System that monitors in real time the amount of News-paper coming into the mailrooms.

Optimizing the stopping of the press and to reduce wastage.

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Degree Programme in Automation Engineering

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Subject of Bachelor's thesis Creating a system that monitors in real time the amount of newspaper coming into the mailrooms.

ABSTRACT

The aim of this thesis was to create a new system that monitors in real time the amount of newspaper production that goes into the mailroom and select the best sensors, counters and in order to improve the accuracy of the machine.

The purpose was also to optimize the stoppage of the press and to reduce wastage. Saving cost, maximising profit and making decision easier.

The thesis was commissioned by Alma Manu Oy maintenance department in Tampere. In spring 2011, Alma Manu Oy decided to improve on their printing accuracy and level of wastage. And in order to achieve this, the right sensors and counters must be duly considered.

The existing technology then only allowed for a total net count of the printed papers right from both control rooms. The printing machines are two with two control rooms in which the printings are being monitored.

Several meetings were held with the maintenance engineer, machine operators and maintenance manager prior to the commencement of the project in order to know the exact approach to use in realising the desired result.

The printing machine name is Rowland colour man a machine which runs on different conveyers, frequency converters, and gripper conveyers lines.

Keywords: Counters, sensors, frequency converter, mail room, gripper lines, and conveyers.

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Appendix 3 Layout design for when there is a problem.

1 INTRODUCTION

The aim of this project was to create a system that monitors in real time the amount of Newspaper that goes into the mailroom and select the best sensors, counters and process for the system. For any industry or business, the zeal towards better productivity is not only mandatory but also essential.

The printing industry has seen tremendous changes in the past 30 years and will see even more change in the next 30. Digital imaging, desktop publishing, large-format offset printing, ink jet production printing and computers are a few examples of advances since the 1970s. Although the technology has changed and the competition is fierce, some aspects of the printing business remain unchanged: customer service, the demand for quality and adhering to the particular ethics and laws regulating the putting of ink on paper.

The actual printing press is an enormous machine often two stories high. The most common method of printing newspaper is called web offset. The "web" refers to the large sheets of blank newsprint that are inserted in rolls, something weighing over a ton, into the actual printing press. The reels of newsprint are loaded in at the bottom floor of the press. The rolls are inserted onto a reel stand, which has three components: the first reel brings a roll of paper up to the press; a second is loaded and ready to replace the first roll when it runs out, and the third reel stays empty and ready to be fed with another when the first reel is almost finished. Each roll of blank newsprint has double-sided tape at its edges, so that when the one roll runs in the press, another smoothly takes up where the other left off without interrupting the printing process.

The plate cylinder then presses the image of the page onto a blanket cylinder, leaving a version of the page's image on the cylinder's soft material. When the paper runs through the press, the blanket cylinder presses the image onto it. The chemical reaction of the ink, which contains oil, and the squirting of jets of water into the process result in the actual newspaper page of black or coloured images on a white back-ground, Since oil and water do not mix, the areas where ink should adhere to the page are black or coloured, and water washes away the parts where ink is not needed. This is why this printing process is referred to as "offset".

New layouts were designed for the mailroom system. A copy count sensor and a copy counter made by Denex (now Baumer) were selected. Then, the most suitable layout design was chosen.

2 BACKGROUND OF THESIS PROJECT

In summer 2011, this thesis project started in Alma Manu Oy. The name of the industrial printing machines used in the company's printing house is

called Roland Colorman. The machines are two namely “10” and “20” which means machine “1”and “2” respectively.
The machines have gripper lines leading to the three mailrooms A, B and C, along to the conveyers, which then proceeds to either the storage or the mailrooms. There are sensors and laser beams, which gives pulses that the counters read to make the necessary counts needed.

2.1 Alma manu Oy

Alma Manu Oy is relatively new unit, but it has a strong experience in printing and distribution businesses. Alma Manu brings together Alma Media's three newspaper printing houses in Tampere, Pori and Rovaniemi as well as the newspaper distribution company Aamujakelu Oy operating in Pirkanmaa, Sea Lapland and Satakunta. The main products are newspaper printing and early distribution of the newspaper. Alma Manu has 1100 employees, including 900 newspaper deliverers.
Aamulehti (Finnish morning newspaper) is published in Tampere. It has the second largest circulation of Finnish dailies with an average circulation of 136,726 per day and 140,802 on Sundays (2004).

Today Aamulehti is part of Alma Media, a large media corporation in Finland. Until 1992 it was aligned to the National Coalition Party, but no longer has official connections to any Finnish political party. It was founded in 1881 to "improve the position of the Finnish people and the Finnish language" during Russia's rule over Finland.
The paper also publishes four weekly supplements: the entertainment-centered Valo ("Light"), which is published on Fridays, and Moro ("Hi" in the dialect of the Tampere region), which explores the culture of Tampere on Thursdays. In 2006 the two Sunday supplements were added: Asiat ("Matters") and Ihmiset ("People").

2.1.1 Alma Manu Oy plating Unit.

In the plating unit, the first thing is to check the sent negatives of the newspaper page by a computer. These are then put in a machine which shines UV light through them onto the plate. The photo-sensitive polymer on the plate absorbs the light and an image of the negative is left on the plate. This is a clever polymer, in that it attracts the ink where it is exposed and where there should be nothing the ink falls straight off. One plate is made for each colour. This process has now been largely superceded by a process called computer to plate (CTP). This is where the image is etched directly from the computer onto the plate using a laser. When they are made, the plates are put on a rotating cylinder alongside the other plates for that paper. The paper is then fed into the press. The route that the paper takes around the press is called the web. This decides how many pages the paper is and where the colour pages are going to be. When the press is ready to run, the ink is switched on and the cylinders on the press rotate very fast and print the newspaper. After the paper leaves the press, many things can happen to it. It can be automatically stacked into bundles and then onto pallets and sent to the public. It can be stored for later use. It

can be automatically inserted, by machine, with a commercial insert, or a product which must have been printed earlier (like a TV magazine) or it can be sent to be Stitched or trimmed. Stitch and trim is the process whereby we put a staple in the product and trim the edges.

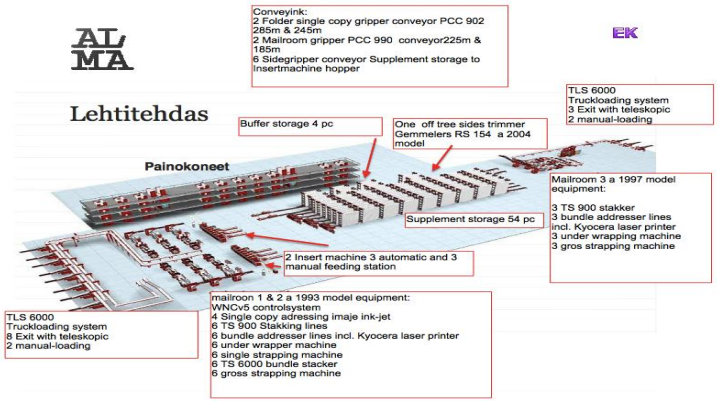


Figure 1 Alma manu oy 3D printing plant template.

2.2 Research methodology

Printing the right amount of newspapers in order to minimize wastage, save time, maximize profit and improve on the printing machine accuracy is a problem calling for a solution.

In this thesis project, suggestions, recommendations and methods were used to collect both primary and secondary data. Meanwhile, consultations were made on books, internet, and manual brochures. On the other hand, interviews were granted by the head of maintenance unit, assistance head of maintenance and some workers. These people actually helped in providing the needed and up to date information.

2.3 Definition of project

Alma Manu Oy is the printing and distribution company of Alma Media Oy. It brings together newspaper printing houses in Tampere, Pori and Rovaniemi as well as the morning newspaper delivery in Pirkanmaa, Satakunta and Sea Lapland. They have a long experience in printing and delivery. Alma Manu employs more than 1 000 people, about 800 of them are newspaper deliverers.
In Tampere, more than 3.2 million newspapers a week are printed. The largest newspaper printed are Aamulehti, Iltalehti and Kauppalehti. The

productions are of high quality meeting the international standard. They are also a member of WAN IFRA. They won the International Newspaper Color Quality Club competition (2010-2012) this brought fame to the company globally.
The main objective of this thesis is to create a system that monitors in real time the amount of newspapers that goes into the mailroom. Since there are many factors to be considered in order to improve the accuracy of the production, reduce wastages, save time and energy, maximize profit etc. The components associated with the mailroom were looked into and they are listed as follows:
Colorman (printing machines 1 and 2)

Conveyors (grip and belt)

Storage buffers
Inserting
Stacking
Addressing
Packaging
Sorting and loading
Copy count sensors

In the case of printing, the only available counter to show the amount of papers printed is the 'net counter'. So, in determining the amount of newspapers paper printed, the net counter is checked but to some extend a substantial amount is wasted and the accuracy a bit poor.
Now, there is need to proffer solution to these problems, so I decided to embark on this project. The three mailrooms were the major focus. The right copy count sensors and the right copy counter were determined; the speed of the conveyers is not left out.

3 PRODUCTION PROCESSES

3.1 Paper/Raw materials warehouse.

Papers are transported down to the warehouse where shafting is done. There are quite a large of papers used every year for printing of newspapers (about 27 000 tn of paper per year - approximately 1000 trucks)
The paper grade in use is at 45g standard paper to 54g/76 bright-coated paper and the capacity of the warehouse is normally 700 tn which is within 1-2 weeks in stock.
The backboards (back covers) are taken off from paper rolls after which the robots transfers the rolls automatically for intermediate storing.
During night production, paper rolls are ordered and robots transfers rolls automatically to printing press since it's already been programmed.

Figure 2 A process of shafting at Alma Manu Oy.

3.1.1 Pre-press

The customers deliver their material in a PDF-file format or in a ready screened TIFF- format. It is expected of all customers to bring a clean and clear print of pages, which will later be verifed. A tabloid size newspaper is made and assembled according to publication. The Laser scanner scans the printing plates and the light penetrates to the sensitive printing area of the photopolymer surface.

The developing machine "washes" the unprinted surface and after that a gum arabic is rubed on the plate for protection against oxidation.

In the bender, bendings are done to the printing plates; this process is carried out carefully. At the printing press, extra checking is done to the plates. The convergence of 4-colour plates is checked and the ones with problem are fixed.

3.1.2 Printing and Rotating.

An offset printing technique is used for the printing of newspaper, which is based on mutual interaction of printing plate, water and colours. The printing press is controlled from drive desk where the registers, line tension, speed and water output is regulated. The quality of printing is observed, samples are taken at intervals for few thousands of print. To make one copy of Aamulehti, one would need:

512 pieces of printing plates
30 tn paper

500 kg printing ink
About 25 rolls change at full speed.
(Note: there could be a failure in every hundred roll change.)

Figure 3 Alma Manu printing drive desk

Figure 4 Alma Manu printing drive desk.

3.1.3 Printing Station

Two Roland Colorman printing machines are in use (model1994) Both have four 4-hi towers and a folding machine. A maximum of 64/128 pages, 4/4 coloured at a normal speed of 30 000 r/h that is 30 000 or 60 000 newspapers p/hr/machine, depending on the mode of production. The line speed is 9.3m/s, 560 m/min, 33.6 km/h.

Special attention is payed to the ink in use. The Anilox- inking unit guarantees equal water output to entire line width (1.6m) the regulation of the

ink, is set to the requirements of the paper texture, rollers, settings and control of the temperature.

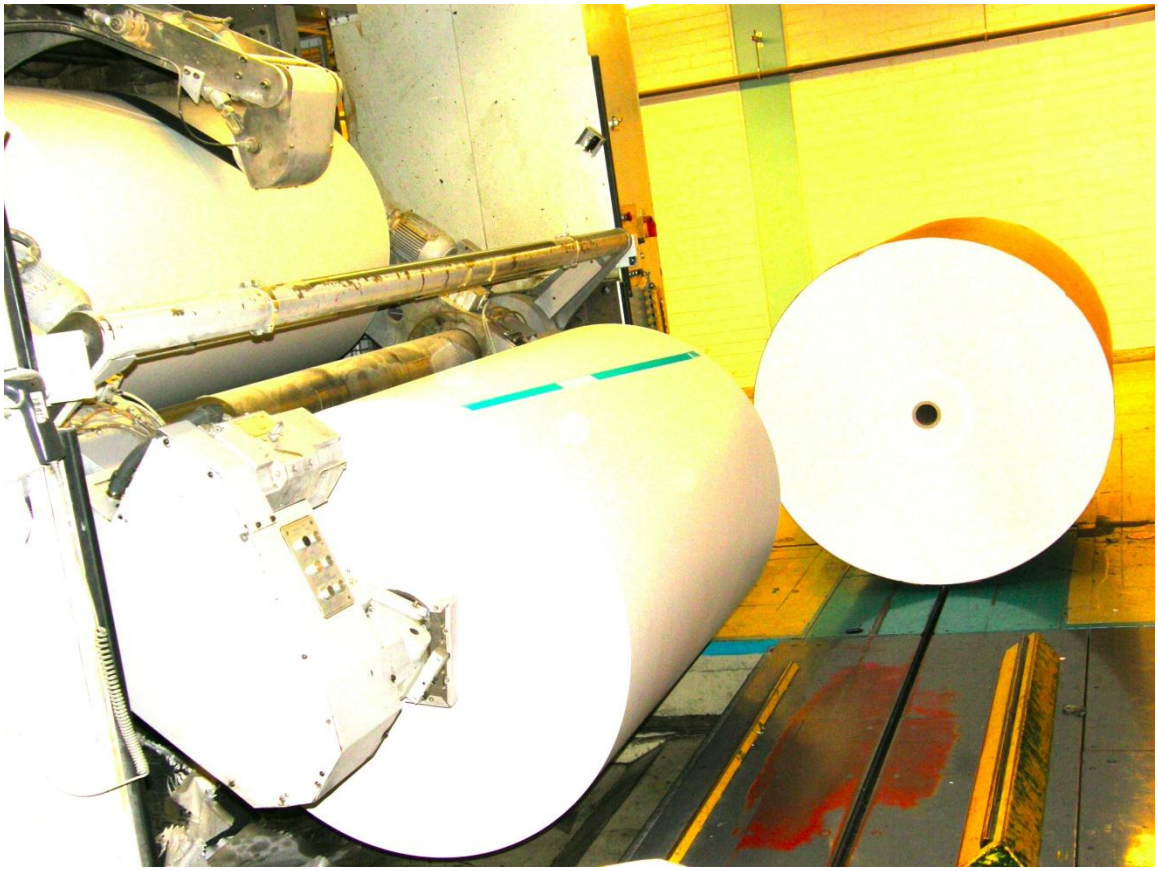


Figure 5 Alma Manu feed rolls

3.2 NEWSPAPER PRINTING MACHINES

There are lots of newspaper printing machines. But, in this project the Manroland printing machines will be the focus. There have been lots of new innovations since the Manroland came into existence.

3.2.1 Manroland colorman

The colorman printing machine is used in Alma Manu. The printing machine is used for all its production. The machine has been in use for the past 18 years now. Though, there's has been some challenges in the recent months but the machine is still functioning at least meeting the needs of the people.

Figure 6 A 4-Hi colorman tower.

Figure 7 Alma Manu 4-Hi tower

3.2.2 Paper Loading

The paper loading can be done both manually and automatically from the down floor tower to the fourth tower.

Figure 8 Alma Manu paper loading

4 THE MAILROOM

A general description of the equipment and flow in a typical newspapers mailroom is shown in figure 9. The numbers in parentheses in the following descriptive text refer to the numbers in the figure. The description only gives a general idea of a typical mailroom set-up. In practice, many variations exist. In larger plants, several parallel mailroom lines are used, and many operations are secured by doubling equipment and parts of the lines. Generally, it can be said that newspaper mailrooms are complex operations with complex machinery, complex material flow, and many tasks that will require frequent manual intervention in order to secure a smooth production flow.

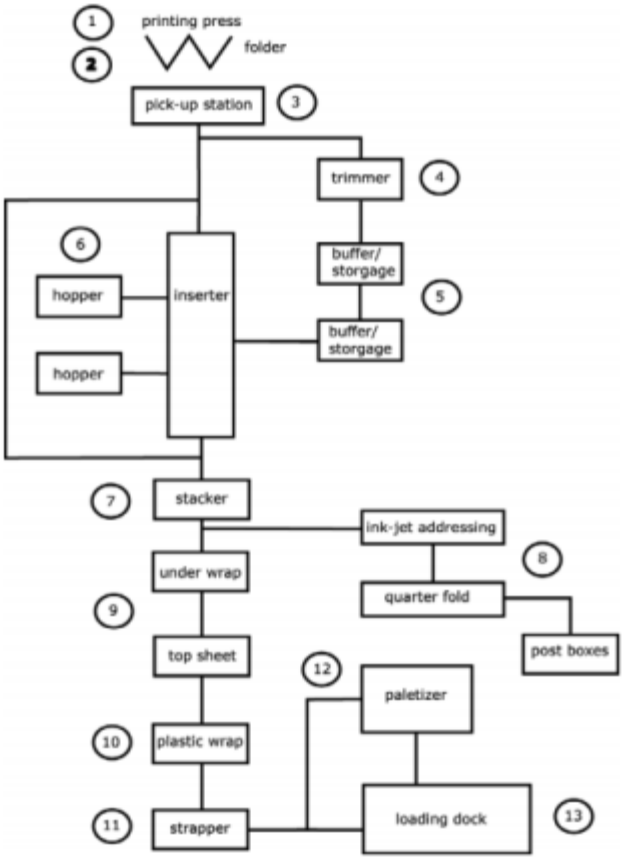


Figure 9 A general scheme of newspaper mailroom production.

4.1 Operations in the mailrooms

Right from the printing press both the 4-high tower and satellite presses the newspapers are set with the right positioning on the reels before the newspapers are printed. The four-high units can be arranged in different ways depending on the operator. The four units can be arranged in the inverted way or unit two and four can be arranged inverted to form two H-type units.

The printed paper is folded by the folder, cut and sometimes collected to make up a newspaper. The newspapers are picked up by gripper conveyors and delivered to the different machines in the mailrooms. At the trimming station the newspapers are trimmed, all three non-folded sides are cut. The newspapers and inserts can be stored in the storage/buffer for later usage

or when there is a problem in the mailroom. The inserting process takes place at the inserter station which afterwards continues on the production line either from the storage/buffer station or from a hopper station or from both at the same time. The principle is that the newspaper is opened one or many times and the inserts are placed inside the open newspaper copy. The stacker makes bundles out of the single newspapers. The bundle size varies depending on the thickness of the single newspaper and on the requirements of the distribution.
The newspapers can be ink-jet addressed, quarter folded, and plastic wrapped. Then they are sent into the loading room where the truck drivers are monitoring the loading for proper delivery.

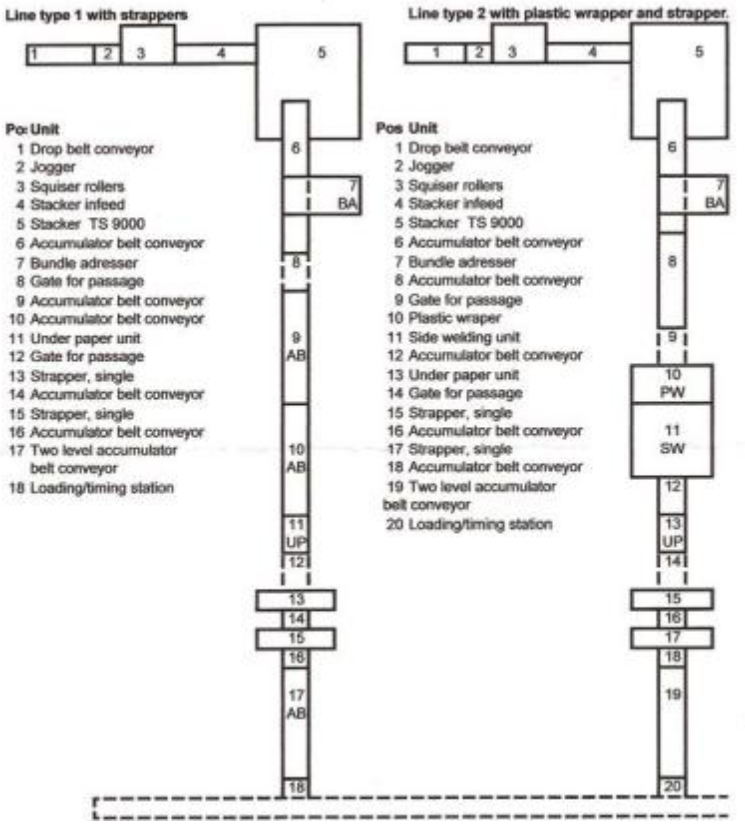


Figure 10 Sample layout design of IDAB WAMAC mailroom.

The Alma Manu printing press have three mailrooms, when papers are coming from either the printing machine one or two the gripper conveyor then conveys the newspaper to any of the three mailrooms. The system controller one and two could decide to channel the papers to mailroom one and two respectively.
Next is the conveying system, there are lots of conveyors. We have the grip conveyor, conveyor belts, gates, rollers and curves. The grip conveyor conveys newspaper to any of the three mailrooms in use.

4.1.1 The mailroom 1and 2

There are 3 IDAB WAMAC (model 1993) stackers in each mailroom. These stackers are connecting three production lines where some other activities take place. The PST 6000 appendix device, is equipped with definite area appendix capable of making (3 appendices/main product) the automatic appendix can take up to a maximum of 540 000 copies.
The bundle lines consist of 10 bundling lines, a single addressing system, a bundle controller, and the automatic loading.
In the year 2003, there was an update on the control system of WNCV5 which is capable of controlling the mailing and putting data on the production line route. (Katja, presentation12.4.2004)

Figure 11 Mailrooms 1 and 2.

4.1.2 Applied concept

The main idea of this concept is to centralise and automate the labour intensive routines used in the preparation of printed media for distribution. The focus is on time saving, money, improve precision, accuracy and minimise loss of prints.

Figure 12 Alma Manu IDAB WAMC stacker.

As earlier said, the storage and buffer helps in storing newspaper for future use and sometimes in use when there is a problem with the inserter, stacker or the mailrooms.
The storage buffer can store about 540,000 copies depending on the size of the product printed.

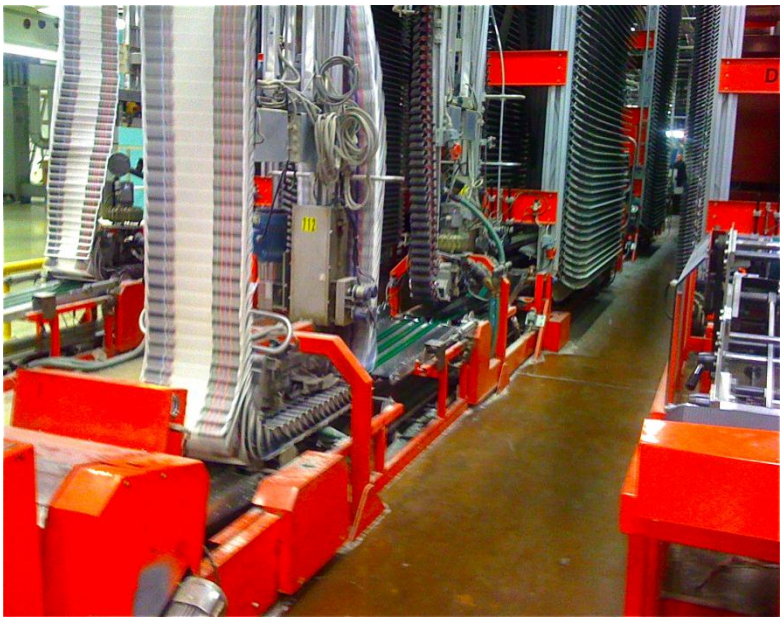


Figure 13 Alma Manu storage buffer

Figure 14 A cross section of Alma Manu storage and buffer (Tampere)

Together with the overall mailrooms control and information system there is the inserter machine and the hopper that can handle various production requirements.

Figure 15 A cross section of Alma Manu inserter

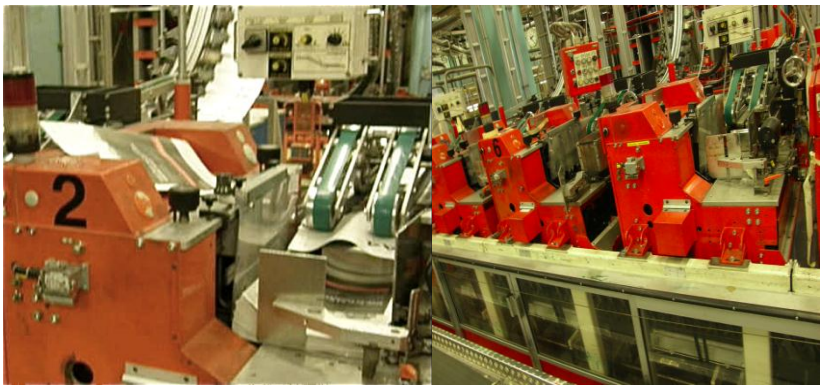


Figure 16 Alma Manu inserter hopper.

Figure 17 Alma Manu Inserter extension.

The addressing is very much needed; amount of copies, route name and zoning is done, in order to meet the needs of the numerous customers and timely delivery.

System that monitors in real time the amount of newspaper coming into the mailrooms.

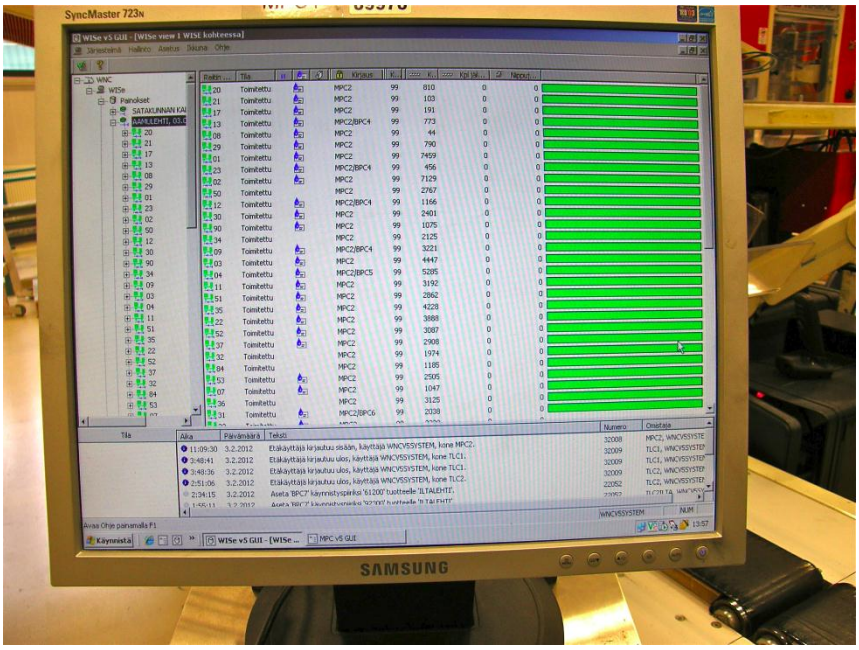


Figure 18 A display of Alma Manu addressing system

The final line of production is the sorting and loading the printed newspapers. Each truck has an assigned route in which delivery is done.

Figure 19 Alma Manu belt conveyor(loading)

5 SOLUTION

As stated already, the purpose of this thesis was to create a system that monitors in real time the amount of newspapers that goes into the mailrooms. And that is why the working principles had to be explained first and some definitions made. In the research, three different counters were considered for the solution to this problem.

To begin with, I considered the gripper conveyor in use, the various laser copy sensors, copy count in use and all other activities that take place.

5.1.1 Gripper Conveyor.

The gripper conveyor speed can be regulated by the printer who is monitoring and controlling the system. The TGG 3160 gripper conveyor and the PCC 902 gripper conveyor from IDAB WAMAC (now known as Schur) are in use.

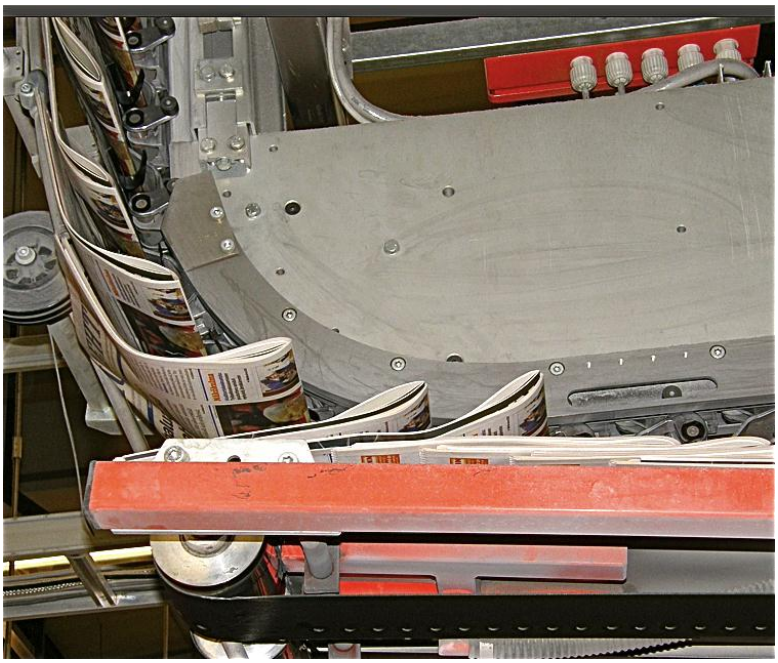


Figure 20 Alma Manu gripper conveyor with newspapers.

5.1.2 Working principle

The printed products are conveyed in an overlapped copy stream from the press folder to the pick-up unit, where they are separated and picked up one by one, each by a single gripper, at any press speed. An interface between the pick-up unit and the press makes sure to synchronize the speed

between the two so that they always work well together, smoothly and efficiently.

5.1.3 Solid Construction

The system is provided with a robust gripper made of reinforced plastics, which holds and transports the newspapers without deforming the shape or causing smearing. The patented gripper opening mechanism provides a simple and reliable release handling. The gripper chain is made up of aluminium links with a small pitch that ensures minimum wear. The gripper track is also made of aluminium with a modular design for flexible layout and easy extension.
Capacity: Up to 60 000 cph (depending on product)

6 SENSORS

Sensors maybe used in a control system for a variety of purposes. In particular, output controls, output signals are measured for feedback control; input signals are measured for feed forward control (Clarence W. de Silva 2007, 207.)

6.1.1 COPY COUNT SENSORS

The sensor type in use is the Denex(now Baumer) laser copysensor. They have continued to be the best and most accurate laser-counting device for lapped/shingled products. Their products are designed for both newspapers and commercial printers

Figure 21 Products from Denex(Baumer)

Products from Denex(Baumer).

The laser copysensor is used as a sensor that sends pulse signals to the copy counter for accurate counting. There are installed beside belt conveyors, gripper conveyors that are connected to the stackers. We also have the laser copysensor edge detector. It is used for best timing of output pulse signals for the ink jet.

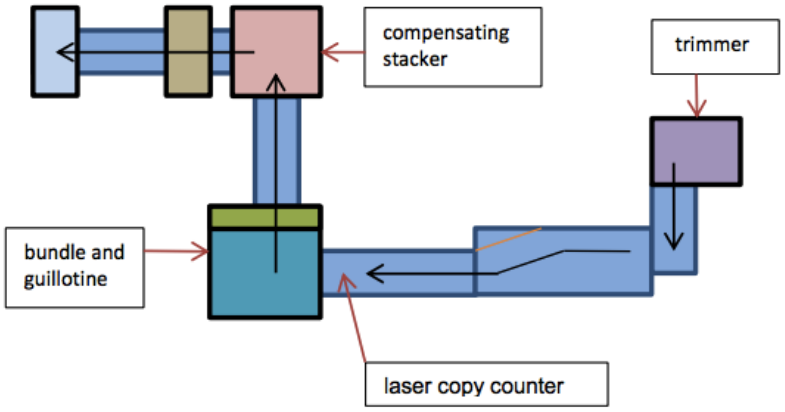


Figure 22 A schematic description of a laser copycounter

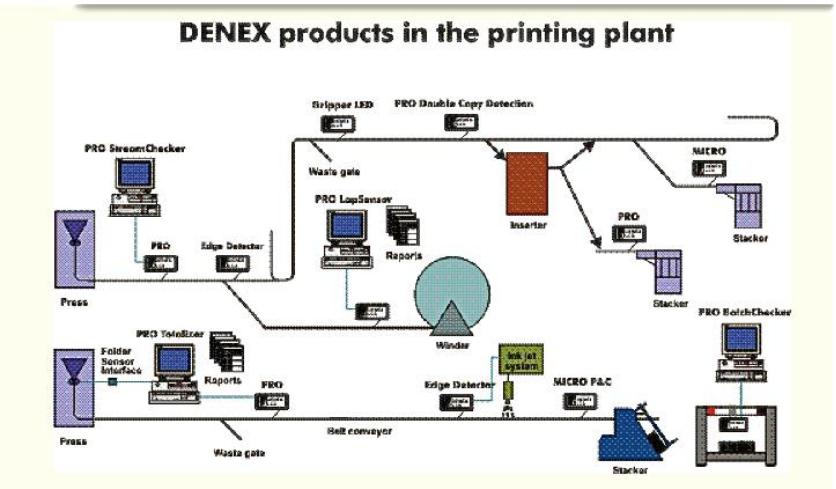


Figure 23 A display of Denex(Baumer) in a typical printing plant.

6.1.2 Gripper led

Figure 24 The latest gripper led from Denex (Baumer)

The gripper led has been specially designed to count on gripper conveyors with the highest possible accuracy. The led technology, instead of a laser,

provides the same performance when used in this application, but is much more affordable. It has a longer lifetime and operates without any adjustments, which guarantees a highly accurate count for a very long time.

6.1.3 Micro

Figure 25 The new Micro

The micro is the most universal Copy counter for lapped or Shingled Streams. In other to get the highest possible accuracy, a microprocessor is needed. Only a microprocessor can intelligently process stream reflections to be able to distinguish between real copies and stitches, back-edges, scratches and so on. This allows the sensor to count both folded edge and cut edge deliveries first.
Whatever the application, newspaper stackers, commercial stackers, ink-jet labelling, packaging, gripper, Pick-up Stations; the laser copy sensor micro will handle the situation. By setting the DIP-switches at installation, the microprocessor will optimize itself to the specific application to reach the highest count accuracy.
The intelligent dynamic blocking function enables the sensor to handle all different stream conditions. The MICRO’s gap detection software will eliminate false counts causes by bent edges or folder pin marks showing when gaps occur in the stream. With the speed sensor input, a fixed-distance blocking zone can be programmed (for ink jet labelling or other needs).

6.1.4 Laser copy sensor micro

Below is the laser copy sensor in use at Alma manu. Though it is an old type but works fine.

Figure 26 Alma Manu laser copy sensor micro (old version)

7 COUNTERS

In digital logic and computing, a counter is a device which stores (and sometimes displays) the number of times a particular event or process has occurred, often in relationship to a clock signal. We have the Electronic counters(Decade counter, Up/down counter, Ring counter, Johnson counter), Computer Science counter and Mechanical counter.

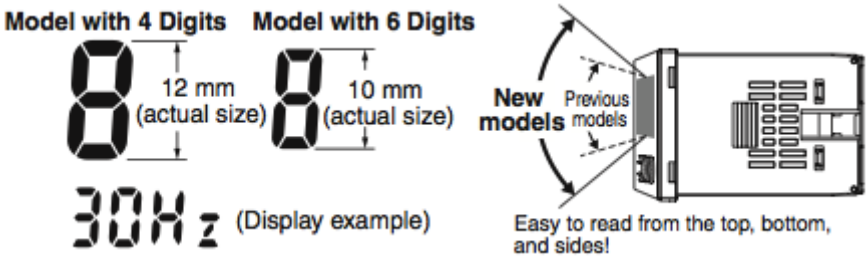
The present counter in use at Alma manu can only tell the overall net count of the print produced. One cannot tell the actual amount of newspaper in the mailroom, gripper conveyor/line, the actual amount in the storage buffer and then of course the actual amount on the belt conveyors.

7.1.1 (H7CX series)The multifunction counter/tachometer.

My research brought about one of the best multifunctional counter or tachometer made by Omron. Model type is H7CX, which is best for printing companies and useful for other applications.
The H7CX has some unique features which made it more suitable for this thesis. The basic features are: Short body with depth of only 59mm (for 12 to 24-VDC Models with Screw Terminals). Better readability with character height of 12mm on 4-digit models and 10mm on 6-digit models. The present value display characters which can be switched between red, green, and orange.

H7CX

It is easy to check the output status from a long distance with changing display colours (red, green, and orange).
Also, it includes total and preset counter, batch counter, dual counter, twin counter, and tachometer.



MODEL NUMBER STRUCTURE

Model Configuration

H7CX Series

		H7CX-A-series Multifunction Preset Counter			H7CX-R-series Digital Tachometer	
Model						
Classification		Preset counter		Preset counter/tachometer	Tachometer	
Model		H7CX-A□-N	H7CX-A4W□-N	H7CX-AW□-N/-AU□-N	H7CX-R11□-N	H7CX-R11W□-N
Function	1-stage preset counter	Yes	Yes	Yes	No	
	2-stage preset counter	No	Yes	Yes	No	
	Total and preset counter	Yes	Yes	Yes	No	
	Batch counter	No	Yes	Yes	No	
	Dual counter	No	Yes	Yes	No	
	Twin counter	No	Yes	Yes	No	
	Tachometer	No	No	Yes*1	Yes	
Tachometer input		No	No	Yes 1 input or 2 inputs (independent measurements, differential, absolute ratio value, and error ratio value)	Yes 1 input	Yes 2 inputs (independent measurement) only
Settings		1-stage	2-stage		1-stage	
External connections		11-pin socket	Screw terminals		11-pin socket	
Display color of present value		Red	Red, green, or orange		Red	
Display digits		4 or 6 digits	4 digits	6 digits	6 digits	

Figure 27 Model Configuration.

The Easiest Operation
Operation is simplified by the Up/Down Key for each digit on 4-digit models and Up Key for each digit on 6-digit models.

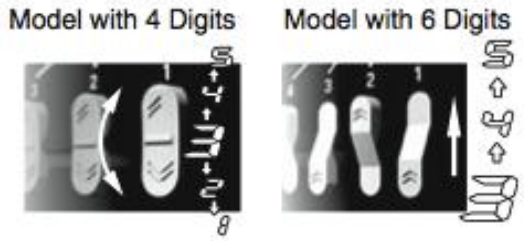


Figure 28 A Display of Models With 4\6 Digits.

Set Value Limit:

You can set an upper limit for the set value to prevent unexpected operation of output devices caused by setting mistakes.

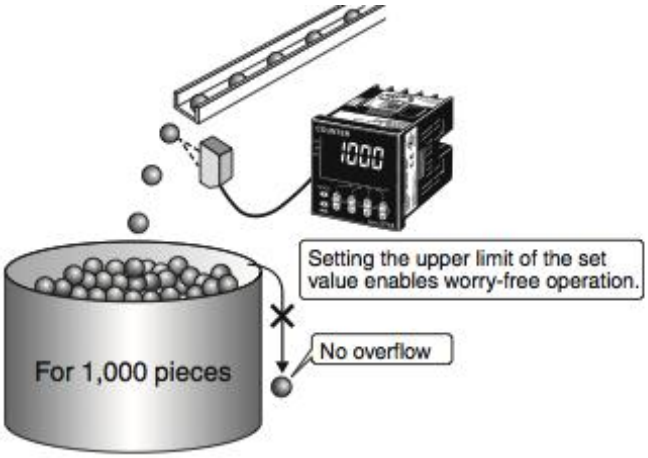


Figure 29 Sample Set Value Limit.

Output counter:

The output counter counts the number of times the output turns ON (alarms can be displayed and the count can be monitored in increments of 1,000 operations). This counter is useful in managing the service life of the Counter/Tachometer or the load.

I/O FUNCTIONS (USING AS A COUNTER)

INPUTS	CP1, CP2	(1) In general (except for Dual Counter Mode) • Reads counting signals. • Increment, decrement, command, individual, and quadrature inputs accepted. (2) When used as a dual counter or twin counter • Reads CP1 count signals with CP1 input and CP2 count signals with CP2 input. • Increment signals can be input.
INPUTS	Reset/reset 1	(1) In general (except for Dual Counter Mode) • Resets present value and outputs (OUT2 when using the batch counter)*2. • Counting cannot be performed during reset/reset 1 input. • Reset indicator is lit while reset input is ON. (2) When used as a dual counter or twin counter. • Resets the CP1 present value (to 0). • Counting for CP1 input cannot be performed while the reset 1 input is ON. • The reset indicator is lit while the reset 1 input is ON.
INPUTS	Total reset or reset 2	The reset function depends on the selected configuration.
OUTPUTS	OUT 1, OUT 2	Outputs signals according to the specified output mode when a set value is reached.

Table 1 Showing Input and Output functions using a Counter.

CONFIGURATION	RESET OPERATION
1-stage/2-stage preset counter	Does not operate(not used)
Total and preset counter	Resets the total count value. The total count value is held at 0 while the total reset input is ON.
Batch counter	Resets the batch count value and batch output (OUT1). The batch count value is held at 0 while the reset 2 input is ON.
Dual counter	. Resets the CP2 present value. Counting for CP2 input cannot be performed while the reset 2 input is ON.
Twin counter	Resets the CP2 present value.

Table 2 Configuration and Reset Operation.

Advantages

Easy to read and operate.
Set up limit.

Disadvantages

Very expensive to maintain.
The limit set up is not reliable.
Cannot withstand the paper dust.

7.1.2 The count display module (CDM)

The count display module was another count considered for the job. It can actually handle some aspect of the task but not everything. It is designed to be clearly visible at a distance of 50 metres even in high ambient lighting. Ruggedly built in stainless steel or painted mild steel option it is designed to withstand the rigours of industrial use.
The CDM is an intelligent system that collects its own data from machine sensors and computes and displays its own values. It can also accept data via LAN or RS232 from other systems.

Figure 30 A CDM displaying various count options.

Figure 31 A CDM displaying waste count.

Figure 32 A mounted CDM.

Advantages:

Saves cost on buying several displays.
A complete production board was put in one unit. View as many as five different data values on one display.
High visibility, 7 digits, 90mm high LED display. Excellent in high ambient light areas
Displays: totals, rates and time, with decimal points, colons, plus and minus. Automatic or manual scrolling sequence for each data set.

Disadvantage:
The main disadvantage of the CDM is that it cannot give you the amount of newspapers on each gripper points which is our main purpose of the thesis topic.

7.1.3 The countmaster Legend (H7CX series)

The ‘countmaster legend’ is the most suitable counter for this project. This is because it is very easy to install and the application is simply the best. It features are all what we need in a counter.

Working Principle of the Countmaster Legend

The laser copysensors output pulses are sent to the countmaster. The countmaster can be set to a particular batch and totalizer. It should be noted here that the countmaster can be used as a batch controller and simultaneously work as a total counter for the production.

When a batch total is reached,(the green led) sends an output pulse. The process continues until the final destination is reached (packaging)

Figure 33 Front view of a countmaster legend.

Figure 34 Back view of a countmaster legend.

7.1.4 How connections were made

Input connection for sensor: 3 pin connector supplied. The below view is that of solder pins.

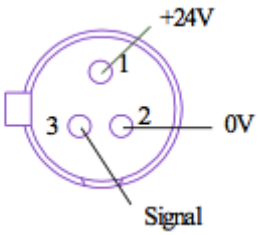


Figure 35 3 Pin connector supply.

Pin 1: 24VDC (usually brown or red sensor wire), pin 2 0VDC (blue) and pin 3: Signal (usually black or yellow.)

There are 3 wire sensors and 4 wire sensors, one is to determine which is configured according to the installed sensor type.

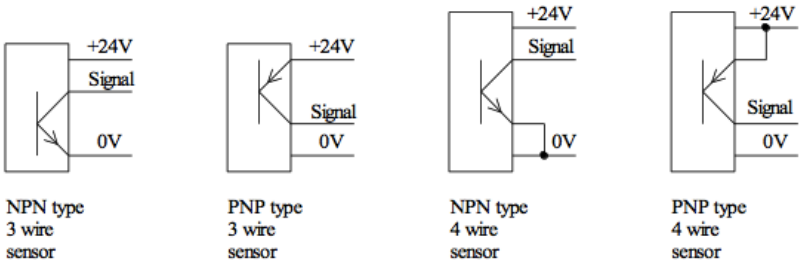


Figure 36 3 wire sensor and 4 wire sensor.

7.1.5 Output connection to batch device:

Below is a 2 pin connector supply. The view is of solder pins as well.

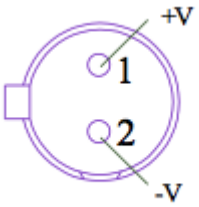


Figure 37 2 pin connector supply

Pin 1: +v and Pin2: -v.

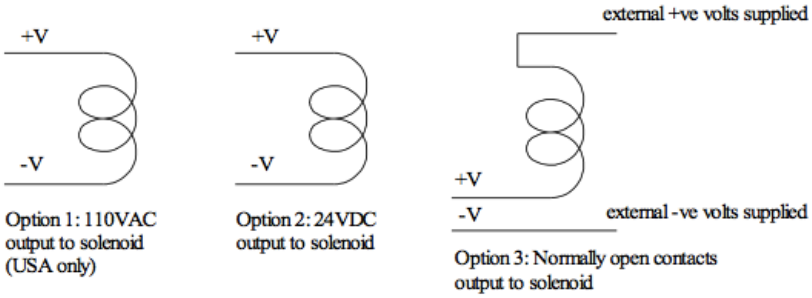


Figure 38 3 different options to connect.

8 THE USER CONTROL INTERFACE

An explanation of the user interface is done below

8.1.1 Front panel:

Count On/Off Push Button: Press the green count button to allow the totalizer/batch counter to count incoming signals from the sensor. The green LED at the center of the push button will be on when the totalizer/batch counter is active. To stop the count, press the button again and the green LED will go off.

Force Batch Push Button: Each time a batch signal is created by the totalizer/batch counter the red LED will light up for the period of the batch output signal. If you need to force a batch early simply press this button.

Totalizer/batch Counter: At a single press, the mode button and the counter display will change from “total display” to “batch display”, press the mode button again and the counter display will change back to “total display”. When the display is in “batch display” mode you can modify the number of counts required to make a batch by pressing the appropriate button underneath the display.

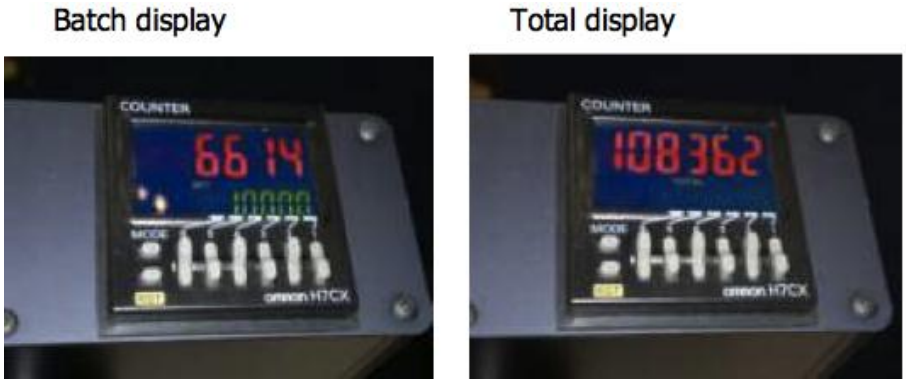


Figure 39 A display of batch and total counts.

8.1.2 Rear Panel

Reset Push Button: Press the reset push button to reset both totalizer and batch counts. The totalizer Settings will be pre-set for one before shipping.

However, one may need to adjust the output batch pulse length which is shipped set at 0.5 seconds. If you enter the set-up mode during a job it is possible that one will lose information from run so one can only access the set-up mode between jobs.

In accessing the settings, one would need to Press and hold the "mode" button for 3 seconds and the word "Cntm" will be displayed on the upper display and the word "up" on the lower display. The upper display is the mode and the lower display is the selectable function. To change the "up" function press the number "1" and the function display will scroll through a number of functions related to this mode e.g. up, down, Ud-R, Ud-b, Ud-C and back to up.

Advantages:

Affordable and saves cost.
Batch controller- displays the amount of newspaper per batch with respect to the set value.
Totalizer can display a total count of newspapers printed.
There is high visibility of LED display. Excellent in high ambient light areas.
Easy installations can be used with any standard sensor.

Disadvantage
Requires adequate check.

9 SUGGESTED LAYOUT DESIGNS.

After spending time monitoring the real printing system and how the laser copysensors works and all other copy counters. I therefore came up with these three accepted layout designs for the production processes.

LAYOUT DESIGN FOR WHEN THERE ARE SUPPLEMENTS

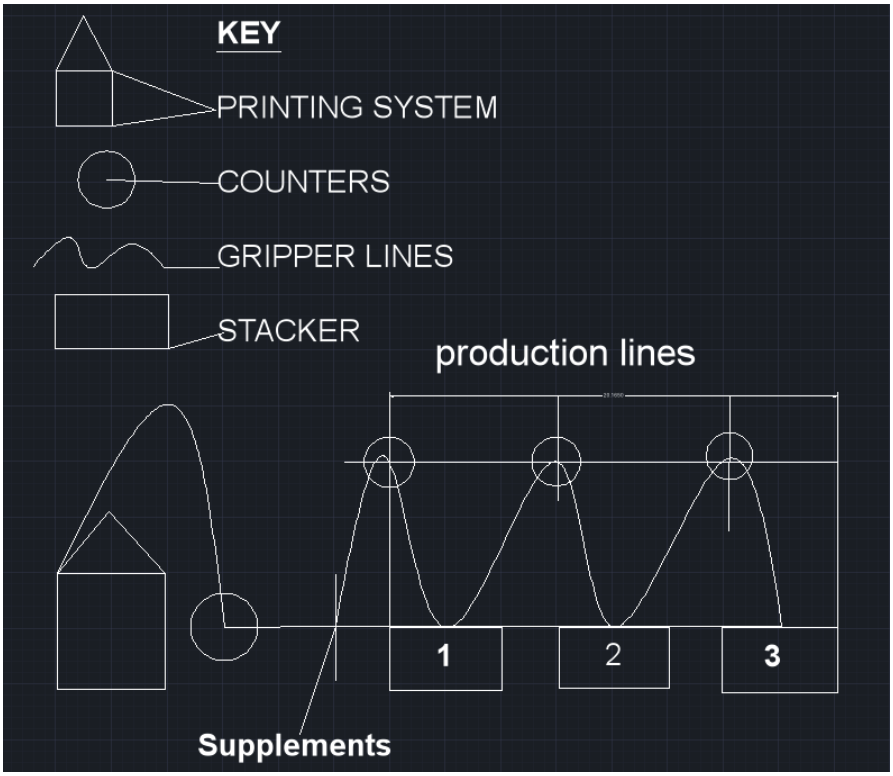


Figure 40 A design for printings with supplements

When printings with supplements are going on, it has been discovered that a lot of waste take place but in order to actually know the amount and proffer the necessary solution to this problem. We need a counter at the exact point (that is, the connecting point between the newspaper gripper line and the conveyor that conveys the newspaper to the rest of the gripper lines.) As seen in figure 37.

Figure 41 The connecting point related to figure 37.

LAYOUT DESIGN FOR WHEN THERE ARE NO SUPPLEMENTS

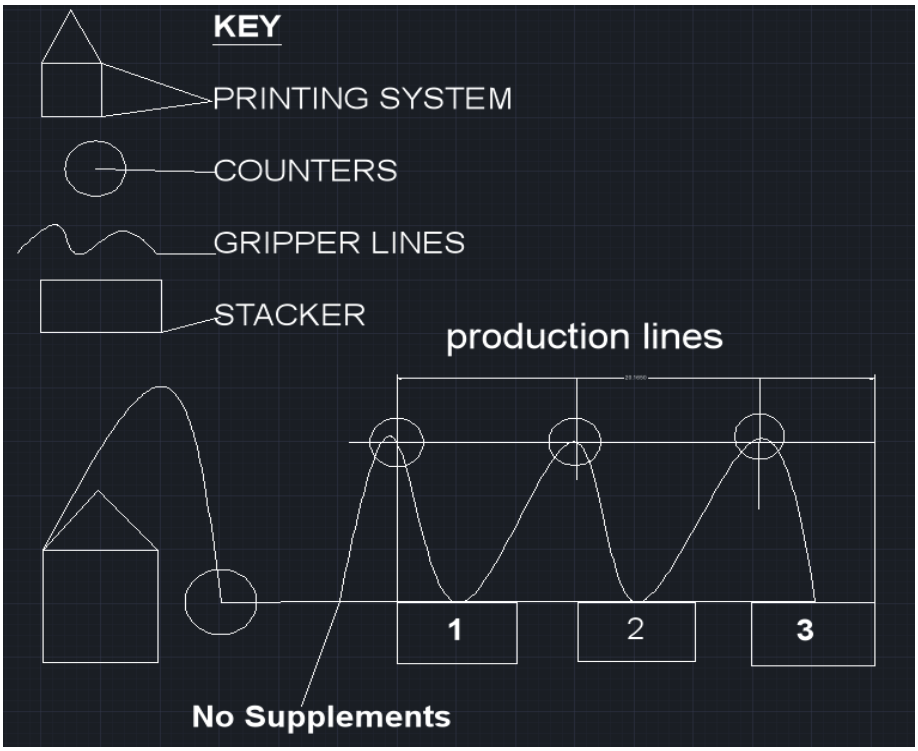


Figure 42 When there are no supplements.

In a situation without supplements, the wastes are not as much as with supplements because there's no need for the connecting point in which we have lots of waste. And this could also serve as a normal everyday newspaper printing.

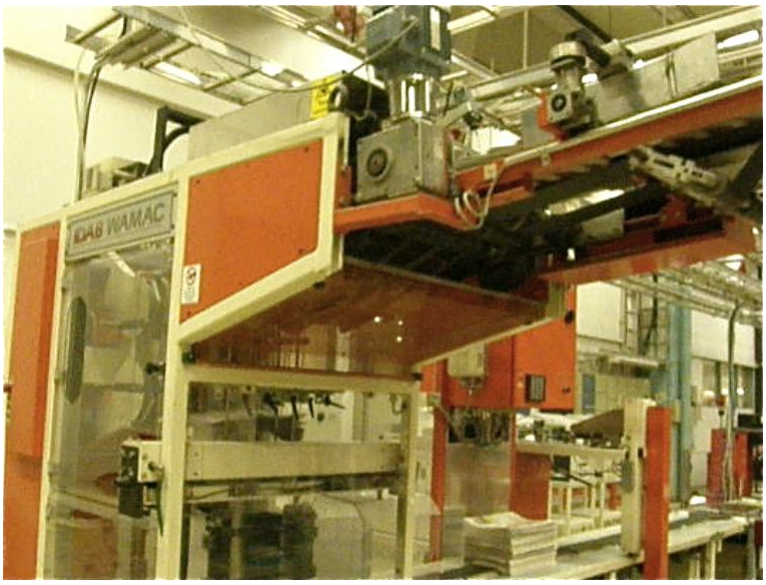


Figure 43 Alma Manu: cross section of a stacker connected to a production line.

Figure 44 Alma Manu: Internal program in stacker

LAYOUT DESIGN FOR WHEN THERE IS A PROBLEM.

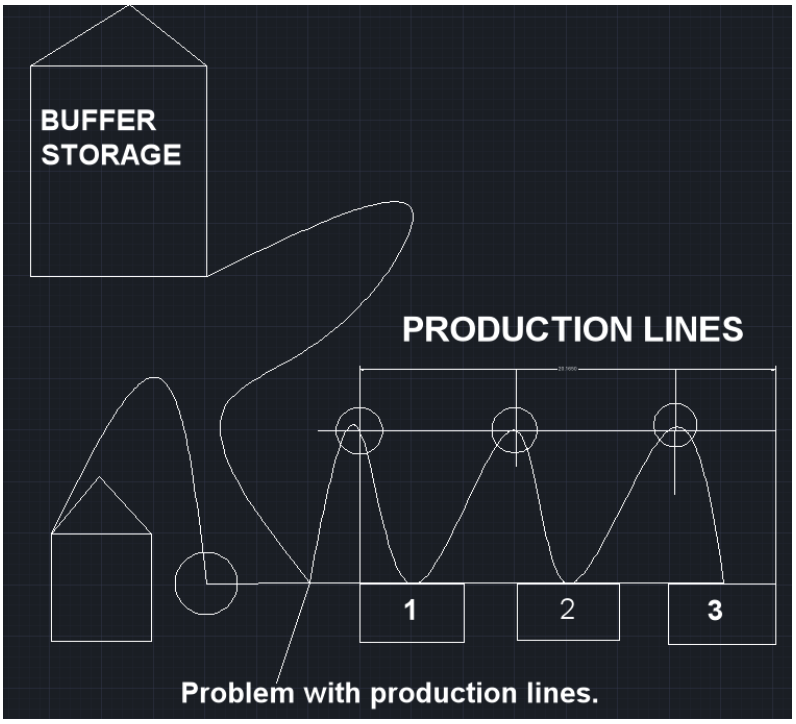


Figure 45 Layout design when there is problem.

Whenever there is a problem with the mailrooms or grippers, then there is the need to make use of the buffer storage system. The printing speed at that time might be reduced as well. After the problem has been rectified, the newspaper is then released again. So, it will go through same process of normal production.

Figure 46 Cross-sectional view of the newspapers directly from the printing press.

9.1.1 General process control and principle

The bindery line production process is monitored by a Management Information System (MIS), which takes the final good copy count from the laser copy counter sensor at the position described in Fig 22.

The final good copycount reported by the MIS sometimes differs with the actual delivered quantity.

The MIS good copy count should accurately reflect the number of copies sent to the customer otherwise:
1. If the MIS has over-counted during a job then the customer's order will be short. In this event the bindery will need to run extra copies to compensate to be certain of fulfilling the contract, adding to the cost of manufacturing.
2. If the MIS has under-counted during a job then the customer's order will be long or the bindery may run short of copies. In this event, the press will need to run extra copies to be certain of fulfilling the contract, adding to the cost of manufacturing. The magnitude of the error of the good copy count at the MIS reflects directly on job costs and its profit margin.

9.1.2 Analysis:

There are two issues that ensure the accuracy of the MIS good copy count and it is important to look at and deal with both these issues in the order described below.
Issue 1: The accuracy of the laser copy count sensor: Ensuring that the copy count sensor is the correct type for this application is very important as any error in count due to the sensor will result in a job profit loss that will outweigh the price of the sensor in terms of re-run or over-run production. The copy stream at the current location of the laser copy count sensor was observed as Fig 44

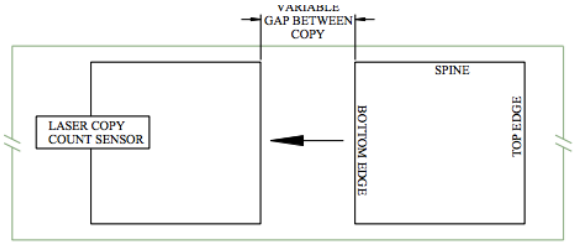


Figure 47 Variable gap between copy.

The bottom and top edges of each copy have been trimmed and are rectangle. The top cover page has a tendency to rise by varying amounts from copy to copy and the distance between copies varies. Consider the condition that will arise where the leading copy top page has risen and that the following copy top page has not risen and there is only a short gap between as seen in figure 45.

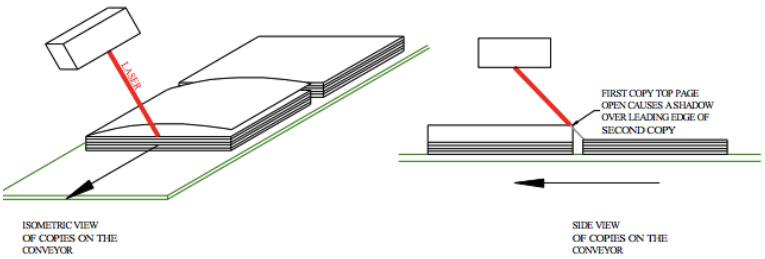


Figure 48 Copy page rise and unrise.

There is an intermittent possibility that copies, where the gap between is short, may not be counted as the shadow, created by the leading copy, covers the edge of the trailing copy. To minimise the possibility of this happening, the angle of the laser light needs to be closer to the vertical as also seen in figure 46.

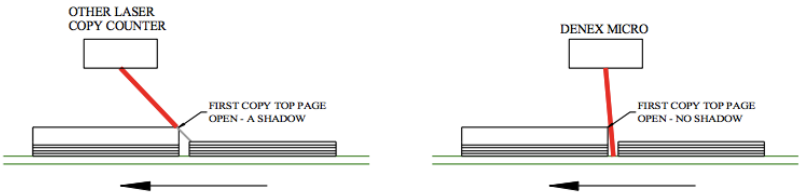


Figure 49 Angle of laser light closer.

On this application, it is therefore important to fit a DENNEX Micro copy count sensor to maximise count accuracy alongside the countmaster legend. Other points to consider are surface ripple and high gloss effects on the optical responses of both sensors. It has been an experience that the Micro has as good if not better rejection of these problems as the other laser copy counter. It is also worth considering the point that if the bundle/guillotine machine is forming its bundles from the count signal of the laser copy counter then any missed count might precipitate a machine jam. If this is the case, then changing to the appropriate sensor, in this application, the DENEX Micro, should resolve the issue of jams caused in this fashion.

Issue 2: The accuracy affected by the operator procedures: This problem revolves round a jam at the bundle/guillotine and should be broken down to two parts:

9.1.3 Activity before the count sensor

When the bundle\guillotine jams, the copies that are on the infeed conveyor butt up against each other. If allowed to continue, once the jam is cleared and the bundle/guillotine restarted, will present no gap between copies for the laser counter to count the edges. Hence, copies will be missed, adding to the count error.

The process to overcome this is for the operator to remove all copies from the infeed conveyor, except the one copy immediately under the copy count sensor, prior to restarting the bundle/guillotine machine. Once the machine has started the good copies are then re-introduced on the main conveyor, up-stream of the infeed conveyor, by hand so that they can be counted by the sensor. Any wasted copies can be put into a waste bin as the MIS will automatically take account of them and the information can directly be seen on the countmaster legend as well.
This process was observed and being carried out during the numerous visits both at night and day time. The bundle/guillotine infeed conveyor speed should be about 10 to 15% faster than the main conveyor feeding into it as this will separate any copies coming onto the infeed conveyor that are touching each other. Again, this appeared to be the case but worth mentioning.

9.1.4 Activity after the count sensor:

Bad Copy: In a situation, where copies have jammed in the bundle/guillotine machine and are damaged or copies that are damaged after the copy count sensor, they need to be put to one side and counted by hand then entered as post stacker waste at the MIS.

Good Copy: Copies that have not been damaged during the jam clearing process or any other copies removed after the copy counter and can be sent to the customer should be made into a bundle and place on the infeed conveyor of the compensating stacker.

CONCLUSION AND RECOMMENDATION

The aim of this thesis project is to create a system that monitors in real time the amount of newspaper that comes into the mailrooms. In doing this, I have been able to go even further by designing a layout that will not only monitor the amount of newspapers in the mailrooms but also design layouts that monitors the amount of newspapers on the gripper lines\conveyors, the amount of waste and the amount of newspapers in the buffer storage. This will also further help in improving the level of precision. The rate of wastage will be very minimal.
The countmaster legend counter is believed to be the best counter for this printing plant. It is cheap, the installation is simple and not expensive to maintain. The suggested layout designs was accepted by Alma Manu Oy, which actually made this thesis project a success.
Replacement of the other laser copy counters with a Denex micro is recommended. The MIS counting issues and possibly the paper jam issues will be reduced. As part of the recommendation, a simulated version of this thesis should be carried out as soon as possible as this will help to put the suggested layout designs into real time usage. Daily maintenance should be carried out on the mailrooms, conveyors, copy sensors and counters.

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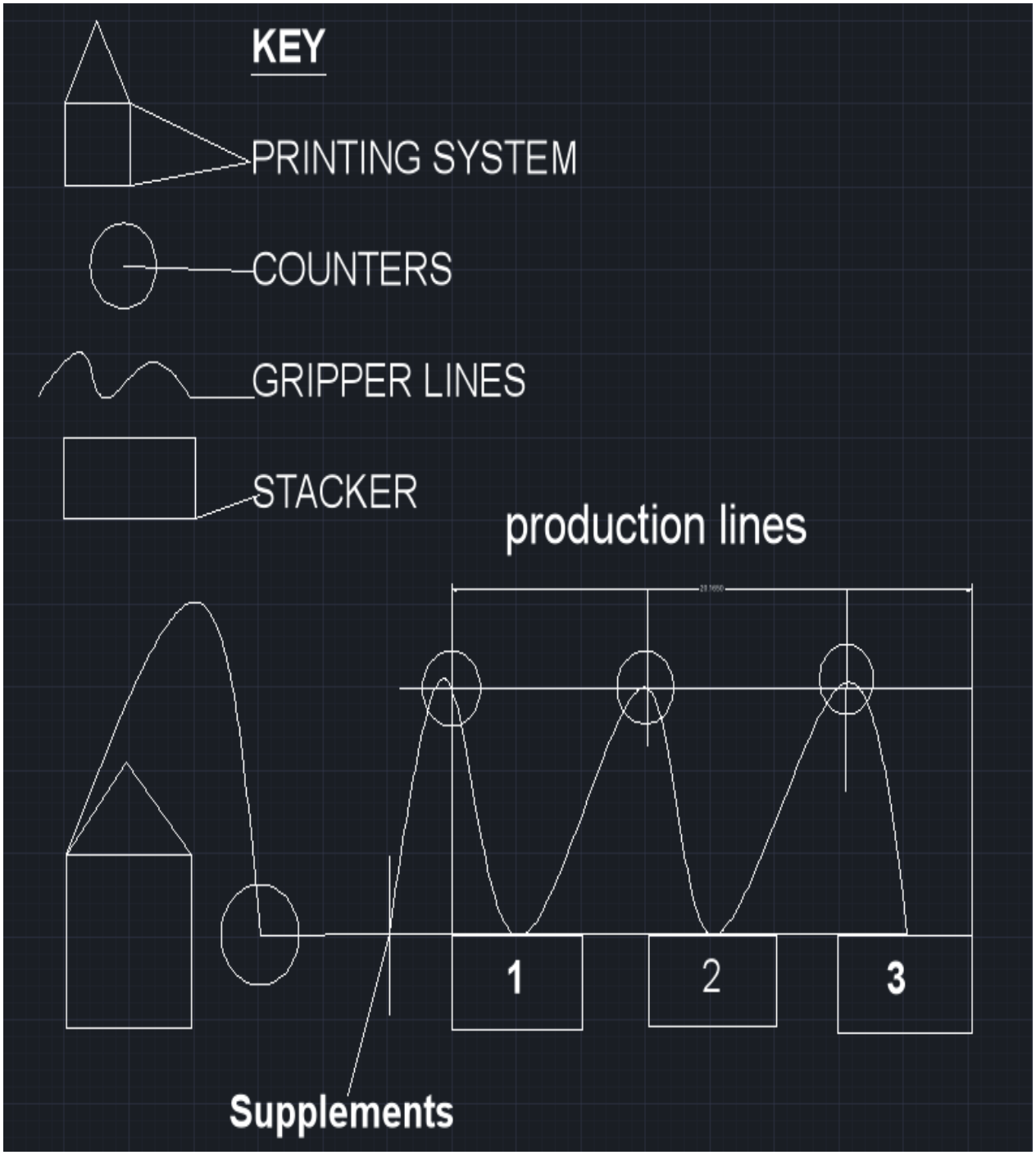
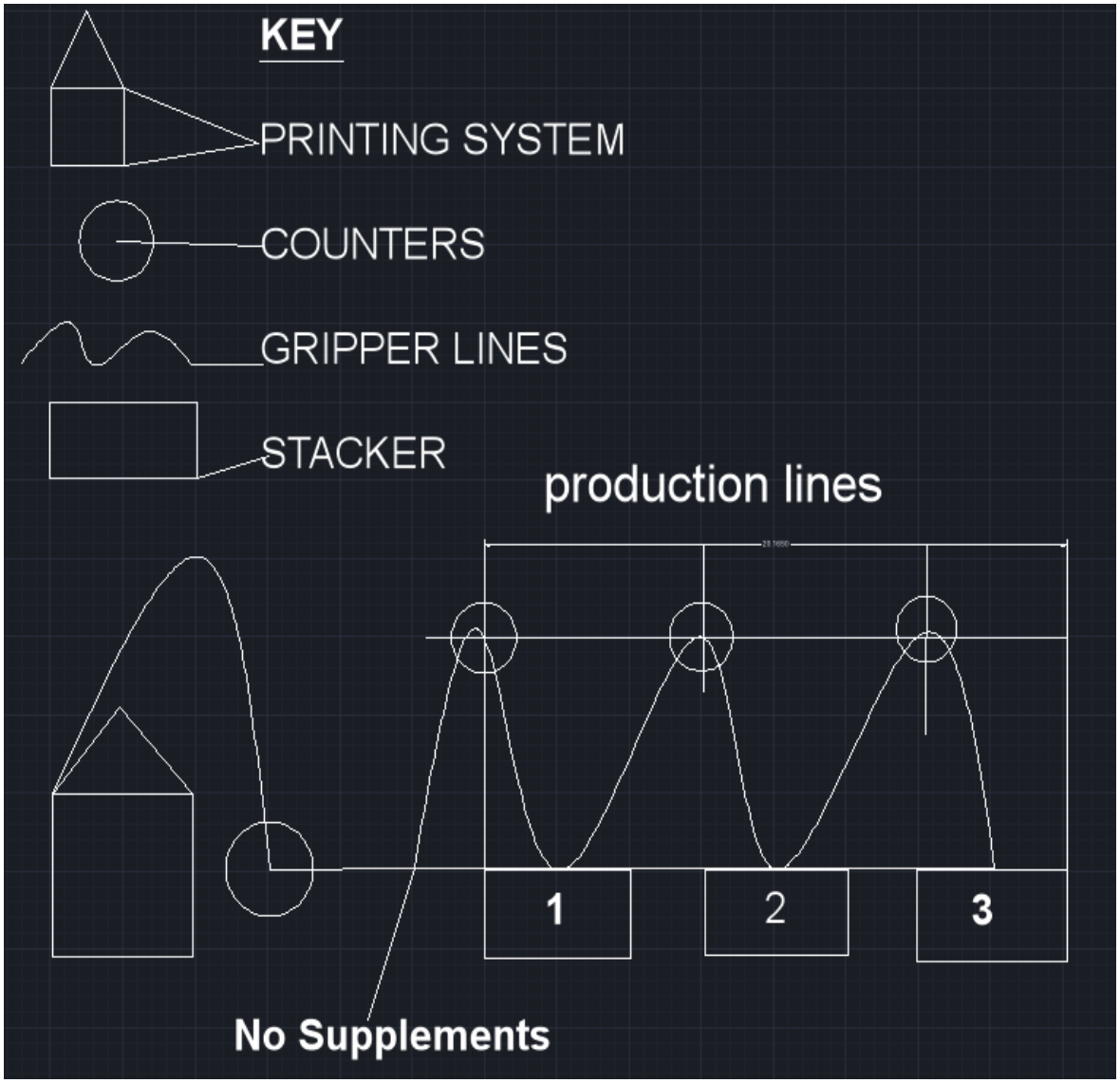
APPENDIX

LAYOUT DESIGN FOR WHEN THERE ARE SUPPLEMENTS



System that monitors in real time the amount of newspaper coming into the mailrooms.

LAYOUT DESIGN FOR WHEN THERE ARE NO SUPPLEMENTS



System that monitors in real time the amount of newspaper coming into the mailrooms.

LAYOUT DESIGN FOR WHEN THERE IS A PROBLEM