

AMETEK[®]

Series 1746R
GEMCO[®]

PLC Resolver Interface Module

Installation & Programming Manual



For Allen-Bradley[®] SLC 500 I/O Chassis



1080 North Crooks Road
Clawson, MI 48017-1097
Phone: (248) 435-0700
FAX: (248) 435-8120
Internet: www.ametekapt.com
www.ametek.com

Preface

This manual will instruct the user in installing and programming the Series 1746R Gemco PLC Resolver Interface Module. Chapter 2 contains information on installing the 1746R PLC Resolver Interface Module. Chapter 3 provides instructions on programming the 1746R, while Chapter 4 contains Application Examples. Specifications and Wiring Diagrams can be found in Appendix A and Appendix B, respectively.

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Chapter 1: Introduction & Overview

The Series 1746R PLC Resolver Interface Module is a resolver based unit that incorporates Allen-Bradley SLC 500 I/O interface technology, and is completely compatible with the A-B Series 1746R I/O chassis. The unit monitors machine/process position and delivers absolute position data with up to 12 bit (4096 count) resolution per turn to the SLC 500 processor.

The Series 1746R PLC Resolver Interface Module is available in two versions:

- 1746R-1 is for single axis applications and uses a single turn resolver. Standard “Turns Counting” software allows a single turn resolver to be used in multi-turn applications.
- 1746R-2 is for dual axis applications and can use two, single turn resolvers to monitor each axis independently, or is field configurable for use with a single, multi-turn dual resolver to monitor a single axis for absolute positioning over multiple revolutions.

The 1746R PLC Resolver Interface Module will read in the “raw position” from 1 or 2 resolvers, convert it to a scaled position and transmit that data to the A-B SLC 500 processor I/O image table.

The software allows field programming of Motion Detection of a RPM value which sets a bit in the I/O image table.

The software also will monitor two auxiliary inputs, that can be field configured to operate in one of two ways:

- Reset-to-Preset. This feature allows you to continuously synchronize position data to the leading edge of the product or to automatically compensate for process drift.
- Brake monitoring in metal stamping applications. In this configuration, automatic calculation of stop time and stop angle is transferred to the I/O image table. In addition, two programmable time limits are available to monitor maximum stop values: the first as a potential maintenance warning, and the second as an error if the press exceeds the programmed maximum acceptable stop time. These status bits are set at the time the limits are exceeded, not after the press stops.

NOTE: A brake fail feature is also in the Brake Monitor configuration. A status bit in the image table will be set if the resolver moves by more than +/- 20 degrees (out of 360 degrees) after a stop has been determined.

System parameters are programmed through the I/O image table. These parameters include the position scaling data, the motion detect RPM, brake monitor data and reset-to-preset data.

System data is read from the I/O Image table. This data includes the scaled position and RPM of each resolver, the state of the inputs and error flags in the system.

1.1: Face Panel Description

The Monitor's operating status is indicated by the two (2) LEDs on the face panel.

RUN	The green LED indicates that the card is operational.
FAULT	The red LED indicates there is a card fault, or when there is a resolver (transducer) fault.

Note: There are four typical causes for a resolver (transducer) fault:

1. Broken resolver cable
 2. Improperly wired cable
 3. Faulty resolver
 4. Non-compatible resolver
-

INSIDE FACE PANEL DOOR

Plug-in connector with 16 terminals. (See wiring diagrams, Appendix B)

Chapter 2: Installation

I/O Rack Installation & Removal

Before installation, confirm that the I/O power is compatible with the Series 1746R PLC Resolver Interface Module. (See Appendix A: Specifications, Power Requirements). The Series 1746R PLC Resolver Interface Module can be installed into any open slot in the A-B SLC 500 rack. Align the module's circuit board with the top and bottom card guides and gently slide in until it latches securely. To remove the module, depress the top and bottom latches and slide the module out of the rack.

NOTE: The Series 1746R has a convenient plug-in terminal strip. Therefore, the module can be removed or replaced without rewiring the terminal strip.

Resolver Installation

It is recommended to use Gemco Series 1986 Resolvers with the Gemco Series 1746R Resolver Interface Module. Series 1986 resolver specifications, mounting guidelines and outline drawings are available from the factory.

NOTE: The Gemco Series 1746R Resolver Interface Module has been designed to be compatible with other resolver inputs. Contact the factory for details.

Resolver Cable Installation

It is recommended that the resolver cable be run in a separate conduit and should be a continuous uninterrupted length. Resolver cable installation is covered in the Wiring Diagrams in Appendix B of this manual. The maximum cable length using Belden 9873 (or equivalent) is 1,000 feet.

Input Wiring

If wiring for Brake Monitoring, the input must be driven "high" (see Appendix A: Specifications) when the brake is disengaged. The input is then released (power removed) when the brake engages to initiate stop time/stop angle calculations.

If wiring for Reset-to-Preset, the input must be driven "high" (see Appendix A: Specifications) to initiate resetting to the preset value.

Power Requirements

See Appendix A: Specifications

Chapter 3: Setup & Programming

Getting Started

Before the 1746R PLC Resolver Interface Module can communicate with the A-B SLC 500 processor, the system must be configured to include the 1746R PLC Resolver Interface Module. This is done through either the APS Software or the hand-held controller. When defining the system, the program will prompt for a SPIOGA ID code. The ID code for the 1746R PLC Resolver Interface Module is: **3535**. This tells the processor that the 1746R uses 8 input words and 8 output words.

I/O Image Table

Data is passed between the A-B SLC 500 processor and the resolver input module through the I/O image table. This table is limited to 8 input words and 8 output words.

Configuration data, such as the scale factor and the offset position, will be programmed through the output image table. Monitoring data, such as the current resolver position and RPM, will be reported back to the SLC 500 processor through the input image table.

Two types of data can be passed through the I/O image table, status/control data and application data. Two bit registers have been placed in word 0 of the input image table and word 0 of the output image table for the status/control data. The rest of the I/O image table is used for application data.

Output Image Table

Because there are more than 8 parameters to program, the 1746R Resolver Interface Module uses a command based programming sequence to enter parameters into the system. The first word of the output image table is the command bit register. This bit register contains a programming bit used to initiate the programming sequence. The second word is the command word and the other 6 words are used for the command parameters as shown in the table below:

Output Image Table	Description
Word 0	Command Bit Register
Bit 15	Programming Bit
Bits 14 - 10	Reserved (0)
Bit 9	Clear Brake Monitor Error Bit
Bit 8	Clear Brake Monitor Warning Bit
Bits 6 - 0	Reserved (0)
Bit 7	Data Format Bit
Word 1	Command Register
Word 2	Parameter 1
Word 3	Parameter 2
Word 4	Parameter 3
Word 5	Parameter 4
Word 6	Parameter 5
Word 7	Parameter 6

Command Bit Register (Word 0)

The Status Bit Register has been defined below:

Bit 15	14	13	12	11	10	9	8
PROG	0	0	0	0	0	Clear Brake Error	Clear Brake Warning

Bit 7	6	5	4	3	2	1	0
Data Format	0	0	0	0	0	0	0

Programming Bit (15)

The 1746R PLC Resolver Interface Module will monitor the programming bit for a 0 to 1 transition. When this is detected, it reads the command register and processes the data based on the command specified. If the command data and parameter data are valid, the acknowledge bit is set in the input image table bit register. If the data is invalid, the error bit will be set in the input image table bit register. These bits are cleared when the programming bit is set back to zero.

Clear Brake Error Bit (9) & Clear Brake Warning Bit (8)

The clear brake monitor error bit and clear brake monitor warning bit are used to clear the error conditions produced by the brake monitor. The 1746R PLC Resolver Interface Module will monitor these bits for a 0 to 1 transition. When it is detected, the corresponding error bit in the input image table will be cleared.

Data Format Bit (7)

The purpose of this bit is to add an option that will allow the customer to display the position value in a more readable format. By setting bit 7 of the Command bit register to one, the position will be displayed in the following format: The thousandths digits will be displayed in the high word and the ones, tens and hundredths digits will be displayed in the low word. See example below and specifications for increased update time.

Example:

Position is 35111.

Without the data format option (Command bit register, bit 7 = 0), the position would be displayed in the input image table as:

```
0           ;high word
-30425     ;low word
```

With the data format option selected (Command bit register, bit 7=1), the position would be

displayed in the input image table as:

35	;high word
111	;low word

Note: If using Configuration 6, the resolver 1 position is displayed only as one word. Therefore, the new data format does not apply to this position.

With the new data format option selected, the position can range from 0 to 32767999.

NOTE: All reserved locations should be set to 0.

Command 1: Configuration

The 1746R PLC Resolver Interface Module can be configured for 6 different applications:

- Single axis, single turn resolver with no turns counting and one brake monitor input.
- Multi-turn dual resolver with no inputs.
- Single axis, single turn resolver with turns counting and one reset-to-preset input.
- Two axis, two single turn resolvers with turns counting and two reset-to-preset inputs.
- Multi-turn dual resolver with one reset-to-preset input.
- Two axis, two single turn resolvers; one with no turns counting and one brake monitor input; the other with turns counting and one reset-to-preset input.

The parameters for this command 1 have been defined below:

Output Image Table	Description
Word 0	Bit Register
Word 1	Command Register (1)
Word 2	Parameter 1 Password (1111)
Word 3	Parameter 2 Configuration Number
Word 4	Parameter 3 Reserved (0)
Word 5	Parameter 4 Reserved (0)
Word 6	Parameter 5 Reserved (0)
Word 7	Parameter 6 Reserved (0)

Parameter 1 is a password to verify that this change is to take place. The password is **1111**. This is to prevent an accidental change in the system. The second parameter contains the Configuration number:

Configuration Number	Description
1	<ul style="list-style-type: none"> ● Single axis, single turn resolver ● No turns counting ● One brake monitor input ● Motion Detect RPM
2	<ul style="list-style-type: none"> ● Multi-turn dual resolver ● No inputs ● Motion Detect RPM
3	<ul style="list-style-type: none"> ● Single axis, single turn resolver ● Turns counting enable ● One reset-to-preset input
4	<ul style="list-style-type: none"> ● Two axis, two single turn resolver ● Turns counting enable ● Two reset-to-preset inputs
5	<ul style="list-style-type: none"> ● Multi-turn dual resolver ● One reset-to-preset input
6	<ul style="list-style-type: none"> ● Two axis, two single turn resolvers ● No turns counting with brake monitor input and Motion Detect RPM ● Turns counting with reset-to-preset input

NOTE: Any other configuration numbers will generate an error. The default configuration is 1.

Command 2: Position Scaling Data

This command will program the scale factor and the total turn count. The parameters for this command have been defined below:

Output Image Table	Description
Word 0	Bit Register
Word 1	Command Register (2)
Word 2	Parameter 1 Resolver Number
Word 3	Parameter 2 Scale Factor (High Word)
Word 4	Parameter 3 Scale Factor (Low Word)
Word 5	Parameter 4 Total Turns Counting (Turns Counting Only)
Word 6	Parameter 5 Turns Ratio (Multi-turn Dual Resolver Only)
Word 7	Parameter 6 Reserved (0)

Parameter 1 is used to indicate which resolver input channel the scale factor and turns count applies to. On two axis (**not multi-turn dual resolver**) modules Command 2 will be programmed twice.

Parameters 2, 3 and 4 are used to establish how position data will count as the resolver rotates.

NOTE: See Chapter 4: Application Examples for dealing with 32 bit numbers..

Parameter 4 is used to enable or disable the Turns Counting software and to establish the number of turns over which the scale factor develops when Turns Counting is enabled. **Parameter 4 must be set to zero when sending this command for multi-turn configurations 2 or 5.**

When parameter 4 is set to zero, Turns Counting is disabled and the system will operate as a single turn system. The scale factor programmed in parameter 2 and 3 will be the number counted to over one rotation of the resolver. The position count will roll over to zero and repeat the same scale factor count for each additional rotation of the resolver.

When parameter 4 is set to any value other than zero, the value will be the number of turns required to count to the scale factor number programmed in parameters 2 and 3. When turns counting is enabled, the count will never roll over and start again at zero. The count will continue to increase or decrease by the per turn count change established by parameter 2, 3 and 4. Rotation in the reverse direction will result in a negative position value. Maximum position values can range from -2,147,483,648 to 2,147,483,647.

Example 1: Parameters 2 and 3 (scale factor) set at 1200
Parameter 4 (turns counting) set at 1

The count will increase from 0 to 1199 over the first rotation, 1200 to 2399 over the second, 2400 to 3599 over the third and will continue changing at this rate per turn for subsequent rotations.

Example 2: Parameters 2 and 3 (scale factor) set at 500,000
Parameter 4 (turns counting) set at 1000

The count will increase from 0 to 499 over the first rotation, 500 to 999 over the second, 1000 to 1499 over the third and will continue counting at this rate to 499,999 at the end of turn 1000. Additional rotation in the same direction will result in the count increasing beyond 500,000 at the same rate per turn.

NOTE: Turns Counting is only valid for modules set up for configuration 3, 4 or 6.

NOTE: The maximum resolution of the module is 4096 counts per turn. Scale factors that are less than 4096 per turn will count in one count increments. Scale factors greater than 4096 per turn will count to the scale factor number in 4096 steps which will not be one count increments.

NOTE: The total accumulated count when turns counting is enabled is a volatile value. This number will be lost on a power failure. Steps should be taken to save this value to a nonvolatile integer file in the SLC processor if maintaining position data is important to your application. The Save Command can also be used to save the current position, therefore, not losing the turns count.

Parameter 5 is only used on two axis modules into which a multi-turn dual resolver assembly is being wired. A multi-turn dual resolver assembly contains two resolvers geared together through a 64:1 or 128:1 precision gear reducer. One resolver provides fine position data per turn of the input shaft while the course resolver keeps track of the number of turns. A zero in parameter 5 configures the module for operation with a 64:1 dual resolver assembly. A one in parameter 5 configures the module for use with a 128:1 dual resolver assembly.

When configured for use with a dual resolver assembly, the scale factor set in parameters 2 and 3 will be the count change over the total number of turns.

For example, if the scale factor was 640 and the ratio was 64:1, each turn would be 10 counts. The total accumulated count of a multi-turn dual resolver system is absolute and will not be lost on a power failure. Also, any movement of the mechanism while power is off will be reflected in the total position count when power is restored.

Example: Parameter 5 (turns ratio) set for 1 (128 turns)
 Parameters 2 and 3 (scale factor) set for 12,800
 Parameter 4 must be set to zero

The position count will count from 0 to 99 over the first rotation, 100 to 199 over the second, 200 to 299 over the third and will continue increasing by 100 counts per turn until 12,799 is reached at the end of turn 128. The system will roll over to zero and begin counting up again if the resolver continues rotation in a positive direction beyond 12,799. Reverse rotation below zero will result in a count that jumps to 12,799 and continuous counting backwards.

The default values for the scale factor is 4096 and the turns counting is set to zero (disabled). The default setting for the multi-turn resolver is 64:1. Save Configuration Command will save these values to EEPROM.

NOTE: When the scale factor or turns count is changed, all offset values will be reset to zero. This includes the home position and all reset-to-preset offsets.

Command 3: Home Positioning Data

This command will reset the position of the resolver indicated to match actual machine position.

Example: With the machine stopped at the “0” position, parameters 2 and 3 (Home Position) must be set to “0”. The parameters for this command have been defined on next page:

Output Image Table	Description
Word 0	Bit Register
Word 1	Command Register (3)
Word 2	Parameter 1 Resolver Number
Word 3	Parameter 2 Home Position (high word)
Word 4	Parameter 3 Home Position (low word)
Word 5	Parameter 4 Reserved (0)
Word 6	Parameter 5 Reserved (0)
Word 7	Parameter 6 Reserved (0)

Parameter 1 will indicate whether the new home position is for resolver 1 or 2.

Parameters 2 and 3 contain the new home position of the reset resolver. When this command is received, the home position will be checked for validity. For a system with no turns counting enabled, the home position must be between zero and the scale factor. For a system with turns counting enabled, the home position must be less than 2,147,483,647. A Save Configuration command will save this offset to EEPROM.

Command 4: Brake Monitor Data

This command will set up the warning time and error time for the brake monitor input. The parameters for this command have been defined below:

Output Image Table	Description
Word 0	Bit Register
Word 1	Command Register (4)
Word 2	Parameter 1 Warning Time*
Word 3	Parameter 2 Error Time**
Word 4	Parameter 3 Reserved (0)
Word 5	Parameter 4 Reserved (0)
Word 6	Parameter 5 Reserved (0)
Word 7	Parameter 6 Reserved (0)

* Warning Time indicates that the press stopping time is deteriorating.

** Error Time indicates that the maximum allowable stopping time has been exceeded.

Parameter 1 contains the warning time for the brake monitor input. If the brake monitor stopping time exceeds this warning time, the warning bit will be set. This value can range from zero to 65,535. The units of measurement are in milliseconds (ms). The default value is 65,535ms (65.535s).

Parameter 2 contains the error time for the brake monitor input. This time must be greater than or equal to the warning time. When the brake monitor stopping time exceeds this value, the error bit will be set. This value can range from zero to 65,535. The units of measurement are in milliseconds (ms). The default value is 65,535ms (65.535s).

NOTE: This command is only valid if the module has been set up for configuration 1 or 6.

Command 5: Motion Detect Data

This command will set the motion detect RPM value. The parameters for this command have been defined on the next page:

Output Image Table	Description
Word 0	Bit Register
Word 1	Command Register (5)
Word 2	Parameter 1 Motion Detect RPM
Word 3	Parameter 2 Reserved (0)
Word 4	Parameter 3 Reserved (0)
Word 5	Parameter 4 Reserved (0)
Word 6	Parameter 5 Reserved (0)
Word 7	Parameter 6 Reserved (0)

Parameter 1 contains the motion detect RPM value. This value can range from zero to 65,535. The default value is zero. When the RPM is greater than or equal to this value, a motion detect bit will be set in the input image table. A zero value will disable the motion detect.

NOTE: This command is only valid if the module has been set up for configurations 1, 2 or 6.

Command 6: Reset-to-Preset Data

This command will program the reset-to-preset value for each resolver. The parameters for this command have been defined below:

Output Image Table	Description
Word 0	Bit Register
Word 1	Command Register (6)
Word 2	Parameter 1 Reset-to-Preset Value for input 1 (high word)
Word 3	Parameter 2 Reset-to-Preset Value for input 1 (low word)
Word 4	Parameter 3 Reset-to-Preset Value for input 2 (high word)
Word 5	Parameter 4 Reset-to-Preset Value for input 2 (low word)
Word 6	Parameter 5 Reserved (0)
Word 7	Parameter 6 Reserved (0)

Parameters 1 and 2 contain the position that resolver #1 should reset to when input 1 is activated.

Parameters 3 and 4 contain the position resolver #2 should reset to when input 2 is activated. When this command is received, the software will verify that the reset-to-preset values are valid positions*. The default values for the reset-to-preset values is zero.

* If turns counting is disabled or configured for multi-turn, the position must be between zero and the scale factor. If turns counting is enabled, the position must be between zero and 2,147,483,647.

NOTE: The reset-to-preset command is only valid if the module has been set up for configurations 3, 4, 5 and 6.

Command 7: Save Configuration

This command will save the data to the EEPROM. The parameters for this command have been defined below:

Output Image Table	Description
Word 0	Bit Register
Word 1	Command Register (7)
Word 2	Parameter 1 Password 1 (2222)
Word 3	Parameter 2 Password 2 (3333)
Word 4	Parameter 3 Reserved (0)
Word 5	Parameter 4 Reserved (0)
Word 6	Parameter 5 Reserved (0)
Word 7	Parameter 6 Reserved (0)

NOTE: The passwords exist to ensure that your intent is to save current changes. A Save Command will automatically delete old program data. Even changing just the scale factor will automatically delete all Home Position offsets and Reset-to-Preset values.

NOTE: The EEPROM on the 1746R is only guaranteed to 10,000 write cycles. Because of this, it is recommended that the save configuration command be used sparingly.

Input Image Table

The Input Image Table is used to send the system data back to the A-B SLC 500 Processor. There are 8 data words in the Input Image Table. The I/O Image Table will vary depending on the configuration as shown below:

	Configuration 1 Single Axis Brake Monitor	Configuration 2 Multi-Turn	Configuration 3 Single Axis	Configuration 4 Two Axis	Configuration 5 Multi-Turn	Configuration 6 Two Axis (Brake Monitor & Reset-to-Preset)
Word 0	Bit Register	Bit Register	Bit Register	Bit Register	Bit Register	Bit Register
Word 1	Configuration	Configuration	Configuration	Configuration	Configuration	Configuration
Word 2	Position (high)	Position (high)	Position (high)	Position 1 (high)	Position (high)	Position 1 (low)
Word 3	Position (low)	Position (low)	Position (low)	Position 1 (low)	Position (low)	RPM
Word 4	RPM	RPM	RPM	RPM 1	RPM	Stopping Time
Word 5	Stopping Time			Position 2 (high)		Stopping Angle
Word 6	Stopping Angle			Position 2 (low)		Position 2 (high)
Word 7				RPM 2		Position 2 (low)

Status Bit Register (Word 0)

The bit register has been defined below:

Bit 15	14	13	12	11	10	9	8
ACK	DATA ERR	INPUT STATE 1	INPUT STATE 2	MOTION DETECT	BRAKE FAIL	BRAKE ERR	BRAKE WARN
Bit 7	6	5	4	3	2	1	0
PRI OPEN RES 1	PRI SHORT RES 1	S1 OPEN RES 1	S4 OPEN RES 1	PRI OPEN RES 2	PRI SHORT RES 2	S1 OPEN RES 2	S4 OPEN RES 2

Acknowledge Bit (15)

This bit is used to acknowledge a command from the output image table. If all the data is valid in the command, the acknowledge bit is set to indicate to the A-B SLC 500 processor that the command was processed. This bit is cleared when the programming bit is cleared in the output image table.

Data Error Bit (14)

This bit is used to indicate an error was detected in the command sent from the output image table. This bit is set if an error is detected in the command parameter data. This bit is cleared when the programming bit is cleared in the output image table.

Input State 1 (13)

This bit will reflect the state of input 1 from the front of the unit.

Input State 2 (12)

This bit will reflect the state of input 2 from the front of the unit.

Motion Detect Bit (11)

This bit will indicate whether the RPM is above or below the programmed motion detect RPM value. If the actual RPM is below the programmed RPM, the bit will be cleared. If the RPM is greater than or equal to the programmed RPM, the bit will be set.

Brake Fail Bit (10)

This bit is used to detect whether the brake monitor input is functioning correctly. This is done by monitoring the state of the brake input when movement is detected in the resolver. If there is movement detected and the brake monitor indicates the brake is still activated, this bit will be set to indicate a possible failure in the brake monitor input circuitry.

Brake Error Bit (9)

This bit is set when the actual brake stopping time exceeds the programmed brake error time. This bit is cleared when a zero to one transition on the clear brake error bit is detected. This bit is set in real time, at the point the internal timer exceeds the time limit.

Brake Warning (8)

This bit is set when the actual brake stopping time exceeds the programmed brake warning time. This bit is cleared when a zero to one transition on the clear brake warning bit is detected. This bit is set in real time, at the point the internal timer exceeds the time limit.

Primary Open Error

The primary open bit will be set if this error is detected on either one of the resolvers. Resolver #1 is in bit 7 and resolver #2 is in bit 3. This bit is clear when no error is present.

Primary Short Error

The primary short bit will be set if this error is detected on either one of the resolvers. Resolver #1 is in bit 6 and resolver #2 is in bit 2. This bit is clear when no error is present.

S1 Open Error

The S1 open bit is set when this error is detected on either one of the resolvers. Resolver #1 is in bit 5 and resolver #2 is in bit 1. This bit is clear when no error is present.

S4 Open Error

The S4 open bit is set when this error is detected on either one of the resolvers. Resolver #1 is in bit 4 and resolver #2 is in bit 0. This bit is clear when no error is present.

Configuration Register (Word 1)

This register will reflect the current configuration number of the system. Because the input image table is set up differently for each configuration, it allows the user to know what data is present in the table and verify that the system is configured the way it is supposed to be.

Position (Words 2 and 3, also Words 5 and 6 for Dual Axis, words 2, 6 and 7 for configuration 6 only)

The scaled position is given in two registers, position high and position low. The position data can range from -2,147,483,648 to 2,147,483,647. (See Appendix A: Specifications.)

RPM (Word 4, also Word 7 for Dual Axis, Words 3, for configuration 6 only)

The RPM data is given in 1 word and ranges from zero to 2048. It is updated every 14.68ms.

Stopping Time (Word 5, for Configuration 1 only, Word 4, for configuration 6 only)

The actual stopping time is given in 1 word and ranges from zero to 65,535ms.

Stopping Angle (Word 6, for Configuration 1 only, Word 5, for configuration 6 only)

The actual stopping angle is given in 1 word and ranges from 0 to 65,535 scaled counts.

NOTE: This is the angular difference between the resolver position when the input was detected and the resolver position when it stopped.

Chapter 4: Application Examples

- (1) For parameters and positions that are 32 bits, the value needs to be spread over two 16 bit words. The high word will contain the most significant 16 bit and the low word will contain the least significant 16 bits.

Example: If the scale factor was 4096, the high word would be 0 (0 hex) and the low word would be 4096 (1000 hex).

Example: If the scale factor was 500,000, the high word would be 7 (7 hex) and the low word would be -14,288 (A120 hex).

- (2) The following is an example program for setting up the 1746R Resolver Interface Module. The 1746R Resolver Interface Module is installed in slot 1 of the SLC 500 rack. The following data defines the command parameters and state flags that are used to program the 1746R Resolver Interface Module:

Configuration Command	#N7:0
Position Scaling Command for Resolver 1	#N7:10
Position Scaling Command for Resolver 2	#N7:20
Reset-to-Preset Command	#N7:30
Home Position Command for Resolver 1	#N9:0
Home Position Command for Resolver 2	#N9:10
Program State Flags	#N10:0
1746R Configuration	#N10:0/0
Resolver 1 Configuration	#N10:0/1
Resolver 2 Configuration	#N10:0/2
Reset-to-Preset	#N10:0/3
Resolver 1 Home Positioning	#N10:0/4
Resolver 2 Home Positioning	#N10:0/5
Configuration Complete	#N10:0/6
Valid Position Flags	#B3:0
Resolver 1 Valid Position	#B3:0/15
Resolver 2 Valid Position	#B3:0/14

On the first scan, the start 1746R configuration flag is set. When this flag is set, the configuration command is copied into the output image table with the programming bit set. This will continue until the command has been acknowledged in the input image table.

CLEAR STATE FLAGS AND SET UP FOR INITIALIZATION

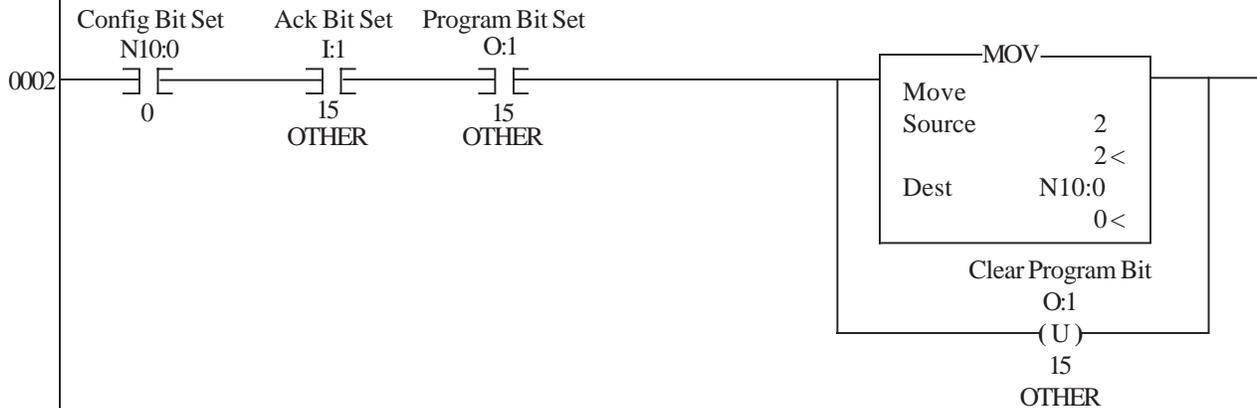


COPY COMMAND TO CONFIGURE THE 1746R CARD



When the 1746R configuration command is complete, the program will copy the position scaling command for resolver 1 into the output image table with the programming bit set. This command will configure resolver 1 for a total scale factor of 1000 and turn count of 10. This will configure the resolver for 100 counts per turn. This continues until the command has been acknowledged.

WHEN COPY OF THE 1746R CONFIGURATION COMMAND IS COMPLETE, SET THE STATE FLAG TO CONFIGURE RESOLVER 1

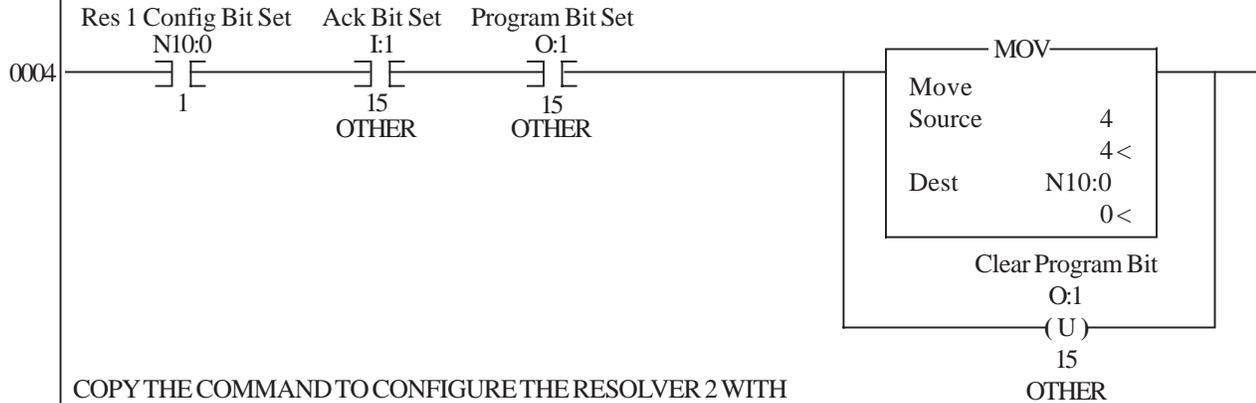


COPY THE COMMAND TO CONFIGURE RESOLVER 1 WITH SCALE FACTOR AND TURNS COUNTING INFORMATION

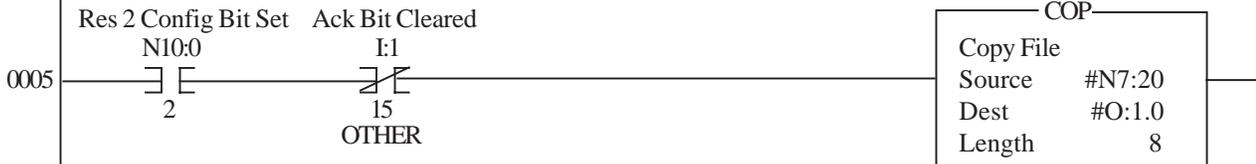


When the position scaling data has been acknowledged for resolver 1, the program will copy the position scaling command for resolver 2 into the output image table. This resolver is set up for a scale factor of 360 with no turns counting. This will continue until the command has been acknowledged.

WHEN COPY OF THE RESOLVER 1 COMMAND IS COMPLETE, SET THE STATE FLAG TO CONFIGURE RESOLVER 2

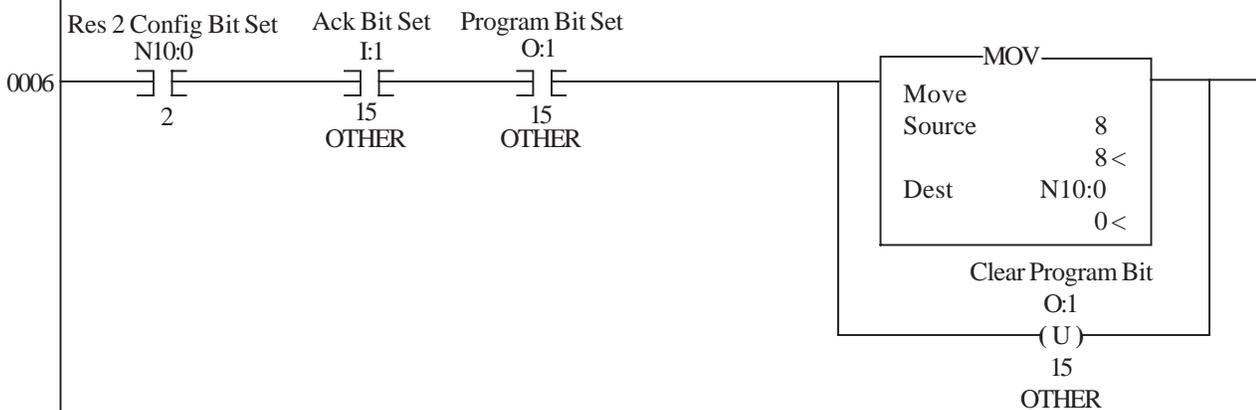


COPY THE COMMAND TO CONFIGURE THE RESOLVER 2 WITH SCALE FACTOR AND TURNS COUNTING INFORMATION



When the position scaling data has been acknowledged for resolver 2, the program will copy the reset-to-preset command into the output image table. The reset-to-preset value for resolver 1 is set to 100 and the reset-to-preset value for resolver 2 is set to 180. The program will wait for the acknowledge bit to be set.

WHEN COPY OF THE RESOLVER 2 COMMAND IS COMPLETE, SET THE STATE FLAG TO CONFIGURE RESET-TO-PRESET

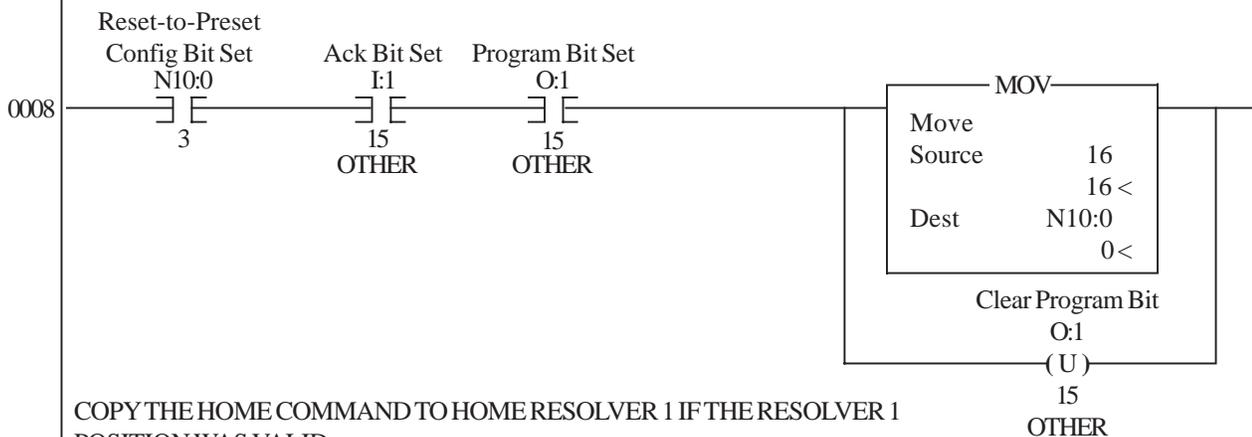


COPY THE COMMAND TO CONFIGURE THE RESET-TO-PRESET

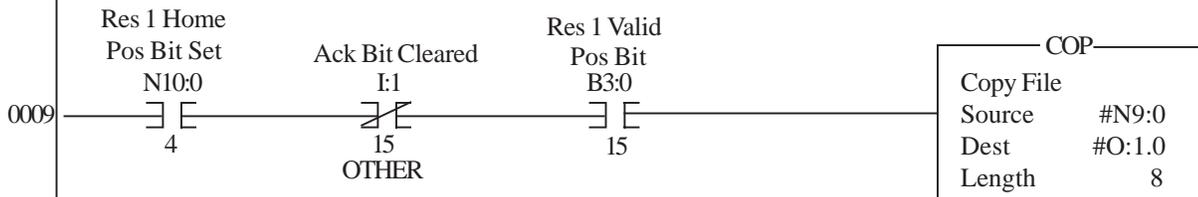


When the reset-to-preset values have been acknowledged, the program will check to see if the resolver positions need to be homed to a previously set position. This is done through the valid position flags, B3:0/15 for resolver 1 and B3:0/14 for resolver 2. If the valid position flag, B3:0/15, is set, it will perform a home command for resolver 1. This command will contain the new position data for resolver 1. If the valid position flag, B3:0/14, is set, it will perform a home command for resolver 2. This command will contain the new position data for resolver 2. After the resolvers have been homed, a configuration complete flag is set to indicate the unit is completely configured.

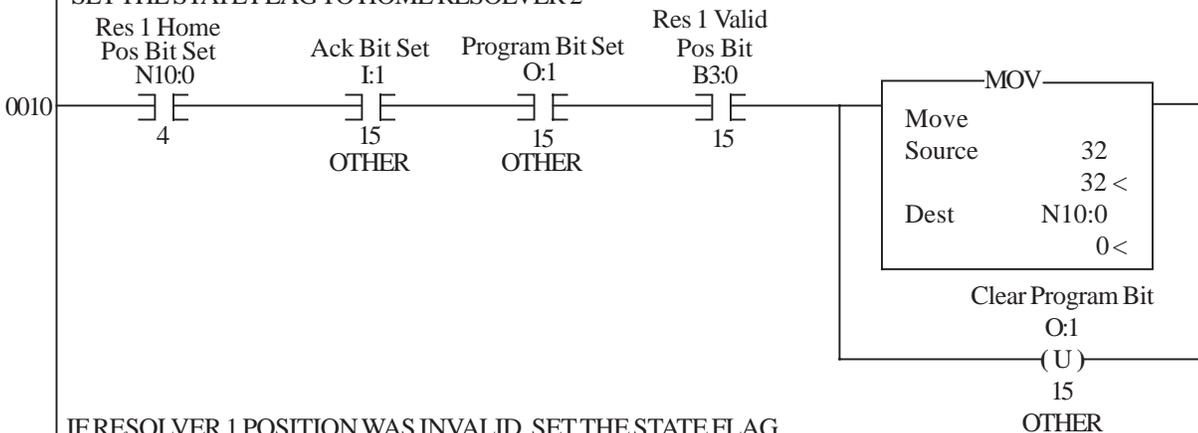
WHEN COPY OF THE RESET-TO-PRESET COMMAND IS COMPLETE, SET THE STATE FLAG TO HOME RESOLVER 1



COPY THE HOME COMMAND TO HOME RESOLVER 1 IF THE RESOLVER 1 POSITION WAS VALID

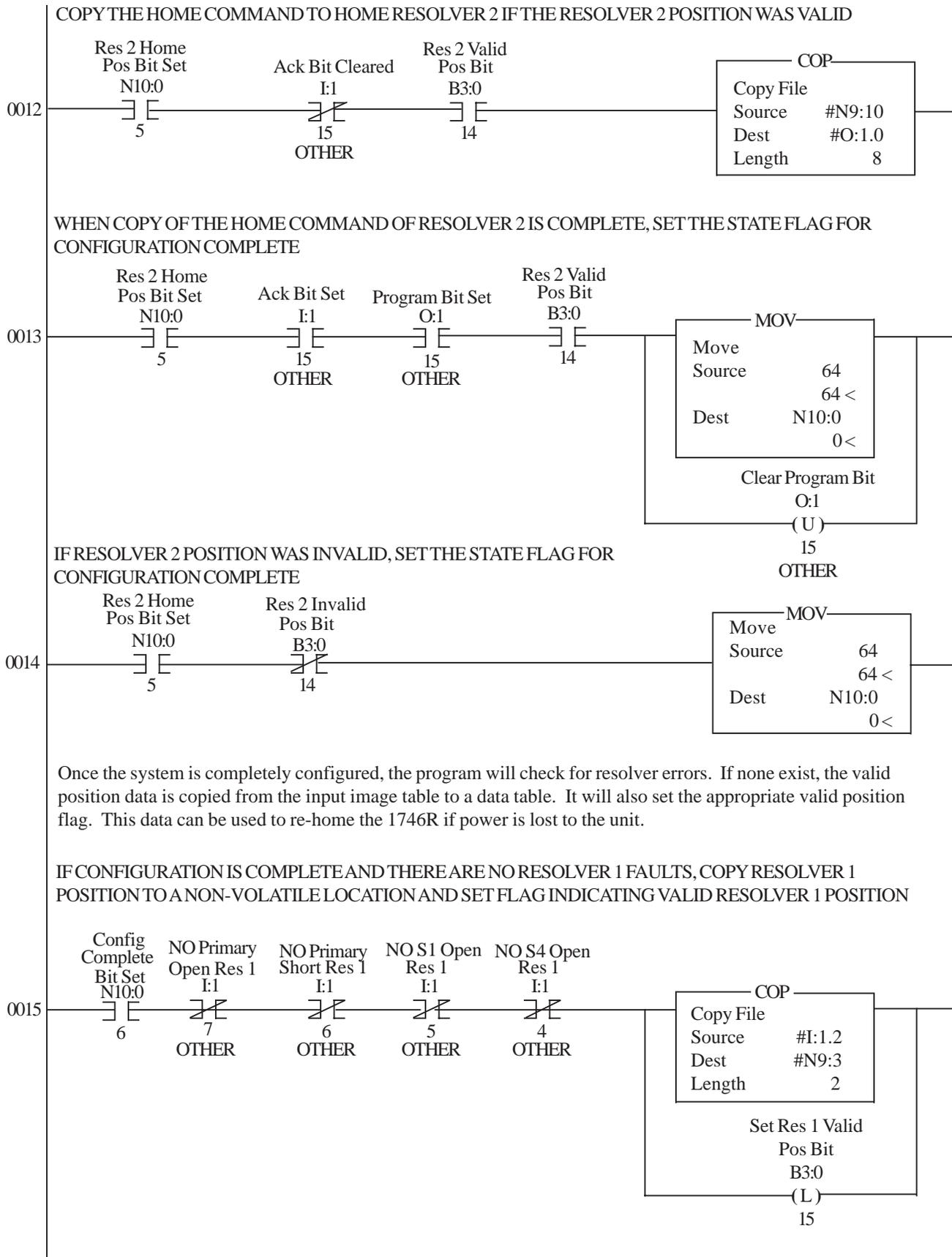


WHEN COPY OF THE HOME COMMAND OF RESOLVER 1 IS COMPLETE, SET THE STATE FLAG TO HOME RESOLVER 2

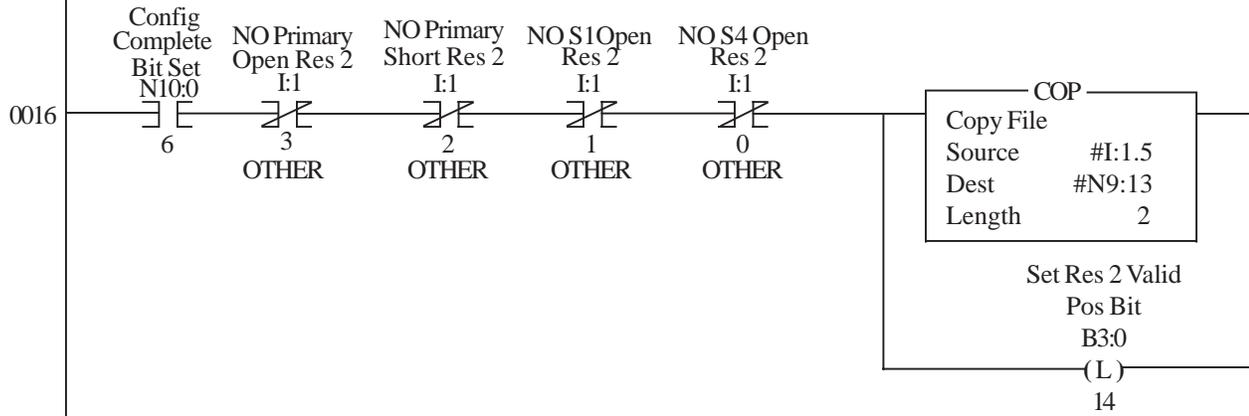


IF RESOLVER 1 POSITION WAS INVALID, SET THE STATE FLAG TO HOME RESOLVER 2

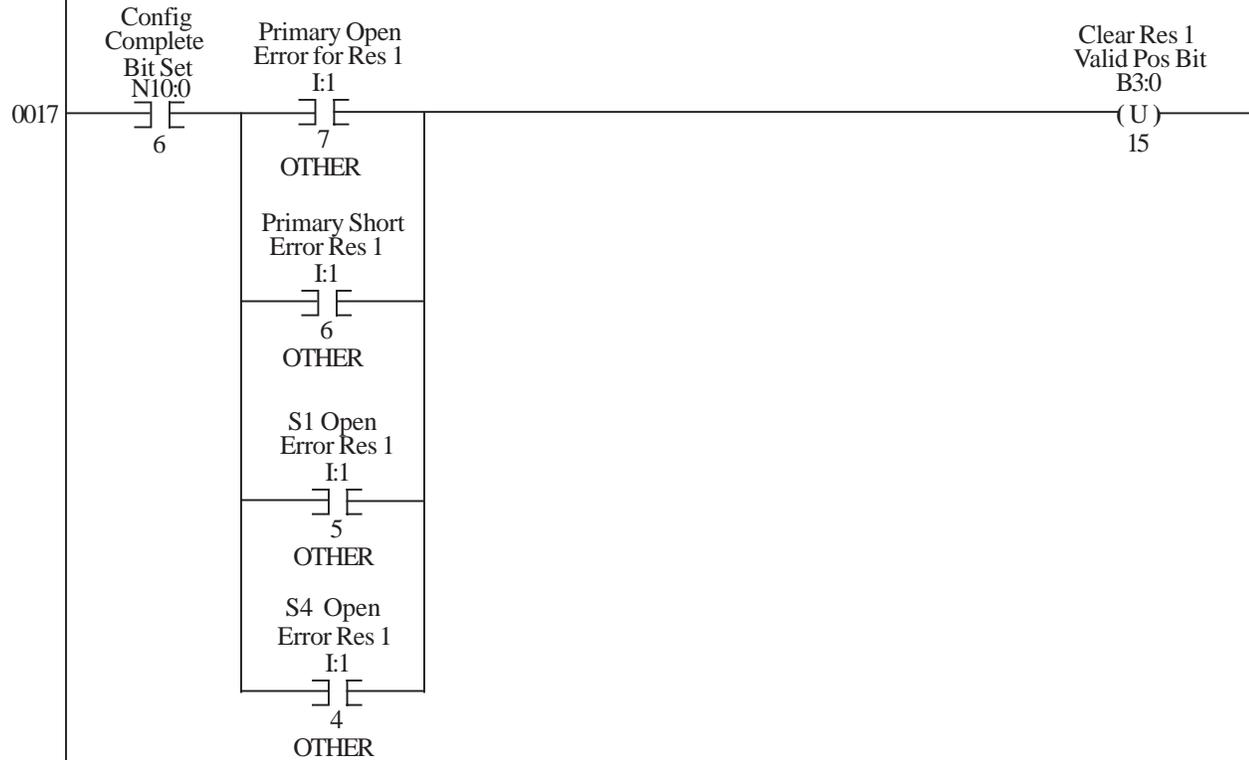


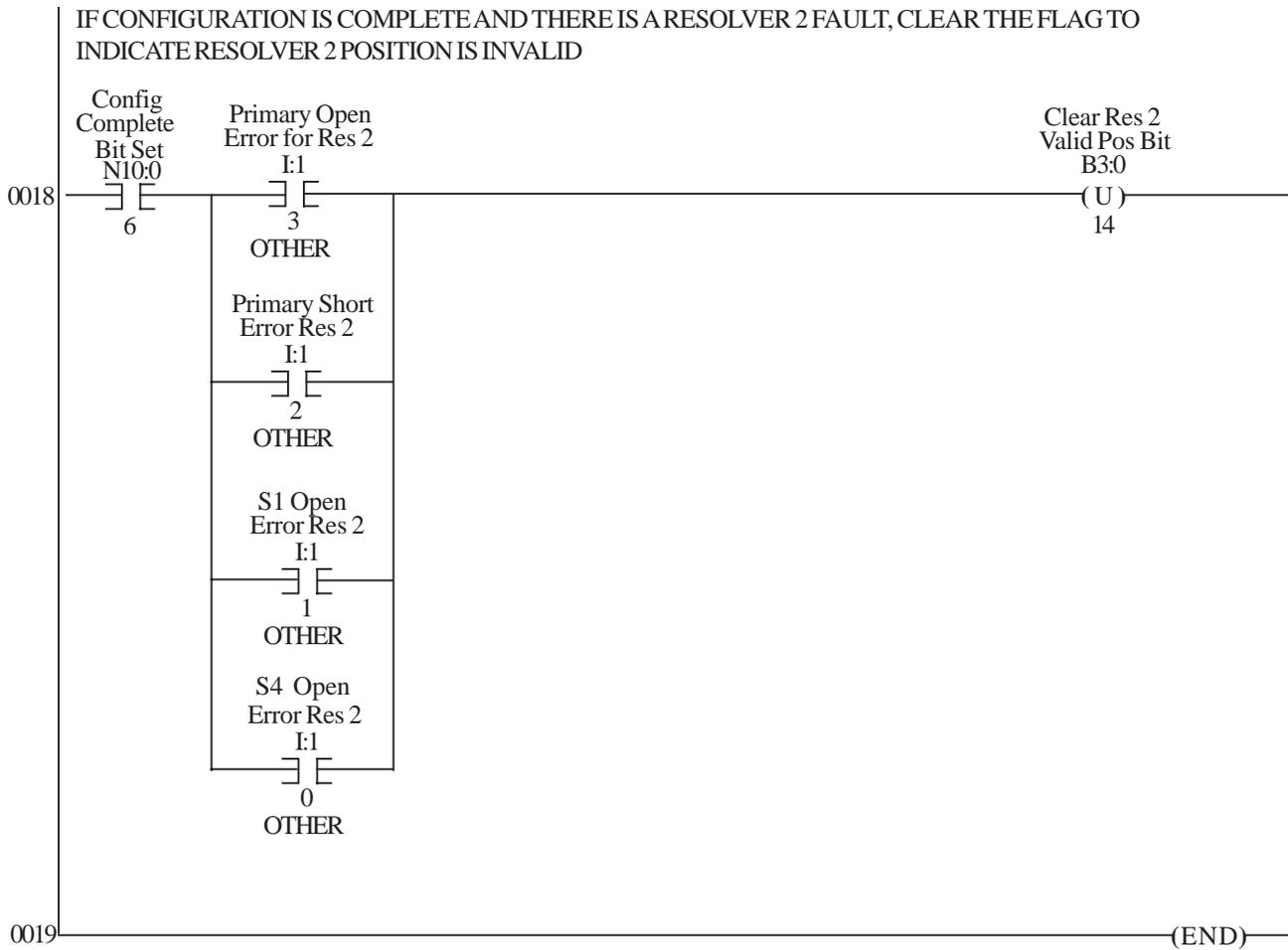


IF CONFIGURATION IS COMPLETE AND THERE ARE NO RESOLVER 2 FAULTS, COPY RESOLVER 2 POSITION TO A NON-VOLATILE LOCATION AND SET FLAG INDICATING VALID RESOLVER 2 POSITION



IF CONFIGURATION IS COMPLETE AND THERE IS A RESOLVER 1 FAULT, CLEAR THE FLAG TO INDICATE RESOLVER 1 POSITION IS INVALID





Data File N7 (dec) -- INTEGER

Offset	0	1	2	3	4	5	6	7	8	9
N7:0	-32768	1	1111	4	0	0	0	0	0	0
N7:10	-32768	2	1	0	1000	10	0	0	0	0
N7:20	-32768	2	2	0	360	0	0	0	0	0
N7:30	-32768	6	0	100	0	180	0	0		

Data File N9 (dec) -- HOME INFO

Offset	0	1	2	3	4	5	6	7	8	9
N9:0	-32768	3	1	0	1179	0	0	0	0	0
N9:10	-32768	3	2	0	58	0	0	0		

Data File N10 (bin) -- PRGM STATE

Offset	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
N10:0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

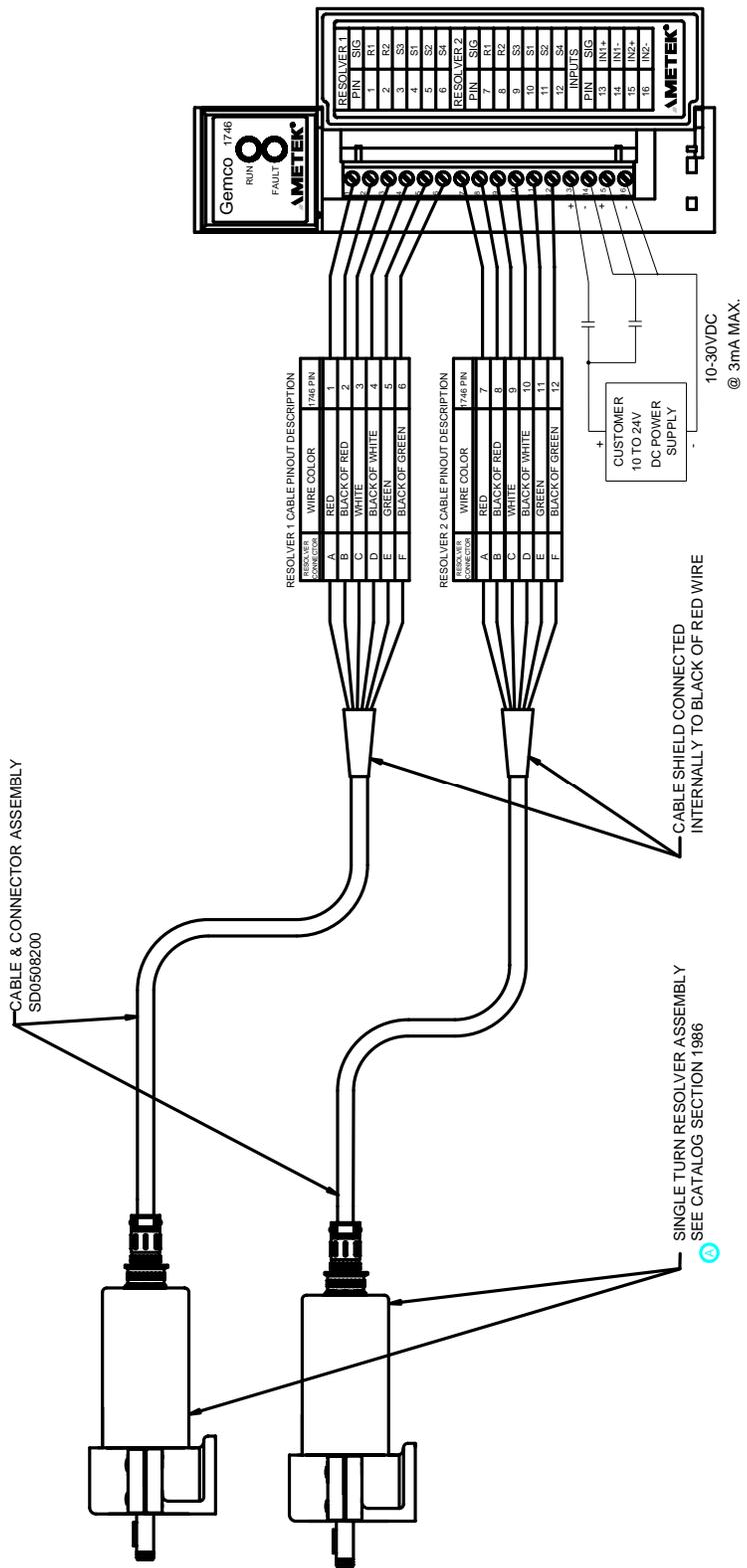
Data File B3 (bin) -- VALID POS

Offset	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
B3:0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix A: Specifications

Power Requirements:	0.250A max. @ 5 Vdc 0.0A @ 24 Vdc
Resolution:	12 bit resolution for standard resolver 18 bit resolution for 64:1 multi-turn resolver 19 bit resolution for 128:1 multi-turn resolver
RPM:	2048 max.
Resolver Cable Length:	1000 ft. max.
Temperature Range:	Operating: 32 - 131°F (0 - 55°C) Storage: 0 - 150°F (-17 - 65°C)
Position Update Time:	300µs single resolver position 600µs dual resolvers 800µs for multi-turn resolvers <u>If Data Format Selected</u> 500µs single resolver (config 1 & 3) 1000µs dual resolver (config 4) 800µs dual resolver (config 6) 1000µs multiturn resolver (config 2 & 5)
RPM Update Time:	14.68ms for RPM
Auxiliary Inputs:	10 - 30Vdc max. @ 3 mA
Brake Monitor:	active (timing starts) when power is removed (1 millisecond resolution)
Reset-to-Preset:	active when power is applied (worst case response is position update time)
Module ID Code:	3535 (Reserve 8 input and 8 output words I/O image table)
I/O Isolation:	500 Vac

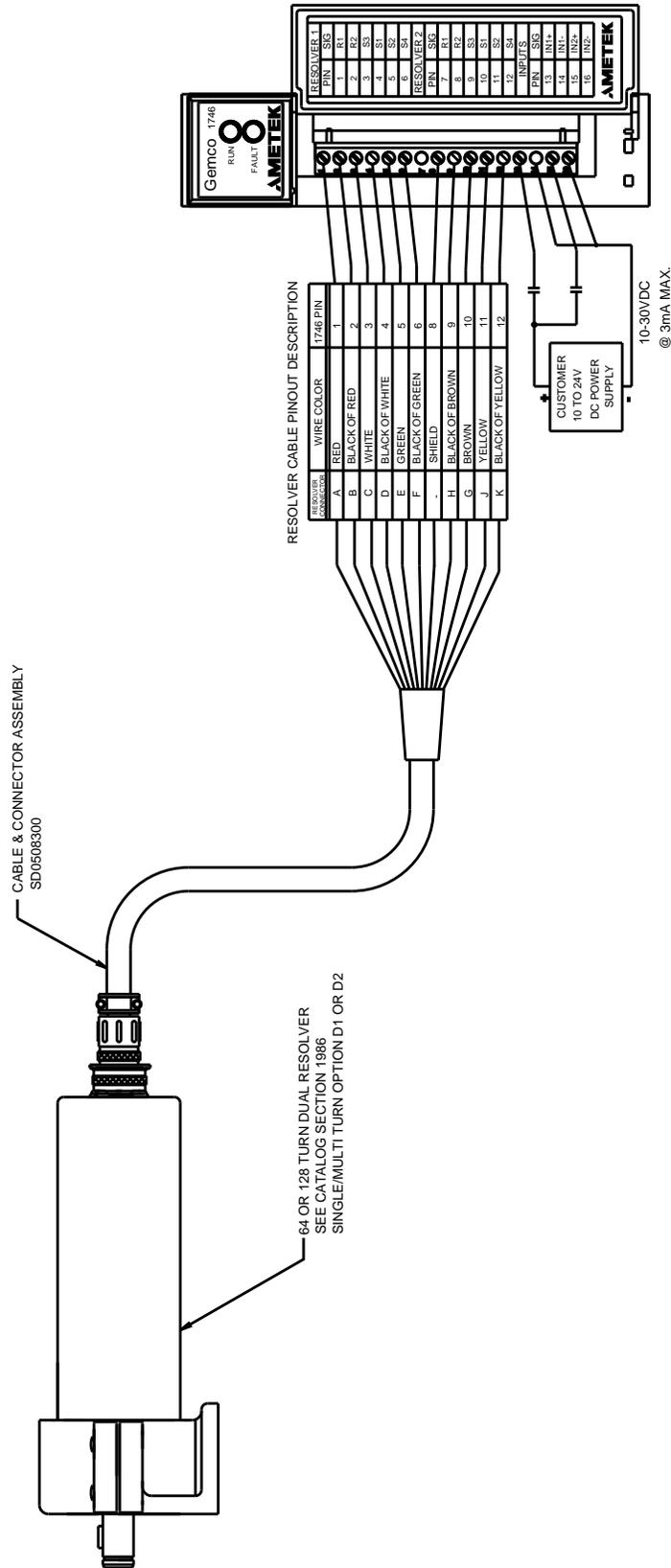
Appendix B: Wiring Diagram



NOTES: UNLESS OTHERWISE SPECIFIED

1. TO REVERSE THE DIRECTION OF ROTATION INTERCHANGE THE GREEN AND BLACK OF GREEN WIRE AT THE INPUT MODULE TERMINAL STRIP.
2. ON SINGLE INPUT VERSIONS OF THIS MODULE RESOLVER 2 AND IN 2 INPUT DESIGNATIONS WILL NOT APPEAR ON THE MODULE DOOR LEGEND PLATE.

Dual resolver wiring diagram



- NOTES: UNLESS OTHERWISE SPECIFIED**
1. TO REVERSE DIRECTION OF ROTATION, INTERCHANGE YELLOW & BLACK OF YELLOW AND INTERCHANGE WHITE & BLACK OF WHITE.
 2. CONNECT SHIELD OF RESOLVER CABLE TO TERMINAL 8.

Single resolver wiring diagram



AMETEK APT • 1080 N. Crooks Road • Clawson, MI 48017
800-635-0289 • 248-435-0700 • Fax 248-435-8120 • www.ametekapt.com

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