these codes shall only return specified status, and return codes. A conforming implementation may provide additional capabilities via Vendor Unique function codes.

If an operating system is not specified in this International Standard, then that operating system shall conform to 9.1 in this International Standard. (See also annex C.)

Claims of conformance to this International Standard shall state:

- whether conformance is claimed with the XPT or the SIM or both;
- which operating systems and environments are supported;
- whether the optional capabilities of target mode or Host Bus Adaptor (HBA) engines are supported.

3 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO/IEC 9316. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO/IEC 9316 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO/IEC 9316:1995, *Information Technology – Small Computer Interface-2*