

Dynamic Pressure Monitoring for Pumping Systems



Pumping systems are common throughout industrial plants around the world. Ironically, pumping problems can be almost as common as the pumps themselves. Cavitation and other forms of flow instabilities can appear without warning and impact the reliability of your plant and process.

While many of these problems are hydrodynamic in nature, plants are often equipped with only static measurements to help diagnose a problem. For basic operations it is common to install a static pressure sensor on the pump discharge, and even occasionally on the pump suction side. These measurements are typically simple 4-20 mA loop instruments and are brought into a local PLC for static trending in plant systems such as a DCS.

However, when the pumping system experiences a hydrodynamic problem, plant personnel have only static data to rely on for diagnosis. Pressure pulsations associated with malfunctions can happen at relatively high frequencies, higher than the capabilities of static pressure sensors.

To address this issue, Bently Nevada* has developed a Hydrodynamic Pressure Monitoring System that provides the rich hydrodynamic data that is available but hidden from static pressure sensors. Unlocking this data with the Bently Nevada Hydrodynamic Pressure Monitoring System allows for a view into the real conditions inside the pumping system.

Even if you can't necessarily control when these problems occur, you can manage their effects more intelligently. Varying speeds, discharge pressure, flow rates, and other variables make hydraulic disturbances a three-dimensional problem—one difficult to solve without dynamic data. Identifying the contributing factors through changing conditions can give you a clear understanding of when these phenomena occur, and help you optimize your operations.

In response to customer requests, Bently Nevada announces the release of our hydrodynamic pressure sensing system. The system leverages our industry-standard 3500 rack already

installed at many industrial sites, adds a new "Hydro Pressure" channel type to the 3500/46M Hydro Monitor, and includes a new Bently Nevada Dynamic Pressure sensor that has been tested and proven in dynamic applications. A unique feature of this system is that it provides **both static and dynamic** pressure measurements from a single sensor and channel.

The hydrodynamic pressure sensing system consists of the hardware¹ you need to retrofit your existing 3500 system, or add to a new 3500 monitoring system for your unit:

- 3500/46M Hydrodynamic Monitor with Multimode Positive Input I/O²
- 350300 Dynamic Pressure Sensor
- 146824 Pressure Sensor Cables (lengths from 10 to 1,000 ft.)

Three sensor static pressure options are available to match the particular characteristics of your pumps: 6.8 bar (100 psi); 13.7 bar (200 psi); and 34.4 bar (500 psi). Others are available upon request. The sensors are capable of measuring pulsations down to 0.2 Hz, and are typically installed in the suction and discharge piping. Each 3500/46M monitor added to your 3500 rack will accept up to four dynamic pressure signals using the new "Hydrodynamic Pressure" channel type.³



The Hydrodynamic Pressure Channel in 3500 provides the following variables and settings:

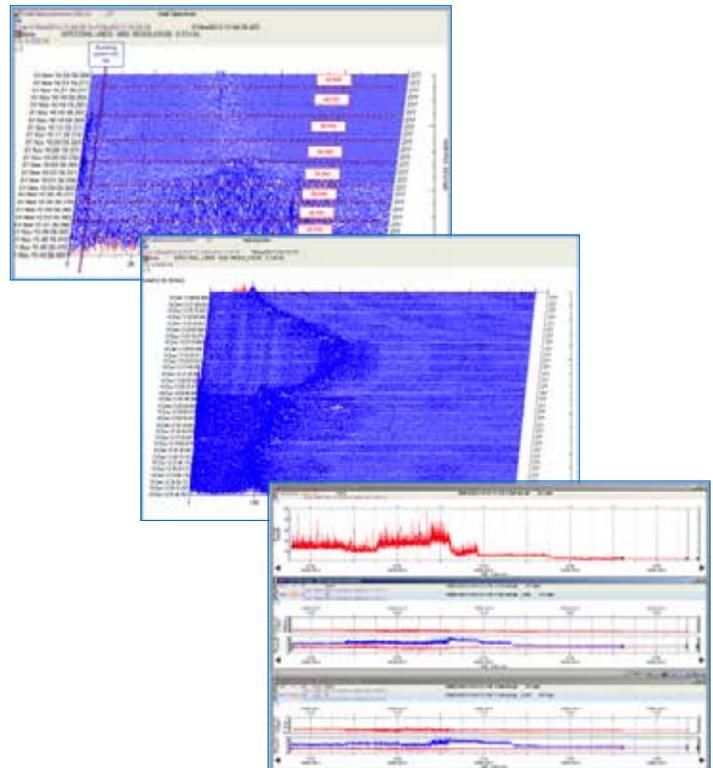
Direct Amplitude	Direct peak (or RMS) amplitude of dynamic pressure in psi or kPa.
Static Pressure	Static pressure measured in psi or kPa.
1X Amplitude	1X filtered peak (or RMS) amplitude of dynamic pressure in psi or kPa.
1X Phase Lag	1X phase lag measured in degrees.
2X Amplitude	2X filtered peak (or RMS) amplitude of dynamic pressure in psi or kPa.
2X Phase Lag	2X phase lag measured in degrees.
Mode	Unique alarm setpoints for each defined mode of unit operation (when multimode feature is enabled).
Alarm Latching/Delays	Additional control of alarm latching and time delays gives additional control of your alarming scheme.
Timed OK Channel Defeat	Intelligent detection of faulty sensor/circuit, protecting you against false trips. Now with time delay.
Recorder Outputs	4-20 mA outputs (1 for each channel) for integration into an external recorder or display.
Trip Multiply	Input contact used to increase Alert and Danger levels for startup and/or shutdown.

System 1 Diagnostic plots available with the Hydrodynamic Pressure Channel:

Trended variables	Trended variables with highly customizable software pre-alarms.
Direct Waveforms	Waveform plots for visual interpretation and diagnostics.
Spectrum plots	Spectrum plots for trending frequencies of interest over time, speed, and other changes.
X-Y plots (e.g., speed vs. pressure)	X-Y plots are useful for plotting pressure pulsations vs. speed.

The 3500 rack provides all of the benefits that you have come to expect from Bently Nevada in terms of reliability, connectivity, and ease of use. The 3500 provides total alarm control with Alert and Danger setpoints for Direct (dynamic pressure) amplitude, static pressure, and dynamic variables.⁴ Data values can be easily mapped into Modbus registers for communication to your plant DCS. The 3500/93 and 3500/94 provide excellent local panel displays with an option for touch-screen.

Use of the 3500/32 or 3500/33 relay output modules provides 4 or 16 channels of relays that can drive alarms and annunciation when conditions worsen. Finally, the data can also be streamed into System 1 Diagnostic software for static trending, and full dynamic analysis with waveforms and spectrum plots, as well as speed or load vs. dynamic pressure amplitudes. System 1 also provides email notification on alarming and easy-to-use Diagnostic Display software that can be installed on any desktop computer in your organization so your team can remain informed and up to date on the status of your pumping systems.



For more information, visit <https://www.gemeasurement.com/condition-monitoring-and-protection>, refer to the 350300 Hydrodynamic Pressure Sensor data sheet (p/n 110M4613), and contact your local GE representative.

Notes:

1. Installation-specific hardware such as isolation valves, piping and brackets not included.
2. An existing 3500/46M with Multimode Positive I/O module can be reconfigured for use with the 350300 Dynamic Pressure Sensors. Note that both channel pairs (all four channels) will become Hydro Dynamic Pressure channel type.
3. Available with 3500/01 Rack Configuration software version 5.2 or later.
4. Available with System 1 version 6.9 or later.

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