Universal Part Number: GS-417-00
Reference Configuration #49992001

Issued 5/05

POLARIS™

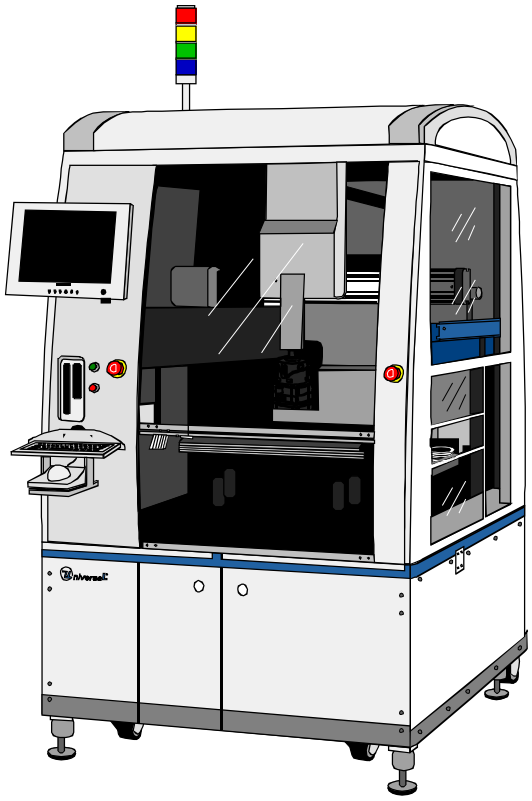
Assembly Cell (7516A)

CE

Universal

Odd Form and Final Assembly

POLARIS™ *Assembly Cell*



Machine Highlights

- **Open and flexible work cell provides a foundation for odd form component placement and final assembly processes.**
- **Graphical user interface allows easy field-based programming.**
- **Adaptable feeder interface supports a variety of input methods.**

Contents

All specifications are subject to periodic review and may be changed without notice. Illustrations may not be drawn to scale.

Introduction

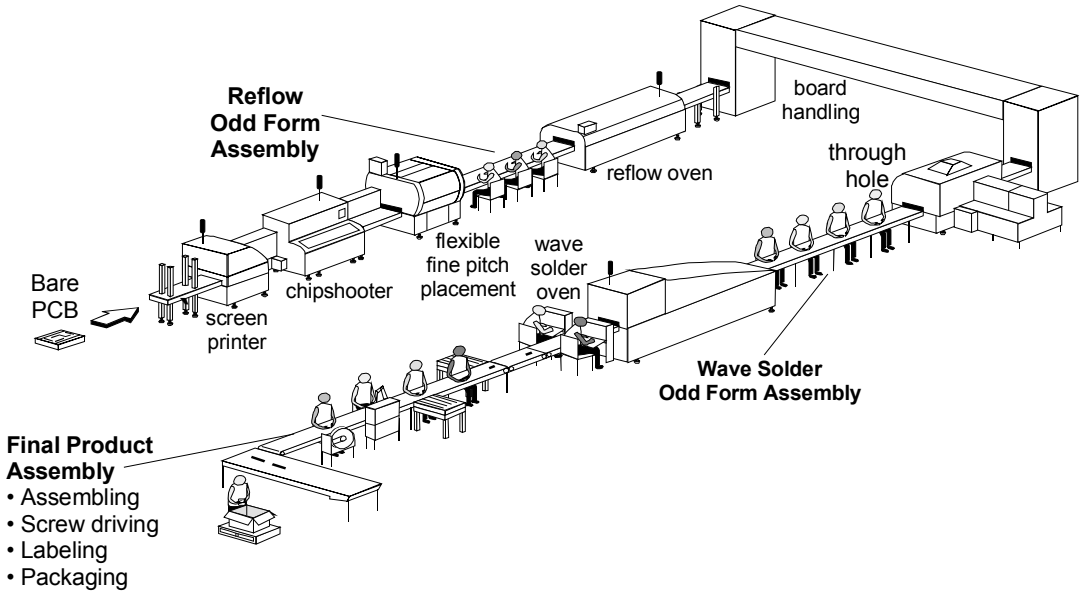
The Polaris Assembly Cell is designed to cost-effectively automate manual processes as well as perform many non- manual processes (i.e. dispensing, test handling, screw driving, inspection, verification, etc.) as required for modern electronics manufacturing. When combined with Universal's variety of feeders, tooling, tool modules and product handling options, it can become an integral part of a complete solution, reducing the total cost of production as well as provide improvements in throughput and yield.

Machine Concept

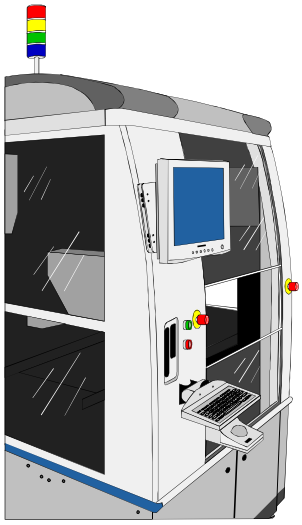
The Polaris cell can fit into just about any manufacturing process. The result is reduced defects, reduced cost as well as improvements in yield, consistency and quality.

The common base Polaris cell can be configured with a variety of tool modules for component insertion, dispensing, screw driving, inspection, label placement and test handling. The common base cell and windows based open architecture software combine to make a modular platform that is capable of performing single or multiple processes on a single cell. Unlike "Hard tooled" custom cells, when requirements change due to end of product or product change, the Polaris cell can be re-configured and re-deployed to meet the new requirements.

The Polaris cell combined with other Universal products provide a complete Manufacturing solution. By integrating multiple tasks across identical cells, the benefit of similar software and hardware reduces the difficulty of dealing with multiple suppliers.



Standard Features



Welded Base Frame
- "U" shaped to allow feeder access to the floor.
- Open access to product assembly area from front.

Positioning System
- Three-axis (X, Y, Z) Cartesian gantry.
- Sealed drive mechanism.
- DC brushless servo, internal ball screws.
- 550 mm x 800 mm (21.7" x 31.5") nominal work envelope.

Open and Accessible Cover Package
- Allows full view and open access to product assembly area.
- Easy set-up and maintenance.

User-Friendly Interface
- Easy-to-read flat panel display adjusts and tilts to suit user.
- Ergonomically designed, based on user input.
- Keyboard folds out of the way when not in use.

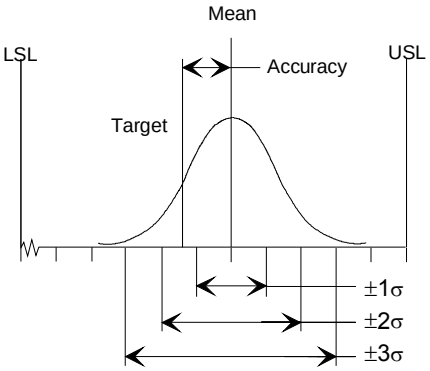
Controller and Software
- Windows XP® operating system.
- Modular software design.

Base Machine Repeatability Specifications

X-Y Cartesian Gantry[1]

Y-axis	
Travel	800 mm (31.5 in.)
Repeatability	± 0.01 mm (± 0.0004 in.)
Velocity	1200 mm/s (47.2 in./s)
Acceleration	1 g (386.4 in./s^2)
X-axis	
Travel	550 mm (21.7 in.)
Repeatability	± 0.01 mm (± 0.0004 in.)
Velocity	1200 mm/s (47.2 in./s)
Acceleration	1 g (386.4 in./s^2)
Z-axis	
Max Stroke	152 mm (6.0 in.)
Repeatability	± 0.01 mm (± 0.0004 in.)

Note:
[1]Applies to the base positioning system without heads or end effector tooling. Reference use only.



The **Mean** is the arithmetic average of a set of measurements.

Standard Deviation is a measure of the variability of a process output.

Accuracy is the distance between the mean and the target value.

Repeatability is one standard deviation.

C_p is a capability index which compares the spread of the process to the distance between the upper and lower specifications.

$$C_p = \frac{\text{Upper Spec Limit - Lower Spec Limit}}{6\sigma}$$

where σ = the standard deviation of the sample

C_{pk} is the process capability index, which is a measure of the process's ability to produce product within specifications.

$$C_{pk} = \frac{\min(\bar{x} - \text{Lower Spec Limit}, \text{Upper Spec Limit} - \bar{x})}{3\sigma}$$

where σ = the standard deviation of the sample and $\bar{x}$ is the sample mean

Placement Specifications (Single Servo Theta Head with Vacuum)

	Without Vision Inspection	With Vision Inspection
Placement Rate[2]	1,800 cph	1,440 cph
Placement Tact[2] Time	2 sec.	2.5 sec.
Component[3] Placement Force	Maximum placement force is 9.5 kg (21.0 lbs.)	

Placement Performance Specification[1]

X, Y: ±75μm @ 4σ
θ: ±0.2° @ 4σ

Notes:

[1] Glass slugs placed on glass plate, using vision inspection (4 mil/pixel Upward Looking Camera).

[2] Rates are based upon a 300 mm (12") total move, 25 mm (1.0") Z-move, vacuum pick, with bent lead detection activated. Machines are verified to the quoted placement times per application. Consult your Universal Sales Engineer for a product-specific throughput analysis.

[3] Component placement force is measured with the servo gripper head in a compliant configuration.

Options

Vision Guidance and Inspection

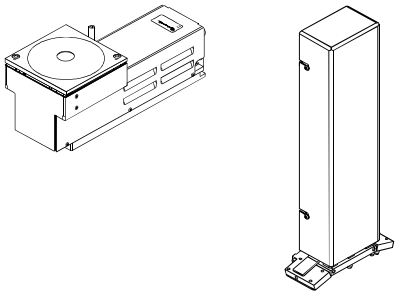
The Polaris cell can be configured with several different Cameras, both downward looking and upward looking. These cameras provide added capability to the Polaris cell.

Vision Guidance

Vision Guidance is used for locating an assembly or the pallet that is used to hold the assembly during population as well as locate the components or parts that are being added, placed or inserted to the assembly.

Inspection

Inspection is used for detection of absence or presence of a programmed feature or characteristic. Depending on the application requirements, color, area, orientation, and shape or some of the measurements that are applied to determine if the product meets the requirements.



Cameras for vision guidance

The downward looking camera (2mil/pixel) is used for Pattern error correction (PEC). The camera is mounted to the X-Y gantry and travels to a programmed location or locations to find fiducials or other known features on the product being assembled. The actual locations where these fiducials or features are found are used to calculate a corrected frame (actual location of the product within the work zone). This corrected frame is passed to the positioning system and is applied for all placements or dispenses. It may also be possible for the downward looking camera to perform some simple inspection tasks such as absence or presence of a programmed feature.

The upward looking camera is used for component or part correction. There are three different magnifications available depending on the requirements. A head will pick a component or part to be assembled or inserted and pass it over the camera. The camera will acquire an image. With this image the vision processor will locate programmed features on the component or part and determine the exact location of the component or part relative to the head. This information is passed to the positioning system in the form of a corrected frame for placement.

- Downward-looking and upward-looking cameras perform orientation and inspection functions.
- Eliminates the need for expensive precision tooling.
- Programmable lighting levels.
- OFA lighting system can illuminate through-hole lead tips.

Cameras for inspection

Third party cameras may also be integrated with the Polaris cell for inspection tasks. These cameras typically have their own vision processors and vision tools which enable inspection characteristics such as shape, color, presence, absence, etc. The camera performs the inspection task and passes the results (typically "Pass" or "Fail") to the Polaris cell.

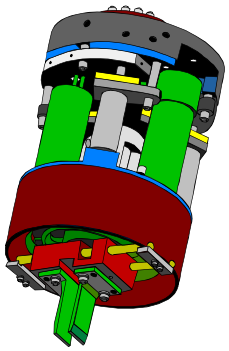
Cognex

Cognex

Keyence

Heads/End Effectors

The Polaris cell is a common base cell that can be configured with different heads and end effectors to perform many different tasks including, Pick and Place, label place (pre-printed or on demand), dispensing, and screw driving. Because of the modular approach for both hardware and software, it is also possible to configure a cell to perform different tasks on the same cell. Universal can evaluate the requirements to determine which head or combination of heads will be required.



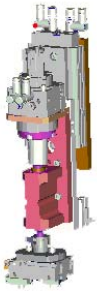
Servo Gripper Head

Head Types – Pick and Place

Servo Gripper Head

- Programmable gripping fingers accommodate a wide range of components.
- Float mechanism compensates for body-to-lead tolerances and misalignment during assembly.
- Compliant Z-axis and impact sensor detects bent leads.
- Optional on-board vacuum spindle.

Servo Theta Head with Vacuum



Pneumatic Theta Head with Pneumatic Gripper

Servo Theta Head
Theta is programmable in .2 degree increments
Can be either vacuum or pneumatic end effector (gripper or nozzle)

Pneumatic Theta Head
Theta is programmable to either 0 or 90 degrees (other configurations possible)
Can be either vacuum or pneumatic end effector (gripper or nozzle)

Custom Heads
Universal can design and / or integrate a custom head for special requirements.

Auger Valve

Valve Types – Dispense

Various dispensing applications and materials require specific types of dispense valves. Consideration of the dispense requirements such as dots, beads, volume, accuracy, material to be dispensed, etc.. will determine the correct valve. Universal can either recommend the correct valve or integrate the customers choice of valve to the Polaris cell. Example of valves listed below.

Auger Valve
Used for a wide variety of materials and is very flexible. Servo controlled auger with programmable auger speed to control the amount of material dispensed. Can be used for dots and contoured beads. Medium to high repeatability for control of the amount of material dispensed.

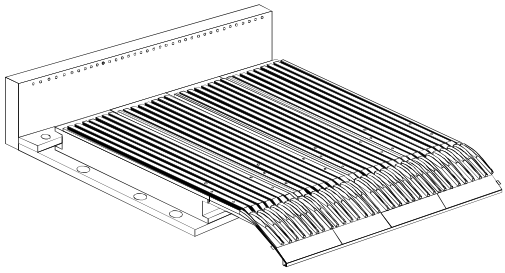
Positive Displacement Valve

Positive Displacement Valve
Used for a wide variety of materials. Can be pneumatic one shot or servo driven. The pneumatic one shot is typically used for low viscosity materials where the repeatability of the “shot” of material dispensed is very good, The servo driven version is typically used when controlled beads of material need to be dispensed. A secondary pump is used to feed the valve from an external reservoir to the valve. The valve feeds the material to the dispense needle. Can also be used in conjunction with an on/off type valve to control dripping

Air Over Valve

Screw Driver

Under Product Screw Driver



32-Slot Feeder Bank

Air Over Valve
Used for medium to low viscosity materials. Material from a syringe is pushed with air through an on/off valve. The speed at which the material is dispensed is dependant on the viscosity of the material, needle size and air pressure.

Screw Driving
Screw driving assemblies, pneumatic or servo driven can be integrated for bot top and bottom side applications. Screws can be presented to the machine via blow tube or vibratory track.

Feeder Interface

Feeder Mounting System

- Universal GSM ® Platform-style feeder interface.
- Fixed bank can be mounted in three different positions to reduce head travel.
- 32 - 8 mm feeder slots available.
- Supports GSM Platform-style feeders.

Custom Feeder mounting can be designed for Non-Universal Instruments feeders.

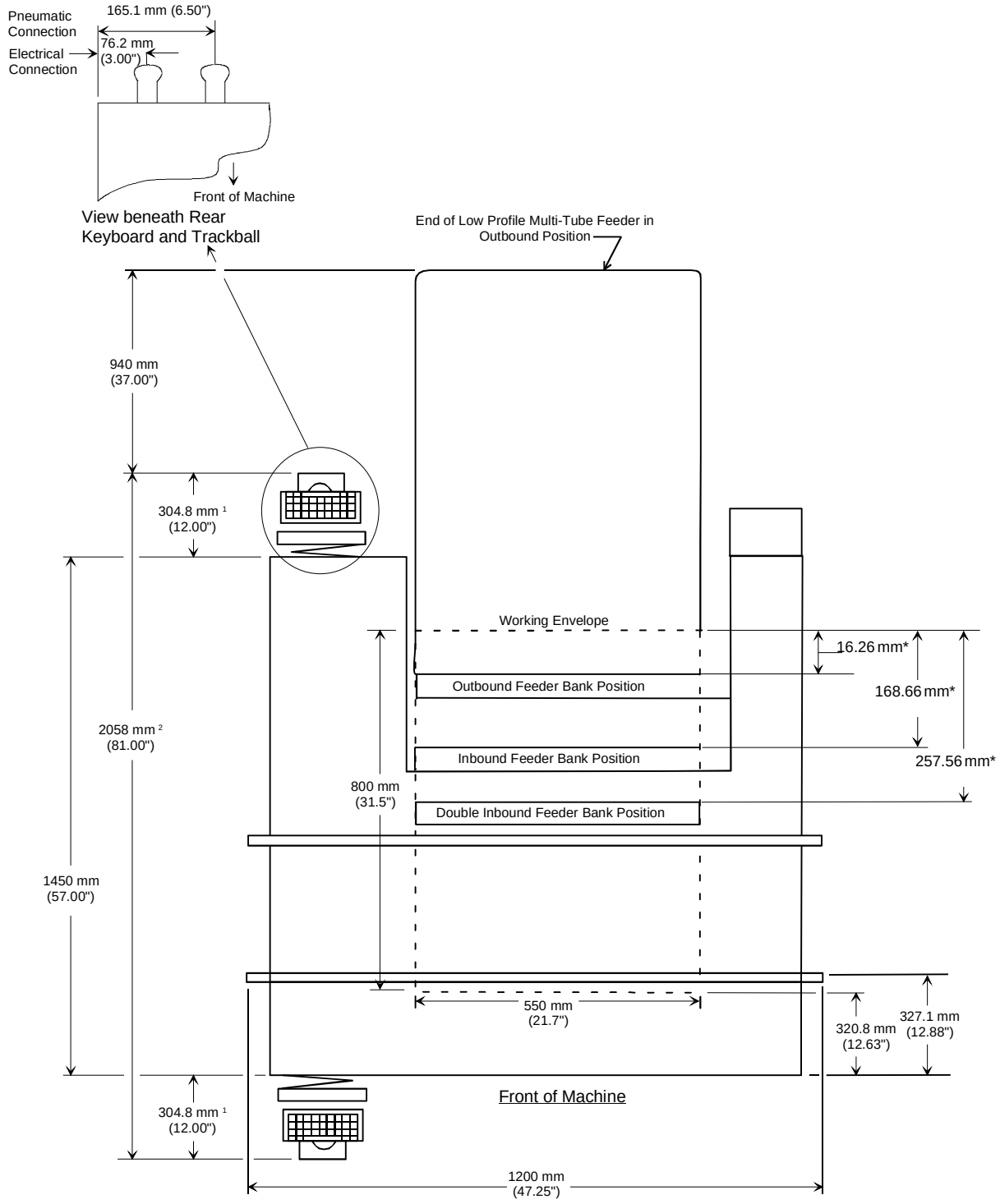
Product Transfer

• Edge-belt conveyor system transports PCB and products into base machine.
• Board stop and clamping system secures product during assembly.

Non Universal Instruments material handling can be integrated.

Supporting Documents

EIA-468-A Electronic Industries Association Standard, Lead Taping of Components in the Radial Configura-tion for Automatic Handling
SMEMA Surface Mount Equipment Manufacturers

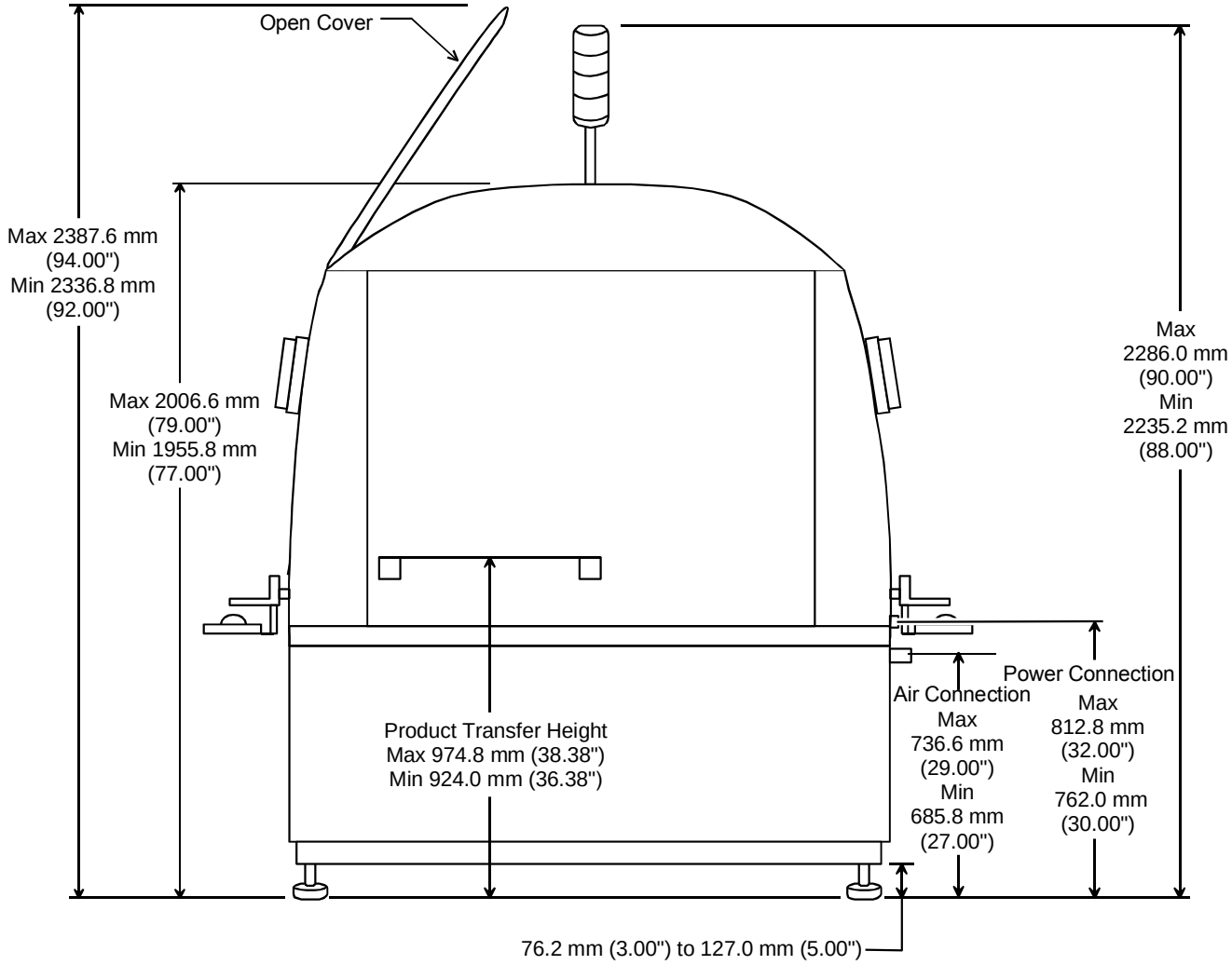


* All dimensions are nominal and head dependent. Dimensions shown are for a standard servo theta head.

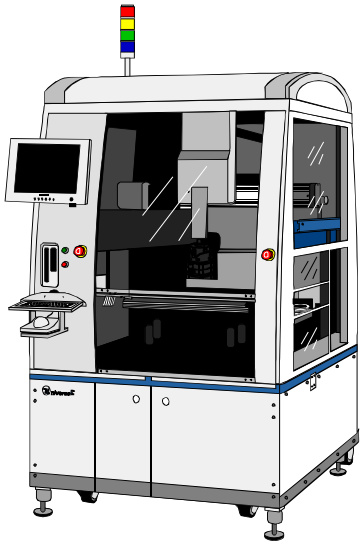
Notes:

1. Keyboard and trackball fold to 203.2 mm (8.00").
2. Minimum depth is 1854 mm (73.00") with keyboards and trackballs folded up.
3. Allow 736.6 mm (29") for feeder loosing and removal.

Top View
Polaris, with Feeders and Board Flow



Side View
Polaris



Installation Considerations

Machine Dimensions

	Length [1]	Depth	Height [2]	Weight
Polaris	1200 mm (47.25")	1854 mm (73.00")	max 2006.6 mm (79.00") min 1955.8 mm (77.00")	1270 kg (2,800 lbs.)

1. Length is in the direction of board flow.
2. Height does not include the light tower.

Service Requirements

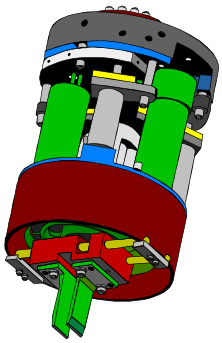
Electrical	208 or 230 VAC configured at factory, nominal ±10%. 380 VAC +10%, -5%.
Frequency	50 or 60 Hz (49-51 or 59-61 Hz).
Phases	3 (not phase dependent)
Number of Wires	4 (3 phase lines and ground)
Service Configuration	Service must be grounded Delta or Wye.
Branch Circuit Size	30 amps
Distortion	<10% total harmonic distortion
Average Power	5,750 watts
Electrical Connection	76.2 mm (3.0") from side to side and 762.0 mm - 812.8 mm (30.0" - 32.0") from floor. (Refer to machine views on pages 10 and 11.)
Pneumatics (clean air)	169.9 liters/minute at 6.21 bar (6 cfm at 90 psi) Clean air is defined as: water, -17°C. (1.4°F.) or less (dew point less than atmospheric pressure); oil, 0.08 ppm at 28°C. (82.4°F); dust (solid), 0.01 micron.
Pneumatic Connection	165.1 mm (6.50") from side, 685.8 mm - 736.6 mm (27.00" - 29.00") from floor. (Refer to machine views on pages 10 and 11.) And a 9.5 mm (0.375") NPT internal thread connection is provided with the machine. Equipment is adequately protected against ingress of solid and liquid contaminants.

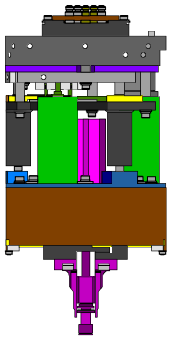
Environmental Requirements

	Minimum	Maximum
Operating Temperature	4.4°C (40°F)	32°C (90°F)
Storage Temperature	-20°C (-4°F)	65°C (149°F)
Operating Humidity	10% noncondensing	80% noncondensing
Operating Altitude	—	2500 m (8202')
Noise	Less than 70.5 dbA in accordance with National Machine Toolbuilders Association Noise Measurement Technique Standard, June 1986	

Appendix A: Heads

Technical Specifications





Component Range - Servo Gripper Head

	Minimum	Maximum
Width/Diameter[1]	—	38.1 mm (1.50")
Length[1]	—	127.0 mm (5.00")
Height	1.5 mm (0.06")	50.8 mm (2.00")[2]
Weight	—	450 g (1 lb.)

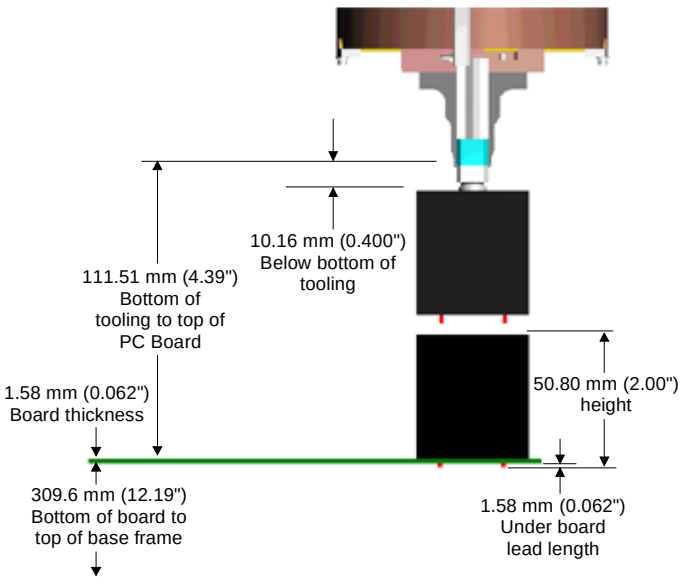
Component Range - Servo Gripper with Vacuum Spindle

	Minimum	Maximum
Height	0.508 mm (0.020")	50.8 mm (2.00")[2]
Weight	—	35 g (0.077 lb.)

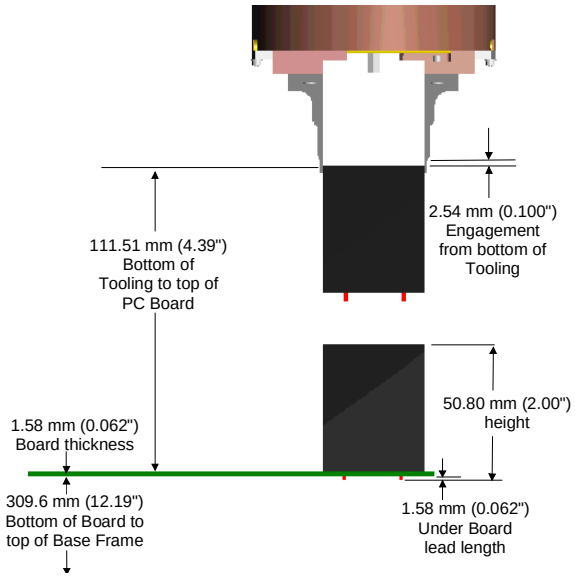
[1] Polaris can handle other size components. Consult with your Universal Sales Engineer.

[2] Maximum component height is determined by the tallest component that can be picked and placed over the top of another component of the same height on a 1.6 mm (0.062") board.

Servo Gripper Head with Vacuum Spindle



Servo Gripper Head



Servo Theta Head with Vacuum

Servo Theta Head with Pneumatic Gripper

Pneumatic Theta Head with Pneumatic Gripper

Pneumatic Theta Head with Vacuum

Component Range – Servo Theta Head with Vacuum[1]

	Minimum	Maximum
Height	.508mm (0.020”)	50.8mm (2.00”) 2
Weight	——-	35 g (0.077 lb)

Component Range – Servo Theta Head with Pneumatic Gripper[1]

	Minimum	Maximum
Width/Diameter	——	Tooling Dependant
Height	1.5 mm (0.060”)	50.8mm (2.00”) 2
Weight	——	450 g (1 lb) 2

****** Theta repeatability for both configurations is +/- .072 degrees

1 Polaris can handle other size components. Consult with your Universal Instruments Sales Engineer.

2 Maximum component Height is determined by the tallest component that can be picked and placed over the top of another component of the same height on a 1.6 mm (0.062”) thick board.

Component Range – Pneumatic Theta Head with Vacuum[1]

	Minimum	Maximum
Height	.508mm (0.020”)	50.8mm (2.00”) 2
Weight	——-	35 g (0.077 lb)

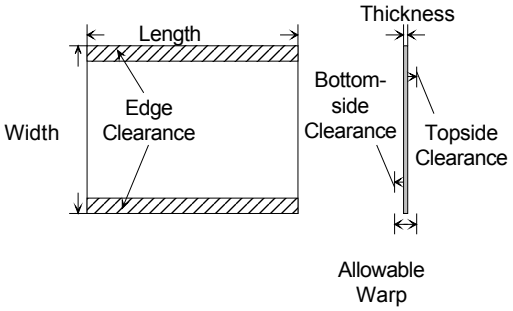
Component Range – Pneumatic Theta Head with Pneumatic Gripper[1]

	Minimum	Maximum
Width/Diameter	——	Tooling Dependant
Height	1.5 mm (0.060”)	50.8mm (2.00”) 2
Weight	——	450 g (1 lb) 2

****** Theta angle is mechanically set between two points, 90 degrees out from each other. Other configurations Available.

Appendix B: Product Handling

Edge Belt Conveyor



Product Specifications

	Minimum	Maximum
Width	63.5 mm (2.50")	457.2 mm (18.00")
Length [1]		
Single Stage length	50.8 mm (2.00")	508.0 mm (20.00")
Triple Stage length	50.8 mm (2.00")	371.5 mm (14.625")
Thickness [2]	0.8 mm (0.03")	5.08 mm (0.20")
Weight	–	6.0 kg (13.2 lbs.)
Allowable Warp	Reference ANSI/IPC-D-300G, Printed Board Dimensions and Tolerances.	
Single Stage Transfer Time [3]		
	6" board: clamp-to-clamp transfer time is 4.0 seconds.	
	12" board: clamp-to-clamp transfer time is 4.3 seconds.	
Triple Stage Transfer Time [4]		
	Clamp-to-clamp transfer time is 1.5 seconds.	

[1] Length is in the direction of product transfer.

[2] Thickness of board plus warpage not to exceed 6.35 mm (0.25").

[3] Transfer cycle time includes 406.4 mm (16.00") input and 406.4 mm (16.00") output conveyors with SMEMA protocol.

[4] If pin locators are used add 200ms to transfer time.

Product Clearance

Topside Clearance [4]	50.8 mm (2.00")	
Edge Clearance	Standard:	5 mm (0.197") ±0.4 mm (0.02") tolerance
	Optional:	3 mm (0.118") ±0.4 mm (0.02") tolerance
Bottomside Clearance	15.7 mm (0.62")	

Board Transfer

Protocol	SMEMA	
Height	Standard Range:	924 mm - 975 mm (36.38" - 38.38")
	Optional Range[5]:	889 mm - 924 mm (35.00" - 36.38")

[4] Topside clearance based upon a 1.6 mm (0.062") thick board.

[5] Casters need to be removed and an optional kit is required to reach this height.

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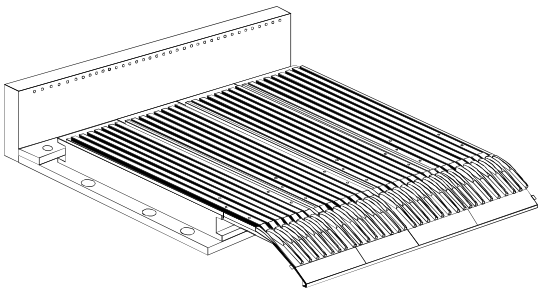
Appendix C: Feeder Interface

Technical Specifications



32-Slot Feeder Bank

32-Slot Feeder Bank

Number of 8 mm feeder slots		32
Number of slots reachable Servo gripper		28
Inputs per slot		2
Outputs per slot		1
Pneumatic specs*		80psi @ 5cfm
Voltages*	12VDC @ 7 A max 24 VDC @5.5 A max 24VAC @ 7 A max	

*Aggregate values for entire feeder bank.

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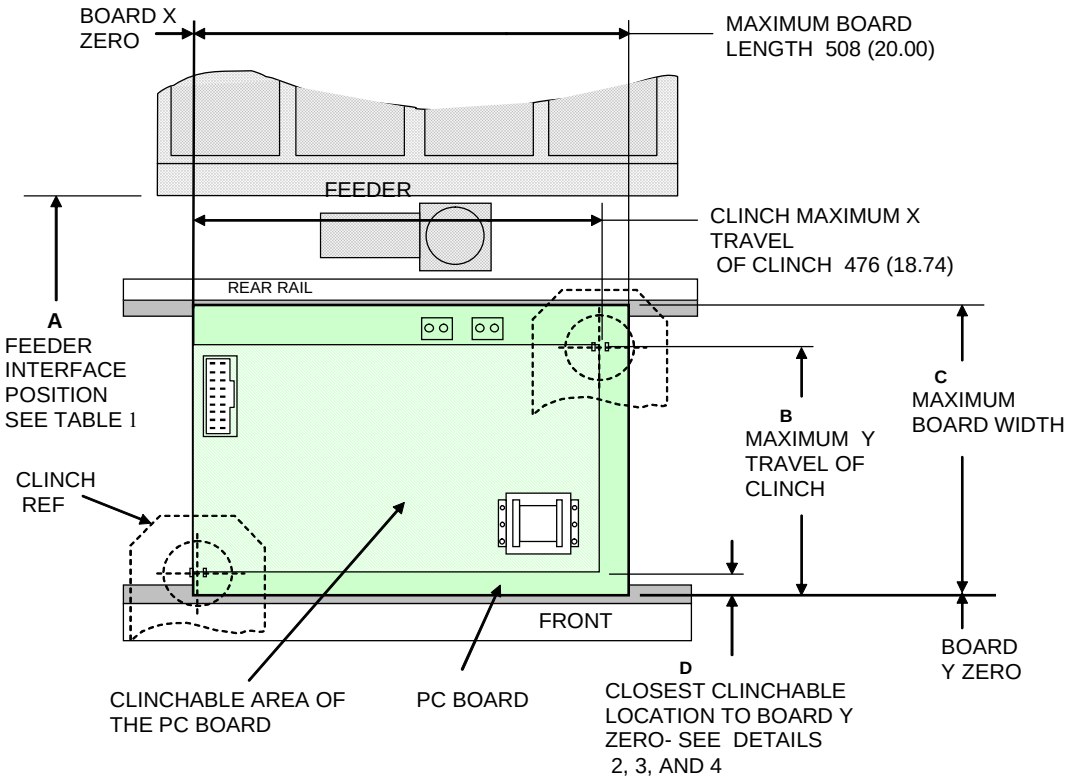
Appendix D: Programmable Clinch Specification

Technical Specifications

The Polaris cell can be configured with a servo driven (X-Y-theta-Span) programmable clinch. The programmable clinch is lead screw driven and travels below the board. A component that requires clinching is picked, placed and then held in position while the clinch head performs it's programmed function. The clinch can be programmed for single or multiple leads, inward or outward at any angle in .1 degree increments. The clinched lead angle is controlled by the travel of the span axis and is programmable. The clinch functions are integrated in the user interface.

Specifications

X and Y repeatability	+/- .05mm (0.0019")
Theta Repeatability	+/- .1 degrees
Maximum Span Force	27 kg (60 pounds)

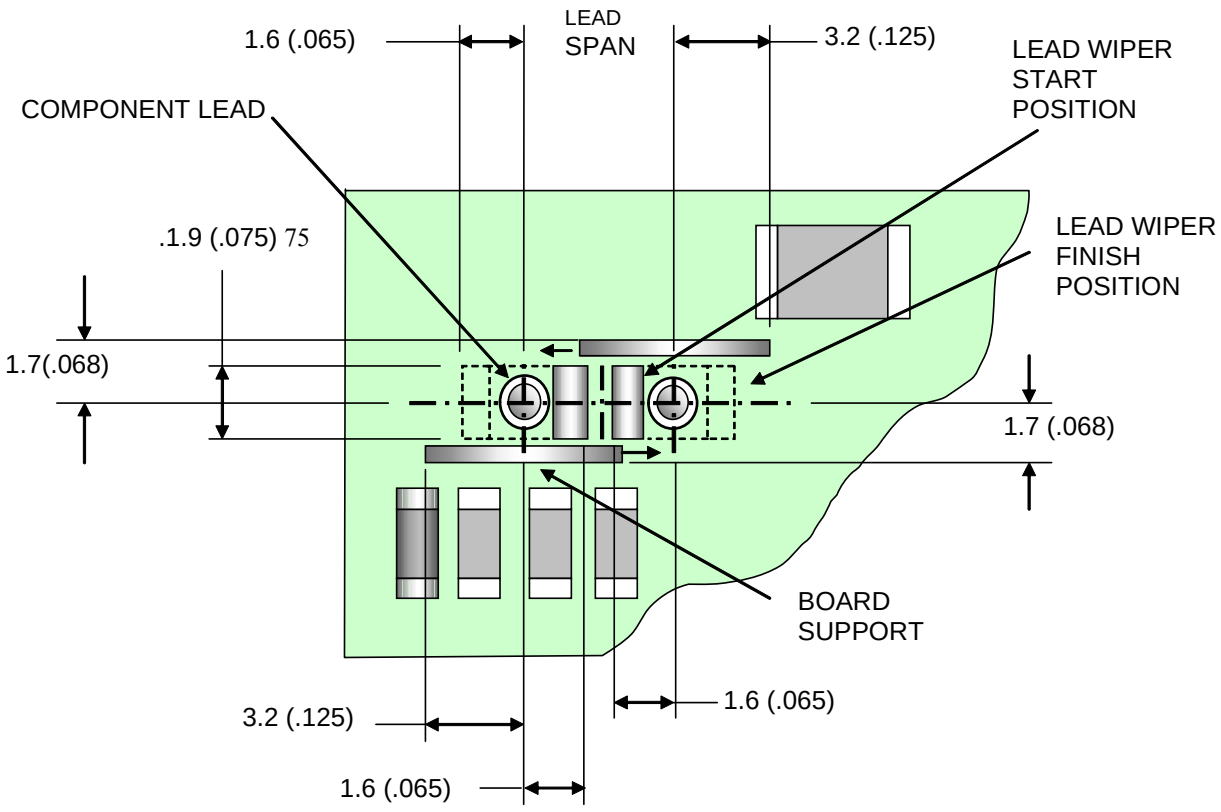


Top View of PC Board in Work Area of Polaris Cell

Maximum board size and maximum clinch Y travel relative to feeder interface location.

A Feeder Interface Location	B Maximum Y Travel of Clinch	C Maximum Board Width
Outbound	419 (16.50)	457 (18.00)
Single inbound	267 (10.50)	305 (12.00)
Dual inbound	178 (7.00)	216 (8.50)

DIMENSIONS SHOWN IN METRIC (INCH)



Clinch Tooling Footprint
Dual Lead Outward Form