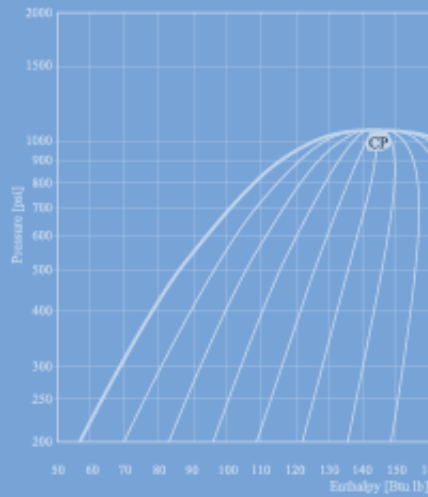


$$\text{COP} \equiv \frac{T_m}{T_m - T_o}$$



Making Sense

Webinar Series



$$D = \frac{1.86 \cdot 10^{-3} T^{3/2} \sqrt{1/M_1 + 1/M_2}}{p \sigma_{12}^2 \Omega}$$



Making Sense Webinars

Emerson and Our Partners Giving Insight on the **Three Most Important Issues** in Refrigeration

We're Making Sense of the promising role of **new refrigerants**.

We're Making Sense of **energy reduction** technologies.

We're Making Sense of the application of electronics to improve **operational visibility**.



The widespread deployment of cost-effective, energy-efficient refrigeration solutions using natural refrigerants is fast approaching.

Emerson Climate Technologies invites you to interact with some of the refrigeration industry's most trusted and respected thought leaders on the emerging role of these groundbreaking natural and alternative refrigerants. Gain insights through paneling, Q&A, and more.

At AHR 2013, we're helping attendees MAKE SENSE of the issues that matter most. Check our website at www.emersonclimate.com/conferences for presentation schedules and topics. Bring this card with you to one of our presentations and you'll be entered for a chance to win an Apple iPad!

> See what makes sense at the AHR Expo, booth #1605.

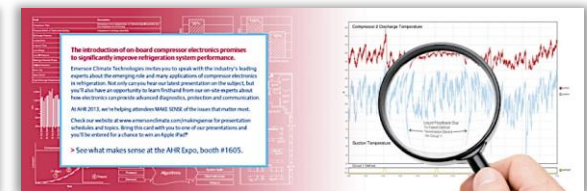


Advanced energy reduction technologies are enabling us to create a new era of system and equipment optimization.

Emerson Climate Technologies partners to network with the refrigeration industry's foremost innovators in energy reduction technologies. We will be bringing a presentation about how the improvements in equipment and system technologies are being utilized in today's refrigeration applications. The experts will be present throughout the event to answer any questions you have about these innovations — from the utilization of digital modulation and electronic expansion valves to the application of scroll and variable speed technologies.

At AHR 2013, we're helping attendees MAKE SENSE of the issues that matter most. Check our website at www.emersonclimate.com/conferences for presentation schedules and topics. Bring this card with you to one of our presentations and you'll be entered for a chance to win an Apple iPad!

> See what makes sense at the AHR Expo, booth #1605.



The introduction of on-board compressor electronics promises to significantly improve refrigeration system performance.

Emerson Climate Technologies invites you to spend with the industry's leading experts about the strategic use and many applications of compressor electronics in refrigeration. Gain critical insights from our global professionals on the subject. And you'll also have an opportunity to learn firsthand from our on-site experts about how the latest compressor advanced diagnostics, protection and communication.

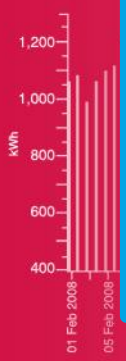
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> See what makes sense at the AHR Expo, booth #1605.

Fault	Description
Compressor Trips	Compressor is in a tripped state and the compressor is not running.
Pressure Switch or Thermostat Cycling	Compressor is running and cycling.
Discharge Pressure	Pressure is out of limits or cycling.
Locked Rotor	Low line voltage or locked rotor.
Long run Time	Indicative of low capacity.
Low Voltage	Low line voltage or voltage drop.
Low Oil Pressure	Low oil pressure.
Missing & Revers	Missing or reversing.
Welded Contact	Welded contact.
Motor Trip	Motor trip.
Open Circuit	Open circuit.
High Discharge T	High discharge temperature.

Making Sense

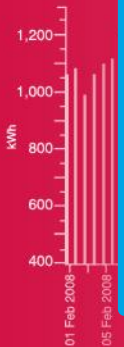
of the application of electronics to improve **operational visibility.**



Fault	Description
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Welded Contact	Welded Contact.
Motor Trip	Motor Trip.
Open Circuit	Open Circuit.
High Discharge T	High Discharge T.

Using Compressor Electronics Data

September 17, 2013



Presented By:

Kurt Knapke

Director, Product Planning and Electronics
Emerson Climate Technologies

Agenda

- **Basics of Compressor Electronics**
 - Definition of CoreSense™ Technology
- **What Type of Data Is Available?**
- **What Are the Benefits?**
- **Applications/Real World Examples**
- **How Can Monitoring Data Across the Enterprise Help?**

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Emerging Trends Create Need for CoreSense Technology



• **Copeland Discus** with CoreSense

Emerging Trends:

- Connectivity
- Aging Contractor Workforce
- System Complexity
- Increasing Warranty Costs

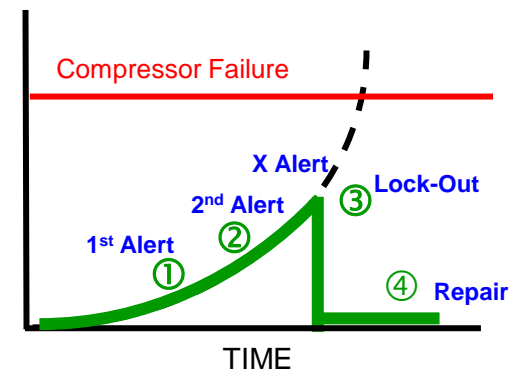
What Is CoreSense Technology:

- Compressor as a Sensor
- To Monitor and Interpret Compressor and System Information
- Delivers Advanced Protection, Diagnostics and Communications
- Enhances Performance and Reliability

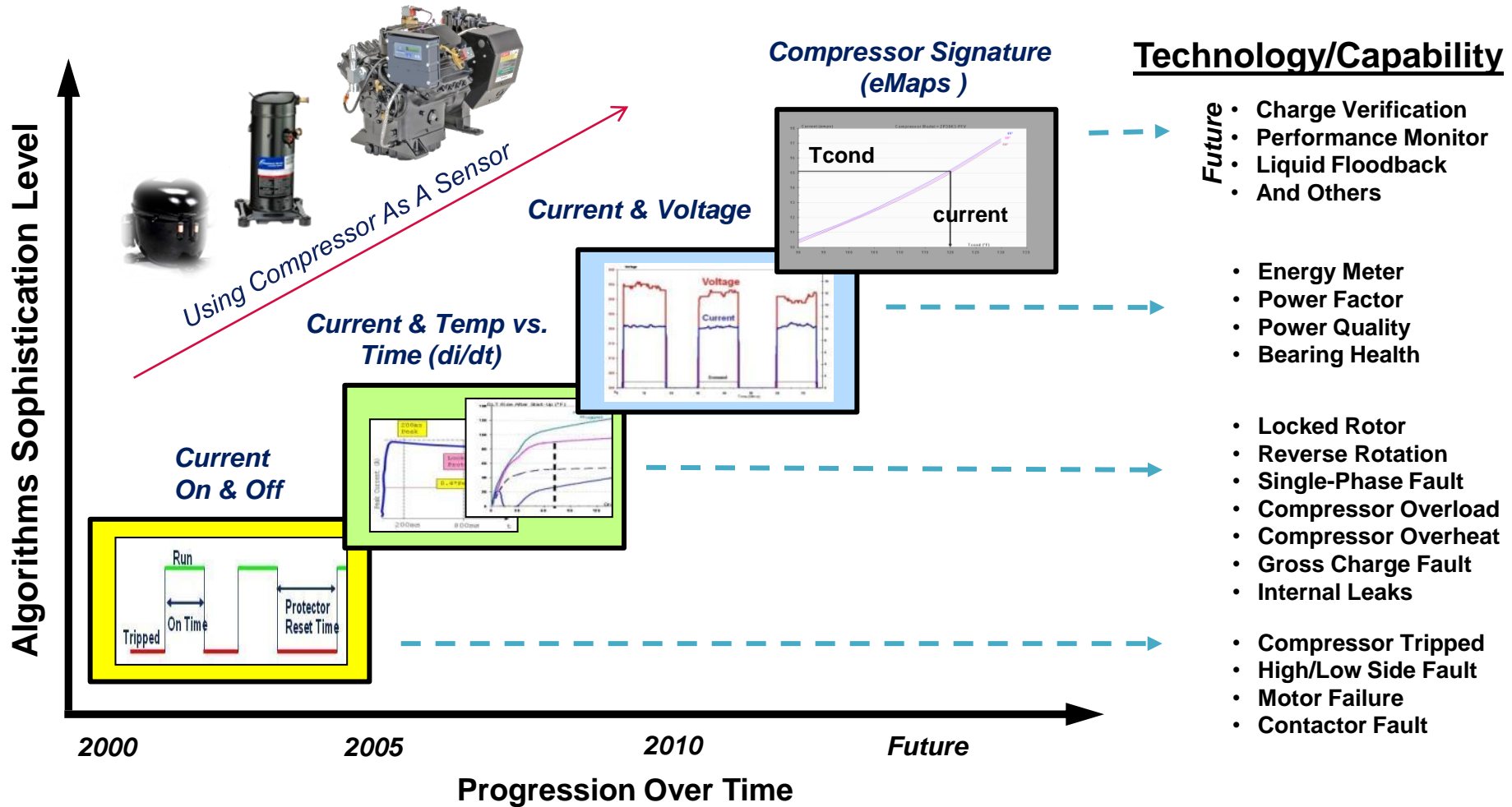
How Does CoreSense Technology Work?

The Basics of Compressor as a Sensor

- **Most Failures Have Early Indicators**
 - Motor Temp and/or Motor Current and/or Disch. Temp
 - Historically Manifests as a Cycle of Motor Protector Trips and Resets
 - Usually No One Knows or Comes Until a Failure Occurs
- **CoreSense Gathers Operating Information**
 - Analyzes Current Signature of the Compressor
 - Characterizes Compressor Protector Behavior
 - Combines This Information to Indicate Operating Condition (Ambient, Temps, Demand, etc.)
- **CoreSense Algorithms Use This Information to Identify:**
 - Electrical Issues and System Faults
 - Escalating Patterns Leading to Catastrophic Faults
- **Gives Facilities Managers/Contractors a Chance to Respond**
 - Can Stop Machine in Extreme Cases (Reset)
 - Enables Proactive Maintenance, Service and Solutions
- **Algorithms Built From Decades of Copeland Testing, Teardown and Operating Experience**
 - Over 1M Units in the Field in Refrigeration, Residential, Commercial Air Conditioning, Heating, Geothermal Systems



CoreSense Technology Capabilities Evolve Over Time



Creates Value for OEM, Contractor and End User

CoreSense Technology Is Being Rolled Out Across All of Our Major Product Platforms



Discus w/CoreSense Diagnostics



Scroll w/CoreSense Diagnostics



Outdoor Condensing Unit



CoreSense Diagnostics Module



Comfort Alert and PerformanceAlert



Discus w/CoreSense Protection



Scroll w/CoreSense Communication



Indoor Condensing Unit



CoreSense Protection

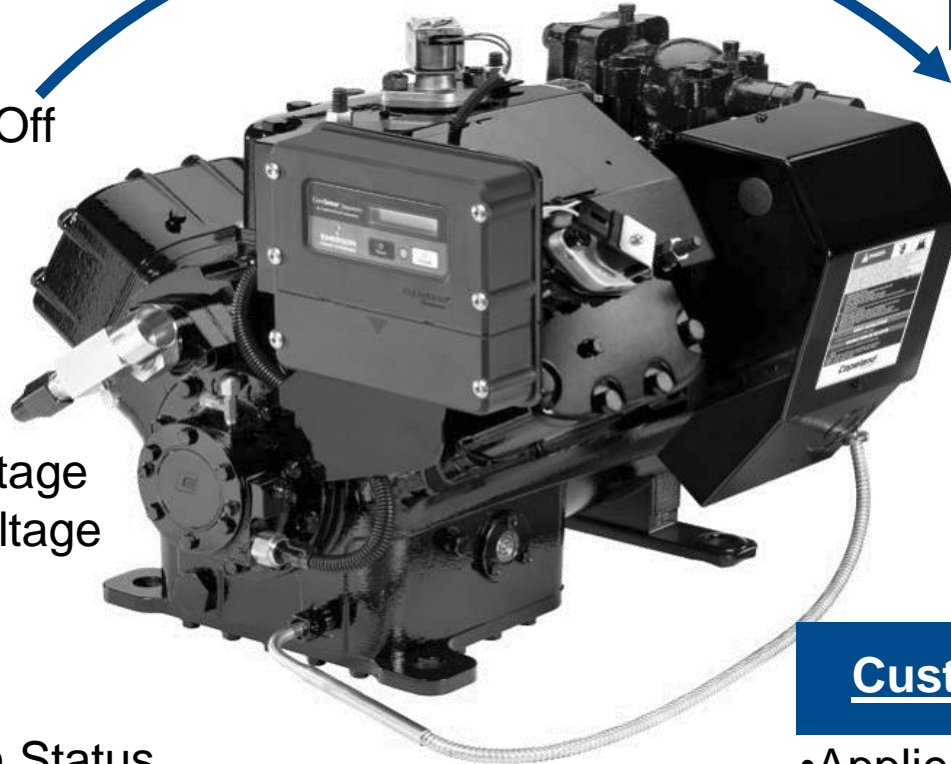


SecureStart™

What Type of Data Is Available?

Sensor Data

- Comp Status On/Off
- Oil Pressure
- Discharge Temp.
- Motor Temp.
- Ambient Temp.
- Comp. Current
- Comp. Power Voltage
- Control Circuit Voltage
- Demand Signal
- Contactor Status
- Unloader Status
- Digital Modulation Status
- Low/High Pressure Cut-Out



Insights

- Asset Information
- Compressor Proofing
- Power Consumption
- Run and Fault History
- Remote Diagnostics
- System Operation

Customer Value

- Applied Cost Savings
- Maintenance Savings
- Energy Efficiency

Multiple Ways to Access Information

A) Locally at Compressor:

- LCD Interface
- LED Indicator Lights

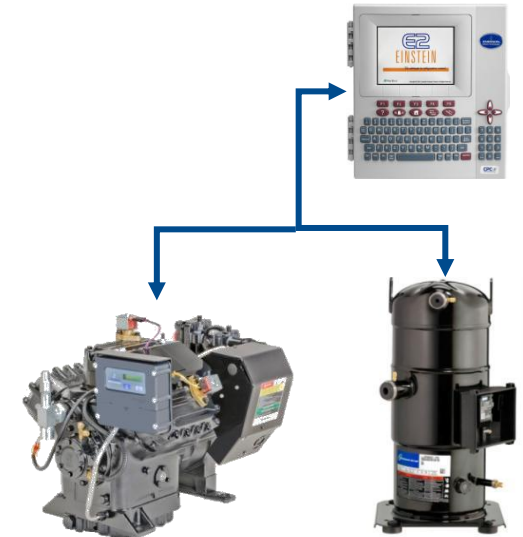


B) Locally Thru Computer



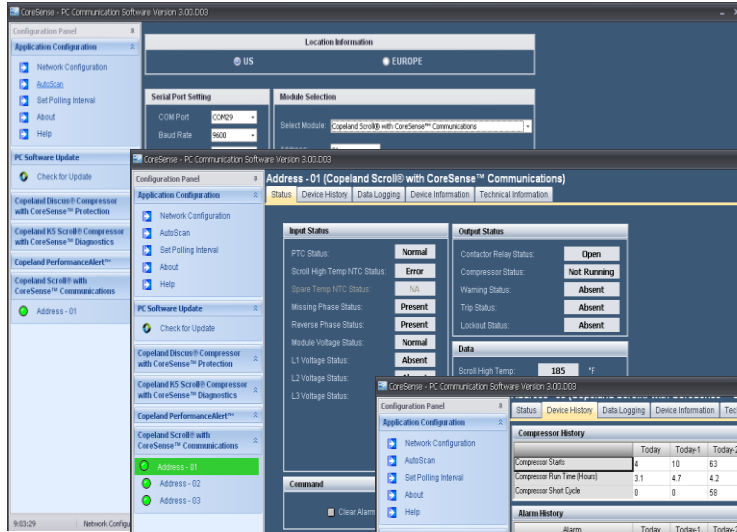
1. Modify User Adjustable Features
2. Review/Download Compressor History
3. Use as Data Logger

C) Locally and Remotely Thru EMS



1. Modify User Adjustable Features
2. Communicate Data and Alerts to System Controller
3. Review Compressor History
4. Use as Data Logger

CoreSense PC Software Provides Access to Data and Fault History



• Network Configuration

- Connect to Multiple Devices at Once



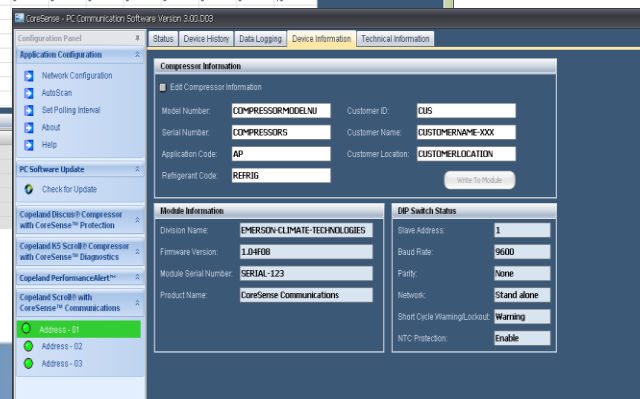
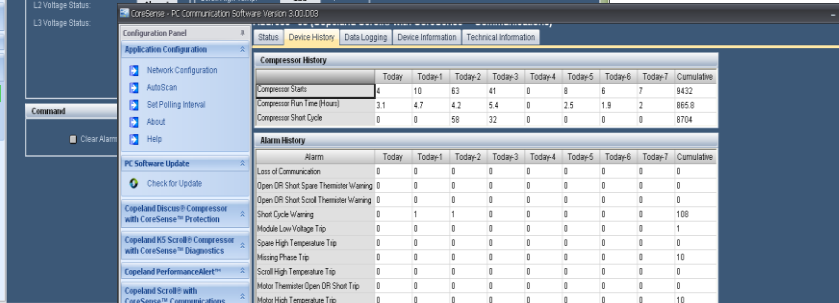
• Module Status

- Input: Motor and Scroll Sensor, Line and Control Voltage
- Output: Contactor, Compressor, Trip, Lockout
- Data: Scroll Temp (°F), Control Voltage (V)



• Device History

- Compressor Starts and Run Time
- Alarm History and 10 Most Recent



• Device Info

- Model Number
- Serial Number
- Firmware Version

* Note: Real-time Data Logging Also Available

CoreSense Provides Information Remotely That Was Not Available Before

Terminal Mode

10-12-08 RX-400 Unit 1 10:04:23
ISD2 Compressor NAMES FULL *ALARM*

ISD 2.0 Compressor

ISD2 COMP001

Req In: Act Out: [14.7]
ON ON

Comm Status : Online
Alarm Status : ..
Display Code: Normal - Running

CURRENT STATUS

Sat Suction Temp : -12.8
Discharge Temp : 190.4
Cntrl Mod Temp : 91.3

DEVICE INFORMATION

Product Name : ISD2.0
Manufacturer : EMERSON-CLIMATE-TECH
Part Number : 526-9999
Revision : 1.16F05
Sens Mod Rev : 1.13F04
Bus Address : 1
FW Updt Prog : ..

ASSET INFORMATION

Comp Model # : 4DT3A220L-TSK-A27
Comp Serial # : 08F00913R

RUN STATUS

Comp Run Time : 307
Comp Starts : 171
Unld 1 Run Time : 7

USAGE STATUS

Current : 8.7
Power : 0.13

Press enter for a list of actions.

F1: SUCTION F3: CIRCUITS F5: SETUP

Discharge Temperature

Asset Data

Compressor Current and Power Consumption

CoreSense Provides Alarm History

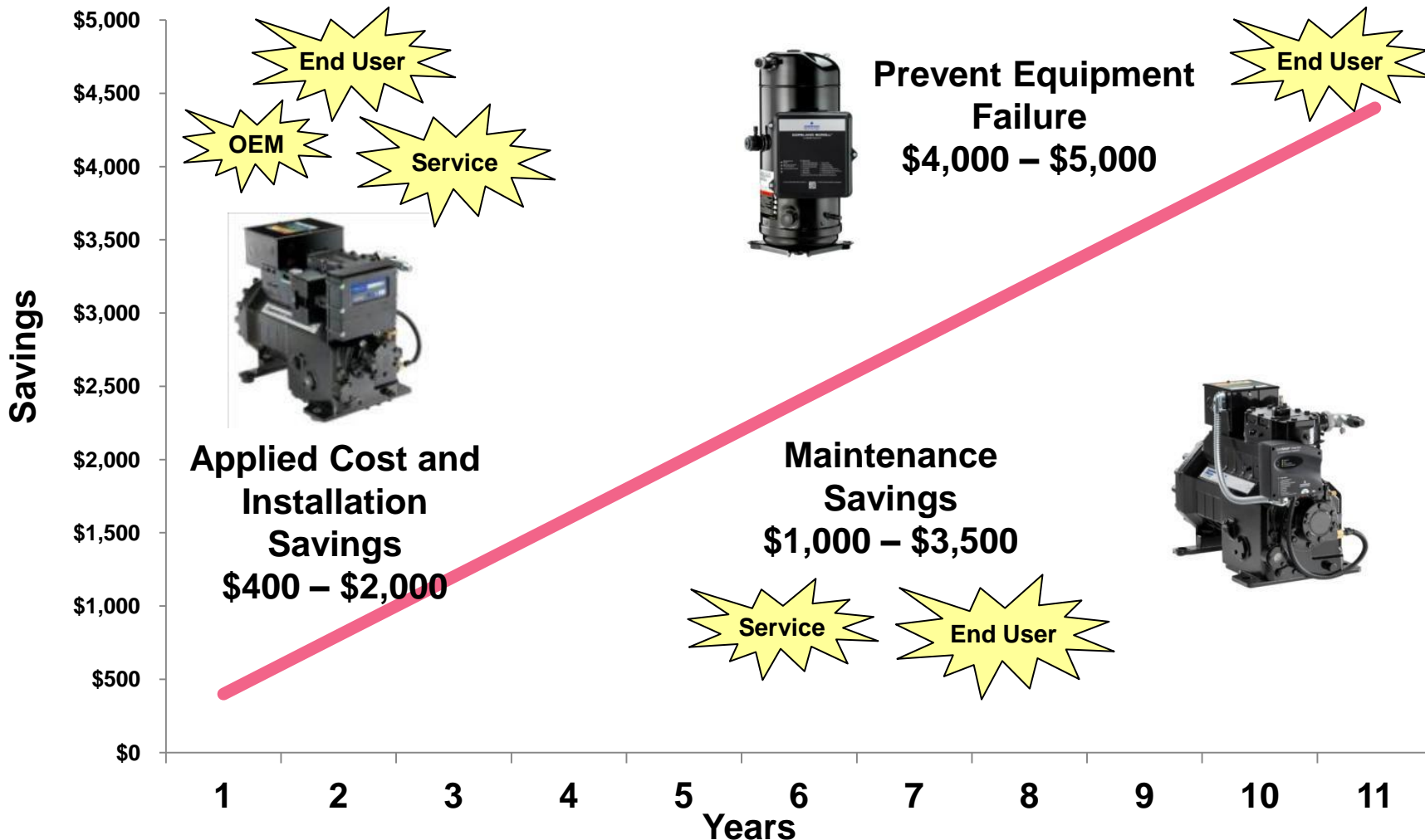
```
04-01-06  RX-400 Unit 1  DETAILED STATUS  NAMES FULL
Use Ctrl-X to Select CX Tabs
C1: Inputs    C2: Outputs    C3: Discus Outs  C4: Alarm Out  C5: SensorModul
C6: History   C7: 7 Day      C8: Alrm Hist   C9: Alrm Table  C0: MORE

Discus: DISCUS_001

Alrm Table  Type          1 2 3 4 5 6 7 8  Count
#1 : Fault Disch Temp      Y N N N N N N N    2
#2 : Comm Loss CT         Y N N N N N N N    1
#3 : Low Oil Prs Warning   Y N N N N N N N    3
#4 : Config Mismatch      Y N N N N N N N    2
#5 : No Communications E2  N N N N N N N N    0
#6 : Disch Temp Trip      Y N N N N N N N    1
#7 : Comp Low Voltage Trip N N N N N N N N    0
#8 : Motor Temp Trip      Y N N N N N N N    8
#9 : Low Oil Prs Lockout  Y N N N N N N N    1
#10 : Disch Temp Lockout  N N N N N N N N   NONE
#11 : Comp Module Failure N N N N N N N N   NONE
#12 : Unused              N N N N N N N N    0
#13 : Unused              N N N N N N N N    0
#14 : Unused              N N N N N N N N    0
#15 : Unused              N N N N N N N N    0
#16 : Unused              N N N N N N N N    0
#17 : Unused              N N N N N N N N    0

Press enter for a list of actions.
F1: PREV TAB  F2: NEXT TAB
```

Compressor Electronics Create Value Throughout System Lifecycle



Applied Cost Savings Opportunities Because of Compressor Electronics

Consolidation of Components



Sentronic Oil Monitor



Demand Cooling Temp. Control



High-Pressure Protection



Low-Pressure Protection



Motor Protection



Control and Input Points

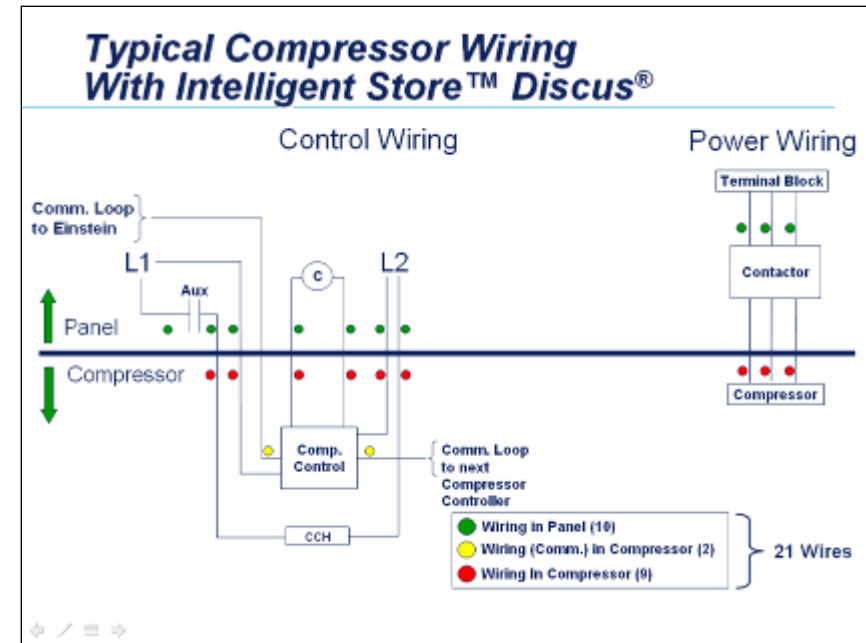
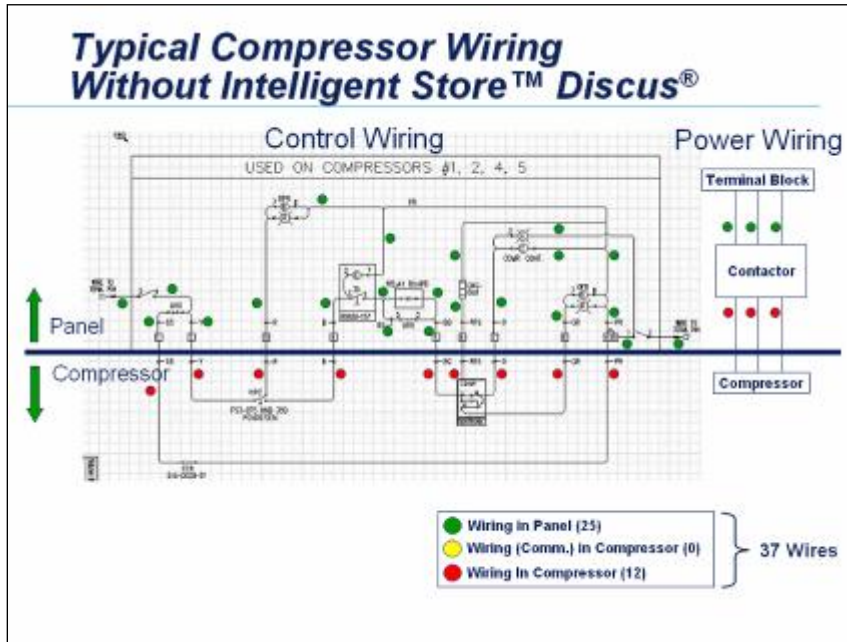


Utilization of Communication Between Compressors and System Controllers:

- Control of Compressor, Unloader, Digital, Liquid Injection
- Alarm Feedback
- Eliminates up to Four Input/Output Control Points

Up to \$420 Applied Cost Savings per Compressor

Consolidation of Components and Utilization of Communications Significantly Reduces Wiring



40% Reduction in Compressor Wiring Simplifying System Manufacturing and Installation

What Impact Can CoreSense Have on Maintenance Activity and Costs?

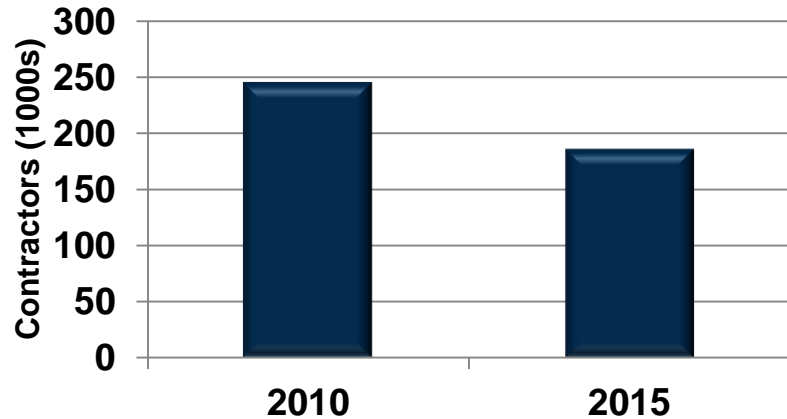
- **Maintenance Impact on Financials**
 - Maintenance Typically Accounts for ~3% of Operating Expenses at ~\$100–250k/store
 - Effectively Every \$1 Spent = ~\$50 in Lost Sales

- **Potential Impact:**
 - A 2% Reduction in Maintenance = 1.3% Increase in Profits
 - For a 1,000-Store Chain = \$4M Increase Profits

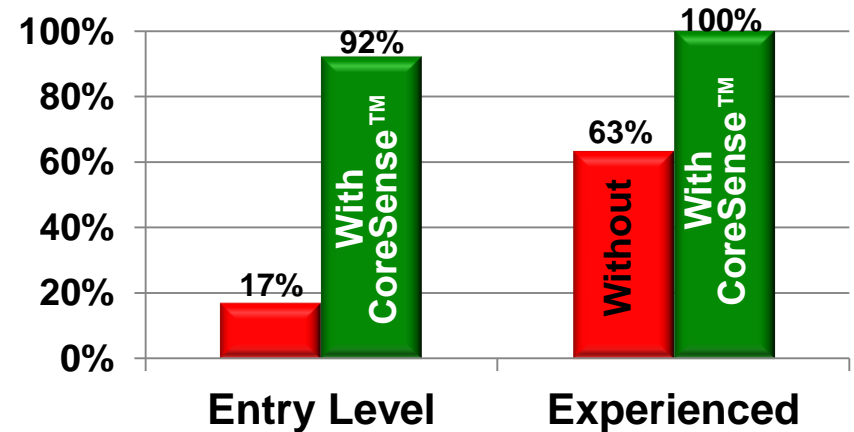
- **Maintenance and Troubleshooting Examples**
 1. High-Case Alarm
 2. High Cycle Rates Failing Contactor
 3. Low-Pressure Cut-Out Failure
 4. Frozen Defrost Timer

Providing Contractors Tools That Improve Troubleshooting Accuracy

Number of Qualified Technicians



First-Time Accuracy Diagnosing a Problem



“My main concern is getting the equipment repaired the first time on the first visit...”

Real-World Example: High-Case Temperature Alarm and Troubleshooting

- First Indications: Alarm Generated for High-Case Temperature
- Alarm Associated With Low Temperature Suction Group on Rack #2

05-05-12 (TM) RX-400 Unit 1 OAT: 72 6:10
ADVISORY LOG *ALF

- = Acknowledged 1 = Current
* = Unacknowledged 160 = Total

DATE	TIME	STATE	Area Ctrl:	Application	Property	MESSAGE
05-05-12	3:06P	ALARM *	Pick/Save:2-6	8-DR F.F.	:CASE TEMP 1	Case Temp Hi L
05-05-12	2:43P	NOTCE *	Pick/Save:2-2	12 DR I.C.	:CASE TEMP 3	Case Temp Hi L
05-05-12	12:07P	ALARM *	Pick/Save:2-2	12 DR I.C.	:CASE TEMP 2	Case Temp Hi L
05-05-12	11:54A	N-NTC *	Pick/Save:2-4	20' MD F.	:CASE TEMP 1	Case Temp Hi L
05-05-12	11:32A	NOTCE *	Pick/Save:2-2	12 DR I.C.	:CASE TEMP 2	Case Temp Hi L
05-05-12	11:05A	NOTCE *	Pick/Save:2-6	8-DR F.F.	:CASE TEMP 1	Case Temp Hi L
05-04-12	9:25P	N-NTC *	Pick/Save:2-6	8-DR F.F.	:CASE TEMP 1	Case Temp Hi L
05-04-12	4:52P	N-NTC *	Pick/Save:2-4	20' MD F.	:CASE TEMP 1	Case Temp Hi L
05-04-12	3:19P	N-NTC *	Pick/Save:2-2	12 DR I.C.	:CASE TEMP 1	Case Temp Hi L
05-04-12	1:15P	NOTCE *	Pick/Save:1-LIQ	LEVEL	:INPUT1	Link to Output
05-04-12	1:15P	NOTCE *	Pick/Save:2-LIQ	LEVEL	:INPUT1	Link to Output
05-04-12	1:15P	NOTCE *	Pick/Save:System		:	Controller sta
05-04-12	1:13P	NOTCE *	Pick/Save:System		:	Controller shu
05-04-12	12:16P	N-ALM *	Pick/Save:2-6	8-DR F.F.	:CASE TEMP 1	Case Temp Hi L
05-04-12	12:06P	N-ALM *	Pick/Save:2-2	12 DR I.C.	:CASE TEMP 2	Case Temp Hi L
05-04-12	11:54A	N-NTC *	Pick/Save:2-4	20' MD F.	:CASE TEMP 1	Case Temp Hi L
05-04-12	11:42A	N-NTC *	Pick/Save:2-2	12 DR I.C.	:CASE TEMP 3	Case Temp Hi L
05-04-12	11:31A	N-NTC *	Pick/Save:2-2	12 DR I.C.	:CASE TEMP 2	Case Temp Hi L
05-04-12	11:08A	N-NTC *	Pick/Save:2-6	8-DR F.F.	:CASE TEMP 1	Case Temp Hi L

STATE: N=Return-to-Normal R=Reset(Forced)-to-Normal.

F1: ALARM ACK | F2: ALARM RST | F3: ALARM CLR | F4: EXPD INFO

Real-World Example: High-Case Temperature Alarm and Troubleshooting

- Suction Group Operating Significantly Higher Than Set Point
- Control Calling for 100% Capacity With All Three Stages Being “On”

05-05-12 TM RX-400 Unit 1 A DAT: 71 6:03
 Press 'Log In/Out' to Log On RX DEU SUMMARY

RACK#2 LOW TMP 23.3 [6.0]

DGTL 100% CAP 100%

S1	S2	S3
ON	ON	ON

SYS-1 MED TEMP 34.5 [35.0] STAGES: 2/ 5
 CAP 50%

LOW TEMP COND 87.2 [87.3]

Controlled By: Differentia Status: Fan(s) On

F1	F2	F3	F4
ON	ON	ON	ON

Circuits	State	Tem
1-01 48' PROD	.Defr	47
1-02 36' DAIRY	.Defr	33
1-03 32' DAIRY	.Refr	33
1-04 W.I. MEAT	.Refr	32
1-05 WI PROD	.Refr	35
1-06 WI DAIRY	.Refr	32
1-07 MEAT PREP	.Refr	50
1-08 24 DAIRY	.Refr	33
1-09 20 LNCH M	.Refr	30
1-10 10-DR BEV	.Refr	37
1-11 32 FR MT	.Refr	29
1-12 36 FR MT	.Refr	29
2-1 12 DR F.F	.Refr	0.
2-2 12 DR I.C.	*Refr	7

Sensor Ctr1	Value	Cn
1 PUMP CNTRL 1	OFF	0
1 PUMP CNTRL 2	ON	0
1-COMP#1 DT	157.3	0
1-COMP#2 DT	85.4	0
1-COMP#3 DT	NONE	0

Press enter for a list of actions.

F1: SUCTION	F2: CONDENSER	F3: CIRCUITS	F4: SENSORS	F5: SETUP
-------------	---------------	--------------	-------------	-----------

Real-World Example: High-Case Temperature Alarm and Troubleshooting

- Three Stages in Suction Group Consist of:

1. 9 HP Comp
2. 10 HP Comp
3. 22 HP Digital Comp

05-07-12 (TM) RX-400 Unit 1 (A) OAT: 51 8:08
Use Ctrl-X to Select CX Tabs SETUP

C1: General	C2: Circuits	C3: Setpoints	C4:	C5: Inputs
C6: Outputs	C7: Stage Setup	C8: Stage Outs	C9: Var Cap	C0: MORE





Enhanced Suction: RACK#2 LOW TMP-LOW TEMP RACK

Stage Setup	Type	Capacity	Proof	Oil Sensor	Oil Dly	Oil Pres
#1	: Comp	9.0	No	None		
#2	: Comp	10.0	No	None		
#3	: Dgt1	22.0	No	None		

Scroll using Next/Prev keys | Type of stage

F1: PREV TAB	F2: NEXT TAB	F3: EDIT	F4: LOOK UP	F5: CANCEL
--------------	--------------	----------	-------------	------------

Real-World Example: High-Case Temperature Alarm and Troubleshooting

05-05-12   RX-400 Unit 1  OAT: 72  Print 6:07
Press 'Log In/Out' to Log On SUMMARY

Summary For Discus

Name	Comp	DLTmp	Current	Network	Alarm	Commission
DISCUS_001	ON	231.8	NONE	Online	..	Yes
DISCUS_002	ON	194.0	NONE	Online	..	Yes
DISCUS_003	ON	89.6	NONE	Online	..	Yes

- Summary of CoreSense Data on Compressors Reveals Discharge Line Temperature of Compressor #3 Suspiciously Low

Real-World Example: High-Case Temperature Alarm and Troubleshooting

Compressor #3 CoreSense Details:

- Controller Calling for Compressor
- Actual Compressor in “Normal Off” State
- Compressor Asset Information:
 - M/N: 4DJXF76ME-TSK
 - S/N: 11J01084R

Results Found Was a Bad Contactor That Could Have Resulted in Product Loss if Not Found and Replaced

```
05-05-12  (TM)  RX-400 Unit 1  OAT: 71  6:07
Press 'Log In/Out' to Log On  Discus

Discus
DISCUS 003
Reg. In:  [ 24.1]
ON
Comm Status : Online
Alarm Status:
Display Code: Normal Off

CURRENT STATUS
Discharge Temp : 89.6

ASSET INFORMATION
Comp Model # : 4DJXF76KE-TSKN-C0
Comp Serial #: 11J01084R

RUN STATUS
Comp Run Time : 1011
Comp Starts : 5

USAGE STATUS
Sensor Module Present: NO
Current : NONE
Power : NONE

Press enter for a list of actions.
F1: SUCTION  F2: CONDENSER  F3: CIRCUITS  F4: SENSORS  F5: SETUP
```


Real-World Example: Supermarket — Stone Mountain, GA

Discuss With CoreSense Diagnostics

Without CoreSense Technology

- High Cycle Rates Result in Contactor Failures, Which Lead to Single-Phase Motor Burns, Destroying Compressors



With CoreSense Technology

Timeline

12/17: Contactor Making Bad Contacts

1/2: Compressor Reset =>
1 Contactor Leg Failed “Single Phase”

1/2: Compressor Reset =>
Contactor Failed

1/2: Replace Contactor

CoreSense Technology

Detected

Voltage
Imbalance

Missing Phase

No 3-Phase

Action

Shut Off
Compressor

Shut Off
Compressor

Shut Off
Compressor

Supermarket End User Avoided Compressor Failure and Saved Approximately \$6,000



Real-World Example: Walk-In Cooler at Convenience Store

Discuss With CoreSense Protection

Without CoreSense Technology

- LPCO Failed → Compressor to Run Continuously, Pulling Itself Into a Vacuum, Overheating Compressor and Causing Repeated Protector Trips



With CoreSense Technology

Timeline

CoreSense Technology

Detected

Action

3/3: LPCO Fails, Resulting to Call for Cooling All the Time

Normal Demand

3/3: Suction Pressure Drops Below Setpoint, System Continues to Run and Pulls Into Vacuum → Compressor Overheats and Protector Trips

Protector Trip

Sends Alarm

3/3 Compressor Cools and Protector Resets → Compressor Runs and Provides Cooling, So No Temperature Rise in Walk-In → Process Repeats

Return to Normal
and
Protector Trip

Sends Alarm

3/3: Because of Notification, Contractor Arrives on Site Because of CoreSense Notification

CoreSense Utilized to Complete
Troubleshooting

**Convenience Store Avoided Compressor Failure,
Saving Over \$6,000**

Real-World Example: Walk-In Cooler at Butcher Scroll K5 With CoreSense Diagnostics



Without CoreSense Technology

- Defrost Timer Froze Over → Would Not Allow Compressor to Run

With CoreSense Technology

Timeline

6/5: Thermostat Calling for Cooling but Defrost Timer Stuck, Opening Control Circuit and Compressor Won't Run

CoreSense Technology Detected Action

System Trip

Sends Warning

6/5: After Four Hours, Control Circuit Does Not Reset

Open Circuit
(No Power at
Compressor)

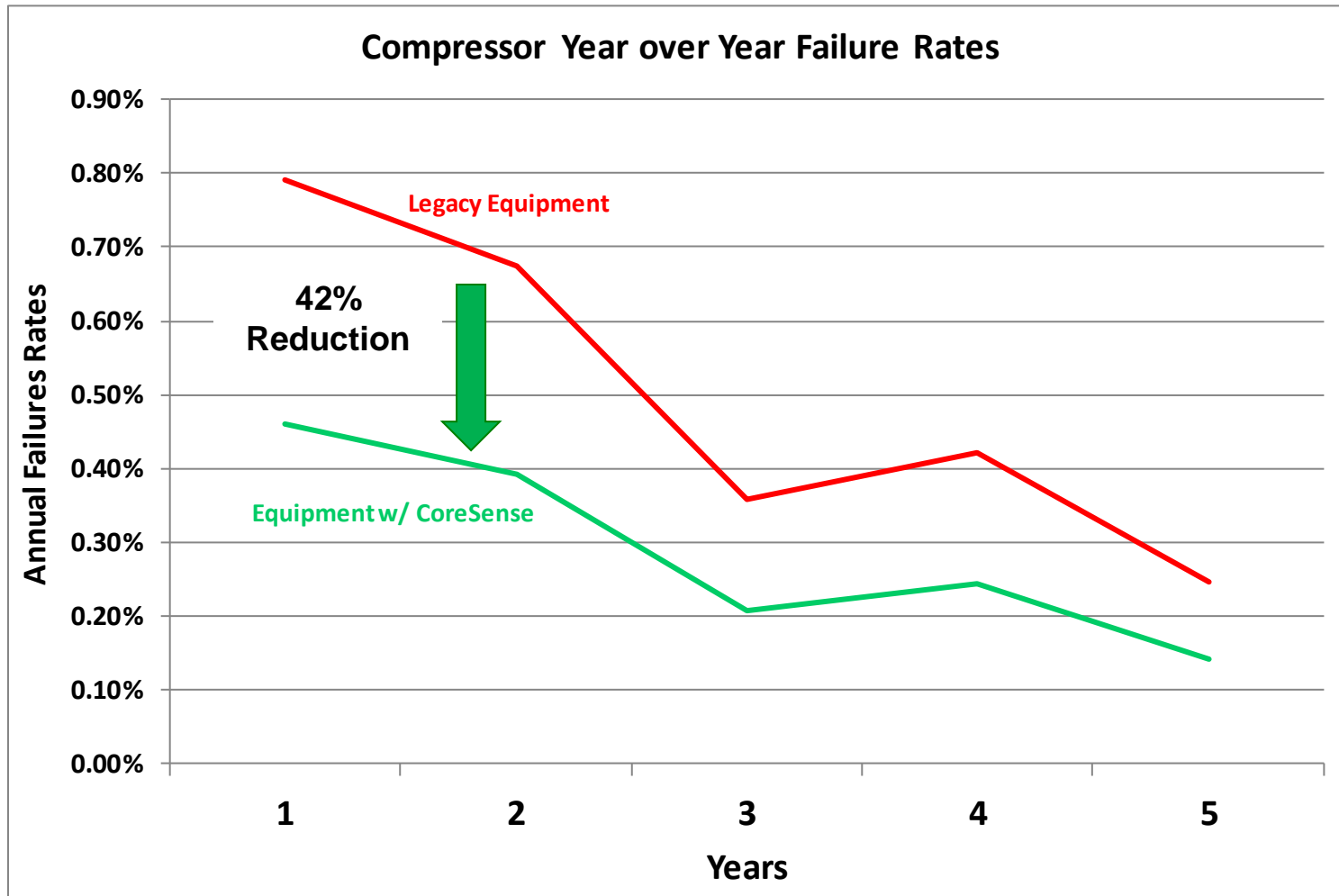
Sends Alarm

6/5: Because of Notification, Contractor Arrives on Site Because of CoreSense Notification

CoreSense Utilized to Complete
Troubleshooting

**Butcher Avoided Losing Meat in Walk-In Freezer,
Saving Over \$10,000**

CoreSense Significantly Reduces Compressor Failure Rates



Maintenance Savings of ~\$350K per Year

Stakeholders Throughout Channel Benefit From Utilizing CoreSense



End User	Contractor
<ul style="list-style-type: none"> ● Easier Field Installations ● Improved System Start-Up ● Lower Maintenance Cost ● Greater Refrigeration Uptime ● Reduced Spoilage ● Reduced Refrigerant Leaks 	<ul style="list-style-type: none"> ● Simpler System Start-Up ● Reliability ● Serviceability ● Additional Comp Info ● Faster Diagnosis
OEM	Emerson Climate Technologies
<ul style="list-style-type: none"> ● Applied Cost Savings ● Less Parts to Design and Inventory ● Simplified Rack Wiring ● Better Quality <ul style="list-style-type: none"> – “Wiring Is #1 Quality Problem With Racks” ● Differentiated Product ● Increased Throughput 	<ul style="list-style-type: none"> ● Better Compressor Protection ● Fault History

How Have Other Industries Used This Type of Technology?

OnStar Vehicle Diagnostics from your 2005 Chevrolet Corvette Coupe as of 10/04/2012

Dear J

See your diagnostics report below for your vehicle's status.

Hands-Free Calling helps ensure that you're in reach, even if you don't have your cell phone or are in a low coverage area. Make and receive calls at the touch of a button. [Watch our helpful videos](#) to learn more.



No Issues Found Action Suggested Immediate Attention

DIAGNOSTIC INFORMATION	VEHICLE INFORMATION
<ul style="list-style-type: none"> Engine and Transmission System Emissions System Air Bag System StabiliTrak® Stability Control System Watch Video Antilock Braking System OnStar System	<p>2005 Chevrolet Corvette Coupe VIN: : GM Owner Center Online</p> <p>For vehicle information, search your online Owner's Manual.</p> <p> Warranty Tracker One or more of your warranties is nearing expiration. See warranty coverage</p>
MAINTENANCE INFORMATION	ONSTAR INFORMATION
<ul style="list-style-type: none"> Vehicle Maintenance No required maintenance due at this time. <div style="border: 1px solid black; padding: 5px; margin: 5px 0;"><p>Remaining Oil Life: 64%</p><p>Mileage: 48,756</p></div> <p>Based on oil life and mileage readings, next required maintenance and 50,000 mile service estimated at 55,700 miles.</p> <p>View maintenance summary</p>	<p> OnStar® Subscription</p> <ul style="list-style-type: none">Account #:Safe & Sound ServicesExpires 02/12/2013Enrolled in Continuous Coverage <p> Hands-Free Callina</p> <ul style="list-style-type: none">Calling #:Minutes Remaining: 0 <p>Take advantage of our special introductory offer.</p> <p>SPECIAL OFFER →</p>
	OTHER INFORMATION
	<p>Insurance Benefit Your mileage makes you eligible</p>

Additional Maintenance Items

One or more maintenance items need to be serviced at 50,000 miles.

[Engine Air Filter](#)

[View other maintenance items](#)

Maintenance Records

Did you know you can [update](#) your maintenance records online?

Tire Pressure: Normal

- No issues found.
- Recommended tire pressure - Front: 30 psi, Rear: 30 psi

Left Front: 28 psi

Right Front: 30 psi

Left Rear: 30 psi

Right Rear: 30 psi

[View tire pressure information](#)

VEHICLE HISTORY

for a low mileage discount on auto insurance.

[EXPLORE OPTIONS →](#)

TIPS AND EXTRAS

Announcing new OnStar service

Stay connected with your loved ones no matter where they go. Add OnStar's Family Link plan and enjoy unique access to the location of your vehicle. [Learn More](#)

All-New Owner Center

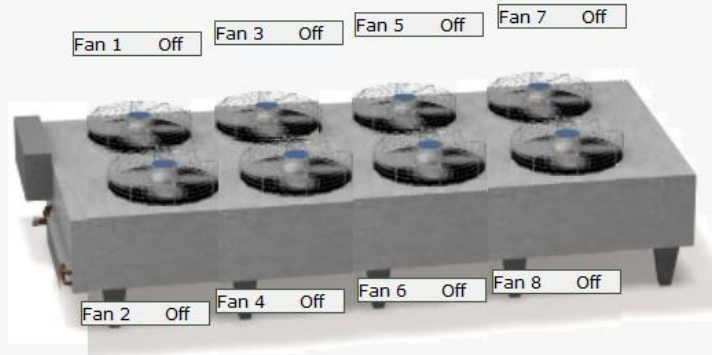
OWNER CENTER

All your owner needs in one place. Manage all of your GM vehicle's maintenance, service history and more from the all-new Owner Center.
[Explore the Owner Center](#)

Source: OnStar

System Dashboard Providing Insight to Each Component and System Operation

INPUT STATUS	
Condenser Type	AIR COOLED
Controller Type	PRESSURE
Fan Type	SINGLE SPEED
Controller Input Type	Discharge
Pres Ctrl Stpt	160.0 PSI
Pres Ctrl In	187.5 PSI



Condenser: Low Performance

Name	State	Temp	Setpt
A01 DAIRY CLR	REFRIGERATION	34.8 °F	36.0
A02 SHOPN PROD	REFRIGERATION	47.2 °F	48.0
A03 MD PROD	REFRIGERATION	38.6 °F	35.0
A04 *FRESH MT*	REFRIGERATION	29.9 °F	29.0
A05 MEAT PREP	REFRIGERATION	42.2 °F	48.0
A06 MD LNCH MT	REFRIGERATION	28.9 °F	30.0
A07 MEAT CLR	DEFROST	36.0 °F	35.0
A08 MD DAIRY	REFRIGERATION	33.6 °F	36.0
A09 MD DAIRY	REFRIGERATION	35.7 °F	36.0

No Issues Found Action Suggested Immediate Attention

DIAGNOSTIC INFORMATION

SYSTEM INFORMATION

- Rack Monitoring Performance System
- Condenser Performance Monitoring System
- Compressor CoreSense Diagnostics Systems
- Refrigerant Leak Detection System



No issues Action Suggested No issues

Controlled Type	Pressure
Control Setpoint	42.0
Control Strategy	Normal
Refrigerant	R407A
Check It Status	NONE

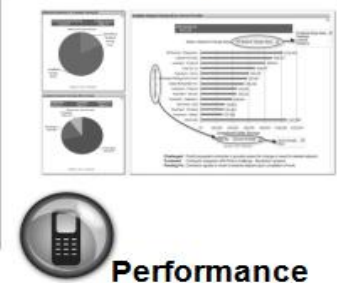
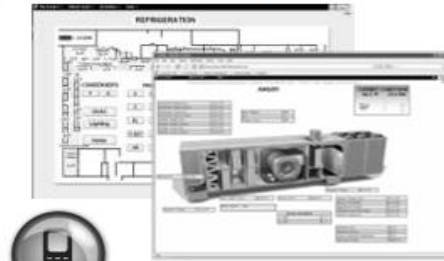
Suction Pressure	42.6 PSI
Suction Temp	50.0 °F
Discharge Pressure	167.0 PSI
Discharge Temp	NONE °F
Float Temp	30.0 °F
Satur Suct Temp	15.1 °F

MAINTENANCE INFORMATION

- Refrigerant Leak Inspection: Level 18% Low
- Condenser Cleaning: High TD 27 F
- Replace Contactor: Comp 02
- Replace Contactor: Comp 03

Our Digital Platform Now Watches Over 2M Fixtures and Processes 50M+ Alarms

Connecting Machines To Enterprise Management Systems



Connecting Machines To Other Machines At Store Level

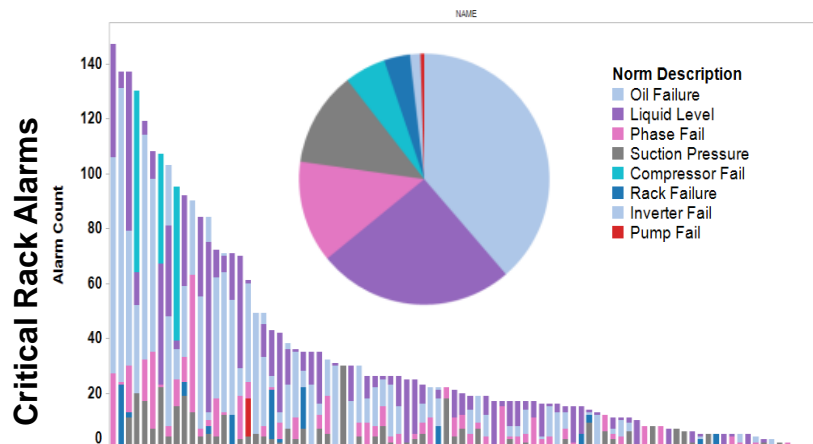


Cumulative Savings of Over \$100M Delivered to Customers Through Remote Services Over the Last 10 Years

Using Data Across Enterprise to Identify Opportunities and Improve Performance



Using Store-Level Data Across Enterprise to Improve Total Cost of Ownership

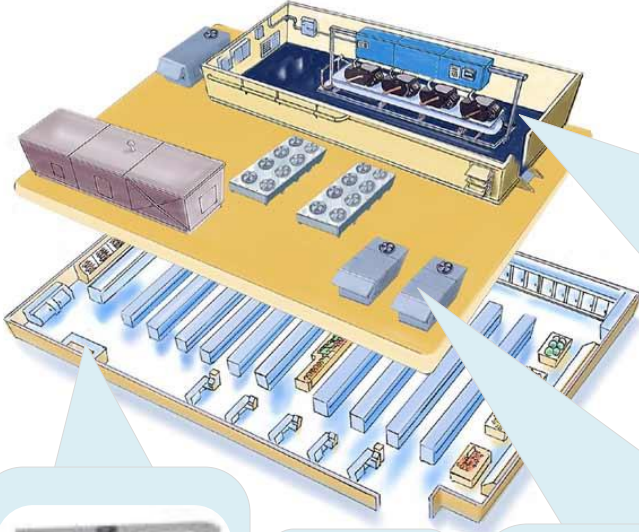


Maintenance and Energy Perspective:

- Identify Top Issues by Occurrence and by Site Location
- Establish “Best of Class” Benchmark and Identify Worst-Performing Stores
- Focus Improvement by Prioritizing Equipment Replacements and Maintenance Efforts

Systems Will Continue to Get Smarter and Have Greater Connectivity...

Today's Supermarket



Smart Racks



Rack Controller



Remote Monitoring



Store Controller

Smart Compressors



Smart Condensing Units

EXV



Smart Case



Case Controls



... Allowing Customers to Improve Refrigeration System
Total Cost of Ownership
(Applied Costs/Operating Costs/Maintenance Costs)

Thank You!

Questions and Answers

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