APPLICATION CONTROL GUIDELINES

LIVING LOGISTICS

Natrix

Shoe Sorter

P/N 1177239

Revision Date: March 01, 2019

CONTENTS

Chapter 1: WARNINGS AND SAFETY INSTRUCTIONS

Failure to follow the instructions and cautions throughout this manual, and warning labels on the conveyor, may result in injury to personnel or damage to the equipment.

Your TGW Systems conveyor is powered by a motor and can be stopped only by turning off electrical power to the motor. As with all powered machinery, the drive-related components – including sprockets, chains, shafts, universal joints, and pneumatic devices – can be dangerous. We have installed or provided guards to prevent accidental contact with these parts, along with warning labels to identify the hazards.

Special attention must be paid to the following areas of this manual:

⚠ WARNING

- Indicates a potentially hazardous situation, which, if not avoided, could result in death or serious injury.

CAUTION

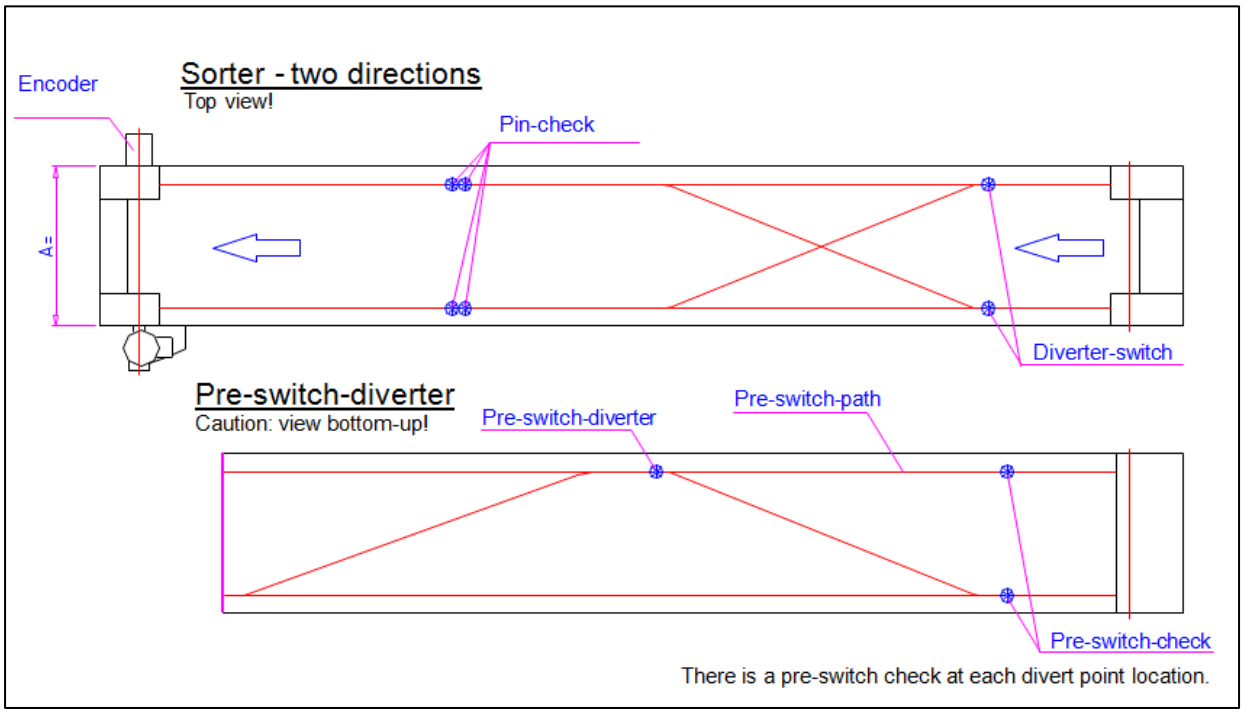
- Indicates a situation, which, if not avoided, could result in property damage.

Chapter 2: CONVENTIONS

The right-hand side and the left-hand side of the Natrix-Sorter are defined by the direction of the material flow.

- **Right meaning** - Is looking at the **material flow frontward** and on the **right** side.
- **Left meaning** - Is looking at the **material flow frontward** and on the **left** side.

2.1: HARDWARE CONFIGURATION



The initiator type mounted is TGW-id-Nr : 00060175

The Natrix control can be set up with two different options.

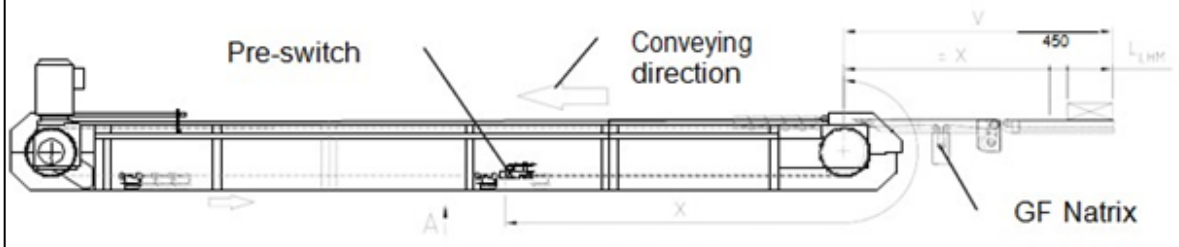
- Working as a slave of the master control system.
- Working as a separate machine, with only data communication to the master control system.

The motor of the sorter is to be controlled by a frequency inverter.

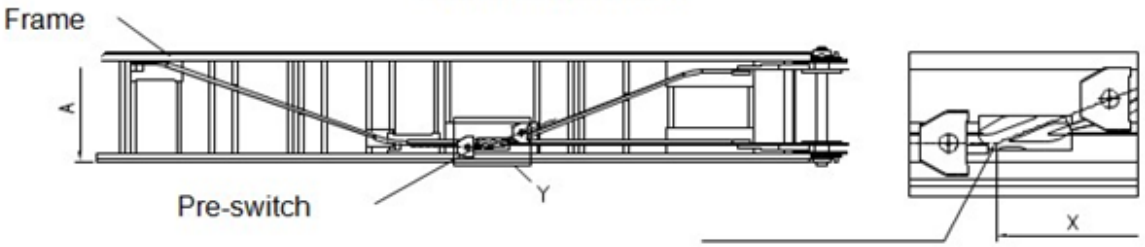
It is very important to use powerful PLC equipment with interrupt inputs and a very low response time. Detailed information will follow later in this document.

Chapter 3: INFEED BELT

Infeed Belt / pre – switch distance

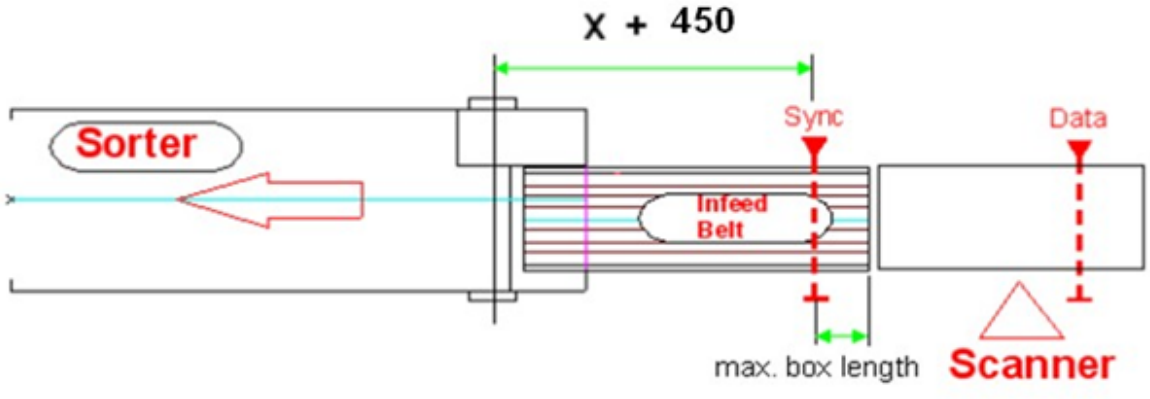


View A : bottom view



Deviating point

		A width			
	[mm]	1020	1220	1420	1620
X	fixed measure	3723	4223	4723	5223
V	pre switch distance	$X + 450 + L_{LHM}$			
L_{LHM}	max. parcel length	depends on plant			



Chapter 4: SENSOR DATA

The Sensor Sync and Data are located on the infeed belt conveyor. The Sensor Data starts scanning the barcode on the box. The Infeed conveyor operates with the same speed as the sorter. All gaps between the boxes should be correct if the box is on the infeed conveyor.

After scanning the barcode, the WMS-System provides the target destination data to the sorter control system. The data has to arrive when the box reaches the sensor Sync. This sensor starts the tracking of the box on the sorter.

The sync photocell can also be used to verify the gap between two consecutive packets. The gap must be large enough to prevent faulty divertion. In case of a failure (gap too small), both boxes should be sent to the fixed end of the sorter.

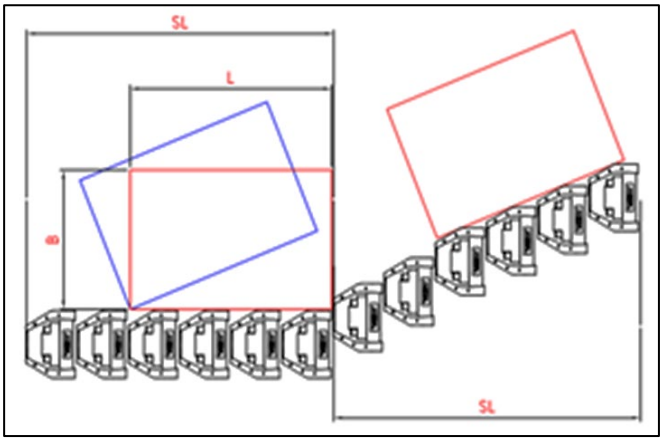
The pre-switch distance is used to pre-sort the shoes when the destination of the incoming box is on the left side. In case of using Natrix-Sorters with the functionality of sorting in only one side (right), the distance should be shorter (close to the sorter).

Chapter 5: TRACKING

On the sorter the package data should be tracked. The tracking information is used for the diverting of the packages and the sort confirmation.

Tracking can be made in two ways:

- With a constant tracking window which, depends only on the maximum box diagonal plus one pusher-shoe at the rear. (Small boxes <400 mm also plus one shoe in front)
- With a variable tracking window which, depends on the real box diagonal plus one pusher-shoe at the rear. (Small boxes <400 mm also plus one shoe in front)



5.1: INSERTING TRACKING

While a package proceeds from the infeed conveyor onto the sorter, the tracking data can be filled in with the target information of the package. The package data can be copied to the tracking data field of each sorter for that package. For each package one leading shoe, and the remaining trailing shoe to get a normal gap, can get the same tracking information.

5.2: ENCODER

On the sorter, an encoder detects the movement of the shoes. The slat width is 152, 4 mm. Every 152, 4 mm the tracking information of all shoes can be shifted 1 slat forward.

With the value of the encoder, it is possible to locate the pin, which should be diverted.

5.3: DIVERTING

The diverter should be used only when it is really needed to avoid mechanical abrasion for necessary movements. If some packages should be diverted one after each other, it makes sense to stay in position of diverting. This is true only if the gap between packages is less than about 4 shoes.

5.4: DIVERTING DECISION

Each diverter is linked with a defined tracking field (value of the encoder). The control system has to control whether the package can be diverted. If diverting is not possible (destination full or out of order), an alternative destination has to be chosen.

5.5: OPERATION

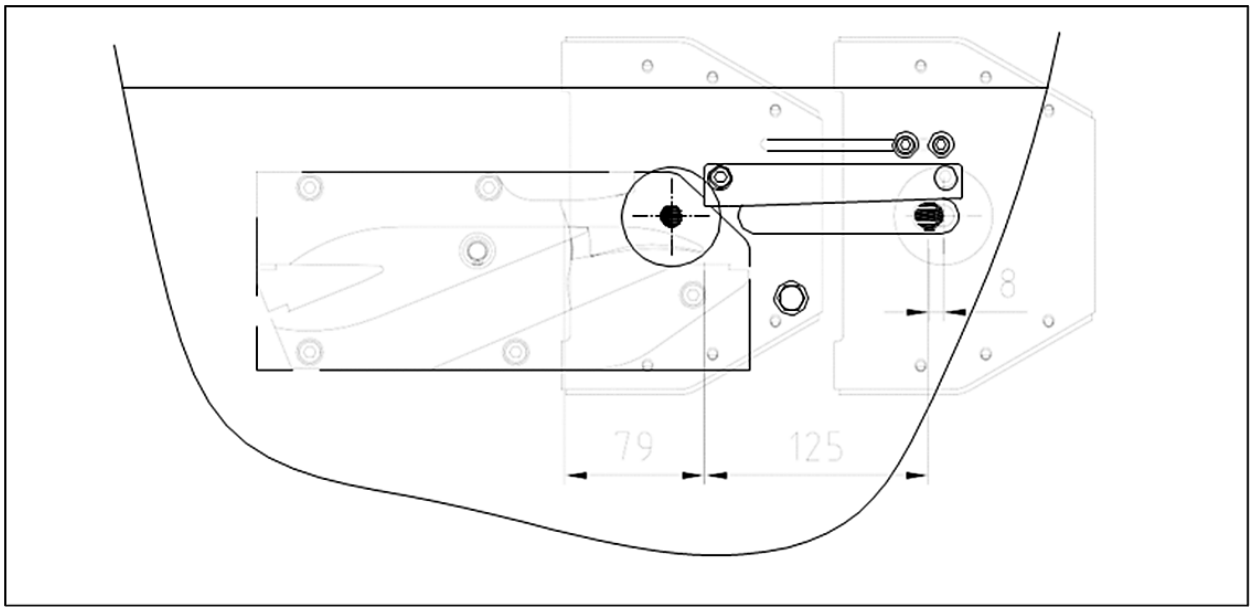
If a divert needs to be started, the pneumatic valve of the switch of the destination has to be activated in the right moment.

Each shoe has its own pin for diverting. Each destination has its own switch and its own inductive proximity switch to detect the pins of the shoes. The inductive proximity switch is mounted in the end position of the mounting hole. Therefore, the time when the signal is needed depends on the speed of the Sorter. The signal has to be delayed several milliseconds to avoid crashing of slat and shoe-pin. It is only allowed to start the switch (power on the valve) between two pins of the shoes. In case of an error (wrong timing of switching), some parts of the sorter can be damaged.

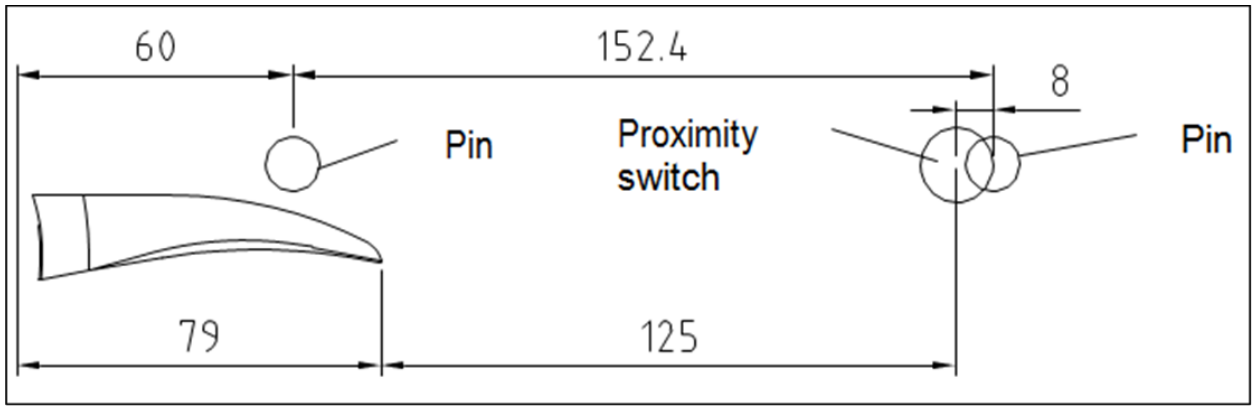
This necessitates a very powerful PLC with interrupt I/O.

Chapter 6: EXAMPLE FOR A SORTER WITH A SPEED OF 2 M/S

If the Sorter moves with a speed of 2 m/s the pins of the shoes move 2 mm per ms



The pitch between two pins is 152.4 mm. The pitch between the inductive proximity switch and the tongue of the switch is 125 mm.



Before delay (0ms)

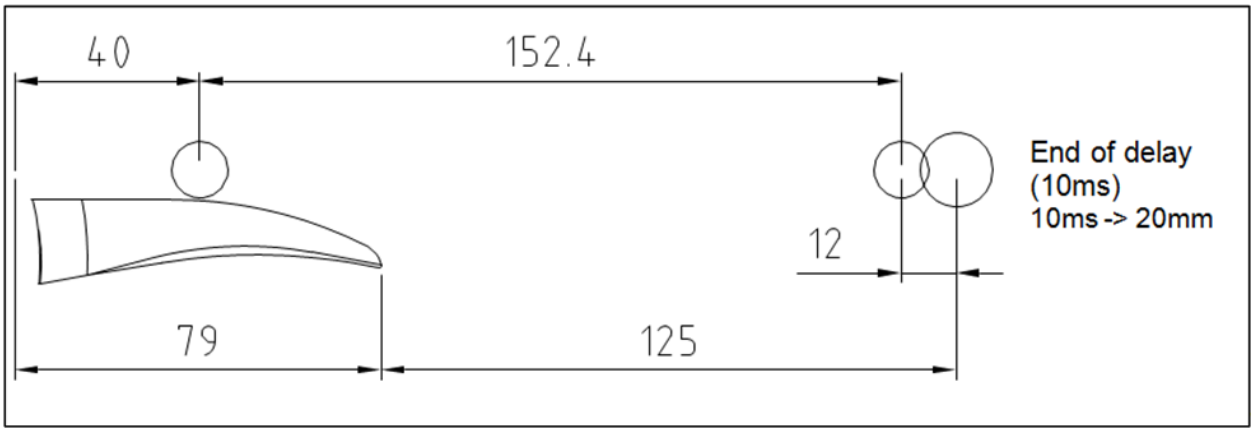
Distance pin-pin = 152,4 mm

Distance of proximity switch to tongue = 125 mm

Distance from the beginning of tongue to tongue-cut = 79 mm Delay proximity switch=2ms delay pressure increase=18ms

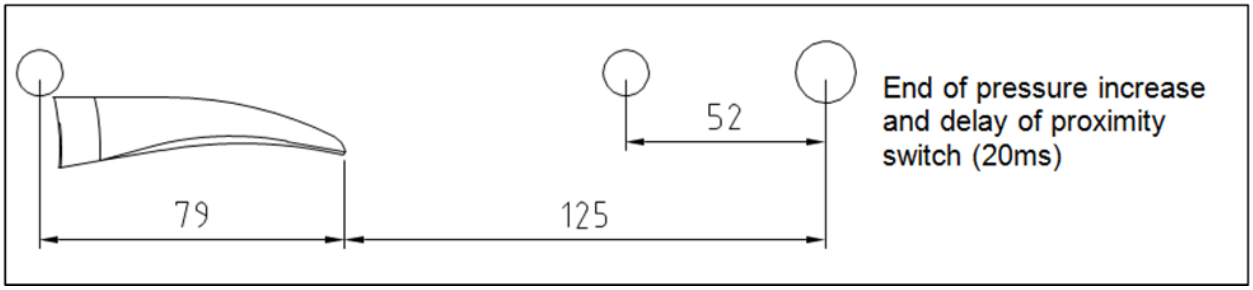
Necessary delay (because no pin is allowed to stay in place of diverter tongue) :$t_{delay}=(60mm/v_{Sorter})-t_{proximity+pressure}$ = $(60mm/2ms^{-1})$ -20ms = 10ms

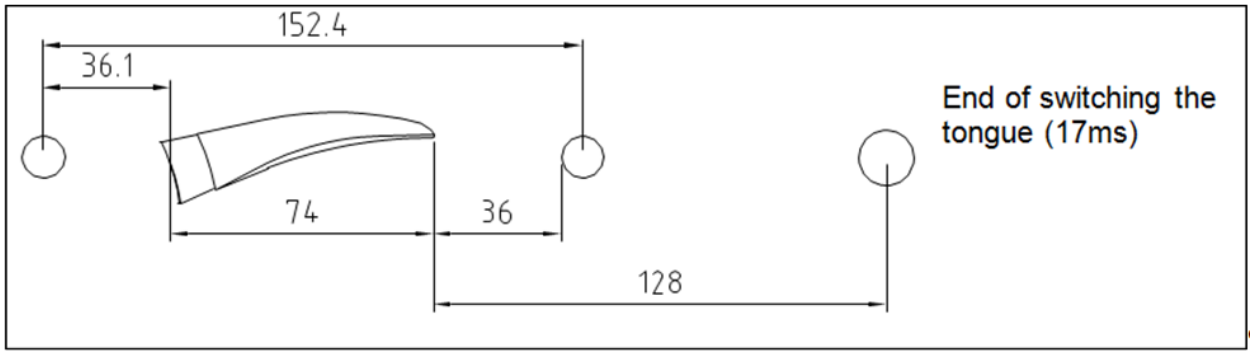
Chapter 7: PROXIMITY SWITCH DELAY



After 2ms delay of proximity switch, the valve of the switch is powered, it takes 18 ms to build up the pressure inside.

The pin of the shoe moves 40 mm in this time. It has to be ensured that no pin is in the area of the switch when the valve is activated.

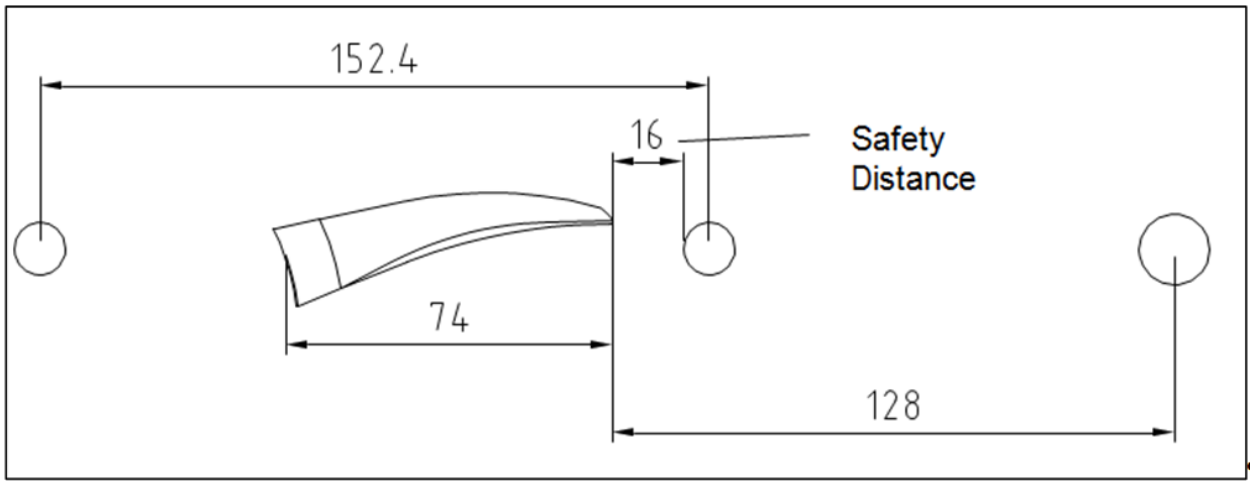




Now the switch is in the right position to guide the shoes to the opposite side for diverting packets.

The pictures shown above are without reacting time of the PLC!

The reaction time of the automation system should be less than 10ms when driving at a speed lower than 2m/s! (Switching reserve for this example, see figure below). The reaction time include all delays of the whole automation system (e.g. delay time to read the input, plc cycle time, delay time to write the output, bus cycle time, exceptional time in case of a failure,….)



At a sorter, speed equal or more than 2 m/s the automation system should have a reaction time less than 5ms!

The time how long the valve is powered depends on the length of the packet (number of shoes required for diverting).

CAUTION
• ATTENTION: The times of mechanical parts are theoretic times, so the correct position of the proximity switch should be tested at every Natrix installation site!

Chapter 8: END OF SORTER

Two inductive proximity switches (Pin-check) can be located at the end of the Natrix on both sides. The proximity switches are 152,4mm remote from each other (one pin length = to detect two pins at the same time). This sensors have to control (count the pins of the shoe => Every 152,4 mm a pin either on the left or on the right side) that the shoes of the sorter are on the left or on the right side. If one shoe is in the middle of the Natrix, an emergency stop should be started to avoid damage of the mechanical equipment.

8.1: DIRECTION OF OPERATION

The Sorter can only be operated in direction of the material flow.

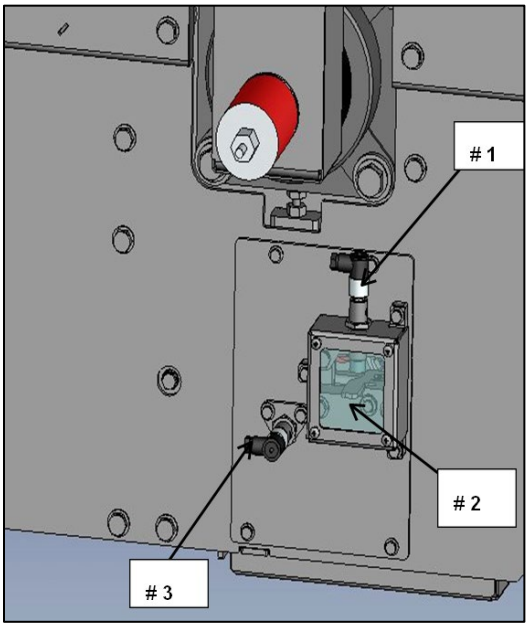
If the direction of movement is wrong, the mechanical equipment will be damaged.

8.2: SPEED OF NATRIX

In time of high output sortation, the Natrix drive with high speed.

If peak capacity is not needed, the speed should be as low as possible, to reduce the times for maintenance and reduce the noise level.

Chapter 9: ADDITIONAL OPTIONAL SENSORS



Optional sensors: placed directly under drive wheel (on both chain sides)

#1. Check for chain tension inductive sensor : Idnr 00060175 normal operating: Signal on chain has less tension.

The signal gets lost.

The controls should be visible to the personal on site! No emergency stop necessary !

Stop in next possible brake (max. 10 hours later)

The Natrix chain must be tightened max. 10 hours later !

#2. After tighten the chain, the detection element must be set in the UP POSITION.

(Use the open place in the cover).

The signal is now on and normal operating that is required.

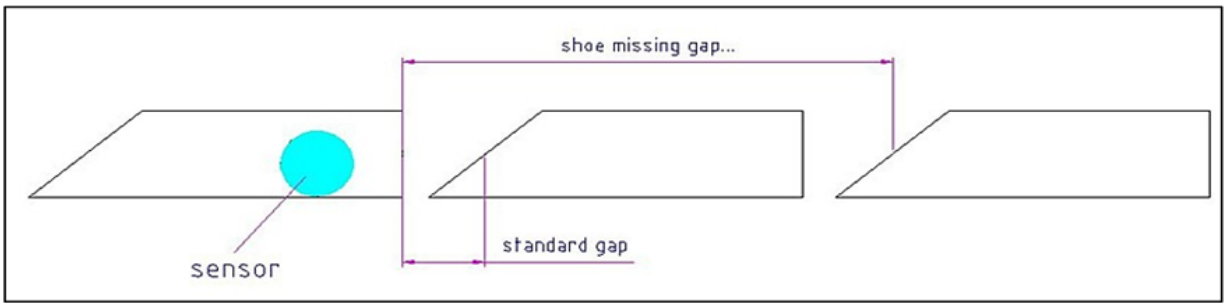
#3. Check for shoe position (lost shoe) capacitive sensor **:** Idnr 00291109

This sensor will show a pulse signal. Caused on shoe/gap/shoe/gap…situation

The pulse is also a function of sorter speed. The sensor must be adjusted and should detect the shoe in every position (shoes drive past with different distances +/-5 mm).

A normal signal run is caused if the sensors on both sides are combined, they will show the normal distance (standard gap) between the shoes running in one line.

It is possible, that a sensor on one chain side detects no signal, because all shoes are positioned on the other chain side. The sensors on left and right side have to work together.



CAUTION

ATTENTION: If one shoe (Red Cap) is missing this will cause one single gap to be longer. The Natrix must stop immediately!!! (Emergency Stop)

9.1: SICK DATA SHEETS (SICK)

SICK
Sensor Intelligence.

Inductive proximity sensors
Cylindrical thread design, IME18

Features

Housing:	Cylindrical
Thread size:	M18 x 1
Sensing range Sn:	8 mm
Assured sensing range Sa:	6.48 mm
Installation type:	Non-flush
Switching frequency:	1,000 Hz
Switching output:	PNP
Output function:	Complementary
Electrical wiring:	DC 4-wire
Enclosure rating:	IP 67 [1)]
Connection type:	Connector M12, 4-pin
Housing:	Standard

[1)] According to EN 60529

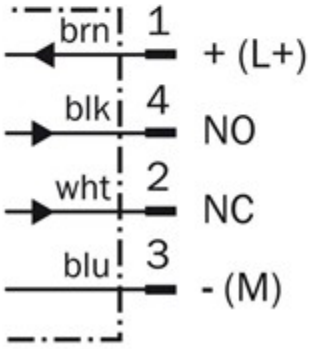
9.2: MECHANICS/ELECTRONICS (SICK)

Mechanics/electronics

Supply voltage:	10 V DC ... 30 V DC
Ripple:	≤ 10 %
Voltage drop:	≤ 2 V
Current consumption:	≤ 10 mA [1)]
Time delay before availability:	≤ 100 ms
Hysteresis:	5 % ... 15 %
Repeatability::	≤ 2 % [2) 3)]
Temperature drift (of Sr):	± 10 %
EMC:	According to EN 60947-5-2
Continuous current Ia:	≤ 200 mA
Short-circuit protection:	✓
Reverse polarity protection:	✓
Power-up pulse protection:	✓
Shock and vibration resistance:	30 g, 11 ms/10 Hz ... 55 Hz, 1 mm
Ambient operating temperature:	-25 °C ... 75 °C
Housing material:	Metal, Nickel-plated brass
Housing cap material:	Plastic, PA6
Housing length:	69 mm
Thread length:	42 mm
Tightening torque, max.:	≤ 40 Nm

[1)] Without load [2)] Ub and Ta constant [3)] Of Sr

Connection diagram

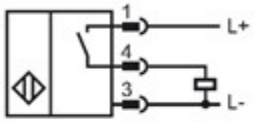


Chapter 10: TECHNICAL DATA (PEPPERL+FUCHS)

10.1: PEPPERL+FUCHS DATA SHEETS

PEPPERL+FUCHS

Connection



CBB8-18GS75-E2-V1 Capacitive Sensor

Technical Data

General specifications		
Switching element function		PNP NO
Rated operating distance	s_n	1 ... 8 mm
Installation		flush
Output polarity		DC
Nominal ratings		
Operating voltage	U_B	10 ... 30 V
Switching frequency	f	0 ... 100 Hz
Reverse polarity protection		reverse polarity protected
Short-circuit protection		pulsing
Voltage drop	U_d	≤ 1.5 V
Temperature drift		max. 20 % at -5 ... 55 °C (23 ... 131 °F)
Operating current	I_L	0 ... 100 mA
No-load supply current	I_0	≤ 18 mA
Time delay before availability	t_v	≤ 300 ms
Indicators/operating means		
LED green		Operating display
LED yellow		indication switching state
Potentiometer		sensitivity adjustment
Ambient conditions		
Ambient temperature		-25 ... 85 °C (-13 ... 185 °F)
Mechanical specifications		
Connection type		Connector M12 x 1 , 3-pin
Housing material		Stainless steel 1.4305 / AISI 303
Sensing face		PBT
Protection degree		IP67
Compliance with standards and directives		
Standard conformity		
Standards		EN 60947-5-2:2007 IEC 60947-5-2:2007
Approvals and certificates		
UL approval		cULus Listed, General Purpose
CCC approval		CCC approval / marking not required for products rated ≤36 V

Chapter 11: SENSORS (SICK)

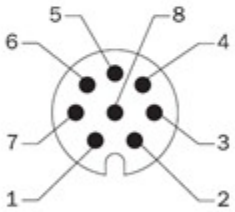
SICK
Sensor Intelligence.

Incremental encoders
DFS25, Rotary

Specifications

Pulses Per Revolution	1024
Supply Voltage/Output Type	8-30VDC supply/8-30VDC line driver output (HTL/push-pull)
Shaft Diameter	10 mm with flat
Supply Current with No Load	50 mA
Load Current	30 mA
Power Consumption with No Load	700 mW
Operating Temperature	-30 to 85°C
Mounting Type	60mm face mount
Counting Direction	CW, 180 degree marker gated with A
Connection Type	Radial exit M12 connector, 8-pin

Signal Pin and Wire Assignments



M12 8-Pin	Signal	Description
1	/A	A phase complement output signal
2	A	A phase output signal
3	/B	B phase complement output signal
4	B	B phase output signal
5	/Z	Z phase complement marker output signal
6	Z	Z phase marker output signal
7	GND	0VDC supply
8	Us	8-30VDC supply

Chapter 12: PNEUMATIC VALVE: (FESTO)

12.1: FESTO JMEH-5/2-1/8-B – 173431

Characteristic Values

Valve function 5/2 Bi-stable

Standard nominal flow rate 650 l / min Pneumatic connection 2 G1 / 8 Pneumatic connection 4 G1 / 8 Operating pressure 1.5 to 8 bar

Design Piston shoe

Certification cULus - Recognized (OL) Nominal size 5 mm

Pilot pressure 1.5 to 8 bar Switching time at 10 ms

Coil characteristics 24V DC: 1.5W

Operating medium Dried air, lubricated or not Medium temperature -5 - 50 ° C

Ambient temperature -5 - 50 ° C Product Weight 142 g

Mounting with through hole Pneumatic connection 1 G1 / 8 Pneumatic connection 3 G1 / 8 Pneumatic connection 5 G1 / 8 Material Information

Seals NBR

Material information Housing aluminum die cast

Chapter 13: CONNECTION FOR PNEUMATIC VALVE:

13.1: FESTO SOCKET MSSD-E - 14098

Characteristic Values

Mounting position any Protection class IP65

Ambient temperature -25 - 120 ° C Product Weight 8 g

Tin

Electrical connection

Dose angled quadrangular design MSE 3-pole Cable diameter 6 - 8 mm

Gland Pg7

Conductor nominal cross-section <= 0.75 mm2 Mounting On solenoid valve with central screw M3 Housing color Black Material information Housing plastic

Chapter 14: PRESSURE CONTROL UNIT: (FESTO)

14.1: FESTO LFR-1/2-D-MAXI-KE - 186 047

Characteristic Values

Size XXL Series D

Regulator lock Rotary knob with detent Mounting position Vertical +/- 5 ° Filtration 40 microns

Condensate drain Manual rotary feeder module

Mechanical construction Pressure Switch

Filter regulator with manometer Max. Condensate volume 80 cm3 Bowl guard Metal bowl guard Pressure display with manometer Pressure control range 0,5 - 12 bar Inlet pressure 1 1 - 16 bar

Max. Pressure differential 0,2 bar Standard nominal flow rate 9,200 l / min Operating medium Compressed air

Medium temperature -10 - 60 ° C

Ambient temperature -10 - 60 ° C Certification Germanischer Lloyd Product weight 2,400 g

14.2: OPTIONAL:

Mounting

Line mounting with accessories

Pneumatic connection 1 G1 / 2 Pneumatic connection 2 G1 / 2 Material Information Housing Die cast zinc

Material Information shell PC

Chapter 15: CONNECTION FOR PRESSURE CONTROL UNIT (FESTO):

15.1: FESTO PEV-1/4-WD LED 24-164274

Characteristic Values

Output status indication LED yellow Operating voltage range DC 15 - 30 V Current carrying capacity 8 A

CE mark according to EU EMC Directive Protection class IP65

Ambient temperature -40 - 90 ° C Angled Electrical connection box 4-pole

Mounting with through hole

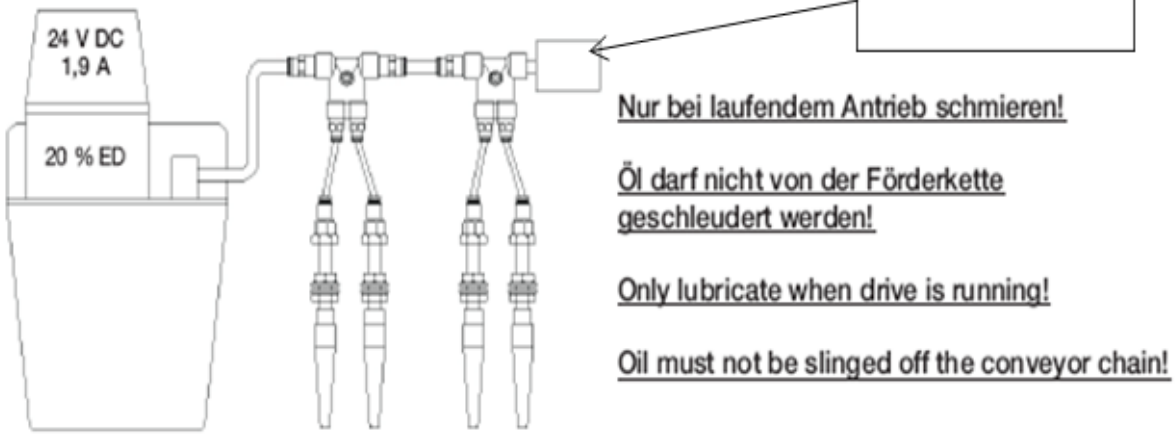
Chapter 16: OIL CONTROL UNIT NATRIX

The pressure inside the oil pipe is controlled with a sensor.

If the pressure level is not reached within 3 sec, the pump must be stopped!

Schmierzyklus: im 100 Betriebsstunden Abstand
Schmierintervall je 2m Natrixlänge: 4 s Pumpenlaufzeit EIN / 20 s Pumpenstillstand AUS

Bsp.: Bei 40m Natrixlänge sind nach je 100 Betriebsstunden 20 Intervalle (4 s Pumpe EIN / 20 s Pumpe AUS) durchzuführen!



Nur bei laufendem Antrieb schmieren!

Öl darf nicht von der Förderkette geschleudert werden!

Only lubricate when drive is running!

Oil must not be slinged off the conveyor chain!

lubricate cycle: every 100 operating hours
lubricate interval every 2m Natrix length: 4 s oil pump ON / 20 s oil pump OFF

for example: At a Natrix length of 40m the Oilpump has to be activated for 20 intervals (4 s oil pump ON / 20 s oil pump OFF) every 100 operating hours!

Chapter 17: TECHNICAL DATA (FESTO)

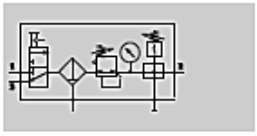
Technical Data (FESTO)

Service unit combinations LFR-KF/LFRS-KF, D series, metal design

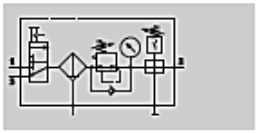
FESTO

Technical data combination LFR-KF/LFRS-KF

LFR/LFRS-...-MINI/MIDI-KF
With condensate drain
manual rotary



LFR/LFRS-...-MAXI-KF
With condensate drain
manual rotary

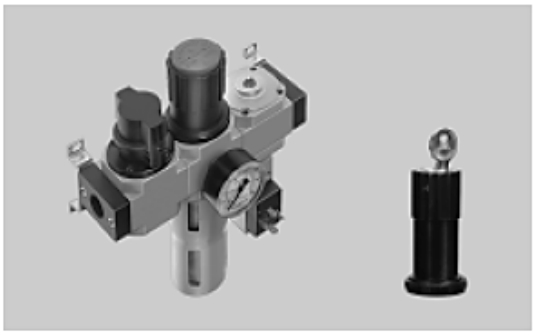


- On-off valve HE manually actuated
- Filter regulator LFR/LFRS
- Branching module FRM with pressure switch
- Mounting accessories

Flow rate
700 ... 8,400 l/min

Temperature range
–10 ... +60 °C

Operating pressure
1 ... 16 bar



- For unlubricated compressed air
- Operating pressure can be opened and closed
- Two branch connections are available
- Electrical pressure monitoring with adjustable switching pressure
- To ensure safe venting of the system, an additional quick exhaust valve is necessary at the output of the service unit combination
- New filter cartridges → 48

General technical data								
Size		Mini		Midi			Maxi	
Pneumatic connection 1, 2		G⅛	G¼	G¼	G⅜	G½	G½	G¾
Type of mounting		Via accessories						
		In-line installation						
Assembly position		Vertical ±5°						
Grade of filtration	[µm]	40						
Air purity class at the output		Compressed air in accordance with ISO 8573-1:2010 [7:8:4] (Compressed air in accordance with ISO 8573-1:2010 [6:8:4])[1]						
		Inert gases						
Bowl guard		Metal bowl guard						
Condensate drain		Manual rotary						
		Fully automatic						
Actuator lock		Rotary knob with detent						
		Rotary knob with integrated lock						
Pressure regulation range	[bar]	0.5 ... 12						
Max. hysteresis	[bar]	0.2	0.2	0.25	0.3	0.25	0.2	0.2
Pressure indication		Via pressure gauge						
Max. condensate volume	[cm³]	22		43			80 (43)[1]	

1) For the LFR-...-D-DL.
Note: This product conforms to ISO 1179-1 and to ISO 228-1

Standard nominal flow rate q_{nN}[1] [l/min]								
Connection		Mini		Midi			Maxi	
		G⅛	G¼	G¼	G⅜	G½	G½	G¾
In main flow direction 1 → 2		700	1,050	1,720	2,420	2,920	8,000 (5,000)[2]	8,400 (6,000)[2]

1) Measured at p1 = 10 bar, p2 = 6 bar and Δp = 1 bar.
2) For the LFR-...-D-DL.

2015/04 – Subject to change → Internet: www.festo.com/catalogue/... 29

Technical Data (FESTO)

Service unit combinations LFR-KF/LFRS-KF, D series, metal design

FESTO

Technical data combination LFR-KF/LFRS-KF

Operating and environmental conditions			
Condensate drain		Manual rotary	Fully automatic
Operating pressure	[bar]	1 ... 16	2 ... 12
Operating medium		Compressed air in accordance with ISO 8573-1:2010 [-:-:-]	
		Inert gases	
Ambient temperature	[°C]	-10 ... +60	
Temperature of medium	[°C]	-10 ... +60	
Corrosion resistance class CRC[1]		2	
Certification		Germanischer Lloyd	

1) Corrosion resistance class 2 according to Festo standard 940 070
Components subject to moderate corrosion stress. Externally visible parts with primarily decorative surface requirements which are in direct contact with a normal industrial environment or media such as coolants or lubricating agents.

Weight [g]			
Size	Mini	Midi	Maxi
LFR	1,200	2,400	3,300 (3,500)[1]
LFRS	1,300	2,640	3,400

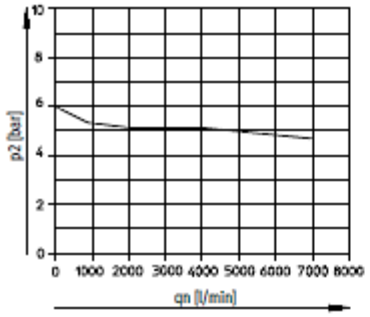
1) For the LFR-...-D-DI.

Note

Materials → Technical data of the individual devices

Standard flow rate qn as a function of the output pressure p2

LFR-½-D-DI-MAXI-KF(-A)



Primary pressure p1 = 10 bar

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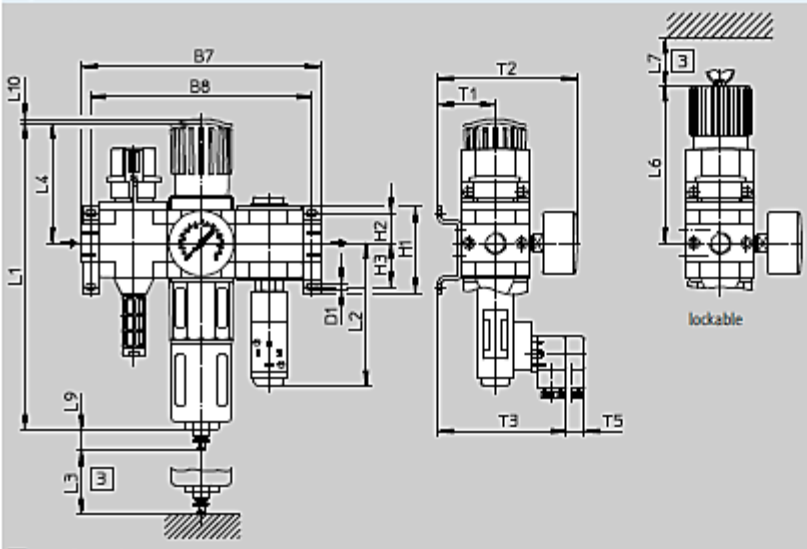
Dimensions Download CAD data → www.festo.com

LFR/LFRS-...-KF



3 Installation dimensions → Flow direction

Type	B7	B8	D1	H1	H2	H3	L1	L2	L3	L4	L6	L7	L9	L10	T1	T2	T3	T5
Mini																		
LFR-...-D-MINI-KF (A)	144	132	4.3	43	17.5	17.5	193	108	60	68	98	60	19	3	39	95	97	15
LFRS-...-D-MINI-KF (A)																		
Midi																		
LFR-...-D-MIDI-KF (A)	195	180	5.3	70	24.5	35.5	250	117	80	99	130	60	19	3	47	114	105	15
LFRS-...-D-MIDI-KF (A)																		
Maxi																		
LFR-...-D-MAXI-KF (A)	228	212	5.3	70	24.5	35.5	252	122	90	82	111	60	19	3	53	126	111	15
LFRS-...-D-MAXI-KF (A)																		
LFR-...-D-DI-MAXI-KF (A)							275			105	135							

Note: This product conforms to ISO 1179-1 and to ISO 228-1

2015/04 – Subject to change → Internet: www.festo.com/catalogue/... 31

Technical Data (FESTO)

Service unit combinations LFR-KF/LFRS-KF, D series, metal design

FESTO

Technical data combination LFR-KF/LFRS-KF

Ordering data

Rotary knob with detent, pressure gauge with outer scale in bar and inner scale in psi

Size	Connection	Condensate drain turned manually		Condensate drain fully automatic	
		Part No.	Type	Part No.	Type
Mini	G1/8	185767	LFR-1/8-D-MINI-KF	185768	LFR-1/8-D-MINI-KF-A
	G1/4	185769	LFR-1/4-D-MINI-KF	185770	LFR-1/4-D-MINI-KF-A
Midi	G1/4	185771	LFR-1/4-D-MIDI-KF	185772	LFR-1/4-D-MIDI-KF-A
	G3/8	185773	LFR-3/8-D-MIDI-KF	185774	LFR-3/8-D-MIDI-KF-A
	G1/2	185775	LFR-1/2-D-MIDI-KF	185776	LFR-1/2-D-MIDI-KF-A
Maxi	G1/2	186049	LFR-1/2-D-MAXI-KF	186050	LFR-1/2-D-MAXI-KF-A
	G3/4	185777	LFR-3/4-D-MAXI-KF	185778	LFR-3/4-D-MAXI-KF-A
Directly actuated pressure regulator with integrated return flow function					
Maxi	G1/2	192445	LFR-1/2-D-DI-MAXI-KF	192459	LFR-1/2-D-DI-MAXI-KF-A
	G3/4	192452	LFR-3/4-D-DI-MAXI-KF	192466	LFR-3/4-D-DI-MAXI-KF-A

Ordering data

Rotary knob with integrated lock, pressure gauge with outer scale in bar and inner scale in psi

Size	Connection	Condensate drain turned manually		Condensate drain fully automatic	
		Part No.	Type	Part No.	Type
Mini	G1/8	195018	LFRS-1/8-D-MINI-KF	195019	LFRS-1/8-D-MINI-KF-A
	G1/4	195032	LFRS-1/4-D-MINI-KF	195033	LFRS-1/4-D-MINI-KF-A
Midi	G1/4	195046	LFRS-1/4-D-MIDI-KF	195047	LFRS-1/4-D-MIDI-KF-A
	G3/8	195060	LFRS-3/8-D-MIDI-KF	195061	LFRS-3/8-D-MIDI-KF-A
	G1/2	195074	LFRS-1/2-D-MIDI-KF	195075	LFRS-1/2-D-MIDI-KF-A
Maxi	G1/2	195088	LFRS-1/2-D-MAXI-KF	195089	LFRS-1/2-D-MAXI-KF-A
	G3/4	195102	LFRS-3/4-D-MAXI-KF	195103	LFRS-3/4-D-MAXI-KF-A

WORKS CITED

FESTO, F. (. (n.d.). *FESTO. (n.d.). FESTO* . . Retrieved 10 1, 2015, from www.festo.com/us

PEPPERL+FUCHS. (n.d.). *PEPPERL+FUCHS*. Retrieved 10 1, 2015, from PEPPERL+FUCHS: http://www.pepperl-fuchs.us

SICK. (n.d.). *SICK Sensor Intelligence*. Retrieved 10 1, 2015, from SICK Sensor Intelligence: http://www.sick.com/US/EN-US/HOME/Pages/Homepage1.aspx

Vogel. (n.d.). *Vogel Central Lubrication*. Retrieved 10 2, 2015, from Lubemec.grouphes.com: http://lubemec.grouphes.com/wc/lubemec/vogel/dateien/us/pdf/izs_pdf/1-1701-us.pdf

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TGW SYSTEMS INFORMATION

Mission

TGW Systems, located in Spring Lake, Michigan, is a leading deliverer of “smart” material handling systems, technologies, products, and services, creating solutions for material flow applications. As a global supplier of conveyor systems and equipment since 1964, TGW Systems provides sorters, conveyors, and accessories to satisfy a broad spectrum of accumulation, transportation, and sortation applications.

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