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HOW TO USE MONITOR

Graphic Display and Operation

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SIGNATURE LOAD PROTECTION TM90 SERIES

HOW TO USE AUTOTrak

Mode Manual AutoTrak
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Press load monitor
Electronic display of actual tonnage the press is producing during the stamping process. Tonnage is dictated by the interference setup between the slide and bed. This is typically controlled by slide adjustment, material and part requirements along with any variation in the process that changes the final interference zone. Presses are rated in tons and tonnage display is one of the most important process variables to maintain quality, safety and machine and die protection.

How it works
Strain sensors, mounted on load bearing members of the press, provide a corresponding electrical output, which is proportional to the tonnage imposed. When connected to a tonnage data processor along with press position, tonnage loads are processed through the working stroke, providing signature analysis. Stored tonnage values for a particular die are checked against recipe masters for acceptance. Many computer graphic interfaces available including WEB based operation.

What can it do?
Tonnage monitors can prevent dangerous under and overloads from occurring during setup and production. Using signature die protection before each die set will protect the die and press from the first hit. Tonnage monitors will help insure quality parts with consistent die setups. Tonnage monitoring prevents “Blind” operation and dangerous repeated cycles by simply using the display during setup. When tonnage monitors are operated with the IDC exclusive feature “AutoTrak”, early detection of abnormal tonnage can prevent catastrophic damage to the die and press.
Unique Features

- Peak Digital Tonnage Load
- Real-time Analog Load display
- Fast Alert Response for Alarms
- Supports many Communication Interfaces
- Graphic display on Network Computers

The unique feature of the TM90 series of monitors is their ability to log and monitor the tonnage produced by an operation throughout the working stroke of the tool, and to report the tonnage at any given distance from the bottom of stroke. Peak digital and real-time analog tonnage loads are displayed on front in plan view of the press. In addition to reporting graphic tonnage signatures, full time dynamic tonnage limits are checked throughout the working stroke of the press, producing an alarm to stop operation if these limits are exceeded. Alarm detection of abnormal tonnage measurement is 2-3 milli-seconds. This provides press and tooling protection. Microprocessor supports many communication protocols to allow plant access of all information and control. WEB software provides signature alarm editing resulting in critical areas to be tightly monitored and non-essential areas to be masked out or limits changed. Nuisance alarms are then eliminated. All editing can be saved in the recipe. Die and press protection limit curves can be downloaded from the server, requested by the host.
Software

• Load Signature Die Footprint
  – Available Interface
    • Control Net
    • Ethernet
    • RS-485
    • AB RI/O

Load Signatures
Load monitors are essential for die setups. The peak value is very important for proper die sets and part quality. However measuring loads throughout the stroke is very important for stretch form and nitrogen assisted dies, deep draws, progressive and multi-station transfer dies. These operations demand signature monitoring where load’s are checked and viewed throughout the working stroke of the press.
Load signatures can be displayed on users computer via many different communication interfaces. Control net, Ethernet, RS485, AB-RI/O FactIS and DOS is a list of current protocols the monitor supports. The most comprehensive system is the WEB based Ethernet package.
Load Monitor Hardware

- Sensor Operation
- Load Monitor Processor
- Position Encoder
- Software
Spring Element of Press

- Press Stretch Indicator (Dial Indicator)
- Press Stretch Indicator (Strain Sensor)
- Press compliance .001”/ton/corner
  - 4 tons/.001”
  - Large presses 4-6 tons/.001
- Level requirements .001/ft of Slide

Presses produce tonnage with interference between slide and bed of press. Typically for every .001” interference a press generates between 4-6 tons of pressure.
Sensor Operation

- Theory of Operation
- Mechanical Stress
- Foil Strain Gauge
- Differential output
- Temperature Stability

Sensor Operation
The strain sensor is the link between the load monitor and the press. This is what converts mechanical stress into corresponding electrical output for tonnage displays. Strain sensors are mounted on load bearing members such as the pitman arms, columns and tie-rods. Proper placement will provide true tonnage loads to be measured. Sensors on load bearing members will measure strain directly related to the tonnage a press is operating at.

Strain sensors are constructed of strain gauge foils configured in a bridge. This type of design offers stable differential outputs and a low impedance source. These are desirable features. The signal output is typically one to two mill volts per volt per 500 micro-strain.

The strain gauge foils are bonded to the steel structure of the sensor. When the sensor is subjected to strain, the mechanical flexing changes the conductivity of the foils. When a source voltage is applied to the sensor, imposed strain will produce a voltage output. This voltage change is proportional to the amount of strain and the strain is proportional to the tonnage.

The full bridge configuration produces four times the output of an individual strain gauge and also provides thermal compensation. Since the bridge output is differential, one output node going positive and one negative, provides excellent common mode noise rejection. This enables the system to operate in electrically noisy environments found in manufacturing.
Strain sensor installation requires careful attention to maintain parallelism between the weld pads. A welding template is provided to keep pads in alignment. The pads require three surfaces to be welded to provide proper sensing. Bolt the mounting pads to the weld template, facing the small surface to the template (large surface facing press member). Simply hold to desired location and tack in place. Then proceed to weld the top, bottom and both sides of the mounting pad. During the welding process it is important to keep welding slag and spatter from the top surface where the sensor mounts on the pad. It is recommended to clean the pad surfaces with a hand file to insure that any weld spatter is removed and to check the surfaces to insure that they are parallel. A cover box may be used to protect sensor and wires.
Welding Sensor Pads/Mounting

- Weld Template
- Welding
- Clean Weld Pads
- Bolt Strain Sensor

Bolt Weld pads to Template. Small surface to face template.

Hold template with bolted weld pads and weld three sides.

Weld pads shown with proper weld, 3 sides.

Use file to remove any weld slag and check for parallel. File parallel if necessary.

After cooling, (1/2 hr) bolt sensor and torque to 15-20 ft Lbs. Use 3/8-16 ½ inch long bolts.
Selecting the location of the strain sensors is probably the single most critical factor in the performance of the tonnage monitor. The sensors obviously must be mounted on load-carrying members of the press, but there are some subtleties associated with the various classes of presses that aren’t so obvious. Since the preferred mounting depends on the type of press the following section is specific recommendations for a top drive press.

Top drive presses have a choice of column, tie rod and pitman arm mounting.

Column mount provides good output, easy installation, low maintenance and only four sensors for dual action presses. The preferred area is the “box” around the tie rod facing towards the press bed.

Tie rod mount is good but have a tendency to “ring”. Second choice if column mount is difficult.

Pitman arm mount is excellent and can show relationship of load sharing between pitman arms. Draw back is cables travel and must be installed for long life.

Pitman arm mount is mandatory for transfer presses where the columns are shared between slides. Usually the “neck” of the pitman is the preferred location. Maintain the same location on each arm so strain comparisons can be checked for lazy links.

It is advisable to use a quick connecting cable/plug arrangement for easy cable replacement on pitman arm mount.
Single Action Sensor Location

- Single action
- Underdrives

Single Action Press Channel Assignment Sensor layout for both Pitman and Column mount.

Channel assignment for a single action press including underdrives.
### Dual Action Press Sensor Location

- Pitman Mount sensors
- Shared Sensors Column Mount

#### For double-action presses:
If the monitor is set up with separate strain sensors for inner and outer rams, i.e., strain sensors on the connecting straps or pull rods of each ram, each sensor has its corresponding input. Chan1-4 are the outer slide, channels 5-8 are the inner.

#### With shared strain sensors (mounted on press frame):
If the strain sensors are mounted on the frame or tie rods of the press, they see the load of both the inner and outer rams. Strain sensors (4) are cross-wired: Cha1 & 5, 2 & 6, 3 & 7 4 & 8 are wired in parallel. In this situation the “Outer Dwell” Prompt must be set to perform a cycle split. Usually 120 degree covers most dual action press.
Transfer Press Sensor Location

- Single Slide
- Dual slide
- Multi-slide

**Dual-ram transfer presses**

With a multi-slide transfer press, it is necessary to place the strain sensors on the pitman arms. The reason for this is that the center columns support the load from both slides and loads measured on the columns could not be distinguished. The only way to separate the load between the two slides is to mount the strain sensors on the pitman arms (compression measurements).

These presses sometimes require two strain sensors per strap, because there is no room to locate a sensor along the neutral (non-bending) axis of the strap. Thus, two sensors must be mounted opposite each other and wired in parallel. Also, the signal wires must be reversed for compression measurements. This means reversing the green and white wires at the strain sensor connection in the monitor. See elementary wiring diagram. It is recommended to utilize high flex cables with plugs to facilitate replacement. Consult factory for details.

Pitman Arm Strain Sensor Location Top View
Underdrive Sensor Location

- Slide Mount
- Pull Rod Mount
- Traveling Cables

Locate strain sensor on top of Slide next to the "ears" where the Pull Rods connect to Slide. This is the preferred location.

Strain sensors may be attached to Pull Rods. Sensors in this location are harder to install and service.
Mounting the strain sensors on the top surface of the slide is an excellent place to monitor tonnage. Sensors are wired to measure tension. It is advisable to utilize a junction box with a plug cable assembly to allow the traveling cable to be easily serviced. Sensors placed on top of the slide are easier to install and maintain when compared to pull rod installation.
Routing strain sensor wiring

The wiring for the strain sensors must be shielded cable, and must not share conduit with control wiring, or be run through control boxes. The reason for this is that the load monitor is a high-gain amplifier, and extraneous noise from relay circuits gets amplified right along with the real signal if the wires are run together.

Depending on the press construction, the strain sensor wiring can be run over the outside of the press, either in conduit or not, according to local requirements. In other cases this wiring can be strung through the framework of the press. In any case, the wiring should not be terminalized any more than absolutely necessary, and if it must be terminalized it must be done in a separate box from any control wiring.

When wiring strain sensors on moving members, keep the travel loops located where they can’t rub against anything, or they’ll wear through in short order. In these instances the travel loop should be located where it’s most accessible.

In some instances, it is possible to “share” a run of shielded cable partway from the monitor to a pair of strain sensors. When this is done, the cable should be shielded pairs, and it is essential not to split a pair between 2 sensors. To put it another way, each strain sensor should be assigned 2 pairs. Also, the excitation should be one of the pairs and the signal output should be the other pair (for each sensor).

Lastly, the shield drain wire must be connected at the monitor, and must be cut off and insulated from the machine at the strain sensor end. Failure to do so can result in serious problems.
Sensor Wiring in Load Monitor

- Shield Hookup
- Color Code
- Tension/Compression

Strain sensor connection in the load monitor follows the color code as shown above. The above wiring is for tension measurements for column and tie rod mount strain sensors. To change for compression measurements, pitman arm strain sensors, reverse the green and white wire.
Sensor Wiring in Monitor 4 Channel

- Channel Assignment
- Tension
- Compression

Typical Four Channel Tonnage monitor Sensor hookup
Sensor Wiring 8 Channel Monitor

- Sensor Connections
- Tension (Column, tie rod)
- Compression (Pitman Arm)

Typical Eight Channel Tonnage Monitor Sensor Hookup
Sensor Wiring 8 Channel Shared Dual Action Press Column Mount

- Sensor Wired for Tension Paralleled
- 1-5 Connection
- 2-6 Connection
- 3-7 Connection
- 4-8 Connection
- Outer Dwell Prompt
Press manufacturers supply a tonnage de-rating curve. This is the operating limit of the machine. To verify the tonnage usage under this curve, monitoring must compare the load against the slide position. This is accomplished with an absolute position encoder attached to the press and software that associates the crank position to slide position in inches. Load signatures can then be checked against the press curve rating along with upper and lower control limits associated for a particular die signature. Software to display graphic load signatures will give the user a complete tonnage view of the die(s).

The load monitor can support absolute digital encoders such as gray, binary and BCD code encoders. Resolvers require a conditioning module (PN IDC-TM90Resolver Mod) to convert the analog signals to a binary output. The selection for the type of encoder is in the software under the “Encoder Type” prompt and hardware options on wiring, jumpers and modules.

Encoder and Resolver interface has the option to operate up to five monitors (multi-slide presses) and utilize internal or external excitation.

Absolute position reading and direction is controlled in software to eliminate the need to mechanically fine-tune the encoder position. This also allows existing resolvers used for other purposes to be connected to the load monitor with position and direction control in the monitor, thus not disturbing other systems.
Position Encoder/Resolver Installation

Digital encoders are rugged and last a long time but most utilize a internal glass scale that may fracture if dropped, hit with a hammer or subjected to severe vibration. Resolvers are physically more rugged but require special processing to interface to any reading device.

Encoder must be installed on a rotary timing shaft that represents one revolution for one press cycle. The direction and actual position is corrected in software so rotary alignment is not necessary. Physical alignment is very important and the use of a good “flex” coupling in important.

Gear and chain or gear and timing belt works very well. The important factor is to make sure that the chain or belt is not too tight or too loose and both sprockets are the same size. Encoder is supplied with slot adjustment for the mounting bolts. When installing encoder maintain adjustment range in slots for tensioning. Many times the cam switch box is a good location to install the position encoder.

Since each press type is unique, installation requires special attention. It is best to consult the factory for recommendations and optional hardware such as split gear assemblies, customs brackets and flex couplings.
Digital Encoder Wiring

- Absolute Gray Code Encoder
- Wiring
- Plug & Cable Assembly

Pin connection in plug assembly

Color Code Belden Cable #9541
Digital Encoder Ribbon Cable Connection

- Ribbon Cable Connection CJ3
- Parallel Connections
- Software Settings

Digital encoders may be connected in Parallel to other monitors on transfer presses. All power connections may also be connected in parallel. Optical Coupler IC’s (3) must be installed for Digital Encoder operation. Software Settings for encoder type in load monitor is selected as either “1” or a “3” depending on direction. See program prompts for complete list of encoder options.
Resolver Encoder Wiring

- Sine/Cosine/Excitation
- Resolver Hook-Up
- Resolver Hardware Settings
- Resolver Module
- Shared with Other Systems
- Multiple Slide Presses

Shielded pairs (3) (Belden 9873 or equivalent) must be used to prevent cross talk.

Resolver Coils Connections for Sine, Cosine and Excitation do not need to follow polarity. Direction and offset is setup in software.

Encoder Connection In load Monitor
When sharing more than one monitor in a transfer press, one position encoder or resolver may be used. When using resolvers on transfer presses (most common) only one monitor is to provide excitation and usually it is the first slide monitor. All others tied together must disable the excitation by removing integrated circuit (IC) U3. U3 is located on the Resolver Module and is socketed for easy removal.
Resolver Module Monitor Hardware

- Module
- Jumper on CPU
- Ribbon Cable Connection on Mother Board
- Remove Optical Couplers
  - (mother board)
- Software Settings

Located on Monitor Door

Jumper installed for Resolver

Resolver Module

Remove U3 for external excitation (from another monitor or source)

Install ribbon cable to CJ4 on motherboard.

Software Settings for encoder type in load monitor is selected as either “0” or a “2” depending on direction. See program prompts for complete list of encoder options.
Resolver Ribbon Cable Connection

Resolver Ribbon Cable Connection

- Ribbon Cable Connection
- Optical Couplers Removal

Resolver field Connection terminal
7,8 = Excitation
9,10 = Sine
11,12 = Cosine

Resolver Cable Connection to Header CJ4

Optical Coupler IC’s (3) must be removed for Resolver Operation.
ENCODER TYPE nnnn
This parameter identifies the type of encoder: the number is a combination of bits controlling code conversion and input inversion as follows: **Note:** 1 & 3 are used for supplied gray code encoder.

**Resolvers typically use 0 or 2.** When the system is powered up and connected depending on the type of encoder used, resolver or digital gray code, the proper prompt group must be selected. Resolver uses a 0 or a 2 and encoders use a 1 or a 3. Cycle the press safely and observe the encoder display (Press Position 0-359) to see that it is counting forward. If display is backwards, select the other number in the type group and check again. Once the direction is correct you may go on to the offset prompt.

0=binary code, non-inverting (*Resolver*)

1=Gray code, Fwd

2=binary code, inverting (*Resolver*)

3=Gray code, Rev

4=BCD code, Fwd (CIO INPUT MODULE)

5=BCD code, Rev (CIO INPUT MODULE)

9=Gray code, inverting Fwd

11=Gray code, inverting Rev

ENCODER OFFSET nnnn
This parameter will perform a software rotate so that the monitor reads 0 at the top of stroke and 180 at bottom. The encoder position is displayed in crank degrees on the load monitor’s front alphanumeric display (Pres Position, 0 to 359). The encoder offset value is programmed in bits (0-255 = 0-360 Deg). To change degrees to bits divide by 1.4.

To set this parameter, first set the ENC.OFFSET and ENC DISPLAY OFFSET to 0000. Inch the press to the top. With the press at top, press the PREV key, then the NEXT key to display the ENC.OFFSET prompt and then press the ENTER key without entering any digits: the unit will read the current encoder position and automatically calculate and enter the appropriate offset. The ENC.OFFSET may then be fine-tuned to correctly display dead bottom loads using a computer with the IDC graphic communications software. This will allow you to line up the peak load with the Dead Bottom marker line (180 deg Purple line) on the graphic display. To adjust, simply increase or decrease the ENC.OFFSET value to achieve peak load at bottom.
Control System Interface

- Emergency Stop Relay
  - Press Curve
  - AutoTrak Mode 1 & 2 selection
- Cycle Stop Relay
  - Die limits
    AutoTrak Mode 0,1&2
- RI/O and Control net coils

Monitor has two form “C” relays one for Emergency Stop and one for Cycle stop. These relay are rated at 8 amps @ 120 VAC. Relay functions are provided in RI/O and Controlnet options. See RI/O and Controlnet manual for listings.

Pilot LED’s on for OK off for fault.

CR 1emergency stop relay. Wires on N.O. contact (terminal 7&8). Relay is energized and drops out upon fault.

CR 2 Cycle stop relay. Wires on N.O. contact (terminal 10&11). Relay is energized and drops out upon fault.

Terminals will accept two #16 wires or one #12.
# Load Monitor Calibration Procedure

## Load Monitor Calibration Procedure

- Load Cell
  - Load Cell Stanchions
  - Load Capacity
  - Load Monitor setup
  - Safety

## Load Monitor Calibration and Operation

After completing the installation of a load monitor system on a press, the stress and strain relationships (tonnage measurements) must be compared to a known load test. This procedure is called the press calibration. The calibration procedure consists of loading the press with calibrated load cells to a specific load (tons) and setting the scale (readings) in the load monitor to match. Load cells of large capacity (250-1000 tons each) are placed on suitable risers in the die space. Risers are required to be solid, equal height and have a load bearing area equal to or greater than the load cells. The press is carefully cycled, similar to bottoming a die, to a desired load displayed by the load cells. Fine-tuning is accomplished with shims and paper. Most presses are calibrated between 50 and 100% of rated capacity.

The load monitor has a digital scale factor and an analog strain sensor gain adjustments that are dialed in to match readings. Once matched readings are accomplished, settings are recorded for future reference so systems can be maintained without the load calibration procedure. This subject is covered in more detail under “Calibrating the Load Monitor”.

Safety is always important and must be observed. Slide and Bed area must be clean and free of oil. Oil can hydraulically stick a load cell to the press slide. Placing a piece of notebook paper on top of load cells will help prevent the load cell from sticking.
Keypad Operations

Using the “Next” and “Prev” keys will navigate through the program prompts. Once you select the desired prompts you may punch in the numbers. They will appear to the right of the top line. You must then press the “Enter” key to perform the function. Data for channel ratings, encoder settings and degree and tonnage table must be entered before press calibration can continue. The following list of programming prompts must be set in order to continue.
Programming the Monitor for Calibration

There are over 100 Prompts in the monitor for setting calibration, WEB and serial addressing, die settings, shut-height option, part counting and batching. For the Calibration it is necessary to set the following prompts before and load measurements can be made. The following is a list of calibration data that must be set. All others may be set to 0. New monitors are pre-set with default settings including tonnage and motion tables.

1) #OuterChan Selects the number of operating channels usually (4) for a single slide or the outer on a dual action.
2) #InnerChan Selects the number of operating channels usually (4) for an inner slide or second slide on a transfer.
3) Encoder Type Selects direction and type of code. 0 or 2 for binary and 1 or 3 for Gray code. Observe display for correct direction when setting.
4) Encoder Offset Performs a software rotate to align 0 to be top and 180 for dead bottom. Use graphic program to align during calibration.
5) Encoder Display Offset Performs an adjustment to software rotate Pres Position display on monitor front only. For calibration procedure set to Zero.
6) Encoder Display Offset Performs a display rotate only. Used to display bottom on presses where BDC is not 180 degrees. Usually set to 000 during calibrations.
7) Outer Dwell Selects a cycle split between outer and inner readings when load monitor is sharing strain sensors to read both slides. Set to 120 degrees.
8) Serial ID. Set address for computer. Usually set to 1 for laptop.
9) Channel Rated 1-4,5-8 Sets full scale of press rating per corner. 1000 ton press is set at 250 per corner or channel. 1-4 is for first slide, 5-8 second slide or (inner).
10) Degree table sets the relationship of crank degrees to inches off bottom (13 Points). See following page for through description
11) Tonnage Table sets alarm values every .5 inch from bottom (13 Points). Once set this is the operating limit cure to be set at or below press manufacturers ratings.
Programming the Degree and Tonnage Tables

Programming the Degree and Tonnage Tables (New Installation)

- Two tables per slide sets the degree relationship to position of slide and tonnage value to position.
- I.Deg @ 0.0 Sets Crank Degrees to inches for inner slide or slide two on Transfer Press Monitors
- O.Deg@0.0 Sets Crank Degrees to inches for outer slide or four channel monitor.
- I.Tons @ 0.0 Sets tonnage curve for inner slide or for slide two on Transfer Press Monitors
- O.Tons@0.0 Sets tonnage curve for outer slide or four channel monitor.

I.Deg@0.0 to 6.0 And O.Deg@0.0 to 6.0 is two 13-point tables that define the crank position to Inches off bottom for both slides. I Deg@0.0-6.0 is not used for single slide presses and set to Zero’s (0). These points are typically given from the press manufacturer and described as a motion table or curve. If the correct data is not available a default value may be entered temporarily to proceed with the calibration.

I or O Deg@0.0 is defined as press bottom of stroke always set to 180 for 4 cha monitors or 180 for inner slide on dual action.

O Deg or I @ 0.5 to 5.6 Motion defined by Press Manufacture. Minimum degree separation between points is 2 deg.

O Tons@0.0 or I is the tonnage value set for the bottom of stroke.

I or O Tons@0.5 to 6.0 is the tonnage values set at 12 increments every .5-inch to 6.0”.

Degree value at 1.0” off of bottom of stroke Example(166)

Degree to Inch Table 13 entry points

Tonnage value at BDC

Tonnage value at 1.5”

Tonnage curve 13 entry points

Degree Value at BDC 180dg
### Quick Reference Prompt Sheet
Software Version E-46

**Read Only Prompts**
- Operator Prompts for “AutoTrak” and Die Monitoring
- Operator Prompts for Manual Limits
- Calibration Data
- Shut Height Data

<table>
<thead>
<tr>
<th>Program Prompts</th>
<th>Example</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>GOOD PARTS</td>
<td>0000</td>
<td>Part counter</td>
</tr>
<tr>
<td>BATCH COUNT</td>
<td>0000</td>
<td>How far you are in a batch count</td>
</tr>
<tr>
<td>#HIGH HITS</td>
<td>0000</td>
<td>How many high alarms</td>
</tr>
<tr>
<td>#LOW HITS</td>
<td>0000</td>
<td>How many low alarms</td>
</tr>
<tr>
<td>WORST HIT</td>
<td>0000</td>
<td>Highest tonnage hit</td>
</tr>
<tr>
<td>BATCH PRESET</td>
<td>0000</td>
<td>Count to batch and stop press: CR2 drops out</td>
</tr>
<tr>
<td>GET DIE#</td>
<td>00-29</td>
<td>To recall press tonnage curves, start and stop margins, + &amp; - margins, &amp; TrakMode for inner and outer slides. 00-29 for a total of 30 dies.</td>
</tr>
<tr>
<td>SAVE DIE#</td>
<td>00-29</td>
<td>To save press tonnage curves, start and stop margins, + &amp; - margins, &amp; TrakMode for inner and outer slides. 00-29 for a total of 30 dies.</td>
</tr>
<tr>
<td>I + MARGIN</td>
<td>0060</td>
<td>Raises “AutoTrak” upper margin for the inner slide. (Values are in Tons and divided equally to each channel)</td>
</tr>
<tr>
<td>I – MARGIN</td>
<td>1000</td>
<td>Lowers “AutoTrak” lower margin for the inner slide. (Values are in Tons and divided equally to each channel) (1000 will essentially disable low limit)</td>
</tr>
<tr>
<td>I DIE MAX</td>
<td>0000</td>
<td>Flat line maximum tonnage value equally divided. (Values are in Tons and divided equally to each Inner channel)</td>
</tr>
<tr>
<td>I DIE MIN</td>
<td>0000</td>
<td>Flat line minimum tonnage value equally divided. (Values are in Tons and divided equally to each Inner channel)</td>
</tr>
<tr>
<td>O DIE MAX</td>
<td>0000</td>
<td>Flat line maximum tonnage value equally divided. (Values are in Tons and divided equally to each Outer channel) (200 each)</td>
</tr>
<tr>
<td>O DIE MIN</td>
<td>0000</td>
<td>Flat line minimum tonnage value equally divided. (Values are in Tons and divided equally to each Outer channel) (50 tons)</td>
</tr>
<tr>
<td>O + MARGIN</td>
<td>0060</td>
<td>Raises “AutoTrak” upper margin for the outer slide. (Values are in Tons and divided equally to each channel)</td>
</tr>
<tr>
<td>O – MARGIN</td>
<td>1000</td>
<td>Lowers “AutoTrak” lower margin for the outer slide. (Values are in Tons and divided equally to each channel) (1000 will essentially disable low limit)</td>
</tr>
<tr>
<td>Parameter</td>
<td>Setting</td>
<td>Description</td>
</tr>
<tr>
<td>---------------------------</td>
<td>---------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>O TrakSpread</td>
<td>0000</td>
<td>Normally set to 0: widens the “AutoTrak” vertical margin spread at steep tonnage edges for the outer slide</td>
</tr>
<tr>
<td>I TrakSpread</td>
<td>0000</td>
<td>Normally set to 0: widens the “AutoTrak” vertical margin spread at steep tonnage edges for the inner slide</td>
</tr>
<tr>
<td>FILL CYCLES</td>
<td>0012</td>
<td>Allows specified number of low “AutoTrak” faults to occur before dropping out the CR2 relay.</td>
</tr>
<tr>
<td>#OUTER CHAN</td>
<td>0004</td>
<td>Selects number of operating channels usually (4)</td>
</tr>
<tr>
<td>#INNER CHAN</td>
<td>000(0-4)</td>
<td>Used for dual action/dual slide presses for selecting inner channels: 0 for single action, 2 or 4 for dual.</td>
</tr>
<tr>
<td>TRACK MODE</td>
<td>(0,1,2)</td>
<td>0= Autotrak limits control CR2, 1= High AutoTrak limit Controls CR1, 2= Mode 1 plus normal AutoTrak function after TrakEnd.</td>
</tr>
<tr>
<td>ENCODER TYPE</td>
<td>0001(3)</td>
<td>Selects gray or binary code and direction: 1 &amp; 3 for gray code, 0 &amp; 2 for binary</td>
</tr>
<tr>
<td>ENC OFFSET</td>
<td>0255</td>
<td>Allows the encoder to be rotated in the software for proper timing. Range: 0-255.</td>
</tr>
<tr>
<td>EncDispOffset</td>
<td>0000</td>
<td>Provides adjustment of the crank angle displayed at the monitor LCD readout to match with other displays. Does not affect operation or signature timing.</td>
</tr>
<tr>
<td>OUTER DWELL</td>
<td>0000</td>
<td>Sets cycle split for dual action presses with shared strain sensors. Set in degrees, usually about 120.</td>
</tr>
<tr>
<td>SERIAL ID</td>
<td>0001</td>
<td>Set the address for networking monitors to computers.</td>
</tr>
<tr>
<td>WEB ADDR 1</td>
<td>100</td>
<td>Sets the 1st group of addresses for Ethernet</td>
</tr>
<tr>
<td>WEB ADDR 2</td>
<td>100</td>
<td>Sets the 2nd group of addresses for Ethernet</td>
</tr>
<tr>
<td>WEB ADDR 3</td>
<td>100</td>
<td>Sets the 3rd group of addresses for Ethernet</td>
</tr>
<tr>
<td>WEB ADDR 4</td>
<td>102</td>
<td>Sets the 4th group of addresses for Ethernet</td>
</tr>
<tr>
<td>NETMASK BITS</td>
<td>24</td>
<td>Series of bits to “mask” certain portions of an IP address.</td>
</tr>
<tr>
<td>GATEWAY #1</td>
<td>000</td>
<td>Address between your computer and the outside world.</td>
</tr>
<tr>
<td>GATEWAY #2</td>
<td>000</td>
<td>2nd Group</td>
</tr>
<tr>
<td>GATEWAY #3</td>
<td>000</td>
<td>3rd Group</td>
</tr>
<tr>
<td>GATEWAY #4</td>
<td>000</td>
<td>4th Group</td>
</tr>
<tr>
<td>CYCLE TIME</td>
<td>0000</td>
<td>Automatic “AutoTrak” time in seconds for normal production. Note 1800=1/2hr</td>
</tr>
<tr>
<td>Parameter</td>
<td>Setting / Description</td>
<td></td>
</tr>
<tr>
<td>---------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>TRAK CYCLES</td>
<td>3-16  # Cycles to make before AutoTrak turns itself on; Also # cycles used in calculation (E026 &amp; later). Minimum cycles are 3, maximum 16.</td>
<td></td>
</tr>
<tr>
<td>TRAK OFFDLY</td>
<td>0000-9999 Time in seconds to turn off “AutoTrak” if press is idle.</td>
<td></td>
</tr>
<tr>
<td>SkipUpstroke</td>
<td>0= Active 1= Skip Set to 1 to remove the press limit curve on upstroke. Mostly used on presses with long bottom dwells for the inner slide. (Triple action presses)</td>
<td></td>
</tr>
<tr>
<td>OutTrakBeg</td>
<td>115 115=approximate Start point for approximately 5” off bottom. (single action press) 60=approximately 5” off bottom (Dual action press)</td>
<td></td>
</tr>
<tr>
<td>OutTrakEnd</td>
<td>170 170deg approximate End point at bottom. (Single action) 95deg for end point at bottom (Dual action presses)</td>
<td></td>
</tr>
<tr>
<td>InrTrakBeg</td>
<td>140deg approximately 5” off bottom. (Inner slide)</td>
<td></td>
</tr>
<tr>
<td>InrTrakEnd</td>
<td>170 deg approximately End point at ½” off bottom.</td>
<td></td>
</tr>
<tr>
<td>Chan x Rated</td>
<td>1-4 outer 250 250 250 The full scale rating of each corner of the press for the outer slide, usually 25% of total tonnage. (Example: 1000 ton press = 250 ton per corner)</td>
<td></td>
</tr>
<tr>
<td>5-8 inner or</td>
<td>50 250 250</td>
<td></td>
</tr>
<tr>
<td>Slide 2</td>
<td>250 250 250</td>
<td></td>
</tr>
</tbody>
</table>
Channels 5-8 are for the inner slide, slide 2

<table>
<thead>
<tr>
<th>I.Deg. @ 0.0”</th>
<th>180</th>
<th>Degree of encoder 0.0 or dead bottom (180 typ)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I.Deg. @ 0.5”</td>
<td>165</td>
<td>Degree of encoder at 0.5” off bottom (165 typ)</td>
</tr>
<tr>
<td>I.Deg. @ 1.0”</td>
<td>160</td>
<td>These prompts will relate every 0.5” of slide position to degrees for the last 6 inches. This calibrates the monitor to accurately measure tonnage off bottom in inches for the inner slide. This allows the tonnage curve to be programmed in inches off bottom. Note: These prompts are not used for single action presses and must be programmed to all zeros (0).</td>
</tr>
<tr>
<td>I.Deg. @ 1.5”</td>
<td>155</td>
<td></td>
</tr>
<tr>
<td>I.Deg. @ 2.0”</td>
<td>150</td>
<td></td>
</tr>
<tr>
<td>I.Deg. @ 2.5”</td>
<td>145</td>
<td></td>
</tr>
<tr>
<td>I.Deg. @ 3.0”</td>
<td>140</td>
<td></td>
</tr>
<tr>
<td>I.Deg. @ 3.5”</td>
<td>135</td>
<td></td>
</tr>
<tr>
<td>I.Deg. @ 4.0”</td>
<td>133</td>
<td></td>
</tr>
<tr>
<td>I.Deg. @ 4.5”</td>
<td>131</td>
<td></td>
</tr>
<tr>
<td>I.Deg. @ 5.0”</td>
<td>129</td>
<td></td>
</tr>
<tr>
<td>I.Deg. @ 5.5”</td>
<td>127</td>
<td></td>
</tr>
<tr>
<td>I.Deg. @ 6.0”</td>
<td>125</td>
<td></td>
</tr>
<tr>
<td>O.Deg. @ 0.0”</td>
<td>110</td>
<td>Degree of encoder 0.0” or dead bottom for outer slide of dual action presses (110 typ), or for single action presses (180 typ).</td>
</tr>
<tr>
<td>O.Deg. @ 0.5”</td>
<td>95</td>
<td>These prompts will relate every 0.5” of slide position to degrees for the last 6 inches. This calibrates the monitor to accurately measure tonnage off bottom in inches for the outer and to check tonnage against the press limit curve. Note: these prompts are used for single-action presses and must be programmed appropriately.</td>
</tr>
<tr>
<td>O.Deg. @ 1.0”</td>
<td>90</td>
<td></td>
</tr>
<tr>
<td>O.Deg. @ 1.5”</td>
<td>85</td>
<td></td>
</tr>
<tr>
<td>O.Deg. @ 2.0”</td>
<td>80</td>
<td></td>
</tr>
<tr>
<td>O.Deg. @ 2.5”</td>
<td>75</td>
<td></td>
</tr>
<tr>
<td>O.Deg. @ 3.0”</td>
<td>70</td>
<td></td>
</tr>
<tr>
<td>O.Deg. @ 3.5”</td>
<td>67</td>
<td></td>
</tr>
<tr>
<td>O.Deg. @ 4.0”</td>
<td>65</td>
<td></td>
</tr>
<tr>
<td>O.Deg. @ 4.5”</td>
<td>63</td>
<td></td>
</tr>
<tr>
<td>O.Deg. @ 5.0”</td>
<td>61</td>
<td></td>
</tr>
<tr>
<td>O.Deg. @ 5.5”</td>
<td>59</td>
<td></td>
</tr>
<tr>
<td>O.Deg. @ 6.0”</td>
<td>57</td>
<td></td>
</tr>
<tr>
<td>Tonnage @</td>
<td>Value</td>
<td>Description</td>
</tr>
<tr>
<td>-----------</td>
<td>-------</td>
<td>-------------</td>
</tr>
<tr>
<td>0.0&quot;</td>
<td>1000</td>
<td>Tonnage rating of inner slide at bottom.</td>
</tr>
<tr>
<td>0.5&quot;</td>
<td>1000</td>
<td>Tonnage rating at 0.5&quot; above bottom.</td>
</tr>
<tr>
<td>1.0&quot;</td>
<td>700</td>
<td>The following table is the de-rating in tons per inches off bottom that creates the press limit for the inner slide. This limit may be saved under the “Save Die”. Typically the manufacturer’s rating is saved under “Save Die 00”. Simply modify this table to fit a current die signature and save it under a new two digit die code (example) “Save Die 02”.</td>
</tr>
<tr>
<td>1.5&quot;</td>
<td>600</td>
<td></td>
</tr>
<tr>
<td>2.0&quot;</td>
<td>550</td>
<td></td>
</tr>
<tr>
<td>2.5&quot;</td>
<td>500</td>
<td></td>
</tr>
<tr>
<td>3.0&quot;</td>
<td>450</td>
<td></td>
</tr>
<tr>
<td>3.5&quot;</td>
<td>400</td>
<td></td>
</tr>
<tr>
<td>4.0&quot;</td>
<td>350</td>
<td></td>
</tr>
<tr>
<td>4.5&quot;</td>
<td>300</td>
<td></td>
</tr>
<tr>
<td>5.0&quot;</td>
<td>275</td>
<td></td>
</tr>
<tr>
<td>5.5&quot;</td>
<td>250</td>
<td>Note: These prompts are not used for single action presses and must be programmed to all zeros (0).</td>
</tr>
<tr>
<td>6.0&quot;</td>
<td>225</td>
<td></td>
</tr>
<tr>
<td>O.0&quot;</td>
<td>1000</td>
<td>Tonnage rating of the outer (or only) slide at bottom.</td>
</tr>
<tr>
<td>O.5&quot;</td>
<td>600</td>
<td>The following table is the de-rating in tons per inches off bottom that creates the press limit for the outer slide. This limit may be saved under the “Save Die”. Typically the manufacturer’s rating is saved under “Save Die 00”. Simply modify this table to fit a current die signature and save it under a new two digit die code (example) “Save Die 02”. Note: these prompts are used for single-action presses and must be programmed appropriately.</td>
</tr>
<tr>
<td>O.1&quot;</td>
<td>350</td>
<td></td>
</tr>
<tr>
<td>O.1.5&quot;</td>
<td>300</td>
<td></td>
</tr>
<tr>
<td>O.2&quot;</td>
<td>250</td>
<td></td>
</tr>
<tr>
<td>O.2.5&quot;</td>
<td>200</td>
<td></td>
</tr>
<tr>
<td>O.3&quot;</td>
<td>175</td>
<td></td>
</tr>
<tr>
<td>O.3.5&quot;</td>
<td>150</td>
<td></td>
</tr>
<tr>
<td>O.4&quot;</td>
<td>125</td>
<td></td>
</tr>
<tr>
<td>O.4.5&quot;</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>O.5&quot;</td>
<td>90</td>
<td></td>
</tr>
<tr>
<td>O.5.5&quot;</td>
<td>80</td>
<td></td>
</tr>
<tr>
<td>O.6&quot;</td>
<td>75</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Setting</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outer Sh Enc Bits</td>
<td>16</td>
<td>Typically 16, however may be 12 to 16.</td>
</tr>
<tr>
<td>Outer Sh Enc Type</td>
<td>00,02</td>
<td>Select the direction of the encoder 0 or 2.</td>
</tr>
<tr>
<td>Outer Sh Len</td>
<td>113500</td>
<td>Calibration count rate based on encoder speed or usage.</td>
</tr>
<tr>
<td>Outer Sh Bias</td>
<td>65.249</td>
<td>Number added to raw encoder value to display actual press opening.</td>
</tr>
<tr>
<td>Inner Sh Enc Bits</td>
<td>16</td>
<td>Typically 16, however may be 12 to 16.</td>
</tr>
<tr>
<td>Inner Sh Enc Type</td>
<td>00,02</td>
<td>Select the direction of the encoder 0 or 2.</td>
</tr>
<tr>
<td>Inner Sh Len</td>
<td>113500</td>
<td>Calibration count rate based on encoder range or usage.</td>
</tr>
<tr>
<td>Inner Sh Bias</td>
<td>55.127</td>
<td>Number added to raw encoder value to display actual press opening.</td>
</tr>
<tr>
<td>Slide Sep</td>
<td>0010.00</td>
<td>Slide separation in inches. Separation relay output fault.</td>
</tr>
<tr>
<td>Show Gains</td>
<td>?</td>
<td></td>
</tr>
<tr>
<td>------------</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td><strong>To show calibration gain setting for each channel to be displayed on channel readout on monitor front. Press must be on top and not running. Press the “End” key and then “Enter” then turn dipswitch 7 on. Number will be displayed on each channel. Turn switch 7 off when done and press the “Enter” key twice to go back to operation.</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Read Only Prompts**
- Operator Prompts for “AutoTrak” and Die Monitoring
- Operator Prompts for Manual Limits
- Calibration Data
- Shut Height Data
Detailed prompt descriptions
   Each prompt which may appear on the LCD screen is listed below with an explanation. For purposes of this explanation, the symbol “nnnn” designates a 4-digit number.

GOOD PARTS nnnn
   This is the current count of how many cycles have been made which fall within the indicated “Window” of tonnage since the Batch Reset input was last activated. This window can be defined several ways:
   1. When Die Maximum and Die Minimum have been entered, the tonnage for a good cycle must lie between those limits if AutoTrak™ is OFF.
   2. When AutoTrak™ mode has been initiated the Die Max & Die Min prompts are not used, the tonnage of each cycle must lie within 3 standard deviations of the average established when AutoTrak™ was set up. This is established independently for each channel.
      For more details on AutoTrak™ operation see sections 3.1, 5.2.2.
   No operator entry is permitted for this prompt.

BATCH COUNT nnnn
   This is a counter indicating the number of cycles made at any tonnage since the Batch Reset input was last activated.
   No operator entry is permitted for this prompt.

# HIGH HITS=nnnn
   This entry is a read-only display of an internal counter keeping track of how many hits (cycles) have been over any of the various limits – either die limits or press limits.
   No operator entry is permitted for this prompt. This prompt is not present in early units.

# LOW HITS=nnnn
   This prompt is a read-only display of an internal counter keeping track of how many cycles have been under the established die minimums (if any minimum value is set or the AutoTrak™ mode is active).

WORST HIT=nnnn
   This prompt is a read-only display of the highest single hit recorded. No operator entry is permitted for this prompt. This prompt is not present in early units.

BATCH PRESET nnnn
   This is a preset which an operator may enter (up to 9999) to stop the press (by turning off the CR2 relay) when the GOOD PARTS count reaches this value. Pushing the fault reset button resets the batch counter when the counter reaches preset value. Entering all zeros will disable this function.
GET DIE # nnnn

This prompt lets the operator select one of many (30) press maximum tonnage curves stored in the EEPROM of the monitor (version 6.89). When a new non-zero number (00-29) is entered for this prompt, a tonnage curve is retrieved from storage. Version 6.88 and earlier store the following items of information:

1. AutoTrak™ flag (on/off)
2. Inner die maximum
3. Inner die minimum
4. Outer die maximum
5. Outer die minimum
6. Batch preset
7. Camswitch settings (when encoder option is in use)
8. AutoTrak™ averages and +/- 3-sigma limits (per cycle or per encoder pulse, depending on whether the PosiTrak™ option is present).

As of Version 6.94D and later, the following items are saved and retrieved by Die ID:

- Inner and Outer “Tons@x.x” Press/Die tonnage curve settings
- Inner and Outer Die Max settings
- Inner and Outer Die Min settings
- Inner and Outer +/- Margins
- Outer Trak Begin Position
- Outer Trak End Position
- Inner Trak Begin Position
- Inner Trak End Position
- TrakMode

SAVE DIE # nnnn

With EPROM version 6.94D or later, up to 30 (00-29) press maximum tonnage curves may be saved by entering a number in this prompt. The tonnage curves in the motion table (O.Tons@x.x nnnn and I.Tons@x.x nnnn) are typically modified for a particular die or set of dies and then saved under this prompt. The previous prompt (Get Die #nnnn) will then re-implement the new press curve along with the following settings.

As of Version 6.94D TM80 &E25 TM90 the following additional items are saved and retrieved by Die ID:

- Inner and Outer Die Max settings
- Inner and Outer Die Min settings
- Inner and Outer +/- Margins
- Outer Trak Begin Position
- Outer Trak End Position
- Inner Trak Begin Position
- Inner Trak End Position
- Trak Mode (TM90)
The current values for all die-related prompts may be changed, AutoTrak™ may be set up, alarm values set, etc: the values will be in the current area of the EEPROM so they will be retained through power-down, but will be over-written the next time a Die ID is recalled from storage.

I. + MARGIN nnnn
This prompt will expand the upper SPC alarm margin when using AutoTrak™ for the inner channels by the value entered. The value (in tons) is divided by the number of channels for the inner ram and is added to each SPC calculated alarm value. This prompt applies to the AutoTrak™ function only.

I. - MARGIN nnnn
This prompt will expand the lower SPC alarm margin for the inner channels by the value entered when using AUTOtrak. The value (in tons) is divided by the number of channels for the inner ram and is added to each SPC calculated alarm value. This prompt applies to the AutoTrak™ function only.

I. DIE MAX nnnnT
This prompt sets a maximum tonnage for the INNER DIE. It is entered in tons, as indicated by the T after the number. The maximum value that may be entered is 110% of the sum of channel ratings 5-8. The entered number is internally divided by the number of channels to set a maximum for each channel. For example, if 100 is entered for a 4-channel inner, any one channel exceeding 25 tons will be a Die tonnage fault.
This parameter, when entered, activates the following activities for each cycle:
1. Each cycle which falls below this limit is counted as a GOOD PART, provided its tonnage is also above the INNER DIE MINIMUM (see below).
2. Any cycle generating tonnage in excess of this value will drop out the CR2 output. If this parameter is 0000, die limit-checking defaults to 100% of the inner channels’ rating if AutoTrak™ is inactive.

I. DIE MIN nnnnT
This is a minimum tonnage for the INNER DIE, entered in tons. Any value up to the INNER DIE MAX tonnage may be entered; attempting to enter a larger value than the Inner Die Max will cause the entry to be rejected, and the display will jump back to the INNER DIE MAX prompt. Entering a value here activates the following tests:
1. Cycles generating tonnage above this value and below the INNER DIE MAX value will be counted as GOOD PARTS.
2. Cycles which generates tonnage lower than this value will drop out the CR2 output and be counted as LOW HITS.
   If 0000 is entered and AutoTrak™ is off, die minimum tonnage checking is disabled.
O.DIE MAX nnnnT
This prompt sets a maximum tonnage for the OUTER DIE. It is entered in tons, as indicated by the T after the number. The maximum value that may be entered is 110% of the sum of channel ratings 1-4. The entered number is internally divided by the number of channels to set a maximum for each channel. For example, if 100 is entered for a 4-channel outer, any one channel exceeding 25 tons will be a die tonnage fault.
This parameter, when entered, activates the following activities for each cycle:
1. Each cycle which falls below this limit is counted as a GOOD PART, provided its tonnage is also above the OUTER DIE MINIMUM (see below).
2. Any cycle generating tonnage in excess of this value will drop out the CR2 output and be counted as a HIGH HIT.
If this parameter is 0000, outer die limit-checking defaults to 100% of each channel if AutoTrak™ is off.

O.DIE MIN nnnnT
This is a minimum tonnage for the OUTER DIE, entered in tons. Any value up to the OUTER DIE MAX tonnage may be entered; attempting to enter a larger value than the outer die max will cause the entry to be rejected, and the display will jump back to the OUTER DIE MAX prompt. Entering a value here activates the following tests:
1. Cycles generating tonnage above this value and below the OUTER DIE MAX value will be counted as GOOD PARTS.
2. Cycles which generate tonnage lower than this value will drop out the CR2 output and be counted as LOW HITS.
If 0000 is entered and AutoTrak™ is off, outer die minimum tonnage checking is subtracted from the average to derive the minimum value. When the AutoTrak™ mode is active the calculated 3-sigma limit is

O.+ MARGIN nnnn
This prompt will expand the upper SPC alarm margin when using AutoTrak™ for the outer channels by the value entered. The value is divided by the number of channels for the inner ram and is added to each SPC calculated alarm value. This prompt applies to the AutoTrak™ function only. This value may be saved in the DIE I.D. prompt.

O.- MARGIN nnnn
This prompt will expand the lower SPC alarm margin when using AutoTrak™ for the inner channels by the value entered. The value is divided by the number of channels for the inner ram and is added to each SPC calculated alarm value. This prompt applies to the AutoTrak™ function only.

OTrackSpread or OUTER MAX nnnnT
For PosiTrak monitors (encoder/resolver based) this entry allows the user to change the AutoTrak™ horizontal margin. Entering a “0” will cause AutoTrak™ to be normal. Entering a “1” will allow AutoTrak™ to add wider margins on steep-edged tonnage changes. This is accomplished by adding adjacent values to steep changes. This technique functions as a low pass filter.
For **non-encoder** monitors this prompt becomes OUTER MAX nnnnT. This is the maximum total tonnage for the outer ram. The tonnage is divided equally amongst the programmed number of Outer channels (typically 4). It differs from the die max described above in that violation of this limit will drop the CR1 output, which is usually wired into the press stop circuit, instead of the CR2 output, which is usually wired into a cycle stop or alarm circuit. Any value up to 110% of the rating of the outer ram may be entered. If 0 is entered the outer ram will default to 100%.

**ITrackSpread or INNER MAX nnnnT**

For PosiTrak monitors (encoder/resolver based) this entry allows the user to change the AutoTrak™ horizontal margin. Entering a “0” will cause AutoTrak™ to be normal. Entering a “1” will allow AutoTrak™ to add wider margins on steep-edged tonnage changes. This is accomplished by adding adjacent values to steep changes. This technique functions as a low pass filter.

For **non-encoder** monitors this prompt becomes INNER MAX nnnnT. This is the maximum total divided equally amongst of the programmed number of Inner channels (typically 4). It differs from the die max described above in that violation of this limit will drop the CR1 output, which is usually wired into the press stop circuit, instead of the CR2 output, which is usually wired into a cycle stop or alarm circuit. Any value up to 100% of the rating of the outer ram may be entered. If “0” is entered the inner ram limit will default to 100%.

**FILL CYCLES nnnn**

This parameter determines how many consecutive below-tolerance cycles will be permitted before shutdown of the press for Die or Signature faults will occur. This eliminates nuisance shutdowns when filling or emptying the dies or when the process may accept out of tolerance hits, such as missed panels in a transfer operation. The Fill Cycle counter works on AutoTrak™ or manually entered die limits. The Fill Cycle counter does not operate on the press limits. The counter controlled by this preset also gets cleared when the RESET input is activated.

**#OUTER CHAN nnnn**

This tells the monitor how many channels (0-4) are dedicated to the OUTER ram (if other than 0-4, the program will assume 4). When strain sensors on the tie rods or press frame are used, as opposed to separate pull rods for the inner and outer, this parameter sets the total number of input channels. In either case, it tells the program how many display channels are dedicated to the outer ram (or FIRST ram, in terms of part flow, in the case of dual-ram transfer presses).
#INNER CHAN nnnn
This tells the monitor how many channels (0-4) are dedicated to the INNER ram. When shared strain sensors are used (sensors located where they see the load due to both the inner and outer rams, such as on the frame or tie rods of a top-drive press) this sets the number of display channels dedicated to the inner ram; otherwise, it sets both the number of input channels and display channels. For dual-ram transfer presses, it specifies the number of channels allocated for the SECOND ram in terms of part flow direction.

TRACK MODE nnnn (version E025+) or Outer Type (version Cxxx or Eyyy prior to 025)
Beginning with EPROM version E025, this function will select how “AutoTrak” faults actuate the output relays.

1) Set to 0: AutoTrak controls the CR2 relay, Beg and End margins will select window of operation.
2) Set to 1: AutoTrak high limit fault controls the CR1 relay, Beg and End margins will select window of operation.
3) Set to “2” “AutoTrak high limit controls the CR1 relay and After the “End Window” setting, AutoTrak will function as a cycle stop (CR2). See “AutoTrak” Mode description diagram below.

For EPROM versions 3.XX, this prompt is Outer Type, and has the following uses:
1) If 0, monitor expects separate channels for inner and outer slides (if inner is used).
2) If 1, monitor expects shared strain cells for inner and outer. The amplifiers will be zeroed at the rising edge of the camswitch input, and all tonnage occurring with the camswitch ON will be attributed to the Inner slide. Tonnage occurring before the camswitch comes on will be attributed to the outer slide.
### “AutoTrak” Mode 0, 1 & 2

<table>
<thead>
<tr>
<th>TrakMode number code</th>
<th>Outer Mode</th>
<th>Inner Mode</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0 0</td>
<td>0 0</td>
<td>Outer Mode 0 Inner Mode 0</td>
</tr>
<tr>
<td>1</td>
<td>1 0</td>
<td>0 0</td>
<td>Outer Mode 1 Inner Mode 0</td>
</tr>
<tr>
<td>2</td>
<td>0 1</td>
<td>0 0</td>
<td>Outer Mode 2 Inner Mode 0</td>
</tr>
<tr>
<td>4</td>
<td>0 0</td>
<td>1 0</td>
<td>Outer Mode 0 Inner Mode 1</td>
</tr>
<tr>
<td>5</td>
<td>1 0</td>
<td>1 0</td>
<td>Outer Mode 1 Inner Mode 1</td>
</tr>
<tr>
<td>6</td>
<td>0 1</td>
<td>1 0</td>
<td>Outer Mode 2 Inner Mode 1</td>
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<td>8</td>
<td>0 0</td>
<td>0 1</td>
<td>Outer Mode 0 Inner Mode 2</td>
</tr>
<tr>
<td>9</td>
<td>1 0</td>
<td>0 1</td>
<td>Outer Mode 1 Inner Mode 2</td>
</tr>
<tr>
<td>10</td>
<td>0 1</td>
<td>0 1</td>
<td>Outer Mode 2 Inner Mode 2</td>
</tr>
</tbody>
</table>

**OTrakBeg@115**
Starting window for “AutoTrak”
Set in Degrees for each die.
Recommended setting to be 2 inches or 10 deg’s above any die contact. However may be programmed anywhere during the down-stroke.

**OTrackEnd 170**
Ending window for “AutoTrak”
Set in Degrees.
Recommended setting to be about .5 inches from bottom of press stroke.

**TrakMode = 1**
Selects AutoTrak **High Limit** to perform E-Stop function (CR1) in **selected window**. AutoTrak **Low Limit** to perform cycle stop. AutoTrak alarms disabled outside window. Each corner has separate custom limit.

**TrakMode = 2**
Mode 1 plus cycle stop alarms (CR2) **after TrakEnd**.
(Both Upper and lower limits).
Applications: Slug and scrap detection at bottom of stroke.

Applications: Early warning tonnage detection of foreign material in die.
ENCODER TYPE nnnn
When an encoder is used for the PosiTrak™ option, this parameter identifies the type of encoder: the number is a combination of bits controlling code conversion and input inversion as follows: **Note: 1 & 3 are used for supplied gray code encoder. Resolvers typically use 0 or 2.**

Table 4.1: Defined Encoder Types

<table>
<thead>
<tr>
<th>Number</th>
<th>Description</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>binary code, non-inverting (Resolver)</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Gray code, Fwd</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>binary code, inverting (Resolver)</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Gray code, Rev</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>BCD code, Fwd (CIO INPUT MODULE)</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>BCD code, Rev (CIO INPUT MODULE)</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Gray code, inverting Fwd</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Gray code, inverting Rev</td>
<td></td>
</tr>
</tbody>
</table>

This prompt has no meaning when the PosiTrak™ option is not in use (EPROM version 3.XX).

ENCODER OFFSET nnnn
When an encoder is used, this parameter will correct the initial encoder alignment so that it reads 0 at the top of stroke and 180 at bottom (for the inner slide on a dual action press). This corrects for any mechanical offset which may occur in mounting the encoder. The encoder position is displayed in crank degrees on the load monitor’s front alphanumeric display (0 to 359). The encoder offset value is programmed in bits (0-255 = 0-360 Deg). To change degrees to bits divide by 1.4.

To set this parameter, first set the ENC.OFFSET to 0000. Inch the press to the top. With the press at top, press the PREV key, then the NEXT key to display the ENC.OFFSET prompt and then press the ENTER key without entering any digits: the unit will read the current encoder position and automatically calculate and enter the appropriate offset. The ENC.OFFSET may then be fine-tuned to correctly display dead bottom loads using a computer with the IDC graphic communications software. This will allow you to line up the peak load with the Dead Bottom marker line (180 deg Purple line) on the graphic display. To adjust, simply increase or decrease the ENC.OFFSET value to achieve peak load at bottom.

Alternatively, placing the unit in the SHOW GAINS mode will cause it to display the current encoder reading in the TOTAL display as binary position (0-255 = 0-360 Deg). You can read this value and compare it with some other indicator of press position to derive an appropriate offset. The display is shown in binary and must be multiplied by 1.4 for degrees.

This prompt has no meaning when the PosiTrak™ option is not in use.
**EncDispOffset nnnn**
The value entered here will add to the press position displayed on the front panel LCD. This allows the load monitor to maintain and process the display loads based on 180 degrees to represent 0.0 inches off bottom. This prompt would be used to change the display readout on the front of the monitor to match existing displays without affecting the process.
The value entered here will be added to the current display in binary (0-255). Divide the degree of desired offset by 1.4 and enter to the nearest degree.

**OUTER DWELL nnnn**
When using an encoder with shared strain sensors, this parameter tells the monitor the press position (in degrees) at which the outer ram has gone into dwell. When the press reaches this position in the cycle, any tonnage occurring up to that point in the cycle will be attributed to the OUTER ram, then the amplifiers will be re-zeroed. Any additional tonnage is then attributed to the inner ram.
This prompt has no meaning when the PosiTrak™ option is not in use.

**SERIAL ID nnnn**
Sets the ID code for the unit’s serial interface when used with a computer network:
0 = no network, 1-240 accepted as ID.

**CYCLE TIME**
This prompt represents the number of seconds between successive cycles when the press is operating at production rate. This prompt is used in conjunction with the next prompt (TRAK CYCLES) to set up the monitor to automatically go into AutoTrak™ mode when automatic operation of the press is detected. Each cycle which occurs within this amount of time from the previous cycle increments an internal AutoCycle counter. If more than this number of seconds elapses between cycles the AutoCycle counter is reset to 0. When this counter reaches the value set in the next prompt (Trak Cycles), AutoTrak™ mode is automatically initiated: that is, the average and +/- 3-sigma limits are calculated based on the last 3 to 16 cycles (see Trak Cycles prompt below) and immediately put into effect as high & low limits. If either this prompt or the next are set to 0000, automatic AutoTrak is inhibited, and AutoTrak™ may only be initiated manually via the reset button or other communication means (Remote I/O, ControlNet, FactIS, etc).
TRAK CYCLES

This prompt sets the number of consecutive cycles, which must be made (each within the time limit set in the Cycle Time prompt above) to automatically calculate “AutoTrak”. If 0, automatic AutoTrak calculation is inhibited, although AutoTrak may be turned on externally by the Fault Reset key or communication commands from a host computer or PLC.

Beginning with version E025, this prompt also specifies how many cycles to include in the AutoTrak calculation, whether initiated externally or automatically. The range is 3 to 16. If less than 3 is entered, the complete history FIFO contents will be used. If more than 16 is entered, the complete history FIFO will be used for the calculation, but automatic calculation will be delayed until the specified number of cycles occur at production speed.

Trak OffDly
This prompt sets a delay in seconds after which AutoTrak™ will be automatically canceled if the press doesn’t cycle. If set to 0000, AutoTrak™ will not be automatically canceled, but may be canceled by the reset input. Any value up to 9999 seconds (2 hours 45 minutes) may be entered. It may be used with or without the TRAK CYCLES automatic calculation mode (it will cancel AutoTrak regardless of how it was initiated).

For EPROM versions Cxxx, this prompt also sets the time delay in seconds to automatically reset the internal cycle counter for the FILTER LENGTH setting (see below) if the press doesn’t cycle. This setting would prevent a die change from displaying the first hit averaged in with previous runs.

OutTrakBeg@
This prompt will control the angular starting point for the AutoTrak™ function for the outer slide. This allows the user to mask out press noise or non-critical functions that might otherwise cause nuisance alarms. To set, select the degrees where the AutoTrak™ is to begin monitoring. Older versions software E25 and earlier and most TM 80 series you must divide the degree value by 1.4. Enter the value and press the “Enter” key.

To determine the point of starting AutoTrak™ it is best to view the signature in the degree mode and count back from 180 degrees (the purple line). Each tic on the horizontal graph is 10 degrees. The beginning point will be displayed by a light brown vertical line.

OutTrakEnd@
This prompt will control the angular ending point for AutoTrak™ to function for the outer slide. This allows the user to mask out press noise or non-critical functions that might otherwise cause nuisance alarms. To set, select the degrees where the AutoTrak™ is to begin monitoring. Older versions software E25 and earlier and most TM 80 series you must divide the degree value by 1.4. Enter the value and press the “Enter” key.

To determine the ending point for AutoTrak™ it is best to view the signature in the degree mode and count back from 180 degrees (the purple line). Each tic on the graph is 10 degrees. The ending point will be displayed by a heavy brown vertical line.
**InrTrakBeg**
This prompt will control the angular starting point for “AutoTrak” to function for the inner slide. This allows the user to mask out press noise or non-critical functions that might otherwise cause nuisance alarms. To set, select the degrees where the “AutoTrak” is to begin monitoring. Older versions software E25 and earlier and most TM 80 series you must divide the degree value by 1.4. Enter the value and press the “Enter” key.
To determine the point of starting “AutoTrak” it is best to view the signature in the degree mode and count back from 180 degrees (the purple line). Each tic on the horizontal graph is 10 degrees. The beginning point will be displayed by a light brown vertical line.

**InrTrakEnd**
This prompt will control the angular ending point for “AutoTrak” to function for the inner slide. This allows the user to mask out press noise or non-critical functions that might otherwise cause nuisance alarms. To set, select the degrees where the “AutoTrak” is to begin monitoring. Older versions software E25 and earlier and most TM 80 series you must divide the degree value by 1.4. Enter the value by entering the number and pressing the “Enter” key.
To determine the point of starting “AutoTrak” it is best to view the signature in the degree mode and count back from 180 degrees (the purple line). Each tic on the horizontal graph is 10 degrees. A dark brown vertical line will display the ending point.

**FilterLength nnnn or CamswEnable nnnn or SkipUpStroke nnnn**
- **Skip up stroke** applies to TM80 version 6.85 or later, and all TM90 Exxx versions. This prompt will remove the mirror tonnage curve after bottom of stroke. To disable the upstroke curve, enter a “1” in this prompt. This will not affect the tonnage curve on the down stroke. This is mainly used on presses that have extended dwell at bottom.
- **Cam Switch Enable** prompt is used only with TM80 versions 6.76 to 6.84. This prompt should be set to 0 at all times except when the optional automation cams are used. If the remote cam switches are used, this prompt must be set to 1.
- **Filter Length prompt** applies to TM80 versions 3.xx and TM90 versions Cxxx without the PosiTrak function. When set, this function causes each channel to display the running average of the last “nnnn” cycles – each new cycle is averaged with the number of previous cycles entered in this prompt (maximum of 10). The fault reset button resets the internal average cycle counter to zero any time it is depressed (if there are no faults). The next cycle will then be displayed by itself, the second cycle will display the average of 2 cycles, the third cycle will display the average of 3 cycles, and so on, up to the number entered here (maximum entry is 10).
This filter is for display only and has no effect on AutoTrak™ or alarm settings. In the event of an alarm, the display will show the actual alarm value and not the averaged display. Alarm cycles will not be put into the FIFO stack to be averaged.
The Trak OFFDly prompt may be used to reset this cycle counter automatically if the press doesn’t cycle within the time setting (entered in seconds).
CHAN n RATEDnnnn

Sets the rated tonnage for each channel. This is used to scale the analog inputs to engineering units, usually tons. It also determines the maximum values which may be entered for Inner & Outer Maximum & Die Maximums. One entry per channel for up to 8 channels are entered using the same basic prompt. Unused channels should be set to 0.

WEB address 1,2,3&4

This set the IP address in the monitor

000.
000
000
000

NETMASK BITS

Series of bits to “mask” certain portions of an IP address.

Gateway address 1,2,3&4

Address between your computer and the outside world.

000
000
000
000

I.DEG.x.x nnnn

This is used with the PosiTrak™ option to enter a table defining the Inner slide position processing: enter the degrees at which the inner slide goes through 0.0”, 0.5”, 1.0”, etc., every half-inch up to 6 or 10 inches. This calibrates the crank angle to slide position in inches off bottom. When connected to a computer this permits identifying the distance from bottom at which work on the die occurs, and also permits calculation of total work done by the Inner ram. Pressing the ENTER key without entering any digits will automatically display and load the present encoder position into the motion table. These prompts should be set to 0 for single-action presses. These prompts have no meaning when the PosiTrak™ option is not in use. See table and chart below. This figure shows the crank degrees and tonnage allowed every .5 inch above bottom. The inches are in bold type at the top and the tonnage and degree are displayed below each position.
O.DEG. x.x nnnn
This is used with the PosiTrak™ option to enter a table defining the Outer slide position processing: enter the degrees at which the outer slide goes through 0.0”, 0.5”, 1.0”, etc., every half-inch up to 6 inches. This calibrates the crank angle to slide position in inches off bottom. When connected to a computer, this permits identifying the distance from bottom at which work on the die occurs, and also permits calculation of total work done by the Outer ram. Pressing the ENTER key without entering any digits will cause the program to read the current encoder position, and automatically enter this reading as the degrees for the current prompt. For single-action presses with the PosiTrak™ option, this entry must be completed, and the equivalent entry for the INNER ram set to 0.
This prompt has no meaning when the PosiTrak™ option is not in use.
See table and chart below. This shows the crank degrees and tonnage allowed every .5 inch above bottom. The inches are in bold type at the top and the tonnage and degree are displayed below each position.

I.TONS x.x nnnn
This is used with the PosiTrak™ option to enter a table of rated press tonnage vs. distance off bottom, from the press manufacturers rating curve or data sheet: enter the rated value each half-inch up to 6” or 10”. This enables protection of the press in areas where it is not rated for full tonnage. This feature is typically used with transfer and stretch draw dies.
Note: The last tons entry point @ 6.0” will set the tonnage alarm curve to top of stroke. If the user decides to disable the alarm above the 6.0” point, enter the last point higher than the 5.5” point. This will automatically disable the alarm curve any point above the 6.0” location.
These tonnage values may be lowered to custom fit a die signature and may be saved and recalled for operation under the “Save Die/Get Die” prompts. Up to 30 Die ID’s are available in the monitor locally.
This prompt has no meaning when the PosiTrak option is not used.
See table and chart below. This shows the crank degrees and tonnage allowed every .5 inch above bottom. The inches are in bold type at the top and the tonnage and degree are displayed below each position.
O.TONS x.x nnnn
This is used with the PosiTrak™ option to enter a table of rated press tonnage vs. distance off bottom, from the press manufacturer’s rating curve or data sheet: enter the rated value each half-inch up to 6” or 10”. This enables protection of the press in areas where it is not rated for full tonnage. This feature is typically used with transfer and stretch-draw dies. These data points are interpolated to create a high-resolution curve for accurate protection.

Note: The last tons entry point @ 6.0” will set the tonnage alarm curve to the top of stroke. If the user decides to disable the alarm above the 6.0” point, enter the last point higher than the 5.5” point. This will automatically disable the alarm curve any point above the 6.0” location.

These tonnage values may be lowered to custom fit a die signature and may be saved and recalled for operation under the “Save Die/Get Die” prompts. Up to 30 Die ID’s are available in the monitor locally.

This prompt has no meaning when the PosiTrak™ option is not in use.
See table and chart below. This shows the crank degrees and tonnage allowed every .5 inch above bottom. The inches are in bold type at the top and the tonnage and degree are displayed below each position.

<table>
<thead>
<tr>
<th>Inner Ram</th>
<th>6.0”</th>
<th>5.5”</th>
<th>5.0”</th>
<th>4.5”</th>
<th>4.0”</th>
<th>3.5”</th>
<th>3.0”</th>
<th>2.5”</th>
<th>2.0”</th>
<th>1.5”</th>
<th>1.0”</th>
<th>0.5”</th>
<th>0.0”</th>
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</thead>
<tbody>
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<td>110</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 1
Shut height option

All IDC TM-90 series load monitor can be fitted with the shut height monitor option allowing the load monitor to display the shut height in inches to .001” accuracy. The software will also check for slide interference when used on double action presses, and de-energize a control relay to prevent the press from cycling when an interference condition exists. The following descriptions are for both the inner and outer settings. Each readout has four parameters to set.

The measurement devices are multi-turn rotary resolvers or linear encoders designed to take the oil and punishment in the press ram. Quick connecting cables to the transducer(s) allow easy replacement in the slides.

The following list of prompts are for programming the shut height transducers.

Outer/ Inner Sh Enc Bits xx

This parameter tells the monitor how long the full count is for a specific length of transducer. Typically 16 bits for most rotary types, but must be set to specific user length for all Balluff type transducers. This does not set the resolution of the measurement but the expected full-scale count. The selection of bits is one of four of the following for maximum user measurement:

- 16 bits for 114 inches max.
- 15 bits for 57 inches max.
- 14 bits for 28 inches max.
- 13 bits for 14 inches max.

For most presses that have slide adjustments of less than 28 inches, 13 or 14 bits are commonly used.
Outer/Inner Sh Enc Type xx

This parameter selects the direction of count from a transducer installed in the press. A zero (0) or two (2) will change count direction. Zero (0) will produce an increasing count when the car is moved away from the connector end of the transducer and two (2) will produce a decreasing count. To set the correct encoder type enter a zero (0) or two (2) and test the direction by observing the digital display on the monitor when the press shut height is changed. Raising the slide should increase the count. Note: You must enter a temporary number (e.g., 28.375) in the following SH LEN prompt in order to check the direction.

Outer/Inner Sh Len xxx.xxx

This parameter tells the shut height monitor how long the Outer/Inner transducer full range is, so that the display can be scaled accordingly. For NSD style linear encoders the length of the encoder selected for the application is entered in inches. Make sure all six digits are programmed. (10” encoder is entered as 010000)

For all BALLUFF style encoders, depending on the length, the value is entered as 113.500 for 16 bits, 56.750 for 15 bits (57” and lower), 28.375 for 14 bits (28” and lower) and 14.188 for 13 bits (14” and lower). This number is factory determined by the counting frequency and the transducer speed. This length represents the maximum user length of measurement and must also be associated with the correct bits. This number may be fine-tuned for installation misalignment by measuring the % of error and multiplying the error times the SH length and re-entering this parameter.

For rotary encoders the entered encoder length is computed since the full adjustment measurement uses less than full count of the encoder. The installation should have a little safety margin on the ends to prevent a rollover. In most installations with presses that have 30” or less of slide adjustment only half of the encoder range is needed to provide .001” accuracy.

For rotary style encoders the encoder length is computed by the number of counts per inch. If the turns are not known, temporarily enter the full range of the encoder in binary (example 65536) into the ENC LEN prompt. Make sure that zeros are entered in the ENC BIAS (next prompt). First check to see that the absolute position is installed close to the position of the slide adjustment: the middle of the range (about 32000) should be close to the middle of the slide adjustment. Check the direction of the display when the slide is adjusted. (Numbers should increase when the slide is raised.) If the count decreases, change the encoder type 0-2 or 2-0. Perform an accurate slide measurement with a dial indicator or an IDC linear calibrator and adjust the slide exactly one inch. Record the difference in the display readings on the monitor for one inch of travel (for example 1956) and enter the results in the denominator. The answer (33505) is entered as the Encoder Length.

\[ \frac{65536}{1936} = \frac{33505}{(1936)} = \text{New Encoder Length} \]
Note: If one inch of slide travel results in less than 999 count, the turns ratio must be increased. If the product of the counts/inch and the user length (slide adj. range) is greater than 65536, the encoder ratio must be decreased.

**Outer /InnerSh Bias xxx.xxx**

**Subject: Shut-Height Calibration Procedure**

Many plants have experienced difficulty in obtaining a true shut-height measurement to accurately calibrate a shut-height readout system. In the past, the nominal accuracy wasn’t considered as important as the repeatability of a numerical setting to enable consistent die sets. Today, with the advent of standard die shut-heights and the plants’ ability to swap dies amongst presses, the nominal accuracy is becoming more important.

Trying to measure a press shut height with dial indicators is difficult for the following reasons.
1) It is difficult to get a press on true bottom.
2) It is difficult to obtain an accurate “Pogo Stick” that will span the distance between the bolster and the slide. Pogo sticks are available with dial indicators on them, and are good for measuring the deviation but not the actual height.
3) Even with an absolute measuring stick, different people can interpret different readings.
4) Even if an absolute measurement can be obtained with a measuring stick, it is done under static conditions, which may not represent the real working conditions for the press.

The easiest, most practical method to accurately measure a true dead bottom shut-height is to adjust the shut-height to apply 50% of the load rating of the press on a set of easily-measured calibration load stands. By applying a significant load to the slide, bearing clearances are exercised, and because the press is in motion while the measurement is made the oil films within all of its bearings at normal operating conditions. Hydraulic overloads, if present, are also in a normal dynamic state. By simply adding up the heights of each load cell riser and load cell, the actual working shut-height can be easily obtained, and the shut-height readout apparatus can be calibrated to this measurement.

This prompt adds the offset to the calibrated reading to display actual shut height in inches. The press slide must be inched to bottom. Measure the slide position at bottom with a pogo stick or tape measure to determine the actual shut height. The current display on the shut height readout plus the encoder offset value will equal the actual shut height measurement. Subtract the current display from the actual measured shut height and enter the results in the OUTER /INNER SH BIAS prompt.
Example: Actual shut height press on bottom the measured value is 54.230”. Current display reading on monitor is 33.390”. Subtract 33.390 from 54.230 and enter the results in the Bias prompt (20.740). Record these values for future reference.

Example setup for Balluff style encoder:

Press with shut height of 46 inches and an adjustment of 10 inches. The four program parameters for each slide must be set to “getting started values” for determining actual operating values. For single action presses use the “Outer” slide setup prompts only. Set the inner prompts to zeros (0).
1. ENCODER BITS (under 28” of measurement) (14)
2. ENCODER TYPE (count direction decreases from connector end) (2)
3. ENCODER LENGTH (value is factory determined by transducer speed) (28.375)
4. ENCODER BIAS (temporarily enter zero (0)). Check for proper count direction by observing display on monitor. The count should increase when slide is moved up. (current display on monitor shows 23.123 inches) (actual measured shut height opening is 52.250 inches) (bias is computed by subtracting 23.123 from 52.250 = 29.127)

Slide Sep xxx.xxx
This parameter applies to double action presses only. This prompt sets the trip point of the differential slide positions that would cause interference between them if the press was cycled. The value entered is dependent on the type of die and press and is determined by the user. When in a slide interference condition, the slide interference relay changes state to prevent the press from cycling. To set: enter the desired value in inches and press the enter key on the keypad.

Note: Slide interference relay may be selected to be normally open or normally closed by moving jumper on shut height board on TM80 CPU or JMP4 on TM90 CPU.

SHOW GAINS?
When calibrating or checking calibration of the press, this prompt can be used to cause the input amplifier gain to be displayed on the corresponding display for each channel (0-255), and the encoder reading to be displayed in the TOTAL channels. When show gain setting is selected, dip switch “7” on the amplifier mother board will send a known reference signal into the final amplifier and the corresponding display will show amplifier setting of the “S” pot. To place monitor in the show gains mode, press the “END” key. The display will say “Turn dip 7 on”. Any key other than Enter will cause the display to advance to the next prompt, which is actually the “home” Good Parts prompt. Note: When a dual action monitor is setup with shared strain sensors, the “OUTER DWELL” prompt must be temporarily set to “0” to display the gain of channels 1-4. After completion of gain checking, set the outer dwell back to the operating value. See calibration procedure for more details on usage of this prompt.

This prompt is also a “gateway” to the routine to reset the Worst Hit record: see calibration procedure for more details.
Description of Pots and Switches

- Balance Pot
- Gain Pot
- Gain Range Sw1,2,3
- Balance Extension Sw 4,5
- Noise Filter 6
- Shunt Cal 7
- Tare Bypass 8

Description of switches and Pots. Each sensor is connected to an amplifier that has gain and balance adjustments as described above. Balance is accomplished by temporarily turning on DIPswitch 8 and adjusting the Balance pot to display about 3 or 4 LED’s on the analog bargraph (green LED’s on front). Gain or sensor sensitivity is accomplished by the range Dipswitches (1,2&3) and the Gain adjustment POT. DIPswitch 4 and 5 extend the balance adjustment range, and DIPswitch 6 is a noise filter, usually in the off position. DIPswitch 7 is an internal shunt cal that when the show gains mode is selected (last prompt) a digital value of the gain pot is displayed on corresponding channel on monitor front for future reference and board or monitor replacement.
Load Monitor Sensor Balance Procedure

Load Monitor Sensor Balance Procedure

• Sensor Balancing Procedure
• Dip switch 8
• Balance Pot
• Balance range Extension

Adjust for mid scale reading on corresponding analog bargraph (green LED’S) when DIP switch 8 is turned on.

Tare Bypass Dipswitch (8) used for initial sensor balance. Off for normal operation.

Balancing the strain sensors
Various mechanical stresses are imposed on the strain sensors as they’re mounted on the press. These stresses are often greater than that created by the loading of the press, and would obscure the press readings if not canceled out in advance. This cancellation procedure is termed “balancing” the amplifier, and is typically required for each amplifier channel. The following procedure will be written up for a single channel, but must be carried out for each channel.

Switch settings for initial balance
Set the amplifier DIP switch 2 on as shown below for presses that have not been calibrated. If the monitor has been in service, leave the first three DIP switch settings in their original positions. Re-calibration usually requires only a minor gain adjustment.

Balancing procedures
Turn on DIP switch 8. Balance each amplifier by adjusting the Balance or Zero Pot (see layout) to display three or four bargraph LED’s on the corresponding channel display on the monitor face: turning the pot counterclockwise reduces the number of LED’s on, turning it clockwise increases the number of LED’s on. Note that this is a non-critical setting because the auto-tare will always insure a perfect zero starting measurement every cycle.

If a channel cannot be balanced, DIP switch 4 may be turned on to get more Positive adjustment (more bargraph LED’s on) or DIP switch 5 may be turned on to get more Negative adjustment (fewer bargraph LED’s). If a channel still won’t balance check sensor wiring (see next page). Note that the balance pots are 20-turn devices, so it may take quite a bit of cranking to achieve a balance. Once the bargraph balance has been achieved, turn Dipswitch 8 off for each channel. Repeat procedure for each channel. When finished depress the fault reset key to re-zero all sensor amplifiers.
Monitor Calibration

- Load Cell Stanchions
- Load Processor Operation
- Loading Press
- Dialing Gain Ranges
- Final Gain Adjustments
- Recording Gain Values

Load Cells placed on Solid Steel Stanchions
Load Cell Placement

- Locate Under Connection
- Shut Height Checks
- Equal Height Stands
- Care and Safety

Locate Load Cell stands under slide connections. Slide connections are defined where the pitman/screw adjustments attach to the slide. This prevents concentrated loads from distorting the slide. Contact area of load cell to slide is often buffered with a large steel plate to prevent the slide surface from dimpling. Load cell placement order is shown below and goes clock wise from one to four. Load cell display processor follows the same layout.
Shut Height Requirements

(Calibration)

- Safe Shut height checks
- Care in handling
- Safety

To insure that safe shut height is encountered during the calibration process measure slide height to bolster when press is inched to bottom of stroke. Measure the complete stack of load cells, risers and any steel plates that are used to make stanchion height. Make sure there is sufficient clearance (.5-2”) and that the slide adjustment will accommodate stack height. When cycling the press with the load cell stack for the first time, cycle slowly to insure press slide is above load cell stack. Then lower the slide to kiss the load cell stack (similar to bottoming a die) and increment the shut height 015” to .025” each time to achieve desired tonnage on calibration display processor.
Load Cell Hook-up and Operation

- Connecting Load Cell Cables
- Channel Assignments
- Connecting Power
- Using Pendant Button
- Sequence of Operation
- Computer Operation

Load cell cable receptacle.
1 = Left Front
2 = Left Rear
3 = Right Rear
4 = Right Front

Calibration Module (used on some models) is assigned to Load Set.

Serial Comm. port for graphic analysis on computer

Power Plug 120vac Must use grounded source

Keypad and Display are for initial setup and Calibration. Not used under normal operation.

Key lock secures program settings.

Chart Recorder output (0-10 Volts)

Peak tonnage display for each Load cell. Total display is Peak of the instantaneous sums.

Trigger Button or Pendant button input will cycle the load cell processor. Press button or pendant button to window measurement. Press on down stroke and release on upstroke.
Matching Readings

- Establish load cell readings
- Check for load balance
- Shimming to level load
- Adjusting Level of press
- Adjusting load monitor to match readings

After initial setup in software, adjust the gain to match readings from load cell.

Care must be taken when cycling on load cells. After every cycle check to make sure that the load cells are not shifting and staying on center of the load stanchions. Fine-tuning of load balance may be accomplished with paper and steel shims provided you don’t use more than .001” per foot of slide distance. Example: 10 ft of distance between load cells should have no more than .010” out of level between load cell stacks.
Once desired readings are achieved on the calibration load cells and the press is level to GM specifications (.001”/ft), the load monitor may be dialed in (calibrated) to match readings. This is accomplished by adjusting the Gain Pot for each channel. Usually it takes several load cycles to sample and dial in the readings on the monitor. If Gain Adjustment pot is out of range, select the Gain Range Switches (1,2,3) to the next level and re-adjust the gain pot to match readings. A “get started” gain setting for new installations is switch 2 on as shown below:

1,2,3 = Gain Range Switches
010 Examples below (ON = 1)
       (OFF =0)
000,001,010 = Low Gain
011,100,101 = Med Gain
110,111  = Max Gain
Recording Gains and Calibration

- Calibration Record Sheet
- Recording Dip Switches
- Recording Gain Pot Adjustment
  - Show Gains Mode (1)
  - Dip Switch 7 on (2)
  - Display Recordings (3)

Put the monitor in the show gains mode: **Make sure that the press is on top and not running.** Press the keys on the keypad in the following order: press the “Fault reset key” then press the END key and then the ENTER key. The LCD display will say “TURN SW 7 ON...” Turn dip switch 7 on for each channel. The calibration number will then appear on the corresponding channel digital display. Record this number along with the dipswitch positions on the calibration record sheet. Repeat this process for all channels. When finished, turn Dipswitch 7 off and press the “Enter” key twice to return back to operation. *Note: On dual action presses operating with “shared” strain sensors, you must temporarily enter a “0” in the “OuterDwell” prompt for this procedure. When finished make sure that the OuterDwell prompt is re-programmed to the original value (usually 120).*

If the press has been calibrated and you are upgrading or replacing the power supply/amplifier board, and you have records of the calibration numbers, you may adjust the “Gain” pots to display the original numbers. Do this when replacing the motherboard or installing a replacement monitor. Make sure that you perform the balance procedure after setting the dipswitches to original positions. When finished turn dip switch 7 off and press the ENTER key twice to terminate the “show gains” mode.
Dynamic Slide Leveling

• Level Press Actively (Cycling)
• Dynamic vs. Static
  – Dies operate Dynamically
  – Equal Height Load Cells
  – Shimming
  – Connection Adjustments (Lazy Links)
  – Hydraulic Overloads
  – Lazy Link/Broken Press Components

Dynamic Slide Leveling
Presses that have been load leveled benefit the user by allowing dies to be shuffled from press to press with little or no adjustments. This save time and allows flexibility in the production process. Even load distribution will result in lower operating tonnage extending press life and will allow more room for production mishaps.

During the calibration process it is necessary to dynamically level the press. This is accomplished with equal height load cells and checking for load balance. Adjusting the screw connection usually levels multi-point presses. Other press anomalies may be discovered during the leveling process that will require repair. Out of level slides may also be caused by, loose tie rods, leaking hydraulic overloads and cracked or broken press components. Calibrating the press “Dynamically” measures load and checks for slide parallelism under the same operating condition of a die. Leveling a press statically, usually with a measuring stick and a dial indicator (pogo-stick) is a starting point but level under load may revile lazy connections. The die operates dynamically and a press should be leveled dynamically.

The following procedure will show how to check and correct the most prevalent problem encountered in four point presses; lazy links. In most instances, if the press has no major problems, a little tweaking of the screw connection is all that is necessary to accomplish this procedure.
Slide Leveling Procedure

Slide leveling Procedure

• Equal Height Risers with Load cells
• Determine Low or High corner(s)
• Disconnect Screw couplings
• Screw adjustment
• Check readings
• Re-connect Couplings

Example: Press below indicating out of level with low tonnage readout on Left Front Corner.
Connection Assembly Large Transfer Press

Connection Assembly Large Transfer press

- Connection Ass.
- Drive Nut
- Worm Gear
- Coupling

Connection Assembly

Coupling Shaft to Worm Gear inside housing

Screw connector

Worm Gear and Coupling

Nut or Wheel with thrust washer
Troubleshooting Load Monitor in Service

- Low Tonnage Readings
  - One corner
  - Adjacent Corners
  - All Channels
  - Sensor Check

Low Tonnage Reading One Channel
The second most likely cause is the Program settings in the monitor.
Other causes are listed below.
Bad amplifier IC, LF-347
Loose strain gauge
Die setup condition causing a load imbalance.
Press with a lazy corner.

Low Tonnage Readings on cross corners (adjacent).
When two displays show a substantially low reading, the most likely cause is a lazy link. This is a common press problem usually on transfers operating at fairly low tonnage levels (10 to 30% of total tonnage). A lazy link may often impose low tonnage readings on its cross corner partner similar to a short-legged chair.
The second most likely cause is bad cable or strain sensors.
The third most likely cause is program settings in the monitor.

Low tonnage Readings All Channels
Light Die tonnage requirements.
Program settings in the monitor, channel rated, encoder settings calibration settings
Strain sensor and wiring and reference voltage in the CPU.
The forth most likely cause is position encoder software setting or malfunction.
Strain Sensor Check at Load Monitor

- Sensor and Cable Check Monitor Connection
- Sensor Resistance Check
- Cable Check
- Sensor Voltage Check

Unplug sensor cable and use a digital meter to measure OHMS (range set to read 350.0).

Strain sensor input
1 top terminal is the shield
2nd terminal from top is the 8VDC power connection
3rd terminal is power common
4th terminal is – input
5th terminal is + input

To check sensor and cable, remove connector and use a digital ohm meter and probe between the 2nd and 3rd terminal for 350 ohms, and between the 4th and 5th terminal for 350 ohms. Additional cable resistance of up to 15 ohms is normal. Readings must be matched to no more than +/- .5ohms.
Sensor Voltage Check in Load Monitor

- Excitation Voltage
  - 8 vdc +/- .2vdc
  - Terminal 2&3

Sensor Voltage output
Less than +/- 25mv
Terminal 4&5

Measure with DVM and set to mille-volt measurement. The sensors static voltage measurement must be less than +/- 25mv when measured between terminals 4 & 5 on sensor input. Monitor must be powered and measurement is with sensor cable plugged in. Also, measure excitation voltage between terminals 2&3, voltage is 8.0vdc +/- .2vdc.
Sensor field checking is accomplished by measuring the resistance with a digital Volt Meter. Set the range to display 350.0 ohms. Unplug wire terminal connector from strain sensor and insert screw plug connector perform the measurements between the following terminals.

1 & 4 = 350 ohms and 2 & 5 = 350 ohms. Readings should be +/- .2 ohms between pairs.
Erratic Tonnage Readings

- One Channel
- All Channels
- Software Display

One channel Erratic
Under each Digital Display is an analog bargraph (green LED’s) that represents tonnage value in %. If digital values are erratic, observe the green LED’s and see if they are behaving erratic also. Usually this indicates an intermittent sensor cable. This issue is more prevalent on transfer presses where the sensors and cable are traveling on pitman arms. See sensor check. Amplifier IC LF347 bad. See amplifier chip replacement. IC is socketed.

All Channels Erratic
If any one of the sensor cables has a short in the power or excitation wires, this will cause all channels to behave erratically. Check all sensor cables. Unplugging them one at a time in the monitor may quickly identify the faulty cable. Check encoder for proper operation. Count on display should increment smoothly.
CPU Circuit Identification

- CPU
- EPROM
- AD converter
- EEPROM
- Extraction Tool
- Watchdog
- Communications Processor

5 Volt Adjustment for A to D converter.

EPROM Operating Program

EEPROM Retains User Program

Fan must be used for any PC 104 interface

Watchdog timer LED “blinking” Processor board running.

A to D converter
Changing EPROMS

• Changing EPROM's
• Proper use of
  Extraction Tool

IC Extraction tool for EPROM, EEPROM and A to D converter. Tool is available from Radio Shack and many other electrical suppliers.

Insert tips of extraction tool into open corners on the IC socket. Push down and squeeze tool. This will cam lift IC out of socket. (Do not pull up, this will damage socket. Do not use screwdriver to pry!)
Encoder Operation and Troubleshooting

- Monitor Program
  - Encoder Type
  - Encoder Timing
  - Encoder Wiring
  - Encoder Bits

Graphic Display shows a missing encoder bit with a tonnage value scattered across the display.

Erratic display in software usually indicates an encoder problem either in the encoder itself, the connection or in software. The press position display is located on the lower right corner on the alphanumeric display. When the press is cycling the count should increase and should not jump or skip degree’s.

Check Encoder Type and Offset prompts in the monitor program. **Digital encoders are either a 1 or 3** for type (direction control). Resolvers are either a 0 or 2 for type (direction control).

Check for missing encoder bit by observing the LED’s located above the encoder connection in the monitor. When press cycles, all bits (8) must transition on and off with the least significant located to the left.

Display of press position. 0-359 degrees. 180 –200 represents bottom of stroke. Display should count forward in a non-erratic manor when the press is cycled.

Encoder ribbon cable plugged into the digital encoder header labeled “encoder” on board.

Encoder bit LED’s indicated encoder status of position. All bits should transition for each press cycle and least significant is to the left.

See encoder installation for color code connection.
Resolver Operation and Troubleshooting

- Monitor Program
  - Resolver Type
  - Resolver Timing
  - Resolver Wiring
  - Excitation
    - External/internal
  - Shared Resolver

Erratic display in software usually indicates a resolver problem either in the resolver itself, the connection, and the module or in software. The press position display is located on the lower right corner on the alphanumeric display. When the press is cycled the count should increase and should not jump or skip degrees.

Check Encoder Type and Offset prompts in the monitor program. Digital encoders are either a 1 or 3 for type (direction control). **Resolvers are either a 0 or 2 for type** (direction control).

Check for Encoder jumper (NSD Enable) present on CPU board.

Check resolver process board on CPU for proper excitation setup. Resolver module may be set for internal or external excitation by removing IC 3. External excitation may be from another monitor or device. Check Excitation input/output on terminals 7&8 on encoder connection. Use oscilloscope to verify signal.

Check to make sure that ribbon cable is plugged into the resolver header and not the encoder header. Also the optical couplers IC’s must be removed for proper operation.

Display of press position 0-359 degrees
180 –200 represents bottom of stroke.
Display should count forward in a non-erratic manor when the press is cycled.

Encoder ribbon cable plugged into header labeled “Resolver” on motherboard.

Optical couplers IC’s (3) removed from their sockets for proper resolver operation. Encoder LED’s do not function for resolver operation.

See resolver installation for wiring.
Resolver Hardware on CPU

- Resolver Module
- Internal/external excitation
  Resolver Enable Jumper

Resolver Enable Jumper must be installed for Resolver operation.

Resolver module shown with internal excitation IC U3 installed.

Excitation IC3 must be removed for slaved monitors (slide 2&3) on multi-slide transfers. Usually the No.1 monitor provides excitation. See Resolver wiring.
Monitor Troubleshooting

Troubleshooting Monitor

- Program Settings in Monitor
- Encoder Operation
- Hardware
- CPU
- Mother/Power Supply
- Displays

Check program for valid information such as Channel Ratings, Encoder setup prompts and degree and tonnage table(s). Step to the prompts by navigating with the Next, Prev key on the keypad. See calibration record sheet and quick reference prompt sheet.

Check for encoder reading (Press Position) on alphanumeric display (lower Right Corner). The bottom of stroke should be somewhere around 180 degrees and counting forward when press is cycling. If no reading is observed see encoder or resolver troubleshooting.

Observe bargraphs (green LED’s) under each digital display on monitor front. They represent tonnage in %. Each LED is 10% of tonnage for that channel. If bargraphs are indicating load when press is cycling, then sensors are working properly.

If bargraphs are completely lit up, that usually means that the CPU is not running. Power the monitor down to reset the CPU. If problem persists, check the 5VDC power supply voltage. See the following page to check and adjust for proper voltage.

Check CPU watchdog timer LED. It should be flashing. No flashing LED indicates a bad CPU or Power Supply. See troubleshooting CPU.

Check power supply voltages. See Mother board Troubleshooting

Check sensor power (excitation) for 8 vdc on 2nd and 3rd terminal on sensor plugs.

Check Strain sensor and cables. See sensor checkout
Measure and adjust the power supply voltage for 5.10 to 5.15 volts between the +5 and LD Ground solder pads. Pads are located and labeled on left side of CPU. Adjustment pot is located under power supply cover on Mother Board.
Resolver Excitation

- Oscilloscope
- Digital Volt Meter
- Internal/External excitation

Connect Scope or AC meter probe to measure Resolver Excitation on terminals 7&8. See oscilloscope waveform below.

Internal excitation provides 5-8 volts peak to peak at 2 to 3 kHz. External excitation input may vary in amplitude and frequency. Minimum voltage level is 3 volts peak to peak and frequency range is from 2 to 5kHz from other sources. Maximum voltage is 8volts peak to peak.

Measure sine and cosine signals on 9&10 and 11 & 12. Sine and co-sine wave form will be similar to the excitation but vary in amplitude depending on resolver position. As press cycles both the sine and cosine signals will vary in amplitude from 0 volts to some maximum voltage that will be less than the excitation input.
Troubleshooting Monitor During Calibration

Troubleshooting Monitor During Calibration

• Monitor Program
• Encoder
• Strain sensor
• Insufficient Gains
• Communications
• Press Problems

Troubleshooting the load monitors during the calibration process can require the knowledge of many skills. Sometimes the press is severely out of level, hydraulic overloads not functioning properly and will require the attention of machine repair personnel. The following is a list of problems encountered during the monitor calibration process.

• Press hydraulic overloads tripping early in load cycle. Check hydraulic pressure for proper setting. If pressure is set properly look for lazy link usually indicated with excessive shimming on load cell(s). An out of level press can cause premature overload tripping. Level press. See leveling procedure.

• Tonnage not indicating on monitor digital. If the monitor program is not set-up properly, monitor will not work. Encoder must be indicating correct direction and position (180 at bottom of stroke). If program and encoder appear to be functional then check sensor wiring. See sensor checkout.

• Sensor may be reading backwards, tension instead of compression or vice versa. To check sensor signal for proper direction, temporarily turn Dipswitch 8 on and balance the display (green Bargraph) to indicate 3-4 LED’s. Cycle the press with load and observe LED’s. If they move down, less signal, the direction must be changed (swap green and white wires). Re-balance the sensor and cycle the press again. If no change is observed, then check sensor mounting for loose or bottomed out bolts (too long). Check for sensor excitation voltage (8VDC). See sensor voltage check.

• Encoder not functioning, display not changing. Check the encoder prompts in the monitor. Use the “Next” key to step down to the “Encoder Type” prompt and check for a 1 or 3 for digital gray code encoder or a 0 or 2 for a resolver interface. Check for proper wiring on terminal strip for the type of encoder. Resolver has six
connections plus the shield. The digital had 10 connections plus the shield. Digital encoders have an LED assigned for each bit. LED’s must transition each press cycle. Resolver must have resolver process board and jumper installed on CPU.

- Ribbon cable must be plugged into proper header on motherboard for type of encoder used. Header labeled “encoder” for digital gray code and “resolver” for six-wire resolver See encoder See encoder installation section for wiring.
- Insufficient gain; cannot get monitor to match reading. This may be caused by one of the following scenarios.
  - Excitation voltage low.  8 Volts DC on Terminals 2&3 in monitor. See sensor checkout.
  - Dip switches 1,2&3 set to low range. Move to higher range.
  - Loose strain sensors; bolt too long or not tight (15-18Ftlbs)
  - Sensor direction wrong, reverse green and white wire on sensor and rebalance.
  - Sensor mounted in dead area on press (column mount). Relocate sensor and be sure sensor is not installed on non-load bearing column. Must be installed on “box” column around tie rods. See sensor Installation.
- Lazy link or (pitman arm) usually indicates a press dynamically out of level. Before machine repair gets involved check sensor for proper installation, loose bolts, bolts too long etc. Check sensor and cable for voltage and resistance. See sensor installation and testing. You may test strain sensor by squeezing and observing the corresponding bargraph. This is accomplished by turning DIPswitch 8 on and adjusting the balance to display 3-4 green LED’s on. Have someone observe the bargraph on the monitor when the sensor is squeezed by hand to verify operation and direction. Pitman mounted sensors should indicate an increase in graph when squeezed (compression). Column mounted will indicate a decrease when squeezed (tension).
How to use Monitor

The following section will discuss practical uses of the monitor including “WEB’ interface. Although the “WEB” software is covered in another manual many of the operations and functions can also be locally controlled. The following topics are discussed.

- Displays Digital and Analog
- Total
- Keypad
- Key lock
- Alphanumeric Display
- Prompts
- Crank angle
- Shut height
- Fault Messages
- “AutoTrak”
- Graphic Display (computer interface)
- WEB (Ethernet)
Keypad lockout Key
Selector Switch
Run position disables the
bottom row.
Run/Program enables the
bottom row to allow the
"Enter" key to function.

"AutoTrak" function on LED.

All monitor functions are
available via keypad and
prompt display.

Alphanumeric display will
work with keypad to step
through prompts. Crank
angle, fault messages and
optional shut height are
displayed.

Digital peak tonnage
and real-time analog
displayed for each
corner of press.

Total tonnage is computed as
true total by adding the
instantaneous sum of the peaks.
IDC load monitors have an operation that over the years have supported many computer graphic programs as technology develops. The latest is “WEB” based operation. Via the serial link, windows and DOS based programs are supported but the most versatile is the “WEB”.

WEB based operations allows graphic view and die recipe management to be functional at client computers anywhere on the Ethernet connection to the server. Client computers may be setup to various levels of operation based on passwords and administrative control. The operation of the “WEB” software is covered in a “WEB” manual, however the operation of the monitor is unchanged except for a few enhancements that the “WEB” has allow. The following discussion will be practical applications and usage of the tonnage monitor.
AutoTrak Function

- The feature of the IDC tonnage monitor is to create an acceptance value of tonnage for a particular die and have these limits perform various operating functions to insure quality and tooling protection. The following will describe the heart of the operating system and ways the system can perform depending upon operator involvement and automation.

**Important facts about the AutoTrak function.**

- When the monitor is told to calculate and operate the AutoTrak function, the calculations are based on the measurement in memory. The monitor always keeps the last 14 signature cycles in memory for each channel. You may select from the last 3 to 14 to be used for the calculation by setting in the “TrakCycles” Prompt 3-14. If 0 (zero) is entered, the monitor will default to 14 for the calculation. Before the “AutoTrak” function is calculated, you must have good samples of the new die load. Any remaining values from a previous die would widen the limits.
- AutoTrak will use +/- 3 sigma on each tonnage measurement point (up to 256 per corner) to establish the range (upper and lower limit).
- AutoTrak can be manually turned on and off at the monitor by pressing and holding the “Fault Reset” button for 3 seconds. The “AutoTrak” LED on monitor front indicates AutoTrak on.
- The WEB based operation can provide tonnage protection immediately before the first hit. The server will look for a die ID code in the mailbox (in the load monitor) and download to the monitor the current “AutoTrak” values for the die. The mailbox in the load monitor can be connected to the local controller for a die recipe code, usually via a PLC using Controlnet or AB R/IO. When the monitor has a download of AutoTrak the function may be turned on and off in the WEB based software.
- AutoTrak values may have a window of operation selected using the Trak Begin and Trak end prompts or in the Die Recipe menu in software.
- AutoTrak may be expanded with the + and – margins prompts or in the Die Recipe menu in software.
- AutoTrak may have every point of measurement selected to a value determined by the operator to customize the upper and lower limits. This is only functional via the WEB based software under “Edit AutoTrak”. Once limits are made they may be saved for each die and loaded to the monitor when the die is requested.
- Another feature is the use of the on-board automatic “AutoTrak”. This feature when setup, will turn “AutoTrak” on when production starts and off when it quits. This is accomplished by setting a couple of prompts in the monitor. This method provides hands free operation. Using the “Cycle Time” prompt and the “Trak-Off Delay” prompt to perform this function.
Basic function of the load monitor is to display operating tonnage for viewing. This is an important parameter for the stamping process. Plants can use a simple documentation methods to perform consistent die tonnage setups. Operators would look-up load monitor settings and adjust die shut-height to display documented values. After successful setups the monitor may then use the “AutoTrak” feature to calculate and implement safeguard limits for that production run. Once the job was finished, “AutoTrak” settings would be turned off and discarded and the procedure would start over for the next die. This type of operation provides safeguarding with in each production batch but manual operator involvement is necessary. AutoTrak is turned on and off by pressing and holding the “Fault Reset” button for about 3 seconds. An “AutoTrak” indicator LED is on monitor front.

Another feature is the use of the on-board automatic “AutoTrak”. This feature when setup, will turn “AutoTrak” on when production starts and off when it quits. This is accomplished by setting a couple of prompts in the monitor. This method provides hands free operation and has been quiet popular.

Both methods require the first few hits to be used for teaching the monitor and thus if any mishaps occur during that time they may go un-noticed. Other download methods can provide the “AutoTrak” feature to be installed before the first cycle.

The new WEB based operation can provide tonnage protection immediately before the first hit. The server will look for a die ID code in the mailbox (in the load monitor) and download to the monitor the current “AutoTrak” values for the die. The mailbox in the load monitor can be connected to the local controller for a die recipe code, usually via a PLC using Controlnet or AB R/IO.
Operating system
Signature Load Protection TM90 Series

“AutoTrak” Mode 0,1&2
This example displays one channel of the upper limit of AutoTrak in use. This is a dos based display but the function is also displayed on Windows and WEB based operation.

How to use AutoTrak

AutoTrak will function properly when these parameters are set in the monitor.
1. The +/- margins
2. Trak Beg and Trak End window
3. Trak Mode

The operation of the AutoTrak: function is to calculate and implement a upper and lower limit. Once these parameters are programmed in the monitor they must be saved in the Press control logic by pressing the “Teach Load Monitor” button located on the press operator control panel.
When the die is re-installed in the press, the ADC will download these saved parameters back to the tonnage monitor automatically.

Mode Manual AutoTrak

1. Establish a good part.
2. Before AutoTrak is initiated, the monitor requires a number of good cycles equal to or greater than the number programmed in the “TrakCycle” prompt (Range is 3-16). The press must cycle full of parts, with no empty cycles and no shut height changes. This guarantees a tight calculated limit.
3. Press and hold the “Fault Reset” key on the load monitor for about two seconds. Press may be running for this.
4. The “AutoTrak” LED on the monitor front will indicate operation.
5. View the calculated limits with the computer. If the computer was on line you must re-attach by pressing the “ESC” Key and the Spacebar. This will bring you back to the press and die selection menu. Select your press and Die. Once re-selected the “AutoTrak” limits will be included in the graphic load signature display.
6. When production is finished you may turn off the AutoTrak function by simply pressing the “Fault Reset” button for two seconds. The AutoTrak LED will go off. Calculated limits are discarded and the monitor will be ready to accept new parameters for the next die. Repeat the process for the next die.
Note: Anytime you change the +/- margins, or re-calculate “AutoTrak” you must re-attach to the computer to update the “AutoTrak” limits on the display. New AutoTrak limits are downloaded from the load monitor only during initial connection.

**Automatic AutoTrak**

There are three prompts in the load monitor that need to be set-up. These prompts tell the monitor that production has started and to turn the “AutoTrak” function on and off automatically.

1. **Cycle Time** prompt is programmed in seconds to represent hit to hit time that would indicate production. Example: If normal production is 10 SPM, then 6 seconds represents normal cycle time (hit to hit). Usually you add one second to this value and 7 would be programmed in the Cycle Time Prompt.

2. **Trak Cycles** prompt is set to count how many production cycles are needed to turn on “AutoTrak”. Minimum value is 3 and maximum value is 16. Once this criteria is fulfilled, the AutoTrak function will turn on.

3. **Trak Off Delay** prompt may be used to turn off the “AutoTrak” function when the press is idle for the number of seconds programmed. 1800= one half hr of time. AutoTrak may come back on again once the Cycle Time and Trak Cycles criteria are fulfilled.

Note: The AutoTrak function may still be toggled on or off manually by pressing and holding the Fault-Reset button for two seconds.
Practical Applications of Load Monitoring

In the ever-shrinking world with manufacturers competing for market share, competition has increased product quality many folds. This attitude has changed the direction of manufacturing forever. Today every process of manufacturing is being optimized for maximum efficiency. SPC feedback and constant monitoring of a process is imperative to producing better parts. Quality monitoring today is inexpensive. It reflects immediate and long-term paybacks.

Basic load monitoring on stamping presses have proven to be an effective way of not only monitoring quality, but to provide tooling and press protection as well. The following is to show some practical load monitoring techniques that the industry has adopted. To truly understand the load monitor we must take a look at the press and understand tonnage and how it is developed.

Spring Element of the Press

The typical mechanical stamping press produces load by the interference created between the upper and lower half of the die. The pressure required to make a part is controlled by the shut height adjustment. The shut height adjustment is what determines the dead bottom position and maximum interference or load. A stamping press has a tonnage rating determined by the manufacturer. The mechanical designs of the load bearing members have a certain amount of displacement at a rated load. Studies have proven that a typical press displaces approximately .001” per ton per corner. This spring rate is what allows the press to perform work on the part. If sheet metal presses were designed extremely stiff, the shut height would be very difficult to set and the work zone would be very small. Work is defined as force vs. distance and the pressure zone would be extremely quick. Most large sheet metal presses have a spring element of .001 inch (.0006-.0015) / ton / per corner. This is easily determined with load cells and steel shims.

Sensor Operation

The strain sensor is the link between the load monitor and the press. This is what converts mechanical stress into corresponding electrical output for tonnage displays. Strain sensors are mounted on load bearing members of the press such as the pitman arms, columns and tie-rods. Proper placement will provide true tonnage loads to be displayed. Sensors on load bearing members will represent a corresponding strain directly related to the tonnage a press is operating at.

Most strain sensors are constructed of strain gauge foils configured in a bridge. This type of design offers stable differential outputs and a low impedance source. These are desirable features. The signal output is typically one to two mill volts per volt per 500 micro strain.

The strain gauge foils are bonded to the steel structure of the sensor. When the sensor is subjected to strain, the mechanical flexing changes the conductivity of the foils. When a
source voltage is applied to the sensor, any strain will produce a voltage output. This voltage change is proportional to the strain and the strain is proportional to the tonnage. The Whetstone bridge configuration produces four times the output of an individual strain gauge and also provides thermal compensation. Since the bridge output is differential, two outputs, one positive and one negative are connected to differential inputs in the tonnage monitor. This provides excellent common mode noise rejection, which enables the system to operate in electrically noisy environments.

**Load Monitor Calibration and Operation**

After completing the installation of a load monitor system on a press, the stress and strain relationships must be compared to a known load test. This procedure is called the press calibration. The calibration procedure consists of loading the press with calibrated load cells to a specific load (tons) and setting the scale (readings) in the load monitor to match. Load cells of large capacity are placed on suitable risers in the die space. The press is carefully cycled, similar to bottoming a die, to a desired load displayed by the load cells. Fine-tuning is accomplished with shims and paper. Most presses are calibrated between 50 and 100% of rated capacity.

**Dynamic Slide Leveling**

During the calibration process one very important event is to dynamically level your press. This is accomplished with equal height load cells and checking for load balance. Adjusting the screw connection usually levels multi-point presses. A lazy link, loose tie rod, cracked or broken press components can be the cause of many quality and setup problems. Presses that have been load leveled benefit the manufacturer by allowing dies to be shuffled from press to press with quick consistent setups.

**Load Signatures**

Load monitors are essential for die setups. The peak value is very important for proper die sets and part quality. However measuring loads throughout the stroke is very important for stretch form and nitrogen assisted dies, deep draws, progressive and multi-station transfer dies. These operations demand signature monitoring where load are checked and viewed throughout the working stroke of the press.

The monitoring system placed in operation will allow specific die load signatures to be compared against press position, either in degrees or inches, and to be studied for process information and part quality. Load signatures are referred to as through the stroke monitoring or the footprint of a particular part. Load monitors today can implement upper and lower limits that profile a die signature. This gives the user complete monitoring of complex loads each and every stroke of the press. Setups are usually saved in a host controller such as an AB PLC or directly in the load monitor.

**Slide Position Monitoring Inches/Degrees**

An inherent characteristic of a crank or eccentric driven machine (e.g., mechanical presses) is that the machine can only support its full “rated” load within a few degrees of bottom dead center. Within this region, the limiting factors are load-bearing members such as the tie rods, pitman arms; pull rods, frame and slide. Stamping presses are rated full tonnage capacity at bottom. This full-load range is typically ¼ to ½ inch from bottom dead center. This area is less for smaller presses. Distance from bottom, the press tonnage rating diminishes rapidly as the press looses mechanical advantage. Limiting factors such as the gear teeth, crank stress and energy in the flywheel/motor cause the press to de-rate the tonnage capacity quite rapidly.
Press manufactures supply a tonnage de-rating curve. This is the operating limits of the machine. To verify the tonnage usage under this curve, monitoring must compare the load against the slide position. This is accomplished with an absolute position encoder attached to the press and software that associates the crank position to slide position in inches. Load signatures can then be checked against the press curve rating along with upper and lower control limits associated for a particular die signature. Software to display graphic load signatures will give the user a complete tonnage view of the die(s).

**Energy and Inch Tons**

Load Monitoring with crank position allows another important rating to be displayed, Inch Tons. This is a rating defined by the manufacturer to be the total work the press is capable of producing through the stroke.

To measure this load, a monitoring system must have a slide position encoder along with standard load monitoring hardware properly calibrated. When viewed with microprocessor technology, this integrated load value is easily calculated and displayed. The press inch ton capacity is derived from the energy components, motor, flywheel, speed and the mechanical limitations of the load bearing members. A die may require inch-tons to exceed the press limitations but may be under the peak tonnage capacity of load bearing members.

**Temperature and Oil Effects on Performance**

We stated earlier that a press has a spring element to produce work and load on a die and part. This displacement with load is about .001” / ton / corner. Adjusting the slide .010” will produce a 10 ton per corner change or a 40 ton change overall. It is obvious that a little slide adjustment may cause a large increase in load.

Other factor that may change the interference or load is the temperature and oil of the machine. The overall shut height may change due to the thermal growth of the press. Load monitors have proven that a .010” adjustment may change the tonnage by as much as 60-80 tons. Variations in press dimension caused by environmental changes can greatly effect tonnage and part quality. Oil clearance in the crank bearings along with counterbalance pressures can cause dimensional inconsistencies in the press stroke. This can alter the interference, tonnage and change part quality.

**Load Monitor Types**

Load monitors come in various displays and operations stemming from simple read-only peak tonnage to signature load profiling for complex dies and off bottom load processing. The needs and costs are compared with paybacks. Cost range from 2 to 10 thousand dollars depending on all the bells and whistles.

Most monitors incorporate a digital display to represent the actual calibrated tonnage the press is operating at. Software limits can be implemented for high and low load faults for quality and tooling protection. More sophisticated load monitors will utilize signature analyzing techniques to monitor complex die loads and off bottom load measurements. Many load monitors offer die recipe storage and remote control connections to many popular controllers, such as Allen Bradley to host recipes and display operations on one screen.
Monitor Uses
Presses have mechanical ratings and one rating is the tonnage capacity. Tonnage is controlled by the interference between the part, die halves and shut-height adjustment necessary to do the work. As pointed out earlier, adjusting a few thousands of interference can drastically change the operating tonnage. Other factors creating interference changes are temperature and bearing clearance. One of the basic uses of a tonnage indicator is to display actual load to the user each cycle of the machine. This information will help setups for part consistency and die sets. This in itself is valuable to the user. It gives you eyes on something that many times has been taken for granted. A tonnage monitor for a press is like a tire pressure gauge. Do you really know how much pressure you have by looking?

Draw Presses
A Press is designed for a specific need. The size of the die space, shut-height, strokes per minute and tonnage rating make up important physical characteristics of a press. The bed size, shut height and strokes per minute are easily defined, but if press tonnage loads are not monitored, one of the most important specifications of the press slips by. The draw die is usually the most expensive die in the stamping process. The inner die may not be visible making it difficult for a die spotter to see where the slide is at. The setup may require many tryout parts before a quality panel is made. Basic load monitoring will greatly reduce setup time and save scrap tryout parts. Since the operator can easily see how hard the press is working.

Trim and Progressive Dies
Typically trim load are not as taxing to a press as the draw. Many times trim loads are 10 times less tonnage than the draw. Usually stop block (kiss blocks) are used to control the die height. When using stop blocks, it is necessary to see how hard a particular die is working them. Using stop blocks to control the die is important. However excessive loading on the stop blocks is many times the culprits for excessive tonnage. When viewing the load on a graph, a dead bottom load indicating the stop block loads will follow the trim operation. The user can then decide if the tonnage is excessive. Another way to check the load is to remove the stop blocks and observe the tonnage for a decrease. Re shimming the blocks to establish contact without excessive tonnage is the ideal setup.

Establishing Tonnage for a Particular die
Various parts in the stamping business have tonnage requirements that may be intolerant to tonnage loads. However, lower operating loads save wear and tear on the die and press. Additional benefits allow more room for mishaps, such as mis-feeds, slug buildups and double metal. Other dies may have a critical window of tonnage allowance and if not setup within that window quality becomes an issue. One very important test is to check and make sure that die steels are not kissing to hard.
Try to find the knee tonnage, where a decrease in load produces an out of tolerance part. Finding the lower tonnage limit requires a little experimentation with die heights and shut-height. Finding the lower limit will then indicate where the tonnage should be by increasing the load to provide a good part. Usually a little safety margin is then added to
take care of production variances and a value is established. Safeguarding can then be implemented and values stored for future setups.

Progressive dies are sometimes more difficult to setup. Dies will interact causing tonnage loads from one station to effect the load and performance of another. Dies that require more tonnage will cause the press to displace, taking interference (tonnage) away from adjacent dies. When insufficient tonnage is noticed on the adjacent dies, the operator will usually lower the overall shut height causing additional tonnage on the dies with the greatest interference. This can cause excessive loads on one or more stations and greatly reduce the safety zone. The best way to combat this interaction is to identify the individual tonnage requirements by operating each station individually and documenting the tonnage requirement for each die. This will require individual stations to be fine tuned with shims or cutting down the highest die in the pack. Typically when one die is lowered the tonnage load on adjacent dies will increase. Then they may need to be lowered which will again cause tonnage on adjacent dies to increase. It becomes a tricky process but the overall tonnage can be significantly reduced allowing for greater tolerance for production mishaps.