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INTERNATIONAL STANDARD

Electricity metering – Payment systems – Part 52: Standard transfer specification (STS) – Physical layer protocol for a two-way virtual token carrier for direct local connection

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International Standard IEC 62055-52 has been prepared by working group 15, of IEC technical committee 13: Electrical energy measurement, tariff and load control.

IEC 62055-52 is complementary to, and should be read in conjunction with, IEC 62055-41.

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

FDIS	Report on voting
13/1424/FDIS	13/1428/RVD

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.

A list of all parts of IEC 62055 series, published under the general title *Electricity metering – Payment systems,* can be found on the IEC website.

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- withdrawn,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(STS) – Application layer protocol for one-way token carrier systems

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

Part 52: Standard transfer specification(STS) – 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 protocol in this International Standard is based on the IEC 62056-21 communication protocol and has been simplified by removing features from the IEC 62056-21 protocol, which are not required for the current requirements of data exchange between the VTC07 client device and the payment meter server.

The main design objective in establishing the protocol has been the requirement to reduce the complexity of the software that is needed to implement this protocol in the payment meter. This directly relates to a smaller memory size that can be translated into a cost saving or the ability to include additional software features for a given memory size.

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 it caters for several message types such as credit, configuration control, display and test instructions. It further specifies devices and Codes Of Practice that allows 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. The Standard Transfer Specification 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 medium used to transport information from a POS or the management system to the payment meter, or from the payment meter to the POS or management system. This part of IEC 62055 specifies a virtual token carrier as embodied in a direct local connection between a management device client and a payment meter server. It has been assigned identification code 07 by the STS Association and is also generally referred to as VTC07. 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.

The STS Association has established 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 52: Standard transfer specification (STS) – Physical layer protocol for a two-way virtual token carrier for direct local connection

1 Scope

This part of IEC 62055 specifies a physical layer protocol of the STS for transferring units of credit and other management information between a client (typically a HHU) and a server (an STS-compliant electricity payment meter), typically over a direct local connection. It is complementary to the application layer protocol specified in IEC 62055-41 and should be used in conjunction with that standard.

This standard is not applicable to payment metering systems employing monetary-based tokens, complex tariffs and currency-mode accounting functions. It is only intended to support the STS functionality as defined in IEC 62055-41 and it does not support the additional functionality required for extended use that includes monetary-based tokens and complex meter functions such as tariffs, real time clocks and currency-mode accounting. If such extended use were required in the future, then it would need new work on this part of IEC 62055 as well as on IEC 62055-41.

It is intended for use across a range of payment meters developed by different manufacturers and to ensure compatibility between these products and other client devices.

It specifies a client/server communications protocol that:

- transfers STS-compliant tokens from a client device to a payment meter server;
- reads the result from the payment meter after transfer and execution of the token;
- transfers management data from the client device to the payment meter server;
- reads management data from the payment meter server and transfers same to the client device.

NOTE Although developed for payment systems for electricity, this standard can also be applied to other utility services, such as water and gas.

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 62051:1999, *Electricity metering – Glossary of terms*

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

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*

IEC 62055-51, *Electricity metering – Payment systems Part 51: Standard transfer specification – Physical layer protocol for one-way numeric and magnetic card token carriers*

IEC 62056-21:2002, *Electricity metering – Data exchange for meter reading, tariff and load control – Part 21: Direct local data exchange*

ISO/IEC 646:1991, *Information technology – ISO 7-bit coded character set for information interchange*

STS 101-1, *Standard transfer specification (STS) – Interface specification – Physical layer mechanical and electrical interface for virtual token carriers*[1]

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.

The term ASCII is used throughout the standard, which shall mean the 7-bit coded character set as defined in ISO/IEC 646.

3.2 Abbreviations

ACK	Acknowledge (ASCII code)
APDU	ApplicationProtocolDataUnit
ASCII	American Standard Code for Information Interchange
BCC	Block Check Character
Char	Character
CR	Carriage Return (ASCII code)
DL	Data Length
ETX	End Of Text (ASCII code)
FOIN	FunctionObjectIdentificationNumber
GPRS	General Packet Radio Service
GSM	Global System For Mobile Communication
hex	hexadecimal
HHU	Hand Held Unit

[1] To be published

ID	Identification, Identifier
ISDN	Integrated Services Digital Network
ISO	International Standards Organisation
LAN	Local Area Network
LF	Line Feed (ASCII code)
ms	milli-second
NAK	Negative AcKnowledge (ASCII code)
OSI	Open Systems Interconnect
PLC	Power Line Carrier
POS	PointOfSale
PSTN	Public Switched Telephone Network
Ref	Reference clause
RID	Register IDentifier code
SOH	Start Of Header (ASCII code)
STS	Standard Transfer Specification
STX	Start Of Text (ASCII code)
TCDU	TokenCarrierDataUnit
VTC07	VirtualTokenCarrierType07
WAN	Wide Area Network

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, TokenLockout 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”;
- attribute names of an object class uses the same convention as for the name of an object class, except that the first letter is in lower case format;
- object class names are capitalized, while names of attributes of a object class start with lower case;
- other terms use the generally accepted abbreviated forms like PSTN for Public Switched Telephone Network.

NOTE The notation used for 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.

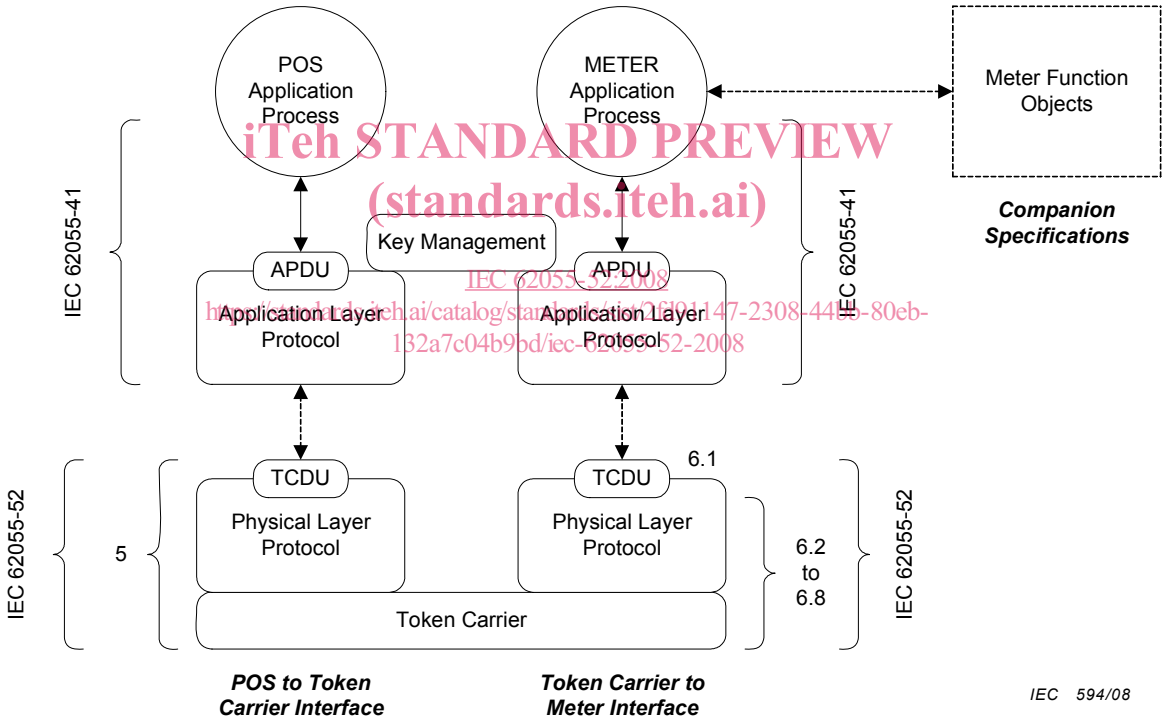
Numbers are generally in decimal format, unless otherwise indicated. Any digit without an indicator signifies decimal format.

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, 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.

This part of IEC 62055 specifies a physical layer protocol that deals with the actual encoding of the token data onto a virtual token carrier comprising of a direct local connection between a client and a server (payment meter) using a serial communications protocol, and operates in conjunction with the application layer protocol specified in IEC 62055-41(see Figure 1).

Examples of other types of virtual token carriers are: PSTN modem, ISDN modem, GSM modem, GPRS modem, Radio modem, PLC modem, Infra-red, LAN and WAN connections and direct local connection, which might be specified in the 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.

The protocol defines a generic write and read message structure that allows for a client to read data from or write data to a payment meter by reference to a virtual register table as a logical interface to actual registers or functions. This standard defines a RegisterTable interface class (see 6.8.1) and a Register interface class (see 6.8.2) for a MeterFunctionObject, which gets defined in a companion specification. Companion specifications are not normative to IEC 62055-52 and are administered by the STS Association (see 6.9).

5 POSToTokenCarrierInterface: Physical layer protocol

The client interface to the virtual token carrier is not defined in detail in this standard, but it shall generally complement the requirements given in the relevant parts of Clause 6.

In practice, the client device is typically a mobile HHU that connects to the payment meter by means of a direct local connection, but it is also possible for the connection to be extended to a remote management system by means of suitable interposing modem devices linked over any appropriate communications medium. Such extended remote connection is not specifically covered in this standard, but in essence it simply means an extension of the physical medium.

6 TokenCarrierToMeterInterface: Physical layer protocol

6.1 TCDU

6.1.1 General

The TCDU is the data interface between the physical layer protocol and the application layer protocol and comprises the following data elements as given in Table 1.

Table 1 – Data elements in the TCDU

Element	Format	Reference
TokenData	66-bit binary	6.1.2
AuthenticationResult	Boolean	6.1.3
ValidationResult	Boolean	6.1.4
TokenResult	Boolean	6.1.5

6.1.2 TokenData

This is the 66-bit binary format of the token data as decoded from the TokenCarrier. It is the same data element as is presented to the TCDU at the POSToTokenCarrierInterface (see 6.4.3 to 6.4.5 of IEC 62055-41).