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HM1756-SGI-UHS
Strain Gage Input Module

User Manual

Force Measurement and Control Solutions

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: Please refer to accompanying manuals
Strain Gage Installation and Helm ControlLogix Navigator Software
for additional information on the application of the Helm HM1756-SGI-PLM module.

PREFACE

Read this preface to become familiar 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 ControlLogix 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 ControlLogix Strain Gage Input Module. It contains the information you need to install, wire, and use the module.

RELATED DOCUMENTATION

Additional documents containing information that may be helpful to you as you use Allen-Bradley ControlLogix products may be found at http://www.ab.com/manuals/cl/ or from your local distributor.

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.

Bypass Mode - Enabled to perform calibration and setup procedures.

Calibration - Procedure, performed by trained personnel, where machine or press is dynamically loaded to impact on load cells. A process of linearity measuring to determine the loading capacity of the machine.

Calibration Number - Amplification values established during machine calibration or pre-assigned on force load cells.

Channel - Refers to one of two, strain gage inputs available on the modules terminal block.

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

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

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

Gain - Amplification of an input signal.

Load/Force - Measurement of impact during a machine cycle. Sensors provide the input for this measurement.

Look Window - Resolver or cam activated window, which allows specific degrees in a machine cycle to be processed.

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.

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

Peak Mode - Normally enabled during job setup.

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 with 2 sensors.

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).

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 controller.

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 strain gage 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 Helm Strain Gage combines machine and tooling monitoring with programmable limit switch function. User programmable high and low limits protect the machine and tooling to ensure part quality.

Critical setup information can be stored and uploaded as part of a die recipe program. An optional resolver input module is used to compare machine/press tonnage to crank angle for real time signature analysis.

The Helm Strain Gage module is attached to the controller or to an adjacent I/O module on the din rail. The system is comprised of two parts; the input module and two Helm Strain gage based sensors.

The primary part of the load monitoring system centers around the measurement. The basic function of the Helm Strain Gain sensor is to detect the amount of deflection imposed on the press or die as parts are being formed. All Strain Gain sensors are matched to within 1% and therefore can be replaced without recalibration of the machine.

The Helm Strain Gain sensors can be mounted to strategic high stress areas of the machine frame or strategically located in tooling or applied to stop blocks. Signals from these sensors are routed to the Strain Gage module for processing. The Helm Strain Gage is capable of measuring either a tension or compression signal.

HARDWARE OVERVIEW

The HM-1756-SGI-1-UHS module fits into any single-slot. It is a Class 1 module (uses four input words and two output words).

The module can accept 1 channels of a 350 ohm strain gage input. Two 700 ohm gages may be paralleled to one channel.

Module configuration requires manual and user programmable setup. The module receives and stores digitally converted analog data into its image table for retrieval.

HM-1756SIG-PLM SPECIFICATIONS

Backplane Power Consumption	10W
Number of Channels	1 (isolated)
I/O Chassis Location	Any I/O module slot except 0
A/D Conversion Method	Successive Approximation - 12 bit
Normal Mode Rejection (between + input and - input)	50 db at 2000 gain
AMP roll-off frequency	650 Hz at 3000 Gain
Calibration	Manual Calibration
Isolation	500 VDC continuous between inputs and chassis ground, and between inputs and backplane
LED Indicators	STATUS, ALARM, OK
Recommended Cable	Strain Gage Cable (Helm part number 6117)

Operating Temperature	0°C to 60°C (32°F to 140°F)
Hazardous Environment Classification	Class 1 Division 2 Hazardous Environment

Type of Input	Strain Gage (350 ohm, 700 ohm)
Input Impedance	1K
Display Resolution	Up to 0.1% of full scale
Overall Module Accuracy	1% of full scale
Requested Packet Interval (RPI)	5 ms

GETTING STARTED

This chapter can help you to get started using the Helm Strain Gage module. The procedures included here assume that you have a basic understanding of ControlLogix 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 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 calibrate the module

REQUIRED TOOLS AND EQUIPMENT

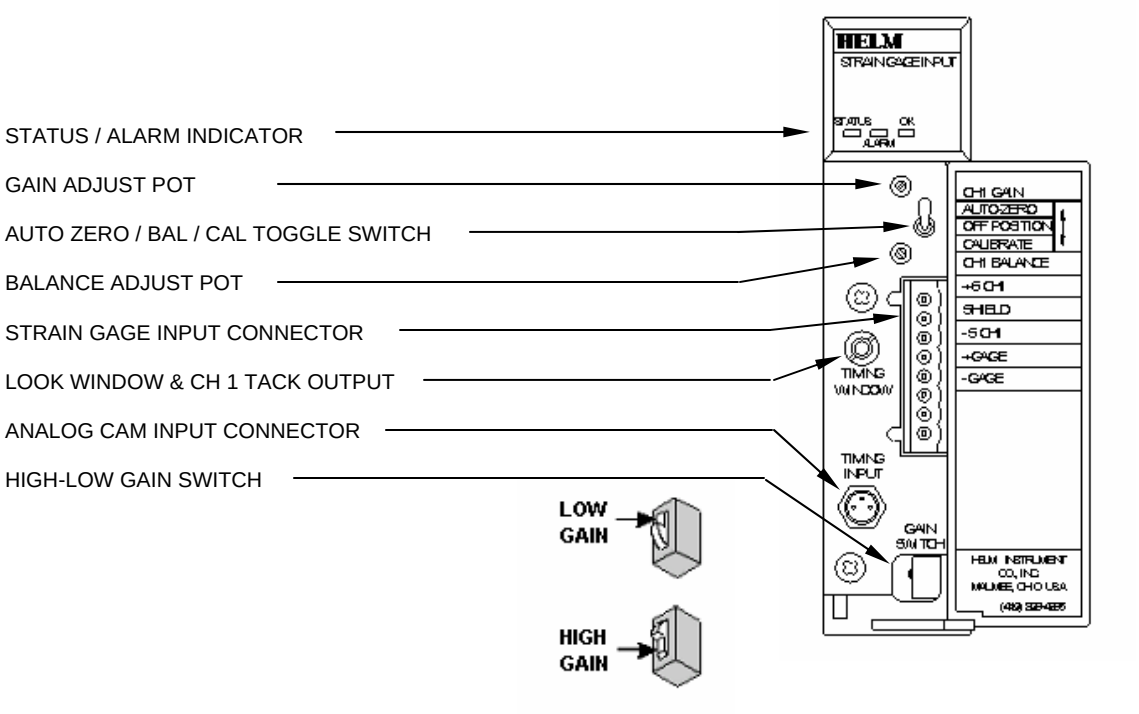
Have the following tools and equipment ready:

- small blade screwdriver
- programming equipment (All programming examples shown in this manual demonstrate the use of Rockwell RSLogix 5000 Software).

SYSTEM OPERATION

The module communicates to the controller through the serial backplane interface and receives +5Vdc and +24Vdc power from the controller power supply through the backplane. No external power supply is required. You may install as many modules in your system as the power supply can support.

FRONT PANEL



Status / Alarm Indicator Lights
Status light is on (green) when module is in Peak or Monitor Parts Mode.
Status light is off when module is in Calibrate Mode.

OK light is on (green) when PLC communication is OK.

Module Setup

All values are 0 (default) on initial start-up. This means that all alarms are disabled. You must make the following adjustments for proper operation:

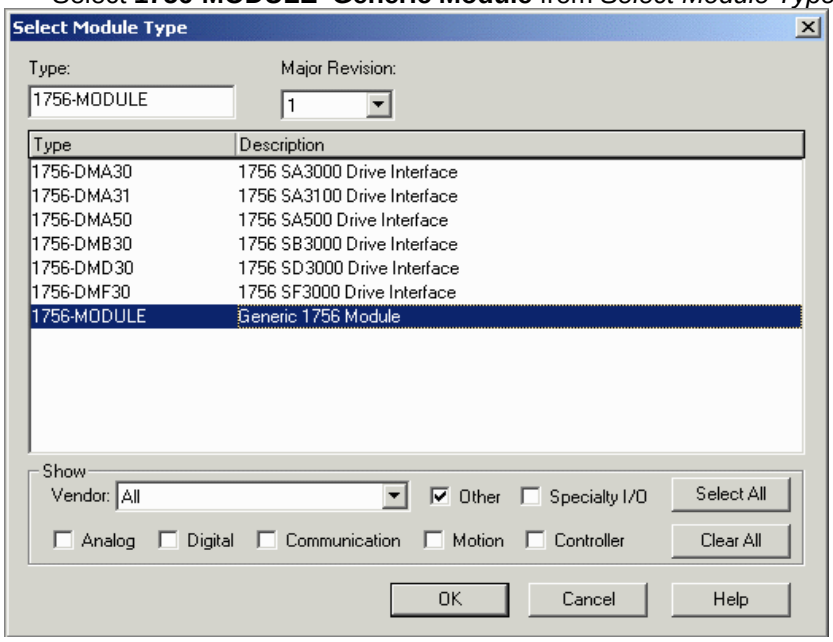
- **set operating mode**
- **set meter scale**

MODULE I/O CONFIGURATION

This shows the preliminary setup and operation required before the module can function in a 1756 I/O system using RSLogix5000

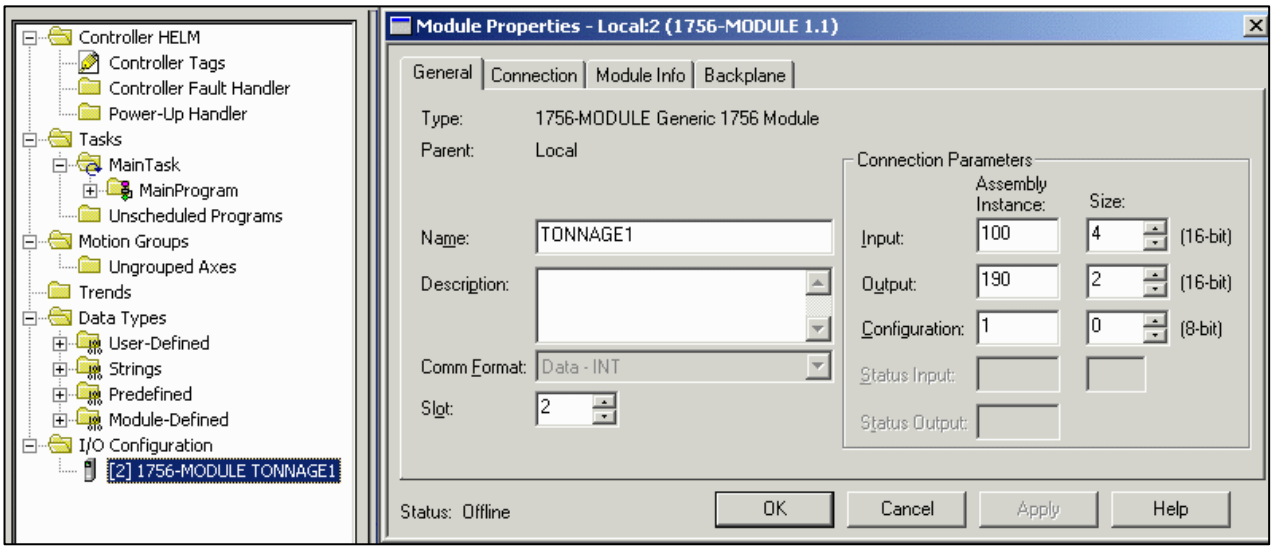
Adding Module to I/O Configuration

Select **1756-MODULE Generic Module** from *Select Module Type* window



Configuration Module's Properties

From the Controller Organizer, right click on the added module and open up Module Properties windows



Type in a name for the module, select a slot number

General: Connection Parameters

	Assembly Instance	Size
Input	100	4
Output	190	2
Configuration	1	0

Connection: Requested Packet Interval(RPI): 5 ms

MODULE I/O CONTROLLER DATA TAGS

Output Tags

The 2 word output data (output from the CPU to the module) contains Information that you configure to define the way the module should work. Example – If you want to access the module located in slot 2 in the ControlLogix chassis, your data tag would be Local:2:O and all 2 words are located as Loca:2:O.Data[0] and Loca:2:O.Data[1]

Data Tags Local:x.O	Data Type	Bit	Description
.Data[0]	Bit Bit Bit	0 1 2	Set Calibrate Mode Set Peak Mode
.Data[1]	INT	-	Set Scale Value

X: slot number

Set Calibrate Mode Bit

When set on (1), the module is in calibration mode.
Note: all other mode bit must be off

Set Peak Mode Bit

When set on (1), the module is in setup (peak only monitoring) mode.
Note: all other mode bit must be off

Set Scale Value

The maximum load rating of the machine per channel. For example, if the machine is rated at 500ton max and two load sensors are installed for the module, then the scale set should be 250.

Input Tags

The 14-word module input image (input from the module to the processor) represents data words and status words. Data words hold the input data that represents the values of the sensor inputs. Status words contain the various status conditions of the module

Data Tags Local:x.I	Data Type	Bit	Description
.Data[0]	INT	-	Processor Communication Counter
.Data[1]	INT	-	ASIC Fault Code
.Data[2]	INT	-	Ch1 Peak value in Ton (in PEAK or MONITOR Mode) Ch1 Calibrate number (in CALIBRATE Mode)
.Data[3]	INT	0 1 2	Module In Calibrate Mode Indication Bit Module In Peak Mode Indication Bit CAM Trigger toggle bit

Processor Communication Counter

Communication Counter increments by one when every time the data has been transferred between two processors in the module. You can check this value to ensure that the module is operating properly.

ASIC Fault Code

Reserved for firmware trouble shoot.

Module In Calibrate Mode Indication Bit

This bit is reported by the module that the module is actually in Calibration mode when On(1)

Module In Peak Mode Indication Bit

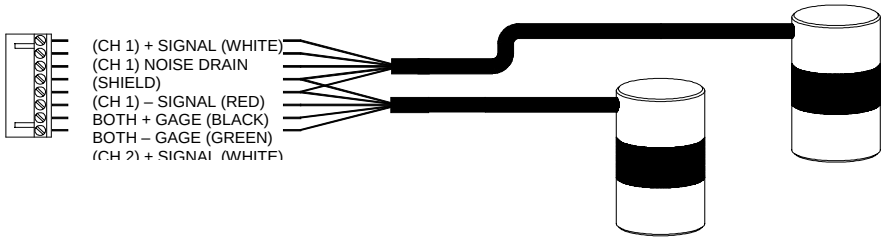
This bit is reported by the module that the module is actually in Peak mode when On(1)

CAM Trigger Toggle bit

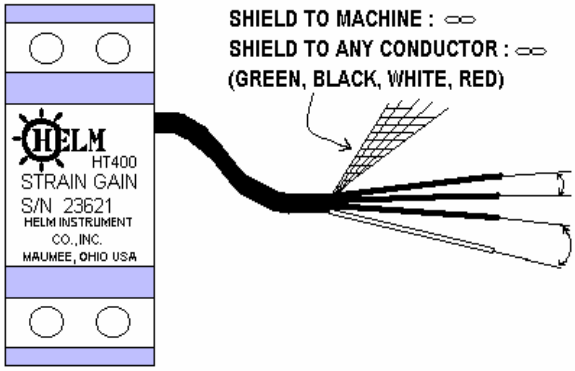
This bit toggles between 0 and 1 when there is a state change of the CAM input from low to high. If there is no CAM input state change, the bit remains the same as the last bit state.

CALIBRATING MODULE WITH SENSOR

WIRING SENSOR(S)



	Tension Operation	Compression Operation
Green (+ Gage)	Green	Black
Black (- Gage)	Black	Green
White (+ Signal)	White	White
Red (- Signal)	Red	Red
Brown (Shield)	Shield	Shield



SHIELD TO MACHINE : ∞
SHIELD TO ANY CONDUCTOR : ∞
(GREEN, BLACK, WHITE, RED)

GREEN - BLACK : 350 OHMS
WHITE - RED : 350 OHMS
GREEN - RED : 263 OHMS
GREEN - WHITE : 263 OHMS
WHITE - BLACK : 263 OHMS
BLACK - RED : 263 OHMS

NOTE:
ABOVE RESISTANCE VALUES SHOULD MEASURE WITHIN ±10 OHMS FOR CABLE LENGTHS UP TO STANDARD 35 FT.

HT-400 "STRAIN GAIN" SENSOR

Connecting CAM Input for Look Window Timing

24VDC timing input needs to be connected to CAM Input connector for Peak load window timing. Refer to APPENDIX C for the connection details.

Set the Run mode bit to Bypass

⇒ From your operator interface, put the tonnage module into bypass mode. (The STATUS light on the tonnage module will turn off).

Balance Sensor Input.

1. Set three-position switch to OFF (center) position.
2. Adjust balance potentiometer until 0's are all displayed from Local:x:I.Data[2]

Calibration Numbers

1. Set three-position switch to calibrate (down) position)
2. Adjust Gain Potentiometer to dial in calibration numbers. These number is displayed at Local:x:I.Data[2]

Always make sure that the three-position switch is in ON (top) position for Normal operation.

The remaining setup procedures can be accomplished with the Run Mode bit in either Bypass, Peak or Monitor Parts Mode. However, the Bypass Mode should only be used when setting calibration values or zero balancing the sensor input.

Set Machine Capacity Scale

The three position switch should be placed in the ON (top) position.

This setting is based off of one channel. It represents the maximum allowable load or tonnage from one sensor location.

Setting Machine Capacity Scale using (2) two sensors:

If 2 sensors are installed on the left and right sides of a 60 ton press, set the Scale to 30 (maximum capacity of one sensor).

Use the following table as a reference for setting the Machine Capacity Scale for a single force module installation with two sensors. Divide the press/machine capacity by the number of sensors (2) and set Scale to the result.

PRESS CAPACITY	SCALE SETTING	PRESS CAPACITY	SCALE SETTING	PRESS CAPACITY	SCALE SETTING
20	10	30	15	40	20
45	22	50	25	60	30
80	40	110	55	150	75
...					
200	100	250	125	300	150

If 2 sensors are installed in the tooling rather than on the press structure, set the Machine Capacity Scale to the highest load/tonnage of one sensor.

Setting Machine Capacity Scale for multiple channel systems.

Divide the Machine capacity by the number of sensors and set Machine Capacity Scale on all modules to the result.

Example: If 4 load modules are used for monitoring a straight side press with 4 sensors mounted on the press columns, set the Machine Capacity Scale on all modules to the highest load/tonnage of one sensor.

Use the following table as a reference for setting the Machine Capacity Scale for a system comprised of (4) force modules and (4) sensors.

PRESS CAPACITY	SCALE SETTING (same on all modules)	PRESS CAPACITY	SCALE SETTING (same on all modules)	PRESS CAPACITY	SCALE SETTING (same on all modules)
100	25	125	31	150	37
175	43	200	50	250	62
275	68	300	75	350	87
400	100	450	112	500	125
...					
800	200	1000	250	1200	300

APPENDIX A: CONTROLLER TAGS

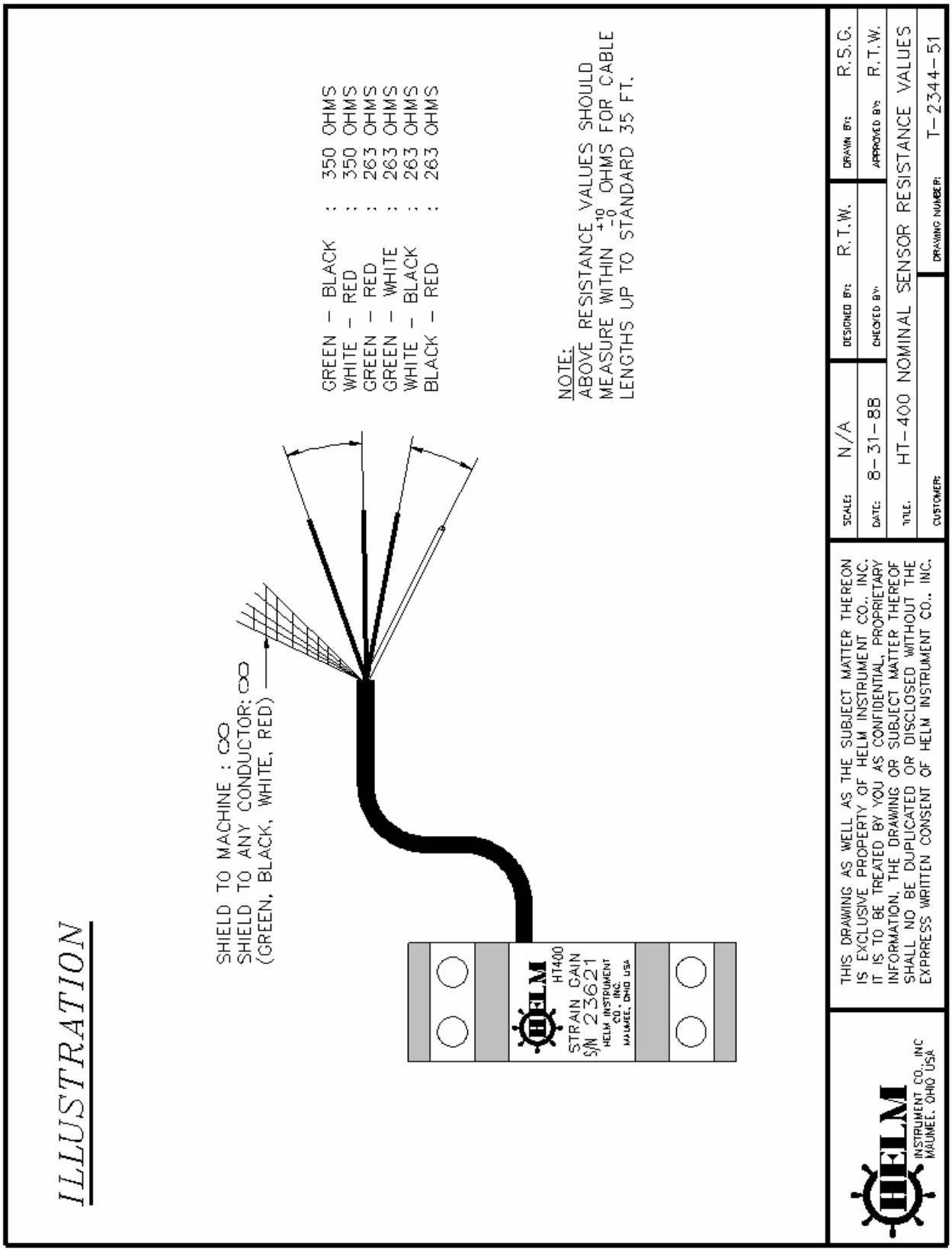
OUTPUT TAGS

Data Tags Local:x.O	Data Type	Bit	Description
.Data[0]	Bit Bit Bit	0 1 2	Set Calibrate mode Set Peak mode
.Data[1]	INT	-	Set Scale Value

INPUT TAGS

Data Tags Local:x.I	Data Type	Bit	Description
.Data[0]	INT	-	Processor Communication Counter
.Data[1]	INT	-	ASIC Fault Code
.Data[2]	INT	-	Ch1 Peak value in Ton (in PEAK or MONITOR Mode) Ch1 Calibrate number (in CALIBRATE Mode)
.Data[3]	INT	0 1 2	Module In Calibrate Mode Indication Bit Module In Peak Mode Indication Bit CAM Trigger toggle bit

APPENDIX B: SENSOR



APPENDIX C: SYSTEM CONNECTION