ShipConstructor
NC-Pyros

By Albacore Research Ltd.

SHIPCONSTRUCTOR LICENSE AGREEMENT

1. License Grant. **Albacore Research Ltd.**, #304 – 3960 Quadra Street, Victoria, B.C. Canada, V8X 4A3 ("ARL") grants to the person accepting this Agreement (the "Licensee") a non-exclusive, non-transferable right to use (the "License") in object code form those program modules ("Software") specified in the Licensee's purchase order or request ("Order") solely on the software and hardware listed in the Software manual ("System Configuration").
2. Ownership. All rights, title and interests in and to the Software and related documentation shall remain the sole property of ARL. Licensee shall not remove or alter any proprietary rights notices on the Software and the documentation, and shall reproduce such notices on any copies that it makes. Licensee shall be liable for the security of the Software and the documentation in its possession.
3. Expertise Required. Licensee is responsible for evaluating whether the Software meets Licensee's requirements, and for operating the Software and the results obtained. The Software is intended for ship modeling and construction purposes only, and must be used by a person who has expertise and knowledge in this field. The Software requires independent confirmation of the reliability and accuracy of all designs, drawings and other Software output.
4. Restrictions on Software Use. Licensee shall not merge, translate or modify the Software, attempt to defeat any copy protection, make copies of the Software or related documentation (except for object code copies required to run the Software on the System Configuration, and archive, back-up and recovery copies), sub-license, sell, loan, rent, lease or otherwise transfer the Software to any person, or decompile, disassemble or reverse engineer the Software.
5. Term of License. The License term commences on the delivery of the Software to the Licensee, and is either perpetual if so requested on the Order, or on a month to month basis that converts to a perpetual term (a) automatically after 12 months of payment of License fees, or (b) earlier on Licensee's payment of the balance of the perpetual License fee (prior monthly payments receiving 80% credit). All Licenses are subject to termination in accordance with this Agreement.
6. System Configuration. Operation of the Software requires use of the specified System Configuration, which Licensee shall acquire and implement. ARL shall not be responsible for any operational problems caused by the System Configuration.
7. Hardware Keys. Software use requires "Hardware Keys" supplied by ARL, which can be used only at the site(s) authorized by ARL. Upon failure of its System Configuration, Licensee may upon advising ARL use the Hardware Keys and Software on another system and/or location.
8. License Fees. Licensee shall pay to ARL the License fees applicable for the Software requested in the Order as either a perpetual License, or a month to month License.
9. Services. Support services after the Warranty period (Section 13), as well as all installation, consulting, training and implementation services, are at an additional charge and are only provided if requested in the Order.
10. Taxes. All amounts payable by Licensee to ARL are exclusive of all taxes such as sales, use, value added, custom duties, excise taxes and other similar government charges, all of which will be paid by Licensee. If Licensee is required by law to withhold any taxes, then Licensee shall pay ARL a gross amount of money such that the net amount received by ARL after deducting or withholding the required taxes is equal to the amount of the fee originally charged by ARL.
11. Interest Charges. If any amount payable under this Agreement is not paid within 30 days of becoming due, ARL shall have the right to impose a charge of 2% per month (24% annually) on the unpaid balance of the amount, from the due date until the date of receipt of all amounts in arrears including interest.
12. Purchase Orders. Any Order from Licensee shall be deemed to incorporate this Agreement by reference. Any terms and conditions on the Order shall not apply except for information which was requested by ARL. All future Orders for additions to the original Order shall be subject to the terms of this Agreement.
13. Limited Warranty. ARL warrants that during a period of 90 days from the date of delivery of the Software to Licensee, the Software will perform substantially in accordance with the Software documentation specifications, when used in accordance with this Agreement on a properly operating System Configuration. ARL's sole obligation under this Warranty, and Licensee's exclusive remedy, are the "Maintenance Services" provisions (Section 15).
14. WARRANTY EXCLUSIONS. THE LIMITED WARRANTY CONTAINED IN SECTION 13 IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED. ALL OTHER CONDITIONS, WARRANTIES, AND REPRESENTATIONS, EITHER EXPRESS OR IMPLIED, ARE EXCLUDED, INCLUDING BUT NOT LIMITED TO CONDITIONS, REPRESENTATIONS AND WARRANTIES RELATING TO MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. ARL DOES NOT WARRANT THAT

THE SOFTWARE IS COMPLETELY ERROR FREE OR THAT ITS OPERATION WILL BE CONTINUOUS AND UNINTERRUPTED.

15. Maintenance Term. Maintenance Services shall commence on expiry of the Warranty and continue until the end of the calendar year requested in the Order ("Maintenance Term"). Maintenance Services are automatically renewed on the same conditions (except the fees which may change) for successive periods of one year, unless Licensee cancels the renewal at least 60 days prior to the renewal date.
16. Maintenance Services. During the Warranty period and the Maintenance Term, between the hours of 7:00 a.m. to 5:00 p.m. Pacific Time (Canada) ARL's help desk will use reasonable commercial efforts to correct errors that Licensee identifies, by fixes or workarounds. If ARL determines that it is unable to make the Software perform substantially as warranted, Licensee may terminate the License and receive a refund of a portion of the License fees, determined on a three year straight-line depreciation basis beginning on the date of delivery of the Software to the Licensee. Upon ARL delivering "Updates" to address known errors in the Software, Licensee shall install and use the Updates within 30 days of their delivery. Upon ARL delivering Software with new functionalities ("New Releases") as part of Maintenance Services, Licensee shall install and use the New Releases within 6 months of their delivery.
17. Excluded Events Maintenance Services do not include correction of errors due to: (a) Software which has been modified by any person other than ARL's representative, (b) use of a version of the Software which has been superseded by a more current Update or New Release for more than 6 months, (c) incorrect operation of the Software or use of the Software for purposes other than ship modelling and construction, (d) any fault in the System Configuration, or incompatible third party software, or (e) use of the Software with products or services not supplied or approved by ARL.
18. Licensee's Cooperation. Licensee shall cooperate in investigating each reported Software error, including assisting in duplicating the error and verifying that the error has been corrected.
19. Loss of Data. ARL shall not be responsible for any loss of or damage to files or data caused by the Software, or be required to restore or rebuild files or data. Licensee shall implementing adequate backup procedures to avoid any loss of files and data.
20. Modifications. Only ARL shall have the right to modify the Software. Modifications requested by Licensee shall be subject to prior written agreement as to scope and fees payable. Ownership of all Software modifications shall vest in ARL.
21. Confidential Information. Each party will not use the confidential information of the other party for any purpose except for the purpose described in this Agreement, and shall not disclose it to any other person except on a confidential basis to its employees and representatives who have a need-to-know the confidential information for such purposes. This Section 21 shall not apply to confidential information which (a) is or has become readily available to the public in the same form other than by an act or omission of the receiving party, (b) was lawfully obtained in the same form by the receiving party from a third party not under an obligation of confidence to the disclosing party, (c) was in the receiving party's possession in the same and material form prior to its receipt from the disclosing party and did not otherwise originate from the disclosing party, or (d) is required to be disclosed by operation of law.
22. Termination. This Agreement may be terminated by either party, immediately by written notice, if the other party commits a breach of any material provision of this Agreement and fails to correct or rectify such breach within 30 days of receipt of the notice requesting it to do so.
23. Effect of Termination. Upon termination of this Agreement Licensee shall immediately cease using the Software, and within 14 days of termination return all Hardware Keys to ARL.
24. CONSEQUENTIAL DAMAGES. IN NO EVENT SHALL ARL BE LIABLE FOR ANY LOSS OF DATA OR PROFITS, ECONOMIC LOSS OR SPECIAL, INDIRECT, INCIDENTAL, CONSEQUENTIAL OR PUNITIVE DAMAGES WITH RESPECT TO THIS AGREEMENT OR THE SOFTWARE, HOWEVER CAUSED, EVEN IF ARL HAD OR SHOULD HAVE HAD ANY KNOWLEDGE OF THE POSSIBILITY OF SUCH DAMAGES.
25. DAMAGES LIMITATION. THE MAXIMUM LIABILITY OF ARL FOR ALL CLAIMS AND DAMAGES OF ANY KIND, WHETHER FOR FUNDAMENTAL BREACH OR ANY OTHER CAUSE UNDER THIS AGREEMENT, SHALL BE LIMITED IN THE AGGREGATE TO THE TOTAL OF ALL FEES PAID BY LICENSEE.
26. LIMITATION OF NON-APPLICABILITY. IN SOME JURISDICTIONS THE EXCLUSION OR LIMITATION OF WARRANTIES OR LIABILITY MAY NOT BE APPLICABLE, AND IN SUCH JURISDICTIONS ARL HEREBY LIMITS ITS LIABILITY TO THE FULLEST EXTENT PERMITTED BY LAW.
27. Applicable Law. This Agreement shall be subject to and construed in accordance with the laws of the Province of British Columbia, Canada, excluding its conflict of laws rules and the application of the UN Convention on Contracts for the International Sale of Goods.

28. References. ARL shall be allowed to incorporate Licensee's name in ARL's customer reference list and to use it for marketing.
29. Dispute. If any dispute arises under this Agreement, a good faith attempt to resolve the dispute will be made by senior management of both parties at a mutually agreeable site and time. If the parties are unable to reach agreement within 30 days after a request for such meeting, the dispute shall be referred to arbitration in English, before one arbitrator in Victoria, British Columbia, Canada, in accordance with the commercial arbitration rules of the British Columbia International Commercial Arbitration Centre.
30. Entire Agreement. This Agreement contains the entire agreement between the parties and shall supersede all prior discussions and agreements between the parties regarding its subject matter.
31. Amendment. Any amendment of this Agreement must be in writing and signed by duly authorized representatives of the parties.
32. Waiver. The waiver by any party of a breach by the other party of this Agreement shall not be construed as a waiver by such party of any succeeding breach by the other party of the same or another provision.
33. Assignments. Licensee may not assign or transfer the License or Licensee's rights or obligations under this Agreement without ARL's prior written consent, and any such assignment or transfer without consent shall be null and void.
34. Successors and Assigns. This Agreement will bind and enure to the benefit of the parties and their respective successors and permitted assigns.
35. Severability. In the event that any provision of this Agreement is declared invalid, illegal or unenforceable by a court having jurisdiction, then the remaining provisions shall continue in full force and effect.
36. Force Majeure. Except as related to Licensee's obligation to make payments to ARL, neither party shall be liable for delays or non-performance if such delays or non-performance are beyond such party's reasonable control. A delayed party shall promptly notify the other party in writing stating the cause of the delay and its expected duration and shall use commercially reasonable efforts to remedy a delay or non-performance as soon as reasonably possible.
37. Survival. The provisions of Sections 2, 19, 21, 23, 24, 25, 29 and 37 shall survive the expiry or termination of this Agreement.
38. Language. It is the express will of the parties that this Agreement and related documents have been prepared in English. C'est la volonté expresse des parties que la présente Convention ainsi que les documents qui s'y rattachent soient rédiges en anglais.

Your ShipConstructor Team

Andrew Wong	Kevin van Donkersgoed
Chris Bracken	Larry Varga
Chris Phillips	Matthew Barber
Christian Zuger	Matthew Fox
Darren Larkins	Paul Crawford
Denis Morais	Peter Andrews
Eric Dionne	Petra Sommerfeld
Jacob Trakhtenberg	Philipa Lattey
Jane Sun	Rolf Oetter
Jason Paterson	Scott Hanson
Jason Rancourt	Silke Sommerfeld
Karen Congdon	Walter Langer

Cover model courtesy of *Bender Shipbuilding and Repair Co.*

ARL
Albacore Research Ltd.

#304 – 3960 Quadra St.
Victoria, BC
Canada V8X 4A3

Toll Free: 1-888-210-7420
Phone: 1-250-479-3638
Fax: 1-250-479-0868

info@ShipConstructor.com

support@ShipConstructor.com

arl@ShipConstructor.com

www.ShipConstructor.com

October 03

Contents

Introduction

Overview

NC-Pyros generates NC-code from CAD DXF files for computer controlled burning tables with plasma arc cutting, gas cutting, laser cutting and other manufacturing applications.

NC-Pyros is designed to run in Windows NT/2000/XP.

NC-Pyros is fast! Typical conversion times including user selection, error checking and simulation are around 1 minute.

The graphical user interface (GUI) makes it easy to learn. A new user can produce reliable NC-code within the first ten minutes of using NC-Pyros. The program has features to catch user errors and automatically compensate for common CAD drawing deficiencies.

NC-Pyros offers the following main features:

- Converts DXF CAD drawings to reliable NC-code for 2D tables.
- Many automatic error correction features save time and money.
- Automatic and manual path generation.
- Automatic and manual data correction methods.
- Intuitive, easy to learn graphical user interface.

NC-Pyros Features

NC-Pyros has the following main features:

- Reads DXF formatted files and converts these to NC-code for burning machines.
- All duplicate entities, i.e. identical lines or arcs, are automatically deleted.
- Allows the user to set the lead-in and lead-out length independently. You can create NC-code with no leads, lead-ins only or lead-ins and lead-outs.
- Allows the user to set a snap tolerance. This is used to ensure that the path will continue even if small gaps exist between the entities.
- Can optimize the complete path automatically from the DXF file or you can manually determine the order of processing. The shapes on each layer are processed from the bottom left corner to the upper right corner.
- An automatic lead collision function detects collisions of leads with any other shapes.
- Lets you set the start of a shape at any position.
- Shapes can be “tabbed” so that they remain fixed to the plate.

- Circles or arcs which cross over the horizontal or vertical axis can be automatically processed in several arc instructions.
- Calibration marks can be inserted to detect slips in the machine or movement of the plate during the burning process.
- You can delete shapes or reverse the direction of cut on the shapes.
- You can edit leads to change the length or orientation.
- Text can be marked.
- Detailed inspection of the path is possible by simulating it step by step or at a variable speed. The generated NC-code is shown as the path is simulated.
- The optimized path can be output to plotters and printers at any scale.
- Calculates the area of the processed parts, minus any holes.
- Text marking from regular text strings in the drawing.
- Text marking using BUGE.
- Full manual control over order of processing.
- Backplot function to convert code back to geometry.
- Reference information handling and collision testing with plate edge and clamping.
- Single step simulation with generated code display.
- Automatic return to origin option.
- Data consistency check for incremental programming.
- Arc or linear lead-ins and lead-outs.
- Linear lead-ins and lead-outs tangential to the shape.
- Layer for cutting without kerf for common cuts or slots.
- Positioning of processed parts using margin to shift parts on a plate.
- Error detection file shows the location of errors that may require further investigation by the user.
- Separating process entities by color.
- Code description for each NC-code.
- Mark using rapid travel speed.
- Generate marking path only.
- Support for inserting dwells, program stops or comments anywhere in the path.
- Support for spline-fitted polylines and ellipses.

Installation

Please refer to the installation manual.

Licensing Changed

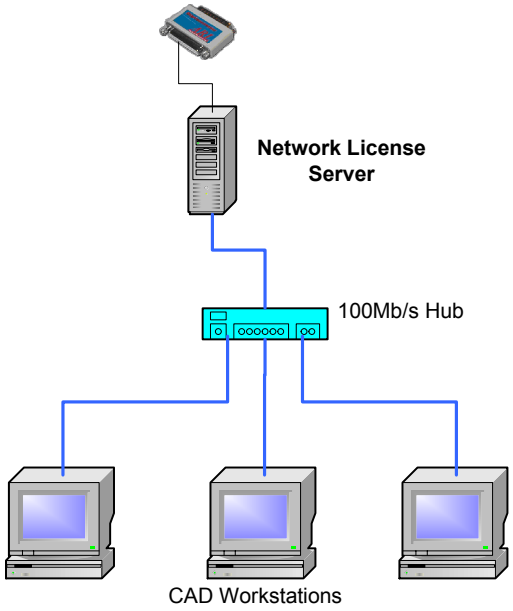
Licensing for NC-Pyros uses a hardware dongle.

Configurations

Standalone Computer

If you have a standalone system then all you need to do is attach the dongle to the parallel port of your computer.

Network License Server



Note: This configuration requires a network lock.

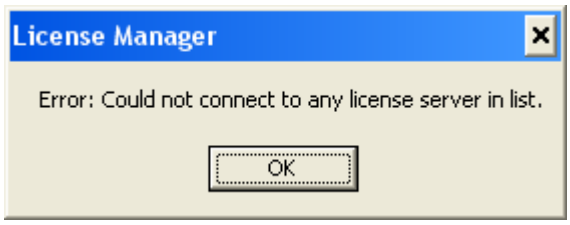
On the Server Computer

See the Manager manual for how to set up the network license server.

On the Client Computers

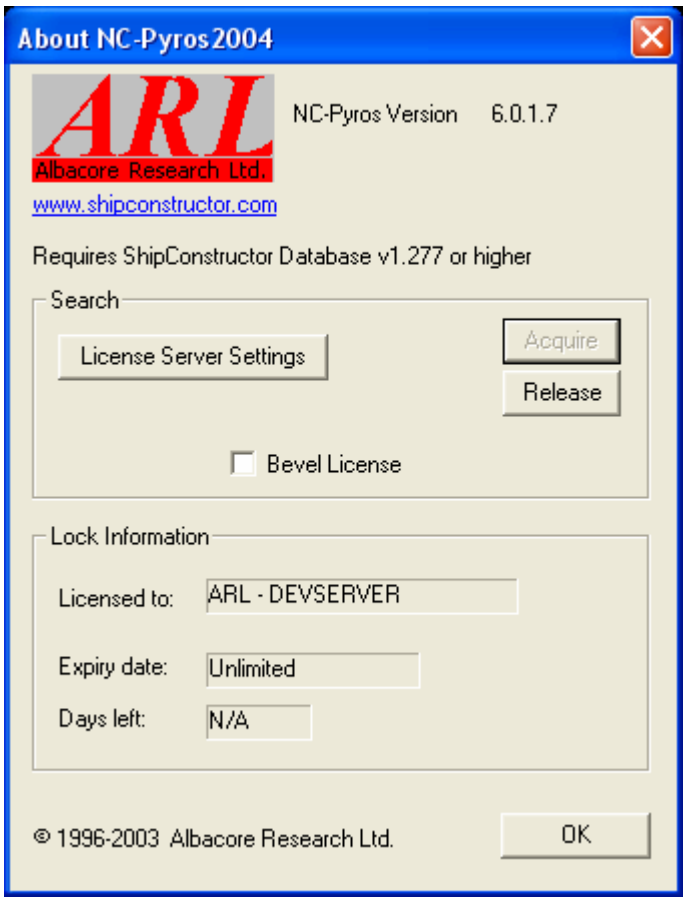
You need to configure NC-Pyros to connect to the network license server.

1. Start NC-Pyros. You may see a warning message like the following.

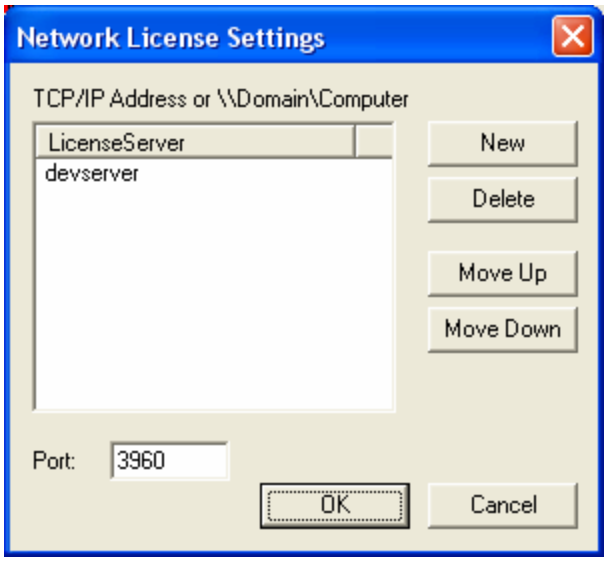


No license server exists on any machine in the server list.

2. Run **Help / About NC-Pyros.** You will see the following dialog.



3. Click **License Server Settings** to change the server to connect to. You will see the following dialog.

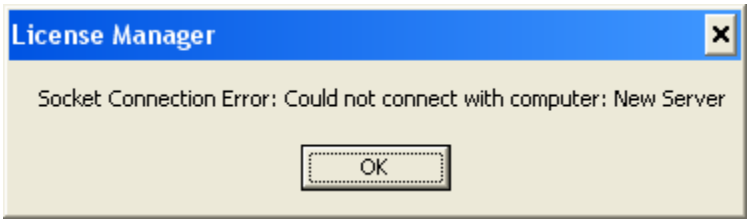


4. Change **<Local Computer>** to *Server* (where *Server* is the name or IP address of your network license server computer). You can change the name in the list by double clicking the name.

Local Computer is actually IP address 127.0.0.1. Do not change the port setting unless instructed to. If you remove all computers from the list then <Local Computer> is added automatically.

5. Click **OK** to return to the About NC-Pyros dialog.
6. Click **Acquire** to get a license.

Common Licensing Problems



This indicates that ARLLicenseServer Service is not running on the computer you are trying to connect to or that computer does not exist.

Technical Support

Albacore Research Ltd. offers all customers technical support for the first 3 months after purchase. Additional support can be obtained through our maintenance and support program. In some cases our staff will offer to check out the problem with your data file. In this case it is advisable to compress the data file, for example with WinZip, and e-mail it to us. We will investigate the problem and forward a solution to you.

Office hours:	7:00 am – 5:00 pm Pacific Time
Toll-free:	1-888-210-7420
Phone:	1-250-479-3638
Fax:	1-250-479-0868
e-mail:	support@ShipConstructor.com
web:	www.ShipConstructor.com

Tutorial

Overview

This chapter provides a number of hands-on examples to get you familiar with the procedures involved in some of the different kinds of NC-code generation.

Operation Basics

You can use NC-Pyros as an integrated module with ShipConstructor or as standalone program.

Integrated With ShipConstructor

In the integrated operation mode NC-Pyros is linked to the ShipConstructor database of the project you will be working on. Many settings, such as directory location for the nested DXF files and colors to determine cutting operation, will be configured by the ShipConstructor database file of that project. NC-Pyros updates the database with parameters calculated during the NC-coding process. These include cutting length and the NC-coding date and the operator's name.

Standalone

Use this mode when converting DXF files to NC-code that are not generated by the ShipConstructor nesting function. You will generally convert many nested DXF files to NC-code during the time it takes to complete the project. You might be processing dozens of nests over a period of days or weeks. Some nests might be recalled because of last minute changes. Planning ahead can save you a lot of time and aggravation. Follow this procedure:

- Create a new folder for the project.
- Move all DXF nest files into this directory.
- Open a DXF file and set up the preferences according to the requirements of the job. The preference settings will be saved in the current folder. The next time you work on any file in this folder, NC-Pyros will remember the settings last used.
- Produce one small NC-code file and double check that it works on your machine
- In general, there are two different procedures of processing the CAD drawing into reliable NC-code:
  - Fully automatic NC-code optimization.
  - Manual optimization of the NC-code.

NC-Code Generation Steps

The following steps are recommended for generating NC-code:

- Open the DXF file.
- Optimize the path automatically - or - Connect the entities into shapes then connect the shapes manually.
- Check the path for lead collisions.
- Simulate the generated path.
- Save the NC-code.
- Overlay the optimized cutting path in the DXF output file (DXO) over the original nest and verify the path.

Default Processing and Error Correction Overview

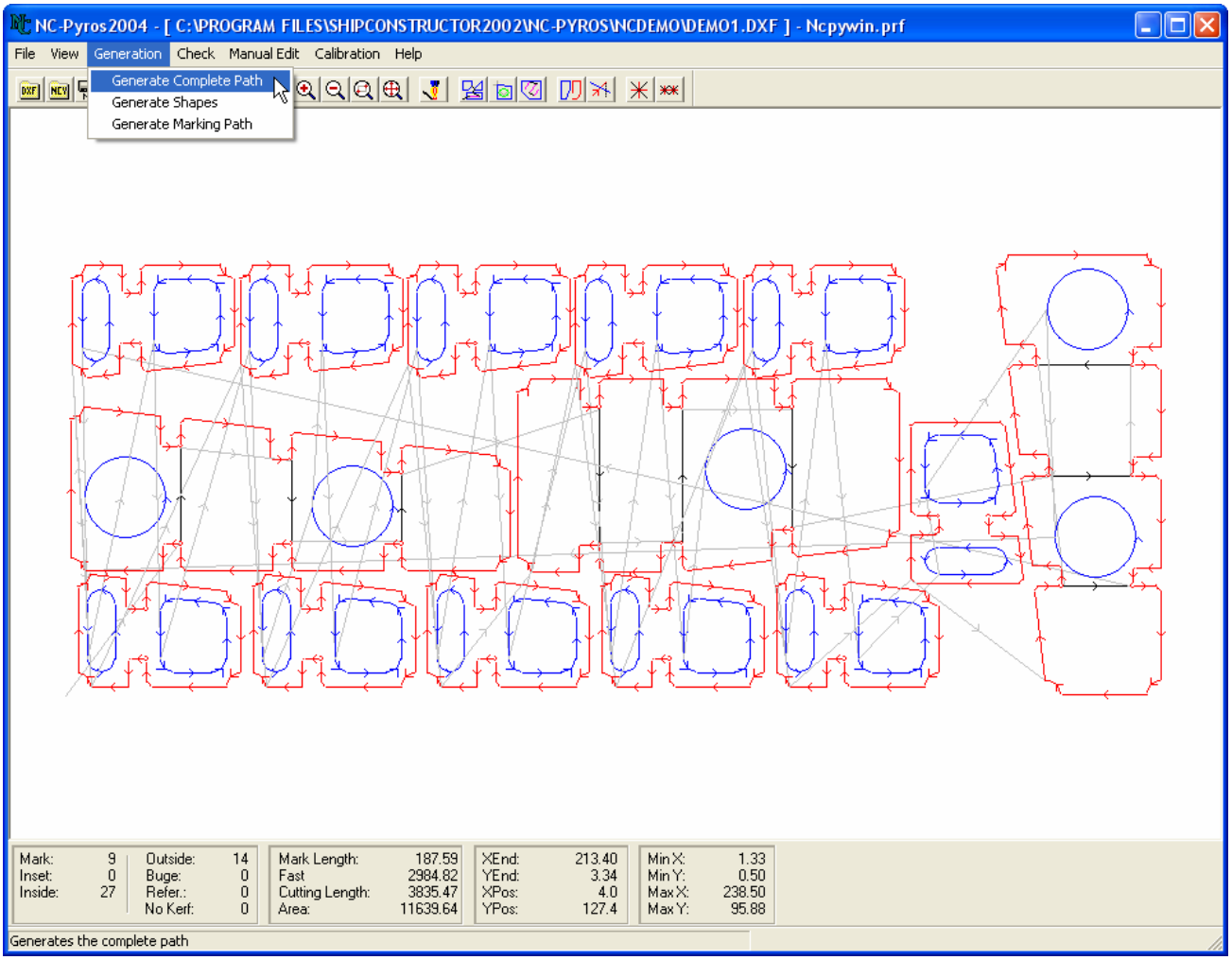
NC-Pyros performs a number of default processing checks when reading or optimizing a path.

When reading the DXF file the following procedures are performed:

- All entities on unspecified layer names (or colors) are ignored.
- Text on the TEXT layer is converted to marking using the character definitions in the CHAR.DAT file (see Appendix 1).
- The entities are shifted appropriately if the nest positioning option is used.
- The entities found are written to temporary files.

When optimizing a complete path the following procedures are performed:

- Duplicate entities are removed automatically.
- All elements within the Snap Tolerance are connected to shapes. A closed shape is a shape that has the same start and end location, i.e. it encloses an area completely in one direction (clock-wise or counter clock-wise). Two entities are considered to be connected if the end points are within the specified snap tolerance. Two entities are connected if the end points fall within a circle with a radius of the snap tolerance, one of the entities is then automatically corrected to close the gap.
- Entities below the "**Erase Elements <**" value are deleted.
- The angles between all elements are checked to detect errors if the path reverses on itself (a common error if stray elements have been left behind in the CAD drawing).
- Lead-ins and lead-outs are automatically generated as specified and checked for the possibility that the leads intersect with the shape.
- All shapes are sorted to produce an optimized processing order.
- The fast travel connectors are generated automatically.
- The total length of each processing type is calculated, i.e. marking and cutting.
- The total area of the processed parts is calculated.
- The processing is on a layer by layer basis when using **Generation / Generate Complete Path**. The order of processing is:
  - Entities on the **MARKING** and **TEXT** layer
  - Entities on the **BUGE** layer
  - Entities on the **NOKERF** layer
  - Entities on the **INSET** layer
  - Entities on the **INSIDE** layer
  - Entities on the **OUTSIDE** layer
- The entities are only connected to shapes. Leads are created as specified when using **Generation / Generate Shapes** to generate shapes only. Use **Manual Edit / Connect Shapes** to connect all shapes in the desired order to a complete path.



Marking

Shapes on the MARKING, TEXT, and BUGE layer will be processed with the scribing unit. All other shapes are processed with the torch specified in the Preferences.

Shapes on the MARKING layer have no specific direction. The rule is that scribing starts at the end of the marking shape that is closest to the X=0, Y=0 location. The next marking shape is processed from the end that is closest to the current scriber location.

Cutting

The shapes on all cutting layers are processed from the lower left to the upper right. Closed shapes on all cutting layers have a defined processing direction. Shapes on the INSET layer and shapes on the OUTSIDE layer are processed in clockwise direction, while shapes on the INSIDE layer are processed in counter-clockwise direction. This results in the kerf always being to the left of the path. The direction of closed shapes is automatically determined by NC-Pyros and corrected if required. Shapes on the NOKERF layer are processed without regard to direction and without leads. Open shapes should only exist on the MARK layer and in some instances on the OUTSIDE layer. Open shapes on the outside layer may be used to cut off an unused part of a partially used stock plate.

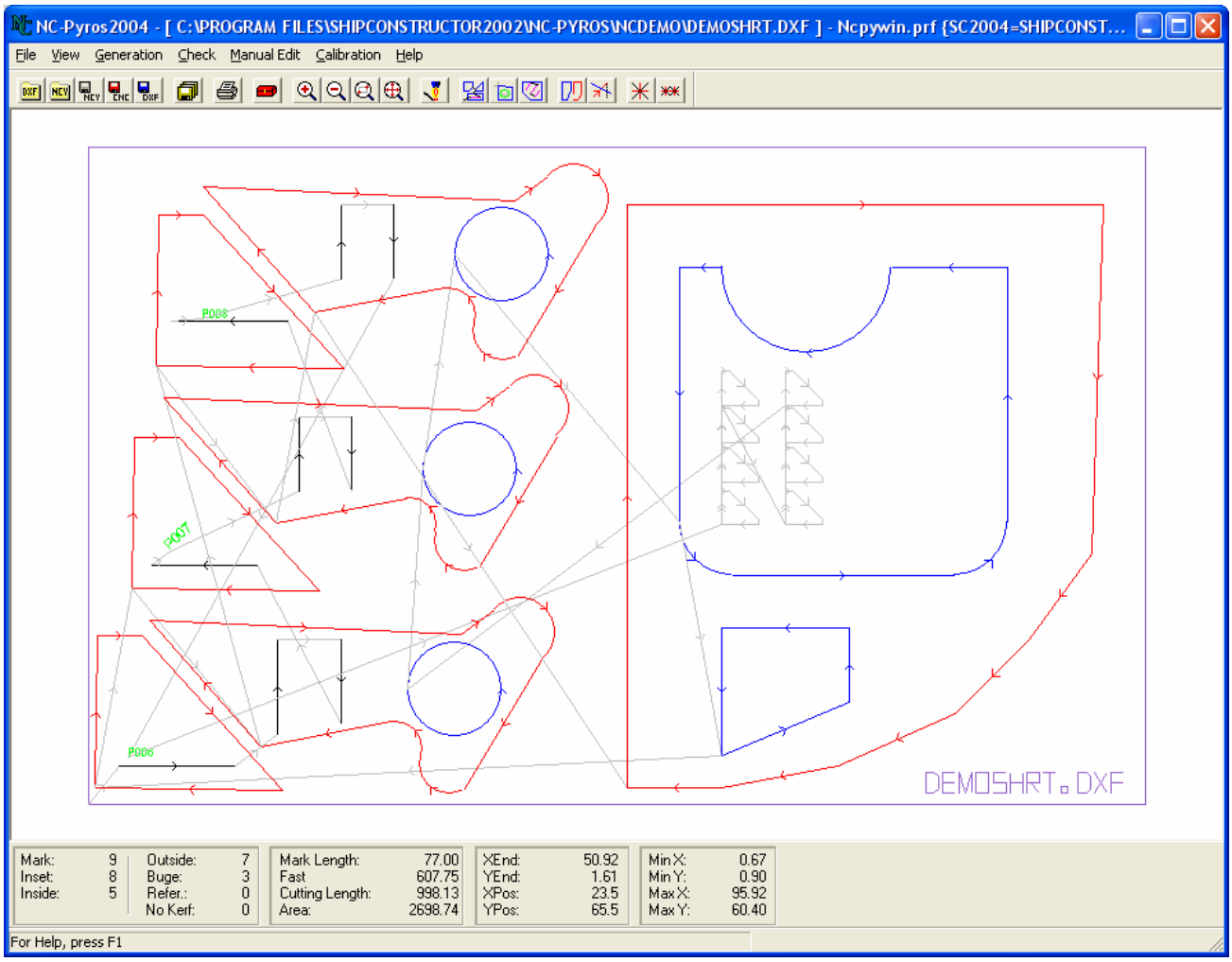
Leads

Leads are automatically placed at the lower left corner of each shape. Leads consist of a lead-in and a lead-out. The opening angle between the lead-in and the lead-out is 60 degrees for non-tangential leads. The lead-in and lead-out each form an angle of 30 degrees for non-tangential leads. The leads always point in the direction of the kerf.

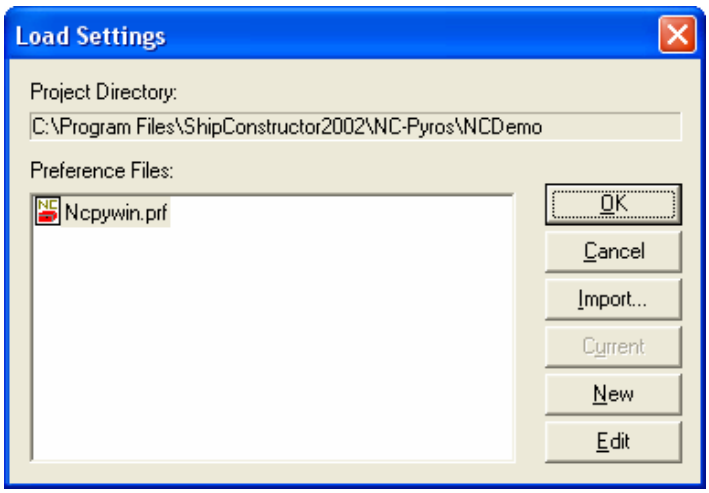
Kerf offsets the torch to one side of the path line by half the width of the cut. This ensures that the finished part will have the specified dimensions. For through holes, the kerf has to be on the inside of the hole; for outside shapes the kerf has to be on the outside of the shape.

Generating NC-Code Without Leads

In this example we will create and optimize a path for a short example nest of the file DEMOSHRT.DXF. During the operation you will learn about the main functions of NC-Pyros. We will open the file, automatically optimize the path and perform a simulation and open shapes checking before we save the NC-code.



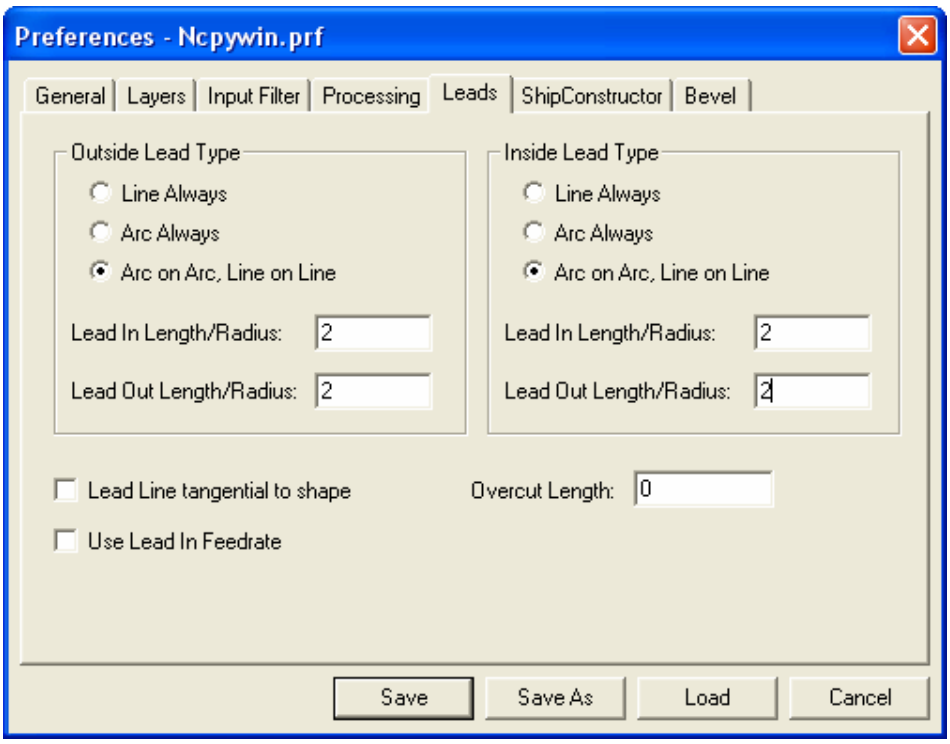
1. **Start NC-Pyros** if it is not running by double clicking the NC-Pyros icon or selecting it from the Start Menu.
2. Select **File / Open DXF** or click  .
3. Browse for the NC-Pyros Demo project directory (default is C:\Program Files\ShipConstructor2004\NC-Pyros\NCDemo) and select the file **DEMOSHRT.DXF**. Since you have just started NC-Pyros, no preferences are loaded yet. The following window lets you select preferences to load.



4. Select the preference file **NCPYWIN.PRF** and click **OK**. The preference file has been setup previously and contains some typical values.
5. The file is loaded and the geometry displayed on the screen. A time bar at the bottom of the screen shows the progress of the loading operation. Also, the number of found entities on each layer is updated in the information window. Each entity on the screen has a direction arrow indicating its processing direction.
6. Select **Generation / Generate Complete Path** from the menu or click  . During path generation, time bars indicate the progress of the operations. After completion, the entire path is displayed. The connectors between the shapes are drawn in light gray and the leads appear in cyan. Notice that the number of entities listed in the information windows has been significantly reduced. Single entities have been connected to shapes. The number of shapes on each layer is now listed. The length of all processes and the area of the processed parts are listed in the information window as well.
7. Select **View / Simulate** or click  . The simulation window will appear at the bottom of the screen.
8. Click the **Go** button. Watch how the path is drawn part by part.
9. Move the **Speed Slider** to adjust the simulation speed.
10. Select **OK** when the dialog box notifies you of the end of the simulation. You can now scroll up and down through the code window to view the generated code.
11. Click the **Cancel** button when you are done.
12. Select **File / Save NC-Code** or click  . The file is written to disk with the same name as the DXF file but with the .CNC extension (**DEMOSHRT.CNC**).

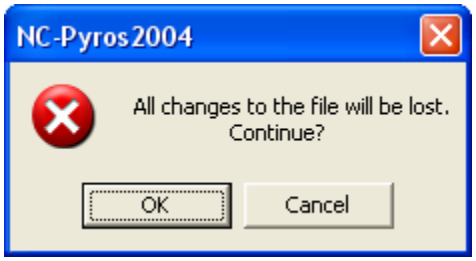
Automatic Lead Collision Check

Using the same file, we will generate a path with long lead-ins and lead-outs to demonstrate how to fix lead collision problems.



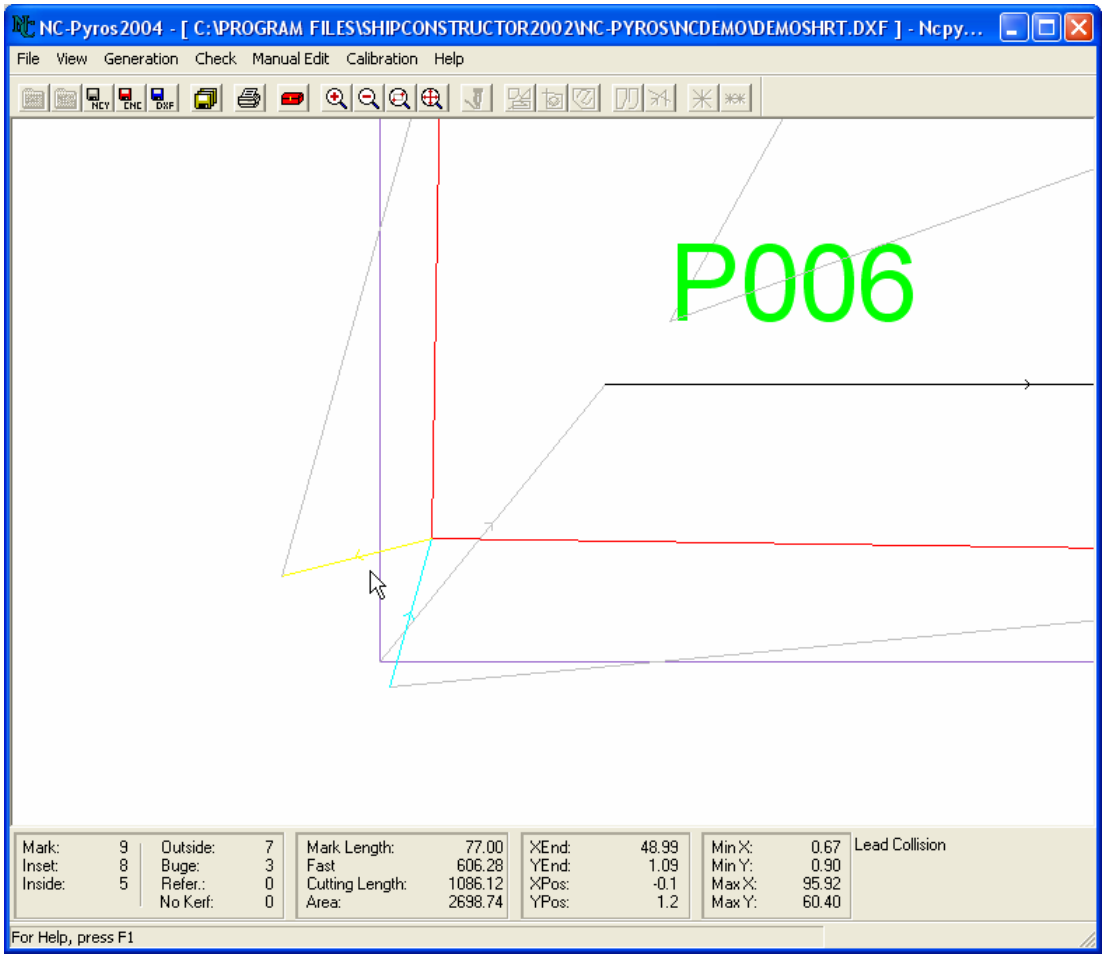
1. Select **File / Preferences** or click  . Make sure the lead-in length and lead-out lengths for inside and outside lead types are set to 2.0. Click **Save**.

2. Select **Generation / Generate Complete Path** or click  . A message will appear asking if you want to continue and lose changes.



3. Click **OK**. All shapes now have very long leads indicated by green lines at the bottom left corner of each shape.

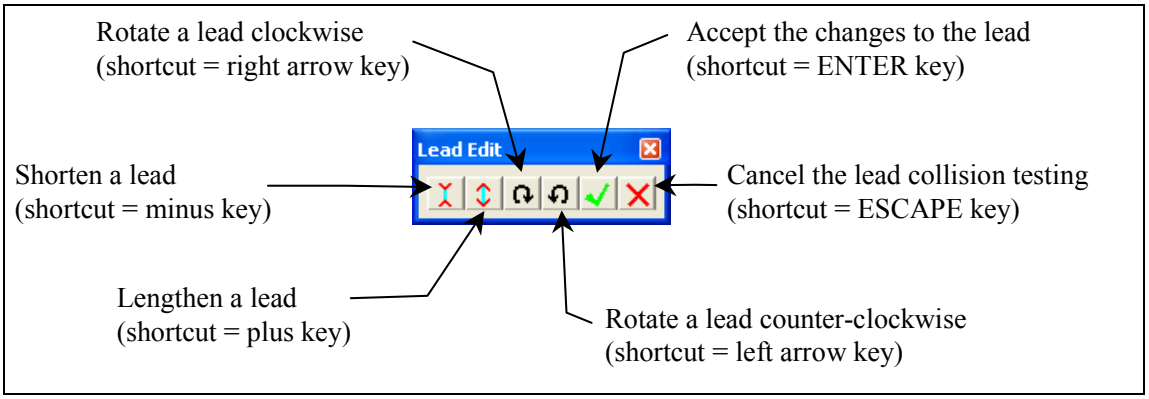
4. Select **Check / Check Lead Collision** or click  . To check every possible case, each lead has to be checked for a collision with all other entities. For example, the program has to check approximately six hundred thousand potential collisions for a nest with 101 shapes and 30 entities per shape. Once a collision has been detected the program automatically zooms into the specified area. The lead colliding with another entity is highlighted in yellow in the center of the screen.



5. The first collision is detected with the plate edge. You can put clamping on the No Process layer to indicate areas where the collision is located. The screen shows a floating toolbar that allows you to edit the lead to avoid the collision.

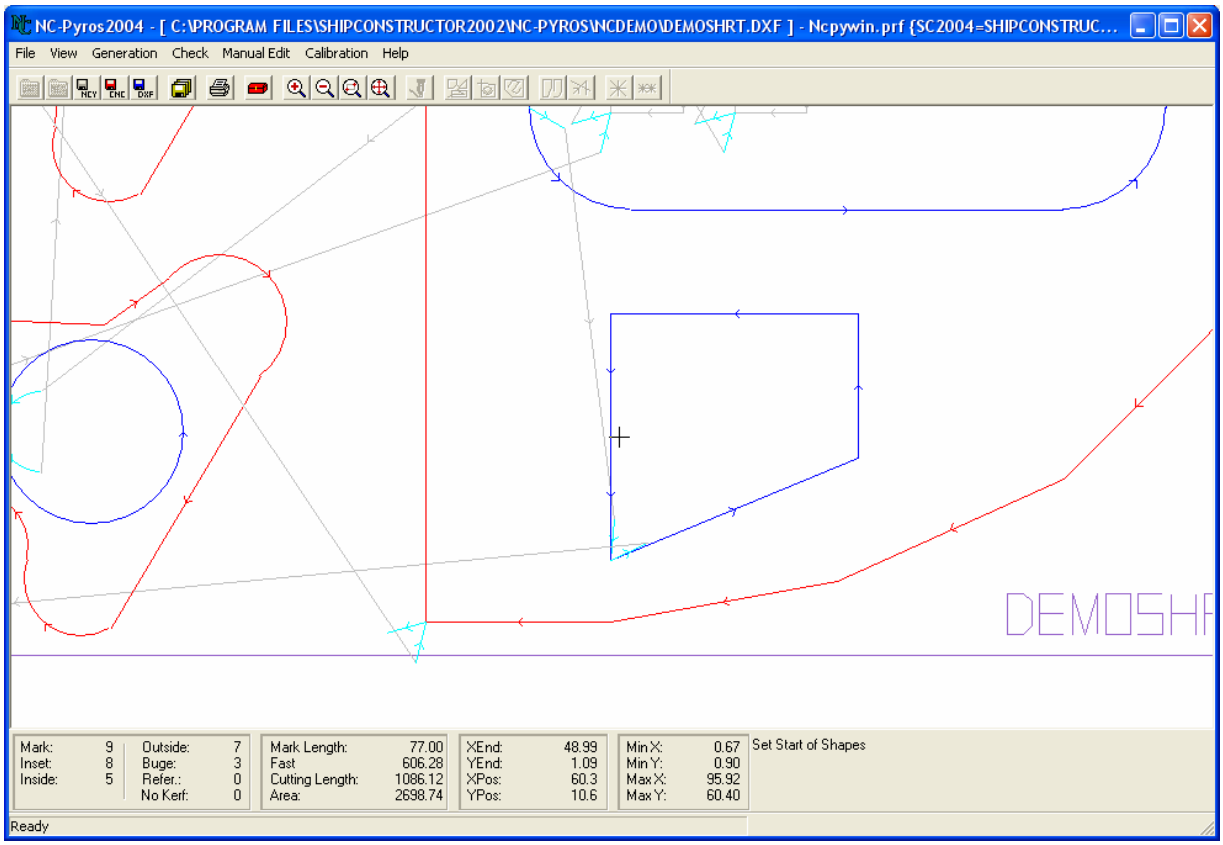
How to Edit the Lead

The figure below shows the floating toolbar with the buttons to edit the leads. Place the cursor over any of the buttons and wait a second to get plain text tool tips on the function of the button.

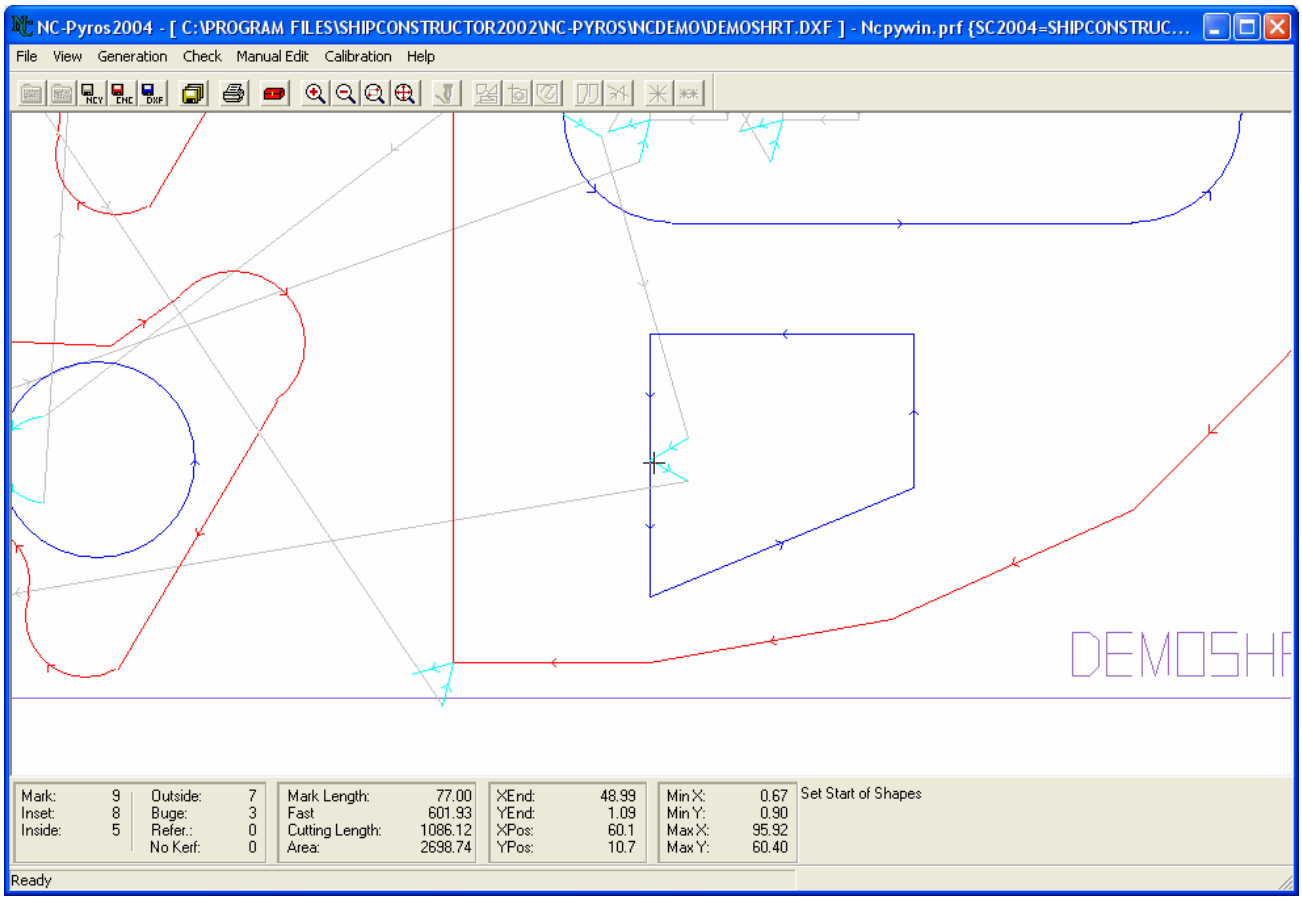


Setting the Start of Shape

By default NC-Pyros sets the start of each shape at the lower left corner. Sometimes this is not appropriate. The lower inside cut on the large right shape has a very sharp corner at the lower left and the leads are not in good position there.



1. Select **View / Zoom** or click  and zoom into the shape as shown in the figure.
2. Select **Manual Edit / Set Start of Shape**.
3. Hold down the **Shift** key and click near the middle of the vertical line on the left of this shape. Watch how the leads are now generated at the new position and automatically connected with fast travel. If you did not hold down the shift key the start point would be located at the start of the element you selected.

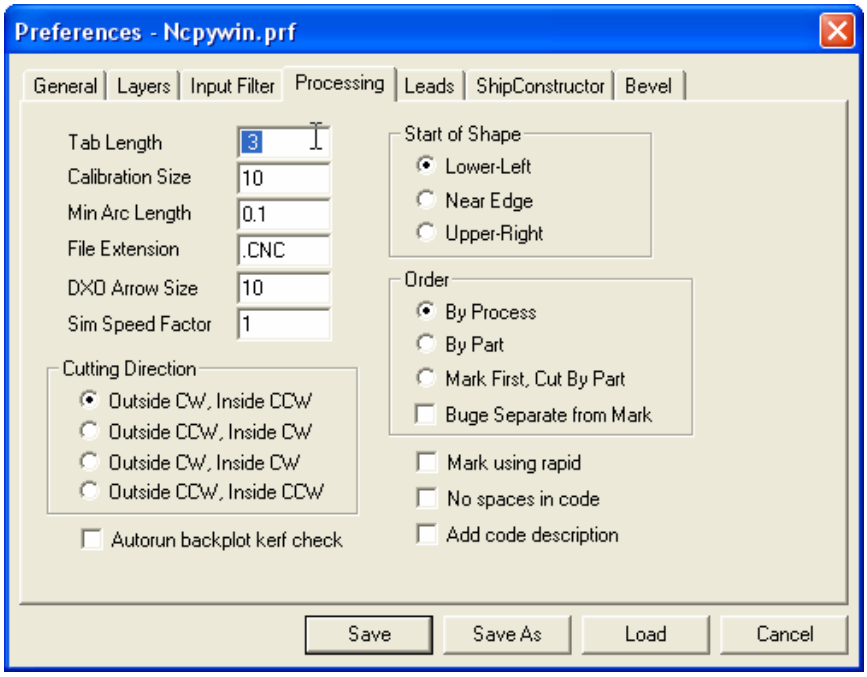


4. Select **Manual Edit / Set Start of Shape** to switch this function off. Most functions on the manual edit menu remain on until selected again or the Escape key is pressed! A check mark to the left of the menu item indicates that a function is active.

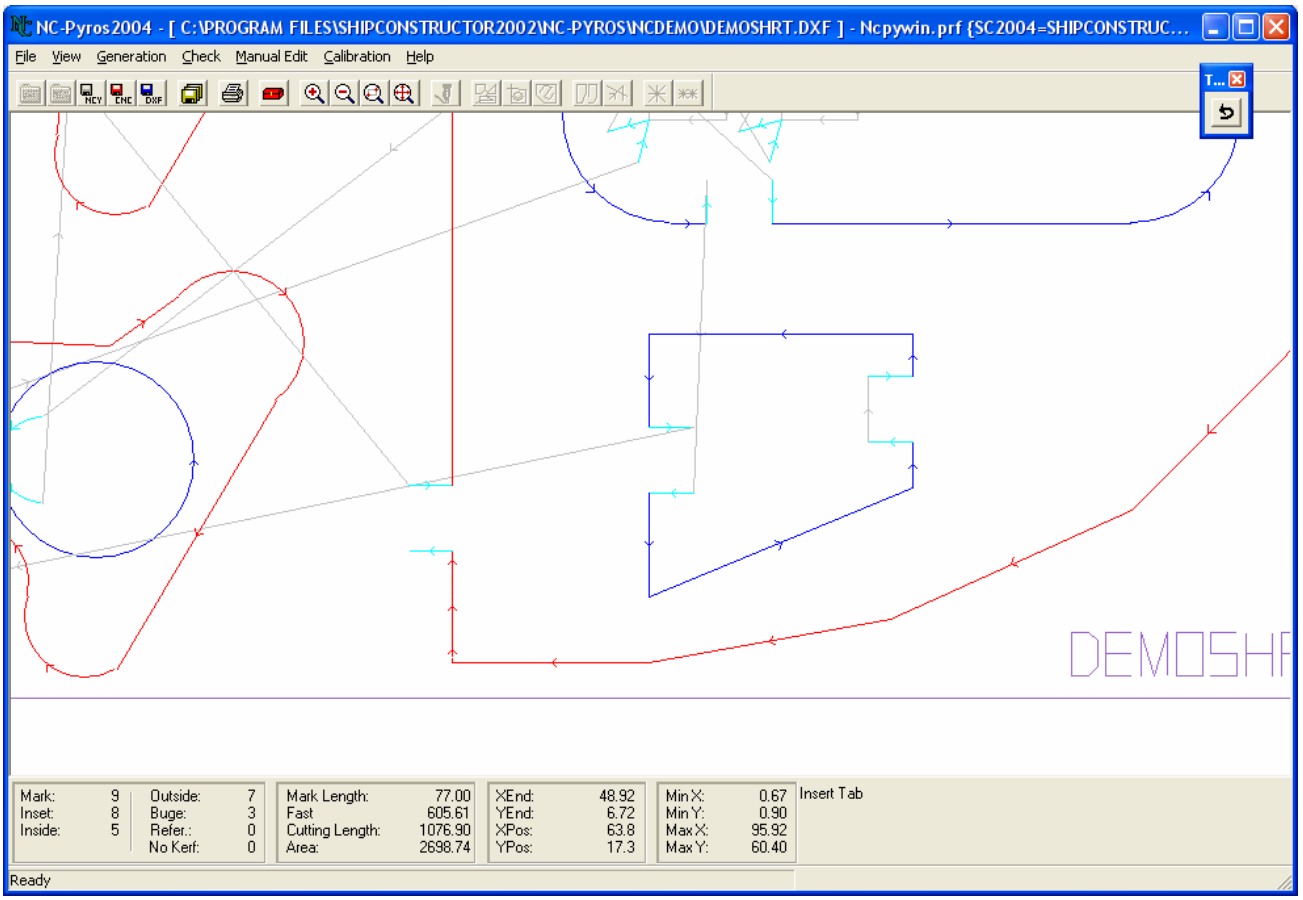
Tabbing Shapes

Tabbing keeps the parts in the nested plate. This is important if you want to ship the processed nest from one place to another. We want to tab some of the outside parts.

1. To prepare for this function select **File / Preferences.**
2. Switch to the **Processing** tab.
3. For this example, set the **Tab Length** value to **3.0** to create large, clearly visible tabs.



Now we can insert tabs into some of the shapes.



1. Select **Manual Edit / Insert Tabs**. This switches this function on until selected again. See the lower right window for the state of the function.

2. Click on some of the outside cuts and watch how tabs are inserted. Leads are generated automatically and the shapes are connected by fast travel. The leads are generated at 90° angles. You can undo the last tab you inserted by clicking on the undo button.

3. Select **Manual Edit / Insert Tabs** to switch this function off. Most functions on the manual edit menu remain on until selected again or the Escape key is pressed. A check mark to the left of the menu item indicates that a function is active.

Reversing Shapes

Note: This procedure should only be used when you have open shapes or for marking when there is no kerf used! In the case of open shapes, NC-Pyros cannot detect the proper direction of processing.

1. Select **Manual Edit / Reverse Shapes**. Pick any shape on the marking layer (White color) and see the arrows indicating the cutting or marking direction and the connectors change.
2. Select **Manual Edit / Reverse Shapes** again to turn this function off.

Placing Calibration Marks

Calibration marks are a very important quality assurance tool. The operator can immediately detect problems by checking the calibration marks after or during the processing. This feature saves times and money by preventing parts that do not fit during assembly.

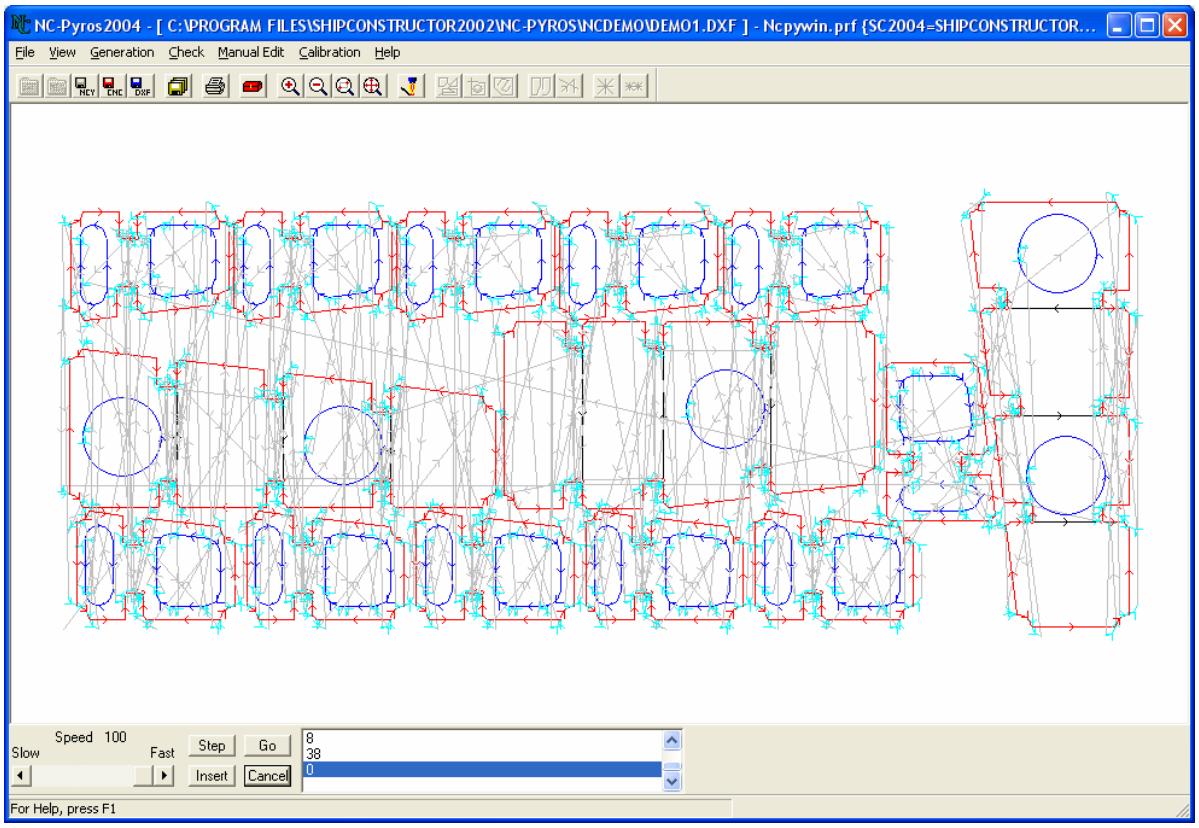
1. Select **Calibration / At Layer Changes** or click  .
2. Click anywhere in the display window and watch how the program places the calibration marks and automatically connects them to fast travel.
3. Select **Calibration / Move Calibrations** then click on or near the calibrations.
4. Move the mouse until you have reached a suitable position. Then press the left mouse button to place the calibrations there.

Demo 1 - Snap Tolerance Problems

1. Select **File / Open DXF** and open the file **DEMO1.DXF**.
2. Select **File / Preferences**, click the **Input Filter** tab and set the **Snap Tolerance** to **0.0**.
3. Select **Generation / Generate Complete Path** or click  . The Area calculation function will display a warning message that there is an open shape for which the area could not be calculated.

4. Select **View / Simulate**. A new window is displayed at the bottom of the screen.

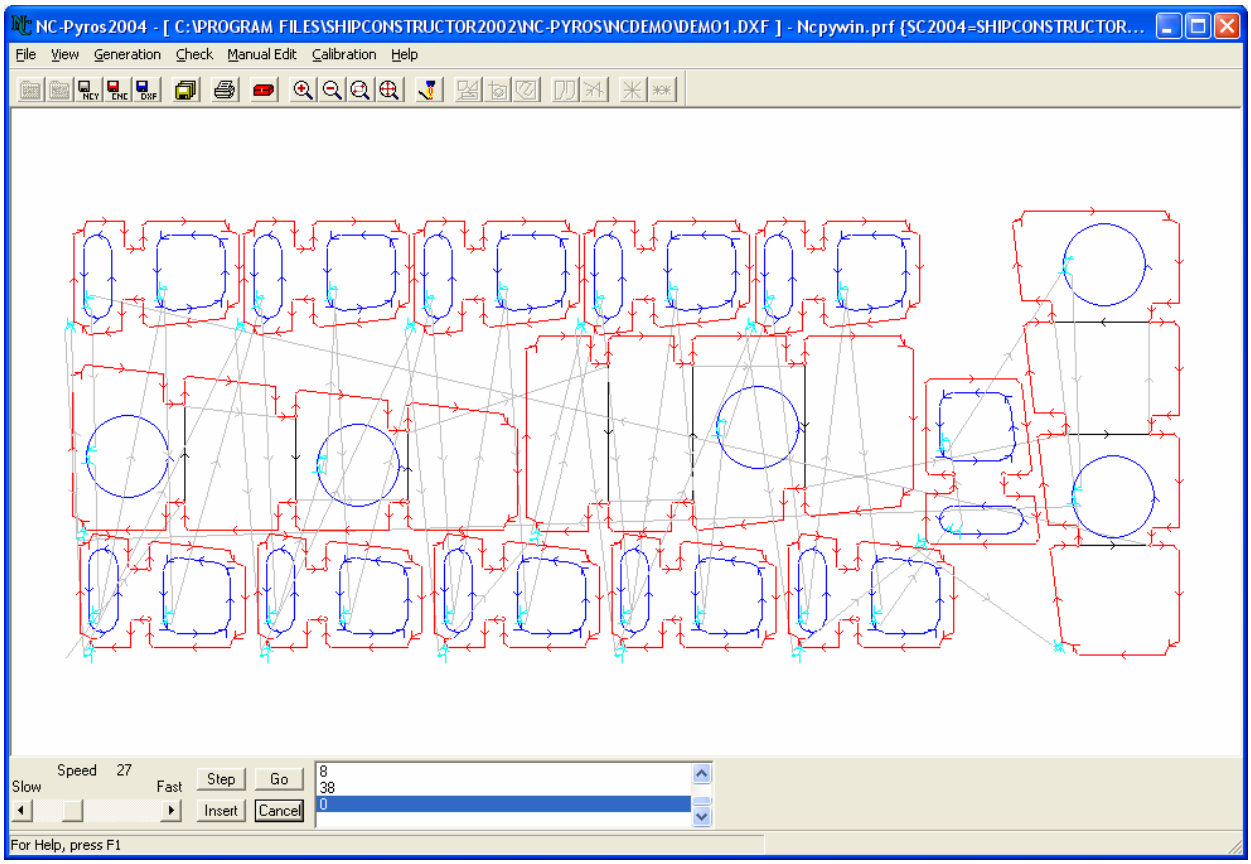
5. Click the **Go** button and watch closely how the path is drawn. Many shapes are not closed and the fast travel connectors are all over the place. Obviously, many of the entities belonging to the same shape have small gaps between them, even though they were drawn using object snap end on in AutoCAD.



6. Select **OK** when the dialog box notifies you of the end of the simulation. Click the **Cancel** button when you are done.

We will correct this problem now by setting a sensible Snap Tolerance. Minute errors in the drawing can be tolerated. Quite often the "error" is really only a floating point rounding or drafting errors too small to see.

7. Select **File / Preferences** and click the Input Filter. Set the **Snap Tolerance** to **0.1**.
8. Select **Generation / Generate Complete Path** to optimize the path again.
9. Select **View / Simulate** again.
10. Click **Go** and watch closely how the path is drawn. Now NC-Pyros connected all elements into the intended shapes and there are no open shapes.

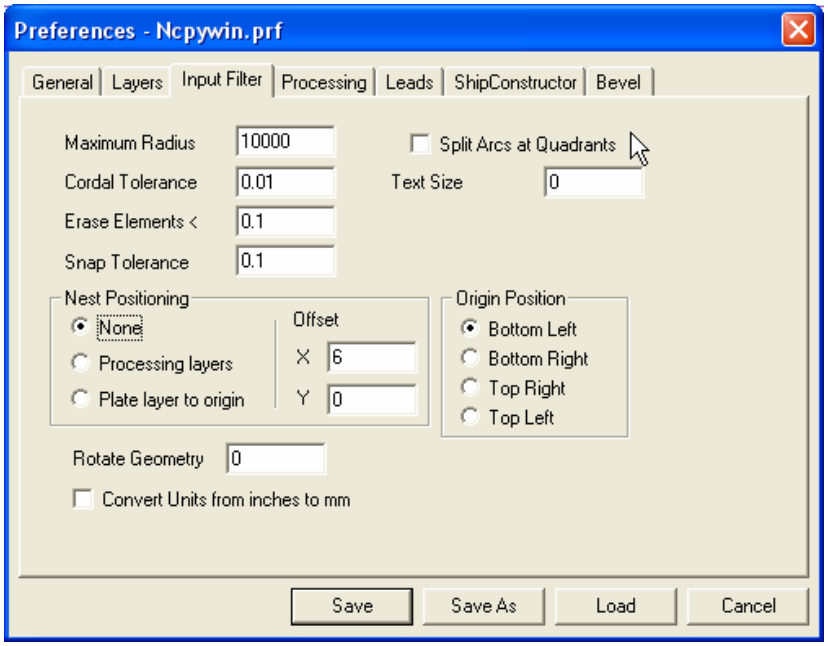


11. Click **OK** when the dialog box notifies you of the end of the simulation. Click the **Cancel** button when you are done.

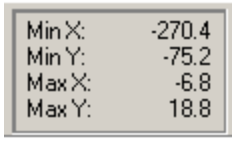
Demo 2 - Nest Positioning and Open Shapes

Often it is more economical to have several nests on the same drawing. Maybe you keep all nests for one construction block in one drawing or keep nests of the same plate thickness on the same drawing. The result is that the parts on the nest are not in the appropriate location. You can customize NC-Pyros to move the nest into the desired position. In this example we will first load the file without re-positioning it, then we will position the nest as desired.

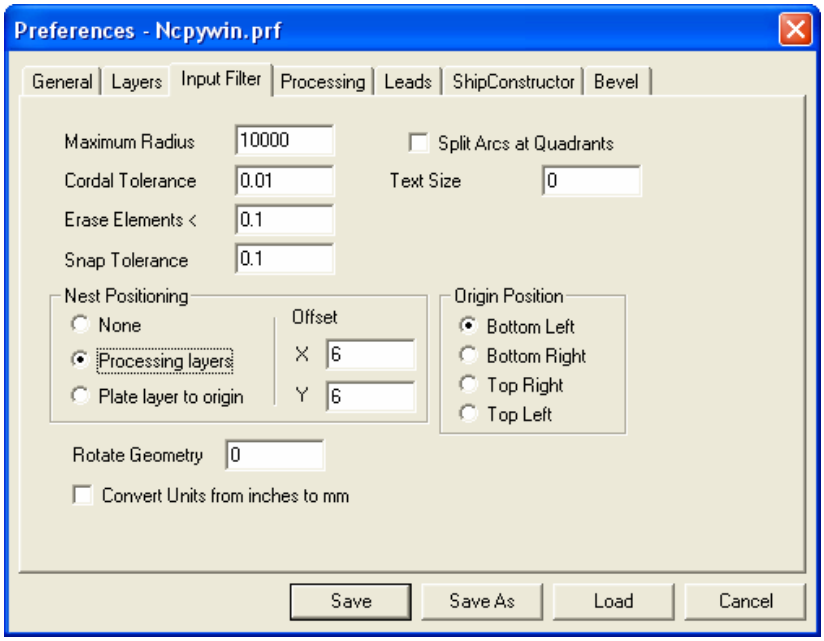
1. Select **File / Preferences**.
2. Select the **Input Filter** tab. Make sure **Nest Positioning** is set to **None**.



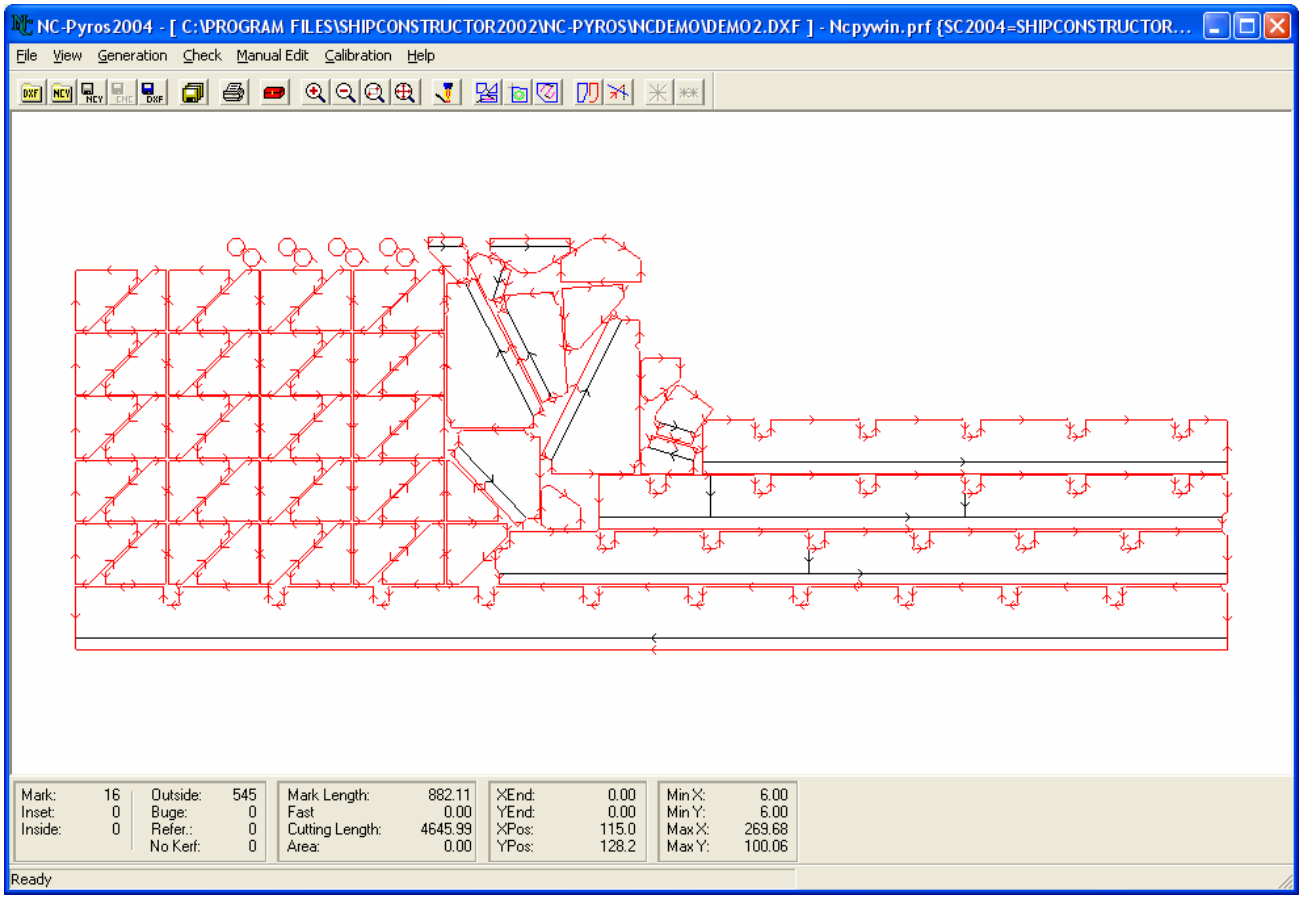
3. Select **File / Open DXF** and open the file **DEMO2.DXF**. Note the minimum values for the geometry are negative!



4. Select **File / Preferences**.
5. Select the **Input Filter** tab, set the **Nest Positioning** to **Processing layers** with **Offset X** set to **6.0** and **Offset Y** set to **6.0**. This will shift all the geometry so that the minimum X and Y values are 6.0. Click **Save**.



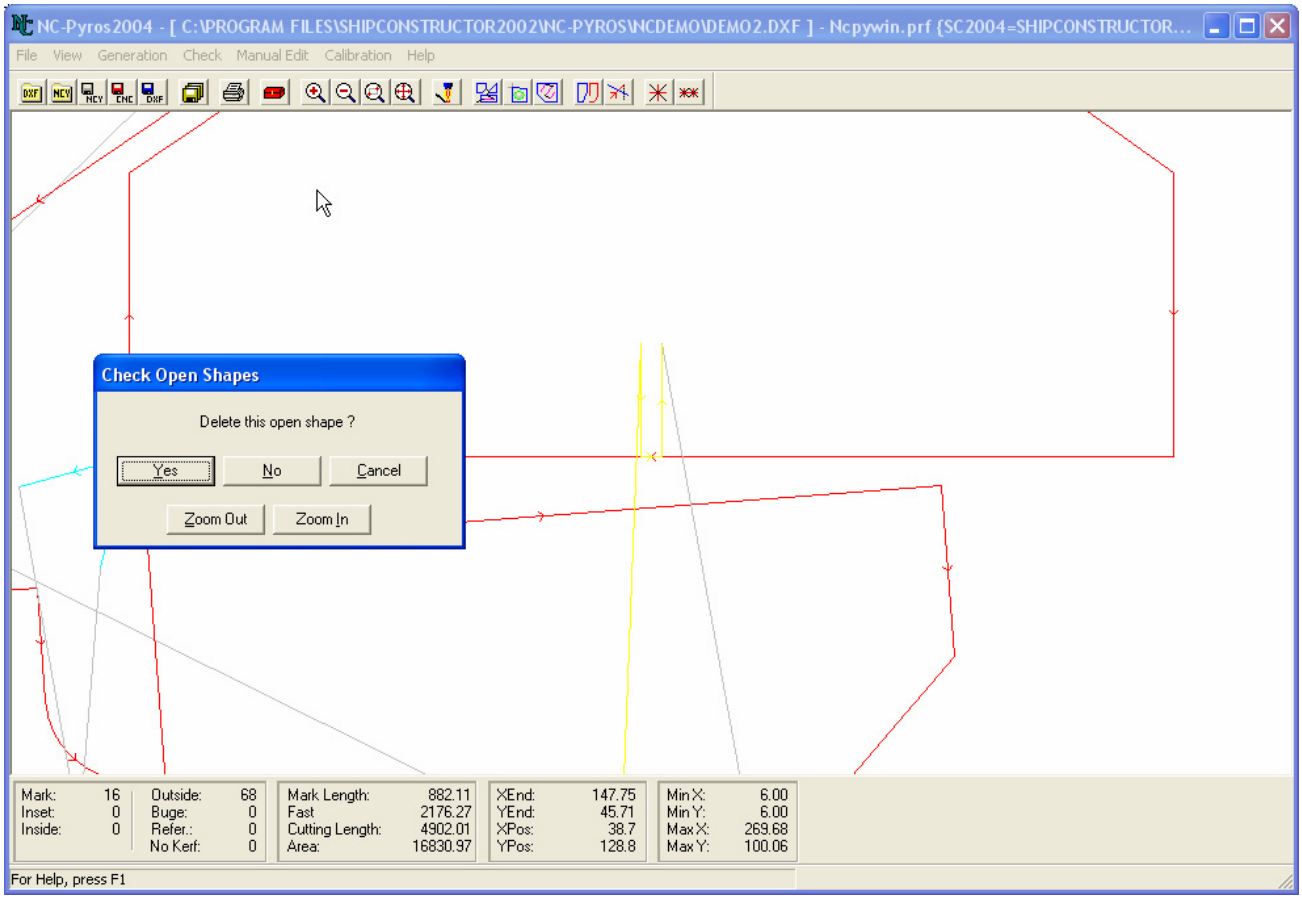
6. Select **File / Open DXF** and open the file **DEMO2.DXF**. Note the minimum values in the status bar at the bottom of the screen for the geometry are both 6 inches now!



Open shapes are indications that the result will not be the desired one. Open shape errors are caused by forgotten elements or elements placed on the wrong layer. The next demo shows an error from an element hidden from view. It is a straight line that is hidden behind a longer straight line.

1. Select the **Input Filter** tab, set the **Snap Tolerance** to **0.1**.
2. Select **File / Open DXF** and open the file **DEMO2.DXF** again.
3. Select **Generation / Generate Complete Path** to optimize the path. The Area calculation function will display a warning message that there is an open shape for which the area could not be calculated.

4. Select **Check / Check Open Shapes**. An open shape is reported. This nest has a very common error. It has a short line segment which hides behind a longer line. The program automatically scans the path for open shapes and zooms into the area of the open shape. The open shape is highlighted in yellow.



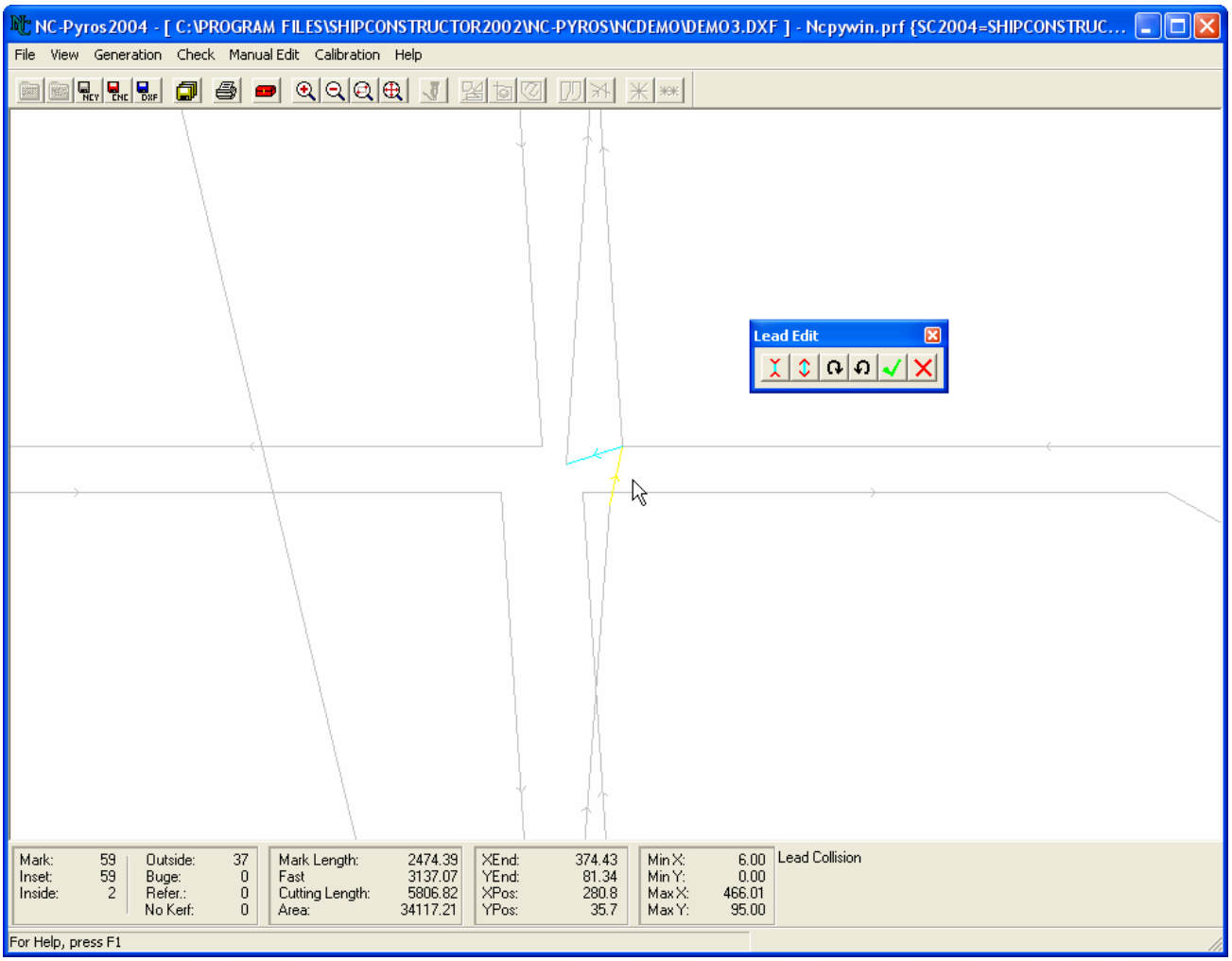
5. Obviously this line was generated by mistake in the CAD program. Click the **Yes** button to delete the shape. The path is automatically updated.

Tip: You should always **Check Open Shapes** before saving an NC-code file.

Demo 3 - Lead Collisions

Lead collisions can ruin parts and therefore must be detected before cutting the plate. Material, time, and money would be wasted. NC-Pyros can detect collisions between the leads and shapes.

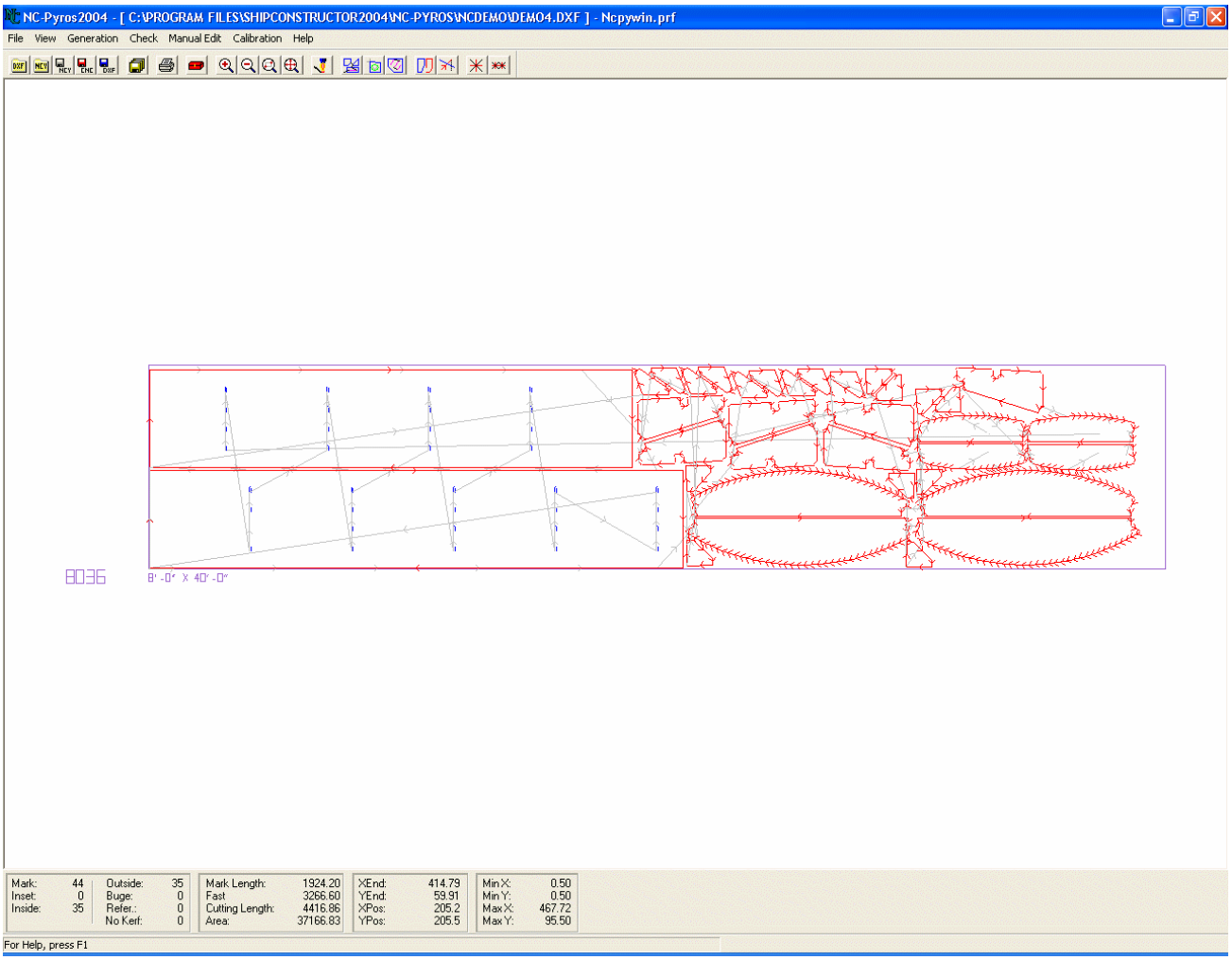
1. Select **File / Open DXF** and open the file **DEMO3.DXF**.
2. Select **File / Preferences** and click the **Input Filter** tab, set the **Snap Tolerance** to **0.2**. On the **Leads** tab, set both **Lead Lengths** to **0.6**.
3. Select **Generation / Generate Complete Path** to optimize the path.
4. Select **Check / Check Lead Collision** to check lead collisions. Whenever NC-Pyros finds a lead collision, the program zooms into the drawing. The center of the screen displays a lead in yellow, indicating the collision with the element of the shape next to it. You can now change the leads using the **Lead Edit** toolbar.



Tip: You should always **Check Lead Collision** before saving a NC-code file.

Demo 4 - A Complex Nest

Demo 4 is a complex nest with a lot of marking information. It demonstrates the complexity of nests that NC-Pyros can handle. This nest has one of the common errors described in the examples before. During editing in the CAD program a portion of one shape was duplicated and left behind, because it is invisible to the user in the CAD drawing.



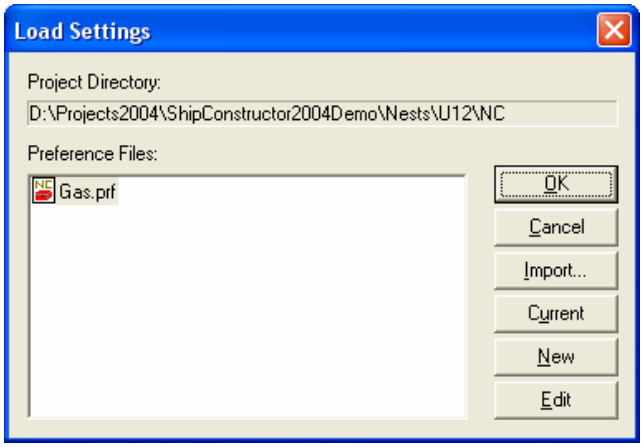
1. Select **File / Open DXF** and select the file **DEMO4.DXF**.
2. Select **Generation / Generate Complete Path**. The path is optimized. The connecting and sorting of the marking information may take a long time. There are over 1500 entities on this layer alone.

Linking with ShipConstructor Projects

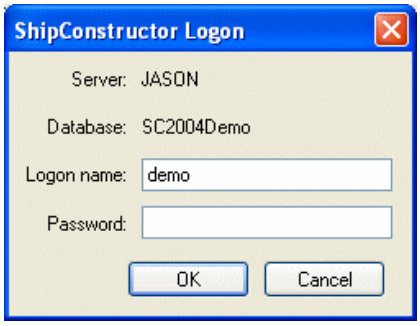
Preparing ShipConstructor for NC Processing

NC-Pyros can be run in a mode in which it will be linked to a ShipConstructor project. In this mode NC-Pyros will update the cut length, mark length, and fast travel length for all nests as they are processed. The update occurs when the NC-code file is saved. The following example requires that the full ShipConstructor suite be installed.

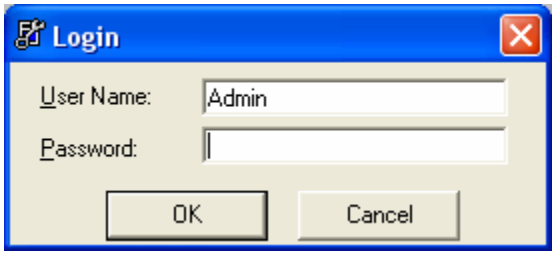
1. Open the file C:\Projects2004\SC2004Demo\Nests\U12\NC\U12P10-01.DXF. Where \Projects2004 is the projects folder you selected when installing ShipConstructor. You will see the following window.



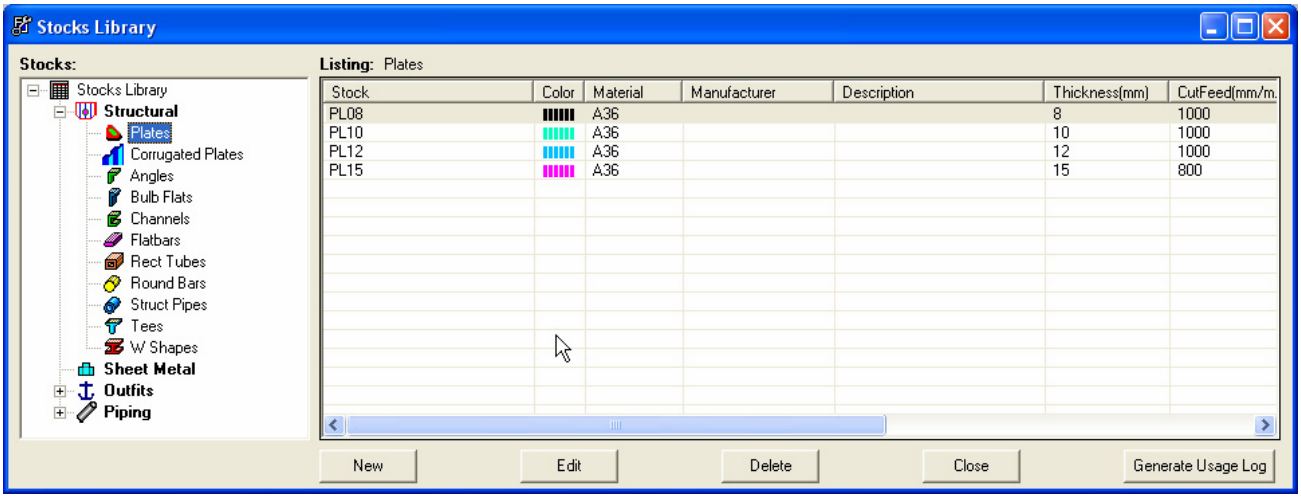
2. Click **OK** to open the file with the Gas preferences.
3. The **ShipConstructor Logon** dialog box is shown for you to log in to the database. Enter the password: **demo** and click **OK**.



4. The nest is loaded and shown on the screen.
5. Open Manager for the current project by selecting **File / Open Manager**.
6. Select the **SC2004Demo** project and click **Select**.
7. Log into **Manager**. Select the user **demo** (the password is demo). The user demo has the permissions to perform the necessary functions on this project. ShipConstructor now has the option to lock certain users out of functions.

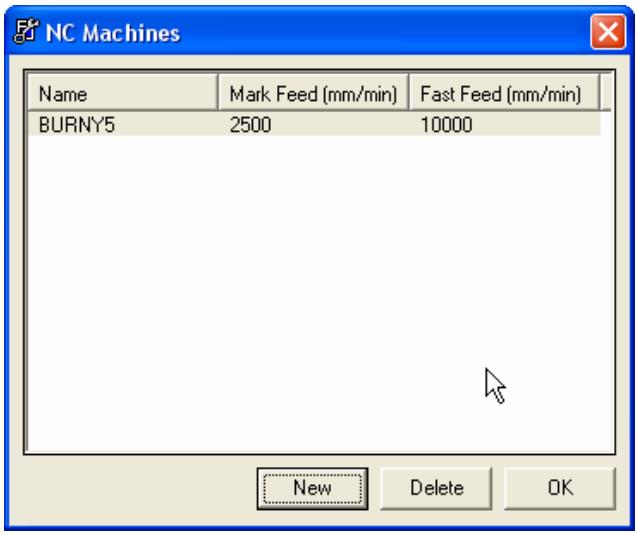


8. Select **Libraries / Stocks**.
9. Click on the **Plates** icon in the left tree pane.
10. The right pane displays all plate stock and several settings for each stock. Each stock has separate settings for NC-machine specific properties, such as CutFeed, Bridge Width, Pierce Time and more. In this example all plate stocks will be cut on the same NC-machine called BURNY5.

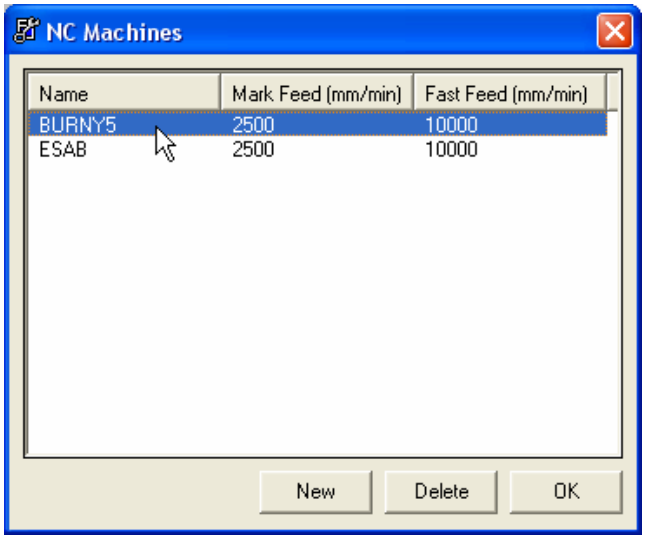


You can create new NC-machines or modify existing ones.

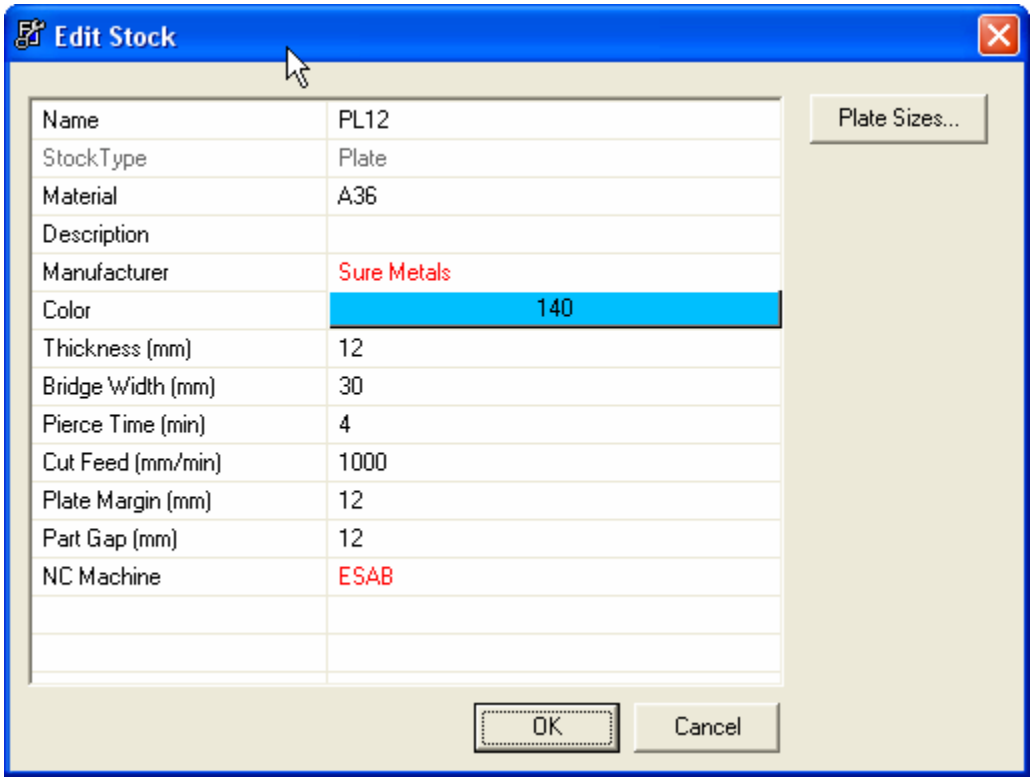
1. Select **Libraries / NC-Machines**. We will create a new machine called ESAB.
2. Click **New**.

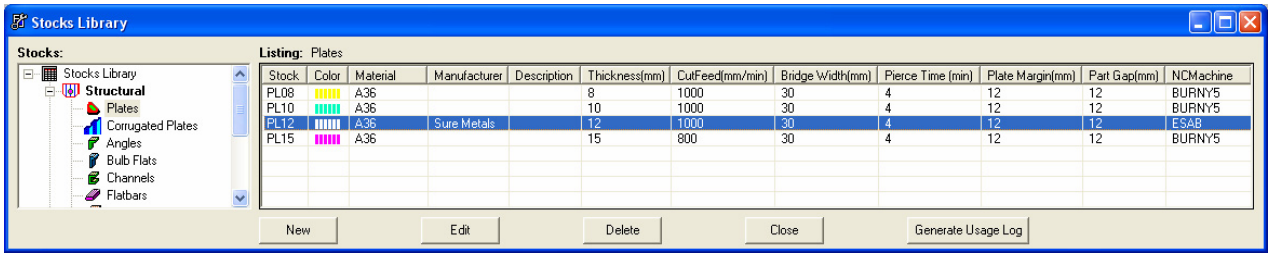


3. Enter data as shown for the ESAB machine. Click **Close.**



4. In the stock library dialog (open it again if it is not on you screen by selecting **Libraries / Stocks** then select **Plates**, just as before).
5. Select the **PL12** stock and click **Edit**.
6. Select the new **ESAB** machine for this stock. Click **OK**.





7. Now use NC-Pyros to process any PL12 plate. NC-Pyros will estimate the processing time using the new values for the ESAB machine.

After processing a nest with NC-Pyros, one should open the nest drawing and update the nest with the data now added by NC-Pyros. This will update the keywords for:

- Cut Feed Rate
- Cutting Length
- Fast Travel Rate
- Fast Travel Length
- Machine Name
- Mark Feed Rate
- Mark Travel Length
- NC-Process Date
- NC-Process Operator

Backplotting an NC-Code File

NC-Pyros can load NC-code files and save them as DXF output files. NC-Pyros places all cutting geometry on the OUTSIDE layer, all marking on the MARK layer and fast travel connection on the NCPYROSCONNECT layer. NC-Pyros will compare the NC-code of the post processor selected in preferences to the NC-code in the CNC file.

To backplot an NC-code file:

1. Select the correct post processor in the preferences. This has to be the same post processor with which the NC-code file was generated, or one that simulates the same code as present in the file that you wish to backplot.
2. If no unit type (millimeters or inches) is specified in the NC-code file, make sure the Units are set correctly in the Preferences.
3. If no code format (incremental or absolute) is specified in the NC-code file, make sure the Code Format is set correctly in the Preferences.
4. Select **File / Backplot NC-Code** and select the NC-code file. You can then save the geometry as a DXF output file (DXO).

This concludes the Tutorial.

Operation Procedures

How NC-Pyros Organizes CAD Geometry

Entities are the lowest level of geometric information.

If you use **CAD blocks** to group your drawing data, explode them just before you write the DXF file and then use the undo command to restore the grouped state.

Leads are short straight lines at the start and end of a shape. They are used to avoid piercing directly on the edge of a part. NC-Pyros places leads automatically at the appropriate location of a shape. The cutting cycle is started at the beginning of the lead-in and terminated at the end of the lead-out which ensures that a "dirty" cut does not ruin the edges of the shapes.

Connectors are straight lines that connect the shapes with each other. Between cutting and marking, the burner head travels along connectors at high speed (fast travel). Connectors can be automatically created by NC-Pyros or you can create them manually by picking the parts in the order that you require.

Shapes consist of a number of connected entities. Shapes may be closed, i.e. the end of the last entity connects with the start of the first entity, or a shape may be open. Closed shapes can be checked for direction of travel, i.e. clockwise or counterclockwise. Open shapes cannot be checked for direction. It is the operator's responsibility to check the direction manually and reverse it if necessary. (See kerf below)

Layers are logical levels in a CAD drawing. Layers contain entities. NC-Pyros assigns a meaning to each layer. The following default layer names are recognized by NC-Pyros. You can change the default layer names to suit your needs.

- MARK shapes are marked on the plate with a scribing unit.
- INSET shapes are OUTSIDE shapes cut from the waste inside through holes.
- INSIDE shapes are cut with the kerf towards the inside of the path. This layer is used for through holes.
- OUTSIDE shapes are cut with the kerf set towards the outside of the closed shapes.
- TEXT layer strings are marked on the plate with a scribing unit. TEXT is automatically converted to lines using an internal character generator.
- BUGE layer allows a machine to use its optional BUGE character generator to automatically create the character marking.
- REFERENCE layer shapes are used to show plate edges, clamping information or text showing nest names. No processing occurs for reference shapes. However lead collision checks are performed.
- NOKERF layer shapes are cut without any kerf.

Entities on other layers are not recognized.

Kerf offsets the torch to one side of the path line by half the width of the cut. This ensures that the finished part will have the specified dimensions. For through holes, the kerf must be on the inside of the hole; for outside shapes the kerf must be on the outside of the shape.

Nest Preparation within a CAD Program

General Information

NC-Pyros converts DXF files to NC instructions for 2D computer controlled cutting machines such as plasma arc, gas burning, laser cutting, wood router, and others. You can use any CAD program that can export the drawing in DXF format that supports layers. The CAD drawing has to meet certain specifications to be able to be processed. The operations described here are specific for using NC-Pyros together with AutoCAD, but are essentially the same for any other CAD program that can export DXF files.

1. Prepare the CAD drawings for all parts.
2. Nest the parts into a single drawing. This can often be done manually using the CAD program or by a third party nesting program.
3. Explode all blocks that you might have in your drawings.
4. Export the drawing as a DXF file.
5. Use NC-Pyros to convert the DXF drawing to NC-code.

Drawing Entities

NC-Pyros supports the following drawing entities:

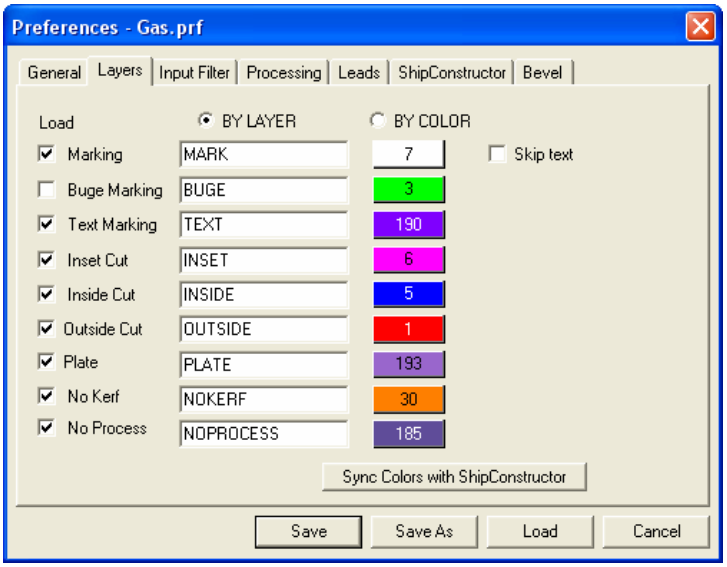
- lines
- polylines - consisting of straight lines and/or arcs
- lightweight polylines
- arcs
- circles
- ellipses and elliptical arcs
- text
- splines

Complex entities that are not made from straight lines or arcs are converted by NC-Pyros to lines.

Entities do not have to meet exactly at their end points. NC-Pyros processes a user defined **Snap Tolerance** to "close" the gaps. However, it is advisable to use **OSNAP End** when drawing entities in AutoCAD to ensure that there are no gaps between the elements of a drawing.

Layers

Each entity has to conform to the layer/color conventions in NC-Pyros to allow NC-Pyros to determine which process (marking, inside or outside cutting) to use. NC-Pyros needs to separate the different processing it performs (marking, inside cut, outside cut, etc…). To accomplish this, NC-Pyros needs to have the entities on different layers or as different colors. These settings are controlled on the **Layers** tab in the **Preferences**.



When using different layers to differentiate processes, it is best to generate a template drawing and use it for each nest drawing. For example, you can use a template drawing with the following layers created: MARK, INSET, INSIDE, OUTSIDE, BUGE, TEXT, REFERENCE, and NOKERF. It is good practice to use a "color-by-layer" entity property setting when not using nest drawings from ShipConstructor. Using "color-by-layer" you can determine visually if all entities are on the appropriate layers. Now you can start the nesting.

Nesting

You can use ShipConstructor, a third party nesting program, or nest the parts manually using any CAD program. A skilled CAD person can nest the parts efficiently using AutoCAD alone. This manual procedure is often economical if the parts are complex and when many different parts of greatly different complexity have to be nested, as is often the case for shipbuilding.

Open a new drawing for the nest. Place one or more rectangles on the reference layer that indicates the size of your stock plates. Insert the all blocked parts randomly on the drawing. Use your CAD system to nest the parts, starting with the largest ones, using the move and rotate commands. You may want to place some parts in through holes, such as small brackets. All entities with outside cuts within a through hole have to be changed to the INSET layer. They **cannot** contain any inside cuts!

The resulting drawing contains all the required information to produce the NC-code for the number of parts to be cut from one plate.

Before exporting the drawing to a DXF file explode all blocks! It is advisable to turn off or freeze all layers that are not required for NC processing. You can save disk space and time by writing just the selected objects to the DXF file.

You can now use NC-Pyros to create NC-code for the nested drawing!

Managing Preferences

NC-Pyros stores its preferences in the directory of the nest drawing DXF file. You can create many different preference files to accommodate different settings. You may need different preference files if you use different controllers or the settings change for different plate thickness.

Error Checking While Loading a DXF File

NC-Pyros runs a number of tests while loading a DXF file:

- The total dimensions of the nested drawing are calculated. A special warning message is displayed if negative values are encountered. Some controllers do not accept negative absolute values.
- AutoCAD sometimes places large arcs into a polyline if curve fitting was used. NC-Pyros will replace large arcs with radii larger than the Maximum Arc value set in Preferences with a series or straight lines. A warning message informs the user of this fact and advises to double check the resulting path with the DXF drawing file. This can easily be done by loading the optimized path over a copy of the nested parts drawing.
- NC-Pyros searches the complete data bases of the drawing elements and checks if duplicate entities are present. These are quite commonly created during the design process, and are unknown to the designer. Any duplicate elements are automatically removed from the database.
- Circles and arcs are split at quadrant lines if specified in the preferences.

Reference Section

Features

This section explains the individual menu commands.

The User Interface consists of several bars and windows:

- title bar,
- menu bar,
- tool bar,
- display window, and
- information window.

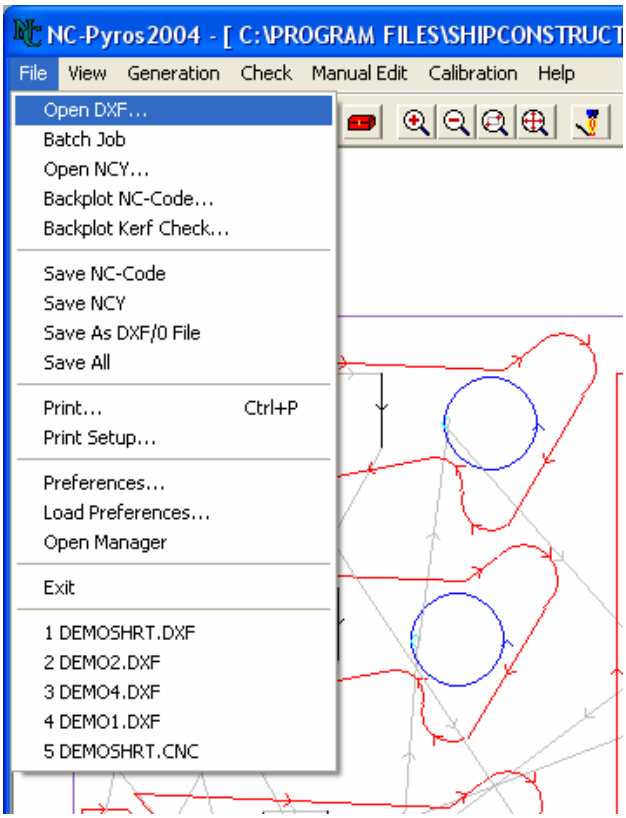
During the execution of NC-Pyros, dialog boxes are also used to present information to the user.

The Title Bar

The narrow window at the top displays the name of the current file.

The File Menu

Overview



The **File** menu contains the following functions**:**

Open DXF

Open DXF to open a DXF file. The DXF file contains the nest for the NC-code generation. The DXF file is read and interpreted using the settings in the preferences. The DXF file has to conform to the NC-Pyros standards to be read successfully.

Open NCY

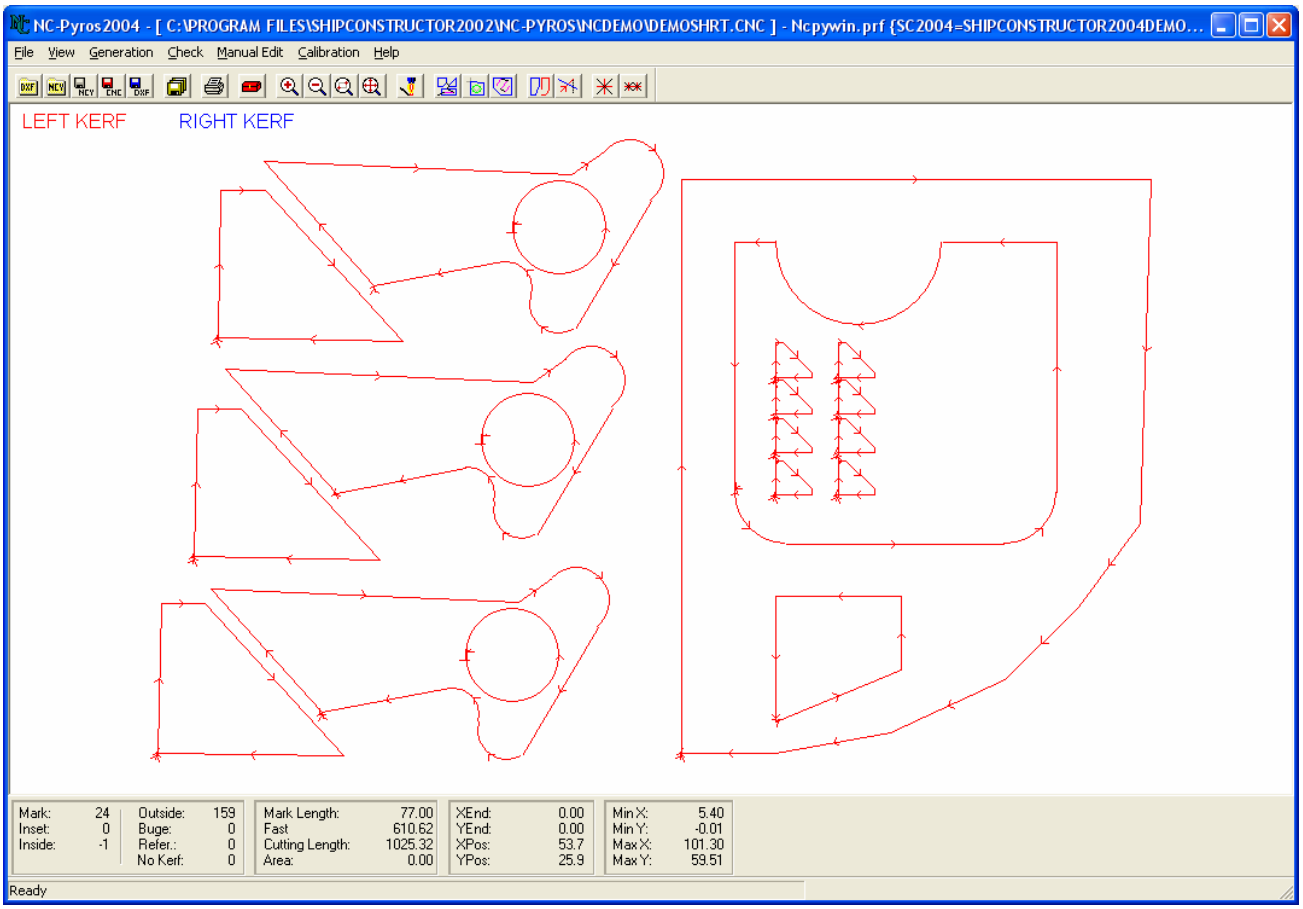
Open NCY to open a file that has been saved in NC-Pyros format. Use this function to read back a previous partially or fully optimized and saved NCY file. This function comes in handy when you have to do further changes to a nest or if you just have to change the post processor for a different controller. The NCY file is a snap shot of the geometry at the moment when you saved the NC-code if you used the **Save All** menu.

Backplot NC-Code

Backplot NC-Code to open an NC-code file for back-plotting. This function allows you to load an NC-code file and convert it back to geometry.

Backplot Kerf Check

Backplot Kerf Check to generate a view of an NC-code file for Kerf checking. You can run this command after you have used the **Generate Complete Path** function and saved the file by **Save NC Code.**



Save NC-Code

Save NC-Code to save the complete path as an NC-code file (path must be complete). NC-Pyros also saves a file with the extension CNS. This text file contains some pertinent information about the processed data file, such as the lengths of marking and cutting and the area of the process parts.

Save NCY

Save NCY to save geometry in a special NC-Pyros format. Use this function to save the current state of manual or automatic optimization. You can use this file later if you have to use a different controller, without having to optimize and test the path again. You can now open the NCY file at a later date and save the NC-code for any post processor.

Save As DXF/O File

Save As DXF/O File to save the geometry as a DXF file format. This file can be overlaid onto the CAD drawing to check the path generation. The entities are stored on layers that are preceded by "NCPYROS" to distinguish them from the original entities.

Save All

Save All to save as a NC-code file, NCY file and DXO file with the same filename (with the appropriate file extensions). This feature is provided so that when you want to save the NC-code, NCY and DXF formats, you can provide a filename and all three formats will be saved with the same filename but their appropriate file extensions.

Print

Select **Print** to print the current display to a Windows plotter / printer.

Print Setup

Printer Setup to set the printer options. This invokes the standard Windows printer setup dialog.

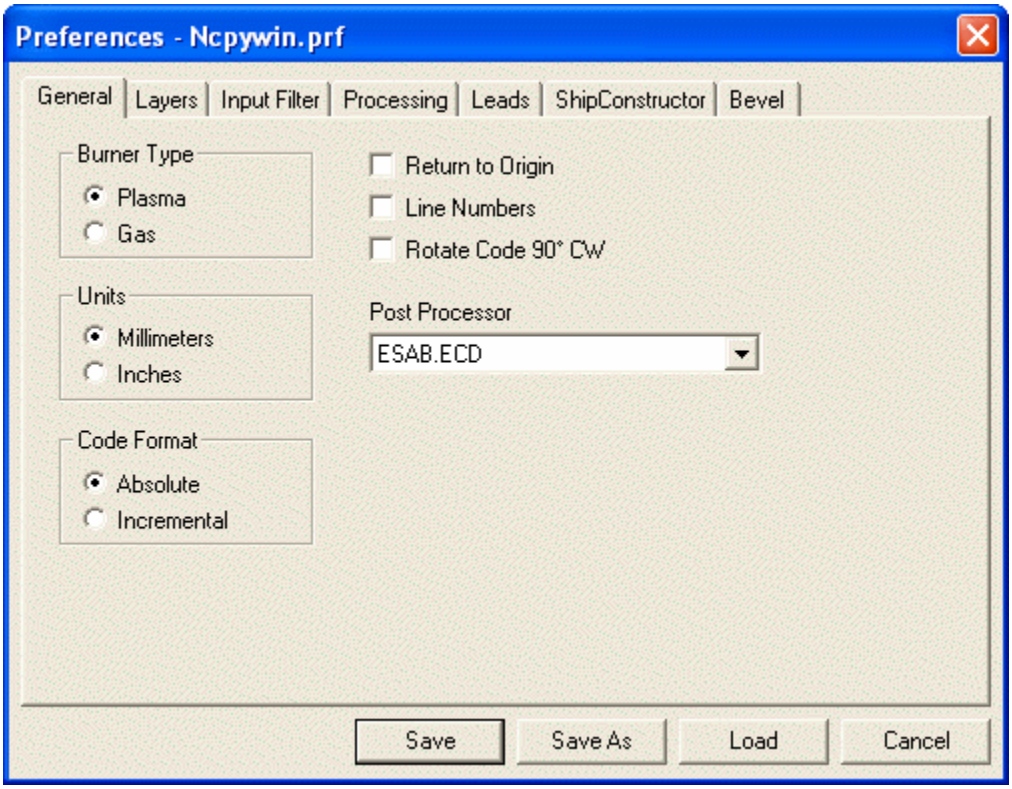
Preferences

Use **Preferences** to select the settings for reading DXF files, processing, and writing NC-code files.

The **Preferences** dialog is a tabbed dialog; you can click at the appropriate tab at the top to select a specific part of the preferences dialog.

General Tab

The **General** tab controls the general settings for the NC-code generation. It contains the following settings:



Burner Type - Select the **Burner Type** by clicking the mouse on the **Plasma** or the **Gas** radio button.

Units - Select the **Units** by clicking the mouse on the **Millimeters** or the **Inches** radio button.

Code Format - Select the **Code Format** by clicking the mouse on the **Absolute** or the **Incremental** radio button.

Return To Origin - Check this box if you want the machine to return to the origin after processing the last command. Uncheck this box if you want the machine to stop after processing the last entity.

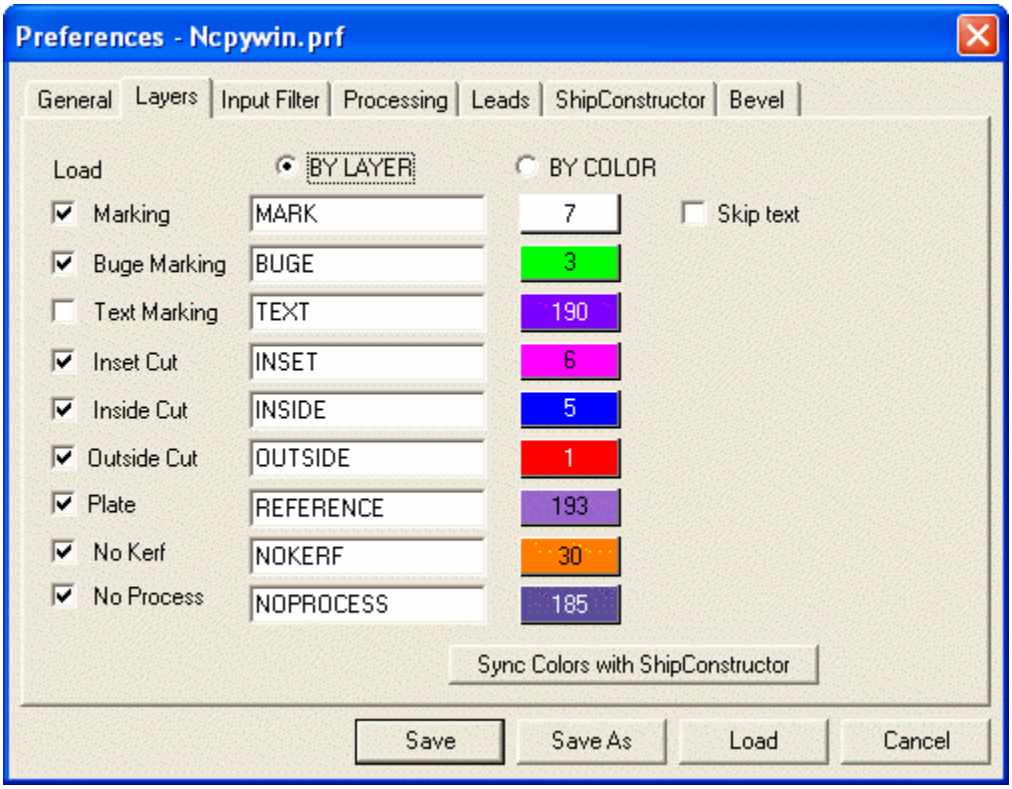
Line Numbers - Check this box if you want to have the line numbers in the G-Code file. This function does not apply to ESSI-code.

Rotate Code 90° CW - Check this box if you want to have the output NC-code rotated 90° clockwise about the origin.

Post Processor - Select the controller file that represents your controller from the NC-Pyros directory. NC-Pyros comes with several pre-configured post processor files. You can use these files, modify any one of them or generate your files. The ".ECD" extension is for the ESSI format; ".GCD" is for the G code format. See the Custom Controller Files for detailed information of the available post processors.

Layers Tab

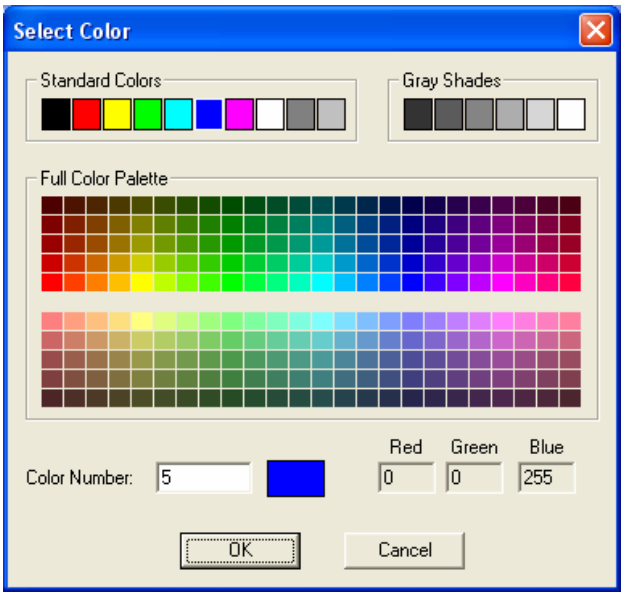
The **Layers** tab contains the following settings:



Load - Check boxes allow layers or colors to be ignored when opening the DXF file.

BY LAYER - The entities are separated by the different layers.

BY COLOR - The entities are separated by the different colors. The colors are shown along with the AutoCAD color number. You can change a color by clicking on the button. The following color picking window appears.



Marking - All entities on the **MARKING** layer are used to produce code for the marking unit of the machine.

Buge Marking - All entities on the **BUGE** layer are used to produce code for the BUGE marking unit of the machine.

Text Marking- All entities on the **TEXT** layer are used to produce code for the marking unit of the machine. Text strings in the DXF are converted to marking information using the information in the CHAR.DAT file described in Appendix 1. Make sure you select the appropriate size in the **Preferences / Processing** tab.

Inset Cut - All entities on the **INSET** layer are used to produce code for the cutting unit of the machine for outside cuts. These entities are usually positioned on through holes.

Inside Cut - All entities on the **INSIDE** layer are used to produce code for the cutting unit of the machine for inside cuts.

Outside Cut - All entities on the **OUTSIDE** layer are used to produce code for the cutting unit of the machine for outside cuts.

Reference - All entities on the **REFERENCE** layer are used for reference and interference (lead collision) checking. No code is produced for entities of this layer.

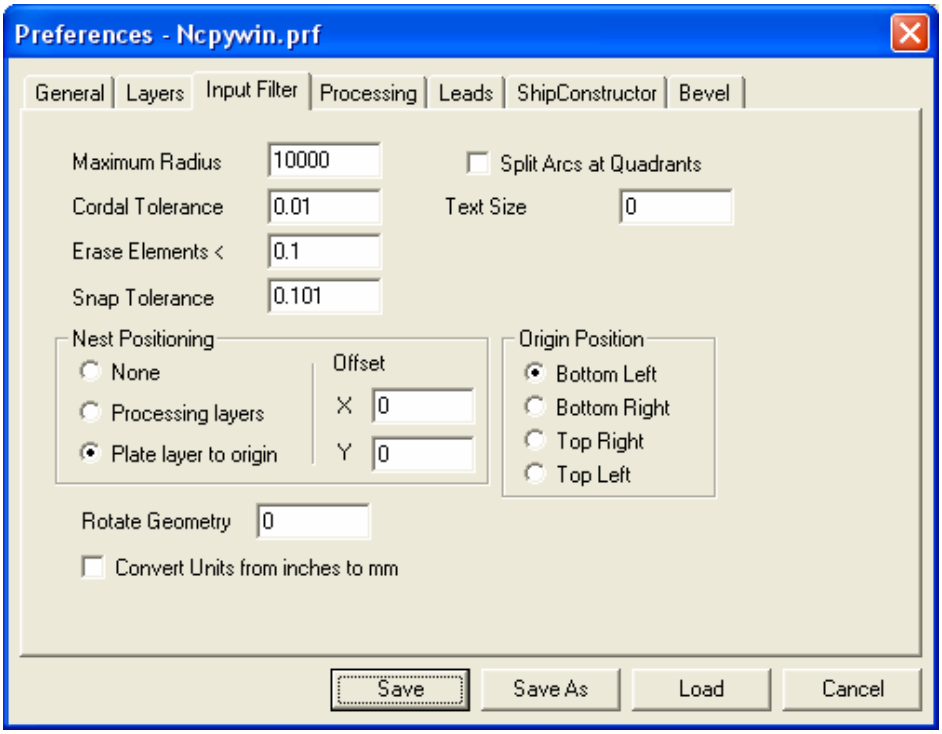
No Kerf - All entities on the **NOKERF** layer are used to produce code for the cutting unit of the machine for cuts with no kerf applied.

Skip Text - Allows TEXT entities on the marking layer to be filtered out while loading the DXF file. When the box is checked, no TEXT entities on the marking layer will be loaded.

Sync Colors with ShipConstructor - Synchronizes the layers to read Nest DXFs from the linked ShipConstructor project.

Input Filter Tab

Input Filter settings are used during reading and translating a DXF file. It contains the following settings:



Maximum Radius - The maximum radius the burner can handle. Check your controller's documentation for this value. If the radius of an arc exceeds this limit, NC-Pyros changes the arc to lines that the burner can handle.

Chord Tolerance - When arcs need to be converted to lines because the maximum radius is exceeded, the Chord tolerance specifies the maximum distance a line can be from the original arc.

Erase Elements < - The maximum length of the short elements that will be erased during **Generate Complete Path** and **Generate Shapes**. Enter an appropriate value. Many controllers cannot process elements below a certain length, and will stop or create erratic results.

Snap Tolerance - The length of the gap between elements of a shape that NC Pyros will jump or connect into a single shape. This compensates for lines not actually joined in the original DXF files. Snap tolerance should be **GREATER THAN** or **EQUAL TO** the length set in **Erase Elements <**. NC-Pyros automatically adjusts two elements to the same meeting point. The program automatically determines which element has to be adjusted to close the gap causing the least change in the path. **Ensure that this value is larger than the value for Erase Elements <!**

Split Arcs at Quadrants - Splits the arc processing at quadrant lines. Some older controllers cannot handle an arc command if the arc crosses a quadrant line (0, 90, 180, 270 degree lines). NC-Pyros can automatically split the arcs into a series of arcs ending and starting at the quadrant lines. For example a circle will consist of 4 arcs of 90 degrees each.

Text Size - The height of any text entities that are loaded. Set the Text Size to 0 to use the entities text height in the DXF file.

Nest Positioning - NC-Pyros can automatically move the geometry to achieve a certain position of the nest on the plate independent of the nest position within the CAD drawing:

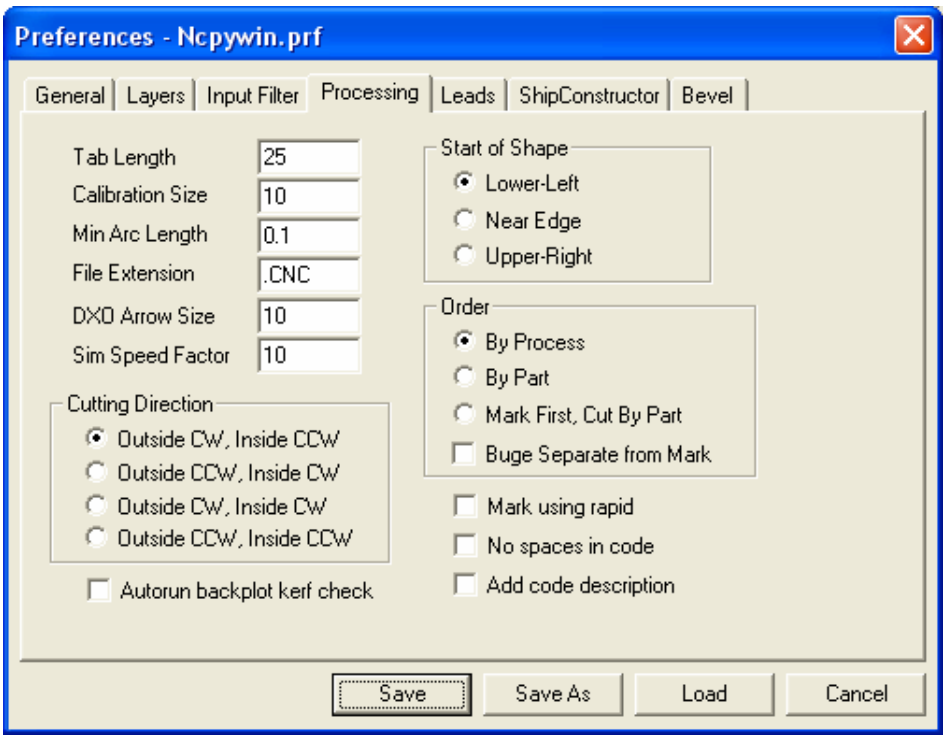
- Select **None** if you want to process the nest exactly as it is specified in the CAD drawing.
- Select **Processing layers** and enter a margin value. All geometry is moved in the X and Y direction in such way that the total minimum x and y values of all processing layers (INSIDE, INSET, OUTSIDE, MARK, TEXT, and BUGE) are such that they are **offset** distance from the X and Y axis's. This can be used if you have more than one nest on one drawing and do not want to move each drawing to the origin to ensure proper processing.
- Select **Plate layer to origin** to move the geometry so that the minimum x and y value REFERENCE layer (plate edge) is positioned at the origin (0, 0).
- **Offset** – The amount to shift the geometry away from the origin.

Convert Units from inches(mm) to mm(inches) – scales the geometry during the open DXF process.

Origin Position – When nest positioning is used then this setting determines where the origin for the nest will be located.

Processing Tab

Processing settings are used during the post processing when generating the NC-code.



Tab Length - The length of a tab that may be inserted to keep parts connected to the plate. Tabs must be entered manually using the **Manual Edit / Insert Tab** menu.

Note: You cannot set the start of shapes after inserting tabs. If you wish to start cutting a shape with tabs at a certain position, make sure that you insert the first tab where you want the cutter to start.

Calibration Size - The size of the calibration marks.

Min. Arc Length - This setting is used to replace **short arcs** with **straight-line segments**. During trimming operations in CAD you could end up with arcs that are very short. Some controllers cannot calculate the kerf for those arcs and produce erratic results. Enter a value that your controller can handle.

File Extension - The default file extension for loading and storing NC-code files (.CNC is the default). Enter a different extension if you like.

DXO Arrow Size - Determines the length of the arrow lines in the DXF / DXO output file. A value of 0.0 suppresses the arrow generation altogether.

Sim Speed Factor - This allows you to adjust the range of speeds of the simulation. The smaller the number, the slower the speed.

Cutting Direction - Determines the direction of the shapes for inside and outside cuts. Typically, users cut outside cuts clockwise and inside cuts counterclockwise.

Autorun backplot kerf check – This is a diagnostic tool when checked will run a backplot kerf check after the CNC file is saved.

Start of Shape - Determines the start position of a shape:

- **Lower-Left** - The start position is located at the closest node point to the lower-left corner of the plate.
- **Near Edge** - The start position is located so that the side of the shape closest to the edge is cut first.
- **Upper-Right** - The start position is located at the closest node point to the upper-right corner of the plate. This option is helpful when a part is unsupported when cutting it.

Order - Determines the processing order of the shapes:

- **By Process** - All mark shapes are processed first, then inset shapes are processed, then inside shapes, and last outside shapes are processed.
- **By Part** - Each shape in a part is processed before processing another part. A shape is part of a part if it is inside the outside geometry.
- **Mark First, Cut By Part** – All marking is done then the cutting is done on a by part basis (Insert then inside then outside).
- **Buge Separate from Mark** – Only for controllers that support buge marking. The Buge is processed after marking is complete. When unchecked the buge marking and regular marking are intermixed.

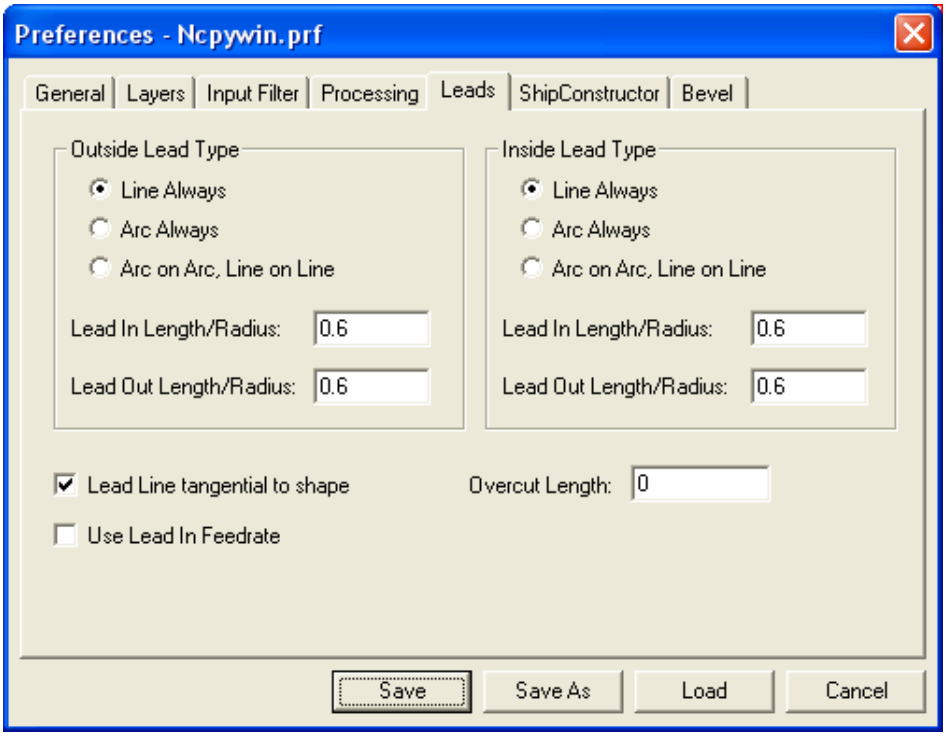
Mark using rapid - Allows the marking process to travel at the fast feed rate. Marking is performed at the slow feed rate if unchecked.

No spaces in code - Removes the spaces in the NC-code. Some controllers require no spaces in the NC-code. This feature can also reduce the size of the code file.

Add code description - Adds description text at the end of each NC-code in the NC-code file or the code window during simulation. Use this feature only for checking code. **Warning! Do not** have this checked for code to be sent to the controller.

Leads Tab

The **Leads** settings are used to modify the type and length of the lead-ins and lead-outs.



Lead In Length/Radius - After the shapes are generated leads may be added to the start of the shapes. A line (or arc) is added if the length is larger than 0.

Lead Out Length/Radius - After the shapes are generated leads may be added to the end of the shapes. A line (or arc) is added if the length is larger than 0.

Outside Lead Type - Determines the shape of the leads on outside cuts

- **Line Always** - Creates leads that are lines of the specified length.
- **Arc Always** - Creates leads that are quarter circular arcs of the specified radius.
- **Arc on Arc, Line on Line** - Creates arc leads that lead to arcs of circles and line leads that lead to lines.

Inside Lead Type - Determines the shape of the leads on inside cuts

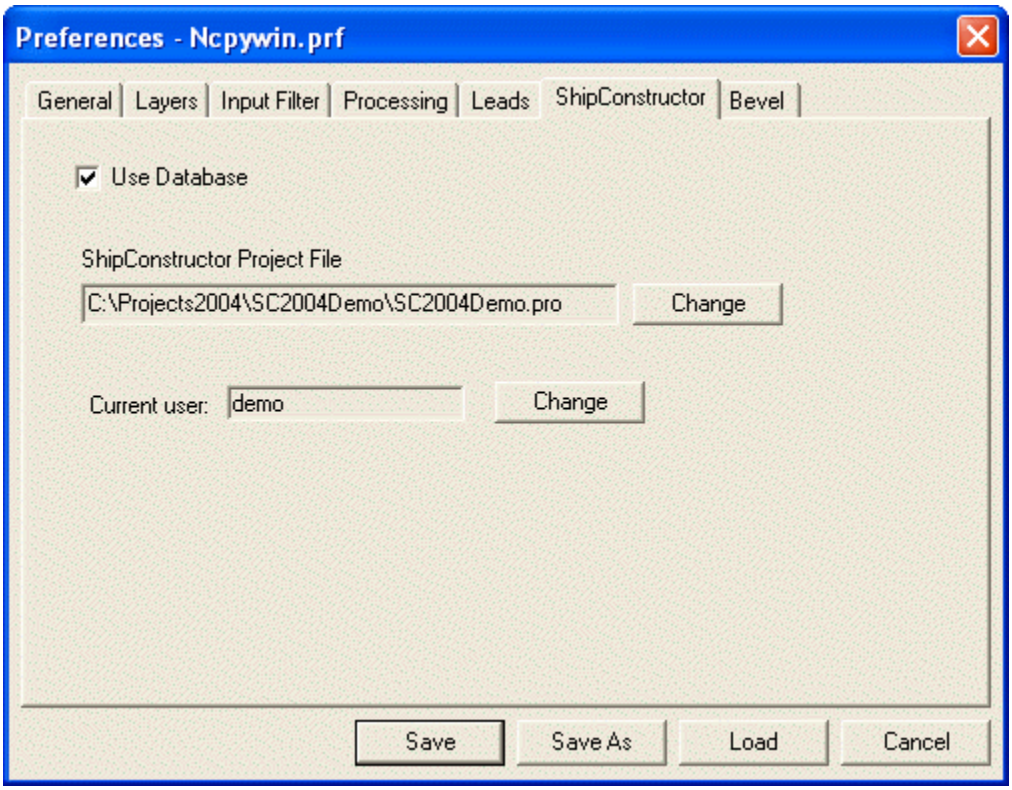
Lead Line tangential to shape - Sets the line leads to lead in or out at an angle tangent to the shape.

Overcut Length - Adds elements to the end of the shape so the end of cutting a shape goes past the start of the shape by the specified amount.

Use Lead In Feedrate - Sets the feedrate for the **LEADIN_FEED** controller code on the lead-in element of a shape.

ShipConstructor Tab

The **ShipConstructor** settings are used to link NC-Pyros to a ShipConstructor project database.



Use Database - This checkbox tells NC-Pyros to output the results to the database.

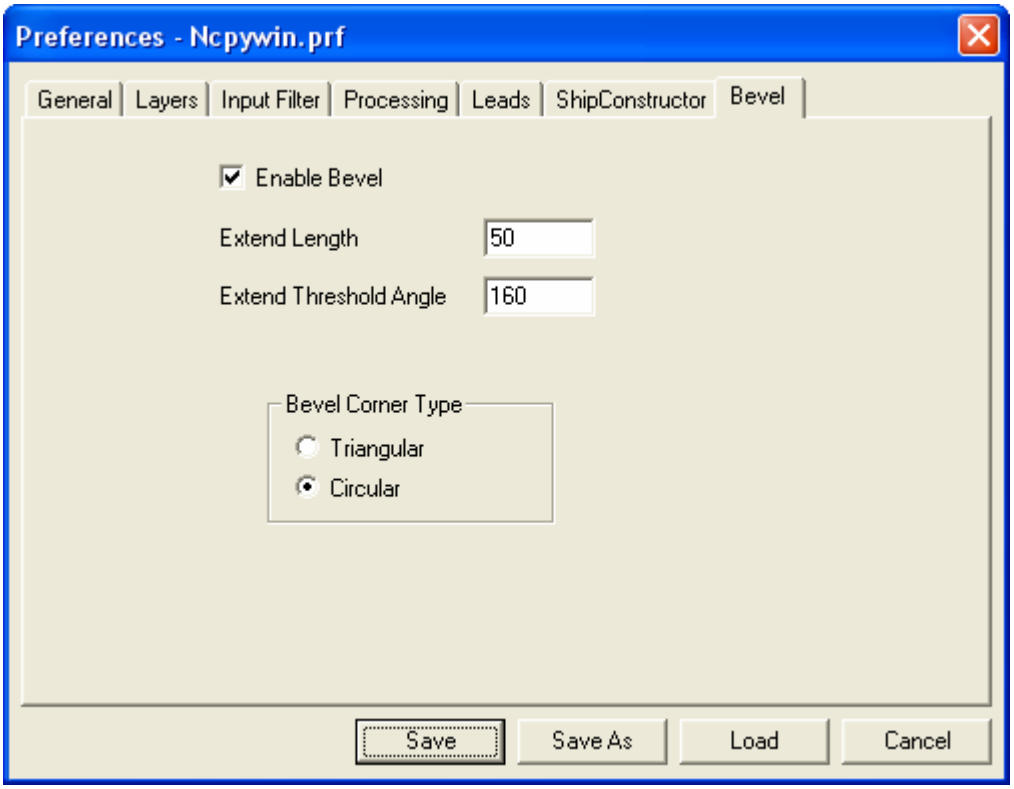
Project Database - The filename of the ShipConstructor project database.

Current user - The name of the user that will be logged as performing the NC processing.

Login - Allows you to change the current user. A password may be required to login.

Bevel Tab

The **Bevel** tab settings are used for bevel cutting operations.



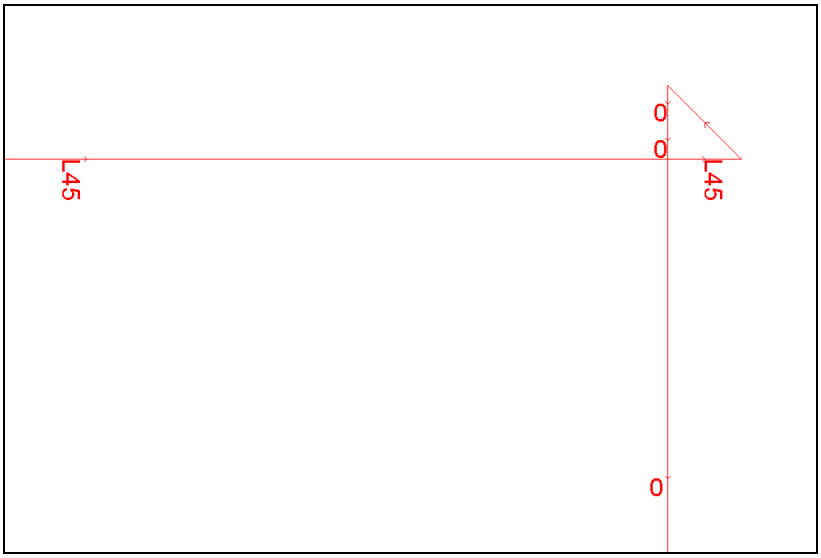
Enable Bevel - Activates NC-Pyros to insert code for bevel angles.

Extend Length - The length to extend away from a shape when a corner routine is inserted.

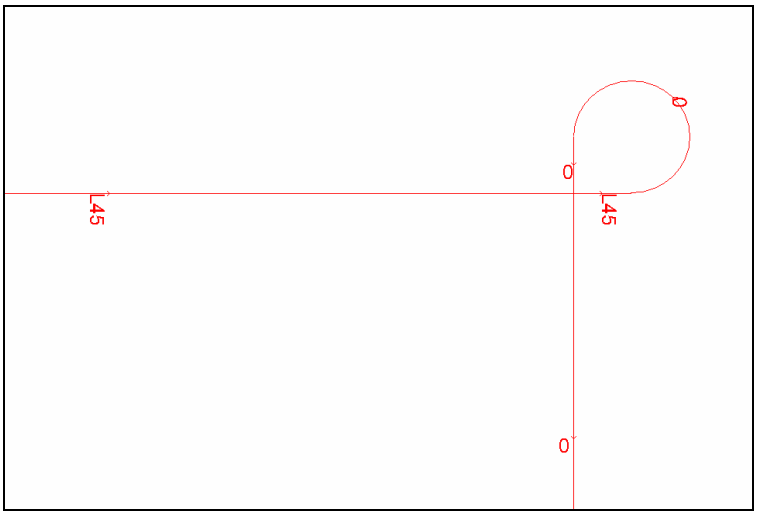
Extend Threshold Angle - The angle that determines when a corner routine is inserted. A triangular corner routine is inserted at any enclosing angle between two elements that is less than the threshold angle.

Bevel Corner Type – when the bevel angle changes at a corner a corner routine is added to produce a clean corner. NC-Pyros provides to types of corner routines.

- **Triangular** – adds the following path.



- **Circular**



Load Preferences

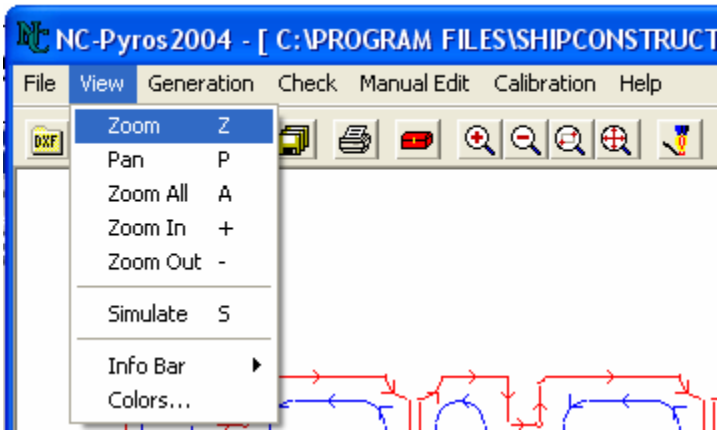
Loads a specific preference file as the current settings.

Open Manager

Starts ShipConstructor Manager and loads the project database set in the preferences. If the preferences are not linked with ShipConstructor then this function does nothing.

The View Menu

Overview



The **View** menu contains the following functions:

Zoom

Zoom magnifies a selected area. Select the area by dragging a zoom window enclosing the area to magnify – hot key '**Z**'. You can also zoom dynamically by scrolling the mouse wheel.

Pan

Pan to move the drawing about the screen – hot key '**P**'. You can also Pan by holding down the middle mouse button

Zoom All

Zoom All to display the entire drawing on the screen – hot key '**A**'.

Zoom In

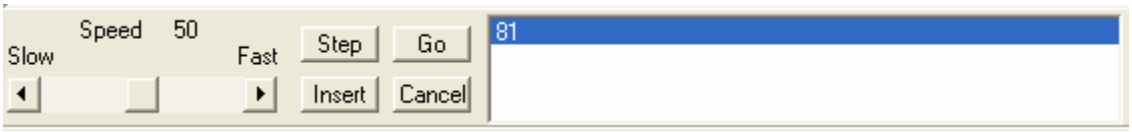
Zoom In to magnify the view by 2 – hot key '**+**'.

Zoom Out

Zoom Out to decrease the size of objects in the view by 2 – hot key '**-**'.

Simulate

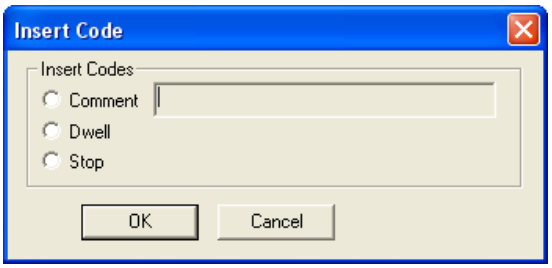
Simulate to draw the path slowly. The following window will appear at the bottom of the screen.



- **Speed Slider** - Changes the speed the path is traveled.
- **Step** - Click this button to process the path one step at a time.
- **Go** - Click this button to start the simulation at the set speed.
- **Cancel** - Cancels or ends the simulation.
- **Insert** - Click this button to insert a comment, dwell, or program stop at the current position in the path.

A scroll window displays the executed NC-code. You can click the step button any time and then scroll up and down the NC-code. Also at the end of the simulation a dialog box asks you if you want to quit the simulation. Click **OK** to keep the NC-code scroll window on the screen to allow you to inspect the code. Press the **Cancel** button to finish the simulation when you are done.

Inserting Code



If you want to insert custom code at some point in the path, step until you reach the point you want to insert the code.

Comment - Inserts the given text in the NC-code. NC-Pyros will attempt to use the IGNORE_ON and IGNORE_OFF codes on the lines before and after the inserted text. If ignore codes are used on the same line as the comment, you must include that code in the given text.

Dwell - Inserts a dwell code at the insertion point. The dwell time is set in the controller code file.

Stop - Inserts a program stop for possibly removing a part from the table or a tool change.

Info Bar

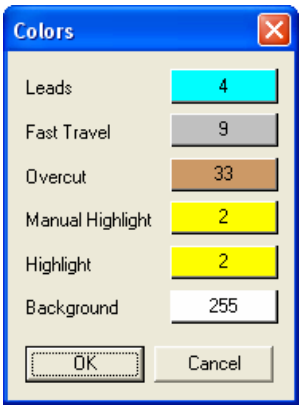
Horizontal - Displays the information window on bottom.

Vertical - Displays the information window on the left side.

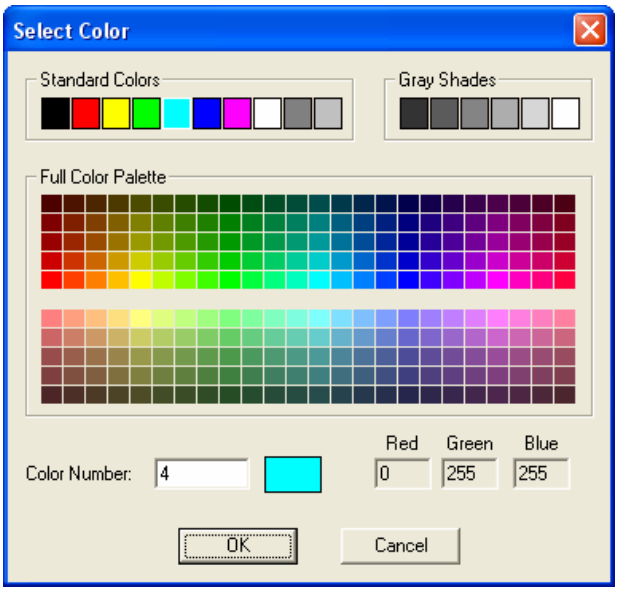
See the section on The Information Window.

Colors

Allows you to change the display colors of objects that are read from the DXF file. The display colors of the elements are located on the **Layers** tab of the **Preferences**.

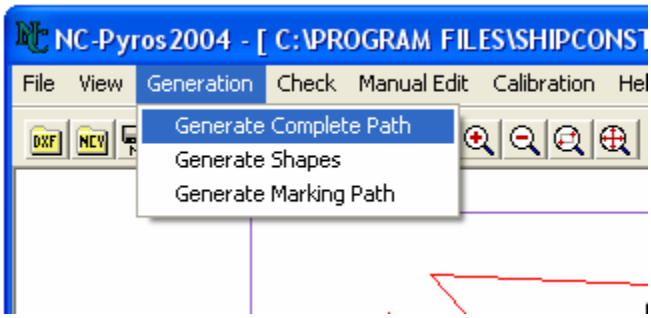


To change a color click on the button of the entity you wish to change. The following window appears. The colors are numbered similarly to AutoCAD. You can change a color by clicking on it or changing the color number.



The Generation Menu

Overview



This menu contains the following functions:

Generate Complete Path

Generate Complete Path - Generates a path and optimizes the nest completely. This function invokes the following procedures:

- Erases duplicate entities.
- Removes short elements as specified in the preferences.
- Connects entities to shapes using the snap tolerance set in the preferences.
- Sorts shapes.
- Optimizes shapes on the marking layer.
- Generates lead-ins and lead-outs for all cutting shapes using the values set in the preferences.
- Generates the fast travel connectors.
- Calculates number of shapes on each layer.
- Calculates marking and cutting lengths.
- Calculates the area of the processed shapes.

Generate Shapes

Generate Shapes to remove short elements and connect entities into shapes on each layer. Use this function to connect the entities to shapes but not to sort or connect them to a complete path. You have to use **Manual Edit / Manually Connect Shapes** to select the order of processing. This function invokes the following procedures:

- Erases duplicate entities.
- Removes short elements.
- Connects all elements into shapes on each layer.
- Calculates number of shapes on each layer.
- Calculates marking and cutting lengths.
- Calculates the area of the processed shapes.

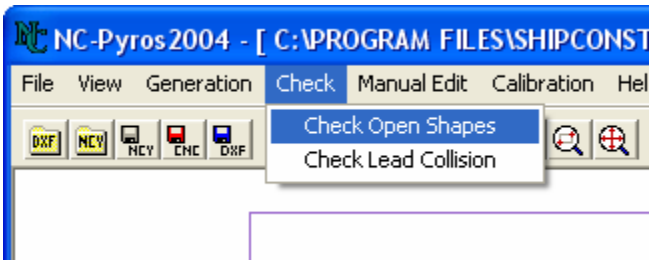
Generate Marking Path

Generate Marking Path to remove short elements and connect entities into shapes on each layer. Use this function to connect the entities to shapes and connect the path for the marking shapes. You have to use **Manual Edit / Manually Connect Shapes** to set the path of cut shapes.

The Check Menu

Overview

The **Check** menu contains the following functions:

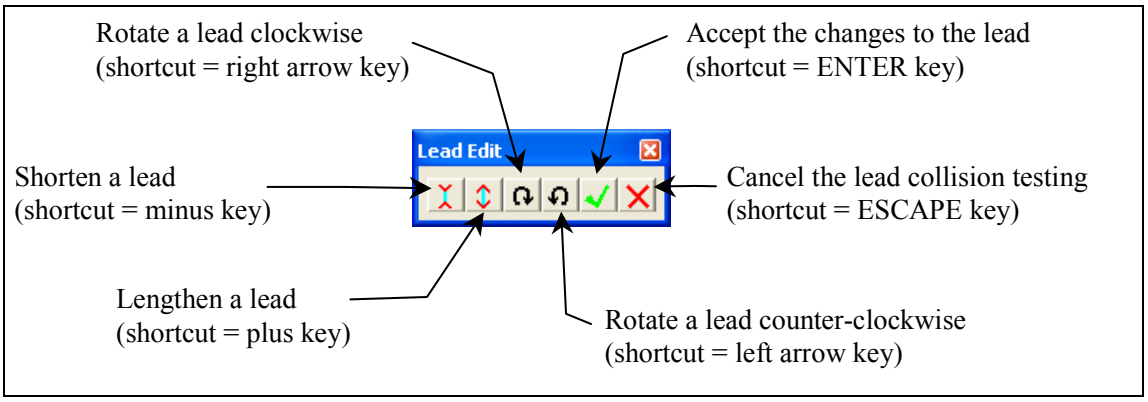


Check Open Shapes

Check Open Shapes finds open shapes, zooms into them, and offers them for deletion. Often single CAD entities are forgotten and left behind. These usually result in small open shapes consisting of just a few CAD entities. Deleting them is the right option in most cases.

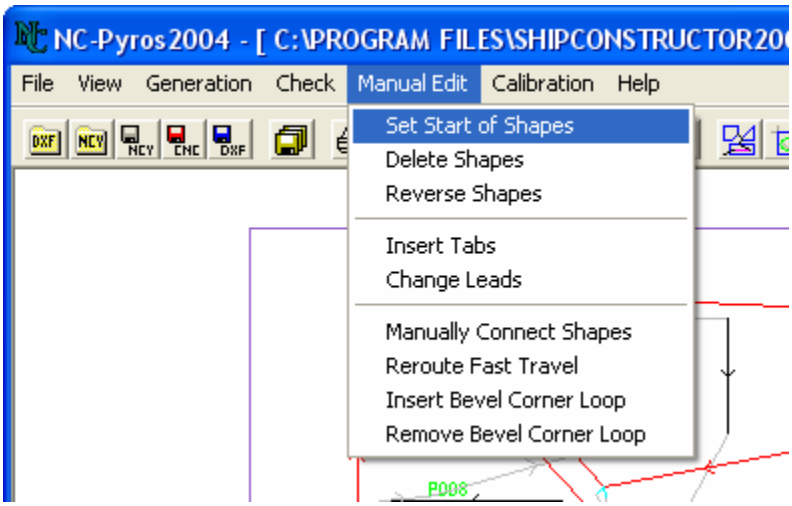
Check Lead Collision

Check Lead Collision to find and correct all lead collisions with other shapes. The program checks each lead with every other shape. If a collision occurs, the program highlights the lead at fault and zooms into it. It offers lead editing capabilities to avoid the collision.



The Manual Edit Menu

Overview



The **Manual Edit** menu contains the following items:

Set Start of Shapes

Set Start of Shapes to change the point at which the cutting of a part begins.

- Finds the selected point on the shape and moves the start of the shape to that point.
- Moves the lead-in and the lead-out, if any, to the new position.
- Redraws the path with new connectors.
- Updates fast travel length in the information window at the bottom of the screen.

To move the start of a shape to the start of an element in a shape, hold down the SHIFT key and select the element you want to cut first. To move the start of a shape to the end of an element in a shape, hold down the CTRL key and select the element you want to cut first.

Delete Shapes

Delete Shapes to remove open or unwanted shapes.

- Highlights the shape you have selected.

- Presents you with a dialog box to allow you to accept the deletion.
- Deletes the shape if you selected Yes in the dialog box.
- Redraws the path and recalculates the path lengths.
- Updates the information in the window at the bottom of the screen.

Reverse Shapes

Reverse Shapes to reverse the cutting direction of shapes so that the kerf is on the correct side.

Insert Tabs

Insert Tabs to manually place tabs anywhere on the shapes. Select the position at which you want to tab the cutting path by clicking with the cursor. You can undo the last inserted tab by selecting the undo button on the floating toolbar. This menu invokes the following functions:

- Checks the preferences settings for tab length.
- Inserts a tab at the specified location in the cutting path.
- Generates a lead-in and a lead-out if necessary.
- Redraws the new path and recalculates the path length.
- Updates path lengths in the information window at the bottom of the screen.

Change Leads

Change Leads to rotate, lengthen, or shorten any lead-in or lead-out. Select the lead you want to edit by clicking on it with the mouse. A toolbar pops up with buttons that allow you to shorten, lengthen and rotate the lead. Select the confirm button to accept the changes or the cancel button cancel the changes. (See the previous section for how to edit a lead).

Manually Connect Shapes

Manually Connect Shapes to manually select the cutting order of the shapes on each layer. This menu invokes the following procedure:

- Starts with a connector at the origin, coordinate (0, 0).
- Draws the connectors to each shape as you select it.
- Notifies you when the path is complete.
- Calculates path length and updates the information window.

During the **Manually Connect Shapes** function a floating toolbar 

with two buttons is displayed on the screen. The left button with the sun symbol draws all connected shapes in yellow color and leaves the rest in their original colors. This lets you easily identify the unprocessed shapes. The right button is the undo button. It allows you to step back through your manual connections to make corrections.

Note: You must use **Path / Generate Shapes** first to connect all entities to connected shapes.

Reroute Fast Travel

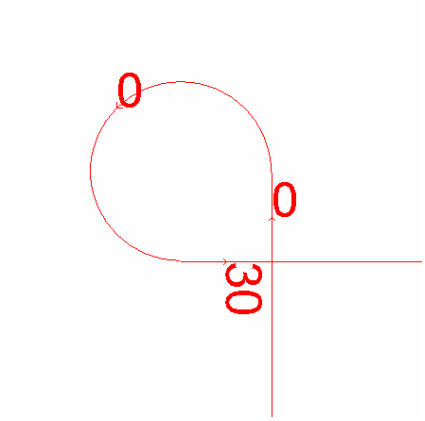
Reroute Fast Travel to change the course of the burner head during fast travel. You may use this function to prevent the head from traveling over previously cut parts. The part may have tilted up and the torch head can get damaged if it collides with it.

- Click on the connector at the position to break it.
- Move the mouse to alter the connector.
- Accept it by pressing the left mouse button**.**

The path length is automatically updated in the information window at the bottom of the screen.

Insert Bevel Corner Loop

Insert Bevel Corner Loop to insert a bevel corner loop at the corner closest to the pick point. This function can only be applied to a shape that contains bevel cuts and after the path is generated. The bevel loop provides a path for the torch to perform its head transition and provide a clean cut at the corner. A sample bevel loop is shown below. NC-Pyros will automatically insert bevel loops determined by the bevel settings in the preferences.

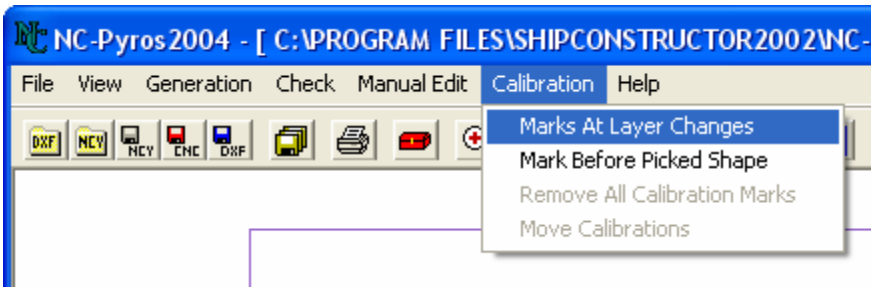


Remove Bevel Corner Loop

Remove Bevel Corner Loop to remove a bevel corner loop, pick anywhere in the bevel loop path. This function provides the capability to remove bevel loops that are not desired.

The Calibration Menu

Overview



The **Calibration** menu contains the following items:

Marks At Layer Changes

At Layer Changes - This function inserts calibration marks before and after processing a layer. Each calibration mark consists of a cross with a horizontal and a vertical line marked before the start of the layer processing and a diagonal cross marked on top of the first cross drawn after the processing for this layer is finished. One set of crosses is drawn for each layer. Each calibration mark for the subsequent layers is offset in the X-direction.

Mark Before Picked Shape

Before Picked Shape - This function inserts a calibration mark before the shape selected by the user. Each calibration mark consists of a cross with a horizontal and a vertical line marked before the start of the shape processing and a diagonal cross marked on top of the first cross drawn after the processing for this shape is finished. One set of crosses is drawn for each selected shape. Each calibration mark for the subsequent shapes is offset in the X-direction.

Remove All Calibration Marks

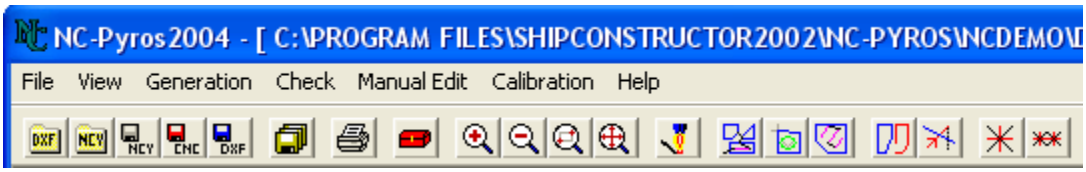
Remove All - This function removes all the calibration marks created.

Move Calibrations

Move Calibrations - This function moves all the calibration marks to a position selected by the user.

The Toolbar

Overview



Each button represents a shortcut to a menu item. No new functions are implemented here. A tool tip will be displayed if you rest the cursor over a button for a short time. A tool tip is a text message that describes the function of the button. The **toolbar** contains the following buttons:

File / Open DXF to open a DXF file.

File / Open NCY to open a file that has been saved in NC-Pyros format.

File / Save NCY to save the geometry in a special NC-Pyros format.

File / Save NC-Code to save the complete path as an NC-Code file.

File / Save As DXF/O File to save the cutting path as a DXF formatted file.

File / Save All to save as a NC-code file, NCY file and DXO file with the same filename.

File / Print to print what is displayed on the screen.

File / Preferences to set the preferences.

View / Zoom In to magnify the display.

View / Zoom Out to zoom out by 2x.

View / Zoom to select the area to be displayed - hot key '**Z**'.

View / Zoom All to display the entire drawing on the screen - hot key '**A**'.

View / Simulate to draw the path at different speeds.

 **Generation / Generate Complete Path** to automatically generate a complete path.

 **Generation / Generate Shapes** to connect entities into shapes on each layer.

 **Generation / Generate Marking Path** to automatically generate a path for all marking.

 **Check / Check Open Shapes** to highlight open shapes for manual editing.

 **Check / Check Lead Collision** to find all lead collisions with other shapes.

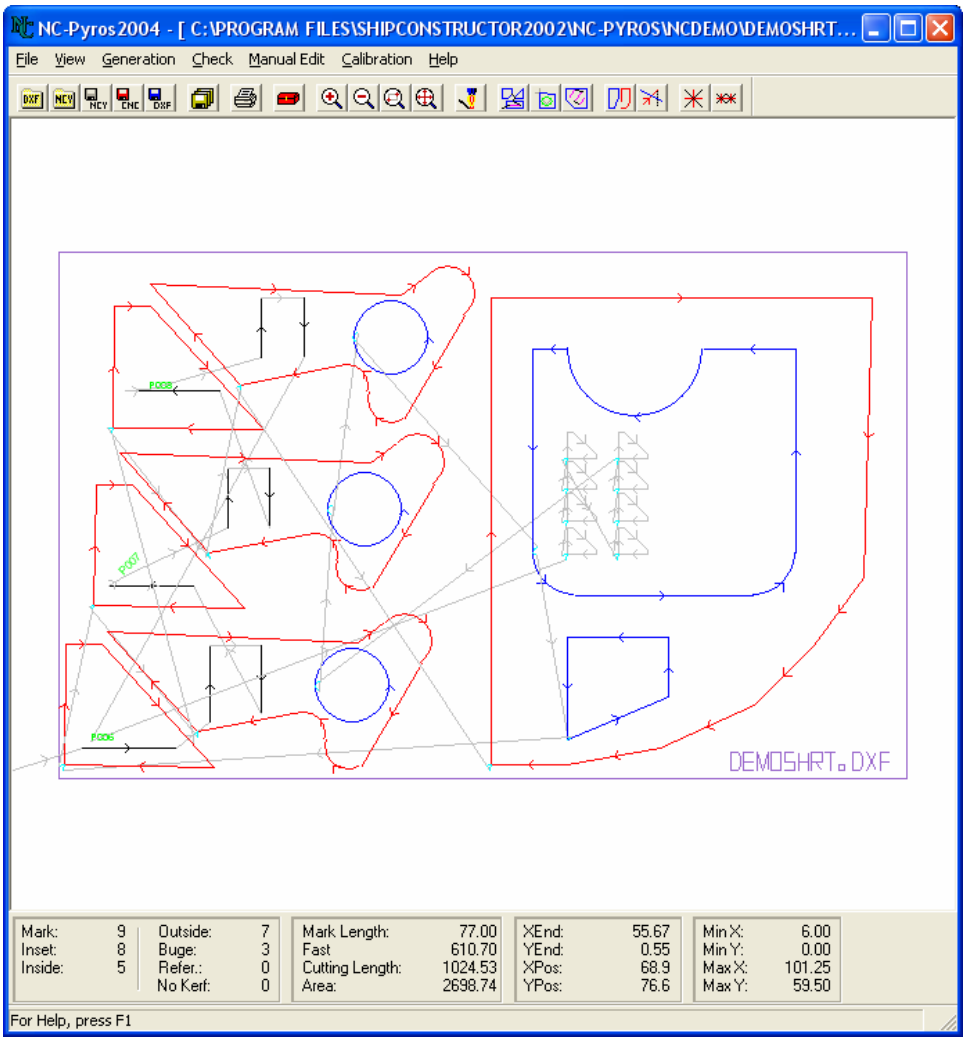
 **Calibration / At Layer Changes** to insert the calibration marks between processing layers.

 **Calibration / Before Picked Shapes** to insert the calibration marks before the shape.

Main Display Window

Overview

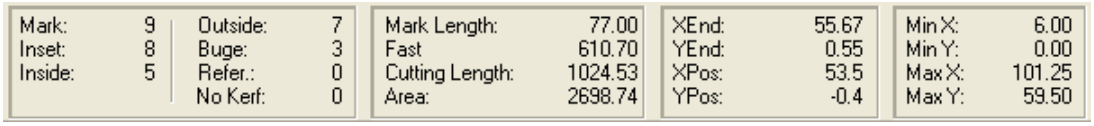
The large center window displays the geometry of the path. Colors are used to distinguish between the different functions of the geometric entities. The DXF object colors can be changed on the **Layers** tab in **Preferences** and the NC-Pyros generated objects can be changed in **View / Colors**.



The Information Window

Overview

The information window can be displayed either at the bottom or at the left side of the screen. Use the **View** menu items to setup the position of this window.



In either the bottom or left side of the screen the same information is displayed. The following items are listed:

- The number of elements found on each layer.
- The length of the path for each kind of travel.
- The area of the processed parts.
- The end position of the cutter after processing all parts.
- The X and Y position of the cursor.
- The path completion state.

Editable TEXT Character Set

Character Description

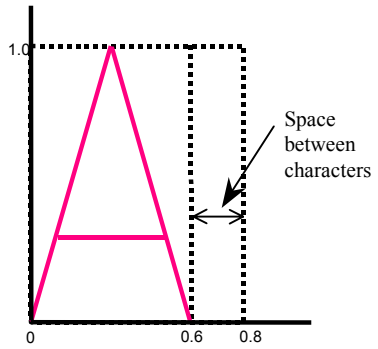
NC-Pyros allows users to create and edit their own custom TEXT characters.

The following characters are provided in the CHAR.DAT file:

a-z, A-Z, 0-9~`!@#$%^&*()-_=+\|[]{};:'"<>/?.,

The character set can be extended to include any characters.

The following example shows how a character is represented in the CHAR.DAT file.



Sample from CHAR.DAT for the character “A”:

```
>A
0.00 0.00
0.30 1.00
0.60 0.00
-1.0 -1.0
0.10 0.30
0.50 0.30
-2.0 -2.0
```

The character following the “>” is the character for which the following geometry instruction will be used. Each ASCII line after the character represents an (x, y) coordinate. Adjacent coordinates are connected by a line in the direction from the first coordinate to the second. There are two special coordinates:

-1.0 -1.0	indicates a break in the marking path description, such as when the horizontal stroke in the letter A is finished
-2.0 -2.0	indicates the end of the character drawing

Customizable Controller Code Files

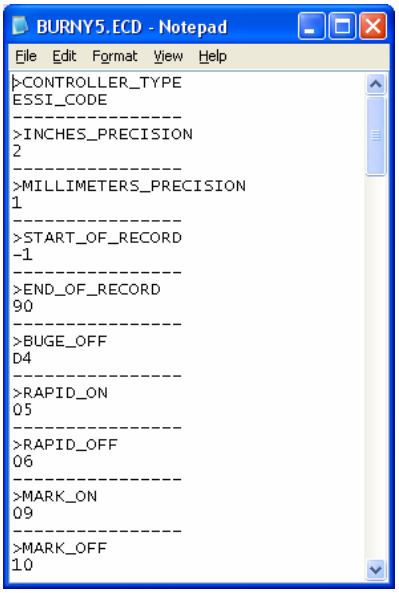
Overview

There are generally two different code formats used for NC-burning machines: G-Code and ESSI-code. Even though both codes are standardized, controllers from different manufacturers use slightly different codes to execute certain functions.

Several aspects should be considered and discussed with the operator of the NC burning machine before producing NC-code. There are a wide variety of NC controllers fitted to burning machines. NC burning machines from the same manufacturer can be fitted with different controllers. Some controllers "understand" only one programming language, others can use two or more languages and or dialects of the same language.

NC-Pyros supports G-CODE and ESSI format. The following ready-made controller files are included with NC-Pyros.

Controller Type	Controller Data Filename
BURNY	burny.ecd, burny.gcd, burny3.ecd, burny5.ecd, burny5.gcd
BYSTRONIC	bystronic.gcd
ESAB	esab.ecd, esab.gcd
L-TEC 2000	ltec2000.gcd
KOIKE	koike.gcd
MESSER GRIESHEIM	messer.ecd
FANUC 15M	fanuc15m.gcd
MICROPATH	micropth.gcd
Union Carbide UCNC-7/8	ucnc78a.gcd for absolute programming ucnc78i.gcd for incremental programming
ANCA	anca.gcd
LINDE CM100	lndcm100.gcd



NC-Pyros uses a controller code file for every type of controller to handle the variations. You can modify or make your own controller files to support any controller. Use a text editor like **Wordpad** or **Notepad** to change the individual codes in a controller file. Just select the code that you wish to change and type in a new value for the specific code.

It is good practice to open a file that represents your needs most closely and to save it under a different name. Make sure to use the extension ".ECD" for ESSI based controllers and ".GCD" for G-Code based controllers.

Each controller function has a separate section in the controller file. Each section starts with a key word of that function. The key word is always preceded by a ">" character. The next line(s) contain the code required to execute that function. You can place the code for the function into one or more lines. The end of the code for the function is indicated by a line with several dashes.

```
>BURNER_OFF
08
66
----------
```

Example for changing a function code:

1. Open the **Notepad** program from the program manager and open the file **BURNY.ECD**. Save the file immediately as **MYBURNY.ECD**.
2. A "-1" in the code file indicates that this controller does not use any code for a specific function. The "-1" after START_OF_RECORD indicates that this controller does not have a code for the start of a record. Suppose you require a "%" sign to mark the start a record.
3. Highlight the old code, "-1", and type in the new correct code, in this case "%".
4. Save the file.
5. Return to NC Pyros and select **MYBURN.ECD** in the **Preferences** dialog.
6. Open **DEMOSHRT.DXF**, optimize it, and save it as CNC.
7. Open the file **DEMOSHRT.DXF** with **Wordpad**. It lists a "%" at the beginning of the file.
8. Conversely, to stop a code from being generated, just change its code value to "-1".

DO NOT REMOVE ANY FUNCTION CODES FROM THE ORIGINAL FILE. Use the "-1" code to disable code generation.

USE SEPARATE LINES FOR MULTIPLE CODE GENERATION. Each code that is generated should appear on a separate line. There is no limit to the number of lines of code that can follow a code name (see below).

Tip: Keep the original controller data files intact. Whenever you customize a controller data file, save it under another name with the same extension. The names of the project or steel cutter make good filenames, i.e. ALBACORE.ECD. It will still appear in the **Preferences Post Processor** list.

Tip: Make sure to keep the same extensions, ".ECD" for ESSI and ".GCD" for G-CODE.

Tip: Since different Preferences data files are kept in the directory of each project, you must be sure that the custom controller filename is still selected in the **Preferences** dialog after you change project.

The controller files contain the following sections:

CONTROLLER_TYPE - Is used to distinguish between G-Code and ESSI controllers. Be sure not to alter this string manually!

MILLIMETERS_PRECISION - NC-Pyros always programs G-Code with decimal values for the coordinates. Controllers usually require a different number of digits after the decimal point depending on the units used. **G-Code**: Most often you will find that three digits are used for inches and two digits for millimeters. Some controllers are tolerant and accept any number of digits. **ESSI code**: Most often you will find that accuracy is 1/100th of an inch for inch units (2 digits of precision) and 1/10th of a mm for millimeters (1 digit of precision).

INCHES_PRECISION - See MILLIMETERS_PRECISION.

START_OF_RECORD - Start block for the controller. This code can be the code that a controller requires to know the start of a program, or the code that the tape reader requires to know where the NC-program starts. The tape reader will usually stop at this position and wait for the operator.

Special keywords can be inserted into the START_OF_RECORD code that will be replaced when the CNC file is generated.

> **$FILENAME** - Is replaced by the filename of the CNC output file.
>
> **$DATETIME** - Is replaced by the date / time.
>
> **$PLATEWIDTH** - Is replaced by the width of the rectangle on the plate layer.
>
> **$PLATELENGTH** - Is replaced by the length of the rectangle on the plate layer.
>
> **$PROMPT** - Is replaced by what the user enters. The comment between the double quotes is shown to the user. The value between the square brackets is the default value shown.
>
> Example: ($PROMPT "Enter Grade/Lot/Line/Shot"[AAM*102P*P100*M-M])

LINE_NUMBER_START- The number used to start from when Line Numbers is turned on. Eg. If this is set to 5 then the first line number used will be N5. This may be necessary because lines in the START_OF_RECORD are not prefixed with line numbers.

END_OF_RECORD - End block to tell the controller or tape reader (or both) that the end of the program has been reached.

RAPID_LINE - The code used for a rapid line travel. Only G-Code controllers use this function. The code precedes the X- and Y-coordinate values in the same line.

CONTROLLED_LINE - The code used for a controlled feed line travel. Only G-Code controllers use this function. The code precedes the X- and Y-coordinate values in the same line.

CW_ARC - The code used for clockwise arcs. Used by G-Code controllers only.

CCW_ARC - The code used for counter-clockwise arcs. Used by G-Code controllers only.

KERF_ON_LEFT - The code used to offset the torch to the left of the cutting path.

KERF_ON_RIGHT - The code used to offset the torch to the right of the cutting path.

KERF_OFF - The code used to cancel the torch offset.

FAST_FEED - The code used to tell the controller to travel at fast feed rate. This can be an F code such as F100 which could mean 100 inches per minute, or, as for UCNC78, an R for rapid. This code is added as the last value to the line movement code. For example: G01 X=1.0 Y=2.0 R.

SLOW_FEED - The code used to tell the controller to travel at slow feed rate. This can be an F code such as F10 which could mean 10 inches per minute. This code is added as the last value to the line movement code. For example: G01 X=1.0 Y=2.0 F10.

LEADIN_FEED - The code to tell the controller the speed when the lead-in is cutting. Typically this is F### for G-Code controllers.

INCHES_UNITS - The code to tell the controller that all units are in inches.

MILLIMETERS_UNITS - The code to tell the controller that all units are in millimeters.

ABSOLUTE_FORMAT - The code to tell the controller that all coordinates are given in absolute values from the origin.

INCREMENTAL_FORMAT - The code to tell the controller that all coordinates are given in relative values from the current position.

BURNER_PLASMA_ON - The code to tell the controller to use the plasma tool and turn it on.

BURNER_PLASMA_OFF - The code to tell the controller to turn the plasma tool off.

BURNER_GAS_ON - The code to tell the controller to use the gas tool and turn it on.

BURNER_GAS_OFF - The code to tell the controller to turn the gas tool off.

MARK_ON - The code to tell the controller to turn the marking head on. This can be punching, spray paint, inking or zinc powder marking.

MARK_OFF - The code to tell the controller to turn the marking head off.

MARKOFFSET_ON - The code to tell the controller to offset the tool head for the marking head.

MARKOFFSET_OFF - The code to tell the controller to turn the marking head offset off.

RAPID_ON - The code to tell the controller to use fast travel for all further movements. Used for ESSI only.

RAPID_OFF - The code to tell the controller to use regular slow feed rate travel for all further movements. Used for ESSI only.

BUGE_TEXT - The code to tell the controller to turn the BUGE text generator on.

BUGE_HEIGHT - The code to tell the controller the size of the BUGE text.

BUGE_STRING_ANGLE - The code to tell the controller the orientation of the BUGE text.

BUGE_ALLOWED_CHARACTERS - The characters that can be used in a BUGE character string for the controller.

BUGE_START_ANGLE - The angle, in degrees, from the horizontal (0 degrees in the x, y coordinate system) to the angle that the controller knows as 0 degrees.

BUGE_ANGLE_PRECISION - The precision in digits of the BUGE text angle.

BUGE_DIRECTION - The direction of the coordinate system of the controller. When a positive angle is in the clockwise direction the BUGE_DIRECTION is 1.0; and when a positive angle is in the counter-clockwise direction the BUGE_DIRECTION is -1.0.

BUGE_OFF- The code to tell the controller to stop generating BUGE characters.

DWELL - The code to tell the controller to dwell. Include dwell time if necessary.

IGNORE_ON - The code to tell the controller to start ignoring some lines.

IGNORE_OFF - The code to tell the controller to stop ignoring the code.

ARC_DIMENSION_TYPE - The format for specifying arcs. Normally IJ define the center of the arc, however some controllers use R for radius (values can be **IJ_FORMAT** or **RADIUS_FORMAT**). Not using this setting defaults arc types to IJ_FORMAT. (*G-code only*)

ARC_ABS_INCR - Determines if the controller outputs an ARC's IJ center point in absolute coordinates or incrementally from the start point. (Values can be **-1** for absolute; **INCREMENTAL** for incremental). (*G-code only*)

CNC_FILE_FORMAT- Used to output CNC files in binary or UNIX format (without LINEFEED character added to end of line character). Set to **BINARY** for binary format, otherwise set to **-1**.

BEVEL_ANGLE_ON - The code to tell the controller to rotate the bevel torch.

BEVEL_ANGLE_NEXT - The code to tell the controller rotation at the end of the segment (variable bevel cutting).

BEVEL_ANGLE_OFF - The code to tell the controller to rotate the bevel torch to vertical.

MATERIAL_THICK - The thickness of the plate for determining bevel cut.

BEVEL_TORCH_ON - The code to tell the controller to turn the bevel torch on.

BEVEL_TORCH_OFF - The code to tell the controller to turn the bevel torch off.

PROGRAM_STOP - The code to tell the controller to stop processing.

FIRST_CUT – This code is inserted before the first cut code.

FIRST_MARK – This code is inserted before the first mark code.

SIGN_IJ – Adds a '+' sign to the I and J codes for positive values.

MARKER_TYPE – If the setting is set to INKJET then special inkjet marking codes are used.

Index