Introductions

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– Houston

2020 Online Events - Register to receive a calendar invite

User Group

Tech Talks

Wednesday, October 28th
Visualization Update – VersaView 6300
10:00am

Wednesday, November 4th
Automation Fair at Home Preview
10:00am

https://www.reynoldsonline.com/eventsUnit.action

Dynamix™ 1444 series
product overview

02 • 24 • 2020

Agenda

1 **What is Integrated Condition Monitoring (ICM)**

2 What is the Dynamix™ 1444 series

3 The Dynamix™ series and the Integrated Architecture® system

4 Condition monitoring software

Scalable analytics

From device to plant to cloud
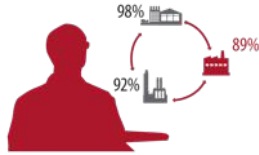
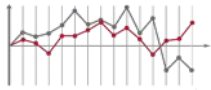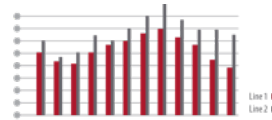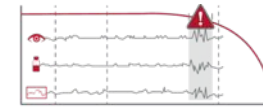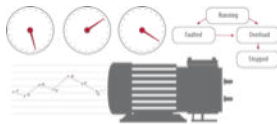|	DESCRIPTIVE	DIAGNOSTIC	PREDICTIVE	PRESCRIPTIVE
ENTERPRISE	What plant performed the best?	Why is site A throughput below plan?	Will I meet plan today? Tomorrow?	How can I change operations to improve profitability? Yield? Quality?
SYSTEM	Is Line 1 running ok?	Why is Line 1 quality poor?	I predict that Line 1 quality is moving out of tolerance.	What action should the operator take to avoid poor quality?
DEVICE	Am I running ok?	Why did a fault happen?	I predict a fault will happen soon.	What action should be taken to avoid the fault?

Condition monitoring applications

There are many ways to apply condition monitoring.
So it is important to consider the objective before selecting a solution.

In any plant, we have assets that we must:

- **Help *protect* from catastrophic damage**

- **Identify and manage problems before they force *downtime***

- **Identify and manage problems before they impact *quality***

- **Identify faults and schedule repairs to reduce *maintenance* costs**

These are optimized by adopting a predictive maintenance strategy

Protection

Production assurance

Quality

Predictive maintenance

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Understanding vibration & fault indicators

Faults can be identified by the *frequency* of vibration that they cause…

What are fault indicators?

- Machine vibration causes faults

- Faults induce **repetitive** impact or cyclic forces at **specific**, **predictable*** frequencies

- Frequencies are related to the speed, mechanical, and electrical attributes of the machine.

- Most fault indicators are at multiples of running speed*. Knowing the machine's **speed** is essential to identifying faults*!

- Example mechanical attributes: bearing type, number of impellor vanes, fan blades, or gear teeth, etc.

- Example electrical attributes: type of motor, line frequency, number of rotor bars or stator slots, etc.
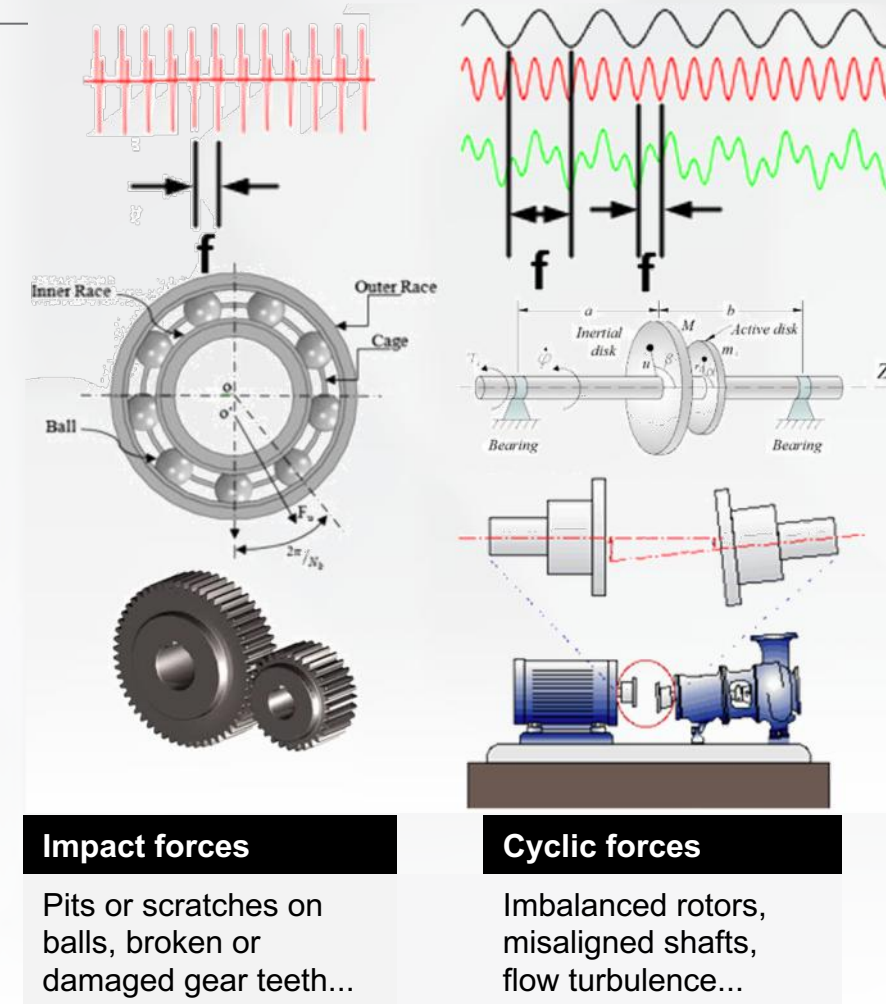
Impact forces

Pits or scratches on balls, broken or damaged gear teeth...
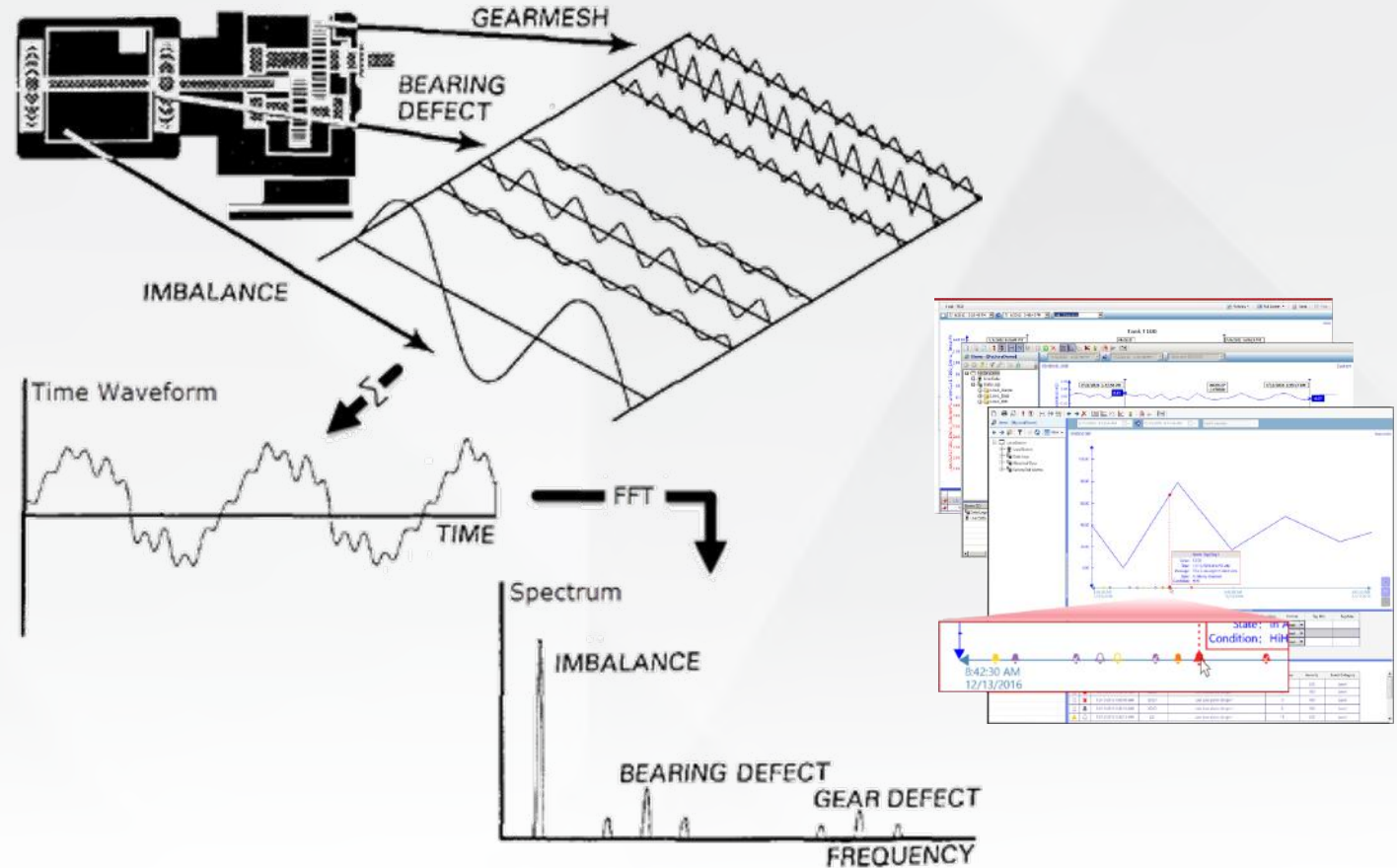
Cyclic forces

Imbalanced rotors, misaligned shafts, flow turbulence...

Understanding vibration & fault indicators

Fault indicators are in the spectrum

How do we observe the fault indicators?

- Fast Fourier Transform (FFT)

- Allows us to measure the frequencies that indicate specific faults

- Monitoring these frequencies make it possible to assess and trend the indicators of specific faults

- The Dynamix™ series use the **Integrated Architecture**® system to capture, alarm, trend, and analyze these indicators, using the **common historians and visualization products** that you already have.

Scalable analytics

From device to plant to cloud

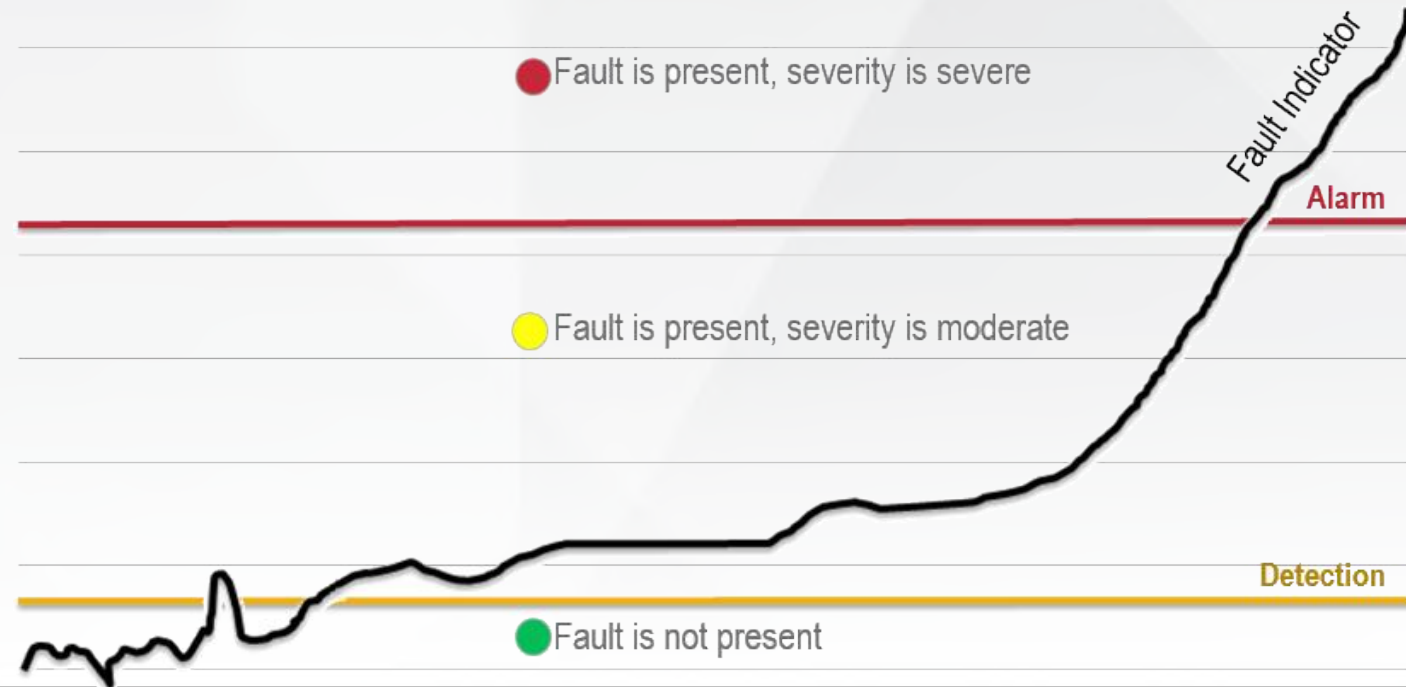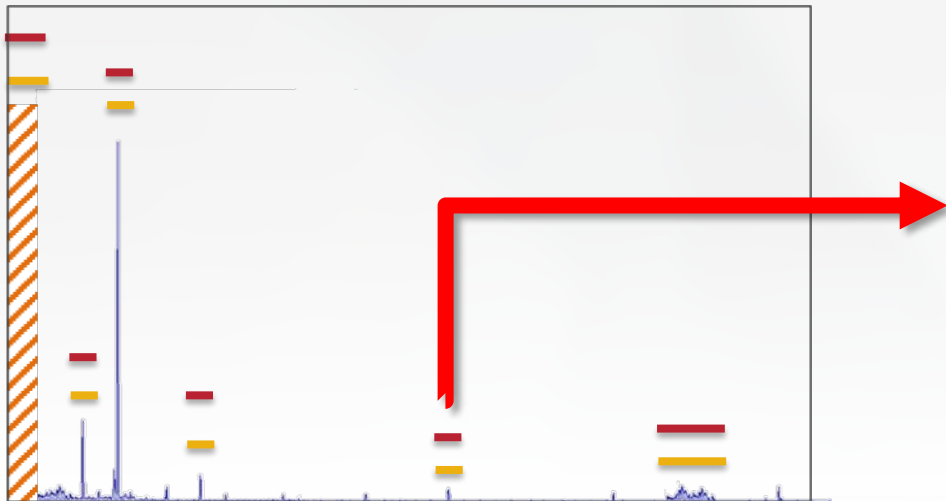|	DESCRIPTIVE	DIAGNOSTIC	PREDICTIVE	PRESCRIPTIVE
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Understanding vibration & fault indicators

Predicting failure by trending fault indicators

Faults almost always propagate in a similar manner

- Fault begins, or worsens until it is above the level of detection

- Fault slowly progresses until it is end of life

- Fault condition deteriorates exponentially until failure

Continued operation above "Alarm" may result in damage to components other than those associated with the original fault…

Compounded faults will cause longer and more expensive repairs, or repairs that do not solve the root problem.

🔴 Fault is present, severity is severe

🟡 Fault is present, severity is moderate

🟢 Fault is not present

Fault Indicator

Alarm

Detection

Rockwell Automation

Integrated Condition Monitoring

What do we mean by "Integrated"?

Condition data available as tags in Logix

- Magnitude of vibration at selected fault frequencies written as common tags in a Logix controller
  - Faults induce forces that cause vibration at specific frequencies
  - The presence of vibration at frequencies that a fault produces, indicates the presence of the fault
  - The magnitude of vibration at frequencies that a fault produces, provides indication of the severity of the fault

This is what the Dynamix™ system does!
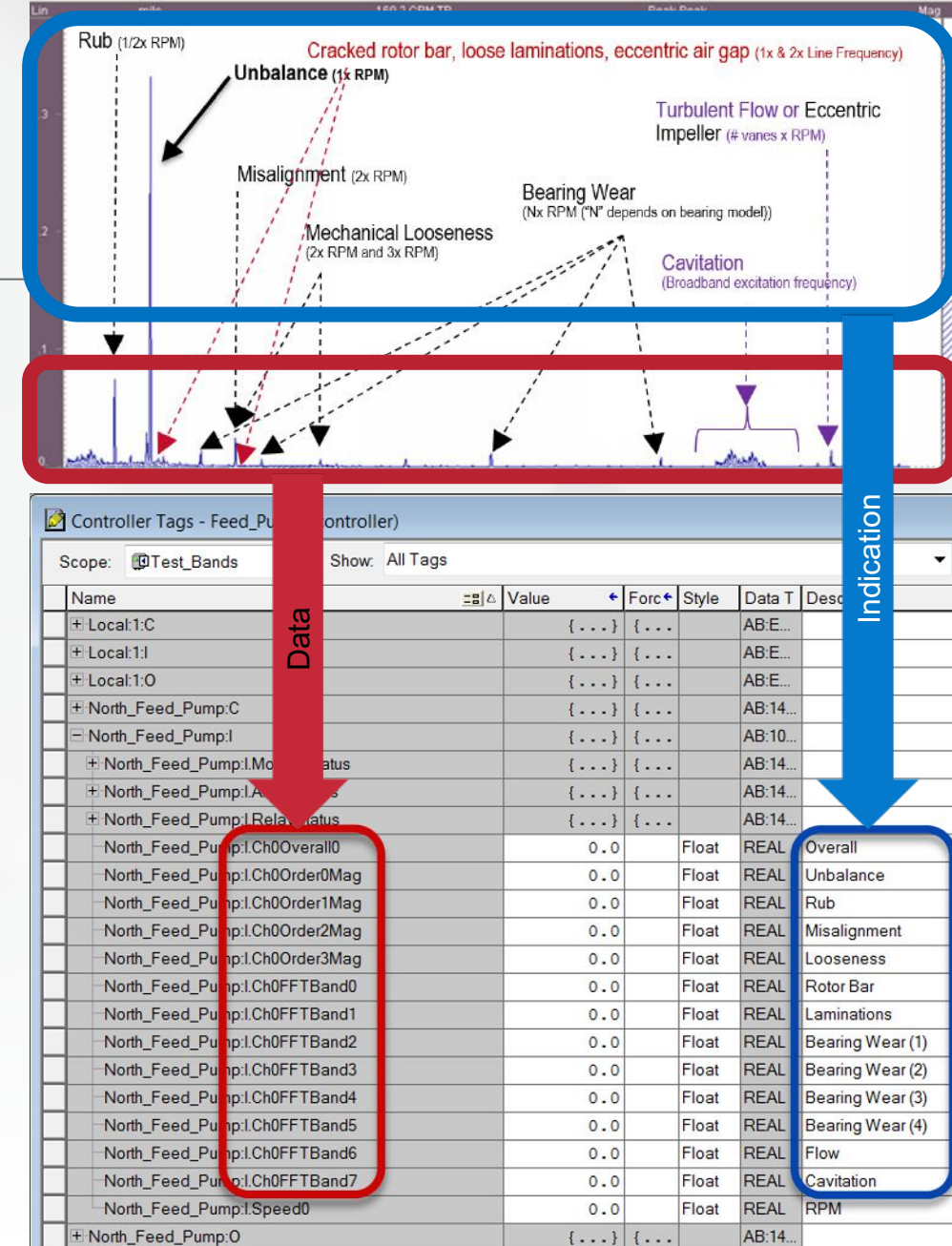
Agenda

1 What is Integrated Condition Monitoring (ICM)

2 **What is the Dynamix™ 1444 series**

3 The Dynamix™ series and the Integrated Architecture® system

4 Condition monitoring software

The Dynamix™ 1444 series

A simple architecture

Distributed I/O on an EtherNet/IP™ network

- A simple distributed system
  - A single main module
  - Three expansion modules
  - Removable plug connectors
    - Available in either spring or screw cage type
- Part of our Integrated Architecture® system
  - Managed and configured from Logix
  - Capable of independent function, and action
    - Regardless of the availability or status of the controller

The Dynamix™ 1444 series

Built on an innovative package

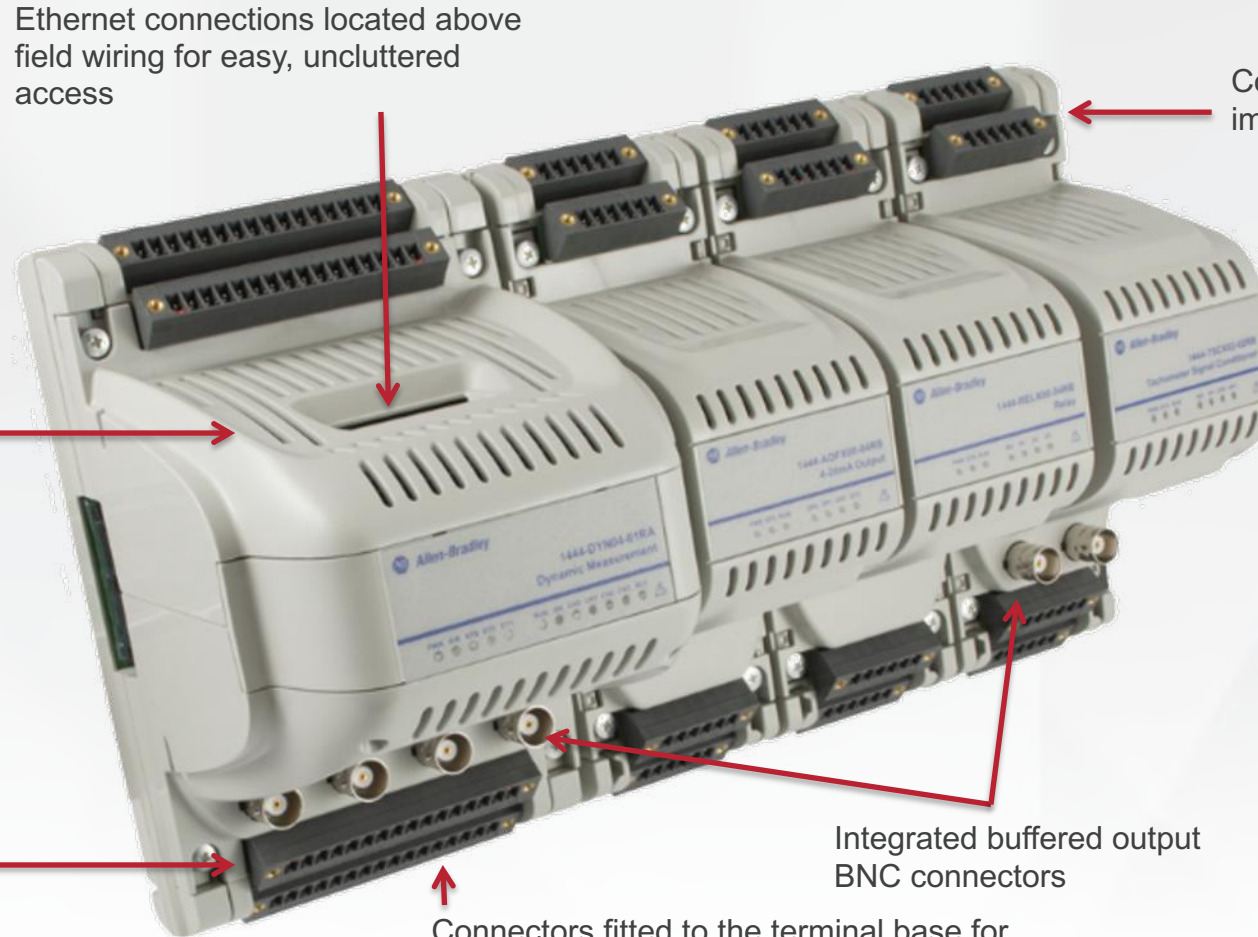Use with removable plug terminal connectors – simplifies wiring

Ethernet connections located above field wiring for easy, uncluttered access

Connectors are angled and labeled for improved access, visibility and ease of use

Recessed frame designed for easy gripping

Innovative DIN mount design with tension and leveling control

Rugged, low noise, fully soldered card stack construction

Connectors fitted directly to the module for sensitive signals – fewer internal circuit connections, less noise, higher reliability

Integrated buffered output BNC connectors

Connectors fitted to the terminal base for non-sensitive wiring such as power, relays, grounds…

The Dynamix™ 1444 series

The Dynamic Measurement Module –
extraordinary functionality in a single, compact design.

The core measurement module

- **Dual processors**
  Auxiliary processor and high
  performance DSP

- **Nonvolatile memory**
  Retains configuration and event log

- **4 dynamic inputs**
  24 bit ADC per channel pair

- **2 speed inputs**
  Measure speeds from TTL inputs, or
  read from controller output assembly

- **1 SPDT relay**
  Max 8A@250VAC /
  5A@30VDC,
  assign to any alarm or fault

- **4 buffered outputs**
  BNC & terminal pin
  connections

- **2 Ethernet ports**
  Single or Device Level Ring (DLR)

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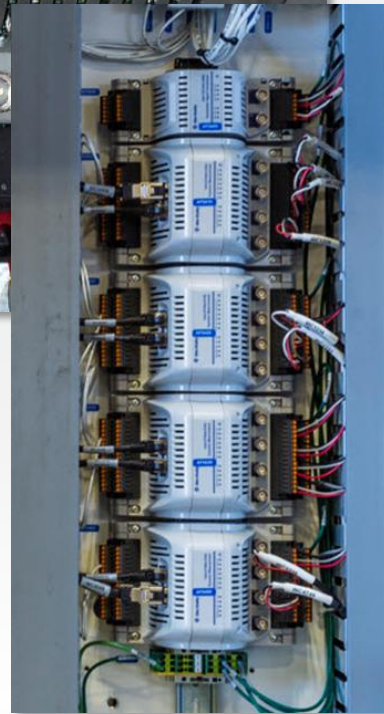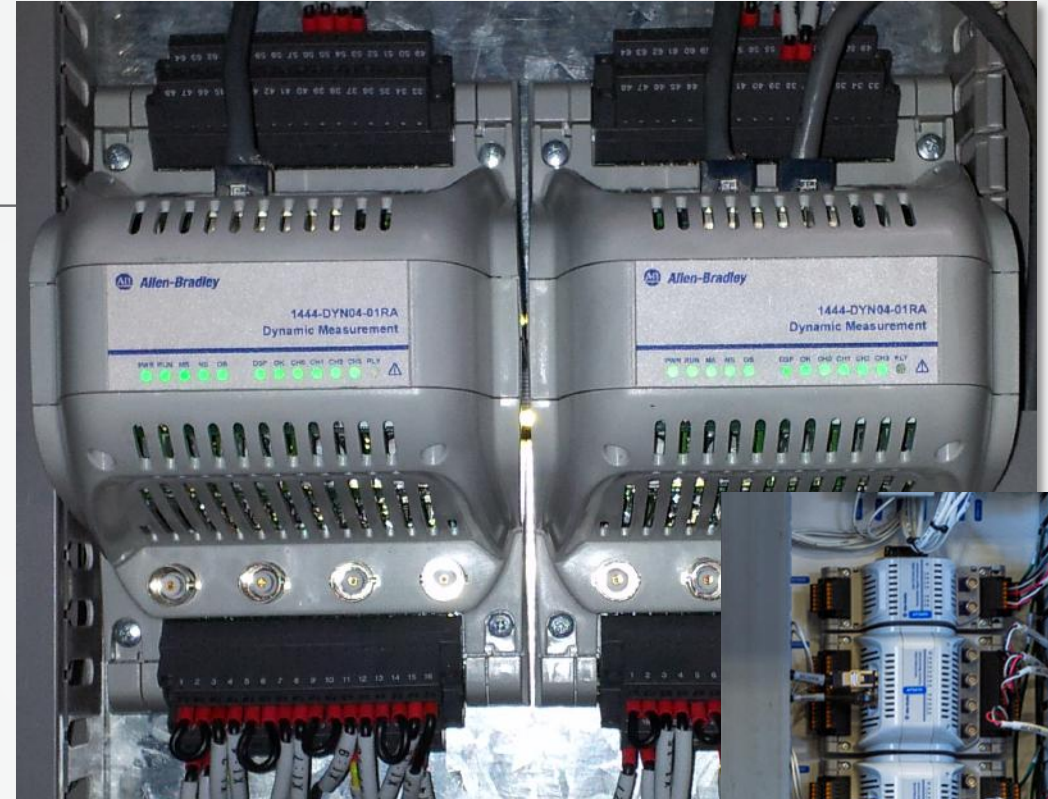
The Dynamix™ 1444 series

6 catalog numbers!
(plus the removable plug connectors)

Dynamic Measurement Module

1444-DYN04-01RA

4 dynamic inputs

2 TTL speed inputs

1 SPDT relay

Most applications require only the Dynamic Measurement Module and its terminal base.

Tachometer Signal Conditioner Expansion Module

1444-TRSX02-02RB

2 speed inputs
- eddy current probes
- magnetic pickups
- NPN / PNP sensors

Minimum input frequency
- Manual threshold:
  1 cpm (0.017 Hz)
- Auto threshold: 6 cpm (0.1 Hz)

2 TTL speed outputs

1 per Dynamic Measurement Module

Can serve speed signals to up to 6 Dynamic Measurement Modules

4-20mA Output Expansion Module

1444-AOFX00-04RB

4 channels

Output referenced to any measured parameter

1 per Dynamic Measurement Module

Relay Expansion Module

1444-RELX00-04RB

4 SPDT Relays
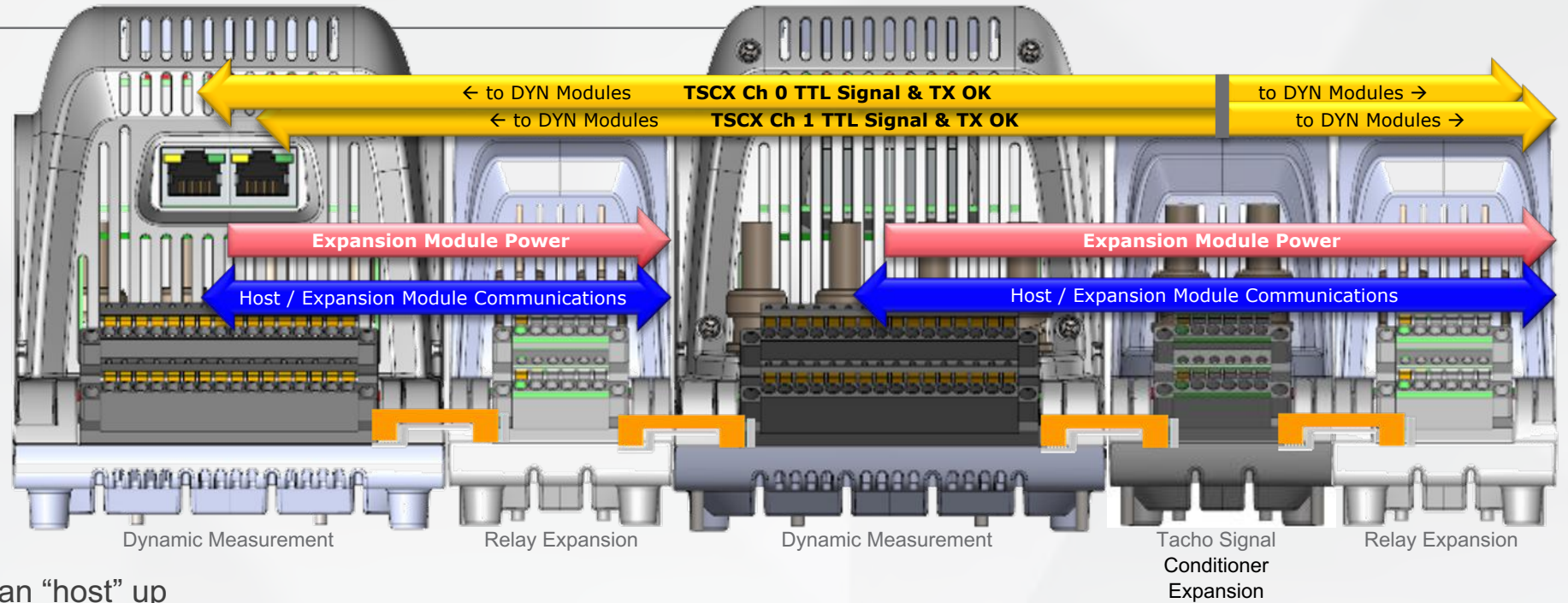
3 per Dynamic Measurement Module

Terminal Bases

1444-TB-A, 1444-TB-B

1 Dynamic Measurement Module base

Includes switch for last octet of the Ethernet address

1 Expansion Module Base

The Dynamix™ 1444 series

Architecture and local bus

← to DYN Modules **TSCX Ch 0 TTL Signal & TX OK** to DYN Modules →
← to DYN Modules **TSCX Ch 1 TTL Signal & TX OK** to DYN Modules →

Expansion Module Power **Expansion Module Power**

Host / Expansion Module Communications Host / Expansion Module Communications

Dynamic Measurement   Relay Expansion   Dynamic Measurement   Tacho Signal   Relay Expansion
Conditioner
Expansion

Architecture

- A Dynamic Measurement Module can "host" up to 5 expansion modules including:
  - 1 tachometer signal conditioner
  - 3 relay
  - 1 analog output
- Host module powers, manages and configures its expansion modules
- Expansion modules mounted to the right of its host

Local bus

- Provides host - expansion module
  - Communications
  - Power distribution
- Distributes speed signals from a tachometer signal conditioner expansion module
- Bus implemented via simple (included) ribbon cable jumper between terminal bases

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The Dynamix™ 1444 Series

Power, environment, certifications & approvals –
an extraordinarily rugged design*!*

Power

Redundant supplies	Integral redundant power supply inputs with supply fault detection and status **available on I/O**
Supply voltage	+24VDC (18V to 32V wide range input) – designed to accommodate **battery backed systems**

Environment

Operating temperature	-25°C to **+70°C**
Conformal coating	All circuit cards are conformal coated

Electrical Safety

CE, CSA & UL

Hazardous Area

IECex-Zone 2 & ATEX – Zone 2
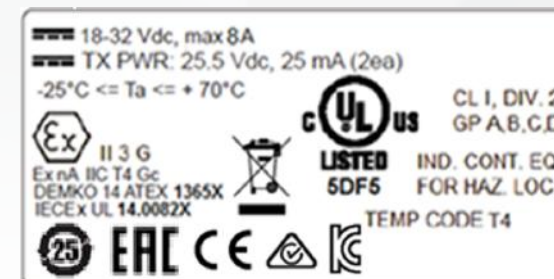cUL – Class 1 Div 2 Groups A,B,C,D

Region & Country Marks

CE, C-Tick, Korean

Marine Certifications

DNV, ABS

**Designed for distributed
& skid mount applications*!***

18-32 Vdc, max 8A
TX PWR: 25.5 Vdc, 25 mA (2ea)
-25°C <= Ta <= + 70°C
Ex nA IIC T4 Gc
DEMKO 14 ATEX 1365X
IECEx UL 14.0082X
II 3 G
c UL us LISTED 5DF5
CL I, DIV. 2 GP A,B,C,D
IND. CONT. EQ. FOR HAZ. LOC.
TEMP CODE T4

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2 What is the Dynamix™ 1444 series

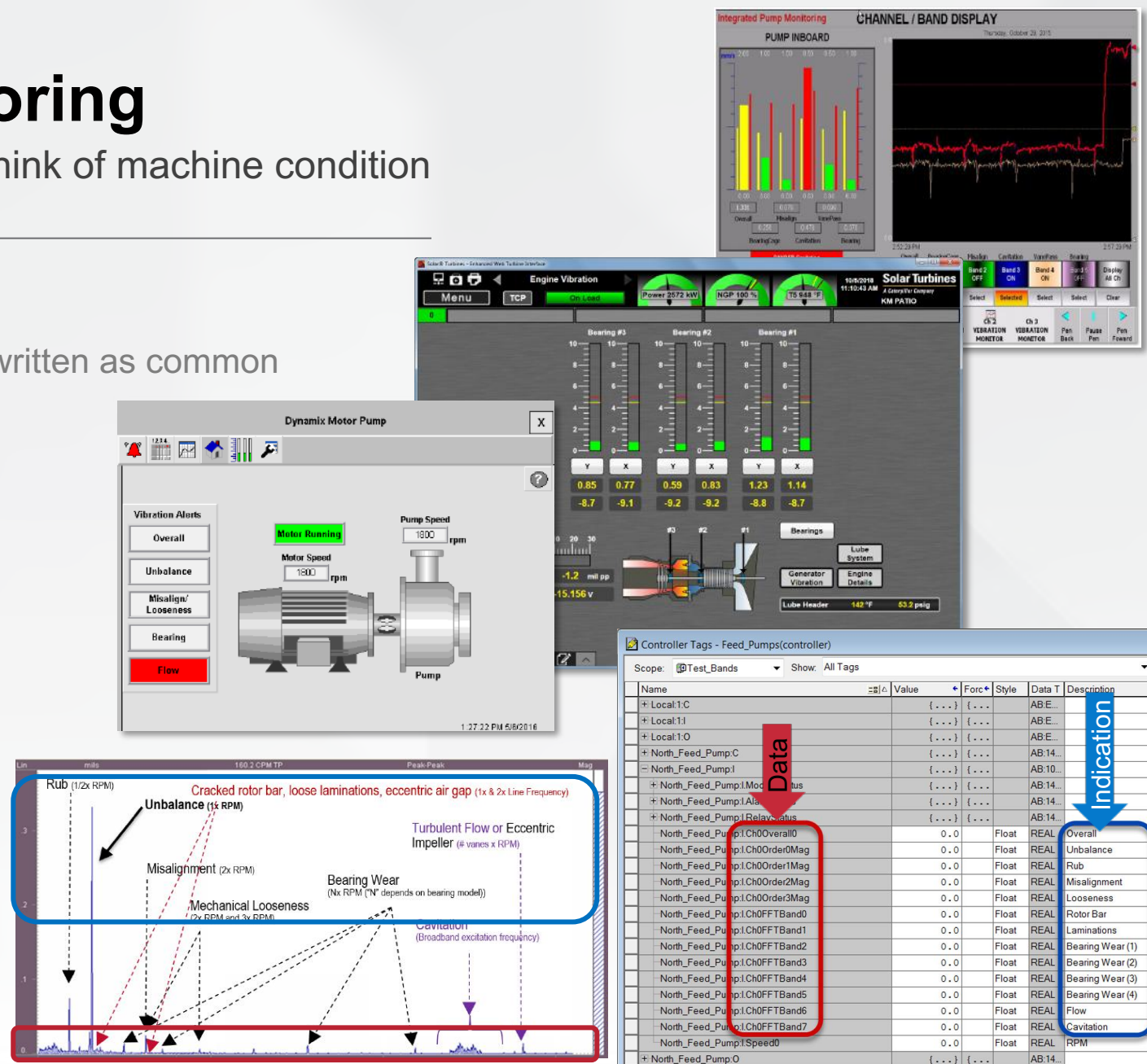**3** The Dynamix™ series and the Integrated Architecture® system

4 Condition Monitoring Software

Integrated Condition Monitoring

Monitoring fault indicators can change how you think of machine condition
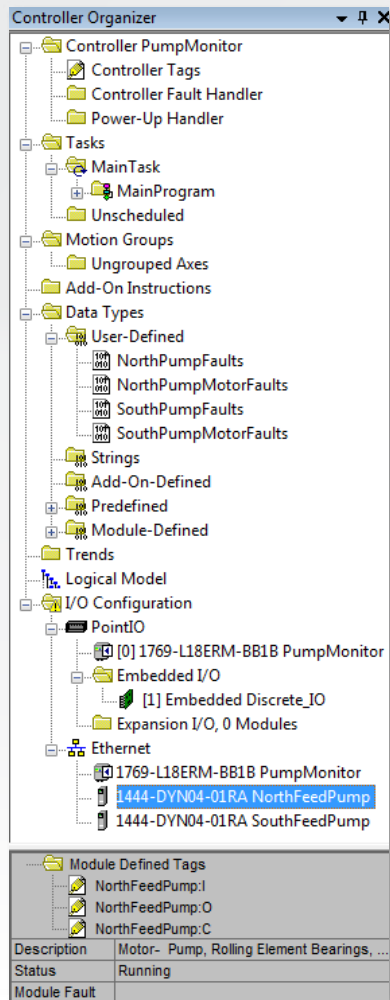
Condition data available as tags in Logix

- Magnitude of vibration at selected fault frequencies written as common tags in a Logix controller

- Machine condition evaluated by Logix

- Monitor and present condition

  o Monitor the status of balance, alignment, bearing condition…

  o Present meaningful, intuitive information rather than numbers

  o When condition is considered in these terms it is far more intuitive, and actionable, than "vibration"

Dynamix™ series in the Integrated Architecture® system

A standard Logix I/O solution for machine condition

Controller input

Input assembly content selected in module definition

Controller output

Control bits

Trip inhibit
Set point multiply (2)
Gate controls (2)

Alarm buffer trigger
Alarm reset
Alarm buffer reset
Transient buffer resets (4)
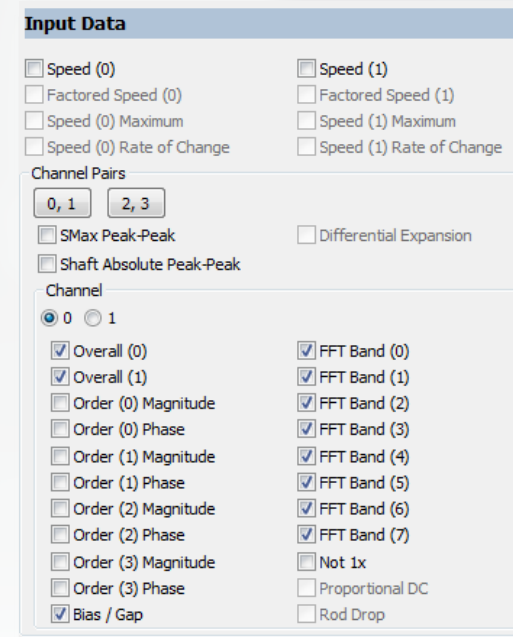
Data

Speeds (2)
Alarm limits (16)

Supported by any Logix controller:

- ControlLogix® controllers
- CompactLogix™ controllers
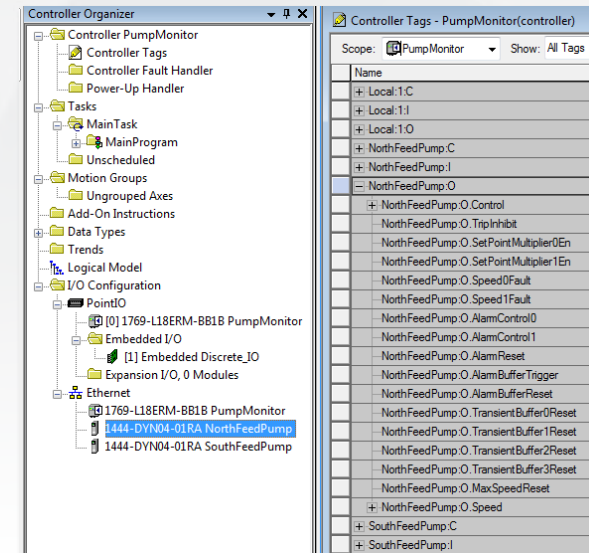- GuardLogix® controllers

Requires Logix version:

- V20 or greater for standard controllers, or
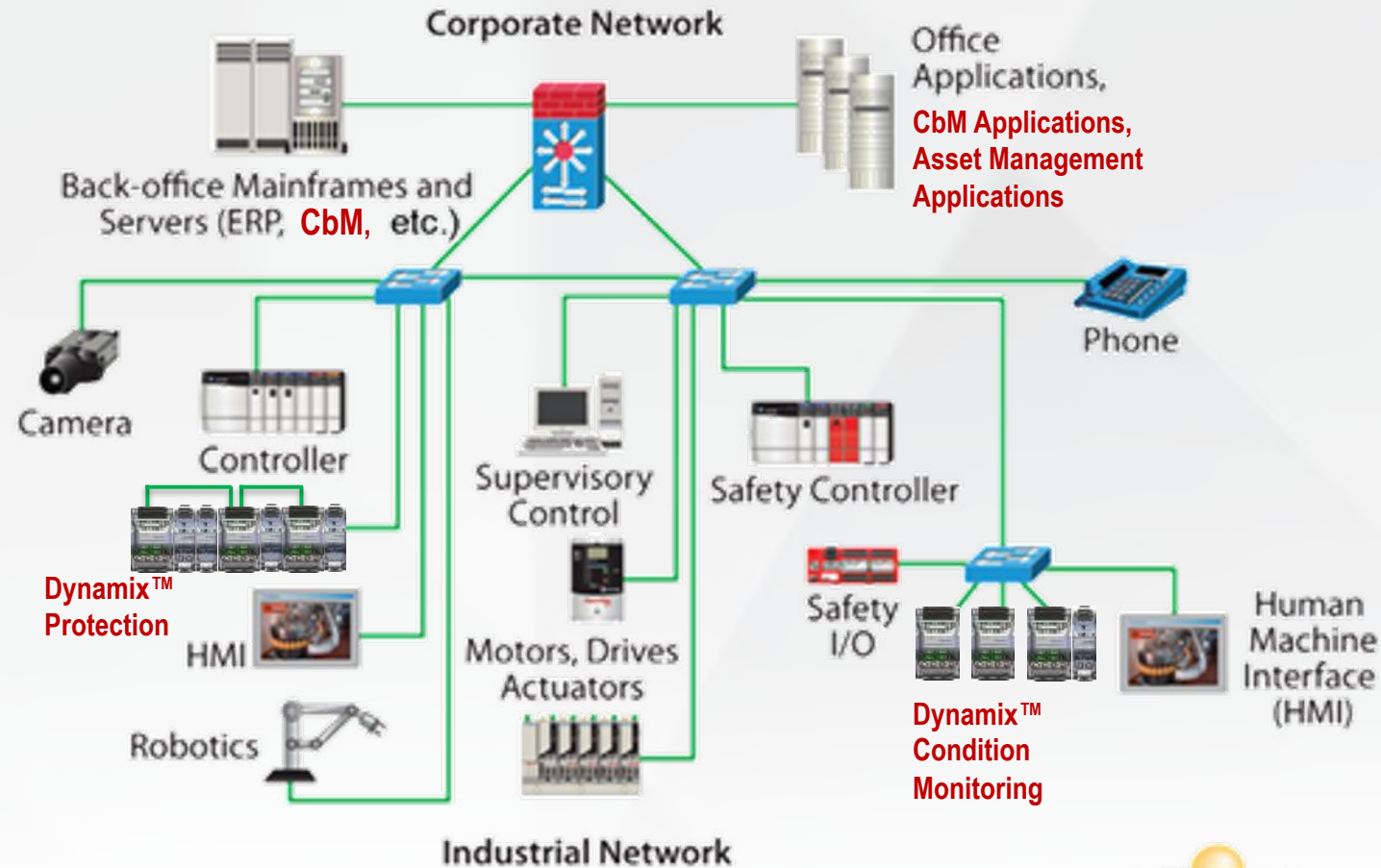- V24 or greater for redundancy

Our EtherNet/IP™ network strategy

A Converged Plantwide Ethernet industrial network

The **Dynamix™ 1444 Series** is an integral part of the **Converged Plantwide Ethernet** strategy from Rockwell Automation.

- Native dual port **Ethernet** and **EtherNet/IP™** protocol

- Supports **Device Level Ring**, **Star** and **Daisy Chain** topologies

- A native EtherNet/IP™ device for **Logix** controllers

- Implement **visualization** of true machine condition *How and Where* you need it

- Enable as comprehensive a solution as necessary by leveraging the products and capabilities of the **Integrated Architecture**® system…

These are what make the **Dynamix™** series the industry's most **open** yet **secure, integrated** and **capable** solution for **machinery monitoring** and **protection** available today*!*

Corporate Network

Office Applications,
CbM Applications, Asset Management Applications

Back-office Mainframes and Servers (ERP, **CbM**, etc.)

Phone

Camera

Controller

Supervisory Control

Safety Controller

Dynamix™ Protection

HMI

Motors, Drives Actuators

Safety I/O

Dynamix™ Condition Monitoring

Human Machine Interface (HMI)

Robotics

Industrial Network

EtherNet/IP®

Dynamix™ system architectures

Condition monitoring within an Integrated Architecture® system
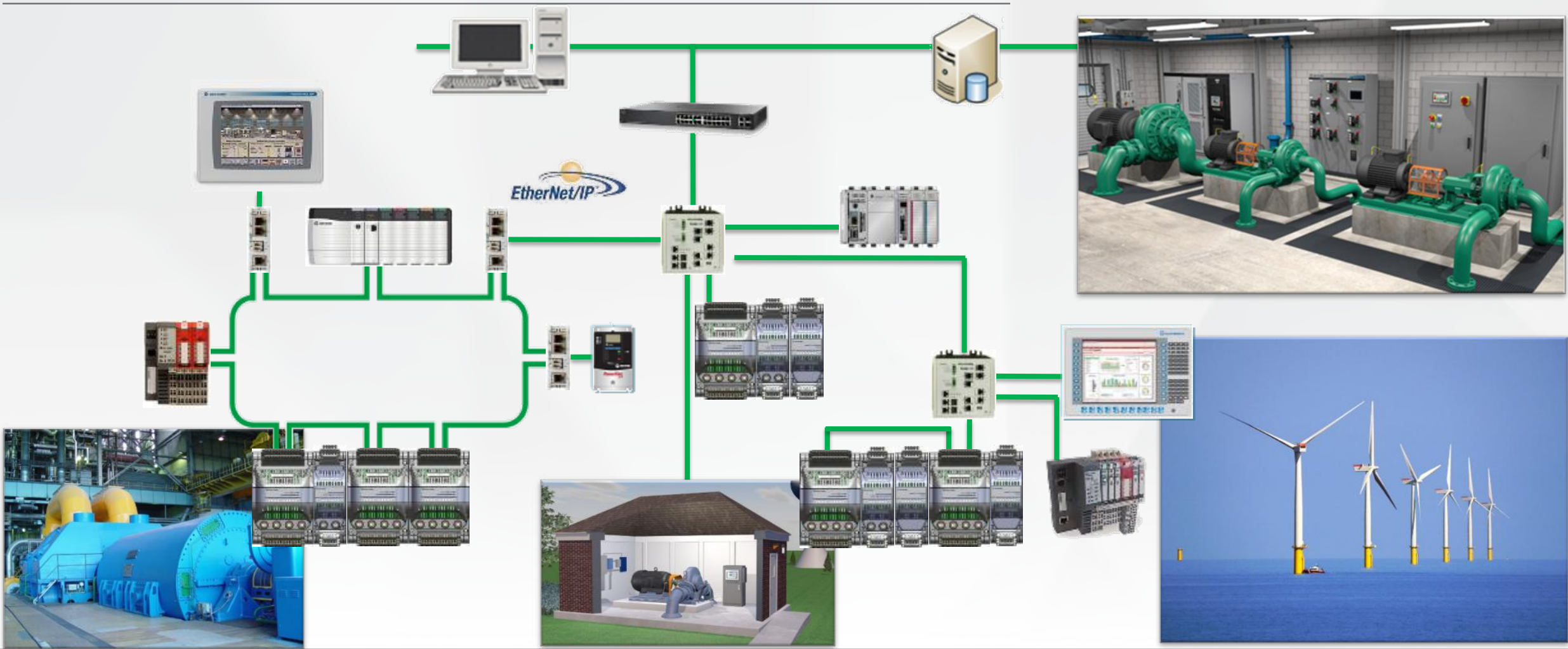
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1 What is Integrated Condition Monitoring (ICM)

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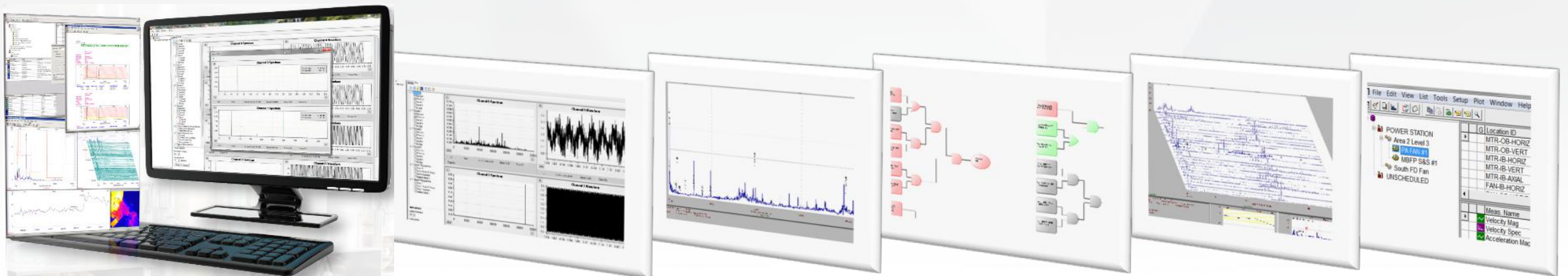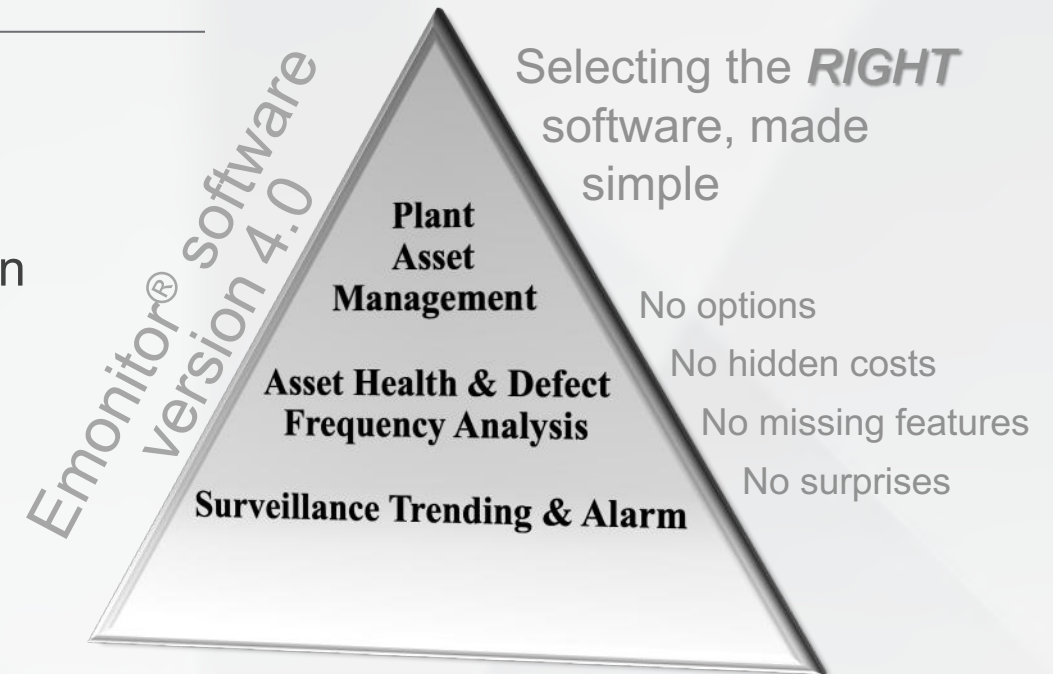**3** The Dynamix™ series and the Integrated Architecture® system

4 Condition monitoring software

Emonitor CMS Software

Because sometimes…

- The problem is "other"
- The actual time waveforms and spectrum must be seen
- Dynamix™ 1444 monitor is a part of a larger predictive maintenance program

When "other" happens, when the solution requires *data* and the *tools* required by **Condition Monitoring professionals**, there's Emonitor® software.

Emonitor® software version 4.0

Selecting the *RIGHT* software, made simple

Plant Asset Management

Asset Health & Defect Frequency Analysis

Surveillance Trending & Alarm

No options
No hidden costs
No missing features
No surprises

Integrated Condition Monitoring

From Rockwell Automation

Dynamix™ 1444 monitors:

- Integrated Condition Monitoring
- API-670 capable machinery protection
- Smart machine monitoring…
  - Automated fault detection and identification within the Integrated Architecture® system
- Secure configuration in Studio 5000 Logix Designer® software

Dynamix™ 2500 portables:

- Data collector for predictive maintenance and machinery vibration diagnostics.
  - Part of a comprehensive Condition Based Maintenance (CbM) program
  - Download your measurements to Emonitor® software
- A real-time, multi-channel signal analyzer
  - A stand alone instrument for use in balancing, run up / coastdown analysis, bump testing, and more.

Emonitor® CMS software:

- Proven, comprehensive tools for executing any size condition based monitoring program
- Online and offline analysis and data collection
- Automated diagnostics
  - Fault frequency identification
  - Built-in and user editable rule sets
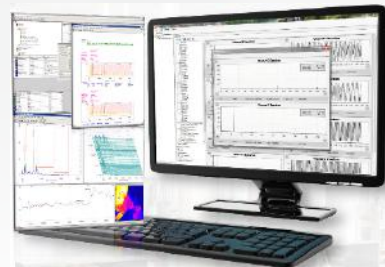
Sensors:

- 1442 series eddy current probes
  - API-670 compliant sensors, extension cables and drivers for all common size and range requirements
- 1443 series sensors
  - Industrial accelerometers, cables, and mounting solutions

1444 Dynamix vs GE Bently Nevada 3500

Bently's most capable monitoring system, the 3500 series, is a traditional rack based system that consists of various modules

3500

- 19" rack based system, must be installed in controlled environment

- High cable installation costs due to location constraints

- Requires 9 modules to perform the functions of one Dynamix 1444

- Complex data such as FFT & TWF requires a connection to GE System 1 or other GE software using a RIM or Gateway

Dynamix 1444

- A distributed system capable of being mounted close the machine All FFT and TWF data is calculated within the module

- Can behave as a standalone device if desired or connected to the control system via Ethernet

- Smaller cost of total system architecture

- Optional deeper visualization and analytics available with Emonitor CMS

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