

Protocol Competence & Test Center





EFFICIENT DATA COMMUNICATION

The Protocol Competence & Test Center of DNV KEMA Energy & Sustainability

Communication between IT systems within and between utilities is increasing, as a result of the introduction of decentralized energy resources, substation automation, the new generation of SCADA/EMS/ DMS and smart metering. To create a cost-effective open solution for such communication, the utility industry needs standardized communication interfaces.

In a typical energy IT environment, several systems and devices from different manufacturers have to interoperate flawlessly. Communication standards are a basic requirement for the realization of open infrastructures and the interoperability of devices. Using open communication standards involves a project approach that differs quite significantly from the approach used for implementation of a vendor-specific proprietary solution.

WHY USE OPEN STANDARDS?

The advantages of using open data communication standards are numerous. You are not dependent on one supplier and will avoid a vendor lock-in situation. You will be able to decrease the cost of engineering and maintenance. Systems complying with open standards can be integrated more efficiently and at lower cost. Because the open data communication protocols are more widely used, there are more products on

the market and prices decrease. Through user groups and conferences, you can rely on the experience of other organizations around the world that have already implemented these open standards. Finally, you can take advantage of the testing and certification services offered by independent test organizations to evaluate the quality of products based on the standards. Standards organizations such as the International Electrotechnical

Commission (IEC) have been developing data communication standards for the energy industry for many years. The current trend in this development is towards protocols and information models that offer more functionality, modularity and flexibility. This trend results in standards that comprise more than just a protocol, because data models, network models, engineering guidelines, test guidelines and configuration languages are also included.



RECOGNIZE RISKS

The DNV KEMA Protocol Competence & Test Center has the expertise to recognize the advantages and potential risks when using standardized communication protocols and information models. Inter-device connectivity doesn't automatically imply inter-device operability. We are able to identify and manage risks for the utility and manufacturer in order to be able to achieve an interoperable and genuinely open system on schedule



and within budget. Our approach covers the complete product lifecycle from conception to operation.

DNV KEMA is familiar with the latest developments. We are more than familiar with the energy market, so we understand your priorities. We participate in IEC, CEN/Cenelec, IEEE and UCA working groups that define the standards and test procedures for utility information exchange. We also have extensive experience in testing data communication protocol implementations and providing related consultancy services. DNV KEMA is able to assist all parties involved in a project with the reliable use of open communication standards, independently and without bias. From initiation of the project right through to the operational phase.

YOUR BENEFITS

- The assurance - before implementation - that the systems from various suppliers will interoperate flawlessly
- The assurance that the system meets your requirements
- Selection of the most costeffective communication standard and vendor solution
- Specification of equipment complying with the latest standards
- Advice focused on integration and migration aspects
- Quick start with customized training and workshops
- Advanced test tools for utilities; acceptance- and performance testing and problem solving
- Advanced test tools for manufacturers and test labs; to speed up and assist during development, acceptance testing and problem solving
- One-stop shopping; all relevant areas covered



COVERING THE FULL LIFECYCLE

Our services

Whether you need protocols for data communication to monitor and control the transmission and distribution grid, to monitor and control decentralized energy resources, wind farms or electrical vehicles or to exchange information with smart meters, the Protocol Competence & Test Center can help you. We give you the assurance that all elements of the system meet your requirements.

The DNV KEMA Protocol Competence and Test Center offers a comprehensive range of services, including functional and technical consultancy, training, project implementation support and testing in the field of data communication. We can provide everything from feasibility studies to the design of communication infrastructures; from acceptance testing to certification. For in-house testing, we offer our clients test tools that enable the analysis and simulation of data traffic according all current IEC standards. We can help you implement your project or

undertake on-site test activities. You can also turn to DNV KEMA for project-related quality assurance and technical protocol training. Our services cover a wide range of communication protocols, such as those listed below.

IEC 61850

The International standard for data communication between metering, protection, control, transformer and switching devices within substations is IEC 61850. IEC 61850 is now extended towards communication between substations, towards decentralized

energy resources and hydropower plants. As well as defined services, the data models of this standard allow for mapping on mainstream broadband communication technology. The standard also comprises a configuration language to engineer the devices and the substation automation system.

IEC 61400-25

The 61400-25 standard series focus on wind turbines, more precise the communications for monitoring and control of wind power plants. The standard provides a solution for access



to wind power plant information with standardized data names and semantics based on the IEC 61850 standard. It gives possibilities to procure monitoring and control solutions as separate or integrated systems to store, analyze and present wind turbine information.

IEC 60870-5 / DNP3

One of the current IEC standards used for data communication and telecontrol activities is the IEC 60870-5 protocol. Although DNP3 is not an IEC standard, they are very similar in technical and functional point of view. They are optimized for the efficient and reliable transfer of process data and commands to and from geographically remote locations.



OUR SERVICES INCLUDE

- Market studies
- Feasibility studies
- Developing requirement specs
- Procurement support
- Conformance testing
- Acceptance testing
- Interoperability testing
- Supply of test tools
- Project implementation and engineering support
- Quality assurance
- Training and workshops



IEC 60870-6 TASE.2 / ELCOM-90

The TASE.2 data communication protocol is the formal IEC alternative for the exchange of process data between control centers. ELCOM originates from a Scandinavian initiative and offers similar functionality. The TASE.2 protocol - formerly known as the Inter-Control Center Communications Protocol (ICCP) - is in great demand in North America, while also gaining popularity in Europe at the expense of Elcom-90.

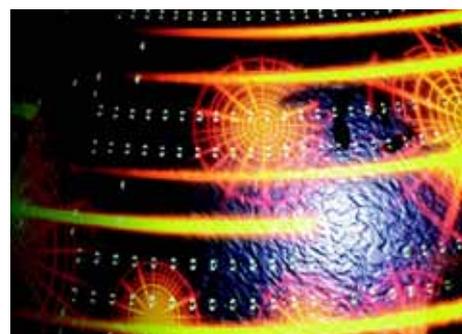
COMMON INFORMATION MODEL (CIM)

The CIM consists of three document series: IEC 61968 describing standards for the integration of applications in utilities, IEC 61970 describing the information model and profiles to exchange information i.e. over an integration bus or to exchange network models, and IEC 62325 describing the information model,

profiles and techniques to exchange energy market information.

SMART METER STANDARDS

Smart metering is a key aspect for realizing the smart grid. The International standard and data model DLMS/COSEM is one of the important standards to facilitate smart metering. The communication technology to transport DLMS can be i.e. 3G/GPRS or power line communication like PRIME. In Germany the SML standard is being developed for smart meter communication providing similar functionalities as DLMS. The M-bus standard (EN 13757) is gaining popularity in Europe to interconnect meters in order to facilitate the multi-utility meter concept connecting i.e. electricity-, gas- and water meters.





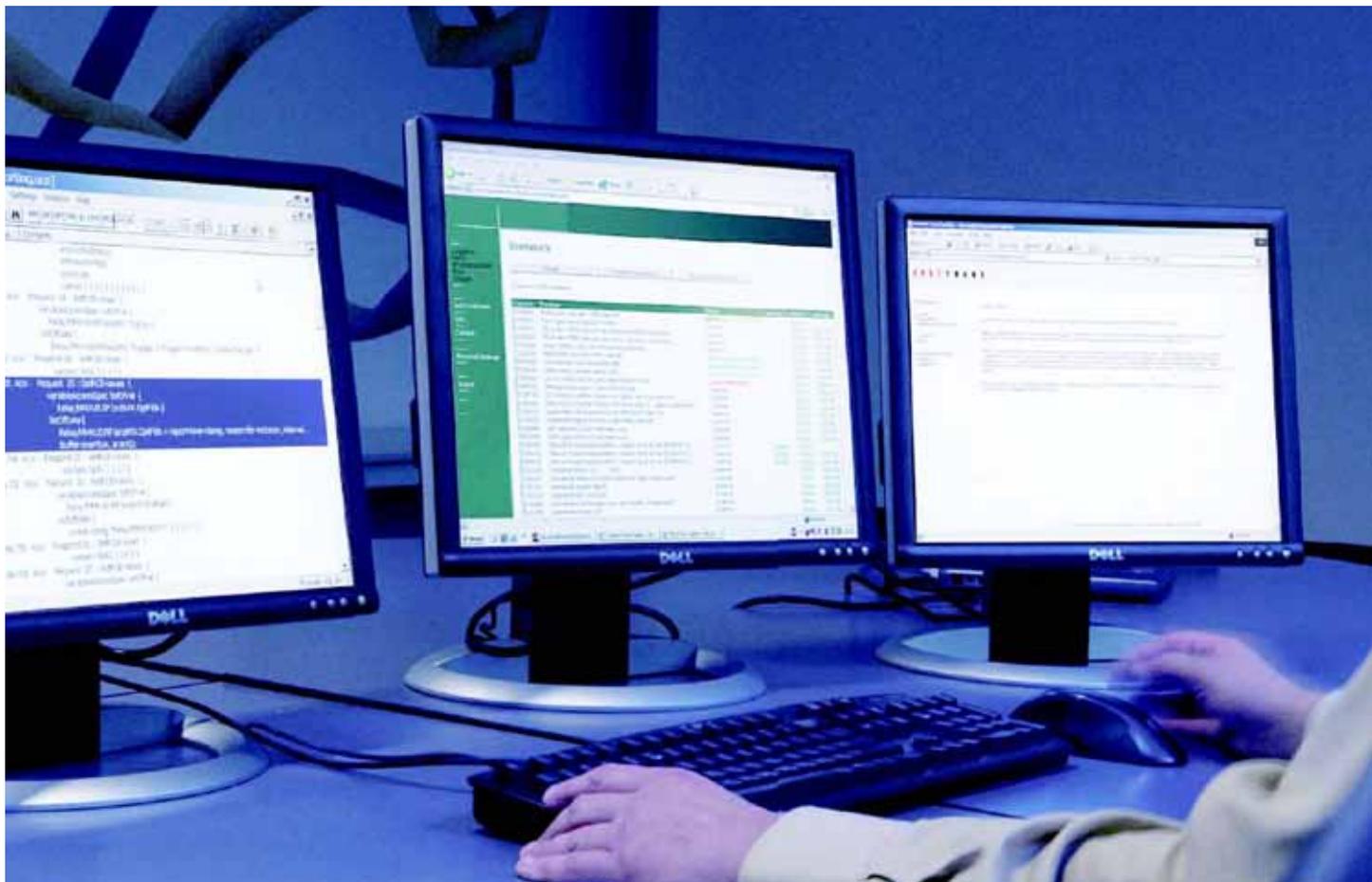
EDI

Forecast and metered energy consumption data are important to market players in the energy market. Exchange of this data should be properly structured and (cyber) secure. Moreover, in an open liberalized market, any party should be able to gain access to this communication flow. Standardization and international standards are key issues for data exchange in an open market and the most frequently used standards for electronic data exchange at the present time are EDIFact and XML. ENTSO-E, developed an XML-based standard for electronic message exchange with TSOs: the ETSO Scheduling Standard (ESS) while the European Federation of Energy Traders defined an XML-based standard to exchange trading deals.



OUR SERVICES COVER THESE PROTOCOLS

- IEC 61850: Power utility automation
- IEC 61400-25 Wind turbine communication
- IEC 60870-5 / DNP3: Telecontrol
- IEC 60870-6 TASE.2/ELCOM-90 Control center
- IEC 61968 (CIM)
- IEC 61970 (CIM)
- IEC 62325 (CIM)
- DLMS/COSEM: Smart metering
- EN 13757 M-Bus: Smart metering
- EDI: B2B communication



MINIMIZE INTEROPERABILITY RISKS

Protocol test tools

All testing activities are aimed at detecting deviations from specifications as early as possible. The DNV KEMA Test Tools will enable you to monitor, simulate and analyze all data communication not only prior to, but also during operation. This approach avoids the need for more time-consuming and costly debugging and modifications at a later stage. Enabling you to complete the project within budget and as planned. Our testing tools play an important role in identifying and minimizing interoperability risks and they allow faster rollout of projects by verifying performance and interoperability. DNV KEMA provides four main types of protocol test tool: analyzers, simulators, observers and websites for on-line testing.

ANALYZERS

These test tools allow you to analyze, monitor, capture and store protocol communication frames. Our analyzers not only display communication packets in human-readable format in the various selectable protocol layers, but also automatically analyze the frames. Due to the build-in protocol knowledge our Analyzers will detect and report frame and interframe errors. Detected errors are shown in easy readable descriptions so you do not need to be a protocol specialist to understand what is going wrong.

This enables engineers without detailed protocol knowledge to use and understand the output of the tools.

SIMULATORS

These test tools enable you to simulate i.e. a control center, substation, data concentrator or smart meter. Besides real live use-cases that you can prepare yourself, you can also simulate negative situations and send corrupted protocol communication frames.

Our simulators are able to simulate master or slave and server or client systems.

Our simulators also contain a flexible editor to construct testscenarios. Once you have created your test scenarios, you will be able to test all kind of situations automatically once or many times without user interaction. With every license, DNV KEMA provides a number of pre-defined scenarios for the simulation of practical communication functions. Our simulators can also be used for database (configuration) testing, performance testing or preparation for conformance testing.

OBSERVERS

The Observer application is provided by DNV KEMA for free. With our Observer you can capture data on-line at remote locations, substations or power plants for off-line analysis by one of our analyzers in case errors occurred. The Observer can for example be configured in a way to save logfiles from the past days, or only save logfiles with errors in it. When detailed analysis of a saved Observer logfile is needed, the file can offline be loaded in the DNV KEMA Analyzer for full detailed analysis.

DNV KEMA'S IEC TEST TOOLS FOR UTILITY AUTOMATION

IEC Protocol	Analyzer	Simulator	Observer
60870-5-101/103/104	UniECom	UniECim	104 Observer
60870-6 ELCOM	UnELCOM		Elcom Observer
60870-6 TASE.2/ICCP	UniCA TASE.2	TASE.2 Simulator	
61850	UniCA 61850	UniCASim Multi IED UniCASim GOOSE UniCASim Client	61850 Observer
61400-25	UniCA 61400-25	UniCASim 61400-25 Client	

These products can be adapted or extended to include customer-specific features. All simulators and analyzers are based on the same technology and user interface, so users can easily switch from one to another in order to handle different protocols.

DNV KEMA TEST TOOLS FOR SMART METERING

Standard	Analyzer	Simulator	Test facility
IEC 62056 (DLMS)	DLMS Analyzer	DLMS Simulator	
DSMR	DSMR P2 and P3 Analyzer	DSMR P2 and P3 Simulator	DSMR Test facility
M-Bus	M-Bus Analyzer	M-Bus Simulator	
SML	SML Analyzer	SML Simulator	
DLMS Spanish profile	DLMS Analyzer	DLMS Simulator	DLMS & PRIME Test facility

The DNV KEMA test tools for smart meters can be used to test conformity and interoperability of the components in the Advanced Meter Infrastructure. Utilities can use the DNV KEMA test tools for acceptance testing, while manufacturers can use the DNV KEMA tools during development, for internal testing or to prepare for a third party conformance test. Using the tools you can simulate a meter, a data concentrator or the central system. In parallel the data communication can be verified using the analyzer. DNV KEMA provides smart meter test tools for amongst others the Dutch, German, Spanish and Portuguese market.

WEBSITES FOR ON-LINE TESTING

For energy market EDI interfaces, DNV KEMA has created facilities for testing the exchange of various types of information. These test facilities are able to test message exchange on several levels: process, transaction, semantics, syntax and transport. It is possible to create error and stress situations in order to see how the system responds. The test facilities support most standards currently in use, such as EFET eCM, ESS, VDEW-MSCONS, EDIG@S, EDINE. Our test facilities are accessible over the Internet 24x7 to facilitate the use in the development and implementation phases. A helpdesk is available to assist users during their test activities.



DNV KEMA'S PROTOCOL TEST TOOLS ARE USED FOR

- Verifying protocol implementations and device configurations
- Conformance testing
- Interoperability and performance protocol testing
- Troubleshooting and protocol development
- Network monitoring
- Database point-to-point testing
- Factory and site acceptance testing
- Learning more about a protocol



TRAINING, WORKSHOP & CONFORMANCE TESTING

How should I migrate to a new communication network architecture? How should I introduce a new communication protocol to my network? How should I migrate to a new situation based on open (International) standards? How does it work in practice? DNV KEMA offers open or in-house communication protocol training courses and communication architecture workshops to answer these and many other questions. DNV KEMA provides protocol training courses and workshops specifically for utility personnel, IT suppliers and research institutes to learn more about the functionality and practical use of IEC and smart meter protocol standards and the impact of new communication network architectures for a utility.

Our training will enable utility personnel to participate in technical discussions and to define requirements, especially technical, engineering, performance, redundancy and test requirements, which are not (always) defined in the standard. This knowledge will help you to draw up a call for tender. In addition, the training courses will provide both developers and users knowledge, practical experience and tips and tricks how to trace and fix communication failures.

The agenda of in-house training sessions can be customized to the requirements of participants. Our workshops for utility personnel working in the SCADA/EMS, DMS, SAS and smart meter area are specially designed to understand the impact of these new communication network architectures on their business.

THEORY AND PRACTICE

Our one, two and three-day courses include both theoretical and practical

training. The theoretical training covers the protocol from the general level, right down to details such as the engineering and configuration aspects. The practical training goes into the practicalities of encoding messages and provides hands-on experience, working with the DNV KEMA test tools for the protocol in question. The program also covers an explanation of the IEC and users organizations and working groups.

INTEROPERABILITY & CONFORMANCE TESTING

If you develop or buy a system using a standard protocol you want to be sure it complies with the standard. DNV KEMA has facilities for testing IEC protocol implementations. The testing involves a number of elements, including interoperability testing and conformance testing.

Interoperability testing entails establishing that data exchange is possible and evaluating application integration between systems from different vendors. If systems are able to interoperate, the test result is positive. However, if two systems are able to interoperate, it does not mean that both protocol implementations comply to the applicable standard. Conformance testing is therefore needed to establish whether a vendor's implementation is compliant. To test compliance, the vendor's system is connected to a reference system maintained by a test organization. Procedures for conformance testing are integral to certain standards (IEC 61850, 60870-5, and DLMS). When testing compliance with these standards, a test organization follows these procedures. The DNV KEMA Protocol Competence

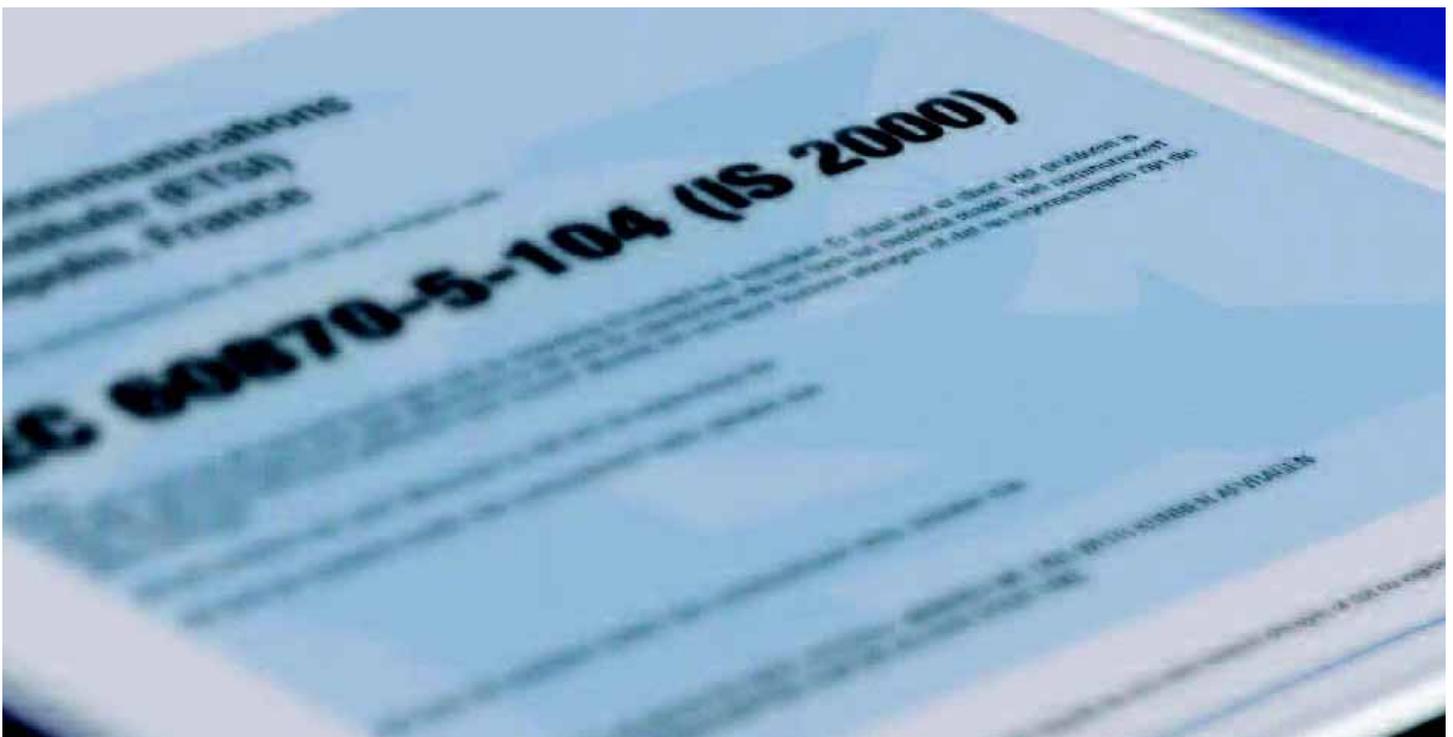
and Test Center is the number one test organization for testing smart meter and smart grid communication implementations. DNV KEMA was the first independent (level A) test organization authorized by the UCA Users Group to perform the official IEC 61850 conformance tests and issue UCA level A certificates.

DNV KEMA is well equipped for conformance testing. First we draw up the test plan based on the test procedures and the customer-specific requirements. We use an advanced conformance test system in combination with a protocol analyzer to test whether a specific device meets the international standard. The test will reveal any interpretation problems and bugs in the software at an early stage (before implementation on the customer's site). Most energy companies require that a product was tested by an independent test lab and has passed the conformance test before they will proceed to purchase. So having a DNV KEMA or UCA certificate also gives a manufacturer a competitive advantage. It has been proven that using certified products significantly reduces communication problems when a device enters service.



A TYPICAL TRAINING COURSE WILL COVER

- Overview standards
- Protocol introduction
- Trends and developments
- Protocol documentation
- Communication functions
- Data formats or object definitions
- Engineering and configuration functions
- Demonstrations
- Exercises with real equipment and/or the KEMA protocol test tools
- Problem solving
- Testing approach



ABOUT DNV KEMA ENERGY & SUSTAINABILITY

DNV KEMA Energy & Sustainability, with more than 2,300 experts in over 30 countries around the world, is committed to driving the global transition toward a safe, reliable, efficient, and clean energy future. With a heritage of nearly 150 years, we specialize in providing world-class, innovative solutions in the fields of business & technical consultancy, testing, inspections & certification, risk management, and verification. As an objective and impartial knowledge-based company, we advise and support organizations along the energy value chain: producers, suppliers & end-users of energy, equipment manufacturers, as well as government bodies, corporations and non-governmental organizations. DNV KEMA Energy & Sustainability is part of DNV, a global provider of services for managing risk with more than 10,000 employees in over 100 countries.

PRESENT AROUND THE GLOBE

- Management & Operations Consulting
- Cleaner Energy Services
- Electricity Transmission & Distribution
- Sustainable Use
- Transportation Systems
- Gas Consulting & Services
- Testing, Inspections & Certification
- Accredited Climate Change Services



- Office locations
- Agents / Business partners