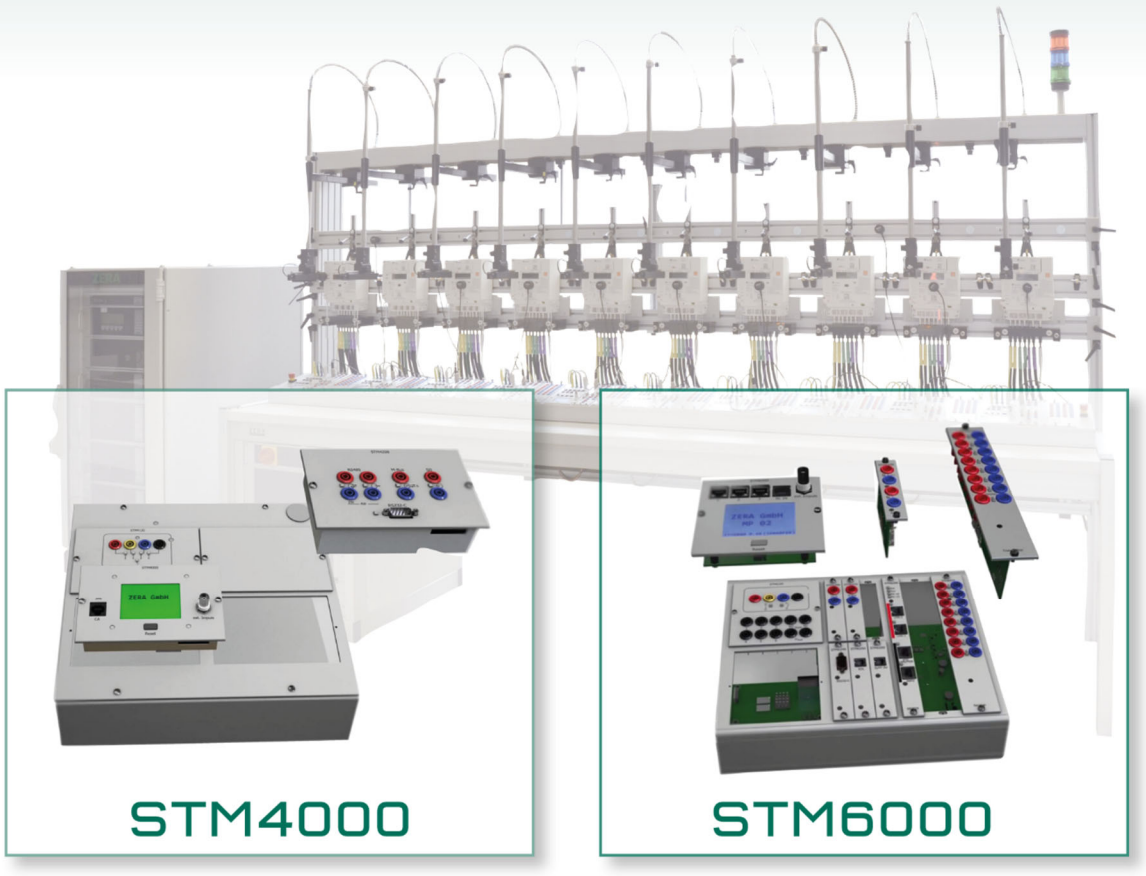
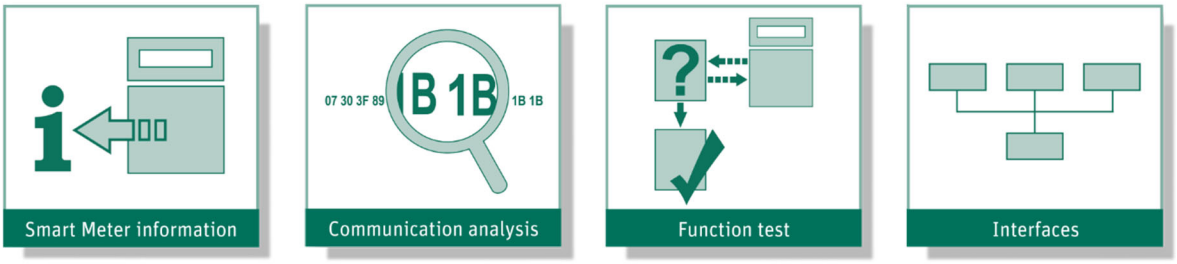
ZERA

STM4000/STM6000 - Digital Measuring Systems

for testing of metrology and data communication

STM4000-STM6000_PROS_EXT_GB_V103





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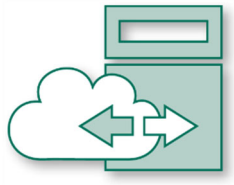
In General

The energy world of the future is a digital world. Power grids and meters must always meet new requirements. Fluctuations, loads and changed distribution channels must be controlled reliably and efficiently. With each new participant, such as e-cars or photovoltaic systems, the number of required interfaces, communication methods and operating states grows. Digital technology is indispensable to manage all these requirements. New technologies allow different grid participants to communicate with each other and, if necessary, react accordingly.

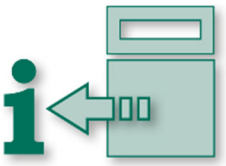
Smart Meter vs. electronic meter – Where is the difference?



Smart Meter

The digital electricity meter (also: Smart Meter) is rapidly replacing the simple, electronic electricity meter. While the electronic meter uses, for example, the infrared interface to be read on-site, complex processes take place in the Smart Meter that go far beyond metrological measurement.
The most significant difference between both types of meters is the data transmission, which takes place via local interface in the case of the electronic meter and via network in the case of the Smart Meter. With Smart Meters, meter readings are no longer taken on-site by the operator of the metering point, but are transmitted via internet. In this context, topics such as data security, encryption and interoperability are of high importance.

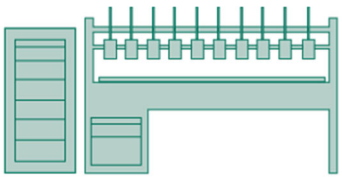
Electronic meter



The term Smart Meter is interpreted and defined differently around the world. What all definitions have in common is that a Smart Meter, in comparison to an electronic meter, has a communication interface and is connected to a network. This interface can have different characteristics and use different technologies and protocols. The objectives of these interfaces remain mostly the same: information from the meter is to be transmitted. Some of this information is generally shown on the display (without request) or sent via communication interface (e. g. the register value), other information must be specifically requested from the meter. Looking into the future shows with great certainty that this communication will be exclusively encrypted. This fulfils the increasing data protection requirements and brings communication up to the current state of the art.

Automatic tests of a Smart Meter

- Metrologic testing of a meter with and without encryption
- Function test
- Communication analysis



Metrologic testing

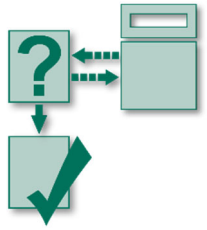
The metrological tests of a Smart Meter and an electronic electricity meter differ particularly in the use of the communication interface.

This interface for the automation of test procedures can be used, for example, to query data that would normally have been read manually. The main task is still the detection of measured values with the corresponding accuracy.

When using Smart Meters, passwords (e.g. DLMS LLS[1]) or cryptographic key material (e.g. DLMS HLS[2]) may be required for this. Even if only the measured values are to be retrieved automatically from your Smart Meter, you also need the information on the key material of your meter for this process. Security functions of this kind can never be deactivated or bypassed, even for metrological checks.

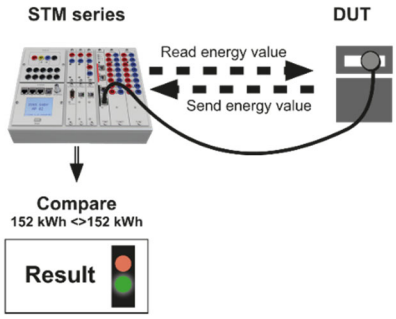
1 LLS = Low Level Security
2 HLS = High Level Security

Function test



The goals of functional tests and communication analysis differ primarily in terms of content. On the one hand, there is the evaluation of a result (true-false).

On the other hand, there is the detailed and precise evalutation of communication (timing, sequence, etc.).



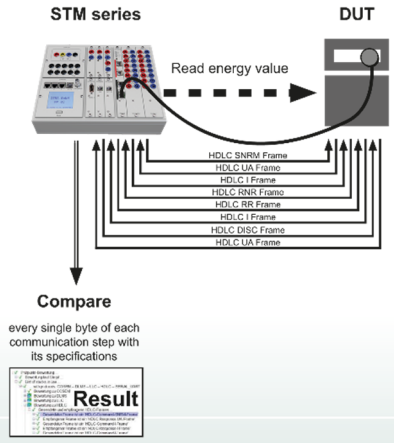
The objective of a functional test is to ensure the proper execution of a functional procedure For example, a predefined value is queried, the corresponding response is compared with the expected value and this is subsequently evaluated (true or false).

Functional tests that have delivered positive results in the laboratory, however, only provide information about whether the meter under test will later be able to communicate properly in the field with other pieces of equipment.

The reason is that a functional test evaluates the ***result***, but not the ***manner*** in which the communication operates between the test system and the meter under test.

Consequently, meters under test are not evaluated based on their communication behaviour, but instead on the result they return.

Communication analysis



The objective of communication analysis is to investigate the communication of the meter under test in detail and to ensure that each byte transmitted complies with the specifications. In contrast to a functional test, the focus of this test is not an evaluation of the content transmitted, but rather ***compliance with the communication procedure*** used in the system.

A meter under test would then be considered to have “failed” if a detail in the transmission was not specification compliant (sequence, protocol-specific contents, timing, etc.). Such a test can be applied for the meter communication which is specified with sufficient clarity. The payload (useful information) to be transmitted is not the focus of a communication analysis.

Our figure shows a schematic representation of a communication analysis with a focus on the HDLC protocol, and the telegrams associated with this. In addition to the query of the meter reading and the response of the meter in the i-frame, six additional communication frames are exchanged. To ensure error-free communication between two devices, every component of these frames must be implemented in compliance with the specification.

Both is important.

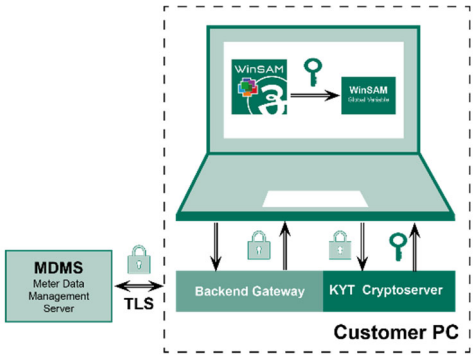
A functional test is important, but it does not allow conclusions to be drawn as to why a meter under test is faulty. When complemented by a communication analysis, which compares all of the protocol-specific parameters and indicators with the specification, you obtain a comprehensive result concerning the quality of your meter under test.

Detailed information about this topic can be found on:
https://www.zera.de/en/company/specialist-topics/smart-meter-knowledge/key-management/

Key management

Key management is a fundamental element in information security. This security must be ensured in the communication between the meter test system and the meter under test. The best solution for this is the protected integration with a Meter Data Management System (MDMS) or a similar infrastructure. The MDMS ensures that all data required for the test procedure will be provided.

Meaning



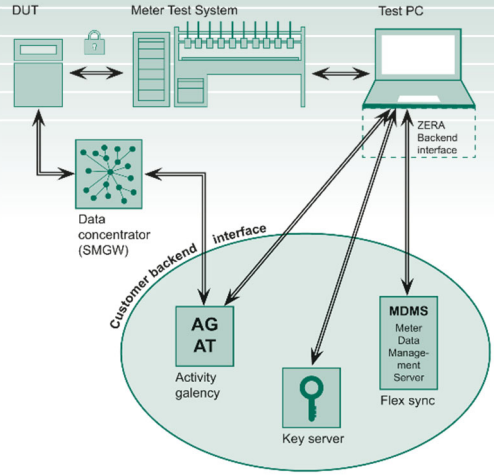
The task of the key management is to administrate the keys required for the encryption procedures (also: cryptographic [1] procedures).

The security of the encrypted communication or the encrypted data depends directly on the key management. It guarantees the privacy of the keys and checks them for authenticity.

The key management is responsible for the generation, storage, exchange, and protection of the keys. Alternative term is *encryption key management* [2].

[1] Cryptologie: Cryptology (Greek κρυπτός kryptós "hidden, concealed, secret" and logic) is a science that deals with the encryption and decryption of information and thus with information security. Source: Wikipedia (Free translation of the German version).
[2] Source: www.security-insider.de (Free translation of the German version).

Meter Data Management System – MDMS



For the communication between the meter test system and the meter, a successful connection to the protected[3] DUT (device under test) is required. Passwords and keys can be provided in encrypted form by means of a protected connection of the test system via MDMS or a similar infrastructure. Manual processing by the operator is inconvenient in this case.

Passwords and keys can be provided in encrypted form by means of a protected connection of the test system via MDMS or a similar infrastructure. The decryption and delivery of the required data is carried out directly at the test system. Although the inspector can follow a successful decryption, but he cannot read it as plain text.

3 protected here means, for example, that passwords are used to verify the authorisation of the user or encryption procedures. Authorisation and encryption are required to ensure that data cannot be read or modified during transmission.

Detailed information about this topic can be found on:

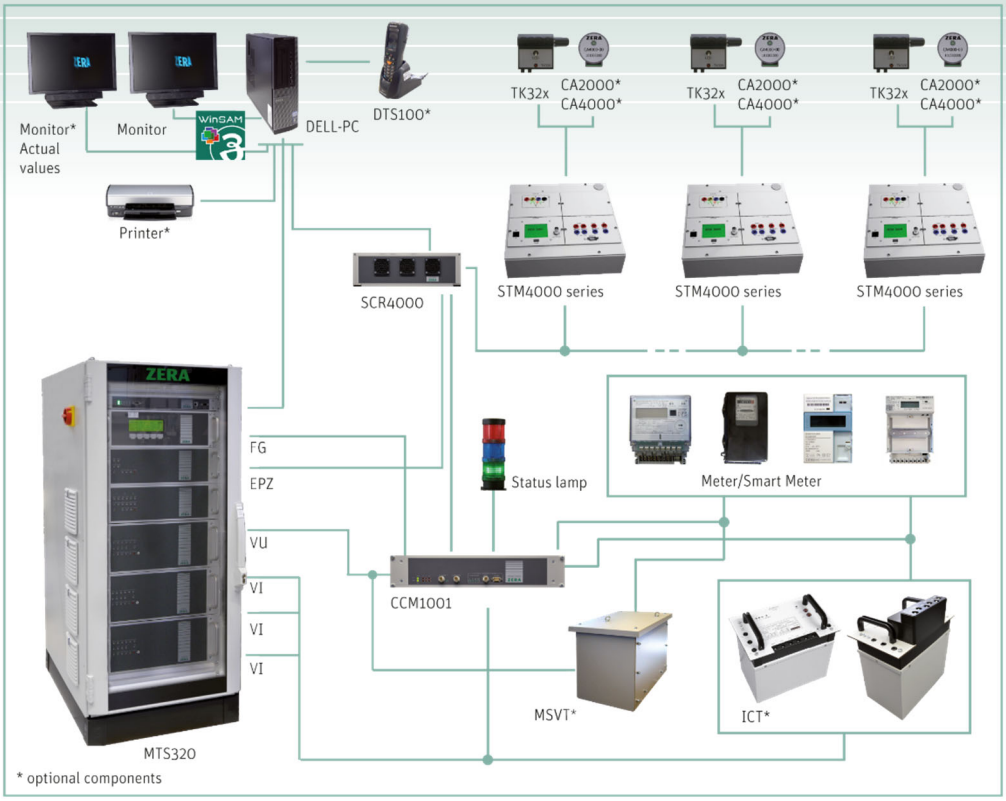
https://www.zera.de/en/company/specialist-topics/smart-meter-knowledge/key-management/

Hardware solutions — STM4000 and STM6000

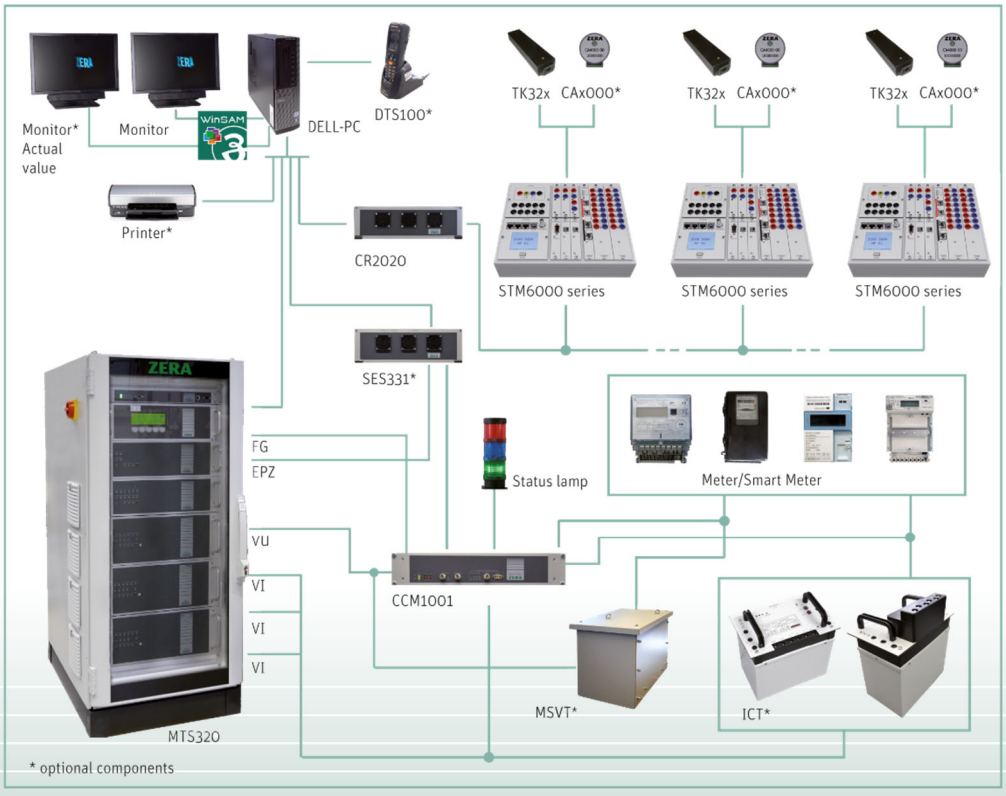
With our digital measuring systems STM4000 and STM6000, you also have the opportunity to take a detailed look at your meter in terms of data communication. Especially when the communication of several devices from different manufacturers and of the same standard (interoperability) becomes important, this analysis is indispensable for the identification of deviations.

Basic function	STM4000 module(s)	STM6000 module(s)
Coloured 2,8“ TFT display	STM4000	STM6000
Reset button	STM4000	STM6000
Metrologic pulse measurement via BNC (incl. divider 1, 10, 100, 1000)	STM4000	STM6000
Metrologic measurement via LED (active/reactive)	STM4000	STM6000
Metrologic measurement via LED (additional external scanning head/communication adapter)	-	STM6000
Individual voltage switching per phase and N	STM4120	STM6000, STM6110, STM6120
Auxiliary circuits	optional	optional
Communication via optical interface (IR), max. 57.600 Baud, IEC 62056-21/IEC 61107 (EN1107), IEC 62056/-42/-46/-53 DLMS/COSEM (HDLC, LLC, DLMS (auth. by LLS, HLS), COSEM), ABB (Elster) Vision	STM4000	STM6220
Communication via Ethernet	-	STM6000
Measurement and adjustment of the light intensity	STM4000, CA4000	STM6000, CA6000

STM4000 series



STM6000 series

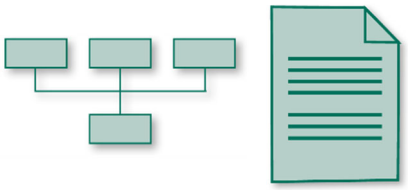


All functions in one Software

The entire, fully automatic control of the metrological testing and the communication analysis is implemented via WinSAM testing and control software.
Optionally, various licences enable the implementation of functional extensions:

- Test cases according FNN requirement specification (German market)
- Acceptance test (German market)
- Backend Gateway (German market)
- DLMS license
- Log viewer

Interfaces and protocolls



Type	STM4000	STM6000
RS485 (2/4-wire), max. 115.2 kBaud - Modbus* - ANSI12.22 (Echelon meter) by software of the meter manufacturer	STM4200	STM6230
Metrological measurement via S0 transmitter (EN62053-31) (Pulse outputs from the DUT)	1x (24V)	4x, 8x, 12x (5 ... 27 V)
Metrological measurement via S0 receiver (EN62053-31) (Pulse inputs from the DUT)	-	4x, 8x, 12x
RS232, max. 115.2 kBaud	STM4200	STM6240
Mbus, max. 38,4 kBaud	Slave	STM621x Master/Slave
tm/te time measurement	-	On all inputs
CL, 20 mA	-	STM6200
Communication via optical interface (IR), 9.6 kBaud, EN62056-21	STM4000	STM6220
Communication via LMN interface (wired, rear side, optical interface, 921.6 kBaud), SML-COSEM (HDLC, TLS, SML, COSEM)	-	STM6290
DLMS-COSEM (HDLC, DLMS, COSEM)	STM4000	STM62x0
EDL (Info/MSB interface), SML	STM4000	STM6250
SyM², Ethernet (interface for data concentrator, gateway, meter)	-	STM6260

* optional

Customised solutions

Besides our standard products, we also offer customised modifications for PLC, RF or NFC. We will be pleased to consult you on this. Contact us on sales@zera.de .

Software

With the WinSAM testing and control software, the entire testing of your stationary systems can be controlled fully automatically, stored measurement results can be logged, and customer data can be managed. WinSAM combines all the functionalities you need for our STM series.

STM4000 info paper

In our information sheet you will find further information, explanations and key data about our digital measuring system of the STM4000 series - our flexible and cost-effective solution for modern meter testing.
https://www.zera.de/en/product/meter-testing/stationary-meter-test-systems-dc/measuring-systems-en/stm4000-basic-module/

STM6000 info paper

A summary of individual modules and their functionalities can be found in our STM6000 information sheet. This digital measuring system shows the highest expansion level of our modern testing solutions. The structure is modularly developed down to the detail - perfect for customised and individual solutions.
https://www.zera.de/en/product/meter-testing/stationary-meter-test-systems-dc/measuring-systems-en/stm6000-basic-module/