DL-NCD Door Light Cut-Out Machine

Operation and Service Manual

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CHAPTER 1  Introduction to the DL-NCD

This chapter provides an overview of the KVAL DL-NCD machine and important safety information to follow when operating the machine.

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Overview of the DL-NCD

The DL-NCD is a Numerically-Controlled Door Light Cut-Out Machine equipped with AC servo control for all four axes of cutting 'X' (Length of the door), 'Y' (width of the door), 'Z' (Depth into the face of the door), and 'W' (Width adjust of door). The ‘Z’ axis servo control makes it simple to program for security locks where the face bore is machined to a precise depth and also allows the operator to reduce the plunge speed to minimize tear out in the bottom face when machining small diameter holes. When the DL-NCD is used as a drill de-burring on the bottom face may be required.

The DL-NCD is equipped with an automatic feed and width adjust system to automatically receive doors, position the door against the stop, clamp the door and start the machining sequence if the instructions have been downloaded.

The DL-NCD can process doors that vary in height from 6'-8" and 8'-0.

The direct drive high frequency spindle motor for cutting the door is equipped with an Tool Holder and access to three (3) additional tool holders placed in a fixture along the fixed side of the machine. Programs can call for an automatic tool change, feed speed, and RPM adjustment for wood, fiberglass or steel doors.

Individual door light patterns are created at the machine console, or remotely using a standard PC. The DL-NCD includes an industrial PC with a standard Ethernet connection for file transfer and library backup, as well as internet, phone support, and updates from Kval.

About this Manual

This manual contains operation information and service and maintenance information. It includes identification of machine assemblies, power-up and power-down steps, and information about using the user interface.

The Troubleshooting and Maintenance sections are directed toward qualified service technicians.

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Safety First!

This machine is a powerful electro-mechanical motion control system. You should test your motion system for safety under all potential conditions. Failure to do so can result in damage to equipment and/or serious injury to personnel.

Safety Sheet Sign-Off Sheet

At the end of this chapter, there is a safety sign-off sheet. It lists personnel and machine safety criteria to understand before operating the machine. It is highly recommended that personnel operating, working on a machine meet the criteria listed in this sheet. It is recommended the sheet be signed and kept for records. See “Safety Sign-Off Sheet” on page 1-17.

Safety Terminology of Labels

In addition to the nameplate, KVAL machines may have other warning labels or decals that provide safety information to operators. Safety labels should be clearly visible to the operator and must be replaced if missing, damaged, or illegible.

There are three types of warning labels or decals:

- **DANGER** means if the danger is not avoided, it will cause death or serious injury.
- **WARNING** means if the warning is not heeded, it can cause death or serious injury.
- **CAUTION** means if the precaution is not taken, it may cause minor or moderate injury.

Safety Guidelines

In addition to the caution and warning labels affixed to this machine, follow the guidelines below to help ensure the safety of equipment and personnel.

Training

Ensure that all employees who operate this machine are aware of and adhere to all safety precautions posted on the machine and are trained to operate this machine in a safe manner.
Protective Gear

Never operate the machine without proper eye and ear protection.

When the Machine is ON

• Never reach hands beyond safety cage. Servo motors can unexpectedly move quickly.
• Never clear screws or hinges out of the machine while it is running.
• Never reach into the router area to retrieve a hinge. The router may still be running down after shut down.
• Never perform any maintenance unless machine is at zero state.
• Never clean the machine while it is running.
• Never walk away from the machine while it is running.

Compressed Air

The compressed air system connected to this machine should have a three-way air valve for shut-off and pressure relief.

All cylinders on machine are under high pressure and can be very dangerous when activated. Before performing any maintenance or repairs on this machine turn off the main air disconnect. Lockout and tagout this connection.

Electrical

Electrical circuitry on this machine is protected by an approved lockable disconnect circuit. In addition to this equipment, you must install an approved disconnect for the electrical power supplying this machine.

When opening the cabinet you must first turn off the disconnect switch. When the cabinet door is open there is still power on the top side of the disconnect switch. Some machines are powered by more than one supply located at different locations. Before performing any repairs or maintenance, lockout and tagout must be installed at all locations.

All maintenance and repairs to electrical circuitry should only be performed by a qualified electrician.

Before Conducting Maintenance

Prior to performing any maintenance, repairs, cleaning or when clearing jammed debris, you must disconnect, tag out, or lock out the electrical and air pressure systems. This should be done in accordance with applicable state and/or federal code requirements.
Compliance with Codes and Regulations

KVAL advises that you request an on-site state safety review of your installation of this machine. This is to ensure conformance to any additional specific safety and health regulations which apply in your geographic area.

Other Hazard Control Action

If you believe any part or operation of this machine is in violation of any health or safety regulation, STOP production. It is your responsibility to immediately protect your employees against any such hazard.

Additional detailed safety guidelines are included in the operating instructions of this manual. KVAL will be pleased to review with you any questions you may have regarding the safe operation of this machine.

Follow Your Company’s Safety Procedures

In addition to these safety guidelines, your company should have on-site and machine specific safety procedures to follow.
Lockout Tagout Procedure

This policy is required by OSHA regulation 1910.147 and Cal OSHA’S SB198 ruling of July 1991.

Use the following lockout procedure to secure this machine while it is powered down. During a lockout, you disconnect all power and shut off the air supply. Be sure to use the tagout guidelines noted below.

**To Lockout the This Machine**

1. Assess the equipment to fully understand all energy sources (multiple electrical supplies, air supply and pressure, spring tension, weight shifts, etc.).
2. Inform all affected personnel of the eminent shutdown, and the duration of the shutdown.
3. Obtain locks, keys, and tags from your employer’s lockout center.
4. Disconnect power:
   a. Turn the disconnect switches on the main electrical panel to the OFF position. Then pull out the red tab and place a padlock through the hole. Place your tag on the padlock, as per the tagout guidelines below. (see illustration below).
   b. Turn the disconnect switch on the larger high-frequency panel to the OFF position. Then pull out the red tab and place a padlock through the hole. Place your tag on the padlock, as per the tagout guidelines below.
5. Turn the main air valve to the OFF position and place a padlock through the hole (see illustration below).

NOTE: Place your tag on the padlock, as per the tagout guidelines below.

6. Once the locks and tags are in place and all personnel are clear, attempt to operate the machine to ensure equipment will not operate.

7. Maintenance or repairs may now be completed. The person performing the work must ensure all tools, spare parts, test equipment, etc., are completely removed and that all guards and safety devices are installed.

8. Before removing the locks and tags, the person who attached them shall inspect the equipment to ensure that the machine will not be put in an unsafe condition when re-energized.

9. The lock and tag can now be removed (only by the person(s) who placed them), and the machine can be re-energized.

10. The tags must be destroyed and the locks and keys returned to the lockout center.

Lockout-Tagout Guidelines

- Place a tag on all padlocks. On a tag, each operator must put their own name and date. (These locks are only to be removed by the person who signs the tag)
- If more than one person is working on the machine, then each additional person places a lock and tag on each disconnect.
- Only each operator may remove their own lock and tag.
Important: When many people are all working on the same machine you will need a multiple lockout device, such as the one shown here.

Follow the P-R-O-P-E-R lockout rule of thumb.

P...... Process shutdown
R ...... Recognize energy type (electrical, pneumatic, mechanical, etc.)
O...... OFF! Shut off all power sources and isolating devices
P...... Place lock and tag
E...... ENERGY: Release stored energy to a zero-energy state
R ...... Recheck controls and test to ensure they are in the “OFF” state
Zero-Energy to Start-Up

Zero-Energy State to Start-Up to Operating State

Starting the equipment properly is just as important as the lockout/tagout guidelines in terms of safety.

**Start-up Guidelines**

The following guidelines below should be followed to start the equipment.

**Inspect**

The equipment must be inspected for proper adjustment before starting equipment.

**Clean Up**

All materials and debris must be cleaned up. Any combustible materials or old parts used during repairs must be cleaned up and/or properly disposed of.

**Replace Guards**

Replace all equipment guards. If part of equipment cannot be properly adjusted after start-up with guard on, contact the KVAL Service team. See “Getting Help from KVAL” on page 1-12.

**Check Controls**

Confirm that all switches are in the “OFF” position. Please be advised that some components of the machine may start automatically when energy is restored.

**Remove Locks**

Each operator must remove his or her own lock and tag. This will ensure that all operators are in a safe place when the equipment is started.

**Perform Visual Checks**

If the equipment is too large to see all around it, station personnel around the area and sound the personnel alarm before starting the equipment. If your operation is more complex, your company’s comprehensive safety procedure may involve additional steps. You will need to ask your supervisor about these procedures. The company’s lockout procedure should be posted at each machine. On larger or long-term maintenance or installation projects, the company’s procedures must be explained to all new operators and a copy of the company’s procedures should be posted on-site for the duration of the work.

The Company’s procedures should also include provisions for safely handling shift changes and changes in operators or new operators. Comprehensive lockout/tagout
may use a gang box or other system to ensure that locks are secure and not removed without authorization.

Remember, lockout/tagout procedures work because you are the only one with the key to your lock. Proper lockout/tagout can save lives, limbs, and money. Help make your work environment safe for you and your fellow workers. Be sure to follow the P-R-O-P-E-R lockout/tagout procedures, and that those around you do also.

**Close the Cage Gate**

Verify all cage gates are securely closed. Ensure all safety protocols are in effect.
Getting Help from KVAL

Before you seek help, first try the troubleshooting procedures. Follow the procedures below.

If you are unable to resolve the problem:

1. Locate the machine’s Specification Plate and record the serial number, 3 phase volts, electrical print number, and air print number.

2. Contact our customer support team:
   - In the U.S and Canada, call (800) 553-5825 or fax (707) 762-0485
   - Outside the U.S. and Canada, call (707) 762-7367 or fax (707) 762-0485
   - Email address is service@kvalinc.com
   - Hours:
     - 6:00 AM to 4:00 PM Pacific Standard Time, Monday through Thursday
     - 6:30 AM to 1:30 PM Pacific Standard Time, Friday

On-Line Help

On machines with a Beckhoff® PLC and an internet connection, our service team are able to connect, run, and troubleshoot your machine. Ask about this procedure when calling our service team. See Chapter 3 “System IT Administration” on page 3-2, for more information.

Product Return Procedure

If you’ve contacted Kval for help and it is determined that a return is necessary, use the procedure below to return the machine or part.

**Note:** Non-Warranty returns are subject to a 15% restocking charge.

1. Obtain the packing slip and/or invoice numbers of the defective unit, and secure a purchase order number to cover repair costs in the event the unit is determined to be out of warranty.
2. **Reason for return**: Before you return the unit, have someone from your organization with a technical understanding of the machine and its application include answers to the following questions:

- What is the extent of the failure/reason for return? What are the relevant error messages or error codes?
- How long did it operate?
- Did any other items fail at the same time?
- What was happening when the unit failed (e.g., installing the unit, cycling power, starting other equipment, etc.)?
- How was the product configured (in detail)?
- Which, if any, cables were modified and how?
- With what equipment is the unit interfaced?
- What was the application?
- What was the system environment (temperature, spacing, contaminants, etc.)?

3. Call Kval customer support for a Return Material Authorization (RMA). When you call:

- Have the packing slip or invoice numbers available.
- Have the documented reason for return available.

4. Send the merchandise back to Kval.

- Make sure the item(s) you are returning are securely packaged and well protected from shipping damage
- Include the packing slip or invoice numbers.
- Include the documented reason for return.
- Include the RMA number with the parts package.
How to Download the Service Application

On machines with Windows (8.1 / 8 / 7 / Vista / XP) and an internet connection, our service team are able to connect, run, and troubleshoot your machine by way of the operator station.

Download Application

1. To download the application, go to the KVAL website (http://www.kvalinc.com)

2. At the KVAL website, select the Support tab. Follow the instructions on the Support web page.

3. Click the Download button to download the application that allows the KVAL technician to have access to the operator station.

4. After the download is completed, double-click the program icon.

Note: Web browsers have different methods of downloading programs. Below are samples of i.e Explorer and Google web browsers.

Sample of Google Browser: Located at the bottom left of the screen.

Sample of i.e Explorer: Located at the bottom of the screen. select the arrow and choose Save and Run
5. A pop-up window is displayed. Accept the request to run the program.

**Note:** Security settings may differ from plant to plant. If issues occur, contact your IT department.

6. The interface of the **KVAL Support App** will be displayed. Enter your name in the **Your Name** field. The fields are described below:

- **Allow Remote Control:** Program is ready to allow technicians to access machine computer
- **Session code:** An internal number to track this machine. It is auto filled.
- **Your Name Field:** Enter your name. The KVAL technician will use this field to identify this machine.
- **Description:** Enter machine Serial number and issue.
- **Indicator:** Green indicates there is a good connection to the service center. If red, there could be an issue with a LAN connection. Check the connections in the plant.

7. After the **KVAL Support App** is loaded and completed, call the KVAL service center (1-800-553-5825) and have the technician connect to the machine computer.

8. Click the **Allow** button to give the KVAL service technician permission to access the operator station. We are now ready to troubleshoot.
Safety Sign-Off Sheet

Machine Model Number: ____________________________

A Note to the Operator:

This machine can help you be highly productive only if you understand how to use it properly and follow the safe operating practices described in this document and the machine’s manual. If you do not understand the machine’s proper operation or ignore the safe operating practices, this machine can hurt or kill you. It’s in your best interest to safely and properly operate this machine.

Personnel Safety Concerns:

- I have been properly trained in the operation of this machine.
- I will always wear ear protection when operating this machine.
- I will always wear eye protection when operating this machine.
- I will never wear loose clothing or gloves when operating this machine.
- I will watch out for other people. Make sure everyone is clear of this machine before operation.
- I will always follow my company’s safety procedures. I have read and understand these guidelines.

Machine Safety Concerns:

- I have been given a tour of the machine and understand all the safety labels, E-Stops and the actions to take in case of an emergency.
- I will make sure all guards are in place before operation
- I will turn off the compressed air, before loading hardware (staples, screws, etc)
- I will turn off the electrical power, for setup
- If the machine should operate in an unexpected manner stop production I will immediately and notify a manager, a supervisor, or a qualified service technician.

I have read and understand this document and agree to operate this machine in a safe manner as described above.

Employee

Name (print): __________________ Signature: __________________ Date: ____/____/____

Supervisor/Safety Officer/Trainer

Name (print): __________________ Signature: __________________ Date: ____/____/____

Note: It is recommended you make a copy of this sheet for new operators. If a copy is needed, you may download a PDF at the KVAL website (http://www.kvalinc.com). You may also contact our Service Department at (800) 553-5825 or email at service@kvalinc.com.
CHAPTER 2  Operation of the DL-NCD

This chapter describes components, assemblies, and the user interface of the KVAL DL-NCD System. The content is geared to help operators understand the basic operation of the DL-NCD.

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Operator’s Tour

This section takes you on a tour of the DL-NCD machine. The figure below shows locations of selected areas, parts, and assemblies on the machine.

FIGURE 2-1. Top View of the DL-NCD
FIGURE 2-2. Out-Feed View
About Sensors

On the DL-NCD, sensors provide input to the PLC as part of the automation of the door cutting process, including feed through, door clamping, and door location. It is important to keep the sensors cleaned and aligned to keep the door process running smoothly. There are two classifications of sensors on the DL-NCD: Photo Electronic and Inductive Proximity Sensor.

For location of the sensors on the machine and electrical information about sensors, see “DL-NCD Sensors” on page 5-2.
About Motion of Servo Motors: X, Y, Z, and W

The figure below shows the motion of the 'X' axis, 'Y' axis, 'Z' axis, and 'W' axis.

FIGURE 2-5. Servo Motor Motions
About the Door Stop System

The door stops are spring loaded. The door stops spring back after the door passes over them. The door then reverses until the reach the stop. There is a door pusher on the out feed end of the machine that push the door up against the stop and the width adjust clamps the door tight so there is no movement.

![Door Stop Locations](image)

### FIGURE 2-6. Door Stop Locations

About the Tool Holder

The DL-NCD is equipped with a Tool Holder. When a door file is downloaded, the DL-NCD determines if a tool change is needed, based on door material defined in the door file. If a tool change is needed, the DL-NCD follows this process to change the tool:

1. Moves to the Tool Changer.
2. If required, the machine scans the tool holders and records which tool holder positions are empty. This is only done if a scan has not been done since the access gate was last opened.
3. The machine moves first to the empty location where the current tool is to be returned to and returns the tool. After the current tool is returned, the head moves to the location of the next tool to be used and picks it up.
4. When the tool change is complete, the DL-NCD head moves to the cut start location and continues with normal operation.

![Tool Holders Diagram](image)

**FIGURE 2-7. Tool Holder and Air Nozzles to Clean**

If the tool changer does not detect a tool or if it encounters any other problem, the KVAL software will display an error message on the Operator’s Station monitor.

**Note:** The DL-NCD retains the tool in the Cutter Motor in memory. If the tool is changed, while the machine is off, make sure that the tool matches the tool currently in the Cutter Motor. For details on how to disable tool holder locations by way of the touchscreen interface, see “Description of User Interface Screens” on page 2-24.

**How to Change a Tool Manually**

For normal operations, the tool is changed automatically. The DL-NCD is programmed to select the appropriate tool for the door material. However, a tool may also be changed manually, (for example, to change a dull bit, if there is a mechanical problem with the tool changer, or if you want to replace the tool when the machine is off). See instructions to change a tool on the next page.

**Note:** After the tool is changed, home the machine to reset reference.
To change a tool manually, follow the steps below.

1. Turn off power and follow lockout and tagout procedures. See “To Lockout the This Machine” on page 1-7.

2. Grasp the tool firmly by the collet.

3. Using the other hand, pull out the black Tool Release button on the top left side of the motor to release the tool from the motor spindle.

   **Note:** Make sure to pull the button out until it clicks in the ON position (motor spindle stays in the unclamped position). Leave the button in this position until instructed to push it in later in this procedure.

4. Once the tool is released from the motor, slide it down and away from the motor. Set the old tool aside.

5. Using one hand, insert the new tool into the spindle. Be sure to push the tool all the way up until the collet can go no farther into the spindle.

6. While holding the tool firmly in place, use the other hand to push in the Tool Release button.

   **Note:** Do not let go of the tool until the spindle clamping assembly pulls the collet up into place!

### Changing a Tool Bit and Using Tool-Change Tightening Fixture

The section describes how to change the bit in a tool, use the Tool-Change Tightening Fixture, and enter data into the Tool Setup Group.
How to Change a Tool Bit

1. Set the tool in the Tool-Change Tightening Fixture.

Quick Release will snap into place after collet is inserted into base

---

FIGURE 2-8. Exploded and Assembled Views of Tool

---

FIGURE 2-9. Using Tool Grip
2. Use the collet wrench to loosen the collet nut, freeing the bit.

3. Remove the old bit, clean the collet with compressed air.

**Note:** Never use a torque wrench to loosen hardware. It could damage the wrench.

4. Check collet for bluing or damage

**Note:** Bluing is a condition that occurs when the collet is overheated. The overheating causes the metal to turn blue. If bluing occurs, the collet must be scrapped.

5. Reassemble the tool. When assembling, bottom out tool and back up about 1/4” to ensure the correct distance. *Tool should not stay bottomed out.*

**Note:** The collet should snap into place into the collet nut

6. Insert the tool into the Tool-Change Tightening Fixture and tighten to a torque rating of 130 ft/lbs.

   ![Torque to 130 ft lbs](image)

**Note:** Always return your torque wrench to zero after it is used.

7. Measure the parameters listed below:
   - Arbor Length - The distance from the collet face to the tool’s cutting edge.
   - Tool Length - The distance from the collet’s face to the tip of the bit.

8. Compare these measurements to the data in the **Tool Setup Group** in the **Calibrate Machine** Screen. This screen is accessed by the Setup Button.

9. Update the data in the **Tool Setup Group**, if needed. See “Tool Setup Group” on page 2-34.

   **Important:** The accuracy of the data **Tool Setup Group** is important. Any errors could damage tooling or product.
About Air Nozzles

The automatic blow off consists of a bank of high-pressure air nozzles to clean dust and debris as the door feeds out of the DL-NCD.

To manually turn off the air, use the slide value located on the side of the machine.

![Air Nozzles for Blow Off of Debris](image)

About Indicator Lights

The Indicator light supplies quick identification of the status of the DL-NCD. See the table below for light status descriptions.

![Indicator Light Located on Top of the Machine](image)

<table>
<thead>
<tr>
<th>Light</th>
<th>Status</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue</td>
<td>Blinking</td>
<td>Tool Change in Process</td>
</tr>
<tr>
<td>Blue</td>
<td>Solid</td>
<td>Motor at Cutting Speed and Ready to Plunge</td>
</tr>
<tr>
<td>Green</td>
<td>Off</td>
<td>Machine Not Homed</td>
</tr>
<tr>
<td>Green</td>
<td>Blinking</td>
<td>Machine Homed but is Idle</td>
</tr>
<tr>
<td>Green</td>
<td>Solid</td>
<td>Door Template is downloaded and is ready to run</td>
</tr>
<tr>
<td>Amber</td>
<td>Solid</td>
<td>Motor Coming up to Speed</td>
</tr>
</tbody>
</table>
About the Electrical Panels

The DL-NCD has a Main Electrical Panel, a High Frequency Panel and Nodes on the Cutter Head and the Frame. This section is an overview of the electrical components. Refer to the machine's electrical prints for in-depth information.

The Main Electrical Panel:
- Supplies voltages to the machine
- Contains the PLC (Programmable Logic Controller)
- Contains servo drives to interact with the servo motors.

The High Frequency Panel:
- Supplies voltages to the machine
- Contains the PLC interface
- VFDs (Variable Frequency Drives) to interact with the cutter motor and the feed motors.

**Warning:** High Voltage is present in this panel at the top of the Three Phase Input even with the disconnect off. If working on the panel, follow disconnect protocol. See “Safety First!” on page 1-3.
About the Frame Node

The Frame Node is directly connected to the PLC Node. It is located at the in-feed frame leg on the fixed side of the machine. This node contains the inputs and outputs of the frame. For example, door sensors, width adjusts, and tool interfaces.

About the Cutter Node

The Cutter Node is connected to the PLC by way of the Frame Node and is located on the cutter head’s fixed side of the machine. This node interfaces with inputs and outputs of the cutter head to the PLC.
About the Cutter Head

The Cutter Head is the “workhorse” of the machine and is designed to rout lock face holes, peep holes, and lights in doors made of fiberglass, steel, or wood. A cylinder with a metal block knocks out cut portions of the door to the drop out area below. The Cutter Head movements and cutting routines are driven by template software, manual input, and the PLC.

FIGURE 2-14. Cutter Head
About the Drop Out Area

The debris from the cutting process drops below to a roller assembly to collect the remnants in a common area.

**Warning:** Be careful in this zone. Slugs will eject out and could cause body injuries if operator is not paying attention.

![Drop Out Area](image)
Description of the Six Light Panel

The six lights on this panel indicate the status of the DL-NCD system.

**Note:** See “Troubleshooting with the Status Light Panel” on page 5-9, for information on using this panel for troubleshooting.

The Sequence that the lights activate is as follows:

1. Control Power
2. Overload Relay
3. E-Stop
4. Stop
5. Start
6. 24VDC

**Control Power** – This light illuminates when the Control Transformer turned on and the power is working on secondary side-of transformer.

**Overload Relay** – This circuit is jumped. It should always light when the Control Power turns on.

**E-Stop** – The back gate is closed and Frame E-stop is not activated when this light is on.

**Stop** – This light will be on if Machine Stop button is deactivated.

**Start** – This light will be on once the Machine Start button is pressed and the ACR Relay is latched.

**24VDC** – This light comes on once the ACR is latch and the 24VDC power Supply is working.
Option G: About the Barcode Scanning Hardware with Stationary Reader

Some machines have a barcode scanner integrated into the operating system of the DL-NCD. The barcode scanner reads the coded lock and light routing patterns off the bar coded door. The program loads the template to the user interface. The barcode scanner is mounted at the in-feed of the machine on the fixed fence. The sensor, to trigger the scanner, is located on the Handler (or similar type of feeder).

![Barcode Scanner and Sensor Location](image)

FIGURE 2-16. Location of Barcode Scanner
Process of Operation

1. Attach the barcode label to the end of the door. Stack the doors at the loader station with the labels facing out.

2. The load station loads the door into the DL-NCD.

3. Once the sensor is triggered to look for barcode:
   a. The barcode scanner turns on.
   b. The scanner reads the barcode.
   c. The code loads the template and door specifications from the barcode to the user screen.
   d. The values will change on the user screen after barcode is read.

4. The door will feed in

5. The barcode scanner turns off

6. The door will be machined with the barcode specifications.

Checking the Barcode Reader

If the barcode is not readable or out of alignment the feeding of the door will stop

To verify if it is a bad read, check the Barcode Status indicator located on the Diagnostic Screen.
   a. If it is a bad read, the red button will be displayed on the screen.
   b. Check the alignment of the label on the door. The label should be on the end and large enough for the reader to capture.
   c. Check for damage or grime on the label.
   d. If needed, clean the lens of the barcode reader.

   Important: Do not look directly into the red light of the scanner.
   e. Contact your engineer or IT support if any of the issues above are not causing the stop.
   f. If needed, enter correct data at the operator’s station and continue production.
Quick Start Description

1. Ensure factory air is present at machine and the DL-NCD main air supply valve is turned on.


4. From the Main Screen, enter your width parameters or choose a Preset button to load the width parameters.

5. Enter door length and door thickness parameters.

6. Select the material type of the door (fiberglass or steel).

7. The tools that, can be used, will be indicated in Tool Selector Boxes.

8. Select one of the available tools that match the door type.

   Note: Loaded = Tool loaded in the Cutter Box

9. Select the quantity of doors to run and any machine options are required.

   Note: By default, Continuous Feed and Auto Feed are enabled, and Setup Mode is disabled.

10. Select the file from the Light Pattern white box. The description of the pattern will display in the blue box below.
11. Select the file from the Lock Pattern white box. The description of the pattern will display in the blue box below.

12. Press the **Start Sequence** Button to load and run program.
Powering Up and Down the DL-NCD

This section describes how to power up and to power down the DL-NCD

Powering up the system includes:

- Applying power to the entire system.
- Starting the Control Circuit.

Powering down the system includes:

- Turning off the computer.
- Shutting down the control power.
- Removing power from the entire system.

How to Power Up the DL-NCD

1. Ensure factory air is applied to machine and main air supply is turned on.
2. Check that all E-Stop buttons are out. (If machine has this option)
3. Make sure the electrical disconnect the electrical cabinet is turned to the ON position.
4. Move the CONTROL TRANSFORMER switch to the ON position. It should light up.
5. Push the green START MACHINE button.
6. All lights on the status light panel on the electrical box should be illuminated.

Note: If a status light does not turn on during the power up process, refer to the DL-NCD Service Manual for assistance in identifying the issue.
How to Home the DL-NCD

The DL-NCD must go through a homing routine before any operations are performed. The homing routine sets a zero reference from which the DL-NCD measures its movement and cutting process.

**Important:** If power is lost or the DL-NCD is reset, the homing routine must be performed again to reset the zero reference.

1. Press the **Home** button on the **Main Screen** touch screen.
   a. The machine will move to the home position.
   b. The machine will then move to the starting position.
   c. The DL-NCD is now ready for work.

**FIGURE 2-17. Homing Sequence**
How to Power Down the DL-NCD

1. Select **Shut Down System** from the **Main Screen** to close operator interface program, computer, and shut down the operating system.

   **Important:** Make sure Windows is shutdown completely before turning off the machine. The hard drive may be damaged and data may be lost if not turned off in this order.

2. Move the **CONTROL TRANSFORMER** switch to the off position. This kills power to the machine. All status lights should be off.

3. KVAL also recommends that you turn the disconnect switch on the electrical cabinet to OFF; this helps reduce possible damage resulting from power surges from electrical storms.

About Emergency Shutdown and Recovery

**Note:** Some options do not have an E-Stop. In this case, the **Stop Button** or an opened Gate lock will stop the machine. Follow the same recovery steps below.

Depending on the model of machine, there are emergency shutdown (E-Stop) switches located at key points around the machine.

The E-Stop switches are to be used when the machine is out of control or is about to damage personnel or equipment.

When an E-Stop switch is activated, high voltage power is cut to the machine. The motors will stop, but power to the PLC and the Operator Station Screen will remain on.

**E-Stop Master Shut OFF**

The DL-NCD can be a master shutoff for other machines hooked up to the Master Control. For example other machines within the same fenced area will shutdown if the safety gate is opened or the DL-NCD E-Stop is pressed. The other machines must be hooked up to the master control of the DL-NCD and is connected at the factory according to machine line lay out.

**To Resume Normal Operation after an E-Stop**

If an E-Stop is activated, use the following procedure to recover, after the cause of the emergency stop is resolved:

1. De-activate the E-Stop switch by pulling it out.
2. Push the **START MACHINE** button on the operator's station
3. Home the Machine.
**Description of User Interface Screens**

This section describes the user interface screen. The user interface allows the operator to use a touch screen to control the door cutting process, auto-run, manually run the door, store door profiles, and use diagnostics to help troubleshoot the DL-NCD.

**About the Operators Station**

The operator’s station contains a touch screen to input data and operate the DL-NCD machine. The interface is Microsoft Window 7® based. The location of the station may vary due to customer specifications. Along with the DL-NCD, other interfaces may also be located in this area. For example, the figure below shows a Handler user interface.

![Handler and DL-NCD interfaces](image)

**FIGURE 2-18. Operator Station**

**About the Out-Feed Food Pedal**

Some options may have an out-feed foot pedal to feed the door out of the machine.
Screen Selection Menu Map

Below are the menu selections for the DL-NCD.

"Main Screen" on page 2-24

"Manual Operation" on page 2-33

"Door Width Preset Screen" on page 2-32

"Machine Calibration Screen" on page 2-29

"Diagnostic Screen" on page 2-37
Machine Feed Back

At the top and at the bottom right-hand corner of all user screens is status feedback information. The information generated is as follows:

1. General Machine Status (located at the top left corner).

2. Current Servo Positions
   • Shows door specifications (located at the right corner).
   • Shows either Cutout and Lock process being performed.

Note: Use this information to isolate issues if having problems with the machine.
About the Main Screen

The Main Screen is also the startup screen for the DL-NCD. From this screen, all the basic user interface controls are available to run a door.

![Main Screen](image-url)

**FIGURE 2-19. Main Screen**
**Home Machine Button**

This button starts the home sequence on the machine. The home sequence moves all four servo axis back to a physical reference point. The home sequence must be performed every time the machine is powered up or reset.

**Refresh File List**

The refresh button rescans the operating files for new code routines that are added during updates or troubleshooting.

**End Sequence Button**

This button stops any action the machine is currently performing.

**Reset Machine Button**

If a fault occurs that cannot be cleared, press the **Reset Machine** button. This button will reset the machine to the start position before homing.

Press **Home Machine** after Reset Machine.

**Shut Down System Button**

Press the **Shut Down System** button to exit out of Windows® and shut the computer down. This must be done before turning power off to the machine.

**Cut Routine Speed**

Manually adjust the cutting speeds by pressing the speed percentage buttons. The new speed will be effective immediately.
Door Specification Group

Set the parameters for the door in the Door Spec group.

- Either enter the door width in the top white box or choose a stored width from the Preset Buttons.

- Enter Door Length and Door Thickness

Note: see “About the Door Width Preset Screen” on page 2-36, for information on programming the Preset Buttons.

Door Material Group

Use this group to select the type of door material and select tool to use in cutting process. Each tool location has its own unique set of parameters that are created in the Machine Calibration Screen, under Setup. Each tool is referenced by the numbers shown below.

Door Material Type: Click the box until the desired door type is found (Steel, Fiberglass).

Tool Selector: Select one tool to use in the cutting process. Make sure selected tools match the door type.

Tool Type: Displays tool type (Fiberglass, Steel).

Tool Status: Displays tool status (Loaded in Cutter, Empty, Disabled)

The parameters for each tool are entered in the Machine Calibration Screen.
Quantity Group

Use this group to set the quantity of doors to be processed with the existing specifications and parameters.

Quantity: Enter the quantity of doors to be processed in the white box.

1. Auto Feed: Press Auto Feed to toggle the auto feed on or off. In auto mode the feed system will:
   a. bring in a door
   b. set auto width
   c. clamp a door
   d. wait for processing to complete
   e. then feed the door out.

Knock-Out: Press Knock-Out to toggle the knock-out function ON or OFF. In knock-out mode, the piston in the cutter head will automatically knock out the cut portion of the door.

Plunge: Press Plunge to toggle the plunge function ON or OFF.

If Plunge is enabled, the cutter bit will plunge into the door once the door is clamped up and cut the cutout routine out.

If Plunge is disabled, once the door is clamped, the router will run the routine without plunging into the door.

Note: This function is a great tool for testing new templates before cutting them.

Re-Feed:

The re-feed button is a momentary button that can be used to re-run a door, or process a door fed into the out-feed of the machine. If re-feed is pressed when there is a door sitting on the feed belts the door will move back into the machine and run the selected routine.

Note: This function is a great tool to use if 2 different cutouts are applied to one door.
**Light and Lock Pattern Group**

The white boxes are populated with stored templates. Select the template from the **Light Pattern** white box to apply to the face of a door. Select a template from the **Lock Pattern** to apply to the lock portion of the door. The blue boxes will display a description of the template selected.

To load and run the selected template(s):

1. Ensure all your parameters are correct and the machine is ready to run

2. Press the **Start Sequence** button.
About Setup Screens

Select the Setup Button on the Main screen to open access to the Machine Calibration screen and the Door Width Preset Screen.

About Calibration Data

In the Machine Calibration Screen, data can be entered to compensate for differences between measured data and expected results. For example, slight changes in positioning may occur after changing to a new tool.

Data is entered into the Offset box and combined to achieve the Actual parameter. The results are stored in permanent memory.

Running a Reference Cut

If you notice any changes in the cut locations, run a reference cut. Run a known good Door Lock Template. The door lock cut is not dependent on door width and offers the best references.

After the door lock is machined, measure the results:

- The Base is the start up reference.
- The differences between the template and the measured (either positive or negative) are entered into the Offset entries.
- The Actual is the combination of the Base and the Offset entries which is the final result.

Entering Calibration Data

Run a test door with a lock pattern and measure the results. Follow the steps below.

1. If there is a number in the Base box, Click Combine with Offset to combine both numbers.
2. Click the ± to Offset to display the keypad. In keypad, enter the positive or negative amount the lock needs to move on the door. Click the green check button to enter the data.
   a. If the lock needs to move towards the top of the door or to the edge of the door, enter a negative number.
   b. If the lock needs to move towards the bottom of the door or towards the center of the door, enter a positive number.
   c. If the depth is too deep, enter a negative number.
   d. If the depth is too shallow, enter a positive number.
   e. If the width needs to be wider, enter a positive number.
   f. If the width needs to be narrower, enter a negative number.
3. Run a second lock and recheck the lock location.
4. If lock location is off, repeat steps 1 through 3
5. If it is correct, go back to the calibration screen and click **Combine with Offset** to combine offset and base to complete the calibration.

**Note:** Click the **Clear Offset** button to clear any incorrect number in the Offset box.

### About the Machine Calibration Screen

From this screen, you can perform machine calibration.
**Tool Setup Group**

In the **Tool Setup** Group, the parameters for each tool at each location is created. The parameters are assigned to each tool location and that tool should stay at the assigned location. The process is the same for each tool number. (Tool 1 through Tool 4)

Toggle button to enable or disable the tool location. If a tool is not in the holder, the disable button must be toggled.

After each tool replacement, tool alteration, or any tool adjustment enter the **Overall Length** and **Arbor length** to set a reference in the program.

Enter **Reciprocate Distance** if needed.

**Important:** The reciprocate distance must be less than Arbor Length minus door thickness.

Check the diameter of the cut and enter measurement and offset data to correct for tool. This adjustment compensates for discrepancies to the actual size of the router bit. See “Entering Calibration Data” on page 2-32, for instructions to input data.
Select the **Tool Type** (Steel, Wood or Fiberglass) for each tool location.

Enter the percentage of the full speed of the cutting speed in the **Speed Factor** box.

For small pilot holes (this number should be very small), enter the penetration rate into the **Plunge Factor**.

### Cut Settings Group

Adjust the X, Y, and Z motor positioning with this block.

Run a lock at 2.75" in backset with a given location with a depth of 1/2 ''. Once the lock is machined, check the measurements of the lock. If the calibration is off, find which axis needs to be calibrated.

If the lock is off in the length of the door, the X-axis needs to be adjusted.

If the backset is off, the Y-axis needs to be calibrated.

If the depth is not correct, the Z-axis needs to be adjusted.

See “Entering Calibration Data” on page 2-32, for instructions to input data.

### Tool Holders Group

If the pick up of the tools from the station is offset, adjust this group to calibrate the motion of the cutter head.

**Important:** Be very careful with this adjustment. If adjusted incorrectly, damage may occur to machine. Make adjustments in small increments (0.010") to verify movement.

**X-Axis:** If the tool needs to travel into the tool holder more, enter a positive number. If the tool needs to back out of the tool hold, enter a negative number.

**Z-Axis:** If the tool needs to be lower when it comes into the fork area, enter a positive number. If the tool needs to be raised when it comes into the fork area, enter a negative number.

**Y-Axis:** If the tool needs to move towards the fix fence, enter a negative number. If the tool needs to move towards the adjustable fence, enter a positive number by the amount it needs to move.
Width Adjust Group

Adjust the 'W' axis motor to compensate for and discrepancies in the width settings.

**Width Adjust**: If the width adjust fence, needs to be moved closer to the fixed fence, enter a negative number. If the fence needs to be wider, enter a positive number.

See “About the Machine Calibration Screen” on page 2-33, for instructions to input data.

**Unclamp Offset**: Enter the amount of desired width of the fence in the unclamping mode. To check, slide door into the machine and firmly press it against the fixed fence. There should be about 1/4" of a gap from the movable fence and the door edge.

The unclamp offset usually works best around 0.50

---

About the Door Width Preset Screen

Enter up to twenty Door Width Presets at this screen.

Click a box in the yellow column to enter the name of the preset desired to be seen on the main screen.

Click the adjacent box in the next column to enter the door width.

The results will be displayed on the Main Screen.
About Manual Operation

From this screen, you can control certain functions of the machine in manual mode.

FIGURE 2-21. Manual Screen
X, Y, and Z Axis Group

This group controls the movement of the X, Y, and Z motors on the carriage.

For Each Axis:
- **Reverse**: Press and hold the Reverse button to reverse the motion of the carriage. Release the button to stop the carriage. The carriage will also stop if the negative travel limit eye is activated.
- **Forward**: Press and hold the Forward button to move the carriage forward. Release the button to stop the carriage. The carriage will also stop if the positive travel limit eye is activated.
- **Speed**: Press to change speed of operation. “100 percent” is the maximum speed of the level selected from the main screen by way of the Cut Routine Speed buttons.

Width Adjust Group

Width Adjust:
- **Open**: Press and hold the Open button to open the width adjust carriage. To stop the carriage, release the button.
- **Close**: Press and hold the Close button to close the width adjust carriage. To stop the carriage, release the button.

Feed:
- **Reverse**: Press and hold the Reverse button reverse the feed of the door. To stop the feed, release the button.
- **Forward**: Press and hold the Forward button to move the door feed forward. To stop the feed, release the button.
- **Normal Speed**: Press and hold the Normal Speed button to slow speed. To return to previous speed, release the button.
Toggle Buttons:

• **Manual Door Stop**: Press Manual Door Stop to pop up the door stop and door clamp. Press the button a second time to release them.

• **Park Current Tool**: Press Park Current Tool to put the tool back in the tool holder and park the head.

  **Note**: The Park Current Tool should be completed before shutting down machine every day. This action will cut down on condensation and keep the spring from weakening inside the arbor.

• **Auto Feed Mode Disable**: Press this button to turn auto feed OFF. Press the button a second time will turn the auto feed back ON.

---

Additional Functions Group

• **Re-Feed Door**: Press the Re-Feed Door Button to re-feed the door for a second cut. See “Quantity Group” on page 2-30 for a description.

• **Force Start Sequence**: Press the Force Start Sequence after a pause or stop in process.

• **Exit Application**: Press the Exit Application button to close the user screen and return to the Windows desktop. This can be used if the operator needs to use a different Windows application.
About the Diagnostic Screen

The Diagnostic screen displays all the tasks the DL-NCD performs. This screen can help with troubleshooting by associating the error code to machine sections or functions. The top line will have the most current routine that is running. This screen also has an indicator to indicate a bad barcode string. This could be a damaged barcode label or coding is incorrect.

If the machine issue cannot be resolved, call KVAL Inc. (1-800-553-5825). Have any error code that is displayed, ready to give the KVAL representative. This will aid in troubleshooting and shorten downtime.
About the Diagnostic Screen
CHAPTER 3  System IT Administration

This chapter describes the KVAL DL-NCD controller. The controller is an on board computer that supplies the user interface and controls the operation of the machine. With the controller, KVAL can remotely help troubleshoot your machine.

Chapter 3 at a Glance

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</table>
**System IT Administration**

For optimum support, the DL-NCD requires internet access. With internet access, KVAL Service Support will be able to access your machine through your company’s Intranet and help solve any issues that may occur. Connection to the Intranet is achieved by interfacing with the DL-NCD controller. The location of the Intranet connection is identified in the figure below (RJ45 to Intranet.)

**About the DL-NCD Computer**

The DL-NCD uses a Beckhoff® CPU module as a PLC (Programmable Logic Controller.) In addition to the CPU and the chipset, the module also contains internal main memory. The computer has a removable Compact Flash card from which it boots. The controller uses a Windows CE 7® operating system with TwinCAT 2® automation software to create the PLC and Motion Control method.

Interface modules include:

- A smart power supply to connect to EtherCat® terminals. This supply contains a LCD to display system and user messages.
- A DVI/USB module to connect to the user interface.
- An Ethernet module to connect to the servo amplifiers.

**Connections on the PLC**

The CPU module is located in the upper left corner of the Electrical Panel. See “About the Electrical Panels” on page 2-12.

![Connections on the Controller](image)
Backing up the Computer

Backups keep your data archived in case of a rare system crash. Click the Back-Up Icon on the desktop to back up your data. The data is stored in a backup folder (C:\Backup) in your Windows® directory. It is recommended to set up a back-up schedule to save your data on a regular occurrence and to backup to a thumb drive or other storage device.

The KVAL service team would be happy to help. If any questions occur, contact our service team at (800) 553-5825 or at www.kvalinc.com.

About Remote Connection to KVAL Service

Remote access is a powerful tool to help fix issues that occur with the DL-NCD machine. With the remote access, our KVAL service technician is able to observe your user screen in real time, read, and adjust programming code. For DL-NCD access, the Intranet connection on the machine controller must have outside access to the Internet.
Updating Door Template Files

A door template is a file containing door parameters and code to cut a door. Individual door light patterns can be created at the machine console, or remotely using a standard computer. Use the Ethernet connection to transfer files from a remote computer to the machine computer.

This section lists some templates provided with the DL-NCD. The templates are text files with variables located at the top of the file. Below the dotted line is the G-code program. The variables can be changed to match the door’s specifications. It is recommended *not* to change any code below the dotted line. Custom templates may also be purchased from KVAL, please contact our service department. See “Getting Help from KVAL” on page 1-12.

**Note:** G-code is a programming language that tells the machine tools and assemblies where to move, how fast to move, and through what path to move.

**Generic Lock Template**

This section lists the variable portion of the lock file and an illustration of the setup parameters. Change the variables in the *User Parameters* section to your door’s specification.

(Rev 2)

(Setup Parameters)
R0=44
R1=2.125
R2=2.75
R3=38.5
R4=2.125
R5=2.75
(---)
R9=0
(---)
R10=R126

(Lock Center)

(Lock Diameter)

(Lock Backset)

(Deadbolt Center - 0 turns off 2nd lock)

(Deadbolt Diameter - 0 turns off 2nd lock)

(Deadbolt Backset - 0 turns off 2nd lock)

(Lock Side Mode. 0= Fixed Fence Lock 1= Movable Fence Lock)

(Feed Rate)

**FIGURE 3-2. G Code Variables for Door Lock**
Generic Rectangle Template (With Round Top Option)

This section lists the variable portion of the Round Top Rectangle file and an illustration of the setup parameters. The arc is calculated in the code. Change the variables in the User Parameters section to your door’s specification.

```plaintext
( - This routine will do both rectangles and round-tops )
( ============================================================== )
( User Parameters )
R0=8  ( Top down dimension )
R1=24  ( Rectangle Width - auto-centered in door )
R2=64  ( Rectangle Height )
R11=4  ( X Knockout offset from corner )
R12=R1/2  ( Y Knockout offset from corner )
R18=0  ( Round-Top Mode  0=off  1=on )
(- - -)
R10=R125  ( Feed Rate )
( ============================================================== )
```

FIGURE 3- 4. G Code Variables for Rectangle

FIGURE 3- 5. Rectangle Variable Dimensions

R18=0: Creates a Standard Rectangle cut

R18=1: Creates a Round Top. Uses same dimensions as the rectangle
Generic Twin Rectangle Template (With Round Top Option)

This section lists the variable portion of the Twin Rectangle file and an illustration of the setup parameters. Change the variables in the Users Parameters section to your door’s specification.

FIGURE 3-6. G Code Variables for Twin Rectangle and Twin Rounded Rectangles

R18=0: Creates a Standard Rectangle cut
R18=1: Creates a Round Top. Uses same dimensions as the rectangle

FIGURE 3-7. Twin Rectangle Variable Dimensions
Template for Specials

This template allows the paste of your own code into the template to allow the creation of other cuts. Knowledge of drafting programs and programming is recommended for using of this template. The template below is a sample. Check with engineering or the IT group for your company's template.

Update the variables to meet the new template.

Cut and Paste Code in this section
FIGURE 3-8. Example of Template for Specials
**DL-NCD Barcode Setup**

The configuration for the barcode system is performed by modifying 5 configuration files, one for each parameter type. The configuration files are then encoded into the barcode. The parameters are:

- Door Width
- Door Length
- Cutout Type
- Door Material Type
- Lock Type

The files are text files (.txt) and are located in the following directory: `C:\KVAL\BarcodeConfig\`

**Configuration File Description**

Each configuration file has three sections. The Cutout configuration file is used as an example below.

1. **Title and Description Section**
   
   This section describes how to use the file and what the file changes.

2. **Character Range Section**
   
   In this section, the characters are defined for each data type. It’s a sequence of two numbers. The first number is the starting character, starting with 0. The second number is how many characters.

   See Table below. If we have a "3,3", this setup counts 3 characters over from the "0" Bit. (the 4th character in the string) and pull 3 characters. In the barcode string is "abcdefg", it would grab "def". If the number pair “0,4” would grab the characters "abcd".

<table>
<thead>
<tr>
<th>Bit Number</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>String</td>
<td>a</td>
<td>b</td>
<td>c</td>
<td>d</td>
<td>e</td>
<td>f</td>
<td>g</td>
</tr>
<tr>
<td>3,3</td>
<td></td>
<td></td>
<td></td>
<td>d</td>
<td>e</td>
<td>f</td>
<td></td>
</tr>
<tr>
<td>0,4</td>
<td>a</td>
<td>b</td>
<td>c</td>
<td>d</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
3. Code Lookup Section

This section holds the look-up values for the characters extracted from the previous section. It defines what the character pattern is linked to.

Configuration Code Samples

This section contains samples of the configuration code files.

Door Width

Start at 0 bit with 2 bit length

If XX (Bits 0,1) = 30, Door Width = 35.75"
If XX (Bits 0,1) = 28, Door Width = 31.75"
etc
Door Length

Start at bit 2 with 1 bit length

If X (Bit 2) = 6, Door length = 79"
If X (Bit 2) = 8, Door length = 95"

Door Material

Start at bit 3 with 1 bit length

If X (Bit 3) = L, Door = Steel
If X (Bit 3) = R, Door = Wood
**Cut-Out**

Start at bit 4 with 3 bit length

<table>
<thead>
<tr>
<th>Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0, 3</td>
<td>DL-NCD Barcode Setup</td>
</tr>
<tr>
<td>7, 2</td>
<td>KV AL DL-NCD Operation/Service Manual</td>
</tr>
</tbody>
</table>

If XXX (Bit 4,5,6) = D21, (call parameters from Full Light_22x64steal)
If XXX (Bit 4,5,6) = HR4, (call parameters from Half Light 22x36steal)

**Door Lock**

Start at bit 7 with 2 bit length

<table>
<thead>
<tr>
<th>Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0, 3</td>
<td>Cut-out Lookup Table</td>
</tr>
<tr>
<td>7, 2</td>
<td>Door Lock Routine Lookup Table</td>
</tr>
</tbody>
</table>

If XX (Bits 7,8) = 1B (call parameters from 2.375BSingle_6-8)
If XX (Bits 7,8) = 2B (call parameters from 2.375BDouble_6-8)
CHAPTER 4  Maintenance of the DL-NCD

This chapter describes preventative maintenance steps for *KVAL DL-NCD*. The content is geared to guide technicians to keep a regular maintenance schedule for your KVAL machine. Keeping your KVAL machine maintained is an important piece for successful operation of your door production process.

Chapter 4 at a Glance

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</tr>
</tbody>
</table>
Maintenance Schedule

KVAL recommends the following maintenance schedule to ensure that the machine operates properly. Refer to this section for steps to perform maintenance.

Daily, Monthly, Six Month Maintenance

### Daily Preventive Maintenance

<table>
<thead>
<tr>
<th>Op</th>
<th>Operation Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Clean</strong></td>
<td>Blow off dust from the entire machine. Wipe down the outside of the machine with a clean dry cloth.</td>
</tr>
<tr>
<td><strong>Check</strong></td>
<td>Check tooling for wear.</td>
</tr>
<tr>
<td><strong>Clean</strong></td>
<td>Wipe off the photo eyes with a clean dry cloth, and check to ensure that all fastening nuts are snug.</td>
</tr>
<tr>
<td><strong>Check</strong></td>
<td>Check the air pressure to make sure it is set at 80 psi to 100 psi.</td>
</tr>
<tr>
<td><strong>Clean</strong></td>
<td>Empty any Dust Collection Units.</td>
</tr>
<tr>
<td><strong>Check</strong></td>
<td>Check for obstructed flow when excessive sawdust appears.</td>
</tr>
<tr>
<td><strong>Check</strong></td>
<td>Check the air filter water trap. Empty if full.</td>
</tr>
</tbody>
</table>

### Weekly Preventive Maintenance

<table>
<thead>
<tr>
<th>Op</th>
<th>Operation Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Check</strong></td>
<td>Check the machine for smooth motion through a complete door cycle</td>
</tr>
<tr>
<td><strong>Clean</strong></td>
<td>Clean linear bearings and the chrome shaft with a clean dry cloth, then lubricate.</td>
</tr>
<tr>
<td><strong>Check</strong></td>
<td>Check all air lines &amp; electrical wiring for kinks or rubbing.</td>
</tr>
<tr>
<td><strong>LUBE</strong></td>
<td>Refill lubricator with an ISO 32 standard hydraulic oil (KVAL part# SYSLUBG)</td>
</tr>
</tbody>
</table>

### Six Month Preventive Maintenance

<table>
<thead>
<tr>
<th>Op</th>
<th>Operation Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Clean</strong></td>
<td>Wash filter and lubricator bowls with soapy water.</td>
</tr>
<tr>
<td><strong>LUBE</strong></td>
<td>Grease all bearings and tighten all bolts. Access to some grease fittings is difficult and will require a special needle point grease tip (supplied with your system).</td>
</tr>
<tr>
<td><strong>Clean</strong></td>
<td>Clean and lubricate all slides and cylinder rods with dry silicone spray.</td>
</tr>
<tr>
<td><strong>Tighten</strong></td>
<td>Tighten all bolts.</td>
</tr>
<tr>
<td><strong>Back-up</strong></td>
<td>Backup computer software.</td>
</tr>
<tr>
<td><strong>LUBE</strong></td>
<td>Lubricate linear bearings and chrome shafts with silicone.</td>
</tr>
</tbody>
</table>
Lubrication Schedule

KVAL recommends the following lubrication schedule to ensure that the machine operates properly.

**TABLE 4-2. Recommended Lubrication Schedule**

<table>
<thead>
<tr>
<th>Type of Assembly</th>
<th>Recommended Schedule</th>
<th>Recommended Lubrication Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linear Bearing</td>
<td>Every 250 Hours of Machine Operation</td>
<td>Dura-Lith Grease (KVAL P/N Lube EP-2)</td>
</tr>
<tr>
<td>Pillow Block Bearing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flange Block Bearing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ball Screw</td>
<td>Every 80 Hours of Machine Operation</td>
<td></td>
</tr>
<tr>
<td>Air Line Lubricator</td>
<td>One drop of oil every 2 or 3 cycles</td>
<td>Either lubricant listed below is approved to use.</td>
</tr>
<tr>
<td></td>
<td>Check the lines every week to two weeks</td>
<td>• KVAL P/N SYSLUBG</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Chevron AW Hydraulic Oil 32</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• G-C lubricants light AW R&amp;O</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Mobile DTE 24</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Shell Tellus32</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Gulf Harmony 32</td>
</tr>
<tr>
<td>Gear Box</td>
<td>2000 Hours of Machine Operation or six months of operation</td>
<td>• AGMA #8 gear lube</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• MOBILUBE HD 80 W-90</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• or equivalent</td>
</tr>
</tbody>
</table>
Lubrication Requirements

This section describes the parts of the machine that require periodic lubrication, and specifies the lubricants. In addition, it explains how to maintain the lubrication systems on the machine.

**Linear Bearings, Flange Bearing, and Pillow Blocks**

If the bearing is equipped with a grease fitting (Zerk Fitting), it should receive 1 Gram (one pump from grease gun) of Dura-Lith Grease (KVAL P/N Lube EP-2) every 250 hours of operation.

**Note:** Bearings without grease fittings have been pre-lubricated at the factory and do not require further lubrication.

![Zerk Fittings](image)

**FIGURE 4-1. Zerk Fittings**
Gear Motor Lubrication Requirements

Oil change is recommended after 2000 operation hours of operation. Use AGMA #8 gear lube or MOBILUBE HD 80 W-90 or equivalent.

Ball Screws (If Applicable)

All ball screws should be lubricated Dura-Lith Grease (KVAL P/N Lube EP-2) for every 80 hours of operation. At each lubrication, grease should be pumped into the fitting until clean grease comes out around the ball screw.

![Ball Screw Lubrication Points](image)

**Important:** Make sure to clean excess grease to avoid contact with feed belts, clamping areas, or the door.

Description of Air Input System

The air input system takes in shop air and supplies clean dry air (CDA) and lubricated air to the machine. The clean dry air is diverted to blow off nozzles. The lubricator, located after the CDA filters, delivers the lubricated air to valve banks and air cylinders.

![Air Line Filter and Lubrication System](image)
Adjusting the Air Line Lubricator

Using the sight glass on the top of the lubricator, adjust until one drop per every other cycle is used (as observed through sight glass.)

(Sight Glass). When the oiler has run dry, open the knob all the way until flow begins. Once you have a steady flow, tighten knob back down until you have one drop per every other cycle.

Drop will form at end of cane shaped tube visible inside glass.

Top of Lubricator

Priming the Air Line Lubricator

New and used machinery runs out of oil from time to time. It is a good practice to check your machine lubricator to insure that it is putting the proper dose of oil in the air lines. Usually, 1 drop of oil every other cycle is a good rule of thumb. The approved list of oil for lubricators are as follows:

- KVAL P/N SYSLUBG
- Chevron AW Hydraulic Oil 32
- G-C lubricants light AW R&O
- Mobile DTE 24
- Shell Tellus32
- Gulf Harmony 32

To prime the lubricator, find an air line on the carriage section of the machine that is energized, and disconnect it, allowing the air stream to bleed air pressure away from any persons. Direct the air stream at the machine so you can see when there is an oily film blowing out of the air hose. Repeat this same procedure for the back section and other trouble areas.

It is recommended to check the lines every week to two weeks.

Replace the X-Axis Self Lubricator

The DL-NCD contains a self lubricating gear assembly on the X-Axis next to the X-Axis motor. The self-lubricator is electronic and produces nitrogen gas in the well to increase pressure to push the oil out. The lubricator well sends a replacement alert to the user screen when oil is low (5%). The alert is a 30 day warning, but it is recommended to change it as soon as possible. Refer to Electrical Drawing for connections labels.
Replace the Lubricator Well

The lubricator kit part number is “Wit Lubricating Kit”. It contains, lubricator well, hose (with oil) and its connectors, bracket, and sensor. Follow the instructions on the next page.
1. Shutdown the machine and follow the Lockout Tagout procedure, in Chapter 1.
2. To prepare, cut the hose included in the kit to match the one on the machine.
3. Add the two hose connectors to the ends of the new hose.
4. On the new lubricator well, set the dip switches.

   a. Remove the protection top from lubricator well. Dip switch is located on the top.
   b. Set the number 5 switch to the “ON” position. This sets Lubricator to a yearly flow cycle.
   c. Set the number 7 switch to the “ON” position. This turns the Lubricator “ON”
   d. Ensure the remaining switches are set to “OFF”

5. Disconnect the black and red wires from the machine connector with a small screwdriver.
6. Disconnect the sensor wires from the Frame Node. (Blue to - VDC, Brown to + VDC, Black to input I-2016)
7. Loosen the bracket, and remove the well from the side of the machine. Do not discard yet.
8. Remove the old hose from the bottom of lubricator well and the applicator.
9. Attach the new hose to the new well and the applicator.
10. Bracket the new well against the machine.
11. Slide the black and red wires into the connector. Secure with a small screw driver.

   **Note:** Polarity is not an issue, but for consistency replace wires as they were.
13. After lubricator well is secure on machine, run a test run.
14. Verify the oil is being applied to the gear and there is no alert on the user screen.
15. Close frame and secure wires with a zip tie.
Lubrication Points

This section shows the main lubrication points on the DL-NCD.

Frame and Feed Through

Cutter Head

Points Located on Both Sides of Cutter Head
CHAPTER 5  Troubleshooting the DL-NCD

This chapter describes troubleshooting steps to help technicians solve issues that may occur with your KVAL machine. If help is needed, call or contact our KVAL Service team at (800) 553-5825 or http://www.kvalinc.com.

Chapter 5 at a Glance

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Refer to the Air and Electrical drawings provided with delivery of the machine. The drawings are normally located in the Electrical Panel. If copies are unavailable, contact the KVAL Service Department. Have drawings numbers, model number, and serial number of machine readily available.

Note:
**DL-NCD Sensors**

On the DL-NCD, sensors provide input to the PLC. The application in the machine is similar to a micro-switch.

**How Sensors Work**

On the DL-NCD, sensors provide input to the PLC as part of the automation of the door cutting process, including feed through, door clamping, and door location. The application in the machine is similar to a micro-switch. It is important to keep the sensors cleaned and aligned to keep the door process running smoothly. There are two classifications of sensors on the DL-NCD------Photo Electronic and Inductive Proximity Sensor.

The **Photo Electronic Detector** uses light as a trigger.

- **Photo Eye Detectors** contain both emitter and receiver. If an object is within the Photo Eye’s sensing field light from the emitter is reflected from the object back to the receiver. With *no object* is in front of the Photo Eye a constant 24VDC is sent to the PLC. If an object is sensed by the Photo Eye, 0VDC is sent to the PLC.
- As a result, any of the photo detectors output equals 0VDC when a door is sensed.

The **Proximity Sensor** detects metallic objects without touching them.

- An inductive proximity sensor consists of a coil and ferrite core arrangement, an oscillator and detector circuit, and a solid-state output. The ferrite core and oscillator create a field generating out the front of the sensor. When a metal object enters the field, a loss in amplitude occurs. The detector circuit recognizes the loss of amplitude and generates 0VDC to send to the PLC. When the metal object leaves the sensing area, the sensor to returns to 24VDC and sends it to the PLC.
- As a result, if a metal object is sensed, the output of the sensor equals 0VDC.

**Troubleshooting Sensors**

If issues point to the sensors, use a DVM (Digital Volt Meter) at the PLC to check the voltages in the “On” and “Off” states. Measure the voltages at the inputs at the PLC terminals. See the machine drawing for detailed wiring connections.
Locations of Sensors from the Out-Feed

I-1003 (Tool 4)
I-1002 (Tool 3)
I-1001 (Tool 2)
I-1000 (Tool 1)
I-1015 (After Out Feed)

FIGURE 5-1. Out-Feed Sensor Locations
Locations of Sensors from the In-Feed

The “I” designators are inputs and the “Q” designators are outputs.

FIGURE 5-2. In-Feed Sensor Locations
Homing and Limit Sensors

Figures 5-3 and 5-4 show the X, Y, and Z Axis homing sensors. See Figure 5-2 for top view locations.

**FIGURE 5-3. Z Axis Sensors**

**FIGURE 5-4. X and Y Axis Homing Sensors.**
Troubleshooting the Air Cylinders

Most cylinders have an extend and retract port. To adjust the extend motion of a cylinder you must adjust the flow control on the retract port; this regulates the air flow exhausting from the cylinder and the opposite is true for the retract motion.

1. Check the air pressure to the machine.
2. Check the flow controls to see that they are adjusted correctly and to the proper specifications.
3. Check for any obstructions to the cylinders such as screws or a misplaced tool etc. FOLLOW ALL SAFETY GUIDELINES AND SIGNS DURING THIS PROCESS.
4. Check the solenoid air valves:

KVAL DL-NCD Operation/Service Manual
5-6
Caution: Once activated, the valve will allow full pressure to cylinder. Make sure you are clear of all moving parts.

a. The solenoid valves can be manually operated by pushing the red manual override button on the end of the valve.

b. If the valve seems to be leaking, the seals may be dry or contaminated with water or it may be that the cylinder “O” rings are damaged and air is passing from one side to the other side of the cylinder which means the air is exhausting through the solenoid valve. It may be necessary to purchase a rebuild kit or a new cylinder.

c. If the valve is not receiving an electrical signal, for instructions. It might be necessary to call in a specialist or check with KVAL customer service at 1-800-553-5825.

5. If an Air Leak is coming from an exhaust port on the solenoid air bank:

a. Check the solenoid for the manual override. If the solenoid has a manual override you can push each of the buttons one at a time. When the air leak stops or weakens it usually means that one or more of the cylinders that the solenoid is operating are faulty.

Adjusting Cylinder Extension Speed:

- Air Supply Out: Clockwise to slow cylinder movement
- Counter-clockwise to speed up cylinder movement

Adjusting Cylinder Retraction Speed:

- Air Supply In: Do Not adjust Factory Set
- “Air Supply In” flow control
- Clockwise to slow cylinder movement
- Counter-clockwise to speed up cylinder movement
Troubleshooting Electrical Problems

Refer to Air and Electrical Schematics provided with delivery of the machine. Schematics are located in the Electrical Panel. If copies are unavailable, contact the KVAL Service Department. Have model number and serial number of machine readily available.

NOTE: The following checks require the electrical panel to be energized. These troubleshooting checks must be performed by a Qualified Electrical Technician.

Warning

The electrical component systems are designed to expedite the troubleshooting process and minimize “down time”. In general, component systems have the input or feed functions at the top. Output or load functions are positioned at the bottom. Most two-voltage electrical panels are designed with the LOW VOLTAGES on the LEFT, and the HIGH VOLTAGES on the RIGHT. The majority of the system components are labeled with numbers that correspond with the electrical prints included in the electrical box door.

Computer controlled machines have signals on the computer that light up when the input or output functions are energized, respectively. Computer controlled as well as non-computer controlled machines have white 120V control power terminal strips. This will indicate power supply from the respective circuits.

PLC controllers also have lights on them for the input and output functions. You can easily find out which circuits are failing by watching the lights turn on or off. Compare the lights on the IDEC or Beckhoff controllers to the electrical print to determine what systems are being affected.

If the Power Stops During Normal Operation

1. Check that the input power disconnect switch is not turned off.
2. Check that all of the emergency stop buttons are in the normal position.

Lockout and Tagout the main power source.

1. Turn the panel disconnect switch in the off position, open the electrical panel door.
2. Observe the disconnect switches. Look for loose or broken wires at the disconnect then at all of the components.
3. Check for continuity of all fuses with an OHM meter. (Fuses need to be removed from the bottom side of the fuse holder before measuring the fuses)
4. Check motor overloads by pressing each white button (usually at the bottom of the panel) in SEQUENCE,. If one is tripped there will be a slight resistance to touch and a “click” sound as it is reset. If an overload is tripped, the 6 lights will only have control power

Check for Tripped Circuits

1. Remove lock and tag outs on the main power sources.
2. Manually close disconnect sensors and energize the control circuit or transformer with its respective sensor. Check the Status Light Panel, If all lights are observed, there are no overloads or emergency stops tripped. See “Troubleshooting with the Status Light Panel” below, for more information.

**Note:** Most electrical problems are related to mechanical malfunction (e.g., stuck motors, jammed chain, blocked photo sensors etc.)

**Note:** If a solenoid valve is suspected, and not cleared in the air checks section (see), it can be electrically jumped to check operation.

**Troubleshooting with the Status Light Panel**

The Status Light Panel is located on the Electrical Panel. All six lights are illuminated when the system is in proper working order. The lights turn on in a sequence and will stop at the point where a fault is first detected.

The sequence that the lights turn on are as follows:

1. Control Power (Amber)
2. Overload Relay (Amber)
3. E-Stop (Amber)
4. Stop (Amber)
5. Start (Amber)
6. 24VDC (Green)

If one or more lights are OFF, follow the process below to isolate the cause.

**NOTE:** Be sure to proceed down the table, starting with the CONTROL POWER light.

STEP 1: Control Power (Amber). If light is OFF go to item A on page 5-10.
STEP 2: Overload Relay (Amber) If light is OFF go to item B on page 5-11.
STEP 3: E-Stop (Amber) If light is OFF go to item C on page 5-11.
STEP 4: Stop (Amber) If light is OFF go to item D on page 5-12.
STEP 5: Start (Amber) If light is OFF go to item E on page 5-12.
STEP 6: 24VDC (Greening light is OFF go to item F on page 5-13.
**Warning**

The following checks require the electrical panel to be energized. These troubleshooting checks *must* be performed by a **Qualified Electrical Technician**.

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**Control Power Light OFF**

1. Check if the Control Transformer button is pulled out.

2. Is the Disconnect Switch on the main electrical cabinet set to **ON**?

3. Is there 208, 220, 440, or 575 V AC to the top side (input) of the Control Transformer? If not, check the fuses at the Fuse Block, and the contacts on the Control Transformer button on the switch panel.

4. Is there 110 VAC between #1 & #2 on the 110 VAC Terminal Strip? If not, check the fuse on the output side of the Control Transformer. If fuse is good, check power coming out of Control Transformer.

5. If no power on the output side, and there is power going into the top of the Control Transformer, replace the Control Transformer.

6. If there is power at the Control Transformer, check the wiring of the black and white wire going from the Control Transformer to the 110 VAC Terminal Strip.
The DL-NCD has no overload circuit. There is a wire jumper bypassing the circuit. If light does not turn on, check the jumper for proper connection.

### E-Stop Light OFF

Check to see if any E-Stop buttons are pulled out.

**NOTE:** Location and quantity of E-Stop buttons varies depending on customer need. Typical locations for E-Stop buttons are near the Rear Access Gate and near the Tool Changer Access Gate.

**For Single E-Stop button machines:** Check for 110 VAC between #2 and #4. If no voltage, check to see if the E-Stop button is pulled out. If the E-Stop button is pulled out and E-Stop light is OFF check the wiring. If no fault is found in the wiring turn off the main power and check for continuity across the pulled out E-Stop switch.

**For multiple E-Stop Button machines:** Check to see if the Back Gate is closed. Check to see if the Disconnect switch on the high-frequency electrical cabinet is ON. If no problem is found, check electrically.

With one side of the meter on #2 check for 110 VAC on #3 through #4. If at any point no voltage is found trace the wires to find the associated E-Stop button and check to see if that button is pulled out. If the E-Stop button is pulled out and the E-Stop light is OFF check the wiring. If no fault is found in the wiring turn off the main power and check for continuity across the pulled out E-Stop switch.

Check for 110 VAC between #2 and #3A on the 110 VAC Terminal Strip. If there is 110VAC, go to next step: If the Disconnect switch on the high-frequency electrical cabinet is OFF (closed) and there is not 110 VAC between #2 and 3A, check the wiring.

Check for 110 VAC between #2 and #3B. If there is 110 VAC, go to next step: If the contact on the Rear Access Gate is closed and there is no power between #2 and #3B, check for wiring problems.
Stop Light OFF

Check for 110 VAC between #2 and #4. If there is voltage, press the Start button. If no voltage, check the Stop button to make sure it is all the way out and not stuck in, then check the contact to make sure it is closed. If still no voltage, check the wiring.

Start Light OFF

Push the Start button. If the Start light remains unlit, push in the Start button and hold it in while a second person checks for voltage between #2 and #5. If there is 110 VAC, replace the ACR relay. If there is no voltage while the button is held in, check the wiring.
24VDC Light OFF

First isolate the power supply. Check between DC+ and DC- for 24VDC. If no DC voltage, disconnect the output (V+ and V-) wires from the 24VDC power supply and check for DC voltage where those wires were disconnected.

If no voltage:
Check the input side for 110 VAC. If no 110 VAC, check the fuse. If there is 110 VAC and no 24VDC, replace the 24VDC Power Supply.

If there is 24VDC.
Reconnect the output wires to the 24VDC power supply.
Trace the output wire to the DC terminal block.
Disconnect all (+ 24V positive) wires from the + DC from the DC terminal block except the + output wire from the + 24VDC power supply.
Check for +24VDC at between any –DC and +DC terminal on the DC Terminal block.
Reinstall the (+ 24V positive) wires one by one, checking for +24VDC after installing each. If at any point no voltage is found trace the last reinstalled wire and check for shorts.
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