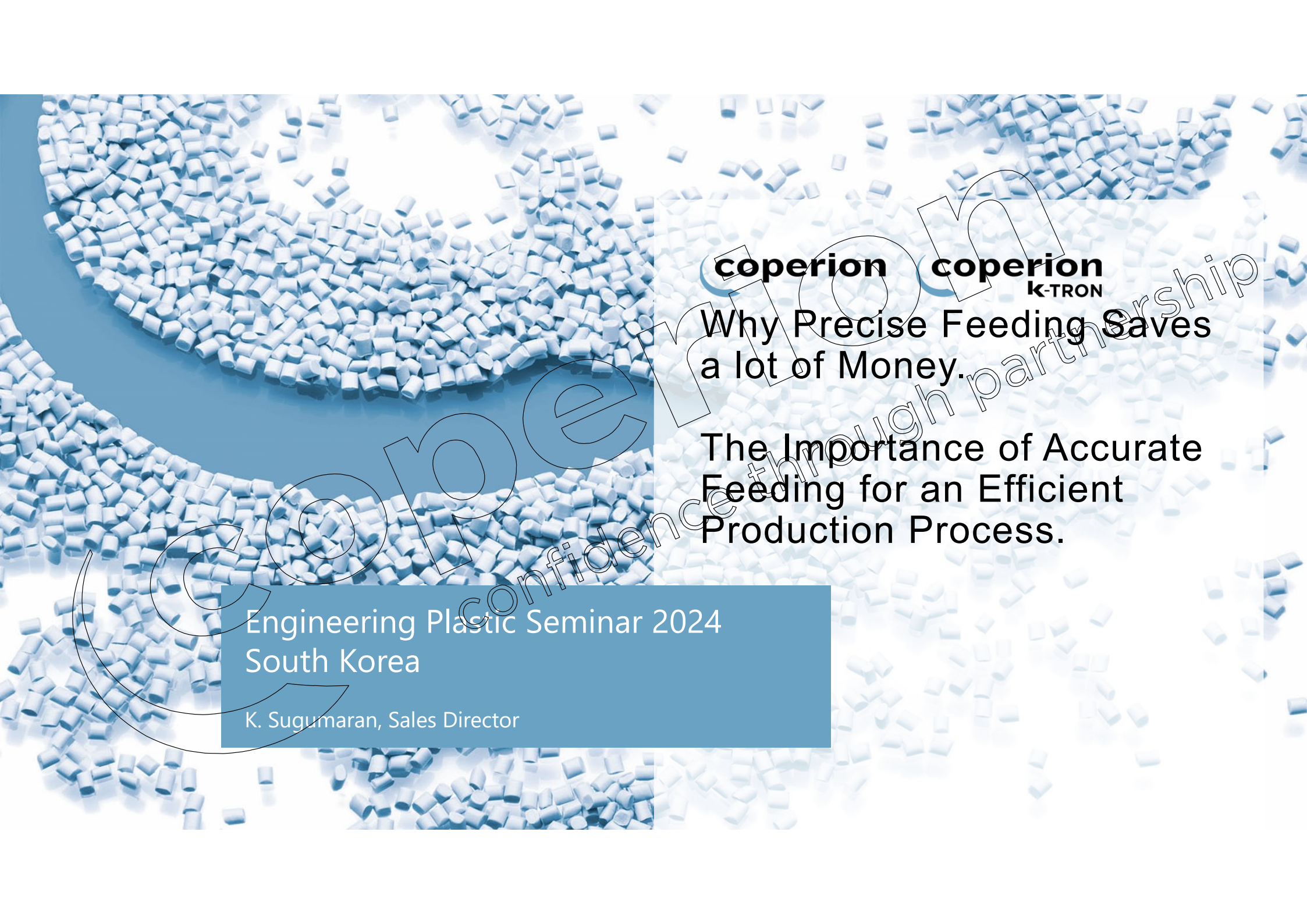




coperion **coperion**
K-TRON

Why Precise Feeding Saves
a lot of Money.

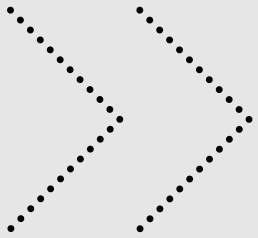
The Importance of Accurate
Feeding for an Efficient
Production Process.

Engineering Plastic Seminar 2024
South Korea

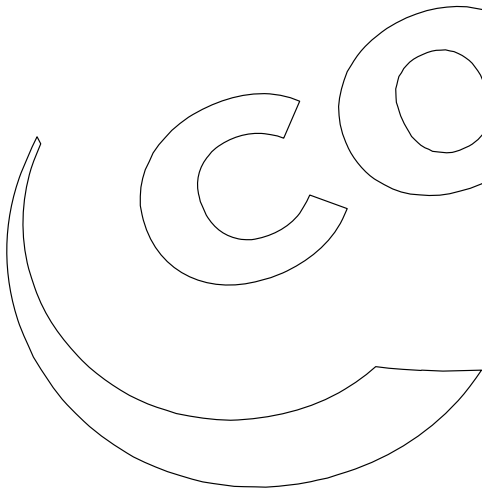
K. Sugumaran, Sales Director

CONTENT

- 1 Typical Feeder Arrangement
- 2 Recipe Management
- 3 The Technology
- 4 Feeder Variety Showcase
- 5 Smart Controllers
- 6 Refill Systems
- 7 Takeaway



Typical Feeder Arrangement



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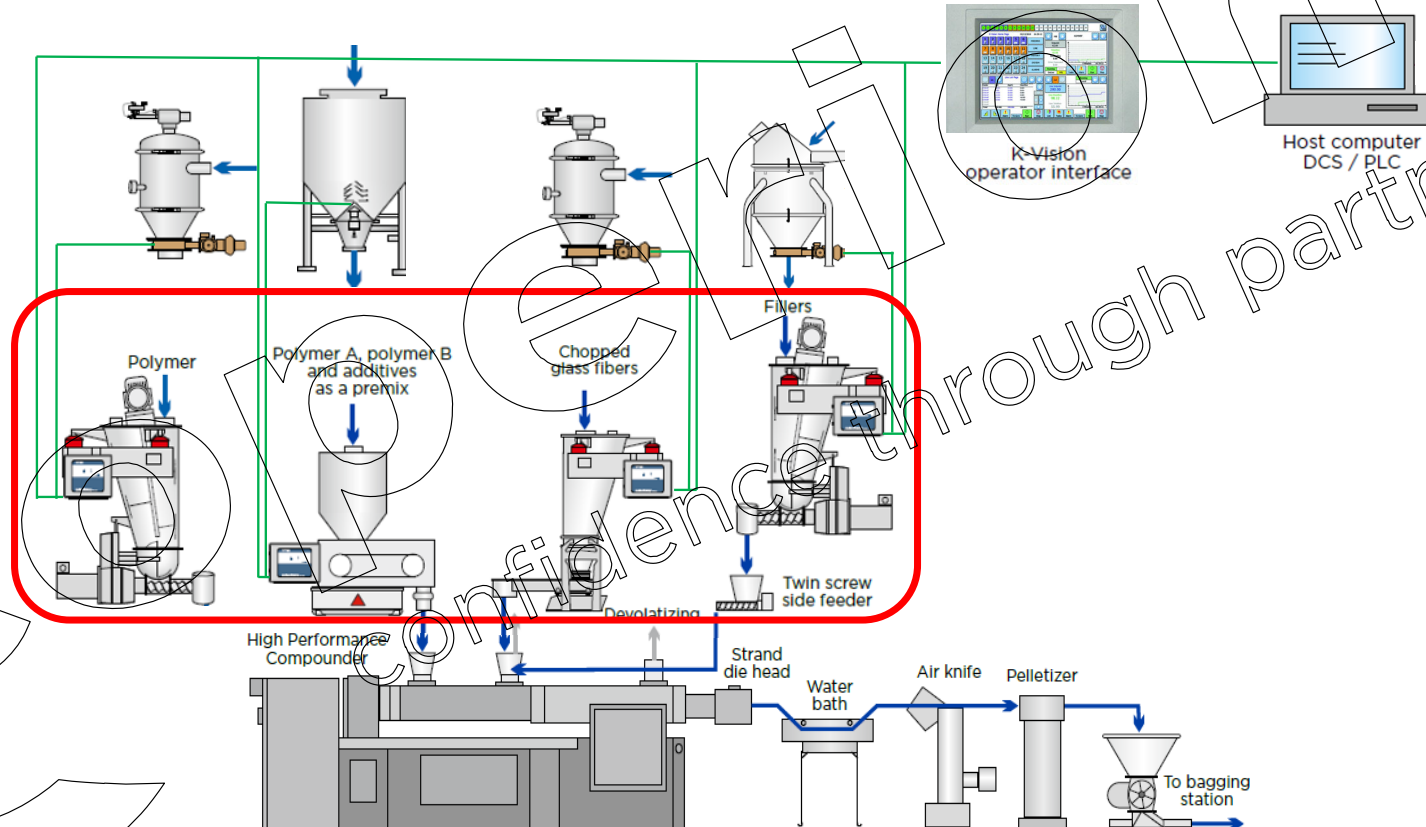
coperion coperion
K-TRON

confidence through partnership

Typical Feeder Arrangement

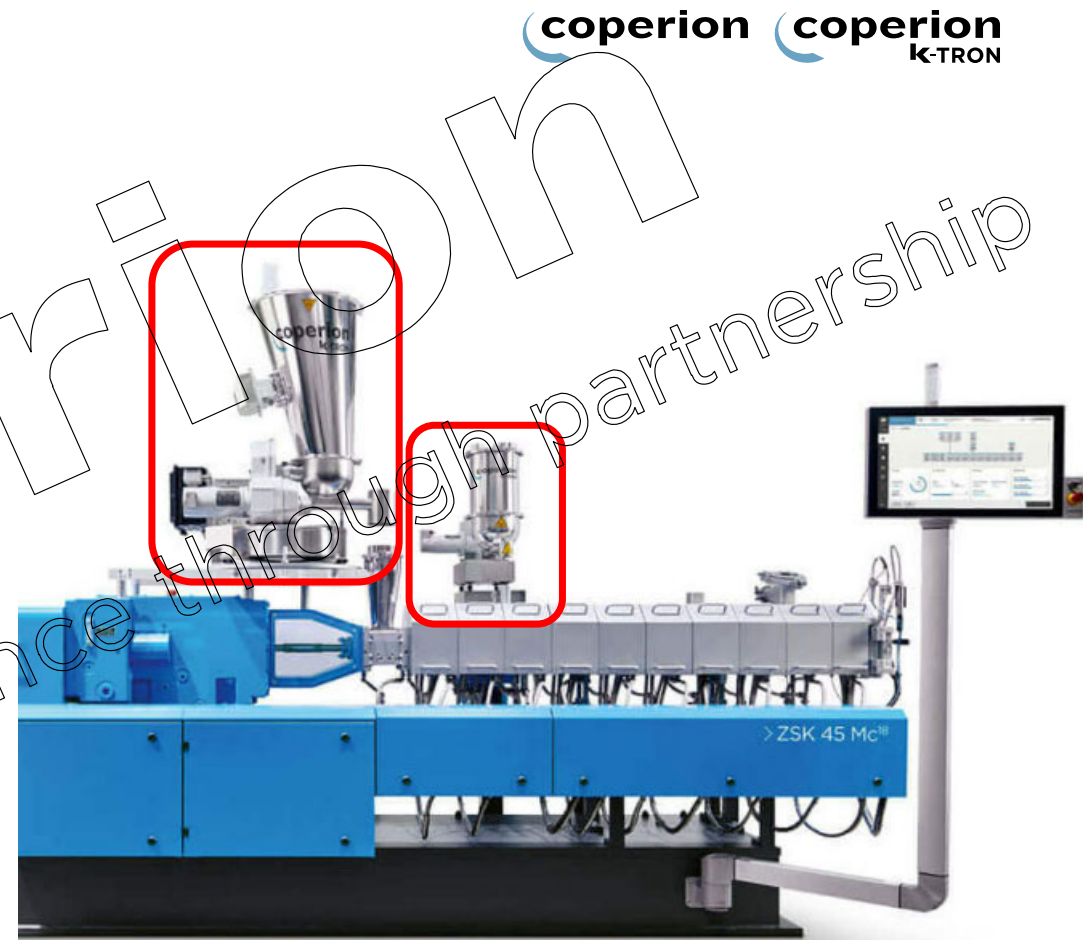
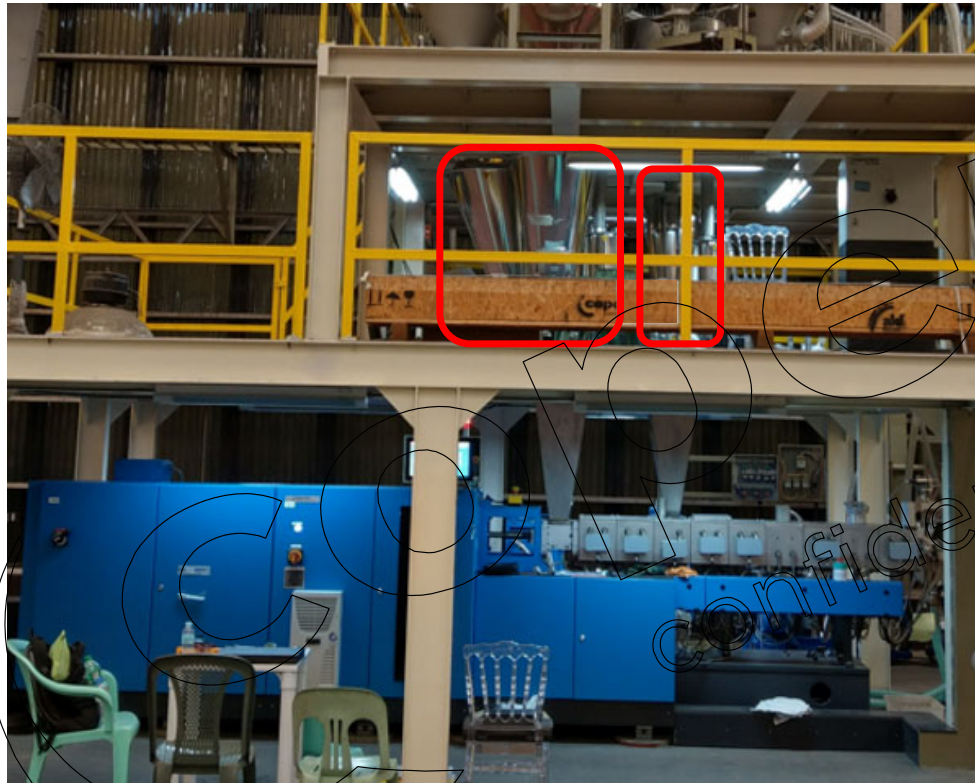
Sample Flow Diagram

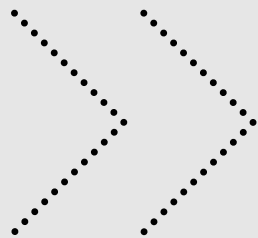
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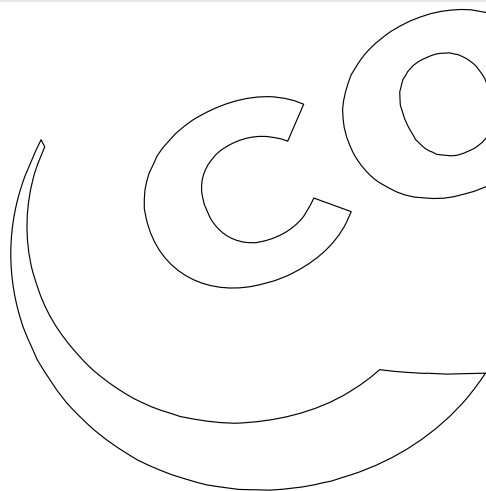
Typical Feeder Arrangement

Sample Site Photos





Recipe Management



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2

confidence through partnership

Recipe Management

Sample Recipe On Compounding

Fdr #	Material	Type	Min %	Max %	Min BD l/kg	Max BD l/Kg	Min Rate kg/ hr	Max Rate kg/ hr	Min Rate l/ hr	Max Rate l/ hr	Feeder Model	Hopper Size	Refill Per Hour
1	Plastic Resin	pellet	15	80	0.4	1	75	400	75	1000	K2-ML-D5-S60	110	8
2	Glass Fiber	fiber	10	50	0.27	0.35	50	250	142.9	925.93	K3-ML-D5-V200	110	8
3	Flame retardant	powder	10	50	0.6	1.6	50	250	31.25	416.67	K2-ML-D5-T35	110	4
4	Filler (CaCo3, BaSo4, talc, silica, mica)	Powder/ flakes	10	50	0.16	1	50	250	50	1562.5	K2-ML-T60	160	9
5	Processing additive mix (AO, dispersant) + pigment	powder	0.5	15	0.4	2.1	2.5	75	1.19	187.5	K2-ML-D5-T35	50	4
6	Modifying additive mix (UV powder, slip powder, PPA powder, coupling agent pellets)	Powder+ pellet	0.5	30	0.3	1	2.5	150	2.5	500	K2-ML-D5-S60	110	4
7	Recyled plastic	flake/ pellet	5	80	0.3	1.2	25	400	20.83	1333.3	K2-ML-S60	180	7
8	Liquid	liquid	1	3	1	1	2.5	250	2.5	250	LLW	60	4

Recipe Management (Hourly Cost Elements)

A) Hourly Material Cost (Extrusion Rate x Unit Material Cost x Uptime)	2,550	\$/ h
Extrusion Rate	1,000	kg/ h
Unit Material Cost	3	\$/ kg
On-Line Production Time (Uptime)	85	%
B) Hourly Waste or Reject Cost { (A) x 1% }	25.50	\$/ h
Reject or Waste Rate	1	%
C) Hourly Production Loss by Changeover (Extrusion Rate x Recipe Changeover downtime x (Material Selling Price - Material Cost))	300	\$/ h
Recipe Changeover Downtime (ignore Labour)	15	%
Unit Material Selling Price	5	\$/ kg
D) Hourly Equipment Burden { Equipment Acquisition Cost / (Life Expectancy Year x Operating hours) }	1.25	\$/ h
Equipment Acquisition Cost	100,000	\$
Equipment Life Expectancy	10	Year
Operating Hours/ Year	8,000	Hrs / year

Recipe Management

Hourly Cost Elements Summary

1

A) Hourly Material
Cost = \$2,550/ h
89%

Priority:

1) Saving Materials to the core with high performance feeders that can improve both momentary and long-term accuracy

3

B) Hourly Waste or Reject Cost =
\$25.5/ h
1%

3) Cutting Reject Rate with consistent and controllable feeding

2

C) Hourly Production Loss by Changeover =
\$300/ h
10%

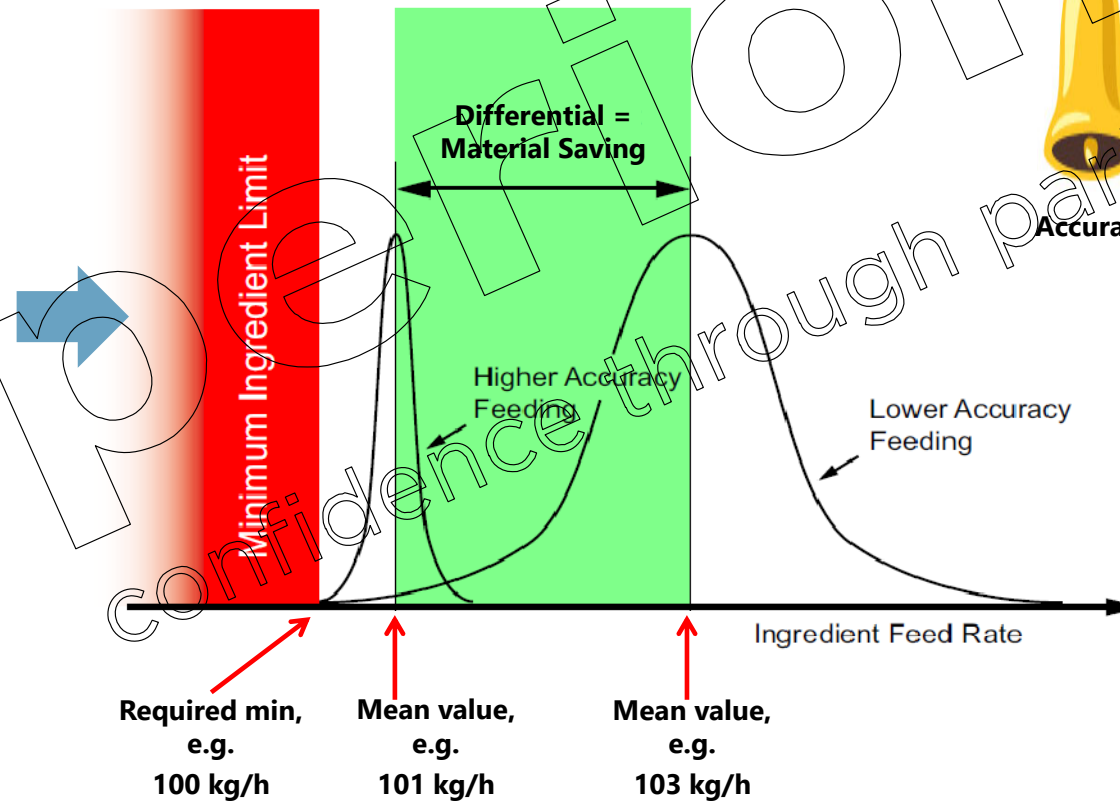
D) Hourly Equipment Burden =
\$1.25/ h
0.04%

2) Reducing Changeover Production Loss with flexible, cleanable, reliable feeding equipment

Recipe Management

Minimizing **EXPENSIVE** Or Critical Materials

Set operating rate
closer to allowable
minimum.



Accurate

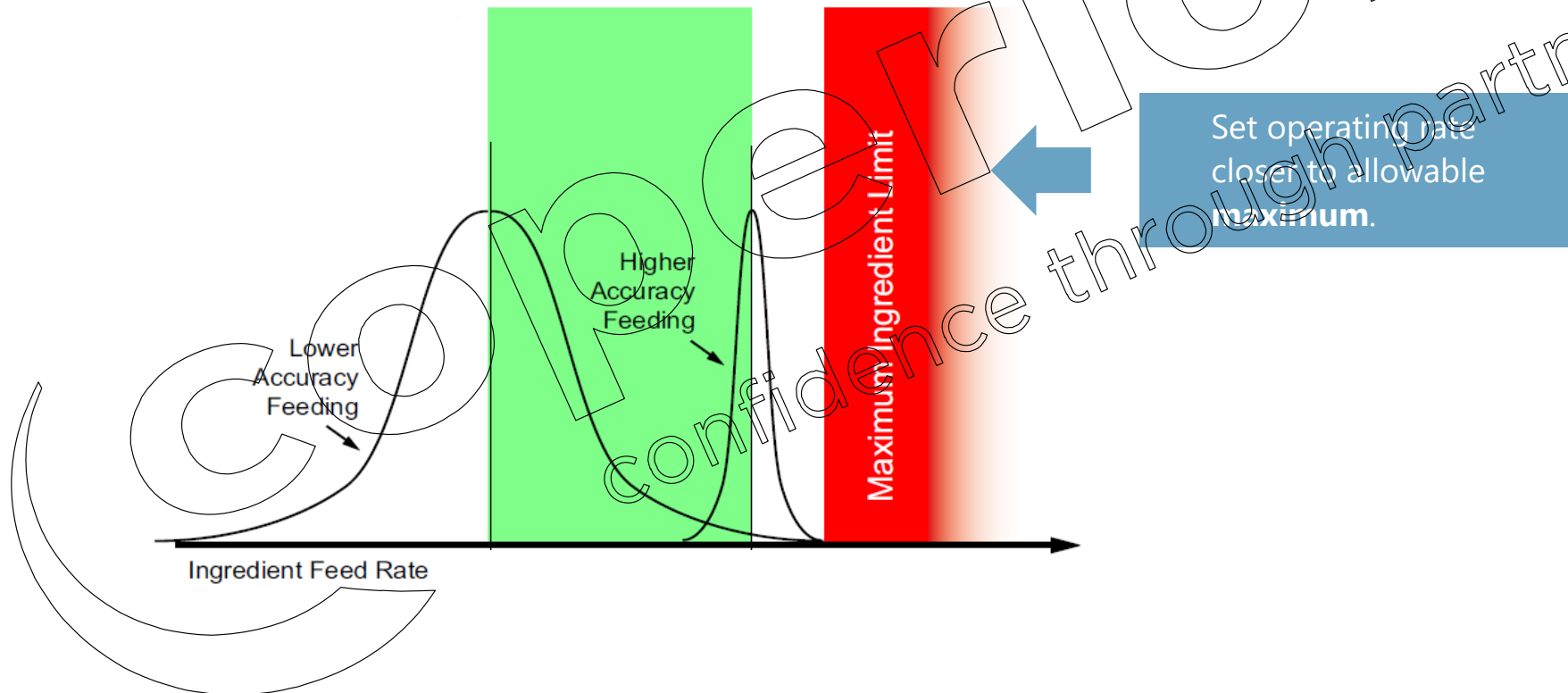
Vs



Less Accurate

Recipe Management

Maximizing **INEXPENSIVE** Or Non-critical Materials



Recipe Management

Recipe Optimization Program As A Whole

Original Recipe Data Entry

No	Ingredient Name	Cost Rank	Ingredient Unit Cost (\$/kg)	Recipe Prop (%)	Rate (kg/hr)	Cost (\$/hr)	Allowable Proportions (%)		Fdr Accuracy +/- % Ing Rate
							Minimum (%)	Maximum (%)	
1	Resin	6	0.2200	45.00	450.00	99.00	41.00	48.00	1.00
2	Filler A	4	0.5000	30.00	300.00	150.00	27.00	33.00	1.00
3	C. Agent	5	0.3400	10.00	100.00	34.00	9.00	11.00	1.00
4	AO powder	2	1.2000	8.00	80.00	96.00	7.20	8.80	1.00
5	MB	3	0.6000	3.00	30.00	18.00	2.70	3.30	1.00
6	Pigment	1	3.5500	4.00	40.00	142.00	3.60	4.40	1.00
Total				100.00	1,000.00	539.00			



Less Accurate

CASE A = Cost-Minimized Recipe at Current Feeder Performance

No	Ingredient Name	Cost Rank	Ingredient Status	Recipe Prop (%)	Rate (kg/hr)	Cost (\$/hr)	Recipe Prop (%)	Rate (kg/hr)	Cost (\$/hr)
1	Resin	6	Maximized	47.50	475.00	104.50	2.50	25.00	5.50
2	Filler A	4	In Range	27.95	279.50	139.75	-2.05	-20.50	-10.25
3	C. Agent	5	Maximized	10.80	108.00	36.72	0.80	8.00	2.72
4	AO powder	2	Minimized	7.33	73.30	87.96	-0.67	-6.70	-8.04
5	MB	3	Minimized	2.75	27.50	16.50	-0.25	-2.50	-1.50
6	Pigment	1	Minimized	3.67	36.70	130.29	-0.33	-3.30	-11.71
Total				100.00	1,000.00	515.72	0.00	0.00	-23.28

Saving

$$515.72 - 539.00 = -\$23.28/h$$

Saving of **-\$186,240** per Year

(By Recipe Optimization Program)

Recipe Management

With Better Accuracy Feeders

Original Recipe Data Entry

No	Ingredient Name	Cost Rank	Ingredient Unit Cost (\$/kg)	Recipe Prop (%)	Rate (kg/hr)	Cost (\$/hr)	Allowable Proportions (%)		Fdr Accuracy +/- % Ing Rate
							Minimum (%)	Maximum (%)	
1	Resin	6	0.2200	45.00	450.00	99.00	41.00	48.00	0.50
2	Filler A	4	0.5000	30.00	300.00	150.00	27.00	33.00	0.50
3	C. Agent	5	0.3400	10.00	100.00	34.00	9.00	11.00	0.50
4	AO powder	2	1.2000	8.00	80.00	96.00	7.20	8.80	0.50
5	MB	3	0.6000	3.00	30.00	18.00	2.70	3.30	0.50
6	Pigment	1	3.5500	4.00	40.00	142.00	3.60	4.40	0.50
Total				100.00	1,000.00	539.00			

CASE A = Cost-Minimized Recipe at Current Feeder Performance

No	Ingredient Name	Cost Rank	Ingredient Status	Recipe Prop (%)	Rate (kg/hr)	Cost (\$/hr)
1	Resin	6	Maximized	47.75	477.50	105.05
2	Filler A	4	In Range	27.72	277.20	138.60
3	C. Agent	5	Maximized	10.90	109.00	37.06
4	AO powder	2	Minimized	7.27	72.70	87.24
5	MB	3	Minimized	2.73	27.30	16.38
6	Pigment	1	Minimized	3.63	36.30	128.87
Total				100.00	1,000.00	513.20

Case A vs Original Recipe Differences

Recipe Prop (%)	Rate (kg/hr)	Cost (\$/hr)
2.75	27.50	6.05
-2.28	-22.80	-11.40
0.90	9.00	3.06
-0.73	-7.30	-8.76
-0.27	-2.70	-1.62
-0.37	-3.70	-13.13
0.00	0.00	-25.80

Accurate

Saving

$513.20 - 539.00 = -\$25.80/h$

Saving of **-\$206,400** per Year

(Further using better accuracy feeder, +/- 0.5% versus +/- 1% feeder)

Recipe Management

Feedsmart Recipe Optimizer sheet



>> Feedsmart Recipe Optimizer sheet is downloadable at the following link

<https://www.coperion.com/en/know-how/technology/feeding-technology/feedsmart/>

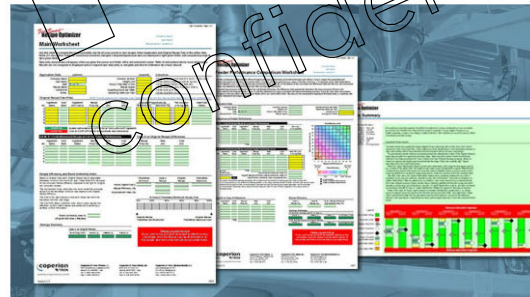


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TECHNOLOGY / FEEDING TECHNOLOGY / FEEDSMART RECIPE OPTIMIZER

FeedSmart Recipe Optimizer

Capture savings hidden in your process recipes

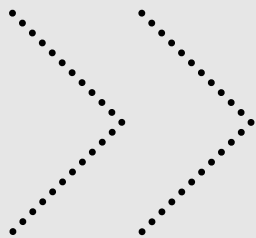


The FeedSmart Recipe Optimizer is based on an easy-to-use Microsoft® Excel® Workbook

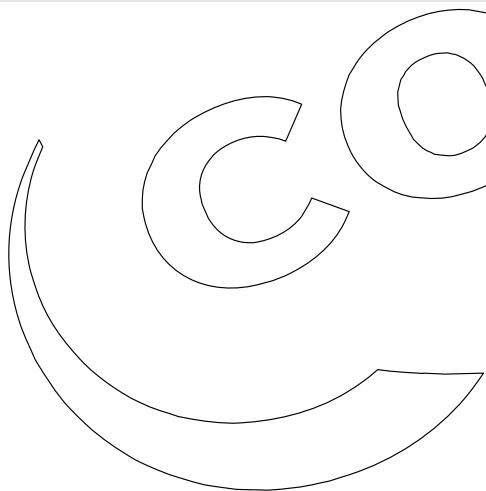
THE TOTAL SAVINGS SOLUTION

The **FeedSmart™ Recipe Optimizer** is a powerful tool developed by Coperion K-Tron that adds a new level of functionality for processors wishing to minimize ingredient costs and evaluate options.

It is complemented by the **TruCost™ Savings Comparator**, a tool to support you in making the best possible decision when it comes time to purchase a new feeding system. These two essential tools are combined in an easy-to-use Microsoft® Excel® Workbook which Coperion K-Tron is offering free of charge as a download from this website.



The Technology



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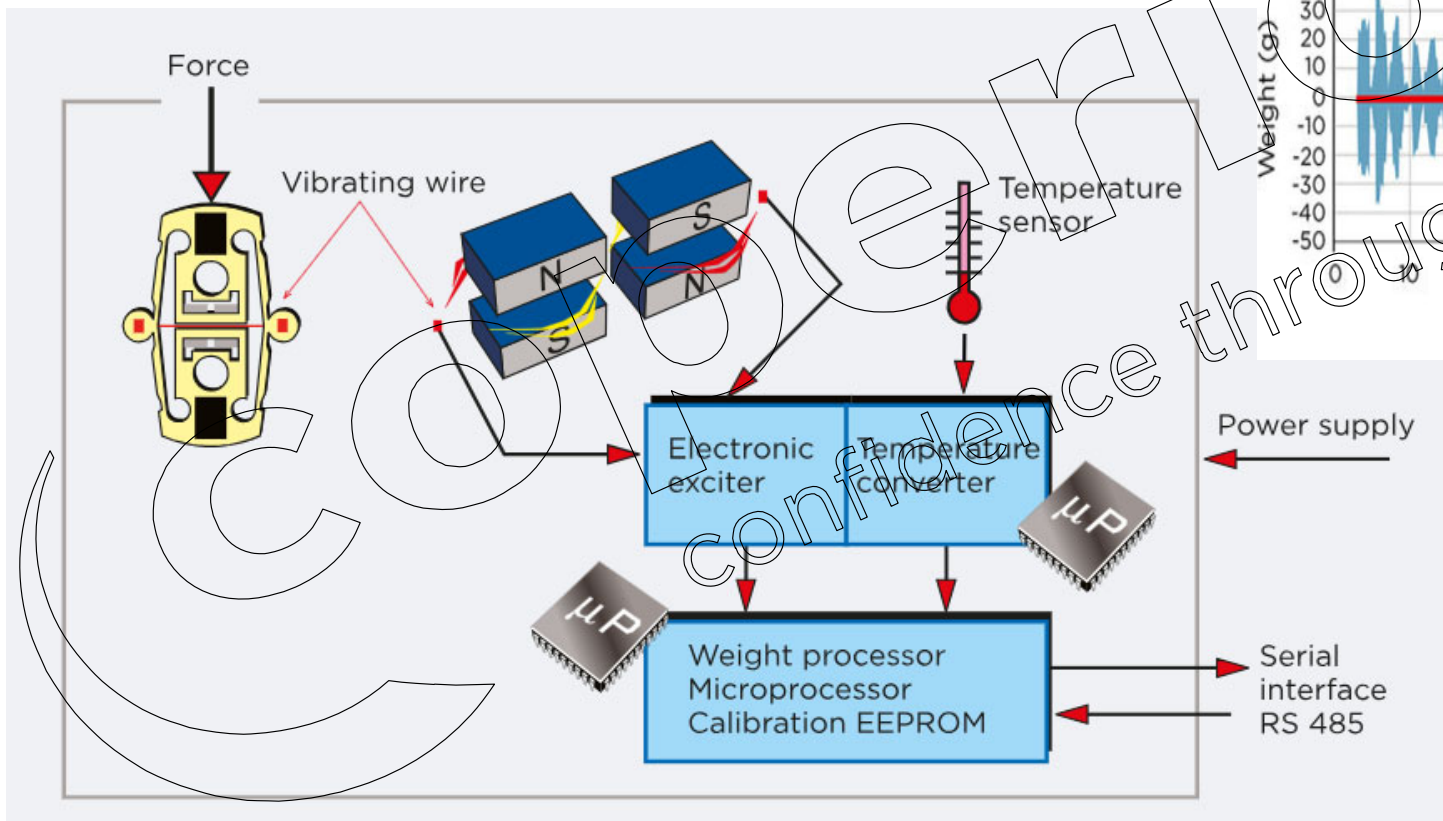
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3

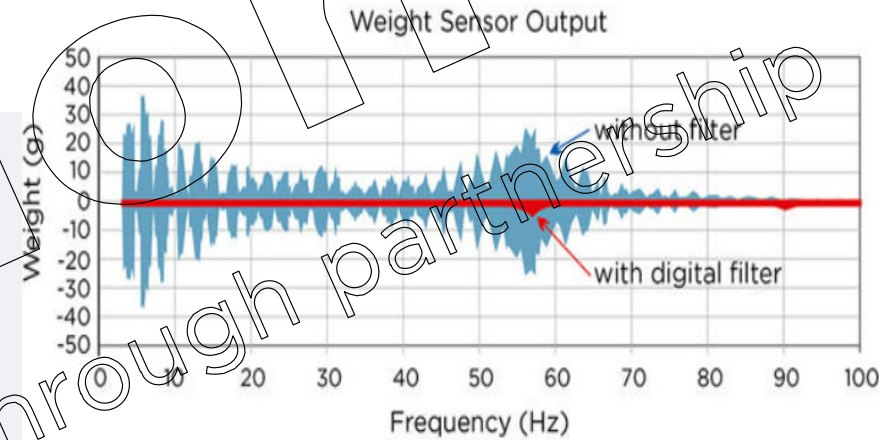
confidence through partnership

Technology

(1) Saving Material - Digital Load Cell With Digital Filter

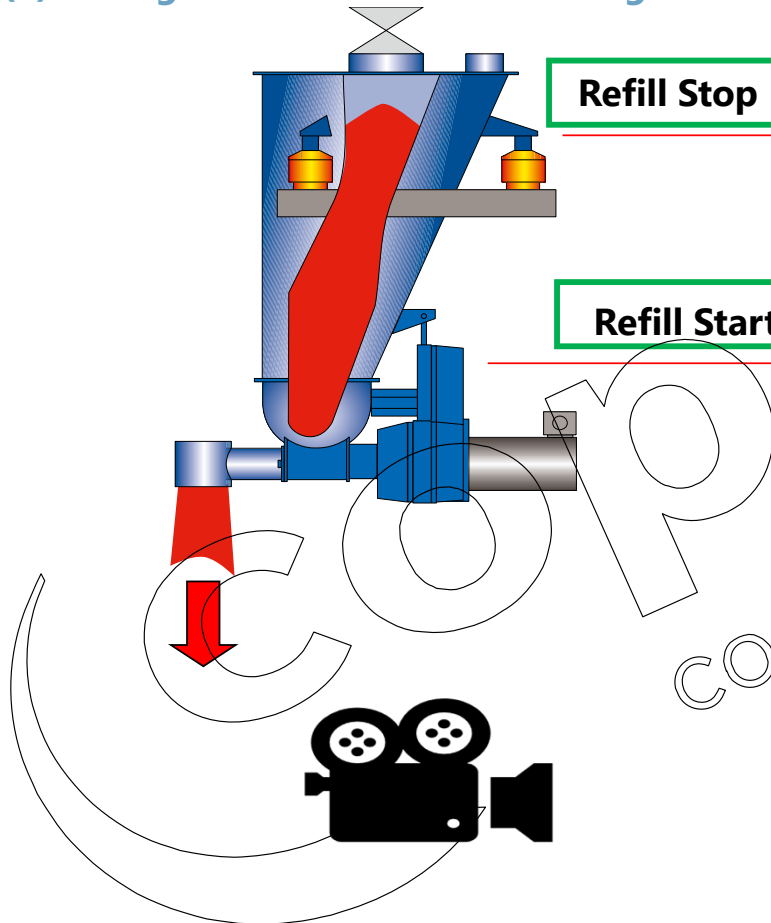


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Technology

(1) Saving Material - Smart Refill Algorithm



Refill Stop

Hopper Weight

Refill Start

Weight change on feeder

Weight on LWF

max.

Hopper contents

min.

min
(Screws)

Motor Speed

no ramp-up

Time t (min.)

Start of change in volume

Refill: time scale expanded

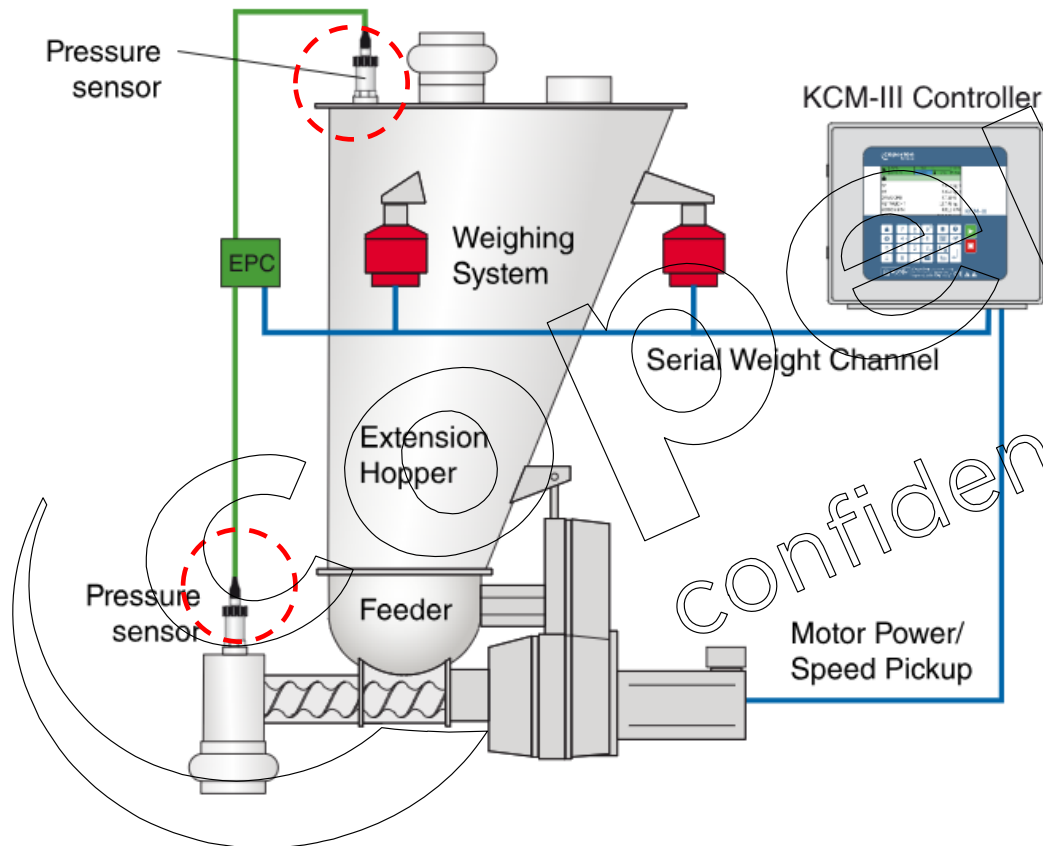
Control
Mode

Gravimetric mode

Volumetric mode

Technology

(1) Saving Material - Electronic Pressure Compensation (EPC)



Technology

(2) Reducing Changeover - The Package Of Versatility

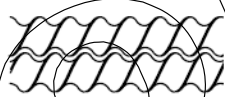
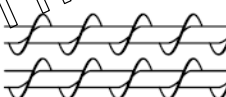
Unprecedentedly High Turndown Ratio

Example:

$$2267/5.2 = 436!$$

(Maximum is 436 times of minimum)

The possibility of **using the same feeder** to feed different material when Line recipe changed

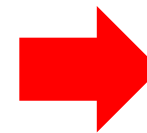
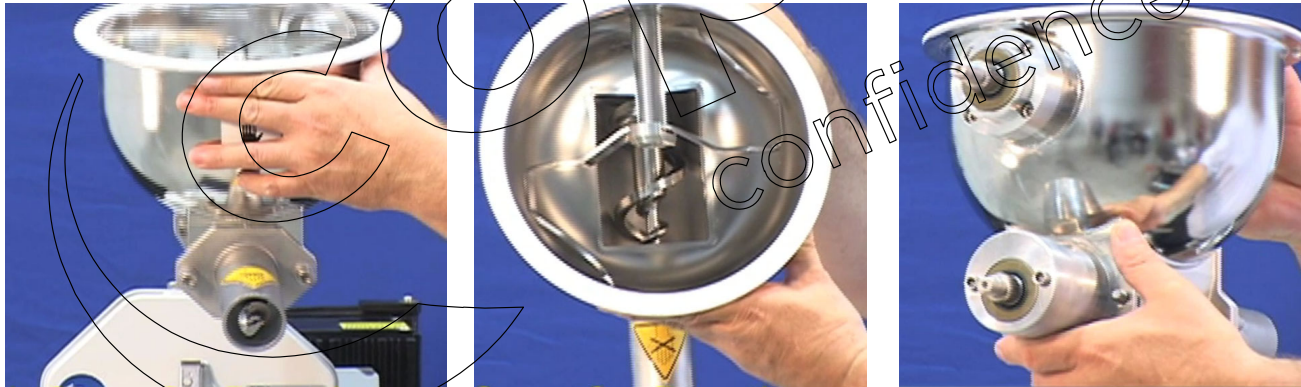
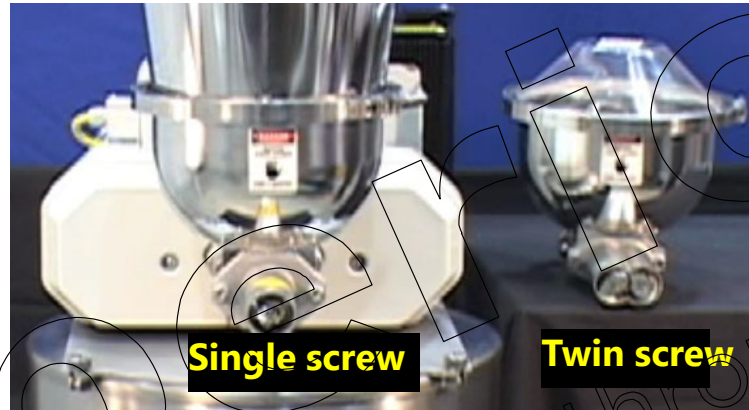
Pitch		 Twin concave screws	 Twin auger screws	 Twin spiral screws	 Double auger screws
coarse pitch	dm ³ /h	2.9 - 1417	5.2 - 2267	3.4 - 1398	4.3 - 1712
	ft ³ /h	0.1 - 50.02	0.18 - 80.03	0.12 - 49.35	0.15 - 60.43
fine pitch	dm ³ /h	2.1 - 920	2.4 - 1370	1.82 - 1023	2.4 - 1254
	ft ³ /h	0.07 - 32.48	0.08 - 48.36	0.06 - 36.11	0.08 - 44.27



Technology

(2) Reducing Changeover - The Package Of Versatility

Quick Change Module



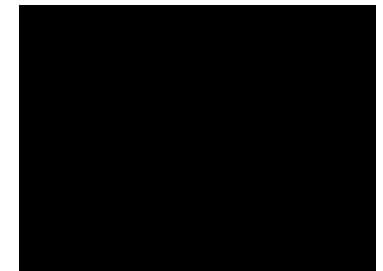
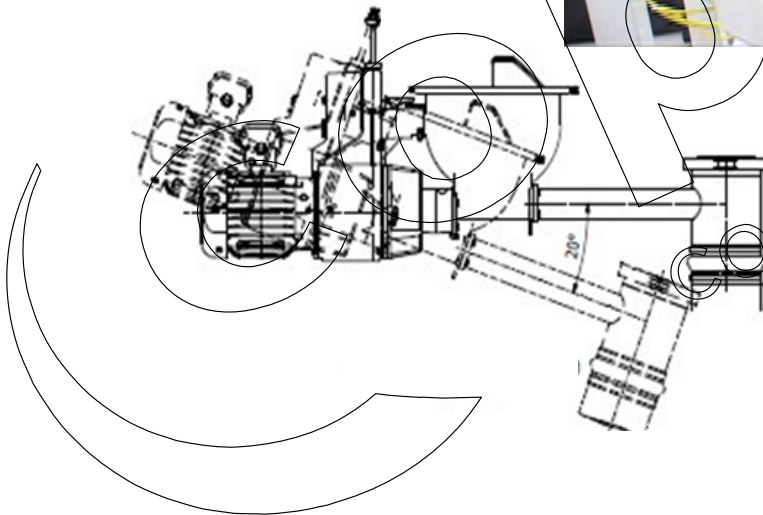
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Technology

(2) Reducing Changeover - The Package Of Versatility

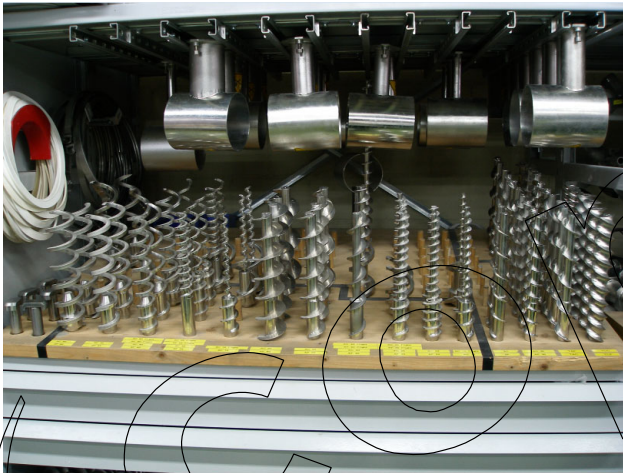
Detachable Bowl
(along with agitator)



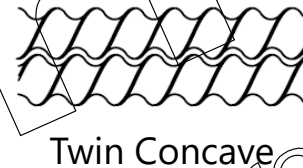
Technology

(2) Reducing Changeover - The Package Of Versatility

Detachable screws

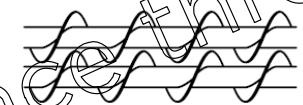


Single Spiral

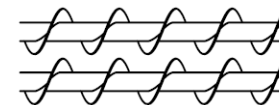


Twin Concave

Single Auger



Twin Auger



Double Auger

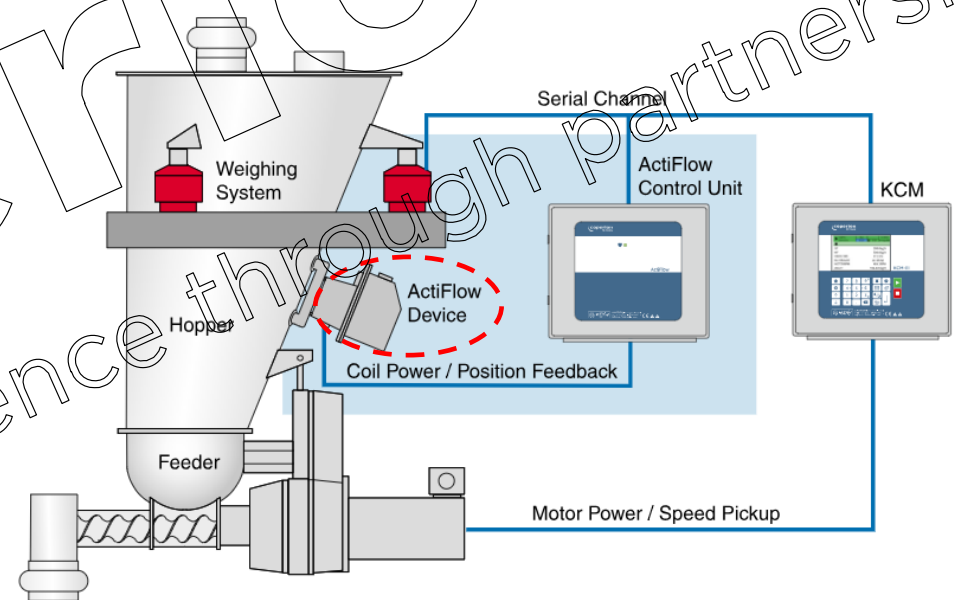
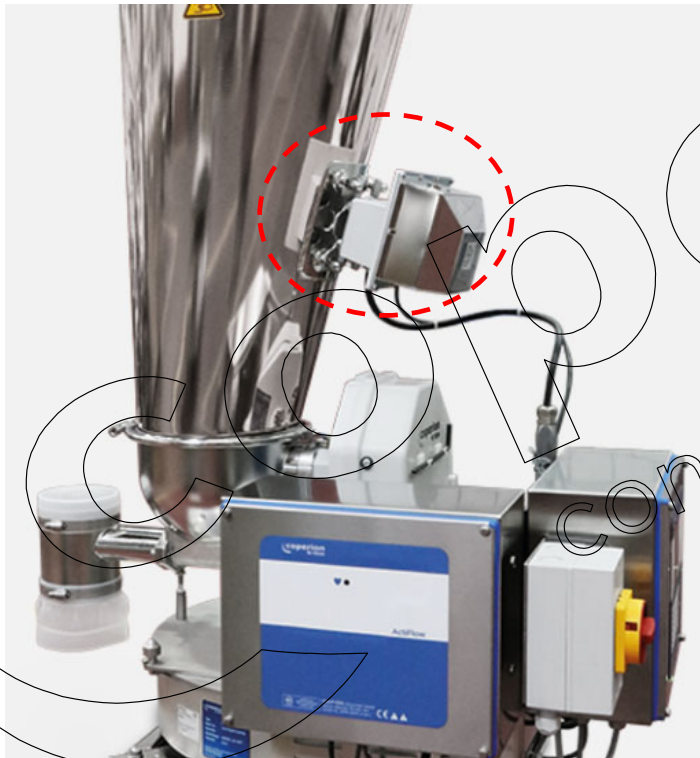


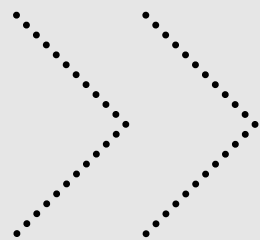
Technology

(2) Reducing Changeover - The Package Of Versatility

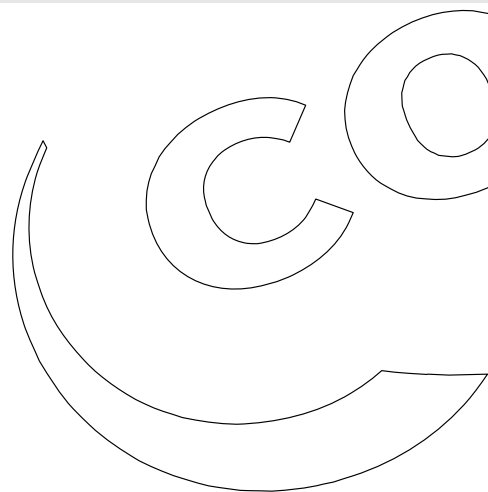
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Actiflow





Feeder Variety Showcase



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4

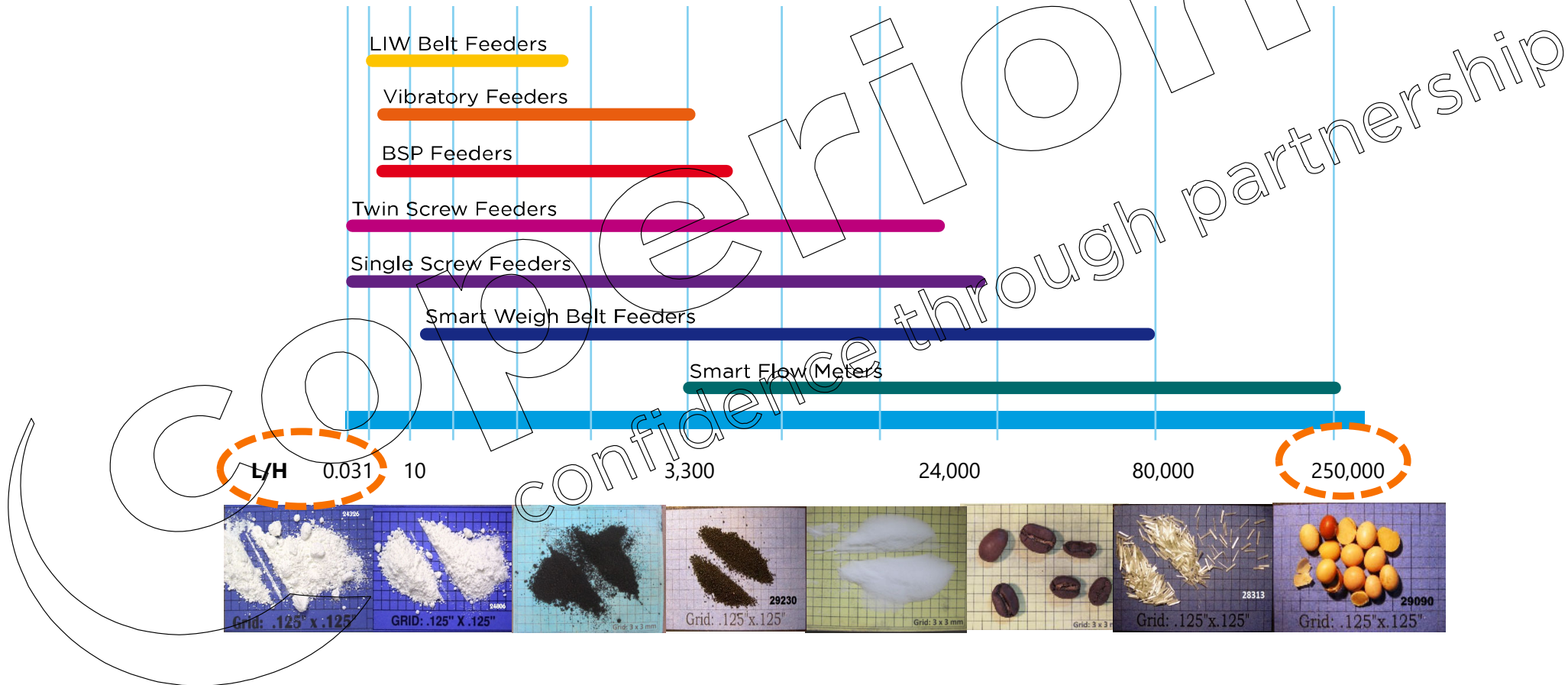
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confidence through partnership

Feeder Variety Showcase

Range of Products



Feeder Variety Showcase

Vibratory Feeder



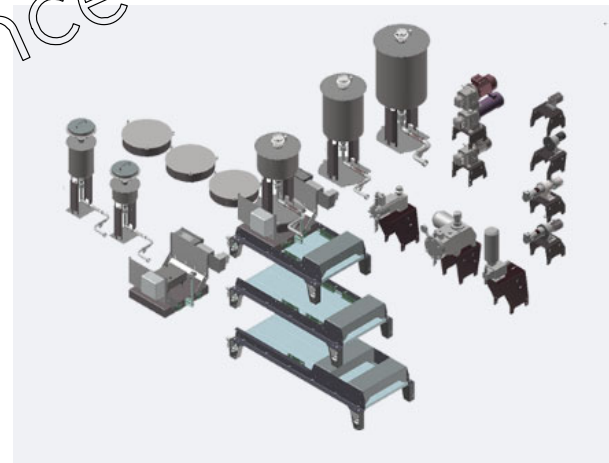
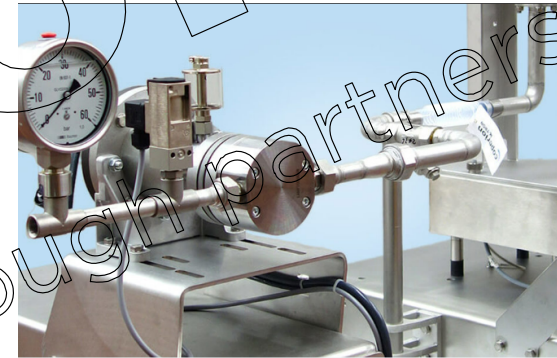
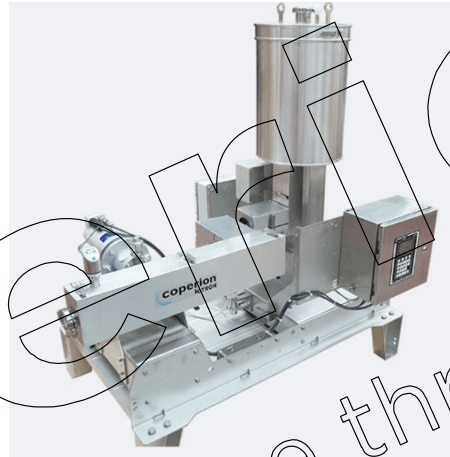
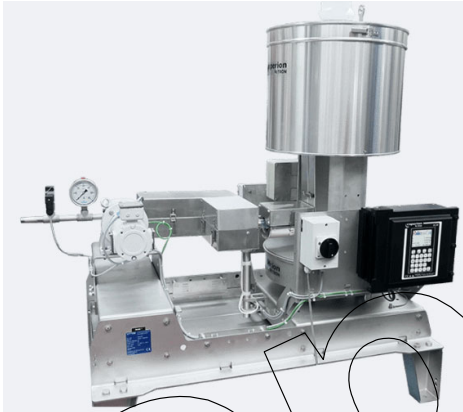
- To handle fragile materials
- Suitable for non-uniform shapes
- Suitable for abrasive materials
- High accuracy
- Least Maintenance
- Low energy consumption

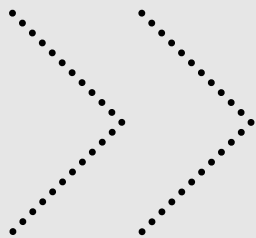


Feeder Variety Showcase

Liquid Loss-In-Weight Feeder

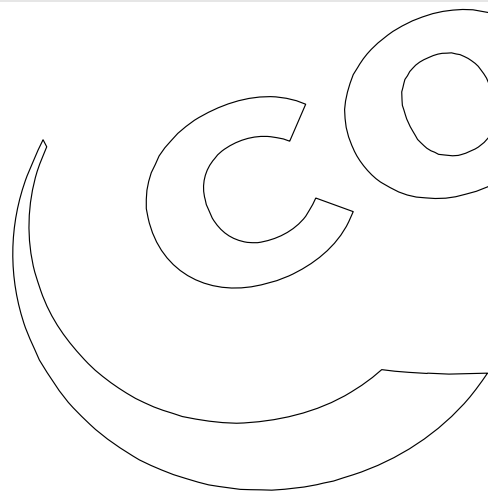
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Smart Controllers

5



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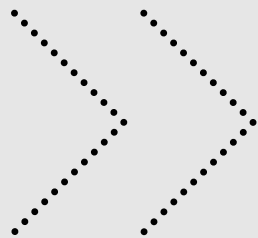
Smart Controllers

KCM / K-Vision

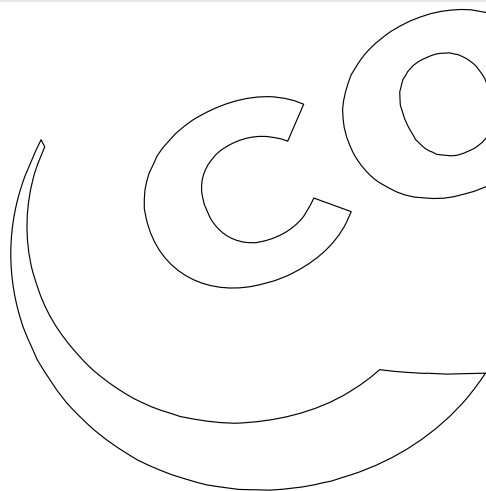


- Combines feeder control and motor drive modules into one component
- Can be mounted at the feeder or remotely
- Comes with all the software needed for continuous or batch applications.
- Data logging including alarm history.
- Supports communication boards for connection to plant systems : Modbus/TCP, Allen Bradley DF1, Ethernet/ IP, Profinet I/O etc.
- Built-in Ethernet & USB Flash drive port
- Option Wi-Fi module





Refill Systems



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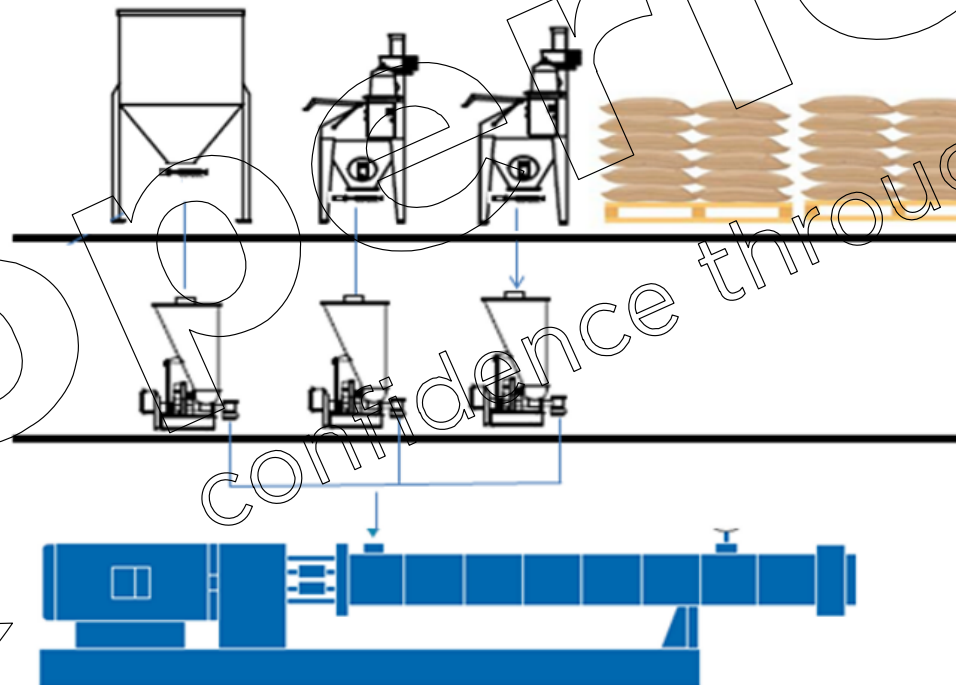
confidence through partnership

Refill Systems

Introduction



The safety risks and efficiency of both workers and materials at high floor cannot be ignored



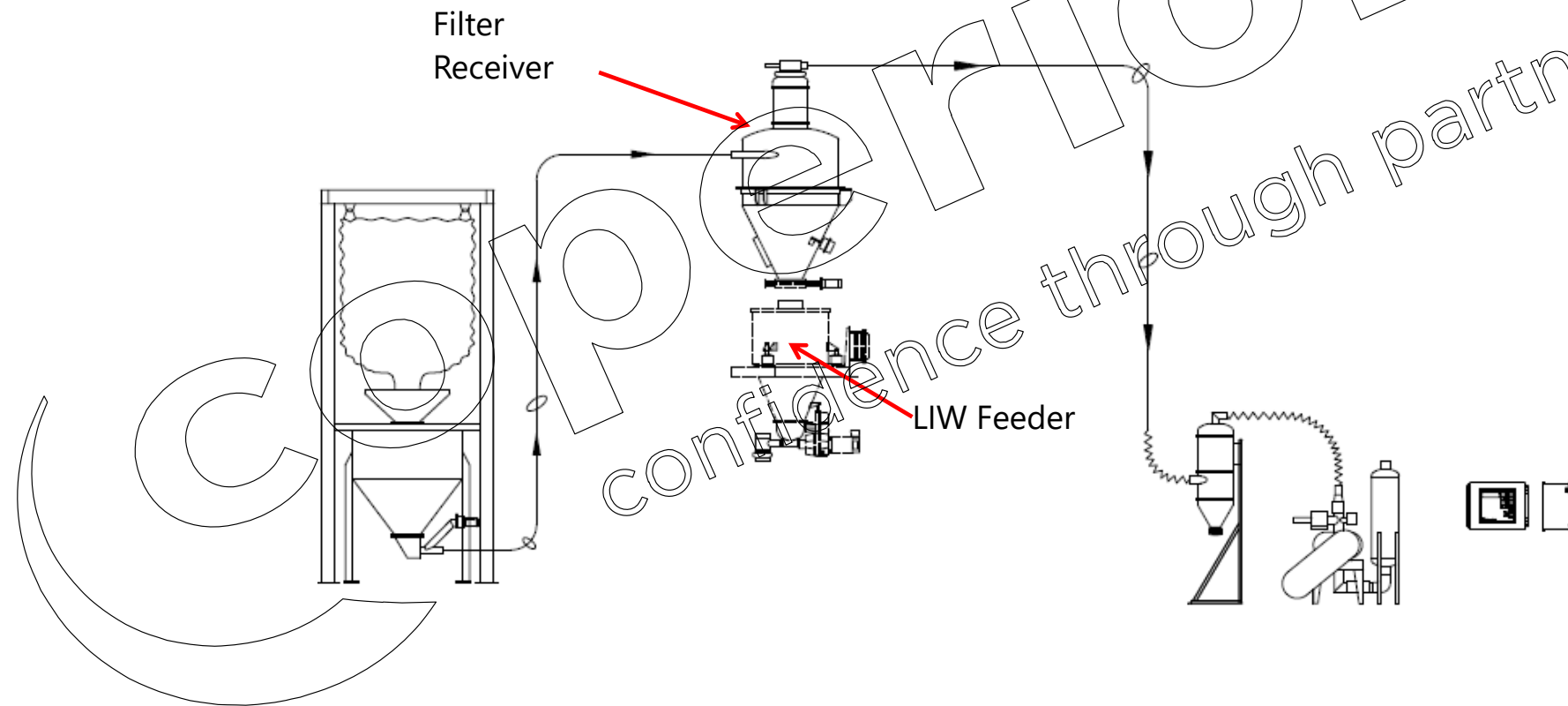
Refill Systems

Direct Refill

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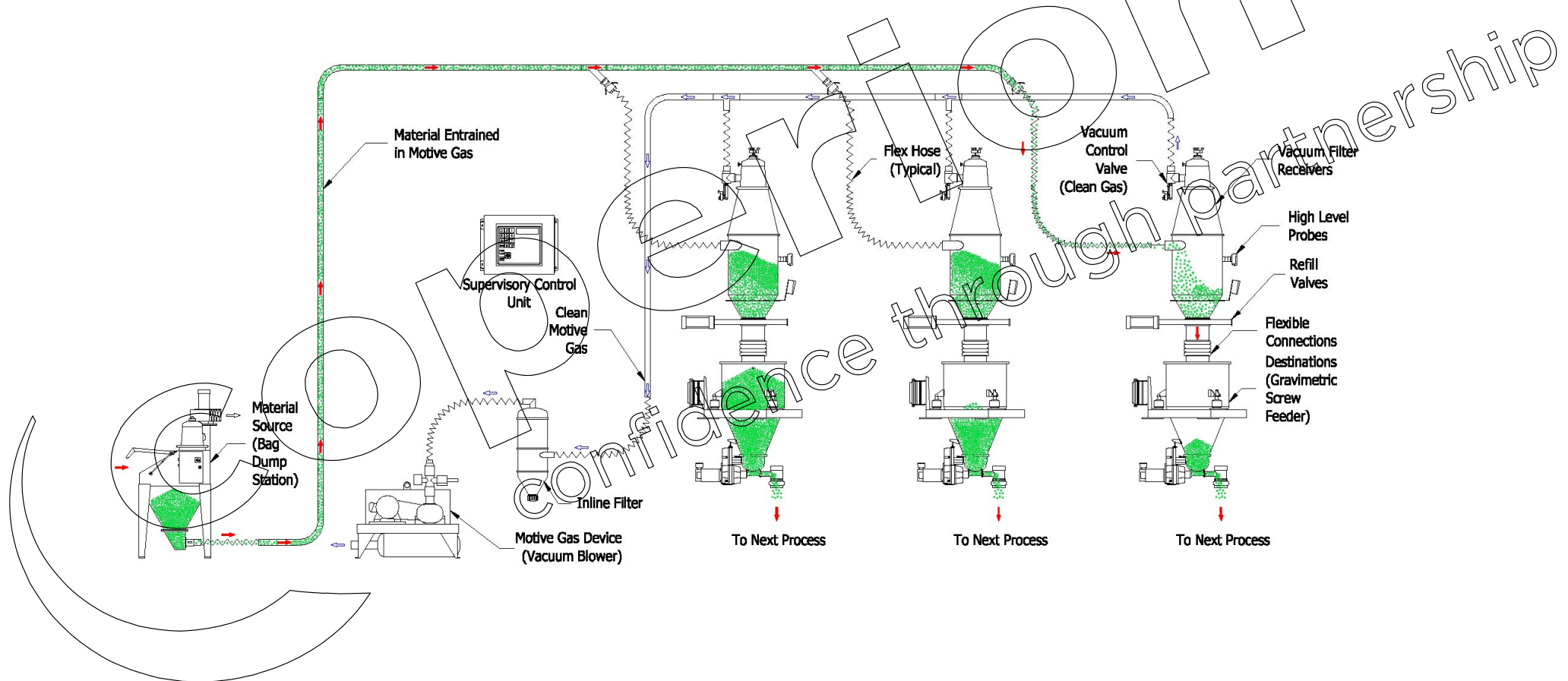
Filter
Receiver

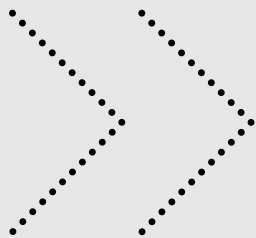
LIW Feeder



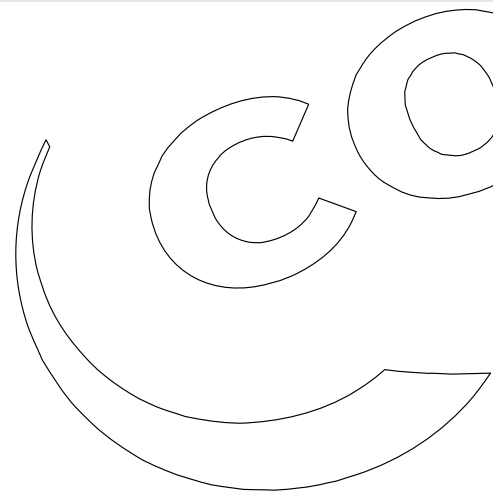
Refill Systems

Sequencing Refills

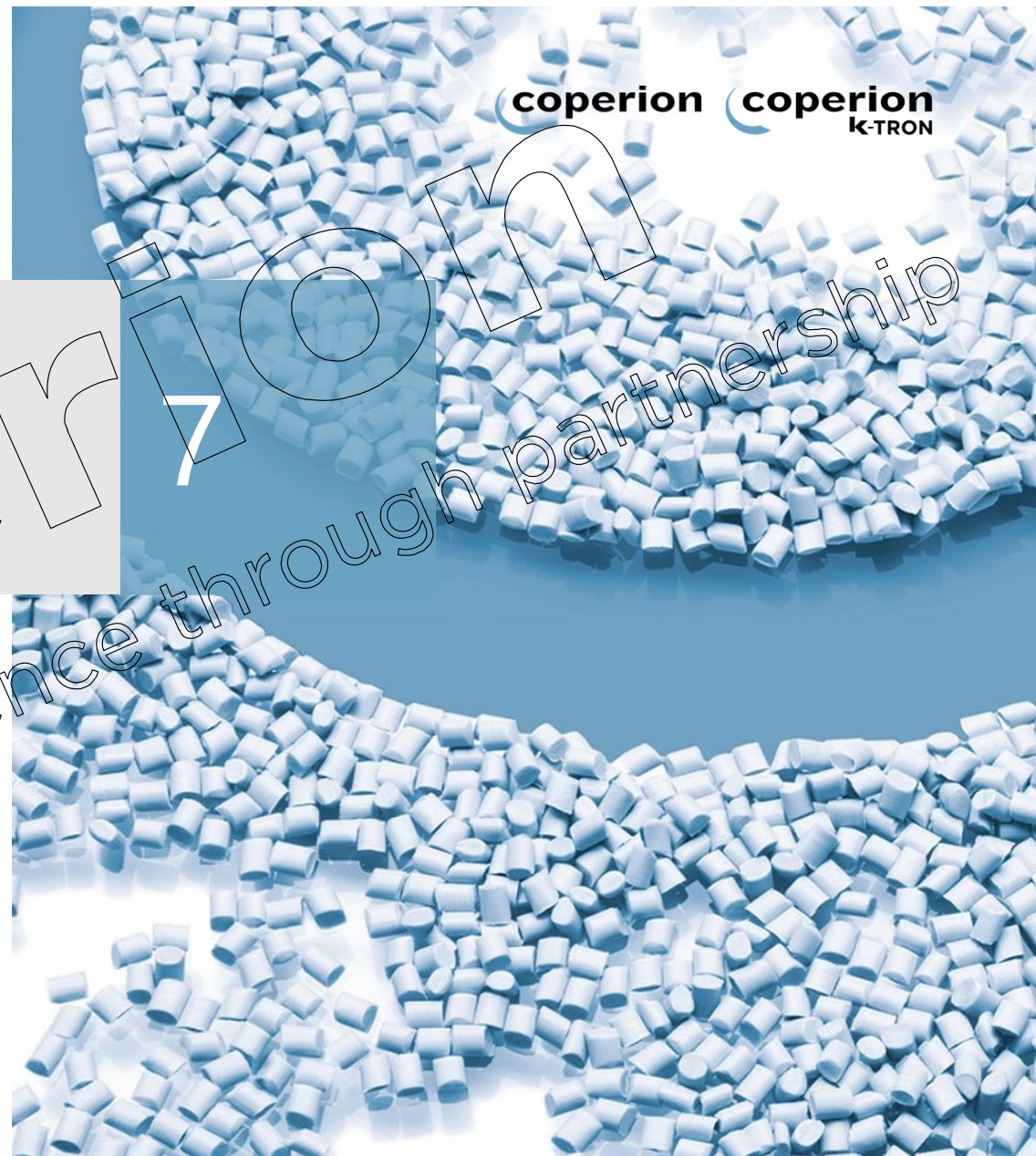




Takeaway



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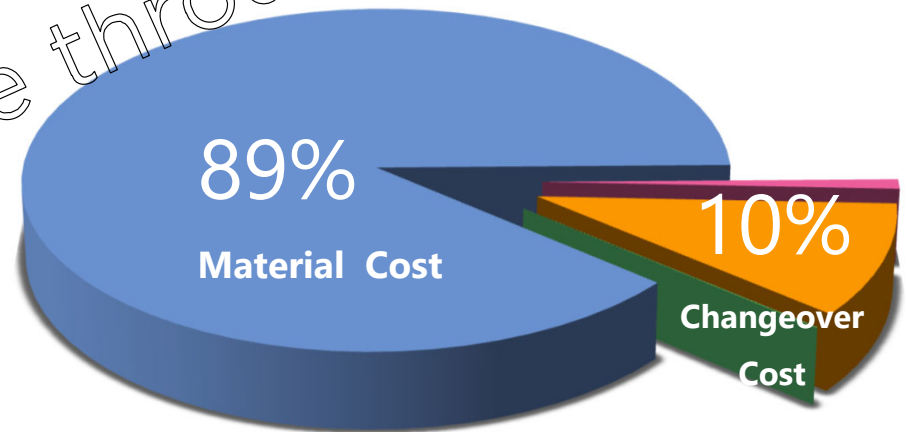
Takeaway

- Use Feedsmart Recipe Optimizer to **save a lot** of money.

>> Feedsmart Recipe Optimizer sheet is downloadable at the following link

<https://www.coperion.com/en/know-how/technology/feeding-technology/feedsmart/>

- Use high accuracy feeders to **save a lot MORE** money
- Supported by top-notch **technology** and **versatility**
- Backed with **smart controllers**: ease of use, great functionalities and connectivity.



Again, this is:

Why Precise Feeding Saves a lot of Money



Contact

K. Sugumaran

Sales Director

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