# ForceGard  Module

## Model HM604E-PLM

*Instruction Manual*

DECEMBER 2000

**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.

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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 to property damage. Identifies information that is especially important for successful application and understanding of the product.

Attentions help you:

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

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

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**Revised 12-00**

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## Preface

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

- who should use this manual
- the purpose of this manual
- terms and abbreviations
- conventions used in this manual
- 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 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 occur while using the load module. |
| A | Specifications | Provides physical, electrical, Environmental, and functional Specifications for the module. |
| B | Ladder Program | |
| C | Panelview Screens | Shows Panelview Screens and explain their various functions. |

## Related Documentation

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

| For | Read this Document | Document Number |
|---|---|---|
| An overview for the SLC 500 family of products | SLC 500 System Overview | 1747-2.30 |
| A description on how to install and use your *Modular* 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 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** - 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.

**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.

**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.

## Terms and Abbreviations (continued)

**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.

## Common Techniques Used in this Manual

The following conventions are used throughout this manual:

- Bulleted lists such as this one provide information, not procedural steps.
- Numbered lists provide sequential steps or hierarchical information.

## 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 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.

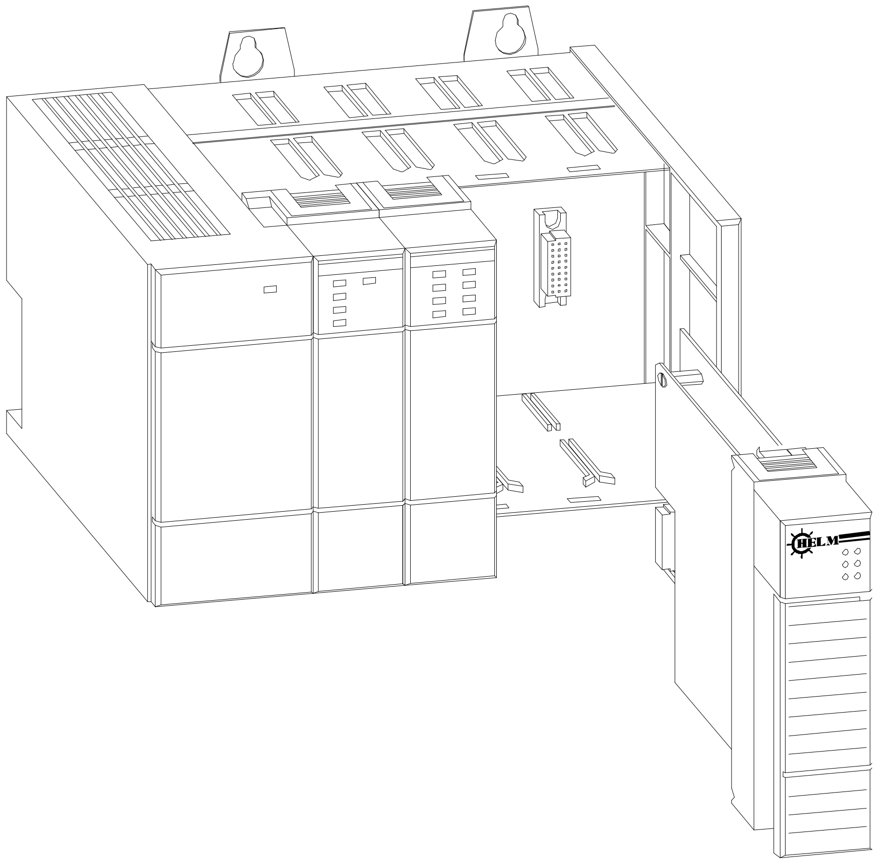
## Strain Gain Transducer Operation

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.




## 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).

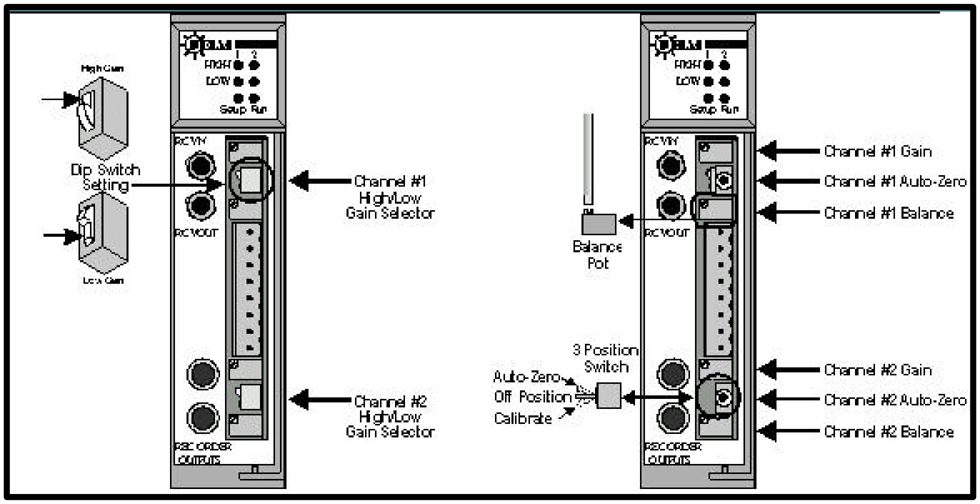
The module can accept input from two sensors. The module has no output channels. Module configuration requires manual and user programmable setup.

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**

## Hardware Features




| | |
|---|---|
| Channel Status Displays | Fault Status - High and Low |
| Door Label | Channel 1-Channel 2 calibrate switch<br>Wiring diagram for (2) sensor inputs |
| Mode Status LED's<br>High/Low LED's | Displays Run Mode<br>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<br>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<br>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. |

## 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 RS Logix 500 Rev. 4.10 for personal computers.)

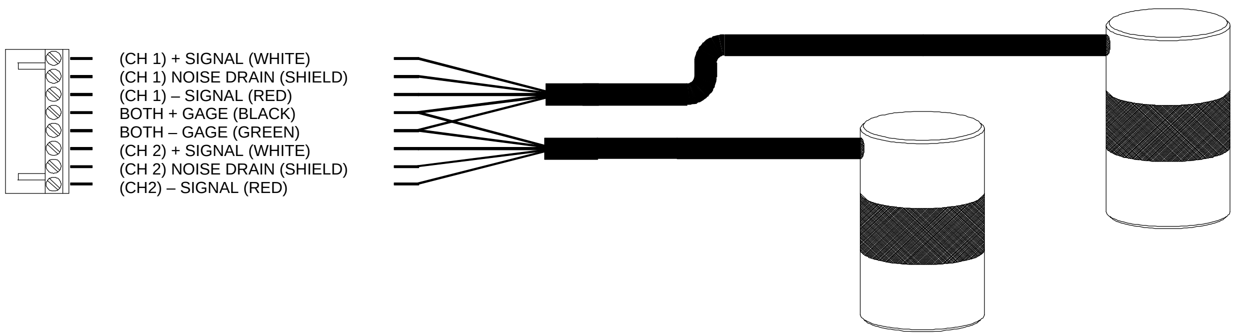
## System Operation

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

Each individual channel on the module can receive input signals from strain gage based sensors. The module converts the analog values directly into digital values.

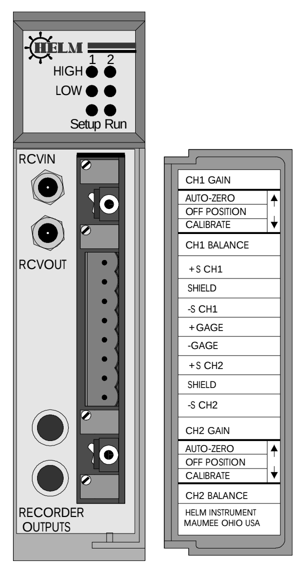
## Sensor Wiring

The module contains an 8-pin orange connector for wiring to the load cells. The pin-out is shown below.




**To ensure proper operation and high immunity to electrical noise, always use Helm strain gage cable.**

**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.

## 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 specialty I/O module residing is a specific slot in the chassis. With RS Logic 500 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)

| | | |
|---|---|---|
| Bit | Look Window Signal CH 1&2 | O:e.0/0 |
| Bit | Bypass Mode CH 1&2 | O:e.0/1 |
| Bit | Peak Mode CH 1&2 | O:e.0/2 |
| Bit | Monitor Parts Mode Bit | O:e.0/3 |
| Bit | Alarm Reset CH 1&2 | O:e.0/4 |
| Bit | Reverse Load CH 1&2 | O:e.0/5 |
| Bit | Low Alarm Inhibit CH 1&2 | O:e.0/6 |
| Bit | Reserved | O:e.0/7 |
| Bit | D0 Bit of Sample Count | O:e.0/8 |
| Bit | D1 Bit of Sample Count | O:e.0/9 |
| Bit | D2 Bit of Sample Count | O:e.0/10 |
| Bit | D3 Bit of Sample Count | O:e.0/11 |
| Bit | D4 Bit of Sample Count | O:e.0/12 |
| Bit | Reserved | O:e.0/13 |
| Bit | Reserved | O:e.0/14 |
| Bit | Reserved | O:e.0/15 |
| Integer | Scale Value | O:e.1 |
| Integer | Capacity Low Alarm Setting Channel 1 | O:e.2 |
| Integer | Capacity High Alarm Setting Channel 1 | O:e.3 |
| Integer | Capacity Low Alarm Setting Channel 2 | O:e.4 |
| Integer | Capacity High Alarm Setting Channel 2 | O:e.5 |
| Integer | Trend High/Low Alarm Setting Channel 1 | O:e.6 |
| Integer | Trend High/Low Alarm Setting Channel 2 | O:e.7 |

**Peak Look Window Bit 0 (O:2/0)**
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:2/)**
When set on (1) module is in calibration mode. Channels are disabled. No alarms are active. Only occurs when in Tonnage Calibration Screen.

**Peak Mode Bit (O:2/2)**
When set on (1) module is in setup (peak only monitoring) mode. Capacity alarms are active.

**Alarm Reset Bit (O:2/4)**
When set on (1) alarm reset occurs. Alarm condition must be cleared.

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

**Low Alarm Inhibit Bit (O:2/6)**
When set on (1) low alarming is disabled for duration. Duration set in ladder counter file.

**Machine Capacity Scale Setting (Integer Word O:2.1)**
Represents the total load rating of each load cell. The Range of the cells being used are 20 Ton. 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.

**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.

**Trend Alarm - Channel 2 High and Low (Integer Word O:e.7)**
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

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

| | | |
|---|---|---|
| Bit | Channel 1 High Capacity Alarm Bit | I:e.0/0 |
| Bit | Channel 1 Low Capacity Alarm Bit | I:e.0/1 |
| Bit | Channel 2 High Capacity Alarm Bit | I:e.0/2 |
| Bit | Channel 2 Low Capacity Alarm Bit | I:e.0/3 |
| Bit | Channel 1 Trend High Alarm Bit | I:e.0/4 |
| Bit | Channel 1 Trend Low Alarm Bit | I:e.0/5 |
| Bit | Channel 2 Trend High Alarm Bit | I:e.0/6 |
| Bit | Channel 2 Trend Low Alarm Bit | I:e.0/7 |
| Bit | Learn Cycle Indicator Bit | I:e.0/9 |
| Integer | Channel 1 Load Value | I:e.1 |
| Integer | Channel 2 Load Value | I:e.2 |
| Integer | Channel 1 Average Sample values in Tons | I:e.3 |
| Integer | Channel 2 Average Sample values in Tons | I:e.4 |
| Integer | Channel 1 Deviation value in Percent | I:e.5 |
| Integer | Channel 2 Deviation value in Percent | I:e.6 |
| Integer | Sample Count | I:e.7 |

**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
Percent 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

**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.**

**Channel 1 Average Sample Value (I:e.3)**
Integer word represents the average of the sample load values on channel 1 in Tons.

**Channel 2 Average Sample Value (I:e.4)**
Integer word represents the average of the sample load values on channel 2 in Tons.

**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 Count.

# Chapter 3

Using RS Logics 500 software, reserve two integer file's for tonnage monitoring. Reserve one counter for tonnage monitoring.

For illustration purposes in this manual, we have reserved Integer file N10:0 - N10:25.

| Data | Description | Address |
|---|---|---|
| Integer | Channel 1 Trend Deviation in percent | N10:1 |
| Integer | Channel 2 Trend Deviation in percent | N10:2 |
| Integer | Channel 1 Low Trend Alarm Setting | N10:3 |
| Integer | Channel 1 High Trend Alarm Setting | N10:4 |
| Integer | Channel 2 Low Trend Alarm Setting | N10:5 |
| Integer | Channel 2 High Trend Alarm Setting | N10:6 |
| Integer | 256 Multiply register | N10:7 |
| Integer | Channel 1 Peak Value in Tons | N10:8 |
| Integer | Channel 2 Peak Value in Tons | N10:9 |
| Integer | Channel 1 High Capacity Alarm Setting | N10:11 |
| Integer | Channel 1 Low Capacity Alarm Setting | N10:12 |
| Integer | Channel 2 High Capacity Alarm Setting | N10:13 |
| Integer | Channel 2 Low Capacity Alarm Setting | N10:14 |
| Integer | Scale | N10:15 |
| Bit | Channel 1 High Capacity Alarm | N10:16/0 |
| Bit | Channel 1 Low Capacity Alarm | N10:16/1 |
| Bit | Channel 2 High Capacity Alarm | N10:16/2 |
| Bit | Channel 2 Low Capacity Alarm | N10:16/3 |
| Bit | Channel 1 High Trend Alarm | N10:16/4 |
| Bit | Channel 1 Low Trend Alarm | N10:16/5 |
| Bit | Channel 2 High Trend Alarm | N10:16/6 |
| Bit | Channel 2 Low Trend Alarm | N10:16/7 |
| Bit | Learn Cycle Bit | N10:16/9 |
| Bit | Low Alarm Inhibit Bit | N10:16/10 |
| Bit | Alarm Indication Bit (Module Alarm Bit) | N10:16/11 |
| Integer | Low Alarm Inhibit Cycle Count | N10:17 |
| Integer | # Samples (set from 1 to 16) | N10:18 |
| Integer | Current Running Sample Counter | N10:19 |
| Integer | Mode Status Value | N10:20 |
| Bit | Cam Cycle Bit | N10:21/0 |
| Bit | Start\Stop Indicator Bit | N10:21/1 |
| Bit | Reverse Load Bit | N10:21/6 |
| Bit | Alarm Reset Bit | N10:21/7 |
| Integer | Channel 1 Calibration Value | N10:22 |
| Integer | Channel 2 Calibration Value | N10:23 |
| Integer | Channel 1 Sample Peak in Tons | N10:24 |
| Integer | Channel 2 Sample Peak in Tons | N10:25 |

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

**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 calibration numbers**
- **set meter scale**
- **set capacity (maximum load) alarms**
- **set minimum load alarms**
- **set sample count**
- **set trend alarms**

Steps 2 and 3 require adjustment to the three position toggle switch on the inside panel of the module.

**Step 1. Set the Run mode bit to Bypass**

⇒ From your operator interface, put the tonnage module into bypass mode. (Both the setup and run lights on the tonnage module should be off.)

```
Rung 3:2
| PANELVIEW |                                                                                     CH'S 1&2   |
| MODE      |                                                                                     MODULE     |
| BUTTON    |                                                                                     BYPASS BIT |
| (BYPASS)  |                                                                                                |
|    N10:20                                                                                         O:4      |
|----] [----------------------------------------------------------------------------------------------( )-----|
|       3                                                                                               1    |
```

NOTE: Make sure that only 1 bit is set at any time for Panel Mode, integer N10:20.

**Step 2. Balance Sensor Input.**

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.

**Step 3. Set Calibration Numbers**

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.**

**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.**

---

**Step 4. 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 N10:14 should be set from your operator interface.

```
Rung 3:21
|                                                                                                          CH'S 1&2        |
|                                                                                                          SCALE INFO      |
|                                                                                                                          |
|                                                                                                     +MOV---------------+ |
|-----------------------------------------------------------------------------------------------------+MOVE             +-|
|                                                                                                     |Source      N10:15| |
|                                                                                                     |                 0| |
|                                                                                                     |Dest         O:4.1| |
|                                                                                                     |                 0| |
|                                                                                                     +------------------+ |
```

**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 |

**Step 5. Set Capacity Alarms**

This value is a discrete load/tonnage value, not a percentage.

NOTE: Although the range of values for capacity alarm settings is 0 to 9999, it is recommended that you do not enter values that exceed the capacity rating of the machine/press. A value of 0 disables capacity alarm set.

To determine the maximum rating for each channel, divide the total machine/press capacity by the number of sensor inputs. EXAMPLE: A press or slide rated at 100 tons with a (2) channel force module would have a capacity alarm setting of 50 tons per sensor input.

This setting differs from the Scale setting as it can be adjusted up or down depending on the nature of the process.

**The recommended maximum value is 195% of Machine Capacity Scale.**

```
Rung 3:23
|                                                                                                         CH1 HIGH          |
|                                                                                                         CAPACITY          |
|                                                                                                         ALARM             |
|                                                                                                         SETTING           |
|                                                                                                    +MOV---------------+   |
|----------------------------------------------------------------------------------------------------+MOVE              +---|
|                                                                                                    |Source      N10:11|   |
|                                                                                                    |                 0|   |
|                                                                                                    |Dest         O:4.3|   |
|                                                                                                    |                 0|   |
|                                                                                                    +------------------+   |
```

**Step 6. Set Minimum Low Alarm**

This value is a discrete load/tonnage value, not a percentage.

The range of this value is 0 to 9999. A value of 0 disables Minimum Low Alarm. Use a value here that represents a minimum load/tonnage that is acceptable for the process.

Use this alarm setting when running in Peak Mode to alarm against low load/tonnage hits.

```
Rung 3:22
|                                                                                                               CH1 LOW         |
|                                                                                                               CAPACITY        |
|                                                                                                               ALARM           |
|                                                                                                               SETTING         |
|                                                                                                          +MOV---------------+ |
|---------------------------------------------------------------------------------------------------------+MOVE              +-|
|                                                                                                          |Source      N10:13| |
|                                                                                                          |                 0| |
|                                                                                                          |Dest         O:4.2| |
|                                                                                                          |                 0| |
|                                                                                                          +------------------+ |
```

**Step 7. 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.

```
Rung 3:34
|           |                                                                                                              D0 BIT OF  |
| PANELVIEW |                                                                                                              SAMPLE     |
| ENTRY     |                                                                                                              COUNT      |
|           |                                                                                                                         |
|    N10:18                                                                                                                O:4    |
|----] [------------------------------------------------------------------------------------------------------------------( )-----|
|       0                                                                                                                     8   |

Rung 3:35
|           |                                                                                                              D1 BIT OF  |
| PANELVIEW |                                                                                                              SAMPLE     |
| ENTRY     |                                                                                                              COUNT      |
|    N10:18                                                                                                                O:4    |
|----] [------------------------------------------------------------------------------------------------------------------( )-----|
|       1                                                                                                                     9   |

Rung 3:36
|           |                                                                                                              D2 BIT OF  |
| PANELVIEW |                                                                                                              SAMPLE     |
| ENTRY     |                                                                                                              COUNT      |
|    N10:18                                                                                                                O:4    |
|----] [------------------------------------------------------------------------------------------------------------------( )-----|
|       2                                                                                                                    10   |

Rung 3:37
|           |                                                                                                              D3 BIT OF  |
| PANELVIEW |                                                                                                              SAMPLE     |
| ENTRY     |                                                                                                              COUNT      |
|    N10:18                                                                                                                O:4    |
|----] [------------------------------------------------------------------------------------------------------------------( )-----|
|       3                                                                                                                    11   |
Rung 3:38
|           |                                                                                                              D4 BIT OF  |
| PANELVIEW |                                                                                                              SAMPLE     |
| ENTRY     |                                                                                                              COUNT      |
|    N10:18                                                                                                                O:4    |
|----] [------------------------------------------------------------------------------------------------------------------( )-----|
|       4                                                                                                                    12   |
```

**Step 8. Set Trend Alarms**

The Trend Alarm settings are established as a percentage of allowable change in load. These percentages are applied to the sample load values. There is a High Trend Alarm set and a Low Trend Alarm set for each channel. The limits can range from 0 to 99%. A setting of 0 disables the alarm.

These alarms are active when the Monitor Parts Mode bit is ON. When monitor parts mode is enabled, the sample process takes place.

Example: Monitor Parts mode is enabled with a sample count of 4 and high and low Trend Alarms set at 10%. The load generated on the next 4 machine cycles is averaged to obtain the sample value for each channel. A sample of 30 tons is calculated for channel 1 and a sample of 40 tons is calculated for channel 2.

If any succeeding machine stroke develops tonnage of 33 (10% of 30 = 3 tons) or higher on channel 1 the High Trend Alarm is reached and the alarm bit is turned ON. If tonnage falls to 27, the Low Trend Alarm set is reached and the alarm bit is turned ON.

You have completed the basic setup and the module is operational.

# Additional Application Notes

## Mode Status

The three modes are Bypass, Peak, Monitor Parts

## Bypass Mode

Used for module setup and at the time of calibration. All alarms are disabled in bypass mode.

```
Rung 3:2
| PANELVIEW |                                                                                                        CH'S 1&2   |
| MODE      |                                                                                                        MODULE     |
| BUTTON    |                                                                                                        BYPASS BIT |
| (BYPASS)  |                                                                                                                   |
|    N10:20                                                                                                           O:4       |
|----] [--------------------------------------------------------------------------------------------------------------( )-----|
|       3                                                                                                                1    |
```

## Peak Mode

In Peak Mode operation, the high capacity alarms and the low minimum alarms are active. There is no sample calculation and high and low Trend alarms are inactive. This mode is used primarily during machine setup operations.

```
Rung 3:3
| PANELVIEW |                                                                                                        CH'S 1&2   |
| MODE      |                                                                                                        MODULE     |
| BUTTON    |                                                                                                        PEAK MODE  |
| (PEAK)    |                                                                                                        BIT        |
|    N10:20                                                                                                           O:4       |
|----] [--------------------------------------------------------------------------------------------------------------( )-----|
|       4                                                                                                                2    |
```

## Monitor Parts Mode

When Monitor Parts Mode bit is turned ON, the sample is calculated based on the number of sample counts and the high and low Trend alarms are activated. The High Capacity and Low Minimum Alarms remain active.

```
Rung 3:4
| PANELVIEW |                                                                                                                   |
| MODE      |                                                                                                        CH'S 1&2   |
| BUTTON    |                                                                                                        MODULE     |
| (MONITOR  |                                                                                                        MONITOR    |
| PARTS)    |                                                                                                        PARTS BIT  |
|    N10:20                                                                                                           O:4       |
|----] [--------------------------------------------------------------------------------------------------------------( )-----|
|       5                                                                                                                3    |
```

The panel function switch in these 3 rungs need to be a button on your operator interface (multistate pushbutton with 3 states) that writes 3 different values to tag N7:6

1st state - 8 bypass
2nd state - 16 peak
3rd state - 32 monitor parts

**Alarm Bits - 9 bits used to determine which alarm condition is detected.**

**High Capacity and Low Capacity Alarm bits - Channel 1 & Channel 2**

```
Rung 3:8
|                                                                                                                               |
|                                                                                                                               |
| CH1 HIGH                                                                                                           CH1 HIGH   |
| CAPACITY                                                                                                           CAPACITY   |
| ALARM BIT                                                                                                          ALARM      |
|    I:4                                                                                                                N10:16  |
|----] [--------------------------------------------------------------------------------------------------------+----(L)-----+-|
|       0                                                                                                        |      0     | |
|                                                                                                                | CH'S 1&2   | |
|                                                                                                                | MODULE     | |
|                                                                                                                | ALARM BIT  | |
|                                                                                                                |    N10:16  | |
|                                                                                                                +----(L)-----+ |
|                                                                                                                      11       |

Rung 3:9
|                                                                                                                               |
|                                                                                                                               |
| CH1 LOW                                                                                                            CH1 LOW    |
| CAPACITY                                                                                                           CAPACITY   |
| ALARM BIT                                                                                                          ALARM      |
|    I:4                                                                                                                N10:16  |
|----] [--------------------------------------------------------------------------------------------------------+----(L)-----+-|
|       1                                                                                                        |      1     | |
                                                                                                                 |            |
                                                                                                               +++          +++
                                                                                                               +++          +++
                                                                                                                 |            |
|                                                                                                                | CH'S 1&2   | |
|                                                                                                                | MODULE     | |
|                                                                                                                | ALARM BIT  | |
|                                                                                                                |    N10:16  | |
|                                                                                                                +----(L)-----+ |
|                                                                                                                     11        |

Rung 3:10
|                                                                                                                               |
|                                                                                                                               |
| CH2 HIGH                                                                                                           CH2 HIGH   |
| CAPACITY                                                                                                           CAPACITY   |
| ALARM BIT                                                                                                          ALARM      |
|    I:4                                                                                                                N10:16  |
|----] [--------------------------------------------------------------------------------------------------------+----(L)-----+-|
|       2                                                                                                        |      2     | |
|                                                                                                                | CH'S 1&2   | |
|                                                                                                                | MODULE     | |
|                                                                                                                | ALARM BIT  | |
|                                                                                                                |    N10:16  | |
|                                                                                                                +----(L)-----+ |
|                                                                                                                      11       |

Rung 3:11
|                                                                                                                               |
|                                                                                                                               |
| CH2 LOW                                                                                                            CH2 LOW    |
| CAPACITY                                                                                                           CAPACITY   |
| ALARM BIT                                                                                                          ALARM      |
|    I:4                                                                                                                N10:16  |
|----] [--------------------------------------------------------------------------------------------------------+----(L)-----+-|
|       3                                                                                                        |      3     | |
|                                                                                                                | CH'S 1&2   | |
|                                                                                                                | MODULE     | |
|                                                                                                                | ALARM BIT  | |
|                                                                                                                |    N10:16  | |
|                                                                                                                +----(L)-----+ |
|                                                                                                                      11       |
```

## Trend High and Low Alarm bits

```
Rung 3:12
|                                                                                                                             |
|                                                                                                                             |
| CH1 HIGH                                                                                                  CH1 HIGH          |
| TREND                                                                                                     TREND             |
| ALARM BIT                                                                                                 ALARM             |
|    I:4                                                                                                       N10:16         |
|----] [--------------------------------------------------------------------------------------------------+----(L)-----+-|
|       4                                                                                                |       4     | |
|                                                                                                        | CH'S 1&2    | |
|                                                                                                        | MODULE      | |
|                                                                                                        | ALARM BIT   | |
|                                                                                                        |    N10:16   | |
|                                                                                                        +----(L)-----+ |
|                                                                                                              11        |
```

```
Rung 3:13
|                                                                                                                             |
|                                                                                                                             |
| CH1 LOW                                                                                                   CH1 LOW           |
| TREND                                                                                                     TREND             |
| ALARM BIT                                                                                                 ALARM             |
|    I:4                                                                                                       N10:16         |
|----] [--------------------------------------------------------------------------------------------------+----(L)-----+-|
|       5                                                                                                |       5     | |
|                                                                                                        | CH'S 1&2    | |
|                                                                                                        | MODULE      | |
|                                                                                                        | ALARM BIT   | |
|                                                                                                        |    N10:16   | |
|                                                                                                        +----(L)-----+ |
|                                                                                                              11        |
```

```
Rung 3:14
|                                                                                                                             |
|                                                                                                                             |
| CH2 HIGH                                                                                                  CH2 HIGH          |
| TREND                                                                                                     TREND             |
| ALARM BIT                                                                                                 ALARM             |
|    I:4                                                                                                       N10:16         |
|----] [--------------------------------------------------------------------------------------------------+----(L)-----+-|
|       6                                                                                                |       6     | |
|                                                                                                        | CH'S 1&2    | |
|                                                                                                        | MODULE      | |
|                                                                                                        | ALARM BIT   | |
|                                                                                                        |    N10:16   | |
|                                                                                                        +----(L)-----+ |
|                                                                                                              11        |
```

```
Rung 3:15
|                                                                                                                             |
|                                                                                                                             |
| CH2 LOW                                                                                                   CH2 LOW           |
| TREND                                                                                                     TREND             |
| ALARM BIT                                                                                                 ALARM             |
|    I:4                                                                                                       N10:16         |
|----] [--------------------------------------------------------------------------------------------------+----(L)-----+-|
|       7                                                                                                |       7     | |
|                                                                                                        | CH'S 1&2    | |
|                                                                                                        | MODULE      | |
|                                                                                                        | ALARM BIT   | |
|                                                                                                        |    N10:16   | |
|                                                                                                        +----(L)-----+ |
|                                                                                                              11        |
```

## Machine / Top Stop bit

```
Rung 2:13
CAUSES EITHER E-STOP OR TOP STOP RELAY TO DROP OUT WHEN THERE IS A TONNAGE
FAULT
| CH'S 1&2  |                                                                                                         E-STOP OR  |
| MODULE    |                                                                                                         TOP STOP   |
| ALARM BIT |                                                                                                         RELAY      |
|    N10:16                                                                                                             O:2    |
|----]/[--------------------------------------------------------------------------------------------------------------( )-----|
|       11                                                                                                               0     |
```

**NOTE:** Customer mapped in output module.

## Low Alarm Inhibit

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.

```
Rung 3:0
| PANELVIEW |                                                                                                      CH'S 1&2   |
| LOW ALARM |                                                                                                      MODULE     |
| INHIBIT   |                                                                                                      LOW        |
| INDICATOR |                                                                                                      INHIBIT    |
|           |                                                                                                      ALARM      |
|    N10:16                                                                                                         O:4     |
|----] [---------------------------------------------------------------------------------------------------------( )-----|
|       10                                                                                                           6    |
```

```
Rung 2:0
| PRESS IN                                                                                                                |
| MOTION BIT                                                                                                              |
|    N10:21                                                                                                  C5:5         |
|----]/[--------------------------------------------------------------------------------------------------+--(RES)-----+-|
|       8                                                                                                 |            | |
|                                                                                                         | PANELVIEW  | |
|                                                                                                         | LOW ALARM  | |
|                                                                                                         | INHIBIT    | |
|                                                                                                         | INDICATOR  | |
|                                                                                                         |    N10:16  | |
|                                                                                                         +----(L)-----+ |
|                                                                                                               10        |
```

**NOTE:** Use N10:21/8 when using Helm’s resolver module and Helm’s press in motion ladder logic or use customer’s own press in motion bit.

```
Rung 2:1
| PANELVIEW                                                                                                               |
| AND CH'S                                                                                                                |
| 1&2 MODULE                                                                                         LOW ALARM            |
| CAM CYCLE                                                                                          INHIBIT              |
| BIT                                                                                                COUNTER              |
|    N10:21  C5:5                                                                              +CTU---------------+       |
|----] [------]/[------------------------------------------------------------------------------+COUNT UP          +-(CU)-|
|       8       DN                                                                              |Counter       C5:5+-(DN) |
|                                                                                               |Preset           4|       |
|                                                                                               |Accum            1|       |
|                                                                                               +------------------+       |
```

```
Rung 2:2
| PRESS IN                                                                                                   PANELVIEW  |
| MOTION BIT                                                                                                 LOW ALARM  |
|                                                                                                            INHIBIT    |
|                                                                                                            INDICATOR  |
|    N10:21  C5:5                                                                                              N10:16  |
|----] [------] [----------------------------------------------------------------------------------------------(U)-----|
|       8       DN                                                                                               10     |
```

```
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| |
|                                                                                                      +------------------+ |
```

**Peak Look Window**

The following example details the peak look window requirement.

```
Rung 2:3
SETS UP CAM WINDOW FOR TONNAGE MODULE
|                                                                                                                      PANELVIEW  |
|                                                                                                                      AND CH'S   |
|                                                                                                                      1&2 MODULE |
|                                                                                                                      CAM CYCLE  |
|                                                                                                                      BIT        |
| +LIM---------------+                                                                                                    N10:21  |
|-+LIMIT TEST        +-----------------------------------------------------------------------------------------------( )-----|
| |Low Lim         90|                                                                                                      0     |
| |                  |                                                                                                            |
| |Test        N153:0|                                                                                                            |
| |                 0|                                                                                                            |
| |High Lim       220|                                                                                                            |
| |                  |                                                                                                            |
| +------------------+                                                                                                            |
```

- OR –

```
Rung 2:7
|           |                                                                |
| prox probe|                                                                |
| or rotary |                                                   ch's 1&2     |
| cam input |                                                   cam bit      |
|    I:4                                                           N10:21    |
|----] [-------------------------------------------------------------( )-----|
|      0                                                             0       |
```

**Note:** Customer mapped in input.

Input for the Look Window can be obtained from a rotary cam limit switch, proximity probe or position resolver.

**N10:21/1** Indicates the machine stop and start status on the Panel.
This bit is set to 1 (ON) when a module alarm occurs.

**N10:21/0** Set bit to 1 (ON) during peak window time, clear at other times.

**Chapter 5**

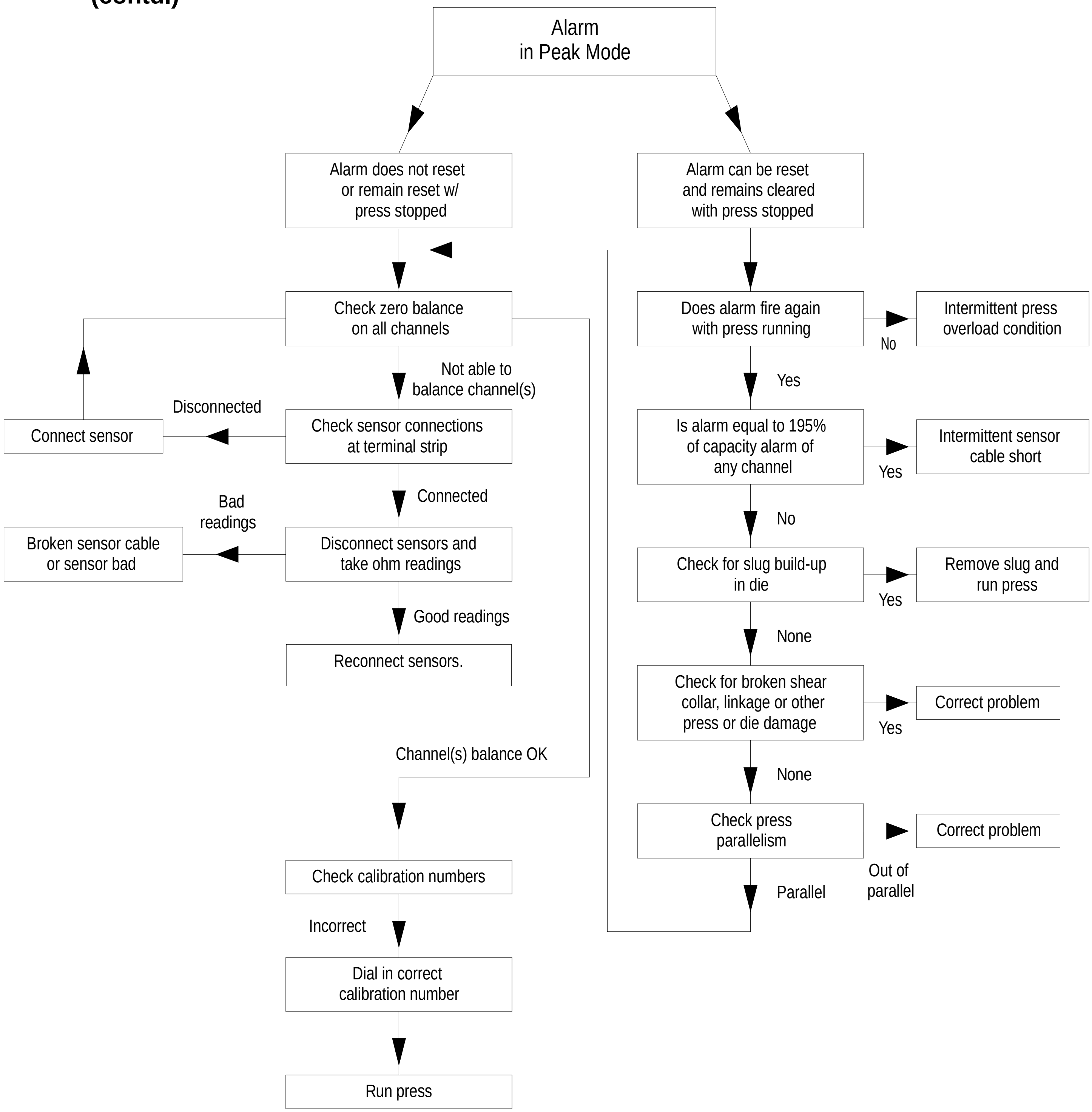
# System Trouble-shooting Guide

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

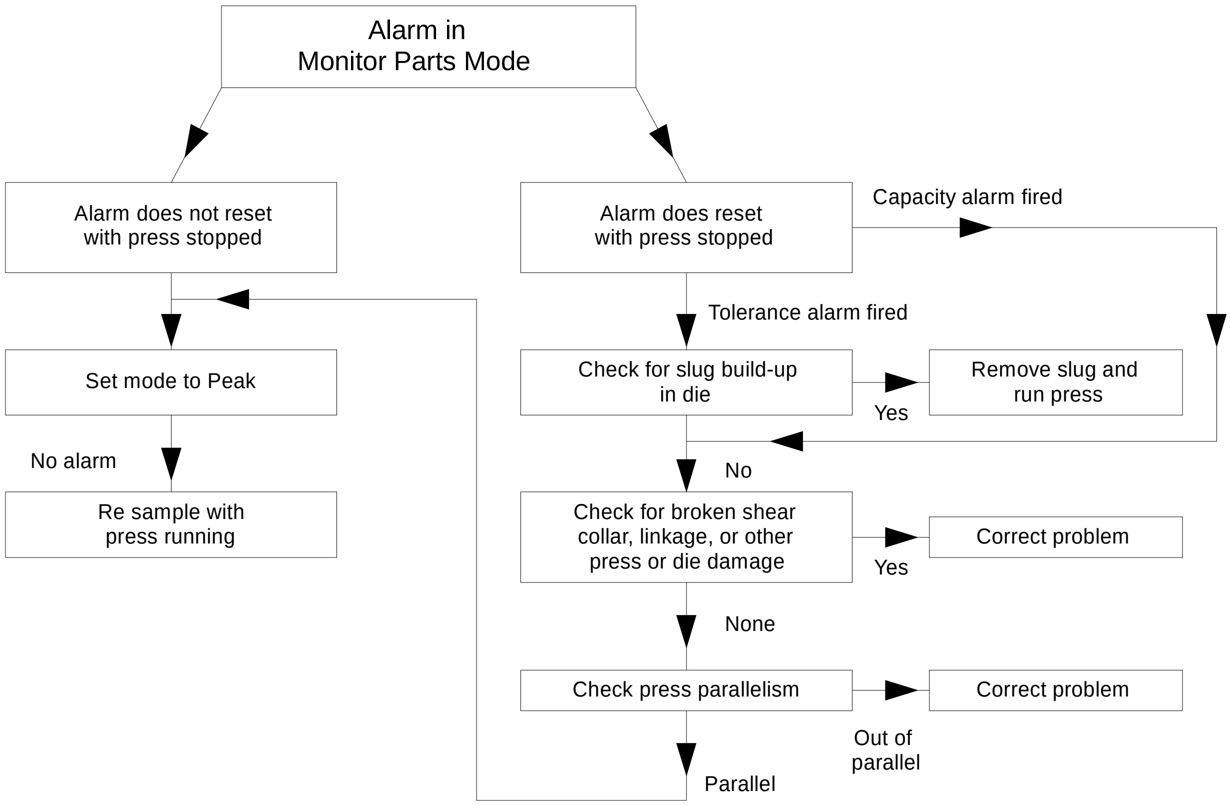
**<u>HT-400 Sensor Ohm Readings</u>**

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

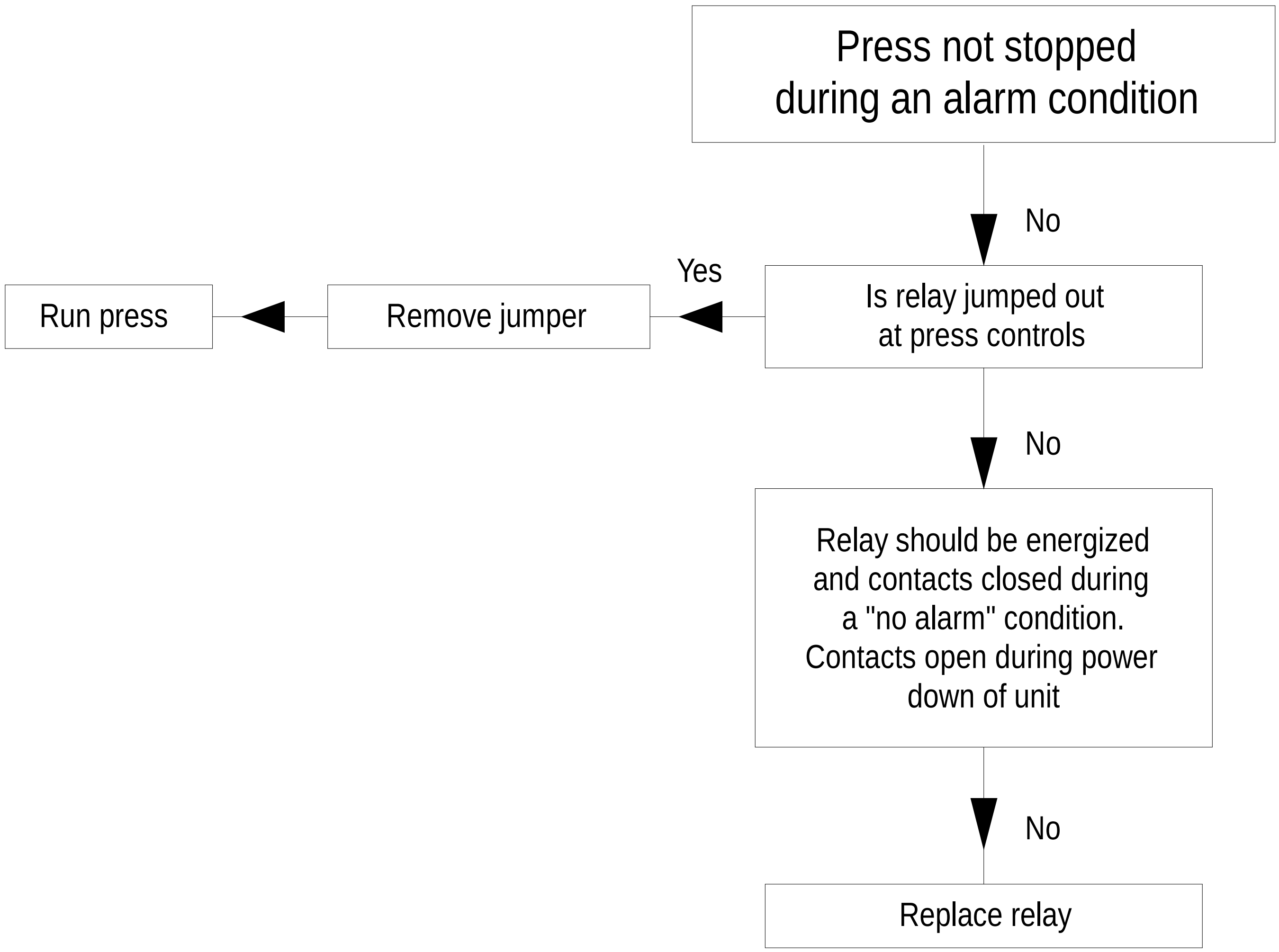
## System Trouble-shooting Guide (contd.)



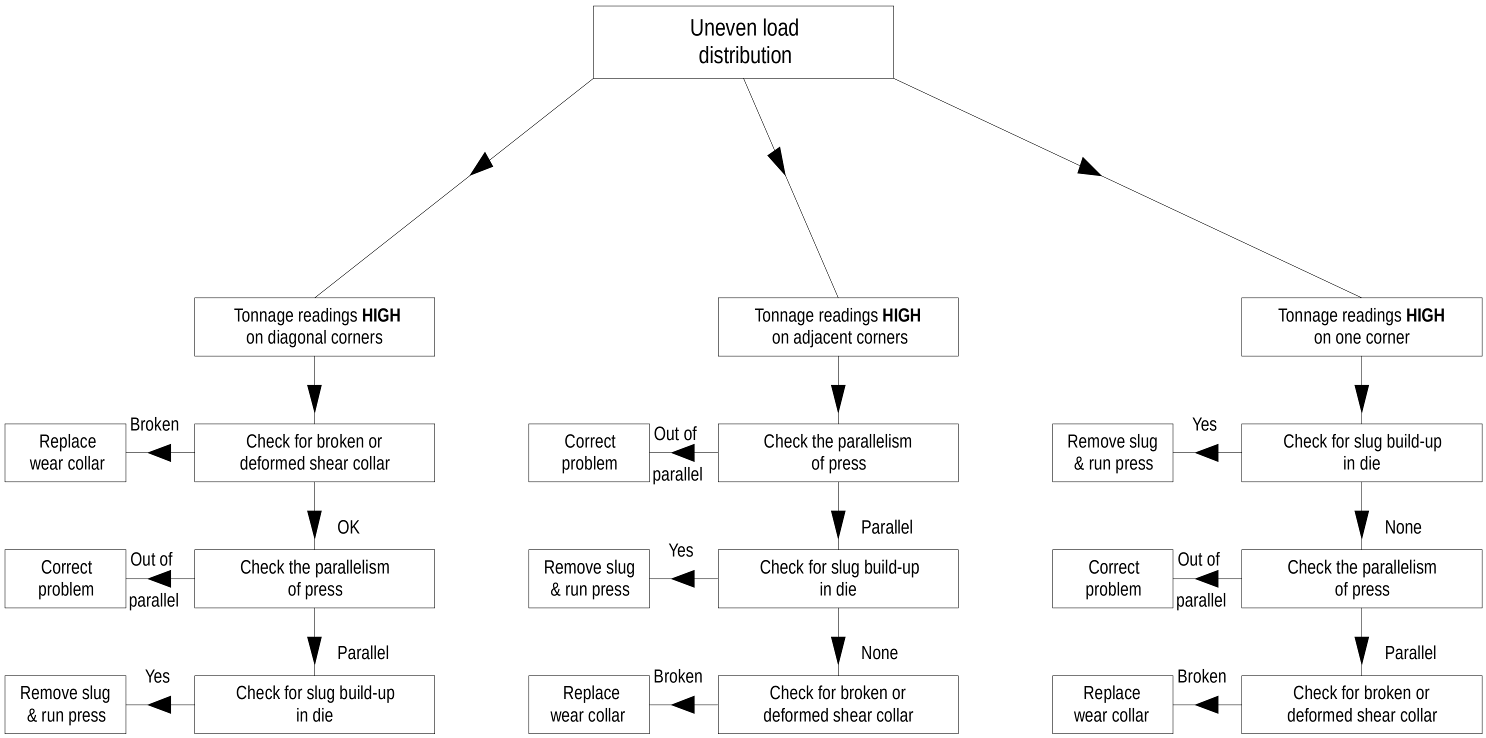
# System Trouble-shooting Guide (contd.)



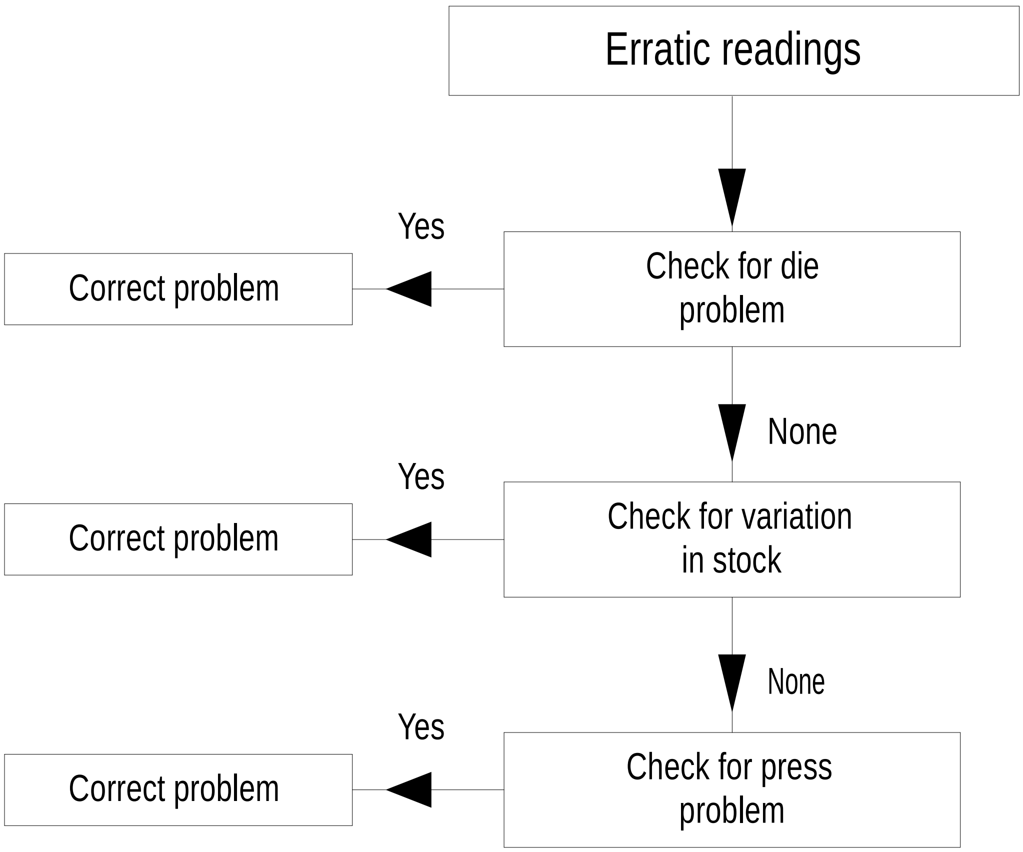
**System Trouble-shooting Guide (contd.)**



# System Trouble-shooting Guide (contd.)



**System Trouble-shooting Guide (contd.)**



**Electrical Specifications:**

| | |
|---|---|
| **Backplane Current Consumption** | |
| **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 |

**cal fications:**

| | |
|---|---|
| **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 |

**onmental fications:**

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

**fications:**

| | |
|---|---|
| **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 |

**Page A-1**
**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 mod

## 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:

```
Rung 2:0
| helm's    |                                                       press in   |
| press in  |                                                       motion bit |
| motion bit|                                                                  |
|   N12:0                                                             N10:21    |
|----] [--------------------------------------------------------------( )-----|
|       4                                                                0    |
```

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

```
Rung 2:1
| customer  |                                                       press in   |
| press in  |                                                       motion bit |
| motion bit|                                                                  |
|     N7:0                                                            N10:21  |
|----] [--------------------------------------------------------------( )-----|
|       0                                                                0    |
```

2.) Resolver or a rotary cam or prox probe

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

```
Rung 2:3
SETS UP CAM WINDOW FOR TONNAGE MODULE
|                                                                                                                   PANELVIEW  |
|                                                                                                                   AND CH'S   |
|                                                                                                                   1&2 MODULE |
|                                                                                                                   CAM CYCLE  |
|                                                                                                                   BIT        |
| +LIM---------------+                                                                                                 N10:21  |
|-+LIMIT TEST        +-------------------------------------------------------------------------------------------------( )-----|
| |Low Lim        600|                                                                                                    0    |
| |                  |                                                                                                         |
| |Test        N153:0|                                                                                                         |
| |                 0|                                                                                                         |
| |High Lim      2830|                                                                                                         |
| |                  |              Note : Centers Signature in look window.                                                  |
| +------------------+                                                                                                         |
```

**b.) If using rotary cam or prox probe and it' a:**
**1.) 2 CH system, modify rung 2:3 (Appendix B, Section 2).**

```
Rung 2:7
|           |                                                          |
| prox probe|                                                          |
| or rotary |                                            ch's 1&2      |
| cam input |                                            cam bit       |
|    I:4                                                    N10:21     |
|----] [-------------------------------------------------------( )-----|
|       0                                                      0       |
```

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

```
Rung 2:4
|                                                                      |
| prox probe                                                           |
| or rotary                                                ch's 1&2    |
| cam input                                                cam bit     |
|    I:4                                                      N10:21   |
|----] [---------------------------------------------------+----( )-----+-|
|       0                                                  |       0    | |
|                                                          |            | |
|                                                          |            | |
|                                                          | ch's 3&4   | |
|                                                          | cam bit    | |
|                                                          |    N11:21  | |
|                                                          +----( )-----+ |
|                                                                  0      |
```

## 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.**

```
Rung 2:5
| ch's 1&2  |                                                  top stop   |
| module    |                                                  or e-stop  |
| alarm bit |                                                  relay      |
|    N10:16                                                       O:7     |
|----]/[--------------------------------------------------------( )-----|
|       11                                                         0    |
```

```
NOTE:  Whenever output module is located.
```

**b.) 4 CH system, modify rung 3:27 (Appendix B, Section 3).**

```
Rung 2:6
| ch's 1&2  |ch's 3&4  |                                         top stop   |
| module    |module    |                                         or e-stop  |
| alarm bit |alarm bit |                                         relay      |
|    N10:16     N11:16                                              O:7     |
|----]/[--------]/[---------------------------------------------( )-----|
|      11         11                                               0    |
```

```
NOTE:  Wherever output module is located.
```

```
Rung 2:0
| PRESS IN                                                                                                                    |
| MOTION BIT                                                                                                                  |
|    N10:21                                                                                                   C5:5            |
|----]/[----------------------------------------------------------------------------------------------------+--(RES)-----+-|
|       0                                                                                                    |            | |
|                                                                                                            | PANELVIEW  | |
|                                                                                                            | LOW ALARM  | |
|                                                                                                            | INHIBIT    | |
|                                                                                                            | INDICATOR  | |
|                                                                                                            |    N10:16  | |
|                                                                                                            +----(L)-----+ |
|                                                                                                                  10       |
Rung 2:1
| PANELVIEW                                                                                                                   |
| AND CH'S                                                                                                                    |
| 1&2 MODULE                                                                                       LOW ALARM                  |
| CAM CYCLE                                                                                        INHIBIT                    |
| BIT                                                                                              COUNTER                    |
|    N10:21  C5:5                                                                           +CTU---------------+              |
|----] [------]/[---------------------------------------------------------------------------+COUNT UP          +-(CU)-|
|       0       DN                                                                           |Counter       C5:5+-(DN) |
|                                                                                           |Preset           4|       |
|                                                                                           |Accum            1|       |
|                                                                                           +------------------+       |

Rung 2:2
| PRESS IN                                                                                                   PANELVIEW  |
| MOTION BIT                                                                                                 LOW ALARM  |
|                                                                                                            INHIBIT    |
|                                                                                                            INDICATOR  |
|    N10:21   C5:5                                                                                              N10:10 |
|----] [------] [-----------------------------------------------------------------------------------------------(U)-----|
|       0       DN                                                                                                10    |

Rung 2:3
SETS UP CAM WINDOW FOR TONNAGE MODULE
|                                                                                                            PANELVIEW  |
|                                                                                                            AND CH'S   |
|                                                                                                            1&2 MODULE |
|                                                                                                            CAM CYCLE  |
|                                                                                                            BIT        |
| +LIM---------------+                                                                                         N10:21  |
|-+LIMIT TEST        +-----------------------------------------------------------------------------------------( )-----|
| |Low Lim        600|                                                                                            0    |
| |                  |                                                                                                 |
| |Test        N153:0|                                                                                                 |
| |                 0|     NOTE: CENTERS SIGNITURE IN LOOKWINDOW                                                       |
| |                  |                                                                                                 |
| |High Lim      2830|                                                                                                 |
| |                  |                                                                                                 |
| +------------------+                                                                                                 |

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 2:13
CAUSES EITHER E-STOP OR TOP STOP RELAY TO DROP OUT WHEN THERE IS A TONNAGE
FAULT
| CH'S 1&2  |                                                                                                E-STOP OR  |
| MODULE    |                                                                                                TOP STOP   |
| ALARM BIT |                                                                                                RELAY      |
|    N10:16                                                                                                     O:7     |
|----]/[--------------------------------------------------------------------------------------------------------( )-----|
|       11                                                                                                         0    |

Rung 2:14
|                                                                                                                       |
|--------------------------------------------------------------+END+----------------------------------------------------------|
|                                                                                                                       |
```

```
Rung 3:0
|                                                                                                                             |
|                                                                                                                             |
| press in                                                                                                                    |
| motion bit                                                                                                                  |
|    N10:21                                                                                                         C5:5        |
|----]/[-------------------------------------------------------------------------------------------------------+--(RES)-----+-|
|       0                                                                                                      |            | |
|                                                                                                              | PANELVIEW  | |
|                                                                                                              | LOW ALARM  | |
|                                                                                                              | INHIBIT    | |
|                                                                                                              | INDICATOR  | |
|                                                                                                              |    N10:16  | |
|                                                                                                              +----(L)-----+ |
|                                                                                                                      10     |

Rung 3:1
| PANELVIEW                                                                                                                   |
| AND CH'S                                                                                                                    |
| 1&2 MODULE                                                                                               LOW ALARM          |
| CAM CYCLE                                                                                                INHIBIT            |
| BIT                                                                                                      COUNTER            |
|    N10:21  C5:5                                                                                   +CTU---------------+      |
|----] [------]/[-----------------------------------------------------------------------------------+COUNT UP          +-(CU)-|
|       0       DN                                                                                  |Counter       C5:5+-(DN) |
|                                                                                                   |Preset           4|      |
|                                                                                                   |Accum            1|      |
|                                                                                                   +------------------+      |

Rung 3:2
|                                                                                                                  PANELVIEW  |
|                                                                                                                  LOW ALARM  |
| press in                                                                                                         INHIBIT    |
| motion bit                                                                                                       INDICATOR  |
|    N10:21   C5:5                                                                                                     N10:16 |
|----] [------] [-----------------------------------------------------------------------------------------------------(U)-----|
|       0       DN                                                                                                       10   |

Rung 3:3
SETS UP CAM WINDOW FOR TONNAGE MODULE
|                                                                                                                PANELVIEW    |
|                                                                                                                AND CH'S     |
|                                                                                                                1&2 MODULE   |
|                                                                                                                CAM CYCLE    |
|                                                                                                                BIT          |
| +LIM---------------+                                                                                             N10:21    |
|-+LIMIT TEST        +-----------------------------------------------------------------------------------------+----( )-----+-|
| |Low Lim        600|                                                                                         |       0    | |
| |                  |                                                                                         |            | |
| |Test        N153:0|                                                                                         |            | |
| |               124|                                                                                         |            | |
| |High Lim      2830|   NOTE: CENTERS SIGNITURE IN LOOKWINDOW                                                 |            | |
| |                  |                                                                                         |            | |
| +------------------+                                                                                         |            | |
|                                                                                                              |            | |
|                                                                                                              |            | |
|                                                                                                              |            | |
|                                                                                                              | CH'S 3&4   | |
|                                                                                                              | MODULE CAM | |
|                                                                                                              | CYCLE      | |
|                                                                                                              | BIT        | |
|                                                                                                              |    N11:21  | |
|                                                                                                              +----( )-----+ |
|                                                                                                                      0      |

Rung 3:4
| PANELVIEW |                                                                                                                 |
| LOW ALARM |                                                                                                      CH'S 3&4   |
| INHIBIT   |                                                                                                      LOW ALARM  |
| INDICATOR |                                                                                                      INHIBIT    |
|           |                                                                                                      MAP IN     |
|    N10:16                                                                                                            O:2    |
|----] [--------------------------------------------------------------------------------------------------------------( )-----|
|       10                                                                                                               4    |
```

```
Rung 3:7
MOVES LOW INHIBIT COUNTS THAT IS ENTERED FROM PANELVIEW INTO PRESET OF THE LOW
ALARM INHIBIT COUNTER
|                                                                                                             +MOV---------------+ |
|-------------------------------------------------------------------------------------------------------------+MOVE              +-|
|                                                                                                             |Source      N10:17| |
|                                                                                                             |                 4| |
|                                                                                                             |Dest      C5:5.PRE| |
|                                                                                                             |                 4| |
|                                                                                                             +------------------+ |


Rung 3:9
COPIES SCALE INFORMATION FROM CH'S 1&2 TONNAGE MODULE 1 INTO CH'S 3&4 TONNAGE
MODULE 2
|                                                                                                             +MOV---------------+ |
|-------------------------------------------------------------------------------------------------------------+MOVE              +-|
|                                                                                                             |Source      N10:15| |
|                                                                                                             |              1000| |
|                                                                                                             |Dest        N11:15| |
|                                                                                                             |              1000| |
|                                                                                                             +------------------+ |


Rung 3:27
DROPS OUT RELAY WHEN THERE IS A TONNAGE FAULT
| CH'S 1&2  |CH'S 3&4  |                                                                                        TOP STOP   |
| MODULE    |MODULE    |                                                                                        RELAY OR   |
| ALARM BIT |ALARM BIT |                                                                                        E-STOP     |
|                      |                                                                                        RELAY      |
|    N10:16     N11:16                                                                                            O:7      |
|----]/[--------]/[---------------------------------------------------------------------------------------------( )-----|
|      11          11                                                                                               0    |

Rung 3:28
|                                                                                                                          |
|--------------------------------------------------------------+END+-------------------------------------------------------|
|                                                                                                                          |
```

```
Rung 3:0
| PANELVIEW |                                                                                                       CH'S 1&2   |
| LOW ALARM |                                                                                                       MODULE     |
| INHIBIT   |                                                                                                       LOW        |
| INDICATOR |                                                                                                       INHIBIT    |
|           |                                                                                                       ALARM      |
|    N10:16                                                                                                            O:2     |
|----] [---------------------------------------------------------------------------------------------------------------( )-----|
|      10                                                                                                                 6    |

Rung 3:1
| PANELVIEW |                                                                                                       CH'S 1&2   |
| AND CH'S  |                                                                                                       MODULE     |
| 1&2 MODULE|                                                                                                       LOOK       |
| CAM CYCLE |                                                                                                       WINDOW     |
| BIT       |                                                                                                       SIGNAL     |
|    N10:21                                                                                                            O:2     |
|----] [---------------------------------------------------------------------------------------------------------------( )-----|
|       0                                                                                                                 0    |

Rung 3:2
| PANELVIEW |                                                                                                       CH'S 1&2   |
| MODE      |                                                                                                       MODULE     |
| BUTTON    |                                                                                                       BYPASS BIT |
| (BYPASS)  |                                                                                                                  |
|    N10:20                                                                                                            O:2     |
|----] [---------------------------------------------------------------------------------------------------------------( )-----|
|       3                                                                                                                 1    |

Rung 3:3
| PANELVIEW |                                                                                                       CH'S 1&2   |
| MODE      |                                                                                                       MODULE     |
| BUTTON    |                                                                                                       PEAK MODE  |
| (PEAK)    |                                                                                                       BIT        |
|    N10:20                                                                                                            O:2     |
|----] [---------------------------------------------------------------------------------------------------------------( )-----|
|       4                                                                                                                 2    |

Rung 3:4
| PANELVIEW |                                                                                                                  |
| MODE      |                                                                                                       CH'S 1&2   |
| BUTTON    |                                                                                                       MODULE     |
| (MONITOR  |                                                                                                       MONITOR    |
| PARTS)    |                                                                                                       PARTS BIT  |
|    N10:20                                                                                                            O:2     |
|----] [---------------------------------------------------------------------------------------------------------------( )-----|
|       5                                                                                                                 3    |

Rung 3:5
| PANELVIEW |                                                                                                                  |
| & CH'S 1&2|                                                                                                       CH'S 1&2   |
| REVERSE   |                                                                                                       MODULE     |
| LOAD      |                                                                                                       REV LOAD   |
| BUTTON    |                                                                                                       BIT        |
|    N10:21                                                                                                            O:2     |
|----] [---------------------------------------------------------------------------------------------------------------( )-----|
|       6                                                                                                                 5    |

Rung 3:6
|                                                                                                             SAMPLE         |
|                                                                                                             SETTING        |
|                                                                                                        +MOV---------------+ |
|-------------------------------------------------------------------------------------------------------+MOVE              +-|
|                                                                                                        |Source      N10:18| |
|                                                                                                        |                 0| |
|                                                                                                        |Dest      C5:0.PRE| |
|                                                                                                        |                 0| |
|                                                                                                        +------------------+ |

Rung 3:7
| MODULE 1  |PANELVIEW                                                                                SAMPLE               |
| CYCLE     |MODE                                                                                     COUNTER              |
| BIT       |BUTTON                                                                                                          |
|           |(MONITOR                                                                                                        |
|           | PARTS)                                                                                                         |
|    N10:21    N10:20                                                                                +CTD---------------+       |
|----] [--------] [---------------------------------------------------------------------------------+COUNT DOWN        +-(CD)-|
|       0          5                                                                                 |Counter       C5:0+-(DN) |
|                                                                                                    |Preset           0|       |
|                                                                                                    |Accum            0|       |
|                                                                                                    +------------------+       |

Rung 3:8
|   PANELVIEW                                                                                                   SAMPLE     |
|   MODE                                                                                                        COUNTER    |
|   BUTTON                                                                                                                 |
|   (PEAK)                                                                                                                 |
|     N10:20                                                                                                         C5:0   |
|-+----] [-----+--------------------------------------------------------------------------------------------------(RES)----|
| |       4    |                                                                                                           |
| |  S:1       |                                                                                                           |
| +--] [-------+                                                                                                           |
|      15                                                                                                                  |
```

```
Rung 3:9
|                                                                                                            CURRENT          |
|                                                                                                            SAMPLE           |
|                                                                                                            COUNT            |
|                                                                                                       +MOV----------------+ |
|-------------------------------------------------------------------------------------------------------+MOVE               +-|
|                                                                                                       |Source     C5:0.ACC| |
|                                                                                                       |                  0| |
|                                                                                                       |Dest         N10:19| |
|                                                                                                       |                  0| |
|                                                                                                       +-------------------+ |


Rung 3:10
|           |                                                                                                       PANELVIEW  |
|           |                                                                                                       LEARN      |
|           |                                                                                                       CYCLE      |
|           |                                                                                                       INDICATOR  |
|    C5:0                                                                                                             N10:16   |
|----] [--------------------------------------------------------------------------------------------------------------( )-----|
|       DN                                                                                                               9     |


Rung 3:11
|                                                                                                                              |
|                                                                                                                              |
| CH1 HIGH                                                                                                        CH1 HIGH     |
| CAPACITY                                                                                                        CAPACITY     |
| ALARM BIT                                                                                                       ALARM        |
|    I:2                                                                                                             N10:16    |
|----] [--------------------------------------------------------------------------------------------------------+----(L)-----+-|
|       0                                                                                                       |       0    | |
|                                                                                                               | CH'S 1&2   | |
|                                                                                                               | MODULE     | |
|                                                                                                               | ALARM BIT  | |
|                                                                                                               |    N10:16  | |
|                                                                                                               +----(L)-----+ |
|                                                                                                                      11      |
Rung 3:12
|                                                                                                                              |
|                                                                                                                              |
| CH1 LOW                                                                                                         CH1 LOW      |
| CAPACITY                                                                                                        CAPACITY     |
| ALARM BIT                                                                                                       ALARM        |
|    I:2                                                                                                             N10:16    |
|----] [--------------------------------------------------------------------------------------------------------+----(L)-----+-|
|       1                                                                                                       |       1    | |
                                                                                                                |            |
                                                                                                                |            |
|                                                                                                               | CH'S 1&2   | |
|                                                                                                               | MODULE     | |
|                                                                                                               | ALARM BIT  | |
|                                                                                                               |    N10:16  | |
|                                                                                                               +----(L)-----+ |
|                                                                                                                      11      |
Rung 3:13
|                                                                                                                              |
|                                                                                                                              |
| CH2 HIGH                                                                                                        CH2 HIGH     |
| CAPACITY                                                                                                        CAPACITY     |
| ALARM BIT                                                                                                       ALARM        |
|    I:2                                                                                                            N10:16    |
|----] [--------------------------------------------------------------------------------------------------------+----(L)-----+-|
|       2                                                                                                       |       2    | |
|                                                                                                               | CH'S 1&2   | |
|                                                                                                               | MODULE     | |
|                                                                                                               | ALARM BIT  | |
|                                                                                                               |    N10:16  | |
|                                                                                                               +----(L)-----+ |
|                                                                                                                      11      |
Rung 3:14
|                                                                                                                              |
|                                                                                                                              |
| CH2 LOW                                                                                                         CH2 LOW      |
| CAPACITY                                                                                                        CAPACITY     |
| ALARM BIT                                                                                                       ALARM        |
|    I:2                                                                                                            N10:16    |
|----] [--------------------------------------------------------------------------------------------------------+----(L)-----+-|
|       3                                                                                                       |       3    | |
|                                                                                                               | CH'S 1&2   | |
|                                                                                                               | MODULE     | |
|                                                                                                               | ALARM BIT  | |
|                                                                                                               |    N10:16  | |
|                                                                                                               +----(L)-----+ |
|                                                                                                                      11      |
```

```
Rung 3:15
|                                                                                                                             |
|                                                                                                                             |
| CH1 HIGH                                                                                                   CH1 HIGH         |
| TREND                                                                                                      TREND            |
| ALARM BIT                                                                                                  ALARM            |
|    I:2                                                                                                        N10:16        |
|----] [-------------------------------------------------------------------------------------------------+----(L)-----+-|
|       4                                                                                                |       4     | |
|                                                                                                        | CH'S 1&2    | |
|                                                                                                        | MODULE      | |
|                                                                                                        | ALARM BIT   | |
|                                                                                                        |    N10:16   | |
|                                                                                                        +----(L)-----+ |
|                                                                                                              11       |

Rung 3:16
|                                                                                                                             |
|                                                                                                                             |
| CH1 LOW                                                                                                    CH1 LOW          |
| TREND                                                                                                      TREND            |
| ALARM BIT                                                                                                  ALARM            |
|    I:2                                                                                                        N10:16        |
|----] [-------------------------------------------------------------------------------------------------+----(L)-----+-|
|       5                                                                                                |       5     | |
|                                                                                                        | CH'S 1&2    | |
|                                                                                                        | MODULE      | |
|                                                                                                        | ALARM BIT   | |
|                                                                                                        |    N10:16   | |
|                                                                                                        +----(L)-----+ |
|                                                                                                              11       |

Rung 3:17
|                                                                                                                             |
|                                                                                                                             |
| CH2 HIGH                                                                                                   CH2 HIGH         |
| TREND                                                                                                      TREND            |
| ALARM BIT                                                                                                  ALARM            |
|    I:2                                                                                                        N10:16        |
|----] [-------------------------------------------------------------------------------------------------+----(L)-----+-|
|       6                                                                                                |       6     | |
|                                                                                                        | CH'S 1&2    | |
|                                                                                                        | MODULE      | |
|                                                                                                        | ALARM BIT   | |
|                                                                                                        |    N10:16   | |
|                                                                                                        +----(L)-----+ |
|                                                                                                              11       |

Rung 3:18
|                                                                                                                             |
|                                                                                                                             |
| CH2 LOW                                                                                                    CH2 LOW          |
| TREND                                                                                                      TREND            |
| ALARM BIT                                                                                                  ALARM            |
|    I:2                                                                                                        N10:16        |
|----] [-------------------------------------------------------------------------------------------------+----(L)-----+-|
|       7                                                                                                |       7     | |
|                                                                                                        | CH'S 1&2    | |
|                                                                                                        | MODULE      | |
|                                                                                                        | ALARM BIT   | |
|                                                                                                        |    N10:16   | |
|                                                                                                        +----(L)-----+ |
|                                                                                                              11       |

Rung 3:19
| PANELVIEW                                                                                                                   |
| TONNAGE                                                                                                                     |
| FAULT                                                                                                      CH1 HIGH         |
| RESET                                                                                                      TREND            |
| BUTTON                                                                                                     ALARM            |
|    N10:21                                                                                                     N10:16        |
|----] [-------------------------------------------------------------------------------------------------+----(U)-----+-|
|       7                                                                                                |       4     | |
|                                                                                                        |             | |
|                                                                                                        |             | |
|                                                                                                        | CH1 LOW     | |
|                                                                                                        | TREND       | |
|                                                                                                        | ALARM       | |
|                                                                                                        |    N10:16   | |
|                                                                                                        +----(U)-----+ |
|                                                                                                        |       5     | |
|                                                                                                        |             | |
|                                                                                                        |             | |
|                                                                                                        | CH2 HIGH    | |
|                                                                                                        | TREND       | |
|                                                                                                        | ALARM       | |
|                                                                                                        |    N10:16   | |
|                                                                                                        +----(U)-----+ |
|                                                                                                        |       6     | |
|                                                                                                        |             | |
|                                                                                                        |             | |
|                                                                                                        | CH2 LOW     | |
|                                                                                                        | TREND       | |
|                                                                                                        | ALARM       | |
|                                                                                                        |    N10:16   | |
|                                                                                                        +----(U)-----+ |
|                                                                                                              7        |
```

```
Rung 3:20
| PANELVIEW                                                                                                                    |
| TONNAGE                                                                                                                      |
| FAULT                                                                                                          CH1 HIGH     |
| RESET                                                                                                          CAPACITY     |
| BUTTON                                                                                                         ALARM        |
|    N10:21                                                                                                         N10:16    |
|----] [-------------------------------------------------------------------------------------------------------+----(U)-----+-|
|       7                                                                                                      |       0    | |
|                                                                                                              |            | |
|                                                                                                              |            | |
|                                                                                                              | CH1 LOW    | |
|                                                                                                              | CAPACITY   | |
|                                                                                                              | ALARM      | |
|                                                                                                              |    N10:16  | |
|                                                                                                              +----(U)-----+ |
|                                                                                                              |       1    | |
|                                                                                                              |            | |
|                                                                                                              |            | |
|                                                                                                              | CH2 HIGH   | |
|                                                                                                              | CAPACITY   | |
|                                                                                                              | ALARM      | |
|                                                                                                              |    N10:16  | |
|                                                                                                              +----(U)-----+ |
|                                                                                                              |       2    | |
|                                                                                                              |            | |
|                                                                                                              |            | |
|                                                                                                              | CH2 LOW    | |
|                                                                                                              | CAPACITY   | |
|                                                                                                              | ALARM      | |
|                                                                                                              |    N10:16  | |
|                                                                                                              +----(U)-----+ |
|                                                                                                                      3      |

Rung 3:21
| PANELVIEW |                                                                                                                  |
| TONNAGE   |                                                                                                      CH'S 1&2   |
| FAULT     |                                                                                                      MODULE     |
| RESET     |                                                                                                      ALARM      |
| BUTTON    |                                                                                                      RESET BIT  |
|    N10:21                                                                                                           O:2     |
|----] [--------------------------------------------------------------------------------------------------------------( )-----|
|       7                                                                                                                4    |



Rung 3:22
| PANELVIEW |                                                                                                                 |
| ALARM     |                                                                                                                 |
| RESET     |                                                                                                     MODULE 1   |
| BUTTON    |                                                                                                     ALARM      |
|           |                                                                                                      BIT       |
|     N10:21                                                                                                         N10:16  |
|----] [----------------------------------------c--------------------------------------------------------------------(U)-----|
|       7                                                                                                               11   |


Rung 3:23
|                                                                                                             CH'S 1&2        |
|                                                                                                             SCALE INFO      |
|                                                                                                                             |
|                                                                                                        +MOV---------------+ |
|--------------------------------------------------------------------------------------------------------+MOVE              +-|
|                                                                                                        |Source      N10:15| |
|                                                                                                        |                 0| |
|                                                                                                        |Dest         O:2.1| |
|                                                                                                        |                 0| |
|                                                                                                        +------------------+ |
Rung 3:24                                                                                                                     |
                                                                                                              CH1 LOW         |
|                                                                                                             CAPACITY        |
|                                                                                                             ALARM           |
|                                                                                                             SETTING         |
|                                                                                                        +MOV---------------+ |
|--------------------------------------------------------------------------------------------------------+MOVE              +-|
|                                                                                                        |Source      N10:12| |
|                                                                                                        |                 0| |
|                                                                                                        |Dest         O:2.2| |
|                                                                                                        |                 0| |
|                                                                                                        +------------------+ |
Rung 3:25
|                                                                                                             CH1 HIGH        |
|                                                                                                             CAPACITY        |
|                                                                                                             ALARM           |
|                                                                                                             SETTING         |
|                                                                                                        +MOV---------------+ |
|--------------------------------------------------------------------------------------------------------+MOVE              +-|
|                                                                                                        |Source      N10:11| |
|                                                                                                        |                 0| |
|                                                                                                        |Dest         O:2.3| |
|                                                                                                        |                 0| |
|                                                                                                        +------------------+ |
```

```
Rung 3:26
|                                                                                                             CH2 LOW         |
|                                                                                                             CAPACITY        |
|                                                                                                             ALARM           |
|                                                                                                             SETTING         |
|                                                                                                        +MOV---------------+ |
|--------------------------------------------------------------------------------------------------------+MOVE              +-|
|                                                                                                        |Source      N10:14| |
|                                                                                                        |                 0| |
|                                                                                                        |Dest         O:2.4| |
|                                                                                                        |                 0| |
|                                                                                                        +------------------+ |

Rung 3:27
|                                                                                                             CH2 HIGH        |
|                                                                                                             CAPACITY        |
|                                                                                                             ALARM           |
|                                                                                                             SETTING         |
|                                                                                                        +MOV---------------+ |
|--------------------------------------------------------------------------------------------------------+MOVE              +-|
|                                                                                                        |Source      N10:13| |
|                                                                                                        |                 0| |
|                                                                                                        |Dest         O:2.5| |
|                                                                                                        |                 0| |
|                                                                                                        +------------------+ |

Rung 3:28
|                                                                                                             CH 1 TREND      |
|                                                                                                             DEVIATION       |
|                                                                                                             IN PERCENT      |
|                                                                                                        +MOV---------------+ |
|--------------------------------------------------------------------------------------------------------+MOVE              +-|
|                                                                                                        |Source       I:2.5| |
|                                                                                                        |                 0| |
|                                                                                                        |Dest         N10:1| |
|                                                                                                        |                 0| |
|                                                                                                        +------------------+ |
Rung 3:29
|                                                                                                             CH 2 TREND      |
|                                                                                                             DEVIATION       |
|                                                                                                             IN PERCENT      |
|                                                                                                        +MOV---------------+ |
|--------------------------------------------------------------------------------------------------------+MOVE              +-|
|                                                                                                        |Source       I:2.6| |
|                                                                                                        |                 0| |
|                                                                                                        |Dest         N10:2| |
|                                                                                                        |                 0| |
|                                                                                                        +------------------+ |

Rung 3:30
|                                                                                                      +MUL---------------+   |
|----------------------------------------------------------------------------------------------------+-+MULTIPLY          +-+-|
|                                                                                                    | |Source A     N10:4| | |
|                                                                                                    | |                 0| | |
|                                                                                                    | |Source B       256| | |
|                                                                                                    | |                  | | |
|                                                                                                    | |Dest         N10:7| | |
|                                                                                                    | |                 0| | |
|                                                                                                    | +------------------+ | |
|                                                                                                    |                      | |
|                                                                                                    |      TREND           | |
|                                                                                                    |      HIGH\LOW        | |
|                                                                                                    |      ALARM           | |
|                                                                                                    |      SETTING         | |
|                                                                                                    |      FOR CH1         | |
|                                                                                                    | +ADD---------------+ | |
|                                                                                                    +-+ADD               +-+ |
|                                                                                                      |Source A     N10:7|   |
|                                                                                                      |                 0|   |
|                                                                                                      |Source B     N10:3|   |
|                                                                                                      |                 0|   |
|                                                                                                      |Dest         O:2.6|   |
|                                                                                                      |                 0|   |
|                                                                                                      +------------------+   |
```

```
Rung 3:31
|                                                                                                        +MUL---------------+   |
|------------------------------------------------------------------------------------------------------+-+MULTIPLY          +-+-|
|                                                                                                      | |Source A     N10:6| | |
|                                                                                                      | |                 0| | |
|                                                                                                      | |Source B       256| | |
|                                                                                                      | |                  | | |
|                                                                                                      | |Dest         N10:7| | |
|                                                                                                      | |                 0| | |
|                                                                                                      | +------------------+ | |
|                                                                                                      |       TREND          | |
|                                                                                                      |       HIGH\LOW       | |
|                                                                                                      |       ALARM          | |
|                                                                                                      |       SETTING        | |
|                                                                                                      |       FOR CH2        | |
|                                                                                                      | +ADD---------------+ | |
|                                                                                                      +-+ADD               +-+ |
|                                                                                                        |Source A     N10:7|   |
|                                                                                                        |                 0|   |
|                                                                                                        |Source B     N10:5|   |
|                                                                                                        |                 0|   |
|                                                                                                        |Dest         O:2.7|   |
|                                                                                                        |                 0|   |
|                                                                                                        +------------------+   |

Rung 3:32
DISPLAYS PEAK TONNAGE FOR CHANNEL 1 AS LONG AS MODULE IS NOT IN SETUP MODE
| PANELVIEW                                                                                                                     |
| MODE                                                                                                                          |
| BUTTON                                                                                                                        |
| (BYPASS)                                                                                                                      |
|    N10:20                                                                                               +MOV---------------+ |
|----]/[--------------------------------------------------------------------------------------------------+MOVE              +-|
|       3                                                                                                 |Source       I:2.1| |
|                                                                                                         |                 0| |
|                                                                                                         |Dest         N10:8| |
|                                                                                                         |                 0| |
|                                                                                                         +------------------+ |

Rung 3:33
DISPLAYS CAL NUMBER FOR CHANNEL 1 ON PANELVIEW
|                                                                                                         +MOV---------------+ |
|---------------------------------------------------------------------------------------------------------+MOVE              +-|
|                                                                                                         |Source       I:2.1| |
|                                                                                                         |                 0| |
|                                                                                                         |Dest        N10:22| |
|                                                                                                         |                 0| |
|                                                                                                         +------------------+ |

Rung 3:34
DISPLAYS PEAK TONNAGE FOR CHANNEL 2 AS LONG AS MODULE IS NOT IN SETUP MODE
| PANELVIEW                                                                                                                     |
| MODE                                                                                                                          |
| BUTTON                                                                                                                        |
| (BYPASS)                                                                                                                      |
|    N10:20                                                                                               +MOV---------------+ |
|----]/[--------------------------------------------------------------------------------------------------+MOVE              +-|
|       3                                                                                                 |Source       I:2.2| |
|                                                                                                         |                 0| |
|                                                                                                         |Dest         N10:9| |
|                                                                                                         |                 0| |
|                                                                                                         +------------------+ |

Rung 3:35
DISPLAYS CAL NUMBER FOR CHANNEL 2 ON PANELVIEW
|                                                                                                         +MOV---------------+ |
|---------------------------------------------------------------------------------------------------------+MOVE              +-|
|                                                                                                         |Source       I:2.2| |
|                                                                                                         |                 0| |
|                                                                                                         |Dest        N10:23| |
|                                                                                                         |                 0| |
|                                                                                                         +------------------+ |

Rung 3:36
|                                                                                                              CH 1             |
|                                                                                                              AVERAGE          |
|                                                                                                              of SAMPLES       |
|                                                                                                              IN TONS          |
|                                                                                                         +MOV---------------+ |
|---------------------------------------------------------------------------------------------------------+MOVE              +-|
|                                                                                                         |Source       I:2.3| |
|                                                                                                         |                 0| |
|                                                                                                         |Dest        N10:24| |
|                                                                                                         |                 0| |
|                                                                                                         +------------------+ |

Rung 3:37
|                                                                                                              CH 2             |
|                                                                                                              AVERAGE          |
|                                                                                                              of SAMPLES       |
|                                                                                                              IN TONS          |
|                                                                                                         +MOV---------------+ |
|---------------------------------------------------------------------------------------------------------+MOVE              +-|
|                                                                                                         |Source       I:2.4| |
|                                                                                                         |                 0| |
|                                                                                                         |Dest        N10:25| |
|                                                                                                         |                 0| |
|                                                                                                         +------------------+ |
```

```
Rung 3:38
|           |                                                                                            D0 BIT OF  |
| PANELVIEW |                                                                                            SAMPLE     |
| ENTRY     |                                                                                            COUNT      |
|           |                                                                                                       |
|    N10:18                                                                                                O:2     |
|----] [------------------------------------------------------------------------------------------------( )-----|
|       0                                                                                                     8    |

Rung 3:39
|           |                                                                                            D1 BIT OF  |
| PANELVIEW |                                                                                            SAMPLE     |
| ENTRY     |                                                                                            COUNT      |
|    N10:18                                                                                                O:2     |
|----] [------------------------------------------------------------------------------------------------( )-----|
|       1                                                                                                     9    |

Rung 3:40
|           |                                                                                            D2 BIT OF  |
| PANELVIEW |                                                                                            SAMPLE     |
| ENTRY     |                                                                                            COUNT      |
|    N10:18                                                                                                O:2     |
|----] [------------------------------------------------------------------------------------------------( )-----|
|       2                                                                                                    10    |

Rung 3:41
|           |                                                                                            D3 BIT OF  |
| PANELVIEW |                                                                                            SAMPLE     |
| ENTRY     |                                                                                            COUNT      |
|    N10:18                                                                                                O:2     |
|----] [------------------------------------------------------------------------------------------------( )-----|
|       3                                                                                                    11    |

Rung 3:42
|                                                                                                                 |
|-------------------------------------------------------------+END+-----------------------------------------------|
|                                                                                                                 |
```