WRDS, inc.
Pump Condition Monitoring

WRDS,INC
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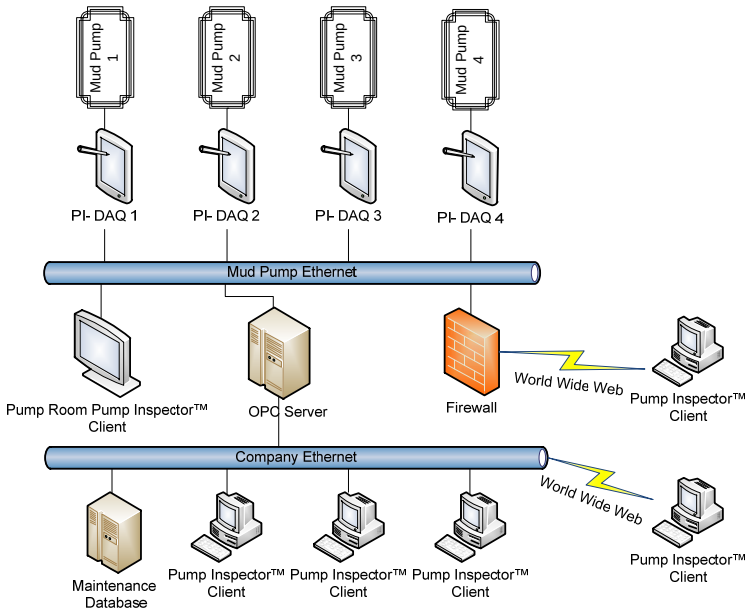
Pump Inspector™ Monitor System

SYSTEM



Easy to install!
Easy to setup!
Easy to maintain!

New Features include:
EZ Calibration
Network Backup (move binary data to network drive)
Network Drive Cleanup (don't run out of space)
Screen Print Frequency (take snapshots (png) of the Real-Time Display at a specified interval for visual review of pump performance. Specify where to place prints)
Everything can be controlled through a single webpage.
New real-time interface

The Pump Inspector™ Display System is designed for reciprocating power pump users to perform leak detection of pump valve and piston/plunger pressure seals. Early detection of seal failures, conditions leading to pending power end failures and marginal system operating conditions are alarmed.

Pressures

- 1 to 6 Single Acting Pump Chambers or 1 to 3 Double Acting Pump Chambers readings are used to provide piston and valve leak detection and determine valve sealing delays, fluid compression delays, chamber overshoot pressure, crosshead loading and shock forces and pump and chamber volumetric efficiency.
- Pump Suction Manifold reading is used for suction operating pressure and system interaction with pump and to determine NPSH Available, extent of cavitation and acceleration head loss.
- Pump Discharge Manifold pressure is used to determine acceleration induced pressure spikes, discharge operating pressure and system interaction with pump.

Temperature

- Fluid temperature reading to determine fluid properties.
- Power End Crosshead readings to determine if lubrication or bearing problems exist.

Other

- Power Input data is used to calculate pump system mechanical efficiency.
- Piping Acceleration reading to determine extent of hydraulic induced piping vibration.
- Pump Rotation Timing Device is used to determine all timed events of the pump within 0.25° of pump crank angle.

Communication

- Network and Web-based pump monitoring and alarming with the Pump Inspector™ Monitor System.

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PUMP STATUS

Pump Inspector™ R/T Display

The Pump Inspector™ R/T Display indicates the condition of the pump expendable components, suction and discharge fluid dynamics, and power-end operating conditions so that corrective action may be taken before serious damage to the pump or system occurs. The pump performance display has been designed to provide visual indication that a failure is occurring and corrective action needs to be planned. Notice the difference that occurs over 9 hours while pumping a bauxite slurry.

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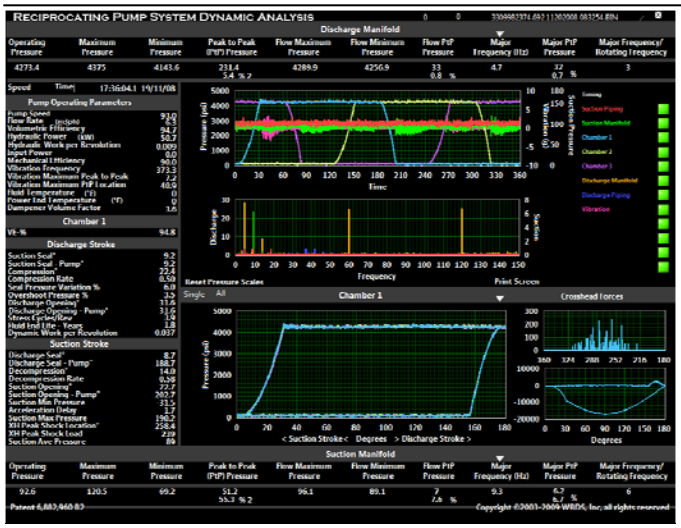
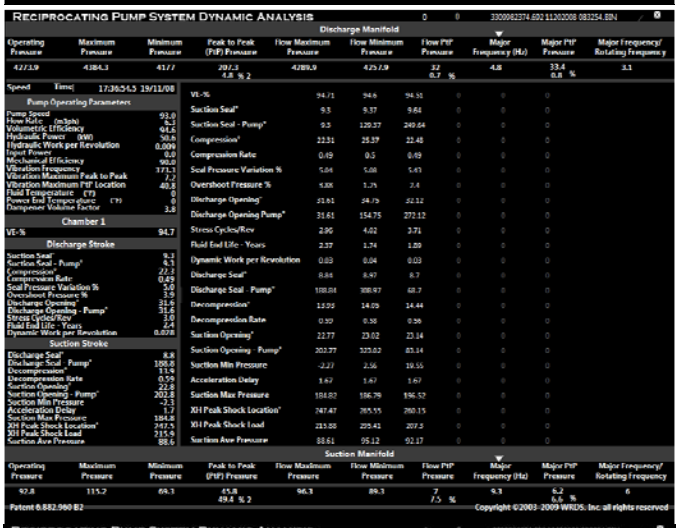
OFFLINE REPLAY

Detailed analysis of the internal workings of the operating pump are available in real-time or 7 day file replay. Calculated results are recorded to a delimited file and submitted to an OPC Server for requests from rig data collection and alarming systems.

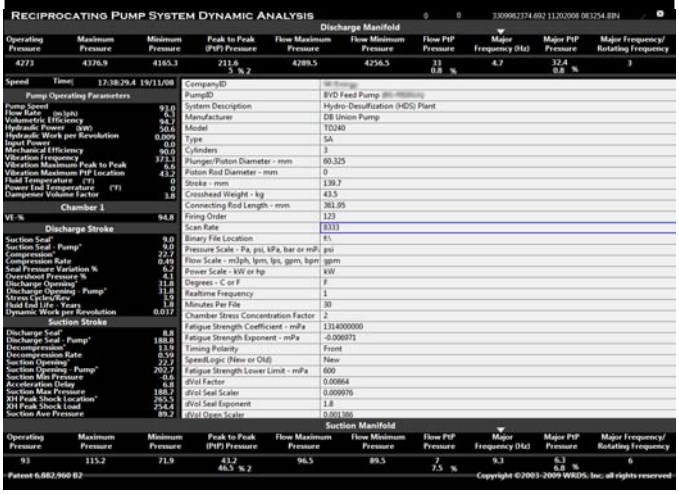


Have a failure and want to look for an event that may have caused it? Use the Pump Inspector™ offline display to replay historical data.

This display may be used to perform valve and fluid-end design analysis.



The above display presents only one pump chambers calculated results. The display to the left displays all the chamber results when moving the mouse over the chamber data in the above display.



The Pump Inspector™ Offline Display can run acquired binary data from any source. Clicking on the top logo (Reciprocating Pump System Dynamic Analysis) the setup information used to acquire the current set of data is displayed.

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OPERATING RESULTS

There are 50 unique calculated results during each revolution of a reciprocating power pump to determine the performance of the pump and system.

When including the four flow lines

- Suction Piping
- Suction Manifold
- Discharge Manifold
- Discharge Piping

and up to six pump chambers

- Chamber 1
- Chamber 2
- Chamber 3
- Chamber 4
- Chamber 5
- Chamber 6

there are up to 214 calculated results that are exported to a text File to provide detailed analysis of the pump valves, seals, and crosshead loading; and piping mechanical and hydraulic dynamics.

Data is presented in the following engineering units:

Flow Rate

- Meters Cubed per Hour
- Liters per Minute
- Gallons per Minute
- Barrels per Hour
- Barrels per Minute

Power

- Kilo-Watts
- Horsepower

Temperature

- Celsius
- Fahrenheit

Pressure

- Pascal
- Kilo Pascal
- Mega Pascal
- Pounds per Square Inch
- Bar

Vibration

- Acceleration—g

Crank Rotation

- Pump Revolution
- 360 Degrees

Selection of Input Values	
Pump Cycle	**Units**
Time	DD/MM/YY HH:MM:SS.S
Speed	RPM
Flow Rate	m3/hr, lpm, gpm, bpm, bph
Volume Displaced	meter3, liter, gallon, barrel
Volumetric Efficiency	%
Hydraulic Power	kW, HP
Work	kW-Hours, HP-Hours
Input Power	kW, HP
Mechanical Efficiency	%
Vibration Frequency	Hertz
Vibration Maximum Peak to Peak Acceleration	g
Vibration Maximum Peak to Peak Location	Degrees
Fluid Temperature	°C, °F
Power End Lubrication Temperature	°C, °F
Dampener Delta Volume	Factor
Flowline per Pump Cycle	**Manifolds - Suction, Discharge**
Operating Pressure	Pa, kPa, mPa, psi, bar
Maximum Pressure	Pa, kPa, mPa, psi, bar
Minimum Pressure	Pa, kPa, mPa, psi, bar
Peak to Peak Pressure	Pa, kPa, mPa, psi, bar
Peak to Peak Pressure	%
Flow Maximum Pressure	Pa, kPa, mPa, psi, bar
Flow Minimum Pressure	Pa, kPa, mPa, psi, bar
Flow Peak to Peak Pressure	Pa, kPa, mPa, psi, bar
Flow Peak to Peak Pressure	%
Primary Frequency	Hertz
Primary Peak to Peak Pressure	Pa Pa, kPa, mPa, psi, bar
Primary Peak to Peak Pressure	%
Frequency/Pump Fundamental	Factor
Chamber Cycle	**Chambers - 1, 2, 3, 4, 5, 6**
Volumetric Efficiency	%
Suction Valve Leak Rate	%
Piston/Plunger Leak Rate	%
Discharge Valve Leak Rate	%
Stress Cycles/Rev	Factor
Estimated Fluid Chamber Life	Years
Dynamic Work per Revolution	kW, HP
Crosshead Shoe Temperature	°C, °F
Discharge Stroke	**Chambers - 1, 2, 3, 4, 5, 6**
Suction Valve Seal - Chamber Cycle	Degrees
Suction Valve Seal - Pump Cycle	Degrees
Compression Degrees Compression Rate	Factor
Seal Pressure Variation	%
Overshoot Pressure	%
Discharge Valve Opening - Chamber Cycle	Degrees
Discharge Valve Opening - Pump Cycle	Degrees
Suction Stroke	**Chambers - 1, 2, 3, 4, 5, 6**
Discharge Valve Seal - Chamber Cycle	Degrees
Discharge Valve Seal - Pump Cycle	Degrees
Decompression	Degrees
Decompression Rate	Factor
Suction Valve Opening - Chamber Cycle	Degrees
Suction Valve Opening - Pump Cycle	Degrees
Suction Minimum Pressure	Pa, kPa, mPa, psi, bar
Acceleration Delay	Degrees
Suction Maximum Pressure	Pa, kPa, mPa, psi, bar
Crosshead Peak Shock Location - Chamber Cycle	Degrees
Crosshead Peak Shock Load	Pa
Suction Average Pressure	Pa, kPa, mPa, psi, bar

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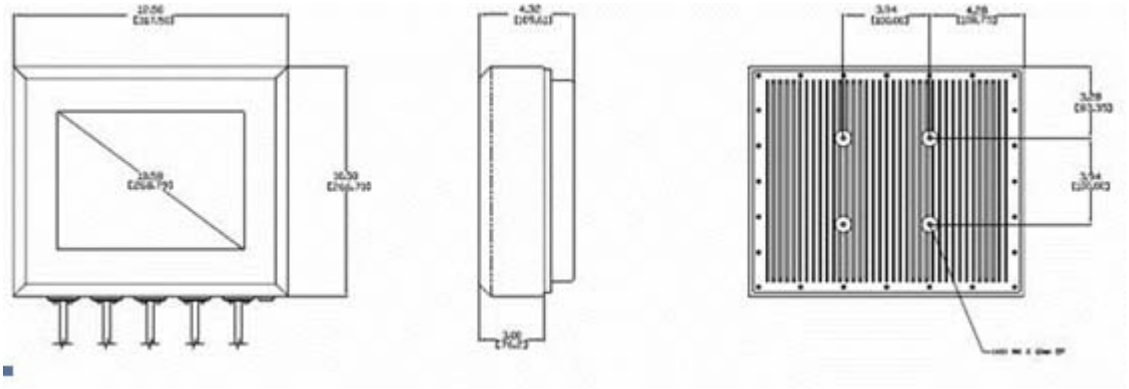
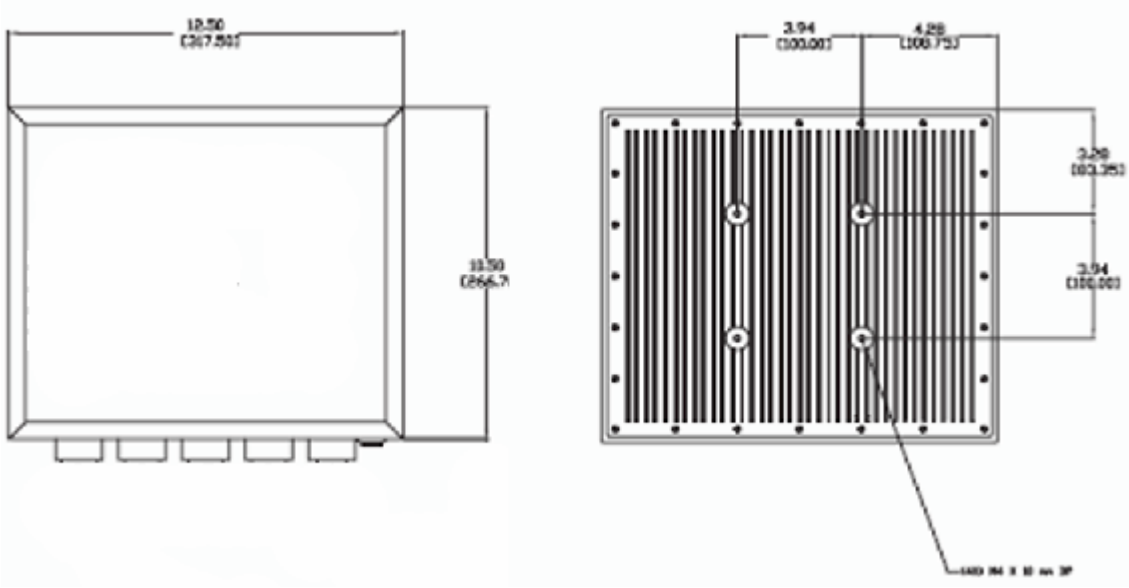
ACQUISITION HARDWARE

The Pump Inspector™ Data Acquisition Hardware now consists of two separate NEMA 4X (IP 66) enclosures connected via Ethernet. This gives the end user greater flexibility on where to mount the display/processing unit and also makes installation of the system easier. Customer supplies 2 Power (110-240v), 2 Ethernet, and 2 Mounts per pump.

The Pump Inspector™ Display / Processing Unit (placed in location of choice)



The Pump Inspector™ Acquisition Hardware (near pump)



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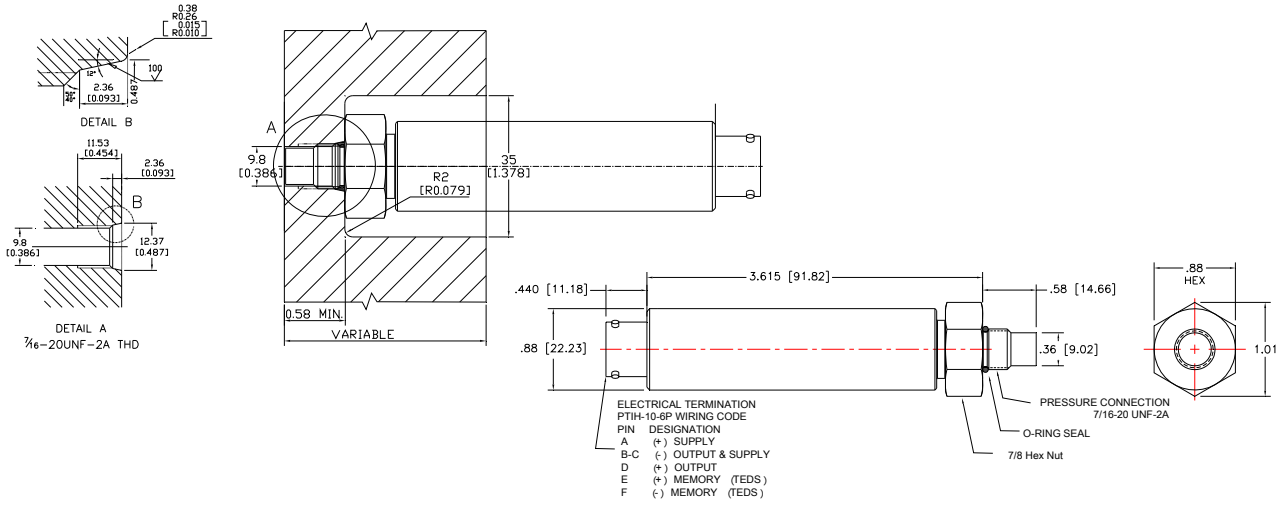
PRESSURE TRANSDUCER

HIGH FREQUENCY RESPONSE
VIBRATION RATED
FLUSH MOUNTED
PRESSURE TRANSDUCER

The model WA105 high level output, vibration rated, flush diaphragm pressure transducer features 4-20mA output with an unregulated power supply. Pressure ranges are available up to 15,000 psi or 1000 bar. The mounting threads are 7/16-20UNF with an o-ring seal. These pressure transducers feature all welded construction and 17-4PH stainless steel wetted parts. The electrical conductor is hermetic with a stainless steel shell and is welded to the transducer body.

Model		WA105
Performance	**Pressure Ranges**	**500, 5000, 15000 psi**
		33, 333, 1000 Bar
	Accuracy (min.)	**±0.5% F.S.**
	Resolution	**Infinite**
	Frequency Response	**8 KHz**
Environmental	**Temperature, Operating**	**-40ºF to 200ºF (-40ºC to 93ºC)**
	Temperature, Compensated	**0ºF to 185ºF (-18ºC to 85ºC)**
	Temperature Effect	
	- Zero (max.)	**±0.015% F.S./ º F (±0.033% F.S./ ºC)**
	- Span (max.)	**±0.020% F.S./ º F (±0.044% F.S./ ºC)**
Electrical	**Output / Power**	**4-20 mA at 16-32 VDC**
	Connector	**PTIH-10-6P or equivalent**
	Mating Connector(not incl.)	**AA111 (PT06A-10-6S)**
	Memory	**TEDS, PLUG & PLAY PER IEEE 1451.4 - Class 2**
Mechanical	**Type of Measurement**	**PSI Gage- Sealed**
	Vibration Rated	**MIL-STD-901**
	Wetted Material	**17-4PH welded stainless steel**
	Overload - Safe	**2X Range**
	Overload - Burst	**5X Range, to a max of 25000 psi**



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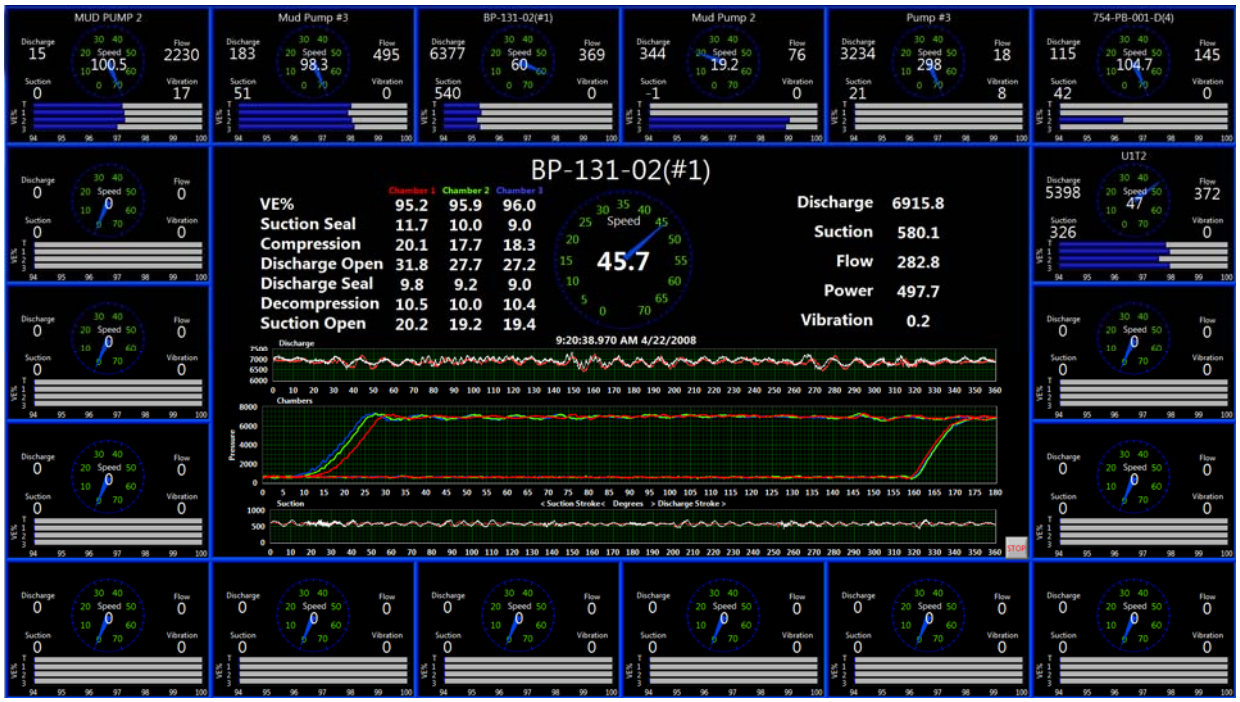
MULTI-PUMP DISPLAY

Remote interface for quick overview of up to 18 pumps. Click on any pump to see that pump in greater detail. Display is subject to change. 1920 x 1080 display resolution required.



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