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Electricity metering – Payment systems –

Part 51: Standard transfer specification (STS) – Physical layer protocol for one-way numeric and magnetic card token carriers

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International Standard IEC 62055-51 has been prepared by working group 15, of IEC technical committee 13: Electrical energy measurement, tariff and load control.

IEC 62055-51 is complementary to, and is to be read in conjunction with, IEC 62055-41.

The text of this standard is based on the following documents:

CDV	Report on voting
13/1406/CDV	13/1410/RVC

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

INTRODUCTION

The IEC 62055 series covers payment systems, encompassing the customer information systems, point of sales systems, token carriers, payment meters and the respective interfaces that exist between these entities. At the time of preparation of this part, IEC 62055 comprised the following parts, under the general title *Electricity metering – Payment systems:*

Part 21: Framework for standardization

Part 31: Particular requirements – Static payment meters for active energy (classes 1 and 2)

Part 41: Standard transfer specification – Application layer protocol for one-way token carrier systems

Part 51: Standard transfer specification – Physical layer protocol for one-way numeric and magnetic card token carriers

Part 52: Standard transfer specification – Physical layer protocol for a two-way virtual token carrier for direct local connection

The Part 4x series specifies application layer protocols and the Part 5x series specifies physical layer protocols.

The standard transfer specification (STS) is a secure message protocol that allows information to be carried between point-of-sale (POS) equipment and payment meters and caters for several message types such as credit, configuration control, display, and test instructions. It further specifies devices and codes of practice that allow for the secure management (generation, storage, retrieval and transportation) of cryptographic keys used within the system.

The national electricity utility in South Africa (Eskom) first developed and published the STS in 1993 and transferred ownership to the STS Association in 1998 for management and further development.

Prior to the development of the STS a variety of proprietary payment meters and POS equipment had been developed, which were, however, not compatible with each other. This gave rise to a definite need among the major users to move towards standardized solutions in addressing operational problems experienced where various types of payment meter and POS equipment had to be operated simultaneously. An STS was developed that would allow for the application and inter-operability of payment meters and POS equipment from multiple manufacturers in a payment metering installation.

The TokenCarrier is the physical device or medium used to transport the information from the vending system to the payment meter. Two types of token carriers are specified in this part of IEC 62055, a magnetic card and a numeric token carrier, which have been approved by the STS Association. New token carriers can be proposed as new work items through the National Committees or through the STS Association.

Although the main implementation of the STS is in the electricity supply industry, it inherently provides for the management of other utility services like water and gas. Future revisions of the STS may allow for other token carrier technologies like smart cards and memory keys with two-way functionality and to cater for a real-time clock and complex tariffs in the payment meter.

The STS Association has established a D-type liaison with working group 15 of IEC TC 13 for the development of standards within the scope of the STS and is thus responsible for the maintenance of any such IEC standards that might be developed as a result of this liaison.

The STS Association is also registered with the IEC as a Registration Authority for providing maintenance services in support of the STS (see Clause C.1 of IEC 62055-41 for more information).

ELECTRICITY METERING – PAYMENT SYSTEMS –

Part 51: Standard transfer specification (STS) – Physical layer protocol for one-way numeric and magnetic card token carriers

1 Scope

This part of IEC 62055 specifies a physical layer protocol of the standard transfer specification (STS) for transferring units of credit and other management information between a point-of-sale (POS) system and an STS-compliant electricity payment meter.

It specifies

- encoding of token data onto token carriers in the physical layer protocol at the POS for various TokenCarrierTypes such as numeric and magnetic cards;
- decoding of token data from token carriers in the physical layer protocol at the payment meter for various TokenCarrierTypes such as numeric and magnetic cards.

It is intended for use by manufacturers of payment meters that have to accept tokens that comply with the STS, and also by manufacturers of POS systems that have to produce STS-compliant tokens, and should be read in conjunction with IEC 62055-41.

NOTE 1 Although developed for payment systems for electricity, the standard also covers tokens used in other utility services, such as water and gas.

NOTE 2 STS-compliant products are required to comply with selective parts of this International Standard only, which should be the subject of the purchase contract (see Annex A).

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60050-300, *International Electrotechnical Vocabulary – Electrical and electronic measurements and measuring instruments – Part 311: General terms relating to measurements – Part 312: General terms relating to electrical measurements – Part 313: Types of electrical measuring instruments – Part 314: Specific terms according to the type of instrument*

IEC 62051, *Electricity metering – Glossary of terms*

IEC 62055-31:2005, *Electricity metering – Payment systems – Part 31: Particular requirements – Static payment meters for active energy (classes 1 and 2)*

IEC 62055-41, *Electricity metering – Payment systems – Part 41: Standard transfer specification – Application layer protocol for one-way token carrier systems*

ISO/IEC 7810:2003, *Identification cards – Physical characteristics*

ISO/IEC 7811-2:2001, *Identification cards – Recording technique – Part 2: Magnetic stripe – Low coercivity*

ISO/IEC 7813:2006, *Information technology – Identification cards – Financial transaction cards*

3 Terms, definitions and abbreviations

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-300, IEC 62051, IEC 62055-31, IEC 62055-41 apply.

3.2 Abbreviations

ANSI	American National Standards Institute
APDU	ApplicationProtocolDataUnit
ASCII	American Standard Code for Information Interchange
DOE	DateOfExpiry
DD	Discretionary Data
EA	EncryptionAlgorithm
ED	ExpirationDate
ETX	ASCII End Of Text character
FS	FieldSeparator
ID	Identification; Identifier
ISO	International Standards Organization
KRN	KeyRevisionNumber
LRC	LongitudinalRedundancyCheck
OSI	Open Systems Interconnection
PAN	PrimaryAccountNumber
POS	PointOfSale
PRN	Printer
PSTN	Public Switched Telephone Network
SC	ServiceCode
SGC	SupplyGroupCode
STS	Standard Transfer Specification
STX	ASCII Start of Text character
TCDU	TokenCarrierDataUnit
TCT	TokenCarrierType
TI	TariffIndex

3.3 Notation and terminology

Throughout this standard the following rules are observed regarding the naming of terms.

- Entity names, data element names, function names and process names are treated as generic object classes and are given names in terms of phrases in which the words are capitalized and joined without spaces. Examples are: SupplyGroupCode as a data element name, EncryptionAlgorithm07 as a function name and TransferCredit as a process name (see note).
- Direct (specific) reference to a named class of object uses the capitalized form, while general (non-specific) reference uses the conventional text i.e. lower case form with spaces. An example of a direct reference is: “The SupplyGroupCode is linked to a group of meters”, while an example of a general reference is: “A supply group code links to a vending key”.
- Other terms use the generally accepted abbreviated forms like PSTN for Public Switched Telephone Network.

NOTE The notation used for the naming of objects has been aligned with the so-called “camel-notation” used in the common information model (CIM) standards prepared by TC 57, in order to facilitate future harmonization and integration of payment system standards with the CIM standards.

3.4 Numbering conventions

In this standard, the representation of numbers in binary strings uses the convention that the least significant bit is to the right and the most significant bit is to the left.

Numbering of bit positions start with bit position 0, which corresponds to the least significant bit of a binary number.

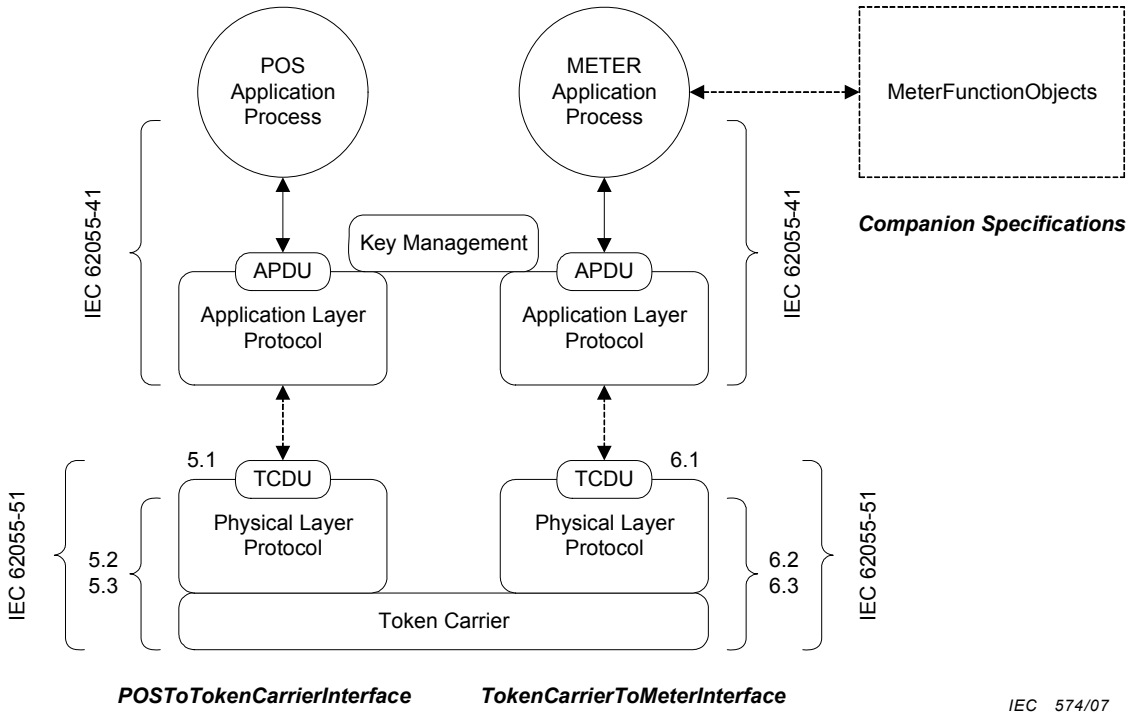
Numbers are generally in decimal format, unless otherwise indicated. Any digit without an indicator signifies decimal format.

Binary digit values range from 0-1.

Decimal digit values range from 0-9.

Hexadecimal digit values range from 0-9, A-F and are indicated by “hex”.

4 STS protocol reference model



Key

APDU ApplicationLayerDataUnit; data interface to the application layer protocol

TCDU TokenCarrierDataUnit; data interface to the physical layer protocol

Relevant clause number references in this standard are indicated adjacent to each box

Figure 1 – Physical layers of the STS protocol stack

The STS is a secure data transfer protocol between a POS and a payment meter using a token carrier as the transfer medium. The application layer protocol deals with tokens and encryption processes and functions and is specified in IEC 62055-41, while the physical layer protocol deals with the actual encoding of the token data onto various types of token carriers (see Figure 1).

This standard specifies a physical layer protocol that deals with the actual encoding of the token data onto a numeric token carrier and a magnetic card token carrier and operates in conjunction with the application layer protocol specified in IEC 62055-41.

Examples of other types of physically transportable token carrier devices are: numeric, magnetic cards, memory cards and memory keys, which might be specified in future in other parts of the IEC 62055-5x series.

A more complete description of the STS reference model and data flows from the POSApplicationProcess to the MeterApplicationProcess may be found in Clause 5 of IEC 62055-41.

5 POSToTokenCarrierInterface: Physical layer protocol

5.1 TCDU

5.1.1 Data elements in the TCDU

The TCDU is the data interface to the physical layer protocol and comprises the data elements given in Table 1.

Table 1 – Data elements in the TCDU

Element	Format	Reference
TCT	2 digits	5.1.2
TokenData	66 bits	5.1.3
IDRecord	35 digits	5.1.4
PRNRecord	Text	5.1.5

5.1.2 TCT

Indicates onto which TokenCarrierType (see 6.1.3 of IEC 62055-41) this TokenData should be encoded.

5.1.3 TokenData

This is the encrypted and/or processed Token from the APDU in the application layer that is to be encoded onto the TokenCarrier for transfer to the payment meter (see 6.4.3 to 6.4.5 of IEC 62055-41).

5.1.4 IDRecord

Optional identification data intended to be encoded onto a payment meter ID card or onto the TokenCarrier together with the TokenData.

The optional IDRecord comprises the data elements given in Table 2.

Table 2 – Data elements in the IDRecord

Element	Context	Format	Reference in IEC 62055-41
MeterPAN	ISO-compliant identification MeterPrimaryAccountNumber for the payment meter	18 digits	6.1.2
DOE	Optional expiry date for the identification data as encoded onto a payment meter ID card or token carrier (see 5.2.4.9)	4 digits	6.1.11
TCT	Indicates which TokenCarrierType is associated with this MeterPAN	2 digits	6.1.3
EA	Indicates which EncryptionAlgorithm is associated with this MeterPAN	2 digits	6.1.5
SGC	Indicates which SupplyGroupCode is associated with this MeterPAN	6 digits	6.1.6
TI	Indicates which TariffIndex is associated with this MeterPAN	2 digits	6.1.7
KRN	Indicates which KeyRevisionNumber is associated with this MeterPAN	1 digit	6.1.8

5.1.5 PRNRecord

Optional data intended to be printed at the same time as the coding of the TokenData onto the TokenCarrier. Certain token carriers such as paper-based magnetic card devices allow printing to be done onto the card surface itself and this operation may be integrated with the magnetic card encoding device. The content and format is not specified and is left to each system to define according to its particular requirements.

5.2 Magnetic card token carrier

5.2.1 General

This protocol is applicable for TCT value = 01.

The TCDU is the data interface to this protocol (see 5.1).

This protocol is intended for use with disposable magnetic cards essentially of paper-based material. However, it may also be applied to magnetic cards of other materials as long as it meets the mechanical and magnetic requirements below.

5.2.2 Characteristics of the card

5.2.2.1 Material

The card material shall not be translucent and shall not contain elements that, with time, will degrade the functionality of the magnetic stripe, or affect the reliability with which the data stored on the magnetic stripe can be recovered.

Data stored on a sample card shall be recoverable after six months, during which time the card shall be kept under ambient conditions.

NOTE This is a design requirement and no specific test procedure is specified.

5.2.2.2 Construction

The construction of the card is not specified.

5.2.2.3 Deformation

The card shall be resistant to damage caused by normal handling, such as being transported on the user's person. The card shall remain functional after first having been deformed within reason and then restored to the extent that it can pass through a slot of 0,4 mm × 54,1 mm.

NOTE This is a design requirement and no specific test procedure is specified.

5.2.2.4 Flammability

Cards need not be flame-resistant.

5.2.2.5 Toxicity

Cards shall comply with the toxicity requirements of ISO/IEC 7810.

5.2.2.6 Resistance to chemicals

Cards shall comply with the resistance to chemicals requirements of ISO/IEC 7810.

5.2.2.7 Stability with temperature and humidity

When exposed to environmental temperatures of -10 °C to +50 °C at relative humidity of 5 % to 95 % with a maximum wet bulb temperature of ≤25 °C, cards shall remain structurally reliable and usable.

NOTE Environmental temperature as defined does not mean card temperature but refers to the environment in which the card is used.

5.2.2.8 Exposure to light

When exposed to normal household lighting, including fluorescent light or sunlight, for a period of six months, the card shall not degrade to such an extent as to affect the reliability of the magnetic data stored on it.

NOTE This is a design requirement and no specific test procedure is specified.

5.2.2.9 Water resistance

The card shall be water-resistant to the extent that, if it is immersed in water at 20 °C for 24 h and then dried, the reliability of the magnetic data stored on the card shall not have been affected.

5.2.2.10 Contamination

Cards shall comply with the contamination requirements of ISO/IEC 7810.

5.2.2.11 Dimensions

The card shall comply with the dimensions of card type ID-1 requirements of ISO/IEC 7810 with the exception of requirements for card thickness and requirements for limits of burrs on card edges.

The thickness of the card shall be at least 0,26 mm and shall not exceed 0,34 mm.

NOTE Paper-based products have a 1 % expansion characteristic; this is currently under investigation and 5.2.2.11 might be amended in the future.

5.2.3 Characteristics of the magnetic stripe

The magnetic stripe shall be physically located as specified in ISO/IEC 7811-2 for use of Track 3 for ID-1 type cards.

The characteristics of the magnetic stripe and the encoding technique shall comply with the requirements as specified in ISO/IEC 7811-2 for use of Track 3.

5.2.4 Information contents and character coding

5.2.4.1 Record options

The information content and character coding shall comply with the encoding specifications for read-write track, Track 3 of ISO/IEC 7811-2.

The error detection shall comply with the error detection specifications of ISO/IEC 7811-2.

Record1 is mandatory, which contains the TokenData and comprises fields 1 to 4.

Record2 is optional, contains additional payment meter identification data (not for use by the payment meter) and comprises fields 6 to 17.

If the optional Record2 is also to be recorded, then both records shall be concatenated as shown in Tables 3, 4 and 5 below with a field of 33 ”0” characters separating Record1 from Record2.

NOTE 1 The structure of Record2 follows the Track 2 structure of ISO/IEC 7813 for financial transaction cards as is normally recorded on Track 2. It replicates that structure in this standard because it serves the same purpose, although it is encoded onto Track 3 in this case.

NOTE 2 Track 2 structure of ISO/IEC 7811-2 allows a maximum of 40 characters in the Record2 length.

NOTE 3 The maximum number of characters for Track 3 for ID-1 type cards of ISO/IEC 7811-2 allows a maximum of 107 characters in the total combined field length.

NOTE 4 The coded character set for Track 3 is defined in ISO/IEC 7811-2.

The data fields given in Table 3, Table 4 and Table 5 shall be encoded on Track 3 of the magnetic stripe as appropriate.

Table 3 – Mandatory data fields for Record1 to be encoded on Track 3

No	Field	Description	Value	Chars	Reference
1	STX	StartSentinel	“;”	1	5.2.4.2
2	<data>	TokenData	20 digits	20	5.2.4.3
3	ETX	EndSentinel	”?”	1	5.2.4.4
4	LRC	LongitudinalRedundancyCheck		1	5.2.4.5
	TOTAL (mandatory for Record1)			23 chars	

Table 4 – Separator data field to be encoded on Track 3 with optional Record2

No	Field	Description	Value	Chars	Reference
5	<space>	Spaces	33 digits of “0”	33	5.2.4.6
	TOTAL (for separator field)			33 chars	

Table 5 – Data fields for optional Record2 to be encoded on Track 3

No	Field	Description	Value	Chars	Reference
6	STX	StartSentinel	”;”	1	5.2.4.2
7	PAN	MeterPAN	18 digits	18	5.2.4.7
8	FS	FieldSeparator	”=”	1	5.2.4.8
9	ED	ExpirationDate	4 digits or “=”	4 or 1	5.2.4.9
10	SC	ServiceCode	”=”	1	5.2.4.10
11	DD1	TCT	2 digits	2	5.2.4.11
12	DD2	EA	2 digits	2	5.2.4.12
13	DD3	SGC	6 digits	6	5.2.4.13
14	DD4	TI	2 digits	2	5.2.4.14
15	DD5	KRN	1 digits	1	5.2.4.15
16	ETX	EndSentinel	”?”	1	5.2.4.4
17	LRC	LongitudinalRedundancyCheck		1	5.2.4.16
	TOTAL (without card expiry date)			37 chars	
	TOTAL (with card expiry date)			40 chars	

5.2.4.2 STX: StartSentinel

Coded character set for Track 3 of ISO/IEC 7811-2: represented by character ";".

5.2.4.3 <data>: TokenData

The 66-bit TokenData value in the TCDU is converted from binary to decimal using the method in 5.3.2.

Each decimal digit is represented by one of the characters "0" to "9" as defined in the coded character set for Track 3 of ISO/IEC 7811-2.

5.2.4.4 ETX: EndSentinel

Coded character set for Track 3 of ISO/IEC 7811-2: represented by character "?".

5.2.4.5 LRC: LongitudinalRedundancyCheck (Field 4)

The LRC shall be calculated on field numbers 1 to 3 inclusive according to the LRC calculation method described in ISO/IEC 7811-2. The resultant LRC is a single character recorded in field number 4. It serves to validate the integrity of Record1.

5.2.4.6 <space>: Spaces

This is a string of 33 characters of "0" as defined in the coded character set for Track 3 of ISO/IEC 7811-2.

It serves to separate Record1 from Record2 if both records are to be recorded. If Record2 is not required, then the <space> field is also omitted.

5.2.4.7 PAN: MeterPAN

The 18-digit MeterPAN value as given in the optional IDRecord in the TCDU is recorded in this field with each digit being represented by characters "0" to "9" as defined in the coded character set for Track 3 of ISO/IEC 7811-2.

5.2.4.8 FS: FieldSeparator

Coded character set for Track 3 of ISO/IEC 7811-2: represented by character "=".

5.2.4.9 ED: ExpirationDate

The value of the ED field is derived from the value of DOE in the TCDU (see 5.1.4).

For the value range and interpretation of DOE, see 6.1.1 and 6.1.11 in IEC 62055-41.

When DOE has a value of YYMM = 0000, then the DOE is not used in the IDRecord, in which case the ED field in Record2 is populated with a single "=" character.

When DOE is used in the IDRecord, then ED is in the format as defined for Track 2 structure in ISO/IEC 7813.

Values less than 10 shall be right justified and left padded with 0 (for example 01, 02.. 09).

5.2.4.10 SC: ServiceCode

The ServiceCode field is fixed with character ”=” in terms of Track 2 structure of ISO/IEC 7813.

5.2.4.11 DD1: TokenCarrierType

The 2-digit TCT value as given in the optional IDRecord in the TCDU is recorded in this field with each digit being represented by characters “0” to “9” as defined in the coded character set for Track 3 of ISO/IEC 7811-2.

Values less than 10 shall be right justified and left padded with 0 (for example 01, 02.. 09).

5.2.4.12 DD2: EncryptionAlgorithm

The 2-digit EA value as given in the optional IDRecord in the TCDU is recorded in this field with each digit being represented by characters “0” to “9” as defined in the coded character set for Track 3 of ISO/IEC 7811-2.

Values less than 10 shall be right justified and left padded with 0 (for example 01, 02.. 09).

5.2.4.13 DD3: SupplyGroupCode

The 6-digit SGC value as given in the optional IDRecord in the TCDU is recorded in this field with each digit being represented by characters “0” to “9” as defined in the coded character set for Track 3 of ISO/IEC 7811-2.

Values less than 6 decimal digits shall be right justified and left padded with 0 (for example 000001, 000002.. 000009, etc).

5.2.4.14 DD4: TariffIndex

The 2-digit TI value as given in the optional IDRecord in the TCDU is recorded in this field with each digit being represented by characters “0” to “9” as defined in the coded character set for Track 3 of ISO/IEC 7811-2.

Values less than 10 shall be right justified and left padded with 0 (for example 01, 02.. 09).

5.2.4.15 DD5: KeyRevisionNumber

The 1-digit KRN value as given in the optional IDRecord in the TCDU is recorded in this field with the digit being represented by characters “0” to “9” as defined in the coded character set for Track 3 of ISO/IEC 7811-2.

5.2.4.16 LRC: LongitudinalRedundancyCheck (Field 17)

The LRC shall be calculated on field numbers 6 to 16 inclusive according to the LRC calculation method described in ISO/IEC 7811-2. The resultant LRC is a single character recorded in field number 17. It serves to validate the integrity of Record2.

5.3 Numeric token carrier

5.3.1 General

This protocol is applicable for TCT value = 02.

The TCDU is the data interface to this protocol (see 5.1).

5.3.2 Decimal number conversion

The 66-bit TokenData value (see 5.1.3) in the TCDU shall be converted into a 20-digit decimal number. The decimal number shall represent the binary number in such a way that the binary number bit position 0 would correspond to the least significant part of the decimal number after conversion.

Example (see Table 6): The conversion from a 66-bit binary number (with the least significant bit on the right hand side in the table), to a 20-digit decimal number (with the least significant digit on the right hand side in the table).

Table 6 – Example of 66-bit binary to 20-digit decimal conversion

Binary number	**11**0110**0101**0100**0011**0010**0001**0000**1001**1000**0111**0110**0101**1010**1011**1100**1101**
Decimal number	62636944367208999885

5.3.3 Numeric string printing format

The 20-digit decimal number may now be further converted into any appropriate numeric string format typically for printing onto any suitable surface such as paper or the like. It may even be printed only on a display screen of a user interface and then written down or read out over a telephone to a distant customer who then writes it down himself before entering it into his payment meter.

This standard does not prescribe the exact format of the printed numeric string, but the basic requirement is that it shall be such that the user will find it simple to copy and enter the sequence of the 20-digit numeric string into the keypad of his payment meter with the least number of errors during the process.

Examples of the format of the printed numeric string that are commonly used are:

a) printed on one line, so formatted that the digits are grouped into five groups of four digits with one or more spaces between each group:

6263 6944 3672 0899 9885

b) printed on five lines with each line showing a group of 4 digits:

6263

6944

3672

0899

9885

c) printed on 2 lines with the first line showing 3 groups of 4 and the second line showing 2 groups of four:

6263 6944 3672

0899 9885

NOTE The above examples serve as guidelines only and the actual format to be used should be the subject of the purchase agreement for token issuing devices.

6 TokenCarrierToMeterInterface: Physical layer protocol

6.1 TCDU

6.1.1 Data elements in the TCDU

The TCDU is the data interface between the physical layer protocol and the application layer protocol and comprises the data elements given in Table 7.

Table 7 – Data elements in the TCDU

Element	Format	Reference
TokenData	66 bits	6.1.2
TokenErase	Boolean	6.1.3
AuthenticationResult	Boolean	6.1.4
ValidationResult	Boolean	6.1.5
TokenResult	Boolean	6.1.6

6.1.2 TokenData

This is the 66-bit binary format of the token data as decoded from the TokenCarrier. This is the same data element as is present in the TCDU at the POSToTokenCarrierInterface (see 5.1.1).

6.1.3 TokenErase

This is an instruction from the application layer protocol and serves to instruct the physical layer protocol to erase the token data from the TokenCarrier (see 6.2.5 for example). See also 7.2.3 of IEC 62055-41 for the origin of this signal.

6.1.4 AuthenticationResult

This is a status indicator to the physical layer protocol to convey the result from the initial authentication checks. See also 7.1.3 of IEC 62055-41 for definition of the AuthenticationResult values.

6.1.5 ValidationResult

This is a status indicator to the physical layer protocol to convey the result from the initial validation checks. See also 7.1.4 of IEC 62055-41 for definition of the ValidationResult values.

6.1.6 TokenResult

This is a status indicator from the MeterApplicationProcess to convey the result after processing the Token so that the physical layer protocol can take the appropriate action. See also 7.1.5 of IEC 62055-41 for definition of the TokenResult values.

6.2 Magnetic card token carrier

6.2.1 General

The TCDU is the data interface between the physical layer protocol and the application layer protocol. See 6.1 for the detailed definition of the TCDU.

This protocol is intended for use with disposable magnetic cards essentially of paper-based material. However, it may also be applied to magnetic cards of other materials as long as it meets the mechanical and magnetic requirements below.

The 20 digit decimal number read from the TokenCarrier shall be converted to a 66-bit binary number in accordance with 6.3.2 and then transferred to the TokenData field of the TCDU.

6.2.2 Characteristics of the card

The card shall comply with the requirements of 5.2.2.

6.2.3 Characteristics of the magnetic stripe

The magnetic stripe shall comply with the requirements of 5.2.3.

6.2.4 Information contents and character coding

The requirements of 5.2.4 shall be applicable, except that it is only mandatory for Record1 to be read from the TokenCarrier.

6.2.5 Token data erasure

When so required (see 6.1.3), it shall be possible for Record1 on the TokenCarrier to be magnetically erased or rendered unreadable by overwriting the Record1 token data, without disturbing the contents of the optional Record2. It is permissible to erase a small portion of the Spaces separating Record1 from Record2, but should be left largely intact, as it would serve as lead-in clocking bits for subsequent reading of the optional Record2 data.

6.3 Numeric token carrier

6.3.1 General

The TCDU is the data interface between the physical layer protocol and the application layer protocol. See 6.1 for the detailed definition of the TCDU.

The 20-digit numeric string shall be entered by means of a suitable reader device, such as a keypad, on the payment meter.

The payment meter shall display the numbers entered during token entry.

It shall be possible for the user to remove digits, one at a time, from the end of a partially entered number, for example, by means of a "Backspace" button.

It shall be possible for the user to clear a partially entered number, for example, by means of a "Clear" or "Enter" button.

The entered 20-digit decimal number shall be converted to a 66-bit binary number in accordance with 6.3.2 and then transferred to the TokenData field of the TCDU.

6.3.2 Decimal to binary conversion

This function is used by other physical layer protocol functions (see 6.2 and 6.3).

The 20-digit decimal number read from the TokenCarrier shall be converted into a 66-bit binary number.

The binary number shall represent the decimal number in such a way that the least significant digit of the decimal number shall correspond to the least significant part (bit position 0) of the binary number after conversion.

Example (see Table 8): The conversion from a 20-digit decimal number (with the least significant digit on the right hand side in the table), to a 66-bit binary number (with the least significant bit on the right hand side in the table).

Table 8 – Example of a 20-digit decimal to 66-bit binary conversion

Decimal number	62636944367208999885
Binary number	**11**0110**0101**0100**0011**0010**0001**0000**1001**1000**0111**0110**0101**1010**1011**1100**1101**

Annex A
(informative)

Procurement options for users of STS-compliant systems

This standard provides for a variety of options, the details of which need to be specified at the time when products and systems are purchased from manufacturers and suppliers.

As a general guide to purchase orders or tender specifications, the items given in Table A.1 are noted.

Table A.1 – Items that should be noted in purchase orders and tenders

Item	Context	Reference
ID record	Whether the vending system needs to record an IDRecord onto token carriers. Options: • use IDRecord on token carriers; • do not use IDRecord on token carriers. (this is the current practice)	5.1.4
Expiration date	If IDRecord is used on token carriers, then whether these records should carry an expiration date. Options: • expiration date should not be used (this is the current practice); • expiration date to be used	5.1.4
PRN record	Whether the vending system needs to print a record onto token carriers. Options: • do not print PRNRecord; • print PRNRecord. (provide details to vending system)	5.1.5
Magnetic card ID record	Whether the vending system needs to use the IDRecord (Record2) on magnetic card token carriers. Options: • use IDRecord on magnetic card token carriers; • do not use IDRecord on magnetic card token carriers. (this is the current practice)	5.2.4

Bibliography

IEC 62055-21:2005, *Electricity metering – Payment systems – Part 21: Framework for standardization*

ISO 4909, *Identification cards – Financial transaction cards – Magnetic stripe data content for track 3*

ISO/IEC 7498-1:1994, *Information technology – Open Systems Interconnection – Basic Reference Model: The Basic Model*

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