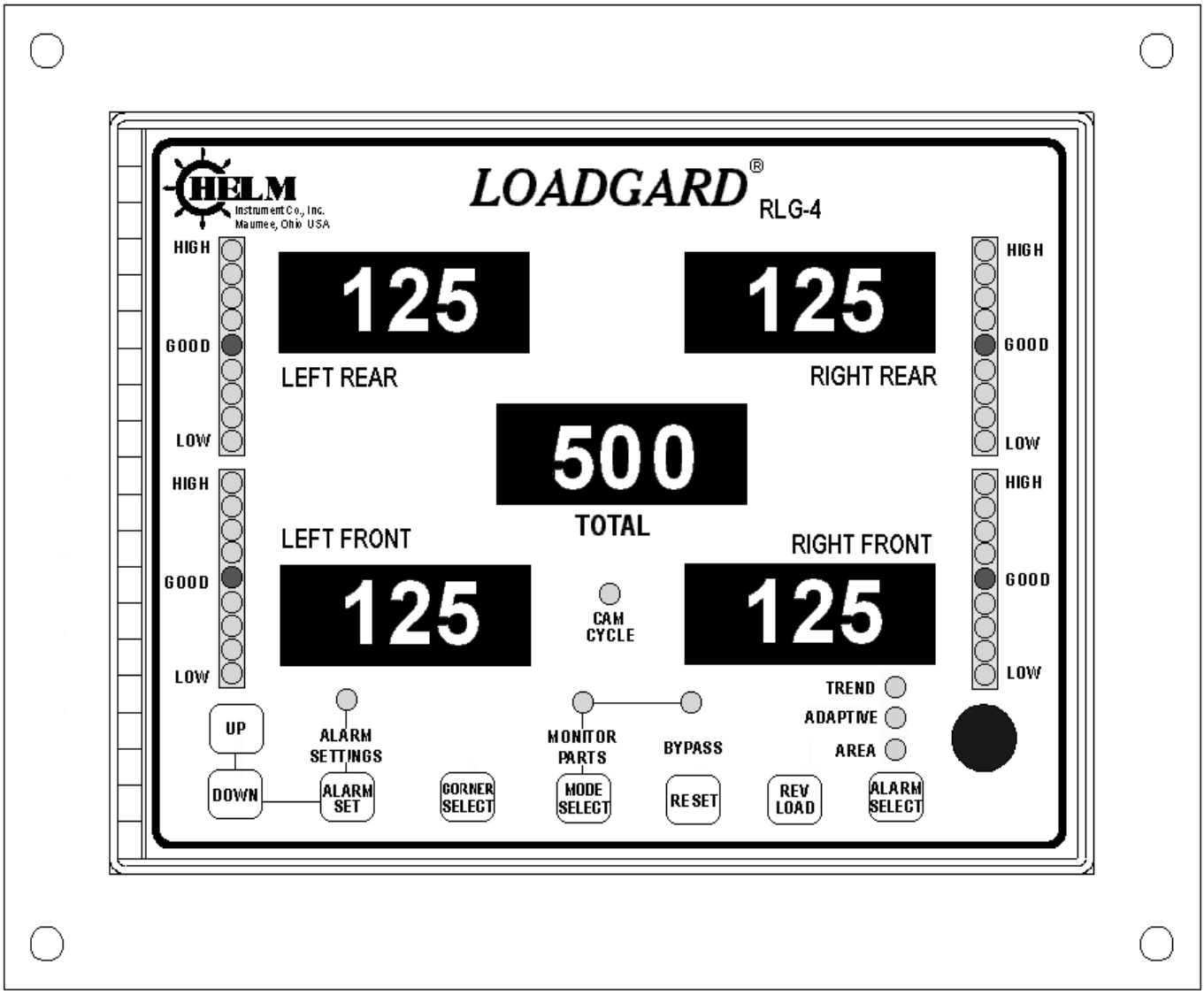
# RLG-4 LOADGARD



# RLG-4 LOADGARD OPERATING INSTRUCTIONS

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Helm Instrument Co., Inc. (”HELM”) hereby warrants that the instruments and sensors (collectively the ”Product”) manufactured by it and sold to customer, are free from defects in material and/or workmanship under normal use subject to the following conditions. This warranty shall not apply to any Product which has been subjected to improper installation, misuse, negligence, accident, alteration, where service has been performed by other than an authorized Helm serviceman, or where the serial number has been defaced or altered. This warranty shall extend for the one (1) year period from date of shipment from our factory or authorized dealer, provided that the product is returned, freight prepaid, to Helm within the one (1) year warranty period within specific written authorization to perform repairs. Helm’s obligations and the exclusive remedy of customer under this warranty are limited to repairing or replacing any defective Product at no additional charge and returning Product to customer freight paid. Repair parts and replacement Products shall be furnished on an exchange basis and shall be either new or reconditioned. All replaced parts and Products shall become the property of Helm.

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**CUSTOMER SERVICE**
**361 WEST DUSSEL DRIVE**
**MAUMEE, OHIO 43537**
**(41 9) 893-4356**

# RLG-4 LOADGARD OPERATING INSTRUCTIONS

## INTRODUCTION

You have just purchased the most advanced load monitoring system available. In addition to this system, HELM INSTRUMENT CO., INC. manufactures a complete line of load monitoring control systems for use on metal stamping, forging, compaction, assembly presses, cold forming, cold heading, injection molding and die cast machines. Standard or custom transducers and load cells are available for in-die monitoring of multi-station transfer or progressive tooling. Easy to use software systems designed for plant-wide SPC programs are also available.

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 efficient.

## SYSTEM OPERATION OVERVIEW

The HELM Model RLG-4 LOADGARD monitor provides press overload protection, die protection, and improved part quality, with minimal operator involvement. Digital meters on the front panel are used to display updated "Peak" load values and high/low alarm settings. Machine stop is initiated by means of two separate alarm relays, which fire when certain alarm limits are exceeded.

Adjustable discreet high CAPACITY ALARMS are provided for all channels for press overload protection. These CAPACITY ALARMS are <u>always</u> active. There is a dedicated CAPACITY ALARM relay, which fires in the event of a CAPACITY ALARM on any channel.

Adjustable high/low TREND ALARMS are provided for all channels, for die protection and improved part quality. Three different types or modes of TREND ALARMS are included, which are PEAK TREND ALARMS, ADAPTIVE PEAK TREND ALARMS, and ADAPTIVE AREA UNDER CURVE ALARMS. Those particular alarm functions are described in greater detail later in this manual. <u>All</u> TREND ALARMS are based on the monitor taking an initial TREND SAMPLE of "Good Part" force values, and storing those values in memory. The unit then compares the force values for each subsequent part to the stored "Good Part" values. There is a dedicated TREND ALARM relay, which fires in the event of a TREND ALARM on any channel. Only one of the three modes of TREND ALARMS is active at one time, as selected by the operator. TREND ALARMS are active <u>only</u> when the unit is in MONITOR mode, and <u>not</u> in BYPASS mode.



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# EXTERNAL POWER SUPPLY OPTIONS

There are two different configurations for the external power supply that feeds the RLG-4 Loadgard. These include the "Standard 24 VDC RLG-4 Loadgard", and the "RLG-4 Loadgard with 110/220 VAC Option".

The "24 VDC" power supply version is the standard and most basic version. This type should be used when a readily available source of 24 VDC power is close to the unit. Such arrangements include mounting of the RLG-4 monitor close to press controls or PLC's where 24 VDC power is utilized. The "C7" connector designated "Power Connector" at the back of the unit is used for making the 24 VDC power connection. A mating Turck interconnect cable is provided.

The "110/220 VAC" power supply version of the RLG-4 unit is furnished as an option. Essentially, this uses a "Box-in Box" design, in which a standard 24 VDC unit is packaged into a larger enclosure with 110/220 VAC input/24 VDC output power supply. The power supply is a "universal" AC power supply, which can accommodate input voltages within a range from 90-264 VAC (Note: 110 VAC and 220 VAC are the two most common user sources). Regardless of the actual input voltage used within the allowable 90-264 VAC range, there are no user adjustments to make. This type of unit should be used when 24 VDC power is not available at the unit, and 110/220 VAC power must be used. The "C7" connector designated "Power Connector" at the back of the unit is used for making the 110/220 VAC power connection. A mating Turck interconnect cable is provided.

For detailed wiring information on both 24 VDC and 110/220 VAC power supply configurations, refer to the following drawings in Appendix "A" or Appendix "B" at the back of this manual:

| Page | Drawing No. | Title |
|---|---|---|
| A-4 | E1008108 | 24 VDC RLG-4 User Connections |
| A-5 | E1008109 | 24 VDC RLG-4 User Cable Wiring Codes |
| B-3 | E1008106 | 110/220 VAC RLG-4 User Connections |
| B-4 | E1008107 | 110/220 VAC RLG-4 User Cable Wiring Codes |



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# RLG-4 LOADGARD OPERATING INSTRUCTIONS

## FORCE SENSORS

### "STRAIN GAIN" FORCE SENSOR OPERATION

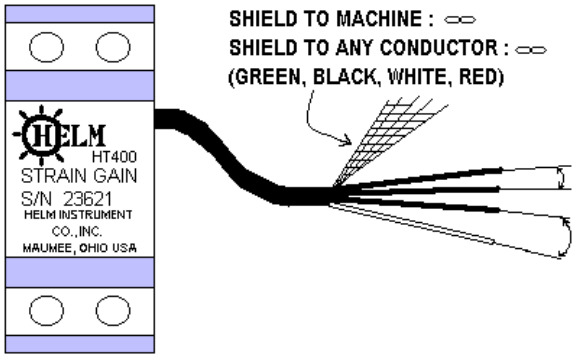
The basic function of the Helm Model HT-400 "Strain Gain" bolt-on force sensor is to detect the amount of deflection imposed on the press as parts are being formed. All "Strain Gain" sensors are matched to within 1%, and therefore can be replaced without re-calibration of the machine.

The HT-400 "Strain Gain" sensors are mounted in a very simple "bolt-on" fashion to strategic high stress areas of the machine frame. They form the basis of a "Frame-Mount" sensor monitoring system, in which deflections of the machine frame are used to generate the force output signals to be monitored. Such systems are the most basic type, and provide a very economical solution for press protection, die protection, and part quality control. For multi-station tools where a higher degree of die protection and part quality control are desired, various Helm "In-Die" force sensors are available as noted below.

Force output signals from the sensors are routed to the RLG-4 Loadgard for processing.
The HT-400 "Strain Gain" is capable of measuring either a tension or a compression deflection.

### "STRAIN GAIN" FORCE SENSOR INSTALLATION AND WIRING

Specific sensor location and mounting instructions for "Strain Gain" sensors are described in the "Installing Strain Gain Transducers" manual. Refer to that manual for proper sensor location and installation for various types of metal stamping presses. Sensor nominal resistance values should check out as shown below. For proper wiring, use separate conduit or sealtite for sensor cables, and avoid running these cables with any press control or high power motor circuits. Sensor cables should never be run near high voltage (220VAC, 440VAC) circuits.




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

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

HT-400 "STRAIN GAIN" SENSOR

For ease of installation, 4 Turck sensor interconnect cables (1 cable per sensor) are furnished with the RLG-4 Loadgard. These allow for simple "Plug-In" connection of the "Strain Gain"

sensors at the back of the unit. The sensor connectors are designated C1 (LF/Ch1), C2 (LR/Ch2), C3 (RF/Ch 3), and C4 (RR/Ch4). For an illustration of the sensor connectors at the back of the unit, refer to drawing E1008108 (page A-4) and drawing E1008106 (page B-3) at the back of this manual.

Please note that the Turck interconnect cables are not pre-wired to the "Strain Gain" sensors themselves, which are normally furnished separately in a "Strain Gain" sensor kit. Rather, the cables have "pigtail" leads at the sensor (non-instrument) end. To complete the sensor wiring, the black cable wires from each "Strain Gain" sensor must be wired to the yellow Turck cable "pigtail" leads. The wiring polarity is shown below:

| | "Strain Gain" Cable Wires | |
|---|---|---|
| Turck Interconnect Cable "Pigtail" Leads | Tension Operation | Compression Operation |
| Green (+ Gage) | Green | Black |
| Black (- Gage) | Black | Green |
| White (+ Signal) | White | White |
| Red (- Signal) | Red | Red |
| Brown (Shield) | Shield | Shield |

## ALTERNATE "IN-DIE" FORCE SENSOR INSTALLATION AND WIRING

As an alternate to the simple bolt-on "Strain Gain" sensors, "In-Die" strain gage force sensors can be used with the RLG-4 Loadgard monitor. "In-Die" force sensors are typically used on multi-station tools, where a higher degree of die protection and part quality control are desired. "In-Die" force sensors are of two basic types, including Helm "calibrated" strain gage load cells (direct tonnage readout), and Helm un-calibrated strain gage "Die Plug" sensors ("reference" load readout). Detailed information on the proper application of these "In-Die" force sensors is available from Helm on request.

For wiring connection of "In-Die" force sensors to the RLG-4 unit, the Turck plug-in interconnect cables must also be used. This is similar to the wiring method used for the bolt-on "Strain Gain" sensors.



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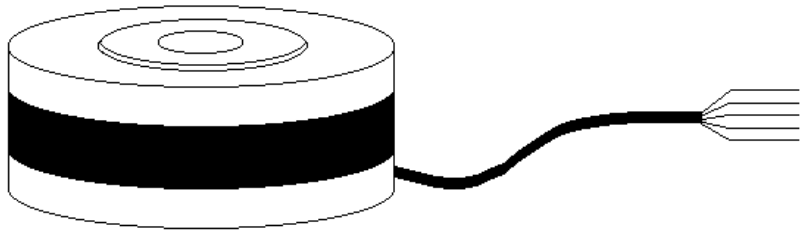
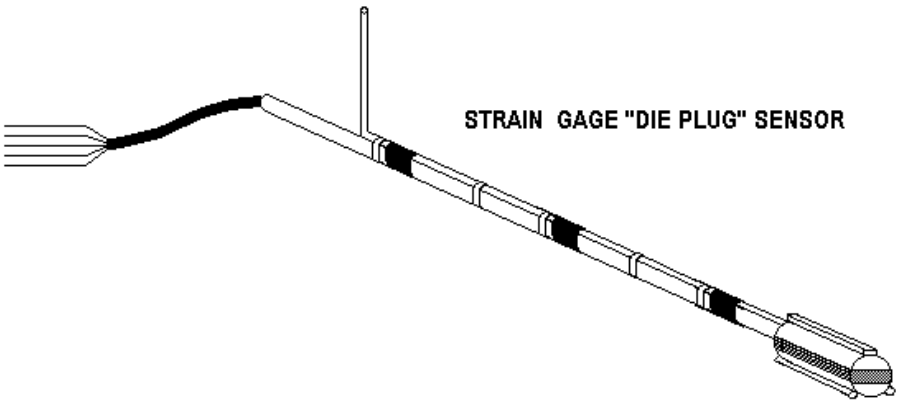
Wiring polarity for “In-Die” strain gage force sensors is shown below.

| Turck Interconnect Cable Pigtail Leads | “In-Die” Force Sensor Cable Wires (Compression Operation) |
|---|---|
| Green (+ Gage) | Black |
| Black (- Gage) | Green |
| White (+ Signal) | White |
| Red (- Signal) | Red |
| Brown (Shield) | Shield |

"IN DIE" STRAIN GAGE LOAD CELL





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# EXTERNAL TIMING INPUT REQUIREMENTS

The RLG-4 Loadgard monitor requires an external “timing input” signal for each machine cycle to be monitored. In general, this timing input signal should start shortly before the forming load begins for the new cycle, and should end shortly after the forming load is finished. In effect, the input of such a timing signal to the unit “tells” the monitor when to “look” at the forming signals for each cycle, and to capture the “Peak” and/or “Area Under the Curve” load values within that time frame. The unit actively monitors the forming process when the external “timing input” signal is “On”, and ignores what occurs when the signal is “Off” between machine cycles.

Three main types of external “timing input” signals can be used with the RLG-4 unit. These include conventional dry contact cam switch, 24 VDC proximity switch, and 24 VDC PLC input. In general, the wiring connections for this input are made at the “C5” Turck connector at the back of the unit. For the standard 24 VDC RLG-4 unit, this “C5” connector is designated “CAM/CAPACITY STOP”, the “CAM” portion of which is used for the timing input signal connections. For the 110/220 VAC RLG-4 unit, this “C5” connector is designated “CAM/REMOTE RESET”, the “CAM” portion of which is used for the timing input signal connections.

For specific detailed information on the external “timing input” signal requirements and related wiring, refer to the following drawings in Appendix “A” or Appendix “B” at the back of this manual:

| Page | Drawing No. | Title |
|---|---|---|
| A-6 | E1008W06 | 24 VDC RLG-4 Input/OutputWiring |
| B-5 | E1008W07 | 110/220 VAC RLG-4 Input/Output Wiring |



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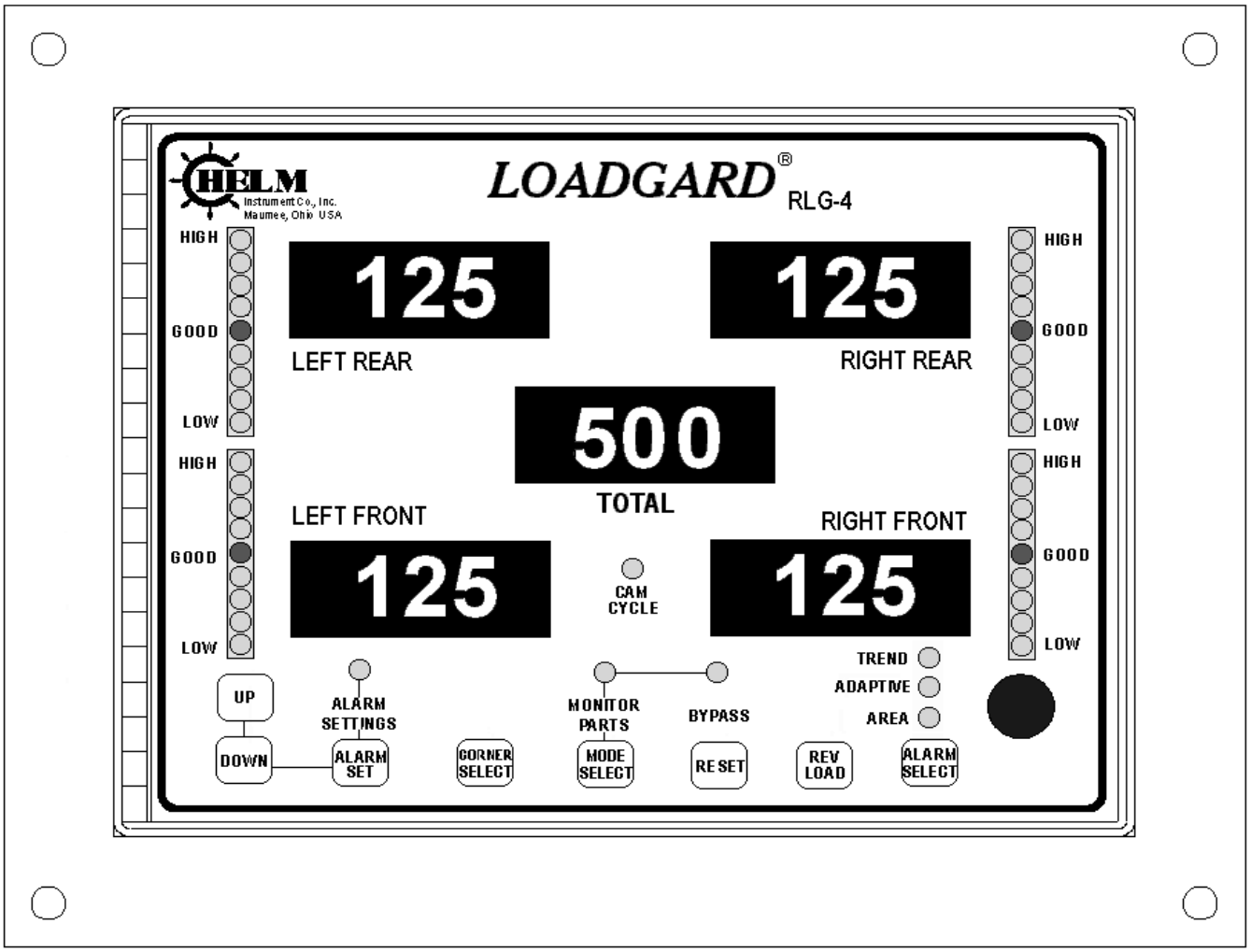
# RLG-4 LOADGARD OPERATING INSTRUCTIONS

## FRONT PANEL ILLUSTRATION

The following illustration shows the front panel tonnage meter details and the various function selector buttons for the RLG-4 Loadgard.




In preparation for setting up and operating the unit, attach the RLG-4 interconnect cables to the Turck connectors at the rear of the unit (C1, C2, C3, C4, C5, C6, and C7). These provide all necessary external connections for force sensors, timing input, power, and alarm relays. The main power switch is located inside the RLG-4 cabinet; turn the power switch "On".

# RLG-4 LOADGARD OPERATING INSTRUCTIONS

## THREE MODE FUNCTION SELECTOR

The MODE SELECT button at the bottom of the front panel is a THREE MODE FUNCTION SELECTOR. It is used to place the unit into one of three possible operating modes, including:

- ALARM SETTINGS mode
- MONITOR PARTS (RESET BUTTON ACTIVE) monitoring mode
- BYPASS (CLEAR) mode

Pressing the MODE SELECT button will "toggle" the unit from one mode to another, with the active mode indicated by the corresponding illuminated LED.

### ALARM SETTINGS MODE

Use this position for setting the high and low TREND ALARMS.

### MONITOR PARTS MODE

During parts production, the instrument should be in the MONITOR PARTS mode.

Once the machine is properly set up and producing good parts, press the MODE SELECT button and set the RLG-4 in the MONITOR PARTS mode. The instrument will then take a TREND SAMPLE of "Good Part" forming load values, and store this sample in memory. The forming loads for each subsequent part are compared to this sample. For each channel, a digital meter and vertical LED array TREND DISPLAY are included on the front panel. The digital meters show the continuously updated "peak" force values from hit to hit. The TREND DISPLAYS use illuminated LED's in either an up or down direction, to show change in the current force values compared to the initial learned TREND SAMPLE values.

TREND ALARMS are automatically activated when the TREND "Good Part" force sample is taken in MONITOR PARTS mode. As stated previously, the TREND ALARMS are for die protection and part quality control, and can be one of three different types (PEAK TREND ALARMS, ADAPTIVE PEAK TREND ALARMS, and ADAPTIVE AREA UNDER CURVE ALARMS.). The TREND DISPLAYS show the force value deviation for the particular active mode of TREND ALARM. A high or low force change on any channel that exceeds the TREND ALARM setting will fire the TREND ALARM relay (TREND STOP) for machine stop.

The following conditions are present in MONITOR PARTS operation:

- Press overload CAPACITY ALARMS are active.
- The TREND DISPLAYS and the TREND ALARMS are "On".

**NOTE:** The TREND SAMPLE load values are erased whenever the RLG-4 unit is placed in the BYPASS mode of operation, or, when power is turned off. To stop the machine for a break,

leave the instrument in MONITOR PARTS mode. When restarting the machine, press the RESET button to clear any alarms.

### BYPASS (CLEAR) MODE

Use this mode of operation for setting high CAPACITY ALARM, METER SCALE, and DECIMAL POINT values.

**NOTE:** After power down and power up, press the MODE SELECT button and set the instrument in BYPASS mode. If the instrument remains in the MONITOR PARTS mode during power down/power up, the machine stop relay will prevent the machine from running, and the digital display will flash zeroes. In such a case, press the MODE SELECT button and set the instrument to BYPASS mode to reset the machine stop relay.

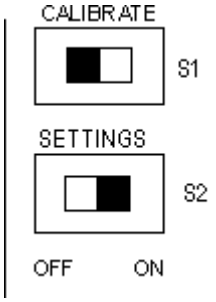
## BASIC MONITOR SET-UP PROCEDURES

### SETTING CAPACITY ALARMS

CAPACITY ALARMS are adjustable discreet high alarms. They are provided for all channels for press overload protection, and are always active. In the event of a CAPACITY ALARM on any channel, the CAPACITY ALARM relay (CAPACITY STOP) will fire to stop the press. To re-start the machine, the alarm RESET button must be pressed to clear the alarm.

For a given press, CAPACITY ALARMS are typically set as a “one-time” adjustment. To set the CAPACITY ALARMS, the following procedure should be used:

1. Press the MODE SELECT button and select BYPASS mode.
2. Open enclosure door and locate slide switches on inside door.
3. Move SETTINGS switch (S2) to the right-hand “On” position.



4. The CORNER SELECT button will allow you to set the high CAPACITY and high/low TREND ALARMS for all channels on a "One-by-one" basis (LEFT FRONT, LEFT REAR, RIGHT FRONT, and RIGHT REAR). Those values will be shown on the individual channel display meters. At the same time, the center TOTAL display meter will also show the SAMPLE SET (1-99), LOW ALARM INHIBIT (0-250), and METER SCALE (0-9999) values.
5. To set a CAPACITY ALARM, select the channel by pressing the CORNER SELECT button. Calculate the proper CAPACITY ALARM value for each channel by dividing the total press capacity by the number of channels on the instrument. For the RLG-4 Loadgard with 4 channels, the total press capacity should be divided by 4. Example: for a press with a total rated capacity of 100 tons, the per channel capacity and CAPACITY ALARM value would be 100 tons/4 = 25 tons per channel.
6. Watching the associated digital meter, adjust the CAPACITY ALARM for each channel by using the UP and/or DOWN buttons located on the front panel, until the desired tonnage is displayed. Note: *when adjusting alarm values up or down on the instrument display, first use the RESET button simultaneously with the UP or DOWN button to acquire the rough value range. Then, use the UP or DOWN button alone to fine adjust the value.*
7. Repeat for all channels.
8. After all the channels have been set, the TOTAL display meter will show three (3) values in sequence as you press the CORNER SELECT button. The first value displayed is the SAMPLE COUNT. Pressing the corner again, the second value displayed is the LOW ALARM INHIBIT. Pressing the CORNER SELECT button again, the third value displayed is the METER SCALE value. The procedures used to adjust and enter those three values are described below.
9. Return SETTINGS switch (S2) on the inside door panel to the left-hand "Off" position.

## SETTING SAMPLE COUNT

The SAMPLE COUNT relates to the"Good Part" TREND SAMPLE taken when MONITOR PARTS operating mode is initiated. The SAMPLE COUNT is the number of machine strokes used to establish the "Good Part" TREND SAMPLE or "benchmark" values. Once the TREND SAMPLE is taken, the high and low TREND ALARMS based on that sample become active. A valid setting is between one (1) and ninty-nine (99) on the TOTAL display. To set the SAMPLE COUNT, use the following procedure:



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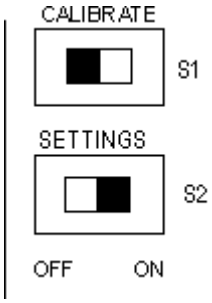
1. Press the MODE SELECT button and set the instrument in BYPASS mode.
2. Open the enclosure door and locate slide switches on inside door.
3. Move the SETTINGS switch (S2) to the right-hand “On” position.




4. Press the CORNER SELECT button until the first value appears on the TOTAL display meter. This is the SAMPLE COUNT value.
5. Adjust the meter display between 1 and 99, using the UP and/or DOWN buttons on front panel.
6. Return the SETTINGS switch (S2) on the inside door panel to the left-hand “Off” position.

## SETTING LOW ALARM INHIBIT

In some processes it may be necessary to “inhibit” or turn off the low TREND ALARMS during machine “ramp-up” after starting the press. This is because the forming loads for a stamped part are typically lower when the press is “ramping up” from a stopped condition to its normal speed. The forming loads reach their normal higher values after the press speed and the tool operation have stabilized. If the low TREND ALARMS were not inhibited during “ramp-up”, “nuisance” low alarms could result from the low tonnage levels. The LOW ALARM INHIBIT setting establishes the number of machine strokes at press start during which the low TREND ALARMS are inhibited. A valid setting is between 0-250 on the TOTAL display.meter.

It should be noted that the LOW ALARM INHIBIT value also determines the TREND SAMPLE DELAY value. The TREND SAMPLE DELAY is a feature whereby the TREND SAMPLE routine is delayed for a certain number of machine strokes at the start of MONITOR PARTS operation. This delay is to allow the process to “stabilize” during machine start-up, so tha a valid “Good Part” TREND SAMPLE is taken of the forming force values.



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To set the LOW ALARM INHIBIT, use the following procedure:

1. Press the MODE SELECT button and set the instrument in BYPASS mode
2. Open the enclosure door and locate slide switches on inside door.
3. Move the SETTINGS Switch (S2) to the right hand "On" position.
4. Press the CORNER SELECT button until the second value appears on the TOTAL display meter. This is the LOW ALARM INHIBIT value.
5. Adjust the meter value between 0 and 250, using the UP and/or DOWN buttons on the front panel.
6. Return the SETTINGS switch (S2) on the inside door panel to the left-hand "Off" position.

## SETTING METER SCALE

The METER SCALE value represents the per channel 100% capacity on which the "calibrated" tonnage values are based for the display meters. Typically, this value is the same as the CAPACITY ALARMS value, and is calculated the same way. For the RLG-4 Loadgard with 4 channels, this is done by dividing the total rated press capacity by 4 to arrive at the per channel capacity. A valid setting is between 0 and 9999.

To set the METER SCALE, use the following procedure:

1. Press the MODE SELECT button and set the instrument in BYPASS mode.
2. Open the enclosure door and locate slide switches on inside door.
3. Move the SETTINGS Switch (S2) to the right-hand "On" position.
4. Press the CORNER SELECT button until the third value appears on the TOTAL display meter. This is the METER SCALE value.
5. Adjust the meter value between 0 and 9999, using the UP and/or DOWN buttons on the front panel.
6. Return the SETTINGS switch (S2) on the inside door panel to the left-hand "Off" position.

## SETTING DECIMAL POINT

The DECIMAL POINT function allows for the optional presence of a decimal point between the 3rd and 4th digits of the individual channel display meters. It has the effect of dividing the normal tonnage values by a factor of 10. To activate the DECIMAL POINT, use the following procedure:

1. Press the MODE SELECT button and set the instrument in BYPASS mode.
2. The DECIMAL POINT function is enabled or disabled by pressing the RESET button on the front display.
3. Press the RESET button to add or remove the DECIMAL POINT. Note: *This feature divides the normal tonnage by a factor of 10.*

For normal monitoring operation, press the MODE SELECT button and return the RLG-4 to the MONITOR PARTS mode.



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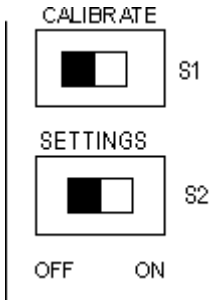
# INSTRUMENT CALIBRATION

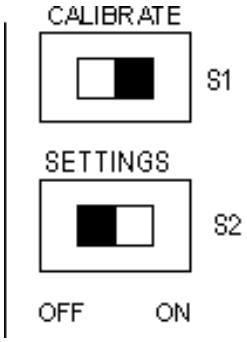
The “Calibration” procedure is used to adjust the monitor for proper tonnage readout values. If this system has been calibrated by a HELM Field Service Technician or by the machine manufacturer, the calibration numbers will be noted on a tag inside the instrument. Once calibrated, it is not necessary to re-calibrate unless the machine is moved, dismantled or otherwise structurally changed. If you have any questions or need a HELM Field Service Technician for calibration, please contact our Field Service Department at 419-893-4356. If this system has not yet been calibrated, refer to the CALIBRATION ADJUSTMENT PROCEDURES outlined below.

## PRELIMINARY CALIBRATION ADJUSTMENT PROCEDURES

1. Open enclosure door.
2. Turn power “On”.
3. Press MODE SELECT button and, select BYPASS mode.
4. Locate slide switches on inside door.
5. In normal monitoring operations, the CALIBRATE (S1) and SETTINGS (S2) switches (located in the inside of the front panel door) are set to the left hand position, as shown in the illustration.
6. For calibration adjustments, move the CALIBRATE switch S1 on the inside door to the right-hand CALIBRATE position.



Normal Monitoring Mode



Calibrate Mode

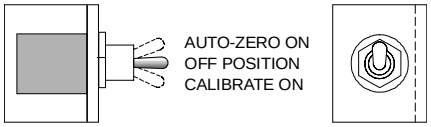
## INDIVIDUAL CHANNEL CALIBRATION ADJUSTMENTS

## MANUAL ZERO BALANCE ADJUST

For the MANUAL ZERO BALANCE ADJUST procedure, refer to both illustrations on the next page that show the inside circuit board and the AUTO ZERO/CAL switch for each channel.

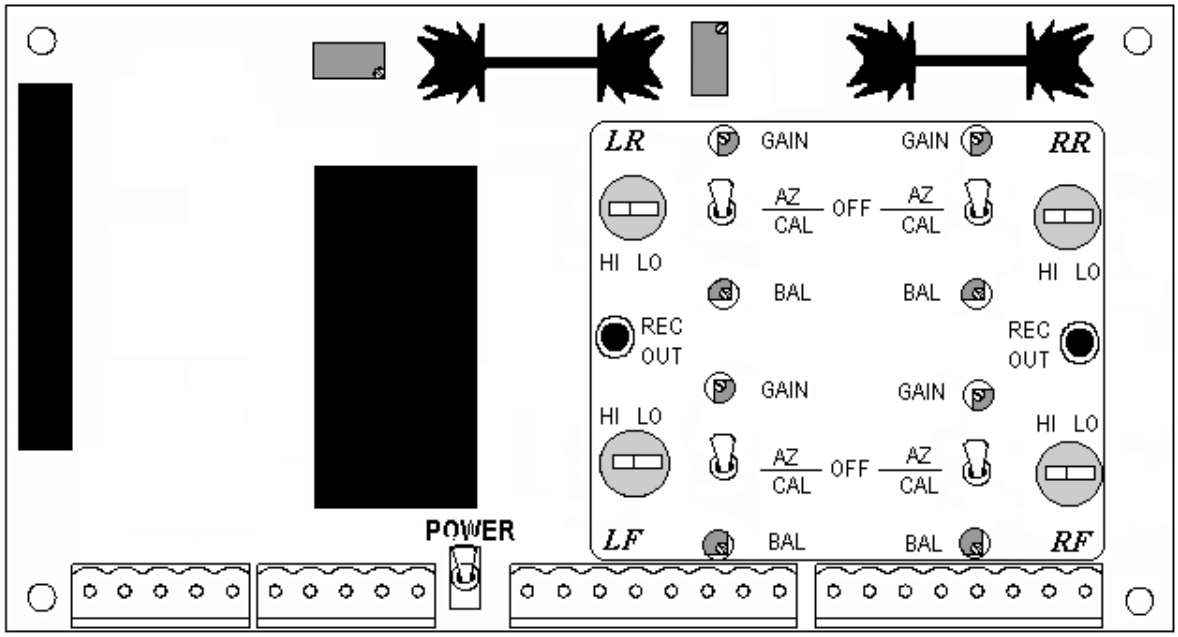
# RLG-4 LOADGARD OPERATING INSTRUCTIONS

1. Push the AUTO ZERO/CAL switch on the inside main circuit board to the center “Off” position.




2. Adjust the ZERO BALANCE

The ZERO BALANCE controls are the small multi-turn potentiometers designated BAL on the inside main circuit board. For Channel 1 (Left Front), observe the front panel digital meter, and turn the ZERO BALANCE potentiometer until the meter displays all zeroes. Repeat this procedure for all channels.




## GAIN ADJUST

The GAIN ADJUST controls are the small multi-turn potentiometers designated GAIN on the inside main circuit board. These controls are used to adjust the force sensor signal amplification or GAIN for each channel. The GAIN is represented by a digital value called a CALIBRATION NUMBER or CAL Number. Adjusting the GAIN ADJUST CONTROLS the proper CAL NUMBER allows the RLG-4 unit to display correct “calibrated” force values (tonnage) on the front panel meters.



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For proper GAIN ADJUST, the following procedure should be used for each channel:

1. Perform MANUAL ZERO BALANCE ADJUST as outlined above.

2. Push the AUTO ZERO/CAL switch to the bottom CALIBRATE ON position. This puts the CALIBRATION SHUNT RESISTOR (simulated load) across the sensor input for that channel.

3. Observe the front panel digital meter, and turn the GAIN potentiometer until the meter displays the correct value. If the press has been previously calibrated, enter the CAL NUMBER recorded on the calibration tag inside the unit. If the press has not yet been calibrated, enter an initial CAL NUMBER of "50". Use calibration load cells and a portable monitor to load the press to rated capacity. Adjust the CAL NUMBER as needed, so that the RLG-4 meter displays the correct load cell tonnage with the unit in normal monitoring mode.

4. Each channel has a HIGH/LOW CALIBRATION SHUNT RESISTOR dip switch, designated as HI LO on the inside main circuit board. That switch controls the value of the CALIBRATION SHUNT RESISTOR (simulated load) used during calibration. The LO switch setting (low GAIN) represents a resistor value of 140K ohms, and should be the initial setting tried. If the proper CAL NUMBER cannot be entered with the LO 140K setting, the HI setting should be used. The HI switch setting (high GAIN) represents a resistor value of 1000K ohms and allows for GAIN values that are 7.14 times greater than for the LO 140K setting with the same CAL NUMBER. In this way, a particular CAL NUMBER is <u>always</u> associated with the proper CALIBRATION SHUNT RESISTOR value (140K or 1000K ohms).

5. Push the AUTO ZERO/CAL switch to the top AUTO ZERO ON position. This removes the CALIBRATION SHUNT RESISTOR (simulated load) from the sensor input. It also turns the AUTO ZERO function on for normal monitoring operation. AUTO ZERO provides for a stable monitoring "baseline" during temperature changes and resulting thermal expansion/contraction in the press and the force sensors.

6. Return the CALIBRATE switch S1 on the inside door to the left-hand normal monitoring position .



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## NORMAL MONITORING OPERATION

For normal monitoring operation, and to utilize the full benefits of press overload protection (CAPACITY ALARMS) and die protection/part quality control (TREND ALARMS), the RLG-4 unit should be put in the MONITOR PARTS mode. This is one of three possible modes that can be selected by pressing the MODE SELECT button.

As stated previously, the discreet high CAPACITY ALARMS for press overload protection are active at all times, including in the MONITOR PARTS mode. TREND ALARMS, based on a learned "Good Part" TREND SAMPLE of force values, are active only in MONITOR PARTS mode. The TREND ALARMS are adjustable high/low % deviation values from the stored "Good Part" force values. Because they are based on a learned "Good Part" condition, TREND ALARMS primarily provide die protection and part quality control. For the best results, TREND ALARMS should be set wide enough to allow for normal process variation, and close enough to detect the desired faults. This is often a "Trial and Error" process. The TREND SAMPLE and TREND ALARMS are described in greater detail below.

TREND SAMPLE

When the RLG-4 Loadgard is put in MONITOR PARTS mode by pressing the MODE SELECT button, the unit takes a TREND SAMPLE of "Good Part" force values for all channels. Those learned "benchmark" values are stored in memory, and then compared to the force values for all subsequent parts. Three different types or modes of TREND ALARMS are associated with the "Good Part" TREND SAMPLE values. Those include PEAK TREND ALARMS, ADAPTIVE PEAK TREND ALARMS, and ADAPTIVE AREA UNDER CURVE ALARMS. When the TREND SAMPLE is taken at the start of MONITOR PARTS mode, the benchmark "Good Part" force values are captured for all three types of TREND ALARMS. As noted below, the unit establishes different TREND SAMPLE values for each of the three types of TREND ALARMS. Only one type of TREND ALARMS is active at one time in MONITOR PARTS mode, as selected by the operator with the ALARM SELECT button.

TREND SAMPLE DELAY

The TREND SAMPLE DELAY is a feature whereby the TREND SAMPLE routine is delayed for a certain number of machine strokes at the start of MONITOR PARTS operation. This delay is to allow the process to "stabilize" during machine start-up, so that a valid "Good Part" TREND SAMPLE is taken of the forming force values.

TREND ALARMS

TREND ALARMS are based on the learned "Good Part" TREND SAMPLE values, and are active only in MONITOR PARTS mode. In the event of any TREND ALARM (high or low), the TREND ALARM RELAY (stop-B) will fire to stop the press. In order to re-start the press, the RESET button must be pressed to clear the alarm.

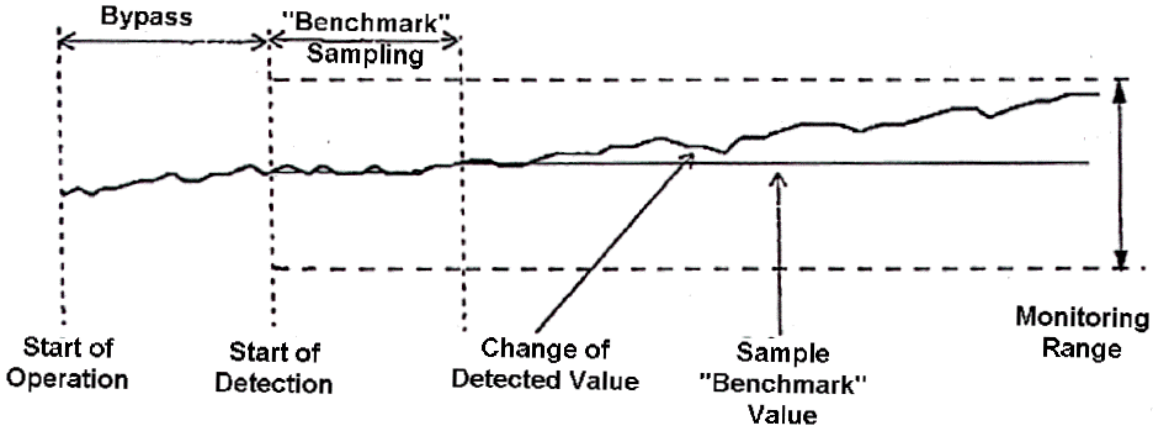
ALARM SELECT BUTTON

The ALARM SELECT BUTTON is used to select one of three types of TREND ALARMS. The type selected (PEAK TREND ALARMS, ADAPTIVE PEAK TREND ALARMS, or ADAPTIVE ARE UNDER CURVE ALARMS) is the only one active at that time. If desired, the type of TREND ALARMS can be changed "On the Fly" during normal monitoring by pressing the ALARM SELECT button. This is because the "Good Part" TREND SAMPLE values are captured and stored in memory for all three types of alarms when the unit is put in MONITOR PARTS mode. The sample values remain in memory until they are "cleared" by putting the unit into BYPASS mode or by turning power off. If the sample values are cleared, new TREND SAMPLE values will be captured when the unit is put into MONITOR PARTS mode again.

## PEAK TREND ALARMS MODE

The PEAK TREND ALARMS represent the simplest and most basic type of TREND ALARMS. For this mode, the ALARM SELECT button should be pressed so that the TREND LED is illuminated. The TREND SAMPLE method and TREND ALARMS operation are shown in the illustration below. At the start of MONITOR PARTS, the "Good Part" TREND SAMPLE values are taken during the number of SAMPLE COUNT machine strokes (0-99). The "Peak" tonnage values for those strokes are averaged, and those average values are stored in memory as the TREND SAMPLE values. At that point, the PEAK TREND ALARMS become active, and the "fixed" sample values are compared to the high/low alarm limits.

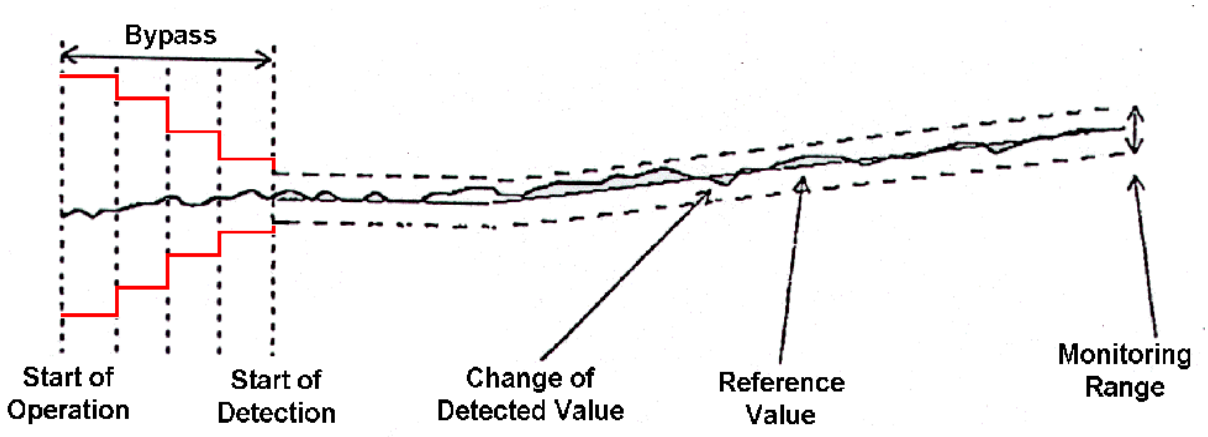
It is important to note that PEAK TREND ALARMS are based on "Peak" tonnage values. Also, the TREND SAMPLE values are "fixed" absolute values, and do not change unless a new sample is taken. PEAK TREND ALARMS can be used to detect instantaneous faults such as broken punches and scrap-in-die, and can also be used to detect small changes over time such as material thickness and hardness. In general, because the TREND SAMPLE values are fixed, the alarm limits for PEAK TREND ALARMS must be set wider to prevent "nuisance" alarms



## ADAPTIVE PEAK TREND ALARMS MODE

The ADAPTIVE PEAK TREND ALARMS are selected by pressing the ALARM SELECT button so that the ADAPTIVE LED is illuminated. They are the same as the simple PEAK TREND ALARMS, except that the TREND SAMPLE values are not fixed or absolute. Rather, the TREND SAMPLE values are continuously updated using a "rolling average" of "Peak" tonnage values. In this way, the TREND SAMPLE "adapts" to the process, canceling the effects of slow changes over time, such as material thickness and hardness changes. As result, the alarm limits can be set closer without "nuisance" alarms. Although slow changes over time would not be detected, ADAPTIVE PEAK TREND ALARMS with alarm limits set closer do allow for greater sensitivity to subtle faults (smaller broken punches, smaller scrap-in-die, etc.). This is shown in the illustration below.

The number of machine strokes included in the "rolling average" is equal to the SAMPLE COUNT value (0-99). Unlike PEAK TREND ALARMS, where the TREND SAMPLE must be complete for all hits before the alarms are active, ADAPTIVE PEAK TREND ALARMS become active after the first machine stroke. Thus, the alarms become active much more quickly after the TREND SAMPLE is initiated in MONITOR PARTS.

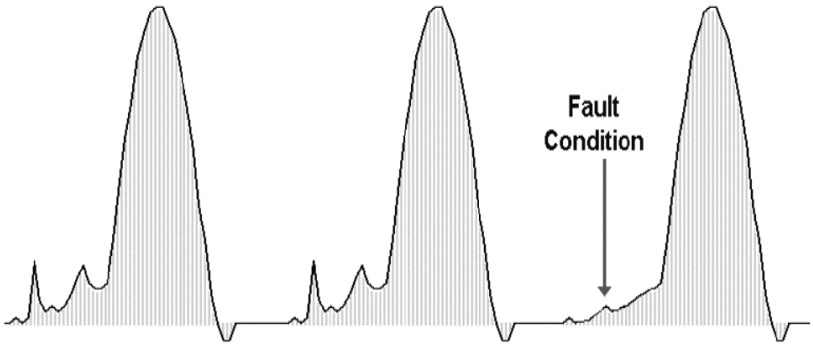



## ADAPTIVE AREA UNDER CURVE ALARMS MODE

The ADAPTIVE AREA UNDER CURVE ALARMS are selected by pressing the ALARM SELECT button so that the AREA LED is illuminated. They are very similar to the ADAPTIVE PEAK TREND ALARMS, except that the TREND SAMPLE is based on load signature "Area" values, rather than "Peak" tonnage values. The load signature "Area", or integration of the force curve, represents the forming work done for a particular machine stroke. The "Area" calculation itself is done by "digitizing" the load signature, summing all of the point force values above zero, and dividing by the total number of points (Note: sample time = 1 millisecond). By using the load signature "Area" values to establish the "Good Part" TREND SAMPLE, ADAPTIVE AREA

UNDER CURVE ALARMS can provide greater sensitivity to certain fault conditions than a “Peak” force monitoring method. This would apply to processes involving an extended load time (draw operations, assembly, orbital riveting, etc.), where the fault does not always produce a change in “Peak” force, but does change the load signature. This is shown in the illustration below.

Like ADAPTIVE PEAK TREND ALARMS, ADAPTIVE AREA UNDER CURVE ALARMS use a continuously updated “rolling average” of values for the TREND SAMPLE. The number of machine strokes included in the “rolling average” is equal to the SAMPLE COUNT value (0-99). Also, ADAPTIVE AREA UNDER CURVE ALARMS become active after the first machine stroke.




## SETTING TREND ALARMS

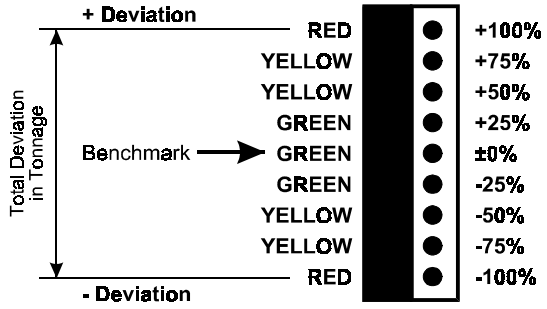
As described above, TREND ALARMS can be any one of three different types (PEAK TREND ALARMS, ADAPTIVE PEAK TREND ALARMS, or ADAPTIVE AREA UNDER CURVE ALARMS). Although only one type of TREND ALARM is active at one time, the alarm limits are set for all three types at once. The alarm settings for TREND ALARMS are digital values from 0-99. They can be independently adjusted high and low for each channel. The TREND ALARM setting is a percentage value, which represents the percent deviation of the force from the learned “Good Part” TREND SAMPLE value. To set TREND ALARMS, use the following procedure.

1. Press the ALARM SET button.
2. Press the CORNER SELECT button to select the proper channel and alarm setting (Left Front – Lo/Hi, Left Rear – Lo/Hi, Right Front – Lo/Hi, and Right Rear – Lo/Hi. Please note that during this process, the CORNER SELECT button is used to ”toggle thru” the alarm settings for all channels. Also, the particular channel meter shows the alarm setting (0-99), while the TOTAL meter shows whether the alarm is low (“Lo”) or high (“Hi”).
3. Press the UP or DOWN button until the desired low and high TREND ALARM percentage (0-99) is displayed. An entered value of “0” for any particular alarm turns off that alarm. Note: w*hen adjusting alarm values up or down on the instrument display, use the RESET BUTTON simultaneously with the UP or DOWN button to acquire the “coarse” value range. Then, use the UP or DOWN button to fine adjust the value*.
4. Repeat this procedure for all channels.

## TREND DISPLAYS

The RLG-4 Loadgard front panel includes a TREND DISPLAY next to the digital meter for each channel. The digital meter shows the continuously updated peak tonnage value. The TREND DISPLAY is a vertical array or column of colored LED's, which depict the load deviation from the TREND SAMPLE in a graphical format. In this way, the TREND DISPLAY shows the consistency or variation of the load values, which relate to the quality of the parts being produced.

Each vertical TREND DISPLAY column of LED's represents one channel of monitoring. At the start of MONITOR PARTS operating mode, the unit takes a sample of "Good Part" force values for all channels, and puts those "learned" sample values into memory as the benchmark TREND SAMPLE. At that time, the high and low TREND ALARMS, as adjusted by the operator, become active. Initially, only the center green GOOD LED on the TREND DISPLAY is illuminated. This represents the "Good Part" TREND SAMPLE value. As each subsequent part is formed, the load deviation from the TREND SAMPLE value is shown on the TREND DISPLAY.




When only the center green GOOD LED is on, the last part was formed at the same load as the "Good Part" TREND SAMPLE (no deviation in load). If load deviation from the TREND SAMPLE does occur, the TREND DISPLAY LED's will illuminate in a corresponding up or down (high or low) pattern. The green LED's above and below the center, plus the adjacent yellow LED's, represent caution. They indicate that the last part was formed at a force level higher or lower than the "Good Part" TREND SAMPLE, but that that force was still within the TREND ALARM settings. Such an indication means that something is changing in the forming process.

The top red HIGH LED of each TREND DISPLAY represents the high TREND ALARM setting. If this LED is on along with the other green and yellow LED's in the high direction, it shows that the last part was formed at a force higher than the high TREND ALARM setting. At that point, the TREND ALARM RELAY (TREND STOP) would fire to stop the press. If the top red HIGH LED is on by itself, it shows that a high CAPACITY ALARM has occurred. At that point, the CAPACITY ALARM RELAY (CAPACITY STOP) would fire to stop the press.

The bottom red LOW LED of each TREND DISPLAY represents the low TREND ALARM setting. If this LED is on, along with the other green and yellow LED's in the low direction, it shows that the last part was formed at a force lower than the low TREND ALARM SETTING. At that point, the TREND ALARM RELAY (TREND STOP) would fire to stop the press.

# RLG-4 LOADGARD OPERATING INSTRUCTIONS

## RLG-4 ADDITIONAL PROGRAM FEATURES :

In addition to the operating features already noted, the RLG-4 Loadgard program also incorporates the following additional features.

**1.) Reverse Load**

"Reverse Load" or negative "Snap-Thru Load" is displayed on the front panel meters by pressing the REV LOAD button.

**2.) 10% of Load Cancel**

This feature is active in BYPASS mode only. If the load on any channel drops below10% of the METER SCALE value, the digital meter will display "0" in lieu of the actual load.

**3.) Ground Noise 5% Threshold**

The "Ground Noise" threshold is established at 5% of the METER SCALE value. This means that any low signal value below 5% of the METER SCALE is ignored by the unit. This feature prevents nuisance erroneous load readings that could otherwise be caused by electromagnetic "Ground Noise" in the unit.



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# APPENDIX A: STANDARD 24 VDC RLG-4 LOADGARD

## STANDARD 24 VDC RLG-4 LOADGARD SPECIFICATIONS

| | | |
|---|---|---|
| **Electrical Specifications:** | Current Consumption | 500 mA at 24vdc |
| | Number of Channels | 4 (isolated) |
| | A/D Conversion Method | Successive Approximation - 12 bit |
| | Normal Mode Rejection (between + input and - input) | 50 db at 2000 gain |
| | Amp Roll-off Frequency | 650hz at 3000 gain |
| | Calibration | Manual Calibration |
| | Isolation | 500VDC continuous between inputs and chassis ground |
| **Environmental Specifications:** | Operating Temperature | 0º C to 60º C (32°F to 140°F) |
| | Hazardous Environment Classification | Class 1 Division 2 Hazardous Environment |
| **Input Specifications :** | Type of Input | Strain Gauge (350 ohm, 700 ohm) |
| | Input Impedance | 1K |
| | Low Range Gain<br>Cal. Resistor (140k-ohm) | Maximum Gain 1176<br>Minimum Gain 54 |
| | High Range Gain<br>Cal. Resistor (1meg-ohm) | Maximum Gain 6959<br>Minimum Gain 347 |
| | Display Resolution | Up to 0.1% of Full Scale |
| | Overall Unit Accuracy | Within 1% of Full Scale |
| | A/D Sample Rate | 100 microseconds |
| **Output Specifications:** | **ALARM RELAY** | **2 SOLID STATE RELAYS (.5A AT 24VDC)** |



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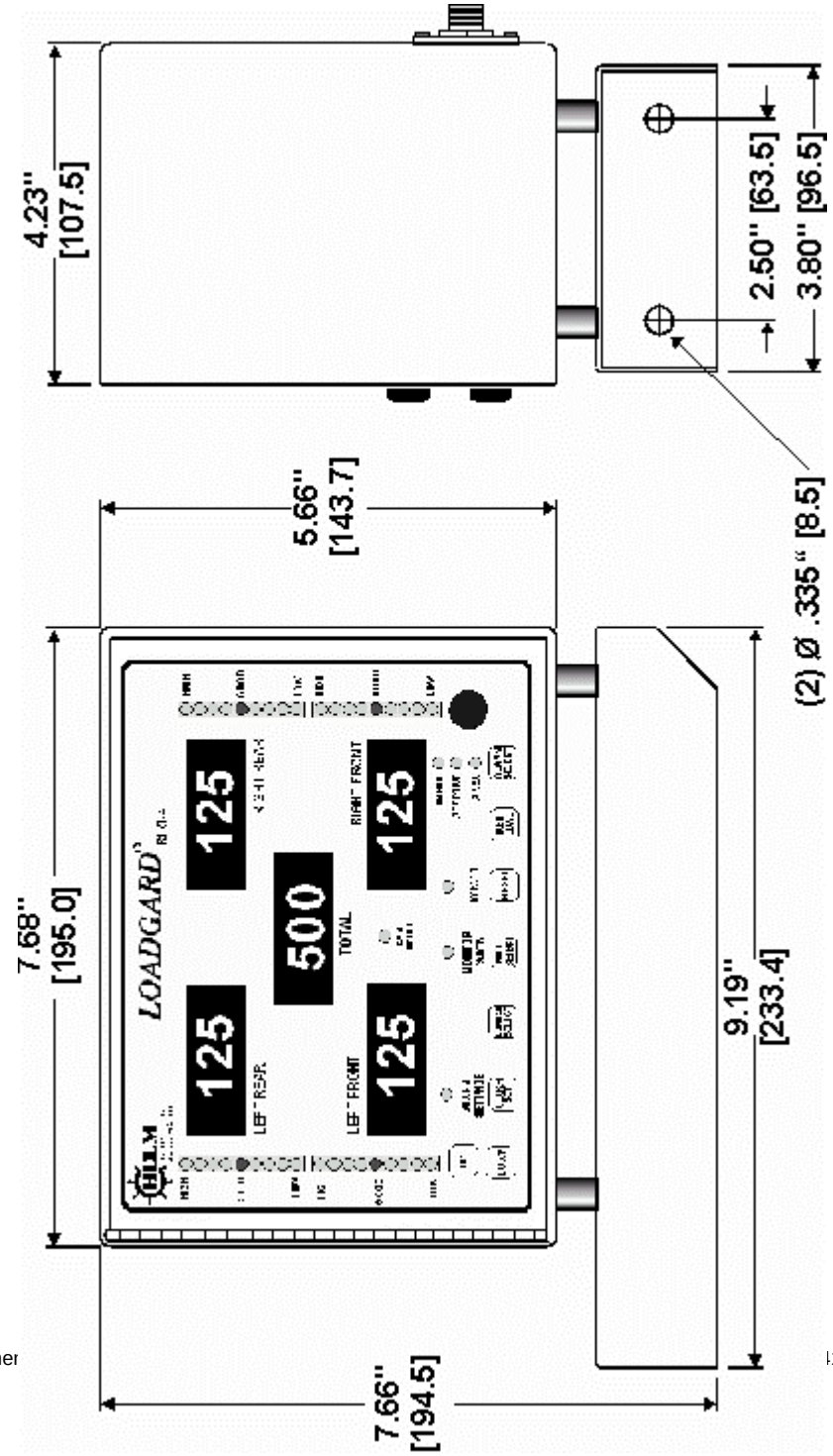
# RLG-4 LOADGARD OPERATING INSTRUCTIONS

## STANDARD 24 VDC RLG-4 BASE-MOUNT ENCLOSURE

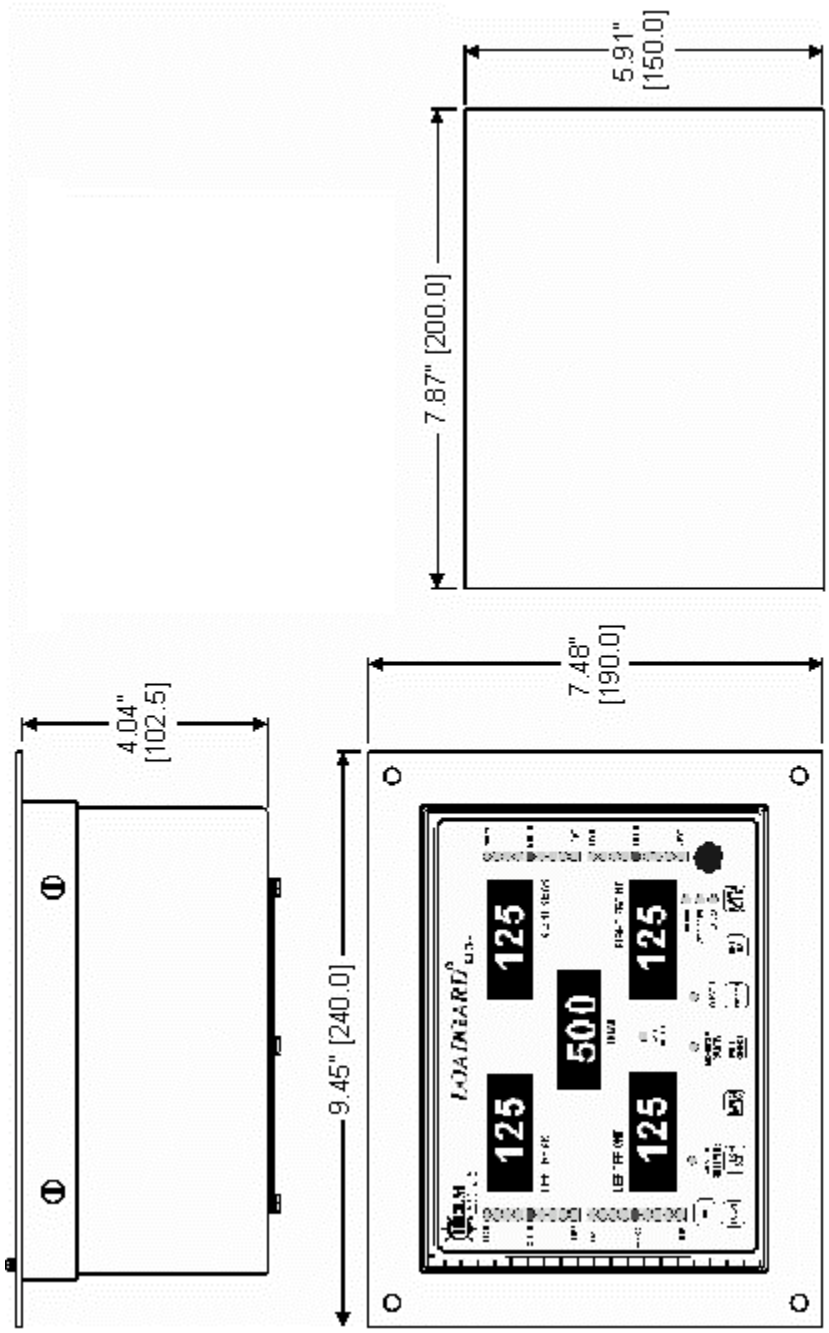
The standard 24 VDC RLG-4 Loadgard is shipped as a base-mount instrument.  A 24 Volt D.C. power source is required.



# RLG-4 LOADGARD OPERATING INSTRUCTIONS

## OPTIONAL 24 VDC RLG-4 FLANGE-MOUNT ENCLOSURE

As an option, the 24 VDC RLG-4 Loadgard can be shipped as a flange-mount instrument. It has been designed to fit within a 150 mm x 200 mm opening, and requires 150 mm depth for installation. A 24 Volt D.C. power source is required.

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# RLG-4 LOADGARD OPERATING INSTRUCTIONS

## 24 VDC RLG-4 USER CONNECTIONS ELECTRICAL DRAWINGS

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## 24 VDC RLG-4 USER CABLE WIRING CODES

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## 24 VDC RLG-4 INPUT/OUTPUT WIRING DRAWING

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# APPENDIX B: RLG-4 LOADGARD WITH 110/220 VAC OPTION

## RLG-4 LOADGARD WITH 110/220 VAC OPTION SPECIFICATIONS

| | | |
|---|---|---|
| **Electrical Specifications:** | Power Input Range | 90-264 VAC |
| | Current Consumption | 100mA at 120 VAC<br>115mA at 220 VAC |
| | Number of Channels | 4 (isolated) |
| | A/D Conversion Method | Successive Approximation - 12 bit |
| | Normal Mode Rejection (between + input and - input) | 50 db at 2000 gain |
| | Amp Roll-off Frequency | 650hz at 3000 gain |
| | Calibration | Manual Calibration |
| | Isolation | 500VDC continuous between inputs and chassis ground |
| **Environmental Specifications :** | Operating Temperature | 0º C to 60º C (32° F to 140° F) |
| | Hazardous Environment Classification | Class 1 Division 2 Hazardous Environment |
| **Input Specifications :** | Type of Input | Strain Gauge (350 ohm, 700 ohm) |
| | Input Impedance | 1K |
| | Low Range Gain<br>Cal. Resistor (140k-ohm) | Maximum Gain 1176<br>Minimum Gain 54 |
| | High Range Gain<br>Cal. Resistor (1meg-ohm) | Maximum Gain 6959<br>Minimum Gain 347 |
| | Display Resolution | Up to 0.1% of Full Scale |
| | Overall Unit Accuracy | Within 1% of Full Scale |
| | A/D Sample Rate | 100 microseconds |
| **Output Specifications:** | **ALARM RELAY** | **DRY CONTACT RELAYS (10A at 240 VAC)** |



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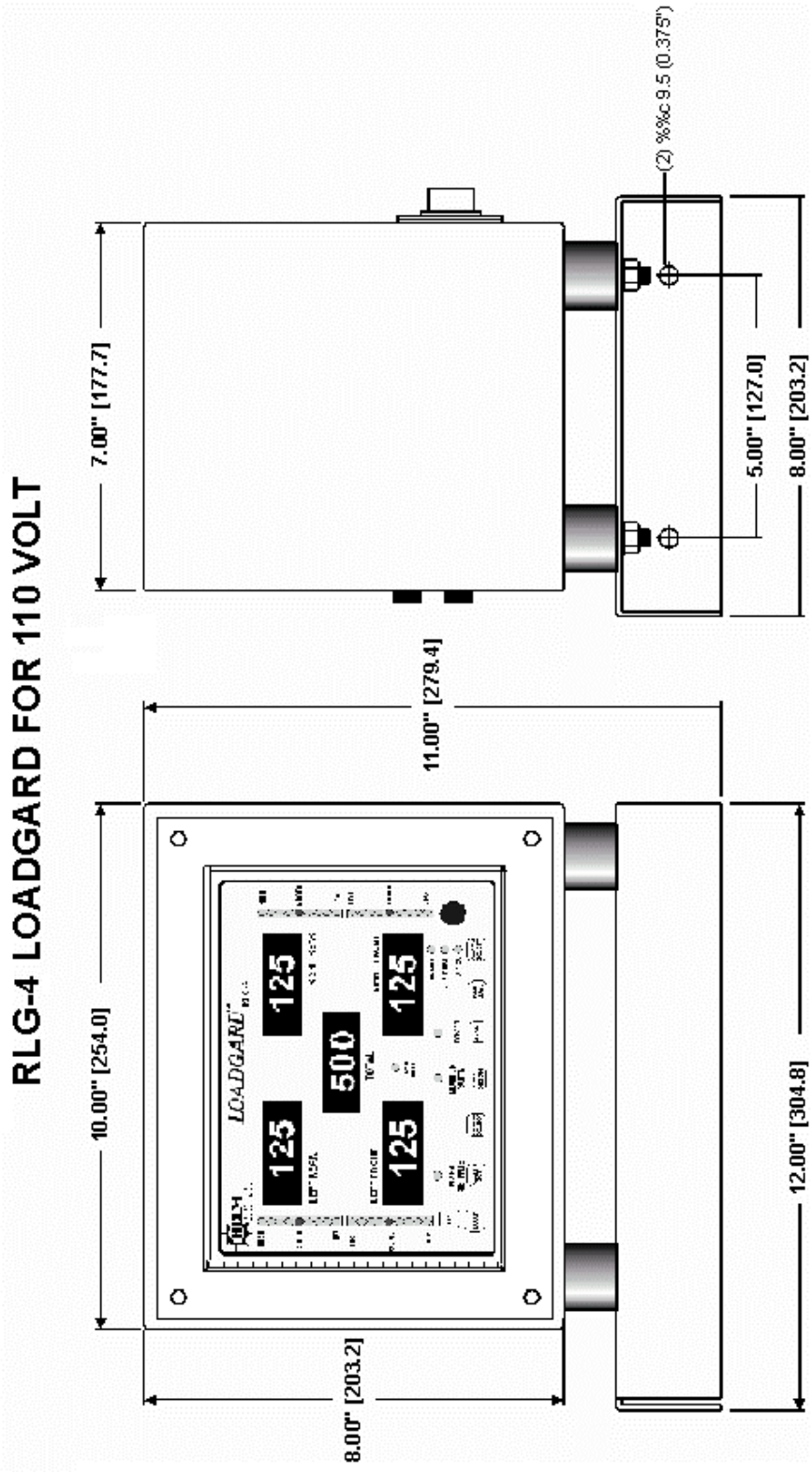
# RLG-4 LOADGARD OPERATING INSTRUCTIONS

## RLG-4 LOADGARD WITH 110/220 VAC OPTION BASE-MOUNT ENCLOSURE

The RLG-4 Loadgard with 110/220 VAC option is shipped as a high voltage base-mount instrument. A 110 or 220 Volt AC power source is required.



## 110/220 VAC RLG-4 USER CONNECTIONS ELECTRICAL DRAWING

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## 110/220 VAC RLG-4 USER CABLE WIRING CODES

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## 110/220 VAC RLG-4 INPUT/OUTPUT WIRING DRAWING

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