Dicing Systems

Kulicke & Soffa Ltd.

Your Resource for Advanced Dicing Solutions

K&S 4500 Series

Digital Series Manual
Wire Bonders

Operations and Maintenance Manual

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Customer Support

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RECORD OF CHANGES

Item	New Part Number	New Page Number(s)	Revision Date	Comments

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SAFETY FIRST

Kulicke & Soffa believes that the safety of personnel working with and around the Model 4500 Digital Series is the most important consideration. Please read the following information before attempting to operate the system or perform any maintenance function.

Important Safety Features

The Model 4500 Digital Series is equipped with a number of features which are meant to help ensure your safety as well as the safety of the system. Get to know each of them.

Protection Circuitry

The Model 4500 Digital Series is equipped with two fuses, one for the general machine and one for workholders, which blows when overcurrent is detected.

Safety Precautions

When working with or near the Model 4500 Digital Series, the following safety precautions are strongly recommended.

1 The Model 4500 Digital Series must be connected to the Main Power source through a Earth Leakage Circuit Breaker.

2 Always keep your hands out of the Working Area while the Bonding Head is in operation.

3 Never touch the Heated Workholders with your hands or any material having a low melting point.

The maximum temperature of the Heated Workholders is limited to 250°C. Wait 30 minutes before replacing the Heated Workholders, illumination lamps or any other hot machine part to allow the parts to cool down.

4 Beware of touching tools, as they may have sharp edges.

5 All maintenance tasks should be performed by trained, authorized personnel. When indicated by the instructions in the Maintenance Manual, contact K&S Customer Support before making the attempt.

6 Never perform any maintenance function while the Model 4500 Digital Series is in operation. Always, power down the system first. Remove the AC plug from the wall outlet as well.

Caution: If available at the site, perform the Lockout Procedure to eliminate any chance of the AC plug being returned to the wall outlet before the end of the maintenance procedure.

7 Read carefully all warnings given in the Maintenance Manual before beginning any maintenance task.

8 No matter what the procedure, read carefully all instructions and study the schematics and drawings provided before beginning to work.

9 Personnel who handle or remove printed circuit boards (PCBs) must be grounded to avoid electrostatic discharge (ESD) damage. Banana Grounding Sockets are located directly below the Base cover.

10 Obey all standard precautions for working with mechanical and electrical equipment.

11 Left and Right Head doors may be opened for adjustment only while the machine is in the RESET position.

12 The Back Cover should be opened only after powering down the machine and removing the power cord from the wall outlet.

Specific Precautions for Models 4524D and 4524AD with N.E.F.O.

Do not touch the electrode or wire during bonding or when manually firing the Negative Electric Flame Off (N.E.F.O.). The system produces a spark between the N.E.F.O. electrode and the wire, which can cause an electric shock if contacted during N.E.F.O. firing. The potential shock hazard is not usually considered life threatening (IEC publication no. 479). However, K&S recommends that those persons with abnormal heart conditions or artificial heart stimulation devices (e.g. pacemakers) should not be permitted to operate or service this equipment.

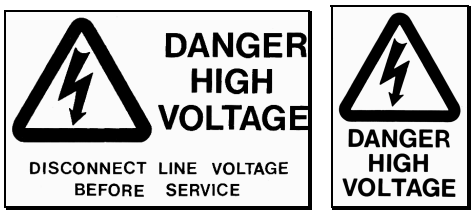
The N.E.F.O. produces high voltage within the N.E.F.O. box, in the electrode and on the high voltage cable.

1 Do not open the N.E.F.O. box. If it becomes necessary to handle the high-voltage cable or remove the N.E.F.O. box, unplug the machine power cable and wait at least five minutes.

2 Use high voltage techniques at all times when handling the N.E.F.O. box.

3 K&S recommends that during bonding operators use insulated gloves and insulated tweezers.

Electrical Safety Labels



About this Manual

This manual describes installation, operation and maintenance of the K&S 4500 Digital Series Manual Wire Bonders. It is assumed that you are knowledgeable about the wire bonding process. All procedures described in this manual should be performed by qualified personnel only.

Note: Unless noted otherwise, the photographs in this manual show views/items that are common for all models of the 4500 Digital Series.

Manual Contents

Chapter 1 **Introduction**

A general description of the K&S 4500 Digital Series Manual Wire Bonders.

Chapter 2 **Installation**

Instructions and guidelines for installing your K&S 4500 Digital Series Manual Wire Bonder.

Chapter 3 **Physical Description**

Description of the principal parts of the K&S 4500 Digital Series Manual Wire Bonder.

Chapter 4 **Controls and Indicators**

Description of the K&S 4500 Digital Series Manual Wire Bonders switches, dials and displays.

Chapter 5 **Setup and Adjustments**

Procedures and instructions for setting up and adjusting the K&S 4500 Digital Series Manual Wire Bonders for operation.

Chapter 6 **Operation**

Descriptions of bonding parameters and procedures for setting bonding modes and performing bonds.

Chapter 7 **Maintenance Overview**

General guidelines and adjustments checklist for maintaining the K&S 4500 Digital Series Manual Wire Bonders.

Chapter 8	**Electrical Subassemblies** Information for maintaining and adjusting the K&S 4500 Digital Series Manual Wire Bonder electrical subassemblies.
Chapter 9	**Mechanical Subassemblies** Details about maintaining the main mechanical subassemblies of the K&S 4500 Digital Series Manual Wire Bonders, including procedures for adjusting and replacing mechanical parts of the machine.
Chapter 10	**Timing Diagrams** Diagrams of each machine's bonding cycle time and motion.
Chapter 11	**Diagnostics** Description of the K&S 4500 Digital Series Manual Wire Bonders' diagnostics functions, such as fault detection in the machine's parts or in the bonding cycle.
Chapter 12	**Preventive Maintenance** Preventive maintenance procedures for various subassemblies of the K&S 4500 Digital Series Manual Wire Bonders.
Chapter 13	**Troubleshooting** Procedures for troubleshooting the K&S 4500 Digital Series Manual Wire Bonders.
Chapter 14	**Options and Accessories** Part numbers of optional items that are available for the K&S 4500 Digital Series Manual Wire Bonders.
Chapter 15	**Parts List** Part numbers of all components and assemblies of the K&S 4500 Digital Series Manual Wire Bonders.

TABLE OF CONTENTS

1. INTRODUCTION

1.1 Product Description

The K&S 4500 Digital Series Manual Wire Bonders offer complete solutions to the various wire bonding applications and process requirements.

The 4500 Digital Series comprises the following bonding machine models: 4523D, 4523AD, 4524D and 4524AD.

1.1.1 Model 4523D Wedge Bonder

The Model 4523D Wedge Bonder is used with aluminum wire, gold wire and ribbon. It is versatile enough to bond simple discrete devices up to complex hybrid, microwave and deep cavity devices.

The 4523D offers control of individual bond parameters, loop height and force, along with the capability of using a wide range of wire diameters.

The new digital option enables programming of unique bonding schedules. Up to 200 different bonding programs may be stored in the memory.

The new bonding head, with the deep access option and tail adjust system, makes it ideal for deep cavity microwave applications where tight control over the tail length is required.

1.1.2 Model 4523AD Auto-Stepback Wedge Bonder

The Model 4523AD Auto-Stepback Wedge Bonder is used with aluminum wire, gold wire and ribbon. It is especially appropriate for your high quality applications requiring tight control of wire length and loop formation.

The 4523AD offers control of individual bond parameters and programmable loop formation along with the capability of using a wide variety of wires.

The new digital option enables programming of unique bonding schedules. Up to 200 different bonding programs may be stored in the memory.

The new bonding head, with the deep access option and tail adjust system, makes it ideal for deep cavity microwave applications where tight control over the tail length is required.

1.1.3 Model 4524D Multi-Process Ball Bonder

The Model 4524D Multi-Process Ball Bonder for gold wire is ideal for Research & Development and small production lots where unique processes are used.

Single point TAB, ball bumping, and coining, together with standard ball bonding, offer process flexibility and versatile capabilities.

Semi-auto and manual operation modes, individual bond parameter control and a wide range of wire diameters make it ideal for a variety of applications.

The new digital option enables programming of unique bonding schedules. Up to 200 different bonding programs may be stored in the memory.

The built-in programmable Negative Electronic Flame-Off (N.E.F.O.) system provides consistency and fine control of ball size.

1.1.4 Model 4524AD Multi Process Auto-Stepback Ball Bonder

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The built-in programmable Negative Electronic Flame-Off (N.E.F.O.) system provides consistency and fine control of ball size.

1.2 Features

1.2.1 Common Standard Features

The following standard features are found on all K&S 4500 Digital Series models:

- **DC Servo/LVDT Closed Loop Control** enables the bonding head to move at maximum speed and high precision between set heights, with gradual starts and stops, and minimum jarring or vibration. All sequence and timing functions are controlled electronically.
- **Ultrasonic System** results in maximum efficiency, minimum power requirement and close control of the bonding process.
  - **High-Q Transducer** is sensitive to changes of load during bonding.
  - **Phase-Locked-Loop (PLL) Ultrasonic Generator** enables the bonder to apply power to the bond at the instantaneous frequency of the system.
- **Control Pad and Digital LCD** Display enable easy configuration of bond schedules and bonding parameters such as force, ultrasonic power, search and loop heights, and bonding duration. Up to 200 different bonding programs may be stored in memory.
- **Air-Damped Bonding** Head provides smooth travel without vibration and ensures soft-touch without impact.
- **Bonding Area** - 134 mm x 134 mm (5.3" x 5.3") for wedge bonding. 152 mm x 152 mm (6.0" x 6.0") for ball bonding.
- **Multi Mouse** Single Hand Integrated Control, an ergonomic "all-in-one" control system, provides:
  - Bonding position control
  - Semi/Auto mode operation - semi-automatic bonding
  - Manual Z mode operation - manual movement of the bonding head
  - Stitch mode operation - programming of stitch cycle.
- **Temperature Controller** controls the temperature of the heated workholders.
- **Diagnostic LEDs** allow fast isolation of faults that may occur during machine operation. Any faults detected during the machine's self-test cause a combination of the LEDs to turn on. This helps the technician determine the cause of the fault.
- **Overhead Microscope** provides up to 85° view of the work area, depending on the bonder's microscope and spotlight (optional) adjustments.
- **Motorized Y Table** with programmable steps provides tight control of wire looping and wire length (4523AD, 4524AD).

- **Manual Z Mode** allows manual control of all bonding operations. This mode is very useful when bonding hybrid packages, or for bonding very fine wire.
- **Lange Coupler Mode** enables semi-automatic bonding of Lange coupler applications. This mode provides exact repetitive table motion and produces consistent low loops (4523AD).
- **Table Tear Mode** enables wedge bonding with table tear method of wire termination.
- **Tail Control System** provides very fine control of the tail length, resulting in tail length consistency throughout the bonding process. The system is driven by a high resolution linear stepper motor. A real-time tail control algorithm allows you to manually control and adjust the tail length during the bonding process (4523D, 4523AD).
- **Negative Electronic Flame-Off (N.E.F.O.)** system forms a ball by generating a spark between the N.E.F.O. wand and the wire (4524D, 4524AD).

1.2.2 Optional Features

The following optional features are available for the K&S 4500 Digital Series models:

- **Clamp 90° Wire Feed** Kit allows up to 12.7 mm (500 mil) access for bonding in deep packages and for rework of microwave and hybrid packages.
- **Height Adjustable Rotary** Table provides simple and accurate control over the required wire angle and the bond level height. This table is useful for applications with bond level variation and different wire directions.
- **Spotlight** eases targeting by projecting a bull's-eye pattern onto the bonding pad. The cross hair pattern provides even greater accuracy with narrower gauge wire.
- **Workholders** - various types of stationary or motorized, heated or unheated workholders are available.
- **Fiber Optic Illumination** Kit provides better illumination than the standard lamp and contains a spotlight target.
- **Deep Access Kit** for Models 4524D, 4524AD allows 12.7 mm (500 mil) deep access capability.

For all optional equipment and accessories, see Chapter 14.

1.3 Specifications

1.3.1 4523D

The K&S 4523D Wedge Bonder has the following specifications.

Wire

Diameter Range	
Gold	12.7 - 76 µm (0.5 - 3.0 mil)
Aluminum	20 - 76 µm (0.7 - 3 mil)
Gold Ribbon (Option)	Up to 25 x 250 µm (1x10 mil)
Spool	12.7 mm (0.5")
Option	50.8 mm (2")

Machine Specifications

Display	LCD (20 x 4 characters)
Program Memory	6 channels; up to 200 programs
Bonding Area	134 mm x 134 mm (5.3" x 5.3")
Throat Depth	143 mm (5.6")
Gross Table Motion	140 mm (5.5")
Fine Table Motion	14 mm (0.55")
Multi Mouse Ratio	6:1
Z Motion System	DC servo/LVDT control
Z Travel	
Low Reset	6.6 mm (260 mil)
High Reset	12.7 mm (500 mil)
Ultrasonic System	High Q 60 kHz transducer PLL ultrasonic generator
Low Ultrasonic Power	1.3 W
High Ultrasonic Power	2.5 W
Bond Time	10 - 100 ms/10 - 1000 ms

Bond Force	Force coil 10 - 160 gr
Wire Termination	Clamp tear
Wire Feed Angle	30/45º
Option	90º (Vertical)
Modes of Operation	Semi-Auto, Manual Z, Stitch
Temperature Controller	up to 250º ± 0.5ºC

Options

- Microscopes and eyepieces
- 90º wire feed angle kit for deep access
- Spotlight target
- Height-adjustable rotary table
- Fiber optic illumination and spotlight target
- Manually height-adjustable, heated workholders
- Motorized index workholders
- ESD kit
- Left-hand operation

Electrical Requirements

Voltage	100 - 120/220 - 240 V ± 10%, 50/60 Hz, 250 VA max.

Physical Dimensions

Height	530 mm (21")
Width	680 mm (27")
Depth	700 mm (27.5")

Weight (basic machine)

Shipping	55 kg (122 lb)
Net	31 kg (69 lb)

Note: These specifications are subject to change without prior notice.

1.3.2 4523AD

The K&S 4526 Auto Stepback Wedge Bonder has the following specifications.

Wire

Diameter Range	
Gold	12.7 - 76 µm (0.5 - 3.0 mil)
Aluminum	20 - 76 µm (0.7 - 3 mil)
Gold Ribbon (Option)	Up to 25 x 250 µm (1x10 mil)
Spool	12.7mm (0.5")
Option	50.8 mm (2")

Machine Specifications

Display	LCD (20 x 4 characters)
Program Memory	6 channels; up to 200 programs
Bonding Area	134 mm x 134 mm (5.3" x 5.3")
Throat Depth	143 mm (5.6")
Gross Table Motion	140 mm (5.5")
Fine Table Motion	14 mm (0.55")
Multi Mouse Ratio	6:1
Motorized Y	
Stepback	Up to 4 mm (160 mil)
Reverse	Up to 0.25 mm (10 mil)
Kink Height	Up to 0.5 mm (20 mil)
Z Motion System	DC servo/LVDT control
Z Travel	
Low Reset	6.6 mm (260 mil)
High Reset	12.7 mm (500 mil)
Ultrasonic System	High Q 60 kHz transducer PLL ultrasonic generator

Low Ultrasonic Power	1.3 W
High Ultrasonic Power	2.5 W
Bond Time	10 - 100 ms/10 - 1000 ms
Bond Force	Force coil 10 - 160 gr
Wire Termination	Clamp tear
Wire Feed Angle	30/45º
Option	90º (Vertical)
Modes of Operation	Semi-Auto, Manual Z, Stitch, Lange Coupler, Table Tear, Automatic Bonding
Temperature Controller	up to 250º ± 0.5ºC

Options

- Microscopes and eyepieces
- Ribbon clamp
- Manually height-adjustable, heated workholders
- Motorized index workholders
- Mini-heater kit
- Fiber optic illumination and spotlight target
- 90º wire feed angle kit for deep access
- Spotlight target
- 3rd channel kit
- Height-adjustable rotary table
- ESD kit
- Left-hand operation

Electrical Requirements

Voltage	100 - 120/220 - 240 V ± 10%, 50/60 Hz, 250 VA max.

Physical Dimensions

Height	530 mm (21")
Width	680 mm (27")
Depth	700 mm (27.5")

Weight (basic machine)

Shipping	55 kg (122 lb)
Net	31 kg (69 lb)

Note: These specifications are subject to change without prior notice.

1.3.3 4524D

The K&S 4524D Multi-Process Ball Bonder has the following specifications.

Wire

Gold	18 - 76 µm (0.7 - 3.0 mil)
Spool	50.8 mm (2")

Machine Specifications

Display	LCD (20 x 4 characters)
Program Memory	6 channels; up to 200 programs
Bonding Area	152 mm x 152 mm (6" x 6")
Throat Depth	143 mm (5.6")
Gross Table Motion	140 mm (5.5")
Fine Table Motion	14 mm (0.55")
Multi Mouse Ratio	6:1
Z Motion System	DC servo/LVDT control
Z Travel	9.1 mm (360 mil)
Ultrasonic System	High Q 60 kHz transducer PLL ultrasonic generator
Low Ultrasonic Power	1.3 W
High Ultrasonic Power	2.5 W
Bond Time	
Ball Bonding/Bumping	20 - 200 ms
Single Point TAB	20 - 1000 ms

Bond Force	Force coil 10 - 160 gr
Wire Termination	Clamp tear
Modes of Operation	Semi-Auto, Manual Z, Ball Bonding, Ball Bumping, Single Point TAB, Coining
Ball Formation System	Negative EFO (N.E.F.O.)
Missing Ball Detector	Indication and auto-stop
Temperature Controller	up to 250º ± 0.5ºC

Options

- Microscopes and eyepieces
- Deep access kit for 12.5 mm (500 mil) Z travel
- Spotlight target
- Fiber optic illumination and spotlight target
- Manually height-adjustable, heated workholders
- Motorized index workholders
- ESD kit and shielded wand
- Left-hand operation

Electrical Requirements

Voltage	100 - 120/220 - 240 V ± 10%, 50/60 Hz, 250 VA max.

Physical Dimensions

Height	530 mm (21")
Width	680 mm (27")
Depth	700 mm (27.5")

Weight (basic machine)

Shipping	55 kg (122 lb)
Net	31 kg (69 lb)

Note: These specifications are subject to change without prior notice.

1.3.4 4524AD

The K&S 4524AD Multi-Process Auto Stepback Ball Bonder has the following specifications.

Wire	
Gold	18 - 76 µm (0.7 - 3.0 mil)
Spool	50.8 mm (2")
Machine Specifications	
Display	LCD (20 x 4 characters)
Program Memory	6 channels; up to 200 programs
Bonding Area	152 mm x 152 mm (6" x 6")
Throat Depth	143 mm (5.6")
Gross Table Motion	140 mm (5.5")
Fine Table Motion	14 mm (0.55")
Multi Mouse Ratio	6:1
Motorized Y	
Stepback	Up to 4 mm (160 mil)
Reverse	Up to 0.25 mm (10 mil)
Kink Height	Up to 0.5 mm (20 mil)
Z Motion System	DC servo/LVDT control
Z Travel	9.1 mm (360 mil)
Ultrasonic System	High Q 60 kHz transducer PLL ultrasonic generator
Low Ultrasonic Power	1.3 W
High Ultrasonic Power	2.5 W
Bond Time	10 - 100 ms/10 - 1000 ms
Ball Bonding/Bumping	20 - 200 ms
Single Point TAB	20 - 1000 ms
Bond Force	Force coil 10 - 160 gr

Wire Termination	Clamp tear
Modes of Operation	Semi-Auto, Manual Z, Ball Bonding, Ball Bumping, Single Point TAB, Coining, Automatic Bonding
Ball Formation System	Negative EFO (N.E.F.O.)
Missing Ball Detector	Indication and auto-stop
Temperature Controller	up to 250° ± 0.5°C

Options

- Microscopes and eyepieces
- Deep access kit for 12.5 mm (500 mil) Z travel
- Spotlight target
- Fiber optic illumination and spotlight target
- Manually height-adjustable, heated workholders
- Motorized index workholders
- ESD kit and shielded wand
- Left-hand operation

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Weight (basic machine)

Shipping	55 kg (122 lb)
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2. INSTALLATION

This chapter contains instructions and guidelines for installing your K&S 4500 Digital Series Manual Wire Bonder.

2.1 Pre-installation Requirements

Before installing the K&S 4500 Digital Series Manual Wire Bonder, ensure that the designated work area includes:

- One or two properly grounded AC wall outlets, supplying 100-120/220-240 V ± 10% at 50/60 Hz (250 VA max).
- Stable work table, as shown in Figure 2-1.
- Vacuum for the workholder (if required).

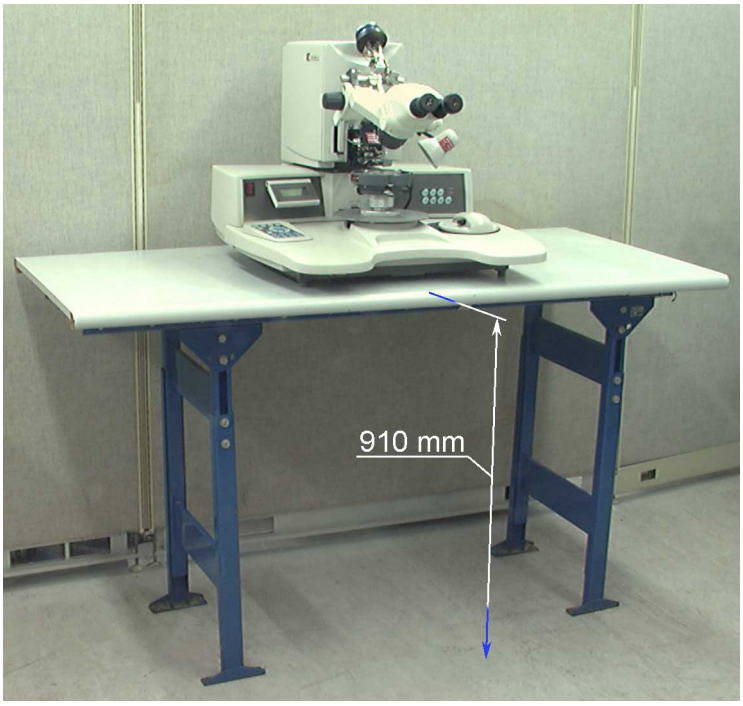


Figure 2-1: Stable Work Table for K&S 4500 Digital

2.2 Unpacking and Installation

Your K&S 4500 Digital Series Manual Wire Bonder model was packed in a reinforced container that provides complete protection against damage during shipment.

To remove the bonder from its container:

1 Remove the packing list from the pocket located on the outside of the shipping crate.

2 Cut the plastic bands that bind the wood.

3 Open the wood clamps on the top cover with a long screwdriver and remove the top cover (see Figure 2-2).

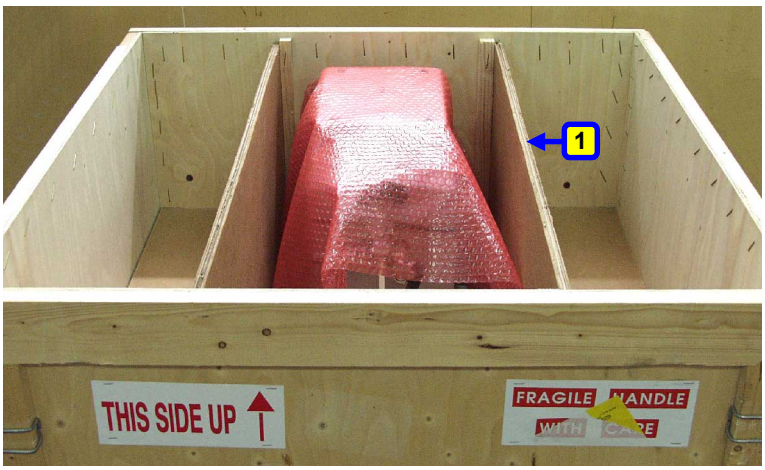
4 Lift the accessories boxes out of their “cages” on the sides of the bonder. From these boxes, remove the box(es) containing the bonder fixtures and accessories (see Figure 2-3).

5 Remove the remaining walls of the shipping crate.

6 Remove the four (4) screws that secure the shipping board to the base of the crate using a hex wrench (see Figure 2-4).

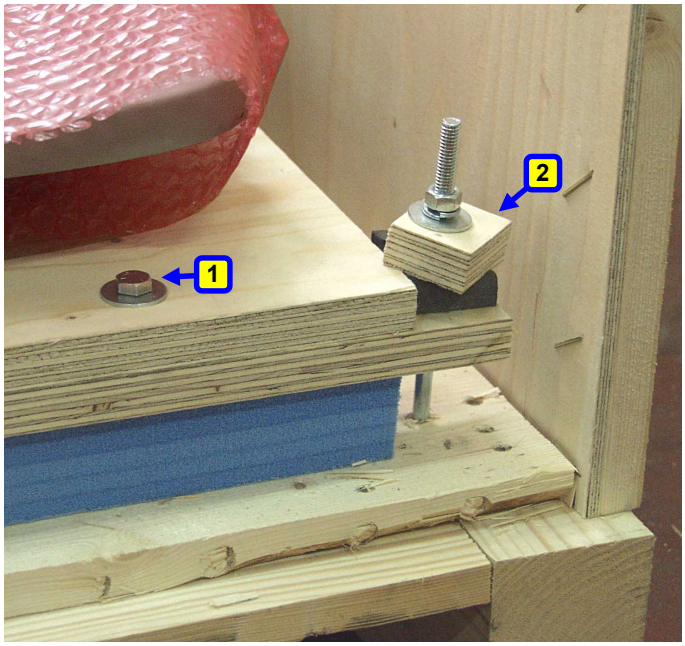
1 Box Accessories

Figure 2-2: K&S Digital 4500 Wire Bonder Packaging



1 Box Holder

Figure 2-3: Removing the K&S Digital 4500 Digital Box Holder



1 Screws attached to base (x4)
2 Square Block

Figure 2-4: Loosening the K&S 4500 Digital Square Blocks

7 Loosen the four (4) nuts holding the four (4) square blocks that tighten the shipping board to the base of the crate (see Figure 2-4). Turn the square blocks to release the shipping board.

8 Lift the bonder with its attached shipping board out of the crate and place it on a cart. This step requires two people (see Figure 2-5).

Caution: Grasp the bonder lower casting. Do not grasp the covers (see Figure 2-5).

9 Remove the protective bubble sheet from the bonder base (see Figure 2-6).

10 Using a flat 9/16” wrench, remove the shipping screws, spacers and shipping board from the base of the bonder (see Figure 2-7).

11 Place the bonder at its designated installation site. Ensure that it rests on a stable platform in a draft-free location. It is not necessary to bolt the bonder to the platform.

12 Remove the protective covering of the area light by cutting the twine at the ends of the woven sponge sleeve and slipping the sleeve off (see Figure 2-6).

13 Remove the masking tape attaching the Multi Mouse.

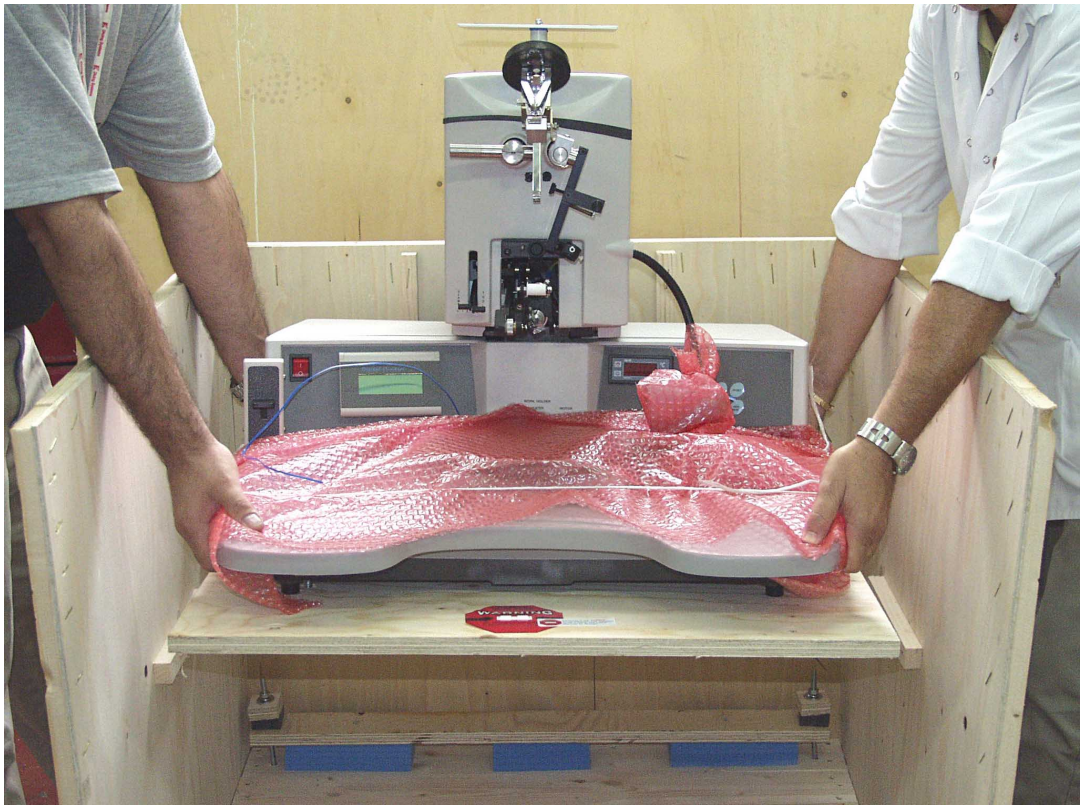


Figure 2-5: Taking the K&S 4500 Digital Wire Bonder Out of the Shipping Carton

14 Open the box(es) containing the bonder fixtures and accessories and verify that the contents are as written in the packing slip.

Note: If any part is missing or damaged, notify your K&S representative and shipper without delay.

15 From the interior right side of the main head, remove the rubber band holding the Height Control Link to the main LVDT holder (see Figure 2-8).

16 Remove the sponge packing located between the cam pulley and the height control link (see Figure 2-8).

17 Remove the protective packaging from the force coil top (see Figure 2-8).

18 Remove the small plastic pads located between the jaws of the wire clamp and the drag clamp (see Figure 2-9).

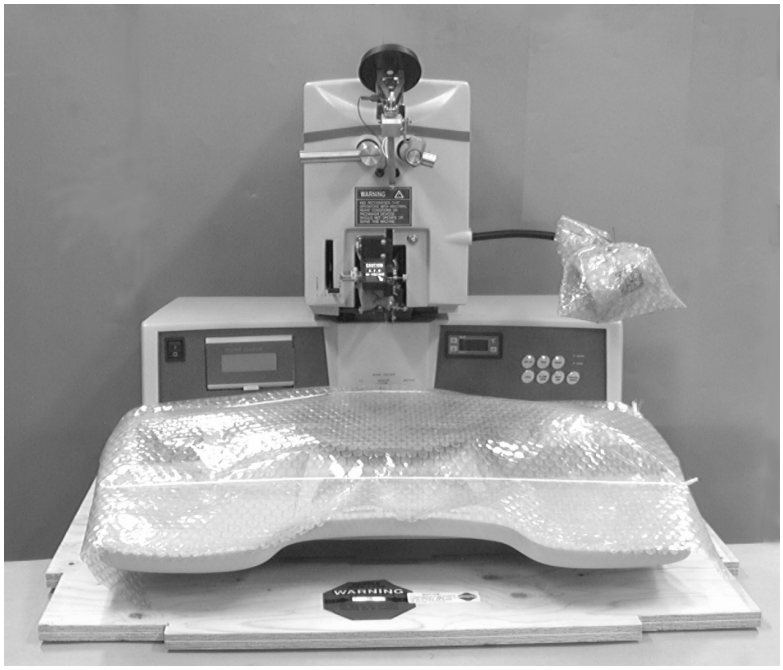


Figure 2-6: K&S 4500 Digital Wire Bonder on Shipping Board

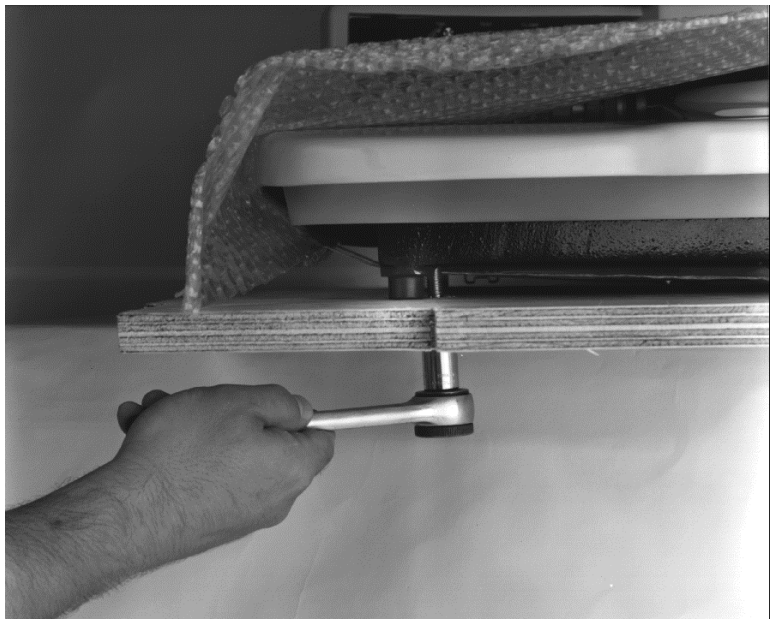


Figure 2-7: Removing the Shipping Screws

19 Remove the sponge padding located between the bonding head and the wand bracket (4524D, 4524AD).

20 Remove the bands holding the bonding head (see Figure 2-8 and Figure 2-9).

Note: The following step requires two people.

Caution: Improper support of the bonder when performing the following step will cause the manipulator to become disassembled and damage the bonder.

21 Free the manipulator assembly as follows (see Figure 2-10):

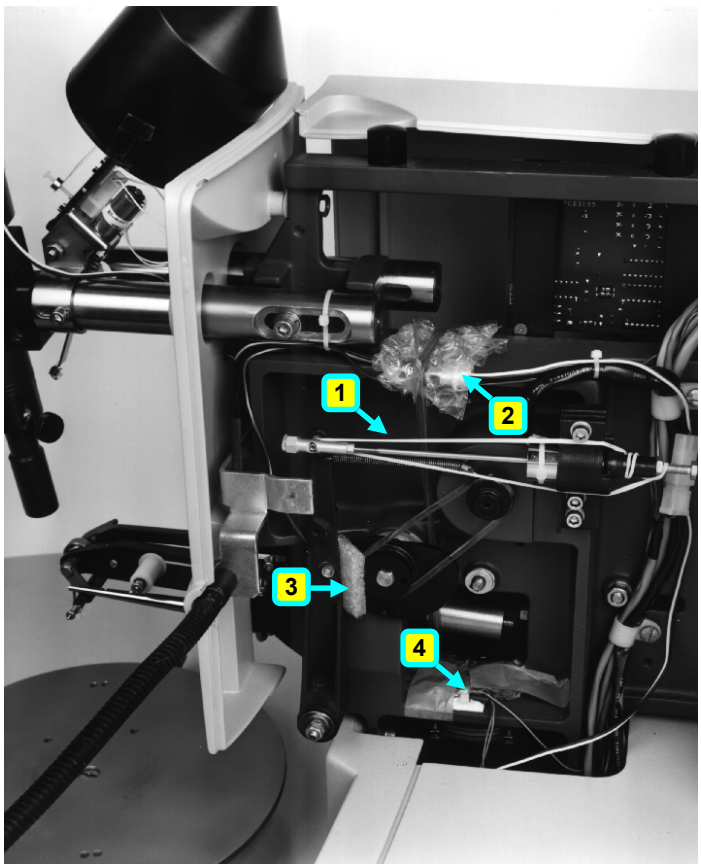
a. Pull the bonder forward so that it projects beyond the table, supporting the chessman and table with one hand. Tilt the bonder backwards to access the bottom of the bonder with the other hand. Take care not to tip the bonder over.

b. Using an Allen wrench, remove the two screws securing the manipulator assembly locking bar. Remove the bar. Retain the bar in case you will have to move the bonder to another location.

c. Slide the bonder back into place on the table.

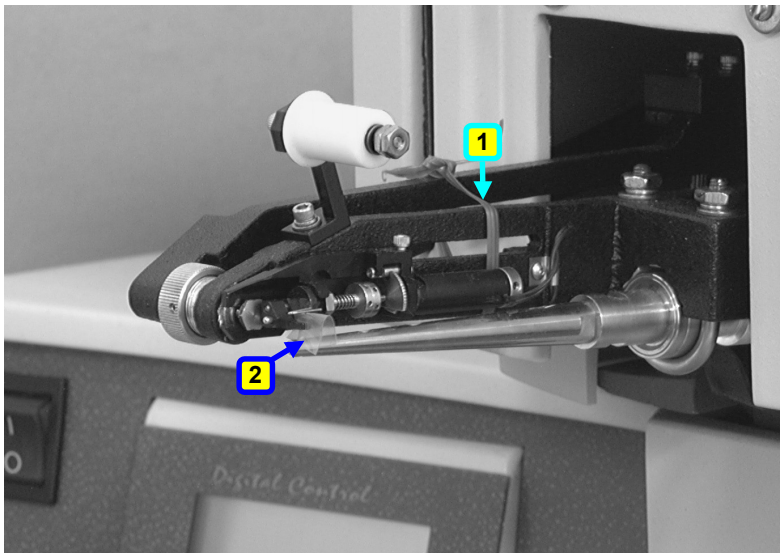
22 Uncoil the power cord. See the bonder nameplate for the operating voltage requirement. Check that your AC wall outlet supplys the correct voltage. If it does not, contact your K&S representative.

Note: If the cord does not have a plug, install a 3-prong plug which fits your AC wall outlet socket. In particular, note the ground connection and remove the GROUND label.



1 LVDT band
2 Bonding Head Band
3 Cam Band
4 Coil Band

Figure 2-8: Main Head Packaging - Inner Right Side



1 Bonding Head Band
2 Clamp Pad

Figure 2-9: Main Head Packaging - Front Side

Figure 2-10: Support the chessman and manipulator and lift

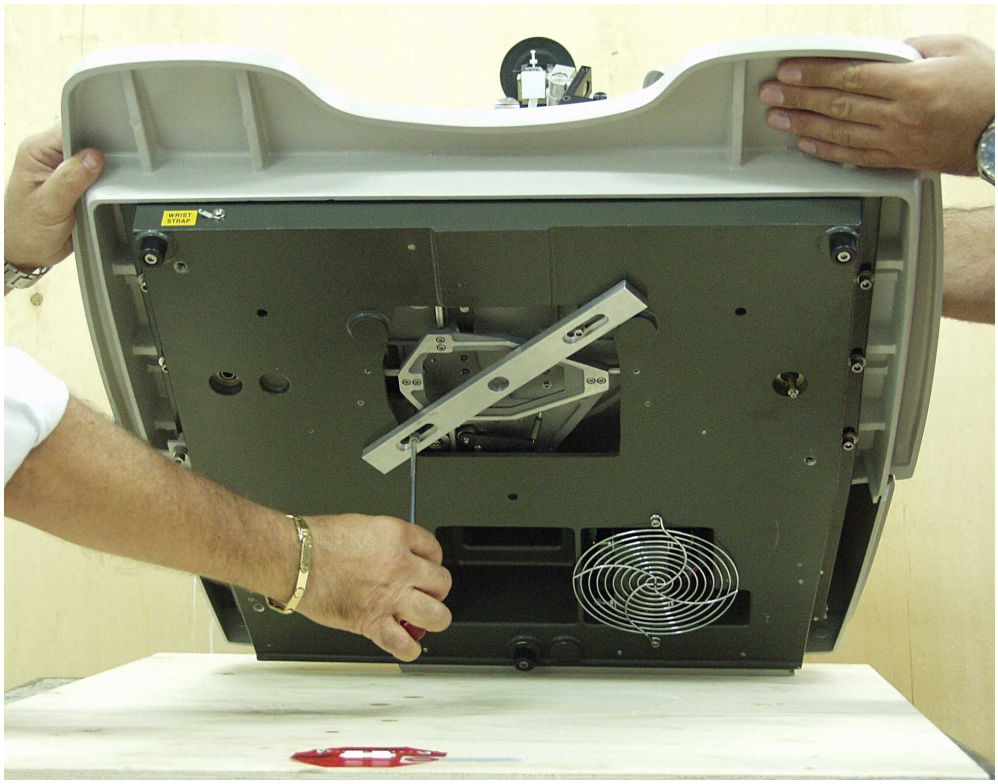


Figure 2-11: Removing the Manipulator Locking Rod

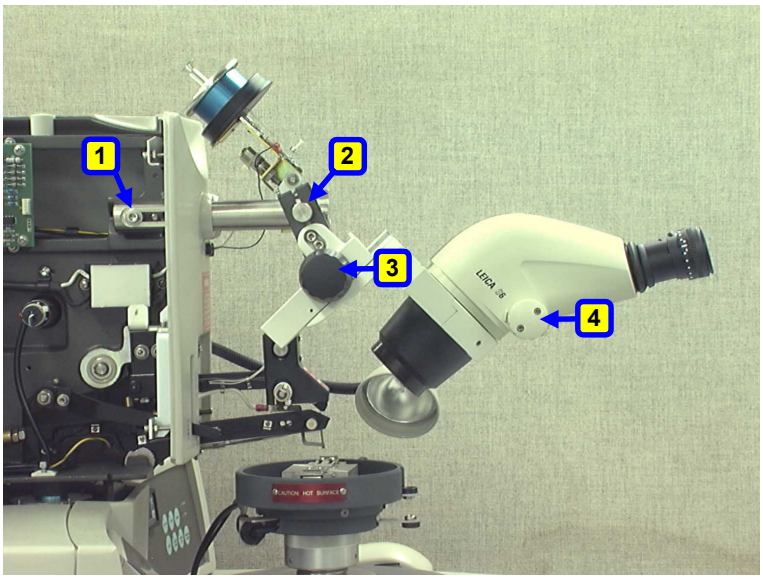
2.3 Microscope Installation

This section describes the installation of the microscope.

2.3.1 Leica S6/MZ-6 Microscope Installation

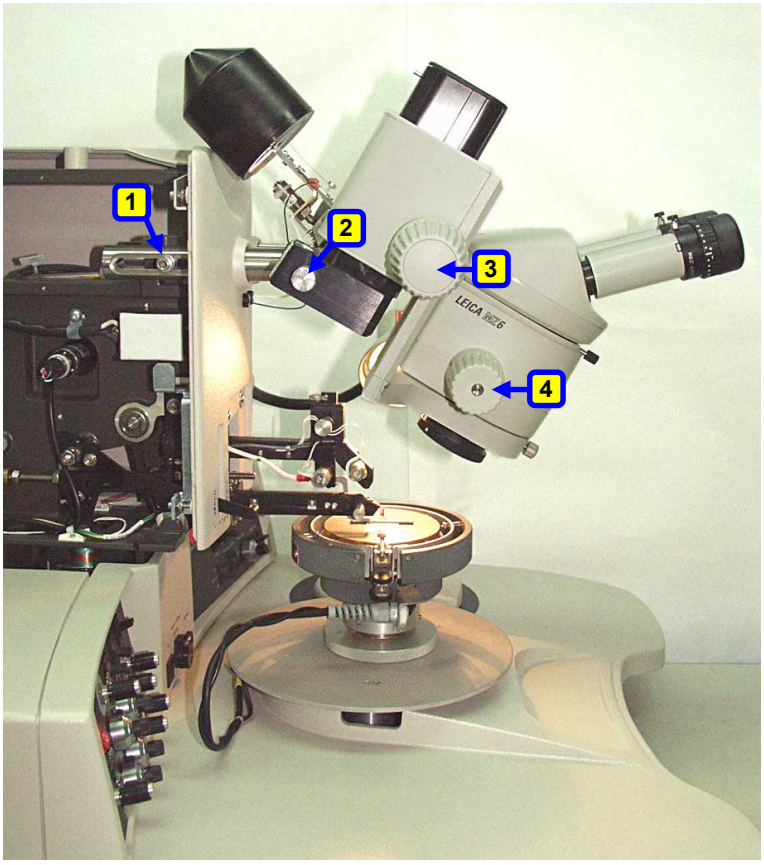
1. Take the microscope holder out of the accessories box. Unwrap and install it on the microscope support.
2. Using a millimetric Allen wrench, adjust the pivot locking screw.
3. To install the microscope, mount it on the pivot from the left side and secure it in place by tightening the pivot locking screw.
4. Install the eye pieces in the oculars.

Note: To adjust the view angle, release the rod locking screw and slide the rod to the required position.



1 Rod Locking Screw
2 Pivot Locking Screw
3 Focus Knob
4 Zoom Knob

Figure 2-12: Leica S6 Microscope Installation



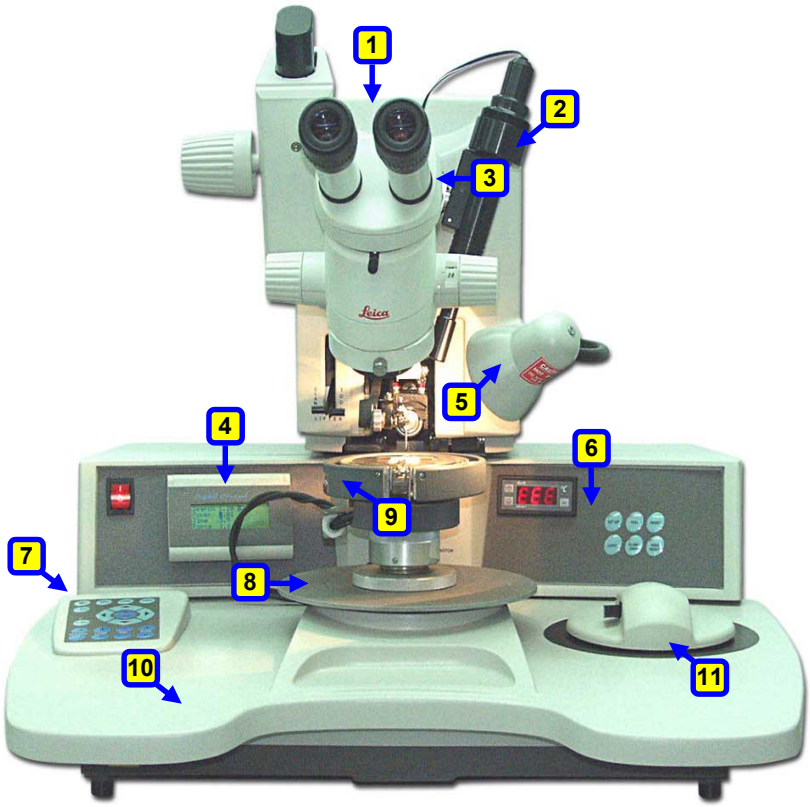
1 Rod Locking Screw
2 Pivot Locking Screw
3 Focus Knob
4 Zoom Knob

Figure 2-13: Leica MZ6 Microscope Installation

3. PHYSICAL DESCRIPTION

This chapter provides a description of the principal parts of the K&S 4500 Series Manual Wire Bonder.

Figure 3-1 shows a general view of the 4500 Manual Wire Bonder.

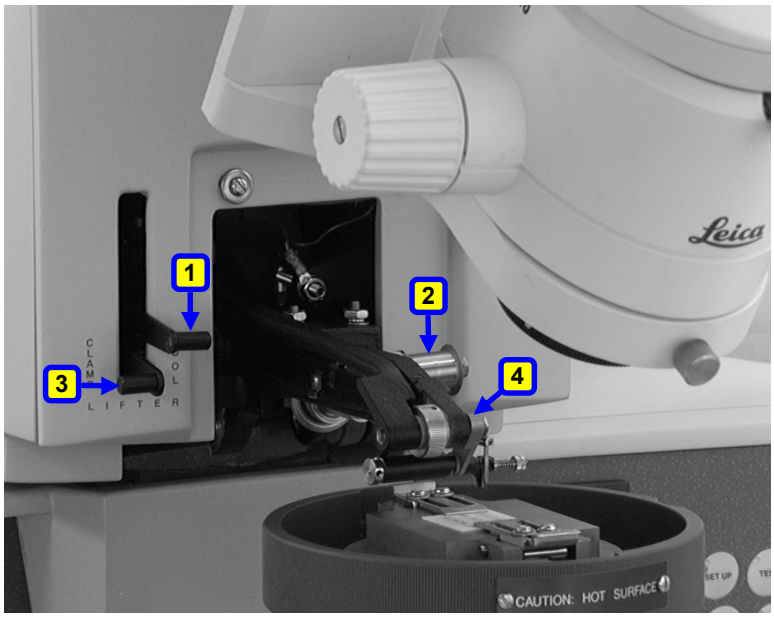


1 Main Head
2 Spotlight
3 Microscope
4 Digital Display
5 Area Light
6 Right Panel
7 Keypad
8 Work Table
9 Workholder
10 Base
11 Multi Mouse

Figure 3-1: Model 4500 Digital Series Manual Wire Bonder - Main Parts

3.1 The Main Head

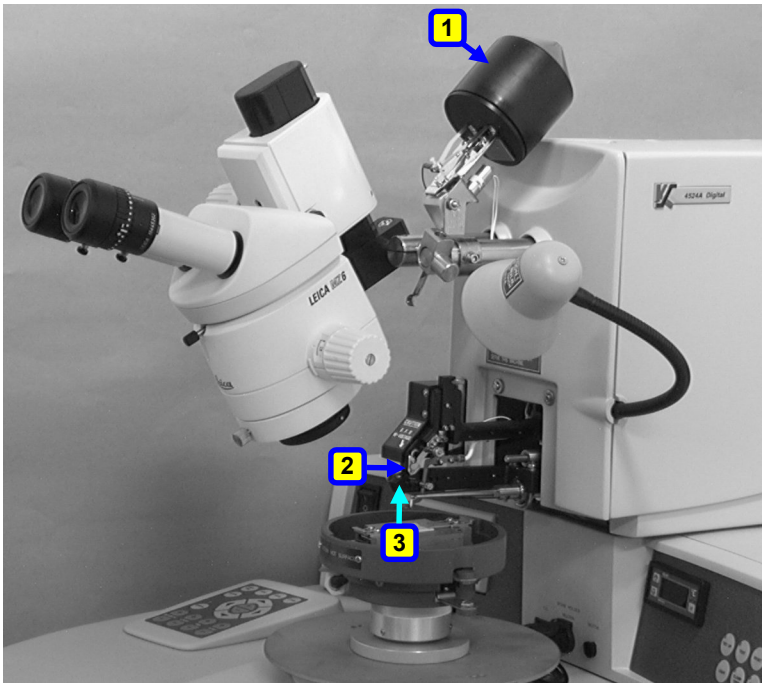
Figure 3-2 shows the main head assembly of Models 4523D and 4523AD.



1 Tool Lifter
2 0.5" Spool for 30°/40° Wire Feed
3 Clamp Lifter
4 Bonding Head

Figure 3-2: The Main Head Assembly - 4523D, 4523AD

Figure 3-3 shows the main head assembly of Models 4524D and 4524AD.



1 2" Spool for Vertical Wire Feed
2 Electrode and Drag Assembly
3 Bonding Head

Figure 3-3: The Main Head Assembly - 4524D, 4524AD

3.1.1 The Wire Feed System

3.1.1.1 2" Spool for Vertical Wire Feed (4524D, 4524AD, 4523D, 4523AD)

The 2" Spool for Vertical Wire Feed System is mounted on the spotlight support. At the top of the system, a 2" spool stores the wire and is held in place by a spool holder. A glass tube for feeding the wire is attached to the spool cap. Below the glass tube, a fixed tensioner provides wire tension, preventing slack.

The 2" spool includes a kicker, which hangs from the top front of the main head. After the first bond is performed, the kicker releases a sufficient amount of wire for the bonder to complete the loop and the second bond (4524D, 4524AD).

A drag clamp retains tension on the wire at certain stages in the bonding cycle. The force is adjusted by rotating an adjustment nut on the side of the clamp. A wire guide leads the wire across the jaws of the clamp (4524D, 4524AD).

For more details, see sections 5.5.2 and 5.5.6.

3.1.1.2 2" Spool for 30°/45° Wire Feed (4523D, 4523AD)

The 2" spool for 30°/45° Wire Feed System is mounted by a bracket on the front cover. The spool is located directly above the 0.5" spool axis, which preserves wire tension. Wire is fed through a hole in the transducer to the wire clamp either over the axis (45°) or under the axis (30°).

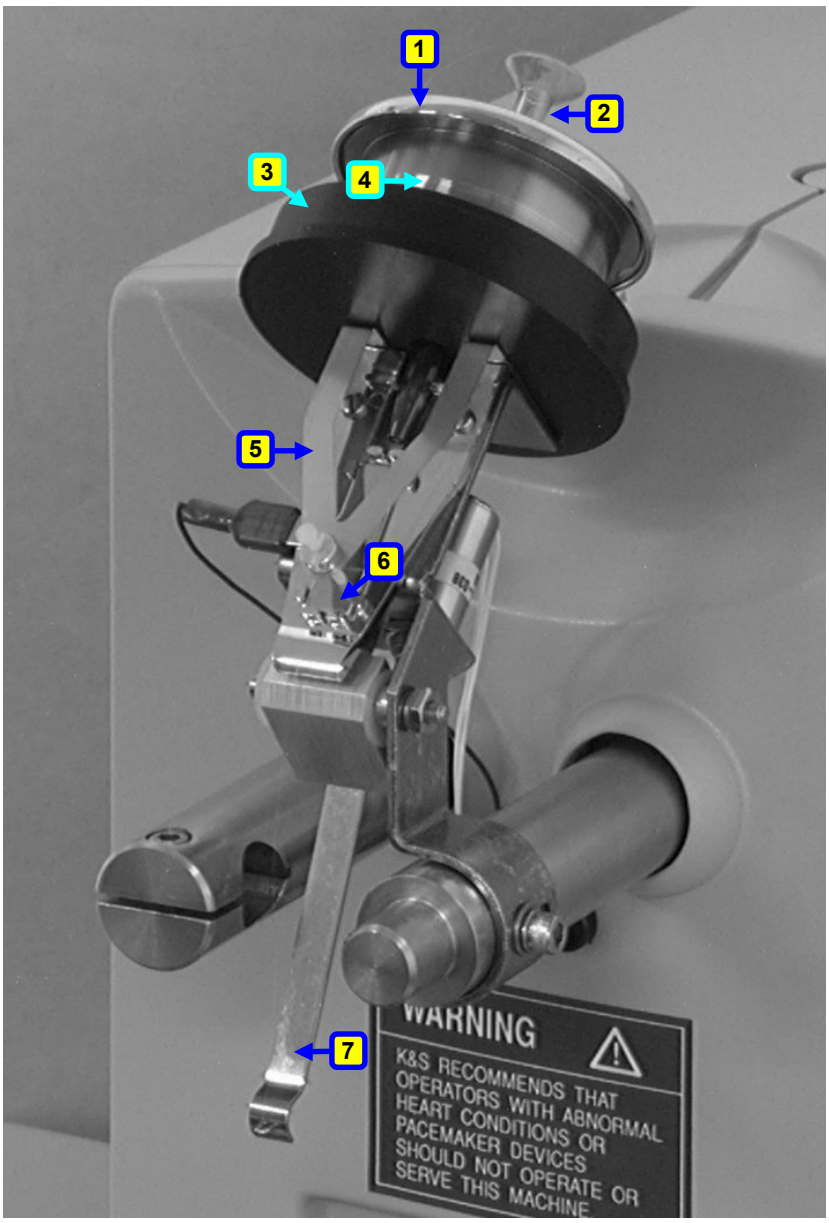
For more details, see section 5.5.4.

3.1.1.3 0.5" Spool for 30°/45° Wire Feed (4523D, 4526AD)

The 0.5" spool is located on the bonding head. The wire is pulled from the spool through the feed holes of the ultrasonic transducer at 30° or 45° angles, depending on the application. The wire is then fed into the wedge.

The spool rotates when the wire is pulled. Wire tension is controlled by turning a nut on the side of the spool.

For more details, see section 5.5.3.



1 Spool Cup
2 Glass Tube
3 Spool Holder
4 Wire Spool
5 Fixed Tensioner
6 Glass Plate
7 Kicker

Figure 3-4: The 2" Spool

3.1.1.4 Spool for Vertical Wire Feed (4523D, 4523AD)

The 2" spool for ribbon bonding is located on the bonding head (Figure 5-12).

The 0.5" spool is located on the bonding head directly above the wire clamp.

The spool rotates as the wire is pulled. Wire tension is controlled by turning a nut on the side of the spool.

For more details, see section 5.5.5.

3.1.2 Microscope

The bonder may be equipped with either a Leica MZ6/S6 or stereo zoom microscope. The microscope has a common focus for both oculars. In addition, the microscope has an adjustable magnification zoom capability.

3.1.3 The Area Light

The area light illuminates the work area so that it may be viewed through the microscope.

The area light is fastened to the front of the main head frame by a flexible gooseneck. The LIGHT on/off control button is located on the right control panel.

3.1.4 The Bonding Head

The bonding head is a horizontal lever with its pivot fixed in the main head frame. The bonding head is driven by a dc servo motor.

The up/down motion of the bonding head is controlled electrically by signals from the logic board and mechanically by the cam pulley and height control link. The air dashpot at the rear of the bonding head assures smooth, vibration-free motion.

Bonding head position feedback to the logic circuits is affected by the main linear variable differential transformer (LVDT). This synchronizes the bonding head motion with the bonding cycle and modulates the bonding head speed.

The front of the bonding head holds the ultrasonic transducer, within which the wedge/capillary is clamped. The wedge/capillary holds the wire above the bonding pad and activates the ultrasonic vibration required to perform the bond.

The bonding head also contains the wire clamp, which performs the tear and tail operations.

3.1.5 The Tool Lifter

The tool lifter enables manual lifting of the front end of the bonding head. This is useful for replacing the wedge/capillary, or for protecting the wedge/capillary when it's not in use. Raising the tool lifter causes its lever to lower the rear part of the bonding head, which raises the bonding head front and the wedge/capillary.

3.1.6 The Clamp Lifter (4523D, 4523AD)

The clamp lifter helps you feed the wire into the wedge wire feed hole. Raising the clamp lifter moves the wire clamp away from the rear of the wedge.

The clamp lifter handle is linked to an arm that raises the rear end of the tear & feed arm, which in turn, pivots the wire clamp to the rear position.

3.1.7 The Negative Electronic Flame Off System (N.E.F.O.) (4524D, 4524AD)

The Negative Electronic Flame Off System (N.E.F.O.) is a standard feature of Models 4524D and 4524AD. The N.E.F.O. has two assemblies:

- A generator box mounted inside the rear of the main head.
- A wand located above the bonding head.

The generator box supplies negative voltage to the wand, producing a spark between the wire and the wand. This spark creates the ball on the wire.

3.1.8 The Spotlight (Optional)

The spotlight emits a bull's-eye pattern on the bonding pad under the tip of the wedge/capillary. This shows you the exact location of the bonding.

Using the centering screws in the spotlight housing, you can center the beam on the bonding target area.

3.2 The Base

The base houses the bonder's electronic and mechanical controls. The following subassemblies are found on the base:

- The Manipulator and Multi Mouse (right or left-hand operation)
- Right and Left Control Panels
- Motorized Y Table (4523AD, 4524AD)
- Workholder Connector Panel
- The Keypad

3.2.1 The Manipulator and Multi Mouse

The manipulator supports the workholder table. It glides on three ball-bearing raceways mounted within the base. The manipulator moves in the horizontal plane, without backlash, and is secured against rotation.

The manipulator helps you maneuver a device, so that the bonding pads rest directly under the wedge/capillary. You can also maneuver the device over a larger motion by moving the workholder on the workholder table.

The Multi Mouse, located on either the right or left side of the base, is used primarily to make fine adjustments in the position of the workholder. Through a mechanical linkage system, the motion of the Multi Mouse is translated, at a 6:1 ratio, to the manipulator.

The Multi Mouse includes buttons for controlling the bonding cycle and programming the stitch cycle. For more details, see section 4.1.

3.2.2 The Motorized Y Table (4523AD, 4524AD)

The motorized Y table is mounted on the manipulator of Models 4523AD and 4524AD. This enables programmable motion along the Y-axis which controls loop formation. The table assembly contains the following:

- Stepper motor
- Lead screw
- Anti-backlash nut
- Linear slides

3.2.3 The Left and Right Control Panels

The left and right control panels are located on the upper face of the base (see Figure 3-1).

The left control panel contains the power on/off switch and a Digital Control Display. The left control panel is common for all 4500 Digital Series Bonders.

The right control panel contains controls and indicators for the bonder's electrical operations, such as the temperature controller, light and clamp transducer testing, and N.E.F.O. system (4524D, 4524AD). The right control panel is specific for each model.

The controls and their functions are described in Chapter 4.

3.2.4 The Keypad

The keypad is located on the base to either the left or right of the workholder table. The keys on the keypad are used to set and control the bonder parameters and also to perform loading and saving of bonding programs. For more details, see section 4.4.

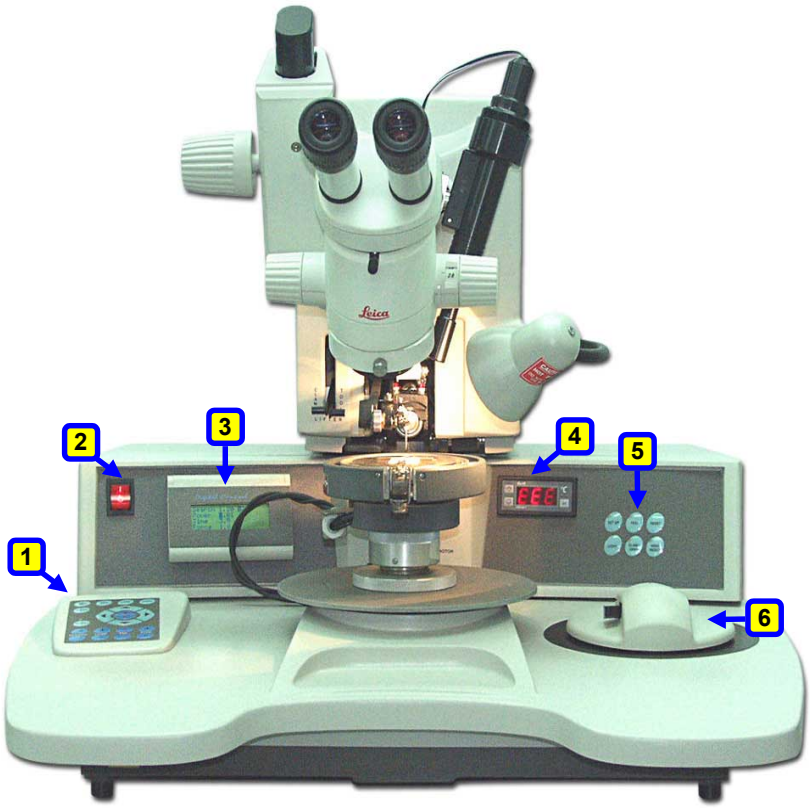
3.2.5 The Workholders Connectors Panel

The workholders connectors panel is located at the center of the bonder directly behind the workholder table. It contains the following connectors:

T.C.	Connects to the workholder thermocouple, which indicates the workholder temperature.
HEATER	Connects to the workholder heating power supply.
MOTOR	Connects two 19 V ac lines to the motorized index workholder power supply.

4. CONTROLS AND INDICATORS

The K&S 4500 Digital Series Manual Wire Bonders include the following controls and indicators as shown in Figure 4-1.



1 Keypad
2 Main Power Switch
3 Display
4 Temperature Controller
5 Right Panel Control Buttons
6 Multi Mouse

Figure 4-1: Model 4500 Digital Series Manual Wire Bonder - Main Parts

4.1 The Multi Mouse

The Multi Mouse is located on the base either to the right or the left of the workholder table. The Multi Mouse has the following three functions:

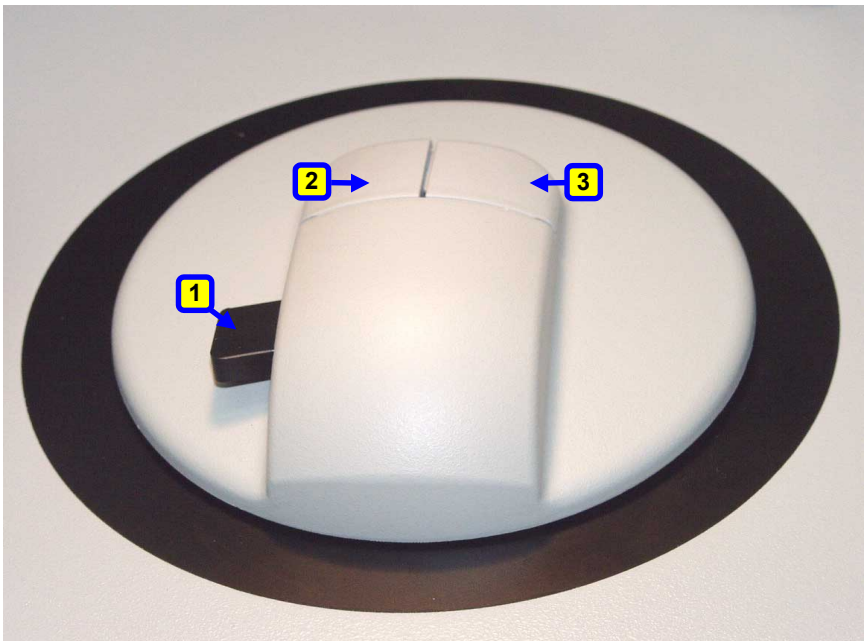
- Controlling the bonding cycle.
- Fine positioning of the bonding pad under the wedge/capillary.
- Programming the stitch cycle.

The Multi Mouse has the following two pushbuttons and a side button (see Figure 4-2):

SEMI/AUTO Left pushbutton on the top side of the Multi Mouse. Used to operate the Semi-Automatic Bonding Cycle.

MANUAL Z The Manual Z activator side button located on the left side of the Multi Mouse. Used in manual operations to control the bonding head movement.

STITCH Right pushbutton on the top side of the Multi Mouse. Used to program the Stitch Cycle (see programming section 4.4).



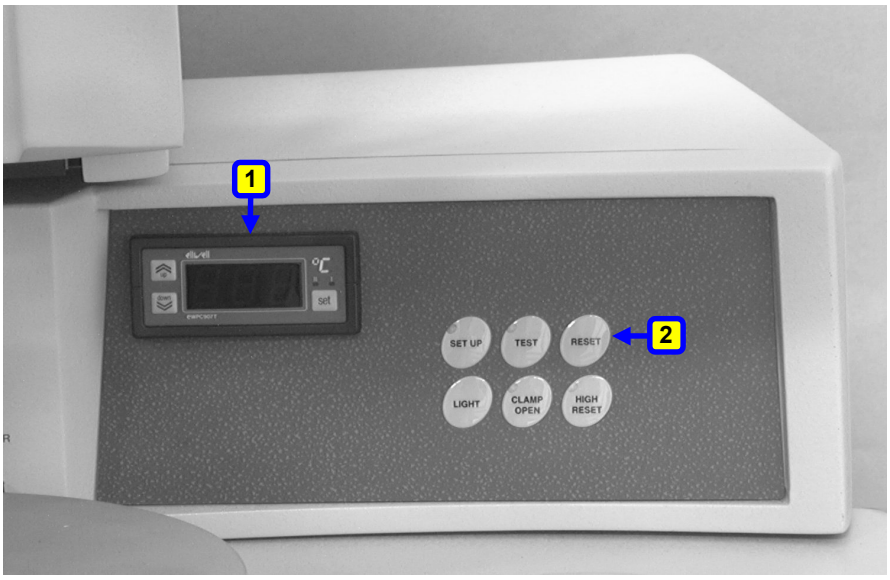
1 Manual Z Sidebutton
2 Semi Auto Pushbutton
3 Stitch Pushbutton

Figure 4-2: The Multi Mouse

4.2 The Right Panel

The right control panel is located on the base to the right of the workholder table. There are two types, one for models 4523D and 4523AD (see Figure 4-3) and another for models 4524D and 4524AD (see Figure 4-4).

4.2.1 Right Panel Controls (Models 4523D, 4523AD)



1 Temperature Controls
2 Control Buttons

Figure 4-3: Right Control Panel (Models 4523D, 4523AD)

The following right panel controls are relevant to models 4523D and 4523AD:

Applies the bond force to the bonding head.
Used while setting up the bonder.
When LED is ON, bond force is applied.

Tests the ultrasonic generator.
When LED is ON, the ultrasonic transducer is active.
This also signals that the ultrasonic circuit is properly tuned.

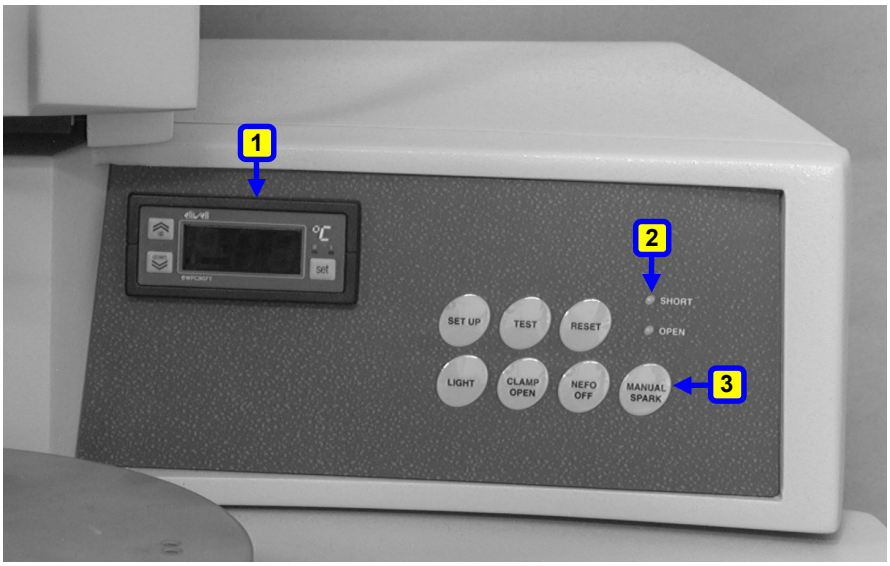
Resets the bonder.

Turns the area light on and off.

Opens the wire clamp for wire loading.
When LED is ON, the clamp is opened.

Selects the height of the RESET postion.
When LED is ON, the RESET position is HIGH.
When LED is OFF, the RESET position is LOW.

4.2.2 Right Panel Controls (Models 4524D, 4524AD)



1 Temperature Controls
2 Open & Short LEDs
3 Control Buttons

Figure 4-4: Right Control Panel (Models 4524D, 4524AD)

The following right panel controls are relevant to models 4524D and 4524AD:

Applies the bond force to the bonding head.
Used while setting up the bonder.
When LED is ON, bond force is applied.

Tests the ultrasonic generator.
When LED is ON, the ultrasonic transducer is active.
This also signals that the ultrasonic circuit is properly tuned.

Resets the bonder.

Turns the area light on and off.

Opens the wire clamp for wire loading.
When LED is ON, clamp is opened.

Disables the N.E.F.O. operation.
The LED, when lit indicates disabled N.E.F.O.

Produces a momentary spark between the wand and the wire. Used for manual ball formation.

OPEN LED indicator that lights when the N.E.F.O. did not produce a spark because of a remaining open circuit between the wire and the wand.

SHORT LED indicator that lights when the N.E.F.O. did not produce a spark because of a short circuit between the wire and the wand.

4.2.3 Temperature Controls (all models)

The temperature controls are located in the right panel control area. They are common to all 4500 Digital Series Bonders and have the following parameters:

SET This parameter sets the workholder temperature.

UP This parameter increases the set point 1 value during temperature setting.

DOWN This parameter decreases the set point 1 value during temperature setting.

LED I Status light which blinks when set point 1 is displayed or changed.

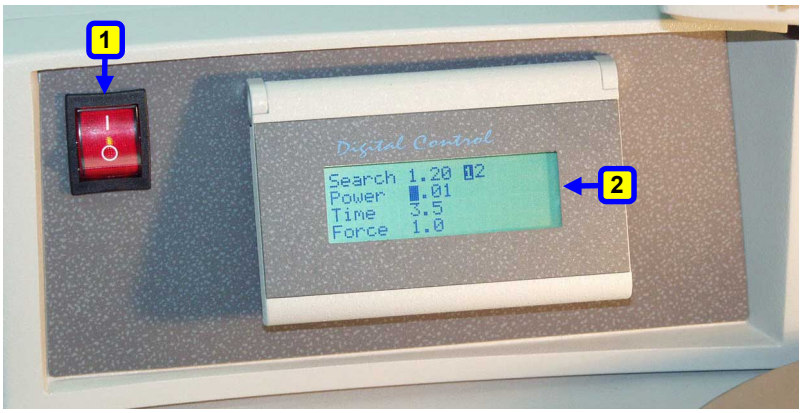
LED II Status light which is not used by the bonder.

TC Display This parameter shows the temperature (°C) of the workholder.

For more details, see the supplied EWPC 907/T Series manual.

4.3 The Left Panel

The Left Panel contains the Main Power Switch and the Display.



1 Main Power Switch
2 Display

Figure 4-5: Left Panel

4.3.1 Power Switch

ON/OFF Switch for powering on the bonder. When the switch is in the up position (1), power from the AC wall outlet is applied to the bonder. (The switch is illuminated.)

4.3.2 Display

All machine parameters can be viewed on a 4 x 20 character LCD used to display:

- Bond schedule
- Bond parameters
- Loop parameters
- Operation modes

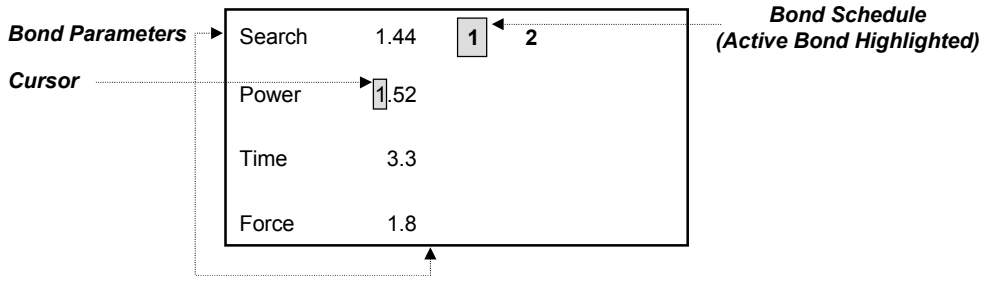


Figure 4-6: 1st Bond Screen (4523AD)

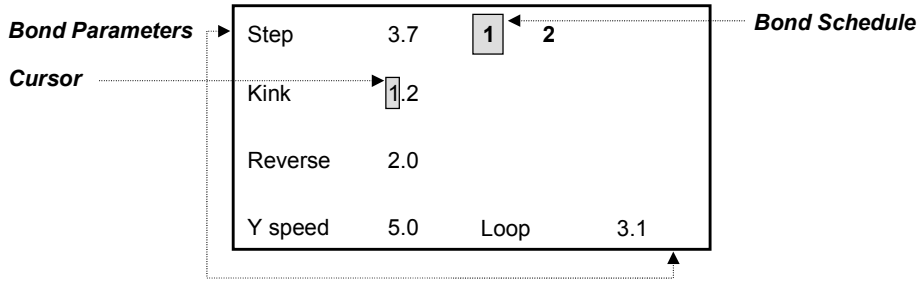


Figure 4-7: Loop Screen (4523AD)

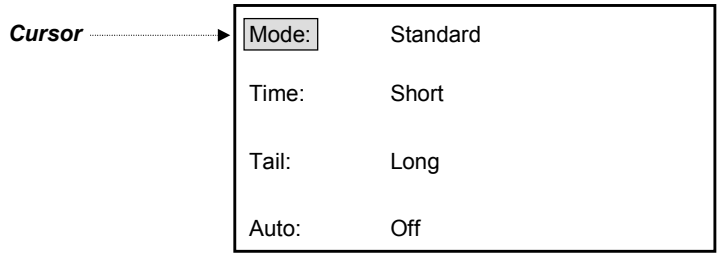


Figure 4-8: Modes Screen (4523AD)

4.3.2.1 Bond Schedule

The bond schedule describes the programmed machine bonding cycle. For example:

12	Describes a simple wire using first bond channel and second bond channel.
12_34	Describes two separate wires using four bond channels.
123 (Models 4523D & 4523AD)	Describes a stitch bond program using three bond channels.
123 (Models 4524D & 4523AD)	Describes a multiple ball bumping/S.P.T bond schedule using three channels.

4.3.2.2 Bond Parameters

The bond parameters are per specific model:

4.3.2.2.1 Search Parameter

This parameter controls the Search height of the bonding head. This is the position at which the bonding head stops above the bond site. At the Search height, you can perform fine positioning (by the Multi Mouse) of the device before bonding the wire. The Search height is set to 75 - 100 µm (3 - 4 mil) above the bond site.

4.3.2.2.2 Power Parameter

Bonding power is the amount of ultrasonic (U/S) energy applied to the bond. High Power parameter settings result in high ultrasonic vibration amplitude and lower settings result in low vibration amplitude. The Power parameter has two scales - LOW and HIGH. The current scale depends on whether the ultrasonic generator has been set to LOW or HIGH. The LOW scale is used for wire thickness of up to 50 µm (2 mil). The HIGH scale is used for wire thickness ranging from 50 to 75 µm (2 - 3 mil). The position of the HIGH/LOW switch on the logic board sets this scale.

Caution: The U/S power level is preset in the factory. The HIGH/LOW switch should be set by authorized service personnel only.

4.3.2.2.3 Time Parameter

This parameter controls duration of the ultrasonic energy and bonding force. Bonding time is the amount of time that the ultrasonic power and force are applied. The TIME parameter scale changes if the bonding time set by the TIME parameter in the MODES screen is set to Short or Long.

The K&S 4500 Digital Series wire bonders are factory-set to a maximum standard bonding time of 120 ms, which is suitable for most applications.

The Time setting in the MODES screen can be set to Long or Short. The TIME parameter of each bond channel can be set to provide a maximum long bonding time of 1000 ms. Longer bonding times may be needed for high temperature bonding, for applications where low ultrasonic energy is required, or for bonding wires other than gold.

To change the Time setting to short or long bonding time:

1 On the Display, move to the MODES screen and select Time.

2 Use the + or − key to change the TIME setting to SHORT or LONG.

Models 4524D, 4524AD are factory-set to the following maximum bonding times:

- 200 ms for Standard Ball Bonding
- 200 ms for Ball Bumping
- 1000 ms for Single Point TAB

4.3.2.2.4 Force Parameter

This parameter controls the downward force exerted by the bonding head during bonding. Bonding force is applied to the wire while the ultrasonic energy is being applied. This force consists of the following:

- Static force, which is set by the position of the counterweights on the bonding head cover.
- Amount of force applied by the electromagnetic coil (set by the FORCE parameter).

4.3.2.2.5 Tail Parameter

This parameter sets the tail length. The tail is the length of wire protruding from the tool after performance of the second bond. A tool with a longer bonding foot requires a higher TAIL parameter setting, and a tool with a shorter foot requires a lower TAIL parameter setting. The setting must always ensure that sufficient tail length exists to enable the N.E.F.O. wand to create the spark for ball bonding (4524D, 4524AD), or to enable a complete first bond for wedge bonding (4523D, 4523AD).

To change the Tail setting to short or long (models 4523D, 4523AD only):

1 On the Display, move to the MODES screen and select TAIL.

2 Use the + or − key to change the TAIL setting to SHORT or LONG.

4.3.2.2.6 Tear Parameter (Models 4523D, 4523AD)

This parameter sets the length of the tear movement after performance of the second bond.

4.3.2.2.7 Ball Parameter (Models 4524D, 4524AD)

The BALL parameter is used for setting the ball size. This parameter should be set at 2 - 3 times larger than the diameter of the wire. If the ball is too small, it can block up the capillary. If the ball is too large, it can cause a short-circuit between the N.E.F.O. wand and the wire.

You can view the ball size in the Reset position (before starting the bonding cycle) by adjusting the microscope magnification.

4.3.2.3 Loop Parameters

The LOOP parameter is common to all models. The other loop parameters: STEP, KINK, REVERSE and Y SPEED are relevant to models 4523AD and 4524AD only.

4.3.2.3.1 Loop Parameter (All models)

This parameter sets the height to which the bonding head rises after performing the first bond. This height is determined by the wire diameter and the specific application.

4.3.2.3.2 Step Parameter (Models 4523AD, 4524AD)

This parameter sets the motorized Y table's Stepback (backward motion). The Stepback is the distance of the motorized Y table motion between the first and the second bond pads. This distance is set by the STEP parameter on the Display using the dedicated STEP **+** and **-** keys.

The Stepback travel saves manipulation time. It is useful for applications requiring a series of parallel wires having equal distances between the first and second bonds.

- In the Semi Automatic Bonding Cycle mode, the maximum Stepback setting is 4mm (160 mil).
- In the Lange Coupler mode, the recommended Stepback setting is 0.5mm (20 mil).

4.3.2.3.3 Kink Parameter (Models 4523AD, 4524AD)

This parameter sets the height to which the bonding head rises after performing the first bond. This setting affects loop formation. The Kink height is the length of wire protruding from the wedge after the bonding head rises following performance of the first bond.

4.3.2.3.4 Reverse Parameter (Models 4523AD, 4524AD)

This parameter sets the motorized Y table's forward motion. This setting affects loop formation. In standard bonding modes, the Reverse parameter is the amount of reverse motion of the motorized Y table following the first bond (which influences looping). This value is set **before** bonding by the Reverse parameter on the Display.

After the bonding head rises to the Kink height, the Y table moves backwards the distance set by the Reverse setting. The bonding head then rises to the Loop height.

In Lange Coupler mode, the Reverse motion is used to create low loops. After making the first bond, the bonding head rises to the Loop height and the motorized Y table returns. At the second Search height, the motorized Y table performs the reverse motion. This reverse motion presses the wire backward, creating a low loop.

4.3.2.3.5 Y Speed Parameter (Models 4523AD, 4524AD)

This parameter sets the motorized Y table speed. This value is used in very fine bonding applications.

4.3.2.4 Operation Modes

4.3.2.4.1 Mode

Used to select the bonding cycle to be performed.

Table 4-1: Available Operation Modes

Model	Modes
4523D	Standard
4523AD	Standard Lange Coupler Table tear
4524D 4524AD	Standard Ball Bumping S.P.T

4.3.2.4.2 Time

You can choose between Short and Long Bonding Time.

4.3.2.4.3 Tail

You can choose between Short and Long Tail.

4.3.2.4.4 Auto

You can choose between On and Off. On indicates automatic complete wire performance and Off indicates standard semi-automatic/manual wire performance.

4.3.3 4523D Screens

Search	1.84	**1**	**2**
Power	1.76		
Time	5.2		
Force	1.8		

Figure 4-9: 1st Bond Screen (4523D)

Search	2.02	**1**	**2**
Power	1.84	Loop	2.9
Time	3.8	Tail	3.0
Force	2.3	Tear	7.0

Figure 4-10: 2nd Bond Screen (4523D)

Mode:	Standard
Time:	Long
Tail:	Short

Figure 4-11: Modes Screen (4523D)

4.3.4 4523AD Screens

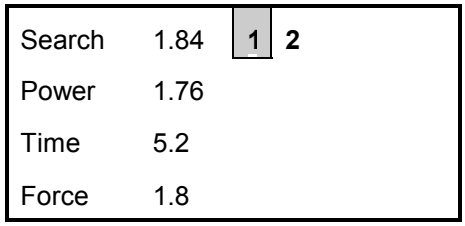


Figure 4-12: 1st Bond Screen (4523AD)

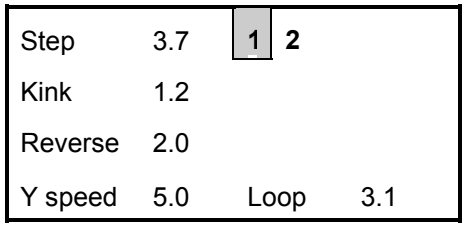


Figure 4-13: Loop Screen (4523AD)

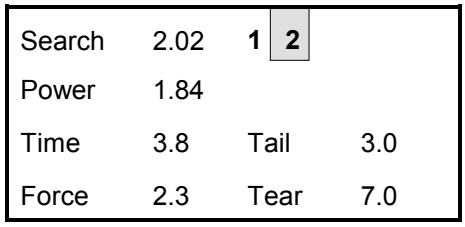


Figure 4-14: 2nd Bond Screen (4523AD)

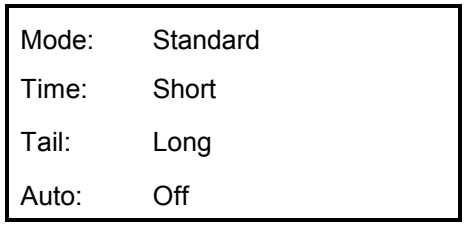


Figure 4-15: Modes Screen (4523AD)

4.3.5 4524D Screens (Standard Mode)

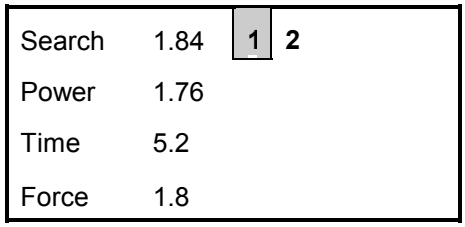


Figure 4-16: 1st Bond Screen (4524D Standard Mode)

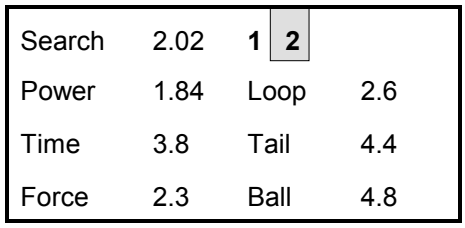


Figure 4-17: 2nd Bond Screen (4524D Standard Mode)

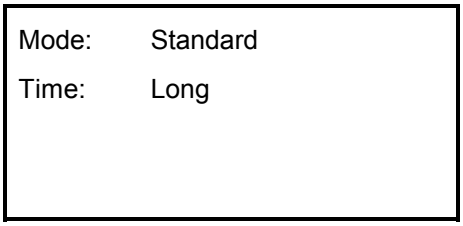


Figure 4-18: Modes Screen (4524D Standard Mode)

4.3.6 4524D Screens (Ball Bumping Mode)

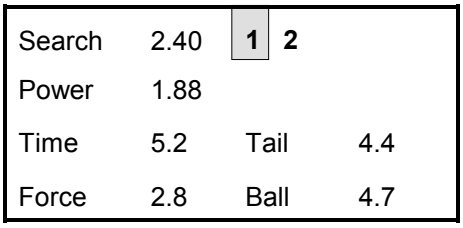


Figure 4-19: 1st and Additional Screens (4524AD Ball Bumping Mode)

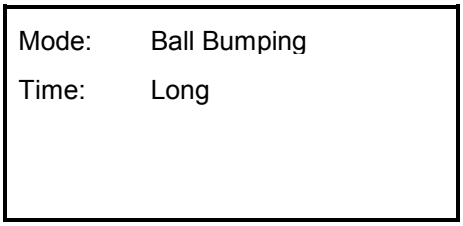


Figure 4-20: Modes Screen (4524D Ball Bumping Mode)

4.3.7 4524D Screens (S. Point Tab)

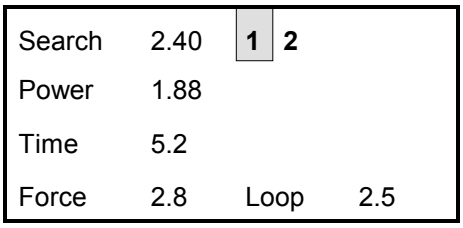


Figure 4-21: 1st and Additional Screens (4524D S. Point Tab Mode)

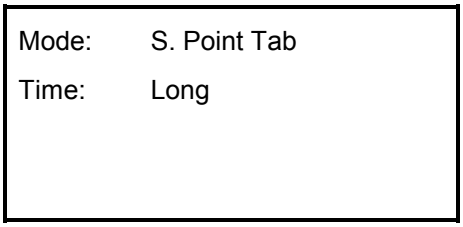


Figure 4-22: Modes Screen (4524D S. Point Tab)

4.3.8 4524AD Screens (Standard Mode)

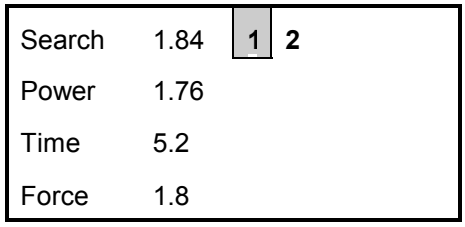


Figure 4-23:1st Bond Screen (4524AD Standard Mode)

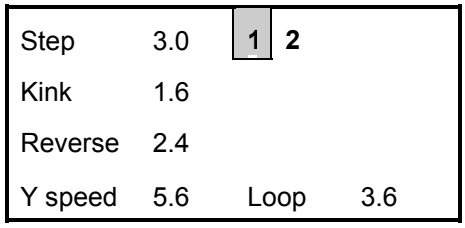


Figure 4-24: Loop Screen (4524AD Standard Mode)

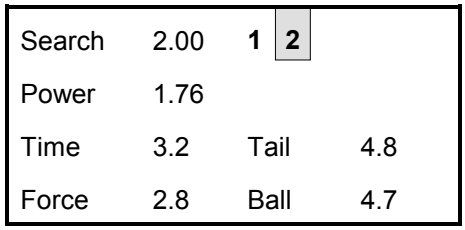


Figure 4-25: 2nd Bond Screen (4524AD Standard Mode)

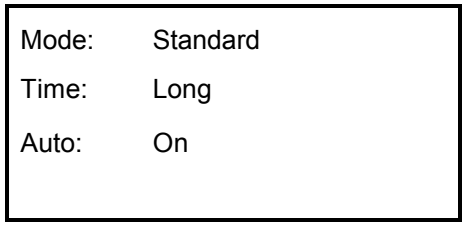


Figure 4-26: Modes Screen (4524AD Standard Mode)

4.3.9 4524AD Screens (Ball Bumping Mode)

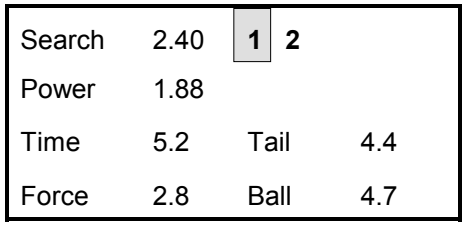


Figure 4-27: 1st Screen (4524AD Ball Bumping Mode)

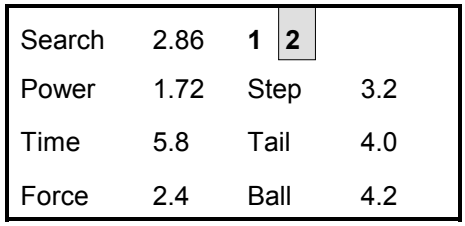


Figure 4-28: 2nd and Additional Screens (4524AD Ball Bumping Mode)

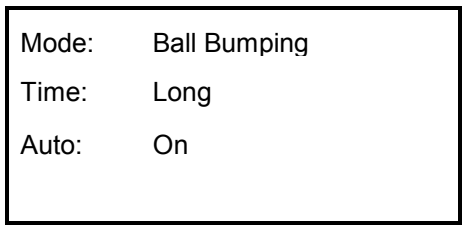


Figure 4-29: Modes Screen (4524AD Ball Bumping Mode)

4.3.10 4524AD Screens (S. Point Tab Mode)

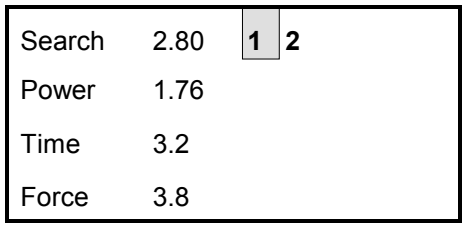


Figure 4-30: 1st Screen (4524AD S. Point Tab Mode)

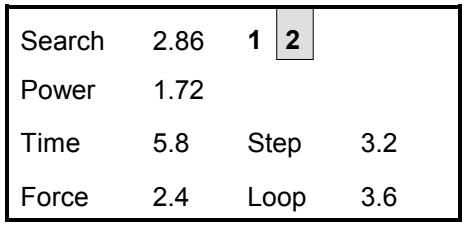


Figure 4-31: 2nd and Additional Screens (4524AD S. Point Tab Mode)

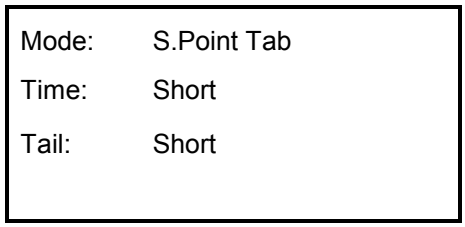


Figure 4-32: Modes Screen (4524AD S. Point Tab Mode)

4.3.11 The Keypad

The keypad is located on the base to the left of the workholder table. The STEP keys are relevant to models 4523AD and 4524AD only. All other keys are common to all 4500 Digital Series Manual Bonders.

Figure 4-33: Keypad

4.3.12 Keypad Control Keys

The following keys are used to set and control the bonder parameters and also to perform loading and saving of bonding programs.

Deletes bond channels.
Escapes load, save and mode change operations.

Adds simple wires.
Adds bond channels in multiple ball bumping and S. Point Tab.

Saves bonding program to memory.

Loads bonding program from memory.

Confirms key action when requested.

Switches between manual and semi auto operation:
When LED is ON, Manual Z operation is selected.
When LED is OFF, Semi-auto operation is selected.

UP/DOWN — Moves cursor up or down one configurable parameter.

Moves cursor up or down one screen.

Note: Cursor skips over dedicated parameters.

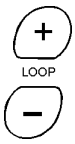
LEFT/RIGHT — Moves cursor to left or right parameter (if available).

PLUS/MINUS — Increases or decreases value of parameter marked by cursor.

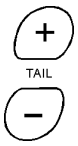
4.3.13 Dedicated Parameters Keys

These keys enable increasing and decreasing search, loop, and tail parameter values. They are active also during the bonding cycle.

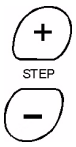
Raises and lowers the bonding head in search position.



Increases and decreases the loop height.



Increases and decreases the tail length.



Increases or decreases Stepback distance (Models 4523AD, 4524AD only).

4.4 Programming

The following sections describe the steps of the programming:

- Changing parameter values
- Changing modes
- Loading and saving bonding schedules
- Creating new bonding schedules

4.4.1 Changing Parameter Values

Common parameter values, such as POWER, TIME and FORCE can be changed using the central **+** or **-** keys. Dedicated values (SEARCH, LOOP, TAIL and STEP) can be changed using the blue dedicated parameter keys.

To change common parameter values:

1 From the first digital display screen, use the arrow keys to move the cursor to the required parameter.

2 Increase (+) or decrease (-) the value of the parameter using the central **+** or **-** key.

To change dedicated parameter values:

1 Move to the relevant bond channel screen containing the required parameter.

2 Press the **+** and **-** keys above and below the blue dedicated keys to increase or decrease the value of the parameter.

Note: Dedicated keys are also used during bonding operations.

4.4.2 Changing Modes and Settings

Use the following procedure for changing modes (Standard, Ball Bumping, Table tear etc. and settings (Time, Auto, Tail etc.).

To change a mode or a setting:

1 Move to the MODES screen.

2 Move to the required parameter.

3 Using the central + or - key, select the mode or setting required.

Changing MODE operation status will be followed by a confirmation request and machine initialization.

To load a bonding program:

1 On the Keypad, press the LOAD key. A Load Program screen appears.

2 Select the required program using the **+** and **-** keys.

3 Press the ENTER key to confirm the selected program. The program is loaded.

To save a bonding program:

1 On the Keyboard, press the SAVE key. A Save Program screen appears.

2 Choose the program number using the + and - keys.

3 Press the ENTER key to confirm the program number. The program is saved.

4.4.3 Creating Bonding Schedules

Various bonding schedules may be defined. Depending on the bonder model and the selected mode you may create:

- Stitch bond schedules (models 4523D, 4523AD)
- Two-wire bond schedules (all models)
- Multiple ball bumping/S. Point Tab schedules (models 4524D, 4524AD)

To create a stitch bond schedule:

1 Use the arrow keys to move to the screen displaying the last bond channel.

2 Press the **Stitch Pushbutton** on the Multi Mouse. A confirmation message appears.

Press ENTER to confirm. An additional bond channel is added to the bond schedule with identical parameters to the previous bond. You may repeat this operation as needed – up to 4 stitches per cycle.

3 Return to the first bond channel screen to start working.

Note: To delete existing stitch bond channels, move the cursor to the last bond channel and press ESC/DEL.

To create a two-wire bond schedule:

1 Use the arrow keys to move to the screen displaying the last bond schedule.

2 Press the ADD key. An additional wire with two bond channels is added to the bond schedule with identical parameters to the previous bond.

Note: To delete existing wires, move the cursor to one of the bond channels of the wire and press ESC/DEL.

To create multiple ball bumping/S.P.T schedules:

1 Use the arrow keys to move to the screen displaying the last bond schedule.

2 Press the ADD key. An additional bond channel is added to the bond schedule with identical parameters to the previous bond. You may repeat this operation as needed.

Note: To delete existing wires, move the cursor to one of the bond channels of the wire and press ESC/DEL.

4.5 Password Protection

The K&S 4500 Digital Series Manual Wire Bonders include a Password Protection feature that protects system parameters from unauthorized personnel. When enabled, the Password Protection feature has two authorization levels, Engineer and Operator. An Engineer can change any parameter in the system, while the Operator has authorization to change the following parameters only:

- Search parameter
- Loop parameter
- Tail parameter
- Step parameter

Furthermore, an Operator can load a program using the LOAD button. The loading sequence remains unchanged.

When Password Protection is enabled, only Users who hold the password can log onto the model 4500 with the Authorization Level of an Engineer. Engineers have the ability to change the password, as described in section 4.5.3.

Systems equipped with the Password Protection feature are supplied with a master password from K&S. Engineers, however, can create a new password, as described in section 4.5.3.

Note: The master password is 4500.

4.5.1 Entering an Authorization Level

The Authorization Screen is the opening screen displayed when the Password Protection feature is enabled in the Model 4500. The User must enter his or her authorization level before continuing.

To Enter the Authorization Level:

1 Turn on the System. The Authorization screen is displayed, as follows:

```
Authorization:

        1. Engineer
        2. Operator
```

2 Use the UP and DOWN ARROW keys to select either **Engineer**, which leads to the Password screen or **Operator**, which leads to the Main Program.

3 Press ENTER.

Note: The System should be turned off in order to switch between an Engineer and an Operator.

4.5.2 Entering a Password

The Password screen, which is available only in Engineer Mode, enables the User to enter the password necessary to access the System as an Engineer.

To Enter the Authorization Level:

1 From the Authorization screen (section 4.5.1), select **Engineer**. The Password screen is displayed, as follows:

```
Enter Password:

        0000
```

2 Enter the password, using the PLUS and MINUS keys to change the digits, and the LEFT and RIGHT ARROW keys to move between digits.

3 Press ENTER. The Change Password screen is displayed, as follows:

```
Change Password:

    1. Yes
    2. No
```

4 Use the UP and DOWN ARROW keys to select **No**.

5 Press ENTER. The Main Program is displayed.

4.5.3 Changing the Password

The Change Password screen, which is available only in Engineer Mode, enables the Engineer to change the password, as required.

To Change the Password:

1 From the Authorization screen (section 4.5.1), select **Engineer**. The Password screen is displayed, as follows:

```
Enter Password:

     0000
```

2 Enter the current password, using the PLUS and MINUS keys to change the digits, and the LEFT and RIGHT ARROW keys to move between digits.

3 Press ENTER. The Change Password screen is displayed, as follows:

```
Change Password:

    1. Yes
    2. No
```

4 Use the UP and DOWN ARROW keys to select **Yes**.

5 Press ENTER. The New Password screen is displayed as follows.

```
Enter Password:

     0000
```

6 Enter the new password, using the PLUS and MINUS keys to change the digits and the LEFT and RIGHT ARROW keys to move between digits.

7 Press ENTER. The Main Program is displayed.

5. SETUP AND ADJUSTMENTS

This chapter contains the procedures and instructions for setting up and adjusting the K&S 4500 Digital Series Manual Wire Bonders for operation. Unless otherwise specified in your order, your machine was adjusted and tested at the K&S factory according to K&S standard procedure.

- Models 4523D/4523AD are factory-set for bonding with 25 µm (1 mil) aluminum wire.
- Models 4524D/4524AD are factory-set for bonding with 25 µm (1 mil) gold wire.

Unpack and install the machine according to the instructions in Chapter 2. Before setting up the machine, familiarize yourself with its control panels (see Chapter 4). Then perform the procedures in this chapter in the order in which they appear (depending on your machine model).

5.1 Tool Installation

5.1.1 Wedge Installation (4523D, 4523AD)

Note: Two setup gauges are supplied with the bonder: one for the 0.750" drop and one for the 0.828" drop. It is recommended to use the 0.750" wedge with either of these gauges. If you use the 0.828" wedge, readjust the wire clamp position.

To install the wedge:

1 Take the plastic tube containing the wedge, Allen wrench and setup gauges out of the machine accessories box.

2 Use the Allen wrench to loosen the wedge set screw located at the front of the transducer. Insert the wedge so that the same amount protrudes out the top of the transducer tip as from the bottom. Tighten the set screw slightly so that the wedge is securely in place.

3 Position the setup gauge under the wedge (see Figures 5-1 and 5-2).

4 Loosen the set screw and gently push the wedge down until its tip just rests on the setup gauge (see Figures 5-1 and 5-2). Tighten the wedge set screw.

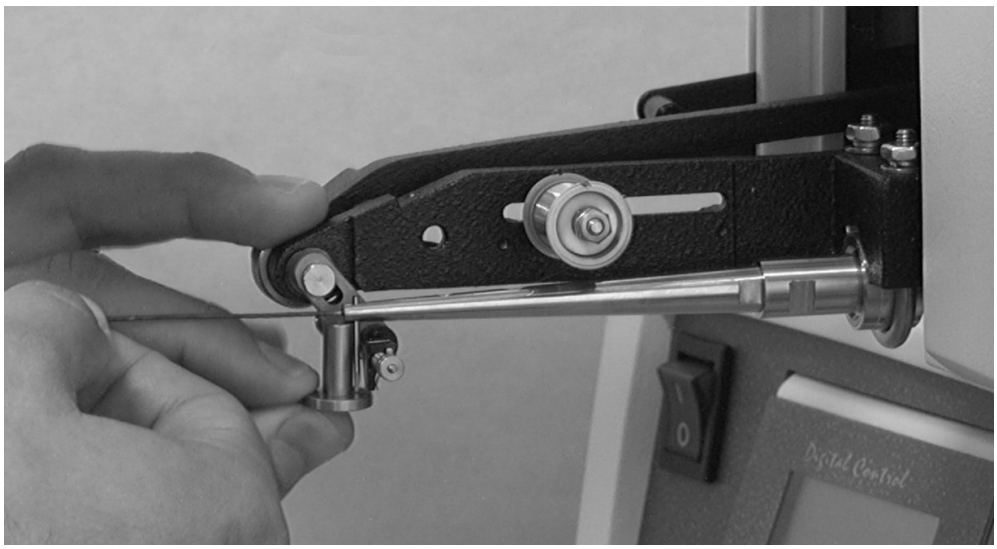


Figure 5-1: Wedge Installation Using the Setup Gauge -4523D, 4523AD with 30°/45° Wire Feed, 0.75" Drop

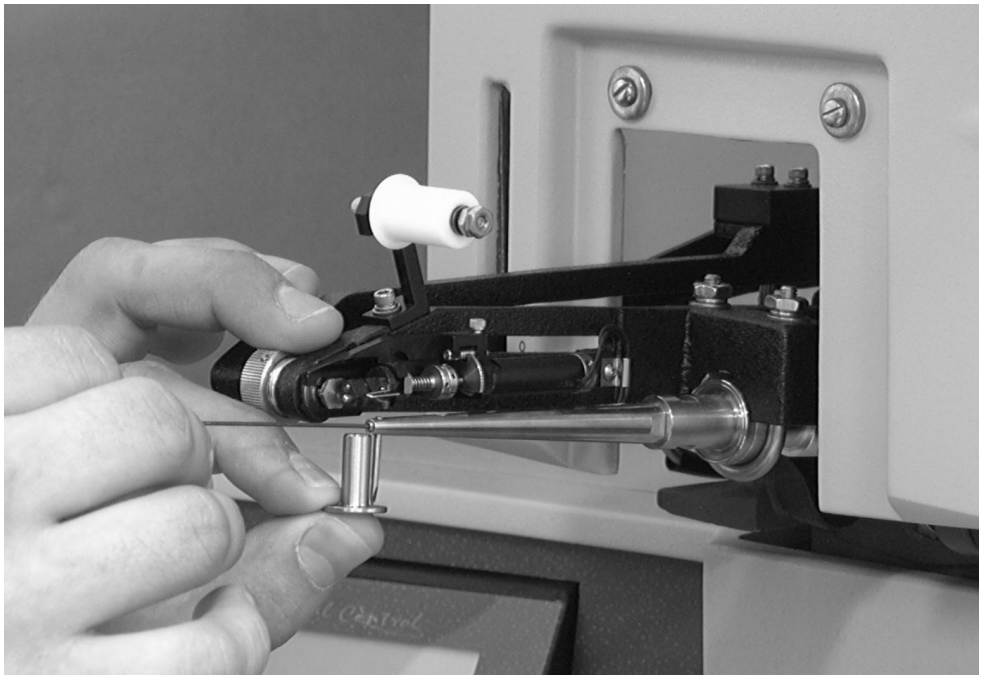


Figure 5-2: Wedge Installation Using the Setup Gauge - 4523D, 4523AD with Vertical Wire Feed, 0.828" Drop

Caution: Do not tighten the set screw all the way since this may damage the screw socket.

Caution: When the wedge tip rests on the setup gauge, do not move the gauge, since this can rub the wedge, damaging the tip.

5 Power on the machine. Wait until initialization is completed.

6 Press the TEST control button and check that the green LED turns On. Release the TEST control button and check that the LED turns Off.

7 Wait at least 30 minutes until the machine warms up.

8 To retest for a tuned condition of the ultrasonic circuit, press the TEST control button and check that the green LED turns On. Release the TEST control button and check that the LED turns Off.

Table 5-1: Recommended Wedges

Model	Description	K&S Part Number	Manufacturer Serial Number
4523D /4523AD Deep Access	1.0 mil, Gold wire, vertical feed	27795-1003-010	Deweyl TKSVD-1/16-750-45-CG-2025-M-A8D Micro-Swiss 4WDE4-1825-TG5-M21
	0.7 mil, Gold wire, vertical feed	27795-1003-007	Deweyl TKSVD-1/16-750-45-F-1510-M-A8D Micro-Swiss 4WDE4-1315-T5F-M21
	2.0 mil, Gold wire, vertical feed	27795-1003-020	Deweyl TKSVD-1/16-750-45-CG-3035-M-A8D Micro-Swiss 4WDF4-3030-T5G-M21
	1x5 mil, Gold Ribbon, vertical feed	27795-1004-050	Deweyl TKSVD-1/16-750-45-CG-1X5-3-M Micro-Swiss 4WRF4-D230-T5G-M21
	1x10 mil, Gold Ribbon, vertical feed	27795-1004-100	Deweyl TKSVD-1/16-750-45-CG-1X10-3-M Micro-Swiss 4WRF4-J240-T5G-M21
	1.0 mil, Aluminum wire, vertical feed	27795-1005-010	Deweyl CKSVD-1/16-750-45-C-2025-M-A8D
4523D /4523AD Standard Access	1 mil, Aluminum wire, 30° feed	40427-0007-152	Micro-Swiss 4WNL0-2025-W5C-M00

Table 5-1: Recommended Wedges			
Model	**Description**	**K&S Part Number**	**Manufacturer Serial Number**
	1 mil, Gold wire, 30° feed	40428-0002-251	Micro-Swiss 4WNL0-2025-T5G-M00
	0.7 mil, Gold wire, 30° feed	40430-1310-251	Micro-Swiss 4WAV0-1315-T5F-M00
	1x5 mil, Gold ribbon, 30° feed	44293-0009-251	Micro-Swiss 4WRL0-D230-T5G-M00
	1x10 mil, Gold ribbon, 30° feed	44293-0015-251	Micro-Swiss 4WRL0-J230-T5G-M00

5.1.2 Capillary Installation (4524D, 4524AD)

To install the capillary:

1 Take the plastic tube containing the capillary, Allen wrench and setup gauges out of the machine accessories box.

2 Use the Allen wrench to loosen the capillary set screw located at the front of the transducer. Insert the capillary so that the same amount protrudes out the top of the transducer tip as from the bottom. Tighten the set screw slightly so that the capillary is securely in place.

3 Position the setup gauge under the capillary (see Figure 5-3).

4 Loosen the set screw and gently push the capillary down until its tip just rests on the setup gauge (see Figure 5-3). Tighten the capillary set screw.

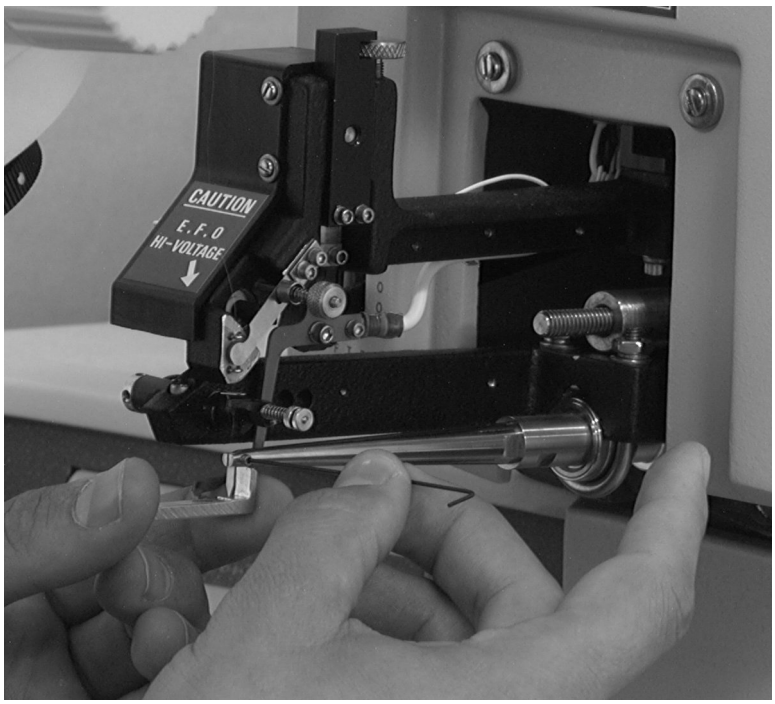


Figure 5-3: Capillary Insertion Using Setup Gauge - 4524D, 4524AD

Caution: Do not tighten the set screw all the way since this may damage the screw socket

Caution: When the capillary tip rests on the setup gauge, do not move the gauge, since this can rub the capillary, damaging the tip.

5 Power on the machine. Wait until initialization is completed.

6 Press the TEST control button and check that the green LED turns On. Release the TEST control button and check that the LED turns Off.

7 Wait about 30 minutes until the machine warms up.

8 To retest for a tuned condition of the ultrasonic circuit, press the TEST control button and check that the green LED turns On. Release the TEST control button and check that the LED turns Off.

Table 5-2: Recommended Capillaries			
Model	**Description**	**K&S Part Number**	**Manufacturer Serial Number**
4524D/ 4524AD Standard Access	1.0 mil, Gold wire	40472-0010-324	Micro-Swiss
	1.3 mil, Gold wire	41464-0013-324	Micro-Swiss
4524D/ 4524AD RC	1.0 mil, Gold wire	40472-0010-624	Micro-Swiss
4524D/4524 AD Deep Access	1.0 mil, Gold wire	40472-0012-344	Micro-Swiss
4524D Ball Bumping	1.0 mil, Gold wire	41494-0024-335	Micro-Swiss
	1.5 mil, Gold wire	41494-0015-335	Micro-Swiss
4524D Coining	For coining ball up to 5 mi	41482-0075-330	Micro-Swiss

5.2 Microscope Adjustment

To adjust the microscope:

1 Turn the ZOOM knob to minimum magnification and turn the area light on.

2 Set the LOOP dial to 0. Press and release the **Semi Auto Pushbutton**. The bonding head passes through the first bond cycle, leaving the wedge/capillary at the Loop height.

3 Release the pivot locking screw and swivel the microscope to the left or right. Pivot it up or down so that you see the wedge/capillary in the center of the field of view of the right eyepiece. Turn the focus knob until the wedge/capillary is in sharp focus.

4 Turn the ZOOM knob to maximum magnification. Repeat step 3 until the wedge/capillary tip is sharply focused in the field of view.

5 Tighten the microscope locking screw.

6 Adjust the distance between the eyepieces by pulling or pushing the oculars sideways.

7 To compensate for differences in right and left eye focus requirements, focus the left eyepiece independently using the left ocular focus ring.

5.3 Bonding Force Adjustments and Setup

Before starting bonding operation, you must verify the bonding forces of your machine and set them to the factory values. For different applications, see the recommended values for your specific model. (The recommended values for each specific wire type are included in Chapter 6 in the Recommended Machine Adjustments tables, and are listed separately for each model).

To set the bonding force:

1 Ensure that the bonding head is in the Reset position.

2 Remove the workholder from the workholder table.

3 Press the SETUP key. The green LED lights.

4 On the Display, set all Search parameters to 0.00.

5 Press and hold the **Semi Auto Pushbutton**.

6 Using a gram gauge (see Figure 5-4), lift the bonding head until the gauge reading starts to rise.

7 Read the gram gauge. This is the first bond force. To adjust this force to the factory recommended setting, or any other setting you require, set the FORCE parameter accordingly (the recommended values for each specific wire type are included in Chapter 6 in the Recommended Machine Adjustments tables, and are listed separately for each model).

8 Release the **Semi Auto Pushbutton**.

9 Press and hold the **Semi Auto Pushbutton**. The bonding head moves to the second Search height. The second bond channel number is highlighted in the Display.

10 Repeat steps 6-9 until all the force parameters are set.

11 Press the SETUP key. The LED turns off.

Note: If the required bonding force appears to be lower than the minimum force (FORCE = 0.0) or higher than the maximum force (FORCE = 9.9), readjust the static force (see section 9.2.3).

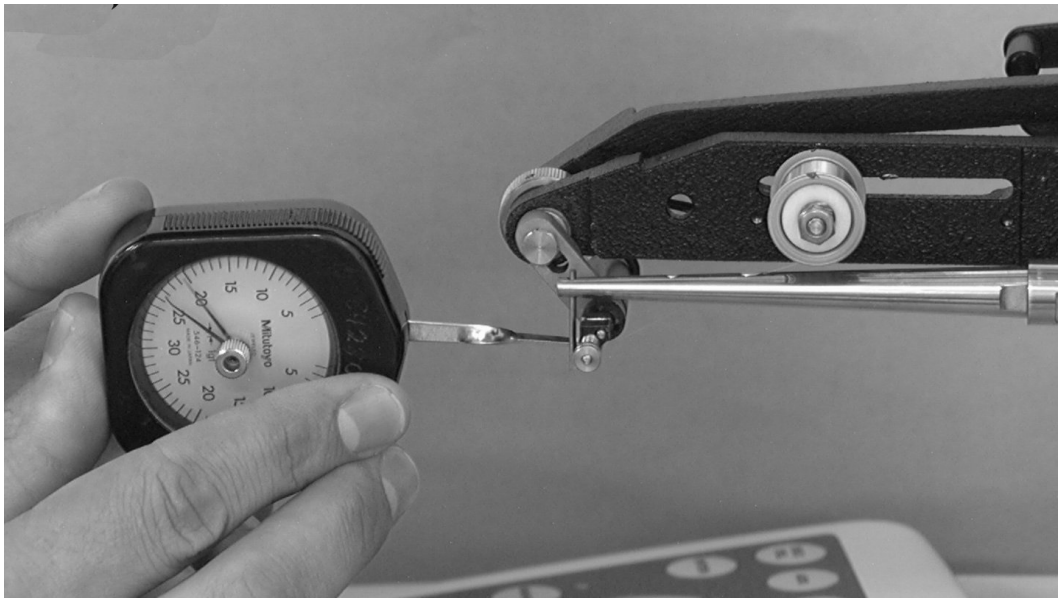


Figure 5-4: Force Adjustment Using a Gram Gauge

5.4 Workholder Installation and Adjustment

Note: This procedure refers to manually height adjustable workholders of type 483, 4142 or 4135. For motorized workholders, see the instructions that are supplied with the workholder.

5.4.1 Workholder Installation

To install the workholder:

1 Take the workholder out of the machine accessories box.

2 Hold the top of the workholder and turn the workholder base counterclockwise until it stops. The workholder is now at its minimum height.

3 Place the workholder on the work station.

4 If using a heated workholder, connect the workholder harness to the HEATER and T.C. connectors on the workholder connectors panel.

5.4.2 Workholder Height Adjustment

To adjust the workholder height (see Figure 5-5):

1 Load a device in the workholder. Adjust the workholder clamps to secure the device in place

2 Set the LOOP parameter to 1. Press and release the **Semi Auto Pushbutton**. The bonding head drops to its lowest position and remains there. Ensure that the display shows the second bond channel screen.

3 Hold the top of the workholder and turn the base of the workholder clockwise to raise the workholder until the wedge/capillary just touches the lowest bonding level.

4 Set the LOOP parameter to 5. Press the **Semi Auto Pushbutton** to return the bonding head to the Reset position.

At this position, a device placed on the workholder should just touch the wedge/capillary tip. The machine can now work within the maximum range of bonding heights and the required overtravel.

5.4.3 Search Height Adjustment

To set the Search height:

1 Power on the bonder.

2 Move the workholder with the device to the bond site. Set the first Search parameter to a high value, so that the wedge/capillary does not hit the device's surface. Press and hold the **Semi Auto Pushbutton**. The bonding head descends to the first Search height.

3 Using the dedicated SEARCH key, set the Search parameter to the required Search height, 75-100 µm (3 - 4 mil). Use a feeler gauge to determine the Search height setting.

4 Release the **Semi Auto Pushbutton**.

5 Verify that the bonding head rises. On the Display, the next bond channel number is highlighted.

6 Repeat steps 2-4 until all the Search parameters are set.

5.4.4 Setting Workholder Temperature

Note: If "EEE" appears in the temperature controller display, check that the workholder is plugged into the workholder connectors panel properly.

To set the temperature of the workholder:

1 Press the **Set Pushbutton** on the temperature controller. The temperature controller display shows the temperature setting (set point 1) for 3 seconds. LED I blinks.

Note: If the Set Pushbutton is pressed again within 3 seconds, set point 2 appears in the display. This value has no function for the 4500 Digital Series.

2 Press the **Up** and/or **Down Pushbutton** until the required temperature setting appears in the display.

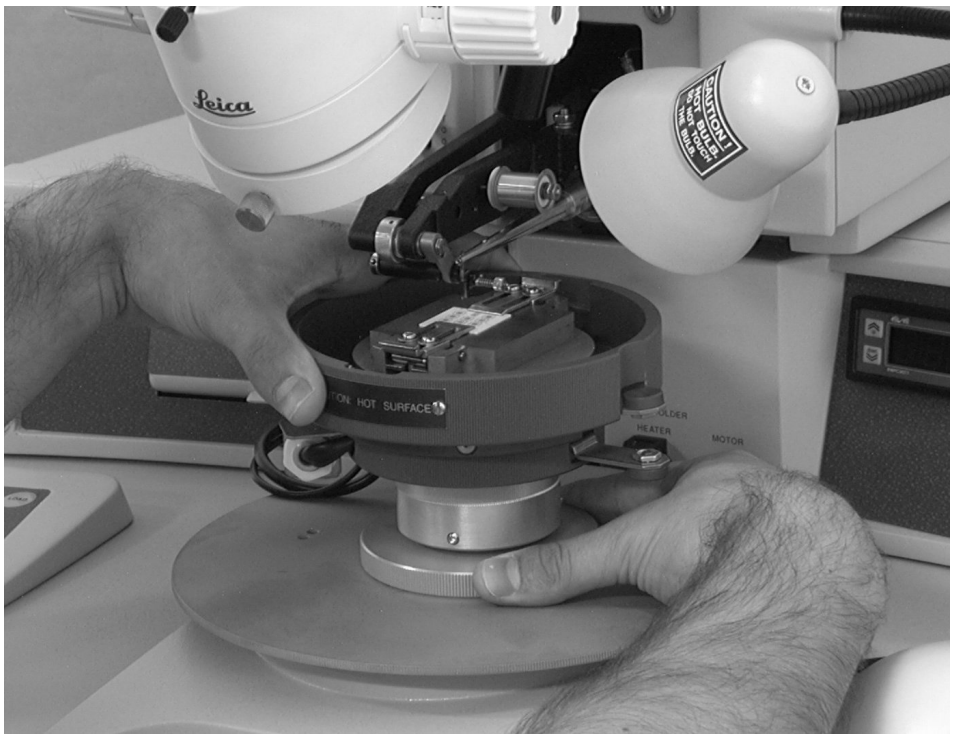


Figure 5-5: Adjusting Workholder Height

3 Release the pushbuttons. Within 3 seconds, set point 1 is stored in the temperature controller memory. The temperature controller display shows the actual workholder temperature. Ensure that LED I is on (indicating that the workholder heater is turned on).

Note: The temperature controller is factory-set to the optimum setup. If the actual workholder temperature deviates from set point 1, recalibrate the temperature controller (see section 12.14). If it is necessary to change parameters other than the set temperature, see the supplied EWPC 907/T Series manual.

5.5 Wire Loading

Caution: When loading a wire, always wear protective gloves. Never touch the wedge/capillary, wire or spool holder with your bare fingers. This leaves oil traces that affect normal operation.

Caution: When handling the wedge/capillary, use a good pair of tweezers such as MicroSwiss' Tool Tweezers, model 43003-0010-001. Poor quality tweezers make wire feeding difficult. This may affect the bonding operation of your machine.

5.5.1 Useful Tips

The following tips should help you during wire loading:

- For best results, use the recommended wedges/capillaries (see sections 5.1.1 and 5.1.2).
- When feeding the wire through the wedge/capillary:
  - Hold the wire about 12 mm (1/2") from the end (4524D, 4524AD).
  - Hold the wire about 2-3 mm (1/8") from the end (4523D, 4523AD - 30°/45° wire feed).
  - For the first feed, hold the wire about 25 mm (1") from the end. For the second feed, hold the wire about 2-3 mm (1/8") from the end (4523D, 4523AD - vertical wire feed).
- Do not squeeze the wire too tightly with the tweezers. Gold is extremely malleable and squeezing can cause the wire to get stuck inside the wedge/capillary.
- When feeding a new wire into the wedge/capillary, tear off a small piece of the wire lead to create a sharp point at the end of the wire. This makes it much easier to insert the wire into the wedge/capillary hole.
- If the wire does not go through the wedge/capillary hole, press and release the TEST control button, while feeding the wire. This applies ultrasonic vibrations to the wedge/capillary, easing the wire feeding.

5.5.2 Wire Loading of 2" Spool - Vertical Wire Feed (4524D, 4524AD)

To load the wire:

1. Power on the bonder. Ensure that the bonding head is in the Reset position (The first bond channel number appears highlighted in the Display).
2. If the 2" spool is not installed, install the spool holder assembly on the spool holder bracket (see Figure 3-4).
3. Remove the plastic dust cover, spool cap and glass feed tube from the spool holder. Place the gold wire spool in the spool holder (see Figure 3-4).
4. While holding the glass feed tube in your hand, slip one of the rubber O-rings over the tube's pointed end. Slide it up to a location 15-18 mm (5/8-3/4") from the tube's flared end. Insert the pointed end of the tube through the spool cap, from the top.
5. Slip the second O-ring over the tube from below, and slide it up so that the spool cap is held securely between the two O-rings. Place the spool cap with the tube (flared end upward) on the spool holder (see Figure 3-4).

6 Place the spool of wire on the spool holder with the free end of the wire facing upwards. Place the spool cap together with the glass tube over the wire spool.

7 Pull the free end of the wire, with the end pointed upward, over the polished circumference of the spool cap and insert the wire into the flared end of the tube. Feed the wire through the tube so that it protrudes from the lower end.

8 Place the dust cover over the spool holder without pinching the wire.

9 Press the CLAMP control button. The LED turns On and the wire and drag clamps open.

10 Using tweezers, grasp the small glass plate of the fixed tensioner (see Figure 3-4) and gently remove it from its seat. If necessary, lift the white plastic screw slightly over the tensioner to clear the way.

11 Pull the wire tip along the tensioner route and feed it through the wire guide.

12 Ensure that the small glass plate is free of dust, grease or fingerprints, and place it on top of the wire on the fixed tensioner bracket. Ensure that the polished, rounded side of the glass plate faces downward on the wire.

13 Pull the wire further through the wire guides and open jaws of the drag clamp and wire clamp. Using tweezers, feed the wire through the capillary so that it protrudes about 12.5 mm (1/2") from the capillary tip.

14 Press CLAMP control button again. The LED turns Off and the clamp closes.

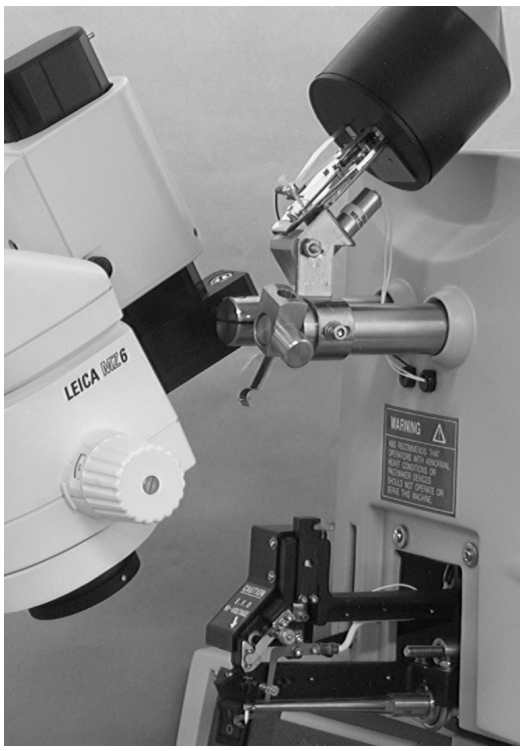


Figure 5-6: Wire Loading of 2" Spool - Vertical Wire Feed

Note: The wire should form a straight line from the kicker down to the capillary. Otherwise, friction may cause looping problems and damage to the wire. If the wire is not straight, reposition the spool holder.

5.5.3 Wire Loading of 0.5" Spool - 30°/45° Wire Feed (4523D, 4523AD)

To load the wire:

1 Power on the bonder. Ensure that the bonding head is in the Reset position. (The first bond channel number appears highlighted in the Display.)

2 Place the spool of wire on the spool holder on the right side of the bonding head.

- If using a 30° wedge, feed the wire through the 30° wire feed hole of the transducer.
- If using a 45° wedge, feed the wire through the 45° wire feed hole of the transducer.

3 Press the CLAMP control button. The LED turns On and the wire clamp opens. Lift the clamp lifter handle up, and feed the wire through the wire clamp above the wire guide and through the wire feed hole in the wedge.

4 Press the CLAMP control button again. The LED turns Off and the wire clamp closes and pushes the clamp lifter handle down.

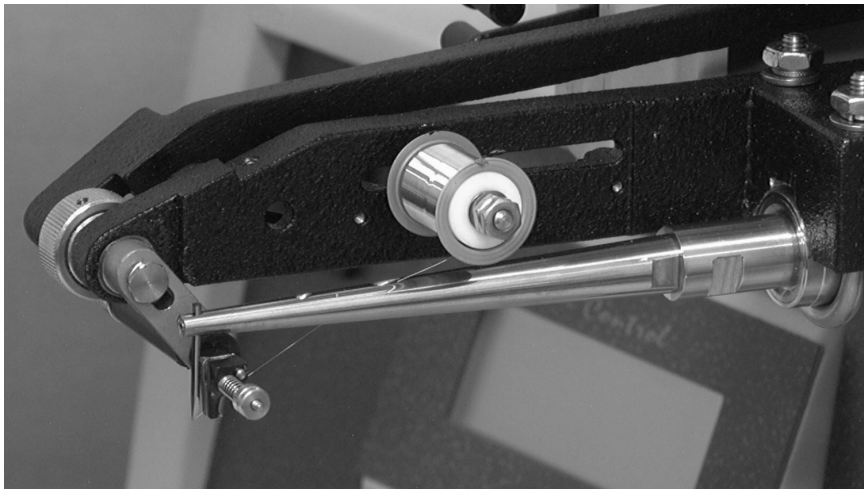


Figure 5-7: Wire Loading of 0.5" Spool - 30°/45° Wire Feed

5.5.4 Wire Loading of 2" Spool - 30°/45° Wire Feed (Optional for 4523D, 4523AD)

To load the wire:

1 Power on the bonder. Ensure that the bonding head is in the Reset position (The first bond channel number appears highlighted in the Display).

2 If the 2" spool is not installed, install the spool holder assembly on the spool holder bracket.

3 Remove the plastic dust cover, spool cap and glass feed tube from the spool holder. Place the wire spool on the spool holder.

4 While holding the glass feed tube in your hand, slip one of the rubber O-rings over the tube's pointed end. Slide it up to a location 15-18 mm (5/8-3/4") from the tube's flared end. Insert the pointed end of the tube through the spool cap, from the top.

5 Slip the second O-ring over the tube from below, and slide it up until the spool cap is held securely between the two O-rings. Place the spool cap with the tube (flared end upward) on the spool holder.

6 Pull the free end of the wire, with the end pointed upward, over the polished circumference of the spool cap and insert the wire into the flared end of the tube. Feed the wire through the tube so that it protrudes from the lower end.

7 Place the dust cover back on the spool holder without pinching the wire.

8 Place the spool of wire on the spool holder on the right side of the bonding head.

- If using a 30° wedge, feed the wire through the 30° wire feed hole of the transducer.
- If using a 45° wedge, feed the wire through the 45° wire feed hole of the transducer.

9 Press the CLAMP control button. The LED turns On and the wire clamp opens. Lift the clamp lifter handle up, and feed the wire through the wire clamp above the wire guide and through the wire feed hole in the wedge.

10 Press the CLAMP control button again. The LED turns Off and the wire clamp closes and pushes the clamp lifter handle down.

Note: The wire should form a straight line from the transducer to the wedge. Otherwise, friction may cause looping problems and damage to the wire. If the wire is not straight, see section 9.6 for Wire Clamp Adjustment procedures.

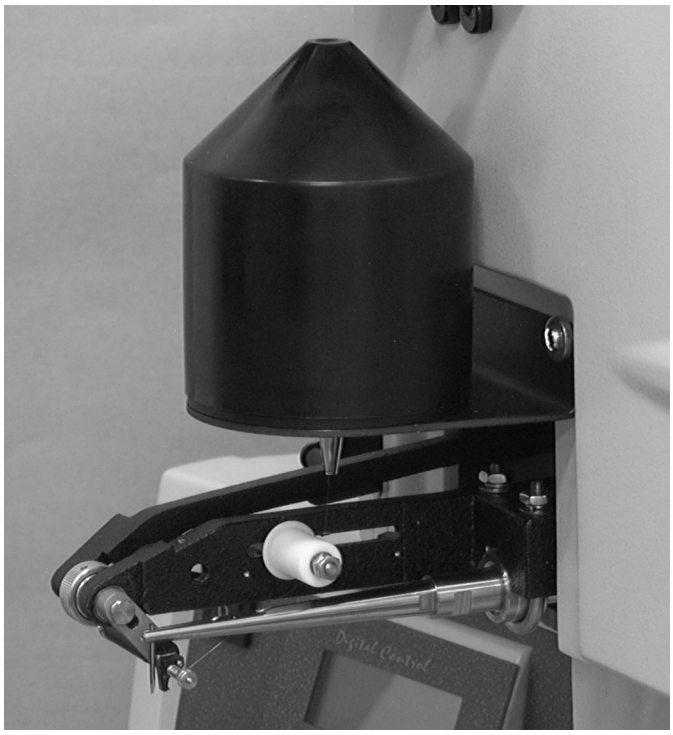


Figure 5-8: Wire Loading of 2" Spool - 30°/45° Wire Feed

5.5.5 Wire Loading of 0.5" Spool - Vertical Wire Feed (Optional for 4523D, 4523AD)

To load the wire:

1 Power on the bonder. Ensure that the bonding head is in the Reset position. (The first bond channel number appears highlighted in the Display).

2 Assemble the spool support bracket (supplied with the vertical wire clamp kit).

3 Place the spool of wire on the spool holder on the right side of the bonding head.

4 Open the clamp manually by pulling the clamp plunger towards you. Then, rotate the clamp plunger slightly to lock it in the open position.

5 Feed the wire into the vertical hole of the wedge until it protrudes from the hole at the bottom.

6 Ensure that the wire is loaded from the front side of the spool, through the wire guide and the clamp, to the wedge.

7 Release the clamp plunger and close the clamp manually.

8 Press the CLAMP control button. The LED turns On and the wire clamp opens. Pull a small length of wire to ensure that the wire is fed properly, without friction.

9 Press the CLAMP control button again. The LED turns Off and the wire clamp closes.

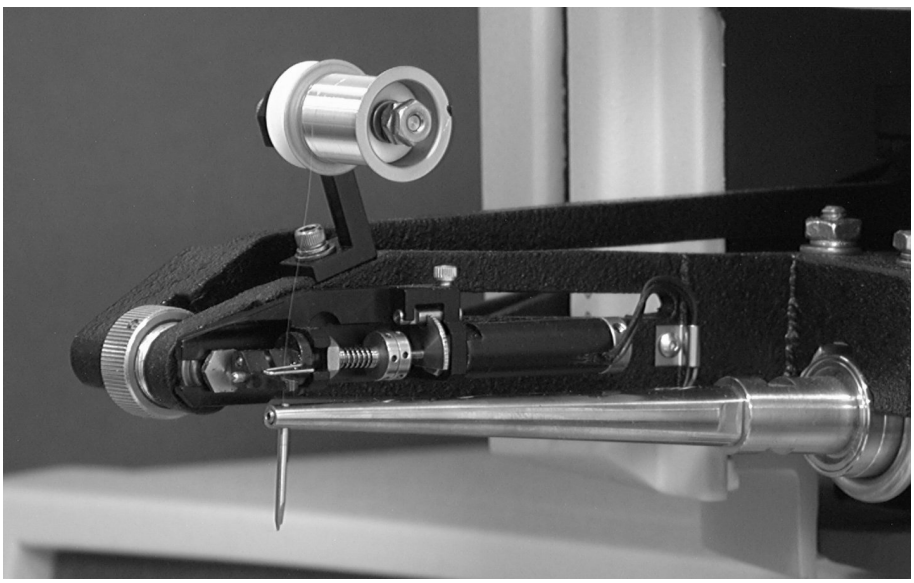


Figure 5-9: Wire Loading of 0.5" Spool - Vertical Wire Feed

5.5.6 Wire Loading of 2" Spool - Vertical Wire Feed (Optional for 4523D, 4523AD)

To load the wire:

1 Power on the bonder. Ensure that the bonding head is in the Reset position. (The first bond channel number appears highlighted in the Display.)

2 If the 2" spool is not installed, install the spool holder assembly on the spool holder bracket (see Figure 3-4).

3 Remove the plastic dust cover, spool cap and glass feed tube from the spool holder. Place the gold wire spool in the spool holder (see Figure 3-4).

4 While holding the glass feed tube in your hand, slip one of the rubber O-rings over the tube's pointed end. Slide it up to a location 15-18 mm (5/8-3/4") from the tube's flared end. Insert the pointed end of the tube through the spool cap, from the top.

5 Slip the second O-ring over the tube from below, and slide it up so that the spool cap is held securely between the two O-rings. Place the spool cap with the tube (flared end upward) on the spool holder (see Figure 3-4).

6 Place the spool of wire on the spool holder with the free end of the wire facing upwards. Place the spool cap together with the glass tube over the wire spool.

7 Pull the free end of the wire, with the end pointed upward, over the polished circumference of the spool cap and insert the wire into the flared end of the tube. Feed the wire through the tube so that it protrudes from the lower end.

8 Place the dust cover over the spool holder without pinching the wire.

9 Open the clamp manually by pulling the clamp plunger towards you. Then, rotate the clamp plunger slightly to lock it in the open position.

10 Using tweezers, grasp the small glass plate of the fixed tensioner (see Figure 3-4) and gently remove it from its seat. If necessary, lift the white plastic screw slightly over the tensioner to clear the way.

11 Pull the wire tip along the tensioner route and feed it through the wire guide.

12 Ensure that the small glass plate is free of dust, grease and fingerprints, and place it on top of the wire on the fixed tensioner bracket. Ensure that the polished, rounded side of the glass plate faces downward on the wire.

13 Feed the wire into the vertical hole of the wedge until it protrudes from the hole at the bottom.

14 Ensure that the wire is fed from the front side of the spool, through the wire guide and the clamp, to the wedge.

15 Release the clamp plunger and close the clamp manually.

16 Press the CLAMP control button. The LED turns On and the wire clamp opens.

17 Pull a small length of wire to ensure that the wire is fed properly, without friction.

18 Press the CLAMP control button again. The LED turns Off and the wire clamp closes.

Figure 5-10: Wire Loading of 2" Spool - Vertical Wire Feed

5.6 Spotlight Adjustment

If your bonder is equipped with the optional spotlight, spotlight adjustment is necessary. Spotlight adjustment includes the following tasks:

- Preparing a reference bond to aid spotlight adjustment
- Positioning the spotlight
- Focusing

To prepare a reference bond:

1 Set the LOOP parameter to 10.
Set the REVERSE and STEP parameters to 0 (4523AD, 4524AD).

2 Maneuver the reference device directly under the bonding head.

3 Move the Multi Mouse to position the device precisely under the wedge/capillary.

4 Perform the reference bond. Do not move the Multi Mouse after the bond is performed. The bonding head is now at the Loop height and the second bond channel number is highlighted on the Display.

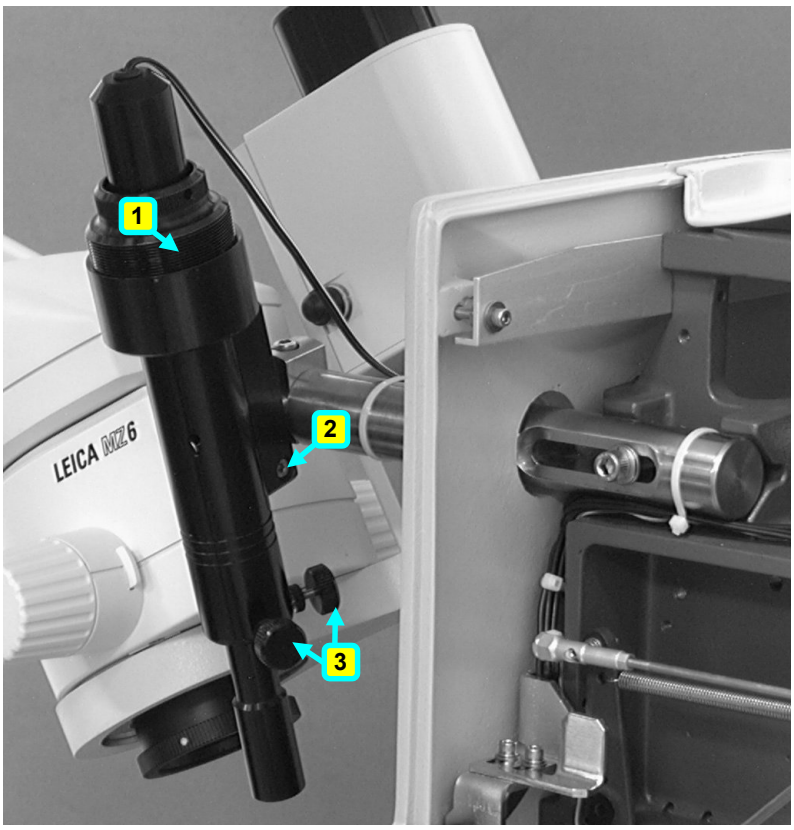
To adjust the spotlight:

1 Loosen the clamping screw on the spotlight housing.

2 Move the spotlight housing so that you see the target spot near the reference bond.

3 Turn the focusing ring at the top of the spotlight so that the target spot appears as a sharp ring.

4 Turn the knurled screws near the bottom of the spotlight housing to make fine adjustments in the target spot position.



1 Focus Ring
2 Spotlight Clamping Screw
3 Knurled Screws

Figure 5-11: Spotlight Adjustment

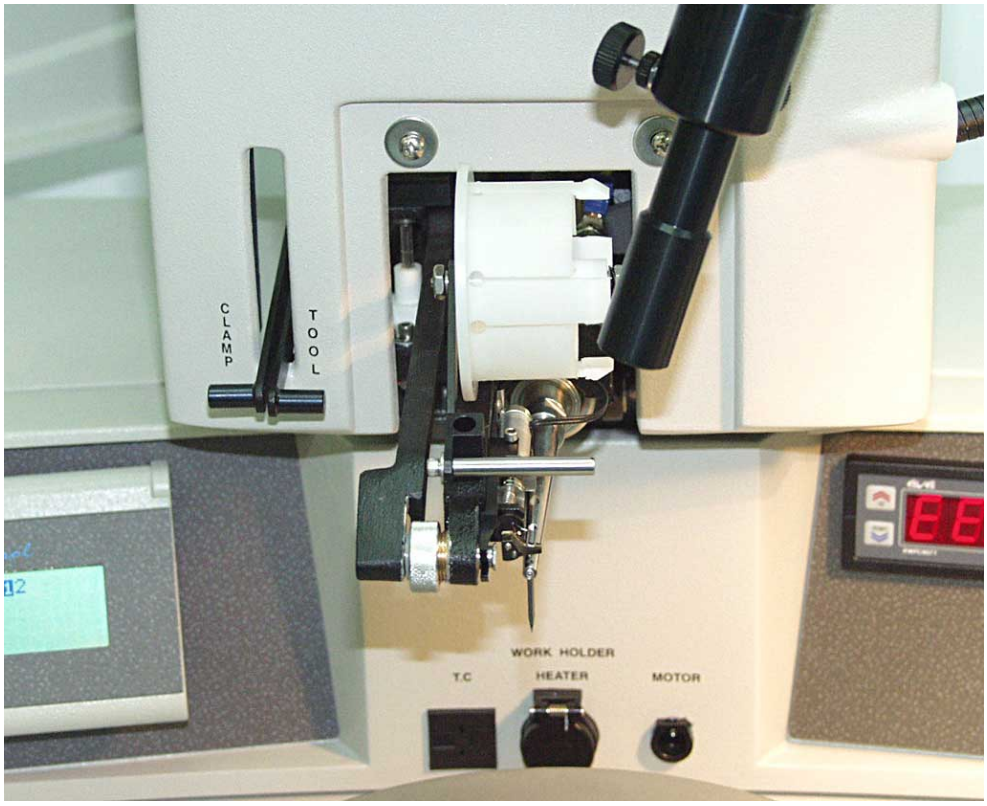


Figure 5-12: 2" Spool for Ribbon Wire Feed

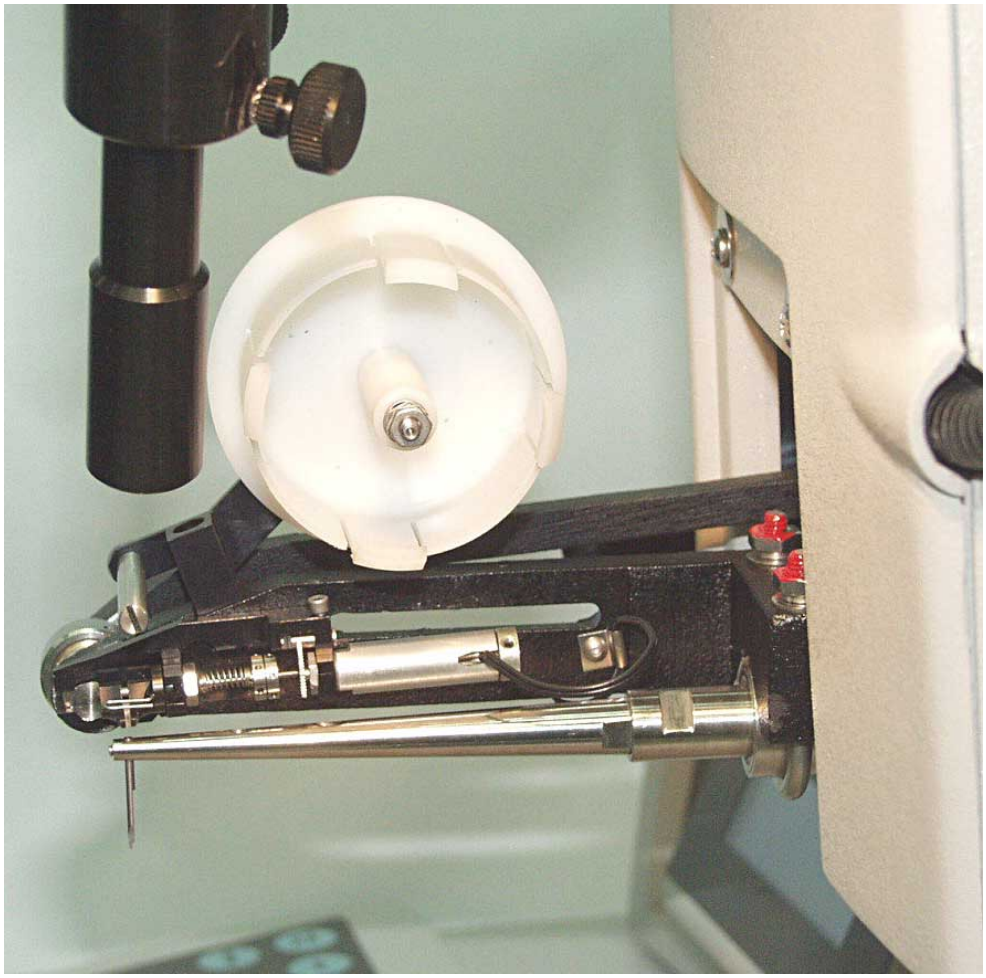


Figure 5-13: Close-up of 2" Spool for Ribbon Wire Vertical Feed

6. OPERATION

This chapter explains how to operate your K&S 4500 Digital Series Wire Bonder. The 4500 Digital Series Wire Bonders have common operation principles and bonding methods. However, each model also has specific process parameters and operation procedures. The process parameters are explained in Chapter 4. The sections that follow describe the operating procedures for each of the different models that comprise the 4500 Digital Series:

- Model 4523D Wedge Bonder
- Model 4523AD Auto Stepback Wedge Bonder
- Model 4524D Multi-Process Ball Bonder
- Model 4534AD Multi-Process Auto Stepback Ball Bonder

Note: When you power on the bonder, the display will show the parameters of the last program used. If this bonding program is not suitable to your needs, change it to the required bond schedule. For more information, see section 4.4.

6.1 Operating Model 4523D

This section describes the bond cycle operation modes and operating procedures for the K&S Model 4523D Wedge Bonder.

The 4523D can operate in the following bonding modes:

- Standard Mode

6.1.1 Standard Mode Wedge Bonding

The 4523D performs standard mode wedge bonding using Semi Auto or Manual Z operation.

Note: Graphic representations of the cycle appear in Figure 6-1 and Figure 6-2.

To perform Standard Mode Semi Auto Wedge Bonding:

1 Ensure that the bonding head is in the Reset position.

2 Position the workholder so that the bonding pad is under the wedge. Ensure that the wire clamp is closed.

3 Press and hold the **Semi Auto Pushbutton** of the Multi Mouse. The bonding head descends to the first Search height (set by the SEARCH parameter) and stops.

4 While still holding the **Semi Auto Pushbutton**, move the Multi Mouse to position the first bonding pad precisely under the wedge.

5 Release the **Semi Auto Pushbutton**. The bonding head descends to the first bonding pad. The bonding force and ultrasonic energy (set by the FORCE and POWER parameters respectively) are applied for the time set by the TIME parameter. The first bond is performed and the wire clamp opens.

The bonding head rises automatically to the Loop height (set by the LOOP parameter). Before the bonding head reaches the Loop height, the linear motor moves to the feed position, set by the TAIL parameter.

Note: Perform wedge bonding in the direction of the wire. If necessary, rotate the device so that the first bond and the second bond pads are aligned with the wire feed line.

6 Move the Multi Mouse to position the second bonding pad directly under the wedge.

7 Press and hold the **Semi Auto Pushbutton**. The bonding head drops to the second Search (set by the second Search Parameter) height and stops. As the bonding head starts its descent, the wire clamp closes momentarily to prevent the wire from feeding back into the wedge feed hole (helping to create a stable loop).

8 While still pressing the **Semi Auto Pushbutton**, move the Multi Mouse to position the second bonding pad precisely under the wedge.

Note: If you are using a stitch bond schedule repeat steps 5-7 to perform the number of stitches required by the program.

9 Release the **Semi Auto Pushbutton**. The bonding head descends to the last bond pad. The last bonding force and ultrasonic energy (set by the second FORCE and POWER parameters) are applied for the time set in the second TIME parameter. After the bond is performed, the wire clamp closes and rises (as set by the TEAR parameter), tearing the wire.

The bonding head rises to the Reset position. The wire clamp drops from the Tear position, feeding a wire tail through the wedge feed hole to prepare for the next bond schedule.

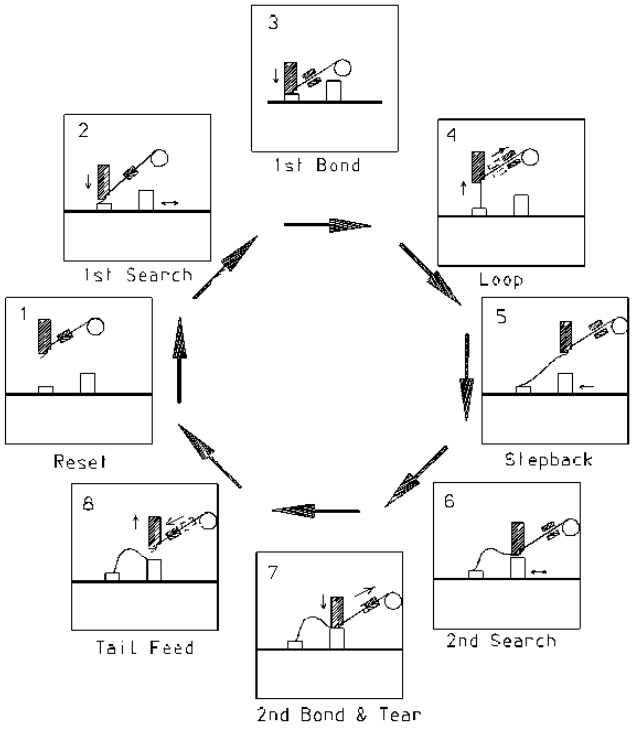


Figure 6-1: Wedge Bonding Cycle in Semi Automatic Mode - 30°/45° Wire Feed

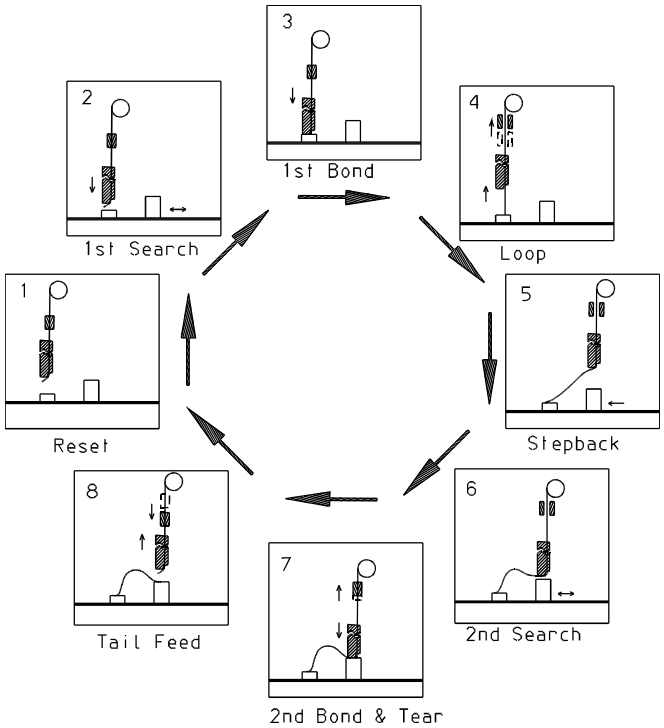


Figure 6-2: Wedge Bonding Cycle in Semi Automatic Mode - 90° Wire Feed

To perform Standard Mode Manual Z wedge bonding:

1 Press the MANUAL control button. The Green LED lights.

2 Press and hold the **Manual Z Control Button** of the Multi Mouse. Lower the bonding head as close as you want to the bonding pad. Move the Multi Mouse to maneuver the first bonding pad precisely under the wedge.

3 Continue pressing the **Manual Z Control Button** to drop the bonding head to the bonding pad and perform the bond as in the Semi Auto mode.

4 Release the **Manual Z Control Button** slowly to raise the bonding head to the Loop height.

5 Move the Multi Mouse to position the second bonding pad directly under the capillary.

Note: If you are using a stitch bond schedule repeat steps 2-5 to perform the number of stitches required by the program.

6 To perform the second bond, press and hold the Manual Z Control Button of the Multi Mouse. Lower the bonding head as close as you want to the bonding pad. Move the Multi Mouse to maneuver the second bonding pad precisely under the wedge.

7 Continue pressing the **Manual Z Control Button** to drop the bonding head to the bonding pad and perform the bond.

8 Release the **Manual Z Control Button** to raise the bonding head to the Reset position.

6.1.2 Off-Line Operations 4523D

6.1.2.1 Initial Parameters and Machine Setting

The following adjustments and parameters are recommended for selected wires. Final bonding parameters should be optimized using microscopic analysis and destructive tests.

Table 6-1: Recommended Machine Adjustments - 30°/45° Wire Feed

Parameter	Setting			
	18 µm Gold	**25 µm Gold**	**25 µm Alum**	**25 x 125 µm Ribbon**
Static bond force (gm)	7 - 10	15	15	15
Wire clamp gap (µm)	70	100	100	100
Wire clamp force (gm)	80 - 100	80 - 100	80 - 100	100 - 120
Workholder temperature (°C)	150	150		150
Initial Bond Parameter Settings				
First POWER	0 - 1	1 - 2	1 - 2	2 - 4
First TIME	3*	5*	4	5*
First FORCE	0 - 1	1 - 2	1 - 2	4 - 5
First FORCE (gm)	12 - 14	25 - 30	25 - 30	60 - 80
LOOP	3	4	4	4
Second POWER	1 - 2	1.5 - 2.5	1.5 - 2.5	2.5 - 4.5
Second TIME	3*	5*	5	5*
Second FORCE	0 - 1	1 - 2	1 - 2	5
Second FORCE (gm)	14 - 16	25 - 30	25 - 30	60 - 80
TAIL	3	5	5	7
TEAR	4	5	5	5

Table 6-1: Recommended Machine Adjustments - 30°/45° Wire Feed	
Parameter	**Setting**
Wires	
Gold	The smaller the wire diameter, the harder the wire should be. The recommended elongation is: 0.5 - 2% for18 μm wire 6 - 8% for 76 μm wire.
Aluminum	1% Silicon wire with elongation of 1 - 3%.

* Operate the bonder in Long time mode.

Table 6-2: Recommended Machine Adjustments - 90° Wire Feed Deep Access				
Parameter	**Setting**			
	18 μm Gold	**25 μm Gold**	**25 μm Alum**	**25 x 125 μm Ribbon**
Static bond force (gm)	7 - 10	15	15	15
Wire clamp gap (μm)	70	100	100	100
Wire clamp force (gm)	80 - 100	80 - 100	80 - 100	100 - 120
Workholder temperature (°C)	150	150		150
Initial Bond Parameter Settings				
First POWER	0 - 1	1 - 2	1 - 2	2 - 4
First TIME	3*	4*	5	5*
First FORCE	0 - 1	1 - 2	1 - 2	4 - 5
First FORCE (gm)	15 - 20	25 - 30	25 - 30	60 - 80
LOOP	3	4	4	5
Second POWER	0 - 1	1 - 2	1 - 2	2 - 4
Second TIME	3*	4*	5	5*
Second FORCE	0 - 1	1 - 2	1 - 2	4 - 5
Second FORCE (gm)	15 - 20	25 - 30	25 - 30	60 - 80

Table 6-2: Recommended Machine Adjustments - 90° Wire Feed Deep Access				
Parameter	**Setting**			
TAIL	3	5	5	3**
TEAR	4	5	5	6
Wires				
Gold	The smaller the wire diameter, the harder the wire should be. The recommended elongation is: 0.5 - 2% for18 μm wire 6 - 8% for 76 μm wire.			
Aluminum	1% Silicon wire with elongation of 1 - 3%.			

* Operate the bonder in Long time mode.

** Operate the bonder in Long Tail Length mode.

6.1.2.2 Bond Strength Optimization

Bond strength depends on the following main parameters:

- Metalization - the bondability and the adhesion of the die and the substrate metals
- Wire type, tensile strength and elongation
- Wedge type
- Bonding parameter settings
- Workholder temperature (for gold wire)

Using a bond shear tester, perform a series of tests such as wire loop pull testing and microscopic analysis of the squashed wire dimensions. Be aware that loop height and the distance from the first bond to the second bond affect the results of pull test measurements.

Figure 6-3 shows typical bonds and loops performed by Model 4523D.

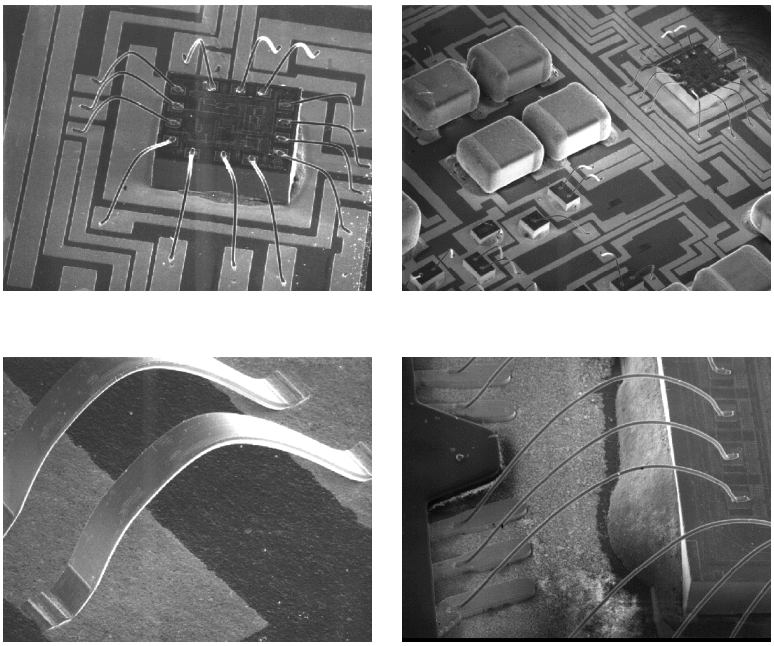


Figure 6-3: Typical Bonds Performed by Model 4523

6.2 Operation - Model 4523AD

This section describes the bond cycle operation modes and operating procedures for the K&S Model 4523AD Auto Stepback Wedge Bonder.

The 4523AD can operate in the following bonding modes:

- Standard Mode
- Table Tear Mode
- Lange Coupler Mode

6.2.1 Standard Mode Wedge Bonding

The 4523AD performs standard mode wedge bonding using Semi Auto, Manual Z operation, or automatic bonding.

To perform Standard Mode Semi Auto wedge bonding:

1 Ensure that the bonding head is in the Reset position and that the MODE is set to STANDARD.

2 Position the workholder so that the bonding pad is under the wedge. Ensure that the wire clamp are closed.

3 Press and hold the **Semi Auto Pushbutton** of the Multi Mouse. The bonding head descends to the first Search height (set by the Search parameter) and stops.

4 While still holding the **Semi Auto Pushbutton**, move the Multi Mouse to position the first bonding pad precisely under the wedge.

5 Release the **Semi Auto Pushbutton**. The bonding head descends to the first bonding pad. The first bonding force and ultrasonic energy (set by the FORCE and POWER parameters respectively) are applied for the time set by the TIME parameter. The first bond is performed and the wire clamp opens.

The bonding head rises automatically to the Kink height position, and travels in a reverse motion to form the Loop shape. The bonding head then automatically performs loop height and Stepback to the second bond position.

Note: Perform wedge bonding in the direction of the wire. If necessary, rotate the device so that the first bond and the second bond pads are aligned with the wire feed line.

6 Press and hold the **Semi Auto Pushbutton**. The bonding head drops to the second Search height and stops. As the bonding head starts its descent, the wire clamp closes momentarily to prevent the wire from feeding back into the wedge feed hole (helping to create a stable loop).

7 While still pressing the **Semi Auto Pushbutton**, move the Multi Mouse to position the second bonding pad precisely under the wedge bonding head to the bonding pad and perform the bond.

Note: If you are using a stitch bond schedule repeat steps 2-7 to perform the number of stitches required by the program.

8 Release the **Semi Auto Pushbutton**. The bonding head descends to the second bond site. The second bonding force and ultrasonic energy (set by the FORCE and POWER parameters of the second bond schedule) are applied for the time set in the second TIME parameter. After the bond is performed, the wire clamp closes and rises (as set by the TEAR parameter), tearing the wire.

The bonding head rises to the Reset position. The wire clamp drops from the Tear position, feeding a wire tail through the wedge feed hole to prepare for the next bond schedule.

The table moves backwards returning the bonding head to the first bond position.

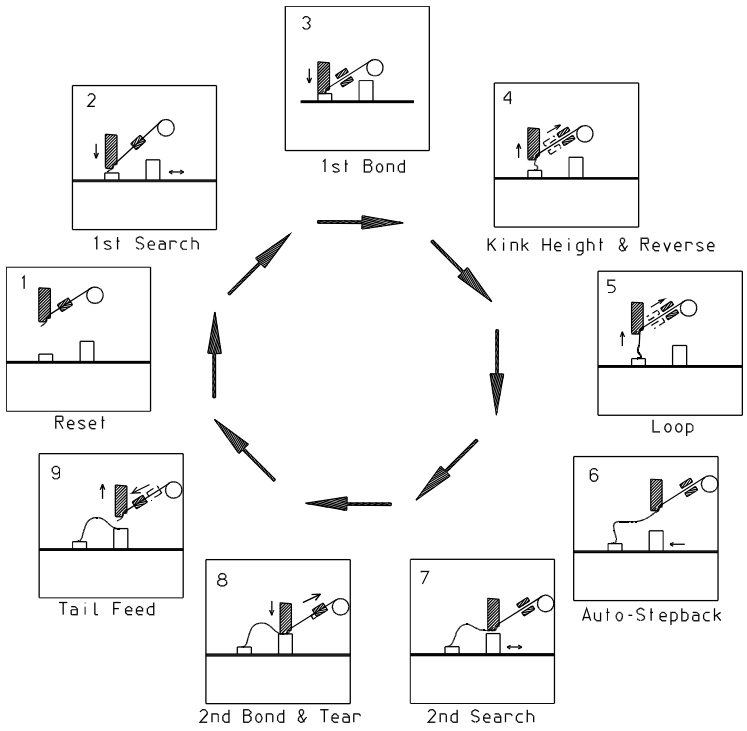


Figure 6-4: Wedge Bonding Cycle in Semi Automatic Mode - 30°/45° Wire Feed

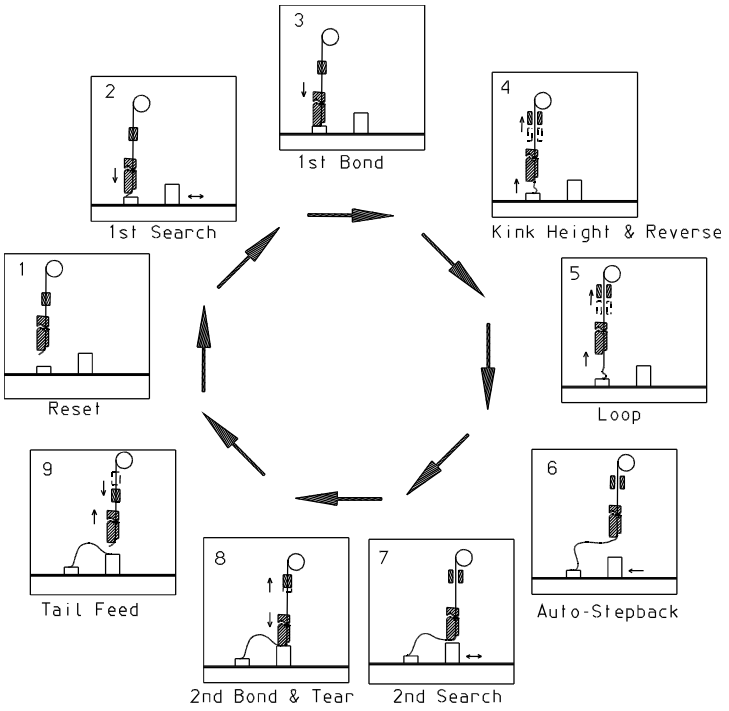


Figure 6-5: Wedge Bonding Cycle in Semi Automatic Mode - 90° Wire Feed

To perform Standard Mode Manual Z wedge bonding:

1 Press the MANUAL key on the Keypad. The green LED lights.

2 Press and hold the **Manual Z Control Button** of the Multi Mouse. Lower the bonding head as close as you want to the bonding pad. Move the Multi Mouse to maneuver the first bonding pad precisely under the wedge.

3 Continue pressing the **Manual Z Control Button** to drop the bonding head to the bonding pad and perform the bond as in the Semi Auto mode. The bonding head rises automatically to the Kink height, and then travels in a reverse motion to the Loop height.

4 Release the **Manual Z Control Button** slowly to raise the bonding head to the Loop height.

5 Move the Multi Mouse to position the second bonding pad directly under the wedge.

Note: If you are using a stitch bond schedule repeat steps 2-5 to perform the number of stitches required by the program.

6 To perform the second bond, repeat steps 2-3.

7 Release the **Manual Z Control Button** to raise the bonding head to the Reset position.

To perform Standard Mode Automatic Wedge Bonding:

1 Ensure that the bonding head is in the Reset position, that the green LED next to the MANUAL control button is Off and that the AUTO setting in the Modes Screen is set to On.

2 Position the workholder so that the bonding pad is under the wedge. Ensure that the wire clamp is closed.

3 Press and hold the **Semi Auto Pushbutton** of the Multi Mouse. The bonding head descends to the first Search height (set by the SEARCH parameter) and stops.

4 While still holding the **Semi Auto Pushbutton**, move the Multi Mouse to position the first bonding pad precisely under the wedge.

5 Release the Semi Auto Pushbutton on the Multi Mouse. The bonding head performs the first bond, the loop and the second bond, then rises to the Reset height and returns to the position of the first bond.

Note: If any additional two-wire bonds are defined, instead of returning to the first bond schedule, the cursor will move to the first bond of the next wire. To perform a stitch bond schedule, repeat steps 2-5.

6.2.2 Lange Coupler Mode Wedge Bonding

(Graphic representations of the cycle appear in Figure 6-6 and Figure 6-7).

Lange couplers may be present in some high frequency microwave amplifiers. A typical Lange coupler requires a series of extremely short and low wire loops connecting thin film leads. Regular wedge bonding cannot achieve loop heights that are low enough. Therefore, the 4523AD has a special Lange coupler bonding capability. In Lange Coupler mode, bonding may be performed semi-automatically as in regular wedge bonding.

Operating procedures are similar to the Standard mode. In Lange Coupler mode, after performing the first bond, the bonding head rises to Loop height and performs the Stepback (without performing the Kink).

After performing the second bond, the table moves automatically backwards to perform the required wire bending, creating a very low loop.

Note: To achieve higher resolution in Lange Coupler mode, the maximum travel range of the Stepback is reduced from 4.0mm (0.16") to 0.5mm (0.02").

6.2.3 Table Tear Mode Wedge Bonding

(A graphic representation of the cycle appears in Figure 6-8).

In the Table Tear mode, wire termination is achieved by motorized table motion. The Table Tear mode is available for all the operation methods (Manual Z, Semi Auto, and Automatic).

Operation steps are similar to standard wedge bonding (see section 6.2.1). After the second bond, the bonding head automatically rises to Second Z height (set by RV3) and the table moves forward to create the tail. Then, the table moves automatically forward to perform the Tear operation and returns to the Reset position.

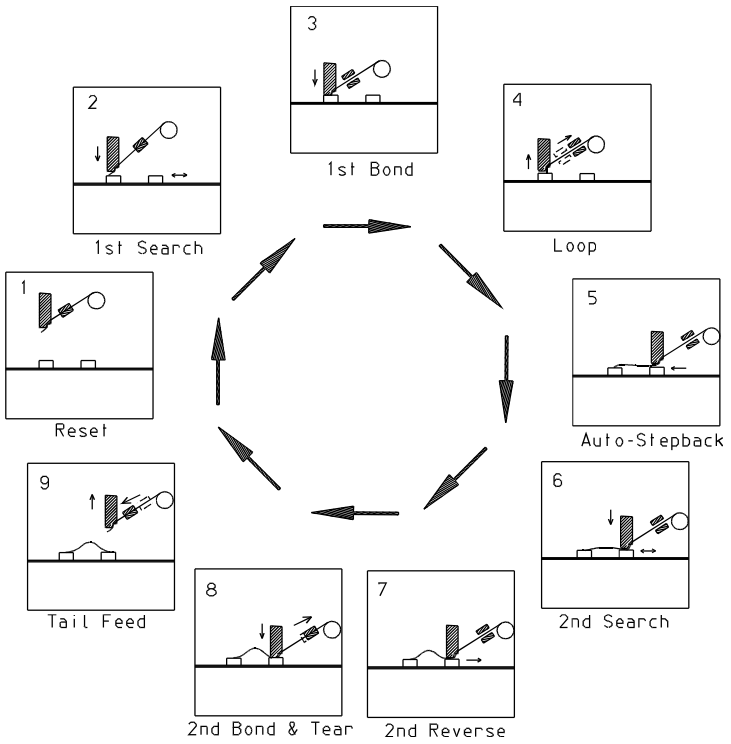


Figure 6-6: Wedge Bonding Cycle in Lange Coupler Mode - 30°/45° Wire Feed

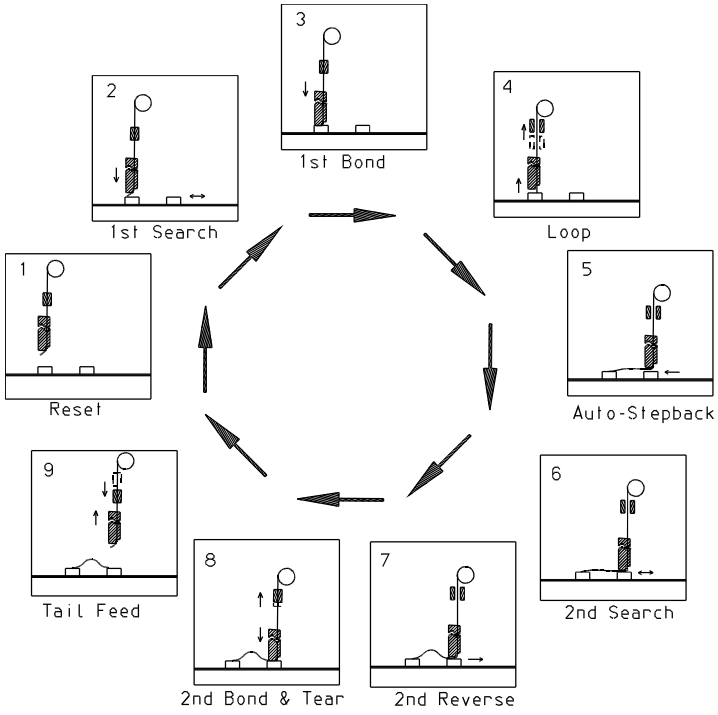


Figure 6-7: Wedge Bonding Cycle in Lange Coupler Mode - 90° Wire Feed

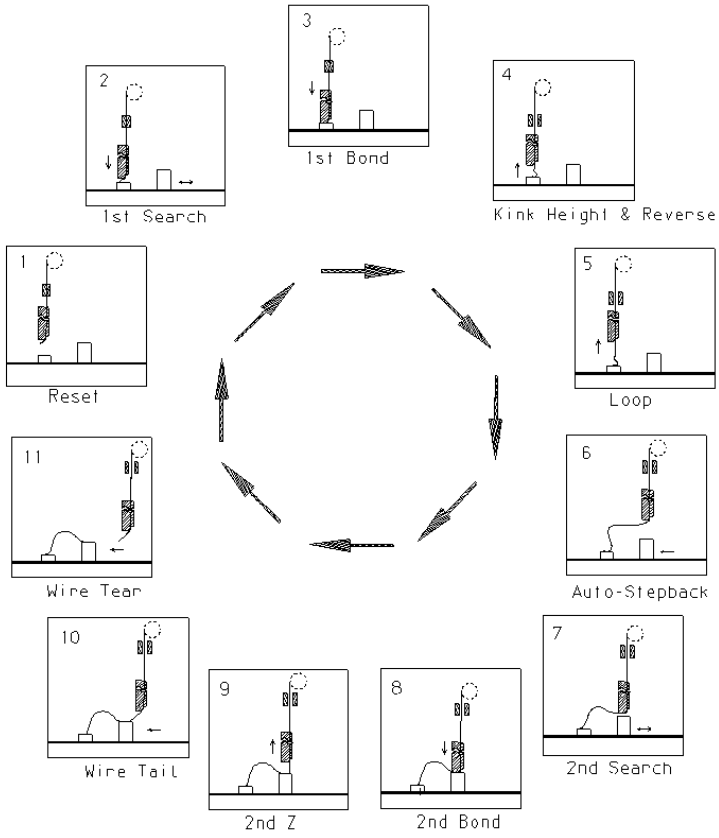


Figure 6-8: Wedge Bonding Cycle in Table Tear Mode - 30°/45° Wire Feed

6.2.4 Off-Line Operations 4523AD

6.2.4.1 Initial Parameters and Machine Setting

The following adjustments and parameters are recommended for selected wires. Final bonding parameters should be optimized using microscopic analysis and destructive tests.

Table 6-3: Recommended Machine Adjustments - 30°/45° Wire Feed

Parameter	Setting			
	18 µm Gold	**25 µm Gold**	**25 µm Alum**	**25 x 125 µm Ribbon**
Static bond force (gm)	7 - 10	15	15	15
Wire clamp gap (µm)	70	100	100	100
Wire clamp force (gm)	80 - 100	80 - 100	80 - 100	100 - 120
Workholder temperature (°C)	150	150		150
Initial Bond Parameter Settings				
First POWER	0 - 1	1 - 2	1 - 2	2 - 4
First TIME	3*	5*	4	5*
First FORCE	0 - 1	1 - 2	1 - 2	4 - 5
First FORCE (gm)	12 - 14	25 - 30	25 - 30	60 - 80
LOOP	3	4	4	4
Second POWER	1 - 2	1.5 - 2.5	1.5 - 2.5	2.5 - 4.5
Second TIME	3*	5*	5	5*
Second FORCE	0 - 1	1 - 2	1 - 2	5
Second FORCE (gm)	14 - 16	25 - 30	25 - 30	60 - 80
TAIL	3	5	5	7
TEAR	4	5	5	5
STEP BACK	1 - 2	2 - 3	2 - 3	4 - 6
REVERSE	2 - 3	3	3	3

Table 6-3: Recommended Machine Adjustments - 30°/45° Wire Feed				
Parameter	**Setting**			
KINK HEIGHT	2	2	2	3
Y SPEED	2	2	2	2
Wires				
Gold	The smaller the wire diameter, the harder the wire should be. The recommended elongation is: 0.5 - 2% for18 μm wire 6 - 8% for 76 μm wire.			
Aluminum	1% Silicon wire with elongation of 1 - 3%.			

* Operate the bonder in Long time mode.

Table 6-4: Recommended Machine Adjustments - 90° Wire Feed Deep Access				
Parameter	**Setting**			
	18 μm Gold	**25 μm Gold**	**25 μm Alum**	**25 x 125 μm Ribbon**
Static bond force (gm)	7 - 10	15	15	15
Wire clamp gap (μm)	70	100	100	100
Wire clamp force (gm)	80 - 100	80 - 100	80 - 100	100 - 120
Workholder temperature (°C)	150	150		150
Initial Bond Parameter Settings				
First POWER	0 - 1	1 - 2	1 - 2	2 - 4
First TIME	3*	4*	5	5*
First FORCE	0 - 1	1 - 2	1 - 2	4 - 5
First FORCE (gm)	15 - 20	25 - 30	25 - 30	60 - 80
LOOP	3	4	4	5
Second POWER	0 - 1	1 - 2	1 - 2	2 - 4
Second TIME	3*	4*	5	5*
Second FORCE	0 - 1	1 - 2	1 - 2	4 - 5

Table 6-4: Recommended Machine Adjustments - 90° Wire Feed Deep Access				
Parameter	**Setting**			
Second FORCE (gm)	15 - 20	25 - 30	25 - 30	60 - 80
TAIL	3	5	5	3**
TEAR	4	5	5	6
STEP BACK	1 - 2	1.5 - 2.5	1.5 - 2.5	2 - 3
REVERSE	2 - 3	2 - 3	2 - 3	3 - 4
KINK HEIGHT	2	2	2	2 - 3
Y SPEED	0	2	2	3
Wires				
Gold	The smaller the wire diameter, the harder the wire should be. The recommended elongation is: 0.5 - 2% for18 μm wire 6 - 8% for 76 μm wire.			
Aluminum	1% Silicon wire with elongation of 1 - 3%.			

* Operate the bonder in Long time mode.

** Operate the bonder in Long Tail Length mode.

6.2.4.2 Bond Strength Optimization

Bond strength depends on the following main parameters:

- Metalization - the bondability and the adhesion of the die and the substrate metals
- Wire type, tensile strength and elongation
- Wedge type
- Bonding parameter settings
- Workholder temperature (for gold wire)

Using a pull tester, perform a series of tests such as wire loop pull testing and microscopic analysis of the squashed wire dimensions. Be aware that loop height and the distance from the first bond to the second bond affect the results of pull test measurements.

Figure 6-9 shows typical bonds and loops performed by Model 4523AD.

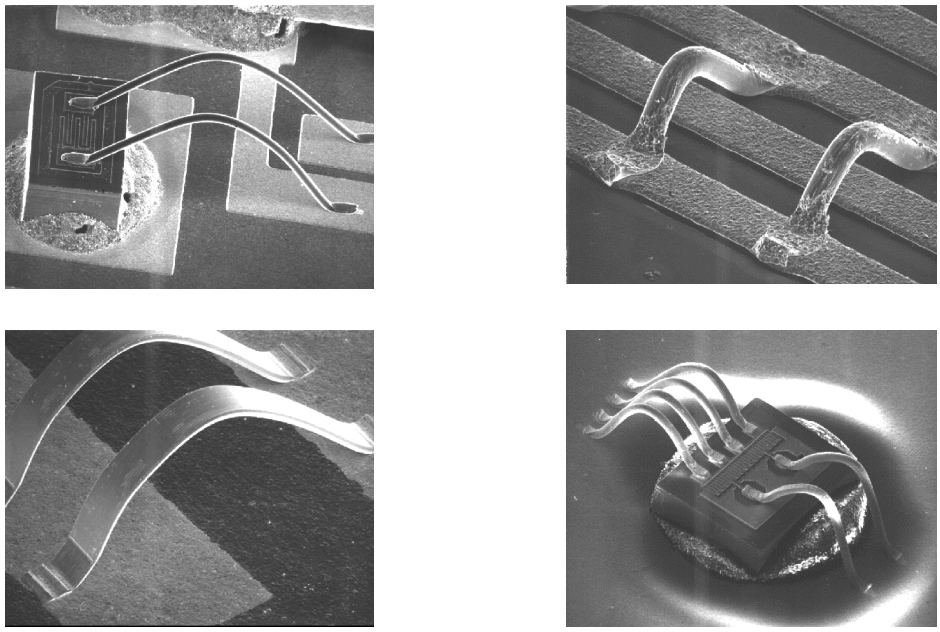


Figure 6-9: Typical Bonds Performed by Model 4523AD

6.3 Operating Model 4524D

This section describes the bond cycle operation modes and operating procedures for the K&S Model 4524D Multi-Process Ball Bonder.

6.3.1 Creating a Ball (manually)

After loading the wire and setting the bonding parameters, but before performing first bond, you must create a ball.

To create a ball:

1. Confirm that the N.E.F.O. unit is On and set the BALL parameter to the recommended setting (see Table 6-5).
2. Press the CLAMP control button to open the wire clamp. The green LED lights.
3. Pull some wire from the capillary tip and bend the wire upwards.
4. Press the CLAMP control button again to close the wire clamp. The LED turns off.
5. Push and hold the N.E.F.O. solenoid, moving the wand to a position under the wire.
6. Press the MANUAL SPARK control button.
7. Verify that a spark was generated and a ball created (in case a ball was not created, repeat steps 1-6).

The 4524D can operate in the following bonding modes:

- Standard mode ball bonding
- Ball bumping mode
- Single Point TAB mode

6.3.2 Standard Mode Ball Bonding

The 4524D performs standard mode ball bonding using Semi Auto or Manual Z operation.

Note: A graphic representation of the cycle appears in Figure 6-10.

To perform Standard Mode Semi Auto bonding:

1 Ensure that the bonding head is in the Reset position and that the Mode is set to STANDARD.

2 Position the workholder so that the bonding pad is under the capillary. Ensure that the ball is ready and that the drag and wire clamps are closed.

3 Press and hold the **Semi Auto Pushbutton**. The wire clamp opens and the kicker pulls out wire slack from the wire spool. The bonding head descends to the first Search height and stops. The drag clamp pulls the wire so that the ball is seated against the capillary tip.

4 While still holding the **Semi Auto Pushbutton**, move the Multi Mouse to position the first bonding pad precisely under the capillary.

5 Release the **Semi Auto Pushbutton**. The bonding head descends to the first bonding pad. The first bonding force and ultrasonic energy (set by the FORCE and POWER parameters) are applied for the time set by the TIME parameter. The first bond is performed, the drag clamp opens and the kicker is released.

After completing the first bond, the bonding head automatically rises to the Loop height (set by the LOOP parameter) and stops.

6 Move the Multi Mouse to position the second bonding pad directly under the capillary.

7 Press and hold the **Semi Auto Pushbutton**. The bonding head drops to the second Search height and stops.

8 While still pressing the **Semi Auto Pushbutton**, move the Multi Mouse to position the second bonding pad precisely under the capillary.

9 Release the **Semi Auto Pushbutton**. The bonding head descends to the second bond pad. The second bond force and ultrasonic energy (set by the second bond schedule FORCE and POWER parameters respectively) are applied for the time set by the second bond schedule Time parameter.

The bonding head rises automatically to the Reset position. The wire clamp closes, after which the wire is snapped, creating a tail for a new ball.

The bonding head remains in the Reset position. The N.E.F.O. wand approaches the tail and fires. A new ball is created for the next bonding cycle.

Note: You can create a multi-wire bond schedule by pressing the ADD key. This procedure is fully described in the Programming section of Chapter 4.

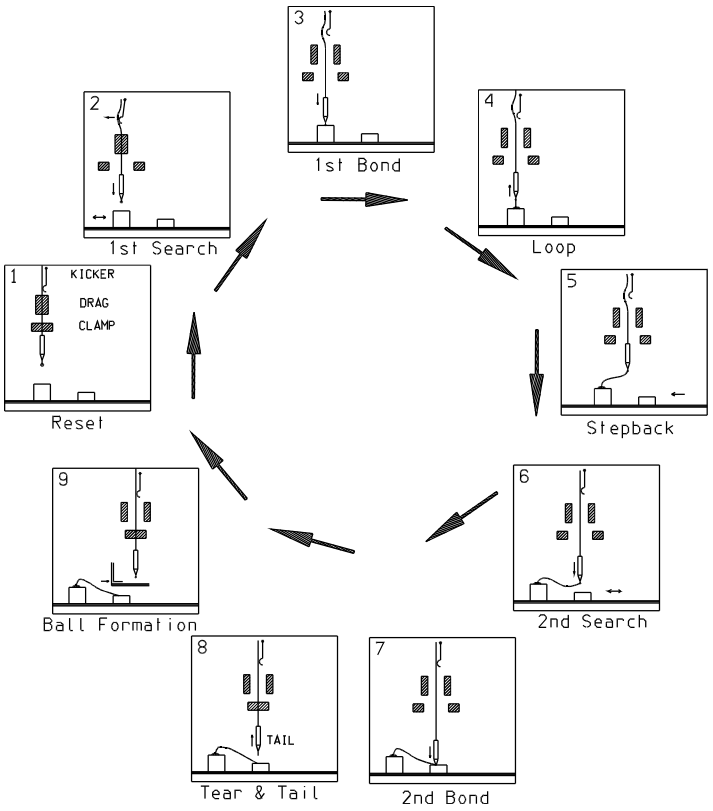


Figure 6-10: Ball Bonding Cycle in Semi Automatic Setting (Model 4524D)

To perform Standard Mode Manual Z bonding:

1 Press the MANUAL key on the Keypad. The green LED lights.

2 Use the **Manual Z Control Button** of the Multi Mouse to lower the bonding head as close as you want to the bonding pad. Move the Multi Mouse to position the first bonding pad precisely under the capillary.

3 Continue pressing the **Manual Z Control Button** to drop the bonding head to the bonding pad and perform the bond as in the Semi Auto mode.

4 Release the **Manual Z Control Button** slowly to raise the bonding head to the Loop height.

5 Move the Multi Mouse to position the second bonding pad directly under the capillary.

6 To perform the second bond, repeat steps 2 and 3.

7 The bonding head rises to the Reset position automatically. The N.E.F.O. then fires to create a ball for the next bonding cycle. Release the **Manual Z Control Button** to start the next cycle.

6.3.3 Ball Bumping Mode Ball Bonding

The 4524D performs ball bumping mode ball bonding using Semi Auto or Manual Z operation.

Note: A graphic representation of the cycle appears in Figure 6-11.

To perform Ball Bumping Mode Semi Auto ball bonding:

1 Ensure that the bonding head is in the Reset position and that the Mode is set to BALL BUMPING.

2 Press and hold the **Semi Auto Pushbutton**. The bonding head lowers to the first Search height.

3 While still pressing the **Semi Auto Pushbutton**, move the Multi Mouse to position the bonding pad precisely under the capillary.

4 Release the **Semi Auto Pushbutton**. The bonding head drops to the bonding pad to perform the bond.

5 The bonding head rises from the bonding pad, forming a tail. The wire clamp closes to tear the wire. The bonding head then rises to the Reset position. The N.E.F.O. fires to create a ball for the next bonding cycle.

On the Display the bond schedule moves to the next bond number (if defined).

Note: You can create a multiple ball bumping schedule by pressing the ADD key. This procedure is fully described in the Programming section of Chapter 4.

To perform Ball Bumping Mode manual Z bonding:

1 Press the MANUAL key on the Keypad. The green LED lights.

2 Use the **Manual Z Control Button** of the Multi Mouse to lower the bonding head as close as you want to the bonding pad. Move the Multi Mouse to position the first bonding pad precisely under the capillary.

3 Continue pressing the **Manual Z Control Button** to drop the bonding head to the bonding pad and perform the bond as in the Semi Auto mode.

4 The bonding head rises to the Reset position automatically. The N.E.F.O. then fires to create a ball for the next cycle. Release the **Manual Z Control Button** to start the next cycle.

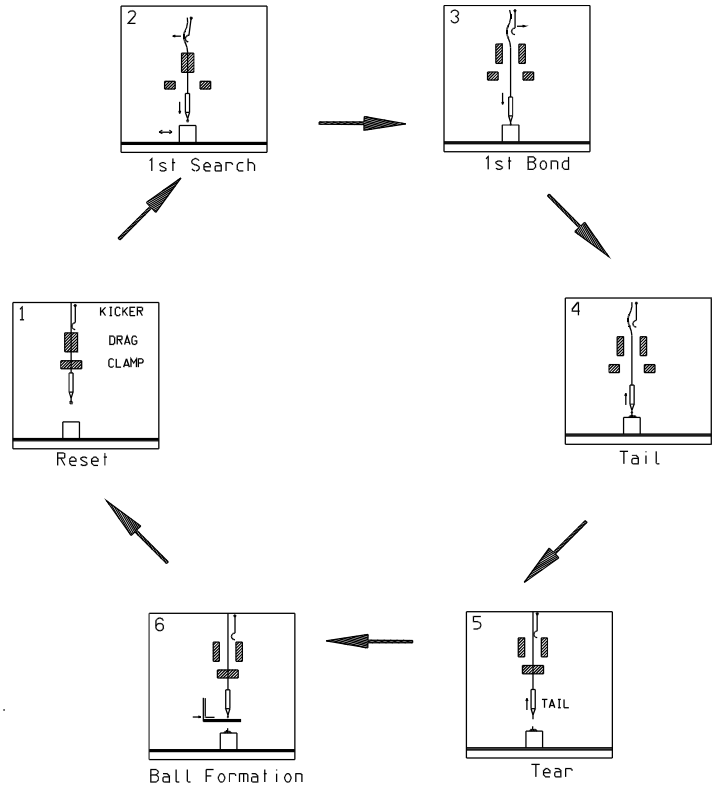


Figure 6-11: Ball Bonding Cycle in Semi Automatic Operation (Model 4524D)

6.3.4 Single Point TAB Mode Ball Bonding

The Single Point TAB bond cycle is used to bond single points. The 4524D performs Single Point TAB mode ball bonding using Semi Auto or Manual Z operation.

Note: A graphic representation of the cycle appears in Figure 6-12.

To perform Single Point TAB Mode Semi Auto bonding:

1 Ensure that the bonding head is in the Reset position and that the Mode is set to S. POINT TAB.

2 Press and hold the **Semi Auto Pushbutton** of the Multi Mouse. The bonding head lowers to the Search height.

3 While still pressing the **Semi Auto Pushbutton**, move the Multi Mouse to position the lead precisely under the tab tool.

4 Release the **Semi Auto Pushbutton**. The bonding head drops to the bonding pad to perform the bond. The bonding head rises from the bonding pad to the Reset position. On the Display, the bond schedule moves to the next number (if defined). If there is more than one bond to be made, the bonding head rises to the Loop height.

5 Repeat steps 2 - 4 until reaching the last bond. After making the last bond, the bonding head rises to the Reset position.

6 Press and hold the **Semi Auto Pushbutton**. The bonding head drops to the first Search height.

7 Press and release the **Stitch Pushbutton** to return to the Reset position.

Note: You can create a multiple S.P.T schedule by pressing the ADD key. This procedure is fully described in the Programming section of Chapter 4.

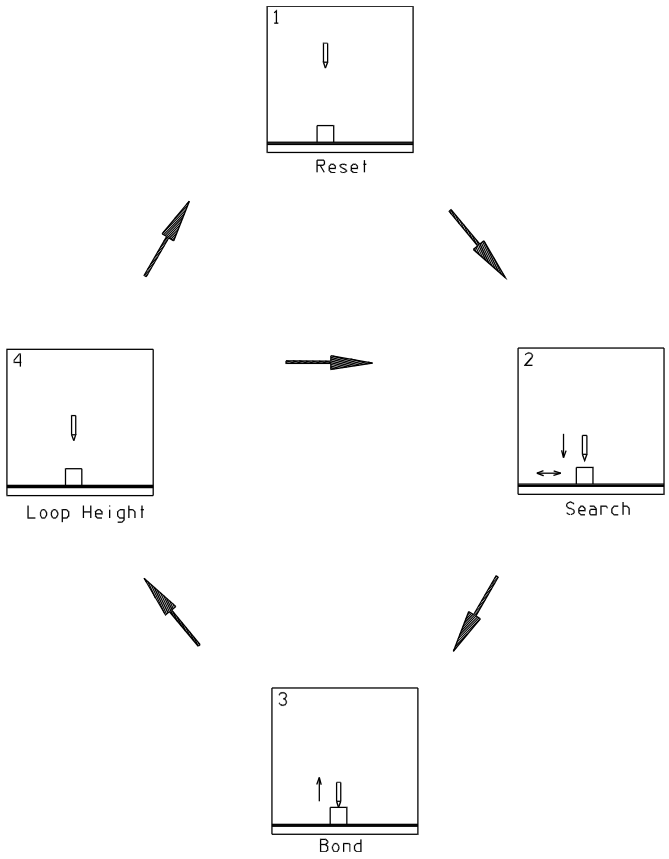


Figure 6-12 Single Point TAB Cycle in Semi-Automatic Mode

To perform Single Point TAB Mode Manual Z bonding:

1 Press the MANUAL key on the Keypad. The green LED lights.

2 Use the **Manual Z Control Button** of the Multi Mouse to lower the bonding head as close as you want to the bonding pad. Move the Multi Mouse to position the first bonding pad precisely under the capillary.

3 Continue pressing the **Manual Z Control Button** to drop the bonding head to the bonding pad and perform the bond as in the Semi Auto mode.

4 The bonding head rises to the Reset position automatically. Release the **Manual Z Control Button** to start the next cycle.

Note: If any additional bonds are defined, the bonding head will not return to the Reset position after performing the bond. In this case, use the **Manual Z Control Button** to raise the bonding head to a position as close as required to the bonding pad, then move the Multi Mouse to position the next bonding pad and repeat steps 3-4 above.

6.3.5 Off-Line Operations 4524D

6.3.5.1 Initial Parameters and Machine Setting

The following adjustments and parameters are recommended for selected wires. Final bonding parameters should be optimized using microscopic analysis and destructive tests.

Table 6-5: Recommended Machine Adjustments

Parameter	Setting		
	25 µm Gold	**30 µm Gold**	**50 µm Gold**
Wire clamp gap (µm)	80	100	120
Wire clamp force (gm)	100	100	120
Drag clamp gap (µm)	250	350	500
Drag clamp force (gm)	6	10	10
N.E.F.O. Wand distance from capillary at Reset (µm)	500	570	625
N.E.F.O. ball size	1.5 - 2.5	2.5 - 4.5	5 - 7
Tail length	4 - 5	5 - 6	6 - 7
Initial Bond Parameter Settings			
1st POWER	1 - 2	1.5 - 2.5	2 - 3
1st TIME	5	4 - 10	5*
1st FORCE	1 - 2	2 - 3	4 - 5
1st FORCE (gm)	40	60	80
LOOP	4	5	7
Second POWER	2 - 3	3 - 4	6 – 8
Second TIME	5 - 7	10	3 - 5*
Second FORCE	4 - 6	7	8 - 10
2nd FORCE (gm)	80	100	120

Table 6-5: Recommended Machine Adjustments	
Parameter	**Setting**
Wires	Loop control is better if the elongation is higher.
Ball Bonding	Recommended wire is 99.99% gold with 2 - 6% elongation.
Ball Bumping	Recommended wire is 98% gold, 2% palladium with 2 - 4% elongation.

* Operate the bonder in Long time mode.

Each bonder is factory-set for bonding 25 µm (0.001") gold wire, 2-4% elongation.

For wire diameter 38 µm or larger, use clamps with ceramic jaws.

6.3.6 Missing Ball Detector

The missing ball detector is integrated within the N.E.F.O. system. If the N.E.F.O. system fails to create a ball, the missing ball detector stops bonder operation.

- The SHORT indicator turns on if a small gap exists between the tail and the wand.
- The OPEN indicator turns on if a large gap exists between the tail and the wand.

To correct a missing ball condition

1 Readjust the tail length or the wand gap.

2 Press the CLAMP control button. The LED turns on and the clamp opens.

3 Pull more wire through the capillary and bend the wire below the capillary tip.

4 Press the CLAMP control button again. The LED turns off and the clamp closes. The bonding head moves to the second Search height and is ready to perform the next bond.

5 Perform the next bond. The bonder will then create a ball for the next cycle.

Note: If you prefer not to use the automatic missing ball detector mechanism, you can create a ball manually by:

1 Turning off the N.E.F.O control button

2 Resetting the bonder

3 Turning on the N.E.F.O

4 Creating a manual spark, see section 6.3.1.

6.3.7 Capillaries and Wires

For best results, use MicroSwiss capillaries. For a list of recommended capillaries, see section 5.1.2.

Always use the setup gauge when installing the capillary. After installing a new capillary, reset the bonder.

Be aware that the hole of the capillary applies some friction on the wire during loop creation. If the hole diameter is too small, wire friction results in loop height variations which are difficult to control. A soft wire produces higher loops than a hard wire, which is important when making long loops.

6.3.8 Factors Influencing Loop Height (Standard Cycle)

The factors influencing the loop height of a wire bonded on the 4524D at a specific distance with a specific height difference are:

LOOP Parameter Setting	For longer distances between the wire bonds, a higher parameter setting is required.
Wire Tension	The higher the tension on the wire as it is pulled out of the spool, the lower the loop will be. Wire tension is controlled by the fixed tensioner glass plate.
Kicker Stroke	The kicker may be used to form loops in long wires by pulling a greater length of wire from the spool and neutralizing the fixed tensioner during wire manipulation.
Wire Elongation Coefficient	A wire with a low elongation coefficient (hard wire) produces lower loops than a wire with a high elongation coefficient (soft wire). Typically, wires with elongation coefficients of 2 - 4% are used for ball bonding.

6.3.9 Bond Strength Optimization

Bond strength depends on the following main parameters:

- Metalization - the bondability and the adhesion of the die and the substrate metals
- Wire type, tensile strength and elongation
- Capillary type
- Ball size
- Bonding parameter settings
- Workholder temperature

Using a bond shear tester, perform a series of tests such as wire loop pull testing and microscopic analysis of the squashed wire dimensions. Be aware that loop height and the distance from the first bond to the second bond affect the results of pull test measurements.

Figure 6-13 shows typical bonds and loops performed by Model 4524D.

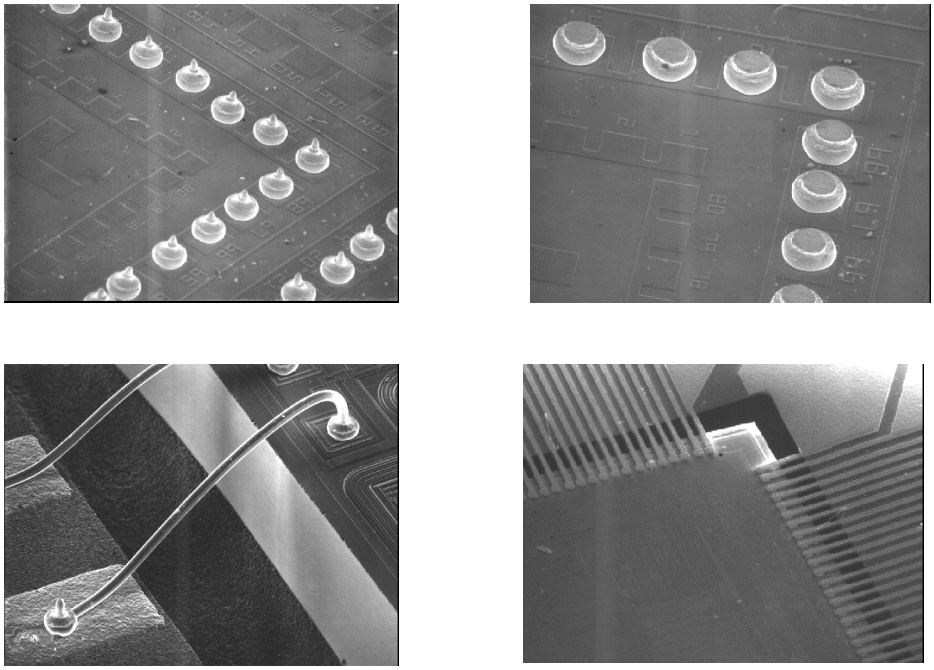


Figure 6-13: Typical Bonds Performed by Model 4524D

6.4 Operating Model 4524AD

This section describes the bond cycle operation modes and operating procedures of the K&S Model 4524AD Multi Process Auto Stepback Ball Bonder.

6.4.1 Creating a Ball (manually)

After loading the wire and setting the bonding parameters, but before performing bonding, you must create a ball.

To create a ball:

1. Power on the N.E.F.O. unit and set the BALL parameter to the recommended setting (see Table 6-6).
2. Press the CLAMP control button to open the wire clamp. The green LED lights.
3. Pull some wire from the capillary tip and bend the wire upwards.
4. Press the CLAMP control button again to close the wire clamp. The LED turns off.
5. Push and hold the N.E.F.O. solenoid, moving the wand to a position under the wire.
6. Press the MANUAL SPARK control button.
7. Verify that a spark was generated and a ball created (in case a ball was not created, repeat steps 1-6).

The 4524AD can operate in the following bonding modes:

- Standard Mode
- Ball bumping Mode
- Single Point TAB Mode

6.4.2 Standard Mode Ball Bonding

The 4524AD performs standard mode ball bonding using Manual Z , Semi Auto or automatic operation.

Note: A graphic representation of the cycle appears in Figure 6-14.

To perform Standard Mode Semi Auto ball bonding:

1 Ensure that the bonding head is in the Reset position and that the Mode is set to STANDARD.

2 Position the workholder so that the bonding pad is under the capillary. Ensure that the ball is ready and that the drag and wire clamps are closed.

3 Press and hold the **Semi Auto Pushbutton**. The wire clamp opens and the kicker pulls out wire slack from the wire spool. The bonding head descends to the first Search height and stops. The drag clamp pulls the wire so that the ball is seated against the capillary tip.

4 While still holding the **Semi Auto Pushbutton**, move the Multi Mouse to position the first bonding pad precisely under the capillary.

5 Release the **Semi Auto Pushbutton**. The bonding head descends to the first bonding pad. The first bonding force and ultrasonic energy (set by the FORCE and POWER parameters) are applied for the time set by the TIME parameter. The first bond is performed, the drag clamp opens and the kicker is released.

The bonding head rises automatically to the Kink height position and travels in a reverse motion to form the Loop shape. The bonding head then automatically performs Loop height and the table steps forward to the second bond position.

6 While still pressing the **Semi Auto Pushbutton**, move the Multi Mouse to position the second bonding pad precisely under the capillary.

7 Release the **Semi Auto Pushbutton**. The bonding head descends to the second bond pad. The second bond force and ultrasonic energy (set by the second bond schedule FORCE and POWER parameters respectively) are applied for the time set by the second bond schedule TIME parameter.

The bonding head rises automatically to the Reset position. The wire clamp closes, after which the wire is snapped, creating a tail for a new ball.

The bonding head remains in the Reset position. The N.E.F.O. wand approaches the tail and fires. A new ball is created for the next bonding cycle.

Note: You can create a two-wire bond schedule by pressing the ADD key. This procedure is fully described in the Programming section of Chapter 4.

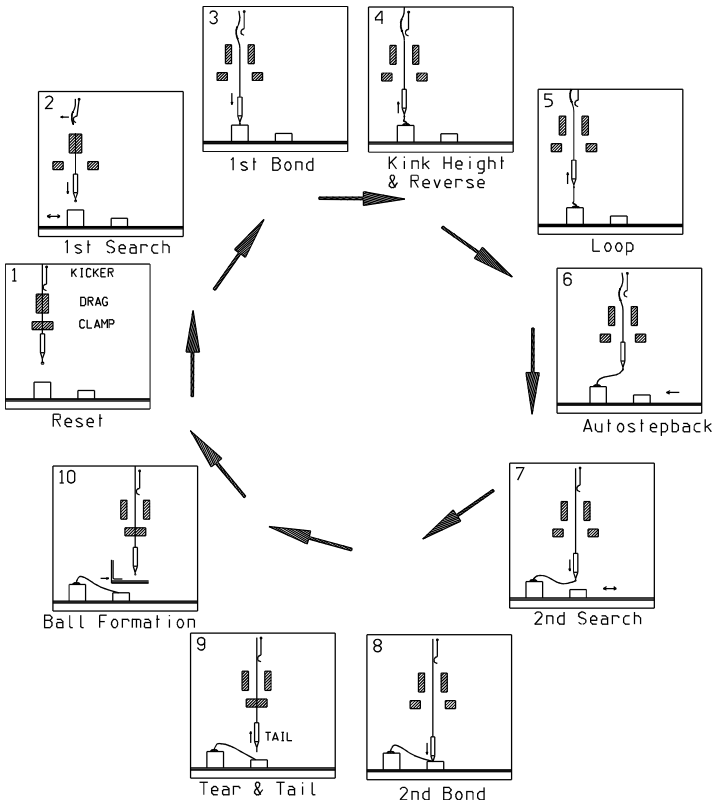


Figure 6-14 Ball Bonding Cycle in Semi Automatic Setting (Model 4524AD)

To perform Standard Mode Manual Z ball bonding:

1 Press the MANUAL key on the Keypad. The green LED lights.

2 Use the **Manual Z Control Button** of the Multi Mouse to lower the bonding head as close as you want to the bonding pad. Move the Multi Mouse to maneuver the first bonding pad precisely under the capillary.

3 Continue pressing the **Manual Z Control Button** to drop the bonding head to the bonding pad and perform the bond as in the Semi Auto mode.

4 Release the **Manual Z Control Button** slowly to raise the bonding head to the Loop height.

5 Move the Multi Mouse to position the second bonding pad directly under the capillary.

6 To perform the second bond, repeat steps 2 and 3.

7 The bonding head rises to the Reset position automatically. The N.E.F.O. then fires to create a ball for the next bonding cycle. Release the **Manual Z Control Button** to start the next cycle.

To perform Standard Mode Automatic Ball Bonding:

1 Ensure that the bonding head is in the Reset position, that the green LED next to the MANUAL control button is Off and that the Auto setting in the Modes Screen is set to On.

2 Position the workholder so that the bonding pad is under the capillary.

3 Press and hold the **Semi Auto Pushbutton**. The wire clamp opens and the kicker pulls out wire slack from the wire spool. The bonding head descends to the first Search height and stops. The drag clamp pulls the wire so that the ball is seated against the capillary tip.

4 While still holding the **Semi Auto Pushbutton**, move the Multi Mouse to position the first bonding pad precisely under the capillary.

5 Release the **Semi Auto Pushbutton** on the Multi Mouse. The bonding head performs the first bond, the loop and the second bond, then rises to the Reset height and returns to the position of the first bond.

Note: If any additional two-wire bonds are defined, instead of returning to the first bond position, the bonding head goes to the Reset height. From there it must be moved manually using the Multi Mouse to the next bond position.

6.4.3 Ball Bumping Mode Ball Bonding

The 4524AD performs standard mode ball bumping using Manual Z, Semi Auto or Automatic operation.

Note: A graphic representation of the cycle appears in Figure 6-15.

To perform Ball Bumping Mode Semi Auto ball bonding:

1 Ensure that the bonding head is in the Reset position and that the MODE is set to BALL BUMPING.

2 Press and hold the **Semi Auto Pushbutton**. The bonding head lowers to the first Search height.

3 While still pressing the **Semi Auto Pushbutton**, move the Multi Mouse to position the bonding pad precisely under the capillary.

4 Release the **Semi Auto Pushbutton**. The bonding head drops to the bonding pad to perform the bond.

The bonding head rises from the bonding pad, forming a tail. The wire clamp closes to tear the wire. The bonding head then rises to the Reset position. The N.E.F.O. fires to create a ball for the next bonding cycle. The table moves forward to the next bond position (if defined this is set by the Step parameter). On the Display the bond schedule moves to the next bond number (if defined).

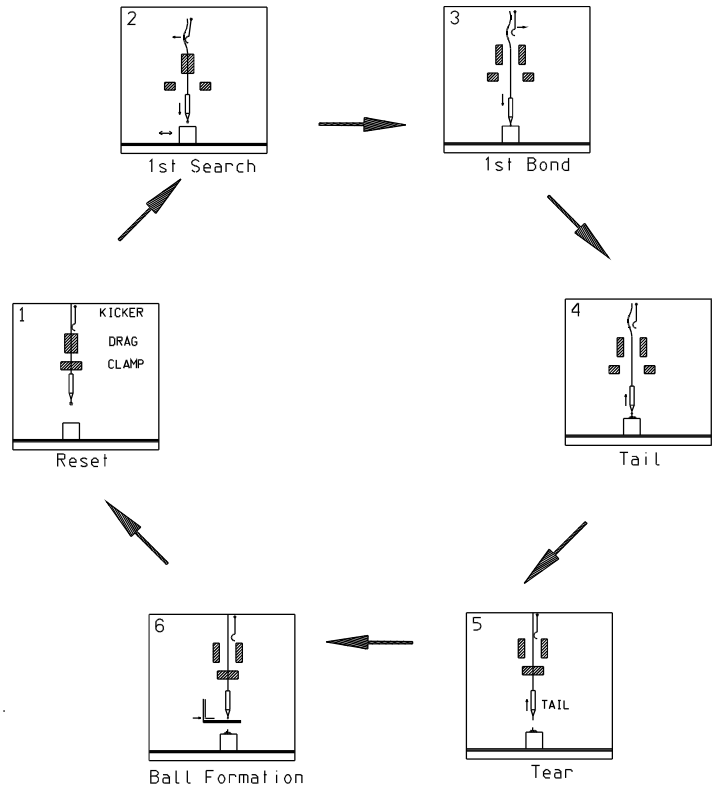


Figure 6-15 Ball Bumping Cycle in Semi Automatic Setting (Model 4524D, 4524AD)

To perform Ball Bumping Mode Manual Z ball bumping:

1 Press the MANUAL key on the Keypad. The green LED lights.

2 Use the **Manual Z Control Button** of the Multi Mouse to lower the bonding head as close as you want to the bonding pad. Move the Multi Mouse to maneuver the first bonding pad precisely under the capillary.

3 Continue pressing the **Manual Z Control Button** to drop the bonding head to the bonding pad and perform the bond as in the Semi Auto mode.

4 The bonding head rises to the Reset position automatically. The N.E.F.O. then fires to create a ball for the next bonding cycle. The table moves forward to the next bond position (if defined this is set by the STEP parameter). On the Display, the bond schedule moves to the next number (if defined).

5 Release the **Manual Z Control Button** to start the next cycle.

Note: If there is more than one bond schedule defined, repeat steps 1-4.

To perform Ball Bumping Mode Automatic Ball Bonding:

1 Ensure that the bonding head is in the Reset position, that the green LED next to the MANUAL control button is Off and that the Auto setting in the Modes Screen is set to On.

2 Position the workholder so that the bonding pad is under the capillary.

3 Press and hold the **Semi Auto Pushbutton**. The bonding head lowers to the first Search height.

4 While still pressing the **Semi Auto Pushbutton**, move the Multi Mouse to position the bonding pad precisely under the capillary.

5 Release the **Semi Auto Pushbutton**. The bonding head drops to the bonding pad to perform the bond.

The bonding head rises from the bonding pad, forming a tail. The wire clamp closes to tear the wire. The bonding head then rises to the Reset position. the N.E.F.O. fires to create a ball for the next bonding cycle. The table moves forward to the next bond position (if defined this is set by the Step parameter). On the Display the bond schedule moves to the next bond number (if defined). The bonding head then drops to the bonding pad again and performs the next bond in the same way.

Note: If there is more than one bond schedule defined, repeat steps 1-4.

6.4.4 Single Point TAB Mode

The Single Point TABS cycle is used to perform tape automated bonding. The 4524AD performs S.P.T mode ball bumping using Manual Z, Semi Auto or Automatic operation.

Note: A graphic representation of the cycle appears in Figure 6-16.

To perform Single Point TAB Mode Semi Auto bonding:

1 Ensure that the bonding head is in the Reset position and that the Mode is set to S. POINT TAB.

2 Press and hold the **Semi Auto Pushbutton** of the Multi Mouse. The bonding head lowers to the Search height.

3 While still pressing the **Semi Auto Pushbutton**, move the Multi Mouse to position the lead precisely under the tab tool.

4 Release the **Semi Auto Pushbutton**. The bonding head drops to the bonding pad to perform the first bond. The bonding head rises from the bonding pad to the Reset position. On the Display, the bond schedule moves to the next number (if defined). If there is more than one bond to be made, the bonding head rises to the Loop height. The table moves forward to a position set by the Step parameter.

5 Repeat steps 2 - 4 until reaching the last bond. After making the last bond, the bonding head rises to the Reset position.

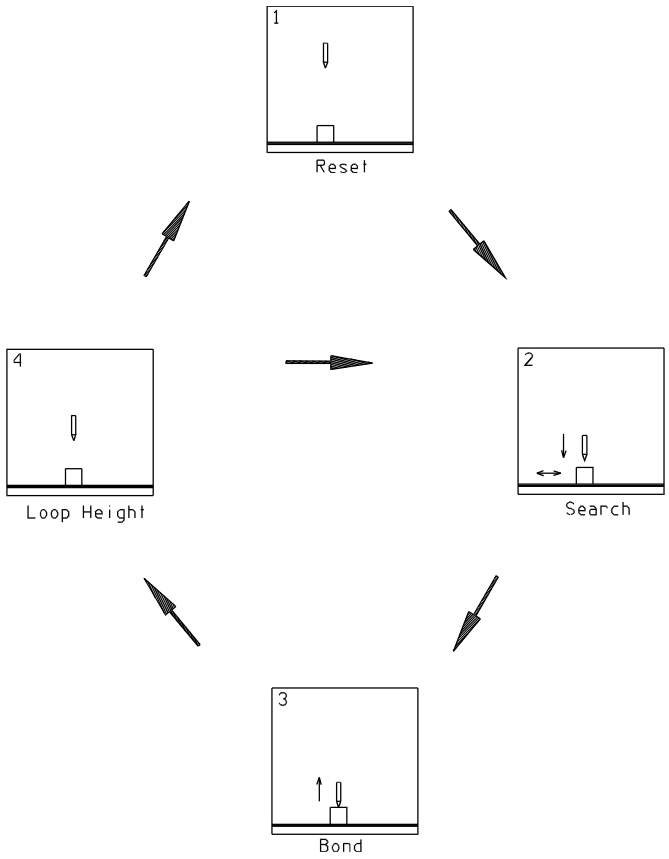


Figure 6-16 Single Point TAB Cycle in Semi-Automatic Mode

To perform Single Point TAB Mode Manual Z ball bumping:

1 Press the MANUAL key on the Keypad. The green LED lights.

2 Use the **Manual Z Control Button** of the Multi Mouse to lower the bonding head as close as you want to the bonding pad. Move the Multi Mouse to maneuver the first bonding pad precisely under the capillary.

3 Continue pressing the **Manual Z Control Button** to drop the bonding head to the bonding pad and perform the bond as in the Semi Auto mode.

4 The bonding head rises to the Reset position automatically. The N.E.F.O. then fires to create a ball for the next bonding cycle. The table moves forward to the next bond position (if defined this is set by the STEP parameter). On the Display, the bond schedule moves to the next number (if defined).

After performing the last bond, the bonding head rises to the Reset position.

Note: If there is more than one bond schedule defined, repeat steps 1-4.

To perform Automatic S.P.T Bonding:

1 Ensure that the bonding head is in the Reset position, that the LED next to the MANUAL control button is off and that the AUTO setting in the Modes screen is On.

2 Position the workholder so that the bonding pad is under the tab tool.

3 Press the **Semi Auto Pushbutton** on the Multi Mouse. The bonding head performs the first bond, then rises to the Reset height and returns to the position of the first bond. If more than one bond is defined, the bonding head rises to Loop height and the table steps forward (as defined by the STEP parameter). The bonding head drops to the next bond position and performs the bond. After the last bond is completed the bonding head returns to the Reset height.

6.4.5 Off-Line Operations 4524AD

6.4.5.1 Initial Parameters and Machine Setting

The following adjustments and parameters are recommended for selected wires. Final bonding parameters should be optimized using microscopic analysis and destructive tests.

Table 6-6: Recommended Machine Adjustments

Parameter	Setting		
	25 µm Gold	**30 µm Gold**	**50 µm Gold**
Wire clamp gap (µm)	80	100	120
Wire clamp force (gm)	100	100	120
Drag clamp gap (µm)	250	350	500
Drag clamp force (gm)	6	10	10
N.E.F.O. Wand distance from capillary at Reset (µm)	500	570	623
N.E.F.O. ball size	1.5 - 2.5	2.5 - 4.5	5 - 7
Tail length	4 - 5	5 - 6	6 - 7
Initial Bond Parameter Settings			
1st POWER	1 - 2	1.5 - 2.5	2 - 3
1st TIME	5	4 - 10	5*
1st FORCE	1 - 2	2 - 3	4 - 5
1st FORCE (gm)	40	60	80
LOOP	4	5	7

Table 6-6: Recommended Machine Adjustments			
Parameter	**Setting**		
Second POWER	2 - 3	3 - 4	6 – 8
Second TIME	5 - 7	10	3 - 5*
Second FORCE	4 - 6	7	8 - 10
2nd FORCE (gm)	80	100	120
STEP	2-3	2-3	4-6
REVERSE	3	3	3
KINK	2	2	3
Y SPEED	2	2	2
Wires	Loop control is better if the elongation is higher.		
Ball Bonding	Recommended wire is 99.99% gold with 2 - 6% elongation.		
Ball Bumping	Recommended wire is 98% gold, 2% palladium with 2 - 4% elongation.		

* Operate the bonder in Long time mode.

Your bonder was factory-set for bonding 25 µm (0.001") gold wire, 2-4% elongation.

For wire diameter 38 µm or larger, use clamps with ceramic jaws.

6.4.6 Missing Ball Detector

The missing ball detector is integrated within the N.E.F.O. system. If the N.E.F.O. system fails to create a ball, the missing ball detector stops bonder operation.

- The SHORT indicator turns on if a small gap exists between the tail and the wand.
- The OPEN indicator turns on if a large gap exists between the tail and the wand.

To correct a missing ball condition:

1 Readjust the tail length or the wand gap.

2 Press the CLAMP control button. The LED turns on and the clamp opens.

3 Pull more wire through the capillary and bend the wire below the capillary tip.

4 Press the CLAMP control button again. The LED turns off and the clamp closes. The bonding head moves to the second Search height and is ready to perform the next bond.

5 Perform the next bond. The bonder will then create a ball for the next cycle.

Note: If you prefer not to use the automatic missing ball detector mechanism, you can create a ball manually by turning off the N.E.F.O control button, resetting the bonder, turning on the N.E.F.O, and then creating a manual spark (see section 6.3.1).

6.4.7 Capillaries and Wires

For best results, use MicroSwiss capillaries. For a list of recommended capillaries, see section 5.1.2.

Always use the setup gauge when installing the capillary. After installing a new capillary, reset the bonder.

Be aware that the hole of the capillary applies some friction on the wire during loop creation. If the hole diameter is too small, wire friction results in loop height variations which are difficult to control. A soft wire produces higher loops than a hard wire, which is important when making long loops.

6.4.8 Factors Influencing Loop Height (Standard Cycle)

The factors influencing the loop height of a wire bonded on the 4524AD at a specific distance with a specific height difference are:

LOOP Parameter Setting	For longer distances between the wire bonds, a higher parameter setting is required.
Wire Tension	The higher the tension on the wire as it is pulled out of the spool, the lower the loop will be. Wire tension is controlled by the fixed tensioner glass plate.
Kicker Stroke	The kicker may be used to form loops in long wires by pulling a greater length of wire from the spool and neutralizing the fixed tensioner during wire manipulation.
Wire Elongation Coefficient	A wire with a low elongation coefficient (hard wire) produces lower loops than a wire with a high elongation coefficient (soft wire). Typically, wires with elongation coefficients of 2 - 4% are used for ball bonding.

6.4.9 Bond Strength Optimization

Bond strength depends on the following main parameters:

- Metalization - the bondability and the adhesion of the die and the substrate metals
- Wire type, tensile strength and elongation
- Capillary type
- Ball size
- Bonding parameter settings
- Workholder temperature

Using a bond shear tester, perform a series of tests such as wire loop pull testing and microscopic analysis of the squashed wire dimensions. Be aware that loop height and the distance from the first bond to the second bond affect the results of pull test measurements.

Figure 6-17 shows typical bonds and loops performed by Model 4524AD.

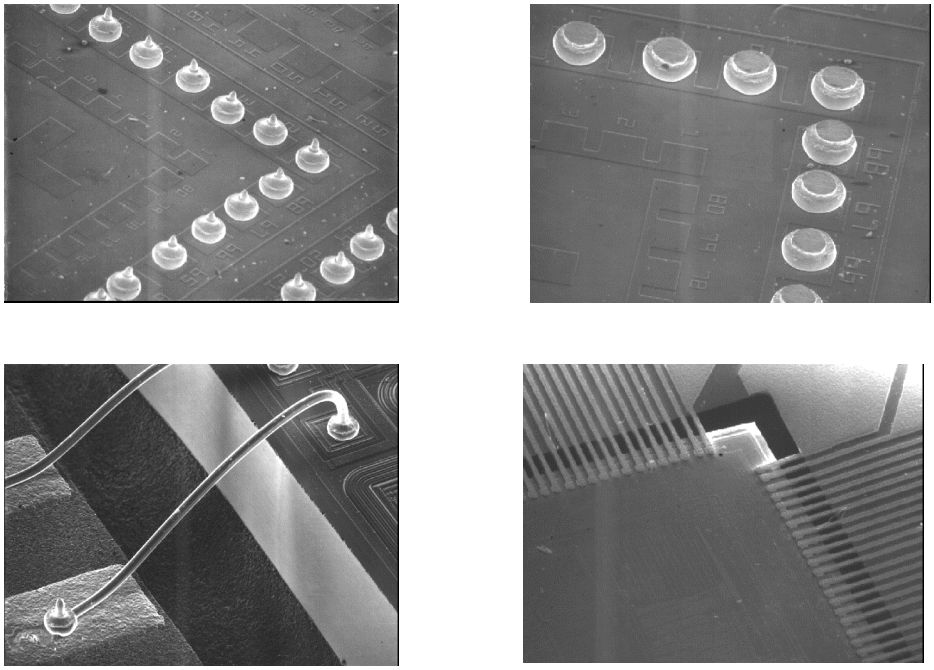


Figure 6-17: Typical Bonds Performed by Model 4524D

7. MAINTENANCE OVERVIEW

The K&S 4500 Digital Series Manual Wire Bonder is a rugged, durable machine, designed to operate trouble-free for many years. However, like any machine, the bonder requires servicing, adjustments, and occasional repairs. Chapters 8-15 provide necessary information to the technician for making repairs and adjustments.

It is assumed that the technician knows how to operate the K&S 4500 Digital Series Manual Wire Bonder.

7.1 General Guidelines

When performing maintenance on the K&S 4500 Digital Series Manual Wire Bonder, adhere to the following general guidelines:

1 Always use the proper tools and equipment, as instructed in the procedures.

2 Never use other than K&S approved spare parts (a complete parts list appears in Chapter 15).

3 If a problem persists after you perform a procedure provided by this manual, refer the problem to your K&S representative. Do not attempt repairs beyond the scope of this manual.

4 Unless otherwise instructed, do not apply oil on any of the parts of the bonder. Oil attracts dust that can interfere with the proper functioning of the parts.

5 Except for adjustments that require bonder operation, perform all maintenance work with the bonder's power off.

7.2 Machine Adjustments Checklist

Because of the interdependence of the electrical and mechanical assemblies for proper bonder operation, the following adjustments appear in the order of their priority. If you perform a specific adjustment, then you must perform the adjustments that follow it in the list. For example, if you perform 18 Vp-p adjustment, then you must also perform Reset Height Adjustment, Verticality Adjustment, and so on down the list.

7.2.1 4524D, 4524AD

1 Reset Height (LVDT) Adjustment (section 9.4)

2 Verticality (Transducer) Adjustment (section 9.5)

3 Force Actuator Adjustment (section 9.3.4)

4 Static Bonding Force Adjustment (section 9.2.3)

5 Wire Path from Kicker to Capillary Alignment (section 5.4)

6 Ultrasonic Free Running Frequency Adjustment (section 8.3.2.1)

7 Ultrasonic Power Adjustment (section 8.3.2.2)

8 Clamp Solenoid Adjustments (section 9.6.2)

9 Drag Clamp Adjustments (sections 9.8.1 and 9.8.2)

10 Kicker Stroke Adjustment (section 9.10.4)

11 N.E.F.O. Wand and Ball Size Adjustment (section 8.2)

12 Bonding Parameters Setup (sections 6.3.5.1 and 6.4.5.1)

7.2.2 4523D, 4523AD

1 Reset Height (LVDT) Adjustment (section 9.4)

2 Transducer Insertion Depth - should be performed according to the wedge type and together with the Clamp Position Adjustment (section 9.5)

3 Verticality (Transducer) Adjustment (section 9.5)

4 Force Actuator Adjustment (section 9.3.4)

5 Static Bonding Force Adjustment (section 9.2.3)

6 Clamp Gap and Force Adjustment (section 9.6.2)

7 Clamp Lateral Position Adjustment (section 9.6.3)

8 Ultrasonic Free Running Frequency Adjustment (section 8.3.2.1)

9 Ultrasonic Power Adjustment (section 8.3.2.2)

10 Bonding Parameters Setup (sections 6.1.2.1 and 6.2.4.1)

16. INDEX

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