INTERNATIONAL STANDARDIZED PROFILE

ISO/IEC ISP 11185-9

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Information technology — International Standardized Profiles FVT2nn — Virtual Terminal Basic Class — Register of control object type definitions —

Part 9:
FVT222 — Paged FEICO (Field Entry Instruction Control Object) No. 1

Technologies de l'information — Profils normalisés internationaux FVT2nn — Classe de base de terminal virtuel — Registre de définitions de type d'objet de commande —

Partie 9: FVT222 — Page FEICO (objet de commande d'instruction d'entrée de zone) nº 1

Reference number
ISO/IEC ISP 11185-9:1994(E)

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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 JTC1. In addition to developing International Standards, ISO/IEC JTC1 has created a Special Group on Functional Standardization for the elaboration of International Standardized Profiles.

An International Standardized Profile is an internationally agreed, harmonized document which identifies a standard or group of standards, together with options and parameters, necessary to accomplish a function or set of functions.

Draft International Standardized Profiles are circulated to national bodies for voting. Publication as an International Standardized Profile requires approval by at least 75% of the national bodies casting a vote.

International Standardized Profile ISO/IEC ISP 11185-9 was prepared with the collaboration of

- OSI Asia-Oceania Workshop (AOW);
- European Workshop for Open Systems (EWOS);
- Open Systems Environment Implementors Workshop (OIW).

This International Standardized Profile ISO/IEC ISP 11185 forms an International Register of information objects in accordance with the procedures for the operation of OSI Registration Authorities laid down in ISO/IEC 9834. It is issued in parts, with additional parts being issued as further entries are added to the register. Each part is prepared in accordance with an approval and maintenance process laid down by the Special Group on Functional Standardization of ISO/IEC JTC1, *Information technology*.

ISO/IEC ISP 11185 is issued under the general title *Information technology — International Standardized Profiles FVT2nn — Virtual Terminal Basic Class — Register of control object type definitions*. At present the following parts are published or are in the course of preparation:

- *Part 1: FVT211, FVT212 — Sequenced and Unsequenced Application Control Objects*
- *Part 2: FVT213, FVT214 — Sequenced and Unsequenced Terminal Control Objects*
- *Part 3: FVT215, FVT216 — Application RIO Record Loading Control Object, Terminal RIO Record Notification Control Object*
- *Part 4: FVT217 — Horizontal Tabulation Control Object*
- *Part 5: FVT218 — Logical Image Control Object*
- *Part 6: FVT219 — Status Message Control Object*
- *Part 7: FVT2110 — Entry-Control Control Object*
- *Part 8: FVT221 — Forms FEICO (Field Entry Instruction Control Object) No.1*
- *Part 9: FVT222 — Paged FEICO (Field Entry Instruction Control Object) No.1*
- *Part 10: FVT231 — Forms FEPCO (Field Entry Pilot Control Object) No.1*
- *Part 11: FVT232 — Paged FEPCO (Field Entry Pilot Control Object) No.1*
- *Part 12: FVT2116, FVT2117, FVT2118, FVT2119 — Generalized Telnet Synch, Signal, Negotiation and Subnegotiation Control Objects*
- *Part 13: FVT2111 — Waiting Time Control Object*
- *Part 14: FVT2112 — Printer Control Object*
- *Part 15: FVT2113 — Field Definition Management Control Object*
- *Part 16: FVT2114 — Terminal Signal Titles Control Object*
- *Part 17: FVT2115 — Help Text Control Object*

Annex A of this part of ISO/IEC ISP 11185 forms an integral part of this International Standardized Profile.

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Introduction

This International Standardized Profile ISO/IEC ISP 11185 is defined within the context of Functional Standardization, in accordance with the principles specified in ISO/IEC TR 10000, "Framework and Taxonomy of International Standardized Profiles". The context of Functional Standardization is one part of the overall field of Information Technology (IT) standardization activities, covering base standards, profiles and registration mechanisms.

The Open Systems Interconnection (OSI) Standard ISO 9040 for the Virtual Terminal Basic Class Service identifies a requirement for an International Register of VT Control Object type definitions. Procedures for the operation of this International Register are laid down in ISO/IEC 9834-5. This International Standardized Profile provides this register. The individual entries in this register constitute Interchange Format and Representation Profiles (F-Profiles) within the framework of ISO/IEC TR 10000.

This part of ISO/IEC ISP 11185 was developed in close cooperation between the three Regional OSI Workshops, namely the OSE Implementors Workshop (OIW) of the United States, the European Workshop for Open Systems (EWOS) and the OSI Asia-Oceania Workshop (AOW). It was developed under the editorship of EWOS. The text is harmonized between these three Workshops and it has been ratified by the plenary assemblies of each Workshop.

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Information technology — International Standardized Profiles FVT2nn — Virtual Terminal Basic Class — Register of control object type definitions —

Part 9:
FVT222 — Paged FEICO (Field Entry Instruction Control Object) No.1

1 Scope

1.1 General

The concept of Profiles for OSI, and the structure of the International Standardized Profiles that document them, are defined in ISO/IEC TR 10000-1. Such Profiles are divided into a number of different classes and sub-classes. Two of these classes contain sub-classes comprising functions of the Virtual Terminal Basic Class Service and Protocol specified in the base standards ISO 9040 and ISO 9041. These are the Application Profiles (A-Profiles) and the Interchange Format and Representation Profiles (F-Profiles).

The relationship between A-Profiles and F-Profiles is described in 7.3.2 of ISO/IEC TR 10000-1 and is as follows. Application Layer base standards require, implicitly or explicitly, the structure of information carried or referenced by them to be specified for each instance of communication. It is the purpose of F-Profiles to specify such information structures. Particular functional requirements may then be met by the combination of an A-Profile with one or more F-Profiles.

Establishment of a VT-association involves the selection by negotiation of a particular Virtual Terminal Environment profile (VTE-profile), and of particular values for any arguments of that VTE-profile. The VTE-profile specification, and possibly also the values of certain VTE-profile arguments, may in turn reference the definitions of VT control object types and assignment types. These VTE-profiles, control object types and assignment types are thus information structures that require explicit reference within the VT protocol. Particular instances of these structures are fully defined within the base standards, but the base standards also provide for further instances to be defined by registration. Each registered instance constitutes an F-Profile within the framework of ISO/IEC TR 10000.

The Virtual Terminal Basic Class Service and Protocol may be used to realise a wide range of distinct functions. Particular functions may be realised through the selection of appropriate VT functional units, F-Profiles and other VTE-profile argument values. The specification of the selection required to realise a particular function and to promote interoperability constitutes a Virtual Terminal A-Profile within the framework of ISO/IEC TR 10000.

The three International Registers of VT information structures and the specifications of VT Application Profiles are each published as a separate multi-part ISP as follows:

— ISO/IEC ISP 11184 is the Register of VTE-profiles;

— ISO/IEC ISP 11185 is the Register of control object type definitions;

— ISO/IEC ISP 11186 is the Register of assignment-type definitions;

— ISO/IEC ISP 11187 contains the specifications of VT Application Profiles.

This part of ISO/IEC ISP 11185 contains the type definition of a Field Entry Instruction Control Object that provides substantial capabilities for local validation of data entry under application control. It is intended for use in form-filling and similar applications. The delegation of such verification to the terminal end system may reduce significantly the demands placed on the communication network and the application process, and may substantially improve the reaction time to users' actions.

1.2 Position within the taxonomy

The taxonomy of International Standardized Profiles for OSI is laid down in ISO/IEC TR 10000-2. Within the classification scheme of this taxonomy, the OSI Profiles specified in this International Standardized Profile are in the Virtual Terminal Registered Object sub-class of the class of Interchange Format and Representation Profiles.

A Profile within this subclass has a Profile identifier of the form FVT*abc*, where *abc* is a structured numerical identifier that identifies the position of the Profile within each of the three levels of subdivision of the subclass. The values of *a* and *b* are single digits but *c* is an integer that is not necessarily a single digit.

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In principle the ISO Virtual Terminal model allows for multiple classes of operation, although at the time of publication of this International Standardized Profile only the Basic Class has been defined. The value of the identifier component *a* distinguishes between distinct types of information object as follows:

— *a* = 1 for Basic Class VTE-profiles;

— *a* = 2 for Basic Class Control Objects;

— *a* = 3 for Basic Class Assignment Types.

Values of *a* greater than 3 are reserved for future developments.

This International Standardized Profile ISO/IEC ISP 11185 contains the specifications of the Profiles with identifiers of the form FVT2*bc*. For this form of identifier, the component *b* distinguishes between the five major classifications of Basic Class Control Objects as follows:

— *b* = 1 for Miscellaneous Control Objects;

— *b* = 2 for Field Entry Instruction Control Objects;

— *b* = 3 for Field Entry Pilot Control Objects;

— *b* = 4 for Reference Information Objects;

— *b* = 5 for Termination Conditions Control Objects.

Each of these classifications corresponds to a sub-register under the procedures of ISO/IEC 9834-5. The identifier component *c* is the serial number of the control object type in the appropriate sub-register. Values of *b* greater than 5 are reserved for new classifications of Basic Class Control Objects that may be defined in future amendments to ISO 9040.

This part of ISO/IEC ISP 11185 contains the definition of the Field Entry Instruction Control Object type with the Profile identifier

FVT222 — Paged FEICO (Field Entry Instruction Control Object) No.1

1.3 Scenario

The specification of the Virtual Terminal Service is given in ISO 9040. It is based on a model in which two VT-users communicate by means of a shared Conceptual Communication Area (CCA) that is a conceptual part of the VT service-provider. Information exchange is modelled by one VT-user updating the content of the CCA and the changed state of the CCA then being made accessible to the peer VT-user.

Control objects (COs) form one of the types of information object that may be present in the CCA. This is illustrated in figure 1, in which CO-1, CO-2, ... CO-*n* represent a number of different control objects present in the CCA. The negotiation during establishment of a VT-association will determine whether or not these will include a control object of the type whose definition is given in this part of ISO/IEC ISP 11185.

The CCA is structured by the Virtual Terminal Service into a number of components. For a control object the Data

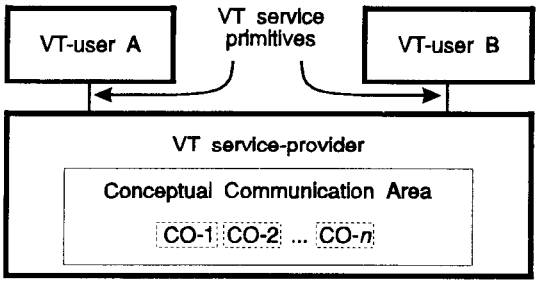

Figure 1 — Control objects in the VT Service model

Structure Definition (DSD) component of the CCA contains the syntax of its information content, including the range of possible values and the permitted update operations. The current value of its information content is contained in the Control, Signal and Status store (CSS) component. Updates to the current value take place through the issue of VT service primitives by one VT-user to the service-provider. Changes of state of the CCA are made accessible through the issue of VT service primitives by the service-provider to the peer VT-user.

By clause 14 of ISO 9040, COs enable VT-users to handle control information related to virtual terminal functions and to real devices. This control is exercised by the VT-users through semantics associated with the information content and with the update operations of the CO. Definition of the semantics, or specification of the source of the semantics if the semantic details are not fully prescribed, forms part of the registered definition of the CO. These semantics are not however of concern to the VT service-provider itself. The DSD will contain an ASN.1 object identifier that identifies the registered definition, but the VT service-provider merely acts as a repository of this value. It is only the VT-user that requires knowledge of the registered definition.

NOTE 1 — The VTE-parameter values that determine the syntax of the information content may not be negotiated explicitly during association establishment. Moreover, in the case of non-parametric COs these values do not determine the details of the syntax. Such values and details form part of the registered definition of the CO. Since the VT service-provider is not required to have knowledge of this registered definition, in principle the VT-users provide the VT service-provider with such information through local management procedures. Whether or not this is necessary in practice depends on the configuration of the implementations concerned.

The control object type defined in this part of ISO/IEC ISP 11185 assumes an asymmetry between the two communicating end systems. One end system is assumed to have a terminal role and to contain devices for the input and display of data and for signalling. These devices form part of the VT-user component of that end system. The other end system is assumed to have an application role and to contain an application package that the terminal end system desires to access. This asymmetry may, but need not, be recognised by the VT Service; provision for such recognition is made in 19.3.2 of ISO 9040 only for an S-mode VT-association.

A control object of the type defined in this part of ISO/IEC ISP 11185 is a Field Entry Instruction Control Object (FEICO) as defined in 20.3.4 of ISO 9040. The content of a FEICO is an array of records known as Field Entry Instruction Records

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(FEIRs) that may be referenced by a Field Definition Record (FDR). Such reference imposes either or both of constraints on the update operations permitted for the content of the field, and instructions concerning the manner in which this content is to be represented by a real display device. Such constraints apply only to updates by the terminal end system. The contents of the FEICO and FDR may be updated only by the application end system.

The definition of a FEICO type specifies the individual Field Entry Instructions (FEIs) that may be used in an FEIR. An FEIR consists of a set of such FEIs. The FEICO type definition also specifies the semantic interpretation of references to such FEIRs by an FDR. Semantic significance for a particular FDR applies to the set of referenced FEIRs as a whole. There need not be a one-to-one correspondence between elements of the semantics and individual FEIs or FEIRs. The FEICO type definition may, for example, both assign semantics to individual FEIs and specify the manner in which conflicts between FEIs are to be resolved.

When a FEICO is present in the CCA, it is required by 14.2 of ISO 9040 that a Field Entry Pilot Control Object (FEPCO) shall also be present. An attempt to update the content of a field in violation of the FEIRs of its FDR constitutes an event that may be recognised as a Field Entry Event by such a FEPCO. The reaction to the attempted violation will be determined by the content of the FDR in conjunction with the type definition of the FEPCO concerned. For S-mode operation a FEPCO type suitable for used with a FEICO of the present type is defined in ISO/IEC ISP 11185-11.

The VT service-provider may store updates received from one VT-user before delivery to the peer VT-user in accordance with the delivery control mechanisms of clause 24 of ISO 9040. So although the model of the VT Service is expressed in terms of a single shared CCA, at any instant the various elements of the two communicating end systems may have differing knowledge of its current content.

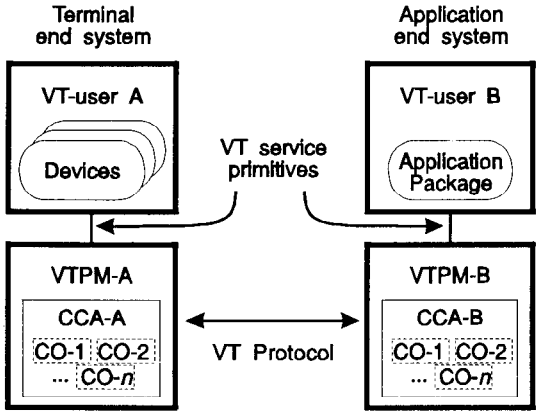

Figure 2 — Control objects in the VT Protocol model

This variation in knowledge extends within the VT service-provider itself. The Virtual Terminal Protocol specification given in ISO 9041-1 models the VT service-provider in terms of protocol exchange between two Virtual Terminal Protocol Machines (VTPMs), each with its own CCA. The CCA of each VTPM is updated both by service primitives received from its own VT-user and by protocol elements received from the peer VTPM. Corresponding service primitives and protocol elements are issued by the VTPM to provide notification of changes to the content of its CCA. This is illustrated in figure 2 in the context of the asymmetric end systems described above. The control object type definition given in this part of ISO/IEC ISP 11185 is expressed in terms of this model.

Each VTPM is permitted to store updates to its CCA before onward delivery, in accordance with the data transfer mechanisms of annex A of ISO 9041-1. These mechanisms permit storage both for updates that result from the reception of service primitives and for those that result from the reception of protocol elements. The combined effect of these mechanisms in both VTPMs is to implement the delivery control mechanisms of ISO 9040. But the effect of such storage is that the content of the two CCAs may differ from one another and that neither need correspond to the CCA of the VT Service model. The CCA of each VTPM should properly be regarded as an incompletely updated copy of the true CCA of the VT service-provider.

For certain types of control object the abstract syntax of ISO 9041-1 does not provide a complete specification for the representation of CO update operations. This arises where the abstract syntax of ISO 9041-1 makes use of an ASN.1 any type, or where symbolic values have to be encoded in terms of an ASN.1 integer type. Control object type definitions are required by ISO/IEC 9834-5 to provide the necessary refinement of the abstract syntax.

NOTE 2 — Since an abstract syntax is made available for use through its inclusion in a presentation context, and since the Presentation service-provider has no knowledge of control object type definitions, in principle the VT-users provide the Presentation service-provider with these refinements to the abstract syntax through local management procedures. Whether or not this is necessary in practice depends on the configuration of the implementations concerned.

2 Normative references

The following documents contain provisions which, through reference in this text, constitute provisions of this part of ISO/IEC ISP 11185. At the time of publication, the editions indicated were valid. All documents are subject to revision, and parties to agreements based on this International Standardized Profile are warned against automatically applying any more recent editions of the documents listed below, since the nature of references made by ISPs to such documents is that they may be specific to a particular edition. Members of IEC and ISO maintain registers of currently valid International Standards and ISPs, and CCITT maintains published editions of its current Recommendations.

ISO 2375:1985[1)], *Data processing — Procedure for registration of escape sequences.*

ISO 7498:1984, *Information processing systems — Open Systems Interconnection — Basic Reference Model.*

1) The Registration Authority for ISO 2375 is the European Computer Manufacturers Association (ECMA), 114 rue du Rhône, CH-1204 Genève, Switzerland, from whom the corresponding register, the ISO *International Register of Coded Character Sets to be used with Escape Sequences*, may be obtained.

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ISO/TR 8509:1987, *Information processing systems — Open Systems Interconnection — Service conventions.*

ISO 8822:1988, *Information processing systems — Open Systems Interconnection — Connection oriented presentation service definition.*

ISO/IEC 8824:1990, *Information technology — Open Systems Interconnection — Specification of Abstract Syntax Notation One (ASN.1).*

ISO 9040:1990, *Information technology — Open Systems Interconnection — Virtual Terminal Basic Class Service.*

ISO 9041-1:1990, *Information technology — Open Systems Interconnection — Virtual Terminal Basic Class Protocol — Part 1: Specification.*

ISO/IEC 9041-2:1993, *Information technology — Open Systems Interconnection — Virtual Terminal Basic Class Protocol — Part 2: Protocol Implementation Conformance Statement (PICS) Proforma.*

ISO/IEC 9834-1:1993, *Information technology — Open Systems Interconnection — Procedures for the Operation of OSI Registration Authorities — Part 1: General Procedures.*

ISO/IEC 9834-5:1991, *Information technology — Open Systems Interconnection — Procedures for the Operation of OSI Registration Authorities — Part 5: Register of VT Control Object Definitions.*

ISO/IEC TR 10000-1:1992, *Information technology — Framework and taxonomy of International Standardized Profiles — Part 1: Framework* (second edition).

ISO/IEC TR 10000-2:1992, *Information technology — Framework and taxonomy of International Standardized Profiles — Part 2: Taxonomy of Profiles* (second edition).

3 Definitions

For the purposes of this part of ISO/IEC ISP 11185 the following definitions apply.

3.1 General OSI terminology

3.1.1 This part of ISO/IEC ISP 11185 makes use of the following terms defined in ISO/TR 8509:

a) service primitive;

b) service-provider.

3.1.2 This part of ISO/IEC ISP 11185 makes use of the following terms defined in ISO 8822:

a) abstract syntax;

b) presentation context.

3.1.3 This part of ISO/IEC ISP 11185 makes use of the following terms defined in ISO/IEC 8824:

a) any type;

b) null type;

c) object descriptor type;

d) object identifier.

3.1.4 This part of ISO/IEC ISP 11185 makes use of the following terms defined in ISO/IEC 9834-1:

a) registration;

b) registration-hierarchical-name.

3.2 Terminology of VT base standards

3.2.1 This part of ISO/IEC ISP 11185 makes use of the following terms defined in ISO 9040:

a) A-mode;

b) array element;

c) character-repertoire;

d) control object;

e) device object;

f) display object;

g) field;

h) Field Definition Record;

i) Field Entry Instruction;

j) Field Entry Instruction Record;

k) logical pointer;

l) object updating device;

m) primary attribute;

n) rendition attribute;

o) S-mode;

p) secondary attribute;

q) VT-association;

r) VT-environment (VTE);

s) VT-user;

t) VTE-parameter;

u) VTE-profile;

v) VTE-profile argument.

3.2.2 This part of ISO/IEC ISP 11185 makes use of the following term defined in ISO 9041-1:

a) protocol element.

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3.3 Terminology of VT-user structure

3.3.1 device control store: A conceptual store containing abstract objects which represent aspects of the internal state of the VT-user that are not associated with a specific object updating device.

3.3.2 device status store: A conceptual store containing abstract objects which represent aspects of the state of a specific object updating device.

3.3.3 DO mask: An abstract object within a device status store that contains a conceptual overlay for the display object of the internal CCA. The overlay modifies the attribute values to be represented by the device, to indicate the location of an entry cursor or for other reasons of local significance.

3.3.4 DO mask element: An element of a DO mask that forms the overlay to a single attribute of a single DO array element.

3.3.5 external CCA: A conceptual copy of the CCA maintained by a VT-user which takes account of all update operations that either have been received from, or have been issued to, the VT service-provider.

3.3.6 internal CCA: A conceptual copy of the CCA maintained by a VT-user which takes account of all update operations that either have been received from the VT service-provider or have been accepted from object updating devices. Its content may differ from that of the external CCA when controlled data entry is in use. In these circumstances it takes account of accepted update operations that have not yet been issued to the VT service-provider.

3.3.7 local action operation: An operation that updates the content of a device status store or device control store.

3.3.8 logical entry location: An abstract object within a device status store, containing a logical address as defined in 13.1.3 of ISO 9040.

3.4 Terminology of controlled data entry

3.4.1 event processing: A function that generates reactions dependent on the Field Definition Record of a field when specified events occur during the entry of data into the field.

3.4.2 FEI-attribute: An abstract object that is associated with a field and whose value is assigned by the content of the Field Definition Record for that field. The contents of all the FEI-attributes for a field together determine the entry rules for controlled data entry into that field.

3.4.3 free field: A field with a content that is subject to update by object updating devices. The Field Definition Record determines whether or not a field is a free field.

3.4.4 input validation: A function applied to test the validity of display object update requests that are generated by an object updating device and that use the logical pointer. The function is applied before the requested updates are applied to the internal CCA. A validation failure may result in a Field Entry Event and may cause the update request to be discarded.

3.4.5 output validation: A function that may be applied to test the validity of the content of a field as maintained by the internal CCA before updates to the content of that field are issued to the VT service-provider. A validation failure may result in a Field Entry Event but it cannot cause any updates to be discarded.

3.4.6 protected field: A field with a content that is not subject to update by object updating devices. The Field Definition Record determines whether or not a field is a protected field.

3.5 Definitions of value types and properties

3.5.1 character: An item that is either a qualified character or an unqualified character.

3.5.2 character-string: An item that is either a qualified character-string or an unqualified character-string.

3.5.3 character-string range: An item that is either a qualified character-string range or an unqualified character-string range.

3.5.4 less than (of unqualified character-strings): Two unqualified character-strings s and s' of the same length and with the same character-repertoire value are compared by comparing sequentially the primary attribute values of corresponding elements, starting from the beginning of each sequence. The string s is defined to be less than s' ($s < s'$) if the same inequality is satisfied by the numeric values of the first pair of primary attribute values that are numerically unequal. If no such pair exists then the character-strings are defined to be equal ($s = s'$). The notation $s \leq s'$ is used to denote that either $s < s'$ or $s = s'$.

3.5.5 lower bound (of an unqualified character-string range): This term is defined in 3.5.13.

3.5.6 qualified character: An unqualified character together with a rendition qualifier.

3.5.7 qualified character-string: An unqualified character-string together with a rendition qualifier; such a string also has a natural interpretation as a sequence of qualified characters.

3.5.8 qualified character-string range: An unqualified character-string range together with a rendition qualifier; such a range also has a natural interpretation as a set of qualified character-strings.

3.5.9 partial rendition: A set of explicit values for one or more of the rendition attributes.

3.5.10 rendition qualifier: A specification of a value for each rendition attribute. Each value may, but need not, be specified explicitly. Values that are not specified explicitly take dynamic default values that are determined at the time of access. The first choice default is the field modal attribute value defined in 13.1.3.2 of ISO 9040. A first choice default value of "null" is resolved as specified in 19.2.2.1 of ISO 9040 for the LOGICAL-TEXT update operation.

3.5.11 unqualified character: A primary attribute value together with a value for the character-repertoire secondary attribute.

3.5.12 unqualified character-string: A sequence of unqualified characters that all have the same value for the character-repertoire secondary attribute.

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3.5.13 unqualified character-string range: A set of unqualified character-strings, all of the same length and with the same character-repertoire value, that has two distinguished members s (known as the lower bound) and s' (known as the upper bound) such that s'' is a member of the set if, and only if, $s \leq s'' \leq s'$.

3.5.14 upper bound (of an unqualified character-string range): This term is defined in 3.5.13.

4 Abbreviations

For the purposes of this part of ISO/IEC ISP 11185 the following abbreviations apply.

AOW OSI Asia-Oceania Workshop;
EWOS European Workshop for Open Systems;
OIW OSE Implementors Workshop;
OSE Open Systems Environment.

All other abbreviations used are defined in ISO/IEC TR 10000-1 or ISO 9040.

5 Principles of conformance to VT Profiles

An implementation of the Virtual Terminal Protocol conforms to an FVT2*nn* Profile that defines a control object type if the protocol implementation is capable of sending and receiving PDUs corresponding to all update operations permitted for that CO type.

Conformance of a protocol implementation to an FVT2*nn* Profile does not place requirements on the ability of the implementation to negotiate the presence in the CCA of an instance of this CO type. Such requirements fall within the scope of conformance to an FVT1*nn* Profile that specifies a VTE-profile.

A system that includes an implementation of the VT Protocol may be claimed to conform also to an AVT*nn* Profile. Conformance to an AVT*nn* Profile may require that CO update operations received by the VT-user component of the system are interpreted in accordance with the semantics defined within the appropriate CO type definition. Conformance to CO semantics is not within the scope of conformance to any FVT*nnn* Profile.

The conformance requirements of the Virtual Terminal Protocol are specified in clause 13 of ISO 9041-1. The supplier of a protocol implementation which is claimed to conform to ISO 9041-1 is required to complete a copy of the PICS proforma provided in ISO/IEC 9041-2. Annex A of this part of ISO/IEC ISP 11185 provides an ISPICS Requirements List (IPRL) for the Profile FVT222 specified herein. This IPRL specifies constraints on the answers that may be given in the completed PICS for a protocol implementation that claims conformance to this Profile.

6 Entry number

The remaining clauses of this part of ISO/IEC ISP 11185 provide the entry for the Paged FEICO No.1 in the International Register of VT Control Object Type Definitions. The entry is structured in accordance with the requirements of ISO/IEC 9834-5. These requirements specify that this International Register shall consist of a number of sub-registers, each corresponding to a major classification of VT Control Object.

This entry is the second in the sub-register for Field Entry Instruction Control Objects. This register assigns it the entry number:

FEICO-2.

7 Name of sponsoring authority

This entry is sponsored by the European Workshop for Open Systems (EWOS).

8 Date

The date of submission of this proposal was 1992-09-02.

9 Identifier

The name assigned to an information object by an International Register is required by ISO/IEC 9834-1 to be a registration-hierarchical-name. A registration-hierarchical-name may have more than one form. The permitted forms include an ASN.1 object identifier as defined in ISO/IEC 8824 and a relative distinguished name as defined in ISO/IEC 9594-2.

In accordance with A.4 of ISO/IEC 9834-5, this register assigns the following object identifier form for the name of this register entry:

{ iso(1) standard(0) 9834 vt-co-def(5) feico(1) 2 }

In accordance with 20.1.1 of ISO 9040, this object identifier shall be used as the value of the CO-type-identifier VTE-parameter for a control object in order to identify this register entry as the source of the information structure and semantic content of the control object. This object identifier shall also be used to identify the ASN.1 module specified within this register entry as the source of abstract syntax by which update operations on this CO are specified within the VT protocol of ISO 9041-1.

This register does not assign any other form to the name of this entry.

NOTE — By ISO/IEC 9834-1 a relative distinguished name for the purposes of the OSI Directory may only be assigned together with an object identifier when the object identifier form is generated under the arc { joint-iso-ccitt(2) country(16) country-name }.

10 Descriptor value

The value of the ASN.1 object descriptor type assigned to this register entry is:

"First harmonized FEICO for use by Paged VTE-profiles".

11 CO parameters

This CO type presumes an asymmetry of use between the two end systems in which one has a terminal role and the other an application role. Such an asymmetry is assigned in accordance with note 1 to clause 12 of ISO 9040. It is not

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necessary for this asymmetry to be recognised by the VT service-provider in accordance with 19.3.2 of ISO 9040, which provides for the assignment, in S-mode only, of Terminal VT-user and Application VT-user roles.

This register entry specifies the following values for VTE-parameters of this control object type:

CO-structure:	"non-parametric"
CO-access:	takes the same value as the CO-access VTE-parameter for the FDCO associated with the same display object
CO-priority:	"normal"
CO-trigger:	"not selected"

The CO-access VTE-parameter for the FDCO, and thus also for this FEICO, should be assigned the value that permits access only by the VT-user with the application role. This value will depend on whether the VT-association was initiated by the terminal or application end system.

NOTE — A single VTE-profile argument may be used to assign values to the CO-access VTE-parameter for all control objects in the CCA that presume an asymmetric assignment of terminal and application roles to the two communicating end systems.

12 CO values, syntax and semantics

12.1 The VT-user model

12.1.1 The semantic definition of this FEICO is based on the structured model of the VT-user of the terminal end system that is illustrated in figure 3. This model is intended solely to assist the process of definition. It is not intended to provide a model for implementations. The requirement upon VT-user implementations is only that their external behaviour corresponds to the external behaviour of the model.

Real devices may possess internal state information. For an object updating device this information determines, among other things, the location of the DO array element that will be updated by the next data input and the manner in which this location will be made known to the human user of the device. In the model, the state information is represented by the content of abstract objects held in a device status store. There will be one device status store for each real device.

NOTE — For an object updating device that consists of a keyboard and display screen, the above aspects of the state information correspond to the location and screen representation of an input cursor. On some object updating devices the above information is maintained by the hardware and is not available outside of it. Movement of the input cursor cannot in such cases generate any DO addressing operations until the content of the whole screen is forwarded to the VT-user. The final cursor location could be internal state information that is separate from the display pointer of the CCA.

The VT-user processes data received both from its object updating devices and from the VT service-provider. It may possess internal state information of its own that affects this processing. Any such information is represented in the VT-user model by abstract objects held in a device control store.

The semantic definition of a control object may include the specification of one or more abstract objects that are to be maintained in a device status store or the device control store. In this way the implementation of a control object may

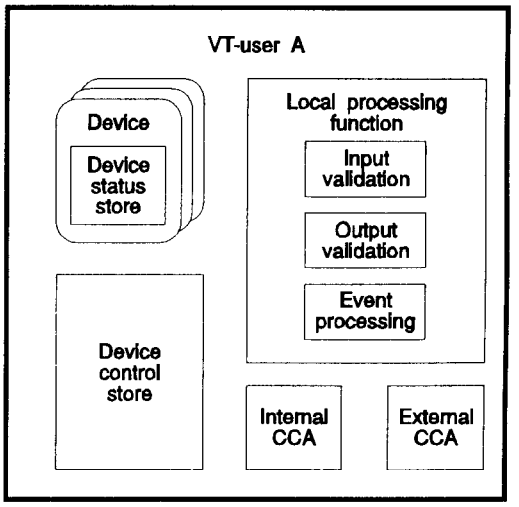

Figure 3 — Structure of the terminal VT-user

place requirements on, and may exert control over, the capabilities of the real devices of the VT-user. The specification of such objects shall include any required rules that concern update access to the object. Abstract objects specified in this way by one control object may be updated and referenced by other control objects if their definitions so permit.

12.1.2 The VT-user receives data from its object updating devices and assembles it into object updates that form permitted content for VT-DATA request primitives, and into local action operations that update objects held in the device status stores and the device control store. Only the object updates may be issued to the VT service-provider. Communication with the VT service-provider uses a model of update queues and priority handling that is specified in 24.5 of ISO 9040. Local action operations have an effect that is purely internal to the VT-user.

A sequence of DO updates and local action operations may be generated by a single action of an object updating device. The VT-user may treat such a sequence as an indivisible macro operation, provided that a single macro operation shall not contain both operations that use the display pointer and those that use the logical pointer. Such macros assume significance when controlled data entry is in use as defined by 14.2 of ISO 9040, since it is the effect of a macro as a whole and not that of any individual constituent item that is considered by input validation procedures.

NOTE — In the example of the note in 12.1.1, entry of a single character at the keyboard during controlled data entry may generate a single indivisible macro consisting of the following items:

— a logical addressing operation, if required, to set the logical pointer to the current position of the input cursor;

— a LOGICAL-TEXT operation to make an appropriate entry into the array element at this address;

— a local action operation to move the cursor position to the final position of the logical pointer.

Subsequent character entries immediately after the first will then not need to perform the first step. If any entered character is rejected by

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the validation procedures of controlled data entry then use of a macro ensures that the associated cursor movement also does not take place.

During the processing of data from its object updating devices, the VT-user may identify events that have a significance in the semantics of objects present in the CCA. Examples are Field Entry Events and termination-events as defined in 3.3.65 and 3.3.72 of ISO 9040 respectively. These events cause actions determined by the semantics of these objects. These actions may result in the generation of object updates or of a 'deliver' stimulus for issue to the VT service-provider, but the event notification itself is not issued to the service-provider.

12.1.3 When controlled data entry is in use, the VT-user operates a local processing function that performs validation tests on DO update requests before they are issued to the VT service-provider. Only those DO update requests that use the logical pointer are subject to validation. In accordance with B.18.4 of ISO 9040, update requests that are accepted as valid are stored by the local processing function until some specific action causes their release. When release occurs, the stored updates are not forwarded as a simple queue. Instead, the effect on the DO of the stored updates is made available to the VT service-provider in accordance with the transmission policy for the fields concerned; see 20.3.3.3 of ISO 9040.

This process is performed in the present model of the VT-user by two local copies of the CCA, an external copy and an internal copy. Each is similar to that maintained by a VT protocol machine as described in 1.3. Both copies takes account of all update operations that either have been received from, or have been issued to, the VT service-provider. The internal copy is updated in addition by DO update requests as they are accepted by the local processing function. It is the DO of the internal CCA that forms the basis for any image displayed to the human user of the terminal end system through the real devices of the terminal VT-user.

NOTE — In general a screen image will not correspond precisely to the content of the DO of the internal CCA. It may deviate from this content through the presence of an entry cursor or of variations in rendition or content for other purposes associated with data entry. It may also take account of update requests that have not yet been submitted for input validation. Within the VT-user model such deviations are determined by the content of objects held in the device status stores, as described below.

When an event occurs that requires stored updates to be made available to the VT service-provider, the differences between the internal and external copies of the CCA are used to generate the updates for issue to the VT service-provider in accordance with the transmission policies of the individual fields of the DO. When they are issued, these updates are also applied to the external CCA. The content of the internal and external CCAs will then coincide, other than for fields whose transmission policy expressly requires field content not to be transmitted.

12.1.4 The device status store of a real device may contain one or more DO masks that modify the representation of the DO by that device. These DO masks form conceptual overlays that are placed on top of the DO content of the internal CCA. A DO mask is composed of independent elements, one for each attribute of each DO array element. Either a DO mask element is empty or it contains a specification for that attribute. The specification may be either an explicit value or a symbolic value from the set ("implicit", "unassigned", "device-dependent"). Any non-empty mask element obscures all underlying mask elements and the corresponding attributes of the DO of the internal CCA itself.

The origin and interpretation of the symbolic values is as follows:

— the value "implicit" represents the use by a rendition qualifier of a dynamic default value for an attribute and is interpreted as specified in 3.5.10;

— the value "unassigned" represents an attribute of an empty array element of the DO that has no value assigned;

— the value "device-dependent" for any mask element permits the device to represent the content of the underlying array element concerned in a device-dependent manner that need not correspond to any valid content for an array element, irrespective of the value of the other attributes of that array element.

The value "unassigned" permits a mask to contain the content of an empty array element that is to be treated as obscuring an underlying non-empty array element. Such a facility is required to enable, for example, a password to be entered into an empty field of the DO without any change to the displayed image; see 12.3.2.3 below.

The provisions of the device object VTE-parameters for attributes should be applied to the content of the DO of the internal CCA as perceived through all overlaid DO masks.

NOTE — DO masks should normally be used only for object updating devices. A real device that is a printer, disk store or other means of generating a permanent record should normally record the DO of the internal CCA without transient modifications.

12.1.5 The local processing function is the only constituent of the VT-user that may apply object update requests only to the internal CCA. Processing of any object update request by the VT-user outside of the local processing function shall result in the update request being entered directly into one of the three input queues to the VT service-provider. This causes the update to be applied to both the internal and the external CCA.

In order to preserve correct sequencing, the imminent entry of any update request into the queue with "normal" update priority shall be an event that requires stored DO update requests to be released to the VT service-provider in accordance with 12.1.3. The update operations so generated shall be added to the "normal" priority queue ahead of the update request that triggered the release. The capabilities of the local processing function are not available during such a release, so that in particular the output validation function (see 12.2.1) is not applied.

NOTE — Output validation is intended to be applied only on termination of data entry. When controlled data entry is in use it is the local processing function that determines when data entry terminates. Release of stored data due to actions outside of the local processing function is not considered as termination of data entry.

12.1.6 The issue of update requests by a VT-user to the VT service-provider does not in itself require the VT Protocol Machine of the end system concerned to forward these requests to the peer VTPM; see 1.3. An event within the VT-user of the terminal end system that requires stored updates to be made available to the VT service-provider therefore

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does not necessarily cause them to be made available also to the peer VT-user. This is so for updates both to the DO and to COs with normal update priority. The terminal end system may use this feature of the VT Service to store such updates until implicit or explicit delivery of updates to the peer VT-user is required in accordance with clause 24 of ISO 9040.

NOTE — Unless quarantine delivery-control is in effect, the terminal end system cannot "net-effect" a sequence of update requests once they have been issued to the VT service-provider by the VT-user of the terminal end system. In particular the transmission policy provisions for fields of the DO are applied within the VT-user and further net-effecting cannot take place once the updates generated by this process have been issued to the VT service-provider.

12.2 Local processing function

12.2.1 Unlike the other constituents of the VT-user of the terminal end system, the local processing function has its operation completely determined by the semantic definitions of the control objects in the CCA. The model used here for its operation is a refinement of that described in B.18.4 of ISO 9040.

The local processing function has three constituents:

— an input validation function;

— an output validation function;

— an event processing function.

The first two of these are specified by the FEICOs present in the CCA and the third is specified by the FEPCOs.

When controlled data entry is in use, the following items shall be passed to the local processing function:

— DO update requests that use the logical pointer, or any macro operation that includes such a request;

— notifications of events of semantic significance to any FEPCO present in the CCA.

DO update requests, including macro operations, are submitted to the input validation function. Event notifications are submitted to the event processing function. Nothing is submitted directly to the output validation function. Instead, it is available to the event processing function on request to test the content of a field in the DO of the internal CCA. It thus provides a test on the accumulated effect of all stored DO update requests, rather than on each individual update request as it is generated.

The event processing function may act upon a validation failure returned by the input validation function. The event processing function may call the output validation function and may initiate different actions according to the result that it returns. The local processing of any item shall proceed to completion before the VT-user initiates the processing of any further items.

12.2.2 A DO update request (or macro operation) submitted to the input validation function is processed sequentially in the context of each field that it addresses. The fields are taken in increasing order of their field addresses as defined in 13.1.3 of ISO 9040. For each field the function determines whether the entry-control provisions of the field, as specified in its FDR, are satisfied or violated by the update request.

The results are used by the local processing function as follows:

— if the update request satisfies the entry-control provisions of every field that it addresses then it is applied to the internal CCA and local processing of that update request is complete;

— if the update request violates the entry-control provisions for one or more fields then a validation failure event is generated in respect of each violated field. These are queued to the event processing function in increasing order of field address, and local processing of the update request is not complete until each of these events has been processed. The fate of the update request is determined by the processing of these events. The actions of the event processing function may include acceptance of the update request, with its consequent application to the internal CCA. If the processing of all the validation failure events terminates without the update request being accepted then the update request is discarded.

NOTE — The representation of DO content by an object updating device will normally take account of every action made by the human user of the device, even though this may include update requests that await validation or for which input is not yet complete. Such updates are represented in the VT-user model by a DO mask containing the changes to the DO that correspond to these updates. This mask will normally lie above every other mask that may be present, except that representing the entry cursor; see 12.3.1.3.2. This procedure is necessary to ensure that the output validation function takes account only of accepted updates.

When a macro operation is accepted, the individual operations that comprise the macro operation are unpacked and performed in sequence. The restrictions on macro operations specified in 12.1.2 are such that each operation corresponds to an update to the DO of the internal CCA, to the device control store or to a device status store. One or more of these operations may itself generate an event that is notified to the event processing function. Such event processing shall occur before processing of the next operation of the macro is initiated.

12.3 FEI-attributes

The FEIRs of this FEICO that are referenced by the Field Definition Record (FDR) of a field together determine a set of FEI-attribute values for that field. The semantic definition of this FEICO is expressed in terms of these FEI-attribute values. This definition specifies the input and output validation functions of 12.2.1 as far as this FEICO is concerned. It also specifies, as described in 12.1.1, a number of abstract objects that are to be maintained in the device control store and the device status stores of devices that are under the control of this FEICO. Other FEICOs present in the CCA may add to any or all of these specifications.

NOTE — The use of FEI-attributes is for convenience only. They are purely conceptual and hold no information that is not already present in the Field Definition Record as defined in 20.3.3.2 of ISO 9040.

The FEI-attributes that may be defined for a field are:

— field-class;

— field-echo-status;

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— field-count;

— field-allowed-entries;

Every field is assigned a field-class value. This value determines which other FEI-attributes, if any, are also assigned a value for that field.

Some of these FEI-attributes have parametric values, and some of the parameters are polymorphic. In the following subclauses the parameter names are given in brackets after the FEI-attribute value. The permitted value types for each parameter are listed separately. All value types that concern attributes of array elements are specified using the terminology defined in 3.5 above.

12.3.1 Field-class

The following values are defined for the field-class FEI-attribute:

— free (inhibit);

— protected.

This value determines whether the field is a free field or a protected field as defined in 3.4. The value type of the parameter is:

— inhibit: a symbolic value from the set ("on", "off").

All other FEI-attributes are defined for a free field. No other FEI-attributes are defined for a protected field.

12.3.1.1 Input validation

12.3.1.1.1 For a free field, if the 'inhibit' parameter has the value "on" then a LOGICAL-ATTRIBUTE operation for a rendition attribute violates this FEI-attribute if it addresses

— any array element of the field, or

— the field modal attribute value of the field.

If the 'inhibit' parameter has the value "off", update operations never violate this FEI-attribute.

12.3.1.1.2 For a protected field, all DO update operations other than addressing operations constitute violation of this FEI-attribute if their extent includes any array element of the field.

12.3.1.2 Output validation

No output validation instructions are provided by this FEI-attribute.

12.3.1.3 Device control

12.3.1.3.1 This FEI-attribute requires the device status store of each object updating device to contain the following abstract objects:

— a logical entry location that contains a logical address (see 13.1.3 of ISO 9040);

— a DO mask as defined in 12.1.4.

The content of the logical entry location need not be a valid address for an array element.

12.3.1.3.2 A device has update access to its logical entry location, but the VT-user may update it independently in accordance with the semantic definition of other control objects in the CCA.

NOTE — The logical entry location is intended to provide a guide to the human user of the device as to where the next entry will take place, and the associated DO mask provides the means by which this location can be distinguished. It is a specific abstract object that corresponds to an entry cursor as described in the notes to 12.1.1 and 12.1.2. However, in macro operations as defined in 12.1.2 the significance of the logical entry location may be less direct. The availability of local action operations in macros enables the user interface to have complete control over the relationship between the logical pointer and the logical entry location.

12.3.2 Field-echo-status

The following values are defined for the field-echo-status FEI-attribute:

— off;

— received-character.

12.3.2.1 Input validation

No input validation instructions are provided by this FEI-attribute.

12.3.2.2 Output validation

No output validation instructions are provided by this FEI-attribute.

12.3.2.3 Device control

This FEI-attribute requires the device status store of each object updating device to contain a DO mask as defined in 12.1.4. This DO mask lies underneath the masks associated with the field-class FEI-attribute.

The initial state of the mask, when a VTE is first brought into use, is that its elements are all empty. All the mask elements of an individual field shall also be reset to the empty state when certain DO update operations are received by the VT-user of the terminal end system from the VT service-provider. Any of the following operations shall have this effect if the operation addresses any DO array element of the field:

— TEXT or LOGICAL-TEXT;

— REPEAT-TEXT or REPEAT-LOGICAL-TEXT;

— ATTRIBUTE or LOGICAL-ATTRIBUTE;

— ERASE or LOGICAL-ERASE.

The mask elements are updated by actions of the terminal VT-user when LOGICAL-TEXT, REPEAT-LOGICAL-TEXT and LOGICAL-ATTRIBUTE operations are applied to the internal CCA. For each DO array element addressed by such an operation, a value is entered into the corresponding mask elements as follows:

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— if field-echo-status has the value 'off' then the content of the DO array element before update is copied into the mask elements (to be interpreted as specified below);

— if field-echo-status has the value 'received-character' then no entry is made in the mask elements.

When an empty array element is copied into the mask in accordance with these requirements then for each attribute of the DO array element that has no value assigned, the symbolic value "unassigned" is entered into the mask element. This differs from an empty mask element as it obscures any underlying specific value assignment in accordance with 12.1.4

NOTE — In accordance with 13.2 of ISO 9040, an array element is said to be empty if it has no primary attribute value currently assigned to it.

12.3.3 Field-count

The following values are defined for the field-count FEI-attribute:

— optional (min);

— mandatory (min).

The value type of the parameter is:

— min: an integer value lying between 0 and the maximum *k* coordinate of the field, both values included.

12.3.3.1 Input validation

No input validation instructions are provided by this FEI-attribute.

12.3.3.2 Output validation

If field-count has the value 'optional', the content of the field is valid if, and only if, at least one of the following predicates is true:

a) since the last test of the provisions of this FEI-attribute for the field, the local processing function has not accepted an update to any array element of the field;

b) either the value of 'min' is 0 or there are no empty array elements with *k*-coordinate value between 1 and the value of 'min', both values inclusive.

If field-count has the value 'mandatory', the content of the field is valid if, and only if, predicate a) is false and predicate b) is true.

NOTES

1 For a DO update to have been submitted to the local processing function, the update must have used logical addressing.

2 In accordance with 13.2 of ISO 9040, an array element is said to be empty if it has no primary attribute value currently assigned to it.

12.3.3.3 Device control

No abstract objects for device control are affected by this FEI-attribute.

12.3.4 Field-allowed-entries

The following values are defined for the field-allowed-entries FEI-attribute:

— output-test (strings, case-sensitive);

— input-test (firstchars, yeschars, nochars, case-sensitive);

in which the value types of the parameters are:

— strings: a set of character-strings (as defined in 3.5.2), each of which has the same length as the field;

— firstchars: one of

— a set of characters (as defined in 3.5.1);

— the symbolic value "null";

— yeschars: one of

— a set of characters (as defined in 3.5.1);

— the symbolic value "all";

— nochars: one of

— a set of characters (as defined in 3.5.1);

— the symbolic value "none";

— case-sensitive: a symbolic value from the set ("yes", "no").

12.3.4.1 Input validation

12.3.4.1.1 If field-allowed-entries has the value 'output-test', it provides no input validation instructions.

If field-allowed-entries has the value 'input-test', it specifies valid contents for array elements. An update satisfies the input validation provisions of this FEI-attribute if, and only if, the update would result in valid contents for every array element that it addresses within the field concerned. An empty array element shall always be considered to have a valid content. Criteria for validity of the content of a non-empty array element are specified in 12.3.4.1.2. In the interpretation of these criteria, the value "all" for the parameter 'yeschars' is to be interpreted as a set containing every character and the value "none" for 'nochars' is to be interpreted as a set containing no characters.

NOTES

1 Array elements of the field that are not addressed by the update are not tested for validity of their contents. Array elements addressed without change of content, i.e. by updating attributes with their current values, are tested for validity.

2 By 13.2 of ISO 9040, if the primary attribute in an array element has a value assigned, then all secondary attributes necessarily have values assigned. The update may set some of the secondary attribute values from the global and modal attribute values (see 19.2.2.1 of ISO 9040). The validation provisions test the final content, including that of attributes whose values are assigned by such default mechanisms.

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12.3.4.1.2 The content of a non-empty element with *k*-coordinate value other than 1 is valid if it is equivalent to some character in the set 'yeschars' and is not equivalent to any character in the set 'nochars'. The test of equivalence is specified in 12.3.4.2.2.

This same rule applies to a non-empty element with $k = 1$ if 'firstchars' takes the symbolic value "null". Otherwise the content of this element is valid if it is equivalent to some character in the set 'firstchars' under the test of equivalence specified in 12.3.4.2.2.

12.3.4.2 Output validation

12.3.4.2.1 If field-allowed-entries has the value 'input-test', it provides no output validation instructions.

If field-allowed-entries has the value 'output-test' then the content of the field is valid if, and only if, it is equivalent to some character-string in the set 'strings'. The field content and a character-string are defined to be equivalent if, and only if, both of the following predicates are true when the array elements of the field are ordered by their *k*-coordinate value starting from $k = 1$:

— the content of each non-empty array element of the field is equivalent to the corresponding character of the character-string under the test of equivalence defined in 12.3.4.2.2;

— the content of each empty array element of the field is equivalent to the corresponding character of the character-string under the test of equivalence defined in 12.3.4.2.3.

12.3.4.2.2 The test for equivalence between a character and the content of a non-empty array element covers only those attributes that are specified for that character, i.e. all attributes for a qualified character but only the primary attribute and the character-repertoire secondary attibute for an unqualified character.

If the character and the array element content have the same numeric value for all attributes covered by the test then they are always considered to be equivalent. They are also considered to be equivalent if the following predicates are all true:

a) the 'case-sensitive' parameter has the value "no";

b) the character and the array element content have the same numeric value for all secondary attributes covered by the test but different numeric values for the primary attribute;

c) the common value for the character-repertoire secondary attribute corresponds to a repertoire whose repertoire-assignment-type has the default value specified in 18.2.4 of ISO 9040;

d) the names of the graphic characters in the common repertoire that are identified by the primary attribute values concerned differ only in that one name has the word CAPITAL where the other has the word SMALL.

NOTE — The names of graphic characters for the default repertoire-assignment-type are recorded in the tables of the ISO International Register of Coded Character Sets to be used with Escape Sequences.

Additional tests of equivalence may be defined by means outside this control object type definition to cover the situation in which predicates a) and b) are true but c) is false.

12.3.4.2.3 An empty array element is defined to be equivalent to a character (as defined in 3.5.1) if, and only if, the primary attribute value of the character represents the graphic character SPACE in the repertoire identified by its character-repertoire secondary attribute value.

NOTES

1 In accordance with 13.2 of ISO 9040, an array element is said to be empty if it has no primary attribute value currently assigned to it.

2 In accordance with 18.2.4.1 of ISO 9040, the default repertoire-assignment-type specifies that if a 94-character G set is used in the GL position of the code table then it is implicit that the SPACE character is available in position 2/0. This position corresponds to primary attribute value 32.

12.3.4.3 Device control

No abstract objects for device control are affected by this FEI-attribute.

12.4 FEI definitions

This subclause defines the available Field Entry Instructions (FEIs) that may be referenced by a Field Definition Record (FDR). The FDR determines the assignment of FEI-attribute values as follows:

— each FEI-attribute itself, and each parameter of each FEI-attribute, is considered separately during the assignment process and each is initially considered as unassigned;

— it is permitted for a value to be assigned to a parameter of an FEI-attribute before a value has been assigned to the FEI-attribute itself;

— the FEIs referenced by the FDR of the field are processed in any order and each makes an assignment to one or more FEI-attributes or parameters;

— any FEI-attribute or parameter that is defined for the field in accordance with 12.3.1, but which remains unassigned after all FEIs have been processed, is assigned a default value that may depend on the values that have been explicitly assigned.

The values assigned by default are as follows:

```
field-class:          free;
    inhibit:          "off";

field-echo-status:    received-character;
    char:             (never set by default);

field-count:          optional;
    min:              0;

field-allowed-entries: IF strings HAS A VALUE ASSIGNED
                       THEN output-test ELSE input-test;
    firstchars:       "null";
    yeschars:         "all";
    nochars:          "none";
    case-sensitive:   "yes";
    strings:          (never set by default);
```


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Some of the FEIs specified below are parametric. The parameters do not have default values, but they may be optional. All value types that concern attributes of array elements are specified using the terminology defined in 3.5 above.

12.4.1 Optional field

This FEI assigns the value 'free' to the field-class FEI-attribute and the value 'optional' to the field-count FEI-attribute.

12.4.2 Mandatory field

This FEI assigns the value 'free' to the field-class FEI-attribute and the value 'mandatory' to the field-count FEI-attribute.

12.4.3 Protected field.

This FEI assigns the value 'protected' to the field-class FEI-attribute.

12.4.4 Inhibit logical rendition attribute operation

This FEI assigns the value "on" to the 'inhibit' parameter of the field-class FEI-attribute.

12.4.5 Echo Received Character

This FEI assigns the value 'received-character' to the field-echo-status FEI-attribute.

12.4.6 Echo Off

This FEI assigns the value 'off' to the field-echo-status FEI-attribute.

12.4.7 Fill field

This FEI assigns the value of the maximum *k*-coordinate of the field to the 'min' parameter of the field-count FEI-attribute.

12.4.8 Minimum entry (min1)

The parameter is mandatory. Its value shall be an integer greater than zero.

More than one occurrence of this FEI may be linked to the same field. If no value has yet been assigned to the 'min' parameter of the field-count FEI-attribute, or if it has been assigned a value smaller than that of 'min1', then this FEI assigns to it the smaller of the value of 'min1' and the maximum *k*-coordinate of the field. If the 'min' parameter has already been assigned a value greater than or equal to that of 'min1' then this FEI has no effect.

12.4.9 Ignore Case

This FEI assigns the value "no" to the 'case-sensitive' parameter of the field-allowed-entries FEI-attribute.

12.4.10 Allowed First Characters (charset)

The parameter is mandatory. Its value shall be a set of characters (as defined in 3.5.1).

More than one occurrence of this FEI may be linked to the same field.

If no value has yet been assigned to the 'firstchars' parameter of the field-allowed-entries FEI-attribute then this FEI assigns to it the value of 'charset'. If a value has already been assigned to the 'firstchars' parameter then this FEI augments the set that forms its current value by adding to it the characters of the 'charset' set.

12.4.11 Allowed Characters (charset)

The specification of this FEI is the same as that for the Allowed First Characters FEI except that the 'firstchars' parameter is replaced by the 'yeschars' parameter.

12.4.12 Disallowed Characters (charset)

The specification of this FEI is the same as that for the Allowed First Characters FEI except that the 'firstchars' parameter is replaced by the 'nochars' parameter.

12.4.13 Allowed String Values (strset)

The parameter is mandatory. Its value shall be a set of character-string ranges (as defined in 3.5.3).

More than one occurrence of this FEI may be linked to a single field.

The value of the 'strset' parameter is first used to construct a set 'fieldset' of character-strings, each of which has the same length as the field. Each character-string range in 'strset' adds to 'fieldset' as follows:

— if the strings of the range are of the same length as the field, they are added to 'fieldset';

— if the strings of the range have a length different from that of the field, each string is converted if possible to the length of the field by the addition or removal of consecutive SPACE characters at the end of the string and is then added to 'fieldset'.

NOTE — See 12.3.4.2.3 concerning the interpretation of SPACE characters. Strings longer than the field that do not terminate in sufficient SPACE characters do not generate additions to 'fieldset'. If the character-repertoire of the range does not contain a SPACE character in this interpretation then no string differing in length from the field can generate an addition to 'fieldset'.

If no value has yet been assigned to the 'strings' parameter of the field-allowed-entries FEI-attribute then this FEI assigns to it the value of 'fieldset'. If a value has already been assigned to the 'strings' parameter then this FEI augments the set that forms its current value by adding to it the character-strings of the 'fieldset' set.

12.4.14 Allowed Numeric Values (strset)

The specification of this FEI is the same as that for the Allowed String Values FEI except for the manner in which the set 'fieldset' is constructed from the value of the 'strset' parameter. For this FEI-attribute the construction is as follows:

— if the strings of the range are of the same length as the field, they are added to 'fieldset';

— if the strings of the range have a length different from that of the field, each string is converted if possible to the length of the field by the addition or removal of consecutive DIGIT ZERO characters at the beginning of the string and is then added to 'fieldset'.

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NOTES

1 A DIGIT ZERO character is a primary attribute value corresponding to a graphic character with this name in the correspondence specified in 12.3.4.2.2. If the character-repertoire of the range does not contain a graphic character with the name DIGIT ZERO then no string differing in length from the field can generate an addition to 'fieldset'.

2 It is intended that the character-strings specified by the parameter value of this FEI should be composed entirely of digits. The comparison operation for character-strings will only correspond to comparison of the integer values represented by the sequences of digits if the primary attribute values of the digits 0 to 9 are in increasing order. Ranges will necessarily be composed entirely of digit sequences only if no non-digit characters have primary attribute values that lie between the highest and lowest values used to represent digits.

12.5 Mutually Exclusive FEIs

The FEI-attribute values set by some FEIs are in conflict with those set by other FEIs. For example, input-validation provisions cannot be assigned when the field-class FEI-attribute has the value 'protected'. Conflicting FEIs shall not be associated with the same field. Table 1 defines the sets of conflicting FEIs for the purposes of this requirement. The problem of conflict between multiple instances of a single parametric FEI linked to the same field is considered in the definition of each such FEI in 12.4.

Table 1 — Conflicting FEIs

FEI	Conflicting FEIs
Optional Field	Mandatory Field, Protected Field
Mandatory Field	Optional Field, Protected Field
Protected Field	All
Fill Field	Protected Field, Allowed String Values, Allowed Numeric Values
Ignore Case	Protected Field
Inhibit Logical Rendition Attribute Operation	Protected Field
Minimum Entry	Protected Field
Allowed First Characters	Protected Field, Allowed String Values, Allowed Numeric Values
Allowed Characters	Protected Field, Allowed String Values, Allowed Numeric Values
Disallowed Characters	Protected Field, Allowed String Values, Allowed Numeric Values
Allowed String Values	Protected Field, Fill Field, Allowed First Characters, Allowed Characters, Disallowed Characters, Allowed Numeric Values
Allowed Numeric Values	Protected Field, Fill Field, Allowed First Characters, Allowed Characters, Disallowed Characters, Allowed String Values

12.6 Update Syntax

The abstract syntax for an update to a FEICO is specified in 12.2.3 of ISO 9041-1 in terms of an ASN.1 any type with type reference FEI. The ASN.1 module ISP11185-FEICO2 defined below provides the resolution of this ASN.1 any type when the update is to this FEICO.

Each FEI with no parameter is represented in this module by a value reference to a null type. Each FEI with one or more parameters is represented by a value of a named type. Parameter values are represented by defined types that are exported from the module. Other control object definitions that make use of the value types defined in 3.5 may thus make use of the same ASN.1 representation.

The representation of a parameter value should be constructed according to the following guidelines:

a) The RendAtrributes type is used to represent a partial rendition or a rendition qualifier as defined in 3.5, according to context. When used to represent a rendition qualifier, attributes that are present in the value take the explicitly specified value and attributes that are absent are specified by the dynamic default mechanism of 3.5.10. In particular, the value '{ }' represents a rendition qualifier in which every rendition attribute is specified by the dynamic default mechanism.

b) The Character type is used to represent a character or character-string as defined in 3.5, according to context. The character or character-string is qualified if the optional 'attributes' element is present and is unqualified if this element is absent.

c) The CharacterValues type is used to represent a set of characters, or a set of character-string ranges, according to context. A set of characters is represented in the same manner as a set of character-string ranges in which each character-string is of length 1. The set of characters then consists of the characters that are in one or more of the ranges.

d) A character-string range represented by the CharacterValues type is qualified or unqualified according as the 'lowValue' element represents a qualified or unqualified character-string under b) above. The 'lowValue' and 'highValue' elements represent the lower bound and upper bound of the range as defined in 3.5. If the 'highValue' element is omitted then the range consists of the single element represented by 'lowValue'.

e) When used as the named types 'allowedStringValues' and 'allowedNumericValues' it is permitted for the 'lowValue' and 'highValue' elements of the CharacterValues type to represent character-strings of different length. The shorter bound is implicitly lengthened by the addition of SPACE characters at the end of the string in the case of 'allowedStringValues' and DIGIT ZERO characters at the beginning of the string in the case of 'allowedNumericValues'. These terms are to be interpreted as in 12.4.13 and 12.4.14 respectively.

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```
ISP11185-FEICO2

{ iso(1) standard(0) 9834 vt-co-def(5) feico(1) 2 }

DEFINITIONS IMPLICIT TAGS ::= BEGIN

EXPORTS FEI, Character, CharacterValues, RendAttributes;

FEI ::= CHOICE {
    fei0                    [0]  NULL,
    fei1                    [1]  NULL,
    fei2                    [2]  NULL,
    fei3                    [3]  NULL,
    fei4                    [4]  NULL,
    fei5                    [5]  NULL,
    fei6                    [6]  NULL,
    fei7                    [7]  NULL,
    minimumEntries          [8]  INTEGER,
    allowedFirstCharacters  [9]  CharacterValues,
    allowedCharacters       [10] CharacterValues,
    disallowedCharacters    [11] CharacterValues,
    allowedStringValues     [12] CharacterValues,
    allowedNumericValues    [13] CharacterValues }

    optionalField           FEI  ::= fei0 NULL
    mandatoryField          FEI  ::= fei1 NULL
    protectedField          FEI  ::= fei2 NULL
    fillField               FEI  ::= fei3 NULL
    echoReceivedChar        FEI  ::= fei4 NULL
    echoOff                 FEI  ::= fei5 NULL
    ignoreCase              FEI  ::= fei6 NULL
    inhibitLogRendAttOp     FEI  ::= fei7 NULL

Character ::= SEQUENCE {
    primaryValue [0] PriValue,
    repertoire   [1] INTEGER,
    attributes   [2] RendAttributes OPTIONAL }

CharacterValues ::= SEQUENCE OF SEQUENCE {
    lowValue  [0] Character,
    highValue [1] PriValue OPTIONAL }

    -- The default for highValue is the primaryValue
    -- component of lowValue.

PriValue ::= OCTET STRING

    -- The PriValue type is used to encode a sequence of
    -- character-box graphic elements from a single
    -- character-repertoire.

RendAttributes ::= SEQUENCE {
    foregroundColour [0] INTEGER OPTIONAL,
    backgroundColour [1] INTEGER OPTIONAL,
    emphasis         [2] PrintableString OPTIONAL,
    font             [3] INTEGER OPTIONAL }

END -- OF FEICO DEFINITIONS
```

12.7 Initial Content

An initial content of a FEICO of this type may be provided in the specification of any VTE-profile that references it. In the absence of such a specification, the FEICO initially contains no FEIRs.

13 Additional information

A CO of this type requires the use of the Structured Control Objects and Fields VT functional units. In S-mode operation it also requires the Enhanced Access-rules functional unit.

The following event that may occur during controlled data entry when a FEICO of this type is present in the CCA is notified to the event processing function (see 12.2.1):

— the failure of validation by the input validation function, in accordance with 12.2.2.

It is intended that a FEICO of this type should be used in conjunction with a FEPCO in which this event is recognised as a Field Entry Event. The correspondence between events defined by a FEICO and recognised by a FEPCO should be part of the specification of any VTE-profile that uses such COs. An appropriate FEPCO type for use during S-mode operation is that with taxonomy identifier FVT232 that is defined in ISO/IEC ISP 11185-11.

Two other facilities are provided by this FEICO type for use by an associated FEPCO. A validation failure event is generated by the input validation function before the update request that has generated the failure is discarded. As specified in 12.2.2, a FEPCO specification may include a Field Entry Reaction (FER) that over-rides the validation failure and permits the update request to be accepted by the local processing function and applied to the internal CCA. In addition an output validation function is available to enable a FEPCO to test the effect of the accumulated updates to a particular field. Different FERs may then be invoked according to the result of the test.

NOTE — The combination of output validation test and over-ride facility is useful when it is desired to achieve other reactions in addition to acceptance of the update request.

14 Usage

A FEICO of this type may be used in both A-mode and S-mode VTE-profiles whenever its comprehensive facilities are required.

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Annex A
(normative)

ISPICS Requirements List

A.1 Protocol requirements

This annex provides an ISPICS Requirements List (IPRL) for the Profile FVT222 specified in this part of ISO/IEC ISP 11185. The PICS proforma for the VT protocol is given in ISO 9041-2. This IPRL specifies constraints on the answers that may be given in the completed PICS for an implementation that claims conformance to these Profiles.

These constraints are given in tables A.1 and A.2. The notation used in the tables is as follows. Individual items in a PICS proforma are referenced by the means specified in A.9.1 of ISO/IEC 9646-2. Such a reference has the form *x-y/z*, where *x* is the number of the ISO Standard that specifies the protocol, *y* is a reference within the PICS proforma of this Standard to the smallest subclause that contains the item concerned, and *z* is the reference number of the item within that subclause. Where this IPRL needs to present the constraints on a particular item as two or more separate cases, a suffix of the form '.*n*' is added to the item reference where *n* is a serial number that labels the different cases.

The item name is taken from the PICS proforma. The "status" columns of the IPRL tables take priority over the corresponding "status" columns of the PICS proforma and they use the notation of that proforma. They refine the PICS proforma status values by evaluating conditional expressions or converting optional values to a more specific form. The following conditional values are used in these tables:

c1 If 9041-A.2.2/1 then m else -;
c2 If application implementation then m else -;
c3 If terminal implementation then m else -;

the referenced predicate from ISO/IEC 9041-2 is that S-mode is supported.

Where an IPRL table has a "Profile values" column, the status value applies separately to each listed Profile value.

For any column in an IPRL table that corresponds to an answer column in the PICS proforma, the values listed are the acceptable answers for the item concerned. The following special notation is used in these columns:

Any The IPRL places no constraint on the answer;
n/a The column is not relevant to this item.

A.2 Profile-specific requirements

An IPRL may also specify constraints on the answers to additional questions that concern Profile-specific conformance requirements which are outside the scope of any referenced base standard. These questions will be given in the IPRL itself.

This IPRL does not specify any Profile-specific constraints.

Table A.1 — VTE requirements for FVT222 (Paged FEICO No.1)

Item reference no. 9041-	Name of item	Status	Numbers supported	Negotiable
A.2.1/6	Enhanced Access-rules	c1	n/a	n/a
A.2.1/7	Structured Control Objects	m	n/a	n/a
A.2.1/9	Fields	m	n/a	n/a
A.3.8/4	Field Definition CO (FDCO)	m	1	No
A.3.8/5	Field Entry Instruction CO (FEICO)	m	≥1	Any
A.3.8/6	Field Entry Pilot CO (FEPCO)	m	≥1	Any

Table A.2 — PDU requirements for FVT222 (Paged FEICO No.1)

Item reference no. 9041-	Name of item	Profile values	SENDING Status	RECEIVING Status
A.5.15.4/12	fdco	n/a	c2	c3
A.5.15.4/13	feico	n/a	c2	c3
A.5.15.4.3/2	content	See note	c2	c3
NOTE — Support is mandatory for the ASN.1 type FEI exported from the module ISP11185-FEICO2.				

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