

Asyst Falcon™ 300mm Loadport Technical Manual with Installation Instructions



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Thank you for helping to improve the manuals and to maintain accuracy.

Acronym List

AGV	Automated Guided Vehicle
APHD	Active Pod Hold Down
ASCII	American Standard Coding for Information Interchange
CAN	Control Area Network
DSP	Digital Signal Processor
EMI	Electromagnetic Interference
EMO	Emergency (Machine) Off
ESD	Electrostatic Discharge
FIMS	Front-opening Interface Mechanical Standard
FOUP	Front Opening Unified Pod
K-Plate	Kinematic Plate (also referred to as FOUP Advance Plate)
MGV	Manually Guided Vehicle
OEM	Original Equipment Manufacturer
OHS	Overhead Hoist Shuttle
OHT	Overhead Transport or Overhead Hoist Transport
PCB	Printed Circuit Board
PN or P/N	Part Number
RFID	Radio Frequency IDentification
SEMI	Semiconductor Equipment and Materials International
SMIF	Standard Mechanical Interface

Preliminary

Revision History

This section gives an overview of the change history for the document.

Date	Author	Version	Revision Information
11/15/2007	Catherine Day	Ax1	Created using 2000-2414-05 Rev. C as a base.
1/10/2008	Catherine Day	Ax2WIP	WIP - Compiled for Mike F. <u>Reference Only</u>
3/21/2008	Catherine Day	Ax2	Compiled for training class. Huge gaps in Installation, Overview, Interfaces and Comm SW which we will attempt to fill during training week 3/24-28.
3/28/2008	Catherine Day	Ax3WIP	WIP - Compiled for Tou Vang. <u>Reference Only</u>
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04/18/2008	Catherine Day	Ax4	Added redlines and new input from Tou Vang, Mike Fahkrabadhi, Selby Sondergaard, Chi Yeh, Gary Durham, Grant Imper, Pranav Desai. Updated more images.
04/24/2008	Catherine Day	Ax5	Added redlines and new input from Tou Vang, Mike Fahkrabadhi, Selby Sondergaard, Matt Hoang. Updated more images.
5/30/2008	Catherine Day	Ax6	Added Content from Tou Vang, Mike Fahkrabadhi and drawings
7/11/2008	Catherine Day	Ax7	Expanded Software upgrade procedure and made it part of the Service Chapter. Added input from John Green and Pranav Desai. Made changes to all chapters and appendices. Incorporated Beta 9 Software release notes, in many case replacing existing content with info from the release notes. Changed multiple illustrations. Updated all Assembly drawings and PCB drawings.

Revision History

Date	Author	Version	Revision Information
9/3/2008	Catherine Day	Ax8	Added input from John Greene, Duc Le, Bob Carlson, and Pranav Desai. Made changes to all chapters and appendices. Incorporated Beta 10 Software release notes. Updated all Assembly drawings and PCB drawings.
9/22/2008	Catherine Day	Ax9	<p>FINAL DRAFT -Removed information duplicated in the Software Communications Manual and just reference that document.</p> <p>Added Remove and Replace instructions for the E84 and AC Power Options. Edited all service procedures to show new front panel removal. Updated all Assembly drawings and PCB drawings.</p> <p>Added customer cable routing for the E84 and AC Option to the Installation Appendix. Added Details about the Vertical Brake.</p> <p>Added comments/corrections from Chris Lueders, John Greene, Duc Le, Bob Carlson and Tou Vang. Added Specifications from Engineering and Matt Hoang.</p>

Preliminary

Table of Contents

Disclaimers	iii
Manual Information	iii
Trademarks	iii
Equipment Modification	iii
Training and Languages	iii
Warranty	iii
Reader Comments	iv
Acronym List	v
Revision History	vii
Preface	1
About this Manual	1
Conventions	2
Chapter 1: Safety Information	3
Introduction	3
Chapter Summary	3
General Requirements	4
General Safety	4
Electrical Safety	4
Responsibility	5
Safety Tags	6
Safety Requirements	7
ESD / EMI Precautions	7
EMO & Electrical Power	8
Lockout/Tagout	8
Pinch Hazards	9
During Installation	11
Seismic	12
Ergonomic	12
Options	13
Wafer Mapper Option	13
100-240VAC Option	13
E84/PIO/ Interlock Option	13

Tilt and Go Wheels Option.	13
Agency Compliance	14
FCC	14
Definition	14
Compliance	14
CE Mark.	14
Safety Features.	15
DC Voltage	15
AC Option	15
Pinch Hazard.	15
Port Door	15
FOUP Advance	15
Moving and Handling	16
Labeling.	18
Chapter 2: Product Overview	23
Product Description.	24
Major Components	25
Features.	26
Power.	26
Specifications	27
FIMS Door.	29
Features.	30
Ball Joint with Clamping for Port Door Alignment.	30
Simplified Twist and Pull Latch Key Drive	30
Sensors	31
Ground Path to FOUP Door	31
Configurable Latch Key Over-Rotation.	31
Vertical-Horizontal Door Drive.	32
Features.	32
Single Motor for Two Axes	32
Upper Pulley/Brake/Encoder Assembly	33
Fan Assembly.	33
FOUP Advance Subassembly.	34
Features.	35
Torque Tube with Cantilevered Supports.	35
Manual Load/Unload Push Button Switch	35
K-Plate Node PCB	36
Cam Activated Pod Hold Down	36

Sensors	36
BOLTS Frame	38
Main Components	38
Light Display Node PCB	38
Excessive Wafer Protrusion Sensor	38
Static Entry Node PCB	39
Options	40
Wafer Mapper Assembly Option	40
100-240VAC Power Option	41
E84/PIO/Interlock Option	43
Components	43
Tilt & Go Wheels Option	44
Operation Sequence	45
 Chapter 3: Interfaces	 49
Introduction	49
Chapter Summary	49
Communication Interfaces	50
Status Indicator Lights	51
Command for LED Configuration	51
Falcon Application Software	52
Using the Falcon GUI	53
Accessing the GUI	53
Navigating Overview	55
System Icon Details	55
Wafer Status Screen	56
Service Mode Commands Screen	56
Motor Control Commands Screen	60
E84 Status Screen	61
LED Controls Screen	61
System Info Screen	62
Setup Icon Details	62
Host Communications	63
Users and Passwords	64
Axes Parameters	65
E84 Configuration	67
Wafer Mapper Parameters	67
DSP Firmware	68
LED Setup	68

System Log Icon	69
Alarms Icon	70
Diagnostics Icon	70
Chapter 4: Service	71
Overview	71
Safety Requirements	72
General Safety	72
Electrical Safety	72
Mechanical Safety	73
ESD Precautions	73
Tool and Fixture Requirements	73
Remove and Replace Falcon 74	
Corrective Service Procedures	81
Introduction	81
CSP1: Replace Falcon K-Plate Node PCB	82
CSP2: Replace Falcon Door Node	89
CSP3: Replace Vertical/Horizontal Drive Motor	95
CSP4: Replace Pod Hold Down Motor Assembly	106
CSP5: Replace Wafer Mapper Assembly	112
CSP6: Replace Display Node PCB	117
CSP7: Replace Static Entry Node	121
CSP8: Replace Link Manager/CPU	127
CSP9: Replace Latch Key Motor Assembly	131
CSP10: Replace V/H Drive Upper Pulley Assembly	137
CSP11: Replace Vertical Drive Belt	147
CSP12: Upgrade Falcon Software	155
CSP13: Vertical Drive Belt Tensioning	161
CSP14: Remove and Replace E84 Board	168
CSP15: Replace AC Power Supply	173
Chapter 5: Troubleshooting	179
Introduction	179
Collecting Falcon Files	179
Emergency Removal of Pod	182
Application	182
Procedure	182
Remove Host Tool's End-Effector	182
Removal Using Falcon Application	182
Error Codes	185

Falcon Alarm Codes	186
Auto Recovery	188
About Alarm Codes	189
Recovery Procedures	189
About Alarm 1 “Position following error”	190
About Alarm 2 “Vertical drive is not home”	190
About Alarm 3 “Motion requested while already busy”	191
About Alarm 4 & 30 “Pod is missing”	191
About Alarm 5 “Aborted by user”	192
About alarm 14, 24, 82, 83, 84, 86 & 87.	192
Abort/Failed Messages	194
Troubleshooting	195
Error Types	195
Factory Default Settings	198
Appendix A: Installation Instructions	199
Introduction	199
Installing Falcon	200
Handling Cautions	200
Operating Caution	201
Installation Summary	201
Verify Asyst Supplied Materials	201
Verify the OEM Supplied Materials	202
BOLTS Interface Mounting	202
Power Cable	202
Grounding Cable	203
Requirement	203
Assembly	203
Communications Cables	203
Prepare for Mounting Falcon	204
Mount Falcon to the Host Tool	212
Verify Operation	213
Adjust and Level Falcon	215
Open Falcon	215
Initial Height Adjustment	216
Perform Final Adjustments	217
Falcon Configuration	220
Display Light Configuration	220

Appendix B: Communications	221
Overview	221
Compact Flash Contents	222
Communication with VxWorks Operating System	223
Communication with Falcon	225
Ethernet	225
Examples	225
Serial Communication	226
Examples	227
Description of Falcon.ini	229
Communication Protocol Settings	229
System Configuration	229
Without Wafer Arm Assembled:	229
With Wafer Arm Assembled:	229
Not Using 5mm Protrusion Sensor	229
Use 5mm Protrusion Sensor	229
Set-up Hyperterminal for Ethernet Communication	230
Set-up Hyperterminal for Serial Communication	233
Appendix C: Material Safety Data Sheet Information	237
Appendix D: Wiring Diagrams	239
3400-6653-01	240
Appendix E: PCB Assemblies	247
3200-4269-01	248
3200-4270-01	249
3200-4346-03	250
3200-4347-03	252
3200-4348-03	254
3200-4349-02	256
3200-4350-01	260
Appendix F: Bills of Material and Assembly Drawings	261
Falcon Final Assembly, 9701-3995-01	262
BOM	262
9701-3995-01	264
Falcon Sub-Systems Assembly, 9701-4033-01	268
BOM	268

9701-4033-01	271
FOUP Advance, 9701-3834-02.....	275
BOM.....	275
9701-3834-02	276
FIMS Door, 9701-3909-01	278
BOM.....	278
9701-3909-01	280
2000-6803-01 Falcon Outline Drawing.....	284
Index.....	287

Preliminary

Preliminary

List of Figures

Figure 1	Falcon Ground Point.	7
Figure 2	Pinch Hazards During Service	9
Figure 3	Shipping Bracket Securing FIMS Door.	10
Figure 4	Areas of Pinch/Crush Hazard.	11
Figure 5	Seismic Attachment Points.	12
Figure 6	Tool Side Corners.	17
Figure 7	Falcon Label Placement (Operator Side).	20
Figure 8	Falcon Label Placement (Host Tool Side)	21
Figure 9	Falcon with AC Option Only	22
Figure 10	Falcon Loadport	23
Figure 11	Falcon Loadport	25
Figure 12	Static Entry Node PCB Assembly with Link Manager/CPU	26
Figure 13	Falcon Basic Outline.	28
Figure 14	FIMS Door, Front View	29
Figure 15	FIMS Door, Rear View (without Cover)	29
Figure 16	Ball Joint Design.	30
Figure 17	Simplified Twist and Pull Latch Key Drive	30
Figure 18	Vertical/Horizontal Door Drive Components.	32
Figure 19	FOUP Advance Plate without Cover	34
Figure 20	FOUP Advance Load/ Unload Push Button Switch	35
Figure 21	Light Display Node PCB.	38
Figure 22	Static Entry Node PCB.	39
Figure 23	Wafer Mapper Uninstalled	40
Figure 24	Components of the 100-240VAC Option	41
Figure 25	Tool Side View	41
Figure 26	Wiring for the AC Option.	42
Figure 27	E84 Board.	43
Figure 28	Falcon Tilt & Go Wheels.	44
Figure 29	Diagram of Falcon Communication Paths	50
Figure 30	LED-IDs, Indicator Lights	51
Figure 31	Falcon System Logon Screen	54
Figure 32	System Overview Screen	55
Figure 33	Wafer Status Screen.	56
Figure 34	Service Mode Commands	56
Figure 35	Motor Drop-Down Menu	57
Figure 36	Servo Control Drop-Down Menu	57
Figure 37	Calibration Axes Drop-Down Menu	57
Figure 38	Wafer Mapper Arm Drop-Down Menu	58
Figure 39	Laser Drop-Down Menu	58
Figure 40	FOUP Advance Drop-Down Menu	58
Figure 41	Vertical Door Drop-Down Menu	58
Figure 42	Latch Keys Drop-Down Menu.	59
Figure 43	Miscellaneous Drop-Down Menu	59
Figure 44	Button Report Drop-Down Menu (Not Active)	59
Figure 45	Motor Control Commands Screen	60
Figure 46	E84 Status Page (Currently Inactive)	61

List of Figures

Figure 47	LED Controls Screen	61
Figure 48	System Info Screen	62
Figure 49	Host Communications Screen	63
Figure 50	Users and Passwords Screen	64
Figure 51	Axes Parameters	65
Figure 52	E84 Configuration Screen	67
Figure 53	Wafer Mapper Parameters Screen	67
Figure 54	DSP Firmware Screen	68
Figure 55	LED Setup Screen	68
Figure 56	Falcon System Log Screen	69
Figure 57	Falcon Alarms Screen	70
Figure 58	Falcon Front Cover	74
Figure 59	Power and Communication Connections	75
Figure 60	AC Power Input (on Falcons with AC Option Only)	75
Figure 61	Shipping Bracket Securing FIMS Door	76
Figure 62	Falcon Tilt and Go Wheels	77
Figure 63	Falcon Mounting - Lower Pivot Mounting	78
Figure 64	Guide Posts for Falcon Front Cover	80
Figure 65	Falcon K-Plate Node PCB	82
Figure 66	FOUP Advance Underside Cover	83
Figure 67	K-Plate Cover	84
Figure 68	The Underside of the FOUP Advance	85
Figure 69	Screw Securing the K-Plate Node Board	86
Figure 70	Falcon Door Node	89
Figure 71	Falcon Door Cover and Cable Grommet	90
Figure 72	Falcon Door Node PCB	90
Figure 73	Cable Connections	91
Figure 74	Attachment Screws - Falcon Door Node	92
Figure 75	Vertical/Horizontal Drive Motor	95
Figure 76	Shipping Bracket Securing FIMS Door	96
Figure 77	AC Option Power Supply	97
Figure 78	E84 Option	97
Figure 79	Vertical Belt Cover/Fan Assembly	98
Figure 80	Drive Belt Tension Adjust and Drive Motor Axle	99
Figure 81	Jam Nut	100
Figure 82	Belt Tension Adjust	100
Figure 83	Motor Cable Connection	101
Figure 84	Vertical Drive Motor	102
Figure 85	Drive Belt Teeth Engaged with the Gear Teeth	103
Figure 86	Active FOUP Hold Down Motor Assembly	106
Figure 87	APHD Motor - Viewed from Underside of FOUP Advance	107
Figure 88	Access Holes for Motor Assembly Screws	108
Figure 89	Locator Guide Pins	109
Figure 90	Motor Assembly Gear Wheel Engaged with Gear Rack	109
Figure 91	Wafer Mapper Assembly	112
Figure 92	Wafer Mapper and Screw Location	113
Figure 93	Wafer Mapper Cable Connections	114
Figure 94	Wafer Mapping Assembly Approaching Guide Pins	114
Figure 95	Display Node PCB	117
Figure 96	Bezel Over the Panel Display Board	118

Figure 97 Panel Display PCB	118
Figure 98 Hardware Stack for Securing Hardware	119
Figure 99 Static Entry Node	121
Figure 100 Belt Cover/Fan Assembly	122
Figure 101 Cable Connections and Link Manager/CPU Screws	123
Figure 102 Screws and Standoff Locations	124
Figure 103 Connections to Static Entry Node Board	125
Figure 104 Link Manager/CPU	127
Figure 105 Belt Cover/Fan Assembly and Link Manager/CPU Location	128
Figure 106 Compact Flash Socket on the Link Manager/CPU	129
Figure 107 Latch Key Motor Assembly	131
Figure 108 Latch Key Motor and Latch Key Drive Plate Assemblies	132
Figure 109 Cable Clamp and Cable Connections	133
Figure 110 Placement of the Latch Key Motor Assembly	134
Figure 111 Motor Encoder Cable Connections	134
Figure 112 Engaging the Lead Nut with the Lead Nut Retainer Pins	135
Figure 113 V/H Drive Upper Pulley/Brake/Encoder Assembly	137
Figure 114 AC Option Power Supply	139
Figure 115 E84 Option	139
Figure 116 Vertical Belt Cover/Fan Assembly	140
Figure 117 Encoder Cable	141
Figure 118 Upper Pulley Cable Connection	141
Figure 119 Encoder Cable Ground Wire on Upper Pulley Assembly	142
Figure 120 Drive Belt Tension Adjust	142
Figure 121 Jam Nut on Drive Belt Tension Adjust	143
Figure 122 Belt Tension Adjust	143
Figure 123 V/H Drive Upper Pulley Assembly Screws	144
Figure 124 Vertical Drive Belt	147
Figure 125 Vertical Belt Cover/Fan Assembly	149
Figure 126 Vertical/Horizontal Drive Upper Pulley Assembly Screws	150
Figure 127 Drive Belt Tension Adjust Bolt	150
Figure 128 Jam Nut on Drive Belt Tension Adjust	151
Figure 129 Vertical/Horizontal Drive Motor Axle	151
Figure 130 Lock Plate Securing the Drive Belt	152
Figure 131 Copy Zip File	155
Figure 132 Paste Zip File	156
Figure 133 Extract Zip Contents to Compact Flash	156
Figure 134 The Ensurehomesteps Value Below [VerticalDoor_1]	158
Figure 135 Compact Flash on the Link Manager/CPU	159
Figure 136 Belt Tension Meter - Power Button	162
Figure 137 Meter Screen Settings	162
Figure 138 Buttons on Meter Screen	163
Figure 139 Sensor Positioning	164
Figure 140 Vertical Drive Upper Pulley/Brake/Encoder Assembly Screws	165
Figure 141 Jam Nut	166
Figure 142 Belt Tension Adjust Nut	166
Figure 143 E84 PCB	168
Figure 144 Belt Cover/Fan Assembly with E84 Board and AC Option	169
Figure 145 Cable Connections and Screws	170
Figure 146 AC Power Supply	173

List of Figures

Figure 147 Cable Wiring Going to the AC Option Power Supply	174
Figure 148 AC Option Power Supply	174
Figure 149 Power Supply Mounting Bracket	175
Figure 150 AC Power Supply Mounting Hardware	175
Figure 151 AC Power Input	176
Figure 152 Run Pop-up Screen	179
Figure 153 Command Window	180
Figure 154 Logged On to Falcon FTP	180
Figure 155 Falcon.ini Opened in a Notepad Window	181
Figure 156 Factory Default Settings	198
Figure 157 Falcon Handling Points	200
Figure 158 Falcon Ground Point	203
Figure 159 Interface Mounting Kit Components	205
Figure 160 BOLTS Interface Kit Components Mounted on Host Tool	206
Figure 161 Alignment Plates	206
Figure 162 FIMS Door Shipping Bracket	207
Figure 163 Foam for Securing Wafer Mapper Arms	208
Figure 164 Ground Connection and Cable Pass-Thru	209
Figure 165 Static Entry Node Connector Panel (selected connectors shown)	210
Figure 166 AC Power Input (on Falcons with AC Option Only)	211
Figure 167 Falcon Mounting - Alignment Ball and Cam Adjustments	212
Figure 168 Hyperterminal with Connection Description	230
Figure 169 Hyperterminal with Connect To	231
Figure 170 ASCII Setup Pop-up	232
Figure 171 Hyperterminal Window	232
Figure 172 Hyperterminal with Connection Description	233
Figure 173 Connect To Pop-up	234
Figure 174 Com1 Properties Pop-up	234
Figure 175 ASCII Setup Pop-up	235

List of Tables

Table 1	List of Falcon Labels.	18
Table 2	Falcon Product Specifications*	27
Table 3	Static Entry Node Connections.	39
Table 4	Vertical Door Taught Positions (mm)	65
Table 5	Recommended Velocity and Acceleration Parameters for the Vertical Door	66
Table 6	FOUP Positions (mm).	66
Table 7	Latch Key Positions (mm).	66
Table 8	Special Tools.	73
Table 9	Corrective Service Procedures.	81
Table 10	Falcon Error Codes	185
Table 11	Alarm Codes with Descriptions.	186
Table 12	Alarm Codes.	188
Table 13	Abort/Failed Messages.	194
Table 14	General Problem Resolutions.	195
Table 15	Wafer Mapping Problem Resolution.	196
Table 16	Falcon Wiring Diagrams	239
Table 17	Falcon PCB Assembly Drawings	247
Table 18	Assembly Drawings	261

Preliminary

Preliminary

About this Manual

The Falcon Technical Manual is organized as follows:

Chapter 1, Safety Information, describes safety hazards related to operating and maintaining Falcon, as well as safety interlocks and labeling.

Chapter 2, Product Overview, describes the major subassemblies and components of the Falcon, and includes technical data, specifications and typical operation sequence.

Chapter 3, Interfaces, includes a description of Falcon's indicator lights, FOUP Advance Activator Button, and Falcon Application Software.

Chapter 4, Service, provides detailed procedures to perform Preventive Maintenance, corrective service and software upgrade on the Falcon.

Chapter 5, Troubleshooting, provides an emergency pod removal procedure, a procedure for data collection, lists of error and alarm codes and messages as well as error modes and recommended corrective actions. An illustration showing factory default settings is provided for reference.

Appendix A, Installation Instructions, gives information related to installing Falcon to a Host Tool and initial set-up.

Appendix B, Communications Software, provides detailed information on ASCII communication.

Appendix C, Material Safety Data Sheet Information.

Appendix D, Wiring Diagrams.

Appendix E, PCB Drawings

Appendix F, Assembly Drawings. For Final Assembly and major subassemblies, such as the FIMS Door Drive and the FOUP Advance (Kinematic) Plate.

An Index is also provided in the back of the manual.

Conventions

The following keyboard conventions and terminology are used.

Example	Meaning
Bold	User action on keyboard keys or other objects are bold .
Choose	The word choose is used for menu choices. Submenus are separated by a >. For example: Choose File > Import > File...
Click	Refers to mouse actions. For example: Click the hand icon.
Courier New Font	Text displayed on the screen uses Courier New. DOS and windows path names are displayed in Courier New. For example: Use the C:\Folder\SubFolder\SubFolder2 to access this file. Source code or DOS commands use courier new. Hexidecimal streams and examples.
Double quotes	Used when discussing or describing an action, functional word, or definition.
Folder	Used instead of Directory, unless discussing DOS movement commands.
<i>Italic</i>	Italics are used to show computer entry from the users keyboard or Teach Pendant.
Press	Shows action by a user on a key or physical button. For example: Press PF1, then type the file name.
Select	Used if the user is to pick from several choices. For example: Select the lot number from the list supplies.
Type	Shows entry. For example: Type the <i>Product Name</i> and <i>Model Number</i> at the top of the page. Press Enter .

Chapter 1: Safety Information

Introduction

Before attempting any operation or service on the Falcon, it is essential that the information presented in this chapter be read and thoroughly understood. Important information is provided regarding safety hazards that may be encountered while working with these Loadports.

Chapter Summary

This chapter addresses the following:

“[Safety Tags](#)” on page 6— provides examples, with definitions, of warning labels used in this manual.

“[Safety Requirements](#)” on page 7— includes ESD/EMI precautions, lockout/tagout procedure, seismic data, and description of hazards.

“[Options](#)” on page 13 — includes

“[Agency Compliance](#)” on page 14 — includes information on FCC and CE Mark Compliance.

“[Safety Features](#)” on page 15 — includes information on the Safety Features of the Falcon Loadport

“[Moving and Handling](#)” on page 16— includes cautions on moving and handling the Falcon.

“[Labeling](#)” on page 18— description of labels, and their locations on the Falcon.

General Requirements

Warnings and cautions are used throughout this manual to identify potential hazards to personnel.

All warnings and cautions immediately precede the step or operation in which the hazardous condition may be encountered. All personnel operating or performing service on Asyst equipment must fully understand warnings, cautions, and all general safety regulations associated with electromechanical equipment.

Personnel should become thoroughly familiar with all aspects of safety for individuals and equipment prior to operating or performing service on this equipment.

General Safety

- Do not allow unauthorized or inexperienced personnel to operate the Falcon.
- Service personnel should follow standard cleanroom protocols.
- Ensure that another person in the area is aware that work is in progress on the tool, and can provide assistance in the event of injury.
- The Host Tool manufacturer's lockout/tagout procedures must be followed during installation or when service is performed on the Falcon to prevent injury or equipment damage.
- Refer to the appropriate Material Safety Data Sheets; contact information for obtaining MSDSs is located in this manual.
- Remove spilled materials immediately to prevent accidents.

Electrical Safety

- Do not bypass electrical interlocks or safety devices unless specifically required to within a procedure.
- Remove power from Falcon prior to performing any service procedure, unless otherwise specified.
- Remove power from Falcon prior to removing or inserting electrical connectors.
- Remove metal jewelry such as rings, chains, and watches.
- Stand on dry insulating mats when working with energized electrical equipment.
- Ensure that all test equipment and accessory electrical units are grounded to facility ground.

Responsibility

It is the responsibility of the Customer to comply with all local, state, and federal ordinances, regulations, and laws applicable to the installation and operation of this equipment.

Asyst Technologies, Inc. assumes no liability, whatsoever, for any personal injuries or damages resulting from the operation or service of this equipment in any manner inconsistent or contrary to the methods supplied in Asyst Technologies, Inc. literature including, but not limited to, manuals, instructions, bulletins, communications, and recommendations.

For emergencies and for product safety related matters, contact:

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Safety Tags

The manual includes the following alert categories. Note that the following are only examples; they do not indicate a specific hazard associated with the Falcon.



DANGER



EXPLOSION HAZARD

DANGERS ALERT PERSONNEL TO POTENTIALLY HAZARDOUS SITUATIONS WHICH, IF NOT AVOIDED, WILL RESULT IN SERIOUS INJURY OR DEATH.



WARNING



MECHANICAL HAZARD

WARNINGS ALERT PERSONNEL TO POTENTIALLY HAZARDOUS SITUATIONS WHICH, IF NOT AVOIDED, MAY RESULT IN SERIOUS INJURY OR DEATH.



CAUTION



LIFT HAZARD

STANDARD CAUTIONS—AS OPPOSED TO EQUIPMENT-DAMAGE CAUTIONS SHOWN BELOW—ALERT PERSONNEL TO POTENTIALLY HAZARDOUS SITUATIONS WHICH, IF NOT AVOIDED, MAY RESULT IN INJURY.




CAUTION


THESE CAUTIONS ALERT PERSONNEL TO SITUATIONS THAT MAY LEAD TO EQUIPMENT DAMAGE. FAILURE TO FOLLOW DIRECTIONS WILL RESULT IN DAMAGE TO THE EQUIPMENT AND/OR DAMAGE TO RELATED PRODUCTS (E.G., WAFERS) AND VOIDING OF WARRANTY.

Safety Requirements

ESD / EMI Precautions

The Falcon with its integrated AdvanTag is a certified Radiated EMI Class A product.


CAUTION


GENERAL HAZARD

FOR ESD AND EMI CONSIDERATIONS AND POWER SUPPLY PROTECTION, THE GROUND CABLE **MUST** BE PROPERLY INSTALLED.

The following instructions must be followed to provide ESD protection and reduced EMI emissions:

- A braided copper ground wire (minimum 12 gauge) with ring-lug connectors (sized for M5 screw) **MUST** be connected between the Falcon ground connection and the Host Tool power supply earth ground point.

 **NOTE . . .**

CHANGES OR MODIFICATIONS TO THE FALCON, NOT EXPRESSLY APPROVED BY ASYST, COULD VOID THE USER'S WARRANTY.

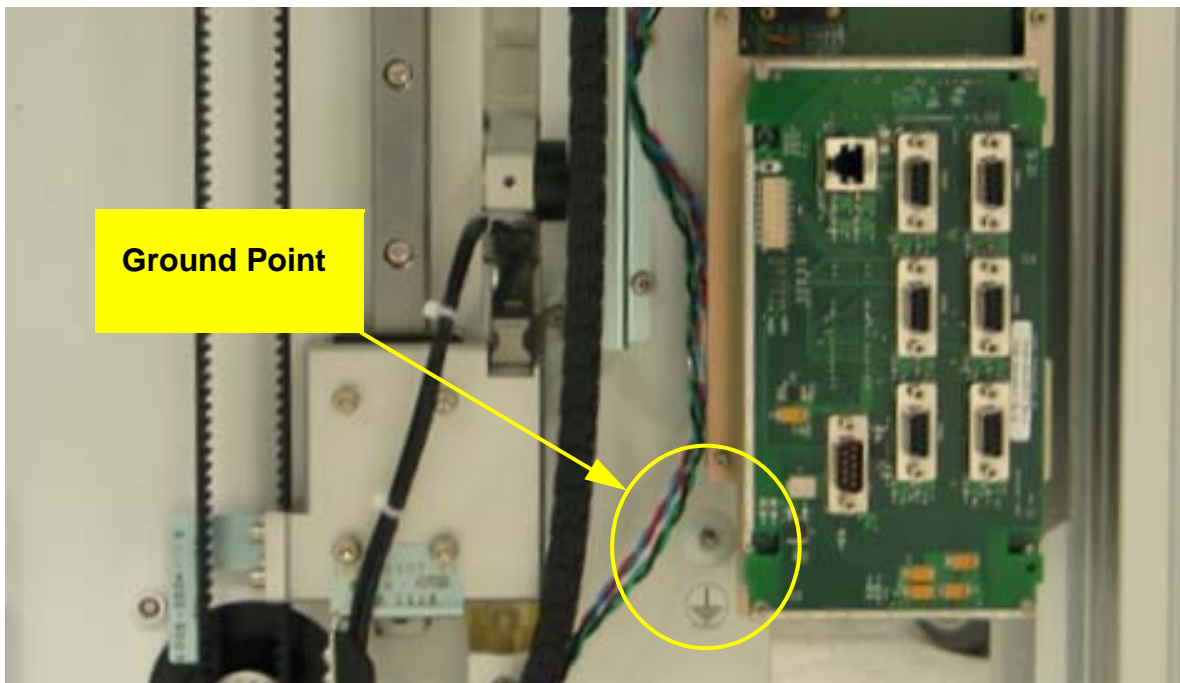


FIGURE 1 *Falcon Ground Point*

EMO & Electrical Power

Electrical power for the Falcon is supplied by the Host Tool. The main electronics are enclosed in the main electronic area, located inside the front cover of the Falcon. Power to the Falcon should be connected through the Host Tool EMO circuitry, and in the event of an emergency all power can be removed from the Falcon by depressing the red mushroom shaped EMO switch mounted on the Host Tool.

Lockout/Tagout

As determined by the Host tool owner, Lockout/tagout may be required on the Host tool when service is performed on the Falcon or when the Falcon is removed /replaced to prevent injury or equipment damage.

 **NOTE . . .**

LOCKOUT/TAGOUT OF THE HOST TOOL MUST BE PERFORMED BY THE HOST TOOL OWNER. ASYST SERVICE PERSONNEL ARE NOT PERMITTED TO PERFORM LOCKOUT/TAGOUT OF THE HOST TOOL.

Where no company procedures exist, follow the guidelines below:

- _____ 1. Notify all affected employees and users that service is to be performed and that the Host tool needs to be shut down and locked out.
- _____ 2. The circuit that provides power to the Host tool must be switched off. (This may require the Host Tool to be powered down.)

Requirements for circuit breaker provided by the customer: The overcurrent device and disconnect device provided for the Falcon should be rated for at least 10,000 RMS symmetrical amperes interrupting capacity.


- _____ 3. Lock out the circuit with an assigned lock.
- _____ 4. Test to make sure the Host tool cannot be turned on accidentally.
- _____ 5. Tag the locked circuit with a statement indicating:
 - _____ • Unauthorized operation of the equipment or removal of tag is prohibited
 - _____ • Date of service performed
 - _____ • Name(s) and contact information of the person(s) performing the service


Pinch Hazards

Normal Operation

There are no pinch hazards during Normal Operation of the Falcon.

During Service


WARNING



MECHANICAL HAZARD

MAINTENANCE PERSONNEL MUST KEEP HANDS AND FINGERS AWAY FROM ALL MOVING PARTS DURING MOTION OF THE FOUNDRY ADVANCE PLATE OR THE PORT DOOR. FAILURE TO COMPLY MAY RESULT IN INJURY.

A pinch hazard exists during the opening/closing of the Port Door.



FIGURE 2 *Pinch Hazards During Service*

See “[Safety Features](#)” on [page 15](#) for Safety Features designed to prevent Pinch Hazards.



WARNING



MECHANICAL HAZARD

FIMS DOOR MUST BE SECURED WITH THE SHIPPING BRACKET EVERY TIME A COMPONENT OF THE VERTICAL/HORIZONTAL DRIVE IS SERVICED. FAILURE TO DO SO MAY RESULT IN SERIOUS INJURY.

Install shipping bracket (Asyst P/N 4003-0842-01) to the FIMS Loadport Door and secure with 8 screws to both the FIMS door and the BOLTS Frame. See [Figure 3](#).

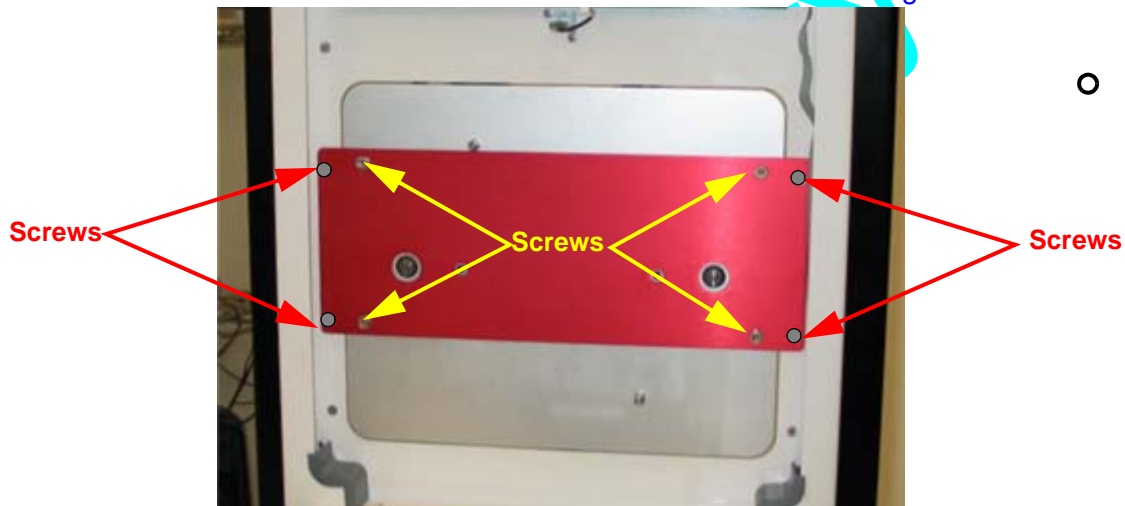


FIGURE 3 *Shipping Bracket Securing FIMS Door*

If Vertical Drive Belt is disengaged or broken the Vertical Drive may free fall creating pinch/crush hazards. All service procedures affecting the belt must use the FIMS door shipping bracket (Asyst P/N 4003-0842-01) to assure the Vertical Drive is immobilized. See [Figure 4 on page 11](#) for affected areas.

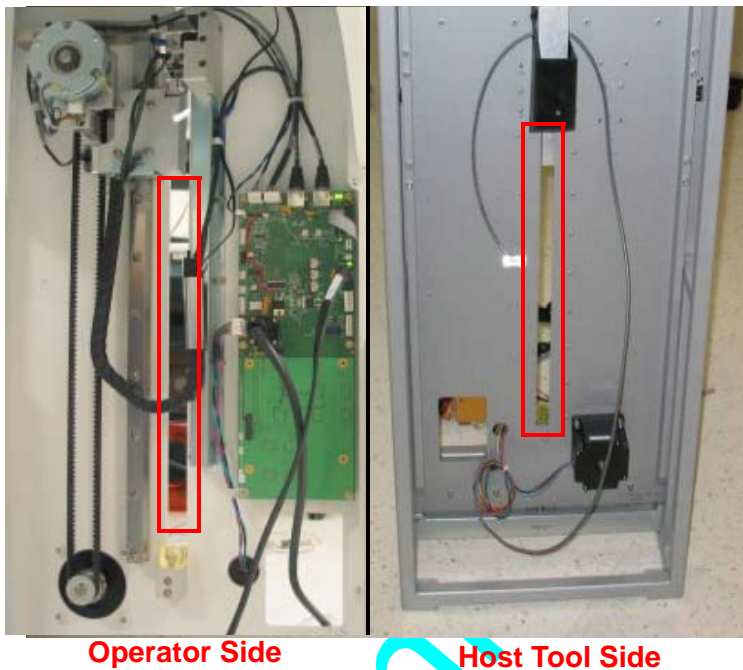


FIGURE 4 *Areas of Pinch/Crush Hazard*

During Installation

During installation, power to the Falcon must be off and the Host Tool in Lockout/Tagout so there are no electrical (current) or mechanical hazards.

Seismic

The position of the center of gravity (CG) will be shown in the forthcoming Outline Drawing. [Figure 5](#) shows seismic attachment points for the Falcon. Follow all installation procedures to ensure compliance with SEMI S2: Safety Guidelines For Semiconductor Manufacturing Equipment, Seismic Requirements.

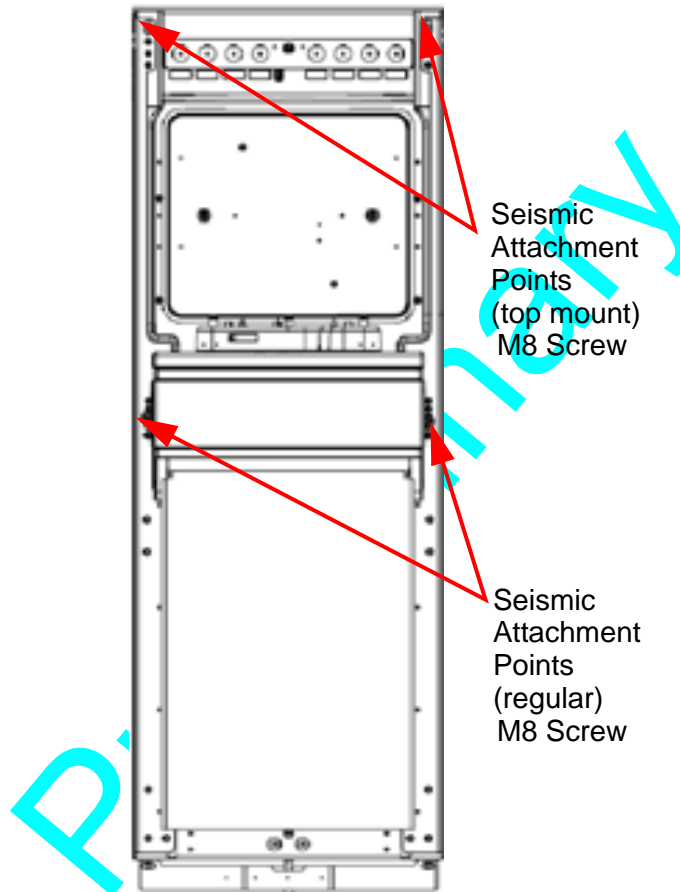


FIGURE 5 *Seismic Attachment Points*

Ergonomic

A fully loaded FOUP exceeds recommended limits for handling by one operator. To conform with SEMI S8, use of AGV, MGV, or OHS is recommended.

Options

Wafer Mapper Option

See “[Wafer Mapper Assembly Option](#)” on page 40 for details.

100-240VAC Option

See “[100-240VAC Power Option](#)” on page 41 for details

E84/PIO/ Interlock Option

See “[E84/PIO/Interlock Option](#)” on page 43 for details.

Tilt and Go Wheels Option

See “[Tilt & Go Wheels Option](#)” on page 44 for details.

Preliminary

Agency Compliance

FCC

Definition

Class A digital device

A digital device that is marketed for use in a commercial, industrial or business environment, exclusive of a device which is marketed for use by the general public or is intended to be used in the home.

Compliance

The Falcon with its integrated AdvanTag has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his/her own expense.



CAUTION

ANY CHANGES OR MODIFICATIONS TO THE FALCON INTEGRATED RFID WITHOUT SPECIFIC WRITTEN APPROVAL FROM ASYST TECHNOLOGIES WILL VOID FCC COMPLIANCE.

CE Mark

The Falcon with its integrated AdvanTag complies with the following directives:

- 2006/95/EC Low Voltage Directive
- 2004/108/EC EMC Directive
- 99/5/EC Radio & Telecommunication Terminal Equipment
- 98/37/EC Machinery Directive

Safety Features

DC Voltage

The Falcon operating voltage is +24 VDC. This voltage is considered non-hazardous and requires no mechanical power interlocks.

AC Option

If equipped with the 100-240VAC Option, the front cover has an electrical warning label which alerts the user to an electrical hazard located behind the Front Cover. Shutdown and lockout/tagout must be performed before opening the Front Cover. Also the front cover is secured with a screw.

Pinch Hazard

During normal operation there is no pinch hazard.

During Service, a number of design points ensure that Service personnel in manual mode are not exposed to hazards as described below:

Port Door

- Pinch hazards due to opening and closing of the Port Door.

The combination of the FOUP placement detection, and the FOUP-at-Port switch provide an interlock to prevent a Port Door pinch hazard.

The FOUP must be in place on the FOUP advance and then must fully advance to the port, sealing the port opening, before the Port Door will open during normal operation in Auto Mode.

During Home Calibration, the Port Door, can move without a FOUP, but the motion speed is slow and easily avoidable.

FOUP Advance

- Although there is no pinch hazard due to FOUP Advance motion, the following safety feature is present:

Current Limiting Circuit limits the amount of force that can be exerted by the FOUP Advance motion to a safe level. When FOUP comes in contact with an object the FOUP Advance motion will stop.

Moving and Handling



WARNING



TIP-OVER HAZARD

MOVING THE FALCON WITH A FOUP MOUNTED MAY CAUSE THE FALCON TO TIP AND FALL OR OTHERWISE BECOME UNSTABLE. INJURY AND/OR TOOL DAMAGE WILL OCCUR IF FALCON FALLS.

NEVER move the Falcon with a FOUP mounted. Always remove the FOUP before removing the Falcon from the Host tool, moving or installing the unit.



WARNING



TIP-OVER HAZARD

MOVING THE FALCON ON UNEVEN OR NON-LEVEL SURFACES MAY CAUSE THE FALCON TO TIP AND FALL OR OTHERWISE BECOME UNSTABLE. INJURY AND/OR TOOL DAMAGE WILL OCCUR IF FALCON FALLS.

The Falcon may have wheels; therefore, once it is removed from the shipping container it should be placed on a level surface. The extended portion of the shipping container base enables the Falcon to be removed from the shipping container in its vertical position.

Store and Move the Falcon only in Vertical Position



CAUTION

HANDLING OR BUMPING CERTAIN AREAS OF THE FALCON MAY RESULT IN DAMAGE TO THE FOUP ADVANCE, DOOR DRIVE, AND PORT DOOR ASSEMBLIES, AS WELL AS THE FRONT COVER.

When moving the Falcon Do NOT place hands on the top section of the FOUP advance assembly, the door drive assembly, or by the wafer mapper assembly.

When moving the Falcon, PUSH from the Tool Side ONLY, placing hands on the corners on the Tool Side of the Falcon. See [Figure 6](#).



FIGURE 6 *Tool Side Corners*

The Falcon is designed to be pushed from the Tool Side only. Do not pull from the Operator Side; do not push from the Operator Side except when mounting.

When moving the Falcon, use both hands to push at all times and push evenly. Keep all four wheels on the ground at ALL times. Do not tilt or rock the Falcon while moving and turning. Doing so may cause the Falcon to tip and fall.

Labeling

See [Table 1](#) for a description of labels used on the Falcon. See [Figure 7](#) on page 20, [Figure 8](#) on page 21 and [Figure 9](#) on page 22 for typical label locations.

TABLE 1 *List of Falcon Labels*

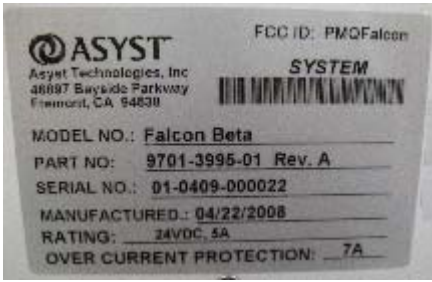
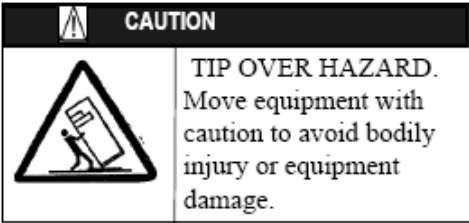


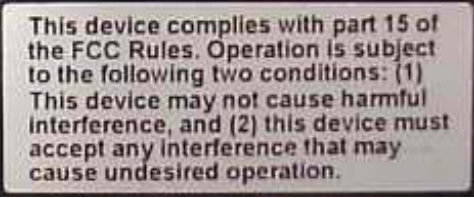
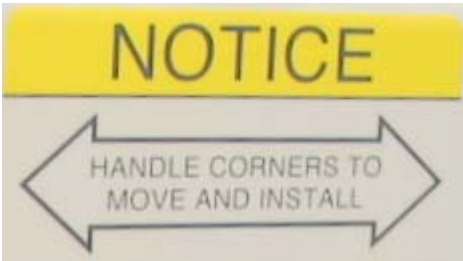
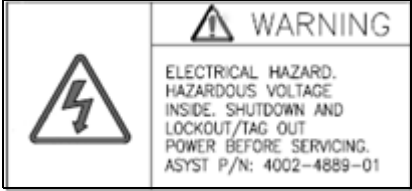

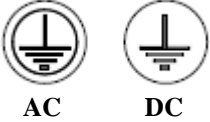
Label	Description/Location
<p>Model/Serial Number Label</p>  <p>The label contains the following information: ASYST Asyst Technologies, Inc. 48897 Bayside Parkway Fremont, CA 94538 FCC ID: PMQFalcon SYSTEM MODEL NO.: Falcon Beta PART NO.: 9701-3995-01 Rev. A SERIAL NO.: 01-0409-000022 MANUFACTURED: 04/22/2008 RATING: 24VDC, 5A OVER CURRENT PROTECTION: 7A</p>	<p>The model and serial number label for the Falcon provides FCC ID and unit specific information required when contacting Asyst Technologies for any matter concerning the equipment.</p>
<p>Tip Over Hazard</p>  <p>The label features a triangle with a person tipping over a box, with the text: CAUTION, TIP OVER HAZARD. Move equipment with caution to avoid bodily injury or equipment damage.</p>	<p>The Tip Over Hazard label is an alert to move the Falcon with caution. It is located above the port door on the Host Tool side.</p>
<p>Mechanical Hazard</p>  <p>The label features a triangle with a gear and a hand, with the text: WARNING, MECHANICAL HAZARD. MOVING PARTS BEHIND THIS PANEL/ASSEMBLY. SHUTDOWN AND LOCK-OUT/TAGOUT POWER BEFORE REMOVING PANEL/ASSEMBLY. ASYST P/N: 4002-4884-02</p>	<p>The Mechanical Hazard label is an alert to moving parts located behind the Cover with the label. Shutdown and lockout/tagout must be performed before opening the Cover. Both Vertical and Horizontal styles are used.</p>
<p>CE Label</p> 	<p>This label identifies equipment that conforms to testing and certification requirements of the European Community.</p>

TABLE 1 *List of Falcon Labels*

Label	Description/Location
<p>FCC Label</p> 	<p>The presence of the FCC label indicates compliance with FCC Rules and Regulations as specified on the Label.</p>
<p>Handle Corners Label</p> 	<p>This label identifies where to handle equipment.</p>
<p>Electrical Hazard Label</p> 	<p>The Electrical Hazard label is an alert to electrical hazard located behind the Front Cover when the Falcon is configured with the AC Power Option. Shutdown and lockout/tagout must be performed before opening the Front Cover. FOR AC OPTION ONLY</p>
<p>Pinch Hazard Label</p> 	<p>The Pinch Hazard label is an alert to moving parts located behind the Cover with the label. Shutdown and lockout/tagout must be performed before opening the Cover.</p>
<p>Ground Point Label</p> 	<p>The Ground Point Label indicates the Falcon grounding point use to connect earth ground wires from the Host tool.</p>

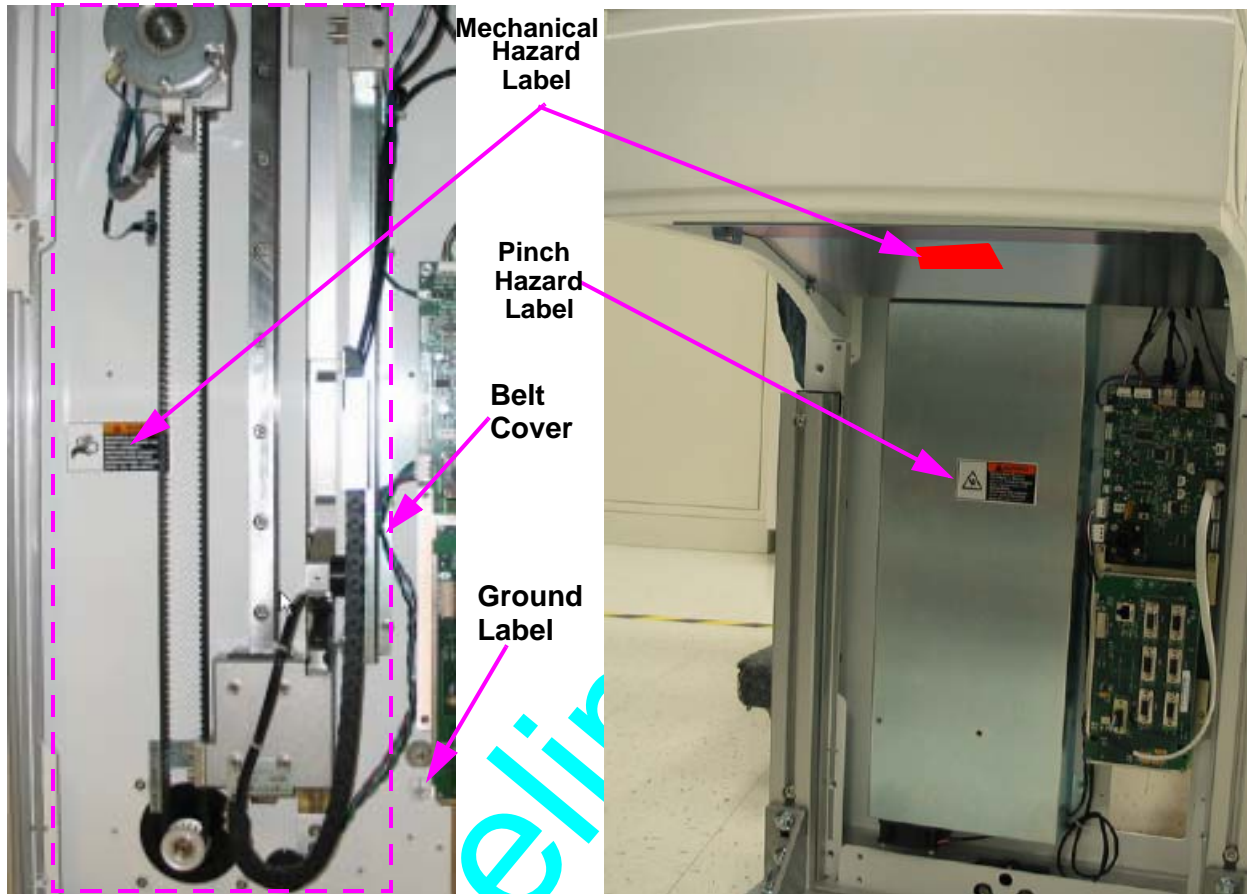


FIGURE 7 Falcon Label Placement (Operator Side)

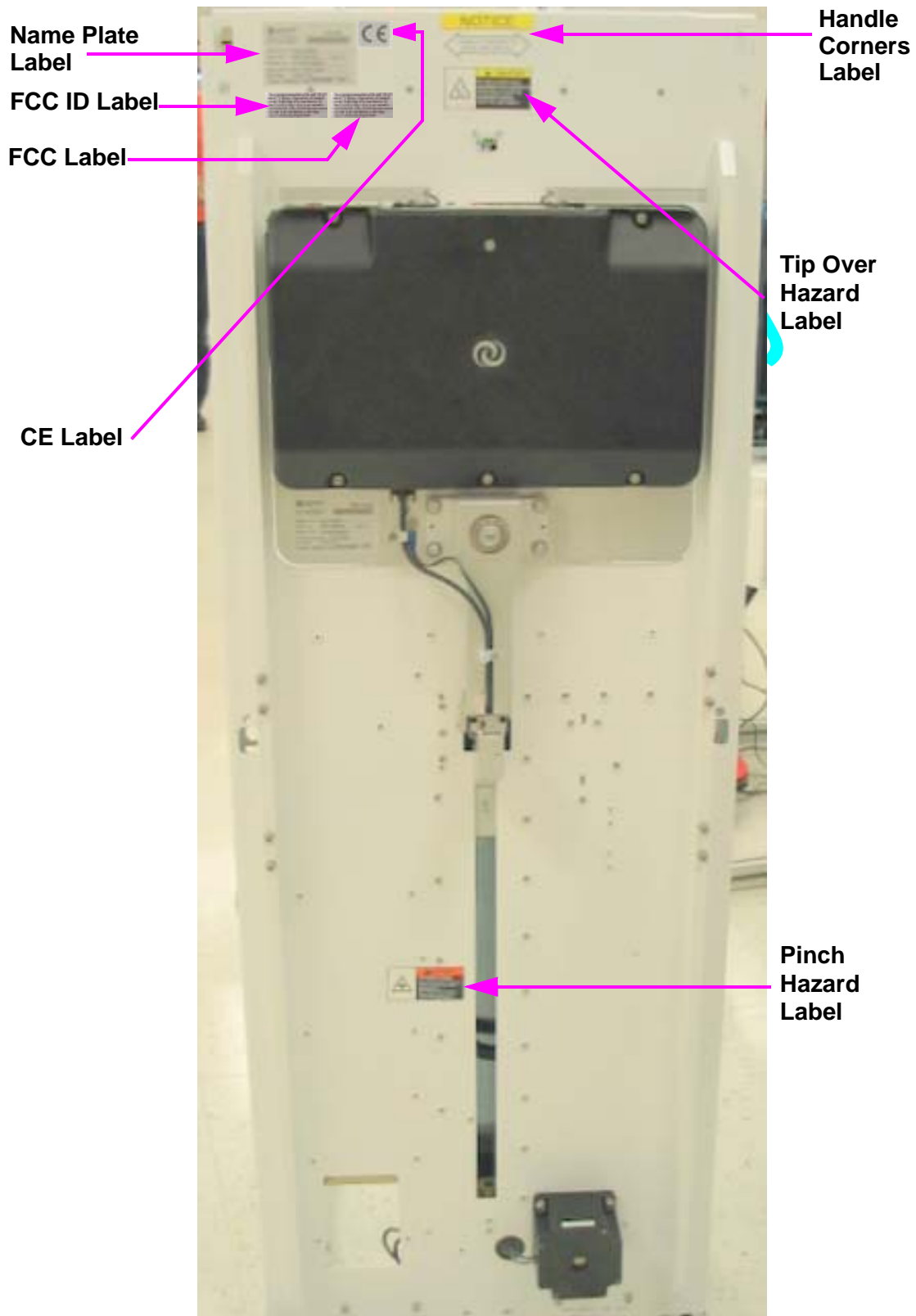


FIGURE 8 *Falcon Label Placement (Host Tool Side)*

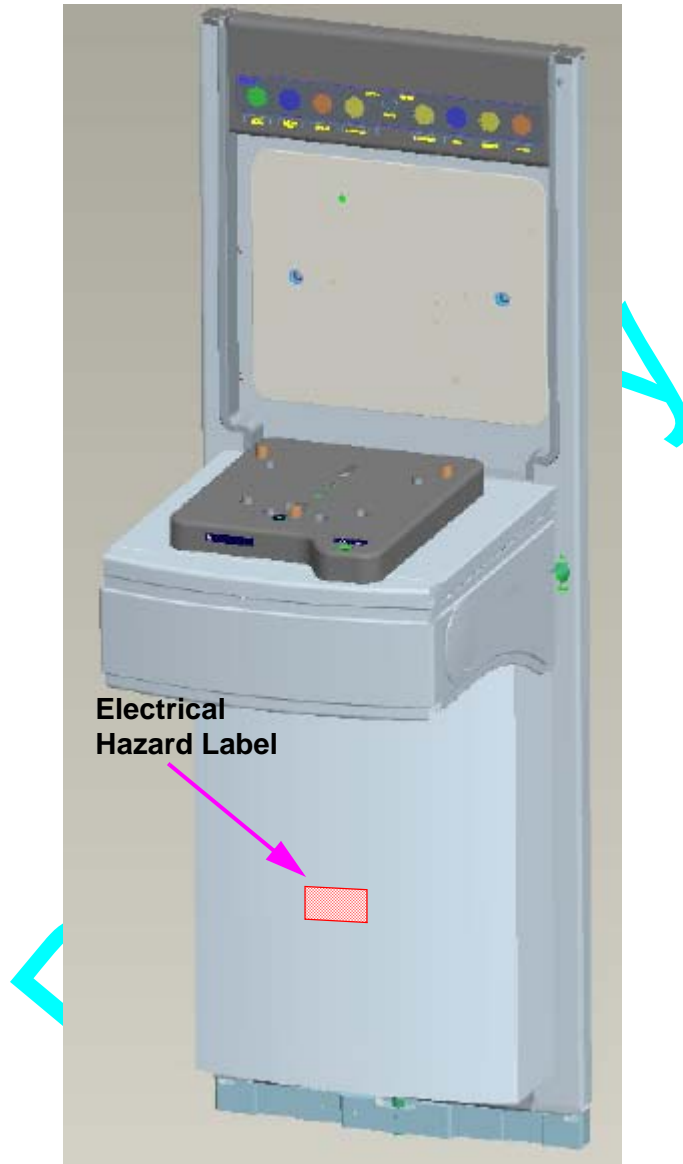


FIGURE 9 *Falcon with AC Option Only*

Chapter 2: Product Overview

This chapter describes the operation of Falcon and the interrelation of all of its mechanical, electromechanical, and electronic subsystems.

The product overview is divided into the following sections:

“[Product Description](#)” on page 24— an overall description of Falcon product.

“[Specifications](#)” on page 27— Technical Data for Falcon.

Major Subassemblies with features, Options and Operational Descriptions:

- “[FIMS Door](#)” on page 29
- “[Vertical-Horizontal Door Drive](#)” on page 32
- “[FOUP Advance Subassembly](#)” on page 34
- “[BOLTS Frame](#)” on page 38
- “[Options](#)” on page 40
- “[Operation Sequence](#)”— describes Falcon’s typical operation sequence.



FIGURE 10 *Falcon Loadport*

Product Description

The Falcon is an all-new loadport design based on Asyst's many years of experience with loadports, incorporating input from a wide range of fabs & OEMs. This elegantly simple design anticipates the customer demand for synergy between AMHS and EFEM requiring seamless integration, faster hand-offs, more efficient buffering and improved productivity.

Asyst is the only loadport supplier with both EFEM and AMHS capability. Falcon has the Best In Class performance for Speed and Cleanliness. Asyst's patented Latch key Twist & Pull Technology to securely hold the FOUP Door during access, means no vacuum is required.

The Falcon design improves reliability and speed of wafer handling, provides more robust alignment stability, and reduces Preventive Maintenance requirements; All reducing the overall cost of ownership. The modular design of the components shortens service times, while eliminating most service alignments.

Falcon is a 300mm Loadport that maintains better than Class 1 environment for loading and unloading (opening and closing) SEMI standard 300mm FOUPs. The Front-Opening Unified Pod (FOUP), designed for 25 wafer capacity, is a sealed carrier pod that provides a sub-class 1 environment. Falcon is compatible with most SEMI standard compliant FOUPs.

The Falcon interface to the Host tool complies with the SEMI 300mm Tool Loadport Specification (E15.1). It is designed to directly mount onto a Host Tool through a SEMI E63 (BOLTS) interface and can be quickly disconnected for ease of servicing.

A system of sensors and use of stepper motors ensure safe operation of Falcon, preventing wafer breakage or errors in mechanical operation. Software provides for integrated self-tests and diagnostics.

Major Components

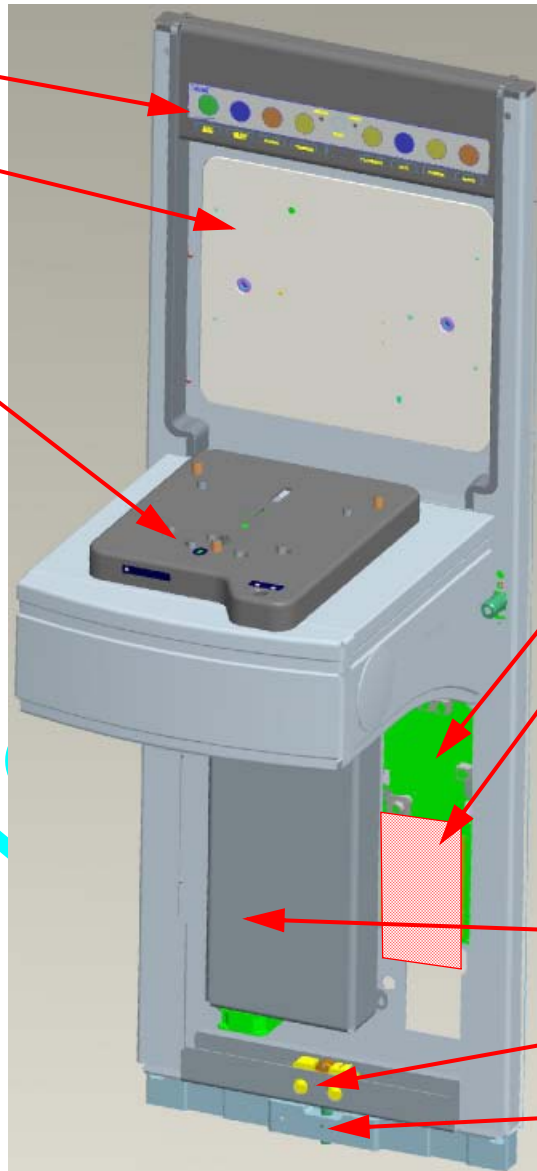
This section describes the major components of the Falcon loadport, with operational descriptions, subassemblies, and features.

**Falcon Indicator
 Display Lights**

FIMS Port Door

FOUP Advance

**Vertical/Horizontal Drive
 (Under the Cover)**



Static Entry Node

**Link Manager
 /CPU**

**Vert/Horizontal
 Drive Belt Cover
 with Fan**

**Falcon BOLTS
 Interface**

**Host Tool BOLTS
 Mounting Plate**

FIGURE 11 *Falcon Loadport*

- “ FIMS Door” on page 29
- “ Vertical-Horizontal Door Drive” on page 32
- “ FOUP Advance Subassembly” on page 34
- “ BOLTS Frame” on page 38

Features

The following features contribute to Falcon's easy adoption, ease of use and overall product robustness.

- Protocol converters to emulate previous & competing loadports
- Browser configurable
- SW configurable indicator lights (no lenses)
- No internal alignment once installed
- Tilt-N-Go installation
- Integrated Features:
 - Manual Load/Unload Push Button Switch
 - AdvanTag RFID
- Integrated Options:
 - ABCD Mechanical Lockout Pin
 - ABCD Sensor
 - Wafer Mapping

Power

Falcon is powered by +24VDC (+10, -2%). The input power is applied through a CPC4 connector "+24VDC IN" (see Figure 12).

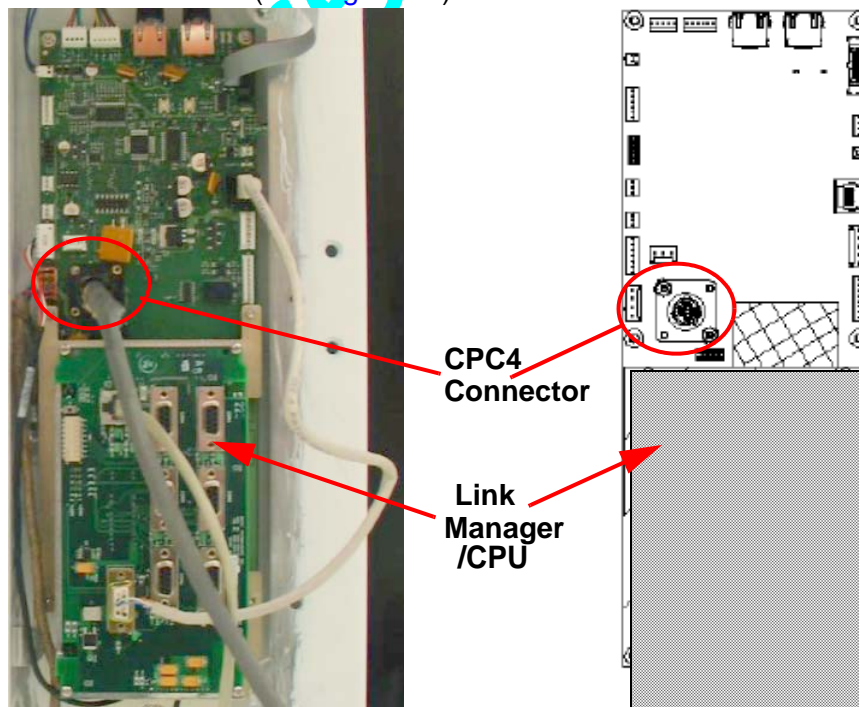


FIGURE 12 Static Entry Node PCB Assembly with Link Manager/CPU

Specifications

TABLE 2 *Falcon Product Specifications**

Wafer Size:	300mm	
Height:	1351.1mm (53.19 in.)	
Width:	470mm (18.5in.)	
Depth:	485mm (19.1 in.) Note: from BOLTS Plane	
Weight:	68Kg (150 lbs) with Tilt & Go Wheels installed	
Mounting:	Falcon is designed to directly mount onto a Host Tool having a SEMI E63 (BOLTS) interface.	
FOUP Load Height:	Per SEMI Standards E15.1 and E63 ± 10 mm Height Adjustability on Host tool	
Contamination Control	Wafer Environment Airborne Particle Cleanliness	Class 1 per ISO 14644-1
	Fab Environment Airborne Particle Cleanliness	Class 5 per ISO 14644-1
	Defect Density	< 0.01 PWP @ 0.15 Particle Size
FOUP Compatibility	The Falcon is designed to operate with SEMI E47 compliant wafer carriers.	
Wafer Mapping	Emitter Sensor - $\pm 1^\circ$ beam angle Collimated IR LED Receiver Sensor - Light-to-voltage photodiode with	
Door Speed (OPEN/CLOSE)	8 Seconds Open with Wafer Mapping 8 Seconds Close with Wafer Mapping	
Power:	<u>Requirement from Host tool:</u> 24 VDC (+10, -2%) @ 7 amps peak	<u>Falcon Power Consumption:</u> 2 Amp standby (max) 5 Amp operating (max) 7 Amp peak (max)
	100-240VAC Option , the customer provides 100-240VAC, 50/60Hz., 3.5A AC Power module converts the power to the +24VDC (+10, -2%), 7A required for Falcon operation.	
Communications:	Serial RS-232C (ASCII or SECS 2), Ethernet (ASCII), Parallel is optional	
Carrier Types	300mm 25-Wafer FOUP (Front Opening Unified Pods)	
Vacuum	None	
Compressed Air	None	

TABLE 2 *Falcon Product Specifications**

Noise	70-80dB RMS: Compliant to SEMI S8	
Environmental:	Operating Temperature	10 to 40° C.
	Operating Humidity	10 to 75% non-condensing
	Storage Temperature	-10 to +55°C.
	Storage Humidity	5 to 90% non-condensing

Falcon complies with content of SEMI S2, SEMI S8, and CE Marking.

*Specifications subject to change without notice

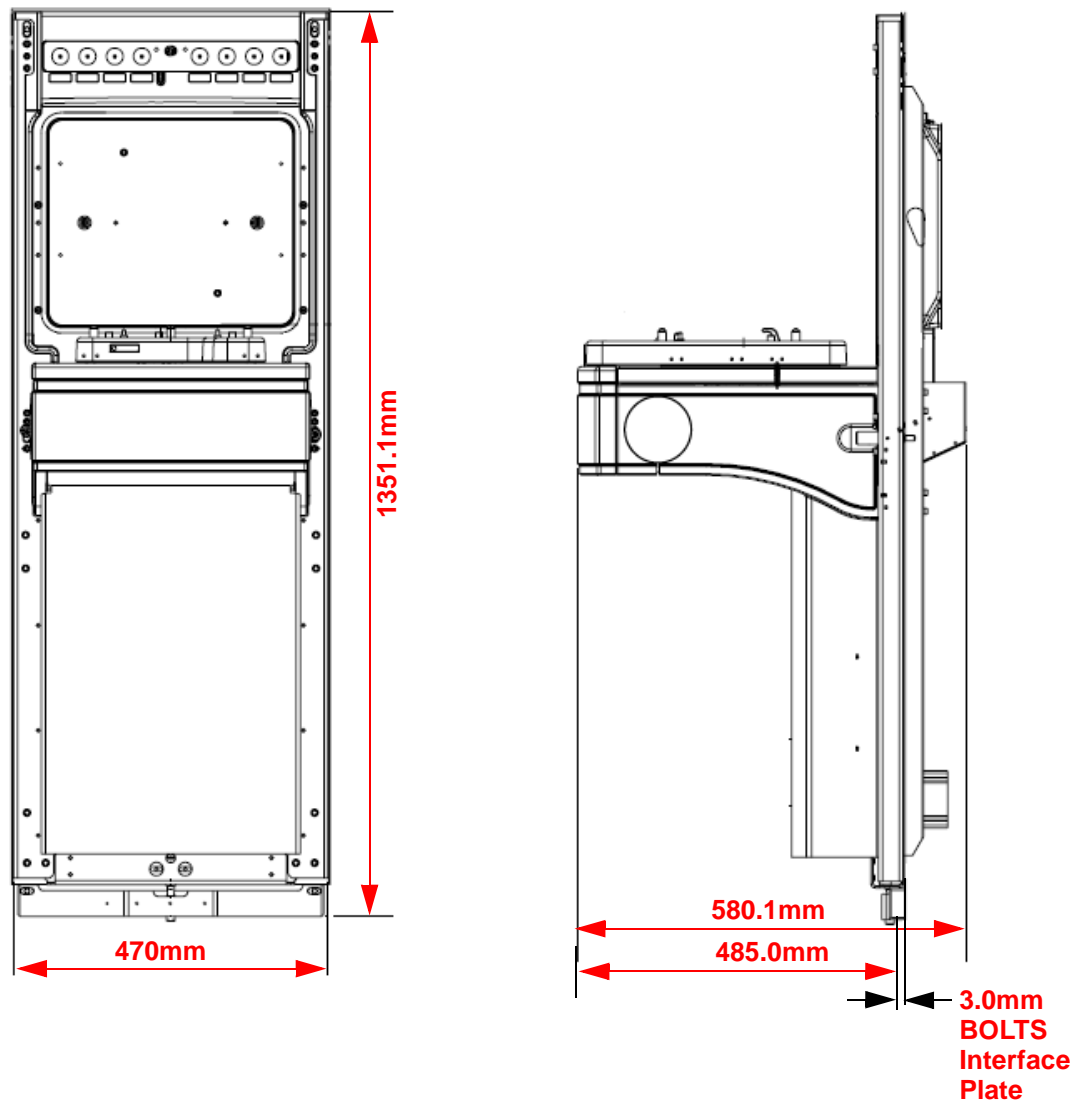


FIGURE 13 *Falcon Basic Outline*

For additional dimensions, interface points and datums see “[2000-6803-01 Falcon Outline Drawing](#)” on page 284.

FIMS Door

The Falcon Front-Opening Interface Mechanical Standard (FIMS) door is used to open a 25-wafer FOUP. Two latch keys located on the FIMS door rotate to horizontal to unlock the FOUP door. Using Asyst's patented Twist & Pull technology, both latch keys retract at the horizontal (unlocked) position to secure the FOUP door.

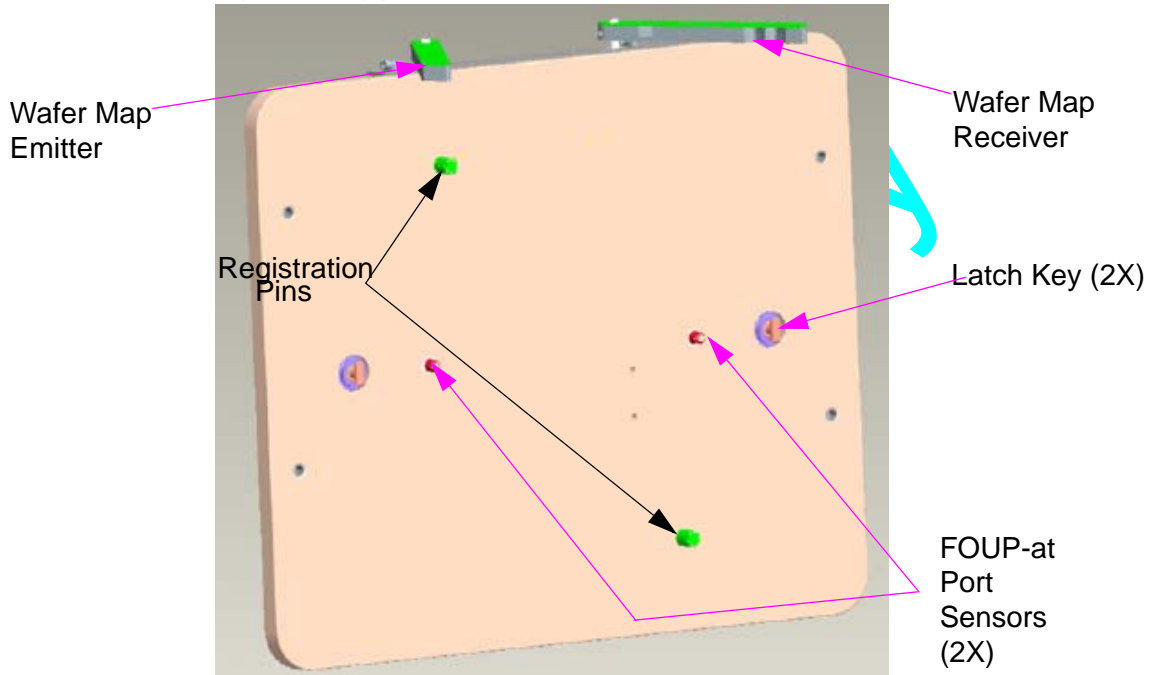


FIGURE 14 *FIMS Door, Front View*

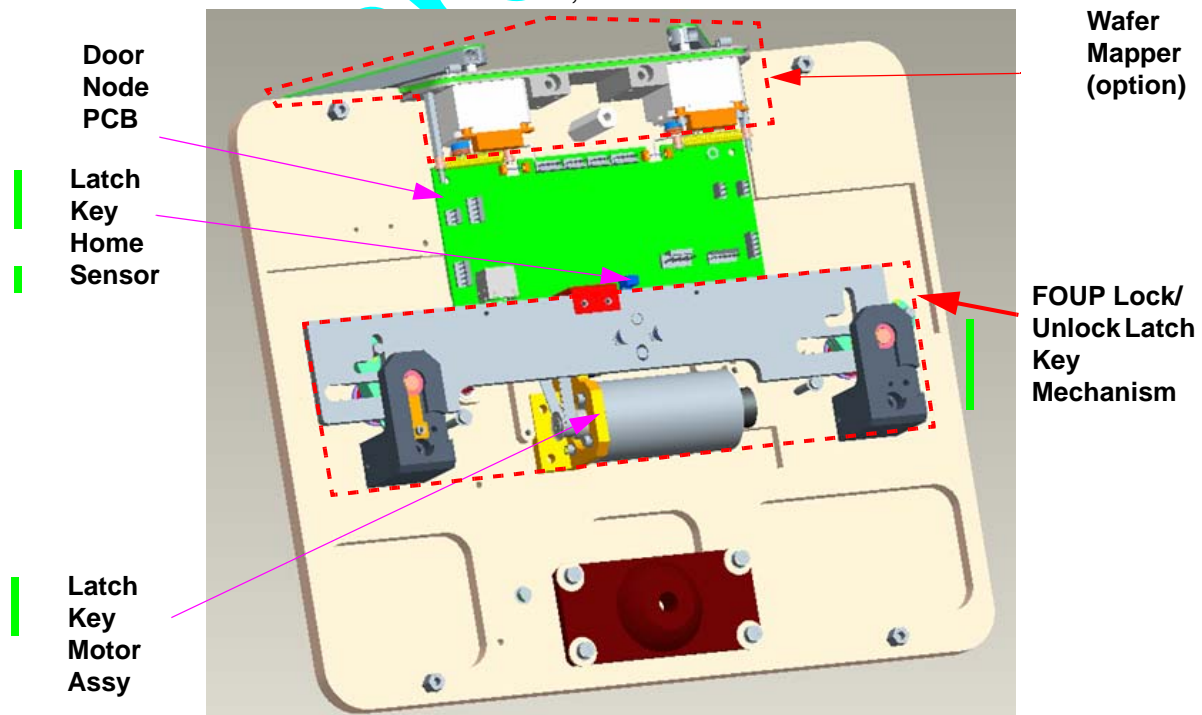


FIGURE 15 *FIMS Door, Rear View (without Cover)*

After the port door latch keys secure the FOUP door, it backs away from the FOUP, then lowers until the FOUP opening is cleared. Once the port door is lowered, the wafers are accessible for processing. For details on how the Port Door works in conjunction with the FOUP Advance plate, see “[Operation Sequence](#)” on page 45.

Features

Ball Joint with Clamping for Port Door Alignment

This feature enables roll, pitch and theta alignment of the port door with one fastener for all three adjustments. This permits setup and alignment to be done with 1 fixture and one tool. The reduced part count reduces the potential for error. See [Figure 16](#).

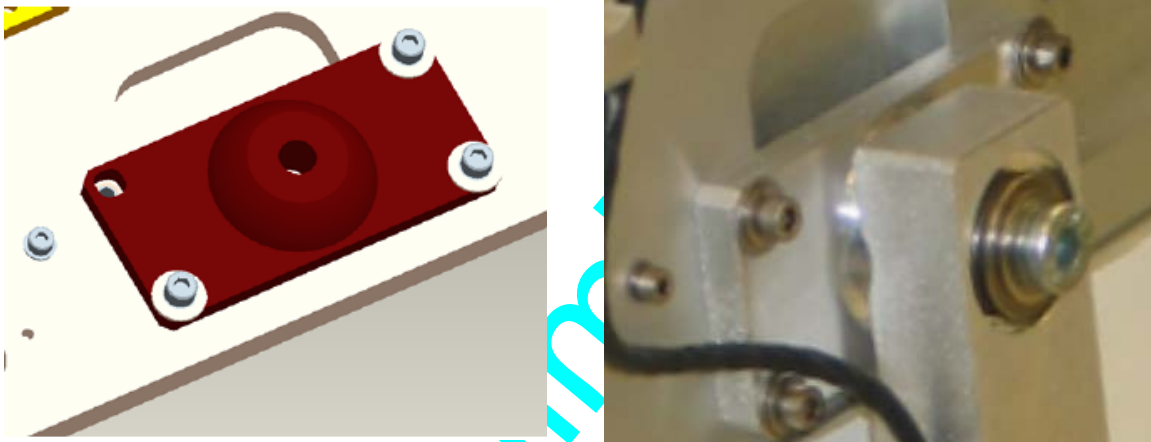


FIGURE 16 *Ball Joint Design*

Simplified Twist and Pull Latch Key Drive

The Falcon design preserves Asyst’s proven and patented twist & pull latch key drive and door retention with no vacuum system needed to secure a FOUP door to a FIMS door. Each latch key provides 3-4 lbs of pulling force. This design uses a one piece cam drive plate, guided by a latch key shaft to move the 2 individual latch key mechanisms. The pull-in FOUP clamping feature is comprised on a spherical bushing and socket detent in the cam drive plate. A compression spring provide the clamping force. The Falcon latchkey are lubricated for the rate life of the unit and requires no preventive maintenance. See [Figure 17](#).

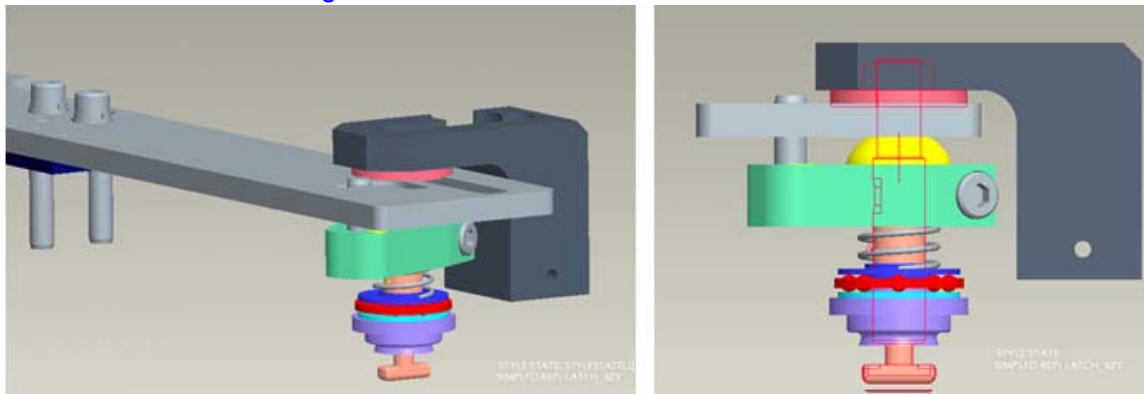


FIGURE 17 *Simplified Twist and Pull Latch Key Drive*

Sensors

There are two FOUP-at-Port (FAP) Sensors that will detect the presence of a FOUP door when up against the FIMS door. Both FAP sensors detect the presence of a FOUP door at the docked position.

Ground Path to FOUP Door

The Falcon provides a path to ground from the FOUP door through the port door latch keys, when the FOUP door is removed from the FOUP.

Configurable Latch Key Over-Rotation

The Falcon rotates the latch key from the locked position at 90 degrees (FOUP Door locked position) to the unlocked position of 0 degrees. Falcon can be configured for over-rotation at the 90 degree position to 1,2, or 3 degrees over-rotate through the GUI Interface. The factory default setting for over-rotate is 2 degrees.

Preliminary

Vertical-Horizontal Door Drive

The vertical and horizontal drive (V/H Drive) has two functions: To open and close the FOUP door. During opening of the FOUP door, the V/H Drive will move backward in horizontal movement to clear to the BOLTS plate and downward to give to host tool access to the wafers. See [Figure 18](#).

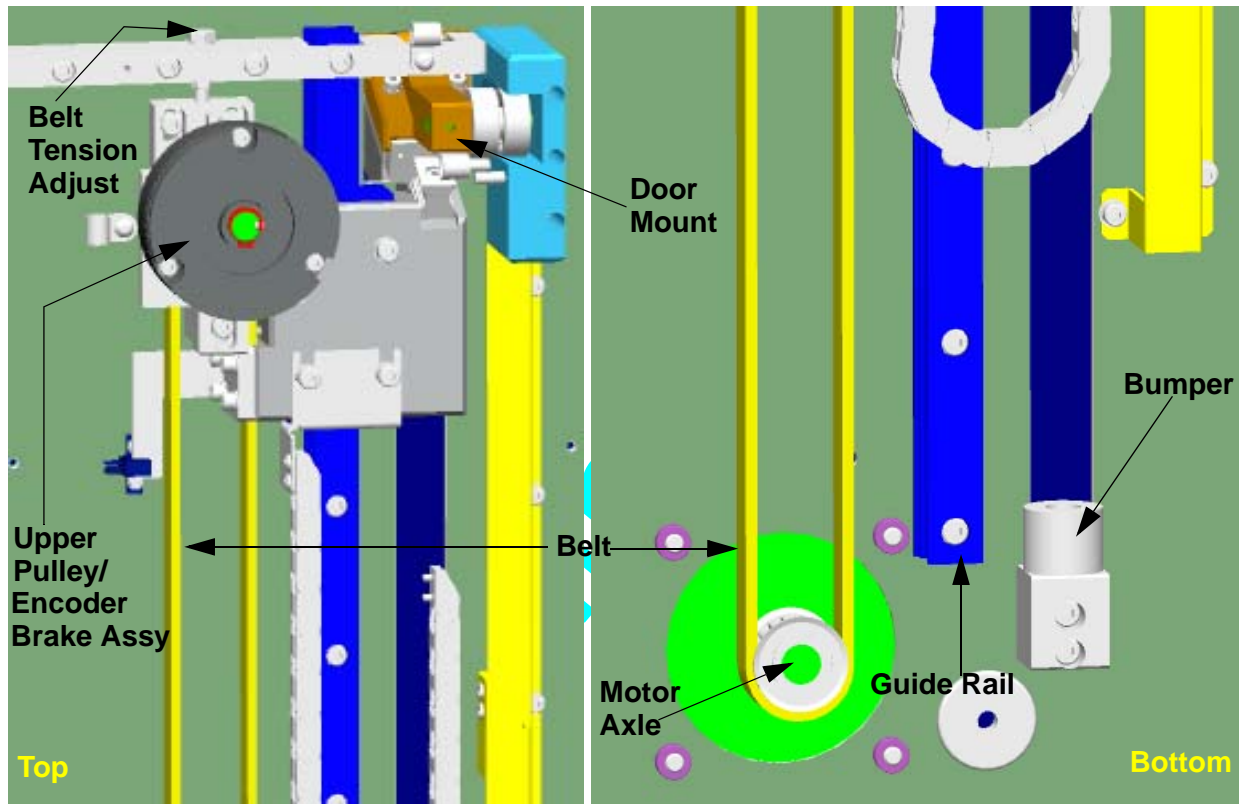


FIGURE 18 Vertical/Horizontal Door Drive Components

During closing, the V/H Drive will move upward and in to close the FOUP.

When configured with the optional wafer mapper, mounted on the door module, the V/H Drive makes 2 stops to allow for wafer mapping during open and/or close cycle.

The V/H Drive is designed to be maintenance free. There are no user serviceable components and no alignments are necessary. Major modules (Motor, Upper Pulley/Brake/Encoder Assembly, Belt) are designed for quick replacement if needed, with no changes to alignment.

Features

Single Motor for Two Axes

The design of the Vertical/Horizontal Drive Assembly incorporates a single stepper motor and Belt Drive to perform both Vertical & Horizontal Door Motions. The Motor mounts directly to the BOLTS plate frame so no machined brackets are required. The use of

Direct stepper drive eliminates the need for a speed reduction system. The integrated design means that fewer sensors, adjustments, and moving cables are required.

Upper Pulley/Brake/Encoder Assembly

The Upper Pulley/Brake/Encoder Assembly includes a 24V Brake used in the event of power loss to stop Z Movement of the FIMS Door. The fail-safe Brake keeps the vertical drive held in place when inactive or during loss of power.

The Encoder, part of the Upper Pulley Assembly, is used to give position feedback and also to work with wafer mapper to detect wafer presence and slot positions in a FOUP.

There is no hard stop for homing the Vertical/Horizontal Drive, the encoder with home sensor is used to determine home position. Home position of the Vertical/Horizontal Drive is at the top of the drive.

The Brake, part of the Upper Pulley Assembly, stops all movement of the Vertical-Horizontal Door Drive:

- anytime power is cut
- at the end of motion (excluding Upper and Lower Mapping positions)
- whenever a following error is larger than its limit (Important during upward movement to prevent the door from dropping)

Vertical/Horizontal Drive components (Motor, Upper Pulley/Brake with encoder, and home sensors) all connect directly to the static entry node on the BOLTS frame.

Fan Assembly

The Fan Assembly is located on the bottom of the removable belt/drive cover. It provides a continuous air flow for airborne particle control for the vertical/horizontal drive mechanisms. This is done to insure no contamination to the Host Tool mini environment by this mechanism.

FOUP Advance Subassembly

The FOUP Advance Module is a component of the Falcon loadport which is required to position the FOUP on the loadport for processing by the Host Tool and AMHS system.

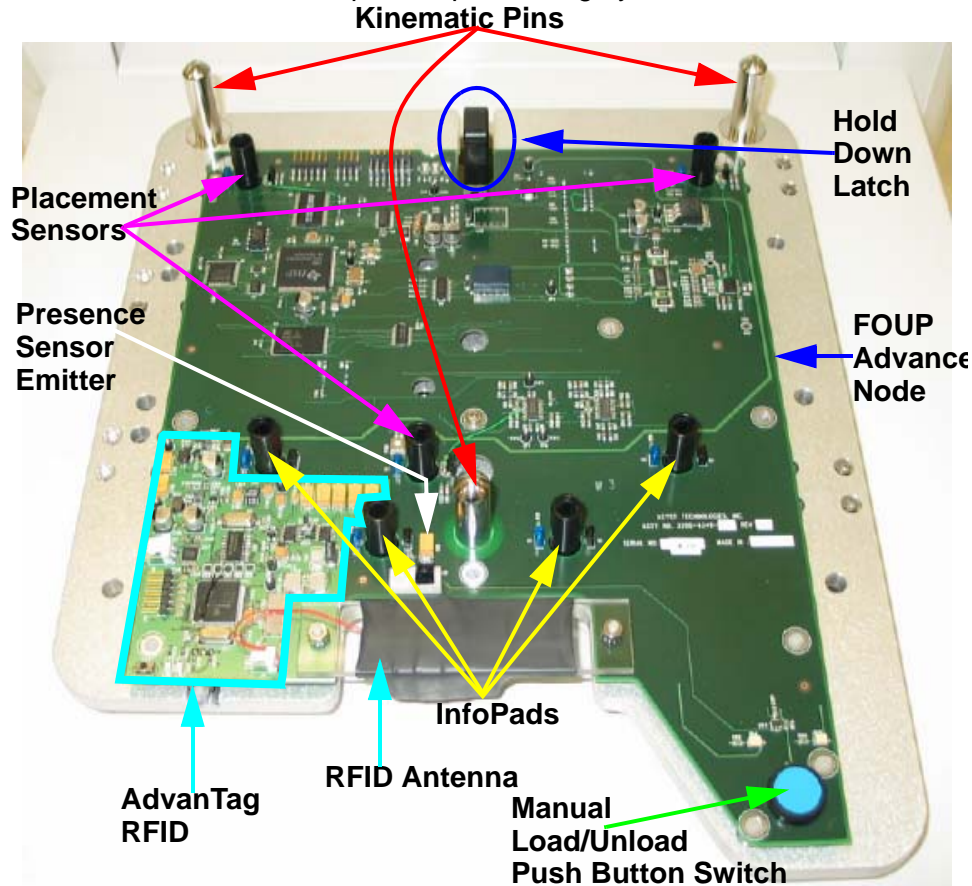


FIGURE 19 *FOUP Advance Plate without Cover*

The FOUP Advance Module positions the carrier using kinematic pins in an orientation for AMHS transfers, positions the FOUP in an orientation for opening the FOUP door and positions the kinematic pins in an orientation using for wafer handling by a front end robot.

The FOUP Advance Module also provides a means of latching the carrier to prevent removal of the carrier by operators with adequate holding force to allow door opening, resisting operator applied forces, and a means of reading and/or writing to the carrier RFID tag.

The K-Plate is supported by 2 linear rails that are attached to the FOUP Advance Base.

Falcon software uses two sensing systems, FOUP Placement and FOUP Presence, to ensure that the FOUP advance will not operate unless the FOUP is properly positioned. When the FOUP is placed on the Kinematic Pins of the FOUP Advance, the Presence sensor detects the presence of the FOUP and the Placement sensors detect that the FOUP has been properly placed.

The FOUP Advance controls horizontal movement of the FOUP and support plate. After both the FOUP placement and presence sensors are triggered, the Active Pod Hold Down (APHD) latches to hold the FOUP to the Kinematic Pins. This ensures the FOUP can not be removed from the Kinematic Pins. The plate then moves towards the port door to the configured FOUP docked position. The FIMS door moves to meet the FOUP door at the Docked position. FAP sensors are actuated by the FOUP door, confirming a FOUP Door is present. The latchkeys then unlock the FOUP door and hold the FOUP door in position on the port (FIMS) door.

Features

Torque Tube with Cantilevered Supports

- Provides major improvement in torsional rigidity/stability in the as-installed condition
- Provides stable reference platform for the FOUP advance /K plate assembly
- Enables one time factory setup/alignment for critical K plate dimensions. No field adjustment required.

Manual Load/Unload Push Button Switch

The FOUP Advance Plate features one push button switch that is end-user configured. It is a Programmable Function Manual Push button with Indicator LEDs. See [Figure 20](#).

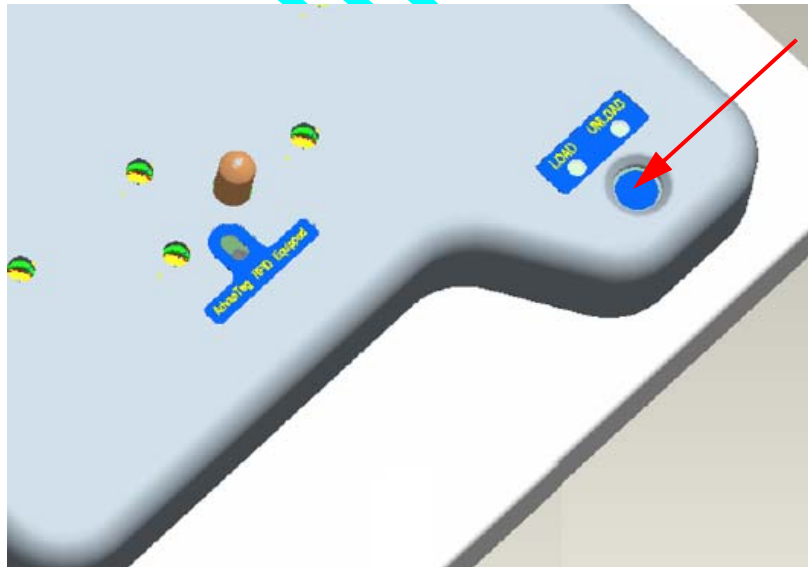


FIGURE 20 FOUP Advance Load/ Unload Push Button Switch

 **NOTE . . .**

THE BUTTON MUST BE PROGRAMMED BY THE USER BEFORE SUBSEQUENT ACTION IS PERFORMED BY THE FALCON AS A RESULT OF THE BUTTON EVENTS.

K-Plate Node PCB

The K-Plate Node PCB, located on the top of K-Plate, has two controllers, both which communicate via CAN to the System Link Manager/CPU module.

Ti-DSP:

- Controls FOUP advance function using close loop Step motor and encoder.
- Controls FOUP Hold Down function using an open loop DC motor, and position sensor.
- Provides approximately 30 general purposes I/Os.
- Monitor FOUP status through 7 on board sensors
- Communicates with system CPU via CAN

PIC-Controller:

- Controls RFID communication and RF power; and communicate with System CPU via CAN.

Integrated AdvanTag Circuitry. The main component of the integrated AdvanTag circuitry is a transmitter that generates radio waves through an antenna. This TIRIS compatible low-frequency (134.2kHz), low-power RF energy is used to read from or write to a transporter near the antenna. The 134.2kHz carrier from the RFID-ASIC is amplified to the proper levels to drive the dual MOSFET power amplifier. This provides a 12Vp-p low impedance drive to the antenna circuit. The antenna is a series resonant LC circuit resonated at 134.2kHz to achieve maximum voltage on the antenna.

Cam Activated Pod Hold Down

The FOUP is held down and cannot be manually removed from the Falcon unless the APHD is released.

- Very fast acting (0.40 seconds)
- No adjustments necessary

Sensors

FOUP Presence Sensors. One Emitter/Receiver pair located in the Status Display board (emitter) and FOUP Advance Plate (receiver) to detect whether a FOUP is present on the Advance plate (the load/unload area).

FOUP Placement Sensors. There are 3 FOUP placement sensors, incorporated into the FOUP Advance Plate; each sensor is located near a kinematic pin. The placement sensors work in parallel to provide accurate detection of a FOUP that is correctly placed on the FOUP Advance Plate/kinematic pins.

InfoPad Sensors. The Falcon provides for InfoPad sensors and/or a mechanical interlock pin to be installed at four location on the FOUP Advance Plate. InfoPads Sensors are used to distinguish between FOUP identities based on info plugs installed on the underside of a FOUP. A mechanical lockout pin can be placed in any InfoPad position. If the pin is placed in the "A" location, then a FOUP with the "A" location blocked cannot be placed properly onto the loadport. This is to prevent wafers in certain FOUPs from entering a process tool.

Preliminary

BOLTS Frame

The BOLTS frame is the structure to which main subassemblies are mounted. It also provides the interface/mounting point for the Host Tool. In addition, the frame includes several key electronic circuits as well as the status indicators.

Main Components

Light Display Node PCB

The Light Display Node PCB controls the indicator lights at the top of the Frame. The Display PCB can only be accessed from the Operator side of Falcon. [Figure 21](#) shows the PCB (with the indicator light panel removed from the top of the Frame).

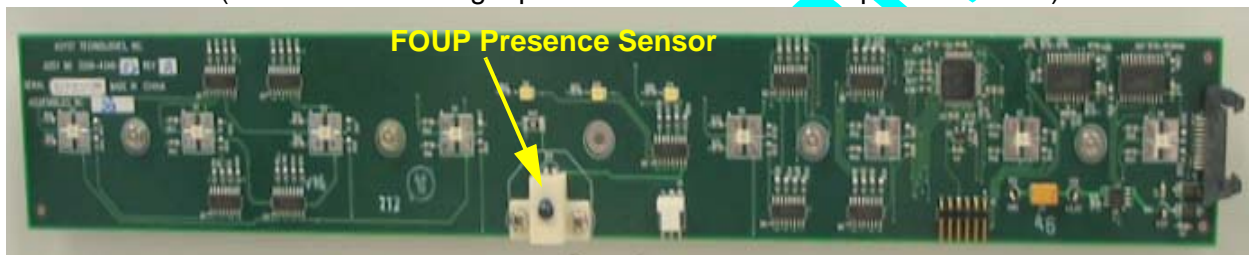


FIGURE 21 *Light Display Node PCB*

The emitter of the FOUP Presence Sensor is located on the Display Node PCB. It works in conjunction with the receiver located on the FOUP Advance assembly to detect whether there is a FOUP on the FOUP Advance plate.

 **NOTE . . .**

THE FOUP PRESENCE SWITCH DOES NOT INDICATE WHETHER THE FOUP IS PLACED CORRECTLY ON THE PLATE, ONLY THAT THERE IS A OBJECT PRESENT ON THE PLATE.

Excessive Wafer Protrusion Sensor

The Excessive Wafer Protrusion Sensor is located on the BOLTS frame assembly, this interlock sensor detects whether a wafer is positioned too far out of the FOUP. If sensed, all movement is halted to prevent damage to wafers and allow manual re-seating into the FOUP.

The Excessive Wafer Protrusion sensor used on the Falcon is break-the-beam type optical sensor. It provides an off/on signal via the digital I/O and an interrupt to the processor when actuated, V/H Door motion is stopped and a fatal error message is sent to the Host (Tool).

Static Entry Node PCB

Located on the Operator side of the BOLTS Frame Assembly, the Static Entry Node controls movement of the Horizontal/ Vertical Drive and FOUP Advance assemblies, and is able to communicate via CAN to the Link Manager/CPU, the Door Node, and the FOUP Advance Node.

The Static Entry Node contains circuitry that monitors voltage and current. If the applied voltage becomes too low or too high the electronics will be shutdown until the correct voltage level is restored. Over current (over load) protection device rating is 9 amp. To recover the operation, power will have to be cycled off and then on again.

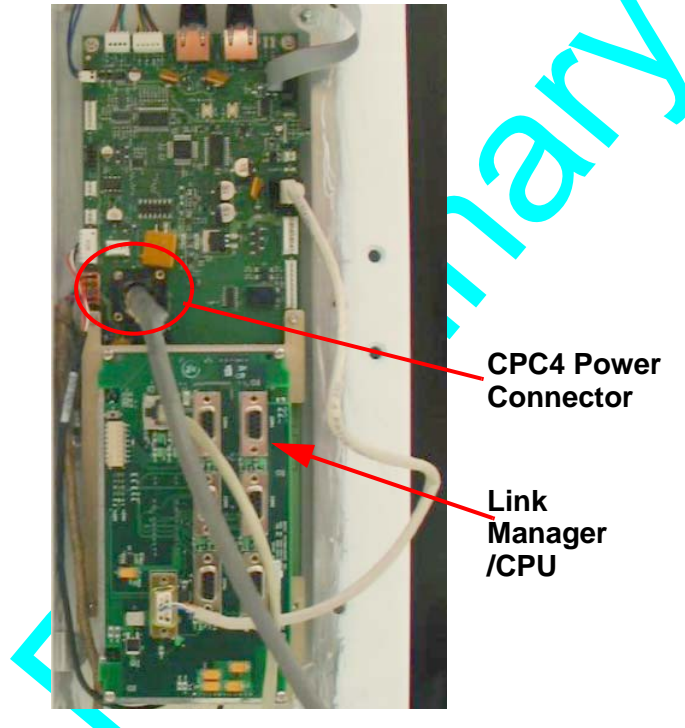


FIGURE 22 Static Entry Node PCB

TABLE 3 Static Entry Node Connections

SEN Connector	Goes To	Link Manager/CPU	
J1	V/H Motor Encoder	J1	Ethernet
J3	V/H Drive Brake	Comm1	RS232 Serial
J9	RJ45 cable goes to ----->	J10	DB9
J22	Main Power In		
J23	V/H Motor		
J25	Fan		
J27	V/H Home Sensor		
J36	Excessive Protrusion Sensor		

Options

Current options available for the Falcon are the Wafer Mapper, the 100-240VAC Power Option, the E84/PIO/Interlock Option and the Tilt & Go Wheel option.

Wafer Mapper Assembly Option

An optional wafer map system can be attached to the FIMS door, that consists of two arms, with sensors, operating during the vertical movement of the port door to determine the position of wafers and detect cross-slotting or double-slotting of wafers within a FOUP. See [Figure 23](#).



FIGURE 23 *Wafer Mapper Uninstalled*

The wafer mapper assembly with protrusion module is comprised of a light source and a receiver. The light source/receiver pair is for detecting wafer presence, empty slots, cross-slotted and double-slotted wafers within the FOUP. This wafer map data is transmitted to the host tool. Two stepper motors are used to deploy and retract the arms.

The Falcon wafer mapper is designed to be maintenance free. There are no user serviceable components and no alignments are necessary.

100-240VAC Power Option

Typically the Falcon is powered by +24VDC (+10, -2%) provided by the Customer, via the Host Tool. Falcon loadports configured with the 100-240VAC 50/60 Hz, 3.5A Option, permit the customer to provide AC power to an AC Power Supply, within the Falcon, that converts the power to the +24VDC (+10, -2%), 7A required for Falcon operation. See [Figure 24](#) for main view of components, see [Figure 25](#) for tool side view and see [Figure 26](#) on page 42 for wiring diagram.

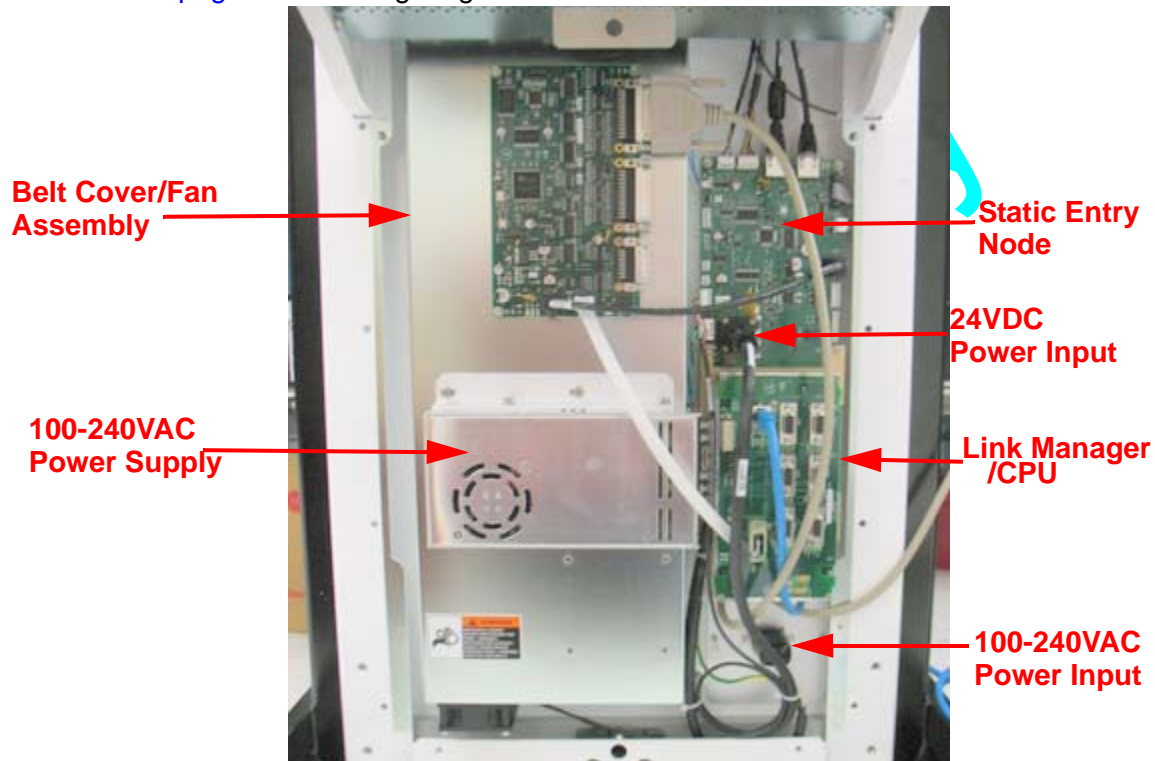


FIGURE 24 Components of the 100-240VAC Option

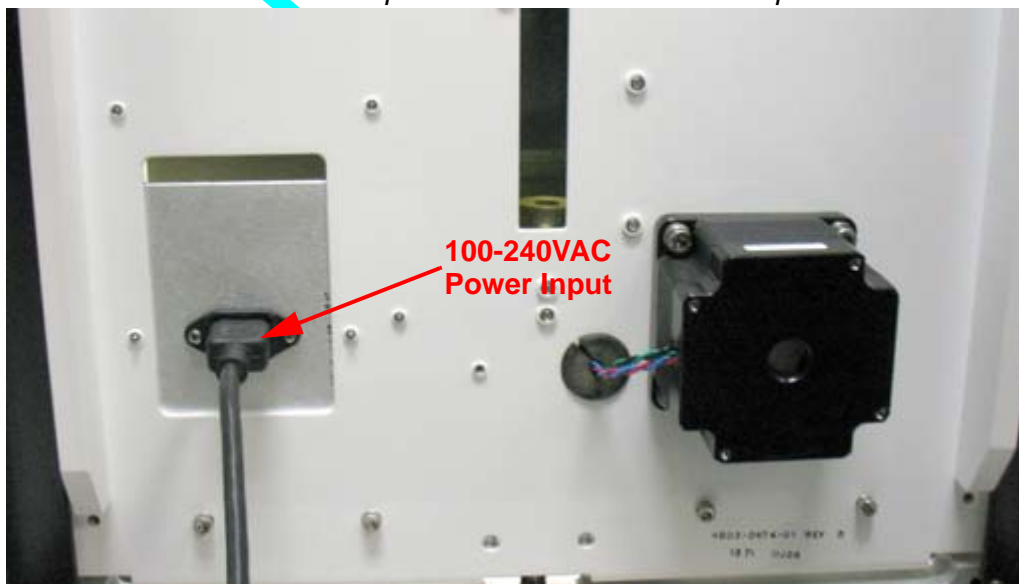


FIGURE 25 Tool Side View

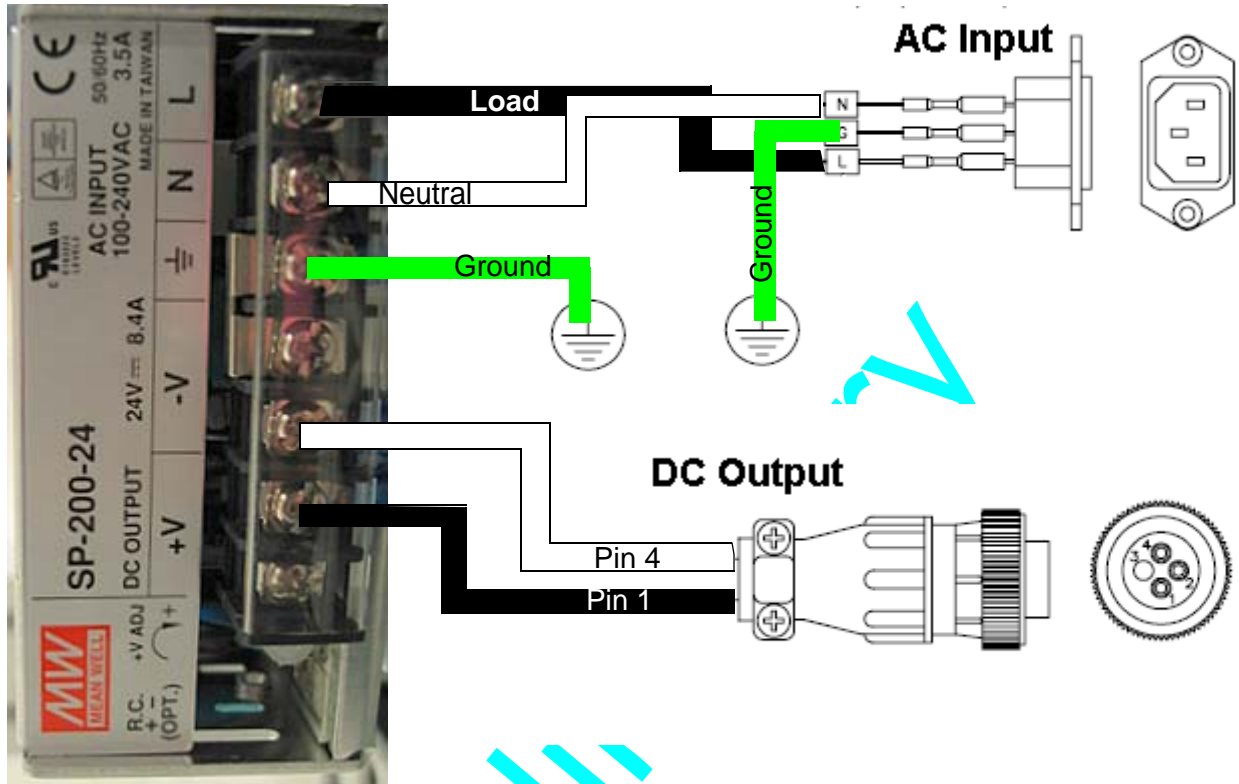


FIGURE 26 *Wiring for the AC Option*

E84/PIO/Interlock Option

The E84/PIO/Interlock Option provides communications interface with a variety of FOUNP delivery systems including AGV, AMHS, or process tools.

The E84/PIO/Interlock Option provides several functions for the Falcon loadport:

- Provides E84 interface for communication with AMHS/AGV systems for FOUNP delivery.
- Provides PIO interface for communication with process tools for door close/open operation.
- Provides an interlock to disable loadport operation.

Components

The E84/PIO/Interlock Option consist of the E84 Node PCB and connecting cables.

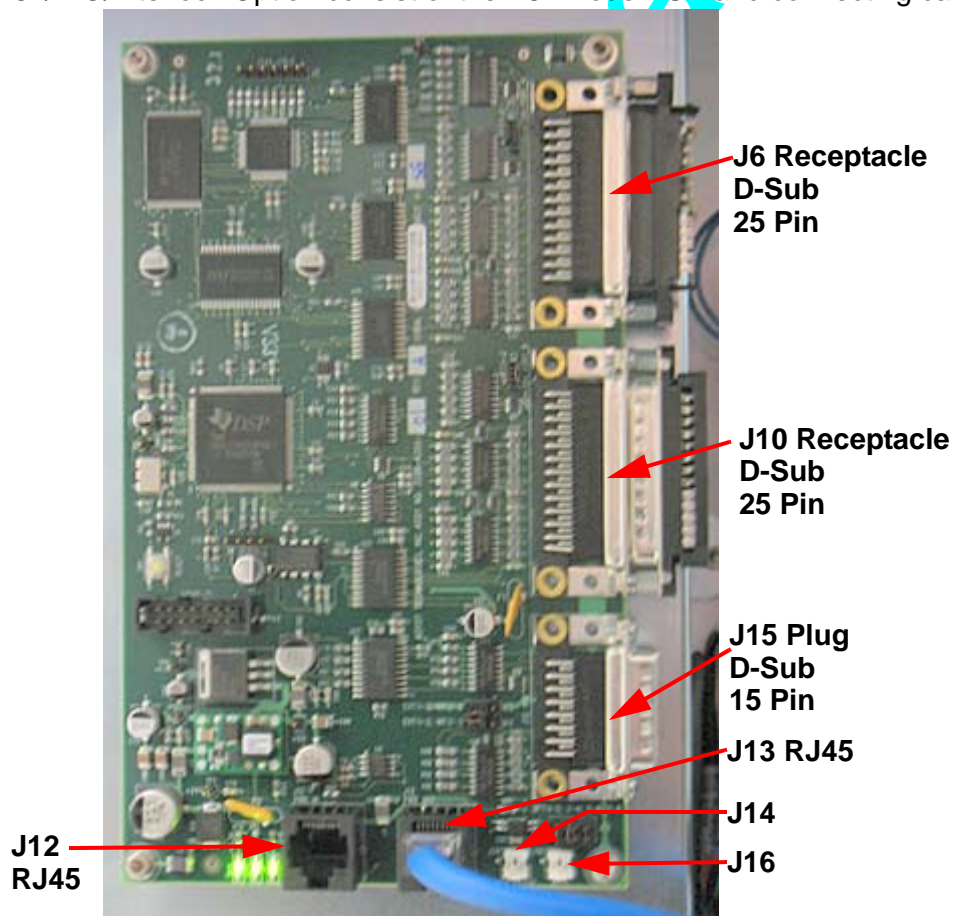


FIGURE 27 E84 Board

Tilt & Go Wheels Option

The Tilt & Go wheels option allows a single operator to assemble and align the Falcon to the Host tool, as well as remove the Falcon from the Host tool. Also, one operator can move the Falcon to various parts of a fab (e.g., from tool to tool, to a repair area). See [Figure 28 on page 44](#).



CAUTION



GENERAL HAZARD

FOR ONE PERSON REMOVAL FALCON MUST HAVE A BASE WHEEL ASSEMBLY ATTACHED BEFORE REMOVING THE FALCON FROM THE HOST TOOL. THE WHEEL ASSEMBLY MAY HAVE BEEN REMOVED AFTER INSTALLATION.



FIGURE 28 *Falcon Tilt & Go Wheels*

NOTE ...

WITHOUT THE TILT AND GO WHEEL OPTION THE FALCON MUST BE MOVED USING A TWO PERSON LIFT, TAKING CARE TO OBSERVE THE MOVING AND HANDLING REQUIREMENTS SPELLED OUT IN THIS CHAPTER. SEE “[Moving and Handling](#)” on page 16.

Operation Sequence

Step 1 Undocked (Home) Position

The operating sequence for Falcon always begins from the undocked (Home) position:

- Vertical Drive is at Home position; Door is at Closed position
- FOUP Advance Drive is at Undocked position
- Latch Keys are in Vertical position
- Wafer Map Arms are retracted
- Active Pod Hold Down is in Open position

Step 2 Place FOUP on FOUP Advance Plate

1. FOUP is properly placed onto the kinematic pins located on the FOUP advance plate. FOUP Presence sensors and FOUP Placement sensors are activated.
2. Falcon reports to Host that the FOUP has arrived.

Step 3 Advance FOUP to Port Door

1. Host sends an Open command to open the FOUP.
2. The FOUP Advance Module latches the carrier to prevent removal of the carrier while the door is open.
3. Integrated AdvanTag reads and/or writes to the carrier RFID tag as initiated by the Host.
4. The FOUP Advance moves the FOUP towards the FIMS door to the configured FOUP docked position.
5. The FIMS door moves to meet the FOUP door at the Docked position.
6. FAP sensors are actuated by the FOUP door confirming a FOUP Door is present.

Step 4 Open and Lower the Port and FOUP Doors

1. Latch Keys unlock the FOUP door and hold the FOUP door in position on the port (FIMS) door.
2. FIMS door with FOUP door are moved horizontally and vertically away from the port to clear the opening.
3. With Wafer Map Option present, vertical drive moves to Mapper Upper position.
4. With Wafer Map Option present, Wafer Map Light Source (IR LED) activates.
5. With Wafer Map Option present, Wafer Mapper arms extend, and the Wafer Map system activates.