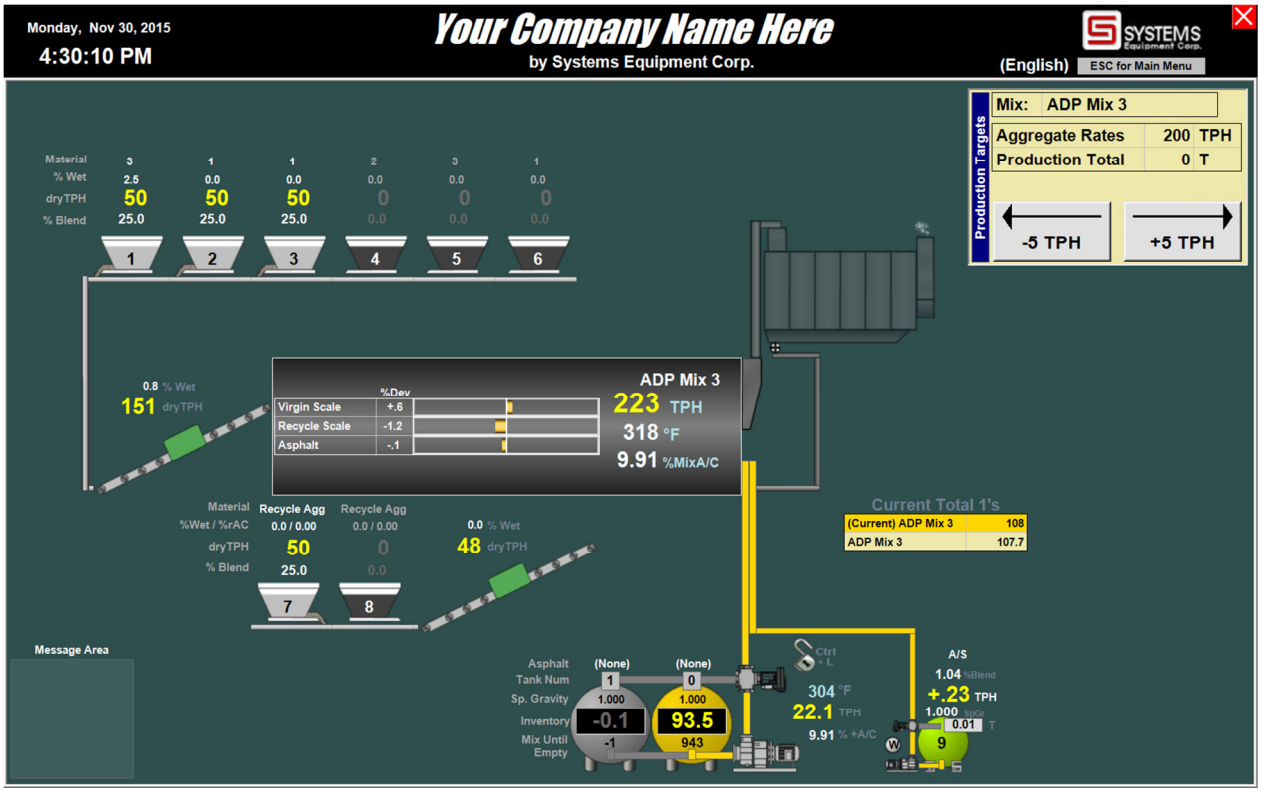
SYSTEMS
Equipment Corporation

ADP100.09 | Graphical User Interface Package (GUI)



Designed to provide a user friendly, graphically enhanced user interface for the Asphalt Drum Mix Control System which connects to the ADP-100 with a single high speed serial cable.

- GUI utilizes Windows® operating system with SYSTEMS' standard ADP-100 text based interface included as a backup option in the unlikely event of PC failure to minimize down time.
- Displays meaningful plant information in both text and graphics based formats.
- Alphanumeric capability allows feeders and asphalt tanks to be labeled with the actual names of the material they contain and mix formulas to have logical names.
- Using the mouse, the operator can point and click on plant equipment images to directly access detailed operational, calibration, and setup data relative to that plant equipment.
- Operators can navigate through the various displays and procedures using the mouse or they can use the PC's function keys and menus in exactly the same manner as is used in the standard text based interface.
- Although not necessary for operation, two flat panel displays can *optionally* be provided to display both the standard text based display and the Windows® based display simultaneously.

- The graphics user interface package allows for a wide variety of useful enhancements that can easily be added without requiring a service call.
- Automatic backup and zero-day restore feature.

ADP-GUI Hardware .....

- Industrial grade, fanless PC with solid state drive, mouse, keyboard, and serial communication ports.
- 10 feet of serial interconnect cable to connect ADP-GUI to users' ADP-100. Serial extensions are available upon request.

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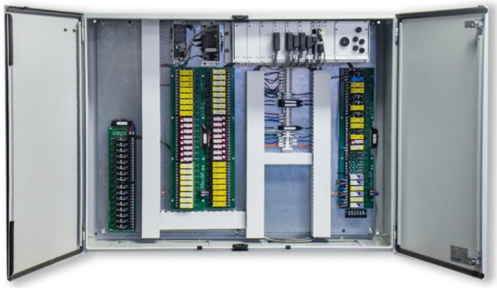
ADP-100 | Asphalt Drum Mix Process System



Designed to proportion aggregates and additives according to prescribed mix design formulas, and to measure and control the liquid asphalt mass flow rate, so the blends are accurately interlocked to the measured aggregate flow.

NOTE

Features and their required interface modules are priced and included according to the user's actual requirement as specified in this proposal's Price Summary section.

Available features include:

Weighbridge Totalizers .....

CAUTION!

The blending results obtained with process control systems can be no better than the signals acquired from the conveyor belt scales. The user is cautioned to carefully examine the conveyor, weighbridge, and any associated signal conditioning amplifiers to determine that these components are at least as state of the art as the process control system. New, high accuracy, high stability scale components are available from **SYSTEMS** if replacement is indicated.

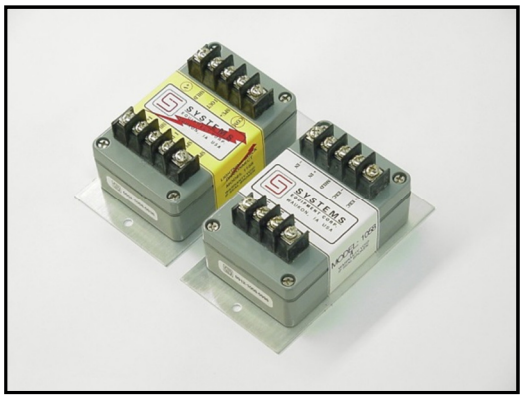
- Integral virgin and recycle aggregate totalizers compatible with SYSTEMS' high stability, high precision, direct-connection weighbridge loadcell amplifier, or with users' stand-alone voltage, current or frequency output belt scale conditioner.
- Operator selected aggregate measurement by the aggregate scales, or optionally and only as a backup, volumetrically by target production rates.
- Moisture correction is automatically calculated from the blend specified in the target mix formula and the individual feeder moistures installed by the operator, or the operator can elect to enter a single moisture value equal to his calculation of the average combined moisture of total aggregate crossing the belt scale.
- Moisture calculations can be based either on the percent of wet material or on the percent of dry material as may be required by the governing specification or agency.

- Measured aggregate rates are constantly compared to the properly time delayed operator entered volumetric target rate and differences are displayed. Deviations from zero can only be attributed to incorrect moisture setting, equipment failure or calibration errors. User defined alarms and shutdown limits are provided.
- Operator entered scale damping and threshold values—the threshold value is automatically disregarded whenever the feeders are supplying material to the scale according to an operator entered mix formula.

- Operator selected weighbridge zero trac provides a continuous, unattended, tracking zero adjustment.
- Single or multi-point scale calibration is available. The multipoint (zero, low, mid & high rates) calibration is suggested for scales with wide operating ranges or very high accuracy requirements.

Direct Connection Weighbridge Loadcell Amplifier(s) .....

- External belt scale loadcell amplifiers/totalizers are not required, and may be removed and discarded. SYSTEMS Integral Totalizer comes with equipment mounted, high stability, high precision, loadcell pre-amplifier and SYSTEMS proprietary *Lightning Quick Disconnect*.
- Loadcell, loadcell amplifier and belt scale speed pickup are automatically disconnected electrically from the control center whenever the ADP-100 is turned off. This disconnect protects against lightning induced transients of up to 1500 volts.



Optional Asphalt Tank Monitoring and Inventory .....

- Operator entered asphalt product name and specific gravity for each asphalt tank.
- Differences between the liquid product defined in the current mix formula and specified in the selected tank are annunciated.
- Tank inventories are maintained for each tank. Provision is made for entering liquid unloaded into the tanks.
- A "mix to go" total is displayed for the tank in use.

Liquid Asphalt Blending

- Asphalt delivery rate established by low voltage potentiometric control compatible with DC, VFAC, and Eddy Current variable speed drives or asphalt rate control by 110-volt INCREASE/DECREASE drive outputs fully compatible with Honeywell modulating valve, Blackmer style variable displacement asphalt pump, or AESCO or BITUMA style hydrostatic variable speed pumps.
- INJECT control output and provision for monitoring separate RUN and DIVERT limit switches.
- Continuous asphalt temperature display utilizing customer's asphalt temperature probe.
- Direct interface to all asphalt meters. Pulse output meters should have an output of greater than 100 pulses per gallon.
- Automatic temperature compensation of volumetric meters to 60°F. The asphalt meter is compensated to its displayed temperature reading. If asphalt temperature is not being read automatically it may be entered by the operator. Mechanical temperature compensators such as used in the Broodie stackup can be removed and discarded. Separate electronic interface cards such as provided with DigiFlo meters are not required and may be removed and discarded.
- Asphalt blend interlocked to virgin aggregate scale delayed by the actual scale to point of asphalt injection process delay.
- Asphalt blend interlocked to recycle aggregate scale delayed by the actual scale to point of asphalt injection process delay. This interlock maintains the desired asphalt content in the total mix, regardless of the uniformity of the aggregate flow from the recycle bin.
- Operator set asphalt recirculation rate.
- Operator set asphalt inject/divert delay interval minimizes the problem of uncoated reject material on plant startup and shutdown.
- Asphalt use totals maintained separately for each mix formula.
- Operator preset asphalt deviation alarm. Frequency of alarm can be printed as part of the periodic recordation.

Aggregate Proportioning

- The ADP-100 computer is capable of controlling feeders powered by DC, variable frequency AC, or Eddy Current electronic drives OR by mechanically variable speed drives, such as those manufactured by Graham, Reeves or others. Material can be proportioned by volume, and for some feeder configurations, by weight.

Material Proportioning by Volume

- The control of all aggregate feeders is properly time delayed to mimic the actual material transport delays.
- All aggregate feeders are provided with a rate control output, tachometer input and low aggregate input interface. A RUN control output is optionally available, and may be required by some drives.
- Low aggregate alarm provides both visual and audible indication of loss of aggregate flow.
- A user set tolerance alarm provides visual and audible indication of any condition during which the drive cannot reach its target rate.
- Multiple use virgin/recycle feeders can optionally be provided. With this option the operator can specify which aggregate scale will measure the feeders output so that the displayed scale errors and alarms will be correct.
- Feeder speed is computer controlled based on delivery rate as measured by tachometer. If a tachometer is not available or operational a DC, VFAC, or Eddy Current feeder drive may be controlled, in an open loop fashion, based on the speed/volumetric rate relationship established at calibration between the desired feeder output and its control setting.
- An assisted calibration screen is provided to allow the operator, during production, to view and optionally correct the feeder's open loop control calibration to the rate measured by the tachometer or other metering device.
- Single or multipoint feeder tachometer calibration is available. Multipoint calibration is suggested for mechanically stable feeders with wide operating ranges or very high accuracy requirements.
- With the multipoint feeder option, a single calibration procedure is available to automatically run the selected feeder at 3 entered rates, measure the resultant material crossing the aggregate scale belt and from that measurement, calculate and install the corresponding 3 point calibration values.
- A single evaluation procedure is available to automatically run any selected feeder at 3 entered rates, measure the resultant material crossing the aggregate scale belt and from that measurement, evaluate the accuracy of the current calibration values. An error report of the 3 point evaluation will be printed.
- A feeder "cleanout" procedure is provided to allow individual feeders to be directly turned on or off at 100% of full speed. Any accumulated production totals are not modified during this operation. No asphalt will be injected during or as a result of this operation.

Feeder Rates Measured by the Recycle Scale

- A single recycle feeder may be operated volumetrically or may be interlocked to the recycle scale. When interlocked to the recycle scale, a control technique called a Smith Predictor is employed to provide a smooth, rapid, and continuous feeder rate correction while accommodating the substantial feeder to scale process delays.
- If a low aggregate alarm input is available, the computer will utilize this signal to prevent feeder overspeed during recovery from bin empty conditions by stopping any further correction of the feeder output until the low aggregate condition is no longer sensed.
- An assisted calibration screen is provided to allow the operator, during production, to view and optionally correct the feeders open loop control calibration to the scale reading.

Recycle Trap Feeder with Gate Controlled Feed Rate

- A single recycle feeder is available whose delivery rate is controlled by the open/closed position of its feed gate. The feeder rate is measured by and interlocked to the recycle scale. A control technique called a Smith Predictor is employed to provide a smooth, rapid, and continuous feeder rate correction while accommodating the substantial feeder to scale process delay.
- If a low aggregate alarm input is available, the computer will utilize this signal to stop any further correction of the feeder output until the low aggregate condition is no longer sensed.

Feeders with Scales mounted directly in the Feeder Assembly

- Feeders with integral belt scales may be operated volumetrically or may be interlocked to the delivery rate as measured by the feeder's weigh bridge and tachometer. Individual totalizers with equipment mounted, high stability, load cell preamplifier and SYSTEMS proprietary *Lightning Quick Disconnect* are provided for each scale.
- Assisted and prompted multipoint scale calibration procedures are provided.
- An assisted calibration screen is provided for use with feeder scales to allow the operator, during production, to view and optionally correct the feeder's open loop volumetric control calibration to the measured scale rate.

Feeders with Scales in the Collector Belt

- Feeder #1 may or may not have its own collector scale. Most often this feeder is interlocked to the Virgin Aggregate scale. This feeder's measured rate is then calculated from the Virgin scale rate minus the appropriately time delayed sum of the rates of all other virgin feeders.
- Feeders with individual collector scales may be operated volumetrically or may be interlocked by the operator to the feeder's scale located in the cold feed collector belt. When interlocked, the feeder is controlled to the delivery rate as measured by the feeder's scale minus the appropriately time delayed rates of all previous feeder outputs.
- While interlocked to its scale, a control technique called a Smith Predictor is employed to provide a smooth, rapid and continuous feeder rate correction while accommodating the feeder to scale process delays.
- Individual totalizers with an equipment mounted, high stability, load cell preamplifier and SYSTEMS proprietary *Lightning Quick Disconnect* are provided for each scale. Collector Scale Totalizers include ZeroTrac, and are provided with assisted and prompted multipoint calibration procedures.
- If low aggregate alarm inputs are available, the computer will utilize these signals to prevent feeder overspeed during recovery from bin empty conditions by stopping any further automatic correction of feeder output until the low aggregate condition is no longer sensed.
- An assisted calibration screen is provided for use with feeder scales to allow the operator, during production, to view and optionally correct the feeders open loop control calibration to the actual rate as measured by the scale.

Feeders with Mechanical Variable Speed Drives

- Feeders controlled by increase/decrease commands can be provided. Feeder speed is adjusted to maintain the desired target rate as measured by tail shaft, motor, or gearbox mounted tachometer. A proprietary technique increases the filtering applied to the rate measurement as the bin approaches the desired speed. This adaptive filtering provides smooth and responsive speed control and minimizes 'hunting' and the excessive wear that control hunting creates on the mechanical speed control components.

Dust Metering Systems

- A **Phantom Dust Loss** feeder can be provided, so that when baghouse dust is wasted, the operator can enter an estimate of the percent dust wasted and the measured aggregate value will be appropriately adjusted to reflect this estimated loss. When used together with dust loss metering equipment, such as a Mel Pod, the user may specify that the aggregate flow rate continuously be corrected by the amount lost as actually measured, or alternatively be corrected by the estimated percent dust loss entered in the mix formula.
- **Depletion Weigh Pod** metering system complete with equipment mounted, high stability, loadcell preamplifier, SYSTEMS proprietary *Lightning Quick Disconnect*, and 110-volt pod 'fill' control output. The user may specify that the dust feeder output be corrected by and interlocked to the actual amount as measured by the depletion weigh pod metering system, or alternatively and as a backup, be corrected by the feeder tachometer or control setting estimate. User established error limits and plant shutdown intervals are provided.
- **Weigh Auger** metering system complete with equipment mounted, high stability, loadcell preamplifier and SYSTEMS proprietary *Lightning Quick Disconnect*. The measured dust delivery rate is displayed in TPH and as a percent of aggregate. A delivered material total is accumulated. The user may specify that the variable speed auger output be corrected by and interlocked to the actual amount lost as measured on a continuous basis by the dust metering system, or alternatively and as a backup, be corrected by the feeder tachometer or control setting estimate.
- **Depletion Silo** metering system complete with equipment mounted, high stability, loadcell preamplifier, and SYSTEMS proprietary *Lightning Quick Disconnect*. The user may specify that the silo's feeder output be corrected by and interlocked to the actual amount as measured by the silo loss in weight or alternatively and as a backup be corrected by the feeder tachometer or control setting estimate. User established error limits and plant shutdown intervals are provided.
- **'Mel' Pod** metering system complete with equipment mounted, high stability, loadcell preamplifier, SYSTEMS proprietary *Lightning Quick Disconnect*, and 110-volt pod 'dump' control output. Dust from the baghouse is continuously delivered to a 'Mel Pod' and this delivery rate is calculated from the pods increasing weight. When full, the pod rapidly empties its contents to a storage silo. The Phantom Dust Loss feeder can be interlocked to this measured amount so that the asphalt added to the measured aggregate is correct for the amount of material lost.
- **Metered Leveling Pod** complete with equipment mounted, high stability, loadcell preamplifier, SYSTEMS proprietary *Lightning Quick Disconnect* and baghouse synchronizing input. Dust from the baghouse is continuously delivered to the leveling pod. A variable speed vane feeder at the bottom of the pod continuously feeds material back to the mixer. Feeder speed can be automatically controlled to maintain a constant average measured pod weight . The measurement of the average pod weight is synchronized to the baghouse cleaning cycle to minimize the time interval required to obtain an accurate measurement.
- **Volumetric Leveling Pod** controls the variable speed van feeder to more uniformly return baghouse dust to the mixer. Pod *Full* and pod *Empty* limit switch annunciator inputs are available.

- **Impact Flowmeter** system with equipment mounted, high stability, loadcell preamplifier and SYSTEMS *Lightning Quick Disconnect*. The flow of fines is continuously measured and this measured flow rate and totals displayed. For systems where the fines flow rate is controlled by a variable speed feeder, the feeder speed can be interlocked to the flowmeter to automatically maintain a desired flow rate.
- For all measuring systems, the total mix rate will be algebraically corrected for material not measured by an aggregate scale so the asphalt content will be correct for the actual amount of aggregate in the final mix.

Liquid Additives

NOTE

Various additive controls are available and may easily be added at a later date. Typical additives include: liquid anti-strip, lime, rejuvenator, water, sulfur, latex, and crumb rubber.

- Liquid additive feeder control interlocked to the delivery rate as measured by the tachometer or pulse output meter. If a tachometer or a suitable meter is not available or operational, the feeder output may be controlled in an open loop fashion, based on the speed/volumetric rate relationship established at calibration between the desired feeder output rate and its control setting.
- Material not measured by an aggregate scale will be algebraically added into the total mix.

Mix Formulas and Material Constants

- Twenty (20) mix formulas with user specified % blend, target % AC, a description of the desired liquid asphalt, and optionally an 8-digit job mix formula number. With the tank sensing option, differences between the asphalt specified and the asphalt in use are annunciated.
- A Phantom Dust Loss Feeder allows the operator to enter an estimate of the percentage dust loss.
- Individual moistures may be entered for each aggregate. Combined scale moistures can be automatically and continuously calculated, based on these entered values and the blend as defined by the target mix formula. Optionally, the user can elect to enter a single value equal to the average combined moisture of total aggregate crossing the scale.
- Specific Gravities may be entered for all liquid additives.
- The percent reclaimed oil for each recycle feeder can be entered by the operator. The percent reclaimed oil for the combined recycle aggregates is automatically and continuously calculated based on these entered values and the blend of aggregates as defined by the target mix formula.
- Mix produced, asphalt and feeder use totals are maintained, displayed and printed for each formula.
- Both resettable and non-resettable aggregate scale and feeder material use totals are displayed and can be printed.

Burner Fuel

- An analog or pulse input is available for measuring burner fuel flow rate. A suitable meter is required.
- A total of fuel used is maintained.
- A heating efficiency value, i.e. Gallon per Ton of Mix, is calculated and continuously displayed.

Silo Loadout.....

- An output at one (1) pulse per ton of mix produced is provided to the user's loadout computer system.

Data Recordation / Graphical Analysis / Data Archival.....

- Full feature data recordation printer.
- Direct screen print of all calibration values/displays.
- Operator defined automatic print interval. On-demand print selected with a single keystroke.
- Operator defined data format including: time/date, mix #, mix rate and temperature, % AC, AC temperature and rates, moistures, totals, measurement method, and error occurrences of each scale, meter, and feeder.
- Operator selected hardcopy record of each scale calibration run, including conditions and results. Record includes time and date stamp, current calibration constants, conditions of the test, results of measurements made, user entered actual totals, and an error analysis of the results.
- Automatic Illinois 6-minute scale calibration test/printout—used with scale test weights, this procedure measures, displays, and prints the average scale rate and totals accumulated over a 6-minute timed test interval.
- New York FIB recordation—records the positions of the automatic/manual feeder, safety interlock, and blend switches. (Switches provided by others.)
- Print spooling—printer access does not interfere with any control or measurement function.
- *Optional* data link allows the processor to share data with other systems. Data transmission over the data link is completely transparent to the user, and does not interfere with plant operation.

Calibration Features.....

- Single calibration entry for each piece of connected equipment. With single entry calibration, there is never any discrepancy between the measured and displayed value, the value used in determining blends, and the value used for recordation.
- No internal screwdriver calibration/setup adjustments are needed or provided. With exception of the data storage memory chip itself, all components can be replaced with only minimal effect on system calibration.
- Computer assisted and prompted temperature, weighbridge, asphalt meter and feeder calibration procedures with user selected printout of test results.
- Pop-up, on screen error calculator for accurate and consistent error analysis.

- Pop-up on screen 'Minnesota Spot Check' interval totalizer of mix produced, asphalt added, asphalt reclaimed, and total asphalt in the mix produced. Start and stop of the production accumulation interval is controlled by the user. This data is automatically logged to the printer at the end of the production interval. When compared to actual material shipped or measured asphalt used during the same time interval, this data may provide some assurance of accurate equipment calibration and operation.
- With the multipoint feeder option, a single calibration procedure will automatically run the selected feeder at 3 entered rates, measure the resultant material crossing the aggregate scale belt and from that measurement, calculate and install the corresponding 3 point calibration values.
- A single evaluation procedure will automatically run the selected feeder at 3 entered rates, measure the resultant material crossing the aggregate scale belt and from that measurement, evaluate the accuracy of the current calibration values. An error report of the 3 point evaluation will be printed.

Operational Features

- Operator entered target rate, mix#, asphalt recirculation rate, and target production total. Target rate can be increased or decreased in 5 TPH increments with a single keystroke. A visual and audible alarm signals production exceeding the target total value.
- Interlocked with the process for hands off loaded start/stop operation.
- English or metric units of measurement selected by the operator. All in-process totals and all calibration values are automatically adjusted to the units chosen, so the operator may switch between units of measure, *even while making mix*, without the need to recalibrate, and without the loss of any production data.
- Operator entered process delay intervals for precise computer control of asphalt injection, divert timing, and feeder sequencing. All computations and controls are based on appropriately time-delayed signals that mimic the actual material transport time delays.
- Operator specified deviation alarms and process shutdowns.
- Watchdog timer alarm output monitors and annunciates any unexpected computer failure.
- Divert valve position and error conditions are continuously monitored and annunciated.
- Multi-tasking—all features available, even while the plant is under computer control.
- Rapid updating—all data is processed and displays are updated every second.
- Interrupt driven—provides N key rollover for fault free data entry, and precision timing for accurate and stable measurement of rates and totals.

ADP-100 Hardware / Characteristics

- All calculations are performed in nine-digit floating point format.
- Fully integrating analog data conversion with greater than +/-0.002% precision.
- No mechanical disk drives required.
- Readily expandable to include or control additional equipment or features. Plug-in modular direct interface to most motor controllers, meters, scales, and probes.
- Oki Data Model 320 Printer—dot matrix parallel printer for ease of replacement.
- Data entry keypad with parameter and asphalt divert valve key locks.

System Packaging

- Computer is typically packaged in 30" H x 39" W x 15" deep NEMA 4/12/13 wall mounted enclosure or other sized enclosure based on user's configuration—(larger enclosure for 8+ feeders is 30"H x 40"W x 12"D) containing computer, power supply, and all input/output interface modules. Enclosure provides a gasketed dust tight seal. No external ventilation or internal fan is required or utilized. Other packages are available as may be required by the application.
- Data display, keypad, and printer are supplied as individual components that can be located remotely from the computer. All necessary interconnecting cables to these components are supplied by SYSTEMS.
- User is to provide a separate line stabilized 110 VAC 15-amp circuit for the computer, printer, and display.