

# WEIGH FEEDERS Models 402 and 404 Series, 405 and 406

"Weight-Loss-Differential"

For Dry Solid Materials



Advanced design technologies for superior performance and reliability.

# Acrison

# WEIGH FEEDERS Models 402 and 404 Series, 405 and 406

"Weight-Loss-Differential" ("Weight-Loss")



Model 406-170-00



# For Continuous or Batch Weigh Feeding Applications

Proven in thousands of installations worldwide, Acrison's "Weight-Loss" Weigh Feeders, with their exceptionally precise and reliable weighing technology and leading edge controls, provide users with superior operational performance, lowest maintenance requirements and unexcelled longevity.

#### Background

The Models 402 and 404 Series, 405 and 406 Weigh Feeders are low profile, economically priced feeders employing Acrison's advanced "Weight-Loss-Differential" weigh feeding concepts and designs for accurately and reliably metering a wide variety of dry solid (and liquid) ingredients at feed rates ranging from a fraction of a pound up to thousands of pounds per hour.

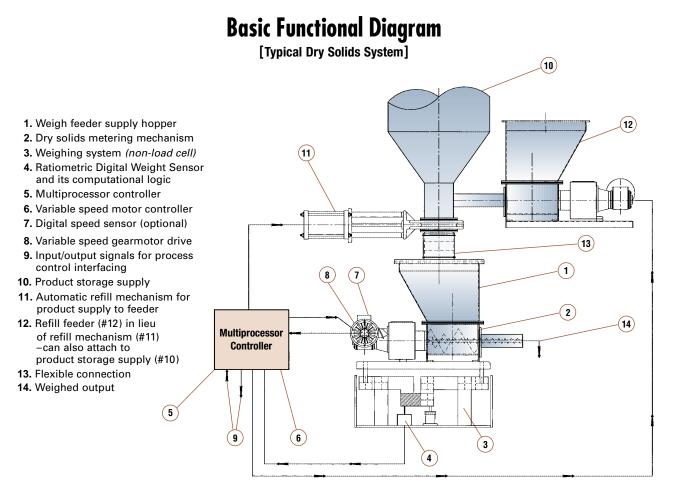
Encompassing incomparably strong, field-proven weighing technology, specifically developed by Acrison for "weight-loss" weigh feeding applications, these particular model weigh feeders consist of uniquely configured "platform" type lever weighing systems where the selected metering devices "mount" onto weigh platforms.

The robustly constructed Acrison lever weighing network is in itself a "scale," utilizing frictionless stainless steel flexures for all pivotal connections. As weight (product) is added to or removed from the weigh platform (metering mechanism), the lever network "moves" in a direct relationship to that weight. This movement is precisely sensed by Acrison's Ratiometric Digital Weight Resolver and instantaneously converted into a highly accurate digital signal directly proportional to weight.

Analogous to the weighing mechanisms used with all of Acrison's various model "weight-loss" weigh feeders, the Model 402 and 404 Series, 405 and 406 Weighing Systems are also permanently calibrated and will remain precise without the need for recalibration and/or adjustment. In addition, these weighing mechanisms are not in any way delicate and/or temperamental and will operate over an ambient temperature range of -10 to 140 degrees Fahrenheit.

Unlike "weight-loss" weigh feeders that incorporate weighing systems designed with one or more load cells... well known for their delicate nature, temperamental behavior and calibration drift... Acrison weighing systems do not use load cells or any other type force measurement device for sensing weight.

The Models 402 and 404 Series, 405 and 406 Weigh Feeders are available with various model and size Acrison dry solids metering mechanisms, typically as outlined in this Bulletin.



#### **Principles of Operation**

As product discharges (feeds) from the scale-mounted metering mechanism, the ultra-high resolution Ratiometric Digital Weight Sensing System continuously transmits precisely derived "loss-of-weight" data to the feeder's controller, which in turn, instantaneously calculates the rate at which product is discharging and compares that rate to the feed rate selection. Simultaneously, the control system adjusts the variable speed drive of the metering mechanism to accurately maintain the specified feed rate, while continuously monitoring all aspects of feeder operation. Response of the metering mechanism is instantaneous, thus achieving smooth short-term performance with the highest possible degree of long-term accuracy.

The "weight-loss" principle for continuous weigh feeding requires periodic refilling of the feeder's supply hopper (or tank for liquid applications) as an operational requirement, which is usually a completely automatic function. The frequency of refills is determined by the feed rate throughput relative to the size of the supply hopper (or tank) within realistic parameters necessary to maintain optimum weigh feeder performance in the gravimetric mode.

All Acrison "Weight-Loss" Weigh Feeder control systems also include "Acri-Lok<sup>®</sup>", an Acrison patented feature that ensures accurate product delivery should the feeder's weighing system sense an abnormal disturbance during operation.

Acrison weigh feeders provide users with maximum return on their investment and an extremely low cost-of-ownership. With simple and quick start-up, exceptional longevity and low maintenance requirements, these weigh feeders offer remarkable durability and will easily withstand the harshest industrial environments. Their field proven *non-load cell* weighing systems are unsurpassed in dependability, precision and ruggedness; they are also permanently calibrated and virtually maintenance-free.

The output weight signal of an Acrison weigh feeder is not "integrated" (averaged) or in any way "manipulated" for stabilization purposes; the weight signal is inherently stable and directly usable by the feeder's controller. (Integration of a weigh feeder's weight signal slows-down weight sensing response time and, in turn, adversely affects feeder performance, especially short-term accuracy.)

The entire weighing mechanism of any Acrison weigh feeder, including its Ratiometric Digital Weight Sensor (and associated electronics), is guaranteed for five years.

Continuous metering accuracy typically ranges between +/- 0.25 to 1 percent or better (error) at two sigma, based on a given number of consecutive one minute weighments.

# Models 402 and 404 Series, 405 and 406 Weigh Feeders

### **Standard Design Features**

- Continuous metering or batch weighing on a "weight-loss" basis — Acrison's "weight-loss" operational concepts and equipment designs combine rugged-duty, permanently calibrated, adjustment-free state-of-the-art weighing systems with the most versatile dry solids metering/handling mechanisms and related controls to provide users with an unsurpassed level of highly reliable overall performance.
- Accuracy All Acrison continuous weigh feeders typically provide metering accuracies ranging between ± 0.25 to 1 percent or better (error), at two sigma, based on a given number of consecutive one minute weighments. Batch accuracies typically range between ± 0.1 to 0.5 percent or better (error), at two sigma, based on a given number of repetitive consecutive weighments.
- No response lag Acrison's various positive-flow metering mechanisms respond instantaneously upon command from the controller to alter the feed output. Absolutely no lag exists since product discharge is directly out of the scale-mounted metering device.
- Feed range As standard, all Acrison "weight-loss" weigh feeders are capable of an overall feed range of 100:1.
- Feed output capacity Depending upon the model and size, the overall feed rate output capability for the various model "weight-loss" weigh feeders described in this Bulletin ranges from less than one pound up to approximately 20,000 pounds per hour.
- Weighing System Acrison's various patented weighing mechanisms are, by far, the most reliable, sensitive and accurate in the industry. The novel lever mechanisms of these frictionless, ultra-high resolution counterbalanced "weight-loss" weighing systems have been ruggedly designed for tough industrial weigh feeding applications. They are designed with an uncommonly high service factor easily capable of withstanding the continual "impacts" associated with refilling without any adverse consequences.

Also, once calibrated (factory completed) these unique weighing systems do not require any type of mechanical re-calibration or adjustment; in fact, such provisions do not exist. They are permanently calibrated.

- Ratiometric Digital Weight Resolver (RDWR) Acrison's Ratiometric Digital Weight System utilizes synchro-resolver technology and innovative electronics to produce a digital weight signal having extraordinary performance specifications. This unamplified, non-integrated, highly precise and stable weight signal is a count ranging from 0 to 1,048,576 (20 bits), capable of use by any of Acrison's multiprocessor weigh feeder controllers. Please see page 5 for additional information.
- No rezeroing Acrison's "weight-loss" principle of operation does not require a zero reference point; thus, the need for rezeroing the weighing system is never required.

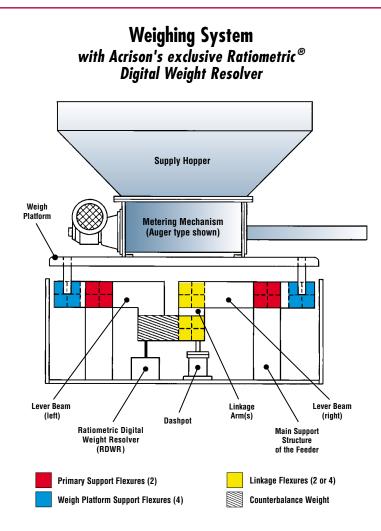
- Acri-Lok<sup>®</sup> All Acrison "weight-loss" weigh feeders include a unique operational feature... Acri-Lok... developed and patented by Acrison to ensure accurate metering whenever the weighing system is disturbed in any manner that would otherwise affect the accuracy of the metered output.
- **Batch-Lok**<sup>®</sup> In addition to *Acri-Lok*, should an abnormal disturbance be detected by the weighing system of an Acrison "weight-loss" weigh feeder operating in a batching mode, a supplementary feature... *Batch-Lok*... is provided to ensure the highest possible degree of batch accuracy.
- Automatic refilling All Acrison "weight-loss" weigh feeder control systems provide for the automatic refilling of the feeder's integral supply hopper (or tank). When automatically refilled, the controller initiates a refill command upon sensing low hopper (or tank) level, provided the feed rate output is within pre-established tolerances.

During the refill period, the feeding mechanism operates in a volumetric control mode, returning to gravimetric control after refill and when the controller senses a normal "weight-loss" condition.

Although refill is generally rapid, Acrison "weight-loss" controllers include a number of very effective operational features specifically designed to ensure optimum metering accuracy during all phases of refill, when the feeder is not in gravimetric control.

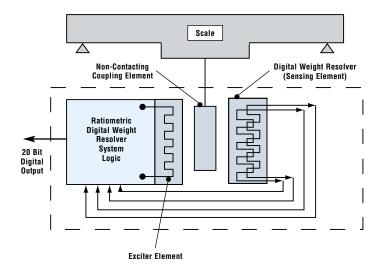
- Unaffected by typical in-plant vibration and dust Typical in-plant vibrations do not affect Acrison weigh feeders, as proven in scores of installations worldwide. The novel overall mechanical design of Acrison's various weighing mechanisms inherently provides excellent resistance to in-plant vibrations without the need to integrate the actual weight signal for stability purposes. Also, based on the "weight-loss" principle of operation, dust accumulation onto any part of the weigh feeder will not present any operational problems whatsoever.
- Ambient operating temperature range All Acrison weigh feeders will operate within an ambient temperature range of -10 to 140 degrees Fahrenheit without any affect on performance.
- Totally enclosed product zone Because of the completely enclosed design of all Acrison "weight-loss" weigh feeders, product remains totally confined, thus assuring a dust-tight and clean operation.
- Minimum of moving parts All Acrison "weight-loss" weigh feeders have been designed with a minimum number of moving parts to ensure the highest possible degree of dependability and longevity, with lowest maintenance requirements.
- Silent operation All Acrison weigh feeders are virtually silent when operating.

# Models 402 and 404 Series, 405 and 406 Weigh Feeders



NOTE: For liquid feeders, the dry solids supply hopper is replaced with a tank and the dry solids metering mechanism with a pump.

#### Ratiometric® Digital Weight Resolver System (RDWR)



The weighing mechanisms used with Acrison Models 402 and 404 Series, 405 and 406 Weigh Feeders are technologically advanced, innovatively designed lever networks utilizing stainless steel flexures for all connecting (pivotal) requirements. They are frictionless in operation and mechanically counterbalanced to "offset" the weight of the entire metering mechanism (mounted onto the weighing mechanisms), greatly enhancing weighing sensitivity.

As noted in the illustration, two Primary Flexures connect each of the two Lever Beams to the Main Structure of the feeder. The two Lever Beams are joined together by either one or two Linkage Arms (depending on the size of the weighing system); the Linkage Arm(s) connects to the Lever Beams with two (or four) Linkage Flexures. Four additional Support Flexures (one in each outside corner of the two Lever Beams) support and connect the Weigh Platform to the Weighing System. The Metering Mechanism mounts onto the Weigh Platform.

These time-proven flexures, designed and manufactured by Acrison, provide optimum structural rigidity of the lever network in both the horizontal and vertical planes, and ensure permanence of the weighing system's calibration and accuracy. The flexures do not wear or change over time, never require adjustment, and are completely unaffected by ambient temperature variations over the designed operating temperature range of the weigh feeder.

The lever weighing mechanism is in itself a "scale", extremely durable and very precise in producing *unamplified* resolution of better than one part in one million. Operationally, as weight is added or removed from the metering mechanism and its supply hopper (or tank), the lever network "moves" in an extremely precise relationship to that weight. This movement (or displacement) is then sensed by Acrison's Ratiometric Digital Weight Resolver (RDWR), instantaneously converting movement into an equally precise signal directly proportional to weight.

Unlike other "weight-loss" weighing systems, the physical weight sensing element (of the RDWR) does not attach to any part of the weighing mechanism's lever network and therefore, cannot be damaged by any amount of overload or shock and/or abuse that the weighing system may experience.

The entire weighing mechanism of the weigh feeder, including the RDWR, is completely calibration and adjustment-free and guaranteed for five years.

Acrison's exclusive Ratiometric Digital Weight Resolver (RDWR) System, used with all Acrison weigh feeders, computes the linear movement of the lever mechanism (scale) into a true binary coded, serially transmitted data stream having a discrete resolution of 20 bits (or the ability to sense 1 part in 1,048,576). This highly precise and advanced electronic displacement measuring technique basically consists of a sensing element and its computational logic.

The physical sensing component is composed of a series of windings collated on a common element that are equally affected by environmental changes and therefore, self-compensating. In addition, because the computational logic of the RDWR System compares relative measurements, rather than absolute values, its input power source can vary up to ±30% without affecting the output. Also, all non-weight data, both cyclic and random in nature that may be super-imposed on the actual data, are cancelled-out.

The RDWR System is linear to within 0.01 percent, repeatable to 0.005 percent, possesses long term stability of 0.005 percent (10,000 hours) and carries a 40,000 hour MTBF.

Acrison's RDWR System is FM (Factory Mutual) Approved and Listed for operation in hazardous environments... Classes I, II and III; Divisions 1 and 2; Groups C, D, E, F and G. This weight sensing system also complies with European hazardous area classifications EEx ia IIB T4 and EEx d [ia] IIB T6.

# Models 402 and 404 Series and 405 Dry Solids Weigh Feeders

# Utilizing Acrison's Model 105 and 140 Series of Double Concentric Auger Metering Mechanisms

# These particular metering mechanisms are capable of providing highly reliable and versatile metering performance at feed rates ranging from a minimum of one pound up to a maximum of approximately 6000 pounds per hour.

#### **Double Concentric Auger Metering Mechanisms**

In operation, the dissimilar speed of the Double Concentric Augers produces a unique *"Inter-Auger-Action"*... functionally described as an opposing sliding parallel movement of product, within the confines of the double augers, that gently "conditions" the material to a constant (natural) density, while continuously and simultaneously, filling the metering auger circumferentially, or from a full 360 degrees — acknowledged as the most viable dry solids metering concept yet devised.

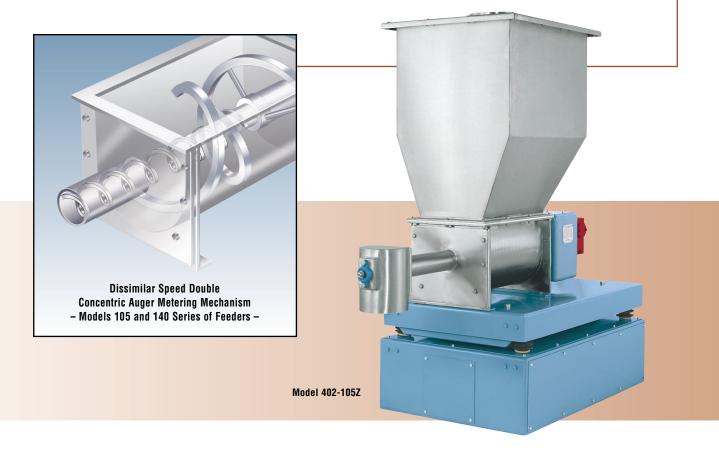
The outer (larger) auger, identified as the Intromitter, rotates in the same direction as the (smaller) metering auger, but at a slower speed. As the Intromitter rotates, the resultant effect is an inward and outward radial action imparted to the material.

The inward radial action gently "conditions" the material, establishing uniform product density, while effectively and efficiently filling the metering auger, providing totally reliable and accurate feed of a wide range of dry solid ingredients. The outward radial action creates an eruptive movement within and above the feed chamber, eliminating any possibility of bridging or product hang-up in the immediate area of the Intromitter, thus ensuring uninterrupted gravity flow into the "Double Concentric Auger Metering Mechanism".

Mechanically, the dissimilar speed Double Augers are geared together in a 'fixed' ratio to each other, powered by a single variable speed gearmotor.

For additional information on the Models 105 and 140 Series of Feeders, please reference Equipment Data Specifications 1-200-0480.

<u>NOTE</u>: For free-flowing ingredients, Acrison's single auger feeder Models 101 or 130 may be utilized as the metering mechanism in lieu of the (illustrated) various Double Concentric Auger models (also reference Equipment Data Specifications 1-200-0479 for information on Model 101 or 130 Feeders).



# Models 402 Series, 405 and 406 Dry Solids Weigh Feeders

# Utilizing Acrison Models BDFM, BDF-1 and BDF-1.5 Bin Discharger Metering/Hoppering Mechanisms

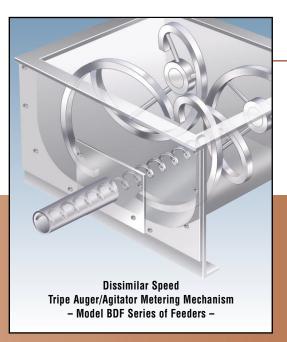
#### These particular model metering/hoppering mechanisms are capable of providing extremely dependable and versatile metering performance at feed rates as low as 0.25 pounds up to approximately 2000 pounds per hour.

#### Model BDF Metering Mechanisms

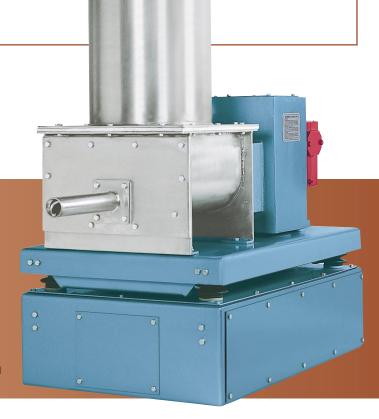
Unlike dry solids feeders where a single auger is typically located at the bottom of a converging "V" shaped trough or a "U" shaped chamber — across which amorphous products easily and often bridge, regardless whether or not agitation is included — the unique design of Acrison's various Model Bin Discharger Feeders totally eliminate any type of convergence that could prove detrimental to product flow and feed. Opposed multiple auger/agitator action plus substantially increased gravity flow into the feed chamber combine to ensure a smooth, gentle and unrestricted movement of even the most stubborn-handling materials.

In addition, certain model Bin Discharger Feeders are also designed to "self-empty," leaving only a minimal amount of residual material when permitted to run empty. Stagnant areas are eliminated by the design and rotation of the two large augers/agitators which continuously move product inward and into the metering auger. Mechanically, the two augers/agitators and the metering auger are geared together in a 'fixed' ratio to each other, powered by a single variable speed gearmotor. The two larger augers/agitators operate at a slower speed than the smaller metering auger.

For additional information on the Models BDFM and BDF-1 Feeders, please reference Equipment Data Specifications 1-200-0482.



Model 405-BDF-1



# Models 402 and 404 Series, 405 and 406 Dry Solids Weigh Feeders

# Utilizing Acrison's Model 170 Series of Flat Bottom, Self-emptying Auger Metering Mechanisms with quick clean-out design.

These particular model metering mechanisms are capable of providing highly reliable and flexible metering performance at feed rates ranging from a minimum of 10 pounds upwards to about 6000 pounds per hour.

#### Model 170 Metering Mechanisms

Designed with a circular, flat bottom feed chamber and a non-restrictive, non-converging product inlet, a slow-speed horizontally rotating conditioning agitator ensures positive flow of product from within the feeder's integral supply hopper and into the feed chamber.

The metering auger is located beneath the flat bottom feed chamber, directly below the conditioning agitator, offset to one side. All areas within the feed chamber and metering auger trough are active; dead zones do not exist and consequently, product stagnation cannot occur anywhere within the feeder. Complete filling of the metering auger with product of consistent density is ensured by the action of the agitator.

With only a few moving parts, Model 170 metering mechanisms have the unique ability to "self-empty"--when permitted to feed until empty, or to "empty-quickly" - when the need to empty the feeder rapidly exists. The latter is accomplished by means of a novel discharge port located in the flat bottom of the feed chamber. Clean-out is extremely fast, simple and complete.

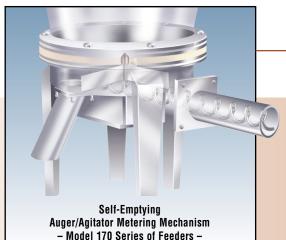
As standard, the Model 170 Series of Feeders utilize two separate drives – one for the agitator and one for the metering auger. The slow speed agitator is usually driven by a

constant speed gearmotor, and the metering auger by a variable speed gearmotor; however, both the agitator and metering auger may be driven by variable speed drives, operating in a proportional ratio (adjustable) to each other.

#### **Optional "Active Hopper" Design**

As an option, based on product handling characteristics, Model 170 Feeders may be equipped with Acrison's exclusive *"Hopper Isolation Pad"*, which allows the feeder's integral supply hopper to become *uniformly active* when a gentle, high frequency vibration is applied to it. In turn, positive flow of even the most difficult-handling products out of the feeder's supply hopper and into the feed chamber is ensured.

For additional information on the Model 170 Series of Feeders, please reference Equipment Data Specifications 1-200-0525.



Model 402-170-2

# **Models 404 Series Dry Solids Weigh Feeders**

# Utilizing Acrison Models BDF-2, BDF-2.5 and BDF-3 Bin Discharger Feeder Metering Mechanisms

These particular model metering/hoppering mechanisms boast optimum versatility and flexibility in metering and hoppering a very broad range of dry solid ingredients. Feed rates range from a minimum of 40 pounds up to about 15000 pounds per hour.

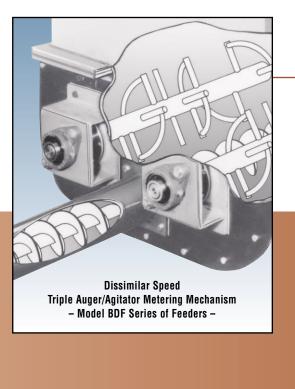
#### Model BDF Metering Mechanisms

The unique design of Acrison Bin Discharger Feeders totally eliminates the converging flow pattern inherent in conical, pyramidal or wedge type bin bottom designs, and/or the severe convergence typical of feed troughs or feed chambers that house the metering auger (or augers) of most dry solids feeders. Opposed multiple auger/agitator action, plus substantially increased gravity flow in the discharge area, combine to ensure a smooth, gentle and unrestricted downward flow of even the most difficult-handling materials into the centrally located metering auger.

The larger augers/agitators not only generate agitation of product within the body of the Bin Discharger, but also, generate progressive internal forces, resulting in opposing vertical vectors in the central area of the unit. The downward vector promotes positive product flow into the metering auger, while the opposite vector produces agitation upwards into the mass of stored product for the promotion of reliable flow. The extent of this upward penetration depends upon the physical characteristics of the product, combined with the design and speed of the augers/agitators.

Mechanically, the two large augers/agitators are normally powered by individual, constant speed, heavy-duty gearmotor drives. The metering auger is driven by a separate variable speed gearmotor.

For additional information on the Models BDF-2, BDF-2.5 and BDF-3 Bin Discharger Feeders, please reference Bulletin 712.



Model 404X-BDF-2



# Models 402 and 404 Series, 405 and 406 Weigh Feeders



# **Weigh Feeder Controllers and Control Systems**

Acrison Weigh Feeder Controllers and Control Systems are universally recognized for their design superiority, unparalleled versatility, ease-of-use and operational reliability. From basic single weigh feeder controllers to multi-feeder supervisory control systems, the technologically advanced designs of these devices, including their cutting-edge software routines, provide users with unexcelled weigh feeder performance to satisfy the most demanding metering requirements across a broad spectrum of applications. With a wide range of options, accessories and interfacing capabilities, these controllers and control systems are also available in a number of different packaging configurations.

#### **Acrison Weigh Feeder Controllers**

For decades, Acrison Weigh Feeder Controllers have provided state-of-the-art performance for thousands of global processors. With leading edge products such as the MD-II-2000<sup>®</sup> and SBC-2000<sup>®</sup> Family of Controllers, these devices, widely recognized for their robust and quality designs, have gained a reputation for exceptional reliability throughout all sectors of the processing industries.

All Acrison Weigh Feeder Controllers will operate in either a continuous or batch mode using internal or external set points, and in master/slave or ratio-proportioning control modes. They are available with a choice of membrane keyboard or graphic touchscreen displays and include multiple languages, recipe storage capability, and a very wide selection of interfacing options (i.e., analog, Bluetooth, digital, wireless Ethernet, infrared, modem, and networking).

#### SBC-2000<sup>®</sup> Family Controllers

Acrison's ongoing investment in research and development continues to result in the evolution of leading-edge controls and control systems, as evidenced by the addition of the Models SBC-2000 CM and DSP Controllers to Acrison's SBC-2000 Weigh Feeder Controller Family. These new, small and powerful devices encompass the latest technologies and functional algorithms, providing users with an unprecedented number of standard and optional features, including native Ethernet connectivity and a single operating program capable of controlling one or more Acrison weigh feeders. In particular, these controllers are ideally suited for those applications that require central computer control with minimal hardware. A variety of keyboard/display options is also available to suit specific user requirements. **Multiple Weigh Feeder Control Systems** 

When combined with Acrison's Acri-Data<sup>®</sup> Supervisory and Control System Software hosted on a wall or desktop-mounted Microsoft<sup>®</sup> Windows<sup>®</sup> Embedded XP Platform, the Model SBC-2000 DSP and/or SBC-2000 CM Controllers form the SBC-2000 MFC Multiple Feeder Control System. This control system, with its color touchscreen, provides the ability to operate and control up to 20 Acrison Weigh Feeders while displaying rapid data and screen updates, and includes master/slave and ratio-proportioning operation, unlimited recipe storage and retrieval, trending, event and alarm logging, automatic shut-down configurability, and more.

User PLC and DCS equipment can also serve as a host for an SBC-2000 Family Controller System.

Reference Design Specifications 1-200-0602, 1-200-0627 and 1-200-113.

All Acrison controllers are certified to UL, CSA and EC specifications.





#### **Discover the difference!** \_

We cordially invite you to witness a test in Acrison's state-of-the-art Customer Demonstration Facilities handling your actual product(s) with the specific equipment we recommend for the application. Usually, there is no cost or obligation for this service.

Discover the difference in technology, quality and performance of Acrison equipment.







#### Acrison products...

- Models 101 and 130 Volumetric Feeders
- Models V101 and V130 Volumetric Feeders
- Model 1015 Volumetric Feeder Series
- Model 105 Volumetric Feeder Series
- Model W105 Volumetric Feeder Series
- Model 120 Volumetric Feeder
- Model 140 Volumetric Feeder Series
- Model 170 Volumetric Feeder Series
- Bin Discharger Feeders
- Model 200 Series of Weigh Belt Feeders
- Model 203B Series of Weigh Auger Feeders
- Model 270 Series of In-Line Weigh Feeders
- Models 402, 404, 405, 406 and 407 Series ("Weight-Loss-Differential") Weigh Feeders
- Model Series 403 ("Weight-Loss-Differential") Weigh Feeders
- Model 403B(D) Batch/Dump Weighing Systems
- Model 404BZ(BU) Bulk Bag Unloader Batch Weigher
- Models 350 and 301 Continuous Blenders and Blending Systems
- Multiple Auger Bin Dischargers and Multiple Auger Bin Discharger Hoppering Systems
- Vibratory and Flat Bottom Bin Dischargers
- Model 500 Series of Polyelectrolyte Preparation Systems
- Water and Waste Water Treatment Systems
- Volumetric and Gravimetric Feeder Controllers and Control Systems
- Accessory Equipment for Acrison Products
- Systems Engineering

#### "Visibly Different... Measurably Better"



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