8 LEAK DETECTING

8.1 General

8.2 IPS-Cu

8.3 IPS-NiCr

8.4 Device Technology

8.5 System Accessories Analog / Digital

8.6 Technical Data

Edition: 16.01.2012

8 LEAK DETECTING

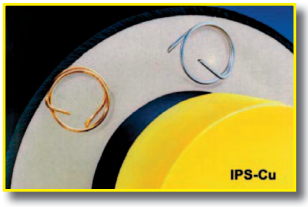
8.1 General

8.1.1 Explanation to Leak Detecting

Even slight leaks may cause essential damages. The result could be heat loss, corrosion at pipelines and interruptions of operation. Therefore **isoplus** offers two leak detection systems and monitoring systems, which will guarantee a continuous monitoring of the complete pipeline concerning moisture and pipeline damages, because of two foamed in copper- or resistance wires and due to different kind of measuring units, suitable for the correspondent application.

The monitoring includes not only the coupler area, but also each meter of the pipeline. Even very slight moisture of the PUR-hard foam caused by leaking weld seams or building-moisture will be indicated, also at high-impedance range. Damages of the PEHD-jacket-pipe, i. e. caused by civil underground engineering or planting as well as wire break, will also lead to a fault indication.

Within the coupler connections and T-branches no sensible fully or half-active electronic components will be used, which will eventually lead to an early wearing of the alarm system. The measuring units with the electronic components are outside of the building, manholes or corresponding pale-distributors.



In case of **IPS-Cu** (Copper) two bare copper wires will be foamed into the pipe bars and into all fittings, as detecting or monitoring wires. In case of **IPS-NiCr** (nickel-chrome) the two detecting wires consist of an isolated resistance-(sensor-wire) an a copper wire (loop-wire).

The isolation of the NiCr-sensor-wire is perforated in cyclic defined distances. All wires are wearing free, corrosion- and temperature resistant.

For optical characteristics feature the detecting wires are coloured coded. **IPS-Cu** by a bare and a tinned copper wire, **IPS-NiCr** by a yellow and a black isolated wire. Therefore any confusion will be excluded. The wires will be connected before foaming the couplers, by use of a press-connection which will be additionally soldered in case of **IPS-Cu** , and in case of **IPS-NiCr** shrinked.

All branch pipelines as well as later pipeline extensions, cann be integrated into the leak detecting system without any problem. The assembling of the leak detecting will be carried out parallel with the insulation and sealing works, by AGFW-/BFW- approved and **isoplus**-factory educated specialists. The wires of each coupler connection will be wired and again tested after the foaming procedure, concerning correct transmission. At the final assembling of all accessories and required equipments, an additional recorded acceptance will be carried out.

Edition: 16.01.2012

8.2.1 Description

The **IPS-Cu** - system is especially suitable for network monitoring of pipelines. An effective safety could be reached due to a simple construction and a consequent further development. Lasting for decades of experience and developments will enable a compatible and manufacturer predominant wire system of the “Nordic Monitoring Technology”.

This standard and the popularity of **IPS-Cu** allow an economic useful production and installation. A standard assembling in the pipe and in the coupler connection will allow a optimum product and function control and will secure the quality requirement. The resulting minimization of the assembling failures will increase the expected life time of the complete pipeline.

Because of its architecture the **IPS-Cu** is already offering a very high degree of failure security. An interrupted loop will i. e. not limit the function because the excavation of the located failure position can be avoided for the time being, due to a simple change over in the wire. Therefore an extreme economical operation of the equipment will be possible during the complete life time.

The special characteristic of **IPS-Cu** are the both bare copper wires. Both wires are available with their complete surface for failure determination in the total pipeline. This will be an essential advantage for an early recognition of a tendency change. The **IPS-Cu** - system offers the optimum solution for various problems, due to a permanent further developing equipment technology, which offers an early and safe recognition and detection.

Two bare copper wires with a standardized 1,5 mm^2 profile will be factory foamed into the compound jacket-pipe. For visual distinctive features one wire is galvanic tinned. Required wire connections within the jacket-pipe couplers will be carried out with squeeze-husks and additional soldering with soft solder.

The wire distance holders will fix the wire position within the coupler area. Both wires are short circuited at the end points of the pipeline, in order to create finally a measuring loop. Branch pipelines will be included directly in consideration to the wiring guidelines. The detecting unit will be installed at the starting point of the measuring loop, i. e. in the heating station.

An additional wiring design will be not necessary, due to the **isoplus**-presentation of the required hard-ware components which have to be installed and the standardized course of the detecting wires. Because of the complete documentation on one view, the unfavourable comparison between wiring and pipeline course as well as the double recording will be a matter of the past.

Edition: 16.01.2012

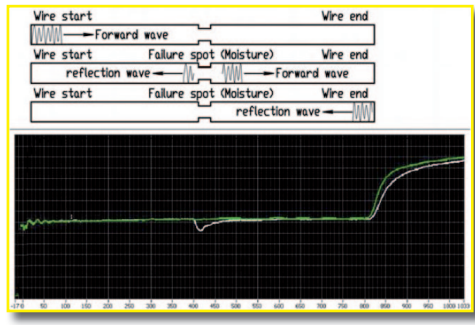
8.2.2 Function

The monitoring in case of **IPS-Cu** will be carried out via the ohm-resistance measurement between the pair of wires and the electric conducting carrier pipe. Because PUR-foam is like an electrical isolator, a high isolation resistance will occur between wire and carrier pipe in case of an intact compound jacket-pipe.

Additionally a wire loop measurement will be carried out for in-house monitoring. A location of determined failures will be made by use of impulse-reflector-measurement, therefore a wire loop will be required.

The impulse-reflector-technology is using the high frequency electrical characteristics of pipelines. Due to the geometrical location of the foamed in bare Cu-wires and the carrier pipe as well as the electrical characteristics of the PUR foam technology, a wave impedance will occur which will be almost constant along the total length.

Electrical impulse of low energy will spread undisturbed with approximate light velocity. The wave impedance in the PUR-foam will change in case of a moisture penetration which has not to be electrical conducting. The spread of the impulse will be disturbed and a reflection of the impulse will occur within this area (echo). The position of the fault will be calculated from the time between transmitted pulse and reflection.



isoplus offers for this purpose the digital leak detecting hardware **IPS-Digital**. The advantage is the impulse feeding via the sample-and-hold procedure. The wire system will be sampled in regular periods (sample) and the signals will be pre-recorded (hold).

At a certain time eventual returning reflections will be recorded. Due to the different time of recording it will be possible to check certain sections of the pipeline in detail concerning echo (reflections). With a total number of 6000 impulses **IPS-Digital** will reach with **IPS-Cu** a definition of at least 0,5 m, the locating exactness will be 0,2 %.

In case of high frequent fault indication the number of impulse will be increased. Also in such a case measurements will be unlimited possible, by use of secondary filters and mathematical algorithm. Also **multiple faults** within a measuring section can be definitely determined and located.

8.3.1 Description

The **IPS-NiCr** - System will be suitable like **IPS-Cu** especially for the monitoring of pipeline networks of all sizes. For extension of an existing NiCr-detection or for application for a steel jacket-pipe system **IPS-NiCr** can be also used. Our experience and development will enable a compatible and manufacture extending monitoring system in the resistance reference technology.

Due to a simple construction, avoiding of active components within the pipeline as well as a standard assembling in the pipe and coupler connection, a high processing safety will be guaranteed. The **IPS-NiCr** stands for a continuous detecting of the pipe and coupler area with parallel high sensitivity.

The special characteristic of the **IPS-NiCr** is the perforated NiCr-wire as sensor technology. This NiCr-wire will be available with its perforation in the total pipeline network. Therefore individual moistures can be exactly detected. In connection with the permanent further developing **IPS**-equipment technology a high degree of safety concerning detecting and monitoring will be guaranteed.

During production of pre-insulated jacket-pipes the two wires will be foamed in. Through the yellow, perforated NiCr-wire the moisture will be detected. The PTFE-isolation (Polytetrafluorethylen resp. Teflon®) which is covering the 0,5 mm² NiCr-wire (NiCr 8020) is resistant up to 260° C and is perforated in regular distances. Due to a special alloying the wire has a constant longitudinal resistance of 5,7 Ω/m.

The black Cu-wire with a profile of 0,8 mm² will be used for loops and has no detection purpose. The isolation resistance up to 205° C consists of FEP (Fluorinatedethylenepropylene). Required connections of NiCr- and Cu-wires within jacket-pipe couplers will be made by use of squeeze-husks. Water tight and up to 150° C temperature resistant shrink-hoses made of PO-Xc (Polyolefin, cross-linked by irradiation) are additionally assembled over the squeeze-husks, in order to protect them against direct moisture contact.

Wire distance holders have to be used, in order to guarantee a defined wire position in the coupler area. The measuring loop with the NiCr- and Cu-wire at the end points of the pipeline, will be connected with the monitoring unit at the determined starting point.

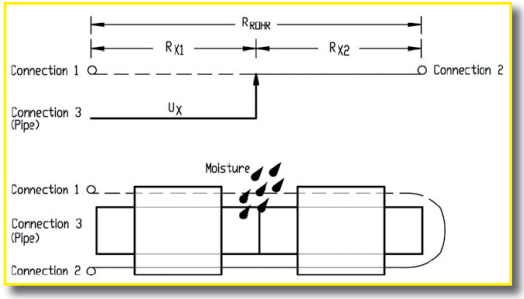
An additional wiring design will be not necessary, due to the **isoplus**-presentation of the required hard-ware components which have to be installed and the standardized course of the detecting wires. Because of the complete documentation on one view, the unfavourable comparison between wiring and pipeline course as well as the double recording will be a matter of the past.

Edition: 16.01.2012

8.3.2 Function

The monitoring will be carried out like at **IPS-Cu** via the ohm-resistance measurement between the pair of wires and the electric conducting carrier pipe. Because the PUR-foam is like an electrical isolator, a high isolation resistance will occur between wire and carrier pipe in case of an intact compound jacket-pipe. Additionally a wire loop measurement will be carried out for in-house monitoring.

The geometric position of carrier pipe as well as the measure- and loop wire is a system with four unknown factors. These are the both part-resistance R_{X1} and R_{X2}, with the resistance of the pipeline $[R_{Rohr}] = R_{X1} + R_{X2}$, the isolation resistance of the PUR-insulation $[R_{ISO}]$ as well as the tension element $[U_X]$. The total resistance R_{Σ} will be determined by the NiCr-resistance wire. The both part-resistance R_{X1} and R_{X2} are depending from the location of moisture.



In case of failure the conducting moisture will transfer a tension-part-value, which is depending from location, on the carrier pipe, which takes the function of the measuring wire, seen from the electrical point of view. The connection “pipe” can be compared with a loop of a potentiometer. The loop preparation will represent the location of the fault.

As shown on the replacement wiring diagram, the tension-part-value - from R_{X1} and R_{X2} - will be not available as direct measurable factor at connection 3, because practically several fault factors will affect. Additionally the isolation resistance $[R_{ISO}]$ and a chemical tension element $[U_X]$, which will occur due to the different metals of resistance wire, have to be considered.

Especially the chemical tension element will adulterate the real loop preparation at connection 3. This circumstance can be recognized practically due to the fact that the measurement of the isolation resistance $[R_{ISO}]$ by use of conventional measuring units, depending from polarity and degree of measuring tension, will lead to different results. Even the presentation of negative resistance, which will of course not occur, will be possible.

The inner resistance of the tension element $[U_X]$ and therefore also the isolation resistance between wire and carrier pipe, are depending from the degree of moisture and chemical structure of the penetrating medium, i. e. water. Both will of course influence essentially the measuring result for determination of the leak location (loop-preparation) and the isolation resistance $[R_{ISO}]$.

Edition: 16.01.2012

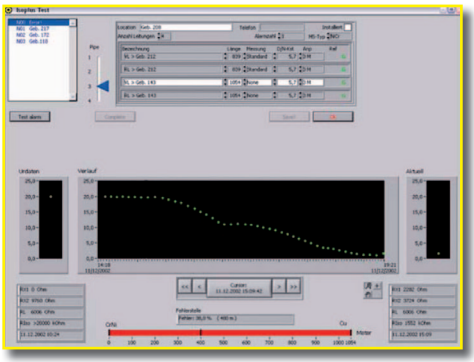
Therefore the isolation resistance [R_{ISO}] is an essential indicator for the evaluation of the pipeline condition. Conventional measuring system will ignore the tension element [U_X], which can lead to essential measuring failures.

The **IPS-NiCr** - system determines all electrical components of wire-/pipe arrangement with a high degree of exactness and a new digital procedure. Several distribution conditions will be set up to the shown connections 1 to 3, **see previous page**, and the occurring tension- and current values will be measured. After digitalisation the measured values will be transmitted to a central computer.

A mathematical algorithm (to the patent announced) will calculate the location of the moisture and the unknown factors of the part-resistances R_{X1} and R_{X2}, with the resistance of the pipeline [R_{Rohr}], the isolation resistance of the PUR-insulation [R_{ISO}] as well as the tension element [U_X]. Due to the physical principle of the “unloaded tension distributor” only single moisture-failures can be exactly located in all **NiCr**-systems.

Several moisture failures cannot definitely locate in contrary to the nordic systems like **IPS-Cu**. Additionally it has to be considered, that in case of **NiCr**-systems only one moisture failure or one wire-pipe contact (short circuit) can be exactly located via the resistance reference-measuring procedure. All other possible failures like i. e. a wire break have to be determined and located manually by use of other measurement technologies. **isoplus** is using the impulse reflector technology like at the **IPS-Cu** - system.

By use of the digital monitoring hardware **IPS-Digital**, **IPS-NiCr** indicates isolation resistance [R_{ISO}] in the range of 10 kΩ to 20 MΩ. From < 10 MΩ a first detection will be carried out for information of the user. The indicator barrier of the alarm indication will be < 5 MΩ. Therefore the user will have the possibility of self-determination of his range of activity.



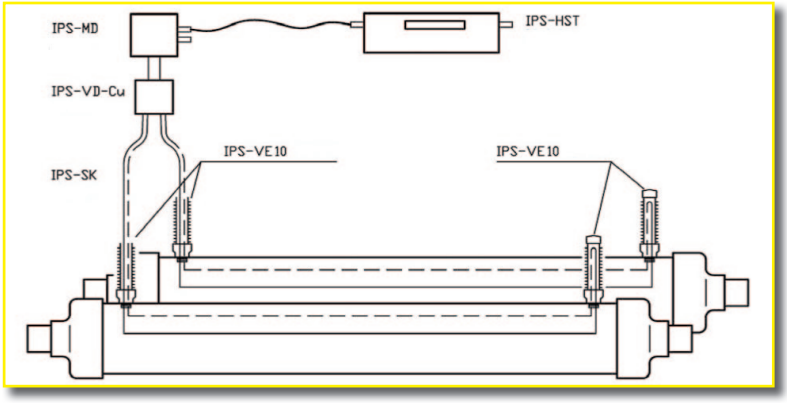
With a recommended limited **NiCr**-wire length of 1.300 m the **IPS-Digital** will reach with **IPS-NiCr** a detection exactness of 0,2 %. The failure detection may be on the total length without restriction of marginal areas. The indication of the failure position will be shown in “meter” and “percent”.

Edition: 16.01.2012

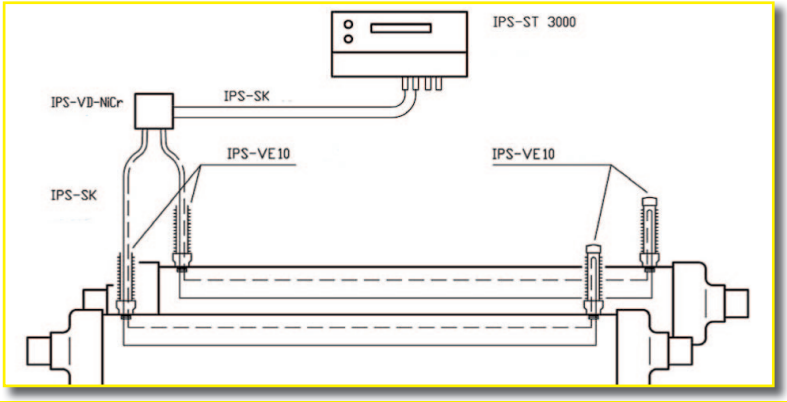
8.4.1 Analog / Monitoring Equipment

The group of monitoring equipment consists of the portable manual system tester **IPS-HST**, the stationary unit **IPS-ST 3000** as well as the combination of, the all-round unit **IPS-MSG**, which will be suitable for smaller to medium pipeline networks. These are offering an automatic monitoring and can be used for **IPS-Cu** and **IPS-NiCr** as well as for technical comparable systems. The **IPS-ST 3000** can be additionally used for hierarchical constructed pipe-network-detecting systems.

IPS-Pipe-Network-Detecting with IPS-HST



IPS-Pipe-Network-Detecting with IPS-ST 3000



Portable Manual System Tester IPS-HST

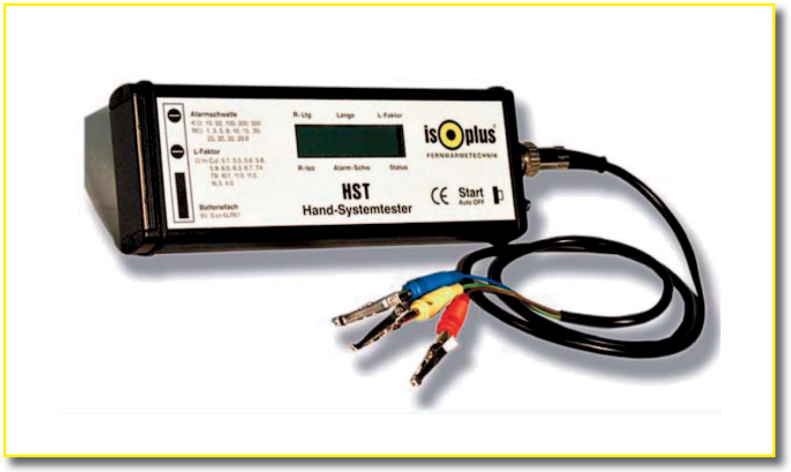
The manual system tester **IPS-HST** is a simple operating all round measuring unit for **IPS-Cu** and **IPS-NiCr** as well as for technical comparable monitoring systems.

The unit will be suitable for:

⇒ Inspection measurements
⇒ Quality control during assembling
⇒ Rotational, manual monitoring of smaller pipeline networks

All measurements will be carried out automatically, program-controlled, for that further adjustments will be necessary. For NiCr-systems different longitudinal resistance values can be selected. The indication of the measuring results, there will be differentiate between isolation and loop, will be shown by a 2 x 16 sign LCD-display as ohm value. In case of lowering the adjusted admissible values, an visual and acoustical signal will be indicated.

The **IPS-HST** is equipped with a connection cable respectively -plug for a safe connection to a measuring box **IPS-MD**, see **Chapter 8.5.3**. It can be also connected directly to leak detecting wires by use of alligator clips respectively tapping clips which are included in the delivery.



Technical parameter see data sheet, **chapter 8.6.1**

Edition: 16.01.2012

Stationary Leak Detecting Unit IPS-ST 3000 with 1- to 4- Channel Technology

The monitoring unit **IPS-ST 3000** is the optimum monitoring technology for a clear pipeline network of medium size. It monitors fully automatically the connected pipelines concerning moisture, sensor wire-pipe contact and sensor wire break. It will be suitable for copper wire- and resistance wire systems like **IPS-Cu** and **IPS-NiCr** as well as for technical comparable systems.

Per channel maximum 2.500 m sensor wire at **IPS-Cu** and 1.300 m at **IPS-NiCr** can be monitored. 10.000 m of nordic Cu-wire respectively 5.200 m NiCr-wire can be monitored with the final level, the four-channel unit **IPS-ST 3000-4**. The kind of connected sensor wire will be recognized automatically.

With the multiple-channel variants it will be possible to allocate every single channel to a different sensor. Therefore it will be especially suitable for mixed pipeline networks with only one central monitoring unit, the **IPS-ST 3000-1, -2, -3** or **-4**. The following measuring data and alarm- respectively failure signals will be shown separately for every channel on the 4 x 20 sign LCD-Display:

⇒ Alarm barrier value
⇒ Isolation resistance
⇒ Failure status resp. -type
⇒ Longitudinal resistance at NiCr- resp. sensor-wire-type at Cu-systems

The isolation values as well as the longitudinal resistances will be indicated in “Ohm”, therefore the comparison with other measuring units will be possible at any time. Additionally to the visual indication it offers a potential-free exit for relaying of signals respectively measuring data. The **IPS-ST 3000** is prepared for the connection with an external detecting unit and will be therefore a favourable detecting position. The very simple control will be made by a pressure-button.

Technical parameter see data sheet, **chapter 8.6.1**

Independent Leak-Monitoring-Modul IPS ST3000 - AUTARK

ST3000 – AUTARK is the first analog isoplus-leak-monitoring-modul which is fully integrated into the **„isoplus-digital** family". It will be used locally and totally **AUTARK** – that means no current supply by conduction wires and no fix data-line (copper-bus or LWL) will be required. The product is equipped with a GSM-unit for data transmission via mobile phone network and with a powerful lithium battery ($Li\text{-}SoCl_2$) with guaranteed lifetime up to 5 years (*).
ST 3000 – AUTARK is able to monitor up to four Cu-wires of 2.500 mtr. each as well as four NiCr-wires of 1.300 mtr. each and to low point sensors, depending from kind of type. All data will be evaluated and displayed with our proved **isoplus-Digital** software.

(*) One measurement per day and one transmission per week to central unit

Furthermore ST3000 - AUTARK offers:

⇒ Failure evaluation via **isoplus**-digital-software (without locating!)
- Moisture / contact / loop interference
- Man-hole monitoring
- Battery status
- Indication of location
- configured for operational control rooms

⇒ Suitable for all known copper- and NiCr-wire-systems
⇒ Variable configurations:
- 230V operation with power unit
- Network usable with COM-Server
- 2/4 measurement channels, 1-2 man-hole monitoring

⇒ Multiple usable:
- Central monitoring of remotelines (so called "outside-lines")
- Central monitoring of not reachable lines (i. e. in man-holes, private houses)
- Central site-monitoring (nocturnal control measurement)

The **ST3000 - AUTARK / SÜ** Module is for pure monitoring man-holes with two digital inputs for water level detectors or other signal transmitters (hourly measurement control).

Technical parameter see data sheet, **chapter 8.6.1**

Edition: 16.01.2012

Mobile Stationary Unit IPS-MSG 500 / 1000

This all-round unit should be used for simple monitoring, combined with automatic detecting of small pipelines with **IPS-NiCr** wire sensor technology as well as for technical comparable systems. The **IPS-MSG** can be used for many applications, by single combination of a stationary monitoring unit with the mobility of a manual measure unit. Monitoring up to 500 m sensor-wire will be possible with **IPS-MSG 500**, and up to 1.300 m with **IPS-MSG 1000**.

The special characteristic is the automatic detection of the centre of moisture. In case of failure checks from additional points of connection can be carried out rapid, due to the flexibility. The **IPS-MSG** can be used equally for:

⇒ Detection measurements
⇒ Inspection measurements
⇒ Quality control during assembling
⇒ Rotational, manual monitoring and detecting of smaller pipeline networks

All measurements will be carried out automatically, program-controlled, without any additional adjustment. The outline of the measured results (differential between isolation and loop) will be shown as ohm-value, via a 2 x 16 sign LCD-display. In case of undershooting of the admissible limiting value, an optical and acoustical alarm will be released.

The detected results will be determined based on the longitudinal resistance of the NiCr-wire of 5,7 Ω/m, for other wire systems an additional indication as per cent value will be possible. The relaying of the failure indication will be possible via the integrated potential relay output.

The **IPS-MSG** is equipped with a connection cable respectively -plug for a safe connection to a measuring box **IPS-MD**, see **chapter 8.5.3**. Additionally it can be connected directly to the power supply by using an Euro-plug power-unit. A direct connection to the monitoring wires will be possible, by using tapping or alligator clips, which are included in the delivery.

Technical parameter see data sheet, **chapter 8.6.1**

8.4.2 Digital / Detecting Units with Monitoring

The **IPS-Digital** - system is the optimal complete solution for a fully automatic monitoring and parallel permanent detection. **IPS-Digital** will be suitable for copper wire- and resistance wire systems **IPS-Cu** and **IPS-NiCr** as well as for technical comparable systems. **IPS-Digital** offers a central leak detecting management for medium- up to big respectively branched pipeline networks.

The modular structure will assist the economical construction of a corresponding adapted monitoring installation. With **IPS-Digital** several specific wire characteristics may be chosen free of any restrictions. Due to this an essential and unique safety at the central recording and evaluation of different sensor-wire-systems can be reached.

Due to the software based control and evaluation of the complete system, a simple up-date and configuration to the project-typical factors will be possible. The automatic recognition of the kind of measuring unit, i. e. **IPS-Cu** or **IPS-NiCr**, the friendly operation as well as an optimum of safety in monitoring and detecting, are additional essential advantages of **IPS-Digital**.

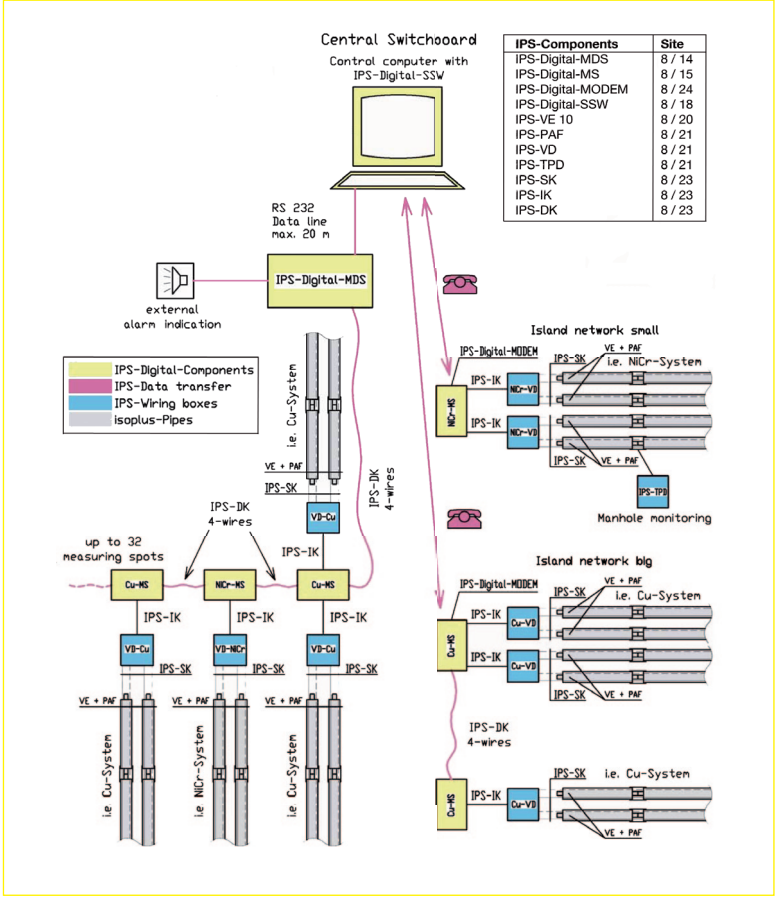
Depending from application the following **IPS-Digital** - components will be available:

Units for an expandable monitoring network IPS-Digital		Site
⇒ IPS-Digital-MDS	Central measuring data acquisition	8 / 14
⇒ IPS-Digital-Cu-MS	Measuring spot for Cu-systems	8 / 15
⇒ IPS-Digital-NiCr-MS	Measuring spot for NiCr-systems	8 / 15
⇒ IPS-Digital-TV	Data T-distributor	8 / 24
⇒ IPS-Digital-MODEM	Modem extension for IPS-MS	8 / 24
⇒ IPS-Digital-PFA	Alarm-reporting-module	8 / 24
⇒ IPS-Digital-FSV	Distant voltage supply	8 / 24
Single units for smaller monitoring networks without extension		
⇒ IPS-Digital-Cu-KMS	Compact measuring spot for Cu-systems	8 / 16
⇒ IPS-Digital-NiCr-KMS	Compact measuring spot for NiCr-systems	8 / 16
Portable units for application at site as well as for unstructured networks		
⇒ IPS-Digital-Cu-MBS	Mobile unit for Cu-systems	8 / 17
⇒ IPS-Digital-NiCr-MBS	Mobile unit for NiCr-systems	8 / 17
⇒ IPS-Digital-UNI-MBS	Mobile unit for Cu- and/or NiCr-systems	8 / 17
Software modules for control, extension and adaptation		
⇒ IPS-Digital-SSW / AUTARK	Control software for IPS-Digital and AUTARK	8 / 18
⇒ IPS-Digital-VISUAL	Failure visualisation with design presentation	8 / 19

Technical parameter see data sheet, **chapter 8.6.2**

Edition: 16.01.2012

Construction of a IPS-Digital - Pipe Network Monitoring



IPS-Components	Site
IPS-Digital-MDS	8 / 14
IPS-Digital-MS	8 / 15
IPS-Digital-MODEM	8 / 24
IPS-Digital-SSW	8 / 18
IPS-VE 10	8 / 20
IPS-PAF	8 / 21
IPS-VD	8 / 21
IPS-TPD	8 / 21
IPS-SK	8 / 23
IPS-IK	8 / 23
IPS-DK	8 / 23

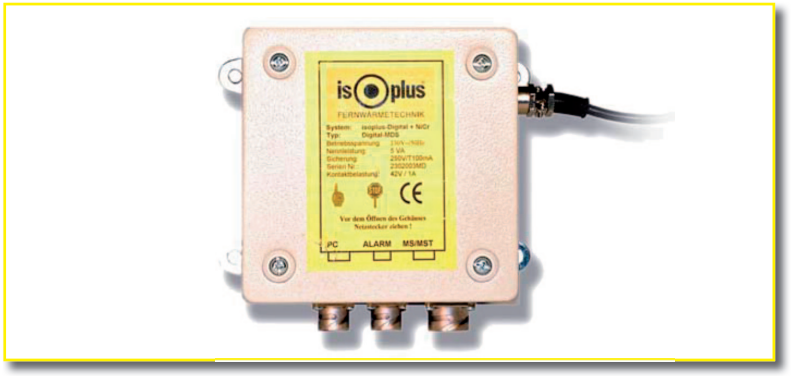
Edition: 16.01.2012

Measuring Data Acquisition Station IPS-Digital-MDS

The central measuring data acquisition station **MDS** is an essential part of the control central of an **IPS-Digital** - network. Together with an usual desktop computer or notebook (PC) and the control software **SSW** the total monitoring network will be central controlled. The **MDS** is the interface between central-control respectively PC and monitoring network, respectively pipeline.

There will be an adaptation from the PC-interface RS 232 to the RS 485 interface of the measuring spot/s **MS**. By use of a data transfer based on interface RS 485 a data intensification respectively a data-refresh will be not necessary.

The **MDS** represents additionally a galvanic separation between external (in direction measuring spot/s) and internal (in direction PC) data network. Because of this a high effective protection against interference- and over-voltage will be required. In case of interference the control software **SSW** will activate a potential-free relay-exit which is integrated in the **MDS**, and which will be available for transmission to a process-control-system.



Technical parameter see data sheet, **chapter 8.6.2**

Edition: 16.01.2012

Measuring Spot IPS-Digital-MS with 2- or 4- Channel Technology

The measuring spot MS is the basic hardware within an **IPS-Digital** - network and is placed at the corresponding end point of a monitoring section, directly at the pipe end. Depending from requirement measuring spots will be used with 2- or 4- channel technology, **MS-2** or **MS-4**. Their control will be made via the measuring data acquisition station **MDS** respectively via the control software **SSW**.

All recorded data will be digitized and send via the RS 485 interface to **MDS**. Each **MS** is equipped with a data input and -output as well as with two respectively four pipeline- respectively measuring connections, depending from grouping of cables. The data connections are galvanic separated against the measuring spots. Several **MS**, which are working parallel like a data-refresh, will be connected interrelated in cascade form.

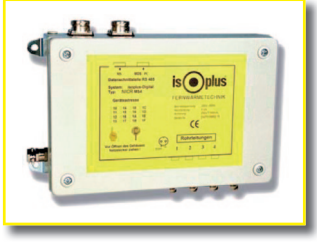
Because of this the maximum possible data transmission length will be available at each of the 16-fold addressable **MS**. For an alternative adaptation and extension each MS can be extended by the data transfer per **MODEM**.

IPS-Digital-Cu-MS 2 / 4

One Cu-MS will supervise and detect changes of impedance on maximum 2.500 m sensor wire per channel. For that the impulse-running-period-measurement will be used. Additional constant- and alternating voltage as well as the ohmic resistance will be determined.

IPS-Digital-NiCr-MS 2 / 4

One NiCr-MS will supervise and detect changes of resistance on maximum 1.300 m sensor wire per channel. For that the constant-voltage-resistance-measurement will be used. The detection of failures will be made via the resistance-detecting measurement procedure.



Technical parameter see data sheet, **chapter 8.6.2**

Compact Measuring Spot IPS-Digital-KMS with 2- or 4-Channel Technology

The compact measuring spot **KMS** is the basic hardware within an **IPS-Digital** - network and is placed directly at the starting point of the monitoring section at the location of the control computer (desktop or notebook). The **KMS** consists of a measuring spot assembled at the end of the pipeline, and of a standard PC with software **SSW**, which should be installed within a distance of maximum 20 m.

Depending from requirement compact measuring spots will be used with 2- or 4- channel technology, **KMS-2** or **KMS-4**, which cannot be interlaced with each other. All recorded data will be digitized and transmitted to the control software **SSW** respectively to the control computer.

The data connections are galvanic separated opposing of the measure-ports. For an optional adaptation and extension each **KMS** can be extended by data transfer per **MODEM**. Each **KMS** has a potential-free contact for transmission to an operating control system.

IPS-Digital-Cu-KMS 2 / 4

One **Cu-KMS** will supervise and detect changes of impedance on maximum 2.500 m sensor wire per channel. For that the impulse-running-period-measurement will be used. Additional constant- and alternating voltage as well as the ohmic resistance will be determined.

IPS-Digital-NiCr-KMS 2 / 4

One **NiCr-KMS** will supervise and detect changes of resistance on maximum 1.300 m sensor wire per channel. For that the constant-voltage-resistance-measurement will be used. The detection of failures will be made via the resistance-detecting measurement procedure.

Technical parameter see data sheet, **chapter 8.6.2**

Edition: 16.01.2012

Portable IPS-Digital - Pipe Network Monitoring

This complete measuring system is suitable for manual monitoring and detection of unstructured networks as well as for site application. Depending from requirement the following system variants, completed in a stable measuring suitcase, will be different:

⇒ **IPS-Digital-Cu-MBS** - Mobile unit for Cu-Systems
- Impulse-running period measurement (i. e. **IPS-Cu** or comparable)

⇒ **IPS-Digital-NiCr-MBS** - Mobile unit for NiCr-Systems
- Resistance measurement (i. e. **IPS-NiCr** or comparable)

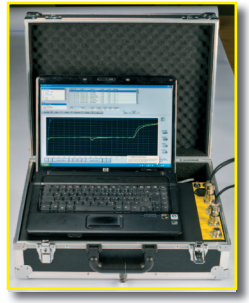
⇒ **IPS-Digital-UNI-MBS** - Mobile combined unit for Cu- and NiCr-Systems

The handling of the mobile station **MBS** is very simple, and due to an integrated accumulator the measuring suitcase can be used also independent from network. The control of all manual or automatic measurements will be made via the included notebook and installed control software **SSW**. For that the notebook will be purchased directly or placed at disposal. Due to the unique flexibility an **MBS** will be especially suitable for:

⇒ Acceptance control with direct protocol print out
⇒ Failure detection with picture print out of impulse-running period
⇒ Automatic monitoring and detection in free defined pipeline sections
⇒ Continuous supervising of construction without additional equipment

All collectable data will be determined by software control, visualised evaluated and archived. An eventually required failure detection will be also made fully automatically. Therefore the **MBS** is an independent measuring equipment. A long term monitoring of one or several pipeline sections will be also possible.

The single sections have to be defined exactly, because each **MBS** will be addressable up to 100-fold. A required data-exchange will be made via the standard interfaces of the notebook. An **MBS** can be of course extended additionally with all available software modules.



Technical parameter see data sheet, **chapter 8.6.2**

8.4.3 Digital / Software

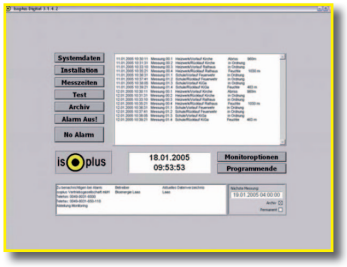
Control Software IPS-Digital-SSW / AUTARK

One single software will be sufficient for the control of the complete **IPS-Digital** - network. All units of the **IPS-Digital** - hardware are using this software. The following basic logic functions will be carried out:

⇒ Measured value- and failure evaluation
⇒ Adjustment of the response levels
⇒ Print out of all measuring data and failures
⇒ Acoustical and visual alarm or forwarding to **PFA**
⇒ Calibration of different kind of sensors, that means kind of wire
⇒ Automatic, software-based detection of failure spots
⇒ Central, menu-driven operation and control of the complete equipment
⇒ Direct evaluation of data and plain text announcement of the pipeline condition
⇒ Automatic recognition of kind of measuring station in mixed equipment
⇒ Archive of measuring data and failures incl. date and time (time-stamp)
⇒ Passing-on alert for IPS-Man-hole water sensor (**ST3000 - AUTARK**)

Optional extension with **VISUAL** will be possible. In order to guarantee an optimal operation, the central and standard desktop computer or notebook should fulfil the following minimum configurations:

Operating system:	Windows® NT, XP, 2000 and more actual
Processor:	> 400 MHz preferable
Working memory:	≥ 64 MB RAM
Free hard disk:	ca. 150 MB, incl. Archive
Graphics:	≥ 800 x 600 Pixel / 256 colours
Drive:	CD-Rom / CD-burner
COM-Port:	1 x RS 232 or USB 1.1/2.0
Sound card:	yes, in case that acoustic signal will be required
Printer:	Printout via commercial printers



Edition: 16.01.2012

Fault Visualisation IPS-Digital-VISUAL

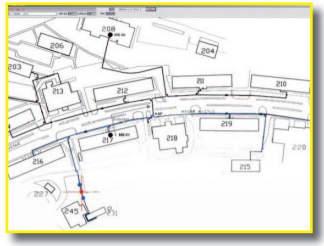
This extension module will be used for presentation of the detected failure spots in the pipeline design. Because of this an enormous simplification concerning the determination of failure spots in expanded pipeline networks will be reached. The module, which will get the required data for presentation from the control software **SSW**, is working on the basis of Bitmap-data (BMP/Tiff).

By simple scanning it will be possible to use also older drawings, which have been not established by CAD. **VISUAL** can be also used with other detecting systems, because a manual input of determined detection data will be possible. The following basic functions will be carried out by **VISUAL**:

⇒ Lens function
⇒ Indication of failure spot
⇒ Mouse controlled menu-guidance
⇒ Coloured codification of single channels
⇒ Automatic data transfer **SSW**
⇒ Manual failure detection input in case of foreign systems
⇒ In mixed systems with **IPS-Cu** and **IPS-NiCr** usable
⇒ Indication of the failure spot and the neighbouring digitizing spots
⇒ Indication of drawings with maximum 2036 x 1442 pixels at 256 grey grades

In order to guarantee an optimal operation, the central and standard desktop computer or notebook should fulfil the following minimum configurations:

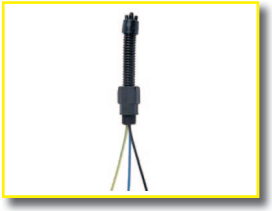
Operating system:	Windows® NT, XP, 2000 and more actual
Processor:	> 400 MHz preferable
Working memory:	≥ 64 MB RAM
Free hard disk:	ca. 150 MB, incl. Archive
Graphics:	≥ 1024 x 768 Pixel / 256 colours
Drive:	CD-Rom / CD-Burner
COM-Port:	1 x RS 232 or USB 1.1/2.0
Sound card:	yes, in case that acoustic signal will be required
Printer:	Printout via commercial printers



8.5.1 IPS-VE10 / IPS-PAF / IPS-KAF / IPS-MSP

Wire End Piece IPS-VE 10

House- resp. wiring-end-point for installation of the continuous sensor-loop at calibration spots, respectively in buildings, or as connection with signal wires to all other IPS-system components. One piece per pipeline end, installed at PEHD-jacket-pipe.

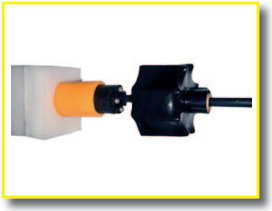


Potential Connection Sensor IPS-PAF

For a safe and permanent welded earth connection to the carrier pipe. One piece per pipeline end at location of the IPS-units.

Cable Exit IPS-KAF

As loop-wire separation in pressure water tight and strain-relieved execution for welding in the PEHD-socket-pipe of weldable couplers, consisting of a PEHD-pipe Ø 63 mm, PN 10, 150 mm long. An annulus sealing, a shrinkable end cap as well as an expansion pad plate 240 x 240 x 80 mm for protection against axial movement will be included in the delivery.



Measuring Point Post IPS-MSP

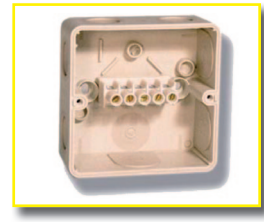
For installation of a surface- and connection point outside of buildings, consisting of a yellow, powder-coated 10.000 V disruptive strength aluminium pipe (ALMgSi). Outside diameter 100 mm, delivery length = 2,00 m, with end cap and spread anchor for site fastening, approx. 70 cm depth, in soil or foundation. Delivery incl. of a triangular crank-key and a fixing plate for a DIN-identification sign.

Edition: 16.01.2012

8.5.2 IPS-VD-Cu / IPS-VD-NiCr / IPS-TPD

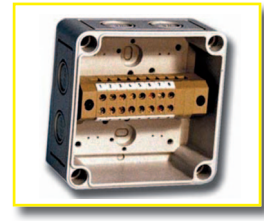
Wiring Box IPS-VD-Cu

For jumping and distributing of measure and sensor wires at **IPS-Cu** or technical comparable systems. Polycarbonate box in moisture-proof execution with 5-pole block binder, 1 piece per pipeline pair.
Protection class: IP 65



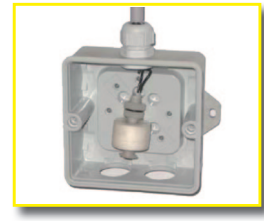
Wiring Box IPS-VD-NiCr / Digital

For jumping and distributing of measure and sensor wires at **IPS-NiCr** or technical comparable systems. Polycarbonate box in moisture-proof execution with numbered 8-pole block binder, 1 piece per pipeline pair.
Protection class: IP 65



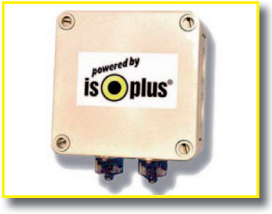
Bottom Point Sensor Box IPS-TPD

For connection of the sensor wire as bottom point monitoring, respectively flooding indicator in buildings, manholes or channels. Switchable as close open contact, consisting of a single wiring box with integrated float switch. One piece per pipeline pair.



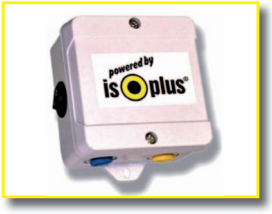
8.5.3 IPS-MD / IPS-MPD / IPS-ID-Cu

Measure Box IPS-MD



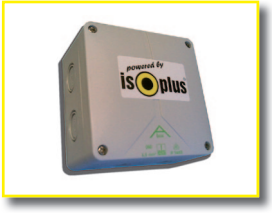
For installation of a measuring point at **IPS-Cu** as well as **IPS-NiCr** oder or technical comparable systems. Connection with the several pole-plug of an **HST** or with other pin-compatible measuring units for manual check of the pipeline will be possible. In moisture-proof execution, preferable one piece per pipeline.
Protection class: IP 65

Measure Point Box IPS-MPD



For installation of one or several measure points within a sensor circle at **IPS-Cu** as well as **IPS-NiCr** or technical comparable systems. For direct connection of a mobile-station **MBS** or other measuring units with 4 mm split plugs. Polycarbonate box in moisture-proof execution, preferable one piece per pipeline.
Protection class: IP 65

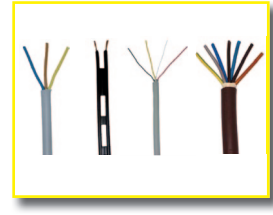
Impedance Wiring Box IPS-ID-Cu



For jumping and distributing of several impedance connection wires at **IPS-Cu** or technical comparable systems. Polycarbonate box in moisture-proof execution. One piece per pipeline pair.
Protection class: IP 65

Edition: 16.01.2012

8.5.4 IPS-SK / IPS-IK / IPS-DK / IPS-EK



Sensor Connection Cable IPS-SK

For wiring of sensor wires with wiring boxes and monitoring units inside of buildings or manholes, type NYM 3 x 1,5 mm^2.

Only suitable for **IPS-NiCr** within an **IPS-Digital** - network. At **IPS-Cu** the impedance connection cable **IPS-IK** has to be used.

Impedance Connection Cable IPS-IK

For correct impedance wiring of the sensor wires with wiring boxes and monitoring units inside of buildings and manholes, type 300 ohm (Ω).

Only suitable for **IPS-Cu** within an **IPS-Digital** - network. At **IPS-NiCr** the sensor connection cable **IPS-SK** has to be used.

Data Transmitting Cable IPS-DK

For data connection of the measuring data acquisition station **IPS-MDS** with the individual measuring points **IPS-MS** within an **IPS-Digital** - network, type J-Y (ST)Y ≥ 2 x 2 x 0,8 mm^2 or similar.

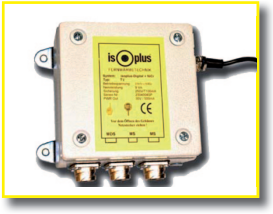
Earth Connection Cable IPS-EK

For buried wiring of the sensor wires at connection couplers with cable exit **IPS-KAF** and for relaying i. e. to a measuring point post **IPS-MSP**, type NYY 7 x 1,5 mm^2.

Edition: 16.01.2012

8.5.5 TV / MODEM / PFA / FSV

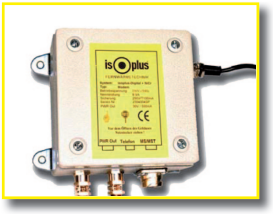
Data T-Distributor IPS Digital TV



With the **TV**, which simultaneously serves as a galvanized separator as well as data refresh, T- and star-shaped data grid structures can build up. Depending on demand, up to a maximum of six outputs can be switched. The option with one outlet is used as a pure power enhancer in very long data strings.

In case of a direct, star-shaped distribution from the main office, the **TV** can also be integrated directly into a measured data acquisition system **MDS** with up to a maximum of three outputs.

Modem Extension IPS-Digital-MODEM



As an expansion module for the **MS** measuring points, the **MODEM** enables data transmission to the **MDS** via an analog or digital (ISDN) telephone dial-up connection. During this process, fixed data lines are dropped and individual **MS** or whole groups of **MS** must be controlled by an individual **MODEM**.
Supply islands distant from the monitoring control center with fixed data transmission can also be connected via the **MODEM** and centrally recorded.
The **MODEM** is available as an extra device to retrofit existing systems. For new systems, this expansion can optionally be directly integrated into the **MS**.

Alarm Module IPS-Digital-PFA

Expansion module with integrated, potential-free output.

Distant Voltage Supply IPS-Digital-FSV

The **FSV** serves to supply individual **MS** via the data line or other appropriate cables. One or multiple separate wires will be connected together independently of the line cross-section and the distance between the **FSV** and **MS**. Parallel operation in a data cable without significant impairment of functionality is possible if DC voltage of max. 30 V is used.

Technical parameter see data sheet, **chapter 8.6.2**

Edition: 16.01.2012

8 LEAK DETECTING

8.6 Technical Data

8.6.1 Analog

isoplus - Device Type IPS-	HST	ST 3000	ST 3000 - AUTARK	MSG 500	MSG 1000
Page	8.4.1	8.4.1	8.4.1	8.4.1	8.4.1
Monitoring manually / automatically	√ / -	- / √	√ / √	√ / √	√ / √
Detection Cu / NiCr	-	-	-	- / √	- / √
Measurement (L x B x H) in mm	230 x 85 x 35	215 x 245 x 115	150 x 300 x 80	230 x 85 x 35	230 x 85 x 35
Weight in kg	0,5	2,0	3,0	0,5	0,5
Casing	Aluminium diecasting	Polycarbonate	Steel plate	Aluminium diecasting	Aluminium diecasting
Powder coated and dip-impregnated	-	-	√	-	-
Operating temperature	0 °C to + 40 °C	+ 5 °C to + 40 °C	- 20° C to + 50° C	0 °C to + 40 °C	0 °C to + 40 °C
Temperature for guaranteed exactness	+ 20 °C ± 8 °C	+ 20 °C ± 8 °C	+ 20° C ± 8° C	+ 20 °C ± 8 °C	+ 20 °C ± 8 °C
Store- resp. ambient temperature	- 10 °C to + 50 °C	- 10 °C to + 50 °C	- 10° C to + 50° C	- 10 °C to + 50 °C	- 10 °C to + 50 °C
Humidity until + 31° C	max. 80 %	max. 80 %	max. 80 %	max. 80 %	max. 80 %
Akku- / Battery Voltage	9 V	-	3,6 V / 12 Ah	9 V	9 V
Akku- / Battery type	6LR61 (9V Block)	-	Li-SoCl$_2$	6LR61 (9V Block)	6LR61 (9V Block)
230 V ± 10 % / 50 Hz net voltage	-	√	- / √	√	√
Euro-plug connection	-	√	- / √	√ / Plug-power-pack	√ / Plug-power-pack
Fuse	-	250 V / T 315 AL	250 V / T 100 mA	-	-
Power consumption operation / standby	35 mA / -	8 VA / -	4,5 VA / 2 VA	35 mA / -	35 mA / -
Consump. per year at 1 measurement per day	-	30 kWh	17 kWh	-	-
Protection Class	III	I	I	III	III
Kind of protection	-	IP 54	IP 66	-	-
Measuring category	I	I	I	I	I
Potential Free Relay Contact	-	Opener / Turnkey	-	Opener	Opener
Contact carrying capacity	-	30 V / 1 A	-	30 V / 1 A	30 V / 1 A
RS 485 - Interface Input / Output	-	-	-	-	-
Voltage level maximum	-	-	0 / 10 V	-	-
Data cable length maximum to MS / MDS	-	-	-	-	-
Data rate 2400 - 38400 baud	-	-	9600 baud	-	-
Automatic selection	-	-	-	-	-
Half duplex transmission at 2-wire RS 485	-	-	-	-	-
Full duplex transmission at 4-wire RS 485	-	-	-	-	-
RS 232 - Interface Input	-	-	-	-	-
Voltage level maximum	-	-	-	-	-
Data cable length maximum to PC	-	-	-	-	-
Data rate 2400 - 38400 baud	-	-	-	-	-
Measure Entries / -Channels	1	1, 2, 3 or 4	2 / 4	1	1
Voltage strength of entries	1.000 Veff	1.000 Veff	-	1.000 Veff	1.000 Veff
Maximum Cu-sensor wire per channel	2.500 m	2.500 m	2.500 m	-	-
Recommended max. Cu-wire lengths / channel	2.500 m	2.500 m	1.000 m	-	-
Maximum NiCr-sensor wire per channel	1.400 m	1.400 m	600 / 1.200 m	500 m	1.300 m
Recomm. max. NiCr-wire lengths per channel	1.200 m	1.200 m	500 / 1.000 m	500 m	1.300 m
Isolation Resistance Measurement	√	√	√	√	√
Measuring range	10 kΩ to 40 MΩ	10 kΩ to 2,5 MΩ	20 kΩ to 20 MΩ	10 kΩ to 10 MΩ	10 kΩ to 10 MΩ
Dissolution	1 kΩ / 10 kΩ / 100 kΩ	10 kΩ / 100 kΩ	10 kΩ	1 kΩ / 10 kΩ / 100 kΩ	1 kΩ / 10 kΩ / 100 kΩ
Measuring voltage maximum	12 V	12 V	10 V	12 V	12 V
Measuring current maximum	3 mA	1 mA	10 mA	3 mA	3 mA
Exactness	± 3 % ± 1 Digit	± 3 % ± 1 Digit	± 3%	± 3 % ± 1 Digit	± 3 % ± 1 Digit
Alarm threshold value "Isolation" adjustable	√	√	am Gerät	√	√
Alarm threshold value from / to in steps	10 kΩ to 39,9 MΩ	20 kΩ to 2,5 MΩ	20 kΩ to 2,5 MΩ	200 kΩ to 10 MΩ	200 kΩ to 10 MΩ
Loop Resistance Measurement	√	√	√	√	√
Measuring range	0 Ω to 8 kΩ	0 Ω to 8 kΩ	0 Ω to 7 kΩ	0 Ω to 2,85 kΩ	0 Ω to 7,40 kΩ
Dissolution	1 Ω	100 kΩ	1 Ω	1 Ω	1 Ω
Voltage level maximum	12 V	12 V	10 V	12 V	12 V
Measuring current maximum	5 mA	1 mA	10 mA	5 mA	5 mA
Exactness	± 0,5 % ± 1 Digit	± 0,5 % ± 1 Digit	1%	± 0,2 % ± 1 Digit	± 0,2 % ± 1 Digit
Alarm threshold value "Loop" adjustable	8 kΩ solid	8 kΩ solid	-	8 kΩ solid	8 kΩ solid
Impulse Running Period Measurement	-	-	-	-	-
Dissolution / Exactness	-	-	-	-	-
Voltage level maximum	-	-	-	-	-
Pulse wave shape	-	-	-	-	-
Impulse running period adjustable from / to (V/2)	-	-	-	-	-
Direct Voltage Measurement (DC)	-	-	-	√	√
Measuring range	-	-	-	± 2 V	± 2 V
Exactness	-	-	-	0,01 V	0,01 V
Dissolution	-	-	-	± 0,6 %	± 0,6 %
Alternating Voltage Measurement (AC)	-	-	-	-	-
Measuring range	-	-	-	-	-
Exactness	-	-	-	-	-
Dissolution	-	-	-	-	-
USB-Interface	-	-	-	-	-
Power distant supply voltage maximum	-	-	-	-	-
Working range power distant supply	-	-	-	-	-
Addressability standard / extended	-	-	-	-	-
Radio interface / GSM	-	-	√	-	-
TC / IP - Ethernet interface	-	-	-	-	-
isoplus - Device Type IPS-	**HST**	**ST 3000**	**ST 3000 - AUTARK**	**MSG 500**	**MSG 1000**

Edition: 16.01.2012

8.6.2 Digital

isoplus - Device Type IPS-	Digital-MDS	Digital-Cu-MS	Digital-NiCr-MS	Digital-Cu-MBS	Digital-NiCr-MBS	Digital-UNI-MBS
Page	8.4.2	8.4.2	8.4.2	8.4.2	8.4.2	8.4.2
Monitoring manually / automatically	- / √ [1]	- / √ [2]	- / √ [2]	√ / √	√ / √	√ / √
Detection Cu / NiCr	-	√ / -	- / √	√ / -	- / √	√ / √
Measurement (L x B x H) in mm	150 x 150 x 80	150 x 300 x 80	150 x 300 x 80	410 x 490 x 180	410 x 490 x 180	410 x 490 x 180
Weight in kg	2,0	3,0	3,0	4,0 without PC	4,0 without PC	4,0 without PC
Casing	Steel plate	Steel plate	Steel plate	Plastic suitcase	Plastic suitcase	Plastic suitcase
Powder coated and dip-impregnated	√	√	√	-	-	-
Operating temperature	- 20° C to + 50° C	- 20° C to + 50° C	- 20° C to + 50° C	- 20° C to + 50° C	- 20° C to + 50° C	- 20° C to + 50° C
Temperature for guaranteed exactness	+ 20° C ± 8° C	+ 20° C ± 8° C	+ 20° C ± 8° C	+ 20° C ± 8° C	+ 20° C ± 8° C	+ 20° C ± 8° C
Store- resp. ambient temperature	- 10° C to + 50° C	- 10° C to + 50° C	- 10° C to + 50° C	- 10° C to + 50° C	- 10° C to + 50° C	- 10° C to + 50° C
Humidity until + 31° C	max. 80 %	max. 80 %	max. 80 %	max. 80 %	max. 80 %	max. 80 %
Akku- / Battery Voltage	-	-	-	8,4 V / 1,7 Ah	8,4 V / 1,7 Ah	8,4 V / 1,7 Ah
Akku- / Battery type	-	-	-	NiCd	NiCd	NiCd
230 V ± 10 % / 50 Hz net voltage	√	√	√	√	√	√
Euro-plug connection	√	√	√	√	√	√
Fuse	250 V / T 100 mA	250 V / T 100 mA	250 V / T 100 mA	250 V / T 100 mA	250 V / T 100 mA	250 V / T 100 mA
Power consumption operation / standby	2,5 VA / -	4,5 VA / 2 VA	8 VA / 2 VA	9 VA / -	9 VA / -	9 VA / -
Consump. per year at 1 measurement per day	21 kWh	17 kWh	17 kWh	17 kWh	17 kWh	17 kWh
Protection Class	I	I	I	I	I	I
Kind of protection	IP 66	IP 66	IP 66	-	-	-
Measuring category	-	I	I	I	I	I
Potential Free Relay Contact	Turnkey	-	-	-	-	-
Contact carrying capacity	48 V / 1 A	-	-	-	-	-
RS 485 - Interface Input / Output	0 / 1	1 / 1	1 / 1	-	-	-
Voltage level maximum	0 / 5 V	0 / 5 V	0 / 5 V	-	-	-
Data cable length maximum to MS / MDS	3.000 m	3.000 m	3.000 m	-	-	-
Data rate 2400 - 38400 baud	√	√	√	-	-	-
Automatic selection	√	√	√	-	-	-
Half duplex transmission at 2-wire RS 485	√	√	√	-	-	-
Full duplex transmission at 4-wire RS 485	√	√	√	-	-	-
RS 232 - Interface Input	1	-	-	1	1	1
Voltage level maximum	± 10 V	-	-	± 10 V	± 10 V	± 10 V
Data cable length maximum to PC	15 m	-	-	15 m	15 m	15 m
Data rate 2400 - 38400 baud	√	-	-	√	√	√
Measure Entries / -Channels	-	2 or 4	2 or 4	4	4	2 Cu + 2 NiCr
Voltage strength of entries	-	-	-	-	-	-
Maximum Cu-sensor wire per channel	-	2.500 m	-	2.500 m	-	2.500 m
Recommended max. Cu-wire lengths / channel	-	2.500 m	-	2.500 m	-	2.500 m
Maximum NiCr-sensor wire per channel	-	-	1.400 m	-	1.400 m	1.400 m
Recomm. max. NiCr-wire lengths per channel	-	-	1.200 m	-	1.200 m	1.200 m
Isolation Resistance Measurement	-	√	√	√	√	√
Measuring range	-	200 kΩ to 20 MΩ	1 kΩ to 20 MΩ	200 kΩ to 20 MΩ	1 kΩ to 20 MΩ	1 kΩ to 20 MΩ
Dissolution	-	1 kΩ / 100 kΩ	1 kΩ	1 kΩ / 100 kΩ	1 kΩ	1 kΩ
Measuring voltage maximum	-	5 V	10 V	5 V	10 V	10 V
Measuring current maximum	-	20 mA	20 mA	20 mA	20 mA	20 mA
Exactness	-	± 3 %	± 0,01 %	± 3 %	± 0,01 %	± 0,01 %
Alarm threshold value "Isolation" adjustable	-	-	via control software	-	via control software	via control software
Alarm threshold value from / to in steps	-	-	1 MΩ to 10 MΩ	-	1 MΩ to 10 MΩ	1 MΩ to 10 MΩ
Loop Resistance Measurement	-	-	√	-	√	√
Measuring range	-	-	0 Ω to 8 kΩ	-	0 Ω bis 8 kΩ	0 Ω bis 8 kΩ
Dissolution	-	-	1 Ω	-	1 Ω	1 Ω
Voltage level maximum	-	-	10 V	-	10 V	10 V
Measuring current maximum	-	-	20 mA	-	20 mA	20 mA
Exactness	-	-	± 0,02%	-	± 0,02%	± 0,02%
Alarm threshold value "Loop" adjustable	-	-	automatic	-	automatic	automatic
Impulse Running Period Measurement	-	√	-	√	-	-
Dissolution / Exactness	-	0,5 m / 0,2 %	-	0,5 m / 0,2 %	-	0,5 m / 0,2 %
Voltage level maximum	-	0 / 5 V to 270 Ω	-	0 / 5 V to 270 Ω	-	0 / 5 V to 270 Ω
Pulse wave shape	-	-	-	-	-	-
Impulse running period adjustable from / to (V/2)	-	90 to150 m/µs	-	90 to 150 m/µs	-	90 to 150 m/µs
Direct Voltage Measurement (DC)	-	√	√	√	√	√
Measuring range	-	± 2 V	± 2 V	± 2 V	± 2 V	± 2 V
Exactness	-	0,01 V	0,01 V	0,01 V	0,01 V	0,01 V
Dissolution	-	± 3 %	± 0,2 %	± 3,0 %	± 0,2 %	± 0,2 %
Alternating Voltage Measurement (AC)	-	√	√	√	√	√
Measuring range	-	2 Vss	2 Vss	2 Vss	2 Vss	2 Vss
Exactness	-	± 3 %	± 0,2 %	± 3,0 %	± 0,2 %	± 0,2 %
Dissolution	-	0,01 V	0,01 V	0,01 V	0,01 V	0,01 V
USB - Interface	√ / via adapter	-	-	√ / via adapter	√ / via adapter	√ / via adapter
Power distant supply voltage maximum	-	-	-	-	-	-
Working range power distant supply	-	-	-	-	-	-
Addressability standard / extended	-	16- / 32-fold	16- / 32-fold	16-fold	16-fold	16-fold
Radio interface / GSM	-	-	-	-	-	-
TC / IP - Ethernet interface	-	possible	possible	-	-	-
isoplus - Device Type IPS-	**Digital-MDS**	**Digital-Cu-MS**	**Digital-NiCr-MS**	**Digital-Cu-MBS**	**Digital-NiCr-MBS**	**Digital-UNI-MBS**

(1) only in connection with **IPS-Digital-Cu-MS** and / or **IPS-Digital-NiCr-MS**

(2) only in connection with **IPS-Digital-MDS**

8 LEAK DETECTING

8.6 Technical Data

isoplus - Device Type IPS-	Digital-Cu-KMS	Digital-NiCr-KMS	Digital-TV	Digital-MODEM	Digital-PFA	Digital-FSV
Page	8.4.2	8.4.2	8.5.5	8.5.5	8.5.5	8.5.5
Monitoring manually / automatically	- / √	- / √	-	-	- / √ [1]	-
Detection Cu / NiCr	√ / -	- / √	-	-	-	-
Measurement (L x B x H) in mm	150 x 300 x 80	150 x 300 x 80	150 x 150 / 300 x 80	150 x 150 x 80	150 x 150 x 80	150 x 150 x 80
Weight in kg	3,0	3,0	2,0 / 3,0	2,0	2,0	2,0
Casing	Steel plate	Steel plate	Steel plate	Steel plate	Steel plate	Steel plate
Powder coated and dip-impregnated	√	√	√	√	√	√
Operating temperature	- 20° C to + 50° C	- 20° C to + 50° C	- 20° C to + 50° C	- 20° C to + 50° C	- 20° C to + 50° C	- 20° C to + 50° C
Temperature for guaranteed exactness	+ 20° C ± 8° C	+ 20° C ± 8° C	-	-	-	-
Store- resp. ambient temperature	- 10° C to + 50° C	- 10° C to + 50° C	- 10° C to + 50° C	- 10° C to + 50° C	- 10° C to + 50° C	- 10° C to + 50° C
Humidity until + 31° C	max. 80 %	max. 80 %	max. 80 %	max. 80 %	max. 80 %	max. 80 %
Akku- / Battery Voltage	-	-	-	-	-	-
Akku- / Battery type	-	-	-	-	-	-
230 V ± 10 % / 50 Hz net voltage	√	√	√	√	√	√
Euro-plug connection	√	√	√	√	√	√
Fuse	250 V / T 100 mA	250 V / T 100 mA	250 V / T 100 mA	250 V / T 100 mA	250 V / T 100 mA	250 V / T 100 mA
Power consumption operation / standby	4,5 VA / 2 VA	8 VA / 2 VA	2,5 VA / -	4 VA / -	2,5 VA / -	10 VA / -
Consump. per year at 1 measurement per day	17 kWh	17 kWh	21 kWh	15 kWh	17 kWh	30 kWh
Protection Class	I	I	I	I	I	I
Kind of protection	IP 66	IP 66	IP 66	IP 66	IP 66	IP 66
Measuring category	I	I	-	-	-	-
Potential Free Relay Contact	Turnkey	Turnkey	-	-	Turnkey	-
Contact carrying capacity	48 V / 1 A	48 V / 1 A	-	-	48 V / 1 A	-
RS 485 - Interface Input / Output	-	-	1 / 1 bis 6	0 / 1	0 / 1	-
Voltage level maximum	-	-	0 / 5 V	0 / 5 V	0 / 5 V	-
Data cable length maximum to MS / MDS	-	-	3.000 m	3.000 m	3.000 m	-
Data rate 2400 - 38400 baud	-	-	√	√	√	-
Automatic selection	-	-	√	√	√	-
Half duplex transmission at 2-wire RS 485	-	-	√	√	√	-
Full duplex transmission at 4-wire RS 485	-	-	√	√	√	-
RS 232 - Interface Input	1	1	-	-	1	-
Voltage level maximum	± 10 V	± 10 V	-	-	± 10 V	-
Data cable length maximum to PC	15 m	15 m	-	-	15 m	-
Data rate 2400 - 38400 baud	√	√	-	-	√	-
Measure Entries / -Channels	2 or 4	2 or 4	-	-	-	-
Voltage strength of entries	-	-	-	-	-	-
Maximum Cu-sensor wire per channel	2.500 m	-	-	-	-	-
Recommended max. Cu-wire lengths / channel	2.500 m	-	-	-	-	-
Maximum NiCr-sensor wire per channel	-	1.400 m	-	-	-	-
Recomm. max. NiCr-wire lengths per channel	-	1.200 m	-	-	-	-
Isolation Resistance Measurement	√	√	-	-	-	-
Measuring range	200 KΩ to 20 MΩ	1 kΩ to 20 MΩ	-	-	-	-
Dissolution	1 kΩ / 100 kΩ	1 kΩ	-	-	-	-
Measuring voltage maximum	5 V	10 V	-	-	-	-
Measuring current maximum	20 mA	20 mA	-	-	-	-
Exactness	± 3 %	± 0,01 %	-	-	-	-
Alarm threshold value "Isolation" adjustable	-	via control software	-	-	-	-
Alarm threshold value from / to in steps	-	1 MΩ to 10 MΩ	-	-	-	-
Loop Resistance Measurement	-	√	-	-	-	-
Measuring range	-	0 Ω to 8 kΩ	-	-	-	-
Dissolution	-	1 Ω	-	-	-	-
Voltage level maximum	-	10 V	-	-	-	-
Measuring current maximum	-	20 mA	-	-	-	-
Exactness	-	± 0,02%	-	-	-	-
Alarm threshold value "Loop" adjustable	-	automatic	-	-	-	-
Impulse Running Period Measurement	√	-	-	-	-	-
Dissolution / Exactness	0,5 m / 0,2 %	-	-	-	-	-
Voltage level maximum	0 / 5 V to 270 Ω	-	-	-	-	-
Pulse wave shape	-	-	-	-	-	-
Impulse running period adjustable from / to (V/2)	90 to 150 m/µs	-	-	-	-	-
Direct Voltage Measurement (DC)	√	√	-	-	-	-
Measuring range	± 2 V	± 2 V	-	-	-	-
Exactness	0,01 V	0,01 V	-	-	-	-
Dissolution	± 3 %	± 0,2 %	-	-	-	-
Alternating Voltage Measurement (AC)	√	√	-	-	-	-
Measuring range	2 Vss	2 Vss	-	-	-	-
Exactness	± 3 %	± 0,2 %	-	-	-	-
Dissolution	0,01 V	0,01 V	-	-	-	-
USB - Interface	√ / via adapter	√ / via adapter	-	-	-	-
Power distant supply voltage maximum	-	-	-	-	-	30 V
Working range power distant supply	-	-	-	-	-	ca. 1.800 m
Addressability standard / extended	16- / 32-fold	16- / 32-fold	-	-	-	-
Radio interface / GSM	-	-	-	-	-	-
TC / IP - Ethernet interface	-	-	-	-	-	-
isoplus - Device Type IPS-	**Digital-Cu-KMS**	**Digital-NiCr-KMS**	**Digital-TV**	**Digital-MODEM**	**Digital-PFA**	**Digital-FSV**