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 Allen-Bradley Company or 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 Allen-Bradley Company or Helm Instrument Company cannot assume responsibility or liability for actual use based on the examples and diagrams.

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

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

ATTENTION: Identifies information about practices or circumstances that can lead 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

ATTENTION: Please check power supply ratings before proceeding! Each tonnage module consumes (+24, 173mA +5, 220mA). Be sure to not overload the power supply.

Table of Contents
ForceGard Load Module
User Manual

Initial Setup Procedures

System Trouble-shooting Guide

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
- Allen-Bradley support

Who Should Use this Manual

Use this manual if you are responsible for the design, installation, programming, or maintenance of an automation control system that used 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 Allen-Bradley representative for the proper training before using this product.

Purpose of this Manual

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

Contents of this Manual

Chapter	Title	Content
	Preface	Describes the purpose, background, and scope of this manual. Also specifies the audience for whom this manual is intended and defines key terms and abbreviations used throughout this book.
1	Overview	Provides a hardware and system overview. Explains and illustrates the components of the system.
2	Installation and Wiring	Provides installation and information and wiring guidelines.
3	Channel Configuration, Data and Status	Examines the channel configuration and the channel status word, and explains how the module uses configuration data and generates status during operation.
4	Ladder Programming Examples	Gives an example of the ladder logic required to define the channel for operation. Also includes representative examples for unique requirements such as sample count, trend calculation, etc.
5	Troubleshooting	Explains how to interpret and correct problems that may occur while using the thermocouple module.
A	Specifications	Provides physical, electrical, environmental, and functional specifications for the module.
B	Ladder Program	
C	Installing Strain Gage Manual	Gives you infomration about sensor location and installation techniques.

Related Documentation

The following documents contain infomration 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* SLC 500 programmable controller	Installation & Operation Manual for Modular Hardware Style Programmable Controllers	1747NI002
A description on how to install and use your *Fixed* SLC 500 programmable controller	Installation & Operation Manual for Fixed Hardware Style Programmable Controllers	1747-NI001
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 instructions. Also indicates whether the documents are available on CD-ROM or in multi-languages	Automation Group Publication Index	SD499
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.

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, 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 - An 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. Infomration 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.

ForceGard - Helm monitoring module; resides on the SLC (1746) backplane; provides processor input from up to two sensors.

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.

Low Alarm Inhibit - Number of consecutive machine cycles where low alarm is inhibited. Used in a process where machine cycles several times before running speed is established.

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.

Monitor Parts Mode - Status condition used during production run. Sample and compare logic is enabled. On resolver based systems, tracking alarm limits can be enabled.

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

Press Curve - Machine manufacturers provide this data table which defines limits on maximum load that should be exerted at a given degree of press stroke. This data is stored in EEPROM memory in the Helm processing unit.

Terms and Abbreviations *(continued)*

Press Curve Alarm - Indication of resolver position and load when load at a given degree meets or exceeds press curve profile.

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 stroke position. Sine/cosine based resolver required for Helm systems.

Reverse Load - Measurement of negative load/force being exerted on machine following the break-through of material. Also referred to as snap through.

Sample - Load/force values established from a series of machine cycles. Also defined as benchmark.

Sample Count - User input value used to specify how many machine cycles to base the sample on.

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 monitor typically enables during die setup. Machine capacity alarms are enabled. On resolver based systems, press curve alarm can be enabled. This mode is also used during machine and resolver calibrations.

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.

Target Load - A reference load established by the user. Used primarily during setup to improve setup time.

Tolerance /Trend Alarm - User defined upper and lower control limits established during the sample and compare process. These limits are established on the peak load and will activate the machine stop relay when exceeded.

Tracking Alarm - Requires resolver input. The sample and compare process is applied to the entire forming force based on user selected upper and lower control limits.

Trend Deviation - Percent of change, high and low, from sample value to current value.

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 enables input channels and make the resulting data values available to the SLC processor.

The following conventions are used throughout this manual:

Common Techniques Used in 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.

Electrical Specifications:

Backplane Current Consumption	220 MA at 5vd 173 MA at 24 vdc
Backplane Power Consumption	10W
Number of Channels	2 (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

Physical Specifications:

LED Indicators	6 LED's for alarm status
Module ID Code	3535
Recommended Cable	Strain Gage Cable (Helm part number 6117)
Terminal Strip	8-pin removable

Environmental Specifications:

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

Input Specifications:

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
Module Update Time	140 µsec

Chapter 1

Overview

You have just purchased the most advanced load monitoring solution available. HELM INSTRUMENT COMPANY, INC. manufactures a complete line of load monitoring control solutions for use on metal stamping, forging, compaction and assembly presses; cold forming, cold heating, injection molding and die cast machines.

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 ForceGard 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.

Components

The Helm ForceGard module resides on the backplane of the Allen-Bradley 1746 SLC-5/03. The system is comprised of two parts; the input module and two Helm strain gage based sensors.

Strain Gain Transducer Operation

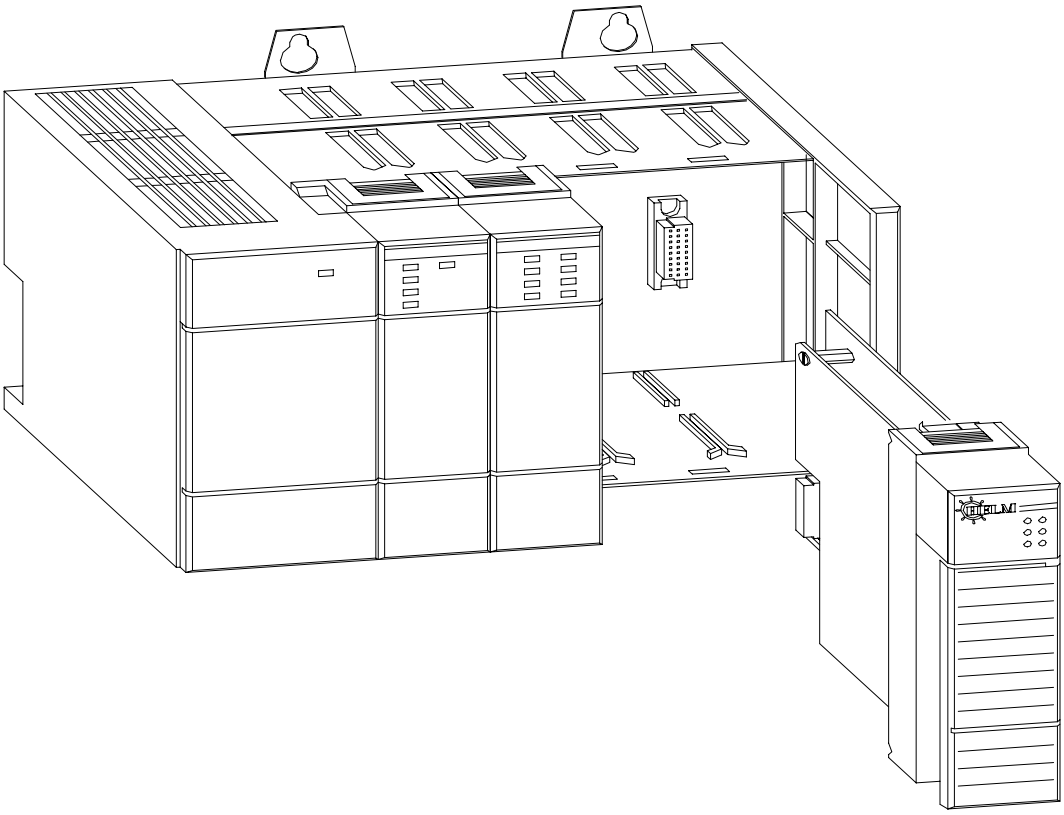
The primary part of the load monitoring system centers around the measurement. The basic function of the Helm Strain Gain sensor is to detect the amount of deflection imposed on the press or die as parts are being formed. All Strain Gain sensors are matched to within 1% and therefore can be replaced 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 ForceGard module for processing. The Helm Strain Gage is capable of measuring either a tension or compression signal.

ForceGard Features

- Sample and Compare Logic - processor memorizes the sample or benchmark load and compares each machine cycle against this sample.
- User programmable Sample Count - selectable number of machine cycles on which to base the sample.
- High and Low Capacity Alarm Sets - a discrete load limit for a maximum allowable load and a minimum allowable load.
- High and Low Trend Alarm Sets - set as a percentage of load change on an established sample.
- Low Alarm Inhibit - User programmable option to disable low alarm during process start-up.

Chapter 1



Hardware Overview

The force module fits into any single-slot, except the processor slot(0). It is a Class 1 module (uses eight input words and eight output words). It interfaces to strain gage based transducers (350ohm or 700ohm).

The module can accept input from two sensors. The module has no output channels. Module configuration requires manual and user programmable setup.

The ForceGard module receives and stores digitally converted analog data into its image table for retrieval by modular SLC 500 processors. The module supports connections from any combination of up to two strain gage sensors.

Any combination of Helm Strain Gage sensors can be used. Contact Helm for additional information on the type and application of different sensor options.

The Helm module requires (1) input from a cam switch or a proximity sensor for establishing the peak look window.

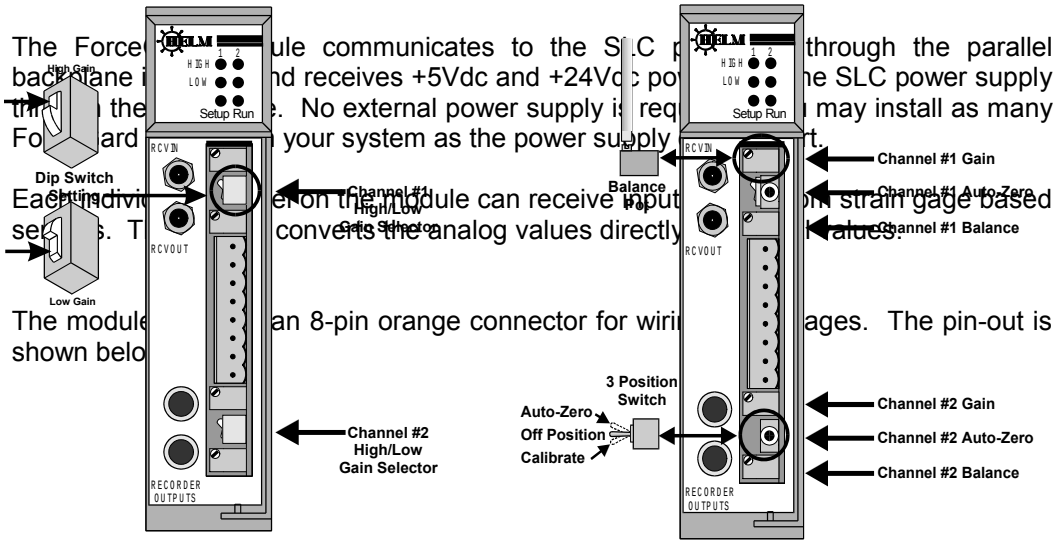
Chapter 1

Hardware Features

The Force[illegible]ule communicates to the S[illegible]C p[illegible] through the parallel backplane i[illegible]nd receives +5Vdc and +24Vd[illegible] po[illegible]e SLC power supply th[illegible] the [illegible]. No external power supply is req[illegible] may install as many Fo[illegible]ard[illegible] your system as the power supply [illegible]t.

Each individ[illegible]el on the module can receive input [illegible] strain gage based se[illegible]s. T[illegible] converts the analog values directly [illegible] values.

The module [illegible] an 8-pin orange connector for wiri[illegible]ages. The pin-out is shown belo[illegible]



Channel Status Displays	Fault Status - High and Low
Door Label	Channel 1-Channel 2 calibrate switch Wiring diagram for (2) sensor inputs
Mode Status LED's High/Low LED's	Displays Run Mode Indicate Alarm Condition
Receive IN	Jack plug for resolver input from Helm resolver module
Receive OUT	Jack plug for link to additional ForceGard modules
Recorder Output	Jacks for analog or track output of sensor data. One jack for each channel. Can be used with chart recorders or Helm Ramcorder™ data recorder.
Bypass/Run Switch Normal run state is top (ON) position.	Three-way switch used during calibration process. Top position is for normal run condition. Center position is used to zero balance sensor input via potentiometers. Bottom position is used to set calibration values via potentiometers.
Potentiometers: Channel Sensor Balance Channel Calibration Set	Two per channel. These small multi-turn pots are used for zero balancing the sensor and setting the calibration values.
Gain Selector	Used to amplify the sensor input. This switch is factory set at high range. Under normal operating conditions, the setting should not be changed. personnel responsible for the calibration of the Helm ForceGard module make the determination of the range setting during the calibration process.
8-Pin Conductor	For sensor input wiring.

Chapter 2

Getting Started

This chapter can help you to get started using the Helm ForceGard 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 channels for the sensor input

Required Tools and Equipment

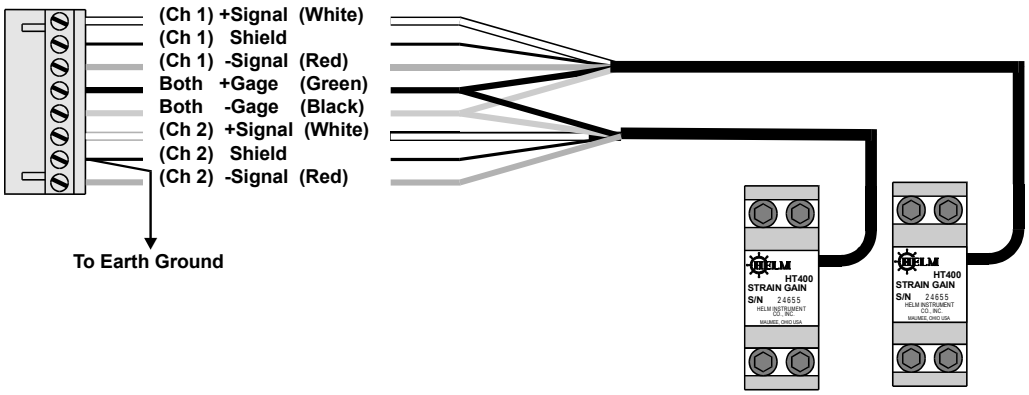
Have the following tools and equipment ready:

- small blade screwdriver
- potentiometer trimmer (tweeker)
- appropriate strain gage cable
- programming equipment (All programming examples shown in this manual demonstrate the use of Allen-Bradley's Advanced Programming Software [APS] for personal computers.)

Chapter 2

System Operation

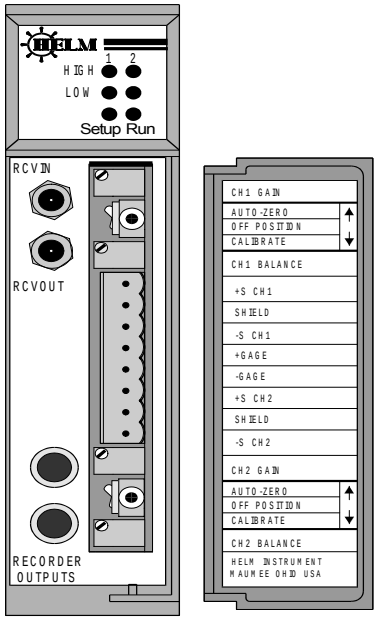
Sensor Wiring



To ensure proper operation and high immunity to electrical noise, always use Helm strain gage cable. (Part Number 6117).

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

The module can support up to two sensor inputs DO NOT attempt to parallel additional gages as you will cause damage to the module and void product warranty.



Chapter 3

Channel Configuration, Data and Status

This chapter explains how the ForceGard 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 speciality I/O module residing is a specific slot in the chassis. With APS software, manually enter the module ID code.

ForceGard Module ID Code 3535

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.

Output Image

The 8 word output image (output from the CPU to the module) contains information that you configure to define the way a specific channel will work. Example - If you want to configure channel 2 on the module located in slot 4 in the SLC chassis, your address would be O:4.2. (O = file type : =element delimiter 4 =slot . =word delimiter 2 =word)

OUTPUT IMAGE TABLE FOR TSM MODULE

CALIBRATE

O:X.0 STATUS BITS
O:X.1 WAVE XFER POINTER
O:X.2 ALARM WINDOW START
O:X.3 ALARM WINDOW STOP
O:X.4 SET CH2 LOW CAPACITY
O:X.5 SCALE SET
O:X.6 PEAK LOOK WINDOW WAVE STEPS
O:X.7 PEAK LOOK WINDOW START DEGREE

PEAK OR MONITOR PARTS

O:X.0 STATUS BITS
O:X.1 WAVE XFER POINTER
O:X.2 CH1 LOW CAPACITY SET
O:X.3 CH1 HIGH CAPACITY SET
O:X.4 LOAD AT ANGLE
O:X.5 CH2 HIGH CAPACITY SET
O:X.6 CH1 HIGH\LOW TREND SET
O:X.7 CH2 HIGH\LOW TREND SET

THIS WORD 0 STAYS THE SAME NO MATTER WHAT MODE THE TONNAGE MODULE IS IN!

O:X/0 CAM BIT
O:X/1 CAL MODE BIT
O:X/2 PEAK MODE BIT
O:X/3 MONITOR PARTS MODE BIT
O:X/4 ALARM RESET
O:X/5 REV LOAD BIT
O:X/6 LOW ALARM INHIBIT BIT
O:X/7 PRESS IN MOTION BIT
O:X/8 BIT 0 OF SAMPLE COUNT
O:X/9 BIT 1 OF SAMPLE COUNT
O:X/10 BIT 2 OF SAMPLE COUNT
O:X/11 BIT 3 OF SAMPLE COUNT
O:X/12 BIT 4 OF SAMPLE COUNT
O:X/13 DELTA\TRACK BIT
O:X/14 ----------
O:X/15 SAMPLE WAVE XFER BIT

Output Image (contd.)

Peak Look Window Bit 0 (O:e.0/0)
When set on (1) the look window is active. When set off (0), the look window is inactive. The module will process data while look window is active.

Bypass Mode Bit (O:e.0/1)
When set on (1) module is in calibrations mode. Channels are disabled. No alarms are active.

Peak Mode Bit (O:e.0/2)
When set on (1) module is in setup (peak only monitoring) mode. Capacity alarms are active. High and low trend alarms are inactive. Sample is cleared.

Monitor Parts Bit (O:e.0/3)
When set on (1) module is in monitor parts mode. Capacity alarms are active. High and low alarms are enabled. Sample data is valid.

Alarm Reset Bit (O:e.0/4)
When set on (1) alarm condition exists.

Reverse Load Bit (O:e.0/5)
When set on(1) reverse load values are stored (I:e.1 - I:e.2).

Low Alarm Inhibit Bit (O:e.0/6)
When set on (1) low alarming is disabled for duration. Duration set in ladder counter file.

Bit 7 is Reserved

Sample Count Bits 8 - 12 (O:e.0/8-12)
Binary value of sample count. Sample count represents how many machine cycles to include for determining benchmark. Trend alarms are established on the sample load.

D4	D3	D2	D1	D0	
0	0	0	1	0	= 2 Sample Counts
0	1	0	1	1	= 11 Sample Counts

Machine Capacity Setting (Integer Word O:e.1)
Represents the total load rating of one corner or side of a press/machine or the maximum load of one sensor input. This value is established at during calibration procedure. Range = 0 to 9999. A value must be present to enable module functionality.

Minimum Load Alarm Setting Channel 1 (Integer Word O:e.2)
Integer value of low capacity alarm setting. Range = 0 to 9999. A value of 0 disables alarm.

Capacity Load Alarm Setting Channel 1 (Integer Word O:e.3)
Integer value of high capacity alarm setting. Range = 0 to 9999. A value of 0 disables alarm.

Minimum Load Alarm Setting Channel 2 (Integer Word O:e.4)
Integer value of low capacity alarm setting. Range = 0 to 9999. A value of 0 disables alarm.

Data Table Output Image (contd.)

Capacity Alarm - High Setting Channel 2 (Integer Word O:e.5)
Integer value of low capacity alarm setting. Range = 0 to 9999

Trend Alarm - Channel 1 High and Low (Integer Word O:e.6)
Integer values of high and low trend alarm settings. Values are set in percent and represent the maximum and minimum percent of change off the sample value.
Range = 0 to 99%. A value of 2520 represents a 25% high alarm and a 20% low alarm. A value of 0 disables alarm.

Data Table Input Image

The 8-word module input image (input from the module to the CPU) represents data words and status words.

Input words (data words) hold the input data that represents the values of the sensor inputs.

Input words (status bits) contain the various status conditions and reflect the configuration settings you have entered into the output configuration words. To obtain the status of Channel 2 Capacity Alarm Bit of the module located in slot 2 of the rack, use address I:2.0/2

(I =file type : =element delimiter 2 =slot . =word delimiter 0 =word / 2 =bit)

INPUT IMAGE TABLE FOR TSM MODULE

CALIBRATE	*PEAK*	*MONITOR PARTS*
I:X.0 ALARM BITS	I:X.0 ALARM BITS	I:X.0 ALARM BITS
I:X.1 CH1 CAL NO.	I :X.1 CH1 PEAK LOAD	I:X.1 CH1 PEAK LOAD
I:X.2 CH2 CAL NO.	I:X.2 CH2 PEAK LOAD	I:X.2 CH2 PEAK LOAD
I:X.3 ----------	I:X.3 CH1 LOAD AT ANGLE	I:X.3 CH1 AVG FOR TREND
I:X.4 ----------	I:X.4 CH2 LOAD AT ANGLE	I:X.4 CH2 AVG FOR TREND
I:X.5 ----------	I:X.5 ----------	I:X.5 % TREND CHANGE CH1
I:X.6 ----------	I:X.6 ----------	I:X.6 % TREND CHANGE CH2
I:X.7 RESOLVER VALUE	I:X.7 SAMPLE COUNT=0	I:X.7 SAMPLE COUNTER

CALIBRATE\PEAK MODES	*MONITOR PARTS MODE*
I:X/0 CH1 HIGH CAPACITY ALARM	I:X/0 CH1 HIGH CAPACITY ALARM
I:X/1 CH1 LOW CAPACITY ALARM	I:X/1 CH1 LOW CAPACITY ALARM
I:X/2 CH2 HIGH CAPACITY ALARM	I:X/2 CH2 HIGH CAPACITY ALARM
I:X/3 CH2 LOW CAPACITY ALARM	I:X/3 CH2 LOW CAPACITY ALARM
I:X/4 CH1 HIGH TREND ALARM	I:X/4 CH1 HIGH TREND ALARM
I:X/5 CH1 LOW TREND ALARM	I:X/5 CH1 LOW TREND ALARM
I:X/6 CH2 HIGH TREND ALARM	I:X/6 CH2 HIGH TREND ALARM
I:X/7 CH2 LOW TREND ALARM	I:X/7 CH2 LOW TREND ALAR M
I:X/8 DELTA TRACK LEARN FLAG	I:X/8 DELTA TRACK LEARN FLAG
I:X/9 PRESS CURVE CH1 BIT	I:X/9 CH1 HIGH TRACK
I:X/10 CH1 LOW TRACK ALARM	I:X/10 CH1 LOW TRACK ALARM
I:X/11 PRESS CURVE CH2 BIT	I:X/11 CH2 HIGH TRACK
I:X/12 CH2 LOW TRACK ALARM	I:X/12 CH2 LOW TRACK ALARM
I:X/13 WAVE XFER ACK BIT	I:X/13 WAVE XFER ACK BIT

Data Table Input Image (contd.)

Channel 1 High Capacity Alarm Bit
When on (1) channel 1 load has met or exceeded the high alarm limit.
Load values are stored at integer word I:e.1.

Channel 1 Low Capacity Alarm Bit
When on (1) channel 1 load has met or dropped below the low alarm limit.
Load values are stored at integer word I:e.1.

Channel 2 High Capacity Alarm Bit
When on (1) channel 2 load has met or exceeded the high alarm limit.
Load value is stored at integer word I:e.2.

Channel 2 Low Capacity Alarm Bit
When on (1) channel 2 load has met or dropped below the low alarm limit.
Load value is stored at integer word I:e.2.

Channel 1 High Trend Alarm Bit
When on (1) channel 1 load has met or exceeded the high alarm percentage of sample.
Load values are stored at integer word I:e.1.
Percent of deviation of sample is stored at integer word I:e.5
ercent of deviation of sample is stored at integer word I:e.5

Channel 1 Low Trend Alarm Bit
When on (1) channel 1 load has met or dropped below the low alarm percentage of sample.
Load values are stored at integer word I:e.1.
Percent of deviation of sample is stored at integer word I:e.5

Channel 2 High Trend Alarm Bit
When on (1) channel 2 load has met or exceeded the high alarm limit.
Load value is stored at integer word I:e.2.
Percent of deviation of sample is stored at integer word I:e.6

Channel 2 Low Trend Alarm Bit
When on (1) channel 2 load has met or dropped below the low alarm percentage of sample.
Load value is stored at integer word I:e.2.
Percent of deviation of sample is stored at integer word I:e.6

Quick-Off Alarm Bit
When on(1) process can be stopped immediately. Valid on trend alarm only.

Channel 1 Load Value (I:e.1)
Integer word represents peak load on channel 1 for current machine cycle.
If Reverse Bit (O:e.0/5) is on (1) value is reverse load on channel 1 for current machine cycle.

Channel 2 Load Value (I:e.2)
Integer word represents peak load on channel 2 for current machine cycle.
If Reverse Bit (O:e.0/5) is on (1) value is reverse load on channel 2 for current machine cycle.

Note: If O:e.0/1 is set to 1 then A/D Value is integer word for calibration set.

Data Table Input Image (contd.)

Channel 1 Sample Value (I:e.3)
Integer word represents sample load value on channel 1. High and low trend alarms are established on this value.

Channel 2 Sample Value (I:e.4)
Integer word represents sample load value on channel 2. High and low trend alarms are established on this value.

Channel 1 Percent of Deviation (I:e.5)
Integer word represents the percentage of change current peak load is to sample peak load.

Channel 2 Percent of Deviation (I:e.6)
Integer word represents the percentage of change current peak load is to sample peak load.

Sample Counter (I:e.7)
Counter used for number of Sample Counts.

Data Table Integer File

Using APS software, reserve one integer file for tonnage monitoring. Reserve one counter for tonnage monitoring.

For illustration purposes in this manual, we have reserved Integer file N10:0 - N10:23.

DATA TABLE INTEGER FILE

For illustration purposes in this manual, we have reserved integer file N7:0-N7:74. This integer is the common file in case you have more than one tonnage module in your SLC rack.

Data	Description	Address		
Integer	Sample Setting Value (2,4,8, or 16)	N7:4		
Integer	Function Switch Value		N7:15	
Bit	Cam Cycle Bit	N7:20/0		
Bit	Press in Motion (0=stopped,1=running)	N7:20/1		
Bit	Reverse Load bit(0=peak load,1=rev load)	N7:20/6		
Bit	Alarm Reset Bit (0=no action,1=reset alarm)	N7:20/7		
Bit	Low Alarm Inhibit Bit(1=low alarms disabled)	N7:20/11		
Bit	Press Curve Enable Xfer Bit	N7:21/4		
Bit	Current Wave Enable Xfer Bit	N7:21/6		
Bit	Sample,Learn,or Ref Wave Xfer Enable Bit	N7:21/8		
Integer	Scale Setting (set to capacity of each channel)		N7:42	(Set in Calibrate Mode Only)
Integer	PKLW Degree Step Value (.2,.4,.8,1.0.or 1.2)	N7:46	(Set in Calibrate Mode Only)	
Integer	PKLW Degree Start Value (0 to 3599)	N7:47	(Set in Calibrate Mode Only)	
Integer	# of Cycles for Low Alarm Inhibit	N7:54		
Integer	Resolver Module Angle Value	N7:55		
Integer	Resolver Offset Value	N7:57		
Integer	Part Counter Low byte Preset Register (0 to 999)	N7:59		
Integer	Part Counter High byte Preset Register (0 to 999)	N7:60		
Integer	Calculated PKLW End Degree Value	N7:61		
Integer	Angle Value used with “Load at Angle” feature	N7:62		
Integer	Resolver Function Switch Value (1=setup,2=run)	N7:63		
Bit	Change Offset Bit (0=no action,1=load new offset)	N7:64/3		
Bit	Clear Offset Value to Resolver Module	N7:64/4		
Bit	Parts Counter “Counted Out” Bit	N7:64/5		
Bit	Reset Parts Counter Bit	N7:64/6		
Bit	Decrement “Load at Angle” by “1 Step”	N7:64/7		
Bit	Increment “Load at Angle” by “1 Step”	N7:64/8		
Bit	Ramp Down “Load at Angle” Bit	N7:64/9		
Bit	Ramp Up “Load at Angle” Bit	N7:64/10		
Integer	Cycle Counter	N7:65		
Integer	Parts Counter Actual Value for Low byte	N7:66		
Integer	Parts Counter Actual Value for High byte	N7:67		
Bit	Delta Track Switch (0=track off,1=track on)	N7:70/8		
Integer	Strokes per Minute Value	N7:73		
Integer	Job # Register (JDC)	N7:74		

DATA TABLE INTEGER FILE

For illustration purposes in this manual, we have reserved integer file N10:0-N7:70. This integer file relates to one tonnage module. If you have two tonnage modules in your system then you would have, for example N10 and Nxx.

Data	Description	Address	
Signed Integer	Ch1 % Trend Value	N10:1	(Only valid in monitor parts mode)
Signed Integer	Ch2 % Trend Value	N10:2	(Only valid in monitor parts mode)
Integer	Trending Flag Status	N10:3	
Integer	Ch1 High Trend Set (5 to 50%)	N10:5	(Set in peak mode)
Integer	Ch1 Low Trend Set (5 to 50%)	N10:6	(Set in peak mode)
Integer	Ch2 High Trend Set (5 to 50%)	N10:7	(Set in peak mode)
Integer	Ch1 Peak Value	N10:8	
Integer	Ch2 Peak Value	N10:9	
Integer	Ch2 Low Trend Set (5 to 50%)	N10:10	(Set in peak mode)
Integer	Load Module Angle Value	N10:11	
Integer	Ch1 Load at Angle	N10:12	(Valid in peak mode only)
Integer	Ch2 Load at Angle	N10:13	(Valid in peak mode only)
Bit	Ch1 High Capacity Alarm	N10:16/0	
Bit	Ch1 Low Capacity Alarm	N10:16/1	
Bit	Ch2 High Capacity Alarm	N10:16/2	
Bit	Ch2 Low Capacity Alarm	N10:16/3	
Bit	Ch1 High Trend Alarm	N10:16/4	
Bit	Ch1 Low Trend Alarm	N10:16/5	
Bit	Ch2 High Trend Alarm	N10:16/6	
Bit	Ch2 Low Trend Alarm	N10:16/7	
Bit	Ch1 High Track Alarm	N10:16/9	
Bit	Ch1 Low Track Alarm	N10:16/10	
Bit	Ch2 High Track Alarm	N10:16/11	
Bit	Ch2 Low Track Alarm	N10:16/12	
Bit	Ch1 PressCurve Alarm	N10:16/13	
Bit	Ch2 PressCurve Alarm	N10:16/14	
Integer	Ch1 Calibration #	N10:17	(Must be in calibrate mode)
Integer	Ch2 Calibration #	N10:18	(Must be in calibrate mode)
Bit	Summation of all top stop alarms	N10:21/0	
Bit	Summation of all e-stop alarms	N10:21/1	
Bit	Learn Cycle Complete Flag	N10:21/2	
Bit	Module Status Flag	N10:21/3	
Bit	Load Module Data Busy(1=Busy)		N10:23/2
Integer	Module Top Stop Alarms	N10:24	
Integer	Module E-Stop Alarms	N10:25	
Bit	E-Stop for Ch1 High Capacity	N10:26/0	
Bit	E-Stop for Ch1 Low Capacity	N10:26/1	
Bit	E-Stop for Ch2 High Capacity	N10:26/2	
Bit	E-Stop for Ch2 Low Capacity	N10:26/3	
Bit	E-Stop for Ch1 High Trend	N10:26/4	
Bit	E-Stop for Ch1 Low Trend	N10:26/5	
Bit	E-Stop for Ch2 High Trend	N10:26/6	
Bit	E-Stop for Ch2 Low Trend	N10:26/7	
Bit	E-Stop for Ch1 High Track	N10:26/9	
Bit	E-Stop for Ch1 Low Track	N10:26/10	

Data Table Integer File

DATA TABLE INTEGER FILE

Data	Description	Address	
Bit	E-Stop for Ch2 High Track	N10:26/11	
Bit	E-Stop for Ch2 Low Track	N10:26/12	
Bit	E-Stop for Ch1 PressCurve	N10:26/13	
Bit	E-Stop for Ch2 PressCurve	N10:26/14	
Bit	Top Stop for Ch1 High Capacity	N10:27/0	
Bit	Top Stop for Ch1 Low Capacity	N10:27/1	
Bit	Top Stop for Ch2 High Capacity	N10:27/2	
Bit	Top Stop for Ch2 Low Capacity	N10:27/3	
Bit	Top Stop for Ch1 High Trend	N10:27/4	
Bit	Top Stop for Ch1 Low Trend	N10:27/5	
Bit	Top Stop for Ch2 High Trend	N10:27/6	
Bit	Top Stop for Ch2 Low Trend	N10:27/7	
Bit	Top Stop for Ch1 High Track	N10:27/9	
Bit	Top Stop for Ch1 Low Track	N10:27/10	
Bit	Top Stop for Ch2 High Track	N10:27/11	
Bit	Top Stop for Ch2 Low Track	N10:27/12	
Bit	Top Stop for Ch1 PressCurve	N10:27/13	
Bit	Top Stop for Ch2 PressCurve	N10:27/14	
Integer	Ch1 High Capacity Set (0 to 9999 tons)	N10:48	(Set in peak or monitor parts mode)
Integer	Ch1 Low Capacity Set (0 to 9999 tons)	N10:49	(Set in peak or monitor parts mode
Integer	Ch2 High Capacity Set (0 to 9999 tons)	N10:50	(Set in peak or monitor parts mode
Integer	Ch2 Low Capacity Set (0 to 9999 tons)	N10:51	(Set in calibrate or monitor parts mode)
Integer	Alarm Window Start	N10:52	(Set in calibrate mode only)
Integer	Alarm Window Stop	N10:53	(Set in calibrate mode only)

Data Table Integer File

DATA TABLE INTEGER FILE

For illustration purposes in this manual, we have reserved integer file N10:19-N10:80. These integers are related to the actual waveform information.

Data	Description		Address
Integer	Alarm Window Stop from Module		N10:19 (Set in calibrate mode only)
Integer	Alarm Window Start from Module	N10:28	(Set in calibrate mode only)
Integer	Ch1 Wave Peak in Tons	N10:29	(Valid in peak or monitor parts mode)
Integer	Alarm Angle Value	N10:30	
Integer	Ch1 tonnage at Alarm	N10:31	(Valid in peak or monitor parts mode)
Integer	Ch2 tonnage at Alarm	N10:32	(Valid in peak or monitor parts mode)
Integer	Ch1 Ref Peak Value	N10:33	
Integer	Ch2 Ref Peak Value	N10:34	
Integer	Ch2 Wave Peak in Tons	N10:41	(Valid in peak mode only)
Integer	Wave Request Register	N10:68	
Integer	Wave Xfer Complete	N10:80	

ADDT'L INTEGERS NEEDED FOR 2 CHANNEL TSM MODULE

N11:0-111 WILL BE USED FOR CH1 CURRENT WAVEFORM
N12:0-111 WILL BE USED FOR CH2 CURRENT WAVEFORM
N17:0-111 WILL BE USED FOR PRESSCURVE
N18:0-111 WILL BE USED FOR CH1 SAMPLE WAVEFORM
N19:0-111 WILL BE USED FOR CH2 SAMPLE WAVEFORM

3 timers will be needed for the ladder logic files and 5 counters will also be needed

Initial Setup Procedures

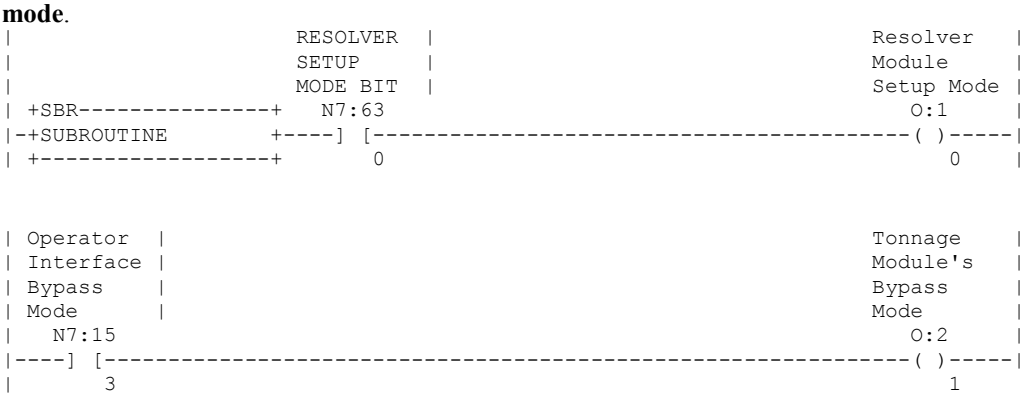
Initial Setup Procedures

****

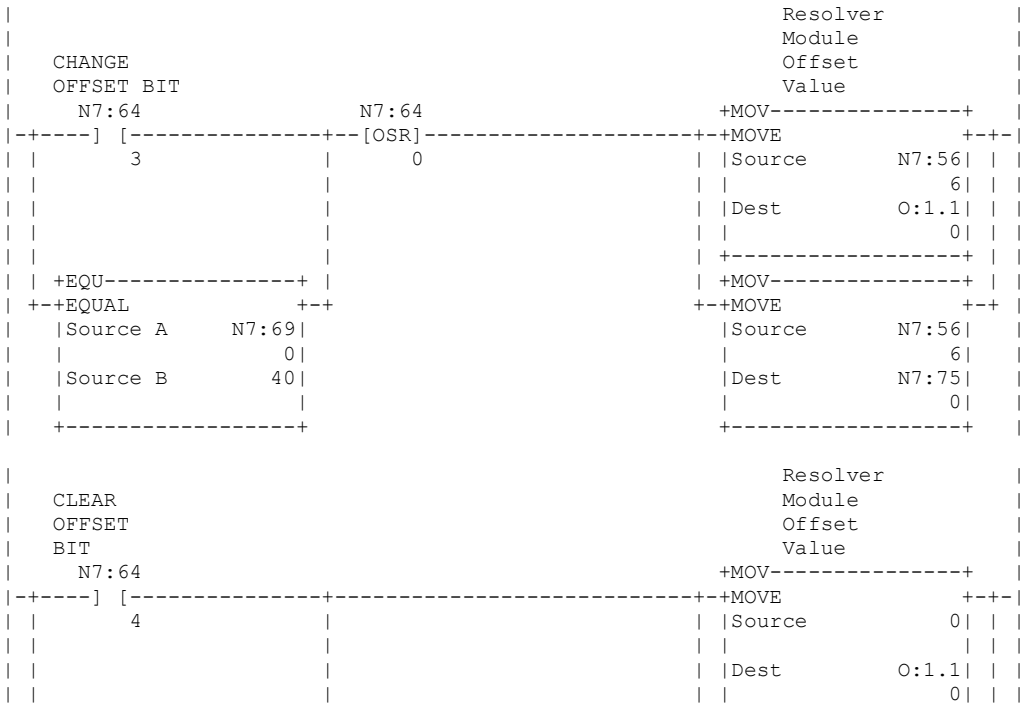
A complete listing of a sample ladder logic program is included at the back of this manual. Examples shown here are for reference only.

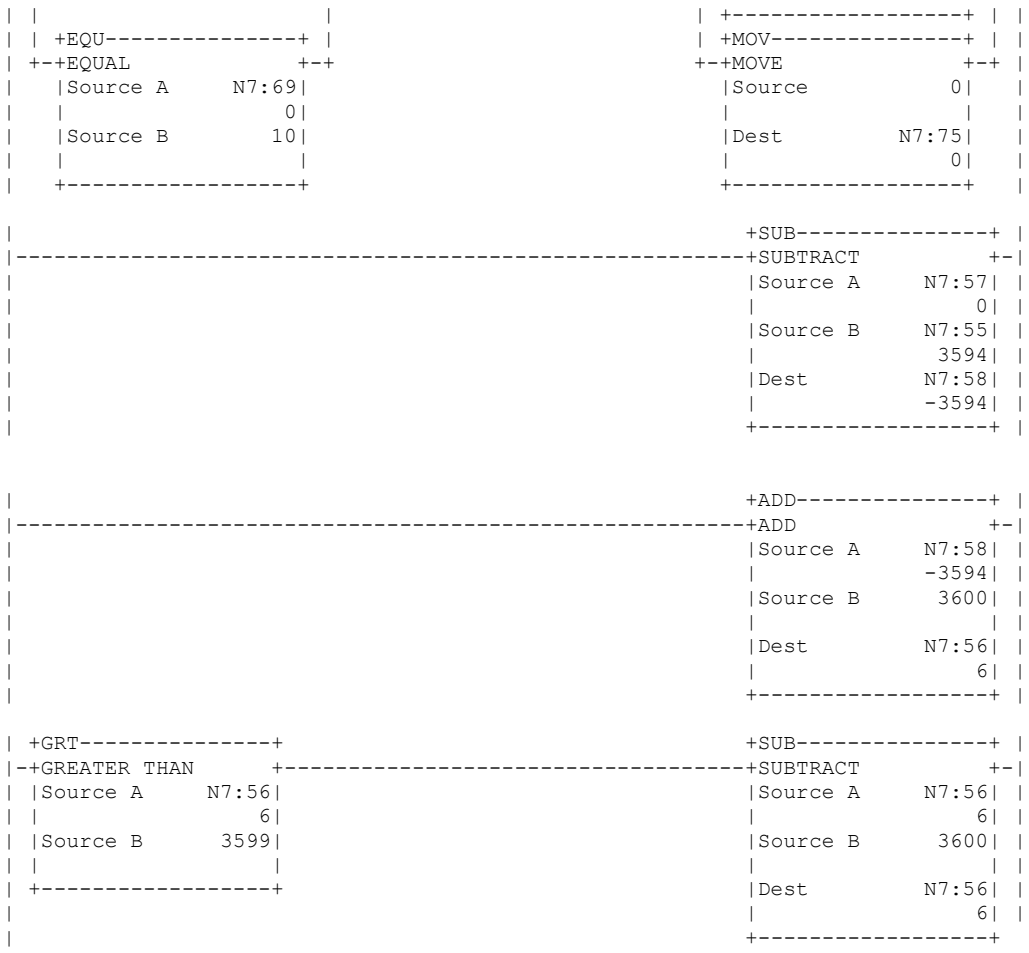
****

1)Put tonnage module(s) into bypass mode and the helm resolver module into calibrate mode.

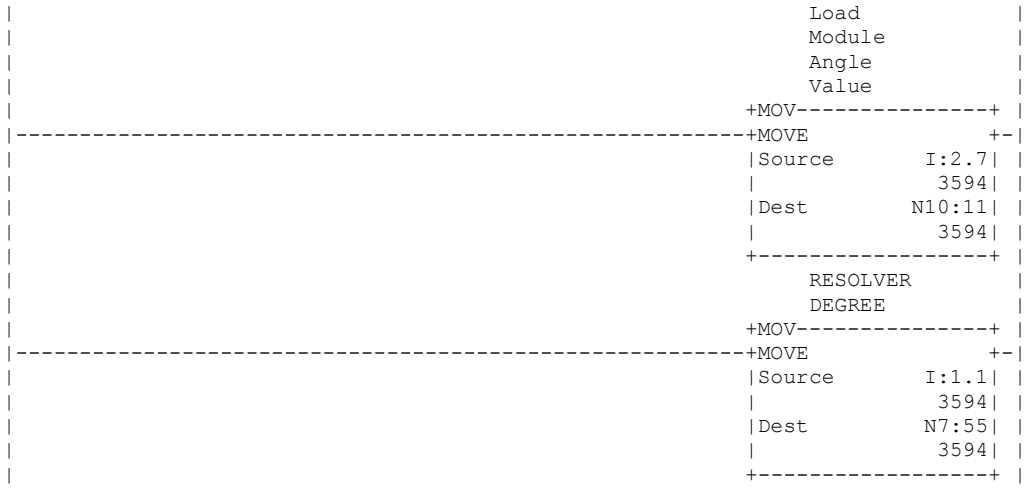


2)Stop the press at top. At this point, you should clear the resolver offset and then zero out the helm resolver so that it reads zero at the top of the stroke.





3)Make sure that Ch's 1&2 tonnage module angle value equals the resolver angle value.



4)Before leaving the resolver setup screen, you must put the helm resolver back into "run" mode.

```
|           |                                                 Resolver   |
| RESOLVER  |                                                 Module Run |
| RUN BIT   |                                                 Mode       |
|   N7:63                                                        O:1     |
|----] [------------------------------------------------------------( )-----|
|       1                                                          1     |
```

***(Steps 5 and 6 require adjustment to the three position toggle switch on the inside panel of the module*.)**

5)Balance Sensors.

1. Set three-position switch to OFF (center) position.
2. Turn balance potentiometer until 0's are all displayed.
3. If two sensors are wired, follow this procedure for both channels

⇒ If you are using Helm Panel Software select SET CAL NO. on menu. Adjust balance pot until 0's are displayed.

```
|                                                            Ch1 Cal#       |
|                                                       +MOV---------------+ |
|------------------------------------------------------+MOVE              +-|
|                                                       |Source       I:2.1| |
|                                                       |                 0| |
|                                                       |Dest        N10:17| |
|                                                       |                 0| |
|                                                       +------------------+ |
|                                                            Ch2 Cal#       |
|                                                       +MOV---------------+ |
|------------------------------------------------------+MOVE              +-|
|                                                       |Source       I:2.2| |
|                                                       |                 0| |
|                                                       |Dest        N10:18| |
|                                                       |                 0| |
|                                                       +------------------+ |
```

6)Set Calibration #'s.

1. Set three-position switch to calibrate (down) position)
2. Turn Gain Potentiometer to dial in calibration numbers.
3. If two sensors are wired, follow this procedure for both channels.

⇒ If you are using Helm Panel Software select the SET CAL NO. Menu. Adjust gain balance pot until calibration numbers are correct for channel 1 and channel 2.

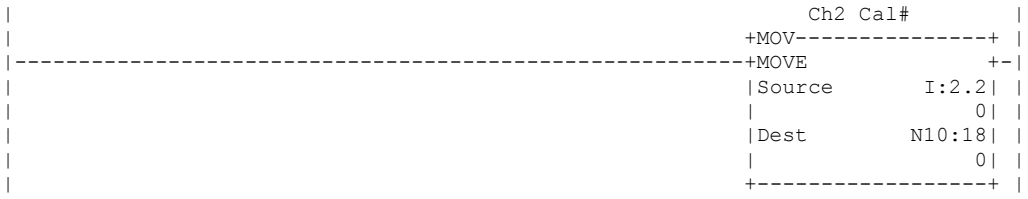
****

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

Bypass Mode should only be used when setting calibration values or zero balancing the sensor input.

****

```
|                                                            Ch1 Cal#       |
|                                                       +MOV---------------+ |
|------------------------------------------------------+MOVE              +-|
|                                                       |Source       I:2.1| |
|                                                       |                 0| |
```



7)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. Integer N10:15 should be set from your operator interface.

Setting Machine Capacity Scale using (1) two channel force module:

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	SWITCH SETTING	PRESS CAPACITY	SWITCH 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 2 load modules are used for monitoring a straight side press with 4 sensors mounted on the press columns, set the Machine Capacity Scale on both 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 (2) force modules and (4) sensors.

PRESS CAPACITY	SWITCH SETTING (same on all modules)	PRESS CAPACITY	SWITCH SETTING (same on all modules)	PRESS CAPACITY	SWITCH 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

8) Set the Peak Look Window(PKLW) Starting Angle in degrees.

9) Set the Peak Look Window Degree Step Value(0.2,0.4,0.6,0.8,1.0,or 1.2). This is the amount of degrees in between each tonnage reading based off of the resolver.

10) Set the Alarm Window Starting Angle in degrees.

```
| Mode                                                                       |
|   N7:15                                                 +MOV---------------+ |
|----] [--------------------------------------------------+MOVE             +-|
|       3                                                 |Source      N10:52| |
|                                                         |               900| |
|                                                         |Dest         O:2.2| |
|                                                         |               900| |
|                                                         +------------------+ |
```

11) Set the Alarm Window Stop Angle in degrees.

```
| Operator                                                                   |
| Interface                                                                  |
| Bypass                                                                     |
| Mode                                                                       |
|   N7:15                                                 +MOV---------------+ |
|----] [--------------------------------------------------+MOVE             +-|
|       3                                                 |Source      N10:53| |
|                                                         |              2000| |
|                                                         |Dest         O:2.3| |
|                                                         |              2000| |
|                                                         +------------------+ |
```

12) Set Channel 2 Low Capacity Alarm Value.

```
| Operator                                                                   |
| Interface                                                                  |
| Peak Mode                                                                  |
|   N7:15                                                 +MOV---------------+ |
|----]/[--------------------------------------------------+MOVE             +-|
|       4                                                 |Source      N10:51| |
|                                                         |                 0| |
|                                                         |Dest         O:2.4| |
|                                                         |                 0| |
|                                                         +------------------+ |
```

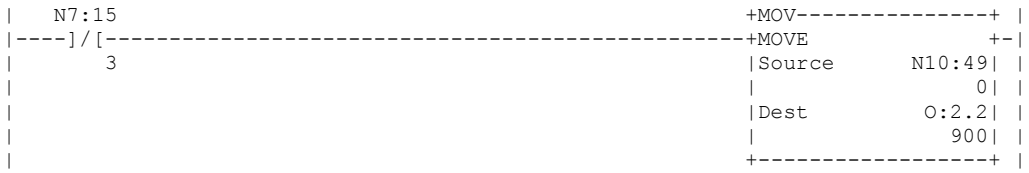
****
the next seven parameters must be set when the tonnage module is in “peak” mode.
****

13) Set Channel 1 High Capacity Alarm Value.

```
| Operator                                                                   |
| Interface                                                                  |
| Bypass                                                                     |
| Mode                                                                       |
|   N7:15                                                 +MOV---------------+ |
|----]/[--------------------------------------------------+MOVE             +-|
|       3                                                 |Source      N10:48| |
|                                                         |                25| |
|                                                         |Dest         O:2.3| |
|                                                         |              2000| |
|                                                         +------------------+ |
```

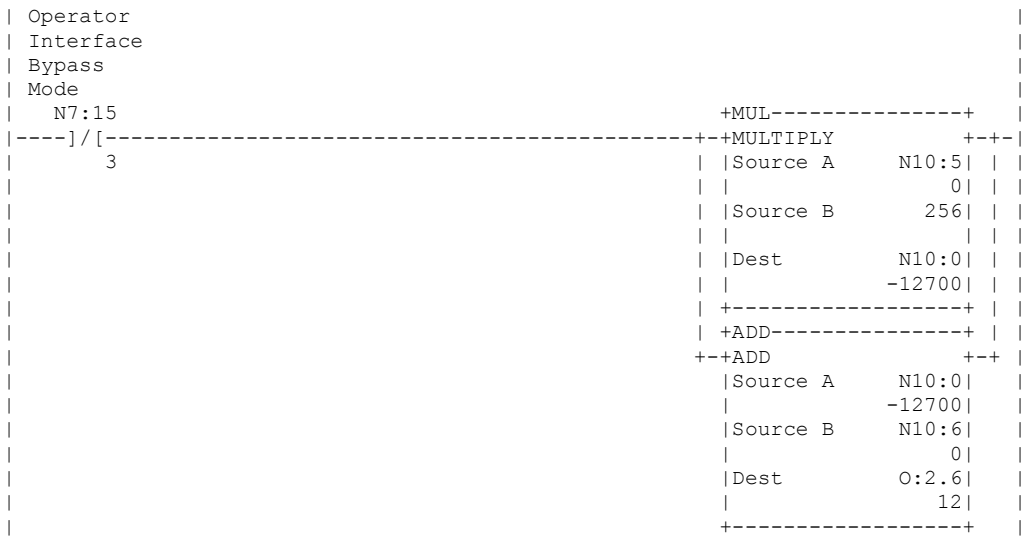
14) Set Channel 1 Low Capacity Alarm Value.

```
| Operator                                                                   |
| Interface                                                                  |
| Bypass                                                                     |
| Mode                                                                       |
```

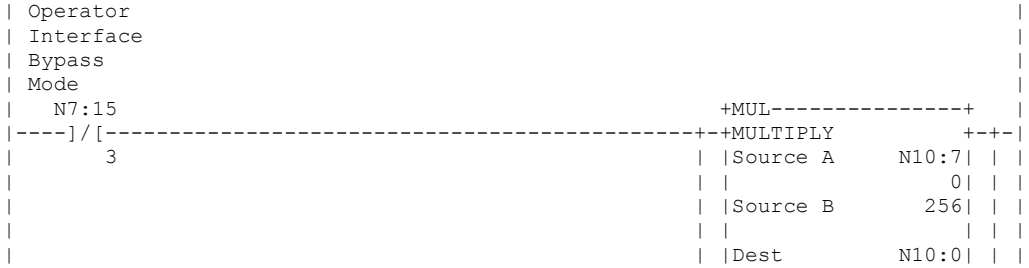


15) Set Channel 2 High Capacity Alarm Value.

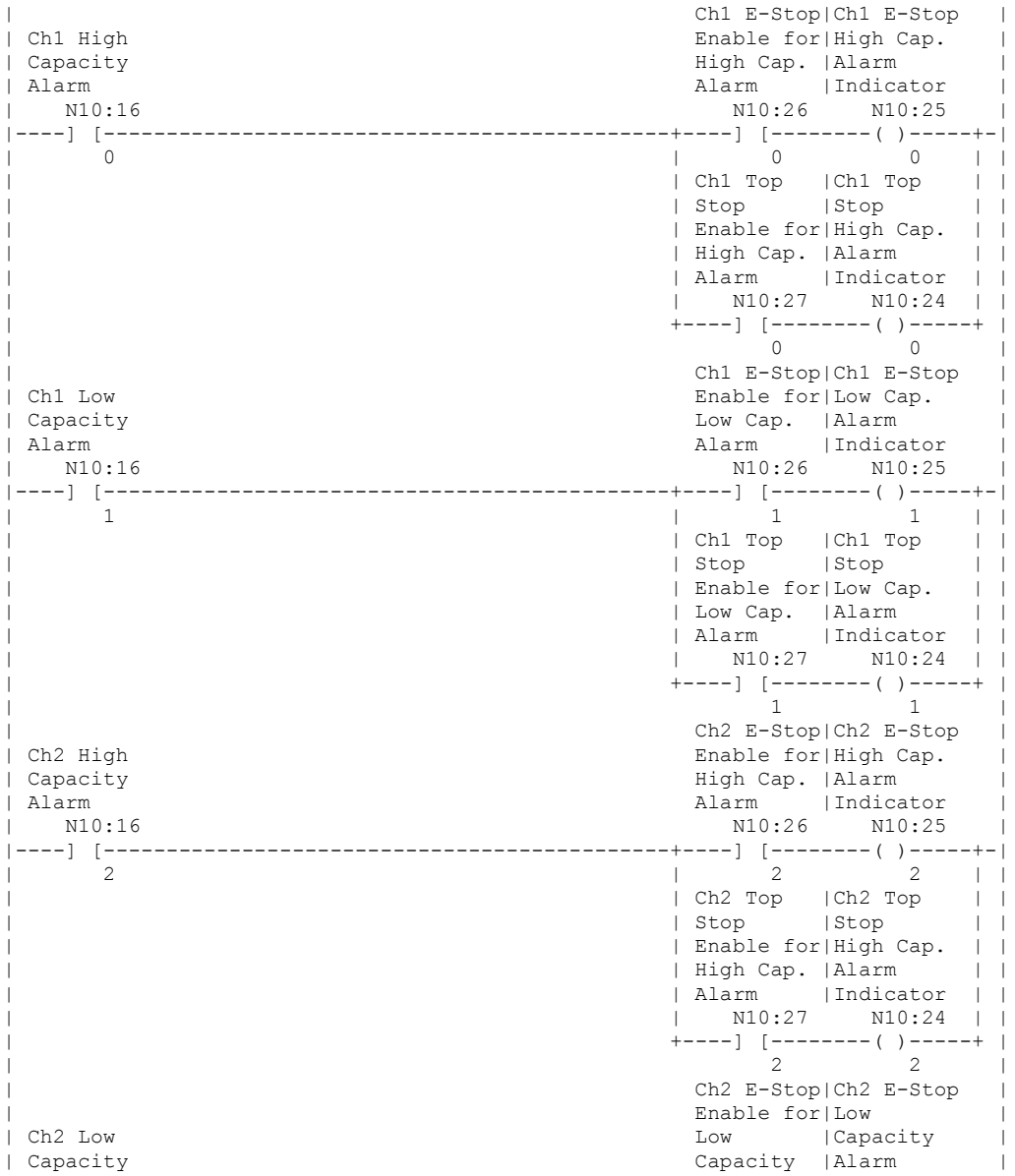
16) Set Channel 1 High and Low Trend Alarm Values.

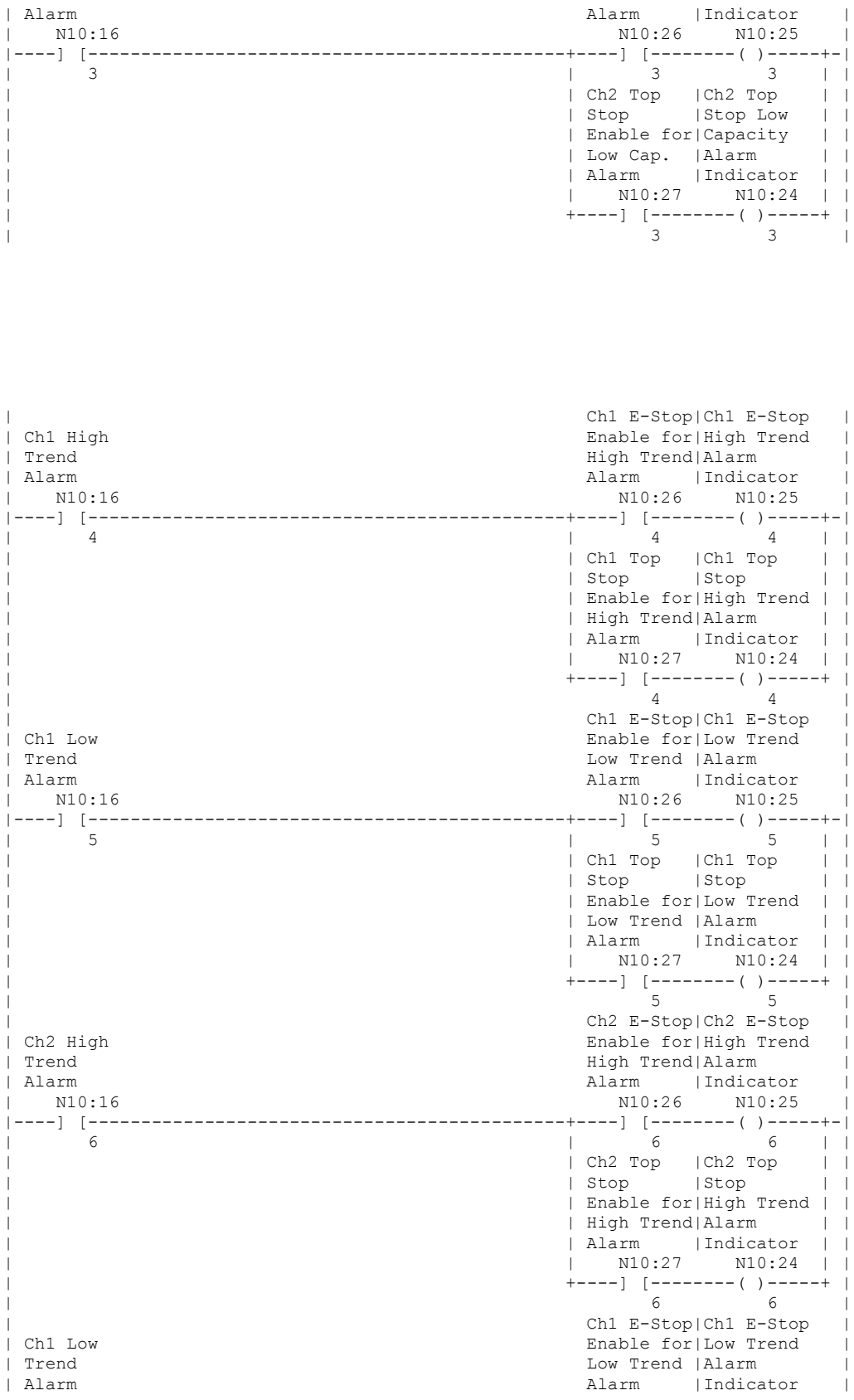


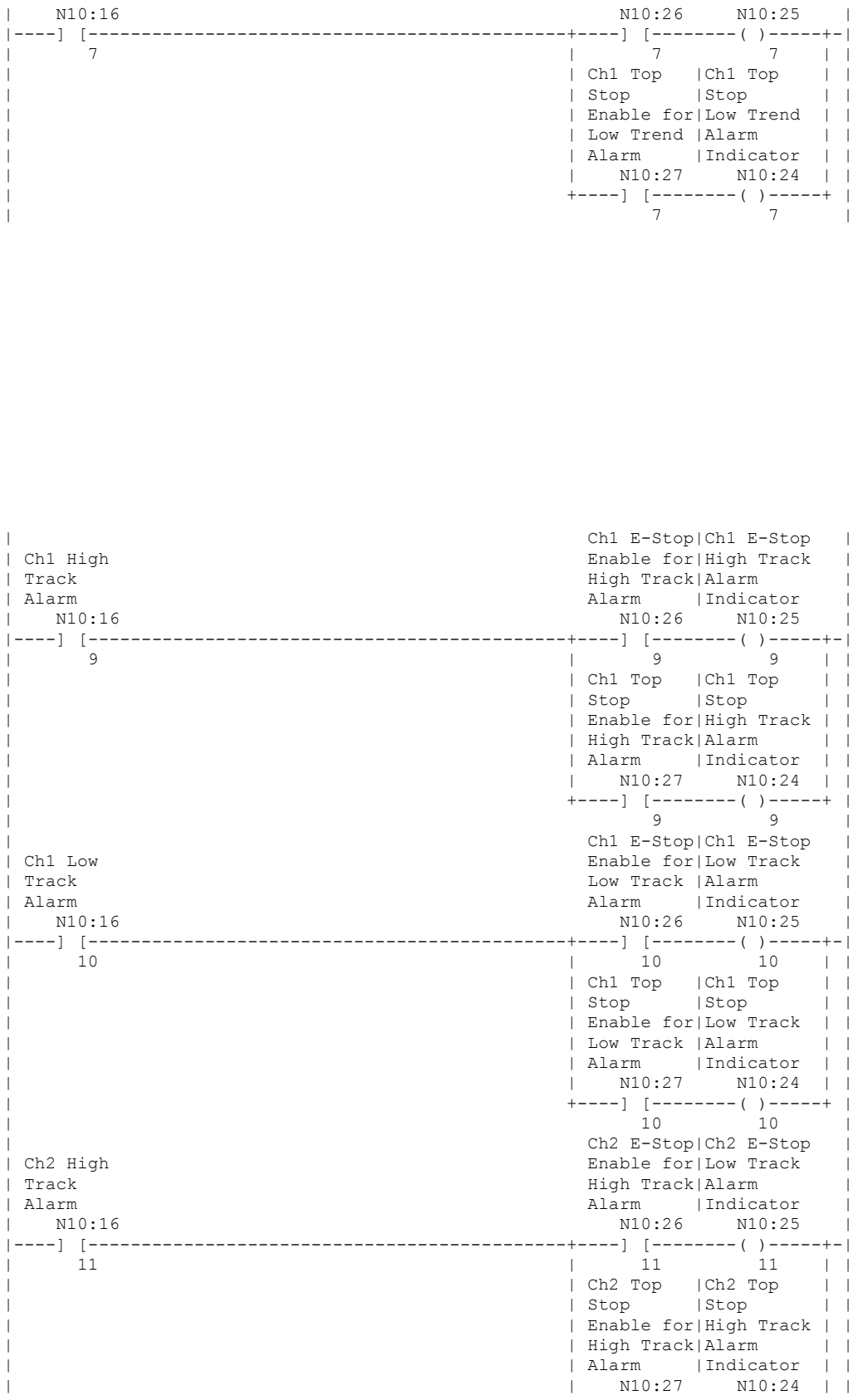
17) Set Channel 2 High and Low Trend Alarm Values.

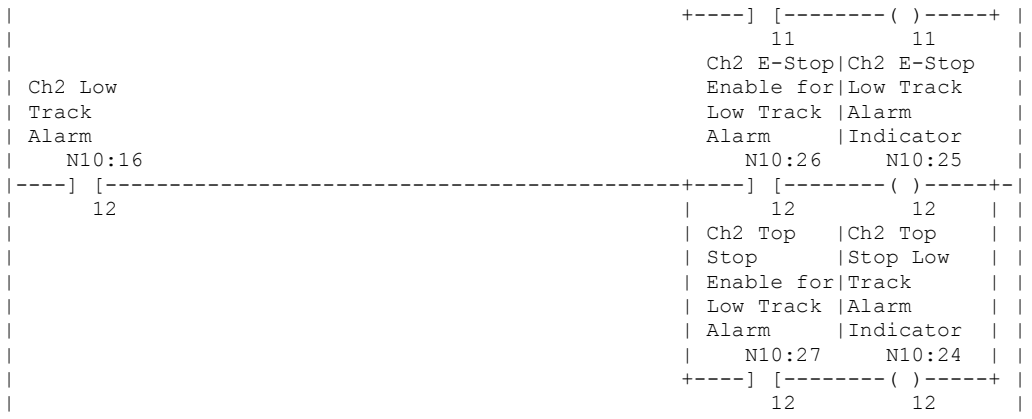


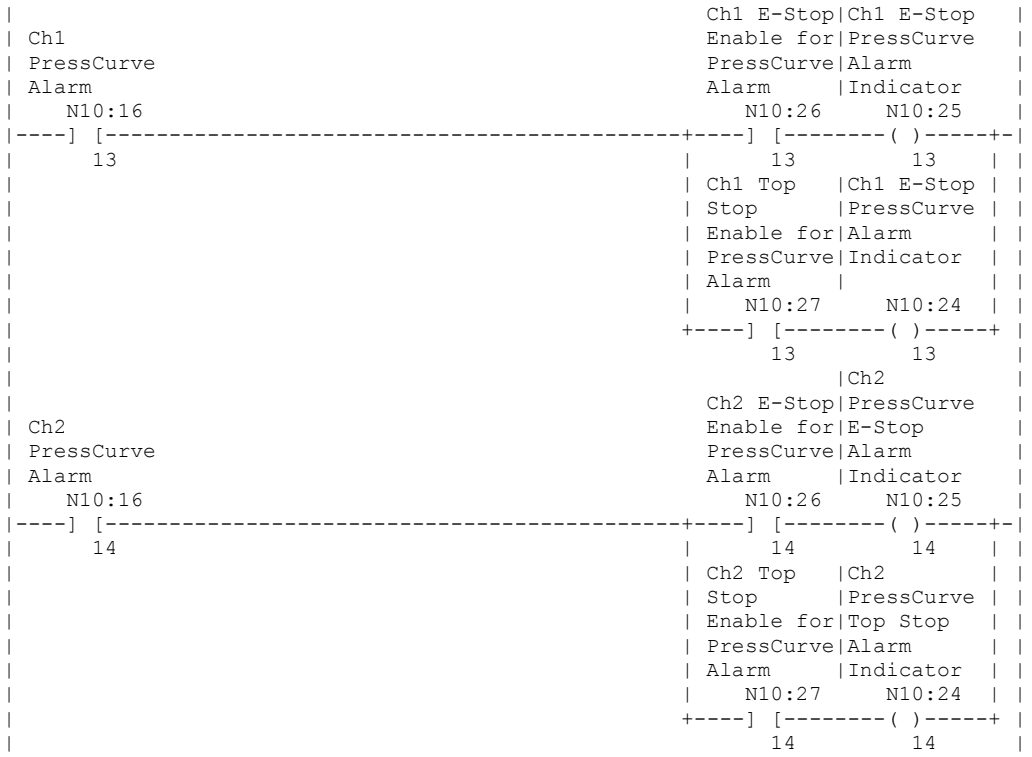
18) For each alarm condition, you can select if you want a Top Stop or an E-Stop when this alarm occurs.



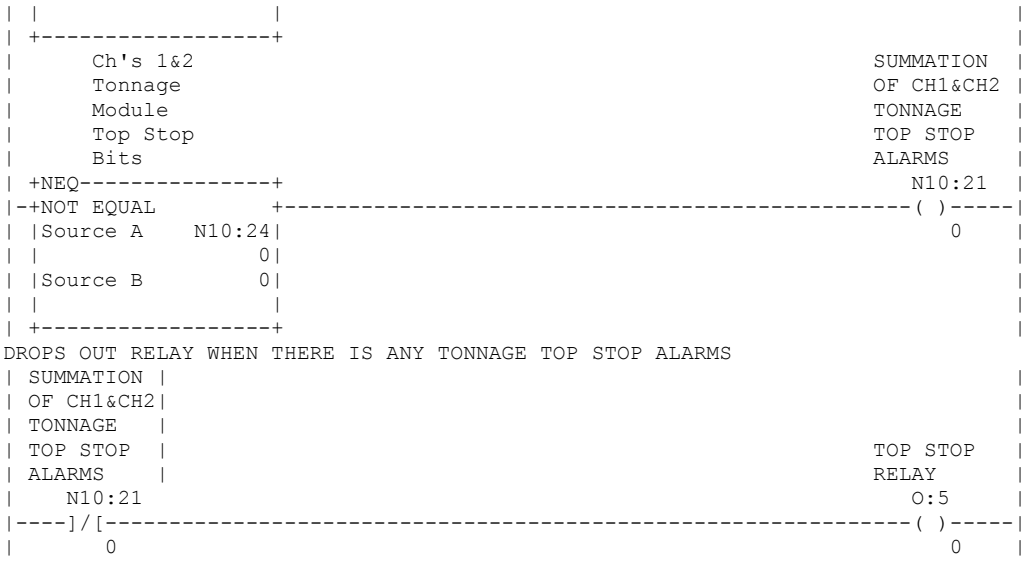

Alarm
N10:16
Alarm
N10:26
Indicator
N10:25
Ch2 Top Stop Enable for Low Cap. Alarm
N10:27
Ch2 Top Stop Low Capacity Alarm Indicator
N10:24
Ch1 High Trend Alarm
N10:16
Ch1 E-Stop Enable for High Trend Alarm
N10:26
Ch1 E-Stop High Trend Alarm Indicator
N10:25
Ch1 Top Stop Enable for High Trend Alarm
N10:27
Ch1 Top Stop High Trend Alarm Indicator
N10:24
Ch1 Low Trend Alarm
N10:16
Ch1 E-Stop Enable for Low Trend Alarm
N10:26
Ch1 E-Stop Low Trend Alarm Indicator
N10:25
Ch1 Top Stop Enable for Low Trend Alarm
N10:27
Ch1 Top Stop Low Trend Alarm Indicator
N10:24
Ch2 High Trend Alarm
N10:16
Ch2 E-Stop Enable for High Trend Alarm
N10:26
Ch2 E-Stop High Trend Alarm Indicator
N10:25
Ch2 Top Stop Enable for High Trend Alarm
N10:27
Ch2 Top Stop High Trend Alarm Indicator
N10:24
Ch1 Low Trend Alarm
Ch1 E-Stop Enable for Low Trend Alarm
Ch1 E-Stop Low Trend Alarm Indicator

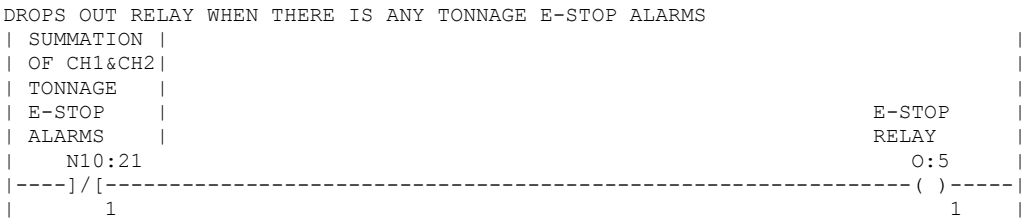

N10:16
7
N10:26
7
Ch1 Top Stop Enable for Low Trend Alarm
N10:27
7
N10:25
7
Ch1 Top Stop Enable for Low Trend Alarm Indicator
N10:24
7
Ch1 High Track Alarm
N10:16
9
N10:26
9
Ch1 E-Stop Enable for High Track Alarm
N10:27
9
N10:25
9
Ch1 E-Stop Enable for High Track Alarm Indicator
N10:24
9
Ch1 Low Track Alarm
N10:16
10
N10:26
10
Ch1 E-Stop Enable for Low Track Alarm
N10:27
10
N10:25
10
Ch1 E-Stop Enable for Low Track Alarm Indicator
N10:24
10
Ch2 High Track Alarm
N10:16
11
N10:26
11
Ch2 E-Stop Enable for High Track Alarm
N10:27
11
N10:25
11
Ch2 E-Stop Enable for Low Track Alarm
N10:27
11
N10:24
11
Ch2 Top Stop Enable for High Track Alarm
Ch2 Top Stop Enable for Low Track Alarm
Ch2 Top Stop Enable for Low Trend Alarm
Ch2 E-Stop Enable for High Track Alarm
Ch2 E-Stop Enable for Low Trend Alarm



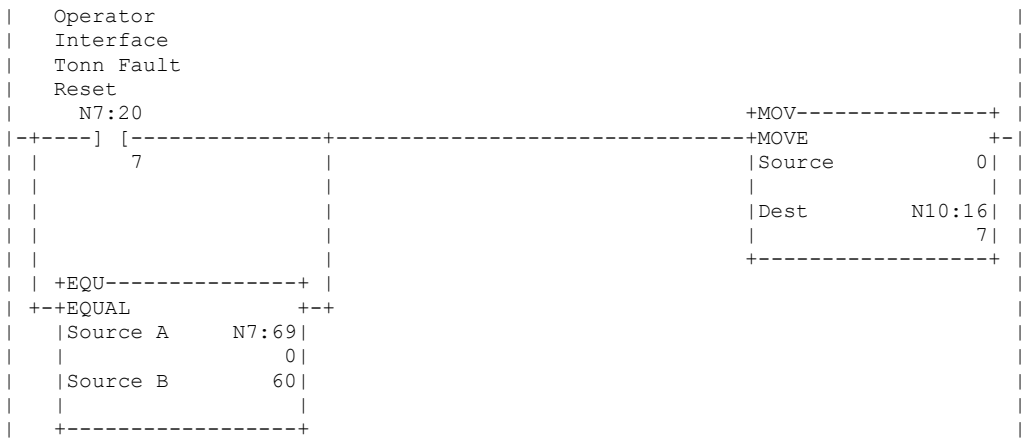


19)Map in the tonnage alarms to your E-Stop or Top Stop outputs.





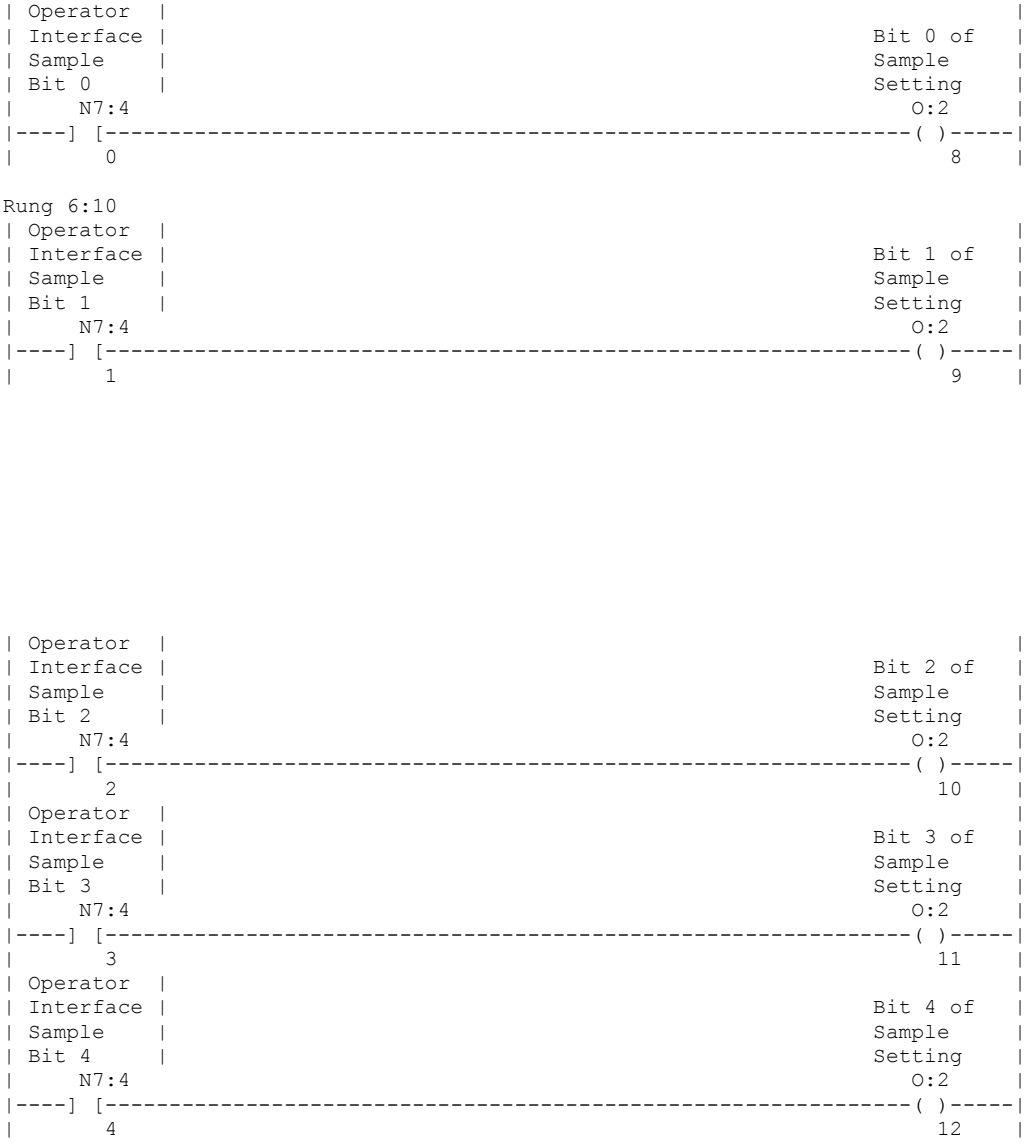
20)Map in the tonnage alarm reset button.



21)Set Sample Count.

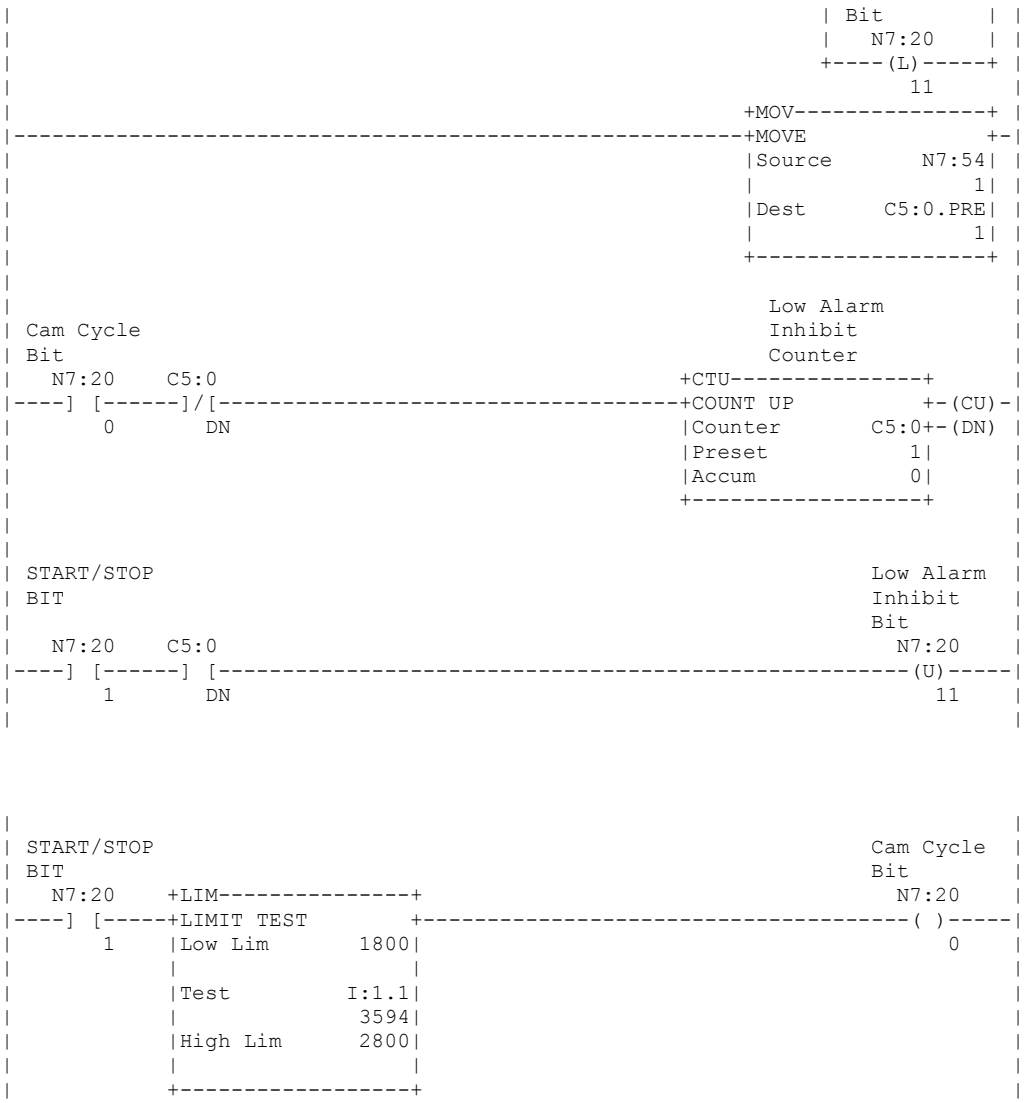
The sample count is a user programmable parameter that tells the processor how many machine strokes are required to establish sample or benchmark load values. The value can range from 0 to 16. A value of 0 invalidates the Monitor Parts mode. You should set Sample Count to a minimum of 1 to enable Monitor Parts mode.

Note: Each time you change Monitor Parts mode bit from ON to OFF, the sample value is cleared. During normal operations, Monitor Parts mode is enabled when beginning a process run. If the process varies due to change in material thickness, for example, it may be necessary to take a new sample.

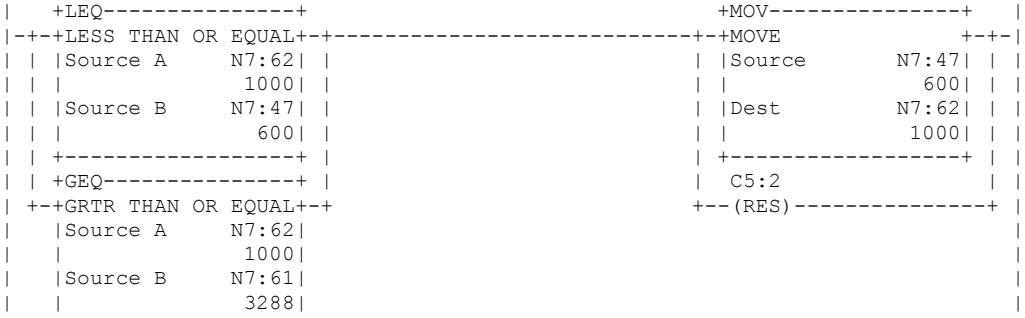


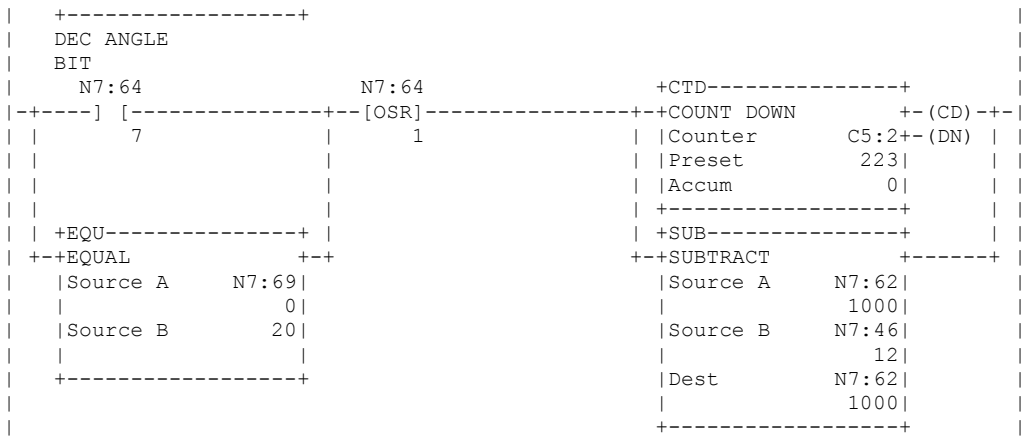
22) Set the Low Alarm Inhibit Counter.

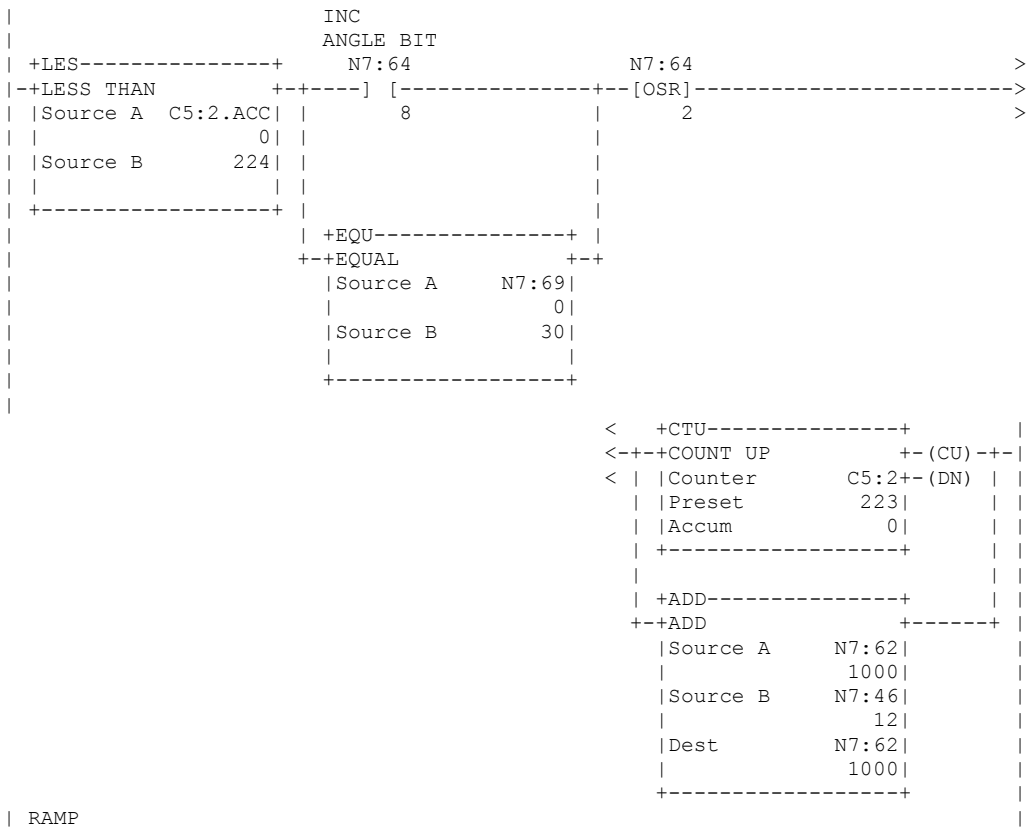
In some processes it may be necessary to inhibit the Low Capacity alarm during machine ramp up. Use the following example to set the low alarm inhibit bit based on a counter.

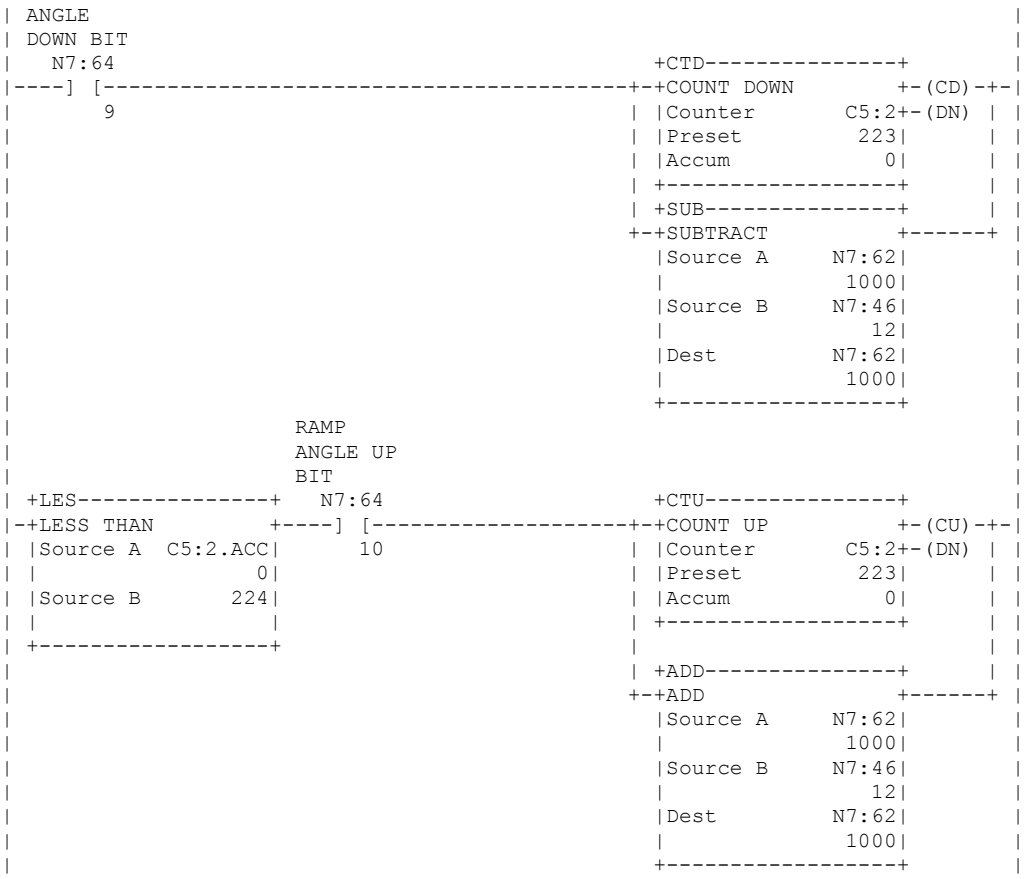


23)A "Load at Angle" is provided as an option within the provided ladder logic. This feature is for someone who is using a panelview for an operator interface and can not draw waveforms. This feature allows you to increase and decrease the angle value while viewing the actual tonnage readings at various resolver angle position's.




DEC ANGLE
BIT
N7:64
7
N7:64
1
EQU
EQUAL
Source A N7:69
0
Source B 20
OSR
CTD
COUNT DOWN
Counter C5:2
Preset 223
Accum 0
CD
DN
SUB
SUBTRACT
Source A N7:62
1000
Source B N7:46
12
Dest N7:62
1000


INC
ANGLE BIT
LES
LESS THAN
Source A C5:2.ACC
0
Source B 224
N7:64
8
OSR
2
EQU
EQUAL
Source A N7:69
0
Source B 30
CTU
COUNT UP
Counter C5:2
Preset 223
Accum 0
CU
DN
ADD
ADD
Source A N7:62
1000
Source B N7:46
12
Dest N7:62
1000
RAMP


ANGLE
DOWN BIT
N7:64
9
CTD
COUNT DOWN
(CD)
Counter C5:2
(DN)
Preset 223
Accum 0
SUB
SUBTRACT
Source A N7:62
1000
Source B N7:46
12
Dest N7:62
1000
RAMP
ANGLE UP
BIT
N7:64
10
LES
LESS THAN
Source A C5:2.ACC
0
Source B 224
CTU
COUNT UP
(CU)
Counter C5:2
(DN)
Preset 223
Accum 0
ADD
ADD
Source A N7:62
1000
Source B N7:46
12
Dest N7:62
1000
LOAD AT
ANGLE
COUNTER
MOV
MOVE
Source C5:2.ACC
0
Dest N7:14
0

Chapter 5

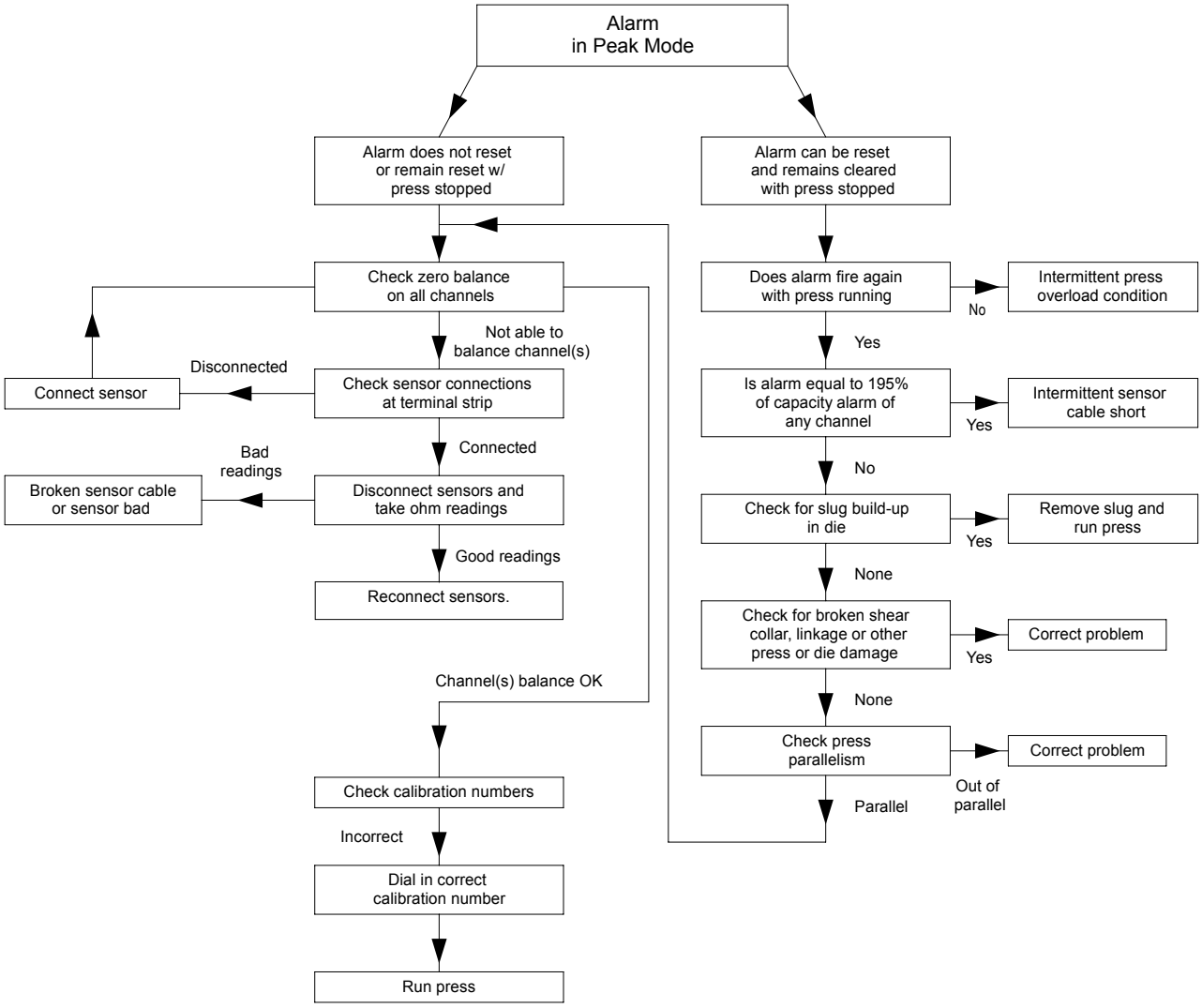
System Trouble-shooting Guide

Make sure three position switch is in top (ON) position. (See diagram page 1-3)

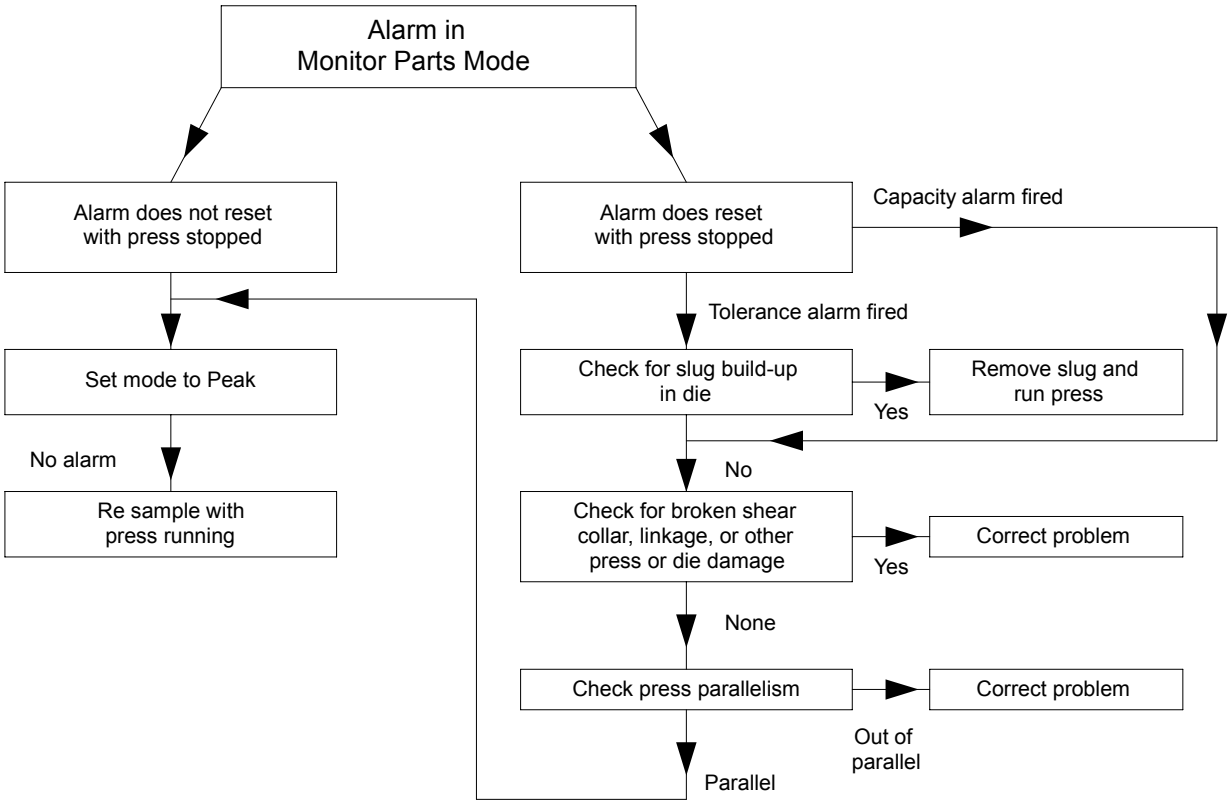
HT-400 Sensor Ohm Readings

Green-Black	350 ohms
Red-White	350 ohms
All other color combinations	266 ohms
All colors to Ground	open
Shield to Ground	open

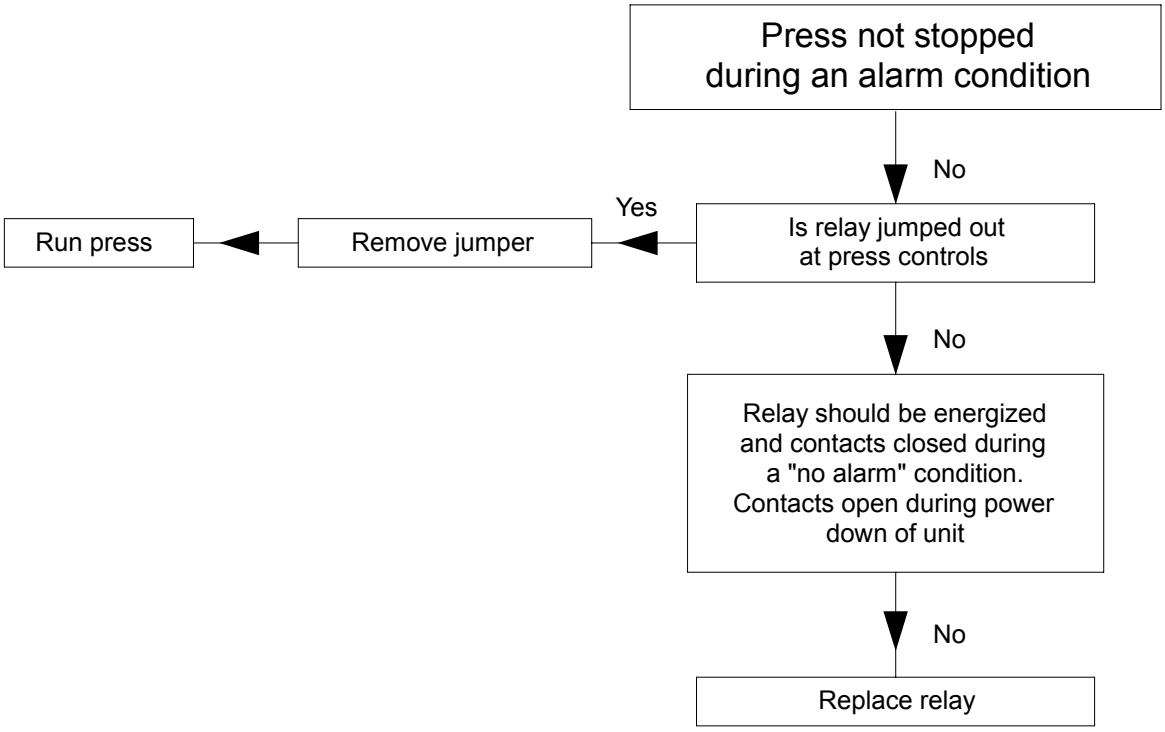
System Trouble-shooting Guide (contd.)



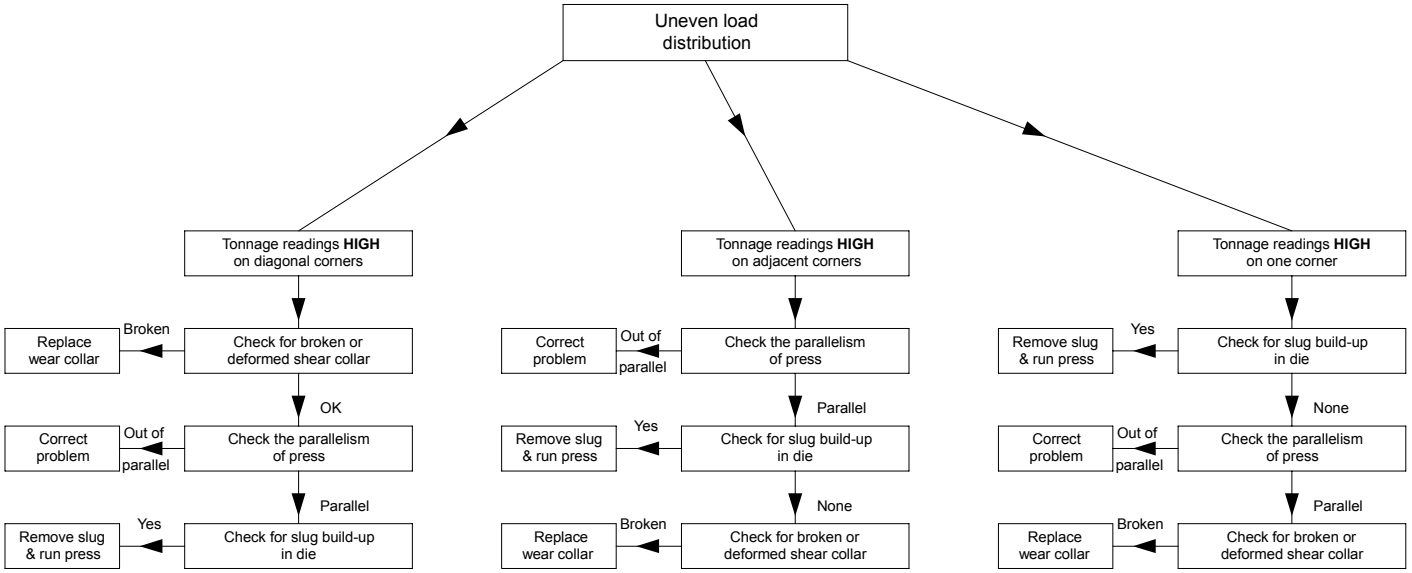
System Trouble-shooting Guide (contd.)



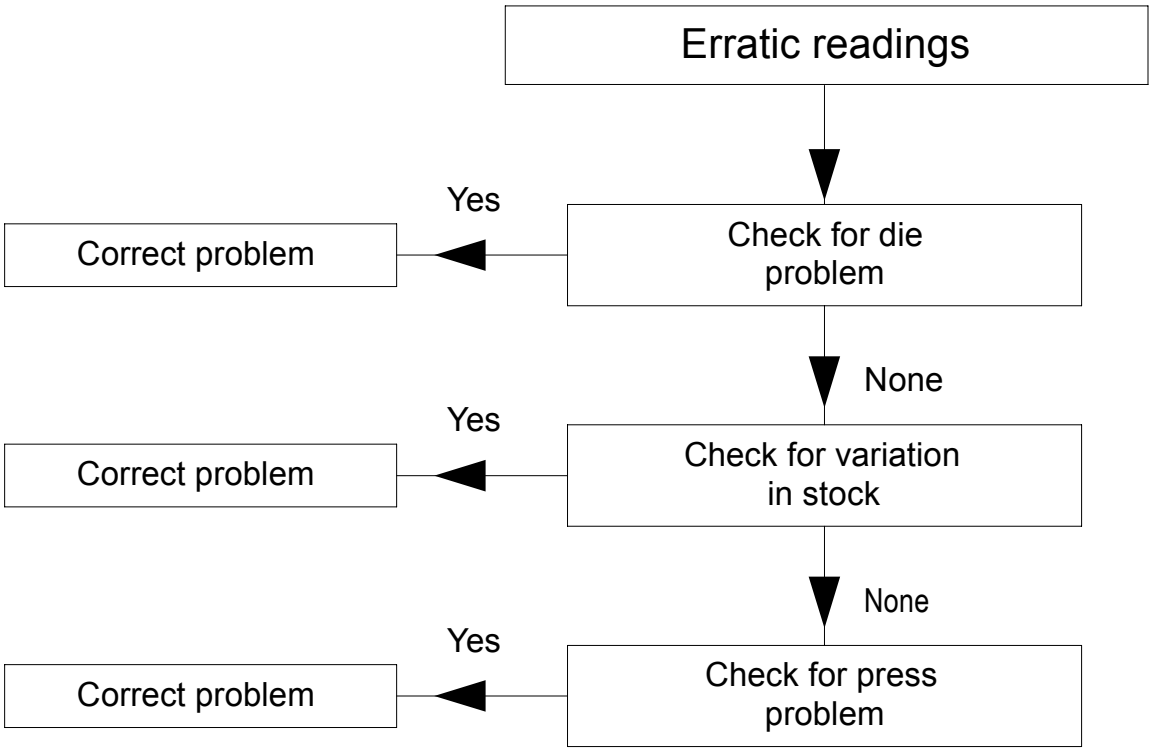
System Trouble-shooting Guide (contd.)



System Trouble-shooting Guide (contd.)



System Trouble-shooting Guide (contd.)



Appendix B - Section 1

Ladder Programming

Ladder Programming Summary:

Appendix B, Section 2 - ladder interface for a 2 channel tonnage system

Appendix B, Section 3 - ladder interface for a 4 channel tonnage system

Appendix B, Section 4 - ladder file required for every Forcegard module in your plc. Ex: 2 tonnage modules = 2 files, each with a different integer table and different I/O addresses.

Note: 1.) For 2 channel system - use ladder in sections 2 & 4

2.) For 4 channel system - use ladder in sections 3 and have 2 files same as section 4, the file for CH'S 1 & 2 uses integer N10 and file and file for CH'S 3 & 4 uses integer N11.

3.) If creating a system with more than 2 Forcegard modules, use Appendix B, Section 3 as a reference. This file has all the common integers needed for each Forcegard module.

Appendix B - Section 1

Ladder Programming Items needed to map into program:

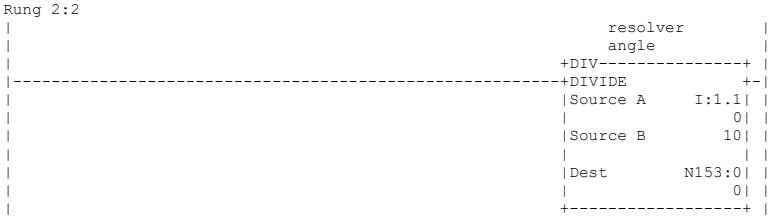
1.) Press in motion bit

a.) If you are using Helm HR-1101 resolver for position input and are using our sample ladder:

b.) If you have your own press in motion bit

2.) Resolver or a rotary cam or prox probe

a.) If using resolver, map the angle value into N153:0



NOTE: Whatever slot resolver is in.

Ladder Programming

b.) If using rotary cam or prox probe and it's a:

1.) 2 CH system, modify rung 2:3 (Appendix B, Section 2).

2.) 4 CH system, modify rung 3:3 (Appendix B, Section 3).

NOTE:
Make sure prox probe or rotary cam is on between 90 to 220°

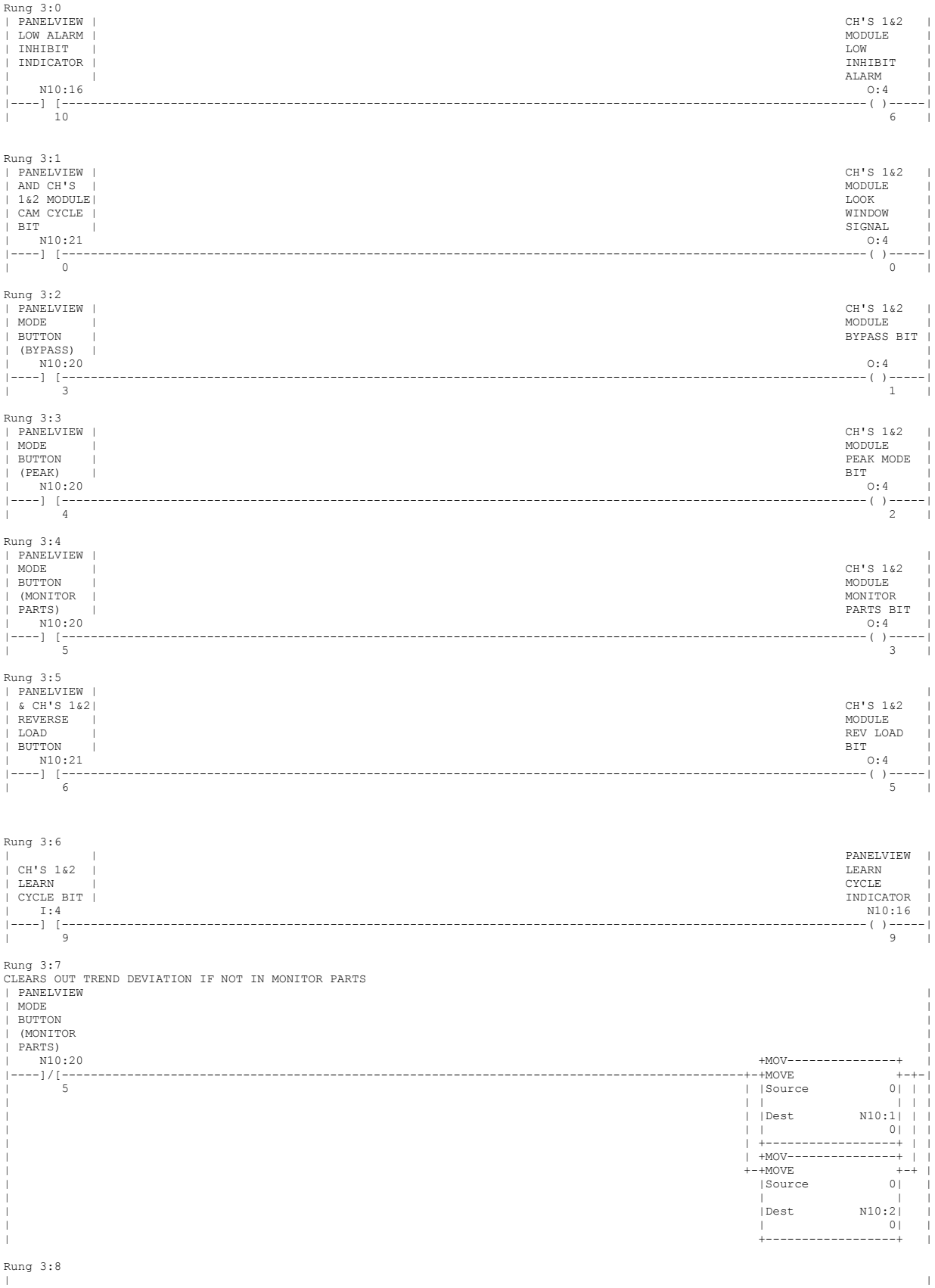
3.) Top Stop or E-Stop

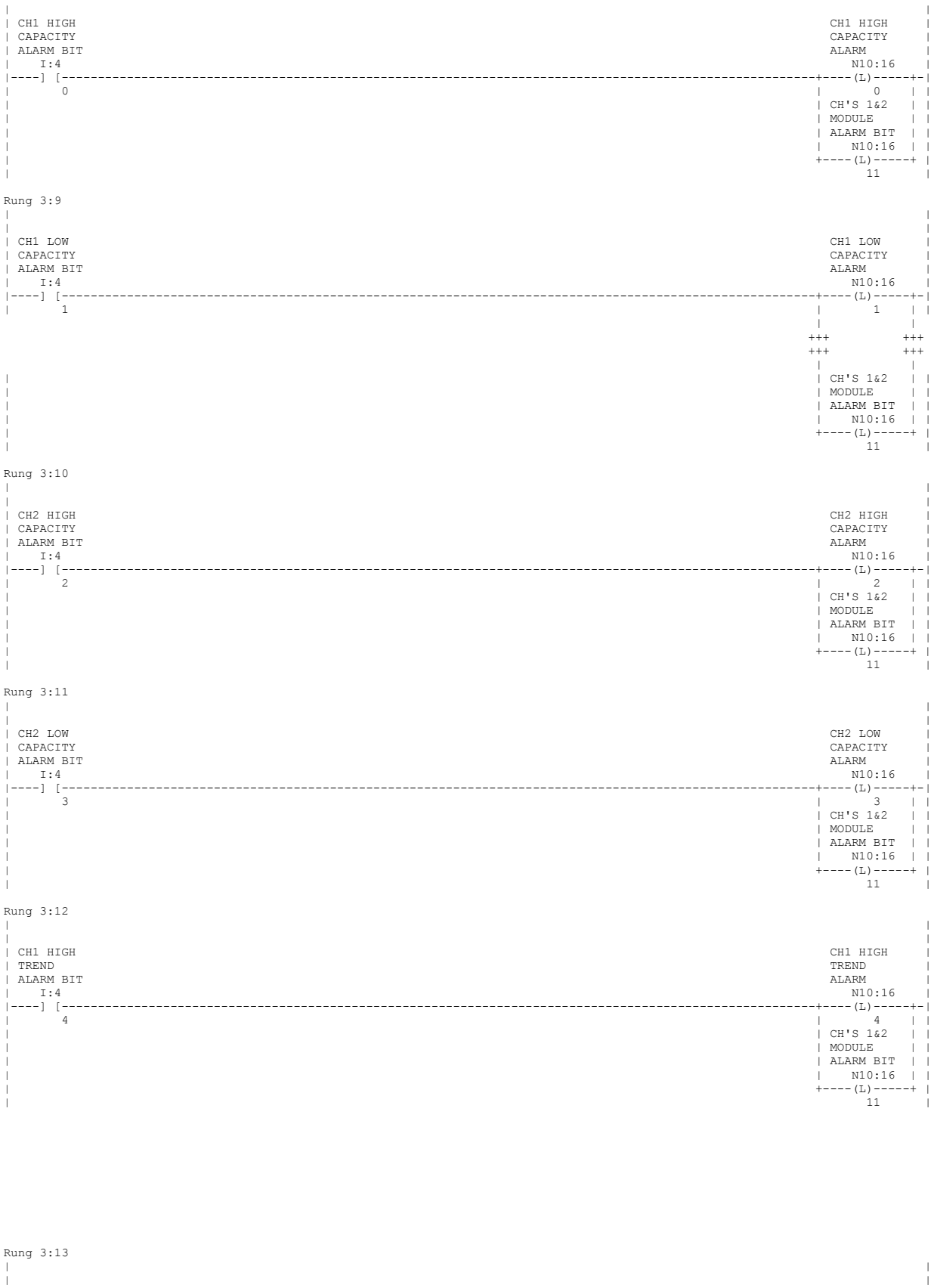
a.) 2 CH system, modify rung 2:13 (Appendix B, Section 2) for where your top stop or e-stop relay is connected.

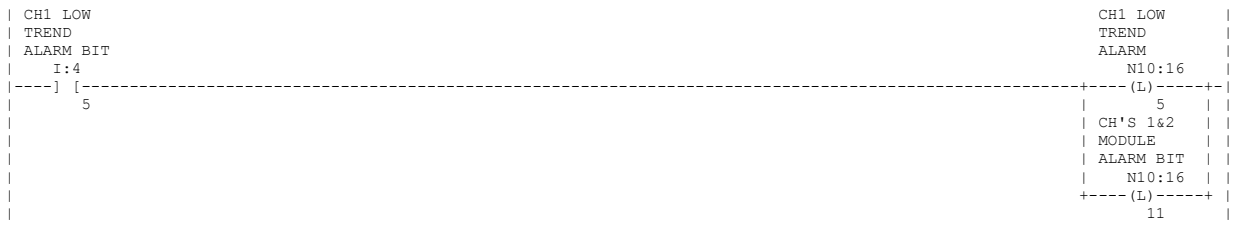
NOTE: Whenever output module is located.

NOTE: Whenever output module is located.

b.)


Rung 3:0
PANELVIEW LOW ALARM INHIBIT INDICATOR
N10:16
10
CH'S 1&2 MODULE LOW INHIBIT ALARM
O:4
6
Rung 3:1
PANELVIEW AND CH'S 1&2 MODULE CAM CYCLE BIT
N10:21
0
CH'S 1&2 MODULE LOOK WINDOW SIGNAL
O:4
0
Rung 3:2
PANELVIEW MODE BUTTON (BYPASS)
N10:20
3
CH'S 1&2 MODULE BYPASS BIT
O:4
1
Rung 3:3
PANELVIEW MODE BUTTON (PEAK)
N10:20
4
CH'S 1&2 MODULE PEAK MODE BIT
O:4
2
Rung 3:4
PANELVIEW MODE BUTTON (MONITOR PARTS)
N10:20
5
CH'S 1&2 MODULE MONITOR PARTS BIT
O:4
3
Rung 3:5
PANELVIEW & CH'S 1&2 REVERSE LOAD BUTTON
N10:21
6
CH'S 1&2 MODULE REV LOAD BIT
O:4
5
Rung 3:6
CH'S 1&2 LEARN CYCLE BIT
I:4
9
PANELVIEW LEARN CYCLE INDICATOR
N10:16
9
Rung 3:7
CLEARS OUT TREND DEVIATION IF NOT IN MONITOR PARTS
PANELVIEW MODE BUTTON (MONITOR PARTS)
N10:20
5
MOV MOVE Source 0 Dest N10:1 0
MOV MOVE Source 0 Dest N10:2 0
Rung 3:8


CH1 HIGH CAPACITY ALARM BIT I:4 0
CH1 HIGH CAPACITY ALARM N10:16 0
CH'S 1&2 MODULE ALARM BIT N10:16 11
Rung 3:9
CH1 LOW CAPACITY ALARM BIT I:4 1
CH1 LOW CAPACITY ALARM N10:16 1
CH'S 1&2 MODULE ALARM BIT N10:16 11
Rung 3:10
CH2 HIGH CAPACITY ALARM BIT I:4 2
CH2 HIGH CAPACITY ALARM N10:16 2
CH'S 1&2 MODULE ALARM BIT N10:16 11
Rung 3:11
CH2 LOW CAPACITY ALARM BIT I:4 3
CH2 LOW CAPACITY ALARM N10:16 3
CH'S 1&2 MODULE ALARM BIT N10:16 11
Rung 3:12
CH1 HIGH TREND ALARM BIT I:4 4
CH1 HIGH TREND ALARM N10:16 4
CH'S 1&2 MODULE ALARM BIT N10:16 11
Rung 3:13



Rung 3:14

Rung 3:15

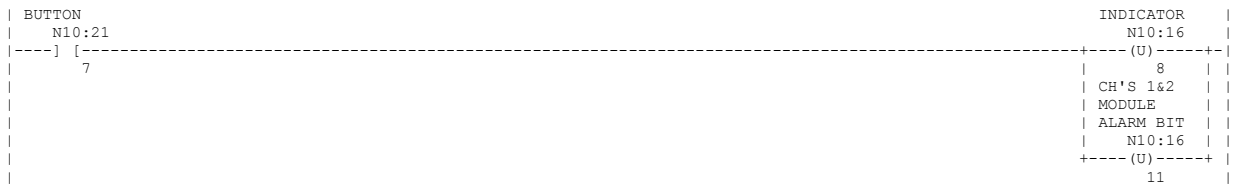
Rung 3:16

Rung 3:17

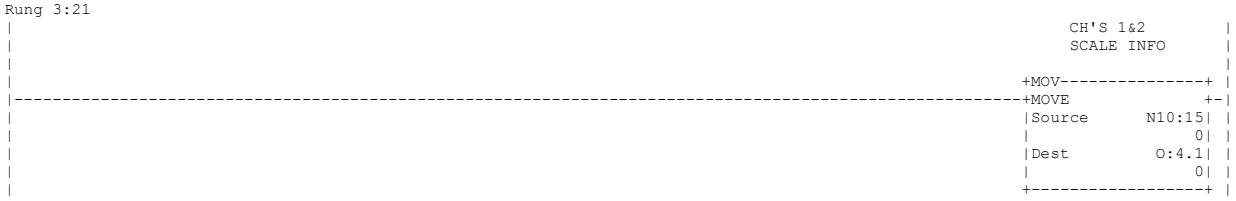
Rung 3:18

Rung 3:19

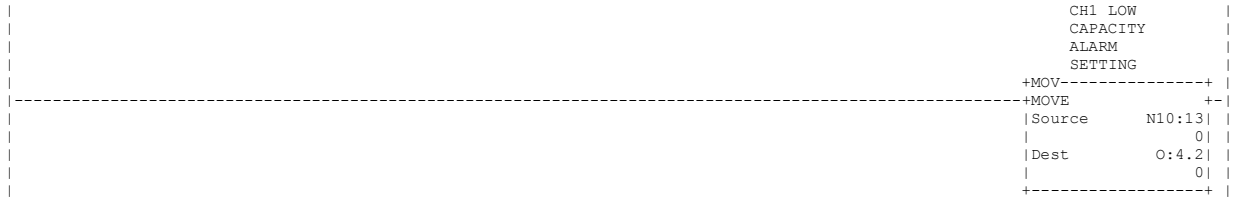
Rung 3:20



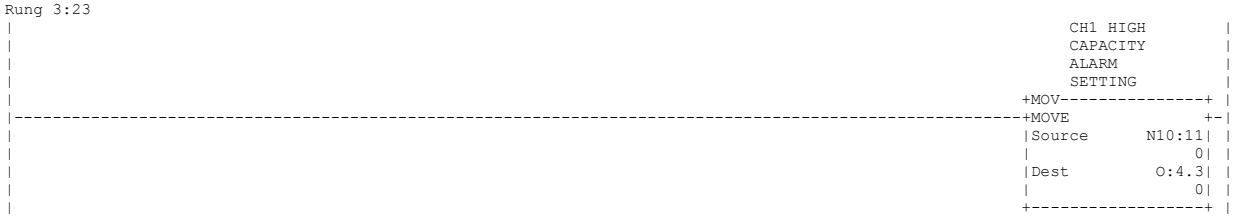
Rung 3:21



Rung 3:22

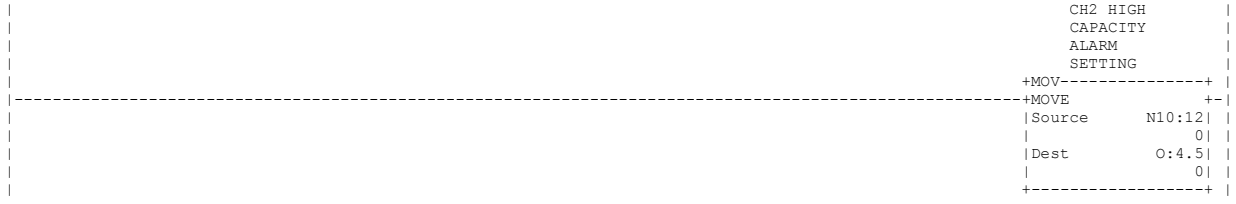


Rung 3:23

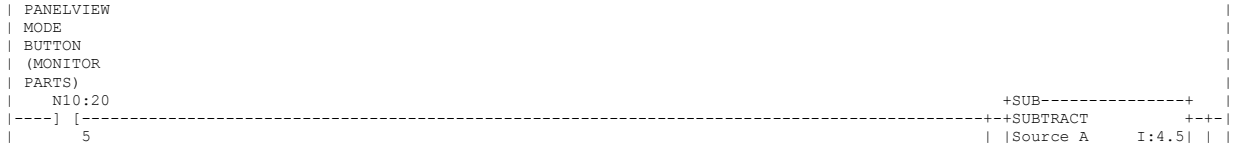


Rung 3:24

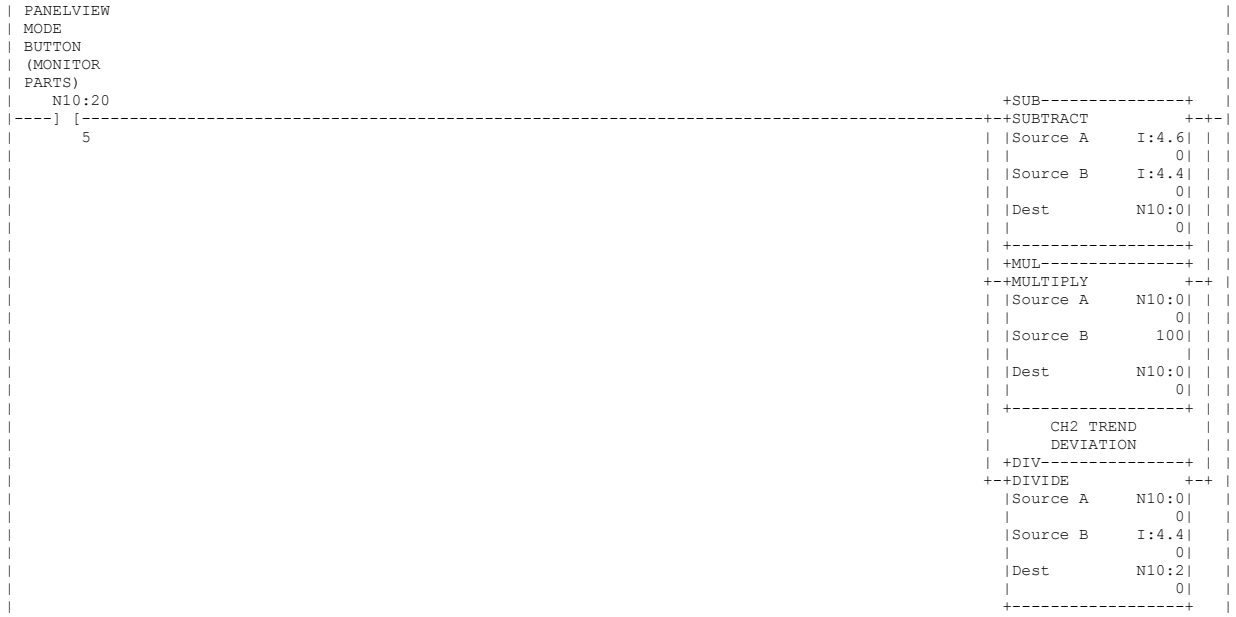
Rung 3:25



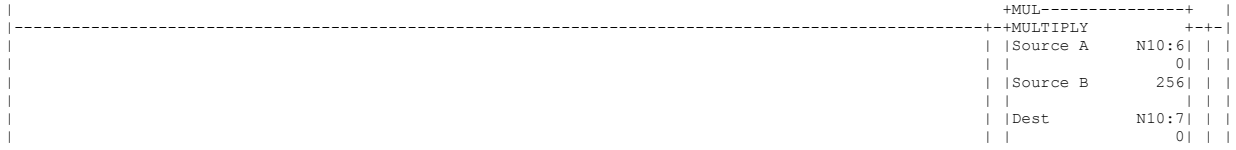
Rung 3:26
THIS RUNG CALCULATES THE TREND DEVIATION WHICH IS DISPLAYED ON THE PANELVIEW



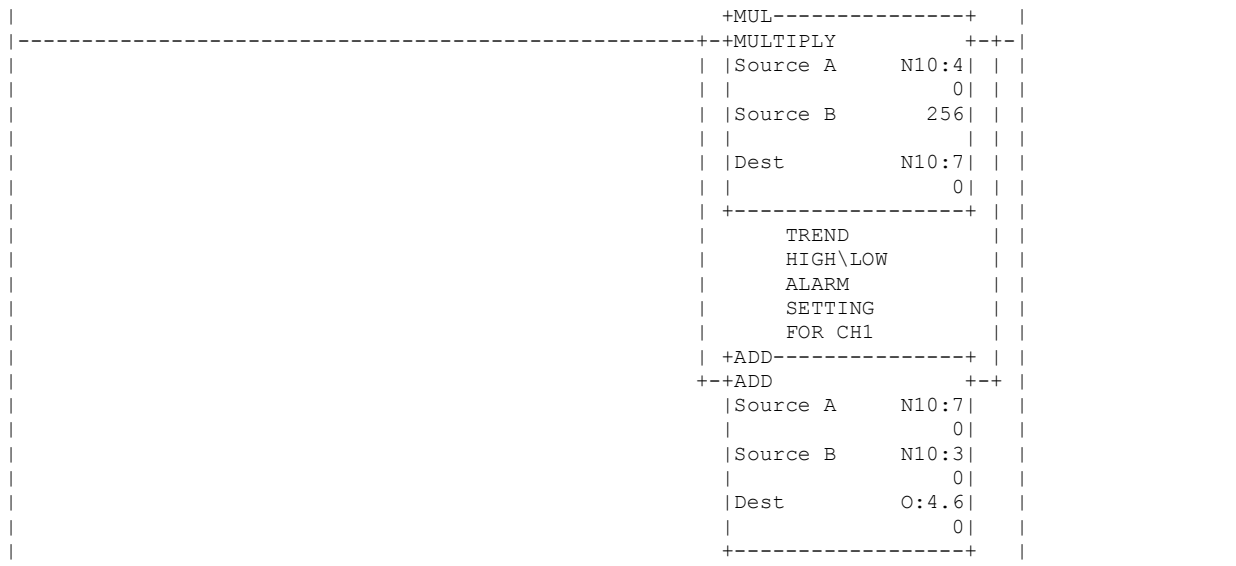
Rung 3:27
THIS RUNG CALCULATES THE TREND DEVIATION WHICH IS DISPLAYED ON THE PANELVIEW



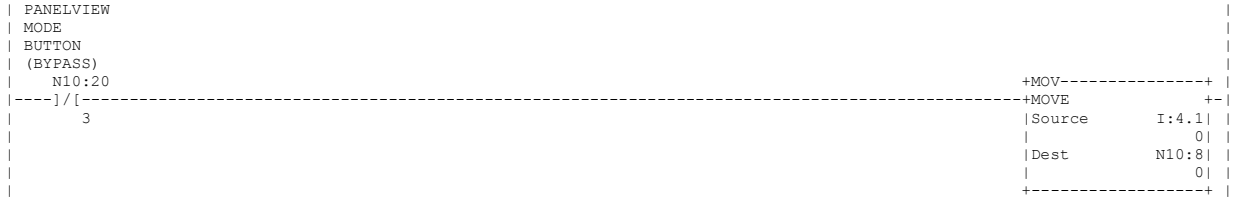
Rung 3:29
TREND HIGH AND LOW ALARM CALCULATION



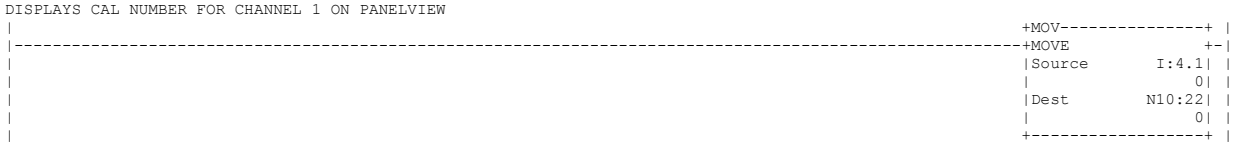
Rung 3:28
TREND HIGH AND LOW ALARM CALCULATION



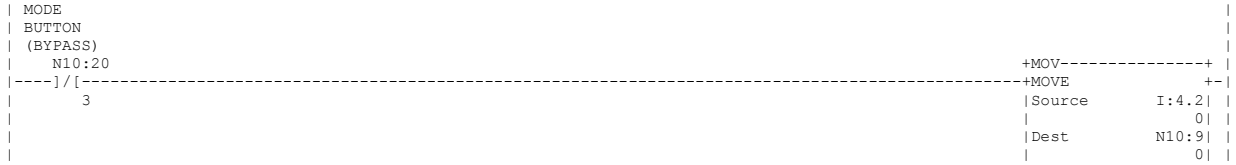
Rung 3:30
DISPLAYS PEAK TONNAGE FOR CHANNEL 1 AS LONG AS MODULE IS NOT IN SETUP MODE

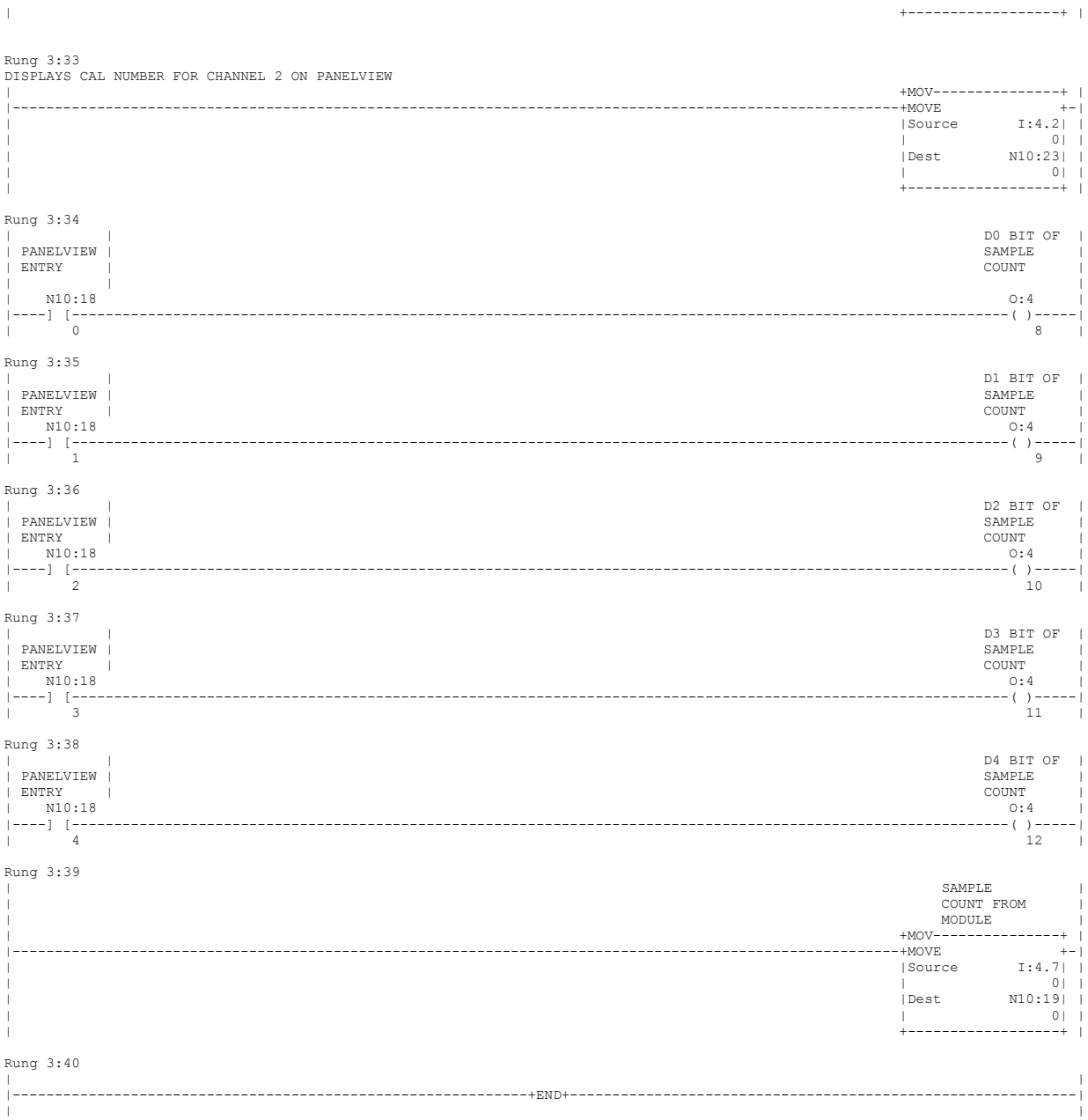


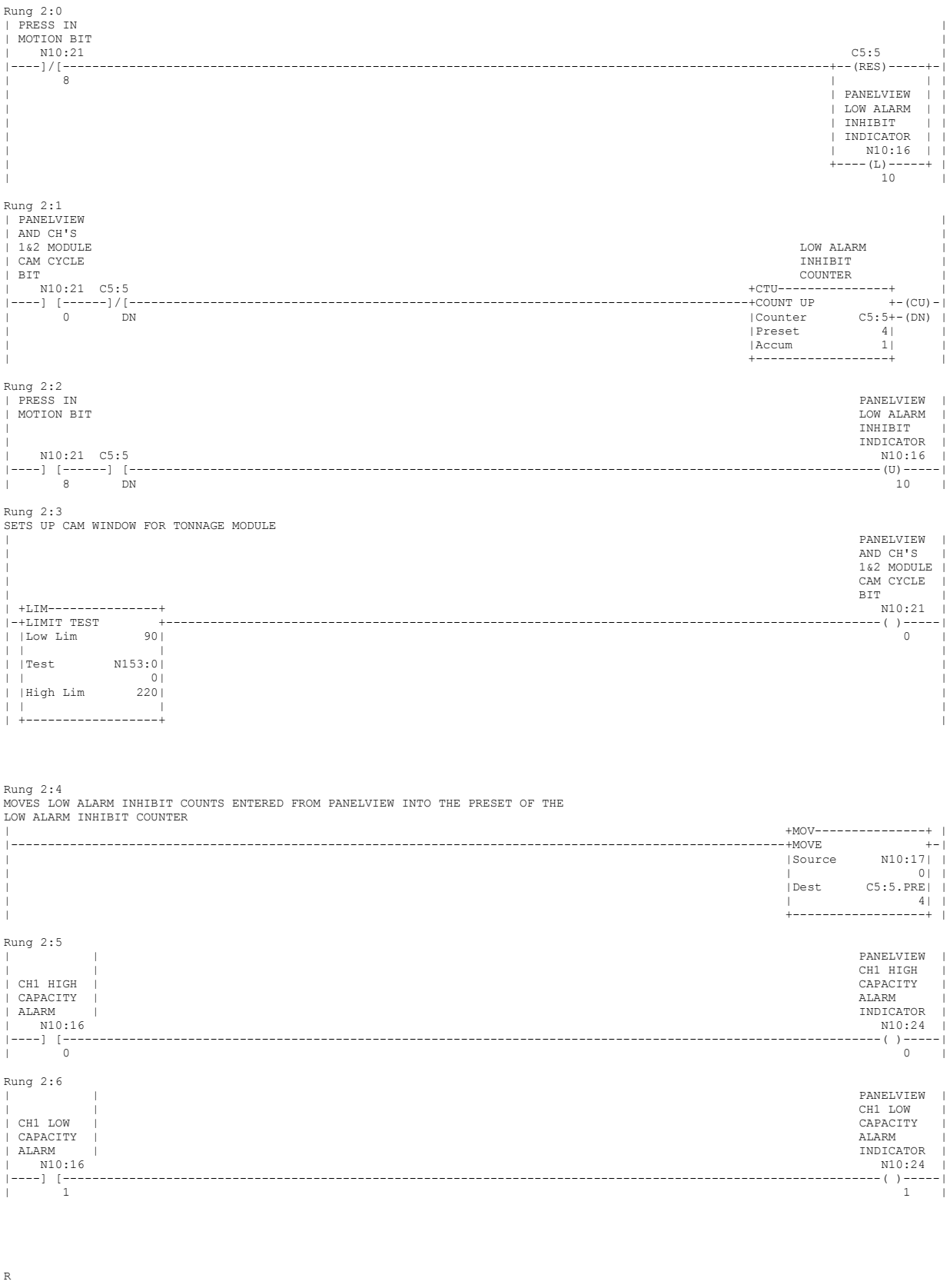
Rung 3:31
DISPLAYS CAL NUMBER FOR CHANNEL 1 ON PANELVIEW



Rung 3:32
DISPLAYS PEAK TONNAGE FOR CHANNEL 2 AS LONG AS MODULE IS NOT IN SETUP MODE

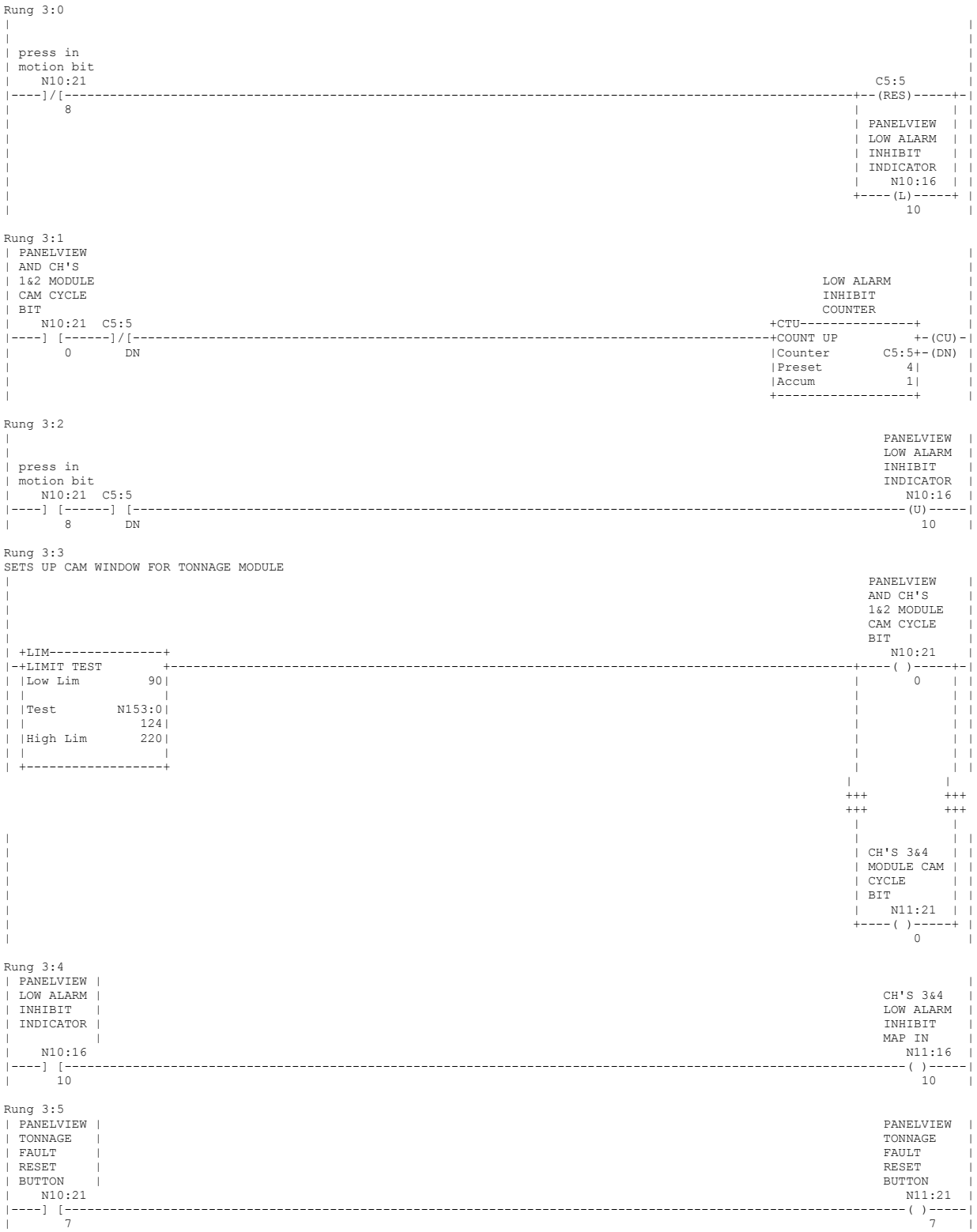



+MOV---------------+
+MOVE   +-
|Source   I:4.2|
| 0|
|Dest   N10:23|
| 0|
+------------------+
Rung 3:33
DISPLAYS CAL NUMBER FOR CHANNEL 2 ON PANELVIEW
Rung 3:34
PANELVIEW ENTRY
N10:18
0
D0 BIT OF SAMPLE COUNT
O:4
8
Rung 3:35
PANELVIEW ENTRY
N10:18
1
D1 BIT OF SAMPLE COUNT
O:4
9
Rung 3:36
PANELVIEW ENTRY
N10:18
2
D2 BIT OF SAMPLE COUNT
O:4
10
Rung 3:37
PANELVIEW ENTRY
N10:18
3
D3 BIT OF SAMPLE COUNT
O:4
11
Rung 3:38
PANELVIEW ENTRY
N10:18
4
D4 BIT OF SAMPLE COUNT
O:4
12
Rung 3:39
SAMPLE COUNT FROM MODULE
+MOV---------------+
+MOVE   +-
|Source   I:4.7|
| 0|
|Dest   N10:19|
| 0|
+------------------+
Rung 3:40
+END+

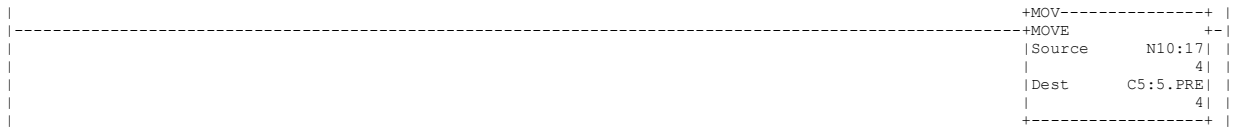

Rung 2:0
PRESS IN
MOTION BIT
N10:21
8
C5:5
RES
PANELVIEW
LOW ALARM
INHIBIT
INDICATOR
N10:16
10
Rung 2:1
PANELVIEW
AND CH'S
1&2 MODULE
CAM CYCLE
BIT
N10:21
C5:5
0
DN
LOW ALARM
INHIBIT
COUNTER
CTU
COUNT UP
CU
Counter
C5:5
DN
Preset
4
Accum
1
Rung 2:2
PRESS IN
MOTION BIT
N10:21
C5:5
8
DN
PANELVIEW
LOW ALARM
INHIBIT
INDICATOR
N10:16
U
10
Rung 2:3
SETS UP CAM WINDOW FOR TONNAGE MODULE
PANELVIEW
AND CH'S
1&2 MODULE
CAM CYCLE
BIT
N10:21
0
LIM
LIMIT TEST
Low Lim
90
Test
N153:0
0
High Lim
220
Rung 2:4
MOVES LOW ALARM INHIBIT COUNTS ENTERED FROM PANELVIEW INTO THE PRESET OF THE
LOW ALARM INHIBIT COUNTER
MOV
MOVE
Source
N10:17
0
Dest
C5:5.PRE
4
Rung 2:5
CH1 HIGH
CAPACITY
ALARM
N10:16
0
PANELVIEW
CH1 HIGH
CAPACITY
ALARM
INDICATOR
N10:24
0
Rung 2:6
CH1 LOW
CAPACITY
ALARM
N10:16
1
PANELVIEW
CH1 LOW
CAPACITY
ALARM
INDICATOR
N10:24
1

R

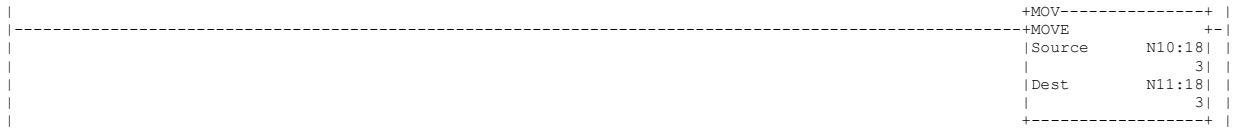

| CAPACITY |
| ALARM |
| N10:16 |
2
ALARM
INDICATOR
N10:24
2
Rung 2:8
PANELVIEW
CH2 LOW
CAPACITY
ALARM
INDICATOR
N10:24
3
Rung 2:9
PANELVIEW
CH1 HIGH
TREND
ALARM
INDICATOR
N10:24
4
Rung 2:10
PANELVIEW
CH1 LOW
TREND
ALARM
INDICATOR
N10:24
5
Rung 2:11
PANELVIEW
CH2 HIGH
TREND
ALARM
INDICATOR
N10:24
6
Rung 2:12
PANELVIEW
CH2 LOW
TREND
ALARM
INDICATOR
N10:24
7
Rung 2:13
CAUSES EITHER E-STOP OR TOP STOP RELAY TO DROP OUT WHEN THERE IS A TONNAGE
FAULT
| CH'S 1&2 |
| MODULE |
| ALARM BIT |
| N10:16 |
E-STOP OR
TOP STOP
RELAY
O:2
11
0
Rung 2:14
END


Rung 3:0
press in
motion bit
N10:21
8
C5:5
RES
PANELVIEW
LOW ALARM
INHIBIT
INDICATOR
N10:16
10
Rung 3:1
PANELVIEW
AND CH'S
1&2 MODULE
CAM CYCLE
BIT
N10:21
C5:5
0
DN
LOW ALARM
INHIBIT
COUNTER
CTU
COUNT UP
Counter
C5:5
Preset
4
Accum
1
CU
DN
Rung 3:2
press in
motion bit
N10:21
C5:5
8
DN
PANELVIEW
LOW ALARM
INHIBIT
INDICATOR
N10:16
U
10
Rung 3:3
SETS UP CAM WINDOW FOR TONNAGE MODULE
LIM
LIMIT TEST
Low Lim
90
Test
N153:0
124
High Lim
220
PANELVIEW
AND CH'S
1&2 MODULE
CAM CYCLE
BIT
N10:21
0
CH'S 3&4
MODULE CAM
CYCLE
BIT
N11:21
0
Rung 3:4
PANELVIEW
LOW ALARM
INHIBIT
INDICATOR
N10:16
10
CH'S 3&4
LOW ALARM
INHIBIT
MAP IN
N11:16
10
Rung 3:5
PANELVIEW
TONNAGE
FAULT
RESET
BUTTON
N10:21
7
PANELVIEW
TONNAGE
FAULT
RESET
BUTTON
N11:21
7

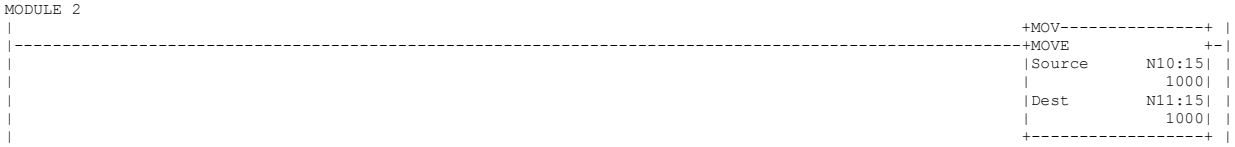
Rung 3:7
MOVES LOW INHIBIT COUNTS THAT IS ENTERED FROM PANELVIEW INTO PRESET OF THE LOW
ALARM INHIBIT COUNTER



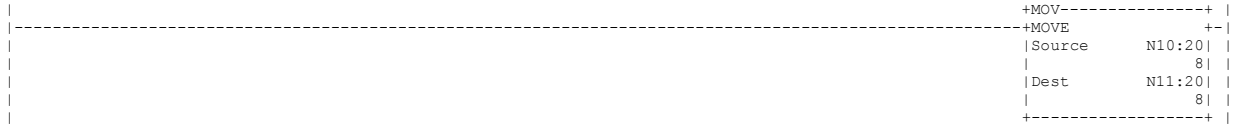
Rung 3:8
COPIES # OF SAMPLES FROM FIRST TONNAGE MODULE INTO THE SECOND TONNAGE MODULE



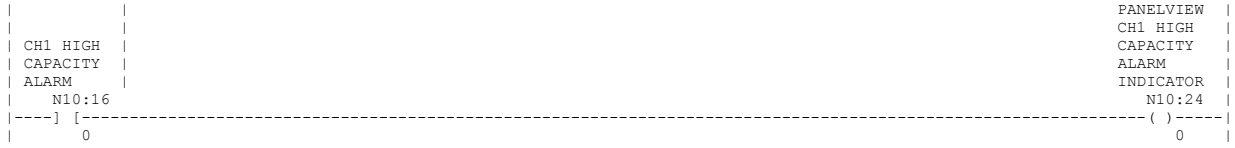
Rung 3:9
COPIES SCALE INFORMATION FROM CH'S 1&2 TONNAGE MODULE 1 INTO CH'S 3&4 TONNAGE
MODULE 2



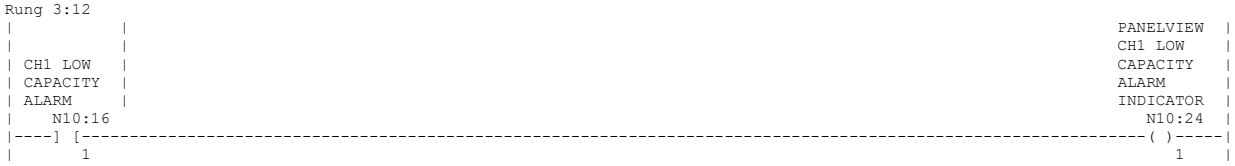
Rung 3:10
COPIES CH'S 1&2 TONNAGE MODULE'S MODE STATUS INTO CH'S 3&4 TONNAGE MODULE



Rung 3:11



Rung 3:12



Rung 3:13

Rung 3:14

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|----] [-------------------------------------
----------------------------------------------------------------------( )-----|
|       3                                                                      3    |

Rung 3:15
|           |                                                                  PANELVIEW  |
|           |                                                                  CH1 HIGH   |
| CH1 HIGH  |                                                                  TREND      |
| TREND     |                                                                  ALARM      |
| ALARM     |                                                                  INDICATOR  |
|    N10:16                                                                     N10:24  |
|----] [-------------------------------------------------------------------------------( )-----|
|       4                                                                          4    |

Rung 3:16
|           |                                                                  PANELVIEW  |
|           |                                                                  CH1 LOW    |
| CH1 LOW   |                                                                  TREND      |
| TREND     |                                                                  ALARM      |
| ALARM     |                                                                  INDICATOR  |
|    N10:16                                                                     N10:24  |
|----] [-------------------------------------------------------------------------------( )-----|
|       5                                                                          5    |

Rung 3:17
|           |                                                                  PANELVIEW  |
|           |                                                                  CH2 HIGH   |
| CH2 HIGH  |                                                                  TREND      |
| TREND     |                                                                  ALARM      |
| ALARM     |                                                                  INDICATOR  |
|    N10:16                                                                     N10:24  |
|----] [-------------------------------------------------------------------------------( )-----|
|       6                                                                          6    |


Rung 3:18
|           |                                                                  PANELVIEW  |
|           |                                                                  CH2 LOW    |
| CH2 LOW   |                                                                  TREND      |
| TREND     |                                                                  ALARM      |
| ALARM     |                                                                  INDICATOR  |
|    N10:16                                                                     N10:24  |
|----] [-------------------------------------------------------------------------------( )-----|
|       7                                                                          7    |

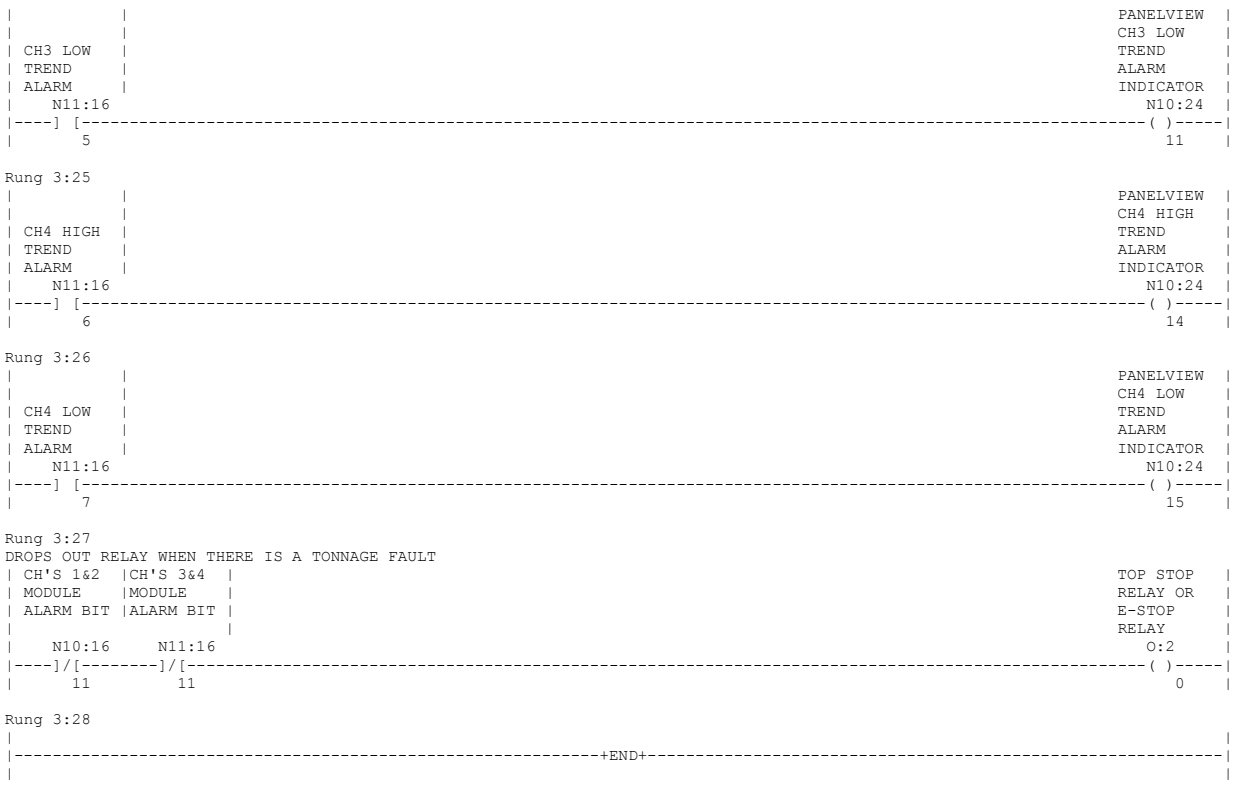
Rung 3:19
|           |                                                                  PANELVIEW  |
|           |                                                                  CH3 HIGH   |
| CH3 HIGH  |                                                                  CAPACITY   |
| CAPACITY  |                                                                  ALARM      |
| ALARM     |                                                                  INDICATOR  |
|    N11:16                                                                     N10:24  |
|----] [-------------------------------------------------------------------------------( )-----|
|       0                                                                          8    |

Rung 3:20
|           |                                                                  PANELVIEW  |
|           |                                                                  CH3 LOW    |
| CH3 LOW   |                                                                  CAPACITY   |
| CAPACITY  |                                                                  ALARM      |
| ALARM     |                                                                  INDICATOR  |
|    N11:16                                                                     N10:24  |
|----] [-------------------------------------------------------------------------------( )-----|
|       1                                                                          9    |

Rung 3:21
|           |                                                                  PANELVIEW  |
|           |                                                                  CH4 HIGH   |
| CH4 HIGH  |                                                                  CAPACITY   |
| CAPACITY  |                                                                  ALARM      |
| ALARM     |                                                                  INDICATOR  |
|    N11:16                                                                     N10:24  |
|----] [-------------------------------------------------------------------------------( )-----|
|       2                                                                         12    |

Rung 3:22
|           |                                                                  PANELVIEW  |
|           |                                                                  CH4 LOW    |
| CH4 LOW   |                                                                  CAPACITY   |
| CAPACITY  |                                                                  ALARM      |
| ALARM     |                                                                  INDICATOR  |
|    N11:16                                                                     N10:24  |
|----] [-------------------------------------------------------------------------------( )-----|
|       3                                                                         13    |


Rung 3:23
|           |                                                                  PANELVIEW  |
|           |                                                                  CH3 HIGH   |
| CH3 HIGH  |                                                                  TREND      |
| TREND     |                                                                  ALARM      |
| ALARM     |                                                                  INDICATOR  |
|    N11:16                                                                     N10:24  |
```


Rung 3:24
CH3 LOW TREND ALARM
N11:16
5
PANELVIEW CH3 LOW TREND ALARM INDICATOR
N10:24
11
Rung 3:25
CH4 HIGH TREND ALARM
N11:16
6
PANELVIEW CH4 HIGH TREND ALARM INDICATOR
N10:24
14
Rung 3:26
CH4 LOW TREND ALARM
N11:16
7
PANELVIEW CH4 LOW TREND ALARM INDICATOR
N10:24
15
Rung 3:27
DROPS OUT RELAY WHEN THERE IS A TONNAGE FAULT
CH'S 1&2 MODULE ALARM BIT
N10:16
11
CH'S 3&4 MODULE ALARM BIT
N11:16
11
TOP STOP RELAY OR E-STOP RELAY
O:2
0
Rung 3:28
END