RS INDUSTRIA

Under Pressure.

USE CASE

How RS Industria can enable efficiency and cost savings for industries and processes using refrigeration compressors.

Introduction.

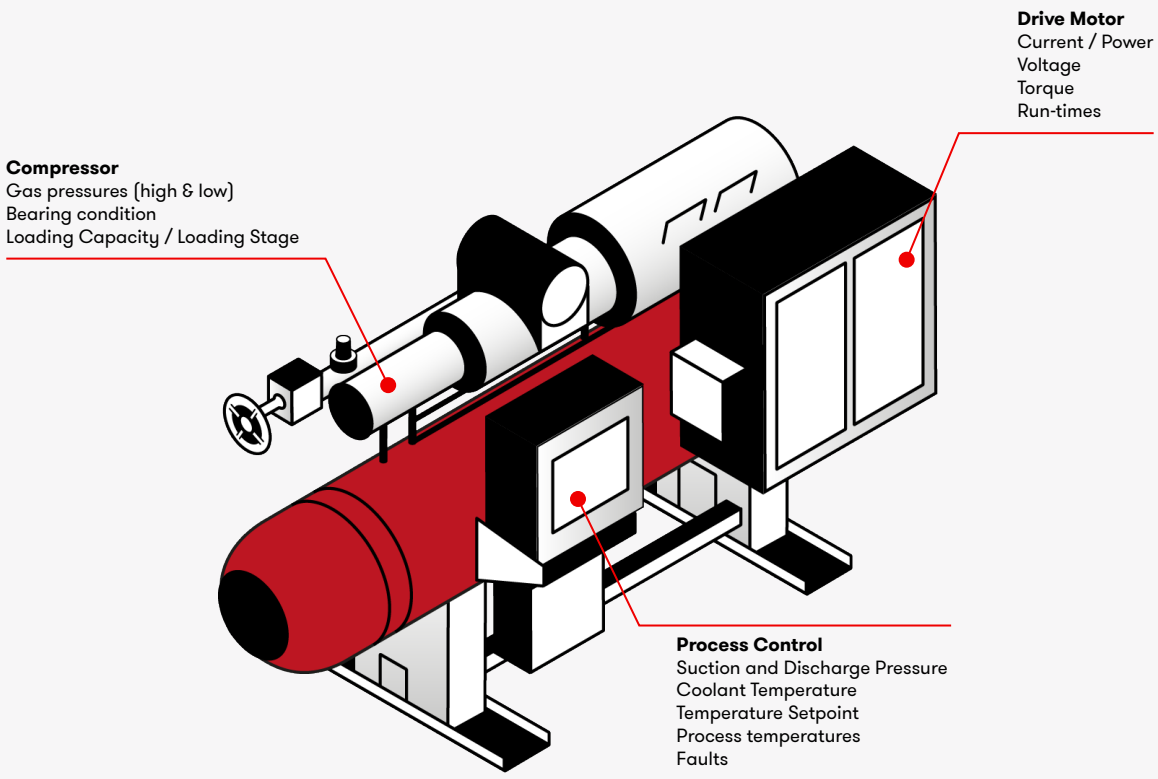
Most industrial refrigeration compressors are large, mechanical units that form the heart of industrial cooling and heating. They draw refrigerant from the evaporator at a relatively low pressure, compress it and then discharge it to a condenser where it is cooled.

The refrigerant then moves to the expansion valve and the evaporator – where it absorbs heat as it changes physical state - before being compressed again.

There are different types of compression mechanisms that are typically used in factory environments: reciprocating (piston), rotary (vane) and screw compressors (three different types).

The refrigeration compressors typically cool a glycol-water mixture or brine contained within a closed thermal exchange system, which is then used as a secondary coolant and pumped as required to chill or freeze environments or equipment, enabling producers to lower the temperature of a product dramatically over a short period of time.

What we monitor.



The Challenges.

Energy

The compressor is the heart of a refrigeration unit compressing the

Operations

- These assets are often process-critical

Maintenance

- Cooling circuit changes can result in a capacity mismatch refrigerant through mechanical compression. Successful operation of the compressor is a key factor in achieving an efficient industrial cooling application.

There are several methods of modulating cooling capacity, depending on the compressor type. Reciprocating compressors are start/stop, variable-speed screw compressors use pressure control valves and fixed-speed screw compressors use a slide valve. These various modes of operation can make it difficult to accurately calculate energy consumption.

- Loss of refrigeration capacity can cause huge disruption to manufacturing
- Raw materials are often wasted as a result of cooling loss
- Regulatory and compliance issues can arise when correct operating temperatures are not maintained
- Health and Safety issues can arise if correct controls are not in place, especially if ammonia or CO2 is uses as a refrigerant. This can also pose an environmental risk

between the compressor and evaporator, leading to excessive loading

- A poorly sized or malfunctioning thermostatic expansion valve and high oil temperatures can all lead to premature failure of the refrigeration compressor
- Slugging is a condition where a liquid (oil or liquid refrigerant) enters the compressor and causes damage (usually on start-up)
- Other common causes of early failure are dirty evaporators, dirty filters, dirty condensers - all of which will increase the compressor workload.

Our Solutions.

Energy

Energy data often be collected direct from the variable speed drive, when used to drive the compressor. If no electrical consumption data is available, then energy meters / current transformers can be easily installed which can pass data directly to RS Industria.

Operations

Process data such as chiller temperature can often be captured directly from the PLC or control system. This will aid accurate operational recording as well as improving problem solving. Where PLCs are not used, a separate data collection unit can be fitted to mirror existing control signals.

Data such as stop/start timings, freezer door opening events and their duration, all create visibility of the system's operational cycle.

Maintenance

Much of the energy data collected can also be used as leading indicators of failure. By tracking current/power consumption, changes in the electrical load can be used to indicate changes in the cooling system. Using the additional data from process control parameters, a more complete picture of asset reliability can be created.

Additional protection of the compressor motor and bearings can be added using a vibration sensor, thus monitoring other mechanical stresses such as looseness & misalignment of the compression elements (pistons or rotary vanes for example) bearing wear or lubrication failure on contact surfaces

Your Benefits.

Typical Cost Savings

Better operating insight means better management of processes and their assets, resulting in lower operating costs. Here are some examples, based on our real-world experience in production environments:

Energy

The energy consumption per compressor can now be accurately measured, highlighting any over-operation and enabling the overall refrigeration system's efficiency to be calculated

Operations

Continuous monitoring of the refrigeration system enables:

- Detection of liquid slugging
- Visibility of coolant operating temperatures and pressures

Maintenance

- Reduce the risk of unplanned failure, avoiding secondary damage and reducing MRO spend
- Enable the move from reactive to planned maintenance

Using this information, it should be possible to optimise the system. For example, a 45kw Screw Air Compressor running for 12hrs per day @ 50p/kWh, will cost £98,550 per annum to run (@ June 2022 prices).

A 10% reduction in consumption due to optimisation will save nearly £10,000 every year.

- More efficient operation
- Detailed temperature history for regulatory and compliance audits.
- Greater understanding of the operating cycle of the compressors and overall cooling system
- Optimisation of the whole cooling cycle
- Vibration data can highlight over or under lubrication of key components
- Protect mechanical assets such as compressors using multiple vibration bands, combined with 'smart' early-warning alerts

Payback & ROI

These indicative calculations show that the system could potentially pay for itself, **on electricity savings alone**, within just 3 months.

330% ROI

Payback within 3 months.

Year 1 Cost – £4,600

Annual Monitoring Cost – £1,600*

Set Up Costs
- Hardware – £1,000
- Commissioning – £2,000

* This represents the compressor's share of the monthly ongoing service cost of £995, which includes 100 parameters

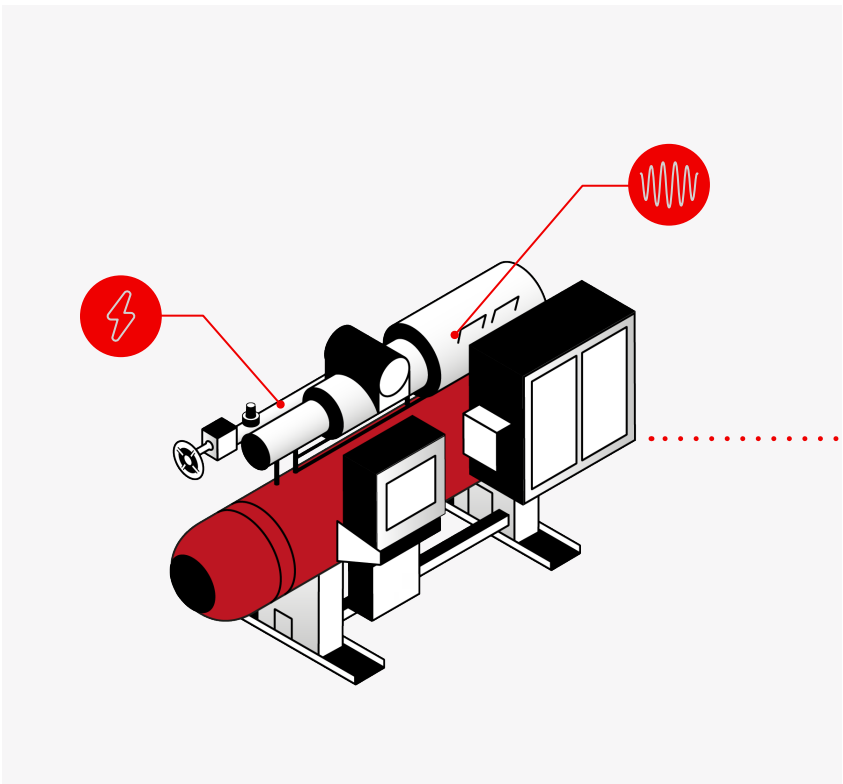
Savings – £20,000

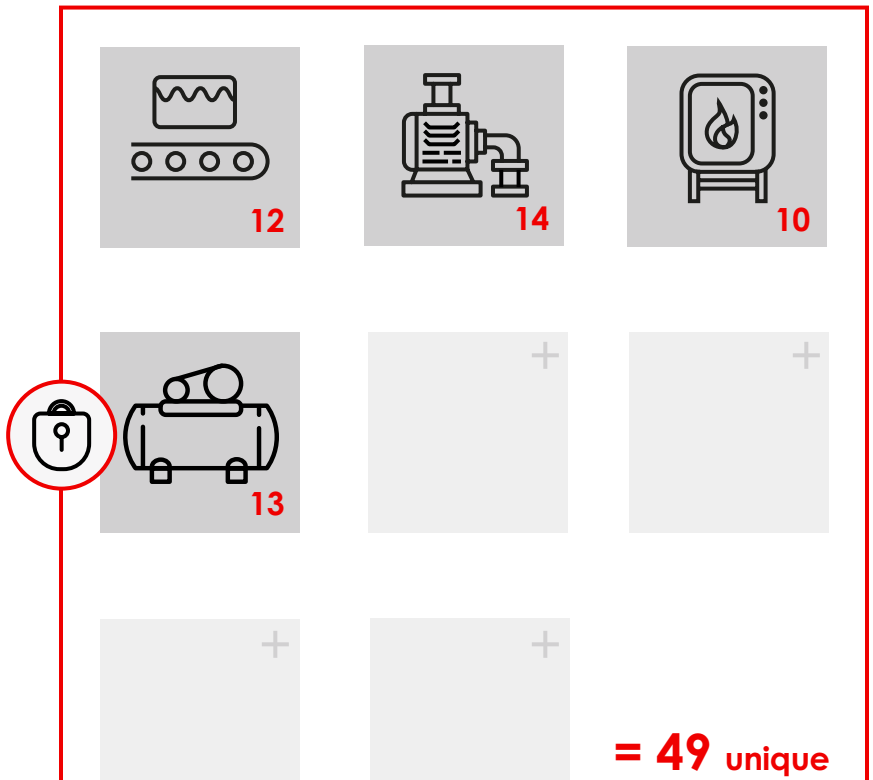
Electricity – £20,000

Operational – £TBC

Maintenance – £TBC

Modular Framework.





13 parameters

parameters

Start Simple, Grow Smart.

Modular and Secure

RS Industria is a modular system, providing an advanced, robust and cyber-secure framework into which any number of assets can be connected. This cloud-based system provides the following;

- **Asset Dashboards** – Designed for the specific asset type being monitored
- **Functional Dashboards** – Displaying Energy, Utilities, Compliance or Uptime for multiple assets, individual production lines or site-wide – all in one place.
- **Rules & Alerts** – Notifications and Warnings sent by SMS or email – or to the mobile app
- **Mobile App** – Real-time data display and alerts - Putting the data in the hands of those who need it, where they need it, when they need it.

Multi-Purpose Data.

Data Integration

As RS Industria integrates data from multiple sources, the system can re-purpose and combine data to extend the scope for asset insight.

	Data Options		
	Energy	Operations	Maintenance
Voltage	✓	✓	✓
Current	✓	✓	✓
Torque	✓	✓	✓
Start/Stop & Runtime		✓	✓
Fault/Operating Mode		✓	✓
Suction and Discharge Pressure		✓	✓
Temperature (Coolant)		✓	✓
Control valve Status		✓	✓
Process Temperatures		✓	✓
Outside Air Temperature (OAT)		✓	✓
Vibration-based			
Bearing Damage Indicator[1] (Fretting, pitting)			✓
Lubrication Warning Indicator[2] (over/under lubricated)			✓
Mechanical Stress Indicator (looseness, misalignment, imbalance)			✓
Primary Paramaters	**3**	**6**	**4**
Re-purposed Parameters	**0**	**2**	**5**

Data Integration

As RS Industria integrates data from multiple sources, the system can re-purpose and combine data to extend the scope for asset insight.

For example, monitoring electrical drive voltages and current enables the system to calculate torque.

All three of these of these variables can be used to not only better understand the energy usage of an electrical drive, but also its physical condition and whether it is operating outside its normal parameters.

High current and torque might indicate a bearing problem, a conveyor belt sticking or a batch of ingredients with the wrong viscosity.

1. **Bearing Damage Indicator** – Using frequencies from selected areas of the spectrum to rapidly identify when a bearing is being damaged,

These indicators can be further enhanced by using the operating data to provide context such as variable loading.

long before such damage is evident, or a failure occurs.

2. **Lubrication Failure Indicator** – this value uses specific frequencies to warn if a bearing is insufficiently lubricated, whether the lubricant is manually or automatically delivered.

Multi-Purpose data offers significant benefits over the use of dedicated single-purpose monitoring systems:

- **Single point of integrated data** – enables comparison between different variables, potentially offering greater insight
- **Context-sensitive alerts** – take account of normal operational variances to avoid false alarms

Gain Asset Insight Now

Find out how we can help lower energy usage, enhance reliability and improve operational performance: in a way that is simple, fast and affordable.

1

Book Requirements Review

Review your requirements with one of our consultants. We'll help you prepare for the next step in the process, which is a detailed discussion with one of our solution design engineers. To book a Requirements Review, **click this link.**

2

Browse Our website

To find out more details including:
- Real-world case studies
- Use-cases like this one
- Product videos
...and more. Visit our website to see what is possible with RS Industria.

https://www.rs-industria.com

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Start Simple Grow Smart®