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Information processing — Coded representation of pictures —

Part 2:

Incremental encoding of point lists in a 7-bit or
8-bit environment

Traitement de l'information — Représentation codée de l'image —

*Partie 2: Codage en accroissement des listes de points dans un
environnement à 7 ou à 8 éléments*



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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 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 Standard ISO/IEC 9282-2 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*.

ISO/IEC 9282 consists of the following parts, under the general title *Information processing — Coded representation of pictures*:

- *Part 1: Encoding principles for picture representation in a 7-bit or 8-bit environment*
- *Part 2: Incremental encoding of point lists in a 7-bit or 8-bit environment*

Annex A forms an integral part of this part of ISO/IEC 9282. Annex B is for information only.

Introduction

This International Standard consists of a series of parts designed to facilitate the interchange and representation of pictures where the interchange is by means of data communications or the exchange of storage media.

ISO 9282 is structured as a multi-part standard. At present, it has two parts :

Part 1: Encoding principles for picture representation in a 7-bit or 8-bit environment.

Part 2: Incremental encoding of point lists in a 7-bit or 8-bit environment.

Other parts may be added later.

Standard methods are given for picture coding in order to assist in coding system design and to prevent a proliferation of different unrelated coding techniques.

Information processing - Coded representation of pictures -

Part 2 :

Incremental encoding of point lists in a 7-bit or 8-bit environment

1 Scope

This part of ISO/IEC 9282 defines

- a set of compression techniques to be used in coding point lists handled by computer graphics applications or by specific applications such as telewriting;
- the data structures to be used to represent the compressed point lists.

A point list specifies a sequence of points, each of them being represented by two coordinates as defined in ISO/IEC 9282-1. A point list contains at least two points but this part of ISO/IEC 9282 is more appropriate when numerous points with short displacements between them are to be coded and, furthermore, when it is required to code the point list in a compact way.

This part of ISO/IEC 9282 does not deal with the presentation semantics of the data; these are defined in the related International Standards.

This part of ISO/IEC 9282 applies either to the encoding of a datastream directly invoked through the identification method of ISO/IEC 9281 or to the subset of a picture which is represented as a point list embedded within a datastream structured in accordance with ISO/IEC 9282-1. Depending on the environment into which the incremental encoding is used, i.e. ISO/IEC 9281 or ISO/IEC 9282-1, different switching mechanisms allow to identify which compression technique is used, they are described in the relevant sub-clauses of this part of ISO/IEC 9282.

It is still possible to code a point list in the displacement mode as defined in ISO/IEC 9282-1 when there is no specific requirement in terms of compression ratio. Any functional standard using ISO/IEC 9282 for the representation of a syntax is free to use either the displacement mode or the incremental mode; ISO/IEC 9282-1 and this part of ISO/IEC 9282 allow for the representation of the displacement mode together with one or several incremental modes.

2 Conformity

A picture coding method is in conformity with this part of ISO/IEC 9282 if the incremental encoding technique used meets the following requirements :

- an incremental mode identification is in conformity with clause 5;
- the incremental mode used is in conformity with one of the modes described in clauses 6,7 or 8.

3 Normative references

The following standards contains provisions which, through reference in this text, constitute provisions of this part of ISO/IEC 9282. At the time of publication, the editions indicated where valid. All standard are subject to revision, and parties to agreements based on this part of ISO/IEC 9282 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of ISO maintain registers of currently valid International Standards.

ISO/IEC 9282-2 : 1992 (E)

ISO/IEC 9281-1 : 1990, *Information technology - Picture coding methods - Part 1 : Identification.*

ISO/IEC 9281-2 : 1990, *Information technology - Picture coding methods - Part 2 : Procedure for registration.*

ISO/IEC 9282-1 : 1989, *Information processing - Coded representation of pictures - Part 1 : Encoding principles for picture representation in a 7-bit or 8-bit environment.*

CCITT T.150, *Telewriting terminal equipment.*

4 Definitions and notation

4.1 Definitions

For the purpose of this part of ISO/IEC 9282, the following definitions apply :

4.1.1 basic grid unit : A binary fraction that identifies the accuracy of coordinates.

4.1.2 bit combination; byte : An ordered set of bits that represents an opcode or an operand or is used as a part of the representation of an opcode or an operand.

4.1.3 code : A set of unambiguous rules that establishes the one to one relationship between each opcode or operand of the set and their coded representation by one or more bit combinations.

4.1.4 differential chain mode : A coding method used in incremental mode, identifying differences between steps (increments).

4.1.5 domain ring : A mechanism for defining the accuracy (number of bits) of the coordinate data.

4.1.6 nibble : An ordered set of bits that represents a step increment in the step increment coding.

4.1.7 opcode : A one or multi-byte representation that identifies a function required by a picture or a computer graphics interface. An opcode may be followed by zero or more operands.

4.1.8 operand : A single or multiple coded representation used to specify the parameters required by an opcode.

4.1.9 pixel, picture element : The smallest element of a display surface can be independently assigned a colour or intensity.

4.1.10 ring : A square defined by its radius and angular resolution factor, used for encoding increments in the incremental mode.

4.2 Notation

4.2.1 7-bit byte

The bits of a 7-bit byte are identified by $b_7, b_6, b_5, b_4, b_3, b_2$ and b_1 where b_7 is highest order, or most significant bit and b_1 is the lowest order, or least significant bit.

The bit combinations are identified by notations of the form x/y , where "x" is a number in the range 0 to 7 and "y" a number in the range 0 to 15.

The correspondence between the notations of the forms "x/y" and the bit combinations consisting of the bits b_7 to b_1 , is as follows :

- x is the number represented by b_7 , b_6 and b_5 where these bits are given the weights 4, 2 and 1, respectively.
- y is the number represented by b_4 , b_3 , b_2 and b_1 where these bits are given the weights 8, 4, 2 and 1, respectively.

4.2.2 8-bit byte

The bits of an 8-bit byte are identified by b_8 , b_7 , b_6 , b_5 , b_4 , b_3 , b_2 and b_1 , where b_8 is the highest-order, or most-significant bit and b_1 is the lowest-order, or least-significant bit.

In this part of ISO/IEC 9282, the bit combinations are identified by notations of the form xx/yy , where xx and yy are numbers in the range 00 to 15. The correspondence between the notations of the form xx/yy and the bit combinations consisting of the bits b_8 to b_1 , is as follows :

- xx is the number represented by b_8 , b_7 , b_6 and b_5 , where these bits are given the weights 8, 4, 2 and 1, respectively ;
- yy is the number represented by b_4 , b_3 , b_2 and b_1 where bits are given the weights 8, 4, 2 and 1, respectively.

4.2.3 Byte interpretation

Bits within a byte may be interpreted to represent numbers in binary notation by attributing the following weights to the individual bits :

Bits of a 7-bit code		b_7	b_6	b_5	b_4	b_3	b_2	b_1
Bits of a 8-bit code	b_8	b_7	b_6	b_5	b_4	b_3	b_2	b_1
Weight	128	64	32	16	8	4	2	1

Using these weights, the bit-combinations of the 7-bit code represent numbers in the range 0 to 127 and the bit-combinations of the 8-bit code represent numbers in the range 0 to 255.

4.3 State variables

State variables are used to control the encoding of a datastream. Such state variables are set to a value by an application at the time a coding/decoding process is initialized.

Depending on the incremental method under which the encoding defined in this part of ISO/IEC 9282 is used, a state variable may remain fixed or may dynamically be modified within the encoded datastream.

The overall list of state variables defined in ISO/IEC 9282-2 is given in annex A.

5 Incremental encoding structure

The incremental coding modes allow for the coding of point lists in a compact manner. This part of ISO/IEC 9282 specifies three incremental coding modes :

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- a) the STEP INCREMENT CODING (SIC) which makes assumption on the smoothness of boundaries of natural objects.
- b) the DIFFERENTIAL CHAIN CODING (DCC) which codes incremental displacements on a ring around successive points.
- c) the ZONE CODING (ZC) which reduces redundancy of handwritten drawings by simulating the sampling of points at a fixed rate.

Specifications of the incremental coding modes are described in the clauses hereafter.

This part of ISO/IEC 9282 does not intend to make comparisons between the different incremental modes in terms of compression ratio, coding/decoding process and types of applications into which each of them is the most appropriate.

According to the definitions given in ISO/IEC 9282-1, a point list is coded as an operand; it is then preceded either by an opcode or by an operand in a datastream.

5.1 Incremental mode identification

The incremental identification is dependent on the environment into which incremental data are to be used.

If an incremental mode is directly invoked through ISO/IEC 9281-1, the incremental mode is identified by a coding method identifier (CMI); CMI's will be assigned by the registration authority for picture coding methods when they are required. Figure 1 shows the incremental coding structure used with ISO/IEC 9281-1.

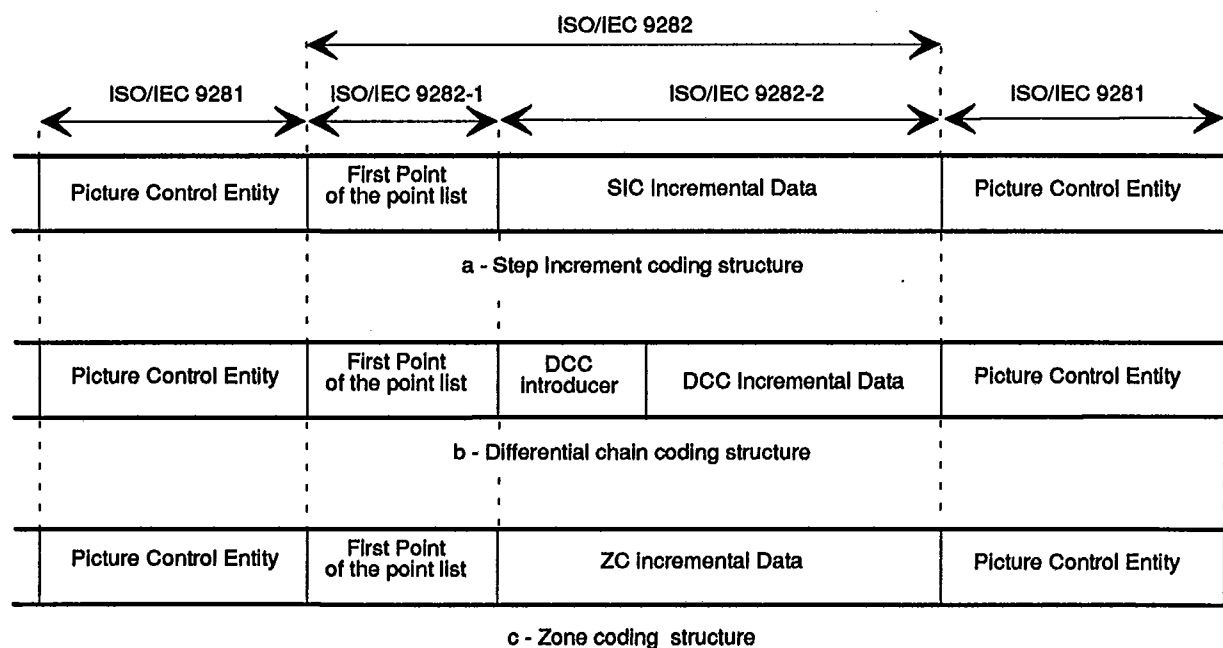


Figure 1 - Incremental coding structure used with ISO/IEC 9281

NOTE - The DCC Introducer is not really necessary for the purpose of ISO/IEC 9282-2, it is maintained for compatibility with CCITT recommendation T.150 on telewriting terminal equipment.

If an incremental mode is invoked through ISO/IEC 9282-1, an incremental coding announcer is used within a point list to announce that the points which follow are coded in incremental mode; furthermore an incremental coding identifier identifies which incremental mode is used. Figure 2 shows the incremental coding structure used with ISO/IEC 9282-1.

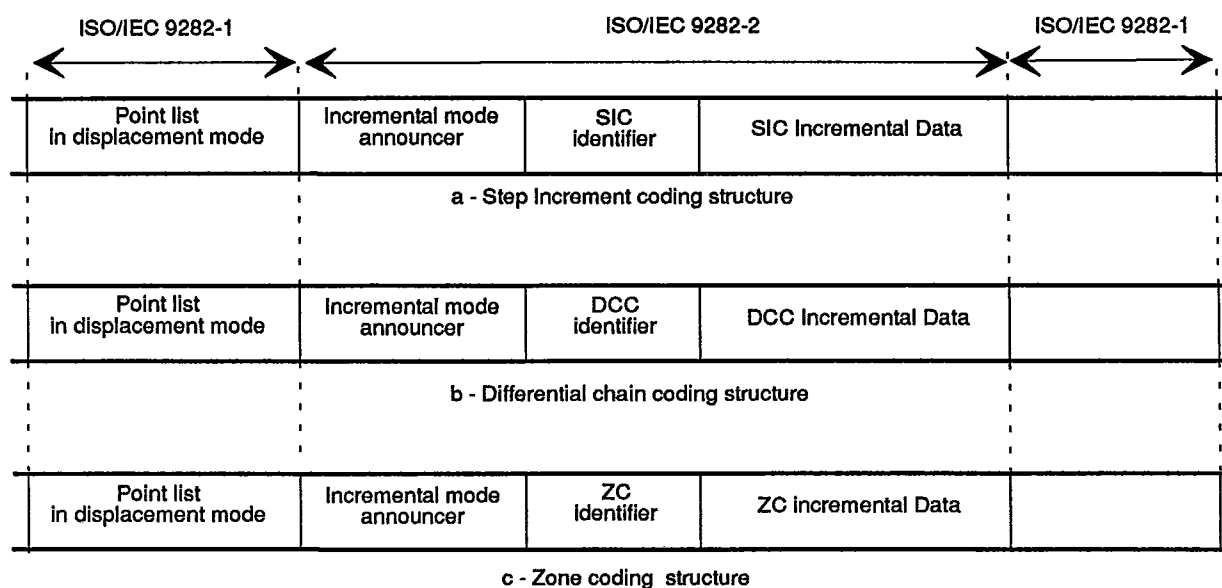


Figure 2 - Incremental coding structure used with ISO/IEC 9282-1

The point list in the displacement mode should, at least, include one point, the first point of the point list.

5.2 Encoding of the first point of a point list

The first point of a point list or the sequence of points which precede the incremental data are coded in the displacement mode as described in 6.3.6 of ISO/IEC 9282-1.

5.3 Encoding of the incremental mode introducer

An incremental mode introducer is composed of two elements :

- An INCREMENTAL MODE ANNOUNCER which indicates that the sequence of points which follows in the point list is coded in one of the incremental modes.
- An INCREMENTAL MODE IDENTIFIER which specifies what incremental mode is used.

The value of the INCREMENTAL MODE ANNOUNCER is conventionally MINUS ZERO, according to the description made in ISO/IEC 9282-1, but its encoding is dependent on the format into which coordinates are coded :

- If coordinates are coded with real numbers using the basic format : the INCREMENTAL MODE ANNOUNCER is a signed integer coded in the basic format on a single byte with the value MINUS ZERO.
- If coordinates are coded with real numbers using the bitstream format : the INCREMENTAL MODE ANNOUNCER is a signed integer coded in the bitstream format with the value MINUS ZERO. It is represented on one or several bytes according to the SIGNED INTEGER LENGTH state variable as defined in ISO/IEC 9282-1.
- If coordinates are coded using interleaved coordinate pairs : the first coordinate pair is coded as a sequence of two coordinates with the value MINUS ZERO. It is represented on one or several bytes according to the INTERLEAVED LENGTH state variable value as defined in ISO/IEC 9282-1.

NOTE - In the two's complement notation, the value zero has a positive sign and MINUS ZERO does not exist. For the purpose of that part of ISO/IEC 9282 MINUS ZERO shall be represented by a sequence of bits, the most significant bit being "1" or sign bit, followed by all "0's" bits.