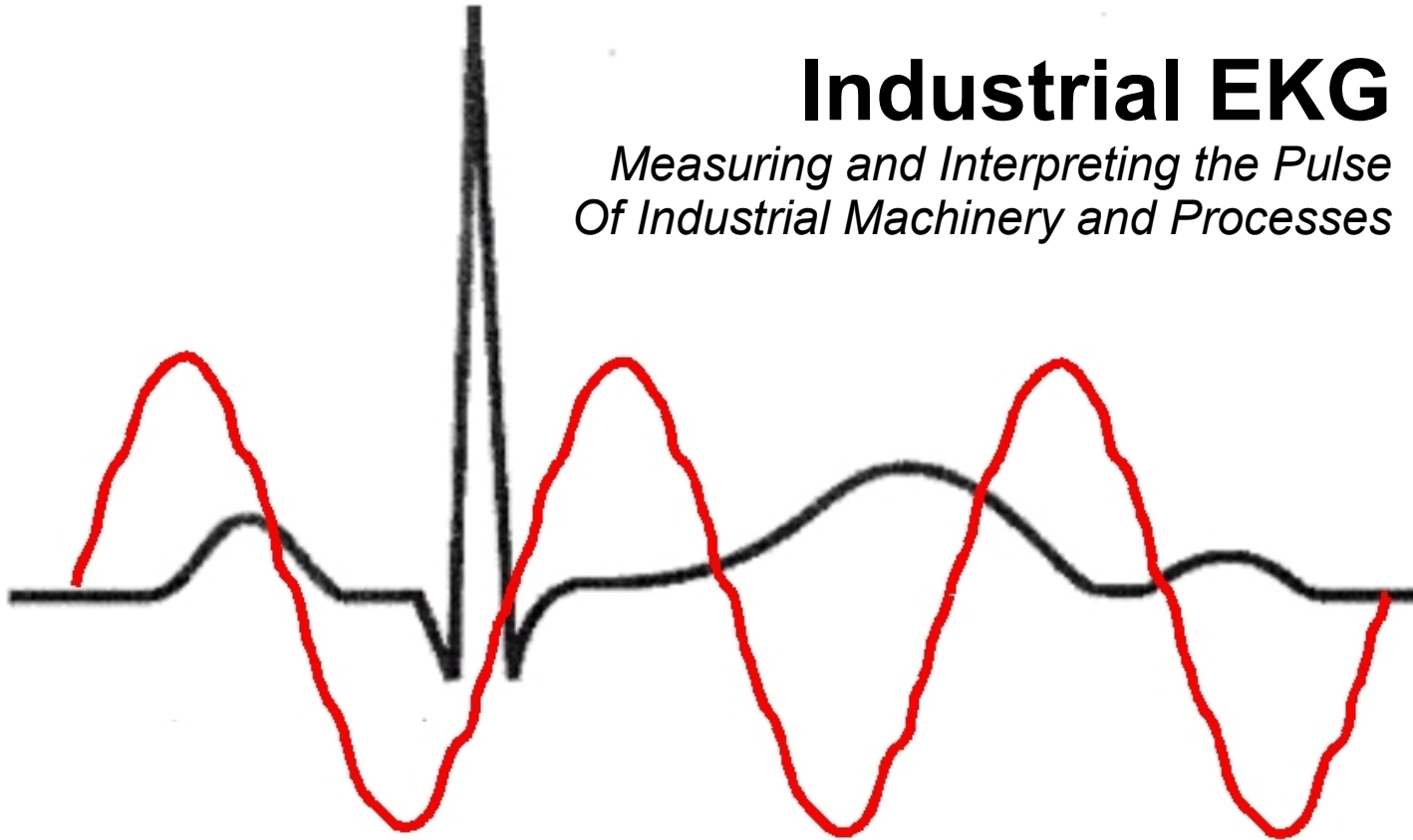


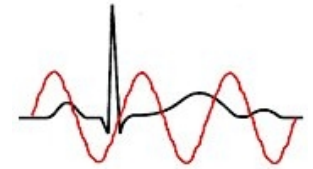
# How Does It Work?

## **Industrial EKG**

*Measuring and Interpreting the Pulse  
Of Industrial Machinery and Processes*



# 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?

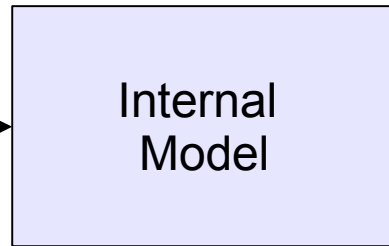
(Theory)



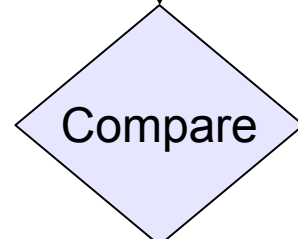
*Measured Voltage*



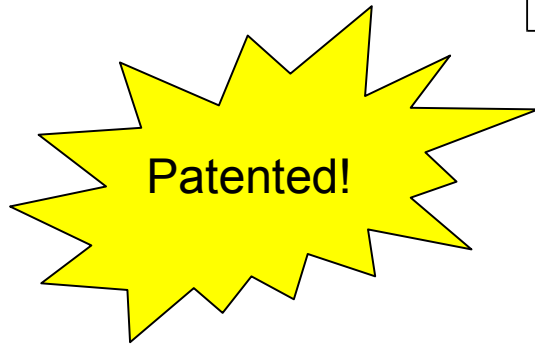
*Measured Current*



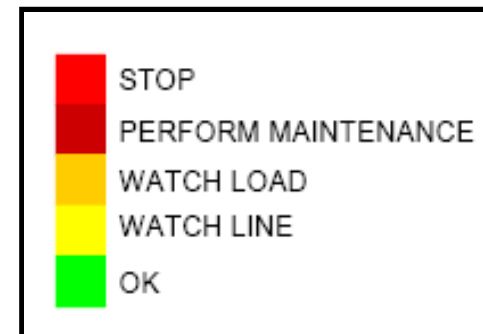
*Predicted Current*



Differences



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



# What's the “Internal Model”?

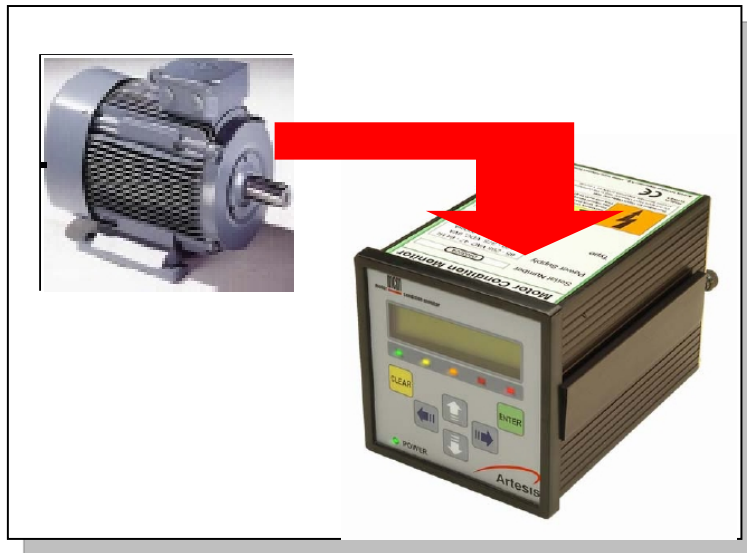


Core pieces (patented):

- **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)

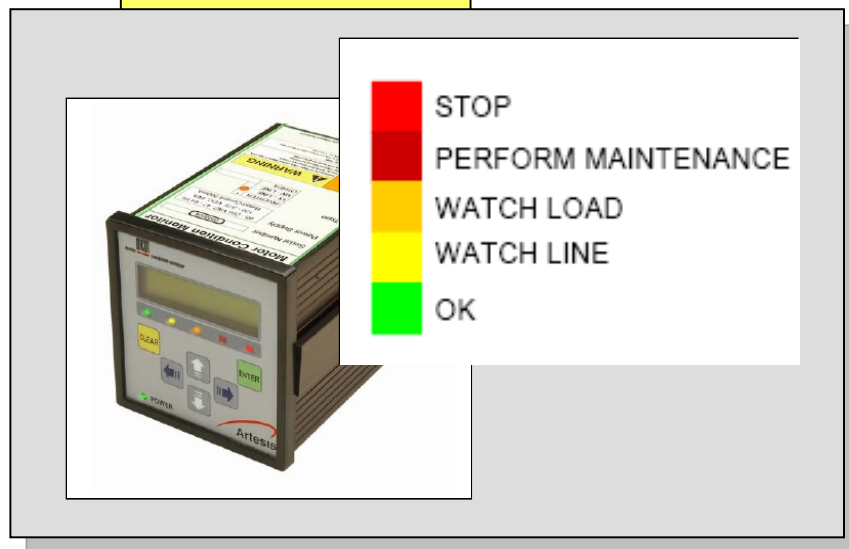
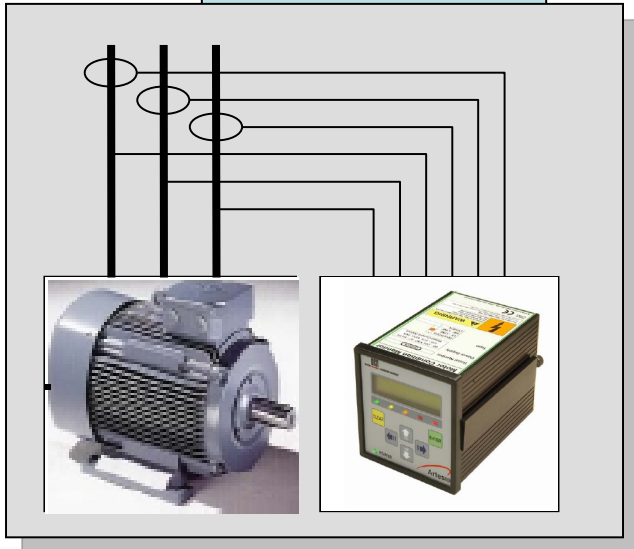


**Unattended!**

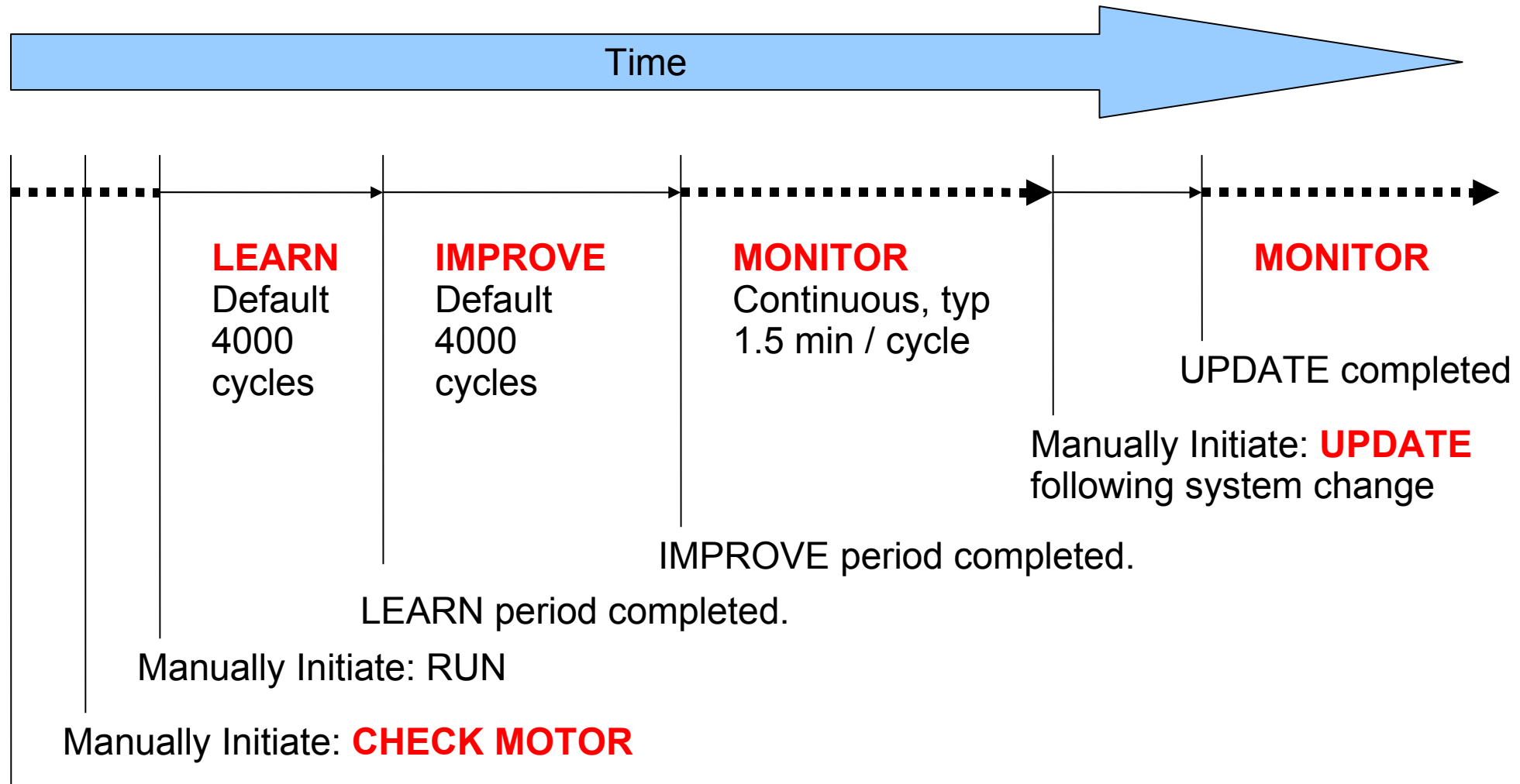
**Install**

**Learn**

**Run**



# Operating Modes

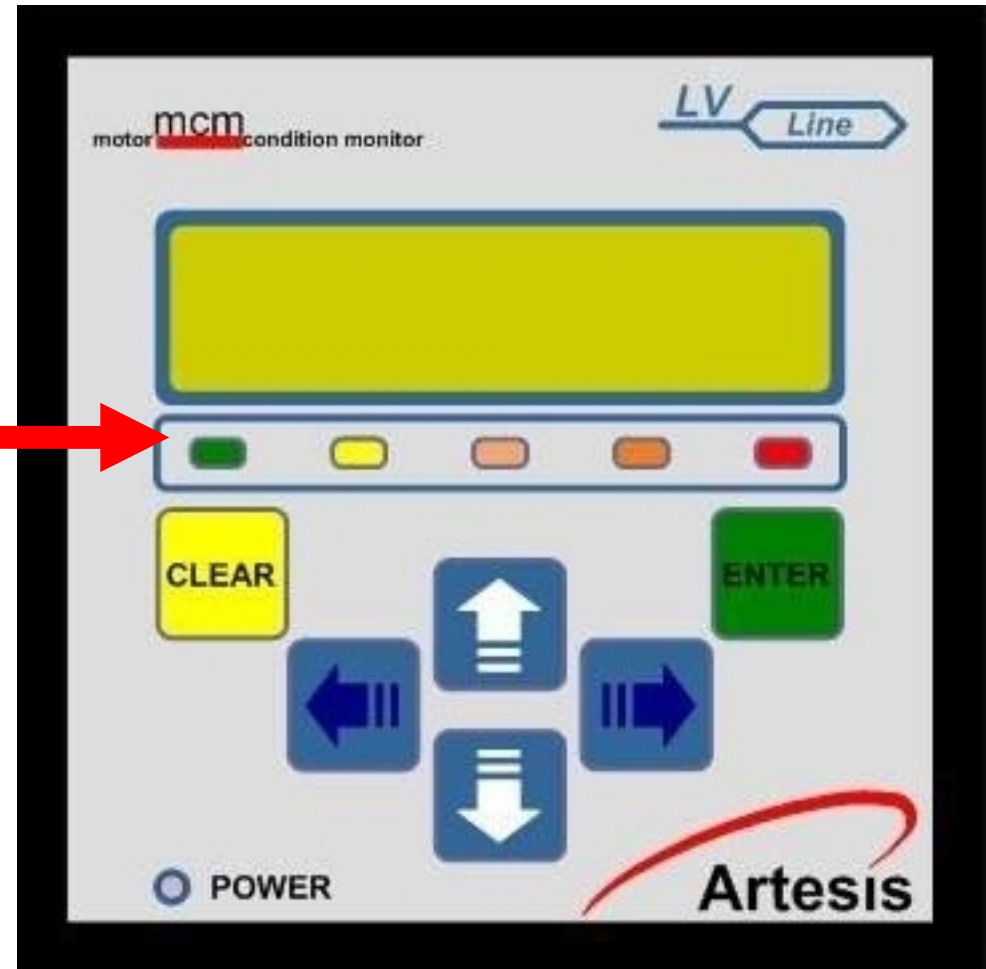


Power ON = **IDLE**; enter nameplate data, other setup parameters

# Condition Levels

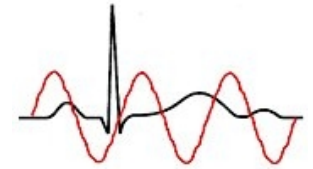


- Normal
- Watch Line
- Watch Load
- Perform Maintenance
- Stop Motor





# 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

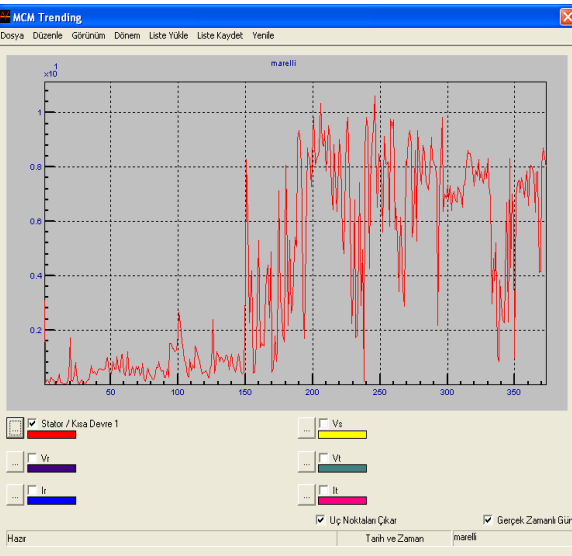
# Trend + Diagnose



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

Ekipman Durumu		Elektriksel Değerler	
OK	Geçmiş Zemin / Komponent	OK	Güç Faktörü 0.93
OK	Balanssızlık/Eksenel Kaçıklık/Kaçırma/Rulman	OK	Aktif Güç [kW] 664
OK	Altarma Elemanı/Süren Ekipman	OK	Reaktif Güç [kVar] 272
OK	Rulman	OK	Vrms [V] 225
OK	Rotor	OK	Irms [A] 1067
<b>İncile</b>	Stator / Kısa Devre	OK	V Dengesizliği [%] 0.46
<b>İncile</b>	Dahil Elektriksel Anıza	OK	I Dengesizliği [%] 0.38
OK	Harici Elektriksel Anıza	OK	Frekans [Hz] 50
OK	Diğer	OK	THD [%] 1.8
OK	Şebeke Durumu	OK	3th Harmonik [%] 0.42
OK	Yük Durumu	OK	5th Harmonik [%] 1.3
		OK	7th Harmonik [%] 0.86
		OK	8th Harmonik [%] 0.07
		OK	11th Harmonik [%] 0.14
		OK	13th Harmonik [%] 0.05

**İNCELE 1** : Gelen mekanik ve/veya elektriksel arızalar tespit edildi. 3 ay içerisinde bakım planlanmalıdır.

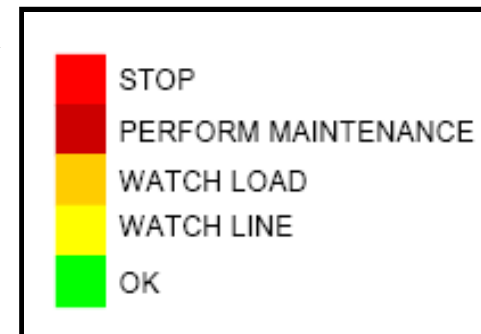
**Ekipman Bilgisi**

Ekipman Adı	marelli	Veritabanı (Son 5 saat)	
Ekipman Tipi	Jeneratör	Başlangıç Tarihi	03/29/2009 17:51:36
Nominal Voltaj [V]	220	Bitiş Tarihi	03/29/2009 22:51:36
Nominal Akım [A]	1760	Veri Sayısı	181
Motor Hızı [dev/dak]	745	Veritabanı Aralığı	03/27/2009 - 03/31/2009
MCM Adresi	1	Veri Sayısı	3000 (2393/3000)

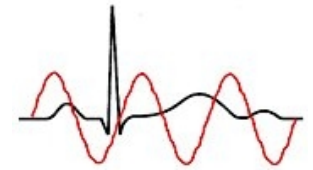
Additional Diagnostic displays

Severity scale is based on standard deviations from "normal" in database

Color Key



# Typical Sequence of Events



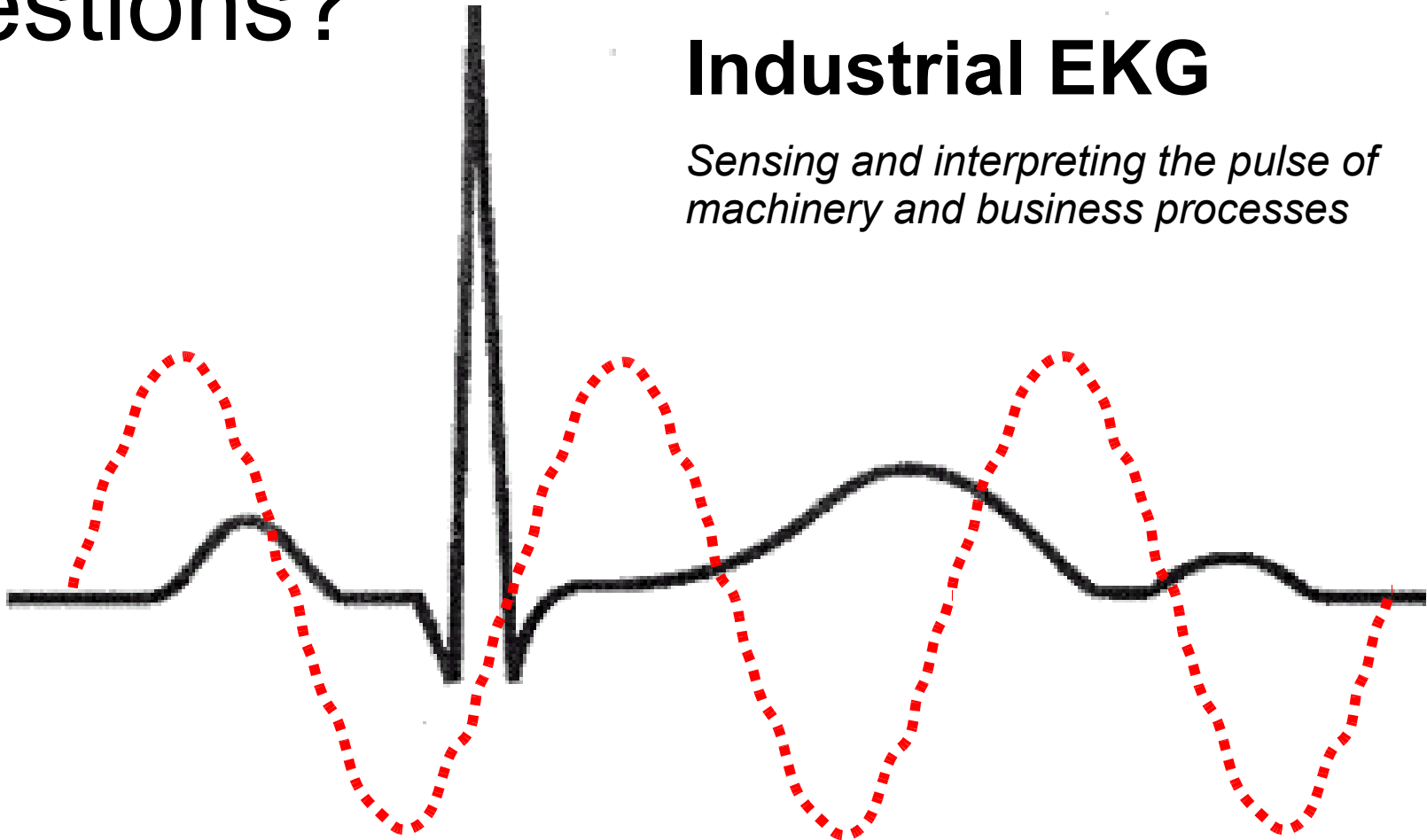
- MCM starts LEARN mode; no alarm possible in this mode
- MCM “Learn” mode completes, MCM goes into “Improve,” then “Monitor” modes
- Any time after “Learn” mode completed, when **Out-of limit condition** is *first* detected, **no alarm**
- MCM watches some cycles for additional **confirmation** (automatically)
- **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](mailto:info@industrialekg.com)