

Modular Anode Control (MAC) Systems

General

A **Modular Anode Control (MAC)** rectifier system is comprised of a pair or small groups of anodes connected to individual rectifiers for the purpose of gaining more precise control of the painting process. Similar to but more precise than a 2- or 3-zone continuous

conveyor process, the **MAC** system maintains specific control over the voltage of each anode pair (or groups of anodes) to maximize coating efficiency and flexibility. All control and monitoring functions are performed by a centralized PLC, which can be programmed

and monitored via an "HMI" (human-machine interface) or through the plant monitoring system.

Note: The "HMI" might also be referred to as the "operator interface terminal" (OIT).

Continuous Conveyor Process

In a standard 2- or 3-zone **continuous conveyor process**, there is usually (1) one rectifier per zone, as well as another rectifier which serves as a backup. In comparison, the **MAC** system brings the multi-zone concept to a new level. Now instead of having 2 or 3 zones, there are 10 or more zones — see the illustration on Page 2. This approach provides the flexibility to control the voltage at every 2 - 4 anodes, which gives the e-coat operator the ability to

address any film-build issues at any anode group as a part passes through the tank.

Besides the capability to fine-tune the e-coat process, the **MAC** system eliminates the need for zone transfer switches and DC switchgear. Anode current monitoring is built into the rectifier, and the information can be monitored via the "HMI" or the plant monitoring system — therefore a separate anode monitoring system is not required.

Note that in a **MAC** system, separate backup rectifiers are not required. If there is a rectifier failure, the **MAC** system PLC will automatically adjust the voltages of the operating rectifiers to compensate for the lost / down rectifier. When the rectifier is returned to service, the voltage levels will automatically re-adjust. Depending on the configuration, it is possible to lose up to (4) four rectifiers at once, and still run production.

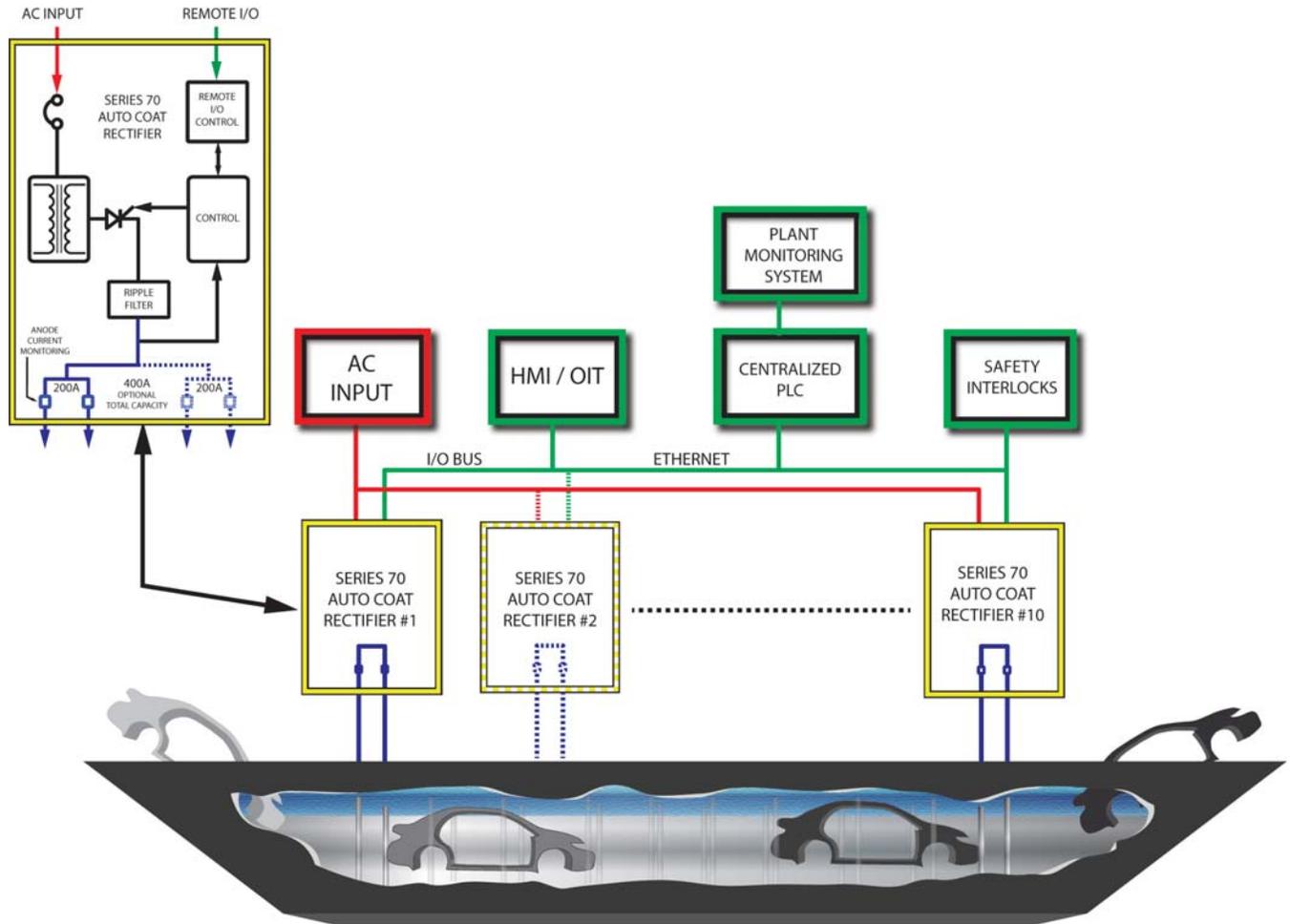
Batch Process

In a **batch process**, the rectifier output voltages are set based on the proximity of the part to the anodes. In a single rectifier configuration, the voltages set for the largest part can over-coat the smaller parts. When using a **MAC** system,

different anodes can be set to different voltages to eliminate any over- or under-coating of the smaller and difficult-to-coat parts. Voltages can be ramped up / down as needed, per the part's proximity to the anodes. Batch processes are

"cold entry" — voltages are therefore controlled and monitored by the PLC, which itself can be programmed and monitored via an "HMI / OIT" or through the plant monitoring system.

MAC System For Continuous Conveyor Automotive E-Coat Using Our “Series 70 AutoCoat” Modular Rectifiers



For the sake of illustration, we have only shown (10) ten rectifiers, each powering (2) two anodes. (Note that most automotive continuous conveyor e-coat lines will have more than (10) rectifiers.) Hard-wired safety interlocks are not shown here, but note that they are available.

Summary

A **Modular Anode Control (MAC)** rectifier system allows e-coat operators to “fine tune” the e-coat process to achieve optimum paint coverage and eliminate any over- or under-coating of car bodies or parts.

The **MAC** system is an alternative to the traditional 2- or 3- zone continuous conveyor process, and the single rectifier

configuration (often times with one “stand-by” rectifier) used in a batch process.

In a **MAC** system, all control and monitoring functions are performed by a centralized PLC. This PLC controls the DC output of each individual rectifier, allowing for a “hands off” approach to e-coating, even as different car body types or

various parts pass through the tank.

The DC output of each **MAC** rectifier is adjustable from 0V to 450V and rated for 200A or 400A. Dedicated outputs — up to (2) for 200A, (4) for 400A — are provided for easy anode connections.