PCM360 Condition Management System

Introduction

ProvibTech’s PCM360 is a machine condition management system that collects, stores, analyzes and is capable of transmitting machine status monitoring information over local or wide area network. The PCM360 provides static, dynamic and transient data collection and analysis; such as graphical indication of vibration level, trend, waveform, spectrum, bode plots, cascade plots and much more.

All ProvibTech’s monitors and transmitters can quickly and easily be integrated to upload machine status and its dynamic data to the PCM360. The PCM360 obtains both critical machinery running status and balance of plant running status. Additionally, the PCM360 collects process data as 4-20mA input or digital monitor input via Modbus, etc. The PCM360 provides an integrated system solution for asset management resulting in a total solution for machine maintenance and protection.

Leading Features of PCM360

- Integrates plant condition monitoring and process data into one database
- User friendly interface for instant data analysis with minimal training required of field staff
- Maximum flexibility and expandability of the software system with object oriented modular design
- Transient, dynamic and process data collection
- Built on Microsoft® SQL Server database to assure better data management and reliable networking

PCM360 Advantage

- Maximize productivity by minimizing machine down time
- Machine management with automatic traffic light status indication and process data collection into a centralized database
- Review, analyze, and diagnose machine running status to minimize machine maintenance costs
- Sharing machine condition management information among various departments and managers by moving data and not men
- Integrates and collects machine running data via third party monitors

Client/ Server architecture enables user to access data anywhere on intranet/ internet
- Readily integrates with third party vibration monitors and process monitors with minimum hardware requirements
- Multiple digital I/O Protocols, such as Modbus RTU/ TCP
- Multiple hardware output modules ready for further data transfer and annunciation in relays and current transmission
- 24 hour notification through on site alarms, operator interface and even SMS messaging on GPRS mobile
- Remote notification with SMS messages to any cellular phone with machine running status
- Advanced post-processing of transient data minimizes data loss, maximizing analysis capability
Portable and Online Condition Monitoring Products

- Around the clock machine condition monitoring
- Alarming operator of the machine problems instantly
- Flexibility of software and hardware modules allow for future modifications as plant expansion occurs.
- Ideal for working with turbines, pumps, blowers, motors, and compressors. Can be used in refinery, petroleum, steel, fossil power, hydro power, cement, transportation etc.
- Assist plant managers to take intelligent maintenance decision based on acquired data
- Simultaneous high speed data acquisition on all channels

PCM360 Unique Features

**User friendly system with integrated layout**
- Software modules works in one unified user interface.
- Designed for easy installation, configuration, and data analysis.
- Significantly decreases the learning/ training time and cost with user friendly interface.

**Universal vibration interface module**
- Works with all ProvibTech hardware monitors.
- Works with other third party monitors.

**Universal process interface module**
- Isolated voltage input
- 4-20mA input

**Advanced post-processing algorithm**
- The algorithm allows one to save the raw data into temporary file.
- Customer has the flexibility to process the collected transient data until satisfactory result are obtained and then save selected processed plots to the database.
- The complete critical transient data will be saved in its original unfiltered unprocessed form so you never lose any important data due to an unlikely misconfiguration of the system.

**Baseline reference**
- Standard baseline data collected during running condition.
- Baseline data can integrate into plots for comparison with newly collected data.
- Difference will indicate machine condition change, providing important information for analysis.

**Dynamic plots**
- In addition to just one channel data analysis, each of the PCM360 dynamic plot contains both X and Y data, and phase information.
- Baseline data can also be included in the plot.
- All the above can be put into one standard plot making comparative analysis much easier.

**More information on transient plots**
- In addition to just one channel data analysis, each of the PCM360 transient plot contains both X and Y data, and phase information.
- With PCM360, the trend plot, waterfall plot and the shaft XY vibration plot with transient data can be viewed with a single mouse click.

**Unique transient data acquisition setup**
- System capable of collecting data up to 30 minutes before triggering of the alarms/ transient data.
- Transient data collection on both speed and time variation can be defined for acquisition.
- Due to high speed parallel data acquisition, much larger data is acquired in given time with PCM360-DAQ hardware system than the built in data-acquisition systems in various vibration monitors.
Alarms output and overall output

- The processed alarms from PCM360 can be programmed to drive relays. Programmable alarm is similar to ladder logic in PLC allowing one to program multiple alarms in logic combination. Each PCM360 system can drive up to 1,024 relays.
- The overall of each channel can be programmed for 4-20mA output.

Remote notification to operator’s mobile phone

- Timed status and overall notification with pre-defined machines, and measurement points.
- Notification triggered by alarms with machine running status and overall vibration values.

Static, dynamic and transient data collection and analysis

**Static**

- PCM Explore for Hierarchy structural machine view
- Machine mimic photo image status view
- Trend plot with history and real-time
- Alarm list
- Overall vibration real-time Status list
- Bar graph
- Process data view
- Screen Print the plot

**Dynamic**

- Waveform XY with optional baseline plot
- Spectrum XY with optional baseline plot
- Shaft XY vibration plot
- Full spectrum plot
- Waterfall XY plot
- Shaft average centerline plot
- 3-D shaft XY mode shape plot with multi-planes
- Band Alarm

**Transient**

- Bode plot
- Polar plot
- Cascade plot
- Trend on Transient
- Waterfall on Transient

**Analysis**

- X, Y with baselines and phase reference on one plot
- Marker
- Zoom in, zoom out
- Harmonics
- Sideband
- 1X, 2X, overall
- Plot group analysis on measurement point
- Plot group analysis on waveform
- Plot group analysis on spectrum
- Plot group analysis on shaft XY vibration
- Baseline
- Slow roll
- Auto full-scale
- Synchronized marker on multi-plots
- Smax on most of the plots
- Waveform and spectrum visible with double clicking the measurement point on the machine photo
- User definition of English or metric units; peak, peak-peak, rms or Smax; 1X, 2X or overall
- Option of define number of data on static, dynamic and transient data plots
Network Ready: Multiple User Access

Microsoft® SQL Server database
- PCM360 adopts the SQL database for data storage and management
- Data structure can be created, maintained, backups stored and restore from existing database on a simple mouse click

Three levels of Security
- Administrator: unlimited access
- Super user: capable of configuring the data acquisition units, output units, and maintenance on database
- User/operator: analysis and report

PCM360 Data Acquisition Input
ProvibTech supplies data acquisition input modules in digital and analog format. The input modules enable you to put all possible plant machine running status information as well as plant machine process information into one integral system. This feature provides our customers with more information at one location and makes the PCM360 a better system than other similar systems available commercially in market today. PCM360 is also designed for easy future expansion of the system.

Direct interface with the following data acquisition hardware unit:
- PT360-DAQ

Monitors link with PCM360 via PT360-DAQ:
- PT2060/80-BK
- TM

Direct interface with the monitors via digital Modbus link:
- DTM

PCM360 Data Acquisition Output
ProvibTech supplies various data acquisition output modules in digital and analog format. The output modules offer other plant management systems the information from the PCM360.

Digital Modbus output:
- Modbus RTU
- Modbus to communicate with additional hardware

Programmable relays output:
- Using ladder logic to program relays (PT373) with various channel alarms
- Relays are dry contact for ideal contact and isolation

Programmable record output:
- 4-20mA output corresponding with any channels overall

Remote notification on group of cellular phone:
- Notification on any alarm events
- Notification on any not ok events
- Notification on pre-selected channel status
- Notification on pre-selected channel overall

Data sharing on the generic Microsoft® SQL Server:
- Ready for data transfer via SQL database

Direct interface with the following PVT sensors via PT360-DAQ and PT360-SC:
- TM0782A or any accelerometers
- TM0793V or any velocity sensors
- TM079VD Low frequency velocity sensors
- 5mm, 8mm, 11mm and 25mm proximity sensors

Monitors link with PCM360 via PT371:
- TR
- VS102

Third party vibration monitors link via PT360-DAQ:
- Most Rack based monitoring system
- Any monitors with buffered output

Third party process variable monitors link via PT371:
- Any transmission monitors with 4-20mA output
- Any monitors with voltage output

Third party process variable monitors link via Modbus:
- Any monitors with Modbus RTU / Modbus TCP
PCM360 Specifications

Frequency Response (+/- 3db)
- 0.5 - 100 Hz
- 2 - 4,000 Hz
- 10 - 20,000 Hz

Measurement Range
- Acceleration (pk or RMS):
  - 0 - 20g
- Velocity (pk or RMS):
  - 0 - 100 mm/sec (0 - 4 in/sec)
- Displacement (pk-pk):
  - 0 - 20 mm (0 - 800 mil)

Unit of Measurement
- Peak
- Peak-peak
- RMS
- Smax

Waveform and Spectrum
- Resolution depends on customer configuration.
- Maximum spectrum resolution is 12,800 lines.

Plant Hierarchy
- Can be configured to four hierarchy layers:
  - Plant
  - Machine-Train
  - Machine
  - Measurement-Point

Storage and Network Database
- Microsoft® SQL Server 2000 or later version of the database

Operating System
- Windows XP or later version of Windows

Data Storage Capacity
- Unlimited by software.
- Limited by hardware storage capacity only.

Routing Capacity
- Unlimited in plant, machine train, machine, and measurement point

System Processing Capability
- Limit of data acquisition units per system: 64
- Limit of Modbus devices per system: 64

Computer Specifications
- Please consult with ProvibTech for details.

Data Acquisition Format
- Synchronous sampling:
  - 32 to 1,024 points per waveform time period
- Asynchronous sampling:
  - Fixed data acquisition sampling rate up to 62KHz per channel

PCM360 Technical Support

PCM360 comes standard with one year technical support. Additional support may be purchased.

- Free software updates for one year
- Enable technical support with the software

PT360-DAQ Data Acquisition Hardware

PT360-DAQ is an industrial computer with data acquisition modules and accessories. It can work as a data acquisition system and a client work station.

Sampling Frequency
- Up to 15 KHz per channel with standard data acquisition module
- Up to 62 KHz per channel with high-speed data acquisition module

Number of Channels per Module
- 16

Maximum Dynamic Channels per System
- 64

A/D Resolution
- 16bit

Input Voltage Range
- -20VDC to +20VDC

Modbus RTU Protocol
- RTU is available with RS485 converter
- TCP/IP on standard Ethernet connection
PT360-SC Signal Conditioning Unit

PCM360-SC is a signal conditioning unit. It can directly power any current mode accelerometer and velocity sensor. It can also power proximity probes with its’ built in -24VDC power supply. Additionally, a +24VDC is available to power the process sensors directly.

Each PT360-SC can power up to 32 sensors. The PT360-SC power supply is isolated from the AC power supply.

Power Input:
- 110VAC +/- 10% with maximum current of 1.0A
- 230VAC +/- 10% with maximum current of 1.0A

Constant Current Sources:
- 16 channels or 32 channels
  - Nominal current: 4mA, constant
- -24VDC Sensor Power:
  - -24VDC +/- 5% @ 200mA
- +24VDC Sensor Power:
  - +24VDC +/- 5% @ 200mA

PCM360-M Portable Data Acquisition System

PCM360-M is an industrial computer with data acquisition modules and accessories. It can work as a data acquisition system and as a client work station.

Sampling Frequency:
- Up to 15 KHz per channel with standard data acquisition module
- Up to 62 KHz per channel with high-speed data acquisition module

Number of Channels per Module:
- 16

Maximum Dynamic Channels per System:
- 64

Amplitude Resolution:
- 16 bit

Input Voltage Range:
- -20VDC to +20VDC

Modbus RTU Input:
- Available with external RS485-USB converter and associated interface software

Microsoft® SQL Server 2000 Server Database:
- Integrated within the system

PT371 Universal Input Module

The PT371 is a 16 channel input module.

It accepts the following inputs:
- Voltage input: 0 - 10V; -5 to +5V
- Current input: 4 - 20mA (with the shunt resistor)
- Thermocouple or thermo resistors:
  - Discrete input: any 0-24V; 0-12V; 0-5V
  - RTD: Pt100, Cu50, Cu100, BA1, BA2, G
  - Wire Unit: 2-wires, 3-wires

Data acquisition rate:
- 1.0 sec

Amplitude A/D resolution:
- PT371 module: 12 bit
  - 0.2% FS
- Power supply:
  - 24VDC +/- 10% @ 150mA
PT372 4-20mA Output Module

The PT372 is a 4 channel 4-20mA output module.

Amplitude A/D resolution:
- PT372 module: 12bit

Power supply:
- 24VDC +/- 10% @ 100mA

Maximum load:
- 750 ohms

PT373 Relay Module

The PT373 is a 16 channel relay module. It is designed for the PCM370 system output (for alarm outputs).

The PT373 can be configured for any logic combination of alarms or status of each channel.

The relays are selectable as: energized/de-energized, latching/non-latching and bypass.

Power supply:
- 24VDC +/- 10% @ 150mA

Relays:
- Seal: epoxy
- Capacity: 0.5A/230VAC/30VDC, resistive load
- Relay type: SPTD
- Isolation: 1000VDC

PCM-SMS Cellular Phone GSM/GPRS Notifier Module

PCM-SMS is a quad-band universal transmission and receiving module that will transmit predefined measurement points about machine running status and overall into any GSM cellular phone. This is useful while operator and service personnel are off site, and there is an alarm due to machine running status change. The module can also be programmed to regularly transmit the status and overall data into a cellular phone. The operator or service personnel can obtain machine condition when off site.

Power supply:
- 6 – 40 VDC @ 500mA or
- 90 - 250 VAC @ 100mA. From 47 - 65 Hz.

Transmit format:
- GSM; GPRS

Transmission frequency band:
- 850MHz
- 900MHz
- 1800MHz
- 1900MHz

Order Information

PCM360 Online System Software

PCM360 on-line condition monitoring system consists of the PCM360 software and PT360-DAQ data acquisition unit.

PCM360-COM-AX

PCM360-COM is a software module that interfaces with communication and data acquisition hardware.

AX: Software option
- A0*: Basic Communication software
- A1: Software updates CD
Order Information Continued

PCM360-DISP-AX
PCM360-DISP is a display and analysis software module.
AX: Software option
A0*: Basic Display Software
A1: Software updates CD

PCM360-MODBUS-AX
PCM360-MODBUS is a Modbus RTU and Modbus TCP software module. This module is for both input and output.
AX: Software option
A0*: Digital communication software
A1: Software updates CD

PCM360-OPC-AX-BX
PCM360-OPC is an OPC software module. This module is for both server and client.
AX: Software option
A0*: OPC communication software
A1: Software updates CD
BX: For Server or Client
B0*: OPC-Server (Offering the PCM360 data for the third party’s OPC software)
B1: OPC-Client (Collecting the data from the third party’s OPC devices)

PCM360-DBM-AX
PCM360-DBM is the Microsoft® SQL Server database management software module (only needs to be installed on SQL server).
AX: Software option
A0*: SQL Data base Software
A1: Software updates CD

PCM360-LIS-AXX-BXX-CX-DX
PCM360-LIS is a software module that controls user options and licenses.
AXX: Communication and data acquisition module user licenses
XX: Number of interface modules
BXX: Display module user licenses
XX: Number of users
CX: Analysis options
C0: Process, dynamic and transient
C1: Process and dynamic
C2: Process

DX: Remote cellular phone notification (software module only)
D0: With remote notification
D1: No remote notification

PCM360 Online Data Acquisition System
Hardware
The PT360-DAQ on-line data acquisition unit is fully configured with the industrial computer or work station, 19” LCD display unit, and signal process modules.

PT360-DAQ-AX-BX-CX-DX
AX: Number of dynamic channels (includes phase reference)
A0*: 16 (14** for PT2060)
A1: 32 (28** for PT2060)
A2: 48 (42** for PT2060)
A3: 64 (56** for PT2060)
A10*: 16 high frequency (14** for PT2060)
A11: 32 high frequency (28** for PT2060)
A12: 48 high frequency (42** for PT2060)
A13: 64 high frequency (56** for PT2060)
BX: Interface kit
B0*: General purpose
B1: PT2060 (standard 1.5 meters)
CX: SQL
C0*: Included
C1: Not included
DX: Configuration
D0*: As both data acquisition and display system (industrial computer)
D1: As a data acquisition system only (industrial computer; monitor display is not available)
D2: As both data acquisition and display system (work station)
D3: As a data acquisition system only (work station; monitor display is not available)

* Note: Default configuration
** Note: Each 14 channels includes 12 dynamic channels and 2 phase reference channels.
Order Information Continued

**PCM360-M Portable Data Acquisition System**
The PCM360-M portable system consists all related software and hardware.

**PCM360-M-AX**
AX: Number of dynamic channels (includes phase reference)
- A0*: 16
- A1: 32
- A2: 48
- A3: 64
- A10: 16 (high frequency)
- A11: 32 (high frequency)
- A12: 48 (high frequency)
- A13: 64 (high frequency)
* Note: Default configuration

**PCM-GP-M**
General purpose interface kit for PCM360-M portable Data Acquisition System.
Including one 1.5m PCM-DAQ cable, Converter box and 16x1m BNC cables

**Accessories**

**PCM360-SUP-AX-BXX**
Extended technical support agreement
AX: Additional years
X = Number of additional years with the agreement
BXX: Machines
XX = Number of machines

**PT360-SC-AX-BX**
Signal condition module that directly interfaces and powers with accelerometers, velocity sensors or proximity probes. No monitor is required.
AX: Number of dynamic channels
- A0: 16
- A1: 32
BX: Power supply
- B0: 230VAC
- B1: 110VAC

**PCM-SERV**
Pre-configured server which is configured with PCM360 software and Microsoft® SQL Server database (software is purchased separately).

**PCM-DPC**
Pre-configured work station computer with PCM360 software (software is purchased separately).

**PCM-LPC**
Pre-configured laptop/notebook computer with PCM360 software (software is purchased separately).

**PCM-485**
RS485 module on PCI slot

**PCM-SQL**
Microsoft® SQL Server 2000 server database

**PCM-GP**
General purpose interface kit that includes PT360-DAQ cable, converter box.

**PCM-SMS**
SMS cellular phone message transmission and receiving hardware module. This module works with any GSM system.

**PCM-PT2060-XXX**
PT2060 and PT360-DAQ interconnection cable
XXX: Cable length in meters

**PT2060/80-BK**
Back panel of the data acquisition module on PT2060 monitor. Specially designed to directly interface with PT360-DAQ

**PT371**
16 channels universal input module

**PT372**
4-20mA, 4 channels output module

**PT373**
Relay alarm module, 16 channel
I. PCM360 Minimum System Configuration

For example, the PCM360 minimum system is configured to interface with the PT2060 monitor. The system consists of:

- PCM360-COM-A0 communication and data acquisition module
- PCM360-DISP-A0 display and analysis module. Computers are equipped with Microsoft Windows XP professional or higher operational system
- PCM360-DBM-A0 database management
- PCM360-LIS-A01-B01-C1 user options and licenses module
- PT360-DAQ-A0-B1-C0-D0 data acquisition system (hardware)

It is a 12 channel system. The entire system, with hardware and software, has been put into an industrial computer. This system will perform data acquisition with process data and dynamic data. The system is ideal for plant operators, maintenance engineers, and managers that perform general data analysis and maintenance.

The features of the system include:

- Integral system with one industrial computer
- Single user
- 12 dynamic channels; 2 phase reference channels
- Directly interfaces with PT2060 monitor
- Microsoft® SQL Server 2000 server database
- Capable of collecting, analyzing and storing dynamic data

Since PCM360 is a modular system, the system can easily expand into a standard plant-wide condition management system; additional features can be realized by adding more modules.

- Transient data collection and analysis
- Up to 128 users access
- Up to 24 PCM360-DAQ
- Up to 300 Modbus RTU devices
- Dedicated server computer
- High frequency data acquisition
- Hardware output of programmed alarms and 4-20mA
- Remote access to the system with Citrix™ server
- Interface with any third company process data and dynamic data
- On-site technical service and training
II. PCM360 Standard Network System Configuration

Example: A plant has 10 machine trains. Each machine train includes a compressor and an electrical motor. The compressor has four proximity probes to measure vibration: one to measure thrust position and one to measure phase reference. The motor has four channels of case mounted accelerometers to measure case vibration. Five PT2060 monitors are mounted in the control room. Each PT2060 can monitor two machine trains with 18 dynamic channels and 2 phase reference channels.

There will be five data acquisition units; assume the plant has 10 users.

Recommendation: the standard PCM360 system with the following modules:

- **PCM360-COM-A0 x 1** communication and data acquisition module
- **PCM360-DISP-A0 x 1** display and analysis module
- **PCM360-DBM-A0 x 1** database management
- **PCM360-MODBUS-A0 x 1** Modbus RTU communication module
- **PCM360-LIS-A05-B10-C0 x 1** user option and license module
- **PT360-DAQ-A1-B1-C1-D1 x 5** Five data acquisition systems (hardware)
- **PCM-SERV x 1** Server computer. Equipped with Windows 2003 server operation system
- **PCM-SQL x 1** Microsoft® SQL Server 2000 server database
- **PCM-DPC x 10** Work stations running DISP software module
- **PCM360-SUP-A5-B10 x 1** Five year technical support plan for 10 machines
III. PCM360 Connection to PT2060 Monitor

The PCM360 directly interfaces with the PT2060 monitor. Each PT2060 can hold a maximum of 48 channels (with condition monitoring modules).

The 4th slot from the right output dynamic signal of channel 1 to 24. The 3rd output channel 25 to 48. On each of the PT2060/80-BK modules, there are two multi-pin connectors, the top connector output data of channel 1 to 12 (25 to 36) with dual phase references. The bottom connector output data of channel 13 to 24 (37 to 48) with dual phase references.

PT360-DAQ can mount next to PT2060 monitor to form a complete protection and data acquisition system.

IV. PCM360 Connection with Modbus Devices or Any Process Data Monitors

Modbus RTU communication is available with PCM360. Each system can hold a maximum of 300 Modbus devices.

For a large system, it is recommend obtaining static and process data through Modbus communication. This will save many dynamic data acquisition channels on both hardware and software.

PT371 can be used to collect process data from any third party monitors. A PCM-485 is required for this configuration.
Application Notes Continued

V. PCM360 Connection Direct To Sensors

Optional rack mount hardware PCM360-SC is required to connect sensors directly without monitors. Each PCM360-SC can hold 16 or 32 channels (including phase reference channels). This signal conditioner can directly drive current mode accelerometers and velocity sensors.

VI. PCM360 Hardware Output of Programmed Relay Alarms and 4-20mA

This is a unique feature of PCM360. PT373 can be programmed with PLC similar logic to drive the dry contact relays. PT372 will output up to four channels of 4-20mA signals.