REMOTE MONITORING DATA ON yourKONECRANES.com

TRUCONNECT® user guide

2021
## Introduction

1. TRUCONNECT tips ................................................................. 3
2. TRUCONNECT status on the overview .......................... 4
3. Connected cranes in the asset fleet view ......................... 5
4. TRUCONNECT data for a single asset .............................. 6
   Condition ........................................................................... 7
   - Hoist DWP .................................................................. 8
   - Brake Service Life ..................................................... 9
   - Brake Monitoring ...................................................... 10
   - Contactors Service Life .......................................... 11
   - Trolley Steel Structure ........................................ 12
   - Wire Ropes .................................................................. 13
   Alerts .................................................................................. 14
5. Operating Statistics ............................................................. 15
   - Running Hours .......................................................... 17
   - Load ............................................................................. 18
   - Starts and Cycles ...................................................... 19
   - Emergency Stops Impact on Brake Service Life ........ 20
   - Overloads vs. Hoist Cycles ..................................... 21
   - Motor Over Temperatures vs. Hoisting Speed ......... 22
6. TRUCONNECT data in the Business Review .................. 23

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<table>
<thead>
<tr>
<th>Condition</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hoist DWP</td>
<td>9</td>
</tr>
<tr>
<td>Brake Service Life</td>
<td>10</td>
</tr>
<tr>
<td>Brake Monitoring</td>
<td>11</td>
</tr>
<tr>
<td>Contactors Service Life</td>
<td>12</td>
</tr>
<tr>
<td>Trolley Steel Structure</td>
<td>13</td>
</tr>
<tr>
<td>Wire Ropes</td>
<td>14</td>
</tr>
<tr>
<td>Alerts</td>
<td>15-16</td>
</tr>
<tr>
<td>Operating Statistics</td>
<td>17</td>
</tr>
<tr>
<td>Running Hours</td>
<td>18</td>
</tr>
<tr>
<td>Load</td>
<td>19</td>
</tr>
<tr>
<td>Starts and Cycles</td>
<td>20-21</td>
</tr>
<tr>
<td>Emergency Stops Impact</td>
<td>22</td>
</tr>
<tr>
<td>Overloads vs. Hoist Cycles</td>
<td>23</td>
</tr>
<tr>
<td>Motor Over Temperatures</td>
<td>24</td>
</tr>
<tr>
<td>TRUCONNECT data in the Business Review</td>
<td>25</td>
</tr>
</tbody>
</table>
In between regular inspections and preventive maintenance, issues can arise due to operator error, irregular crane usage or other unforeseen events. TRUCONNECT data can alert you to problems with your cranes before they give way to critical issues that can impair safety and performance, helping you plan and leaving less room for surprises.

Analyzing TRUCONNECT data can also help you develop an operational baseline and identify opportunities for maintenance and process improvements. Learning about how you can use TRUCONNECT data to increase safety and save time and expenses with less downtime. It doesn’t take a data scientist to interpret the information—TRUCONNECT data is presented in easy to read graphs and color indicators on yourKONECRANES.com.

What to look for
Throughout this guide we give examples of anomalies, patterns and trends in the data and what it can mean. We’ve also added icons to indicate things you should be watching out for if you’re responsible for safety, production or maintenance.

Safety
Safety-critical alerts make it easy to see what needs the most immediate attention. Seeing how your cranes are being used can also indicate the need for operator training to address unsafe practices.

Production
Production issues can result in crane stoppage or production downtime. Seeing how your cranes are being operated gives insights into how the production process is working and alerts call attention to problem areas.

Maintenance
Issues related to maintenance can include when to replace components or perform overhauls. Data can also indicate a need to review inspection and maintenance schedules.
Connect your entire fleet
Remote Monitoring expands your view of your lifting equipment, providing a complete timeline of all crane operation data, rather than a static look at one crane at a time. Having a comprehensive view can help keep you from missing a minor usage abnormality—or help you connect seemingly unrelated problem patterns—before it becomes or contributes to a larger problem.

Data for your own service teams
For in-house maintenance teams, the data can help your technicians fine tune common inspection focuses, prepare maintenance, and record results of remedial measures against crane performance goals.

Use TRUCONNECT data for training program enhancement
Looking at the whole history of your crane usage, including trends in, and frequency of, abnormal use can be used to plan and execute operator and service training programs.

New training programs can clarify operator responsibilities and refine operator capabilities, helping to improve work cycle times and reduce some crane use problems.

Reach out for help
If you have questions about what you see in the data or concerns about component wear or operator training contact us.

Get the most from TRUCONNECT Remote Monitoring

TRUCONNECT tips

What is yourKONECRANES?
The yourKONECRANES customer portal is the online home for all your crane maintenance information and TRUCONNECT data. You can see your agreement details including your Konecranes contact, a fleet view of your assets, service reports, quotations and more. yourKONECRANES is more than just lists and data—your information is highlighted with easy-to-read graphs and the most important details such as safety and production risks are front and center.
When you log into yourKONECRANES you’ll first see the Overview page. This is where you can get a quick glance at your TRUCONNECT information. Cumulative component condition and alerts are highlighted so you can act on them quickly.

Clicking on Component Condition or Operating Alerts takes you to the asset fleet view where you can see all connected assets pre-sorted by lowest condition or highest number of safety or production alerts.

The frequency with which you should check your TRUCONNECT data on yourKONECRANES depends on your equipment criticality and frequency of use. The more your cranes are used and the more critical to your operations, the more frequently you’ll want to check in on their condition and usage.

You’ll also want to check TRUCONNECT information for annual planning to help you make decisions on maintenance and training.

TRUCONNECT status on the overview

This section shows total safety and production alerts on TRUCONNECT assets. Click to go to the Fleet view and see alerts by asset.

Open TRUCONNECT items show the number of components having a design working period (DWP) or remaining service lifetime under 10% left. Click to go to the Fleet view and see condition by asset.
The asset fleet view is another important page to check on a regular basis. This shows you the current overall status of your connected equipment.

You can sort assets by alerts, condition, running hours, brake status and more. This will give you a clear picture of assets that need attention for safety, production or maintenance issues and you can easily dive deeper into the data by clicking on an asset.

**SAFETY TIP:** Filter by safety alerts with the view sorted by priority to see which assets have the most safety alerts or those with the highest number of alerts per hour. You can also filter by overloads or emergency stops.

**MAINTENANCE TIP:** Filter by lowest condition by component and brake status to get a quick view of possible maintenance needs.

**PRODUCTION TIP:** Filter by production alerts with the view sorted by priority to see which assets have the most production alerts or those with the highest number of alerts per hour. You can also filter by over temperatures - because even one episode of significant over temperature can halve the service life of the motor putting production at a standstill.

**MAINTENANCE TIP:** Sort assets by priority order to see what needs the most attention, or by asset criticality to see your most critical assets’ needs.

**SAFETY TIP:** Filter by safety alerts with the view sorted by priority to see which assets have the most safety alerts or those with the highest number of alerts per hour. You can also filter by overloads or emergency stops.

**PRODUCTION TIP:** Filter by production alerts with the view sorted by priority to see which assets have the most production alerts or those with the highest number of alerts per hour. You can also filter by over temperatures - because even one episode of significant over temperature can halve the service life of the motor putting production at a standstill.

**MAINTENANCE TIP:** Filter by lowest condition by component and brake status to get a quick view of possible maintenance needs.
There is a TRUCONNECT page in yourKONECRANES for each connected asset in your fleet. The page begins with a summary showing the main items that require attention in each category.

**Condition:** This shows the shortest current service life of a component from the Condition section. Condition values will change over time due to differences in the wear rate of components and different crane operating patterns, as these can significantly accelerate the wear rate. The effects of operation are described more closely in the Operating Statistics section.

**Alerts:** This shows the cumulative number of alerts in the review period from the Alert section. Details are provided in the Pareto analysis in the Alerts section.

**Operating Statistics:** The shows the current most significant problem that could affect the safe operation or condition of the crane from the Operating Statistics section.

The following pages explain in more detail the data in the Condition, Alerts and Operating Statistics sections.

Data availability

Collected data varies depending on asset make and model so what you see here may not be available for all your assets. TRUCONNECT Remote Monitoring also has the option of special sensors for advanced condition monitoring of select critical components including Brake Monitoring and Wire Rope Monitoring.
**Condition**

TRUCONNECT condition data shows the current condition of the components, any risks related to safety and production, and the estimated remaining service life based on the usage history. Condition data also indicates when critical components should be replaced, inspected or overhauled/modernized.

Condition monitoring can be used to check component replacement frequency, which provides a clear indication of **upcoming maintenance needs** and how changes in the operator’s actions affect the service life of components.

Together with TRUCONNECT alerts, condition data provides essential information that can be used to plan and schedule maintenance actions and for troubleshooting in order to **improve safety** and **reduce unplanned downtime**.

Having the ability to plan an outage, rather than respond to a breakdown, helps **safeguard production goals** and keep your operations running smoothly.
**CONDITION**

**Hoist DWP**

**What the TRUCONNECT data tells you**
Hoist DWP is a calculation of the remaining service life of the hoist and the remaining fatigue life of the machinery components.

**Common issues and corrective actions you can take**
When the hoist DWP is between 30% and 10%, you can begin to plan for an overhaul or replacement. The hoist DWP estimate gives you an estimated end of service life so you can plan well in advance.

If you notice an unusually fast decline in the hoist DWP, it can be because of continuous usage of the hoist near the rated capacity and/or continuous hoist operation. This can lead to premature wear on the hoist and hoist components so you may want to modify your inspection and preventive maintenance schedule to help avoid unplanned downtime.

Graph indicates that the hoist has 40% of its theoretical service life left. It’s also shown as the black line on the graph below.

If hoist usage changes, i.e., longer running time or heavier loads, the end of service life will come sooner.

Begin planning for overhaul or replacement.

![Hoist DWP Graph](image)
CONDITION

Brake Service Life

What the TRUCONNECT data tells you
Remote Monitoring data shows you when the entire brake must be replaced. The Brake DWP calculation is based on the number of hoisting motor starts and the number of emergency stops during lifting and lowering motions.

Common issues and corrective actions you can take
Continuous hoist operation, motor jogging, and emergency stops during lifting or lowering motion (hoist brake) or traversing and traveling motion (trolley or bridge brake) can lead to premature brake wear or failure. You should schedule brake replacement with Konecranes when required by physical inspection or when brake life warning is indicated in the graphic.

Brake service life is the calculated estimate of the mechanical service life of the electromagnetic disc brake.

MAINTENANCE TIP:
If this graph shows orange (warning level) you’ll want to schedule a brake replacement.
If this graph shows red (alert level), you’ll want to tag out the crane.

Hoist A brake was recently replaced and Hoist B isn’t utilized as much as A as indicated by the graph.
**CONDITION**

**Brake Monitoring**

**What the TRUCONNECT data tells you**

Brake Monitoring measures opening current and indirectly shows the status of air gap and friction material wear. As the air gap of the brake increases, the value decreases toward 0%. If the value is under 5%, there is very probable risk that the brake will not open. If the brake does not open you can be faced with sudden brake failure that can result in load drop and severe danger to everyone in the vicinity of the crane.

Brake Monitoring provides safety alerts so you can be alerted to brake issues such as condition warnings and failures by text or email. Alerts are shown in the Alerts section.

**Common issues and corrective actions you can take**

An increase in air gap and moderate wear in the friction material of the brake indicate a need for corrective action. You’ll want to closely monitor the condition of the brake and brake friction materials. You can also have the brake mechanics and electrics inspected and an inspection and adjustment of the air gap of the brake.

As the measurement approaches zero, adjust the air gap and change worn friction materials.

The lower the value, the more wear there is in the brake lining, and the larger the air gap.

In a properly operating brake, the value is typically 80% to 30%. As the brake lining wears, the brake air gap increases, and the value trends towards 0%.

The Brake Monitoring Unit measures the opening current of the electromagnetic disc brake.
**CONDITION**

**Contactors Service Life**

**What the TRUCONNECT data tells you**

The service lifetime of hoist contactors is directly influenced by the usage rate of the hoist and, most significantly, by the use of jogging/inching. TRUCONNECT data indicates when you should start planning for, or there is an immediate need, to change the hoist contactors.

**Common issues and corrective actions you can take**

Operator behavior, such as jogging / inching of the hoist, peaks in production demands, or excessive hoist operation above design class of hoist motor starts can lead to sudden contactor failure that results in crane stoppage.

When contactor life levels reach warning level you’ll want to plan for changing the hoist motor contactors. If the contactor life reaches alert level, you’ll need immediate maintenance.

**PATTERN:** The graph shows that the contactor service life reached under the 30% threshold around 15 months after it was replaced. This can help you plan for replacement of components.
Trolley Steel Structure

What the TRUCONNECT data tells you
Trolley and bridge steel structure DWP is a calculation of the remaining service life of the trolley steel structure. When the DWP value approaches zero, the steel structure should be overhauled or replaced. TRUCONNECT data shows the theoretical remaining DWP of the machinery based on the operating history.

Common issues and corrective actions you can take
If you notice a steep decline in DWP, it may be due to premature fatigue of the trolley steel structure. You should consider a Crane Reliability Study.

On or before reaching the end of DWP, a general overhaul is typically required. You can also use the information to modify your inspection schedule based on actual usage.
WHAT THE TRUCONNECT DATA TELLS YOU

With TRUCONNECT Wire Rope Monitoring, sensors gather data while the crane is in normal operation to allow for continuous monitoring of the most wearing sections of the wire rope. Wire Rope Monitoring data shows a trend view which indicates the progress of rope defects over the selected time frame. Warning and discard limits are shown so you can plan for replacements or there is an immediate need to replace the wire rope.

Safety alerts can be sent by email when a Wire Rope Monitoring safety issue appears such as a pre-warning for a need to replace the wire rope or a warning that the wire rope needs to be replaced immediately.

COMMON ISSUES AND CORRECTIVE ACTIONS YOU CAN TAKE

Continuous hoist operation, especially when the same lifting height is used repeatedly, shock loads and overloads, repeated rope bends through rope sheaves during hoist operation with burden, and rope surface damage for an external reason such as a collision or corrosion can indicate that the number of broken wires is increasing which can cause sudden rope failure. Replace the wire rope according to the TRUCONNECT alerts.

YourKONECRANES CUSTOMER PORTAL
Alerts

In addition to Brake Monitoring and Wire Rope Monitoring alerts, Remote Monitoring also provides text or email alerts for safety and production critical issues.

Overloads, emergency stops and motor over temperatures can all contribute to premature wear on components. Alerts can help you take appropriate and immediate action before safety and production is compromised.

When you get alerts by email - you can click to go to that asset’s TRUCONNECT information on yourKONECRANES.
In the Alert Pareto a 20/80 rule can be formed to show the 20% of the causes that are responsible for 80% of the problems. In other words, the 20% of the most common causes are responsible for 80% of problems related to safety and/or production downtime.

By eliminating the root causes of the most frequently occurring alert types, it is possible to significantly improve the safety and reliability of the equipment.

**ANOMALY:** The graph shows a much higher number of safety alerts in May. The high number of e-stops may indicate operator misuse or an issue with the pendant or radio control.

Safety-critical risks indicate a safety risk to the crane or its operation and can include emergency stops, overloading and brake faults.

Production-critical risks can result in crane stoppage or production downtime and can include motor overheating, inverter faults and control system faults.

The Pareto analysis displays and ranks the most important causes of alerts related to the safety and usability of the crane.
Operating Statistics

Operating Statistics show how different crane operating patterns affect the safe operation and condition of the crane and the service life of critical components.

Operating patterns can significantly influence the service life and safety of individual components. Looking at operating data can help you make decisions in regards to the appropriate operation of your cranes in order to achieve optimal results in terms of the safety, service life and maintenance costs of your crane investment.

Every crane is designed according to its anticipated use and your production process depends on the reliability of your lifting equipment. However, actual usage often varies and changes through the lifetime of the crane, based on factors such as application, production cycles and operator capabilities. Operating statistics can help tell you if your crane is being used in the way it was intended and designed and can give you insight into your process.
What the TRUCONNECT data tells you

Under normal operation, hoist running hours should not exceed the estimated design limit for its duty class. TRUCONNECT data shows the daily running hours of the hoist relative to the maximum design running time. If the design running time is exceeded, the hoist is being operated in excess of the design and its mechanical components service life will shorten.

Looking at the running hours trend is an easy way to examine hoist-specific running times, changes and the possible asymmetrical operation of different hoists. If only one in a pair of hoists is frequently used, it will reach the end of its service life much faster than the unused hoist.

Common issues and corrective actions you can take

Process flow, long lifts, excessive use of low speed motion and long running periods at peak production demands can cause excessive running hours. This can affect the condition and temperature of the hoisting motor and increased motor temperature can lead to an over temperature condition and operational interruptions.

Excessive running hours can also increase wear of crane components such as the bridge, trolley and drive and reduce the service life of the hoist. You should review your inspection and preventive maintenance schedule so you can make changes according to actual usage.
What the TRUCONECT data tells you
Load data shows the production volume of the crane or individual hoist. Load spectrum shows the distribution of loads the crane operates with and whether the crane is in heavy or light use.

Operation close to the rated load value causes stress on the crane structures and requires increased attention to maintenance.

Common issues and corrective actions you can take
If loads are continuously at or in excess of 50%, it must be taken into account in the maintenance planning of the crane.

The load spectrum can also be used to assess the suitability of the crane for the current type of operation based on the frequency of overloading and how often the load spectrum reaches the rated load.
OPERATING STATISTICS

Starts and Cycles

**What the TRUCONNECT data tells you**

Hoist motor starts per work cycle (jogging/inching) shows the frequency of incremental lifting of the load. Inchng significantly reduces the service life of the brake and hoist contactors, stresses mechanical structures and overheats the electric motor.

**Common issues and corrective actions you can take**

Operator behavior, such as jogging and/or inching (repeatable motor starts), peak production demands, and loose cabling can cause excessive starts. This can lead to premature wear of the brake, contactors and other components and reduce the lifetime of control equipment such as radio remote or pendants. Excessive starts can also increase the motor temperature which can lead to an over temperature condition and operational interruptions.

Excessive starts can indicate the need for operator training, inspection of brake components, motor and hoist contactors, and a review of your inspection and preventive maintenance schedule.

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If the cumulative number of motor starts during a single hoist cycle is more than eight, it is considered light inching/jogging. If the cumulative number of motor starts during a single lift cycle is more than 20, it is clearly considered inching and/or jogging.

**Starts per hour show the average number of hoist 2-speed motor starts per hour relative to the maximum start design values. If the design value is exceeded, the hoist motor can reach the end of its service life faster than the design value indicates.**

**Utilization Rate for Starts**

- **Host A**: 11% of starts are within the design class.
- **Host B**: 11% of starts are within the design class.

**Starts by hoist**

- **Host A**: 46,086
- **Host B**: 6,157,629

0,157,429 since installation
What the TRUCONNECT data tells you
The maximum number of work cycles is an estimate of the remaining working period of the hoist. The working period is calculated from the cumulative number of maximum hoist cycles. TRUCONNECT trend data shows the remaining working period based on the operating history. When the end of the safe working period is reached, the hoist should be overhauled.

Common issues and corrective actions you can take
If there is an indication that the hoist is being used more than expected, you should consider operator training, an application study to determine whether the equipment suits current production and operating demands, and a review of your inspection and preventive maintenance schedule.

 OPERATING STATISTICS
Starts and Cycles

Work cycles per hour shows the average number of work cycles per hour relative to the design value. If the design value is exceeded, the hoist is being operated in excess of the design and its mechanical components service life will shorten.

The maximum number of cycles in an hour that the hoist was designed for.

Pay attention to the gap between the starts and hoisting cycles. The wider the gap, the fewer starts there are per cycle. This can help you spot differences in the amount of jogging between hoists.

HOIST A
39 Cycles/h
50 Design class
79%

HOIST B
40 Cycles/h
50 Design class
81%

Utilization Rate for Hoist cycles

Hoist cycles

1,193
139,055 since Installation

Starts and Cycles
What the TRUCONNECT data tells you
TRUCONNECT data shows the impact of emergency/abnormal stops on the brake service life in addition to the hoist motor starts. The impact of a single emergency stop during lifting or lowering corresponds to 50 normal starts. You can see the cumulative number of emergency stops per period and the service life trend of the brake.

Common issues and corrective actions you can take
Emergency stops can be caused by operator behavior such as using the e-stop as a normal means of stopping or lifting the hook to the upper limit switch, power quality including radio power, and loss of control signal between the controller and equipment.

Emergency stops can indicate an actual emergency so it’s important to look into the use of the e-stop. When emergency stops are misused it can lead to shock loading and premature wear of the brake, contactors and other components.

Abnormal e-stop usage can indicate a need for operator training, pendant or remote controller maintenance, power supply issues or the need for a hoist brake or other machinery brake inspection.

Emergency Stops Impact on Brake Service Life

OPERATING STATISTICS

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<thead>
<tr>
<th>Emergency Stops</th>
<th>Impact on Brake Service Life</th>
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<tr>
<td>Total number of emergency stops in the selected time frame - in this case 30 days.</td>
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Emergency Stops Brake wear impact

- **HOIST A BRAKE**
  - 11 Emergency Stops
  - 10% Brake wear

- **HOIST B BRAKE**
  - 0 Emergency Stops
  - 0% Brake wear

The percentage refers to the share by which emergency stops increase brake wear.

A higher number of emergency stops can indicate why brake service life is declining faster than expected.
What the TRUCONNECT data tells you
Overloading is registered when the load exceeds the rated capacity of the hoist. TRUCONNECT records the cumulative number of overloading episodes and the period at which the load exceeds the set limit.

TRUCONNECT load spectrum data shows how close to the rated load the hoist is operated at on average. It provides an indication of the suitability of the hoist to the application and the operator’s usage habits. The information can be used to examine the frequency of overloading in work cycles.

Common issues and corrective actions you can take
Overloads can be caused by operator error such as attempting to lift loads beyond the rated capacity, shock loading or starting a load lift in high speed, improper rigging, improperly calibrated load monitoring device or improper use of below-the-hook devices. This can cause cumulative fatigue or damage to crane or hoist components such as hooks, weld seams, sheaves, wire rope, drums, gearboxes, couplings, motors and brakes.

If the data shows overloads you may want to consider operator training to address rigging, crane controls, load swing and pre-operational inspections. You may also need a more in-depth look at the critical components of your crane such as a gear case inspection or coupling inspection or a rail survey.

Total number of overloads during the selected time frame - in this case 30 days.

If there is more than one overload occurrence per 1,000 hoisting cycles, the reason should be investigated.
What the TRUCONNECT data tells you
Over temperature has a significant impact on the service life of the motor. Even one episode of significant over temperature can halve the service life of the motor. TRUCONNECT data shows the ratio of low and high-speed operation of a 2-speed motor and the number of over temperature episodes in the same period. Frequent operation at low speed increases the likelihood of over temperature.

Common issues and corrective actions you can take
Hoist motor over temperature can be caused by excessive operation at slow speeds, too many starts in a short time frame, ED values have exceeded the nominal ED value of the hoist duty class, high ambient temperature and/or a dirty environment, the work environment is hotter than the design limit of the motor, the hoist is used above its design duty cycle, or the motor is dirty or the fan is inoperative. This can lead to premature motor failure.

If excessive over temperature events are occurring you may want to consider operator training, check the motor design class, measure resistance and insulating resistance of motor windings, and review your inspection and preventive maintenance schedule.

A motor over temperature occurrence can result in a burned up motor, so any instance should be investigated.

Operating the hoist in slow speed for extensive periods of time increases the likelihood of over temperature occurrences. As a general rule, slow-speed operating time must not exceed 30% of the fast-speed operating time.
Once a year or as needed, we'll conduct a Business Review with you using the information in the Business Review section of your KONECRANES. You can check this information at any time and choose any time frame for the data.

The Business Review section of your KONECRANES provides an in-depth look at your service relationship with Konecranes. The TRUCONNECT information in this section gives you a high-level view of safety and production risks for connected assets. This information is useful for planning next actions.

The information in the TRUCONNECT section can help you pinpoint assets that need attention and make appropriate plans for budgeting and maintenance.

### TRUCONNECT data in the Business Review

#### PATTERN:
The safety alerts remained nearly constant over a three-year period and only went down when usage decreased. Operator training may be needed.

#### ANOMALY:
The usage went down, but production alerts increased. An adjustment to the maintenance plan may be needed.

This overview of alerts lets you see which alert type is most prevalent. Safety alerts show a need to address e-stops and hoist overloads.

Production alerts show repeated motor issues. Motor overheating, inverter faults and control system faults can all contribute to unplanned production stoppage.

The breakdown of alerts and running hours by asset helps you see which assets need the most attention so you can include them in planning.