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# **8200 Analyzer**

## **Operational and Technical Overview**

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## 1.0 Introduction

This document is intended to give managers and users a brief overview of the Refinery Systems Division model 8200 octane analyzer. It summarizes the system's features, the computer technology leveraged, console operation and the blender interface. For additional information please consult the 8200 Operations Manual.

## 2.0 Features

The model 8200 analyzer is the successor to the models 8195 and 8154. The 8200, when used in conjunction with a CFR™ research or motor method engine, automatically determines the quality of in-line blended gasolines. Octane analysis can be performed by either the knock intensity or the compression ratio approach as defined by ASTM D2885. The analyzer console replaces the engine console desk which conserves floor space and a model 8200 would be required for each CFR knock test engine.

- √ **Compliant with the latest ASTM D 2885 Method** - Since Core Laboratories Refinery Systems Division is an active member of ASTM, the model 8200 analyzer is continually updated as the ASTM D 2885 method evolves.
  
- √ **Automated Fuel to Air Ratio Determination** - Independent prototype and line maximum knock fuel/air is determined and held constant thereby enabling the engine to operate in a stable condition at the optimum ratio.
  
- √ **Simple, User Friendly Computer Operations** - The analyzer utilizes a graphical user interface and touchscreen to view live data, navigate the analyzer system and control all analyzer operations.
  
- √ **Provides Necessary Engine/Analyzer Functions** - The model 8200 includes; ASTM compliant D 2885 blending, prototype tank calibration, system qualification checkout routines and analyzer calibration procedures.
  
- √ **Includes Rugged Engine Hardware** - Provided are; modern analyzer enclosure, fuel position verification and easy access to internal components. Also included are a microvalve and spill tower carburetor, fuel heat exchanger and fuel junction assembly with fuel pumps and solenoids.
  
- √ **Closed Loop Blend Control** - The model 8200 performs delta octane calculations on a four minute cycle (configurable). The delta octane number is communicated to the blender as either a delta (proto or target) or absolute octane number, enabling closed loop control and volumetric blend octane determination.

- √ **Easy Maintenance** - A pull-out drawer allows access to the analyzers internal components. The modular design allows for easy replacement of failed parts. The model 8200 utilizes state-of-the-art electronics.
  
- √ **Built-in Diagnostics** - Troubleshooting is performed via a graphical user interface with direct access to analog and digital signals and control.
  
- √ **Alarm Monitoring** - Available alarms include: low condenser water level\*, low and high knock intensity limit, fuel drain overflow\*, fuel switching verification and microvalve limit.

\* The alarm causes engine shutdown.

### 3.0 Analyzer Technology Overview

The model 8200 utilizes an industrial touchscreen computer for display and input via the operator interface. The computer also performs analog and digital control over a RS-485 communications line to the analyzer's SNAP I/O™ hardware. Reports, trending and printouts are performed by the industrial touchscreen computer.

#### 3.1 Modular I/O Hardware

The modular I/O hardware provides delta octane (typically 4-20mA) output and synchronization with the blend control system. In addition, the digital I/O (typically dry contacts) provides alarm and analyzer state information as well as remote control of blend monitoring and fuel/air ratio search initiation.

#### 3.2 Engine Requirements

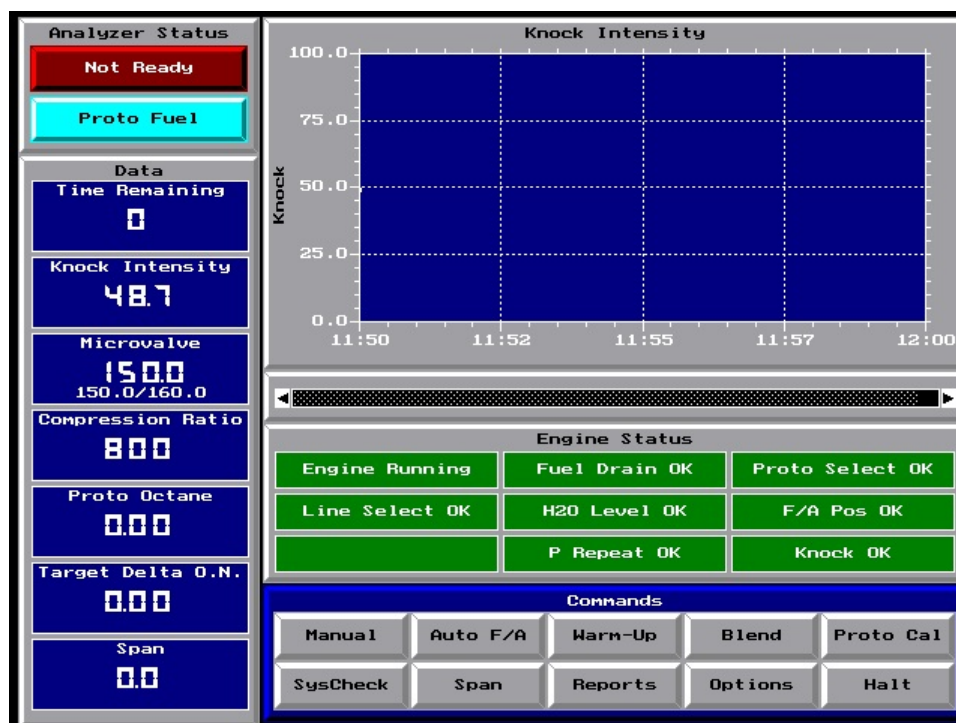
The 8200 analyzer utilizes a CFR engine with the following requirements; ASTM 2699 / 2700 compliant, detonation meter Model 501-C or 501-T, standard enclosed engine console, electronic ignition system and a compression ratio change motor.



## 4.0 Console Operation

### 4.1 Graphical User Interface

The 8200 interface provides a graphical view of engine parameters and the system state. Trending is configurable for various engine parameters. Analyzer alarms are shown in green or red depending on the state of the alarm.



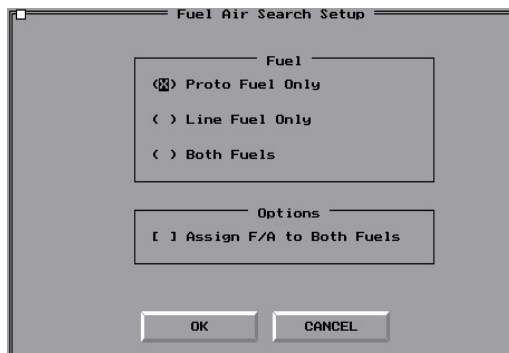
The touchscreen allows for simple menu driven navigation via command buttons and data entry via a calculator style keypad.

### 4.2 Manual Control

Manual control of the analyzer is available through the manual interface. This interface allows for fuel switching, continuous pump operation and control of the variable analyzer components along with graphical meters displaying current instrument values.

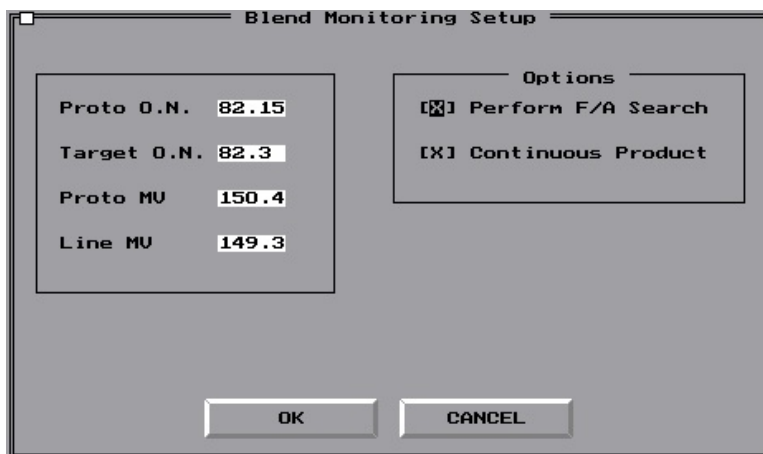
### 4.3 Automated Routines

The analyzer system provides automated routines such as the System Calibration routine which determines the span characteristics required for octane number calculations, Fuel Air Search routine for optimum microvalve fuel/air positioning and a warm up routine used at engine startup.



#### 4.4 Blend Configuration

Blend monitoring is initiated by selecting the *Blend* button and entering the following; the Proto O.N. is the octane number is the calibrated octane in the prototype storage tank. The Target O.N. is the desired blend batch octane number. The Proto and Line MV are the microvalve positions for the determined maximum fuel to air ratio. Options allow for an automated fuel air search to be performed as part of the blend start and continuous product flow in order to obtain the most recent sample from the blend header.



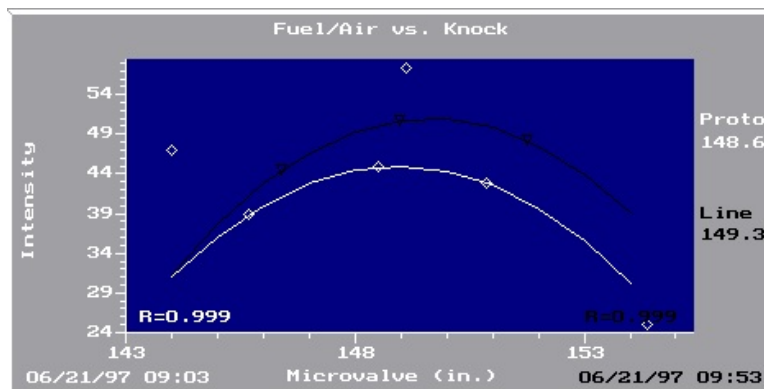
The image shows a dialog box titled "Blend Monitoring Setup". It contains two main sections: a left section for numerical inputs and a right section for options. The left section has four input fields: "Proto O.N." with value 82.15, "Target O.N." with value 82.3, "Proto MV" with value 150.4, and "Line MV" with value 149.3. The right section, titled "Options", contains two checked checkboxes: "[X] Perform F/A Search" and "[X] Continuous Product". At the bottom of the dialog are "OK" and "CANCEL" buttons.

#### 4.5 Options Screens

The analyzer menu options screens provide for customization of the various procedures and alarm settings. Also included under this heading are routines for performing software calibration of analog input signals from sensor devices.

#### 4.6 Reports Screens

The reports menu item provides access to various reports, trending options and the system log. Reports show the latest data for blending, calibration, etc. and the system log shows a line by line summary of the analyzer activities with various messages.



## 5.0 Engine Hardware

### 5.1 Description

The model 8200 analyzer comes with complete engine hardware and accessories. The system requires valid working CFR Research or Motor method engines with compression ratio motor control. The system also requires engine coolant from a Core Lab Intake Air Refrigeration Unit (IAR).

### 5.2 Carburetor

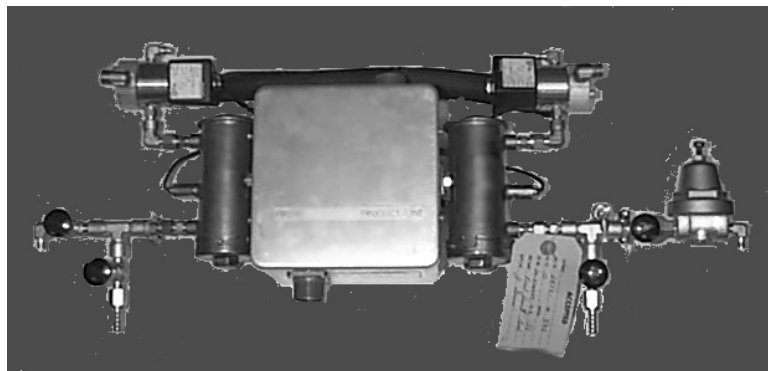
The carburetor has been re-designed to include additional features over the traditional carburetor design. Included in the stepper motor fuel switching mechanism is a position proximity sensor to detect position feedback. This feedback verifies that a fuel switch has taken place. The stepper motors used for control of the microvalve and fuel switching are now the same therefore spare part requirements are simplified.

### 5.3 Heat Exchanger

The heat exchanger is supplied to cool the prototype and product fuel before it enters the intake venturi of the engine. It is mounted to the CFR crankcase and requires a coolant mixture which is supplied by Core Lab's IAR. The ASTM method requires that fuel be chilled to 50° Fahrenheit (10° C). The heat exchanger includes rotometers that provide independent proto / product fuel flow regulation.

### 5.5 Fuel Junction Assembly

The fuel junction assembly is usually mounted to the engine's foundation block. This assembly provides switching solenoids and fuel pumps to supply the appropriate fuel to the CFR engine. Manual block valves are available to supply canned fuel to the engine for engine analyzer calibration and the system qualification checkout exercise.



## 6.0 Specifications

<b>Accuracy</b>	<b>Octane Number</b>	<b>RON</b>	<b>MON</b>
	80	0.21	0.21
	85	0.16	0.16
	90	0.12	0.19
	95	0.11	0.20
100	0.12	0.26	
<b>Year 2000 Compliancy</b>	The model 8200 complies with Core Labs Y2K compliancy program. See document T-TECW.001 for further information.		
<b>ASTM Compliancy</b>	The model 8200 meets all the instrument requirements for ASTM Standard D 2885 and provides the ability to certify gasoline product.		

## 7.0 Site Requirements

<b>HVAC</b>	<p>Ambient room temperature should not exceed 80 degrees Fahrenheit. The room should receive between 5 and 12 air changes per hour. The room pressure should be maintained at 0.1 inches of water (positive pressure). Intake air should be taken from a non-hazardous area, typically 20 to 30 feet above ground, away from exhaust output through an explosion proof air conditioner. Thermal loads (heat dissipation) are as follows:</p> <p>Motor Method Engine                    13,100 BTU/Hr.  Research Method Engine                10,100 BTU/Hr.  Intake Air Refrigeration Unit        4,100 BTU/Hr.</p>
<b>Engine Foundation</b>	The engine should be mounted on an isolation block per ASTM D2699 and D2700 Section A5.2.3. The block anchors the engine to the floor and provides vibration isolation.
<b>Engine Cooling Water</b>	Cooling water should be cooler than 95 degrees Fahrenheit and be potable and free of sediment. Flow rate 1.5 Gal/min. (Per engine) minimum pressure of 20 psi. There will be a temperature rise of 30 degrees as it flows through the engine condenser coil and water cooled exhaust system. Water supply should be piped as close to the engine as possible with a manual shutoff valve.
<b>Crankcase Ventilation</b>	Crankcase ventilation is furnished by a breather valve located on the left crankcase door. The outlet is fitted for 3/4" pipe to conduct crankcase vapors out of the room. A condensation trap should be provided to prevent moisture from running back into the crankcase.

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<b>Exhaust Ventilation</b>	<p>Exhaust Back Pressure - The exhaust back pressure at the water cooled exhaust pipe should be as low as possible, but in no case should it be outside the limits of 0 to 10 inches (254mm) of water pressure.</p> <p>Discharge Pipe - It is desirable to use a discharge pipe of 3 in. (76.2 mm) minimum diameter with 60 ft. (18.28m) maximum length and containing no more than three (3) elbows or other restrictions. It is recommended to have a separate exhaust system for each engine. If a common discharge pipe is used for a multiple exhaust system, the limits of 0 to 10 inches (254mm) of water pressure. A trap must be provided in the water drain line and the drain line must discharge to atmospheric pressure, one for each engine.</p>
<b>Engine Air Consumption</b>	<p>The CFR engines consume intake air at the following rates:</p> <p>Research Engine        6.48 cfm (11 m<sup>3</sup>/hour)</p> <p>Motor Engine            9.73 cfm (16 m<sup>3</sup>/hour)</p> <p>The specific humidity of the intake air should be between 25 to 50 grains/lb of dry air.</p>
<b>Sound Levels</b>	<p>The peak noise level for the Motor or Research engine at maximum knock intensity is approximately 80 db(A) including the 10 db(a) background reading.</p>
<b>Electrical Requirements</b>	<p>The analyzer console uses about 1.5A from the 115v circuit of the CFR engine's main fuse. The CFR engine requires both single phase current (for the engine control and instruments) and three phase current (for the synchronous motor). Engine voltages and line frequencies are selected from the site facilities. A transformer is available to produce the 115 VAC circuit if it is not available. The analyzer can operate from 48 to 62 hertz line frequency. However, correct engine rpm is only achieved by using 50 or 60 hertz power. The spark plug ignition wire must be replaced on the CFR engine with an EMI/RFI noise suppression cable.</p>

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