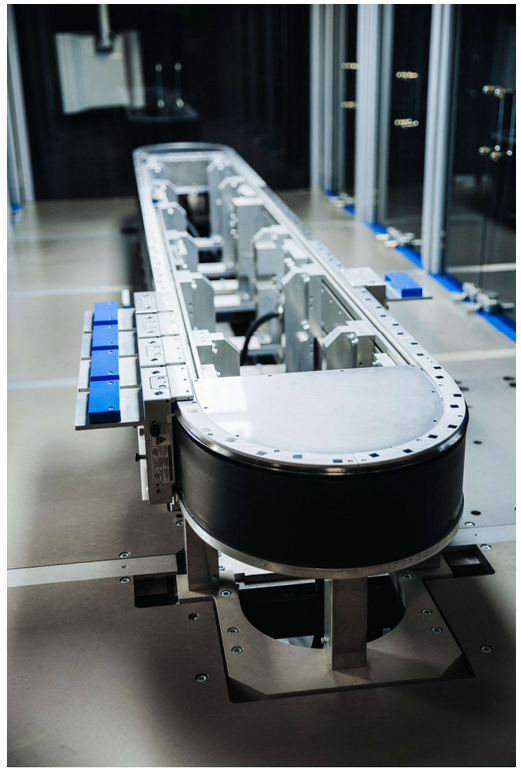
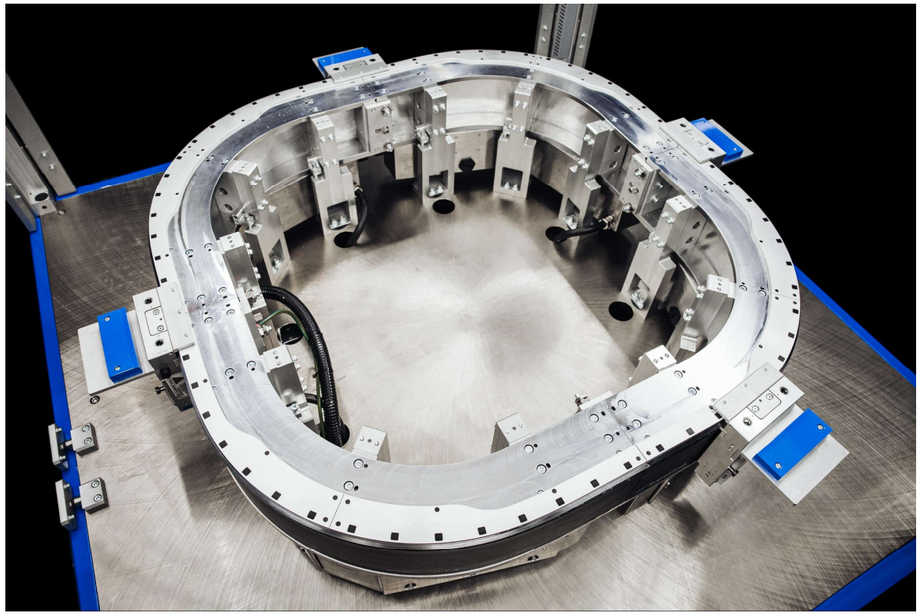
SuperTrak GEN3™ Conveyance Platform Design Considerations

This document provides design considerations when incorporating the SuperTrak CONVEYANCE™ platform into a machine or system. It covers features, options, things to watch out for, and important general information for new users. This document is designed to be a quick reference. More details can be found in the Operations and Maintenance Manual (OMM) and in the SuperTrak CONVEYANCE™ platform Design Package.



Contents:



For further information, please contact us at: SuperTrak_support@atsautomation.com

Other References:

- SuperTrak GEN3™ Operations and Maintenance Manual
- SuperTrak GEN3™ Design Package – 2022-12.zip

1. Systems

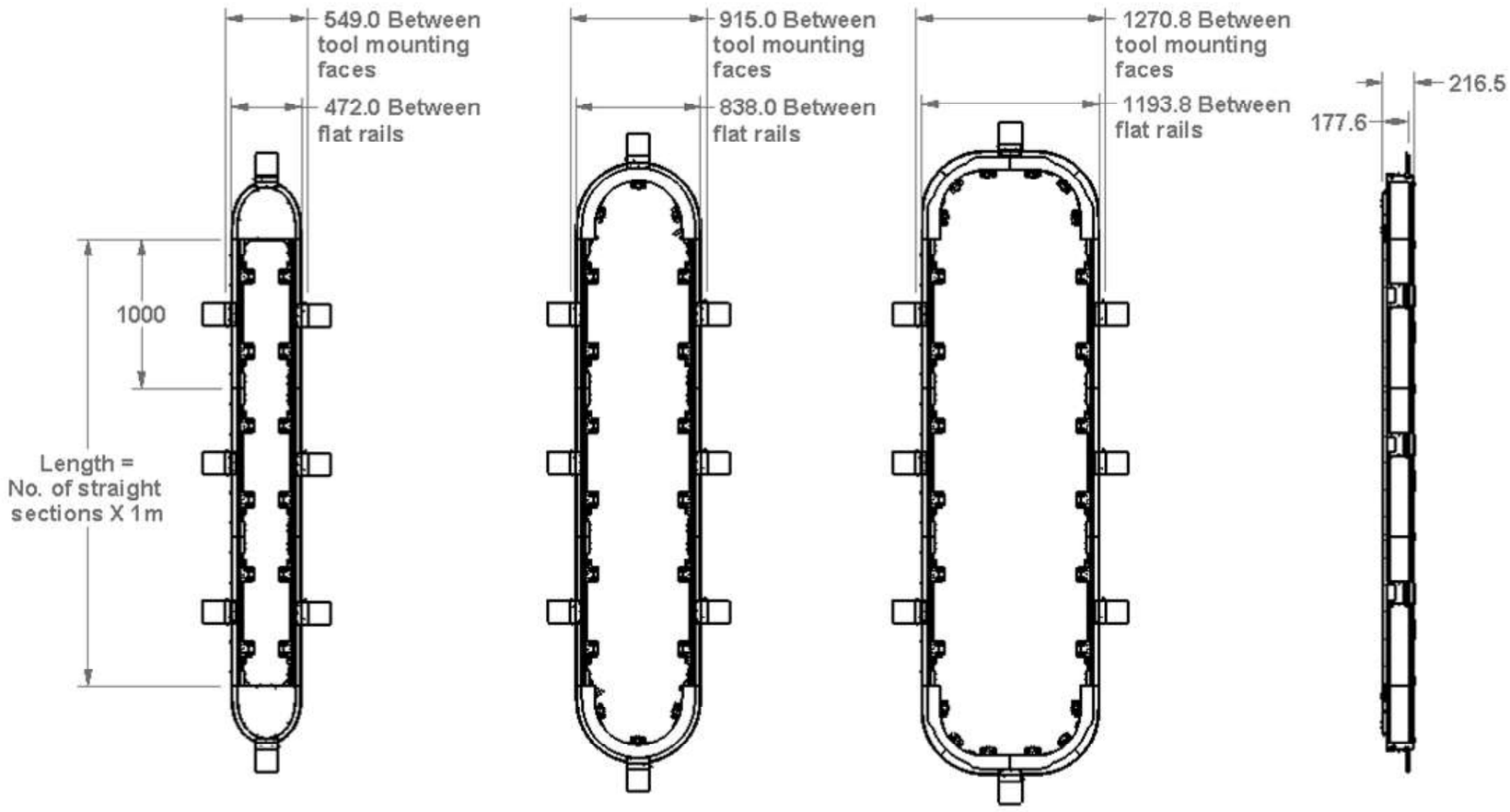
500 Wide

800 Wide

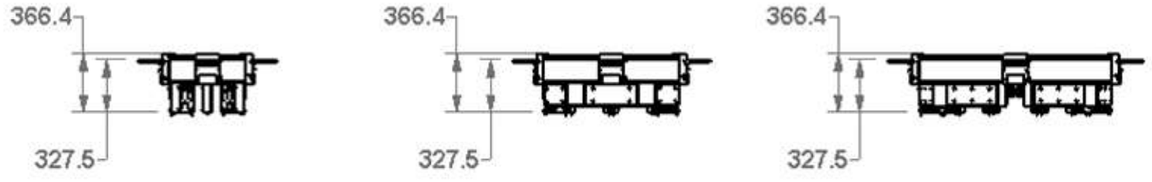
90 Degree

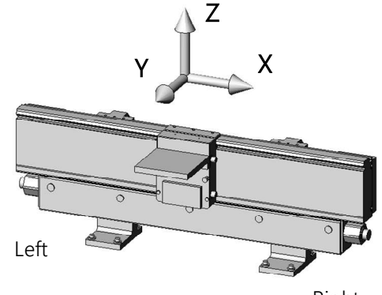
Over-Under

Top View



Front View





System Limitations:
Max System Length (500 wide): 31m
Max System Length (800 wide): 30m
Max System Size (90 deg.): 64 sections
Max Number of Shuttles: as many as physically fit
Max Payload: 10kg, 4kg on curves of Over-Under
Max Shuttle Tooling width: 600mm

Note: All dimensions are reference. Consult SuperTrak Design Package for dimensions and tolerances. All dimensions in millimeters unless otherwise noted.

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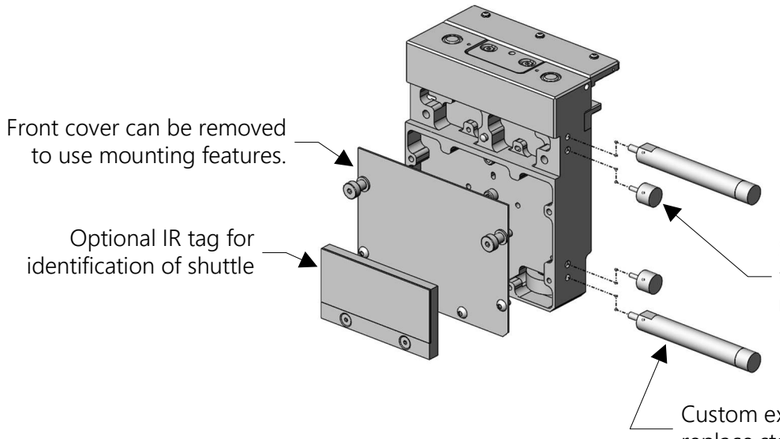
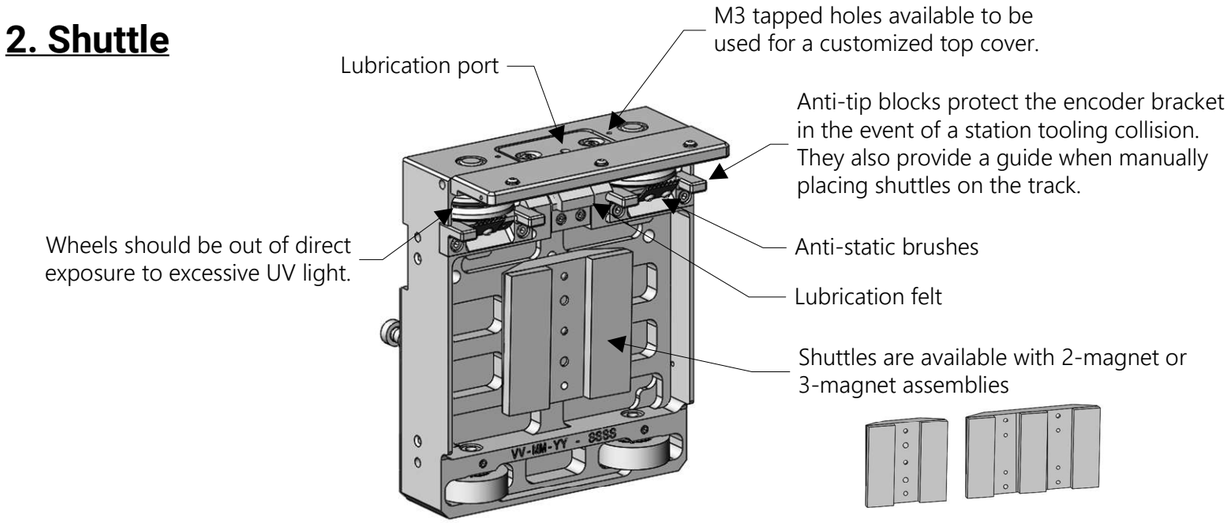
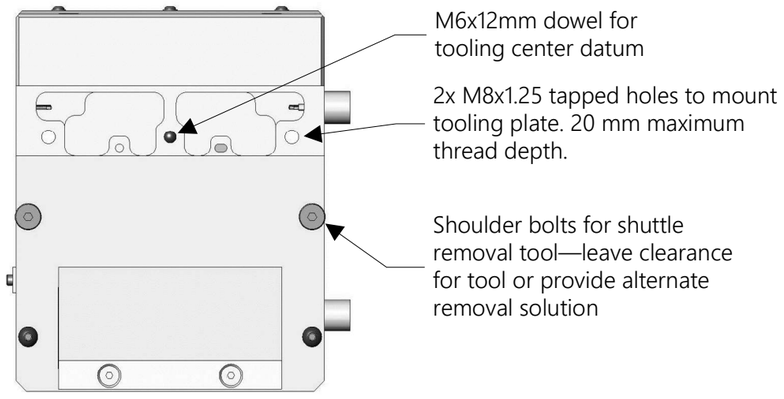
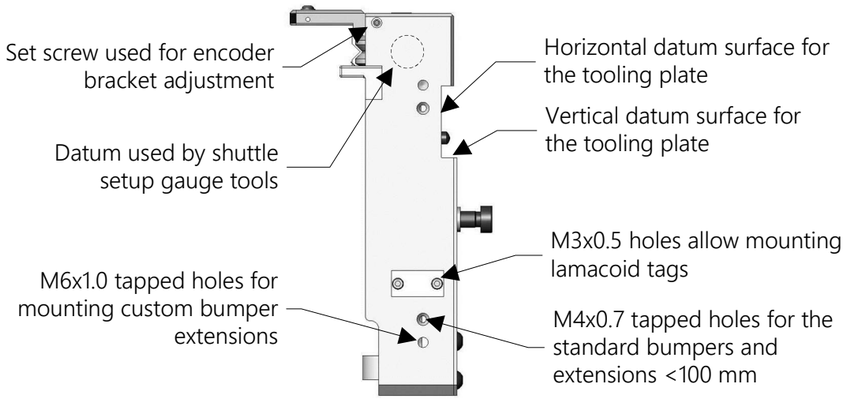
2. Shuttle

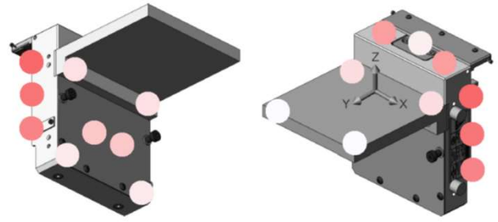






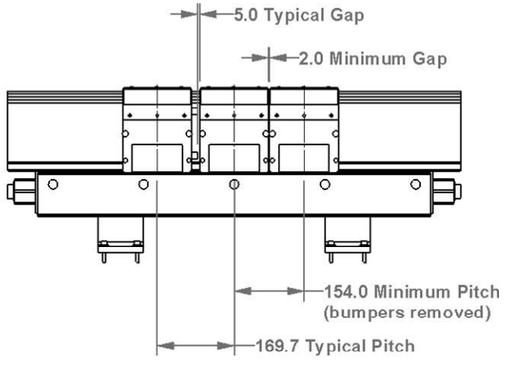


Magnetic Field Strength:

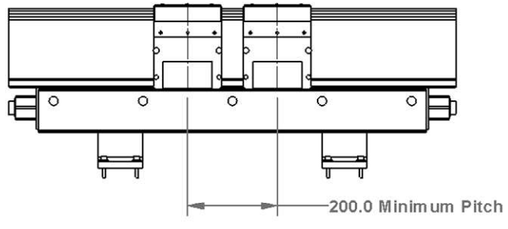


Although the shuttles contain powerful magnets, the field is well contained. For most applications, no special provisions are required. For very sensitive applications, shuttle magnetic field strength measurements can be found on the Shuttle Data Sheet in the OMM. When a shuttle is removed from the track, a keeper plate is used to contain the magnetic field.

2-Magnet Shuttles



3-Magnet Shuttles



Part Numbers:

	With IR	Without IR
2 Magnet	25193340	25193342
3 Magnet	25193341	25193343

Note: Shuttles may also be referred to as “pallets” in some documentation.

Typical Shuttle Wheel Lifespan

Shuttle Wheel	Distance*	Velocity	Rating**
V-wheels with lubrication	50,000 km	Up to 4 m/s	<0.05 mm wear from radius
Lower flat wheels	25,000 km	Up to 4 m/s	<0.05 mm wear from radius

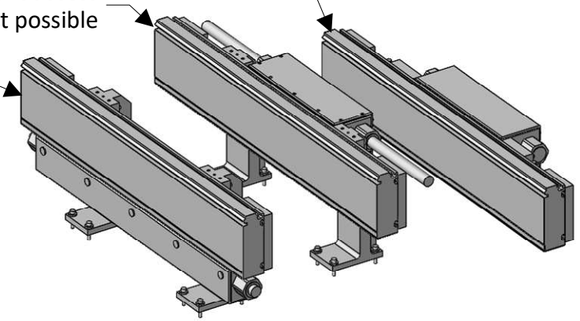
*Assumes correct alignment. Lifespan improves when the system is correctly aligned and installed in a clean environment
**Wheel life may be considered shorter in applications where repeatability of shuttle tooling position is critical and may be considered longer in applications with less precision required.

3. Straight Section

Rear Mounted Electronics (RME) Low-profile (most commonly used in over-under configurations)

RME used when front access is not possible

Front Access Electronics (FME)



Recommended clearance to replace encoder bracket: 30mm

Minimum clearance to replace encoder bracket: 20 mm

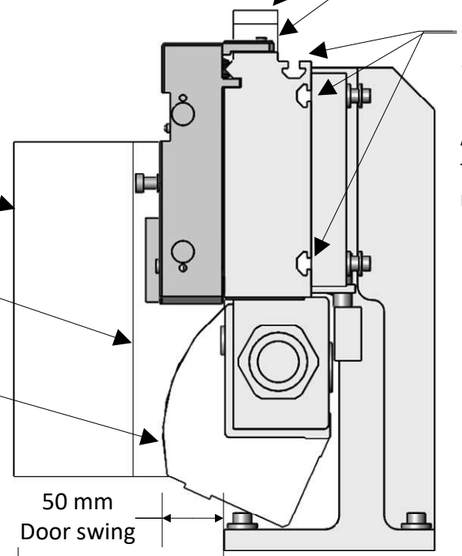
T-slot available for light duty structures. Compatible with Bosch 8mm T-Nuts and T-Bolts.

Access behind the motor is not required.

Conservative enclosure clearance

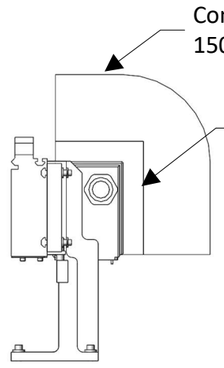
Minimum enclosure clearance (if not fully blocked for hand access)

Door swing clearance



Conservative clearance 150 mm

Minimum clearance 35 mm

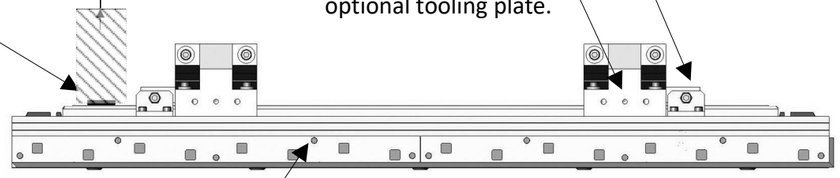


Each stand allows leveling adjustment of track.

Mounting features for optional tooling plate.

Allow ~125 mm for cable bend radius

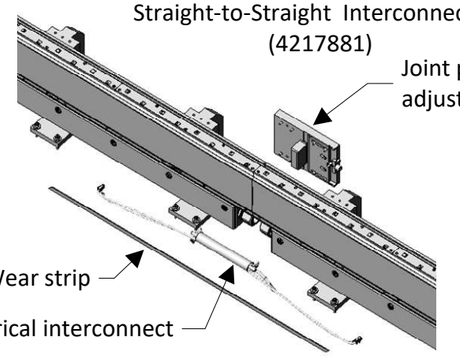
Cable entry location for power supply or IR reader. Allow 90mm for wrench clearance.



Flush mounted plastic hole plugs can be used when debris entrapment is a concern. (package of 10: SP-3708389-PK)

Straight-to-Straight Interconnect Kit (4217881)

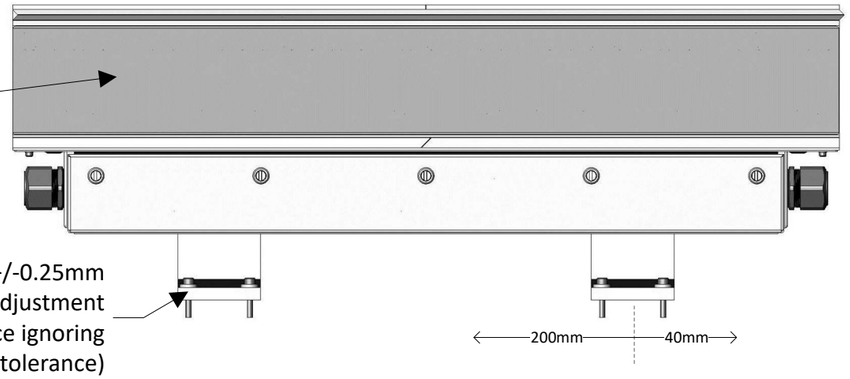
Joint plate with wedge adjust and magnetic shunt



Wear strip

Electrical interconnect

Cover label can be peeled off and replaced if damaged



M8 mounting screws in 11.0+/-0.25mm diameter holes; therefore linear adjustment is +/-1.375mm (+/-1.5mm clearance ignoring hole tolerance)

200mm

40mm

Stands can be adjusted up to 200mm towards center of section or up to 40mm away from center.

Part Numbers:

Straight section FME	1060391
Straight section FME w/o stands	1060387-S
Straight section RME	125780473
Straight section low-profile	125414648

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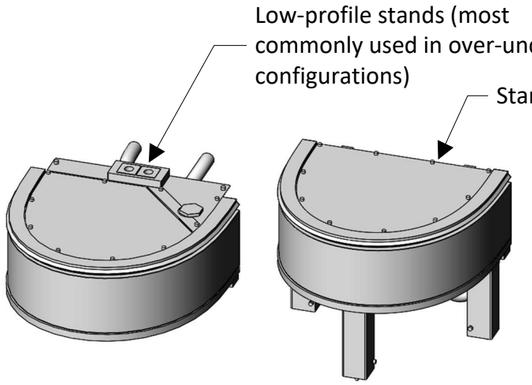
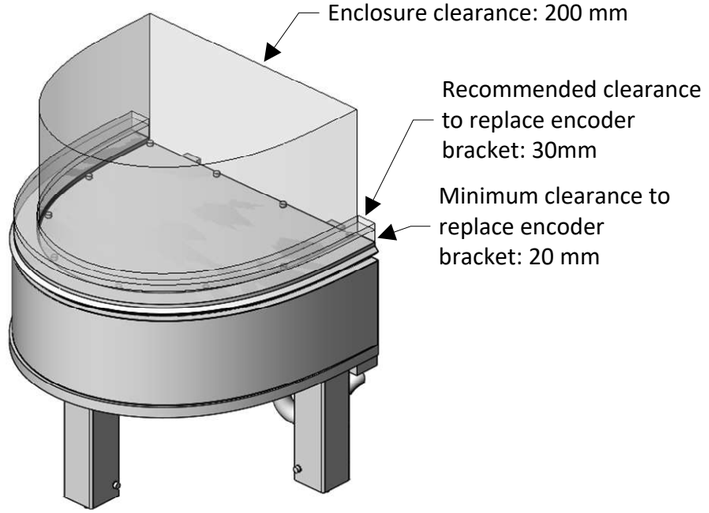
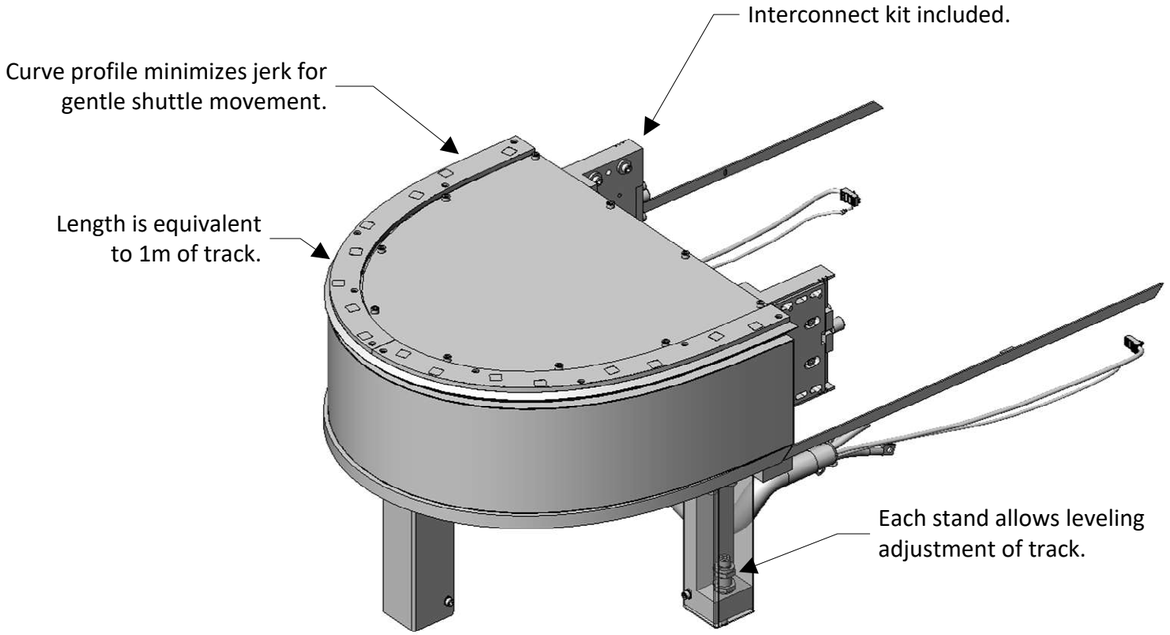
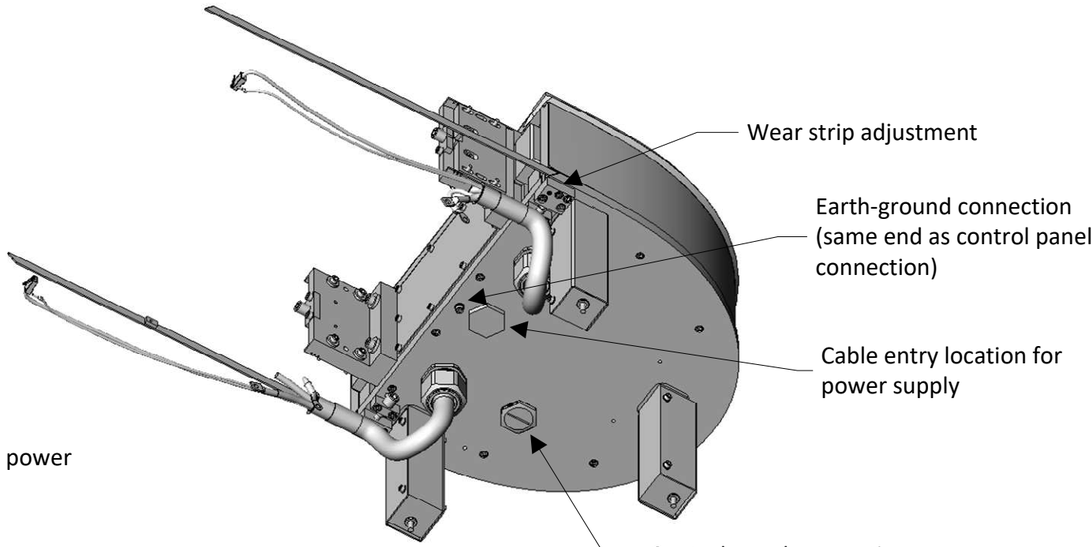
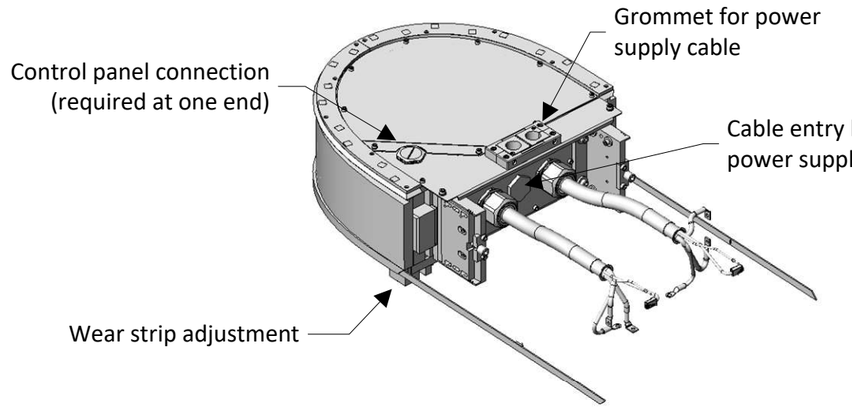
4. 180° Section (500mm)











Part Numbers:

180 Deg. Section (500 mm)	1060638
180 Deg. Section (500 mm) low-profile	125420930

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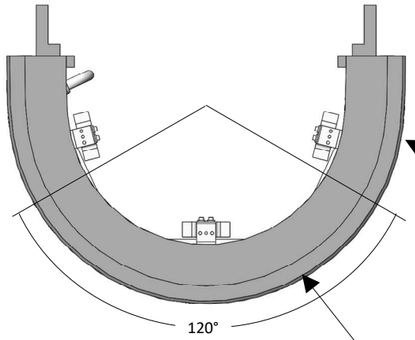
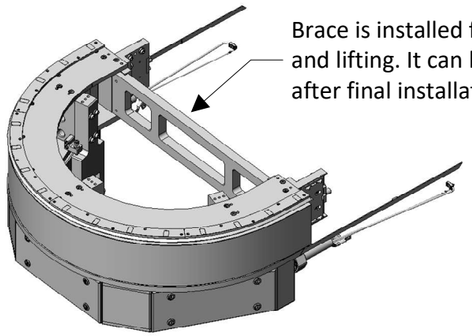
5. 180° Section (800mm)

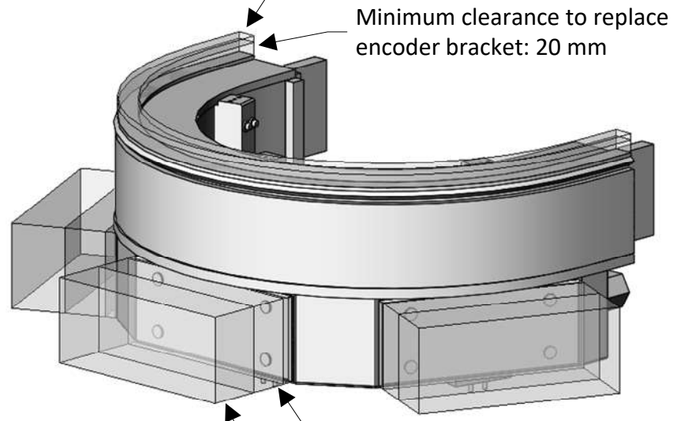


Transitional profiles minimize jerk for gentle transition to/from curves.

When both shuttle wheels are within this region, the profile is circular.



Brace is installed for shipping and lifting. It can be removed after final installation.

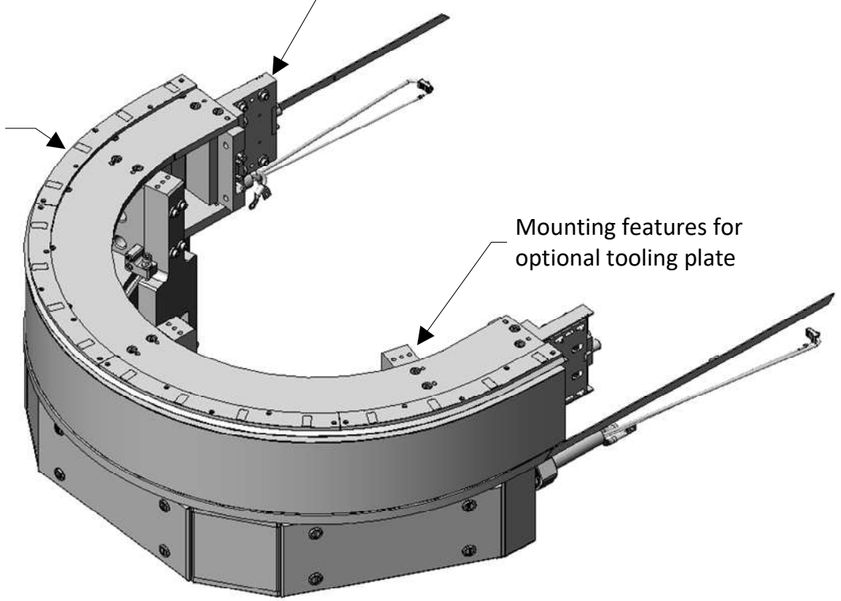


Recommended clearance to replace encoder bracket: 30 mm

Minimum clearance to replace encoder bracket: 20 mm

Minimum enclosure clearance: 80 mm

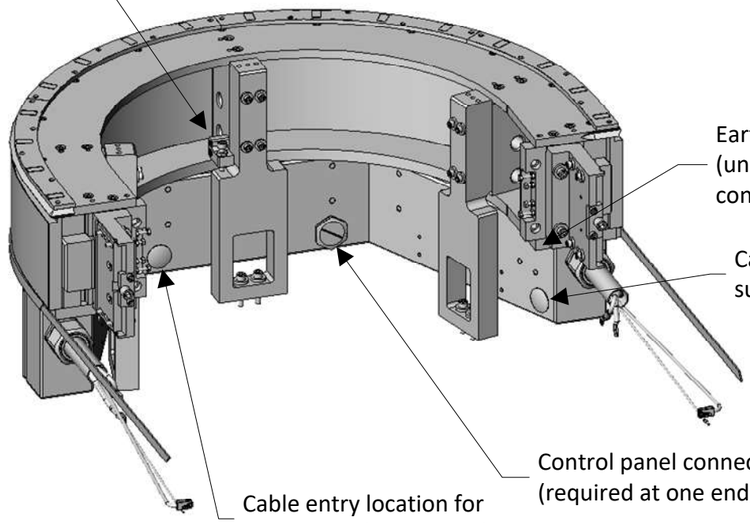
Enclosure clearance: 165 mm



Interconnect kit included

Length is equivalent to 1.5m of track

Mounting features for optional tooling plate



Each stand allows leveling adjustment of track.

Earth-ground connection (under plate, same end as control panel connection)

Cable entry location for power supply or IR reader

Control panel connection (required at one end)

Cable entry location for power supply or IR reader

Part Numbers:

180 Deg. Section (800 mm)	25232698

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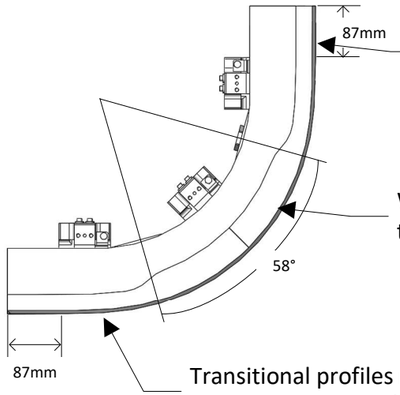
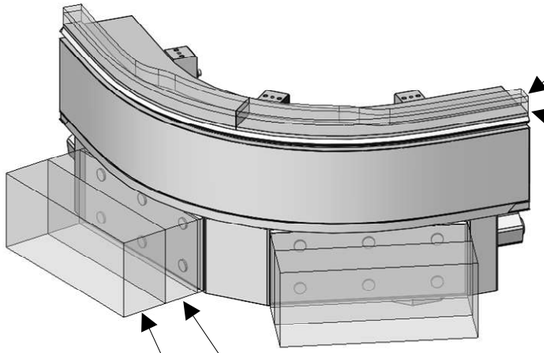
6. 90° Section



When both shuttle wheels are within this region, the profile is straight.

When both shuttle wheels are within this region, the profile is circular.

Transitional profiles minimize jerk for gentle transition to/from curves.

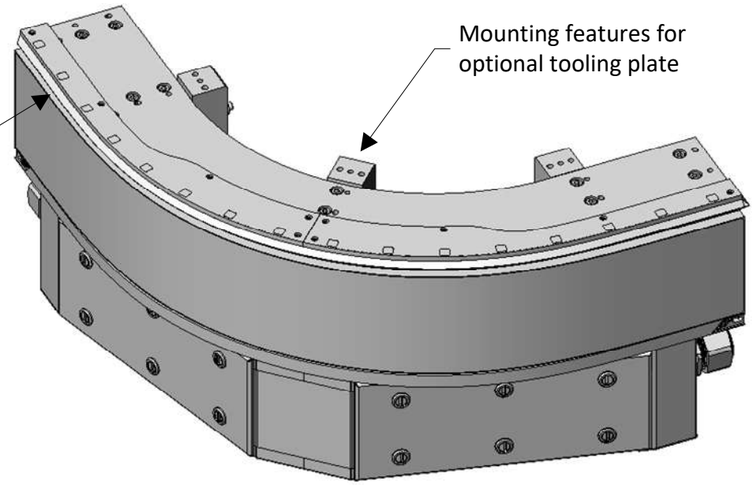


Recommended clearance to replace encoder bracket: 30mm

Minimum clearance to replace encoder bracket: 20 mm

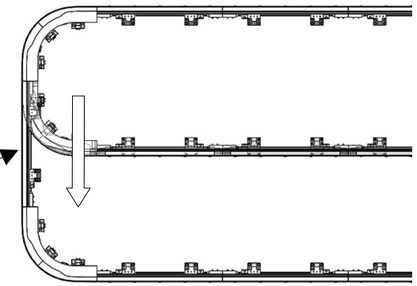
Minimum enclosure clearance: 80 mm

Enclosure clearance: 165 mm

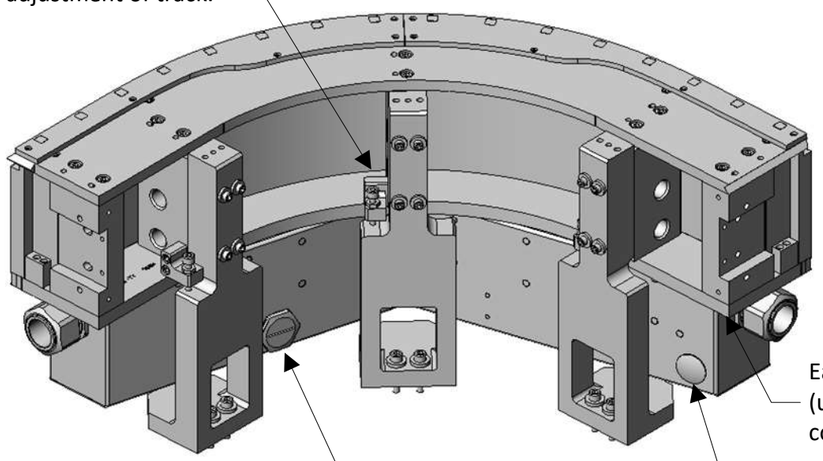


Length is equivalent to 1m of track.

Mounting features for optional tooling plate



Straight sections can be installed between 90 deg. sections.

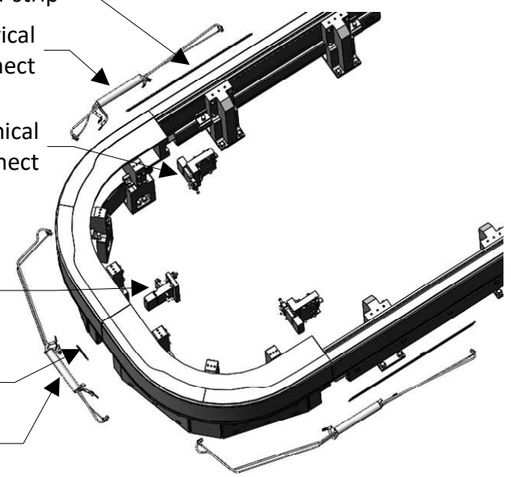


Each stand allows leveling adjustment of track.

Earth-ground connection (under plate, same end as control panel connection)

Control panel connection (required on one curve)

Cable entry location for power supply or IR reader



Straight-to-90 Degree Interconnect Kit (8041325)

Wear strip

Electrical interconnect

90 deg. mechanical interconnect

90 Degree-to-90 Degree Interconnect Kit (7843650)

90 deg.-90 deg. mechanical interconnect

Wear strip

Electrical interconnect

Part Numbers:

90 deg. section	125426817

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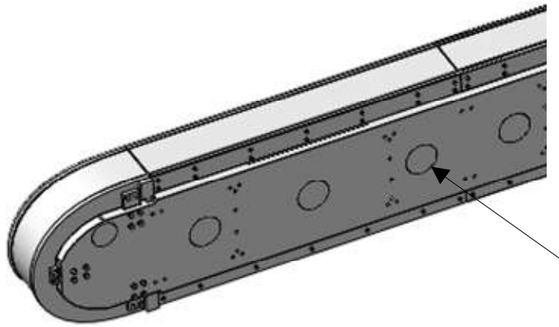
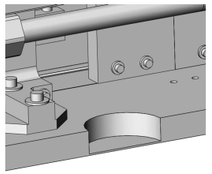
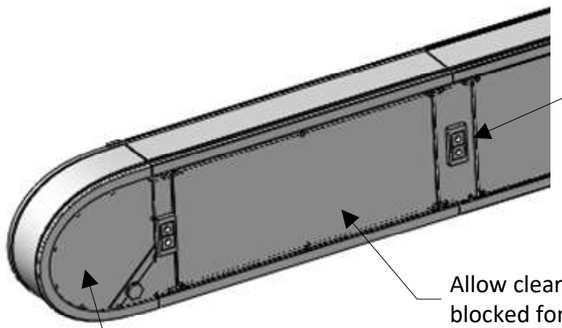
7. Over-Under Configuration

Electrical connections can pass through the front or back of the Over-Under configuration.





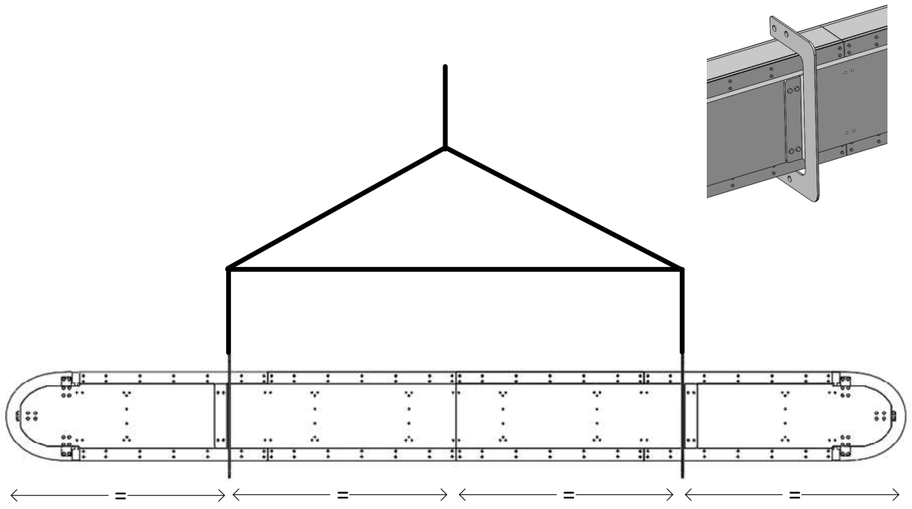
Pockets in aluminum plate allow for installation of electrical pass-throughs.



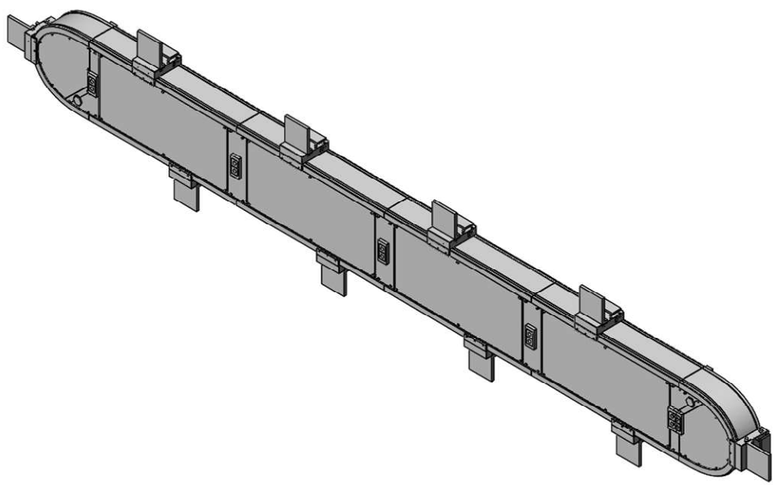
Grommets in the front covers allow cables to pass through the front covers of the conveyor.

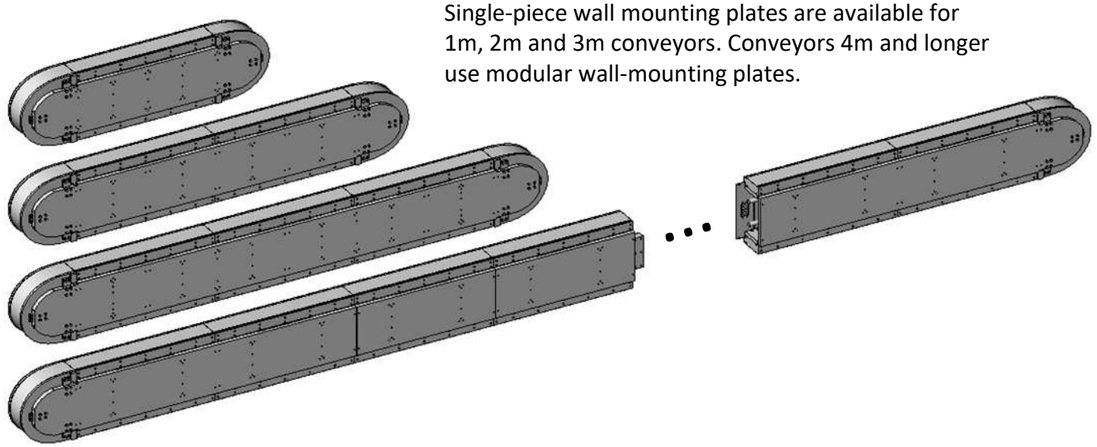
Allow clearance: Minimum 35 mm (if not fully blocked for hand access), conservative 150 mm

Allow clearance: 200 mm



Optional brackets are available for lifting conveyors up to 4m long, or sections up to 5m with one 180 section.
Position the brackets to balance the load on each side of the brackets. A spreader bar must be used so that the lifting force on the brackets is vertical.





Single-piece wall mounting plates are available for 1m, 2m and 3m conveyors. Conveyors 4m and longer use modular wall-mounting plates.

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8. Power Supply

Top View

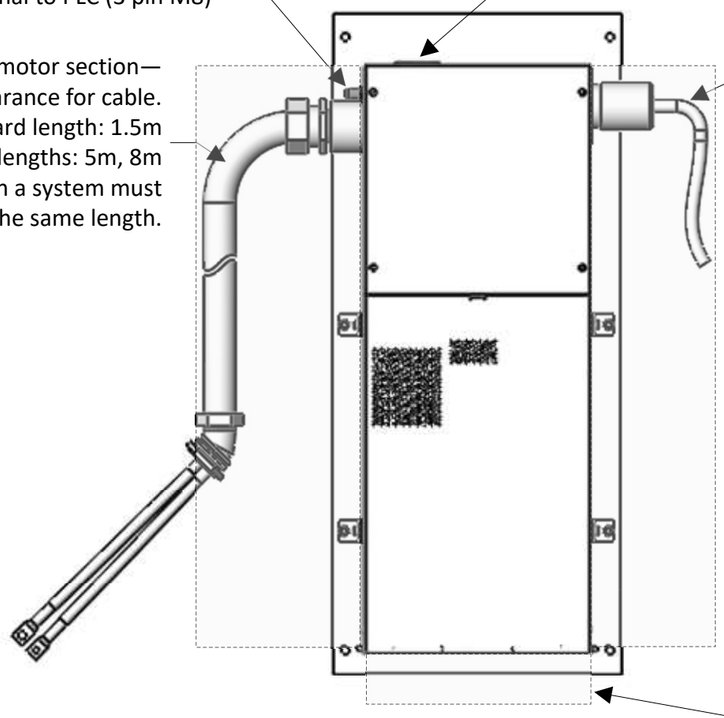
Leave minimum 50mm clearance for cooling air flow.

Output for “Power Supply OK” 24V signal to PLC (3 pin M8)

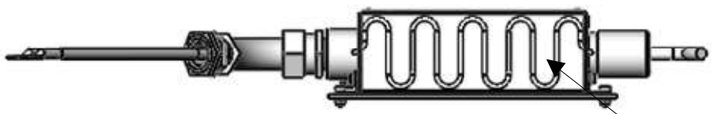
Alternate DC cable orientation

DC power output to motor section— allow 140mm clearance for cable.
Standard length: 1.5m
Optional lengths: 5m, 8m
All cables on a system must be the same length.

AC power input from control panel— allow 100mm clearance for cable.



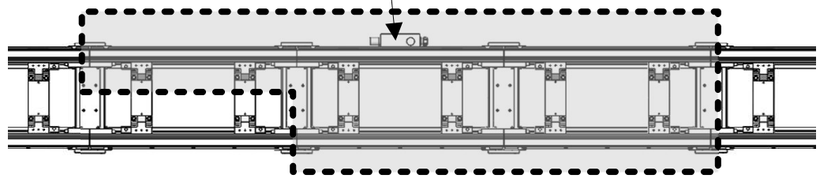
Leave minimum 50mm clearance for cooling air flow and filter replacement.

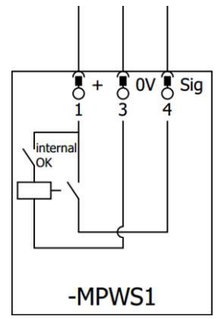


Filter to be replaced when dirty

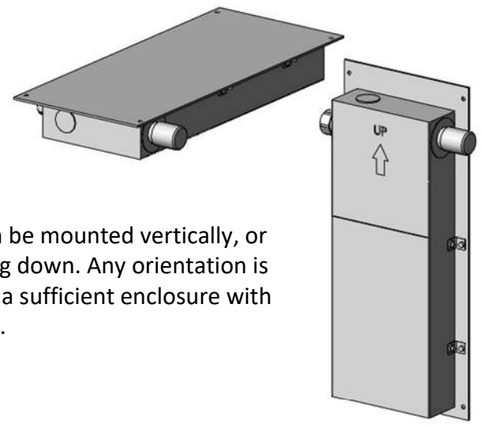
Bottom View

A power supply mounted as shown, can be connected to any of the five highlighted sections with the standard 1.5m cable.





“Power Supply OK” 24V signal



Power supply can be mounted vertically, or horizontally facing down. Any orientation is possible if within a sufficient enclosure with adequate cooling.

Part Numbers:

Motor Power Supply with Mount Plate	25195828
Motor Power Supply	25270337

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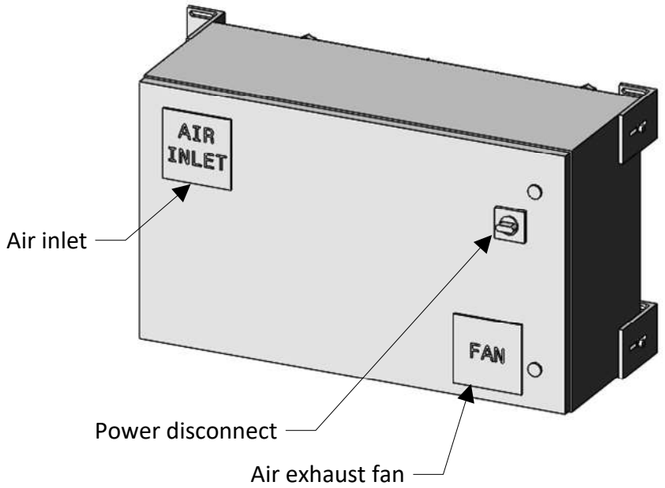
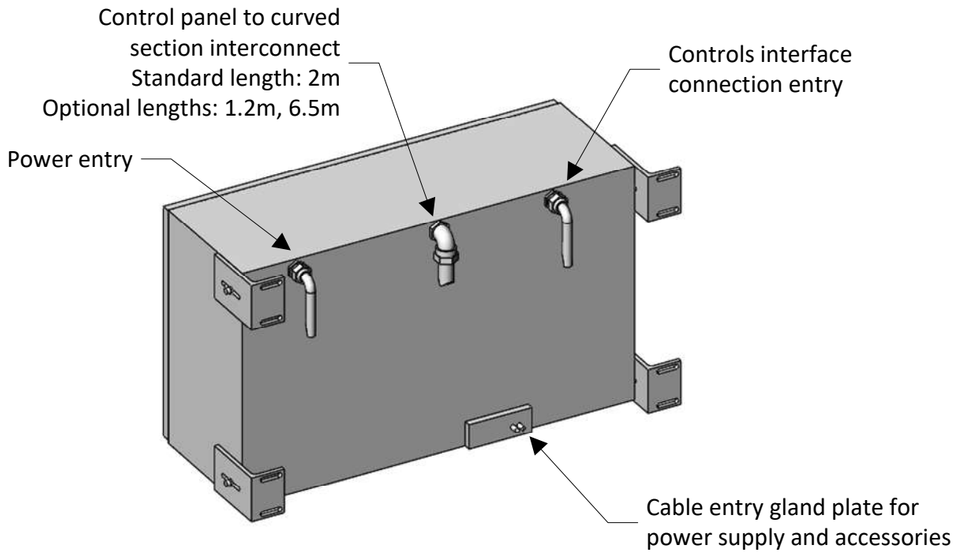
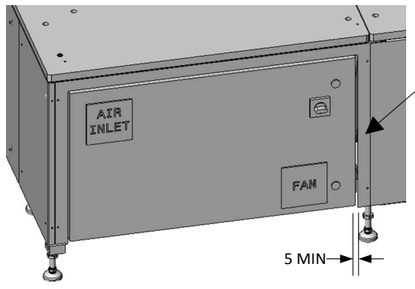
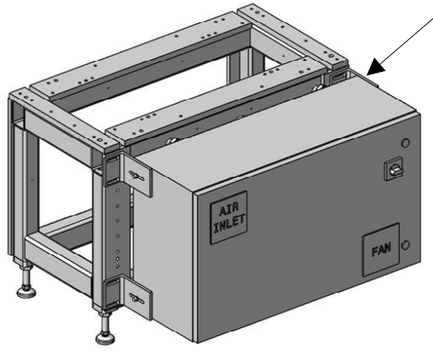
9. Control Panel







The control panel can be mounted flush with table skirting. Allow a minimum of 5mm between the control panel and the skirt.



Standard mounting brackets attached to the control panel allow mounting to frames. They may be removed for alternate mounting.

Interconnect Part Numbers:

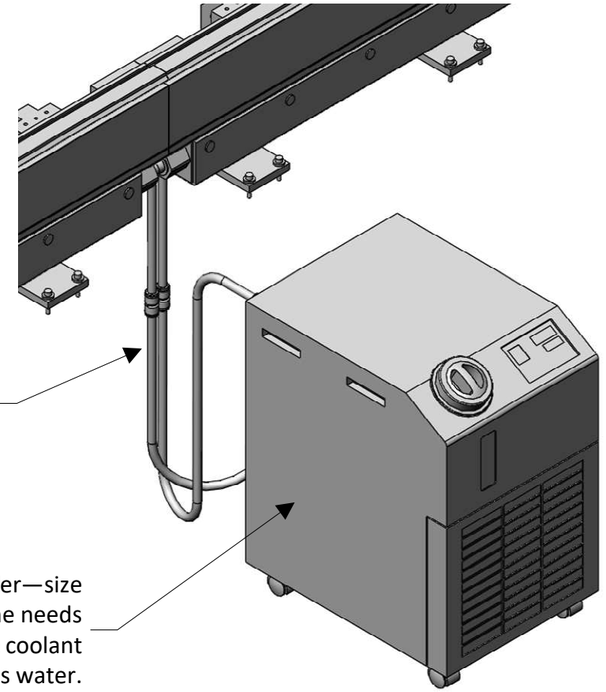
1.2m Control Panel to E-Turn Interconnect	25240470
2m Control Panel to E-Turn Interconnect	125362696
6.5m Control Panel to E-Turn Interconnect	25221246

Control Panel Part Numbers:

25202161	X	X	X	X
	EU	400Y230VAC 50/60Hz		
	NA	208Y120VAC 50/60Hz		
		EC	EtherCAT	
		N	PowerLink	
		EI	Ethernet/IP	
		PR	PROFINET	
			I3	I3 processor
			I5	I5 processor (obsolete)
			(blank)	supports up to 6 power supplies
			E3	supports up to 9 power supplies
			E6	supports up to 12 power supplies

10. Cooling Options

In high-temperature environments, an added cooling system may be required. A cooling system may also be beneficial in situations where the conveyance system transports heavy shuttle payloads, accelerates shuttles at high speeds, or where there is a high-percentage duty cycle. All cooling options are retrofittable.



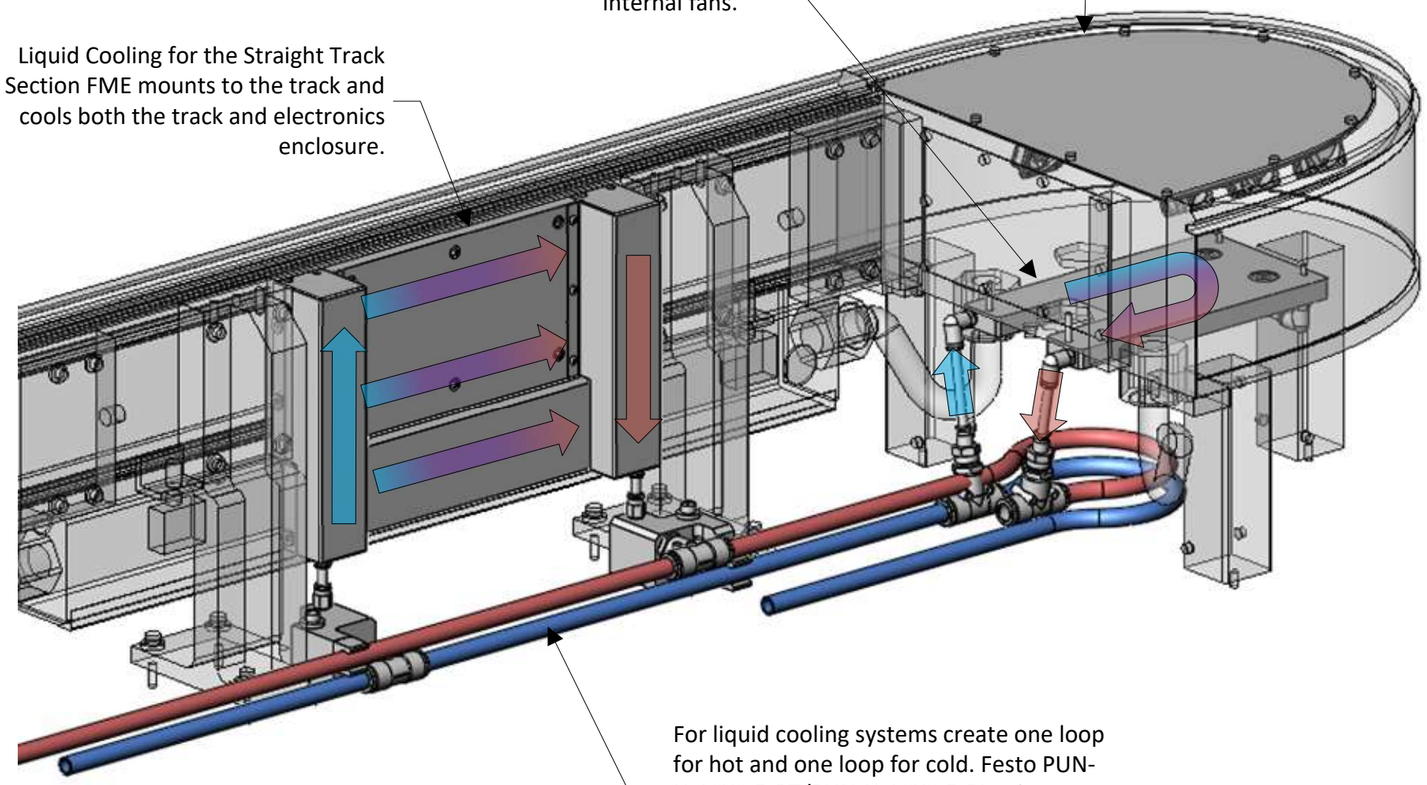
Chiller lines can be spliced between any two sections. The connection should be made so that a reverse return loop is created.

Reference liquid chiller—size chiller according to the needs of the application. The coolant typically used is water.

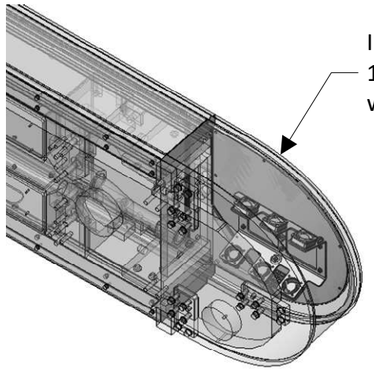
Internal Fans for the 180° Section (500mm) circulate air within the electronics enclosure. May be used alone or with liquid cooling.

Liquid Cooling for the 180° Section (500mm) mounts to the underside of the bottom plate. Use with internal fans.

Liquid Cooling for the Straight Track Section FME mounts to the track and cools both the track and electronics enclosure.



For liquid cooling systems create one loop for hot and one loop for cold. Festo PUN-H-16X2,5-RT/PUN-H-16X2,5-BL tubing is provided to connect adjacent sections. Additional tubing will be required to reach chiller.

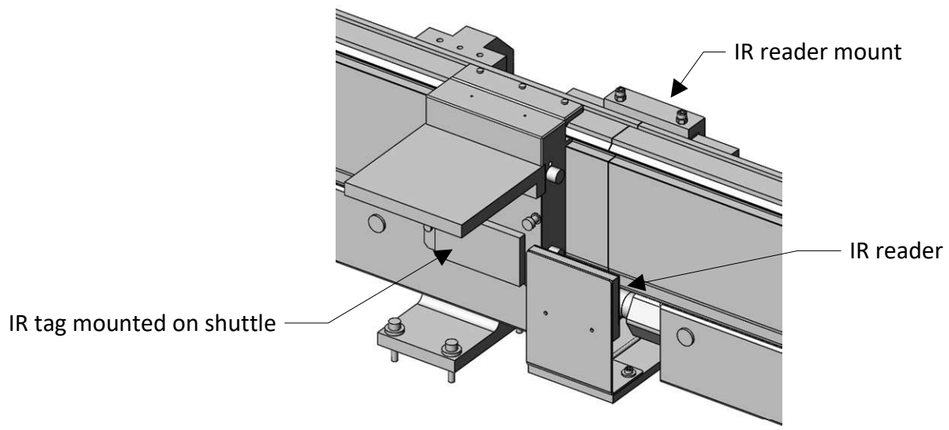


Internal Fans for the Over-Under 180° Section (500mm) circulate air within the electronics enclosure.

11. Accessories and Tools

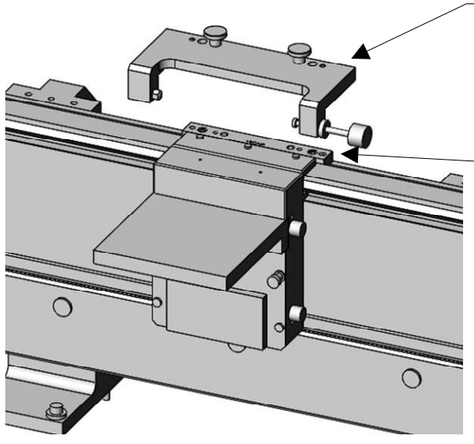
IR Reader and Mount

The IR reader enables on-the-fly reading of shuttle IR identification tags. The mounting bracket allows for convenient mounting of the IR reader at the joint between any two straight sections.



Station Setup Tools

The station setup tools are used to repeatably datum a shuttle during station setup.



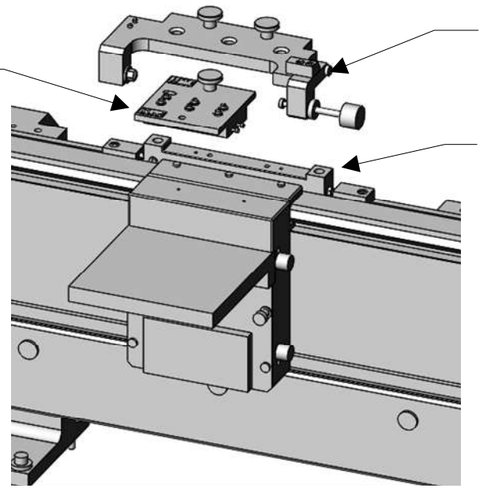
Station setup removable locate – locks a shuttle into a repeatable, known position for station tooling alignment while power is removed from track system. At least one is needed per system.

Station setup stationary mount – provides a fixed mounting surface for the station setup tool. One is needed per station.

Shuttle Setup Tool Kit

The Shuttle Setup Tool Kit is used to align and calibrate shuttle encoder strip assemblies if they are replaced. Only one setup kit is needed per system.

Shuttle setup adjustable chip finder – accurately positions the stationary mount.

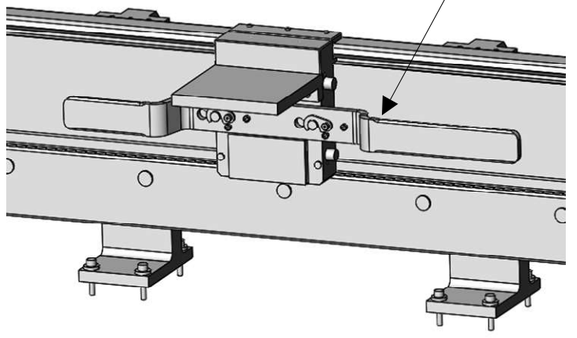


Shuttle setup removable locate – locates the shuttle during adjustment of the encoder strip assembly.

Shuttle setup stationary locate – provides a permanent mounting surface for the shuttle setup tools.

Shuttle Removal Tool

The shuttle removal tool attaches securely to the shoulder bolts on the front of the shuttle, allowing for quick and easy removal and placement of shuttles at any point along straight or curved sections.



Part Numbers:

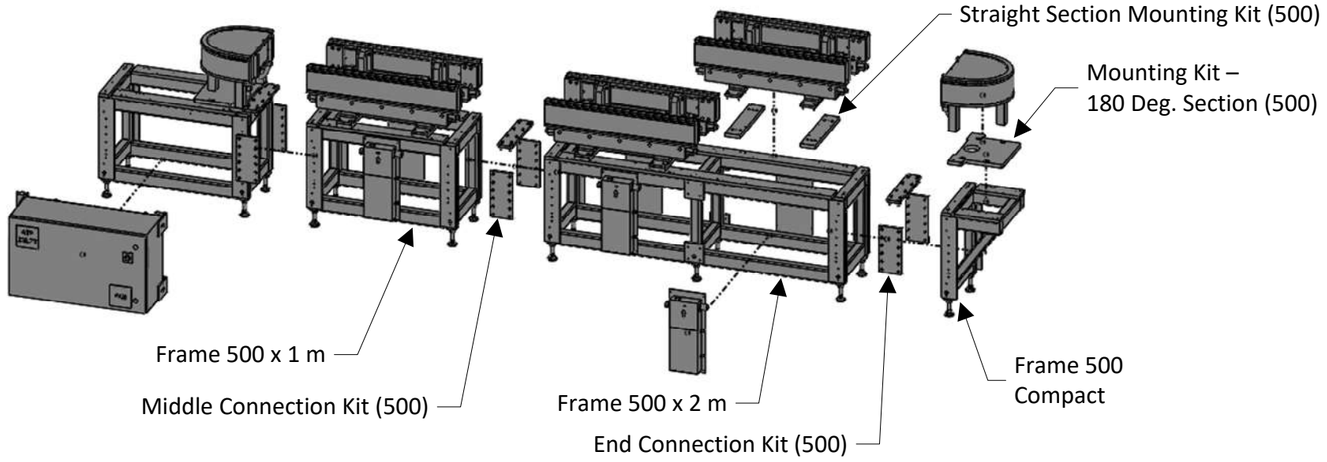
Station Setup - Removable Locate	25202306
Station Setup - Stationary Locate	25202305
Shuttle Setup Tool Kit	4736082
Shuttle Removal Tool	25172729
IR Reader Assembly with Mount	25202309
IR Reader Assembly	SP-25202314

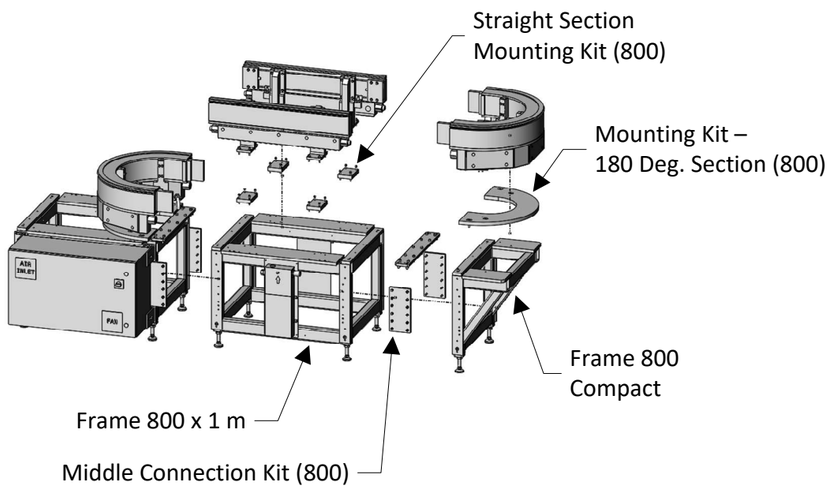
SuperTrak™ CONVEYANCE

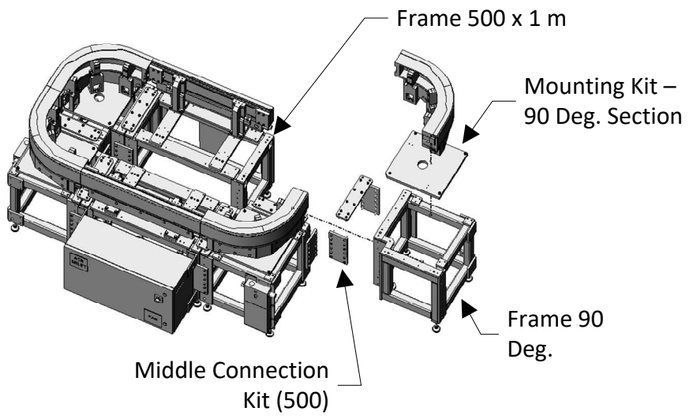
12. SuperTrak GEN3™ “Prolato” Frames

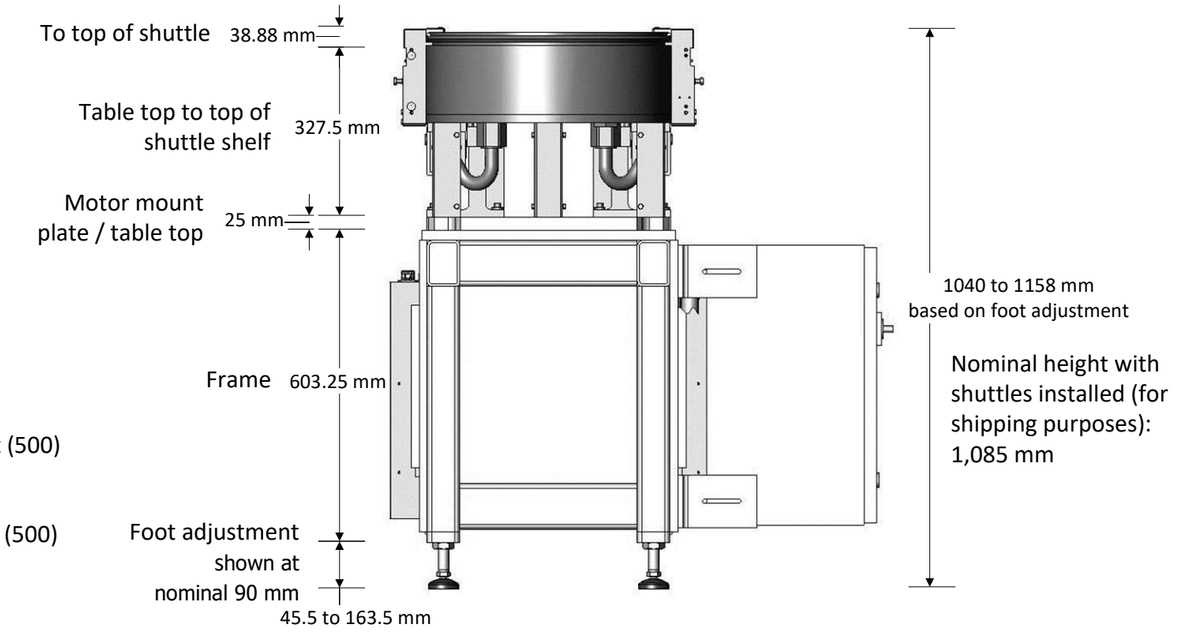
Part Numbers:

SuperTrak GEN3 Frame 500 x 1 m	125354246
SuperTrak GEN3 Frame 500 x 2 m	125767467
SuperTrak GEN3 Frame 500 Compact	125354247
SuperTrak GEN3 Frame 800 x 1 m	125721554
SuperTrak GEN3 Frame 800 Compact	700066211
SuperTrak GEN3 Frame 90 Deg.	125777464
Middle Connection Kit (500)	125354248
End Connection Kit (500)	125354250
Middle Connection Kit (800)	125659677
Straight Section Mounting Kit (500)	125354251
Straight Section Mounting Kit (800)	25249251
Mounting Kit - 180 Deg. Section (500)	125354252
Mounting Kit - 180 Deg. Section (800)	125721562
Mounting Kit - 90 Deg. Section	700052303

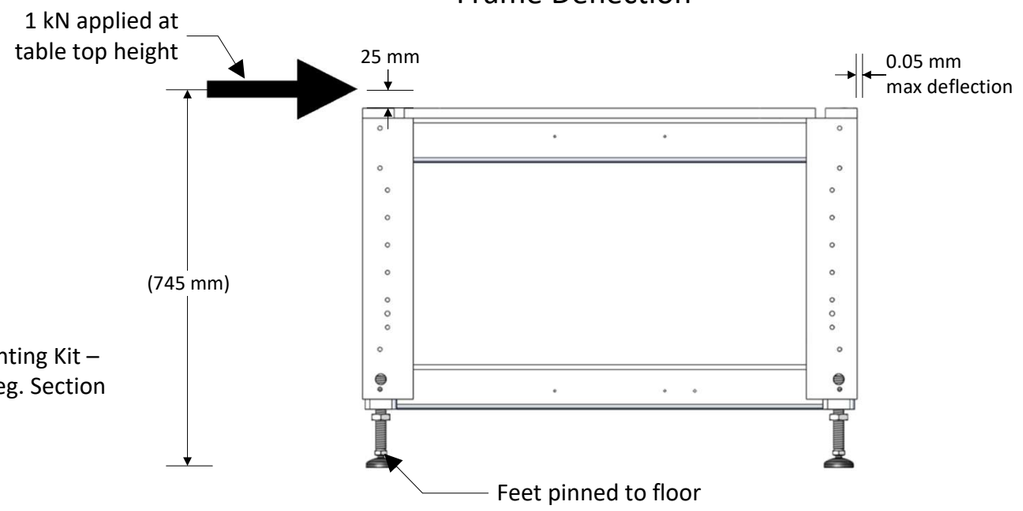






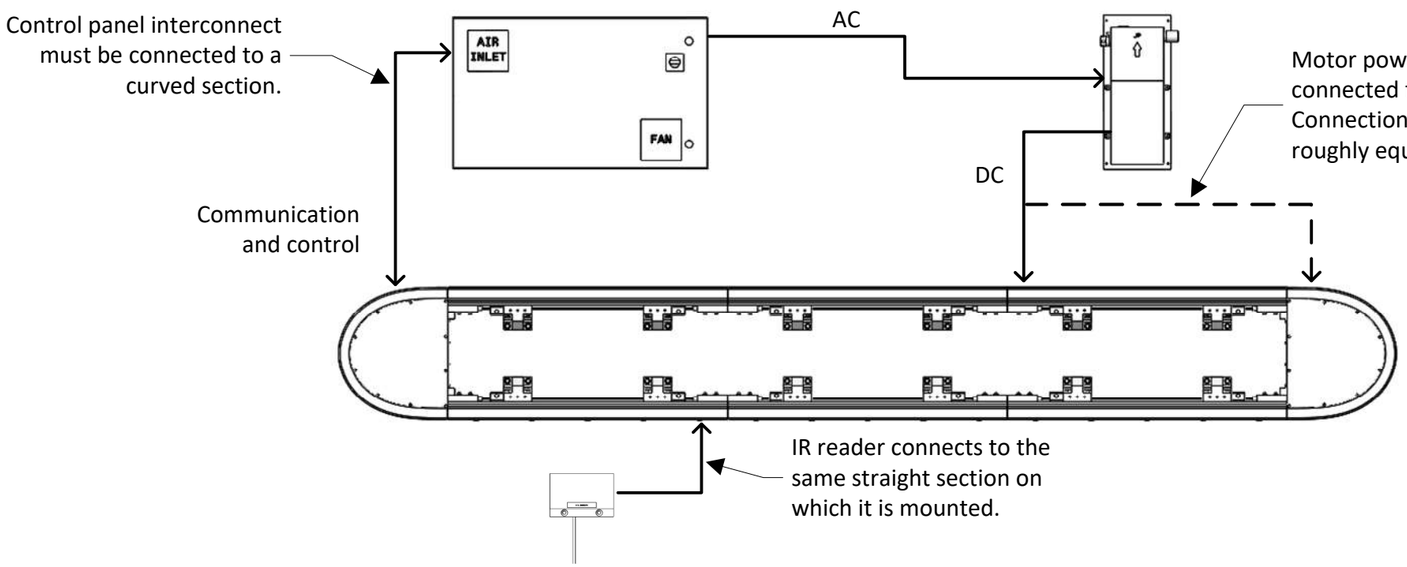


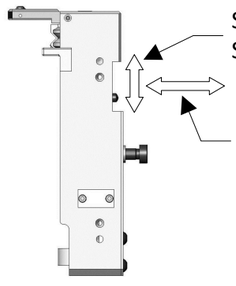
Frame Deflection

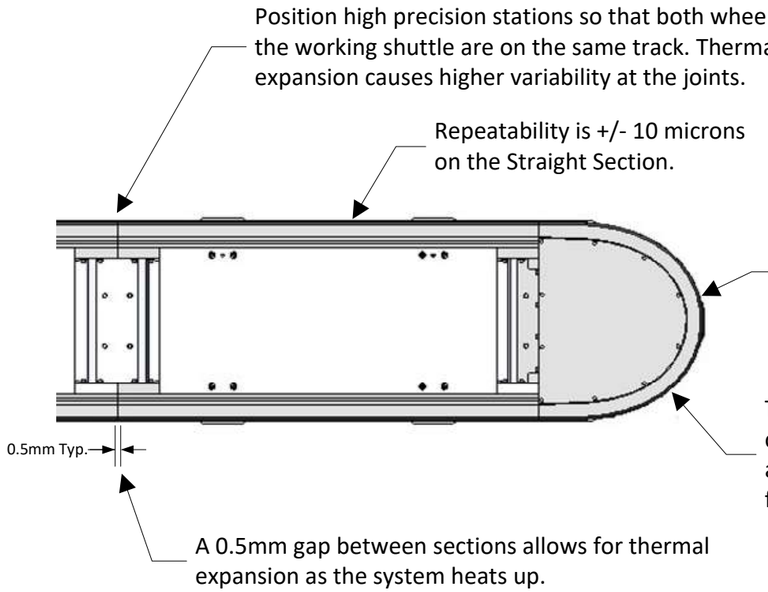


SuperTrak™ CONVEYANCE

13. Power and Performance







Improving Shuttle-to-Shuttle Repeatability:

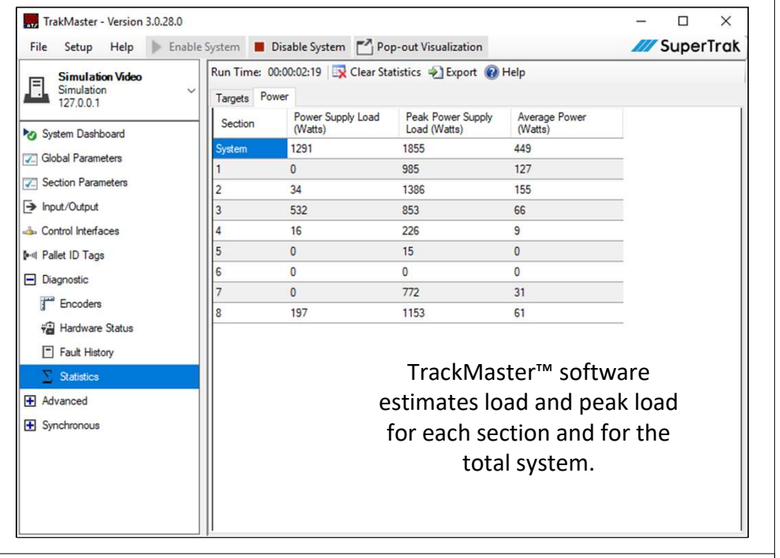
- Include a grind spacer between the tooling shelf and shuttle (see Reference Designs)
- Build adjustability into tooling shelf.
- Use shuttle IR tags and program unique offsets for each shuttle.
- Do not adjust the encoder bracket. Always use software offsets.
- When using vision systems, add fiducials to the tooling plate.

Thermal Considerations:

- All SuperTrak GEN3™ sections are engineered to minimize error due to thermal variations. However sections may warp slightly during thermal cycling.
- Preheat the sections before fine adjustments and before operation.
- Use different calibration values for a cold vs. a warm section.
- For stations requiring precise processes, avoid station tooling at joints due to higher thermal expansion variation.

Power Supply Information:

- Input: 200-240VAC Single Phase 50/60Hz (110-120VAC 50/60Hz – limited power, lab testing only) FLA 10Amps
- Supply voltage to be removed during operator interaction with the track/shuttles
- Supply voltage on/off/on period should be longer than 2 seconds.
- If the system is designed with an extra power supply, the machine can continue running if a power supply faults. The PLC with provide a warning.
- Standard DC cable length is 1.5m. Longer cables are available as an option. All power supplies on a system must have the same length cable to maintain balance.



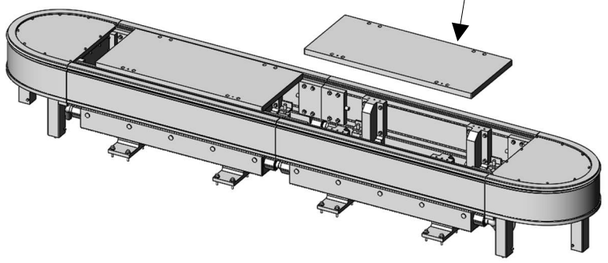
Section	Power Supply Load (Watts)	Peak Power Supply Load (Watts)	Average Power (Watts)
System	1291	1855	449
1	0	985	127
2	34	1386	155
3	532	853	66
4	16	226	9
5	0	15	0
6	0	0	0
7	0	772	31
8	197	1153	61

TrackMaster™ software estimates load and peak load for each section and for the total system.

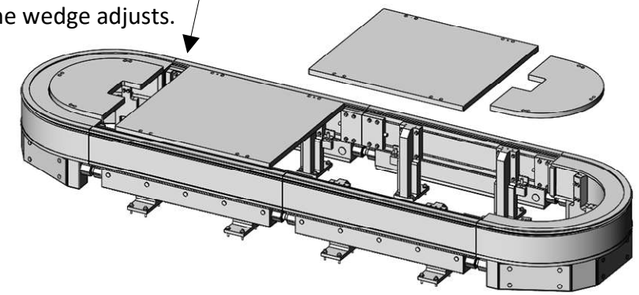
14. Reference Designs

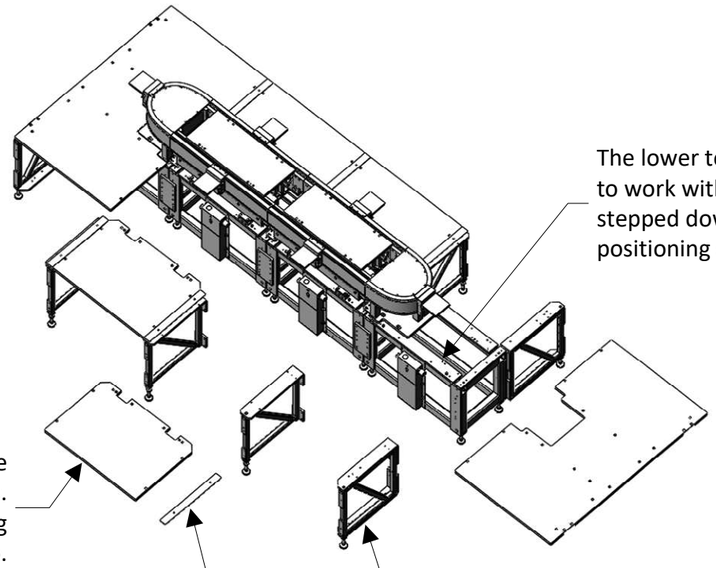
Reference designs can be found in the SuperTrak GEN3 Design Package.

Upper tooling plates mount to the section stands. They can be used to mount tooling inside the SuperTrak loop.



A gap between top plates at joints is recommended to allow for access to the Z-adjust screws and the wedge adjusts.





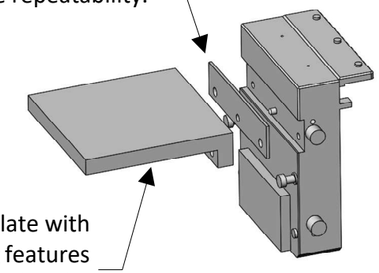
The lower tooling plates are designed to work with MISUMI JPBB12-16 stepped dowels (not included) for positioning on standard frames.

Lower tooling plates mount to the standard frames and table extensions. They can be used to mount tooling outside the SuperTrak loop.

Optional lower deck inlays fill the gap between modular sections.

Table extensions mount to the standard frames.

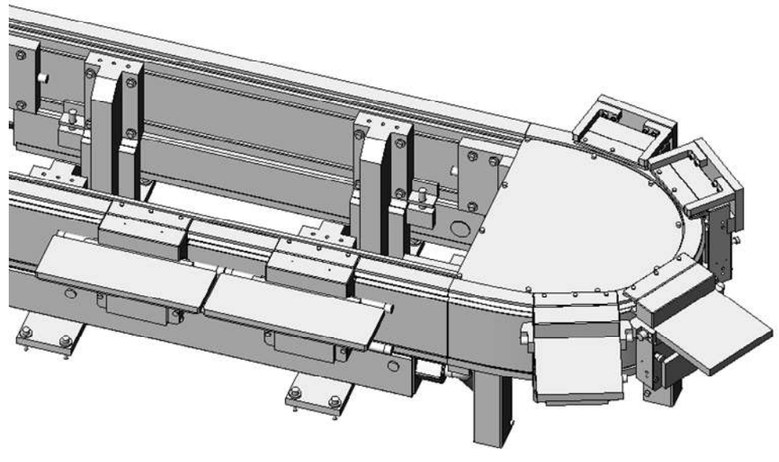
Grind spacer may be used to improve fixture-to-fixture repeatability.



A reference tooling plate with recommended mounting features and tolerances is provided in the Design Package.

Custom Bumpers

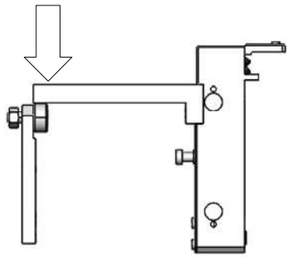
During normal operation, SuperTrak's TrakMaster™ software automatically prevents collisions. However, when power is removed (for example during maintenance), the shuttles can easily be moved manually. Custom extended bumpers can be added to the shuttles to prevent impacts between tooling plates when the plates are wider than the base shuttle. Special bumpers can also be designed to prevent impacts of the encoder brackets on curved sections when frequent manual handling is expected in these regions.



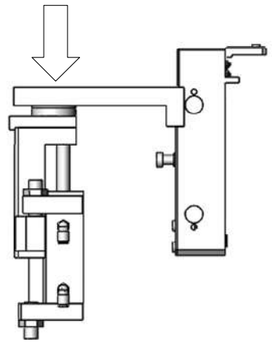
15. Example Solutions

Backups

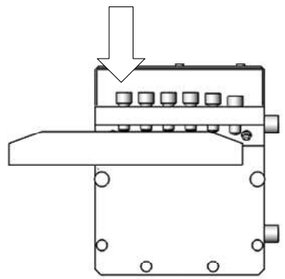
Backups can be added to support the tooling shelf or parts during pressing operations so that the maximum force and moment are not exceeded.



Fixed backup - load is transferred from shuttle to backup only when the shuttle is deflected slightly. It is recommended to use a grindable striker plate with lead-in and a cam follower. Grind each plate to reduce variation across shuttles. The cam follower should be adjusted with a slight air gap (0-0.1mm) on all shuttles.



Active backup - backup extends and is configured to suit applied force.



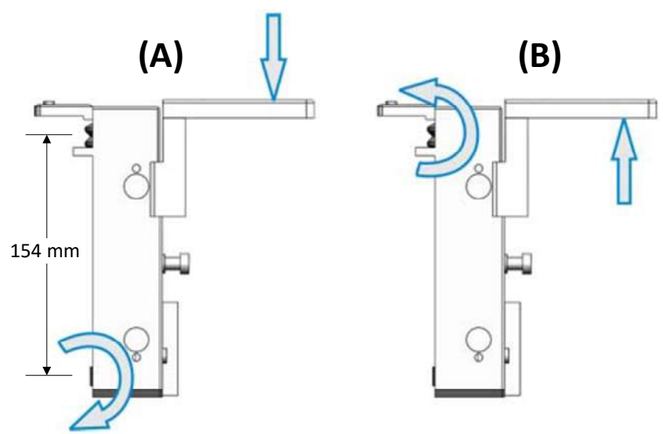
Isolated product - product is supported by auxiliary tooling such that the load is transferred through the auxiliary tooling, not the shuttle.

Maximum force applied up, down, or away from the track: 150 N
Maximum force applied toward the track: 150 N to any wheel
Maximum force applied in the direction of shuttle travel: not rated

Maximum unsupported moment:

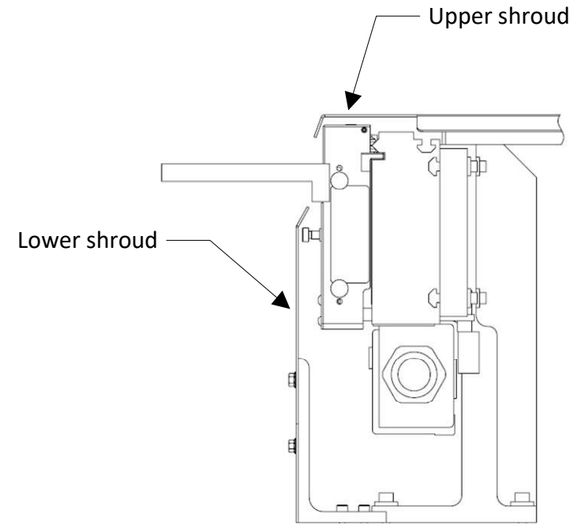
- 2-magnet shuttle: 30 Nm (22.13 ft.-lbf)
- 3-magnet shuttle: 50 Nm (36.88 ft.-lbf)

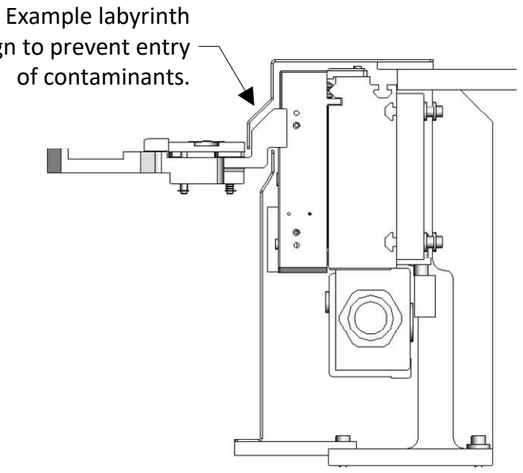
*Applied force/moment includes process force, product fixture weight, and product weight. The rotation point for the moment load is calculated from the flat wheels for downward forces (image A) and from the v-wheels for upward forces (image B).



Shrouding

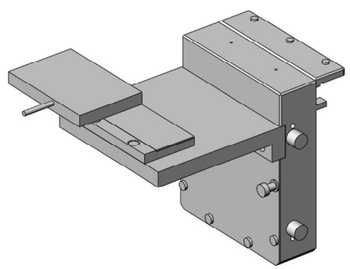
Shrouding can be used to protect the SuperTrak CONVEYANCE™ platform from harsh processes, contaminants and UV exposure, and to improve cleanability.





IR Tag

Alternate mounting is possible if the default IR tag location cannot be used . Maintain standard setup dimensions.



16. Cleanroom Considerations

Although the the SuperTrak CONVEYANCE™ platform does not have a formal cleanroom certification, it is commonly used in cleanroom environments where the full system requires cleanroom specifications. In effect, it is possible to incorporate the SuperTrak system into cleanroom machines. To be clear, it is the “full, automated machine” that needs to be certified, not just the conveyor.

Generally, the SuperTrak CONVEYANCE™ platform has been comfortably used in applications requiring Class 1000, ISO6 with application design considerations.

Depending on the environment’s required class of cleanroom, there are various measures that can be taken to ensure compliance and pass the overall machine classification. Keeping in mind that the ONLY contact surfaces are the shuttle wheels, here are some considerations that have been used in aggressive cleanrooms.

- Keep the product fixturing above the shuttle wheels—mount the parts high on the shuttle above sources of particulate.
- Maintain downward air flow to force particulate down and away from the working surface.
- Install shrouding over the base shuttle (see shrouding examples) to separate the product from the shuttle.
- Install shrouding AND negative air pressure within the shrouding to further ensure particulate is contained.

17. Simulation Considerations

A simulation can help to:

- Identify areas requiring additional shuttle queueing
- Determine the correct number of shuttles required to achieve the desired throughput
- Validate the number of required power supplies
- Determine the number of shuttles per minute that the machine will achieve
- Provide feedback regarding shuttle move times or shuttle exchange times
- Identify the machine bottlenecks
- Create a visualization of the working machine

A simulation requires the following inputs:

- Desired machine throughput (parts per minute)
- Payload (includes product and shelf/product fixture)
- Shelf/product fixture width (in the direction of product flow)
- Number of parts per shuttle
- Pitch between the parts on the shuttle
- Shuttle flow direction (CCW or CW)
- Machine layout showing process station locations
- Process station information for each station, including:
  - Number of identical parallel stations (for example, a shuttle only needs to stop at one of the parallel stations)
  - Number of parts worked on at a time
  - ON shuttle working time (how long the shuttle must be stationary for the process to complete)
  - OFF shuttle working time (the time required between shuttles for the station to prepare for the next shuttle)