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HM7100-RES Resolver Input Module

Force Measurement and Control Solutions

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IMPORTANT USER INFORMATION

Solid state equipment has operational characteristics differing from those of electromechanical equipment. "Safety Guidelines for the Application, Installation and Maintenance of Solid State Controls" (Allen-Bradley Publication SGI-1.1) describes some important differences between solid state equipment and hard-wired electromechanical devices. Because of this difference, and also because of the wide variety of uses for solid state equipment, all persons responsible for applying this equipment must satisfy themselves that each intended application of this equipment is acceptable.

In no event will the Helm Instrument Company be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

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

No patent liability is assumed by Helm Instrument Company with respect to use of information, circuits, equipment, or software described in this manual.

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



ATTENTION: Identifies information about practices or circumstances that can lead to property damage, identifies information that is especially important for successful application and understanding of the product.

Attentions help you:

- Identify a hazard
- Avoid the hazard
- Recognize the consequences

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PREFACE

Read this preface to familiarize yourself with the rest of this manual. This preface covers the following topics:

- Who should use this manual
- The purpose of this manual
- Terms and abbreviations
- Conventions used in this manual
- Helm Instrument support

WHO SHOULD USE

Use this manual if you are responsible for the design, installation, programming, or maintenance of an automation control system that uses Allen-Bradley small logic controllers.

You should have a basic understanding of SLC 500 products. You should understand electronic process control and be able to interpret the ladder logic instructions required to generate the electronic signals that control your application. If you do not, contact your local Helm representative for the proper training before using this product.

PURPOSE OF THIS MANUAL

This manual is a learning and reference guide for the Helm Process Automation Module. It contains the information you need to install, wire, and use the module.

RELATED DOCUMENTATION

The following documents contain information that may be helpful to you as you use Allen-Bradley SLC products. To obtain a copy of any of the Allen-Bradley documents listed, contact your local Allen-Bradley office or distributor.

For	Read this Document	Document
		Number
An overview for the SLC 500 family of products	SLC 500 System Overview	1747-2.30
A description on how to install and use your Modular	Installation & Operation Manual for Modular	1747NI002
SLC 500 programmable controller	Hardware Style Programmable Controllers	
A description on how to install and use your Fixed	Installation & Operation Manual for Fixed	1747-NI001
SLC 500 programmable controller	Hardware Style Programmable Controllers	
A procedural manual for technical personnel who use APS to develop control applications	Allen-Bradley Advanced Programming Software (APS) User's Manual	1747-NM002
A reference manual that contains status file date, instruction set, and troubleshooting information about APS	Allen-Bradley Advanced Programming Software (APS) Reference Manual	1747-NR001
An introduction to APS for first-time users, containing basic concepts but focusing on simple tasks and exercises, and allowing the reader to begin programming in the shortest time possible	Getting Started Guide for APS	1747-NM001
A procedural and reference manual for technical personnel who use an HHT to develop control applications	Allen-Bradley Hand-Held Terminal User's Manual	1747-NP002
An introduction to HHT for first-time users, containing basic concepts but focusing on simple tasks and exercises, and allowing the reader to begin programming in the shortest time possible	Getting Started Guide for HHT	1747-NM009
A resource manual and user's guide containing information about the analog modules used in your SLC 500 system	SLC 500 Analog I/O Modules User's Manual	1746-NM003
A complete listing of current Automation Group documentation, including ordering	Automation Group Publication Index	SD499
instructions. Also indicates whether the documents are available on CD-ROM or in multi-languages		
A glossary of industrial automation terms and abbreviations	Allen-Bradley Industrial Automation Glossary	ICCG-7.1
An article on wire sizes and types for grounding electrical equipment	National Electrical Code	Published by the National Fire
		Protection
		Association of
		Boston, MA.
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TERMS AND ABBREVIATIONS

The following terms and abbreviations are used throughout this manual. For definitions of terms not listed here refer to *Allen-Bradley's Industrial Automation Glossary, Publication ICCG-7.1.*

Calibration - Procedure, performed by trained personnel, to set the RMS (mean square root) voltages of the resolver.

Chassis - A hardware assembly that houses devices such as I/O modules, adapter modules, processor modules, and power supplies.

Configuration Word - Contains the configuration information needed by the module to configure and operate. Information is written to the configuration word through the logic supplied in your ladder program.

Data Word - A 16-bit integer that represents the value of the analog input channel. The channel data word is valid only when the channel is enabled.

LSB - (Least Significant Bit) Refers to a data increment defined as the full scale range divided by the resolution. The bit that represents the smallest value within a string of bits.

Master/Slave Operation - Selectable mode of module operation. Default is Master when module is wired to a Helm Model HR1101 resolver. Mode is Slave when module receives input by tapping off of an existing resolver.

Monitor Mode - Normal run state.

Multiplexer - A switching system that allows several input signals to share a common A/D converter.

Offset - A value represented in degrees to restore resolver to zero at the top of the stroke. Required when resolver has not been mechanically set to zero.

Remote Configuration - A control system where the chassis can be located several thousand feet from the processor chassis. Chassis communication is via the 1747-SN Scanner and 1747-ASB Remote I/O Adapter.

Resolution - The smallest detectable change in a measurement, typically expressed in engineering units (e.g. 0.15C) or as a number of bits. For example a 12-bit system has 4,096 possible output states. It can therefore measure 1 part in 4096.

Resolver - Sometimes called encoder. Device attached on a machine to determine machine stroke position. Sine/cosine based resolver required for Helm Resolver Input Module.

TERMS AND ABBREVIATIONS (CONTINUED)

Sampling time - The time required by the A/D converter to sample an input channel.

Scale - Value used to describe the press/machine overall tonnage. Set for maximum value of one channel. For example, settings for a 150 ton press = 75.

Setup Mode - Status condition of module. Normally enabled to perform calibration and setup procedures.

Status Word - Contains status information about the channel's current configuration and operational state. You can use this information in your ladder program to determine whether the channel data word is valid.

Strokes per Minute (SPM) - Value calculated when a machine cycles through a complete rotation (0 to 360 degrees).

TSM - Acronym for Through-the-Stroke load monitoring. Resolver input is required for monitoring the load being developed during machine cycle.

Update Time - The time required for the module to sample and convert the input signals of all enabled input channels and make the resulting data values available to the SLC processor.

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.

PRODUCT SUPPORT

Contact your Helm representative or call Helm direct at 419/893-4356:

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

Your Questions or Comments on this Manual

If you have any suggestions for how this manual could be made more useful to you, please send us your ideas.

OVERVIEW

You have just purchased the most advanced high speed resolver input module available. HELM INSTRUMENT COMPANY, INC. manufactures a complete line of monitoring control solutions for use on metal stamping, forging, compaction and assembly presses; cold forming, cold heating, injection molding and die cast machines. Resolvers, standard or custom transducers and load cells are available for in-die monitoring of transfer or progressive tooling.

At HELM, quality is inherent not only in the design of our products but in the attitudes of our employees as well. We're working together to give you the best. After all, that's what our business is all about - providing innovative instrumentation to help make your manufacturing process more productive and your operation more effective.

The HM7100-RES Resolver Module - is an intelligent module designed for applications requiring high-speed input to output response. This module accepts sine/cosine resolver input at speeds up to 1200 strokes per minute.

The HM7100-RES module is configured through the SLC processor where it performs its algorithm independent of the processor scan time. Components

The Helm Resolver module resides on the backplane of the Allen-Bradley 1746 SLC-500. The system is comprised of several parts; the input module, a sine/cosine based resolver (*such as the Helm Model HR-1101 resolver*) and the Helm 6117 resolver cable.

The HR-1101 sine/cosine Resolver is housed in a rugged enclosure designed especially for industrial applications. The resolver is a very accurate absolute position shaft encoder known for it's extreme durability. Helm resolvers are passive devices which consist of brushless rotary transformers with one rotor and two stator windings. These windings are positioned at 90 degrees apart from one another thus providing a sine and cosine analog output signal corresponding to the shaft position.

HARDWARE OVERVIEW



The HM7100-RES resolver module fits into any singleslot, except the processor slot(0). It is a Class 1 module (uses eight input words and eight output words).

The Helm resolver module can accept input from one resolver.

Module configuration requires manual and user programmable setup. The resolver module receives and stores digitally converted analog data into its image table for retrieval by modular SLC 500 processors.

HM-7100 RES SPECIFICATIONS



Input Resolution Display Resolution Linearity Logic Scan Time Position Update Time Operating Temperature Backplane Current Consumption

HM-7100-RES

Sine Cosine Resolver 12 bit (4096 points) 0.1 Degree .05% Full Scale 1.2 msec 200 μsec 0° to 60°C (32° to 140°F) .268A @ 5V, .109mA @ 24V

Resolvers supported:

Helm Model HR1101

CHAPTER 1

HM-7100-RES Operating Instructions





Master/Slave Dip Switch Set dip switch (S1) to Master (ON) position or Slave (OFF) position.

HM-7100-RES TECHNICAL SPECIFICATIONS

Resolver LED	Indicates a resolver cable fault
By-Pass LED	Indicates Offset mode
Run LED	Normal operating mode
Door Label	Resolver wiring diagram
Transmit Connector	Connector for communication with Helm ForceGard module via Receive IN jack.
8-Pin Connector	For resolver input wiring
Dip Switch	S1- Switch for Master/Slave operation
Potentiometers	For authorized factory use only.

GETTING STARTED

This chapter can help you to get started using the Helm PAM module. The procedures included here assume that you have a basic understanding of SLC 500 products. You should understand electronic process control and be able to interpret the ladder logic instructions required to generate the electronic signals that control your application.

Because it is a start-up guide, this chapter does not contain detailed explanations about the procedures listed. It does, however, reference other chapters in this book where you can get more information about applying the procedures described in each step. It also references other SLC documentation that may be helpful if you are unfamiliar with programming techniques or system installation requirements. If you have any questions or are unfamiliar with the terms used or concepts presented in the procedural steps, always read the referenced chapters and other recommended documentation before trying to apply the information.

This chapter will:

- tell you what equipment you need
- explain how to install and wire the module
- show you how to set look windows for resolver input

REQUIRED TOOLS AND EQUIPMENT

Have the following tools and equipment ready:

- small blade screwdriver
- appropriate resolver cable

• programming equipment (All programming examples shown in this manual demonstrate the use of Rockwell Software's Logic's 500 version 4.10 on a PC.)

SYSTEM OPERATION

The Resolver module communicates to the SLC processor through the parallel backplane interface and receives +5Vdc and +24Vdc power from the SLC power supply through the backplane. No external power supply is required. You may install as many Resolver modules in your system as the power supply can support. Any modules, other than the primary module set to MASTER, must be set to SLAVE mode.

RESOLVER WIRING

The module contains an 8-pin green connector for wiring the resolver. The pin-out is shown below. Please note, as referenced at the bottom of this sheet, that the Helm Resolver cable wiring code has been changed as of 1-01-01. SLAVE modules must be wired in parallel.



Attention: To ensure proper operation and high immunity to electrical noise, always use Helm resolver cable. (Part Number 66012).

To limit noise, keep resolver cable as far away as possible from power and load lines.



- Ref. Gnd (Green)
- R1 Ref. (White)
- S4 Cosine Gnd (Blue)
- S2 Cosine (Orange)
- SH Shield

R2

- S1 Sine Gnd (Red)
- S3 Sine (Black)



ATTENTION: As of 1/01/2001 Part Number 66012 Resolver cable

Has been modified to the following configuration.





CHANNEL CONFIGURATION, DATA AND STATUS

This chapter explains how the Resolver Input module and the SLC processor communicate through the module's input and output image. It lists the preliminary setup and operation required before the module can function in a 1746 I/O system.

MODULE ADDRESSING

The module identification code is a unique number encoded for each 1746 I/O module. This code defines for the processor the type of specialty I/O module residing in a specific slot in the chassis. With APS software, manually enter the module ID code.



No special I/O configuration (SPIO CONFIG) information is required. The module ID code automatically assigns the correct number of input and output words. The following memory map shows how the output and input image tables are defined.

INTEGER FILES USED FOR PAM RES MODULE

1)	Timers
	-

Last Address T4:2 N12:40 N61:255

2) Common integer

COMMON INTEGER FILE FOR PAM RES MODULE

N12:2/7	Press in Motion Trigger Bit
N12:3/0	Brake Monitor Input
N12:4/5	Press in Motion MAP IN Bit
N12:4/6	Pam RES Module Mode (0=Setup,1=Run)
N12:4/7	Zero Resolver
N12:5	Brake Monitor Fault Time to Compare to
N12:6	Resolver Angle (xxx.x)
N12:9	Data Xfer Pointer From SLC
N12:10	Resolver Offset Angle Calculation
N12:11	Resolver Offset Angle Calculation
N12:12	Resolver Offset Angle
N12:13	Press in Motion Calculation
N12:14	Press in Motion Calculation
N12:40/2	Brake Monitor Fault MAP IN Bit
N12:40/3	Resolver Fault MAP IN Bit
N61:255	SPM Value

PAM RES MODULE I/O IMAGE

Inputs

l:x.1	Resolver Degree Value (xxx.x)
l:x.3	SPM and I:x.3/15 Resolver Fault Bit Indicato
l:x.5	Brake Monitor Start Angle
l:x.6	Brake Monitor Stop Angle
l:x.7	Brake Monitor Time Value

Outputs

Put into Setup Mode
Put into Run Mode
Download job info
Brake Monitor clutch input
Data Xfer Pointer from SLC

START UP

The following files are located on the distribution disk.

RESOLVER_SETUP.RSS SLC Ladder Logic

Before attempting to load software, reserve the following files.

	Last Address
Timers	T4:2
Common integer	N12:40
Current job	N61:255

Using RS Logic rev 4.10 software install the required RSS software in the SLC processor.

This rung sets the PAM RES module into setup mode when PanelView setup/run button, on the Resolver Setup screen, is set to setup mode. The resolver must be in setup mode before you can zero the resolver.



This rung sets the PAM module into run mode when the PanelView setup/run button, on the Resolver Setup screen, is set to run mode. The resolver should be in this mode for normal operation.



CHAPTER 3



Brake Monitor Fault Bit N12:40/2



PanelView Resolver Fault Indicator Bit N12:40/3

RESOLVER SETUP PANELVIEW EXAMPLE



ZERO RESOLVERS

Inch press to Top Dead Center (TDC). Press "ZERO RESOLVER". Resolver angle should now display "0".

BRAKE FAULT TIME

Enter brake fault time to manufactures recommended setting.