

# Advanced Automation System In Packaging Board Plant

Agarwal N. K. , Goswami S, Singh Anil, Bhavsar Ranjit, Dode D.D.,  
Srivastava Manish

## ABSTRACT

**“Only one thing is permanent in this world and that is CHANGE”.**

The speed and volume by which the Technological changes are going it is becoming the Skelton of all the changes taking place in 21<sup>st</sup> Century. The advancement in the Database system, artificial intelligence, expert systems, robots, neural network, open system and Information Technology has changed the boundaries of automation and control as it is no more limited only to sensors and process control but also reaching at the enterprise level for the management control. We, at JK Paper, are not only using automation for cross functional support, but also trying to explicitly convert the implicit knowledge of Human Capital into production and processes. In this paper we have mentioned some cases out of the many where we have compressed the cost of production by using automation and increased the production by using the latest technology.

### Introduction

Automation has become an informative intensive application domain, in which

- 1) Users need right information, in the right place, in right time, and in the right format to perform well.
- 2) More and more information is available in various electronic forms, eg. design documents, process and simulation models
- 3) Rise of semantically tagged data

- JK Paper Ltd. Unit CPM at Fort Songadh is an integrated Pulp and Paper Mill in Western India with installed capacity 55000 TPA of Paper and 60000 TPA of Packaging Board.
- Product- Writing Printing Papers utilizing Bamboo and Hardwood as Raw Materials and Premium quality Coated Packaging Board with some percentage of imported pulp.
- Unit originally installed in 1966, which was acquired by JK Organization in 1992 and rehabilitated in 1993-94.
- Unit is ISO 9001, ISO 14001 and OHSAS 18001 certified apart from number of national level awards and also the first integrated Pulp and Paper Mills in the country to have been awarded TPM Consistent Commitment Award by Japan

Institute of Plant Maintenance (JIPM), Japan.

- Manufacturing Premium Quality Packaging board e.g. Ultima and Tuffcoat and Writing and Printing papers example Maphlitho, Copier, Ledger, Parchment, MICR Cheque Paper.

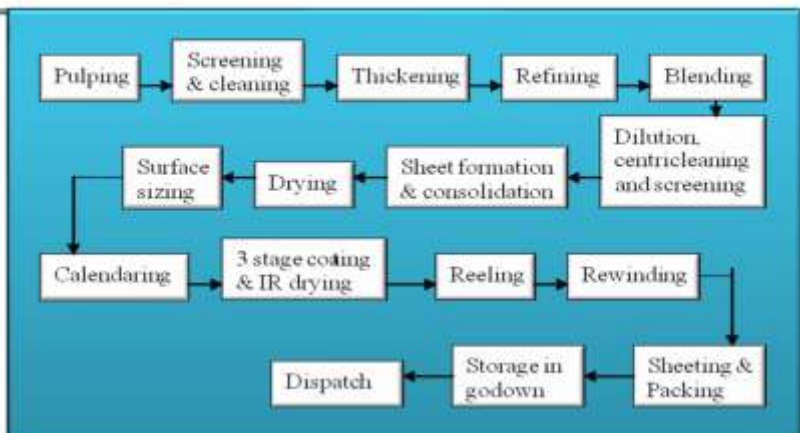
### Advantages Of Automation:

- 1) Maintain consistent quality.
- 2) Performing tasks that are beyond human capabilities of size, weight, speed, endurance, etc.
- 3) Reduces operation time and work handling time significantly.
- 4) Replacing humans in tasks done in dangerous environments (i.e. fire, space, volcanoes, nuclear facilities, underwater, etc.)

- 5) Economy improvement: Automation may improve in economy of enterprises, society or most of humanity.

Fiber based materials enjoy a strong and well deserved status in packaging world. Paperboard is smooth and strong, light and bright, versatile and cost effective. A generous printing surface and superb print quality makes paperboard cartons ideal information carriers and brand builders. Reliability in high speed filling lines saves money and minimise production downtime. We produce a wide selection of paperboards in every category and provide the largest variety of Polymer coatings. We have strong and modern board machine that ensure consistent quality.

### BRIEF MANUFACTURING PROCESS OF PACKAGING BOARD



JK Paper Ltd. Unit : CPM  
P.O. Fort Songaah, Dist. Tapi (Gujarat)

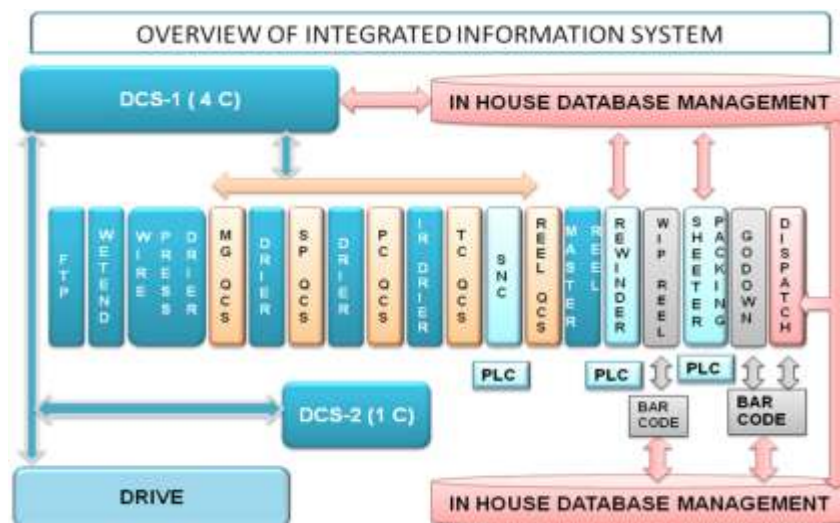
But even more than that we are committed to vertical innovation in the way to promote the efficiency and sustainability of fibre based packaging. Manufacturing of Multilayer Board is very complex, to maintain its various parameters like:

- 1) Physical Properties e.g. GSM, Stiffness and Caliper
- 2) Optical Properties e.g. Brightness, Whiteness and Gloss
- 3) Printing Properties e.g. Ply Bond, IGT and PPS

To maintain above properties we require proper refining, consistency control, head box pressure control, proper vacuum in wire and press part, press load control, steam and condensate control, uniform coating and proper loading of Hardnip and Softnip calender, final winding with hardness control.

### Network Configuration In Packaging Board Machine:

The Paper and Packaging Board industry are using several equipments for its manufacturing processes. These equipments belong to several vendors, each vendor is having his own control system. This makes the information system in the plant disintegrated. Moreover, retrieval of information between different departments require several procedures, people and time. We have developed in-house database management system in board machine which integrates the information from DCS up-to Sales and Marketing. This has made our system transparent and accurate information is available in real time throughout the network. Below diagram explains our integrated information system.



### Section-wise Automation

Automation in Board Plant is distributed over four areas for process measurement and control.

- 1) FIBER TREATMENT PLANT
- 2) WET END
- 3) DRY END

For process measurement and control we are using DCS, QCS, Drives, PLC's. These communicate with each other through Profibus, Hardwire, Optical Fiber

### Fiber Treatment Plant Automation:

We have three streets for pulping. Street A is having continuous process, whereas street B & C is batch process. Street A is used mainly for pulping HW chemical pulp whereas Street B & C is mainly used for pulping BCTMP.

We have different types of screening systems. Control of FIBER TREATMENT PLANT is from FIBER TREATMENT PLANT control room. Development / modification of process as per requirement is very easy in DCS. We have introduced new logic in pulping operation. During discharge sequence of street B & C pulper, a small amount of pulp was getting splashed. To save this, we modified the logic of sequences of addition of dilution water during discharge operation which ultimately eliminated splashing of pulp. This resulted into a saving of Rs 22 lacs/annum.

Modified logic has helped us reduce the batch preparation time with same output, which ultimately saves the power, equivalent to 106920 kWh per year, amounting to Rs 3.2 lacs / annum.

### Batch Pulper Sequence

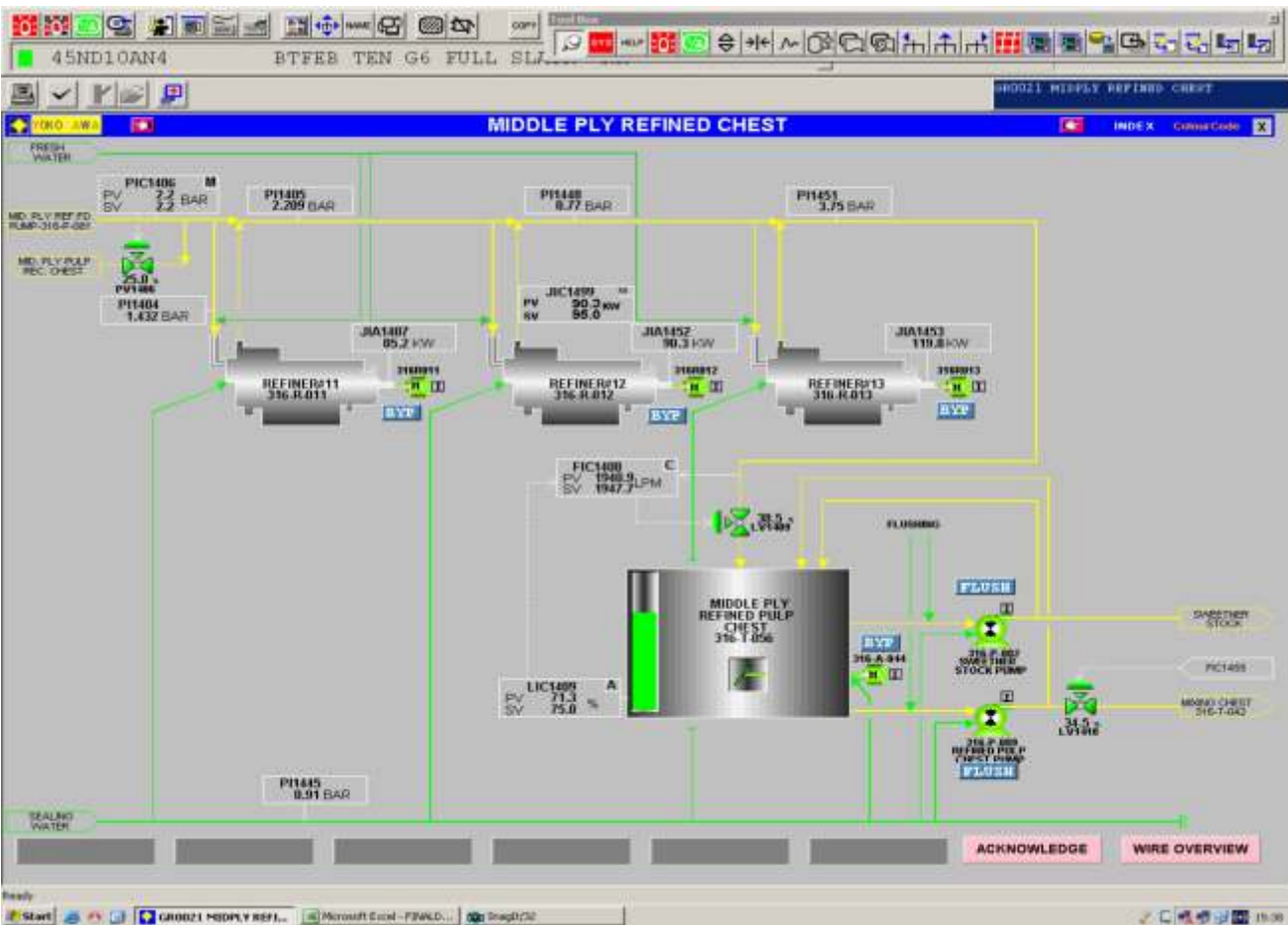
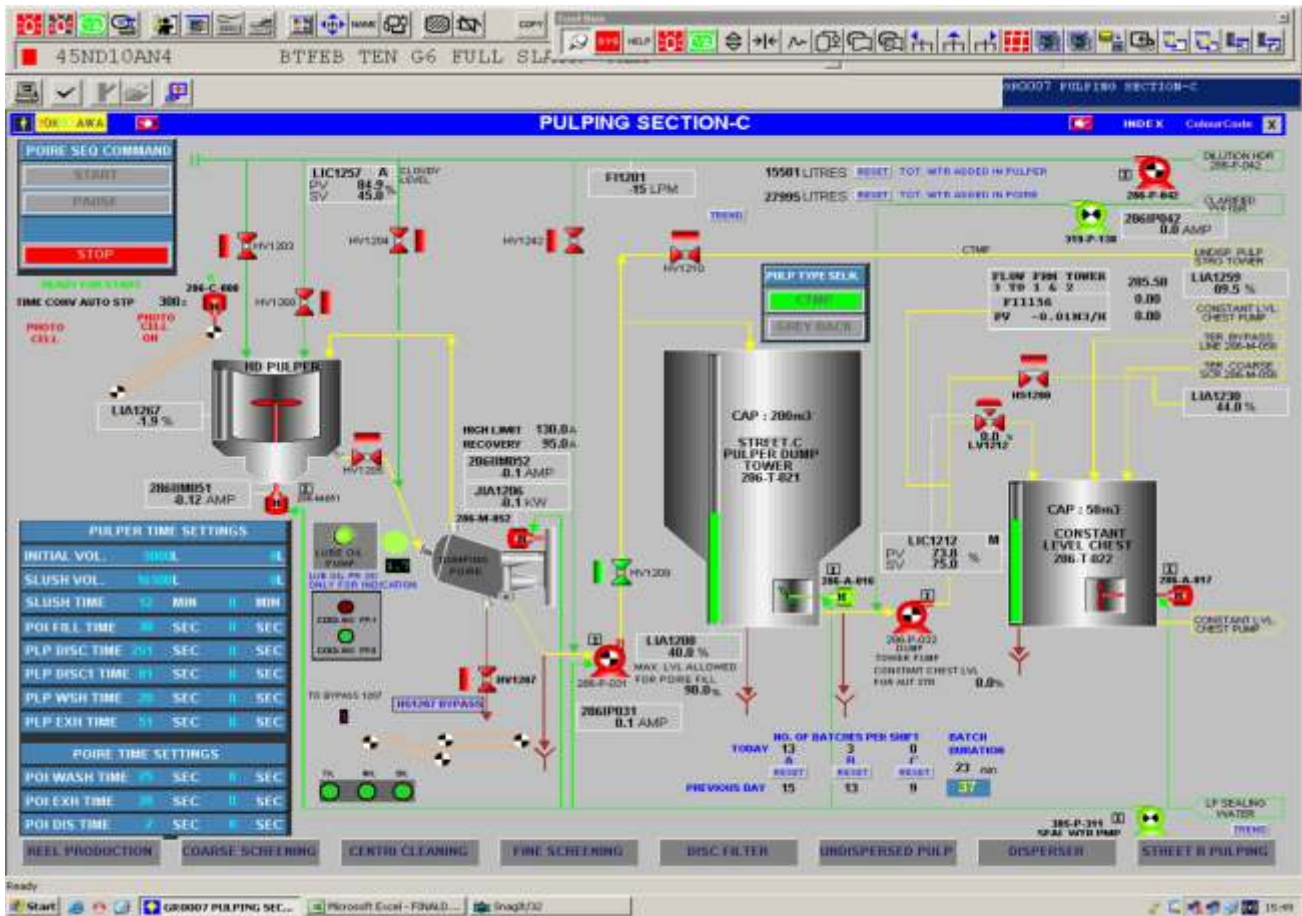
#### Wet End Automation:

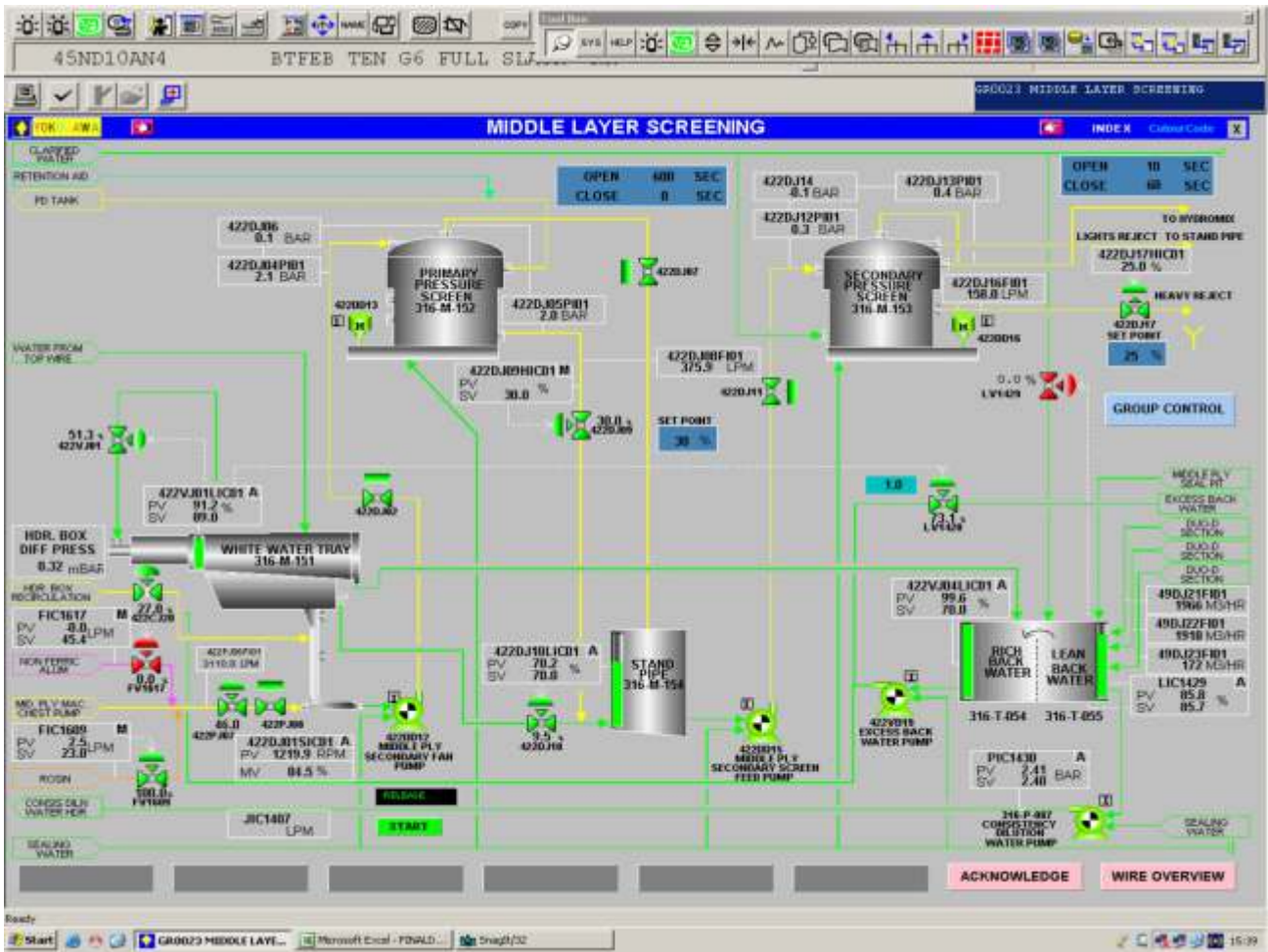
#### Approach Flow:

- 1) Refiner plays a big role to maintain / improve Physical properties of board. By proper refining we can improve in Stiffness and Bonding properties of board. So by automation we are controlling Inlet Pressure, Flow and Consistency before refiner and also apply load as per desired °SR.
- 2) Use of Hydramix in all three layers with Cascade Control Loop for Head Box Pressure control, this control loop takes input from Head Box slice opening, Wire Speed and Head Box Pressure and control Speed of Secondary Fan Pump.
- 3) The size press QCS gives the GSM of whole base board and not giving the GSM and draw of individual layer in the board. So we have made a program in DCS to get this information. Our DCS and QCS suppliers are not same so we have to retrieve Total GSM from QCS server to DCS. The information in below shown pages is compiled from several graphical pages and MIS reports.
  - 1) Dosing chemicals as per draw of its respective layer.
  - 2) To know the contribution of GSM of each layer in total GSM of Board for the optimized use of pulp of most expensive layer.
  - 3) Totalize the individual layer pulp actually being used in making the base board at size press.
  - 4) The above information also gives the online usage of the pulp in board for each layer.
  - 5) Contribution of broke in TPH in middle layer and its percentage.
  - 6) Totalizer of broke used per day.
  - 7) Accurate information about pulp in WIP prevents in making excess amount of pulping helps lot during grade change.
  - 8) Online and Accurate reports in DCS save the time of executives.

#### Wire Section:

- 4) Wire part is playing important role in making board, web formation takes place in wire part. Ply bond can also be varying by controlling proper removal of water by using





### COMPILED PAGE FOR IPPTA

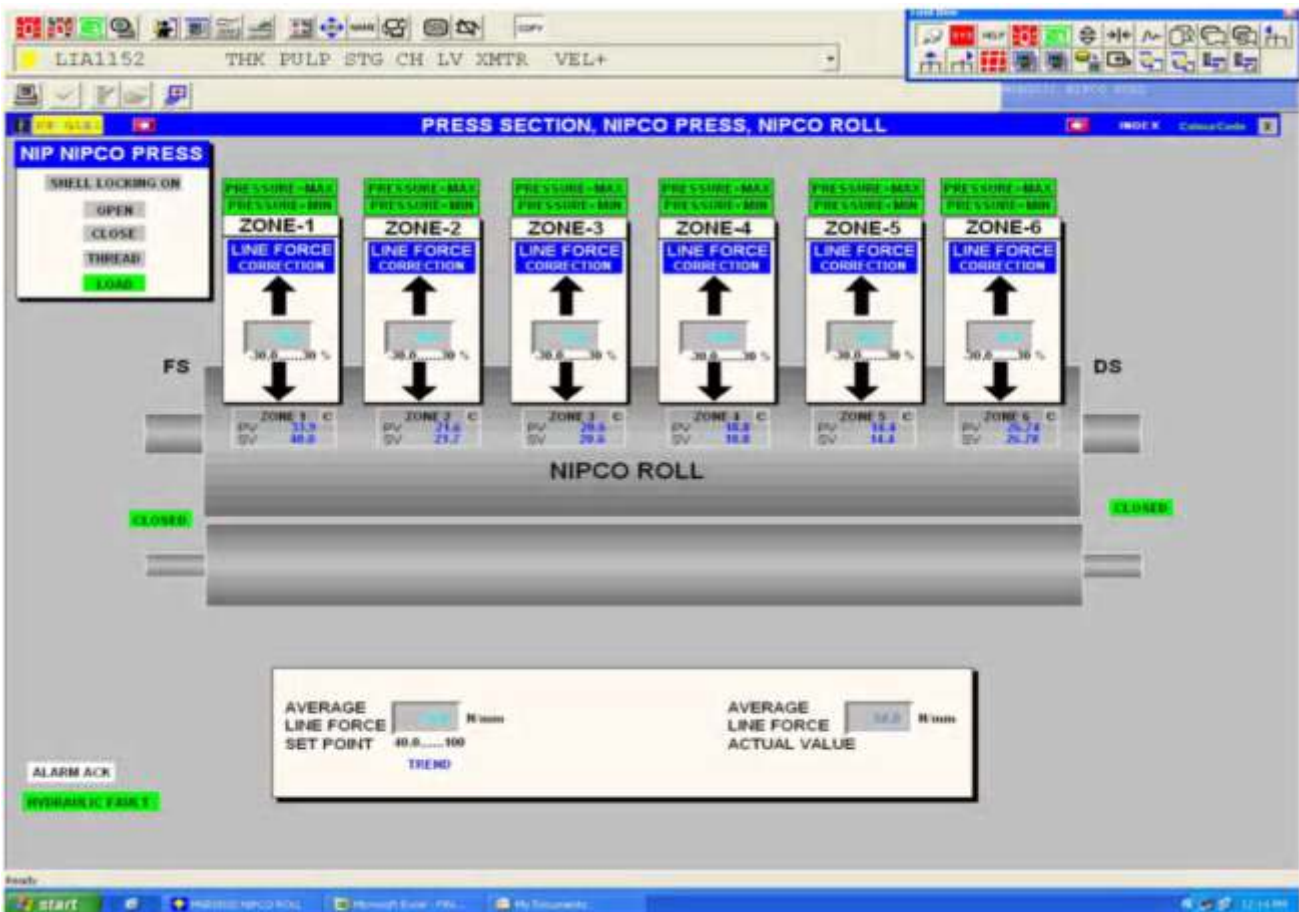
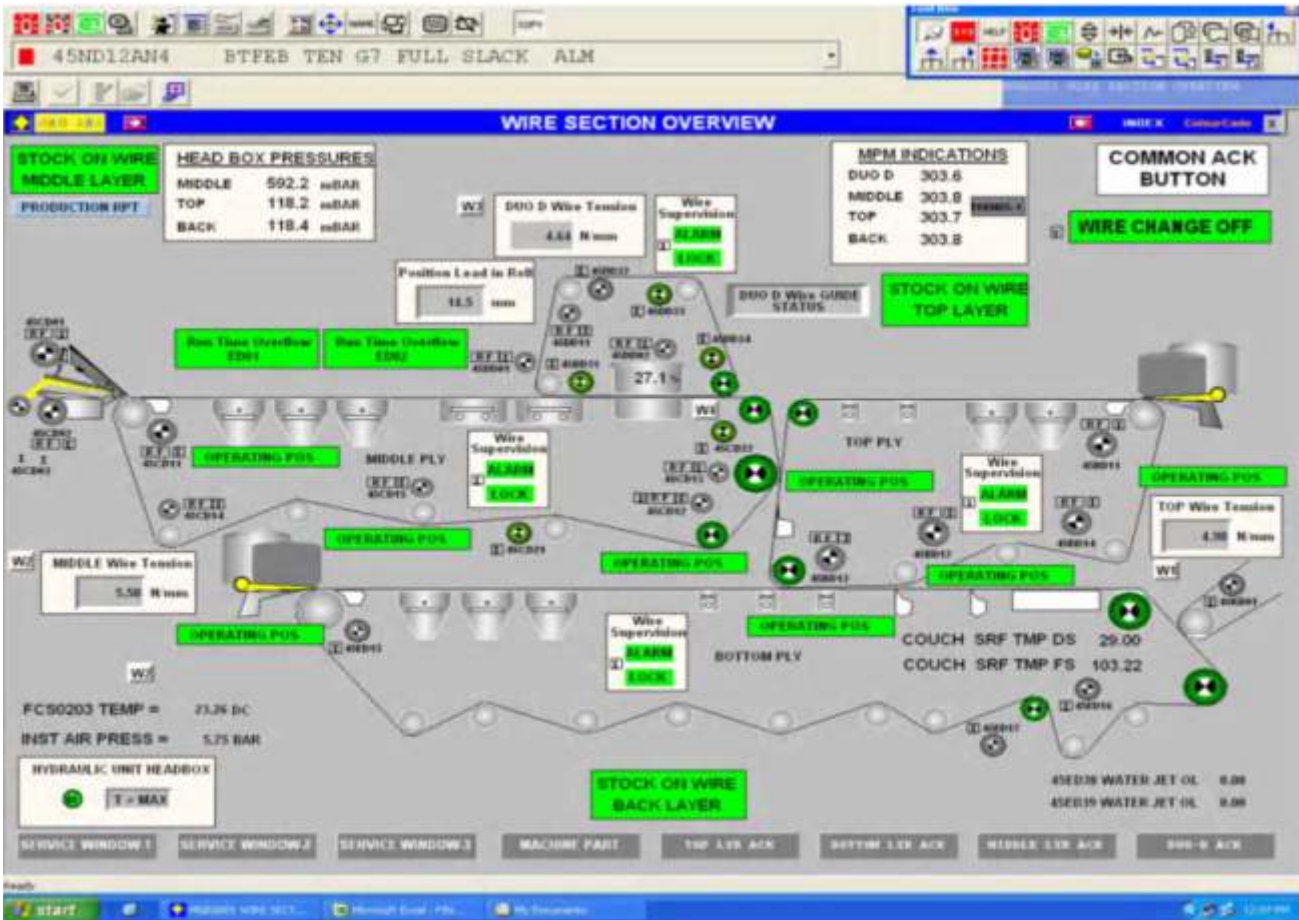
EACH LAYER CALCU. GSM AND RATE			EACH LAYER PLP CONS. SHIFT REPORT				BLENDING CALCULATION						
	GSM	DRAW (TPH)	A	B	C	TOTAL							
TOP LAYER	73.92	2.46	16.55	7.86	0.00	24.41	REFIND STOCK WEIGHT = 3.66 TPH						
MIDDLE LAYER	280.64	9.32	61.60	29.68	0.00	91.28	BROKE BD WEIGHT = 2.55 TPH						
BOTTOM LAYER	42.23	1.40	9.21	4.71	0.00	13.93	BROKE % = 27.38 %						
<b>TOTAL</b>	<b>396.78</b>	<b>13.18</b>					<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <th colspan="2">BROKE BD CONS.</th> </tr> <tr> <td>TODAY</td> <td>27.33</td> </tr> </table>			BROKE BD CONS.		TODAY	27.33
BROKE BD CONS.													
TODAY	27.33												

CHEMICAL DOSING CASCADED WITH LAYER DRAW									
CHEMICAL	TOP LAYER			MIDDLE LAYER			BOTOM LAYER		
	DOSING	GPL	FLOW(LPM)	DOSING	GPL	FLOW(LPM)	DOSING	GPL	FLOW(LPM)
ALUM	2.0	290	0.3	100.0	290	53.6	2.0	290	0.2
DYE (gm/T)	3.6	0.2	0.7	6.0	3.6	0.2	3.5	0.2	0.4
OBA	3.0	100	1.2	3.0	100	4.7	3.0	100	0.7

PREVIOUS DAY CLOSING STOCK				TOTAL B BOTTOM LAYER				
SHIFT	A	B	C	CHEST/TOWER	CY.	O.D. WT./SHIFT(MT)		
						A	B	C
STREET A TOP LAYER	11.2	10.6	9.5	TOWER NO.2	4.7	5.2	7.0	0.0
STREET B BOTTOM LAYER	9.1	8.9	12.8	THIC. CHEST	4.7	2.5	2.5	0.0
STREET C MIDDLE LAYER	31.9	30.0	27.1	RECE. CHEST	4.7	1.6	1.8	0.0
TOTAL (SHIFTS)	48.8	56.9	49.4	REF. CHEST	4.5	1.4	1.3	0.0
				MIXING CHEST	3.0	1.1	1.1	0.0
				M/C CHEST	3.0	1.1	1.1	0.0
				DISPER. CHEST	4.7	0.0	0.0	0.0
						12.82	14.63	0.00



vacuum automation. We can control auto wire tension, auto wire cleaning system, Vacuum setting of Duo former etc.

**Press Section:**

5) Main function of press part is to remove water by mechanical pressing (pneumatic or hydraulic). We have Bi-nip press, Jumbo Press and Nipco press. Nipco press has

six zones, each zone pressure measures and controls through DCS. Due to this we can maintain Moisture and Caliper profile.

Due to automation of Wet End system, runnability of machine improved and consistent quality of board with respect to the customers' requirement (printability) become evident from the feedback of the customers.

**Vacuum Trail Threading :**

The VTT is installed for automatic passing of board from one section to another previously it was manual feeding.

The following page has been made in DCS for analyzing passing time of Board between different sections of machine and to know the section where first brake took place in machine.

JKPL		BREAK ANALYSIS		INDEX	
				PASSING TIME	PRESENT MONTH
				BREAK COUNTER	
BREAK COUNTER TODAY	1	AT PRESS SECTION	0	14	
BREAK COUNTER PREVIOUS DAY	1	AT MG SECTION	0	5	
BREAK COUNTER THIS MONTH	102	AT SP SECTION	0	4	
BREAK COUNTER PR MONTH	105	AT HNC SECTION	0	13	
LAST STOCK OFF TIME	213	AT CTR-3 SECTION	17	16	
STOCKON TO POPEREEL TIME	44	AT SNC SECTION	1	50	
TRENDS-1		TRENDS-2			

	during running machine(N)	GSM change, Quality change and stock off(F)	break	Time in min after VTT	time taken in min after VTT	time taken before VTT	time in min before VTT for same number of break	machine available for production	saving observed before and after VTT
<b>SUC COUCH Total</b>	<b>9</b>	<b>5</b>	14	628	44.9	56.9	796.6	169	12
<b>MG CYLIND Total</b>	<b>5</b>	<b>0</b>	5	107	21.4	30.4	152	45	9
<b>SIZE PRES Total</b>	<b>0</b>	<b>4</b>	4	118	29.5	37.5	150	32	8
<b>HNC CALEN Total</b>	<b>13</b>	<b>0</b>	13	309	23.8	28.8	374.4	65	5
<b>TOP COAT Total</b>	<b>7</b>	<b>9</b>	16	332	20.8	20.8	332.8	0	0
<b>SNC CALEN Total</b>	<b>0</b>	<b>50</b>	50	484	9.7	9.7	485	0	0
<b>TOTAL</b>								311	
Total time save in min in the month of				311					
Total extra production due to VTT				51.8					
Amount saving per month				777000					
Amount saving per year				9324000					

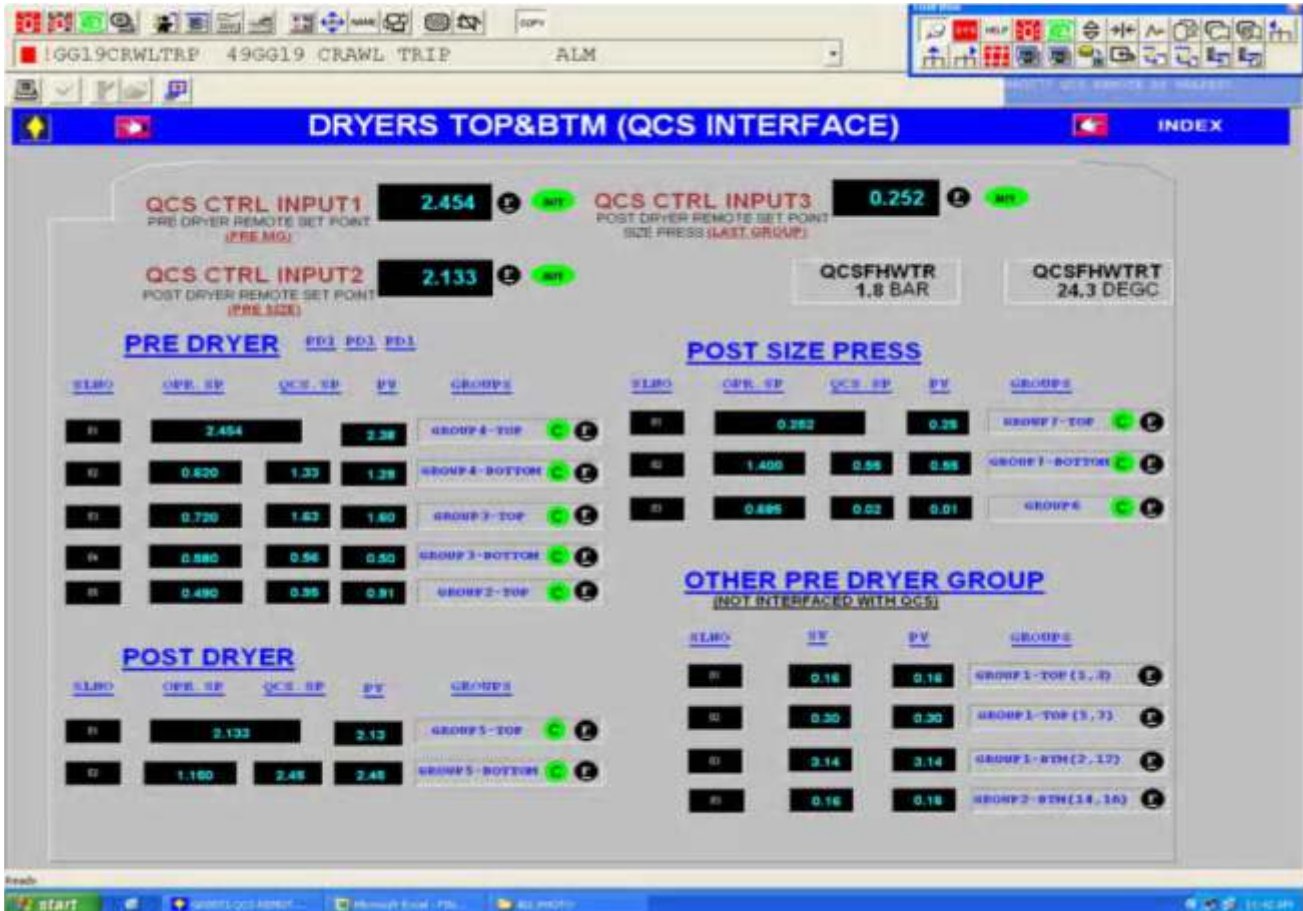
**DRY END AUTOMATION:**

1) In dry end area we developed logics: a) Web break sensor interlock with chopper, broke conveyor speed up, shower on/off, IR system, Rope stretcher etc. b) If stock off then steam and condensate pressure control valve close and take its original set point after stock on, also PV fan and blower stopped and start after stock on. C) Steam

and Condensate has important role in paper board, so in this area we have modified / developed logics and Graphics without effect of final board quality. We have developed one page in DCS for controlling individual group pressure control and this is co-relation with QCS. If we put moisture control loop in auto in QCS then steam pressure control loop came in Cascade and set point

transfer to DCS. In DCS page operator gives set point to individual Top and Bottom group of Pre and Post dryer. The benefits due to dry end automation are :

1. After implementation of the above automation system in dry end, we are maintaining the uniform moisture profile of the Board.
2. Reduction in steam consumption by



0.22 Tn/Tn of Board which is equivalent to Rs 90 lacs per annum.

3. The improved moisture profile of the board leads to better runnability at customers' end and excellent customer feedback.

### 1) Online Roll Bearing Temperature Monitoring System.

This is one of the unique cross functional initiatives for measuring the temperature of the running roll bearing. There are some locations which are difficult to access due to high temperature in running condition of machine. To monitor such locations we have installed the RTD on the roll bearing housing and taken the signal to the group supervisory unit which gives alarm to DCS if the temperature of the bearing rises above the desired level for the appropriate action.

This has resulted in reduction in unplanned stoppage which influenced the reduction in downtime by approx. 1%, and the saving achieved is Rs approx. 98 lacs per annum.

### QCS: QCS System To Improve Quality And Productivity:

Profitable papermaking means continuous production with minimal deviations from quality specifications. While steady-state control performance is essential, the elimination of waste during transitions such as grade changes and break recoveries is where the greatest economic gains can be achieved. As production rates rise, often stretching the design capacity of the paper machine, Quality Control Systems (QCS) allow you to improve production efficiency and quality.

- QCS serves many purposes since it is providing continuous measurement of the product in real-time. Data from the QCS scanning sensors is processed to support the Management and process information reporting system provides a wide range of advanced reports that are available for immediate use to document machine production and paper quality. These reports provide rapid feedback to engineering and operations On-line data Analysis within the Da Vinci system includes color maps, statistical analysis, frequency analysis, and other tools to help monitor and troubleshoot the paper machine. These tools are on-line functions that provide

immediate data to production and engineering.

- Supervisory Control functions receive the data from the scanning measurements and then control the process to optimize these properties of the sheet.
- Performance of MD Controls:
  - 1) Basis Weight Control: Machine direction basis weight control from feedback & feed forward control for each layer.
  - 2) Decoupled Moisture Control: Independent moisture control with compensation for moisture variation due to basis weight variation.
  - 3) Additional Moisture control: Moisture control at pre dryer & post dryer through feed back control.
  - 4) Dryer Shutdown (Auto steam reduction) control: Dryer steam reduction while web break.
  - 5) Dry Stock Flow Control: Compensate for short-term consistency upsets. Feed forward correction to stock valve.
  - 6) Dry Stock Ratio Control: Control individual layer GSM keeping the desired percentage in each layer and getting feed back from the total GSM of the final sheet. Also we can select mode of operation for each layer independently.
  - 7) Co-ordinate speed change: Stock, speed and steam pressure change are time co-ordinate in a feed forward and feedback manner to minimize transient upset. Direct digital control of weight, moisture and head box variable.
  - 8) Co-ordinate grade change: Stock, speed and steam pressure changes are time co-ordinate in a feed forward and feedback manner to minimize transient upset during a pre defined grade change.
    - QCS is the application server, which runs the Performance controls and supports the Precision Platform scanners and Precision Measurement sensors. Together, these provide:
      - Accurate measurements
      - Performance MD, supervisory machine-direction controls
      - Performance CD, supervisory cross-direction controls
      - Process information, Historical trending, Statistical analysis & Printed reports.
      - A d v a n c e d s c a n n i n g

measurements are available to address the following needs

- Basis Weight
- Moisture
- Caliper
- Coat Weight
- Surface Moisture
- Each Precision Platform incorporates a dedicated Precision Measurement Processor (PMP). This high-speed signal processor communicates over a dedicated Precision NET Ethernet network to provide High-speed, high-resolution, on-line measurements
- Built-in scanner and sensor health monitoring
- Continuous sensor accuracy verification fast scanning, at 600 mm / sec (24" / sec), exposes profile changes three to five times faster than conventional slow-scanning systems.

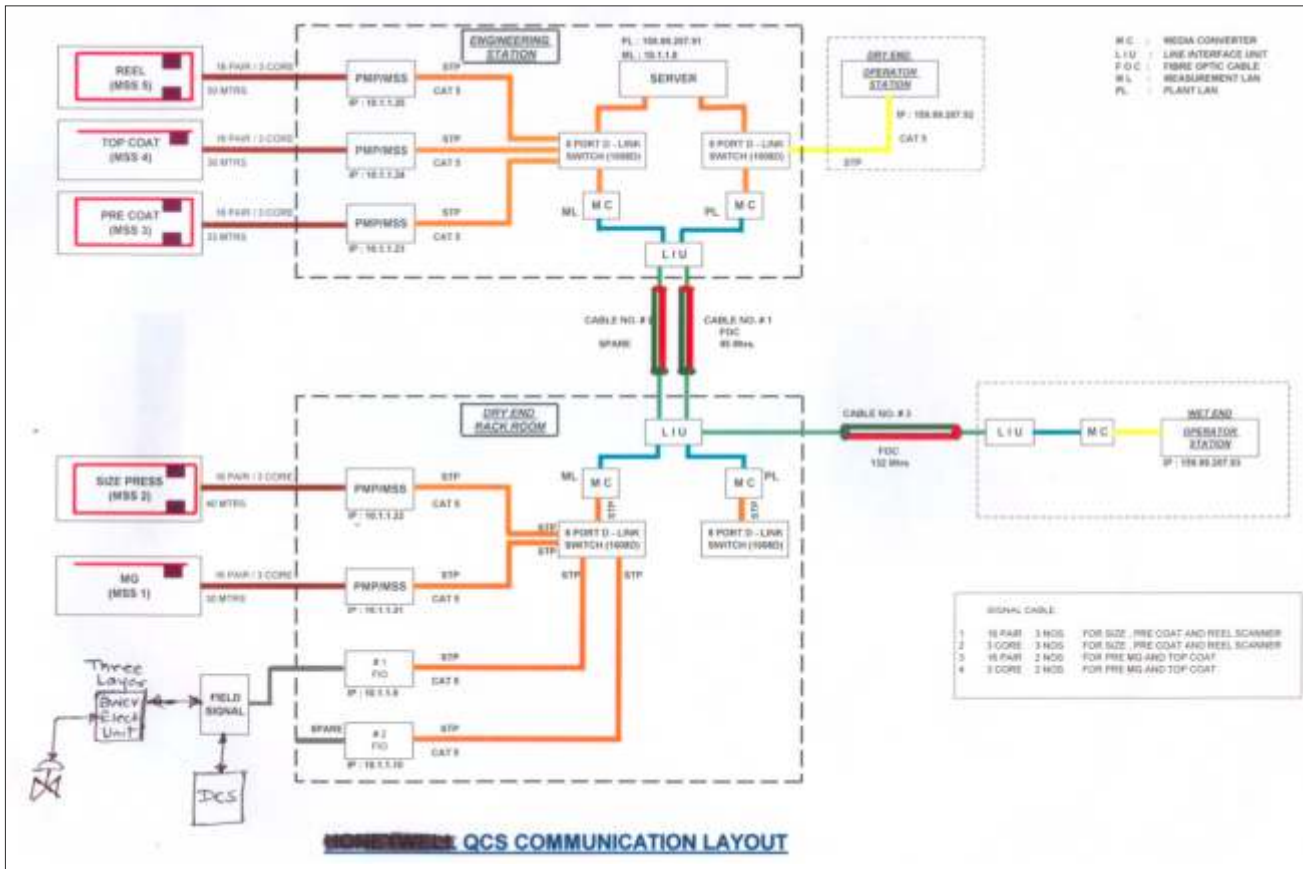
We installed Five nos. of Scanners for Measure and Control of board properties.

- 1) Before MG: Scanner measures and controls Top surface moisture. Due to this we can maintain board quality of Gloss and Smoothness.
- 2) Before Size Press: Scanner measures and controls base board GSM & Moisture. Due to this we can maintain Surface Strength (IGT) property of board by controlling board moisture before sizing.
- 3) Before Pre Coat: Scanner measures and controls Top surface moisture and measure base board.
- 4) Before Top Coat: Scanner measures Top surface moisture and Pre Coat weight.
- 5) Before Reel: Scanner Measures and Controls final GSM & Moisture, also Measures Caliper, Moisture, Total Top Coat weight.

### In house built Barcode based Godown management system.

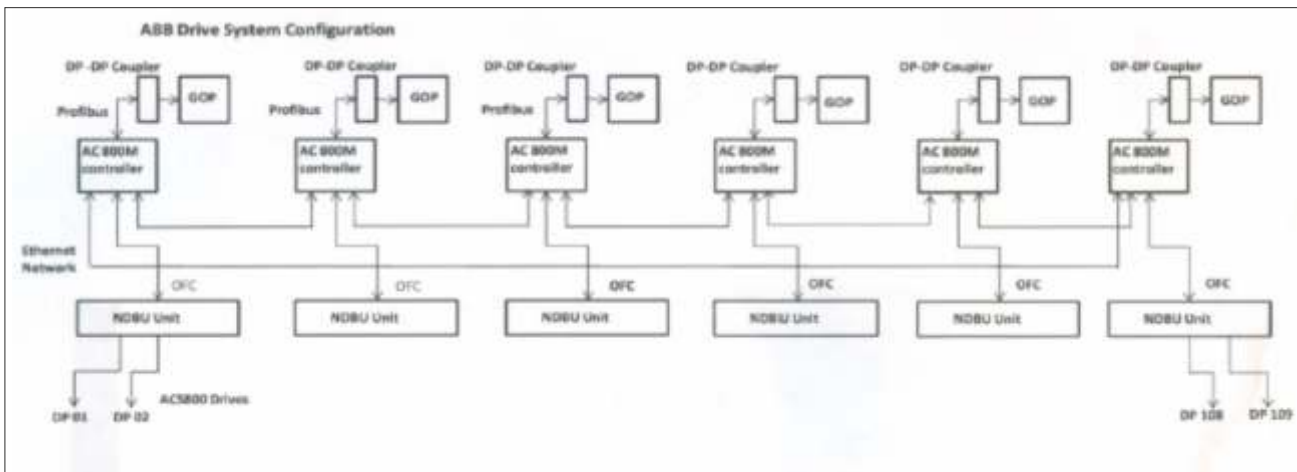
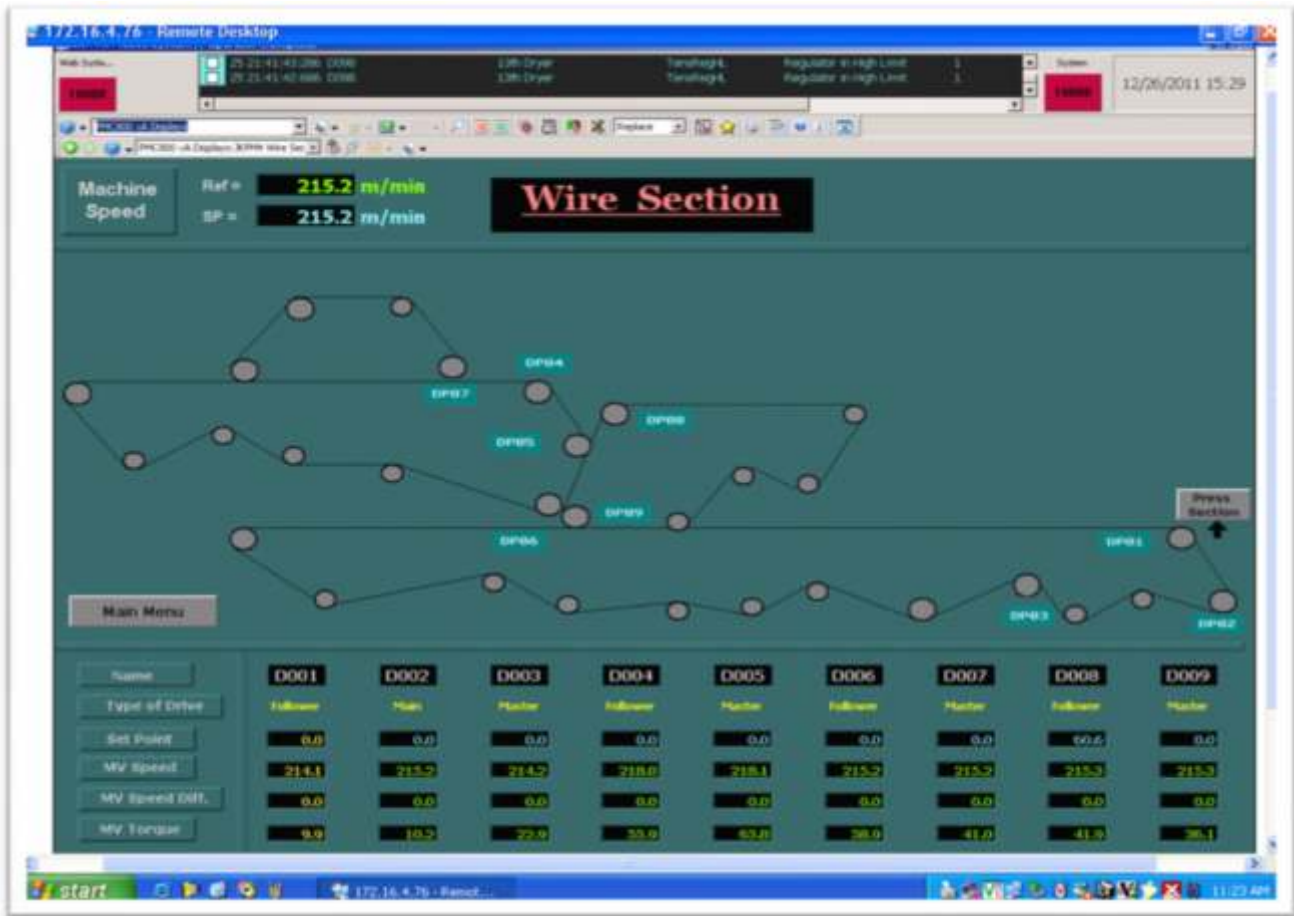
Barcode is generated which contains the information like Manufacturing Advice No, GSM, Quality, weight and Packing Advice number pasted on the reel or bundle. Then the location on which the bundles are to be stored also scanned by the supervisor. Then bar code device provides all data to the computer. Then this data is stored in the form of table in computer. During the





Drive Room





dispatch the reels and bundles can be easily identified and loaded in the lorry or truck. During the loading of the reels and bundles on truck all the reels are scanned again to make packing list. The same bar code system is implemented between Rewinder and Sheeter for tracing and proper stacking of reels.

**Benefits of the system are :**

Fast and Reliable traceability of Reels and bundles, Detailed up to date and Accurate information, Reduced Labour

Costs, Improved Godown Management, Better Decision Making and less time consumed in Planning, Retrieval and Loading of material. It has also resulted in improved customer satisfaction due to on-time and in-full delivery.

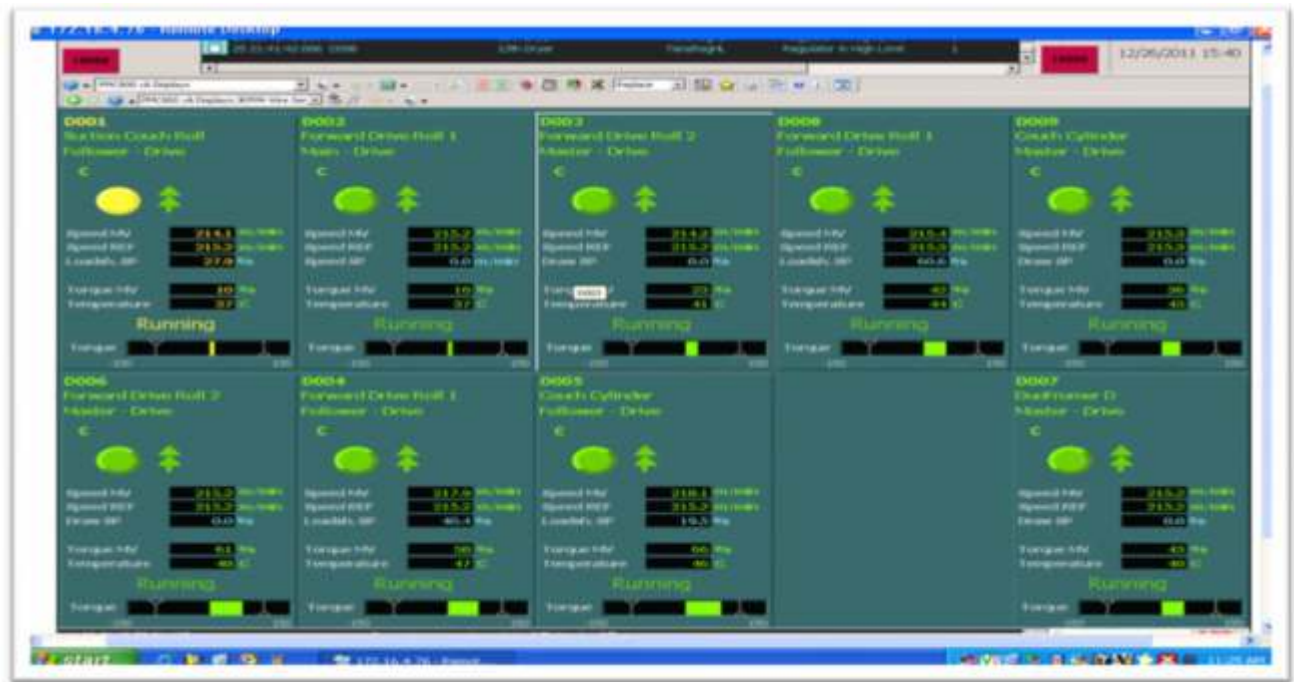
**Customized Auto deckle matching software.**

All the orders by the marketing branches are punched in the ERP. Then this information is entered into the

Software. The software gives the best possible combination for those orders to achieve the maximum deckle, which resulted into 30mm deckle increased in all qualities and GSMs.

**Due to increased deckle utilization, savings of Rs 87 Lacs/Annum was realized while the cost of software is only Rs. 4.7 Lacs.**

**DRIVES SYSTEM FOR BOARD**



**PLANT**

- Drives which are advanced technology drives with add-on flexibility are installed for PM4 board machine.
- Total 118 drives are connected to board m/c area through a network.
- All drives are communicated with DCS through hardwire and profibus to DCS, which are also interlocking

of process interlocks with drives.

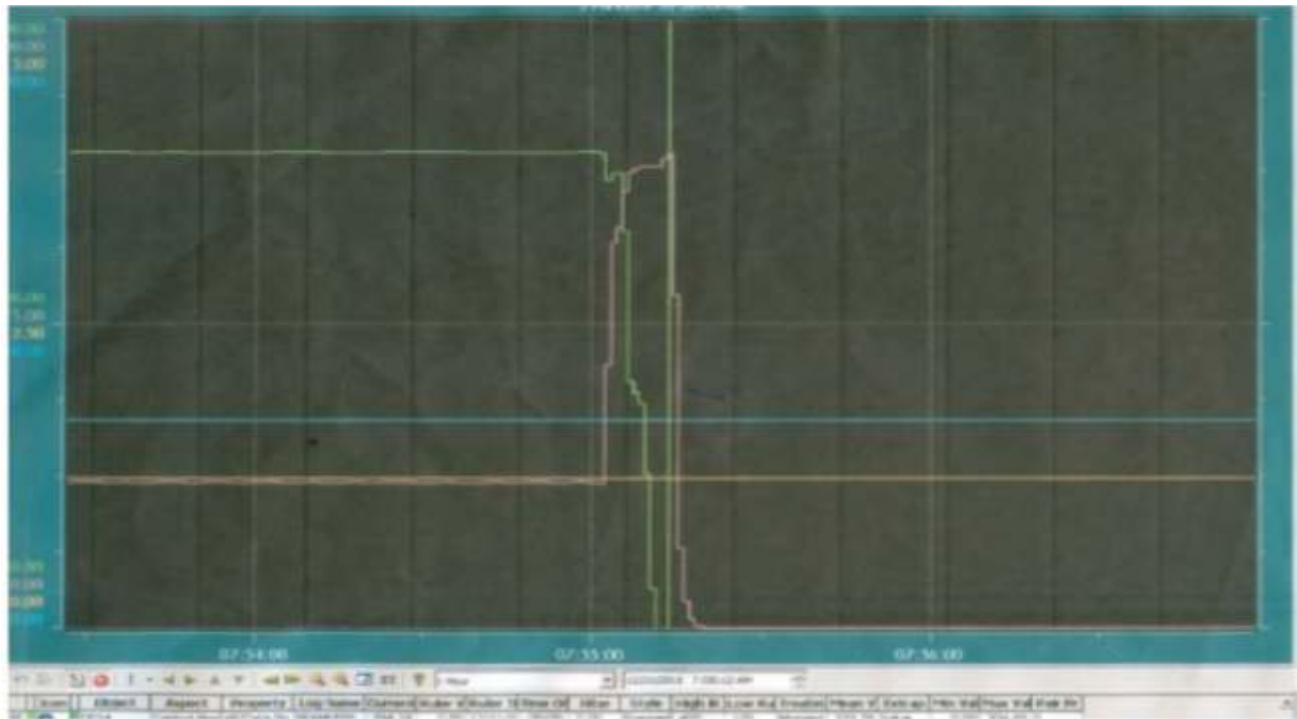
**Wire Section**

- Total no of drives are divided among 6 Nos of controllers of Drives.
- Communication in between 6 no's controller are Ethernet communication & server of supervisory control system is also

communicated through Ethernet communication.

- Process operation are carried out by GOP panel total no of GOP are installed for completed operation of section drives.
- All GOP are communicated to controller through Profibus using DP-DP coupler.
- All GOP has all necessary operation





### Overview of Drives 2

Drive	Speed (m/min) Hz	Drive Load (%)		Torque (%) Hz	Drive	Speed (m/min) Hz	Drive Load (%)		Torque (%) Hz
		SP	Hz				SP	Hz	
0042 80% Drive Drive 1	350.0	33.4	0.0	45	0063 Head Top Cal Top Roll	354.0	0.40	0.00	21
0043 80% Drive Drive 2	351.7	33.5	0.0	25	0064 Head Top Cal Bottom Roll	354.5	37.4	0.0	20
0044 80% Drive Drive 3	350.5	-0.13	0.00	-40	0065 Paper Roll 85-90	351.4	-0.07	0.00	-13
0045 80% Drive Drive 4	352.1	0.16	0.00	25	0066 Rewe Spreader Roll	352.5	-0.21	0.00	60
0046 80% Drive Drive 1	349.1	33.4	0.0	30	0070 Coaster 1 Backing Roll	355.6	0.64	0.00	20
0047 80% Drive Drive 2	349.7	33.5	0.0	30	0071 Paper Roll 71-73	350.0	-1.17	0.00	-13
0048 80% Drive Drive 3	350.5	0.01	0.00	30	0072 Drive 11 Cylinder 61, 62	355.5	0.06	0.00	6
0049 80% Drive Drive 4	350.5	0.11	0.00	30	0073 11 Drive 11 Cylinder 62	356.2	0.17	0.00	23
0050 Paper Roll 50	350.2	0.00	0.00	-10	0075 Paper Roll 75	354.0	-0.11	0.00	19
0052 Fibrous Conveyor 3	0.0	17.50	0.00	0	0076 Rewe Spreader Roll	355.0	0.00	0.00	30
0053 Rewe Press Top Roll	355.3	1.07	0.00	39	0077 Coaster 2	352.3	0.57	0.00	34
0054 Rewe Press Mid Roll	355.1	50.1	0.0	34	0078 Paper Roll 78-79	353.0	-0.40	0.00	33
0055 Rewe Spreader Roll	354.6	-0.30	0.00	33	0080 Tension Roll	353.6	-1.27	0.00	-4
0056 Drive Cylinder 50	354.5	-1.00	0.00	30	0084 Paper Roll 81-83	352.0	-0.50	0.00	53
0056_1 100% Drive Cylinder 50	356.1	0.11	0.00	34					
0057 100% Drive Drive 1	352.1	50.0	0.0	45					
0058 100% Drive Drive 2	353.0	50.3	0.0	40					
0059 100% Drive Drive 3	353.3	-0.40	0.00	45					
0060 100% Drive Drive 4	353.5	0.10	0.00	45					
0061 Paper Roll 61	358.4	0.18	0.00	-13					
0062 Rewe Spreader Roll	356.3	0.00	0.00	-16					
0071 Fibrous Conveyor 4	0.0	30.20	0.00	0					

Tension Control			
SP	Hz	Hz	(kN)
0073	730.0	703.0	-13.9
0074	630.0	596.0	-11.3
0085	680.0	662.5	-1.3
0090	650.0	640.1	-0.5
0103	900.0	882.2	-0.0

**TENSION AREA**

**Graphical Operating Panel**

**Wire Section Face Plate**

- In each group drives are configured as master & slave, approximately 4

- no of drives in each group.
- Drives have inbuilt protection like earth fault, over current, over temperature, DC under voltage & so many.

- Master slave configurations are done by using optical fiber cable in between drives to another channel

**Drive Parameter Backup**

- Drives windows are also connected all running parameter & trend can be seen on drive window OS.
- In our supervisory control system we can monitor each parameter of each drives.
- In our system 5 Nos tension controllers are installed to maintain web tension. Required tension can be set through GOP which can be controlled by adding reference signal to sequential drives through controller.

**Conclusion.**

Adoption of advanced automation

system has helped us achieve considerable savings as concluded below. Furthermore, this automation system has integrated with the upgradation of 9 Nos of new ACS800 Multi Drives, 5 Nos Single Drives for Vacuum Tail Threading System, DC Bus Integration, Integration of the DC bus of the new Drives with the existing system, Software Integration of the new control system with the existing system and new DCS system after replacement of Old Pope Reel with modern Master Reel. The production capacity of Packaging Board has been increased from 60000 TPA to 84000 TPA.

**References**

1. Innovative ideas brainstormed by Inhouse Cost Compression Cross-functional Task Force.
2. Based on the automation system incorporated through different vendors.

**Acknowledgement**

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**List Of Saving Due To Advanced Automation System In Packaging Board Plant**

S.N	Theme	Calculation	Savings (in lac/Annum)
1	<b>Fiber Treatment Plant</b> During discharge sequence of street B & C pulper, approx 5 kg of pulp getting splash. To save that we modify the sequence: "Dilution water gets open at the end of sequence, due to this splashing reduce.	Saving: Avg. total No. of Batches = 50, Pulp fiber saved = 50X5=250 kg/day, 250X330 = 82.5 MT/Annum, =82.5X2700=	<b>22.27</b>
2	<b>Reduce High Density Pulper total batch preparation time:</b> To reduce HD pulper total batch preparation time (from 30min to 24 min) for power reduction and pulper capacity enhancement by 1. Modifying pulper and Poire logic and 2. Reduction of slashing time by 3 min Pulper Motor KW = 360, Running load = 24 Amp., Empty load = 12 Amp., Calculation on no load in one batch = (7.732x6600x12x0.8)/1000=110 KWH. No of Batches = 60/day. Reduce time 06 min per batch = 360 mins = 06 Hrs/day. Take 50% pulper stoppage time = 180 mins = 3.00 Hrs/day	Power save = 3x110 = 330 kwh /day = 330x27x12 = 106920	<b>3.15</b>
3	<b>Dry End</b> Proper removal of condensate from system To get proper drainage, we started to control the vacuum level. Earlier, we used to run in a constant high level of vacuum, which invites steam more than required to condenser. By controlling vacuum in proper level, we are able to remove the condensate from the initial dryers having very low pressure (some times under vacuum) without getting excess amount of steam to condenser. We developed logic in DCS i.e. select lowest pressure value from group 1 to 8 then minus its differential pressure process value from its group pressure. This loop work in cascade mode and control bleed valve.		
4	Removal of non condensable gases in air: if condenser is overloaded (more steam entry or less steam entry), some steam is removed by vacuum pump, and its sealing water temperature rises. We are monitoring the same and in case of such incident, we reduce the vacuum level through bleeding. We installed temperature transmitter in vacuum pump drain line and one control valve in parallel of manual valve in suction line. This practically helps condenser to work efficiently and produce maximum return condensate to boiler. The health of vacuum pump is also taken care of through this action.		

5	<p><b>Indication of Condensate loss detail :</b>  If ratio set point of bottom group is not given proper by operator then our condensate will be more or problem in control the differential pressure. So troubleshoot this problem easily we have provided one page in main condensate page that shows condenser loss index high alarm.  Operators are requested to make sure that the "Condenser Loss Index" (A1) to keep zero by adjusting the steam set points. This helped a lot to reduce condenser loss through incorrect setting of steam pressure across the groups.</p>		
	<p><b>Total of S. N(3 + 4 + 5) Steam saving = 0.22 Ton/Ton of Board</b></p>	Total saving by above schemes (Equivalent) = Rs. 90 Lacs.	<b>90</b>
6	<p><b>Online Roll Bearing Temperature Monitoring System.</b>  This is one of the unique cross functional initiatives for measuring the temperature of the running roll bearing. There are some locations which are difficult to access due to high temperature in running condition of machine. To monitor such locations we have installed the RTD on the roll bearing housing and taken the signal to the group supervisory unit which gives alarm to DCS if the temperature of the bearing rises above the desired level for the appropriate action.</p>	This has resulted in reduction in unplanned stoppage which influenced the reduction in downtime by approx. 1%	98
7	<p><b>Saving due to Installation of Vacuum Trail Threading reduces the Board reeling time</b></p>		<b>93</b>
8	<p>Power saving in hood and ventilation system we have developed logic in DCS: If stock off in wire then after 20 min all hood &amp; ventilation system fans will be stop in sequence. After stock on wire all will start in sequence.</p>	12 No of motors. Saving:499 KW for 12 motors = 499x.95 = Rs. 1472 per Hr. Provided timer for measure motor stop time.	0.83
9	<p><b>Customized Auto deckle matching software:</b>  All the orders by the marketing branches are punched in the ERP. Then this information is entered into the Software. The software gives the best possible combination for those orders to achieve the maximum deckle which resulted into 30mm deckle increased in all qualities and GSMs.</p>	Due to increased deckle utilization saving of Rs. 87 Lacs/Annum was realized while the cost of software is only Rs. 4.7 Lacs.	87
	<b>TOTAL SAVING</b>		<b>394.25</b>