Invensys®
Process Magnetic Resonance Analyzer
Model NMRC

INTRODUCTION

The Process MRA (Magnetic Resonance Analyzer) makes the power of magnetic resonance technology available to the hydrocarbon processing industry. Because it does not rely on light and optics, the Process MRA is equally capable of handling crude oil, blended gasoline and diesel, or unit streams in between.

Using the same principle employed in MRI, the Process MRA permits real-time, on-line analysis of multiple chemical and physical properties in multiple streams. Thus, it provides precise information minute by minute that would otherwise require numerous, slower on-line analyzers or off-line laboratory methods. By making more information available more quickly, the Process MRA allows more precise control of processes to maximize throughput and safety while maintaining product quality targets. Resulting profit improvement typically pays for the system in less than one year.

BENEFITS

Continuous, frequent measurement of process stream parameters permits:

- Reduced consumption of costly catalysts
- Use of a wider range of feedstocks
- Tighter adherence to product quality targets
- Optimum throughput control, even with variable feed quality
- Safer operation close to design limits
- Multicomponent, multiproperty analysis even for optically dense process samples.

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FEATURES

Key features of the Process MRA include:

- Complete, integrated application solution
- Calibration model and application software (models available for many applications)
- Standard Ethernet communication with external data and control systems
- Field-proven reliable operation, running continuously in refinery applications since 1995
- Multi-variable analysis from a single instrument and a single sample
- High measurement resolution
- Stable, homogeneous magnetic field with no fringe field
- No moving parts in the core analyzer
- Variety of sample probes
- Built-in reference for measuring chemical shifts of all process components
- Automatic shim control to ensure magnetic field uniformity for process measurement
- Availability of continuing service and support contracts
- System display, operation, and supervision performed from a remote computer.

PROPRIETARY APPLICATION SOFTWARE

Application software and calibration models supplied with the Process MRA are configured by Invensys in support of specific process analysis objectives, taking into account specific process stream characteristics. Continued evaluations and improvements of the model maintain conformance with ASTM and other standard methods.

INTEGRATED APPLICATION SOLUTION

The Process MRA, combined with advanced control tools, provides a turnkey, engineered solution for a specific process control improvement task. The analyzer, calibration model, data communication, advanced control, and follow-up support are all provided by Invensys — one supplier for the entire package.

MRA chemometric models are available for specific process applications. All are designed and field tested to meet the operating goals of the particular process, such as to maintain product quality, maximize yield, and enhance feedstock flexibility.

HAZARDOUS AREA DESIGN

The Model NMRC Process MRA system is designed to meet applicable hazardous area requirements for field-mounting in operating areas or installation in shelters. It is enclosed in a stainless steel NEMA 4 (IP55) cabinet. It is certified for use in ATEX pressurized II 2 G EEx p II T4, Zone 1 and Group 2 hazardous locations and is designed to meet CSA and NEC ratings.

DATA COMMUNICATIONS

The system is designed to be operated from a remotely mounted PC via Ethernet console and/or a modem. Connection to a distributed control system (DCS) is via modbus RS-485.

FIELD-PROVEN, RELIABLE OPERATION

Systems based on this design have been installed and operating successfully since 1995.

MULTI-VARIABLE ANALYSIS

The Process MRA gives continuous, simultaneous measurement and computation of one or multiple sample chemical properties. New readings are typically available at two-minute intervals.

NON-OPTICAL TECHNOLOGY

Because the Process MRA is not optically based, optically dense samples do not limit applicability of the technology. This simplifies development of calibration models, minimizes the requirement for rigorous sample conditioning to remove water and particulates, and maximizes analytical reliability of sampling and models.

AUTOMATIC SHIM CONTROL

Program controlled shimming automatically detects and corrects transient changes in the field of the magnet, ensuring short-term repeatability and long-term reproducibility of analyzer results.

BUILT-IN REFERENCE SAMPLE

A capsule within the sample probe, typically filled with lithium chloride, is continuously monitored and used as a reference for shim control.

GLOBAL SUPPORT

Continuing contracts for local training, service, and technical support anywhere in the world are available from Invensys.

APPLICATION SOLUTIONS

The Process MRA can be combined with real time optimization and multi-variable predictive control (MPC) packages to detect changing operating conditions and enable better controller and optimizer model correction.

MULTI-STREAM SAMPLE SWITCHING SYSTEM

An automatic sample switching system can be provided. This unit, which is mounted in a separate enclosure, accepts samples from up to six process streams. It may also be specified to provide sample auto collection to support development and validation of calibration models. The sample sequencing and timing is controlled by the Process MRA. Process streams arriving at the sample switching system should meet the following conditions:

- Temperature between 5 and 120°C (41 to 248°F)
- Maximum Working Pressure = 24 kg/cm^2 (350 psig)

FUNCTIONAL SPECIFICATIONS

Type of Protection and Area Classification
ATEX pressurized II 2 G EEx p II, Zone 1. (see note)

Nuclei Observed
H^1 (primary)

Operating Frequency
58±1.0 MHz for H^1

Fringe field
Less than 1 gauss on external enclosure of magnet

Heavy Oil Probe (Type D-MASH)
Heavy Oil Type D-MASH Dewar Probe designed to handle liquids at 5 to 120°C (41 to 248°F) and at maximum pressure of 24.0 kg/cm^2 (350 psi).

Magnet System
Temperature stabilized, self-condensed field, permanent (neodymium) magnet with integral field gradient (shim) coils and automatic shim control

Field strength
1.35 tesla at 45°C

Note: For detailed information or status of testing laboratory approvals/certifications, contact Invensys.

PHYSICAL SPECIFICATIONS

Enclosure
NEMA 4, 12 gauge stainless steel, air purged

Size
188.2 cm H x 120.6 cm W x 71.5 cm D
(714.1 in H x 47.5 in W x 28.2 in D)
Add 15 cm (6 in) to height for shipping pallet.

Weight
635 kg (1400 lb) net weight,
750 kg (1650 lb) gross shipping weight

Clearance
Left and Right Sides: 100 cm (39 in)
Front: 145 cm (57 in)
Top: 50 cm (20 in)

Lifting Facilities
Forklift access front

Anchor Bolts
Four 13.0 mm (0.51 in) holes for 11.9 mm (0.47 in) anchor bolts

Process Sample Probes
TYPE D-MASH HEAVY OIL PROBE –
HIGH TEMPERATURE, STANDARD PRESSURE
5 to 120°C (41 to 248°F), up to 24 kg/cm^2 (350 psi)
External Diameter: 3/8 in (9.525 mm)
Internal Diameter: 0.3 in (52.3 mm)
Length: 2.06 in (52.3 mm)

Utilities
POWER REQUIREMENTS
200-240 V ac: 7 kVA, 50-60 Hz (L1, L2, Grd).
Recommended Protection: 1-pole, 40 A breaker slow blow type.

380-415 V ac, 3 phase, 7 kVA, 50-60 Hz
(L1, L2, l3, Grd).
Recommended Protection: 3-pole, 20 A breaker, slow blow type

220-240 V ac: - 1 phase, 7 kVA, 50-60 Hz (L1, Grd).
Recommended Protection: 1-pole, 40 A breaker slow blow type

Remote Computer Requirements
Pentium™ processor with 128 MB RAM and WIndows 2000/XP™ operating system with 10/100 LAN card.

Purging Gas Requirements
Air Pressure: 80 psi (5.5 bar) minimum.
Air Quality: dry, oil-free instrument air
Flow Rate During Normal Operation:
1.1 m^3/h (40 scfm)
Flow Rate During Startup: 15 m^3/h (555 scfm)

OPERATING, STORAGE, AND TRANSPORTATION CONDITIONS

Environmental Parameter	Normal Operating Conditions	Transportation and Storage Limits
Hazardous Location	ATEX pressurized II 2 G EEx p II, Zone 1.	N/A
Ambient Temperature	8 to 38°C (46 to 100°F)	5 and 55°C (41 and 131°F) **CAUTION:** Failure to maintain magnet temperature above 4°C (41°F) causes permanent damage to the magnet.
Shelter	Protect from direct sun and rain	N/A
Relative Humidity	5 to 95%, noncondensing	0 to 100%
Supply Voltage	NMRC-1: 200-240 V ac NMRC-2: 380 - 415 V ac three phase NMRC-3: 220-240 V ac single phase	N/A
Vibration	Not more than 0.3 mm/s^2 in all 3 axes	Not more than 0.3 mm/s^2 in all 3 axes
Indirect Lightning Transients	Can withstand a transient surge up to 2000 V common mode or 1000 V normal mode without permanent damage.	N/A
RFI Effect	Output error is less than 0.1% of calibrated span for radio frequencies in the range of 27 to 1000 MHz and field intensity of 30 V/m when the analyzer is properly installed with shielded conduit and conductive door gaskets in place.	N/A

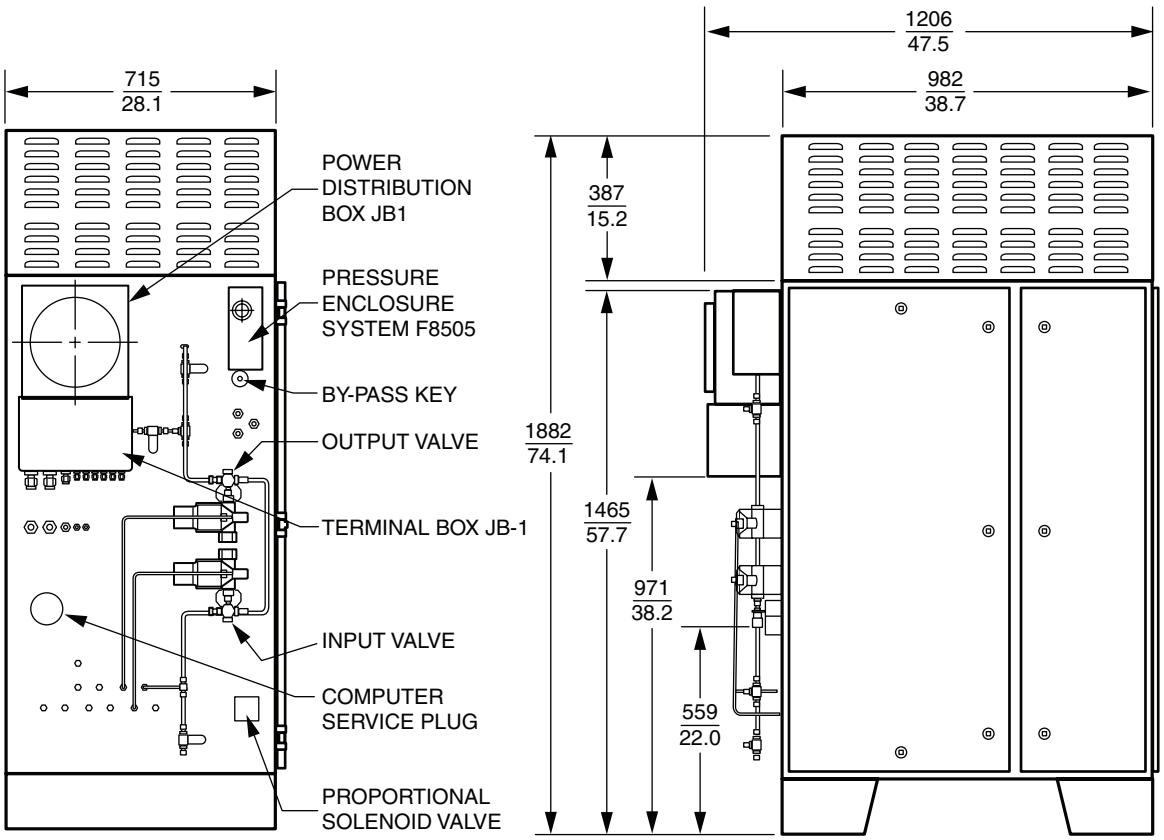
MODEL CODE

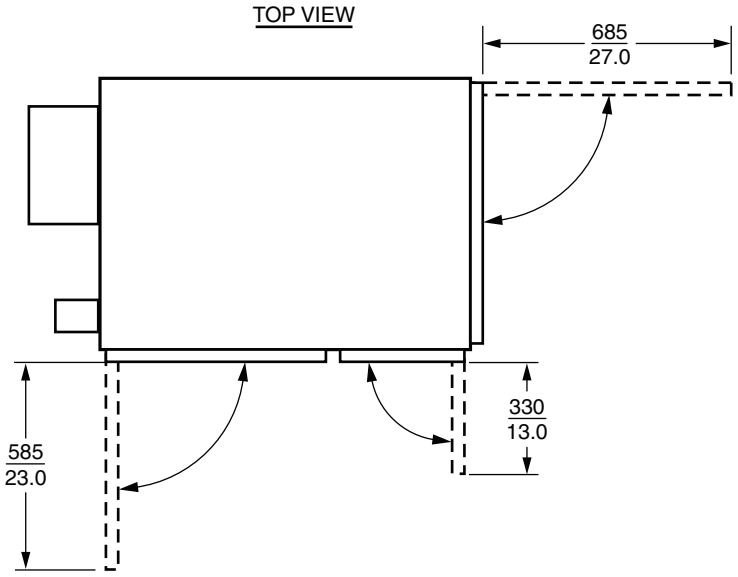
Model NMRC

Description	Model
Invensys Magnetic Resonance Analyzer System	NMRC
Electrical Classification and Power Configuration	
ATEX, II 2 G EEx p II t4, US Power Configuration: 200-240 V ac, 7 kVA (L1, L2, Grd)	-1
ATEX, II 2 G EEx p II t4, European Power Config: 380-415 V ac, 3 Phase, 7 kVA (L1, L2, L3, Grd)	-2
ATEX, II 2 G EEx p II t4, European Power Config: 220-240 V ac, 1 Phase, 7 kVA (L1, Grd)	-3
Number of Streams to be Analyzed	
Total Number of Streams (specify 1 to 6)	x
Number of Properties	
Total Number of Models for all Streams (specify 001 to 999)	xxx
Application	
Gasoline Blending	A
Diesel Blending	B
Fuel Oil Blending	C
Naphtha Cracking	D
FCCU Feed and Distillates	E
FCCU Distillates only	F
Crude Switching/Blending	H
Catalytic Reforming	J
CDU Feed and Distillates	K
CDU Distillates only	L
Special	X
DCS Communications	
Modbus with RS485 Interface to DCS from analyzer	M
Input/Output	
Standard 8 DI and 8 DO	1
Extended 16 DI and 16 DO	2
Extended 24 DI and 24 DO	3
Remote PC	
Remote PC	R
No Remote PC	N
Optional Features	
Number of 2-Channel IS Barriers for Alarm Inputs (specify 01 to 99)	-xx
Additional Solenoid Valves (specify 1 to 9)	-x
Example: NMRC-33049AM1R-093	

DIMENSIONS – NOMINAL

mm
in





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