

FTIR Process Analysis Integrated System

Model AS 300

Specially designed for supporting the TOPNIR/FTIR Process Application.

Ten definitive benefits over the other existing systems have been considered in this development :

- 1- System and Analyser processing, Model Data Base Interfacing and Data Interchanges integrated in the same Control Unit for unified architecture.
- 2- Architecture designed around PC hardware and Windows™ operating system.
- 3- Front panel key-board and graphic displays allow users to change , modify or edit locally all analyser and calibration parameters. Maintenance graphic display allows full visibility of flow-sheet and offers fast learning circuitry with minimum training.
- 4- Three levels of Data Interchanges to customer DCS ; customer Maintenance Acquisition System and process /benchtop Inter-Spectro supported by Data Highway.
- 5- Improved calibration transferability from the benchtop analyser.
- 6- Digital temperature control of the optical cell operated by chiller compressor to accept most severe climatic conditions. No Vortex cooler requiring huge instruments air consumption.
- 7- System can integrate up to 8 streams auto-switched to the same optical flow cell plus up to 8 channels featuring independent optical flow cell when sample segregation is required.
- 8- Three styles of Sample Conditioning designed for Crude /White & Yellow / Black oils.
- 9- Flushing & Auto-Validation systems feature Piston Floating Cylinders for full integrity.
- 10-Rugged cabinet in Stainless Steel, 30/10 mm sheet and IP65 rating can accept outdoor location in harsh environments.

The FTIR Process Analysis Integrated System Model AS 300 is a complete integration executing all the functions required by the TOPNIR/FTIR Process Applications e.g. :

- 1) Sample pre-conditioning assembly
- 2) Outliers auto-grabbing
- 3) Multi-stream switching system (optional)
- 4) Optical cell assembly
- 5) Multi-chanel arrangement (optional)
- 6) Cell flushing & validation
- 7) Utilities control bloc assembly
- 8) System and analyser Control Unit
- 9) Model Data Base Interfacing
- 10) Data Interchanges
- 11) System packaging



I - SAMPLE PRE-CONDITIONING :

Three styles of sample pre-conditioning systems are available for supporting the different applications :

I-1) CRUDE-OIL SAMPLE PRE-CONDITIONING :

Usually designed for sample take-off at the desalter outlet , this system is packaged in a S. S. cabinet and features two by-pass pre-filters auto-switched ;the circuit in stand-by been flushed at high temperature.

Downstream a second stage filtration unit heated at programmed temperature is provided for removing excess waxes.

Plugging indicator/alarm is supplied on pre-filter and second stage filtration.

I-2) WHITE & YELLOW OIL SAMPLE PRE-CONDITIONING :

Dedicated to gasoline , naphtha , kerosene , gas and diesel oil , this system assembled in S.S. plate features a double pre-filter and a double stage filter-coalescer manually switched.

Plugging indicator/alarm is supplied on pre-filter and filter-coalescer stages.

I-3) BLACK-OIL SAMPLE PRE-CONDITIONING :

Designed for oils from fuel to residue this system packaged in a S.S. cabinet features a rotative pre-filter with plugging indicator alarm .

GENERAL :

All the styles of pre-conditioning systems integrate a fast loop with flow-meter and a pumping unit when required.

II - OUTLIERS AUTO-GRABBING :

Two of 500 cc capacitance outlier collection cylinders are supplied per oil colour.

When an outlier is detected by the TOPNIR software package:

Outlier sample is automatically grabbed in the cylinder N°1.

Fast loop is routed in by-pass through the Nc port of the 3 ways diverting valve

Confidence alarm is issued through the Customer DCS (CDCS) and the Customer Maintenance Acquisition System (CMAS) data loop .

The outlier cylinder changeover from cylinder 1 to cylinder 2 is manual

Confidence alarm will be cleared locally by the operator switch on front door after cylinder changeover.

III - MULTI-STREAM SWITCHING SYSTEM :

When different streams are required to be analysed on a unique oil

colour , a multi-stream system is acceptable otherwise a multi-channel system featuring independent cells is required.

The multi-stream switching system ,available for up of height streams interfaces the pre-conditioning and the optical cell assembly systems.

Automatic switching is controlled by the Control Unit Processor (CPU) and operated with double bloc and bleed air operated valves.

IV - OPTICAL FLOW CELL ASSEMBLY :

Cell is a transmission type featuring the sapphire window lens connected to the FTIR analyser by a Zirconium Fluoride glass fiber optic interface .

Upstream of the cell , the sample is filtered at 2 microns , flow controlled at 60 cc/min and temperature conditioned through a thermal exchanger This temperature is controlled at 35 °C for Crude oil / 25 °C for White & Yellow oils / 50°C for Fuel oil and 150°C on Residue by the combined oil chiller / heater bath located in the controller cabinet and PID controlled by CPU .

V - MULTI-CHANNEL SYSTEM : (optional)

Used when different sample colours have to be segregated (e.g. : gasoline and diesel streams) .

This is a multi-cells system (up to height independent cells) light sourced by a static optical multiplexer and connected to a multi-detector channel (up to height independent detectors) tuned to the different requirements when the cell path length has to be different.

VI - CELL FLUSHING and VALIDATION :

A flushing and auto-validation programmable cycle is operated at customer request (before to a new blending start for instance) .

This cycle is announced through the CDCS data loop and can be deleted by the DCS return of communication if continuous measurement is required at this time.

Four successive steps are processed by double bleed air operated valves :

- Cell back flush by N2
- Zeroing with low N2 flow
- Pentane flushing
- Toluene injection for validation

Pentane and Toluene are stored in two piston floating cylinders (6 L. capacitance)to keep a great integrity and avoid N2 bubbling.

The level position is indicated and a low level alarm is issued through the CMAS data loop.

The low alarm level being detected, only four auto-validation are authorised before of inhibition of the validation cycle by the application software.

VII - INTERFACES RACK ASSEMBLY :

This bloc integrates the Control Unit Processor Discrete Interface Modules ,the alarms interlock, the cabinet and oil reservoir Temperature Controllers and the DC Power :



Sample preconditioning

VIII - ANALYSER RACK :

The BOMEM FTIR SPECTROMETER is mounted on sliding rack with the FIBER OPTIC INTERFACE and the analyser cooler controller.

IX - OIL TEMPERATURE CONTROLLED BATH :

A reservoir of 12 l. oil is continuously chilled at 22°C and a heater is PID controlled at 25 °C (white & yellow oils) ; 35°C (crude oil) ; 50°C (fuel oil) or 150°C (residue) .

A programmed temperature system for Crude Oil and black oil is provided at the reservoir outlet.

The chiller condenser calories are removed by a water circulation supplied by customer as utility. The flow of water required is 320 l/H for a maximum temperature of 40 °C.

By extension the system can be provided for cooling water at 50 °C.

If no water is available an air condenser can be provided.

The system is rack mounted on sliding rack at the base of the control unit cabinet.

X - CONTROL UNIT PROCESSOR (CPU) :

The System and FTIR Analyser Processing , Model Data Base Interfacing and Data Interchanges are integrated in the same CPU for unified architecture .

Operator can view the analysis results , diagnostic ,maintenance graphic display, sampling system input/output diagram and spectrums on the front panel screen or on remote PC connected to the CMAS by RS 485 data link . Analysis and calibration parameters can be changed , modified or edited locally through the glass plated key-board or remotely .

Interspectro (process/lab) communication Modem is supplied .

Architecture is designed around PC hardware and Windows™ operating system : analysis method tables are easily changed modified or edited in the same operating format .

DATA PROCESSOR DESCRIPTIVE :

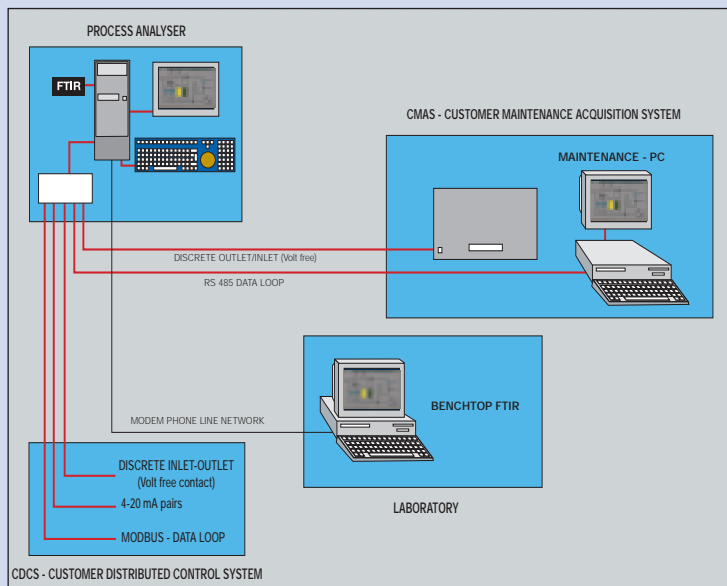
- Pentium CPU , 550 MHz
- 64 Mo RAM extended to 768 Mo
- 2 ports serial RS-485 , 1port parallel and 2 ports USB
- Hard disk 4,3 Go
- Windows 98
- 15 inch diagonal front panel display
- 102 keys glass plated sensitive key-board supporting all interactive tasks to be achieved locally
- 3 data loops:
 - ⇒ RS 485 dedicated to the CMAS communication .
 - ⇒ MODBUS bi-directional dedicated to the CDCS
 - ⇒ MODEM for the process / benchtop inter-spectro
- 24 analogic : 4-20 mA loops
- 32 relay to DCS & CMAS
- Hardware supporting the internal integrated system processing : PT 100 inlet / PID temperature controllers / Programmable Digital Controllers etc...

SOFTWARE PACKAGE :

Operating four functions :

- Analysis system processing
- FTIR Analyser control
- Model Data Base interfacing
- Three levels Data Interchanges to customer DCS (CDCS), Customer Maintenance Acquisition System (CMAS) and process /benchtop Inter-Spectro

DATA INTERCHANGES :

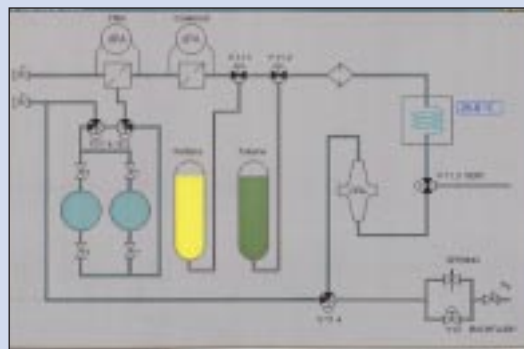


a) Communication to CDCS

Only relevant information for Process Control are provided on this bus through MODBUS bi-directional and / or analogic + relay outputs e.g. :

- ⇒ Come & read (outlet)
- ⇒ Measurements (analogic 4-20 mA outlet)
- ⇒ Flushing & validation cycle (outlet)
- ⇒ Confidence alarm (outlet)
- ⇒ Fatal alarm (outlet)
- ⇒ Grade selection 92/95 (inlet)
- ⇒ Flushing & validation cycle deleted (inlet)

b) Communication to CMAS



All the CDCS information package plus diagnostic information are provided through RS485 serial loop (for printing) or through relay output e.g.:

- ⇒ System fault (outlet)
- ⇒ Prediction (outlet)
- ⇒ Filter plugged (outlet)
- ⇒ Coalescer plugged (outlet)
- ⇒ Cell temperature measurement & alarm (outlet)
- ⇒ Low level pentane (outlet)
- ⇒ Low level toluene (outlet)
- ⇒ Water condenser low flow alarm (outlet)
- ⇒ Remote flushing & validation switching (inlet)

c) Inter-Spectro interchanges :

This MODEM connection supports the calibration transfer between the benchtop and the process FTIR analysers.

When this MODEM connection is not available on site ,the model transfer is manually operated by floppy-disk.

Both analysers and optical interfaces are similar for the most accurate and reliable calibration transferability.

d) Input /output specifications :

Analogic outputs : 4-20 mA powered , Resistive load : 1 kOm maximum.

Discrete inputs : ON/OFF switch , voltage free .

Discrete outputs : 24 V on 75 Ohm minimum (315 mA maximum)

IX - SYSTEM INTEGRATION :

The system integration is dissociated within two cabinets juxtaposed and fully distributed and interconnected :

1) CONTROL & UTILITIES CABINET : Model AS 300



System integration

This cabinet features four racks for the system control and utilities:

Rack N°1 enclosing CPU with 15" screen and glass plated sensitive keyboard

Rack N°2 for the system electrical interface

Rack N°3 containing the FTIR Analyser with the removable bulkhead optical features for removing the whole part assembly

Rack N°4 enclosing the oil temperature controlled bath

This cabinet is auto-air purged by a monitor located on the top side
Temperature is controlled by electrical radiator & PD controller

Main specifications :

- ⇒ Rugged cabinet in S. S. with 30/10 mm sheet
- ⇒ IP 64 rating

⇒ Size: 2000 (H) x 800 (L) x 800 (D) mm

⇒ CENELEC certified EEx pd ib IIB T3

2) SAMPLING & CELL CABINET :



Cell enclosure

Enclosing all the plumbing part of the system e.g.:

- ⇒ Cells housings
- ⇒ Containers housing

This cabinet is heated by a radiator with PD controller mounted in the Interface Rack Assembly .

The pre-conditioning system is dissociated for mounting near of the cabinet .

Main specifications :

- ⇒ Rugged cabinet in S. S.
- ⇒ IP 55
- ⇒ Size 1300 (H) x 780 (L) x 500 (D) mm

Sizing can be changed on multi-stream or multi-channel applications.

3) SYSTEM UTILITIES REQUIREMENT

- ⇒ Power supply: 110 / 220 VAC - 50/60 HZ - 1800 VA
- ⇒ Air instrument supply: automatic air purge monitor, requires air source clean and dry - e.g. (20°C dew point), pressure 3 to 8 Kg/cm²g - flow-rate : 25 Sm³/h at startup during purge ; 0.5 Sm³/h normal service
- ⇒ Water supply : for the oil chiller condenser a flow rate of 320 l/h at 40°C maximum temperature is required. When a water source is not available, the chiller condenser can be cooled by air (option)

Nitrogen cylinder for zeroing: 10 M3 cylinder, purity 99.

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