Genesis Platform
GC-120Q

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General Specification

Surface Mount Division of Universal Instruments
Automation in Electronic Assembly

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Glossary of Acronyms and Specialized Terms

Acronym/Term	Meaning
AC	Alternating Current: type of electrical power generation
APE	Advanced Product Editor (Universal brand name)
ASCII	American National Standard Code for Information Interchange
AWG	American Wire Gauge: wire size standard
CAD	Computer-Aided Design
CD-ROM	Compact Disc-Read Only Memory
CE	Conformité Europeanne: European safety standard
CFM	Cubic Feet per Minute: measurement of air flow
CPH	Components per Hour
CTA	Component Transfer Assembly
DC	Direct Current: type of electrical power generation
DVD	Digital Video Disc
EIA	Electronic Industries Alliance: Industry Standards Organization
GEM	Generic Equipment Model
GS	General Specification (Universal brand name)
GUI	Graphical User Interface
HSMS	High Speed SECS Message Service: implements SECS2 messaging over a network link
Hz	Hertz (cycles per second): measurement of electrical frequency
I/O	Input/Output
IEC	International Electrotechnical Commission: Industry Standards Organization
IP	Index of Protection: resistance of machine to contamination by foreign objects
IPC	IPC: Industry Standards Organization
JEDEC	JEDEC Solid State Technology Association: Industry Standards Organization
LED	Light Emitting Diode: electrical component
MMIT	Mini Machine Interface Translator (VME to I/O bus)
P.C.	Personal Computer
PCB (or PC board)	Printed Circuit Board
PPM	Parts Per Million: measurement of machine performance
RFQ	Request For Quote
SCFM	Standard Cubic Feet per Minute: measurement of airflow
SECS	Semiconductor Equipment Communications Standard: interface between host computer and assembly machines
SEMI	Semiconductor Equipment & Materials International
SMC	Surface Mount Components
SMEMA	Surface Mount Equipment Manufacturers Association
TCP/IP	Transfer Control Protocol/Internet Protocol: network communication protocol
UICS	Universal Instruments Control Software (Universal brand name)
UPS	Universal Platform Software (Universal brand name)
VA	Volt-Amps: measurement of electrical power consumption
VAC	Volts Alternating Current
VDC	Volts Direct Current
VGA	Video Graphics Array: type of CRT monitor standard
VME®	Versa Module Eurocard (Motorola brand name): industry standard for 32-bit computer bus
VRM	Variable Reluctance Motor

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

Introduction

Concept

The Genesis GC-120Q is Universal's High Speed Quad Gantry Chip Shooter based upon the proven success of the Platform design. The Genesis GC-120Q provides superior cost per placement performance. Due to its GSM heritage and Genesis design, it is equipped to manage the accuracy and repeatability demands of emerging technologies.

The Genesis GC-120Q is specifically designed to provide:

- Superior throughput
- High pick performance
- Fewer maintenance requirements
- Ease of use
- Broad component handling range, capable of handling 0402mm (01005) to 30mm (1.18") square

Consistent with the original Platform concept, the Genesis GC-120Q employs common mechanical, electrical, and software interfaces with other Genesis Platforms that allow Universal to develop options (heads, cameras, feeders, etc.) in response to changing production demands.

Many options developed for original Genesis Platforms are compatible with the Genesis GC-120Q. The Genesis GC-120Q maintains the same proximity for air and power connections as other Platform products to simplify migration and reduce installation expenses.

The Genesis GC-120Q 4991 Platform shall comply with Appendix A of ESD-SP10.1-2000 for all markets.

Operation

The Genesis GC-120Q is an automated electronic assembly machine built to assist in the manufacture of printed circuit boards (PCBs). Its primary function is to accurately place components on printed circuit boards.

The Genesis GC-120Q Platform is built on a solid welded steel plate frame and employs a quad-gantry positioning system driven by Universal's patented linear motors, using VRM (Variable Reluctance Motor) technology. This allows a unique combination of high positional repeatability with high-speed component placement. A 30-spindle rotary head located on each beam picks components from various fixed feeder locations. The components are vision inspected and then placed on a stationary PCB. The machine consists of two modules (Module A and Module B), each containing two beams. Each module, functioning independently of the other, picks parts with one beam while placing parts with the other beam. Each module can contain up to two PC boards, one being populated and one staged for a maximum of 4 boards in the machine at any given time.

Features

Welded Base Frame

The welded steel base frame is designed to minimize tolerance accumulation from sub-assembly to sub-assembly. All major sub-assemblies are edge-justified or dowel-pin registered to precision datum surfaces or holes in the base frame. This ensures that the positional relationships are held mechanically, not through adjustment. The frame torsional stiffness contributes to maintaining reliability and reducing setup time associated with installing or relocating the machine on the factory floor.

Linear Motor Positioning System

The overhead, quad-gantry-positioning system utilizes Universal's patented linear motors, using VRM technology. VRM technology provides greater accuracy at faster acceleration and velocity than belt or lead screw driven positioning systems.

Each gantry is driven from both ends of the beam. This method eliminates "beam whip" (cantilevering) and positional errors experienced by single drive systems. In addition, settle times have been minimized, allowing the Genesis GC-120Q to reach higher placement speeds. 1-micron resolution linear scales are used to ensure positional repeatability and accuracy.

VRM technology is superior to other linear motor technologies because it maintains stable thermal characteristics during operating conditions. This guarantees that the Genesis GC-120Q linear motors will consistently run near ambient temperature.

Lightning Placement Head

The 30-spindle rotary placement head provides the foundation for high-speed small part placement. Each gantry on the base machine supports one placement head.

Each head features 30 intelligent spindle assemblies. Each quick-change intelligent spindle assembly provides a direct drive theta-axis as well as dedicated valves for vacuum generation and air kiss.

Each head supports both a narrow field of view and a wide field of view camera, broadening the component range. All vision processing is performed "on the fly" to maximize throughput.

Each head is equipped with a single Z-axis drive mechanism and touch down sense. The system learns and continuously updates X, Y, and Z-height pickup and placement locations. This assures accurate component pickup as well as true programmed placement forces.

Each head utilizes an onboard reject bin for small components. This eliminates non-value-added time and any throughput derates associated with rejecting defective components.

Nozzles

Lightning nozzles are designed to provide a robust coupling between the spindle and nozzle assembly. Stainless steel, ceramic and compliant nozzles are available for use on the Lightning head. Stainless steel and ceramic nozzles have a designed life expectancy of 8 million cycles, and compliant-tipped nozzles have a designed life expectancy of 3 million cycles. Of course nozzle life is dependant on many factors such as component types handled, nozzle cleanliness, excessive dry cycling, etc. Therefore, it is recommended that the customer budget for replacing all chip nozzles on an annual basis. Four Large Part Nozzle Kits are included with the purchase of each GC-120Q. Please refer to 'Nozzles' in the Specifications section (page 26) for more details.

Genesis GC-120Q Camera Systems

All cameras used on the Genesis GC-120Q Platform utilize CCD (charge-coupled device) technology. In addition, these camera systems support multiple angle illumination, which can utilize one or multiple angles to image any feature/component. All Genesis GC-120Q camera illumination systems can be easily calibrated to ensure consistency across cameras or machines over time.

On-The-Head Cameras

Two on-the-head cameras mount directly to the Lightning head and maximize machine efficiency by imaging components while the head travels from the feeders directly to the PCB. The narrow field of view camera can image components from 0402mm (01005”) to 8mm (0.315”) square. The wide field of view camera can image components up to 30mm (1.18”) square. The Lightning head is also capable of imaging components up to 6mm (0.236”) tall. See ‘Component Handling Capabilities’ in the Specifications section (page 25) for limitations.

Both on-the-head cameras are equipped with front, side, and on-axis lighting, which can be activated individually or in concert to best illuminate a component’s critical features.

See ‘Camera Specifications’ in the Specifications section (page 25) for more details.

Fiducial Inspection Camera

Fiducials register the board in the machine and compensate for linear board distortions (stretch, shrink, and non-orthogonality). Local fiducials are used to measure local board distortions. A downward-looking pattern error correction (PEC) fiducial inspection camera is mounted under each beam. The field of view for these cameras is approximately 12mm (0.47”) square. Refer to’ Fiducial Locations’ in the Specifications section (page 28) for details.

The PEC camera can also process bad board sense features. It utilizes three different illumination wavelengths (red, blue, and green) which can be programmed independently or in concert to create white light. Each wavelength expands the types of substrates or fiducials that can be imaged.

See ‘Global and Local Fiducial Shapes and Dimensions’ in the Specifications section (page 27) for more information.

High Capacity Nozzle Changer

One high capacity nozzle changer is installed for each Lightning placement head. This provides a storage capability of 70 individual nozzles per head. The High Capacity Nozzle Changers are mounted between the feeder banks and board transfer rails, thereby maximizing online nozzle capacity without compromising board size or feeder capacity. Nozzle changing is only performed during job changeover. The nozzles on the Lightning head remain fixed during the production run. This nozzle changer is specifically designed for the Lightning head and is not compatible with FlexJet heads or any heads other than Lightning. Four High Capacity Nozzle Changers come standard on every GC-120Q machine.

Staged Board Handling

Staged Board Handling features automatic width control based on programmed board parameters. While one board is being populated, the next board is buffered within the lane. Board transfer capabilities include left-to-right (default), pass-through, and right-to-left, as well as 3mm edge clearance. Mechanized board stops are standard and accommodate unique board shapes. Staged Board Handling II supports board sizes from 50mm (2”) long x 89mm (3.5”) wide x 0.5mm (0.02”) thick up to 350mm (13.8”) long x 350mm (13.8”) wide x 5mm (0.2”) thick. Each module of the GC-120Q contains an independent board handling system.

Standard SMEMA interface is used to communicate to up-line and down-line modules. See ‘Board Handling Specification’ in the Specifications section (page 28) for more information.

Board Support

This equipment minimizes the effects of board warp, sag, and/or flex by supporting the board during component placement. The board support uses a grid pattern containing removable magnetic pins. In addition, the open architecture of the Genesis GC-120Q Platform supports integration of 3rd party board support systems.
Refer to ‘Board Support Specifications’ in the Specifications section (page 29) for more details.

PrecisionPro™ Feeder Interface

The Genesis GC-120Q Platform includes the PrecisionPro Feeder Interface for High Performance Gold and PrecisionPro Tape feeders and feeder bank change support. The PrecisionPro Feeder interface incorporates the following features:

- 3-Point registration of 8mm and 12mm for improved pick performance when using High Performance Gold tape feeders
- 42V DC drive voltage for faster index rate of High Performance Gold and PrecisionPro tape feeders and increased throughput
- Self-ID control of High Performance Gold and PrecisionPro tape feeders with feeder serial number, cycle count tracking, and the ability to support multiple tape inputs in a single slot
- Support for High Performance Gold and PrecisionPro tape feeders
- Support for new 18-slot Feeder Banks
- All High Performance Gold feeders are splice compatible, and are available with an option that detects when a reel has been removed, thus requiring the barcode on the new reel be scanned to ensure that the correct reel has been spliced
- Dual Track 8mm and continuous splice 8 – 32mm feeders do not need to be removed from the machine for removal of Mylar

18 Slot Modular Feeder Banks

Four feeder banks are installed on the base of the machine. Each feeder bank is removable for quick job changeover. All four banks must be mounted for the machine to operate.

The mounting location allows one 18-slot feeder bank to be positioned in each module, front and rear. The GC-120Q configuration supports 18 accessible slots per feeder bank. This allows a total of 72 useable feeder slots. With the addition of dual-track 8mm tape feeders, capacity grows to 144 inputs in reel sizes up to 330.2 mm (13").

Genesis GC-120Q Platform Machine Control System Architecture

The control system of the GC-120Q includes the following:

- VME (Versa Module European) Buses
- Intel Pentium-based embedded CPUs, with on board Ethernet controllers, and 2GB RAM per CPU
- SATA hard disk drive
- Motorola Power PC-based machine controllers
- Intelligent DSP-based motion controllers
- DVD R / CD R/W combo drive

Microsoft Windows XP Operating System

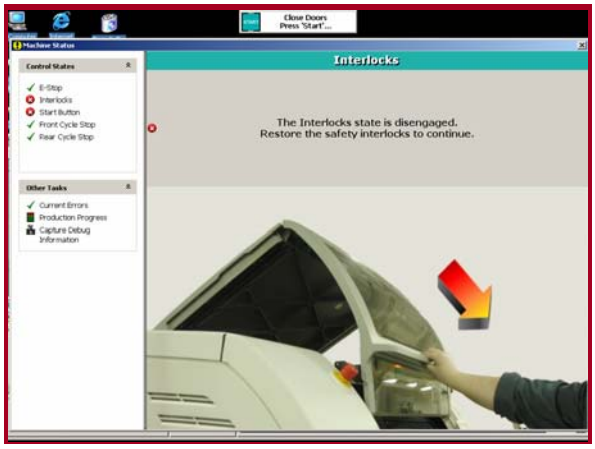
The Genesis GC-120Q Platform uses Microsoft's Windows XP operating system. Windows XP provides:

- Expanded system security
- Easy data transfer and manipulation
- Multiple language support
- Better software development and test tools

UPS+ (Universal Platform Software +)

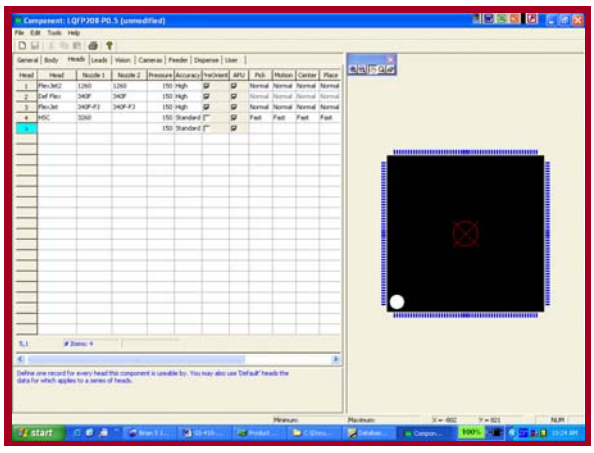
Universal's UPS+ software runs on Microsoft Windows XP operating system. It provides state-of-the-art programming, operation, and diagnostic tools for use within the Genesis GC-120Q Platform. This software is the same software found on all Genesis and AdVantis platforms. Benefits of this commonality are:

- Common product editor across all machines
- Common component database across all machines
- Common user interface across all machines

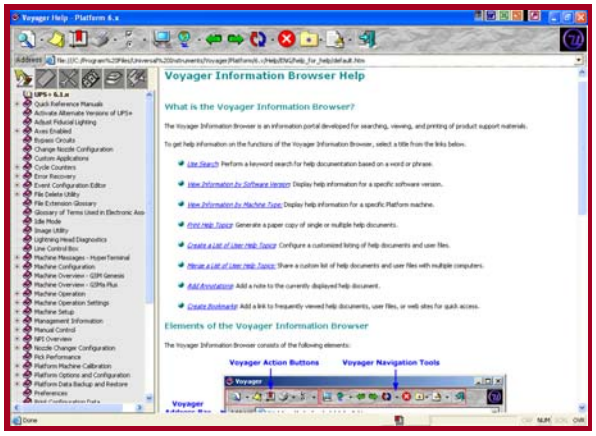


Features of UPS+

- Graphic user interface with configurable icons and machine status messages
- Graphical pattern programming tools with spreadsheet-style data entry
- Networkable component, feeder, and fiducial database
- User configurable optimization aid
- Comprehensive data import/export
- Powerful query tools
- Programmable feeder templates
- On-the-fly vision inspection
- Enhanced product setup, simplifying component and board programming by teaching images
- Machine Status information display for quick ID of error and recovery
- Powerful diagnostic and manual axis control tools
- Genesis GC-120Q can measure its own accuracy and repeatability performance and provide statistical information back through the user interface (MMI/AT)
- Management Information includes detection and reporting of pick, vision inspection, feeder, nozzle, and head performance
- Missing ball detection and pitch inspection for BGA and CCGA devices including all ball count
- Configuration template export facilitates off-line program generation, optimization, and simulation for multiple Genesis GC-120Q Platform configurations
- Software license manager. See additional information at the end of this section
- Expanded System Security
- Built-in Links to Universal.com
- On-line Documentation - VOYAGER
- Detailed Event Messages
- Detailed Error and Warning Messages
- Advanced Product Editor
- UPS+ Component Database
  - Incorporates an intuitive layout that organizes data by tabs
  - Unique programming values for multiple head and camera types that facilitates the existence of a factory-wide sharing of single component database
  - Includes over 1,200 industry-standard default component definitions
  - Spreadsheet–style data entry with tool tip information for each field to streamline data entry
  - Supports offset pick and place centroid coordinates for a wider range of applications

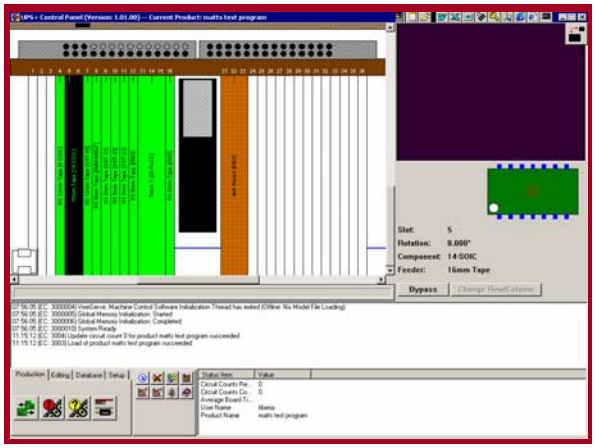


- Customizable User Interface Templates for the following user levels
  - Operator
  - Technician/Maintenance
  - Operator (advanced)
  - Programmer
  - Line Engineer
  - Manager/Supervisor
- Operator Interface and Production Setup Tools
- True-to-scale Configuration Graphics



GC-120Q Supported Features (with UPS+6.2)

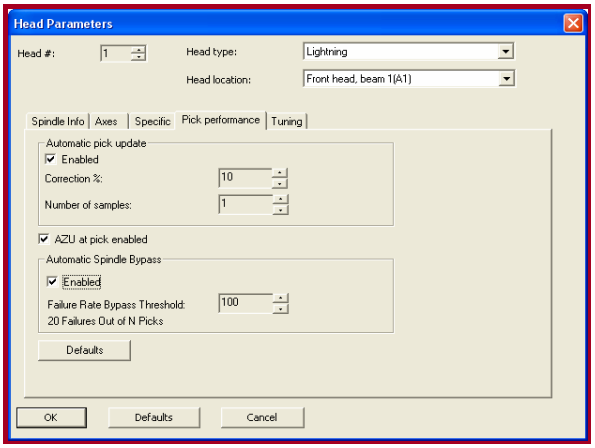
- Circuit level traceability
- Compliant tip nozzle support
- Board pass-through mode
- Dimensioning tolerance for chips on a component specific basis
- New Product Introduction – Software tools that not only streamline and simplify the New Product Introduction process, but benefit everyday production by providing a quick and easy method to resolve process related issues. See New Product Introduction Section (page 11) for more information
- Auto Feeder Pocket Teach mode – When activated, automatically teaches the feeder pick location whenever a 0603mm (0201) , 1005mm (0402), or 1608mm (0603) feeder is installed on the machine. This provides a starting point for APU to fine tune pick performance while the machine is running
- Level 2 diagnostics for on-the-head-camera lighting
- Level 2 diagnostics for XY life testing
- New XP-style interface for NPI mode – Familiar interface to reduce learning time
- MMI / AT (auto-trim) with live parts – More convenient method for quickly dialing in spindle offsets
- Circuit bypass
- Component pre-pick prior to board loading can be turned on or off
- 6mm tall component capability (with appropriate nozzles)
- Board deformity compensation



Auto-Pick Update and Auto-Z Update

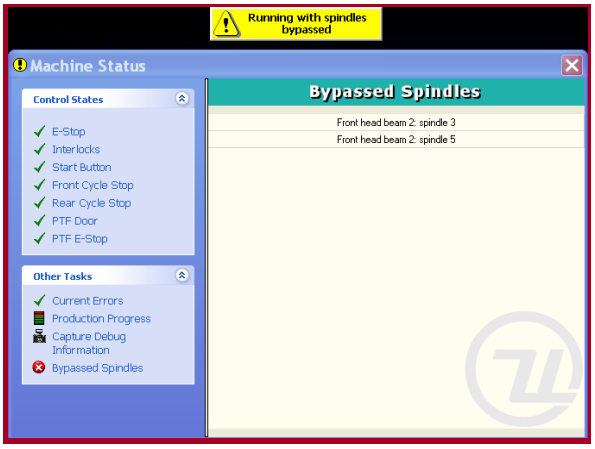
- Auto-Pick Update automatically tunes feeder pick point based on vision results for optimal small-part pick performance. This feature is selectable by head and/or by Component ID
- Auto-Z Update is a selectable feature that can be used at pick and/or place
  - When activated at pick, the machine learns the impact height when a part is picked from a feeder. This assures the component remains stable in its carrier during pick and minimizes nozzle wear.
  - When activated at place, the machine learns the impact height of each spindle during placement. This feature helps to eliminate such problems as improperly programmed component thickness and minimizes nozzle wear.
- Data is retained on product load and segment repairs
- Data is reset if a feeder is un-mounted, the feeder database is modified, or the machine is power cycled

Auto-Spindle Bypass



- The feature is initiated by exceeding a set PPM threshold or by a spindle related fault
- If one of the above conditions is encountered while the machine is populating a board, the problematic spindle is automatically bypassed (pending nozzle availability)and the remaining placements are re-optimized so the board can be completed
- When the current board is completed, the product is re-optimized with the spindle bypassed
- The product is loaded, the machine re-zeros, and starts processing the following boards automatically, no operator intervention required. The original product remains unaltered
- If a different product is loaded and a spindle is bypassed, the Auto Spindle Bypass function is automatically invoked

Skip Component Quick Bypass



- Selecting “Skip Component” within the feeder repair window quickly bypasses component, no segment repair is generated
- Supports multiple component bypasses
- Configurable to skip the component for current board only or for all boards
- If configured for current board only, the component will be placed on all subsequent boards transferred into the machine
- If configured for all boards, then the component remains bypassed until a product is loaded via E-Stop, soft E-Stop, or a manual product load

Software License Manager Key:

- Purchased UPS+ products are delivered with a “life of the product” software license key. This means that the operating system in a purchased UPS+ machine (including purchased options), and purchased Dimensions software applications, will continue running without interruption due to software license expirations
- Products that are not purchased, such as those on loan for temporary evaluation or rental, may be delivered with shorter license keys that are set to expire after the temporary use has been completed. Further, some software options delivered with a purchased product may be separately keyed with a shorter validity period; this will be extended to a “life of the product” license upon purchase of the option
- Software license keys may need to be revalidated due to other causes, such as certain hardware failures, software upgrades, or forced date changes

Please refer to your UPS+ Software Manual and/or UIC License Manager Manual for additional information.

New Product Introduction Software (NPI)

Supplied with every Genesis GC-120Q machine, the NPI software package provides the following benefits to not only New Product Introduction and First Article build, but to everyday production issues no matter what the manufacturing environment. Features included within this software are:

Feeder Inspection

- User can select all feeders or individual feeders to inspect
- User can verify pick point, rotation, and pitch setting. Inaccurate data is updated and stored in the product
- An auto mode can be used to sequentially drive to each feeder selected without user intervention
- Graphic overlays can be used if selected components have an orientation mark
- Modifiable move increments ensure tight accuracy
- User can index feeder from screen ensuring components are available for initial pick

Fiducial Inspection

- User can select all or individual fiducials to inspect
- Actual fiducial find algorithms are executed ensuring that the fiducials can be found. Corrections can be made to light levels and geometry
- Fiducial locations can be updated. The first location updated will not affect CAD coordinates, but rather the reference point of the product so that the relationship to placements coordinates will not be lost

Pre-placement Inspection

- Users can select all placements or a subset of placements to inspect. A hot button can be used to select 1 of each component ID for inspection
- Users can select Auto mode which automatically steps through placements or steps through placements individually
- Users can modify location and or rotation of components
- Users can select to display a graphic of component with orientation mark
- A drive-to-corner function is available if a component is larger than the field of view

Circuit / Offset Inspection

- Users may select Fiducials or placements to verify circuit/offset information
- Users can edit location and or rotation of circuits/offsets if necessary

Board Population

- Users can make corrections to component definitions as necessary (light level, geometry, etc.)
- Allows component editing on-the-fly.
- Upon vision failures (in NPI full cycle mode) an error recovery screen is displayed allowing the user to reject, skip, or edit the component
- If editing, the component's description is displayed with the failed vision image
- The user can reject, re-inspect, skip, or place the component with failed image
- The user can edit the component definition and re-inspect the part until a successful image acquisition is received
- The component stays on the nozzle until action is taken thus eliminating scrap
- The zoom function can bring small components into an effective field of view for debug
- A detailed log file comprehensively stores all modifications to components with pre and post change values
- The log file can be overwritten, appended, or created per job depending upon the user's preference
- Components can be placed without successful image acquisition if scrap is not possible. In this case, nozzle tip center will be used for placement centroid

Post-placement Inspection

- The user may select all or a subset of placements for post-placement inspection
- The user may individually or automatically step through the selected placements
- The user can verify rotations and or locations
- This is a semi-automatic optical inspection

Optional Equipment

Input Power

There are two embedded input power options available on all Genesis platforms. One of the two following selections must be made when configuring a machine:

- 200 – 240 VAC 3 Phase 50/60 Hertz
  - Requires CE and/or UL compliance
- 380 – 415 VAC 3 Phase 50/60 Hertz
  - CE compliance optional

The above selections are the only power selections required and note that they cannot be reconfigured in the field. For customer supplied input power that falls outside of the range of the above power input options, there are external power conversion transformers available. Consult the Genesis Product Team for more information.

Feeders

Feeder options include support for single and dual track continuous splice tape feeders, tape widths of 8mm – 32mm only. The GC-120Q only supports High Performance Gold (recommended) and PrecisionPro tape feeders for component input. Also available are Component Reject Bins for handling larger components that cannot be rejected to the on-the-head reject bin. The GC-120Q only supports High Performance Gold, and PrecisionPro feeders.

Feeder Inputs

Feeder Type		Feeder Size	Number of Feeder Slots Consumed (Total Available = 68)
Tape Feeders	High Performance Gold (Continuous Splice)	Dual Lane 8mm 0201 capable	1 Slot – two 8mm inputs
		Single Lane 8mm and 12mm	1 Slot
		Single Lane 16mm, 24mm, 32mm	2 Slots
	PrecisionPro	44mm	3 Slots
Component Reject Station		N/A	3 Slots
Component Reject Bin		N/A	0 Slots

Refer to GS-412, Platform Feeders for more information.

Feeder Bank Changing

For a given bank, while one removable bank option is being utilized in production on the machine, an offline removable bank can be setup/validated for the next job. The feeder bank change option reduces changeover time by swapping up to 18 feeders at one time by one operator. Feeder bank change requires at least one feeder bank change cart, and one docking module for a given feeder bank. One additional feeder bank per docking module and at least one feeder setup table are recommended for an effective feeder bank change option. Bank change components and accessories are compatible with all Genesis Platform machines. See 'Recommended Configuration for an Individual Bank or Machine' (page 14).

Feeder Bank Change Cart

The rolling feeder bank change cart option is used for removable feeder bank installation, removal, or transport. Both feeder banks on each side of the machine may be serviced at one time. Insertion or removal of a feeder bank requires the machine to be in a stopped condition.

A minimum of 1524mm (5') aisle space is required to properly maneuver the feeder bank change cart and service feeders. This equates to 4369mm (172") minimum machine spacing from front board handling fixed rail to fixed rail. If dual track feeders are used with 13" reels, addition space between machines is required for changing banks. See 'Aisle Considerations for Use of Feeder Carts' in the Specifications section (page 23) for more information.

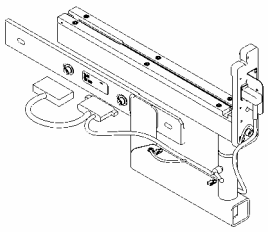
Removable Feeder Bank Storage Table

The feeder bank storage table provides off-line storage for two removable feeder banks with or without feeders. The feeder storage table can be used for offline bank setup to minimize job change time.

Feeder Setup Cart

This CE-compliant cart, used to load and index feeders, reduces production delays associated with feeder replenishment since feeders are easily prepared for use offline. This cart also increases Platform utilization by allowing for off-line feeder setup. A lower-cost tabletop version is also available.

Feeder Load Station (Machine Mounted)



This self contained, powered station is used to load and index Precision Pro feeders. It increases utilization and reduces production delays associated with feeder replenishment since feeders are easily prepared offline right at the machine. This CE compliant unit is cost effective and conserves floor space.

Recommended Configuration for an Individual Bank or Module

	Fully Bank Changeable Module
Feeder Bank Change Cart	2
Removable Banks	8
Docking Modules[1]	4
Feeder Storage Tables	4

1 Must identify which bank location to receive appropriate docking

It is important to note that all Genesis removable banks are designed to conform to CE safety standards. Genesis removable feeder banks are not GSM compatible and vise versa. Any attempt to use feeder banks not designed for the Genesis machine violates CE safety compliance standards.

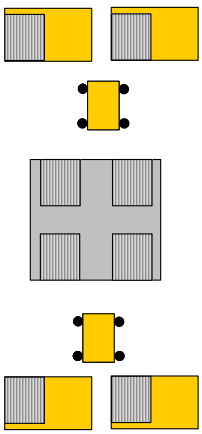
Feeder bank change can be configured on a per bank basis. For feeder bank locations that are not to be bank change capable, fixed feeder banks must be installed.

Bank Change Method Examples

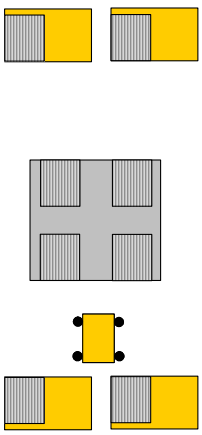
There are several different methods for performing bank changes. Criteria to consider when deciding upon which method to use are cost, floor space, speed, and convenience of changeover. The examples below illustrate contrasting methods of accomplishing bank changes.

Example 1 is the recommended method for changing banks. This method is the best balance between cost, floor space, and efficiency. The convenience of this method makes changing banks quick and simple for one or two operators.

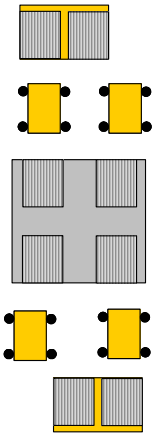
Example 1 (Recommended)



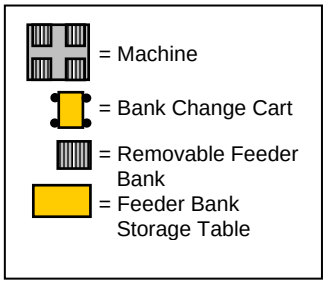
Example 2



Example 3



Legend



Example 2 is the lowest cost method, but requires slightly more floor space and time to perform. This method supplies only enough equipment for one operator to perform a changeover for one machine.

Example 3 is a higher cost method, but requires less floor space than example 1, and the changeover time can be greatly reduced by adding enough equipment to utilize an additional operator to assist in performing the bank change, making it possible to change banks on the front and rear of the machine simultaneously.

In all the above examples, the feeder bank transfer carts can be shared among multiple machines in the line. This of course, limits changeover to one machine at a time, but is an effective way to minimize costs and the amount of floor .space. consumed by idle carts.

Storage and Scrap Management Options

Feeder Storage Cart

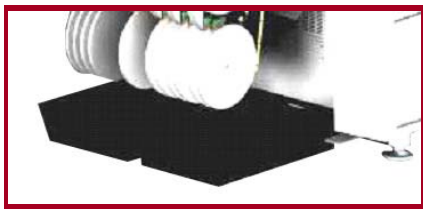
This cart reduces product changeover delays and improves work-place appearance by storing and protecting idle tape feeders in one convenient location. Each cart holds up to 132 8mm-tape feeders.

Tape Scrap Bin

The rolling tape scrap bin provides a means of collecting tape scrap during production. Up to four scrap bins may be positioned at the Genesis GC-120Q Platform, one for each bank.

Low Profile Tape Scrap Bin

A low profile tape scrap bin is available to manage tape scrap for applications where the standard tape scrap bin or the scrap tape cutter is not compatible or practical. Up to four low profile scrap bins may be positioned at the Genesis GC-120Q Platform. This bin is compatible with all feeders and machine configurations.



Component Reject Bin

Stores components that cannot be rejected using the On-The-Head reject bin. Components are stored in a bin and can be removed during routine machine maintenance. Four Reject Bins come standard with every GC-120Q machine.

Component Reject Station

Two modes of operation move rejected components away from the placement head and within reach of the operator:

- Programmable indexing cycles components until a sensor at the end of the belt's travel is interrupted, stopping the machine.
- The belt moves continuously, moving components off the end into a collection box

Calibration

MCCM Calibration Fixtures

The Genesis GC-120Q Platform supports a portable MCCM Calibration system, utilizing fixtures that conveniently locate on the feeder banks.

MCCM also benefits customers in the following ways:

- All camera light levels can be calibrated to ensure illumination remains consistent across an entire factory over time
- Interruptions caused by user errors (i.e. fixture upside down), can be recovered during calibration thereby greatly reducing calibration time
- Any individual subsystem or complete system can be calibrated, thereby streamlining the calibration process
- Individual Intelligent Spindle Assemblies may be calibrated

Auto-Trim/MMI Kit

Auto-Trim is a required process that is used to dial-in spindle offsets. The Machine Measuring Itself (MMI) option allows the user to measure the placement accuracy and repeatability of the Genesis machine using the machine positioning system and optics. This kit is part of complete calibration process to ensure the highest level of placement accuracy.

Refer to GS-416, Calibration Kits, for more information

Spare Parts and Tool Kits

Spare Parts Kit

Basic Spare Parts Kit

The basic spare parts kit includes items that are considered wearable items needing replacement on a regular basis, or items that may be susceptible to damage. The GC-120Q basic spare parts kit includes the following:

- Leveler assembly
- Timing belts
- Fuses

Full Spare Parts Kit

The full spares kit includes all the items in the basic spares kit plus the following:

- Power supplies
- PC boards
- Amplifier
- Encoders
- Sensor assembly
- Fan

Chemical and Lubrication

The chemical and lubrication kit includes the grease and oils required to properly maintain the GC-120Q. The lubricants included are as follows:

- Isoflex grease
- Kluber GLY2100 oil
- Molykote G4500 Grease
- Synthetic Anderol grease

Failure to use Universal specified maintenance schedules and lubricants may void factory warranty.

Lightning Head

This spare parts kit includes items that are considered wearable. Items in this kit include the following:

- Slip ring assembly
- Circuit boards
- Z axis motor
- Strain gauge assembly

Spindle Kit

This spindle kit includes air filters and five spindle assemblies. It is recommended to have at least two kits per GC-120Q machine.

Pneumatic Filter Kit

This kit contains a replacement filter and separator for the main air supply. At least one kit per site is recommended. The filter can and should be cleaned every six weeks according to the preventative maintenance schedule, and must be replaced every two years.

8mm Dual Lane Hardware Kit

This kit includes 20% of the total hardware that is required by 25 feeders. Items in this kit include the following:

- Pins
- Springs
- DL plugs
- Torx tools
- Screws, nuts etc.

Tool Kits

Genesis Tool Kit

The Genesis tool kit includes the tools required to perform the proper maintenance on the Platform. This kit includes the following item:

- Machine zero fiducial fixture for establishing machines zero when necessary
- Grease gun
- Stator lubrication oil
- Pipe coupling – custom grease gun attachment for accessing grease fittings
- 4.5” needle nozzle – custom grease gun attachment for accessing grease fittings
- Cleaning cloth

A minimum of one kit per site is recommended. Additional kits may be added to help expedite routine maintenance.

Lightning Head Tool Kit

This tool kit contains all the necessary tools required for maintaining the Lightning placement head. This kit includes the following:

- Vacuum test fixture
- Spacers for read and scanning head setup
- Hex drivers
- Retaining ring pliers
- Custom grease tips

A minimum of one kit per site is recommended. Additional kits may be added to help expedite routine maintenance

Nozzle Cleaning Kit

This kit contains a variety of wire sizes use for cleaning all Lightning nozzles.

Installation Kits

Platform Installation Kit

This kit includes all the basic tools required to install and or move a Genesis Platform machine. One kit per site is recommended. This kit includes the following:

- Ratchet
- Sockets
- Precision Levels
- Spanner wrench
- Combination wrench
- Machine aligners

Software

Machine Level Software Options

GEM

Generic Equipment Model (GEM) software provides a set of communication, data collection, command and control tools for the Genesis GC-120Q Platform. This software driver based on the Semiconductor Equipment and Materials International standard (SEMI E30-93) opens the system architecture for integration into factory data collection and automation systems.

Platform Traceability

Traceability at the component and board level gives you a closed-loop feedback system that can both confirm quality and zero in on potential problems – quickly, easily, accurately, and automatically.

Refer to GS-414, Dimensions General Specifications, for more information.

Bar Code Product Changeover

The Genesis GC-120Q Platform is capable of handling bar code changeovers if it is equipped with the bar code changeover option. This option allows for seamless product changeovers without requiring the user to manually load product data or press the start button. The changeover is accomplished when a bar code string is received, then a lookup is performed in a cross-reference lookup table to verify what product should be executed for a given bar code.

This option is completely local to the Genesis GC-120Q Platform. No external host machine is required. It is a separate purchased option to the UPS+ software.

Refer to Appendix B (page 32) for information on bar code types accepted.

Refer to GS-414, Dimensions General Specifications, for more information.

Platform Setup Validation (PSV) Option

The Genesis platform supports Platform Setup Validation (PSV), which prevents operator-related errors during feeder setup or reloading by verifying the correct components are loaded into the correct feeder slots. PSV minimizes product costs by reducing rework, thereby improving product yield while providing a validation log, which tracks each feeder dismount, scan, and mount routine. Minimal operator training is required due to the simple closed-loop operation and common look of the graphical user validation.

Incorporating PSV provides numerous benefits:

Prevents operator related loading errors: The closed-loop feedback system ensures the correct feeders and components are loaded into the appropriate feeder slot whenever a tape feeder is mounted or spliced on the Genesis platform

Eliminates costly rework: Since PSV cannot enable a mismatched component and feeder slot; the wrong components are simply not picked, thus preventing any associated rework.

Improves product yield: PSV ensures correct component usage. This means you won't be forced to rework boards because the wrong part was placed. Hence, your first pass yield may increase.

Increases operational efficiency: When integrated with Dimensions and GEM software, component consumption can be monitored / integrated into a customer's MRP system to assure parts are replenished without production interruption.

Refer to GS-414, Dimension General Specification for more information.

Line Level Software Options

Please refer to GS-414, Dimensions General Specification, for more information on line level software.

Specifications

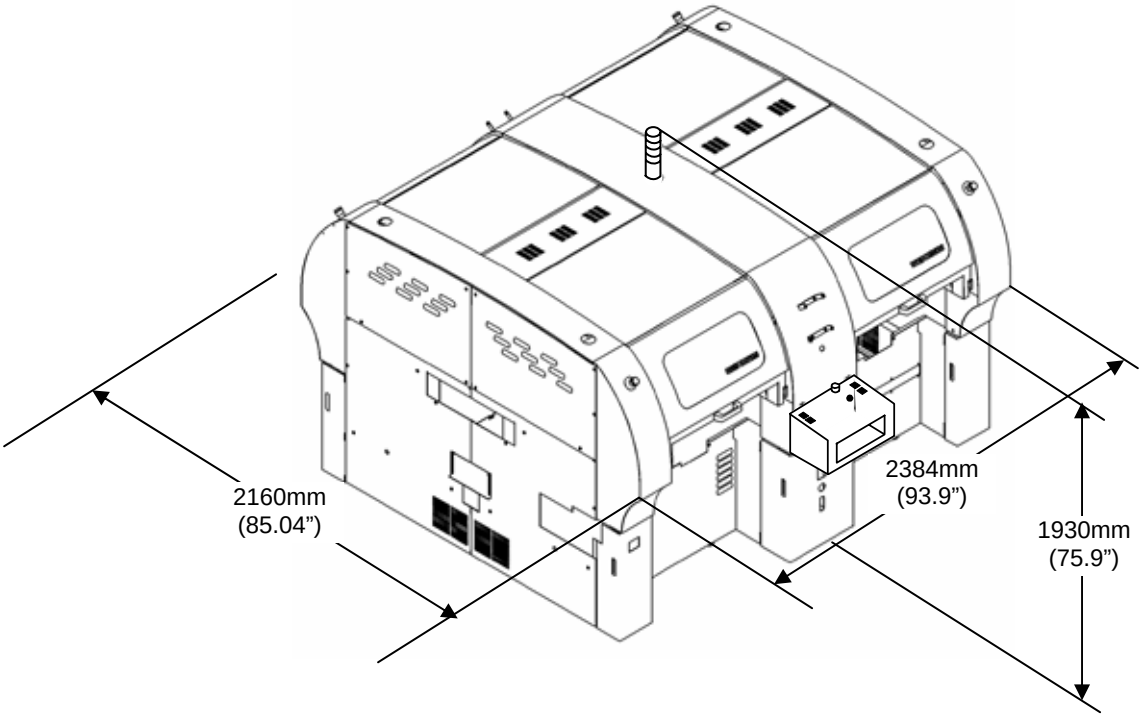
Installation Specifications

Installation Considerations

Machine Dimensions: Genesis

	Length[1]	Depth	Height[2]	Weight[3]
Base Machine	2384mm (93.9”)	2160mm (85.04”)	1930mm (75.9”)	3740kg (8245lbs)
Domestic Shipping	3048mm (120”)	2261mm (89”)	2032mm (80”)	4044kg (8915lbs)
Air Freight	3081mm (121.3”)	2294mm (90.3”)	2032mm (80”)	4309kg (9500lbs)
Sea Freight	Same as Air	Same as Air	Same as Air	Same as Air

1 Length is in the direction of board flow
2 Machine light tower included in height
3 Weight includes docking modules and removable banks but no feeders



Genesis GC-120Q Platform Installation Hardware

- 15k lb. Lift Truck with 10ft length forks
- Platform Install Kit

Floor Loading Requirements

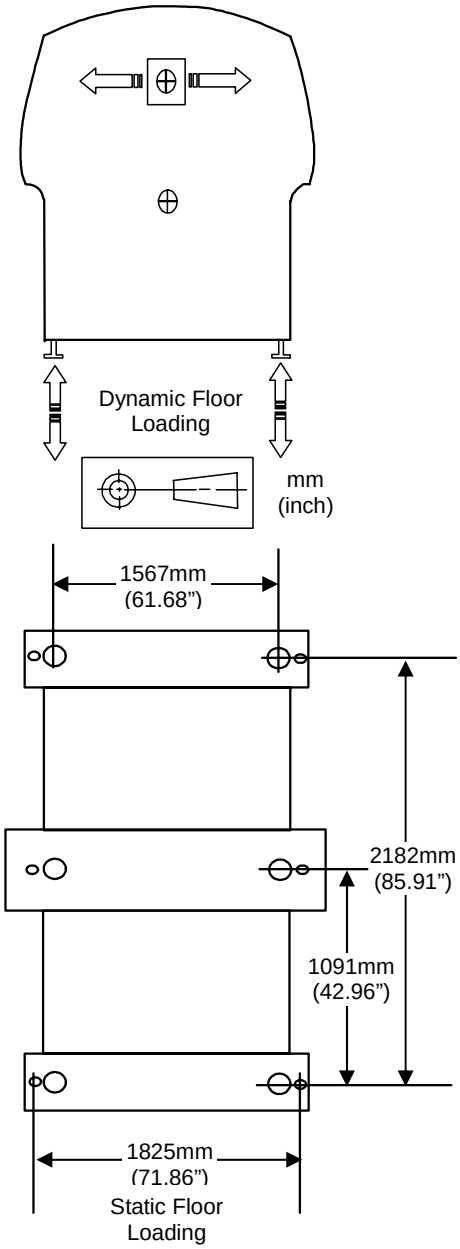
(See following diagrams)

Units	Genesis GC-120Q	Comments
Static Floor Loading (N/m^2)	9150	w/o Feeders
Static Floor Loading (lb/ft^2)	190	w/o Feeders
Static Floor Loading (N/m^2)	9950	w/Feeders
Static Floor Loading (lb/ft^2)	210	w/Feeders
Dynamic Load/Area (N/m^2)	3600	
Dynamic Load/Area (lb/ft^2)	75	
Total Floor Loading (Static + Dynamic) (N/m^2)	12750	w/o Feeders
Total Floor Loading (Static + Dynamic) (lb/ft^2)	265	w/o Feeders

Notes:
All loads are assuming machine is properly leveled and the load is evenly distributed.
Loads are based on 6" (150mm) reinforced concrete on compacted soil sub-base.
Loads are calculated as average over the area occupied by the machine leveling system.
Loads per unit area are concentrated about leveling legs.
Loads with Feeders are based on 72 Dual Track 8mm Feeders with two - 7" Reels.
All loads are vertical.
Dynamic loads will be applied upward and downward.
It is the customer's responsibility to determine appropriate structural requirements to support the machine.

The following diagrams illustrate the effects of Static and Dynamic floor loading. The Static diagram illustrates the footprint of the machine and the locations of the footpads to determine the surface area affected by the Static Floor Loading. The Dynamic diagram illustrates the forces applied to the floor as the positioning system moves.

This information is supplied for illustrative purposes only. It is recommended that a Structural Engineer be consulted to determine the proper floor loading requirements.


Dynamic Floor
Loading
mm
(inch)
1567mm
(61.68")
2182mm
(85.91")
1091mm
(42.96")
1825mm
(71.86")
Static Floor
Loading

Service Requirements

Electrical	200-240VAC, nominal or 380 – 415VAC, nominal
Frequency	50-60 Hz (+/- 2%)
Phases	3
Numbers of Wires	4 (3 Phases and Ground)
Service Configuration [2,3]	Must be grounded Delta, or Wye
Branch Circuit Size	35 Amps (200 – 240VAC) 20 Amps (380 – 415VAC)
Distortion	10% total Harmonic distortion
Average Power	10 KW
Electrical Connection[1]	290mm (11.4”) front left corner 501mm (19.7”) from floor

1 Electrical interface in the machine is in same proximity as GSMs and other Genesis Platforms
2 A customer-supplied transformer **cannot be a** “SPLIT-PHASE AUTOTRANSFORMER.” Split-phase transformers are typically two small autotransformers that get wired in series with the machine. The machine warranty will be voided if a customer attempts to operate Genesis in this configuration.
3 Do not hipot test the Genesis machine due to risk of damage to the machine’s electronics. Genesis utilizes a transformer-less AC Input System. Subjecting the machine to hipot testing will void the machine’s warranty.

Pneumatics (clean air)

Air Flow[1]	8.4 CFM @ 90psi (238 liters/min @ 6.2 bars)
Air Consumption[2]	45 SCFM (1274.3 S liters/min)
Pneumatic Connection	12.7mm (1/2”) ID or larger to machine 580mm (22.8”) from left front corner, 605 (23.8”) from floor. Internal thread connection is 1/2 NPT and provided with the machine. Equipment is adequately protected against ingress of solid and liquid contaminants.

1 Air Flow values are used to represent momentary peaks of demand for the machine to size input air lines. As with air consumption, it accounts for heads.
2 Air consumption is an average for air used by the base machine during a normal machine cycle and is measured in standard cubic feet per minute. It accounts for heads.

Clean Air is Defined as:

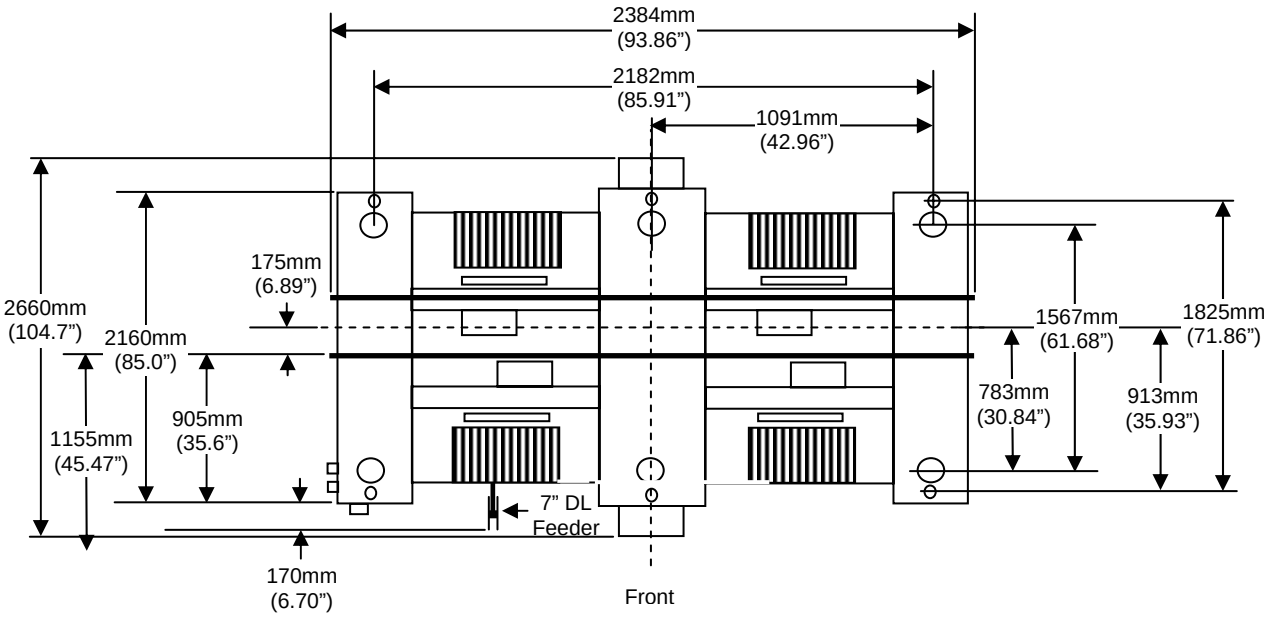
1	Dew Point	Must be 20 degrees F (11 degrees C) below ambient temperature
2	Oil	.08 ppm at 82 degrees F (28 degrees C)
3	Input Air	Filtered to 5 microns particle size

Environmental Requirements

	Minimum	Maximum
Operating Temperature	4.4 Degrees C 40 Degrees F	35 Degrees C 95 Degrees F
Operating Temperature Change Tolerance		6 Degrees C/Hr 10.8 Degrees F/Hr
Storage Temperature	-20 Degrees C -4 Degrees F	65 Degrees C 149 Degrees F
Operating Humidity	10% non-condensing	90% non-condensing
Operating Altitude		2500 Meters 8202 Feet
Noise Level[1]		73

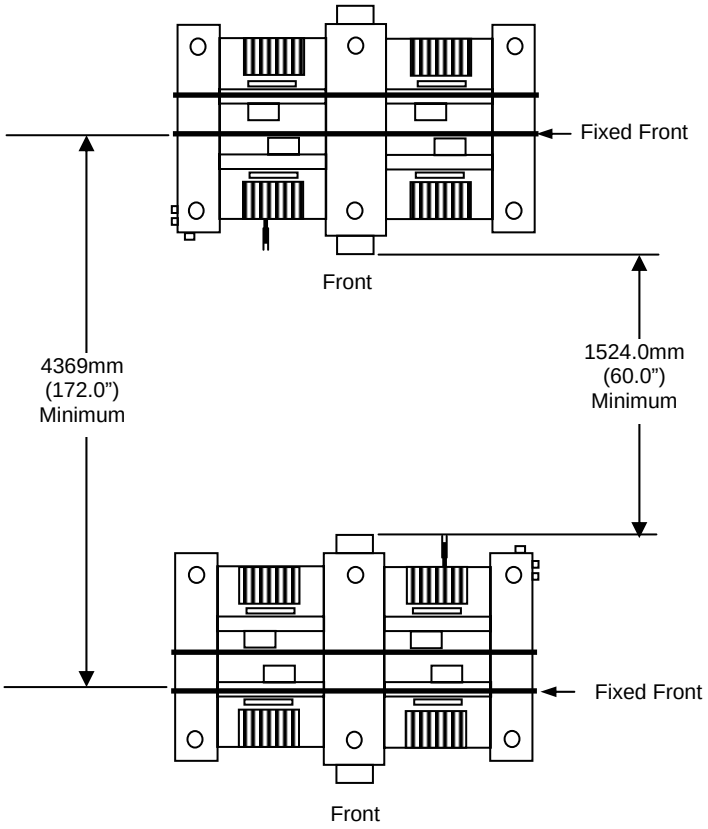
1 In accordance with National Machine Toolbuilders Assoc. Noise Measurement Technique Standard – June 1986

Genesis GC-120Q Platform Footprint



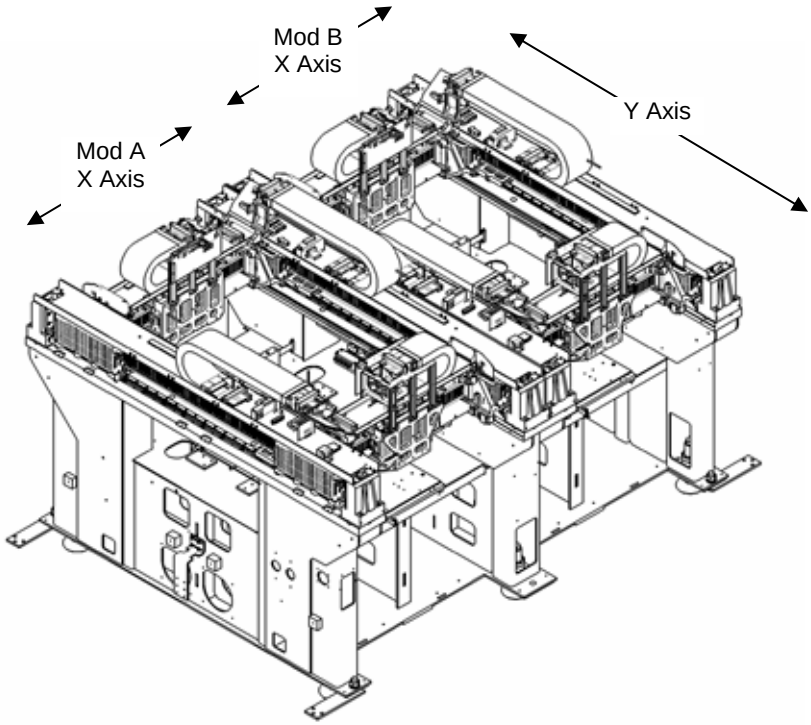
Aisle Considerations for Use of Feeder Carts

If using Dual Track feeders with 13" reels add an additional 18" to minimum space between machines



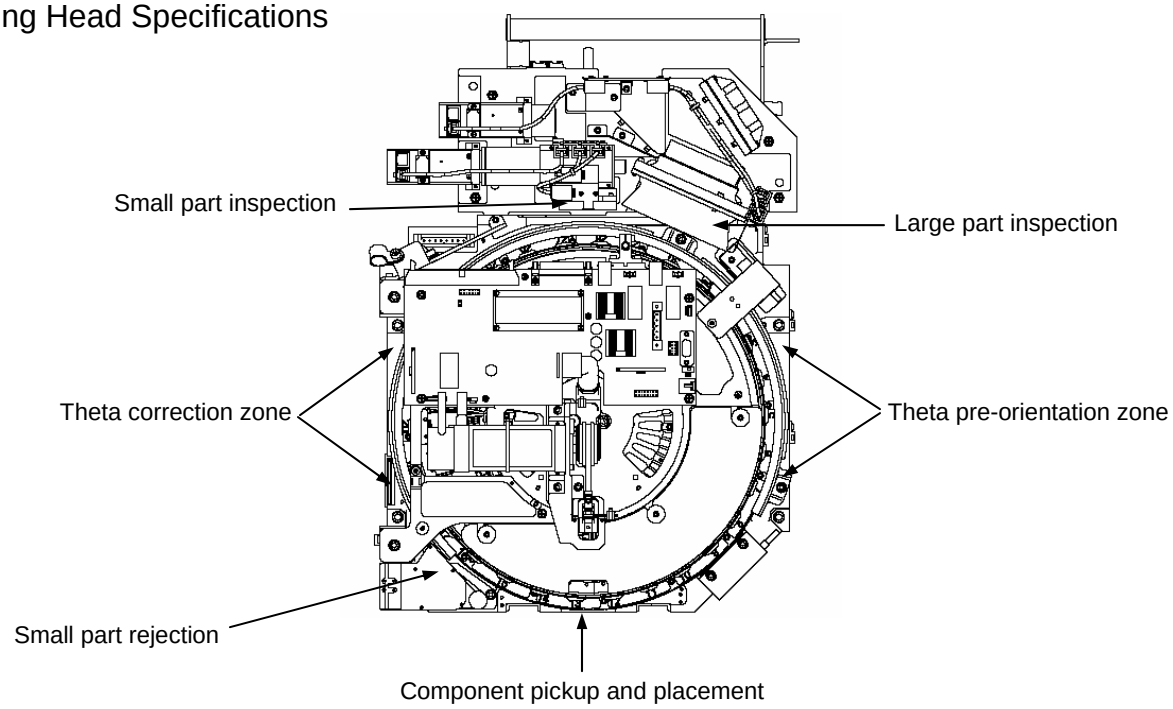
Genesis GC-120Q Positioning System Specifications

X Axis Travel	365mm (14.4”)
Y Axis Travel	802mm (31.6”)
Resolution	.0010mm (.00004”)



Placement Head

Lightning Head Specifications



Component Handling

Component Handling Capabilities	Lightning	
	Minimum	Maximum
Component Width	0.127mm (0.005")	30mm[1] (1.181")
Component Length	0.25mm (0.01")	30mm[1] (1.181")
Component Height	0.15mm (0.006")	6mm (0.24")[2]
Component Weight		4 gr
Placement Force (grams)		200 ± 20%
MELF Diameter		3.5mm (0.14")
Lead Pitch (wide camera)	0.3mm (0.012")	N/A
Lead Pitch (narrow camera)	0.1mm (0.004")	N/A
Minimum Lead Width (30 mm Square Component Size)	0.46mm (0.018")	N/A
Minimum Lead Width (20 mm Square Component Size)	0.36mm (0.014")	N/A
Bump Diameter (narrow camera)	0.102mm	N/A

1 For components greater than 20mm square, an RFQ is required
2 4mm with standard nozzle and 6mm with short nozzle

On-The-Head-Camera Specifications

	Camera			
	0.8 mils/pixel		2.87mils/pixel	
Maximum Component Size	mm	inches	mm	inches
Maximum Component (square)	8.000	0.315	30.000	1.182
Maximum Component Height	6.000[1]	0.236	6.000[1]	0.236
Leadless Components				
Minimum Length	0.244	0.010	0.875	0.034
Minimum Width	0.122	0.005	0.437	0.017
Leaded Components				
Minimum Pitch	0.081	0.003	0.292	0.011
Minimum Length/Width - Centering	0.041	0.002	0.146	0.006
Minimum Length/Width - Inspection	0.051	0.002	0.182	0.007
Multi-Pattern Components				
Minimum Centering	0.122	0.005	0.437	0.017
Minimum Inspection	0.132	0.005	0.474	0.019
BGA & C4				
Minimum Pitch	0.203	0.008	0.729	0.029
Minimum Ball Dia	0.102	0.004	0.364	0.014
Minimum Ball Spacing	0.081	0.003	0.292	0.011
1 with short nozzles				

Nozzles

Lightning Nozzles

In addition to the four large part nozzle kits shipped with each machine, the customer must also select either a small part nozzle kits or elect to order the required nozzles independently. All nozzles and nozzle kits are outlined below.

Available Nozzles

Nozzle	Description	OD/ID (mm)	Sample Component Range	Designed Life Expectancy (cycles)
Compliant Tip Nozzles				
3220	Nozzle Tip 125	3.23 / 2.16	1812,PLCC18, SOIC8, SOIC14	3 million
3240	Nozzle Tip 234	5.94 / 2.79	SOIC18, SOJ42, ALCAP10x10	3 million
3260	Nozzle Tip 340	8.64 / 5.08	PLCC100, PLCC32, PLCC84, QFP100, QFP160, SOIC10	3 million
3520	Nozzle Tip 402 Compliant Blade	N/A	0402C, 0402R	3 million
3530	Nozzle Tip Compliant 603	0.904/0.701	0603C, 0603R	3 million
3540	Nozzle Tip Compliant 805	1.3 / 0.899	0805C, 0805R	3 million
3550	Nozzle Tip Compliant 1.8mm	1.8 / 1.1	1206C, 1206R, 1210C, 1210R	3 million
Melf Nozzles				
3320	Nozzle Tip 042MF	1.32/1.02	MELF - 2.0x1.3	8 million
3340	Nozzle Tip 083MF	2.11/1.60	MELF - 3.4x1.4 to MELF - 9.3x2.6	8 million
Stainless Steel Conical Nozzles				
3420**	Nozzle Tip 402	0.599 / 0.399	0402C, 0402R	8 million
3430	Nozzle Tip 603	.904/.701	0603C, 0603R	8 million
3440	Nozzle Tip 805	1.3/0.9	0805C, 0805R	8 million
3450	Nozzle Tip 1.8mm	1.8/1.1	1206C, 1206R, 1210C, 1210R	8 million
Bladed Chip Nozzles				
3020*	Nozzle Ceramic Tip 0201	N/A	0201C, 0201R	8 million
3021*	Nozzle Ceramic Tip 0201	N/A	0201C, 0201R	8 million
Short Nozzles (For components > 4mm and < 6mm)				
4220	Nozzle Tip 125S	3.23 / 2.16	1812,PLCC18, SOIC8, SOIC14	3 million
4240	Nozzle Tip 234S	5.94 / 2.79	SOIC18, SOJ42, ALCAP10x10	3 million
4260	Nozzle Tip 340S	8.64 / 5.08	PLCC100, PLCC32, PLCC84, QFP100, QFP160, SOIC10	3 million

* Placement Density is .007" (0.178mm)
** Placement Density is .012" (.3mm)

Standard Large Part Nozzle Kit – Supplied with each Lightning Head

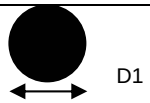
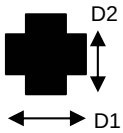
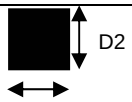
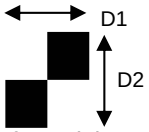
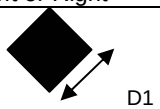
Nozzle Code	Quantity in Kit
3220	4
3240	4
3260	4
3320	4
3340	4

Recommended Small Part Nozzle Kit

Nozzle Code	Quantity in Kit
3420	30
3530	30
3540	30
3550	30

Fiducial Specifications

Global and Local Fiducial Shapes and Dimensions

Shape	D1	D2
 Disc	Min=0.40 mm (0.016") Max=6.10 mm (0.250")	—
 Swiss Cross	Min=1.02 mm (0.040") Max=6.35 mm (0.250")	Min=0.508mm(0.020") Max=5.84 mm(0.230")
 Rectangle (Square)	Min=0.40 mm (0.016") Max=6.35 mm (0.250")	Min=0.40 mm (0.016") Max=6.35 mm (0.250")
 Double Box Left or Right	Min=1.0 mm (0.040") Max=6.35 mm (0.250")	Min=1.02 mm (0.040") Max=6.35 mm (0.250")
 Diamond	Min=1.0 mm (0.040") Max=6.35 mm (0.250")	—

Recommended Fiducial and Bad Mark Sense

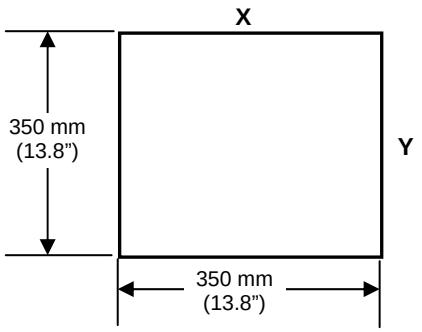
Universal recommends that a minimum of three global fiducials be used for boards assembled on the Genesis Platform—two to six fiducials depending on the process. Although the Genesis Platform handles a range of fiducial types, the most reliable fiducial recommendations follow:

Shape	Disc (solid, filled circle)
Size	Minimum -- 0.8 mm (0.032") Maximum -- 3.00 mm (0.118")
Tolerance	0.025 mm (0.001")
Clearance	The fiducial clearance area must be at least two times the diameter of the fiducial.
Material	Bare copper or copper covered with either clear anti-oxidation coating, nickel plating, tin plating, or hot air leveled solder coating.
Flatness	The fiducial surface should be flat within 0.015 mm (0.0006")
Mask	Solder resist coatings should not cover a Fiducial mark or its clearance area.
Max # of Fids	500
Max # of Bad Sense Marks	254

Fiducial Locations

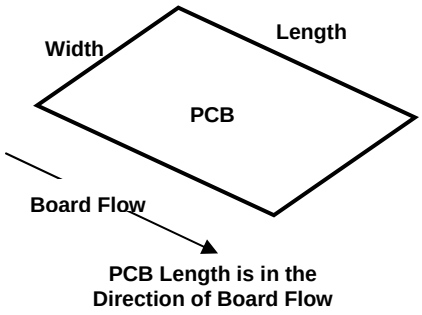
Fiducials must be located within the following board dimensions (dimensions from lower left corner of board):

Board Handling	Y Axis (measured from the fixed front rail)	X Direction
Standard 350mm x 350mm (13.8” x 13.8”)	350mm (13.8 inches)	350mm (13.8 inches)



Board Handling Specifications

Board Specifications – Standard Board Handling



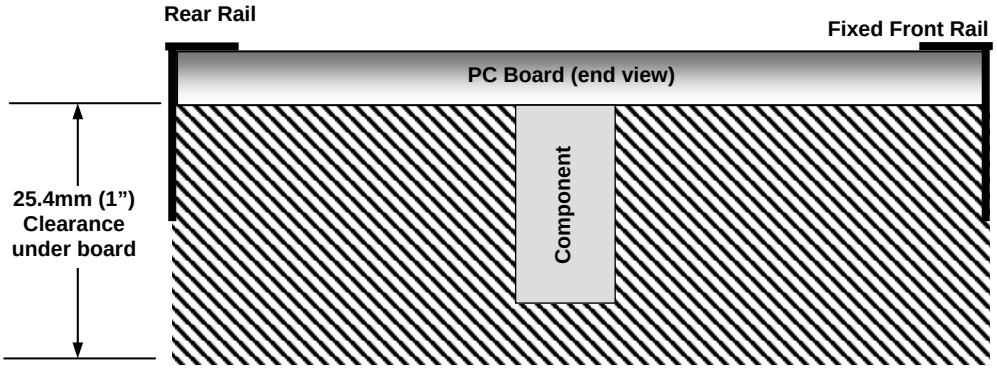
	Minimum	Maximum
Length	50.8mm (2”)	350mm (13.8”)
Width	89mm (3.5”)[1]	350mm (13.8”)
Thickness	.508mm (.02”)	5.08mm (0.2”)
Weight		1.81kg (4lbs)[2]
Allowable Warp	For Board Transfer	5.537mm (.218”) minus board thickness
	For Placement	.75% of board length (per IPC-2221), not to exceed 3.175mm (.125”) total

1 Optional kit is available for board widths between 50.8mm (2”) and 89mm (3.5”).
2 Represents the sum of all board weights within one module of the Genesis GC-120Q Platform board handling system and components placed.

Board Clearance

Topside Clearance Before Placement	Tallest part on board + thickest part being placed by Lightning must be less than 11mm (Assumes no board warpage in the clamped position)
Bottom Side Clearance*	See Illustration

* Bottom side clearance is limited by board support pins to 25.4mm (1”). Without board support pins the bottom side clearance is 32mm (1.3”).



Maximum Underboard Clearance Area

Board Handling Transfer Specifications

	Minimum	Maximum
Transfer Height (from floor)	899mm (35.4”)	965.2mm (38”)
Transfer Time		1.7 sec
Edge Clearance	Standard	3mm (0.12”), +/- .4mm (.016”)

Board Support Specifications

Board Support	Max Board Width Supported	Max Board Length Supported
Standard	350mm (13.8”)	280mm (11”)

Performance Capability

Performance

Final Placement Performance 50 DPM
Intrinsic Availability 98%
Maintenance Interval 11.4 Hours every 6 weeks

Placement Capability – Universal Reference Method with Glass Slugs on Glass Plates or Live Parts on FR4

Camera Type	Part Type	X/Y Spec Limits (um)	Theta Spec Limits (deg)	Min Cpk
OTHC	Leadless*	65	N/A	1.33
	Leaded**	65	1.0	1.33

* Across-the-board, requires MCCM and 0201 Live Part Trim to be performed
** Across-the-board, requires MCCM and MMI-AT to be performed

Machine Speed

CPH	Part Type	Comments
120,000	1005 (0402)	Maximum CPH*
63,000	1608 (0603)	4 board IPC

*Based on chip – 1005 (0402) chip capacitor (240 placements), picked from single dual track 8mm Precision Pro feeders located in each quadrant of the machine, placed in the center area of a 13.8” x 13.8” (350mm x 350mm) board.

Appendix A

Model Specifications Summary

Machine Configuration	Genesis GC-120Q
Machine Architecture	
Machine Type	Gantry
Number of Gantries	4
Drive System	Dual Linear Motor
X,Y Motor Type	VRM Linear
Operating system	Win XP
Machine Capabilities	
Machine Dimensions	
Length x Depth (meters)	2.38 x 2.16
Board Handling	
Max Board Size	
Standard(L x W) (mm)	350 x 350
Load Time(s) - Standard	1.7
Dual Lane Option	No
Topside Clearance (mm)	11.0
Bottom side Clearance (mm)	25.4
Feeders	
8mm Input	144
12mm Input	72
16mm Input	36
Tube Input	No
Bulk Input	No
Bank Change	Yes
Splicing	Yes
Component Capabilities	
Min Component	0402mm (01005")
Max Component (square) - standard	20mm (0.79")
Max Component (square) - RFQ	30mm (1.18")
Max Component Height	6mm (0.24")
Min Component Pitch	0.081mm (0.003")
Min Ball Dia.	102um
Placement Force (grams)	200 ± 20%
Special Vac Nozzle (Odd-form)	No
Gripper Nozzle (Odd-form)	No

Machine Configuration (continued)	Genesis GC-120Q (cont)
Performance	
Max CPH	120,000
CPH/m^2	23,342
1608 CPH – Single Lane board Handling (IPC 9850 4-board)	63,000
100QFP CPH	-
Practical Chip TACT	0.057
Practical SOIC TACT	N/A
Practical Odd-form TACT	N/A
Accuracy	
1608 Accuracy	65um @ 1.33 CpK
100QFP Accuracy	65um @ 1.33 CpK
Supported Hardware	
Head Type	Lightning - 4-Heads 30-Spindles/head
Upward Looking Camera	N/A
PTF	No
SMTF	No
DPTF	No
Wafer Handler	No
PrecisionPro Feeder Interface/Bank Change	Yes
Nozzle Changer Inventory	280
Production Characteristics	
Auto Nozzle Change during production	During Changeover
Linear Sensor Equipped	No
Repair Mode	End of pattern
Vision lighting modes	Front
Qty of Feeder duplicates for High-Running Component(Min.)	1
Closed-Loop Splice Validation	Yes

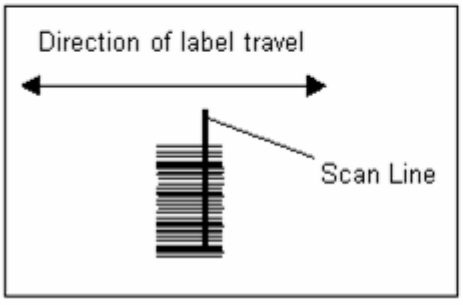
Appendix B

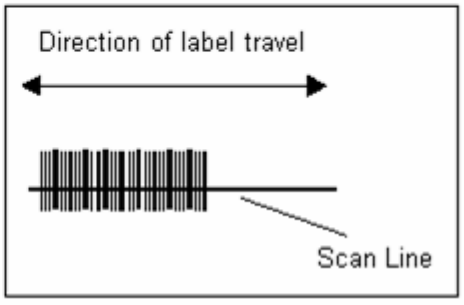
Bar Code Types

The scanner is a high-density .127mm (.005") line width, capable of reading the following bar code types:

Code 39; UPS; Codabar; Code 128; Interleaved 2 of 5

Narrow Bar Width	Read Range	Maximum Scan Width
	High Density, Right Angle Down	
0.127 mm (0.0050")	50.8 mm to 78.7 mm (2" to 3.1")	53.3 mm (2.1")
0.191 mm (0.0075")	50.8 mm to 102 mm (2" to 4")	91.4 mm (3.6")
	Low Density	
0.191 mm (0.0075")	63.5 mm to 140 mm (2.5" to 5.5")	102 mm (4")
0.254 mm (0.0100")	50.8 mm to 165 mm (2" to 6.5")	127 mm (5")
0.381 mm (0.0150")	50.8 mm to 190 mm (2" to 7.5")	152 mm (6")
0.508 mm (0.0200")	50.8 mm to 254 mm (2" to 10")	178 mm (7")
0.762 mm (0.0300")	50.8 mm to 254 mm (2" to 10")	178 mm (7")
1.02 mm (0.0400")	50.8 mm to 254 mm (2"to 10")	178 mm (7")
	Right Angle Down	
0.191 mm (0.0075")	31.8 mm to 102 mm (0.25" to 4")	102 mm (4")
0.254 mm (0.0100")	25.4 mm to 127 mm (1" to 5")	127 mm (5")
0.381 mm (0.0150")	25.4 mm to 152 mm (1" to 6")	152 mm (6")
0.508 mm (0.0200")	25.4 mm to 216 mm (1" to 8.5")	178 mm (7")
0.762 mm (0.0300")	25.4 mm to 216 mm (1" to 8.5")	178 mm (7")
1.02 mm (0.0400")	25.4 mm to 216 mm (1" to 8.5")	178 mm (7")





The bar code label should be placed away from the front edge of the PCB depending on rail clearance (3 or 5mm).

Appendix C

Acceptance Criteria

SRVC001.1.Rev. H

Core Machine Acceptance Testing

This document outlines the standard and optional protocols for Factory QAC Testing at Universal and Final Acceptance Testing (commissioning) at the customer's facility. Standard protocols are included at no additional cost to the customer. Optional protocols proceed through Universal's Request For Quote (RFQ) process to determine the additional cost and schedule impacts.

- Systems: **see separate Systems Acceptance Testing section below.**
- OFA Division **assembly products are processed through RFQ and are not covered by these processes.**

Standard Factory QAC: Factory Quality Assurance Checklist (QAC) testing and inspection is performed by Universal personnel in accordance with detailed processes to assure that the machine(s)/systems we deliver meet Universal's exacting quality standards. Throughput, accuracy, yield, and intrinsic availability are tested in accordance to established Universal and Industry standards. Results are documented and verified against published specifications. If any process is found to be outside acceptable performance parameters, testing is halted, the root cause of the failure is determined and corrected, and testing is restarted. Machines that pass the requisite QAC processes are approved for shipment.

Factory testing outside these parameters is considered "optional" and fall under Universal's Request For Quote (RFQ) process.

Standard On-site Acceptance: After delivery of the machine(s) to the customer's facility, Universal will commission the equipment to prepare it for production use by the customer. We will:

1. Inspect all items to make sure the delivery is complete against the ordered items.
2. Position the machine(s) in its final installation location. (Customer is responsible for unloading and moving the equipment on the factory floor.)
3. Level the machine(s), make the mechanical and electrical connections into the line (if required), and make all power connections. Facility must be prepared per the GS (General Specification) requirements. UIC is not responsible for any facility modifications, or for integration of / communication with any customer / 3rd party equipment or computer networking. UIC will undertake standard mechanical and electrical connections.
4. Cycle the machine(s) through its standard operational routine and prepare it for acceptance.
5. Create programs for up to two customer products, based on standard GS (General Specification) parameters and within the constraints of the "as delivered" equipment configuration.
6. Provide 4 hours of basic operator training for up to 6 persons.
7. Machine testing:
   - 7.1. If customer product was not run for factory acceptance testing and conforming* customer product is available for on-site final acceptance testing, then our standard process defaults to preparing the machine(s) to run the conforming product for a maximum 4 hour period or 10,000 placements / insertions, while meeting the standard acceptance criteria per the tables below. Customer is responsible to make the necessary materials available for immediate use in acceptance testing.
     *Conforming product means product where the substrates, components, fiducials and all other characteristics fall within the machine parameters as stated in the applicable GS (General Specification).
   - 7.2. If customer product was not run for factory acceptance testing and conforming customer product is not available, then our standard acceptance process defaults to dry cycling the machine(s) for four (4) hours to demonstrate operation and complete final acceptance testing.
   - 7.3. If customer specific product was run during factory testing (conforming or non-conforming), then our standard acceptance process includes preparing the machine(s) to run that same product, and running it for a maximum 4 hour period or 10,000 placements / insertions for that product, while meeting the performance standards per the below tables. Customer is responsible to make the necessary product materials available on-site for immediate use in acceptance testing.
   - 7.4. If Universal provided acceptance materials are ordered for final acceptance testing via a Request For Quote (RFQ), then our standard process defaults to running the acceptance to demonstrate the machine(s) meets the stated operational capabilities per the GS (General Specification).
   - 7.5. If any process is found to be outside acceptable performance parameters, testing is halted, the root cause of the failure is determined and corrected, and testing is restarted.
8. Upon successful completion of the above, the machine(s) will have met the final acceptance criteria. Customer will be asked to sign off on our Customer Service Report, acknowledging this milestone has been achieved.
9. As described in the Terms and Conditions of Sale document, any use of product for purposes other than inspection and test shall constitute acceptance.

Note: Acceptance testing outside these standard parameters must be processed through Universal's RFQ process, and will result in additional cost and schedule.

Minimum acceptance levels - Core Machines

Surface Mount

Universal Facility			Customer Facility		
Prod Code	Placements	Placement DPM	Placements	Placement DPM	IA
4687A	5000	50	4 Hr Run	50	98%
4687B	5000	50	4 Hr Run	50	98%
4699	Fact Quote	Fact Quote	Fact Quote	Fact Quote	--
4982	6850	50	4 Hr Run	50	98%
4983A	13600	100	4 Hr Run	100	98%
4983B	6850	50	4 Hr Run	50	98%
4797 L/S/B/	27,500	100	4 Hr Run	100	98%
X/R	5000	50	4 Hr Run	50	98%
4988	6850	75	4 Hr Run	75	98%
4990	13,600	75	4 Hr Run	75	98%
4991	TBD	TBD	TBD	TBD	98%
5588A	27,500	50	4 Hr Run	50	98%
5685	Fact Quote	Fact Quote	Fact Quote	Fact Quote	--
5785	Fact Quote	Fact Quote	Fact Quote	Fact Quote	--

Intrinsic Availability = IA DPM = Defects Per Million

Line Level Software Products

	Universal Facility	Customer Facility		
Prod Code	Performance	Performance	DPM	IA
8684X	Fact Quote Note 1	Fact Quote Note 1	N/A	98%

Notes:
1. Application and configuration dependant.

Optional acceptance testing scenarios requiring Request For Quote (RFQ):

Optional factory acceptance at Universal (Factory acceptances void all published machine lead times)**:**

1. Factory acceptance testing using customer specific product: In addition to the standard QAC process, the customer may request a demonstration of the machine's capability to produce a specific circuit assembly product. If this is requested by the customer, specific details regarding product design, quantity to be run, schedule for delivery of substrates, components, CAD and BOM files, etc. to Universal, and other relevant factors, must be agreed prior to the time of order placement. Please note:

1.1. These activities are outside the scope of standard factory QAC, and will result in an additional charge to the customer and additional time to ship.

1.2. Customer provided product (boards and components) that fall outside the stated GS (General Specification) parameters may result in additional cost (and schedule) to configure the machine for the specific product (change to the customer's purchase order).

1.3. Customer specific product that is run in the Universal factory will also be used for Final Acceptance Testing at the customer's site. Deviations to this must be processed through a separate RFQ process, at additional cost.

1.4. If any process is found to be outside acceptable performance parameters, testing is halted, the root cause of the failure is determined and corrected, and testing is restarted

2. Factory acceptance testing using Universal supplied acceptance material: If the customer does not have specific product to run, but still wants to witness its machine in an operating mode before it leaves the factory, Universal may be asked to provide a quotation for an acceptance material that can be used to demonstrate the standard placement or insertion capabilities of the machine. (If these optional acceptance materials are used for factory acceptance, then additional materials and lead time will be required to demonstrate the same operational capabilities during final acceptance testing at the customer's site.) The decision to proceed with the acceptance material purchase must be made prior to the time of order placement. Delivery lead times and cost will be affected.

Optional on-site final acceptance testing. Any on-site acceptance testing that is outside the standard parameters defined above requires a Request For Quote (RFQ). This may include, but is not limited to, the following scenarios:

1. Extended acceptance testing to include set-up and running of additional customer products (more than one); longer test runs for products; creation of additional pattern programs (more than two), etc.

2. Any situation where the customer wants to run non-conforming product on-site, and Universal has not been made aware of and been given complete product definition prior to the time of order placement. The RFQ may result in recommended changes to the machine configuration, accessory equipment, as well as time and material for supporting the additional acceptance testing.

3. Any non-standard testing scenario not covered above.

4. If any process is found to be outside acceptable performance parameters, testing is halted, the root cause of the failure is determined and corrected, and testing is restarted

Any non-standard acceptance testing activities that were not defined / quoted at the time of order placement are outside the scope of the original order, and payment for delivered equipment is expected based on the standard acceptance test processes outlined above. Payment for the additional (RFQ) activities shall be made per separate agreement between Universal and the customer.

System Acceptance Testing - System acceptances are available on a Request For Quote (RFQ) basis. Due to the logistics associated with assembling a system, it is very important to give consideration to order cycle timing. Universal is not responsible for the installation and/or integration, or operation, of non-Universal brand equipment included in the system. Universal will cooperate with all other vendors to provide necessary electrical, mechanical and software handshake information to facilitate total system installation and testing.

I. Factory Acceptance Option One

System acceptance tests may be designed to validate the operation of the equipment as an assembly system. Core machines within a system will have individually completed the Core Machine Acceptance tests and as such, these tests are not repeated as part of the standard system procedure.

1. Operational walk through and visual inspection.
   a. Visual inspection of all equipment.

2. Capability test of the material handling system.
   a. The printed circuit board (PCB) transfer system is tested by performing a board "pass through" run.
      I. Quantity of boards transferred is dependent on size and complexity of system. Minimum quantity is 100. The acceptance criteria is 100% reliable transfer of the PCB's (no PCB jams, miss-locations or dropped boards).

II. Factory Acceptance Option Two

1. Capability test on the assembly system using UIC material.

   a. Through Hole Assembly System
      I. Assemble 100 PCB's on the system
         a. Populated PCB's are examined for part insertions, clinch angles, lead lengths, component stability and DPM level.

   b. Surface Mount Assembly System
      I. Assemble two PCB's on the system, using conforming customer material. Applicable sections (a-g) are performed.
      a. Verify placement accuracy (relative to pad location and coverage) complies with published machine specifications. *****
         - Print solder paste on five sample boards. (customer screens and paste required)
      b. Verify print consistency and accuracy complies with specifications for the screen printer.
      c. Apply adhesive dots to two sample PCB's.*****
         - Verify dot consistency and accuracy complies with published specifications.
      d. Monitor temperature profiles from the process oven.
         - Verify required profile temperatures are maintained throughout the process.
      e. Assemble two sample PCB's on the system.
         - Verify system performance to achieve baseline for final acceptance run.
      f. Perform a 100 PCB assembly run.
         - Verify machine performance and availability complies with machine specification.
         - Compare system throughout rate with pre-established estimate.
      g. The acceptance criteria for placement reliability are based on the individual DPM specifications on a per machine basis.

III. Field Acceptance, On-Site at Customer's Facility
On-site customer acceptances for systems will follow the same outline as the Factory Acceptance test for systems.

IV. Special Products/OFA Acceptance Testing
Acceptance criteria for all special products or custom engineered solutions are defined at the time of quotation. Unless otherwise specified, customer supplied materials are required for machine setup, debug and acceptance for special applications.

- Accuracy verification methodology to be defined during the RFQ process, otherwise defaulting to 75% part to pad placement. Alternatives include MMI or CeTaQ as defined at time of quotation.

END OF DOCUMENT

Field Acceptance Kit

The field acceptance kit includes the parts see in the following table. This kit is intended for use in the absence of customer supplied boards and components. This kit is designed to accommodate FlexJet, InLine 4, and Lightning head equipped machines whether single beam or dual beam. This kit requires an RFQ.

NQAP Board
1206 Capacitor
1206 Resistor
0402 Capacitor
0402 Resistor
0603 Capacitor
0603 Resistor
0805 Capacitor
0805 resistor
Resistor Network
SOT23
SOT89
SSOP8
QFP100
Double Sided Tape

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