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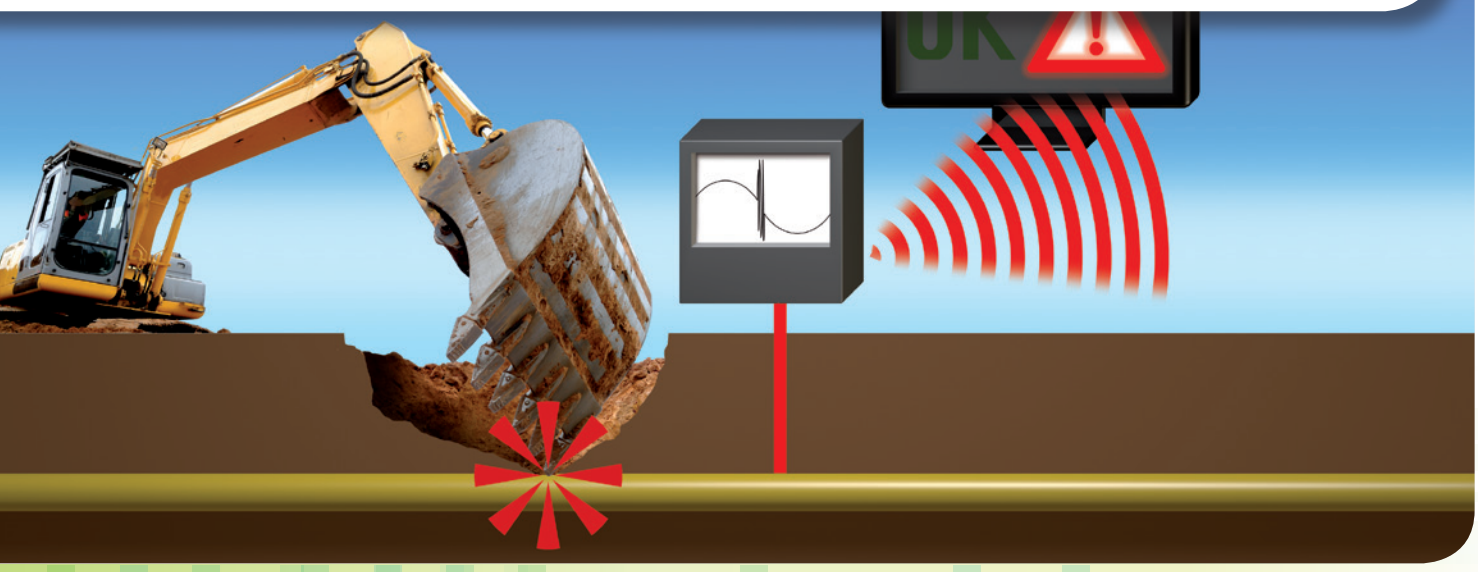

GAS NETWORK DAMAGE DETECTOR

SECURITY FOR YOUR GAS NETWORK

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The SmartKKS remote monitoring system

SmartKKS is the new remote monitoring system at Cathodic Corrosions Protection

Cathodic corrosion protection (CCP) is a technical system which is used to reliably protect underground steel pipes against external corrosion. For high pressure gas pipelines of public gas supply with an operating pressure more than 4 bar, the installation of this protection method is even stipulated.

Remote monitoring systems are used to check the effectiveness of CCP based on measurements. The generated data can also be used to assess the condition of cathodically protected pipes.

The remote CCP monitoring technology used at present has been designed to collect tho measurement parameteres which are required to prove the effectiveness of CCP and send the information as raw data to the evaluation centre. This technology, however, is not suited for a permanent monitoring of cathodically protected pipelines.

For a continuous monitoring, a new technology has to be applied which generates a constant stream of CCP measurement data at a high sampling rate which is processed and evaluated in situ, so that only relevant information will be transmitted to the evaluation centre.

This technology, which is innovative in the field of CCP, is called online monitoring.

Areas of application

The SmartKKS system is used in cathodic corrosion protection of metallic underground installations as gas pipelines. Due to the injection of protective current the corrosion process is reduced to a technically negligible level.

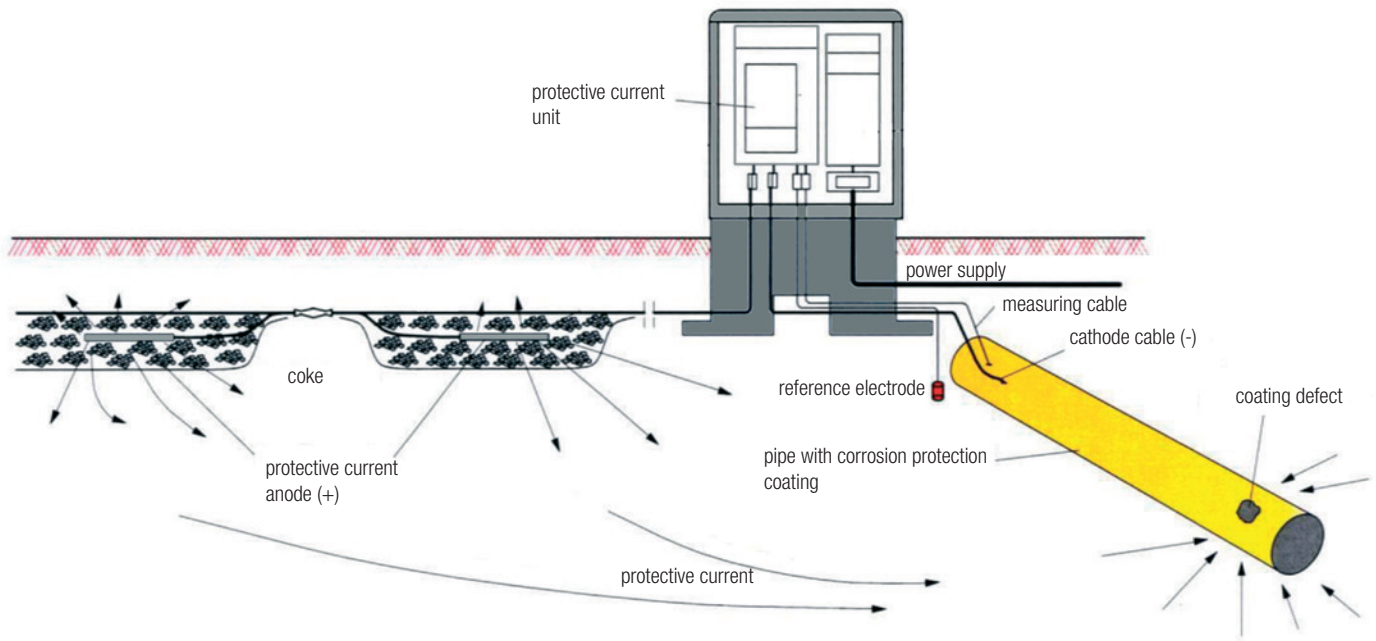
The SmartKKS equipment consists of a combination of protection current unit, integrated measurement technology and integrated remote monitoring technology.

The figure illustrates the principle of the cathodic corrosion protection (CCP) with a SmartKKS system.

Normally, the SmartKKS devices are connected to the control and analysis software at the control centre via wireless communication. It is also possible to connect the devices using an existing communication infrastructure of the operator.

Special software tools are available for the control and analysis of the SmartKKS devices. In addition to the CCP operation in accordance with the specifications of the DVGW rules and regulations the system can also detect short-term external impacts on the protected object which have a high impedance compared with the protected object. Hereby, an additional danger prevention, e.g. for high-pressure gas pipelines, is created.

SmartKKS enables a permanent surveillance of the protected object – the online CCP monitoring.



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Detection of external impacts

SmartKKS offers the possibility to detect external impacts to underground pipelines with cathodic protection. These can be short-term metallic contacts which have a high-impedance spreading resistance in comparison to that of the pipeline itself.

These include excavators and trench cutting machines which might damage the pipeline during road-building and excavation activities.

The monitoring runs autonomously. The SmartKKS devices permanently measure and assess the corresponding values at the pipeline.

As soon as an external contact is detected, an alarm message is send to the software platform via text message to a mobile phone, via e-mail or directly to the control centre.

The detection of an external contact depends on the extent of the protection area, its spreading resistance and the external interference.

These dependencies vary with every protected object and have to be evaluated in correspondence with the desired detection performance.

Taiwan gas explosion: Blasts kill 25 with many injured in Kaohsiung

Comparison of new SmartKKS and CCP technology

Features	Conventional CCP technology	SmartKKS technology
CCP system can be controlled via remote access	✔	✔
Collecting measured CCP values and transmission to evaluation centre	✔	✔
Test directives: CE, VDE, AfK, EMC	✔	✔
Time synchronisation DCF77, GPS	✔	✔
Detection of external contact, e.g. impacts from excavator bucket	✗	✔
Economical set-up of remote CCP monitoring as per DVGW Code of Practice GW 16, Category 2c	✗	✔
Continuous, non-stop measurement and evaluation of all electrical signals on the pipeline	✗	✔
Separate evaluation of the electrical signals on the pipeline by disturbance parameters and the proportion caused by the CCP	✗	✔
Smart control of the CCP protective current on pipelines affected by induced AC voltage	✗	✔
Remote access at any time	✗	✔
Data transmission with remote access via GPRS/UMTS wireless communication	✗	✔
Data transmission with remote access via Ethernet, fibre optic cabling	✗	✔
Logger function via remote access	✗	✔
Parametrisation, software updates, data access, control:	✗	✔
On site via display input, notebook, tablet, smartphone	✗	✔
Remote access via PC, tablet, smartphone with Internet access	✗	✔
Server-based evaluation platform with interfaces to other software products including user administration and data export	✗	✔
Modular design of power electronics and measurement technology for individual requirements	✗	✔

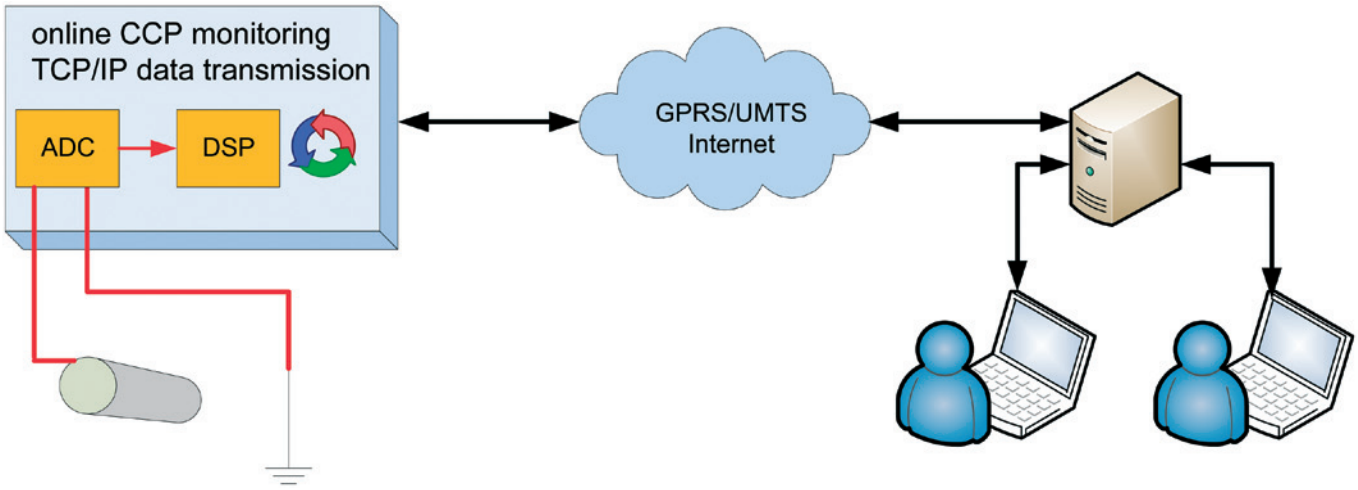
Your Benefits

- Condition assessment of pipelines -> asset management
- Reduction of operating costs
- Higher operational security of the pipeline -> external impacts
- Prevention of consequential damages
- Compensational claims in case of damage to the pipeline by a third party
- Higher operational availability

Web interface of the device

The main module provides a web interface to enable an easy local parameterization of the SmartKKS device. This allows – in addition to the input and display via touch screen – for a comprehensive setup and display of detailed operational data.

The web interface can be started e.g. on a notebook. To do so, the notebook has to be connected to the main module via an Ethernet cable. Furthermore, it is possible to connect an appropriately configured WLAN router to the Ethernet port of the main module. Thus, the web interface can be opened via WLAN.

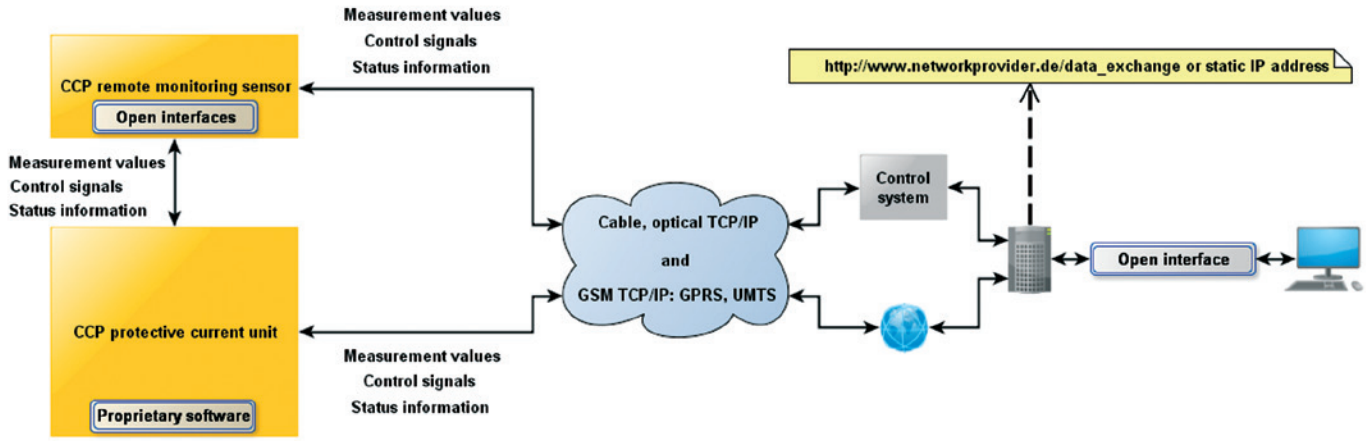


Connection to a control system

Many energy providers and operators of pipeline networks use control systems to control the installation and collect measured data and status information of their equipment. At the control system all relevant data are gathered. Alarms, error messages and status messages are combined and displayed on a management and monitoring system.

A control system offers the possibility to integrate new components via telecontrol protocols and standardized interfaces, as long as the new components offer the same interfaces.The telecontrol protocol IEC 60870-5-104 is a widely used interface in the European and Asian region. Most control systems use this protocol, which is a general transmission protocol between network control systems and their substations.

The data is transferred via the underlying TCP/IP protocol and the participants use the protocol IEC 60870-5-104 to communicate



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Embedded systems

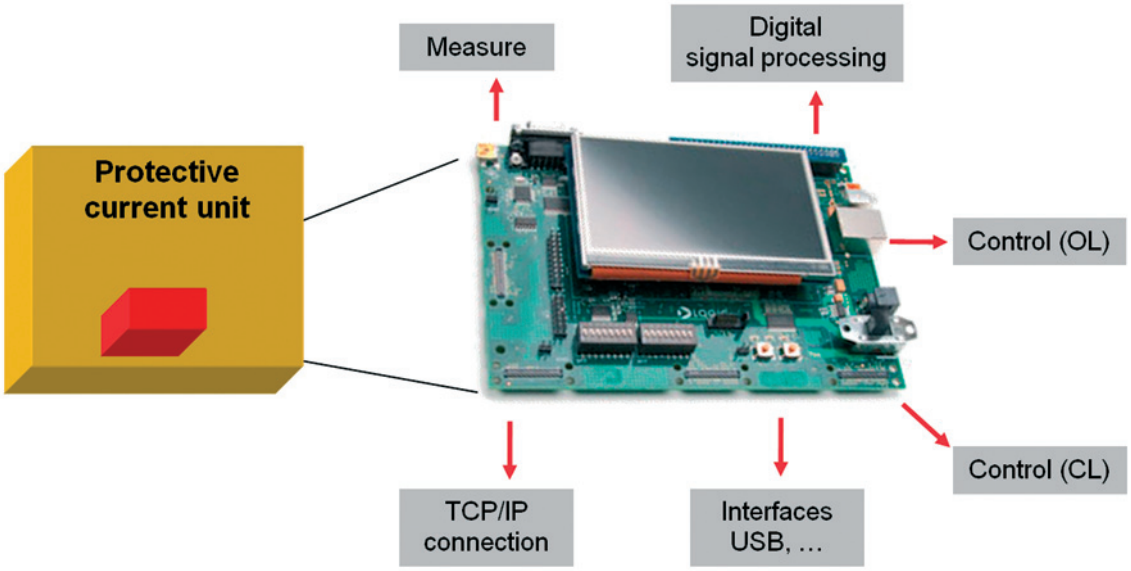
To fulfil the functionality mentioned above, the protection current units and remote monitoring sensors have to meet certain requirements. All units and sensors have to provide network-based communication procedures to set up a network.

Every protection current unit and remote monitoring sensor needs a control unit which facilitates the implementation of the TCP/IP protocol and the remote control protocol IEC 60870-5-104. Furthermore, it is recommended that the communication interfaces of these devices can be adapted to the IT infrastructure of the particular network operator or CPP service provider.

So-called embedded systems – well known in the IT world – offer a good solution to implement these requirements. An embedded system refers to a unit comprising both hardware and software, which add the required intelligence to protection current units and remote monitoring sensors, so that they can be integrated into the network and communicate with other devices.

The hardware of an embedded system consists of a microprocessor and numerous components for signal processing and communication. The operating system and software running on the microprocessor provides the necessary functionality.

The software is based on an operating system, e.g. the freely available Linux system. It handles the communication among protection current units and remote monitoring sensors and also the communication with the central system. Special software algorithms are set up to acquire and process the measured values and to perform all necessary control and monitoring tasks.



SmartKKS software platform

The SmartKKS system consists of the SmartKKS devices and a corresponding SmartKKS software platform.

This software platform is used to remotely control and monitor the devices. All measured data is transmitted to the software platform, where it is stored and provided for further analysis.

The software platform and the devices can communicate at any point of time and the devices are always accessible.

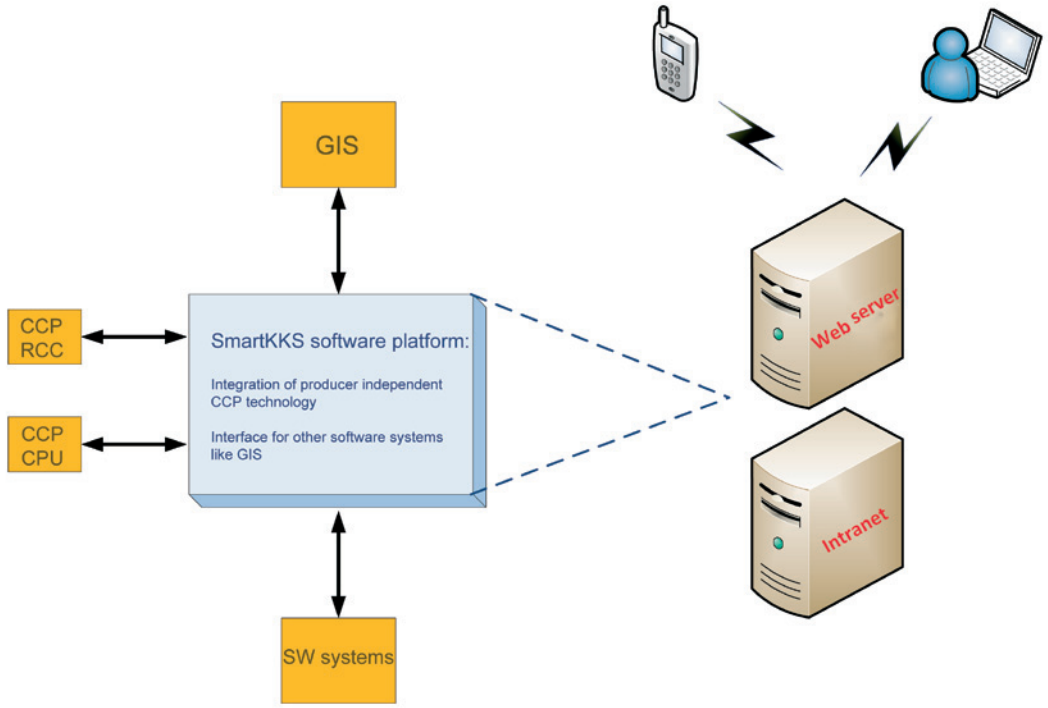
All set up CCP protection areas and CCP devices are organized and managed via the software platform. To analyse the measured CCP data a tabular and graphical presentation of the data is possible.

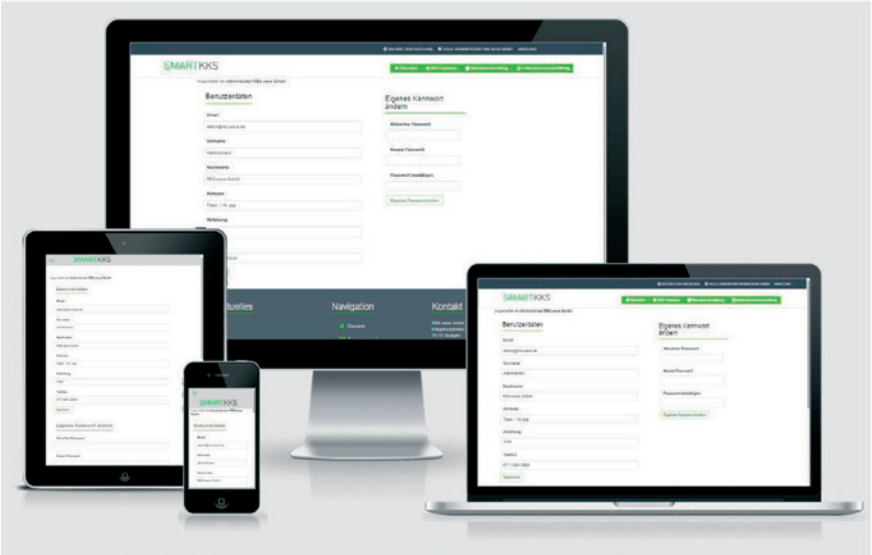
In order to assess the effectiveness of the cathodic corrosion protection regular measurements have to be carried out. They are parameterized as a “routine measurement” process. This comprises the determination of the points in time of the measurements and the measurands to be collected.

With the “online measurement” function selected measurands are transmitted to the software platform in real time.

Thus, a picture of the current state of the measured values from the protected object is available, e.g. the current protection current or external a.c. impacts on the protected object.

The enhancement of the functionalities, the connectivity to remote cathodic corrosion protection systems of other providers as well as the provision of interfaces for data exchange with other software applications are an integral component of the SmartKKS concept.





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Technical data, Overview basic version

Electrical data:

Infeed / external influence: 400 W

Protection potential:	max. 42 V, continuously selectable
Protection current:	max. 2 x 12.5 A = 25 A
Voltage measurement:	Measurement resolution few µV up to 150 V
Current measurement:	Measurement resolution few µA up to >100 A
Time synchronization:	DCF77, time server
Communication:	wireless communication UMTS, cable connection, Ethernet, fibre optic cable, VPN encryption

Environmental conditions:

Operating temperature range:	-20 °C to +50 °C
Relative humidity:	max. 75 %
Degree of protection:	IP 41

Basis protection against overvoltages: basic protection according to EMC directives

Other regulations: The device corresponds with the relevant VDE, AfK and EMC guidelines.

Housing

The enclosure is made from aluminium. To mount the device an angular steel is fixed to the wall. Via an angled construction the enclosure is mounted to the angular steel. Additionally, the enclosure is screwed onto the wall for better fixation. Therefore, two mounting lugs are placed on the lower side of the case.

Dimensions of the enclosure: (W x H x D) 400 x 400 x 221 mm
Weight: 7 kg
Housing connection for equipotential bonding.

Technical specifications and standards

Assessment of corrosion rates at pipelines and vessels made from non-alloy and low-alloy ferrous materials buried in the ground
DVGW worksheet GW 9, yellow paper, released for publication

Cathodic Corrosion Protection for underground gas distribution networks and gas pipelines
Draft version of the DVGW worksheet of the project group “G 412” at the Technical Committee

Cathodic Corrosion Protection (CCP)
DVGW worksheet GW 10 and GW 16: New findings and operational experience at the commissioning and monitoring of Cathodic Corrosion Protection Systems

Design and setting up of cathodic corrosion protection (CCP) for buried storage vessels and steel pipelines
Draft version of the DVGW worksheet GW 12, published

Qualification requirements for specialized companies for Cathodic Corrosion Protection (CCP)
Publication of the DVGW worksheet GW 11, yellow paper – text identical to the FKKS Quality Surveillance Guideline

Abbreviation/Term

ADC	Analog Digital Converter
CE	Communautés Européennes
DCF77	Radio Call Sign of the International Frequency List IFRB
DCF77	German Longwave Time Signal and Standard-frequency Radio Station
DSP	Digital Signalling Processor
DVGW	German Association of Gas and Water Companies
EDGE	Enhanced Data Rates for GSM Evolution
EMC	Electromagnetic Compatibility
EN	European Standard
GIS	Gas Insulated Switchgear
GPRS	General Packet Radio Service
GPS	Global Positioning System
GSM	Global System for Mobile Communications
IEC	International Electrotechnical Commission
IFRB	International Frequency Registration Board
CCP	Cathodic Corrosion Protection
LTE	Long Term Evolution
LWL	Fibre optic cable
PCU	Protection Current Unit
TCP/IP	Transmission Control Protocol/Internet Protocol
UMTS	Universal Mobile Telecommunications System
USB	Universal Serial Bus
VDE	Verband der Elektrotechnik, Elektronik und Informationstechnik German Association for Electrical, Electronic & Information Technologies
VPN	Virtual Private Network
WLAN	Wireless Local Area Network

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