

customer manual

ORIGINAL INSTRUCTIONS

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SAFETY PRECAUTIONS — AVOID INJURY — READ THIS FIRST!

Safeguards are designed into this application equipment to protect operators and maintenance personnel from most hazards during equipment operation. However, certain safety precautions must be taken by the operator and repair personnel to avoid personal injury, as well as damage to the equipment. For best results, application equipment must be operated in a dry, dust-free environment. Do not operate equipment in a gaseous or hazardous environment.

Carefully observe the following safety precautions before and during operation of the equipment:



Always wear approved eye protection while operating equipment.



Moving parts can crush and cut. Always keep guard(s) in place during normal operation.



Electrical shock hazard.



Observe main electric on/off switch.



Always turn off the main power switch and disconnect the electrical cord from the power source when performing repair or maintenance on the equipment.



Ensure that guards are in place and secure to equipment.



Do not operate the equipment without guards in place.



Always disconnect air supply and then exhaust system air pressure before performing maintenance or repair on the equipment.



Always disconnect the air and lockout the tool when not in use or when head or tool holder is detached.



Use caution when working with this equipment.



Never insert hands into installed equipment. Never wear loose clothing or jewelry that may catch in moving parts of the equipment.



Never alter, modify, or misuse the equipment.



Never stare at the bright light used for machine lighting. Bright light can damage the eye.



Never use the machine for other than what it is designed, which is pressing connectors onto circuit boards. Do not use the machine for crushing any items.

In case of partial or general machine malfunction, **ALWAYS** perform the following steps:

- ◆ Actuate an Emergency-Stop button.
- ◆ Actuate the System Shutdown function, if possible.
- ◆ Actuate the machine Disconnect Switch.
- ◆ Use lock-out / tag-out device on the machine Disconnect Switch.
- ◆ Unplug / switch off machine Power from power source.
- ◆ Seek immediate medical attention, if required.
- ◆ Contact TE Connectivity Support Center

SUPPORT CENTER

CALL TOLL FREE 1-800-522-6752 (CONTINENTAL UNITED STATES AND PUERTO RICO ONLY)

The **Support Center** offers a means of providing technical assistance when required. In addition, Field Service Specialists are available to provide assistance in the adjustment or repair of the application equipment when problems arise which your maintenance personnel are unable to correct.

INFORMATION REQUIRED WHEN CONTACTING THE SUPPORT CENTER

When calling the Support Center regarding service to equipment, it is suggested that a person familiar with the device be present with a copy of the manual (and drawings) to receive instructions. Many difficulties can be avoided in this manner.

When calling the Support Center, be ready with the following information:

1. Customer name
2. Customer address
3. Person to contact (name, title, telephone number, and extension)
4. Person calling
5. Equipment number (and serial number if applicable)
6. Product part number (and serial number if applicable)
7. Urgency of request
8. Nature of problem
9. Description of inoperative component(s)
10. Additional information/comments that may be helpful



Figure 1

1. INTRODUCTION

When reading this manual, pay particular attention to DANGER, CAUTION, and NOTE statements.



DANGER

Denotes an imminent hazard that may result in moderate or severe injury.



CAUTION

Denotes a condition that may result in product or equipment damage.



NOTE

Highlights special or important information.



NOTE

Dimensions in this customer manual are in metric units [with U.S. customary units in brackets]. Figures are for reference only and are not drawn to scale.

1.1. About This Manual

This manual contains the installation, safety, operation, and maintenance procedures for the CAP-6T (Drawer Machine) and CAPI-6T (Conveyor Machine) 6 ton Automatic Electric Press. See Figure 1.

1.2. Press Overview

The CAP (designates commonality of the CAP-6T or CAPI-6T) all electric automatic servo press was designed for two primary purposes. First, to satisfy the increasing need for controlled pressing of connectors on today's complex circuit boards. As the density of connectors increase they become more fragile, and at the same time circuit boards have increased complexity, susceptibility to damage, and cost. This trend will undoubtedly continue and accelerate as interconnect PCB's move from simple passive elements to more complex devices with components buried in the inner layers. In a similar way, it has become obvious that the old methods of "slamming" the connectors into the board are no longer acceptable. The CAP, being a servo-electric driven press, precisely controls the force and speed of each pressing cycle. In addition to control, quality feedback in the form of SPC analysis and reporting are available. Valuable data can be captured and analyzed to improve the entire interconnect process.

The second purpose is to improve the efficiency of the pressing process. The techniques traditionally used for pressing connectors have been very labor intensive. The end result is that the throughput and quality have been operator driven, which inevitably produces variable results. The automatic press dramatically improves throughput per labor hour expended while yielding highly consistent computer controlled results with quality data feedback. Thus, the dual purpose of this press meets the needs of the OEMs, CMs and the end customer.

1.3. Production Details

A. Manufacturer:

TE CONNECTIVITY
Berwyn, PA 19312
USA

B. Machine Title:

CAP-6T Drawer Machine (P/N 1689700-1)
CAPI-6T In-line Conveyor Machine (P/N 1689700-2)
CAPI-6T Shuttle Machine (P/N 1689700-3)

C. Machine Function

Compliant pin connector press.

D. Machine Usage

The CAP is an automatic stand-alone unit that presses compliant pin connectors into a printed circuit board (PCB).

E. Restriction on Hazardous Substances (RoHS)

Information on the presence and location of any substances subject to RoHS (Restriction on Hazardous Substances) can be found at the following website:

<http://www.te.com/usa-en/utilities/product-compliance.html>

Click on Find Compliance Status and enter equipment part number.

1.4. General Specifications

A. Dimensions

- Length: 1910 mm [75 in.] (without monitor attachment)
- Width: 1525 mm [60 in.] (including door handles)
- Height: 1780-1830 mm [70-72 in.] (Adjustable feet to allow setting the conveyor height to SMEMA specification.)

B. Weight

Approx. 1814 kg [4,000 lbs] (shipping weight 2042 kg [4,500 lbs])

C. Atmosphere

Ambient Operating Temperature range: 5 to 40°C [41 to 104°F].

Altitude: Up to 1000 m [3300 ft] above sea level.

Relative Humidity range: 20 to 95% (non-condensing).

Transportation and Storage: -25 to 55°C [-13 to 131°F] and up to 65°C [149°F] for short periods not exceeding 4 hours. Suitable means shall be provided to prevent damage from excessive moisture, vibration, stress, and mechanical shock during shipment.

Electrical power: (recommended) 208-230VAC, 25 Amp, 50/60 Hz, 1-phase (full range: 200-240VAC).

Pneumatic: .55 to .83 MPa [80 PSI to 120 PSI].

Not for operation within an explosive atmosphere.

1.5. Capabilities

The CAP delivers a controlled force of up to 6 tons 53.4 Kn [12,000 lbs]. Up to (12) connector pressing tools (top tools) and (1) calibration tool are stored in an integrated tool rack. They are automatically loaded into the exclusive "floating head" as needed. Lead-in on the pressing tool and connector guides the floating head up to 0.4 mm [.015 in.] in any direction to correct for inaccuracies in connector position, as the tool is inserted into the connector. Force transducers detect the force and can stop the process immediately before damage is done to the connector or board.

For the CAP-6T, the PCB size limit is 762 mm [30 in.] x 914 mm [36 in.].

For the CAPI-6T, the PCB length & width is adjustable:

Length	60 mm to 860 mm	[2.36 to 34 in.]
Width	76 mm to 712 mm	[3 to 28 in.]
Thickness	1.5 mm to 6 mm	[0.06 to 0.31 in.]

With alternate clamps, the thickness is 4.00 mm to 10 mm [0.15 to 0.39 in.].

PCB Weight is 16 kg max [35 lbs. max].

PCB edge clearance is 3 mm [.118 in.] on the top side of the PCB.

PCB edge clearance is 4.8 mm [.187 in.] on the underside of the PCB.

Top board clearance is max: 25.4 mm [1 in.]

Bottom board clearance is max: 20 mm [.787 in.]

The minimum lower fixture height is 32 mm [1.26 in.]

The program for pressing is a simple table of connector type, position and head angle. Each pressing cycle, called a profile, is precisely defined by the user to control force, speed, and distance as the connector is pressed. This highly flexible technique allows a virtually unlimited variety of pressing options to satisfy the needs of present and future connectors. Data describing the connectors, tools, PCB, and pressing profile are programmed through Editors and stored in databases.

A. Pressing Methods

Pressing cycle control can be done with one of four basic techniques. The simplest is press to absolute force. In this technique, the total pressing force for the cycle is calculated by using programmed force per pin, multiplied by the number of pins in the connector. Thus, each connector receives the same pressing force regardless of how much force is actually needed to seat it. This has been the technique used in the past on simple force controlled presses.

A more sophisticated technique the CAP uses is called PARS-FPPL, which stands for "Percent Above Range Sample - Force Per Pin Limited". In this technique, the force is the average measured over a user-defined distance range as the connector is pressed. The pressing cycle is then terminated by continuing to press until this average force is exceeded by a user defined percentage, to ensure complete seating. The advantage of this method is the ability to dynamically adjust the force that is applied to match what is actually needed, thus reducing the stress on the PCB and connector. No matter what percentage above the average is defined, the maximum force applied is limited by the pre-defined maximum force per pin.

The "gentlest" pressing technique is press to height. This method yields the absolute minimum stress to the board and connector because the force applied is 100% absorbed by the pin's compliant section interface with the board. The connector housing is pressed to a programmed height above the board without actually touching it. It is especially useful for low force or fragile components like relays. The PCB thickness option must be used to accommodate board and fixture thickness variations.

The final technique is called Force Gradient. This technique monitors the rate of change of force to distance. This method is used for robust connectors that need to be seated against the board surface firmly. Generally, the force vs. distance plot will make a steep upturn as the connector contacts the board surface. The connector stops moving so the force rises quickly. A minimum angle is specified for the upturn which corresponds to how solidly the connector is pressed against the board.

B. Board Thickness Measurement

The board thickness measurement option facilitates the press to height technique by measuring the actual thickness of the PCB before the pressing cycle starts. If the board thickness is not measured, the program uses the nominal thickness that is entered for the height calculations.

C. SPC

The SPC option provides real time data on the pressing force on each connector. Charts can be viewed live on screen, or recalled later for review. The supporting raw data is available for local or network access. The charts and data might be shared with the end user to increase their confidence in the quality of the pressing process.

D. Bar Code Reader

Hand held bar code reader option allows PCB serial numbers to be quickly entered for tracking purposes. Reports include the scanned serial number. Without this option, data must be typed in by the operator.

1.6. Layout

The press is a four-axis servo controlled machine. The pressing head moves 94 mm [3.70 in.] in the Z direction at speeds up to 45 mm [1.8 in.] per second. The press head assembly is driven by linear servo motors from side to side 914 mm [36 in.] and front to back 762 mm [30 in.] at a velocity of 1 m [39.4 in.] per second. The PCB remains stationary on the support fixture. The fixture support table has a grid of dowel and threaded holes used for locating and mounting PCB support fixtures. The center of the press head is calibrated to the first dowel hole (lower-left) of the fixture support table (Machine 0,0). Once a fixture is located and fastened to the fixture support table, the board is positioned on its fixture using tooling pins in the fixture. This establishes the relationship to the fixture and therefore the exact location of the component coordinates on the PCB.

Each axis is controlled by a servo controller. Each motor includes a linear encoder.

The electrical controls are located in cabinets on the front and rear of the machine. The high voltage, servo amplifier, DC power supplies, digital I/O and air valves are located in the rear chassis and the computer is located in the front.

The pressing tools are stored in the tool rack directly behind the fixture support table assembly. The tool holder is a static assembly for holding the tools. A Tool ID system is incorporated in the tool rack to manage the presence and position of each tool. The press head will pick and place from the tool rack automatically as required.

2. SAFETY

The CAP is designed to comply with the latest safety standards.

- ◆ The operator is protected from pinch points and flying debris by proper and reasonable use of guarding and interlocking.
- ◆ Operators have ready access to an E-stop button. E-stops are unguarded, mushroom red operator maintained twist/pull to reset with yellow background.
- ◆ The Display screen displays all pertinent, real-time status information to the user. Additionally, standard work commands are displayed on this screen.
- ◆ The Maintenance screen (I/O) indicates the real-time status of all input devices and handshaking signals. All output devices are controllable from this menu.
- ◆ The Setup screen is password protected. All changeable system parameters are edited and viewed from this screen.
- ◆ Removable panels are removable with a standard hex key. Doors guarding hazards are included in an interlocked safety circuit.
- ◆ Electrical cabinet doors are lockable and labeled. All locks are keyed the same. See Figure 2.



Figure 2

2.1. Equipment Lockout

A master power disconnect switch is provided that can be locked in the OFF position only. See Figure 3.



Figure 3

2.2. Emergency Machine Off (EMO) / ESTOP

The Emergency Machine Off / Emergency Stop switches are mounted on the front and back of the press. They are clearly marked. When pressed, the switch latches in the pressed state and must be twisted to release. The EMO circuit is a hardware-based (dry contact) latching circuit that does not reset when the EMO switch is released.

All voltage that is above 24VDC and external to the control cabinet (with the exception of the computer monitor) is removed when the EMO is pressed.

3. INSTALLATION

This section describes the installation steps and requirements.

3.1. Shipping

The press should be shipped on a pallet, shrink-wrapped and crated for protection. The computer, monitor assembly, leveling feet, and other miscellaneous loose parts should be removed, labeled properly and shipped with the machine.

3.2. Uncrating

Remove the shrink-wrap and unpack the monitor assembly, computer and other shipped parts. Remove Press from pallet by lifting Press up from front side with Forklift until threaded feet studs clear the supports on the pallet. Screw on the support foot pads to the Press, if not already. See Figure 4.

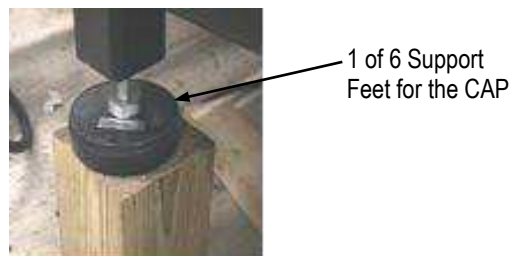


Figure 4

3.3. Initial Assembly

1. Remove X and Y Axis shipping straps.
2. Level procedure: Verify that the Press is sitting flat on all six supports. Use a Bubble gage, set in both the X and Y Axis position and located on the Horizontal center plate (bottom tool fixture support). Adjust the feet, as appropriately, to level bubble gage in both X and Y Axis.
3. Install customer supplied 4-conductor power cord (230VAC 1Ø 25 Amp) thru bottom pass-thru in the rear chassis and into Master Disconnect Switch in the rear electrical enclosure.
4. Install customer supplied industrial airline to the Air Regulator located inside rear chassis. Verify that shop air input has approximately 80 P.S.I. (.55 MPa) (5.5 bar) to the CAP Air Regulator.
5. Install Monitor assembly on left front side. Connect VGA, USB and power cable to monitor. Install keyboard and trackball to the monitor stand.
6. Install computer in left front enclosure. Connect VGA, USB and power cables. Connect keyboard and trackball to computer. Plug computer into internal power strip located inside front enclosure on the left side.
7. Connect USB to CAN interface to USB port of computer.
8. Install Light Beacon/tower to top cover on left side.
9. Power up Press by turning on Master Power Switch. Verify that computer comes "up". If proper supervisor data (specific customer assignments) is installed in computer database, Press should be fully operational.

3.4. Facilities Labeling

The electrical requirements are given on the label on the right-rear side of the machine. See Figure 5.

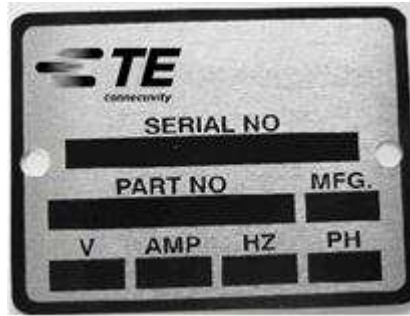


Figure 5

3.5. Electric Supply Circuit

Electrical supply circuit must be 208-230 VAC, 25 Amp, 1-phase, 50/60 Hz.

4. OPERATION

4.1. Operator Interface

All selections on the computer monitor can be made by either touching the screen with a finger or by pointing and left clicking with the trackball. Alpha-numeric entries can be entered by the keyboard or by touching the screen buttons provided. Note that any moisture on the face of the touch screen will prevent normal operation until it is removed. See Figure 6.

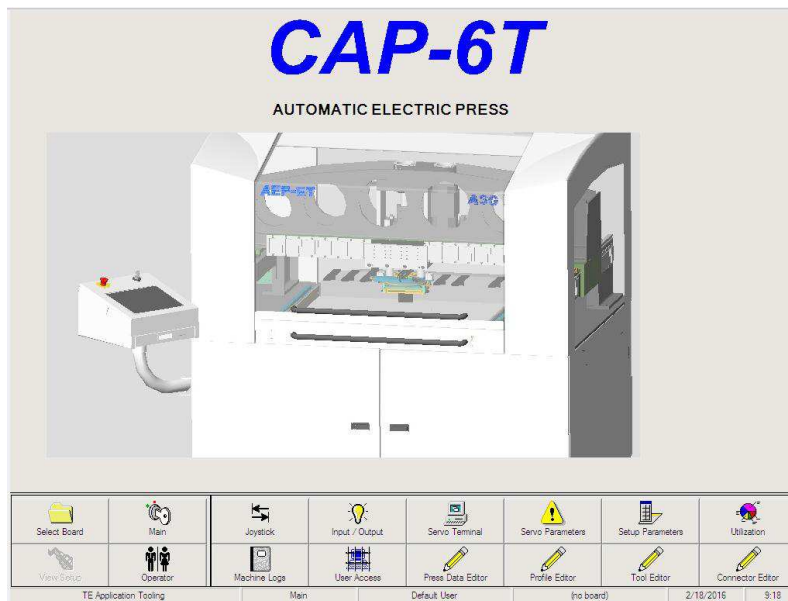


Figure 6

4.2. Logging On

When the boot process is complete, the startup screen is displayed. The only option available is the "OPERATOR" icon. Touch the icon with your finger or left click with the mouse pointer. See Figure 7.



Figure 7

Select your name from the list displayed (if your name does not appear on the list you must see the system manager to add it). See Figure 8A and 8B.

8A



Operator Log-On Screen (Enter Your Password and Press "OK")

8B



Password Entry Screen

Figure 8

4.3. Selecting the Board

Press the "SELECT BOARD" button on the lower left area of the screen. Now select the board from the list presented. Use the up and down arrow keys as needed to change pages. See Figure 9.



Figure 9

4.4. Running the Board

Double click the "RUN" icon or press the "START/PAUSE" green pushbutton on the front left or right of the machine to start the pressing process. The run screen will display showing a rendering of the PCB based on the input data on the left, a blank graph for the pressing force and distance data on the right, and a series of buttons along the bottom. If an error message regarding missing data is displayed, you must return to the editors to correct the problem.

The rendering will be shown with the next connector to be pressed highlighted in blue. This will be connector #1 unless the board being run was aborted before completion. To run the board, double click the "RUN" button on the screen or press the green "START/PAUSE" button mounted on the front left or right of the machine. The automatic cycle will continue until the board is complete or an error condition is encountered. See Figure 10.

Run Screen Buttons

(Run Screen for Press Operations)

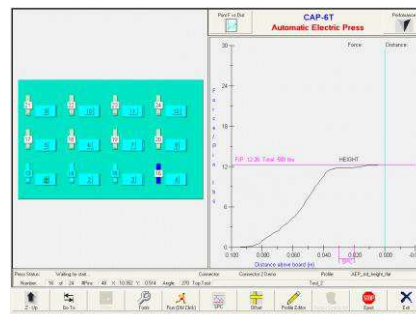


Figure 10

Depending on the access level of the person logged in, only some of the buttons will be available. The unavailable buttons are not shown. The purposes of the buttons from left to right are as follows.

“Z Up” - Used to raise the Z axis after a normal cycle is interrupted. An interruption can be caused automatically by an error condition, or manually by pressing the green START/PAUSE button or the STOP icon on the screen.

“Go To” - Used for random access to any connector on the PCB. Using the mouse pointer, click on the desired connector. The selected connector will be highlighted. Now press “GO TO” to select this connector to be pressed next. The automatic sequence will continue from this point once the cycle is started.

“Tools” - Used to access the tool rack information. A graphic image of the tool rack(s) displays the locations of all the tools currently installed. This button is not available to all user access levels.

“Run” - Double click to start the automatic pressing cycle. The double click requirement eliminates accidental startup. The green “START/PAUSE” button will start the process in the same way.

“SPC” - Gives access to the SPC options. If SPC is not available, this button will be low lighted. This button is not available to all user access levels.

“Offset” - Used to change the pressing location for all or selected connectors. The offset window allows a stored offset to be changed for all connectors on the PCB, or only the current connector type. A check box selects between these options. The Z axis offset is particularly useful in compensating for the many variables encountered when pressing to height. When changing an offset, verify the name of the connector in the upper right of the screen to avoid unexpected results. This button is not available for all user access levels.

“Profile Editor” - Used to enter a new pressing profile, or to modify the current profile at run time. See the Editors section for details on usage. This button is not available for all user access levels.

“Stop/Eject” - Used to stop pressing at the end of the current process. The green “START/PAUSE” button will stop the pressing process in the same way. Pressing “START” again will restart the process where it left off.

“Exit” - Used to return to the main screen as displayed on startup. This is usually done at the completion of a press run. From the main screen, a new PCB can be selected, or the operator can log off. Logging off, when leaving the machine unattended will prevent unauthorized access.

4.5. On Screen PCB Rendering

The PCB rendering drawn on the screen shows the connector locations relative to each other and the board edges. It is a good check for gross errors when running a new program for the first time. It will be obvious for example if a connector is off the board or if there is interference. It also shows the pressing sequence by number and gives the connector name. To read the detailed information, zoom in by double clicking the rendering with your finger on screen or using the mouse left button. You can step through the three zoom levels by continuing to double click. Panning around the PCB is done by touching or pointing and left clicking, then dragging in the direction to pan.

4.6. Interrupting the Pressing Cycle

Pressing the green “START/PAUSE” button during the pressing cycle will cause the head to stop. Once the cycle is stopped, pressing the button again will resume normal sequence where it left off. This makes it possible to slowly “jog” the tool into the connector to more closely observe the interaction between the connector and tool. The “Z Up” on screen button can be pressed to bring the tool out of the connector. Pressing the green “START/PAUSE” button after “Z Up” will cause the cycle to restart at the current position. To capture a force graph for inspection, press the green button when the head starts up and hold it until the head stops at the up position. You can also press the on-screen “Cycle Stop” button. The graph will remain on the screen until the next cycle is initiated. The normal sequence can be restarted by pressing the green button again or double-clicking the on-screen “Run” button.

4.7. Changing the Pressing Sequence

The next connector to be pressed can be changed after a cycle has been interrupted. Using the mouse pointer or finger on the touch screen, mark the connector to be pressed next, then press the “Go To” button at the bottom of the screen. Pressing the green button will start the sequence from the new point, and will automatically step to the next connector according to the program.

4.8. Error Conditions

Some of the common error conditions encountered during pressing are detailed below. The error conditions generated by the Profile program are user defined, so the wording can vary. In addition, new error conditions not covered here may be introduced.

Premature Contact - This error is generated by the Profile program and is likely to be the most common error condition that is encountered during normal operation. It occurs when the pressing tool makes contact with the connector before it should. The contact force and position thresholds are defined in the Profile for the connector. Here are some of the possible causes:

- The connector is tilted too much for the tool to enter cleanly
- The pressing tool hit a bent pin in the connector
- The connector and tool are keyed and the connector is in wrong
- The wrong connector is in the current position
- The PCB is in the wrong position
- There is a position error in the Press Data File (*.pdf)
- There is an error in the Press Profile program (*.prs)

When this condition is encountered, the press head will rise up to the board clearance position and display a message. Careful inspection will usually reveal the problem. If the error is generated the first time a new program is run, expect a position error has been entered in the Press Data File. In some cases it is OK to use the "Retry" option in case the connector was tilted and the tool corrected the lean when it touched it. Use caution when retrying because if there is a bent pin the retry may bend it over further and press it flat to the connector bottom.

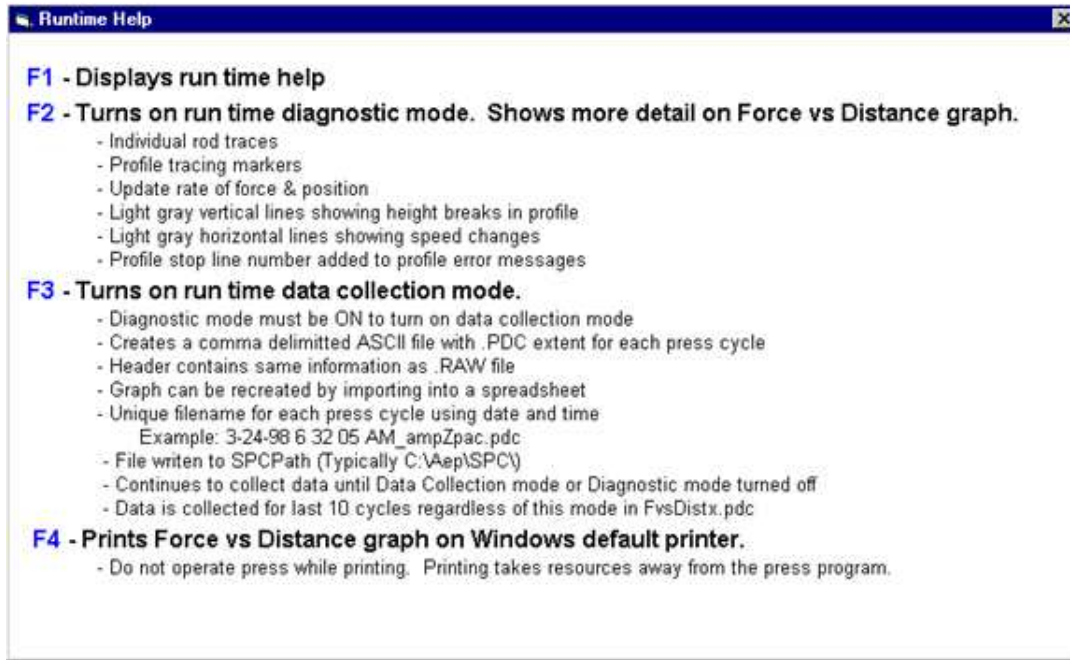
Missing Connector - This error is generated by the Profile program. It will be obvious if a connector is missing. If the connector is not missing, there is an error in the Profile program, which must be corrected by the programmer.

Excess Force - This error is generated by the Profile program. It is displayed when the force required to seat the connector exceeds the programmed limit. There may be a problem with the connector or PCB causing too much resistance before the connector reaches its seated height. The fixture could be too thick causing the connector to contact the PCB higher than expected. There may be a problem with the force or height definitions in the Profile program.

Insufficient Force - This error is generated by the Profile program. It can be caused by a loose pin to hole interference. It can also be caused by the platen being too thin, connector thickness problems, or Profile program errors. The programmer should be consulted to correct the problem.

4.9. Runtime Help Screen

This is the screen that can be brought up by pressing the F1 Key while in the 'Runtime mode' to assist in Diagnostics of Profile performance. Also, this screen will indicate to you how to start the Data Collection mode that creates a file defining 'point by point' performance within the press profile and logs this file to the SPC Directory within the Press computer hard drive. See Figure 11.



Runtime Help Screen

Figure 11

5. PROGRAMMING AND DATA ENTRY

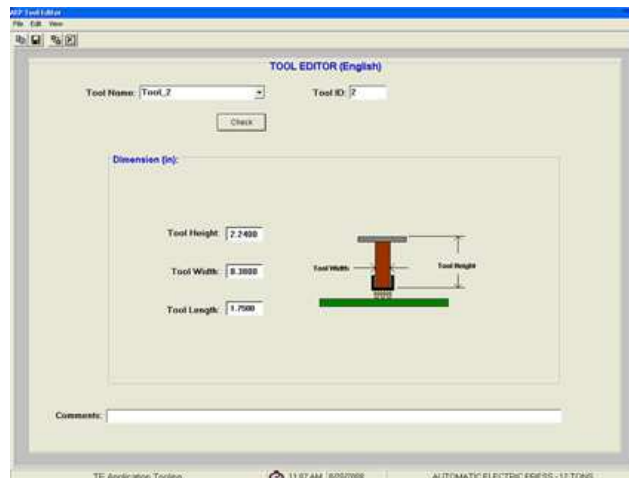
The press is a highly versatile tool due to the built in programmability. Four data bases (accessed through “editors”) are used to guide the press through specific sequences of operations. The variables stored include pressing tool information, pressing profile information, connector information, and PCB information. Once the information has been stored, it is available for use by current and future operations.

Access to the editors is normally restricted to levels higher than “operator”.

5.1. The Tool Data Base Editor

A. Purpose

The tool data base editor is used to view and modify the tool data base, which is an Access Data Base file. The tool data base contains all the necessary information about the mechanical pressing tools (top tools), which are used during the pressing process. See Figure 12.



Tool Editor Screen

Figure 12

The editor can be accessed from the icon at the bottom of the screen. The following fields are maintained in the data base.

B. Entries

“Tool Name” - This is a name you choose up to 20 characters long, spaces allowed, that will be used to refer to this tool in the future. Enter the name from the keyboard.

“Tool Id” - This is the unique code that is programmed into the tool holding plate’s ID memory device.



NOTE

Note: No two tools should ever have the same number unless one is a spare tool mounted on a tooling plate. Only one entry is made in the database.

“Tool Height” - The tool height information is needed in order to know the pressed height of the connector. Enter the height of the tool as measured from the top surface of the tool holder plate to the part of the tool (usually the end) that does the pressing. Top tools should be 56.8 ±0.5 mm [2.236 ±.020 in.] including tool bar. Enter the number from the keyboard.

“Tool Width” - This is used for drawing the PCB assembly rendering on the screen and for collision avoidance with obstructions. Enter the width of the tool at the widest points. Maximum tool width is 25.4 mm [1.00 in.] centered on tool bar.

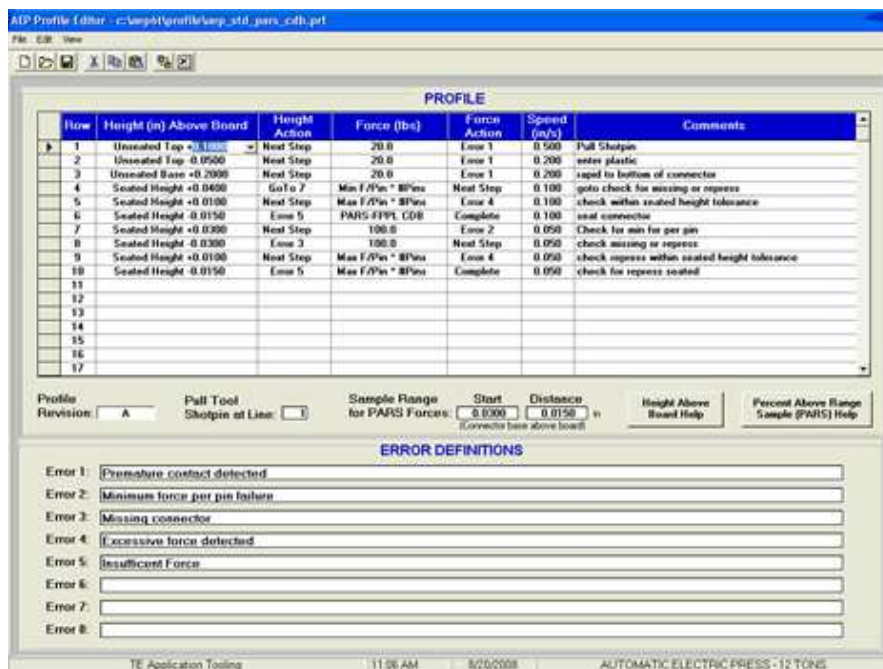
“Tool Length” - This is used for drawing the PCB assembly rendering on the screen and for collision avoidance with obstructions. Enter the length of the tool at the longest point. Maximum tool length is 203 mm [8.00 in.] centered on tool bar.

“Comments” - Enter any comments desired such as a short description of the tool application.

5.2. Profile Editor

A. Purpose

The pressing Profile information that is used to control the pressing process including speed, force, and height. It is at the heart of the control sequence, and allows the user to define in detail how fast, how far, and with how much force a connector is pressed into the PCB. Profiles are stored as ASCII files with a user-specified name. The .prf extension is automatically added. The files can be viewed in any text editor. See Figure 13.



Profile Editor Screen
Figure 13

B. Explanation

The editor provides up to 20 steps, numbered at the left of the screen, to be entered for a given profile. The insertion process starts at row 1, and proceeds from there. Each row has two “events”. “Height Above the Board” and “Force”. As the press head travels down, the program continuously monitors these events and acts on whichever occurs first (Height event has priority). Each event has an “action”, which either continues the pressing process at another step or generates an error. These events and actions are used to:

- detect and announce unexpected contact
- detect unacceptably high or low force generated during pressing
- detect a missing connector condition
- press to/verify the proper seated height
- repress a connector that has already be partially pressed

There are four basic methods of pressing, and each requires a unique profile.

- **FIXED FORCE PER PIN** - A connector can be pressed with a force proportional to the number of pins, such as 30 pounds per pin. This is slightly better than simply using an overall fixed force, such as a hydraulic or pneumatic press provides, because it recognizes that the force applied should be proportional to the number of pins being pressed. It cannot compensate for normal variations in required force per pin for different connectors, in different positions, in different boards.
- **PERCENT ABOVE RANGE SAMPLE (PARS)** – A connector can be pressed with force that is proportional to the actual resisting force detected during the pressing cycle. This is called Percent Above Range Sample or PARS. In this technique, the connector’s resisting force while pressing is sampled and averaged over a distance Range before seating to the board surface. The final force exerted on the connector is limited to a user-programmed Percent Above the Sample force. This percent added assures complete seating of the connector. This is the most widely used technique because it limits the stress to the assembly and does not require accurate board thickness measurement.
- **PRESS TO HEIGHT** – A connector can be pressed to within a programmed distance short of seating on the board surface. This is the gentlest process possible because it exerts only enough force to press the pins into the board. No excess force is pressed into the connector plastic or the board. This sophisticated technique is made possible by the control available using an electric servo press head and a rigid press structure. In order for press to height to be accurate, the board thickness must be precisely known. This can be done using the thickness measurement probe and sequence provided.
- **FORCE GRADIENT** - Monitors the rate of change of force to distance. This method is used for robust connectors that need to be seated against the board surface. Generally, the force vs distance plot will make a steep upturn as the connector contacts the board surface. The connector stops moving so the force rises quickly. A minimum angle is specified for the upturn which corresponds to how solidly the connector is pressed against the board. See “Press Profile” for more detail.

The “standard” profile for each of the techniques above is provided with the press. They use variables whose values come from the Connector and Tool databases rather than discrete numbers. Since each connector requires the same basic steps, one profile with variables can be used for many different connectors.

C. Entries

“Height” - This defines the next destination of the pressing surface of the tool in inches above the board. The press head will drive to this height at a speed that is linearly “ramped” from the height and speed of the previous step.

The initial height (before step 1) is defined in the “Board Clearance” section of the “Press Data File”. The available variables are shown in Figure 14. Alternatively, a numeric height can be entered.



Figure 14

“Height Action” - This defines the action to be taken when the height at this step is reached. Actions are selected from the drop down menu shown in Figure 15. The available actions are:

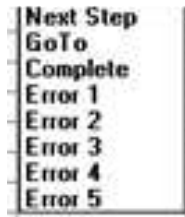


Figure 15

- *Next Step* - This directs the process to the next step below.
- *Go To* - This directs the process to continue at any step below. The step number is entered from the keyboard.
- *Complete* - This signals that the pressing process is complete. The head will stop immediately and rise to the next tool clearance height.
- *Error 1 - 8* - These are user defined error messages. If the height is reached and the action is an error. The pressing process is immediately halted and the error message is displayed on the screen. The operator must acknowledge the error message to continue.

“Force” - This defines the force which will trigger the force action. It is used to detect force errors and to define cycle completion based on the force generated. There are four variable choices provided on the drop down menu. Alternatively, an actual force can be entered from the keyboard. See Figure 16.



Figure 16

- *PARS-FPPL xx%* - This is a dynamic press cycle termination based on actual forces generated during the pressing process). PARS Help button will produce the picture shown in Figure 17.

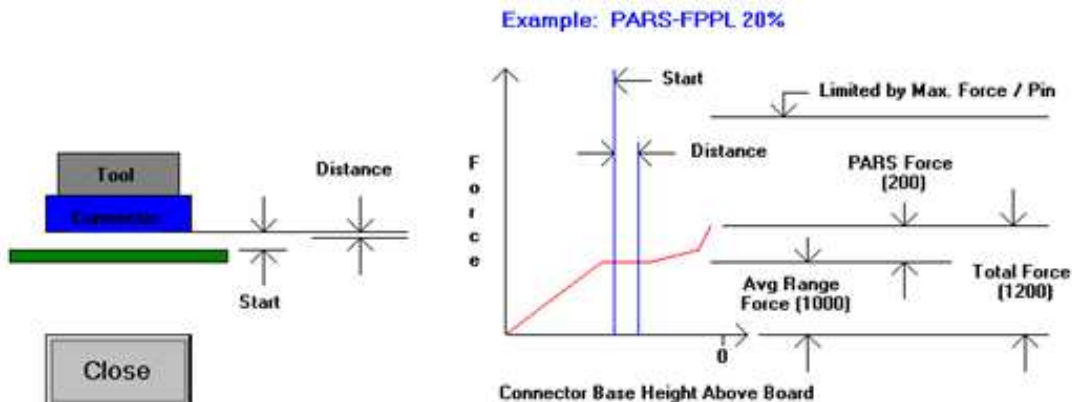


Figure 17

PARS-FPPL is an abbreviation of “Percent Above Range Sample - Force Per Pin Limited”. This force condition uses a special algorithm that calculates the average force generated while pressing the connector into the PCB. The “Start” and “Distance” boxes in the middle of the screen define the bounds for the average. Thus, rather than pressing to a specific force, the actual force required is dynamically calculated for each cycle and termination is based on this force. The “xx%” is an excess force, as a percentage of the calculated average, which is added to the average to ensure the connector is fully seated.

For example: The “Start” height is entered as .030 in. and the “Distance” as 0.015 in.. PARS-FPPL force is invoked in the ‘Force (lbs)’ column, row 6, and 25% is used from what is entered in the connector database. As the connector is pressed, the force readings taken from .030 to .015 in. above the board are averaged. The head continues to press until the force generated is 25% higher than this average.

- *Min F/Pin * #Pins* - This force is calculated by multiplying the number of pins in the particular connector being pressed by the minimum required force per pin. Both the number of pins and the minimum force per pin are entries in the connector database. This can be used to assure at least a minimum force is generated during the pressing process.
- *Max F/Pin * #Pins* - This force is calculated by multiplying the number of pins in the particular connector being pressed by the maximum allowable force per pin. Both the number of pins and the maximum force per pin are entries in the connector database. This can be used to prevent excessive force from being generated during the pressing process.
- *User F/Pin * #Pins* - This variable is provided for the flexibility of defining a force event variable other than Max and Min force per pin. Its use is up to the programmer’s discretion. For example, while pressing to force it may be useful to terminate on “User F/Pin * #Pins” rather than “Max F/Pin * #Pins”. The variable “Max F/Pin * #Pins” would still be used to generate an error if the allowable force is exceeded.

“Force Action” - This defines the action to be taken when the force at this step is reached. Actions are selected from the drop down menu. The force actions are the same as the height actions. See Figure 18.

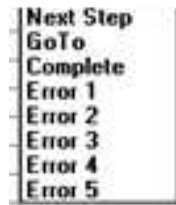


Figure 18

- *Next Step* - This directs the process to the next step below.
- *Go To* - This directs the process to continue at any step below. The step number is entered from the keyboard.
- *Complete* - This signals that the pressing process is complete. The head will stop immediately and rise to the next tool clearance height.
- *Error 1 - 8* - These are user defined error messages. If the height is reached and the action is an error. The pressing process is immediately halted and the error message is displayed on the screen. The operator must acknowledge the error message to continue.

“Speed (in/sec)” - This is the speed target for the current step in the process. See Figure 19.



Figure 19

The speed starts at “Run Speed” (entered in the “Servo Parameters” edit screen) and changes linearly (“ramps”) down to the speed given in step 1. When step 1 is reached, the speed begins ramping down to the speed given in the next step processed. This will generally be step 2, but not if a “Go To” action programmed in step 1 is executed.

Typical speeds range from 1.8”/ second during approach down to 0.02”/ second when pressing. Some experimenting may be required to optimize the process. Some connectors are more fragile than others and may require slow speeds, while others can be pressed quickly.

“Comments” - This entry is for your use as information and reminders. Typically each step has a purpose such as “rapid to clearance above connector” or “slow down to enter connector and engage pins”, etc.

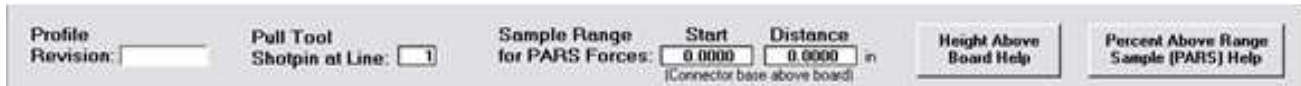


Figure 20

“Profile Revision” – This is an optional entry used to track changes to the profile file.

“Pull (retract) Tool Shot pin at Line” – This option allows selection of which line in the Profile that the Tool shot pin is retracted. Normally, this should be set to Line 1. In most cases it will be desirable to retract the Tool shot pin before the tool enters the connector during a press cycle.

“Start” - This is the distance between the board surface and the bottom (seating surface) of the connector when PARS force readings are started. A typical number is between 0.030 - 0.020 in.

“Distance” - This is the distance over which force readings are averaged for PARS use. A typical number is 0.010 – 0.015 in. The shorter the distance, the fewer the number of points averaged. Look at the screen plot after the connector is pressed (PARS information is overlaid on the graph) to be sure the average is being taken over the correct range.

“Height Above Board Help” - A text and graphic help screen is provided when this button is pressed.

“PARS Help” - A text and graphic help screen is provided for PARS when this button is pressed.

“Action Errors” - Up to eight errors can be defined here. They are used in the “Action” columns above. Typical errors are “Premature Contact”, or “Excessive Force”, or “Missing Connector”.

D. Saving The File

Select “File” from the dropdown menu, then “Save” or “Save As”, then “Exit”. If you press “Exit” before saving, you will be warned and given the opportunity to save or quit without saving.

E. Example

PROFILE						
Row	Height (in) Above Board	Height Action	Force (lbs)	Force Action	Speed (in/s)	Comments
1	Unseated Tool Top +.030	Next Step	50	Error 1	0.300	move to tool top
2	Seated Height +.030	GoTo 5	Min F/Pin * #Pins	Next Step	0.150	test missing or repress
3	Seated Height +.010	Next Step	Max F/Pin * #Pins	Error 4	0.100	test within seated heig
4	Seated Height -.010	Error 2	PARS-FPPL 25%	Complete	0.100	seat connector
5	Seated Height	Error 3	100	Next Step	0.100	test missing
6	Seated Height +.010	Next Step	Max F/Pin * #Pins	Error 4	0.100	test repress within sea
7	Seated Height -.010	Error 2	Max F/Pin * #Pins	Complete	0.100	seat repress

Example #1 – Pressing with PARS

Figure 21

The screen capture example shown in Figure 21 is a typical PARS press profile. The comments at the right end of each line indicate the action that line will perform. In general, PARS pressing is the preferred method because it limits excess pressing force but still presses the connector to the board surface. Fragile connectors that cannot accept any excess force must be pressed to height as described in the example below.

1. Move the head from the tool clearance height (as given in the Tool Database) down to .030 in. above the unseated top of tool. The speed will ramp linearly from the press “Run Speed” to .300 in. per second. When the height is reached, the sequence will continue on the next step. If more than 50 pounds is detected before the height is reached, terminate and display error #1, typically “Premature contact detected”.
2. Continue to move down to until the connector is .030 in. above its seated height. The speed is reduced to .150 in./second. This line tests to see if a connector is actually detected. If it is, as indicated by detecting at least the minimum force per pin multiplied by the number of pins, the process continues on the next line. If not, the process continues on line 5.
3. Press until the connector is within .010 in. of the desired seated height. When this position is reached, the connector will be within a generally accepted tolerance of seated height. The .010 in. can be adjusted as needed for specific circumstances. If the force exceeds the maximum force per pin multiplied by the number of pins before the height is reached, an error message is displayed, in this case Error 4.
4. The destination of this step will theoretically over press the connector, but the process will actually be complete as soon as the force reaches the PARS force plus 25%. The height given simply provides a destination that is not intended to be reached because the force condition will be satisfied first. If the destination is reached before the PARS force is reached, then there is most likely an error in the parameters used to calculate the distance relationship between connector, tool, and board surface. If this occurs, review the tool height, the connector base thickness, the backup fixture thickness, and the board thickness.
5. This “GO TO” step tests to see if there is a connector below the head. If the normal seated height is reached without generating at least 100 pounds of force, it is determined that the connector is missing. If the force is reached, the process continues on the next line.
6. This line verifies the connector is pressed to within generally accepted height tolerance, and the maximum force per pin is not exceeded.
7. This line gives a destination below the nominal seated height, and terminates on the maximum force per pin * # of pins. This variable here could also be “user force per pin” rather than maximum.

A typical resulting screen plot using 30% PARS is shown in Figure 22. The PARS average force is given as 9.62 pounds per pin, or a total of 1,203 pounds total. With 30% added to ensure seating, the force becomes 12.56 pounds per pin. Note the average is taken between the vertical ‘PARS Sample’ lines.

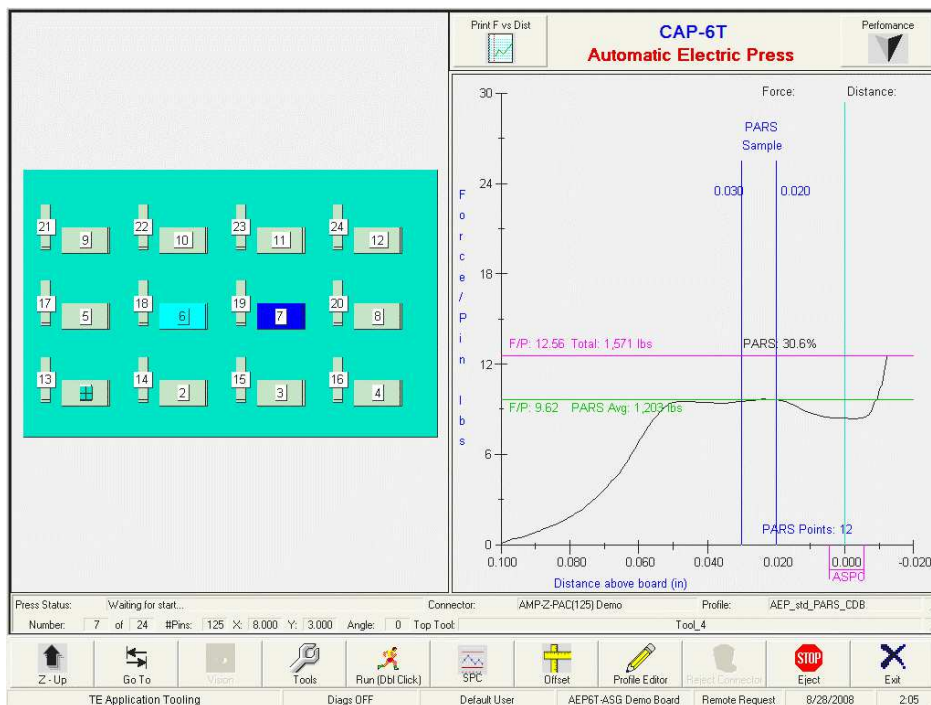


Figure 22

5.3. The Connector Editor

A. Purpose

The Connector Editor is used to enter and store physical data for the connectors. The data is stored in an Access Database file. See Figure 23.

Connector Editor Screen

Figure 23

B. Entries

“Connector” - This is a name you give to the connector. It can be anything you choose, but is usually a descriptive name or manufacturer’s part number.

“Tool” - Select the corresponding Press (Insertion) Tool for this connector from the pull down list provided. The tool must be entered in the tool data base before the connector data can be completed.

“Profile” - This is the name of the profile file to be used when pressing the connector (entry required) .

“Sub Code” - Allows the option for connector substitution (example: different connector manufacturer). Giving multiple connectors the same code will initiate a prompt asking operator to identify connector (type) prior to press setup.

“Number of Pins” - Enter the TOTAL number of pins per connector. If more than 1 connector is to be pressed at a time, enter the full pin count for all connectors to be pressed as a group. The number of pins on a connector is used to calculate force when using max or min force per pin in the profile. It is also used to calculate and graph the force per pin within the run screen.

“Comments” - This is a user field for useful comments.

GRAPH SCALE – These entries define the generated graph parameters for each press cycle.

- **“Force”** - value entered defines the graph (Y) scale range (Force lbs/pins) and should be greater than Max force / Pin + PARS %.
- **“Distance”** - value entered defines the graph (X) scale height above board surface (start w/ .150).

- **FORCE** – These entries defined limits that establish the press forces during the connector press cycle.
- “*Min Force / Pin*” - the minimum force per pin necessary to fully insert connector.
- “*Max Force / Pin*” - the maximum force per pin necessary to insert connector without damage.
- “*User Force / Pin*” - the force per pin determined by user.
- “*Other Force*” - used to define other fixed force, not per pin (example: force from fixture die springs).
- **PARS** – Percent Above Range Sample (a detailed explanation is given on the next page).
- “*Percent*” - enter PARS percent desired during press cycle
- “*Start Height*” - the height above board surface at which the range sample is initiated.
- “*Distance*” - specified distance from the start height at which range sample is completed.

FORCE GRADIENT (“Degrees”) – user defined angle of force vs. distance curve where press cycle will terminate.



NOTE

Force Gradient angle is observed as the graph force curve suddenly increases, indicating connector contacting the PCB. When the connector-seating results are undesirable, increase or decrease angle until desired seating is achieved. The degrees value is not an absolute, since the observed angle depends on the graph scale.

DIMENSIONS – This section of the Editor allows entry of critical Connector dimensions.

- “*Base Thickness*” - This is the thickness of the connector between the inside (mating section) bottom and the outside bottom. It can be defined as: the distance from the surface of the connector that contacts the tool to the surface of the connector that contacts the PCB. It is used to calculate the position the head must achieve to seat the connector to the proper height.
- “*Unseated Top*” - Defined as: the distance from the surface of the connector that contacts the tool to the surface of the PCB (typically measured with the connector preloaded into the PCB).
- “*Overall Height*” - Defined as: the distance from the top surface of the connector to the ends of the connector pins.
- “*Body Height*” - Defined as: the distance from the top surface of the connector to the connector surface that will contact the PCB.
- “*Seated Height*” - This is the desired distance between the board surface and the bottom of the connector. It is usually zero, but may be set above the board surface for press to height applications

C. SPC Entries



Connector Editor Screen (Bottom) – SPC Section

Figure 24

RANGE – The SPC range should be set to capture the pins as they slide down into the PCB holes. Generally, this is the flat portion of the curve, which occurs after the force knee indicating the compliance section giving way to the force applied. A “Start Height” of .025 with a “Distance” of .010 will capture the average force from .025 to .015 (distance of .010 from the start height) off the surface of the board. These are typical SPC range numbers, which should capture the pins sliding into the PCB. It may be necessary to adjust the SPC range settings within the Connector Editor Screen (shown below), to suit specific compliant pin types. See Figure 24.

TE Connectivity recommends using the same parameters for SPC Range as are entered for the PARS Sample Range in the Connector Editor. This is due to the similarity of the force sample location necessary for both.

LIMITS – The SPC “Min Force (Range)” and “Max Force (Range)” Limits are specification limits, which the press force is compared against to determine if the press is good (within the limits) or bad (outside the limits). These spec limits will affect CPK (process capability index). Of course, the wider these limits the better the process capability appears. To keep the CPK meaningful, realistic spec limits must be entered.

These numbers correspond to the limits that you will find on the SPC chart. TE recommends that the SPC “Min Force” limit be set equal to the “Min Force/Pin” value under the Force section; whereas the SPC “Max Force” limit should be set slightly less than the “Max Force/Pin” value under the Force section. The reason for the Max limit being set less is due to the purpose of the Max value in the profile. It’s an error condition; realistically, it will never be reached in a successful press cycle. Specifying a limit that is less than the Max force value also allows SPC to alert the operator that an undesirable trend is occurring.

“Stop on Out of Spec Limits” - When this box is checked, the average force within the SPC Sample Range for each connector is compared against the specification limits entered in the SPC Limits. If the force detected is outside the “Min Force” or “Max Force” limit, an error message is generated indicating the problem. If the box is not checked, no error will be displayed. Whether a message is displayed or not, the out of spec condition will always be noted within the .RAW file.

Keep in mind that the SPC Min and Max specs are not necessarily the same as Min and Max force per pin entries, which are used as forces within the press profiles. Typically, the Min limits will be the same but the Max SPC spec limit is less than the Max force allowed in the profile. Remember that the SPC range should be set to capture the compliant pin section sliding down the hole. This force is generally less than the Max force allowable on the connector because the Max force is usually applied right before termination as the connector contacts the board’s surface.

“Flag 7 Point Trend” - This check box indicates whether the points plotted on the X-bar chart should be analyzed for a seven-point trend. A seven-point trend is seven consecutive points:

- with increasing values
- with decreasing values
- above the mean
- below the mean

The objective is to identify trends that indicate a change in the process is occurring. If one of these trends is found, it will be highlighted in red on the SPC chart.

“Flag Control Limit Violation” - When this box is checked, the SPC button within the run screen will display red flashing bars to indicate when a connector has an out of control limit condition. Remember that each connector type has its own SPC Limits. An out of control limit condition on any graph will cause the red bars to flash. To acknowledge the condition and clear the red flashing bars simply view the graph or graphs displaying the control limit violations. The chart selection dropdown in the upper left hand corner of the runtime SPC screen indicates which connectors have an out of control condition by showing “*****” in front of the connector name.

We allow control limit violation flagging to be turned on and off because the pressing process is not a typical SPC application. Remember there is no knob to turn to correct the process. All that can be done to correct violations is to reject components. Unless the customer has a specific action plan for an out of control condition, the flashing bars are just an annoyance and are better turned off. All SPC data will be gathered and the SPC charts can still be viewed. This same idea applies to the “out of spec limits” described above. Unless the operator has been trained on what to do when they see this message, it should not be turned on.

“Run Length (Boards)” - Run length must be set for each connector. TE recommends using a minimum of 30, which has shown to be a good lot size for trend detection. In addition, this recommendation is due to 30 being the maximum number of points that can be displayed on the X-bar and R charts. While points for the last 30 boards will always be displayed, all SPC data collected since the board program was first run is maintained in a file (C:\AEP\SPC\boardname.mdb), and is never deleted.

CPK is calculated based on the last “Run Length” boards. Typically, run length is set to 30 so the CPK would be calculated based on the points displayed on the graph. However, run length can be set less than or greater than 30. CPK would then be based on that number, and not on the displayed number of points.

5.4. The Press Sequence Editor

A. Purpose

The Press Sequence Editor (Figure 25) is used to enter and store the data about the board including board physical data and connector information. All connectors to be used on the board being programmed must be defined in the connector data base before the press data file can be generated.

The file is ASCII format with a .prs extension. It may be convenient to open an existing file and do a “Save As” to a new name in some cases.

Row	X (in)	Y (in)	Angle	Connector / Step	Comments
1	0.0000	0.0000	270	Product 1	
2	7.0000	0.0000	270	Product 1	
3	1.5000	0.2500	180	Product 2	
4	3.5000	0.0000	270	Product 3	
5	3.5000	2.0000	180	Product 3	
6	4.0000	0.0000	270	Product 3	
7	6.0000	0.0000	180	Product 4	
8					
9					
10					
11					
12					
13					

Press Sequence Editor Screen

Figure 25

B. Entries

“Revision” - This is the revision level of the board to be pressed, or alternatively the revision of the Press Data program. This entry is not required. It is used as reference in this file only.

“Description” - This is a description of the board to be pressed.

“Board Clearance” - This is the “safe” distance that the tool is above the board that the head will allow when moving between connectors. Be sure to allow enough clearance for the tallest component on the board.



NOTE

The distance is actually dynamic in that the press will provide the same clearance between the board and pressing tool, regardless of tool length. The tool length in the tool database is used to calculate this required head position.

“Board Thickness” - This is the nominal board thickness which is used to calculate the connector pressed height. If the board thickness measurement option is selected, the measured thickness will be used.

“Fixture Thickness” - This is the thickness of the “platen” or “fixture” that supports the board. It must be accurately measured in order for press to height to be accurate. Maximum fixture thickness is 50 mm [2.00 in.].

“Fixture ID” – The fixture may be identified with an ID number. If a value is entered in this field, the user will be prompted to verify the correct fixture ID when the cycle is started. This entry is not required.

“No. of Char. Req’d for Serial Number” – The serial number of the board, if entered, is stored with the raw pressing data. The force for each connector will be stored with this serial number and XY coordinates.

This feature has three types of entry: A zero (0) means no serial number prompt will be given. A positive number means exactly that number of characters is required for a valid serial number, and a negative number means at least that number of characters is required.

Bar code scanning is the preferred method of data entry.

“No. of Char. To Clear Between Boards” – This feature is used in conjunction with the serial number entry. In the case of sequential serial numbers, the program will clear this number of characters from the end of the previous serial number. This is generally used when manual serial number entry is used.

“Verify Text” – This feature is intended to verify that the correct board type is used with its press data editor. If text is entered in this cell, board identification (type, name, model, etc.) will be required when first entering the run screen, and each time a new board is started. Any text or number can be used, but ideally, a bar code label will be available. Text can also be entered manually.

To enter the name, type “%V” followed by the string of characters.

“Prompt for Connector Substitution” – This check box enables substitution connectors to be selected at run time. For example, manufacturer “A” may be the prime source for a given connector, but “B” is also approved as interchangeable on this board. If this box is checked, the operator will be offered a selection of possible alternates for the connector at run time. This selection will drive the tools and profile identified for pressing that connector. Thus, it is possible to press an alternate connector that requires different tools and profile than the primary connector. The alternates are associated with each other through use of “substitution codes” that are defined in the connector database. Each associated connector must be individually entered into the database, but will be “linked” by the common substitution code.

“First Article Signoff” – This feature stops the pressing cycle after the first board is complete. An approval is required from a person other than the operator of the machine.

“Load/Unload Time per Board (s)” - This Administrative tool allows the entry of a set time (in seconds) for a specific board run cycle. If machine run performance is not kept within this specific time allotment, an alarm situation will occur. In addition, an audible Alarm Duration set time (in seconds) has been made available.

“Alarm Duration (s)” - The alarm situation described above has an audible alarm in addition to the machine stack-light system. Enter the desired audible Alarm Duration (seconds) in the box provided.

“Board Width” - This is the dimension of the board in the Y axis direction (front to back) as mounted in the machine. It may or may not be the smaller board dimension, depending on how the board is oriented in the machine. The maximum PCB width is 762 mm [30 in.].

“Board Length” - This is the dimension of the board in the X axis direction (left to right) as mounted in the machine. It may or may not be the larger board dimension, depending on how the board is oriented in the machine. The maximum PCB length is 914.4 mm [36 in.].

“Measure Board Thickness” - The check box calls for board thickness to be measured on each board. The X & Y entries provide the location on the board for the thickness to be measured. Only one point on the board is measured.

“Board Edge to Datum” - This entry is used by the program to properly display the connectors on the board. It is the nominal distance from the lower left edges of the board, in the X & Y directions, to the board’s Datum described below.

“Machine 0 To Datum” - It is the distance from the machine’s origin (0,0) point to the boards Datum. The Machine 0 is the most lower-left Dowel hole in the table top. The Datum is normally a tooling hole in the board used to locate the board to the support fixture. This distance can be determined by using the distance from Machine 0 to one of the dowel hole locations used to mount/locate the fixture to the table top. Then, take the distance from this dowel hole, to the locating pin on the fixture that engages the

Datum. Remember that the X direction is always defined as left to right with the board mounted in the press. See Figure 26.

“Datum Board Frame Coordinates” – It is the coordinate value of the Datum described above in relation to the board’s origin point (the point from which X & Y locations for the connectors are defined). See Figure 26.

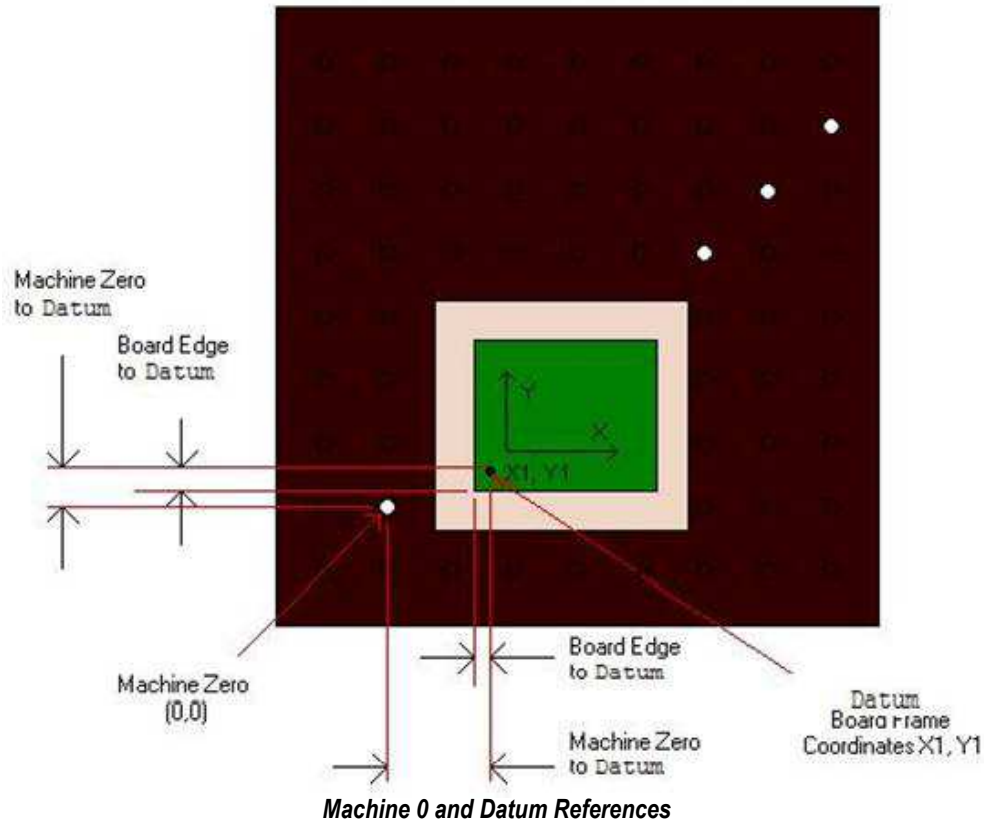


Figure 26

“X, Y” - These entries define the position of the connector relative to the board’s coordinate system datum. Each coordinate pair defines the location of the geometric center of the area that the pressing tool engages, enabling the program to drive the pressing tool directly over the desired press area. This is generally the center of the connector, but in some cases, it is not.

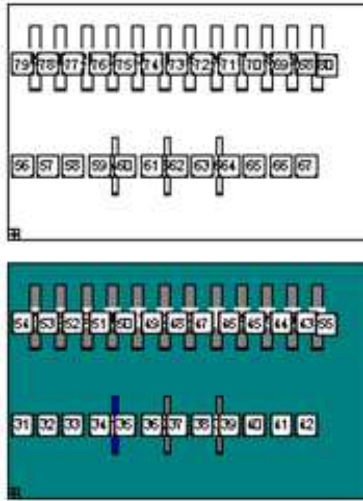
“Angle” - This defines the angle of the connector relative to the board mounted on the machine. Select the appropriate angle from the drop down menu. Angles are defined by the head rotation as follows. The head is at zero degrees when longer protrusion of the tool bar (containing the ID device) is toward the left side of the machine. Positive 90 degrees is a ¼ turn counter clockwise as viewed from the top. Thus, the tool load / unload angle is 270 degrees.

“Connector” - The connector to be pressed is selected from the connector database by using the drop down menu. All connectors to be used on the board must be defined in the connector database before the press data file can be generated. The pressing sequence follows the order of the connectors entered here, so thought should be given to optimize the travel. Connectors of one type should be pressed before proceeding to the next type to minimize tool changes.

“Comments” - User defined comment for future reference and reminder.

C. Step & Repeat

The Step & Repeat feature provides convenient and efficient pressing of multiple identical PCBs loaded in the machine at the same time. The main program is written the same way as a single up version, but one new line is added for each additional PCB. See Figure 27.



From Run Screen Graphic

PRESS DATA				
Row	X	Y	Angle	Connector / Step
28	13.546	7.913	270	dummy
29	12.346	7.913	270	dummy
30	11.146	7.913	270	dummy
31	9.946	7.913	270	dummy
32	8.746	7.913	270	dummy
33	7.546	7.913	270	dummy
34	6.346	7.913	270	dummy
35	5.146	7.913	270	dummy
36	3.946	7.913	270	dummy
37	2.746	7.913	270	dummy
38	1.546	7.913	270	dummy
39	0.346	7.913	270	dummy
40	14.503	7.851	90	dummy
41		12.000		Step&Repeat
42				

Example of the Step & Repeat Command Line

Figure 27

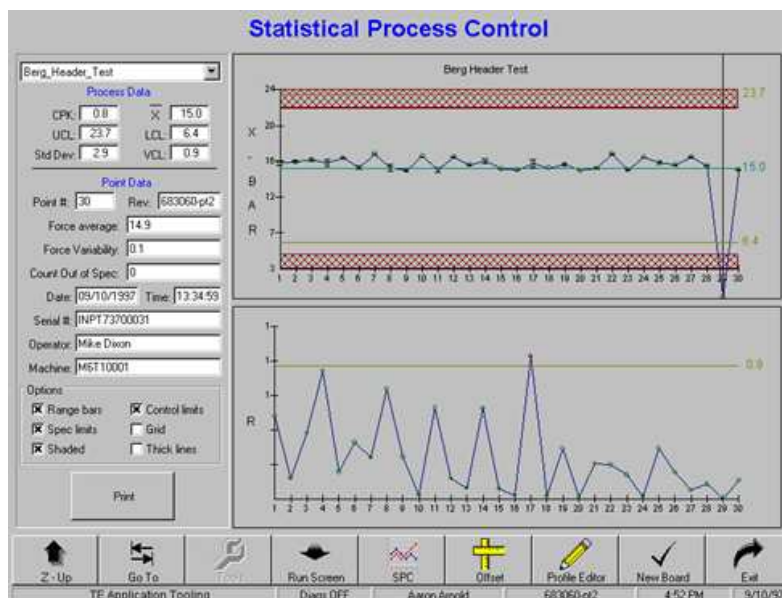
The step for each PCB is the distance from the main PCB 0,0 to the new PCB 0,0. The X direction step distance is entered in the X column, and the Y distance in the Y column. To complete the step & repeat entry, select the "STEP & REPEAT" option from the Connector drop down.

The program automatically completes each operation, including board thickness measurement and connector pressing, on all active PCBs in the step & repeat sequence. For example, all boards are measured before starting pressing connectors. The first tool is then selected from the tool rack and all connectors of that type are pressed on all active boards before the next tool is selected.

Mouse clicking the small square (on the board rendering) that designates the board zero reference will deselect that board. The background switches from green to clear when a board is deselected. Clicking it again reselects the board.

6. SPC OPTION

The SPC option is a software package of data collection, analyses, display, and printing. See Figure 28.



SPC Results Screen

Figure 28

6.1. Overview

Raw data for the **average force per pin** for each connector pressed is maintained in a file with the same name as the connector, with a .RAW extension. SPC information is calculated from the raw data and displayed on command.

Please refer to the “Connector Database” section above for SPC related parameters that are entered for each connector type.

To view data for a connector, select the connector name from the drop down list in the upper left corner of the SPC screen. All data on the SPC screen is for the **specific connector type** selected. The force data for a connector is stored in the same file regardless of the specific PCB type (part number, model, etc.) it is pressed into. In other words, the SPC data for a specific connector pressed into PCB type ABC is stored in the same file as the data for connectors pressed into PCB type XYZ.

The raw data is stored on the hard drive indefinitely. It includes the PCB model, serial number (if used), date, time, operator, the SPC force reading point, the maximum force read, and the maximum force reading point. The header at the top of the raw data file explains the data format in detail.

An average force reading for each connector of a given type on a PCB is calculated and plotted as one point on the X-bar chart. In other words, each point on the chart is the **average of all connectors of the same type** on a specific PCB.

The difference between the highest and lowest force readings for **the same connector type** on a specific PCB is plotted on the “R” (Range) chart. The “R” chart becomes an “S” (Standard Deviation) chart when the subgroups size is greater than 5 connectors. The “S” chart plots the standard deviation of **all connectors of the same type** on a specific PCB.

6.2. Process Data

This area (Figure 29) shows data that is calculated for the process. It is a measure of the “health” of the process for a number of PCBs.



Figure 29

CPK (Process Capability) - This quality measure is often used to evaluate the capability of the process being monitored. A number between 1 and 1.5 is generally considered to indicate a process is “in control”. The CPK is higher for a tighter and more centered distribution, and conversely lower for a broad or poorly centered distribution. A distribution is “centered” when the average of the measured data is near the target value for that data. A distribution is “tight” when all measured values are close to each other.

X-Bar (Process Average) - This is the average of all the points on the X-bar chart. Each point on the chart is the average of a connector type on a specific PCB.

Std Dev. (Standard Deviation) - This is the standard deviation (Inter Quartile Range method) of the plotted X-bar points.

UCL (Upper Control Limit) - If the plotted X-bar point exceeds this value, the process is considered out-of-control.

LCL (Lower Control Limit) - If the plotted X-bar point is less than this value, the process is considered out-of-control.

VCL (Variability Control Limit) - If the plotted variability point (R or S) exceeds this value, the process is considered out of control.

6.3. Point Data

This area (Figure 30) displays the data for a specific point. To view the data for any point on the chart, point to it and click the left mouse button.



Figure 30

Point - The plotted point number.

Xbar - The average force for all connectors of the charted type on the current board.

Var - The force variability for all connectors of the charted type on the current board. May be R (range) or S (std. dev.).

Fail - The number of connectors that the force was outside of the spec limits for the charted connector type on the current board.

Time - Time of day the board was run.

Date - Date the board was run.

Profile - Name of profile used to press the charted connector type.

Oper - Operator name logged on when the board was run.

Prf Rev - Revision of profile used to press the charted connector type.

Brd Rev - Revision of board file.

6.4. Options

See Figure 31 for the following options.

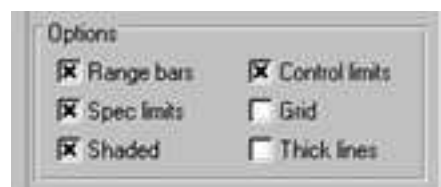


Figure 31

Range Bars - The range for the data whose average forms a point on the X-bar chart can be displayed on the X-bar chart. It is represented as a vertical line through the plotted point, with a short horizontal line at the maximum and minimum readings for the averaged data. Checking this box enables range displaying.

Control Limits - Checking this box enables the displaying of control limits on the charts.

Spec. Limits - Checking this box enables the displaying of specification limits (max and min force) on the charts.

Grid - This check box enables grid line display on the graphs.

Shaded - This adds shading between the spec limits and control limits.

Thick Lines - This thickens the plotted lines.

Print - Press this button to print the charts on a printer. The printer driver must be installed using the standard windows method.

7. PRESSING TOOLS

This section defines general requirements for connector pressing tools that will be used in the CAP. In many cases, insertion tools used in manual pressing operations can be adapted to the CAP. The guidelines below must be followed in order to ensure optimum performance.

Separate requirements for insertion tools and support fixtures are given below. “Insertion Tools” are those tools that are used to engage and press the connectors into the PCB. They generally press on the pin tips, pin shoulders, or connector housing (flat rock). Every connector uses an “Insertion Tool”. Support fixtures are used to support the PCB below the connector being pressed and are sometimes referred to as a “platen”.

7.1. Insertion Tools

See Figure 32 for insertion tooling information.



CAUTION

Consideration must be given to any portion of the fixture that is close to the fixture mount plate side rails and the tool rack areas, to ensure that the fixture height and the Press tool length are adequate to prevent the press head from contacting these areas during pressing.

- **Width** - Up to 25.4 mm [1.00 in.], including any mounting features.
- **Height** – 56.8mm +/- 0.5 mm [2.236 ±0.020 in.] including mounting plate (tool bar).
- **Length** - Up to 203 mm [8 in.], single or multiple tool combination.
- **Tool Bar** - The tools will be mounted on a “Tool Bar”. Each plate is encoded with a unique code which provides a specific tool ID. Zero is not allowed. Number 1 is reserved for the calibration/thickness tool.
- **Mounting** - The tool must be mounted precisely centered ± 0.05 mm [± 0.002 in.] on the plate, and parallel with the tool bar edges. It is a good practice to dowel the tool in place when possible. Please note the orientation of the tool ID on the tool bar; it must always face down when the tool is loaded into the machine. Do not drill a hole in the pressing tool at the center hole position in the tool holder.
- **Lead-In Chamfers** - There must be lead-in chamfers on the tool, the connector, or preferably both. The capture provided should be at least 0.38 mm [.015 in.] in any direction, but more is better. The tool should, when possible, engage the plastic before the pins begin to enter the pressing tool. For tools that press on the pin tips rather than shoulders, generous lead-in (countersinks) should be provided around the holes to capture the pins. The floating head will guide the tool into the connector using these capture features.
- **Tool Rack** – The fixed tool rack is capable of holding (13) tools: (1) thickness probe and (12) customer tools.

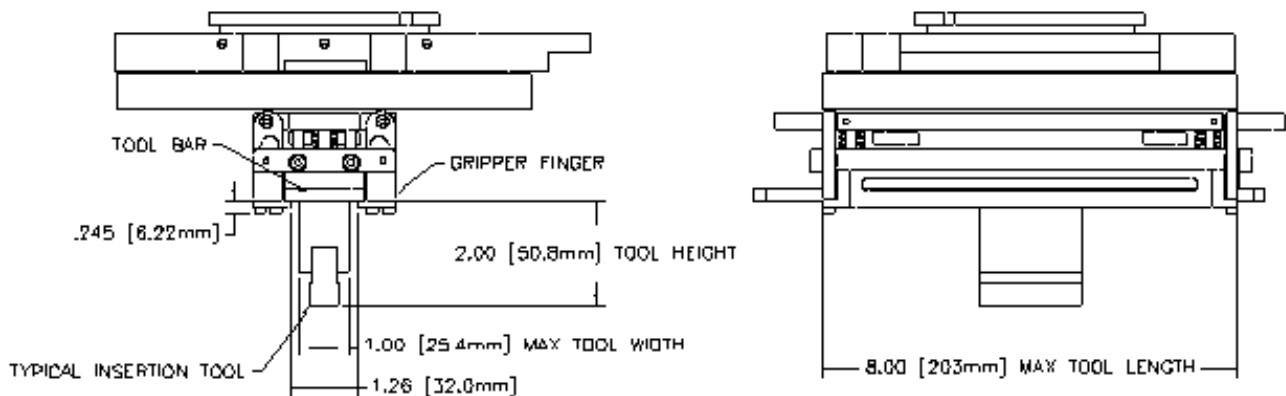


Figure 32

7.2. PCB Support – CAP-6T (Drawer Loaded Press)

A. Support Fixture Plate (Figure 33)

The press uses a custom fixture specific to the PCB to support the board during the pressing cycle. The fixture is located on the fixture support plate (a pull-out “drawer” style support) for ease of installation and removal. This fixture support plate has fixture locating M6 dowel holes as well as M5 x 0.8 threaded holes. The pull-out support is then slid back into position and automatically secured in place. This is the same method that can be used to load or remove large PCBs during normal operation.

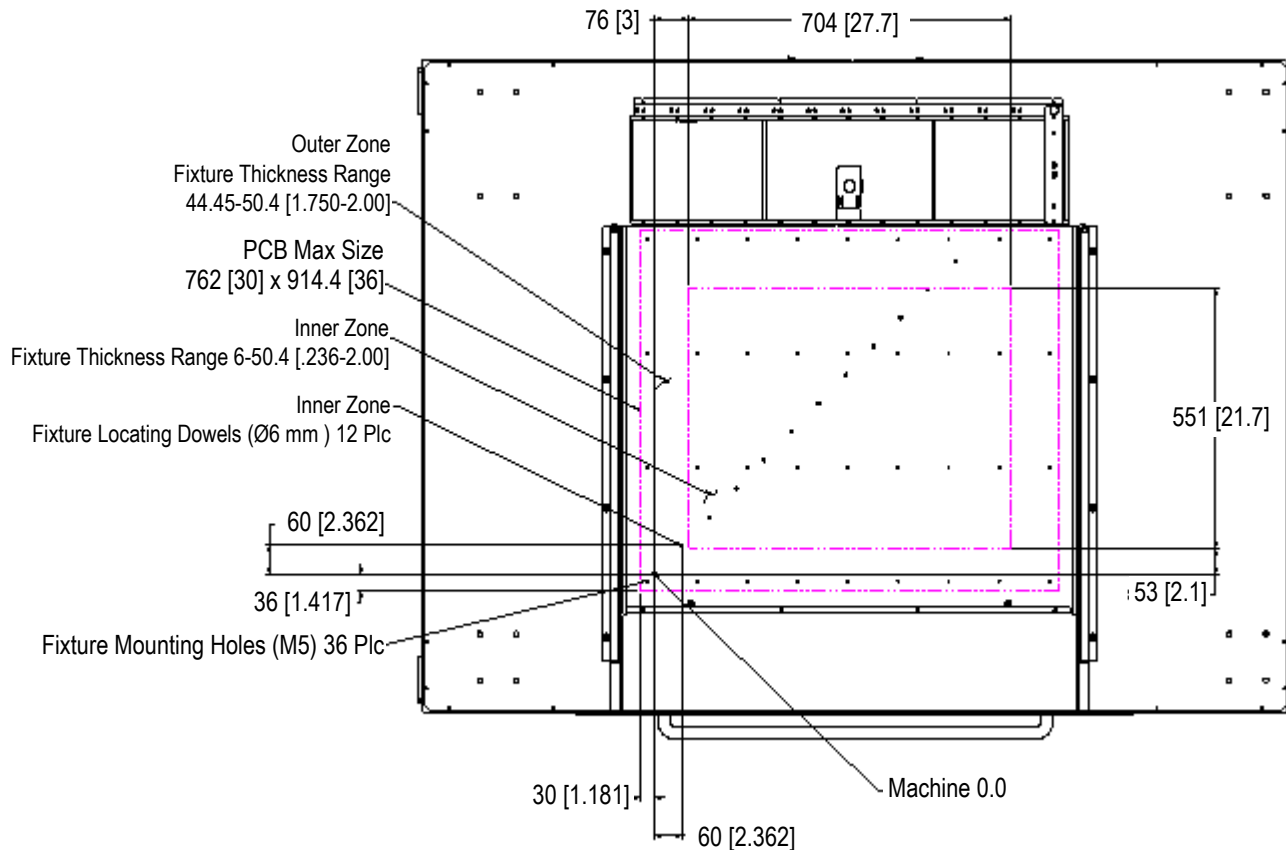


Figure 33

B. PCB Support Fixture Specifications



CAUTION

Consideration must be given to any portion of the fixture that is close to the fixture mount plate side rails and the tool rack areas, to ensure that the fixture height and the Press tool length are adequate to prevent the press head from contacting these areas during pressing.

- **Height** – minimum 6 mm [.236 in.], maximum 50.8 mm [2.00 in.]. Flatness and parallelism of top and bottom surfaces should have a maximum run-out of 0.13 mm [.005 in.].
- **Length** - Up to 914.4 mm [36 in.].
- **Width** – Up to 762 mm [30 in.].
- **Mounting** - The fixture must precisely locate and orient the PCB relative to the “Origin” (0, 0) position dowel in the fixture support plate. Any two of the dowel holes provided in the machine table top can be used.
- **Connector Support area** - The support fixture should be designed with maximum clearance possible around the pin holes in the PCB. It should generally be a series of slots cut through the width of the individual “support islands” or drilled holes. The slots or holes should be as wide as possible, limited only by the amount of contact area required to prevent marking or stressing the surface of the PCB.

- **PCB Clamp** – Each fixture should provide a means to clamp the PCB down. This prevents the PCB from being lifted when an insertion tool is retracted from a pressed connector. Also, the clamp holds the PCB flat to the fixture.

7.3. PCB Support – CAPI-6T (Conveyor Loaded Press)

A. Support Fixture Plate (Figure 34)

The press uses a custom fixture (similar to that used on the CAP-6T) specific to the PCB to support the board during the pressing cycle. The fixture is located on the fixture support plate that is affixed to the table top of the machine. The fixture support plate has fixture locating M6 dowel holes as well as M5 x 0.8 threaded holes.

An automatic conveyor system moves the PCB over the fixture plate, lowers it onto self-centering pins, and then clamps the board in place. At the completion of pressing, the board is automatically unloaded from the machine by the conveyor system.

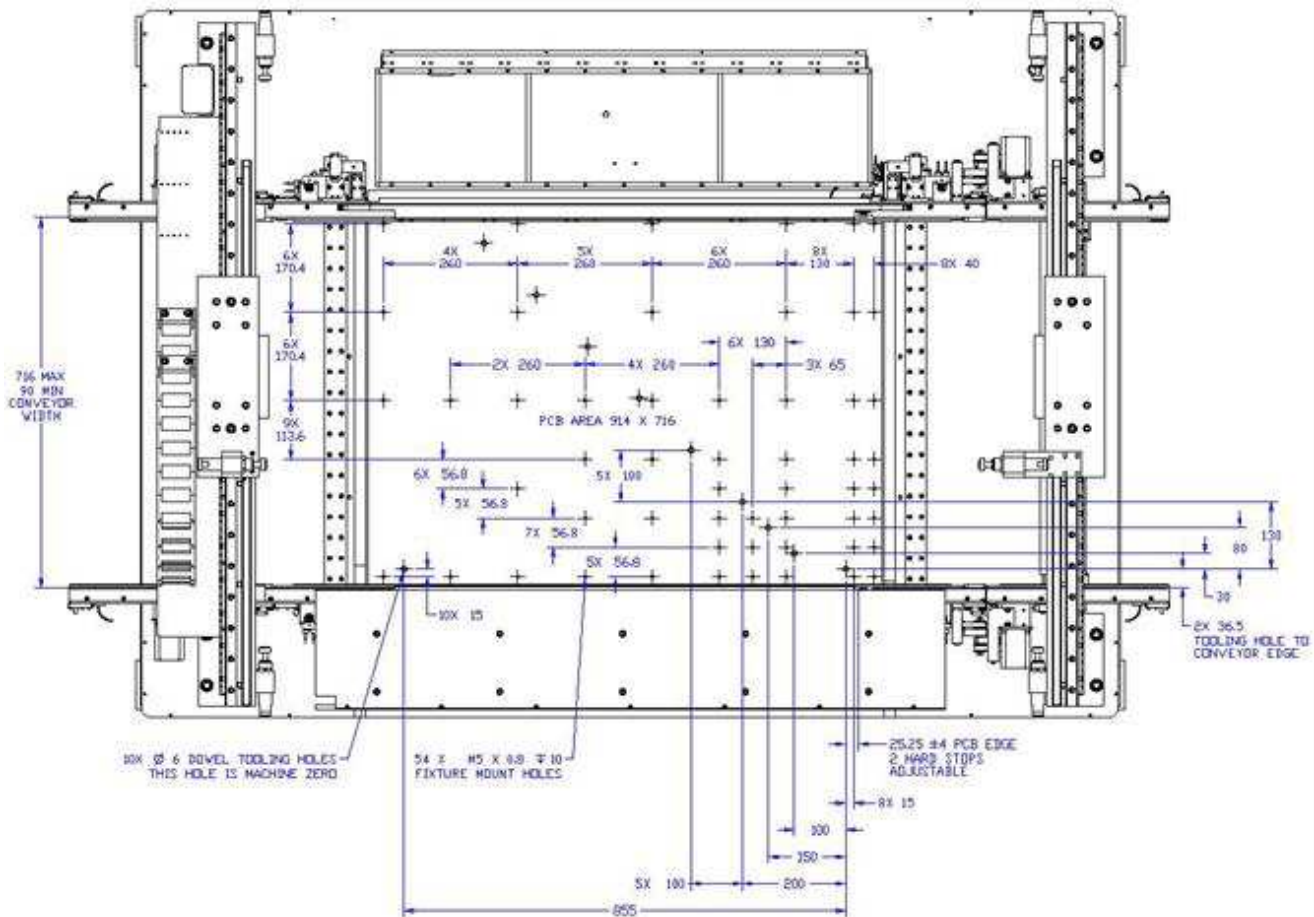


Figure 34

B. PCB Support Fixture Specifications



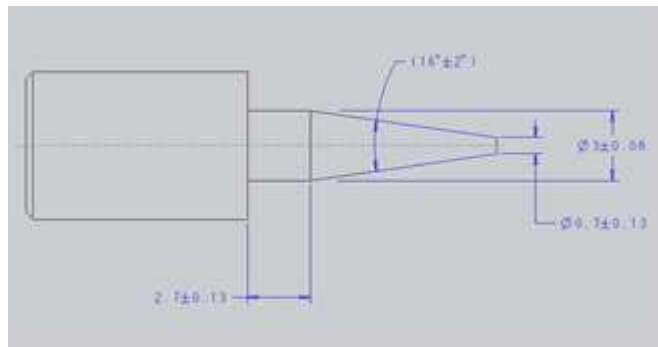
CAUTION

Consideration must be given to any portion of the fixture that is close to the conveyor side rail, to ensure that the fixture height and the Press tool length are adequate to prevent the press head from contacting these areas during pressing.

- **Height** – The fixture height as measured from the fixture support plate is based on the PCB resting on the fixture with the conveyor slightly below it. This height minimum is 32 mm [1.26 in.]. If the fixture height is less than that, damage to the conveyor will occur. The maximum fixture height as measured from the fixture support plate is based on the required clearance of components on the bottom side of

the PCB to clear the fixture when the PCB is conveyed. The conveyor will lift the PCB up 25 mm [.98 in.] before it conveys the PCB. This maximum height as measured from the fixture support plate to the conveyor belt is 55 mm [2.17 in.]. Flatness and parallelism of top and bottom surfaces of the fixture should have a maximum run-out of 0.13 mm [.005 in.].

- **Length** – 60 to 914.4 mm [2.40 to 36 in.].
- **Width** – 90 to 711.2 mm [3.5 to 28 in.].
- **Mounting** - The fixture is precisely located and orients the PCB relative to the “Origin” (0, 0) position dowel in the fixture support plate. Any two of the dowel holes provided on the fixture support plate can be used. However, the fixture must be located on the fixture support plate so that the front edge of the PCB will align with the PCB stops in the conveyor rail.
- **Connector Support area** - The support fixture should be designed with maximum clearance possible around the pin holes in the PCB. It should generally be a series of slots cut through the width of the individual “support islands” or drilled holes. The slots or holes should be as wide as possible, limited only by the amount of contact area required to prevent marking or stressing the surface of the PCB.
- **PCB Clamping** – The conveyor uses adjustable positioned clamp fingers to clamp the PCB down to the fixture. This prevents the PCB from being lifted when an insertion tool is retracted from a pressed connector. Also, the clamp holds the PCB flat to the fixture. The height of the clamp bar is adjusted so it provides a small clearance of 1 mm [.03 in.] when the clamp bar is in the up position and the PCB is being conveyed. PCB thickness range is 1.5 to 6 mm [.06 to .236 in.]. Alternate mounting of clamp fingers allows thickness of 10 mm [.39 in.].
- **PCB Edge Clearance** – The conveyor uses adjustable positioned clamp fingers to clamp the PCB down to the fixture. The edge clearance on the top side of the PCB is 3 mm [.12 in.]; clearance on the bottom side of the PCB is 6 mm [.236 in.]; this meets SMEMA specifications.
- **PCB Locating Method:** Provide self-centering on tapered locating pins of $\varnothing 3\text{-}5$ mm [.118-.197 in.]. PCB locating hole to pin clearance shall not exceed 0.25 mm [.010 in.].



Sample Locating Pin

Figure 35

— **Quick Facts:** (Figure 36)

Board handling:

Length: 60 to 914.4 mm [2.40 to 36 in.]

Width: 90 to 711.2 mm [3.54 to 28 in.]

Thickness: 1.5 to 6.5 mm [.06 to .256 in.]

Or 4 to 10 mm [.15 to .39 in.] with alternate clamps

PCB Weight: 16 kg [35 lbs] max

Board edge clearance: 3 mm [.118 in.] above (SMEMA)

6mm [.236 in.] below (SMEMA)

Above PCB clearance: 95 mm [3.75 in.] max; as measured from the conveyor belt in the up (convey) position to the bottom surface of the tool bar in the tool holder on the head.

Allow clearance for PCB thickness plus components.

Below PCB clearance: 55 mm [2.17 in.]. Allow clearance for components on underside of PCB.

Transport criteria: Left to right, Fixed front rail, Single lane.
 Height: Floor to conveyor 952.5 ±12.7mm (37.5 ±.5 in.) SMEMA interface.
 2-Stage conveyor, reversible and adjustable speed (0.1 m/s to 0.254 m/s) [0 to 10 inch/s].
 Transport system accuracy: ±0.5 mm.

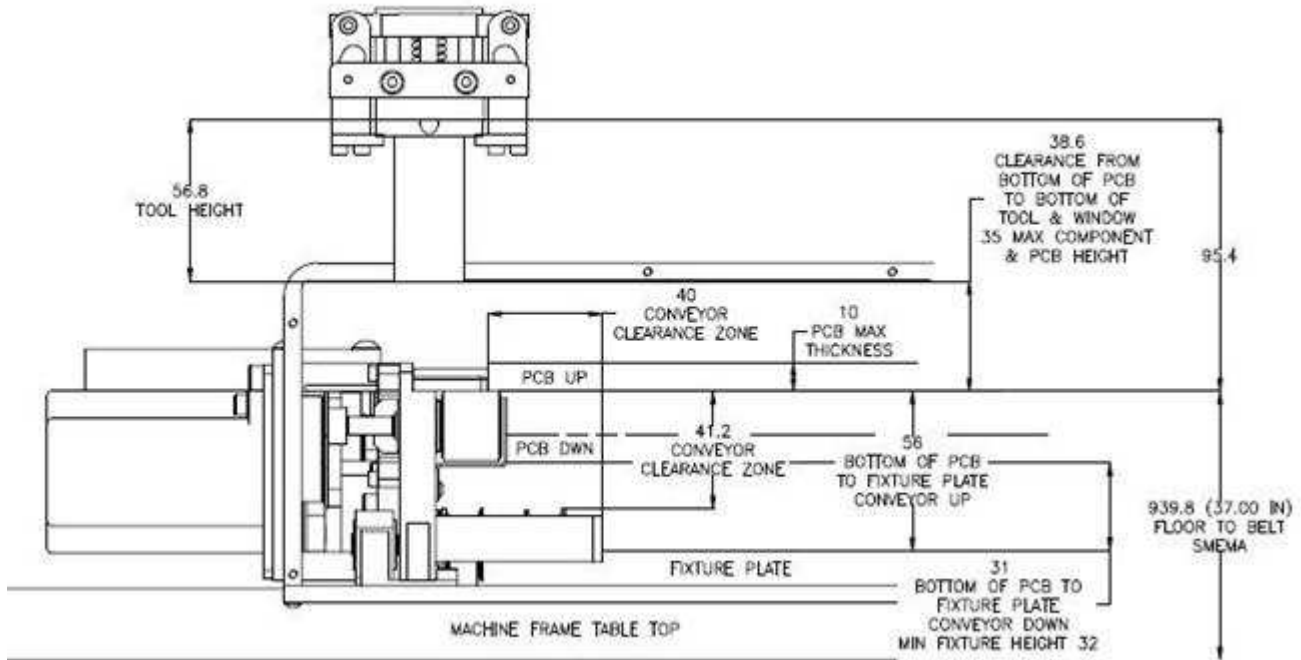


Figure 36

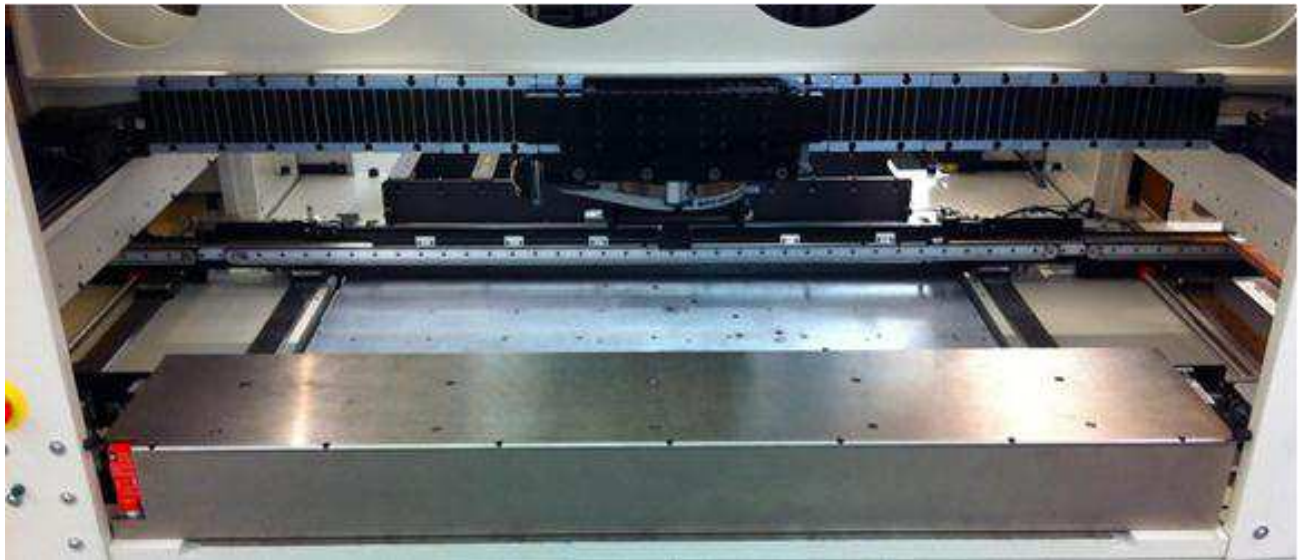
8. AUTOLOAD OPTION FOR THE CAPI-6T



NOTE

The following portion of this manual may not apply to your machine configuration.

The Autoload option used with an adjustable width conveyor will allow either in-line or stand-alone operation and increases the throughput capabilities of the CAPI-6T over the CAP-6T. PCBs are loaded and secured automatically. Once a press sequence has completed, the Autoload conveyor unloads the PCB. See Figure 37.



Conveyor – Viewed from the Front Side of CAPI-6T

Figure 37

The conveyor rear rail is mounted on bearing blocks with dual ball screws on the Y-axis (front-to-back direction). The position of the rear rail can be manually adjusted to the desired width of the PCB by means of a hand crank knob inside the front cabinet of the machine. The Autoload conveyor is pneumatically raised for PCB loading/unloading and uses belts to transport the PCB through the machine. Pneumatically actuated hard stops locate the PCB at the correct position above the pressing fixture during loading.

8.1. Configurations

A. In-Line

The CAPI-6T Autoload option allows the press to be incorporated into a SMEMA left-to-right automated PCB processing line (Production mode) and a SMEMA right-to-left automated PCB processing line (Reverse Production mode). Changing modes requires a software configuration change and that the SMEMA cables be exchanged from side to side. After the appropriate software configuration settings are modified (contact TE Service for specifics) and the AEP application is restarted, the machine may require a power cycle to complete the mode change. With regard to the cables, the SMEMA connector on the left side of the machine is always the “upstream” connector and the SMEMA connector on the right is always the “downstream” connector. Logically, operating the machine in Reverse Production mode flips the “upstream” and “downstream” directions; this requires the SMEMA cables be routed from the opposite sides of the CAPI-6T, to the adjacent inline machines.

If the press is located at the beginning or end of a PCB line, then a Conveyor Extension (2018690-1) must be attached to the left or right side of the press. The Conveyor Extension provides a safe PCB loading (or unloading) position for the processing line and provides required safety guarding for the end of the press that is not protected by an adjacent machine. A Conveyor Extension may also be required on the left side to allow longer boards to completely load and buffer on the Autoload infeed conveyor.

B. Stand Alone

The CAPI-6T Autoload option can also be configured for stand-alone use (Reverse Shuttle mode). This mode requires a Conveyor Extension attached to the right side of the press and safety guarding (block-off plate) attached to the left side of the press. In this mode the conveyor loads a PCB from the Conveyor Extension. After pressing, the PCB is returned to the Conveyor Extension for operator removal. This machine configuration is also available under TE part number 1689700-3. See Figure 38.



Infeed Conveyor with Block-Off Plate for Stand Alone (Reverse Shuttle) Operation

Figure 38

Changing to Reverse Shuttle mode requires a software configuration change. After software configuration settings are modified (contact TE Service for specifics) and the AEP application is restarted, the machine may require a power cycle to complete the conveyor mode change.

**NOTE**

If desired, the CAPI-6T with Autoload option configured for In-line operation may also be operated as a stand alone press if Conveyor Extensions are attached on both sides.

**DANGER**

The press used in Autoload mode must NEVER be operated without required safety guarding in place. The conveyor openings on each end of the press MUST be covered by an adjacent machine, a block-off plate or a Conveyor Extension.

8.2. Operation

A. Loading the PCB

First, initiate production operation by selecting the desired board from Main menu and then double-clicking on the <Run> button. After responding to all user prompts, press the green Start/Pause button on the front of the machine, or double-click on the screen <Run> button.

In-line Mode: If the CAPI-6T is the first machine in a PCB line, place the desired PCB on the upstream Conveyor Extension, which must be previously installed and aligned to the upstream side of the CAPI-6T.

The Autoload system checks the optic sensor mounted on the Conveyor Extension and stages the PCB into the machine. If the CAPI-6T is not the first machine in the line, the previous machine is first prompted to transfer a PCB. In Production mode (left-to-right), the Autoload system will attempt to keep a PCB staged in the infeed conveyor at all times to maximize throughput. When a PCB is transferred to the main conveyor, it is moved against the hard stops. The main conveyor then lowers the PCB onto the fixture, clamps are actuated to secure the PCB in position and the CAPI-6T initiates the press fit operation. When the PCB processing is completed the main conveyor unclamps the PCB, rises to the transfer height and moves the PCB downstream in preparation to unload it to the next machine in line. In Reverse Production mode (right-to-left), the Autoload system will buffer the completed PCB staged on the downstream (referred to as the infeed) conveyor so that the next PCB may be processed on the main conveyor, thus maximizing throughput. If the CAPI-6T is the last machine in the line, manually remove the PCB from the exit Conveyor Extension when prompted.

Reverse Shuttle Mode: Place the desired PCB on the Conveyor Extension when prompted. The Conveyor Extension must be previously installed and aligned to the exit side of the CAPI-6T. The cover for the infeed conveyor opening must also be previously installed. The infeed conveyor is not used in this mode and must be closed off for safety.

Once the PCB is placed on the Conveyor Extension, acknowledge the prompt by clicking the screen message or pressing the green Start/Pause button. The conveyor then transfers the PCB into the CAPI-6T past the hard stops; the hard stops are engaged and the PCB is moved back against the hard stops. The conveyor then lowers the PCB onto the fixture; the clamps are actuated to hold the PCB down and the CAPI-6T initiates the press fit operation. When the PCB processing is completed the conveyor unclamps the PCB, rises to transfer height and moves the PCB back out to the end of the Conveyor Extension to be manually removed. Remove the PCB from the exit Conveyor Extension when prompted.

8.3. Testing the Autoload Function

Enter the Input/Output screen and select the 'Autoload' tab. The **Load Board** button, when pressed, performs a PCB load operation. When configured for In-line Production mode, the upstream machine is prompted to transfer a PCB to the infeed conveyor unless a PCB is already present on the infeed conveyor. The PCB is then transferred to the main conveyor where it is moved against the hard stops. The main conveyor retracts the hard stops, lowers and then clamps the PCB against the fixture. When configured for Reverse Shuttle or Inline Reverse Production mode the main conveyor transfers the PCB backwards (into the machine) from the output Conveyor Extension past the hard stops, extends the hard stops, moves the PCB forward against the hard stops, lowers and then clamps the PCB against the fixture. The unload function can be initiated by pressing the **Unload Board** button to release the PCB, raise the main conveyor and deliver the PCB to the end of the main conveyor / Conveyor Extension or in In-line Reverse Production mode, to the downstream (referred to as the "infeed") conveyor. The Autoload system then waits for a prompt from the downstream machine to send a PCB before transferring the PCB, or for the operator to remove the PCB from the Conveyor Extension.



NOTE

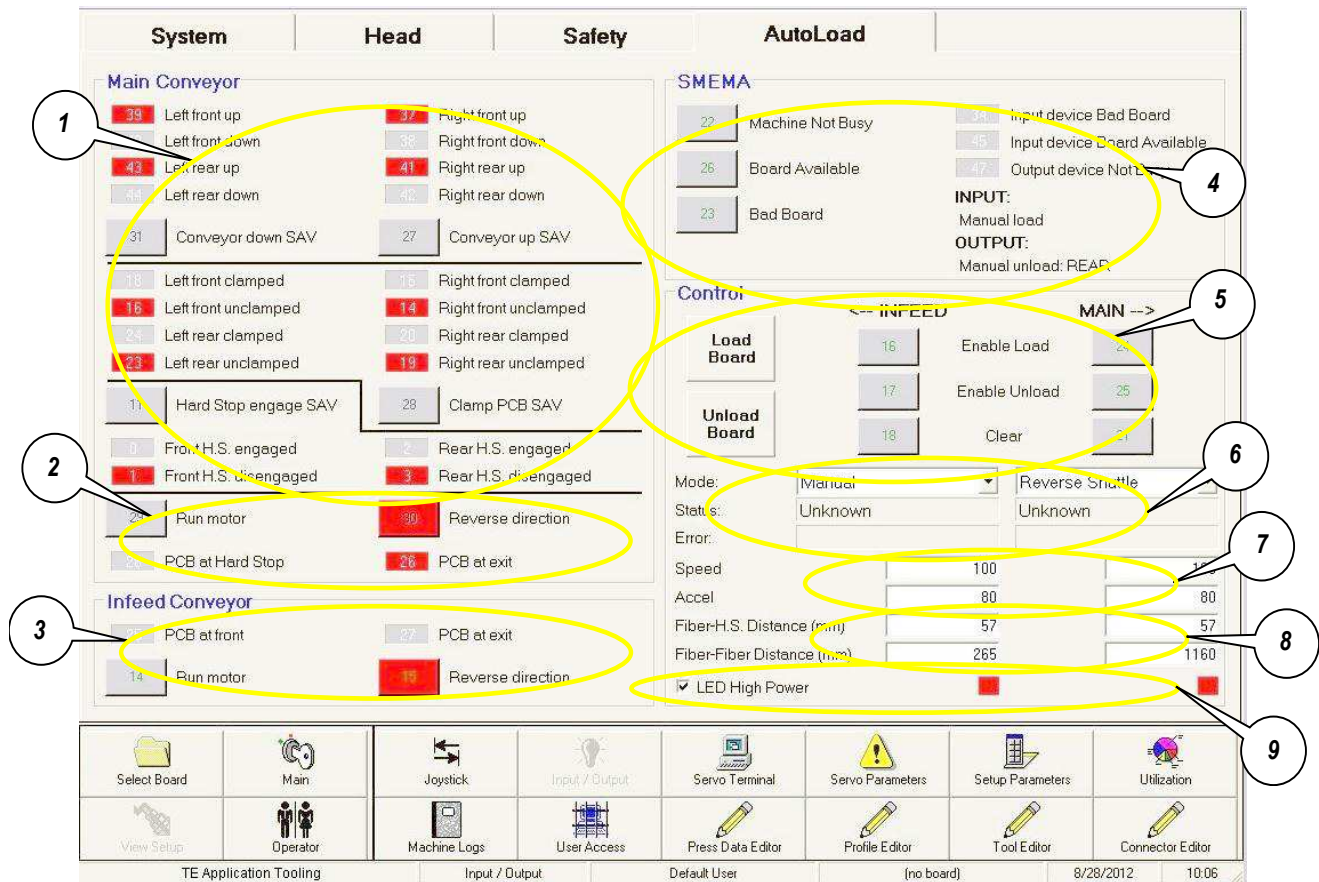
Most of the controls on the IO Autoload tab require machine power for correct operation. The **Machine Enable** control on the 'Safety' tab should be activated before selecting the IO tab.

Basic manual Autoload functions are available on the IO Screen Autoload tab for use during part setup or to allow clearing a conveyor jam. Refer to Setting Up Autoload.



NOTE

The notations on the IO Autoload tab are not reconfigured when the conveyor mode is changed. They always refer to the conveyor working in its default direction, left-to-right. Therefore, the "Infeed" and "PCB at " notations will appear logically opposite when the conveyor mode is Reverse Production (right-to-left).



I/O Screen – Autoload Tab

Figure 39

8.4. Other Operating Functions

See Figure 39 for other operating functions.

1. The **Conveyor up SAV** and **Conveyor down SAV** buttons allow for manual raising and lowering of the main Autoload conveyor rails. When both SAV (Solenoid Air Valve) buttons are off, both ports of the lift air cylinders are closed to maintain position. The state of the four (4) conveyor lift air cylinder sensors is indicated by the related input displays. The **Clamp PCB** button lowers and raises the two main conveyor clamping bars that lock the PCB into position on the fixture. The state of the four (4) clamping bar air cylinder sensors is indicated by the related input displays. The **Hard stop engage SAV** button extends and retracts the main conveyor PCB hard stops that stop the PCB in position directly above the fixture. The state of the two (2) hard stop air cylinder sensors is indicated by the related input displays.



NOTE

This group of buttons is only active when the main conveyor Mode is set to 'Manual'. And it's important to remember the current Conveyor mode when switching from it to 'Manual' – you will need to switch back!

In other modes, the state of these buttons (outputs) is controlled by the main conveyor controller (mounted under the tabletop). The input displays are always active.

- The **Run motor** button turns the main conveyor belt motor on and off. The **Reverse direction** button toggles the belt direction from left-to-right to right-to-left (reverse).


NOTE

The main conveyor PCB transport belt can only be jogged forwards and backwards with these buttons when the main conveyor Mode is set to 'Manual'. And it's important to remember the current Conveyor mode when switching from it to 'Manual' – you will need to switch back!

In other modes, the state of these buttons (outputs) is controlled by the main conveyor controller (mounted under the tabletop). The 'PCB at hard stop' and 'PCB at rear' input displays continuously indicate the status of the two (2) main conveyor PCB fiber thru-beam sensors. 'At hard stop' indicates that a PCB is present at the pressing position. 'At rear' indicates a PCB is at the end of the main conveyor or output Conveyor Extension and is ready for transfer to the next machine or operator removal, or is ready to be loaded in Reverse Shuttle Mode.

- The **Run motor** button turns the infeed conveyor belt motor on and off. The **Reverse direction** button toggles the belt direction from left-to-right to right-to-left (reverse).


NOTE

The infeed conveyor PCB transport belt can only be jogged forwards and backwards with these buttons when the infeed conveyor Mode is set to 'Manual'. And it's important to remember the current Conveyor mode when switching from it to 'Manual' – you will need to switch back!

In other modes, the state of these buttons (outputs) is controlled by the infeed conveyor controller (mounted under the tabletop). The 'PCB at front' and 'PCB at exit' input displays continuously indicate the status of the two (2) infeed conveyor PCB fiber thru-beam sensors. 'At front' indicates that a PCB is present and ready to be staged. 'At exit' indicates a PCB is staged and ready for transfer to the main conveyor.

- The input and output devices are usually other SMEMA-compliant PCB processing equipment, or conveyor buffers. The press can also be used in a stand-alone configuration where the PCB's are loaded and unloaded at the output of the main conveyor (Reverse Shuttle Mode). The 'Input device Board Available' display indicates if a PCB is available to be loaded from the upstream machine. The 'Output device Not Busy' display indicates if the output machine is ready to receive a PCB from the press. The **Machine Not Busy** button toggles the status of the output to the upstream device. The **Board Available** button toggles the status of the output to the downstream device.


NOTE

These buttons can only be used when the appropriate conveyor mode is set to 'Manual'. And it's important to remember the current Conveyor mode when switching from it to 'Manual' – you will need to switch back!

In other modes, the state of these buttons is controlled by the appropriate conveyor controller. The 'Input device Bad Board' display and 'Bad Board' output button are only provided for future SMEMA functionality.

- The **Enable Load**, **Enable Unload** and **Clear** buttons initiate the respective low level functions in the appropriate conveyor controller. The **Load Board** and **Unload Board** buttons execute the same high level manual load or unload functions used for normal operation, as described above.
- The 'Mode', 'Status' and 'Error' displays are intended for low-level troubleshooting of the conveyor controllers by factory trained personnel.
- These are the basic conveyor belt motor parameter values. 'Speed' is the belt motor speed in steps/second and 'Accel' is the belt motor acceleration in steps/second*second. These values can be increased to reduce PCB load/unload time or reduced to avoid jostling of the unpressed connectors or other components on the PCB.


NOTE

Speed should never be set greater than two times acceleration. Certain combinations of speed and acceleration may produce noisy or jerky motion with a particular load, particularly at lower values. If this is encountered while adjusting these values, try different combinations.

8. 'Fiber-H.S. Distance' is the distance (always in millimeters) from the thru-beam fiber pair "Board sensor 1" (see Figure 40) to the hard stops.

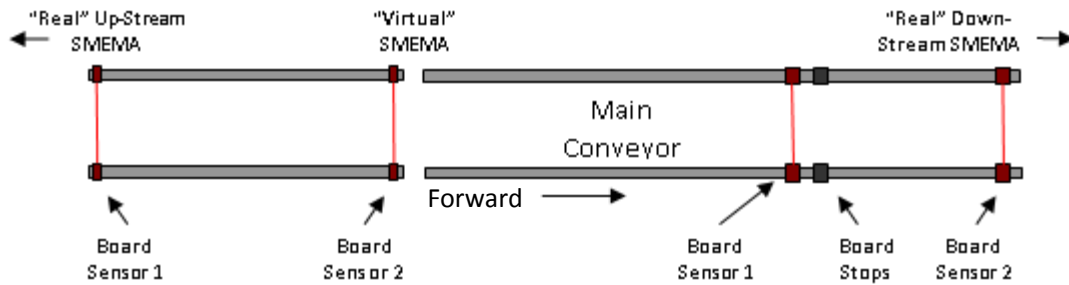


Figure 40

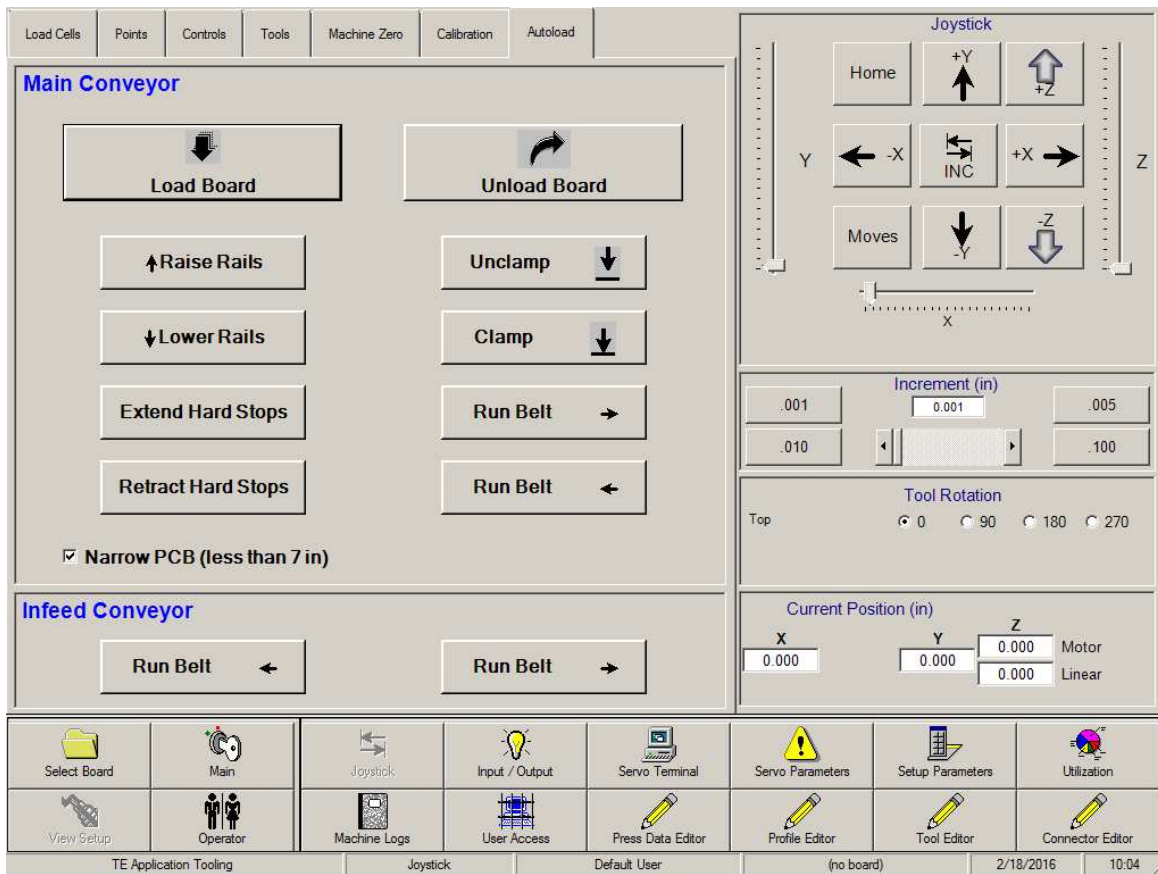
9. The main conveyor controller will bring the PCB to a stop after traveling this distance once the PCB trips the fiber sensor beam. This value should be adjusted to cause the PCB to **lightly** contact the hard stops during loading. This parameter is not used by the infeed conveyor. 'Fiber-fiber Distance' is the distance (always in millimeters) between the two thru-beam fiber sensor pairs "Board Sensor 1" and "Board Sensor 2" on each conveyor (main or infeed). When a conveyor extension is added to either end of the conveyor, this value must be changed since one of the fiber pairs ("Board Sensor 1" for infeed input extension, "Board Sensor 2" for main output extension) is moved to the end of the conveyor extension. Each conveyor controller uses this value to determine transport timeout durations.
10. The 'LED High Power' checkbox shows the current conveyor requested LED power level. The two input indicators show the actual power level for each conveyor. High Power is required for most PCB's. When the conveyor rails are set very close together for narrow boards, the LED power should be set to low to avoid saturation of the fiber sensor amplifiers. During normal operation, the LED power level is set automatically based on the Board Width specified in the program loaded. The maximum width to be considered a "narrow PCB" can be changed on the Setup Parameters screen, if necessary. Note: When machine power is down, the conveyor controllers switch the LED's to low power to extend LED life. When power is restored (Machine Enable active), the LED power is set to the requested state indicated by the checkbox.

8.5. Setup Autoload Width

To manually adjust the Autoload conveyor width, perform the following steps. Refer to Figure 41.

1. Open the right front door on the CAPI-6T base to access the conveyor width hand crank.
2. Go to the Autoload tab on the Joystick screen to access the manual conveyor functions.
3. Use the buttons to retract the hard stops, release the clamps and lower the main conveyor.
4. Use the hand crank to open the conveyor rails wider than the desired PCB width.
5. Place a PCB onto the pressing fixture. Adjust the back conveyor rail tight against the PCB with the hand crank, then move the rail back just enough to provide a slight clearance. The width needs to be tight enough that the PCB cannot fall out while traversing the conveyor but loose enough to allow for individual PCB width variation.
6. Loosen the hard stop blocks and then extend the stops. Adjust each stop block position against the leading edge of the PCB and tighten the block adjustment screw.
7. Loosen the clamp finger screws and slide several clamp fingers over the PCB edges at even spacing.
8. Lower the clamps, then press gently down on each clamp finger and tighten the screws. The clamp height should be such that the height limiter screws at each end of the clamp bars contact the conveyor guide rails, all 4 clamp cylinder 'down' sensors are lit and the fingers are just touching or have a gap of 0.4mm (.015") to the PCB. Each clamp finger has slotted mounting holes to accommodate different PCB thicknesses.

9. Raise the clamps and conveyor rails and retract the hard stops, then slide the PCB along the rails from one end to the other while checking for tightness or excessive looseness. Adjust conveyor width slightly if needed.
10. Extend the hard stops and push the PCB against them. Retract the stops and lower the rails while observing if the PCB is smoothly guided onto the fixture guide pins. Re-adjust conveyor width and hard stop position if needed.



Joystick Screen – Autoload Tab

Figure 41

8.6. Autoload Conveyor – Maintenance

Features on the CAPI-6T Autoload system that may require periodic visual checks have been listed below. See Figure 42.

- ◆ Check Guide Rods, Y axis (PCB width) bearing guide rails, conveyor belts, and all other areas of motion for foreign matter (dust, dirt, metal shavings, etc.). Wipe or clean as necessary. Use a light general purpose oil on the bearing guide rails.
- ◆ Check all air lines for crushing/crimping during motion of the clamps, hard stops and/or main conveyor rails.
- ◆ Check for any binding in the up/down motion of the clamps, in/out motion of the hard stops and up/down motion of the main conveyor rails. If necessary, loosen the mount / attachment screw to the actuators; check for smooth fixture motion and retighten as necessary.
- ◆ Check the condition of the conveyor belts for tightness, alignment and physical integrity.
- ◆ Observe smooth and equal up / down motion of clamps and main conveyor rails. Small in-line pneumatic flow controls are provided at each of the conveyor lift cylinders –see below. Front cylinder controls are under the sheet metal cover. “Down” controls are plumbed to the lower port, “up” controls are plumbed to the upper port on the air cylinder. Adjust the flow controls as required to eliminate “slamming” the PCB and equalize motion speed for all four corners of the conveyor. Four additional flow controls (up &

down, for front & back) for adjusting clamp motion are located under the tabletop near the conveyor controllers. Once initially adjusted, it is unlikely the clamp flow controls will require future adjustment.

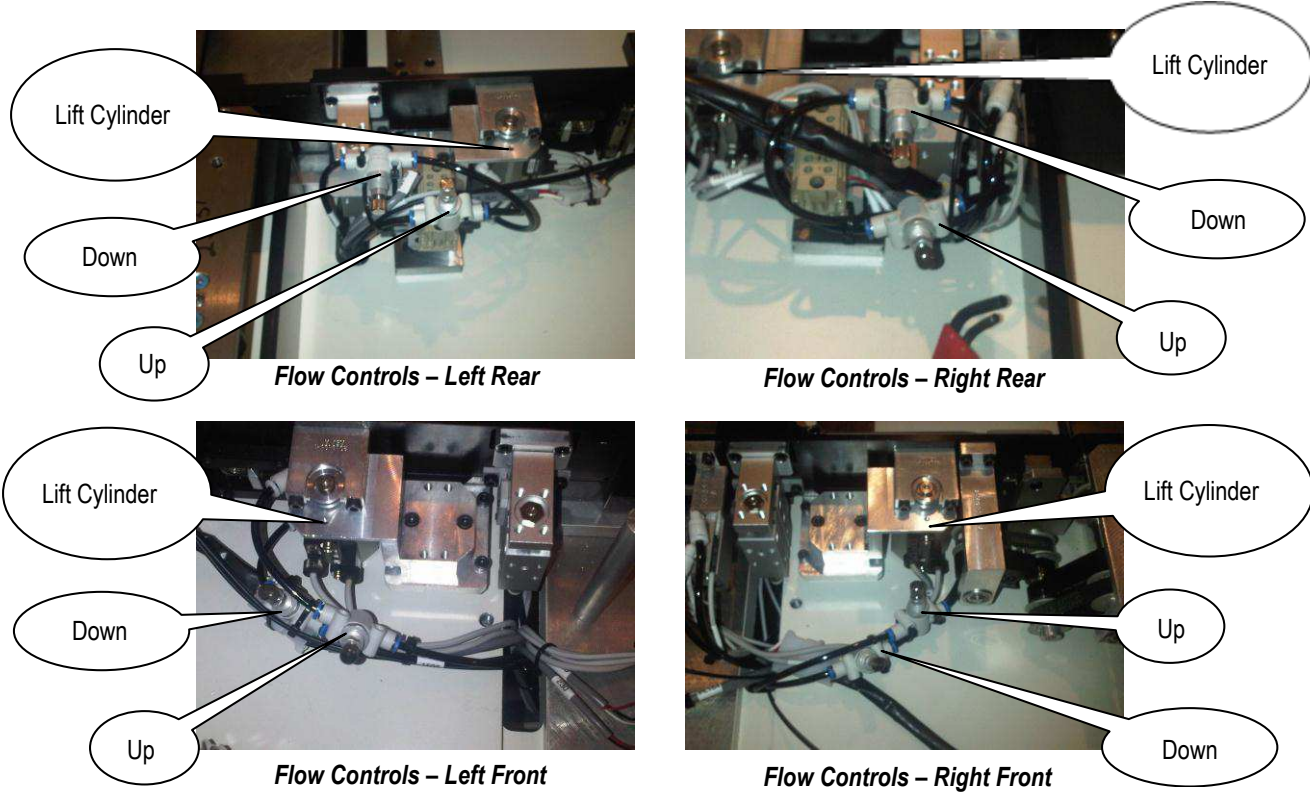


Figure 42

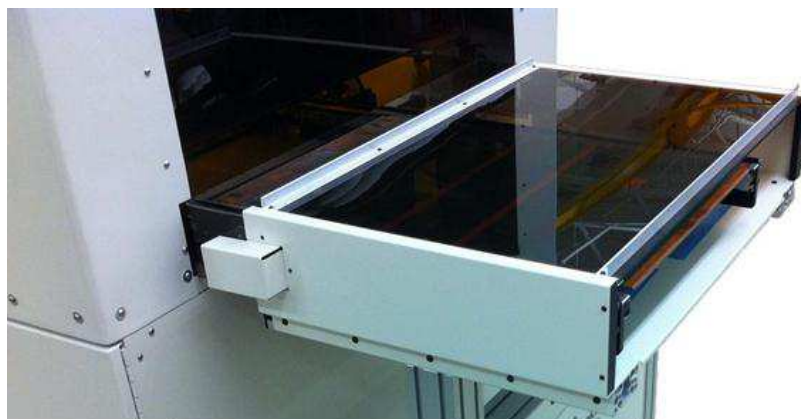
9. CONVEYOR EXTENSION - AUTOLOAD OPTION



NOTE

The following portion of this manual may not apply to your machine configuration.

Conveyor Extensions (TE P/N 2018690-1) are available to provide safe operator loading and/or unloading stations. They can also be used as an interface between machines to provide sufficient input staging length for longer boards to be processed in-line. The extension is a simple edge guide belt conveyor mechanically connected to the CAPI-6T main or infeed conveyor rails and belt motor. The CAPI-6T conveyor input or exit sensors are moved to the end of the extension rails. The extension has no electrical controls or components. Guarding on the extension prevents operator access to areas inside the CAPI-6T through the conveyor openings. See Figures 43 and 44.



Autoload Conveyor Extension

Figure 43

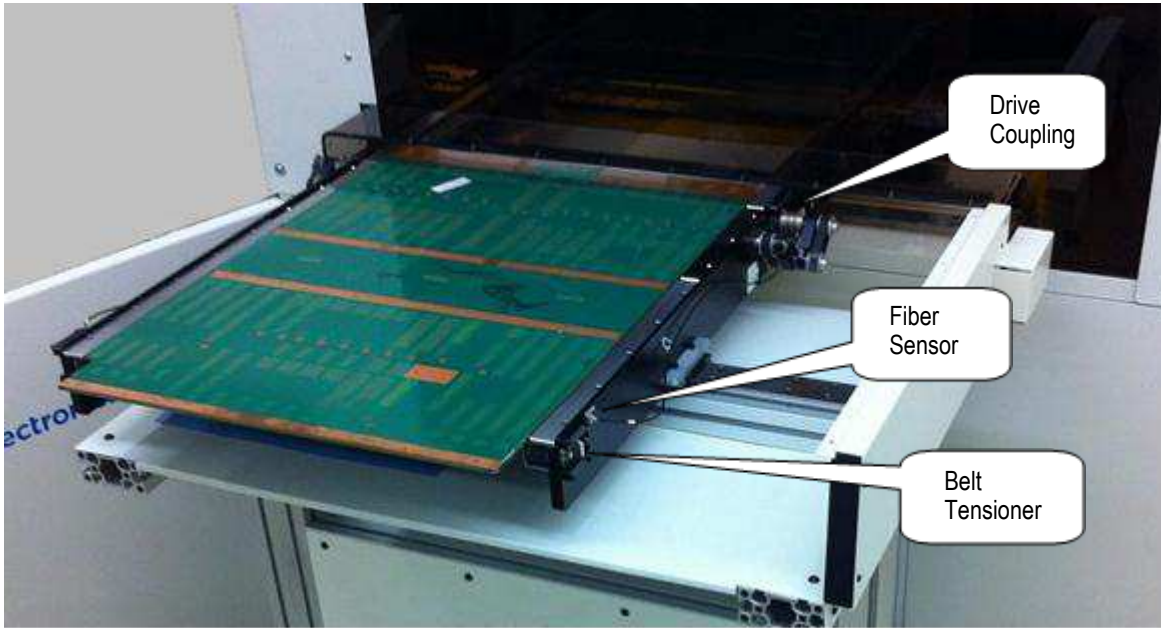


Conveyor Extension Cover Detail

Figure 44

9.1. Installation

1. Remove the top cover on the Conveyor Extension.
2. Loosen the screws that attach the side covers to the frame and slide the covers away from the machine side of the Conveyor Extension to remove them and expose the rail alignment pins and drive couplers.
 - The plastic end caps will need to be removed (pried off) to remove the side covers.
3. Position the Conveyor Extension so that the fixed rail is in line with the fixed rail of the machine conveyor. The adjustable rail on the Conveyor Extension should be behind (larger width) the adjustable rail on the machine.
4. Adjust the feet as necessary so the heights of the belts on the extension are the same as the belt heights on the machine conveyor.
5. Connect the two drive couplers on the Conveyor Extension to the drive shafts on the ends of the machine conveyor rails.
6. Position the Conveyor Extension against the end of the machine conveyor rails. Make sure the conveyor extension rail alignment pins are engaged in the slots in the end of the machine conveyor rails.
7. Use a long straight edge to align the Conveyor Extension rails to the rails on the machine conveyor.
8. Connect the Conveyor Extension to the side panel on the machine with the L brackets attached to the legs.
9. Replace the side covers and top cover.
10. Relocate the exit fiber sensors (with mounting brackets) from the end of the machine conveyor rails to the end of the Conveyor Extension rails.
11. Measure the distance (in millimeters) from the fiber sensors at the PCB load position of the CAPI-6T to the new position of the fiber sensors at the exit of the conveyor extension. On the CAPI-6T screen, go to the Autoload tab of the I/O screen and change the Fiber-Fiber distance for the main conveyor to match the measured distance. See Figure 45.



Conveyor Extension Detail



Conveyor Extension Drive Coupling

Figure 45

9.2. Operation

When attached to the CAPI-6T conveyor, the Conveyor Extension operates as an integral part of the machine conveyor. Once properly installed, no additional actions are required to operate the CAPI-6T with extension(s).

10. PREVENTATIVE MAINTENANCE (PM)

The press has been designed to minimize maintenance as much as possible. Preventive maintenance should be done on the intervals given below.

10.1. Cleaning

All surfaces should be kept clean and free of dust buildup. Wipe down all exposed flat surfaces with a soft rag. Using light air pressure, blow the press head, tool rack(s), and structure areas clean from the top down periodically.

10.2. Inspection

Visually inspect for loose parts or wires and hoses out of place. All wires and hoses should be constrained to avoid snagging.

10.3. Air Supply Filter

The air supply water trap should be checked weekly and emptied as needed. Depending on the quality of the incoming air, the filter may have to be replaced quarterly or annually.

10.4. Lubricating

Regular lubrication is very important for the long term life of the press. Grease fittings are provided on each of the axis linear slide cars. Load a small amount of grease into each fitting at the required interval. Z-axis guide rods should be greased by hand. The main bearing housing at the top of the Z axis screw is lubricated at assembly. Lubrication of these bearings should only be performed by trained maintenance personnel and is normally only required every two to three years. Be particularly careful not to over pack the Z axis bearing housing as it can push the grease seal out of the top of the housing. The Z-axis ball screw nut should be lubricated every three to six months, depending on use. The Z-axis ball screw nut has a M6 threaded port on the underside of the flange. The four screws that fasten the ball screw nut must be removed to lift the ball screw nut for access. For all lubrication, lithium soap grease (similar to THK AFB-LF) should be used.

11. CALIBRATION PROCEDURES

11.1. Purpose

To perform initial and yearly (or as designated) calibration of CAP press force accuracy from Zero to Full Span and to setup / calibrate positioning in the X / Y / Z Axis.

11.2. Automatic Load Cell Calibration (Optional)

The pressing process requires accurate force measurement data to insure a quality connector application, and to protect both the product and machine from damage due to excessive force. To maintain this accuracy, the strain gauge load cells must be regularly calibrated. TE offers an on-site calibration service, as well as an optional ACAL kit for customers who wish to perform their own load cell calibrations. Instructions for performing calibration are included with the ACAL option. See Figure 46

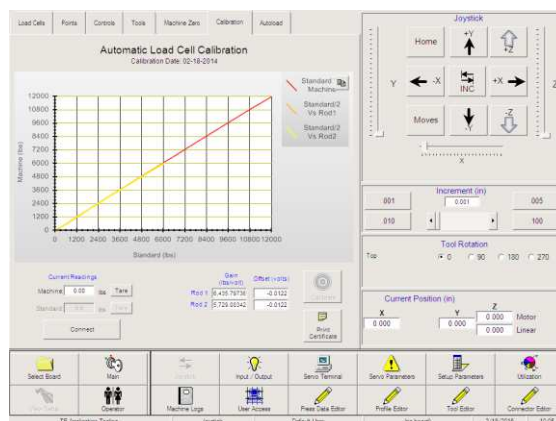


Figure 46

11.3. Machine Zero

Since the pressing process is data driven, each axis must be properly zeroed before using. If any motor or encoder is removed or loosened, re-zeroing will be necessary.

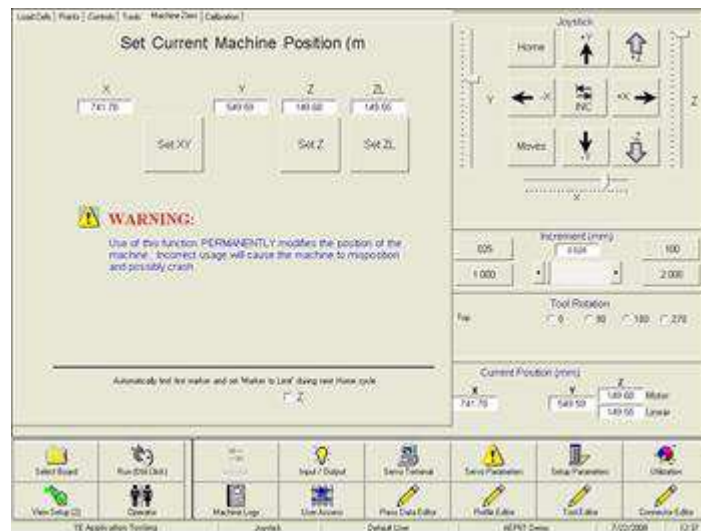


Figure 47

A. Z-axis Zero

The Z-axis zero point is defined by the relationship between the X/Y-axis surface plane that the support fixture rests on and the lower surface of the tool holder that is in the press head tool holder. The Z-axis is at the zero position when the tool holder lower surface is in the same plane as the top surface of the table top (Fixture mounting surface) with 200 pounds force applied to take out all clearances. The Z-axis cannot physically reach the actual zero point. A special “Calibration/Thickness Tool” (2018055-1) is provided with the machine. The height of this tool is 56.79 mm [2.236 in.]. Using this tool, apply 200 lbs to the table top. On the Machine Zero tab, set both “Z” and “ZL” positions at 56.79 [2.236 if English units are displayed] and then press **Set Z** and **Set ZL** buttons.

B. X/Y-axis Zero

The X/Y-axis zero is defined as the center of the press head positioned directly above the front-left dowel hole on the fixture mounting plate (table top). This dowel hole represents the machine origin (0, 0). To set/check the zero point:

1. Load the Calibration/Thickness tool in the press head manually using I/O output to open gripper.
2. Install 6 mm diameter dowel pin in the fixture mount plate at the Machine 0,0 point (lower-left dowel position).
3. Move the X & Y axis above the pin.
4. Slowly lower the Z-axis, making minor adjustments in X and Y until the dowel pin enters the hole in the thickness probe.
5. When the position is satisfactory, go to “Points” tab and enter 0 in both the “X” coordinate box and “Y” coordinate box and then press **Set XY** button.

12. PREVENTATIVE MAINTENANCE (PM) SCHEDULE

The table in Figure 48 provides information on the preventative maintenance schedule.

ITEM	DAILY	WEEKLY	1 MONTH	YEARLY
Blow/Wipe Machine Down		✓		
Inspect Wires and Hoses		✓		
Lubrication as Indicated Above			✓	
Drain Water Trip		✓		
Calibrate Z Axis Load Cells				✓
Inspect Ball screw and Belts				✓

Figure 48

13. SEQUENCE OF OPERATION

13.1. CAP-6T Drawer Loaded Press

The sequence below is for a CAP-6T that is manually loaded and unloaded. This sequence is provided to indicate to the Operator the flow of material through the press. It is assumed that the PCB being processed is already programmed, as described in previous sections.

- The operator will populate a PCB with compliant pin components either outside the CAP-6T or on the PCB support fixture mounted in the CAP-6T. An optional bar code scanner may be used to scan the PCB.
- The operator will place the assembled PCB onto the fixture, if not already. Note: The operator will need to slide the “Pull-out” tabletop into place, if used during loading. The fixture will be secured in position automatically by the machine. If the front upper door is opened, it must be closed.
- As soon as the operator is clear and the access doors are closed, the press cycle can start.
- The press shall stop instantaneously if the press area is intruded upon.
- The operator will start the press cycle by double-clicking the on-screen “Run” button or pressing the green “Start/Pause” push-button.
- The press will automatically retrieve the tooling that is required and begin the cycle. Each connector will be pressed in the sequence that is programmed, changing tools when needed. If any errors occur during the press cycle, the operator will be notified with the option to either retry (if appropriate) or cancel.
- The operator may interrupt the press cycle by clicking the on-screen “Stop” button or pressing the green “Start/Pause” push-button. The press cycle will stop after the current connector is completed. Pressing the green “Start/Pause” button during execution of a connector press profile will immediately halt the press head.
- If the press cycle was interrupted, the operator may resume operation by double-clicking the on-screen “Run” button or pressing the green “Start/Pause” push-button. Any error conditions must be corrected first.
- The operator will be notified when the operation is complete (BOARD COMPLETE message) and that it is safe to remove the completed assembly from the machine.
- This can be done by pulling the drawer out and removing the completed PCB and commencing with a new PCB for processing.

13.2. CAPI-6T Autoload Conveyor

The Autoload (Conveyor Machine) replaces the fixture drawer with a complete PCB in-line conveyor system. The conveyor system currently offers two modes of operation: Production (in-line) and Reverse Shuttle. In Production mode, the PCB flows left to right through the press. PCB’s can flow automatically in from and/or out to other SMEMA compliant machines, or with optional Conveyor Extension kits (TE P/N 2018690-1) can be manually loaded and/or unloaded at each end of the conveyor system. In Reverse Shuttle mode the PCB is manually loaded and unloaded from a conveyor extension on the right.

The following sequence is for a CAPI-6T with the Autoload option that is manually loaded and unloaded in Reverse Shuttle mode. This sequence is provided to indicate to the Operator the flow of material through the press. It is assumed that the PCB being processed is already programmed, as described in previous sections.

1. The operator will populate a PCB with compliant pin components outside the CAPI-6T.
2. As soon as the operator is clear and the access doors are closed, the press cycle can start.
3. The press shall stop instantaneously if the press area is intruded upon.
4. The operator will start the pressing cycle by double-clicking the on-screen “Run” button or pressing the green “Start/Pause” push-button. The pressing head will first move to a position clear of the conveyor.
5. When prompted, the operator will place the assembled PCB onto the conveyor extension (if not already) and acknowledge the prompt, either by pressing the green “Start/Pause” button or by clicking the “OK” button on the screen message. An optional bar code scanner may be used to scan the PCB when prompted.
6. The press will automatically convey the PCB from the Conveyor Extension into the pressing area. The PCB will then be lowered onto the pressing fixture and clamped down to it.
7. The press will automatically retrieve the tooling that is required and begin the cycle. Each connector will be pressed in the sequence that is programmed, changing tools when needed. If any errors occur during the press cycle, the operator will be notified with the option to either retry (if appropriate) or cancel.
8. The operator may interrupt the press cycle by clicking the on-screen “Stop” button or pressing the green “Start/Pause” push-button. The press cycle will stop after the current connector is completed. Pressing the green “Start/Pause” button during execution of a connector press profile will immediately halt the press head.
9. If the press cycle was interrupted, the operator may resume operation by double-clicking the on-screen “Run” button or pressing the green “Start/Pause” push-button. Any error conditions must be corrected first.
10. When the operation is complete, the PCB will be unclamped, raised above the fixture and conveyed out of the press area onto the Conveyor Extension. The operator will then be prompted to remove the completed assembly from the Conveyor Extension. Once the PCB is removed, the operator must acknowledge this by pressing the green “Start/Pause” button or clicking the “OK” button on the screen message.
11. The next cycle begins with the operator again prompted to load an assembled PCB onto the Conveyor Extension.
12. The Production mode sequence is similar except that the PCB flows through the machine from left to right and once the cycle is started, no further operator intervention is required when loading from or unloading to another SMEMA compliant machine.
13. If the press is the first machine in a line, the operator will be prompted as described above to place an assembled PCB onto the left side Conveyor Extension, if one is not already present.
14. If the press is the last machine in a line, the operator will be prompted as described above to remove each completed PCB from the right side Conveyor Extension.

14. MACHINE LOGS

14.1. Error Log

The error log is automatically appended with every error message that is displayed during any machine function. This includes time and date stamp, operator, description of error message, and duration of error condition. Cold startup is also captured. By reviewing the log, machine operation can be evaluated on a detailed level. Data covering Selected Dates can be viewed, or All can be chosen. Also see the Machine Utilization section for related data. See Figure 49.

The error log can be purged by selecting the data period that you would like to save, then pressing Update Error Log. For example, to delete all but the last 60 days of data, select “60 Days”, then press Update Error Log.

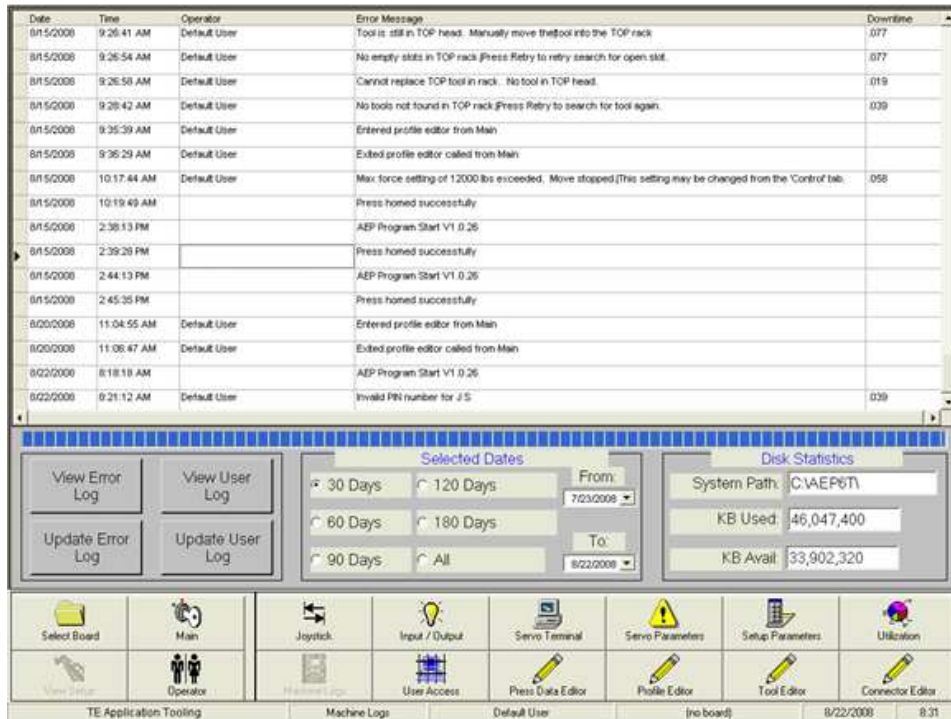


Figure 49

14.2. User Log

The user log is automatically appended every time there is a log in or out event. Data covering Selected Dates can be viewed, or All can be chosen. See Figure 50.

The user log can be purged by selecting the data period that you would like to save, then pressing Update User Log. For example, to delete all but the last 60 days of data, select "60 Days", then press Update User Log.

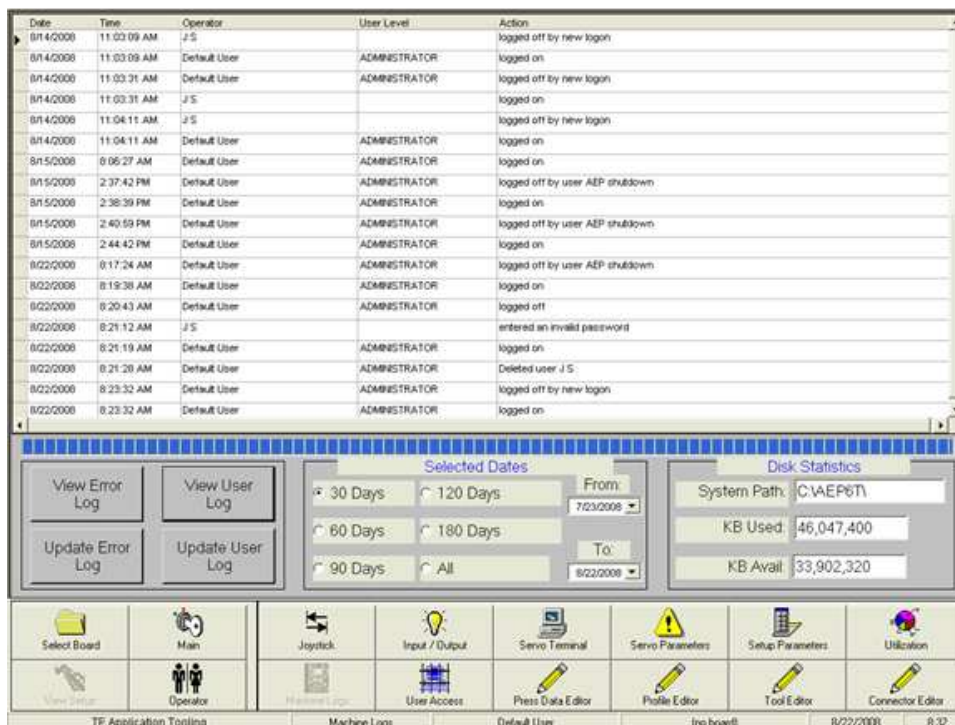
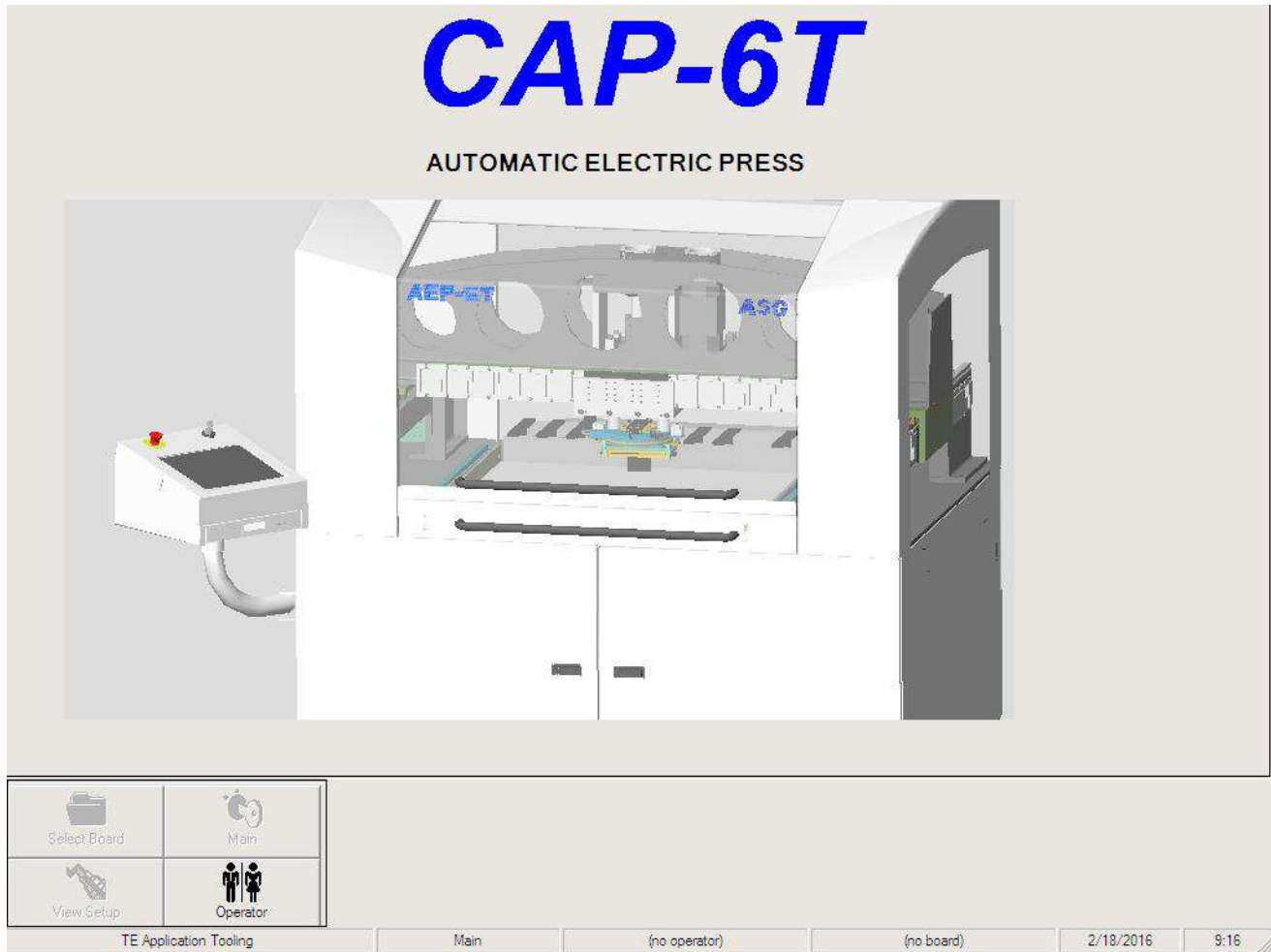


Figure 50

15. ADDITIONAL SCREEN REFERENCE

Each of the screen images shown on the following pages (Figures 51 through 66) are followed by a brief description.



Initial AEP Screen

This screen is displayed when the main press program is initiated from the Windows desktop. The only action available is the Operator button, which will initiate the Operator Access Screen on the next page.

The Status Bar, located at the bottom of the screen, indicates no operator is currently logged into this machine.

Figure 51



Qualified Operators

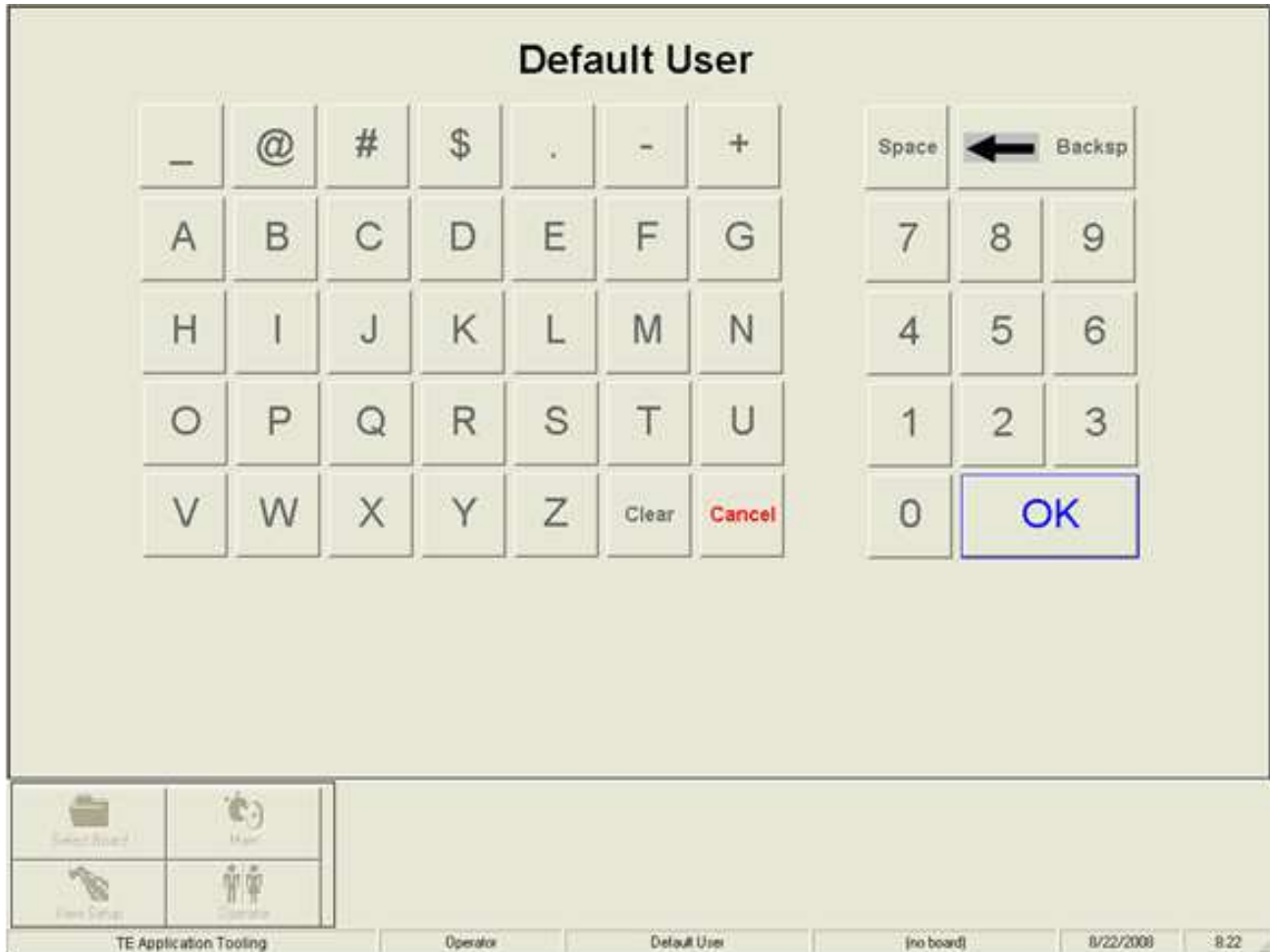
This screen allows the Press to be activated by any number of qualified Press Operators.

If there are a substantial number of people authorized to use the Press, additional sheets can be accessed by the **Page Up** or **Page Down** buttons or the Alphabetical Tabs located on the top of the screen.

The **Log Off** button refers to logging off the current operator and going back to the Initial AEP Screen. If an operator is currently logged onto the machine, the Status Bar at the bottom will indicate the name of the current operator. If there is no current operator, the **Log Off** button will be 'Grayed out'.

The **Cancel** button closes the Operator selection screen.

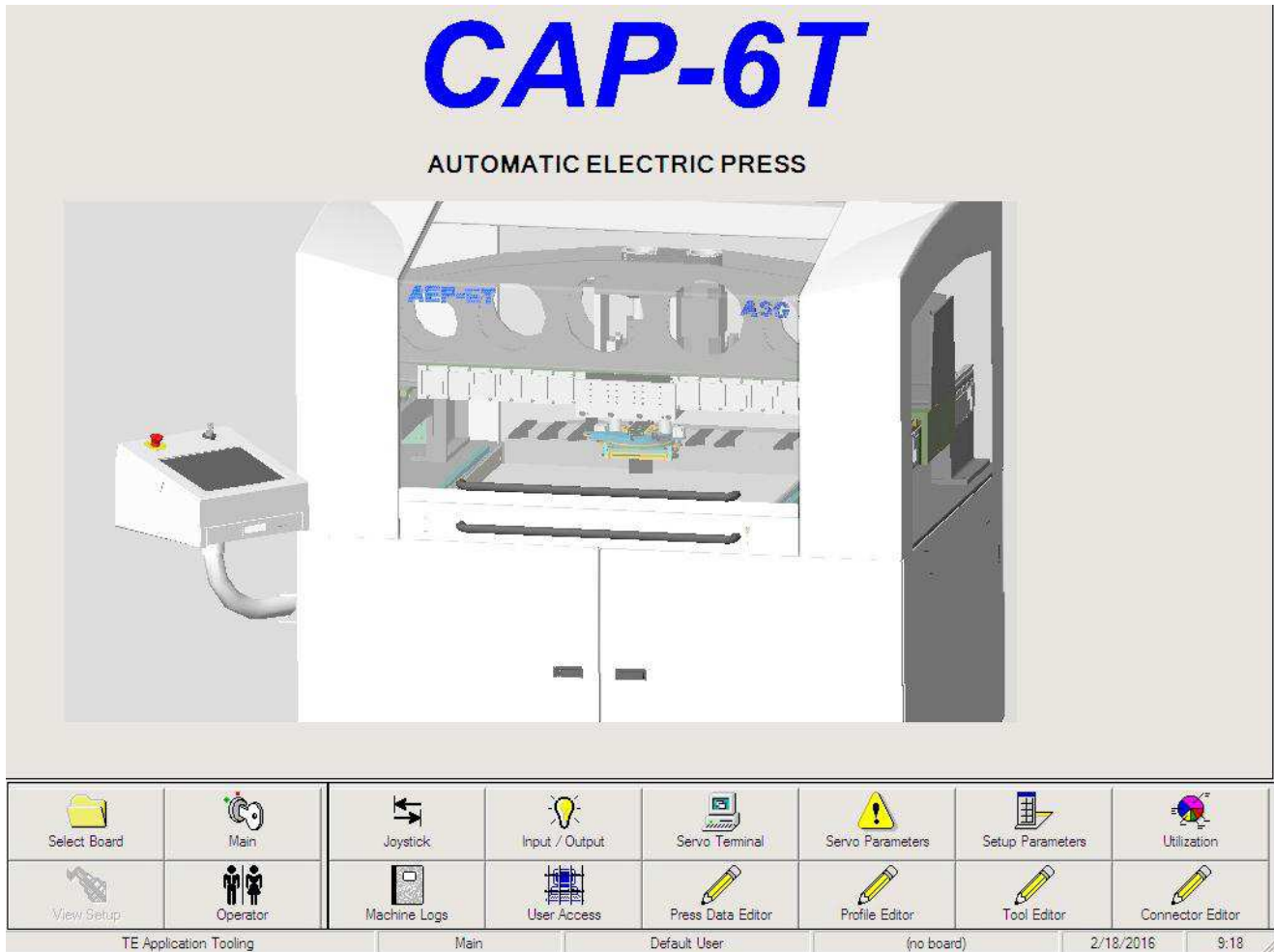
Figure 52



Operator Password

The Password Entry Screen allows the operator selected on the previous page to enter his/her individual Password. Enter Password by using the screen buttons (cursor or touch), then press the **OK** button.

Figure 53



Main Screen

The Operator activated Main Screen allows the Operator access to Press functions as authorized by the designated machine administrator.

In most cases, a standard operator will only have access to the **Run** button. Technicians could be allowed, at Supervisor discretion, the ability to access the Joystick screen for manual operation and various Setup and Editor screens.

Figure 54

User Access

New User

Default User		

Page Up

 Page Down

 Cancel

TE Application Tooling		User Access		Default User		[no board] 8/22/2008 8:25	

User Access Input

If the Administrator or Lead Technician needs to add another operator or modify an existing operator, this Main Menu option allows that individual to be entered into the database of qualified people.

The individual inputting new user information is limited by their level of access, and can only extend that level or below to the new user.

Figure 55

Define User Access

User Name: First Last

Password:

Notes:

Administrator

Run Access

- Offsets
- Profile Editor
- Inspector
- Temporarily Disqualify

Utility Access

- Joystick
- Input/Output
- Servo Terminal
- Servo Parameters
- Backup Utility
- Setup Parameters
- Utilization
- Machine Logs
- User Access
- Press Data Editor
- Profile Editor
- Tool Editor
- Connector Editor

TE Application Tooling		User Access		Default User		[no board]	
						8/22/2008 8:26	

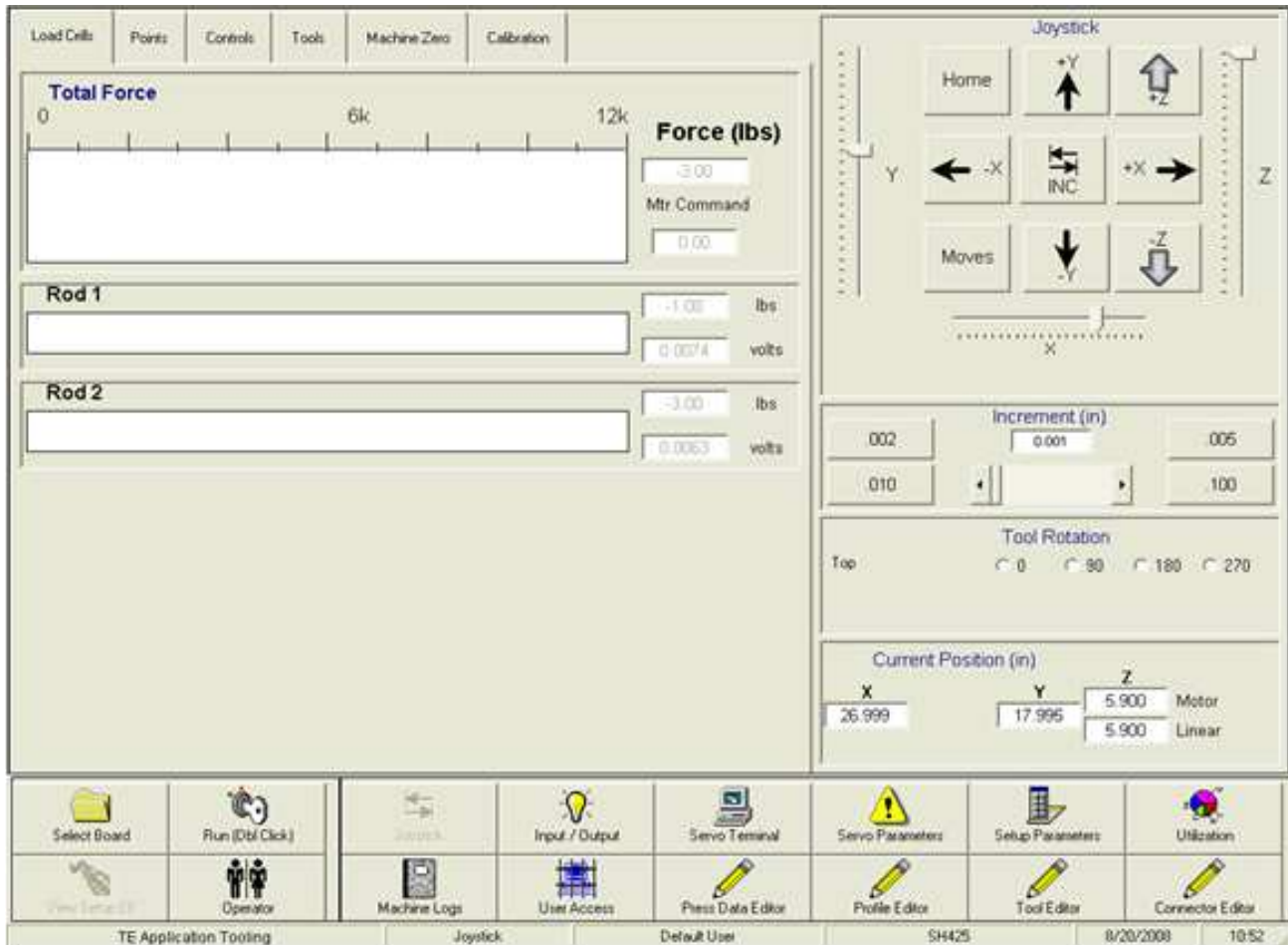
New User Access

This screen allows access level entry or modification for an operator. Select the desired access boxes depending on Administrative discretion. The Administrator or Superman symbol allows access to all screens and editors.

Note: the level of access is limited by the level of the operator currently logged on.

‘Temporarily Disqualify’ allows a user with equal or above access level authority to remove an operator’s access pending further decision.

Figure 56



Joystick: Analog / Position Input

The 'Joystick' Pad on the upper right controls Press Head travel in the X, Y, and Z axes. The Sliders on the side of the Joystick indicate actual positions of the Press Head.

The X-axis indicates the movement side to side of the Press Head.

The Y-Axis indicates the 'Gantry' motion used to position the Press Head in the front to back direction.

The Z Axis indicates the vertical movement of the Press Head.

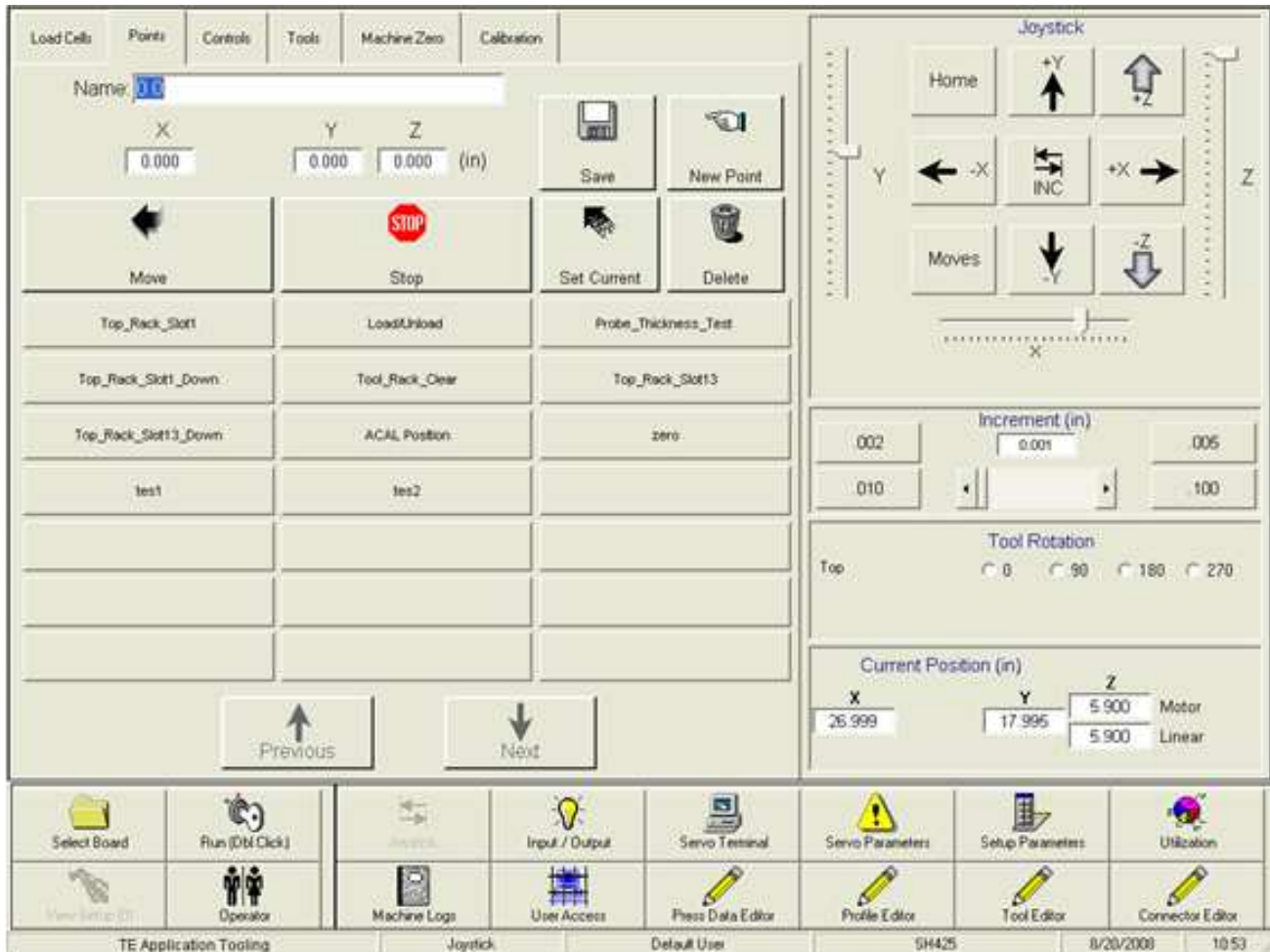
All motions can be Jogged at either a predetermined velocity or Incremented a specific distance by clicking on the center Joystick button.

The tool holder can rotate 360 degrees in 90 degree increments and this is accomplished by selecting the appropriate Tool Rotation.

When the Press tools come in contact with the item to be pressed, the active, graphic load bars on the left side of the screen indicate the 'real-time' contact pressures being generated by each individual rod. Total force is what the pressed object sees (the additive force of the 2 rods).

The X, Y, Z axis real-time positions are indicated by the encoder position readouts with resolutions to the thousandth of an inch. This is the Joystick screen **tabbed** to the Load Cell section.

Figure 57



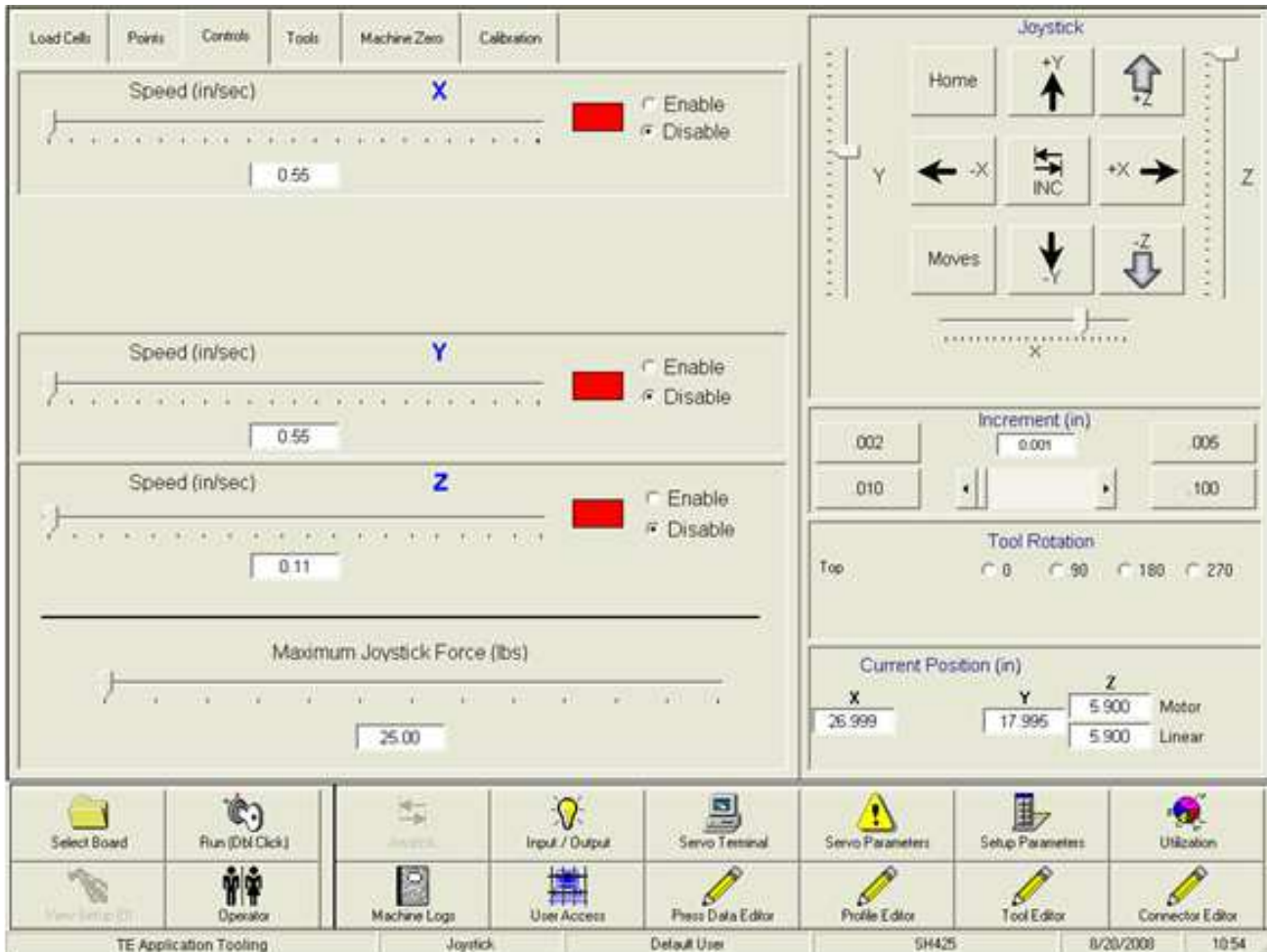
Joystick: X / Y / Z Position points

The Joystick pad and associated controls remains the same on the right-hand side.

This screen allows you to create preprogrammed X / Y / Z positions that, with the appropriate button push, will bring you to the correct coordinates. The safety feature is the **Move** button; you activate the desired position but the Press Head will not move until the **Move** button is depressed.

New preprogrammed buttons are created by depressing the **New Point** button and then clicking on the **Set Current** button for where you are at the present moment or typing in the X / Y / Z coordinates that you desire. Assign a name to your new point coordinates and depress the **Save** button.

Figure 58



Joystick: Speed & Force control

Controls remain the same on the Right hand side.

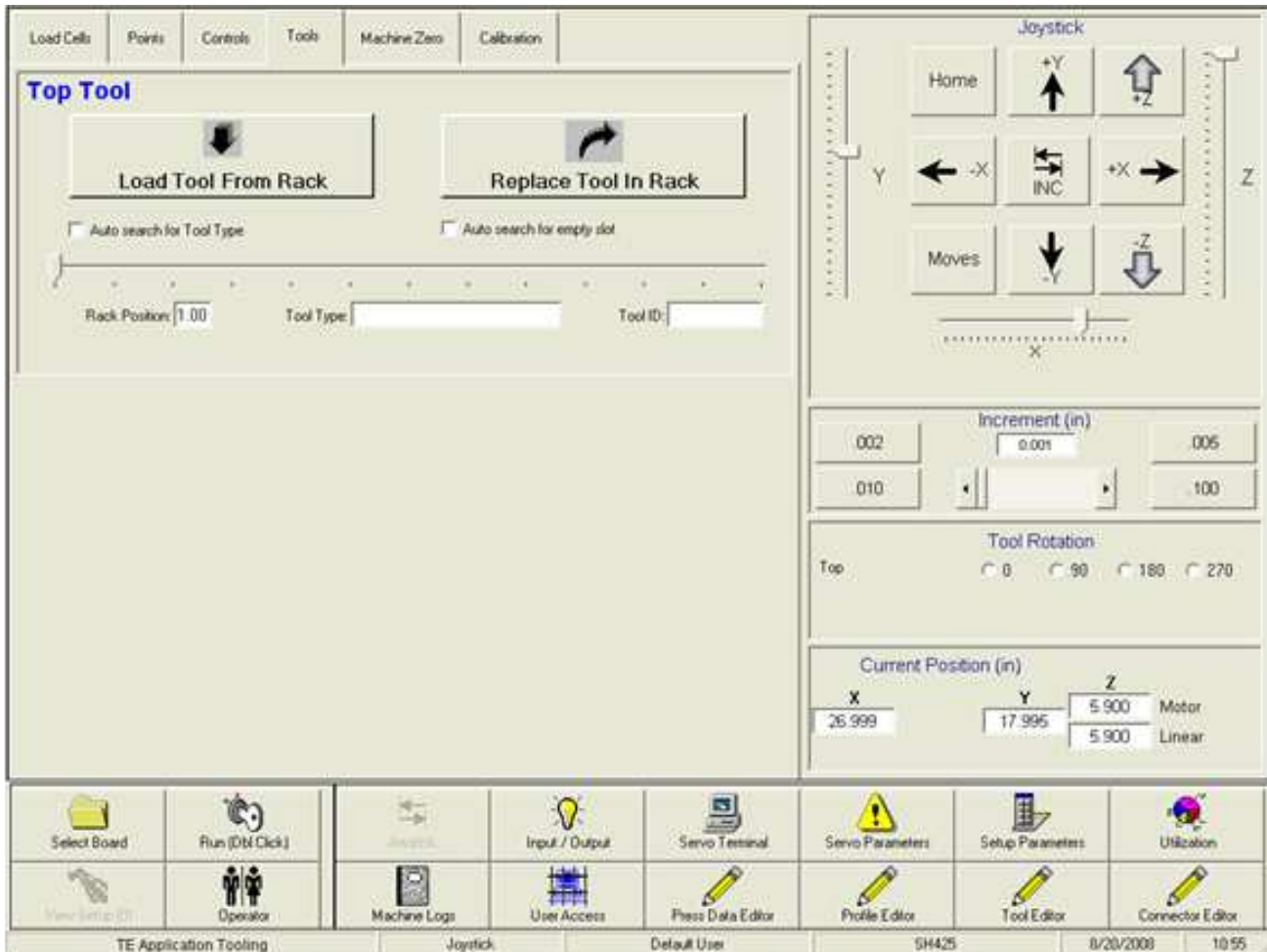
These slider controls are self-explanatory. They control the maximum programmed speed in the X / Y / Z Axis that the Joystick can give you in Jog mode or programmed motion can generate.

Maximum Joystick generated force is controlled by the bottom slider.

In Run mode the maximum speed and force are controlled by the software and the settings in the Servo Parameter screen.

Each Axis can be deactivated by the 'Enable' / 'Disable' boxes.

Figure 59

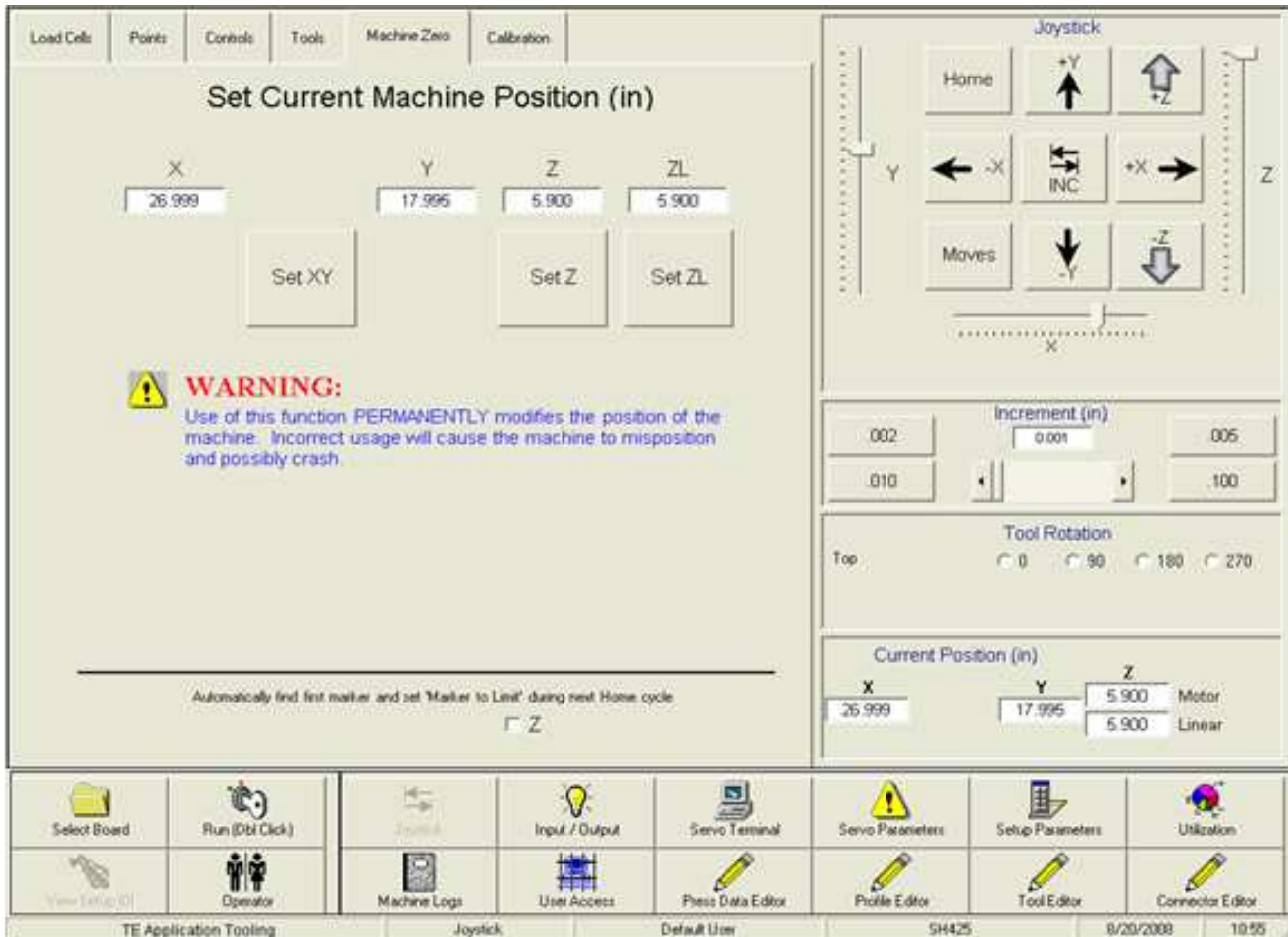


Joystick: Tools

The Joystick (right side of the screen) remains the same.

The purpose of this screen is to insert or remove press tools to/from the Tool rack. The sliders govern which tool (by slot number) the loading mechanism will go to load / replace the press tool. It can be programmed, by check box, to 'auto search' for a specific tool (as listed in the Tool Type Box) if you desire when loading a tool. It will also auto search for an empty slot, if you desire and check the box, to unload a tool when done with the appropriate task. Tool ID's are also programmed using this screen.

Figure 60

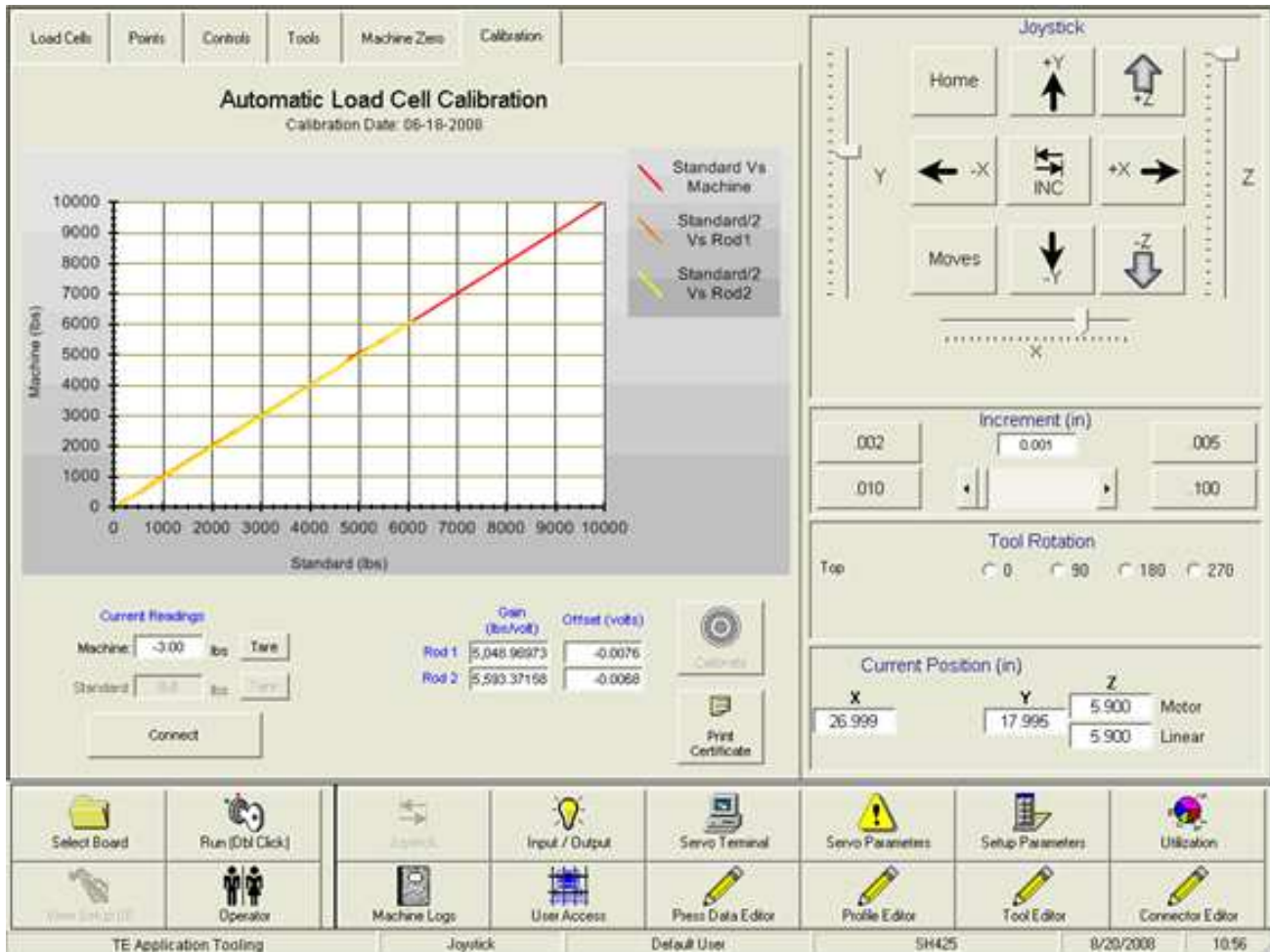


Joystick: Machine Zero

Joystick Functions (Right side of the screen) remain the same.

This screen is used to set up the actual Machine Zero (0, 0) of the coordinate system used by the motion control system. This should only be performed by qualified personnel.

Figure 61

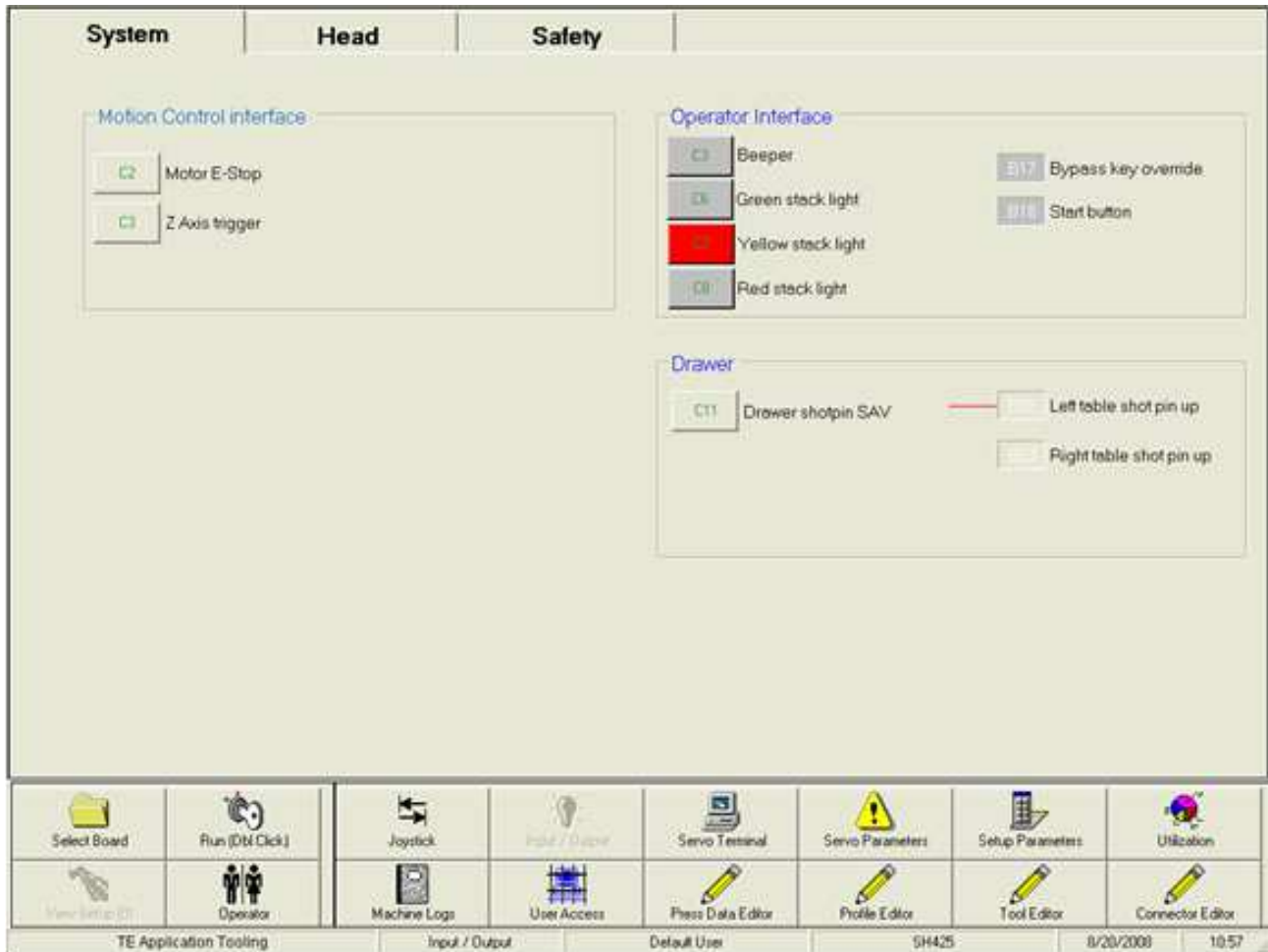


Joystick: Calibration

Controls on the right side of the screen are the same as before.

The left side controls are used for automatic calibration of the load cells using the ACAL unit load cell standard. This calibration is performed initially at the factory. It is recommended to perform annual calibration.

Figure 62



Digital I / O Screen

This screen is used to access the digital inputs and outputs used by the machine. The status of the inputs can be viewed and the Outputs can be manually activated.

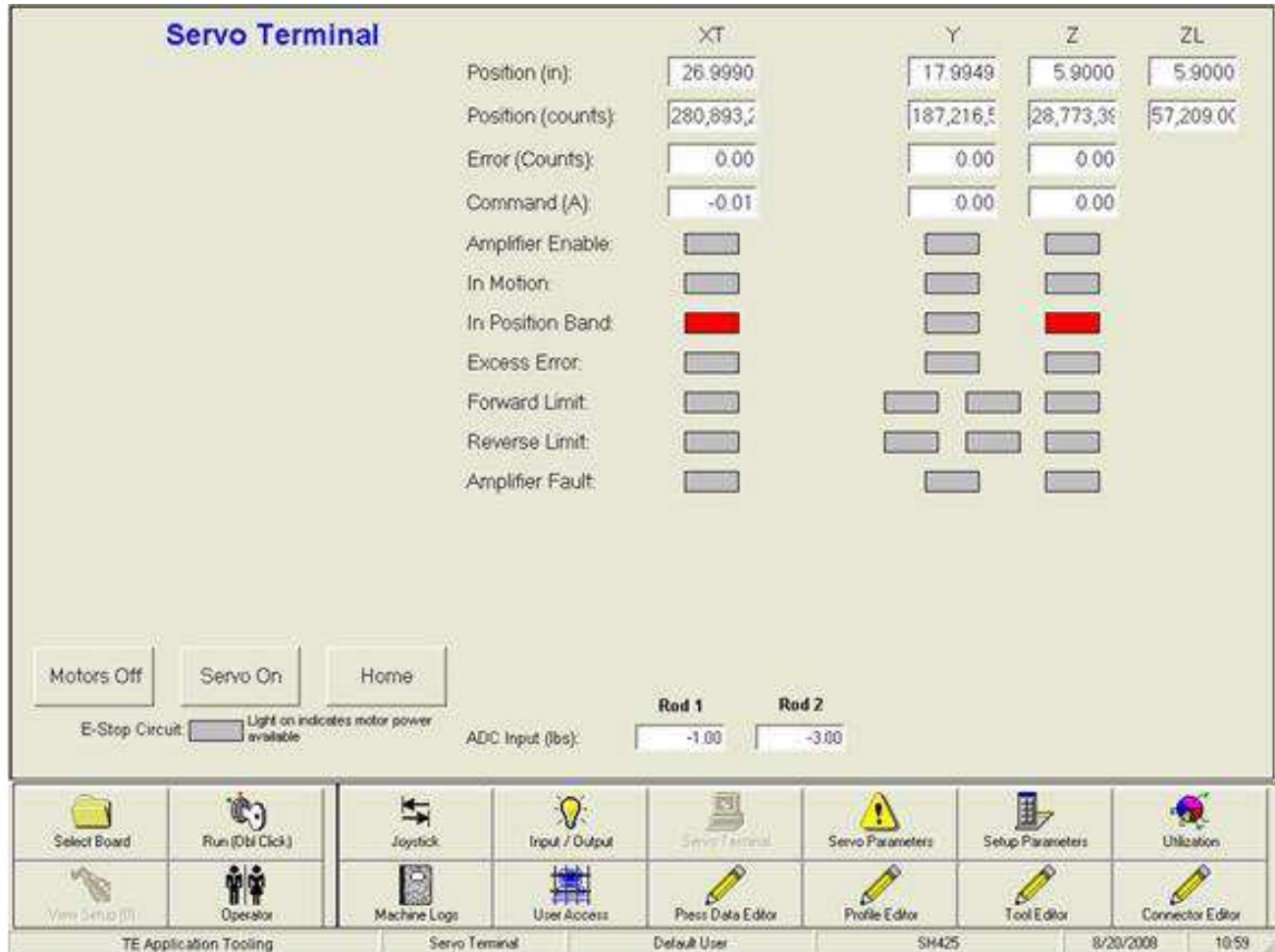
This screen is very useful in troubleshooting sensor adjustment, shot pin functioning, and fixture table action.

Several Tabs are available within this Screen:

- Head
- System (shown above)
- Safety

Autoload (optional)

Figure 63



Servo Terminal

This is for the advanced administrators only. It allows for programming of the Servos used on all the axes (X / Y / Z).

The right side of the screen indicates 'Real-Time' tracking of the Servo outputs for all axes (as active readouts in their associated boxes) and indication, through simulated 'lamps' of any tracking errors and hard / soft limits reached by the Servos. This section is useful for watching encoder operation in action.

Figure 64

Servo Parameters

	X	Y	Z	ZL	
Scale Ratio Gear box / L	1.00000000	1.00000000	0.00066666	1.00000000	
P gain (A/m)/1000	70.55	668.98	1.50		
D gain (s.A/m)/1000	0.17	0.77	0.00		
I gain (A/(s.m)/1000)	228.88	915.53	67.33		
I delay (sec)	0.00	0.00	0.00		
Accel (m/sec ²)	160.0	100.0	40.0	40.0	ZL acc / dec active during press down
Decel (m/sec ²)	160.0	100.0	40.0	700.0	
Jerk Time (ms)	10.0	10.0	30.0		
Min Speed (in/sec)	0.5	0.5	0.1	2.00	ZL speed is press retract sp
Max Speed (in/sec)	45.0	40.0	2.0	30.0	Press retract acceleration
Run Speed (in/sec)	45.0	40.0	2.0		
Home Speed (in/sec)	1.0	1.0	0.1	0.0	
Marker to Limit Dist (in)	0.0000	0.0000	0.0000		
Marker to Zero Offset (in)	16.9213	15.1609	5.9346	-6.1812	
Minimum Coordinate (in)	-3.6000	-1.4000	2.0000		
Maximum Coordinate (in)	36.9000	31.3760	5.9000		
Excess Error Limit (in)	0.4000	0.4000	1.0000	0.2500	ZL EWC sets tracking limit of motor to linear
In Position Band (in)	0.0020	0.0020	0.0008		
Torque Limit (A)	14.12	29.29	30.00		
Stall Detect Time (sec)	0.003	0.003	0.005		

✓
Save

⊘
Cancel

WARNING:
Changing these parameters may adversely affect the performance of the system, cause servo instability, or may cause a crash.

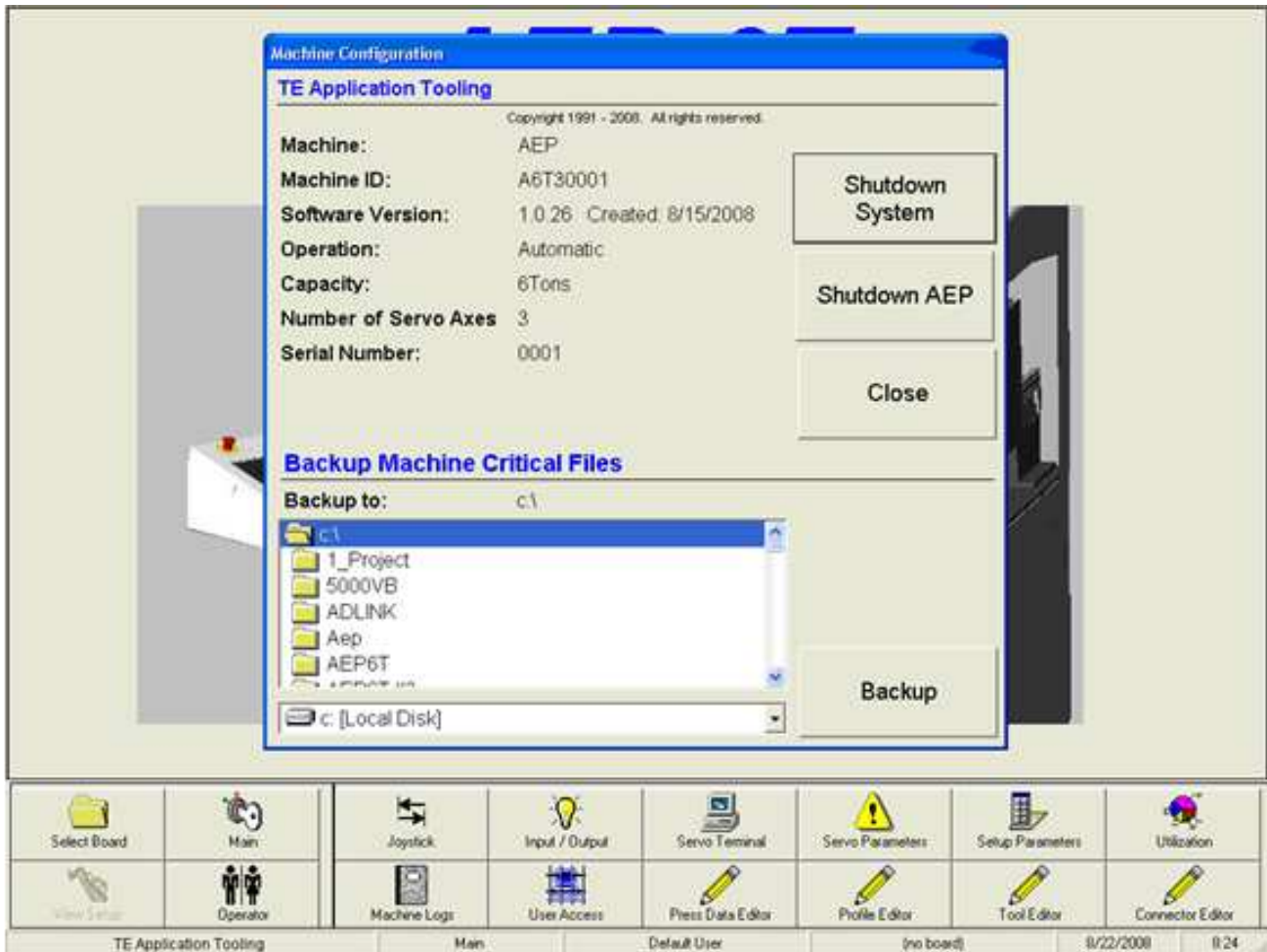
TE Application Tooling Servo Parameters Default User 5H425 8/20/2008 11:00

Servo Parameters

This is a screen that can be used only by the manufacturer to set the parameters required to operate the servo system safely. These values should only be accessed by qualified personnel under the instruction of the manufacturer. Damage can occur to the machine or personnel nearby.

These numbers control the action of each servo axis.

Figure 65



Shutdown Screen

Utilize this screen to shut down the AEP by double clicking on the picture of the press, then selecting Shutdown System. Once the system has completed the shutdown process, and has saved all critical files, it is safe to power down the machine.

Figure 66

16. REPLACEMENT AND REPAIR

To order replacement parts or recommended spares, call 1-800-522-6752, send a facsimile of your purchase order to 717-986-7605, or write to:

CUSTOMER SERVICE (038-035)
 TE CONNECTIVITY CORPORATION
 PO BOX 3608
 HARRISBURG PA 17105-3608

Call 1-800-522-6752 for customer repair service.

17. REVISION SUMMARY

Initial release