Allen-Bradley

REC
Resolver-to-
Encoder
Converter
(Cat. No. 4100-5.1)

Installation and Setup Manual

Important User Information

Because of the variety of uses for the products described in this publication, those responsible for the application and use of this control equipment must satisfy themselves that all necessary steps have been taken to assure that each application and use meets all performance and safety requirements, including any applicable laws, regulations, codes and standards.

The illustrations, charts, sample programs and layout examples shown in this guide are intended solely for purposes of example. Since there are many variables and requirements associated with any particular installation, Allen-Bradley does not assume responsibility or liability (to include intellectual property liability) for actual use based upon the examples shown in this publication.

Allen-Bradley publication SGI-1.1, *Safety Guidelines for the Application, Installation, and Maintenance of Solid-State Control* (available from your local Allen-Bradley office), describes some important differences between solid-state equipment and electromechanical devices that should be taken into consideration when applying products such as those described in this publication.

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

ATTENTION: Identifies information about practices or circumstances that can lead to personal injury or death, property damage or economic loss.

Attention statements help you to:

- identify a hazard
- avoid the hazard
- recognize the consequences

Important: Identifies information that is critical for successful application and understanding of the product.

Preface

Chapter 1 – Overview

Chapter 2 – Installation & Hook-Up

Preface

Read This Manual

Read and understand this instruction manual. It provides the necessary information to let you install, connect, and set up the AEC for safe, reliable operation. This preface covers the following topics:

- Who should use this manual
- The purpose of this manual
- Terms
- Common techniques used in this manual
- Allen-Bradley support

Who Should Use this Manual

You should read this manual if you are responsible for the installation, set up or operation of the AEC (Absolute Encoder Converter).

If you do not have a basic understanding of the products listed below, contact your local Allen-Bradley representative for information on available training courses before using this product.

- S Class Compact motion controller
- 1394 GMC System module
- GML (Graphic Motion Language) Commander software

Purpose of this Manual

This manual is an installation and set up guide for the REC (resolver to encoder converter) and describes the procedures necessary to properly install and configure it into your motion control system.

Safety Precautions

The following general precautions apply to the AEC:

ATTENTION: Electric shock can kill. Make sure the AEC is safely installed in accordance with the Installation and Set-up chapters of this manual. Avoid contact with electrical wires and cabling while power is on. Only trained service personnel should open the electrical cabinet.

ATTENTION: This product contains stored energy devices. To avoid hazard of electrical shock, verify that all voltage on the capacitors has been discharged before attempting to service, repair, or remove this unit. You should only attempt the procedures in this manual if you are qualified to do so and familiar with solid-state control equipment and the safety procedures in publication NFPA 70E and BS-EN60204.

ATTENTION: The system integrator is responsible for local safety and electrical codes.

ATTENTION: An incorrectly applied or installed product can result in component damage or a reduction in product life. Wiring or application errors, such as undersizing or inadequate DC supply, or excessive ambient temperatures can result in a malfunction.

ATTENTION: The AEC contains ESD (Electrostatic Discharge) sensitive parts and assemblies. Static control precautions are required when installing, testing, servicing, or repairing this assembly. Component damage can result if ESD control procedures are not followed. If you are not familiar with static control procedures, refer to Allen-Bradley publication 8000-4.5.2, Guarding Against Electrostatic Damage or any other applicable ESD Protection Handbook.

Contents of this Manual

Chapter	Title	Contents
	Preface	Describes the purpose, background, and scope of this manual. Also specifies the audience for whom this manual is intended.
1	Overview	Provides a general description of the REC, its features and mechanical specifications.
2	Installation	Provides the steps needed to successfully mount and wire the REC to a Resolver and the S Class Compact Motion Controller or the 1394 GMC system.
3	Set-Up	Provides the guidelines for setting up and configuring the REC.
Appendix A	Specifications	Provides physical, electrical, environmental, and functional specifications for the AEC.

Related Documentation

The following documents contain additional information concerning related Allen-Bradley products. To obtain a copy, contact your local Allen-Bradley office or distributor.

For	Read This Document	Document Number
Programming Allen-Bradley motion controller with GML	GML Commander User Manual v4.01 GML Commander Reference Manual v4.01	GMLC-5.1 GMLC-5.2
Instructions for installation and set-up for the 1394 GMC system	1394 Digital, AC, Multi-Axis Motion Control System User Manual	1394-5.0
Instructions for installation and set-up for the S Class Compact motion controller	IMC S Class Compact Motion Controller Installation and Set-up Manual	999-122
An article on wire sizes and types for grounding electrical equipment (North American standards)	National Electrical Code	Published by the National Fire Protection Association of Boston, MA.
An article on wire sizes and types for grounding electrical equipment (European standards).	BS-EN 60204 Electrical Equipment of Machines	Published by British Standards Institute
A complete listing of current Allen-Bradley documentation, including ordering instructions. Also indicates whether the documents are available on CD-ROM or in multi-languages	Allen-Bradley Publication Index	SD499
A glossary of industrial automation terms and abbreviations	Allen-Bradley Industrial Automation Glossary	AG-7.1

Terminology

The following terms are specific to this product. For a complete listing of Allen-Bradley terminology, refer to the Allen-Bradley Industrial Automation Glossary, (publication number AG-7.1).

Resolver Element - A small electrical mechanical device that has a single winding on the rotor and a pair of windings on the stator that are electrically positioned at right angles to each other. When the rotor winding is excited with an AC reference signal, the stator windings produce AC voltage outputs that vary in amplitude according to the sine and cosine of the shaft position.

Resolver Package - An electrical mechanical device that has a single input shaft and one or more resolver elements. The resolver elements are geared to the input shaft.

Common Techniques Used in this Manual

The following conventions are used throughout this manual:

- Bulleted lists such as this one provide information, not procedural steps.
- Numbered lists provide sequential steps or hierarchical information.
- Words that you type or select appear in bold.
- When we refer you to another location, the section name appears in italics.
-

ATTENTION: The exclamation point inside of a triangle, followed by the word “ATTENTION” indicate circumstances that can lead to personal injury, death, property damage or economic loss.

- **Important:**Identifies information that is critical for successful application and understanding of the product.

REC Product Receiving and Storage Responsibility

You, the customer, are responsible for thoroughly inspecting the equipment before accepting the shipment from the freight company. Check the item(s) you receive against your purchase order. If any items are obviously damaged, it is your responsibility to refuse delivery until the freight agent has noted the damage on the freight bill. Should you discover any concealed damage during unpacking, you are responsible for notifying the freight agent. Leave the shipping container intact and request that the freight agent make a visual inspection of the equipment.

Leave the product in its shipping container prior to installation. If you are not going to use the equipment for a period of time, store it:

- in a clean, dry location
- within an ambient temperature range of 0 to 85° C (32 to 185° F)
- within a relative humidity range of 5% to 95%, non-condensing
- in an area where it cannot be exposed to a corrosive atmosphere
- in a non-construction area

Allen-Bradley Support

Allen-Bradley offers support services worldwide, with over 75 Sales/ Support Offices, 512 authorized Distributors and 260 authorized Systems Integrators located throughout the United States alone, plus Allen-Bradley representatives in every major country in the world.

Local Product Support

Contact your local Allen-Bradley representative for:

- sales and order support
- product technical training
- warranty support
- support service agreements

Technical Product Assistance

If you need to contact Allen-Bradley for technical assistance, please review the information in this manual first. Then call your local Allen-Bradley representative. For the quickest possible response, we recommend that you have the catalog numbers of your products available when you call. See the *Related Documentation* section of this chapter for the publication numbers of other manuals that can help with this product.

The Rockwell Automation Technical Support number is:

1-800-GMC-TECH

Overview

REC Description

The REC converts a single or dual (Master/Vernier) resolver input signal to an A Quad B quadrature encoder output signal. The A Quad B quadrature output signal can be directly connected to the 1394 GMC System module or the S Class Compact motion controller.

In operation, the REC uses differential quadrature encoder output signals to send incremental position data to the motion controller based on the position of the resolver. Absolute position can be sent to the motion controller for re-calibration.

The REC provides an independent fault detector with normally open relay contacts and an LED indicator for each axis. The relay fault outputs can be:

- used to disable external devices in the event of a fault.
- incorporated into the machine's E-stop string.
- incorporated into other protective circuitry.

The REC can trigger an encoder loss fault when it is used with the 1394 GMC system module or the S Class Compact.

REC Features

The REC has the following features:

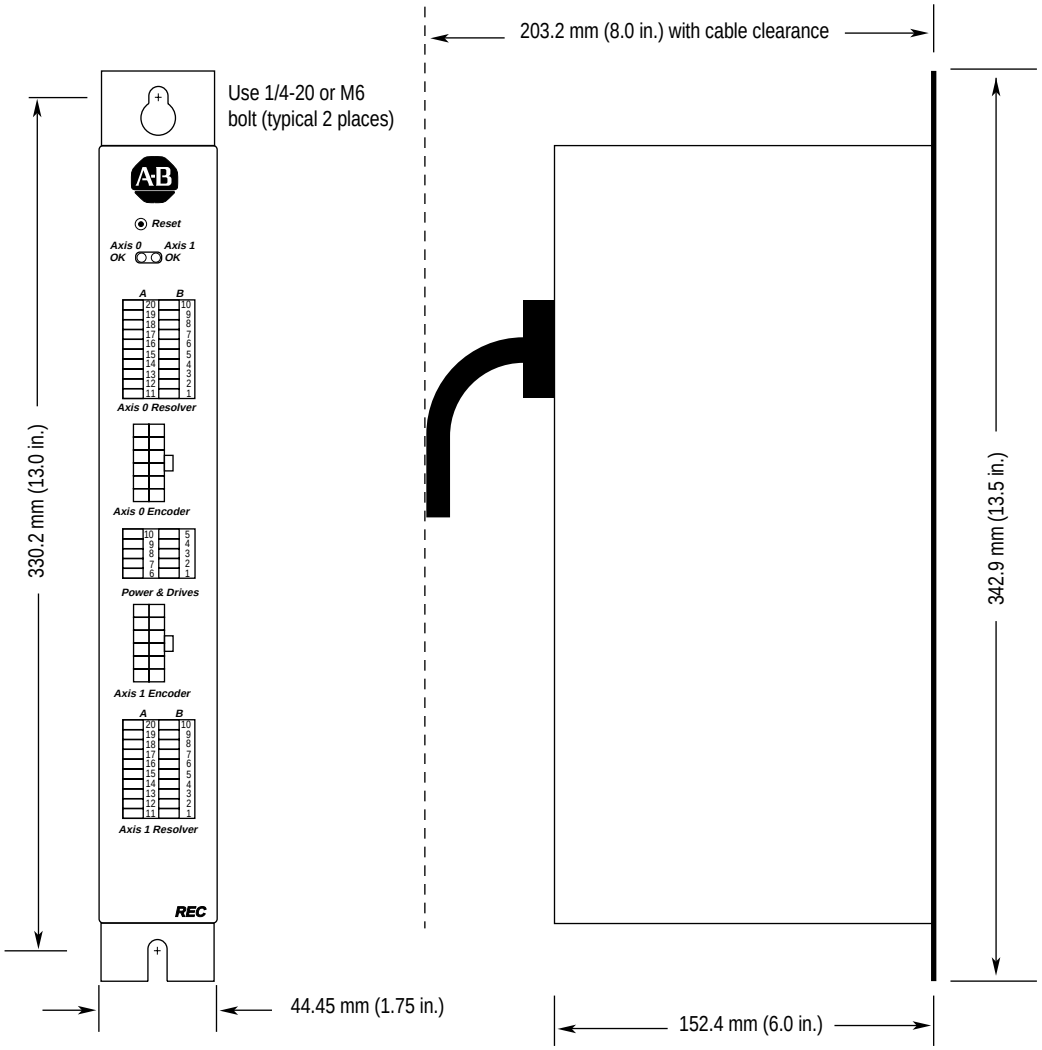
- Two AQB quadrature encoder output channels.
- Two resolver input channels that support Allen–Bradley single or dual resolver packages.
- Resolution of 12 bits per resolver rotor rotation.
- The ability to interface directly with the Allen–Bradley 1394 GMC System and the S Class Compact motion controller.
- The ability to provide differential A and B quadrature encoder output signals using 26C31 (or equivalent) driver IC.
- A resolver phase loss circuit that detects the loss of resolver signals.
- Normally-open fault outputs for each encoder channel.
- A watchdog LED for each encoder conversion channel.
- An on-board reset switch that resets both axes.
- An absolute home request that remotely clears corrected faults for each axis independently.
- A rugged steel housing with mounting tabs.

- The ability to be powered with a single18-36 V DC power supply.
- Automatic resolver phase compensation for accurate position tracking.

REC Mechanical Specifications

Figure 1.1 shows the placement and labeling of major items on the REC front panel.

Figure 1.1
REC front panel



Package Specifications	
Package size mm and (in.)	342.9 x 152.4 x 44.45 (13.5 x 6.0 x 1.75)
Product weight kg and (lbs.)	2.27 (5.0)
Material	Painted Steel

Installation & Hook-Up

Chapter Objectives

Read this entire chapter before beginning to mount, connect, or wire any of the components to the REC. It is the responsibility of the installer to see that the installation conforms to the directions in this manual and local codes and procedures. This chapter covers the following topics.

- European Union Compliance
- Mounting the REC.
- Connecting the REC to the 1394 GMC system.
- Connecting the REC to the Compact motion controller.
- Wiring the REC to the resolver package.
- Wiring the Power & Drives connector.
- Wiring the drives signal for an S Class Compact.
- Connecting a Fault relay.

Installing the REC

The REC is designed to mount in an electrical cabinet using the flanges on its back panel. This installation method should be observed for all applications. Before powering the REC, make sure it has been configured correctly and that the resolver package, drives, and control devices (controller) are connected to it correctly.

Complying with European Union Directives

The information contained in this document pertains to the Resolver-to-Encoder Converter (REC), an Allen-Bradley product. If the REC is installed within the European Union or EEA regions and has the CE mark, the following regulations apply.

EMC Directive

The REC is tested to meet Council Directive 89/336 Electromagnetic Compatibility (EMC) in accordance with Article 10 (1). The following directives apply:

- EN 50081-2 EMC-Generic Emission Standard, Part 2-Industrial Environment.
- EN 50082-2 EMC-Generic Immunity Standard, Part 2-Industrial Environment.

The REC, as described in this document, is intended for use in an industrial environment and is not intended for use in a residential, commercial, or light industrial environment.

To meet CE requirements, the following are required:

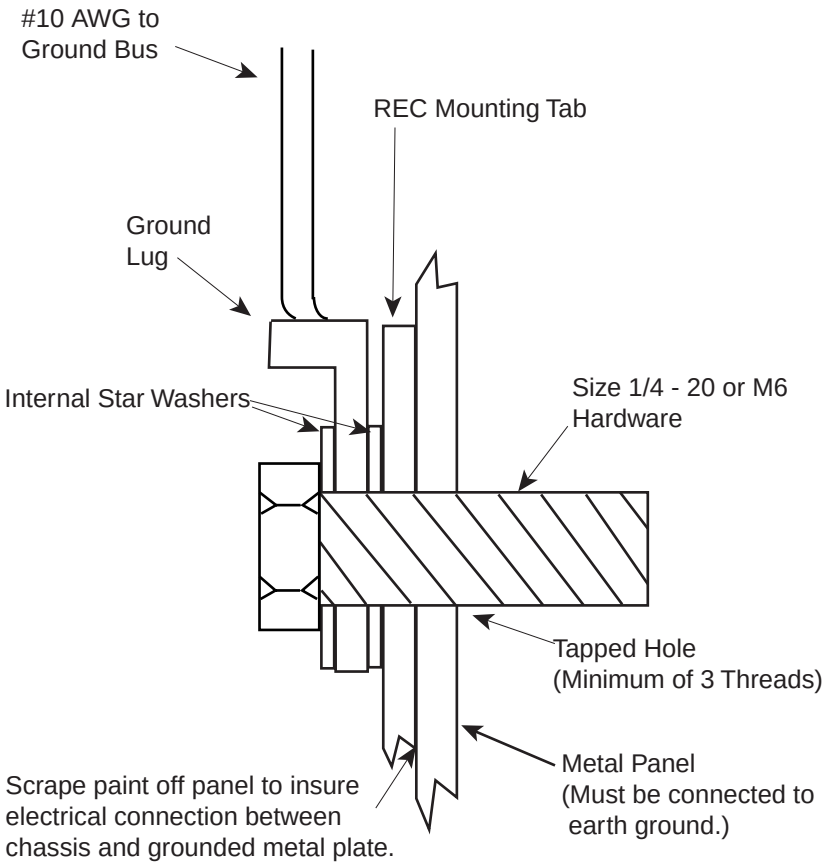
- The REC must be mounted in an IP 54 rated metal enclosure on a metal panel.
- All equipment must be bonded.
- You must use the specified Allen-Bradley cables.
- The REC is designed to function without maintenance when operated in the environment specified in this manual.
- Under normal conditions, the REC should not require any periodic maintenance. However, if conditions are less than ideal and any superficial dust has accumulated on the controller over time, remove the dust carefully. Also, it is recommended to periodically inspect all cables for abrasion and all connectors for proper seating.

Mounting the REC

Before mounting the REC, verify that the 1394 GMC System or the S Class Compact motion controller is installed correctly. Refer to the *1394 Digital AC Multi-Axis Motion Control System User Manual* (publication 1395-5.0) or the *IMC 23/x Installation and Set-up Manual* (publication 999-122) for installation instructions.

The REC must be properly grounded to the metal enclosure panel. the following diagram shows how to ground the REC to the panel.

Figure 2.1
Mounting and Grounding Diagram

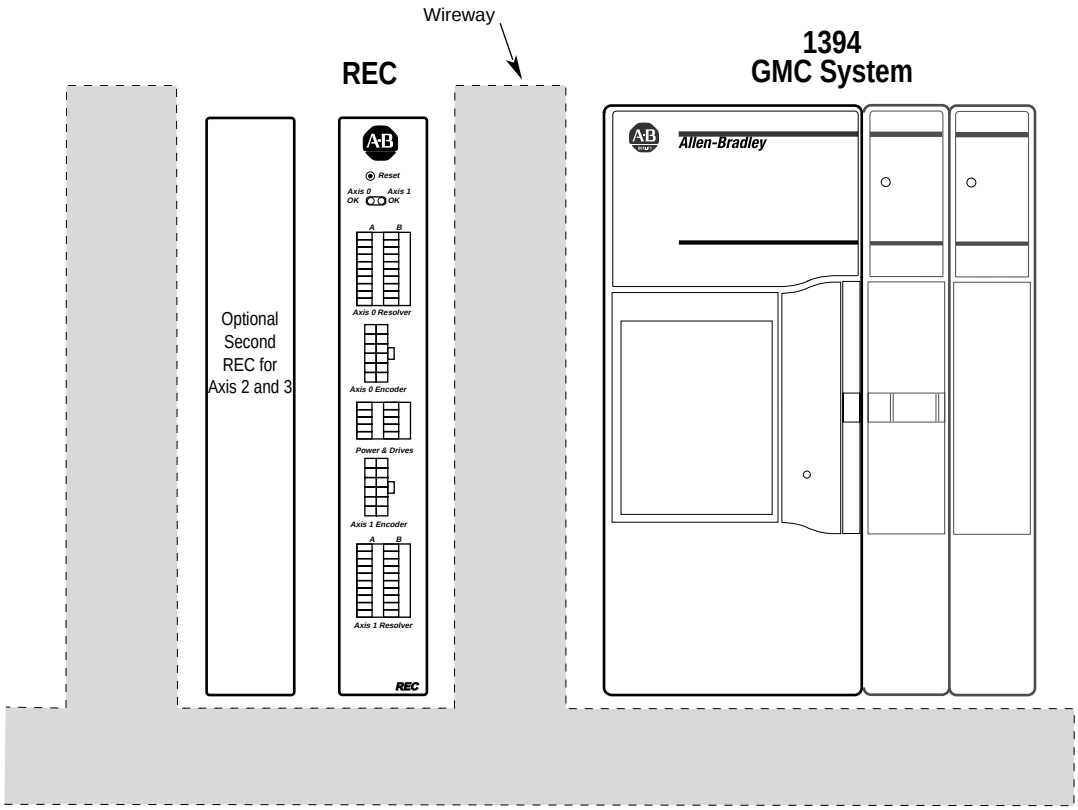


Mount the REC next to a 1394 GMC system or an S Class Compact motion controller on a metal enclosure panel using two 1/4 -20 or M6 bolts. Refer to the *Mechanical Specifications* in the *Overview* chapter of this manual for mounting dimensions. Figures 2.2 and 2.3 in this chapter show where to mount the REC.

ATTENTION: To avoid a shock hazard, remove all power to the system panel before mounting the REC.

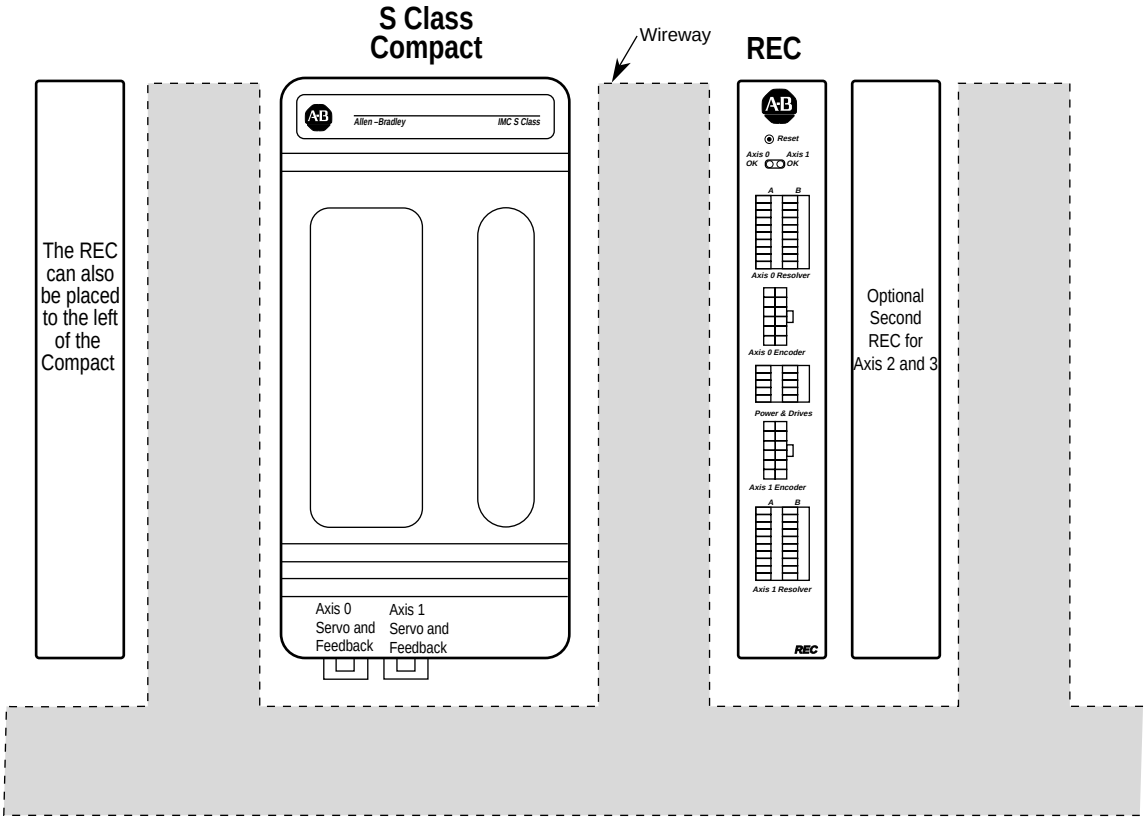
ATTENTION: The 1394 contains stored energy devices. To avoid the hazard of electrical shock, verify that all voltages are zero (0.00) before proceeding.

Figure 2.2
Mounting the REC next to a 1394 GMC on a system panel



Important: The REC can only be mounted on the left side (when looking directly at the mounted 1394) of the 1394 GMC System. This is due to cable specifications and module expansion of the 1394.

Figure 2.3
Mounting the REC next to an S Class Compact motion controller.



Important: The REC can be mounted on either side of the S Class Compact motion controller on the system panel.

Connecting the REC

The following section details how to connect the REC encoder connectors to the 1394 GMC System and the S Class Compact motion controller.

ATTENTION: Do not attempt to make any electrical connections to the REC while power is applied. Doing so risks damage to the REC, peripheral equipment, and your health and safety.

ATTENTION: The REC does not support the removal or the insertion of any connectors when under power. The power disturbance can result in unintended machine motion, loss of process control, or an electrical arc that can cause an explosion in a hazardous environment.

Connecting the REC to the 1394

Connect the REC to a 1394 GMC System using the encoder cable (catalog number 1394-GR04) for each axis. This is a four foot cable that connects Axis 0 Encoder or Axis 1 Encoder connector on the REC to the J3, J4, J5, or J10 encoder feedback connector on the 1394.

Important: This cable is polarity sensitive.

Important: The REC does not require power from the 1394 to operate nor does it provide power to the 1394. However, the 1394 requires a separate 5V power supply to run its interface circuitry.

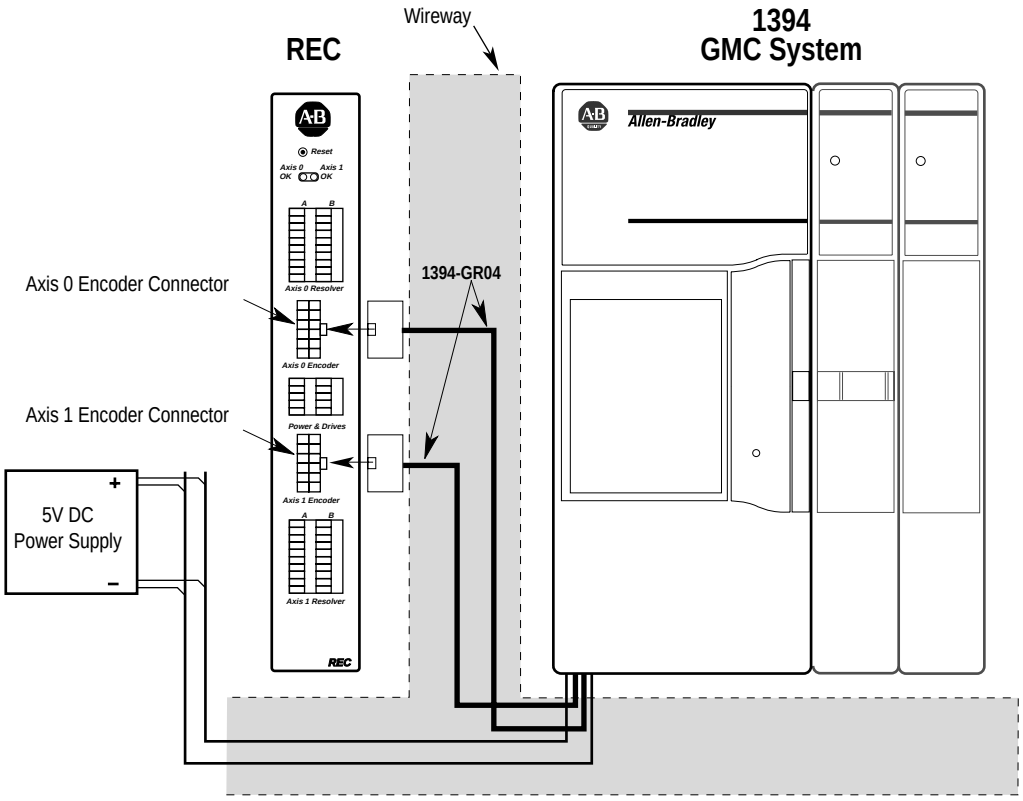
The 1394 interface circuitry requires 0.325A to operate. Any additional devices connected to the 1394, such as incremental encoders, can require an additional 0.2A per device (check your device for the precise requirements).

To connect the encoder cables:

1. Insert the 12-pin plug labeled “REC/AEC” in the Axis 0 Encoder or Axis 1 Encoder connector on the REC.
2. Insert the 12-pin plug labeled “1394” in the J3, J4, J5, or J10 encoder feedback connector on the 1394.
3. Wire the remaining auxiliary power labeled “ENC. PWR” to the 5V DC power supply. The red wire is +5V and the black is a +5 common.

Important: When using multiple Encoder devices, we recommend you wire all of the auxiliary power cables to the same 5V DC power supply.

Figure 2.4
Connecting the Encoder Cables and the 5V Power Supply to the 1394



Important: Anchor the cable so that no more than 2 feet of cable is left unsupported. The excessive weight of an unanchored cable could pull the plug out of the connector.

Connecting the REC to the Compact

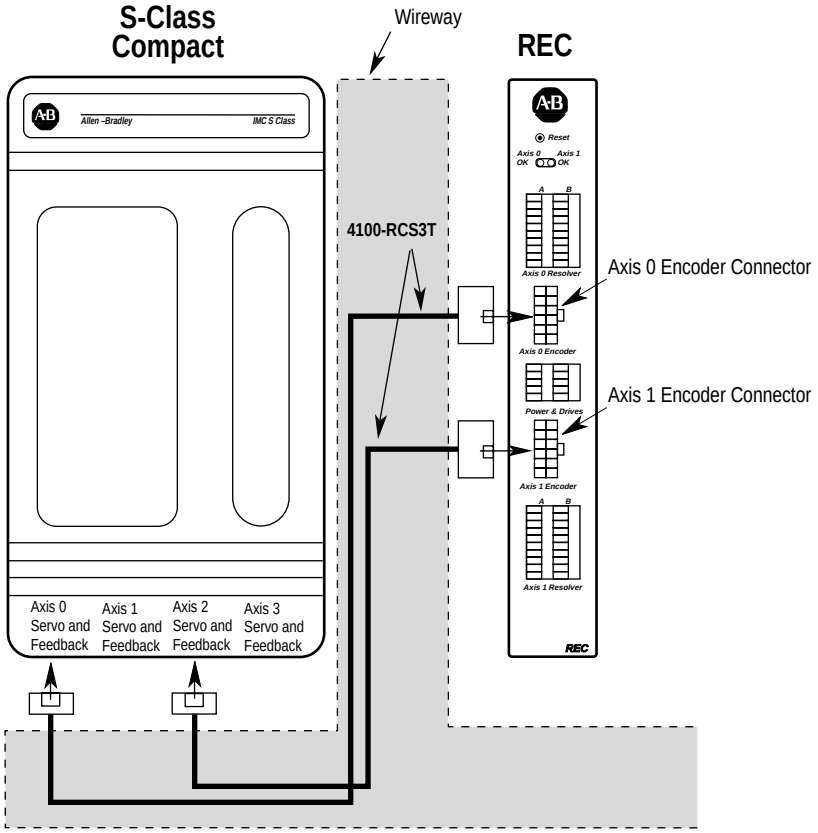
To connect the REC to the S Class Compact motion controller, use the encoder cable (catalog number 4100-RCS3T) for each axis. This three foot cable connects the Axis 0 Encoder or the Axis 1 Encoder connector on the REC to the Axis 0, 1, 2, or 3 servo and feedback connector on the S Class Compact. The Compact sends the drive servo output signal through the 4100-RCS3T cable. Figure 2.4 shows where to connect the encoder cable to the REC and the Compact.

Important: This cable is NOT polarity sensitive.

To connect the Encoder cable:

1. Insert one 12-pin plug in the Axis 0 Encoder or Axis 1 Encoder connector on the REC.
2. Insert the remaining 12-pin plug in the Axis 0, 1, 2, or 3 servo and feedback connector on the Compact.

Figure 2.5
Connecting the Encoder Cables to the Compact



Important: Anchor the cable so that no more than 2 feet of cable is left unsupported. The excessive weight of an unanchored cable could pull the plug out of the connector.

Wiring the REC

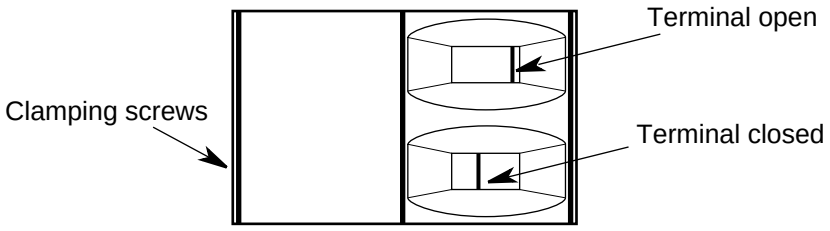
The REC has two resolver connectors (Axis 0 Resolver and Axis 1 Resolver) that support single or dual resolvers. Each connector comes with two removable 10-position plugs. The resolver cable flying leads wire directly to the screw terminals on the plugs.

Wiring Cable Flying Leads to the Plugs

To wire the cable leads to the plug:

1. Look at the plug to make sure the terminal is open. Figure 2.5 shows both an open and a closed terminal.

Figure 2.6
Terminal diagram



2.

Table 1: Terminal Steps

If the terminals are:	Do this:
Not open	Go to step 3
Open	Go to step 4

3. Using a small, flat-head screwdriver, turn the clamping screw counter-clockwise several times.

4. Using a proper stripping tool, strip the wire insulation back on the cable lead.

Important: All terminals accommodate a maximum of 14 gauge wire.

5. Trim the cable lead so that 0.275 inches of metal wire is exposed.

6. Insert the cable lead in the appropriate terminal. Refer to the proper figures for their locations.

7. Use the screwdriver to tighten the clamping screw to the proper torque (0.25 N-m/2.2 in-lb.).

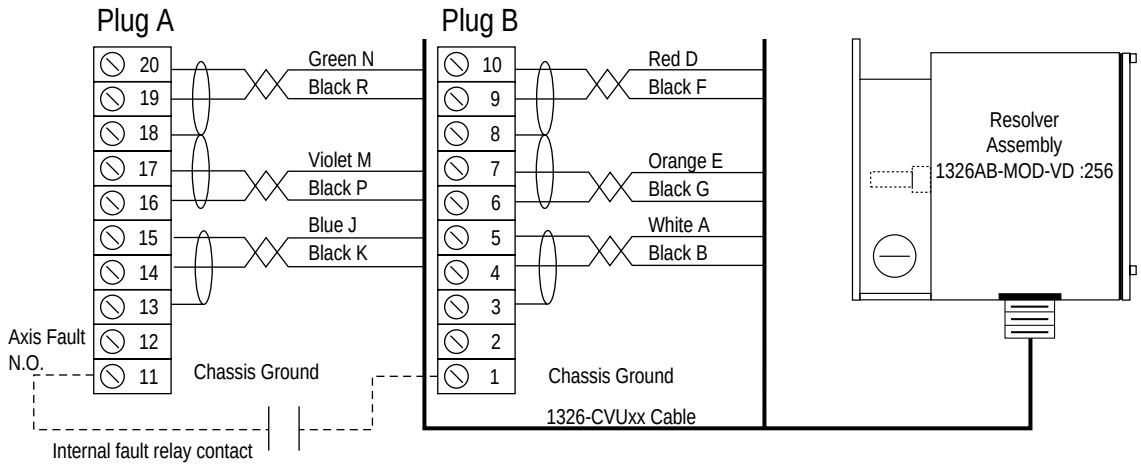
8. Verify that the cable lead does not pull out of the terminal.

9.

Table 2: Cable Leads

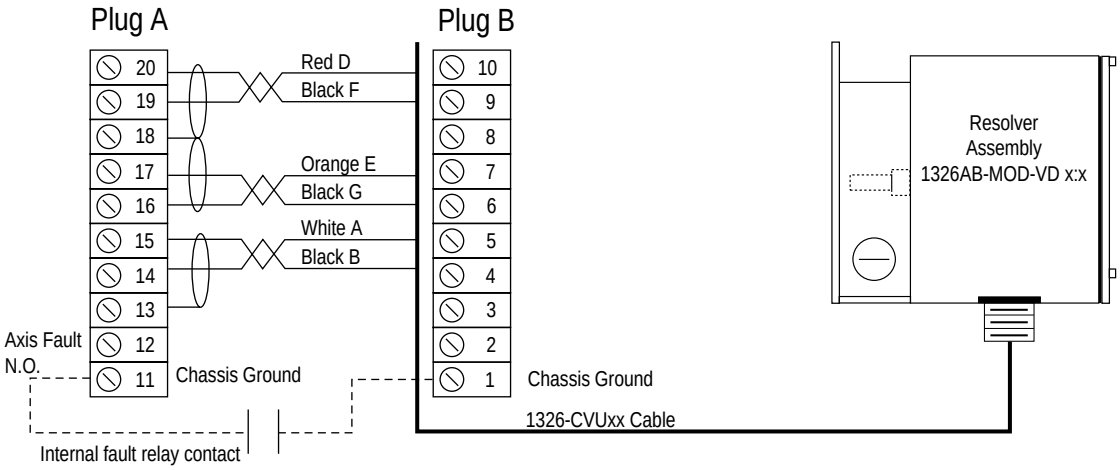
If the cable lead:	Do this:
Pulls out of the terminal	Repeat steps 3 through 9 again
Does not pull out of the terminal	Repeat steps 3 through 9 for the next terminal

Figure 2.7
Wiring a 1326AB-MOD-VD:256 Master/Vernier Dual Resolver package to the Axis 0 Resolver plugs or the Axis 1 Resolver plugs on the REC.



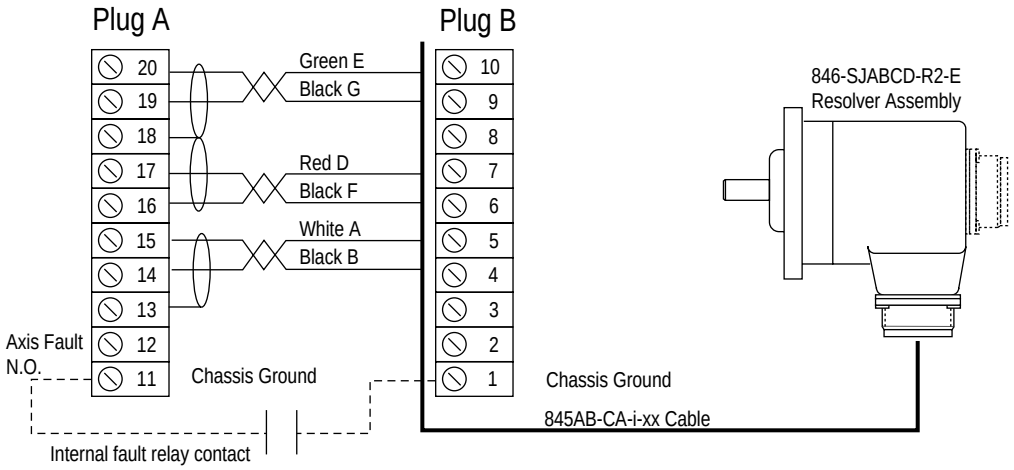
Important: Anchor the cable so that no more than 2 feet of cable is left unsupported. The excessive weight of an unanchored cable could pull the plug out of the connector.

Figure 2.8
Wiring a 1326AB-MOD-VD x:x resolver package to the Axis 0 Resolver plugs or the Axis 1 Resolver plugs on the REC



Important: Anchor the cable so that no more than 2 feet of cable is left unsupported. The excessive weight of an unanchored cable could pull the plug out of the connector.

Figure 2.9
Wiring an 846-SJxxxx-R2-x single resolver package to the Axis 0 Resolver plug or the Axis 1 Resolver plug on the REC



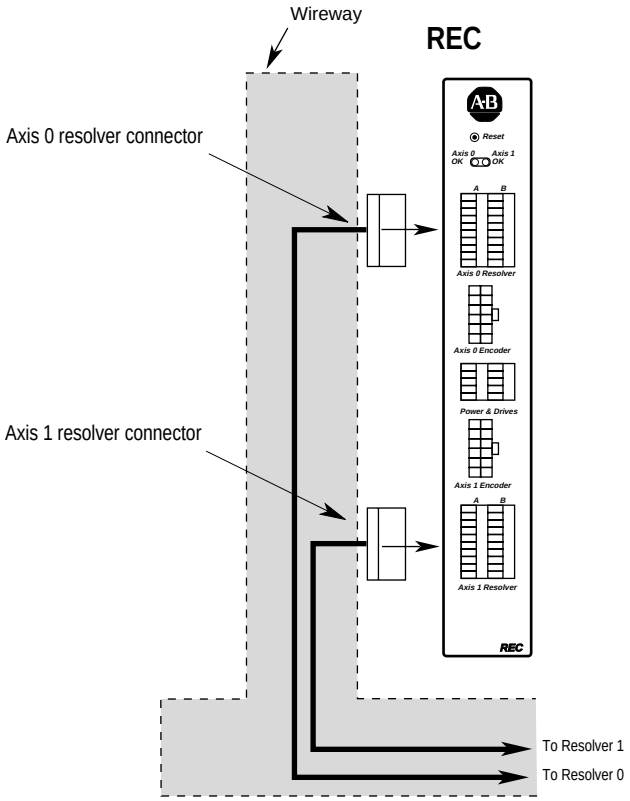
Important: Anchor the cable so that no more than 2 feet of cable is left unsupported. The excessive weight of an unanchored cable could pull the plug out of the connector.

Connecting the Resolver to the Plug

After you have wired the resolver cable leads to the plugs, insert the plugs in the resolver connectors on the REC. Figure 2.10 shows where the resolver plugs connect to the REC.

Important: We designed and tested the REC to work with Allen–Bradley resolver packages and cables up to 100 ft. If you use longer cables, or cables other than those specified, the product does not perform as specified.

Figure 2.10
Connecting the Resolver Cable to the REC



Important: Anchor the cable so that no more than 2 feet of cable is left unsupported. The excessive weight of an unanchored cable could pull the plug out of the connector.

Wiring the Power and Drives Connector

The Power & Drives connector comes with two removable 5-position plugs. The connectors provide input power for the REC and the drive reference signal outputs for the S Class Compact. Input power enters the connector through the following pins:

- pin 1 (18-36V DC)
- Pin 6 (power ground)
- Pin 7 (chasis ground)

Wire Requirements

The REC draws 12W maximum (0.5A at 24V DC). Use the appropriate gauge wire to accommodate the current draw of the REC while maintaining 18V DC minimum at the Power & Drives connector (Refer to local wiring codes).

Important: The plug accommodates a maximum of 14 guage wire.

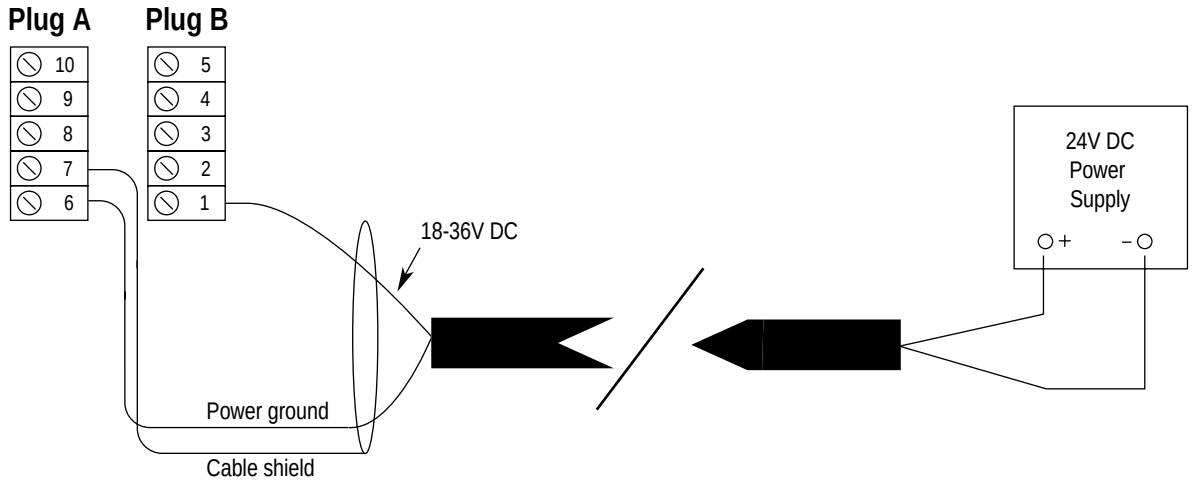
Important: You must use both 5-position plugs when you power-up the REC. We recommend you use twisted, shielded wire that is UL listed. Refer to local wiring codes for more information.

Power Supply Requirements

Use a 12W power supply with 24V DC output to power the REC. Use a larger supply if you want to run multiple RECs or other devices. Figure 2.11 shows where to connect the power supply ot the REC.

Important: Choose a power supply that complies with the regulations and agencies in your area.

Figure 2.11
Wiring the Power Supply cable leads to the REC



Important: Anchor the cable so that no more than 2 feet of cable is left unsupported. The excessive weight of an unanchored cable could pull the plug out of the connector.

REC Internal Power Requirements

The REC converts the input power into its internal power requirements using a DC-to-DC converter. The input power (500V DC) is isolated from the internal circuitry and the chasis of the REC. However, the common mode voltage of the input power with respect to the chassis must not exceed +/- 100V DC.

Important: The REC is equipped with protection and filtering circuits at various input, output, and power terminals. You must earth ground the REC at a stable poiint for this circuitry to operate properly. The earth ground is applied to the REC through the chassis at the mounting tasbs of the enclosure.

Wiring the Drives Signal for a Compact

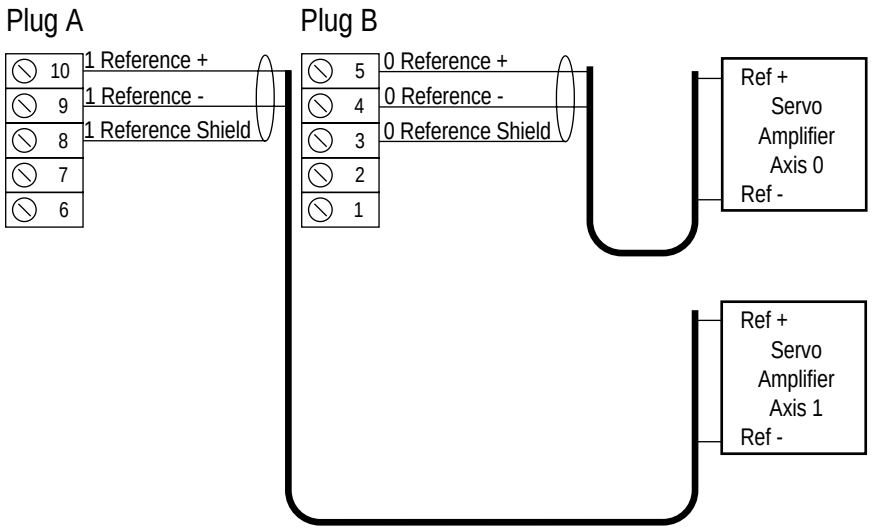
When using the REC with an S Class Compact, the drive reference signals (+/-10V) are passed from the Compact to the REC at terminals 8, 9, and 10 on plug A (Axis 1), and at terminals 3, 4, and 5 on Plug B (Axis 0). To wire the drives signal:

1. Connect the drive signal to the servo amplifier using a twisted, shielded cable (Belden 9501 or equivalent).
2. Wire the cable leads to the appropriate Power & Drives plugs ofr the required axis. Figure 2.12 shows where to connect the drives reference signals to the Power & Drives connector.

Both Axis 0 and Axis 1 can have drive signals present at their connectors.

Note: You do not need to wire the drive reference signal to the 1394 because it handles the reference signal output internally.

Figure 2.12
Wiring the Drive Reference Signal to an S Class Compact Motion Controller



Important: Anchor the cable so that no more than 2 feet of cable is left unsupported. The excessive weight of an unanchored cable could pull the plug out of the connector.

Connecting a Fault Relay

The REC is equipped with a fault detector that handles internal logic voltage malfunctions and resolver phase loss faults. The fault detector consists of:

- An internal relay contact output that opens for each axis
- An LED indicator that turns red for each axis
- An encoder driver disabler for each axis

The relay output can be used to disable external devices or incorporated into your machine's E-stop string (or other protective circuitry) for fail-safe protection. The REC provides Form_C (Normally Open) contacts to disable external equipment in the event of a malfunction.

Important: Both the fault relay and the LED (Axis OK) are activated during normal operation and deactivated during a malfunction.

The fault output relay contacts are UL listed and CSA certified for 1A at 30V DC. Figures 2.13 and 2.14 are examples of typical fault relays.

Figure 2.13
A typical Normally Open Fault status contact

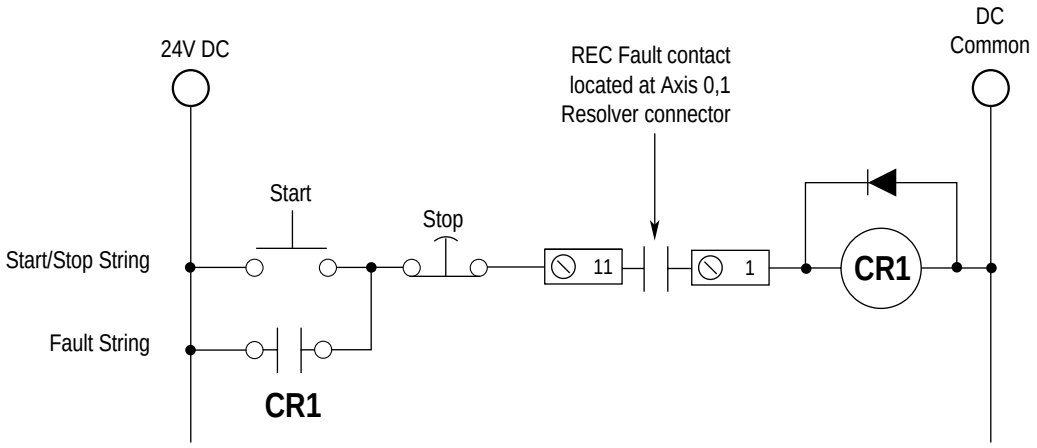
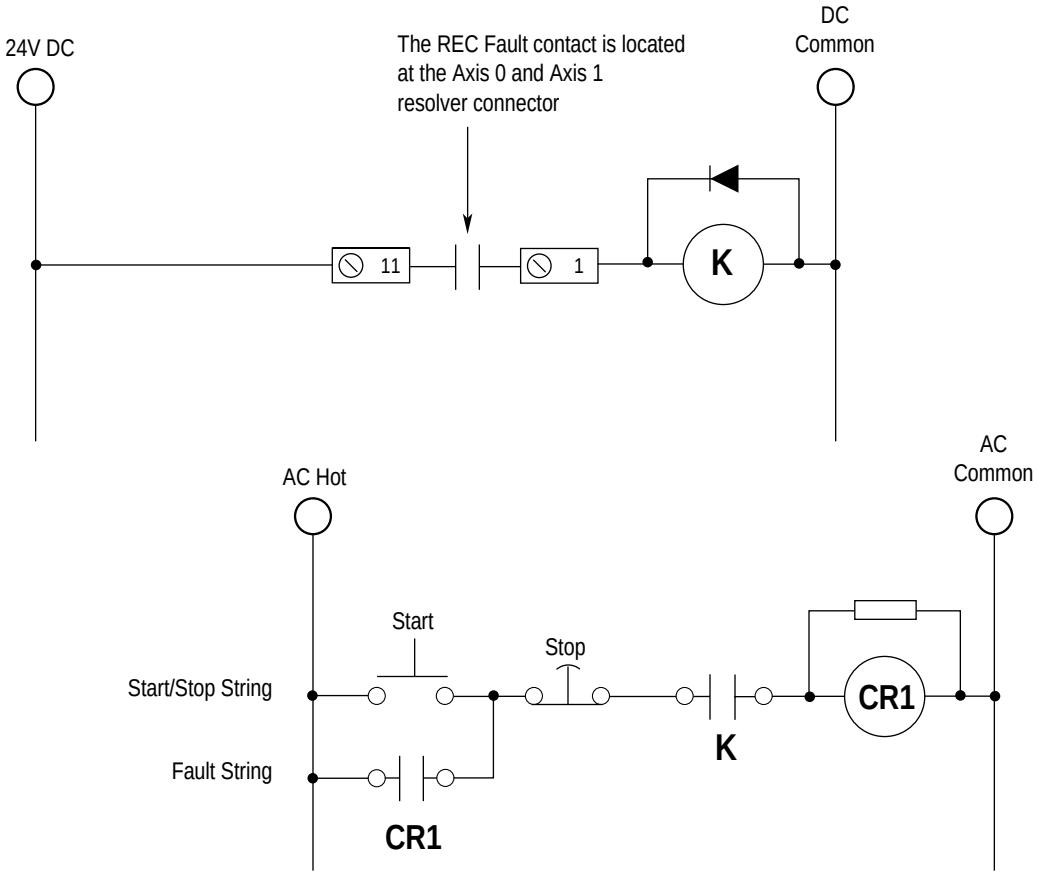


Figure 2.14
Typical Fault Relay for Switching AC



We recommend that you use an external relay controlled by the REC fault relay when you switch AC.

The fault connections shown above are typical. You can modify them to fit the requirements of your application.

Encoder Loss Detection Circuit

The 1394 GMC System and S Class Compact motion controller have an encoder loss circuit that detects when the encoder drivers are disabled. When the REC faults:

- The REC disables the encoder drivers.
- The REC signals an encoder loss fault ot the controller.

Important: The Transducer Loss Detection feature is an option in the Edit Axis window in GML. We recommend that you keep the transducer loss detection feature enabled in the motion controller. Consult your motion controller's Installation and Setup Manual/User Manual and GML Programming Manual for more information about how to apply this feature.

Setup

Chapter Objectives

The REC was designed to complement the 1394 GMC System or the S Class Compact motion controller and not intended to be used as a stand-alone product. This manual assumes that you are running GML (Graphical Motion Language) version 3.81 or greater and using Firmware 3.3 or greater. This chapter contains the information you need to:

- Configure the motion controller using GML.
- Align resolver packages.
- Use a resolver package with a linear axis.
- Define a non-zero home position.

Adding the REC to your GML Diagram

Using the REC, the 1394 GMC System and S Class Compact can support single resolver and dual resolver packages. Follow the procedures below when you setup your GML diagram.

Selecting the REC as a Transducer

After you have defined your application in GML, select the REC as your transducer. To select the REC:

1. From the menu bar, select **Definitions**. The Definitions menu appears.
2. Select **Axis Use**. The Axis Configuration window appears.
3. Select the axis that interfaces with the REC resolver converter output channel. A check mark appears next to the text.
4. Select **Edit.** The Axis Configuration edit window for the axis you checked appears.
5. From the Transducer menu, select the **REC**. The word *REC* appears in the field.
6.

If you are using a:	Go to:
1394 GMC System	*Setting the Transducer Counts per Motor Revolution for the 1394*
S Class Compact motion controller	*Setting the Homing Position*

Setting the Transducer Counts per Motor Revolution for the 1394

You have to adjust the Transducer Counts per Motor Revolution parameter when you use an external transducer to close the servo position loop. This parameter is used to scale internal variables for tuning the axis.

With the Axis Configuration edit window open, set the transducer counts per motor revolution. To set the transducer counts per motor revolution:

1. From the Configuration menu, select **Drive/Motor 1394**.

Note: If a GML Info window appears, note the information and select **OK**.

2. Enter a value in the Transducer Counts/Mtr Rev field.

If the Ratio:	Do this:
between the motor shaft and the resolver package input shaft si 1:1	Enter 4096
between the motor shaft and the resolver package input shaft is not 1:1	Adjust the value to compensate for the ratio (refer to the examples for more information).

For Example: If the motor shaft to resolver package shaft gear ration is 10:1 (every time the resolver package shaft makes one revolution, the motor shaft makes ten.), enter 409.6. Please note that this example is valid for single/dual packages that have a resolver element to input package shaft gear ration of 1:1.

For Example: If the resolver package to resolver element shaft gear ratio is 2.5:1 (every time the internal resolver element makes one revolution, the resolver package shaft makes 2.5) and the motor shaft to resolver package shaft is 10:1 (every time the resolver package shaft makes one revolution the motor makes ten) enter ((4096/2.5) / 10) = 163.84.

3. Go to *Selecting the Homing Procedure*.

Selecting the Homing Procedure

With the Axis Configuration edit window open, set the homing position. To set the homing position:

1. From the Configure menu, select **Homing**. The homing options appear.

2.

If your system uses a:	Select:
Single resolver package	Absolute
Dual resolver package	Absolute_MV

If you select Absolute_MV, an Assembly Part # menu that contains a list of supported Allen-Bradley dual resolver part number appears.

Note: Currently, the REC supports the 1326AB-MOD-VD 256/255 dual resolver package.

The **Custom** menu choice (located in the Assembly Part # menu) allows you to enter a custom master/vernier dual resolver turns range. Currently, the REC supports the 1326AB-MOD-VD 256/255 resolver with a turns range of 256. Allen-Bradley is reserving the Custom menu choice for future dual resolver packages. if you want to use a master/vernier resolver other than the 1326AB-MOD-VD 256/255 dual resolver package consult Allen-Bradley to verify that it is supported.

Setting the Transducer Position Units

With the Axis window still open, set the transducer position units. To set the transducer position units:

1. From the Configure menu, select Position Units. The Position Units options appear.

2. Enter a value into the Transducer Counts/Unit field.

The units you enter into the Position Units field depend on the application. When you use the REC, it is important to know the number of counts received from the transducer per position unit.

The REC sends 4096 counts to the motion controller per resolver element revolution and dual resolver package shaft revolution.

3. When you are finished making all of your modifications, select **Save**. The Axis window disappears.

On-Line Axis Setups

Axis hookup and servo parameters can be readily handled through the GML On-Line Manager Setup functions. For example, the *Motor/ Encoder Test* and the *Align Absolute Transducer* procedure are just two of the functions that can be controlled using GML. The On-Line Manager provides you with an interactive means of setting up your motion controller axes. The sections below show how to use these functions to help setup the REC. Refer to your controller's *Installation and Setup Manual/User Guide* and *GML Programming Manual* for more information on how to use the On-Line Setup functions.

Important: Before you proceed with On-Line Setups, verify that the REC is installed correctly and that the GML program is configured properly.

Selecting Axis/Drive Data Downloads

Before you proceed with On-Line setups you have to download your GML diagram to the motion controller so that the information contained in the diagram can be made available to the motion controller.

To transfer the axis specific setup parameters from the diagram to the motion controller, you have to select the Axis/Drive Data Downloads option in GML before you download the diagram. To select Axis/ Drive Data Downloads:

1. From the menu bar, select **Definitions**. The Definitions window appears.
2. Select **Control Options**. The Control Options window appears.
3. Select **Axis/Drive Data Downloads**. An X appears next to the text.
4. Select **Save**. The Control Options window disappears.

Running a Motor/Encoder Test

Use the Motor/Encoder Test to check the electrical connection of the servo drive and encoder interface and to establish the correct rotational direction of the servo drive and encoder. Establishing these motor and encoder polarities helps prevent runaway axis when the feedback loop is closed. To select a Motor/Encoder Test:

1. From the menu bar, select **Diagram**. The Diagram menu appears.
2. Select **Online**. The Online Manager window appears.
3. Select **Download Diagram**. The program downloads to the controller.
4. When the download is finished, select **Enter Setups**. The Do Setups window appears.

5. Select Motor/Encoder Test. A black circle appears in the radio dial next to the text.

6. Select Execute. Refer to your GML Programming Manual and your motion controller's Installation and Setup/User Manual for more information on Motor/Encoder Tests.

Aligning the Absolute Transducer

After you have completed the *Motor/Encoder Test*, you need to align the resolver package position to the axis position. Using the *Align Absolute Transducer* procedure, you can randomly attach the transducer to the physical axis. You do not need to match the actual position of the resolver package to the actual position of the axis because the alignment routine reads the position relative to the actual position of the axis and then compensates this position relative to the actual position of the axis. After the alignment procedure completes successfully, the axis and resolver package are adjusted to read zero at this position.

If you are using a dual resolver package, the alignment procedure will also synchronize both internal resolver elements by electronically offsetting them to zero. This eliminates the need for the user to manually perform this procedure. To align the absolute transducer:

1. Select Align Absolute Transducer. A black dot appears in the radio dial next to the text.

Important: If the axis is not still when you align or home the resolver package the position information will be incorrect. The axis must be still before performing the alignment procedure.

Important: When executing the alignment procedure on a servo axis, feedback is momentarily disabled and then enabled again (if the error checking features do not detect an error) in the motion controller. If the axis has stored energy or the ability to move during the time feedback is disabled, you have to apply a breaking mechanism to the axis before you execute an alignment routine.

For single resolver packages, the alignment routine reads the absolute position of the transducer. If no encoder noise or loss faults occur, the routine completes successfully. The motion controller negates the read position and stores it in its working memory. For absolute devices, the home position is used as a home offset and is added to the transducer's actual position during a homing command.

For Example: Assume the actual position of the absolute transducer is 1 at the alignment point. After alignment, the home position (home offset) variable equals -1. Therefore, the axis position is defined as 1 + (-1) = 0. Assume the axis is moved one unit and the position of the absolute transducer is now 2. If you execute a home command at this point, the axis position is 2 + (-1) =1.

For dual resolver packages the alignment routine uses the home position and a transparent parameter called Vernier Offset to calculate the alignment position. The Home Position stores the master resolver element position offset and Vernier Offset stores the vernier resolver element offset.

2. Select **Execute**.

If:	Do this:
The Align Absolute Transducer window appears	Go to step 3
A GML Error window appears	1. Check your application program. 2. Check your REC installation procedures.

3. Move the axis to its minimum travel position. The alignment routine will define this position as zero.

4. Select **OK** to align the position to zero.

5. While the alignment routine is running, verify that you have selected the proper absolute device (the absolute device you selected shows up in the window that appears while the axis is aligning).

6.

If the transducer alignment:	Do this:
Was successful	1. Select OK 2. Go to the *Updating the Diagram* section.
Was unsuccessful	Check your GML diagram.

Updating the Diagram

Once the Alignment routine completes successfully, the resolver offsets (Home Position and Vernier Offset) and axis specific information gathered during on-line setups is stored in the motion controller's working memory. You must update your diagram to include your latest changes.

To update your diagram:

1. While still in the Enter Setups window, select **Tuning Complete, Save Data/Update Diagram**.
2. Select **Execute**. The diagram updates and the Do Setups window disappears.
3. Select **Exit Online**. The Online Manager window disappears.

Homing the Axis

The motion controller executes a home command to determine the absolute position of the resolver package. To execute the home axis command:

1. Double click on the Home Axis block in your GML diagram.
2. Select **Wait for Completion**. An X appears in the check box.
3. Select **Save**. The Home Axis window disappears.

Important: Before you use any of the position information sent by the REC, you have to home the axis because the home command configures the REC for single resolver or dual resolver package applications.

Important: When executing the homing procedure on a servo axis, feedback is momentarily disabled then enabled again (if the error checking features do not detect an error) in the motion controller. If the axis has stored energy or the ability to move during the time feedback is disabled, you have to apply a breaking mechanism to the axis before you execute a homing routine.

Important: If the axis is not still when you home a dual resolver package, the position information will be incorrect. Depending on your application, a breaking mechanism may be required to stabilize the axis before you execute a home command in the motion controller.

Using a Resolver Package with a Linear Axis

If you installed and configured your system for a dual resolver package, you can set the axis for linear positioning. When you define the axis to be linear, the 256 turn dual resolver package's internal absolute travel range is:

-5 <travel<=251 turns

The motion controller uses a home command to determine the absolute position of the axis. After a home command, the REC incrementally reports any movements back to the motion controller. This new information builds upon the absolute value obtained during homing and can cause the position of the axis to exceed the range in either direction. However, during an absolute home command, the initial absolute position of the 256 turn dual resolver package can only be obtained within the range above.

If the travel range was defined to be 0 =< travel <256 and the axis homed, after moving it slightly negative of the (zero) position, the controller would think that the axis was near 256 instead of near zero. The internal travel range allows the axis to dither about zero by -5 turns thus eliminating unwanted roll over at the alignment position. If you homed the axis after moving it slightly negative of -5 the axis position would roll over to just less than 251.

When you use a single resolver, the absolute travel range is 0 <= travel < 1 turns (for geared resolver packages with a 1:1 gear ratio). There is no built-in procedure implemented in the control to handle dither about the alignment (zero) position. If you desire a dither feature, you can use the algorithm shown below to program a dither value. This value is typically a small percentage of the travel range.

Inside a Home block select:

- Normal
- Wait for Completion

Inside an If block build the expression:

- Actual Position >= (1 + dither value)

Inside the Redefine Position block:

- Select Relative
- Select Actual
- Enter -1

Defining a Non-Zero Home Position

When you align the transducer to the physical axis using the Align Absolute Transducer routine, the routine adjusts the home position to offset the transducer position to zero.

Important: We recommend that you do not change the home position established by the *Align Absolute Transducer* routine.

You can establish a non-zero reference point using the GML *Redefine Position* command after a *Home* command.

Defining the Redefine Position Command

After you have executed the home command, you need to define the Redefine Position Command. To define the Redefine Position Command:

1. Create a Redefine Position block and place it next to the Home Axis block.
2. Double-click on the **Redefine Position** block.

3. Select the axis you are configuring. The name of the axis appears in the field.

4. Select **Relative** from the **Mode** menu. The word *Relative* appears in the field.

Note: This feature compensates for any dither that may occur while executing the program

5. Select **Actual** from the Position menu. The word *Actual* appears in the field.

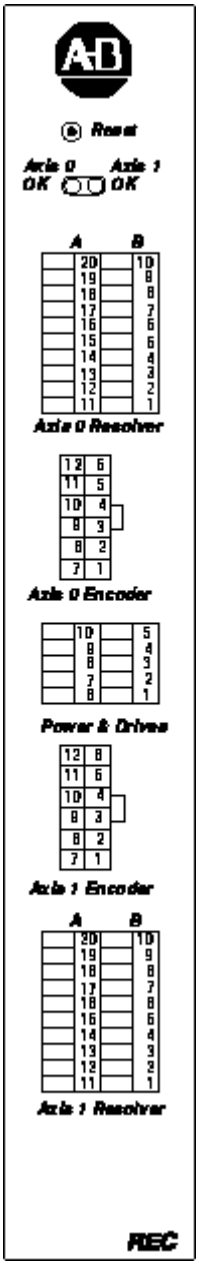
6. Enter a positive or negative value to redefine the current actual position.

Note: If the axis was previously aligned to zero, the actual position is zero.

7. Select **Save**. The Redefine Position window disappears.

Specifications

Figure A.6



AEC Front Panel

Figure A.1 shows the terminal locations for the REC. The following tables provide the pin numbers and their respective descriptions.

Important: Refer to Wiring Axis 0 and Axis 1 Resolvers for wiring your Allen-Bradley resolver package to the REC.

Resolver Connector Terminal Description

Plug A	Plug B
20 = Cosine high	10 = Cosine high
19 = Cosine low	9 = Cosine low
18 = Stator shields	8 = Stator shields
17 = Sine high	7 = Sine high
16 = Sine low	6 = Sine low
15 = Cosine high	5 = Cosine high
14 = Rotor low	4 = Rotor low
13 = Rotor shield	3 = Rotor shield
12 = Chassis ground	2 = Chassis ground
11 = Fault normally open	1 = Fault common

Power & Drives Connector Terminal Descriptions

The table below shows the terminal descriptions for the Power & Drives connector.

Plug A	Plug B
10 = 1 Reference +	5 = 0 Reference +
9 = 1 Reference -	4 = 0 Reference -
8 = 1 Reference shield	3 = 0 Reference shield
7 = Chassis ground	2 = Not Used
6 = Power ground	1 = 18-36V DC

Encoder Connector Terminal Descriptions

The table below shows the terminal descriptions for Axis 0 and Axis 1.

A	B
12 = Z -	6 = Z +
11 = B -	5 = B +
10 = A -	4 = A +
9 = Strobe -	3 = No Connection
8 = Reference Shield Input	2 = Strobe +
7 = Reference - Input	1 = Reference + Input

Environmental Specifications

Operating and Storage Conditions

The table below details the environmental specifications of the REC

Specification	Description
Operating Temperature	0 to 60 °C
Storage Temperature	-40 to 70 °C
Humidity	95% non condensing @ 60 °C

Electrical Specifications

Resolver Specifications

The table below details the electrical specifications for the resolver.

Specification	Description
Number of resolver inputs	2 conversion channels, each capable of supporting single or dual resolver packages
Resolver type	Transmitter (rotor primary)
Excitation amplitude	4.77V rms +5% at a 4000Hz +20%
Resolver transformation ratio	0.45 to 1 Strator to Rotor +5% Zss = 275 Ohms
Maximum Resolver phase shift	Each conversion channel self-compensates within the range of +/- 25 degrees maximum resolver phase shift (rotor to strator).

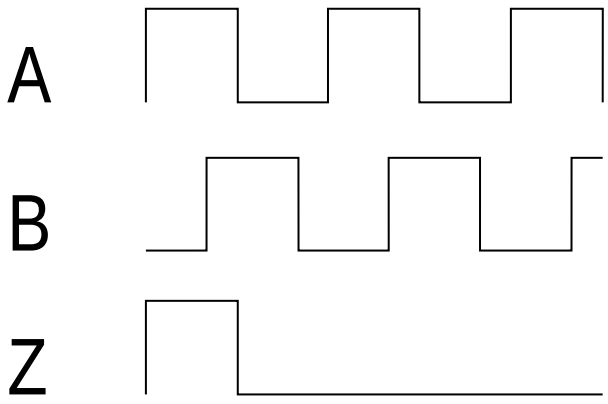
Specification	Description
Supported resolver packages	1326AB-MOD-VD1:x single resolver package. x = rotor to input shaft ration x = 1, 2, 2.5, or 5
	1326AB-MOD-VD:256/255 dual resolver package. 256/255 is the master to vernier gear ratio.
	Use cable 1326AB-CVUxx for the specified Bulletin 1326 resolver packages above. xx = length in feet (100 ft. maximum)
	846-SJ abcd-R2-e single resolver package. a = mounting configuration b = connector style c = connector location d = gear ratios R2 = Harlowe resolver element 11BRCX-300-C or equivalent. e replaces c if mating connector is supplied.
	Use cable 845AB-CA-i-xx xx = length in feet (up to 100 ft.)
Strobe Inputs: Type Source Impedance Maximum active Voltage Minimum Inactive Voltage	 Current Sourcing Active Low 10k Ohm 0.6V DC 2.2V DC

Encoder Output Specifications

The table below details the electrical specifications of the encoder output.

Specification	Description
Number of encoder outputs	2 (0 and 1)
Type of encoder output	Incremental quadrature with marker, EIA RS 422 level
Equivalent line count	4096 counts under 4X decode mode
Maximum update rate	1.6 MHz
Marker output	Synchronized 180 degrees to A channel. See figure A.2 for a picture of the output for the three channels

Figure A.7
Marker Output



Important: The marker pulse is synchronized to the resolver element's zero position which is not necessarily the axis zero position.

Power Supply Specifications

The table below details the electrical specifications of the power supply.

Specification	Description
power input requirements	18 to 36 V DC at 12W maximum
Note: Input has reverse polarity protection	

Product Performance

Resolver-to-Encoder Conversion

The table below details the product performance of the resolver-to-encoder conversion for the REC.

Specification	Description
Resolution	12 bits per revolution
Repeatability	1 LSB (5.3 arc minutes)
Acceleration error	5.6 e $^{-3}$ LSBs at 100 rev/sec^2
Dynamic following error	5 LSBs at 6000 RPM
Resolver element shaft speed	0 to 6000 RPM

Excitation Oscillator

The table below details the product performance of the excitation oscillator for the REC.

Specification	Description
Excitation Frequency	4000Hz at +25%
Amplitude	4.77V rms +5%

Phase Loss Detection

The table below details the product performance of the phase loss detection circuit for the REC.

Specification	Description
Purpose	To detect loss of resolver signals.
Action	When fault occurs: • The status indication LED turns from green to red • The 30V DC 2A/125V AC 0.6A rated relay contact output opens • The motion controller detects loss of feedback After the problem is corrected, you can clear the fault for each axis by: pushing the reset button on the REC or by using a home request from the motion controller
Response range	0 < resolver shaft speed < 6000 rpm
Response Time	The phase loss detection circuit will respond within 180 degrees of resolver element rotation as long as you use no more than 100ft of specified cable.
Resolver inputs	The REC has been designed to use Allen-Bradley Bulletin 846 and 1326 absolute feedback packages that feature Harlowe 11BRCX-300-C or equivalent resolver elements. The 4.77V rms excitation amplitude has been adjusted so that when you use the resolvers listed above with the REC the strators receive 2V rms +10%.

Index

W

Rockwell Automation

Allen-Bradley

Allen-Bradley, a Rockwell Automation Business, has been helping its customers improve productivity and quality for more than 90 years. We design, manufacture and support a broad range of automation products worldwide. They include logic processors, power and motion control devices, operator interfaces, sensors and a variety of software. Rockwell is one of the world's leading technology companies.

Worldwide representation.

Argentina • Australia • Austria • Bahrain • Belgium • Brazil • Bulgaria • Canada • Chile • China, PRC • Colombia • Costa Rica • Croatia • Cyprus • Czech Republic • Denmark • Ecuador • Egypt • El Salvador • Finland • France • Germany • Greece • Guatemala • Honduras • Hong Kong • Hungary • Iceland • India • Indonesia • Ireland • Israel • Italy • Jamaica • Japan • Jordan • Korea • Kuwait • Lebanon • Malaysia • Mexico • Netherlands • New Zealand • Norway • Pakistan • Peru • Philippines • Poland • Portugal • Puerto Rico • Qatar • Romania • Russia-CIS • Saudi Arabia • Singapore • Slovakia • Slovenia • South Africa, Republic • Spain • Sweden • Switzerland • Taiwan • Thailand • Turkey • United Arab Emirates • United Kingdom • United States • Uruguay • Venezuela • Yugoslavia

Allen-Bradley Headquarters, 1201 South Second Street, Milwaukee, WI 53204 USA, Tel: (1) 414 382-2000 Fax: (1) 414 382-4444

Publication 4100-5.1 – June 1998 PN 999-126

Supercedes Publication 999-126 February 1996