

XLamp® Pick and Place Application Note



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EXECUTIVE SUMMARY

The process for automated pick and place manufacturing for surface mount devices (SMDs) has been in use since the 1980s. These systems are used for high-speed, highly accurate placement of a wide range of electronic components. This process has been focused on a solid- or hard-epoxy molded, flat top-side package, like capacitors, resistors and integrated circuits. This process required changes when LEDs with a glass or soft silicone molded dome were introduced. This application note discusses some issues in the pick and place process for LEDs and presents a method to troubleshoot and resolve these issues.

INTRODUCTION

The inclusion of high-power LEDs in the pick and place process introduced many variables that can affect the performance of the pick and place system. LEDs require specific process parameters for the pick and place equipment to optimize the system's performance. This is due mainly to the dome material and weight distribution of the LED component.

Pick and place manufacturers have gained a great deal of knowledge over the past 25 years picking various types components. A typical example is shown in Figure 1.¹ The high-power LED, with its soft molded silicone or glass dome, as shown in Figure 2, has been in use for only about 5 years and there is still a significant amount of pick and place process refinement to ensure these components can be placed similar to the SMDs already being used.

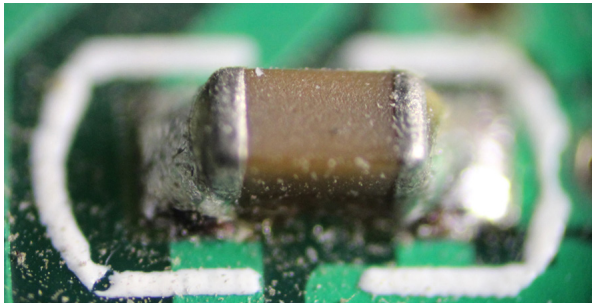


Figure 1: Typical SMD

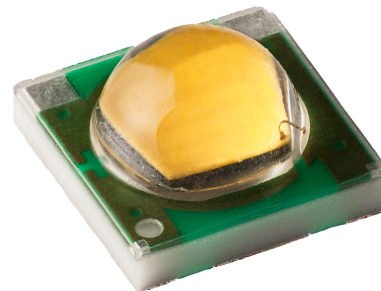


Figure 2: Example of high-power LED in SMD format

Cree LED understands that, for solid-state lighting products to be successful, not only are the best and brightest LEDs on the market required, but the knowledge and support to handle these components in a high-speed, accurate manufacturing process resulting in high yields, low defect rates and no damages to LEDs is critical. Cree LED has been working with a number of pick and place manufacturers to assist our customers in identifying the best options available to maximize their system's performance through modifications and adjustments to minimize mis-picks and increase yield.

Mis-pick is the term generally used to describe what happens when a component is not picked properly out of the carrier tape pocket. A mis-pick can be due to a number of reasons that are discussed in this application note.

This application note:

- Explains an approach to assist in troubleshooting an automated pick and place system.
- Identifies areas of pick and place process concern including mis-pick, alignment and placement.

¹ Image © Alex Khimich, released under the Creative Commons Attribution-ShareAlike 3.0 Unported (CC BY-SA 3.0) license creativecommons.org/licenses/by-sa/3.0/

- Identifies key items to help minimize mis-pick rates.
- Identifies solutions that have been found to help reduce mis-picks.
- Presents solutions from automated-system manufacturers.

TROUBLESHOOTING APPROACH

Most companies experiencing pick and place problems with high-power LEDs automatically assume the component is the cause of the problem. This is often the case when the LED component with which they are experiencing issues is new to their assembly process, and the LED has unique processing demands.

Cree LED has taken a straightforward approach to pick and place process issues to graphically show the best methods for troubleshooting a mis-pick issue with silicone-domed style components. Cree LED has found it helpful to think of the approach as a pyramid. The simple illustration in Figure 3 should help clarify this analogy by indicating the steps to follow in order from 1 to 4. Starting troubleshooting at the top of the pyramid will not produce much change but, by starting at the bottom, the foundation is strong and finishing touches can be applied the at the top of the pyramid.

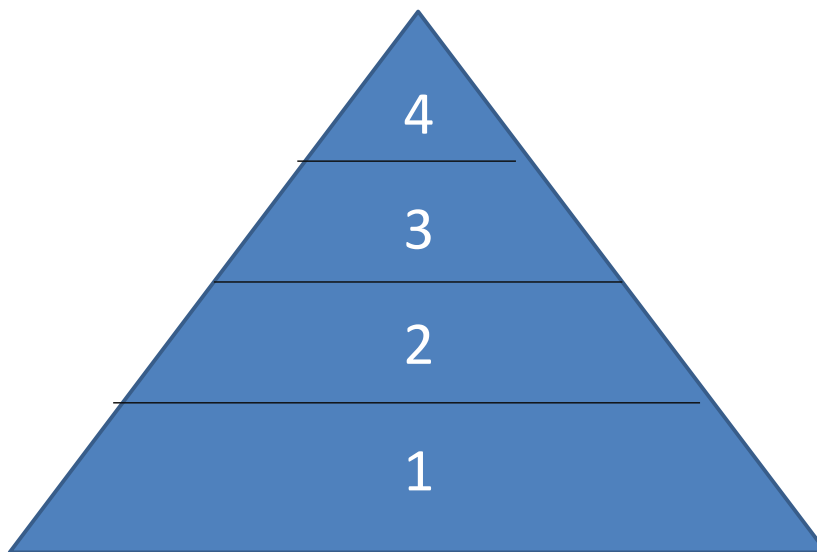


Figure 3: Troubleshooting pyramid

This simple illustration conveys a step-by-step approach that has been found to help resolve most issues and provides direction to the corrective actions required. This also helps prevent spending time fine tuning when the issue may be more than what can be resolved from a few minor parameter changes.

When experiencing pick and place problems, the most accurate way to determine the root cause is to film the operation with a high-speed camera. Although this is the best way, a high-speed camera is often not available and not used. If a high-speed camera cannot be used, the next best option is to slow down the pick and place system so that its exact operation can be observed. A good starting point is to stand back and watch the equipment in operation and typically an anomaly will appear, narrowing the focus on the root cause.

AREAS OF CONCERN

Figure 4 illustrates the key areas on which to focus to reduce failure rates. The incremental gains in the failure rate are listed next to each level of the pyramid. In many cases, quick fine tuning is attempted to resolve pick and place failures, but when there are more significant areas to address, fine adjustments can actually show very little result. First, the more significant issues must be addressed.

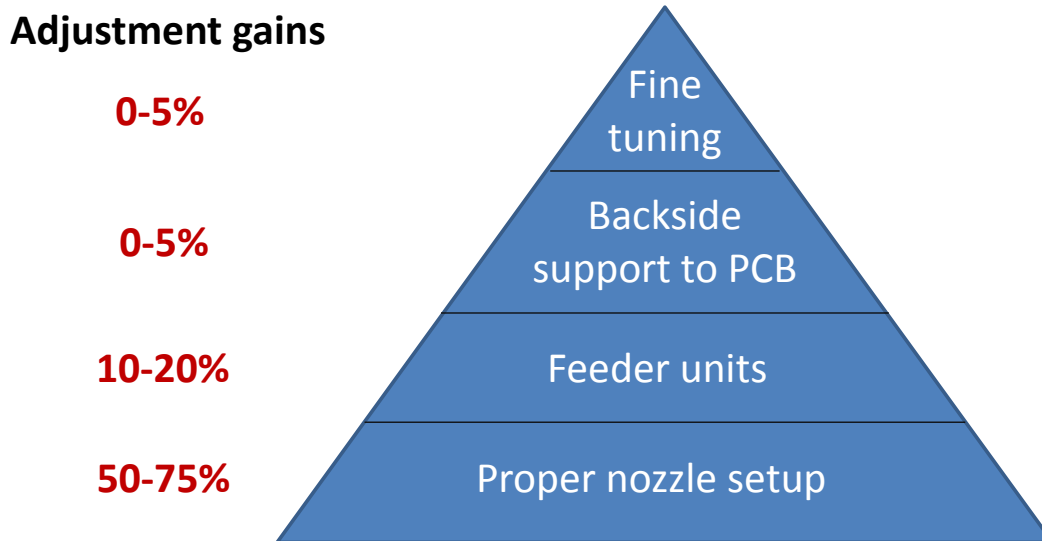


Figure 4: Troubleshooting pyramid and gains expected

The best option for resolving the major factors in mis-pick fallout is to start at the bottom of the pyramid in Figure 4 and ensure compliance with the recommendations provided by the LED manufacturer as well as the pick and place equipment manufacturer. Cree LED has initiated a Partner program with a number of pick and place suppliers and has worked with them to supply product and recommendations.

The Appendix contains information supplied by several major suppliers of pick and place tools and equipment and includes part numbers for modifications and pick nozzles needed for process improvement.

KEY ITEMS TO HELP REDUCE MIS-PICK RATES

This section discusses the key areas of focus to reduce mis-pick rates. Steps to address these areas are given in the next section.

1 PROPER NOZZLE SETUP

The first troubleshooting step is to ensure the proper nozzle setup is being used. This is one of the easiest steps and results in the fastest improvements. Pick and place systems can handle a variety of components and can handle from 1-30 components at a given time. Pick nozzles and process parameters for SMDs have been developed over many years but the softer silicone dome of an LED requires specific nozzle materials. In the past, metal or steel pick and place nozzles were the norm, but since silicone can act like a gasket and form a seal to a metal nozzle, releasing an LED component after placement can be an issue. Due to this interaction between the silicone dome and the steel nozzle, there has been nozzle material development by pick and place manufacturers and third-party suppliers to improve the

placement or release of the soft silicone LED. These nozzle materials are listed in the Cree LED Soldering and Handling documents,² and recently a polyurethane nozzle has been shown to have some of the best results.

2 FEEDER UNIT

Once the proper nozzle configuration has been implemented, the next step is to investigate the feeder unit. There are two sections to this unit that can exhibit issues when indexing the component and exposing the LED to the pickup nozzle. Addressing these two areas, listed below, can significantly minimize the effects on the LED and how it sits in the pocket during indexing.

2.1 COVER TAPE ANGLE

The first area to address is the angle at which the cover tape pulls back. This may sound trivial, but pulling the cover tape back at a high angle (which is shown in this application note) can pull the LED out of the pocket or arrange the LED in the pocket so that the nozzle does not pick the LED properly.

2.2 INDEXING SYSTEMS

The second area that can attribute to misorientation of the LED to the nozzle during picking is the method by which the system performs indexing. There are two main indexing methods.

2.2.1 PNEUMATIC INDEXING

Pneumatic indexing is one of the most common methods to index components on automated assembly equipment. A pneumatic actuator uses compressed air to create the linear indexing motion. In addition to the actuator, the system is comprised of a piston, a cylinder and valves or ports that supply air pressure from the actuator to the piston and exhaust the air to allow the cylinder to release. The piston is covered by a diaphragm, or seal, that keeps the air in the upper portion of the cylinder, allowing air pressure to force the diaphragm forward, moving the piston, which in turn moves the valve stem to create the indexing on the feeder sprocket wheel.

2.2.2 SERVO-MOTOR OR BELT-DRIVEN INDEXING

A stepper motor is a brushless DC electric motor that divides a full rotation into a number of equal steps. The motor's position can be commanded to move to and hold at one of these steps. The DC servo motor is usually coupled directly to the sprocket wheel through a spring type of coupling device.

Belt-driven indexing also uses a DC servo motor, but allows the motor to not directly couple to the sprocket wheel. This system usually has a gear or sprocket on the DC motor connected by a belt to a secondary gear on the sprocket wheel that does the indexing.

3 BACKSIDE SUPPORT FOR PCB

The backside support step may not always be an issue, but those who use larger dimensioned printed circuit boards (PCB) either in whole or pre-sawn to allow for easy post-assembly separation should pay attention to this step.

All automated pick and place systems utilize a track-feed system that presents the PCB to a pre-determined location for alignment and clamping. Clamping holds the board in place for alignment and during the pick and place process. This clamping process with large PCBs or with PCBs that are pre-sawn or scribed for easy post-assembly singulation can cause the PCB to bow or flex so that it is not level across the placement surface.

² At www.cree-led.com/products/leds/, select the LED of interest, then the Documentation tab. The document can be found under the Application Notes heading.

Automated pick and place systems utilize known zero references as guides for both the pick and the place process. If the board is flexing downward when the system moves the component to placement, the component may not contact the board and this lack of applied tension from the solder paste will not assist with the removal of the component from the nozzle and can cause placement issues.

4 FINE TUNING

The final area to address is the fine tuning of the system. This addresses only a small percentage of the mis-pick rate, but can be fruitful once the other items have been addressed.

Fine tuning encompasses the maintenance of the system as well as the cleaning of the pick nozzles and the frequency at which this is done. Fine tuning also covers the parameters utilized by the software to assure proper timing, accurate placement and the best UPH (units per hour). In many cases this is the first step taken to resolve mis-pick or misplacement issues. A number of parameters can be adjusted in most software by trained personnel. There are two types of parameters to adjust.

4.1 GLOBAL SYSTEM ADJUSTMENTS

Global parameters are the most commonly used. One such parameter is the overall speed at which the system operates for all actions.

4.2 INDIVIDUAL PARAMETERS

Individual parameters are typically something that only a field applications engineer or highly trained technician should adjust. These include values such as the acceleration and deceleration of a specific section of the tool, for example the z height speed of the nozzle head, the indexing tuning of a servo motor system and the amount and duration of “air kiss” or purge used during placement.

Cree LED recommends that only properly trained personnel adjust any of these parameters because doing so can cause catastrophic failure and endanger coworkers.

SOLUTIONS TO HELP MINIMIZE MIS-PICK RATES

There are simple solutions that can improve the pick and place process. These solutions can apply to all systems or be specific to certain pick and place manufacturers. (See the Appendix for manufacturer recommendations.)

1 PROPER NOZZLE SETUP

One of the simpler solutions for mis-pick and misplacement issues is to employ the correct nozzle design. Cree LED has done a significant amount of work to determine the appropriate nozzle dimensions for our LEDs. These dimensions are given in all Cree LED Soldering and Handling documents.³ One of the most critical dimensions for the nozzle design is the internal dimension (ID). It is easy to use a set of calipers to measure this dimension, but understanding that the dome does not drop straight down to the substrate is the critical aspect that can be missed when performing this measurement, as shown in Figure 5.

3 Ibid.

This area is called the flashing. It can cause a nozzle to stick to the component by sealing to the nozzle.

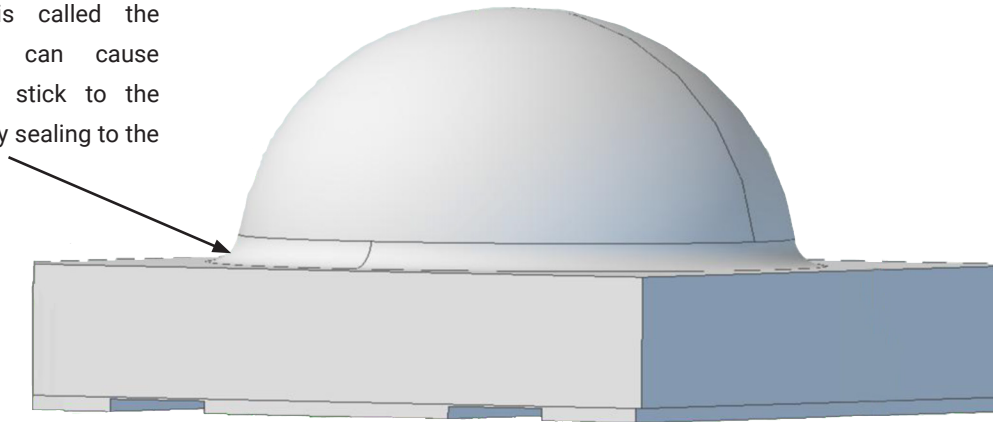


Figure 5: LED diagram

The image in Figure 5 is a 3D depiction of the XLamp® XP LED; STEP (.stp) files for Cree LED products can be found on the Cree LED website.⁴

With this understanding of the flashing, nozzles have been developed that can pick from the substrate to hold an LED flat to the pick nozzle. In each LED's Soldering and Handling document there is a drawing of a nozzle that allows customers to pick from the dome only. This is not an issue as long as the inside of the nozzle has a smooth quality finish.

In addition to proper nozzle setup, regular nozzle maintenance and cleaning is recommended based on the operational demands of the system.

1.1 LED PLACEMENT

If LED placement is an issue and the component does not release from the nozzle, there are a few adjustments that can assist in releasing the component. One major assistance is known as a purge or "air kiss". This occurs when a system uses forced air to help push the component from the nozzle. The amount of air pressure and duration completely depends on the system and the nozzle material being used. For most components this option is not needed, and with LEDs it is unnecessary with proper recommended nozzle design and over-travel setup, but can assist with placement issues. Pick and place manufacturers can assist in using this option if it is available. The Appendix has helpful suggestions from the pick and place suppliers with whom Cree LED is currently working.

A purge or air kiss is not always available or allowed because it can affect parts already mounted on the board. Using the correct nozzle material and dimensions recommended by Cree LED's Soldering and Handling document for each XLamp LED can obviate the need for purge.

2 FEEDER UNIT

2.1 COVER TAPE ANGLE AND PEEL-BACK LOCATION

Another simple solution that helps minimize the mis-pick rate is to change the location at which the cover tape pulls back. If the cover tape pulls back multiple pockets prior to the pickup location there is normally a metal top plate or an indexing guide piece to keep the parts in the pocket. Changing the peel-back location to be closer to the pickup position minimizes the chances for the components to stick to the indexing guide.

⁴ Ibid., The files can be found under the Design Files heading.

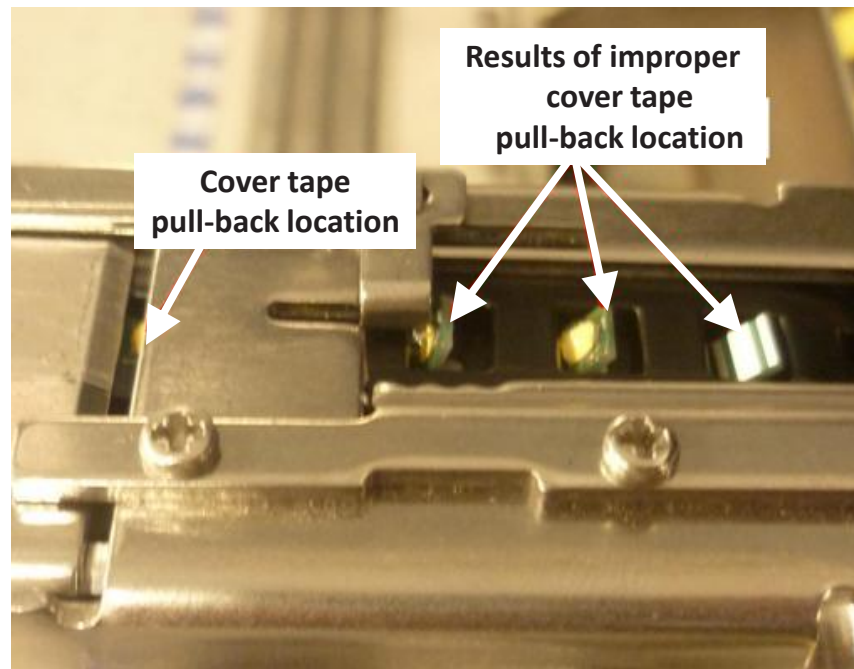


Figure 6: Example of improper cover tape pull-back location

Locating the tape pull-back position closer to the pickup position has shown significant improvement in the mis-pick rate and most systems have already started making these modifications available, as shown in Figure 7.

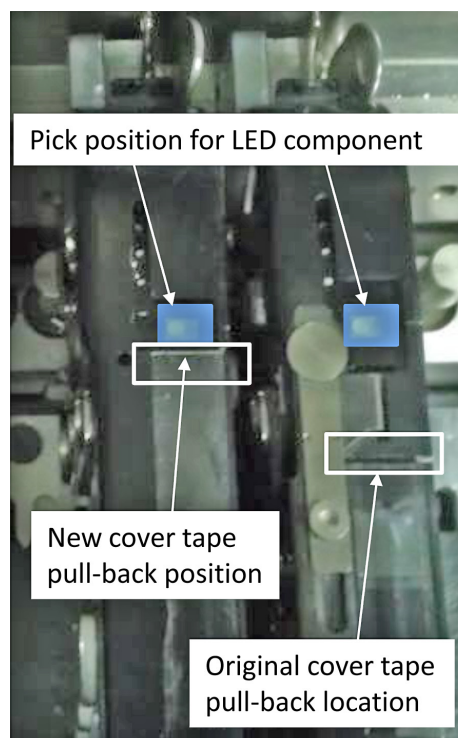


Figure 7: Example of pick position change

In addition to changing the cover tape pull-back location, adjusting the angle at which the cover tape is pulled back from the carrier tape is helpful. If the angle is high ($>30^\circ$), an LED may be lifted from the pocket as the cover tape is peeled back. Adjusting this to a lower angle ($<30^\circ$) can minimize the chance of the LED flipping or become misaligned in the pocket prior to pickup. Figures 8 and 9 show an example of this adjustment.

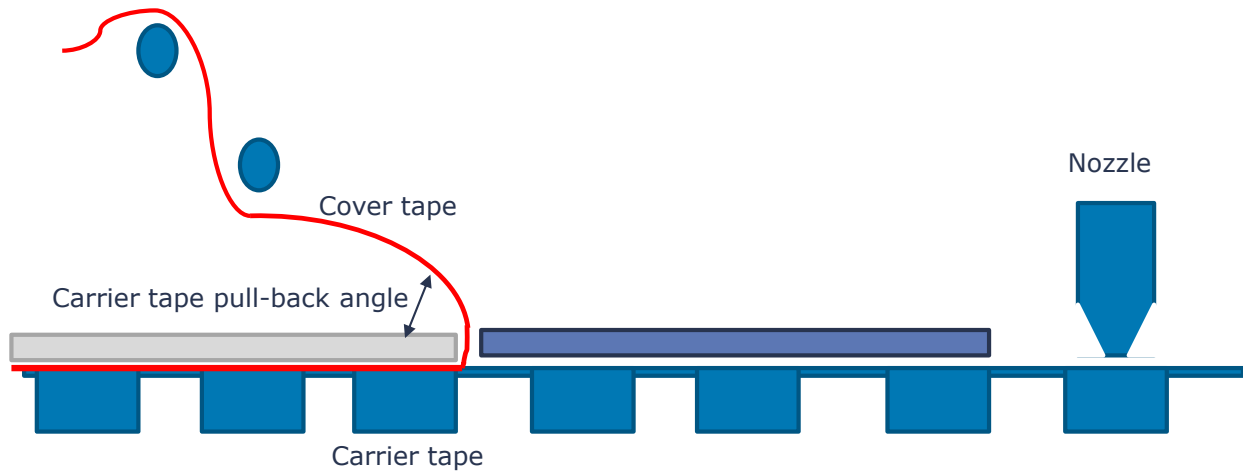


Figure 8: Cover tape pulled back at high angle, potentially lifting LED out of the pocket

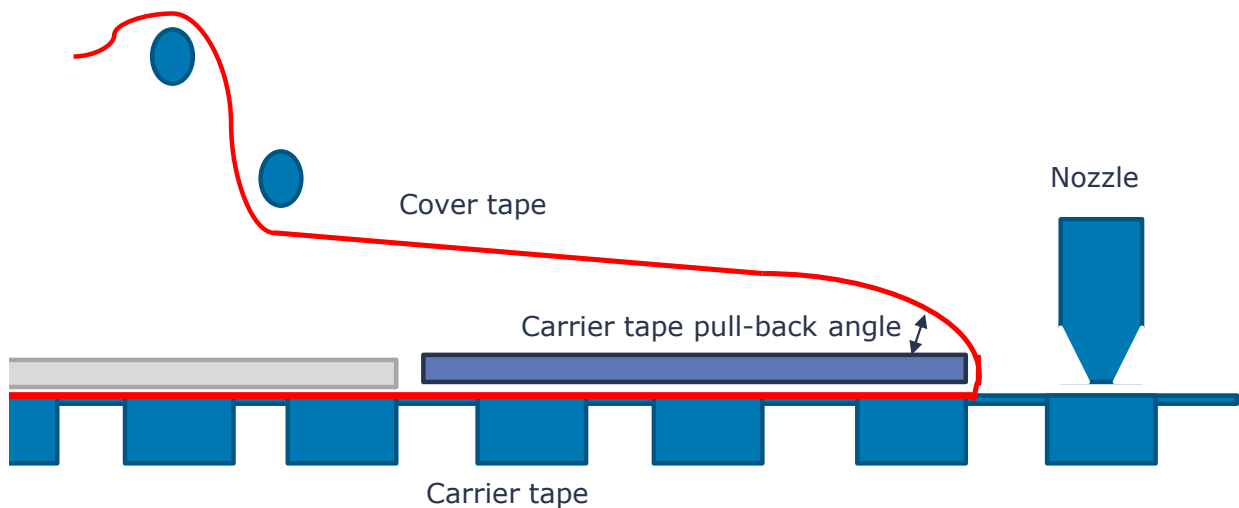


Figure 9: Adjusting cover tape pull-back location closer to pickup position, cover tape pulled back at a lower angle, minimizing chances of LED lifting out of the pocket

This adjustment can be seen in Figure 10 by bypassing roller #1 and using only roller #2.

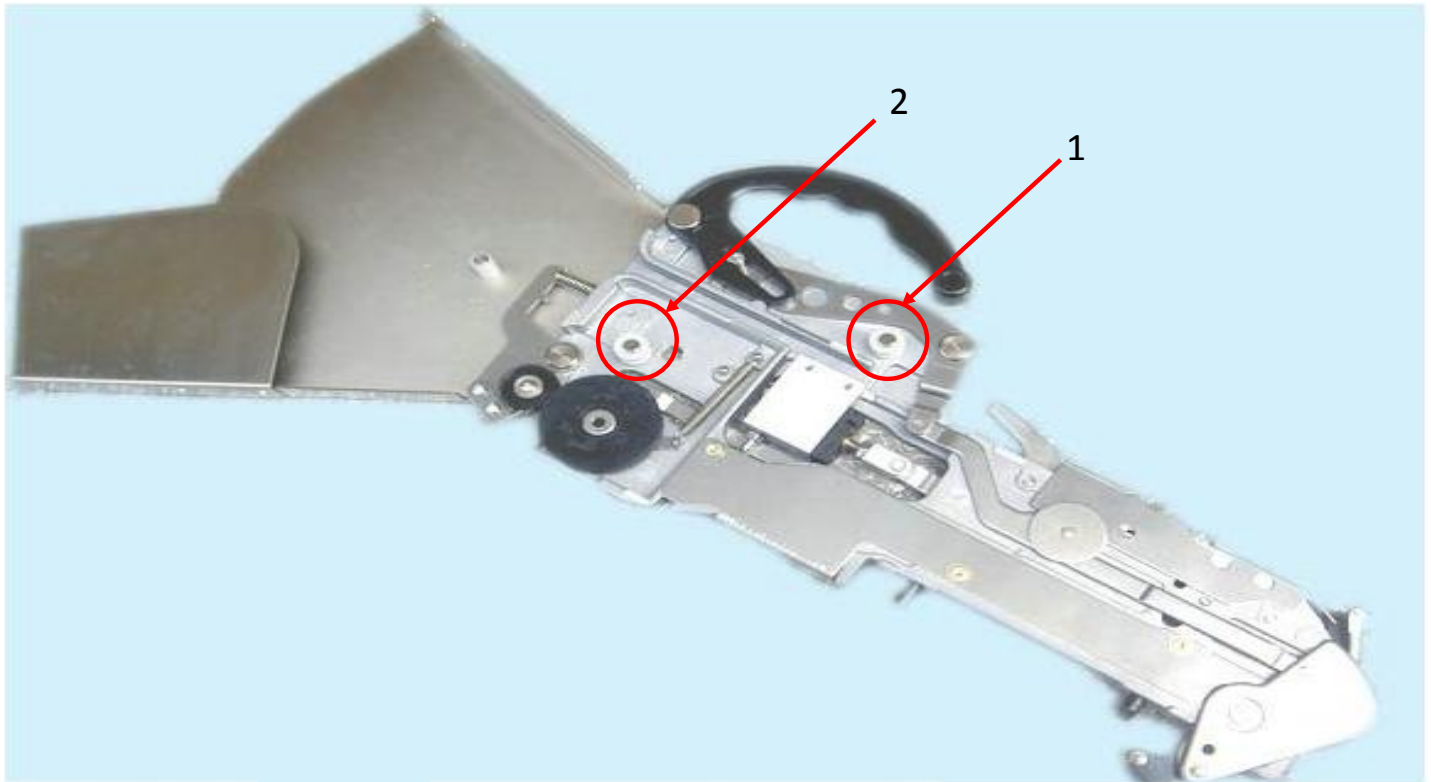


Figure 10: Adjusting cover tape pull-back location

2.2 INDEXING CHANNEL AND CARRIER TAPE GUIDES

Because the pocket on an embossed carrier tape is thin walled, the tape is semi-rigid. The guide rails on the feeder can allow for indexing imprecision, allowing components to move in the pocket and potentially be ejected from the pocket.

2.3 INDEXING SYSTEMS

On some systems the pneumatic solenoid is separate from the actuator. (See Figure 11.) This distance can sometimes cause an issue with actuation of the indexing because the exhaust of the valve is too far from the actuation, causing a buildup of air pressure and during the next index, actuation can be rather abrupt, which can dislocate the LED.

Other concerns that can also contribute to indexing issues with this type of feeder include wear on mechanical parts and air leakage through the supply lines. Cree LED advises contacting the pick and place manufacturer to get help tuning these feeders to the LED carrier tape.

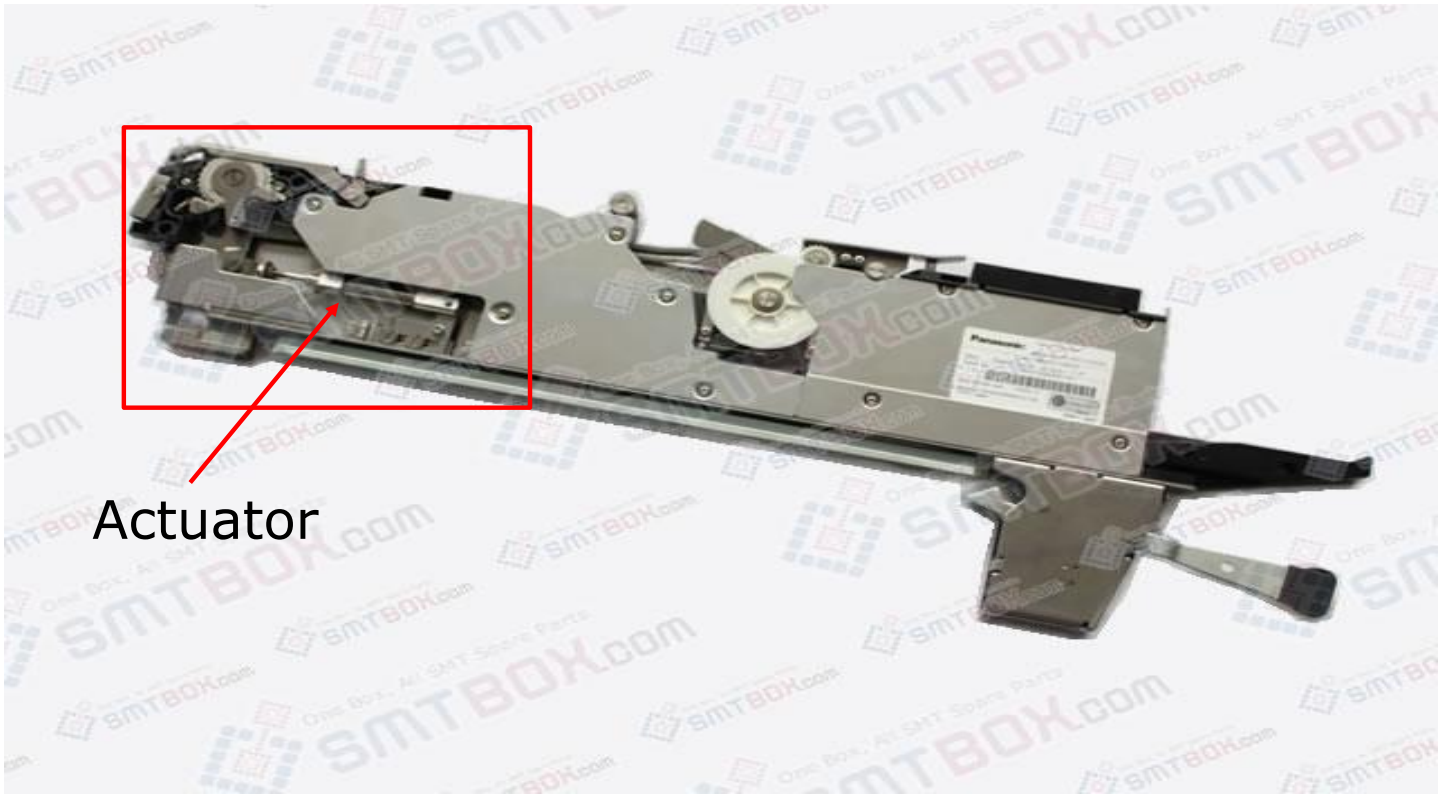


Figure 11: Example of separate actuator and solenoid
(Picture supplied by SMTBOX.com)

On some systems the actuator and the solenoid are in close proximity to each other, as shown in Figure 12, minimizing this effect. A regulator or needle valve can help minimize component “jump” during indexing.

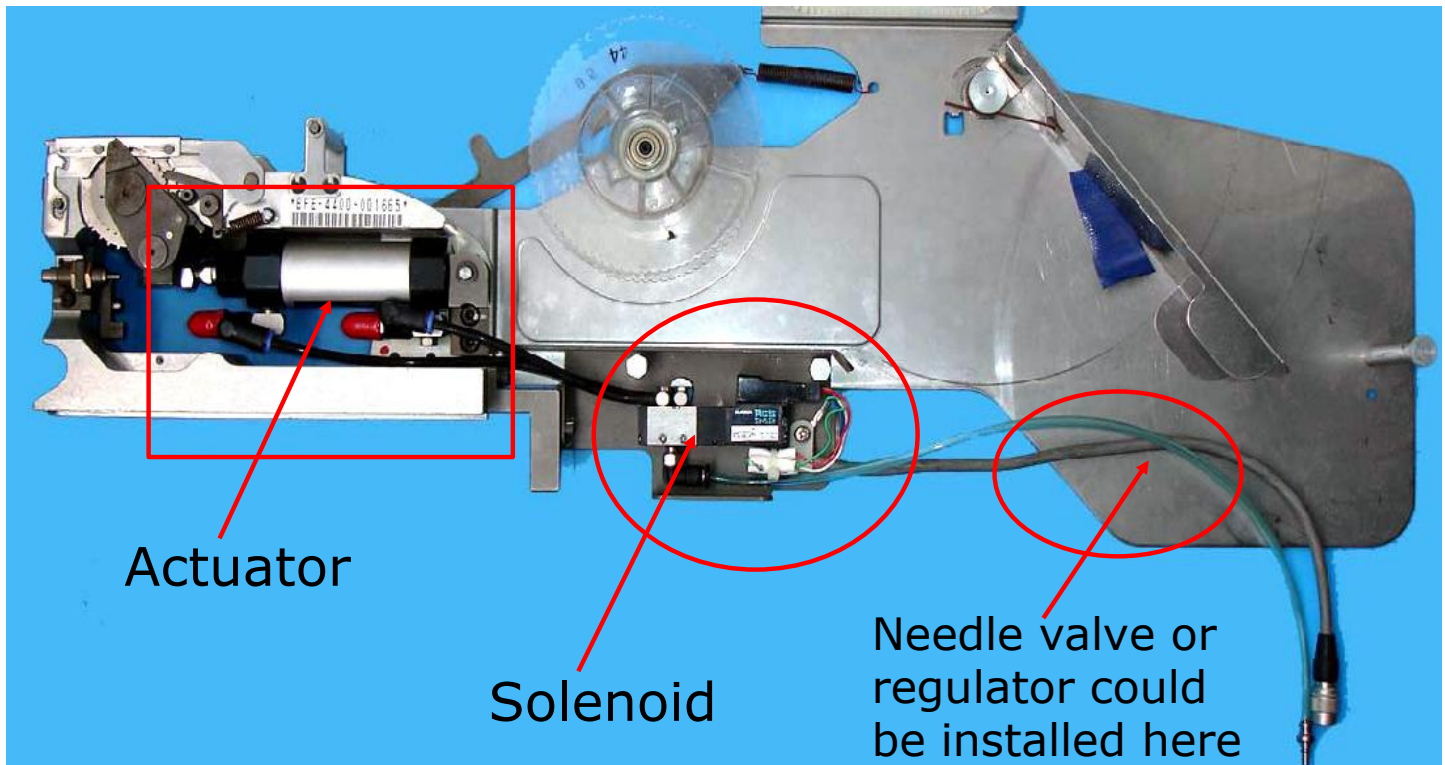


Figure 12: Example of actuator and solenoid in close proximity

Servo motor or DC stepper motors have been found to have the smoothest indexing, due mainly to their ability to precisely control the motor. The motor can be tuned by most field engineers through changes to the acceleration, deceleration, and overall velocity at which the system indexes. Other changes to a proportional integral derivative (PID) controller can help make this motion as smooth as needed to maximize feeder efficiency. There is less wear on the mechanics and a smoother indexing motion with this type of feeder unit.

3 BACKSIDE SUPPORT FOR PCB

A factor that can contribute to issues with placement that is not commonly considered is flexure of the PCB during the clamping process. As a PCB is indexed into an automated pick and place system, the board is typically driven against a mechanical stop at which time the system activates pneumatic actuators that clamp the board and hold it in place. Depending on the size of the PCB, a downward flexure that changes the placement zero plane may occur. By changing this zero plane location, the pick head moves down to the known position and may not have the over-travel to touch the solder, causing the tackiness of the solder to not assist in accurately placing the LED.

Most systems have the option for backside support. This can be a pneumatically or mechanically actuated bar or multiple long pins that come up behind the PCB and ensure that the zero plane is maintained across the PCB's entire surface. This can be seen in Figure 13.

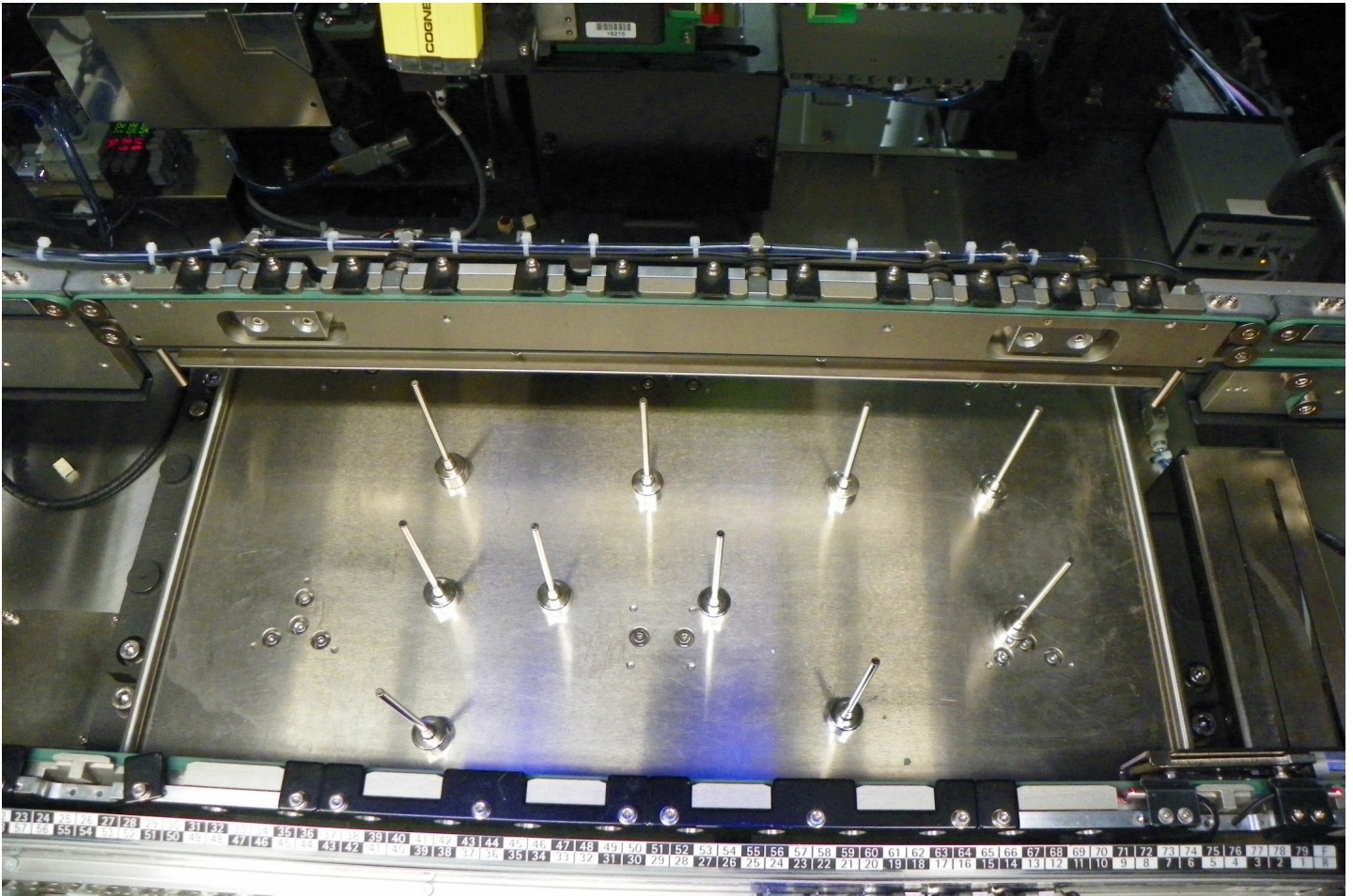


Figure 13: Example of backside support

4 FINE TUNING

There are a number of fine tuning adjustments to help reduce the mis-pick rate. The Appendix lists a number of these adjustments for specific systems. These adjustments include the following.

1. The depth to which the pick nozzle moves inside the pocket
2. The speed at which the pick head moves out of the pocket
3. The alignment acceptable percentage for the automated optical inspection (AOI)
4. The values for the component alignment systems
5. The amount of over-travel used during placement
6. The spring tension or force feedback used to place the component
7. The vacuum level settings for component presence checks

SUMMARY

Cree LED developed this application note together with leading pick and place suppliers to assist our customers in reducing mis-pick rates for LEDs. This is not a Cree LED-specific issue but these suggestions can help anyone experiencing issues picking and placing LEDs on an automated high-speed production line. The recommendations presented here have shown significant reductions in mis-picks and other component handling issues with automated systems. Cree LED continues to support on-going process improvements for our products through analysis and feedback from our customers and our pick and place equipment partners.

Cree LED has found that using the pyramid troubleshooting method helps reduce errors and operator interaction during the pick and place process. The proper nozzle, feeding adjustments, backside support, and settings have been demonstrated in numerous situations to assist in making pick and place equipment perform at a high level. The steps of the pyramid are not the only items that can cause errors, but the suggestions in this application note provide direction in the correction of some of the concerns with placing LEDs.

Millions of LEDs are processed daily resulting in a wealth of knowledge being gained, so if you have questions please contact your pick and place manufacturer and get them in contact with your Cree LED field applications engineer. Cree LED is happy to assist you in working to achieve quality in manufacturing.

APPENDIX

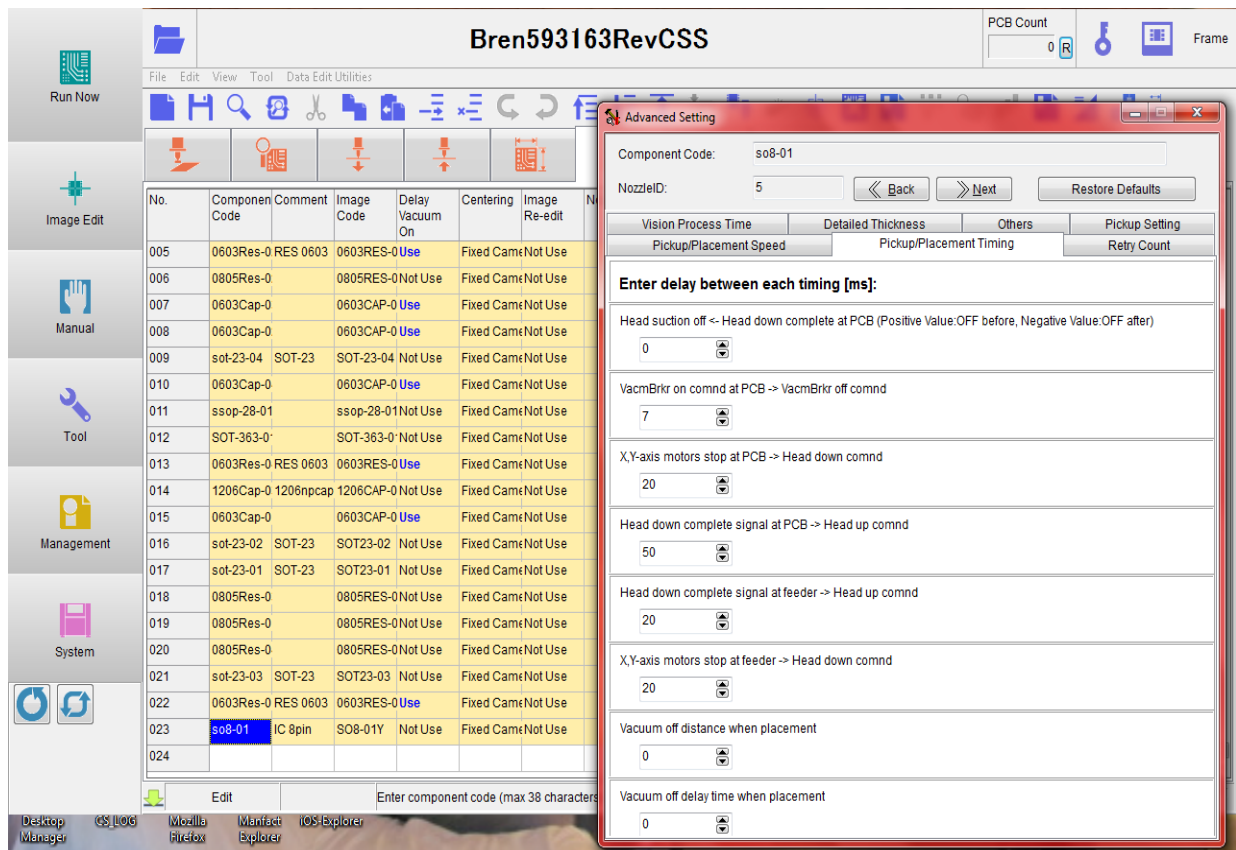
This appendix provides a number of adjustments to various pick and place equipment.

AMISTAR AUTOMATION

Parameter Tables

Every component in the Component Library has its own set of 'parameters' for Speed and Timing. The image below is called Advanced Setting – Pickup/Placement Timing. Values for when suction turns on / off, when vacuum breaker (purge air) turns on / off, and many other timings can be adjusted here. Every i-PULSE machine comes with default values for all types of components, but these parameter tables are available for the user to adjust as desired.

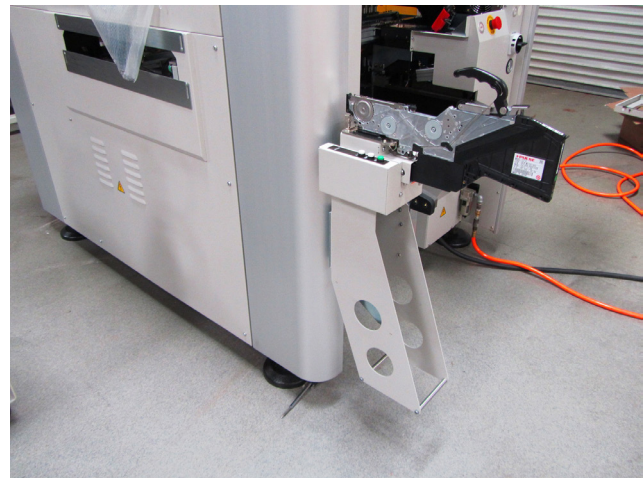
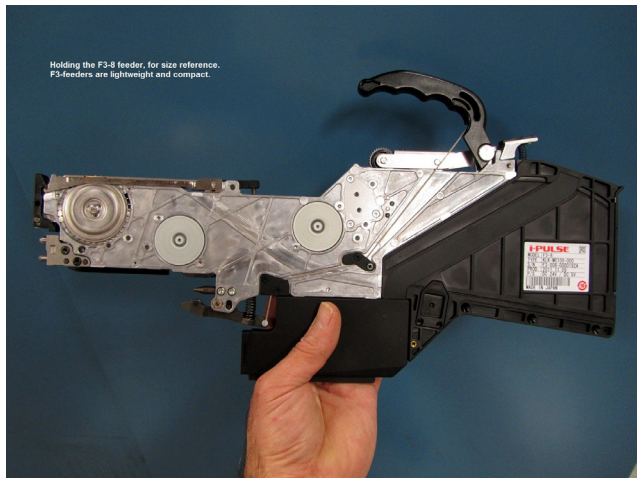
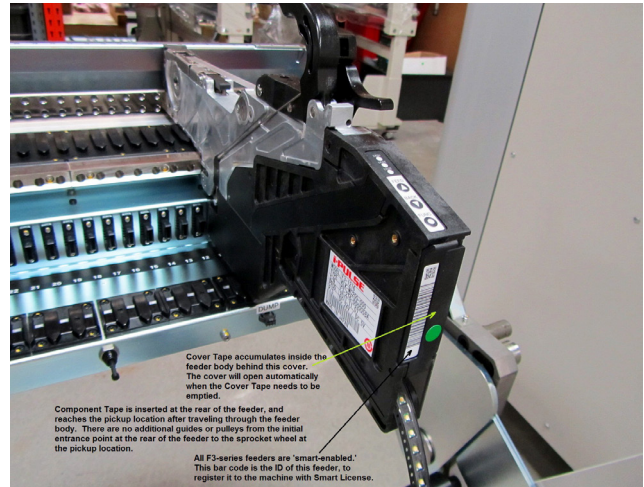
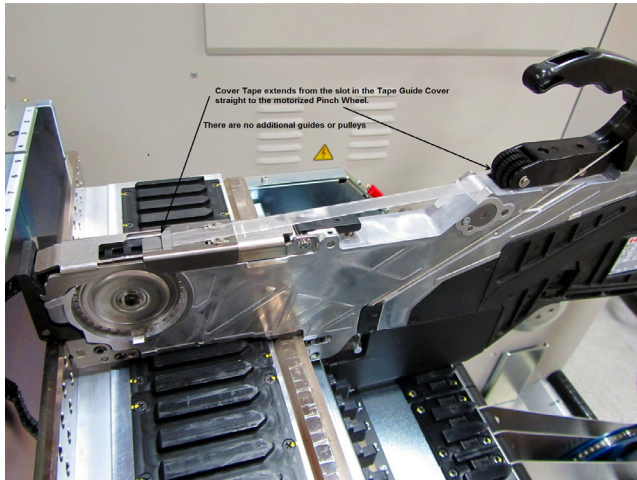
As can be seen in the Advanced Setting window, there are many more tables available for 'custom setting'.



In addition to setting each component for speed and timing, the F3-series feeders can be set for index speed as well, electronically, to accommodate "difficult" packages with odd shapes, or parts that are loose in pockets.

F3 Feeders

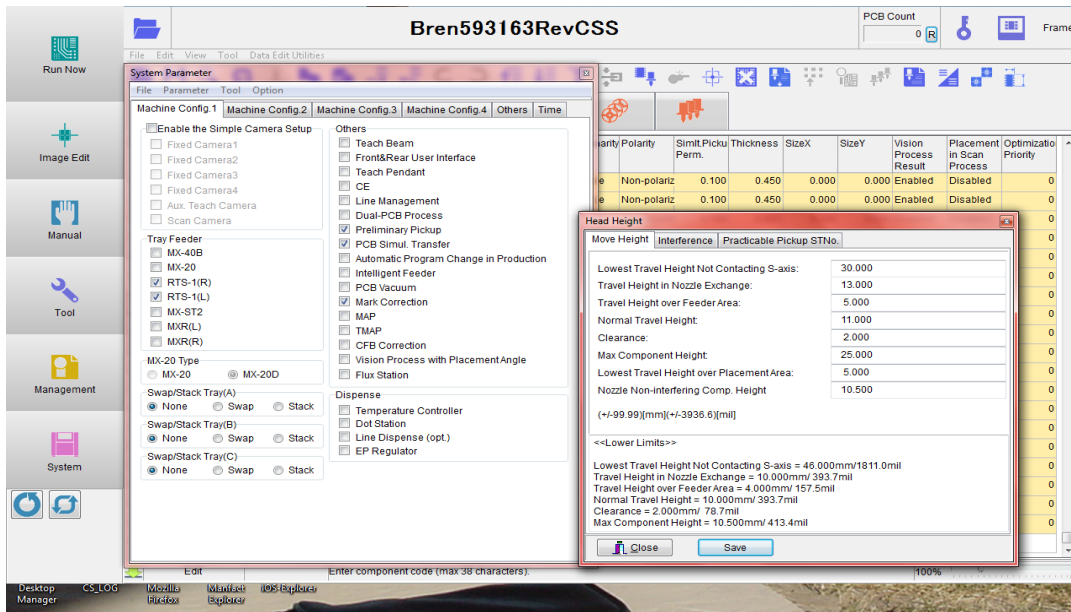
For the application of LED placement, the F3-series Tape Feeders from i-PULSE are an excellent solution. These are all-electric feeders which are very easy to load/unload, all have "smart" capability, and are electronically adjustable for index speed and pitch.



This on-board setup station is available for F3 Feeders, to adjust the pitch of each feeder. Once the pitch is set and recorded, the machine "remembers" this data and will index this feeder accordingly, until it is changed using the setup station. There is also an offline setup station available.

Application Questions – Cree LED: Z-Height Settings / Travel Height

The window below is the system parameter table for head height. This is the various travel heights during various machine functions. There are default settings which can be manipulated, but it is recommended to use default settings.



When determining the exact position for travel height, i-PULSE machines take into consideration the thickness of components being processed. The window below is the Component Library, which has a column including component thickness. This value comes automatically from the Image Library, where the component thickness is entered originally.

Bren593163RevCSS

No.	Component Code	Comment	Image Code	Delay Vacuum On	Centering	Image Re-edit	Nozzle No.	Coplanarity	Polarity	Simt.Pickup Perm.	Thickness	SizeX	SizeY	Vision Process Result	Placement in Scan Process	Optimization Priority
005	0603Res-0	RES 0603	0603RES-0	Use	Fixed Cam	Not Use	52	Not Use	Non-polariz	0.100	0.450	0.000	0.000	Enabled	Disabled	0
006	0805Res-0		0805RES-0	Not Use	Fixed Cam	Not Use	53	Not Use	Non-polariz	0.100	0.450	0.000	0.000	Enabled	Disabled	0
007	0603Cap-0		0603CAP-0	Use	Fixed Cam	Not Use	52	Not Use	Non-polariz	0.100	0.800	0.000	0.000	Enabled	Disabled	0
008	0603Cap-0		0603CAP-0	Use	Fixed Cam	Not Use	52	Not Use	Non-polariz	0.100	0.800	0.000	0.000	Enabled	Disabled	0
009	sot-23-04	SOT-23	SOT-23-04	Not Use	Fixed Cam	Not Use	52	Not Use	Polarized (r	0.100	0.980	0.000	0.000	Enabled	Disabled	0
010	0603Cap-0		0603CAP-0	Use	Fixed Cam	Not Use	52	Not Use	Non-polariz	0.100	0.800	0.000	0.000	Enabled	Disabled	0
011	ssop-28-01		ssop-28-01	Not Use	Fixed Cam	Not Use	5	Not Use	Polarized (r	0.100	1.860	0.000	0.000	Enabled	Disabled	0
012	SOT-363-0		SOT-363-0	Not Use	Fixed Cam	Not Use	52	Not Use	Polarized (r	0.100	0.990	0.000	0.000	Enabled	Disabled	0
013	0603Res-0	RES 0603	0603RES-0	Use	Fixed Cam	Not Use	52	Not Use	Non-polariz	0.100	0.450	0.000	0.000	Enabled	Disabled	0
014	1206Cap-0	1206ncap	1206CAP-0	Not Use	Fixed Cam	Not Use	53	Not Use	Non-polariz	0.100	0.840	0.000	0.000	Enabled	Disabled	0
015	0603Cap-0		0603CAP-0	Use	Fixed Cam	Not Use	52	Not Use	Non-polariz	0.100	0.800	0.000	0.000	Enabled	Disabled	0
016	sot-23-02	SOT-23	SOT-23-02	Not Use	Fixed Cam	Not Use	52	Not Use	Polarized (r	0.100	0.960	0.000	0.000	Enabled	Disabled	0
017	sot-23-01	SOT-23	SOT-23-01	Not Use	Fixed Cam	Not Use	52	Not Use	Polarized (r	0.100	0.980	0.000	0.000	Enabled	Disabled	0
018	0805Res-0		0805RES-0	Not Use	Fixed Cam	Not Use	53	Not Use	Non-polariz	0.100	0.460	0.000	0.000	Enabled	Disabled	0
019	0805Res-0		0805RES-0	Not Use	Fixed Cam	Not Use	53	Not Use	Non-polariz	0.100	0.460	0.000	0.000	Enabled	Disabled	0
020	0805Res-0		0805RES-0	Not Use	Fixed Cam	Not Use	53	Not Use	Non-polariz	0.100	0.460	0.000	0.000	Enabled	Disabled	0
021	sot-23-03	SOT-23	SOT-23-03	Not Use	Fixed Cam	Not Use	52	Not Use	Polarized (r	0.100	0.980	0.000	0.000	Enabled	Disabled	0
022	0603Res-0	RES 0603	0603RES-0	Use	Fixed Cam	Not Use	52	Not Use	Non-polariz	0.100	0.450	0.000	0.000	Enabled	Disabled	0
023	so8-01	IC 8pin	SO8-01Y	Not Use	Fixed Cam	Not Use	5	Not Use	Polarized (r	0.100	1.660	0.000	0.000	Enabled	Disabled	0
024																

ASSEMBLEON

1. Modifications to the system feeder units?

ITF3 feeders do not require special modifications to handle LED parts in tape. For older style ITF2 feeders, several upgrade options exist. Please contact an Assembleon representative for more info.

a. Any parts numbers required from the manufacturer needed for modification?

Not required for ITF3.

b. Any changes that a customer can perform on their own, such as a needle valve installation in the air supply line to slow down the indexing?

Not required.

2. Nozzle part numbers listed by LED types (XR, XP, MX, ML, XM, XB-D, XT-E, XP-E HEW) from your list that have been utilized and proven with LEDs?

In many cases LED components require dedicated nozzles; below is a brief overview for our A-series. For those types where “to be defined” is indicated, the dedicated nozzle can be made on customer request:

XR: 9466-918-30631

XP: 9466-918-37431 & 9466-918-34491

MX: To be defined

ML: 9466-918-37431

XM-L®: 9466-918-37051

XB-D: 9466-918-22211

XT-E: To be defined

XP-E HEW: To be defined

3. Where to access parameters like purge, z height, over-travel or pressure adjustments, AOI parameters – screen tab callouts where adjustments can be made?

All dedicated nozzles are delivered with dedicated nozzle and component files to ensure the best conditions for picking, aligning and placing of LED parts. When modifications are required, please consult an Assembleon expert.

4. Specific Feeder units that would be recommended for potential upgrades in feeding for LEDs?

ITF3 feeders do not require special modifications to handle LED parts in tape. For older style ITF2 feeders, several upgrade options exist. Please contact an Assembleon representative for more details.

5. How does your system index the feeder unit, pneumatic or servo?

Feeder indexing is done using a servo system. The servo system is optimized for a smooth indexing and a highly reproducible part positioning.

6. How does the cover tape pull back?

Tape cover peel-off position is standard closest to the pick position. The peel-off angle is always < 10 degrees (see picture).



- a. Show how to adjust multiple guides to just a single guide.

Not applicable.

7. Are there parameter tables for customers to reference to optimize their systems in a table?

All dedicated nozzles are delivered with dedicated nozzle and component files to ensure the best conditions for picking, aligning and placing of parts. When modifications are required, please consult an Assembleon expert.

- a. Purge times?

NA. Included in dedicated component file.

- b. Purge pressure settings if applicable?

NA. Monitored in robot. If outside of desired range the machine is stopped with an error.

- c. Z height settings?

NA. Heights are automatically detected/taught via our closed loop force control on every pick/place action.

- d. Over-travel or recommended pressure settings?

NA. Closed loop force control on every pick/place action.

- e. Speed settings for optimal performance?

NA. Included in dedicated component file.

- f. Over-travel settings if applicable?

NA. Closed loop force control on every pick/place action.

- g. AOI parameters for alignment?

NA. Included in dedicated component file.

- h. System input pressure (if venture is used for vacuum this could be critical)?

NA. Incoming air-pressure levels are monitored. If outside of desired range the machine is stopped with an error.

8. Anything else you would like to refer customers to?

- a. Some LEDs have a sticky dome, causing the LED material to deposit a little of its surface material on the nozzle tip, even when using Teflon coating. Regular cleaning of nozzles (and re-applying PTFE spray) can reduce but not eliminate this effect.
- b. Increasing purge pressures too much might result in "blowing away" neighbor parts or solder paste deposits already present.
- c. Don't start experimenting with changing settings as this might have negative effects on the performance. Consult an Assembleon expert.

JUKI AUTOMATION SYSTEMS

526 Nozzle Installation Procedure

Introduction:

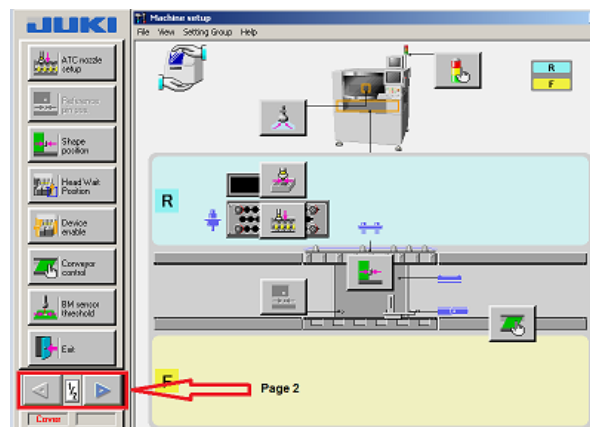
Main purpose is provide detailed instructions to install nozzle INI files for use of custom nozzle on KE, FX, CX, JX series machines. Custom nozzles must be registered in the machine software before they can be used or automatically recognized by ATC setup.

Quick Guide:

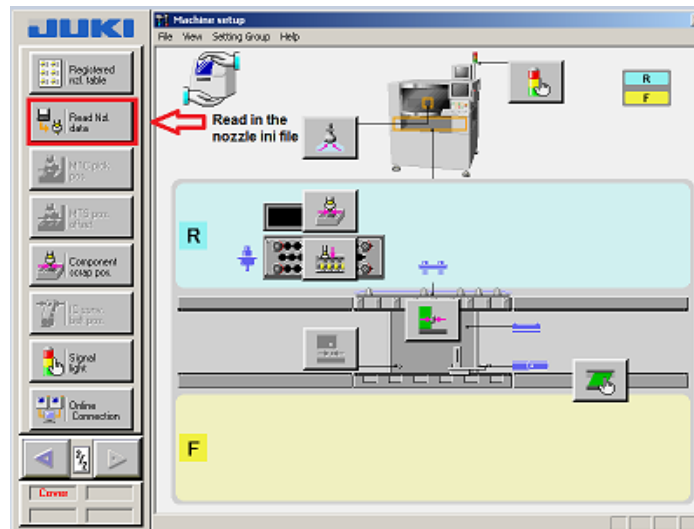
- 1) The 526 ini file will be provided with the purchase of the nozzle.
- 2) Move copied INI file to hard drive of machine.
- 3) Read and register nozzle INI file to machine software.
- 4) Perform ATC setup for machine to recognize the new custom nozzle.
- 5) Exit and save new nozzle configuration.
- 6) Setting up the new 526 nozzle for use in production.
- 7) Part number and drawing for custom 526 nozzle.
- 8) Feeder considerations.

Installation Instructions:

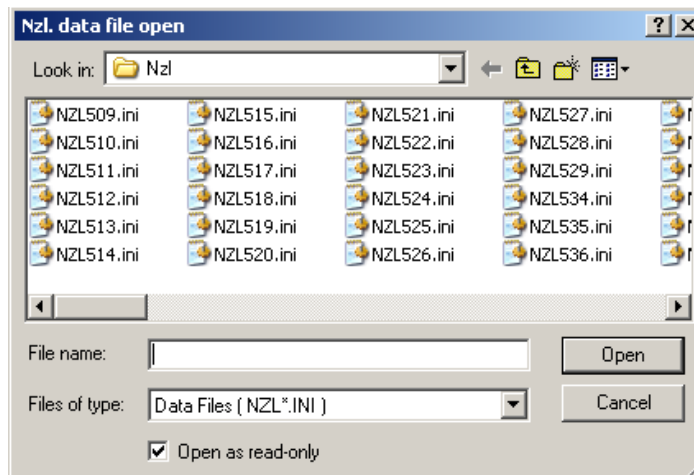
- 1) First, copy the INI file received with the nozzle to the machines hard drive. This can be done by USB, network, or floppy depending on the model of machine you have. If the file already exists overwrite it with the new one. The INI file MUST be copied to the following folder:
 - a. KE2010-KE2060R
C:\Juki\Data\Custom\NZL
 - b. KE2070, KE2080, JX100, JX200, FX1R, FX3, 3020
D:\Juki\Data\Custom\NZL
- 2) Login as Service Engineer. Then go to Machine Setup, go to Page 2.



- 3) Select the "Read Nzl data" button

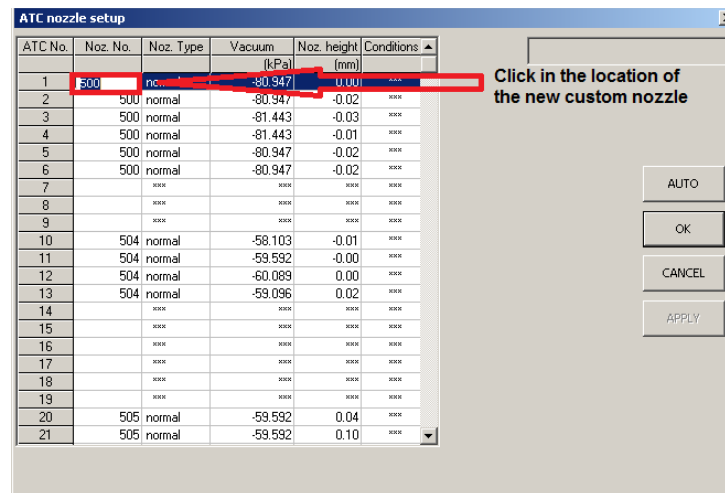


- a. Select the new nozzle INI file from where you put it and select Open. Note: This may take a minute to register the new INI file.



ATC Setup:

- 1) While still in Machine Setup, return to Page 1.
- 2) Physically install the nozzle into the ATC (automatic tool changer). Make note of the location you put the nozzle in.
- 3) Select the ATC nozzle setup tab from the top left corner.
- 4) Click in the cell for the location you put the new custom nozzle in and select F3 on the keyboard. The machine will automatically pick up the new nozzle and calibrate the vacuum and nozzle height, then add it to the list.

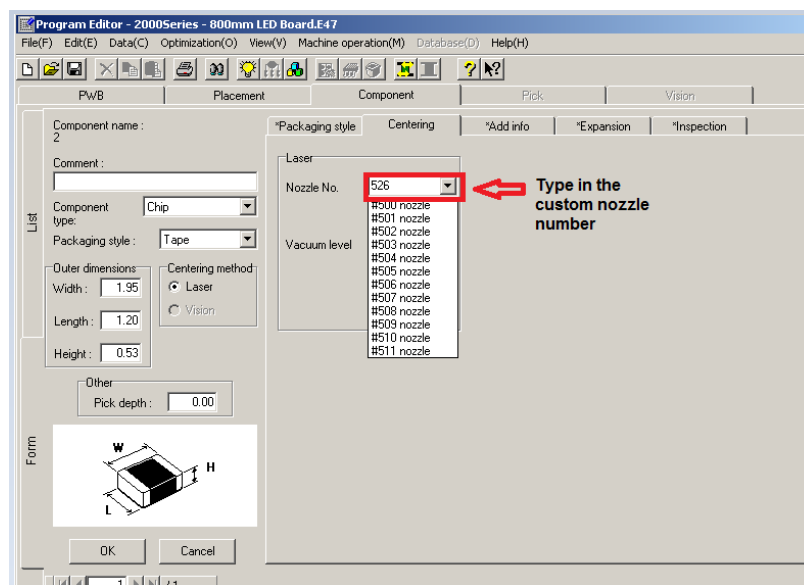


NOTE: If there is a nozzle with the same nozzle dimensions registered then in the system a list of nozzle numbers will pop up and give you a choice of which nozzle it is. Select the correct nozzle (example NZL526).

5) Exit and save. When prompted, reset the I/O.

Using the New Custom Nozzle:

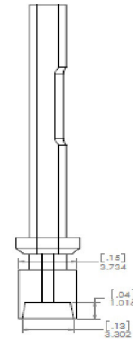
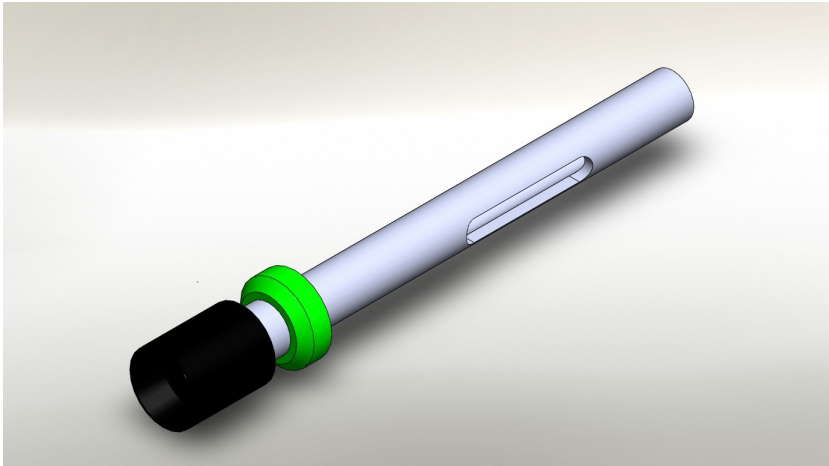
- 1) Open Program Editor.
- 2) Go to the component list and double click on the Component name of the part you want to use the new custom nozzle on.
- 3) Select the Centering tab and type in the new nozzle number. The custom nozzle number WILL NOT show up in the default nozzle list.



4) Optimize and save.

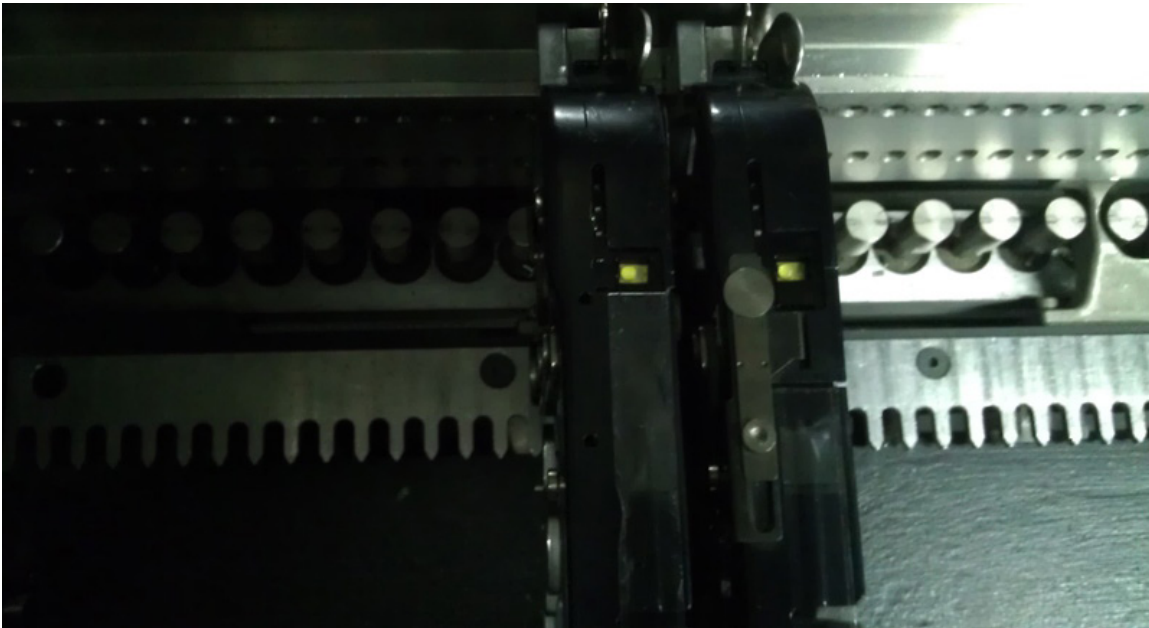
Note: If auto measure is used, it will try and put the default nozzle number back in after the measurement is done.
Make sure to say no when asked to change the nozzle number when prompted.

Part number CN-CREEXPE2-00:



Mechanical Feeder Considerations:

- 1) If LEDs are sticking to the Mylar
- 2) If the feed shutter is making contact with the LED during feed advance causing the LEDs to flip up in the pocket
- 3) A replacement tape cover is available from Juki Part # FA-25470. Contact the Juki sales department for pricing and availability.
- 4) Below is a comparison of the standard tape cover and the modified one.



Electronic Feeder Considerations:

- 1) Juki's electronic feeders need no modification to insure proper advance of components.

PANASONIC

Custom Nozzle Development

XLamp XP-E & XP-G LEDs

For MSF & BM-Series Machines: PN QUBS80709018-ASSY

- Nozzle Library Definition (entry #31 below):

No.	Nozzle Name	Light	Type	Shape	Height Offset (mm)	Nozzle Size
22	CN-R10	1:Reflect	1:Spring	2:Wide	0.00	1:L
23	CN-R11	1:Reflect	1:Spring	2:Wide	0.00	0.5
24	CN-R12	1:Reflect	1:Spring	2:Wide	0.00	0.5
25	CHUCK-S	1:Reflect	3:Chuck	2:Wide	0.00	1:L
26	CHUCK-M	1:Reflect	3:Chuck	2:Wide	0.00	1:L
27	CHUCK-SS	1:Reflect	3:Chuck	2:Wide	-12.00	1:L
28	CHUCK-SM	1:Reflect	3:Chuck	2:Wide	-12.00	1:L
29	MG	1:Reflect	1:Spring	1:Circle	0.00	0.5
30	MG-P	1:Reflect	1:Spring	1:Circle	0.00	0.5
31	XPE	1:Reflect	1:Spring	1:Circle	0.00	0.5
32		1:Reflect	1:Spring	1:Circle	0.00	0.5
33		1:Reflect	1:Spring	1:Circle	0.00	0.5
34		1:Reflect	1:Spring	1:Circle	0.00	0.5
35		1:Reflect	1:Spring	1:Circle	0.00	0.5
36		1:Reflect	1:Spring	1:Circle	0.00	0.5
37		1:Reflect	1:Spring	1:Circle	0.00	0.5
38		1:Reflect	1:Spring	1:Circle	0.00	0.5

For CM-Series & NPM Machines:

- 16 & 12-Nozzle VHS Head: QUBS60209008-ASSY

◇ PT200 Nozzle Library Definition

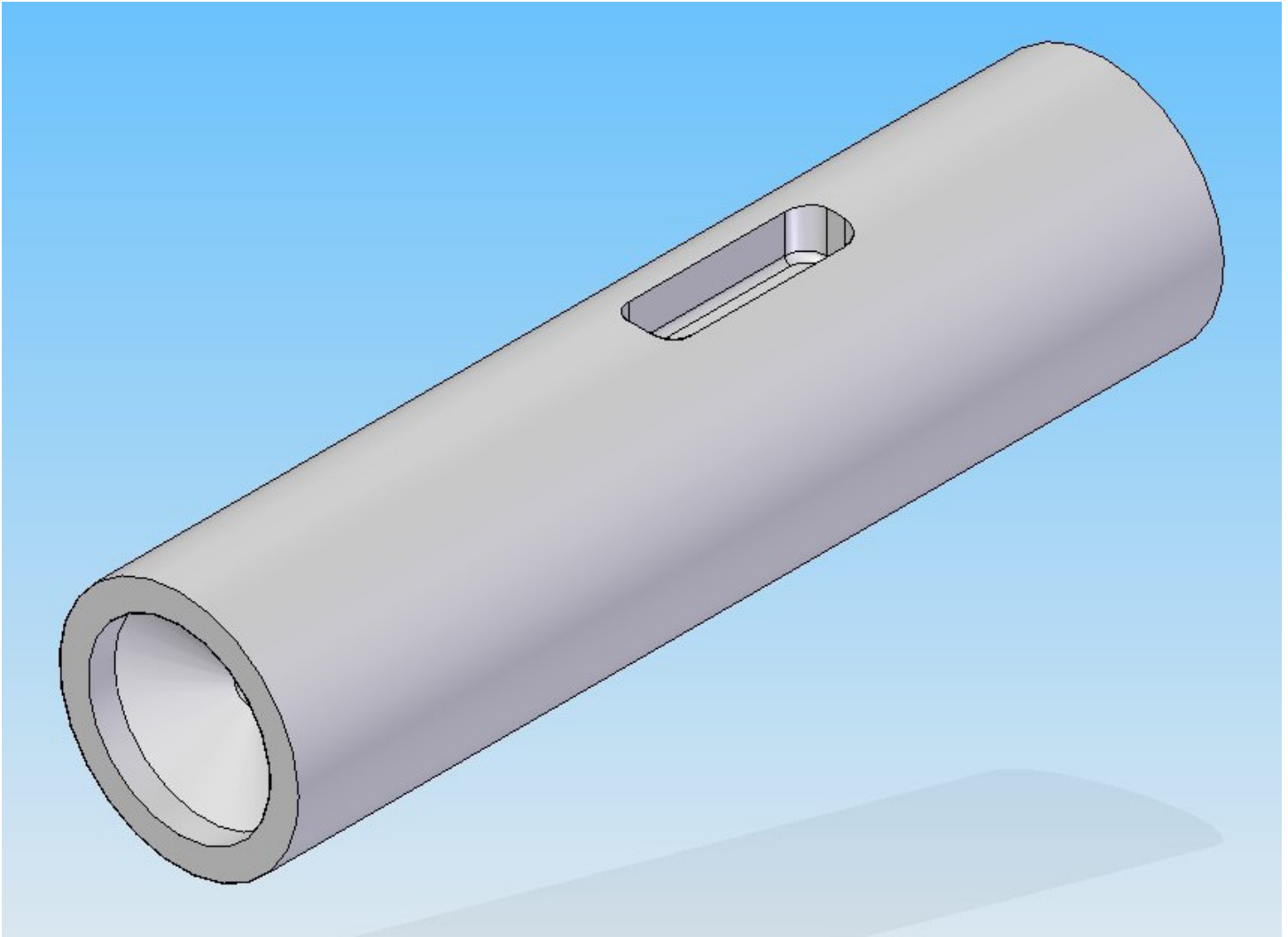
NOZZLE#	TUPH	MAXH	X	Y	SIZE	CO	LO	TO	VU	VD	TT	MT	PM	PF
111S	13.8	13.8	4.0	4.0	STD	0	0	0	5	-2	5	0	-5	-65

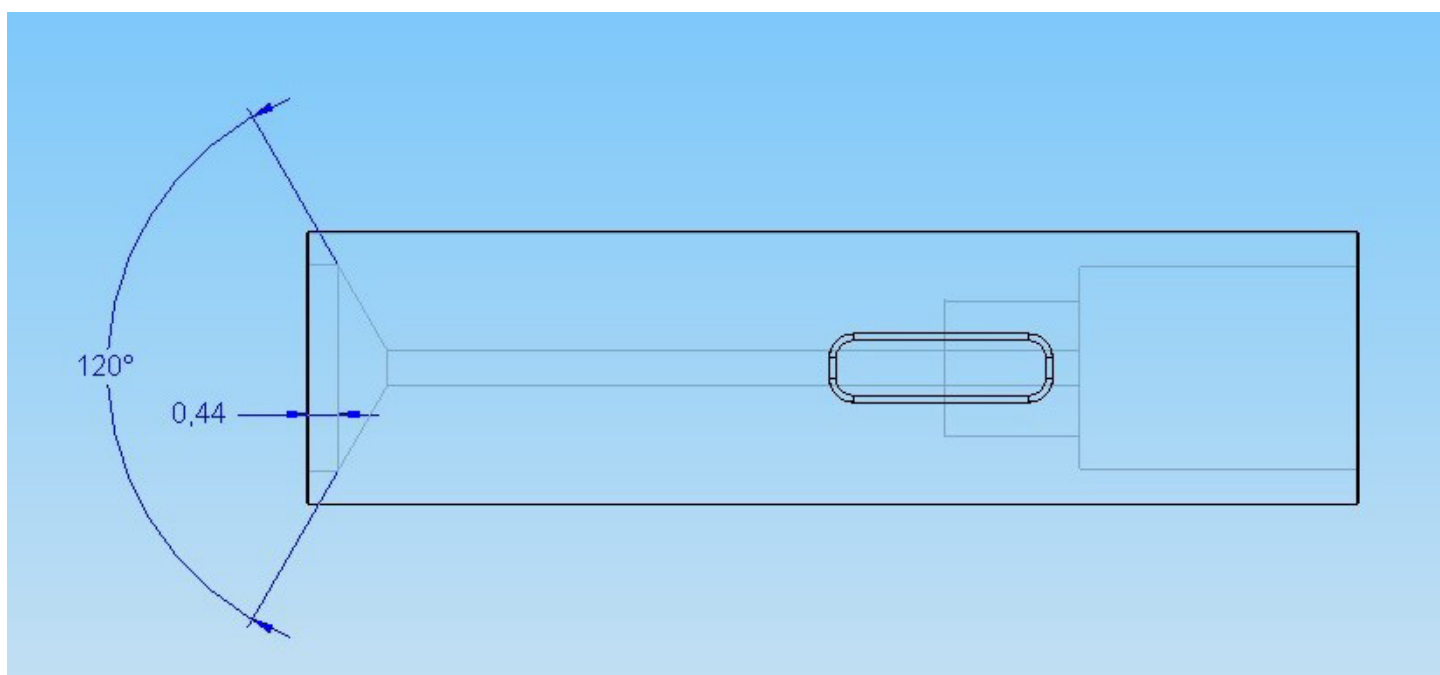
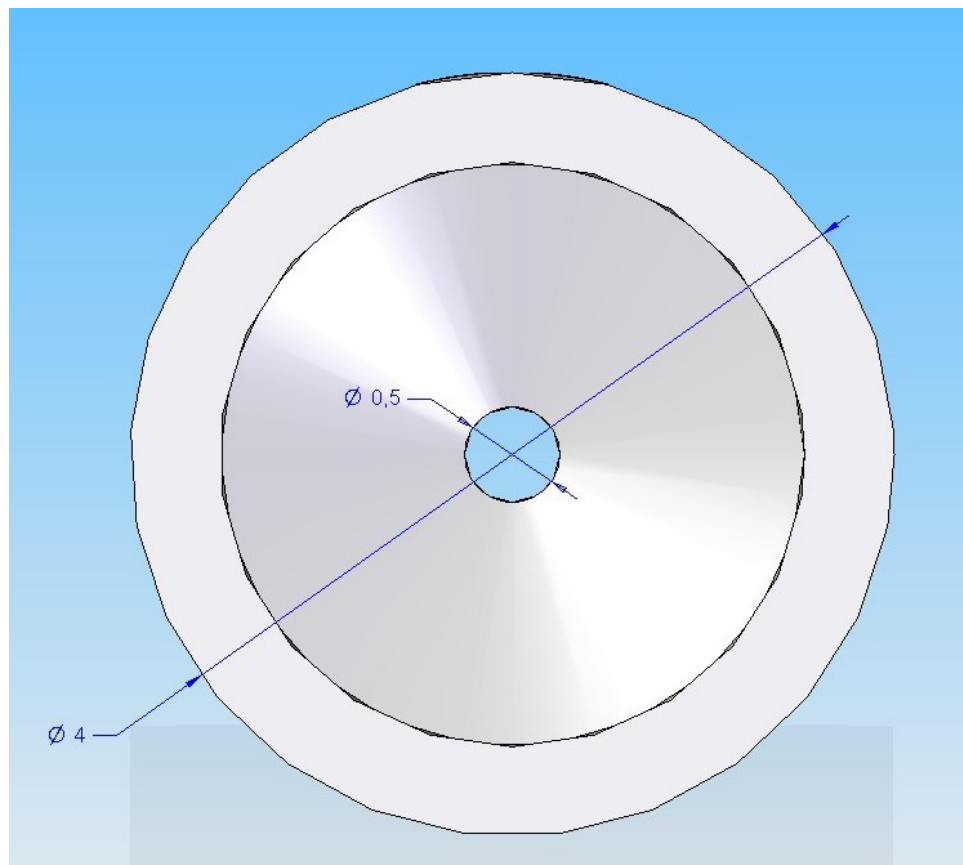
- 8-Nozzle Head HS/HF Head: QUBS40209112-ASSY

◇ PT200 Nozzle Library Definition

NOZZLE#	TUPH	MAXH	X	Y	SIZE	CO	LO	TO	VU	VD	TT	MT	PM	PF
111	13.8	13.8	4.0	4.0	STD	0	0	0	5	-2	5	0	-5	-65

All of the above nozzles have the vacuum tip shown here:





CLM3A-WKW/MKW

For MSF & BM-Series Machines: PN QUBS80709024-ASSY

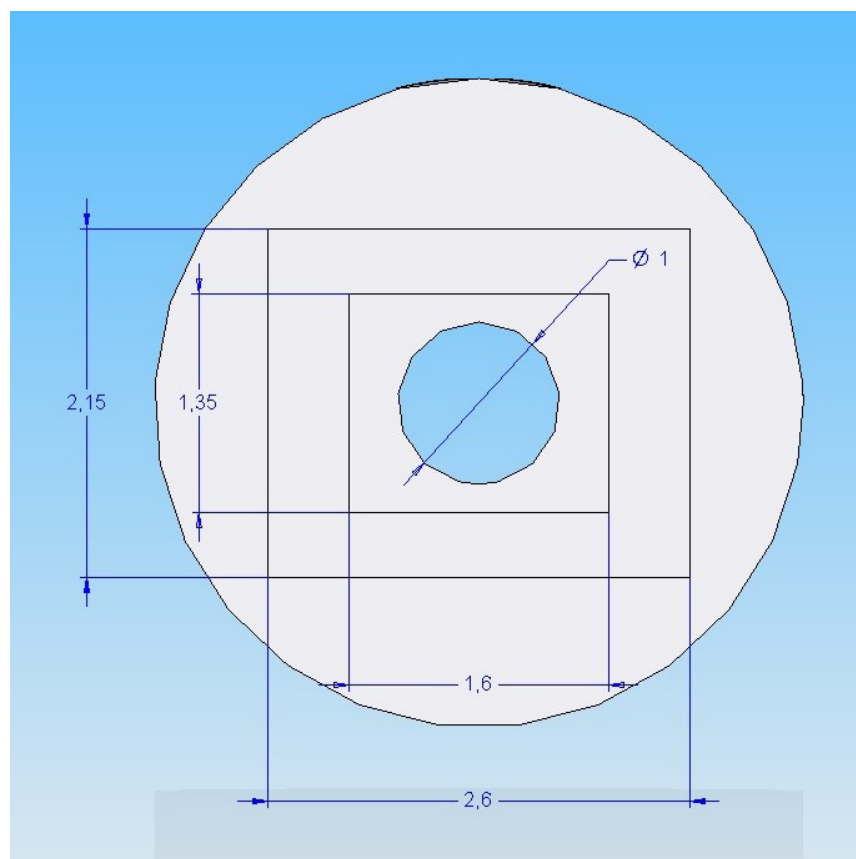
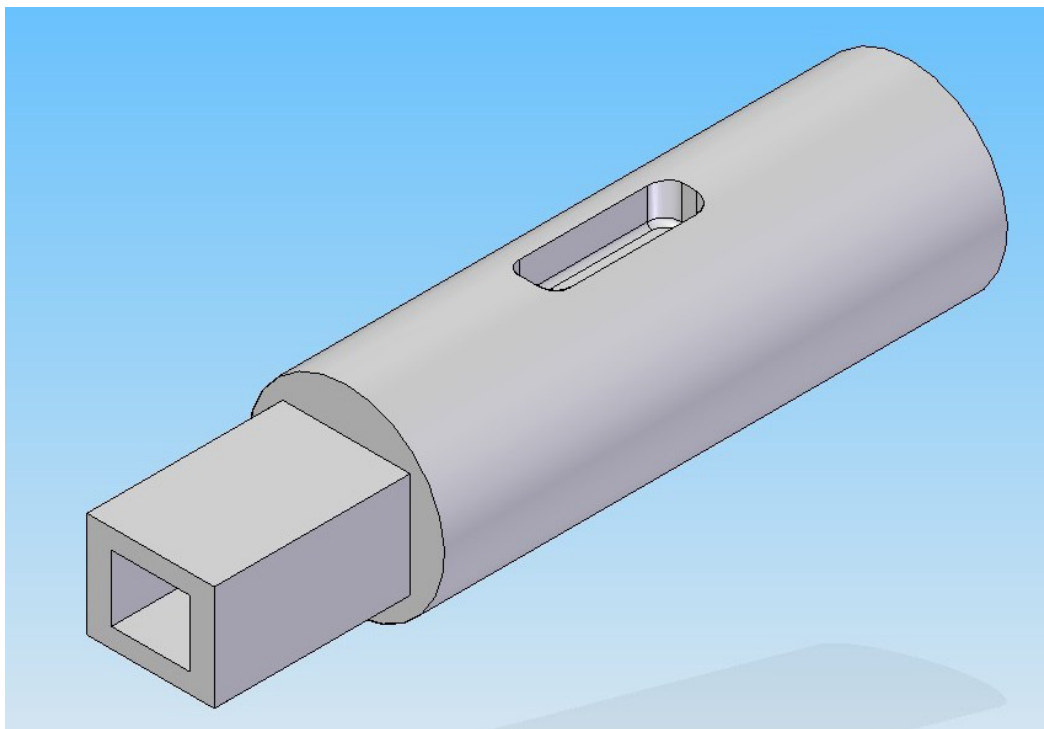
- Nozzle Library Definition (entry #31 below):

V1 - Nozzle Editor(BM)

File Edit View

No.	Nozzle Name	Light	Type	Shape	Height Offset (mm)	Nozzle Size
19	CN-R7	1:Reflect	1:Spring	2*Wide	0.00	1:L
20	CN-R8	1:Reflect	1:Spring	2*Wide	0.00	0:S
21	CN-R9	1:Reflect	1:Spring	2*Wide	0.00	1:L
22	CN-R10	1:Reflect	1:Spring	2*Wide	0.00	1:L
23	CN-R11	1:Reflect	1:Spring	2*Wide	0.00	0:S
24	CN-R12	1:Reflect	1:Spring	2*Wide	0.00	0:S
25	CHUCK-S	1:Reflect	3:Chuck	2*Wide	0.00	1:L
26	CHUCK-M	1:Reflect	3:Chuck	2*Wide	0.00	1:L
27	CHUCK-SS	1:Reflect	3:Chuck	2*Wide	-12.00	1:L
28	CHUCK-SM	1:Reflect	3:Chuck	2*Wide	-12.00	1:L
29	MG	1:Reflect	1:Spring	1:Circle	0.00	0:S
30	MG-P	1:Reflect	1:Spring	1:Circle	0.00	0:S
31	CLM	1:Reflect	1:Spring	4:Bias 0 degree	0.00	0:S
32		1:Reflect	1:Spring	1:Circle	0.00	0:S
33		1:Reflect	1:Spring	1:Circle	0.00	0:S
34		1:Reflect	1:Spring	1:Circle	0.00	0:S
35		1:Reflect	1:Spring	1:Circle	0.00	0:S

Ready

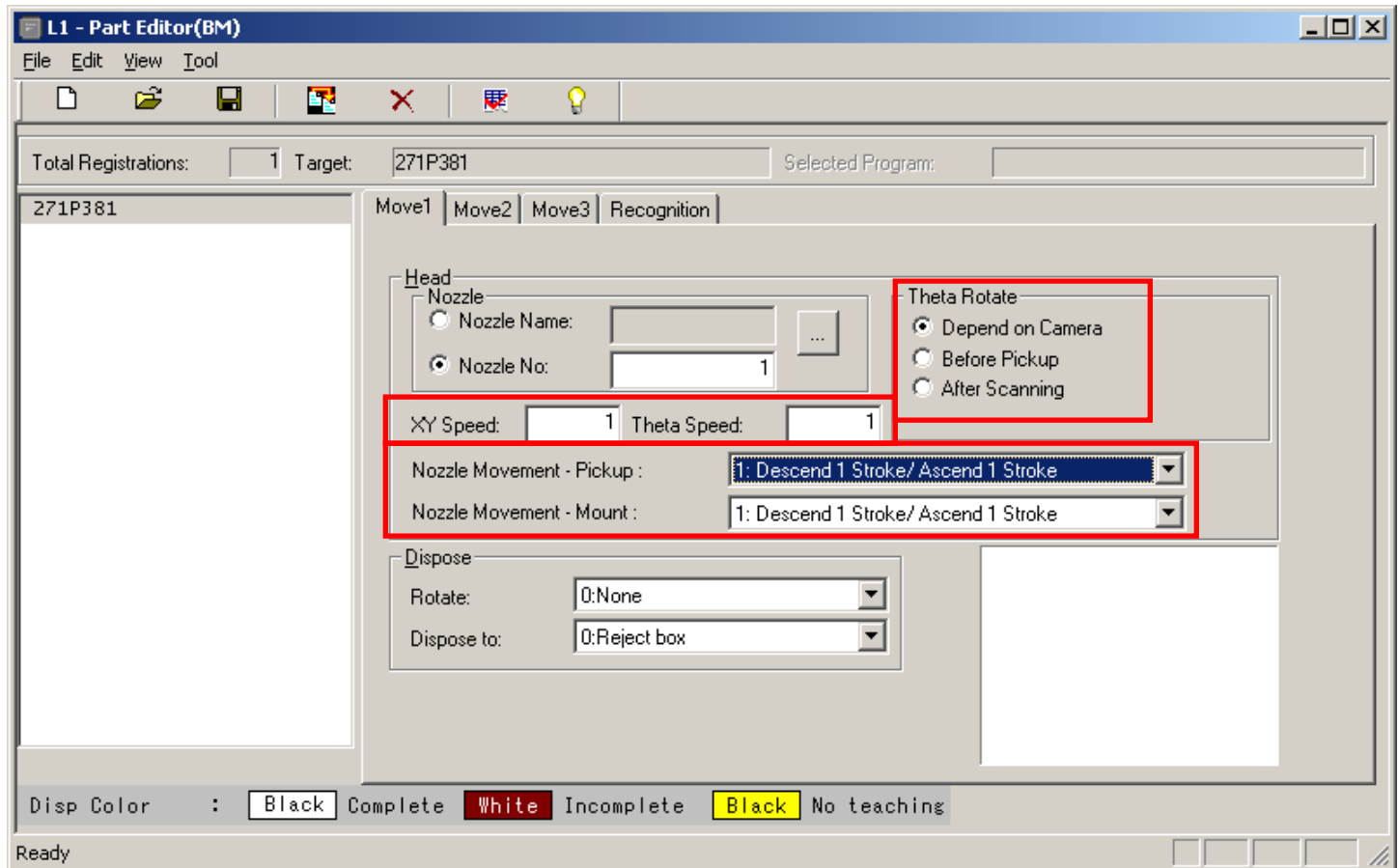


Machine-Specific Programming Notes

MSF & BM-Series

Standard Panasonic Pneumatic and Electronic Pitch-Programmable feeders are fully capable of supplying LED components without upgrade or modification.

Each PN can be programmed to minimize pickup and mount errors as follows:



Theta Rotate: This field is used to specify when in the pick-place process to rotate the head/nozzle. Before the pickup, so the part crosses the REC camera at the placement orientation (no gross rotations after recognition) or After Scanning so the part is recognized at zero degrees (the orientation in the pocket) and rotated to the placement orientation after recognition.

XY Speed (1-8) where 1 is the max speed & 8 is the slowest speed. Adjust XY gantry speed in order to ensure LED stability on the nozzle.

Theta Speed (1-4) where 1 is the max speed & 4 is the slowest speed. Adjust Theta speed in order to ensure LED stability on the nozzle.

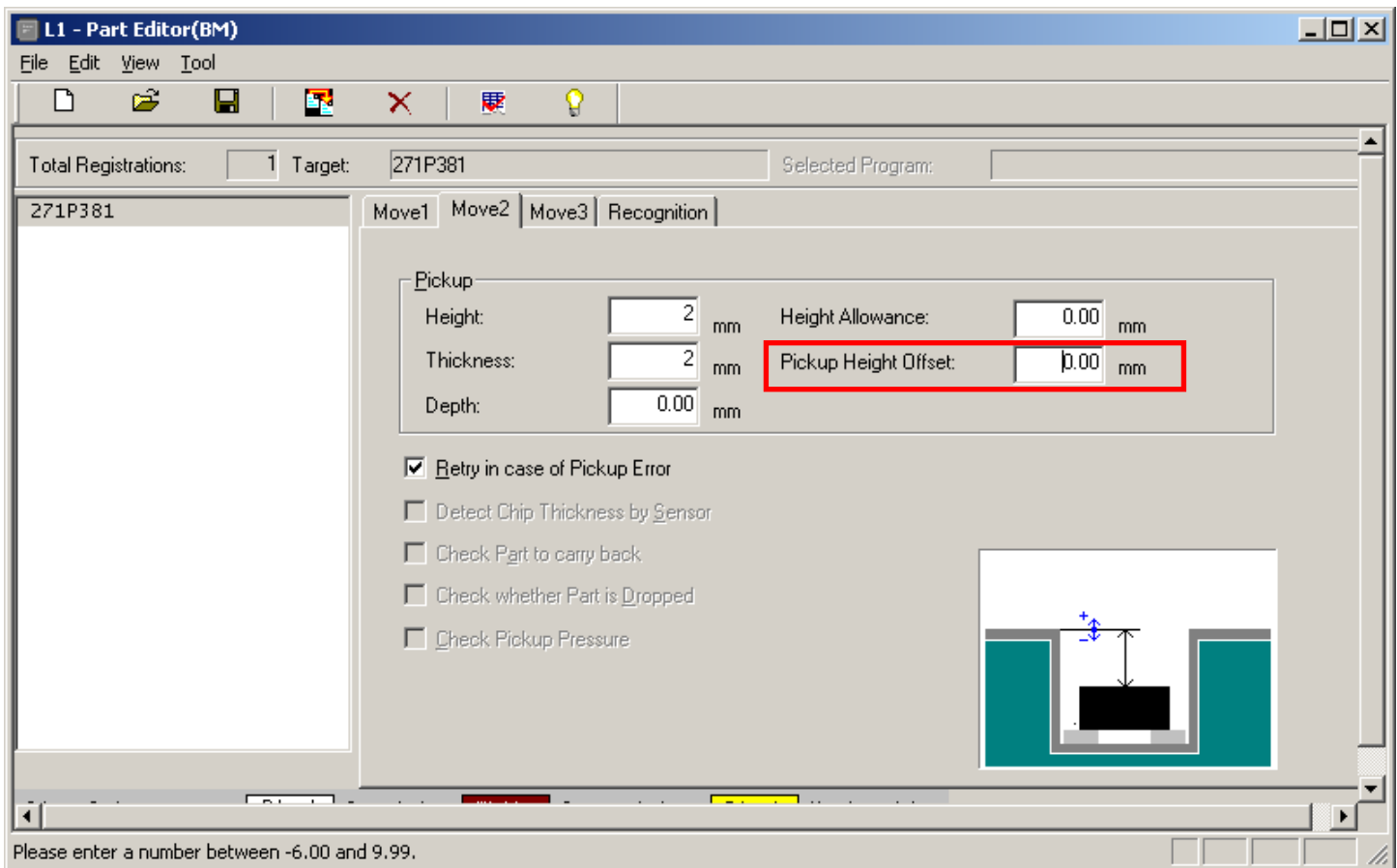
Nozzle Movement – Pickup: This field is used to program a delay at pickup during the nozzle descent into the feeder position and/or the nozzle ascension after pickup. This field is used to create a pause at pickup in order to ensure vacuum stability:

- 1: Descend 1 Stroke / Ascend 1 Stroke

- 2: Descend 2 Strokes / Ascend 1 Stroke
- 3: Descend 1 Stroke / Ascend 2 Strokes
- 4: Descend 2 Strokes / Ascend 2 Strokes

Nozzle Movement – Mount: This field is used to program a delay at pickup during the nozzle descent into the placement position and/or the nozzle ascension after placement. This field is used to create a pause at placement in order to ensure vacuum break/release.

- 1: Descend 1 Stroke / Ascend 1 Stroke
- 2: Descend 2 Strokes / Ascend 1 Stroke
- 3: Descend 1 Stroke / Ascend 2 Strokes
- 4: Descend 2 Strokes / Ascend 2 Strokes

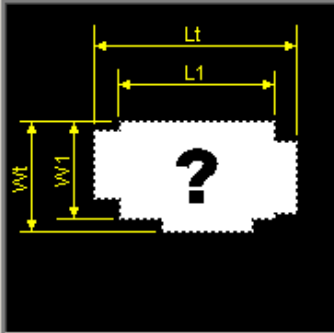


The above Pickup Height Offset can be used in order to properly vertically align the nozzle tip to the vacuum surface on the LED (Z Pickup Height Adjustment). An overstroke into the feeder is a negative value.

Any required XY Pickup Position offset can be programmed on a per-part basis using this field:

Set Standard Parameters for Component Recognition

Parts Class- Parts Type (P)
 106 - 0 106 : FL - Combination Type (Select Primitive Geometry)



Body Dimension (B) [mm]
 L1: 6.00 W1: 5.00
 L2: 0.00 W2: 0.00

Lead Count (N)
 Nu: 0 Nd: 0 NI: 0 Nr: 0

Lead Size (L) [mm]
 d1: 0.00 h1: 0.00 Pt: 0.000
 d2: 0.00 h2: 0.00

External Dim (Q) [mm]
 Lt: 6.00 Wt: 5.00

Sensor and Lighting (Q)
 Camera: 2D Large FOV Upper L: 3 Middle L: 2 Lower L: 0 Get Default

Pickup Offset (V) [mm]
 Dx: 0.00 Dy: 0.00 Detail

Recog Option Data Save and Quit CANCEL

Set Offset for Pickup

Camera View

max 60.00 mm

max 220.00 mm

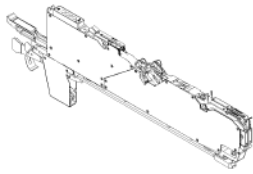
X: -3.00 < 0.00 < 3.00 [mm]
 Y: -2.50 < 0.00 < 2.50 [mm]

Save and Quit CANCEL

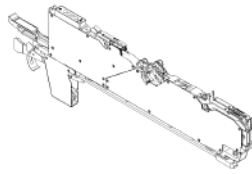
The magnitude of the XY pickup offset is a function of the overall size of the part & the offset is based on a Cartesian coordinate system: X positive to the right of the feeder.

CM-Series Machines

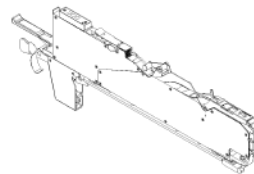
Standard Panasonic CM/NPM Intelligent Parts Cassettes (Feeders) are fully capable of supplying LED components without upgrade & modification.



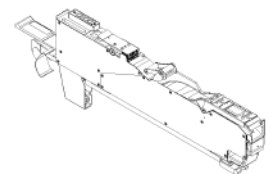
8 mm double tape feeder



8 mm single tape feeder



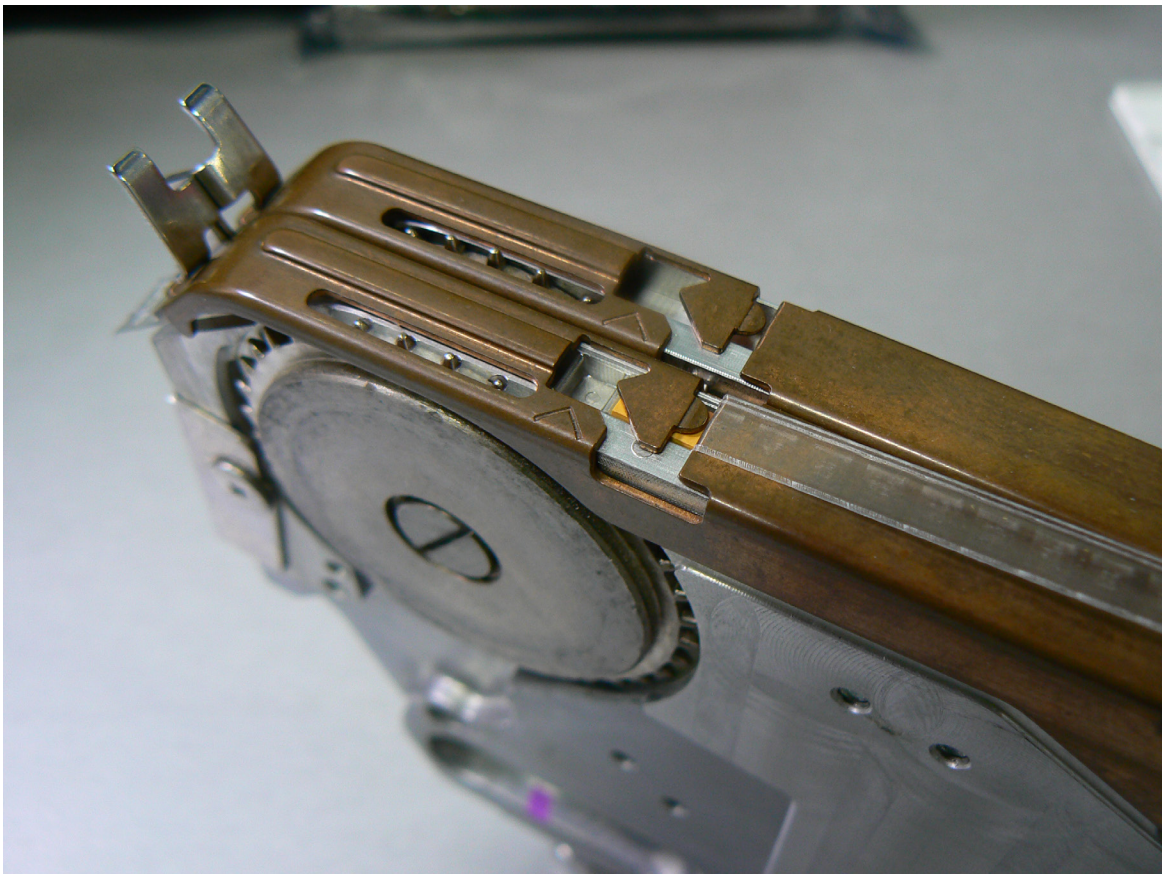
Tape feeder for both
12 mm and 16 mm

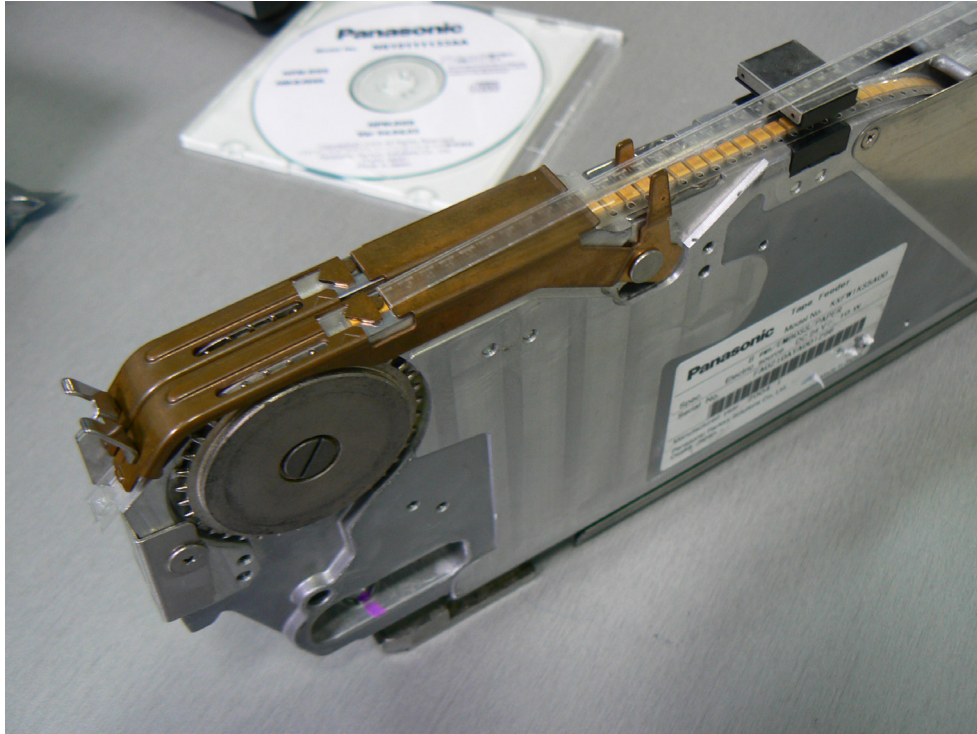


Tape feeder for both
24 mm and 32 mm

8-mm Single & Double Feeder Notes:

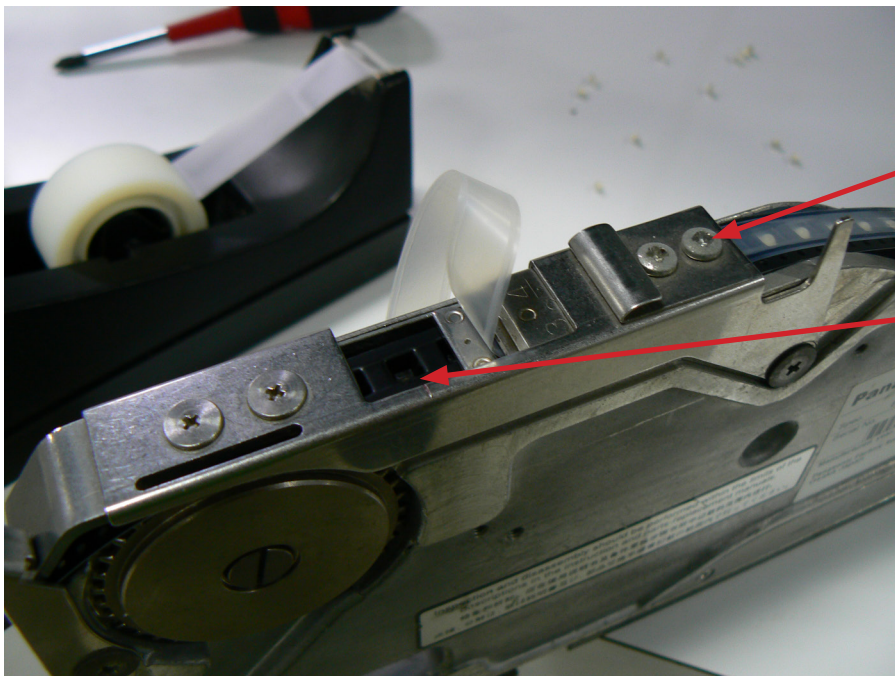
- No shutter to adjust – only 1 component is exposed at the pick position (as indicated with the arrow stamped on the shutter surface), as shown:

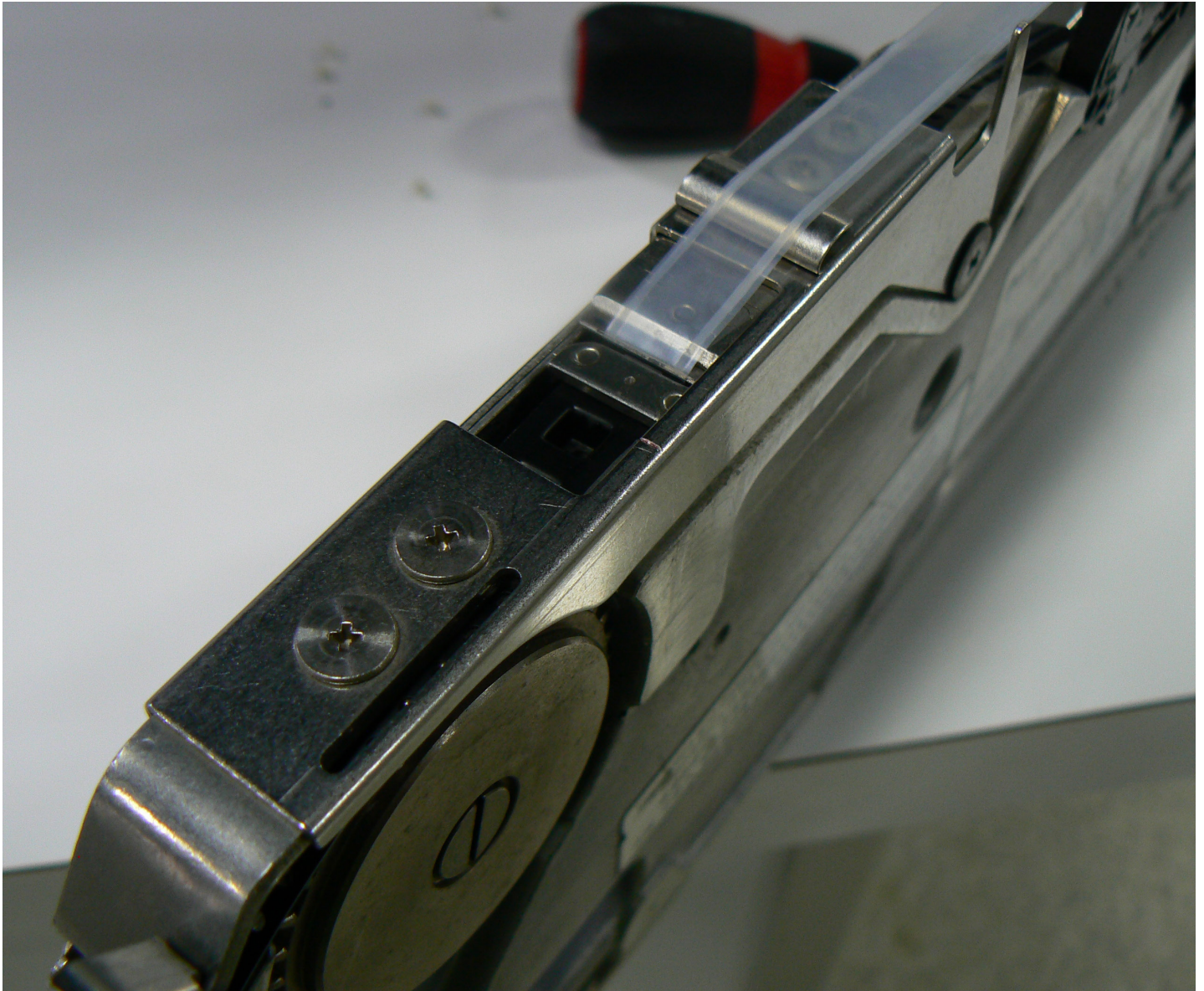




12-mm & Larger Feeder Notes:

Shutter can be adjusted by loosening the 2 Phillips screws & positioning the shutter so only 1 part is exposed at the pick position (as indicated by the red line):





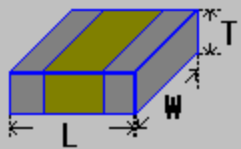
A properly loaded 12-mm wide feeder with the shutter position adjusted correctly.

CM-Series Component Data Library:

2012-06-06 10:45:54
MC_CIM-T1


Chip data


Chip name : 1005C



	L [mm]	W [mm]	T [mm]
Size	1.00	0.50	0.50
Max	1.00	0.50	


REF 55 REF select
Lamp Offset

Gap [mm]		
Mount	0.00	
Pick	0.00	



GAP

Pickup position		
X [mm]	Y [mm]	Z [mm]
0.00	0.00	0.00



Nozzle

110	0	0
0	0	

Chip count 3000

Exten chip Exten Option Detail chip data

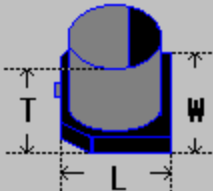
V6. 53 (034 PE) CM602-L edtechip

- The Mount & Pickup Gap fields (an overstroke into the feeder at pickup or the PCB at mount is a positive value) are used for fine-tuning pickup and mount rates. These 2 fields have a valid input range of -1.0 mm to +1.0 mm.
- The Pickup Position Offsets (X, Y & Z) are used to properly locate the nozzle center to the component vacuum position.

2012-06-12 13:10:00
BOSE-ALCAP

Detail chip data

Chip name : 255071-100C



Recog speed
Auto (Fast) Fast Mid **Slow**

Pickup speed
20 40 60 80 100

Fdr drive time
Std Mid Slow

Mount speed
20 40 60 80 100

Pickup keep time
Std double 4th

Munt keep time
Std double 4th

Pick vacSensor **Unuse**

Refer to help

Recog hgt [mm] 0.00
Eject hgt 0.00
(2step move)

↑
↓
Change

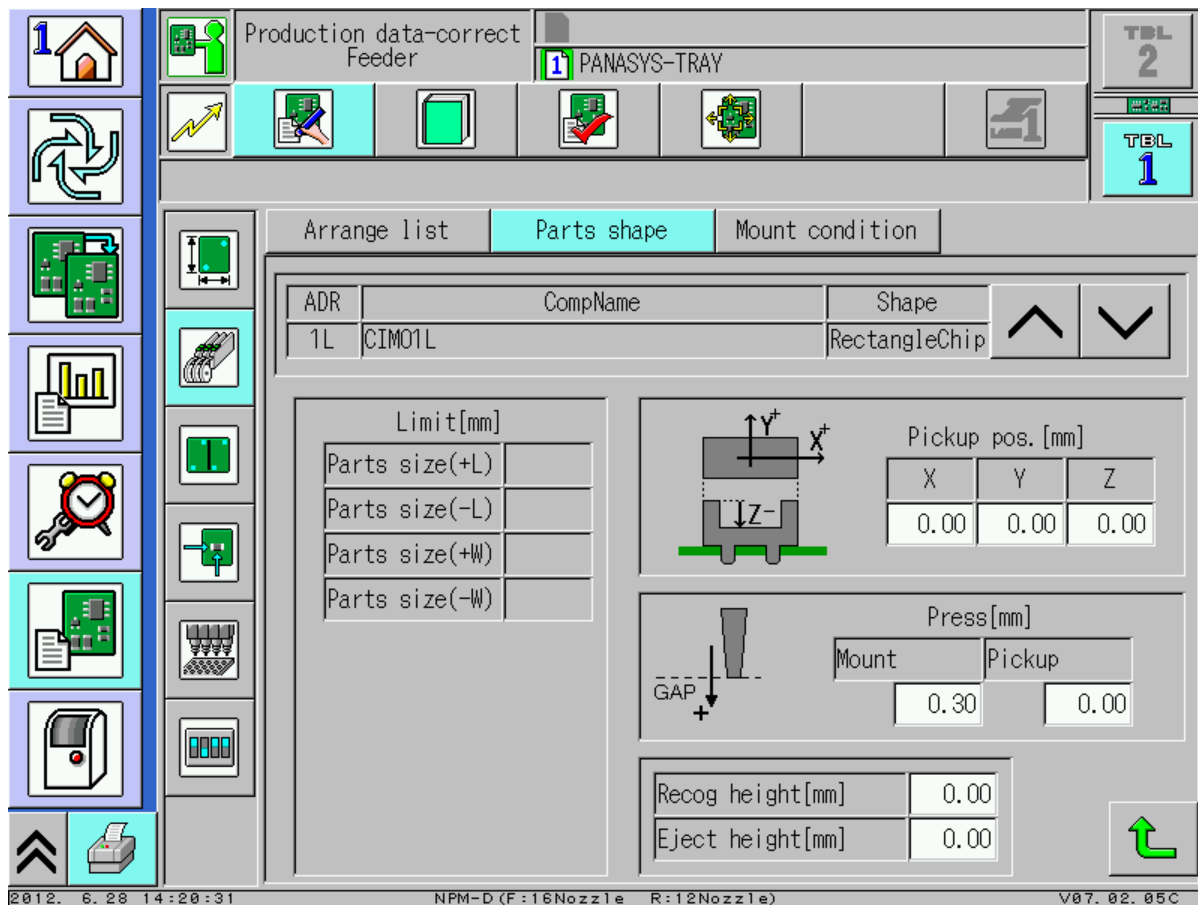
V6. 53 (034 PE) QM602-L edtec pdt

- The Recognition, Pickup & Mount Speeds can all be adjusted on a per-part basis in order to maintain component stability on the nozzle under movement.
- The Feeder Drive Time field is used to adjust the speed at which the feeder indexes from pick to pick. The speed can be reduced when the size of the embossed pocket is large with respect to the size of the part, allowing the part to shift, fall-over or flip inside the pocket prior to pickup.
- The Pickup and Mount Keep Time are delay timers to allow extra time to create vacuum at pickup and break vacuum at mount.

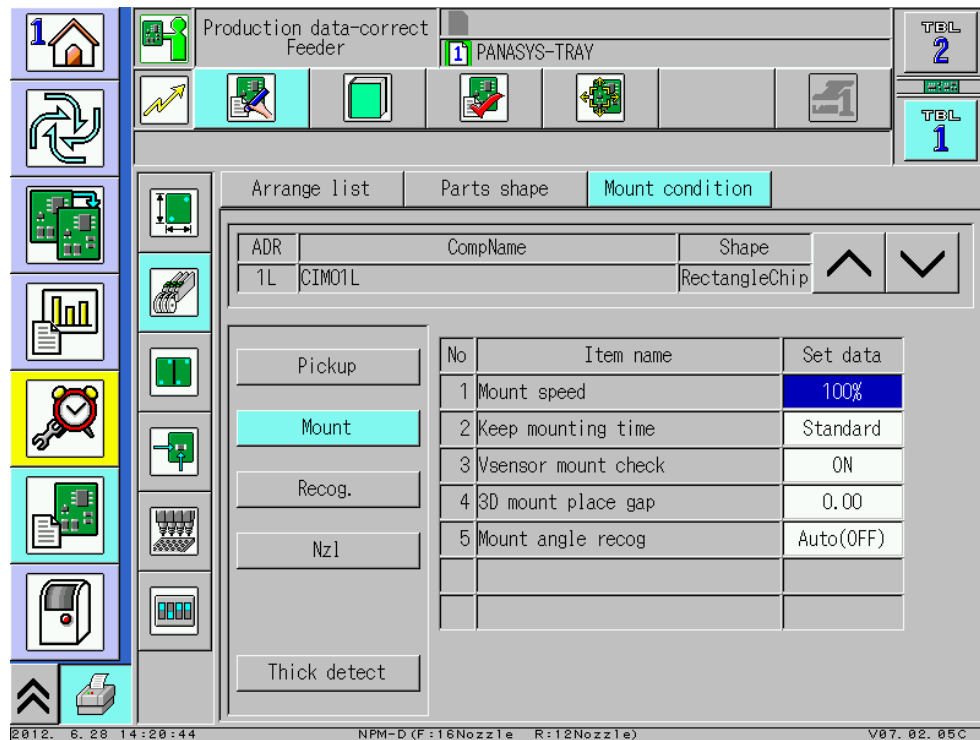
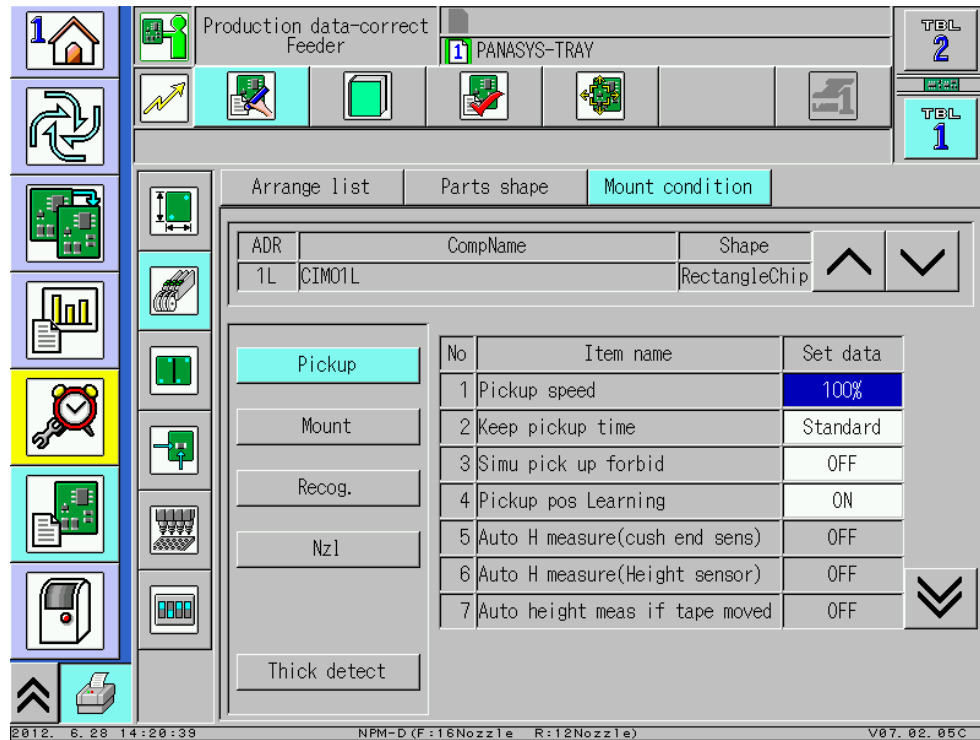
NPM-Series Machines

Feeders & Nozzles are common with CM-Series machines – see above.

Programming:



- The Mount & Pickup Gap fields (an overstroke into the feeder at pickup or the PCB at mount is a positive value) are used for fine-tuning pickup and mount rates. These 2 fields have a valid input range of -1.0 mm to +1.0 mm.
- The Pickup Position Offsets (X, Y & Z) are used to properly locate the nozzle center to the component vacuum position.










- The data for Pickup, Mount and Recognition are separated on the machine interface, as shown above. However, their functions are the same as those described on the CM-Series machines.

- The Recognition, Pickup & Mount Speeds can all be adjusted on a per-part basis in order to maintain component stability on the nozzle under movement.
- The Pickup and Mount Keep Time are delay timers to allow extra time to create vacuum at pickup and break vacuum at mount.

UNIVERSAL INSTRUMENTS

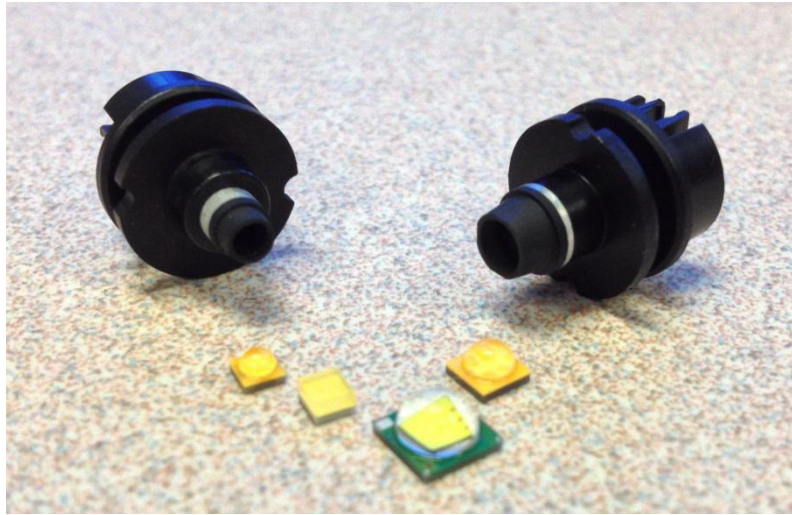
LED Automation Requirements

Component	HSC, Lightning	InLine 7, FJ 2/3	FlexJet 07/09	InLine 4	Feeder
Cree LED XR	51288157	51620038	****		Standard
	UPS + 8.0 & higher Drive To Touch Down Pick = Slow Tip Offset = .082" Length Delta = -.039"				
Cree LED XP	52449241	52449240	****		Standard
	UPS + 8.0 & higher Drive To Touch Down Pick = Slow Tip Offset = .048" Length Delta = -.0"				
Cree LED ML	52449292	****	****		Standard
	*Tact control Fast *Drive To Touch Down optional				
Cree LED MX	52449277	****	****		Standard
	*Tact control Fast Drive To Touch Down optional				
Cree LED XM	****	****	****	****	Standard
	UPS + 8.0 & higher Drive To Touch Down Pick = Slow Tip Offset = .092" Length Delta = -.0"				
Cree LED XB-D	****	****	****	****	Standard
					
Cree LED XT-E	****	****	****	****	Standard
					

Universal Instruments has developed the necessary application pieces to provide pick and place performance for LEDs. Depending on an LED's physical characteristics, one or several application pieces are required. For up-to-date LED application information, please refer to <http://parts.uic.com/cree/>.

Application Specifics:

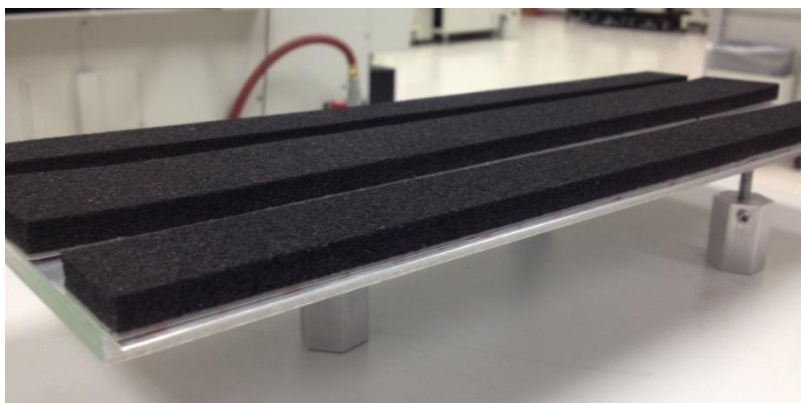
1. LED Nozzle: Universal offers a full array of LED nozzles for all 30-, 7- and 4-spindle heads. Each nozzle utilizes the material and tip geometry to handle the unique characteristics of a given LED.



2. LED Feeder: Universal offers specialized LED feeders and feeder retrofits that ensure proper LED positioning and eliminate Mylar-related failures.



3. LED Board Support: Many LED PCBs require additional board support to guarantee peak performance during placement of LEDs. Universal's LED board support options are suited to varying application demands and include automated pneumatic kits as well as custom-designed solutions.



4. Software Upgrade: For LED performance on 30-spindle placement heads, Universal's LED software upgrade incorporates specialized machine parameters to enhance placement performance. The LED software upgrade leverages a combination of special timing, "air kiss" and variable placement speeds to handle the latest-generation LEDs.

Machine settings and application specifics depend on the LED and are available at the time of order. For more information on the Universal Instruments LED Application, access <http://parts.uic.com/cree/> or contact a Universal Custom Tooling Group representative.

SPECIAL THANKS

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- Juki Automation Systems - www.jas-smt.com - Larry Moon (lmoon@jas-smt.com)
- Panasonic - www.panasonic.com - Brian Mathey (Brian.Mathey@us.panasonic.com)
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