

# Automation System Questionnaire and Checklist

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# I. Questionnaire – Should I Automate?

## A. Which Tool do I Need?

This questionnaire has been developed to assist you with the assessment of whether you wish to automate, and if so, how to select the best system for your situation. We have tried to provide non-biased questions and answers that will lead you to the best system for your needs, whether it is the Confirmed Automation System or a system provided by one of our competitors.

### 1. Why do you want to automate?

Answering this question may be the most critical. Benefits of automation include:

- reduction of manpower
- improved productivity from your equipment
- faster equipment operation,
- consistency of operation,
- improved quality of production,
- ability to control to levels that would be unachievable with manual control,
- ability to operate during non-standard hours,
- alarming
- automated data collection from your equipment

Figure out which of these goals apply to your situation. If you are just looking for a monitoring or alarming system, your installation will be very different that full control system.

### 2. Fundamental Features

Automation systems can include the following fundamental features. Within each of these items, there are many details, but the fundamental features identify the main feature sets that can be provided with automation systems. Which of the fundamental features do you need?

- Automatic operation of equipment with user configured program rules
- Control using schedules, which provide more capability than standard start and stop times
- Control using inputs and outputs
- Interface screen to watch equipment operation. This is often called an MMI or HMI screen.
- Manual control of equipment from the automation system
- Simplicity of setup (see below)
- Remote Control from the Internet
- Alarming
  - On the interface screen
  - By email
  - By telephone
- Reporting

### 3. Inputs and Outputs

Inputs are the places where you connect devices such as instruments and sensors. A temperature sensor or level sensor would be a typical input. Outputs are the places where you connect devices that you want your automation system to control. A light would be connected to an output, so your system can turn the light on or off.

### 4. Analog and Discrete

Inputs and outputs can be analog, which means that the signal is variable. This includes signals such as temperature, speed, percent full or any variable measure. Discrete inputs or outputs can have one of only two values. Usually ON or OFF. Lights in a room are a typical discrete value.

Analog values are normally much more expensive than discrete values. For level sensors, a level switch is a discrete point, and this is less expensive than a level transmitter which will provide a continually variable level signal. The sensors that provide analog signal are usually more expensive, and the module to read the analog data are also generally more expensive.

### 5. Number of points

The number of points included with the automation system is important. Use the following table to determine your needs. Note that adding spares can be expensive initially, but as your business grows, and your experience with automation, you will be surprised at how many devices can be included. It is recommended to add at least 10 to 20% spares on the initial installation. Also, if there is a type of point that you do not have in your system, check whether you may wish to add one or two for future additions.

Type of Point	Number	Spares	Total
Discrete Input			
Analog Input			
Discrete Output			
Analog Output			

### 6. Types of points

The types of devices to which you are connecting should be identified. Discrete inputs and outputs include DC and AC devices. Outputs will include electronic or relay outputs, with relay outputs varying from 5 to 240 VAC. Analog devices will include 0–10 VDC and 4–20 mA devices and RTD for temperature measurement.

The complexity and quantities of devices that are available should be studied carefully. An electrician should be consulted to determine what types of inputs and outputs your

device will need. Sometimes your device signals can be modified to suit the types of input and output connections required by the automation system you select.

## **7. Remote Operation**

Monitoring and operation of your equipment over the Internet can be a valuable asset. Check whether Internet controls are available and what these controls actually do. Will you be able to see your equipment operation, watch the sensor values and equipment status, and control your equipment? Can the program configuration be changed over the Internet?

Remember, if you get an alarm, you may wish to change your program rules or operate your equipment manually over the Internet to deal with the alarm situation.

## **8. Custom system for your needs?**

Face it, the best system for your operation is one that has been developed specifically for you. In some cases, this is the best solution. System integrators can be retained to use automation tools and software to develop custom solutions. Larger industrial customers will take this alternative. HMI screens will be custom developed to show the operators exactly what they need to see for effective monitoring and operation of the equipment. The advantages are obvious. In addition, if the correct tools are chosen, the automation system can be connected with most types of devices. These systems are usually developed with expansion in mind.

The disadvantage of custom systems is usually cost. In addition to the initial purchase, development and installation costs, there are often monthly or annual fees tied to the software.

## **9. Ready to install?**

When you buy an automation system, what are you provided? If it is a simple software package, you will be required to purchase the correct computer, install and configure the software on the computer.

Figure out what is involved with connecting your equipment to the automation system. An electrician may provide the best advice on how this is done.

If the system has more than one fundamental feature (from the list above), confirm whether these features are automatically provided and integrated. Do you have to purchase separate hardware? What is involved in connecting the components that provide the various fundamental features?

## **10. Complexity of set up**

One of the biggest challenges facing the home automation market is the complexity of setting up the system. Many systems are available with simple controls. Turning a light on when the temperature reaches a certain level can be easy to set up in most systems.

Check whether your system includes more complex requirements. When asking questions before purchasing, see if the vendor will advise how you would program one of your more complex program scenarios.

### **11. What's involved to connect your equipment?**

This is best answered by your electrician. Figure out what types of inputs and outputs are available with the automation tool, and make sure your electrician can connect them without having to rewire your equipment.

### **12. Ethernet Connection?**

Ethernet connection is the standard for communication over the Internet and with most office networks. Some industrial networks have moved to Ethernet communication, but many are using communication protocols such as DeviceNet, Profibus and Modbus.

Check the benefits of utilizing an Ethernet protocol, and whether the automation system can communicate over Ethernet.

### **13. Simplicity of programming**

How important is it to have simple program development tools? Usually the capability will be reduced if the program can be easily created. Check by asking the vendor to show you an example of the most complex operation your equipment is expected to monitor or perform.

System integrators can be used for more complex program development. Find one with whom you can communicate your needs. Make sure he/she can fully understand how your equipment operates. And confirm the tools being used. You may wish to have a different system integrator later on. Without comments in the program, or manuals, it will be very difficult, and expensive to have a different programmer figure out what was built before.

### **14. Proprietary Devices**

Many automation systems will require the input sensors to be from the same supplier as the automation system. Check whether your existing equipment can be connected to the automation system you are considering.

As your business grows, you may wish to apply your automation system to other uses, such as building controls and security functions. Make sure to ask whether this can be handled.

### **15. Reliability**

How does the automation system deal with reliability? Is the hardware tried and proven? Can spare parts be readily purchased? How easy is it to replace components that fail?

During operation of your system, if the computer should fail, what actions are taken? Is there a Watchdog tool to monitor the computer / controller behaviour, and deal with computer / controller problems?

## **16. Alarms**

Alarms can come in a variety of forms.

- Lights or audible alarms are just outputs that can be connected as outputs, and programmed to activate using program rules.
- HMI screen alarms will flash on the interface screen to warn operators of alarm conditions
- Email alarms can be sent to various email addresses. This is usually used for situations that do not require immediate response.
- Telephone alarms are the most

How easy is it to change who gets the alarm? Can you change the alarm based on a schedule? For example weekdays during day shift the alarm is sent to one group of recipients, and after hours and weekend calls have the alarms going to a different group.

## **17. Schedules**

Most automation systems can have events occur based on time of day, and day of week. If your equipment may require more complex schedules, check if there is a schedule tool that will allow for this.

## **18. Camera**

Cameras can be provided separately from automation systems to monitor your equipment. Integration of your camera with your automation system may be of value.

## **19. Trending**

Trending is one of the most important fundamental features to understand. This tool provides incredible benefits to operations, but will usually add complexity and significant cost to the installation. It is rarely available, unless a custom installation is being provided.

A trending tool consists of a database which records all of the device signals. A graphing tool will then allow the user to create a graph of the data, which will show how the equipment has performed over time. A typical graph may show how the temperature in a room has changed over a week, providing maximum and minimum values as required.

The benefits of trending include:

- Confirmation that the equipment is operating as expected.
- Confirmation that maximum or minimum values have not been exceeded, or confirmation that control has been steady.

- Forecast when events will occur, such as when a tank will need refilling.
- See what happened – this provides invaluable information for troubleshooting equipment operation.
- Quality of product can be confirmed using graphs that show the equipment operation.

## **20. Automated Reporting**

Automated Reporting from an automation system is usually only available with custom installations. A database of equipment operation is required, often the same database that is used for the trending tool. The reporting tool can query the database to ascertain production levels, equipment performance indicators, or even produce the data necessary for your accounting department.

In all cases, development of the report will require a programmer capable of working with databases and reporting tools. Creating the database from the automation system is also required. Check what is involved with creating such a database and reporting tool. Also confirm whether separate hardware is required for your reporting tool, and whether it is included with your purchase.

## **21. Budget**

As always, this is the most important questions. The challenge is to find out all of the inter-related costs that will go into development of the automation system you are creating. This should include:

- Hardware purchase
- Installation costs
- Initial program development
- Ongoing maintenance or license fees.

And each of these costs should be considered for each of the fundamental features included in your system. If you have more than one fundamental feature, there may also be hardware, installation and programming costs related to integrating the various features.

If you have a simple system that includes each of the fundamental features you require, developing a cost estimate can be done with price information from the vendor and the electrician that will assist with the installation. When a more complex solution is being considered, a system integrator may be required to advise on the various components that are required, and how they will be integrated to provide the final product.

Integration of applications may not happen with the initial installation. Make sure that you consider the future. Once you have decided on an automation tool, it could be very costly if the tool does not provide the expandability to provide some of the fundamental features in the future.

## 22. Maintenance, license or upgrade fees

Many suppliers will charge monthly or annual fees for their systems. Check the fees, and make sure when doing the cost comparisons that these fees are included.

# II. Automation Selection Checklist

This questionnaire has been developed to assist you with the assessment of whether you wish to automate, and if so, how to select the best system for your situation. We have tried to provide non-biased questions and answers that will lead you to the best system for your needs, whether it is the Confirmed Automation System or a system provided by one of our competitors.

## 1. Why do you want to automate?

Benefit	Does this apply?
reduction of manpower	
improved productivity from your equipment	
faster equipment operation,	
consistency of operation,	
improved quality of production,	
ability to control to levels that would be unachievable with manual control,	
ability to operate during non-standard hours,	
Alarming	
automated data collection from your equipment	

## 2. Fundamental Features

Fundamental Feature	Automation System Checklist		
Automatic operation of equipment with user configured program rules			
Control using schedules, which provide more capability than standard start and stop times			
Control using inputs and outputs			
Interface screen to watch equipment operation. This is often called an MMI or HMI screen.			
Manual control of equipment from the automation system			
Simplicity of setup (see below)			
Remote Control from the Internet			
Can program rules, alarms and HMI screens be changed “on the fly”, or does system need to be shut down?			
Alarming			
On the interface screen			
By email			
By telephone			
Reporting			

## 3. Inputs and Outputs

Inputs / Outputs	Automation System Checklist		
Are Inputs provided?	Yes / No	Yes / No	Yes / No
Are outputs provided?	Yes / No	Yes / No	Yes / No

## 4. Number of points

Calculate the number of input and output points for your equipment. Include outputs such as lights that will be used as alarms. Also include ancillary systems such as lighting and building ventilation controls, security monitors and other devices.

Point Category	Number	Spares	Total Points	Automation System Checklist		
Discrete Input						
Analog Input						
Discrete Output						
Analog Output						

## 5. Types of points

There are many types of points, and your electrician will be able to convert depending on the cost of the automation system inputs and outputs that are being considered. Use the table below to identify details of your preferred I/O Points.

Point Type	Number	Spares	Total Points	Automation System Checklist		
Discrete Input						
Analog Input						
Discrete Output						
Analog Output						

## 6. Remote Operation

Internet Access	Automation System Checklist		
Internet Monitoring	Yes / No	Yes / No	Yes / No
Full HMI Screen	Yes / No	Yes / No	Yes / No
Remote Access Manual Control?	Yes / No	Yes / No	Yes / No
Can you remotely Change Alarm settings?	Yes / No	Yes / No	Yes / No
Can you Change Program Rules?	Yes / No	Yes / No	Yes / No

## 7. Custom system for your needs?

The decision on whether you need a custom system will come from reviewing the responses from above and below. The table immediately below provides some questions that should be asked if you are heading to a custom installation. It is presumed that the work will be done by a System Integrator.

Custom System Questions	Automation System Checklist		
Do you need custom work? Check out whether a tool exists that you can program yourself.			
Will pricing be guaranteed. Get an estimate, and ask what your system integrator will do to ensure your final cost is close to the estimate.			
Ask to see samples of past work. Are the screens clear and easy to understand? Do they provide all the information the operators need to see?			
Will the system integrator do all hardware selection, purchasing and installation for you? If not, an expert will be required to handle this.			
Research your system integrator, get references. Remember, it is difficult to have one company develop a system, and then have maintenance from a different company. You will likely have a long term relationship with the system integrator you select.			
Ask about maintenance, how often they expect to be back. Some systems have integrators on site every month making adjustments and improvements.			
Find out about monthly or annual maintenance and license fees that will be required after the installation is complete.			

## 8. Ready to install?

When you purchase a system, make sure you understand what you require to provide all of the functions you require. Many systems advertise capability in certain areas, but you must purchase extra components or computers to make it work.

Included Components	Automation System Checklist		
I/O Modules or Panel, to connect you input and output devices on your equipment.			
Controller to automatically run your program rules.			
Development software to configure your controller with your program rules.			
HMI screen to see display your equipment status.			
Computer on which HMI screen is presented.			
Development software to configure your HMI screens.			
Data Historian software to collect data from your equipment operation.			
Data Historian server / computer to hold the collected data.			
Licenses or software for the database in your data historian.			
Graphing or Trending tool to see plots of your equipment operation.			
Reporting software to query the data and develop automatic reports.			
Connection between all of these components. Includes wiring and any software required to allow communication between the different components.			

## 9. Complexity of set up

How complex is the set up of your proposed system? If you plug in the cables, will all components automatically communicate with each other?

Set up Requirements	Automation System Checklist		
Are I/O modules provided for standard industrial protocols?			
How does the controller talk to each device on your equipment?			
How hard is it to program your controller? Ask the vendor for an example.			
Is the HMI integrated with the controller or is connection required?			
How hard is it to configure HMI screens? Get an example.			
Does the HMI computer come with software already installed? How hard is it to install.			
Does Data Historian database and computer come with software already installed?			
How does data historian connect to your controller?			
What is involved with having the data historian pick up data from the controller or devices on your equipment?			
What is involved with configuring the graphing or trending tool to see plots of your equipment operation?			
Will standard database software be able to query your equipment data to generate reports?			
How can data from the trending tool or reporting tool be sent to your office computers for use in accounting and production reporting?			
What software or configuration is required to allow communication between the different components of the system?			

## 10. What's involved to connect your equipment?

This is best answered by your electrician. Compare your inputs and outputs with using "Table 5. Types of Points".

## 11. Ethernet Connection?

Ethernet Capable?	Automation System Checklist		
Do the system components communicate using Ethernet protocol?			

## 12. Simplicity of programming

The table below shows the types of programming features that may be required by your system. Check what is required for your equipment, and what the systems may provide.

Program Capability	Automation System Checklist		
Conditions for turning devices on or off.			
Delays for turning devices on or off.			
Time based decisions.			
Schedules for automatic actions, such as weekdays only, etc.			
Ability to have repeaters, such as turning on a pump for 5 minutes every hour.			
Ability to include deadbands to prevent rapid cycling of devices.			
Ability to scale device readings. If sensor reads degrees C, change it to degrees F.			
Ability to have multiple input conditions to be considered when deciding whether an output should be turned on or off.			
Ability to set output values, also referred to as analog or variable outputs.			
Ability to modulate the outputs based on setpoints. Examples include PID (Proportional, Integral, Derivative) control.			
Ability to drive batch processes. Many devices only include continuous control.			

## 13. Proprietary Devices

Proprietary	Automation System Checklist		
Does the system require proprietary devices to be used?	Yes / No	Yes / No	Yes / No

## 14. Reliability

How does the automation system deal with reliability? Is the hardware tried and proven? Can spare parts be readily purchased? How easy is it to replace components that fail?

Reliability	Automation System Checklist		
Is a Watchdog included to monitor the controller operation?	Yes / No	Yes / No	Yes / No
Can system operation be monitored by another off site device, over the Internet for example?	Yes / No	Yes / No	Yes / No
Can Redundant controllers be installed?	Yes / No	Yes / No	Yes / No
Can spare parts be readily purchased at a reasonable price?	Yes / No	Yes / No	Yes / No
What is involved in replacing broken parts in your controller? Is it complex?	Yes / No	Yes / No	Yes / No

## 15. Alarms

Alarms	Automation System Checklist		
Can turn lights or sirens on or off?	Yes / No	Yes / No	Yes / No
Can show alarm conditions on a screen?	Yes / No	Yes / No	Yes / No
Can email alarm messages?	Yes / No	Yes / No	Yes / No
Can telephone alarm messages?	Yes / No	Yes / No	Yes / No
Can use voice alarm messages on telephone?	Yes / No	Yes / No	Yes / No
Can alarms be changed remotely?			

## 16. Schedules

If the system has schedule capability, what features are included?

Schedule Capability	Automation System Checklist		
Can daily activities be configured?	Yes / No	Yes / No	Yes / No
Can weekday or weekend activities be configured?	Yes / No	Yes / No	Yes / No
Can different times be identified for different days?	Yes / No	Yes / No	Yes / No
Can weekly schedules be set up, alternating weeks for example?	Yes / No	Yes / No	Yes / No
Can monthly schedules be set up? First Thursday of every month? The third day of every month?	Yes / No	Yes / No	Yes / No
Can annual events be configured?	Yes / No	Yes / No	Yes / No

## 17. Camera

Is a camera required? Should it be tied to your automation system?

Camera	Automation System Checklist		
Camera included?	Yes / No	Yes / No	Yes / No

## 18. Trending

Remember that trending is one of the most important features if you wish to use the control system for troubleshooting and reporting on your equipment performance.

Trending Capability	Automation System Checklist		
Is trending included?			
Can historical data be trended?			
Can analog and discrete devices be plotted?			
Can more than one device be plotted on the same graph for comparison purposes?			
Does the trending tool provide basic statistics such as maximum, minimum and average values between two points in time? For example, this could be used to confirm the temperature remained with specified range.			
Will the Trend tool provide a live view of the data, so you can watch devices simultaneously over time?			
How much data can be stored? If it is only one day, maybe you will need more.			

## 19. Automated Reporting

Automated Reporting Capability	Automation System Checklist		
Is automated reporting included?			
Is data stored in a format that other reporting tools can read?			
Can reports be communicated in a fashion that can be integrated with your accounting and production tracking systems?			

## 20. Budget

Cost Estimate	Automation System Checklist		
Hardware Purchase			
Hardware installation and configuration			
Software Purchase – Programming Controller			
Software Purchase – HMI			
Software Purchase – Data Historian			
Software Purchase – Trending			
Initial development of program rules			
Initial development of HMI Screens			
Integration with existing office systems.			

## 21. Maintenance, license or upgrade fees

Ongoing Fees	Automation System Checklist		
License Fees – license to enable software to continue running.			
Maintenance Fees – monthly or manual fees to enable you to get technical support.			
Upgrade Fees – are upgrades provided at no charge?			