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About Workswell
COMPANY AND PRODUCT PORTFOLIO INTRODUCTION

Workswell is a Central European based manufacturing company with headquarters located in Prague and established in 2010. The company is focused on developing, producing and selling thermal imaging cameras, systems and solutions for Industrial, R&D, OEM and Medical applications.

WORKSWELL MISSION
“Our mission are deliveries of complex products & solutions, as well as individual elements for non-contact temperature measurement and data evaluation.”

WORKSWELL PRODUCT PORTFOLIO
Workswell thermal imaging product portfolio is divided into the several divisions:

- systems for process control and automation
- UAV payloads including optical gas imaging cameras
- early fire detection systems
- systems for detecting elevated body temperature
- calibration sources

Workswell is also providing OEM products like **OEM cameras for drones**, **USB3 and GigE modules** for thermal cores and OEM Thermolnpector. You can find many of our products as part of a third-party solution.

Workswell products are suitable for many applications from many fields such as:

- process control
- industrial production
- technical diagnostics and inspection
- search and rescue
- research and development
- early fire detection systems
- non-destructive testing (NDT)
- precious agriculture

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>Company Establishment</td>
</tr>
<tr>
<td>2011</td>
<td>System integrator</td>
</tr>
<tr>
<td>2013</td>
<td>First Workswell thermal camera</td>
</tr>
<tr>
<td>2015</td>
<td>Thermal camera WIRIS for drones</td>
</tr>
<tr>
<td>2016</td>
<td>Thermal camera SMARTIS</td>
</tr>
<tr>
<td>2017</td>
<td>30 partners worldwide</td>
</tr>
<tr>
<td>2018</td>
<td>MWIR gas imaging thermal camera</td>
</tr>
<tr>
<td>2019 Q1</td>
<td>Fire safety system SAFETIS</td>
</tr>
<tr>
<td>2019 Q2</td>
<td>Next generation of WIRIS thermal cameras</td>
</tr>
<tr>
<td>2020 Q1</td>
<td>Fever screening camera</td>
</tr>
<tr>
<td>2020 Q2</td>
<td>60 partners worldwide</td>
</tr>
</tbody>
</table>
Workswell WIRIS® Pro has been designed first and foremost as an inspection camera. Its thermal camera is equipped with a LWIR microbolometric sensor with 640 x 512 px resolution (in the 7.5 – 13.5 μm range) and the Super resolution mode functionality providing an option to have the final thermogram in the 1 266 x 1 010 px resolution.

The RGB camera comes with a Full HD (1920 x 1080 px) resolution and, most importantly, it provides an absolutely unrivaled optical ultrazoom 10x in real-time. The highest possible temperature that the thermal camera can measure is 1 500 °C (2 732 °F).

**High measurement accuracy and precision metrology.** We are aware that industrial applications can be very demanding when it comes to metrology and that at each stage.

Each thermal camera is precisely and individually manufactured and calibrated.

---

### Workswell WIRIS Pro
**RADIOMETRIC DRONE THERMAL CAMERA**

WIRIS Pro Key features description

- **Super Resolution Mode**: WIRIS Pro takes Super Resolution Mode 1.3Mpx IR images in one shot
- **Operating onboard system**: WIRIS OS for full real-time data streaming and control during the flight
  - operating system ensures the full access to all camera functions
  - easy camera control via S.Bus, CAN bus, MavLink, RJ-45 or Trigger
- **10x Optical Anti-vibration zoom**: Full HD 10x optical zoom camera with anti-vibration compensation

### Thermal camera specification

- **IR camera resolution**: 640 x 512 pixels
- **IR Super Resolution Mode**: 1 266 x 1 010 pixels (improvement of native resolution up to 1.3 Mpx)
- **FPA active sensor size**: 1.088 x 0.8705 cm
- **Temperature ranges**: -25 °C to +150 °C (13 °F to +302 °F), optional temperature range 50 °C to 1 500 °C (122 °F to 2 732 °F)
- **Temperature sensitivity**: Standard 0.05 °C (50 mK, 0.09 °F) or optional 0.03 °C (30 mK, 0.054 °F)
- **Accuracy**: ±2 % or ±2 °C (±3.6 °F) in temperature range 0 °C to +150 °C (32 °F to +302 °F), after camera stabilisation
  - climate chamber and black body testing for all products
- **Frame rate**: 30 Hz or < 9 Hz
- **Spectral range / detector**: 7.5 – 13.5 μm / Uncooled VOx microbolometer
- **Calibration of each lens**: Package includes a calibration certificate
- **Available lenses**: 18°, 32°, 45°, 69° (exchangeable lenses, all calibrated), visit FOV calculator
- **Protective filter on lens**: Filter protects the lens against external damage during the flight
- **IR Digital zoom**: 1 – 14x continuous

### Digital visual camera

- **Resolution**: 1 920 x 1 080 pixels (Full HD), 1/3” sensor
  - Auto white balance, Wide dynamic range
  - Backlight compensation
  - Exposure and Gamma control
- **Optical zoom**: 10x optical zoom with vibration compensation
- **View angle**: ultra zoom 6.9° - extra wide 5.82", focal 33.0 mm - 3.3 mm
- **Noise reduction**: Special 3D noise reduction function
- **Focus**: Autofocus with Direct Focus Zoom synchronization

### Memory and data recording

- **Memory**: Internal high-speed SSD 128 GB or 256 GB for image and video recording
  - External slot for Micro SD card & USB 2.0 for USB stick for taking images
- **Image and video formats**: Radiometric JPEG images and Digital camera Full HD JPEG images
  - Radiometric TIFF images (Pix4D and Agisoft compatible for 3D modeling)
  - Digital camera h.264 encode video HD recording
  - Radiometric full-frame IR recording (raw data recording in 30 Hz or < 9 Hz)
Workswell WIRIS ProSc
THERMAL CAMERA FOR THE MOST DEMANDING APPLICATIONS

Workswell WIRIS ProSc is a state of the art thermal imaging camera used for the most challenging applications like a geological, archeological and forest research, ecological and enviromental research, structural research of buildings (dams, chimneys, bridges) etc.

Workswell WIRIS ProSc camera is designed for applications requiring the highest temperature sensitivity and accuracy, excellent service and software support. That’s why the camera is offered in a research and education kit with WIRIS Data SDK for users application development and WIRIS Ethernet SDK for ethernet application development.

We want you... to measure accurately. Each WIRIS ProSc thermal camera is precisely calibrated in the climatic chamber. Not only is the accuracy of the thermal camera when measuring different temperatures, but also at different operating temperatures. We managed to achieve unmatched measurement accuracy in the field of aerial thermography, ie. ±2 °C or ±2 % (±3.6 °F).

Many interfaces (CAN, S.BUS, Ethernet, USB and more) make Workswell WIRISSc a completely versatile system that can be placed on the DJI M600 Pro drone and the most drones by other manufacturers such as AceCore Zoe, VideoDrone, Flydeo, Height Technologies etc.

Workswell WIRIS ProSc is the only UAV thermal imaging camera that can meet all the requirements of this extremely demanding application.

- highest thermal sensitivity (< 30 mK)
- really low temperature drift even during long flight
- very high homogeneity in thermogram

Water and plant management influence the local microclimate. By draining and removing greenery on large areas, we induce a desert climate, especially in cities or fields, that does not solve any technical equipment.

Thanks to this image, it is clear from which places in the landscape drought and loss of vegetation coming from. We can see that the naked hill on the right above the vineyard warms its surroundings and reaches through the vineyard.

We believe, that in terms of land management, Workswell WIRIS ProSc is a useful tool. And with its help it is possible to localize, visualize and reverse local processes, the cause of which is currently considered global and the processes are considered as locally irreversible.
Workswell WIRIS Agro R
CAMERA DESIGNED TO MAP WATER STRESS ACROSS LARGE AREAS

Workswell’s WIRIS Agro R is the first device of its kind designed to map water stress across large areas in the field of precision agriculture. The aim of this method and device is to determine the value of water stress in the plant stand.

Crop drought - actual and real value. In the dry season what we are usually interested in is the actual effects of drought on crops. These impacts are not only dependent on the condition of the so-called climatic drought, but also on the groundwater drought, the size of the plant root system, etc. Measuring the water stress of plants with CWSI (Crop Water Stress Index) camera will help you to determine the actual and real effects of drought on the crop.

WIRIS Agro R offers four different colourmaps. From the point of view of data processing it is not important which colourmap you choose. In the application point of view a suitable palette choice can be very helpful.

**WIRIS Agro R Camera key features description**

- **CWSI onboard processing**: Evaluation of Crop Water Stress Index (CWSI) onboard in real-time as well as temperature value
- **Operating onboard system**: Workswell OS for full real-time data streaming and evaluation during the flight
- **Biomass cover index in %**: Real-time percentage calculation of the mass of the vegetation in RGB

**WIRIS Agro R specification**

- **Sensor resolution**: 640 x 512 pixels
- **Real-time CWSI evaluation**: Workswell patented WIRIS Agro R camera technology based on crop water stress index (normalized to value from 0 to 1) brings information about the crop stress and crop water management on large areas. The information can then be used to determine yield maps, manage irrigation or implement water management related remedies.
- **FPA active sensor size**: 1.088 x 0.8705 cm (LWIR band sensor)
- **Radiometry**: Yes, temperature value in each pixel
- **CWSI evaluation range**: 0 – 100 % (100 % means very stressed)
- **Temperature sensitivity**: 0.03 °C (30 mK, 0.054 °F)
- **Field of view of the lens**: 45°
- **Color maps**: 4 color maps for CWSI and Water management evaluation
- **CWSI Range settings**: Automatic or manual
- **CWSI digital zoom**: 1 – 14x continuous
- **Software ThermoLab**: Yes, included in the package 2 licenses
- **Memory and data recording**: Internal high-speed SSD 128 GB for image and video recording, External slot for Micro SD card & USB 2.0 for USB stick for taking images
Water was very low. Water could be better distributed over the land or saved. No drought effect.

Under the correct irrigation
The water stress level corresponds to the current situation (sunny day, no precipitation). Irrigation helps prevent crop damage and works properly.

High level of stress
The irrigation system is not functioning properly and part of the crop is wilting. High level of water stress.

CWSI
Crop Water Stress Index

NDVI
Normalized Differential Vegetation Index

**Situation in a real time**
See the current situation! You can see how "it works" and how to "improve it" in a real time. Intervention could be evaluated during a few hours.

**Physiological process**
You observe the actual crop's physiological process under given conditions at a given time. This is great, for example, for controlling of irrigation systems or locating vegetation infested by pests.

**Before it's too late!**
You can take actions before the crops die, i.e., when the stress is already occurring but the process is still reversible. The effectiveness of the intervention can be evaluated immediately after applying it.

**Dead or live**
NDVI is used to detect live green plant canopies in multispectral remote sensing data. So you can only quantify the photosynthetic capacity of plant canopies in that time.

**Not the process but the result**
You observe the long-term effects of stress factors and environmental conditions on the state of vegetation but it is often very difficult to identify the causes.

**It is too late!**
It is very difficult to make the right intervention as you cannot monitor the response quickly enough after applying the intervention. The NDVI shows the impact and result after longer period of time.

**CWSI**

<table>
<thead>
<tr>
<th>Index range</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.96 - 1</td>
<td>Healthy</td>
</tr>
<tr>
<td>0.86 - 0.96</td>
<td>Moderately Healthy</td>
</tr>
<tr>
<td>0.76 - 0.86</td>
<td>Dead crop</td>
</tr>
</tbody>
</table>

**NDVI**

<table>
<thead>
<tr>
<th>Index range</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.33 - 1</td>
<td>Healthy</td>
</tr>
<tr>
<td>0.33 - 0.56</td>
<td>Moderately Healthy</td>
</tr>
<tr>
<td>0.07 - 0.33</td>
<td>Dead crop</td>
</tr>
</tbody>
</table>
Workswell WIRIS® Security is a LWIR (7.5 – 13.5 μm) thermal camera for drones designed specifically for search & rescue applications, such as building and perimeter surveillance, searching for missing persons, firefighting operations etc.

This thermal camera is fully adapted to these applications with a high-resolution thermal camera (800 × 600 px), 30x optical zoom in RGB spectrum, search & rescue functionalities, excellent temperature sensitivity, as well as rugged mechanical construction made of lightweight aluminium.

High resolution and great thermal sensitivity. The thermal camera offers unrivaled resolution 800 × 600 px and thermal sensitivity 40 mK! No other thermal imaging camera for drones will offer you the same parameters!

Great night vision RGB camera, 30x optical zoom and more. Workswell WIRIS® Security camera is equipped by incorporated specialized visual band imagery RGB camera with high sensitivity for dusk and night vision and possibility of optical ZOOM. Thus, the RGB camera image is clear even with minimum light of 0.0008 lux. Focal length is variable within interval of 129.0 mm – 4.3 mm and it equals up to 30x optical ZOOM.

Workswell WIRIS Security also brings an interface enabling the widest range of connections to the drone, the control unit, an external GPS sensor, etc. Wi-Fi low latency live video streaming is also available.

WIRIS Security Key feature specification

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>800px Infrared UAV camera</td>
<td>800 x 600 px IR sensor with 25 Hz frame rate (Worldwide shipping)</td>
</tr>
<tr>
<td>Advanced Noise Reduction Technology</td>
<td>filters noise from the image for clearer results in low-light conditions</td>
</tr>
<tr>
<td>the de-fog feature allows clearer viewing in foggy or misty scenes</td>
<td></td>
</tr>
<tr>
<td>when the feature is activated, the camera detects the haze level and automatically applies the required effects.</td>
<td></td>
</tr>
<tr>
<td>Auto IR-cut Filter Function</td>
<td>in low-light conditions, the camera automatically switches from Day to Night vision mode</td>
</tr>
<tr>
<td>the IR-cut filter function allows to boost sensitivity for clear pictures in darkness.</td>
<td></td>
</tr>
<tr>
<td>Wide-D Image Processing Technology</td>
<td>gives the ability to see clear, detailed images in high-contrast or backlit environments</td>
</tr>
<tr>
<td>Operating onboard system</td>
<td>WIRIS OS for full real-time data streaming and control during the flight</td>
</tr>
<tr>
<td></td>
<td>operating system ensures the full access to all camera functions</td>
</tr>
<tr>
<td></td>
<td>easy camera control via S.Bus, CAN bus, MavLink, RI-45 or Trigger</td>
</tr>
<tr>
<td>30x Optical Antivibration zoom</td>
<td>Full HD 30x optical zoom camera with anti-vibration compensation</td>
</tr>
<tr>
<td>Thermal camera specification</td>
<td></td>
</tr>
<tr>
<td>IR camera resolution</td>
<td>800 x 600 pixels</td>
</tr>
<tr>
<td>Scene range</td>
<td>-20 °C to +150 °C (-4 °F to +302 °F)</td>
</tr>
<tr>
<td>Temperature sensitivity</td>
<td>Extra sensitivity of 0.04 °C (40 mK, 0.072 °F)</td>
</tr>
<tr>
<td>Frame rate</td>
<td>25 Hz or 9 Hz</td>
</tr>
<tr>
<td>Spectral range / detector</td>
<td>7.5 – 13.5 μm / Uncooled VOx microbolometer</td>
</tr>
<tr>
<td>Available lenses</td>
<td>35 mm (21.2° x 16.2°), visit FOV calculator</td>
</tr>
<tr>
<td>Digital zoom</td>
<td>1 – 12x continuous</td>
</tr>
<tr>
<td>Digital visual camera</td>
<td></td>
</tr>
<tr>
<td>Resolution</td>
<td>1 920 x 1 080 pixels (Full HD), 1/2.8&quot; EXMOR R CMOS sensor</td>
</tr>
<tr>
<td>Optical zoom</td>
<td>30x optical zoom with vibration compensation and image stabilization</td>
</tr>
<tr>
<td>Minimum illumination</td>
<td>0.0008 lux (ICR on, Slow shutter 1/4s, High sensitivity on)</td>
</tr>
<tr>
<td>View angle / Focal length</td>
<td>Ultra zoom 2.3° - extra wide 63.7° / 129.0 mm – 4.3 mm</td>
</tr>
<tr>
<td>Focus and exposure time</td>
<td>Autofocus with automatic or manual exposure time control</td>
</tr>
<tr>
<td>Image enhancement</td>
<td>Auto-white balance, WDR, IR cut filtering, DEFOG, 3D Noise reduction</td>
</tr>
<tr>
<td>Memory and data recording</td>
<td></td>
</tr>
<tr>
<td>Memory</td>
<td>Internal SSD 256 GB or 512 GB for image and video recording</td>
</tr>
<tr>
<td></td>
<td>External slot for Micro SD card &amp; USB 2.0 for USB stick for taking images</td>
</tr>
</tbody>
</table>
Under certain circumstances, thermal cameras are highly useful for detecting gas leaks and the presence of specific gases in the air.

Workswell GIS-320 is a perfect solution to detect gas leaks using drones or as handheld camera. The combination of a thermal and digital camera brings you the opportunity of environment protection as well as human health and safety!

Wide spectrum of detectable gases. GIS-320 can detect a wide spectrum of gases, which are invisible to a human’s eye. The Workswell GIS-320 has a high sensitivity with a range of detection between 3.2–3.4 μm.

Ready to fly combo. The Workswell GIS-320 thermal camera is fully compatible for instance with the Accecore Technologies drone NEO and both are available in a ready to fly combo. The camera is the ideal solution for the unmanned air vehicles. Both can be fully operated by one standard RC controller.

List of detectable gases: Benzene, Ethanol, Heptane, Ethylbenzene, Hexane, Isoprene, Methanol, MEK, MBK, Octane, Pentane, Toluene, Xylene, Butane, Ethane, Methane, Propane, Ethylene and other gases.
Payloads for Gremsy gimbals
CAMERAS COMPATIBLE WITH GREMSY S1, T7 AND PIXY WS

Payloads for Gremsy S1 (S1/S1V2/S1V3)

Gremsy S1 is the world’s first ever small gimbal (camera stabilizer) with onboard HDMI and SMA ports fully supported for infrared camera WIRIS Pro. Developed based on Gremsy T1 technology with a larger camera cage, the S1 can plug and play with various platforms to provide high precision pointing accuracies for every industrial need.

S1 is first single arm gimbal made by Gremsy that supports multiple camera models. Gremsy S1 is the most advanced single arm gimbal for industry experts in the market. Small and lightweight.

COMPATIBLE CAMERAS

Payload for Gremsy PIXY WS

PIXY WS is a particular version of Pixy series, specifically designed to fit Wiris Security camera to provide for the most demanding metrological applications such as security, search and rescue.

Pixy WS is only 470g, what makes it one of the lightest gimbals among Gremsy gimbals. Built for a specific camera on tray, no balancing nor tuning is required. Pixy WS delivers excellent quality stabilization.

COMPATIBLE CAMERAS

Payload for Gremsy T7

Gremsy T7 brings the next level of industrial gimbals. Boasting a robust design and powerful motor, Gremsy T7 is the next level of heavy lifting gimbal for industrial applications.

With a large camera cage and ability to carry up to 7 lbs, the T7 expands the range of compatible cameras and is capable of loading multiple specialized sensors at once.

COMPATIBLE CAMERAS
Acecore Ready to fly solutions
ACECORE DRONES COMPATIBLE WITH WORKSWELL CAMERAS

Acecore ZOE

Acecore Zoe could offer max. **40 minutes fly time** with max. **6 kilograms payload weight** and **4 independent motors**. Acecore Zoe impressive flytime up to 40 minutes before changing battery packs and there is also option for a tethered solution for unlimited flight time.

Zoe has **triple redundant autopilot** that compensates any error. It is also equipped with **encrypted radio link** that guarantees a secured operation.

Zoe is compatible with George Base Station and different controllers may be used - Hereling George, FrSky George, FrSky GCS Pro and other options.

Acecore NEO

Acecore Neo is a very robust drone with a **maximum flight time of 25 minutes**, max. **payload 9 kg** and **8 independent motors**.

The Acecore Neo drone is completely made of carbon fibers and it is ready for any weather conditions. The **triple redundant autopilot will compensate for any error**. Encrypted radio link guarantees a secured operation.

Done is compatible with George Base Station. The station can be selected as an accessory.

George is a modular base station that allows drone pilots to work with up to **three FPV displays** or other modules, which is capable of powering the controller and attachments through multiple flights.
Thermodiagnosis of photovoltaic power plants

The worldwide increased knowledge of the environment and the risk of exhausting non-recoverable energy sources is a reason that various methods of using alternative resources have been sought.

Solar energy is an inexhaustible source which, thanks to the programmes for the support of the construction of solar power plants is most often used.

A fast, cheap and reliable method where it is possible to check the quality of a large area of solar panels is thermodiagnostics using the Workswell WIRIS thermal imaging system attached to the drone.

Pipeline inspection with thermal diagnostics

Pipeline – this is defined as a “special form of transport used to transport liquids (i.e. liquids and gases), or liquid mixtures with solid particles”.

The issue of thermographic pipeline inspection applies to long-distance piping systems supplying variable media with a temperature different from the temperature of the surrounding atmosphere.

By using thermographic systems, it is possible to determine and localize defects to pipeline insulation and leaks of the transferred media. In some cases, leaks can even be determined and localized in underground pipelines.

Thermodiagnostics of flat roofs

Flat roofs were originally built in areas with low rainfall. For example, they can be found in the architecture. In the modern era, the quality of insulation against atmospheric conditions increased so flat roofs appeared on factory halls as well as highly architecturally appreciated buildings.

The benefits of such roofs are that they save material, are less labour intensive, provide the option of variable roofing layouts and the potential use of roof areas. Thermal imaging systems provide the perfect tool to evaluate the technical condition.

The thermal imaging system located on the drone provides a fast and economical solution for surveying wide roofs on industrial sites.
# UAV application overview

## LIST OF MOST COMMON WIRIS APPLICATIONS

<table>
<thead>
<tr>
<th>Photovoltaic panels</th>
<th>Pipelines inspection</th>
<th>High voltage power lines</th>
<th>Checking flat roofs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Building diagnostics</td>
<td>Cultivation and phenotyping of cereals</td>
<td>Detection of water stress</td>
<td>Fakel burner inspection</td>
</tr>
<tr>
<td>Security applications</td>
<td>Firefighting</td>
<td>Gas leaks visualization</td>
<td>Roe deer mortality reduction</td>
</tr>
<tr>
<td>Drone based 3D thermal modeling</td>
<td>Monitoring in climate change research</td>
<td>Improvement of potatoes phenotyping</td>
<td>Green roof inspection</td>
</tr>
</tbody>
</table>
Contact information
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Global partner network

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