# IBAK inspection and rehabilitation systems

IBAK

*The illustrations in this brochure may show special equipment that is subject to additional charge.*

EN

# Content

# High-tech for the environment

**For more than 80 years, IBAK has been working on the progress of the sewer industry. The family-run company develops and produces high-quality sewer inspection and rehabilitation solutions for worldwide use. As a reliable partner, IBAK helps customers to make a decisive contribution to functional sewer systems and proper wastewater disposal. For a clean environment and secure supply.**

A functioning sewer system is an important part of our civilisation and contributes significantly to environmental protection. Because: Leaking sewers contaminate the soil and our groundwater. Defects in sewer systems and laterals mean that sewage can exfiltrate into the soil, the groundwater and bodies of water, thereby endangering the environment. The infiltration of extraneous water into the sewer system is also problematic: On the one hand, the dilution of wastewater reduces the effectiveness of the wastewater treatment plant. On the other hand, the greater volume of water can overload sewers, stormwater basins and wastewater treatment plants.
Only if the condition of the underground sewer networks is known, it is possible to take early action in the event of defects and to counteract these processes. With the inspection systems developed and produced by IBAK, sewers and laterals can be inspected in detail. Additionally, IBAK develops systems to check the tightness of pipes as well as cutting and repair robots for sewer rehabilitation. The accompanying software is also developed by IBAK.

- High image resolution, mobility and optimised handling for ergonomic and efficient work processes are our focus points in the field of sewer inspection.
- Our cutting and rehabilitation robots are characterised by flexibility and versatility, enabling a wide range of rehabilitation techniques.
- In addition to the test and measuring methods that can be applied with our inspection and rehabilitation systems, we provide systems for sewer leak tests.
- Our modular solutions are consistent and investment-proof – from inspection to rehabilitation.

IBAK's technical solutions are used around the world to ensure that sewer networks function safely. IBAK systems stand for reliability and security under the demanding conditions of the system-relevant underground infrastructure. At IBAK, highly specialised engineering and development competence meets decades of industry knowledge. Our accumulated knowledge as a producing company from the very beginning in the sewer industry benefits network operators, service providers and engineering offices worldwide. As a vertically integrated manufacturer, IBAK offers matched systems from a single source.
The company's founder Helmut Hunger made history in 1957 by inventing the world's first sewer inspection camera. As the sewer industry's pioneer, it is IBAK's motivation and obligation to continue providing added value to the daily work of users. Since 1945, IBAK has been developing and producing in Kiel, Germany, with a solution-oriented approach. Thereby, IBAK relies on innovative technologies and high-quality vehicles that make the processing of orders future-proof. Customers benefit from IBAK's experience in development and precise production of highly stressed components by using state-of-the-art electrical engineering and IT. IBAK's practice-oriented solutions pave the way for the customers' success.

# Milestones in the company’s history

**1945**: Established by Helmut Hunger as an engineering office; sale of medical devices such as ophthalmic magnets

**1959**: Banknotes forged during World War II salvaged from Lake Toplitz with IBAK underwater searchlights and cameras

**1973**: Herwig Hunger succeeds his father as managing director; production of the 679 FM, the world’s largest searchlight at that time

**1982**: Construction of the Eastern Scheldt storm surge barrier under observation by an IBAK camera specially developed for the purpose

**1991**: Dr. Werner Hunger, hitherto senior executive, joins his Herwig Hunger in the management

**1995**: The company’s 50th anniversary; the IBAK staff has increased to 166 employees


**2002**: Invention of the PANORAMO technology for the generation of 360° spherical images

**2011**: Opening of the branch offices IBAK-Nordwest in Georgsmarienhütte and IBAK-West in Krefeld

**2013**: Development of the POLARIS push-rod camera with which, among other things, 3D-GeoSense pipe run measurements can be performed


**2015**: On the company’s 70th anniversary, the staff of more than 300 are the epitome of innovative products and services

**2020**: Dorian and Daniel Hunger join their father in the management; IBAK makes manhole inspection with 4K resolution possible: PANORAMO SI 4K; the company’s 75th anniversary: IBAK has more than 400 employees

**1957**: Introduction of the first sewage pipe TV system

**1972**: Development of a TV and photo carriage for manganese nodule exploration in depths of 6000 m on the research ship Valdivia

**1980**: Delivery of the 200th IBAK inspection vehicle



**1987**: Presentation of the first sewer analysis software IKAS 10

**1993**: Introduction of LISY, the world’s first lateral inspection system, for making turns from main lines to laterals.

IBAK presents the first ARGUS with the patented ROTAX panning mechanism.

**2000**: IBAK launches the first camera that can be operated both with a push rod and a tractor on the market: ORION

**2003**: Opening of the branch office IBAK-Süd in Senden



**2012**: Extension of the product portfolio with electrically driven cutting robots, new subsidiary IBAK Robotics GmbH

IBAK introduces the first full HD inspection camera: PEGASUS HD

**2014**: Establishment of the subsidiary IBAK Australia Pty. in Australia



**2019**: Opening of branch offices in Freigericht and Leipzig.The electric cutting robot for the lateral sector starts practical operation: NanoGator; IBAK is working on software that is based on artificial intelligence to reduce the burden on inspectors during inspection data capture: ArtIST

**2023**: Daniel and Dorian Hunger take over as managing directors

# Product overview

## Cameras

**AxialCam**
≥ DN 50
*Page 56*

**NANO/NANO L**
≥ DN 80
*Page 58*

**NANO 2/NANO 2 L**
≥ DN 80
*Page 58*

**POLARIS 2/POLARIS 3**
≥ DN 100
*Page 59*

**ORION 3**
≥ DN 100
*Page 60*

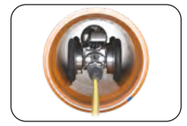
**ORION 3 L**
≥ DN 100
*Page 61*

**ORPHEUS 2**
**ORPHEUS 3**
≥ DN 150
*Page 62*

**ORPHEUS 2 HD**
**ORPHEUS 3 HD**
≥ DN 150
*Page 63*

**ARGUS 6**
≥ DN 200
*Page 64*

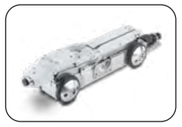
**Manned-Entry Adapter**
Inspection on foot of large-diameter sewers
*Page 66*



**RETRUS 2/2 HD**
≥ DN 100
*Page 67*

## Tractors

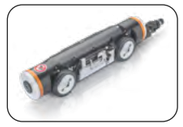
**T 66/T 66 HD**
≥ DN 100
*Page 72*



**T 76/T 76 HD**
≥ DN 150
*Page 72*

## Complete systems

**PANORAMO 150 4K**
≥ DN 150
*Page 70*



**PANORAMO 4K**
≥ DN 200
*Page 70*

**PANORAMO SI 4K**
≥ DN 300 manhole inspection
*Page 69*

**LISY 4**
≥ DN 150
*Page 71*

## Mobile systems

**MiniLite 3**
≥ DN 50
*Page 82*

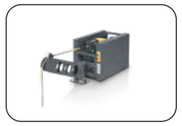
**MainLite 2**
(KW 207/307)
*Page 83*

**MainLite 2 easy**
(KT 157)
*Page 83*

**ASPECTA 3**
Manhole zoom camera
*Page 68*

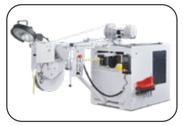
## Cable winches

**KW SI/KW SI 50**
Camera cable max. 50 m
*Page 83*



**KW 207/307**
Camera cable max. 200 m/300 m
*Page 85*

**KW 305**
Camera cable max. 300 m
*Page 84*



**KW 505/310**
Camera cable max. 600 m
*Page 84*

**KW LISY Synchron**
Camera cable max. 180 m
*Page 84*

## Operating devices and systems

**BP 3**
*Page 86*

**BS 10X/BS 10X-3.5**
*Page 86*

## Software

IKIS

IKAS evolution

IKAS cleaner

## Cutting robots

**MicroGator**
*Page 76*

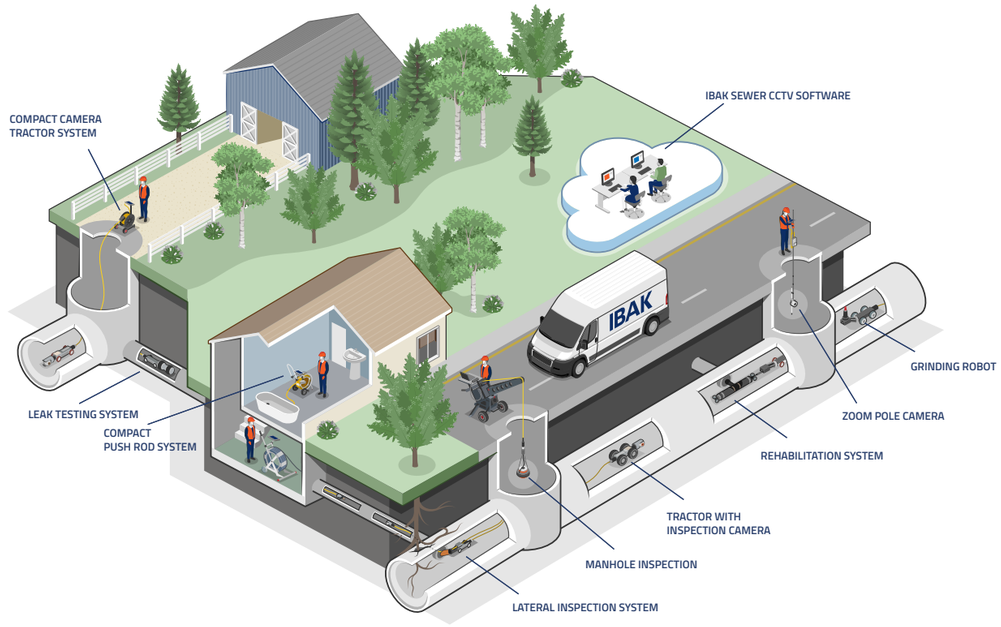
**MicroGator 150**
*Page 76*

**MicroGator Air**
*Page 77*

**MicroGator Air 150**
*Page 77*

**MicroGator GT/GT Lite**
*Page 80*

# Areas of application



# Mobile systems

# MiniLite 3

## Push-rod camera system for small and medium nominal diameters

Application range from DN 50/80 and up

- **Can be used everywhere:** Typically for operation in laterals – even if they are strongly ramified
- **Added value:** Thanks to extensive measuring functions for qualified condition assessment
- **Versatile use:** Different cameras and push rods can be adapted to any inspection requirement
- **More possibilities:** As an ideal addition to an IBAK tractor inspection system
- **Fast data transmission:** Easy transmission of inspection results to the contractor

The **IBAK MiniLite 3** is a compact push-rod camera system for inspection of lateral and property sewer systems. It enables a wide range of applications thanks to the modular extendibility and many accessory parts.
The MiniLite 3 is equipped with a exchangeable reel with an 80-metre HD push rod (PP5) with an integrated 512 Hz transmitter as standard. The camera models **ORION, NANO** and **POLARIS** (HD versions), which can also be used to determine the diameter, can be operated with it. Depending on requirements, the system can be equipped with an additional extension function (extension system) and software. For simple projects without complicated data exchange formats, the IKAS recorder is available. If inspections for sewage systems shall be recorded according to the European standard EN 13508-2, the IKAS mini can be installed and the inspection results can be issued as clearly-structured reports on paper or as PDF.
If specific data exchange formats are required or if a 3D site plan shall be created after a 3D-GeoSense pipe run measurement, the use of a complete IKAS evolution is recommended.

# MiniLite 3 extension system

## Extension function

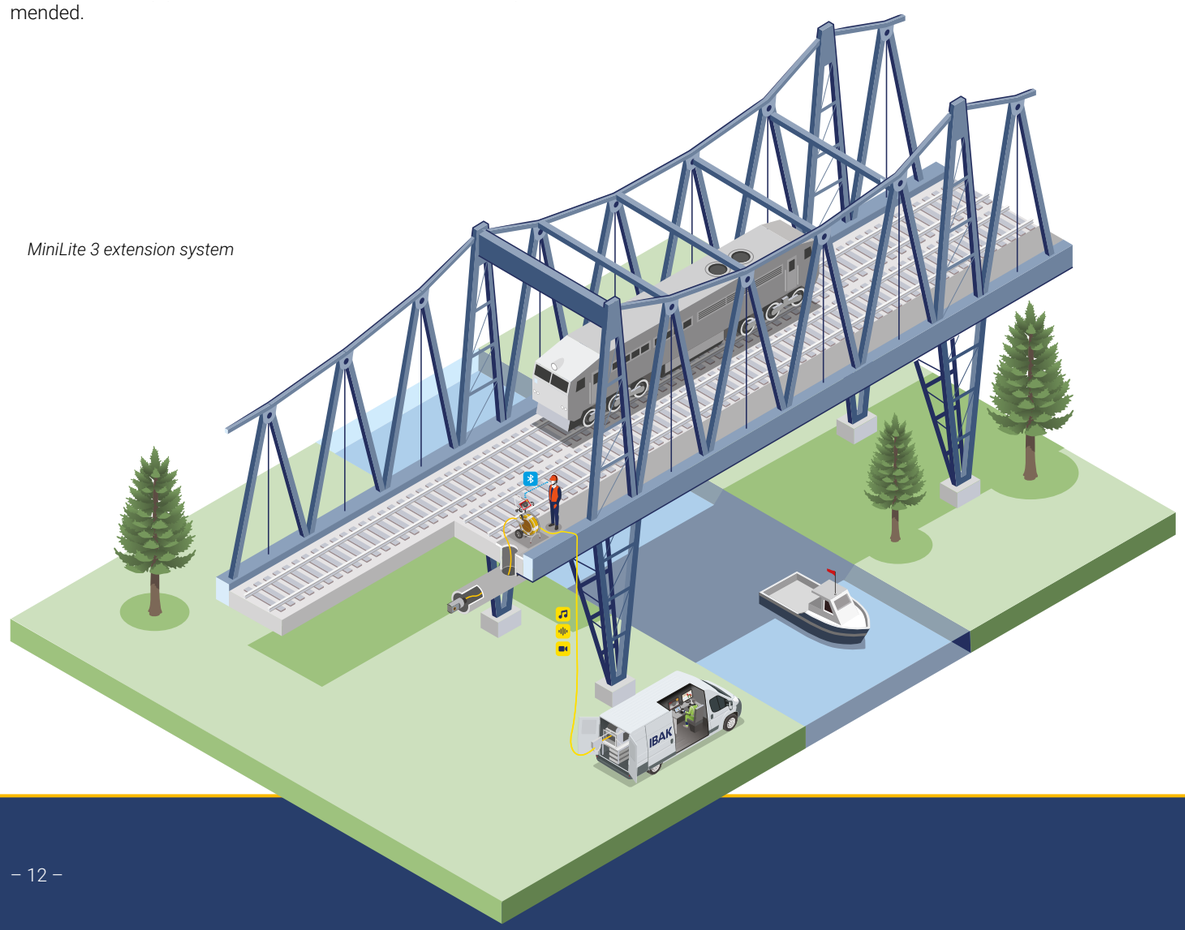
Extension system

**Extension system function with voice connection**

With the extension system, the MiniLite can be connected to a large system so that even difficult-to-access sections and laterals can be inspected from the vehicle.

**Advantages:**

- Transmission of the video and length values to the vehicle
- Convenient operation by using the software in the vehicle
- Parallel monitoring of the inspection by persons at the MiniLite and in the vehicle
- Communication of persons involved via a headset or loudspeaker and microphone in the vehicle




*MiniLite 3 extension system*

| Camera | AxialCam | NANO 2 | POLARIS 3 | ORION 3 |
|---|---|---|---|---|
| | *Page 56* | *Page 58* | *Page 59* | *Page 60* |
| *MiniLite 3* | ✓ | ✓ | ✓ | ✓ |
| Classification | Axial camera | Pan and tilt camera | Pan and tilt camera | Pan and tilt camera |
| Field of application | DN 50 and up* | DN 80 and up | DN 100 and up | DN 100 and up |
| Push-rod operation | ✓ | ✓ | ✓ | ✓ |
| Tractor operation | X | ✓ | X | ✓ |
| Turning ability | (✓) | ✓ | ✓ | ✓ |
| SD | ✓ | X | X | X |
| Full HD | X | ✓ | ✓ | ✓ |
| Upright image | ✓ | ✓ | ✓ | ✓ |
| Correctly orientated image every 180° (eFlip) | X | ✓ | ✓ | ✓ |
| 3D-GeoSense (optional) | X | ✓ | ✓ | ✓ |
| Optical zoom | X | X | X | ✓ |
| Digital zoom | X | X | X | ✓ |
| Joint gap lighting | X | X | X | X |
| Ex protection (optional) | X | ✓ | ✓ | ✓ |


**With separate exchangeable reel*

# MainLite 2 fit

## Transportable inspection system for main lines

Application range from DN 100 and up

- **Added value**: Thanks to extensive measuring functions for qualified condition assessment
- **Safe investment**: Flexible and future-proof thanks to modular system design
- **Variable operation**: In a vehicle and as a mobile inspection system
- **Turnkey solution**: Hardware and software from a single source
- **Fast data transmission**: Easy transmission of inspection results to contractors

The system can be used with many camera/tractor combinations (HD versions) for various pipe diameters and applications. For example, a T 66 can be operated with the ORION camera in small pipe diameters from DN 100 and up, or a T 76 camera tractor with an ORPHEUS camera in larger pipes from DN 150 and up. MainLite fit consists of the versatile control console BP 3 with rugged tablet and two joysticks for camera and tractor control as well as the motorised winches with 200-metre (KW 207) or 300-metre camera cable (KW 307). Using the mobile rack, they can be transported to places that are difficult to access with vehicles. With the integrated seat, it is also possible to work comfortably outside of the inspection vehicle. Cutter and rehabilitation systems can also be connected (KW 207).


# MainLite 2 fit




| With camera | NANO 2 | ORION 3 | ORPHEUS 2/3 HD | ARGUS 6 (HD) |
|---|---|---|---|---|
| *Techn. data* | *Page 58* | *Page 61* | *Page 63* | *Page 64* |
| Classification | Pan and tilt camera | Pan and tilt camera | Pan and tilt camera | Rotate, pan and tilt camera |
| Field of application | DN 80 and up | DN 100 and up | DN 150 and up | DN 200 and up |
| Push-rod operation | ✓ | ✓ | X | X |
| Tractor operation | ✓ | ✓ | ✓ | ✓ |
| Turning ability | ✓ (Version L) | ✓ (Version L) | X | X |
| SD | X | ✓ | X | X |
| Full HD | ✓ | ✓ | ✓ | ✓ |
| Upright image | ✓ | ✓ | ✓ | ✓ |
| Permanently correctly orientated image (ROTAX) | X | X | X | ✓ |
| Correctly orientated image every 180° (eFlip) | ✓ | ✓ | ✓ | X |
| 3D-GeoSense | ✓ | ✓ | ✓ | ✓ |
| Optical zoom | X | 2x | 10x | 10x |
| Digital zoom | X | 16x | 16x | 16x |
| Joint gap lighting | X | X | ✓ | ✓ |
| Ex protection | ✓ | ✓ | ✓ (Version 3) | ✓ |




| With tractor | T 66 | T 76 |
|---|---|---|
| *Technical data* | *Page 72* | *Page 72* |
| Field of application | DN 100 and up | DN 150 and up |
| Steering function | ✓ | ✓ |
| Cruise control | ✓ | ✓ |
| Wheel quick-change system | X | ✓ (Optional) |
| Speed | Continuously adjustable | Continuously adjustable |
| Pressure monitoring | ✓ | ✓ |
| Inclination measurement | ✓ (Optional) | ✓ (Optional) |
| Temperature measurement | ✓ (Optional) | ✓ (Optional) |
| Ex protection | ✓ (Optional) | ✓ (Optional) |

| | MG Air/ MG 150 Air | MG GT Lite |
|---|---|---|
| *Techn. data* | *Page 77* | *Page 77* |
| Field of application | DN 150/200 and up (relined) | DN 200 and up (system-dependent) |
| Maximum working range | Up to 300 m | System-dependent |
| Cutter motor drive | Pneumatic | X |
| Pressure monitoring | ✓ | ✓ |
| Speed | Continuously adjustable | Continuously adjustable |
| Monitoring camera | ✓ | ✓ |
| Front camera | X | X |
| Back-eye camera | ✓ | ✓ |
| Camera lens cleaning | ✓ | ✓ |
| Inspection | ✓ | ✓ |
| Ultra-high pressure water jet cutting | X | ✓ |
| Top hat installation | ✓ | X |
| Sleeve installation | ✓ | X |
| Mortar injection | X | ✓ |

# MainLite 2 easy

## Transportable inspection system for main lines

Application range from DN 100 and up

- **Can be used everywhere**: Easy transport even to difficult-to-access places
- **Added value**: Thanks to extensive measuring functions for qualified condition assessment
- **Extends radius of action**: With the portable base for main line inspections independent of the vehicle
- **Fast data transmission**: Easy transmission of inspection results to contractors

The **MainLite easy** is used when fully-fledged inspections in high quality are to be performed in main lines, but where the system must also be easy to transport to locations that are difficult to access with a vehicle. The MainLite easy consists of a motor-driven cable winch with 150 metres of camera cable and a control console (BP 3).
Comprehensive software such as IKAS evolution can be installed on the PC of the control console. If, alternatively, only basic software in the form of IKAS recorder is required to record, save and transmit videos and images, this is also possible, as is the installation of IKAS mini. With this variant, inspections of sewage systems can be performed in compliance with the European EN 13508-2 standard or WRc. Condition and defects data of sections and manholes as well as photo and video recordings can be easily entered and saved thanks to intuitive menu guidance. The results of the inspection are documented in well-structured reports and stored as a PDF. Data can be transmitted to contractors via USB stick or WLAN.
Winding on the camera cable of the KT 157 cable winch is motor-aided, which is a great handling advantage as opposed to a manual cable winch. Large wheels and a folding transport handle ensure smooth transport and good stability even on uneven ground. The low weight of the KT 157 allows operation by one person and transportation even to places that are difficult to access.
An integrated counter measures the cable length. The measured value is transmitted to the control console and overlaid in the video. To operate the system, only a 230-volt socket or a battery pack is required.

The IBAK camera tractors T 66 HD and T 76 HD and the cameras NANO 2 (L), ORION 3 (L), ORPHEUS 2/3 HD and ARGUS 6 can be operated with the MainLite easy.


| With camera | NANO 2 | ORION 3 | ORPHEUS 2/3 HD | ARGUS 6 (HD) |
|---|---|---|---|---|
| *Techn. data* | *Page 58* | *Page 61* | *Page 63* | *Page 64* |
| Classification | Pan and tilt camera | Pan and tilt camera | Pan and tilt camera | Rotate, pan and tilt camera |
| Field of application | DN 80 and up | DN 100 and up | DN 150 and up | DN 200 and up |
| Push-rod operation | ✓ | ✓ | X | X |
| Tractor operation | ✓ | ✓ | ✓ | ✓ |
| Turning ability | ✓ (Version L) | ✓ (Version L) | X | X |
| SD | X | ✓ | X | X |
| Full HD | ✓ | ✓ | ✓ | ✓ |
| Upright image | ✓ | ✓ | ✓ | ✓ |
| Permanently correctly orientated image (ROTAX) | X | X | X | ✓ |
| Correctly orientated image every 180° (eFlip) | ✓ | ✓ | ✓ | X |
| 3D-GeoSense | ✓ | ✓ | ✓ | ✓ |
| Optical zoom | X | 2x | 10x | 10x |
| Digital zoom | X | 16x | 16x | 16x |
| Joint gap lighting | X | X | ✓ | ✓ |
| Ex protection | ✓ | ✓ | ✓ (Version 3) | ✓ |

| With tractor | T 66 | T 76 |
|---|---|---|
| *Technical data* | *Page 72* | *Page 72* |
| Field of application | DN 100 and up | DN 150 and up |
| Steering function | ✓ | ✓ |
| Cruise control | ✓ | ✓ |
| Wheel quick-change system | X | ✓ (Optional) |
| Speed | Continuously adjustable | Continuously adjustable |
| Pressure monitoring | ✓ | ✓ |
| Inclination measurement | ✓ (Optional) | ✓ (Optional) |
| Temperature measurement | ✓ (Optional) | ✓ (Optional) |
| Ex protection | ✓ (Optional) | ✓ (Optional) |

# ASPECTA 3

## Transportable checking system for main lines

### Application range from DN 150 and up

The ASPECTA 3 enables quick condition capture and assessment of sewers from adjacent manholes.

- **Immediate visual inspection**: For a quick first impression in full HD resolution without requiring much time and equipment
- **Time-saving aid**: For efficient and targeted use of existing inspection resources
- **Useful basis**: To prioritise inspection, cleaning and rehabilitation measures
- **Revealing insights**: For more certainty in the evaluation of structures that are difficult to access
- **Versatile use**: Tanks, pits, boilers and many other vessels can also be inspected in addition to sewers

# Vehicle-bound systems

# Main line and lateral inspection

## Tractor systems with T 66 and T 76

- **Professional inspection**: The powerful vehicle system for all requirements
- **Added value**: Thanks to extensive measuring functions for qualified condition assessment
- **Safe investment**: Flexible and future-proof thanks to modular system design
- **Turnkey solution**: Hardware and software from a single source
- **Fast data transmission**: Easy transmission of inspection results to the contractor

IBAK vehicle systems provide high-resolution, full HD recordings from the main line and from laterals with a LISY satellite inspection system.
The IBAK camera tractors T 66 and T 76 form the basis for all inspection requirements from DN 100 and up. All accessories fulfil IBAK's high quality standards and therefore comply with the high requirements for flexibility, short setup times and efficiency.
Since the hardware and IKAS evolution software are optimally matched, quick data capture and comprehensive data transmission to the contractor are possible.

| With tractor | T 66 | T 76 |
|---|---|---|
| *Technical data* | *Page 72* | *Page 72* |
| Field of application | DN 100 and up | DN 150 and up |
| Steering function | ✓ | ✓ |
| Cruise control | ✓ | ✓ |
| Wheel quick-change system | X | ✓ (Optional) |
| Speed | Continuously adjustable | Continuously adjustable |
| Pressure monitoring | ✓ | ✓ |
| Inclination measurement | ✓ (Optional) | ✓ (Optional) |
| Temperature measurement | ✓ (Optional) | ✓ (Optional) |
| Ex protection | ✓ (Optional) | ✓ (Optional) |

| With camera | ORION SD | ORION 3 | ORPHEUS 2/3 | ORPHEUS 2/3 HD | ARGUS 6 (HD) |
|---|---|---|---|---|---|
| *Techn. data* | *Page 60* | *Page 61* | *Page 62* | *Page 63* | *Page 64* |
| Classification | Pan and tilt camera | Pan and tilt camera | Pan and tilt camera | Pan and tilt camera | Rotate, pan and tilt camera |
| Field of application | DN 100 and up | DN 100 and up | DN 150 and up | DN 150 and up | DN 200 and up |
| Push-rod operation | ✓ | ✓ | X | X | X |
| Tractor operation | ✓ | ✓ | ✓ | ✓ | ✓ |
| Turning ability | ✓ (L version) | ✓ (L version) | X | X | X |
| SD | ✓ | ✓ | ✓ | X | X |
| Full HD | X | ✓ | X | ✓ | ✓ |
| Upright image | ✓ | ✓ | ✓ | ✓ | ✓ |
| Permanently correctly orientated image (ROTAX) | X | X | X | X | ✓ |
| Correctly orientated image every 180° (eFlip) | ✓ | ✓ | ✓ | ✓ | X |
| 3D-GeoSense | ✓ | ✓ | ✓ | ✓ | ✓ |
| Optical zoom | 2x | 2x | 10x | 10x | 10x |
| Digital zoom | 16x | 16x | 16x | 16x | 16x |
| Joint gap lighting | X | X | ✓ | ✓ | ✓ |
| Ex protection | ✓ | ✓ | ✓ (Version 3) | ✓ (Version 3) | ✓ |

Can be operated with MicroGator Air and MicroGator Air150

# Main line inspection

## PANORAMO 4K, 360° technology

### Application range from DN 150 and up

- **Productive inspection**: Thanks to fast capture of the entire pipe interior view
- **Objective basis for decision-making**: Thanks to the unique 360° all-round view inside the pipe
- **Complete documentation**: Precise data capture including measurements serves as a basis for qualified condition assessment
- **Optimal use of resources**: Evaluation can be carried out directly on site or in the office and supported by artificial intelligence (AI)
- **Safe investment**: Flexible and future-proof thanks to modular system design
- **Fast data transmission**: Easy transmission of inspection results to the contractor

The IBAK vehicle system with **PANORAMO 4K** supplies ultra-high resolution 3D interior views from main lines. Instead of video recordings, hemispherical images are taken with the two high-resolution 4K digital cameras, which are mounted at the front and rear of the tractor and are equipped with 185° fisheye lenses. These photos are then combined into 360° spherical images. In this way, a real 3D interior view of the complete pipe is generated and the inspected section can be viewed from all angles of view. Condition capture can also be performed at the workplace in the office independently from the inspection, which increases productivity.

The data quality and integrity of the inspection data provide an optimum basis for processing and analysis by the artificial intelligence-based ArtIST software, because the PANORAMO 4K systems perform a complete scan of the pipe interior view, completely in 4K resolution. PANORAMO ArtIST (Artificial Intelligence Software Tool) recognises defects, laterals etc. automatically and helps users to identify and document defects largely automatically.

ArtIST

| **360-degree camera** | **PANORAMO 150 4K** | **PANORAMO 4K** |
|---|---|---|
| *Technical data* | *Page 70* | *Page 70* |
| Classification | 360-degree camera | 360-degree camera |
| Range of application | Main line inspection | Main line inspection |
| Field of application | DN 150 and up | DN 200 and up |
| 4K | ✓ | ✓ |
| Cruise control | ✓ | ✓ |
| Wheel quick-change system | X | ✓ |
| Pressure monitoring | ✓ | ✓ |
| Inclination measurement | ✓ | ✓ |
| Ex protection | ✓ | ✓ |

## Main line and lateral with flushing unit

### Lateral inspection from main lines

# Vehicle-bound systems

## LISY: Lateral inspection from main lines

### Application range from DN 150 and up in main lines, lateral diameters from DN 80 and up

The lateral inspection system **LISY** can be operated in main lines with diameters of DN 150 and up and from there enables the inspection of connector pipes from DN 80 and up.
A hinged joint allows easy entry of the system even if there are bends in the channel; the system can be adapted to the pipe diameter with the electric height adjusting device (LISY Lift).

The camera can be propelled either with or without using water. When using water for the propulsion and to achieve a certain cleaning effect, a PHOBOS cleaning nozzle can be connected. For this, the TITAN flushing unit is installed in the vehicle in addition to the inspection unit.

With the LISY system, it is possible to perform pipe run and position measurements during the inspection.
In particular in the case of complex and ramified lateral runs, precise information on the actual pipe run and position is an important prerequisite for maintenance, exact localisation of defects and for planning further measures.

### 3D-GeoSense

In the same work step as the inspection, pipe run measurements are automatically recorded via a 3D sensor integrated in the camera and the xyz-coordinates are determined.

### Hydrostatic height measurement

With an additional hydrostatic height measurement, the height can be determined to the centimetre and the z-axis data can be verified.




| With camera | NANO | NANO 2 | POLARIS | POLARIS 3 | ORION SD | ORION 3 |
|---|---|---|---|---|---|---|
| *Technical data* | *Page 58* | | *Page 59* | | *Page 60* | *Page 61* |
| Classification | Pan and tilt camera | | Pan and tilt camera | | Pan and tilt camera | |
| Field of application | DN 80 and up | | DN 100 and up | | DN 100 and up | |
| Push-rod operation | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Tractor operation | ✓ | ✓ | X | X | ✓ | ✓ |
| Turning ability | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| SD | ✓ | X | ✓ | X | ✓ | ✓ |
| Full HD | X | ✓ | X | ✓ | X | ✓ |
| Upright image | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Permanently correctly orientated image (ROTAX) | X | X | X | X | X | X |
| Correctly orientated image every 180° (eFlip) | ✓ | ✓ | X | X | ✓ | ✓ |
| 3D-GeoSense (optional) | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Optical zoom | X | X | X | X | 2x | 2x |
| Digital zoom | X | X | X | X | 16x | 16x |
| Joint gap lighting | X | X | X | X | X | X |
| Ex protection (optional) | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

# Main line and lateral inspections with pressure test system


## IBAK modular sewer leak test

TV inspection remains the indispensable basis for any rehabilitation decisions that may be necessary. However, as leaks also often have causes that are not visible, the tightness of sewers cannot always be reliably determined by a TV system.
The **IBAK DPS** leak test system is designed for operation in circular profiles from DN 100 and up. Depending on the variant, positive air pressure or negative air pressure tests are possible. The IBAK DPS components provide a flexible system to check sections and joints for leaks.
The IBAK pressure test components can be integrated into IBAK TV systems. A joint control console and a cable winch (KW 505) with 250 metres of combined camera and compressed air cable (hybrid cable) ensure a clear arrangement of devices. All components are easy to handle and have short setup times; they are designed for one-person operation and efficient working procedures.

# DPS

## Leak test systems

### Application range from DN 100 and up

**Vehicle system for main line and lateral inspection with leak test unit**
The IBAK vehicle system for main line and lateral inspection provides inspection data from main lines, laterals and manholes as well as information on tightness.

- **Effective combination**: Inspection and leak test according to standards with a single vehicle system e.g. for acceptance of a new construction
- **Added value**: Thanks to extensive measuring functions for qualified condition assessment
- **Safe investment**: Flexible and future-proof thanks to modular system design
- **Turnkey solution**: Hardware and software from a single source
- **Fast data transmission**: Easy transmission of inspection results to the contractor

### Section test and joint test (with air)

The section to be inspected is sealed off with a sealing cushion and a test sealing cushion in the immediate vicinity of the manhole. Using a pressure vacuum pump, either positive or negative air pressure is generated in the test area (depending on the desired test method).

A pressure sensor measures the pressure and reports it to the connected PC. The pressure curve is displayed graphically on the PC monitor; the measured data is saved and can be viewed and printed out as a test report at any time. If the values for the permissible pressure drop are not achieved, the pressure test is not passed and the sewer is labelled as leaking (DIN EN 1610 and DWA-A139). This is clearly stated in the report that is created with IBAK's own IKAS software, just like all other required information.
When testing joints, a special test packer is positioned above the joint. The packer is pressurised with air in front of and behind the joint so that it is completely sealed and a test space is created at the joint. Here, too, pressure is generated with a pressure-vacuum pump, which is monitored with sensor technology. The pressure values are displayed as graphics and tables in IKAS and a standardised protocol is created.

# Main line and lateral inspections with rehabilitation option


## Professional systems for rehabilitation of laterals and sewers

The sewer system is subjected to various loads due to its permanent use. In the course of time, mistakes during transport and installation of the pipes as well as later external loads on the pipes also cause damage that impairs the functionality and can lead to the destruction of the pipes in the long run.

With the powerful cutting and rehabilitation robots, economical repair procedures can be performed efficiently and trenchlessly to improve the condition in the long term and to maintain the net asset value for future generations.

The range of applications includes repairs, opening connections after inserting liners, removal of deposits with cutter tools or ultra-high pressure water jet technology as well as packer-guided sealing tasks.

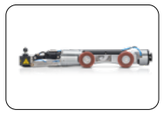
# Vehicle-bound systems

## Cutting and rehabilitation

### Application range from DN 150 and up

**IBAK MicroGator vehicle system for electric or pneumatic cutting and rehabilitation tasks in main lines**

- **Effective cutting**: Through precise control of the cutting process
- **Reliable in operation**: Electrically-driven and low-noise or pneumatic operation
- **Safe investment**: Flexible and future-proof thanks to modular system design
- **Added value**: Installation of top hats and sleeves, mortar injection, ultra-high pressure cutting and inspection
- **Ready for immediate use**: Turnkey solution






| Cutting robots | MicroGator 150 | MicroGator | MicroGator 150 Air | MicroGator Air | MicroGator GT | MicroGator GT Lite |
|---|---|---|---|---|---|---|
| *Technical data* | *Page 76* | *Page 76* | *Page 77* | *Page 77* | *Page 77* | *Page 77* |
| Field of application | DN 150 and up (relined) | DN 200 and up (relined) | DN 150 and up (relined) | DN 200 and up (relined) | System-dependent | System-dependent |
| Maximum working range | Up to 150 m | Up to 150 m | Up to 50 m | Up to 300 m | System-dependent | System-dependent |
| Cutter motor drive | Electric | Electric | Pneumatic | Pneumatic | – | – |
| Pressure monitoring | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Speed | Continuously adjustable | Continuously adjustable | Continuously adjustable | Continuously adjustable | Continuously adjustable | Continuously adjustable |
| Monitoring camera | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Front camera | X | ✓ | X | X | X | X |
| Back-eye camera | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Camera lens cleaning | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Inspection | ✓ | ✓ | X | X | X | ✓ |
| Ultra-high pressure water jet cutting | X | X | X | X | ✓ | ✓ |
| Top hat installation | ✓ | ✓ | X | ✓ | X | X |
| Sleeve installation | ✓ | ✓ | X | ✓ | X | X |
| Mortar injection | X | ✓ | X | ✓ | ✓ | ✓ |

# Vehicle-bound systems

## Cutting and rehabilitation: Adapters/accessories

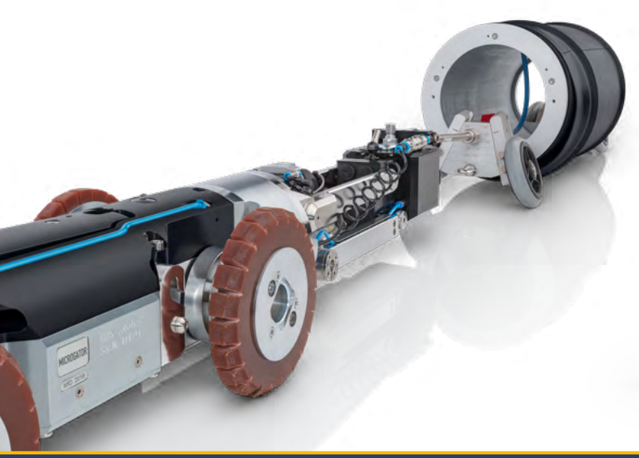
Application range from DN 150 and up

### Top hat installation packer adapter

- Adapter for attachment of Schwalm packers on the MicroGator and insertion into the sewer
- For insertion of resin-soaked short liners or top hat profiles to seal cracks or joints
- Integrated camera for exact positioning at the defective sewer section or connection to be rehabilitated

### Sleeve installation packer adapter

- Adapter that can be mounted to install liner sleeve packers
- The sleeve system seals and stabilises the defect mechanically
- Without using any chemicals and independent of the pipe material
- Exact positioning of the packer with sleeve at the area to be sealed thanks to CutterCam monitoring camera
- High range thanks to long cable length of the system and good traction of the MicroGator
- Sleeves available up to DN 800



### ORION inspection camera adapter

- Inspection camera adapter for the MicroGator
- Performance of a fully-fledged inspection of the sewer to be cut before its rehabilitation
- Acceptance inspection after completed rehabilitation with minimum time requirements

### FrontCam

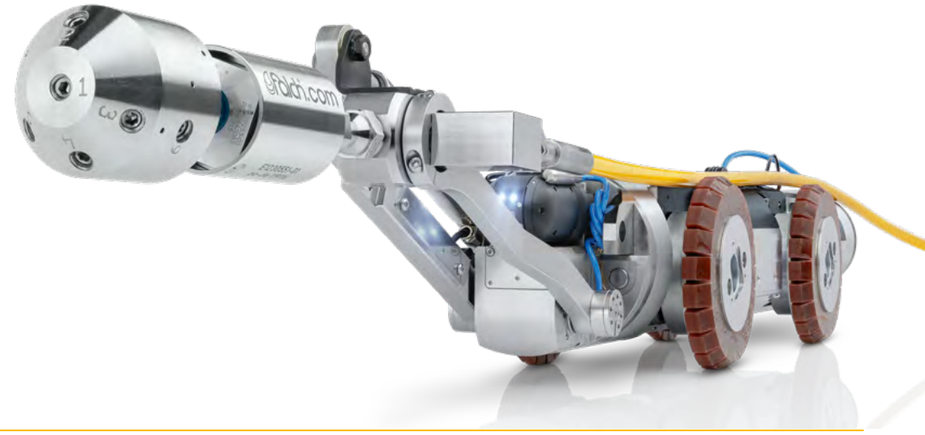
- Axial camera for assembly in front of the MicroGator motor, size 1
- Identification of side connections that must be opened after liner insertion
- Optimum illumination of the sewer due to its position at the front of the cutting robot
- No visually obstructing shadows of the cutter tool

### CutterCam

- Focussed image of the cutting area
- High image quality at all times, even with closer pipe walls
- Convincing image material for evaluation and documentation of repair results
- Permanent air flow in front of the CutterCam's lens reliably removes cutting dust
- Additional water nozzle for removal of larger particles
- Removal of extreme contamination without residues by panning the camera over a rubber lip

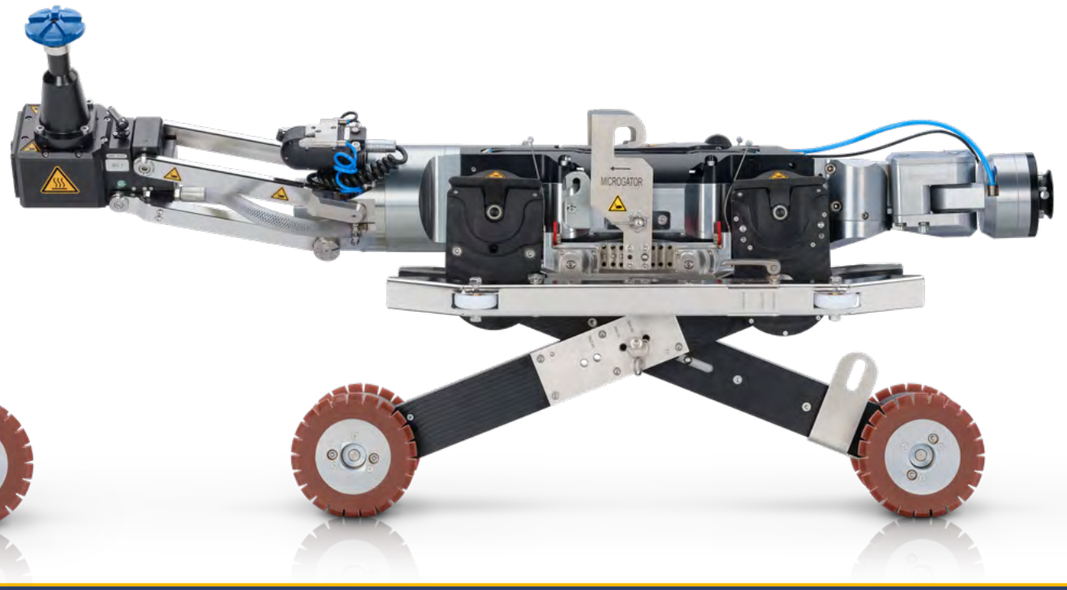
### Ultra-high pressure water jet cutter adapter

- For removal of large-scale, resistant deposits in sewers with ultra-high pressure water jets
- MicroGator device carrier (GT) for operation of a swivel-mounted cleaning nozzle (made by e.g. falch or Hammelmann)
- GT components: Tractor, control technology and CutterCam
- Mobile mount to tilt, pan and incline the tool
- Continuously adjustable water pressure from 600 to 2500 bar to remove e.g. solid sintering over longer pipe distances within a very short time under camera monitoring




### Ovoid pipe device

- For tractor T 76 and MicroGator



# MicroGator vehicle system for main line rehabilitation and cleaning


**The IBAK vehicle system for electric cutting and rehabilitation tasks in main lines.**

- **Effective cutting**: Through precise control of the cutting process
- **Reliable in operation**: Power-driven, low-noise operation
- **Safe investment**: Flexible and future-proof thanks to modular system design
- **Added value**: Installation of top hats and sleeves, mortar injection, ultra-high pressure cutting and inspection
- **Ready for immediate use**: Turnkey solution

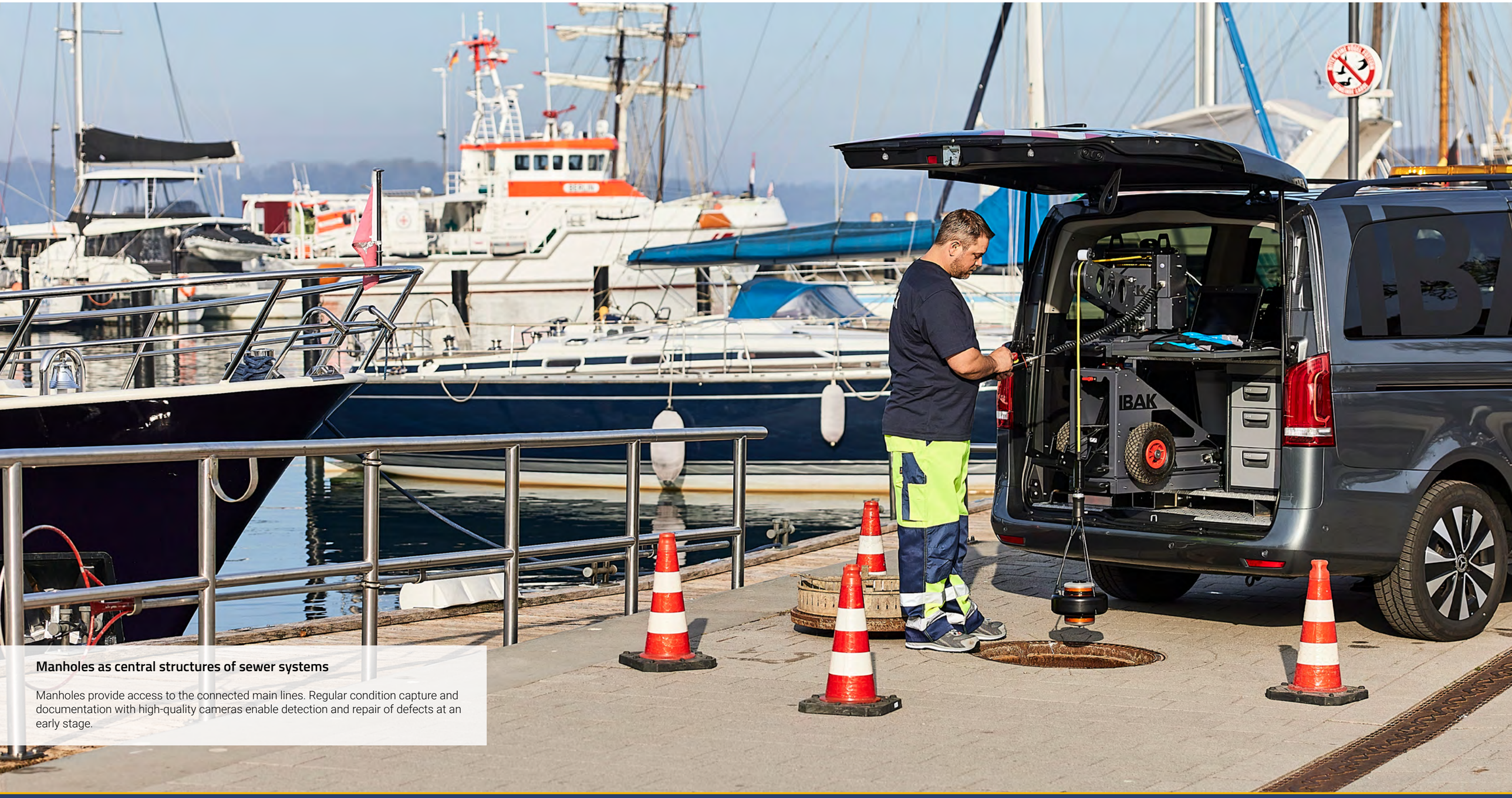
# MicroGator Air vehicle system for main line rehabilitation and cleaning (MainLite)


## MicroGator Air rehabilitation and inspection system – mobile or in a vehicle

The IBAK system for pneumatic cutting and rehabilitation tasks as well as inspections in main lines.

- **Effective cutting**: Through precise control of the cutting process
- **Reliable in operation**: Pneumatic and powerful
- **Safe investment**: Flexible and future-proof thanks to modular system design
- **Added value**: Installation of top hats and sleeves, ultra-high pressure cutting and inspection
- **Variable operation**: In a vehicle and as a mobile rehabilitation system

# Manhole inspection




## Manholes as central structures of sewer systems

Manholes provide access to the connected main lines. Regular condition capture and documentation with high-quality cameras enable detection and repair of defects at an early stage.

# PANORAMO SI 4K

## Inspection system for manholes

### Application range from DN 300 and up

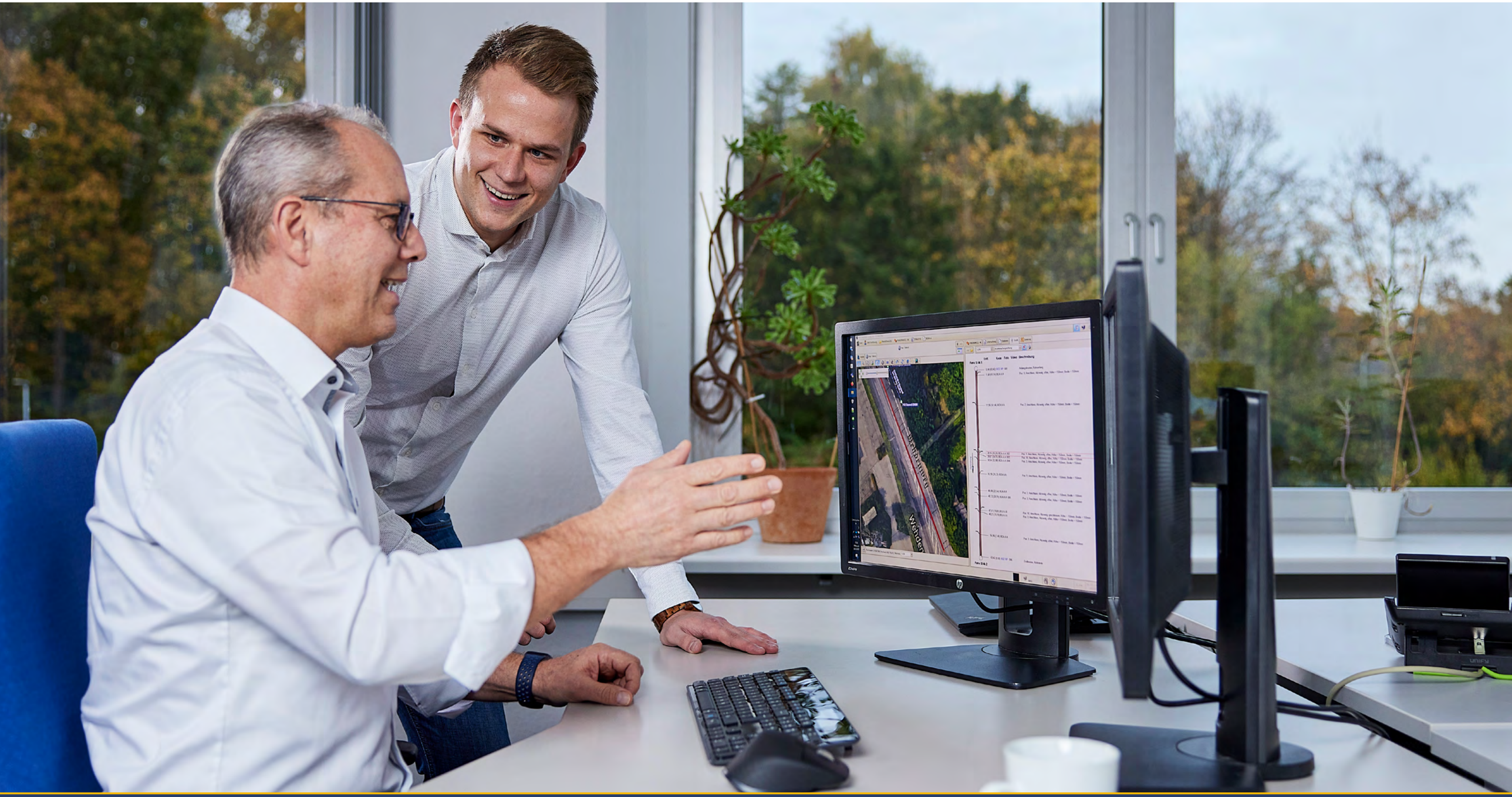
- **Productive inspection**:
  Thanks to fast capture of the entire manhole interior view
- **Objective basis for decision-making**:
  Thanks to the unique 360°all-round view inside the manhole
- **Complete documentation**:
  Precise data capture including measurements serves as a basis for qualified condition assessment
- **Variable operation**: In a vehicle and as a mobile inspection system
- **Safe investment**: Flexible and future-proof thanks to modular system design
- **Fast data transmission**: Easy transmission of inspection results to contractors

The PANORAMO SI 4K manhole inspection system provides ultra-high resolution 3D manhole recordings and precise measuring data thanks to the proven scan technology.

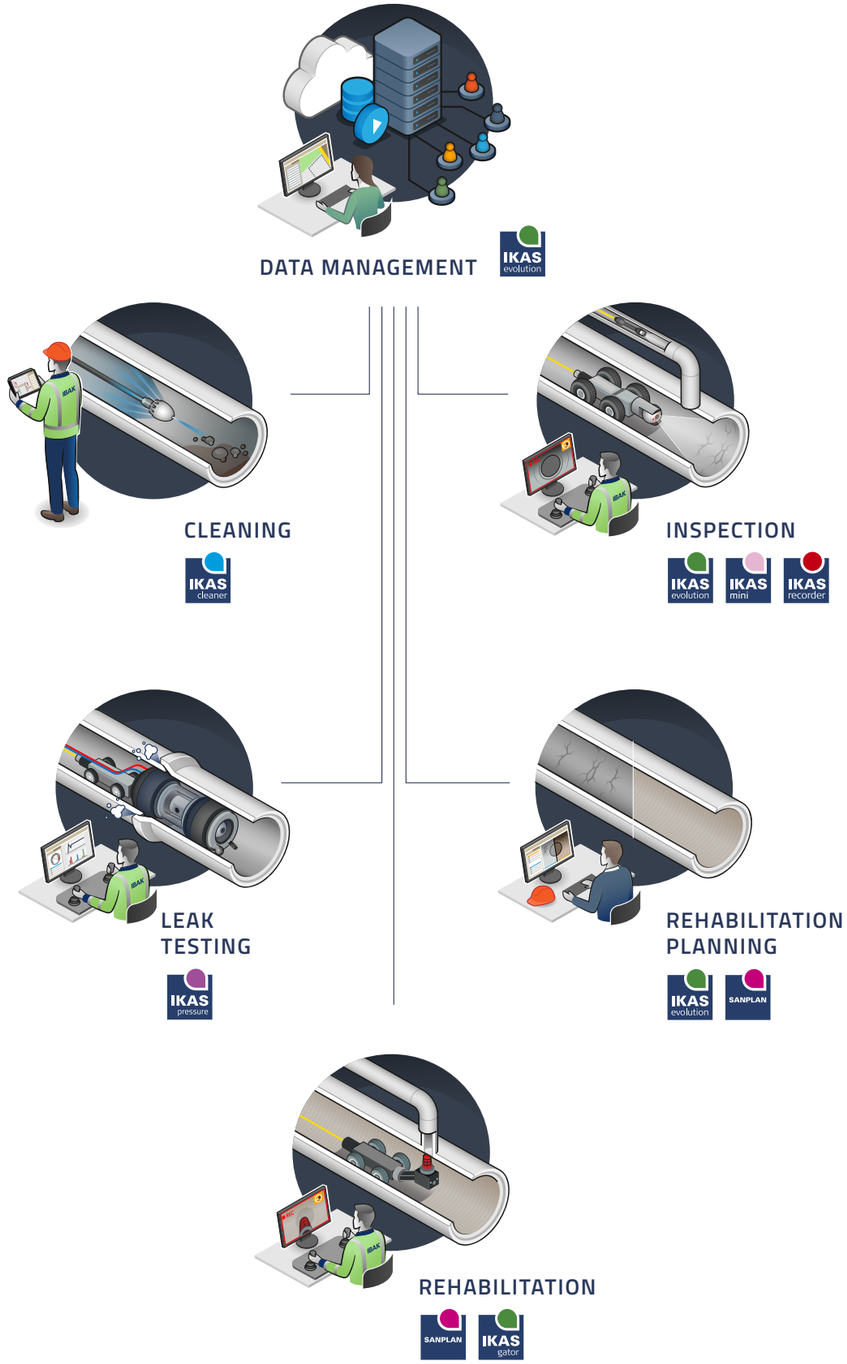
The system with 12-metre cable winch can be used both from a vehicle or in mobile operation. It can be converted in a few steps so that it is possible to react flexibly to the local conditions and also reach manholes that are difficult to access. Alternatively, the PANORAMO SI 4K can be operated on large inspection winches that are installed in vehicles such as the KW 505 or KW 310, or on a 50-metre cable winch (KW SI 50). Using the IKAS evolution software, a completely digital data cycle is generated. This enables a recording, an immediate or later condition capture in the office as well as a transmission of the data with IKAS.

| | PANORAMO SI 4K |
|---|---|
| Classification | 360-degree camera |
| Range of application | Manhole inspection |
| Field of application | DN 300 and up |
| 4K | ✓ |
| Cruise control | ✓ |
| Pressure monitoring | ✓ |
| Ex protection | ✓ |

# Software



## Equipment variants and licences




### IKAS evolution for inspection, analysis and documentation of sewer data

The software can be used on the inspection system and in the office.

- **Perfect match**: Software and hardware from a single source
- **The right tool for every task**: The scope of functions can be extended easily and according to requirements
- **Paperless data cycle**: Consistent digital workflows possible
- **Optimised processes**: The targeted use of assistants facilitates complex tasks
- **Improved basis for decision-making**: Thanks to extensive measuring functions for qualified condition assessment
- **Effective data analysis**: Value-added information as a basis for rehabilitation planning
- **Working according to standards**: Capture, evaluation and transmission according to all established rules and regulations
- **Fast data transmission**: Easy configuration and transmission of inspection results with one click

### IKAS cleaner: Software for administration of cleaning and flushing data

Easy and digital documentation and management of cleaning and flushing data.

- **Working more efficiently**: Linking the software and sewer cleaning truck enables structured processing of orders and simplified work processes
- **Digital documentation**: Master data, site plans and map material supplemented with cleaning data
- **Perfect interaction**: An ideal supplementation to the sewer inspection software

### IKAS mini – The entry-level software for sewer inspection

Capture and documentation of sewer data by use of standard damage catalogues.

- **Perfect match**: Software and hardware from a single source
- **Paperless data cycle**: Basic digital workflows possible
- **Improved processes**: The targeted use of input assistants facilitates complex tasks
- **Fast data transmission**: Easy transmission of inspection results with one click

### IKAS recorder

The software for easy video and photo recordings in sewers.

- **Perfect match**: Software and hardware from a single source
- **Quick access to operation**: Easy to learn and ready to start immediately after a short introduction

### SanPlan

Comprehensive planning and performance of the service phases according to HOAI.

Preliminary planning (budget planning): Individual technology tables for each planning step / automatic allocation of measures

- **Design planning / approval planning**: Comparative cost calculation of different rehabilitation variants
- **Detailed design**: Determination of the rehabilitation method / preparation of a list of services
- **Project control / documentation**: Data export / report export / data exchange

### IKAS pressure

The software for leak tests and digital documentation of pressure test data.

# Technical data

**AxialCam**
Axial camera
Application range from DN 50 and up

- Very small dimensions
- Inspection starting at DN 50
- Great bend-passing capability
- Always upright image

Mounted to the MiniLite push-rod camera system, the **AxialCam** is the ideal camera for inspection of ramified laterals with small diameters.
It is suitable for the application range from DN 50 and up and is permanently installed on the push rod. With its small diameter of 39 mm and its optimised bend-passing capability, it is the ideal camera for inspection of ramified lateral networks. The integrated adjustable LED lighting provides optimum illumination of the inspection area and even this small axial camera always provides an upright image.

| **AxialCam technical system data** | |
|---|---|
| Product classification | Axial camera |
| Field of application | DN 50 and up |
| Dimensions | Ø 39 mm / length 47 mm |
| Weight | 180 g |
| Push-rod operation | ✓ |
| Tractor operation | X |
| Upright image (UPC) | ✓ |
| Correctly oriented image | X |
| Zoom | X |
| F (shutter) | 1:2.2 |
| f (focal length) (mm) | 2.5 |
| Lighting | 6 high-power LEDs |
| Light sensitivity (lux) | 0.025 lux |
| Protection class | IP68 |
| Permissible ambient temperature | 0° C to +40° C during operation |
| Pressure monitoring | X |
| Aperture function | Fixed shutter |
| Panning range | Axial view |
| Angle of rotation | – |
| Focus | 5 cm – 20 cm, fixed |
| Sensor | 1/4“ CMOS |
| TV standard | NTSC or PAL |
| Horizontal image resolution | 420 TVL |
| Integrated laser | X |
| Integrated locating transmitter | X |
| Ex protection | X |
| 3D-GeoSense | X |

| **Can be combined with** | |
|---|---|
| IBAK push-rod system | MiniLite/MiniLite 3 |
| IBAK control system | BP 3 |

## NANO/NANO L (SD)
## NANO 2/NANO 2 L (HD)

Pan and tilt camera

Application range from DN 80 and up

- Great bend-passing capability
- Automatic return to neutral position
- Optional 3D-GeoSense sensor
- Flexible use on push-rod systems or tractors
- Optional Ex protection

The **NANO / NANO L/NANO 2 / NANO 2 L** camera is the smallest pan and tilt camera in the IBAK portfolio. It can be used from DN 80 and up and is available with or without "Kieler Stäbchen" (Kiel rod). Desired directions of view are achieved by the microprocessor-controlled pan head, which can also rotate endlessly around its own axis. The pan function enables a view in all directions up to automatic joint panning as well as a view to the rear into branches. Three preselectable focus memory points make the process of joint panning even more convenient and helps users to achieve their goal quickly, as there is no need for frequent refocussing. The NANO generates an upright image in axial view by means of the UPC function (Upright Picture Control).
With its slim diameter of 47 mm, the camera can be connected to all current IBAK push-rod camera systems, tractors and the IBAK LISY satellite system and is fully suitable for bends (can make turns in up to DN 150). In addition, it can be used with 3D-GeoSense systems to create 3D site plans thanks to the optional sensors.
The IBAK NANO / NANO L can extend the range of application of an IBAK system – it is particularly in its element in relined and/or ramified DN 100 laterals. The industrial sector with its difficult-to-access, long and ramified lateral networks is also an ideal field of application for the NANO and NANO L.

| NANO/NANO 2 technical system data | |
|---|---|
| Product classification | Pan and tilt camera |
| Field of application | DN 80 and up |
| Dimensions | Ø 47 mm / length 83 mm |
| Weight | Approx. 0.320 kg |
| Push-rod operation | ✓ |
| Tractor operation | ✓ |
| Upright image (UPC) | ✓ |
| Correctly oriented image | ✓ |
| Zoom | X |
| F (shutter) | 1:2.0/1:2.4 |
| f (focal length) (mm) | 3.8/4.3 |
| Lighting | 4 white power LEDs |
| Light sensitivity (lux) | 0.025 lux / 0.01 lux |
| Protection class | IP68 |
| Permissible ambient temperature | 0° C to +40° C during operation |
| Pressure monitoring | 2 integrated pressure sensors |
| Aperture function | Fixed shutter |
| Panning range | +/-120° |
| Angle of rotation | Endless |
| Focus | Manual 1 cm – ∞, remote-controlled in endless operation, autofocus |
| Sensor | 1/4" CMOS/ 1/2.8" full HD |
| TV standard | NTSC or PAL/HD, full HD |
| Horizontal image resolution | 420 TVL/1100 TVL |
| Integrated laser | ✓ (Optional) |
| Integrated locating transmitter | ✓ (Optional) |
| Ex protection | ✓ (Optional) |
| 3D-GeoSense | ✓ (Optional) |

| Can be combined with | |
|---|---|
| IBAK tractor | T66, T76 |
| IBAK push-rod system | MiniLite/MiniLite 3 |
| IBAK satellite system | LISY |
| IBAK control systems | BP 3, BS 10X, BS 10X-3.5 |



## POLARIS 2 (SD)
## POLARIS 3 (HD)

Pan and tilt camera

Application range from DN 100 and up

The **IBAK POLARIS** push-rod camera is suitable for bends and can make 90° turns with 100% field of view and can be used from DN 100 and up. As the camera is positioned right at the front, no guide device appears in the image during inspection. In addition, the camera can pan at an angle of 90° to the pipe wall and therefore ensures optimum inspection. The POLARIS can also automatically pan pipe joints (360°). Three preselectable focus memory points make the process of joint panning even more convenient and helps users to achieve their goal quickly, as there is no need for frequent refocussing.

- Suitable for 90° bends from DN 100 and up
- 360° joint panning
- 100% clear field of view
- Optional 3D-GeoSense sensor
- Optional Ex protection

| POLARIS 2/POLARIS 3 technical system data | |
|---|---|
| Product classification | Pan and tilt camera |
| Field of application | DN 100 and up |
| Dimensions | Ø 60 mm / length 285 mm (can be angled) |
| Weight | Approx. 0.8 kg |
| Push-rod operation | ✓ |
| Tractor operation | X |
| Upright image (UPC) | ✓ |
| Correctly oriented image | X |
| Zoom | X |
| F (shutter) | 1:2.0/1:2.4 |
| f (focal length) (mm) | 3.8/4.3 |
| Lighting | 4 white power LEDs |
| Automatic return to neutral position | ✓ |
| Light sensitivity (lux) | 0.025 lux / 0.01 lux |
| Protection class | IP68 |
| Permissible ambient temperature | 0° C to +40° C |
| Pressure monitoring | 2 integrated pressure sensors |
| Aperture function | Fixed shutter |
| Panning range | +/-120° |
| Angle of rotation | Endless |
| Focus | Manual 1 cm – ∞, remote-controlled in endless operation, autofocus |
| Sensor | 1/4" CMOS/ 1/2.8" |
| TV standard | NTSC or PAL/HD, full HD |
| Horizontal image resolution | 420 TVL/1100 TVL |
| Viewing range | +/-150° |
| Integrated laser | ✓ (Optional) |
| Integrated locating transmitter | ✓ (Optional) |
| Ex protection | ✓ (Optional) |
| 3D-GeoSense | ✓ (Optional) |

| Can be combined with | |
|---|---|
| IBAK push-rod system | MiniLite/MiniLite 3 |
| IBAK satellite system | LISY |
| IBAK control systems | BP 3, BS 10X, BS 10X-3.5 |

## ORION 3 SD/ORION 3 SD L

Pan and tilt camera

Application range from DN 100 and up

| ORION 3 SD technical system data | |
|---|---|
| Product classification | Pan and tilt camera |
| Field of application | DN 100 and up |
| Dimensions | Ø 60 mm / length 100 mm |
| Weight | 500 g |
| Push-rod operation | ✓ |
| Tractor operation | ✓ |
| Upright image (UPC) | ✓ |
| Correctly oriented image | ✓ (eFlip) |
| Zoom | Digital: 16x digital, analogue 2x optically loss-free |
| F (shutter) | 1:4.0 |
| f (focal length) (mm) | 4 |
| Lighting | 12 high-power LEDs |
| Light sensitivity (lux) | 0.01 lux |
| Protection class | IP68 |
| Permissible ambient temperature | 0° C to +40° C during operation |
| Pressure monitoring | 2 integrated pressure sensors |
| Aperture function | Fixed shutter |
| Panning range | +/-120° |
| Angle of rotation | Endless |
| Focus | One-push autofocus, manual focus, ~10 mm – ∞ |
| Sensor | 1/2.8" CMOS |
| TV standard | NTSC or PAL |
| Horizontal image resolution | 700 TVL |
| Integrated laser | ✓ (Optional) |
| Integrated locating transmitter | ✓ (Optional) |
| Ex protection | ✓ (Optional) |
| 3D-GeoSense | ✓ (Optional) |

| Can be combined with | |
|---|---|
| IBAK tractor | T66, T76 |
| IBAK push-rod system | MiniLite |
| IBAK satellite system | LISY |
| IBAK control systems | BS 10X, BS 10X-3.5 |

The **IBAK ORION** (version 3 SD) can both be operated with all SD push-rod systems and all SD tractors, making it a versatile IBAK camera. Any desired direction of view is achieved without delay with the microprocessor-controlled pan head; the camera head can also rotate endlessly around its own axis. The pan function enables a view in all directions up to automatic pipe joint panning and a view to the rear into branches. In axial view, the camera always generates an upright image thanks to the UPC function (Upright Picture Control). With its slim diameter of 60 mm, the camera can be connected to all SD IBAK tractors and is fully suitable for bends as a push-rod camera.

The system is protected by an internal operating pressure of 2 bar and inside pressure monitoring – in case of a pressure drop, the user receives a warning notice on the LCD display and a warning sound in the operating device. The ORION features a wide aperture angle, high light sensitivity, a powerful zoom and a great depth of field, enabling inspections up to DN 600 without an additional headlight.

The 3D version of the ORION can be used for pipe run measurements – with or without Ex protection depending on the requirements. The position of the ORION can be determined at any time with the integrated locating transmitter that can be switched on, and the built-in laser enables convenient diameter and deformation measurements (in combination with the IBAK IKAS software) during inspections in the sewage pipe.

The ORION L is used in ramified lateral networks. Its guiding rod, the "Kieler Stäbchen" (Kiel rod), can be rotated and panned in all directions and guides the camera smoothly into the branch.

- 360° joint panning
- Optional rod for making turns
- Programmable approach to viewing positions
- High-performance power LED lighting (can be changed at the construction site)
- Optional 3D-GeoSense
- Can be used with push-rod systems or tractors
- Optional Ex protection



## ORION 3/ORION 3 L (HD)

Rotary and Pan and tilt camera

Application range from DN 100 and up

- Suitable for 90° bends from DN 100 and up
- Can be used as SD or full HD camera
- 360° joint panning
- Automatic return to neutral position
- Optional rod for making turns
- Programmable approach to viewing positions
- High-performance power LED lighting
- Optional 3D-GeoSense
- Flexible use on push-rod systems or tractors

| ORION 3 technical system data | |
|---|---|
| Product classification | Pan and tilt camera |
| Field of application | DN 100 and up |
| Dimensions | Ø 60 mm / length 100 mm |
| Weight | 500 g |
| Push-rod operation | ✓ |
| Tractor operation | ✓ |
| Upright image (UPC) | ✓ |
| Correctly oriented image | ✓ (eFlip) |
| Zoom | Digital: 16x digital, analogue 2x optically loss-free |
| F (shutter) | 1:4.0 |
| f (focal length) (mm) | 4 |
| Lighting | 12 high-power LEDs |
| Light sensitivity (lux) | 0.01 lux |
| Protection class | IP68 according to DIN 40050 |
| Permissible ambient temperature | 0° C to +40° C during operation |
| Pressure monitoring | 2 integrated pressure sensors |
| Aperture function | Fixed shutter |
| Panning range | +/-120°, with rod: 75°–165°, with rod on the tractor: 0°–165° |
| Angle of rotation | Endless |
| Focus | One-push autofocus, manual focus, ~10 mm – ∞ |
| Sensor | 1/2.8" CMOS |
| TV standard | HD, full HD, PAL, NTSC |
| Horizontal image resolution | Analogue: 700, digital: 1100 TVL |
| Integrated laser | ✓ (Optional) |
| Integrated locating transmitter | ✓ (Optional) |
| Ex protection | ✓ (Optional) |
| 3D-GeoSense | ✓ (Optional) |

| Can be combined with | |
|---|---|
| IBAK tractor | All current tractors |
| IBAK push-rod systems | MiniLite/MiniLite 3 |
| IBAK satellite system | LISY |
| IBAK control systems | BS 10X, BS 10X-3.5, BP3 |

Depending on the system configuration, the **IBAK ORION 3** provides a full HD image (1920 x 1080 pixels), an HD image (1280 x 720) or an SD image (720 x 576 pixels). It can therefore not only be used with a full HD system but also with analogue systems. When used with a non-HD push rod, for example, it is automatically recognised as an analogue camera and the system switches accordingly. In addition, the desired resolution can be set in the user menu on a full HD system depending on the situation. If the ORION 3 is operated as a full HD camera with an inspection system, it transmits uncompressed HDSDI signals via an optical fibre cable and therefore generates video images of highest quality without any time delay between recording in the pipe and display on the monitor.

## ORPHEUS 2/3 (SD)

Pan and tilt camera

Application range from DN 150 and up

- 360° joint panning
- Automatic return to neutral position
- Programmable approach to viewing positions
- Power LED lighting can be switched on flexibly (temperature-monitored)
- One-push autofocus
- Optional Ex protection (ORPHEUS 3)
- Inside pressure monitoring
- Optional 3D-GeoSense
- Optional LaserScan profile and deformation measurement

The **IBAK ORPHEUS** is a camera that can be operated with all IBAK tractors from DN 150 and up. Features such as optional Ex protection, locating transmitter or 3D sensor for pipe run measurement make the ORPHEUS a versatile all-rounder. In addition, its integrated lasers offer the possibility of continuous deformation and profile measurements over the entire section length.

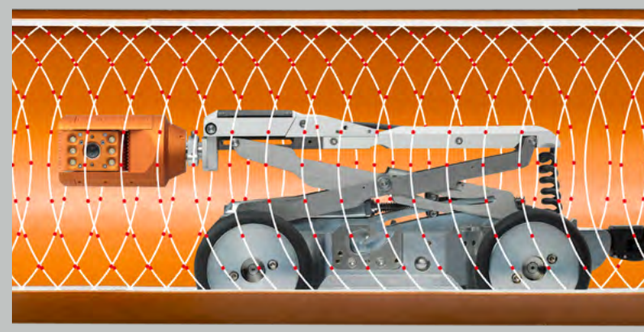
The IBAK ORPHEUS features a high light sensitivity and powerful illumination with 12 power LEDs so that also pipes with larger diameters can be inspected without additional lighting. The power LEDs can be switched on and off flexibly and are equipped with integrated joint gap lighting and an automatic lighting adjustment function which adapts the brightness of the LEDs to the pipe environment. Factors such as the pipe diameter and material affect the amount of light required. The automatic lighting control always ensures that only as much power as necessary is used and blooming is prevented. The camera head can rotate endlessly and automatic panning around joints is possible. In addition, the ORPHEUS is equipped with a 10x optical zoom.

| ORPHEUS 2/3 technical system data | |
|---|---|
| Product classification | Pan and tilt camera |
| Field of application | DN 150 and up |
| Dimensions | Ø 110 mm / length 160 mm |
| Weight | 1.8 kg – 2.2 kg (depending on the equipment) |
| Push-rod operation | X |
| Tractor operation | ✓ |
| Upright image (UPC) | ✓ |
| Correctly oriented image | ✓ (eFlip) |
| Zoom | 10x optical; 12x digital (optional) |
| F (shutter) | 1:1.8 to 1:22 |
| f (focal length) (mm) | 3.3 to 33 |
| Lighting | 10+2 high-power LEDs, (2x for joint gap) can be switched and controlled, temperature-controlled |
| Light sensitivity (lux) | 0.5 lux |
| Protection class | IP68 |
| Permissible ambient temperature | 0° C to +40° C during operation |
| Pressure monitoring | 2 integrated pressure sensors |
| Aperture function | Manual, automatic, remote-controlled |
| Panning range | +/-120° |
| Angle of rotation | Endless |
| Focus | Manual 1 cm – ∞ Remote-controlled, autofocus |
| Sensor | 1/3" (full HD 16:9, 4,080,000 px) |
| TV standard | NTSC or PAL |
| Horizontal image resolution | > 720 lines PAL |
| Integrated laser | ✓ (2x, LaserScan mode) |
| Integrated locating transmitter | ✓ (Optional) |
| Ex protection | 2: X 3: ✓ |
| 3D-GeoSense | ✓ (Optional) |

| Can be combined with | |
|---|---|
| IBAK tractor | T66, T76 |
| IBAK control systems | BS 10X, BS 10X-3.5 |

### LaserScan measurement and 3D-GeoSense

**LaserScan deformation and profile measurements** can be performed with all current ORPHEUS models so that an analysis of the pipe profile or deformation over the entire section can be created. Pipes with circular and ovoid profiles and many special profiles are supported. The measurement is performed while reversing out of the sewage pipe via two laser points that are aligned at an angle of 90° to the pipe wall. The camera is set in rotation and captures the complete profile of the section. This produces a spiral pattern of laser measuring points that are evaluated by the software and displayed both in graphical form and as a report. If the position and height coordinates of the lateral network are required in addition to the analysis of the pipe profile, a **3D-GeoSense pipe run measurement** can be performed additionally to determine the xyz-coordinates. Particularly when it is assumed that the pipe run is not linear, an exact geodetic site measurement can supply relevant data for the planning of rehabilitation measures. With the mentioned measurements, information that goes far beyond the results of purely optical inspections is yielded. The measurement results essentially offer an important basis for the selection, calculation and planning of the most suitable rehabilitation methods in terms of technology and cost-effectiveness.



## ORPHEUS 2 HD/3 HD

Pan and tilt camera

Application range from DN 150 and up

In addition to the features of the ORPHEUS 2/3, the ORPHEUS HD models are equipped with an image sensor in full HD format (1920 x 1080 = 2.08 million pixels), which has approx. 5 times as many pixels as a conventional PAL sensor. From generation of the image in the camera head to display and storage in the control console, the workflow is digital throughout (HDSDI technology). The signals are transmitted via optical fibre cable so that there is no time delay between the recording in the pipe and display on the monitor in the operator's section. Camera cables with optical fibre cables are not susceptible to interference and are extremely hard-wearing. In addition, they can be easily shortened and reinstalled if a repair is necessary.

| ORPHEUS 2HD/3HD technical system data | |
|---|---|
| Product classification | Pan and tilt camera |
| Field of application | DN 150 and up |
| Dimensions | Ø 110 mm / length 170 mm |
| Weight | 1.8 kg – 2.2 kg (depending on the equipment) |
| Push-rod operation | X |
| Tractor operation | ✓ |
| Upright image (UPC) | Permanently self-levelling |
| Correctly oriented image | ✓ (eFlip) |
| Zoom | 10x optical; 16x digital (optional) |
| F (shutter) | 1:1.8 to 1:22 |
| f (focal length) (mm) | 3.3 to 33 |
| Lighting | 10+2 high-power LEDs, (2x for joint gap) can be switched and controlled, temperature-controlled |
| Light sensitivity (lux) | 0.5 lux |
| Protection class | IP68 |
| Permissible ambient temperature | 0° C to +40° C during operation |
| Pressure monitoring | 2 integrated pressure sensors |
| Aperture function | Manual, automatic, remote-controlled |
| Panning range | +/-120° |
| Angle of rotation | Endless |
| Focus | Manual 1 cm – ∞ Remote-controlled, autofocus |
| Sensor | 1/3" (full HD 16:9, 4.080.000 px) |
| TV standard | Full HD (SDI) |
| Horizontal image resolution | 800 TVL |
| Integrated laser | ✓ (2x, LaserScan mode) |
| Integrated locating transmitter | ✓ (Optional) |
| Ex protection | 2: X 3: ✓ |
| 3D-GeoSense | ✓ (Optional) |

| Can be combined with | |
|---|---|
| IBAK tractor | All current HD tractors |
| IBAK control systems | BP 3, BS 10X, BS 10X-3.5 |

## ARGUS 6 (HD)

Rotate, pan and tilt camera

Application range from DN 200 and up

The **IBAK ARGUS 6** features the tried and tested functions of the ARGUS 5 but is the first IBAK camera model that combines the proven ROTAX panning mechanism with full HD resolution. On tractor-operated IBAK HD systems, the speed can be adapted to the nominal diameter for automatic joint panning so that an optimum recording quality is always achieved.

| **ARGUS 6 technical system data** | |
|---|---|
| Product classification | Rotate, pan and tilt camera |
| Field of application | DN 200 and up |
| Dimensions | Ø 120 mm / length 209 mm |
| Weight | Approx. 3.8 kg |
| Push-rod operation | X |
| Tractor operation | ✓ |
| Upright image (UPC) | ✓ |
| Correctly oriented image | ✓ (ROTAX) |
| Zoom | 10x optical, 16x digital |
| F (shutter) | 1:1.8 to 1:22 |
| f (focal length) (mm) | 3.3 to 33 |
| Lighting | 8 white power LEDs, 6 white<br>5 mm LEDs for joint gap lighting |
| Light sensitivity (lux) | 0.5 lux |
| Protection class | IP68 |
| Permissible ambient temperature | 0° C to +40° C during operation |
| Pressure monitoring | 2 integrated pressure sensors |
| Aperture function | Manual, automatic,<br>remote-controlled |
| Panning range | +/-120° |
| Angle of rotation | Endless |
| Focus | Manual, one-push autofocus,<br>1 cm – ∞, remote-controlled |
| Sensor | 1/3“ (Full HD 16:9, 4.080.000 px) |
| TV standard | HD, full HD |
| Horizontal image resolution | 800 TVL |
| Integrated laser | ✓ |
| Integrated locating transmitter | X |
| Ex protection | ✓ (Optional) |
| 3D-GeoSense | ✓ (Optional) |

| **Can be combined with** | |
|---|---|
| IBAK tractor | T 76 HD |
| IBAK control systems | BP 3, BS 10X, BS 10X-3.5 |

## Manned-Entry Adapter

Adapter for hand-held inspections of large-diameter profiles

Inspection on foot of large-diameter sewers

- **Professional inspection**: Inspection of main lines, which can be accessed on foot, in full HD quality
- **Meaningful addition**: Can be connected to large IBAK systems
- **Intuitive operation**: Simple control of the camera functions from the vehicle
- **Easy handling**: Connection to the person who is inspecting on foot via headphones
- **Added value**: Thanks to laser measurement for detailed documentation of defects

The **IBAK Manned-Entry Adapter** is a worthwhile addition to all IBAK inspection systems for the optical condition capture of large-diameter sewers that can be accessed on foot. To perform an inspection of large-diameter profiles in full HD resolution, the Manned-Entry Adapter is used in combination with an ORPHEUS 2 HD.

The hand-held inspection camera that features an ergonomically designed holder, low weight and automatic shutter and focus functions, which can be activated as required, is equipped with all desirable camera functions such as 10x optical zoom, autofocus and an automatic/manual shutter.

The hand-held camera is connected to the TV system via the MEA audio box. Continuous voice contact is available between the person in the sewer and the person in the vehicle. A headset ensures interference-free communication via the camera cable.
The projection of two laser points at a defined distance makes it easy to estimate relative dimensions in the TV picture, calculate the size of cracks and thus efficiently evaluate the condition of the sewer.

| Manned-Entry Adapter technical system data | |
|---|---|
| Product classification | Hand-held camera |
| Field of application | Inspection on foot of large-diameter sewers |
| Dimensions | H 301 mm / D 230 mm |
| Weight | Handle 850 g, audio box 850 g<br>ORPHEUS 2150 g<br>Handle + ORPHEUS 3000 g |
| Push-rod operation | X |
| Tractor operation | ✓ (ORPHEUS without handle) |
| Upright image (UPC) | Permanently self-levelling |
| Correctly oriented image | ✓ (eFlip) |
| Zoom | 10x optical, 16x digital (optional) |
| F (shutter) | 1:1.8 to 1:22 |
| f (focal length) (mm) | 3.3 to 33 |
| Lighting | 10+2 high-power LEDs, (2x for joint gap) can be switched and controlled, temperature-controlled |
| Light sensitivity (lux) | 0.5 lux |
| Protection class | IP68 |
| Permissible ambient temperature | 0° C to +40° C during operation |
| Pressure monitoring | 2 integrated pressure sensors |
| Aperture function | Manual, automatic, remote-controlled |
| Panning range | +/-120° |
| Angle of rotation | Endless |
| Focus | Manual 1 cm – ∞<br>Remote-controlled, autofocus |
| Sensor | 1/3" (full HD 16:9, 4.080.000 px) |
| TV standard | Full HD |
| Horizontal image resolution | 800 TVL |
| Integrated laser | ✓ |
| Integrated locating transmitter | ✓ (Optional) |
| Ex protection | X |
| 3D-GeoSense | ✓ (Optional) |

| Can be combined with | |
|---|---|
| IBAK control systems | BS 10X, BS 10X-3.5 |


## RETRUS 2 (SD)
## RETRUS 2 HD
## Back-eye camera

Application range from DN 100 and up

- Convenient, safe operation when reversing
- Integrated LED lighting
- Inside pressure monitoring
- Optional Ex protection
- Easy to retrofit thanks to modular design (pluggable)

The **IBAK RETRUS** is a back-eye camera that makes reversing easier and safer in many situations. Problematic areas that are encountered during forward travel such as protruding obstacles, defects and misplacements are recognized again when reversing so that it is possible to react accordingly and to prevent damage to the system.
Synchronisation between the IBAK winches and tractors guarantees a maximum range at a constant speed as well as fast automated reversing – but there are still situations where it is advisable to supervise the reversing procedure with a back-eye camera.
Reversing when the winch is disengaged (with the synchronisation switched off) can also be controlled with the RETRUS so that the tractor can be prevented from running over the camera cable in good time.

| RETRUS/RETRUS 2 HD technical system data | |
|---|---|
| Product classification | Back-eye camera |
| Field of application | DN 100 and up |
| Dimensions | L 100 mm / W 60 mm / H 70 mm |
| Weight | Approx. 1 kg |
| Push-rod operation | X |
| Tractor operation | ✓ |
| Upright image (UPC) | ✓ (Fixed by the tractor) |
| Correctly oriented image | ✓ (Fixed by the tractor) |
| Zoom | X |
| F (shutter) | 2 |
| f (focal length) (mm) | 2.5 |
| Lighting | 2 white LEDs, adjustable |
| Light sensitivity (lux) | 0.025 lux |
| Protection class | IP68 |
| Permissible ambient temperature | 0° C to +40° C during operation |
| Pressure monitoring | 2 integrated pressure sensors |
| Aperture function | Fixed shutter, electronic shutter, remote-controlled |
| Focus function/range | Fixed focus |
| TV standard | PAL/NTSC/full HD |
| Horizontal image resolution | 700 TVL/1100 TVL |
| Integrated laser | X |
| Ex protection | ✓ (Optional) |
| 3D-GeoSense | X |

| Can be combined with | |
|---|---|
| IBAK tractor | All |
| IBAK control systems | All control systems |

## ASPECTA 3 (HD)

Manhole zoom camera

Electronic sewer mirror

The **ASPECTA 3** (manhole zoom camera or electronic sewer mirror) allows a view into connected sewers from a manhole without anyone having to enter it. The ASPECTA 3 is used to check the operating state and can be used, for example, to plan sewer cleaning according to requirements and to plan additional inspection measures. Thanks to the high zoom factor (30x optical) and adequate lighting even in larger sewers, a view is also possible into sections far away from the manhole, up to a distance of 30 metres. With the integrated laser, the distance to specific points over the entire 30 metres can also be measured (depending on pipe condition).

| **ASPECTA 3 technical system data** | |
|---|---|
| Product classification | Tilt head camera |
| Field of application | From DN 150 to DN 1200 |
| Dimensions | Ø 123 mm, length 136 mm |
| Weight | System approx. 11 kg<br>Camera approx. 1.5 kg |
| Push-rod operation | X |
| Tractor operation | X |
| Upright image (UPC) | X |
| Correctly oriented image | X |
| Zoom | 30x optical, 32x digital |
| F (shutter) | 1:1.5 – 1:16 |
| f (focal length) (mm) | 4.3 mm – 129 mm |
| Lighting | 11 white power LEDs,<br>reflectors 15° angle of radiation |
| Light sensitivity (lux) | 0.5 lux |
| Protection class | IP68 |
| Permissible ambient temperature | -10 °C to+35 °C in operation |
| Pressure monitoring | ✓ |
| Aperture function | Manual, automatic,<br>remote-controlled |
| Panning range | Bottom 90°, top 60° |
| Angle of rotation | – |
| Focus | Manual 1 cm – ∞<br>Remote-controlled, autofocus |
| Sensor | 1/3" CMOS |
| TV standard | Full HD |
| Horizontal image resolution | 800 TVL |
| Integrated laser | ✓ |
| Integrated locating transmitter | X |
| Ex protection | Optional |

| **Can be combined with** | |
|---|---|
| IBAK tractor | – |
| IBAK push-rod systems | – |
| IBAK control systems | BP 3 |

| **Telescopic rod** | |
|---|---|
| Material | GFRP/CFRP (black) |
| Weight | 2.4 kg (standard set of 5) / 2.6 kg (optional set of 6) |
| Diameter of handle/tip | 40 mm/21 mm (standard set of 5)<br>40 mm/17 mm (optional set of 6) |
| Locking system | Quick fastener |
| Length | 1.90 m – 8.15 m (standard set of 5)<br>1.95 m – 10.0 m (optional set of 6) |

| **Power supply** | |
|---|---|
| Battery | 18 VDC, 5 Ah (Li-ion), 1x |

| **Operation/data transmission** |
|---|
| => See BPs/control consoles |

| **Accessories** | |
|---|---|
| Bipod stand | Aluminium, adjustable 109 cm – 180 cm, weight 1.95 kg |
| Manhole grid | Work grid, Ø 670 mm with recess, weight 5.6 kg |



## PANORAMO SI 4K

Manhole camera

Application range from DN 300 and up

- 4K resolution
- Efficient operation: Inspection independent from analysis in the office
- Flexible application options: With large systems or mobile systems
- Space-saving: Can be installed in a compact vehicle in combination with the KW SI
- Mobile frame: For use in difficult-to-access manholes

| **PANORAMO SI 4K technical system data** | |
|---|---|
| Product classification | Manhole inspection |
| Field of application | DN 300 and up |
| Dimensions | Ø 250 mm / height 184 mm |
| Weight | Approx. 7.6 kg |
| Protection class | IP68 |
| Permissible ambient temperature | 0° C to +40° C during operation |
| Internal operating pressure | 2.0 bar |
| Scanning speed | Max. 35 cm/s |
| Zoom | Digital |
| Recording | 360° spherical image |
| Lighting | Xenon flashlight |

| **Can be combined with** | |
|---|---|
| IBAK cable winches | KW 310, KW 505, KW SI, KW SI 50 |
| IBAK control systems | BS 10X, laptop (with KW SI) |

With the **IBAK PANORAMO SI 4K**, the advantages of the PANORAMO technology are also available for manhole inspection and enable complete and fast optical condition capture in manholes.

Two high-resolution digital cameras with distortion-free wide-angle lenses that were specially designed for this purpose capture the entire interior of the manhole in a single vertical movement and in just a few seconds. The digitally transmitted images are immediately live at the operator's disposal; condition assessment can be performed optionally in the office or directly on site.

In contrast to a video from a conventional Pan and tilt camera that only saves the image section observed at the time of recording, the IBAK PANORAMO SI 4K viewer software provides a complete manhole inspection. It is possible to stop at any position in the manhole, do a 360° pan, zoom in and save still photos.

At the same time, an unfolded view of the manhole can be generated, which provides a rapid overview of the condition of the structure and enables objects on the manhole walls to be measured. In addition, a so-called point cloud of geometric data is generated, creating a 3D model of the structure. The PANORAMO SI manhole inspection option of the IKAS software is available for further evaluation. With this option, PANORAMO SI films are analysed in a simple and efficient manner.

The results are inspection reports and inspection data suitable for all common data interfaces. With the licence-free IBAK viewers, the contractor also has a comprehensive overview.

The PANORAMO SI 4K can be operated as a mobile system with the KW SI with a 12 m cable and a laptop but also equally as well with large systems with the KW SI 50, KW 310 4K and KW 505 4K with BS 10X.

## PANORAMO 4K / PANORAMO 150 4K
## Camera system / 3D scanner
Application range from DN 150 and up

| PANORAMO 4K technical system data | | PANORAMO 150 4K |
|---|---|---|
| Field of application | DN 200 and up | DN 150 and up |
| Steering function | X | ✓ |
| Speed | Continuously adjustable, max. 35 cm/s | Continuously adjustable |
| Folding connector | Bends horizontally and vertically | Bends horizontally and vertically |
| Pressure monitoring | 2 integrated pressure sensors | 2 integrated pressure sensors |
| ATC | X | ✓ |
| Ex protection | Optional | Optional |
| Viewer software | IBAK PANORAMO Viewer (freeware) | IBAK PANORAMO Viewer (freeware) |

| Can be combined with | | |
|---|---|---|
| IBAK cameras | Does not apply as camera is integrated | Does not apply as camera is integrated |
| IBAK cable winches | KW 310 (4K), KW 505 (4K) | KW 310 (4K), KW 505 (4K) |
| IBAK control systems | BS 10X | BS 10X |

ATC = Automatic Tilt Compensation

The **IBAK PANORAMO 4K** system takes hemispherical images with two high-resolution 4K digital cameras, which are equipped with 185° fisheye lenses both at the front and rear of the tractor. These images are then combined into 360° spherical images, enabling a view from all angles. The real 3D interior view of the entire pipe can also be evaluated at any time in the office, independent from the inspection.
The Xenon flashlight, which was specially developed by IBAK for the PANORAMO technology, ensures razor-sharp images despite the high inspection speed of up to 35 cm per second.
The inspection result includes a 3D film, an unfolded view (unfolded representation of the pipe in 2D) and, if required, video sequences. This technology forms the basis for the complete identification, documentation and measurement of defects and for the use of PANORAMO ArtIST (Artificial Intelligence Software Tool). PANORAMO ArtIST is built upon software for automated recognition of defects, laterals, etc. by using artificial intelligence techniques, and helps users to identify and document defects more efficiently and partly automatically. The PANORAMO technology provides an optimum basis for this, as 100% of the pipe is captured without gaps.

## LISY
## Lateral inspection system
Application range from DN 150 and up in main lines, from DN 80 and up in laterals

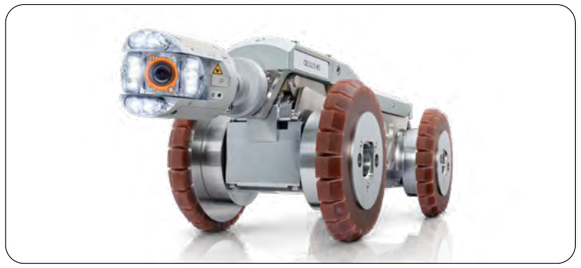
**IBAK LISY** is a lateral inspection system that can be used in main lines with diameters from DN 150 and up.
Inspections of connector pipes from DN 80 and up can be performed from laterals.
Various flushing nozzles are available for flushing and inspection in a single operation. With the corresponding camera, the LISY system is 3D-GeoSense capable so that the inspection and recording of the pipe run can be performed in one step.

- Flexible use for different nominal diameters
- Hinged joint for easy insertion
- Can be combined with numerous IBAK push-rod cameras
- Can be used for purely electric push-rod operation and with water propulsion
- High, continuously selectable propulsion speed
- Optional Ex protection
- Can be used with 3D-GeoSense and hydrostatic height measurement
- Practical handling thanks to the LISY Lift for height adjustment
- Assembly without tools thanks to quick-change funnels as positioning aid for the camera into laterals

| Technical system data | |
|---|---|
| Field of application | DN 150 and up |
| Steering function | ✓ |
| Speed | Depends on tractor |
| Folding connector | ✓ |
| Pressure monitoring | ✓ |
| ATC | ✓ |
| Ex protection | Optional |
| Height adjustment | LISY Lift, alternatively by conventional means |

| Can be combined with | |
|---|---|
| IBAK cameras | NANO, NANO L, NANO 2, NANO 2 L, POLARIS, POLARIS 3, ORION, ORION L, ORION 3, ORION 3 L |
| IBAK tractor | T 76, T 76 HD |
| IBAK coilers/ winches | KW LISY Synchron plus KW 305 / 310 / 505 |
| IBAK control systems | BS 10X, BS 10X-3.5 |

**T 66/T 76 (SD and HD)**
Camera tractor
Application range from DN 100/150 and up



| T 66/T 66 HD technical system data | | T 76/T 76 HD |
|---|---|---|
| Product classification | Camera tractor | Camera tractor |
| Field of application | DN 100 and up | DN 150 and up |
| Weight | Approx. 9 kg (with rim 93 and CC2.1) | Approx. 21 kg (with rim 93 and CB3) |
| Steering function | ✓ | ✓ |
| Speed | Continuously adjustable | Continuously adjustable |
| Folding connector | Bends horizontally and vertically | Bends horizontally and vertically |
| Protection class | IP68 | IP68 |
| Pressure monitoring | 2 integrated pressure sensors (LCD indicator and acoustic signal in the operating device) | 2 integrated pressure sensors (LCD indicator and acoustic signal in the operating device) |
| ATC | ✓ | ✓ |
| Inclination measurement | ✓ (Optional) | ✓ (Optional) |
| Temperature measurement | ✓ (Optional, via temperature measurement module) | ✓ (Optional, via temperature measurement module) |
| Ex protection | ✓ (Optional) | ✓ (Optional) |
| IBAK camera connections | CC1.1 (swivel-mounted and hinged), CC2.1 (fixed), CC4.1 (height-adjustable), CC5.1 (height-adjustable) (HD) | Type CB 3, CB 3.2 S, CB 3.2 S Ex (HD) |
| Electric height adjusting device | ✓ (CC Lift) | ✓ (Lifting height up to 210 mm) |

| Can be combined with | | |
|---|---|---|
| IBAK cameras | All IBAK (HD) tractor cameras | All IBAK (HD) tractor cameras |
| IBAK cable winches | KW 305 (SD), KW 310 (HD), KW 505 (HD) | KW 305 (SD), KW 310 (HD), KW 505 (HD) |
| IBAK control systems | BS 10X, BS 10X-3.5, BP3 | BS 10X, BS 10X-3.5, BP3 |

ATC = Automatic Tilt Compensation

EASY TO USE

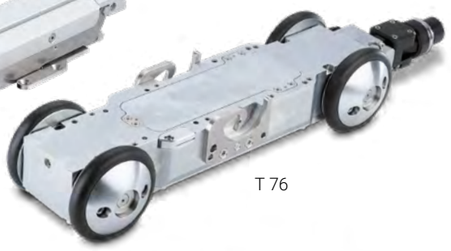
- Modular system
- Short setup times (QuickX wheels)
- Maximum robustness
- Optional Ex protection

CC Lift

Camera connection CB3

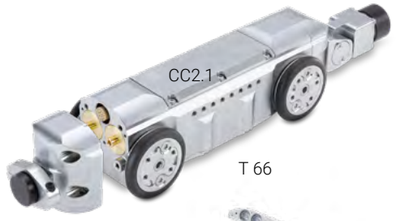
CC5.1

CC1.1



Electric height adjusting device

T 76



CC2.1

T 66

## Sets of wheels for T 66 and PANORAMO 150

**Wheel 52**
For hard pipe materials, e.g. concrete, plastic, vitrified clay

**Wheel 70**
For hard pipe materials, e.g. concrete, plastic, vitrified clay

**Wheel 93-66**
For hard pipe materials, e.g. concrete, plastic, vitrified clay

**Wheel 122-6**
For hard pipe materials, e.g. concrete, plastic, vitrified clay

**Wheel 140-6**
For hard pipe materials, e.g. concrete, plastic, vitrified clay

**Wheel 75 PUR**
For hard pipe materials, e.g. concrete, plastic, vitrified clay

**Wheel 105 PUR**
For hard pipe materials, e.g. concrete, plastic, vitrified clay

**Wheel 118 PUR**
For hard pipe materials, e.g. concrete, plastic, vitrified clay

**Wheel 75 NBR**
For hard pipe materials, e.g. concrete, plastic, vitrified clay

**Wheel 105 NBR**
For hard pipe materials, e.g. concrete, plastic, vitrified clay

**Wheel 118 NBR**
For hard pipe materials, e.g. concrete, plastic, vitrified clay

**Granulated wheel 75**
For hard, smooth pipe materials, e.g. landfill pipes and vitrified clay

**Granulated wheel** 105
For hard, smooth pipe materials, e.g. landfill pipes and vitrified clay

**Granulated wheel** 120
For hard, smooth pipe materials, e.g. landfill pipes and vitrified clay

**Tungsten carbide** wheel 57
For soft pipe materials, e.g. inliners

**Tungsten carbide** wheel 70
For soft pipe materials, e.g. inliners

**Tungsten carbide** wheel 93-66
For soft pipe materials, e.g. inliners

**Pneumatic tyres 6 x 1 1/4**
For all kinds of large-diameter profiles



## Sets of wheels for T 76 and PANORAMO

**Wheel 78**
Universal use for hard pipe materials

**Wheel 93**
Universal use for hard pipe materials, e.g. concrete, plastic, vitrified clay

**Wheel 108**
Universal use for hard pipe materials, e.g. concrete, plastic, vitrified clay

**Wheel 130**
Universal use for hard pipe materials, e.g. concrete, plastic, vitrified clay

**Wheel 122 PUR**
Universal use for hard pipe materials, e.g. concrete, plastic, vitrified clay

**Wheel 122 NBR**
Universal use for hard pipe materials, e.g. concrete, plastic, vitrified clay

**Tungsten carbide** wheel 78
For soft pipe materials, e.g. inliners

**Tungsten carbide** wheel 120
For soft pipe materials, e.g. inliners

**Granulated wheel** 100-4
For hard, smooth pipe materials, e.g. landfill pipes and vitrified clay

**Granulated wheel** 120
For hard, smooth pipe materials, e.g. landfill pipes and vitrified clay

**Granulated wheel** 150
For hard, smooth pipe materials, e.g. landfill pipes and vitrified clay

**Pneumatic tyres 200 x 50**
For all kinds of large-diameter profiles

**Pneumatic tyres** 3.00-4
For all kinds of large-diameter profiles

**Pneumatic tyres** 4.00-4
For all kinds of large-diameter profiles

## MicroGator/MicroGator 150

Electric cutting robot

**Application range from DN 150 and up (relined)**

The IBAK vehicle system for electric cutting and rehabilitation tasks in main lines.

- **Effective cutting**: Through precise control of the cutting process
- **Reliable in operation**: Power-driven, low-noise operation
- **Safe investment**: Flexible and future-proof thanks to modular system design
- **Added value**: Installation of top hats and sleeves, mortar injection, ultra-high pressure cutting and inspection
- **Ready for immediate use**: Turnkey solution

The **MicroGator/MicroGator 150** is a cutting robot for main lines with pipe diameters from DN 150/DN 200 (relined) to DN 800. It is equipped with an efficiently working electric motor that is more powerful than commonly used air and hydraulic cutting robots despite its compact size. No power-consuming generators or loud compressors are required for its operation. Batteries that can be recharged at low cost and operated in an environmentally friendly manner are sufficient for daily work.
All materials to be found in sewage pipes can be reliably processed with the different cutter heads; working areas at greater distances and that are located deeper into connections can be accessed with cutter extensions. Motors of different sizes enable work to be performed deep into connections even in small main lines.

## MicroGator Air/MicroGator Air 150

Pneumatic cutting robot

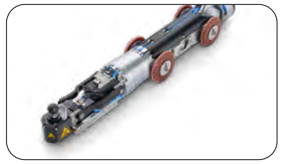
**Application range from DN 150 and up (relined)**

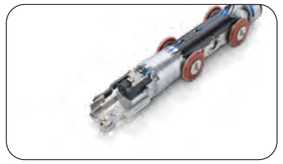
The IBAK system for pneumatic cutting and rehabilitation tasks in main lines.

- **Effective cutting**: Through precise control of the cutting process
- **Reliable in operation**: Pneumatic and powerful
- **Safe investment**: Flexible and future-proof thanks to modular system design
- **Added value**: Installation of top hats and sleeves, ultra-high pressure cutting and inspection
- **Variable operation**: In a vehicle and as a mobile rehabilitation system

For **mobile operation**, the BP 3 control console is used in combination with the KW 207. This device constellation enables user-friendly operation and offers a high level of flexibility for many different applications. Use is also possible with systems that are installed in vehicles. This is possible with both the compact KW 207 and conventional inspection winches (KW 305/310/505).

## Overview of electric and pneumatic cutting robots



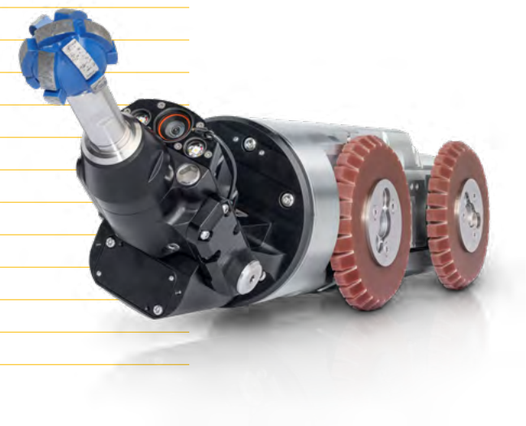


| Technical system data | MicroGator | MicroGator 150 with cutter head | MicroGator 150 with carrier head |
|---|---|---|---|
| Field of application | Main line | Main line | Main line |
| Pipe diameter | DN 200 (relined) to DN 800 | DN 150 (relined) to DN 300 | DN 150 (relined) to DN 300 |
| Length[1] | 104 cm | 84 cm | 84 cm |
| Inflexible length[2] | 72 cm | 60 cm | 60 cm |
| Minimum circumscribed circle | Body 150 mm, 160 mm over the wheels | Body 112 mm, 130 mm over the wheels | Body 112 mm, 130 mm over the wheels |
| Weight | 55 kg | 32 kg | 32 kg |
| Control | BS 10X | BS 10X | BS 10X |
| Maximum working range | 150 m hybrid cable | 150 m hybrid cable | System-dependent |
| **Tractors** | | | |
| Maximum speed | 15 m/min | 12 m/min | 12 m/min |
| Rotating module, rotating angles | 400° | 450° | 450° |
| Traction | Implemented with various sets of wheels and additional weights | Implemented with various sets of wheels and additional weights | Implemented with various sets of wheels and additional weights |
| Length of stroke of the raising/lowering unit | 200 mm | 160 mm | 160 mm |
| **Working equipment** | | | |
| Type | Electric cutting system, water-cooled | Interchangeable head system with electric cutter motor, water-cooled | Interchangeable head system for various rehabilitation applications |
| **Easy handling and safety** | | | |
| Lowering hook with chain hoist | ✓ | ✓ | ✓ |
| Sewer aeration system | ✓ | ✓ | X |
| Pressure monitoring | ✓ | ✓ | ✓ |
| Monitoring camera | CutterCam | CutterCam | CutterCam |
| Back-eye camera | Option in the hybrid cable | Option in the hybrid cable | Option in the hybrid cable |
| Camera lens cleaning | Air/water | Air/water | Air/water |
| Front camera | Can be attached to cutter motor | X | X |
| Inspection | Mounting adapter for ORION | X | X |
| Ultra-high pressure water jet cutting | X | X | ✓ |
| Top hat installation | ✓ | X | ✓ |
| Sleeve installation | ✓ | X | ✓ |
| Mortar injection | ✓ | X | X |

1 From cutting motor to hinged joint
2 From tractor front edge to hinged joint



| MicroGator Air | MicroGator 150 Air |
|---|---|
| Main line | Main line |
| DN 200 (relined) to DN 800 | Cutting: from DN 150 and up (relined)<br>Inspection: from DN 125 and up (relined) |
| 104 cm | 66 cm |
| 72 cm | 42 cm |
| Body 150 mm, 160 mm over the wheels | 130 mm over the wheels |
| 53 kg | 11 kg |
| BS 10X/BP 3 | BS 10X/BP 3 |
| Up to 300 m of compressed air hose | 50 m compressed air hose |
| | |
| 15 m/min | 12 m/min |
| 400° | Endless |
| Implemented with various sets of wheels and additional weights | Implemented with various sets of wheels and additional weights |
| 200 mm | 140 mm |
| | |
| Pneumatic cutting system | Pneumatic cutting system/camera tractor to connect: CC1.1 (swivel-mounted and hinged), CC2.1 (fixed), CC4.1 (height-adjustable), CC5.1 (height-adjustable) HD |
| | |
| ✓ | ✓ |
| X | X |
| ✓ | ✓ |
| CutterCam | Integrated (HD/SD) |
| ✓ | ✓ |
| Air/water via ST50 GT | Air |
| X | X |
| X | X |
| X | ✓ |
| ✓ | X |
| X | X |
| X | ✓ |



## MicroGator GT/MicroGator GT Lite

| Technical system data | MicroGator GT | MicroGator GT Lite |
|---|---|---|
| Field of application | Main line | Main line |
| Pipe diameter | DN 200 (relined) to DN 800 | DN 200 (relined) to DN 800 |
| Length[1] | 104 cm | 104 cm |
| Inflexible length[2] | 72 cm | 72 cm |
| Minimum circumscribed circle | Body 150 mm, 160 mm over the wheels | Body 150 mm, 160 mm over the wheels |
| Weight | 49 kg plus adapter for rehabilitation system | 49 kg plus adapter for rehabilitation system |
| Control | BS 10X | BS 10X/BP3 |
| Maximum working range | System-dependent | System-dependent |
| **Tractors** | | |
| Power | 200 watts | 200 watts |
| Motors | 2 electric motors | 2 electric motors |
| Maximum speed | 15 m/min | 15 m/min |
| Rotating module, rotating angles | 400° | 400° |
| Traction | Implemented with various sets of wheels and additional weights | Implemented with various sets of wheels and additional weights |
| Length of stroke of the raising/ lowering unit | 200 mm | 200 mm |
| **Working equipment** | | |
| Type | Adapter system for various rehabilitation tasks | Adapter system for various rehabilitation tasks |
| **Easy handling and safety** | | |
| Lowering hook with chain hoist | ✓ | ✓ |
| Sewer aeration system | X | X |
| Pressure monitoring | ✓ | ✓ |
| Monitoring camera | CutterCam | CutterCam |
| Back-eye camera | Option in the hybrid cable | ✓ |
| Camera lens cleaning | Air/water | Air |
| Front camera | X | X |
| Inspection | X | X |
| Ultra-high pressure water jet cutting | ✓ | ✓ |
| Top hat installation | ✓ | ✓ |
| Sleeve installation | ✓ | ✓ |
| Mortar injection | ✓ | ✓ |

1 From cutting motor to hinged joint
2 From tractor front edge to hinged joint

## MiniLite 3
Compact push-rod camera system
Application range from DN 50/80 and up

### MiniLite 3

The **IBAK MiniLite** is a compact push-rod camera system for inspection of lateral and property sewer systems.
Thanks to its modular extendibility and numerous accessories, a wide range of applications are possible. The cameras are also compatible with other IBAK systems.
Depending on the requirements, the system can be additionally equipped with an extension function (extension system) for operation with large systems and the corresponding software. Diameter measurements are also possible. IKAS recorder is available for simple projects without any complicated data exchange formats. If inspections of sewage systems shall be performed according to the European standard EN 13508-2, IKAS mini can be installed. If specific data exchange formats are required or if a 3D site plan shall be created after a 3D-GeoSense pipe run measurement, the use of a complete IKAS evolution is recommended.

The MiniLite is delivered with an 80-metre HD exchangeable reel with integrated 512 Hz locating transmitter as standard.

| **MiniLite 3 technical system data** | |
|---|---|
| Product classification | Compact push-rod camera system |
| Push rod | HD exchangeable reel with 80 m HD push rod (PP5 with 512 Hz transmitter) |
| Control | Rugged tablet with high-definition 12" touch display (suitable for outdoors); BP 3 docking station for rugged tablet, (V1: 1 joystick, V2: 2 joysticks) |
| Data storage | Text input or storage of image and video files (MPEG 4 AVC/H.264) on the integrated PC, data transmission via USB 3.0 |
| Length measurement/ display | ✓ |
| Power pack | 18 VDC 4 Ah or 5 Ah (Li-ion), 2x |

| **Can be combined with** | |
|---|---|
| IBAK cameras | POLARIS 3, ORION 3, ORION 3 L, NANO 2, NANO 2 L, AxialCam (separate reel) |
| IBAK extension system | ✓ |
| 3D-GeoSense | ✓ |



## MainLite 2 (KW 207/307)
Cable winches for MainLite 2 fit
200/300 m cable

### MainLite 2 fit

The MainLite fit consists of a cable winch (**KW 207/KW 307**) with up to 300 m of cable, a mobile rack and the **BP 3** control console.
With the mobile rack, the motor-driven winches with 200-metre (KW 207) or 300-metre camera cable (KW 307) can be transported to locations that are difficult to access with a vehicle. With the integrated seat, it is also possible to work comfortably outside of the inspection vehicle.

| **KW 207/307** | |
|---|---|
| Product classification | Cable winch |
| Max. cable length | 200 m/300 m |
| Width x height x depth In mm | **Cable winch only:** KW 207: 370 x 415 x 774 KW 307: 440 x 415 x 774 **With mobile rack** KW 207: 570 x 590 x 980 KW 307: 640 x 590 x 980 |
| Weight | KW 207: approx. 44 kg incl. cable KW 307: approx. 54 kg incl. cable Mobile rack approx. 12 kg |
| Length measurement/indicator | ✓ |
| Motor-driven | ✓ |
| Correct cable winding | ✓ |
| Remote control | X |
| EMERGENCY STOP button | ✓ |

| **Can be combined with** | |
|---|---|
| IBAK cameras | All current IBAK HD cameras |
| IBAK tractor | T 66 HD, T 76 HD |
| IBAK control systems | BS 10X, BP 3 |
| IBAK cutter and rehabilitation systems | MicroGator Air, MicroGator 150 Air, MicroGator GT (with KW 207 only) |

## MainLite 2 easy (KT 157)
Cable drum for MainLite 2 easy
150 m cable

### MainLite 2 easy

The MainLite easy is a portable system with 150 m cable and consists of the **BP 3** control console and the electrically driven **KT 157** cable winch.
The KT 157 holds 150 metres of camera cable. Winding on the cable is supported by a drive motor. The compact design, the large wheels and the hinged carrying handle enable inspections at difficult-to-access locations that cannot be reached with a vehicle or even with the MainLite fit. The low weight enables the system to be transported by a single person. A 230-volt socket or an appropriately dimensioned lithium battery is sufficient to operate the system.

| **KT 157** | |
|---|---|
| Product classification | Cable drum |
| Max. cable length | 150 m |
| Width x height x depth | 420 x 660 x 770 mm |
| Weight | Approx. 41 kg without BP 3 Approx. 45 kg with BP 3 |
| Length measurement | ✓ |
| Motor-driven | ✓ |
| Correct cable winding | X |
| Remote control | X |

| **Can be combined with** | |
|---|---|
| IBAK cameras | All current IBAK HD cameras |
| IBAK tractor | T 66 HD, T 76 HD |
| IBAK control systems | BP 3 |

## KW 305, KW 310, KW 505, KW LISY Synchron

Winches for vehicle installation

300–600 m cable

| Technical system data | KW 305 | KW 310 | KW 505 | LISY Synchron |
|---|---|---|---|---|
| Product classification | Cable winch | Cable winch | Cable winch | LISY cable winch |
| Fully automatic | ✓ | ✓ | ✓ | ✓ |
| Motor-driven | ✓ | ✓ | ✓ | ✓ |
| Max. cable length | 300 m | 300 m | 500/600 m | 180 m<br>(incl. 40 m push rod) |
| Length measurement/indicator | ✓ | ✓ | ✓ | ✓ |
| Correct cable winding | ✓ | ✓ | ✓ | ✓ |
| Remote control | ✓ | ✓ | ✓ | ✓ |
| EMERGENCY STOP button | ✓ | ✓ | ✓ | ✓ |
| Steel rope winch [1] | ✓ | ✓ | ✓ | ✓ |
| Workplace light | ✓ | ✓ | ✓ | X |

| Can be combined with | | | | |
|---|---|---|---|---|
| IBAK cameras | All | All | All | All |
| IBAK tractor | T 66 / T 76 | All | All | All |
| IBAK control systems | BS 10X, BS 10X-3.5 | BS 10X, BS 10X-3.5 | BS 10X | BS 10X, BS 10X-3.5 |
| IBAK camera systems | All except PANORAMO | All | All | All except PANORAMO |
| IBAK extension system | ✓ | ✓ | ✓ | ✓ |

[1] To insert the camera system

The **IBAK KW 305, KW 310** and **KW 505** are fully automatic, motor-driven cable winches that hold up to 600 m of camera cable. They are designed for operation with IBAK tractors and cameras and the LISY system. Like the IBAK full HD cameras, the IBAK camera systems PANORAMO 4K, PANORAMO 150 4K and PANORAMO SI 4K can be operated fully digital with the KW 310 and KW 505.
The winches synchronise the interaction of the tractor and winch with the integrated traction regulating device: Depending on the tractor speed, the cable is wound on and off accordingly. This prevents the tractor from running over the camera cable and at the same time ensures reversing at a constant speed.
The swivel-mounted boom of the winches enables precise positioning above the manhole. Via a steel rope winch, the respective camera system is lowered into the manhole and an automatic cable guide ensures that the camera cable is always wound on correctly.
The KW 310 and KW 505 cable winches transmit the image digitally (HDSDI), loss-free and without interference. For this, a robust optical fibre cable (FO) is used in full HD operation and for PANORAMO systems. The KW 305 is equipped with a coaxial cable for analogue video transmission.
The **IBAK LISY synchronous winch** supplies the camera that is connected to the LISY with up to 180 metres of camera cable including 40 metres of push rod. The KW LISY Synchron is motor-driven; the speed for winding on and unwinding is automatically synchronised with the speed of the respective cable winch.



## KW SI/KW SI 50

Cable winch for the PANORAMO SI

12/50 m cable


The **KW SI** cable winch enables flexible operation with the PANORAMO SI 4K manhole camera. The winch can be installed in a vehicle in a space saving manner and it can also be used in a mobile rack with a laptop. It combines the advantages of a mobile system with those of a compact installed system for efficient manhole inspection from the vehicle.

The winch can be easily removed from the vehicle with the mobile rack by means of the quick-fastening system and can be converted into a mobile system in a few steps. All components of the mobile system are designed for outdoor operation: The large air tyres allow even difficult-to-access manholes to be reached. The laptop for control of the system is particularly robust and splash-proof. Power is supplied by powerful exchangeable batteries or from a lithium battery installed in the vehicle.


| KW SI/KW SI 50 | |
|---|---|
| Product classification | Cable winch |
| Max. cable length | 12 m/50 m |
| Width x height x depth in mm | 280 x 400 x 400 mm |
| KW SI weight | Approx. 16 kg with 12 m cable |
| KW SI 50 weight | approx. 35.8 kg with 50 m cable<br>Approx. 51.4 kg with winch extension and boom |
| Length measurement/indicator | ✓ |
| Motor-driven | ✓ |
| Correct cable winding | ✓ |
| Remote control | ✓ |
| EMERGENCY STOP button | ✓ |

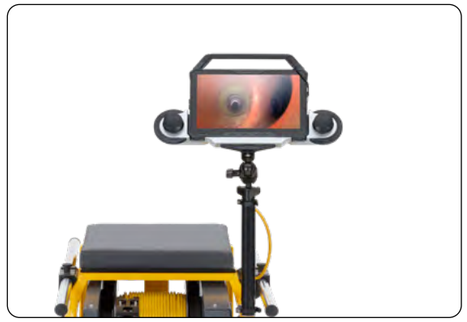
| Can be combined with | |
|---|---|
| IBAK cameras | PANORAMO SI 4K |
| IBAK tractor | – |
| IBAK control systems | Laptop |

## BS 10X, BS 10X-3.5
Control systems

### BS 10X
- For inspection of main lines and laterals (with up to 500 m of camera cable, additionally for KW 505, PANORAMO)
- For UHP cleaning
- For pneumatic cutting and rehabilitation

### BS 10X -3.5
- For inspection of main lines and laterals (with up to 300 m of camera cable, for applications with KW 305.2 S and KW 310 with LISY; also as full HD system control)
- For UHP cleaning
- For operation with MicroGator GT Lite and MicroGator

## BP 3
Control console



### BP 3
The **BP 3** consists of a docking station and a robust tablet that can be attached to the MainLite 2 and MiniLite 3 without needing any tools. The tablet is also compatible with the ASPECTA 3.
Depending on the purpose of application, different variants are available: V1 for the MiniLite 3 with 1 joystick to control the IBAK camera, V2 for the MiniLite 3 or MainLite 2 with 2 joysticks to control IBAK cameras or tractors. One variant (V2 NH) additionally features an emergency stop and can be operated with the MicroGator Air.

| Control console | BP 3 |
|---|---|
| Width x height x depth | 470 x 245 (290 with handle) x 73 |
| Weight | Approx. 3.2 kg |
| Connections | 2x USB C, 2x USB A 3.0; current standard: Tablet Dell Latitude 7230 |
| Data storage | Text input or storage of image and video files (MPEG 4 AVC/H.264) on the tablet PC, data transmission via USB 3.0 and via WLAN |
| Monitor | Protected against dust and water jets (IP55), approx. 12" touch display; suitable for daylight and low reflection |
| Battery charge level indicator | ✓ |
| Battery replacement indicator | ✓ |
| Length measurement/display | ✓ |

## Software versions for the BP 3 control console

| | IKAS recorder | IKAS mini | IKAS evolution |
|---|---|---|---|
| **Functions** | | | |
| Project management | X | X | ✓ |
| Sewer database | X | ✓ | ✓ |
| Video recording | ✓ | ✓ | ✓ |
| Video overlay (by hotkey and text input) | ✓ | ✓ | ✓ |
| Video overlay from sewer database | – | ✓ | ✓ |
| Individual photos | ✓ | ✓ | ✓ |
| Condition codes according to standard (EN 13508,WRc) | X | ✓ | ✓ |
| Sewer data interface | X | X | ✓ |
| **Data transmission** | | | |
| Video and photo files | ✓ | ✓ | ✓ |
| Inspection video player with data index and PDF reports | X | ✓ | ✓ |
| Complete sewer data viewing program (reports, films, photos, MAP/GIS) | X | X | ✓ |
| **Options** | | | |
| DN measurement | ✓ | ✓ | ✓ |
| Measurements | X | X | ✓ |
| MAP (GIS) | X | X | ✓ |
| Further IKAS evo options | X | X | ✓ |

## Software licences for compact systems

### Dongle/device recognition

| | | IKAS recorder | IKAS mini | IKAS evolution | IKAS evolution | IKAS evolution |
|---|---|---|---|---|---|---|
| **System** | | | | **Push** | **Starter** | **Professional** |
| Push-rod and manhole operation | MiniLite 3 | ✓ | ✓ | ✓ | ✓ | ✓ |
| | ASPECTA | ✓ | ✓ | ✓ | ✓ | ✓ |
| Mobile systems in tractor operation | KW 207/307 (MainLite 2 fit) + BP 3 | ✓ | ✓ | X | ✓ | ✓ |
| | KT 156 (MainLite 2 easy) + BP 3 | ✓ | ✓ | X | ✓ | ✓ |
| Installation in a vehicle during tractor operation | KW 207/307 (MainLite solid) + PC + BS 10X | ✓ | ✓ | X | X | ✓ |

Depending on the configuration of the terminal devices, software licences for IKAS evolution Push, IKAS evolution Starter and IKAS evolution Professional are possible.

**Contact persons**
Consulting and sales

IBAK

250619_Gesamtprospekt
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