Automation & Control Planning Guide

Making Informed Decisions About Your Installed Equipment

Make the most of your energy℠

Schneider Electric

Introduction

This guide has been assembled for customers, like you, with an installed base of Schneider Electric equipment, including programmable logic controllers. This tool is designed to provide a structure and framework for making decisions consistent with your intentions for your equipment.

Whether your goal is to prolong the life of the installed automation equipment, upgrade to Schneider Electric brand Modicon® PLC systems or to plan for future process changes/ expansions, we can help. With use of this tool and the help of your Schneider Electric certified installed base consultant, you can answer questions such as:

- What are the associated maintenance costs of keeping older automation equipment in service?
- In what ways can these maintenance costs be minimized?
- Besides maintenance costs, what other factors should I consider in deciding if I should upgrade my equipment or sustain operations with my existing equipment?
- How easily can my engineering and maintenance organizations adapt to newer technologies?
- If I do upgrade, can I spread the associated costs and scheduled downtime over several months or years, so that I can better manage the risks?

Following each section of this guide is a sample of the type of information your installed base consultant will collect during the first of a two-step consultation service. You can use these samples to collect data in preparation for your meeting or to determine who should participate in the meeting. With the information collected within these exercises, Schneider Electric will compile a comprehensive personalized report, which will help clarify your current state and outline your options – positioning you to make effective decisions now, for the future of your operations.

Sample Exercise A: Business Profile

1. Who is our primary contact at your facility for this process?
2. What are your top three operational concerns?
3. What vendors and models of the following equipment types are used at your facility, and what is the approximate quantity of each?
   - Programmable logic controllers (PLCs)
   - Human machine interfaces (HMIs)
   - Variable frequency (AC) drives
   - Servo drives
   - SCADA software

History of the Modicon PLC

In 1969, Bedford Associates (Bedford, MA) invented a specialized computer intended to make America's industrial base more competitive in an ever-expanding global market. The original **MO**dular **DI**gital **CON**troller, or Modicon, featured a rugged design, modular inputs/outputs (I/0) to connect easily to a wide range of field devices and a revolutionary programming language, called Ladder Logic, that simulated the behavior of the relay contacts and coils that were already familiar to industrial process engineers. This new technology ushered in a huge advancement in the field of industrial automation, keeping manufacturing profit margins up and products affordable, and directly contributing to the success of the U.S. as the world's leading industrial economy.

Today, what's commonly called the programmable logic controller can be found everywhere: from chicken farms to amusement parks, factory floors to wastewater plants, and railroad stations to battleships. Many of these existing applications are based on the widely popular Modicon 984 and Modicon Compact 984 PLC platforms; though the model 984 is now decades old, this system still provides its users with reliable operation.

Through the acquisitions of Modicon, Telemecanique® and Square D® companies, Schneider Electric has brought together the best of three product lines into a single, cohesive offer supported by a global network of field offices and distributor partners. This approach empowers our customers with the ability to maintain their legacy systems with world-class services, while simplifying the transition to the latest automation technology as business conditions require.

Consistent with the Modicon product line's 40+ year tradition of innovation and high quality, Schneider Electric has continued in its evolution of PLC technology. These advancements include the adoption of advanced processors, function block programming and integrated Ethernet with embedded web servers. Today's flagship products are sold under the Modicon Quantum™, Modicon Momentum™, Modicon Premium™ and Modicon M340™ PLCs – and represent the industry's highest achievements toward making automated processes easier to maintain, more efficient and more affordable to purchase and to integrate.

40+

Schneider Electric has continued in its evolution of PLC technology advancements, as well as keeping consistent with the Modicon product line's 40+ year tradition of innovation and high quality.

Timeline

Modicon 484

CPU Part Number Series:
AS-C484-xxx

Actively Sold:
1977 – 1983

Current Status:
Not for active sale. Full repair/ refurbishment may be available for some CPUs; some refurbished exchange units may be available

Support Remote I/O Platforms:
Local I/O only;
J471 I/O expander (local)

Networks Supported:
None; up to 10 channels local

Programmed with:
P190 programmer

Max. number of digital I/Os:
256 I/O

Max. number of analog I/Os:
Not to exceed the remainder of the 256 I/O from digital

Modicon 584

CPU Part Number Series:
AS-584A-xxx; AS-584M-xxx; AS-584L-xxx

Actively Sold:
1979 – 1984

Current Status:
Not for active sale. Full repair/ refurbishment may be available for some CPUs; some refurbished exchange units may be available

Support Remote I/O Platforms:
S901 500, 200 and 800 Series I/O support

Networks Supported:
Modbus®/ASCII, S901 or S908 communications with upgrades up to 32 remote channels

Programmed with:
Modsoft®, ProWORX® Plus/NxT/32 software

Max. number of digital I/Os:
Each channel supports a max. of 128 I/O. 200 series 16 discrete I/O modules with 16 points. 500 series channel support 64 discrete I/O modules 4 points. 800 series 128 I/O points

Max. number of analog I/Os:
See above; can not exceed max. for any of the series of I/O

Modicon 984 Chassis Mount

CPU Part Number Series:
P1-984X-008; Px-984A-xxx; Px-984B-xxx

Actively Sold:
1985 – 1999

Current Status:
Not for active sale. Full repair/ refurbishment may be available for some CPUs; some refurbished exchange units may be available

Support Remote I/O Platforms:
200, 500 and 800 Series

Networks Supported:
Modbus, Modbus Plus™ communications

Programmed with:
ProWORX Plus/NxT/32 and Modsoft software

Max. number of digital I/Os:
8192 any mix

Max. number of analog I/Os:
2048 I/O

Modicon 984 Slot Mount

CPU Part Number Series:
PC-E984-3xx; PC-D984-xxx; PC-K984-xxx

Actively Sold:
1987 – 2006

Current Status:
Not for active sale. Full repair/ refurbishment may be available for some CPUs; some refurbished exchange units may be available

Support Remote I/O Platforms:
200, 500 and 800 Series

Networks Supported:
Modbus, Modbus Plus communications

Programmed with:
ProWORX Plus/NxT/32 and Modsoft software

Max. number of digital I/Os:
16,384 I/16,385 O

Max. number of analog I/Os:
1088 I/O

Modicon Compact 984

CPU Part Number Series:
PC-A984-xxx; PC-E984-2xx

Actively Sold:
1991 – 2007

Current Status:
Not for active sale. Full repair/ refurbishment may be available for some CPUs; some refurbished exchange units may be available

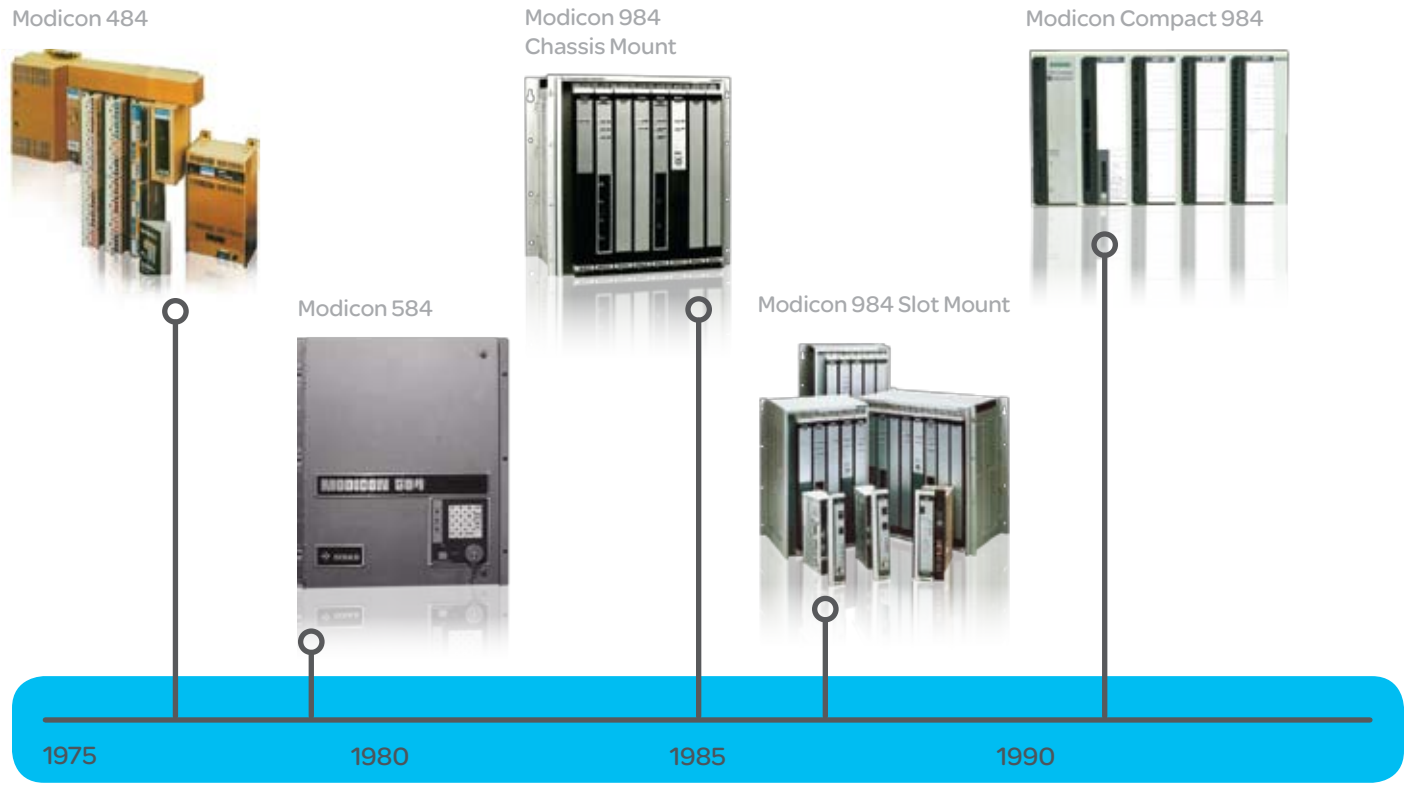
Support Remote I/O Platforms:
I/O bus

Networks Supported:
Modbus Plus, Interbus S communications

Programmed with:
Modsoft, ProWORX Plus/NxT/32, Concept™ (common platform only) software

Max. number of digital I/Os:
256 max. discrete + register I/O up to total of 32 words in/out 285 up to 512 words in and 512 out

Max. number of analog I/Os:
Not to exceed the remainder of the 256 I/O from digital



Sample Exercise B: Current Inventory

1. Specific quantity of each Modicon PLC model employed in your plant or process

Modicon Micro

CPU Part Number Series:
110CPU311xx; 110CPU411xx; 110CPU512xx; 110CPU612xx

Actively Sold:
1993 – 2006

Current Status:
Not for active sale. Full repair/refurbishment may be available for some CPUs; some refurbished exchange units may be available

Support Remote I/O Platforms:
Local I/O only up to 4 racks, also parent child configuration

Networks Supported:
Modbus and ASCII communications

Programmed with:
Modsoft, ProWORX Plus/ NxT/32 software

Max. number of digital I/Os:
Built in fixed I/O 16 I/12 O; expandable with Compact I/O up to 4 racks

Max. number of analog I/Os:
4 I/ 2 O

Modicon Quantum

CPU Part Number Series:
140CPUxxxxx

Actively Sold:
1994 to present

Current Status:
Active sale. Full repair/refurbishment available for all CPUs.

Support Remote I/O Platforms:
Up to 32 remote drops

Networks Supported:
Ethernet, Modbus, Modbus Plus, RTU, ASCII, RIO, Profibus, Interbus S communications

Programmed with:
ProWORX 32, Concept, Unity™ software

Max. number of digital I/Os:
2048 I/O words in/2048 I/O words out

Max. number of analog I/Os:
2048 I/O words in/2048 I/O words out

Modicon Premium

CPU Part Number Series:
TPCX57xxxx; TSXP57xxxx

Actively Sold:
1998 to present

Current Status:
Active sale. Full repair/refurbishment available for all CPUs

Support Remote I/O Platforms:
FIPIO

Networks Supported:
Ethernet, Modbus Plus, Modbus, Fipway, ASi, CANopen, Profibus, Interbus, Unitelway communications

Programmed with:
PL7 or Unity software

Max. number of digital I/Os:
2048 in rack

Max. number of analog I/Os:
512 in rack

Modicon Momentum

CPU Part Number Series:
171CCC7xxxx; 171CCS7xxxx; 171CCC9xxxx

Actively Sold:
1998 to present

Current Status:
Active sale. Full repair/refurbishment available for all CPUs

Support Remote I/O Platforms:
I/O bus

Networks Supported:
Modbus Plus, MBTCPIP, Profibus, DeviceNet, FIPIO, IObus communications

Programmed with:
ProWORX, Concept software

Max. number of digital I/Os:
8192 I/O (A total of 8192 bits can be configured for discrete and analog I/O, any mix up to the stated limits)

Max. number of analog I/Os:
26,048 I/O (A total of 26,048 words can be configured for discrete and analog I/O, any mix up to the stated limits)

Modicon M340

CPU Part Number Series:
BMXP341000, BMXP342010, BMXP342020, BMXP342030

Actively Sold:
August 2007 to present

Current Status:
Active sale. Full repair/refurbishment available for all CPUs

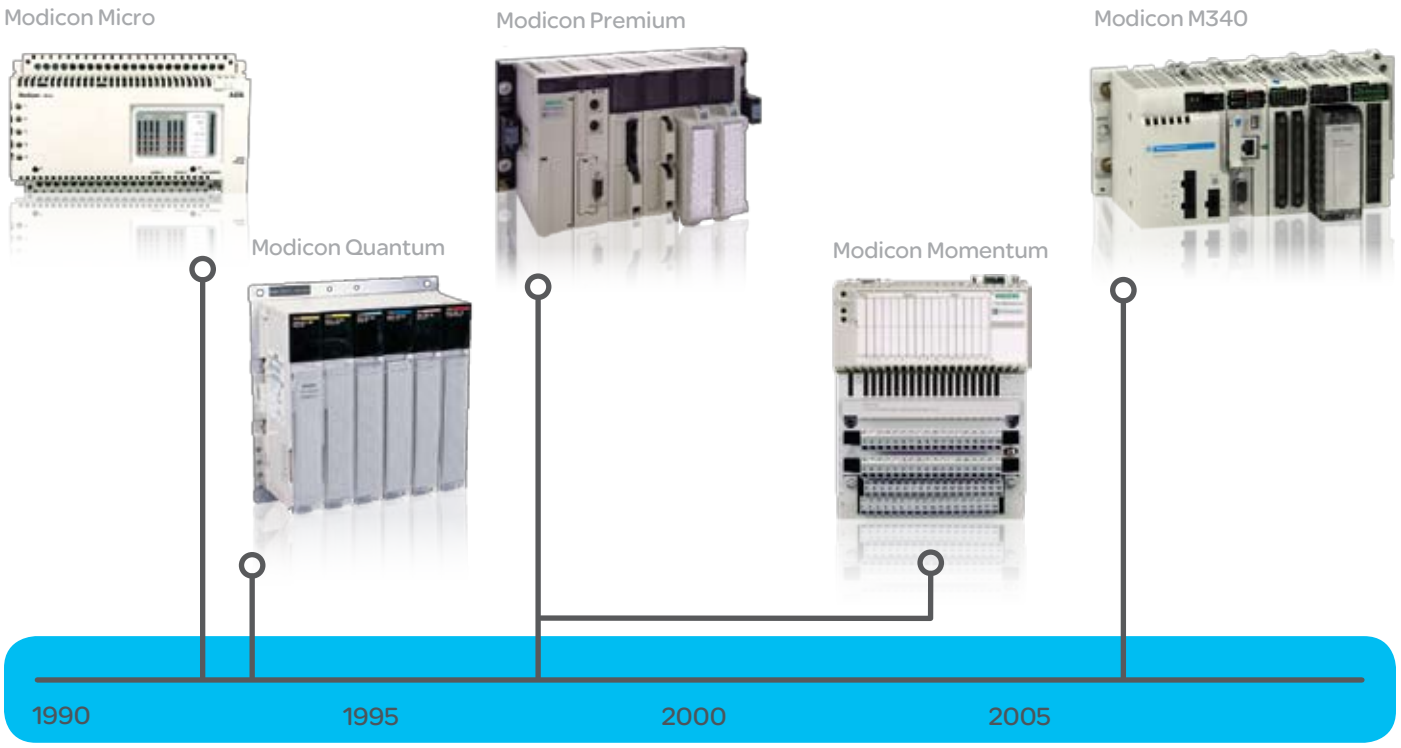
Support Remote I/O Platforms:
No

Networks Supported:
CanOpen, Ethernet, Modbus communications

Programmed with:
Unity V3.0 software

Max. number of digital I/Os:
1024 I/O words (BMXP342xxx)

Max. number of analog I/Os:
256 I/O words (BMXP342xxx)



History of the IEC Standards

Throughout most of the history of industrial automation, the programming interface of each PLC was vendor-specific; that is, a programmer or maintenance specialist of a Modicon PLC system was unlikely to be as efficient on another company's platform, and vice versa. This caused most end users to "standardize" on one brand or another – rarely would you find multiple PLC brands in a single facility. In order to allow for more flexibility in selection of a PLC vendor, a consortium of industrial customers established the IEC 61131 programming standards in 1993. These IEC standards, which most major PLC manufacturers now comply with, significantly reduce the barriers for a customer to employ the best-in-class automation architecture for a given application. Now, it's common to see automation products from multiple manufacturers in a single facility or process, all programmed with the common look, feel and functionality of the IEC standards.

1993 Industrial customers established the IEC 61131 programming standards in 1993.

Decision Criteria

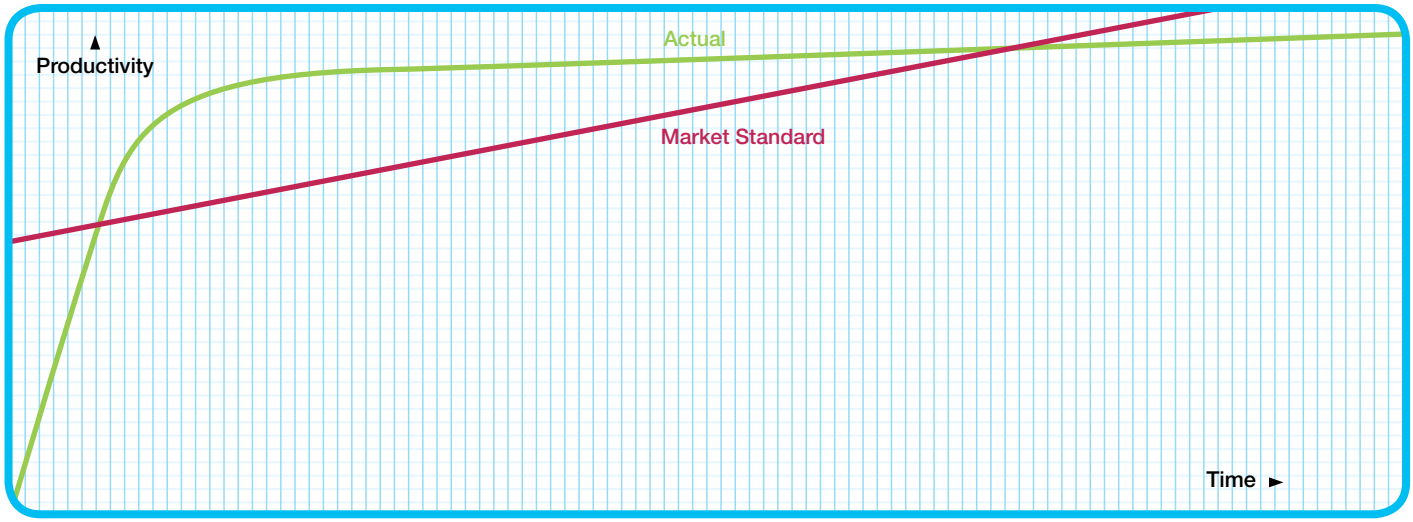
There are four primary considerations that industrial customers cite when formulating plans for the future of their automated plant or process:

1. Process efficiency and resource utilization
2. Maintenance costs
3. Process modifications and expansions
4. Safety and security

1 Process efficiency resource utilization

In its early stages, an industrial process exhibits tremendous gains in productivity as new equipment is employed, information systems are integrated, startup problems are resolved and personnel become efficient at their new jobs. Eventually, the rate of productivity will level off, as the focus shifts towards incremental cost reduction and process flow improvement.

Initially, the payback against the "market standard" benchmark for productivity is positive, as the modern plant or process is able to offer a return on investment. As the process ages, however, the productivity of the market becomes higher than that of the process, to the point where incremental efficiency gains may not be enough to stay competitive.



A plant's effort to increase productivity at a market standard rate could be limited by several factors:

Capacity of equipment: existing machines originally designed for a certain throughput may need to undergo significant redesign or may even need to be replaced to make an impact on efficiency.

Manual troubleshooting: older production systems need more time to recover from unscheduled downtime than newer plants that may employ self-diagnostic and preventative maintenance technologies.

Inefficient level of spares inventory: as systems age, the right mix of spare production equipment becomes critical. Too much inventory drives up costs, while too little creates downtime risk.

Flexibility of engineering and service personnel: incremental expansions and modifications may employ a mixture of various pieces of equipment from several different vendors. This could have a negative impact on the flexibility of maintenance personnel and controls engineers that service the entire operation.

Sample Exercise C1: Production Rate

1. Target and actual production rate for entire facility.
2. Total operating hours per year, first shift and other shifts.

Sample Exercise C2: Lean Manufacturing Technologies

1. What process do you use to dispatch maintenance personnel?
2. How effective is this process?

Sample Exercise C3: Spares Assessment

1. How do you manage your spare parts?
2. What is your average inventory turnover, in parts per year, of the device types such as programmable logic controllers (PLCs), human machine interfaces (HMIs), variable frequency (AC) drives, or servo drives.

Sample Exercise C4: Adaptability of Personnel

1. What is the size of your maintenance and engineering staff?
2. Their average years of experience?
3. How much of this experience is with IEC or related programming and diagnostics?

2 Maintenance costs

Electronic products from **any** manufacturer that were manufactured in the ’80s and early ’90s are based on components, such as memory chips and microprocessors, which are no longer available on the open market. While spare parts production is maintained with salvage equipment, last-time buys, and discrete redesigns, future indefinite supply of these components cannot be assured. This reduced availability has a direct impact on maintenance costs. Moving to a platform that uses modern electronic technologies can significantly reduce the costs of spare parts and extend the working life of the process or machine.

Sample Exercise D: Potential Maintenance Cost of Sustaining Legacy Equipment

1. What is the cost per hour of downtime, both in terms of maintenance labor, as well as in lost production?

3 Process modifications and expansions

If a process or machine needs to be functionally modified or expanded, doing so with a legacy PLC platform will likely add costs and complexity:

- Older PLC platforms may not be able to interface with today’s high performance networks without expensive bridges and gateways.
- Buying additional racks, I/O cards, CPUs and other accessories for an obsolete product line may be cost-prohibitive.
- Adding functionality to a decades-old ladder logic program, without a negative impact on current performance, can require significant engineering time and specialized talent.

Exercise E is intended to assess the degree that a plant or process will undergo modifications for reasons other than maintenance costs.

Sample Exercise E: Non-Financial Motivators

1. Weighted judgments on specific motivators that are difficult to quantify, such as:
   - Is your industry growing?
   - Is your company growing within your industry?
   - Is your process sensitive to environmental considerations?
   - Do startups and line changes need to be performed more quickly?

4 Safety and security

Today’s business climate demands attention to serious safety and security threats such as terrorism, identity theft, workplace accidents, industrial sabotage, environmental and product liability, public safety, process traceability, and natural disasters. With proper planning and design of safeguards, the risks and recovery costs of these events can be minimized.

Sample Exercise F: Safety and Security Assessment

1. Which plant safety standards are you required to comply with?
2. Select among listed NFPA-70E requirements those you already meet today.

Incremental Upgrade Strategy

If your intention, either long- or short-term, is to upgrade your automation equipment, based on process efficiency, maintenance costs, expansion plans or security concerns, you have several options to consider:

- Should you upgrade the processor and keep the same software?
- If you upgrade the software, which platform should you use?
- What changes are necessary to the I/O architecture?
- What accommodations should be made for network connectivity?
- What technical attributes of a new platform would you benefit most from?
- What is the optimum upgrade schedule?
- How do you manage budget constraints?
- How can downtime be minimized during the changeover?

The answers to all of these questions depend on the information you will provide in your consultation with your installed base consultant, plus your assessment of the value that comes from upgrading specific components in your automation systems.

Exercise G will help to better qualify the recommendations in your personalized report.

Sample Exercise G: Benefit Assessments

1 Determine how important each of the following benefits are to you, in considering an upgrade of your automation equipment:
   - Increased system performance: speed, memory capacity, etc.
   - Labor versatility: diagnostic tools, intuitive programming environment, etc.
   - System flexibility: communication networks, I/O selection, etc.

Looking ahead

It's never too soon to start planning for the ongoing success of your operations. Take the first step and meet with your installed base consultant to complete the in-depth interview of your current situation and future objectives. You will then receive your personalized, comprehensive report, upon which you can base sound business decisions for your company's future.

Put our experience to work for you

For more information, contact your local Schneider Electric sales representative, automation distributor, or visit us online at http://www.schneider-electric.us

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