2D Radar Solutions
for safety and automation
in tough environments

Sensor System Application Range: Positioning, Collision Avoidance and Surface Profiling
Robust • Reliable • Real Time • High Performance
indurad’s radar technology is a multifunctional key technology for the mining industry. Wherever rough environments can be found, radar is proven to be a superior solution for measurement and detection. indurad has developed many solutions for the mining and material handling industry based on their unique requirements.

### Functions and Applications

#### iTuck™
- Collision avoidance and unique productivity
- Reduced false alarms for operator assistance, no annoyance
- Fully integrated 2D, GPS, inertial, camera, color touch panel
- Blackbox incident memory, transparency and reporting
- Fast single shift installation

#### iProximity™
- Multipurpose application for machinery, stacker, shiploader, crane
- Electronic fence instead of tripper switch or lanyards
- Easy cell based multi collision zone definition and analysis
- 50x50 m object localization area
- Whitelisting of non-collision structures

#### iBelt™
- World’s first radar based belt volume scanner and speed sensor
- Worry-free technology – works in dense fog and extreme dust
- Volume not mass is the limiting factor for belts, stockpiles, silos
- Combined with a belt scale, iBelt™ delivers density measurement
- Unique fully integrated data analysis tool with trends and counters

#### iDome™
- World’s first 2D/3D radar scanner for silo, bunker and dome
- Inventory control accuracy improved in large silos by >30%
- Fast measurement / real time processing cycles up to 15 Hz update rate
- For high dynamic loading / discharging (apron feeder protection)
- Applicable in harsh conditions like cement clinker

#### iStockpile™
- 1D iATR™ overhead crane or tripper car location measurement
- 2D iDRR™ profile scanning with multiple sensors
- 3D online stockpile and bunker inventory control
- Flexible zone adjustments for different stockpile areas
- Applicable in harsh conditions like cement clinker

#### iStacker™
- 1D iATR™ stacker position measurement along the rail track
- 2D iDRR™ profile scanning from head of stacker / reclaimers boom
- 3D online stockpile inventory control
- Telecommanding and automation by full process transparency
- Flexible zone adjustments for different stockpile areas
FROM ARCTIC TO DESERT

indurad offers a variety of different standardized solutions. The solution is highly customizable to meet the specific needs of our customers around the world in different industries. indurad offers an extended variety of interfaces from 4...20mA to TCP/IP. The iWEB™ technology allows for easy installation and parameterization and comes with a highly advanced user interface.

**Customer Benefits**

- Full 150 m range state, adaptive passive obstacle detection
- Tip head + crusher reversing assistance plus camera backup
- Lane assistance and window / berm localization
- Sensor fusion and redundancy by passive sensing and GPS
- Aerial picture map overlay, 4 GB logging, reporting, analysis.

- Totally independent of weather and environmental conditions
- Full collision avoidance, not bubble based proximity detection
- Easy to install and parameterize
- Object tracking and identification
- Blackbox functionality allows scenario analysis.

- For short conveyors, high inclination, apron feeders
- Contact less sensing of belt volume flow and belt speed
- Over the belt installation – not in the belt installation
- Single easy calibration and fast integration
- Online data analysis tool with counters, trendcharts, shift reports.

- High volume accuracy due to custom container and surface modeling
- 3D visualization for material distribution over draw points
- Zero maintenance with only one initial parameterization required
- Alarm system for empty apron feeders
- Unique fully integrated data analysis tool with trends and counters.

- Permanent online status of heap / stockpile information and history
- Draw point control without manual health & safety critical gauging
- 3D visualization for material distribution and improved dispatching
- Automated shift / weekly / monthly / quarterly / annual reports
- Unique fully integrated data analysis tool with trends and counters.

- 3D Information and volumetric information about the stockpile
- Effective dump height control and dust mitigation
- Collision avoidance stacker / infrastructure / vehicles on trajectory
- Exact position of the stacker with +/- 0.05 m up to 1500 m distance
- Unique fully integrated data analysis tool with trends and counters.
Sophisticated solutions for demanding customers. indurad is a strong partner for OEMs and end customers. We engineer tailor-made solutions, specifically designed for individual machine types. We primarily serve customers from the mining, material handling, construction and metallurgy industries.

**Shearer Loader Collision Avoidance (CAS)**
- Narrow longwall environment and high radar selectivity
- High dust, extreme mechanical shock and vibrations
- Flame proof ATEX design for underground coal.

**Bucket Wheel Excavator Predictive Cutting Control**
- Very high accuracy requirements due to machine dimensions
- Large raw data amounts of 12 iDRR™ Sensors
- Special calibration procedures due to large 100 m high machine.

**Loading Unit Automation & Transfer Point Positioning**
- Synchronism at flexible transfer points of IPCC
- Operator positioning assistance and full automation mode
- High dust and vibrations at transfer points.

**Challenge and Objectives**
- Solution
  - iProximity™ Base Software Package
  - Special inclination compensation software extension
  - Special roof support mapping and adaptive ranging arm control
  - Support for patenting and system documentation.

**Conclusion**
- This cutting edge solution has won several awards, including the RAG Coal Mine Research Award 2009 and the bauma Innovation Award 2010.

**Customer Benefits**
- Large step to functional safety and teleremote operations
- Increased productivity by controlling coal flow in tunnel section
- Reduced mechanical damage on cutting drums / lost picks.

**Solution**
- iProximity™ Base Software Package
- Special inclination compensation software extension
- Special roof support mapping and adaptive ranging arm control
- Support for patenting and system documentation.

**Conclusion**
- This solution works 24h, 365 days per year, even under dense fog conditions, when operators stand in most need of technical assistance.

**Customer Benefits**
- Predictive volume flow information and operator assistance
- Online 3D mine model update reducing manual surveying
- Smooth slowdown - no hard shut-off by lanyards / tripper switch.

**Solution**
- iProximity™ Base Software Package
- Special inclination compensation software extension
- Special roof support mapping and adaptive ranging arm control
- Support for patenting and system documentation.

**Conclusion**
- indurad has achieved a breakthrough compared to other technologies like laser and ultrasonic that failed both in the testing and evaluation process.

**Customer Benefits**
- Minimize re-positioning times and loss of production
- Crew size and task optimization for operator + service personnel
- Reduced corrective movements and less collisions with belt frame.
indurad Solutions are complex, robust and innovative. The unique solutions are truly high-tech for the field, having been developed for the tough requirements of the mining industry. indurad is not just a sensor manufacturer but an integrated solution provider. indurad plays a pioneering role in development of innovative products based on hardware, software and engineering. indurad is leading the market with its 2D/3D radar based solutions.

**Hardware**

The indurad Dual Range Radar™ iDRR is indurad’s core product. It is the only 2D/3D radar scanner on the market. Our solutions are based either on the iDRR™ standalone or on multi sensor concepts.

**Active Transponder Radar™ iATR**

Is a sensor system for distance measurement in tough environments. It allows for linear positioning and speed measurement of tripper cars, cranes and other moving machinery with an accuracy better 0.05 m up to 1500 m.

**Dual Range Radar™ iDRR**

A unique radar sensor with 50° visibility and a range of up to 150 m. The compact 210x130x80 mm sensor operates in the high precision scan band of 77 GHz, where it can focus 3x more than classic level radar sensors. It’s 15 Hz scan speed allowed to be used in dynamic environments for process control and automation.

**Doppler Velocity Radar™ iDVR**

Measures precise velocities and determines at the same time the linear distance to the target. Using monopulse methods, it can estimate the angle to single objects. Contrary to other sensors, the iDVR™ can measure slow moving objects (<0.1 m/s).

**State Measurement Unit™ iSMU**

A compact box including an individually configured set of small state sensors. It can contain an electronic compass for orientation measurement, GPS for position estimation, multi axis inclinometers and multi axis acceleration sensors. The sensor package allows inertial stabilizing functions on dynamically moving machines.

**Radar Processing Unit™ iRPU**

All sensors are connected to the iRPU™ which is the central processing unit. It can be equipped upon customer’s request with different interfaces. It is fan less and suitable for high altitudes and hot & humid environments.

**Industrial Interfaces**

Additional to the iWEB™ indurad offers several industrial interfaces, like:

- 4…20mA
- Digital I/O
- RS 232, 422, 485
- Ethernet/WLAN
- Socket TCP/IP
- Modbus TCP/IP
- Ethernet IP
- Profibus DP
- CAN-Bus

indurad customizes protocols and telegrams to a customer’s infrastructural needs.

**Software**

Our software, both sensor firmware and application software, has been developed for industrial use. It is robust, reliable, fast and scalable. Based on the application area, one or several different software modules are used.

indurad’s operating system, which runs on the iRPU™, is based on the real-time linux kernel, and contains only essential libraries for robust industrial use.

**iFramework™**

The iFramework™ Technology is a modular industrial grade C++ toolbox proprietarily developed by indurad for sensor interfacing, signal processing, data streaming, logging, modeling and output interface control. Application specific plugins (e.g. for surface profiling, collision avoidance, positioning) can be added.

**iWEB™**

The iWEB™ human machine interface (HMI) is an easy to use web application to avoid a cost intensive SCADA integration. It allows secured access to all required information for setup, parameterization as well as visualization and process analysis.

It also supports complex 3D visualizations for stockpiles. The process data visualized in the browser is live and updated by using a push principle real time update technology. Multiple clients can connect simultaneously, and user access levels are differentiated from operator to maintenance manager.
Hightech For The Field

indurad is the only supplier to develop, manufacture and integrate efficient, compact and robust industrial 2D radar sensors and to integrate them into turnkey 2D/3D solutions. Since the beginning of the basic research for this groundbreaking technology, which commenced in 2003 at RWTH Aachen University, we have been growing fast and have become a global SME enterprise with an extensive high-tech network to universities as well as to industry research and third party sensor manufacturers.

Strong Partners

indurad is a German based global player. Our philosophy is providing our customers the best performance products in combination with the best local support. We have selected our strategic partners around the world by their ability to understand our customers’ needs and to design the best solution for them. Our partners stand for fast response times and competent local support.

Customer Focus

Customer satisfaction is at the center of our attention. We provide our systems to solve a customer’s specific challenges. Our code of conduct states: We have to provide the best solution on the market to the customer. If we cannot guarantee this, we will recommend other companies to take over the job. indurad believes in longterm business relations based on trust.

Highly Qualified Employees

indurad is a team of highly qualified experts with different educational backgrounds, including mining engineers, electrical and automation engineers, computer scientists, high-frequency and signal processing engineers, and also field service engineers. This strong team allows us to understand and satisfy our customers’ demands. We believe in diversity and in building a team with flattening hierarchies to achieve at full customer satisfaction, to innovate new products and to improve existing solutions.