Rotary Program Generator (RPG) Manual
Software version 1.0+

Index

User Mode Tabs
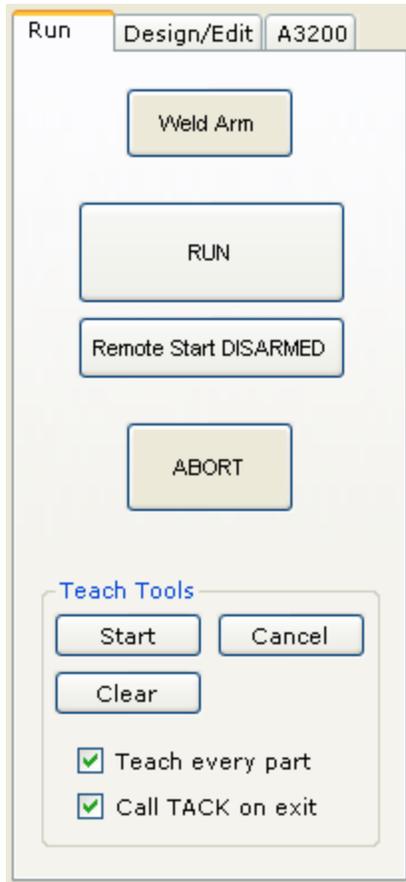
Run Tab

The **Run tab** is how you actually operate the welding/cutting process.

Weld Arm button toggles on/off and when it is green, the Weld Arm flag is set. For the automatic welding to actually emit a beam (open shutter, enable laser, etc) Weld Arm must be active.

RUN button allows you to execute the job from this page. It first compiles and downloads the program to the A3200 before running it. The program that is run is in your application directory and is named RunFile.pgm.

Remote Start ARMED/DISARMED sets the system up and ready to use an external input (like a footswitch, anti-tiedowns, etc) to run the system. You must have the Remote Start input defined. (see IO Display). When Remote Start ARMED is activated, the current design is compiled and downloaded only once to the A3200. After that, each activation of the Remote Start input causes the downloaded program to be executed. If you need to modify any parameters, you must DISARM then re-ARM so the new program is compiled and downloaded.

Abort button aborts any motion or program running on the A3200. It also sets the analog output to the laser to 0 and turns all outputs off.

Design/Edit Tab

The Design/Edit tab is where you create and modify your programs.
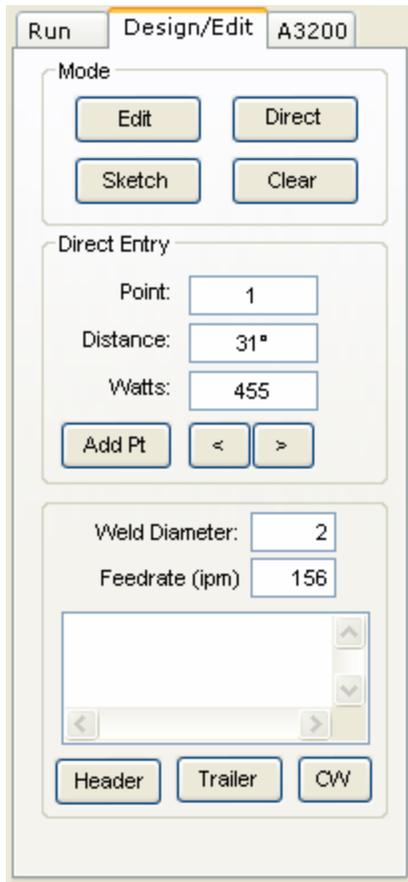
NOTE: You can use + and – before a value entered in either the distance or watts box to specify an incremental distance from where that point currently is. (+10 moves 10 degrees right)

You can enter a value in Point field, press <enter> and that point will be selected. Edit any data for that point and it will be updated.

Or, use the mouse to click a point and drag it. Any highlighted point or range can be moved with the arrow key on the keyboard. Hold shift to move by grid increments.

Modes…..

Edit is basically active at all times.

Sketch mode allows you to point and click to create a weld profile.

Direct mode prompts you to enter a distance (inches / degrees) defining the rotary position of that point. It will also prompt for the power level for that point.

Add Pt adds a new point at the end of this design prompts for the distance and power values.

< And > buttons move the selected point to the next/previous point. Hold down the shift key to select an entire range. <- and -> arrow keys do the same thing.

Weld Diameter is the diameter of your part at the weld joint.

Feedrate is always specified as inches per minute of surface speed.

Header button picks the header file to add to the beginning of the output code. Be sure to use a PSO type header if using pulsed operations.

Trailer button adds a trailer file to the end of the output code for this program.

CW (CCW) button toggles the direction of the weld.

The text field under Feedrate is for any commands you wish to execute before the currently selected point. This may be any executable A3200 program code. Any complicated code may cause motion "burps". Use this cautiously.

A3200 Tab

You can get direct access to some basic and programmable features of the A3200 here.
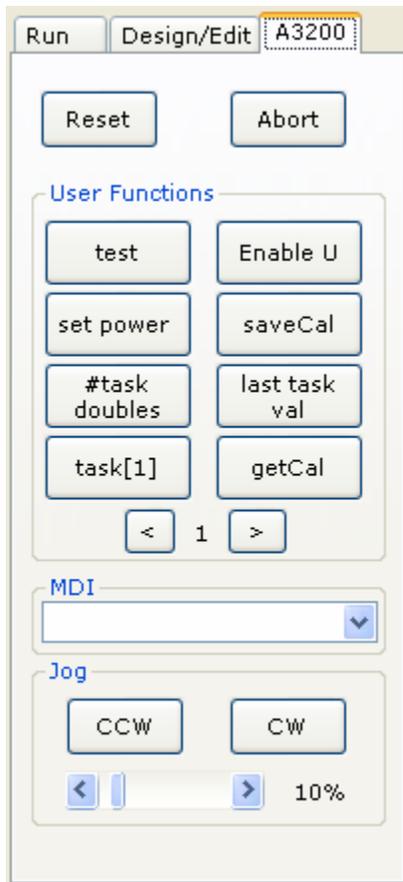
Reset button causes a hard reset of the A3200 system. This may take a few seconds.

Abort button causes any motion to decelerate and stop, all I/O to go off and the analog voltage to the laser to go to 0v.

MDI text box will take any command you type and execute it when you press the <enter> key. A list of your past commands are available via the drop down list.

Jog **CCW** and **CW** buttons cause the rotary axis to move at an adjustable rate. You can adjust the job rate using the slider below the jog buttons. This slider represents 1-100% of the maximum feedrate for your rotary axis, as set in the parameter file.

User Function buttons allow you to define any function that will occur when you press and/or release this button.

Right click on any button to get its configuration popup.
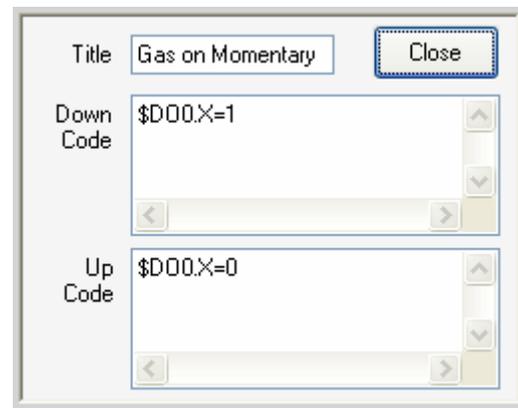
There is an **On code** and an **Off code** either of which can be programmed or left blank. If you wish to have a button that only turns a gas valve on while you hold it down, you would set the On code to $DO0.X=1$, then the Off code to $DO0.X=0$.

The < and > buttons select 1 of 4 pages of buttons available.

Note, you can hide unused buttons by selecting that option in the Preferences, Misc Options dialog.

Preferences Dialog

Misc Settings

On the **Misc Settings** tab are a variety of settings related to your specific system and it's operation.
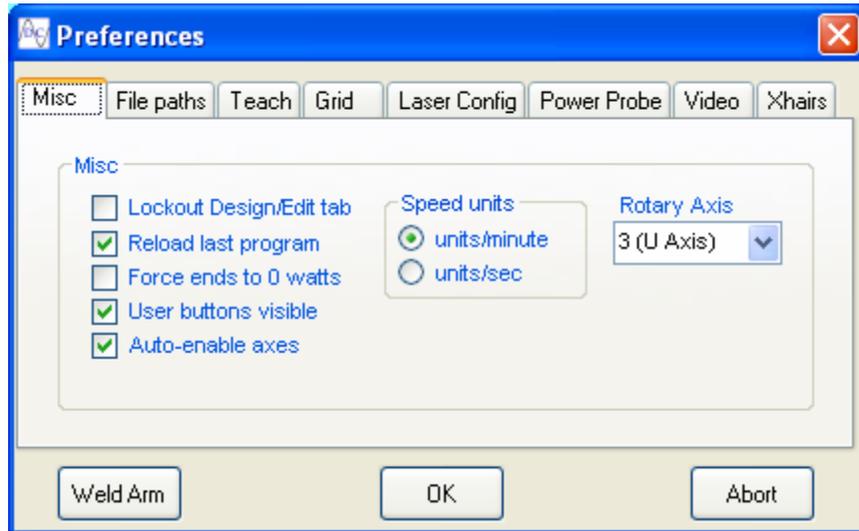
Lockout Design/Edit tab when checked will disable anyone from editing your rotary program design.

Reload last program will load the last opened file open starting up the software.

Force ends to 0 watts assures that your programs will start and end at 0 watts.

User buttons visible shows ALL user buttons (uncheck this to see blank, hidden ones)

Auto-enable axes will enable the rotary drive and any teach axes upon software startup or reset.

Rotary Axis selector defines which axis on your system is the rotary axis.

Speed units determine if velocity units are in degrees (or inches) per minute or second.

Weld Arm button is the same as the arm button on the main application's **Run** tab. It enables the beam on your system.

OK button exits the Preferences dialog.

Abort button aborts the A3200. This button is the same as the abort button on the main application's **Run** tab.

File Paths

The File paths tab allows you to set the default directory for opening/saving files, as well as the option to set a specific A3200 parameter file to use with the RPG program. If you leave this option blank (you can delete the text in the box), then the system will use whatever the default parameter file specified in the A3200.INI file (as set by the Nview MMI program).
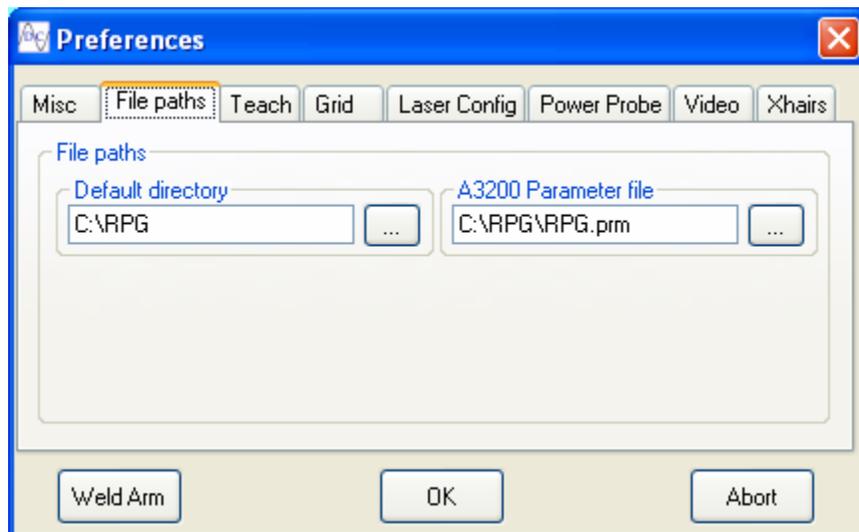
Grid Tab

The Grid tab allows you to specify the type of grid to use, wether to use it and what scale it should be. Grid color, background color and drawing color can all be set by the Edit/Default Colors or Program/Colors menu items.

Note: The distance grid will be based on the current settings of Degrees or Inches as the design units.

When you have Snap to grid enabled, then as you sketch, or stretch a design's points, they will snap to the nearest grid intersection.
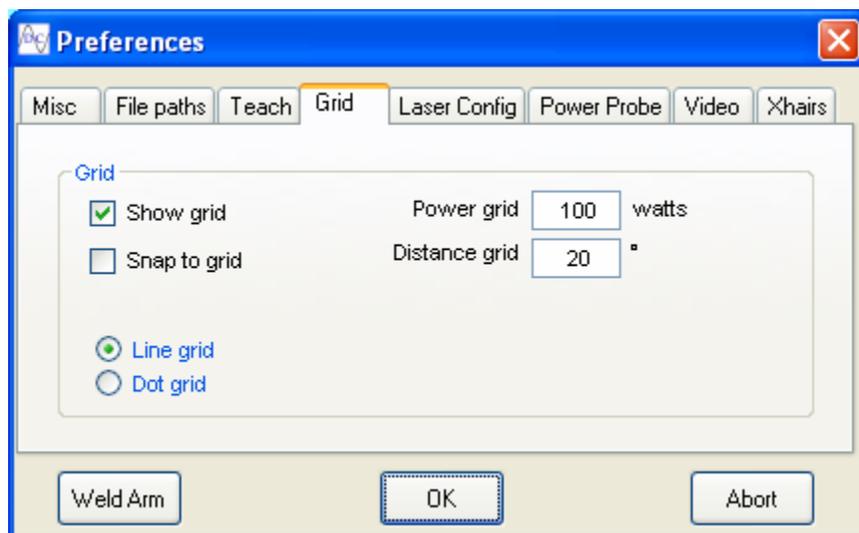
Laser Config Tab

The configuration tab allows you to set some basic values related to your system. The laser wattage is the maximum output of your laser. The Watt/Volt values define you specific laser's programmable power input and output signals. For example, the following shows a 500 watt laser with a Watts/Volt output value of 50. Since our analog inputs are 10v, then (50 watts x 10 volts) = 500 watts. As far as the **From Laser** field, that value can be calibrated to an external probe. (*See Probe Tab*.)
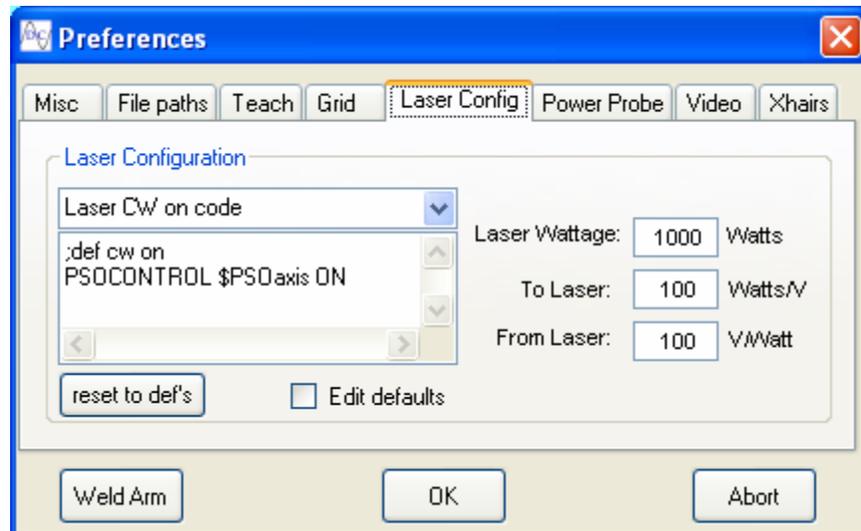
There is a drop-down list that enables you to set the laser on/off codes and a variety of other items like what to do when aborting or resetting. These values also have default settings that you can override. To edit the defaults, click the **Edit defaults** checkbox. It is important to understand that as long as that checkbox is checked, you will be editing the defaults, not the active program's current settings. Each time you leave this dialog, that checkbox will be cleared.

You can put any A3200 compatible commands in here for each command. Every program can have a different set of commands. Or, you can simply press the **reset to def's** button to replace your current settings with the defaults.

Power Probe Tab

To begin with, you need to test and adjust the calibration of the laser's feedback analog signal to your external power probe. The Power Probe tab can with that task. First, select a power level that is compatible with your probe in the **Power to use** field. Also set the beam time required for your specific probe in the **Time delay** field.

Press the **Timed Beam** button to take a power reading. Once your probe reading is available, enter it into the Probe results field (it will be highlighted for you). The **Avg fdbk V** field displays an average of what the laser's feedback voltage was during the probe exposure.
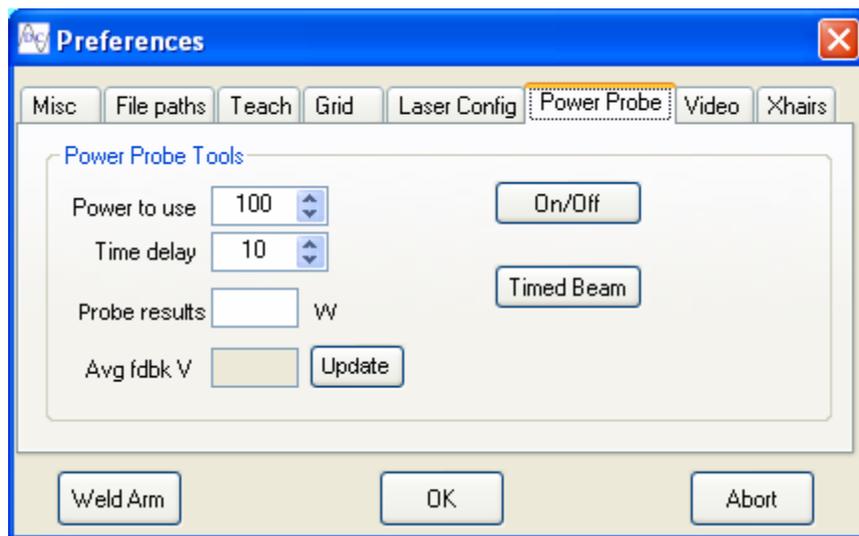

Press the check mark button for some calculations, and if you wish to use the newly calculated Feedback Watts/Volt value, simply press Ok.
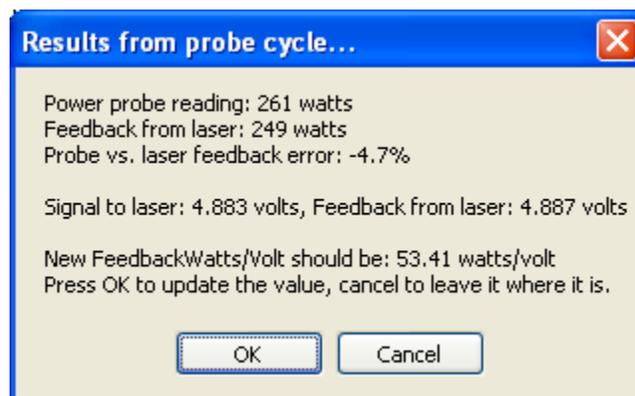
You can use the On/Off button to turn the beam on and off in this page.

Teach Tab
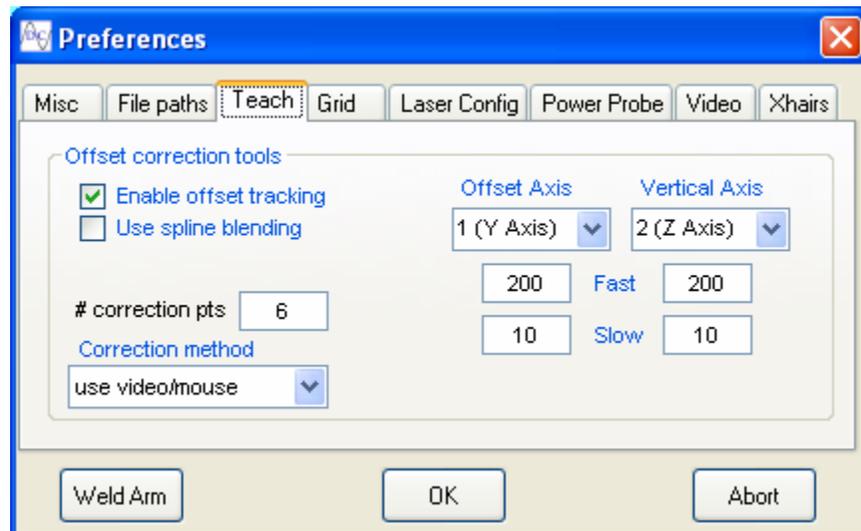
Enable offset tracking enables/disables the tracking feature.

Use spline blending uses spline method of blending rotary and linear moves; otherwise they will be blended linearly.

#correction pts sets the number of portions to divide up a single rotation. For example, if you set to 12, then a correction point will be established every 30 degrees (360/12).

Offset and **Vertical Axis** selectors allow you to pick the axis used in the correction routine. The **Fast** and **Slow** values represent the joystick speeds or the speed using the keyboard (note: **Fast** is only used when the shift-key is also down while using the arrow keys).

Correction method determines what method you will use to jog the axes. You can use the arrow keys on the keyboard or the joystick. When using the joystick, a Slew 8 command is used to turn the joystick on. You need to set up Slew 8 to match your axes. The third option is used in conjunction with the video image, allowing you to click on an offset in the display area. When you click, the motion system will move the offset axis to the point you clicked on. You must calibrate your system for this feature to be accurate, see the Xhairs tab for more information. To move your focus axis, you can use the wheel on your mouse.

Video Setup

If your system has the video option installed, this tab allows you to adjust various simple camera settings.
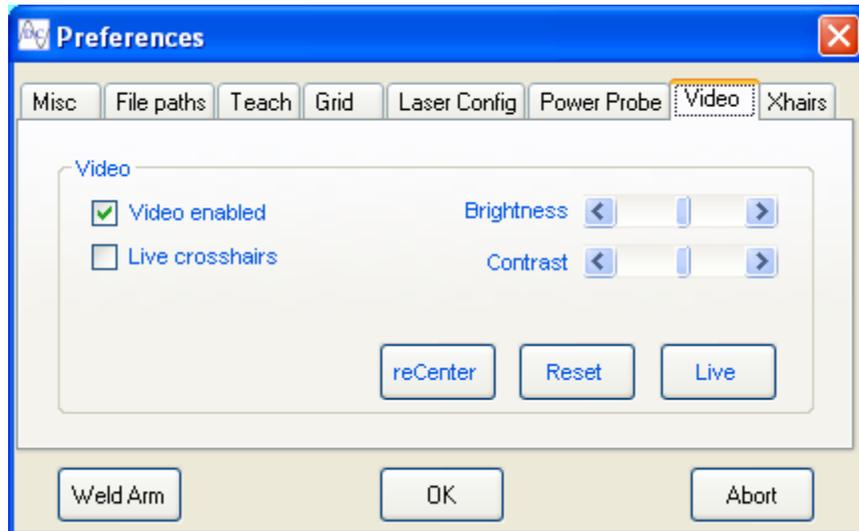
Video enabled sets this feature active or not.

Live crosshairs draws a set of cross hairs over the live image.

**Brightness** and **Contrast** are self explanatory.

reCenter button resets the crosshairs to the middle of the display.

Reset resets the video capture card.

Live enables the live image display.

Xhairs Tab

The Xhairs tab allows you to adjust and calibrate the live crosshairs in the video image display.
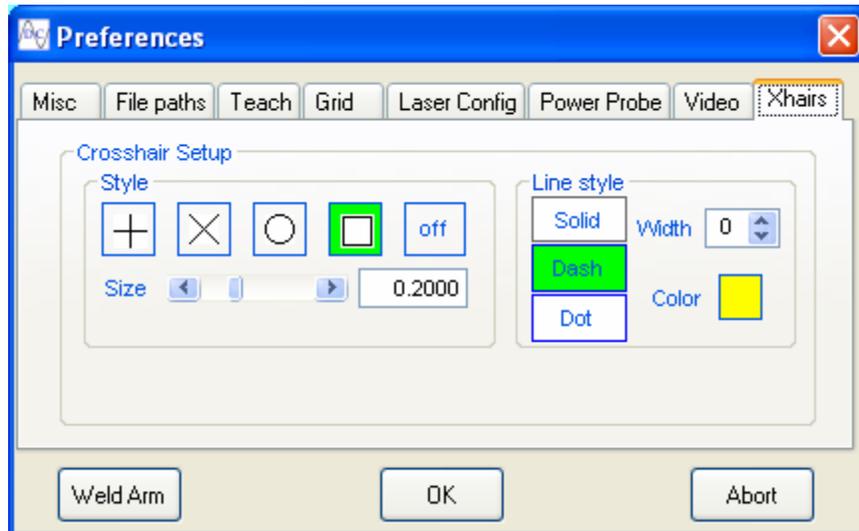
The Style group gives you the ability to select the shape and size of the crosshairs. Next to the size scrollbar is a textbox which shows you the current cursor width/height in inches.

To calibrate your video system, simply take a picture of an object of known size (gauge pin, block, etc.) and then adjust the Size scrollbar so that your crosshairs are the same size as the calibration object. Once you have done that, simply enter the size of the calibration object into the text box. You are now calibrated. As you adjust the slider, you will now see the true size of the crosshairs in inches displayed in the text box.

Teach Tools

The teach tools allow you to correct for part offsets in 1 or 2 axes (see Setup for configuration information).   It uses cam tables to implement this function. A cam table will be generated for each axis that requires offsetting (see A3200 documentation for more info). The following controls enable you to teach as well as clear out any offsets that may already exist. If you do not clear the offsets, the last offsets will be used as a starting point. This is advantageous when you have parts that have similar distortion in the same areas. If you do clear the offsets, the system will move to the next rotary position, but maintain the last taught offsets. This minimizes the amount of jogging you typically would do an a part with runout.

There are three buttons that control the teaching operation. The **Start** button begins a teaching routine. Press **Cancel** (and Abort) to terminate a teach session before it is completed. The **Clear** button removes any previously taught offsets.

When **Teach every part** is checked, then each time you press **Run**, the teach **Start** function will automatically be called allowing you to teach each part before it is run.

When **Call TACK on exit** is checked, then each time you press the Exit button on the joystick (or Enter if using the keyboard's arrow keys) the tack call will be made. You are responsible for setting up a #define tack <xxxxx> function. As you teach each point, a tack will be done at that location before moving to the next teach point.
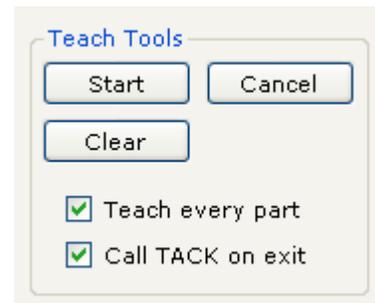
IO Status and Overrides Page

Under the File menu is the IO Display option. This brings up the **IO Status and overrides Page.** This page can be opened and left open to monitor/control your IO along with the main application.

There are 16 outputs and 16 inputs that can be monitored and controlled. The devices that can be controlled are any A3200 IO definition of type $DI, $DO, $BI or $BO.

Output buttons can be selected as Momentary, the output only is activated while the button is pressed, or Toggle, where the output toggles on and off with each activation of the button. The state of that output (Green if ON) is actually the status of that input or output on the A3200 device itself. So, you can have an output like GAS1 below that will light up when it is commanded on within your program. This can also be a valuable tool to monitor your program's IO activity.

The Remote Start input is required if you wish to use a footswitch or other remote switch tied to one of the system's inputs. It can be either a $DI or $BI definition, it just has to be named Remote Start. See Run Tab for more information on the Remote Start input.

The Laser Busy input can be defined and it will control the Laser Busy indicator on the main window. Simply define the input with the title Laser Busy and then put the $DI value of your Laser Busy input on the system as its IO address.

To program an IO button, simply right click on the button. Right clicking an output button will pop up the following dialog:
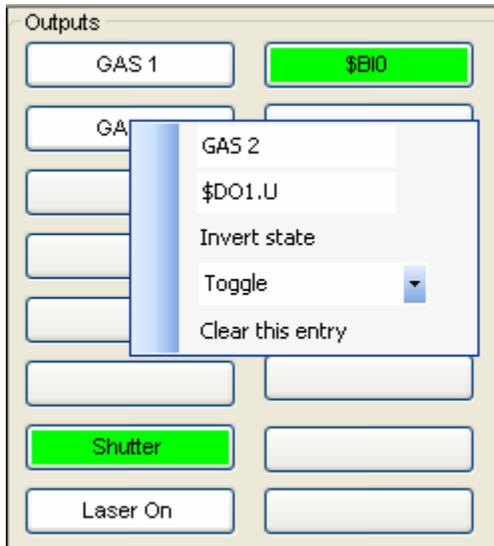
The first line is the button's title, here it's GAS 2. On the second line is the IO address. Here it's a digital output on the U axis. It can be any valid $DO or $BO point.

Invert state allows you to make the input button light up when the monitored point is off and go off when the point is on.

The switch mode drop down list gives you the ability to set the button to Momentary or Toggled action as well as disable it. Toggle buttons alternate their state with each activation. Momentary buttons only activate the output while being pressed.

Clear this entry deletes all the field values.

Right clicking an input button will pop up the following dialog:
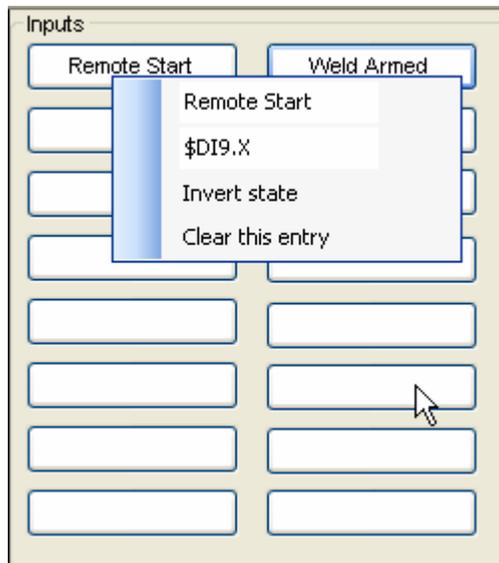

The first line is the button's title, here it's Remote Start.

On the second line is the IO address. This can be any valid $DI or $BI point.

Invert state allows you to make the input button light up when the monitored point is off and go off when the point is on.

Clear this entry deletes all the field values.

The Menus
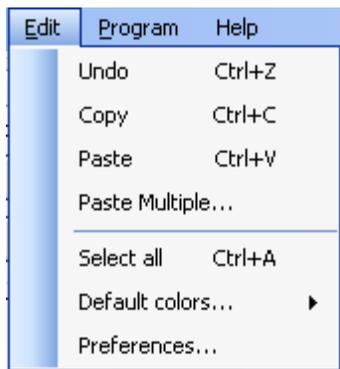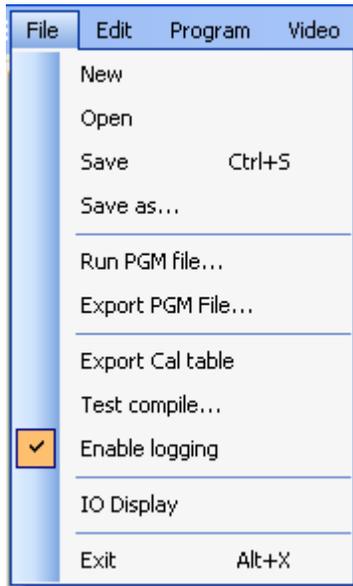
File

New creates a blank design.

Open opens any existing design.

Save your current design to disk.

Save as a copy of this design.

Run PGM file allows you to run a previously saved PGM file.

Export PGM file creates the A3200 code for this design and saves it to disk.

Export Cal table creates a text file of all the data points in the cal table in a format that can be directly opened in Excel and graphed.

Test compile picks a file to compile and defines any errors and their place in the file.

Enable logging shows all the commands sent to A3200 (for debugging).

IO Display brings up the IO Display and overrides window. *See IO Display*

Edit

Undo restores the design to it's last state. Up to 20 undo levels can exist.

Copy copies the current selection of data points.

**Paste** places the data points you copied at the end of the current design.

Paste Multiple repeats a pattern of the data points you copied at the end of the current design.

Select all selects all data points in design

Default colors sets the initial line, grid and background colors in a design

Preferences brings up the Preferences dialog (*see Preferences Dialog*)
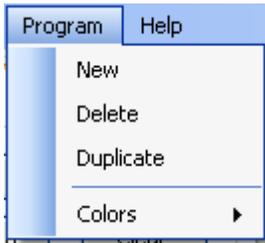
Program

New creates a new program tab. You can have up to 10 program tabs in a design. Creating another tab is a safe way to experiment while not destroying your original (perhaps production) design.

Delete will remove any program tab as long is it is not the last one, it cannot be deleted.   If you delete a tab by mistake, use Undo to bring it back (but do it quickly!).

Duplicate will create an exact copy of the currently selected program tab.

Colors allow you to change the line, grid and background colors only for this program tab.

If you double click on the title in the program tab, you can rename it to whatever you wish. Simply type the new text and press <enter>.
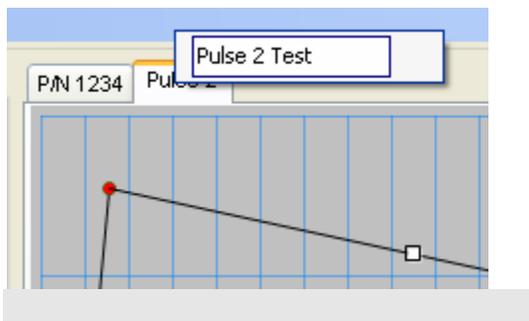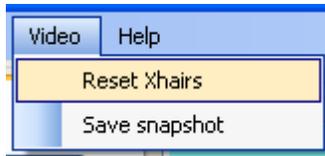
Video

Reset Xhairs sets the crosshairs back to their center positon.

Save snapshot saves a BMP bitmap file of the current image.

General Items

Calibration Overview   (CURRENTLY DISABLED)

The calibration system uses a CalTable, consisting of 1 entry per watt of power. When you calibrate the table, you are adjusting the voltage values going to the laser so that the resulting output power will be accurate. The software has the tools to help you calibrate your laser's feedback to a known external power measurement device (power probe). From that point, there is an automatic system to set a power level at the laser, and then adjust it to match the desired power based on the compensated laser feedback signal.

Once your system is calibrated, you can simply use the call **POWER 100** to set your laser to 100 watts. If you have a very critical application that requires you to verify and adjust your power setting per part, you an simply call **CALIBRATE 100** at any time in your program and that power level's entry in the CalTable will be readjusted (if necessary).

The feedback from your laser is assumed to be linear. There is no mapping of that input. When you calibrate your input feedback using the Power Probe tools, only 1 power point is sampled and a linear scale is calculated for all feedback based on that point. It is probably best to try and set the laser to its maximum power (giving you maximum feedback) and running the Power Probe tools at that level for greatest accuracy. If you cannot do that, perhaps due to the ultimate power capability of your probe, just use the highest power level you can to give you the most accurate calibration. The entire integrity of the CalTable and the calibration scheme relies on the accuracy and repeatability of your laser's feedback signal.

System Status Panel

Monitored Values

The status panel shows the Rotary position either in Degrees or Inches, depending on the current settings.

Rotary Velocity will be in inches or deg's per minute (or second)

The Laser Power Feedback is the current real-time feedback from your laser.

Laser Mode

These 3 buttons and data fields set the operating mode of your beam.

When in **CW**, the Pulsing Data will be disabled.

In **FreeRun** mode, the laser will pulse using the **Width** and **Frequency** values, the **Spacing** value will be disabled.

In **Position** mode, the laser will pulse using the **Width** value and a pulse will occur at each interval defined in **Spacing** (either deg or inches). The frequency will be the calculated frequency based on the current feedrate.

The **Duty Cycle** is a read-only value showing the projected pulse duty cycle using the current settings. If the duty cycle exceeds 100%, the field will turn red alerting you to the error.

When duty cycle exceeds 100%

Display/Zoom

X1 set display to 1 pixel = 1 degree
Fit scales to match your design
Slider simply zooms in or out
Degrees all distance units are in degrees
Inches all distance units are in inches

Video Tools
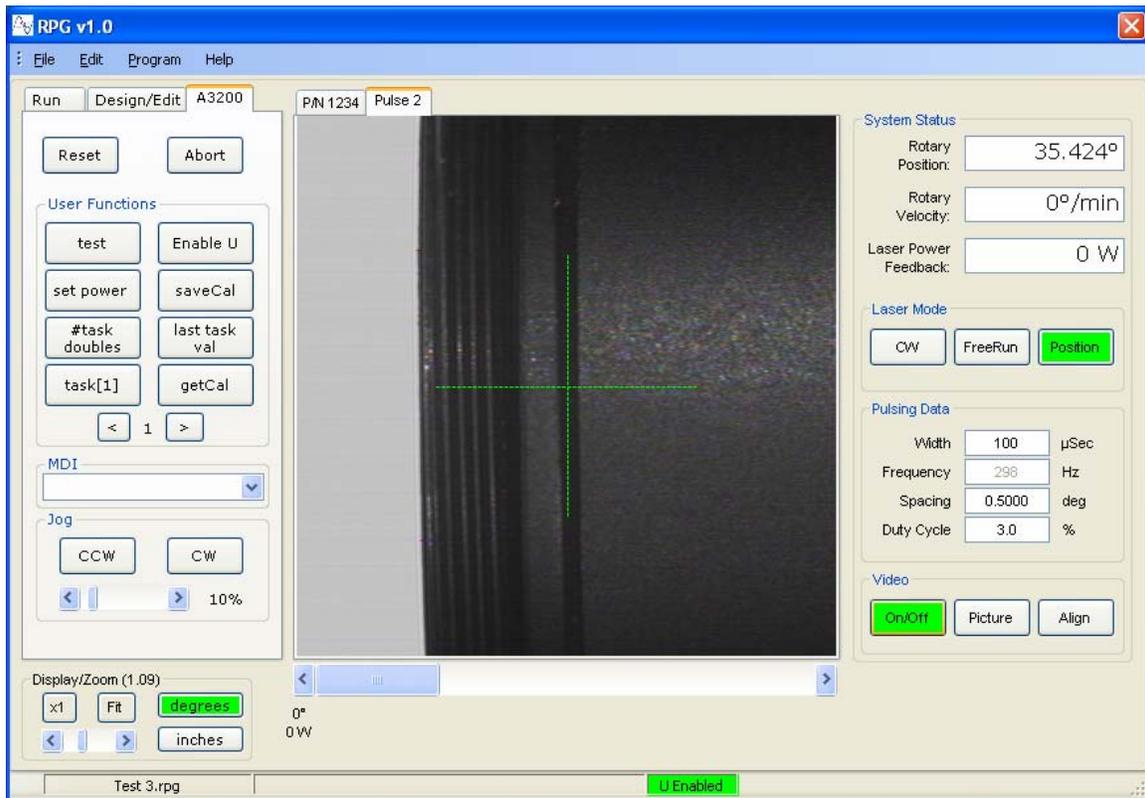
With the Video Tools option installed, your display can also be used as a live video display from your system (or off axis camera). Use the Video group of buttons to control the video display. See Preferences, Video tab for setup information.
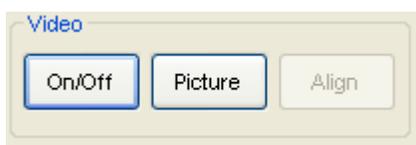
Video display is off. Your normal design is show in the center of the program tabs.
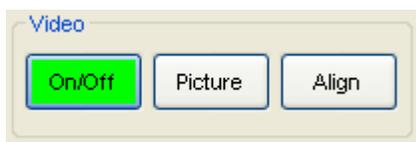

Video display is on and live video is active. Toggle this on/off to switch between program view and live video.

When you take a picture, the live video is turned off but is still active, indicated by the yellow On/Off button. Click On/Off to go back to live or program view.

Note: You can turn the crosshairs off if you like in Preferences, Video tab

Aligning the crosshairs

You can use the **Align** button to adjust the crosshair position on the video display.

To align, click on the Align button and you will be prompted to click on the alignment point on the screen to center. So, if I click on the joint where my beam is, the video crosshairs will be shifted to that point.
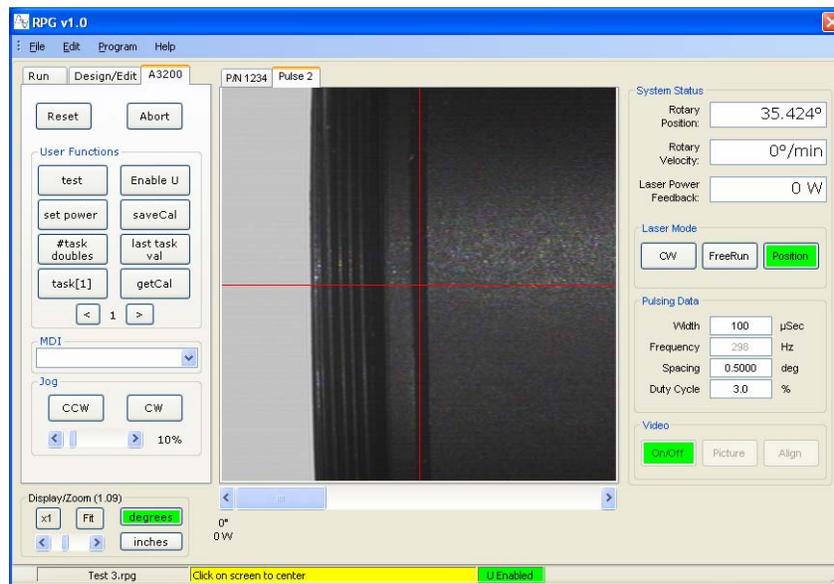
The crosshair location will be saved automatically and will be restored to its last position when the software initializes.