Belt Conveyors

(5362i)

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Product Highlights

- Independent, stand-alone programmable logic controllers.
- Quick-adjust/slide width support assemblies.
- Built-in SMEMA communications interface.
- Variable speed drive motors.
- Configurable length.
- Configurable multi-belt section (buffer) transfer assemblies.
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Introduction

Universal’s model 5362i conveyors are “state-of-the-art” board handling modules designed to operate in a multitude of printed circuit board (PCB) assembly environments. These modules are engineered for smooth material transfer in order to meet the stringent requirements of today’s electronic assembly processes.

The modules are capable of transporting PCBs between a variety of board assembly process stations and can be configured with respect to height, depth, transfer speed, and travel direction. Designed with the end-user in mind, our conveyors provide trouble-free operation and transparent support to core assembly process equipment.

Additionally, Universal’s 5362i conveyor modules are reliable, flexible, and are supported by in-house process configuration experts. They excel with regard to ergonomic design and aesthetic qualities, such as professional appearance, consisting of clean-room compliant colors that can be customized upon request.

The following configurations of conveyor modules are available:

- Edge-guide belt conveyors
- Floor-style conveyors
- Overhead-style conveyors
- Work stations

Functional Description

The various configurations of 5362i conveyors play a vital role in any line of automated printed circuit board (PCB) assembly equipment. By reliably ensuring that boards are presented to assembly process machines, the conveyors act as a “transparent” support mechanism. Whether equipped with belt or roller chain, configured as single lane or dual lane, PCB movement can be programmed in such a way as to further exploit intrinsic operational characteristics, such as board speed-up and subsequent slow-down for beginning and end of travel of the conveyor.

The 5362i conveyors facilitate ESD-safe and expeditious transfer while ensuring that risks associated with transporting partially/fully populated PCBs are minimized.
The following are categories of conveyor modules currently offered by Universal:

- Single lane conveyors
- Special application conveyors
  - Dual lane (see Appendix A)
    - Rails comply with SMEMA specifications (dual lane standards)
  - Maximum board width – 50.8mm to 215.9mm (2.0” to 8.5”)
  - Supports 1-4 belt sections
  - Incline/decline
  - Narrow depth (limits maximum board width)
  - Pitched – for ergonomic manual assembly
  - Combination incline/decline – for wave solder exit & transition back to standard line transfer height
  - Non-powered slide line – for manual assembly operations

Information regarding all but the dual-lane special application conveyors is contained in Appendix B.
Standard Features

**Independent programmable controller** - Use of standard components such as programmable controllers, motor drives, and point-to-point wiring allows for commonality in design across product lines.

**Quick-adjust/slide width support assemblies** - Innovative width support extrusions offer smooth, quick adjustment. The depth of the conveyor can be cut according to specifications.

**Built-in SMEMA communications interface** - Built-in SMEMA 1.2 up-line/down-line standard communications interface allows for integration to SMEMA compliant modules for “plug-and-play” compatibility in board passing protocol.

**CE compliant** - All 5362i-conveyor modules carry the CE mark. This is a necessity in the European communities and a benefit to the rest of the world.

**Variable speed transfer drive motors** - Variable speed independent transfer drives allow for matching up-line/down-line process speed modules and, as a standard feature, offer “speed in/speed out” compatibility when interfacing with process ovens.

**Configurable conveyor length** - The transfer rail assembly allows a conveyor to be built to specification, easing manufacturing issues and adding in flexibility during line configuration.

**Configurable multi-belt section (buffer) transfer assemblies** - Features such as multiple belt sections, inspect/transfer, and board pushers are functions supported on standard conveyors. Additional functionality, such as bar code readers, board stops, and locators, is available.

**E Stops** - Standard on all units.
PC Board Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>76.2mm – 508mm (2” – 20”)</td>
</tr>
<tr>
<td>Width</td>
<td>50.8mm – 457.2mm (2” – 18”)</td>
</tr>
<tr>
<td>Thickness</td>
<td>0.64mm – 3.18mm (0.025” – 0.125”)</td>
</tr>
<tr>
<td>Weight</td>
<td>3.18 kg (7 lbs.)</td>
</tr>
<tr>
<td>Standard Edge Clearance</td>
<td>3mm (0.120”))</td>
</tr>
<tr>
<td>Warpage Sag</td>
<td>3.18mm/mm max. (0.125” max.)</td>
</tr>
<tr>
<td>Length:Width Ratio</td>
<td>1:1 min.¹</td>
</tr>
<tr>
<td>Maximum Height</td>
<td>50.8mm (2.0”) above board clearance</td>
</tr>
<tr>
<td></td>
<td>25.4mm (1.0”) bottom-side clearance²</td>
</tr>
</tbody>
</table>

¹ Length can increase
² Includes PCB thickness

Temperature Thresholds

<table>
<thead>
<tr>
<th>Belt Material</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intermittent Temperature</td>
<td>107° C maximum (-10° to 225° F maximum)</td>
</tr>
<tr>
<td>Continuous (Ambient)</td>
<td>121° C maximum (250° F maximum)</td>
</tr>
</tbody>
</table>

Note: High temperature belts (intermittent operation up to 325° F maximum) are available in a variety of lengths.

Alert! – If your board does not comply with any of the above specifications, please contact the System Applications Group for available alternatives.

Code Compliance Statement

Any code requirement/approval other than UL, CSA, or CUL can be provided at our manufacturing facility in Binghamton, NY upon request. Please consult the System Applications Group for cost and lead-time.
Conveyors are configured with a snap-in card guide design.

Standard 3mm edge clearance card guides are manufactured from static dissipative ultra high molecular weight plastic (UHMW). This material has a low coefficient of friction as well as excellent wear characteristics. Card guides provide edge clearances of 3mm and 5mm are available upon request.

For ceramic applications, steel card guides are available.

Standard belts are available in various lengths up to a maximum length of 2032mm (80”). Minimum belt section length for a multi-belt conveyor is 171.5mm (6.75”). The minimum belt section length for a single-belt conveyor is 279.4mm (11”).

High temperature belts are available in limited lengths. These belts may be required when handling PC boards that have not cooled to less than 37.8° C (100° F).

Grooved belts are available for any product less than 0.635mm (0.025”) thick (PCMCIA boards) - diagram required.

Maximum board weight is 2.27 kg (5 lbs) for the belt.

Units up to 6.10m (20’), overall length, are made from individual 558.8mm (22”) belt sections (rail extrusion is continuous).

ALERT! If you have requirements outside these limits, contact the System Applications Group for special applications.
Conveyor Belt Drive

Conveyor Belt Drive
Universal Instruments Conveyor Systems use Belt Guided Transfer Sections to move product through the conveyor module. The belts are positioned to provide friction drive along the front and rear edges of the PCB, as it is edge guided through the conveyor. Belt material is continuous, antistatic, woven fiber, impregnated with conductive carbon filled neoprene. The following ESD characteristics apply to belt material:

All conveyor components that come in contact with the product comply to Static Dissipative ratings. This specifies measured surface resistivity of $10^6 - 10^9$ ohms/sq.

Each Belt Section has a photoelectric sensor and is capable of buffering one board. Boards automatically pass to the next section once that section is free. This provides a smooth flow, maintaining spacing between PCBs at all times.

Belt Drive System
Belt Transfer Conveyors use independent motors for front and rear drive system. Both motors are wired in parallel to a single motor drive. This keeps mechanical hardware between front and rear transfer rails to a minimum. The independent motors are positioned in a direct-drive mounting bracket that eliminates the need for any gear reduction or couplings.

The motors used on belt sections are PITTMAN model GM9234 Brush Commutator type.

Motor Specifications:

- Internal Gear Ratio: 11.5:1
- Max. Operating Voltage: 38 VDC
- Max. Operating Current/motor: 0.3 amps
- Max. Belt Load: 2.27 kg (5 lbs.)
- Belt Speed: 12.7mm - 508mm (0.5” - 20”)/sec
- Duty Cycle: 50% maximum, total cycle 60 sec
- Electrical Connection: Supplied with 1.83m (72”) of wire, terminated at screw-in terminal blocks.
**Speed Adjust**

Speed is set via panel mounted potentiometers located inside the control enclosure. A feature of the conveyor system provides for two-speed operation on the last belt section. There are two potentiometers provided for this feature. This feature allows for an exact belt speed match to upline and dowline equipment. The switch from speed one to speed two occurs when the board reaches the photoelectric sensor at the end of the belt section. The actual range of speed can be adjusted from 12.7mm to 508mm (0.5" to 20") per second.

**Flat Belt**

Flat belt conveyors are available for back end/final assembly applications where board orientation is no longer a priority. All flat belt sections are made of black, antistatic, urethane coated polyester that can withstand board/component temperatures up to 230º F (110º C). Load capacity is contingent upon conveyor size, incline, motor position, accumulated loads and other factors. Flat belt widths range from 5.08mm - 61mm (2" - 24") and nominal conveyor lengths from 61mm - 365.8mm (24" - 144"). The 2.54mm (1") diameter drive spindle rotates approximately 8.89mm (3.5") of belt per revolution.

The motors used on flat belt conveyors are Dorner model 22-010R-3115-7.

**Motor Specifications:**

- **Internal Gear Ratio:** 10:1
- **Operating Voltage:** 115 VDC, 50/60 Hz single phase
- **Max. Belt Load:** 22.68 kg (50 lbs.)
- **Belt Speed:** 4.88m - 6.1m/sec. (16’ - 20/sec.)
- **Torque:** 2438.4 mm/kg (96”/lb.)

**Drive Specifications:**

- **Manufacturer:** DART model 123D
- **Input voltage:** 36 VAC
- **Output voltage:** 0-36 VDC
- **Max. output current:** 150mA – 5.5A

**Alert!** If you have requirements outside these limits, contact the System Applications Group for special applications.
Roller Chain

- Edge clearance 3mm/5mm/0.250mm.
- Rollers (free spinning), with stops available for continuous run operation.
- Stationary chain plates available for incline/decline operation.
- All material is static dissipative (10^6 - 10^9 ohms/sq) to avoid damage of static sensitive components.
- Material is resistant to fluctuations in temperature typically associated with input and exit from process oven.
- Maximum board/pallet weight is 5.44 kg (12 lbs.) for roller chain.

ALERT! If you have requirements outside these limits, contact the System Applications Group for special applications.

Un-driven Belt Sections

- Belt sections with no drive mechanism for manual assembly / slide lines are also available.
- UHMW card guide and support provides low coefficient of friction to allow effortless passing of PC boards/pallets from operator-to-operator in a manual assembly area.

Width Adjust Options (standard single lane conveyors)

The 5362i conveyor can be configured with a wide range of width adjust options to meet specific application requirements. These options are designed to reflect the varying requirements that exist within each manufacturing environment and allow each manufacturer the flexibility to select the configuration that is optimum for their manufacturing needs.

Manual Slide Width Adjust

This configuration is designed for manufacturing systems with moderate to moderately high width change requirements. The conveyor rear rail is mounted on a slide mechanism that is manually adjusted to match board width requirements. The slide design requires no tools for adjusting to different widths and changes can be performed quickly (per conveyor).
Hand Crank Width Adjust

This configuration is also recommended for moderate to moderately high changeover requirements. The conveyor rear rail is mounted to lead screws that are adjusted through a manually operated hand crank. Product width changes can be performed quickly (per conveyor).

Programmable Width Control (PWC)

This configuration is recommended for high changeover requirements. PWC utilizes the same lead screw design as the hand-crank adjust, but incorporates a rear rail drive system for adjusting the conveyor width. A thumb-wheel mounted on the front of the conveyor is used to manually enter the board size value, the conveyor rear rail automatically drives to the new board dimension. Width changes can be performed quickly (per conveyor).

The standard controller used is an Allen-Bradley MicroLogix 1000 series controller. All inputs are solid state and are wired such that applying positive 24 VDC will energize the input. Of the 12 outputs, the first two are dry contact relay outputs, and the remaining 10 are solid state and are wired such that each one supplies 24 VDC when it is energized. Power is supplied to the controller from the 24 VDC-power supply for the control system.

Available Options

- Adjustable debounce timers for all sensor inputs.
- Adjustable transfer error timers to accommodate various belt speeds.
- Board output pace delay, for spacing boards exiting the conveyor.
- Up to two inspect stations per conveyor.
- Speed-out adjustments on last belt section of all conveyors.
- Short pusher for pushing into non-driven board handling equipment.
- Selectable error handling –
  1. Error only on boards entering conveyor or remaining over sensor.
  2. Error on all missing boards and failed transfers.
A hand held programmer is available to allow customizing of parameters for individual conveyors. The hand held programmer can be used to adjust or enable/disable all options listed above.

In addition, the hand held programmer can store approximately eight unique programs. This allows for backups to be maintained in case of a controller failure and replacement. These programs are stored on a FlashProm cartridge in the hand held programmer, which can be removed and replaced to allow more programs to be stored.

All control devices (relays, push-button/lights, solenoids, light towers, and sensors) are operated at 24 VDC. This is a common control voltage, which facilitates easy modifications and spares replacement.

The motor drives are powered by 36 VAC. This allows the drive to create a DC bus for the PWM output which does not exceed the voltage capability of the motors.

Flag and Follow

This configuration is recommended for very high, fully automated changeover requirements. The Flag and Follow option utilizes the same mechanical mechanism as the PWC, excluding the digital width setting, but the board width adjustments are triggered by either upline process machine width changes or, with the first conveyor in line, downline process machine width changes. Width changes can be performed extremely quickly.
Corporate Specifications

Equipment produced by Universal is designed and manufactured in accordance with accepted practices, specifications and standards for industrial equipment. Specifically our equipment has been inspected to ANNEX I EC Machine Directive, EN 292 Safety of Machinery, EN 294 Safety of Machinery, EN 349 Safety of Equipment and EN 60-204 General Requirements of Industrial Machines. When determining what standards to use both US and European standards were considered. It was felt that the EN or European requirements were equal to, and in most cases exceeded, the US requirements. Therefore the international requirements were followed.

Universal welcomes the inspection of the quoted equipment by the customer’s authorized representative to assure compliance to specific requirements. Additions to, or modifications of, the equipment to assure compliance will then be quoted on a time and materials basis.

Integration

All 5362i conveyors transfer boards based on the protocol described in SMEMA standard version 1.2. A 14-position socket connector is provided on each side of the machine for the electrical connection to adjacent machines. An adapter cable is used on the down-line side of the machine to provide a 14-position pin connector to the down-line machine, to be compliant with the SMEMA standards.

Currently, the SMEMA dual lane standard is in a draft state. However, all 5362i dual lane conveyors comply with the electrical portion of the draft. Mechanically, all 5362i conveyors are capable of complying with the draft, however the configuration of the rail locations is determined by the customer and is sometimes specified to be different than the dual lane SMEMA-specified position.
Appendix A: Dual Lane Conveyors

The 5362i conveyors are available configured with dual lane transfer rails. Dual lane use includes, but is not limited to, the ability to:

- Run multiple products simultaneously
- Perform double sided assembly without modification or excessive use of floor space
- Run prototype boards while simultaneously running production boards

The technical specifications corresponding to the physical operational characteristics are standardized by SMEMA. The characteristics primarily pertain to the relationship between rails and width, but also include total conveyor height. The following diagram contains a graphical representation of the fundamental SMEMA dual lane standards.

Front

Rails 1 & 3 = Fixed
Rails 2 & 4 = Adjustable
Additionally, Universal’s 5362i conveyors are compliant with the following SMEMA standards:

<table>
<thead>
<tr>
<th>Item</th>
<th>SMEMA Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conveyor Height</td>
<td>Each machine must have the transport conveyor height adjustable from 939mm to 965.2mm (37” to 38”) from the floor to the bottom of the PC board.</td>
</tr>
<tr>
<td>Conveyor-Lane Width</td>
<td>Each conveyor must be able to be independently adjusted for 50.8mm to 215.9mm (2.0” to 8.50”) wide boards.</td>
</tr>
<tr>
<td>Conveyor Spacing Between</td>
<td>The distance between rail 2 and 3 must adjust to a minimum spacing of 35mm (1.38”).</td>
</tr>
<tr>
<td>Center Lanes</td>
<td></td>
</tr>
<tr>
<td>Conveyor Fixed-Rail</td>
<td>Rails 1 and 3 must be able to be fixed at a spacing of 251mm (9.88”) apart. All but rail 1 can adjust, but at a minimum, rails 2 and 4 must be able to be adjusted.</td>
</tr>
<tr>
<td>Configuration</td>
<td></td>
</tr>
<tr>
<td>Asynchronous Control</td>
<td>Asynchronous control of the two lanes must be available. Asynchronous control is defined as the ability to move each conveyor independent from the other and at different times.</td>
</tr>
</tbody>
</table>
Appendix B: Special Application Conveyors

Incline/Decline Conveyors
For applications requiring interfacing between SMEMA and non-SMEMA transfer heights and for applications requiring non-horizontal product transfer, our incline/decline conveyors are available. Consistent with regular conveyors in all but the support mechanism, incline/decline conveyors are available in a variety of configurations, consistent with those identified above. The conveyor legs are adjustable with a pivoting member attached to the bottom of the module’s frame.

Narrow Depth Conveyors
Narrow depth conveyors are specially designed to accommodate the precise requirements of applications where product will be limited to a finite range of small sizes. Conveyors configured as narrow depth are limited to maximum board sizes of 254mm (10") and 355.6mm (14"), although special requests can be accommodated.

Pitched Conveyors
Our pitched conveyors have been designed to ergonomically address requirements for final assembly where assemblers will manually manipulate product while it is physically located on the conveyor. The modules are tilted towards the user, available with angles from 0° to 30° in order to satisfy virtually any application specific requirements.

Combination Incline/Decline
Primarily used for wave solder entrance and exit applications, these modules can be configured with edge belt, roller chain, or flat belt transfer mechanisms to suit a variety of application specific requirements. Edge belt and roller chain conveyors of this type are 2.44m (96") long and can return a board to a horizontal orientation from the exit angle of a wave solder machine.
Our flat belt combination conveyor requires less floor space to return a board to its horizontal orientation because of the reduced restriction for board alignment as the board is transitioned from the exit angle of the wave solder machine to the horizontal orientation of the board.

Applications containing edge or roller chain transfer mechanisms down-line of our incline/decline conveyor must use the same transfer configuration due to board alignment.

Non-Powered Slide Line
Our non-powered slide line of conveyors contains no motors or belts for product movement. Product is moved by line personnel, typically assemblers, and rests on a lip of UHMW for movement. Applications requiring non-standard assembly progression and/or high labor input typically call for our non-powered modules.