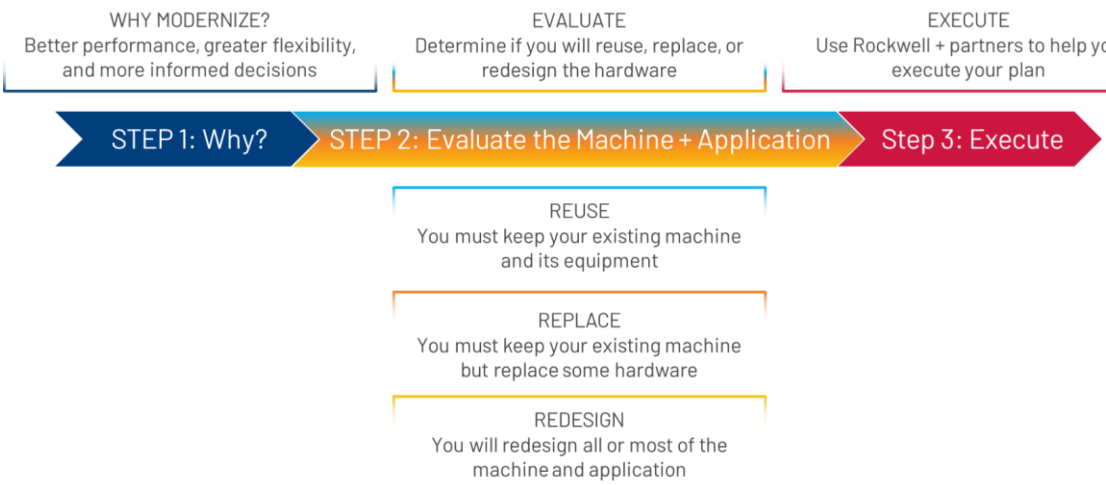
Rockwell Automation

Step Forward to Motion Modernization

Explore the steps along the modernization path.

Introduction – Steps in the Modernization Path

Our experience has shown that we can conceptualize the Modernization path in three steps, shown below. In some cases, Modernization includes migration of hardware.



Step 2 consists of three different paths depending on the machine, the application, and where you are in the modernization journey. This white paper will describe some of the key points and considerations that you can use to develop your strategy for Modernization. In general, the terms Modernization and migration are used interchangeably.

STEP 1 – Think about Modernization

Modernization – what does it mean to you? Why should you consider it?

Modernization is leveraging the latest technology for industrial applications. It typically results in performance improvements, increased productivity, and the ability to make more informed decisions. Justifying the risk and expense of control system upgrades is a challenge, however legacy systems operate in isolation and outdated equipment is costly to maintain.

It may seem that the threat of obsolescence is less daunting than upgrading. Today, the benefits of smart manufacturing may cause you to rethink that. To meet the demands of modern manufacturing, companies are looking to new technologies to optimize their processes and equip their people for higher performance and efficiency. Modern technologies highlighted in Industrial Internet of Things (IIoT) strategies are already helping forward-thinking manufacturers reap the benefits of Smart Manufacturing.

[Learn More About Smart Manufacturing and The Connected Enterprise®]

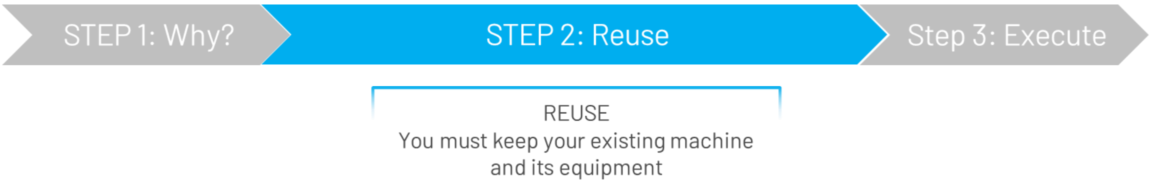
Compelling reasons to consider modernization include:

- Advancements in human and machine safety
- Flat (standard and singular) network architectures
- Device simplification
- Architecture scalability
- Security improvements
- Smarter machines that share more data and act on meaningful KPIs

Beyond the benefits outlined, in some instances, Modernization is born of necessity. Products' internal circuitry, components, and overall technology makes them obsolete over time. To illustrate, a number of servo drives in the Kinetix® portfolio are approaching End of Life status due to obsolescence of internal circuitry components.

For the most accurate and up-to-date lifecycle status of any Allen-Bradley® product, you can refer to the Product Lifecycle Status search tool.

STEP 2 – Evaluate your Application; Reuse



Evaluate your machine and application – what are you trying to do?

This path applies if you must keep your existing machine and its equipment.

REUSE (Implementation: easiest):	Engineering Time	ROI	Cost	Expertise
	low	low/med	low	low/med

Modernization comes in many forms. In this use case, you want to just 'update' the features of your machine and bring it up to present day functionality. For example, did you know that active Kinetix drives were introduced as early as 2014? You may consider updating the firmware of your Logix controller and drives to unlock the latest enhancements. These enhancements have many benefits that all fit into the Modernization evaluation such as higher machine throughput, improved sustainability, and increased machine uptime.

This is an inherent benefit to using *The Connected Enterprise®*, which includes integrated control systems, intelligent motor control, and smart devices – all designed to provide you scalable, future-proof technologies.

Some examples of enhancements that may be realized by upgrading firmware include:

- *Tuningless Technology*: used to accelerate commissioning, adapt to large and/or variable loads, and improve motion performance
- General Axis and Motion Improvements: including additional Motion Library tools and instructions; functions like Time based indexing and the multiplexed Motion Group,
- Robotic Functions: simplified control for common geometries
- Command Notch Filter: designed to remove visible oscillations and load vibrations – including slosh control, gantry sway and robot end-effector vibration
- *Virtual Torque Sensor*: designed to detect a product jam, an over tightened belt, a misalignment between the motor and load, and other mechanical issues.

STEP 2 – Evaluate your Application; Replace

STEP 1: Why? | **STEP 2: Replace** | Step 3: Execute

REPLACE
You must keep your existing machine
but replace some hardware

Evaluate your machine and application – what are you trying to do?

This path applies if you must keep your existing machine but will replace some hardware.

REPLACE (Implementation: medium):	Engineering Time	ROI	Cost	Expertise
	med	med	low/med	med

In this use case, you might consider a small or even a small to medium retrofit.

A small retrofit would include keeping most of the hardware while replacing a few devices. Use this strategy to minimize the effort to modernize the machine. Centralized devices like controllers and network architectures would likely be maintained, whereas end-devices, like drives and IO systems, would be replaced.

A small to medium retrofit would include keeping some critical hardware, like the controller and software, and changing the drive and network technology.

This is a good time to think about new features and to determine the best "fit" for the device replacement.

Consider a small retrofit example in which the drives will be replaced, but the motors will not. It is helpful to consider the following guidance when migrating to an "Active Status" drive:

- Is there a comparable drive in terms of specifications (ex. current, voltage, dimensions, etc.)?
- Are the features of the current and replacement drive comparable (or better)?
- Do both drives have the same environment and IP Ratings (where is the drive physically located and how is it being used)?

Keep in mind that Rockwell Automation has migration and selection guides that help you determine the suitability of a new drive system for your machine.

Next, consider examples in which the application uses outdated technology for:

Driving Mechanisms and Actuators (air, hydraulic, electric, etc.). These components usually have dependencies on the machine and can require an evaluation of the replacement drive sizing requirements. However, you can realize meaningful energy savings and application flexibility by converting from pneumatic systems to electric, for example. Similarly, you can reduce the environmental and maintenance effort by replacing hydraulic systems with electric.

"Black Box" or specialized controllers. Specialized controllers often present challenges with support and spares, which means uptime can be a challenge. Documentation for these devices may be sparse, so you must be diligent in understanding the features and functions that these controllers use in your application. Be sure that the planned migration solution is a suitable replacement.

Drives. Determine the status of your existing devices. Take some time to understand the features your device has and further, what features are being used. If necessary, you may be required to replace both the drives and actuators. This is an opportunity to future-proof and improve the machine.

STEP 2 – Evaluate your Application; Redesign

STEP 1: Why? | STEP 2: Redesign | Step 3: Execute

REDESIGN
You will redesign all or most of the machine and application

Evaluate your machine and application – what are you trying to do?

This path applies if you have decided to redesign your existing machine and migrate hardware.

REDESIGN (Implementation: harder):	Engineering Time	ROI	Cost	Expertise
	high	high	med/high	med

In this use case, you might consider a large retrofit that includes a part or entire redesign of the machine.

A retrofit would consist of keeping certain devices while replacing others. If hardware obsolescence impacts your machine, this can impact the feasibility of a retrofit. When the machine is outdated or cannot be retrofitted, a redesign of part or the entire machine can be required.

Although a redesign may seem complex – it can lead to many compelling improvements to justify the effort. Take this opportunity to plan and decide if the modernization plan should use a phased approach or if it's tackled in its entirety; move at *YOUR* pace.

Redesigning presents a unique opportunity to evaluate how the machine can benefit from new features. Examining a part, or all, of your machine can uncover many opportunities for improvements in flexibility, productivity, and maintainability.

Consider the following areas that can be examined in the redesign process:

Mechanical Design. Modifying and changing the mechanical design can lead to higher production, a smaller footprint, improved human interaction, and increases in regulatory compliance, just to name a few benefits. For example, the demand for increasing numbers of SKUs requires faster turnaround time and more machine flexibility; manufacturers must run smaller batches and often change recipes or format. Today's solutions use advanced technology like robotics, Independent Cart Technology (ICT), and analytics to design and to deploy these flexible solutions.

Application. New additions to the machine may improve the overall application, such as infeed/outfeed conveyor synchronization to another machine, for example. By evaluating the application requirements (ex. small, medium, large machine type) you can optimize control architectures and potentially reduce costs by selecting the right "sized" product within the portfolio.

Electrical Design. There are many benefits that can be uncovered in the electrical design.

> *Drive technologies* – Can the application benefit from leveraging servo, motion control, variable-frequency drives, or both? Are there existing architectures that you must keep or work with? Are there other machines that the machine must interface with?
>
> *Bus Architectures* – Does the application lend itself to mixed product architectures? Can the design leverage multi-bus or standalone architectures?
>
> *Communication Layer* – Can physical wiring be replaced with Ethernet/IP communications? Can the network be completely "flattened" to use standard, unmodified Ethernet/IP communication?
>
> *Controller Layer* – Will the design involve replacing or working with an existing controller? Many advantages can be achieved by replacing the controller (ex. ease of integration with the redesign and with other machines).
>
> *Operating Voltage* – Can the availability and quality of the operating voltage be evaluated and considered?

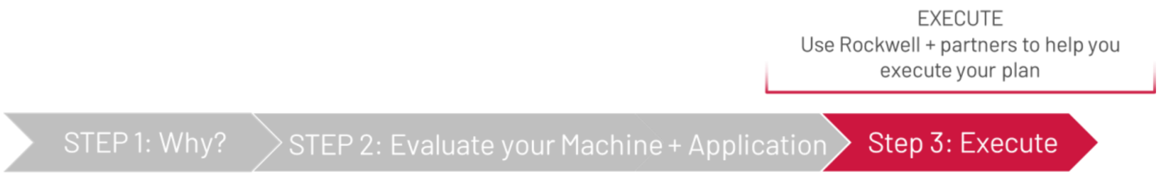
Safety Requirements. Smarter, integrated safety control offers many benefits as opposed to traditional, hardwired safety. Consider replacing individual wiring to many devices with an Ethernet/IP based solution. Has the scope of safety requirements changed on this machine or within the plant? Is a risk assessment now required? The Rockwell Automation Services team can help.

Functional Control. Benefits can be uncovered by replacing physical components with electronic functions (Cams, Glue Dispensers, pumps, etc.). For example, by designing an integrated system, it's possible to achieve coordination between different parts of the machine, which may mean increased throughput, simplified operator control, and even remote access and support. Modern offerings include many popular programming languages, and uptime can be increased by leveraging modern features and capabilities, such as tuningless technology.

Data. Modern, integrated systems bring many benefits regarding contextualized data which yield meaningful operations metrics. These systems can pass data among all business systems and can even be an opportunity for software-based control. By implementing a modern system, you can be sure that the machine uses the latest security capabilities for industrial automation applications.

Sustainability. Motion systems that are designed to use active power supplies can regenerate power back to the line and recoup energy that can be used by other devices. By converting pneumatic systems to electric, you can improve the design by reducing the compressor energy consumption and simplifying the associated infrastructure. Modern systems include considerations for the environmental impact of using fluids or excessive electricity. They are also including decisions that include environmentally friendly materials for production.

STEP 3 – Execute Your Plan



Execute your plan – move at *YOUR* pace.

Modernization comes in many forms. Once you develop your plan, you'll then execute it. Use our expertise and knowledge to help. Rockwell Automation has an extensive ecosystem to support your plan. Be sure that your plan is executed at YOUR pace.

In Summary

Knowledge is power. This white paper is intended to provide you some key points to consider with Modernization. Although your Modernization journey may seem daunting, the resulting impact is compelling. Modernization can yield a future-proof machine that will be productive, sustainable, and well equipped to provide meaningful data to your enterprise. Use our expertise and resources to help you along the path to Modernization.

Resources

Helpful links for further information:

Product Lifecycle Status

Product Compatibility Download Center (PCDC)

Legacy Support and Lifecycle Extension

Consulting and Engineering

Modernization Tools

Integrated Architecture® Builder

Motion Analyzer Software

Popular Archtiecture Drawings

Integrated Motion on Ethernet/IP & SERCOS Analysis and Comparison

SFAT (Safety Function Application Techniques) – applying devices to safety environments

Safety Automation Builder® – streamline safety system development

Integrated Architecture® Recommended Literature

Controllers Selection Guide

Kinetix Motion Selection Guide

KNX-TD001, Kinetix Rotary Motion Specifications Technical Data

KNX-TD002, Kinetix Linear Motion Specifications Technical Data

KNX-TD003, Kinetix 5700, 5500, 5300, and 5100 Servo Drives Specifications Technical Data

KNX-TD004, Kinetix Rotary and Linear Motion Cable Specifications Technical Data

KNX-TD005, Kinetix 3/300/350/2000/6000/6200/6500/7000 Servo Drives Specifications

MOTION-AT005, Motion System Tuning Application Technique

IA-AT003, Integrated Architecture and CIP Sync™ Configuration Application Technique

MOTION-UM001, SERCOS and Analog Motion Configuration and Startup User Manual

Kinetix Servo Drive Migration Guides

Kinetix Motion Control Application Techniques

Kinetix Motion Control White Papers

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