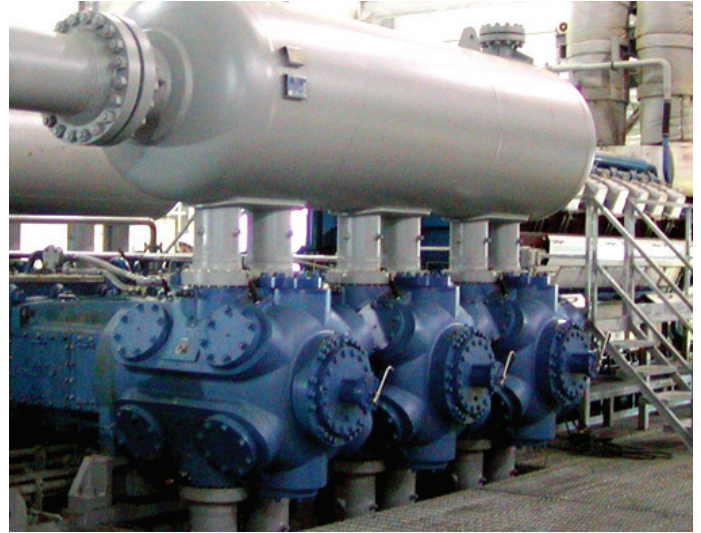


Reciprocating Compressor Monitoring



Why choose Metrix for monitoring your reciprocating compressors?
The answer is simple: **better value.**

1. Scalability

Metrix is the only provider to offer monitoring solutions easily scalable to the various sizes of reciprocating compressors, namely packaged/skid-mounted up to API 618 machines. In contrast to their much larger API 618 counterparts, packaged recips are typically smaller in size, but can still occupy a prominent role in the plant. While a complex measurement suite and accompanying diagnostic software may not be appropriate, Metrix provides affordable and comprehensive solutions for this smaller – but no less important – class of machines. Metrix is now able to offer a focused solution for API 618 type recips including shutdown and alarm for frame vibration, impact severity, rod drop, and crosshead acceleration. Large or small, Metrix truly delivers a scalable solution.

2. Simplicity

Our approach to reciprocating compressor monitoring is to simplify it without sacrificing effectiveness. Accordingly, we have designed our offerings to use simple measurement concepts focused on the four key areas in which reciprocating compressors are most prone to mechanical problems. Metrix is the only company offering 4-20mA transmitter-based solutions. Our

solutions focus on simplifying the user experience for installing, maintaining, and using the instrumentation, while delivering outstanding results and excellent value for the money.

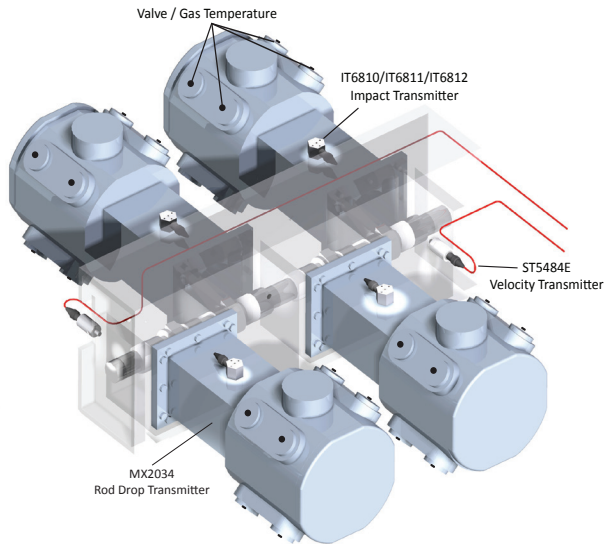
3. Experience

Metrix monitors an estimated 3,000 reciprocating compressors around the world – more than any other provider. Our solutions have been proven in-use for more than a decade and are purchased by OEMs and end-users alike.

4. Innovation

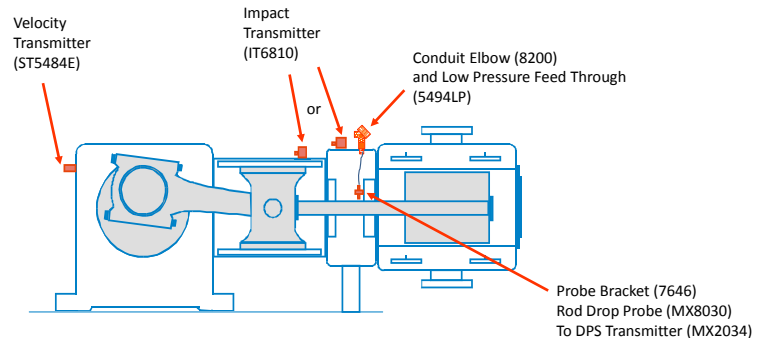
Metrix pioneered our patented impact measurement technology more than 10 years ago as a way for customers to reliably – yet simply – detect problems in running gear such as looseness in crosshead shoes, wrist pins, connecting rods/nuts, and other components. We also pioneered the first commercially available 4-20 mA seismic vibration transmitter. Today, we continue to pioneer with the world's first digital, programmable proximity system. Our DATAWATCH IX monitoring system builds on this programmable theme by offering a flexible monitoring module – a 4 or 8-channel system programmable for virtually any vibration or position transmitter measurement.

Area	Measurement	Metrix Solution
		Transmitter-based
Crank, Frame, and Bearings	Seismic Vibration Monitoring	ST5484 into PLC
Running Gear	Impact Monitoring	IT681X into PLC
Rider Bands	Rod Drop Monitoring	MX2034 into PLC
Valves	Temperature Monitoring	RTD or TC into PLC



Transmitter Solution

- Simple
- Cost-effective
- Takes advantage of existing control systems, PLCs or SCADA systems



Impact Monitoring

The impact measurement was originally developed as a reliable means of protecting reciprocating compressors. Mechanical conditions such as loose rod nuts, loose bolts, excessive slipper clearance, worn pins and liquid in the process are routinely detected on recip using the impact measurement.

The IT681X Impact Transmitter outputs a current level based on the registered number of events above a user-set threshold level that occurred within a configurable time window. Metrix calls this a measurement of "impact severity." An output of 4mA indicates no events occurred over the threshold level within the time window. An output of 6mA indicates 2 events, 8mA indicates 4 events, etc., up to 20mA for 16 events. If set up correctly, the events equal the number of impacts due to looseness.

Valve Temperature

Valve temperature is a proven method for detecting valve problems. Broken valves are a common mode of failure for reciprocating compressors according to industry studies. Metrix offers the ability to monitor valve temperature using DATAWATCH IX with RTD/TC input to the monitor.

Rod Drop

An indicator used to determine rider band wear is rod drop. Using a proximity probe to trend band wear helps to avoid piston to cylinder liner contact and associated downtime for unexpected repairs. A rod drop measurement provides the user the average position or an instantaneous position of the piston. Alert and danger levels can be programmed with DATAWATCH IX or your PLC allowing maintenance to be anticipated and scheduled.

Frame Vibration

Frame vibration measurements are useful for monitoring vibration related to the running speed and forces acting on the machine. Used in conjunction with an impact transmitter or an accelerometer, malfunctions associated with low frequency and high frequency events can be reliably detected. Metrix recommends the use of the ST5484E Velocity Transmitter for frame vibration.



Scalable Monitoring Solutions for Reciprocating Compressors

Measurements	Metrix Transmitter Solution
Target Machine Class	Packaged/Skid-mounted
Frame Vibration	● ^{1,3}
Crosshead / Cylinder Impact	●
Rod / Plunger Drop	●
Machine Speed / Phase	●
Bearing Temperature	●
Discharge Gas Temperature	● ¹
Valve Temperature	● ⁴
Pressure Packing Temperature	●

- 1) Required for shutdown by ISO 13631, 1st Ed., Petroleum and Natural Gas Industries – Packaged Reciprocating Gas Compressors (based on API 11P)
 2) Required for shutdown by API 618, 5th Ed., Reciprocating Compressors for Petroleum, Chemical, and Gas Industry Services
 3) Referred to as “high vibration” in ISO 13631.
 4) TC/RTD input to PLC or DATAWATCH IX Monitoring System.

Provider Comparison	Metrix -Transmitters	Bently Nevada 3500 / System 1	Prognost SILver / NT
Target Machine Class	Packaged/API 618	API 618	API 618
Cost per throw (USD)*	\$3K - \$10K	\$25K – \$150K	\$25K – \$150K
Frame Vibration	●	●	●
Crosshead/Cylinder Impact	●		
Crosshead/Cylinder Acceleration	●	●	●
Machine Speed / Phase	●	●	●
Bearing Temperature	● ⁴	●	●
Valve Temperature	● ⁴	●	●
Rod / Plunger Drop	●	●	●
Rod / Plunger Position	●	●	●
Dynamic Cylinder Pressure		●	●
Condition Monitoring SW	●	●	●
Advantages	<ul style="list-style-type: none"> - Simple - Cost-effective - Solutions for rotating and recip machines - Impact measurements available - Simplified spares - Comprehensive measurements 	<ul style="list-style-type: none"> - Comprehensive measurements - Cylinder performance (PV curves) - Automated Diagnostics - Solutions for rotating and recip machines 	<ul style="list-style-type: none"> - Comprehensive measurements - Cylinder performance (PV curves) - Automated Diagnostics - Excellent data visualization
Disadvantages	<ul style="list-style-type: none"> - Requires PLC, DCS, or 4-20mA input system - Setup performed at machine - Limited measurements - Limited diagnostics (dynamic data available via BNC connectors) 	<ul style="list-style-type: none"> - Complex - Expensive - Not cost-effective for pkgd recip - Numerous installation pitfalls - Impact measurements not available 	<ul style="list-style-type: none"> - Complex - Expensive - Not cost-effective for pkgd recip - Numerous installation pitfalls - Solutions only for recip machines - Impact measurements not available

* Approximate cost to instrument a 4-throw, 8-valve-per-cylinder compressor with all bulleted measurements



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