The Digital Geographic Information Exchange Standard (DIGEST)

Part 3
CODES and PARAMETERS

Edition 2.1
September 2000

*Produced and issued by the **D**igital **G**eographic **I**nformation **W**orking **G**roup (DGIWG)*

DIGEST Part 3
Codes and Parameters

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NOTICE TO USERS

Refer to the Notice to Users/Record of Amendments in DIGEST Part 1.

RECORD OF AMENDMENTS

NUMBER	DATE	ENTERED BY	REMARKS

FOREWORD

Refer to the Foreword in DIGEST Part 1.

1 SCOPE, PURPOSE, AND FIELD OF APPLICATION

Refer to the Scope, Purpose, and Field of Application in DIGEST Part 1.

2 CONFORMANCE

Refer to the Conformance in DIGEST Part 1.

3 REFERENCES

Refer to the References in DIGEST Part 1.

4 TERMINOLOGY

Refer to the Terminology in DIGEST Part 1.

5 DATA TYPES AND CODE TABLES

5.1 Specification of Data Types

The fundamental building blocks out of which all forms of DIGEST data exchange are composed are primitive data elements consisting of numbers, coordinate pairs or triplets, text strings and special items such as a date. Although each of the encapsulations of DIGEST encode these data elements in different ways, the basic elements remain constant. That is, the range of values for numeric entities and repertoire of valid text characters are common to the various encapsulations of DIGEST. Different encoding techniques are appropriate to the various encapsulations of DIGEST for efficiency and structural reasons as well as for alignment with the underlying encapsulation specifications.

The specification below defines each of the data items as primitive elements for the ISO 8211, ISO 8824/5 (ASN.1), VRF and IIF representations of DIGEST (Annexes A, B, C and D of Part 2 respectively). These items can be classified into four main groups: single items; coordinate strings; other items such as Triplet ID, Date, etc.; and text. Single items consist of individual occurrences of items of particular types, whereas coordinate strings consist of multiple occurrences of coordinates.

Two types of text strings are required. These are a Basic Text String text (used to encode labels, etc.) and a generalized text format to handle place names and other information including accents and special characters to support information written in any language in the world. The "Basic Text String" data element type would include any string of characters from the ASCII (International Reference Version - IRV alphabet of the ISO 646 standard). The "General Text String" encompasses any characters including accents, diacritical marks, special characters, and any other ISO standardized alphabet. This permits the handling of place names to be described in any language. There exist a number of different world standards for the handling of general text. A graduated common repertoire supporting both direct (multi-byte) and composite (telecommunication oriented) coding is described.

The following table illustrates the various data types and the encoding used in each of the DIGEST encapsulations. All references to Annexes A, B, C or D in this clause refer to DIGEST Part 2.

Note: For the purpose of all DIGEST encapsulations a "byte" is defined to be an 8-bit octet. This applies to interchange of data. Systems may choose to map basic numerical data types to internal structures that may or may not be of equivalent bit length. Developers of systems must be careful to represent special cases, such as the Not A Number (NAN) value to an appropriate internal value, that will be dependent on the internal bit length used on the particular platform.

Table 5-1 Data Types

Type	**Short Description**	**ISO 8211**	**ISO 8824/25**	**VRF**	**IIF**
<u>Single Entities</u>					
Integer Number	a signed Integer Number, the length of the Integer Number is encapsulation and usage dependent. Some encapsulations provide both short (2-byte)(16-bit) and long 4(byte) (32-bit) integer numbers, whereas others provide length integers or integer numbers of a specific number of digits.	I format (arbitrary-length (integer) I n [where n is number of digits] (specific length of digits)	IMPLICIT INTEGER (arbitrary-length integer)	S,1 (Short Integer) 2 byte I,1 (Long Integer) 4 byte	BCS-N integer (composed of digits 0 to 9, + and -) and BCS-N positive integer (composed of digits 0 to 9). Both are BCS-N (Basic Character Set-Numeric - arbitrary-length number) subsets.
Real Number	a signed real (floating point) number consisting of a mantissa and an exponent, the length of the real number is encapsulation and usage dependent. Some encapsulations provide both short (4-byte)(32-bit) and long (8-byte)(64-bit) real numbers, whereas others provide arbitrary length real numbers.	R format (arbitrary-length real) Rn [where n is number of text characters] Rn.m [where n is number of text characters and m is the number after the decimal point.]	Real-Number composed of two arbitrary-length Integers one for mantissa & one for exponent.	F,1 (Short Real) 4 byte R,1 (Long Real) 8 byte	BCS-N (Basic Character Set-Numeric - arbitrary-length real number, composed of digits 0 to 9 and + and - and .) NOTE: No exponential form
Fraction Number	the fraction part of a real number, a number ranging between 0.0 (inclusive) and 1.0 (exclusive) used to represent real numbers normalized to a unity range. Normalized numbers are used for efficiency in some situations.	R format (arbitrary-length real)	Fraction-Number represented as an Integer data field	F,1 (Short Real) 4 byte R,1 (Long Real) 8 byte	(not applicable)

Type	Short Description	ISO 8211	ISO 8824/25	VRF	IIF
<u>Single Entities</u>					
Bit-Value	a set of bits representing a single bit coded value such as a pixel value	B format (string of bits in a bit-field)	OCTETSTRING (string of bits grouped as octets)	(Not Applicable)	Image Bit Field (string of bits in a bit-field)
X,Y Coordinate	a ordered pair of numbers representing an X, Y coordinate pair.	R format (pair of R format elements)	two fraction numbers encoded as an OCTET STRING or an element of a packed differential coordinate string	C,* (two coordinates, short floating point) 8n+4 bytes or B,* (two coordinates, long floating point) 16n+4 bytes	(not applicable)
X,Y,Z Coordinate	a ordered triplet of numbers representing an X, Y,Z coordinate value.	R-format (triplet of R-format elements)	three fraction numbers encoded as an OCTET STRING or an element of a packed differential coordinate string	Z,* (three coordinates, short floating point) 12n+4 bytes or Y,* (three coordinates, long floating point) 24n+4 bytes	(not applicable)
<u>Strings</u> **Abs-Coordinate-String**	an arbitrary-length string of absolute coordinates	Repeating set of R format	SEQUENCE of Coord [where Coord is defined as an X,Y or X,Y,Z Coordinate built out of fraction numbers]	Relational table columns of short or long real (floating point) numbers, in C, B, Z or Y format.	(not applicable)

Type	**Short Description**	**ISO 8211**	**ISO 8824/25**	**VRF**	**IIF**
<u>Strings</u> **Rel-Coordinate-String**	an arbitrary-length string of coordinates, which are described as relative to a Reference Coordinate defining a Local Coordinate System. [see Part 2 clause 10.2]. A Scale factor relates the local coordinate system to the absolute coordinate system. In ISO 8824 the Reference Coordinate and Scale factor are defined by the Local Coordinate System. The string consists of a sub-string length indicator and the string of coordinates with coordinates described in interleaved normalized binary integer form. In VRF the Reference Coordinate and Scale factor are described once for the tile in the TILEREF AREA Feature Table. The length of the coordinate values is implicit in the format types G, H, V or W.	(not applicable)	SEQUENCE (INTEGER, OCTETSTRING)	Relational table columns of short or long integer numbers, in G, H, V or W format. Note: Reference coordinate and scale factor in TILEREF Feature Table.	(not applicable)
Dif-Coordinate-String	an arbitrary-length string of coordinates, which are encoded as relative to the previous coordinate in the string. The initial position is described as a coordinate relative to the Reference Coordinate defining a Local Coordinate System. A Scale factor , defined at the Layer/Coverage level, relates the local coordinate system to the absolute coordinate system. The differential coordinate string contains the initial position of the differential coordinate string, a differential factor, a sub-string length indicator and a string of coordinates. In ISO 8824 the string consists of an initial coordinate followed by a differential factor, a sub-string length indicator and a string of coordinates, with coordinates described in interleaved normalized binary integer form.	(not applicable)	SEQUENCE (Coord, INTEGER, INTEGER, OCTETSTRING)	(not applicable)	(not applicable)
Bit String	an arbitrary-length string of Bit coded values	Repeating set of B format	SEQUENCE (Bit-Value)	(not applicable)	(string of bits in a bit-field)

Type	Short Description	ISO 8211	ISO 8824/25	VRF	IIF
Other					
TripletID	ID Triplet. Used in edge and face primitive tables to provide cross-tile topology and seamless databases	(not applicable)	(not applicable)	K,1 (Triplet ID) 1 to 13 bytes	(not applicable)
Date	defines the local calendar date and time	A(8)	IMPLICIT GENERALIZED TIME	D,1 (Date and time) 20 bytes	BCS-N positive integer (usage defined at field level)
Null Field	a place holder element of null value (null fields are required in some encapsulations)	(not applicable)	IMPLICIT NULL	X,1 null values are available for single numeric data entities	(not applicable)
Text String					
Basic-Text	an arbitrary-length string of ASCII data (ASCII is defined by ISO 646)	A format	IMPLICIT-GRAPHIC-STRING	T, n (fixed-length text) n byte fixed table column width	BCS-A (Basic Character Set-Alpha numeric)
General-Text	an arbitrary-length string of text data including accents and special characters from one of three levels of repertoire: Level 0 - Basic ASCII text , (IRV of ISO 646) Level 1 - Extended ASCII (including accents for Western European Latin alphabet based languages, ISO 8859 part 1 Latin Alphabet 1 repertoire) (ASCII+ all Latin alphabet accents) Level 3 - Universal Character Set repertoire UCS-2 implementation level 2 (Base Multilingual plane of ISO 10646) (i.e. including Latin, alphabet, Greek, Cyrillic, Arabic, Chinese, etc.) Note: Level 2 - is obsolete and retained only for compatibility with earlier versions of DIGEST.	A format	IMPLICIT-GRAPHIC-STRING	T,* (variable-length text) *+4 byte text string indirectly referenced T, n (fixed-length text) n byte fixed table column width T,* (variable length text) *+4 byte text string indirectly referenced	Level 0 = BCS-A (Basic Character Set-Alpha numeric) Level 1 = ECS-A (Extended Character Set – Alpha numeric) Level 3 = (not applicable)

Each of the four encapsulations, in ISO 8211, ISO 8824/5, VRF relational tables and IIF, make use of different techniques to identify the data type being used in any particular section of the data set.

The ISO 8211 standard makes use of a data descriptive technique, which facilitates the exchange of files containing data records between systems in a media independent manner. It defines a generalized structure for a wide variety of data types and structures in terms of a Data Descriptive Record (DDR) which specifies the size and position of each data element within a data file. It also provides the means within the DDR for the description of use for the contents of the data fields.

In the ISO 8824/5 implementation the type of an item is determined from the context (Tag Structure) of the syntactic description in ASN.1. Note that the term "IMPLICIT" in the equivalence statements below ensures that double tags are not assigned to these elements. All direct data types (coordinates, topological pointers, etc.) make use of the Integer-Number data type, whereas structural data about the interchange format, such as counters, etc. are expressed in the INTEGER primitive directly.

In the relational table implementation data is encapsulated in terms of tables contained in separate files. Each table contains a header, which defines the data type of each column of the table.

In the IIF implementation data is encapsulated using byte counts to delimit data fields in the format. The data that appears in all header/subheader information fields is represented using the Extended Character Set (ECS) and subsets.

The following sections identify each of the data types as used in the various encapsulations. Certain data types are unique to specific encapsulations. For example the ISO 8824 encapsulation supports a fraction number data type. This is the mantissa part of a real number, and it can be carried efficiently in the equivalent of an integer data field. It is particularly useful for carrying normalized coordinate data. It is used in the ISO 8824 telecommunications oriented encapsulation in order to improve efficiency in telecommunications systems.

Null values for specific data entities are defined along with the data entities.

5.1.1 Single Data Entities

5.1.1.1 ISO 8211 Single Data Entities

Integer (I)	ISO 8211 "I" format -- a signed Integer Number (Implicit point number) of arbitrary size encoded as a string of text characters. The null value is a zero field width.
Integer (I n)	ISO 8211 "I" format -- a signed Integer Number (Implicit point number) of "n" characters encoded as a string of text characters. The null value is the maximum negative value possible (e.g. -9999 for an I5 Integer format).
Real (R)	ISO 8211 "R" format -- a signed Real Number (Explicit point number) of arbitrary size encoded as a string of text characters. The null value is a zero field width.
Real (R n)	ISO 8211 "R" format -- a signed Real Number (Explicit point number) of "n" characters encoded as a string of text characters. The null value is the maximum negative value possible (e.g. -9999. for an R6 Real format).

Real (R n.m)	-- ISO 8211 "R" format. -- a signed Real Number (Explicit point number) of "n" characters with "m" characters after the decimal point. The null value is the maximum negative value possible (e.g. -9999.99 for an R8.2 Real format).
Fraction Number	(This number form is currently not used in Annex A. Fraction number values will in the future be handled in Integer number fields, as stated above, to handle normalized offset coordinate units.)
Bit (B 8)	ISO 8211 "B" format -- a set of 8 bits in an ISO 8211 fixed bit field. A string of bits of arbitrary-length corresponding to a pixel value, are padded to fill an integer number of octets. There is no null value.
X,Y Coordinate	(There is no specific X,Y coordinate format in Annex A. Coordinates are handled as a pair of " R " format numbers.) -- a ordered pair of real numbers representing an X,Y coordinate pair.
X,Y,Z Coordinate	(There is no specific X,Y,Z coordinate format in Annex A. Coordinates are handled as a triplet of " R " format numbers.) -- a ordered triplet of real numbers representing an X,Y,Z coordinate value.

5.1.1.2 ISO 8824 Single Data Entities

(Note: the following is ISO 8824 ANS.1 code for the identified items)

Integer-Number	::= IMPLICIT INTEGER -- a signed Integer Number of arbitrary-length. The null value is a zero field width.
Real-Number	::= IMPLICIT OCTETSTRING -- a signed Real Number is composed of an octet-string of arbitrary-length, in compliance with the ANSI/IEEE 754 floating point number standard. The precision of the number is determined from the length. Both 32 and 64-bit precision are used. The null value is the "Not A Number" value defined in ANSI/IEEE 754.
Fraction-Number	MACRO ::= BEGIN TYPENOTATION := IMPLICIT INTEGER --fraction-- VALUENOTATION := ".", INTEGER END -- a signed normalized fraction represented in an integer field of arbitrary-length. The Most Significant Bit represents the sign (using the two's complement convention). This is followed by an implied fractional point (decimal/binary point) followed by a representation of the fraction. The null value is a zero field width.
Bit-Value	::= OCTETSTRING -- a string of bits of arbitrary-length corresponding to a bit value, carried in a string of octets, padded to fill an integer number of octets. The null value is a zero field width.

X,Y Coordinate	(There is no specific X,Y coordinate entity in Annex B. Coordinates are handled in absolute, relative or differential coordinate strings. A single coordinate can be handled as a string containing only one coordinate entity.) -- a ordered pair of real numbers representing an X,Y coordinate pair.
X,Y,Z Coordinate	(There is no specific X,Y,Z coordinate entity in Annex B.) -- a ordered triplet of real numbers representing an X,Y,Z coordinate.

5.1.1.3 VRF Relational Tables Single Data Entities

In the relational table form of DIGEST the format of each column of data is given in the first row of the table. Certain data elements can be expressed in either short or long format. Which headers are used in particular tables are given in Annex C. Allowable field types are given in Table C-47 in section C.10.1.6. Since tables are of fixed column width it is necessary to make a distinction between an empty column entry and one of zero value. For each type of data there is a defined null/no value which is used to indicate an empty field. Numbers are represented in two's complement number format. The bit patterns and equivalent numbers shown below for the null/no value "Not A Number" (NAN) are for S,1 (Short Integer) 2 byte and I,1 (Long Integer) 4 byte numbers in VRF exchange data sets. The internal representation of these NANs may vary dependent upon the architecture of the platform upon which a system is implemented. The NAN value for Real numbers is defined in the IEEE 754 standard for "Binary Floating Point Arithmetic". The NAN value for Integer numbers is the maximum negative value of the twos complement number negative range, that is, the number at the extreme of the negative number range that has no positive equivalent under the absolute value operation. For systems that have different, usually longer, word lengths, the system must map the NAN value in the exchange data set into an equivalent internal number, not just store the NAN value in the exchange data set into the same bit pattern in the internal system.

The column headers for each data type are given below:

Integer Number (Short)	S,1 -- a signed Integer Number of 2-byte (16-bit) length. The null value is defined to be the bit pattern 10000000 00000000, which is equivalent to the maximum negative number in "two's complement number format". Therefore, the number range is from -32767 to 32767 with -32768 corresponding to the null value, for a 16-bit length number.
Integer Number (Long)	I,1 -- a signed Integer Number of 4-byte (32-bit) length. The null value is defined to be the bit pattern 10000000 00000000 00000000 00000000, which is equivalent to the maximum negative number in "two's complement number format". Therefore, the number range is from -2147483647 to 2147483647 with -2147483648 corresponding to the null value, for a 32-bit length number.
Real-Number (Short) **(Single Precision)**	F,1 -- a signed Real Number of 4-byte (32-bit) length in compliance with the ANSI/IEEE 754 floating point number standard. For table entries of this type that are "empty" the Not-a-Number form" defined in IEEE 754 is used. Note, there are implementation dependent limits on the guaranteed precision of floating point numbers defined in accordance with IEEE 754.
Real-Number (Long) **(Double Precision)**	R,1 -- a signed Real Number of 8-byte (64-bit) length in compliance with the ANSI/IEEE 754 floating point number standard. For table entries of this type that are "empty" the Not-a-Number form" defined in IEEE 754 is used. Note, there are implementation dependent limits on the guaranteed precision of floating point numbers defined in accordance with IEEE 754.
Fraction-Number	(This number form is currently not used in Annex C. Fraction number values will in the future be handled in Integer number fields, as stated above, to handle normalized offset coordinate units.)
Bit-Value	(This number form is currently not used in Annex C.)

X,Y Coordinate	C,n or C,* or B,n or B,* -- a ordered pair of numbers representing an X,Y coordinate pair. "C,n" corresponds to a 2-coordinate array of short Real (F,1) numbers with the null value equal to both coordinates being "Not-a-Number (NAN)". "C,*" corresponds to a 2-coordinate string, with the null value equal to a string length of 0. "B,n" corresponds to a 2-coordinate array of long Real (R,1) numbers with the null value equal to both coordinates being "Not-a-Number (NAN)". "B,*" corresponds to a 2-coordinate string, with the null value equal to a string length of 0.
X,Y,Z Coordinate	Z,n or Z,* or Y,n or Y,* -- a ordered triplet of numbers representing an X,Y,Z coordinate value. "Z,n" corresponds to a 3-coordinate array of short Real (F,1) numbers with the null value equal to both coordinates being "Not-a-Number (NAN)". "Z,*" corresponds to a 3-coordinate string, with the null value equal to a string length of 0. "Y,n" corresponds to a 3-coordinate array of long Real (R,1) numbers with the null value equal to both coordinates being "Not-a-Number (NAN)". "Y,*" corresponds to a 3-coordinate string, with the null value equal to a string length of 0.

5.1.1.4 IIF Single Data Entities

In the IIF form of DIGEST, information is defined in the form of a header and image, text and graphic elements. The header is coded purely as characters with the length of data fields defined in terms of a character count. The characters in the data fields are defined in terms of characters from the Base Multilingual Plane (BMP) of ISO 10646, or from the Base Character Set (BCS) (which corresponds to the first 8-bit "page" of ISO 10646 and is also equivalent to ISO 8859-1). In addition some fields make use of restricted repertoires of the BCS which allow for only Real numbers or Integers.

Positive Integer	IIF BCS-N positive integer character set -- Basic Character Set Numeric – positive integer. Positive Integer numbers may be composed of a subset of the Basic Character Set-Numeric characters, with the limitation to integer based on the field description.
Integer	IIF BCS-N integer character set -- Basic Character Set Numeric - integer. Integer numbers may be composed of a subset of the Basic Character Set-Numeric characters, with the limitation to integer based on the field description.

Real	IIF BCS-N character set -- Basic Character Set-Numeric. A signed Real Number (Explicit point number) of arbitrary size encoded as a string of text characters. The range of allowable characters consists of minus to the number “9”, BCS codes 2/13 to 3/9, and plus, code 2/11.
Bit (Image Data Format)	IIF Image data format -- The Pixel Value Type field (PVTYPE) defines the type of encoding used: allowed values are INT for integer, B for bi-level, SI for 2's complement signed integer, R for Real, C for Complex.
X,Y Coordinate	(There is no specific X,Y coordinate format in Annex D. Coordinates are handled as a pair of "BCS-N" numbers.) -- a ordered pair of real numbers representing an X,Y coordinate pair.
X,Y,Z Coordinate	Not Applicable

5.1.2 Coordinate Strings

5.1.2.1 ISO 8211 Coordinate Strings

Strings	-- Strings of data elements, such as strings of coordinates, strings of bit values etc., are carried in ISO 8211 as repeating fields of single elements or sets of single elements; for example a repeating string of coordinates would be carried as a repetition of the set of two real number fields corresponding to X and Y. There is no special structure for strings of data in the ISO 8211 encapsulation.

5.1.2.2 ISO 8824/5 Coordinate Strings

(Note: the following is ISO 8824 ANS.1 code for the identified items)

Abs-Coordinate-String	::= SEQUENCE OF Coord -- an arbitrary-length string of absolute coordinates

Rel-Coordinate-String ::= SEQUENCE { INTEGER, OCTETSTRING}
-- an arbitrary-length string of coordinates, which are described as relative to a Reference Coordinate defining a Local Coordinate System [see Part 2 clause 10.2]. A Scale factor relates the local coordinate system to the absolute coordinate system.

The string consists of a sub-string length indicator and the string of coordinates with coordinates described in interleaved normalized binary integer form.

The sub-string length indicator specifies the bit length of each coordinate element. Each coordinate consists of a pair of elements corresponding to binary fraction numbers representing dX, dY coordinates relative to the current coordinate position.

Dif-Coordinate-String ::= SEQUENCE {Coord, INTEGER, INTEGER, OCTETSTRING}
-- an arbitrary-length string of coordinates, which are encoded as relative to the previous coordinate in the string. The initial position is described as a coordinate relative to the Reference Coordinate defining a Local Coordinate System. A Scale factor, defined at the Layer/Coverage level, relates the local coordinate system to the absolute coordinate system. The differential coordinate string contains the initial position of the differential coordinate string, a differential factor, a sub-string length indicator and a string of coordinates in interleaved normalized binary integer form.

The differential factor is common to all differential coordinates in the string and the coordinate length indicator specifies the bit length of each coordinate element. Each coordinate consists of a pair of elements corresponding to binary fraction numbers representing a $dX*2^F$, $dY*2^F$ coordinate relative to the current coordinate position, where F is a differential factor.

Bit-String ::= SEQUENCE {Bit-Value}
-- an arbitrary-length string of Bit Values.

Coord
```
::=   CHOICE {   [0] OCTETSTRING,   --X,Y
                 [1] OCTETSTRING,   --X,Y,Z
   }
```
-- a ordered pair or triplet of binary fraction numbers representing an X, Y or X, Y, Z coordinate where the octet string is divided into two or three equal-length pieces which correspond to the two or three fraction numbers.

5.1.2.3 VRF Relational Tables Coordinate Strings

Strings -- Strings of data elements, such as strings of coordinates, strings of pixel values etc., are carried in Annex C as columns in relational tables in C, B, Z or Y format.

Strings -- Strings of data elements, such as strings of coordinates, strings of pixel values etc., are carried in Annex C as columns in relational tables in C, B, Z or Y format.

5.1.2.4 IIF Coordinate Strings

Strings	-- Strings of data elements, are carried as repeating fields. There is no special structure for strings of data in the IIF encapsulation.

5.1.3 Other Data Entities

A date format YYYYMMDD is common to all encapsulations, in accordance with ISO 8601.

5.1.3.1 ISO 8211 Other Data Entities

ID Triplet	(The ID triplet field type is not used in Annex A.)
Date	A coding of date in an ASCII data field. -- an item defining calendar date in accordance with ISO 8601. A specific A type data field is constructed to carry date information. The null value is all SPACE characters in the field.
Null Field	(The use of Null data elements in not applicable for Annex A.)

5.1.3.2 ISO 8824/5 Other Data Entities

(Note: the following is ISO 8824 ANS.1 code for the identified items)

ID Triplet	(The ID triplet field type is not used in Annex B.)
Date	IMPLICIT GENERALIZEDTIME -- an item defining the local calendar date and time, in accordance with ISO 8601 for the specification of a calendar date. The null value is a zero field width.
Null Field	::= IMPLICIT NULL -- A place holder element of null value
Further-Study	::= IMPLICIT NULL -- An equivalent to "Null Field" Items which are for further study in the interchange format in Annex B are identified within the syntactic structure by a null element.

5.1.3.3 VRF Relational Tables Other Data Entities

ID Triplet

K,1
- The ID triplet field type is used in edge and node primitive tables to provide cross-tile topology and seamless databases. This field type replaces the integer foreign key used in untiled coverages. The triplet is composed of an 8-bit type byte, followed by 1-4 subfields. The type byte is broken down into four 2-bit pieces that describe the subfields (Table 5-2). Figure C-22 is an example of the ID triplet field

Table 5-2 Type Byte Definitions

Bit Count	Number Bits in Subfield
0	0
1	8
2	16
3	32

This design allows optional references to the next tile, in addition to internal references, without the necessity for having them stored exhaustively throughout the database. It also saves storage space when used with typical IDs (a sequence of IDs that runs from 1 up to 100,000 requires 92% of the space required by 32-bit integers).

Date

D,1
-- an item defining the local calendar date and time, in accordance with ISO 8601 for the specification of a calendar date in 20 bytes. Generally only the first 8 bytes are used. The null value is all SPACE characters.

Null Field

X,1
-- A place holder element of null value.

5.1.3.4 IIF Other Data Entities

Date

A coding of date in an BCS-N positive integer data field.
-- a string of characters in a BCS-N positive integer field describing a date in accordance with a format defined for each particular data field in which it is used. (YYYYMMDD or CCYYMMDDhhmmss)

5.1.4 Textual Information

This standard supports two different types of text string - basic and general text, one for labels and other identifiers represented as characters, and one for human readable text in any language. Labels and identifiers are primarily meant for computer systems and are nothing more than an alphabetic code. Therefore they can be restricted to a relatively small character set. Human readable text may be expressed in any language of the world. As such it is necessary to have much more flexibility.

Three Lexical Levels are defined for text ranging from basic ASCII text to the generality of the Multilingual Plane of the ISO 10646 standard covering virtually every language in the world using a double byte code.

These are:

Lexical Level

0 - Primary ASCII text (ISO 646)

1 - Extended ASCII (including accents for Western European Latin alphabet based languages ISO 8859 Part 1 (Latin Alphabet 1))

3 - Universal Character Set (Base Multilingual plane of ISO 10646) (note: 2 bytes per character)

2 - Obsolete - This level is based on a now obsolete ISO character coding standard and the code is retained for backward compatibility with previous versions of DIGEST.

Basic Text
Basic Text is used for all text subfields, which are alphanumeric identifiers, labels etc. and must be in ASCII only. (Lexical Level 0)

General Text
General Text is used to handle text subfields, which potentially would contain information in any language. General Text is composed of levels of alphabetic repertoire Lexical Level 1-3.

Only a small number of text fields throughout the standard may take on General Text. These General Text fields are identified in Table 5-7 below. An identifier associated with each general text field identifies the Lexical Level of that particular field. This is done in an implementation-dependent manner dependent upon the encapsulation.

The details of the method of identifying which general text fields are at which Lexical Level differs among the various encapsulations, as described in Annexes A, B, C and D.

In Annex A an optional "L" format is defined for any General Text subfield. This is a constructed text format which is implemented using ISO 8211 "A" format with the Lexical Level for that field defined in the Data Descriptive Record (DDR) of the data field in the data set.

In Annex B General Text is implemented by specifying a special General Text production which contains a tag identifying the Lexical level.

In Annex C the header for a table contains an indication of the Lexical Level of the text data in the table for a particular column.

In Annex D the IIF defines characters in terms of a Base Character Set and the Base Multilingual plane of ISO 10646. The Base Character Set - Alphanumeric (BCS-A) corresponds to BASIC TEXT (Lexical Level 0).

The Base Character Set (BCS) corresponds to GENERAL TEXT (Lexical Level 1). The Base Multilingual Plane (BMP) corresponds to GENERAL TEXT (Lexical Level 3).

General Text may also be used in text attributes. The Lexical Level of the attributes is done in an implementation-dependent manner dependent upon the encapsulation. For Annex A the value format subfield of the Explicit Attribute Labels and Values Field specifies which attributes may contain general text and the ISO 8211 Data Descriptive Record for a data field specifies the Lexical Level for that field. For Annexes B,C and D it is implemented in the same manner as for text fields within the standard.

Text is handled in the international character set standards in terms of two concepts: repertoire and coding. The repertoire is the list of possible characters, which are permitted. The coding is the assignment of computer bit patterns to identify each character. Both the repertoire and coding of the various character sets are described below. The repertoire remains the same between different encapsulations. The coding used may differ for efficiency or to accommodate restrictions such as relational form.

5.1.5 Text Syntax

5.1.5.1 ISO 8211 Text Syntax

Basic-Text (A)	ISO 8211 "A" format -- an arbitrary-length string of text characters taken from the International Reference Version (IRV) primary character code table (ASCII) as defined in ISO 646 including both the graphic G set and control C set as well as the SPACE character. The null value is a zero field width.
Basic-Text (A n)	ISO 8211 "A" format -- a string of "n" text characters taken from the International Reference Version (IRV) primary character code table (ASCII) as defined in ISO 646 including both the graphic G set and control C set as well as the SPACE character. The null value is a field filled with the DEL character.

General-Text (L)

"L" format text
- an arbitrary-length string of text taken from one of four repertoires.

0 - basic ASCII text (ISO 646)
1 - Extended ASCII (including accents for Western European Latin alphabet based languages ISO 8859 Part 1 (Latin Alphabet 1))
2 - obsolete - retained for backward compatibility
3 - Universal Character Set (Base Multilingual plane of ISO 10646) UCS-2 implementation level 2 (note: 2 bytes per character)

The null value is a zero field width. The distinction between which repertoire and coding is used is defined by the Lexical Level.

"L" format is a constructed format for ISO 8211; that is, the identifier "L" is used in the description of DIGEST in Annex A to identify those text fields which may take general text. "L" format is actually implemented as ISO 8211 "A" format, where the repertoire and coding is specified in accordance with the LEX flag or attribute.

When other than the default ASCII character set (Lexical Level 0) is used in an entire data set, ISO 8211 requires that the character sets used for each field be described in the Data Descriptive Record in the field controls which precede the field name for each field.

The character repertoires used in DIGEST are progressive supersets. This means that the highest level of character set used in any subfields in a field should be described in the DDR field controls for that field.

The following indicates the character set code identifier which should be put in DDR field controls for each Lexical Level:

Lexical Level 0 (ASCII - ISO 646 IRV) - (2/0) (2/0) (2/0)
Lexical Level 1 (Latin 1 - ISO 8859) - (2/13) (4/1) (2/0)
Lexical Level 2 obsolete -
Lexical Level 3 (Multilingual - ISO 10646) - (2/5) (2/15) (4/3)

The ISO 8211 unit terminator UT used to separate the subfields and the field terminator FT must be encoded in the character set used for the field for which they occur. See Table 5-6.

In addition DDR in Relative Position RP 17 to 19 should contain (2/0) (2/1) (2/0) to indicate that individual fields may contain extended (non-ASCII) character sets.

DDR RP 10 and 11 should contain "09" indicating that there are 9 bytes containing field controls - the last three of which are escape sequences identifying extended character sets.

If lexical level 2 or 3 is used anywhere throughout the data set then DDR RP 7 should contain "E" (rather than "SPACE") to indicate that in-line code extension may be encountered in the data file.

5.1.5.2 ISO 8824/5 Text Syntax

Basic-Text-String

::= IMPLICIT GRAPHICSTRING
- - {ISO 2022 abstract syntaxes (1) 1 6}

-- an arbitrary-length string of data taken from the International Reference Version (IRV) primary character code table (ASCII) as defined in ISO 646 including both the graphic G set and control C set as well as the SPACE character. These are registered under ISO 2375 with registration numbers 6 and 1 respectively, and standardized under CCITT recommendation T.50. The null value is a zero field width.

General-Text-String

::= CHOICE { - - an arbitrary-length string of text
- - taken from one of four repertoires.
[0] GRAPHICSTRING - - basic ASCII text (ISO 646 IRV)
- - {ISO 2022 abstract syntaxes (1) 1 6}}
[1] GRAPHICSTRING - - Extended ASCII (including
- - accents for Western European Latin alphabet based
- - languages ISO 8859 Part 1 (Latin Alphabet 1))
- - {ISO 2022 abstract syntaxes (1) 1 6 142}
[2] NULL - - obsolete
[3] GRAPHICSTRING - - Universal Character Set (Base
- - Multilingual plane of ISO 10646) (note: 2 bytes per
- - character)
- - {ISO 10646 transfer-syntaxes (0) two-octet-BMP-- - - form (2)}
}
The null value is a zero field width. The subfields which may use a General-Text-String are described in Table 5-7.

5.1.5.3 VRF Relational Tables Text Syntax

Textual information can be either variable-length or fixed-length in Annex C. The null state of a variable-length text string is of zero length. The null state of a fixed-length text string requires that a specific code be selected. The character DEL (code table position 7/15) should be used as the padding character. The character code NUL (code table position 0/0) and a number of other C0 control characters (see 5.2 below) may have special meaning on some computer systems and should not appear in any text strings. A NUL or a SUB (^Z) in a file is an "end of file" mark on some computers and should not be used in DIGEST text strings. Only those characters specified in the identified repertoire should be used at each lexical level.

Annex C does not make an explicit distinction between Basic Text and General Text. Certain data fields can only be expressed in Basic Text (ASCII).

Others may be expressed in Lexical Level 1 to 3. (The default is level 0 ASCII). These fields are identified in Table 5-7 below.

Basic-Text-String

T,n or T,*
-- a fixed-length (T,n) or an arbitrary-length (T,*) string of text characters taken from the International Reference Version (IRV) primary character code table (ASCII) as defined in ISO 646 including both the graphic G set and control C set as well as the SPACE character. The null value is a zero field width for a variable width text field or blank filled for a fixed width text field.

General-Text-String

T,n or T,* or L,n or L,* or N,n or N,* or M,n or M,*
-- an arbitrary-length string of text taken from one of four repertoires.

0 - Basic ASCII text (ISO 646)
1 - Extended ASCII (including accents for Western European Latin alphabet based languages ISO 8859 Part 1 (Latin Alphabet 1))
2 - Obsolete
3 - Universal Character Set (Base Multilingual plane of ISO 10646) UCS-2 implementation level 2 (note: 2 bytes per character)

The null value is a zero field width for a variable width text field or blank filled for a fixed width text field.

The distinction between which repertoire and coding is used is identified by the Field Type in each table header row.
The following list indicates the Field Type code for each Lexical Level:

T,n or T,*	Level 0 (ASCII - ISO 646 IRV)
L,n or L,*	Level 1 (Latin 1 - ISO 8859)
N,n or N,*	Level 2 obsolete - retained for backward compatibility
M,n or M,*	Level 3 (Multilingual - ISO10646)

The asterisk (*) indicates variable-length string. The "n" indicates a fixed-length.

5.1.5.4 IIF Text Syntax

Basic-Text-String

BCS-A
-- an arbitrary-length string of data taken from the Basic Character Set-Alphanumeric BCS-A which is a subset of the International Reference Version (IRV) primary character code table (ASCII) as defined in ISO 646. The range of allowable characters consists of space to tilde, codes 2/0 to 7/14.

General-Text-String -- an arbitrary-length string of data taken from one of three repertoires dependent upon the lexical level.

Level 0 = BCS-A (Basic Character Set-Alpha numeric) (ASCII) which is a subset of the International Reference Version (IRV) primary character code table as defined in ISO 646. The range of allowable characters consists of space to tilde, codes 2/0 to 7/14.

Level 1 = ECS (Extended Character Set) Extended ASCII and ECS-A (Extended Character Set – Alphanumeric) which are subsets of ISO 8859 Part 1 (Latin Alphabet 1)) which is also equivalent to the base page (row 0x00) of the BMP A-zone of ISO 10646. ECS is composed of the whole Level 1 text Repertoire except BackSpace (0/8), Horizontal Tab (0/9) and Vertical Tab (0/11). ECS-A is composed of character codes from 2/0 to 7/E, and A/0 to F/F

Level 2 = (not used)

Level 3 = (not used)

5.2 Code Tables

All text is defined in terms of character set code tables. Particular character codes are identified by a code table arranged into rows and columns in which 94 (or 96) character codes are assigned. A number of different character code tables are in use internationally, and these code tables are registered with the International Organization for Standardization (ISO) under ISO 2375. ISO 10646 provides a comprehensive multilingual character set, which eliminates the need to select individual alphabets from the ISO registry. ISO 10646 contains as its base page the ISO 8859 part 1 Latin alphabet 1, which itself contains as its base the International Reference Version (IRV) alphabet ISO 646. ISO 646 (IRV) is equivalent to ASCII (American Standard Code for Information Interchange ANSI X3.4).

The alphabetic part of the ISO 646 (IRV) and ISO 8859 code tables is termed the Graphic or “G” set. Another specialized code table, the Control or “C0” set, is also defined. Some of the C0 control characters are reserved for specialized use, such as transmission control in an asynchronous communications system or application level delimiting such as is used by ISO 8211 (the DIGEST Annex A encapsulation). The only Format Effector C0 characters required by DIGEST are: Carriage Return (CR), Line Feed (LF), Back Space (BS), Horizontal Tab (HT), Vertical Tab (VT) and Form Feed (FF). Since DIGEST/VRF operates in an 8-bit coding environment with three defined character repertoires corresponding to ISO standards, there is no need for the code extension characters Escape (ESC), Shift In (SI), or Shift Out (SO). All other C0 characters are not used in DIGEST text and have a null meaning. The use of C0 characters may be further restricted by a relevant product specification.

The ASCII (ISO 646 IRV) code table caters largely to the needs of the English language. It defines 94 characters within a single 7-bit code table (with bit 8 set to zero in an 8-bit implementation). For other Latin languages where accented letters are used extensively, and for other alphabets, the International Organization for Standardization (ISO) has defined other standards. There are several different standards defined by ISO dependent on the size of the repertoire of characters which must be addressed.

The ISO 8859 standard uses bit 8 of an 8-bit character field to switch between two code tables, the ASCII code table on the left and a supplementary code table on the right containing 94 additional characters. Each character has a single code.

The ISO 10646 standard defines a "Universal Character Set" for virtually all languages in the world. To do this it must use 16 bits or more to identify each character. DIGEST/VPF makes use of the Base Multilingual plane of ISO 10646 which uses 16 bits per character, handling ASCII, virtually all Latin alphabet languages, Greek, Hebrew, Cyrillic, Arabic, Chinese (Han - including Japanese Kanji and Korean Hangul), Japanese Katakana, etc. Virtually every modern alphabet is specified. Excluded are such character sets as ancient Egyptian hieroglyphics which require 32 bits per character.

The specific characters available under a given character set standard are called the repertoire of that standard. Different character set coding standards may be used as long as the character repertoires are identical. It doesn't matter whether the ISO 8211 encapsulation uses one bit combination (code) to represent a given character and ISO 8824 uses a different code, as long as the character identified is the same. Coding is an encapsulation issue, but, some of the ISO standards provide far richer repertoires of characters than do others, and therefore it is necessary in DIGEST to define several different levels of standard character repertoires. The defined repertoire of available characters is what is of principle importance for compatibility.

Three levels of repertoire are defined for DIGEST ranging from basic ASCII text to the support of any alphabet registered nationally or internationally. This range is broken into two broad levels: Basic Text and General Text.

Basic text (Level 0) is simply ASCII data and is used throughout the standard for various purposes. The repertoire is simply the 94 characters defined in the ASCII character set plus the SPACE character plus specific C0 control characters (Carriage Return (CR) and Line Feed (LF), etc.). Other C0 characters are not used in basic text.

General text includes the Latin alphabet accents and special characters and other alphabets. General text is normally used to specify attributes such as place names which can be defined in any world alphabet or for free text subfields or attributes. Three levels of general text repertoire are defined. These levels have been defined to be efficient in various encodings and at different levels of usage. For example Level 1 general text makes use of the Latin Alphabet 1 repertoire (commonly called 8-bit ASCII) which is directly compatible with virtually all computer systems. Level 1 general text addresses the needs of Western European languages. Level 2 is based on a now obsolete standard and is not used. The code level is retained for backward compatibility. Level 3 general text addresses the needs of almost all world languages, but it is less efficient in coding.

DIGEST may be extended to a fifth level of general text, which addresses the needs of all languages using the full capabilities of ISO 10646 UCS-4 requiring 4-bytes per character. However, this approach can be very complex and inefficient and is reserved for further study at this time.

5.2.1 Alphabets and Repertoire

The basic alphabet used in DIGEST is the International Reference Version alphabet of ISO 646, which is equivalent to ASCII. This alphabet is also standardized for Telematic interchange by the UN International Telegraphic Union (ITU-T), International Telephone and Telegraph Consultative Committee (CCITT). The International Reference Alphabet of CCITT recommendation T.50 is also equivalent to ASCII.

5.2.1.1 Level 0 Text Repertoire

The following code table presents the DIGEST Level 0 text repertoire, the Latin Alphabet Primary Code Table (ASCII). Both the G0 graphic and C0 control code tables are shown. Only the C0 Format Effector characters are illustrated. All other C0 control codes are not used. The code extension characters from the C0 set (ESC, SI, and SO) are not used in DIGEST. The 7-bit code table is shown. Bit 8 in an 8-bit field is set to 0.

Table 5-3 Latin Alphabet Primary Code Table; (ASCII)

				column b8	0	0	0	0	0	0	0	0
				b7	0	0	0	0	1	1	1	1
				b6	0	0	1	1	0	0	1	1
				b5	0	1	0	1	0	1	0	1
b4	b3	b2	b1	row	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
0	0	0	0	**0**			Space	**0**	**@**	**P**	**'**	**p**
0	0	0	1	**1**			**!**	**1**	**A**	**Q**	**a**	**q**
0	0	1	0	**2**			**"**	**2**	**B**	**R**	**b**	**r**
0	0	1	1	**3**			**#**	**3**	**C**	**S**	**c**	**s**
0	1	0	0	**4**			**$**	**4**	**D**	**T**	**d**	**t**
0	1	0	1	**5**			**%**	**5**	**E**	**U**	**e**	**u**
0	1	1	0	**6**			**&**	**6**	**F**	**V**	**f**	**v**
0	1	1	1	**7**			**´**	**7**	**G**	**W**	**g**	**w**
0	0	0	0	**8**	BS		**(**	**8**	**H**	**X**	**h**	**x**
0	0	0	1	**9**	HT		**)**	**9**	**I**	**Y**	**i**	**y**
0	0	1	0	**10**	LF		*****	**:**	**J**	**Z**	**j**	**z**
0	0	1	1	**11**	VT		**+**	**;**	**K**	**[**	**k**	**{**
0	1	0	0	**12**	FF		**,**	**<**	**L**	****	**l**	**|**
0	1	0	1	**13**	CR		**-**	**=**	**M**	**]**	**m**	**}**
0	1	1	0	**14**			**.**	**>**	**N**	**^**	**n**	**~**
0	1	1	1	**15**			**/**	**?**	**O**	**_**	**o**	
					CO		GO					

5.2.1.2 Level 1 Text Repertoire

The following code table presents the DIGEST Level 1 text repertoire, which is the 8-bit code table from ISO 8859 part 1. The G0 graphic portion is equivalent to ASCII (used in DIGEST Level 1 text). The same C0 code table is also used with the same restriction to only Format Effector characters. All other C0 control codes are not used. The right hand side of the 8-bit coding environment contains the ISO 8859 supplementary code table and a blank C1 table. The supplementary characters are direct characters; that is, individual character codes are assigned for each accented character in the repertoire. In DIGEST Lexical Level 0 and 1 each character is coded using a single character. There are no constructed characters. This simplifies processing of such data.

Table 5-4 Latin Alphabet 1 Code Table; ISO 8859 -1

b4	b3	b2	b1	row \ column	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
				b8	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
				b7	0	0	0	0	1	1	1	1	0	0	0	0	1	1	1	1
				b6	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1
				b5	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
0	0	0	0	**0**			Space	0	@	P	'	p			NBSP	°	À	Ð	à	ð
0	0	0	1	**1**			!	1	A	Q	a	q			¡	±	Á	Ñ	á	ñ
0	0	1	0	**2**			"	2	B	R	b	r			¢	²	Â	Ò	â	ò
0	0	1	1	**3**			#	3	C	S	c	s			£	³	Ã	Ó	ã	ó
0	1	0	0	**4**			$	4	D	T	d	t			¤	´	Ä	Ô	ä	ô
0	1	0	1	**5**			%	5	E	U	e	u			¥	µ	Å	Õ	å	õ
0	1	1	0	**6**			&	6	F	V	f	v			¦	¶	Æ	Ö	æ	ö
0	1	1	1	**7**			´	7	G	W	g	w			§	•	Ç	×	ç	÷
0	0	0	0	**8**	BS		(	8	H	X	h	x			"	¸	È	Ø	è	ø
0	0	0	1	**9**	HT		)	9	I	Y	i	y			©	¹	É	Ù	é	ù
0	0	1	0	**10**	LF		*	:	J	Z	j	z			ª	º	Ê	Ú	ê	ú
0	0	1	1	**11**	VT		+	;	K	[	k	{			«	»	Ë	Û	ë	û
0	1	0	0	**12**	FF		,	<	L	\	l	|			¬	¼	Ì	Ü	ì	ü
0	1	0	1	**13**	CR		-	=	M	]	m	}			SHY	½	Í	Ý	í	ý
0	1	1	0	**14**			.	>	N	^	n	~			®	¾	Î	Þ	î	þ
0	1	1	1	**15**			/	?	O	_	o				¯	¿	Ï	ß	ï	ÿ
					C0		G0						C1		G1					

5.2.1.3 Level 3 Text Repertoire

The Level 3 text repertoire supports all characters in the Base Multilingual Plane of ISO 10646, which is known as Universal Character Set 2 (UCS-2) for 2-byte coding. This character set is also known as "Unicode". It covers almost all languages in the world including the large iconographic character sets such as Chinese, Japanese and Korean. It is based on a 2-byte (16-bit) coding scheme.

There are several levels of sub-repertoire defined in ISO 10646 UCS-2. For DIGEST, UCS-2 level 2 is used because it permits the widest selection of characters including the combination accents used in Arabic and some other languages, but it is restricted only to unique character combinations that exist in real languages. Many computer systems only implement UCS-2 level 1, which is rigidly defined as one character per code. DIGEST data using UCS-2 level 2 would make use of default representations of any combined characters according to the rules of ISO 10646.

The two-byte coding scheme of UCS-2 makes use of two character codes (16 bits) to address into a very large code table (or plane). UCS-4 uses four 8-bit codes (32 bits) to index into an enormous code space. The base plane of the UCS-4 code space, called the base multi-lingual plane, is equivalent to the UCS-2 code plane. The other planes support less frequently needed codes such as extended Chinese, Ancient Egyptian, etc. The first eight bits of the address space of both UCS-2 and UCS-4 match the ISO 8859 character set, and the first seven bits match ASCII. To the user of a database UCS codes are just 16 or 32-bit character codes. Direct support for ISO 10646 is provided in this manner by many computer vendors.

The entire repertoire of ISO 10646 is much too large to reproduce in this standard. Reference should be made to ISO 10646-1993. In brief the alphabets supported are:

Table 5-5 Character Set Repertoire of ISO 10646 Base Multilingual Plane

Collection Number	**Name**	**Code Positions**
1	Basic Latin	0020 - 007E
2	Latin-1 Supplement	00A0 - 00FF
3	Latin Extended-A	0100 - 017F
4	Latin Extended-B	0180 - 024F
5	IPA Extensions	0250 - 02AF
6	Spacing Modifier Letters	02B0 - 02FF
7	Combining Diacritical Marks	0300 - 036F
8	Basic Greek	0370 - 03CF
9	Greek Symbols and Coptic	03D0 - 03FF
10	Cyrillic	0400 - 04FF
11	Armenian	0530 - 058F
12	Basic Hebrew	05D0 - 05EA
13	Hebrew Extended	0590 - 05CF, 05EB - 05FF
14	Basic Arabic	0600 - 0652
15	Arabic Extended	0653 - 06FF
16	Devanagari	0900 - 097F, 200C, 200D
17	Bengali	0980 - 09FF, 200C, 200D
18	Gurmukhi	0A00 - 0A7F, 200C, 200D
19	Gujarati	0A80 - 0AFF, 200C, 200D
20	Oriya	0B00 - 0B7F, 200C, 200D
21	Tamil	0B80 - 0BFF, 200C, 200D
22	Telugu	0C00 - 0C7F, 200C, 200D
23	Kannada	0C80 - 0CFF, 200C, 200D
24	Malayalam	0D00 - 0D7F, 200C, 200D
25	Thai	0E00 - 0E7F
26	Lao	0E80 - 0EFF
27	Basic Georgian	10D0 - 10FF
28	Georgian Extended	10A0 - 10CF
29	Hangul Jamo	1100 - 11FF
30	Latin Extended Additional	1E00 - 1EFF
31	Greek Extended	1F00 - 1FFF
32	General Punctuation	2000 - 206F
33	Superscripts and Subscripts	2070 - 209F
34	Currency Symbols	20A0 - 20CF
35	Combining Diacritical Marks for Symbols	20D0 - 20FF
36	Letter Like Symbols	2100 - 214F
37	Number Forms	2150 - 218F
38	Arrows	2190 - 21FF

39	Mathematical Operators	2200 - 22FF
40	Miscellaneous Technical	2300 - 23FF
41	Control Pictures	2400 - 243F
42	Optical Character recognition	2440 - 245F
43	Enclosed Alphanumerics	2460 - 24FF
44	Box Drawing	2500 - 257F
45	Block Elements	2580 - 259F
46	Geometric Shapes	25A0 - 25FF
47	Miscellaneous Symbols	2600 - 26FF
48	Dingbats	2700 - 27BF
49	CJK Symbols and Punctuation	3000 - 303F
50	Hiragana	3040 - 309F
51	Katakana	30A0 - 30FF
52	Bopomofo	3100 - 312F
53	Hangul Compatibility Jamo	3130 - 318F
54	CJK Miscellaneous	3190 - 319F
55	Enclosed CJK Letters and Months	3200 - 32FF
56	CJK Compatibility	3300 - 33FF
57	Hangul	3400 - 3D2D
58	Hangul Supplementary-A	3D2E - 44B7
59	Hangul Supplementary-B	44B8 - 4DFF
60	CJK Unified Ideograms	4E00 - 9FFF
61	Private Use Area	E000 - F8FF
62	CJK Compatibility Ideograms	F900 - FAFF
63	Alphabetic Presentation Forms	FB00 - FB4F
64	Arabic Presentation Forms-A	FB50 - FDFF
65	Combining Half Marks	FE20 - FE2F
66	CJK Compatibility Forms	FE30 - FE4F
67	Small Form Variants	FE50 - FE6F
68	Arabic Presentation Forms-B	FE70 - FEFE
69	Halfwidth and Fullwidth Forms	FF00 - FFEF
70	Specials	FFF0 - FFFD

5.2.2 Coding of Character Sets

The coding used for DIGEST Text Level 0 and 1 is simply 8-bit character codes. One character code corresponds directly to one character. Control characters used as delimiters in ISO 8211 and on some telecommunications lines are avoided. This coding is supported by all encapsulations (ISO 8211, ISO 8824/5, VRF and IIF) in the same manner.

The coding of characters in for Lexical Level 3 makes use of 16 bits per character. This approach is supported directly in the relational table encapsulation and in the ISO 8824 encapsulation. In the ISO 8211 encapsulation 16-bit character encoding is also used, however, sub fields and fields are delimited or terminated by use of the control characters "unit terminator" UT and "field terminator" FT. These control characters must be encoded in the character set used for the field in which they occur. The following table defines the terminators for each level in an ISO 8211 encapsulation.

Table 5-6 - The Coding of ISO 8211 Terminators

Lexical level	UT	FT
level 0	(1/15)	(1/14)
level 1	(1/15)	(1/14)
level 3	(0/0) (1/15)	(0/0) (1/14)

Note: In a previous version of DIGEST a coding scheme for level 3 characters, called UTF-1 that "folded" 16-bit character codes into a variable-length stream of 8-bit character codes, was used in order to avoid any conflicts with the terminator characters. The approach described above, using two byte terminator characters, was recommended by the ISO JTC1 committee that is responsible for ISO 8211. This approach is also compatible with the coding of 16-bit character codes in the International Hydrographic Organization S-57 Version 3 standard.

5.2.3 Lexical Fields

The following is a table of text subfields which may carry general text. These text fields may have a Lexical Level of 0, 1, 2 or 3.

Table 5-7 Table of General-Text Fields Defined in DIGEST

Record	**Field Name**	**Field Tag (see note 1)**	**SubField Name**	**Subfield Label (see note 1)**
GENERAL INFORMATION	GENERAL_INFORMATION (see note 2)	GEN	Free Text (e.g. description of digitizing equipment)	
SOURCE	COPYRIGHT	CPY	Copyright statement	CPZ
SUPPLEMENTARY TEXT	SUPPLEMENTARY_TEXT (see note 2)	SUP	(Free text (supplementary text)	TXT
QUALITY	OTHER_QUALITY_INFORMATIO N	QOI	Free text	OQI
TEXT REPLACEMENT (Text associated with identified feature)	FTX	TEXT	TXT	Text

Notes:

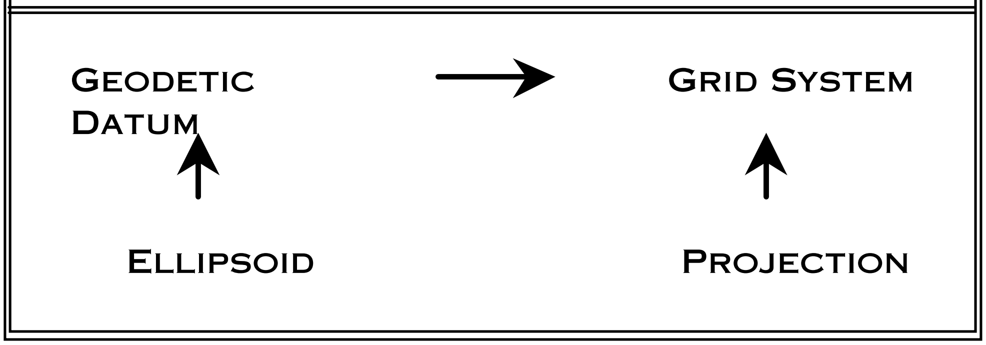
1. The Annex A Field Tags and Subfield Labels have been used for clarity.

2. Due to a limitation in ISO 8211-1985 and ISO 8211-1994 there is no capability of specifying the character set (Lexical Level) being used at the subfield level. Therefore, an entire field must be of the same Lexical Level. This affects only two fields: the GENERAL_INFORMATION field and the SUPPLEMENTARY_TEXT field. In both of these fields there exists an "A" format subfield which takes on specific values. In the GENERAL_INFORMATION field the IMR (Image Rectification Field) can take on the value "Y" or "N". In the SUPPLEMENTARY_TEXT field the TRY(Supplementary text record type) can take on the values "CONV", "CPYZ", "DATM", "MISC", "NOTE", "XXXX". Since these are specific text strings composed of only ASCII characters, and because these characters take on the same bit patterns at all Lexical Levels, there is no actual difficulty. Until this restriction is corrected in a future version of ISO 8211, care must be taken when maintaining DIGEST so that no additional "A" subfields are added to records that contain "L" format subfields.

6 GEODETIC CODES AND PARAMETERS

The 4 main geodetic concepts in this chapter are ellipsoid, datum, projection and grid system.

A geodetic datum includes an ellipsoid as one of its defining components. A grid system includes a datum and a projection among its defining components. The way in which geodetic datum, ellipsoid, grid and projection are inter-related is shown in Figure 6-1.



Concept Relationship Diagram
Each arrow means "... is an input which helps to define ..."

Figure 6-1 Concept Relationships

The codes identifying ellipsoid, datum, projection and grid are listed in Tables 6-1, 6-2, 6-5 and 6-6.

It should be noted that the grid codes in Table 6-6 are allocated to both grid systems and grid categories. A grid category includes a number of different grids, with variations in geodetic datum and/or zone of application. The most obvious example is Universal Transverse Mercator.

Each table is in alphabetic order of codes. However, where an entity and its code do <u>not</u> begin with the same letter, a cross-reference is given after the expected group of codes. For example, "Ayabelle Lighthouse *(see code PHA)*" is shown after the datum codes beginning with "A".

6.1 Ellipsoid Codes

The parameters (semimajor axis a and inverse flattening 1/f) are purely to assist ellipsoid identification. The abbreviation "*Alt:*" is used to denote alternative codes originating from DIGEST 1.2, which are included for backward compatibility.

In some cases, ellipsoids have come into existence as part of a datum definition. As a result, some ellipsoids are known by the same name as the datum, although the codes will differ.

Note the presence of special codes: NO for no ellipsoid, ZY for other known ellipsoid and ZZ for unknown ellipsoid.

Table 6-1 Ellipsoid Codes

Ellipsoid **(followed by parameters a, 1/f)**	**Ellipsoid** **Code**
Airy (1830) (6377563.396, 299.3249646)	AA *Alt:* AAY
US - Modified Airy UK - Airy Modified (6377340.189, 299.3249646)	AM *Alt:* AAM
Australian National (1966) (6378160.000, 298.2500000)	AN
APL 4.5 (1968) (6378144.000, 298.2300000)	AP
Average Terrestrial System 1977 (6378135.000, 298.2570000)	AT
Airy (War Office) (6377542.178, 299.3250000)	AW
Bessel (Modified) (6377492.018, 299.1528128)	BM
Bessel 1841 (Namibia) (6377483.865, 299.1528128)	BN
US - Bessel 1841 (Ethiopia, Indonesia, Japan, Korea) UK - Bessel (1841) Revised (6377397.155, 299.1528128)	BR
Clarke 1858 (6378235.600, 294.2606768)	CA
Clarke 1858 (Modified) (6378293.645, 294.2600000)	CB
Clarke 1866 (6378206.400, 294.9786982)	CC *Alt:* CLK
US - Clarke 1880 UK - Clarke 1880 Modified (6378249.145, 293.4650000)	CD *Alt:* CLJ
Clarke 1880 (Cape) (6378249.145, 293.4663077)	CE
Clarke 1880 (Palestine) 6378300.782, 293.4663077)	CF
Clarke 1880 (IGN) (6378249.200, 293.4660213)	CG
Clarke 1880 (Syria) (6378247.842, 293.4663517)	CI
Clarke 1880 (Fiji) (6378301.000, 293.4650000)	CJ
Clarke 1880 (Unspecified) (-,-)	CL
Danish (1876) or Andrae (6377104.430, 300.0000000)	DA

Delambre 1810 (6376985.228, 308.6400000)	DB
Delambre (Carte de France) (6376985.000, 308.6400000)	DC
US - Everest (India 1830) UK - Everest (1830) (6377276.345, 300.8017000)	EA
US - Everest (Brunei and E. Malaysia (Sabah and Sarawak)) UK - Everest (Borneo) (6377298.556, 300.8017000)	EB
US - Everest (India 1956) UK - Everest (India) (6377301.243, 300.8017000) UK takes 1/f as 300.8017255.	EC
US - Everest (W. Malaysia 1969) UK - Everest (Malaya RSO) (6377295.664, 300.8017000)	ED
US - Everest (W. Malaysia and Singapore 1948) UK - Everest (Malaya RKT) (6377304.063, 300.8017000)	EE
Everest (Pakistan) (6377309.613, 300.8017000)	EF
Everest (Unspecified) (-,-)	EV
US - Modified Fischer 1960 (South Asia) UK - Fischer 1960 (South Asia) (6378155.000, 298.3000000)	FA
Fischer 1968 (6378150.000, 298.3000000)	FC
Fischer 1960 (Mercury) (6378166.000, 298.3000000)	FM
Germaine (Djibouti) (6378284.000, 294.0000000)	GE
Geodetic Reference System: *see codes RE, RF*	
Hayford 1909 (6378388.000, 296.9592630) The original version, based on a=6378388, b=6356909.	HA
Helmert 1906 (6378200.000, 298.3000000)	HE
Hough 1960 (6378270.000, 297.0000000)	HO
IAG Best Estimate 1975 (6378140.000, 298.2570000)	IA
Indonesian National (1974) (6378160.000, 298.2470000)	ID
US - International 1924 UK - International (6378388.000, 297.0000000)	IN *Alt:* INT
Krassovsky (1940) (6378245.000, 298.3000000)	KA *Alt:* KRA
Krayenhoff 1827 (6376950.400, 309.6500000)	KB
Modified Airy: *see code AM*	

Modified Fischer: *see code FA*	
No ellipsoid	NO
NWL-8E (6378145.000, 298.2500000)	NW
Plessis Modified (6376523.000, 308.6400000)	PM
Plessis Reconstituted (6376523.994, 308.6248070)	PR
Geodetic Reference System 1967 (6378160.000, 298.2471674)	RE
Geodetic Reference System 1980 (6378137.000, 298.2572221)	RF
South American (6378160.000, 298.2500000)	SA
Soviet Geodetic System 1985 (6378136.000, 298.2570000)	SG
Ellipsoid Junction	SJ
Soviet Geodetic System 1990 (6378136.000, 298.2578393)	SN
Struve 1860 (6378298.300, 294.7300000)	ST
Svanberg (6376797.000, 304.2506000)	SV
Walbeck 1819 (Planheft 1942) (6376895.000, 302.7821565)	WA
Walbeck 1819 (AMS 1963) (6376896.000, 302.7800000)	WB
World Geodetic System 1966 (6378145.000, 298.2500000)	WC
World Geodetic System 1972 (6378135.000, 298.2600000)	WD *Alt:* WGC
World Geodetic System 1984 (6378137.000, 298.2572236)	WE *Alt:* WGE
World Geodetic System (Unspecified) (-,-)	WF
US - War Office 1924 (McCaw) UK - War Office 1924 (6378300.000, 296.0000000)	WO
World Geodetic System 1960 (6378165.000, 298.3000000)	WS
Other Known Ellipsoid	ZY
Unknown Ellipsoid	ZZ

6.2 Datum Codes

Table 6-2 provides the allowable datums and their codes for the Geodetic Datum fields. Details of transformations between most of the datums and WGS84 can be found in DMA Technical Report 8350.2.

In some cases a geodetic datum with a 3-letter code is followed by 4-letter codes referring to the same datum but specifying particular regions. See, for example, codes AINA and AINB which follow AIN.

The 4-letter codes are **not different datums**, but "regional" solutions to the datum. **Regional solutions represent regional variations in the datum's relationship with WGS 1984** (arising from regional distortions in the datum). Use of the 4-letter code is recommended when there is a need to identify that relationship.

Unless indicated otherwise at the end of the datum name, the Zero Meridian is always Greenwich. Datums with a zero meridian other than Greenwich have "1" as a 4th character in the datum code.

To assist the process of matching ellipsoids to datums, ellipsoid codes are shown in the final column.

The abbreviation "*Alt:*" is used to denote alternative codes originating from DIGEST 1.2, which are included for backward compatibility.

Note the presence of special codes:

Geodetic Datums (Table 6-2): UND for undetermined datum and ZYX for other known datum.

Sounding Datums (Table 6-4): ZYX for other known sounding datum and ZZZ for unknown.

Table 6-2 Geodetic Datum Codes

Geodetic Datums Each Horizontal Datum below can also be used as a Vertical Datum (but only in the case where the ellipsoid is the surface from which elevation is measured)	**Datum Code**	**Ellipsoid Code**
Adindan	**ADI**	CD
Adindan (Ethiopia)	**ADIA**	CD
Adindan (Sudan)	**ADIB**	CD
Adindan (Mali)	**ADIC**	CD
Adindan (Senegal)	**ADID**	CD
Adindan (Burkina Faso)	**ADIE**	CD
Adindan (Cameroon)	**ADIF**	CD
Adindan (Mean value: Ethiopia and Sudan)	**ADIM**	CD
Afgooye (Somalia)	**AFG**	KA
Antigua Island Astro 1943	**AIA**	CD
Ain el Abd 1970	**AIN**	IN
Ain el Abd 1970 (Bahrain Island)	**AINA**	IN
Ain el Abd 1970 (Saudi Arabia)	**AINB**	IN
American Samoa Datum 1962	**AMA**	CC
Amersfoort 1885/1903 (Netherlands)	**AME**	BR
Anna 1 Astro 1965 (Cocos Islands)	**ANO**	AN
Approximate Luzon Datum (Philippines)	**APL**	CC

Arc 1950	**ARF**	CD
Arc 1950 (Botswana)	**ARFA**	CD
Arc 1950 (Lesotho)	**ARFB**	CD
Arc 1950 (Malawi)	**ARFC**	CD
Arc 1950 (Swaziland)	**ARFD**	CD
Arc 1950 (Zaire)	**ARFE**	CD
Arc 1950 (Zambia)	**ARFF**	CD
Arc 1950 (Zimbabwe)	**ARFG**	CD
Arc 1950 (Burundi)	**ARFH**	CD
Arc 1950 (Mean value: Botswana, Lesotho, Malawi, Swaziland, Zaire, Zambia, and Zimbabwe)	**ARFM**	CD
Arc 1960	**ARS**	CD
Arc 1960 (Kenya)	**ARSA**	CD
Arc 1960 (Tanzania)	**ARSB**	CD
Arc 1960 (Mean value: Kenya, Tanzania)	**ARSM**	CD
Arc 1935 (Africa)	**ART**	CD
Ascension Island 1958 (Ascension Island)	**ASC**	IN
Montserrat Island Astro 1958	**ASM**	CD
Astro Station 1952 (Marcus Island)	**ASQ**	IN
Astro Beacon "E" (Iwo Jima Island)	**ATF**	IN
Average Terrestrial System 1977, New Brunswick, Nova Scotia, Prince Edward Island	**ATX**	AT
Australian Geod. 1966 (Australia and Tasmania Is.)	**AUA**	AN
Australian Geod. 1984 (Australia and Tasmania Is.)	**AUG**	AN
Astro DOS 71/4: *see code SHB*		
Astro Term Is. 1961: *see code TRN*		
Ayabelle Lighthouse: *see code PHA*		
Djakarta (Batavia) (Sumatra Island, Indonesia)	**BAT**	BR
Djakarta (Batavia) (Sumatra Island, Indonesia) with Zero Meridian Djakarta	**BAT1**	BR
Bekaa Base South End (Lebanon)	**BEK**	CG
Belgium 1950 System (Lommel Signal, Belgium) *See code ODU for Belgium 1972*	**BEL**	IN
Bermuda 1957 (Bermuda Islands)	**BER**	CC
Bissau (Guinea-Bissau)	**BID**	IN
Modified BJZ54 (China)	**BJM**	KA
BJZ54 (A954 Beijing Coordinates) (China)	**BJZ**	KA
Bogota Observatory (Colombia)	**BOO**	IN
Bogota Observatory (Colombia) with Zero Meridian Bogota	**BOO1**	IN
Bern 1898 (Switzerland)	**BRE**	BR
Bern 1898 (Switzerland) with Zero Meridian Bern	**BRE1**	BR
Bukit Rimpah (Bangka & Belitung Islands, Indonesia)	**BUR**	BR
Belgium 1972: *see code ODU*		
Bellevue (IGN): *see code IBE*		
Cape Canaveral (Mean value: Florida and Bahama Islands)	**CAC**	CC
Campo Inchauspe (Argentina)	**CAI**	IN
Camacupa Base SW End (Campo De Aviacao, Angola)	**CAM**	CD
Canton Astro 1966 (Phoenix Islands)	**CAO**	IN
Cape (South Africa)	**CAP**	CE
Camp Area Astro (Camp McMurdo Area, Antarctica)	**CAZ**	IN
S-JTSK, Czechoslovakia (prior to 1 Jan 1993)	**CCD**	BR
Carthage (Tunisia)	**CGE**	CG
Compensation Géodésique du Québec 1977	**CGX**	CC
Chatham 1971 (Chatham Island, New Zealand)	**CHI**	IN
Chua Astro (Paraguay)	**CHU**	IN

Corrego Alegre (Brazil)	**COA**	IN
Conakry Pyramid of the Service Geographique (Guinea)	**COV**	CG
Guyana CSG67	**CSG**	IN
Dabola (Guinea)	**DAL**	CD
DCS-3 Lighthouse, Saint Lucia, Lesser Antilles	**DCS**	CD
Deception Island, Antarctica	**DID**	CD
GUX 1 Astro (Guadacanal Island)	**DOB**	IN
Dominica Astro M-12, Dominica, Lesser Antilles	**DOM**	
Djakarta (Batavia): *see codes BAT, BAT1*		
DOS 1968 (Gizo Island): *see code GIZ*		
Easter Island 1967 (Easter Island)	**EAS**	IN
Wake-Eniwetok 1960 (Marshall Islands)	**ENW**	HO
European 1950	**EUR**	IN
European 1950 (Western Europe: Austria, Denmark, France, Federal Republic of Germany, Netherlands, and Switzerland)	**EURA**	IN
European 1950 (Greece)	**EURB**	IN
European 1950 (Norway and Finland)	**EURC**	IN
European 1950 (Portugal and Spain)	**EURD**	IN
European 1950 (Cyprus)	**EURE**	IN
European 1950 (Egypt)	**EURF**	IN
European 1950 (England, Channel Islands, Scotland, and Shetland Islands)	**EURG**	IN
European 1950 (Iran)	**EURH**	IN
European 1950 (Sardinia)	**EURI**	IN
European 1950 (Sicily)	**EURJ**	IN
European 1950 (England, Channel Islands, Ireland, Northern Ireland, Scotland, Shetland Islands, and Wales)	**EURK**	IN
European 1950 (Malta)	**EURL**	IN
European 1950 (Mean value: Austria, Belgium, Denmark, Finland, France, Federal Republic of Germany, Gibraltar, Greece, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, & Switzerland)	**EURM**	IN
European 1950 (Iraq, Israel, Jordan, Kuwait, Lebanon, Saudi Arabia, and Syria)	**EURS**	IN
European 1950 (Tunisia)	**EURT**	IN
European 1979 (Mean value: Austria, Finland, Netherlands, Norway, Spain, Sweden, and Switzerland)	**EUS**	IN
European Terrestrial Reference System 1989 (ETRS89)	**EUT**	RF
Oman (Oman)	**FAH**	CD
Observatorio Meteorologico 1939 (Corvo and Flores Islands, Azores)	**FLO**	IN
Fort Thomas 1955 (Nevis, St Kitts, Leeward Islands)	**FOT**	CD
Gan 1970 (Addu Atoll, Republic of Maldives)	**GAA**	IN
Gandajika Base (Zaire)	**GAN**	IN
Geocentric Datum of Australia (GDA)	**GDS**	RF
GDZ80 (China)	**GDZ**	IA
Geodetic Datum 1949 (New Zealand)	**GEO**	IN
DOS 1968 (Gizo Island, New Georgia Islands)	**GIZ**	IN
Graciosa Base SW (Faial, Graciosa, Pico, Sao Jorge, and Terceira Island, Azores)	**GRA**	IN
Greek Datum, Greece	**GRK**	BR
Greek Geodetic Reference System 1987 (GGRS 87)	**GRX**	RF
Gunong Segara (Kalimantan Island, Indonesia)	**GSE**	BR
Gunong Serindung	**GSF**	BR
Guam 1963	**GUA**	CC
GUX 1 Astro: *see code DOB*		

Guyana CSG67: *see code CSG*		
Herat North (Afganistan)	**HEN**	IN
Hermannskogel	**HER**	BR
Provisional South Chilean 1963 (or Hito XVIII 1963) (S. Chile, 53°S)	**HIT**	IN
Hjörsey 1955 (Iceland)	**HJO**	IN
Hong Kong 1963 (Hong Kong)	**HKD**	IN
Hong Kong 1929	**HKO**	CA
Hu-Tzu-Shan	**HTN**	IN
Hungarian 1972	**HUY**	RE
Bellevue (IGN) (Efate and Erromango Islands)	**IBE**	IN
Indonesian 1974	**IDN**	ID
Indian	**IND**	
Indian (Thailand and Vietnam)	**INDA**	
Indian (Bangladesh)	**INDB**	EA
Indian (India and Nepal)	**INDI**	EC
Indian (Pakistan)	**INDP**	EF
Indian (1954)	**INF**	EA
Indian 1954 (Thailand)	**INFA**	EA
Indian 1960	**ING**	EA
Indian 1960 (Vietnam: near 16°N)	**INGA**	EA
Indian 1960 (Con Son Island (Vietnam))	**INGB**	EA
Indian 1975	**INH**	EA
Indian 1975 (Thailand)	**INHA**	EA
Ireland 1965 (Ireland and Northern Ireland)	**IRL**	AM
ISTS 061 Astro 1968 (South Georgia Islands)	**ISG**	IN
ISTS 073 Astro 1969 (Diego Garcia)	**IST**	IN
Johnston Island 1961 (Johnston Island)	**JOH**	IN
Kalianpur (India)	**KAB**	EC
Kandawala (Sri Lanka)	**KAN**	EA
Kertau 1948 (or Revised Kertau) (West Malaysia and Singapore)	**KEA**	EE
KCS 2, Sierra Leone	**KCS**	WO
Kerguelen Island 1949 (Kerguelen Island)	**KEG**	IN
Korean Geodetic System 1995 (South Korea)	**KGS**	RF
KKJ (or Kartastokoordinaattijarjestelma), Finland	**KKX**	IN
Kusaie Astro 1951	**KUS**	IN
Kuwait Oil Company (K28)	**KUW**	CD
L.C. 5 Astro 1961 (Cayman Brac Island)	**LCF**	CC
Leigon (Ghana)	**LEH**	CD
Liberia 1964 (Liberia)	**LIB**	CD
Lisbon (Castelo di São Jorge), Portugal	**LIS**	
Local Astro.	**LOC**	
Loma Quintana (Venezuela)	**LOM**	IN
Luzon	**LUZ**	CC
Luzon (Philipines except Mindanao Island)	**LUZA**	CC
Luzon (Mindanao Island)	**LUZB**	CC
Marco Astro (Salvage Islands)	**MAA**	IN
Martinique Fort-Desaix	**MAR**	IN
Massawa (Eritrea, Ethiopia)	**MAS**	BR
Manokwari (West Irian)	**MAW**	
Mayotte Combani	**MCX**	IN
Mount Dillon, Tobago	**MDT**	CB
Merchich (Morocco)	**MER**	CG
Midway Astro 1961 (Midway Island)	**MID**	IN
Mahe 1971 (Mahe Island)	**MIK**	CD

Minna	**MIN**	CD
Minna (Cameroon)	**MINA**	CD
Minna (Nigeria)	**MINB**	CD
Rome 1940 (or Monte Mario 1940), Italy	**MOD**	IN
Rome 1940 (or Monte Mario 1940), Italy, with Zero Meridian Rome	**MOD1**	IN
Montjong Lowe	**MOL**	BR
M'Poraloko (Gabon)	**MPO**	CD
Viti Levu 1916 (Viti Levu Island, Fiji Islands)	**MVS**	CD
Modified BJZ54: *see code BJM*		
Montserrat Island Astro 1958: *see code ASM*		
Nahrwan	**NAH**	CD
Nahrwan (Masirah Island, Oman)	**NAHA**	CD
Nahrwan (United Arab Emirates)	**NAHB**	CD
Nahrwan (Saudi Arabia)	**NAHC**	CD
Naparima (BWI, Trinidad and Tobago)	**NAP**	IN
North American 1983	**NAR**	RF
North American 1983 (Alaska, excluding Aleutian Islands)	**NARA**	RF
North American 1983 (Canada)	**NARB**	RF
North American 1983 (CONUS)	**NARC**	RF
North American 1983 (Mexico and Central America))	**NARD**	RF
North American 1983 (Aleutian Islands)	**NARE**	RF
North American 1983 (Hawaii)	**NARH**	RF
North American 1927	**NAS**	CC
North American 1927 (Eastern US)	**NASA**	CC
North American 1927 (Western US)	**NASB**	CC
North American 1927 (Mean value: CONUS)	**NASC**	CC
North American 1927 (Alaska)	**NASD**	CC
North American 1927 (Mean value: Canada)	**NASE**	CC
North American 1927 (Alberta and British Columbia)	**NASF**	CC
North American 1927 (Newfoundland, New Brunswick, Nova Scotia and Quebec)	**NASG**	CC
North American 1927 (Manitoba and Ontario)	**NASH**	CC
North American 1927 (Northwest Territories and Saskatchewan)	**NASI**	CC
North American 1927 (Yukon)	**NASJ**	CC
North American 1927 (Mexico)	**NASL**	CC
North American 1927 (Central America - Belize, Costa Rica, El Salvador, Guatemala, Honduras, and Nicaragua)	**NASN**	CC
North American 1927 (Canal Zone)	**NASO**	CC
North American 1927 (Caribbean, Barbados, Caicos Islands, Cuba, Dominican Republic, Grand Cayman, Jamaica, Leeward Islands, and Turks Islands)	**NASP**	CC
North American 1927 (Bahamas, except San Salvador Island)	**NASQ**	CC
North American 1927 (San Salvador Island)	**NASR**	CC
North American 1927 (Cuba)	**NAST**	CC
North American 1927 (Hayes Peninsula, Greenland)	**NASU**	CC
North American 1927 (Aleutian Islands East of 180°W)	**NASV**	CC
North American 1927 (Aleutian Islands West of 180°W)	**NASW**	CC
Revised Nahrwan	**NAX**	CD
New French or Nouvelle Triangulation Française (NTF) with Zero Meridian Paris	**NFR1** ***Alt:* FDA**	CG
North Sahara 1959	**NSD**	CD
Ocotopeque, Guatemala	**OCO**	
Belgium 1972 (Observatoire d'Uccle)	**ODU**	IN
Old Egyptian (Egypt)	**OEG**	HE

Ordnance Survey of Great Britain 1936	**OGB**	AA
Ordnance Survey G.B. 1936 (England)	**OGBA**	AA
Ordnance Survey G.B. 1936 (England, Isle of Man, and Wales)	**OGBB**	AA
Ordnance Survey G.B. 1936 (Scotland and Shetland Islands)	**OGBC**	AA
Ordnance Survey G.B. 1936 (Wales)	**OGBD**	AA
Ordnance Survey G.B. 1936 (Mean value: England, Isle of Man, Scotland, Shetland, and Wales)	**OGBM**	AA
Old Hawaiian	**OHA**	CC
Old Hawaiian (Hawaii)	**OHAA**	CC
Old Hawaiian (Kauai)	**OHAB**	CC
Old Hawaiian (Maui)	**OHAC**	CC
Old Hawaiian (Oahu)	**OHAD**	CC
Old Hawaiian (Mean value)	**OHAM**	CC
Oslo Observatory (Old), Norway	**OSL**	BM
Oman: *see code FAH*		
Observatorio Meteorologico 1939: *see code FLO*		
Padang Base West End (Sumatra, Indonesia)	**PAD**	BR
Padang Base West End (Sumatra, Indonesia) with Zero Meridian Djakarta	**PAD1**	BR
Palestine 1928 (Israel, Jordan)	**PAL**	CF
Potsdam or Helmertturm (Germany)	**PDM**	IN
Ayabelle Lighthouse (Djibouti)	**PHA**	CD
Pitcairn Astro 1967 (Pitcairn Island)	**PIT**	IN
Pico de las Nieves (Canary Islands)	**PLN**	IN
SE Base (Porto Santo) (Porto Santo & Madeira Islands)	**POS**	IN
Provisional South American 1956	**PRP**	IN
Prov. S. American 1956 (Bolivia)	**PRPA**	IN
Prov. S. American 1956 (Northern Chile near 19°S)	**PRPB**	IN
Prov. S. American 1956 (Southern Chile near 43°S)	**PRPC**	IN
Prov. S. American 1956 (Columbia)	**PRPD**	IN
Prov. S. American 1956 (Ecuador)	**PRPE**	IN
Prov. S. American 1956 (Guyana)	**PRPF**	IN
Prov. S. American 1956 (Peru)	**PRPG**	IN
Prov. S. American 1956 (Venezuela)	**PRPH**	IN
Prov. S. American 1956 (Mean value: Bolivia, Chile, Colombia, Ecuador, Guyana, Peru, & Venezuela)	**PRPM**	IN
Point 58 Mean Solution (Burkina Faso and Niger)	**PTB**	CD
Pointe Noire 1948	**PTN**	CD
Pulkovo 1942 (Russia)	**PUK**	KA
Puerto Rico (Puerto Rico and Virgin Islands)	**PUR**	CC
Provisional South Chilean 1963: *see code HIT*		
Qatar National (Qatar)	**QAT**	IN
Qornoq (South Greenland)	**QUO**	IN
Rauenberg (Berlin, Germany)	**RAU**	BR
Reconnaissance Triangulation, Morocco	**REC**	CG
Reunion 1947	**REU**	IN
RT90, Stockholm, Sweden	**RTS**	BR
Revised Nahrwan: *see code NAX*		
Rome 1940: *see codes MOD, MOD1*		
Santo (DOS) 1965 (Espirito Santo Island)	**SAE**	IN
South African (South Africa)	**SAF**	CD
Sainte Anne I 1984 (Guadeloupe)	**SAG**	
South American 1969	**SAN**	SA
South American 1969 (Argentina)	**SANA**	SA

South American 1969 (Bolivia)	**SANB**	SA
South American 1969 (Brazil)	**SANC**	SA
South American 1969 (Chile)	**SAND**	SA
South American 1969 (Columbia)	**SANE**	SA
South American 1969 (Ecuador)	**SANF**	SA
South American 1969 (Guyana)	**SANG**	SA
South American 1969 (Paraguay)	**SANH**	SA
South American 1969 (Peru)	**SANI**	SA
South American 1969 (Baltra, Galapagos Islands)	**SANJ**	SA
South American 1969 (Trinidad and Tobago)	**SANK**	SA
South American 1969 (Venezuela)	**SANL**	SA
South American 1969 (Mean value: Argentina, Bolivia, Brazil, Chile, Columbia, Ecuador, Guyana, Paraguay, Peru, Trinidad and Tobago, and Venezuela)	**SANM**	SA
Sao Braz (Sao Miguel, Santa Maria Islands, Azores)	**SAO**	IN
Sapper Hill 1943 (East Falkland Islands)	**SAP**	IN
Schwarzeck (Namibia)	**SCK**	BN
Soviet Geodetic System 1985	**SGA**	SG
Soviet Geodetic System 1990	**SGB**	SG
Selvagem Grande 1938 (Salvage Islands)	**SGM**	IN
Astro DOS 71/4 (St. Helena Island)	**SHB**	IN
Sierra Leone 1960	**SIB**	CD
South Asia (Southeast Asia, Singapore)	**SOA**	FA
S-42 (Pulkovo 1942)	**SPK**	KA
St. Pierre et Miquelon 1950	**SPX**	CC
Stockholm 1938 (Sweden)	**STO**	BR
Sydney Observatory, New South Wales, Australia	**SYO**	CB
SE Base (Porto Santo): *see code POS*		
S-JTSK: *see code CCD*		
Tananarive Observatory 1925	**TAN**	IN
Tananarive Observatory 1925, with Zero Meridian Paris	**TAN1**	IN
Tristan Astro 1968 (Tristan da Cunha)	**TDC**	IN
Timbalai 1948 (Brunei and East Malaysia - Sarawak and Sabah)	**TIL**	EB
Timbalai 1968	**TIN**	BR
Tokyo	**TOY**	BR
Tokyo (Japan)	**TOYA**	BR
Tokyo (Korea)	**TOYB**	BR
Tokyo (Okinawa)	**TOYC**	BR
Tokyo (Mean value: Japan, Korea, and Okinawa)	**TOYM**	BR
Trinidad 1903	**TRI**	CA
Astro Tern Is. 1961 (Tern Island, Hawaii)	**TRN**	IN
Undetermined or Unknown *(see Note 1)*	**UND**	
Voirol 1875	**VOI**	CG
Voirol 1875 with Zero Meridian Paris	**VOI1**	CG
Viti Levu 1916: *see code MVS*		
Wake Island Astro 1952	**WAK**	IN
World Geodetic System 1960	**WGA**	WS
World Geodetic System 1966	**WGB**	WC
World Geodetic System 1972	**WGC**	WD
World Geodetic System 1984	**WGE**	WE
Wake-Eniwetok 1960: *see code ENW*		
Yacare (Uruguay)	**YAC**	IN
Zanderij (Surinam)	**ZAN**	IN
Other Known Datum	**ZYX**	

Note 1. In the case of an unknown or unspecified datum, it is potentially dangerous to assume a default of WGS 84. Unless the application is small-scale mapping and the zero meridian is known to be Greenwich, such an assumption could cause significant positioning errors.

Table 6-3 Codes for Vertical Datums

Vertical Datum Reference	Code
Geodetic *(see Note 1)*	GEOD
Name of a gravity-related surface *(see Note 2)* Examples: Mean Sea Level Singapore EGM96 Model Geoid	MSL

Note 1. In the geodetic case, elevations in the dataset are referenced to the ellipsoid of the specified geodetic datum, which means they are ellipsoidal heights.

Note 2. In the case of a gravity-related surface, elevations in the dataset are referenced to:

Mean Sea Level, an average level of the surface of the sea for all stages of the tide. Derived from localised measurements of the sea surface over a given period of time, using one or more tide gauges (example: Mean Sea Level Singapore).

OR

Geopotential Model, a mathematically-defined surface which closely models mean sea level (example: EGM96 Model Geoid).

Table 6-4 Codes for Sounding Datums

Sounding Datum	Code
Approximate Lowest Astronomical Tide	ALAT
Approximate Mean Low Water Springs	AMLS
Approximate Mean Low Water Tide	AMLT
Approximate Mean Low Water	AMLW
Approximate Mean Sea Level	AMSL
Chart Datum (Unspecified)	CD
Equinoctial Spring Low Water	ESLW
Highest Astronomical Tide	HAT
Higher High Water Large Tide	HHLT
Highest Normal High Water	HNHR
Higher High Water	HRHW
Highest High Water	HTHW
High Water	HW
High Water Springs	HWS
International Great Lakes Datum 1985	IGLD
Indian Spring High Water	ISHW
Indian Spring Low Water	ISLW
Lowest Astronomical Tide	LAT
Local Datum (arbitrary datum defined by local harbour authority)	LD
Lower Low Water Large Tide	LLLT

Lowest Low Water Springs	LLWS
Lower Low Water	LRLW
Lowest Low Water	LTLW
Low Water	LW
Low Water Springs	LWS
Mean Higher High Water	MHHW
Mean Higher Water	MHRW
Mean High Water	MHW
Mean High Water Neaps	MHWN
Mean High Water Springs	MHWS
Mean Lower Low Water Springs	MLLS
Mean Lower Low Water	MLLW
Mean Low Water	MLW
Mean Low Water Neaps	MLWN
Mean Low Water Springs	MLWS
Mean Sea	MSL
Mean Tide Level	MTL
Nearly Lowest Low Water	NLLW
Neap Tide	NT
Spring Tide	ST
VALUE INTENTIONALLY LEFT BLANK	VILB
Other Known Sounding Datum	ZYX
Unknown	ZZZ

Individual sounding datums are defined in the IHO Hydrographic Dictionary.

6.3 Projection Codes and Parameters

Table 6-5 provides the allowable projections and their codes and parameters for the Dataset Map Projection Group. These codes and parameters are necessary for conversion of geographic coordinates to/from grid coordinates (as used on a map). Also needed are Easting False Origin and Northing False Origin, as well as the geodetic datum.

The abbreviation "*Alt:*" is used to denote alternative codes originating from DIGEST 1.2, which are included for backward compatibility.

Note the presence of a special code ZY for other known projection.

Table 6-5 Projection Codes and Parameters

Projection	**Proj'n Code**	**Parameters**			
		1	**2**	**3**	**4**
Albers Equal-Area Conic	**AC**	Longitude of Origin	Std. Parallel Nearer to Equator	Std. Parallel Farther from Equator	Latitude of Origin *(see Note 5)*
(Lambert) Azimuthal Equal-Area	**AK**	Longitude of Proj. Origin	Latitude of Proj. Origin	-	-
Azimuthal Equidistant	**AL**	Longitude of Proj. Origin	Latitude of Proj. Origin	-	-
Bonne	**BF**	Longitude of Proj. Origin	Latitude of Proj. Origin	Scale Factor at Proj. Origin	-

Equidistant Conic with 1 Standard Parallel	**CC**	Longitude of Central Meridian	Latitude of Proj. Origin	Latitude of Standard Parallel	-
Equirectangular (La Carte Parallélogrammatique)	**CP**	Longitude of Central Meridian	Latitude of True Scale	Radius of Sphere *(see Note 2)*	-
Cassini-Soldner	**CS**	Longitude of Proj. Origin	Latitude of Proj. Origin	-	-
Cylindrical Equal Area: *see code LI*					
Eckert VI	**ED**	Longitude of Central Meridian	Radius of Sphere *(see Note 2)*	-	-
Eckert IV	**EF**	Longitude of Central Meridian	Radius of Sphere *(see Note 2)*	-	-
Equidistant Conic: *see codes CC, KA*					
Equirectangular: *see code CP*					
French Lambert: *see code MJ*					
Gnomonic	**GN**	Longitude of Proj. Origin	Latitude of Proj. Origin	-	-
General Vertical Near-Side Perspective: *see code VX*					
Hotine Oblique Mercator based on 2 Points	**HX**	Scale Factor at Proj. Origin	Latitude of Proj. Origin	Longitude of 1st Point defining Central Line	Latitude of 1st Point defining Central Line
(Note the 5th and 6th Parameters shown right.)		Longitude of 2nd Point defining Central Line	Latitude of 2nd Point defining Central Line	-	-

Hotine Oblique Mercator (RSO): *see code RS*					
Equidistant Conic with 2 Standard Parallels	**KA**	Longitude of Central Meridian	Latitude of Origin *(see Note 5)*	Latitude of Standard Parallel Nearer to Equator	Latitude of Standard Parallel Farther from Equator
Laborde	**LA**	Longitude of Proj. Origin	Latitude of Proj. Origin	Scale Factor at Proj. Origin	Azimuth at Origin of Axis of constant scale
Lambert Conformal Conic *(see Note 1)*	**LE**	Longitude of Origin	Std. Parallel Nearer to Equator	Std Parallel Farther from Equator	Latitude of Origin *(see Note 5)*
Cylindrical Equal Area	**LI**	Longitude of Central Meridian	Latitude of Origin	-	-
Lambert Equal-Area Meridional	**LJ**	Longitude of Central Meridian	Latitude of Proj. Origin	-	-
Lambert Azimuthal Equal-Area: *see code AK*					
Mercator	**MC**	Longitude of Central Meridian	Latitude of True Scale	Latitude of Reference Origin *(see Note 6)*	-
Miller Cylindrical	**MH**	Longitude of Central Meridian	Radius of Sphere *(see Note 2)*	-	-
French Lambert	**MJ**	Longitude of Proj. Origin	Latitude of Proj. Origin	Scale Factor at Proj. Origin	-
Mollweide	**MP**	Longitude of Central Meridian	Radius of Sphere *(see Note 2)*	-	-
New Zealand Map Grid	**NT**	Longitude of Proj. Origin	Latitude of Proj. Origin	-	-
Oblique Mercator	**OC**	Longitude of Reference Point on Great Circle	Latitude of Reference Point on Great Circle	Azimuth of Great Circle at Reference Point	Radius of Sphere *(see Note 2)*
Orthographic	**OD**	Longitude of Proj. Origin	Latitude of Proj. Origin	Radius of Sphere *(see Note 2)*	-
Oblique Stereographic: *see code SD*					
Polar Stereographic	**PG**	Central Meridian (Longitude straight down from Pole on map)	Latitude of True Scale	-	-
Polyconic	**PH**	Longitude of Central Meridian	Latitude of Proj. Origin	-	-

Hotine Oblique Mercator (Rectified Skew Orthomorphic)	**RS** ***Alt:* RB**	Longitude of Proj. Origin	Latitude of Proj. Origin	Azimuth East of North for Central Line (Skew X-Axis) at Proj. Origin	Scale Factor at Proj. Origin
Robinson	**RX**	Longitude of Central Meridian	Radius of Sphere *(see Note 2)*	-	-
Sinusoidal	**SA**	Longitude of Central Meridian	Radius of Sphere *(see Note 2)*	-	-
Oblique Stereographic	**SD**	Longitude of Origin	Latitude of Origin	Scale Factor at Origin	-
Space Oblique Mercator	**SX**	Application Code *(see Note 3)*	Vehicle Number *(see Note 4)*	Orbital Path Number *(see Note 4)*	
Transverse Mercator	**TC**	Longitude of Central Meridian	Central Scale Factor	Latitude of Origin *(see Note 5)*	-
Transverse Cylindrical Equal Area	**TX**	Longitude of Central Meridian	Latitude of Origin	Scale Factor along Central Meridian	-
Van der Grinten	**VA**	Longitude of Central Meridian	Radius of Sphere *(see Note 2)*	-	-
General Vertical Near-Side Perspective	**VX**	Longitude of Proj. Origin	Latitude of Proj. Origin	Height of Perspective Point above Surface (in metres)	-
Other Known Projection	**ZY**	-	-	-	-

Note 1. The parameters of the Lambert Conformal Conic projection are based on the version derived from 2 Standard Parallels. Where the projection is derived from a single standard parallel with a scale factor, data producers need to compute the equivalent parameters for the 2-standard-parallel case.

Note 2. This radius can be omitted if the chosen sphere has the same surface area as the chosen ellipsoid. The radius R which has that property may be derived from the ellipsoid parameters as follows:

Compute e^2 and e from $e^2 = 2*f - f^2$.
$Qp = 1 + ((1-e^2)/(2*e))*Ln((1-e)/(1+e))$.
$R = a*Sqrt(Qp/2)$.

Note 3. Application Code:

1 = “Landsat, USGS equations”.
2 = “Landsat, EOSAT equations”.
(Other values to be added as and when required.)

Note 4. These parameters combined with the Application Code determine the mathematical parameters used in the projection.

Note 5. The Origin included here is the point where Easting False Origin and Northing False Origin are applied, rather than the Projection Origin.

Note 6. This parameter is the latitude where Northing False Origin is defined. If it is the Equator, which is the usual and recommended choice, it can be omitted.

6.4 Grid Codes

Table 6-6 provides the allowable grids and their codes for the Grid System field.

To assist the process of matching datums and projections to grids, datum codes and projection codes are shown in the last 2 columns.

It should be noted that some of the entries are **grid categories**, that is to say there is more than one possible grid. This can be due to more than one possible datum or more than one possible zone, or indeed both. In a small number of cases, a grid category covers zones which use different projections. Grid categories are marked with an asterisk (*).

In the context of a DIGEST dataset, the possible ambiguity of a grid category is resolved when the datum, projection and the values of the projection parameters are specified. Zone number may also be specified to improve identification.

Note the presence of special code MS for other known grid.

Table 6-6 Grid Codes

Grid Description	**Grid Code**	**Datum Code**	**Proj'n Code**
Aden Zone	**AD**		LE
Afghanistan Gauss-Krüger Grid	**AF**		TC
Air Defense Grid	**AG**		
Air Support Grid	**AI**		
Alabama Coordinate System * *(see Note 2)*	**AJ**		TC
Alaska Coordinate System * *(see Notes 1 and 2)*	**AK**		
Algeria Zone *	**AL**		MJ
Albania Bonne Grid	**AM**		BF
Alpha-Numeric (Atlas) Grid	**AN**		
Arbitrary Grid	**AO**		
American Samoa Coordinate System * *(see Note 2)*	**AP**		LE
Argentine Gauss-Krüger Conformal Grid *	**AQ**		TC
Artillery Referencing System	**AR**		
Arizona Coordinate System * *(see Note 2)*	**AS**		TC
Map Grid of Australia 1994 (MGA94) *	**AT**	GDS	TC
Australia Belt *	**AU**		TC
Arkansas Coordinate System * *(see Note 2)*	**AV**		LE
Australian Map Grid *	**AW**		TC
Azores Gauss Conformal Grid	**AX**	LOC	TC
Azores Zone	**AZ**	LOC	LE
Austria Gauss-Krüger Grid: *see code KA*			
Baku 1927 Coordinate System	**BA**		
Bavaria Soldner Coordinate System	**BB**		
Belgium Lambert Grid *	**BC**		
Baltic Region Transverse Mercator Grid	**BD**	EUT	TC

Belgium Bonne Grid	**BE**		BF
Brazil Gauss Conformal Grid *	**BF**		TC
Soldner-Berlin (Müggelberg) Grid	**BL**	RAU	
Borneo Rectified Skew Orthomorphic Grid *	**BO**		RS
British West Indies Grid *	**BW**		TC
British Cassini Grid: *see code CW*			
Bulgaria Gauss-Krüger Grid: *see code KB*			
California Coordinate System * *(see Note 2)*	**CB**		LE
Canada British Modified Grid	**CD**		
Ceylon Belt (Transverse Mercator)	**CE**	IND	TC
Canary Islands (Spanish Lambert Grid)	**CF**		
Chile Gauss Conformal Grid *	**CG**		TC
China Belt *	**CH**		TC
Canary Islands Zone	**CI**		LE
China Lambert Zone	**CJ**		LE
Colorado Coordinate Zone * *(see Note 2)*	**CK**		LE
Connecticut Coordinate System * *(see Note 2)*	**CM**		LE
Caspian Zone	**CN**		LE
Costa Rica Lambert Grid	**CO**	OCO	LE
Crimea Grid	**CQ**		LE
Crete Zone	**CR**		LE
Cuba Lambert Grid *	**CT**	NAS	LE
Caucasus Zone	**CU**	NAH	LE
Cape Verde Islands Zone	**CV**		LE
British Cassini Grid *	**CW**	OGB	CS
Czechoslovak Uniform Cadastral Coordinate System	**CX**		
Cyprus Grid *	**CY**		CS
Czechoslovak Military Grid	**CZ**	HER	
Cape Verde Peninsula Grid: *see code DK*			
Colombia Gauss Conformal Grid: *see code KF*			
Danube Zone	**DA**	GRK	LE
Dahomey Belt	**DB**		
Denmark General Staff Grid	**DC**		
Delaware Coordinate System * *(see Note 2)*	**DD**		TC
Dominican Lambert Grid	**DE**		LE
Denmark Geodetic Institute System 1934	**DJ**		
Cape Verde Peninsula Grid	**DK**		
East Africa Belt *	**EA**		TC
English Belt	**EB**		TC
Egypt Gauss Conformal Grid *	**ED**		TC
El Salvador Lambert Grid	**EE**		LE
Estonian Grid	**EF**		
Estonia Lambert Conformal Grid	**EL**	EUT	LE
Hungarian Unified National Mapping System (EOTR)	**EO**	HUY	TC
Egypt Purple Belt	**EP**		TC
Egypt Red Belt *	**ER**		TC
Egypt 35 Degree Belt	**ET**	OEG	
Fernando Poo Gauss Grid	**FA**		
Fiji Grid	**FB**		
Florida Coordinate System * *(see Notes 1 and 2)*	**FC**		
French Bonne Grid	**FD**		BF
French Guiana Gauss Grid	**FE**		TC
French Somaliland Gauss-Laborde Grid	**FF**		
French Indochina Grid	**FI**		

Franz Josef Land Zone	**FJ**		LE
French Lambert Grid *	**FL**		MJ
Formosa (Taiwan) Gauss-Schreiber Coordinate System	**FO**		
French Equatorial Africa Grid	**FS**		
Finland Gauss-Krüger Grid: *see code KF*			
Gabon Belt *	**GA**		TC
Gauss-Boaga Grid (Transverse Mercator)	**GB**	EUR	TC
Gabon Gauss Conformal Grid	**GC**		TC
Geographic Reference System (GEOREF) *	**GE**		
Guadeloupe Gauss-Laborde Grid	**GF**		
Colombia Gauss Conformal Grid	**GG**	BOO	TC
Sweden Gauss-Hannover Grid	**GH**		TC
Georgia Coordinate System * *(see Note 2)*	**GI**		TC
Gauss-Krüger Grid (Transverse Mercator) *	**GK**		TC
Greece Azimuthal Grid	**GL**		
German Army Grid (DHG) *	**GN**		TC
Ghana National Grid	**GO**		TC
Greece Bonne Grid	**GP**		BF
Greece Conical Mecklenburg Coordinates	**GQ**		LE
Greece Conical Mecklenburg Coordinate (New Numbering)	**GR**		LE
Greenland Lambert Grid	**GT**	NAS	LE
Guinea Zone	**GU**		LE
Guam Coordinate System	**GV**		
Guatemala Lambert Grid	**GW**		LE
Guyana Transverse Mercator Grid	**GY**	LOC	TC
German Gauss-Krüger Grid: *see code KG*			
Haiti Lambert Grid	**HB**		LE
Hawaii Coordinate System * *(see Note 2)*	**HC**		TC
Hawaii Grid	**HD**		
Honduras Lambert Grid	**HE**		LE
Hong Kong New System Cassini Grid	**HF**	HKO	CS
Hungary Stereographic Grid	**HG**	LOC	
Hong Kong Colony Grid	**HR**		
Hungarian Unified National Mapping System: *see code EO*			
Idaho Coordinate System * *(see Note 2)*	**IA**		TC
Illinois Coordinate System * *(see Note 2)*	**IB**		TC
Indiana Coordinate System * *(see Note 2)*	**IC**		TC
Indonesia Mercator Grid	**ID**		MC
Indonesia Polyhedric Grid *	**IE**		
Iowa Coordinate System * *(see Note 2)*	**IF**		LE
Ivory Coast Azimuthal Grid	**IG**		
Irish Cassini Grid	**IH**	EUR	CS
Ivory Coast Belt	**IJ**		
Irish Transverse Mercator Grid	**IK**	IRL	TC
Iceland New Lambert Zone	**IL**	HJO	LE
India Zone *	**IN**		LE
Iberian Peninsula Zone	**IP**		LE
Iraq Zone *	**IQ**		LE
Iraq National Grid	**IR**		TC
Italy Zone *	**IT**		LE
Ivy - Found on an HA in Marshall Islands	**IY**		
Iceland Zone	**IZ**	HJO	LE
Jamaica Foot Grid	**JA**		LE
Japan Plane-Rectangular Coordinate System	**JB**		

Japan Gauss-Schreiber Grid	**JC**		
Jamaica National Grid (metric)	**JM**		LE
Johore Grid	**JO**		CS
Austria Gauss-Krüger Grid	**KA**		TC
Bulgaria Gauss-Krüger Grid	**KB**		TC
Katanga Grid	**KC**		
Kansas Coordinate System * *(see Note 2)*	**KD**		LE
Kentucky Coordinate System * *(see Note 2)*	**KE**		LE
Finland Gauss-Krüger Grid	**KF**		TC
German Gauss-Krüger Grid	**KG**		TC
Kenya Colony Grid	**KH**		CS
Korea Gauss-Schreiber Coordinate System	**KJ**		
Louisiana Coordinate System * *(see Note 2)*	**KK**		LE
Lithuania Gauss-Krüger Grid	**KL**		TC
Kwantung Province Grid	**KN**		
Turkey Gauss-Krüger Grid	**KT**		TC
Kwangsi Province Grid	**KW**		
Luxembourg Gauss-Krüger Grid	**KX**	EUR	TC
Lambert Conformal Conic Grid *	**LC**		
Latvia Coordinate System	**LD**		
Levant Zone	**LE**	EUR	MJ
Levant Stereographic Grid	**LF**		
Liberia Rectified Skew Orthomorphic Grid	**LG**		RS
Libya Zone	**LI**	EUR	LE
Lithuanian LKS-94 Grid	**LK**	EUT	TC
Sirte (Libya) Lambert Grid	**LL**		LE
Lithuania Gauss-Krüger Grid: *see code KL*			
Louisiana Coordinate System: *see code KK*			
Luxembourg Gauss-Krüger Grid: *see code KX*			
Malaya Grid *	**MA**		CS
Malta Belt	**MB**	LOC	TC
Maldive-Chagos Belt	**MC**		TC
Madiera Zone	**MD**		LE
Mediterranean Zone *	**ME**		LE
Maine Coordinate System * *(see Note 2)*	**MF**		TC
Malaya Rectified Skew Orthomorphic (Yard) Grid	**MG**	KEA	RS
Martinique Gauss Grid	**MH**		TC
Maryland Coordinate System * *(see Note 2)*	**MI**		LE
Massachusetts Coordinate System * *(see Note 2)*	**MJ**		LE
Mexican Lambert Grid	**MK**		LE
Michigan Coordinate System * *(see Notes 1 and 2)*	**ML**		
Mecca-Muscat Zone	**MM**		LE
Minnesota Coordinate System * *(see Note 2)*	**MN**		LE
Madagascar Grid (Laborde)	**MO**	TAN	LA
Mississippi Coordinate System * *(see Note 2)*	**MP**		TC
Morocco Zone *	**MQ**		MJ
Other Known Grid	**MS**		
Missouri Coordinate System * *(see Note 2)*	**MT**		TC
Mauritius Zone	**MU**		LE
Montana Coordinate System * *(see Note 2)*	**MV**		LE
Mozambique Lambert Grid	**MW**		LE
Mozambique Polyconic Grid	**MX**		PH
Map Grid of Australia 1994: *see code AT*			
Northwest Africa Zone	**NA**	MER	LE

New Jersey Coordinate System * *(see Note 2)*	**NB**		TC
Nigeria Colony Belt *	**NC**		TC
National Grid of Great Britain	**ND**	OGB	TC
Northern European Zone *	**NE**		LE
Nebraska Coordinate System * *(see Note 2)*	**NF**		LE
Numeric Grid	**NG**		
New Hampshire Coordinate System * *(see Note 2)*	**NH**		TC
Niger Zone	**NI**		LE
Netherlands Stereographic Grid (Old Numbering)	**NJ**	PDM	
North Korea Gauss-Krüger Grid	**NK**		TC
Netherlands Stereographic Grid (New Numbering)	**NL**	PDM	
Netherlands East Indies Equatorial Zone British Metric Grid (Lambert) *	**NM**		MC
Nord de Guerre Zone *	**NO**		MJ
New Mexico Coordinate System * *(see Note 2)*	**NN**		TC
Nevada Coordinate System * *(see Note 2)*	**NP**		TC
New Sierra Leone Colony Grid *	**NQ**		
New York Coordinate System * *(see Notes 1 and 2)*	**NR**		
Netherlands East Indies Southern Zone	**NS**		LE
New Zealand Map Grid (NZMG)	**NT**	GEO	NT
Nicaragua Lambert Grid *	**NU**		LE
Niger Belt	**NV**		LE
North Carolina Coordinate System * *(see Note 2)*	**NW**		LE
North Dakota Coordinate System * *(see Note 2)*	**NX**		LE
Netherlands East Indies Equatorial Zone U.S. Yard Grid *	**NY**		LE
New Zealand Belt *	**NZ**		TC
Northern Malaya Grid: *see code OA*			
Norway Gauss-Krüger Grid: *see code OB*			
Northern Malaya Grid	**OA**		
Norway Gauss-Krüger Grid *	**OB**	OSL	TC
Ohio Coordinate System * *(see Note 2)*	**OD**		LE
Oklahoma Coordinate System * *(see Note 2)*	**OE**		LE
Orange Report Net	**OR**	NAS	
Oregon Coordinate System * *(see Note 2)*	**OS**		LE
Palestine Belt *	**PA**		TC
Panama Lambert Grid	**PB**		LE
Palestine Civil Grid (Cassini) *	**PC**		CS
Paraguay Gauss-Krüger Grid	**PD**		TC
Peiping Coordinate System of 1954	**PE**		
Pennsylvania Coordinate System * *(see Note 2)*	**PF**		LE
Polish PSWG 1992 Grid	**PG**	EUT	TC
Peru Polyconic Grid	**PI**		PH
Philippine Plane Coordinate System	**PJ**	LUZ	PH
Poland Gauss-Krüger Grid	**PK**		TC
Poland Quasi-Stereographic Grid	**PL**		
Philippine Polyconic Grid	**PP**	APL	PH
Portugal Bonne Grid, Old	**PQ**		BF
Portugal Bonne Grid, New	**PR**		BF
Portugal Gauss Grid	**PS**	LIS	TC
Puerto Rico & Virgin Islands Coordinate System *	**PT**		LE
Puerto Rico Lambert Grid	**PU**		LE
Pulkovo Coordinate System of 1932: *see code RT*			
Qatar Cassini Grid	**QA**		CS
Qatar Peninsula Grid (or Qatar National Grid (TM))	**QU**	QAT	TC

Russian Belt *	**RB**	EUR	TC
Reunion Gauss Grid	**RC**		TC
Rhode Island Coordinate System * *(see Note 2)*	**RD**		TC
Romania Bonne Grid	**RE**		BF
Soviet Coordinate System of 1942 *	**RF**	PUK	TC
Romania Lambert-Cholesky Grid	**RH**		
Rikets National Grid *	**RK**	STO	TC
Romania Stereographic Grid	**RI**		SD
Pulkovo Coordinate System of 1932	**RT**		
South Africa Belt (yards) *	**SA**		TC
Senegal Gauss Conformal Grid (Belt)	**SB**		TC
South Africa Coordinate System (South Africa Belt (English feet)) *	**SD**		TC
Senegal Belt	**SE**		TC
South Carolina Coordinate System * *(see Note 2)*	**SF**		LE
Sahara Zone	**SH**		LE
South Dakota Coordinate System * *(see Note 2)*	**SI**		LE
South Libya Zone	**SJ**		LE
Sarawak Grid	**SK**		CS
Spain Lambert Grid	**SL**	EUR	LE
Southern New Guinea Grid *	**SN**		LE
South Georgia Lambert Grid	**SQ**		LE
South Syria Lambert Grid	**SR**		LE
Spanish North-Morocco Lambert Grid	**SS**		LE
Svalbard Gauss-Krüger Grid	**SV**		TC
Svobodny 1935 Coordinate System	**SX**		
Seychelles Belt	**SY**		TC
Spitzbergen Zone	**SZ**		LE
Sirte (Lybia) Lambert Grid: *see code LL*			
Soldner-Berlin (Müggelberg) Grid: *see code BL*			
Soviet Coordinate System of 1942: *see code RF*			
Sweden Gauss-Hannover Grid: *see code GH*			
Switzerland Bonne Grid: *see code WB*			
Switzerland Conformal Oblique Cylindrical Grid: *see code WC*			
Tanganyika Territorial Grid	**TA**		
Tashkent 1875 Coordinate System	**TB**		
Tennessee Coordinate System * *(see Note 2)*	**TC**		LE
Texas Coordinate System * *(see Note 2)*	**TD**		TC
Tobago Grid	**TE**	MDT	CS
Trinidad Grid	**TF**		CS
Trucial Coast Cassini Grid	**TG**		CS
Trucial Coast Transverse Mercator Grid	**TH**		TC
Turkey Bonne Grid	**TI**		BF
Tunisia Zone *	**TN**		MJ
Turkey Gauss-Krüger Grid: *see code KT*			
Uganda Cassini Coordinate System *	**UA**		CS
Unidentified Grid	**UB**		
Uruguay Gauss-Krüger Grid	**UC**		TC
Utah Coordinate System * *(see Note 2)*	**UD**		LE
Universal Polar Stereographic System * *(Note: 61 is recommended Zone Number for Northern Polar Zone, -61 for Southern Polar Zone)*	**UP**		PG
U.S. Polyconic Grid System	**US**	NAS	PH

Universal Transverse Mercator * *(Note: 1 to 60 are recommended Zone Numbers for Northern Zones, -1 to -60 for Southern Zones)*	**UT**		TC
Vermont Coordinate System * *(see Note 2)*	**VA**		TC
Virginia Coordinate System * *(see Note 2)*	**VB**		LE
Venezuela Modified Lambert Grid	**VE**		
Vietnam Azimuthal Grid	**VI**		
Voirol 60 Zone *	**VL**	NSD	MJ
West Malaysia Rectified Skew Orthomorphic (Metric) Grid	**WA**		RS
Switzerland Bonne Grid	**WB**		BF
Switzerland Conformal Oblique Cylindrical Grid	**WC**		OC
West Virginia Coordinate System *	**WD**		LE
Wisconsin Coordinate System *	**WE**		LE
Wyoming Coordinate System *	**WF**		TC
Washington Coordinate System * *(see Note 2)*	**WH**		TC
World Polyconic System	**WP**		PH
Yugoslavia Gauss-Krüger Grid (Not Reduced)	**YA**	HER	TC
Yugoslavia Reduced Gauss-Krüger Grid	**YG**	HER	TC
Yunnan Province Grid	**YU**		

* grid category, covering more than one possible grid

Note 1. In this case, not all zones use the same projection.

Note 2. For US State Plane Coordinate Systems, the recommended grid zone number is the 4-figure code given by (a) FIPS PUB 70-1 for grids on North American Datum 1927 and (b) NOAA Manual NOS NGS 5 for grids on North American Datum 1983.

7 UNITS OF MEASURE CODES

DIGEST defines units of measurement as referenced by ISO 1000 "SI units and recommendations for the use of their multiples and of certain other units". However, there are certain units outside the SI (Système Internationale), some of which are recognized by International Committee for Weights and Measures (CIPM), which need to be included in DIGEST because of their practical importance, i.e. occurrence in DGI datasets. These units have their codes enclosed by parentheses ( ).

When a compound unit is formed by multiplication of two or more units, it can be indicated in one of the following ways:

$N \cdot m$ or $N\ m$

DIGEST preference is "$N \cdot m$" to avoid misinterpretation of the blank space.

When a compound unit is formed by dividing one unit by another, it can be indicated in one of the following ways:

$\frac{m}{s}$ or m/s or $m\ s^{-1}$

The DIGEST preference is "m/s".

Table 10-1 lists the SI, and commonly recognized (shown in parentheses), units of measure which are most likely to occur within a DIGEST dataset, and their codes (abbreviations) for the various Units of Measure fields of the Data Set Parameter Group. They also are referenced in Part 4 - Annex B (Attribute and Value Codes).

Table 7-1 Units of Measure Codes

Units	**Code**
LENGTH	
Micrometres	UM
Millimetres	MM
Centimetres	CM
Decimetres	DM
Metres	M
Kilometres	KM
Inches	(IN)
Feet	(FT)
Yards	(YD)
Fathoms	(FM)
Fathoms and Feet	(FF)
Statute Miles	(MI)
Nautical miles	(NM)

TIME	
Seconds	S
Minutes	MIN
Hours	H
Days	D
SPEED	
Metres per Second	M/S
Kilometres per Hour	KM/H
Miles per Hour	(MPH)
Knots	(KNOT)
AREA	
Square metres	(M2)
Square kilometres	(KM2)
Hectares	(HA)
ANGULAR MEASUREMENT	
Mils	ML
Milliseconds (of arc)	(MSC)
Seconds (of arc)	(SEC)
Minutes (of arc)	(MA)
Degrees (of arc)	(DEG)
WEIGHT (MASS)	
Kilograms	KG
Kips (Kilopounds)	(KIP)
PRESSURE	
Millibars	MBAR
Hectopascals	HPA
ELECTRICITY	
Volts	V
Kilovolts	KV
Watts	W
Megawatts	MW
Gigawatts	GW
Amperes	A
Hertz	HZ
Kilohertz	KHZ
Megahertz	MHZ
MISCELLANEOUS	
Percent	(%)
Unit	(UNIT)

Note: Codes enclosed in parentheses indicate non-ISO 1000 units. The parentheses themselves do not form part of the code.

8 USE OF CIE VALUES

CIE is an international colour system for defining colour produced by the "Commission Internationale de l'Eclairage". A number of systems for identifying colours, and the difference between colours, have been promulgated by the CIE. These are all based on measuring the Tristimulus values (Red, Green and Blue intensities) of a colour relative to a standard white. DGIWG has chosen the CIE system featuring the coordinates (x,y,Y) as described in Table 8-1 and illustrated in Figure 8-1. This is also the method used in the [US] DoD Standard Printing Color Catalog.

Table 8-1. Representations of Colour in CIE System

Representation	Description	Comment
RGB intensity values R,G,B.	Red, Green, Blue intensities, relative to a standard white.	Sometimes called spectral primaries.
CIE stimuli X,Y,Z.	CIE primaries chosen such that Y is the reflectance.	There is a one-to-one relationship between (X,Y,Z) and (R,G,B). In fact, there are constants K_1 to K_9 (which depend on physical factors like illuminants & temperatures) such that: $X = K_1*R + K_2*G + K_3*B$, $Y = K_4*R + K_5*G + K_6*B$, $Z = K_7*R + K_8*G + K_9*B$.
CIE Coefficients x,y,Y.	x = X/(X+Y+Z), y = Y/(X+Y+Z); Y is reflectance.	The CIE Chromaticity Chart, which plots x & y, shows the relative values of X,Y,Z (which are in the same ratio as x,y,1-x-y).

Of the other two systems considered, the CIELUV system is more applicable to the TV industry, and the CIELAB system, while providing finer discrimination between similar colours, is unnecessarily complex for the requirements of raster images. It is only necessary to uniquely identify what a colour should be; any difference in hue from the colour printed or captured by the scanner is irrelevant.

Defining accurately and consistently the colours that should appear in the raster image of a map, irrespective of any changes in colour introduced by both the printing and scanning processes, should not be difficult. In most cases the map specification defines what the various colours used in its production should be by reference to a standard colour chart or catalogue. An example of this is the DoD Standard Printing Color Catalog, which as well as printing sample colours also gives the CIE Values for that colour. Where the standard colour catalogue referenced by a map specification does not give the CIE Values, then these may be obtained by:

- identifying the CIE Values for the catalogue in accordance with the DoD Operators Manual for the MC&G Standard Printing Color Identification System, which defines the standard white to be used and the method to be adopted; or

- identifying the closest approximation to each colour in the DoD Standard Printing Color Catalog, and assigning those CIE Values to the local standard colour catalogue. This method should only be used where the precise definition of a colour is not critical (i.e. the map series is only produced and/or scanned by one agency).

Defining what a map colour should be according to a recognized standard will ensure that:

- the colour can be readily identified by the receiving agency or user;

- precise consistency of colour can be achieved between samples of the same raster product produced not only by the same agency, but by different agencies; and

- users of applications will not be distracted by changes in colour and luminosity (which is worse) when traversing map boundaries.

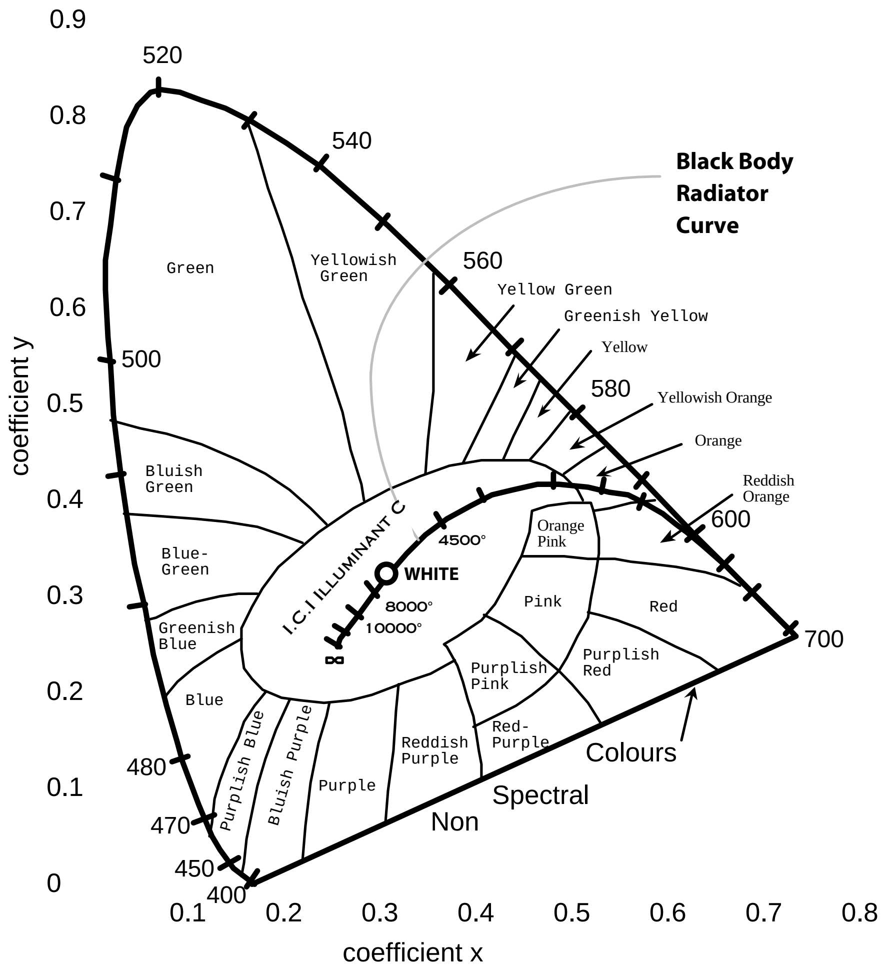


Figure 8-1 CIE Chromaticity Chart

Notes:

1. The numbers round the rim of the graph are the values of the dominant wavelength in nanometres. The straight line between the values 400 and 700 consists of non-spectral colours.
2. The alignment WHITE is usually chosen to be that white radiated by a body at a given temperature, somewhere along the Black Body Radiator curve. In the particular case shown above, the standard illuminant ringed as the alignment white is actually Illuminant C with CIE Chromaticity Coefficients $x_W = 0.310$ and $y_W = 0.316$.

9 DIGITAL GEOGRAPHIC DATA VOLUME TRANSMITTAL FORM

DATA EXCHANGE FORM

Part 1. – National Organizations

1. SENDER: ______________ 2. ADDRESSEE: ______________

3. SECURITY CLASSIFICATION: T S C R U

4. SPECIAL HANDLING:

Date & Level of Downgrading: ______________

Bi or Multilateral agreement(s): ______________

Agreement between Country(s): ______________

Name / Signature: ______________

Creation Date: ______________

Part 2. – Data Exchange Specifications

5.a. EXCHANGE MEDIA:

Type:		**Spec**:	
Mag. Tape:	______	Density:	______
CD-ROM:	______	1.4 MB:	______
3.5" Floppy:	______	1.2 MB	______
5.25" Floppy:	______	720K:	______
		Other:	______
		4 mm	______
		8 mm	______
Cartridge	______	Other	______

5.b. FORMATTING / COMPRESSION:

Number of Cylinders: ______________

Number of Sectors: ______________

Compression: Yes: __________ No: ________

Technique Used: ________________

6. EXCHANGE SPECIFICATION:

DIGEST Edition: ________________ Date: ________________
Annex A ISO 8211: ________________
Annex B ISO 8824: ________________
Annex C VRF: ________________
Annex D IIF: ________________
Comments ________________

7. OPERATING SYSTEM:

Unix: ________ System: ________ Version: ________________
PC / MS - DOS Version: ________________
VAX / VMS Version: ________________
Mac O/S Version: ________________
Other: Version: ________________

8. READ / WRITE STATEMENT: ________________
Load ________________

9. VOLUME CONTENTS:

File No.	File Name	Area of Coverage	Data Structure	Product Type	Remarks	Size

Part 3. - Additional Information

10. REMARKS: ________________

____

____

11. ADDITIONAL INFORMATION: ________________

____

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10 BIBLIOGRAPHY

Refer to the Bibliography in DIGEST Part 1.

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