

Case Study



AMP realizes cutting-edge AI-powered sorting robots with high-speed EtherCAT

AMP™

AMP is a leader in AI-powered sortation for recycling automation. AMP builds and deploys technology to solve the central challenges of recycling - sort materials to achieve high-quality new base materials. AMP transforms the economics of the waste industry by making recycling more efficient, scalable, and sustainable.



AMP is modernizing and scaling the world's recycling infrastructure by applying AI-powered sortation to increase recycling rates and economically recover recyclables as raw materials for the global supply chain. AMP is headquartered in Colorado and has hundreds of deployments across North America, Asia, and Europe. AMP's deployments range from AI-enabled retrofitting of recycling solutions to the full design and operation of new turn-key recycling facilities.

Vac is an innovative product from AMC that harvests thin film, like plastic grocery bags, off conveyor belts at recycling facilities. Historically, thin film was considered a contaminant in recycling facilities because it is known to tangle downstream equipment and reduce the sorting efficiency of the line. Recently, however, it has also become a reclaimable commodity, offering additional incentives for its efficient sorting. AMP Vac utilizes a series of high-speed drives, motors, sensors, I/O, and safety systems to remove the thin film effectively and safely. To operate optimally, the advanced hardware systems in Vac demand an equally sophisticated communication system.

Design Challenge: Inadequate Communication

AMP initially faced significant design challenges with the servo systems used due to the limitations of the original communication protocol. AMP's first Vac prototype system, which was developed under significant time constraints, used servos communicating over Modbus RTU via a serial connection. AMP quickly realized that the communication rates of Modbus RTU were insufficient, which resulted in delayed movements, missed movements, and command drops. Furthermore, the baud rate of the communication protocol was not sufficient to measure the high-rate position of the system or capture data from numerous safety sensors. AMP's software engineering manager, Vin Taylor, described the initial situation: "It was just horrible. We couldn't communicate with [Vac] at the rate we wanted to."

There was a clearly defined need for a more robust and capable communication system to improve the reliability, functionality, and effectiveness of Vac's operation.

EtherCAT: The Fast and Reliable Communication Network

After facing significant initial design challenges and limitations due to an inadequate communication protocol, the AMP development team decided to upgrade to a more capable and robust communication protocol, even if it might be considered overkill for their needs. Thanks to its reputation as one of the fastest industrial communication protocols available, EtherCAT was identified as a suitable communication solution.



Public documentation, price, and responsiveness of your team were the three big standouts for acontis."

Vin Taylor

AMP's team also expressed that there was a desire to reduce the total number of protocols and peripheral devices used in the Vac system. While EtherCAT was initially explored to address the design challenges within the drive system, an added benefit of using EtherCAT was that the other subsystems, like I/O and safety, could now be consolidated under the same protocol. This unification is possible due to EtherCAT's open standard, which supports interoperability between thousands of devices from various vendors, ensuring integrators will never be limited to devices from a single manufacturer.



After that experience with Modbus RTU, we wanted to swing the pendulum the other way entirely. So, we felt like EtherCAT was the technology that would be the most reliable and would not have any issues with communication rate."

Vin Taylor

First steps with open source

AMP began transitioning from Modbus RTU to EtherCAT using an open-source EtherCAT Master, SOEM (Simple Open EtherCAT Master). Over the next four weeks, AMP developers made some progress and started to see the benefits of using EtherCAT in Vac ; however, they were also running into limitations presented by the open-source stack such as unsupported features, unsatisfactory technical support and documentation.

While there are several free, open-source EtherCAT master stacks available, such as SOEM, they are often limited in out-of-box feature support, documentation, and technical support. Especially in case of not fully featured software, this means significant effort for developers, as key features, such as full Mailbox communication and Distributed Clocks, must be implemented on their own.

While this might be feasible for EtherCAT experts, it can pose a significant challenge for many developers and can hinder focus on product development, putting development budgets and time-to-market at risk. This is especially true as these limitations can not just significantly increase development efforts and costs but might also result in a less robust communication and control system compared to a fully supported and maintained commercial solution like acontis' EC-Master.

Switch to acontis EC-Master allows Fast and Powerful EtherCAT Controller Implementation

After weeks of wrestling with the open-source EtherCAT Master, AMP began looking for a "more mature" EtherCAT offering in hopes of finding a solution that would limit unforeseen efforts and would allow them to fast-track the switch to EtherCAT. After researching commercial EtherCAT master solutions, the AMP team identified three options including acontis' EC-Master.

The team at AMP requested a free evaluation version of EC-Master and spent some time testing the solution against their project requirements and two other commercial solutions. The Vac developers were able to stand up a proof of concept quickly thanks to the comprehensive example applications and extensive documentation provided by acontis. Impressed by EC-Master's performance and high compatibility with their existing hardware, AMP decided to move forward with the acontis solution for use in the Vac system.

Results and Benefits for AMP Customers

The implementation of EC-Master resulted in significant performance improvements in the Vac system as well as reduced operational challenges, and improved system reliability. The integration of the I/O, sensor, and emergency stop systems into a single network reduced the complexity of the Vac system, resulting in a streamlined supply chain, simplified maintenance, and accelerated implementation processes. These improvements led to better thin film sorting quality, reduced downtime, and improved overall operational efficiency.

The AMP team highlights these benefits of acontis' EC-Master:

- Optimal performance
- Out-of-box support for mailbox protocols via acontis APIs
- Outstanding technical support
- Thorough product documentation and example applications

...resulting in highly relevant benefits for AMP:

- Drastically reduced occurrences of missed or dropped commands
- Eliminated development needs for required features (CoE)
- Improved operational efficiency
- Faster time to market

Conclusion

The partnership between AMP and acontis technologies exemplifies how the right technology solutions can dramatically improve industrial processes, solve complex design challenges, and maximize product performance. This collaboration not only addressed AMP's immediate issues but also set a path for future innovations in the recycling industry.

For those facing similar challenges in automation and robotics, acontis technologies offers world-class technology solutions that drive efficiency, inspire innovation, and are backed by top-notch technical and customer support.



Vin Taylor
Staff Robotics Software Engineer

“

We were trying to use SOEM. We pretty quickly ran into limitations there. We tried for maybe three weeks or a month on that before we saw that it's not well supported enough, it's not well documented enough.

We really were just running into brick walls. One of the major issues we were having with SOEM was that the CoE support was minimal. It provided an interface, but you still had to implement all the code behind the interface yourself, which was a major hurdle for us, so having to not build that was a payoff to go to acontis.”

“

After we signed up with acontis and started integrating EC-Master, it definitely went faster than with SOEM; no doubt about that. I was happy with the progress”

Vin Taylor’