Bently Nevada
a Baker Hughes business

ORBIT 60 SERIES

Condition Monitoring

(CMM) - Data Security White Paper

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1. Purpose

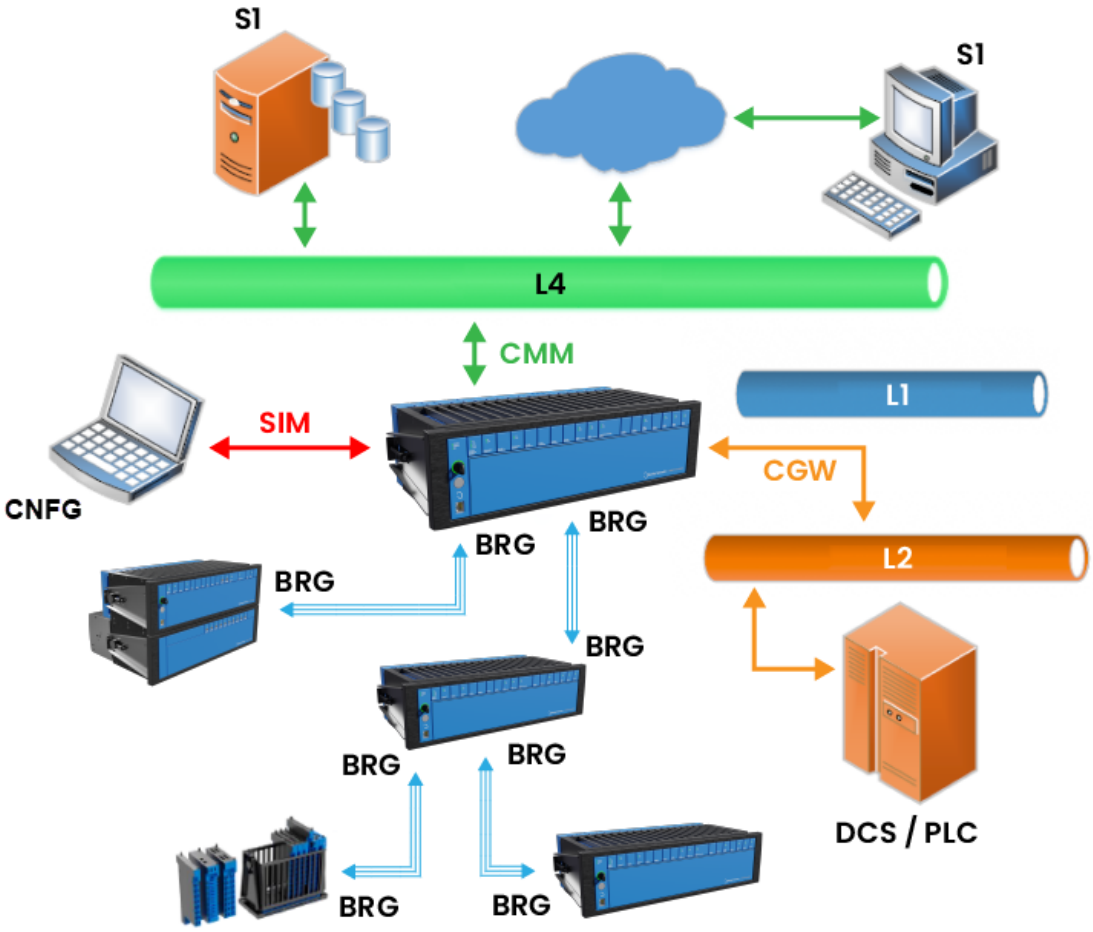
This document describes how the Condition Monitoring Module in the Orbit 60 Series Monitoring System provides a secure solution with full high-resolution data to external networks. All of this is accomplished without jeopardizing the operation of the protection functions.

2. Overview

Modern machinery monitoring systems are combinations of protection and data collection functions. While the protection function must be isolated from external networks for protection purposes, operationally, the condition monitoring data needs to be available across the business network, as well as remotely from the plant.

Available solutions drive the use of expensive data diodes to bridge plant control networks. This allows the condition monitoring data to be used externally from the plant control network. However, the condition monitoring software is unable to alter the data collection configuration to improve the data set.

This paper describes how the Orbit 60 Series Monitoring System resolves the limitations by placing the diode function between the module collecting the condition monitoring data and the remainder of the protection system. This solution keeps the protection isolated from the more open networks while allowing the collection of condition monitoring data to remain flexible.



SIM - System Interface Module

CMM - Condition Monitoring Module

CGW - Comm Gateway Module

S1 - System 1 Server or Client

CNFG - Orbit Studio Configuration Software

DCS/PLC - Distributed Control Systems/ Programmable Logic Controller

L1 - Unit Network **L2** -Control Network
L4 - Business Network

Figure 1: Orbit 60 System Level Diagram

One System Interface Module (SIM) defines a system of up to 88 dynamic channels*, accommodating multiple machine trains and supporting unrestricted synchronous Keyphasors for any channel. The Condition Monitoring Module (CMM) interfaces to the business network through a cyber-secure access port. The Communications Gateway (CGW) sends(data, status, setpoints) and receives (inhibit, reset, trip multiply)* high speed process data with the control systems. Bridged (BRG) connections allow up to 3 chassis to act as a single system while decreasing overall installation costs, reducing ground loops, and minimizing electrical noise.

* Features not available first release.

3. Application

In the Orbit 60 Series Monitoring System, all the modules send their data to each other over a proprietary internal fault tolerant network. This data includes:

- Full bandwidth digitized signal from all dynamic transducers connected to the system
- All calculated measurements
- All statuses
- System and alarm events
- Process data received from the control network
- Asset information
- System configuration
- System Diagnostic Information

Any module connected to this internal network can access all the data from all non-CM modules. All the modules within the system have the capability to receive and transmit data on the internal network except for the Condition Monitoring module (CMM). The CMM is only able to listen to data from the network.

The CMM's circuitry only has receiving electronics, unlike the other modules that have bidirectional electronics. Therefore, it is impossible for the CMM to affect the operation of the protection system even if there is a successful cyber attack that takes control of the CMM.

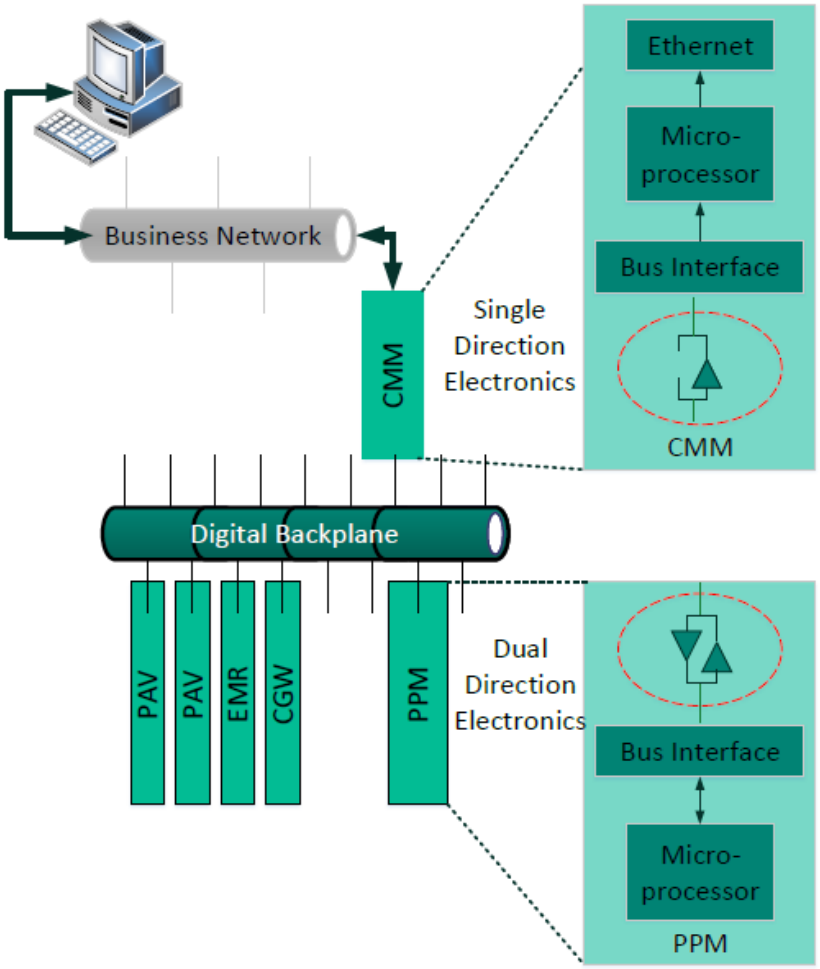


Figure 2: Data Flow through the CMM vs. PPM

Because the CMM cannot request information, the Orbit 60 Series Monitoring System broadcasts all data, allowing the CMM to acquire data without requesting it. Fault tolerance is built into the data stream, enabling complete data transmission without requiring acknowledgments.

The CMM accepts all the measurements made by the system and performs its own analysis of the transducer data. This is possible because the CMM receives the raw data from all transducers. With this data, the CMM can alter the sampling rates used to acquire the data for time base or spectral presentations.

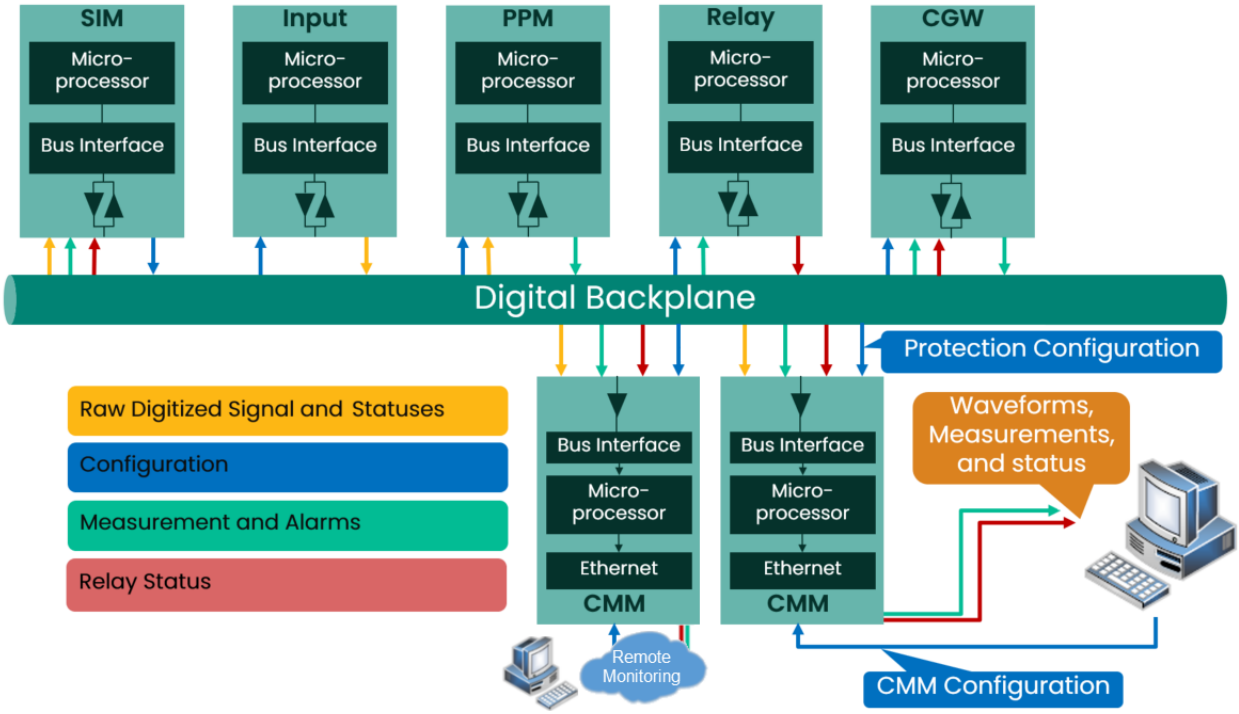


Figure 3: Multiple CMMs without Interference

The system architecture allows for multiple CMMs to be used within a system attached to different hosts without threat of interfering with each other or the protection function. An end user and a machinery OEM can have individual access to condition monitoring data with their own configuration and on different networks.

In addition to system generated measurements, the system can be used to move processed data through the system's Communication Gateway through the CMM and on to the business network, while protecting the plant control network from cyber attacks.

The internal isolation method ensures the protection function will be safe. This includes: control of relays, data transmission from the Communication Gateways, and recorder outputs. In addition to safe guarding of the protection functions, the CMM module utilizes state of the art network security to prevent unauthorized access to condition monitoring data.

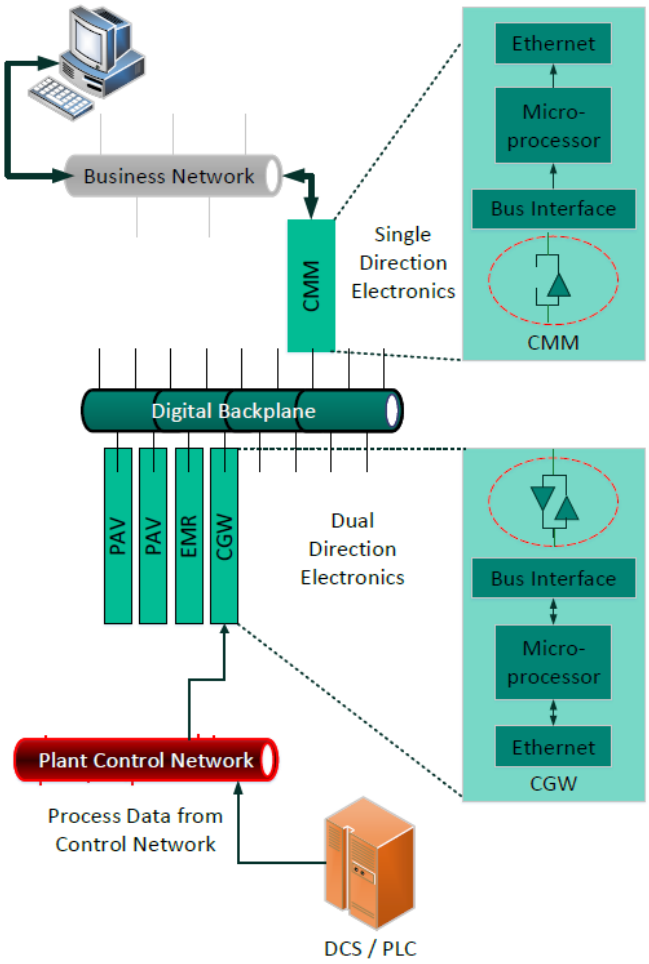


Figure 4: Data Flow through the CMM vs. CGW

4. Advantages

The integration of the data diode function within the system provides several advantages over current methods of cyber protection. It removes the need to:

- Perform database replication
- Use external expensive data diodes
- Implement complex firewalls and network rules

By eliminating these requirements, the cost of deployment of a system is reduced and the flexibility of the system is increased.

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