

ADAPT 3701/46 Hydro Monitor

Bently Nevada* Asset Condition Monitoring

Advanced Distributed Architecture Platform Technology - ADAPT



GE's Bently Nevada Advanced Distributed Architecture Platform Technology, or ADAPT 3701, is a family of compact, high performance safety and machinery protection and condition monitoring solutions. ADAPT products are targeted at specific assets and applications, and excel at the intensive signal processing necessary to identify early indicators of machine failure modes long before an alarm.

Description

The ADAPT 3701/46 Hydro Monitor is designed specifically for protection and condition monitoring on Hydro Turbines. It is optimized for the lower speeds of hydro turbines and has specialized measurements to detect rough load zone, propeller, blade, or bucket nX frequencies and cavitation as well as conventional measurements of shaft radial position and vibration, thrust position, and absolute vibration using accelerometers or velocity sensors.

The compact size and channel count of the 3701/46 Hydro Monitor make it well suited for hydro turbines requiring no more than 12 sensor points. Hydro turbines in this category can range in size and type but are most commonly smaller units.

The 3701/46 is configured and validated with Bently Nevada Monitor Configuration (BNMC) software. BNMC is a simple and powerful configuration and validation environment used for the 3701/46 Hydro Monitor. It is ordered separately and is required for operation.

The 3701/46 Hydro Monitor is a self-contained device that is ordered with a single part number and is made up of the following major components:

Part	Quantity Required in each 3701/46
3701 Terminal Base	1
3701 Processor Module	1
3701 Input Module	1 or 2
3701 Output Module	1 or none



3701/46 Overview

The 3701/46 is a robust, compact, self-contained 12-channel device with sophisticated signal processing capability and with a form-factor suitable for distribution close to individual hydro turbines. It has a modular construction that allows field changing of components and is fully-configurable. It combines protection and condition monitoring (CM) in a single package. With the ability to define measurements and alarms within the monitor, it can act as a stand-alone protection and CM system. There is no need for any interaction with external software to trigger or control the monitor during operation.

3701 Digital Communications

The 3701/46 has two independent Ethernet physical RJ45 connections for digital communication with Bently Nevada software products hosted on network computers and plant automation systems. It uses a proprietary Ethernet protocol for communicating with System1* Evolution software and the BNMC configuration software.

The 3701/46 includes two Ethernet ports which provide Ethernet TCP/IP communications capabilities. Standard industrial protocols are:

- Modbus TCP/IP
Modbus over Ethernet is available for connection to HMI's, unit control systems, or other plant automation equipment. The 3701 can only be configured as a server.
- Ethernet Global Data (EGD)
EGD is a GE protocol used on Mark VI and Mark Vie controllers and by GE Programmable Automation Controllers and certain 3rd party automation equipment.

3701/46 System Description

The 3701/46 monitor is powered by single or dual redundant external +24 V DC power. It consists of four main physical components: the terminal base, processor module, one or two input modules, and an output module.

The terminal base is the mounting platform for the monitor. The different modules install into the terminal base and two pluggable field wiring termination blocks plug into the terminal base. Sensor wiring terminates on the wiring blocks and terminations for discrete inputs (Reset, Trip Multiply, etc.) terminate directly on the base but on the opposite side from sensor wiring.

The processor module is the monitor's CPU. It is the center of the logic and signal processing for the monitor.

The input modules are the interface to the sensors. Each input module type covers multiple sensor varieties but due to the number of sensor types there are different input modules. The input modules condition the analog sensor signals for delivery to A/D conversion on the processor module. The input modules are simple, reliable, analog circuitry but with a simple microcontroller (outside the protection path) to provide diagnostics and fault detection on each module. Buffered transducer outputs are provided at a multi-pin Dsub connector on each input module. An accessory cable is available to fan the buffered outs to BNC or ADRE 408 Dspi compatible connectors.

The output modules are for monitor outputs such as relay contacts or 4- 20 mA analog outputs. At the current time only the 8-Channel Relay Output Module is available. It contains 8 programmable SPDT relays and a dedicated monitor Protection Fault (OK) Relay. Relay logic is created in the BNMC software using the graphical logic editor.

Processor Module

The processor module, or CPU module, performs A/D conversion, digital signal processing, alarm and logic processing, and communications to GE Bently Nevada software and plant automation systems. The CPU module employs sophisticated diagnostics and fault detection processing to enhance reliability, availability, and maintainability of the protection and monitoring system.

Input Modules

3701 Proximito* Accelerometer* Velomitor* (PAV) Input Module

The 3701 PAV input module is a 6-channel + Keyphasor/speed input module that interfaces to a variety of sensors such as: -24 Volt Proximito sensors, -24 Volt 3-wire Accelerometers, Velomitores, and constant current 2-wire sensors that are compatible with the -24 Volt 2-wire Velomitor interface.

Any of the PAV's six channels (1 – 6) can be independently configured for one of the supported transducers. Each PAV supports one dedicated Keyphasor or speed measurement on channel 7 that is configurable for Proximito sensors or magnetic pick-ups.

3701 Proximitor Accelerometer Seismic (PAS) Input Module

The 3701 PAS input module is a 6-channel + Keyphasor/speed input module that interfaces to a variety of sensors such as: -24 Volt Proximitor sensors, -24 Volt 3-wire Accelerometers, 2-wire Seismoprobes and compatible 3rd party inertial mass velocity sensors, or dynamic pressure sensors.

Any of the PAS's six channels (1 – 6) can be independently configured for one of the supported transducers. Each PAS supports one dedicated Keyphasor or speed measurement on channel 7 that is configurable for Proximitor sensors or magnetic pick-ups.

3701 Positive (PoV) Input Module

The 3701 PoV input module is a 6-channel + Keyphasor/speed input module that interfaces to a variety of positively powered sensors such as: +24 V Proximitor sensors, +24 V Interface modules, and two-wire IEPE sensors using 3.3 mA constant current.

Any of the PoV's six channels (1-6) can be independently configured for one of the supported transducers. Each PoV supports one dedicated negatively powered Keyphasor or speed measurement on channel 7 that is configurable for Proximitor sensors or magnetic pick-ups.

Output Modules

3701 8-Channel Relay Output Module

The 3701 8-Ch Relay Output Module provides 8 SPDT relay outputs or 4 "virtual" DPDT outputs and a dedicated Protection Fault relay. Relay logic is user programmable in the BNMC software using the graphical logic editor. The processor module operates on the relay logic to drive relay state.

The Protection Fault relay is a normally energized SPDT relay that will de-energize on fault conditions that can compromise the monitor's availability to protect machinery. The protection fault relay is similar to a traditional OK relay but certain conditions that do not compromise protection will not cause the Protection Fault relay to de-energize.

The relays are configured for Normally De-Energized (NDE) or Normally Energized (NE) in four sets of two relays each by using switches on the relay module.

Relay wiring terminates on the output module using pluggable connectors and exits on the opposite side of the monitor from the sensor inputs.

Terminal Base

3701 Simplex Terminal Base

The term "simplex terminal base" identifies, or distinguishes this type of terminal base as one with a single (simplex) processor module as opposed to a dual (or duplex) terminal base with two processor modules. The duplex terminal base is not available with the 3701/46.

The 3701 simplex terminal base is the mounting and installation component of the monitor. It supports a single processor module, one or two input modules, and an output module.

The terminal base mounts to a bulkhead, or enclosure or wall sub-panel using the four mounting holes at the corners of the base. Mount vertically for optimal convection cooling.

Terminal base features:

- Two pluggable terminal blocks provide sensor wiring terminations that are individually marked for the sensor wire type. The termination blocks can be removed for wiring ease or maintenance work and, when installed, are fixed in place with a locking mechanism.
- A dedicated connection terminal for single point connection to system earth.
- A single point earth connection switch to separate physical (chassis) earth from system common (instrument earth) to enable system common connection to an external intrinsic safety earth.
- Primary and Secondary connectors for single or redundant +24 V DC power input.
- Six discrete inputs (DI) for dedicated dry contact DIs: Trip Multiply, Alarm/Relay Inhibit, Latch Reset, Special Alarm Inhibit, Run Mode, and IP/Account reset.

Channel Types, Sensors, and Measurements

The 3701/46 Hydro Monitor supports a set of standard channel types and the common sensors used with those channel types as well as custom configurable sensors. Support for sensor types is dependent on input module type as listed in tables located below in this datasheet section. Each channel type has default measurements that can be enabled or disabled and each channel type can have user customizable nX and bandpass measurements added to the channel and then customized to the application.

The 3701/46 can have up to 12 vibration input channels (Six per input module) and two Keyphasor/Speed inputs (One per input module). The monitor supports the channel types listed here:

- Acceleration
- Dynamic Pressure
- Radial Vibration
- Thrust Position
- Velocity
- Keyphasor/Speed

Channel Type support by Input Module

Input Module	Channel Types
PAS Channels 1 - 6	Acceleration Radial Vibration Thrust Position Velocity Proximitor Speed
PAS Channel 7	Magnetic Pickup Speed Proximitor Speed (single and multi-event)
PAV Channels 1 - 6	Acceleration Dynamic Pressure Radial Vibration Thrust Position Velocity Proximitor Speed
PAV Channel 7	Magnetic Pickup Speed Proximitor Speed (single and multi-event)
PoV Channels 1 - 6	Acceleration Dynamic Pressure Radial Vibration Thrust Position Velocity
PoV Channel 7	Keyphasor/Speed (Proximitors, single and multi-event or Mag pickup, single and multi-event).

PAV and PAS channels 1 – 6 can also be configured to support an additional Keyphasor input provided it is a single event per revolution, less than 10,000 rpm, and uses a Proximitor sensor. This cannot be done with the PoV module.

Input Module compatibility with acceleration inputs

Input Module	Accelerometer or Accelerometer Interface Module
PAS	155023-01 High Freq 200g Accel I/F Module 23733-03 Accel I/F Module 24145-02 High-Freq Accel I/F Module 330400 100 mV/g Accelerometer 330425 25 mV/g Accelerometer 330450 High Temp Accelerometer 350501 Acceleration Charge Amplifier 49578-01 Accel I/F Module Custom

PAV	155023-01 High Freq 200g Accel I/F Module 23733-03 Accel I/F Module 24145-02 High-Freq Accel I/F Module 330400 100 mV/g Accelerometer 330425 25 mV/g Accelerometer 330450 High Temp Accelerometer 350501 Acceleration Charge Amplifier 49578-01 Accel I/F Module Custom
PoV	GSI 122, 124 and 127 Galvanic Interface Unit TP100 Commtest Accelerometer TP500 Commtest Accelerometer 200350 Accelerometer 200355 Accelerometer 786-500 Wilcoxon Accelerometer 626B02PCB Accelerometer HS-170 Hansford Accelerometer HS-100F series Hansford Accelerometer CMSS-2100 SKF Accelerometer 351M35 PCB Accelerometer

Input Module compatibility with velocity inputs

Input Module	Velomitors, Seismoprobes, and interface modules
PAS	9200 Seismoprobe 74712 Hi Temp Seismoprobe 47633 Seismoprobe 86205 BoP Seismoprobe Custom
PAV	330500 Velomitor 330525 Velomitor XA 190501 Velomitor CT 330750 High Temp Velomitor 330752 High Temp Velomitor 330505 Low Freq Velocity Sensor 330530 Radiation Resistant Velomitor Custom
PoV	HS-160 Velocity Sensor

Input Module compatibility with Proximitor sensors

Input Module	Proximitor Sensor
PAS or PAV	3300XL 8 & 11 mm 3300XL NSV 3300 RAM Proximitor
PoV (Keyphasor)	3300 5 & 8 mm 3300 16 mm HTPS 7200 5, 8, 11, 14 mm Custom

Input Module compatibility with dynamic pressure inputs

Input Module	Dynamic Pressure Sensor
PAS	3-Wire (Com/Sig/-24VDC)
PAV	3-Wire (Com/Sig/-24VDC) Constant current compatible with Velomitor interface
PoV	2-wire PCB 121A21 2-wire PCB 121A44 2-wire PCB 121A22

Measurements

Each channel type has a set of default measurements typical of the channel type. In addition, user customizable nX vectors and bandpass measurements may be added to each channel.

Default Measurements by Channel Type

Input Type	Meas.	⁽²⁾ Configurable Attributes
RV	Direct	Full scale range Units (mils or μm peak-peak or rms) High pass corner frequency Low pass corner frequency High pass filter order (1,2,4,6, or 8 th) Low pass filter order (1, 2, 4, 6, or 8 th) Clamp value (amplitude)
	Rough Load Zone	Full scale range Units (mils or μm peak-peak or rms) Low pass filter order (1, 2, 4, 6, or 8 th) Clamp value (amplitude) Running Speed
	1X	Full scale range Keyphasor association Integer or non-integer order in increments of 0.1x from 0.1x to 100x (phase not valid for non-integer orders). Units (mils or μm peak-peak or drms) Clamp value (amplitude and phase)
	2X	Full scale range Keyphasor association Integer or non-integer order in increments of 0.1x from 0.1x to 100x (phase not valid for non-integer orders). Units (mils or μm peak-peak or drms) Clamp value (amplitude and phase)
	Gap	Low Pass Corner Frequency Clamp Value (Volts)
Accel	Direct	Full scale range Units (English or metric, peak or rms) High pass corner frequency Low pass corner frequency High pass filter order (1,2,4,6, or 8 th)

		Low pass filter order (1, 2, 4, 6, or 8 th) Clamp value (amplitude) Integrated
	Cavitation	Full scale range Units (English or metric, peak or rms) High pass corner frequency Low pass corner frequency High pass filter order (1,2,4,6, or 8 th) Low pass filter order (1, 2, 4, 6, or 8 th) Clamp value (amplitude)
	1X	Full scale range Keyphasor association Integer or non-integer order in increments of 0.1x from 0.1x to 100x (phase not valid for non-integer orders). Units (English or metric, peak or drms) Clamp value (amplitude and phase) Integrated
	2X	Full scale range Keyphasor association Integer or non-integer order in increments of 0.1x from 0.1x to 100x (phase not valid for non-integer orders). Units (English or metric, peak or drms) Clamp value (amplitude and phase) Integrated
Veloc.	Bias	Low Pass Corner Frequency Clamp Value (Volts)
	Direct	Full scale range Units (English or metric, peak or rms) High pass corner frequency Low pass corner frequency High pass filter order (1,2,4,6, or 8 th) Low pass filter order (1, 2, 4, 6, or 8 th) Clamp value (amplitude) Integrated
	1X	Full scale range Keyphasor association Integer or non-integer order in increments of 0.1x from 0.1x to 100x (phase not valid for non-integer orders). Units (English or metric, peak or drms) Clamp value (amplitude and phase) Integrated
	2X	Full scale range Keyphasor association Integer or non-integer order in increments of 0.1x from 0.1x to 100x (phase not valid for non-integer orders). Units (English or metric, peak or drms) Clamp value (amplitude and phase) Integrated

	Bias	Low Pass Corner Frequency Clamp Value (Volts)
Thrust	Position	Full scale range Units (mils or μm peak-peak or rms) Low pass corner frequency Clamp value (amplitude)
	Gap	Low Pass Corner Frequency Clamp Value (Volts)
Dynam Press.	Pressure	Full scale range Units (psi or mbar peak-peak, dpp or rms) High pass corner frequency Low pass corner frequency High pass filter order (1,2,4,6, or 8 th) Low pass filter order (1, 2, 4, 6, or 8 th) Clamp value (amplitude)
	Band-pass	Full scale range Units (psi or mbar peak-peak or rms) High pass corner frequency Low pass corner frequency High pass filter order (1,2,4,6, or 8 th) Low pass filter order (1, 2, 4, 6, or 8 th) Clamp value (amplitude)
	Bias	Low Pass Corner Frequency Clamp Value (Volts)
Prox Speed	Speed	Top Scale Clamp Value
	Gap	Low Pass Filter Frequency Clamp Value (Volts)
Mag Pickup Speed	Speed	Top Scale Clamp Value

In addition, user customizable nX vectors, amplitude extractions and bandpass measurements may be added to each (non-speed) channel.

The number of measurements that can be added and enabled depends on the signal processing capability of the processor module. There is no limitation, other than processor performance, to the number of measurements that can be added to a single channel or across all channels. A performance calculator in the BNMC software provides feedback during the configuration process on performance margin as measurements are added or removed and their attributes modified.

Additional Measurements by Channel Type		
Input Type	Meas.	⁽¹⁾ Configurable Attributes
RV, Thrust, Dynam Press, Accel, Velocity	Band-pass	Full scale range Units (English or metric, peak to peak or rms) High pass corner frequency Low pass corner frequency High pass filter order (1,2,4,6, or 8 th) Low pass filter order (1, 2, 4, 6, or 8 th) Clamp value (amplitude)
	nX	Full scale range Keyphasor association Integer or non-integer order in increments of 0.1x from 0.1x to 100x (phase not valid for non-integer orders). Units (English or metric, peak to peak or drms) Clamp value (amplitude and phase)
	Amp. Extract	Full scale range Units (English or metric, peak to peak or rms) Clamp value (amplitude) Associated Spectrum Center Frequency Bandwidth
	Spec Band	Full scale range Units (English or metric, peak to peak or rms) Clamp value (amplitude) Associated Spectrum Start Frequency Stop Frequency

- (1) Technically feasible configurations depend on the interaction between many factors. Certain selections may not be feasible. Use the BNMC software to create an off-line configuration to determine technical feasibility.

Waveforms and Spectral Data

Acquisition of multiple synchronous and asynchronous waveforms can be configured for each 3701 channel in the BNMC software. These waveforms are used as the data source for extraction of measurements that require spectral data such as nX vectors and peak extractions.

Waveform configuration for spectral data consists of f_{max} and the number of lines in the spectral data.

Asynchronous spectral waveforms:

F_{max} can be set between 10 Hz and 40 kHz in 12 discrete steps. F_{min} is always at 0 Hz.

The number of spectral lines can be set from 12.5 to 3200 in 12 discrete steps.

Synchronous spectral waveforms:

Number of samples per revolution can be set from 8 to 4096.

Number of revolutions per waveform can be set from 1 to 1024.

Amplitude Extractions

An Amplitude extraction is the amplitude at a user configured center frequency and with a user configured bandwidth. The band around the center frequency is limited in size and can range from a single spectral line (bucket) closest to the configured center frequency, to the center spectral line plus 5 lines on each side (11 total buckets).

Alarming and Setpoints

Alert and Danger over and under alarm setpoints can be created individually for each measurement. Additionally, alarm attributes such as enable/disable, alarm time delay (ATD), and latching/non-latching can be independently configured on each measurement.

In addition, the alarming attributes (enable/disable, ATD, and latching/non-latching) can be set independently on the Alert and Danger alarms on the same measurement.

Relay logic is created in the graphical relay logic editor in BNMC software by mapping the enabled alarms to OR and AND gates to drive a relay.

Individual relays can be configured as latching/non-latching or enabled/disabled independently (or in addition to) the settings on the measurement alarms.

Network Operation

The processor module supports two Ethernet RJ45 physical connections located on the terminal base. The two connectors are termed Net A and Net B and each has its own configurable IP address. All configuration and interface to Bently Nevada software as well as communication using an industrial protocol is with one or both of these connections.

Display and HMI Options

GE Bently Nevada offers System 1* Basic as a simple, low cost, easily installed, and light footprint HMI. System 1 Basic is part of the System1: Evolution platform.

The Modbus TCP or EGD industrial protocols can be used to serve data to a plant or unit HMI where users can build display environments using standard 3rd party HMI software.

Bently Nevada Configuration Software (BNMC)

BNMC software is necessary to configure and verify the 3701/46 Hydro Monitor.

Bently Nevada Monitor Configuration software will run on most Windows desktop or notebook computers and is designed and fully tested for operation on Microsoft® Windows® 7 and 8.1 (32 bit and 64 bit) and Microsoft Windows 2008 Server and 2012 (64 bit).

Language support at the current time is English version operating systems with keyboard preference set to English.

BNMC is ordered separately from the monitor hardware. See the spares section in the Specifications portion of this datasheet for the part number.

System 1 Evolution Connectivity

3701 monitors connect to System 1 Evolution and support current value and time-based data collection of all static values, waveforms, and spectral data. This includes System 1's full suite of plots and tools for conditioned monitoring and asset management.

Applications

This section describes selected applications where 3701 function and feature offers particular benefits.

Radial Shaft Vibration, Axial Position, and Casing Vibration

3701 supports the standard industry measurements for these applications but, in addition, users can create custom measurements on these channels using spectral bands, bandpass timebase measurements, amplitude extractions, nX measurements, integrated and non-integrated, and rms or peak measurements.

Detection of certain mechanical, aerodynamic, and hydraulic, faults can be enhanced by improved measuring capability. For example, on an axial compressor there may be increased sub-synchronous axial vibration at the onset of a surge condition – a bandpass timebase measurement or synchronous spectral band measurement on an axial position probe can enhance detection of this specific fault mode.

Roller Element Bearings

Use spectral bands to focus on bearing fault frequencies. (nX measurements can also be used but the spectral band allows customizing the bandwidth to the bearing fault frequency response whereas the nX measurement is narrow band.)

Outer Race Ball Pass (ORBP)	A spectral band using synchronous enveloped or non-enveloped data can be set around the expected ORBP
Inner Race Ball Pass (IRBP)	A spectral band using synchronous enveloped or non-enveloped data can be set around the expected IRBP
Cage	A spectral band using synchronous enveloped or non-enveloped data can be set around the expected cage frequency
Ball Spin 1X	A spectral band using synchronous enveloped or non-enveloped data can be set around the expected ball spin 1X frequency
Ball Spin 2X	A spectral band using synchronous enveloped or non-enveloped data can be set around the expected ball spin 2X frequency
Overall and non-REB fault frequencies	Set one or more bandpass measurements to look at

	overall vibration at frequencies where rotor, casing, or structural vibrations are expected. nX measurements can also be used for rotor related vibration.
HF band	Set a spectral band using enveloped synchronous or asynchronous data sources on a broader high frequency band to detect low level impact events. (A simple bandpass with an appropriately set high pass filter can be configured in addition.)

Gear Boxes

There are many types of gear boxes with correspondingly different vibration monitoring needs. This short section is intended only to highlight some particular features of the 3701 system.

Feature	Description
Gear Mesh (GM) 1X, 2X, or 3X	Set a synchronous spectral band, or an nX measurement (or both) on the 1X, 2X, and 3X GM. For each gear set.
Gear Mesh Side Bands	If you know the fundamental frequency of an expected side band based on your gear kinematics then you can set a synchronous spectral band on a specific sideband.
Enhanced measurements from Radial Vibration Proximitors	For API 613 gearboxes where XY radial vibration probes are typically specified you can set the GM related spectral bands described above as well as nX's based on hi and low speed shaft Keyphasors.
Enhanced measurements from Thrust Position Proximitors	For API 613 gearboxes where axial position probes are typically specified. Axial vibration can be measured by setting bandpass filtered or nX measurements in addition to the conventional thrust position measurement.

Gas Turbine Combustion Dynamic Pressure

Spectral bands and/or amplitude extractions as well as bandpass filtered timebase measurements can be configured to selectively monitor the different tones produced by pressure pulsations in combustion turbines.

Specifications

3701/46 Monitor Power Requirements

Input Voltage

Min: 18VDC
Max: 36VDC

Current

2.3 amps max current (Simplex)

Inrush Current

3.0 amps max inrush less than 5 mS (Per processor card)

Supply must be 2006/95/EC Low Voltage Directive compliant for CE installations.

Supply must be Class I, Div 2 or Class I, Zone 2, (CL2 SELV), compliant for hazardous area Installations.

3701/46 Processor Module Specifications

Inputs

Max: 12 dynamic signals and 2 Keyphasor/speed signals

Signal/Noise Ratio

110db @ 102.4 ksps

A/D Conversion

Sigma- Delta 24 bit

Bandwidth

0.0625Hz to 40Khz

Outputs

Two Independent Ethernet ports

Net A: 10/100 BaseT
Net B: 10/100 BaseT

Buffered Signal Outputs

15 pin DSUB connector, available accessory cable for BNC and SMC options.
550 ohm output impedance

LEDs

Module OK LED

Indicates when the module is functioning properly.

Protection Fault LED

Indicates that the monitor has experienced a fault that is affecting protection

User Inhibit LED

Indicates that there has been a user initiated inhibit of alarming functionality

Attention LED

Indicates a condition on the monitor has occurred that may require action

Danger LED

Indicates a Danger condition

Alert LED

Indicates and Alert condition

KPH 1 OK LED

Indicates that Keyphasor signal 1 is triggering.

KPH 2 OK LED

Indicates that Keyphasor signal 2 is triggering.

NetA

Indicates that Network A has a valid link

TX/RX A

Indicates that network traffic is flowing on Network A

Net B

Indicates that Network B has a valid link

TX/RX B

Indicates that network traffic is flowing on Network B

PWR 1 OK

Indicates that the first power input is functioning correctly

PWR 2 OK

Indicates that the second power input is functioning correctly

Accuracy

Direct pk or rms

Within $\pm 0.5\%$ of full-scale typical,
1.1% Worst Case

Bias

+0.4 V / -0.8 V typical, +0.8V / -1.34
V worst case.

Tracking filters

nX tracking filters are have a
bandwidth of 0.075X, where X is the
speed of the associated speed
channel.

Alarming

Setpoints

Over/under user configurable

Time Delay

100mS – 60 minutes

Latching

User configurable alarming or relay
latching

Input Impedance

All 3-wire Inputs (PAS & PAV)

Nominal input impedance is 10 k Ω .

2-Wire Input – PAS (Siesmaprobes)

Nominal differential input
impedance is 9.98 k Ω .

2-Wire Input – PAV (Velomitors)

Nominal constant current is 3.3267
mA.

Speed Signal Inputs

Speed Range:

Dedicated Speed/Keyphasor Input

1 to 120,000 rpm

Auxiliary Proximito Keyphasor Input

1 to 10,000 rpm

Conditioned Speed/Keyphasor Input

1 to 120,000 rpm

Speed Resolution

1 to 100 rpm ± 0.1 rpm

100 to 2000 rpm ± 1 rpm

Gap

± 8.2 mV typical

± 22.3 mV worst case

Phase Accuracy:

Dedicated Speed Input

± 1 degree up to 120,000 rpm

Auxiliary Proximito Speed Input

± 1 degree up to 10,000 RPM

Auto Threshold

Use for any input above 1 rpm for
1 event/resolution.

Manual Threshold

± 150 mV, user selectable from
+3.5 to -23.5 Vdc.

Hysteresis:

User selectable from 0.2 to 10
volts.

Signal Amplitude:

Minimum signal amplitude for
trigger is 2 volts peak-to-peak.

Note: Refer to Hazardous Area Special Considerations
Section for Maximum Magnetic Pickup amplitude
requirements for hazardous area applications.

Relay Output Specifications

Relay Type

Single Pole Double Throw (SPDT).
Normally Open (NO), Normally
Closed (NC), and Armature (ARM)
contacts

Contact Ratings

5A/250 Vac/1500 VA Max.

5A/250 Vdc/150 VA Max.

Minimum Switching Current

12Vdc/100mA

Normally De-Energized (NDE) or Normally Energized (NE)

NDE/NE independently selectable
for relay pairs 1-2, 3-4, 5-6 and 7-8.

Note: Refer to Hazardous Area Special Considerations
Section for Relay specifications when used in
hazardous area applications.

3701/46 Environmental Specifications

Indoor Use Only

Operating Temperature Range

-30 C to +65 C†
(-22 F to 149 F)

† If the 3701 is operated 100% at +65C, its life will be reduced to approximately 11 years. Any portion of the time it is operated below +65C or any convective airflow will increase its lifespan.

Storage Temperature Range

-40C to +85C
(-40 F to 185 F)

Relative Humidity

0% to 95% rH non-condensing
Operating and Storage

Vibration

5g @ 57-500 Hz.
IEC 60068-2-6

Shock

15g, 11ms
IEC 60068-2-27

Altitude

< 2000 m (6,562 ft)

Pollution Degree

Pollution Degree 2

Installation Category

Category II

Physical

Simplex Base Dimensions

26.7 x 20 x 18.2 cm (10.5 x 7.87 x
7.15 in)

Weight

4.5 kg (9.9 lbs)

Mounting

Bulkhead
4 mounting bolts or screws at
corners.

Compliance and Certifications

EMC

Standards

EN 61000-6-2
EN 61000-6-4

European Community Directives:
2004/108/EC

Electrical Safety

Standards

EN 61010-1

European Community Directives:
2006/95/EC Low Voltage

Cyber Security

Achilles Communications Certification
Level1

*Certification in process. Contact Bently
Nevada)*


Hazardous Area Approvals

For a detailed listing of country and product specific approvals, refer to the Approvals Quick Reference Guide (document 108M1756) located at the following website: www.GEmeasurement.com.

CSA/NRTL/C

Class 1 Div 2, Groups A-B-C-D; T4
AEx/Ex nA IIC T4 Gc
T4 @ -30 °C to +65 °C
Installed per drawing 100M0771
CSA 14.2712664

ATEX

 II 3G
Ex nA nC IIC T4 Gc
T4@ -30°C ≤ Ta ≤ +65°C
SIRA 15ATEX4288X

 1180

IECEX

Ex nA nC IIC T4 Gc
T4@ -30°C ≤ Ta ≤ +65°C
IECEX SIR15.0099X

Hazardous Area Special Considerations

- Power supplies must be Class I, Div 2 or Class I, Zone 2 compliant for hazardous area installations.
- Hazardous area installations require relay contact voltages below 30 Vac rms, or 30 Vdc to minimize hazard.

- Hazardous area installations require relay contact amperages below 5 Amps DC, or AC to minimize hazard.
- Hazardous area installations require relay contact power below 100 Watts DC, or 100 VA AC to minimize hazard.
- Hazardous area installations require inter-terminal base connectors to remain unused.
- Magnetic Pickup input amplitude must not exceed 60Vrms to minimize hazard.
- Reference 100M8172 section 3 for additional Hazardous Area restrictions and information regarding installation of the 3701/46 system.

For further certification and approvals information, visit the following website:

<http://www.GEmeasurement.com>

Ordering Information

For a detailed listing of country and product specific approvals, refer to the Approvals Quick Reference Guide (document 108M1756) located at the following website: www.GEmeasurement.com.

3701/46-AXX-BXX-CXX-DXX- EXX

A:	Redundancy		
		01	Simplex
B:	Input Module 1		
		00	None
		01	Prox/Accel/Velom
		02	Prox/Accel/Seismic
		04	Positive Input Module
C:	Input Module 2		
		00	None
		01	Prox/Accel/Velom
		03	Prox/Accel/Seismic
		04	Positive Input Module
D:	Output Module		
		00	None
		01	8 CH Relay Module
E:	Approvals		
		00	None (This does include the non-Hazardous area general safety certification)
		01	CSA
		02	ATEX/IECEX
		XX	Country specific

Spares

3701/46	3701/46 Hydro Monitor
177896-01	3701/46 Processor Module
177988-01	Prox Accel Seismic (PAS) Module
177989-01	Prox Accel Velom (PAV) Module
105M6001-01	Positive Input (PoV) Module
177897-01	3701 Output Relay Module
175794-01	3701 Simplex Terminal Base
177992-01	3701 Terminal Block – Standard
100M9465-01	Bently Nevada Monitor Configuration (BNMC) SW DVD

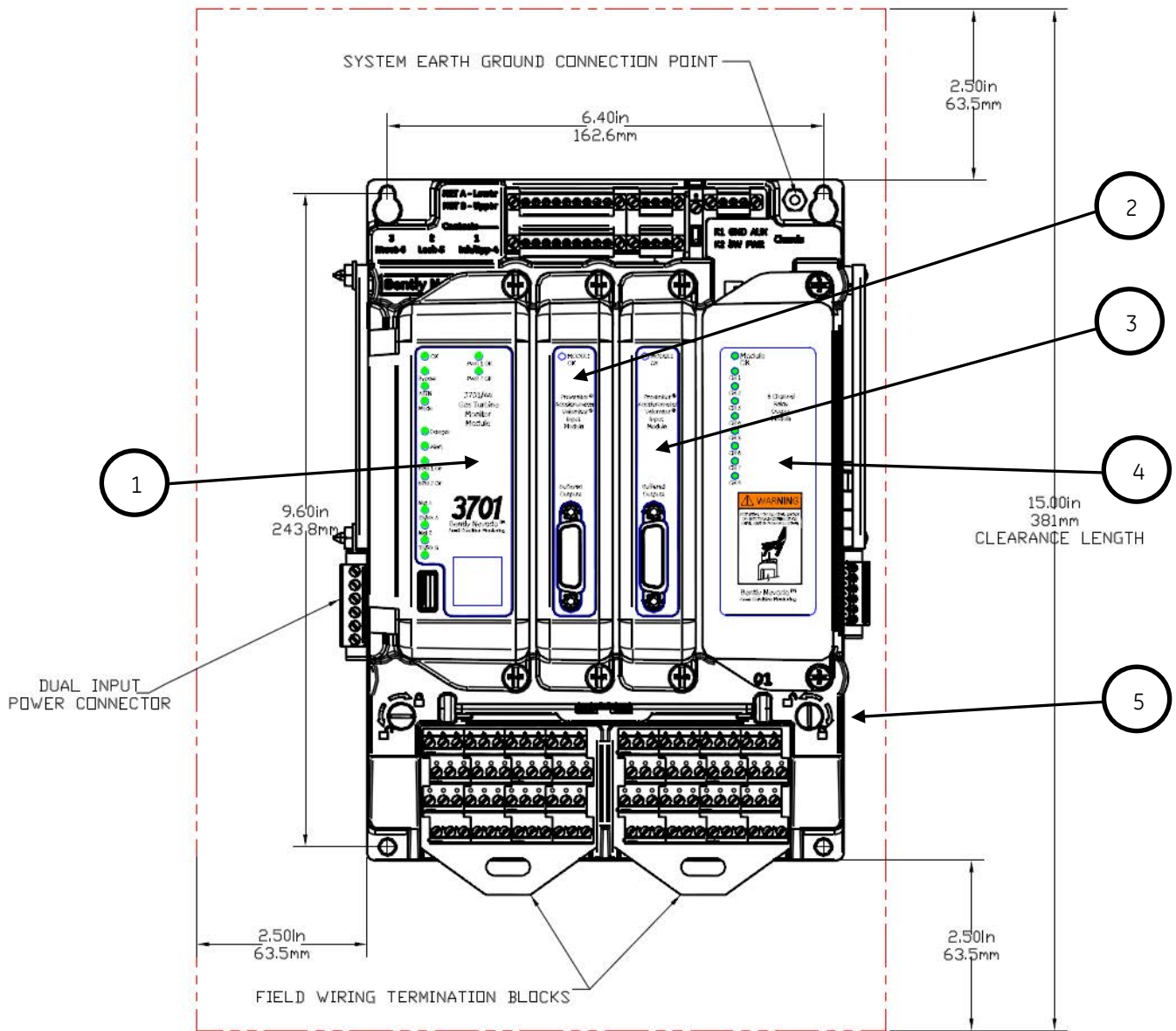
Accessories

323314-01	Buffered Output cable 15 pin D-Sub to 7 SMA connectors. (SMA connectors work with the ADRE 408)
323314-02	Buffered Output cable 15 pin D-Sub to 7 BNC connectors
324343	Weatherproof Housing Kit

Bently_Manuals

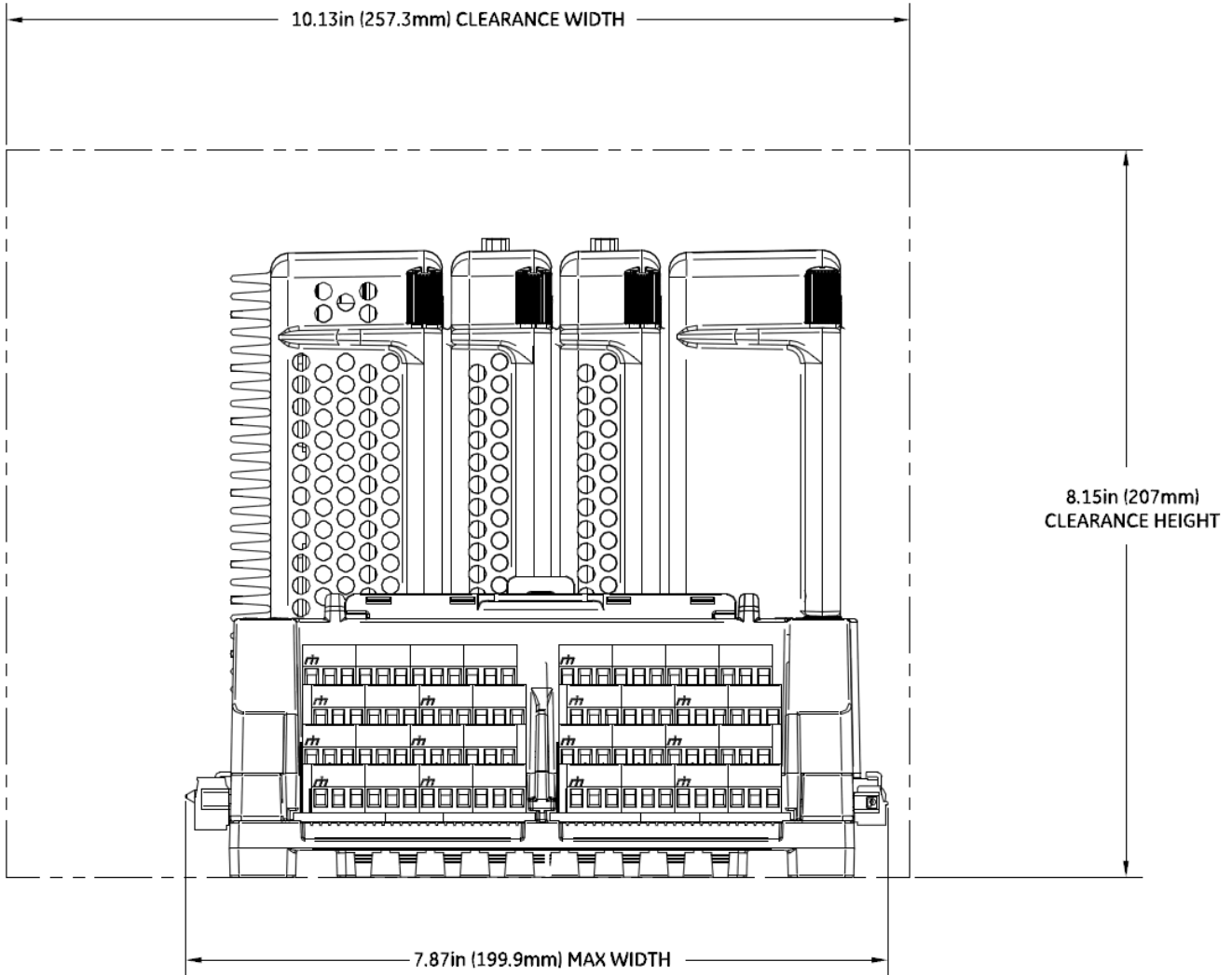
Customer DVD containing all Bently Manuals, FWD, App Notes, and Install Guides in all available languages

3701/46 Simplex Terminal Base



- 1. Processor Module
- 2. Input Module 1
- 3. Input Module 2
- 4. Output Module
- 5. Terminal Base

3701/46 Simplex Terminal Base Top View



3701/46 Simplex Terminal Base Side View

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