Autotech Controls
M1950 $I^2 \cdot$ PLS
Peak Tonnage Module
Instruction & Operation Manual

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MAN-M1950-PEAK
REV 01 11/04/97

M1950 Peak Tonnage Module Introduction

The M1950 Peak Tonnage Module is designed to be used in conjunction with the M1950 PLS/PLM Base Unit. The Peak Tonnage Module provides four ways to protect the press and die from overload and damage as well as monitor the consistency of the production process. The four die and press protection functions of the M1950 include:

1. **Critical Curve Limit** monitors tonnage readings between 90 and 270 degreees during press strokes. If any of the sensor readings exceed the critical curve settings, the positive press protect output will deactivate.
2. **Negative Press Protect** monitors negative peak tonnage between 90 and 270 degrees. If any of the sensor readings exceed the programmed value, the negative press protect output will deactivate.
3. **Positive/Negative Die Protect Limit** checks negative and positive deviation from the reference profile. It detects tonnage that would cause damage to the die. If any of the sensor readings exceed the limits, the associated output will deactivate.
4. **Positive/Negative Process Control Limit** verifies repeatability of the strokes signaling any rapid changes in peak reading. If a rapid change is detected the associated output will deactivate.

These functions are explained further in the Programming Reference Section of this manual.

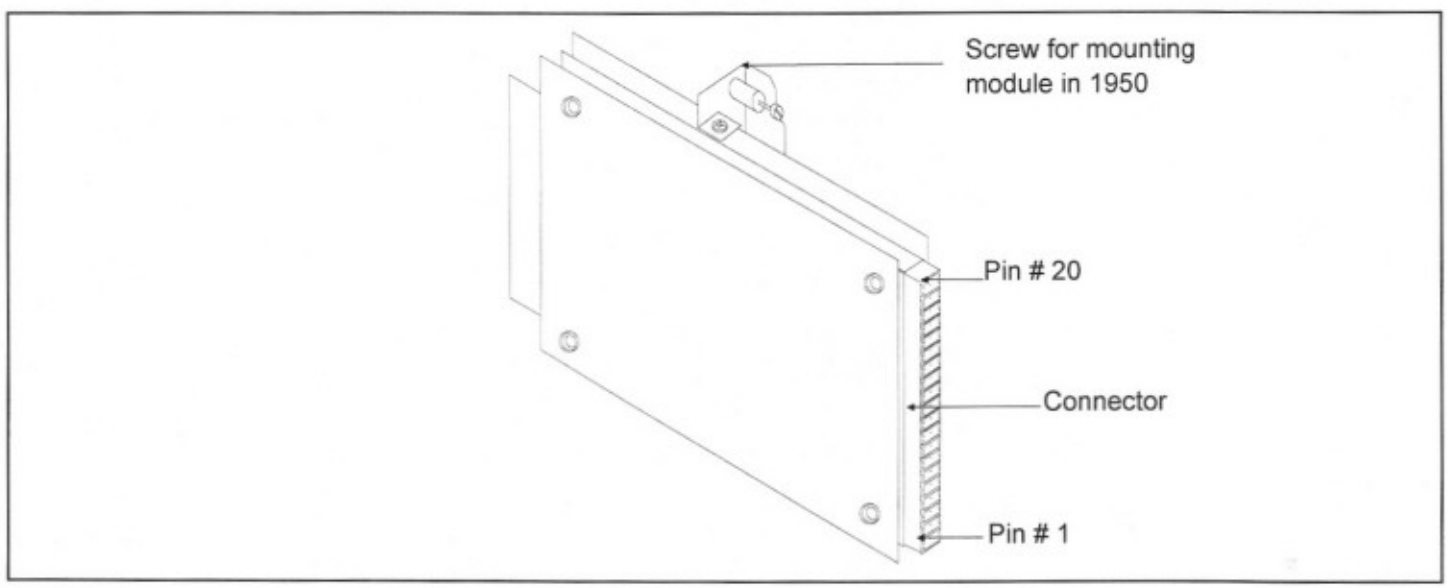


Illustration 1 - M1950 Peak Tonnage Module

Peak Tonnage Module Specifications

Maximum Number of Modules per M1950 ..... 5 total, per M1950,
- PLS ..... 3 per M1950, 16 channels per module
- Tonnage ..... 2 per M1950, 4 sensors per module
- Die Protection ..... 3 per M1950, 8 inputs per module
- Peak Tonnage ..... 2 per M1950, 4 sensors per module

Peak Tonnage Module

Number of Set-ups ..... 100 Tools

Tonnage Load Sensor ..... Autotech's sensor with built-in electronics to provide 4-20 mA current signal

Number of Sensors ..... 4 per module

Inputs
- Fault Reset and Disable Die Protect Input: .... Optically Isolated
- TRUE ..... Contact closure to VS- or less than 1 VDC
- FALSE..... Open circuit or greater than 3.8 VDC
- Input Power
  - 5 VDC ..... From the main terminal block of the M1950 base unit
  - 12 VDC ..... From the main terminal block of the M1950 base unit
- Customer VS+..... 11-28 VDC external power supply from customer or Autotech Relay Chassis
- VS- ..... Common for 5 VDC - 12 VDC from main terminal block and common for customer VS+ (Note: Terminal number 11 and 12 are internally shorted together)

Outputs ..... P or N type, factory ordered
- N ..... NPN Sink Transistor
  - *Logic True*..... Transistor ON, 1.1 V max @ 100 mA
  - *Logic False* ..... Transistor OFF, 0.1 mA leakage @ 50 VDC
- P..... PNP Source Transistor
  - *Logic True*..... Transistor ON, 1.7 VDC drop @ 100 mA
  - *Logic False* ..... Transistor OFF, 0.2 mA leakage @ 50 VDC
- Negative Press Protect Output ..... Measured tonnage exceeds negative press protect limit
- Positive Press Protect Output..... Measured tonnage exceeds positive press protect limit
- Negative Fault Output..... Measured tonnage is less than die and/or process low limit
- Die Protect or Process Control
  Positive Fault Output ..... Measured tonnage is greater than die and/or process high limit

How to Order

1. Tonnage Module

ASY-M1950-PEK4N. . . . . Peak Tonnage Module for up to 4 sensors
(Sensors are not included, see step 6)
N = NPN Sinking Outputs

ASY-M1950-PEK2N. . . . . Peak Tonnage Module for up to 2 sensors
N = NPN Sinking Outputs

2. I^2 PLS

ASY-M1950-PEAKx is plugged in M1950 base unit. Select appropriate base unit depending upon your power input requirement (See limitations on Page 2). The following M1950 base units are available:

SAC-M1950-01A. . . . . Base unit to support PLS, Die Protection and Tonnage at Angle, 110V, 60 Hz

SA2-M1950-01A . . . . . Base unit, same as above, but with 220-240VAC, 50/60 Hz AC power input

SA4-M1950-01A . . . . . Base unit, same as above, but with 24 VAC power input

3. Other Plug-In Modules Available

Maximum of five (5) modules of ANY combination:

ASY-M1950-16x . . . . . PLS Output Module - 16 Channel
ASY-M1950-DPx. . . . . Die Protect Module for up to 8 inputs
ASY-M1950-TAx . . . . . Tonnage at Angle Module for up to 4 sensors
(Sensors are not included, see step 6)

Where x =
P PNP Sourcing Outputs
N NPN Sinking Outputs

4. Remote Power Relay Output Chassis

4.1 Tonnage Module provides transitor level outputs. For relay type of outputs, use relay output chassis. Select relay chassis part number. Must use NPN type of output module (see step 2). Relays are not included, see step 3.2 below to order:

ASY-RLYCH-08RL . . . . . Chassis for 8 EM-relay outputs with motion detector output and built-in power supply (Use KSD-012DC-10A Relays only)
ASY-RLYCH-16RL . . . . . Chassis with 16 EM-relay output (Use KSD-012DC-10A Relay only)
ASY-RLYCH-08SS. . . . . Chassis for 8 solid state or EM (KSD-A12DC-10A) relay outputs
ASY-RLYCH-16SS. . . . . Chassis for 16 solid state or EM (KSD-A12DC-10A) relay outputs
Note: For 220/240 VAC, 50/60 Hz AC power input, change the "Y" in "ASY" to "2"

4.2 Select type and number of output relays (required to ASY-RLYCH-xxx relay chassis):

KSD-012DC-10A. . . . . Electro-mechanical relay, SPDT, 120 VAC @ 10 amps resistive (For use with ASY-RLYCH-08RL and 16 RL relay chassis only)

KSD-A12DC-10A . . . . . Electro-mechanical relay, SPST, Form A, 120 VAC @ 10 Amps resistive (For use with ASY-RLYCH-08SS and ASY-RLYCH-16SS Relay Chassis)

KSS-60VDC-3AMP . . . . . DC Solid state relay, 3 Amp, 60 VDC

KSS-120AC-3AMP. . . . . AC Solid state relay, 3 Amp, 120 VAC,

KSS-200DC-1AMP. . . . . DC Solid state relay, 1 Amp, 200 VDC

4.3 Cable connecting cam modules to relay chassis:

CBL-15S22-DAXXX. . . . . 15 conductor cable, with overall foil sheild, XXX ft. length and sub "D" connector on one end. Length ordered must be 10, 25, 50, and in 50 foot increments.

CBL-RLYCH-D04 . . . . . 15 conductor cable, with overall foil shield, 4 ft. length, sub "D" connector on one end and open on the other, for interconnection of relay chassis to the PLS

NOTE: Two cables are required for one PLS output module. Each cable accomodates 8 outputs.

5. Tonnage Monitor Sensors, Amplifiers, Cables and Installation Kits

5.1 Tonnage Module supports upto four sensors. Select number and type of Strain Gauge Sensors or Amplifiers Needed:

SAC-M1030-SEND. . . . . 1 strain gauge sensor with amplifier assembly, box and cover, 2 torque pads and 4 mounting screws 1/4-28 x 3/4" socket head cap

SAC-M1030-SENW . . . . . 1 strain gauge sensor with amplifier assembly, box and cover, 2 weld pads, 2-torque pads, and 4 mounting screws (1/4-28 x 3/4" socket head cap)

ASY-M1030-AMP. . . . . Retro-fit amplifier assembly includes amplifier assembly mounted on standard cover, screw terminals for sensor connection

ASY-M1030-AMPD . . . . . Retro-fit amplifier assembly includes amplifier assembly for die sensors, screw terminals for sensor connection

ASY-M1030-STG . . . . . Strain Gauge Element, with connector for Autotech's Amplifier Assembly

5.2 Select Installation Kit needed:

KIT-M1030-INSTL. . . . . Installation kit includes: Gauge block and temporary mounting screw, #8 HS drill bit, 1/4-28 NF tap, and 4 temporary weld pad mounting screws

KIT-M1030-TORQ. . . . . (2) Torque Pads and (4) mounting screws 1/4-28 x 3/4"

KIT-M1030-WELD . . . . . (2) Weld pads & (4) temporary screws 1/4-28x1"

5.3 Select cable length:

CBL-10T22-Cxxx . . . . . Recommended shielded cable for the sensor wiring. 22 AWG, 10 conductor (5 twisted pairs) overall foil shielded cable, without connector. xxx =Length. Must be be 010, 020, 050 feet and increments or 50 ft increments up to 2500 ft.

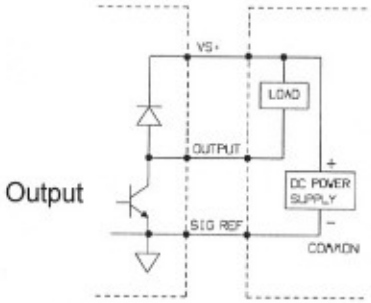
Installation and Wiring

Peak Tonnage Terminal Connections

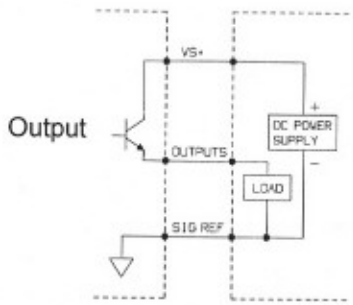
Refer to **Illustrations 2 and 3** (Rear Module Insertion and Function Diagram) when wiring the PEAK TONNAGE Module.

TON Terminal #	Designation	Function / Description
1	Input Sensor 4	4-20 mA *
2	Input Sensor 3	4-20 mA*
3	Input Sensor 2	4-20 mA
4	Input Sensor 1	4-20 mA
5	Sensor "+" (12 VDC Out)	
6	Sensor "-" (Sensor Common)	
7	Fault Reset Input	Active Low
8	Disable Die Protect Input	Disable Die Protection when Low
9	Not Used	
10	Not Used	
11	Vs-	
12	Vs-	
13	Not Used	
14	+5 V External Power Supply	
15	+12 V External Power Supply	
16	External Vs+ Input	11-28 V Input
17	Negative Press Protect Output	Normally ON
18	Positive Press Protect Output	Normally ON
19	Die Protect or Process Control Negative Fault Output	Normally ON
20	Die Protect or Process Control Positive Fault Output	Normally ON

* ASY-M1950-PEK4N only. Terminals 1 and 2 not present on -PEK2N.



Illust. 4 - N Type Output

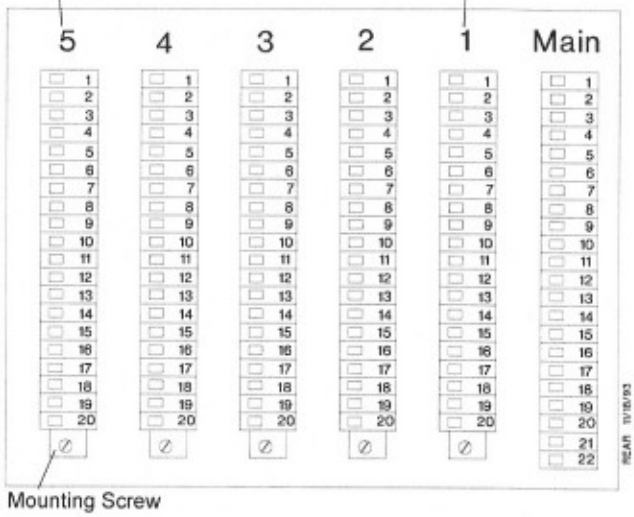


Illust. 5 - P Type Output

Module Insertion Into Backplane of M1950

Modules may be installed in any Slot (1 through 5):
PLS (maximum of 3)
Tonnage (maximum of 2)
Die Protection (maximum of 3)

Slot Numbers:
Modules may be placed in any of the slots. Module Numbers are used during Module Selection in the programming mode.



Modules should be inserted in to the slots with the mounting screw on the bottom.

Illustration 2
Rear Module Insertion

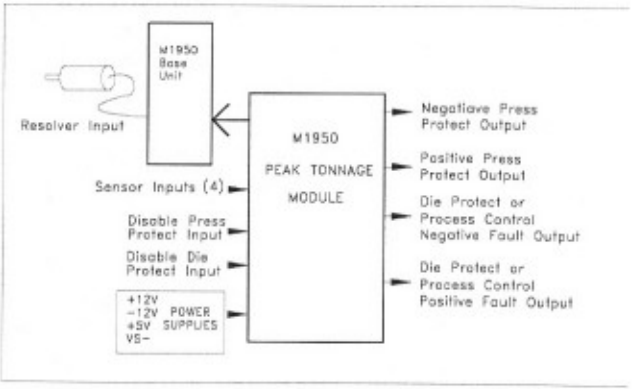


Illustration 3 - M1950 Peak Tonnage Function Diagram

Programming Overview

The 20 key keypad and alpha-numeric displays are used for programming the I^2●PLS M1950. Programming is menu driven. The display will show several choices. A blinking choice on the display prompts the user to make changes to the value (if necessary). Choices are selected as follows:

- ARROW (RIGHT/LEFT or UP/DOWN) keys move the cursor selection from one choice to the other. The UP and DOWN arrow keys are used for programming.
- ENTER key will select and save the choice.
- MODE key is context dependent. This key steps to the next programmable display in the programming sequence or returns to the previous or first screen in the sequence.

The numeric values may be entered in two ways:

- Enter the number directly using number keys; entry is accepted only after pressing of ENTER key.
- UP and DOWN ARROW keys to increment or decrement values. Values are modified immediately, however they are not saved until ENTER is pressed.

☞ Before any programming may be done, the PE (Program Enable) must be TRUE (LOW). Supervisor 1 and 2 must be TRUE (LOW) for some modes (See **Program Management**).

Program Management

The table below lists the programming controls which must be used to access certain features of the M1950 Peak Tonnage Module:

Security Type must be TRUE	To Access:
Supervisor 1	Limits and Learn Modes
Both Supervisor 1 and 2	Setup Modes
Program Enable	All Value Changes

The System Security is provided on the Main Terminal Block located on the back of the unit. The Terminals 14-16 are Supervisory 1 and 2 and Program Enable. These may be installed as remote "key switches" and must be tied to Vs– for the user to access certain screens as shown.

See **Peak Tonnage Module Screen Flowchart** on page 19.

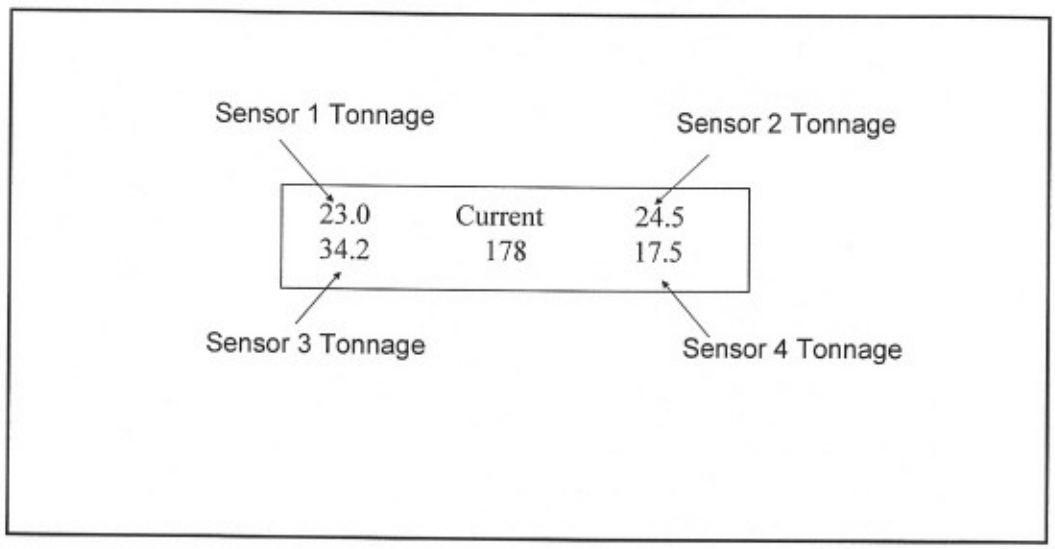


Figure 6 - Display Locations for Sensors

Programming Reference

With the Peak Tonnage Module installed, programming modes are accessed as follows:

- Press Mode key from Base Default Screen, then choose "Edit" from the Change, Edit, Setup Menu Display on the M1950 , then press Enter.
- Select "TON" module from the next display (Module Selection Display). An example of this display is shown below:

```
  1   2   3   4   5
PLS PLS           TON
```

A flowchart of all programming displays is shown on page 19.

This section describes the screen displays for the M1950 Peak Tonnage Module. There are two major modes, Run and Die Management Mode.

Run Mode. The first six displays which may be accessed are considered to be part of the Run Mode . These displays show what the Tonnage Module is reading and do not require any programming. The Run Mode includes: Current Tonnage, Last Hit, Positive Peak, Negative Peak, Counter, and the Fault Mode.

Die Management Mode. Through the main menu of this mode, there are three sub-modes which may be selected: Limits, Learn and Setup. Each mode is described in this Programming Reference section.

Run Mode 1: Current Tonnage Mode

Previous Mode: Module Selection Display

```
23.0    Current    24.5
34.2      178      17.5
```

This display shows current tonnage read from each installed sensor at any given angle. The tonnage signal can be monitored in very slow changing processes through this display. The number in the lower center location indicates current resolver position.

Tonnage of the four sensors is read as follows:

Position on the display:	*Tonnage read from sensor #:*
Top Left	Sensor 1
Top Right	Sensor 2
Lower Left	Sensor 3
Lower Right	Sensor 4

☞ If a sensor is not installed, its corresponding window is blank..

Keypress responses are shown below:

Key Pressed	*Response*
Mode	Switches to Die Management Mode
Up/Down Arrow	No Action
Right Arrow Left Arrow	Moves to Last Hit Mode Display Fault Screen
Enter	Check Sum/Version Screen

Run Mode 2: Last Hit Mode

Previous Mode:Current or Positive Peak Mode

```
7.0    Last Hit    6.7
4.7      128       3.5
```

Information about tonnage recorded from the previous stroke is viewed in this display. Position at which tonnage was recorded is shown in the lower center location of the display. Position can be adjusted from 90 to 269 degrees.

Keypress responses are shown below:

Key Pressed	*Response*
Mode	Switches to Die Management
Up/Down Arrow or Numeric	Enter desired resolver position
Right Arrow Left Arrow	Switches to Pos. Peak Mode Switches to Current Tonnage Mode
Enter	Enters numerical key entries

Run Mode 3: Positive Peak Mode

Previous Mode: Last Hit or Counter Mode

```
 57.2    Positive      78.4
 34.9      229.8       59.3
```

The four corners of this display show positive peak readings recorded from the last stroke. Information is gathered from the 90 to 270 degree range. Displayed peak values are updated each time the resolver crosses 270 degrees. Positive peak reading is calculated as a difference between signal read at zero degrees and maximum signal value read between 90 and 270 degrees. The value in the center is the total positive peak reading of all four sensors.

The following table explains how to read the positive peak values of the four sensors:

Position on the display:	***From sensor #:***
Top Left	Sensor 1
Top Right	Sensor 2
Lower left	Sensor 3
Lower right	Sensor 4

Keypress responses are shown below:

Key Pressed	***Response***
Mode	Switches to Die Management
Up/Down Arrow	No Action
Right Arrow Left Arrow	Moves to Counter Mode Moves to Last Hit Mode
Enter	Switches to Negative Peak Mode

Run Mode 4: Negative Peak Mode

Previous Mode: Positive Peak Mode

```
 23.1    Negative      34.1
 15.5      86.1        13.4
```

The four corners of this display show negative peak readings recorded from the last stroke. Information is gathered from the 90 to 270 degree range. Displayed peak values are updated each time the resolver crosses 270 degrees. Negative peak reading is calculated as a difference between signal read at zero degrees and minimal signal value between 90 and 270 degrees. The value in the center is the total negative peak reading of all four sensors.

Keypress responses are shown below:

Key Pressed	***Response***
Mode	Switches to Die Management
Up/Down Arrow	No Action
Right Arrow Left Arrow	Moves to Counter Mode Moves to Last Hit Mode
Enter	Switches to Positive Ton Mode

Run Mode 5: Counter Mode

Previous Mode: Positive Peak or Fault Mode

```
 123456     Hits     Reset
   100%       Good
```

The counter indicates the number of strokes which occurred with comparison turn ON (See Die Management Mode). Good hits percentage is calculated as a division of strokes which did not cause a fault to total number of strokes.

Keypress responses are shown below:

Key Pressed	***Response***
Mode	Switches to Die Management Mode
Up/Down Arrow	No Action
Right Arrow Left Arrow	Moves to Fault Mode Moves to Positive Peak Mode
Enter twice	Resets counter

Run Mode 6: Fault Mode

Previous Mode: Counter Mode or Current Tonnage Mode
This display is used to indicate fault status of a unit.

With no fault present, the display shows:

```
NO FAULT PRESENT!
```

With a die protect fault present, the screen shows:

```
Sensor #1  Fault Die+
Signal=14.7%  lim=10%
```

There are four types of faults which may be detected. The table below shows fault priority from highest to lowest:

1
- Positive Press Protect (Critical Curve)
- Negative Press Protect

2
- Die Protect Limit - Positive
- Die Protect Limit - Negative

3
- Process Control Limit - Positive
- Process Control Limit - Negative

4
- Sensor Offset Limit - Positive
- Sensor Offset Limit - Negative

Limits and signal values are displayed as tons or percents depending on selection made in the Setup Menu. The fault display shows only the first fault which occurred after a no fault status.

☞ The "Reset" input (Term. 7) clears all faults.

Keypress responses are shown below:

Key Pressed	*Response*
Mode	Switches to Die Management Mode
Up/Down Arrow	No Action
Right Arrow	Moves to Current Tonnage Mode
Left Arrow	Moves to Counter Mode
Enter	No Action

Die Management Menu

Previous Mode: Setup 9 ; Learn 3; or Limits 6; or any of the Run Modes: Current Tonnage, Last Hit, Positive/Negative Peak, Counter or Fault

To access this mode, press the MODE key while in any of the "Run" modes: Current Tonnage, Last Hit, Positive Peak, Negative Peak, Counter or Fault Mode

```
P#25      Die Name     OFF
Limits     Learn     Setup
```

The top line of the display shows
- Die Number
- Die Name, and
- Comparison Status.

☞ **Comparison ON activates Die and Process Control Limit Checking (See Limits Mode 2). Limits are ignored with Comparison OFF. Negative and Positive Press Protect checking is not effected by this selection and takes place all the time regardless of comparison status.**

Three selections are available through the bottom line of the display if the appropriate Supervisory level is TRUE:
- Limits Mode (Supervisory 1 TRUE)
- Learn Mode (Supervisory 1 TRUE)
- Setup Mode (Supervisory 1 and 2 TRUE)

Keypress responses are shown below:

Key Pressed	*Response*
Mode	Returns to the "RUN Mode" at any time while in Die Management Mode
Up/Down Arrow	Toggles between On and Off when Comparison Activation is selected (Top right corner of display)
Right/Left Arrow	Flashing text cursor moves through display: Limit, Learn, Setup and Comparison On/Off Activation
Enter	Switches to the selected Die Management Sub-Modes: Limits, Learn or Setup

Setup Mode 1: Critical Curve Entry Mode

Control Inputs: Supervisor 1, Supervisor 2, and PE must be TRUE for programming

Previous Mode: Die Management Mode

```
Sensor #1  Angle = 90
Critic Cur:   120.0 ton
```

Critical curve is a limit which protects the press from excessive overload. The allowed load depends on the shaft angle. There are four critical curves in the M1950 Peak Tonnage Module (one for each sensor). The peak tonnage value for each degree is entered in the lower right corner of the display.

Tonnage is monitored between 90 and 270 degrees. The critical curve is symmetrical around 180 degrees which means that the user enters tonnage only for angles from 90 to 179 degrees.

The critical curve is stored in the EEPROM so it is entered only once and can be used with all dies that the press will run.

☞ **The tonnage limits** on all installed sensors must not exceed the allowable press tonnage at the specified angle. Critical curve limit is press specific and does not depend on die limit settings nor collected reference peak values.

If critical curve is not necessary and "flat" limit can be used for press protect, see Setup Mode 2.

CAUTION

If the signal value exceeds the critical curve settings, the fault will be detected and the Positive Press Protect Output will be de-energized.

Key press responses are shown below:

Key Pressed	*Response*
Mode	Moves to Setup Mode 3: Negative Press Protect Mode
Numeric	Enters values
Up/Down Arrow	Fine tunes values Change sensor number
Right/Left Arrow	Moves through selection on display
Enter	While sensor number is flashing, switches unit to critical curve FAST entry Mode

Setup Mode 2: Critical Curve Fast Entry Mode

Control Inputs: Supervisor 1, Supervisor 2, and PE must be TRUE for programming

Previous Mode: Die Management Mode

```
Sensor #1      ENTER
Critic Cur:    150.0 ton
```

The Critical Curve FAST Entry Mode is used if a critical curve is not necessary and "flat" limits can be used for press protect.

Pressing the ENTER key while the Sensor Number is flashing will change Angle = xxx to ENTER.

Pressing the ENTER key with the "ENTER" text flashing recalculates critical curve for all 180 degrees to be equal to the number in the lower right corner of the display. This number, as well as the sensor number, can be adjusted using the UP OR DOWN ARROW keys or the NUMERIC keypad.

Keypress responses are shown below:

Key Pressed	*Response*
Mode	Moves to Setup Mode 3: Negative Press Protect Mode
Numeric	Enters values
Up/Down Arrow	Fine tunes values Change sensor number
Right/Left Arrow	Moves through selection on display
Enter	While sensor number is flashing, pressing ENTER switches unit to critical curve

Setup Mode 3: Negative Press Protect Mode

Control Inputs: Supervisor 1, Supervisor 2, and PE must be TRUE for programming

Previous Mode: Setup Mode 2: Critical Curve FAST Entry Mode

```
Negative press protect
Sensor #1  10.0 ton    YES
```

The Negative Press Protect Limit protects the press from excessive negative overload. This limit is entered for each sensor separately. If the negative peak falls between 90 and 270 degrees and exceeds the programmed value, a fault will be detected. The Negative Press Protect Output will be de-energized. Negative Press Protect can be disabled by selecting NO instead of YES while this selection is flashing.

Keypress responses are shown in the table to the right.

Key Pressed	*Response*
Mode	Moves to Setup Mode 4: Delay Fault Output Generation Mode
Numeric	Enters values
Up/Down Arrow	Fine tunes values, Up for Yes, Down for No, Change sensor numbers
Right/Left Arrow	Moves through selection on display
Enter	Entering Numerical Tonnage Value

Setup Mode 4: Delay Fault Output Generation Mode

Control Inputs: Supervisor 1, Supervisor 2, and PE must be TRUE for programming

Previous Mode: Setup Mode 3: Negative Press Protect Mode

```
Delay peak:   3 degree
Delay die:    1 degree
```

This mode allows delay between fault detection and fault output activation to be adjusted. The limit must be violated continuously for a set amount of degrees to generate a fault. Limit adjustable from 1 to 10 degrees.

Keypress responses are shown in the table to the right:

Key Pressed	*Response*
Mode	Moves to Setup Mode 5: Sensor Installation Mode
Numeric	Enters values
Up/Down Arrow	Fine tunes values
Right/Left Arrow	Moves through selection on display
Enter	Enter Values

Setup Mode 5: Sensor Installation Mode

Control Inputs: Supervisor 1, Supervisor 2, and PE must be TRUE for programming

Previous Mode: Setup Mode 4: Delay Fault Output Generation

```
Sensor #1  Sig = 4.0 mA
   Installed:      YES
```

This mode is used to turn on or turn off tonnage sensors. The top right corner of the display shows actual current from the sensor. Signal strength is displayed in milliamps. Signal strength with the press in the idle state (usually with resolver position around zero degrees) should read around 4 mA (± .4 mA). Adjustment can be done by turning the adjustable potentiometer on the sensor amplifier board. For further information, refer to sensor installation guide.

Keypress responses are shown in the table to the right:

Key Pressed	*Response*
Mode	Moves to Setup Mode 6: Offset Limits Mode
Numeric	No Action
Up/Down Arrow	Change sensor number
Right Arrow	Toggles between sensor installed (YES) and uninstalled (NO)
Enter	No Action

Setup Mode 6: Offset Limits Mode

Control Inputs: Supervisor 1, Supervisor 2, and PE must be TRUE for programming

Previous Mode: Setup Mode 5: Sensor Installation Mode

```
Sensor #1     Sig = 3.2mA
Lo = 2mA  Hi = 6 mA  ALM
```

This mode allows setting maximum and minimum values of signal offset read from a sensor. Sensor offset is read at zero degrees. If the offset signal does not fall within the limits, a fault is generated. Depending on the user selection, the fault may be tied to an output which allows emergency action in response to broken sensor cables or offset drift. In the case of a fault, the user should check sensor wiring and adjustment. The user has the following options for selecting between fault generation:

- without activating a fault output (option ALM), or
- generating a fault and activating a fault output (option STOP).

☞ **IMPORTANT**

The Positive Press Protect Limit (Critical Curve) is dependent on the Hi Offset Limit:

- Higher Offset Limit causes the Press Protect Limit (Critical Curve) to be limited to lower values.

The Negative Press Protect Limit is dependent on the Lo Offset Limit:

- Lower Lo Offset Limit requires less adjustment to the Negative Press Protect Limit.

Keypress responses are shown below:

Key Pressed	*Response*
Mode	Moves to Setup Mode 7: Calibration Mode
Numeric	Changes Hi/Lo
Up/Down Arrow	Changes Hi/Lo, Sensor #, and ALM/STOP, Up = ALM, DN = Stop
Right/Left Arrow	Moves through selection on display
Enter	Enters numerical value

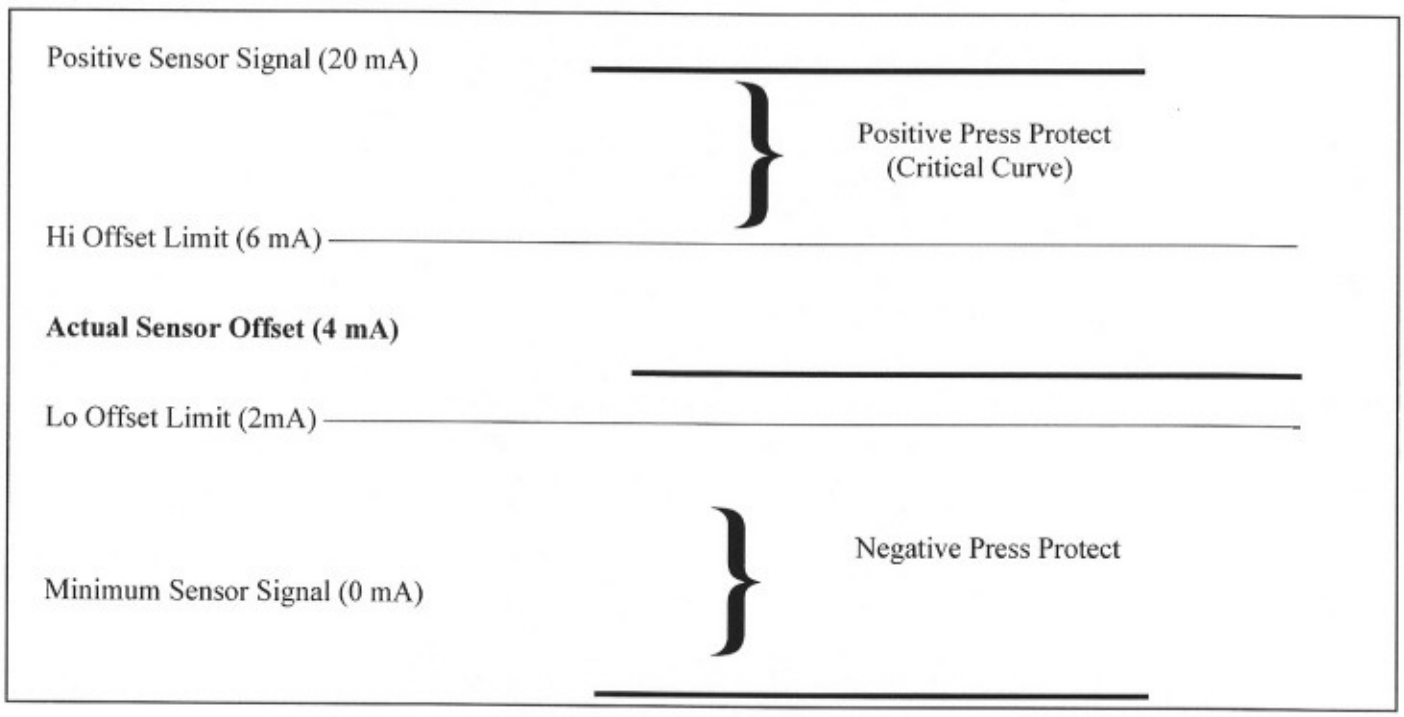


Illustration 7 - Offset Limits Mode

Setup Mode 7: Calibration Mode

Control Inputs: Supervisor 1, Supervisor 2, and PE must be TRUE for programming

Previous Mode: Setup Mode 6: Offset Limits Mode

```
    Null      Sensor #1
Peak=12.4 mA = 40.0 ton
```

The Calibration Mode is used to calibrate the sensors. During the press operation, the "tonnage zero" reading is continuously checked and, if necessary, corrected. Tonnage which should be assigned to the peak reading is entered in the lower right corner of the display.

Follow the six calibration steps below:

1. Cycle the press once with the load around 50-70% of the maximum load, i.e. for a 400 ton press the load should be between 200 and 300 tons.
2. The peak reading for the sensor is shown in the lower left corner. The peak value of the signal is displayed in mA.
3. The following rule applies:

$$\frac{Peak\ reading}{20\ mA} <= \frac{Load}{Maximum\ Load}$$

   Gain on the amplifier board should be set to the maximum so that the peak reading does not violate this rule. Cycling the press may be repeated until satisfactory results are obtained.

4. Press RIGHT ARROW keys to switch between the sensor number and the tonnage value assigned to the peak reading.
5. After entering the tonnage value (which is usually read from the calibrating device), press ENTER. "Done" will be viewed in the lower left corner of the display.
6. Repeat procedures 1 through 5 for each installed sensor.

☞ Sensitivity of the sensor may be trimmed by changing the location of the jumper on the sensor itself. See the sensor manual for details.

Keypress responses are shown below:

Key Pressed	*Response*
Mode	Moves to Setup Mode 8: Calibration Number Mode
Numeric	Changes tonnage value
Up/Down Arrow	Changes sensor number
Right Arrow	Moves through programmable display: Null, sensor number and tonnage value assigned to peak reading
Enter	After entering tonnage value (Step 5) press Enter to view "Done"

Setup Mode 8: Calibration Number Mode

Control Inputs: Supervisor 1, Supervisor 2, and PE must be TRUE for programming

Previous Mode: Setup Mode 7: Calibration Mode

```
  Calibration Number
Sensor #1       125
```

This display shows the sensor number and the calibration number which are unique for each sensor installed. If the M1950 Peak Tonnage Module unit is exchanged with another unit, the user can enter the calibration numbers for each sensor instead of going through the calibration procedure.

Keypress responses are shown below:

Key Pressed	*Response*
Mode	Moves to Setup Mode 9: Process Limit Sample
Numeric	Changes Sensor Calibration Value
Up/Down Arrow	Changes Sensor Value or Sensor Number
Right Arrow	Moves flashing text highlighting cursor through display.
Enter	Enters Calibration Value

Setup Mode 9: Process Limit Sample Average Mode

Control Inputs: Supervisor 1, Supervisor 2, and PE must be TRUE for programming

Previous Mode: Setup Mode 8: Calibration Number

```
Process Control Lim
Sample Avg:  4 stroke
```

In this mode the user enters the number of strokes the signal will be averaged over before comparing the current peak value against the process control limit. The maximum number of strokes that can be entered is 10.

Keypress responses are shown below:

Key Pressed	*Response*
Mode	Moves to Setup Mode 10: Limits Units
Numeric	Changes number of strokes
Up/Down Arrow	Changes number of strokes
Right/Left Arrow	No Action
Enter	Enters numerical entry

Setup Mode 10: Limits Units Mode

Control Inputs: Supervisor 1, Supervisor 2, and PE must be TRUE for programming

Previous Mode: Setup Mode 9: Process Limit Sample Average Mode

```
Limits Units are %
<RGHT ARR> to change
```

This mode allows selection between limits units (percents or tons). This is what the Die/Process Limits will be unit mated to in Limits Mode. See Page 17.

Keypress responses are shown below:

Key Pressed	*Response*
Mode	Moves to Die Management Menu Display
Numeric	No Action
Up/Down Arrow	No Action
Right Arrow	Toggles selection between tons and percents
Enter	No Action

Learn Mode 1: Average Strokes Mode

Control Inputs: Supervisor 1 and
PE must be TRUE for programming
Previous Mode: Die Management Menu:
Learn Mode Selected

```
Average:   12 strokes
        >START<
```

Each time a new die is installed for the first time, the user must collect the new reference peak values. This is done in the Learn Mode. The press (with a load which would be expected through normal press operation) must be cycled several strokes. After several strokes, the unit will take an average of the collected strokes and store it as a reference peak value. Reference peak can be viewed in the Reference Mode screen (Limits 1 Mode). The number of strokes that the unit will average is adjustable. The number of strokes to average is one to 16.

Press ENTER while "START" is flashing to start the collection process.

Keypress responses are shown below:

Key Pressed	*Response*
Mode	Moves to Die Management Menu Display
Numeric	Changes number of strokes
Up/Down Arrow	Changes number of strokes
Right/Left Arrow	Moves between number of strokes and start
Enter	Press while "START" is flashing to start process of collection

Learn Mode 2: Learning

Control Inputs: Supervisor 1 and
PE must be TRUE for programming
Previous Mode: Learn Mode 1, Average Strokes Mode

```
Learning:  7 out of 12
<MODE> to abandon
```

The above-screen indicates the process of collecting reference profile has begun. If during the collection process the user decides to abandon collection, pressing the MODE key will return the display to the Die Management Menu. If the collection process has been interrupted, the "old" reference will be left unaffected. At the end of the learn process the unit will switch automatically to the Learn Completed Mode (Learn Mode 3)

Key press responses are shown below:

Key Pressed	*Response*
Mode	Abandons Collection Process
Numeric	No Action
Up/Down Arrow	No Action
Right/Left Arrow	No Action
Enter	No Action

Learn Mode 3: Learn Completed Mode

Control Inputs: Supervisor 1 and
PE must be TRUE for programming
Previous Mode: Learn Mode 2, Learning Mode

```
Learn Completed!
 Run ?:   YES
```

After completion of the learning process, the user has two choices:

YES: Turn comparison On and switch directly to one of the "Run" modes.

NO: Go back to Die Management Menu. Profile comparison will be disabled.

Keypress responses are shown below:

Key Pressed	*Response*
Mode	No Action
Numeric	No Action
Up/Down Arrow	No Action
Right Arrow	Toggles between YES and NO
Enter	Selects choice (Yes or No)

Limits Mode 1: Reference Mode

Control Inputs: Supervisor 1 and PE must be TRUE for programming

Previous Mode: Die Management Menu

```
 45.2      Reference    47.1
 48.4        195.0      54.3
```

Reference Mode shows the collected peak tonnage for each of the sensors. These numbers refer to the average peak values recorded during the learn process. The center value is the peak reference of all four sensors. Each die will have it's own unique set of peak values.

The display for the average peak values of the four sensors is read as follows:

Position on the display:	***From sensor #:***
Top Left	Sensor 1
Top Right	Sensor 2
Lower left	Sensor 3
Lower right	Sensor 4

Keypress responses are shown below:

Key Pressed	*Response*
Mode	Switches to Limits Mode 2
Numeric	No Action
Up/Down Arrow	No Action
Right/Left Arrow	No Action
Enter	No Action

Limits Mode 2: Limit Enable Mode

Control Inputs: Supervisor 1 and PE must be TRUE for programming

Previous Mode: Limits Mode 1, Reference Mode

```
Process Limits:    YES
Die Pro Limits:    NO
```

There are two optional types of limits which can be applied to tonnage readings received from sensors. These limits can be enabled or disabled from the front display of the M1950 at any time:

Process Control Limit is designed to capture rapid changes of peak readings. These changes may not be dangerous to the die itself, but may be an indication of some type of rapid, undesired fluctuation in stamping process. Current peak reading is compared against average peak readings from several previous strokes. Numbers of averaged strokes is adjustable and can be changed in the Process Limit Sample Average Mode (Setup 8 Mode). Change of peak reading must be within the restricted range of values, otherwise process control fault will be generated. Process Control Limit detects changes rather than deviation from some preset values.

Die Protect Limit is designed to detect tonnage which may be dangerous for the die itself. Current peak value is required to be within certain limits as compared to collected peak stored for the die.

The die protect limits (positive and negative) are referenced to the stored peak reading, while the process control limits are referenced to the average peak reading calculated from the selected number of previous strokes. These values can be entered either as tonnage values or as a percentage change from the reference reading.

Keypress responses are shown below:

Key Pressed	*Response*
Mode	Moves to Limits Mode 3, Positive Die Protect Limit Entry
Numeric	No Action
Up Arrow Down Arrow	No Action No Action
Right/Left Arrow	Selects editable window on display
Enter	Toggles between Yes/No

Limits Mode 3: Positive Die Protect Limit Entry Mode

Control Inputs: Supervisor 1 and PE must be TRUE for programming

Previous Mode: Limits Mode 2, Limit Enable Mode

```
Sensor #1          Die Pro
Positive              10%
```

In this mode the user enters allowed positive deviation from a reference peak. Deviation is entered for each sensor separately and can be entered either as tons or percentage change. Units type (tons or percents) depends on selection made in Unit Type Selection Mode (Setup 9 Mode) All limits can be adjusted in 1% to 50% range if using percents.

Keypress responses are shown below:

Key Pressed	*Response*
Mode	Moves to Limits Mode 4, Negative Die Protect Limit Entry Mode
Numeric	Numerical entry of tons/percents
Up/Down Arrow	Changes sensor number, ton/percents
Right/Left Arrow	Moves between sensor number and ton/percent
Enter	Enters numerical entry

Limits Mode 4: Negative Die Protect Limit Entry Mode

Control Inputs: Supervisor 1 and PE must be TRUE for programming

Previous Mode: Limits Mode 3, Positive Die Protect Limit Entry Mode

```
Sensor #1          Die Pro
Negative              15%
```

Allowed negative deviation from a reference peak is entered for a Die Protect Limit. Deviation is entered for each sensor and can be entered either as tons or percentage change (per Setup Mode 9).

Keypress responses are shown below:

Key Pressed	*Response*
Mode	Moves to Limits Mode 5, Positive Process Control Limit Entry Mode
Numeric	Numerical entry ton/percent
Up/Down Arrow	Changes sensor number or ton/percent
Right/Left Arrow	Moves between sensor number and ton/percent
Enter	Enters numerical entry

Limits Mode 5: Positive Process Control Limit Entry Mode

Control Inputs: Supervisor 1 and PE must be TRUE for programming

Previous Mode: Limits Mode 4, Negative Die Protect Limit Entry Mode

```
Sensor #1          Process
Positive              10%
```

Allows positive deviation from previous peak readings is entered here either as a tons or percentage change (per Setup Mode 9).

Keypress responses are shown below:

Key Pressed	*Response*
Mode	Moves to Limits Mode 6, Negative Process Control Limit Entry Mode
Numeric	Numerical entry, ton/percent
Up/Down Arrow	Changes sensor number or ton/percent
Right/Left Arrow	Moves between sensor number and ton/percent
Enter	Enters numerical entry

Limits Mode 6: Negative Process Control Limit Entry Mode

Control Inputs: Supervisor 1 and PE must be TRUE for programming

Previous Mode: Limits Mode 5, Positive Process Control Limit Entry Mode

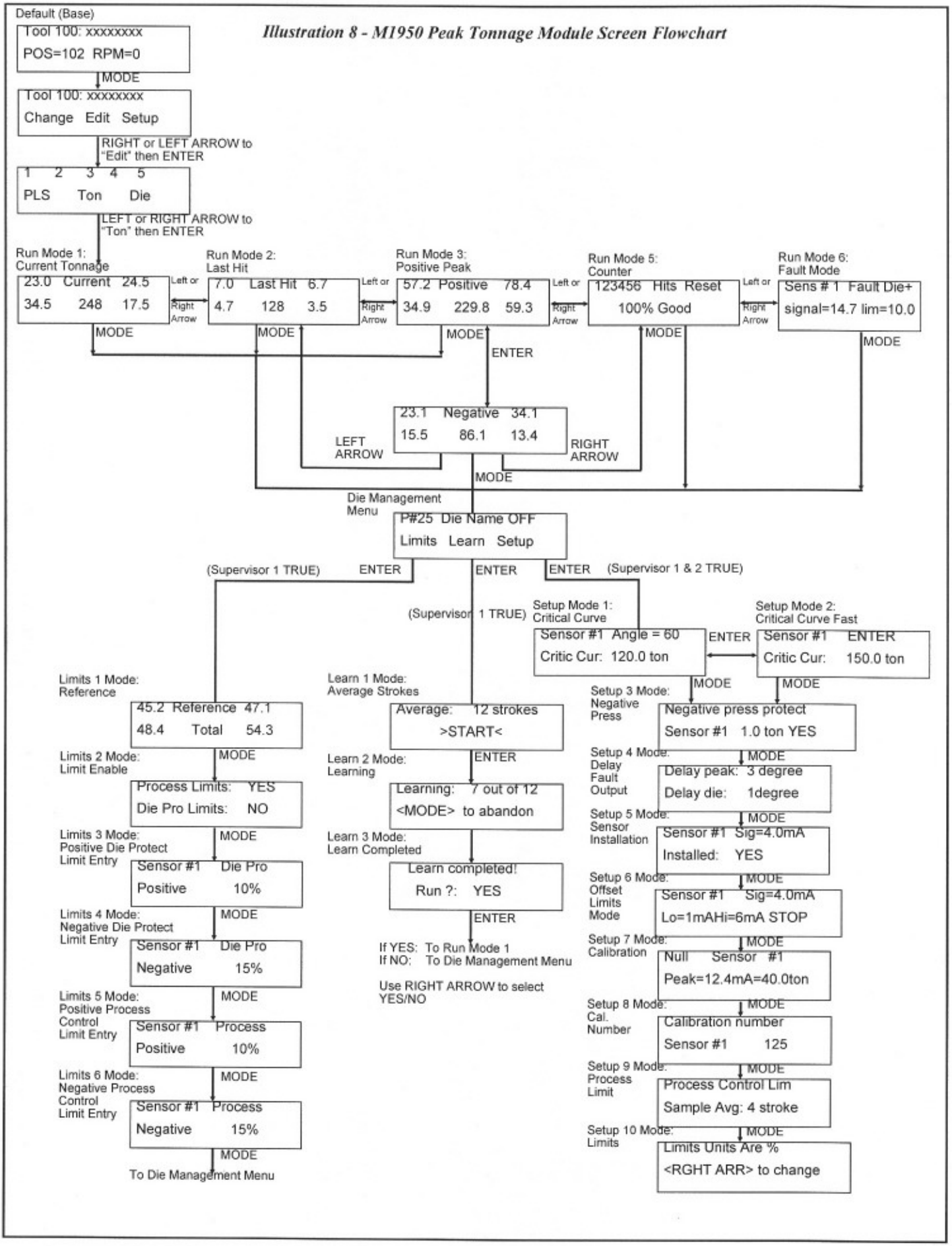
```
Sensor #1          Process
Negative             15%
```

Negative deviation from previous peak readings is entered here either as a tons or percentage change.

Keypress responses are shown below:

Key Pressed	*Response*
Mode	Moves to Die Management Menu
Numeric	Numerical entry of tons/percents
Up/Down Arrow	Changes sensor number, ton/percents
Right/Left Arrow	Moves between sensor number and ton/percent
Enter	Enters numerical entry

Illustration 8 - M1950 Peak Tonnage Module Screen Flowchart



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