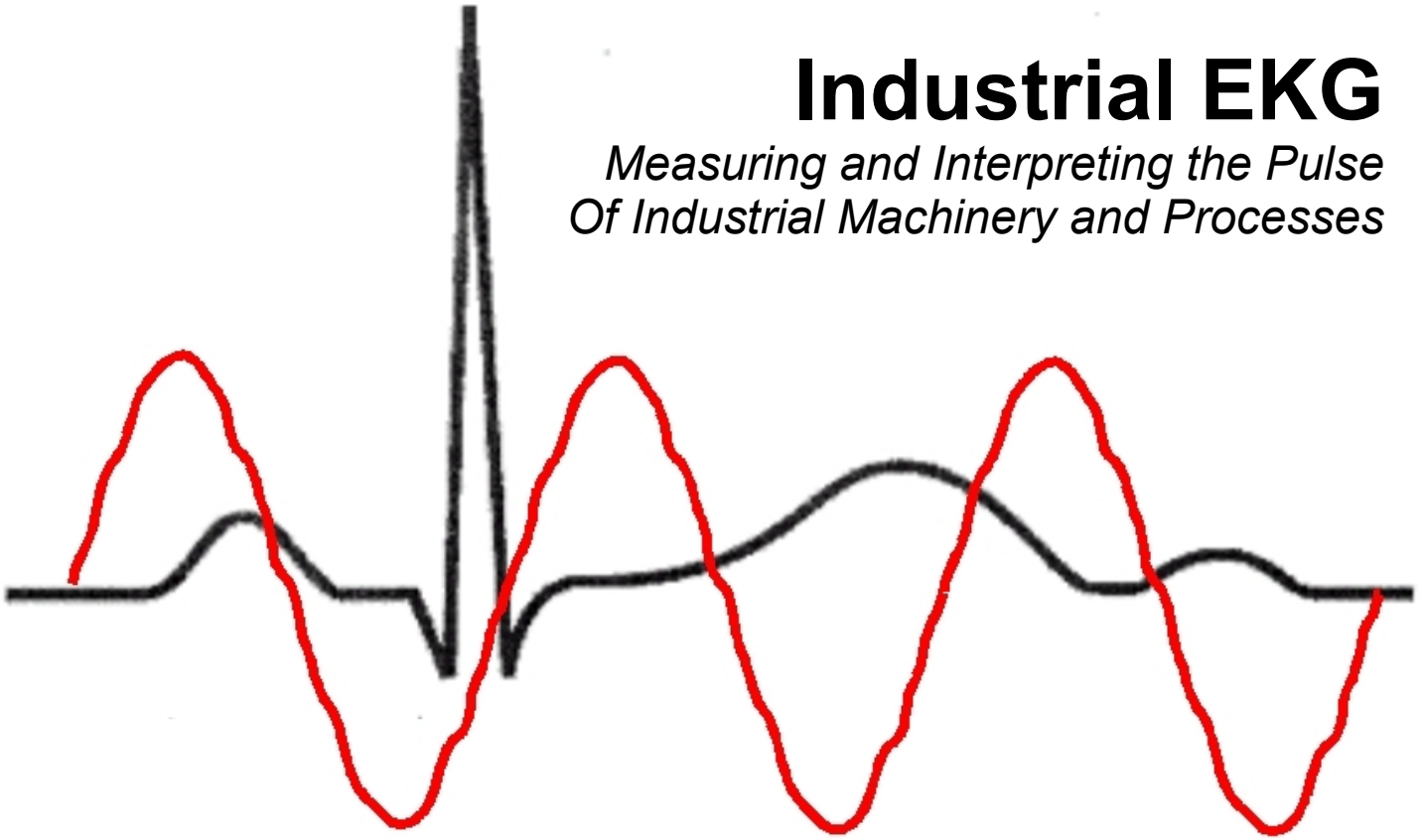
How Does It Work?



What We Do

We help you reduce energy and operating costs by using EKGs to monitor the health of industrial equipment instead of people, like industrial cardiologists.

Our uniqueness:

- we don't need sensors on the monitored machines, no cables to install;
- an experience database of over tens of thousands of motors to compare your equipment against;
- multiple monitors in one product – energy efficiency & consumption, power line condition, electrical and mechanical motor condition; and mechanical condition of driven equipment;
- we *directly* measure how even mechanical faults like unbalance, misalignment,and loose connections waste energy dollars, making ROI calculation fast, easy, clear and unambiguous.

How Does It Work?

Theory of Operation

Typical Sequence of Events

Condition levels & meanings

Trending & diagnosis

How Does it Work?

(Theory)

Measured Current

Measured Voltage

Compare

Differences

Internal Model

Predicted Current

Patented!

STOP

PERFORM MAINTENANCE

WATCH LOAD

WATCH LINE

OK

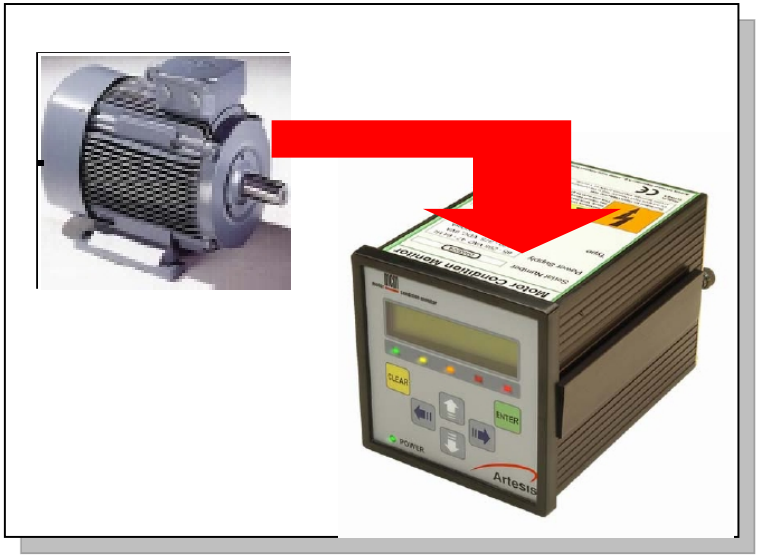
*Model is based on testing & analyzing more than **10 million motors***

What's the “Internal Model”?

Core pieces (patented):

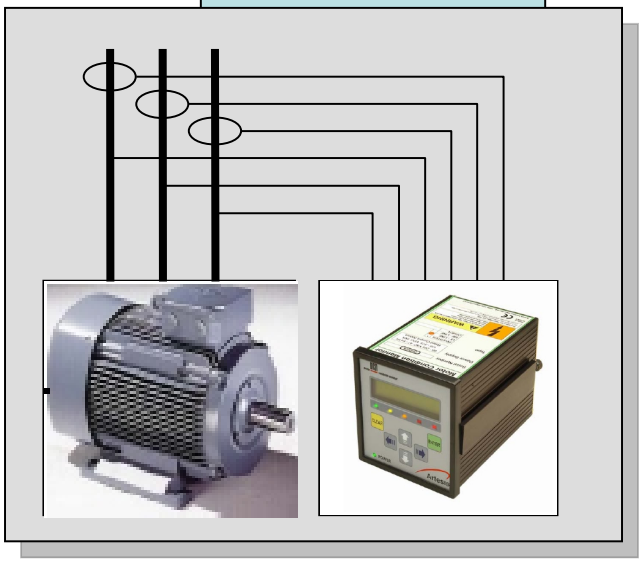
- **Discrete-element circuit model** of motor (or generator); circuit elements derived from measurements, nameplate data, + experience
- **Proprietary algorithm** derives one (1) PSD from several measurements
- Database of expected behavior from experience testing > 10 million motors, used to establish **limit levels in standard deviations** for waveforms, spectra, and RMS values

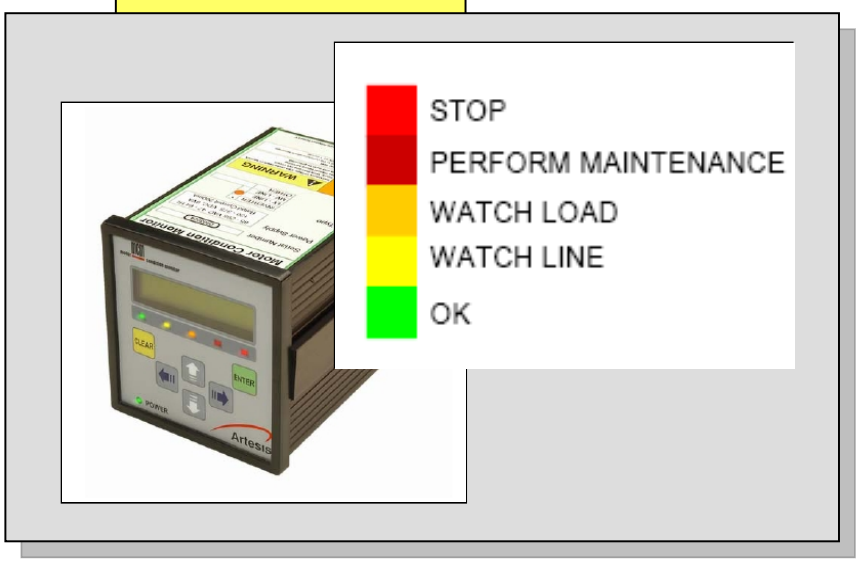
How Does it Work?
(Operation)



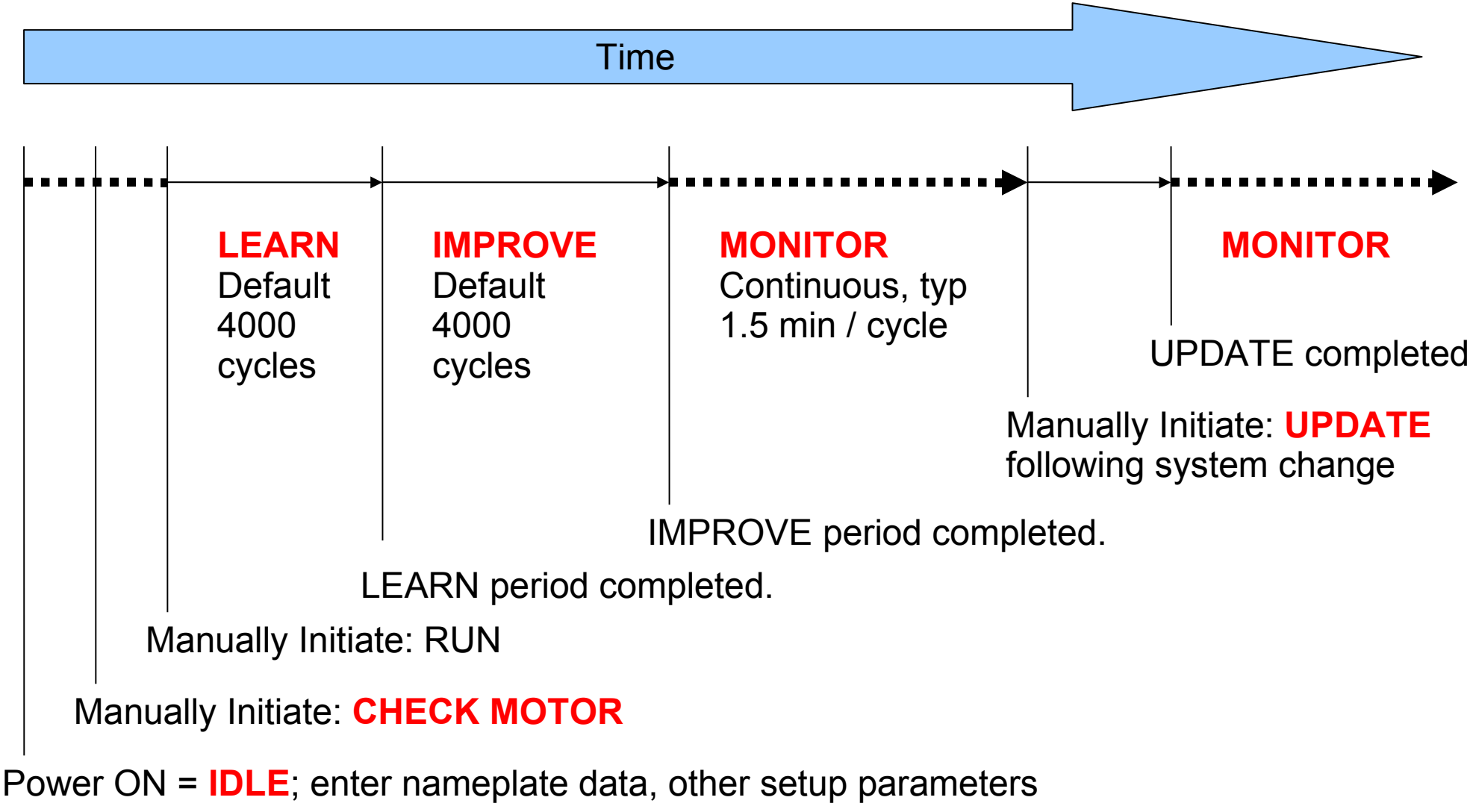
Unattended!

Install → **Learn** → **Run**



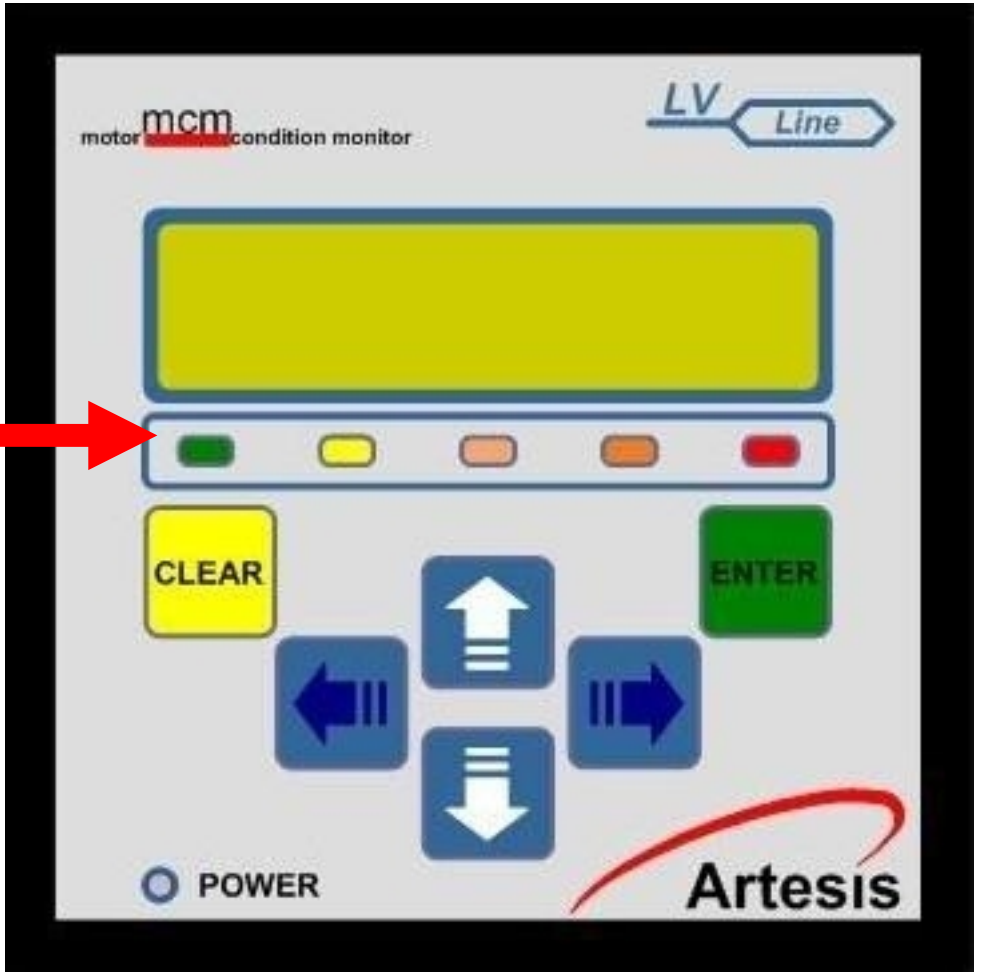


Operating Modes



Condition Levels

- Normal
- Watch Line
- Watch Load
- Perform Maintenance
- Stop Motor



Level Meaning

- **Normal**
- **Watch Line** - eg abnormal voltage dips, spikes other anomaly detected
- **Watch Load** - eg total load on the equipment is exceeding permitted normal range
- **Perform Maintenance** – more specific detail from MCMScada software report & screens
- **Stop** – urgent problem, more specific detail from MCM Scada software report & screens

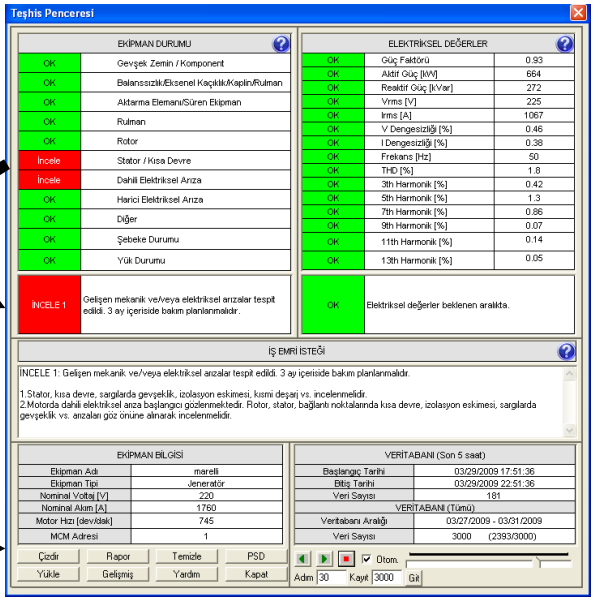
Trend + Diagnose

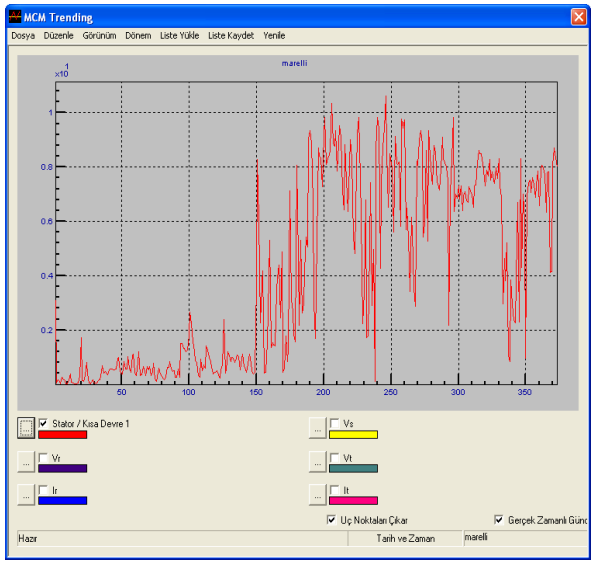
See parameter(s) causing Alarm Condition

Detailed description of alarm condition

Click colored area to see parameter trend graph with related parameters used in description, for time scale reference to see how fault is developing

Parameter Names

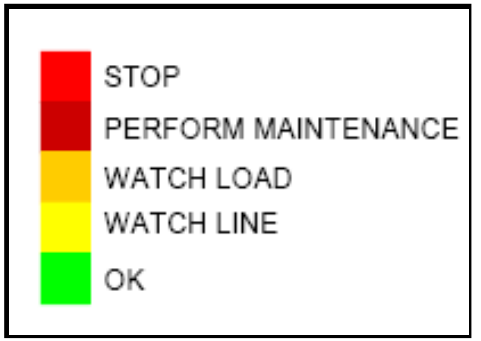




Additional Diagnostic displays

Severity scale is based on standard deviations from “normal” in database

Color Key



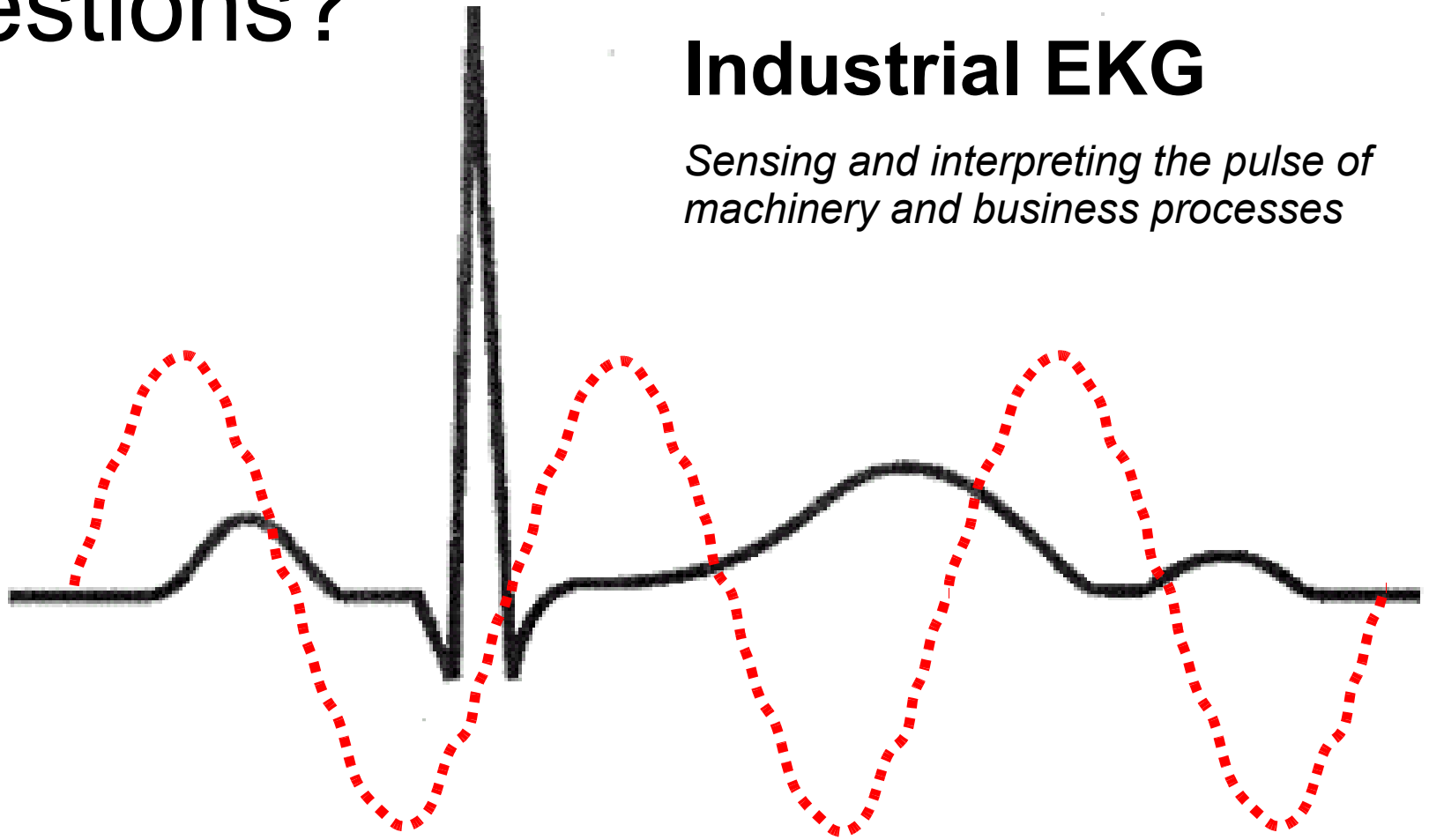
Typical Sequence of Events

- MCM starts LEARN mode; no alarm possible in this mode
- MCM “Learn” mode completes, MCM goes into “Improve,” then “Monitor” modes
- Any time after “Learn” mode completed, when **Out-of limit condition** is *first* detected, **no alarm**
- MCM watches some cycles for additional **confirmation** (automatically)
- **Change Condition Level**; change **relay** condition as required; MCMScada sends **email** as required
- Operator checks further in MCM and/or using MCMScada software
  - What action is required?
  - How soon is action required?
- Operators monitor condition more closely and do other checks as required
- Condition is corrected
- Monitoring resumes

Questions?

Industrial EKG

Sensing and interpreting the pulse of machinery and business processes



info@industrialekg.com