SOLUTIONS FOR
PROCESS NIR ANALYSIS

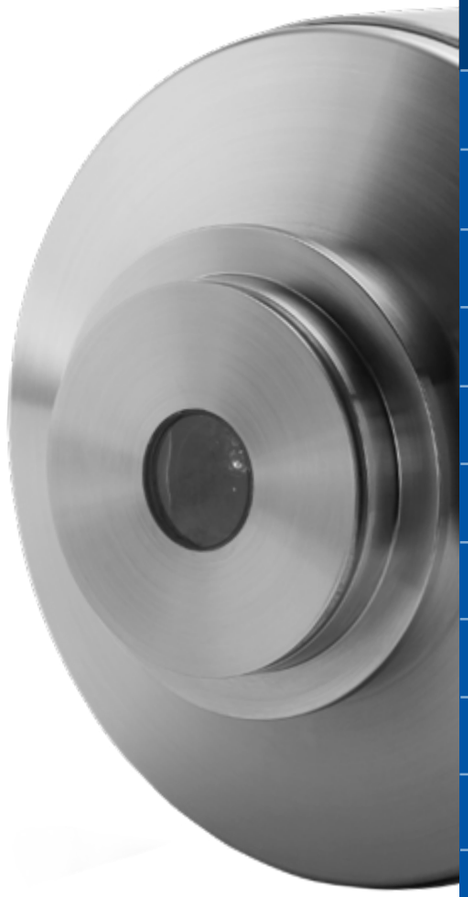
Technology You Can Trust. Expertise You Can Count On.

A Complete Portfolio of Process NIR Solutions

In-Line NIR · On-Line NIR · Software · Calibrations

Perten
a PerkinElmer Company

NIR – AN EVOLVING TECHNOLOGY



Near-infrared spectroscopy (NIR) is an ideal technique for the food processing industry, enabling both fast and accurate measurements of a wide range of key compositional parameters, including moisture, fat, protein, starch, fiber, sugars and flavorings. Utilizing non-destructive analysis techniques, NIR can deliver multi-parameter results in seconds, without the use of expensive and time-consuming in-lab wet chemistry methods.

Recent technology innovation and advancements have allowed users to move testing from the lab to the processing line, with NIR instruments now integrated in-line on a mixer or in a pipe, or on-line over a conveyor belt or at a transition point, offering unparalleled versatility to perform measurements at key decision points.

Perten, a PerkinElmer company, has a wide array of process monitoring solutions to meet the diverse needs of the food industry, from grain harvest, to flour and corn milling, oil seed processing, dairy production, sugar refining, meat and poultry processing, and more. The flexibility and robustness of our near infrared (NIR) technology, paired with intuitive software and versatile calibrations, enables deployment and installation in a nearly endless number of applications to meet the unique needs and specifications of our customers. Leveraging our 30 years' experience and more than 10,000 NIR installations, you can trust Perten to deliver the right solution for your needs.

DA 7250 AT-LINE NIR

DA 7350 IN-LINE NIR

DA 7440 ON-LINE NIR

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ACHIEVE A NEW LEVEL OF VALUE AND EFFICIENCY

Rising production and energy costs, along with the emerging shortage of skilled workers has led food processors to embrace new technologies to control and monitor their processes. By leveraging continuous monitoring throughout manufacturing, activities such as drying, cooling and segregating can be optimized. Utilizing real-time data, trends in ingredient variability can be identified before they begin to have a costly impact on product consistency and quality, enabling processors to reduce safety margins which can increase yield and reduce energy costs and raw material usage. This in turn reduces expensive product give-away, waste, re-works, and claims. Additionally, process NIR instruments can be used to control ingredient additions and blending, and can monitor incoming raw materials to ensure stable quality with less fluctuation, which can help increase yield and end-product consistency.

Process Control

Achieve unmatched precision and stability, saving money and achieving the product consistency consumer's demand. Further, continuous monitoring can provide complete quality records of the entire production batch or run, and additional data points can be used to bolster existing production models.

Increase Yield

Leveraging improved process control, food manufacturers can increase their yield on finished products, while also reducing waste of key components, such as protein and fat, by achieving consistently tighter control limits within their manufacturing processes.

Maximize Margin and Profit

Reduced indirect costs tied to labor and energy savings, coupled with less waste and tighter control specifications, ensure that your margins and profits are maximized, and that you begin to see a return on your investment quickly.

Traceable Quality

Continuous monitoring of product quality and specifications enables 100% traceability of quality throughout the manufacturing process.

Scalable Solutions

The scalable and connected nature of process NIR solutions allow you to add to or modify your setup, with multiple instrument configurations, a robust calibration library and easy integration into an existing SCADA system.

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AN NIR FOR EVERY APPLICATION

The core of each of our NIR products is an industry-leading NIR sensor featuring the latest diode array technology. Capable of measuring spectra in the 950 - 1650 nm range, our NIR solutions provide spectral information from first and second overtones with combinations. Perten's NIR products utilize continuous wavelength stabilization and an automatic internal reference to ensure accurate measurements and stability over time. Whether your application requires direct contact measurements with our DA 7350 in-line sensor, non-contact measurements, such as those over a conveyor belt, with our DA 7440, or in-lab/at-line bench testing with the DA 7250, our NIR solutions include a range of features to ensure accurate and reliable measurements:

- **No moving parts in the spectrometer** ensures trouble free operation and reduced downtime, which are paramount in harsh manufacturing environments.
- **Robust design developed for 24/7 operation** and continuous monitoring of processes, with durable housing carrying IP67, dust ATEX, IP69K and/or IP65 certification.
- **Thermoelectrically cooled InGaAs detector** array provides measurements with high signal-to-noise ratio.
- **Robust calibrations facilitating** accurate multi-parameter measurements over a wide range of product types, with easy transferability from DA 7250 benchtop NIR instruments to both DA 7350 and DA 7440 process NIR instruments.
- **Intuitive and easy to use** Process Plus software enables remote monitoring of results and product images.
- **Smart and modern connectivity options** with full spectral output via Industry 4.0-compliant interfaces such as OPC UA.
- **Seamless integration** into existing plant control systems. Rapid results provide the ability to manually control plant processes or to use feed forward-feedback control loops for complete automation. Using OPC, analog 4-20mA, Modbus ASCII, Modbus RTU, Profibus and direct SQL platforms, Perten offers a communication protocol for even the most challenging production plant's infrastructure requirements.

Easy Transferability between instruments

Easy Transferability between instruments

DA 7350 IN-LINE NIR
Contact measurements of bulk products, pastes, slurries and liquids.
LEARN MORE

DA 7250 AT-LINE NIR
Fast 6-second analysis of a wide range of samples utilized in lab environments.
LEARN MORE

DA 7440 ON-LINE NIR
Non-contact measurements of products over conveyor belts or similar use cases.
LEARN MORE

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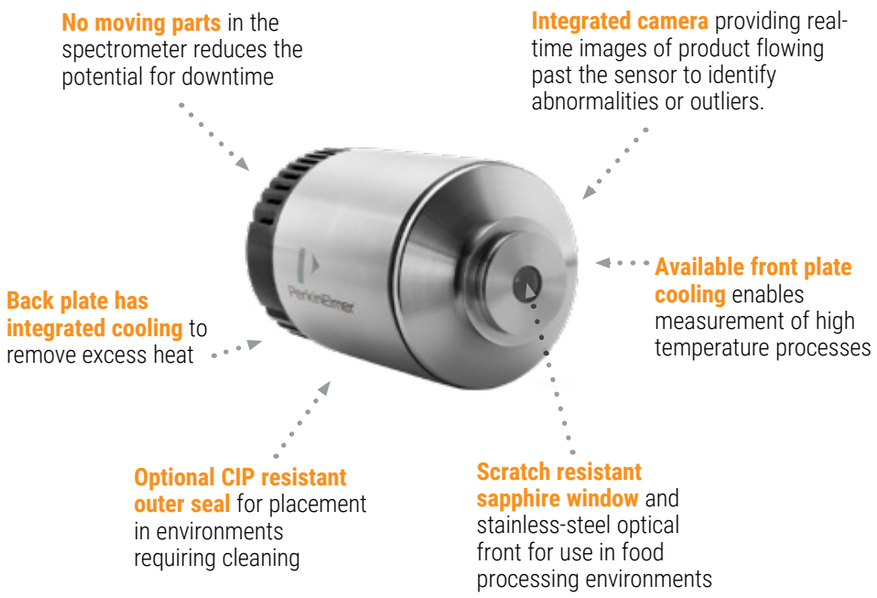
DA 7350 IN-LINE NIR

Designed for applications in which the instrument comes in direct contact with the product, the DA 7350 is designed to be mounted in plant equipment and machinery to measure bulk products, such as grains, granules, powders and pellets, as well as pastes, liquids and slurries. The DA 7350 collects approximately 50 measurements per second through a scratch-resistant sapphire window on the front of instrument. The robust nature of the DA 7350 makes it suitable for installation in demanding plant environments, with optional **ATEX configurations** (zones 20, 21 and 22), as well as **clean-in-place** and **high-temperature** models carrying IP67 and IP69K certifications.



SPECIFICATIONS	
Power Requirements	24 V DC, 5 A
Dimensions (HxWxD)	313.5 x Ø 192 mm, 12.34 * Ø 7.56 In.
Net Weight:	9.75 kg (22 lbs.)
Operating Temperature Range	-10 to 45 °C, extended temperature range with front cooling accessory
Ingress Protection	IP67 and IP69K
Measurements	NIR, Digital color camera
Speed of Measurement	Approximately 50 spectra per second
Products	Grains, meals, flour, pastes, pellets, extruded products, etc
Parameters	Moisture, protein, fat/oil, ash, starch, sugar, speck count, Color in the CIE L*, a*, b* color space etc
Approvals	ATEX & IECEx Zones 20, 21, and 22 in potentially dust explosive atmospheres
Communication	UPC UA, PROFINET, Modbus TCP, Profibus DP, Modbus ASCII, Analogue outputs, SQL Queries and more
Computer	On-board computer
Spectral Range	950 to 1650 nm
Detector	Thermoelectrically cooled 256-element InGaAs with internal line source reference

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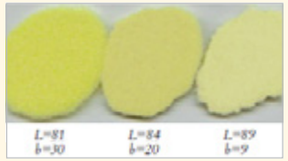
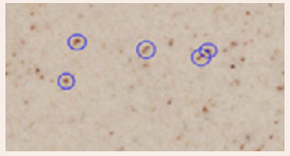
DA 7350 IN-LINE NIR

In addition to the advanced diode array technology utilized in all of Perten's NIR products, the DA 7350 also includes a built-in camera for color measurements and speck detection in flours and powders. Further, the DA 7350's camera also provides real-time images of products during manufacturing to enable visual monitoring of flowing materials. This product view offers operators a unique insight into products from the control room, providing a better understanding of the process and whether there are any obvious non-conformities or outliers, such as foreign objects or materials, broken kernels, granulation/particle size, impurities, or flows/blockages.



The integrated digital camera can measure color of products and materials. The dedicated LED illumination provides optimal conditions for color measurement enabling superior repeatability and improved alignment with laboratory methods. The standard color measurement according to CIE LAB space produce L*, a* and b* results. The example shows the measurement of Durum semolina.



The DA 7350 includes speck counting as standard, which helps flour millers detect cloth breakages quickly. Specks can be classified by size and contrast in up to 16 different groups. By configuring alarms you can be notified immediately in case speck count exceeds set limits

Real-time images of the process can be accessed from any networked computer. The images can be incorporated into control system user interfaces and displayed in real-time. The images provide a unique, real-time view directly into the process stream. Operators can immediately detect the presence of foreign material, visible defects, product color changes, and blockages. The system can be set up to automatically capture images of the product at various intervals.

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DA 7440 ON-LINE NIR

The DA 7440 system is the ideal solution for measuring and monitoring product composition either over a moving conveyor belt, or in non-contact food processing areas, to accurately report multiple parameters such as moisture, fat, protein, fiber, sugar, ash, seasoning and more. Robust calibration models and flexible installation options enable analysis of a wide range of product types including granules, pellets, grain, feed, potato chips, solid dairy products, extruded snack foods, meat and poultry, tobacco, liquid, and wood chips. With both **general-purpose** and **sanitary design configurations**, as well as a **cooled version** for installation in areas with elevated temperatures, the adaptability and scalability of the DA 7440 ensures that it will deliver fast ROI through process and margin optimization.

Optional ATEX model with ATEX dust zone 21 and 22 certification for installation in dusty or potentially-explosive environments.

High visibility light indicator with status and alarm conditions with different colors, to alert operators of current operating conditions.

Air-Purge Window to ensure measurements are free from contamination.

Flexible connectivity options, with Ethernet connection to the plant network where ProcessPlus software is running on a PC, server or a virtual machine.

Automatic detection of product presence on belt and handles process changes, including varying product height, color, and temperature, without any undue effort or effect on measurement results.

SPECIFICATIONS	
Power Requirements	24 V DC, 2 A
Dimensions (HxWxD)	195 mm x 461 mm x 210 mm
Net Weight	11 to 14 kg (24.25 to 30.87 lbs), depending on configuration
Operating Temperature Range	0 to 40° C, (Active air-cooler version can be installed in environments up to 70° C)
Ingress Protection	**DA 7440 GP:** Sensor IP65 (without closed connectors) IP67 (with closed connectors)
	DA 7440 SD: Sensor IP69K
	DA 7440 EX: Sensor IP69K
Measurements	NIR
Spectral Range	950 to 1650 nm
Detector	Thermoelectrically cooled 256-element InGaAs with internal line source reference
Speed of Measurement	Approximately 50 spectra per second
Products	Grains, meals, flour, pastes, pellets, extruded products, liquids, slurries, etc.
Parameters	Moisture, fat/oil, protein, ash, starch, sugar, and more.
Approvals	ATEX Zones 21 and 22 in potentially dust explosive atmospheres (depending upon instrument configuration)
Communication	UPC UA, PROFINET, Modbus TCP, Profibus DP, Modbus ASCII, Analogue outputs, SQL Queries and more

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VERSATILITY OF INSTALLATION OPTIONS

While superior hardware is important, ensuring that the hardware is installed and integrated into existing manufacturing and processing environments is paramount. Adding process NIR sensors to critical control points is key to increasing efficiency, and working with a partner with the experience and proven capability to install the technology in a wide range of applications will help achieve ROI faster.

Examples of mounting and installation options include:

Farm and Trade

- Harvest
- Storage

On-combine

Receival

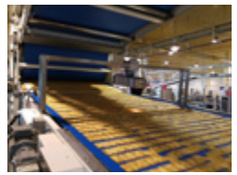
- Binning
- Blending

At Transition Point

Processing

- Mixing
- Fermenting
- Baking
- Cooking
- Frying
- Extruding
- Coating

In a Pipe



Over the Belt

After Coater

Loadout

- Verifying

Outdoors

Retail

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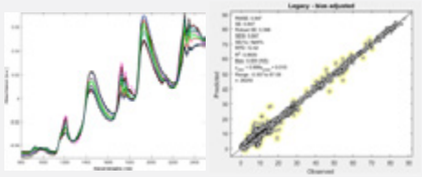
A LEADER IN CALIBRATIONS

Calibration models are the key to producing accurate and reliable data when using process NIR technologies. As NIR is a secondary technique, calibrations are necessary to model the relationships between an NIR's spectra and reference (primary) chemistry results. Perten leverages its 30 years' experience in NIR to create one of the largest and most diverse commercial libraries of proven calibrations for raw materials, intermediates and finished goods. Our standard calibrations can be utilized to monitor parameters such as moisture, protein, fat/oil, ash, starch, fiber, sugars and many more. For instances of customized processes or products where standard calibrations are unavailable, we provide calibration development services leveraging our highly trained and experienced Applications Teams to ensure you have the right calibrations for your sample type and application. Additionally, for users wanting to build their own calibrations, Perten offers PerCal Plus calibration software to facilitate development.

Our calibrations have been developed utilizing one of the following methods:

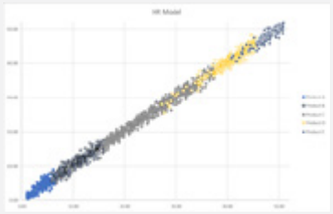
Partial Least Squares (PLS)

Linear regression models are ideal for routine applications and for small sets of linear data.



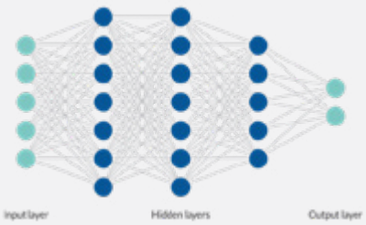
Honigs Regression (HR)

A proprietary calibration method enabling the creation of calibrations for non-linear groups of data.



Artificial Neural Network (ANNr)

Machine learning for creating models with large, non-linear data sets.



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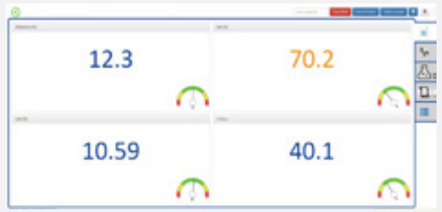
SOFTWARE THAT'S SIMPLE AND INTUITIVE

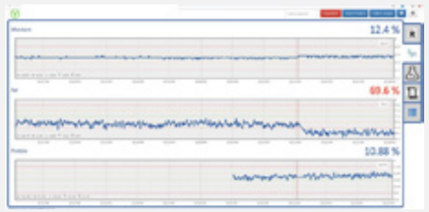
Software plays a critical role in enabling the efficient interpretation and use of data collected utilizing process NIR.

ProcessPlus software integrates seamlessly with your process NIR sensors to provide **web-based real-time access** to data and images from the production floor, the control room, or anywhere with an Internet connection. ProcessPlus delivers a range of benefits including:

- Data integration from all Perten process NIR sensors in one place for a unified view that simplifies data management and analysis.
- Numerical and visual cues to facilitate monitoring of process conditions utilizing exportable results tables and easy to read gauges.
- Web-based access available to an unlimited number of users on displays, remote control rooms or via cellular devices.
- Easy entry of reference values for bias and calibration updates.
- Multi-instrument custom views can be built using ProcessPlus Master.



Color coded results with gauge displays make identification of outliers fast and easy.



Real-time graphics measurement and trending of results with auto-scaling or fixed limits.

Optional batch report functionality for use during product changes, or manual change-overs.

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For users seeking the ability to build their own calibrations, PerCal™ Plus software is designed to **streamline calibration development** for both novice and expert users alike. It delivers a simplified experience and maximum productivity, with a **workflow-oriented user interface** that's easy to use and can be employed for both routine calibration development and maintenance, utilizing both PLS (partial least square) and HR (Honigs Regression) methods. With PerCal Plus software, you can organize and analyze your data, then create and validate your models for deployment across your fleet of instruments.

Data Review Plot Dashboard, raw spectra (top), PCA scores of spectra (bottom left), reference value counts in percentage of the total number of rows in dataset (bottom right).

PLS Regression Dashboard, Prediction versus Reference plot with outlier marked for exclusion (left), Root Mean Square Error vs. PLS factors for selection of factors (right).

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ACCESSORIES TO CUSTOMIZE AN INTEGRATE

To make your process NIR system meet the unique needs of your manufacturing environment, Perten offers a wide range of versatile and adaptable accessories:

Power Supplies

External open frame power supply devises for powering one (24 VDC 5 A (120 W)) or multiple sensors (24 VDC 10 A (240 W)), with or without panel PC.

Panel PC

At-line touch screen computer and IP69K/IP68 enclosure for the visualization of results and operator interactions in ProcessPlus software for up to 3 DA 7350 or DA 7440 sensors (or a combination of both models), and input/output to DCS over ethernet.

Communication Protocols

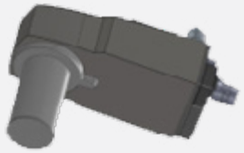
Enables the implementation of automated controls, to view the results on integrated GUI or to include measurement results in their report system, we offer a range of communication protocols including Modbus TCP and PROFINET.

Mounting Accessories

We offer a range of accessories to simplify and speed up the installation process on site, including mounting flanges, clamps, pipe sections, mounting panels and measurement chambers.

Liquid Interface Modules

Enables measurements in reflection of liquids. Cross flow cell available in stainless steel with sanitary design for measurement of opaque liquids with the DA 7440. Transflection flow cell with adjustable path available for DA 7350.



Reference Check Cell

Inert measurement tile used to validate long term stability of the instrument through tracking of deviation from initial measurement taken at installation.

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A SOLUTION FOR EVERY APPLICATION

A seemingly endless combination of instruments, accessories, installation and software options ensures that Perten's process NIR solutions can be adapted to meet nearly any application or use case, including the following:

Flour Milling

Maximize yield and ensure flours meet end-use requirements.

PRODUCTS
- Whole wheat
- Bran
- Germ
- Streams
- Patent flour

PARAMETERS
- Moisture
- Protein
- Ash
- Speck Counts
- Colour
- More!

USES
- Blend wheat at in-take
- Test streams for optimal extraction
- Load-out to ensure proper deliveries
- Gluten loops

Feed Milling

Use ingredient results to least-cost formulate and maintain optimal quality and consistency.

PRODUCTS
- Grains
- Meals
- By-products
- Finished feeds

PARAMETERS
- Moisture
- Protein
- Fat
- Fiber
- More!

USES
- Pay, bin, and segregate at receival
- Monitoring mixing
- Test before/after dryers/extruders
- Monitor load-out

Corn Milling

Process monitoring allows wet and dry corn millers helps minimize energy use and waste.

PRODUCTS
- Whole corn
- Germ
- Gluten meal
- Starch
- DDGs

PARAMETERS
- Moisture
- Protein
- Oil
- Starch/Sugars
- More!

USES
- Blend and segregate corn
- Monitor conversion processes
- Optimize drying regimens

Oil Seeds

Maximum oil extraction and valuation of co-products.

PRODUCTS
- Soybeans
- Canola
- Cakes
- Meals
- Oil

PARAMETERS
- Moisture
- Oil
- Protein
- Fatty acids
- More!

USES
- Monitor incoming materials to optimize production
- Test meals for extraction
- Optimize drying and oil extraction process

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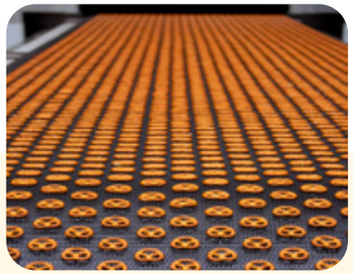

Snack Foods

Reduce waste and optimize use of ingredients to produce baked, extruded, and other snack foods.

PRODUCTS
- Flour
- Corn masa
- Potato Flakes
- Finished snacks

PARAMETERS
- Moisture
- Oil
- Protein
- Seasonings
- More!

USES
- Test and bin ingredients
- Monitor extrusion
- Optimize cooking and drying
- Confirm optimal seasoning

Petfood

Ensure quality and nutritional value of wet and dry pet foods.

PRODUCTS
- Ingredients
- Meat by-products
- Wet/dry petfoods

PARAMETERS
- Moisture
- Protein
- Fat
- Fiber
- More!

USES
- Optimize formulation
- Monitor extrusion
- Optimize drying
- Verify spray oil addition

Dairy

Create the most value from milk when producing added value dairy products.

PRODUCTS
- Cheese
- Yogurt
- Butter
- Dairy powders
- Milk/cream

PARAMETERS
- Total solids
- Butterfat
- Protein
- Lactose
- More!

USES
- Optimize spray drying
- Maximize cheese yield
- Test butter in-line to ensure it meets specifications

Meat and Rendering

Maximize extraction, quality, and pricing of animal by-products.

PRODUCTS
- Meat/poultry
- Meat and bone meal
- Poultry meal
- Feather meal
- MSM

PARAMETERS
- Moisture
- Protein
- Fat
- Ash
- More!

USES
- Monitor, segregate incoming meat
- Hit meat blending targets
- Measure and control drying of meat meals

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