



ANALYZING LOGGING

TESTING MEASURING

Digitalization in the Energy Market

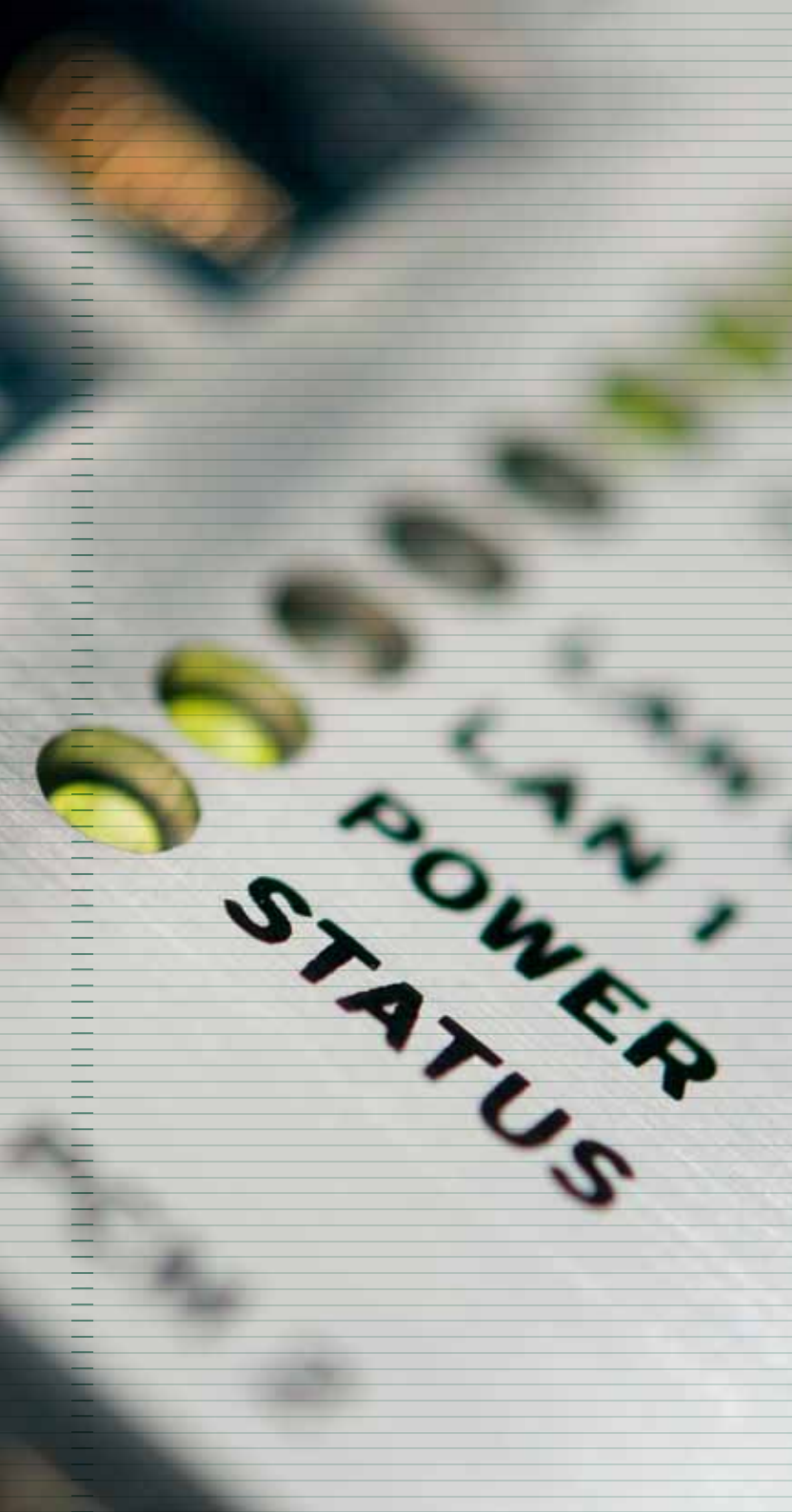
Test Technology for the
Electricity Market 2.0

Do you have any questions or wishes?
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ZERA

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Interconnected? Of course!

Renewable energies are the pivotal issue in the energy transition; their use is continually on the rise. This poses complex challenges for the entire supply system: Modern electricity meters and smart metering systems are absolutely essential in order to efficiently link energy production with consumption and to uncover potentials for savings. The only way for the energy transition to be successful is for these systems, in which metrology and digital technology meld together, to operate correctly, safely and reliably.

As a certified expert for energy measurement technology, ZERA is setting the course for the quality assurance and testing of smart metering systems using future-oriented testing technology for both for individual components and for the overall unit.

With this brochure, we hope to provide you with an overview of a dynamic market and our solutions.

Neander Pütz
Product Manager for New Technologies

INTRODUCTION

The electricity market in flux

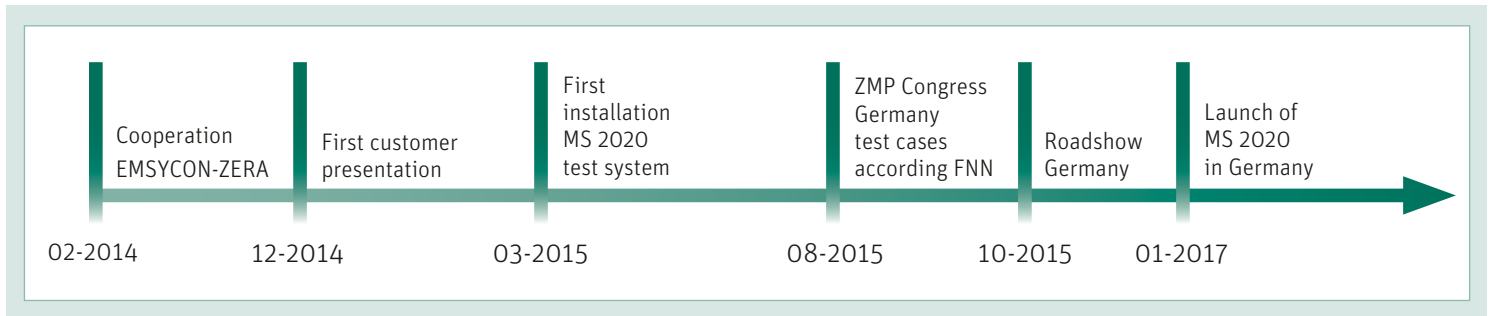
The structure of energy supply has changed fundamentally. Power is no longer only consumed, but also fed into the grid decentrally. The requirements made of today's power grid are multifaceted – including the fact that consumers can now also become producers. The new challenges in the electricity market demand integrated solutions.

The reason is that metering alone is no longer adequate: Simply recording the current energy consumption is a thing of the past. Today, sharply varying flows of electricity must be controlled and automated while at the same time consumption needs to be reduced. This means that a vast array of data must be recorded. And not only that, these data must be processed and commu-

nicated intelligently. Consequently, two elements must come together to make the power grid future-proof: Metrology and modern communication technology.

Smart and reliable

Modern measurement and communication systems are essential for managing the complex network of data. IT has long formed the core of the new world of meter technology. A fusion of the two fields – data measurement and data processing – is only possible when they can communicate with each other. To ensure the quality of modern electricity meters and smart metering systems, ZERA has developed a test system for the MS 2020 Basic Meter. This test system has already been in operation at a number of customer sites since 2015 and represents an initial developmental step towards a stationary, overall solution for testing the MS 2020 metering system.



What is the situation in the electricity market?

The use of renewable energy sources is being called for and promoted worldwide. Environmental conservation through climate protection and energy efficiency is of paramount importance in this energy production transition. In Germany, the energy transition also includes the phasing out of nuclear power; almost one third of the electricity produced in 2015 was already obtained from wind, solar or biogas plants. These sources of electricity deliver energy spontaneously, and it cannot be predicted or stored reliably.

An electrical supply system in which renewable energies occupy an increasingly large place creates completely new tasks. The various players involved in the market (industry, utility companies, grid operators and, ultimately, legislators as well) are reacting to the great changes taking place in energy production and consumption.

What does the legal framework look like?

In Germany, a series of laws were passed in 2016, in part related to EU directives, such as the Electricity Market Act, the reform of the Renewable Energies Act (EEG 2017) and legislation concerning the digitalization of the energy transition.

Also included amongst them is the Metering Point Operation Act (MsbG): Smart metering systems and modern metering equipment form the primary focus here. On the one hand, it governs the rights and obligations of metering point operators and on the other, the technical and

temporal requirements for the operation of smart metering systems are defined here as well.

In short, within this framework, the entire market is morphing at high speed – to become the electricity market 2.0.

Test System MS 2020

Fundamentals

- Grid technology/Grid operation (FNN) specifications
- Law, guidance, regulations
- FNN test case specifications
- User/Customer specifications and requirements

FNN

- Test case specification Basic Meter
- Technical specification Functional Features
- Technical specification line-bound LMN protocols

- Digitalization
- MsbG
- Standardization
- Interoperability
- Energy industry law (EnGW)
- Industry 4.0
- Electrical industry
- Energy efficiency
- Technical specification BSI TR-03109
- EEG 2017

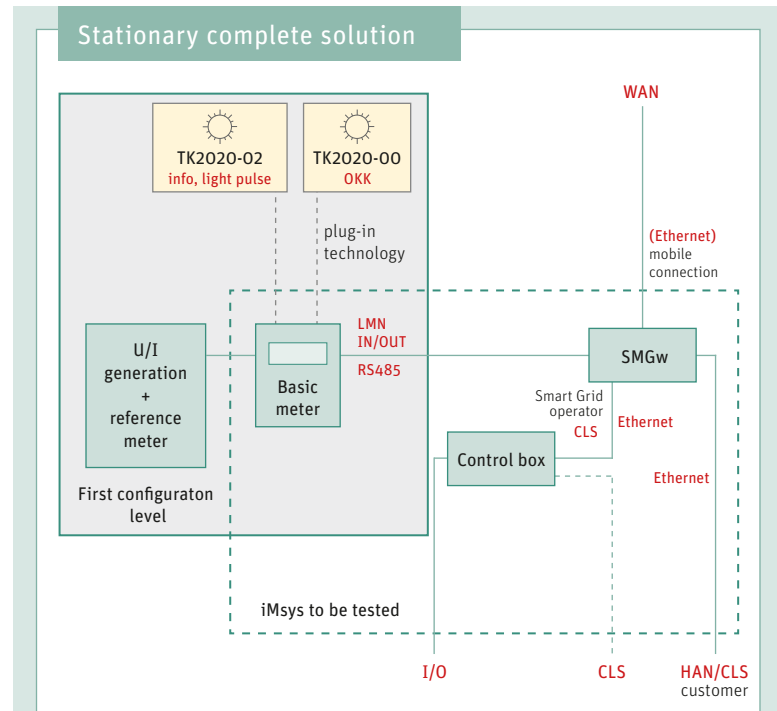
The ZERA test system: The complete solution

With the stationary complete solution for testing the MS 2020 metering system, ZERA offers the option of testing all the components in the smart metering system individually or as an interconnected unit. This fulfills the prerequisites for flexibly verifying the testing tasks of the individual components and the smart metering system itself under real-use conditions.

The complete solution from ZERA tests and analyses the metering performance of the MS 2020 Basic Meter, the data communication between the Basic Meter and the Smart Meter Gateway as well as the overall function of the complete system.

The stationary complete solution offers verification testing of the components listed below:

- MS 2020-Basic Meter
(variants 3.HZ, eHZ, SLP and RLM)
- MS 2020-Smart Meter Gateway (SMGw)
- Control box as a separate device or integrated into the SMGw
- OKK – Optical communication head for the rear interface of the MS 2020 plug-in meter
- iMsys – All components interconnected



CLS	Controllable Local System
HAN	Home Area Network
I/O	Input/Output
LMN	1Mbit RS485 interface
OKK	Optical communication head
SMGw	Smart Meter Gateway
TK2020-00	Optical head which communicates via the rear interface of the Basic meter in plug-in technology
TK2020-02	Optical head which communicates via the info interface of the Basic meter
U/I	Voltage/Current
WAN	Wide Area Network



SOLUTIONS

Test environments for the ZERA test system

There are two different connection modules for testing the MS 2020 Basic Meter: the 3-point technology version and the plug-in version. With both versions, the overall system is operated and controlled using the WinSAM V6 software.

1. The 3-point technology version

This meter is connected to the test system via an electrical RS485 interface (LMN IN/OUT) and the optical customer/information interface.

2. The plug-in technology version (as for eHZ)

This meter is connected to the test system via the optical interface (OKK) located on the rear and the optical customer/information interface.

	USB	CR2020-Bus	CR2020-P2P
Kernel			
Test cases			
Viewer			
KoaLa GUI			

function matrix

Kernel

The Kernel acts as the central software component for control of all communication tasks. It serves to provide the following functions to the interfaces (USB, CR2020 bus, CR2020-P2P):

Basic module, reading and writing of registers, initial reading and final result for dosage, control of “flashlight” of TK2020-02 (flashing, switch options, calling up stored values to the display).

Test cases

The following test cases are implemented according to the Forum for Grid technology/Grid operation (FNN) and can be carried out by the kernel:

Test cases according to FNN test specification “Basic meter, functional features 1v2”

Test cases according to FNN test specification “LMN 1v1” (available for “basic meter“ function)

Viewer

The viewer analyses the recorded communication and is available for all interfaces.

KoaLa GUI (software from EMSYCON)

Using the KoaLa GUI, the test cases are freely programmable. The program is only available for interface CR2020-P2P.

Two experts - One goal

Metrology meets communication

For ZERA, “Test Technology for the Electricity Market 2.0” is more than a slogan: With the stationary complete solution for testing the Metering System 2020, we have combined our expertise in metrology with EMSYCON’s smart data communication technology. For us, this represents the decisive step into the future of meter testing. By linking the know-how of two independent specialists, we are able to offer both precision measurement results and perfect communication.

Smart test technology for tomorrow’s electricity market

The cooperation between ZERA and EMSYCON opens up new perspectives for the testing tasks our customers deal with. The test system for the MS 2020 Basic Meter offers all of the options needed to test and check the Basic Meter comprehensively. From the acceptance test to sampling inspection and conformity testing of the Basic Meter, the ZERA test system makes all of the test types possible, creating a foundation for competent and reliable assessment of these devices.

EMSYCON

As a specialist in data communication, EMSYCON is responsible for digital realization: The engineering office with 20 years of professional experience in meter data communication develops embedded systems for hardware and software. Several specifications issued by associations as well as standards for electricity meters and their additional components are supported by EMSYCON. At customers’ requests, EMSYCON was responsible for creating some of these standards.

In order to realize the interoperability of MS 2020, EMSYCON developed the software and hardware: KoaLa test case driver (↔ kernel) and the CR2020 communication test device.

ZERA

ZERA is an experienced developer and manufacturer of systems and individual components for testing electricity meters. The company supplies customized testing systems for metrological institutes, utility companies test laboratories and meter manufacturers. ZERA provides all of the components for the metrological testing of the MS 2020 Basic Meter.

Within the framework of various bodies of experts, ZERA engages in continuous interaction with the industry sector. This includes cooperation with the Grid Technology/Grid Operation Forum (FNN), ongoing collaboration in the International Electrotechnical Commission (IEC) as well as membership of the Agency for Measurement Quality and Innovation (a:m+i)

BZ - Basic Meter

The basic meter is the electricity metering device within the intelligent measuring system.

CLS - Controllable Local System

A secure communication link into the WAN to an external provider can be established via the CLS interface of the intelligent measuring system (iMsys).

This controls connection user components such as photovoltaic systems or intelligent household appliances.

Fieldbus

A fieldbus connects measuring sensors with communication participants such as basic meters via the LMN interface with the Smart Meter Gateway.

HAN - Home Area Network

Home area networks are used for intelligent households as well as home offices. HANs are the base for the central control of end-consumers and their functions.

iMsys - Intelligent measuring system

The intelligent measuring system is composed of multiple components. These include the basic meter, gateways, and control box, as well as add-on devices. Energy consumption and supply are metered, determined and controlled by computer.

IOP - Interoperability

The interoperability describes the ability of a device to communicate with further devices of the same standard including a system environment which is comparable. With reference to the intelligent measuring system the aim is to guarantee the direct interchangeability of devices of different manufacturers.

LAN - Local Area Network

The local or public network is a computer network which is restricted in its extent.

LMN - Local Metrological Network

The intelligent meters of the local generators and consumers, as well as a gateway (within the intelligent grid), are networked with each other via the local metrological network. It can be used for energy management. Data communication occurs via LMN interface.

M-Bus - Meter-Bus

The M-bus is a standardized fieldbus for recording of consumption data e. g. of energy, gas or water meters. It is a communication system for transferring meter data.

MS 2020 - MeasuringSystem 2020

MS 2020 is a project initiated by VDE and FNN in order to develop a future-oriented, standardized measuring system for the German market. The devices and IT solutions of different manufacturers should be usable in the future without modifications (keyword: interoperability).

In the future, the measuring system will consist of smart meters, gateways, add-on devices and an energy management system, and will communicate independently of manufacturer.

OKK - Optical communication head

The optical communication head is a data sensor which is responsible for data communication between basic meter with plug-in technology and smart meter gateway.

P2P - Peer-to-peer

The peer-to-peer connection is a communication model in which each party has the same rights and capabilities and therefore can initiate a communication session. For example at a ZERA Meter Test System it is possible that the basic meters can communicate inside the test environment LMN peer-to-peer. The type of communication complies with the structure of test cases according to FNN.

Smart Grid

“Smart grid” describes the intelligent power grid that comprises the communicative networking and control of current generators, storage devices, electrical consumers, and power supply equipment in energy transmission and distribution networks of the electricity supply.

Smart Meter

Very generally speaking, a smart meter is an intelligent energy meter. The label does not differentiate between intelligent electricity, water, or thermal meters.

Smart meters operate digitally and are equipped with their own, sometimes high intelligence. They detect not only energy consumption, but also the energy supplied by photovoltaic systems, for example.

Smart Metering

Smart metering is the computer-based measurement, determination and controlling of energy consumption and supply. This is relevant both for corporations and for private households.

SMGw - Smart Meter Gateway

The smart meter gateway is the central communication unit of an intelligent measuring system. The SMGw is used for processing, saving, tariffing and forwarding the detected electrical energy (in Germany according to the guidelines of the German Federal Office for Information Security - BSI).

SML - Smart Message Language

Smart Message Language is a communication protocol for electricity meters which was developed not only for the exchange of metering data, but also for firmware upgrades. This protocol is used in eHZ, SyM², EDL and basic meters.

TLS - Transport Layer Security

The transport layer security is used for security of networked systems and describes a protocol layer for encoding, for example, communication data. These data are exchanged - on the WAN side - between the smart meter gateway and authorized participants or - on the LMN side - between the smart meter gateway and intelligent meters.

WAN - Wide Area Network

The wide area network (WAN) is a computer network which, in contrast to a local area network (LAN), extends over a very large geographical area.

The number of connected computers is unlimited. WANs can extend across countries or even continents. WANs are used to network not only different LANs but also individual computers together.

Sources:

<http://www.itwissen.info>

<http://www.voltaris.de>

<https://www.internet-sicherheit.de>

