User Manual

Allen-Bradley

Micro810 Programmable Controllers

Catalog Numbers 2080-LC10-12AWA, 2080-LC10-12QWB, 2080-LC10-12QBB, 2080-LC10-12DWD

Allen-Bradley • Rockwell Software

Rockwell Automation

Important User Information

Solid-state equipment has operational characteristics differing from those of electromechanical equipment. Safety Guidelines for the Application, Installation and Maintenance of Solid State Controls (publication SGI-1.1 available from your local Rockwell Automation sales office or online at http://www.rockwellautomation.com/literature/) describes some important differences between solid-state equipment and hard-wired electromechanical devices. Because of this difference, and also because of the wide variety of uses for solid-state equipment, all persons responsible for applying this equipment must satisfy themselves that each intended application of this equipment is acceptable.

In no event will Rockwell Automation, Inc. be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Rockwell Automation, Inc. cannot assume responsibility or liability for actual use based on the examples and diagrams.

No patent liability is assumed by Rockwell Automation, Inc. with respect to use of information, circuits, equipment, or software described in this manual.

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Throughout this manual, when necessary, we use notes to make you aware of safety considerations.

	**WARNING:** Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.
	**ATTENTION:** Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid a hazard, and recognize the consequence
	**SHOCK HAZARD:** Labels may be on or inside the equipment, for example, a drive or motor, to alert people that dangerous voltage may be present.
	**BURN HAZARD:** Labels may be on or inside the equipment, for example, a drive or motor, to alert people that surfaces may reach dangerous temperatures.
IMPORTANT	Identifies information that is critical for successful application and understanding of the product.

Read this preface to familiarize yourself with the rest of the manual. It provides information concerning:

- who should use this manual
- the purpose of this manual
- related documentation

Who Should Use this Manual

Use this manual if you are responsible for designing, installing, programming, or troubleshooting control systems that use Micro800 controllers.

You should have a basic understanding of electrical circuitry and familiarity with relay logic. If you do not, obtain the proper training before using this product.

Purpose of this Manual

This manual is a reference guide for Micro800 controllers, plug-in modules and accessories. It describes the procedures you use to install, wire, and troubleshoot your controller. This manual:

- explains how to install and wire your controllers
- gives you an overview of the Micro800 controller system

Refer to the Online Help provided with Connected Components Workbench software for more information on programming your Micro800 controller.

Additional Resources

These documents contain additional information concerning related Rockwell Automation products.

Resource	Description
Micro800 Programmable Controller External AC Power Supply Installation Instructions 2080-IN001	Information on mounting and wiring the optional external power supply.
Micro810 USB Adapter Plug-in Module Wirng Diagrams 2080-WD001	Information on mounting and wiring the Micro810 USB Adapter Plug-in Module.
Micro800 1.5" LCD Display and Keypad Module Wirng Diagrams 2080-WD009	Information on mounting and wiring the Micro800 1.5" LCD Display and Keypad Module.
Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1	Provides general guidelines for installing a Rockwell Automation industrial system.
Product Certifications website, http://ab.com	Provides declarations of conformity, certificates, and other certification details.

Resource	Description
Application Considerations for Solid-State Controls SGI-1.1	A description of important differences between solid-state programmable controller products and hard-wired electromechanical devices.
National Electrical Code - Published by the National Fire Protection Association of Boston, MA.	An article on wire sizes and types for grounding electrical equipment.
Allen-Bradley Industrial Automation Glossary AG-7.1	A glossary of industrial automation terms and abbreviations.

You can view or download publications at http://www.rockwellautomation.com/literature/. To order paper copies of technical documentation, contact your local Rockwell Automation distributor or sales representative.

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Hardware Overview

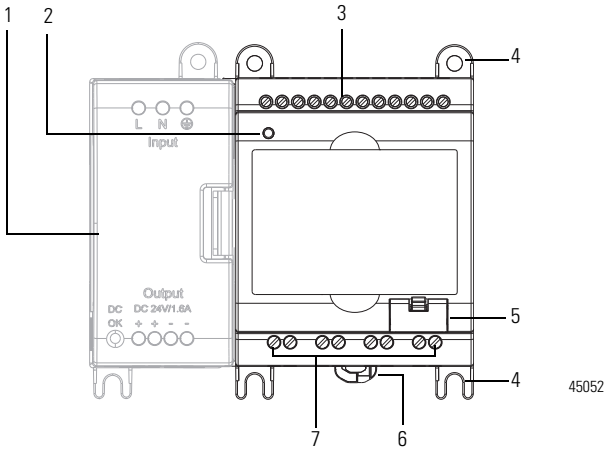
Hardware Features

The Micro800 controller is an economical brick style controller with embedded inputs and outputs.

Micro810 12-point controllers cannot use Micro800 plug-in modules, but do support a USB adapter, and an LCD module, which can be used as a backup memory module.

It also accomodates any 24V DC output power supply that meets minimum specifications such as the optional Micro800 power supply.

Micro810 12-Point Controllers



Controller Description

	Description		Description
1	Optional power supply	5	USB port (for use with USB Adapter only)
2	Status indicator	6	DIN rail mounting latch
3	Input terminal block	7	Output terminal block
4	Mounting screw hole/ mounting foot		

Status Indicator

State	During Normal Operation	During Firmware Update or Program/Data Transfer
Off	No power applied to device, or in Fault mode	No power applied to device, or in Fault mode
Solid green	Device operating normally	Program transfer successful
Flashing green	Operating System error	Firmare update in progress

Micro810 Controllers

Catalog Number	Power	Inputs			Outputs		Analog In 0…10V (shared with DC In)
		120V AC	240V AC	12…24V DC /V AC	Relay	24 V DC SRC	
2080-LC10-12QWB	24V DC			8	4		4
2080-LC10-12AWA	120…240V AC	8			4		
2080-LC10-12QBB	12…24V DC			8		4	4
2080-LC10-12DWD	12V DC			8	4		4

About Your Controller

Agency Certifications

- UL Listed Industrial Control Equipment, certified for US and Canada. UL Listed for Class I, Division 2 Group A,B,C,D Hazardous Locations, certified for U.S. and Canada.
- CE marked for all applicable directives
- C-Tick marked for all applicable acts

Compliance to European Union Directives

This product has the CE mark and is approved for installation within the European Union and EEA regions. It has been designed and tested to meet the following directives.

EMC Directive

This product is tested to meet Council Directive 2004/108/EC Electromagnetic Compatibility (EMC) and the following standards, in whole or in part, documented in a technical construction file:

- EN 61131-2; Programmable Controllers (Clause 8, Zone A & B)
- EN 61131-2; Programmable Controllers (Clause 11)
- EN 61000-6-4
  EMC - Part 6-4: Generic Standards - Emission Standard for Industrial Environments
- EN 61000-6-2
  EMC - Part 6-2: Generic Standards - Immunity for Industrial Environments

This product is intended for use in an industrial environment.

Low Voltage Directive

This product is tested to meet Council Directive 2006/95/ECLow Voltage, by applying the safety requirements of EN 61131-2 Programmable Controllers, Part 2 - Equipment Requirements and Tests.

For specific information required by EN 61131-2, see the appropriate sections in this publication, as well as the following Allen-Bradley publications:

- Industrial Automation Wiring and Grounding Guidelines for Noise Immunity, publication 1770-4.1
- Guidelines for Handling Lithium Batteries, publication AG-5.4
- Automation Systems Catalog, publication B115

Installation Considerations

Most applications require installation in an industrial enclosure (Pollution Degree 2[1]) to reduce the effects of electrical interference (Over Voltage Category II[2]) and environmental exposure. Locate your controller as far as possible from power lines, load lines, and other sources of electrical noise such as hard-contact switches, relays, and AC motor drives. For more information on proper grounding guidelines, see the Industrial Automation Wiring and Grounding Guidelines publication 1770-4.1.

WARNING: If you insert or remove the module while power is on, an electrical arc can occur. This could cause an explosion in hazardous location installations.
Be sure that power is removed or the area is nonhazardous before proceeding.

WARNING: The local programming terminal port is intended for temporary use only and must not be connected or disconnected unless the area is assured to be nonhazardous.

WARNING: When used in a Class I, Division 2, hazardous location, this equipment must be mounted in a suitable enclosure with proper wiring method that complies with the governing electrical codes.

WARNING: If you connect or disconnect wiring while the field-side power is on, an electrical arc can occur. This could cause an explosion in hazardous location installations. Be sure that power is removed or the area is nonhazardous before proceeding.

WARNING: The USB port is intended for temporary local programming purposes only and not intended for permanent connection. If you connect or disconnect the USB cable with power applied to this module or any device on the USB network, an electrical arc can occur. This could cause an explosion in hazardous location installations.
Be sure that power is removed or the area is nonhazardous before proceeding.
The USB port is a nonincendive field wiring connection for Class I, Division2 Groups A, B, C and D.

WARNING: Exposure to some chemicals may degrade the sealing properties of materials used in the Relays. It is recommended that the User periodically inspect these devices for any degradation of properties and replace the module if degradation is found.

WARNING: To comply with the CE Low Voltage Directive (LVD), this equipment must be powered from a source compliant with the following:
Safety Extra Low Voltage (SELV) or Protected Extra Low Voltage (PELV).

WARNING: To comply with UL restrictions, this equipment must be powered from a source compliant with the following:
Class 2 or Limited Voltage/Current.

WARNING: Do not wire more than 2 conductors on any single terminal.

WARNING: Be careful when stripping wires. Wire fragments that fall into the controller could cause damage. Once wiring is complete, make sure the controller is free of all metal fragments.

(1) Pollution Degree 2 is an environment where normally only non-conductive pollution occurs except that occasionally temporary conductivity caused by condensation shall be expected.

(2) Overvoltage Category II is the load level section of the electrical distribution system. At this level, transient voltages are controlled and do not exceed the impulse voltage capability of the products insulation.

ATTENTION: Do not remove the protective debris strips until after the controller and all other equipment in the panel near the module are mounted and wired. Remove strips before operating the controller. Failure to remove strips before operating can cause overheating.

ATTENTION: Electrostatic discharge can damage semiconductor devices inside the module. Do not touch the connector pins or other sensitive areas.

ATTENTION: This product is intended to be mounted to a well-grounded mounting surface such as a metal panel. Additional grounding connections from the power supply's mounting tabs or DIN rail (if used) are not required unless the mounting surface cannot be grounded. Refer to Industrial Automation Wiring and Grounding Guidelines, Allen-Bradley publication 1770-4.1, for additional information.

ATTENTION: The USB cable is not to exceed 3.0 m (9.84 ft).

Environment and Enclosure

This equipment is intended for use in a Pollution Degree 2 industrial environment, in overvoltage Category II applications (as defined in IEC 60664-1), at altitudes up to 2000 m (6562 ft) without derating.

This equipment is considered Group 1, Class A industrial equipment according to IEC/CISPR 11. Without appropriate precautions, there may be difficulties with electromagnetic compatibility in residential and other environments due to conducted and radiated disturbances.

This equipment is supplied as open-type equipment. It must be mounted within an enclosure that is suitably designed for those specific environmental conditions that will be present and appropriately designed to prevent personal injury resulting from accessibility to live parts. The enclosure must have suitable flame-retardant properties to prevent or minimize the spread of flame, complying with a flame spread rating of 5VA, V2, V1, V0 (or equivalent) if non-metallic. The interior of the enclosure must be accessible only by the use of a tool. Subsequent sections of this publication may contain additional information regarding specific enclosure type ratings that are required to comply with certain product safety certifications.

In addition to this publication, see:

- Industrial Automation Wiring and Grounding Guidelines, Rockwell Automation publication 1770-4.1, for additional installation requirements.
- NEMA Standard 250 and IEC 60529, as applicable, for explanations of the degrees of protection provided by different types of enclosure.

Preventing Electrostatic Discharge

This equipment is sensitive to electrostatic discharge, which can cause internal damage and affect normal operation. Follow these guidelines when you handle this equipment:

- Touch a grounded object to discharge potential static.
- Wear an approved grounding wriststrap.
- Do not touch connectors or pins on component boards.
- Do not touch circuit components inside the equipment.
- Use a static-safe workstation, if available.
- Store the equipment in appropriate static-safe packaging when not in use.

Safety Considerations

Safety considerations are an important element of proper system installation. Actively thinking about the safety of yourself and others, as well as the condition of your equipment, is of primary importance. We recommend reviewing the following safety considerations.

North American Hazardous Location Approval

The following information applies when operating this equipment in hazardous locations:	**Informations sur l'utilisation de cet équipement en environnements dangereux:**
Products marked "CL I, DIV 2, GP A, B, C, D" are suitable for use in Class I Division 2 Groups A, B, C, D, Hazardous Locations and nonhazardous locations only. Each product is supplied with markings on the rating nameplate indicating the hazardous location temperature code. When combining products within a system, the most adverse temperature code (lowest "T" number) may be used to help determine the overall temperature code of the system. Combinations of equipment in your system are subject to investigation by the local Authority Having Jurisdiction at the time of installation.	Les produits marqués "CL I, DIV 2, GP A, B, C, D" ne conviennent qu'à une utilisation en environnements de Classe I Division 2 Groupes A, B, C, D dangereux et non dangereux. Chaque produit est livré avec des marquages sur sa plaque d'identification qui indiquent le code de température pour les environnements dangereux. Lorsque plusieurs produits sont combinés dans un système, le code de température le plus défavorable (code de température le plus faible) peut être utilisé pour déterminer le code de température global du système. Les combinaisons d'équipements dans le système sont sujettes à inspection par les autorités locales qualifiées au moment de l'installation.
 **EXPLOSION HAZARD** • Do not disconnect equipment unless power has been removed or the area is known to be nonhazardous. • Do not disconnect connections to this equipment unless power has been removed or the area is known to be nonhazardous. Secure any external connections that mate to this equipment by using screws, sliding latches, threaded connectors, or other means provided with this product. • Substitution of any component may impair suitability for Class I, Division 2. • If this product contains batteries, they must only be changed in an area known to be nonhazardous.	 **RISQUE D'EXPLOSION** • Couper le courant ou s'assurer que l'environnement est classé non dangereux avant de débrancher l'équipement. • Couper le courant ou s'assurer que l'environnement est classé non dangereux avant de débrancher les connecteurs. Fixer tous les connecteurs externes reliés à cet équipement à l'aide de vis, loquets coulissants, connecteurs filetés ou autres moyens fournis avec ce produit. • La substitution de tout composant peut rendre cet équipement inadapté à une utilisation en environnement de Classe I, Division 2. • S'assurer que l'environnement est classé non dangereux avant de changer les piles.

Disconnecting Main Power

WARNING: Explosion Hazard
Do not replace components, connect equipment, or disconnect equipment unless power has been switched off.

The main power disconnect switch should be located where operators and maintenance personnel have quick and easy access to it. In addition to disconnecting electrical power, all other sources of power (pneumatic and hydraulic) should be de-energized before working on a machine or process controlled by a controller.

Safety Circuits

WARNING: Explosion Hazard
Do not connect or disconnect connectors while circuit is live.

Circuits installed on the machine for safety reasons, like overtravel limit switches, stop push buttons, and interlocks, should always be hard-wired directly to the master control relay. These devices must be wired in series so that when any one device opens, the master control relay is de-energized, thereby removing power to the machine. Never alter these circuits to defeat their function. Serious injury or machine damage could result.

Power Distribution

There are some points about power distribution that you should know:

- The master control relay must be able to inhibit all machine motion by removing power to the machine I/O devices when the relay is de-energized. It is recommended that the controller remain powered even when the master control relay is de-energized.
- If you are using a DC power supply, interrupt the load side rather than the AC line power. This avoids the additional delay of power supply turn-off. The DC power supply should be powered directly from the fused secondary of the transformer. Power to the DC input and output circuits should be connected through a set of master control relay contacts.

Periodic Tests of Master Control Relay Circuit

Any part can fail, including the switches in a master control relay circuit. The failure of one of these switches would most likely cause an open circuit, which would be a safe power-off failure. However, if one of these switches shorts out, it no longer provides any safety protection. These switches should be tested periodically to assure they will stop machine motion when needed.

Power Considerations

The following explains power considerations for the micro controllers.

Isolation Transformers

You may want to use an isolation transformer in the AC line to the controller. This type of transformer provides isolation from your power distribution system to reduce the electrical noise that enters the controller and is often used as a step-down transformer to reduce line voltage. Any transformer used with the controller must have a sufficient power rating for its load. The power rating is expressed in volt-amperes (VA).

Power Supply Inrush

During power-up, the Micro800 power supply allows a brief inrush current to charge internal capacitors. Many power lines and control transformers can supply inrush current for a brief time. If the power source cannot supply this inrush current, the source voltage may sag momentarily.

The only effect of limited inrush current and voltage sag on the Micro800 is that the power supply capacitors charge more slowly. However, the effect of a voltage sag on other equipment should be considered. For example, a deep voltage sag may reset a computer connected to the same power source. The following considerations determine whether the power source must be required to supply high inrush current:

- The power-up sequence of devices in a system.
- The amount of the power source voltage sag if the inrush current cannot be supplied.
- The effect of voltage sag on other equipment in the system.

If the entire system is powered-up at the same time, a brief sag in the power source voltage typically will not affect any equipment.

Loss of Power Source

The power supply is designed to withstand brief power losses without affecting the operation of the system. The time the system is operational during power loss is called program scan hold-up time after loss of power. The duration of the power supply hold-up time depends on the type and state of the I/O, but is typically between 10 milliseconds and 3 seconds. When the duration of power loss reaches this limit, the power supply signals the processor that it can no longer provide adequate DC power to the system. This is referred to as a power supply shutdown. The processor then performs an orderly shutdown of the controller.

Input States on Power Down

The power supply hold-up time as described above is generally longer than the turn-on and turn-off times of the inputs. Because of this, the input state change from "On" to "Off" that occurs when power is removed may be recorded by the processor before the power supply shuts down the system. Understanding this concept is important. The user program should be written to take this effect into account.

Other Types of Line Conditions

Occasionally the power source to the system can be temporarily interrupted. It is also possible that the voltage level may drop substantially below the normal line voltage range for a period of time. Both of these conditions are considered to be a loss of power for the system.

Preventing Excessive Heat

For most applications, normal convective cooling keeps the controller within the specified operating range. Ensure that the specified temperature range is maintained. Proper spacing of components within an enclosure is usually sufficient for heat dissipation.

In some applications, a substantial amount of heat is produced by other equipment inside or outside the enclosure. In this case, place blower fans inside the enclosure to assist in air circulation and to reduce "hot spots" near the controller.

Additional cooling provisions might be necessary when high ambient temperatures are encountered.

TIP Do not bring in unfiltered outside air. Place the controller in an enclosure to protect it from a corrosive atmosphere. Harmful contaminants or dirt could cause improper operation or damage to components. In extreme cases, you may need to use air conditioning to protect against heat build-up within the enclosure.

Master Control Relay

A hard-wired master control relay (MCR) provides a reliable means for emergency machine shutdown. Since the master control relay allows the placement of several emergency-stop switches in different locations, its installation is important from a safety standpoint. Overtravel limit switches or mushroom-head push buttons are wired in series so that when any of them opens, the master control relay is de-energized. This removes power to input and output device circuits. Refer to the figures on pages 16 and 17.

WARNING: Never alter these circuits to defeat their function since serious injury and/or machine damage could result.

TIP If you are using an external DC power supply, interrupt the DC output side rather than the AC line side of the supply to avoid the additional delay of power supply turn-off.

The AC line of the DC output power supply should be fused.

Connect a set of master control relays in series with the DC power supplying the input and output circuits.

Place the main power disconnect switch where operators and maintenance personnel have quick and easy access to it. If you mount a disconnect switch inside the controller enclosure, place the switch operating handle on the outside of the enclosure, so that you can disconnect power without opening the enclosure.

Whenever any of the emergency-stop switches are opened, power to input and output devices should be removed.

When you use the master control relay to remove power from the external I/O circuits, power continues to be provided to the controller's power supply so that diagnostic indicators on the processor can still be observed.

The master control relay is not a substitute for a disconnect to the controller. It is intended for any situation where the operator must quickly de-energize I/O devices only. When inspecting or installing terminal connections, replacing output fuses, or working on equipment within the enclosure, use the disconnect to shut off power to the rest of the system.

TIP Do not control the master control relay with the controller. Provide the operator with the safety of a direct connection between an emergency-stop switch and the master control relay.

Using Emergency-Stop Switches

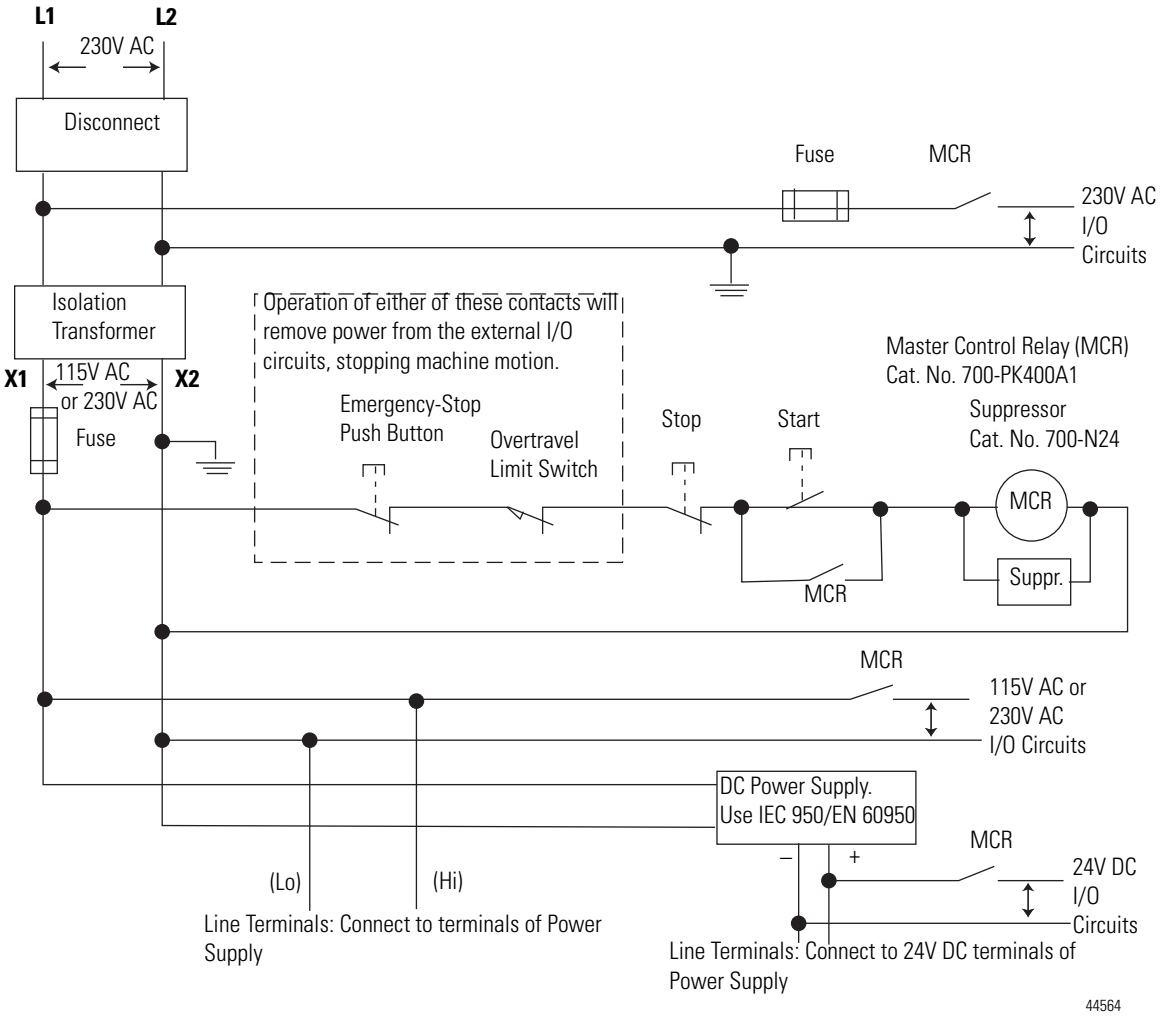
When using emergency-stop switches, adhere to the following points:

- Do not program emergency-stop switches in the controller program. Any emergency-stop switch should turn off all machine power by turning off the master control relay.
- Observe all applicable local codes concerning the placement and labeling of emergency-stop switches.
- Install emergency-stop switches and the master control relay in your system. Make certain that relay contacts have a sufficient rating for your application. Emergency-stop switches must be easy to reach.
- In the following illustration, input and output circuits are shown with MCR protection. However, in most applications, only output circuits require MCR protection.

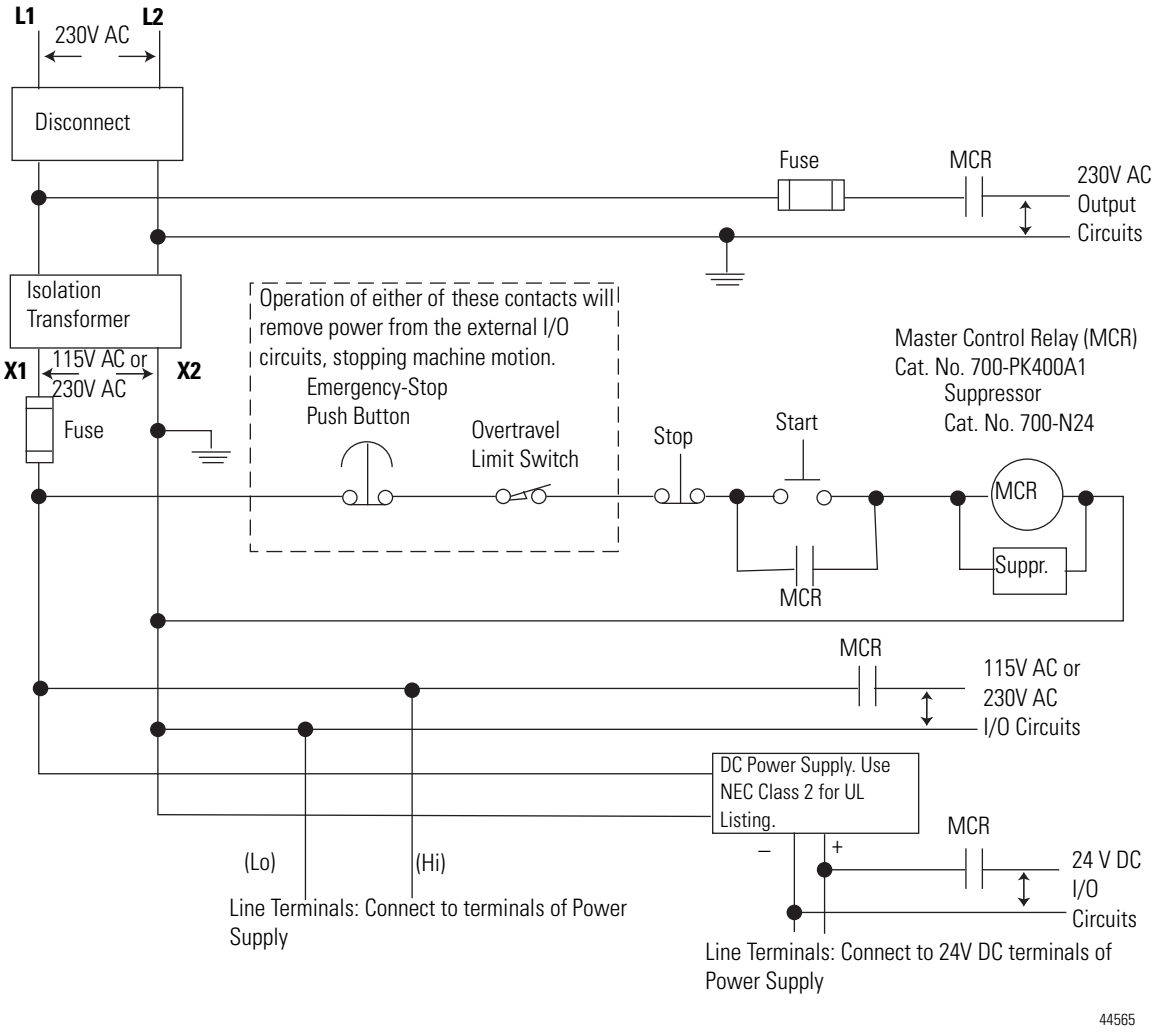
The following illustrations show the Master Control Relay wired in a grounded system.

TIP In most applications input circuits do not require MCR protection; however, if you need to remove power from all field devices, you must include MCR contacts in series with input power wiring.

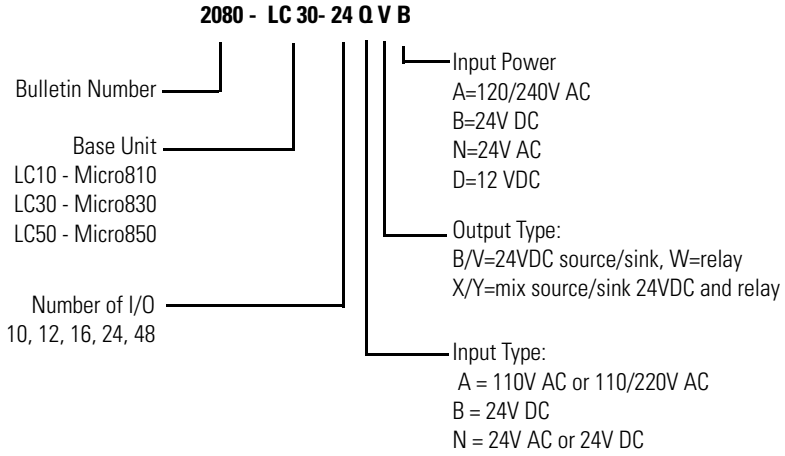
Schematic (Using IEC Symbols)



Schematic (Using ANSI/CSA Symbols)



Micro800 Catalog Number Details



Notes:

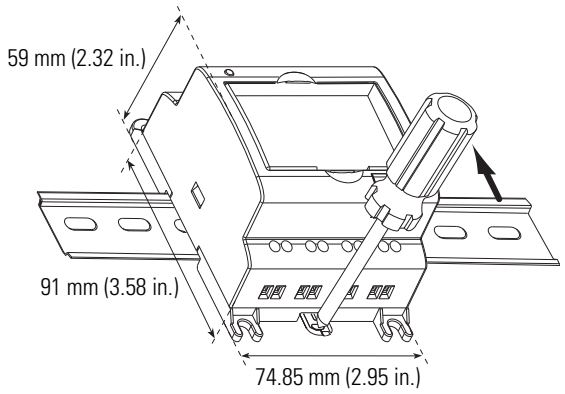
Installing Your Controller

Controller Mounting Dimensions

Mounting Dimensions

Mounting dimensions do not include mounting feet or DIN rail latches.

Micro810 Controllers
2080-LC10-12AWA, 2080-LC10-12QWB, 2080-LC10-12QBB, 2080-LC10-12DWD



Module Spacing

Maintain spacing from objects such as enclosure walls, wireways and adjacent equipment. Allow 50.8 mm (2 in.) of space on all sides for adequate ventilation. An exception to this spacing guideline is allowed for the side at which you are connecting the optional power supply, 2080-PS120-240VAC.

DIN Rail Mounting

The module can be mounted using the following DIN rails: 35 x 7.5 mm x 1 mm (EN 50 022 - 35 x 7.5).

TIP For environments with greater vibration and shock concerns, use the panel mounting method, instead of DIN rail mounting.

Before mounting the module on a DIN rail, use a flat-blade screwdriver in the DIN rail latch and pry it downwards until it is in the unlatched position.

1. Hook the top of the DIN rail mounting area of the controller onto the DIN rail, and then press the bottom until the controller snaps onto the DIN rail.
2. Push the DIN rail latch back into the latched position.
   Use DIN rail end anchors (Allen-Bradley part number 1492-EA35 or 1492-EAHJ35) for vibration or shock environments.

To remove your controller from the DIN rail, pry the DIN rail latch downwards until it is in the unlatched position.

Panel Mounting

The preferred mounting method is to use four M4 (#8) screws per module. Hole spacing tolerance: ±0.4 mm (0.016 in.).

Follow these steps to install your controller using mounting screws.

1. Place the controller against the panel where you are mounting it. Make sure the controller is spaced properly.
2. Mark drilling holes through the mounting screw holes and mounting feet then remove the controller.
3. Drill the holes at the markings, then replace the controller and mount it. Leave the protective debris strip in place until you are finished wiring the controller and any other devices.

Wiring Your Controller

Wiring Requirements

Wiring Recommendation

WARNING: Before you install and wire any device, disconnect power to the controller system.

WARNING: Calculate the maximum possible current in each power and common wire. Observe all electrical codes dictating the maximum current allowable for each wire size. Current above the maximum ratings may cause wiring to overheat, which can cause damage. *United States Only*: If the controller is installed within a potentially hazardous environment, all wiring must comply with the requirements stated in the National Electrical Code 501-10 (b).

- Allow for at least 50 mm. (2 in.) between I/O wiring ducts or terminal strips and the controller.
- Route incoming power to the controller by a path separate from the device wiring. Where paths must cross, their intersection should be perpendicular.

TIP Do not run signal or communications wiring and power wiring in the same conduit. Wires with different signal characteristics should be routed by separate paths.

- Separate wiring by signal type. Bundle wiring with similar electrical characteristics together.
- Separate input wiring from output wiring.
- Label wiring to all devices in the system. Use tape, shrink-tubing, or other dependable means for labeling purposes. In addition to labeling, use colored insulation to identify wiring based on signal characteristics. For example, you may use blue for DC wiring and red for AC wiring.

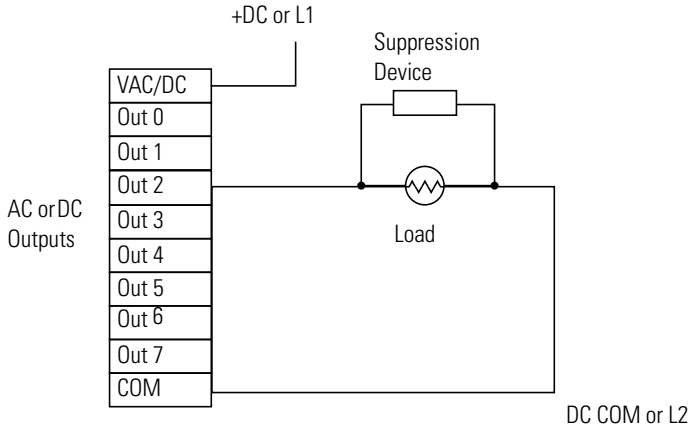
Wire Requirements

	Wire Size
Micro810 Controllers	0.32... 2.1 mm² (22...14 AWG) solid copper wire or 0.32... 1.3 mm² (22...16 AWG) stranded copper wire rated at 90 °C (194 °F) insulation max.

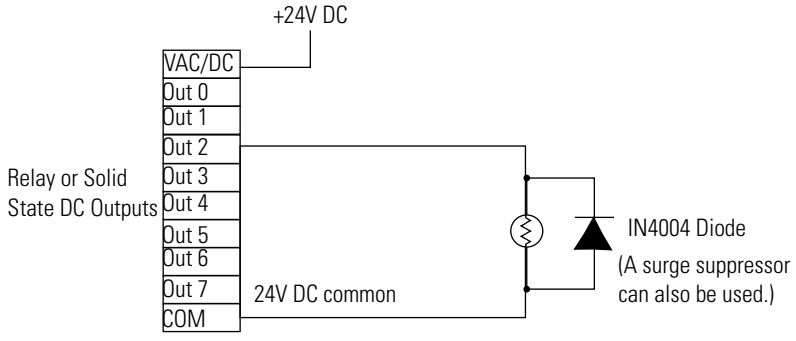
Using Surge Suppressors

Because of the potentially high current surges that occur when switching inductive load devices, such as motor starters and solenoids, the use of some type of surge suppression to protect and extend the operating life of the controllers output contacts is required. Switching inductive loads without surge suppression can *significantly* reduce the life expectancy of relay contacts. By adding a suppression device directly across the coil of an inductive device, you prolong the life of the output or relay contacts. You also reduce the effects of voltage transients and electrical noise from radiating into adjacent systems.

The following diagram shows an output with a suppression device. We recommend that you locate the suppression device as close as possible to the load device.



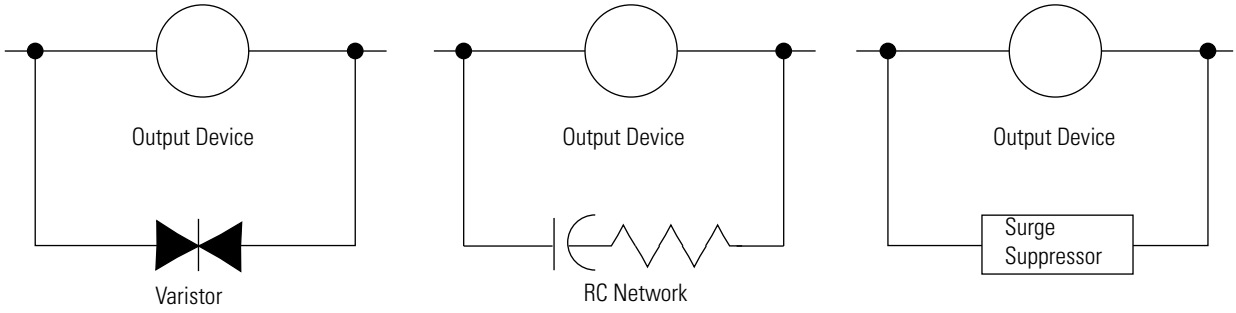
If the outputs are DC, we recommend that you use an 1N4004 diode for surge suppression, as shown below. For inductive DC load devices, a diode is suitable. A 1N4004 diode is acceptable for most applications. A surge suppressor can also be used. See page 25 for recommended suppressors. As shown below, these surge suppression circuits connect directly across the load device.



Suitable surge suppression methods for inductive AC load devices include a varistor, an RC network, or an Allen-Bradley surge suppressor, all shown below. These components must be appropriately rated to suppress the switching

transient characteristic of the particular inductive device. See Recommended Surge Suppressors on page 25 for recommended suppressors.

Surge Suppression for Inductive AC Load Devices



Recommended Surge Suppressors

Use the Allen-Bradley surge suppressors shown in the following table for use with relays, contactors, and starters.

Recommended Surge Suppressors

Device	Coil Voltage	Suppressor Catalog Number
Bulletin 509 Motor Starter Bulletin 509 Motor Starter	120V AC 240V AC	599-K04(1) 599-KA04(1)
Bulletin 100 Contactor Bulletin 100 Contactor	120V AC 240V AC	199-FSMA1(2) 199-FSMA2(2)
Bulletin 709 Motor Starter	120V AC	1401-N10(2)
Bulletin 700 Type R, RM Relays	AC coil	None Required
Bulletin 700 Type R Relay Bulletin 700 Type RM Relay	12V DC 12V DC	199-FSMA9
Bulletin 700 Type R Relay Bulletin 700 Type RM Relay	24V DC 24V DC	199-FSMA9
Bulletin 700 Type R Relay Bulletin 700 Type RM Relay	48V DC 48V DC	199-FSMA9
Bulletin 700 Type R Relay Bulletin 700 Type RM Relay	115-125V DC 115-125V DC	199-FSMA10
Bulletin 700 Type R Relay Bulletin 700 Type RM Relay	230-250V DC 230-250V DC	199-FSMA11
Bulletin 700 Type N, P, or PK Relay	150V max, AC or DC	700-N24(2)
Miscellaneous electromagnetic devices limited to 35 sealed VA	150V max, AC or DC	700-N24(2)

(1) Varistor – Not recommended for use on relay outputs.
(2) RC Type – Do not use with Triac outputs.

Grounding the Controller

This product is intended to be mounted to a well grounded mounting surface such as a metal panel. Refer to the Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1, for additional information. Additional grounding connections from the mounting tab or DIN rail, if used, are not required unless the mounting surface cannot be grounded.

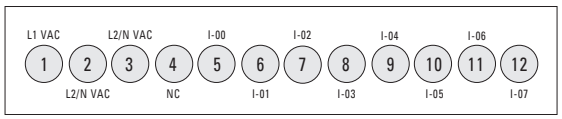
Wiring Diagrams

The following illustrations show the wiring diagrams for the Micro800 controllers. For controllers with DC inputs, inputs 0...3 can be wired as either sinking or sourcing inputs, however, inputs 4...7 can only be wired as sinking inputs. Sinking and sourcing does not apply to AC inputs.

Micro810 Controllers

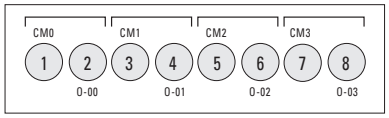
2080-LC10-12AWA

Input Terminal Block



45055

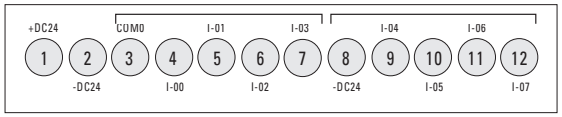
Output Terminal Block



45059

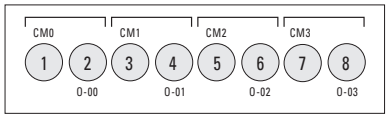
2080-LC10-12QWB

Input Terminal Block



45056

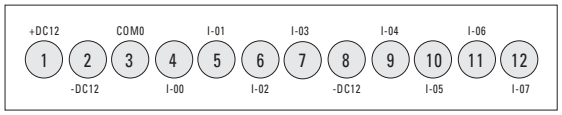
Output Terminal Block



45059

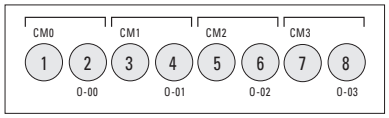
2080-LC10-12DWD

Input Terminal Block



45057

Output Terminal Block



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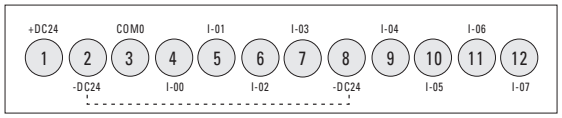
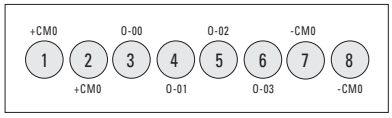
2080-LC10-12QBB

Input Terminal Block



45056

Output Terminal Block



45058

Controller I/O Wiring

Minimize Electrical Noise

Because of the variety of applications and environments where controllers are installed and operating, it is impossible to ensure that all environmental noise will be removed by input filters. To help reduce the effects of environmental noise, install the Micro800 system in a properly rated (for example, NEMA) enclosure. Make sure that the Micro800 system is properly grounded.

A system may malfunction due to a change in the operating environment after a period of time. We recommend periodically checking system operation, particularly when new machinery or other noise sources are installed near the Micro800 system.

Analog Channel Wiring Guidelines

Consider the following when wiring your analog channels:

- The analog common (COM) is connected to earth ground inside the module. These terminals are not electrically isolated from the system. They are connected to chassis ground.
- Analog channels are not isolated from each other.
- Use Belden 8761, or equivalent, shielded wire.
- Under normal conditions, the drain wire (shield) should be connected to the metal mounting panel (earth ground). Keep the shield connection to earth ground as short as possible.
- To ensure optimum accuracy for voltage type inputs, limit overall cable impedance by keeping all analog cables as short as possible. Locate the I/O system as close to your voltage type sensors or actuators as possible.

Minimize Electrical Noise on Analog Channels

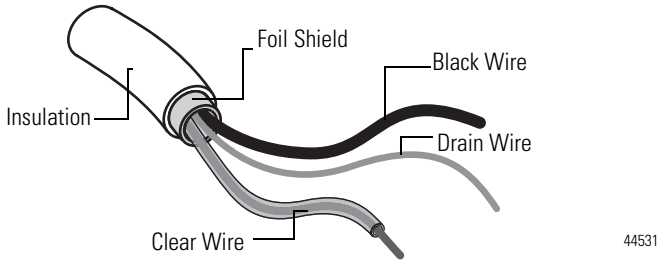
Inputs on analog channels employ digital high-frequency filters that significantly reduce the effects of electrical noise on input signals. However, because of the variety of applications and environments where analog controllers are installed and operated, it is impossible to ensure that all environmental noise will be removed by the input filters.

Several specific steps can be taken to help reduce the effects of environmental noise on analog signals:

- install the Micro800 system in a properly rated enclosure, for example, NEMA. Make sure that the Micro800 system is properly grounded.
- use Belden cable #8761 for wiring the analog channels, making sure that the drain wire and foil shield are properly earth grounded.
- route the Belden cable separately from any AC wiring. Additional noise immunity can be obtained by routing the cables in grounded conduit.

Ground Your Analog Cable

Use shielded communication cable (Belden #8761). The Belden cable has two signal wires (black and clear), one drain wire, and a foil shield. The drain wire and foil shield must be grounded at one end of the cable.



IMPORTANT Do not ground the drain wire and foil shield at both ends of the cable

Notes:

About Plug-In Modules and Accessories

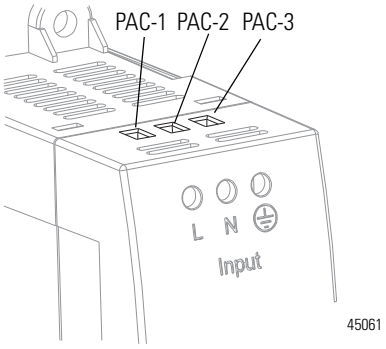
Accessories

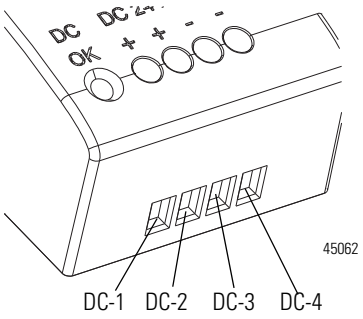
This chapter highlights the accessories you can use with the Micro810 controller.

External AC Power Supply

Use this optional power supply (2080-PS120-240VAC) in applications with smaller systems when a 24V DC power supply is not readily available.

Wire the Module





AC Input Connectors				DC Output Connectors (DC 24V/ 1.6 A)		
PAC-1	AC hot	100…240V AC		DC-1	+	
PAC-2	AC neutral	100…240V AC		DC-2	+	
PAC-3	Safety ground			DC-3	-	
				DC-4	-	

1.5" LCD Display and Keypad Module

This module also functions as a backup memory module for the Micro810 controller.

This module offers an affordable and simple method of viewing status and configuring the Micro810 Controller. With this LCD module. limited numbers of variables can be monitored and edited, and you can also modify core Smart Relay function blocks.

The LCD Display instructions can be used to display custom messages as well as to read keystrokes.

This module should only be inserted or removed when power is not applied to the controller.

Insert the LCD Module

1. Remove power from controller.
2. Remove blank cover plate (show).
3. Push in the LCD module until it latches on the top and bottom.
4. Restore power to the controller

Remove the LCD Module

1. Remove power from controller
2. Squeeze the top and bottom latches, then pull out the top first, then the bottom.
3. Restore power to the controller.

Access the Main Menu

Press the ESC and OK buttons at the same time to access the Main Menu screen.

LCD Screen navigation to be inserted! Pending new emulator release.

USB Adapter

This module provides the Micro810 controller with a USB port.

Use a standard USB A Male to B Male cable for programming the controller.

45221

Notes:

Specifications

Micro810 Controllers

General - 2080-LC10-12AWA, 2080-LC10-12QWB, 2080-LC1012DWD, 2080-LC10-12QBB

Attribute	2080-LC10-12AWA	2080-LC10-12QWB	2080-LC1012DWD	2080-LC10-12QBB
Number of I/O	8 Input (4 digital, 4 analog/digital, configurable) 4 Output			
Dimensions HxWxD	91 x 75 x 59 mm (3.58 x 2.95 x 2.32 in.)			
Supply voltage range	85V…263V	20.4…26.4V DC	10.8V…13.2V DC	11.4V..26.4V DC
Supply frequency range (AC supply)	47…63 Hz	N.A.		
Voltage range	100…240V AC, 50/60 Hz	24V DC Class 2	12V DC Class 2	12/24V DC Class 2
Power consumption	5V A	5 W		
I/O rating	Input: 120…240V AC, 8.4V A Output: C300 R150, 8A 250V AC General Use	Input: 24V DC, 8 mA Output: C300 R150, 8A 250V AC General Use	Input: 12V DC, 8 mA Output: C300 R150, 8A 250V AC General Use	Input: 24V DC, 8 mA Output: 24V DC 1A, 25 °C, 24V DC 0.5A 55°C
Shipping weight, approx.	0.203 kg (0.448 lb)			
Wire size	0.32... 2.1 mm² (22...14 AWG) solid copper wire or 0.32... 1.3 mm² (22...16 AWG) stranded copper wire rated at 90 °C (194 °F) insulation max.			
Wiring category(1)	2 - on signal ports 2 - on power ports			
Wiring torque	1.085 Nm (8 lb-in)			
Wire type	use Copper Conductors only			
Fuse, type	Rated 250V 3.15 A-RADIAL			
Enclosure type rating	None (open-style)			
North American temp code	T5			
Insulation stripping length	7 mm (0.28 in)			
Isolation voltage	250V (continuous), Reinforced Insulation Type, I/O to Aux and Network, Inputs to Outputs. Type tested for 60 s 3250V DC, I/O to Aux and Network, Inputs to Outputs	250V (continuous), Reinforced Insulation Type, I/O to Aux and Network, Inputs to Outputs Type tested for 60 s at 720V DC, Inputs to Aux and Network, 3250V DC Outputs to Aux and Network, Inputs to Outputs		50V (continuous), Reinforced Insulation Type, I/O to Aux and Network, Inputs to Outputs Type tested for 60 s at 720V DC, I/O to Aux and Network, Inputs to Outputs

(1) Use this Conductor Category information for planning conductor routing. Refer to Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1.

Non-isolated AC Inputs (2080-LC10-12AWA)

Attribute	Value
On-state voltage, nom	120/240 V AC
On-state voltage, min	79 V AC
On-state voltage, max	265 V AC
Off-state voltage, max	40 V AC
Operating frequency, nom	50/60 Hz
Input impedence	423.7 kΩ
Operating frequency	47…63 Hz

DC Inputs (2080-LC10-12QWB, -12QBB, -12DWD)

Attribute	Non-isolated, shared with analog inputs (Inputs 4…7)	Isolated (Inputs 0…3)
Voltage category	24V DC sink/source	
On-state voltage, nom	12/24V DC	
On-state voltage, min	9.8V DC	
On-state voltage, max	28.8V AC	
Off-state voltage, max	5V DC	
Off-state current, max	0.5 mA	1.5 mA
On-state current, min	0.75 mA @ 10.8V DC 1.0 mA @ 15 V DC	1.8 mA @ 10.8V DC 2.7 mA @ 15 V DC
On-state current, nom	1.7 mA @ 24V DC	6 mA @ 24V DC
On-state current, max	2.1 mA @ 28.8 V DC	7.5 mA @ 28.8 V DC
Nominal impedance	14.1 kΩ 3.	74 kΩ (isolated)
IEC input compatibility	Type 1	Type 3

Analog Inputs (2080-LC10-12QWB, -12QBB, -12DWD) (Inputs 4…7)

Attribute	Value
Input type	DC voltage
Input voltage range	0…10V DC
Input voltage, max	26.4V DC
Value of LSB	2.5 mV
Input resolution	10-bit
Smoothing	None, smoothing
Overall accuracy	5% of full-scale (2% with calibration) (25…55 °C) (77…131 °F)
Noise rejection	50/60 Hz
Common mode rejection	40 dB, DC to 60 Hz with Smoothing filter
Nominal impedance	14.1 kΩ (non-isolated)

DC Output (2080-LC10-12QBB)

Attribute	Value
User supply voltage, min	10 V DC
User supply voltage, max	26.4V DC
On-state voltage drop	1V @ max load current 2.5V @ max surge current
Current ratings	0.5A @ 55 °C max 1.0A @ 30 °C max 1.0 mA min
Surge current, peak	4.0 A
Surge current, max duration	10 ms
Turn-on- time, max	0.1 ms
Turn-off time, max	0.1 ms

Relay Outputs (2080-LC10-12AWA, -12QWB, -12DWD)

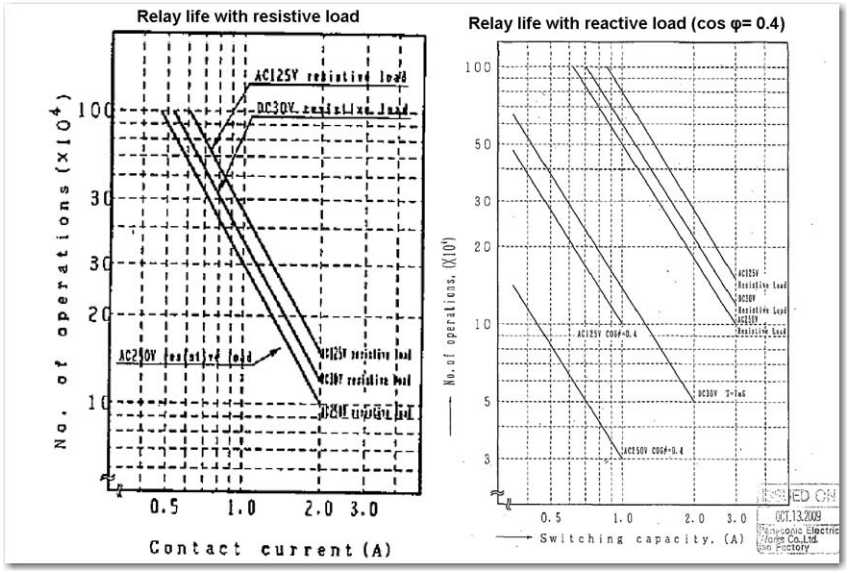
Attribute	Value
Output rating	Relay 00 & 01: 8 A @ 240V AC, 5A @ 24V DC, B300 Relay 02 & 03: 4 A @ 240V AC, 2A @ 24V DC, C300, R150

Relay Outputs (2080-LC10-12AWA, 2080-LC10-12QWB)

Attribute	Value
Voltage, min	5V AC/DC
Voltage, max	250V AC, 30V DC
Turn on time	15 ms
Turn off time	5 ms

Relay Output life

Attribute	Value
Mechanical	10,000,000 cyclces
Electrical with UL test load	100,000 cycles



to be re-oriented.

Rajesh, please confirm if these are up-to-date.

Maximum Volts	IEC 947	Amperes		Amperes Continuous	Volt-Amperes	
		Make	Break		Make	Break
120V AC	AC-15	30 A	3 A	5 A	3600 VA	360 VA
240V AC	AC-15	15.0 A	1.5 A	5 A	3600 VA	360 VA
125V DC	DC-13	0.22 A		1.0 A	28 VA	
250V DC	DC-13	0.11 A		1.0 A	28 VA	
24V DC	DC-13	1.2 A		5.0 A	28 VA	

Environmental

Attribute	Value
Temperature, operating	IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock): -20…55 °C (-4…131 °F)
Temperature, surrounding air, max	55 °C (131 °F)
Temperature, storage	IEC 60068-2-1 (Test Ab, Unpackaged Non-operating Cold), IEC 60068-2-2 (Test Bb, Unpackaged Non-operating Dry Heat), IEC 60068-2-14 (Test Na, Unpackaged Non-operating Thermal Shock): -40…85 °C (-40…185 °F)
Relative humidity	IEC 60068-2-30 (Test Db, Unpackaged Damp Heat): 5...95% non-condensing

Environmental

Attribute	Value
Vibration	IEC 60068-2-6 (Test Fc, Operating): 2 g @ 10…500 Hz
Shock, operating	IEC 60068-2-27 (Test Ea, Unpackaged Shock): 30 g
Shock, nonoperating	IEC 60068-2-27 (Test Ea, Unpackaged Shock): 30 g (DIN Rail Mounted) 30 g (Panel Mounted)
Emissions	CISPR 11 Group 1, Class A
ESD immunity	IEC 61000-4-2: 4 kV contact discharges 8 kV air discharges
Radiated RF immunity	IEC 61000-4-3: 10V/m with 1 kHz sine-wave 80% AM from 80…2000 MHz 10V/m with 200 Hz 50% Pulse 100% AM at 900 MHz 10V/m with 200 Hz 50% Pulse 100% AM at 1890 MHz 3V/m with 1 kHz sine-wave 80% AM from 2000…2700 MHz
EFT/B immunity	IEC 61000-4-4: ±2 kV at 5 kHz on power ports ±2 kV at 5 kHz on signal ports
Surge transient immunity	IEC 61000-4-5: ±1 kV line-line(DM) and ±2 kV line-earth(CM) on power ports ±1 kV line-line(DM) and ±2 kV line-earth(CM) on signal ports ±2 kV line-earth(CM) on shielded ports
Conducted RF immunity	IEC 61000-4-6: 10V rms with 1 kHz sine-wave 80% AM from 150 kHz…80 MHz
Voltage variation	IEC 61000-4-11: 60% dip for 5 and 50 periods on AC supply ports 30% dip for 0.5 period at 0° and 180° on AC supply ports 100% dip for 0.5 period at 0° and 180° on AC supply ports ±10% fluctuations for 15 min on AC supply ports >95% interruptions for 250 periods on AC supply ports

Certifications

Certification (when product is marked)(1)	Value
c-UL-us	UL Listed Industrial Control Equipment, certified for US and Canada. See UL File E322657. UL Listed for Class I, Division 2 Group A,B,C,D Hazardous Locations, certified for U.S. and Canada. See UL File E334470.
CE	European Union 2004/108/EC EMC Directive, compliant with: EN 61000-6-2; Industrial Immunity EN 61000-6-4; Industrial Emissions EN 61131-2; Programmable Controllers (Clause 8, Zone A & B) EN 61131-2; Programmable Controllers (Clause 11)
C-Tick	Australian Radiocommunications Act, compliant with: AS/NZS CISPR 11; Industrial Emissions

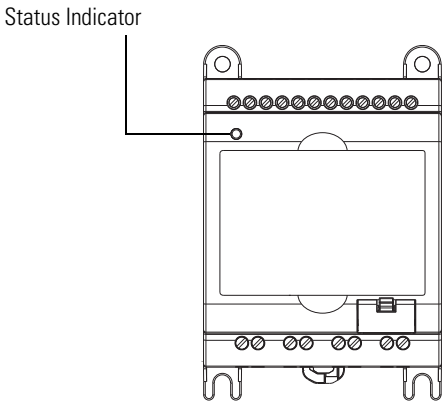
(1) See the Product Certification link at http://www.ab.com for Declaration of Conformity, Certificates, and other certification details.

Notes:

Troubleshooting

Status Indicators on the Controller

Micro810 Controllers

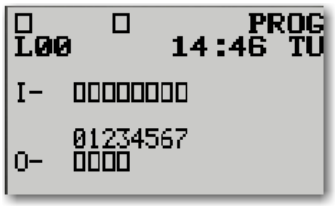


Status Indicator on the Controller

State	During Normal Operation	During Firmware Update or Program/Data Transfer
Off	No power applied to device, or in Fault mode	No power applied to device, or in Fault mode
Solid green	Device operating normally	Program transfer successful
Flashing green	Operating System error	Firmare update in progress

Status Indicators on the LCD Module

Show Screenshots of LCD with I/O indicators. pending build 10 with new UI.



Error Conditions

If an error exists within the controller, the controller indicator operates as described in the following table.

Indicator Behavior	Probable Error	Probable Cause	Recommended Action
			Any indicator behavior for error conditions?
????	Operating system fault	Firmware upgrade unsuccessful	Refer to Using ControlFLASH to Upgrade Your Operating System on page 45.

Error codes

This section lists possible error codes for your controller, as well as recommended actions for recovery.

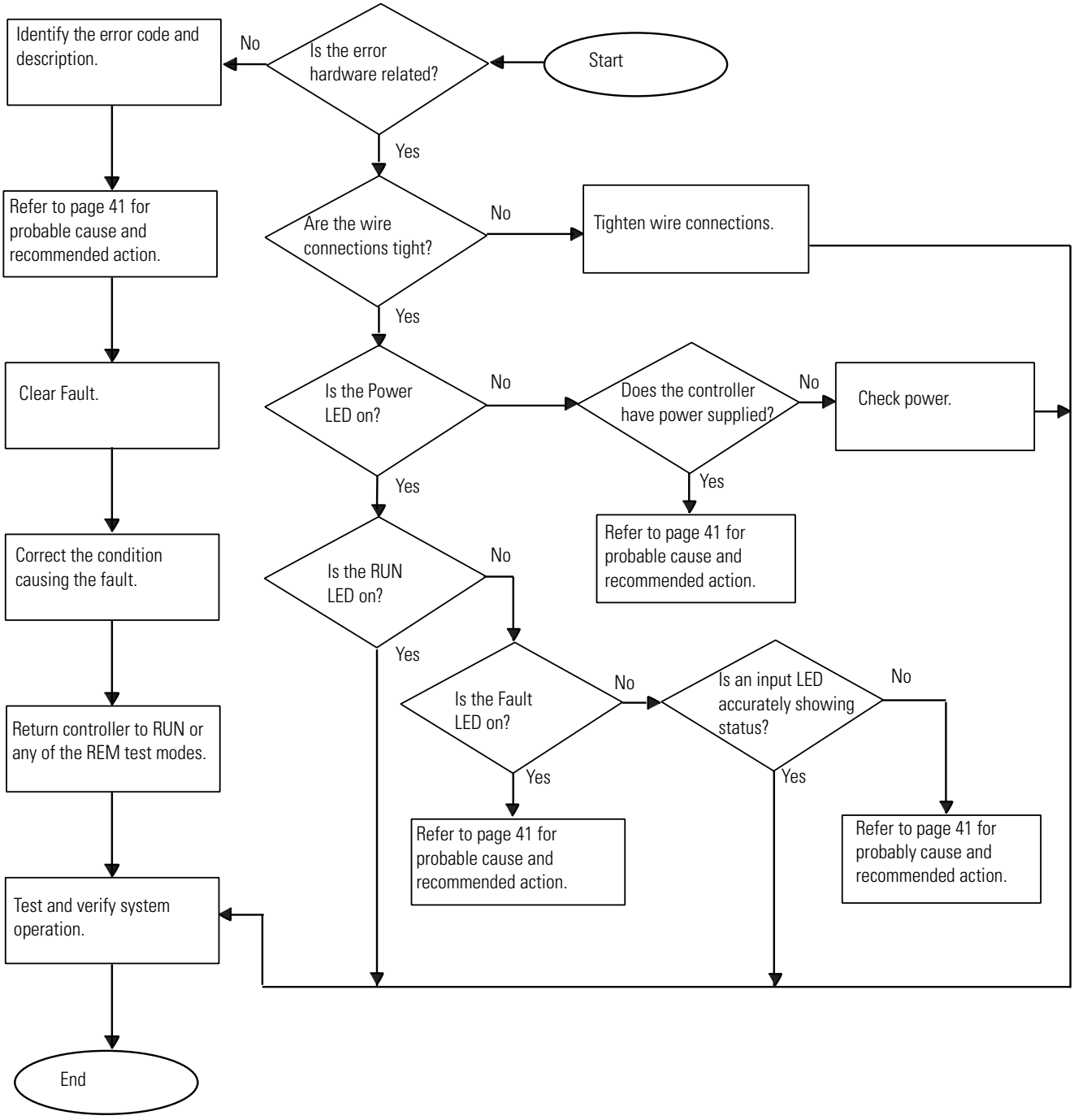
If an error persists, contact your local Rockwell Automation technical support representative. For contact information, go to http://support.rockwellautomation.com/MySupport.asp

List of Error Codes for Micro800 controllers

Error Code	Description	Recommended Action
0xF000	The controller was unexpectedly reset due to a noisy environment or an internal hardware failure. Controller program is cleared.	• Download the program into the controller again. • Refer to Wiring Requirements on page 23.
0xF001	The controller program is cleared. This can occur if: • a power-down occurred during program download or data transfer from the memory module, • if the connection is lost in the middle of download, or • the RAM integrity test failed.	Download or transfer the program to the controller, using the Micro800 Data Log, Recipe Backup and High Accuracy RTC Plug-In Module. You can also use Connected Components Workbench (CCW) to download or transfer the program.
0xF002	The controller hardware watchdog was activated, and the controller program is cleared.	Download the program using the CCW download menu option, after connection has been reestablished with the controller.
To be completed after list of error code descriptions and recommended actions are re-reviewed for clarity.		

Controller Error Recovery Model

Use the following error recovery model to help you diagnose software and hardware problems in the micro controller. The model provides common questions you might ask to help troubleshoot your system. Refer to the recommended pages within the model for further help.



Calling Rockwell Automation for Assistance

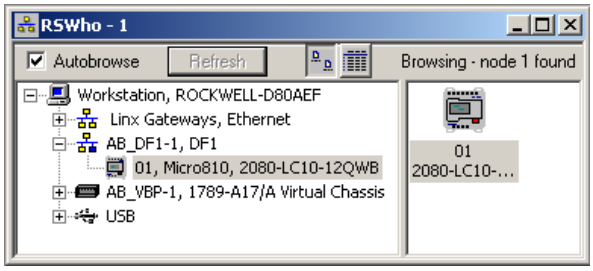
If you need to contact Rockwell Automation or local distributor for assistance, it is helpful to obtain the following (prior to calling):

- controller type, series letter, revision letter, and firmware (FRN) number of the controller
- controller indicator status

Using ControlFLASH to Upgrade Your Operating System

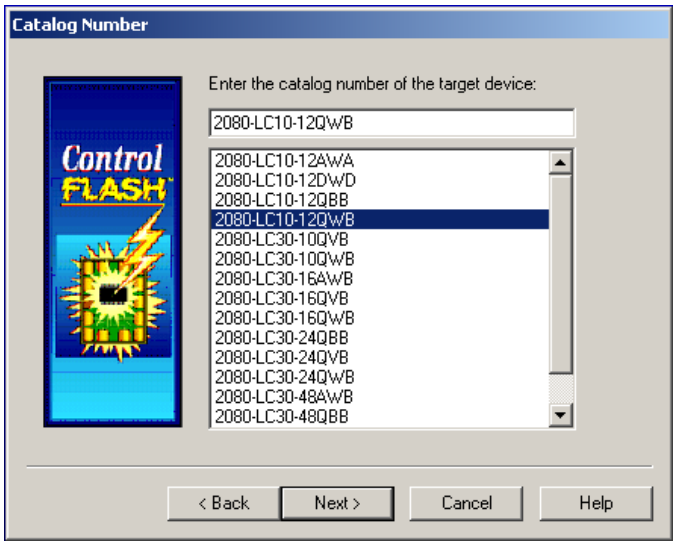
The operating system (OS) can be upgraded through the USB port of the controller. In this chapter, you are shown how to flash update the firmware in a Micro830 controller using a ControlFLASH kit (ControlFLASH.msi file).

1. Verify successful RSLinx communications with the Micro810 controller via USB using RSWho. For more information on verifying RSLinx communications, refer to Establish Communications Between RSLinx and Micro810 via USB on page 53.

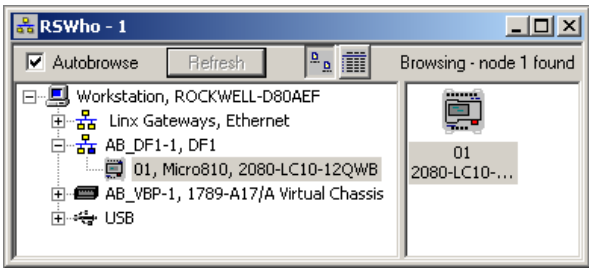


2. If you haven't already installed your Micro800 firmware ControlFLASH kit, do that first.
   After installing the ControlFLASH kit, start ControlFLASH and click Next.

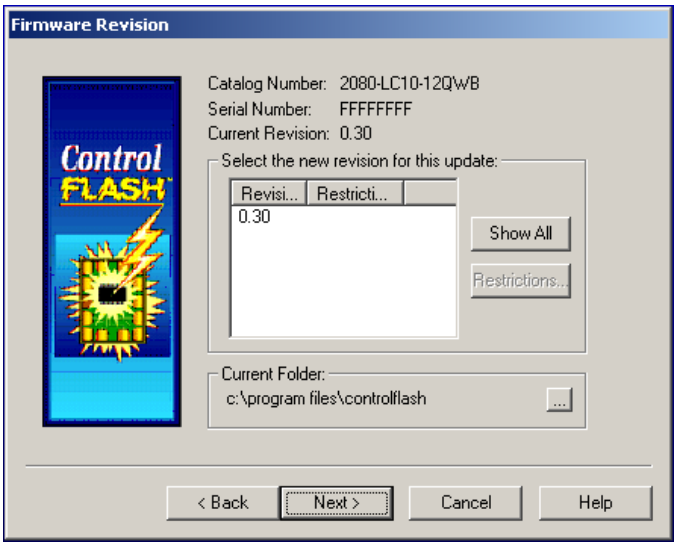
3. In the dialog box that appears, select the catalog number of your Micro810 controller and click Next.



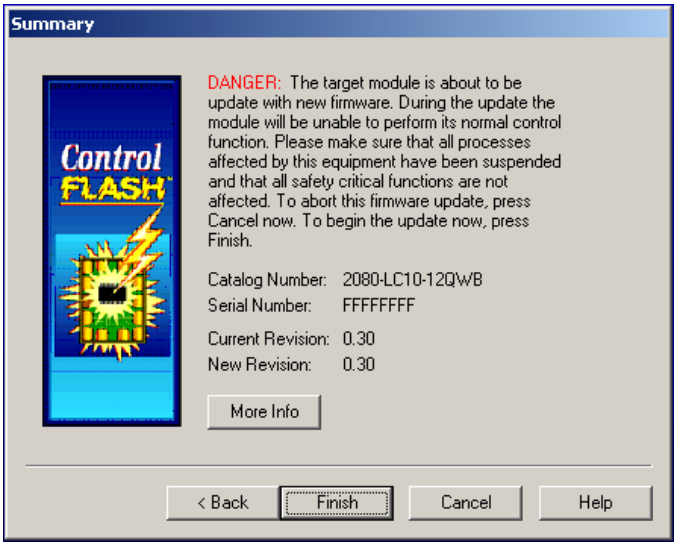
4. If your screen looks different from this, you should click Cancel to end ControlFLASH. Obtain and run the CtrlFlashCustVersion.reg file.
   After which, you can run the CtrlFlashEngVersion.reg file again to restore ControlFLASH back to the "Engineering Version".
   Start ControlFLASH again, and continue up to the previous step.
5. Select the Micro810 controller to be updated from the RSWho display and click OK.



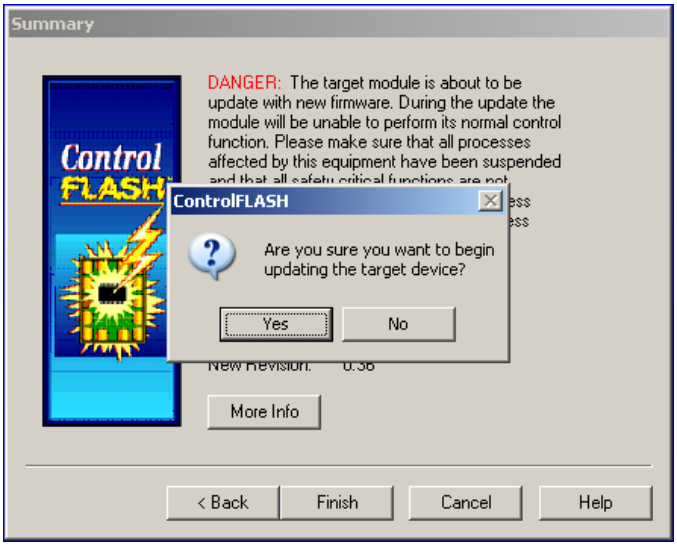
6. Select the firmware revision, and click Next.



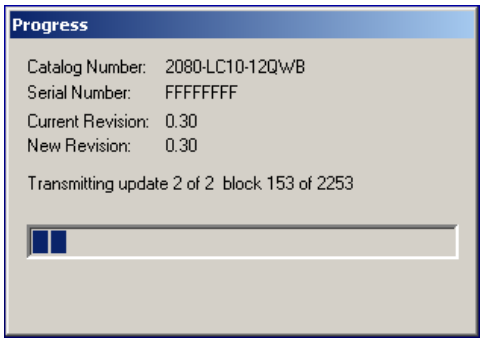
7. Review the information shown in the dialog box that appears. If you want to proceed, click Finish.



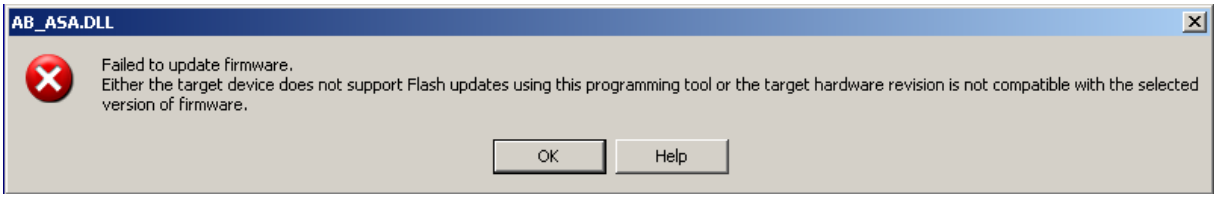
8. Click Yes in the dialog box that appears to begin the flash update.



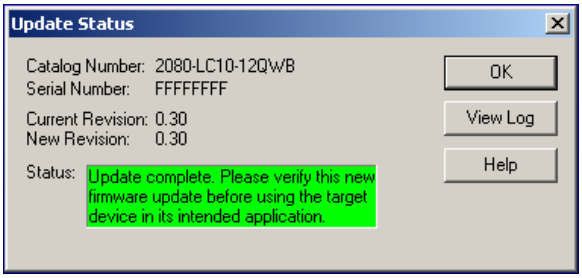
A dialog box showing the progress of the update appears.



9. If you get the following error message instead, make sure the controller is not faulted and that the mode switch is switched to Program.



10. When the flash update is complete, you should get a status screen similar to the following. Click OK, then Yes to complete.



Notes:

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Establish Communications Using RSLinx Classic version 2.55 (and higher)

Establish Communications Between RSLinx and Micro810 via USB

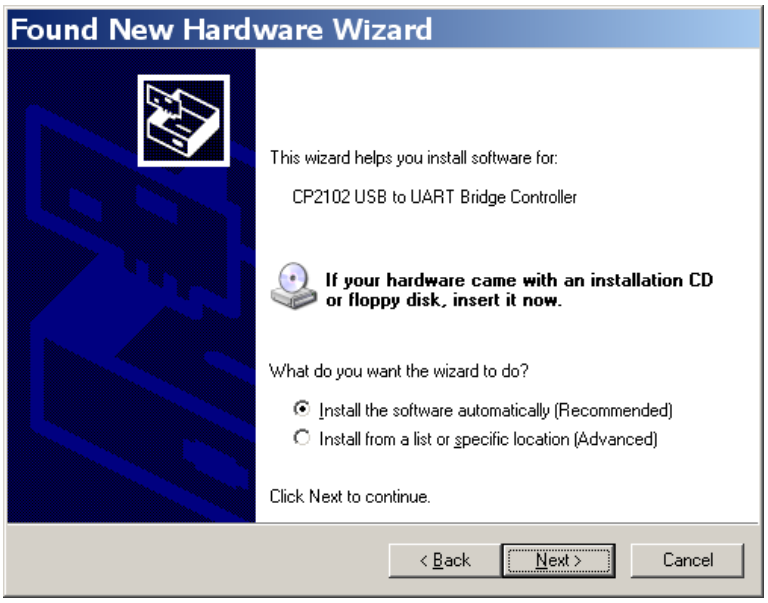
This section shows you how to get RSLinx RSWho communicating with a Micro810 controller via USB.

You can install the necessary driver files for the 2080-USBADAPTER in two ways. You can download and install the latest VCP Driver Kit from the Silicon Labs website at http://www.silabs.com/products/mcu/pages/usbtouartbridgevcpdrivers.aspx , or you can allow Windows to search the Internet for the proper files through the Found New Hardware Wizard.

This section describes the installation by using the Found New Hardware Wizard.

1. If not already installed, install RSLinx Classic version 2.55 (or higher).
2. Power up the Micro810 12-point controller.
3. Plug USB adapter into the Micro810, then plug the USB A/B cable directly to your PC and the adapter.
4. When Microsoft Windows discovers the new hardware, click Yes, this time only. Then, click Next.

5. When this dialog box appears, choose the Install the software automatically (Recommended) option, then click Next.



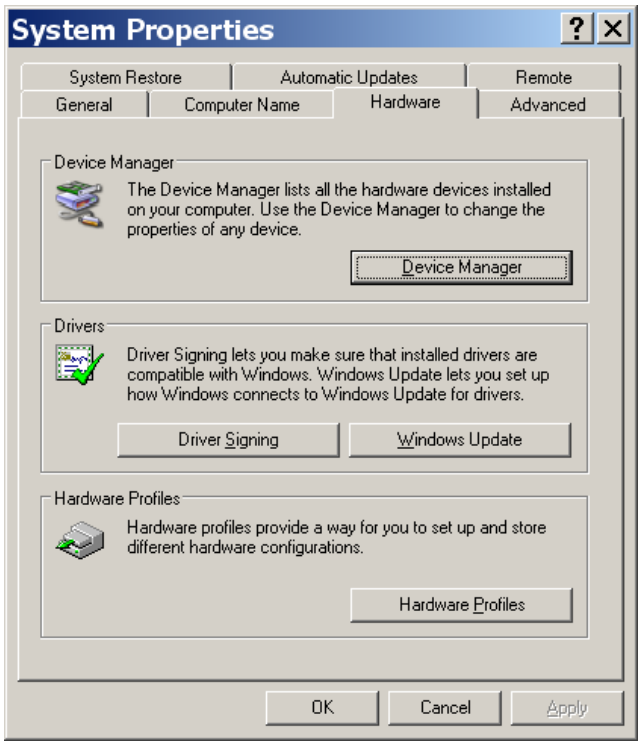
6. When the installation is complete, click Finish in the following dialog box:

7. When Microsoft Windows discovers more new hardware, click Yes, this time only. Then, click Next.

8. When this dialog box appears, choose the Install the software automatically (Recommended) option, then click Next.

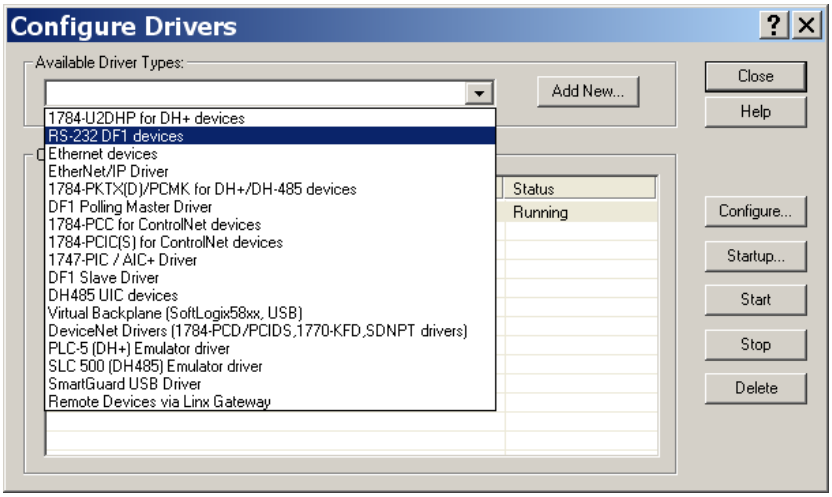
9. When the installation is complete, click Finish in the following dialog box:

10. The 2080-USBADAPTER is a USB to serial (COM port) interface. Now that the driver installation is complete, we need to determine which COM port the device is using. Launch your computer's Device Manager.



11. In the Device Manager dialog box, click the + sign to expand the Ports (COM & LPT) item.

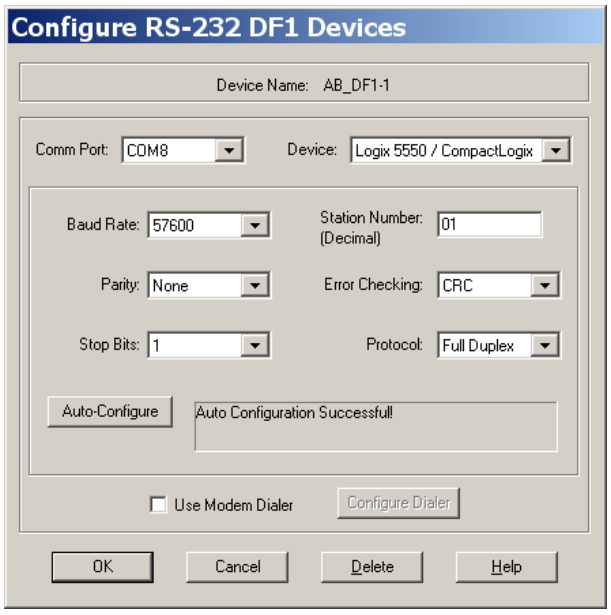
12. Note the COM port assigned to CP210x USB to UART Bridge Controller (COM8 as shown above).
13. Close Device Manager.
14. Open up RSLinx Classic and then click the icon to open the Configure Drivers dialog box.
15. From the Available Driver Types dropdown menu, select RS-232 DF1 devices and click the Add New... button.



16. Accept the default driver name, or create your own (15 characters maximum) and click OK.

17. Select the Comm Port previously identified for the USB adapter and click the Auto-Configure button.

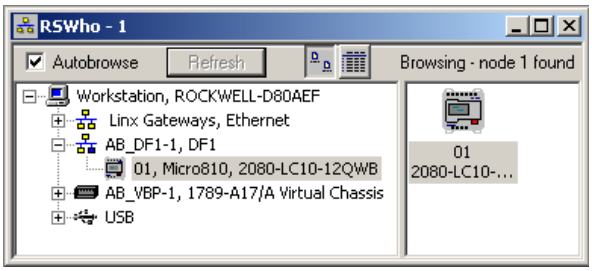
18. After several seconds, the Auto Configuration Successful! message appears. Note that if the Station Number is 00, change it to 01.



19. Click OK and then Close to complete the driver configuration.

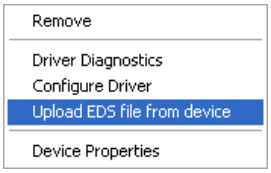
20. Run RSWho by clicking on the  icon.

21. Verify that the Micro810 controller shows up under the DF1 driver. Otherwise, the proper EDS file may not be installed. If so, refer to Upload the EDS file from the controller on page 59 to get the correct EDS file.



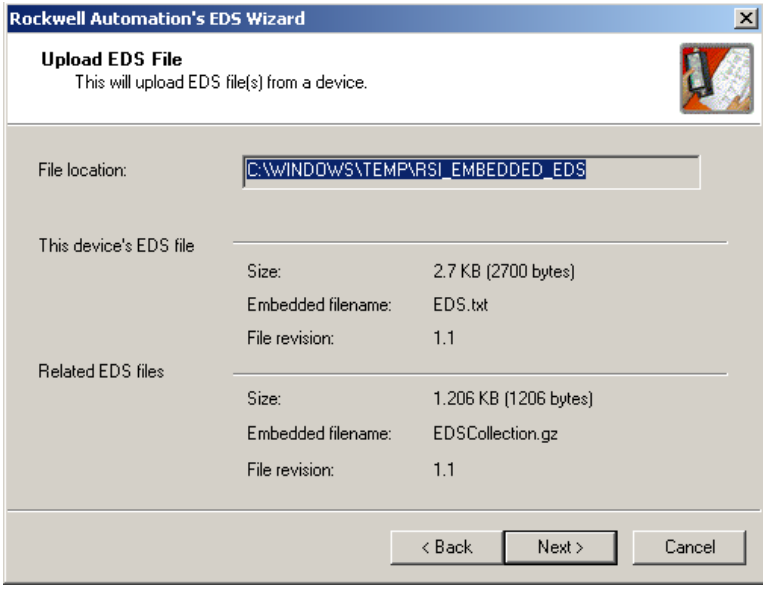
Upload the EDS file from the controller

1. If the Micro810 shows up as an unrecognized device, then the proper EDS for this major revision of firmware has not yet been installed.
2. Micro810 controllers support embedded EDS files. Right-click this device and select Upload EDS file from device:

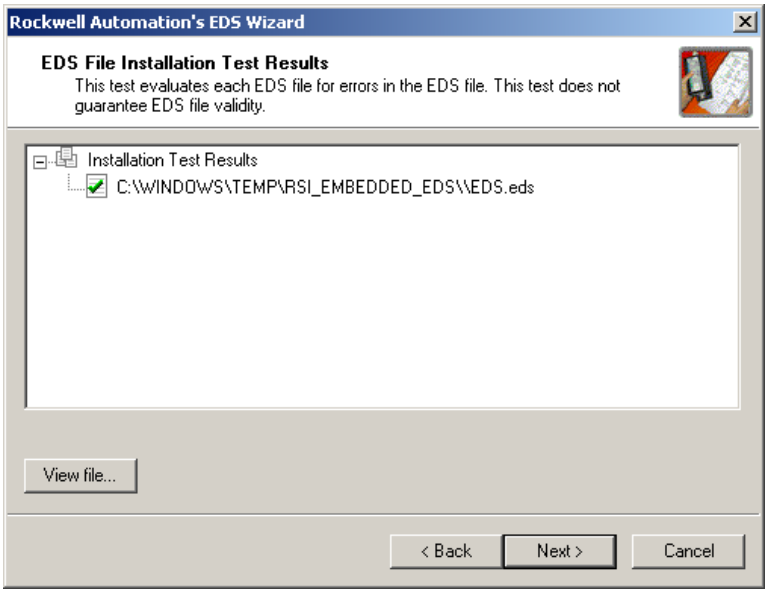


3. This launches the EDS wizard. Click Next to continue.

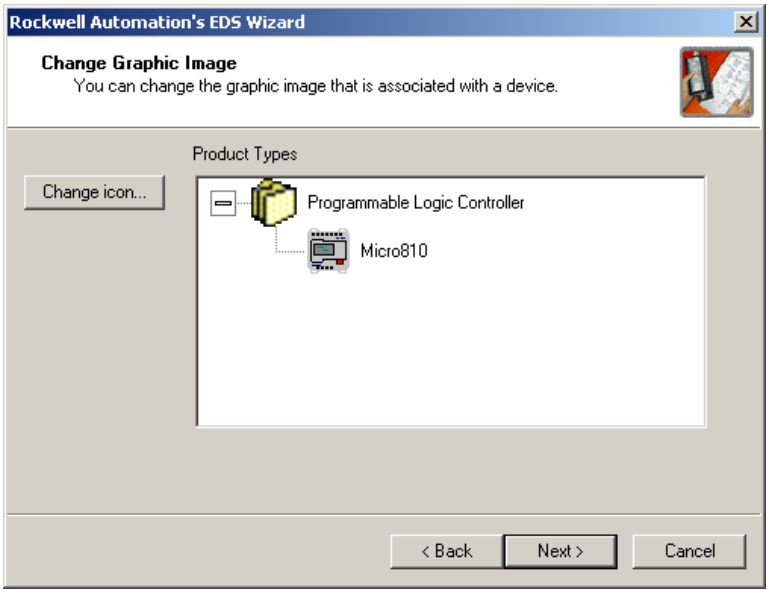
4. Click Next to continue.



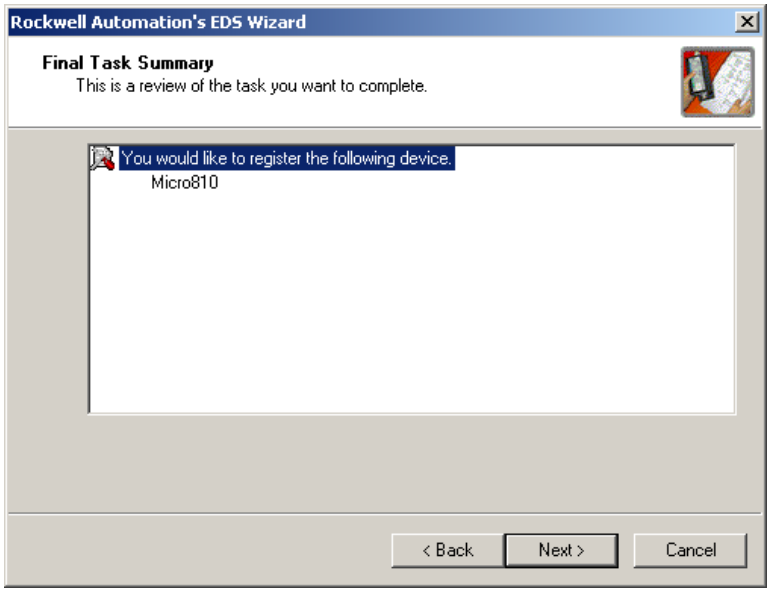
5. Click Next again to continue.



6. Click Next again to continue.

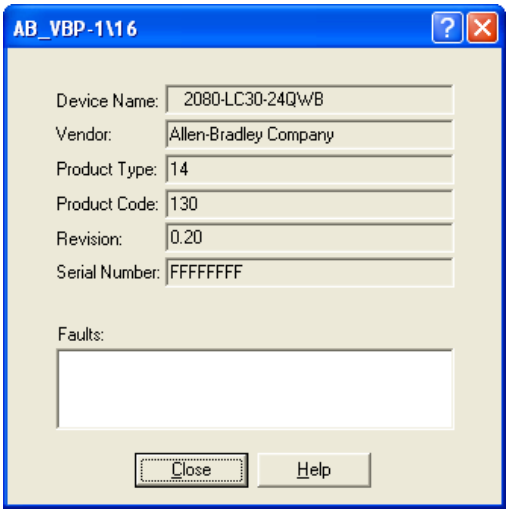


7. Click Next again to continue.



8. Click Finish.

9. Verify that the Micro810 controller shows up under the DF1 driver.
   If the Micro810 still shows up as an unrecognized device, then you are probably running pre-release firmware which is reporting itself as Major Revision 0, which does not match the embedded EDS file.
   To confirm the firmware revision, right-click the device and select Device Properties (firmware Revision is Major.Minor).



Notes:

Connecting to Networks via RS-232/RS-485 Interface

The following protocols are supported from the RS232/RS485 non-isolated combo serial port:

- DF1 Full Duplex
- DF1 Half-Duplex Master/Slave
- DF1 Radio Modem
- DH-485
- Modbus RTU Master/Slave
- ASCII

RS-232 Communication Interface

The communications port on the Micro830 controller utilizes a combined, non-isolated RS-232/485 interface. RS-232 and RS-485 are Electronics Industries Association (EIA) standards that specify the electrical and mechanical characteristics for serial binary communication. They provide a variety of system configuration possibilities (RS-232 and RS-485 define electrical connection characteristics, *not* protocols).

The Micro830 controller supports an additional, non-isolated RS-232 interface on Channel 2. One of the biggest benefits of an RS-232 interface is that it lets you integrate telephone and radio modems into your control system (using the appropriate DF1 protocol only, not DH-485 protocol), but it is for point-to-point connections only between two devices.

RS-485 Communication Interface

The RS-485 interface supports connection of devices in a multidrop hard-wired configuration using DH-485, DF1-Half Duplex, Modbus, or DNP3 protocols. Also, the RS-485 interface supports connection in a multidrop hard-wired configuration using ASCII protocols.

DF1 Full-Duplex Protocol

DF1 Full-Duplex protocol provides a point-to-point connection between two devices. DF1 Full-Duplex protocol combines data transparency (American National Standards Institute ANSI - X3.28-1976 specification subcategory D1) and 2-way simultaneous transmission with embedded responses (subcategory F1).

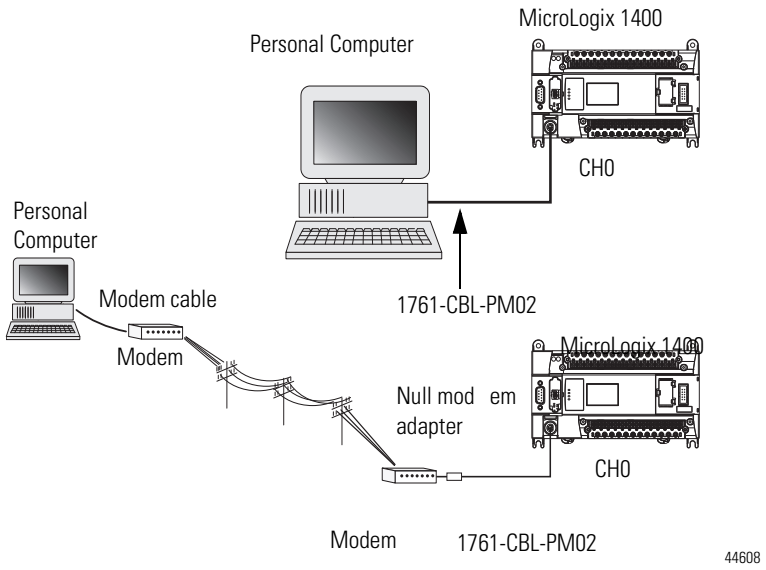
The MicroLogix controller supports the DF1 Full-Duplex protocol via RS-232 connection to external devices, such as computers, or other controllers that support DF1 Full-Duplex.

DF1 is an open protocol. Refer to DF1 Protocol and Command Set Reference Manual, publication 1770-6.5.16, for more information.

DF1 Full-Duplex protocol (also referred to as DF1 point-to-point protocol) is useful where RS-232 point-to-point communication is required. DF1 protocol controls message flow, detects and signals errors, and retries if errors are detected.

Example DF1 Full-Duplex Connections

For information about required network connecting equipment, see Chapter 4, Communication Connections.



DF1 Half-Duplex Protocol

DF1 Half-Duplex protocol is a multi-drop single master/multiple slave network. DF1 Half-Duplex protocol supports data transparency (American National Standards Institute ANSI - X3.28-1976 specification subcategory D1). In contrast to DF1 Full-Duplex, communication takes place in one direction at a time. You can use the RS-232/485 port on the MicroLogix as both a Half-Duplex programming port and a Half-Duplex peer-to-peer messaging port.

DF1 Half-Duplex Operation

A DF1 Half-Duplex master device initiates all communication by “polling” each slave device. The slave device may only transmit when it is polled by the master. It

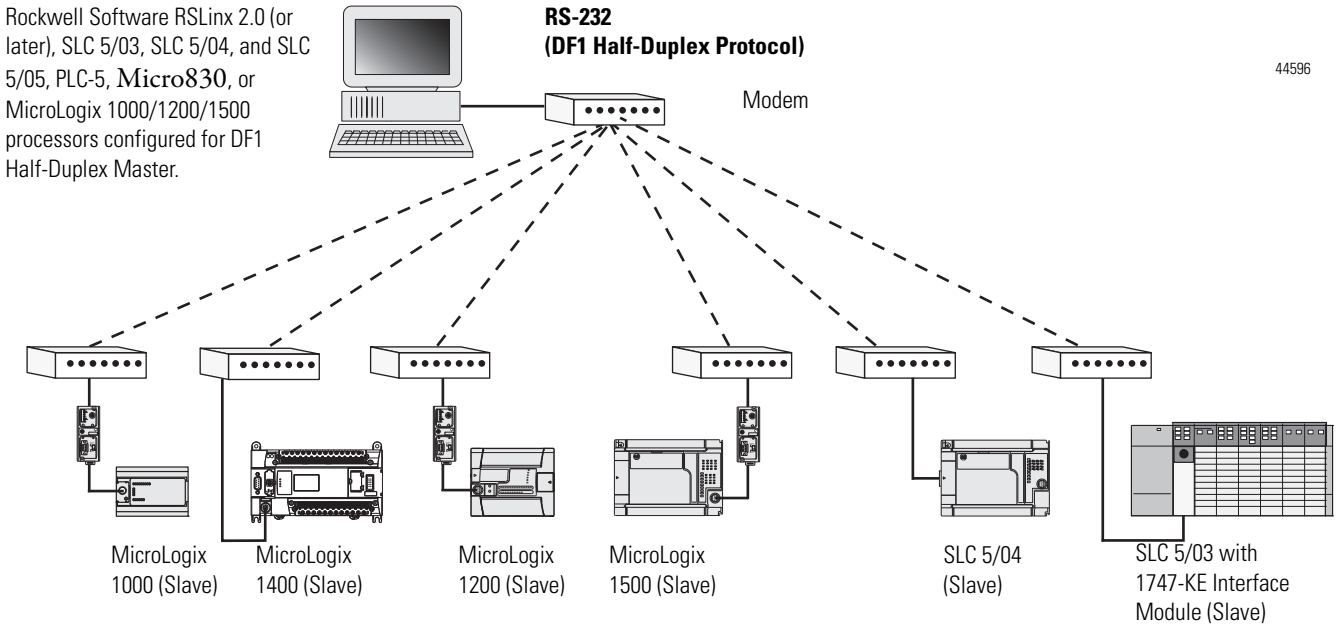
is the master's responsibility to poll each slave on a regular and sequential basis to allow slave devices an opportunity to communicate.

An additional feature of the DF1 Half-Duplex protocol is that it is possible for a slave device to enable a MSG write or read to/from another slave. When the initiating slave is polled, the MSG is sent to the master. The master recognizes that the message is not intended for it, but for another slave, so the master immediately forwards the message to the intended slave. The master does this automatically; you do not need to program the master to move data between slave nodes. This slave-to-slave transfer can also be used by programming software to allow slave-to-slave upload and download of programs to processors (including the master) on the DF1 Half-Duplex link.

Micro830 can act as the master or as a slave on a Half-Duplex network. When the Micro830 is a slave device, a master device is required to "run" the network. Several other Allen-Bradley products support DF1 Half-Duplex master protocol. They include the SLC 5/03™ and higher processors, enhanced PLC-5 processors, MicroLogix 1200/1500 and Rockwell Software RSLinx (version 2.x and higher).

DF1 Half-Duplex supports up to 255 devices (address 0 to 254) with address 255 reserved for master broadcasts. As a DF1 Half-Duplex slave device, the MicroLogix supports broadcast reception. As a DF1 Half-Duplex master, the Micro830 supports both the reception and initiation of broadcast write commands (via the MSG instruction). The MicroLogix also supports Half-Duplex modems using RTS/CTS hardware handshaking.

Example DF1 Half-Duplex Connections



Considerations When Communicating as a DF1 Slave on a Multi-drop Link

When communication is between either your programming software and a MicroLogix Programmable Controller or between two Micro830 Programmable Controllers via slave-to-slave communication on a larger multi-drop link, the devices depend on a DF1 Half-Duplex Master to give each of them access in a timely manner. As the number of slave devices increase, the time between when slave devices are polled also increases. This increase in time may also be large if you are using low baud rates. As these time periods grow, you may need to increase the poll timeout and reply timeout values for slave devices.

IMPORTANT	If a program download is started when using DF1 Half-Duplex, but then is interrupted due to electromagnetic interference or other events, discontinue communications to the controller for the *ownership timeout* period and then restart the program download. The *ownership timeout* period is 60 seconds. After the timeout, you can re-establish communications with the processor and try the program download again. The only other way to remove program ownership is to cycle power on the processor.

Using Modems with MicroLogix Programmable Controllers

The types of modems you can use with MicroLogix controllers include the following:

- dial-up phone modems.
  A MicroLogix controller, on the receiving end of the dial-up connection, can be configured for DF1 Full-Duplex protocol with or without handshaking. The modem connected to the MicroLogix controller should support auto-answer. The Micro830 supports ASCII out communications. Therefore, it can cause a modem to initiate or disconnect a phone call.

- leased-line modems.
  Leased-line modems are used with dedicated phone lines that are typically leased from the local phone company. The dedicated lines may be in a point-to-point topology supporting Full-Duplex communications between two modems or in a multi-drop topology supporting Half-Duplex communications between three or more modems.

- radio modems.
  Radio modems may be implemented in a point-to-point topology supporting either Half-Duplex or Full-Duplex communications, or in a multi-drop topology supporting Half-Duplex communications between three or more modems. Micro830 also supports DF1 Radio Modem protocol.

- line drivers.
  Line drivers, also called short-haul modems, do not actually modulate the serial data, but rather condition the electrical signals to operate reliably over long transmission distances (up to several miles). Line drivers are available in Full-Duplex and Half-Duplex models. Allen-Bradley's AIC+ Advanced Interface Converter is a Half-Duplex line driver that converts an RS-232 electrical signal into an RS-485 electrical signal, increasing the signal transmission distance from 50 to 4000 feet (8000 feet when bridged).

For point-to-point Full-Duplex modem connections that do not require any modem handshaking signals to operate, use DF1 Full-Duplex protocol with no handshaking. For point-to-point Full-Duplex modem connections that require RTS/CTS handshaking, use DF1 Full-Duplex protocol with handshaking.

For radio modem connections, use DF1 Radio Modem protocol, especially if store and forward capability is required.

For general multi-drop modem connections, or for point-to-point modem connections that require RTS/CTS handshaking, use DF1 Half-Duplex slave protocol. In this case, one (and only one) of the other devices must be configured for DF1 Half-Duplex master protocol.

IMPORTANT	Never attempt to use DH-485 protocol through modems under any circumstance.

TIP	All MicroLogix controllers support RTS/CTS modem handshaking when configured for DF1 Full-Duplex protocol with the control line parameter set to Full-Duplex Modem Handshaking or DF1 Half-Duplex slave protocol with the control line parameter set to "Half-Duplex Modem". Micro830 controllers also support DCD (Data Carrier Detect) line for DF1 Radio Modem protocol. For other protocols, you can only access the DCD signal from your ladder logic. No other modem handshaking lines (such as Data Set Ready and Data Terminal Ready) are supported by Micro830 controller.

DH-485 Communication Protocol

The DH-485 protocol defines the communication between multiple devices that coexist on a single pair of wires. DH-485 protocol uses RS-485 Half-Duplex as its physical interface. (RS-485 is a definition of electrical characteristics; it is *not* a protocol.) RS-485 uses devices that are capable of co-existing on a common data circuit, thus allowing data to be easily shared between devices.

The DH-485 network offers:

- interconnection of 32 devices
- multi-master (peer-to-peer) capability
- token passing access control

- the ability to add or remove nodes without disrupting the network
- maximum network segment of 1,219 m (4,000 ft.)

The DH-485 protocol supports two classes of devices: initiators and responders. All initiators on the network get a chance to initiate message transfers. To determine which initiator has the right to transmit, a token passing algorithm is used.

Control of message transfers on the DH-485 network is performed by rotating the token along the nodes on the network. A node holding the token can send a message onto the network. Each node is allowed a fixed number of transmissions (based on the Token Hold Factor) each time it receives the token. After a node sends a message, it passes the token to the next device.

The allowable range of node addresses is 1...31. There must be at least one initiator on the network (such as a MicroLogix controller, or an SLC 5/02 or later processor).

DH-485 Configuration Parameters

When MicroLogix communications are configured for DH-485, the following parameters can be changed:

DF1 Full-Duplex Configuration Parameters

Parameter	Options
Baud Rate	9600, 19.2K
Node Address	1…31 decimal
Token Hold Factor	1…4

See Software Considerations on page 73 for tips on setting the parameters listed above.

Devices that use the DH-485 Network

In addition to the MicroLogix controllers, the devices shown in the following table also support the DH-485 network .

Allen-Bradley Devices that Support DH-485 Communication

Catalog Number	Description	Installation	Function	Publication
Bulletin 1761 Controllers	MicroLogix 1000	Series C or later	These controllers support DH-485 communications.	1761-6.3
Bulletin 1762	MicroLogix 1200	Series A or later	These controllers support DH-485 communications.	1762-UM001
Bulletin 1763	MicroLogix 1100	Series A or later	These controllers support DH-485 communications.	1763-UM001
Bulletin 1764	MicroLogix 1500	Series A or later	These controllers support DH-485 communications.	1764-UM001

Allen-Bradley Devices that Support DH-485 Communication

Catalog Number	Description	Installation	Function	Publication
Bulletin 1747 Processors	SLC 500 Processors	SLC Chassis	These processors support a variety of I/O requirements and functionality.	1747-UM011
1746-BAS	BASIC Module	SLC Chassis	Provides an interface for SLC 500 devices to foreign devices. Program in BASIC to interface the 3 channels (2 RS232 and 1 DH-485) to printers, modems, or the DH-485 network for data collection.	1746-UM004 1746-PM001 1746-RM001
2760-RB	Flexible Interface Module	(1771) PLC Chassis	Provides an interface for SLC 500 (using protocol cartridge 2760-SFC3) to other A-B PLCs and devices. Three configurable channels are available to interface with Bar Code, Vision, RF, Dataliner™, and PLC systems.	1747-6.12 2760-ND001
1784-PKTX, -PKTXD	PC DH-485 IM	PCI Computer Bus	Provides DH-485 using RSLinx.	1784-6.5.22
1784-PCMK	PCMCIA IM	PCMCIA slot in computer	Provides DH-485 using RSLinx.	1784-UM519
2711-K5A2, -B5A2, -K5A5, -B5A5, -K5A1, -B5A1, -K9A2, -T9A2, -K9A5, -T9A5, -K9A1, and -T9A1	PanelView 550 and PanelView 900 Operator Terminals	Panel Mount	Provides electronic operator interface for SLC 500 processors.	2711-UM014

Important DH-485 Network Planning Considerations

Carefully plan your network configuration before installing any hardware. Some of the factors that can affect system performance are:

- amount of electrical noise, temperature, and humidity in the network environment.
- number of devices on the network.
- connection and grounding quality in installation.
- amount of communication traffic on the network.
- type of process being controlled.
- network configuration.

The major hardware and software issues you need to resolve before installing a network are discussed in the following sections.

Hardware Considerations

You need to decide the length of the communication cable, where you route it, and how to protect it from the environment where it will be installed.

When the communication cable is installed, you need to know how many devices are to be connected during installation and how many devices will be added in the future. The following sections help you understand and plan the network.

Number of Devices and Length of Communication Cable

The maximum length of the communication cable is 1219 m (4000 ft). This is the total cable distance from the first node to the last node in a segment. However, two segments can be used to extend the DH-485 network to 2438 m (8000 ft.). For additional information on connections using the AIC+, refer to the Advanced Interface Converter (AIC+) User Manual, publication 1761-6.4.

Planning Cable Routes

Follow these guidelines to help protect the communication cable from electrical interference:

- Keep the communication cable at least 1.52 m (5 ft.) from any electric motors, transformers, rectifiers, generators, arc welders, induction furnaces, or sources of microwave radiation.
- If you must run the cable across power feed lines, run the cable at right angles to the lines.
- If you do not run the cable through a contiguous metallic wireway or conduit, keep the communication cable at least 0.15 m (6 in.) from AC power lines of less than 20 A, 0.30 m (1 ft.) from lines greater than 20 A, but only up to 100K VA, and 0.60 m (2 ft.) from lines of 100 K VA or more.
- If you run the cable through a contiguous metallic wireway or conduit, keep the communication cable at least 0.08 m (3 in.) from AC power lines of less than 20 A, 0.15 m (6 in.) from lines greater than 20 A, but only up to 100 K VA, and 0.30 m (1 ft.) from lines of 100 K VA or more.

  Running the communication cable through conduit provides extra protection from physical damage and electrical interference. If you route the cable through conduit, follow these additional recommendations:
  - Use ferromagnetic conduit near critical sources of electrical interference. You can use aluminum conduit in non-critical areas.
  - Use plastic connectors to couple between aluminum and ferromagnetic conduit. Make an electrical connection around the plastic connector (use pipe clamps and the heavy gauge wire or wire braid) to hold both sections at the same potential.
  - Ground the entire length of conduit by attaching it to the building earth ground.
  - Do not let the conduit touch the plug on the cable.
  - Arrange the cables loosely within the conduit. The conduit should contain only serial communication cables.
  - Install the conduit so that it meets all applicable codes and environmental specifications.

For more information on planning cable routes, see *Industrial Automation Wiring and Grounding Guidelines*, publication 1770-4.1.

Software Considerations

Software considerations include the configuration of the network and the parameters that can be set to the specific requirements of the network. The following are major configuration factors that have a significant effect on network performance:

- number of nodes on the network
- addresses of those nodes
- baud rate

The following sections explain network considerations and describe ways to select parameters for optimum network performance (speed). See your programming software's user manual for more information.

Number of Nodes

The number of nodes on the network directly affects the data transfer time between nodes. Unnecessary nodes (such as a second programming terminal that is not being used) slow the data transfer rate. The maximum number of nodes on the network is 32.

Setting Node Addresses

The best network performance occurs when node addresses are assigned in sequential order. Initiators, such as personal computers, should be assigned the lowest numbered addresses to minimize the time required to initialize the network. The valid range for the MicroLogix controllers is 1...31 (controllers cannot be node 0). The default setting is 1. The node address is stored in the controller Communications Status file (CS0:5/0 to CS0:5/7).

Setting Controller Baud Rate

The best network performance occurs at the highest baud rate, which is 19,200. This is the default baud rate for a MicroLogix device on the DH-485 network. All devices must be at the same baud rate. This rate is stored in the controller Communications Status file (CS0:5/8 to CS0:5/15).

Setting Maximum Node Address

Once you have an established network set up and are confident that you will not be adding more devices, you may enhance performance by adjusting the maximum node address of your controllers. It should be set to the highest node address being used.

IMPORTANT All devices should be set to the same maximum node address.

MicroLogix Remote Packet Support

MicroLogix controllers can respond and initiate with communications (or commands) that do not originate on the local DH-485 network. This is useful in installations where communication is needed between DH-485 and DH+ networks.

The example below shows how to send messages from a device on the DH+ network to a MicroLogix controller on the DH-485 network. This method uses an SLC 5/04 processor as the bridge connection.

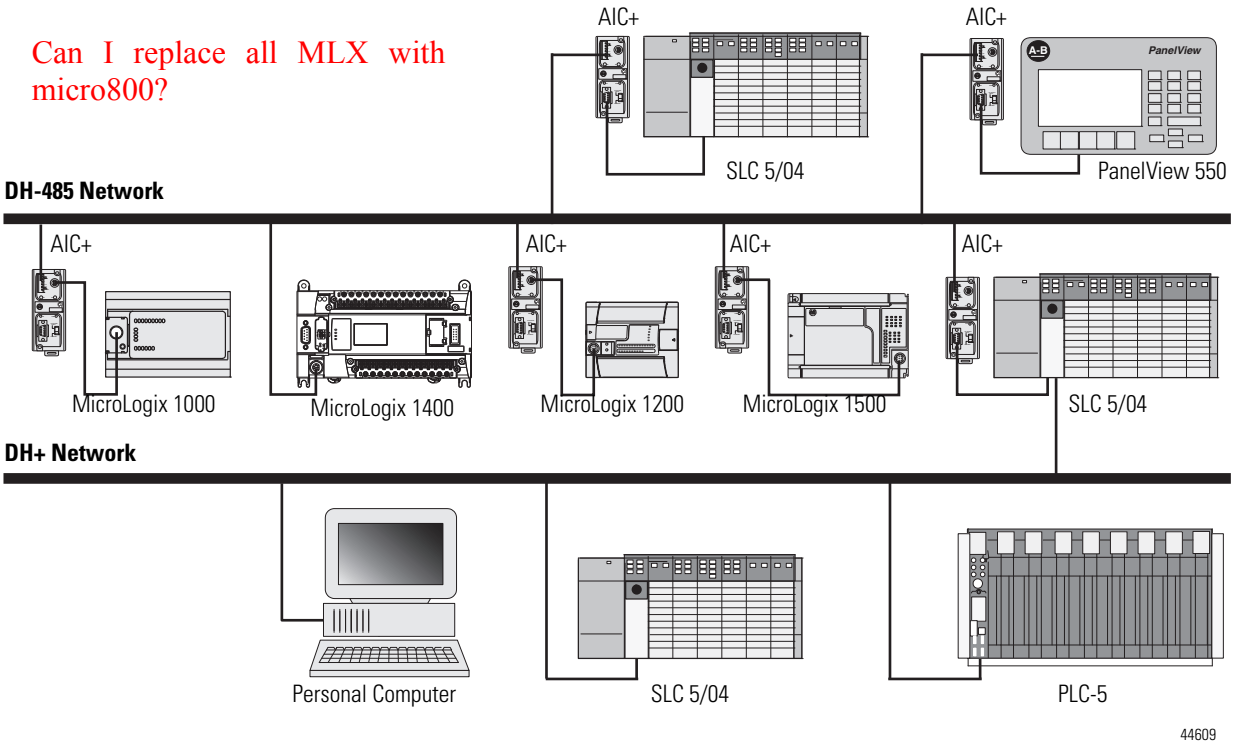
When using this method (as shown in the illustration below):

- PLC-5 devices can send read and write commands to MicroLogix controllers.
- MicroLogix controllers can respond to MSG instructions received.
- The MicroLogix controllers can initiate MSG instructions to devices on the DH+ network.
- PC can send read and write commands to MicroLogix controllers.
- PC can do remote programming of MicroLogix controllers.

TIP Use a 1763-NC01 Series A or later cable to connect a Micro830 controller to a DH-485 network.

You can connect a Micro830 controller to your DH-485 network directly without using a RS-232 to RS-485 converter and optical isolator, such as the AIC+, catalog number 1761-NET-AIC, as shown in the illustration below, because Channel 0 has isolation and RS-485 built-in.

Can I replace all MLX with micro800?

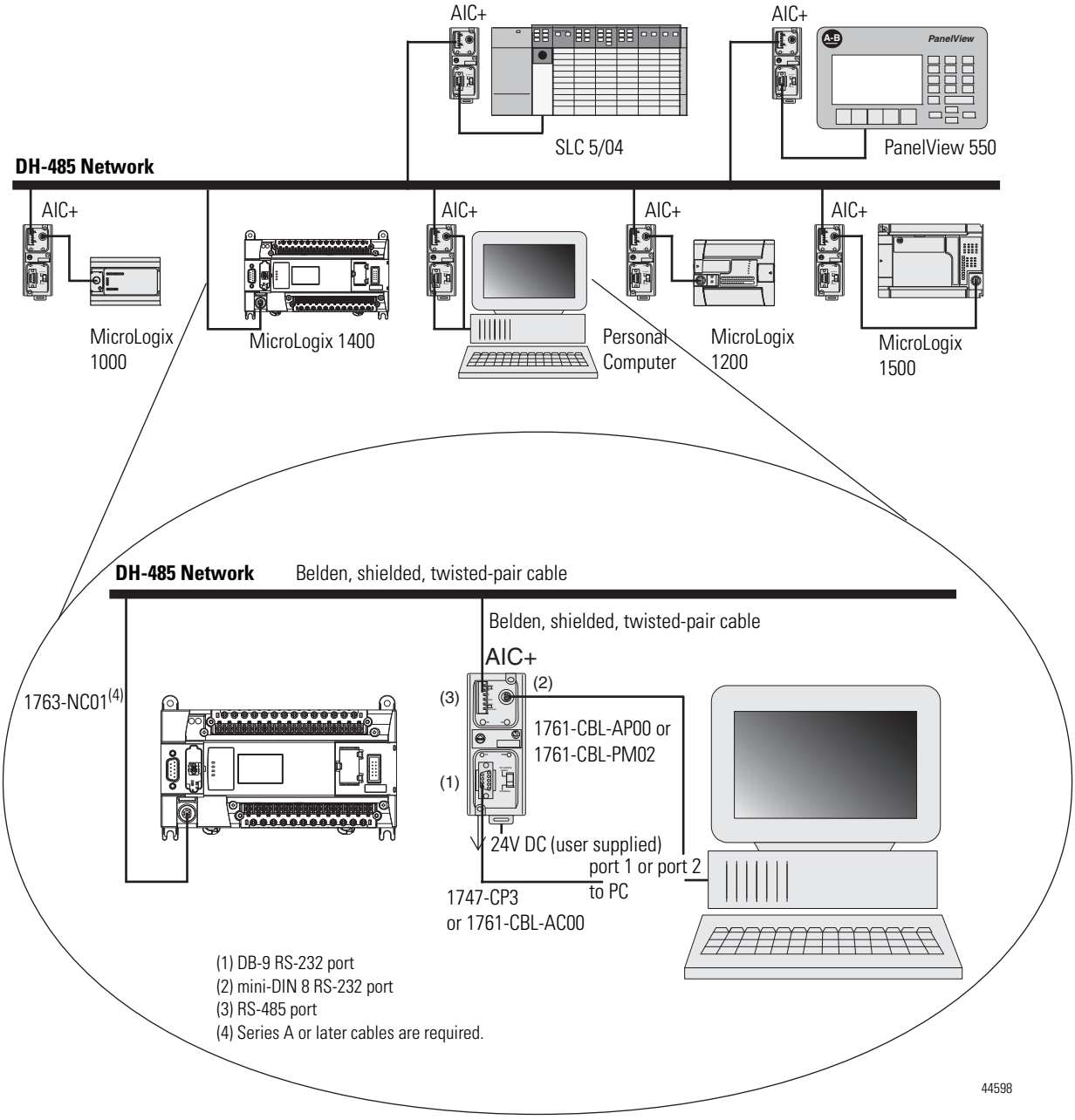


Example DH-485 Connections

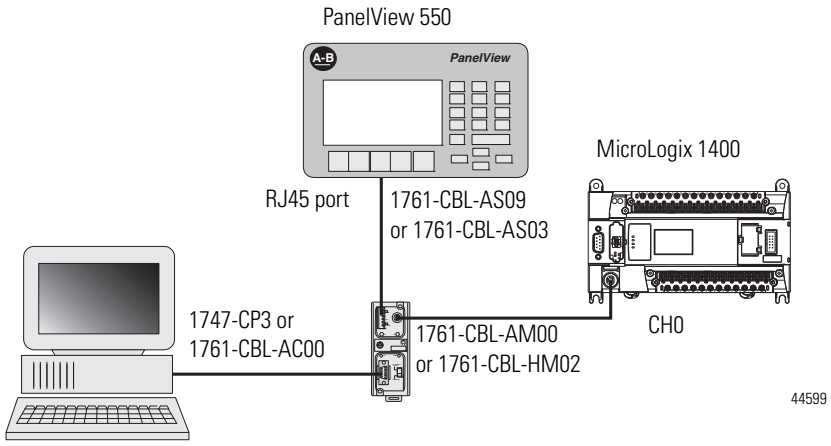
The following network diagrams provide examples of how to connect MicroLogix controllers to the DH-485 network. You can connect a Micro830 controller to your DH-485 network directly without using a RS-232 to RS-485 converter and optical isolator, such as the Advanced Interface Converter (AIC+), catalog number 1761-NET-AIC, as shown in the illustrations below, because Channel 0 has isolation and RS-485 built-in.

However, you may need to use an AIC+ to connect Channel 2 of the Micro830 controller to a DH-485 network. For more information on the AIC+, see the Advanced Interface Converter and DeviceNet Interface Installation Instructions, Publication 1761-5.11.

DH-485 Network with a MicroLogix *Controller*



Typical 3-Node Network



TIP This 3-node network is not expandable.

Modbus Communication Protocol

Modbus is a Half-Duplex, master-slave communications protocol. The Modbus network master reads and writes coils and registers. Modbus protocol allows a single master to communicate with a maximum of 247 slave devices. Micro830 controllers support Modbus RTU Master and Modbus RTU Slave protocol.

For more information on configuring your Micro830 controller for Modbus protocol, refer to the Connected Components Workbench online Help. For more information about the Modbus protocol, see the Modbus Protocol Specifications (available from http://www.modbus.org).

ASCII

ASCII provides connection to other ASCII devices, such as bar code readers, weigh scales, serial printers, and other intelligent devices.

You can use ASCII by configuring the RS-232/485 port, channel 0 and the RS-232 port, Channel 2 for the ASCII driver. Refer to the Connected Components Workbench online Help for more information.

Notes:

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W

Rockwell Automation Support

Rockwell Automation provides technical information on the Web to assist you in using its products.
At http://www.rockwellautomation.com/support/, you can find technical manuals, a knowledge base of FAQs, technical and application notes, sample code and links to software service packs, and a MySupport feature that you can customize to make the best use of these tools.

For an additional level of technical phone support for installation, configuration, and troubleshooting, we offer TechConnect support programs. For more information, contact your local distributor or Rockwell Automation representative, or visit http://www.rockwellautomation.com/support/.

Installation Assistance

If you experience a problem within the first 24 hours of installation, review the information that is contained in this manual. You can contact Customer Support for initial help in getting your product up and running.

United States or Canada	1.440.646.3434
Outside United States or Canada	Use the Worldwide Locator at http://www.rockwellautomation.com/support/americas/phone_en.html, or contact your local Rockwell Automation representative.

New Product Satisfaction Return

Rockwell Automation tests all of its products to ensure that they are fully operational when shipped from the manufacturing facility. However, if your product is not functioning and needs to be returned, follow these procedures.

United States	Contact your distributor. You must provide a Customer Support case number (call the phone number above to obtain one) to your distributor to complete the return process.
Outside United States	Please contact your local Rockwell Automation representative for the return procedure.

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