OCTAMATIC
ELECTRONIC SYSTEMS DESIGN
A Business Unit of The Protectoseal Company

On-Line & Laboratory Analyzers for the Determination of Octane Number Using the Falling Level Method

(Conforming to ASTM Standards: D2699, D2700 & D2885)

ON-LINE OCTANE ANALYZER SYSTEM

This fully automated analyzer uses multiple fuel bowls, eliminating the need to flush between determinations. Proto fuel is reduced by up to 60%, a substantial cost savings.

The On-Line Octane Analyzer System is used in conjunction with your Waukesha CFR test engine. This analyzer is particularly appropriate for larger refineries where there is little or no time to stop production and make batch corrections to the blend.

Sample fuel is drawn directly from the flowing production stream. A supply of comparison reference fuel (prototype or proto fuel) is also provided. These fuels are conditioned according to ASTM Standard requirements and are delivered to the analyzer and the engine. The octane number of each fuel is determined, and the system reports continuously on the difference in octane number between the production fuel and the reference fuel (ASTM D2885 - Standard Test Method for Determination of Octane Number of Spark-Ignition Engine Fuels by On-Line Direct Comparison Technique).

The basic analyzer includes six fuel supply bowls. These are filled, analyzed, emptied and refilled automatically by the system, in appropriate sequence, to provide the desired information.

Determination of the octane number is accomplished by using the Falling Level Method, known as the Dynamic Level Method in ASTM D2699 and ATSM D2700. Each fuel bowl is filled, and empties as fuel is consumed by the engine. As the fuel level decreases, the changing fuel / air ratio (rich to lean) produces a knock intensity (K.I.) and back to a low knock condition. By comparing the peak value to that of a known fuel (prototype) the delta octane number can be calculated. With this technique, the need for moving the cylinder height and/or needle valve control during rating is eliminated.

This analyzer is based upon using a central computer(s) to handle as many engines as are required. In order to run multiple engines, a multi-user operating system is supplied.

FEATURES INCLUDE:

General:

- Reduces octane giveaway that affects profitability.
- With properly maintained engines, a standard deviation of 0.08 (MON) and 0.06 (RON) can reasonably be expected. This translates to significant blending cost reductions. Allows blending and certifying directly to the pipeline.
- ASTM D2885 compliant.
- Analysis updates every four minutes.
- Blend directly to pipeline accurately and reliably.
- Process control signals (delta O.N., K.I., data-valid, alarm, others) to the main blending computer.
- Runs tests on multiple engines simultaneously. ESD has installed systems with up to 14 engines.
- Use of proto fuel will be reduced by as much as 60% from your present practices as we only draw fuel to top off the proto bowl after a peak determination. The remainder of the time, the proto line is closed. This will reduce the frequency of preparing tanks with proto fuels.

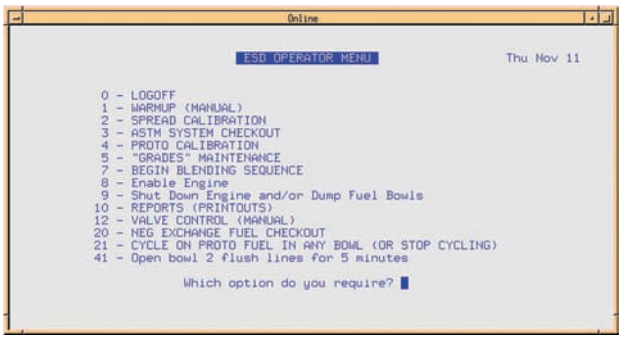
FEATURES INCLUDE: (continued)

General:

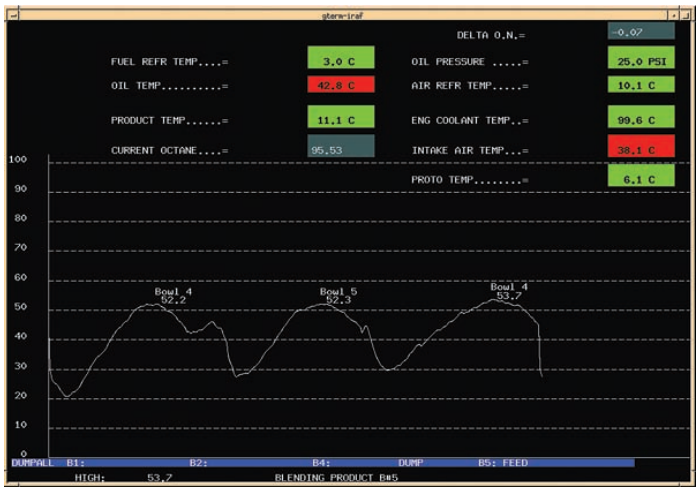
- Each engine has its own terminal from which the operator initiates the blend analysis.
- Minimizes operator transcription errors (all data is handled by computer).
- The operator and/or supervisory personnel also use engine terminal for proto calibration and ASTM checkout procedures.
- Proto calibration, ASTM system checkout, quality control analysis all included.
- Far superior testing of octane than manual means.
- No moving parts, increasing reliability.
- Always finds correct fuel / air ratio for maximum knock.
- Frees operator from continual fuel / air adjustment.
- Provides the ability to trim the blend to take advantage of changing component values and inventories, and real time feedback of blend quality.
- With backup computers and stock spares, time to transfer control to backup computer is minimized.
- Minimum downtime via redundant cold backup server.
- Includes automatic temperature control based on digital temperature and input monitoring for air intake and mixture temperatures for all engines.
- Water-cooled aluminum block brings fuel temperature down to ASTM requirements.
- Multiple product bowls speed up analysis as one bowl is being dumped and filled, the other is being analyzed.
- Two bowls dedicated for product, one for proto fuel, one for quality control check fuel.
- Each bowl is equipped with fill, dump and engine feed solenoids. Product bowls also have bypass solenoids.
- Stainless steel sonic level sensors assure repeatable fill levels.
- Manifold solenoids with fuel and additive resistant seals assure long life.
- Top cover on bowl reduces evaporative losses.
- Bowls swing out of way quickly, giving access to the engine for maintenance.
- Minimal maintenance; can be accomplished by in-house personnel.
- Delivers customized hardware and software.

Software & Programming:

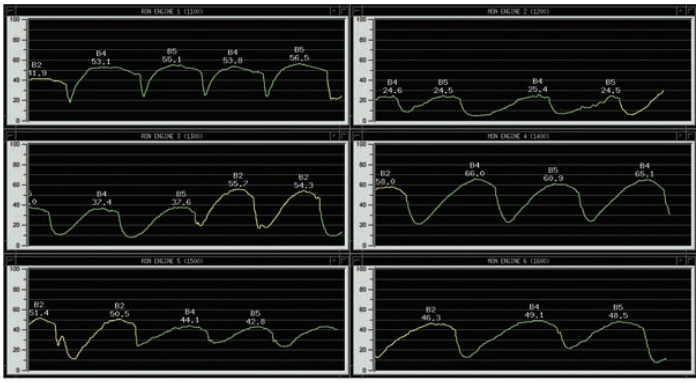
- An interactive screen program through which the operator, at the engine, enters the variables of the blend to be analyzed, i.e., type of fuel to be made, and the blend size. All other factors are stored in the system and can be changed under a supervisory menu. Examples: proto fuel to be used, number of cycles of product per cycle of proto. This reduces the probability that the operator will enter something in error.
- Application programs written in DecisionPlus and C++ to operate the system at each engine.



- A menu which lists the supervisory programs. These include, but are not limited to, features that are not normally available to the operator, such as performing spread calibration, proto rating, ASTM qualification, NEG rating, proto tank record maintenance, system parameter settings, system calibrations, records management, and running historical reports (ASTM checkout, proto rating, blend files, spead cal runs, NEG history, SQC history). The system keeps a complete history of all activities listed above that have been performed since installation.
- A continuously running scanner program to read and control all the analog and digital signals at high speed.
- A moving average is maintained on all variables resulting in precise, noise-free data acquisition.
- Software to communication with Modbus interface to refinery blend computer.



On-line computer updates the analysis every four to five minutes, providing a continual stream of reports.



Remote display in blender control room showing all running curves from six engines.

FEATURES INCLUDE: (continued)

Hardware:

- Mounted at each engine is a stainless steel instrument cabinet with viewing window. This contains signal conditioner modules for knock signals, RTD temperature sensors and oil pressure.
- The console includes two computers, each having a dual mirror hard drive and dual power supplies. The second computer is a cold backup; minimal time to transfer control to backup computer. The main control console may be located anywhere within 500 ft. of the engine room.
- Includes UNIX-based system for high reliability, reduced costs and ease of expansion.
- 300 gigabyte RAID hard drives for program and data reliability.
- Color printer for reports.
- Uninterruptible power supply for entire system.

Engineering & Installation:

- Professional installation and startup will be performed by Electronic Systems Design field engineer(s). Optionally, a software engineer may also be on-site, if needed, during startup and commissioning. (This will be determined on a site-by-site basis.)
- Operator and supervisory training is included, which will be done during the installation phase. Our policy is to stay on-site until the project is complete and the customer is satisfied that all training has been done and everything is working properly. If there is a problem during the first twelve (12) months that your staff cannot resolve, we will make a return trip at no charge.

Comprehensive Report Generation:

- Blend History Report
- System Configuration Reports
- Proto Tank Definitions Report
- Pre-Blend Checkout Report
- ASTM Checkout Report
- Proto Rating Report
- Historical Pre-Blend Checkout Report
- Current Spread Table
- Historical ASTM Checkout, Proto Rating and Spread Run Reports
- NEG Exchange Fuel Rating Report
- Graphs of Blend Results: delta O.N., proto K.I.
- Alarm Log Report per Engine
- Detailed Log of Internal System Operations

Engine Parameters:

ESD Octamatic Systems typical monitor the engine parameters shown below and are delivered with alarm and warning limits consistent with the relevant ASTM specifications. These limits are easily changeable by the customer.

- Oil pressure
- Intake air temperature
- Fuel refrigerant temperature
- Proto & product fuel temperature
- Air refrigerant temperature
- Mixture temperature (MON)
- Oil temperature
- Knock intensity (K.I.)

Optional measurements that are often specified:

- Humidity
- Oil pressure (switch)
- Water level (switch)
- Condenser temperature
- Barometric pressure
- Water pressure (switch)
- Product pressure (switch)

Alarms & Warning Limits:

Alarms are considered more serious than warnings: the occurrence of an alarm required corrective action before measurements can continue. Warnings and alarms are displayed to the operator and must be cleared by the operator. In addition, some alarms act as a backup to the safety system provided by the engine manufacturer. The following engine conditions will trigger engine shutdown:

- Coolant temperature over 220° F.
- Oil pressure under 20 PSI
- Low oil pressure switch (optional)
- Low water pressure switch (optional)
- High coolant temperature switch (optional)
- QC bowl became fuel during blending (indicates level sensor failure)

Other warning conditions:

- Excessive proto drift from previous proto measurement
- Any temperature out of operating limits
- Rate of change of delta O.N. too large
- Out of fuel warning
- Delta O.N. out of user-specified range
- Product pressure low (optional)

Other alarm conditions:

- Oil pressure out of operating range
- Product O.N. out of range
- No peak K.I. found after two attempts
- Proto K.I. over 80 or under 20
- Product K.I. over 99 or under 10
- Any abnormal exit from blending screen

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