**Introduction**

Vayeron® Smart-Idler® is an innovative monitoring system, which intelligently predicts and reports failure for conveyor rollers in bulk materials handling operations. The Smart-Idler® system improves productivity and personnel safety, while reducing downtime and excessive roller expenditure.

Using conventional roller management processes bulk material handling operators are continually faced with costly downtime due to unplanned roller changeouts.

![Conventional Roller Management Process without Vayeron® Smart-Idlers®](image_url)

With the Smart-Idler® system, operators can wirelessly monitor rollers 24/7, through the automated system and can instantly predict roller failure and supply metrics to improve conveyor productivity.

The Vayeron® Smart-Idler® automates the roller management process by eliminating manual monitoring of conveyors and preempting roller faults before they occur.

![Roller Fault Process](image_url)

The easy-to-operate Vayeron® interface keeps teams out of harm’s way, while monitoring roller temperature, vibration faults and roller shell-wear to predict roller failure. As a roller subcomponent, the Smart-Idler® works with existing roller brands and roller manufacturers, converting them from regular conveyor rollers into something far smarter.
The components of the Vayeron® system are defined as follows:

a. Smart Idler® – an electronic module housed within a mechanical conveyor roller. The conveyor roller monitors the temperature, vibration and sound within the conveyor roller and communicates this data to the Gateway via a wireless network.

The Smart-Idler® is powered directly from the rotation of the conveyor roller. Sub-components of the Smart-Idler® module are as follows:

1. Rotor – Internally coupled to the rotating conveyor roller bearing housing. The rotor is sized to follow the outside diameter dimensions of the bearings themselves.

2. Stator – Shaft-mounted component which contains the on-board data acquisition, analysis and radio electronics.

3. Antenna Cap – Protective cover to ensure that the Smart-Idler® antenna is not damaged in the field.
b. Gateway - an electronic device that allows a Programmable Logic Controller (PLC) or cloud-based server to interface with the conveyor roller wireless network. The Gateway interfaces with the PLC via a Modbus interface over a Modbus -RTU protocol or to the cloud-based server via TCP/IP over 100 Base-T Ethernet.

c. Hand-Held Barcode reader: A device which is capable of reading a barcode and establishing a list of scanned Smart-Idler® embedded conveyor rollers that can be uploaded to the Vayeron® cloud server to populate the network.
d. Server - the Vayeron® database which allows accumulated data from Smart-Idlers® to be stored, categorised and presented. Information from the server can be pushed or pulled into third party software systems.

Figure 5. Vayeron® server
Commissioning Overview

The Smart-Idler® modules need to be integrated as a conveyor roller sub-component within conveyor rollers. The rollers are manufactured by third party conveyor roller companies based in various locations around the world.

Once a Smart-Idler® module is installed within the conveyor roller, the final product sold by the conveyor roller manufacturer can be delivered to a bulk materials handling operator for commissioning.

The steps to achieve this are outlined as follows:

1. CAD Integration (Roller Manufacturer)
   1.1 Roller Manufacturer Collaboration
   1.2 Share CAD Models
   1.3 Design Agreement
   1.4 Order Code Definition

2. Smart-Roller Manufacturing

3. Smart-Roller Testing
   3.1 Conveyor Roller Spin-Up Jig
   3.2 End of Line (EOL) Unit

4. Field Commissioning Roller into Conveyor
   4.1 Commissioning Software/Hardware

5. Gateway Installation

6. Data Visualisation

7. Third Party Integration

8. Control System Integration
1 CAD Integration

CAD integration is the first step of the roller integration process and is detailed in the following steps:

1.1 Roller Manufacturer Collaboration

Vayeron® will collaborate with conveyor roller manufacturers in order to integrate the Smart-Idler® into their line of roller products. This process facilitates a new product line offering for the roller manufacturers to commercialise.

Vayeron® provides guidelines and assistance to ensure the success of the integration process. Further detail can be found in Technical Manual - 03 Roller Integration.

1.2 Share CAD Models

Vayeron® will provide the appropriate CAD models of the Smart-Idler® system to the roller manufacturer to meet their roller specifications.

Typical files that will be shared are:

<table>
<thead>
<tr>
<th>Standard components</th>
<th>Tailored to roller specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antenna Overmould</td>
<td>Rotor Assembly</td>
</tr>
<tr>
<td>NTC Overmould</td>
<td>Stator Assembly</td>
</tr>
<tr>
<td></td>
<td>Antenna Cover</td>
</tr>
</tbody>
</table>

Once the initial integration has been completed, Vayeron® will review to ensure the system is properly integrated.

1.3 Design Agreement

After design of the integrated roller has been verified by Vayeron®, both the roller manufacturer and Vayeron® need to sign off on the integration drawings. Failure to comply with the agreed design may result in the system not working properly.

1.4 Order Code Definition

Once the design is agreed, the order code of the Smart-Idler® components is required and can be obtained from the Order Code Lookup Table. See Technical Manual - 02 Product Ordering page 4.

This order code specifies sizes and lengths required.
2 Smart-Roller Manufacturing

With an agreed design, the manufacturing of the roller can proceed. Initial assembly is done with a small number of rollers (as specified in Technical Manual - 03 Roller Integration), to validate the factory assembly, verify the procedure, and establish the manufacturing area and distribution.

During this process, Vayeron can provide technical expertise and support to ensure the Smart-Roller functions successfully.

3 Smart-Roller Testing

When the assembly of the roller is finished, it must be tested and barcoded to allow the field commissioning of the roller as detailed in the following steps:

3.1 Conveyor Roller Spin-up Jig

Firstly, the Smart-Rollers must be tested on a conveyor roller spin-up jig at a speed of around 500 RPM. The Smart-Idler® module powers itself when rotated.
3.2 End of Line (EOL) unit

Using Vayeron’s® EOL unit, users can ensure the rollers are fit for purpose, capture the roller signal and print barcodes to be attached to the rollers.

Refer to Technical Manual - 03 Roller Integration, page 15 for further detail on using the EOL unit.

Contact Vayeron® for pricing and availability of this unit.

Figure 8. End-of-Line unit
Once the Smart-Rollers have been tested, barcoded and transported on site, they need to be commissioned into the conveyor.

This is done with a heavy-duty scanner using a proprietary commissioning application, sold by Vayeron®, which is used as a dedicated tool for the commissioning process. The software can also be downloaded as an application on any android device that has a camera or barcode scanner.

The Vayeron® Field Commissioning Application is used to scan the unique barcode of each smart roller and assign the roller to the network. Conveyor name, roller frame and roller position are recorded by the person installing the smart roller.

For detailed information, please refer to Technical Manual - 04 Onsite Installation.

The location of the Gateway, the power connection and the connection to the network need to be defined. Once the Gateway is installed, and the rollers are commissioned, the system can be accessed online.

When the Gateway is installed and the Smart-Rollers are commissioned and operational, data will be collected by the system and visible on the dashboard.

The Vayeron® system supports third party integration via REST API. To understand more about third party integration and REST API, please refer to Technical Manual - 07 Software.

The Vayeron® system supports industry standard control systems through SCADA. The scope for control system integration is defined on a case-by-case basis.

For further information and available options please contact Vayeron®.
1. **Who is responsible for installation of the Smart-Idler® in the rollers?**
   
   Approved conveyor roller manufacturers are responsible for the installation of the Smart-Idler® in the rollers. Vayeron® provides 24/7 technical support to ensure successful installation.

2. **What is a typical system architecture?**
   
   The Gateway aggregates all information from the network of Smart-Idler® modules. Each Gateway communicates with up to 5000 Smart Rollers using 433MHz radio. The Smart Rollers mesh network the data down the conveyor to the Gateway.

3. **Does every roller require a Smart-Idler® module?**
   
   Vayeron® recommends every roller has a Smart-Idler® module as the network will be more robust with multiple paths of redundancy. It also means every roller is being monitored, ensuring all deterioration will be detected.

   However, the Smart-Idler® system can still operate successfully when implemented in localised areas.