**BERAN**

Proven Condition Monitoring Solutions







# PlantProtech™

# 7600 PCMS

**Machinery protection and condition monitoring system**

# Introduction

**Automated vibration trip system providing AP1670 compliant machinery protection with integrated condition monitoring functionality**

## PlantProtech 7600 PCMS machinery supervisory equipment

Protection and condition monitoring systems are essential to monitor critical assets and understand machinery health for long term safe, efficient operation by plant owners and operators to prevent machine failure, planning maintenance tasks and activities.

PlantProtech 7600 PCMS is the latest addition to the PlantProtech family, building on Beran's 40 years of machine monitoring experience to create a new generation of condition monitoring systems with the option of machinery protection.

PlantProtech 7600 PCMS can be configured to meet your individual requirements, and can be used as

* standalone protection system

* online vibration and condition monitoring system

* integrated protection and online vibration condition monitoring system

Plant protection functionality provides automatic trip to protect plant in the case of high vibration exceedance. Online vibration and condition monitoring gives enhanced analysis including 24/7 real-time data and using advanced condition monitoring alarms enables early warning of machinery health changes.

Protection and condition monitoring solutions are needed in a wide variety of applications and the PlantProtech 7600 PCMS modular design supports a wide range of protection applications and installations within the power generation and industrial sectors.

## Designed for...

PlantProtech 7600 PCMS has been designed to comply with ISO7919, API670 and with a lifecycle aligned with IEC 61508 Safety Integrity Level (SIL) applications.

* Turbo generators

* Steam turbines

* Gas turbines

* Hydro turbines

* Main boiler feed pumps

* Emergency boiler feed pumps

* Industrial gas turbines

* Cooling tower fans

* Auxiliary plant items such as ID, PA, FD Fans

* Machinery requiring protection and/or continuous monitoring

## Flexible modular protection system provides

- Plug-in modules to provide comprehensive advanced protection

- Up to 44 protection channels per chassis

- Interfaces to accelerometers, velometers, displacement (Eddy Current) probes and non-vibration sources (temperature, position, radial position), LVDT's

- Flexible modular designed built up from four channel vibration inputs per module

- Two tacho inputs per module

- 24Vdc supplies for displacement (Eddy Current) probes on each tacho and vibration input

- IEPE (ICP®) power supply for each vibration input

- Buffered BNC outputs on front for temporary connection of monitoring systems

- Buffered outputs on rear with screw terminals for permanent connection of monitoring systems

- Fixed and dynamic trip multiply

- Local protection configuration interface

- Health LEDs present for each input

- Configurable proportional outputs for user selected measurements

- Proportional outputs configurable as: 0 to 10Vdc or 4 to 20mA loops

- 4x DPDT relays per module with configurable normally energised / normally de-energised states. Both normally open and normally closed contacts are available

- Relay state readback (relay fault detection)

- 1x DPDT relay for system / module failure

- Industry standard 6U 19" rack mount

- Dual redundant power supplies

- All protection modules hot swappable

- Up to 32 additional relay outputs per rack

**003541-01 PCMS Chassis Assembly**
19" rack 6U enclosure to house protection and condition monitoring modules.

**003553-01 Power Supply Unit**
Multi ranging input power supply hot swappable module.

**004090-01 Protection Relay Expansion Module**
16 channel relay expansion module.

**003551-01 Digital Protection Input Output Module**
Interfaces for external sensors, alarm relay outputs, 4-20mA proportional outputs and dynamic buffered outputs.

**003544-01 Digital Protection Processing Module**
Signal and alarm processing of dynamic vibration inputs.

**003973-01 Communications Module**
Communications interface between the protection modules and external systems, such as SCADA systems.

**004052-01 8 Channel Condition Monitoring Module**
8 channel dynamic vibration measurement and 2 phase marker inputs for condition monitoring without protection grade-TSE.

**004053-01 Condition Monitoring Analyser Module**
Performs condition monitoring functions, including harmonic analysis, condition indicators, condition monitoring alarms, state detection and data acquisition, TCP/IP ethernet.

**004043-01 Quasi Static Amplification Module**
Connection of 16 DC static condition monitoring input channels.

# Powerful condition monitoring diagnostic software

**To aide with plant fault diagnosis the PlantProtech 7600 PCMS provides versatile powerful vibration and condition monitoring functionality to determine root cause analysis and help run plant safely and efficiently.**

## Powerful diagnostic capability

Providing a powerful and versatile condition monitoring system compliant with the stringent requirements of API670. Where both real-time and diagnostic monitoring is required.

Machine data can be captured in long term operational modes, such as online generation, machine run-up or coast-down to ensure transient events are captured.

Data is accessed across standard IT infrastructure.

## Typical applications for condition monitoring include:

- Plant commissioning
- Long-term asset health monitoring
- Return to service works
- Machine balancing
- Troubleshooting and root cause analysis
- Unattended diagnostics

## Condition monitoring key features

- Up to 96 condition monitoring channels using 8 channel input modules each with 2 phase markers
- Up to 52 channels of combined protection and condition monitoring per chassis
- Multiple chassis may be connected together for high channel count systems and flexibility
- Parallel acquisition of all dynamic vibration inputs
- Steady state and transient data capture
- 24-bit ADC resolution
- Machine operating speeds from 0rpm to 50,000rpm
- Dynamic channels support acceleration, velocity, displacement or dynamic pressure sensors
- Simultaneous acquisition of vibration and process data
- Integral IEPE support
- High and low pass filters
- Up to 40kHz measurement bandwidth per vibration channel depending on configuration
- Multiple FFT line resolution, programmable FFT bands
- Harmonic orders magnitude and phase, sub-synchronous levels, intra-harmonic level, gap
- Assignment of dynamic channels to multiple speed phase signals
- Rpm and time based data acquisition control
- Multiple configurable event conditions
- Real-time diagnostic displays
- Historic data displays
- Overlay capability to display real-time run-up / run-down files with historic baseline reference
- Interface to OSI Soft™ PI and third party applications using OPC interface
- High speed GBit LAN ports
- Condition monitoring data is independent from protection system
- Modbus RS485 and TCP/IP interface

## Early warning condition monitoring alarms

Independent from protection alarms is a powerful and comprehensive suite of condition monitoring alarms, providing early warning of changes to monitored plant.

Alerts and alarms with hysteresis are available for all dynamic, static and process channels. Separate vector alarms are provided for all monitored harmonics on both amplitude and phase, including step changes.

The system offers intelligent functionality, enabling different levels to be configured for specified combinations of machine state and other key plant parameters. Unique conditions for each plant item may be entered, to minimise the occurrence of false alarms. For example, an individual alarm may be set to function only when the shaft speed is greater than 1,100 rpm. Different alarm thresholds can be set for different plant load settings, and for hot, cold or warm start-ups.

The boundaries of ellipse alarms may be automatically calculated with respect to the plant historical running conditions. For example, the user may request an automatic calculation of the position and size of an ellipse alarm setting based on the last three month's normal steady-state running.

## Automatic data capture on machine event

*   Storing the 'rolling buffer' data
    (one hour before,or 30 minutes before and after)
*   Change data storage rate
*   Storing FFT spectral data
*   Relay contact closure

## Key points:

*   Machinery protection alarms
*   Independent condition monitoring alarms
*   User configured custom alarms
*   Password controlled configuration
*   Above or below limits
*   Within boundaries
*   Step alarms
*   Vector alarms
*   Combination alarm based on machine mode and process parameter
*   Alarm status can be sent to DCS
*   Alarm emails
*   Alarm event logs
*   Alarm relay modules

## Diagnostic software

PlantProtech Vision software has been the industry standard for diagnostic monitoring of strategic machinery assets such as turbine generators and other critical plant items and has now been further developed. The PlantProtech dashboard is a real time graphical display tool for control rooms and local plant displays. Data is stored for easy user access under site name, machine monitored and machine operational condition such as run-up/online. All user graphical displays can be exported to Microsoft Office type applications.

## Flexible measurement regime

Users can configure the system to store data at periodic time intervals or as a result of speed change during a transient event. All data acquisition is controlled independently for each monitored machine.

PlantProtech P7600 CMS provides a flexible monitoring approach to ensure high resolution data can be captured preceding, during and after any event.

- Fully-automated and flexible monitoring regime
- User-configured time, level and/or RPM based acquisition intervals
- Data acquired on alarm or trigger event
- High resolution buffer files auto-store for pre-and-post event capture
- Multiple data acquisition regimes can be configured for different plant operating modes

## Powerful condition monitoring software displays

- Overall levels
- Peak to peak levels
- Order locked vibration levels, magnitude and phase
- Smax
- Shaft speed
- Shaft centreline
- Filtered and unfiltered orbits
- FFT (single Point / waterfall / intensity)
- FFT frequency levels and frequency components bands
- Full spectrum
- Synchronous / asynchronous time domain
- Polar plot
- Time series
- Condition monitoring alarms
- Alarm logs
- DC gap and bias voltage
- Process parameters
- Trend displays
- Bode
- Overlay displays
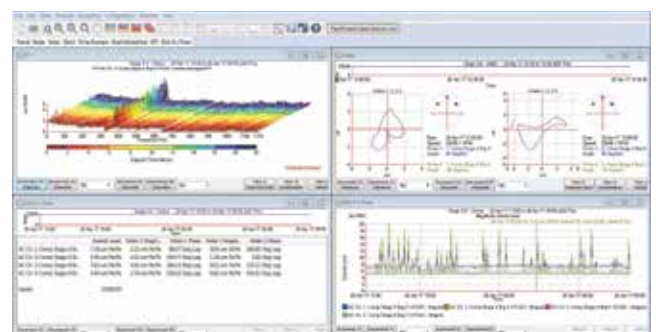
# PlantProtech 7600 PCMS protection specification



## Protection specification

| | |
|---|---|
| **Power input** | 90Vac to 264Vac 47 to 65 Hz |
| **Environmental** | -30°C to +65°C |
| **Dynamic inputs** | Up to 44 protection channels in 4 channel modules (protection system) |
| **Input (Voltage)** | -24V to +24V |
| **Bandwidth** | 0.1 Hz to 40 kHz |
| **Interface (current excitation)** | 4.7 mA @ 28V |
| **Interface (proximity probe driver)** | -24Vdc |
| **Input type** | Acceleration, velocity, displacement, LVDT, user-defined |
| **Speed inputs** | 2 per module |
| **Speed range** | 0.1 to 50,000 rpm |
| **Interface (speed)** | Proximity probe, magnetic speed sensor, TTL |
| **Measurements (dynamic)** | Radial vibration, radial position, axial position, eccentricity, seismic vibration, shaft vibration, absolute housing expansion, differential housing expansion |
| **Output – front panel (per module)** | Buffered raw dynamic output per channel (BNC) <br> Processed TTL speed output per channel (BNC) |
| **Output – rear panel (per module)** | 6 x Buffered raw dynamic output per channel / Processed TTL speed output per channel 4 x 4 – 20mA or 0 – 10Vdc outputs |
| **Alarm relays** | 4 per module, plus up to 32 additional per rack |
| **Alarm relay type** | DPDT |
| **Alarm relay output type** | Normally closed, normally open |
| **Alarm operation** | Latching / non-latched, normally energised |
| **Protection danger alert** | Over level, below level, latched, non-latched, delay (1 – 60 Seconds) |
| **Protection shutdown alarm** | Over level, below level, latched, non-latched, delay (1 – 60 Seconds) |
| **Alarm detection and initiation** | < 100 ms |
| **API670 compliant** | Designed to meet the requirements of API670 |
| **Segregated data** | Internal one way protection data bus separate from condition monitoring data |

## Beran Instruments

Decrease risk and increase your revenues with our proven PlantProtech™ protection and condition monitoring solutions.

PlantProtech™ is Beran's platform for condition monitoring and protection of rotating machinery, built on nearly forty years of industrial experience and innovation.

The PlantProtech hardware and software is in use around the world installed on nuclear, fossil, hydro, CCGT, combined cycle and renewables sites.

Originally designed to meet the requirements of the power generation industry, our customers PlantProtech systems have been proven to pay for themselves many times over. As user requirements have increased, the PlantProtech range has developed accordingly.

Our PlantProtech 7600 PCMS system is designed to meet the requirements of ISO7919, API670 and IEC61508.

By means of continuous online vibration monitoring, changes in the health of the plant can be detected early. Powerful analysis tools allow the root cause of the problem to be identified, enabling operators to make crucial decisions, and in many cases, plant can be run with confidence through to planned outage or scheduled maintenance.

The PlantProtech range of integrated hardware and software products provides you with a solid foundation, which can be expanded as required, ensuring the safe and efficient continued operation of your assets.

Beran Instruments is part of the Condition Monitoring Group (CMG) family. CMG formed in 2006, combines long term established companies: Beran Instruments; power generation condition monitoring, Helitune; rotary wing aircraft monitoring systems, Prosig; noise and vibration analysis, Systems & Electronic Inc; structural health monitoring and Semia; vibration in aeronautics. CMG is an international group with offices in USA, Germany, France and Italy as well as supporting regional sales and support partners across the world.