



INTRODUCING GRACO'S  
INTELLIGENT PAINT KITCHEN

**Take full control  
of your  
paint mix room**



## PAINT MIX ROOM CHALLENGES

Relies too  
much on  
humans

Difficult to  
keep up and  
running

Expensive  
to  
maintain

Limited  
control and  
monitoring

Not ready  
for Industry  
4.0

## INTRODUCING GRACO'S INTELLIGENT PAINT KITCHEN

- 1. What is an Intelligent Paint Kitchen?**
- 2. What are the main benefits?**
- 3. How does it work?**
- 4. Which components are used?**





# 1. What is an Intelligent Paint Kitchen?







**Modular, easy, and cost-effective**  
system for monitoring and controlling your paint mix room



It allows you to **monitor and control**  
your paint mix room components  
**without the use of a PLC**

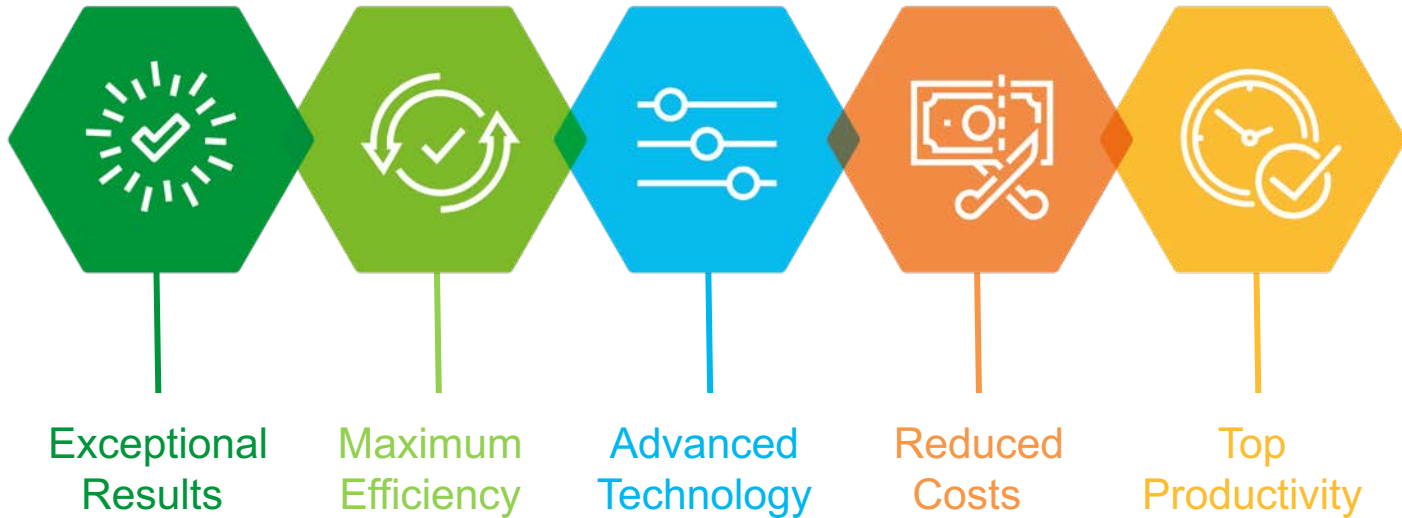


It's **pre-programmed**,  
so just **set the parameters**  
to your preferences and you're off

## 2. What are the main benefits?



# INTELLIGENT FROM START TO FINISH



# Exceptional Results

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Optimizes the balance and performance of your paint supply and paint circulation system(s), leading to a high quality finish

- Superior finish
- Consistent quality
- Reduced paint shear



# Maximum Efficiency

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**Monitors and controls pressure, flow rates, tank levels, and agitator speeds to ensure your system is operating at peak efficiency**

- Easy start-up and operation
- Modular and scalable design
- Less human intervention



# Advanced Control

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**Real-time access to key paint circulation data from inside and outside the paint mix room enables quick diagnosis of issues**

- Remote monitoring
- With or without PLC
- Traceable and clear



# Reduced Costs

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**An inexpensive way to take full control of your paint mix room. You save on installation, operating, programming, and paint costs**

- Cost-effective
- No programming required
- Increased competitiveness

# Top Productivity

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**Ensures your paint circulation systems are operational at all times, informing you and adjusting when necessary**

- Minimal downtime
- Always on and connected
- Ready for IoT and Industry 4.0



### 3. How does it work?





**A smart set of sensors, actuators, and control modules** communicate with each other to optimize the performance of your paint supply and paint circulation system(s)





A smart set of sensors, actuators, and control modules communicate with each other to optimize the performance of your paint supply and paint circulation system(s)



Tank control

Pump control

Overall control



# Pump control



# Pump control



- ✓ Controls fluid pressure and flow rates
- ✓ Keeps your pressure and flow stable and in balance
- ✓ Reduces paint shear



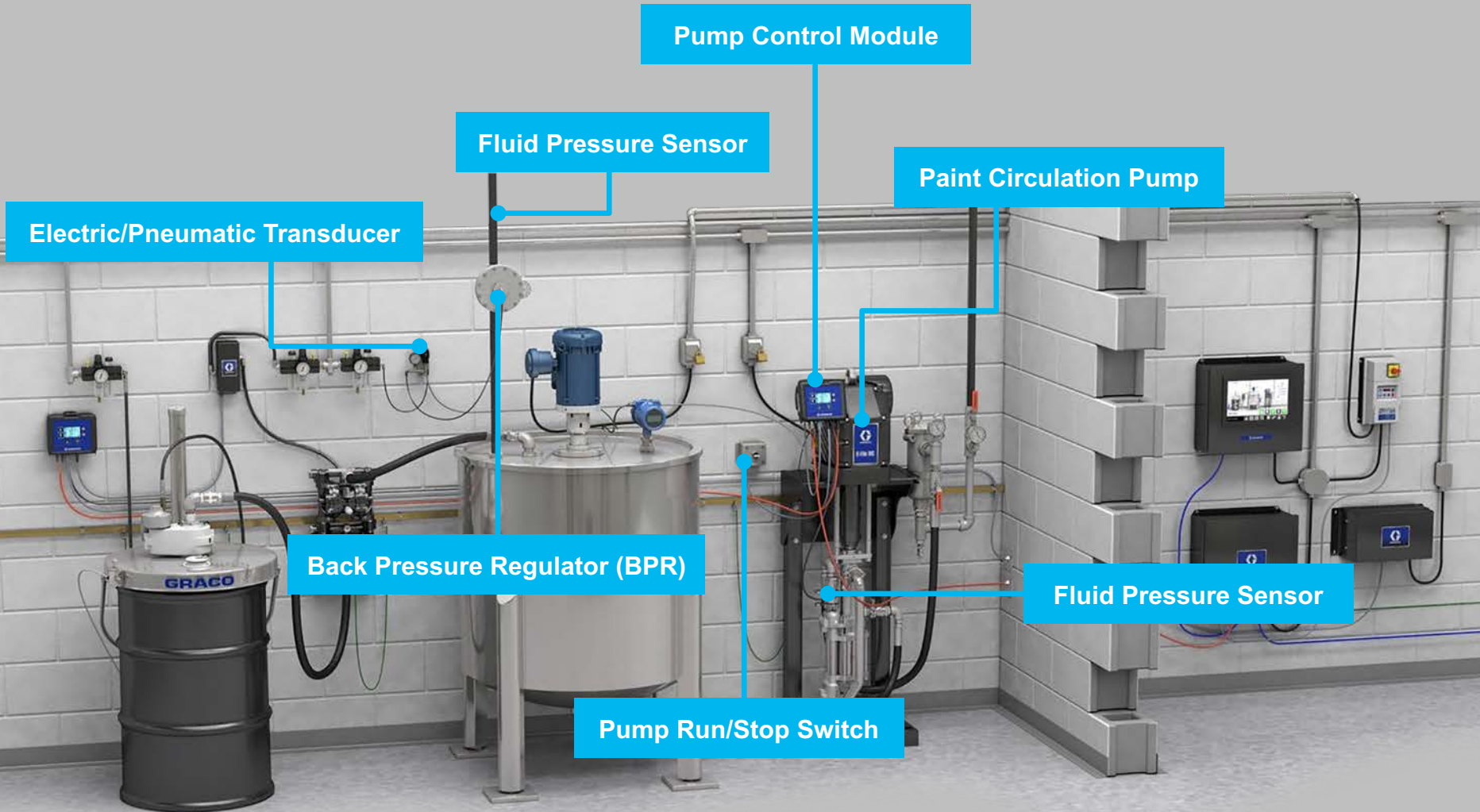
# Pump control



- **Contains:**
  - Electric/pneumatic Paint Circulation Pump
  - Pump Run/Stop Switch
  - Fluid Pressure Sensors
  - Back Pressure Regulator (BPR)
  - Electric/Pneumatic Transducer
- Connected to and monitored by the **Pump Control Module**







In this presentation we use our **electric paint circulation pump** to visualize the system setup



E-Flo DC



But the Intelligent Paint Kitchen  
also works with our **pneumatic**  
**paint circulation pumps**

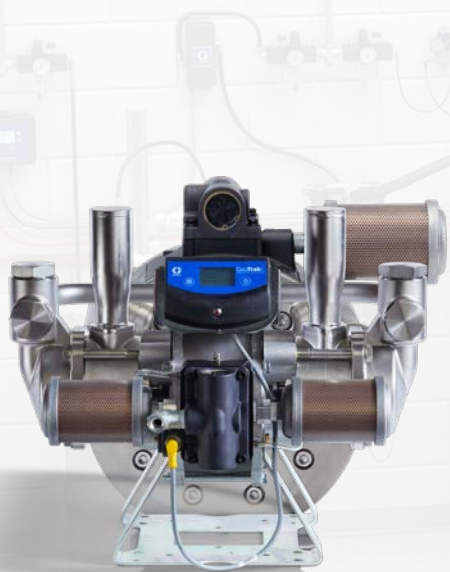


High-Flo





But the Intelligent Paint Kitchen  
also works with our **pneumatic**  
**paint circulation pumps**



Endura-Flo



# Controls fluid pressure and flow rates



The Intelligent Paint Kitchen gives you the possibility to choose between pressure, flow, and hybrid mode. These modes are available for both electric and pneumatic pumps:

- **Pressure mode**  
Steady fluid pressure in the paint circulation line
- **Flow mode**  
Steady flow rate in the paint circulation line
- **Hybrid mode**  
Fluid pressure and flow within the set pressure or flow operating window

# Controls fluid pressure and flow rates



PRESSURE MODE



# Controls fluid pressure and flow rates



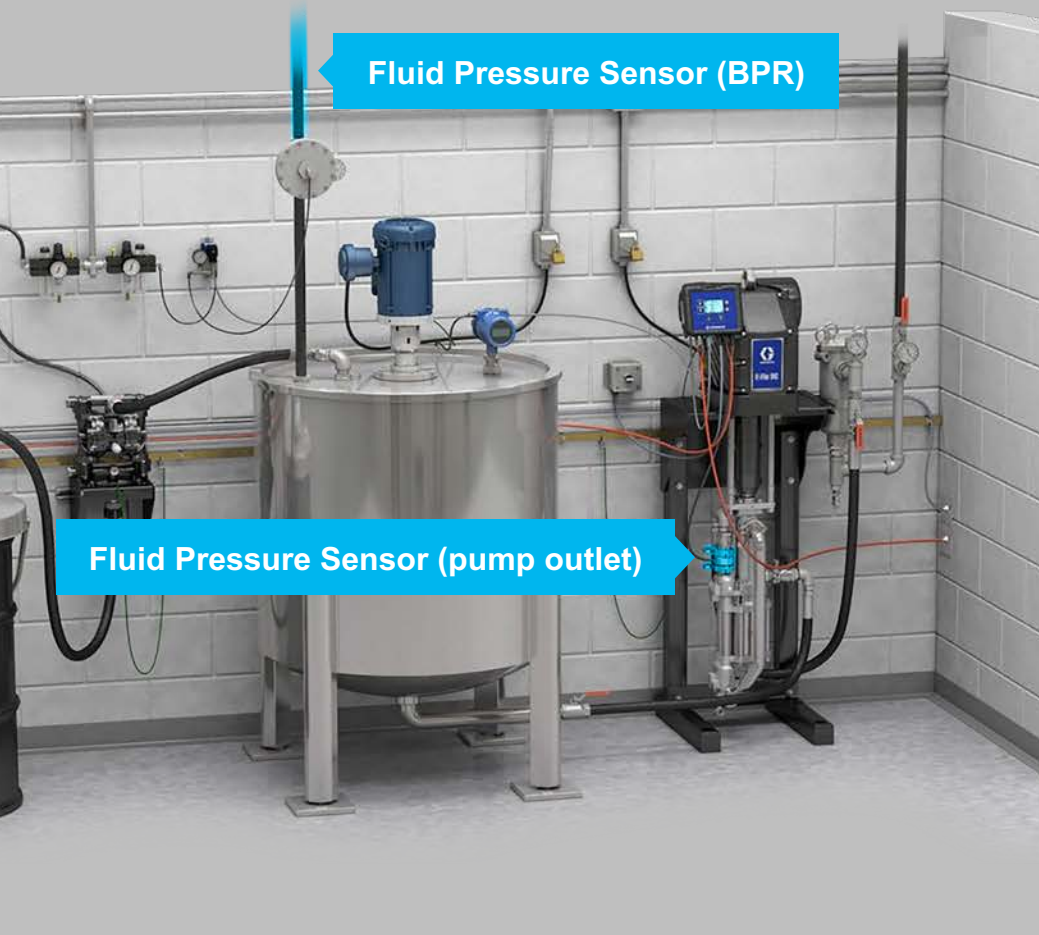
## PRESSURE MODE

1. The **target fluid pressure is set** in the Pump Control Module.





# Controls fluid pressure and flow rates



## PRESSURE MODE

1. The **target fluid pressure** is set in the Pump Control Module.
2. The **Fluid Pressure Sensors measure** the fluid pressure inside the paint circulation line:
  - At the pump outlet
  - At the Back Pressure Regulator



# Controls fluid pressure and flow rates



## PRESSURE MODE

1. The **target fluid pressure** is set in the Pump Control Module.
2. The **Fluid Pressure Sensors measure** the fluid pressure inside the paint circulation line:
  - At the pump outlet
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3. The Pump Control Module **compares the target fluid pressure** with the actual fluid pressure at the pump outlet.

# Controls fluid pressure and flow rates



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4. The Paint Circulation Pump **automatically adjusts** the pressure (PID Closed Loop) to meet the pressure setpoint.

# Controls fluid pressure and flow rates



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1. The **target fluid pressure** is set in the Pump Control Module.
2. The **Fluid Pressure Sensors measure** the fluid pressure inside the paint circulation line:
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3. The Pump Control Module **compares the target fluid pressure** with the actual fluid pressure at the pump outlet.
4. The Paint Circulation Pump **automatically adjusts** the pressure (PID Closed Loop) to meet the pressure setpoint.
5. This results in **steady pressure** in the paint circulation line and **minimal pulsing** at the pump outlet.

# Controls fluid pressure and flow rates



FLOW MODE



# Controls fluid pressure and flow rates



## FLOW MODE

1. The **target flow rate** is set in the Pump Control Module.





# Controls fluid pressure and flow rates



Back Pressure Regulator (BPR)

The image shows a complete industrial pump control system. On the left is a large, cylindrical stainless steel tank supported by four legs. To its right is a black pump assembly mounted on a stand, featuring a digital display and various gauges. A network of pipes, hoses, and electrical conduits connects these components to a wall of light-colored cinder blocks. A blue callout box with a white border points to a blue circular component on the tank, labeled as the Back Pressure Regulator (BPR).

## FLOW MODE

1. The **target flow rate** is set in the Pump Control Module.
2. The **Back Pressure Regulator** is set to deliver the desired fluid pressure in the system.

# Controls fluid pressure and flow rates



## FLOW MODE

1. The **target flow rate** is set in the Pump Control Module.
2. The **Back Pressure Regulator** is set to deliver the desired fluid pressure in the system.
3. The Paint Circulation Pump **circulates the paint at the desired flow rate**, based on the volume of the pump and the position of the piston.

# Controls fluid pressure and flow rates



## FLOW MODE

1. The **target flow rate** is set in the Pump Control Module.
2. The **Back Pressure Regulator** is set to deliver the desired fluid pressure in the system.
3. The Paint Circulation Pump **circulates the paint at the desired flow rate**, based on the volume of the pump and the position of the piston.
4. This results in a **steady flow rate** in the paint circulation line, while the system monitors the pressure transducers to prevent pump runaway.



# Controls fluid pressure and flow rates



**HYBRID MODE**



# Controls fluid pressure and flow rates



## HYBRID MODE

1. The **minimum and maximum flow rates** required by the circulation conditions are set in the Pump Control Module.

# Controls fluid pressure and flow rates



## HYBRID MODE

1. The **minimum and maximum flow rates** required by the circulation conditions are set in the Pump Control Module.
2. The **minimum and maximum fluid pressure** to maintain proper spray conditions are set in the Pump Control Module.

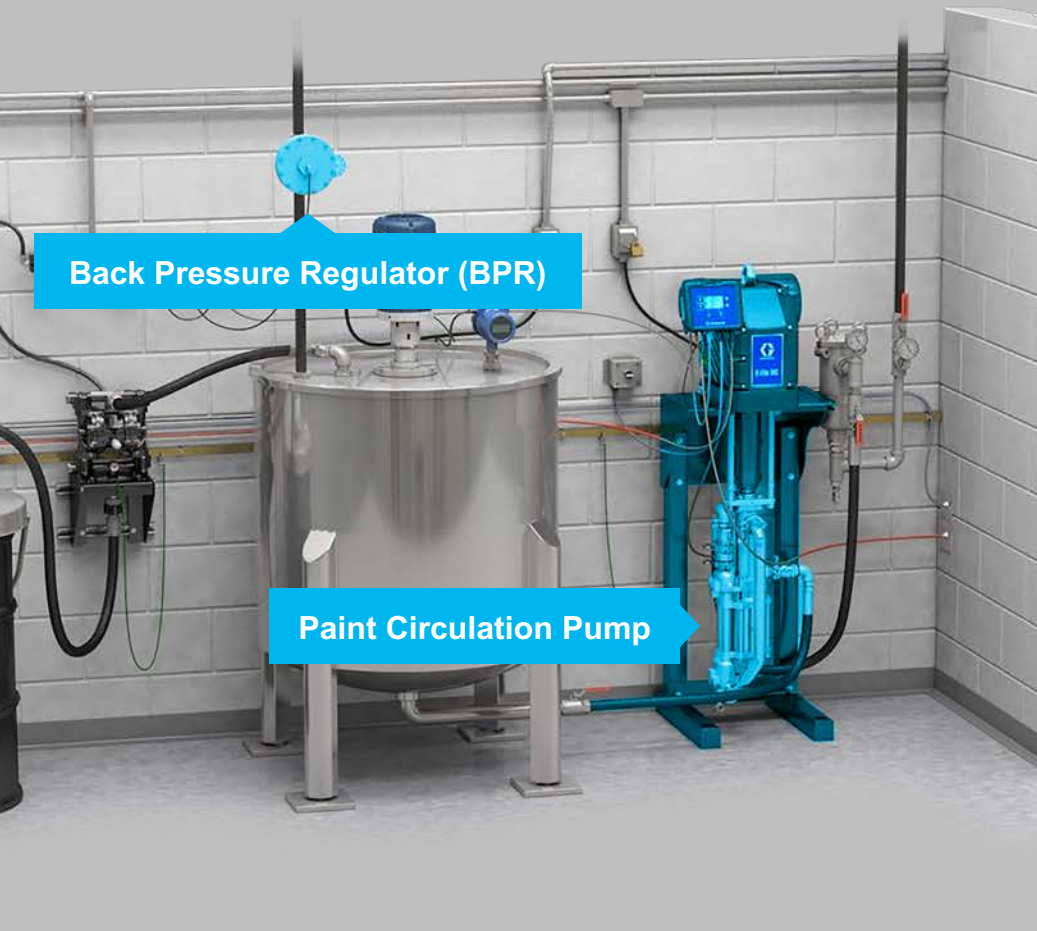
# Controls fluid pressure and flow rates



## HYBRID MODE

1. The **minimum and maximum flow rates** required by the circulation conditions are set in the Pump Control Module.
2. The **minimum and maximum fluid pressure** to maintain proper spray conditions are set in the Pump Control Module.
3. The system **actively manages the pump pressure and flow rate** to keep the system within the pressure or flow operating window.

# Controls fluid pressure and flow rates



Back Pressure Regulator (BPR)

Paint Circulation Pump

## HYBRID MODE

1. The **minimum and maximum flow rates** required by the circulation conditions are set in the Pump Control Module.
2. The **minimum and maximum fluid pressure** to maintain proper spray conditions are set in the Pump Control Module.
3. The system **actively manages the pump pressure and flow rate** to keep the system within the pressure or flow operating window.
4. Changes in viscosity or the number of guns in use will cause the system to **adjust the Paint Circulation Pump and Back Pressure Regulator** to maintain system pressure and flow requirements.



# Controls fluid pressure and flow rates



## GOOD TO KNOW

Max. **2 Fluid Pressure Sensors** can be **connected** to the Pump Control Module.

**Both fluid pressures can be seen** on the Pump Control Module.

By comparing the Fluid Pressure Sensors, **delta P can be measured**. In case of a large pressure difference an **alarm can be activated**, which allows you to detect pressure drops in the paint circulation line.

Max. **1 Fluid Pressure Sensor** can be activated for the **constant pressure closed loop function**.

The pump can also run **without Fluid Pressure Sensor**, called % force, but it will be less accurate and reactive towards fluid pressure pulses at the pump outlet.



# Keeps your pressure and flow stable and in balance



Back Pressure Regulator

Pump Control Module

## 1. A **production** and a **non-production profile** are set in the Pump Control Module:

- **Production mode**
  - Constant pressure
  - BPR open/closed percentage set by user
- **Non-production mode (sleep mode)**
  - Constant flow (to keep the paint in optimal condition)
  - Back Pressure Regulator **as open as possible** (depending on the paint)

# Keeps your pressure and flow stable and in balance



Electric/Pneumatic Transducer

1. A **production** and a **non-production profile** are set in the Pump Control Module:
  - **Production mode**
    - Constant pressure
    - BPR open/closed percentage set by user
  - **Non-production mode (sleep mode)**
    - Constant flow (to keep the paint in optimal condition)
    - Back Pressure Regulator **as open as possible** (depending on the paint)
2. The Electric/Pneumatic Transducer automatically reaches the **setpoint of the BPR.**

# Keeps your pressure and flow stable and in balance



Back Pressure Regulator

Electric/Pneumatic Transducer

1. A **production** and a **non-production profile** are set in the Pump Control Module:
  - **Production mode**
    - Constant pressure
    - BPR open/closed percentage set by user
  - **Non-production mode (sleep mode)**
    - Constant flow (to keep the paint in optimal condition)
    - Back Pressure Regulator **as open as possible** (depending on the paint)
2. The Electric/Pneumatic Transducer automatically reaches the **setpoint of the BPR**.
3. The Electric/Pneumatic Transducer **adjusts the Back Pressure Regulator**, depending on the target back pressure required.

# Keeps your pressure and flow stable and in balance



## GOOD TO KNOW: Paint shear

Paint shear takes place **mainly in the Back Pressure Regulator.**

Opening the BPR as much as possible (constant flow mode) means less stress on the paint, which **reduces paint shear.**

It also **lowers energy consumption** as the pump will run more slowly (just enough to keep the paint in motion).

# Tank control





# Tank control



- ✓ Controls tank levels and agitator speeds
- ✓ Keeps your fluids at level and in perfect condition



# Tank control



## ■ Contains:

- Refill Pump
- Refill Pump Solenoid
- Radar Level Sensors
- Supply Tank
- Production Tank
- Electric/Pneumatic Agitators

- Connected to and monitored by the **Tank Control Module**

Tank Control Module

Radar Level Sensor

Refill Pump Solenoid

Electric or Pneumatic Agitator

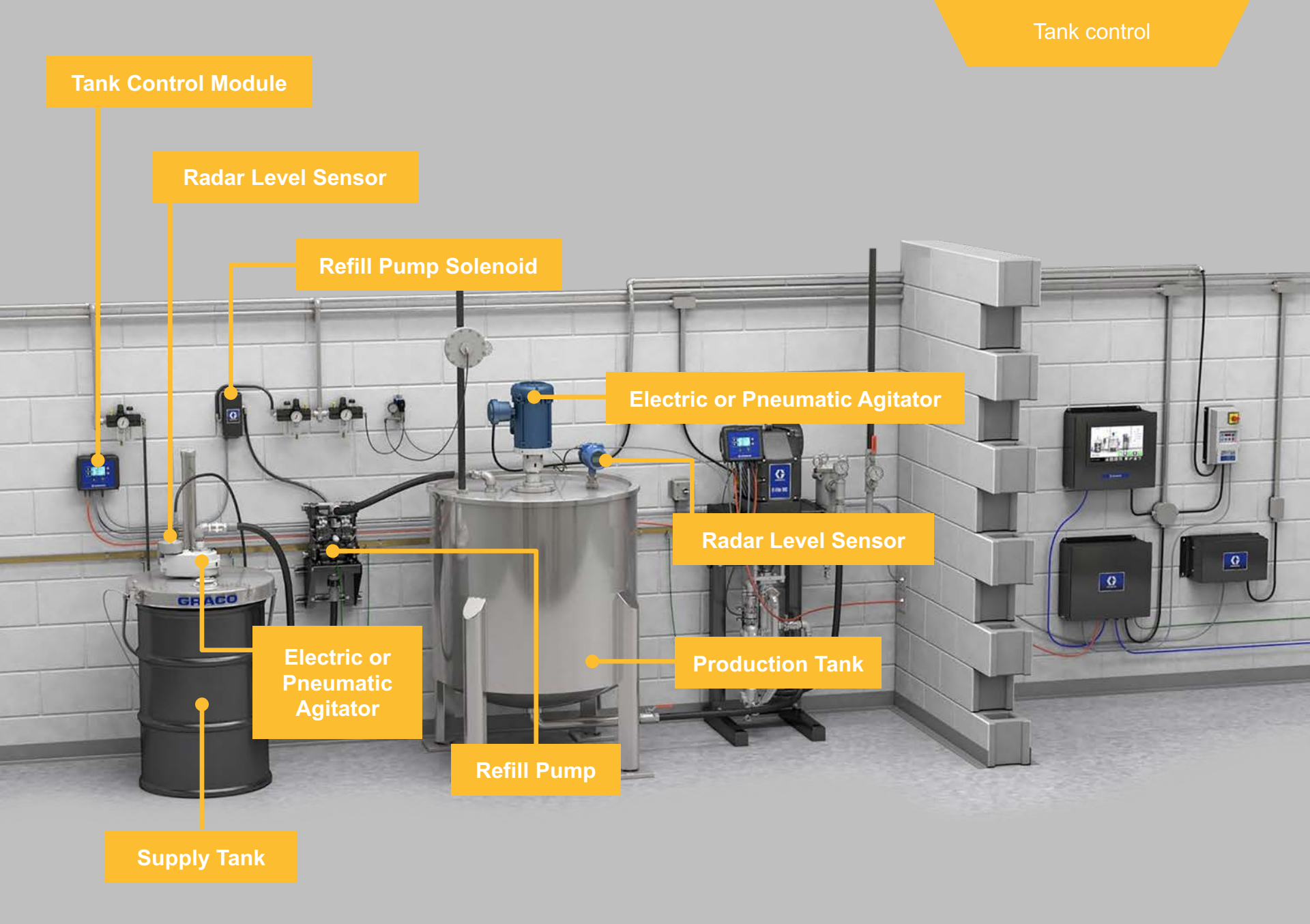
Radar Level Sensor

Electric or Pneumatic Agitator

Production Tank

Refill Pump

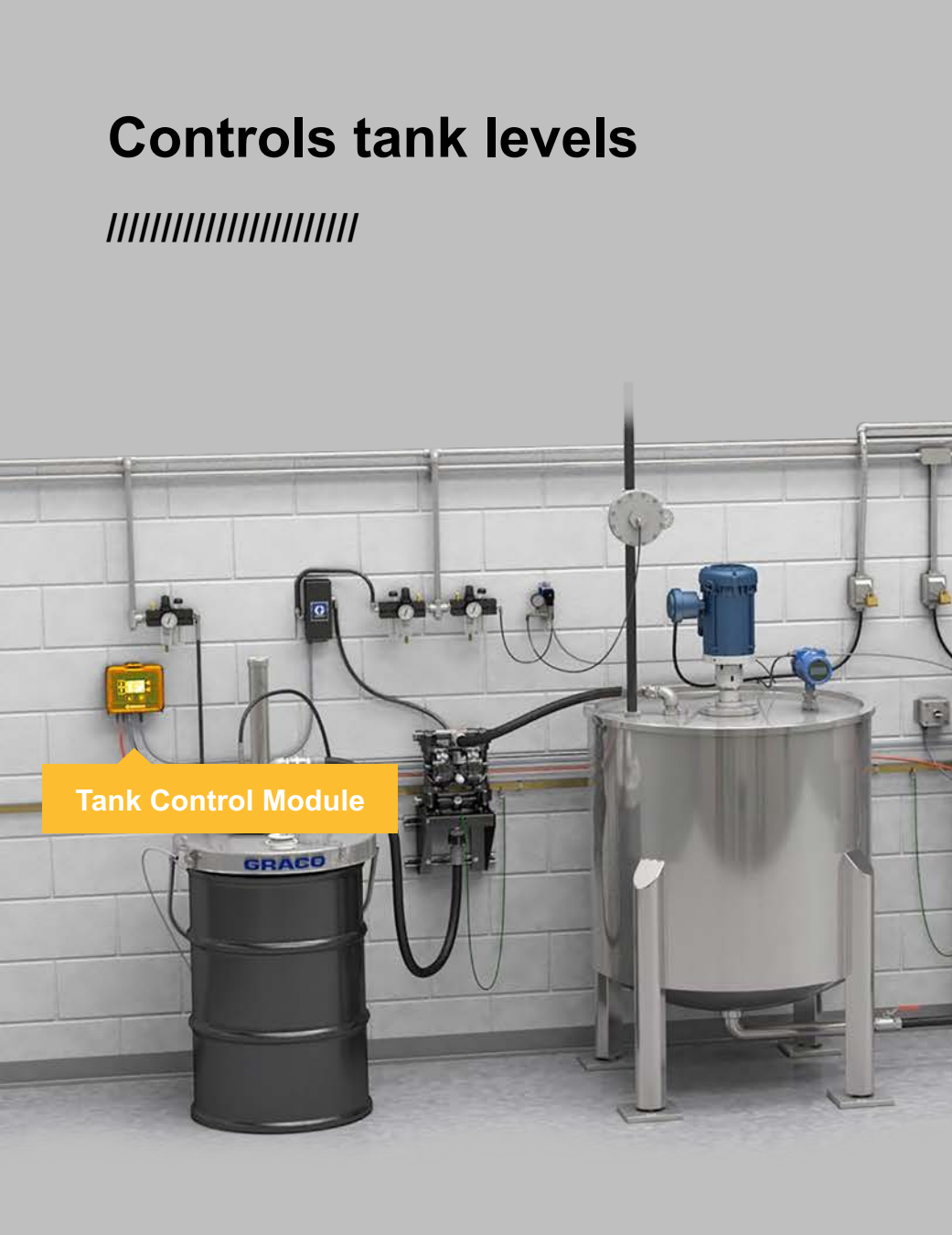
Supply Tank



# Controls tank levels



1. The **tank target level** is set in the Tank Control Module.



# Controls tank levels



1. The **tank target level** is set in the Tank Control Module.
2. The **Radar Level Sensor** measures the tank levels inside the Production Tank:





# Controls tank levels



Tank target level

Tank fill level

1. The **tank target level** is set in the Tank Control Module.
2. The **Radar Level Sensor** measures the tank levels inside the Production Tank:
  - Tank target level
  - Tank fill level



# Controls tank levels



1. The **tank target level** is set in the Tank Control Module.
2. The **Radar Level Sensor** measures the tank levels inside the Production Tank:
  - Tank target level
  - Tank fill level
3. The **Radar Level Sensor** detects if the **tank fill level** has been reached and communicates with the Tank Control Module.

# Controls tank levels



1. The **tank target level** is set in the Tank Control Module.
2. The **Radar Level Sensor** measures the tank levels inside the Production Tank:
  - Tank target level
  - Tank fill level
3. The **Radar Level Sensor** detects if the **tank fill level** has been reached and communicates with the Tank Control Module.
4. The Tank Control Module **activates the Refill Pump Solenoid**, which starts up the Refill Pump.

# Controls tank levels



1. The **tank target level** is set in the Tank Control Module.
2. The **Radar Level Sensor** measures the tank levels inside the Production Tank:
  - Tank target level
  - Tank fill level
3. The **Radar Level Sensor** detects if the **tank fill level** has been reached and communicates with the Tank Control Module.
4. The Tank Control Module **activates the Refill Pump Solenoid**, which starts up the Refill Pump.
5. The **Refill Pump** fills the **Production Tank** until the tank target level is reached.

# Controls tank levels



Tank target level

Tank fill level

1. The **tank target level** is set in the Tank Control Module.
2. The **Radar Level Sensor** measures the tank levels inside the Production Tank:
  - Tank target level
  - Tank fill level
3. The **Radar Level Sensor** detects if the **tank fill level** has been reached and communicates with the Tank Control Module.
4. The Tank Control Module **activates the Refill Pump Solenoid**, which starts up the Refill Pump.
5. The **Refill Pump** fills the **Production Tank** until the tank target level is reached.
6. This sequence is **repeated** based on the paint level changes in the Production Tank.

# Controls tank levels



## GOOD TO KNOW

The **actual tank level** can be seen on the Tank Control Module.

A **tank level low and high alarm** can be set via the Tank Control Module. Once the min./max. tank level is passed, an alarm is generated and the Refill Pump Solenoid stops the Refill Pump.

In non-production mode, a '**paint freeze level**' can be activated. If the paint level in the Production Tank continues to drop, a paint leakage can be detected and monitored and an alarm can be generated.

The **Supply Tank paint level** is also measured by a Radar Level Sensor. Once the tank level low deviation (TLLD) is reached, an alarm will be generated and the operator will need to replace the empty Supply Tank with a full one or refill the tank manually up to the required level.



# Controls agitator speeds



## 1. The **Electric Agitator** parameters are set:

- Minimum speed (%)
- Minimum tank level (%)
- Maximum speed (%)
- Maximum tank level (%)
- On-Off time programming

# Controls agitator speeds



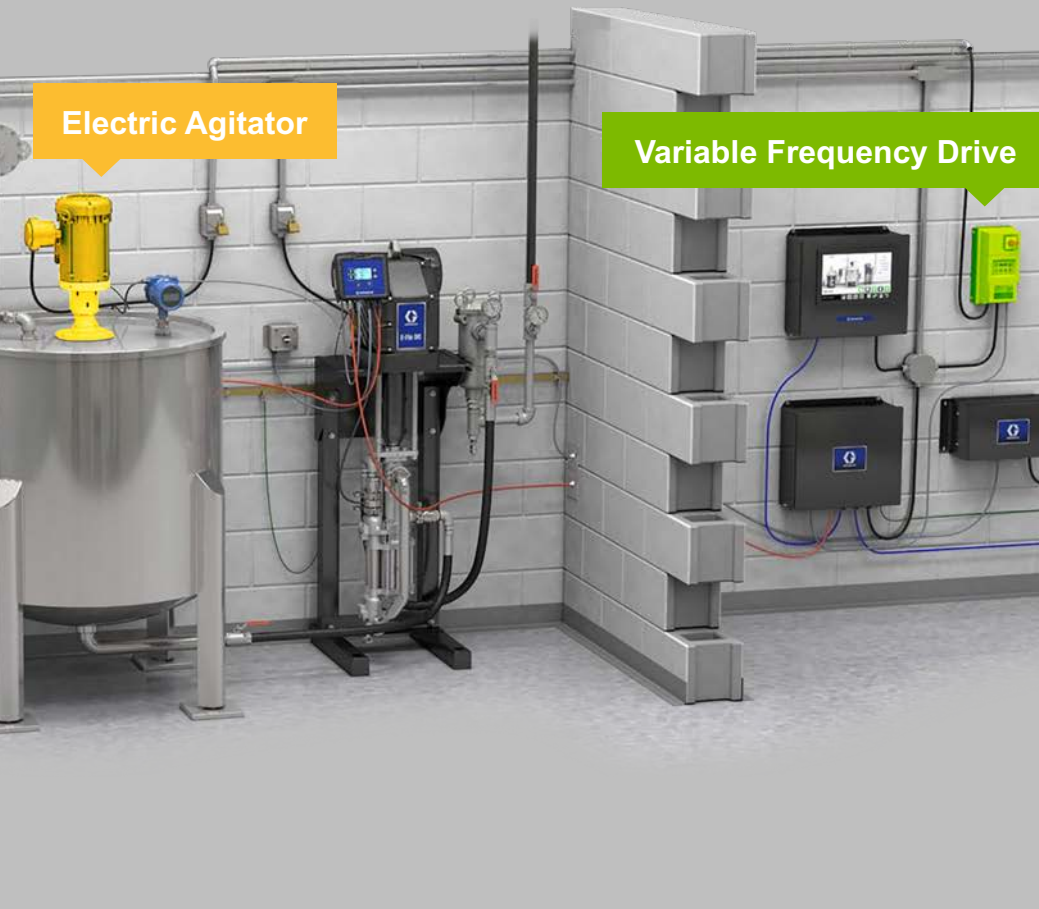
Radar Level Sensor

Pump Control Module

Supervisor Box

1. The **Electric Agitator** parameters are set:
  - Minimum speed (%)
  - Minimum tank level (%)
  - Maximum speed (%)
  - Maximum tank level (%)
  - On-Off time programming
2. The Radar Level Sensor **measures the tank level** inside the Production Tank and sends a 4-20 mA signal to the Pump Control Module and the Supervisor Box.

# Controls agitator speeds



Electric Agitator

Variable Frequency Drive

1. The **Electric Agitator** parameters are set:
  - Minimum speed (%)
  - Minimum tank level (%)
  - Maximum speed (%)
  - Maximum tank level (%)
  - On-Off time programming
2. The Radar Level Sensor **measures the tank level** inside the Production Tank and sends a 4-20 mA signal to the Pump Control Module and the Supervisor Box.
3. The **Variable Frequency Drive** (controlled by the Tank Control Module and the Supervisor Box) **activates the Electric Agitator**.

# Controls agitator speeds



1. The **Electric Agitator** parameters are set:
  - Minimum speed (%)
  - Minimum tank level (%)
  - Maximum speed (%)
  - Maximum tank level (%)
  - On-Off time programming
2. The Radar Level Sensor **measures the tank level** inside the Production Tank and sends a 4-20 mA signal to the Pump Control Module and the Supervisor Box.
3. The **Variable Frequency Drive** (controlled by the Tank Control Module and the Supervisor Box) **activates the Electric Agitator**.
4. The **Agitator will automatically slow down** when the tank level is falling and **automatically speed up** when the tank level is rising

# Controls agitator speeds



## GOOD TO KNOW

There are **2 different agitator profiles** available. They can be linked to production or non-production mode. Agitator profiles and production modes can easily be **enabled or disabled**.

**Idle time** can be programmed and agitator operation can be controlled via a **week/weekend scheduler**.

**The Variable Frequency Drive (VFD)** can also be controlled via the HMI Touchscreen or via an external PLC (connected to the Supervisor Box).

A speed-controlled **Pneumatic Agitator can be installed on the Supply Tank**. It will agitate at a constant manually set speed, independent of the tank level in the Supply Tank.



# Overall (remote) control



# Overall (remote) control



- ✓ Allows you to control the paint mix room from outside the hazardous area
- ✓ Gives you access to (real-time) key paint circulation data



# Overall (remote) control



## ■ Contains:

- Supervisor Box
- HMI Touchscreen
- Variable Frequency Drive (VFD)
- Power Supply







# Allows control from outside the hazardous area

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1. Pump and tank control settings and configurations are done via the **Pump Control Module** and **Tank Control Module**.



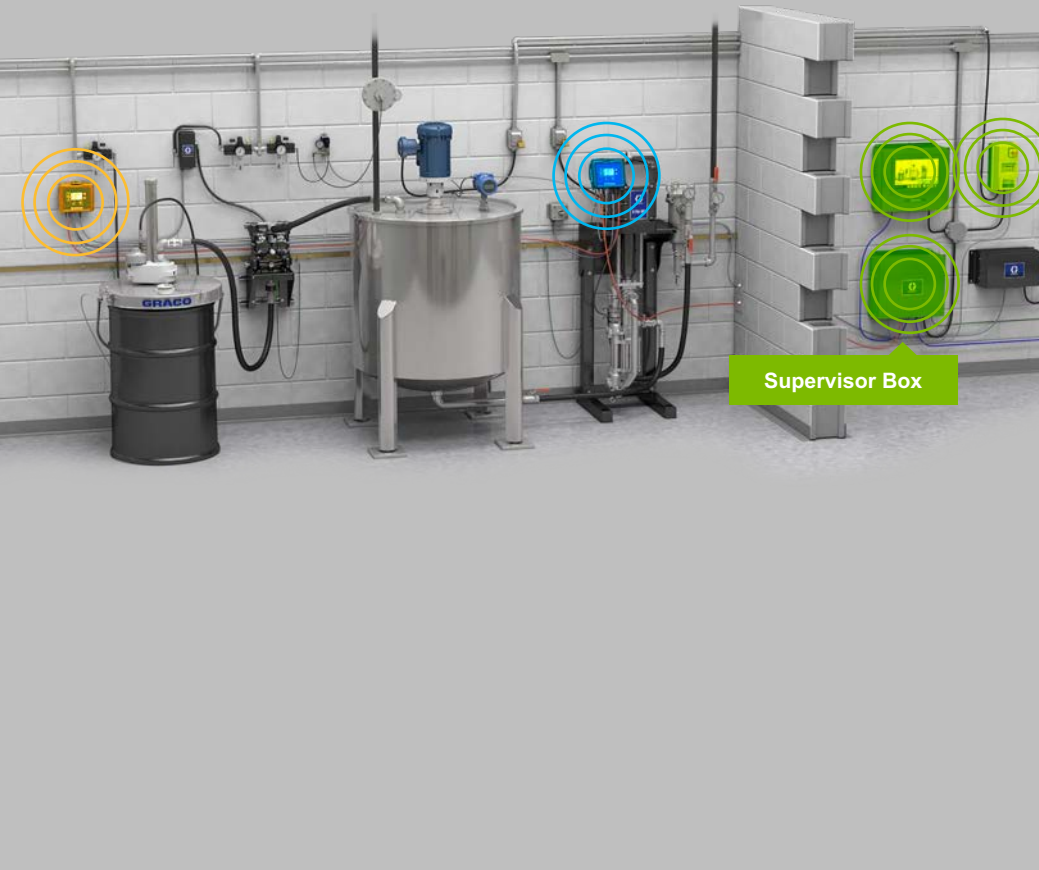


# Allows control from outside the hazardous area



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2. All settings and configurations can also be done from outside the hazardous area via the **HMI Touchscreen**.

# Allows control from outside the hazardous area



1. Pump and tank control settings and configurations are done via the **Pump Control Module** and **Tank Control Module**.
2. All settings and configurations can also be done from outside the hazardous area via the **HMI Touchscreen**.
3. The **Supervisor Box** communicates with all key Intelligent Paint Kitchen components:
  - Pump Control Module
  - Tank Control Module
  - HMI Touchscreen
  - Variable Frequency Drive (VFD)

# Allows control from outside the hazardous area



1. Pump and tank control settings and configurations are done via the **Pump Control Module** and **Tank Control Module**.
2. All settings and configurations can also be done from outside the hazardous area via the **HMI Touchscreen**.
3. The **Supervisor Box** communicates with all key Intelligent Paint Kitchen components:
  - Pump Control Module
  - Tank Control Module
  - HMI Touchscreen
  - Variable Frequency Drive (VFD)
4. From outside the hazardous area, **paint kitchen control and real-time access to key data** are done via the HMI Touchscreen.

## Allows control from outside the hazardous area



### GOOD TO KNOW

One Supervisor Box can control **up to 20** paint supply or paint circulation systems.

It is possible to **switch** between local control (Control Modules) and remote control (HMI Touchscreen or PLC) without any issues.

Up to **10 fiber-optic converters** can fit in the Supervisor Box. For additional fiber-optic converters, an Expansion Box can be used.

To **communicate with an external PLC**, an additional communication gateway needs to be connected to the Supervisor Box.

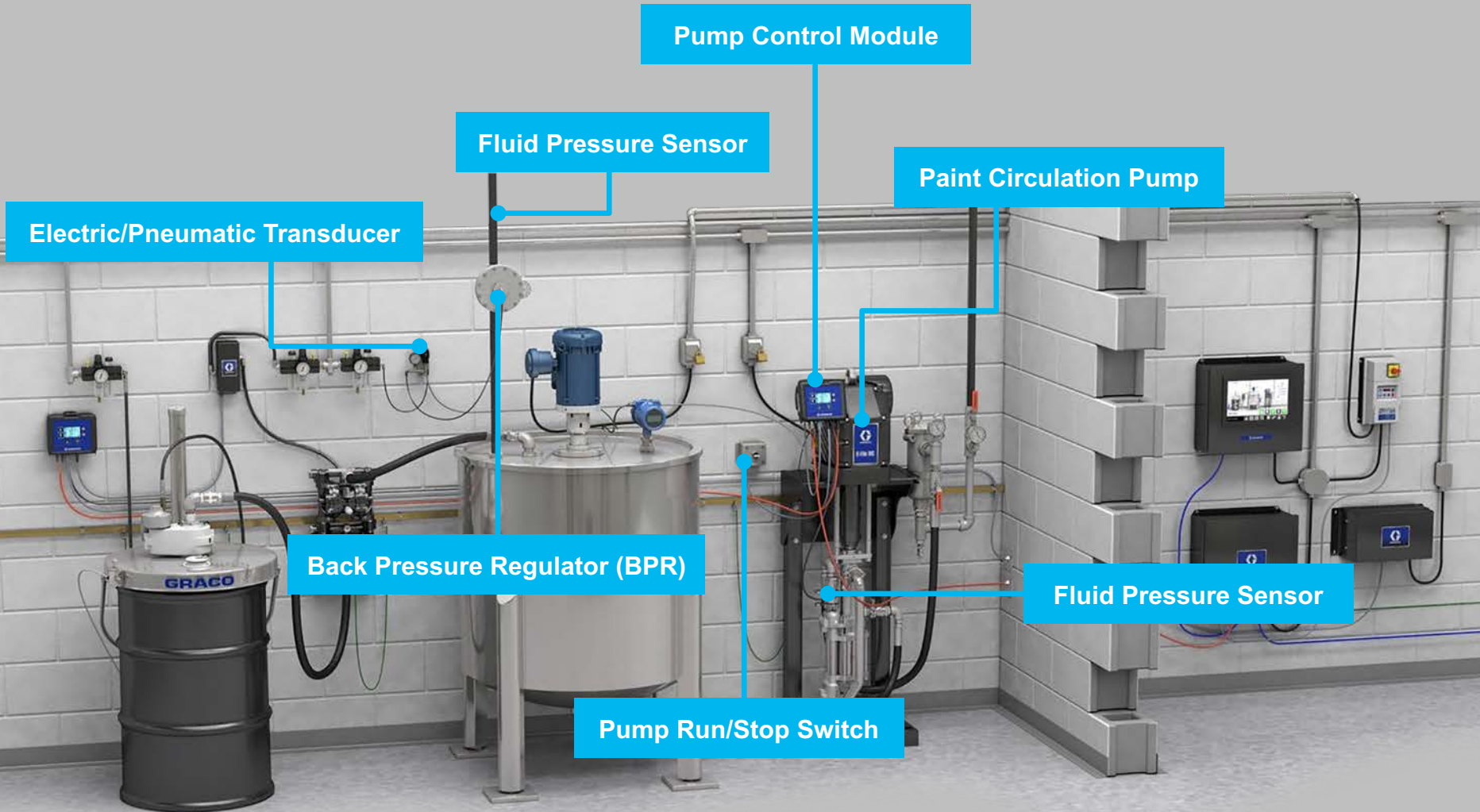
HMI data and control access levels can be **protected by a password**.

# 4. Which components are used?

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Tank Control Module

Radar Level Sensor

Refill Pump Solenoid

Electric or Pneumatic Agitator

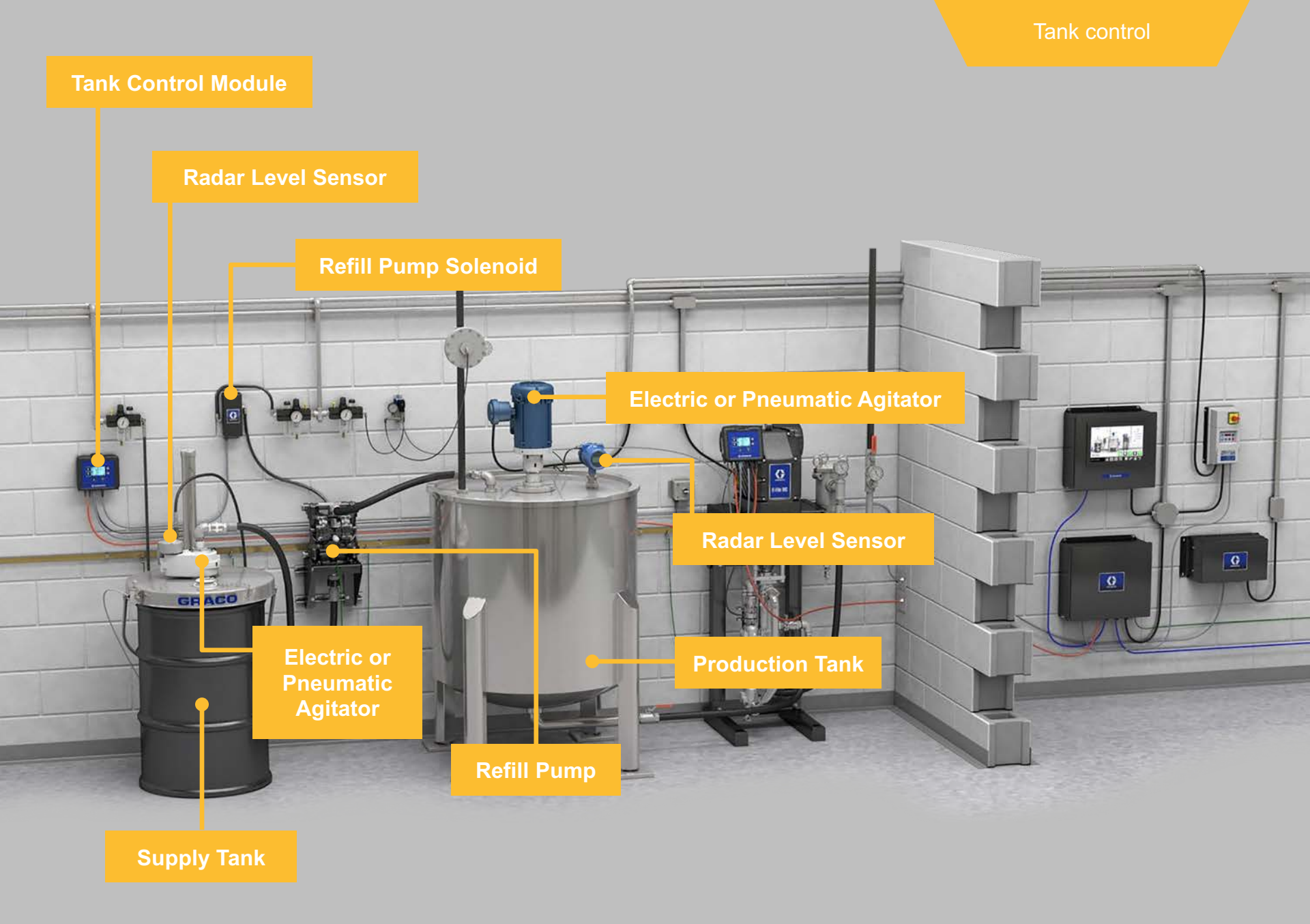
Radar Level Sensor

Electric or Pneumatic Agitator

Production Tank

Refill Pump

Supply Tank





Variable Frequency Drive (VFD)

HMI Touchscreen

Supervisor Box

Power Supply

# Electric Paint Circulation Pump

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- **E-Flo DC Pump:**
  - Energy-efficient reciprocating piston pump
  - Electric Brushless Dual Control Motor
- Continuously circulates one paint color through the paint mix room
- Can operate two ways:
  - Constant Pressure Mode
  - Constant Flow Mode
- Each pump is controlled by the Pump Control Module

# Electric Paint Circulation Pump

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- ✓ Constant fluid pressure and flow rate
- ✓ Can stall under pressure (similar to pneumatic pressure)
- ✓ Optimal paint feed to the applicators
- ✓ Low pulse, low noise, no icing



# Pneumatic Paint Circulation Pumps

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**Endura-Flo**

Small to mid-sized double diaphragm pump that offers industry-leading flushing capabilities



**High-Flo**

4-ball piston pump that delivers in mid-size to large circulation applications using the low-maintenance sealed 4-ball lower



**Glutton**

4:1 pump that is made for tough applications and has been an industry workhorse for many years

# Pump Control Module

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- Pump control 'brain'
- Connection point and power source for all pump control components
- Allows advanced monitoring and controlling of the pump
- Has its own software to send instructions between the non-hazardous and hazardous area
- One Pump Control Module for each pump
- Can be mounted on the pump or remotely

# Pump Run/Stop Switch

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- Physical switch to start and stop the pump without switching off the AC Power to the DC Motor
- Mounted close to the pump

# Fluid Pressure Sensors

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- Measures fluid pressure inside the paint circulation line
- Two pressure sensors can be installed:
  - One at the pump outlet
  - One close to the BPR
- Both sensors connected to and controlled by the Pump Control Module

# Fluid Pressure Sensors

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- ✓ Fluid pressure can be read out on the Pump Control Module
- ✓ Pump outlet sensor can be used to reduce pulsing at the pump outlet
- ✓ Can be activated to run in closed loop function



# Back Pressure Regulator (BPR)

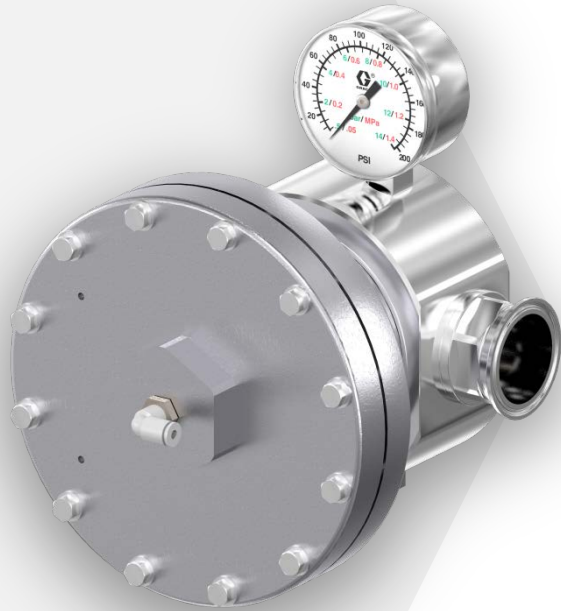
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- Maintains the back pressure in the paint circulation system
- Based on profiles set in the Pump Control Module
- Easy switching from production to non-production profiles

# Back Pressure Regulator (BPR)

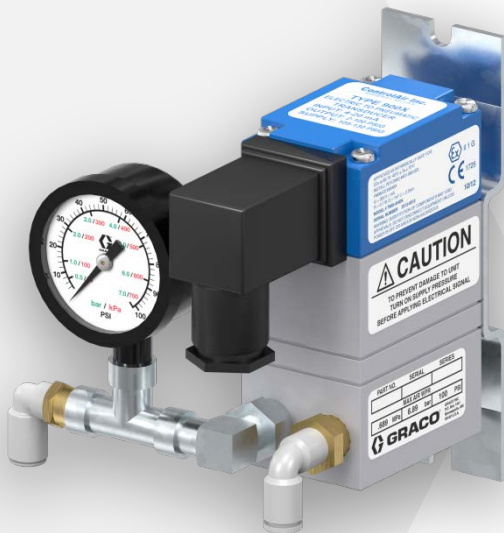
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- ✓ Stable pressure at any time
- ✓ Less paint shear and maximum material life
- ✓ Increased energy savings

# Electric/Pneumatic Transducer

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- Converts a current input signal to a linearly proportional pneumatic output pressure
- Based on a closed loop pressure feedback system:
  - Closely controls output
  - Compensates for supply pressure variations
- Adjusts the BPR according to target back pressure required

# Refill Pump

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- Air-operated double diaphragm pump
- Fills the production tank from the Supply Tank, when needed
- Stops automatically when fluid target level is reached
- Includes a Reed Switch for cycle detection

# Tank Control Module

//////////



- Tank control 'brain'
- Allows advanced monitoring and controlling of tanks
- Connection point and power source for all tank control components
- Sends instructions between non-hazardous and hazardous area



# Refill Pump Solenoid

//////////



- Pneumatic controlled air valve
- Enables control of the pneumatic Refill Pump
- Starts the Refill Pump when fluid level in the Production Tank falls below a user-specified level
- Stops the pump when fluid level reaches the user-specified level

# Radar Level Sensors

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- Contactless fluid level sensors
- Detect and communicate the fluid levels:
  - In the Supply Tank
  - In the Production Tank
- When the production tank level is low, the sensor activates the Refill Pump Solenoid to start up the Refill Pump
- Generates an alarm if the minimum or maximum level is exceeded

# Supply Tank



- Stores supply paint for the paint line

# Production Tank



- Stores mixed paint for the paint line

# Electric or Pneumatic Agitators

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- Keeps the paint mixed and homogeneous without incorporating air into the fluid
- Speed of the Agitator depends on tank level
- Mounted on each tank



# Supervisor Box

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- Communication hub for the Intelligent Paint Kitchen
- Links with your Programmable Logic Controller (PLC)
- Contains the software that runs the Intelligent Paint Kitchen
- Can control up to 20 paint supply and paint circulation systems

# HMI Touchscreen

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- Remote interface between the Intelligent Paint Kitchen and operator
- Displays all paint mix room conditions and settings
- Allows users to change parameters and preferences or install updates
- Allows users to schedule production and non-production times

# Variable Frequency Drive (VFD)

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- Makes it possible to adjust the speed of the Electric Agitator:
  - Agitator slows down when the tank level is falling
  - Agitator speeds up when the tank level is rising
- Three agitator profiles are available, depending on paint type and production

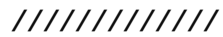
# Variable Frequency Drive (VFD)

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- ✓ Agitator speed is controlled from the non-hazardous area
- ✓ Decreases paint shear and prevents paint foaming

# Power Supply



- Powers up to three Tank Control Modules (and pneumatic pump if applicable)
- Includes safety barrier

A photograph of a blue car body on an assembly line. The car is positioned on a conveyor belt, and its body panels are highly reflective. In the background, there are industrial structures and a large, stylized hexagonal logo with yellow diagonal stripes. The text "Thank you." is overlaid in white, bold font.

**Thank you.**

Questions?