customer manual

ORIGINAL INSTRUCTIONS

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.

Always insert customer-supplied optional power plug into a grounded receptacle to avoid electrical shock.

Electrical shock hazard.

Observe main electric on/off switch.

Always turn off the main power switch and disconnect 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.

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 to wire.
Do not use the machine for crushing any items.

IMPORTANT SAFETY INFORMATION

NOTE
Keep all decals clean and legible and replace them when necessary.

DANGER
FIRE HAZARD
Do not use solvents or flammable liquids to clean the machine. Solvents or flammable liquids could ignite and cause serious injury or property damage.

Failure to heed these warnings could result in severe injury from harmful fumes or burns from flying debris.

CAUTION
Do not perform any service or maintenance other than as described in this manual. Injury or damage to the machine may result. Failure to observe these precautions may result in injury or property damage.

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 not drawn to scale.

This manual contains the installation, safety, operation, and maintenance procedures for the C*x*P servo presses. This includes the Connector Benchtop Press CBP-5T and Connector Manual Presses CMP-5T, CMP-6T, CMP-10T, and CMP-12T. The information provided applies to all C*x*P presses, except where specified as applicable to certain models.

2. SAFETY

The C*x*P is designed to comply with the latest safety standards required by OSHA, NFPA-79 and CSA. In addition, the CBP-5T conforms to the current CE requirements.

2.1. Electrical

A. CBP

Appropriate machine grounding is critical for safe operation. Therefore, an external copper ground conductor with a minimum cross section of 2 mm^2, must be connected to the machine's PE point. This is located on the right-side frame and is labeled with "PE". Be aware that electrical hazards exist where labeled.

The main power disconnect switch with "lock-out" function is provided on the right side of the machine and is clearly marked.

B. CMP

Due to power line filter components the leakage current is higher than 10mA. Therefore, a threaded bolt is fixed to the machine frame and labeled with a ground symbol. A separate additional ground line has to be connected to that point. The wire cross section must be at least 10 mm^2.

The main power disconnect switch is provided in the rear panel of the machine and is clearly marked. When it is in the "ON" position, it is mechanically interlocked to prevent the access door from being opened. When it is in the "OFF" position, the switch may be locked in position by lifting the red center tab (see Figure 2) and fitted with a pad-lock. In addition to the mechanical interlock, the door is equipped with a keyed lock.

Lock Out/Tag Out

Figure 2

2.2. Eye/Ear Protection

Eye protection should be worn at all times when operating or servicing this machine. In the event a connector is crushed during the pressing operation, pieces of the connector could become airborne. Please note: the laser sensor does not require eye protection use. See Figure 3.

No ear protection is required. Emission sound pressure level at workstation does not exceed 70 dB(A).

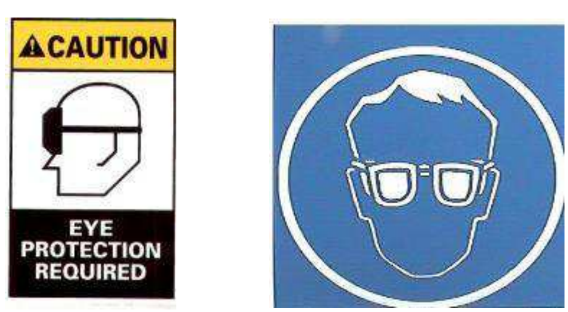


Figure 3

2.3. Safety Covers/Guards

All safety guards must be in place before operating the press. This includes all sheet metal and Lexan panels around the machine. See Figure 4.

Figure 4

2.4. Laser Sensor

The CMP (only) is equipped with a Class I laser sensor. The sensor emits a visible red laser beam with a wavelength of 655 nm and a maximum power of 350 µw. The laser beam is not directly viewable during normal operation due to the mounting position. Exposure to the laser beam is not harmful. No special eye protection is required.

2.5. Emergency Machine Off (EMO) / ESTOP

The Emergency Machine-Off (EMO) circuit controller monitors the safety interlocks (see interlock information below) and the computer to decide if it is safe to allow motor power and movement. When the EMO circuit is de- energized, the motor servo controller is disabled and power is cut off from the motor.

With all of the safety interlocks correctly set, the EMO circuit will energize when signaled by the computer. An interruption by any interlock will de-energize the EMO circuit. Note that resetting an interlock will not automatically re-energize the EMO circuit.

2.6. Emergency Stop Interlocks

The Emergency Stop switches are mounted on the lower left and lower right front corners of the press. Though they are clearly visible, an operator should purposely note their position and understand their operation in case of an emergency. Pressing either switch de-energizes the EMO circuit and motion is halted. When pressed, the switch latches in the pressed state and must be turned to be released.

2.7. Two-Hand Start Interlock

The Two-Hand Start switches are the primary operator safety devices. They are located just below the tabletop on the right and left sides of the press (CBP) or keyboard tray (CMP). Zero force is required for actuation due to their optical switch design.

Each switch is monitored for both actuation and release. Before a motion cycle can be initiated, both switches must be released and then actuated within ½ second of each other. If either switch is released during a cycle, the EMO circuit is de-energized and motion is halted. In addition to their safety function, messages displayed on the computer screen can be acknowledged and cleared by touching either of the switches.

Refer to Mode Key-Switch section below for additional information.

2.8. Light Curtain Interlock

The Light Curtain is a secondary operator safety device. When the light curtain senses an obstruction, the EMO circuit is de-energized and motion is halted. The interlock automatically resets when it is clear of obstructions (though the EMO circuit will remain de-energized.)

2.9. Mode Key-Switch

The Mode Key-Switch is used to configure the press's mode of operation. Normally, the key-switch is set to "AUTO" (automatic), configuring the press to work with an operator present and interlock functions as explained above. However, two other modes are available as follows:

Set to "MAN" (manual), the key-switch configures the press for maintenance and setup functions. This mode allows the press to be "homed" (initialized) and "jogged" (manually positioned) with only one of the two-hand switches held active. Thus the operator's other hand may be used to tend to the computer. It is not possible to enter "Production" in this mode.

Set to "RC" (remote-control), the key-switch configures the press for operation in an automated line and without an operator present. This mode allows remote control of the press while ignoring the state of the two-hand switches. It is not possible to operate the machine from the local console in this mode.

In addition to securing the mode of operation by key, "MAN" mode and "RC" mode are software protected by password. Only operators trained to safely use "MAN" mode and "RC" mode should have access to the key and password.

2.10. Pneumatic System

The pneumatic system is provided for the optional air bearing table that allows floating a PCB support fixture for ease of positioning beneath the Press head. On the CMP, the pneumatic system also provides air to the air bearing that floats the head for side to side adjustment. There are no special precautions required for pneumatic system considerations.

2.11. CMP Only

The following safety items apply only to CMP models.

A. Caster Wheels

The CMP is mounted on four swivel casters. The rear two casters are lockable. Two people are required when moving the machine as it is heavy.

B. Seismic Restraints

Protection from unwanted motion during an earthquake can be achieved by bolting the frame to the floor. This can be done in many ways, two of which are described here.

1. Drill holes through the lower frame tube on the right and left sides of the machine. Secure Eye-Bolts to the holes. Anchor similar Eye-Bolts into the floor below the machine. Secure the machine to the floor using chain or cable.
2. Fabricate steel angle plates to bolt to the lower frame tube at the left and right sides of the machine. Anchor the angle plates to the floor.

A seismic restraint kit is available from TE upon request.

C. Frame Construction and Weight Distribution

The frame is constructed of tubular steel welded together as shown in Figure 5 and supports the very heavy press frame.

NOTE: CMP-12T shown;
CMP-5T, -6T and -10T similar

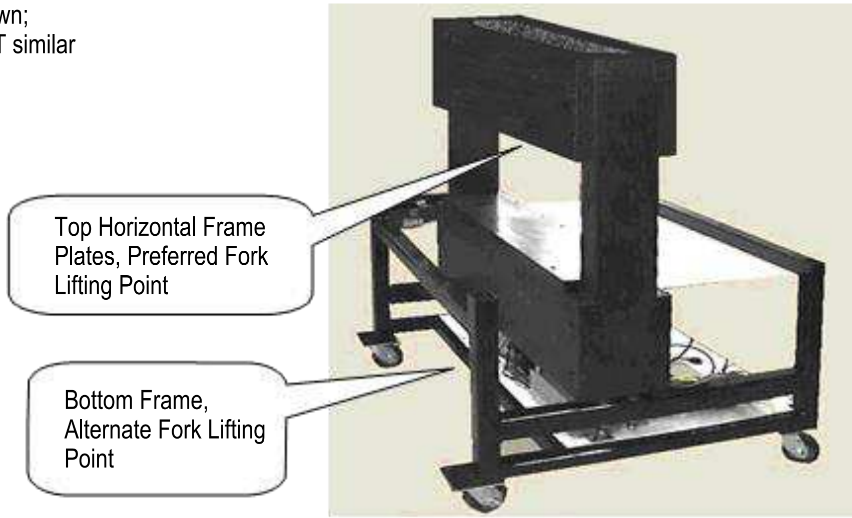


Figure 5

3. INSTALLATION

This section describes the installation steps and requirements for CBP and CMP presses.

3.1. CBP INSTALLATION

A. Uncrating

The press, computer, monitor, leveling feet, and other removed parts are shipped on one pallet, which is shrink- wrapped for protection. Remove the shrink-wrap and unpack the monitor, computer and other shipped parts. Remove Press from pallet by unbolting hold-down bolts on four legs and lifting up with a forklift or hoist.

NOTE
Lift from bottom of structure. Keep forks spread as wide as possible for better stability.

B. Initial Assembly

1. Using the four supplied Foot Levelers (p/n TE-150), install the four Levelers to bottom of Press and adjust X / Y axis of tabletop level with a ‘bubble gauge’.
2. Install customer-supplied 3-conductor power cord appropriate for the available voltage (120-240VAC 1Ø6 Amp) on back of CBP.
3. Route customer supplied 3-conductor power cord through the strain relief on the side of the Press. Connect ground conductor to stud marked “PE” on the side of the Press frame. Connect line conductors to Master Power Switch terminals.
4. Install customer-supplied industrial airline to ‘Quick Disconnect’ on optional Air Table foot switch, if applicable.
5. Locate Monitor and Computer alongside of Press on bench top. Reinstall computer power cord, monitor video cable, USB and Ethernet connectors to backside of computer. Plug computer and monitor into outlet located under tabletop at rear of machine. Important: check computer for possible voltage switch on back of case, in the area where the power cord attaches. If one is present, be sure to select the voltage setting that matches the power source voltage.
6. Connect Barcode Reader (if supplied), keyboard and mouse to computer.
7. Remove Press head lockdown brackets, if installed.

8. Power up Press by turning on Master Power Switch. Verify that computer boots up and start ASG press application from desktop icon. If proper supervisor data (specific customer assignments) is installed in computer database, Press should be fully operational. Log on using “Default User” with password “1”.

NOTE
Administrator (Customer / Owner) should change this initial logon name from’ Default User’ to ‘Administrator’ with appropriate password.

C. Facilities Labeling

The electrical and weight specification are given on the label on the left side of the machine as shown in Figure 6.

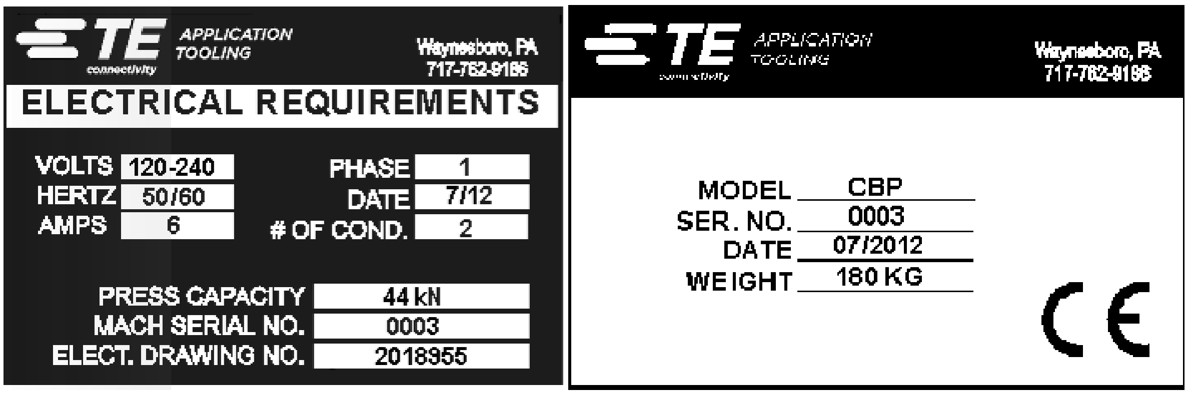


Figure 6

D. Electric Supply Circuit

Electrical supply circuit must be 120-240 VAC 50/60 Hertz single phase.

E. Pneumatic Supply

The pneumatic supply must be connected to the port provided in the Foot Switch. Compressed air is used only for the optional Air Table. Air consumption is minimal. Pressure for the Air Table should be set to the minimum necessary to “float” the PCB fixture used.

3.2. CMP INSTALLATION

A. Uncrating / Lifting

The press, computer, monitor, leveling feet, and other removed parts are shipped on one pallet and are shrink- wrapped for protection. Remove the shrink-wrap and unpack the monitor, computer and other shipped parts. Remove Press from pallet by unbolting hold-down bolts on four legs and lifting up several inches with a forklift. Use “2x4” or equivalent wood blocking between underside of Top Horizontal Frame Plates (see Figure 5) and forklift blades. Alternately, the machine may be lifted by lifting on the bottom frame cross members (see Figure 5). In either case, keep forks spread as wide as possible for better stability.

B. Initial Assembly

1. Using the four supplied M10 x 16 long socket head screws (4-18023-5) per wheel, install the four Caster Wheels (226047-1) to bottom of Press Frame (2216143-7).
2. Install customer supplied 3-conductor power cord (2 phases and ground conductor) through right-angle cable gland (located on the left side panel of the machine. On the inside of the machine, route cable up. Terminate ground wire to PE ground stud on machine frame. Terminate phase wires to the enclosed main power disconnect switch (see Figure 7).

Figure 7

3. Install customer-supplied industrial airline to 'Quick Disconnect' input on lower back side of Press. Verify that shop air input has a minimum of 80 P.S.I. to CMP Air Regulator.
4. Re-attach Monitor Stand (1-2216145-8) using the Pivot Bolt (2256274-1) and two Spring Washers (994979-9) to Extension Arm (1-2216145-5). Attach Extension Arm (1-2216145-5) to the installed Mount Block (2216145-7) with a second Pivot Bolt (2256274-1) and another two Spring Washers (994979-9).
5. Reinstall Barcode Reader (if supplied) and Touch Pad on Monitor Stand.
6. Install Touch Screen Monitor on Stand using 2 lockdown brackets (supplied) on monitor base. Reattach power cord, video cord and touch screen control cable to monitor back.
7. Remove Press Head lockdown brackets, if installed.
8. Install Computer into the rear electrical cabinet. Reinstall computer power cord, Monitor video cable, Etel amp Ethernet cable and IO USB cable to backside of computer. Attach mouse, keyboard, touchscreen and external USB cables to backside of computer.
9. Power up Press by turning on Master Power Switch. Verify that computer boots up and start ASG press application from desktop icon. If proper supervisor data (specific customer assignments) is installed in computer database, Press should be fully operational. Log on initially using "Default User" with password "1".

NOTE

Administrator (Customer / Owner) should have changed this initial logon name from Default User to 'Administrator' with appropriate password.

C. Facilities Labeling

The electrical requirements and weight specification are given on the label on the left side of the machine as shown in Figure 8.

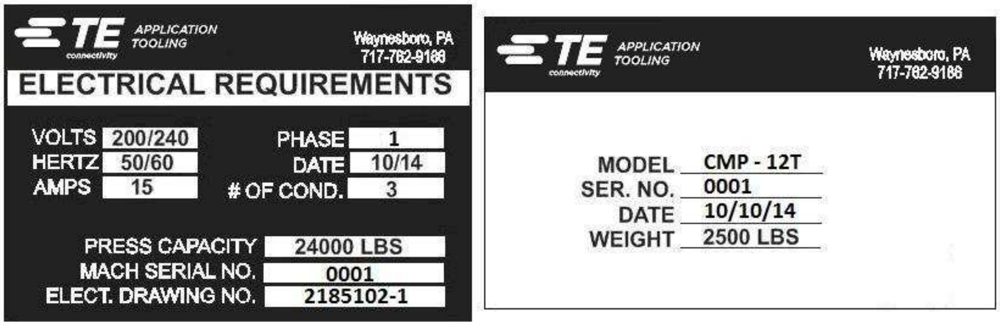


Figure 8

D. Electric Supply Circuit

Refer to the machine's Facilities Labeling (located on the left side panel of the machine) for exact requirements but in general, the electrical supply circuit must match the following: 200 to 240 VAC, 50/60Hz, 1 phase, 2 wire service. It must be protected by a breaker rated for at least 10,000 IAC.

E. Pneumatic Supply

The pneumatic supply must be connected to the port provided at the lower left corner of the press. Pressure between 80-120 PSI is acceptable. Compressed air is used only for the head positioning air bearing and optional Air Table. Air consumption is minimal.

4. MACHINE END OF LIFE CYCLE

A decommissioned machine should be returned to TE Connectivity (TE) for proper disposal.

5. PRESS OVERVIEW

This section introduces the CBP and CMP presses. They will be collectively referred to in this manual as C*x*P. A brief review of the purpose, capabilities, options, and layout is given.

5.1. Purpose

The C*x*P servo electric press was designed for two primary purposes. First, to satisfy the increasing need for controlled quality pressing of connectors on today’s complex circuit boards. As the density of connectors increases, they become more fragile. At the same time, circuit boards have become more complex, susceptible to damage, and costly. This trend will undoubtedly continue and accelerate as interconnect PCB’s continue to move from simple passive elements to more complex devices with surface mount devices, and devices buried in the inner layers. In recent years, back panel assembly shops have had to dramatically increase their process sophistication. It has become obvious that the old methods of “slamming” the connectors into the board are no longer acceptable. The C*x*P, being an electric servo driven press, precisely controls the force and speed of each pressing cycle. In addition to control, quality feedback in the form of SPC analysis, display, and reports is available for the first time. Valuable data can now be captured and analyzed to improve the entire interconnect process.

The second purpose is to improve the efficiency of the pressing process. The manual techniques traditionally used for pressing connectors have been very labor intensive, unsafe, and ergonomically unacceptable. The result is that the throughput and quality has been operator dependent, which inevitably produces variable results. The electric servo press improves throughput while yielding more consistent computer controlled results with quality data feedback.

Thus, the dual purpose of this press meets the needs of the assembly shop and the end customer simultaneously.

5.2. Layout

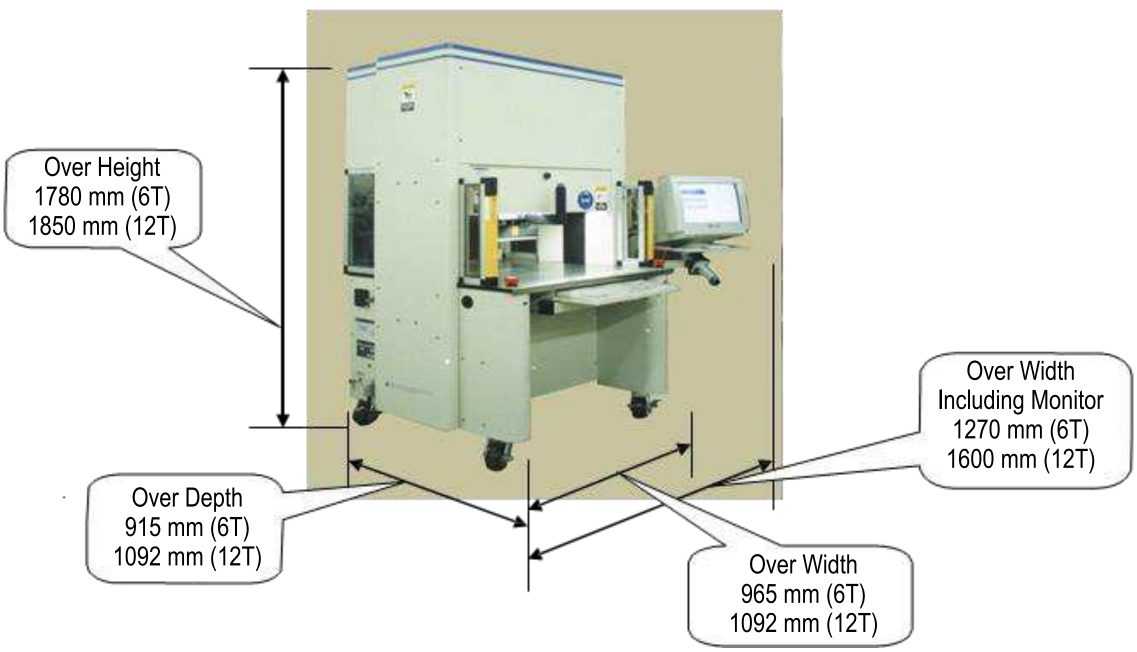


Figure 9

5.3. Capabilities

A. CBP Specifics

The CBP delivers a controlled force of up to 44 kN (5 tons/10,000 lbs) through a 200 mm long X 37 mm wide "flat rock" anvil head. The Z axis travel is 50mm.

NOTE
A total of 160 mm of pressing space is available by installing a 50 mm adapter on the anvil. The normal retract position gives 140 mm space between the press head and table top; 90 mm in full extend. The 50 mm adapter adjusts the space envelope to 90 mm retracted and 40 mm extended. The "up" head position can be programmed for any desired tool clearance while pressing. This improves efficiency by limiting the stroke travel per cycle. It can also be very convenient to use the press head as a tool support for unstable tool/connector situations. Additionally, the Press has a Press Head that rotates manually 90° and air bearing capability for a PCB support fixture on the Table Top.

The PCB size limit is 450 mm wide X 900 mm long. The structure opening width is 550 mm and the press head can be moved from side to side on a slide to access the edges of wide boards.

B. CMP Specifics

The CMP delivers a controlled force of:

- 44.5 kN (5 tons/10,000 lbs) for the CMP-5T or 53 kN (6 tons/12,000 lbs) for the CMP-6T, through a 250 mm long x 35 mm wide “flat rock” head.
- 89 kN (10 tons/20,000 lbs) for the CMP-10T or 106 kN (12 tons/24,000 lbs) for the CMP-12T, through a 270 mm long x 38 mm wide “flat rock” head.

The Z axis travel is greater than 125 mm and the “up” position can be programmed for any desired clearance above the tool before pressing. This improves efficiency by limiting the stroke travel per cycle. It can also be very convenient to use the press head as a tool support for unstable tool/connector situations.

The PCB size limit is 610 mm (CMP-5T, CMP-6T) or 760 mm (CMP-10T, CMP-12T) wide X 910 mm long. The press head can be moved from side to side to access the edges of wide boards.

C. Precise Control of Pressing

The pressing process can be controlled in one of five ways.

1. **FIXED FORCE -** A connector can be pressed to a set force, such as 5 kN. This is a common technique used by hydraulic and pneumatic presses. It is the least sophisticated method available, and is the most likely to damage the PCB or connector.
2. **FIXED FORCE PER PIN -** A connector can be pressed to a set force per pin, such as 150 N per pin. This is slightly better than the first method because it recognizes that the force applied should be proportional to the number of pins being pressed. It cannot, however, compensate for normal variations in required force per pin for different connectors, in different positions, in different boards.
3. **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. 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.
4. **(PARS) – PERCENT ABOVE RANGE SAMPLE –** A connector can be pressed with force that is proportional to the actual resisting force detected during the pressing cycle. We call this Percent Above Range Sample, or PARS. In this technique, the connector’s resisting force while pressing is sampled and averaged over a distance range above final seating to the board surface. The final force percent added assures complete seating of the connector. This is the most widely used technique because it limits the stress to the assembly while not requiring great accuracy for board thickness measurement.
5. **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.

   The program for pressing is a simple table of connector types and positions. 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 stored in databases that can be modified either on or off line.

   Many useful features and utilities are provided for maintenance. This includes on-screen display of all machine inputs, and access to force all outputs.

   User-definable I/O is available via a connection on the rear of the machine to remotely control the press by triggering and receiving events.

D. SPC (Statistical Process Control)

The SPC capability provides real time data on the average 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. Configurable reports are also available. The charts and data can be shared with the end user to increase their confidence in the quality of the pressing process.

E. Board Thickness Measurement

Board thickness measurement 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 a nominal thickness in height calculations.

5.4. Options

A. Touch Screen SVGA Monitor

The touch screen monitor provides a very convenient operator interface. It allows the operator to quickly respond to messages without diverting their attention from the screen.

B. Bar Code Reader

The bar code reader option allows PCB serial numbers to be quickly entered for tracking purposes. Stored data and printed reports include the scanned serial number.

Pressing tools can also identified by bar code for efficient and accurate control. A setup check box allows tool identification to be turned on and off.

C. Tool Sensor

The Tool Sensor is an aid to correctly positioning the PCB under the press head. Proper positioning can be achieved by providing a target on the top of the pressing tool, which the operator aligns with the center of the Press Head.

The Tool Sensor provides visual feedback to confirm the presence of a tool via a retro-reflective target on the top of the tool. The pressing cycle is inhibited if no tool is detected by the sensor. This provides an added level of safety and quality.

D. Light Curtain

The light curtain is mounted across the front access area of the press. If it is obstructed, the pressing process is inhibited. A bypass key allows access to maintenance personnel when needed. This safety device is a secondary backup to the two-hand anti-tie-down switches that are standard.

E. Air Table

The air bearing table is activated by the provided foot pedal. It allows floating a heavy PCB support fixture on a cushion of air for ease of positioning beneath the Press head.

5.5. Machine Specific Configuration

The configuration of the machine can be viewed by double-clicking the left mouse button in the center of the main screen. The main screen is always displayed at startup or when no operator is logged on. Pressing the Production button on the main toolbar at the bottom left of the screen will also display the main screen. The machine attributes are given as shown in Figure 10. The status of the available software protected options is also shown. Only users with administrator access rights will see both the Shutdown CBP button and Backup Files section. Non-administrator users may be granted access to the Backup Files section.

NOTE: CBP Machine Configuration Screen – CMP Similar

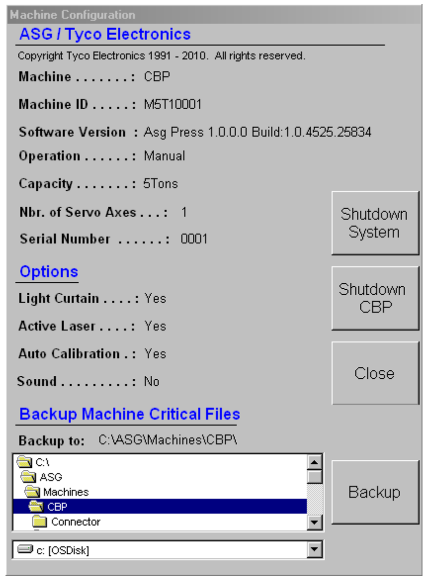


Figure 10

6. OPERATION (PRODUCTION)

6.1. Getting Started

This startup procedure assumes all necessary information has been entered in the Tool Database, Connector Database, Profile Data File(s), and Press Data File. See the programming section for details on entering data in these files. CBP screen examples are shown below. CMP screens are similar.

6.2. Operator Interface

All selections on the computer monitor can be made either by touching the screen with a finger or by pointing and left-clicking with the mouse. Alpha-numeric entries can be entered by the keyboard or by touching the screen buttons provided. Some can also be entered using the optional barcode scanner. Note that a drop of moisture on the face of the touch screen may prevent normal operation until it is removed.

Navigation between the primary functional screens is accomplished using button toolbars along the bottom of the screen. The main toolbar is broken into two parts. The left side of the toolbar contains buttons for selecting the operational mode - Production, Programming, Maintenance, Data or Setup (see Figure 11).

Figure 11

The buttons on the right side of the toolbar select the specific functional screens available for the operational mode selected. Selecting a different mode will display the most recently used functional screen for that mode. Operational mode and/or specific function buttons may not be available, depending on the user's access level. See the User Access section for more information.

During production pressing operation, only a single toolbar is displayed at the bottom of the screen. The buttons on this toolbar provide access to the functions available during board processing. Some function buttons may not be available, depending on the user's access level (see Figure 12).

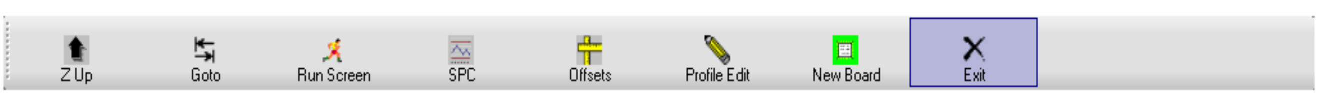


Figure 12

A status bar at the very bottom of the screen provides general information. The left-most panel shows the machine manufacturer's name. The next panel to the right indicates the current function screen or operational mode. The 3rd panel shows the name of the user currently logged in. The panel to the right of that shows the currently selected recipe (board program name). The 5th panel shows the most recently received request from the optional Remote Control interface. The two right-most panels show current date and time (see Figure 13).

Figure 13

6.3. Powering Up

The main power disconnect is mounted on the side (CBP) or rear (CMP) of the machine. Turning the switch to the "OFF" position disconnects the incoming power. It can be locked out for safety and security proposes. Turn it to the "ON" position to start the machine.

6.4. Logging On

When the program is started, the main startup screen is displayed. The only option available on startup is the "Operator" button, used to log on. Touch the "Operator" icon with your finger or left-click with the mouse to display the Select Operator screen (see Figure 14).

Figure 14

NOTE
Select your name from the list displayed. If your name does not appear on the list, you must see the system ADMINISTRATOR to have your name added.

Figure 15 (Continued)

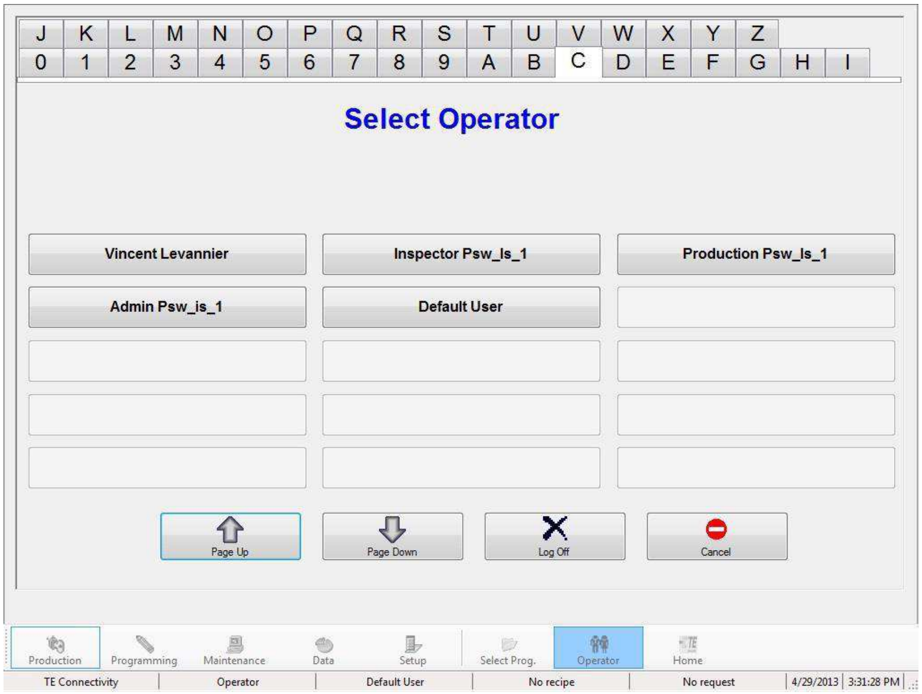


Figure 15 (End)

A password entry screen will now appear on top of the Select Operator screen. Enter your password and press "OK", using either the onscreen keypad or the keyboard. See Figure 16.

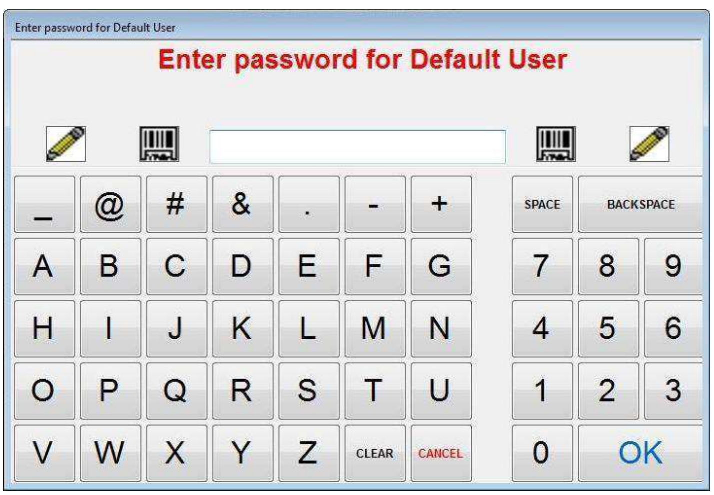


Figure 16

6.5. Selecting the Board

Press the "Select Prog" button on the lower right area of the screen (see Figure 17).

Figure 17

Now select the program from the list presented. The first 15 board programs are shown on the first page. Use the Page Up and Page Down buttons to show the page that contains the desired board program. All available programs are listed alphabetically. Clicking a character key at the top of the screen will display the first page containing a program name that begins with that character. See Figure 18.

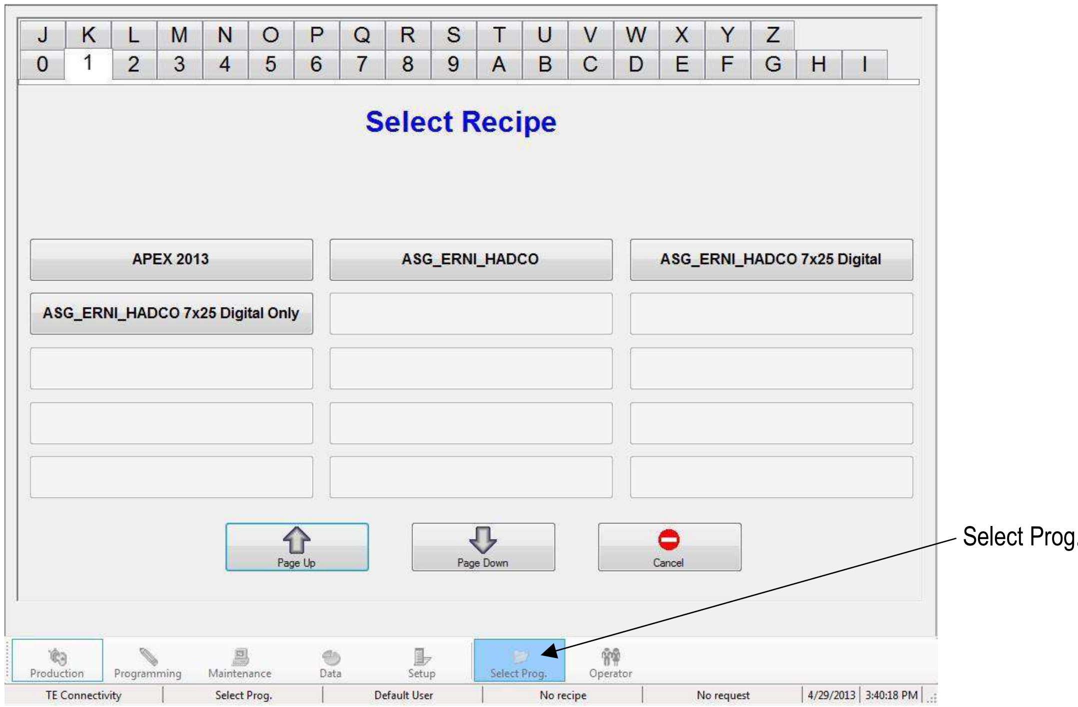


Figure 18

6.6. Running the Board

Click on the "RUN" button to enter the runtime production mode (see Figure 19). If the machine axis has not yet been homed, on screen message prompts will guide you through the steps to perform this action. The two-hand switches must be actuated together and maintained until the homing process is completed.

Figure 19

The first screen displayed upon entering Run mode will depend on which options have been turned on in the Press Sequence Editor for the current board. The requested information can be entered at this time, or press "Cancel" to enter it later. See the "Start Pressing" section in Figure 20 for details on information that may be requested before pressing each board.

During runtime, any messages which require a user response can be acknowledged by swiping one of the two-hand switches to select the default response (such as "OK"). This shortcut often saves time over having to point and click with the mouse or reach up to touch the touch screen.

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 vs. 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. See the "Programming" section below for details on information in the databases.

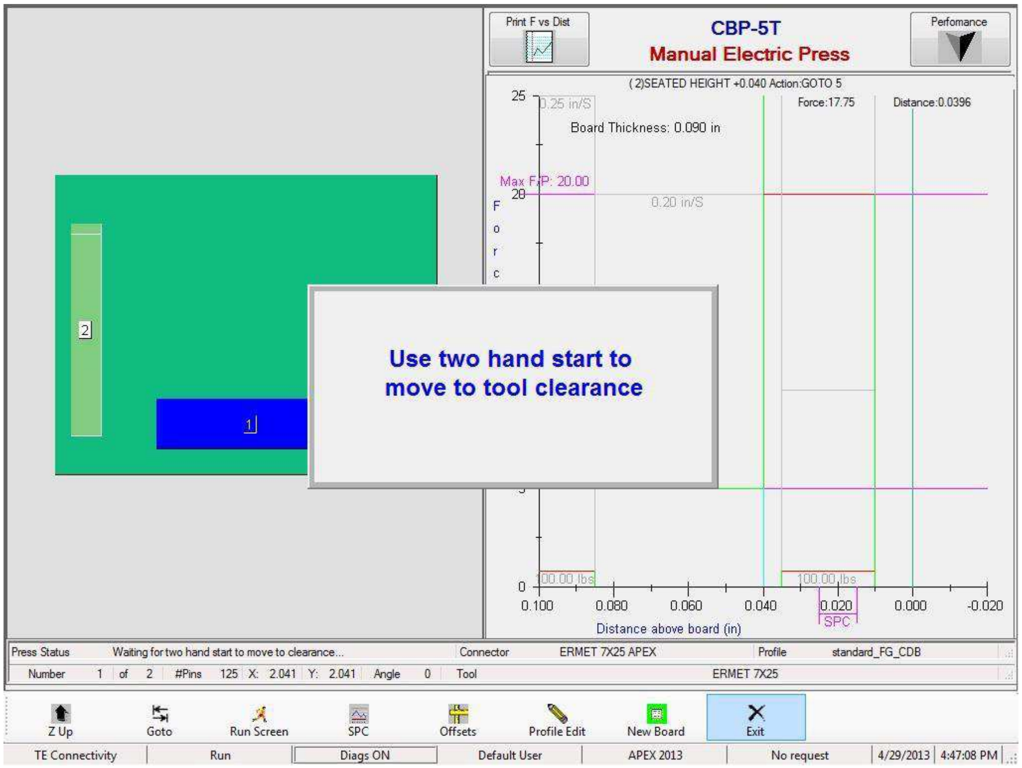


Figure 20

6.7. Run Screen Buttons

Depending on the access level of the person logged in, only some of the buttons may be available. The purpose of each button, from left to right, is as follows:

“Z Up” - Used to raise the Z axis completely. After pressing this button, the user will be prompted to use the two- hand switches to begin moving to the Z-Up position.

“**Goto**” - Used to randomly access any connector on the PCB. Select the desired connector by touching or left-clicking on the connector image in the PCB rendering shown on the left side of the screen. The selected connector will be highlighted in pink. Now press the “Goto” button to move to this connector in the pressing order. The connector to be pressed next is always indicated in blue.

“**Run Screen**” - Used to return to the Run screen from the SPC screen, or to refresh any operator prompts which might have become hidden during the sequence of events.

“**SPC**” - Gives access to the SPC data screen. If SPC is not available, this button will remain low lighted (grayed out). If any SPC parameter goes out of control, the icon will flash with two red horizontal bars. See SPC section for details on display and use of this feature.

“**Offsets**” - Used to change the pressing height or graph alignment. The offset window allows a stored offset to be changed for the *current connector type* on the PCB. Pressed Height Offset is particularly useful in compensating for the many product lot variables encountered when pressing to height. The offset shown when this button is pressed applies to the *next connector* to be pressed in the current sequence. When changing an offset, verify the name of the connector in the upper right of the screen to avoid unexpected results. The Graph Offset only changes the alignment of the displayed data to the graph X-axis. This is useful to correct the display to align the upturn in the plot that occurs when the connector touches the board surface, with the vertical “0.00” line. The Offsets button may not be available for all users’ access levels. Offsets should only be used to compensate for normal product lot variation, not errors in tool/connector/fixture height data or incorrect profile definitions (see Figure 21).

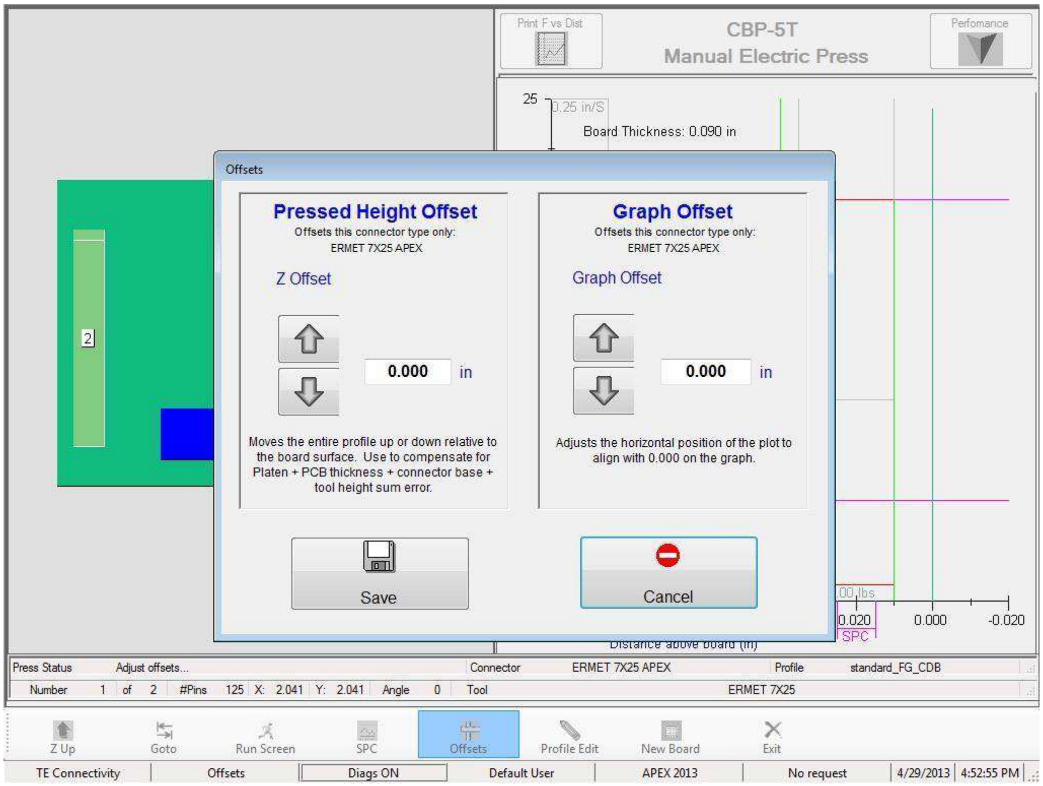


Figure 21

"**Profile Editor**" - Used to view or modify the current pressing profile at run time. See the Editors section for details on usage. This button is not available to all user access levels.

"**New Board**" - Used to reset the sequence pointer to the first connector. The result is the same as touching connector # 1 and pressing the "Go To" button. A prompt will be given to verify a return to the first connector is desired.

"**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 before leaving the machine unattended will prevent unauthorized access.

"**Performance**" – The performance button is in the upper right corner of the screen. Pressing this button displays process performance parameters. The Throughput parameters are self-explanatory. The Profile Timing / Errors section shows the number of seconds taken to press the last connector of each type. It also shows the number of profile errors of each type that have occurred. The force monitor section shows the average force over a distance range (this is the SPC distance range if available). It also shows the maximum force and the height where it was measured (see Figure 22).

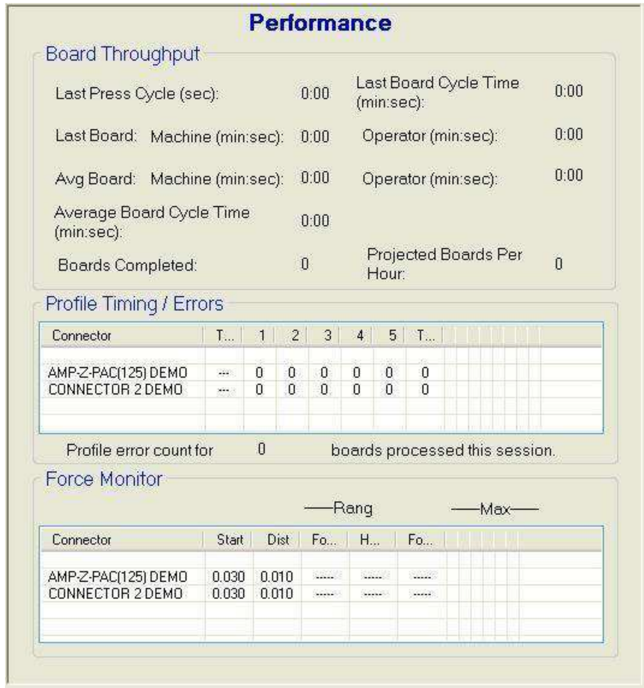


Figure 22

6.8. On Screen PCB Rendering

The PCB rendering drawn on the screen shows the connector locations relative to each other and the board edges. The board thickness measurement point is shown as a circle with an "M" inside. The rendering 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, if there is any interference between connector locations or if connector angles do not match the actual PCB layout (see Figure 23).

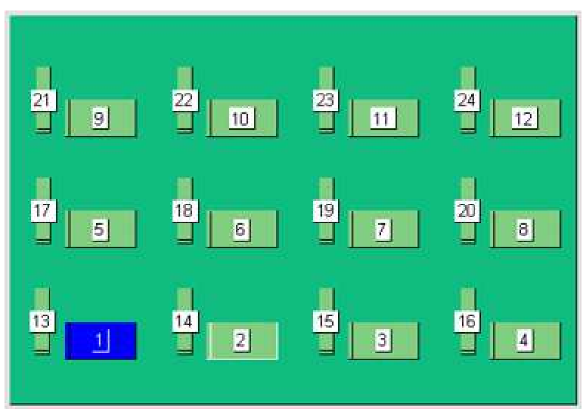


Figure 23

The rendering is shown with the first connector to be pressed highlighted in blue. This will be either the board thickness measurement location, if the option is enabled, or the first connector in the sequence. The thickness measurement location is shown as a circle, while connectors are shown as rectangles.

It also shows the pressing sequence by number and gives the connector name. To read the detailed information, zoom in by double-clicking (or double-tapping on the touch screen) the rendering using the left mouse button. You can step through the three zoom levels by continuing to double-click. Panning around the PCB is done by pointing and left-clicking (or touching), then dragging in the direction to pan.

6.9. Start Pressing

Each individual pressing process is started by pressing and holding the two-hand switches simultaneously when prompted. If further information is required before running the board, it will be requested before the operator is prompted to use the two-hand switches. There are four entries that may be requested, if the options have been selected in the Press Sequence Editor. Keep in mind that a combination of any, all, or none of these may be prompted, depending on the program being run. The information can be typed from the keyboard, entered via the touch screen, or scanned using the optional bar code scanner.

Connector Substitution - This feature allows for interchangeable connectors, typically from different manufacturers, to be selected at runtime. If any connector on the currently selected board has an alternate and this feature has been checked in the Press Sequence editor (see the Connector and Press Sequence Editors for programming of this feature), you will be prompted to make a selection. Pressing “enter” will select the default connector type.

PCB Verify - This feature requires verification of the “type” or “model” of the board being run. Ideally, the board will be bar coded with this information, but typing it in will also work.

Serial Number - This feature requests the serial number for each board. Bar code scanning is the most convenient method to use but the serial number can also be entered from the keyboard or touch screen. For data options, refer to the Press Sequence Editor section (see Figure 24).

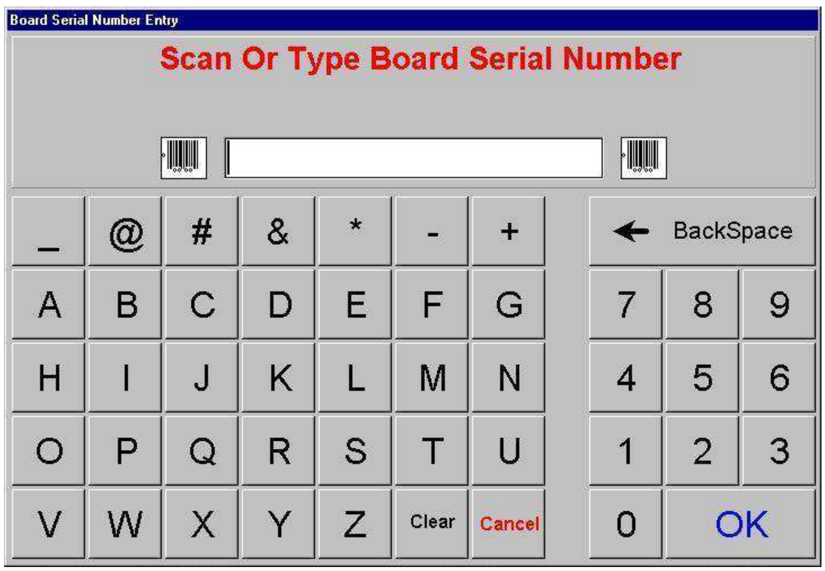


Figure 24

Tool ID - This feature requires the tool identification to be verified before pressing can proceed. It is a quality confirmation that reduces the possibility of a mismatch between what the press expects and what the operator is doing. The ID can be typed in or scanned.

6.10. First Article Signoff

If this feature is activated, the press will stop after the first board is completed, and will not continue until signoff has been performed. Signoff is controlled by options set in the Press Sequence Editor. See the Press Sequence Editor section for details.

6.11. Changing the Pressing Sequence

The next connector to be pressed can be changed after a cycle has been completed or interrupted. Using the mouse pointer or a finger on the touch screen, highlight the connector to be pressed next and then press the “Goto” button at the bottom of the screen. The sequence will continue from the new point, and will automatically step to the next connector in the program sequence. If the board program specifies Non-Sequential mode (refer to the Press Sequence Editor section), the press will remain on the current connector position (or board thickness measurement) until Goto is used. This mode is primarily used for PCB repair activities.

6.12. Profile Error Conditions Related to the Board, Connector, Tools, and Programs

Some of the more common profile error conditions encountered during pressing are detailed below. The error conditions generated by the Profile program are user defined, so the wording may vary. The profile programmer may also define other error messages. Additional error messages not covered here may be introduced in the future.

Premature Contact - This is likely to be the most common profile error encountered during normal operation. It occurs when the press head makes contact with the tool before expected. 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 so it is sitting too high
- The pressing tool is raised on the connector by a bent pin
- The connector is raised above the PCB by a bent pin that prevents all pins from entering the holes
- The connector below the head is not the one expected (the PCB is in the wrong position)
- There is an error in the Press Profile file (*.prs) such that the head contacts the tool before expected
- An incorrect board or fixture thickness is called out in the Press Data file (*.pdf)
- An incorrect tool height is called out in the tool database
- An incorrect connector unseated height is called out in the connector database

When this condition is encountered, the press head will rise 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 dimensional error in one of the data files. In some cases it is OK to try again, such as when the un-pressed connector was tilted and the head corrected the lean when it touched the tool. 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. A properly defined Profile will detect this condition and generate an appropriate error, but the connector may be damaged beyond repair at that point.

Missing Connector – When this error is generated it will be obvious if a connector is missing. If the connector is not missing, then there is probably an error in the Profile or tool/connector/PCB/fixture dimensions that must be corrected by the programmer. This might also occur if the Machine Zero setting is incorrect due to a condition that requires repair of the press.

Excess Force - This error is displayed when the force required to seat the connector exceeds the programmed limit. There may be a problem with the connector (oversized/bent pins) or PCB (undersized holes) causing too much resistance before the connector reaches its seated height. The fixture, PCB, tool and/or connector 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. In addition to the user-defined profile error message, an “Excess Force” profile error message will appear any time maximum force per pin (MaxFPP), as specified in the connector database, is exceeded – even when another Force (such as PARS) and/or Force Action is specified on the profile line.

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

6.13. Runtime Help Screen:

Pressing the F1 Key while in the Run mode will display this screen. It describes how to activate functions available to assist in diagnosing 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 25).

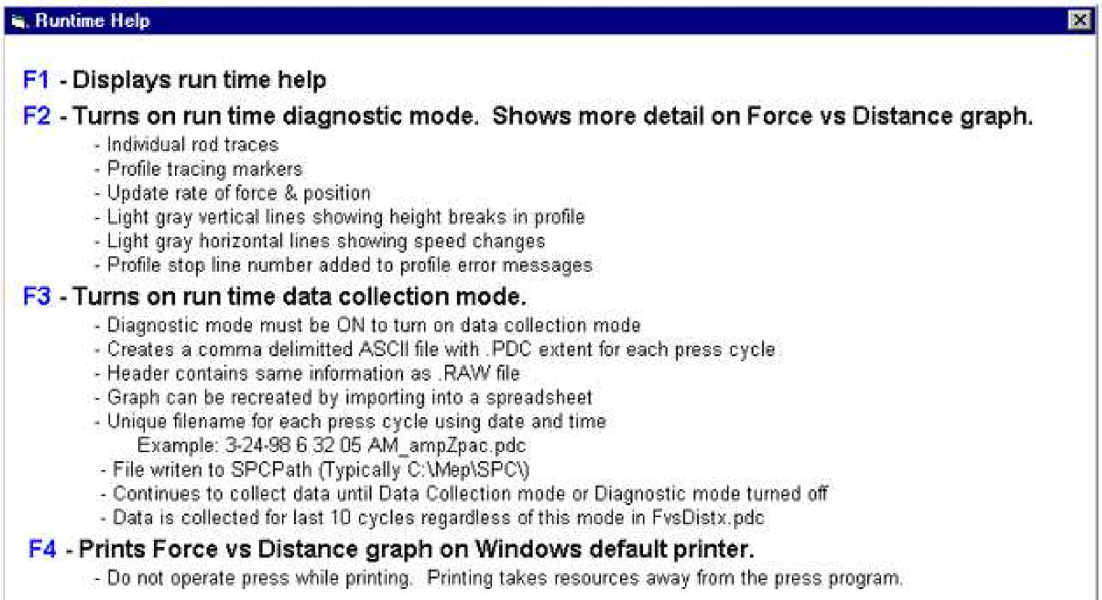


Figure 25

"Runtime Help" – "F1" displays runtime help. It gives a brief description of function keys available while in the run screen.

"**Diagnostics**" – Press the function key "F2" to toggle diagnostics mode. The current state is shown at the bottom of the screen. When diagnostics is active, "Diags ON" state is displayed and detailed information relating to the pressing process is shown on the screen. The profile speed and transition points are shown, and the termination of each profile step is shown as "F" for force or "H" for height. This data can be useful in understanding the profile path taken while pressing. It also shows the update time for the force and height readings in milliseconds.

"Data Collection" – Press the function key "F3" to toggle data collection mode. When data collection is active, "Diags – DC" state is displayed at the bottom of the screen. Detailed data is collected for each press and written to the computer hard drive. This option is only available while Diagnostics mode is active.

"Print Force vs. Distance Graph" – Press "F4" to print the displayed Force vs. Distance Graph.

7. PRESSING TOOLS AND FIXTURES

This section defines the general requirements for connector pressing tools and fixtures (platens) that will be used in the press. In most cases, insertion tools and fixtures used in other manual pressing operations can be used in this press.

7.1. Tools

The guidelines below must be followed in order to ensure optimum performance.

- Width – May be any width that adequately supports the pressing force
- Height – There is up to 130 mm clearance from table to the full up pressing head (less if using anvil spacer on CBP). The tool, backup fixture, connector, and board assembly must be less than this measurement.
- Length – may be up to 250 mm (to stay within the capture of the flat rock head), single or multiple tool combination.

7.2. Support Fixtures (Platens/ Backup Fixtures)

The support fixture, sometimes called a platen, must be made of a reasonably rigid material. The flatness should be held to a maximum deviation of 0.10 mm for best results. Most fixtures in use on other type presses are adequate, but flatness is often poor. Pressing to height will be a problem if the fixture is not flat.

8. PROGRAMMING & DATA ENTRY

The press is a highly versatile tool due to simple yet flexible programmability. Four databases are used to guide the press through specific sequences of operations. The variables stored include pressing tool physical information, pressing profile information, connector physical information, and PCB/ backup fixture information. Once the information has been stored, it is available for use by current and future programs.

Access to the editors is normally restricted to levels higher than “operator”. The editors can be accessed from the main toolbar. To display the buttons for the editors, select the Prog button on the left toolbar. To open the desired editor, select the appropriate button on the right toolbar. The Profile editor may also be accessed from the Run screen using the Profile Edit toolbar button (see Figure 26).

8.1. The Tool Editor

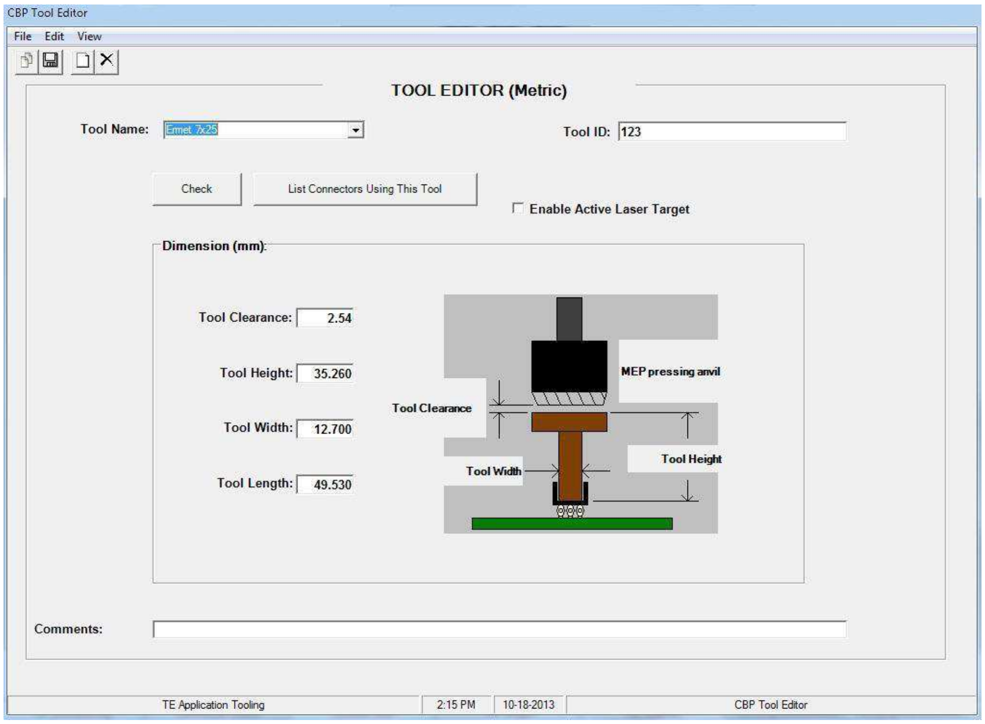


Figure 26

A. Purpose

The tool editor is used to view and modify the tool data base, which is an Access Database file. It contains all the necessary information about the mechanical pressing tools that are used during the pressing process. The editor can be accessed either from the icon at the bottom of the screen, or from the optional off line editor running on a desktop PC. The following fields are maintained in the database and are saved immediately as they are changed so there is no save operation on exiting.

B. Entries

“Tool Type” - 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. To enter a new tool type, click on “Edit” in the upper left of the screen, then select “Add New Tool”. Alternatively, you can select “Copy Tool” to copy the currently viewed tool. You must enter a new name. Selecting “Delete Tool” will delete the currently viewed tool entry.

“Bar Code” - This is the unique number that is used to identify the tool. It can be engraved and/or bar coded the tool. It is convenient to use a bar code reader to confirm the tool type at run time.

NOTE
No two tools should ever have the same number except for interchangeable duplicates. In this case, only one entry is made in the database.

"Enable Active Laser Target" – Select this checkbox if you are using the laser tool presence verification option. See Pressing Tools section above for further explanation of this option.

"Dimensions"

Tool Height – The tool height information is needed in order to confirm the pressed height of the connector. Enter the height of the tool from the top surface to the plane that presses on the connector as shown in the graphic.

Tool Width – This entry is used to draw a rendering of the connector width in the PCB drawing on the screen. Tool Length – This entry is used to draw a rendering of the connector length in the PCB drawing on the screen

"Comments"

Enter any comments desired such as a short description of the tool application.

8.2. The Connector Editor

A. Purpose

The Connector Editor is used to view and modify the connector data base, which is an Access Database file. The editor can be accessed either from the icon at the bottom of the screen or from the optional off line editor running on a desktop PC. All changes are saved immediately so there is no save operation on exiting (see Figure 27).

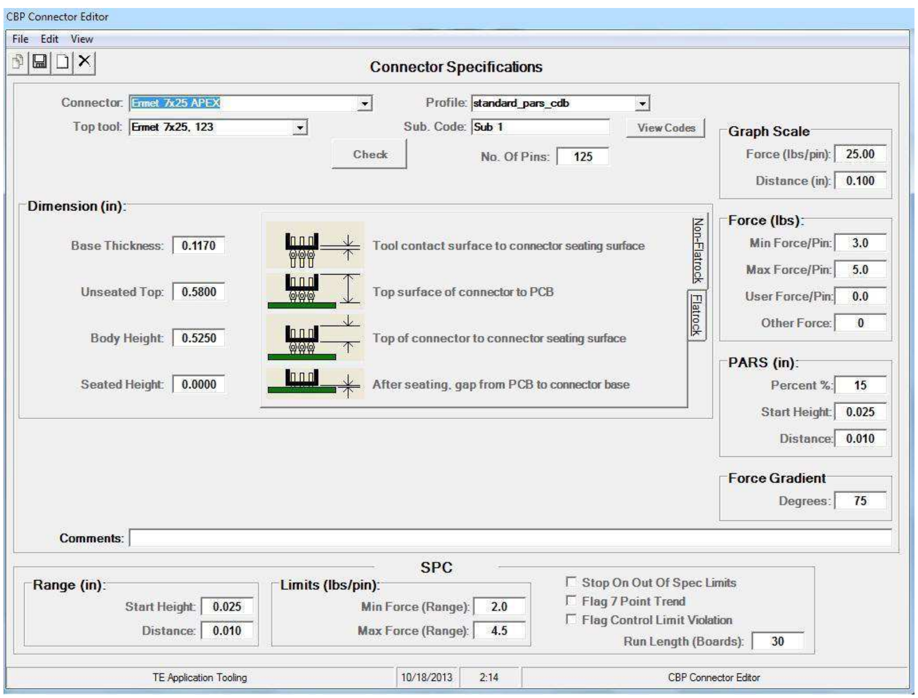


Figure 27

B. Entries

"Connector Type" - This is a name you choose up to 20 characters long, spaces allowed, that will be used to refer to this connector in the future. To enter a new tool type, click on "Edit" in the upper left of the screen, then select "Add New Connector". Alternatively, you can select "Copy Connector" to copy the currently viewed connector. You must enter a new name. Selecting "Delete Connector" will delete the currently viewed connector entry.

"Tool" - This is the type or name of the tool to be used for pressing the connector. It is picked from the tool data base entries using the drop down menu. The tool must be entered in the tool database before the connector data can be completed.

“Number of Pins” - This is the number of pins in the connector. It 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 on the run time screen.

“Profile” - This is the name of the profile file to be used for the connector. It is picked from the profile data base entries using the drop down menu. The profile must be completed before the connector database can be generated.

“Dimensions”

Base Thickness - This is the thickness of the connector between the inside (mating section) bottom and the outside bottom as shown. It is used to calculate the head travel to seat the connector to the proper height.

Unseated Top - This is the measurement of the distance of the top surface of the connector to the top surface of the PCB.

Height - This is the measurement of distance from the top of the connector to the seating surface of the connector. Subtracting ‘Unseated Top’ from ‘Height’ will give actual amount of distance left to press connector to seated condition.

Seated Height - This is the desired distance between the board surface and the bottom of the connector after pressing. It is usually zero, but may be set above the board surface for press to height applications.

“Graph Scale” - These entries control the graphing scale for the pressing process. The first is the vertical full scale in pounds per pin, and the second is the horizontal scale in distance from the bottom of the connector to the board surface.

“Force”

- Min Force / Pin - This is the minimum acceptable force per pin. It is referenced in the pressing profile.
- Max Force / Pin - This is the maximum acceptable force per pin. It is referenced in the pressing profile.
- User Force / Pin - This is a user defined force per pin. It is referenced in the pressing profile.
- Other Force - This is a user defined fixed total force offset (not per pin) such as might be utilized to compensate for using a spring loaded pressing die. This force is subtracted from the force readings before they are compared to the press profile Force limits and graphed.

“PARS” - A connector can be pressed with force that is proportional to the actual resisting force detected during the pressing cycle. This profile is controlled by the start and finish connector height and % of force applied over what is detected at end of cycle. The % value entered here is used when **PARS-FPPL CDB** is selected in the Profile Editor.

“Force Gradient” - Monitors the rate of change of force to distance. Generally, the force vs. distance plot will make a steep upturn as the connector contacts the board surface. A minimum angle is specified for the upturn which corresponds to how solidly the connector is pressed against the board. Enter the gradient angle at which you want to complete the press cycle. The value entered is used when Force Grad CDB is selected in the Profile Editor.

“Comments” - This is a field for useful comments

8.3. The Profile Editor

A. Purpose

The Profile Editor is used to view and modify pressing profiles. A pressing Profile is information that is used to control the pressing process speed, force, and height. It is the heart of the control sequence, and allows the user to define exactly how a connector is pressed into the PCB. The editor provides up to 20 steps, numbered at the left of the screen, to be entered for a given profile. Profiles are stored as ASCII files with a user-specified name. The .prf file extension is automatically added when saving. The profile editor can be accessed either from the icon at the bottom of the screen, or from the optional off line editor running on a desktop PC. The raw .prf files can also be viewed using any text editor (see Figure 28).

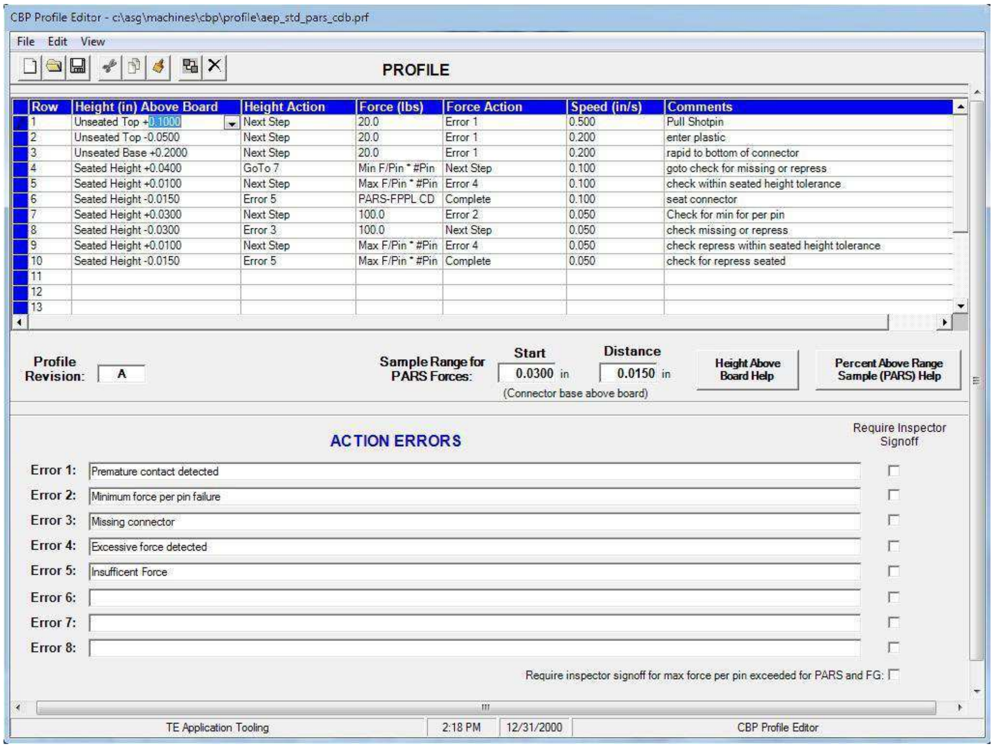


Figure 28

B. Explanation

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. The Height event is checked first so it takes priority in the case that both occur simultaneously. 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 been partially pressed
- pause for a fixed time period before proceeding
- retract the head a small distance to momentarily relieve force before proceeding
- wait for an input state or transition before proceeding
- set an output state or pulse and continue

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 the simplest method of pressing to a single fixed total force 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 seating force that is proportional to the actual pin resisting force detected during the pressing cycle. This is called “**Percent Above Range Sample**”, or **PARS**. In this technique, the connector’s pin resisting force while pressing is sampled and averaged over a distance **R**ange before final seating to the board surface. The final force exerted on the connector is limited to a user-programmed **P**ercent **A**bove the **R**ange **S**ample force. This percent added assures complete seating of the connector against the PCB. This is the most widely used technique because it limits the stress to the assembly, does not require accurate board thickness measurement and automatically adjusts for small variations in connector and PCB thickness.

- **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 plated holes in 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 sudden 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. Note that the angle calculated is dependent on the graph axis scales selected. See “Press Profile” for more detail.

A “standard” profile template 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.

The standard profiles are named “standard_force_CDB”, “standard_pars_CDB”, “standard_HGT” and “standard_FG_CDB”. Example #1 below is the “standard_pars” profile.

C. Entries

“Height” - This defines the next destination of the pressing surface of the tool above the board. The press head will drive down to this height at a speed that is linearly “ramped” from the height and speed of the previous step (see Figure 29).

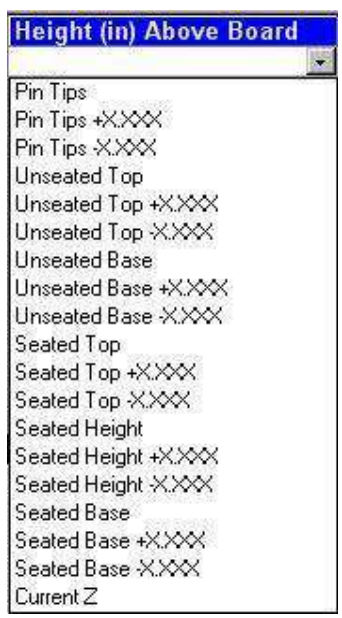


Figure 29

The initial height (before step 1) is defined in the “Board Clearance” section of the “Press Sequence File”. The available variables are shown here. Alternatively, a fixed positive numeric height can be entered. This specifies a height of the tool above the press table top surface, without regard to PCB, connector or fixture thickness.

“Height Action” - This defines the action to be taken when the height at this step is reached as shown in Figure 30.

Actions are selected from the drop down menu. The available actions are:

- **Next Step -** This directs the process to the next step below.

- **Go To -** This directs the process to continue at the specified step. 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 - 5 -** 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.
- **Retract -** This directs the process to stop and retract the head by the specified distance before continuing with the next step below. The retract distance is entered from the keyboard.
- **Delay -** This directs the process to stop the head and dwell for the specified time before continuing with the next step below. The delay interval is entered from the keyboard.
- **Output -** This directs the process to immediately set an output state or pulse and continue with the next step below. Selecting this action opens another window on the screen to allow selecting the user output number and the desired state or pulse to set.
- **Wait Input -** This directs the process to stop the head and wait for an input state or transition. Wait Input can only be used as a Height Action event, and only when the height selected is Current Z. The process will continue with the next step below when the Input condition is satisfied. If the Wait Input times out, then the Force Action specified will occur instead. Selecting this action opens another window on the screen to allow selecting the user input number and the desired state or pulse for which to wait.

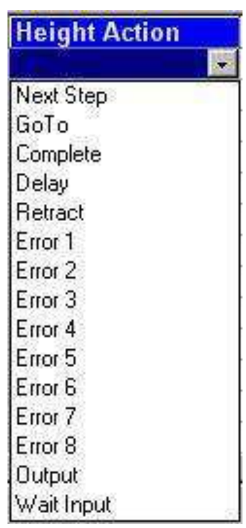


Figure 30

“Force” - This defines the force which will trigger the force action. There are seven variable choices provided on the drop down menu. Alternatively, an actual force in pounds can be entered from the keyboard (see Figure 31).

Figure 31

- **PARS-FPPL xx% -** This is a dynamic press cycle termination based on actual forces generated during the pressing process. Pressing the PARS Help button will produce the picture shown in Figure 32.

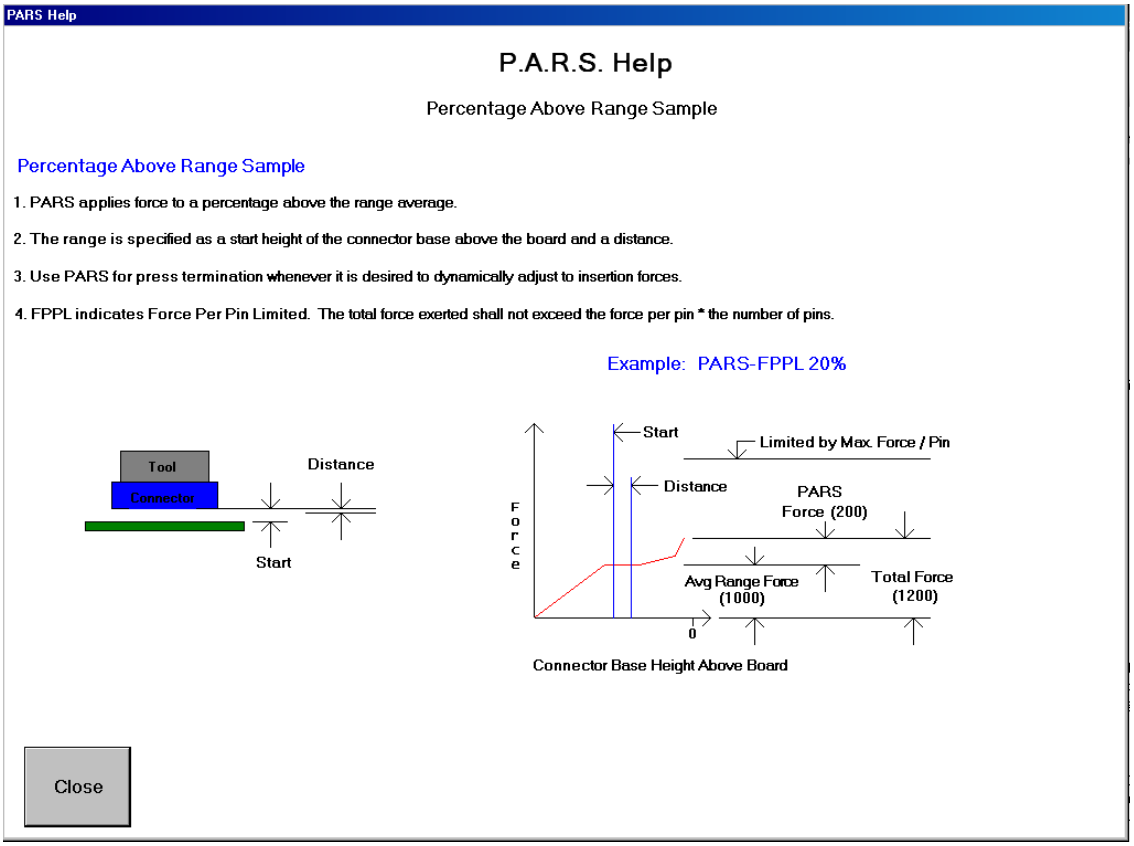


Figure 32

PARS-FPPL is defined as “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 0.40 mm and the “Distance” as 0.20 mm. PARS-FPPL force is invoked in the ‘Force (N)’column, row 4, and 25% is entered. As the connector is pressed, the force readings taken from 0.40 mm to 0.20 mm above the board are averaged. The head continues to press until the force generated is 25% higher than this average. Note that if the force exceeds 125% of the average before the PARS-FPPL line (row 4 in this example) is reached, the press will stop at the higher % value attained when row 4 is reached. The “FPPL” feature means that the press will always stop on error if Max FPP (specified in the Connector Editor) is exceeded before the specified PARS value is reached.

- **PARS-FPPL CDB -** Same as above except the percent value is obtained from the connector database entry for this connector type.

  - **Force Grad x° -** This technique monitors the rate of change of force to distance. This method is used for robust components that need to be seated firmly. Generally, the force vs. distance plot will make a sudden steep upturn as the component contacts the mating surface. The component stops moving so the force rises quickly. A minimum angle is specified for the upturn, which corresponds to how solidly the component is pressed. Note that the angle calculated is dependent on the graph scaling.

  - **Force Grad CDB -** Same as above except percent value is obtained from the connector database entry for this connector type.

● **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 data base. 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 data base. 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 33).

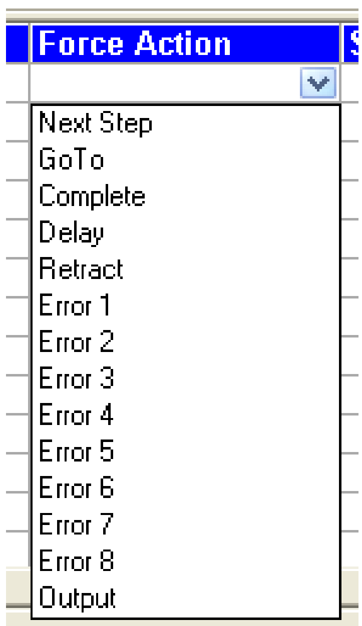


Figure 33

● **Next Step -** This directs the process to the next step below.

● **Go To -** This directs the process to continue at the step specified. 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. The speed starts at "Run Speed" as entered in the "Servo Parameters" editor, and changes ("ramps") linearly down to the speed given in step 1. When step 1 Height is reached, the speed then ramps to the speed given in the next step processed. This will generally be step 2, but not if a "Go To" was programmed as an action (see Figure 34).

Typical speeds range from 8 mm/second during approach, down to 1 mm/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.

Speed (in/s)
0.300
0.150

Figure 34

"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.

"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 0.50 mm (see Figure 35).

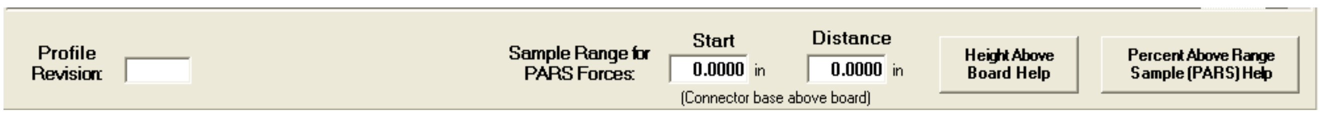


Figure 35

"Distance" - This is the distance over which force readings are averaged for PARS use. A typical number is 0.20 mm. 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.

"PARS Help" - A text and graphic help screen shown above 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", "Excessive Force" or "Missing Connector".

Saving The File - Press "File", "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.

Example

Example: Pressing with PARS (Figure 36)

Height (mm) Above Board	Height Action	Force (N)	Force Action	Speed (mm/s)	Comments
Unseated Tool Top +.750	Next Step	250.0	Error 1	7.000	move to tool top
Seated Height +1.000	Goto 5	Min F/Pin * #Pins	Next Step	5.000	test missing or r
Seated Height +.250	Next Step	Max F/Pin * #Pins	Error 4	5.000	test within seat
Seated Height -.500	Error 2	PARS-FPPL CDB	Complete	2.000	seat connector
Seated Height +.900	Next Step	250.0	Error 5	2.000	check for min fo
Seated Height -.500	Error 3	250.0	Next Step	2.000	test missing
Seated Height +.250	Next Step	Max F/Pin * #Pins	Error 4	2.000	test repress with
Seated Height -.508	Error 2	Max F/Pin * #Pins	Complete	2.000	seat repress

Profile Revision: Sample Range for PARS Forces: Start 0.800 Distance 0.4 (Connector base above board) Percent Above Range Sample (PARS) Help

Figure 36

The screen capture shown in Figure 36 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 0.75 mm above the unseated top of tool. The speed will ramp linearly from the press “Run Speed” down to 7 mm per second. When the height is reached, the sequence will continue on the next step. If more than 250 newtons are detected before the height is reached, terminate and display error #1, typically “Premature contact detected”.
2. Continue to move down until the connector is 1.0 mm above its seated height. The speed is reduced to 5 mm/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 (MinFPP), the process continues on the next line. If not, the process continues on line 5 to attempt a repress of a previously pressed (full or partial press) connector.
3. Press until the connector is within 0.25 mm of the desired seated height. When this position is reached, the connector will be within a generally accepted tolerance of seated height. The 0.25 mm can be adjusted as needed for specific circumstances. If the force exceeds the maximum force per pin (MaxFPP) before the height is reached, an error message is displayed.
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 region average force plus an additional percentage specified in the connector database. 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 (on the correct connector) 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. Note that a PARS line also monitors for MaxFPP. If MaxFPP is exceeded before reaching the PARS force, then pressing will stop with an “excess force” error. The speed will linearly slow to 2 mm/second by the target height.
5. This step is only reached by the “GO TO” Height Action from Step 2. It tests for a connector that simply failed to reach MinFPP by the appropriate height, by checking for 250 Newtons force detected within 0.1 mm below the MinFPP minimum height from Step 2. The speed will linearly slow to 2 mm/second by the target height (see Figure 37).

PARS Screen Plot (Typ)

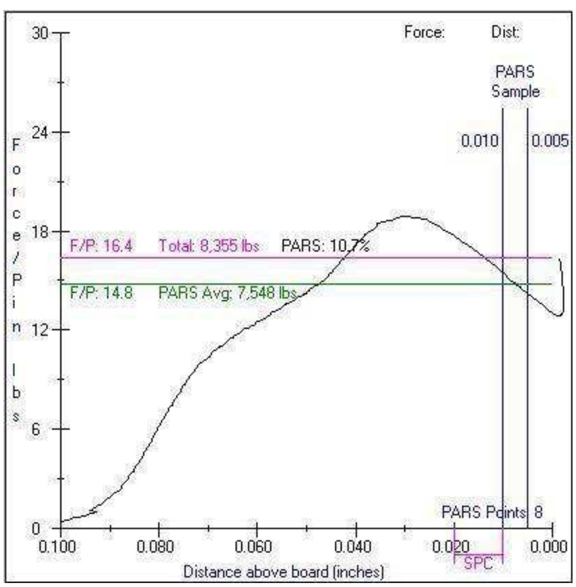


Figure 37

6. This step checks for a missing connector if 250 Newtons force is not detected, even below the lowest seated height. As soon as this level of force is detected, the process continues on the next line.

7. This line verifies the connector is pressed to within generally accepted height tolerance, and the maximum force per pin is not exceeded.
8. 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” instead of MaxFPP, if a lower repress force is desired. Final seating of a repress is generally done to a target force because the initial position of a repress cannot be known. PARS termination cannot be used for a repress since there often is no “pin penetration” force region to sample when the connector has previously been partially pressed. While Force Gradient termination could be used with very rigid connectors and PCB’s (after reaching some minimum seating height and force), most connector represses apply MaxFPP.

8.4. Press Sequence Editor

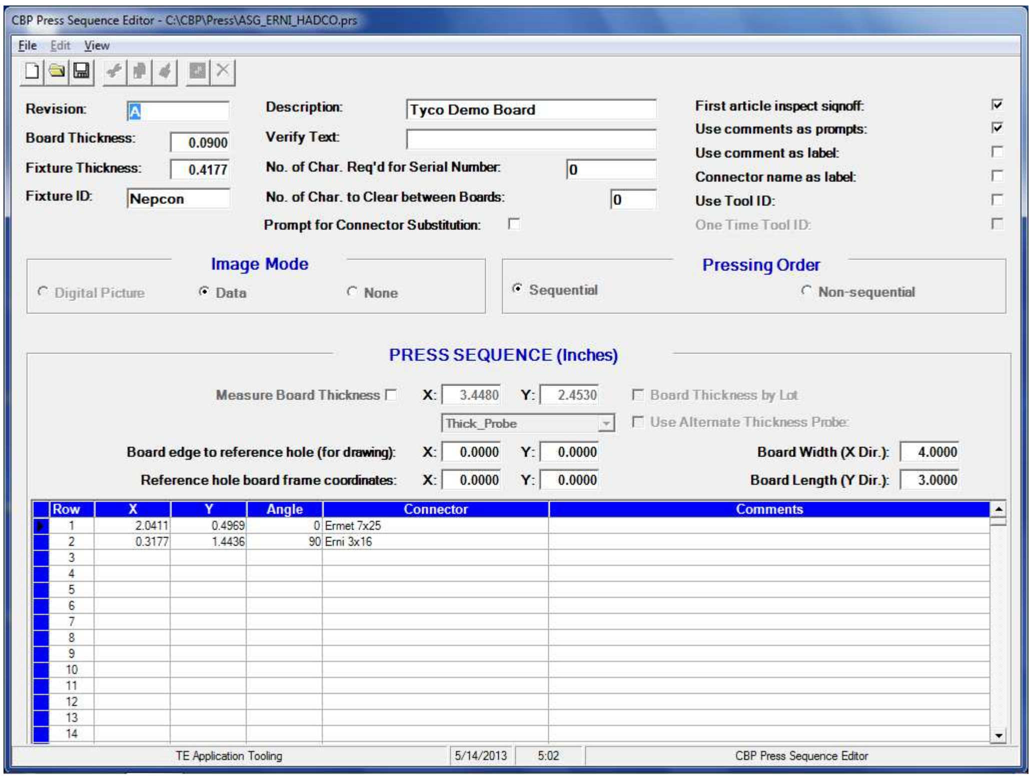


Figure 38

A. Purpose

The Press Sequence Editor is used to enter and store the data about the board including board physical characteristics and connector locations. All connectors to be used on the board being programmed must be defined in the connector database before the press data file can be generated.

The file is ASCII format with a .prs extent. When generating a new press program, it may be convenient in some cases to open an existing press file and do a “Save As” to the new program name.

B. Entries

NOTE
Not all entries described are applicable to every type of press.

“Revision” - This is the revision level of the board to be pressed, or alternatively the revision of the Press Sequence program. It is used as reference in this file only.

"Board Clearance" – On multi-axis automated presses, this is the required minimum height of the press top tool above the PCB when moving.

CAUTION
If this is not set greater than the height above the PCB of the tallest component, the tool may make contact with components on the PCB and damage the component, PCB, tool and/or machine.

"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 instead.

"Fixture Thickness" - This is the thickness of the fixture or "platen" that supports the board. It must be accurately measured in order for press to height to be accurate.

"Fixture ID" – This feature is intended to verify that the correct fixture (support platen) is used with the PCB. If text is entered in this cell, the operator will be prompted to use this fixture upon entering Run mode. If the text entered begins with "**%F:**", then the operator will instead be prompted to enter the fixture identification string. The text entered by the operator must exactly match the text that follows the colon ('**:**'). In addition to this entry format ('**%F:***string*'), the fixture ID text can be extracted from a longer text string, such as from a barcode scan entry that contains additional information. The fixture ID parsing format to accomplish this is '**%F***start***,***length***:***string*', where *start* is the first character position in the entry (barcode) string to use, *length* is the number of characters to use (or to the end of string if shorter) and *string* is the text string to match exactly.

"Description" - This is a general description of the board to be pressed. It is used as reference in this file only.

"Verify Text" – This feature is intended to verify that the correct board type is used with its associated press sequence program (recipe). If text is entered in this cell, board identification (type, name, model, recipe name, etc.) matching this text will be required on first entering the run screen, and each time a new board is started. Any text string can be used (numbers, letters and most printable characters are allowed). Ideally, a bar code label will be available to scan. The text can also be entered manually. The text entered at the runtime prompt must *exactly* match the string entered here.

When using bar code scanning to enter the Verify Text string, the desired product identification string (product code, for example) may be embedded within a longer bar code string that contains other information. To handle this case, a parsing string may be used instead. A Verify Text parsing string begins with the characters "**%V**" or "**%S**". The required format is [**%V***start***,***length***:***string*], where *start* is the first character position in the barcode string to use, *length* is the number of characters to use (or to the end of string if shorter) and *string* is the text string to match exactly.

Verify Text Parsing Example1: A barcode will be scanned each time that contains the factory order number, product code and work station identifier. We want to verify the product code is correct for the program loaded. The barcode string to be read is 'FO123456_ProductA_Staion123', so the verify text parsing format entered is '%V10,8:ProductA'. The text extracted from the barcode will then be 'ProductA'. In this example, *start* = 10 ('P' is 10th character), *length* = 8 (extract 8 characters) and *string* = 'ProductA'. If the 10th-17th characters of the barcode are not "ProductA", then a Verify Text error will occur. The operator will have to either obtain the correct product to process, or load the correct program for the current product he is attempting to process.

In the example above, the barcode containing the string to match ('ProductA') also contained the serial number. When this is the case and the PCB serial number is also required, enter "%S" instead of "%V" in the Verify Text parsing string above. This tells the press to extract the verify text string from the text string entered (scanned) at the serial number entry prompt. Both Verify Text validation and serial number entry are accomplished with a single barcode scan.

Verify Text Parsing Example2: In this example, a barcode will be scanned from each PCB to be processed. This barcode also contains the PCB serial number, which we also want to enter (see "No. of Char. Req'd for Serial Number" entry below). When this is the case, we use a **%S***start***,***length***:***string* in the Verify Text parsing string. There will be no separate prompt for board verification displayed, only the prompt to enter the serial number. The barcode to read in this example is 'ProductA_SN123456_Week26', so the Verify Text string would be '%S1,8:ProductA', where *start* = 1 ('P' is 1st character), *length* = 8 (extract 8 characters) and *string* = 'ProductA'. If the first 8 characters of the barcode are not "ProductA", then a Verify Text error will occur. The operator will have to either obtain the correct PCB to process, or load the correct program for the current PCB he is attempting to process. If the first 8 characters are a match, then the serial number will be parsed from this same text entry according to the parsing specification in "No. of Char. Req'd for Serial Number" entry (see below).

"No. of Char. Req'd for Serial Number" – The serial number of the board, if entered, is stored with the raw pressing data in a file on the computer hard drive. If the connectors are pressed sequentially, the forces for each connector press will be stored with the serial number, X-Y coordinates and other data.

This feature accepts three types of numeric values for the number of serial number characters required entry.

- A zero value means no prompt will be given for a serial number.
- A positive number (50 or less) means *exactly* that number of characters is required for a valid serial number. A negative number means *at least* that number of characters is required. Bar code scanning is the preferred method of data entry.
- A negative number means *at least* that number of characters is required. Bar code scanning is the preferred method of data entry.

When using bar code scanning to enter the PCB serial number, the serial number may be embedded within a longer bar code string. To handle this case, a parsing string may be entered instead of a number. A serial number parsing string always begins with the characters "%S". The required format is [%Sstart,length:number], where start is the first character position in the barcode string to use, length is the number of characters to use (or to end of string if shorter) and number is the number of characters required (as described above).

Serial Number Parsing Example: If the barcode string to be scanned is 'ProductA_SN123456_Week26' and the serial number parsing format entered is '%S12,6:-4', then the serial number extracted from the barcode is '123456'. In this example *start* = 12 ('1' is 12th character), *length* = 6 (extract 6 characters) and *number* = -4 (*at least* 4 characters required for valid S/N).

"No. of Char. To Clear Between Boards" – This feature is used in conjunction with the serial number entry above. If the number entered is 1 -20, the program will clear this number of characters from the end of the previous serial number entered. The operator need only type in (or scan) this many characters at the end of a longer serial number. If '0' is entered, then no characters will be cleared at the end of the previously entered serial number – so the operator **must** edit the previous serial number. If the value entered is less than 0 (any negative number), then all characters will be cleared each time. This is generally used when manual serial number entry (from the keyboard) of sequential serial numbers is employed.

"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. Their selection will drive the tool and profile selected for pressing that connector.

Thus, it is possible to press an alternate connector that requires a different tool and different profile than the primary connector. The alternates are associated with each other by "substitution codes" that are defined in the connector database. The associated connectors are individually entered into the database, but they are "linked" by a common substitution code. See the connector editor for details on entering connector substitution codes.

“First Article Signoff” – When this feature is checked, inspector approval is required after the first board is completed. The pressing process cannot continue until inspector signoff. Inspector approval is required from a *different person* than the one currently logged in, unless the current operator has administrator status. Only operators given Inspector access privileges (includes all users with administrator status) can perform signoffs.

“Use Comments as Prompts” – When this feature is checked, the operator will be prompted for each connector position. The text entered in the Comment column for that connector will be displayed as the prompt message.

“Use Comment as Label” – When this feature is checked, the text entered in the Comment column for each connector position will be displayed with the sequence number on each connector in the runtime PCB drawing.

“Connector Name as Label” – When this feature is checked, each connector’s Name text (from the connector database) will be displayed with the sequence number on each connector in the runtime PCB drawing. This option takes priority over the “Use Comments as Label” option.

“Use Tool ID” – If this feature is checked, the operator will be prompted to enter the tool identification number on first entering the run screen and each time a tool change is encountered. The tool ID is the alphanumeric identification listed in the tool database. The ID can be entered manually, or by scanning a bar code mounted on the tool. This entry does not support parsing of the tool ID from a longer string.

“One Time Tool ID” – When this feature is checked, the operator will only be prompted to enter tool ID’s when processing the first board. This verifies that the operator has the correct tools necessary for processing the board. This option is only available when “Use Tool ID” is checked.

“Image Mode” – The image mode determines the type of board display shown during runtime.

● Digital Picture – This option uses a bitmap picture from a digital camera or scan of a photograph to show the board being pressed. Instead of entering connector position and angle information into a spreadsheet, a visualeditor is used. The Sequential mode pressing sequence is established by picking connectors from the database and placing them on the digital picture in the desired order.

● Data Image – This option creates an image from the X, Y, angle, and connector data to display at runtime. Information is entered into the Press Sequence spreadsheet. The Sequential mode pressing sequence follows the order of the connectors in the spreadsheet.

● None – This option is only allowed when “Non-sequential” pressing order is selected. No image of the PCB is displayed on the screen in Run mode. Instead, a list of the connectors on the PCB is displayed along with their associated tools. Instead of using the “GoTo” runtime function, the next connector to press is chosen by clicking on the list. This option may be useful when performing PCB repair operations.

“Pressing Order” – The mode chosen determines if the pressing sequence follows the order of the connectors entered or is determined by the operator at runtime.

● Sequential – The pressing sequence follows the order of the connectors in the Press Sequence spreadsheet or entered in the Digital Picture visual editor screen.

● Non-Sequential – The operator must select the next connector to press at runtime. In Digital Picture or Data Image mode, this is done with the “GoTo” runtime function. When Image Mode is “None”, the operator chooses the connector type to press from a list. The press will press this same connector each time until the operator chooses another one. This mode is often used for PCB repair activity.

C. Press Sequence

“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 thickness by Lot” - The check box calls for measuring board thickness only once for the current manufacturer's board type within the present production run. A "Lot" is defined as a number of identical PCBs used in a current production run. Selecting a board program (recipe) - even the current one - marks the end of a lot.

“Board Edge to Reference Hole” - This entry is used by the program to properly locate and display the connectors on the board. It is the nominal distance from edge of the board, in the X & Y directions, to the board’s datum. The datum is the point on the board from which the X & Y locations (entered as explained below) of the connectors are defined. In other words, it is the (0,0) for the array of connectors. The datum can be any convenient point, and is usually either a tooling hole or the board edge.

Remember that the X direction is always defined as left to right with the board in normal orientation in the press. For manually positioned presses, this dimension is only used for drawing the board.

“Reference Hole Board Frame Coordinate” - This is the distance from the datum (0, 0) of the board which locates the connectors (as explained immediately above) to the *datum hole* in the board. The *datum hole* mates with a pin in the fixture (platen) which locates the board on the fixture. It is generally one of the board’s tooling holes, but could be any hole chosen to physically locate the board. For manually positioned presses, this dimension is only used for drawing the board.

“Board Width” - This is the dimension of the board in the X axis direction (left to right) as normally positioned in the machine. It may or may not be the smaller board dimension. For manually positioned presses, this dimension is only used for drawing the board.

“Board Length” - This is the dimension of the board in the Y axis direction (front to back) as normally positioned in the machine. It may or may not be the larger board dimension. For manually positioned presses, this dimension is only used for drawing the board.

“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. This is generally the centroid of the connector, but in some cases it is not. For manually positioned presses, these entries are only used for drawing the board.

“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 with zero degrees to the right. The positive 90 degree position is ¼ turn counter clockwise as viewed from the top. The connector “pointer” for angles is the polarized end if defined. For manually positioned presses, this dimension is only used for drawing the board.

“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 movements. Connectors of one type should be pressed before proceeding to the next to minimize tool changes.

“Comments” - User defined comment for future reference and reminder. These may be used as the text of user prompts for each connector and/or overlaid on the runtime PCB image to identify each connector.

8.5. SensiPress Optimization

A. Introduction

As the industry moves to high-performance connectors with higher pin densities and smaller pin tails, the ability to detect bent pins at the early stage of the pressing cycle is becoming more challenging. The high sensitivity measurement capabilities of SensiPress technology enables TE Connector press fit machines to more accurately measure press force and halt the seating cycle if it detects early contact with the tool, which may indicate that one or more pins are bent or out of alignment. TE Connectivity enhanced the detection of bent pins in connector press fit applications by reducing mechanical noise, thereby increasing accuracy, reducing scrap and simplifying troubleshooting and maintenance.

B. How it Works

The machine works by following a profile (series of steps) and analyzing the force and position data to determine the action at the end of each step. Each step has a force and height target. As it is moving to the target height it monitors the force. If the target force value is achieved before the target height is reached, the force action is taken. If the height is reached the height action is taken. Anomalies in the process are detected by having a step in the profile that looks for a given force in a specific height range.

The bent pin detection works the same way. It detects bent pins (or improperly pre-seated connectors) by looking for a low force value at a height range that is just above where the anvil normally makes contact with the tool and begins to build force. There is no new or special analysis associated with SensiPress. The addition of SensiPress has improved error detection by allowing the use of a much smaller force value (previously 50-100lbs, now 2-5lbs). That enables the detection of fewer and smaller bent or stubbing pins.

C. Bent Pin Error Detection

Machines will detect an error when force is detected in the “Early Contact Detection Zone”. With SensiPress Technology we are now able to detect early contact forces in the 2 - 5lbf (see Figure 39).

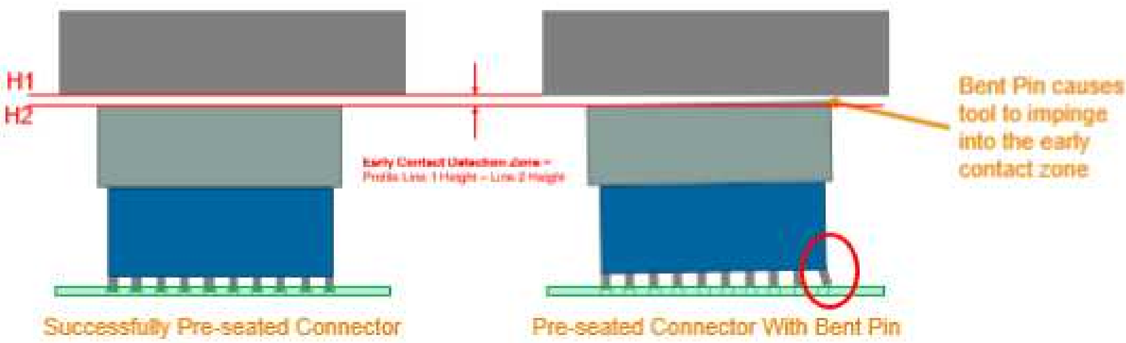


Figure 39

If the pin is bent too much, it will not generate force in the early contact detection zone and therefore will not be detected as an error. In cases like this, the overall difference in force will be well within the normal variation of the pressing process. Therefore, it will be undetectable with typical force analysis regardless of the sensitivity or accuracy (reference Figure 40).

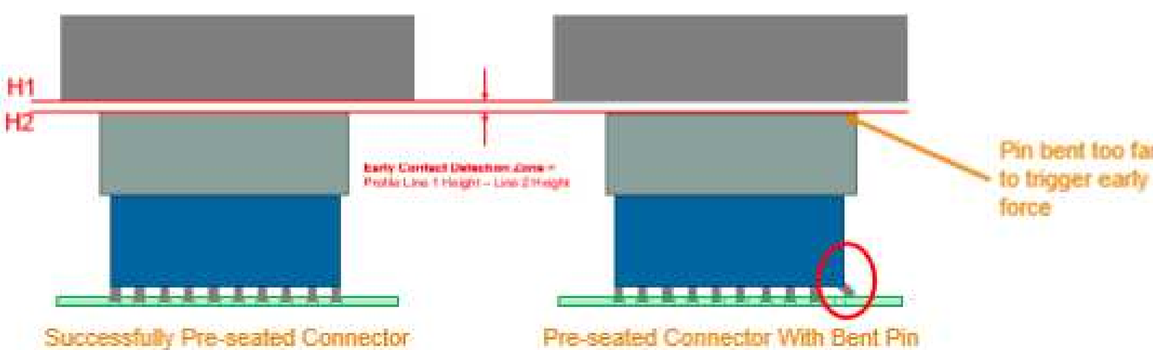
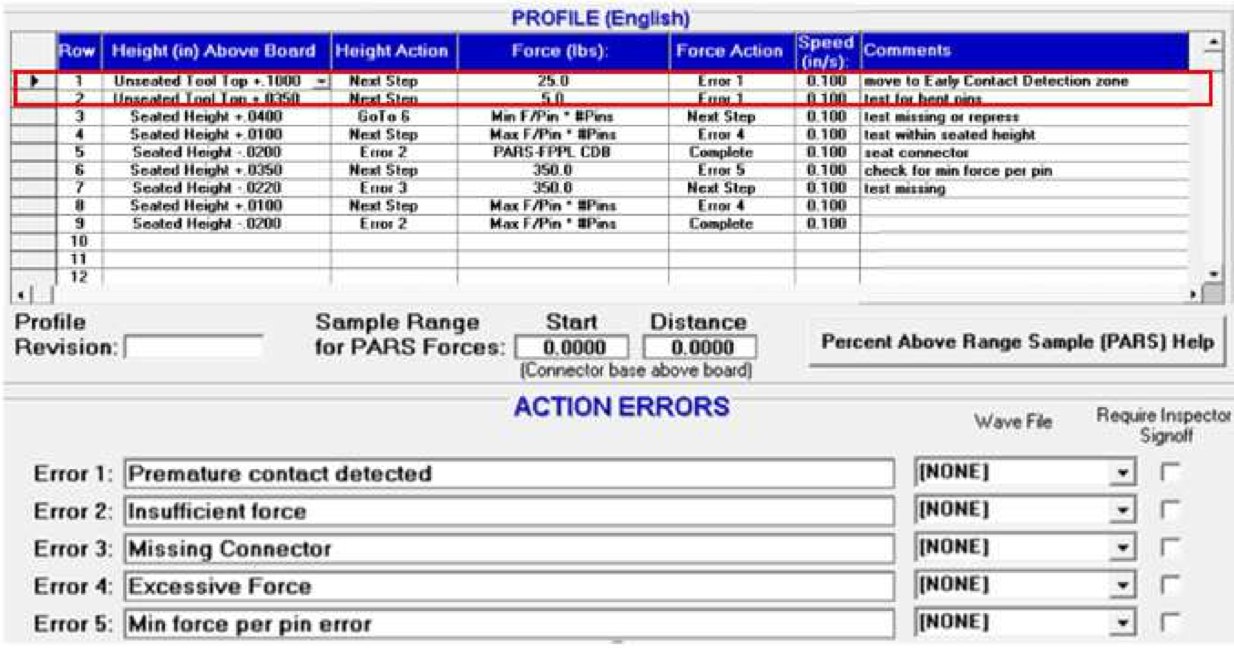


Figure 40

D. Profile Set Up (reference Figure 41)

1. Add Line 1 to the current connector Profile. The force for this line can be 25-50 lbs.
2. Make sure that Line 1 Unseated Tool Top +.xxxx value is at least .0500 greater than the Tool Clearance height (in Tool Editor).
3. Adjust Line 2 so that it can detect a bent pin very close to the unseated tool top. Use press data from good terminations to tune this value.


PROFILE (English)

Row	Height (in) Above Board	Height Action	Force (lbs):	Force Action	Speed (in/s):	Comments
1	Unseated Tool Top +.1000	Next Step	25.0	Error 1	0.100	move to Early Contact Detection zone
2	Unseated Tool Top +.0350	Next Step	5.0	Error 1	0.100	test for bent pins
3	Seated Height +.0400	GoTo 6	Min F/Pin * #Pins	Next Step	0.100	test missing or repress
4	Seated Height +.0100	Next Step	Max F/Pin * #Pins	Error 4	0.100	test within seated height
5	Seated Height -.0200	Error 2	PARS-FPPL CDB	Complete	0.100	seat connector
6	Seated Height +.0350	Next Step	350.0	Error 5	0.100	check for min force per pin
7	Seated Height -.0220	Error 3	350.0	Next Step	0.100	test missing
8	Seated Height +.0100	Next Step	Max F/Pin * #Pins	Error 4	0.100	
9	Seated Height -.0200	Error 2	Max F/Pin * #Pins	Complete	0.100	
10						
11						
12						

Figure 41

4. Line 1 and 2 determine the “Early Contact Detection Zone” .1-.035 gives us a range of .065” in which we are looking for an early contact force of 5 lbs. (as specified in line 2)

   The force in Line 2 can be adjusted to detect a bent pin. The CMP 5T can use an early detection force setting of as low as 1 lbf. However, it is recommended to start with 5 lbs. and adjust lower if needed.

E. No Bent Pin (reference Figure 42)

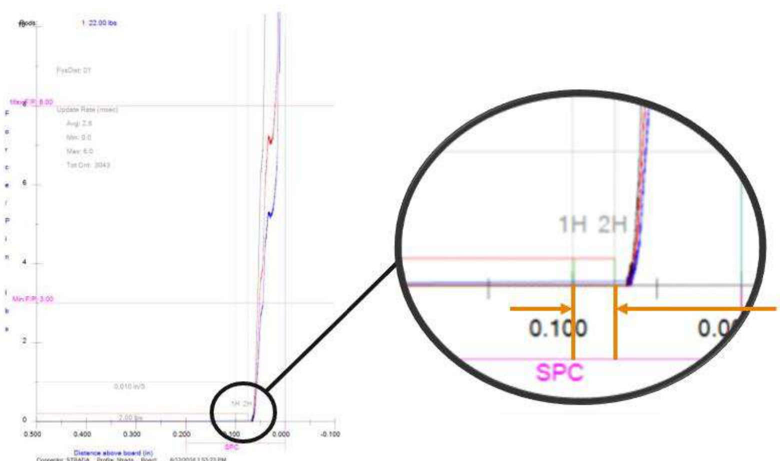


Figure 42

Adjust “Unseated top Tool + x.xxx” dimensions in Line 1 and Line 2 as needed to set the early contact zone to defect force just before the curve starts. A few test presses with no bent pins may be needed to tune the profile correctly.

F. Bent Pin Press

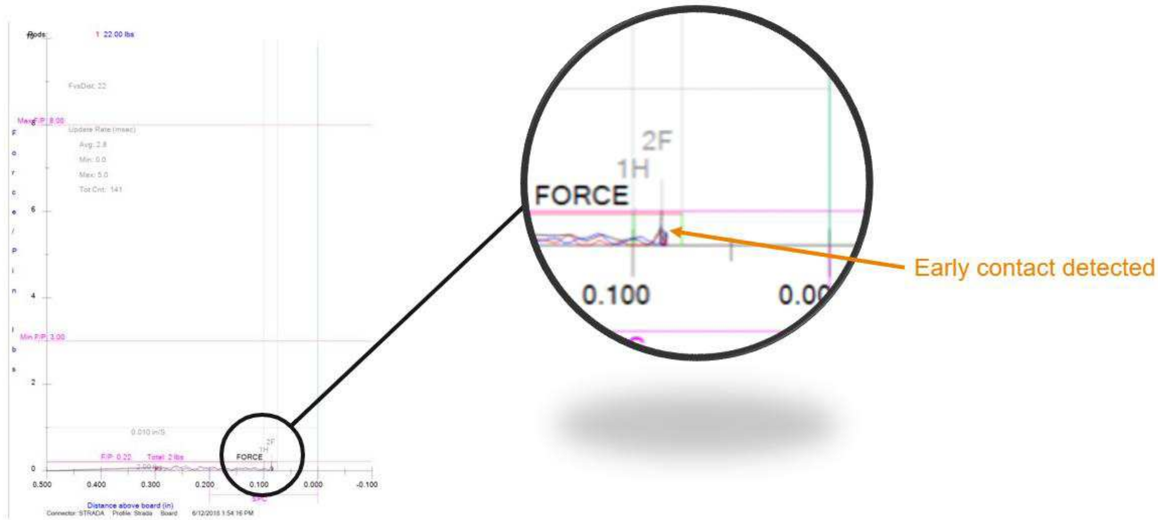


Figure 43

G. Profile Optimization

For best performance:

- It may be necessary to tailor a profile for each connector or family of connectors.
- The speed should not be changed between step 1 and 2. The inertia of the anvil can induce a force on the load cells during acceleration which could trigger a false early contact error.
- Speed can influence performance. Generally, slower speeds yield better performance.

H. Other Factors

- Because the bent pin detection is reliant on looking for a very small force in a narrow height range, anything that can have an impact on the overall stack height will influence reliability and functionality. Therefore, customers will want to eliminate sources of variation as much as possible.

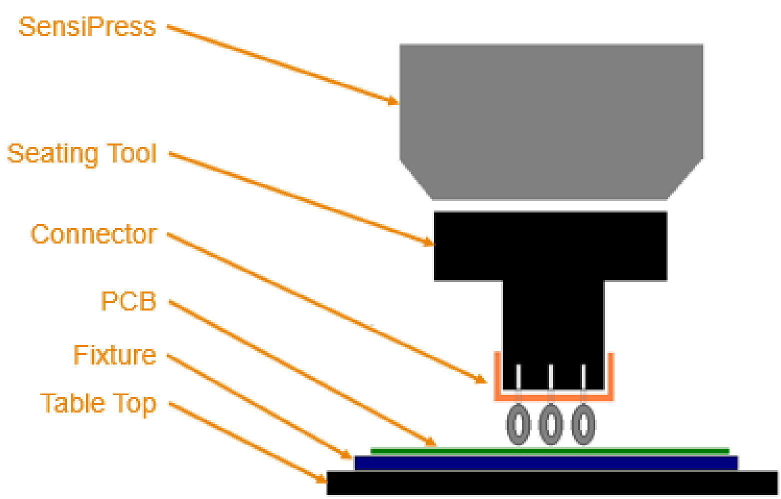


Figure 44

- Board & Fixture Flatness
  Any curvature in either the PCB or fixture will affect the height at which the pressing force begins. Curvature and variation in curvature will make it difficult to evaluate for bent pins. It can lead to both false positives and false negatives. The resolution is to raise the detection force or increase the H2 detection height which will limit the ability to detect bent pins.

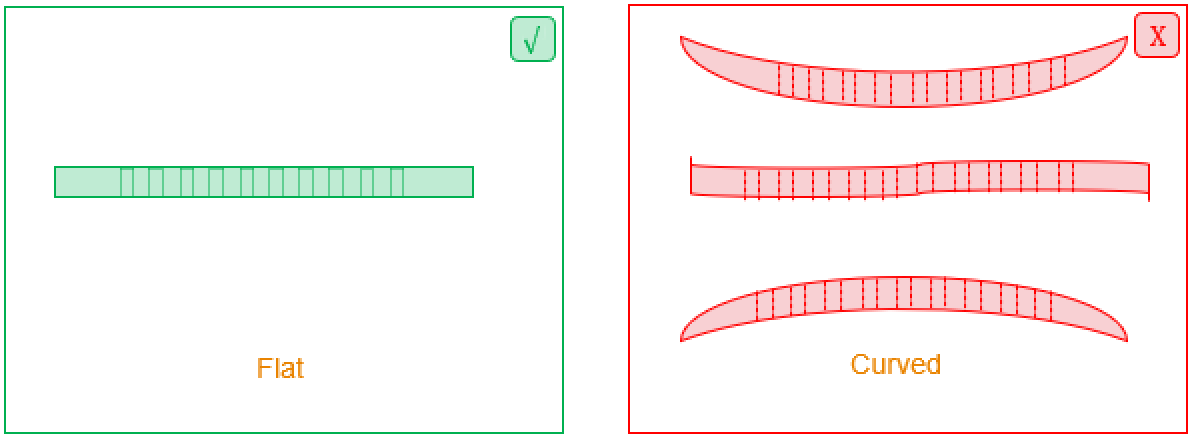


Figure 45

- Board Thickness Tolerance
  For optimal performance, PCB thickness variation should be minimal. If too large, the performance would be inconsistent. If excessive PCB thickness variation is a potential, use the Measure Board Thickness option in the press data editor to verify the thickness of the PCB.

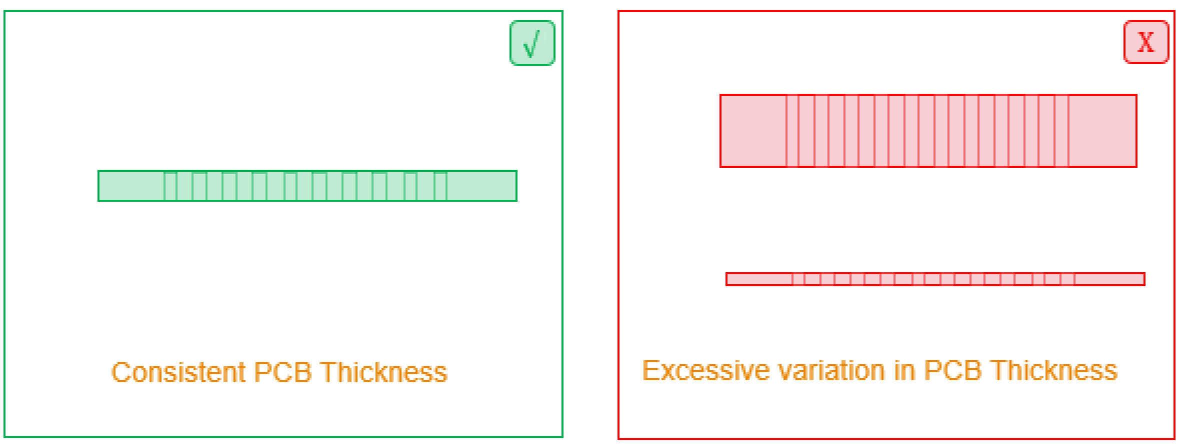


Figure 46

I. Tooling and Fixture Match Up

It is not recommended to use seating tools and fixtures interchangeably. If the customer has multiple copies of the same tool or fixture, it is recommended to dedicate the tooling combination to a specific machine and tune the profile on that machine to match the tooling.

An alternative option would be to apply a unique ID to each tool and fixture and then use the tool ID and Fixture ID fields in the software to verify that the correct tooling is used. They would have to create programs for every potential combination of tooling. Naturally, this could become complicated if there are numerous copies of the same tooling.

If neither of these options work, the alternative is to adjust the profile to be more tolerant of the variation which will make it less likely to detect bent pins.

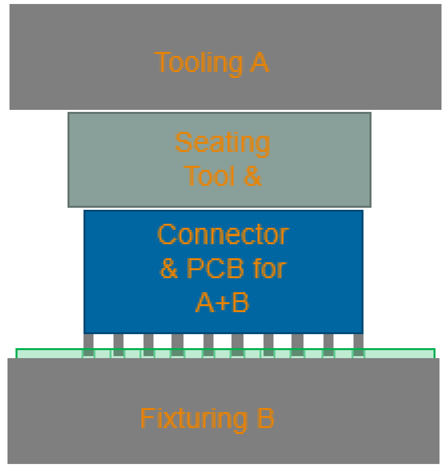


Figure 47

9. MAINTENANCE UTILITIES

The press software provides maintenance utilities as described below.

9.1. Joystick

The Joystick screen (shown in Figure 48) is used for servo setup, maintenance and troubleshooting purposes. The upper left quadrant of the screen provides information on the status of the servo system from the amplifier drive. The Servo Params button provides access to a screen for viewing/editing low level servo control parameters. The Speed control allows setting the servo movement speed in Joystick mode by either typing a number into the box or dragging the slider.

The upper right quadrant provides the Joystick controls for manually operating the servo axis. The Power button toggles the main power to the amplifier On/Off through the safety circuits. The Servo button toggles motor power On/Off at the amplifier (Amplifier Enable). The Home button initiates a sequence to initialize the motor position. Search Limits initiates a sequence to find the limit switch positions and set the upper and lower motion limits to an appropriate distance from the switch positions. Z+ and Z- buttons cause the head to move up or down. The Inc./Jog button toggles between Increment and Jog mode. In Increment mode, pressing a Z button initiates a single move of “Step” distance. In Jog mode, the head continues to move until the Z button is released, or the motion limit is reached.

The lower portion of the screen shows both total machine force and individual load cell forces in force units and as bar graphs. It also shows the individual digital input count (inc.) from each load cell. A small variation due to electrical “noise” (less than +/- 0.2% of full scale) in these readings is normal. The Max Force slider sets the desired force limit for Joystick operation. When the total force approaches this limit, the force bar graphs change to a yellow color. When the limit is exceeded, the bar graphs turn red and further downward motion is inhibited. When operating near the desired force limit, caution should be exercised. Further downward moves should be done in very small steps and/or at very slow speeds. Rapid downward travel into a rigid load may generate forces well in excess of the set limit before the motion can be halted.

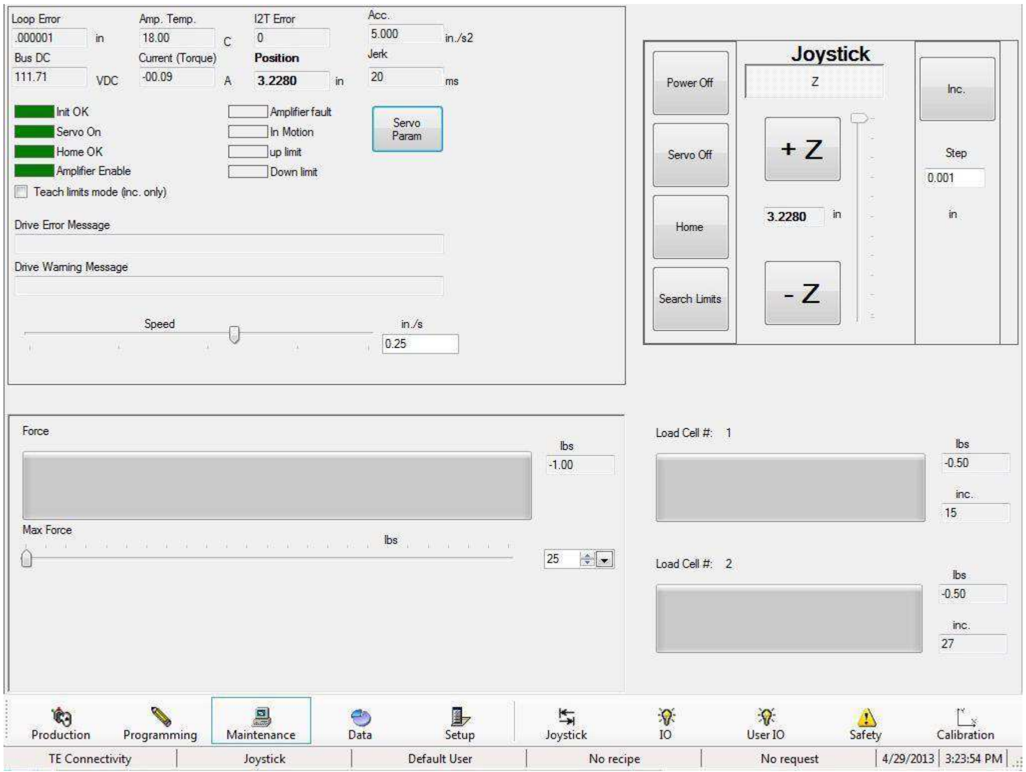


Figure 48

9.2. IO (Input/Output)

The IO (Input/Output) screen (shown in Figure 49) is provided for diagnostic purposes. All standard non-safety machine inputs are shown on the left side of the screen. A green indicator icon signals an "on" condition for the given input. All standard machine outputs are shown on the right half of the screen. Clicking on an output icon will toggle the corresponding output on/off. A green icon indicates the output is currently in the "on" state.

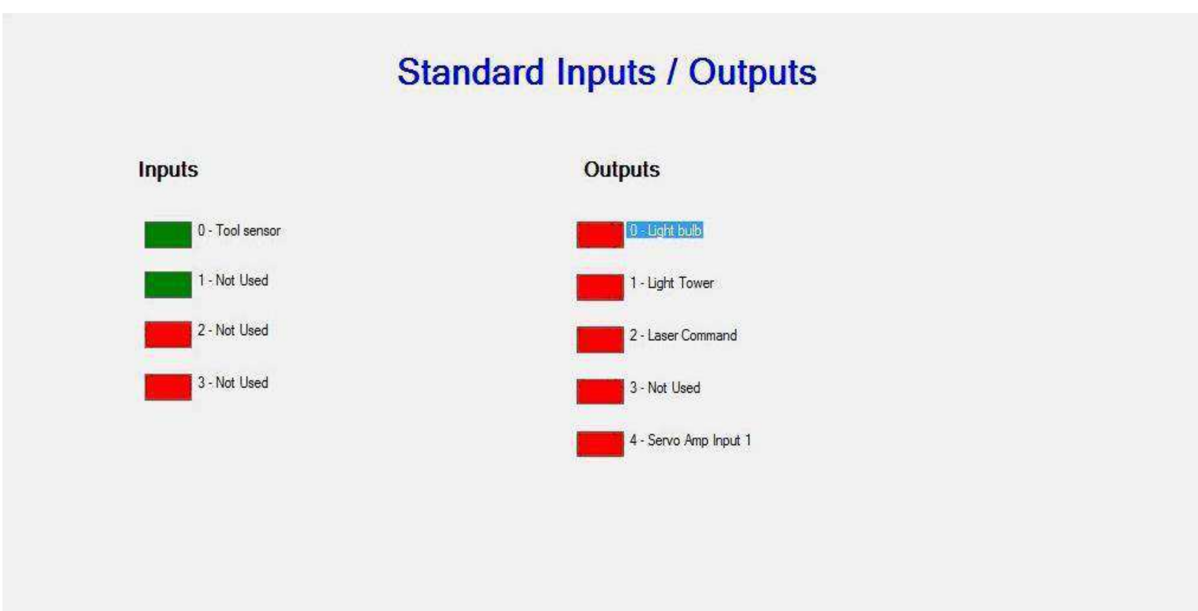


Figure 49

9.3. User IO

The User IO screen (shown in Figure 50) displays the on/off status of optional (for custom applications) user-defined inputs and outputs.

Figure 50

9.4. Safety

The Safety screen (shown in Figure 51) shows the status of the safety module inputs as well as the main power contactor output. Clicking the output icon will toggle the output state on/off. All of the safety inputs must be in allowed states before the main power output can be switched on. A green icon indicates an “ON” state, while a red icon indicates “OFF”.

Figure 51

9.5. Calibration

The Calibration screen (shown in Figure 52) allows access to the optional automatic load cell (force) calibration function as well as showing information on the most recent calibration performed. A Tare Machine button allows manually zeroing the load cell readings to compensate for normal drift in the readings. This is normally done automatically at the beginning of each pressing cycle, but a manual method is useful during maintenance activities. Refer to the documentation provided with the Automatic Calibration (ACAL) option for instructions on performing this function. TE also offers a load cell calibration service.

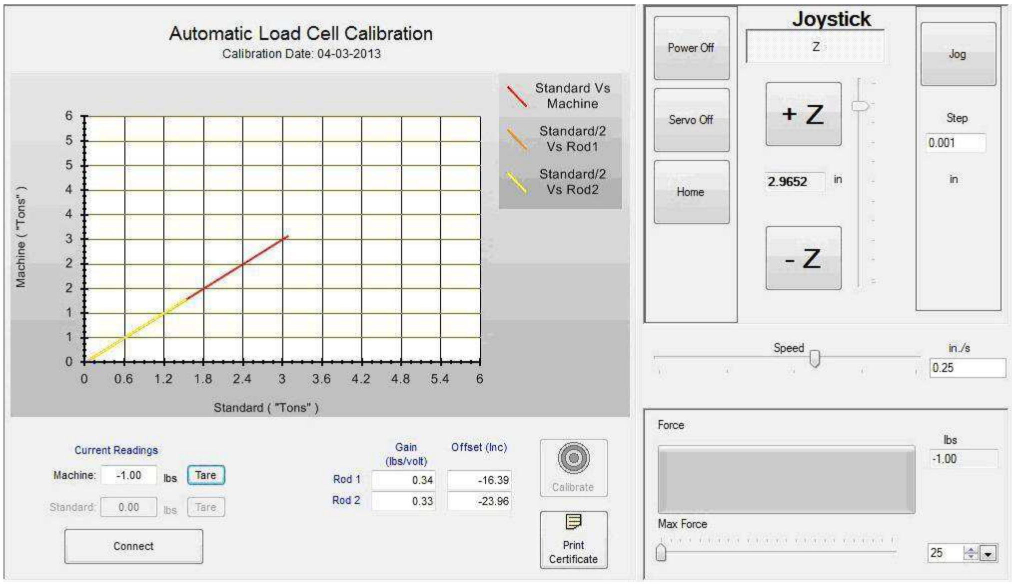


Figure 52

10. DATA UTILITIES

Figure 53

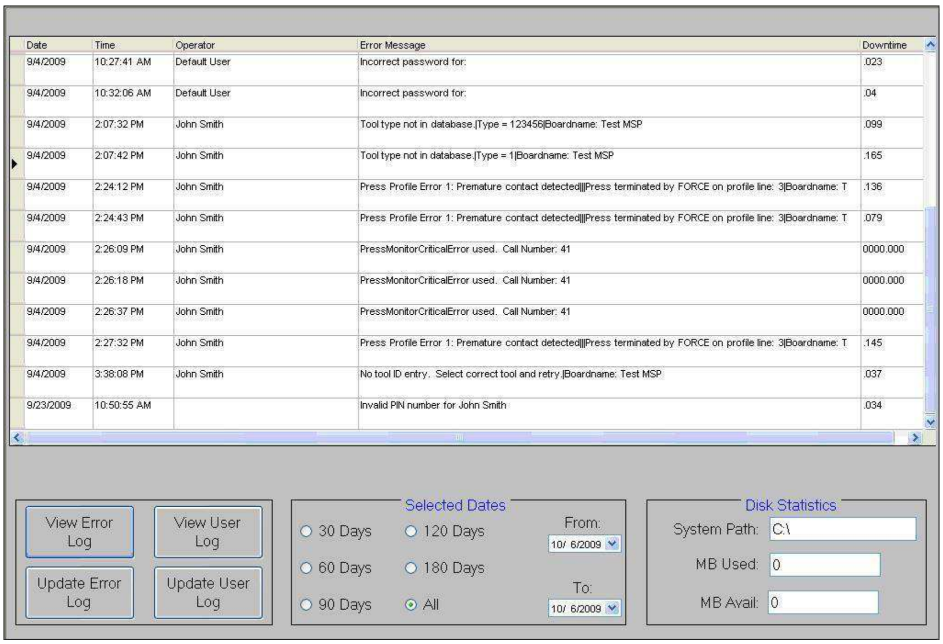
10.1. Machine Logs

The Logs screen (Figure 54) allows viewing and maintaining the error and user logs. Data covering Selected Dates can be viewed, or All data can be chosen. Each log can be purged by selecting the data period that you would like to save, then pressing Update Error Log or Update User Log. For example, to delete all except the last 60 days of error data, select "60 Days", then press Update Error Log. Also see the Machine Utilization section for related data.

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, and duration of error condition. Program startup is also captured. By reviewing the log, machine operation can be evaluated on a detailed level.

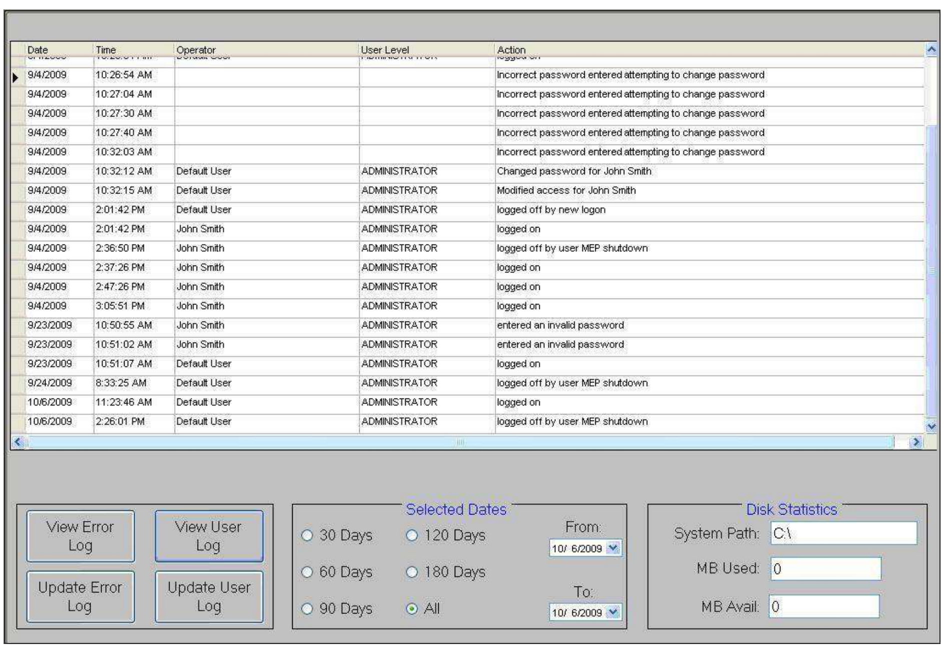
The user log is automatically appended every time there is a log in or out event.

Error Log



Date	Time	Operator	Error Message	Downtime
9/4/2009	10:27:41 AM	Default User	Incorrect password for:	.023
9/4/2009	10:32:06 AM	Default User	Incorrect password for:	.04
9/4/2009	2:07:32 PM	John Smith	Tool type not in database.|Type = 123456|Boardname: Test MSP	.099
9/4/2009	2:07:42 PM	John Smith	Tool type not in database.|Type = 1|Boardname: Test MSP	.165
9/4/2009	2:24:12 PM	John Smith	Press Profile Error 1: Premature contact detected|||Press terminated by FORCE on profile line: 3|Boardname: T	.136
9/4/2009	2:24:43 PM	John Smith	Press Profile Error 1: Premature contact detected|||Press terminated by FORCE on profile line: 3|Boardname: T	.079
9/4/2009	2:26:09 PM	John Smith	PressMonitorCriticalError used. Call Number: 41	0000.000
9/4/2009	2:26:18 PM	John Smith	PressMonitorCriticalError used. Call Number: 41	0000.000
9/4/2009	2:26:37 PM	John Smith	PressMonitorCriticalError used. Call Number: 41	0000.000
9/4/2009	2:27:32 PM	John Smith	Press Profile Error 1: Premature contact detected|||Press terminated by FORCE on profile line: 3|Boardname: T	.145
9/4/2009	3:38:08 PM	John Smith	No tool ID entry. Select correct tool and retry.|Boardname: Test MSP	.037
9/23/2009	10:50:55 AM		Invalid PIN number for John Smith	.034

User Log



Date	Time	Operator	User Level	Action
9/4/2009	10:26:54 AM			Incorrect password entered attempting to change password
9/4/2009	10:27:04 AM			Incorrect password entered attempting to change password
9/4/2009	10:27:30 AM			Incorrect password entered attempting to change password
9/4/2009	10:27:40 AM			Incorrect password entered attempting to change password
9/4/2009	10:32:03 AM			Incorrect password entered attempting to change password
9/4/2009	10:32:12 AM	Default User	ADMINISTRATOR	Changed password for John Smith
9/4/2009	10:32:15 AM	Default User	ADMINISTRATOR	Modified access for John Smith
9/4/2009	2:01:42 PM	Default User	ADMINISTRATOR	logged off by new logon
9/4/2009	2:01:42 PM	John Smith	ADMINISTRATOR	logged on
9/4/2009	2:36:50 PM	John Smith	ADMINISTRATOR	logged off by user MEP shutdown
9/4/2009	2:37:26 PM	John Smith	ADMINISTRATOR	logged on
9/4/2009	2:47:26 PM	John Smith	ADMINISTRATOR	logged on
9/4/2009	3:05:51 PM	John Smith	ADMINISTRATOR	logged on
9/23/2009	10:50:55 AM	John Smith	ADMINISTRATOR	entered an invalid password
9/23/2009	10:51:02 AM	John Smith	ADMINISTRATOR	entered an invalid password
9/23/2009	10:51:07 AM	Default User	ADMINISTRATOR	logged on
9/24/2009	8:33:25 AM	Default User	ADMINISTRATOR	logged off by user MEP shutdown
10/6/2009	11:23:46 AM	Default User	ADMINISTRATOR	logged on
10/6/2009	2:26:01 PM	Default User	ADMINISTRATOR	logged off by user MEP shutdown

Figure 54

10.2. Utilization

Machine utilization is tracked in four categories; Error, Idle, Run, and Off. The data can be displayed on the screen as shown in Figure 55 or printed in color or black and white. A check box in the lower right of the screen allows the graph to show off time along with the other categories.

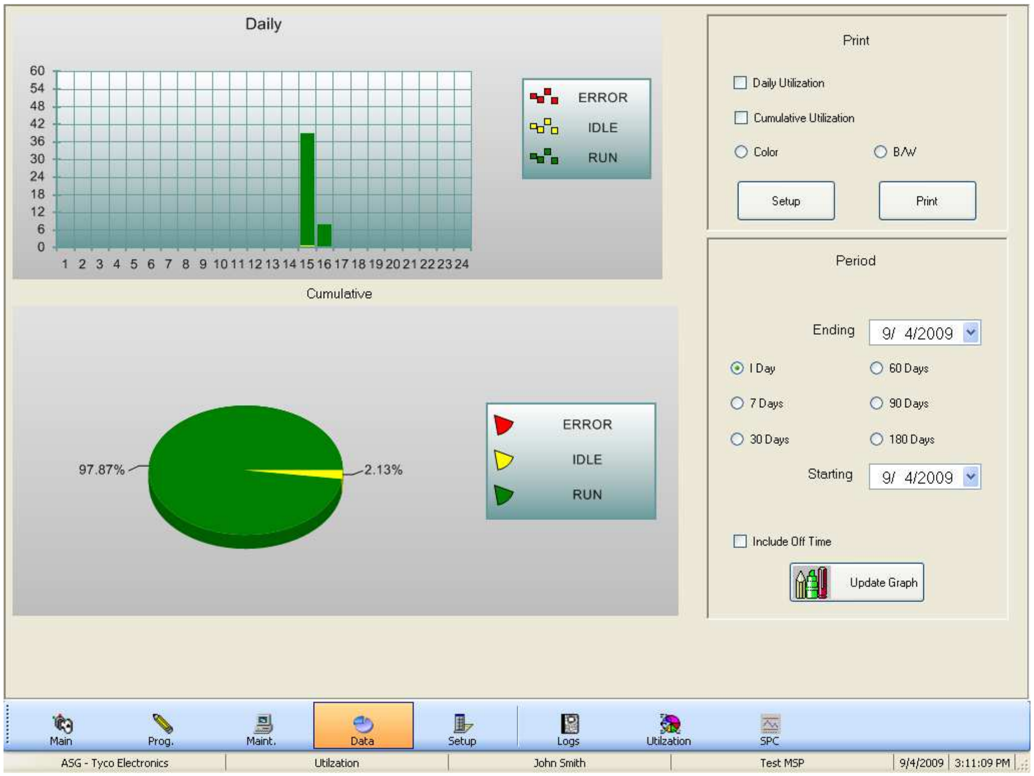


Figure 55

A. Period

The period to display or print can be selected using the controls at the right side of the screen. To update the graph for a new period, press the “Update Graph” button.

B. Print

Printing charts is selected from the panel in the upper right of the screen. The standard printer setup dialog is provided. The daily chart shows breakdown on an hourly basis, while the cumulative chart shows the distributions as a pie chart.

10.3. SPC

The SPC feature is a software package for data collection, analyses, display, and printing (see Figure 56).

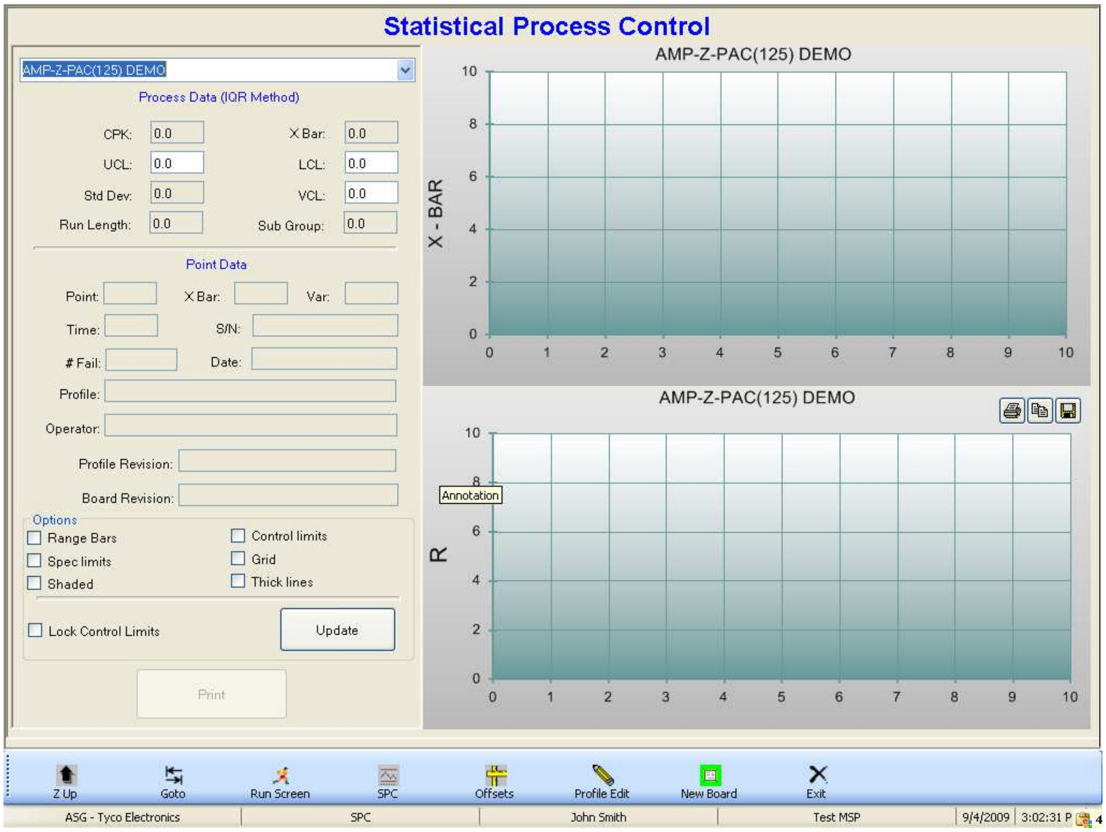


Figure 56

A. 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. The raw data in the file is stored as text in U.S. units (lbs, inches).

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 (height above PCB). The header at the top of the raw data file explains the data format in detail

NOTE
Over time, the number of files in the SPC directory may grow large, as will the size of the SPC database file. This can eventually lead to erratic errors due to lack of Windows resources. The files in the SPC directory should be cleaned out (moved or deleted) on a regular basis - at least annually for a press that sees regular production use, more often if Data Collection mode is always active. If storage of extended historical data is desired, the files should be archived to another location.

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.

B. Process Data

This area shows data that is calculated for the process. It is a measure of the “health” of the process for a number of PCB’s (see Figure 57).

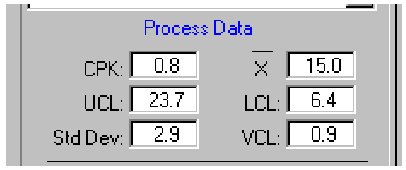


Figure 57

C. 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.

D. 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.

E. Std Dev. (Standard Deviation)

This is the standard deviation (InterQuartile Range method) of the plotted X-bar points.

F. UCL (Upper Control Limit)

If the plotted X-bar point exceeds this value, the process is considered out-of-control.

G. LCL (Lower Control Limit)

If the plotted X-bar point is less than this value, the process is considered out-of-control.

H. VCL (Variability Control Limit)

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

I. Point Data

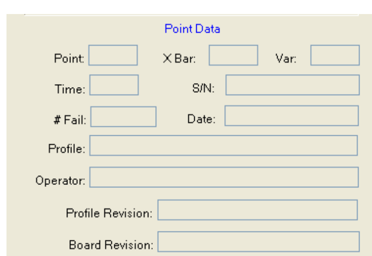


Figure 58

This area 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 (see Figure 58).

J. Options

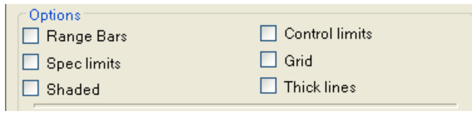


Figure 59

K. 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 has a short horizontal line at the maximum and minimum readings for the averaged data. Checking this box enables range displaying.

L. Control Limits

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

M. Spec. Limits

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

N. Grid

This check box enables grid line display on the graphs.

O. Shaded

This adds shading between the spec limits and control limits.

P. Thick Lines

This thickens the plotted lines.

Q. Print

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

11. SETUP UTILITIES

Figure 60

11.1. Set Zero

The Z axis zero is defined as the position where the head pressing surface is in contact with the table and loaded to 300 pounds-force. The load is applied to be sure all clearance is eliminated from the various head components such as the ball screw and the head to structure air gap.

Since the head cannot actually travel all the way to this point, a 50.8mm spacer block must be placed between the head and the table to set the zero position. A tool is supplied with the press for this purpose. This same tool is also used for PCB thickness measurement.

To set or verify the Z axis zero position, place the spacer block on the table, centered beneath the head anvil. The head should be positioned at the center of the machine. Reduce the speed slider below 1 mm/s. Set the Max Force slider to 1500 – 2000 N. Very carefully jog the head down until it is almost touching the spacer block. At this point, change to incremental mode and move only in increments of .02 mm. Apply load until 1350 +/- 50 N is achieved.

WARNING
Due to the machine's high rigidity the force can build very quickly, resulting in significant force overshoot if the Z axis is moving faster than the minimum speed. Always reduce the speed when approaching an object such as the thickness probe tool. Use incremental mode @ 0.10 mm or 0.02 mm when manually pressing in the joystick.

When the load reaches 1350 +/- 50 N, read the Z axis position shown in the center of the Joystick screen quadrant. It should read 50.80 mm (or the exact height of the spacer block used, if it is not exactly 50.80 mm tall), +/- 0.05 mm. If the position reading is incorrect, click in the box above the "Set Z" button and enter the known height of the spacer block (or thickness probe). Then click the "Set Z" button to correct the machine's position. This will permanently modify the Z axis position. Although not required, it is good practice to re-home and then confirm the zero position by repeating this procedure (see Figure 61).

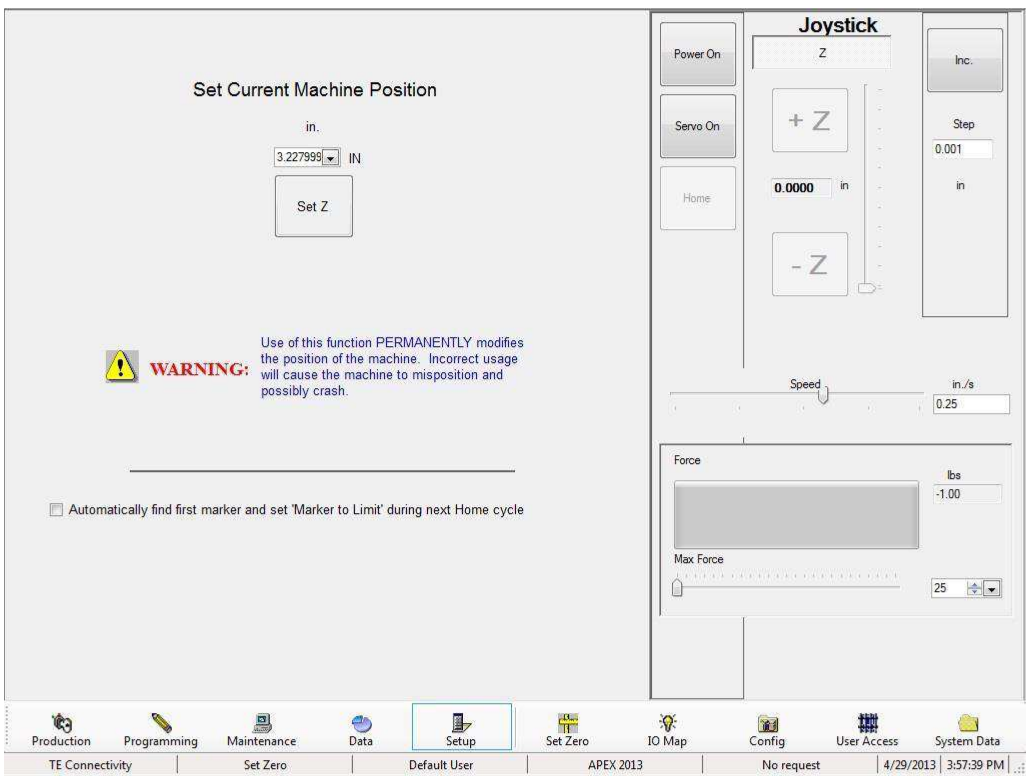


Figure 61

Checking "Automatically find first marker and set 'Marker to Limit' during Home cycle" enables re-teaching the position of the motor marker pulse in relation to the upper limit sensor during the next homing. This should be used any time the upper limit sensor or flag is disturbed, or any maintenance is done on the motor, gearbox or ball screw. During normal homing (checkbox is not checked), the position of the marker pulse relative to the limit sensor is compared to the saved value and an error is displayed if too great a difference is found.

This checkbox is automatically cleared at the next homing and the new value saved. If homing fails for any reason, the checkbox will be cleared but the saved value will not be updated. The checkbox will have to be checked again before another homing attempt is performed.

11.2. Config

Accesses the Setup Parameters screen, used for setting miscellaneous parameters as described below (see Figure 62).

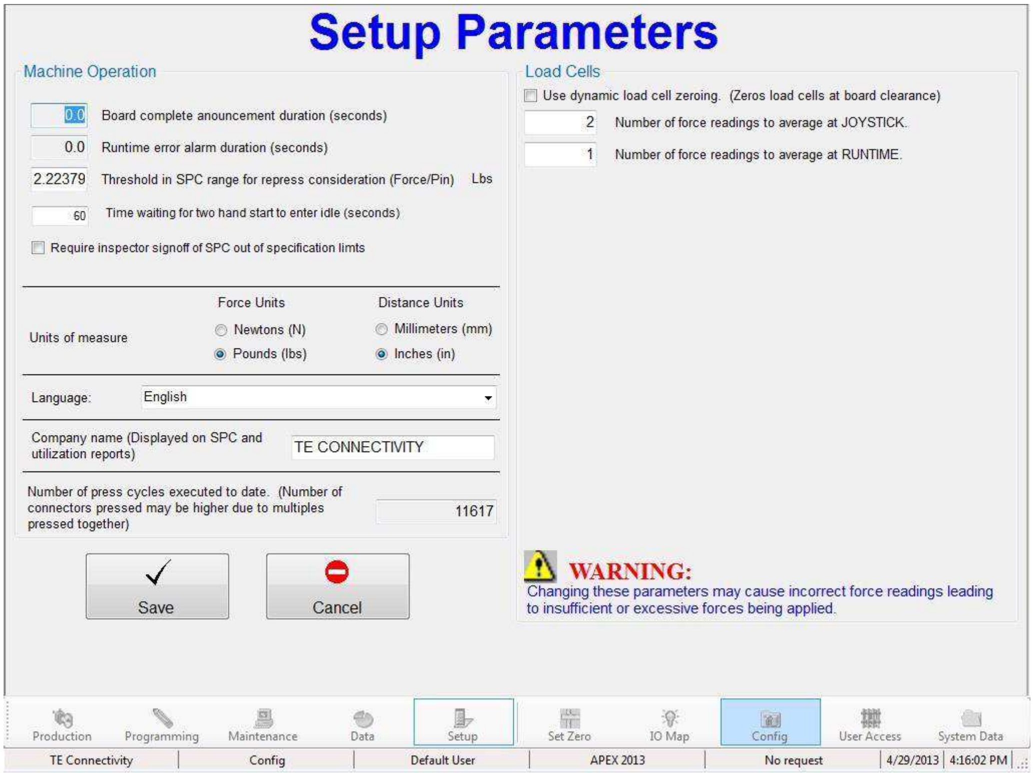


Figure 62

A. Machine Operation

1. Threshold in SPC range for repress consideration

If the SPC force for a connector is less than this value, the connector is considered to have been repressed (the connector has been partially repressed before). Repressed connectors are not used for SPC analysis as they would “pollute” the data from their low forces in the SPC range.

2. Time Waiting for Two Hand Start

This is the time allowed before the machine utilization tracking changes from “Run” to “Idle”. If the next cycle is initiated within this time, the utilization tracking remains in “Run” mode. The mode is changed from “Idle” to “Run” as soon as the next cycle is started by pressing the two-hand buttons.

3. Number of Press Cycles

This is a non-resettable (read only) cumulative cycle counter. Each time a production pressing cycle is completed, this counter is incremented.

B. Load Cells

The load cells measure the pressing force as each connector is being pressed. The force reading for each load cell will be graphed if Diagnostic mode is active (“Diags ON”). Otherwise, only the total (sum) force is graphed.

Dynamic load cell zeroing is a feature that automatically eliminates any offset (difference from zero reading) detected when no force is being applied. If checked, the offset updates at the beginning of each pressing cycle.

Multiple readings from the load cells can be averaged before evaluating and graphing. This reduces the “noise” that is present in typical analog signals. A setting of one will provide the fastest update, but could cause a false reading if a noise spike is read as a real force. The larger this number is, the slower the response will be. A setting of three is recommended, but may be increased if “noise” is a problem - typically when pressing very low force connectors.

C. Save

Pressing this button will save the changes and exit the screen.

D. Cancel

Pressing this button will cancel the changes and exit the screen.

11.3. User Access

User access to the various machine functions is controlled by password protected individual user accounts. To create a new user, an individual with User Access permission must log in and press the “User Access” button, then select the New User button on the Select Operator screen. A new user’s access will be limited to not exceed the level of the individual currently logged in. When modifying an existing user’s account, non-administrators may not modify administrator accounts, or the status of permissions which they have not been granted (see Figure 63).

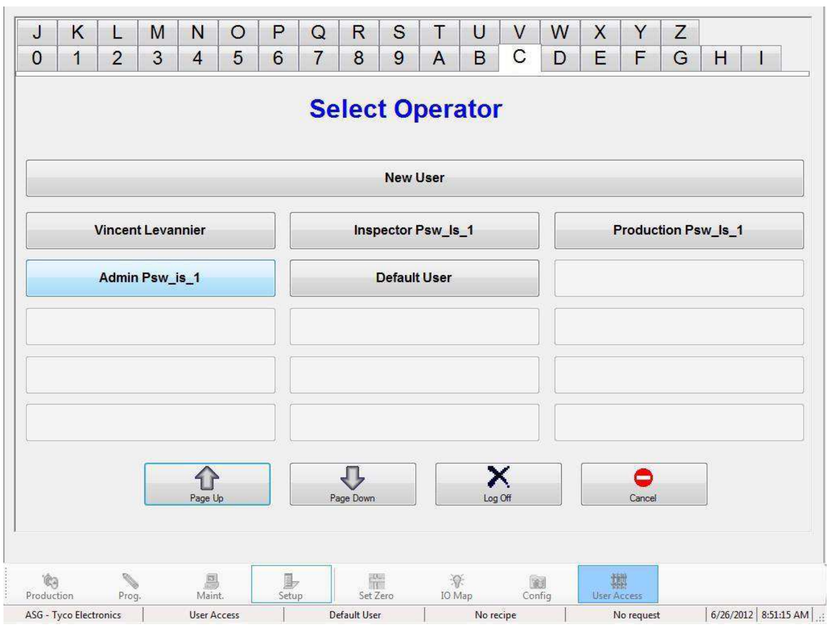


Figure 63

Fill in the first and last names, the password, and the options the user will be permitted to access on the Define User Access screen. The Notes entry may be used for any purpose (see Figure 64).

The “Temporarily Disqualify” selection allows a user name to stay in the computer but not be useable. It can be re- enabled at a later time.

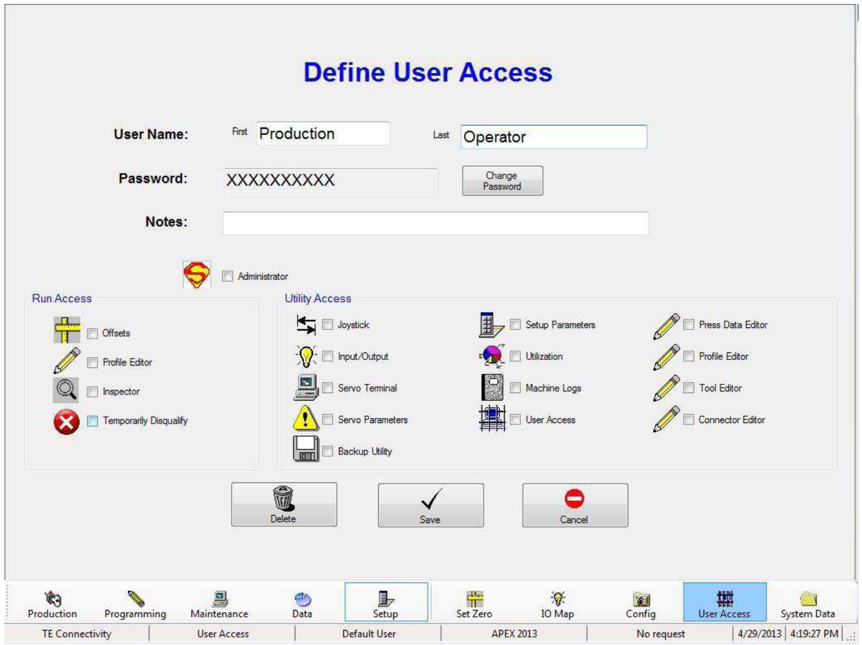


Figure 64

12. PREVENTATIVE MAINTENANCE

The Press has been designed to minimize maintenance as much as possible. The following preventive maintenance procedures should be done on the intervals given below. An annual inspection, adjustment, and calibration service is offered by TE.

DANGER
Always turn off the main power switch and disconnect the electrical cord from the power source when performing maintenance on the press.

12.1. Accessing the Press Head (CBP)

To gain access to the CBP press head for inspection or service, the upper sheet metal housing must be removed using the following procedure.

1. Remove the four mounting screws from the optional light tower (if equipped) on the top of the top housing.
2. Remove the light tower (if equipped) and set aside.
3. Remove the four screws in the top corners of the top housing.
4. Lift up the left side of the top housing and disconnect the Status light and light tower cables at the inline connections.
5. With one person on each side of the machine, lift the housing straight up until it clears the motor and move it to the rear of the machine. Place the housing on the floor or bench behind the machine.

To gain access to the CMP press head, remove the front cover panel.

12.2. Cleaning

All surfaces should be kept clean and free of dust buildup. Wipe down all exposed flat surfaces with a soft rag. If allowed in the facility, use light air pressure to blow the press head and structure areas from the top down.

12.3. Inspection

Visually inspect the press head area. The top sheet metal housing on front cover panel should be removed once per year to allow a thorough inspection. See procedure above for top housing removal.

With respect to CBP only, whenever the top sheet metal housing is removed, the main power surge protector should be checked. The surge protector is located immediately to the right of the main circuit breaker in the center of the rear electrical panel. With the machine energized, verify that the green LED on the surge protector is illuminated. If not, it is likely the machine has been exposed to one extreme voltage surge or several significant surges, such as might be generated by nearby lightning strikes to the power lines supplying the facility.

If the LED is not illuminated, the machine will still operate but is no longer protected from potentially destructive power line events. Replace the surge protector to restore protection.

12.4. Lubricating

Light machine oil or 30W non-detergent motor oil should be used in the following areas of the machine:

A. Z Axis Rods

With the Z axis in the down position, put a small amount of oil on the rods above each of the linear guide bushings. Grease linear bushings thru Zerk fittings.

B. Z Axis Screw

With the Z axis in the down position, put a small amount of oil on the screw and wipe down with a rag. There should only be a thin coating of oil remaining. Grease thru Zerk fitting on nut.

12.5. Torqueing Critical Bolts

NOTE
This procedure requires the top sheet metal housing to be removed on CBP. See the procedure above for details. The critical bolts on the pressing head should be checked for proper torque. The Z axis bearing housing is a 50mm thick block, mounted to the top of two upright plates with 6 M10 x 1.5 socket head bolts. Torque bolts to 90 Nm.

12.6. PM Schedule

Figure 65 provides a preventative maintenance schedule for these machines.

ITEM	DAILY	WEEKLY	QUARTERLY	YEARLY
Blow Machine Off	●			
Wipe Machine Down		●		
Inspect Wires and Hoses			●	
Oil as Indicated Above			●	
Torque Head Bolts				●
Drain Moisture Separator				●
Calibrate Z Axis Load Cells				●
Inspect Ball Screw				●

Figure 65

13. REVISION SUMMARY

- Added CMP-5T (2216007) and CMP-10T (2216008) presses (and associated changes throughout)
- Added Section 8.5 SensiPress Optimization; including 9 figures.
- Re-numbered subsequent figures and changed all applicable references
- Added Revision Summary (Section 13)
- Changed Appendix formats and removed from Section numbering
- Revised Appendix A and B

APPENDIX A – SPARE PARTS

1.CBP Spare Parts List

TE PART NUMBER	DESCRIPTION
2216172-1	KIT, SPARE PARTS CBP
2216172-2	KIT, SPARE PARTS CBP 300V
2216172-4	KIT, SPARE PARTS EXTENDED OPENING CBP

NOTES:

● Identify kit per TE Specification 115-67-12 (part number, revision letter, and country of origin)
● Kit 2216172-1 is used with most top level CBP configurations (refer to drawing 2018873)
● Kit 2216172-4 is used with 260MM Extended Opening CBP configurations

2. CMP Spare Parts List

TE PART NUMBER	DESCRIPTION
2216259-1	KIT, SPARE PARTS CMP-5T
2216538-1	KIT, SPARE PARTS CMP-6T
2216260-1	KIT, SPARE PARTS CMP-10T
2216539-1	KIT, SPARE PARTS CMP-12T

APPENDIX B – FEATURES & SPECIFICATIONS

1.Features

- PC computer with Windows software
- SPC calculation, display, log & print
- Touch screen monitor
- On-line setup drawings and photographs
- Operator log in & out with password protection
- Multiple operator levels for limiting function access
- Error log with date, time & operator information saved to disk
- Light Curtains
- Air Bearing Table
- Maintenance & setup software utilities
- Graphic display of board in process
- Force-Vs-distance on-screen graphs
- Software controlled pressing profile with error detection and user defined messages
- Electric servo pressing (Z axis)
- High rigidity: 2 large Z axis guide rods with linear bearings
- Press to force
- PCB thickness measurement and press to height
- PARS and Force Gradient pressing
- Missing connector detection
- Bar Code Scanner - Option
- Clean & Quiet
- Energy efficient

2.Specifications

CBP-5T

- Force: 44 kN
- Force sensitivity: 50 N
- Z axis travel: >50 mm
- Z axis speed: up to 8 mm/sec
- Power: 120-240 VAC, 1 Phase, 6 A
- Dimensions: 766 mm Wide X 612 mm Deep X 960 mm High
- Weight: Approximately 180 kg (400 lbs)

CMP-5T

- Force: 44.5 kN
- Force sensitivity (SensiPress): 4.4 N
- Z axis travel: 127 mm
- Z axis speed: up to 25 mm/sec
- Power: 220VAC, 1 Phase, 10A
- Dimensions: 1345.4 mm Wide X 988 mm Deep X 1724.7 mm High
- Weight: 680.5 kg (1500 lbs)

CMP-6T

- Force: 53 kN
- Force sensitivity (Standard): 133.4 N
- Z axis travel: 127 mm
- Z axis speed: up to 25 mm/sec
- Power: 220VAC, 1 Phase, 10A
- Dimensions: 1345.4 mm Wide X 988 mm Deep X 1724.7 mm High
- Weight: 680.5 kg (1500 lbs)

CMP-10T

- Force: 89 kN
- Force sensitivity (SensiPress): 13.3 N
- Z axis travel: 127 mm
- Z axis speed: up to 19 mm/sec
- Power: 220VAC, 1 Phase, 10A
- Dimensions: 1600 mm Wide X 1092.2 mm Deep X 1902.8 mm High
- Weight: 1134 kg (2500 lbs)

CMP-12T

- Force: 107 kN
- Force sensitivity (Standard): 222.4 N
- Z axis travel: 127 mm
- Z axis speed: up to 19 mm/sec
- Power: 220VAC, 1 Phase, 10A
- Dimensions: 1600 mm Wide X 1092.2 mm Deep X 1902.8 mm High
- Weight: 1134 kg (2500 lbs)

3.Updates

For information on how to obtain the latest version of the C*x*P Operating System, call (888) 782-3349 or email fieldservicesnorthamerica@te.com

APPENDIX C – ELECTRICAL/MECHANICAL SCHEMATICS