

## ANODE CURRENT MONITORING

### AnodeMon™

Anode Current Monitoring for Metal Finishing Processes



#### Applications:

- Electrocoating
- Anodizing
- Other Metal Finishing Processes

## THE UNIQUE & PROVEN SOLUTION

### Experience, Quality, And Field Reliability

Controlled Power Company engineers and manufactures the industry's highest quality and most innovative **anode cell monitoring and distribution systems**. Capitalizing on over 50 years of expertise, this quality is reflected in the design, material, workmanship, and operating performance of each product we build. The result is a rugged and reliable system that will stand up to the rigors of 24 x 7 operation, even in harsh industrial environments.

Our products' durability and performance maximize end-user productivity and minimize downtime. If / when field service is necessary, Controlled Power Company will provide available parts and service for the life of each system we manufacture, which is often 20+ years!

Controlled Power Company is ISO 9001:2015 certified, assuring quality and customer satisfaction from order entry to system start up and beyond.

### OEM's & System Integrators

As a leading manufacturer of **anode cell current monitoring systems**, Trystar understands and strictly adheres to each OEM's and system integrator's specifications. A custom equipment design reflects job-specific requirements including PLC components, NEMA ratings, monitoring and controls, dimensions / footprint, and product weight.

Each system is designed and manufactured for simple installation, start-up, and service. Input and output terminations, component placement, and wiring connectivity are all configured to keep installation costs to a minimum, and to eliminate the need for any field customization during the installation process.

Trystar's staff of design and application engineers work together to make sure job requirements are satisfied. In addition, expertise is always on-hand to assist with future expansions, and help implement control improvements or monitoring enhancements.

### Customer Support & Field Service

All Trystar **anode cell current monitoring systems** are designed and manufactured to have a low MTTR (mean time to repair). Components and sub-assemblies can be easily field-tested, removed, and serviced without excessive and costly hours of maintenance and downtime.

Every product manufactured is backed by 24 x 7 customer support and service. Experienced, knowledgeable staff and technicians are familiar with e-coating and other metal finishing applications, and are ready to assist with service contracts, startup, training, and phone support. Replacement parts and components can be quickly and easily shipped to a customer's site. When requested, a factory technician is dispatched and can most-often be onsite within 24 hours.



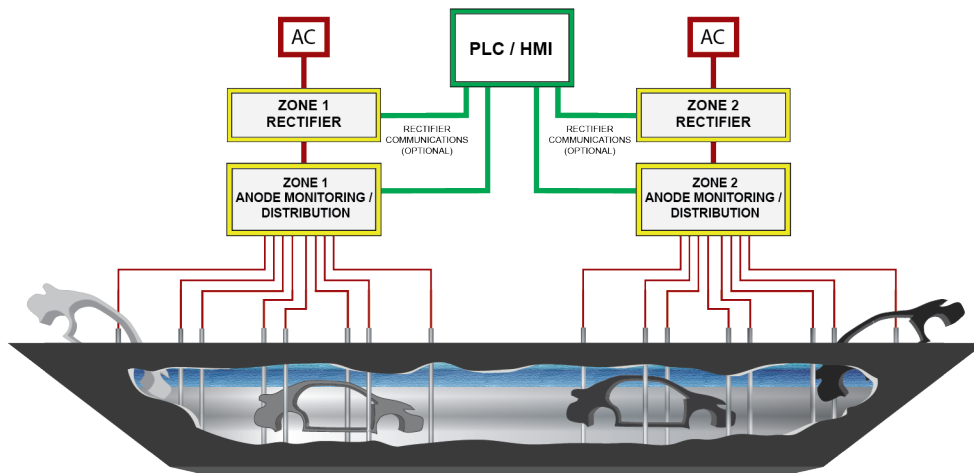
Photo courtesy of a Trystar customer.

## ANODEMON™ CONFIGURATIONS

**AnodeMon** is a PLC-based, anode cell current monitoring and distribution system for cathodic and anodic metal finishing systems such as e-coat and anodizing. Using its PLC-based architecture, **AnodeMon** gives the system operator real-time values of individual cell current during the finishing process. Each of these values are viewable on and stored in an HMI for further analysis and/or evaluating trends for system process efficiency and cell life. With the optional “**AnodeHealth**” software, **AnodeMon** can also project when an anode is near the end of its life, and can inform the user when maintenance should be performed. **AnodeMon** performs “Anode Current Monitoring” in two (2) distinct configurations: “With” and “Without” Electrical Distribution. See below for descriptions and illustrations of each configuration.

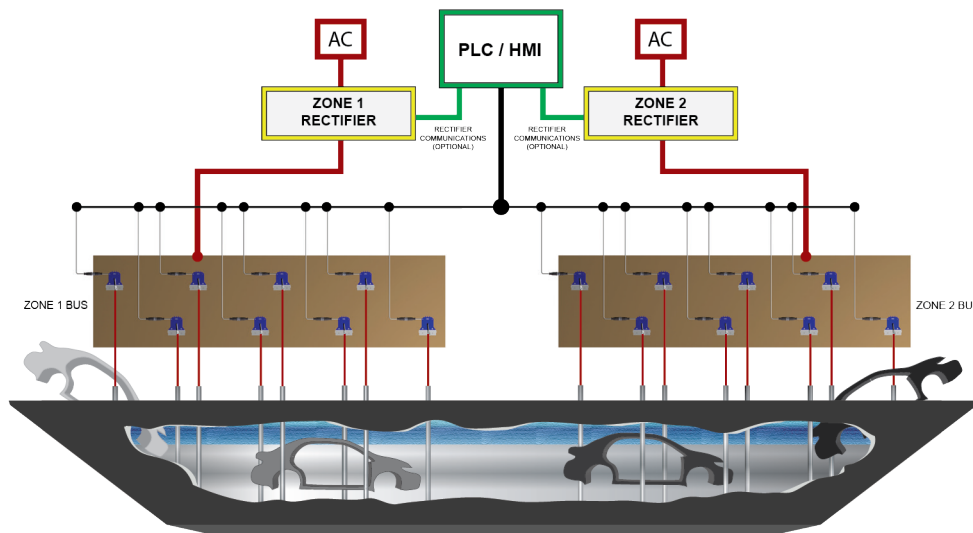
### Anode Current Monitoring With Electrical Distribution

For this configuration, the DC power from the rectifier is connected directly to the anode monitoring panel. The power connections for each anode are then individually connected to the panel. A main tank bus is not required for this configuration. In two-zone e-coat systems, there may be 2 main buses or 2 separate panels; this is customer preference. The anode monitoring panel contains all of the equipment necessary for monitoring the current, e.g., hall effect sensors, PLC, HMI, distributed I/O, fuses, diodes etc. The illustration below depicts this configuration in a two-zone e-coat system:



## Anode Current Monitoring Without Electrical Distribution (At Tank)

For this configuration, the DC power from the rectifier is connected directly to the main bus near the tank that the anodes connect to. The current monitoring sensors and blocking diodes (if required) are mounted to the tank bus, or near it. The only required power connections are the wires from the current sensor to the anode. The sensor wires are then run to the panel that contains the PLC, HMI, distributed I/O, and terminals. These sensor (or signal) wires have IP64, twist-lock connectors on them, for ease of installation. The illustration below depicts this configuration in a two-zone e-coat system:

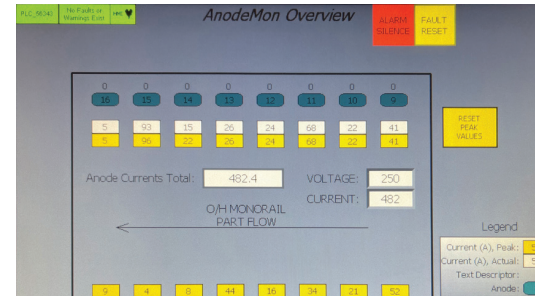


## FEATURES & OPTIONS

Capitalizing on our 50+ years of expertise in the metal finishing field, as well as inputs from our customers, we have designed and manufactured a product that incorporates all of the features and equipment that metal finishers have requested over the years.

### AnodeMon Standard Software Features

- Easy-to-read, on-screen current values for each anode
- Easy-to-read rectifier voltage values (if available)
- Logging of current and voltage values for analysis
- Downloadable (to USB drive) voltage and current values for graphing / analysis
- Optional, on-screen fuse blown monitoring
- On-screen voltage and current trending
- Programmable sampling rates
- Capability of monitoring hundreds of anodes



AnodeMon screen current values / tank.

### AnodeMon Software Options

- “AnodeHealth” anode life analysis tools
- HMI display of fuse blown alarms
- Rectifier control and monitoring
- Plant PLC integration and monitoring
- Customizable interface for specific requirements

### AnodeMon with DistributionStandard Hardware Features

- Hall-effect sensors for current monitoring
- Fuses
- On-board LED fuse blown indication
- Terminals for anode wire connections
- Programming port
- Laptop shelf
- All-copper bussing
- Top and bottom entry flexibility
- PLC and HMI
- \*Allen-Bradley PLC components

\* Other PLC options are available.

---

## AnodeMon with Distribution Optional Hardware Features

- Blocking diodes
- Panel meters
- Distributed I/O only
- NEMA 2
- Schneider PLC (cost savings)

## Key Benefits of Using the AnodeMon Cell Current Monitoring System

- Decreased part rejection from underperforming anodes
- Reduces untimely anode maintenance
- Capability to budget for anode replacement
- Analyzing an accurate graphic representation of anode performance
- Downloading and saving anode performance data
- Centralized control and monitoring of the rectifier and other plant equipment
- Reduction in rectifier voltage

“ANODEHEALTH”

In today’s e-coat paint systems, anode cells play a crucial role in the quality of the paint finish. As anodes age, they become less efficient at delivering proper throw power (voltage) and current to the parts being painted in the tank. This results in insufficiently and/or unevenly painted parts, excessive rectifier voltage, and dead spots in the tank. Some e-coat companies document individual cell currents over time to determine if anodes are declining in performance. However this is time-consuming and inefficient.

By contrast, we have an efficient, PLC-based solution. “AnodeHealth” is optional software that runs on a PLC / HMI system that is already running standard AnodeMon software. “AnodeHealth” uses six (6) different technical analyses to determine anode life, and subsequent service / replacement.

Peak Current Analysis

As an anode begins to age, the resistance of the anode increases and thus its ability to conduct current is reduced. “AnodeHealth” analyzes the peak current of each anode over time and when the peak current falls to a certain level, “AnodeHealth” informs the user that the anode requires service or replacement.

Amp-Hour Consumption Analysis

Anode life can be measured by the amount of current that flows through the anode over time. “AnodeHealth” features a resettable amp-hour counter to log the total amp-hours for each anode. When the counter reaches a defined number of amp-hours, the system alerts the user of this threshold limit and that the anode may need service or replacement.

Current Density Analysis

Anode life can be most-accurately measured by current density measurements over time. Anode manufacturers provide a life rating in hours at a specific current density. “AnodeHealth” monitors the amount of current over time, and performs current density calculations to estimate the remaining anode life. Upon reaching the current density hour threshold, “AnodeHealth” alerts the user that the anode should be serviced or replaced.

Anode Age Analysis

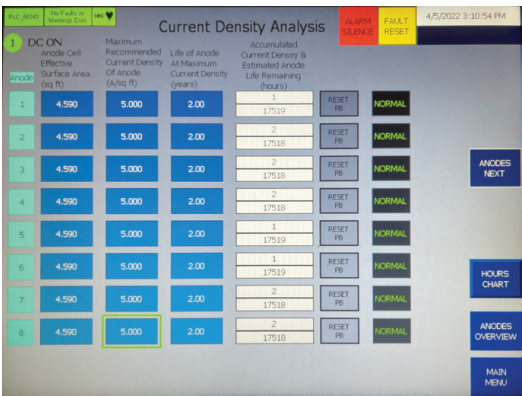
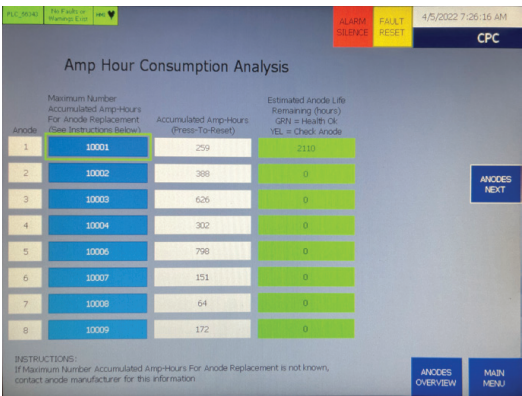
Many anode manufacturers determine anode life by age. Anode age is counted in either calendar time or “DC On” time. “AnodeHealth” uses a simple age analysis to determine when anodes need to be serviced. In the “AnodeHealth” software, a user enters a time period for each anode. When that time period expires, the HMI and/or PLC notifies the user that the anodes require service.

Current Draw Analysis

If an anode’s resistance increases more than an anode perpendicular to it, the current draw will not be equal between the two anodes. “AnodeHealth” compares the current draw with perpendicular anodes; and if one varies by an adjustable percentage, “AnodeHealth” informs the user that an anode requires inspection.

Anode Membrane Analysis

The membrane is another part of the anode that has a usable life span. Most



anode membranes have a fixed life rated in hours. **“AnodeHealth”** features a separate time counter for the anode membrane. This time counter can count in either calendar time hours or “DC On” hours. Once the timer expires, **“AnodeHealth”** informs the user that the membrane is at end of life and needs to be serviced.

### **Anode Rotation**

In continuous conveyor e-coat processes, the anodes in the entry zone of the tank usually wear faster than the anodes in the exit zone. Many e-coaters move the anodes in the front of the tank to the back, and move the anodes in the back to the front. This practice of “rotating” the anodes extends their life. **“AnodeHealth”** allows the user to reassign anodes in the **AnodeMon** software, in case they are rotated in the tank. All anode life and electrical data are preserved.



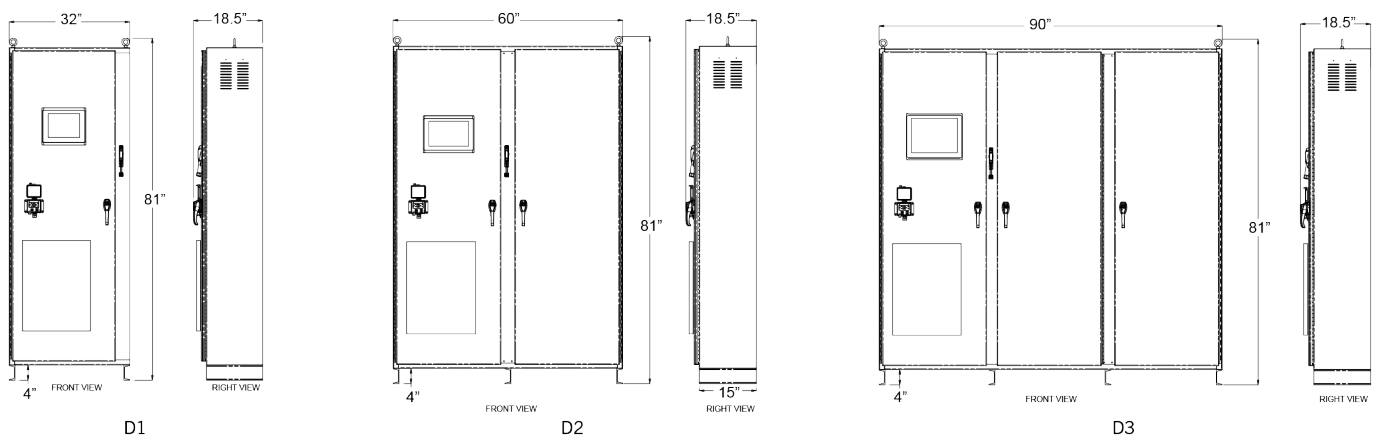
## SPECIFICATIONS & CABINET DIMENSIONS

### Specifications

- Enclosure: All steel, powder-coated, NEMA 1 (NEMA 2 Optional)
- DC Voltage Input / Output: 0 to 600VDC
- AC Input: 120V 60Hz (Standard), other voltages and frequencies available upon request
- Minimum Anode Capacity: 8
- Maximum Anode Capacity: Unlimited
- Ambient Temperature Rating: 0°C (32°F) to 45°C (104°F), 0°C (32°F) to 50°C (122°F) Optional
- Humidity: 95% non-condensing
- Storage: -20°C (-4°F) to 50°C (122°F)
- Reliability: 65,000+ hours MTBF
- Entry: Top or Bottom
- Cooling: Air-Cooled
- AC Over-Current Protection: Circuit Breaker
- DC Over-Current Protection: Fuses, Breakers (Optional)
- Standard Fuse Sizes: 50A, 100A (Other sizes available upon request)

### Cabinets

Anode Monitoring with Distribution only. For units without distribution, contact factory for dimensions and weights.



NUMBER OF ANODES MONI- TORED	WITHOUT DIS- TRIBUTION	8 to 16	24 to 40	48 to 64	72 to 80	OVER 80
Cabinet	D1	D1	D2	D3	D2 x 2 (back to back or side by side)	Configurations are flexible, consult factory for dimensions.
Weight	460 lbs	460 lbs	970 lbs	1475 lbs	1940 lbs	Consult factory

**Warranty:** Controlled Power Company guarantees the unit to be free from defects in material and workmanship for a period of (1) year following shipment from the factory.



TRYSTAR®