REDUCING OF PICK-UP ERROR THE MACHINE SURFACE MOUNT TECNOLOGY

Final Project

By:
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Politeknik Negeri Batam
2025

Statement of Authenticity of Final Project

I, the undersigned, certify that the contents of part or all of my Final Project entitled: "REDUCING OF PICK-UP ERROR THE MACHINE SURFACE MOUNT TECNOLOGY " is my own work, completed without the use of materials that are not permitted , and is not the work of other parties which I acknowledge as my own work. All references cited or referred to have been written in full in the bibliography. If it turns out that my statement is not true, I am willing to accept sanctions in accordance with applicable regulations.

Batam, 12 Dec 2025

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Approval sheet

The Final Project is structured to fulfill one of the requirements for obtaining a degree
Bachelor of Associate Engineer (AMd.T.)
in
Batam State Polytechnic

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Session date: 12 Dec, 2025

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Reducing Of PICK-UP Error The Machine Surface Mount Tecnology

Abstract

The problem of pick-up error in Surface Mount Technology (SMT) machines is one of the factors that can reduce production efficiency and increase the rejection rate in the electronic component assembly process. This study aims to identify the main causes of pick-up errors and implement corrective measures to reduce them. The methods used in this study include direct observation of the SMT machine, analysis of historical error data, and implementation of improvements such as nozzle reset, calibration feeder, and pick-and-place program optimization. The results showed that after repairs, there was a significant decrease in the number of pick-up errors up to 40% compared to the initial condition. These findings suggest that simple but targeted technical improvements can improve SMT machine performance and reduce potential production losses.

Keywords: SMT, pick-up error, feeder, pick and place machine, production efficiency

Foreword

Praise and gratitude to Allah SWT, for His grace and blessings, enabling the author to complete the research for this final project report in the 6th semester. This research was conducted as part of the final project report, which is one of the requirements for graduation from the Diploma III Program in the Electrical Engineering Department, Manufacturing Electronics Study Program at Politeknik Negeri Batam.

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The author would like to thank all parties, and if there are parties whose names are not written, the authors apologize. The author hopes that this final report can be useful for those who read it, and the knowledge gained will be a blessing for myself and those around me.

Batam, 12 Dec 2025

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Reducing Of PICK-UP Error The Machine Surface Mount Tecnology

Abstract— **The problem of pick-up error in Surface Mount Technology (SMT) machines is one of the factors that can reduce production efficiency and increase the rejection rate in the electronic component assembly process. This study aims to identify the main causes of pick-up errors and implement corrective measures to reduce them. The methods used in this study include direct observation of the SMT machine, analysis of historical error data, and implementation of improvements such as nozzle reset, calibration feeder, and pick-and-place program optimization. The results showed that after repairs, there was a significant decrease in the number of pick-up errors up to 40% compared to the initial condition. These findings suggest that simple but targeted technical improvements can improve SMT machine performance and reduce potential production losses.**

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I. INTRODUCTION

In the use of SMT Mounter, there are technical or operational constraints that can affect the performance of the pick-up nozzle, resulting in various problems such as the inability of the nozzle to pick up components, the imbalance of the position of the components in the pick-up nozzle, and the falling of the components from the nozzle during movement. These problems not only have the potential to hinder efficient production but can also lead to a decrease in the quality and reliability of the final product (*Introduction to Surface Mount Technology (SMT)*, 2024; NeoDen Technology Co., 2019).

Therefore, a systematic approach is needed to overcome these constraints and improve the overall performance of SMT Mounters. PT. SP MANUFACTURING (SPM) has implemented an information system using computer devices in its operations, especially in the Surface Mount Technology (SMT) section. Unfortunately, there are often pickup errors on the machine that result in an increase in the operator's workload because they are still using an offline system. This situation not only affects the accuracy of the work, but also takes a long time when the machine experiences pickup errors. 17% of machine downt time is due to pick-up errors,which can reduce production out put, not only reducing output but also causing quality issues during production and not being able to produce maximum products This condition can have serious impacts, such as decreased operational efficiency and increased risk of data loss if not addressed immediately. Through in-depth research into these issues, researchers aim to develop improvement and improvement strategies for technical and operational aspects of SMT Mounter, namely by carrying out private maintenance and calibration to reduce the occurrence of many pick up errors during production (Adrian, 2025a).

This action plan will involve an in-depth understanding by the Technicians, scheduled preventive maintenance, and the implementation of advanced software for the monitoring and optimization of the pick-up nozzle performance. By identifying the root of the problem and providing effective solutions, it is hoped that this proposal can help improve operational efficiency, reduce machine downtime, and in turn, support the achievement of production targets with optimal quality. With these considerations, the author is interested in designing and building a pick up error monitoring system, Pick errors occur because the pick position is not in the middle of the component, after analysis, the occurrence of pick ups that are not centered is due to feeder offset (Adrian, 2025b; Electronics, 2026).

II. METHOD

A. Process Flow

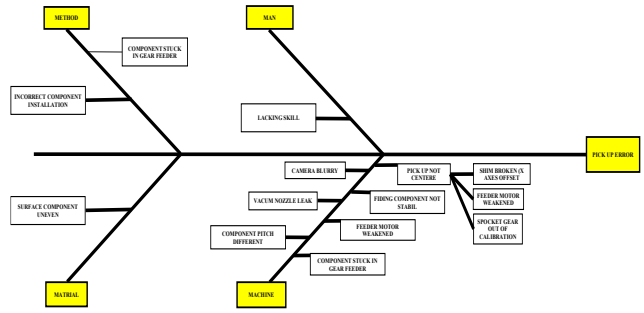

Figure 1. Diagram fish bond

This fish bond diagram is some of the causes of pick-up error on pick and place machine(SMT) in Figure 1, in this diagram shows that many pick up errors occur on the machine because of the problem with feeder thefore i took the initiative to unravel the amount of down time by mean of predictive maintenance calculation how long the feeder can be used while production is progress, in order to unravel pick-up errors and produce better product.

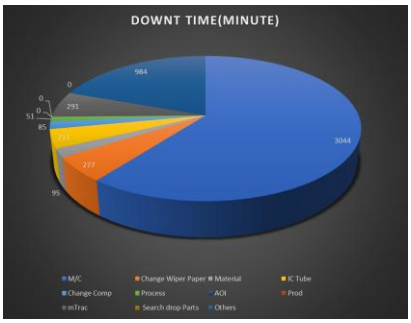

Figure 2. Diagram all downt time production

It can be seen from the diagram that from the overall downtime on the machine, there are several causes of machine downtime, especially due to pick up errors caused by suboptimal feeders so that when picking up components using the nozzle to the feeder, the nozzle position is not in the center of the component body, causing the nozzle to leak and the component pickup to fail.

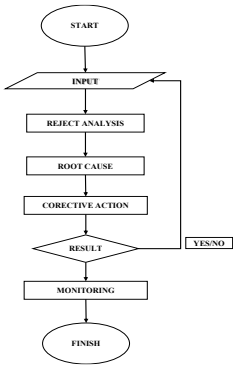

Figure 3.Stages Of Research Methode

The process flow used in this project ilustrate in Figure 3. That consists of several key stages.

1) Input

The first step to are complaints in production regarding problems that occur during work which result in reduced product and output that does not match the existing cycle time, therefore excessive downtime occurs

2) Reject Analysis

After seeing the situation in production, it turns out that there were also reject products during production. After analysis, there were product obstacles due to the process of installing components to the PCB in the machine Pick and place. To carry out predictive maintenance, We have to prepation several feeders to find out how effectively these fedeers can be used ensure the producr is good.

3) Root Cause

After analyzing the problem, it was found that the problem was in the pick and place machine when the component was being picked using a nozzle and the component was not centered, resulting in air leaks the nozzle.

4) Corrective Action

Due to large number of reject on the product and resulting in excessive down time after counducting the analysis, there is a feeder that has an X or Y offset on the feeder that is not centered when pick up component,therefore the feeder must be calibrated but private maintenance is also carried out so that the feeder that will be calibrated is scheduled.

B. System Notice Machine Calibration

Table1. Current system machine

Feeder size	Notice count (x10000)	Stop count (x10000)
8mm	100	150
12mm	50	100
16mm	50	100
24mm	25	50
32mm	25	50

Figure 4. Current System machine

Table 1 shows the number of index feeders in Figure 4 This machine system will notify the operator that the feeder has reached a feeder index of 1,000,000. Once the feeder index reaches 1,500,000, the feeder will stop and cannot be used for production until it is calibrated.

C. Pick Up Position

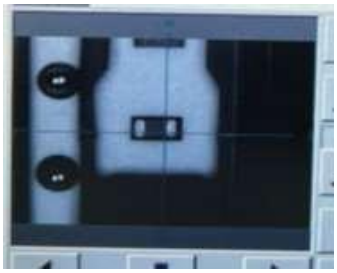

Figure 5. Pick up not center

Figure 5. Pick errors occur because the pick position is not in the middle of the component, after analysis, the occurrence of pick ups that are not centered is due to feeder offset, Therefore, private maintenance must be carried out on feeders like this so that the feeder is in the middle, thus reducing the possibility of pick-up errors.

III. RESULT AND DISCUSSION

A. *Reasult Predictive maintenance*

After predictive maintenance,it can reduce the occurrence of reject in product, resulting in better product. Not only that, it can also reduce the occurance of down time in production when running.

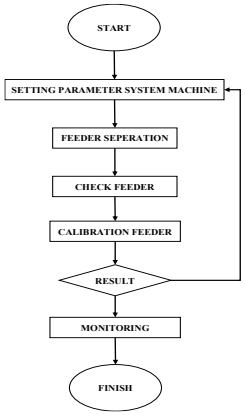

Figure 6. Flowchart Implement Predictive Maintenance

The process flow used in this project ilustrate in Figure 6. That consists of several key stages.

1) Setting Parameter Setting System Machine

The first step to carry out this project is to make adjustments to the machine system

Table 2. New system machine

Feeder size	Notice count (x10000)	Stop count (x10000)
8mm	25	50
12mm	25	50
16mm	25	50
24mm	25	50
32mm	25	50

Figure 7. New System machine

Table 2 shows the number of index feeders in Figure 7. This machine system will notify the operator that the feeder has reached a feeder index of 250.000 Once the feeder index reaches 500,000, the feeder will stop and cannot be used for production until it is calibrated. pick up error on the machine so that there no excissive down time during production and can produce good product.

2) Feeder Separation

To carry out predictive maintenance, We have to prapera several feeders to find out how effectively these fedeers can be used ensure the producr is good.

Figure 8,Feeder

3) Check Feeder

After the feeder is used with the matrix system that has been set, a notification will appear on the machine informing us that the feeder has reached the number of index, After that, The operator will replace the feeder with another feeder. Before replacing it, it must be marked with a calibration sticker then,we take the feeder for private maintenance and check xy offet feeder use machine calibration (Gd-Admin, 2022).

Figure 9. Machine Calibration

1) Calibration Feeder

Feeder Calibration is part of personal maintenance carried out on the calibration feeder, which is to ensure that the feeder does not shift on the X and Y axes if the feeder is not centered during reading using the calibration machine with serial number KHJ-MD800-100 . In that case, the feeder must be calibrated. If the X offset of the feeder is out, the feeder must replace the necessary feeder spare part (SHIM). And if the Y offset of the feeder is out, the calibration machine will automatically adjust as long as there is no problem with the feeder gear. This ensures that during production use, pick-up errors occur that can lead to downtime (List, n.d.).

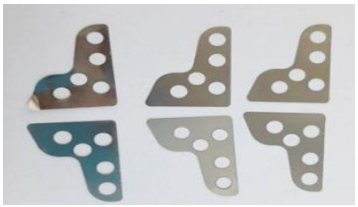

Figure 10. SHIM

Figure 11.Master tape

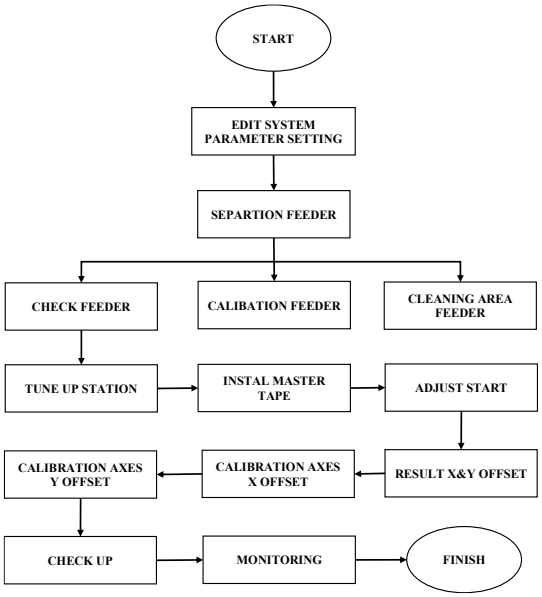

Figure 12.Ilustrasi calibratio

Figure 12 is an illustration of feeder calibration when checking the feeder which will produce the x and y offset results, for the y offset it will be auto-calibrated from the calibration machine and for the x offset there will be additional stainless steel plate material to calibrate it. If the feeder has been calibrated and the results are okay then the feeder can be used for production (SS FEEDER User's Manual EU9L19C610, n.d.).

B. Result from testing running feeder in production for 3 mount.

Figure 13. Diagram Problem Downt Time In Production Before predictive maintenance

This figure 13 diagram show the 3 mount from june to august which is the downt time that hamperes the production process. The down time problem is due to the component offet feeder and the nozzle not being centered during the component pick-up process which result in leaks in the nozzle so that the component cannot be picked up, and for the system notice maintenance feeder 1,000,000 feeder notice maintenance and 1,500,000 feeder cannot be used by production and the feeder will automatically turn off. This problem is in the private maintenance of the feeder which is not managed in detail which is schedule for 3 mount for the new feeder in private maintenance(calibration).

Figure 14. Diagram Problem Downt Time In Production After predictive maintenance

This figure 14 diagram is after counducting an evaluation from September to November which had a good impact and many changes after conducting the evaluation, I carried out predictive maintenance by checking each feeder 100,000 index again using a calibration machine after this 200,000 to 500,000 index after that, and for the system notice maintenance feeder 250.000 index feeder notice maintenance and 1,500,000 index feeder cannot be used by production and the feeder will automatically turn off I monitored it with 5 different feeder, when monitoring the feeder there were no problem and no quality issue so that the feeder could be used by production in good condition and currently every machine notice system machine is being implemented to use the 250,000 to feede maintenance notice system feeder cannot be used if they have not been calibrated.

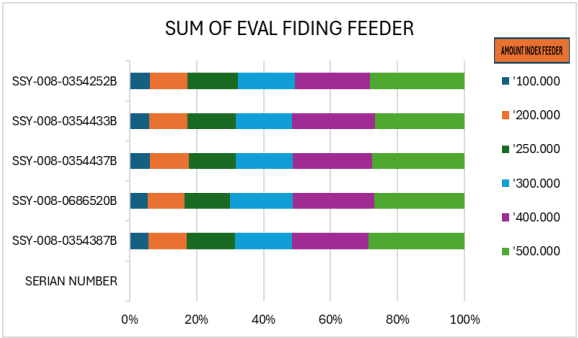

Figure 15. SUM of eval fiding feeder

I conducted an evaluation using 5 feeders from feeder index 100,000 to 500,000 to obtain optimal results and ensure that there is no shift in the X and Y axis offset on the feeder. It can of course be concluded that at the 500,000 index, it serves as a reference for the feeder which must be calibrated before any X or Y axis offset occurs and before a pick-up error happens on the machine.

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