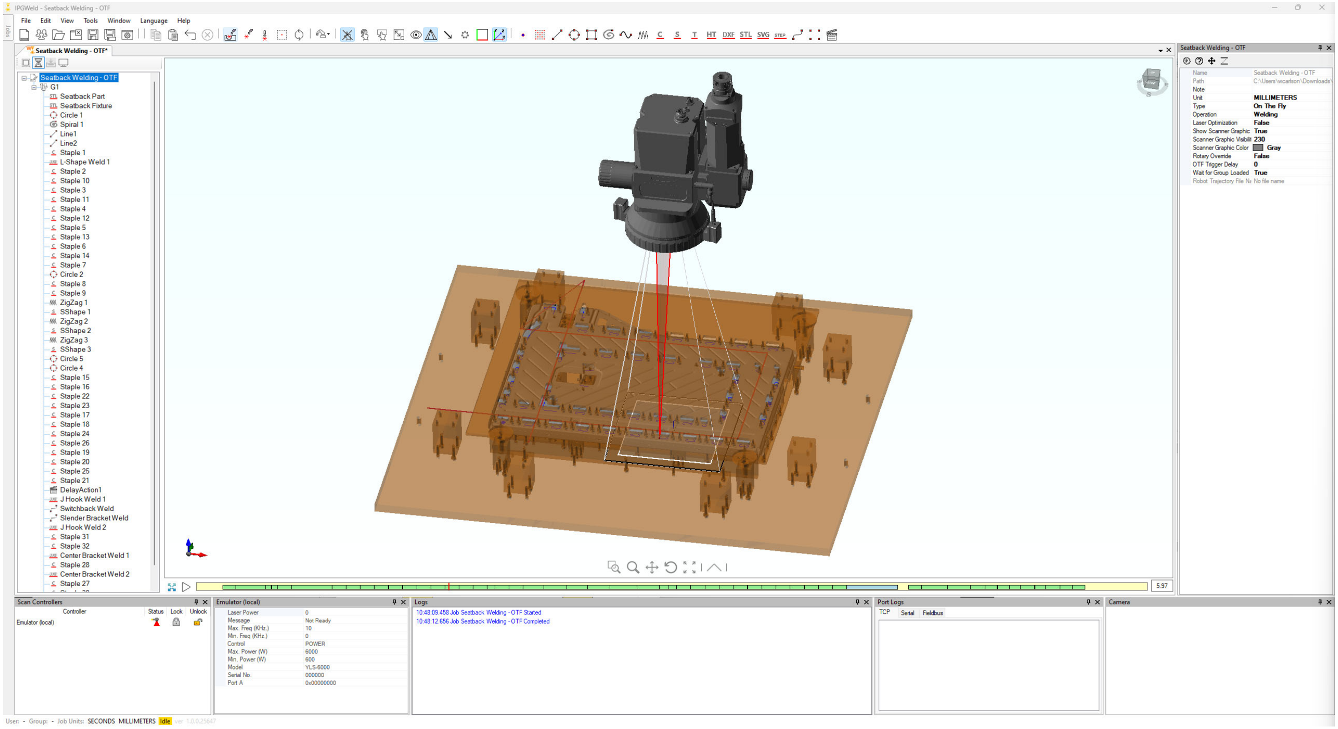
IPGScan Software



Seatback Welding - OTF

Name	Seatback Welding - OTF
Path	C:\Users\wcarlson\Downloads\
Note	
Unit	MILLIMETERS
Type	On The Fly
Operation	Welding
Laser Optimization	False
Show Scanner Graphic	True
Scanner Graphic Visibili	230
Scanner Graphic Color	Gray
Rotary Override	False
OTF Trigger Delay	0
Wait for Group Loaded	True
Robot Trajectory File Na	No file name

Controller	Status	Lock	Unlock
Emulator (local)			

Laser Power	0
Message	Not Ready
Max. Freq (KHz.)	10
Min. Freq (KHz.)	0
Control	POWER
Max. Power (W)	6000
Min. Power (W)	600
Model	YLS-6000
Serial No.	000000
Port A	0x00000000

```
10:48:09.458 Job Seatback Welding - OTF Started
10:48:12.656 Job Seatback Welding - OTF Completed
```

User: - Group: - Job Units: SECONDS MILLIMETERS Idle ver 1.0.0.25647

USER GUIDE

Part Number: DOCOXUGGUIXX0001 | Date: 6/4/25 | Rev: C | DCO: D7077

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Preface

This user guide is a reference manual for end-users and administrators of the IPGScan Software product.

Technical Support

Most issues and questions regarding the safety, setup, operation, and maintenance of IPG products can be resolved by carefully reading this User Guide. If, after reading this User Guide, you have questions regarding the safety, setup, operation or maintenance of your IPG product, contact IPG Customer Service by calling 1-508-373-1157 or e-mailing service@ipgphotonics.com.

Language

The original language of this document is English.

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List of Tables

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1 Overview

IPGScan and the Scan Controller seamlessly interface to IPG lasers. With the addition of the application software, IPG is able to offer a complete remote solution to Integrators and OEMs.

1.1 Computer Requirements

In order to operate any IPG Scanner with a Scan Controller, a computer must be connected and running IPGScan at all times.

Table 1 (below) details minimum computer specifications that must be met for use with IPGScan software.

Table 1: Computer Specifications

Operating System	• Windows 10, Professional or Enterprise | 64-bit
CPU	• 6 cores • 3.60 GHz Operating Frequency • CPUmark (23323 MT / 2256 ST)
RAM	• 32 GB DDR4-2400 ECC
Hard Drive	• 250 GB SSD
Connections	• Ethernet Ports – One is required for connecting to the Scan Controller – (Robotic OTF Processing Only) One for robot communications – (Optional) One for Remote API (TCP/IP) functionality with IPGScan – (Optional) One for connecting to laser software (i.e. LaserNet) – (Optional) One for an Ethernet camera

While IPG does not supply a computer with the purchase of a scanner, the computer that is supplied with the purchase of an LDD system is capable of running IPGScan. Please refer to the appropriate LDD documentation or consult with an LDD Product Specialist for details concerning the LDD computers.

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2 Software Installation

2.1 Software Installation Overview

IPG Scanning software consists of a number of different software suites. These software suites consist of the following:

1. IPGScan
    a. IPGScan is the user facing software for programming the scanning system. This software is what users will interface with 95% of the time when working with a scanner.
2. ScanPack
    a. While users will not interface with a ScanPack graphical user interface (GUI), this is an essential software component for the scanners to function properly. ScanPack takes the users program information from IPGScan and converts this information into something that is actionable by the scanner. Ultimately, users simply need to install ScanPack and then can forget that it exists.
3. The Scan Controller Utility
    a. The Scan Controller Utility is primarily used for setup of the scanner when a system is initially being setup. Some of the primary functions that users will perform using the Scan Controller Utility include, changing laser specification files, setting IP address settings, or backing up the scanner. Additional scanner setup functions exist but will rarely be utilized once a process is setup.
4. Bug Reporting Utility
    a. Unfortunately, no software is perfect. While IPG strives to develop robust and reliable software, testing does not always catch every bug prior to a software release. The Bug Reporting Utility provides a means for users to report these bugs to IPG for further improvement of the software.

2.2 Software Download

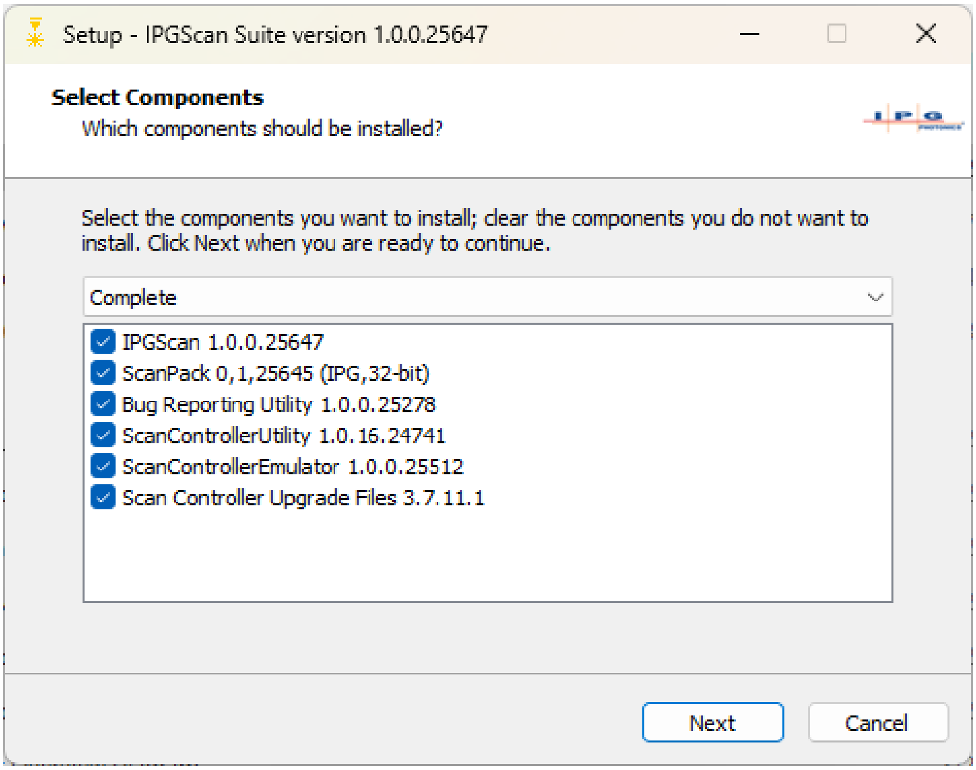
To download the appropriate scanning software, visit software.ipgphotonics.com. Once at the software website, navigate to the following location:

- ScannerSoftware → IPGScan

Within the IPGScan folder is the software suite installer that can be downloaded for the appropriate scanning software.

2.3 Software Suite Installer

Once the software is downloaded from the software website, users can run the software suite executable. Once run, users will be prompted to check which software they would like to have installed (see Figure 1). In general, it is best to install all software packages.



Setup - IPGScan Suite version 1.0.0.25647

Select Components

Which components should be installed?

Select the components you want to install; clear the components you do not want to install. Click Next when you are ready to continue.

Complete

☑ IPGScan 1.0.0.25647
☑ ScanPack 0,1,25645 (IPG,32-bit)
☑ Bug Reporting Utility 1.0.0.25278
☑ ScanControllerUtility 1.0.16.24741
☑ ScanControllerEmulator 1.0.0.25512
☑ Scan Controller Upgrade Files 3.7.11.1

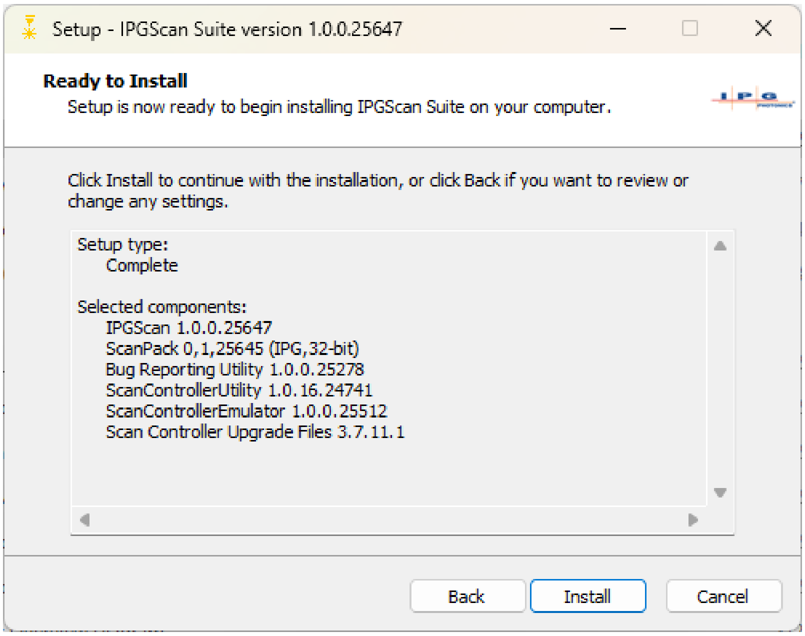
Figure 1: Select Components Screen

If earlier versions of the software were installed prior to running the software suite installer, the installer will handle uninstalling the software prior to installing the new software. This means that users do not need to uninstall software from the Control Panel prior to installing the latest software.

IMPORTANT

If users need to install an older version of software from what is currently installed on the computer then it is necessary to uninstall the current software in the Control Panel prior to installing the older software. Older version software suites will not uninstall new versions of software automatically.

Click “Next” in the Select Components Screen to display the Ready to Install Screen for the IPGScan Suite.



Setup - IPGScan Suite version 1.0.0.25647

Ready to Install

Setup is now ready to begin installing IPGScan Suite on your computer.

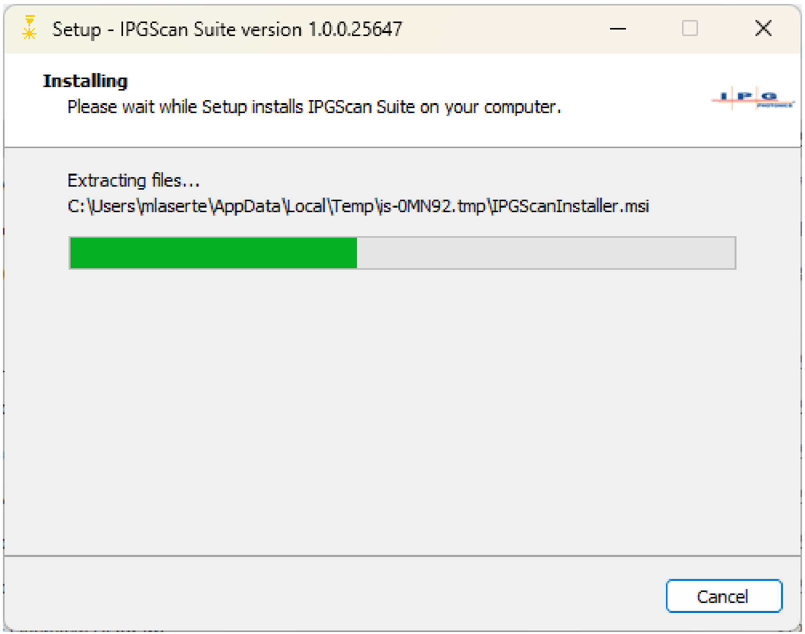
Click Install to continue with the installation, or click Back if you want to review or change any settings.

```
Setup type:
    Complete

Selected components:
    IPGScan 1.0.0.25647
    ScanPack 0,1,25645 (IPG,32-bit)
    Bug Reporting Utility 1.0.0.25278
    ScanControllerUtility 1.0.16.24741
    ScanControllerEmulator 1.0.0.25512
    Scan Controller Upgrade Files 3.7.11.1
```

Figure 2: Ready to Install Screen

Click “Install” in the Ready to Install Screen to begin the installation of the IPGScan Suite. The following screen is displayed while the software components are installed.



Setup - IPGScan Suite version 1.0.0.25647

Installing

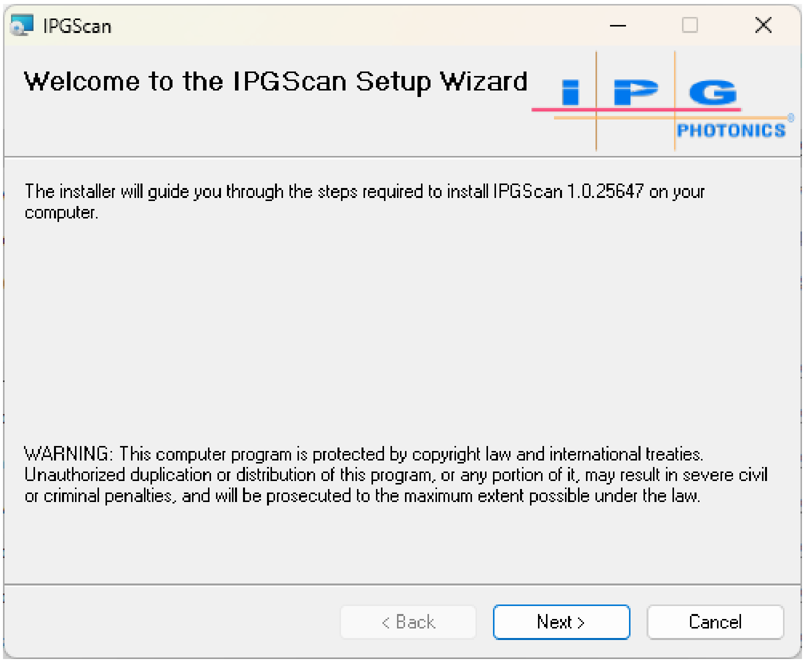
Please wait while Setup installs IPGScan Suite on your computer.

Extracting files...
C:\Users\mlaserte\AppData\Local\Temp\is-0MN92.tmp\IPGScanInstaller.msi

Figure 3: Installation Progress Screen

2.3.1 IPGScan Installer

The following screen is displayed after the IPGScan Suite is installed.

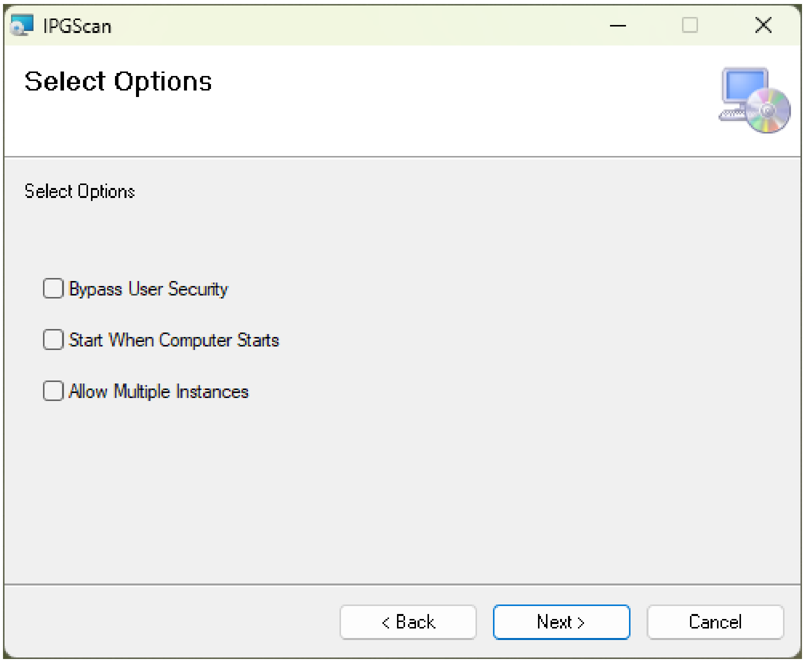


The installer will guide you through the steps required to install IPGScan 1.0.25647 on your computer.

WARNING: This computer program is protected by copyright law and international treaties. Unauthorized duplication or distribution of this program, or any portion of it, may result in severe civil or criminal penalties, and will be prosecuted to the maximum extent possible under the law.

Figure 4: Setup Wizard Welcome Screen

Click “Next” in the Setup Wizard Welcome Screen to display the Setup Options Screen, which is shown below.



Select Options

□ Bypass User Security

□ Start When Computer Starts

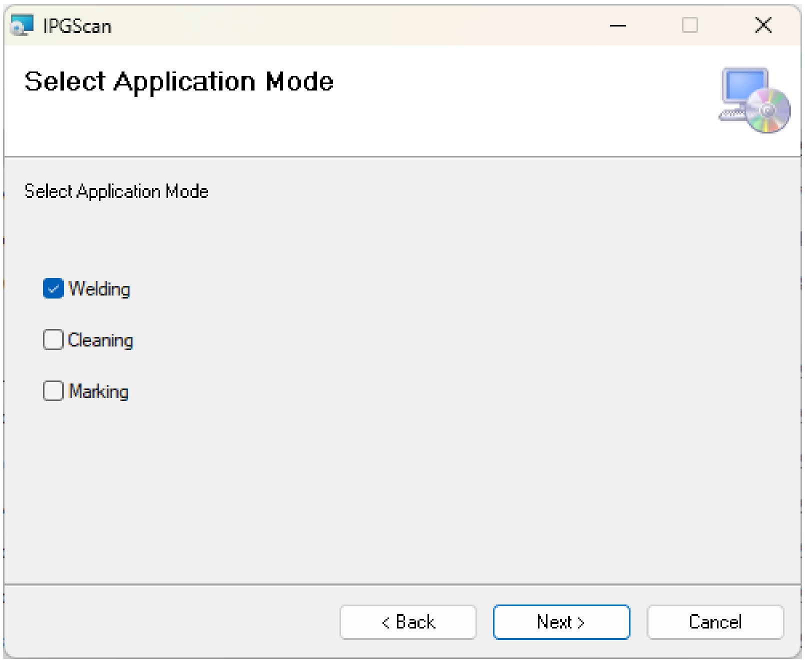
□ Allow Multiple Instances

Figure 5: Setup Options Screen

The Setup Options Screen contains prompts to bypass user security, start when the computer starts, and allow multiple instances (see Figure 5 on page 28). These selections can be summarized in short:

- Bypass User Security
  a. Checking this makes it so users do not need to setup IPGScan security in order to use the software. It is often recommended that users bypass user security and set it up once they are finished with developing their process.
- Start When Computer Starts
  a. Checking this will cause IPGScan to startup when the computer starts.
- Allow Multiple Instances
  a. Checking this will allow you to run up to four instances of IPGScan.

Click “Next” in the Setup Options Screen to display the Select Application Mode Screen.



Select Application Mode

Select Application Mode

☑ Welding
☐ Cleaning
☐ Marking

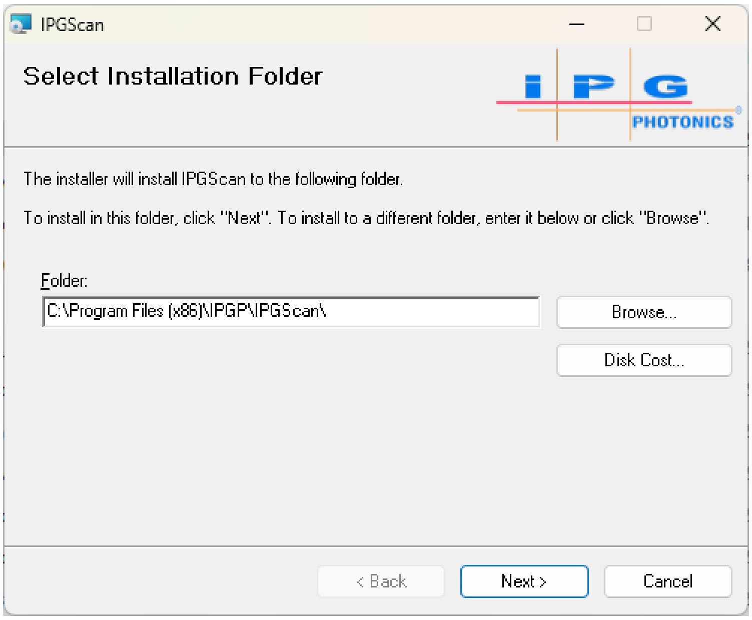
Figure 6: IPGScan Installer Options

The application mode should be selected on what job types users will be expecting to work with for their given application. These can be summarized as follows:

- Welding
  - Most commonly used for welding applications that utilize YLS, YLR, and AMB lasers.
- Cleaning
  - Most commonly used for cleaning applications that utilize pulsed YLPN lasers.
- Marking
  - Most commonly used for marking applications that utilize Integrated Markers.

Click “Next” in the Select Application Mode Screen to display the Select Installation Folder Screen.

In the Installation Folder Screen, you can click the “Browse...” button to select an Installation Folder other than the default installation folder, or you can accept the default Installation Folder (**C:\Program Files (x86)\IPGP\IPGScan\**).



Select Installation Folder

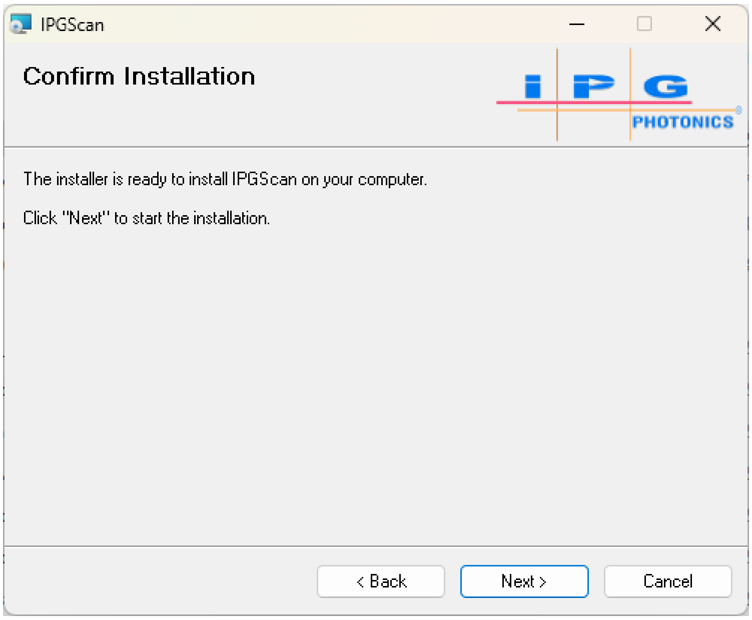
The installer will install IPGScan to the following folder.

To install in this folder, click "Next". To install to a different folder, enter it below or click "Browse".

Folder:
C:\Program Files (x86)\IPGP\IPGScan\

Figure 7: Select Installation Folder Screen

Click “Next” in the Select Installation Folder Screen to display the Confirm Installation Screen.



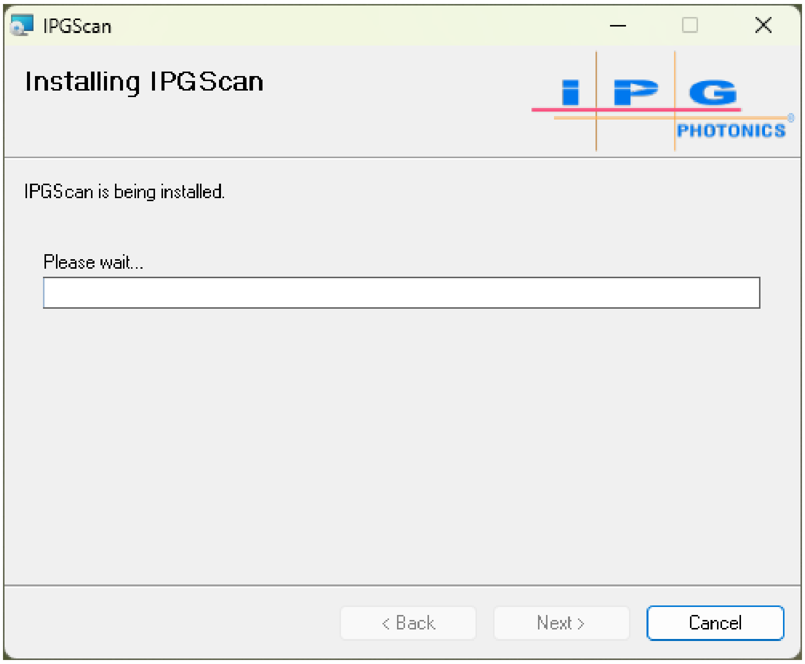
Confirm Installation

The installer is ready to install IPGScan on your computer.

Click "Next" to start the installation.

Figure 8: Confirm Installation Screen

Click “Next” in the Confirm Installation Screen to begin the software installation.



IPGScan

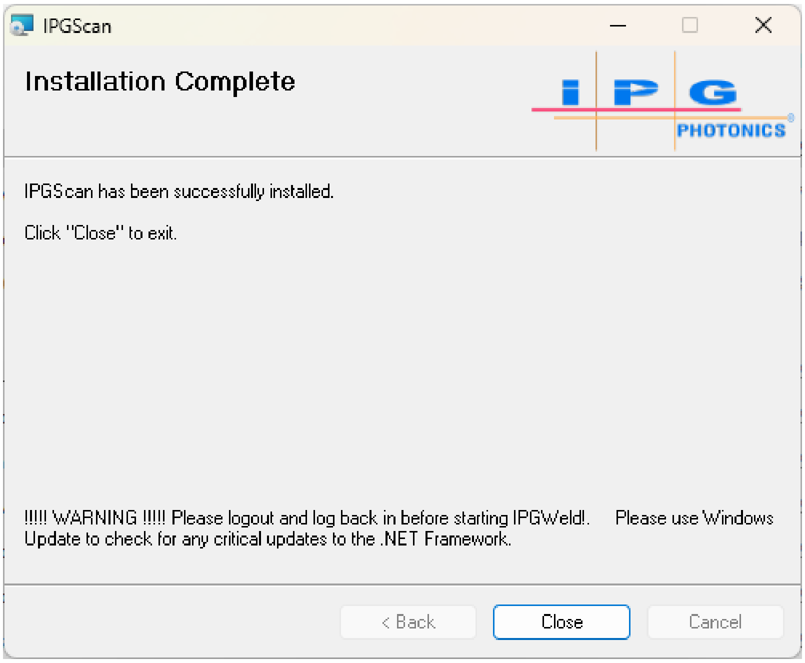
Installing IPGScan

IPGScan is being installed.

Please wait...

Figure 9: Software Installation Screen

After the software installation is done, the Installation Complete Screen is displayed,



IPGScan

Installation Complete

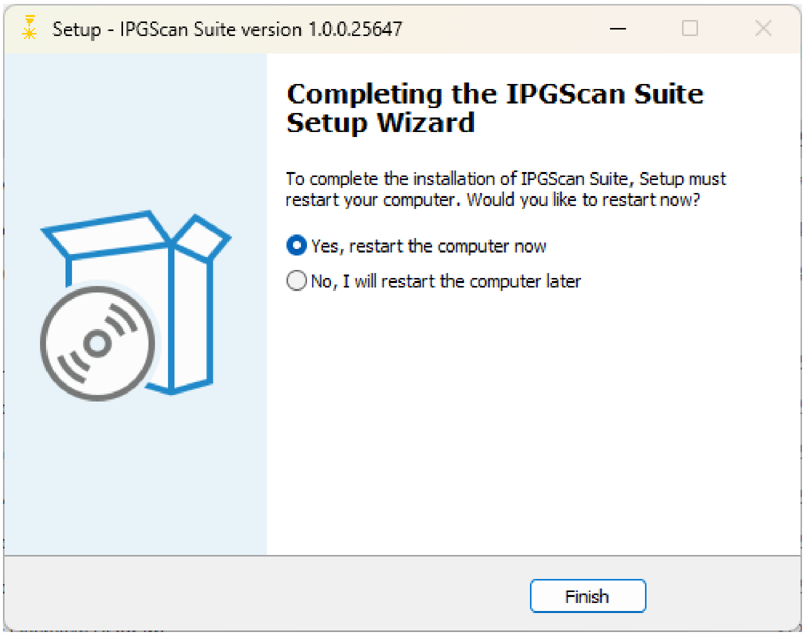
IPGScan has been successfully installed.

Click "Close" to exit.

!!!!! WARNING !!!!! Please logout and log back in before starting IPGWeld!. Please use Windows Update to check for any critical updates to the .NET Framework.

Figure 10: Installation Complete Screen

Click the Close button in the above screen; a series of progress messages is displayed. Then the following screen is displayed.



Setup - IPGScan Suite version 1.0.0.25647

Completing the IPGScan Suite Setup Wizard

To complete the installation of IPGScan Suite, Setup must restart your computer. Would you like to restart now?

● Yes, restart the computer now

○ No, I will restart the computer later

Figure 11: Finish Screen

Select the “Yes” radio button and click the “Finish” button to restart the computer now.

Click the “No” button and click the “Finish” button to restart the computer to restart the computer later.

After the computer is restarted, you can start IPGScan by double-clicking the IPGScan icon on the Desktop.

2.3.2 Additional Software Package Installers

For software packages such as ScanPack, The Scan Controller Utility, and the Bug Reporting Utility, the software suite installer will install these automatically.

3 System Security

3.1 Overview

When installing IPGScan, users have the option to "Bypass User Security." When this option is checked during installation, security is not utilized in IPGScan. If the "Bypass User Security" option is not checked when IPGScan is installed, security is utilized in IPGScan and users will be required to provide login credentials for feature permissions.

IPGScan offers the ability for Users and Groups to have different levels of access. The primary user has the ability to choose what privileges each group has, whether Operator, Technician, Supervisor, or Engineer. A Windows user with administrative rights is required to create and assign users to groups.

3.2 Security Settings in IPGScan

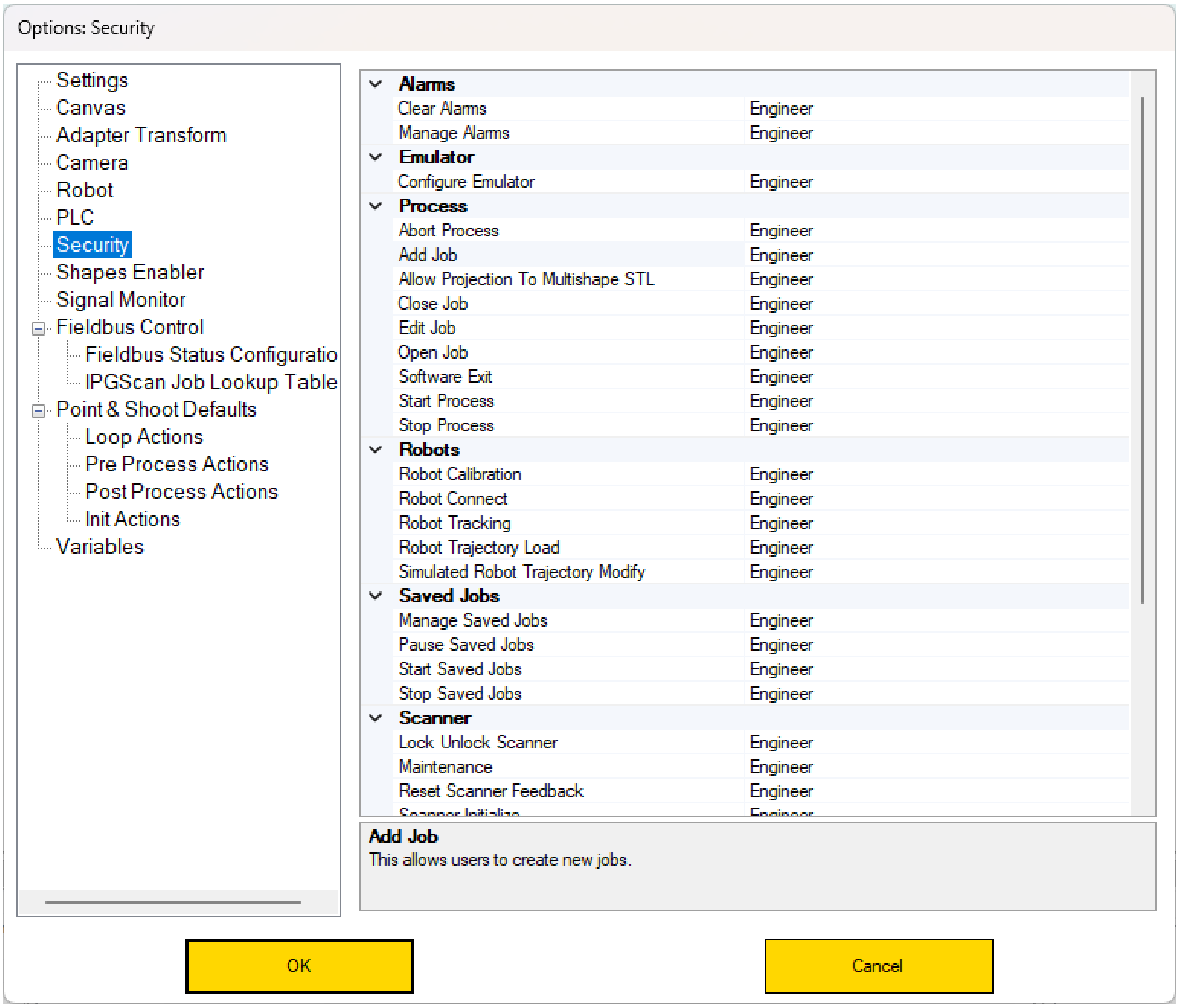
There are four security levels in IPGScan. Listed in order from highest to lowest below, each security level can perform operations specified at its level and levels below.

- Engineer
- Supervisor
- Technician
- Operator

For example, if an operation is set to the level of Supervisor, only users who are Supervisors or Engineers could do the operation.

By default, all settings are set to Engineer level. To adjust the security levels, use the following process.

1. Open IPGScan.
2. Click "View."
3. Click "Options."
4. Click "Security."
    a. In this window, users can define the permissions level that can perform given software functionality. See Figure 12 on page 34.



Alarms	
Clear Alarms	Engineer
Manage Alarms	Engineer
Emulator	
Configure Emulator	Engineer
Process	
Abort Process	Engineer
Add Job	Engineer
Allow Projection To Multishape STL	Engineer
Close Job	Engineer
Edit Job	Engineer
Open Job	Engineer
Software Exit	Engineer
Start Process	Engineer
Stop Process	Engineer
Robots	
Robot Calibration	Engineer
Robot Connect	Engineer
Robot Tracking	Engineer
Robot Trajectory Load	Engineer
Simulated Robot Trajectory Modify	Engineer
Saved Jobs	
Manage Saved Jobs	Engineer
Pause Saved Jobs	Engineer
Start Saved Jobs	Engineer
Stop Saved Jobs	Engineer
Scanner	
Lock Unlock Scanner	Engineer
Maintenance	Engineer
Reset Scanner Feedback	Engineer
Scanner Initialize	Engineer

Add Job
This allows users to create new jobs.

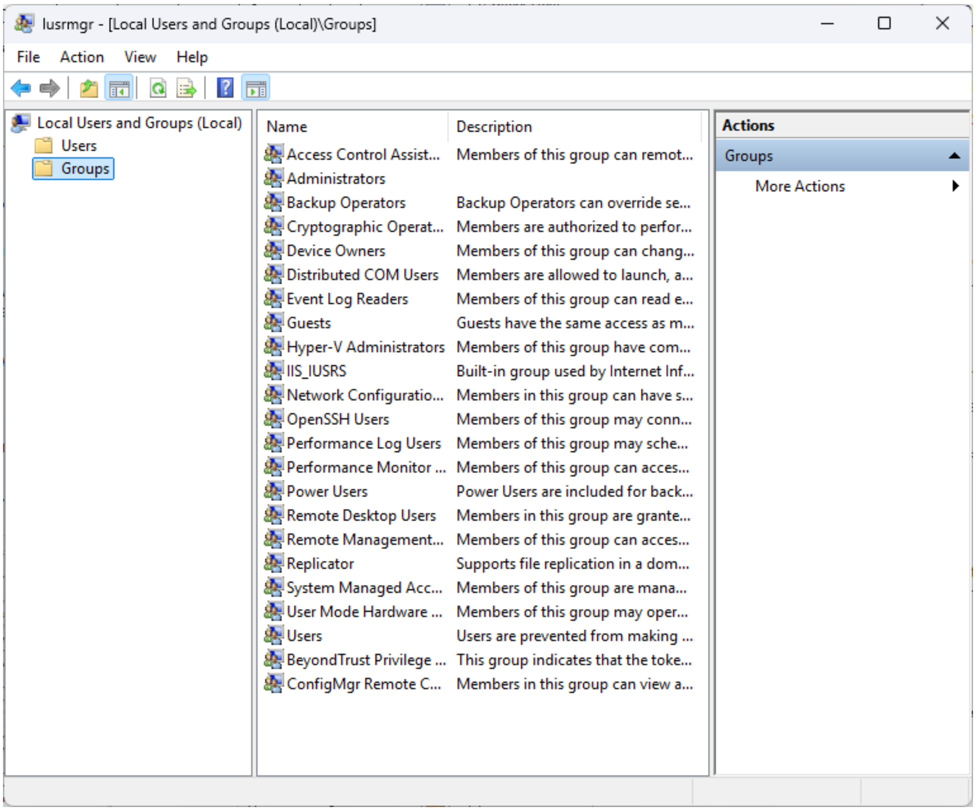
Figure 12: IPGScan Security Options

3.3 Assigning Users to Groups

If users do not "Bypass User Security" when installing IPGScan, it is necessary to assign "Users" to given login levels, also known as "Groups". Users must then sign into IPGScan prior to being able to utilize the software. This provides a means for users to setup permissions to be able to limit certain individuals to a given level of functionality in the software.

Users can be assigned to Groups using the following procedure.

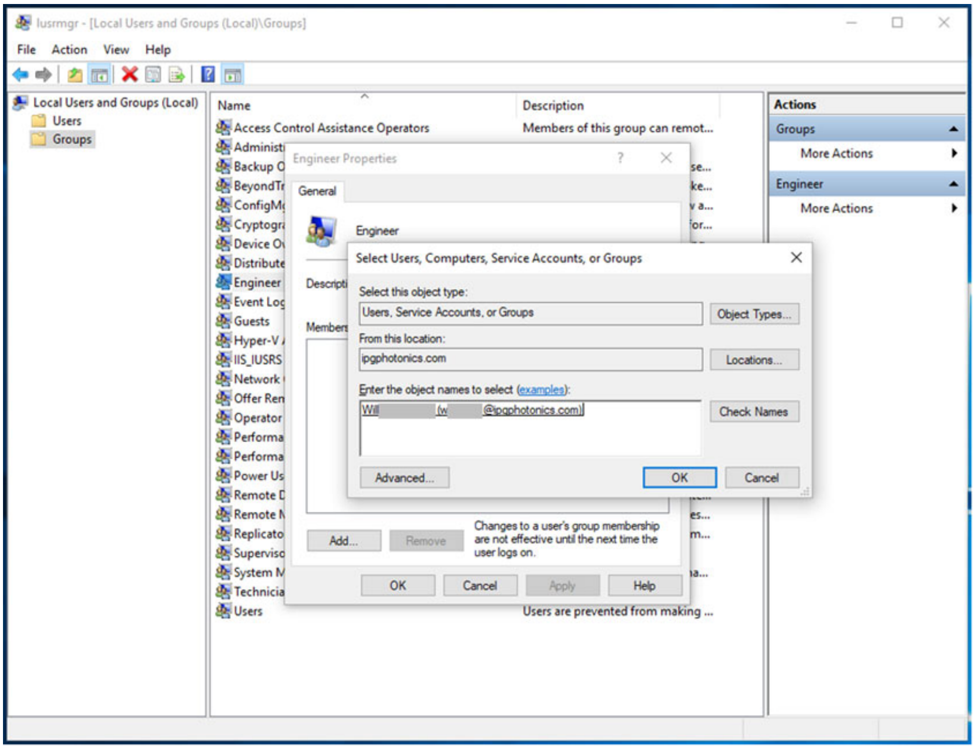
1. In the Run bar, type "lusrmgr.msc".
2. Run "lusrmgr.msc as an administrator.
3. With the Local Users and Groups window open, open the "Groups" folder (see Figure 13).


lusrmgr - [Local Users and Groups (Local)\Groups]
File
Action
View
Help
Local Users and Groups (Local)
Users
Groups
Actions
Groups
More Actions

Name	Description
Access Control Assist...	Members of this group can remot...
Administrators	
Backup Operators	Backup Operators can override se...
Cryptographic Operat...	Members are authorized to perfor...
Device Owners	Members of this group can chang...
Distributed COM Users	Members are allowed to launch, a...
Event Log Readers	Members of this group can read e...
Guests	Guests have the same access as m...
Hyper-V Administrators	Members of this group have com...
IIS_IUSRS	Built-in group used by Internet Inf...
Network Configuratio...	Members in this group can have s...
OpenSSH Users	Members of this group may conn...
Performance Log Users	Members of this group may sche...
Performance Monitor ...	Members of this group can acces...
Power Users	Power Users are included for back...
Remote Desktop Users	Members in this group are grante...
Remote Management...	Members of this group can acces...
Replicator	Supports file replication in a dom...
System Managed Acc...	Members of this group are mana...
User Mode Hardware ...	Members of this group may oper...
Users	Users are prevented from making ...
BeyondTrust Privilege ...	This group indicates that the toke...
ConfigMgr Remote C...	Members in this group can view a...

Figure 13: Local Users and Groups Window

4. Double click a desired security level (Engineer, Supervisor, Technician, or Operator) to add a user to.
5. In the pop-up window for the Group properties, click "Add."
6. In the "Select Users, Computers, Service Accounts, or Groups" window, users can now be added to the group (see Figure 14 on page 36).
   a. If the computer is connected to a network domain, then user login domains can be used, otherwise, users will need to be created locally on the computer. Additional detail on creating users locally on the computer can be found in Section 3.3.1 on page 36.



Name	Description
Access Control Assistance Operators	Members of this group can remot...
Users	Users are prevented from making ...

Select Users, Computers, Service Accounts, or Groups

Select this object type: Users, Service Accounts, or Groups

From this location: ipgphotonics.com

Enter the object names to select (examples): Wil[redacted] (w[redacted]@ipgphotonics.com)

Changes to a user's group membership are not effective until the next time the user logs on.

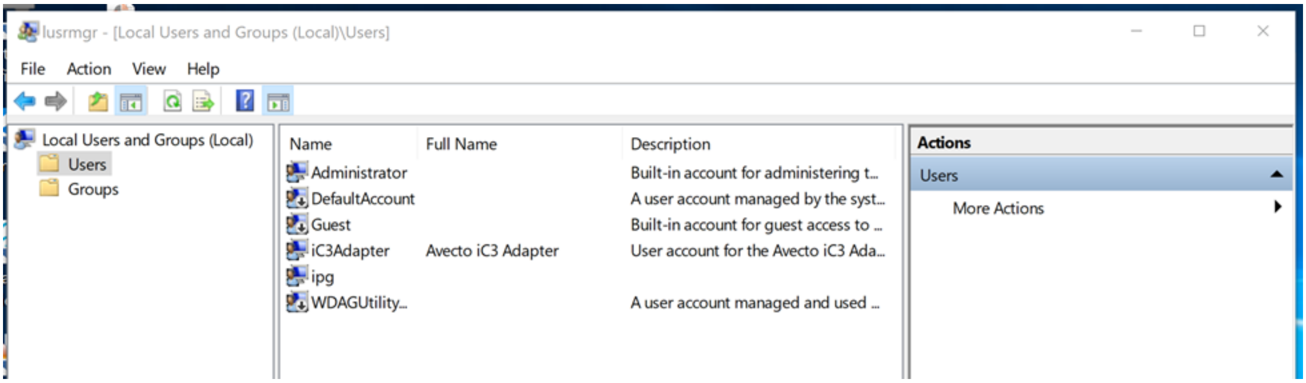
Figure 14: Adding a User to a Group

7. Click "Ok" and repeat this for as many users as desired.

3.3.1 Creating a Local User

Local users can be created by performing the following procedure:

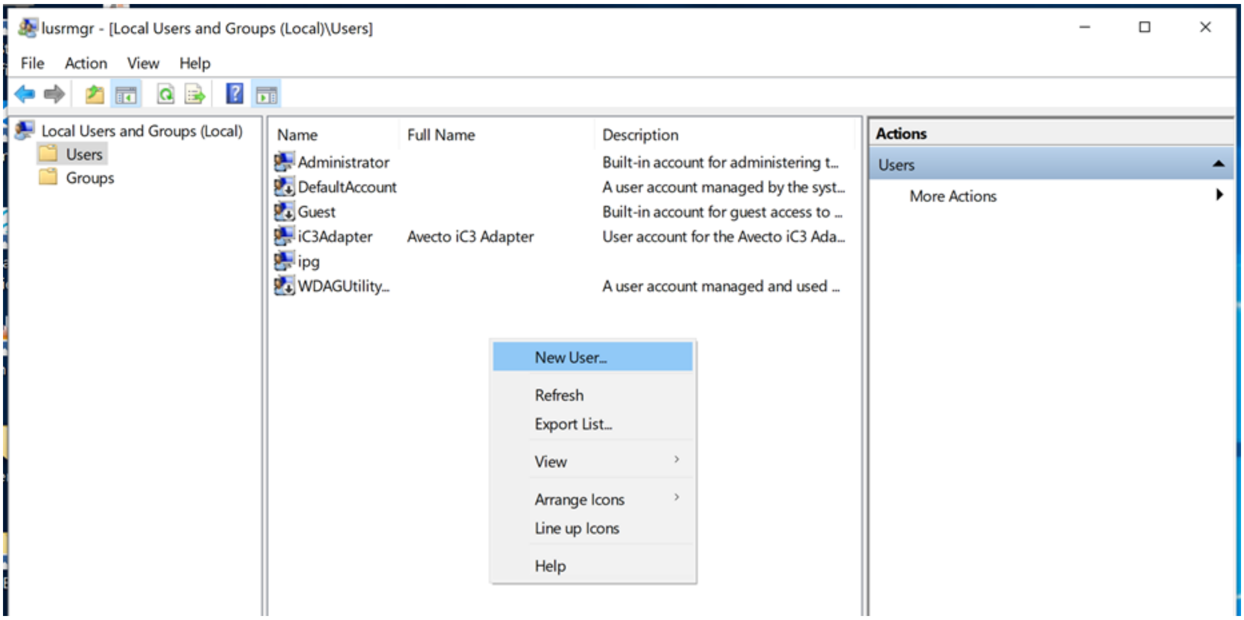
1. In the Run bar, type "lusrmgr.msc".
2. Run "lusrmgr.msc as an administrator.
3. With the Local Users and Groups window open, open the "Users" folder (see Figure 15).


lusrmgr - [Local Users and Groups (Local)\Users]
File
Action
View
Help
Local Users and Groups (Local)
Users
Groups
Actions
Users
More Actions

Name	Full Name	Description
Administrator		Built-in account for administering t...
DefaultAccount		A user account managed by the syst...
Guest		Built-in account for guest access to ...
iC3Adapter	Avecto iC3 Adapter	User account for the Avecto iC3 Ada...
ipg		
WDAGUtility...		A user account managed and used ...

Figure 15: Local Users Folder

4. Right click and select "New User..." (see Figure 16).

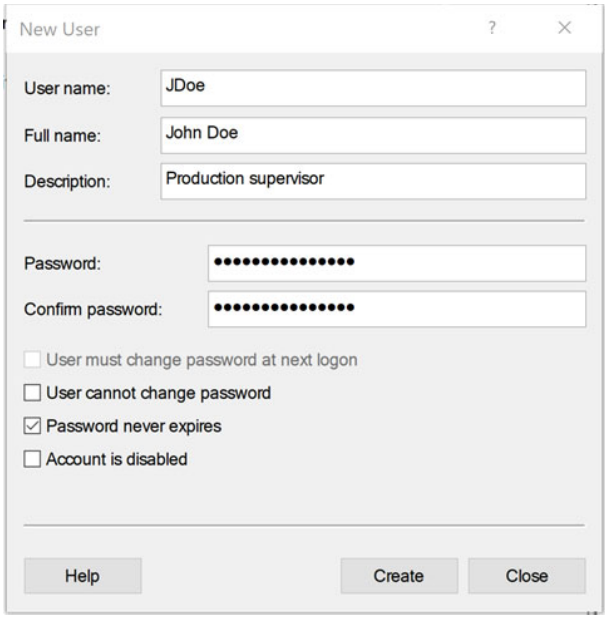


Name	Full Name	Description
Administrator		Built-in account for administering t...
DefaultAccount		A user account managed by the syst...
Guest		Built-in account for guest access to ...
iC3Adapter	Avecto iC3 Adapter	User account for the Avecto iC3 Ada...
ipg		
WDAGUtility...		A user account managed and used ...

Figure 16: Opening the New User Window

5. Enter the user credentials as desired. See Figure 17 as an example.

a. Please note, password requirements are based on Network requirements or computer requirements. IPGScan does not dictate the password requirements for creating local users.



User name: JDoe

Full name: John Doe

Description: Production supervisor

Password: •••••••••••••••

Confirm password: •••••••••••••••

□ User must change password at next logon

□ User cannot change password

☑ Password never expires

□ Account is disabled

Figure 17: Creating a Local User

5. Click "Create" to finish creating the local user. This user can now be assigned to a Group.

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4 First Time Startup

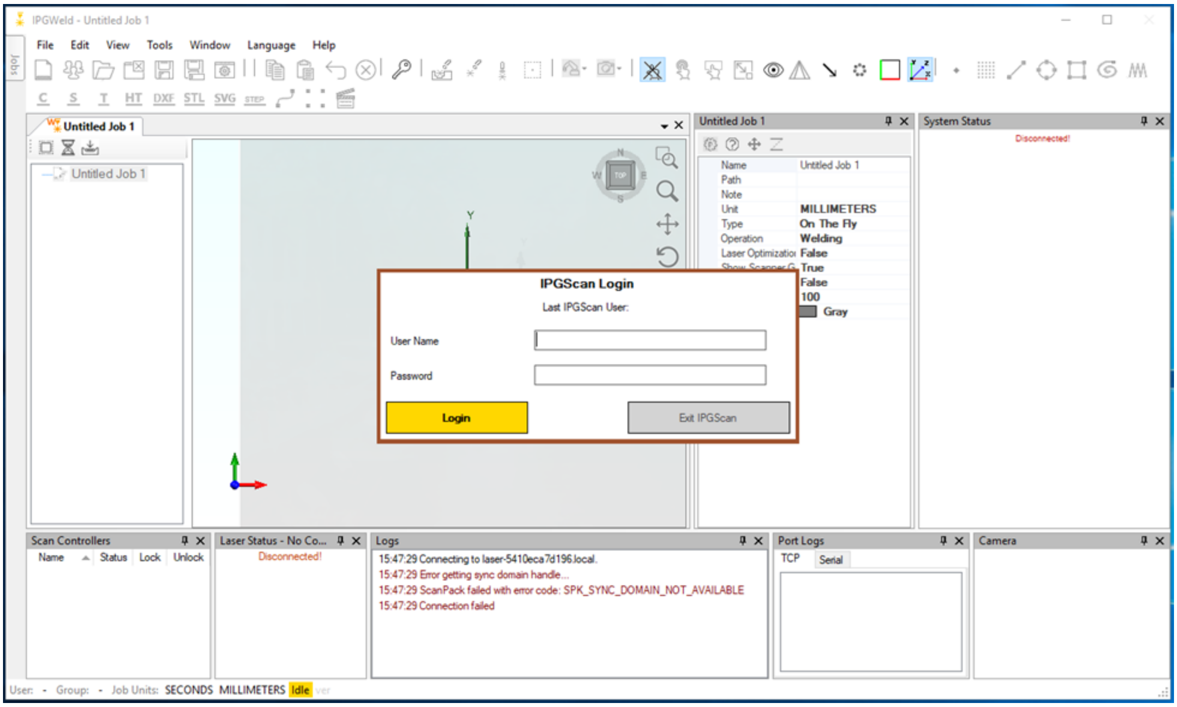
IPGScan is a powerful and versatile software package that allows users to develop a scanning process with IPG scanners or integrated markers. The software has job types that are specific to Welding, Cleaning, or Marking applications. Each application is tailored to the lasers that are commonly utilized for those applications, thus, optimizing the parameters available to users for their given application. Finally, IPGScan is packed with a number of software tools allows users to create and modify standard process objects such as lines, circles, and staples while more advanced features include DXF import, dynamic text and barcode objects, and custom shapes. Ultimately, IPGScan serves as a powerful tool for users to develop a scanning process that is suited to their needs.

The following sections detail both setup and functionality of IPGScan.

4.1 Starting IPGScan

To start IPGScan:

1. If "Bypass User Security" was not enabled when IPGScan was installed, ensure that "System Security" has been completed (see Chapter 3 on page 33).
2. Go to Window's Start Menu. Under All Programs → IPG Photonics folder.
3. Select IPGScan. The IPGScan Login window will appear, as shown in Figure 18.



IPGScan Login

Last IPGScan User:

User Name

Password

Login

Exit IPGScan

Untitled Job 1

Name	Untitled Job 1
Path	
Note	
Unit	MILLIMETERS
Type	On The Fly
Operation	Welding
Laser Optimizatio	False
Show Scanner G	True
	False
	100
	Gray

Disconnected!

Disconnected!

```
15:47:29 Connecting to laser-5410eca7d196.local.
15:47:29 Error getting sync domain handle...
15:47:29 ScanPack failed with error code: SPK_SYNC_DOMAIN_NOT_AVAILABLE
15:47:29 Connection failed
```

User: - Group: - Job Units: SECONDS MILLIMETERS Idle

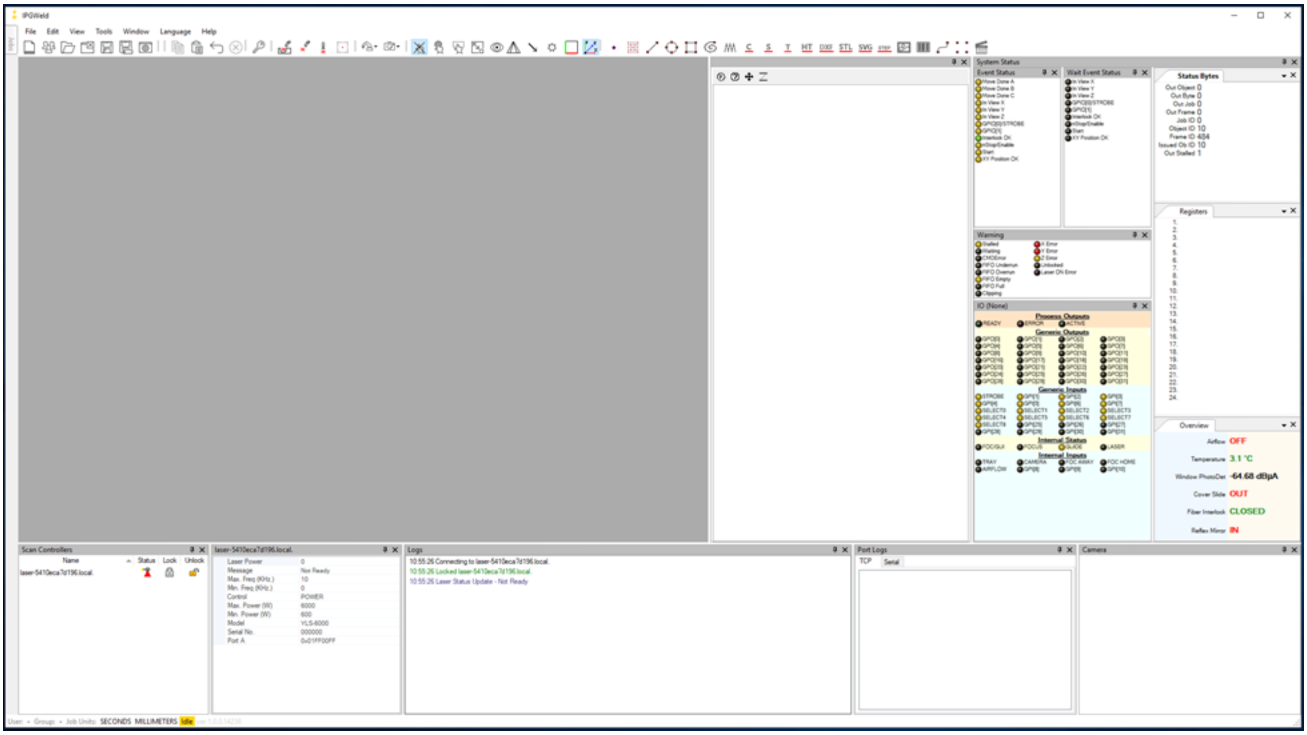
Figure 18: IPGScan Login Window

4. Enter your user name and password.
   a. If users were added from the network, enter the network domain name in the User Name box.
      Example: *XYZCompany-Domain\jsmith*.

b. If users were added on the local drive of the computer, enter the local computer name in the User Name box. Example: MyPC\jsmith.

c. The last user logged in will not be prompted to login again.

5. Click "Login". The IPGScan Workspace appears, as shown in Figure 19.



Name	Status	Lock	Unlock
laser-5410eca7d196.local.			

laser-5410eca7d196.local.

Laser Power	0
Message	Not Ready
Max. Freq (KHz.)	10
Min. Freq (KHz.)	0
Control	POWER
Max. Power (W)	6000
Min. Power (W)	600
Model	YLS-6000
Serial No.	000000
Port A	0x01FF00FF

```
10:55:26 Connecting to laser-5410eca7d196.local.
10:55:26 Locked laser-5410eca7d196.local.
10:55:26 Laser Status Update - Not Ready
```

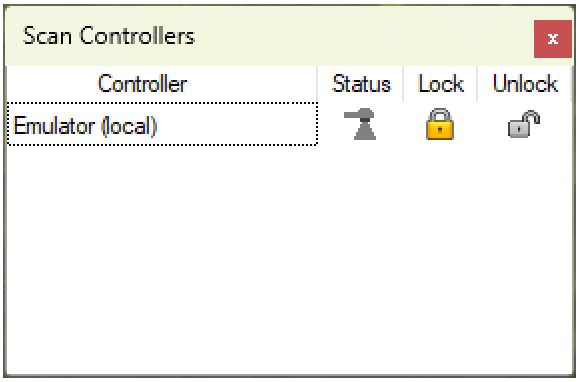
Airflow	OFF
Temperature	3.1 °C
Window PhotoDet	-64.68 dBµA
Cover Slide	OUT
Fiber Interlock	CLOSED
Reflex Mirror	IN

User: • Group: • Job Units: SECONDS MILLIMETERS Idle ver 1.0.0.14238

Figure 19: IPGScan Workspace

4.2 Connecting to a Scanner or the Emulator

To connect to a scanner or the Emulator, double-click on its lock icon in the Scan Controllers Window of the IPGScan Workspace.



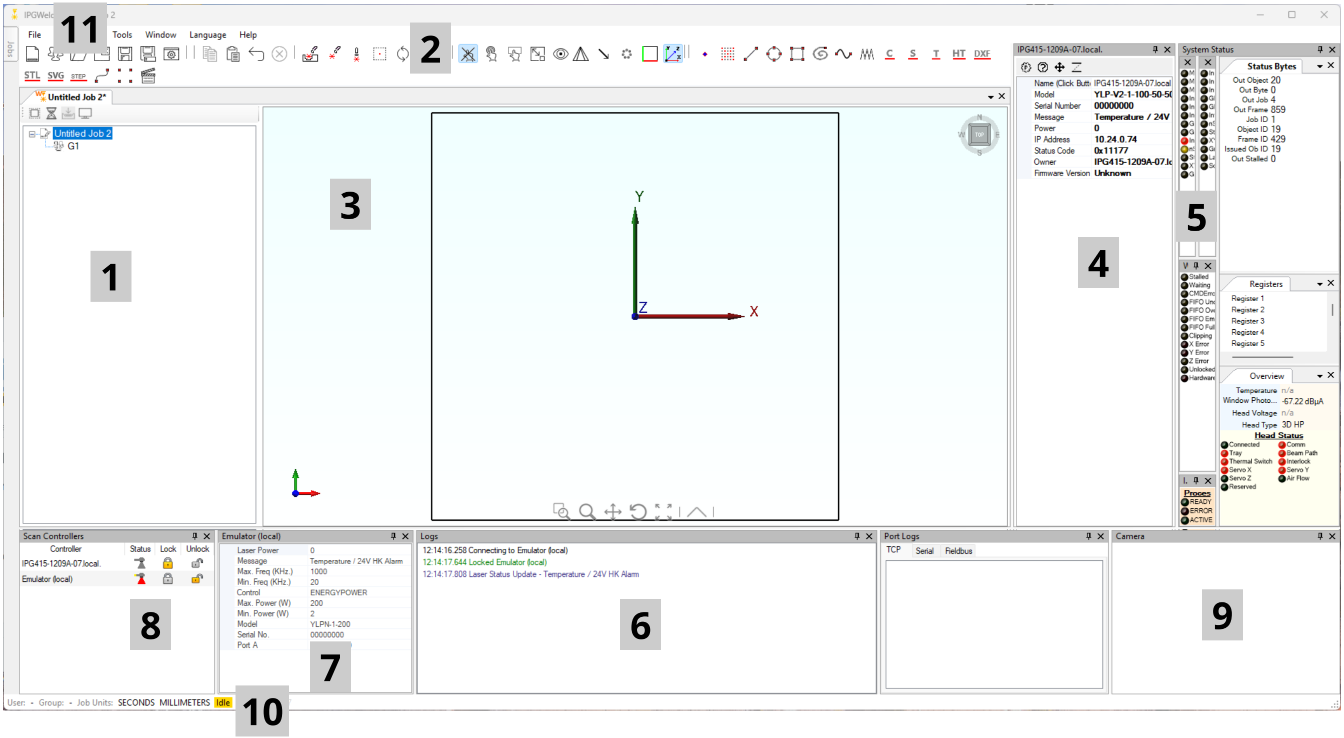
Controller	Status	Lock	Unlock
Emulator (local)			

Figure 20: Scan Controllers Window

5 User Interface

5.1 IPGScan Layout

Users will find that IPGScan contains a number of windows, each of which provides setup functionality or system status information. Figure 21 (below) shows the IPGScan software main window layout while Table 2 provides a brief description of each item.



Name (Click Butt IPG415-1209A-07.local
Model YLP-V2-1-100-50-50
Serial Number 00000000
Message Temperature / 24V
Power 0
IP Address 10.24.0.74
Status Code 0x11177
Owner IPG415-1209A-07.lo
Firmware Version Unknown

Out Object 20
Out Byte 0
Out Job 4
Out Frame 859
Job ID 1
Object ID 19
Frame ID 429
Issued Ob ID 19
Out Stalled 0

Register 1
Register 2
Register 3
Register 4
Register 5

Temperature n/a
Window Photo... -67.22 dBµA
Head Voltage n/a
Head Type 3D HP

Controller	Status	Lock	Unlock
IPG415-1209A-07.local.			
Emulator (local)			

Laser Power 0
Message Temperature / 24V HK Alarm
Max. Freq (KHz.) 1000
Min. Freq (KHz.) 20
Control ENERGYPOWER
Max. Power (W) 200
Min. Power (W) 2
Model YLPN-1-200
Serial No. 00000000
Port A

```
12:14:16.258 Connecting to Emulator (local)
12:14:17.644 Locked Emulator (local)
12:14:17.808 Laser Status Update - Temperature / 24V HK Alarm
```

User: - Group: - Job Units: SECONDS MILLIMETERS Idle

Figure 21: IPGScan Software Layout Window

Table 2: IPGScan Software Layout Items

Number	Description
1	Job Tree
2	Tool Bar
3	Canvas Field of View/Viewport
4	Data/Parameter Window
5	System Status
6	Logs and Port Logs
7	Laser System

Table 2: IPGScan Software Layout Items

Number	Description
8	Scan Controllers
9	Camera Window
10	Program Information
11	File Menu

5.1 Resetting the IPGScan Layout

Users have the ability to modify the IPGScan layout by dragging and dropping individual windows. Windows can also be closed if users feel they do not serve a purpose. For instance, IPGScan has the ability to display an Ethernet camera video within the software. If users prefer to utilize HDMI cameras, this window then serves no purpose and users may want to close it.

Should users wish to reset the IPGScan layout back to the default configuration, the following procedure can be followed.

1. Click "View" in the Tool Bar.
2. Click "Reset Layout."
3. Close IPGScan and relaunch the software.

Individual windows can also be reopened without resetting the IPGScan layout by selecting the appropriate window from the "View" menu. See Figure 22 (below).

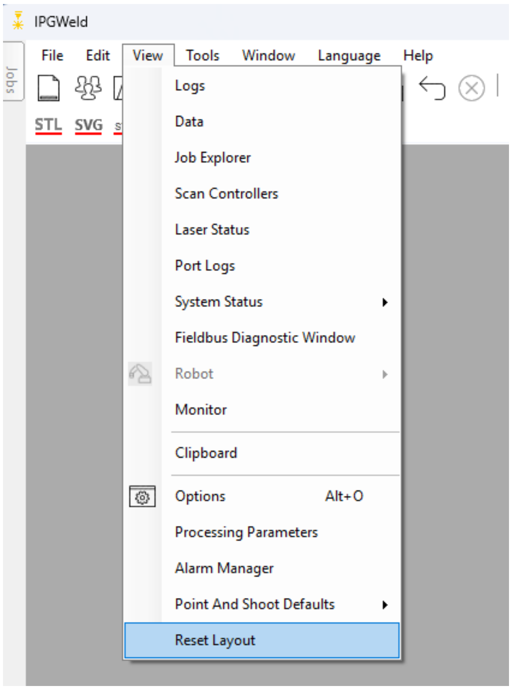
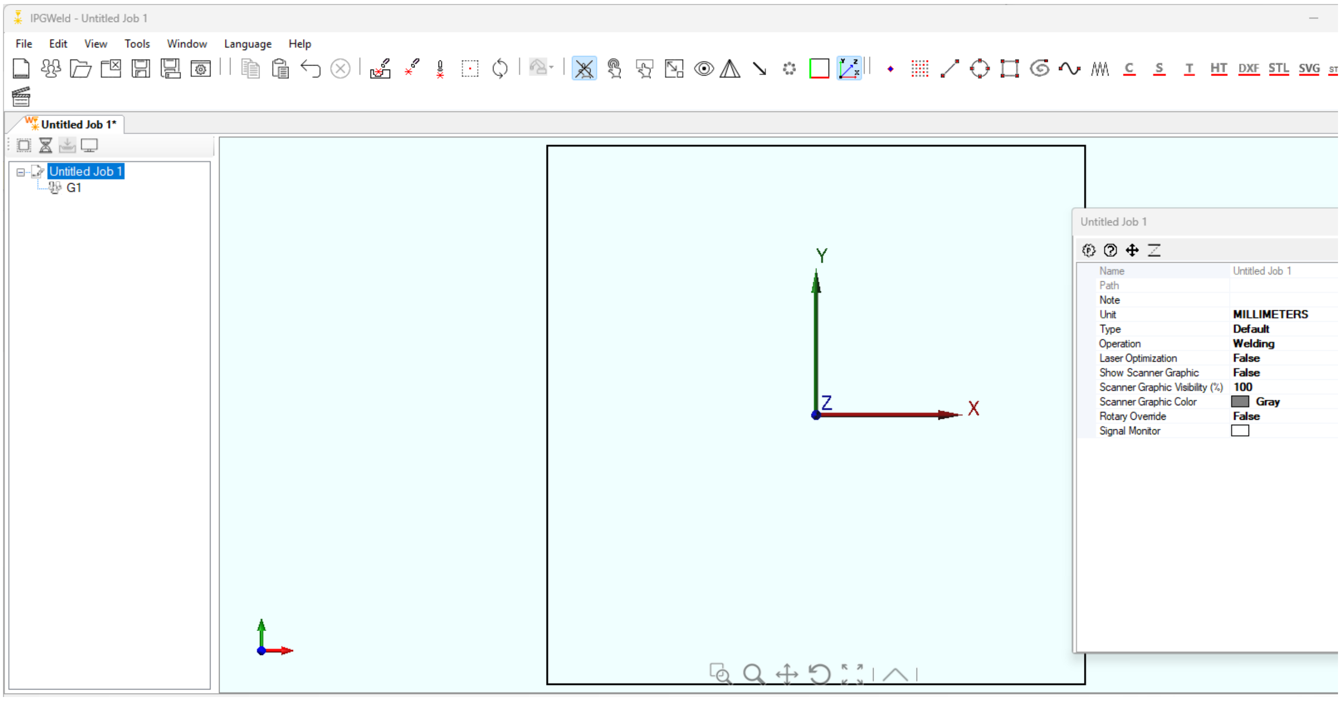


Figure 22: Resetting the IPGScan Layout

6 Creating a Job

The following section details how users can create a new Job in IPGScan, create Groups within the Job, and add Process Objects or Action Controls to Groups.

1. Select **File→New** or click the New icon in the Tool Bar to create a new Job file. An unsaved and untitled Job will as appear as shown in Figure 23 (below).



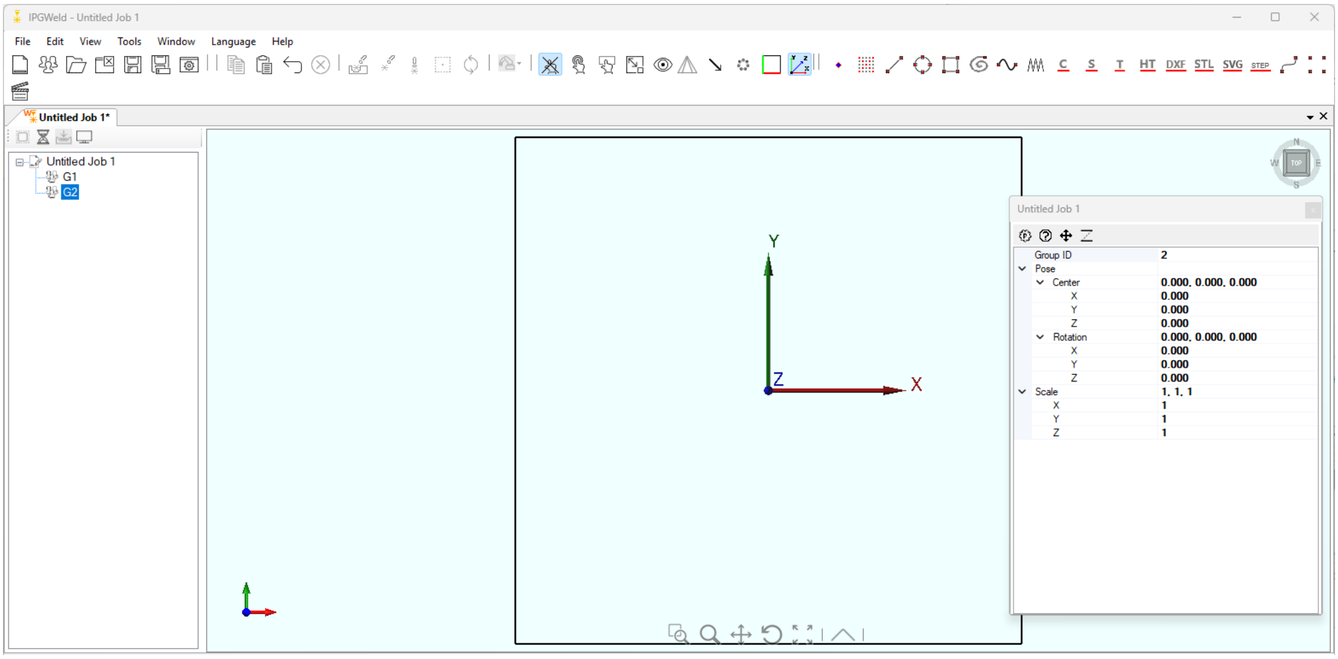
Name	Untitled Job 1
Path	
Note	
Unit	MILLIMETERS
Type	Default
Operation	Welding
Laser Optimization	False
Show Scanner Graphic	False
Scanner Graphic Visibility (%)	100
Scanner Graphic Color	▇ Gray
Rotary Override	False
Signal Monitor	□

Figure 23: New Job Window

The Job Tree window displays the new Job. When the Job is selected, the type of Job is listed in the Properties window. Job types (Default/On The Fly/Point & Shoot) can be changed in this menu.

Once a Job is created, users can then add Groups to the Job. Groups allow users to break the Job into sections that can be called/executed at desired times in a process using automation equipment such as a PLC or Robot Controller. By selecting a Group in the Job Tree, users can locate the Group ID for the Group, as shown in Figure 24 on page 44. The Group ID is what allows users to utilize the SELECT Bits on an External Interface to select which Group to execute and when to execute it.

2. To create a Group in IPGScan, click **File→New Group** or click the Create Group icon in the Tool Bar.

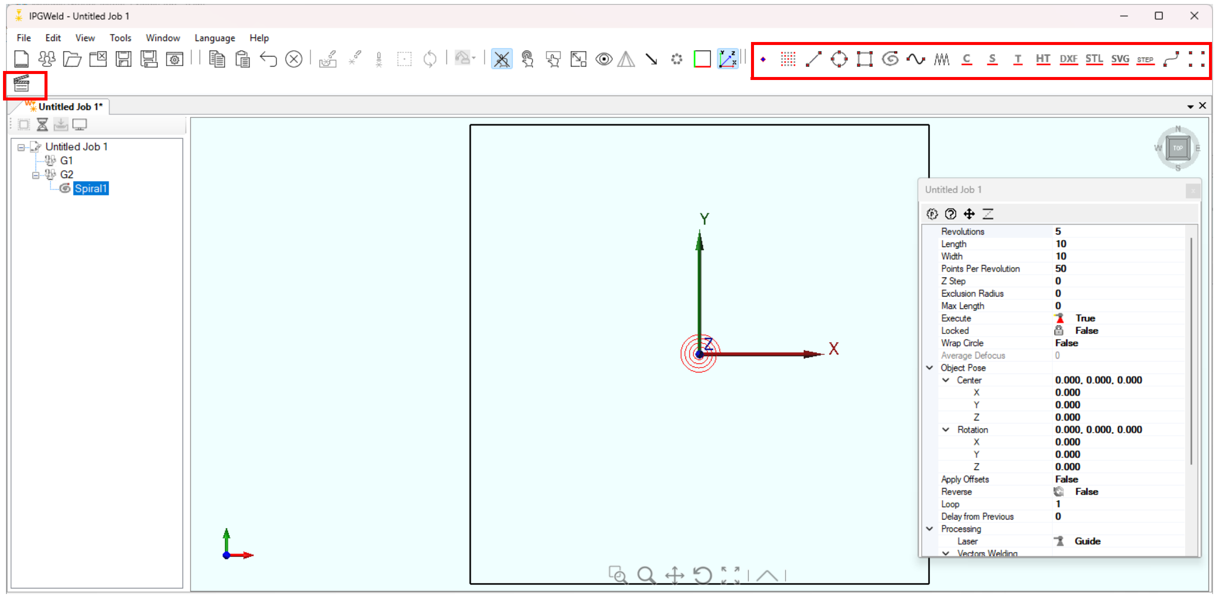


Group ID	2
Pose	
Center	0.000, 0.000, 0.000
X	0.000
Y	0.000
Z	0.000
Rotation	0.000, 0.000, 0.000
X	0.000
Y	0.000
Z	0.000
Scale	1, 1, 1
X	1
Y	1
Z	1

Figure 24: Multiple Groups within a Single Job

Within Groups, Process Objects and Action Controls can be added. Process Objects are the patterns that the user wishes to have the scanner perform while firing the laser Action Controls provide additional control functionality within the IPGScan Job.

3. To add a Process Object or Action Control to a particular Group, simply select the desired Group in the Job Tree and click on the desired Process Object icon or Action Control icon in the Tool Bar. See Figure 25.



Revolutions	5
Length	10
Width	10
Points Per Revolution	50
Z Step	0
Exclusion Radius	0
Max Length	0
Execute	True
Locked	False
Wrap Circle	False
Average Defocus	0
Object Pose	
Center	0.000, 0.000, 0.000
X	0.000
Y	0.000
Z	0.000
Rotation	0.000, 0.000, 0.000
X	0.000
Y	0.000
Z	0.000
Apply Offsets	False
Reverse	False
Loop	1
Delay from Previous	0
Processing	
Laser	Guide
Vectors Welding	

Figure 25: Adding Process Objects and Action Controls to Groups

If users wish to rename Groups, Process Objects, or Action Controls, simply right click on the desired item and click Rename. Selecting the desired item in the Job Tree and clicking F2 on a keyboard will also allow users to rename items.

Finally, once a Job has been created, users can save the Job clicking **File→Save** or by clicking the Save icon.

With a basic understanding of how to create an IPGScan Job and Job structure, users can begin to develop a process.

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7 Basic Operation

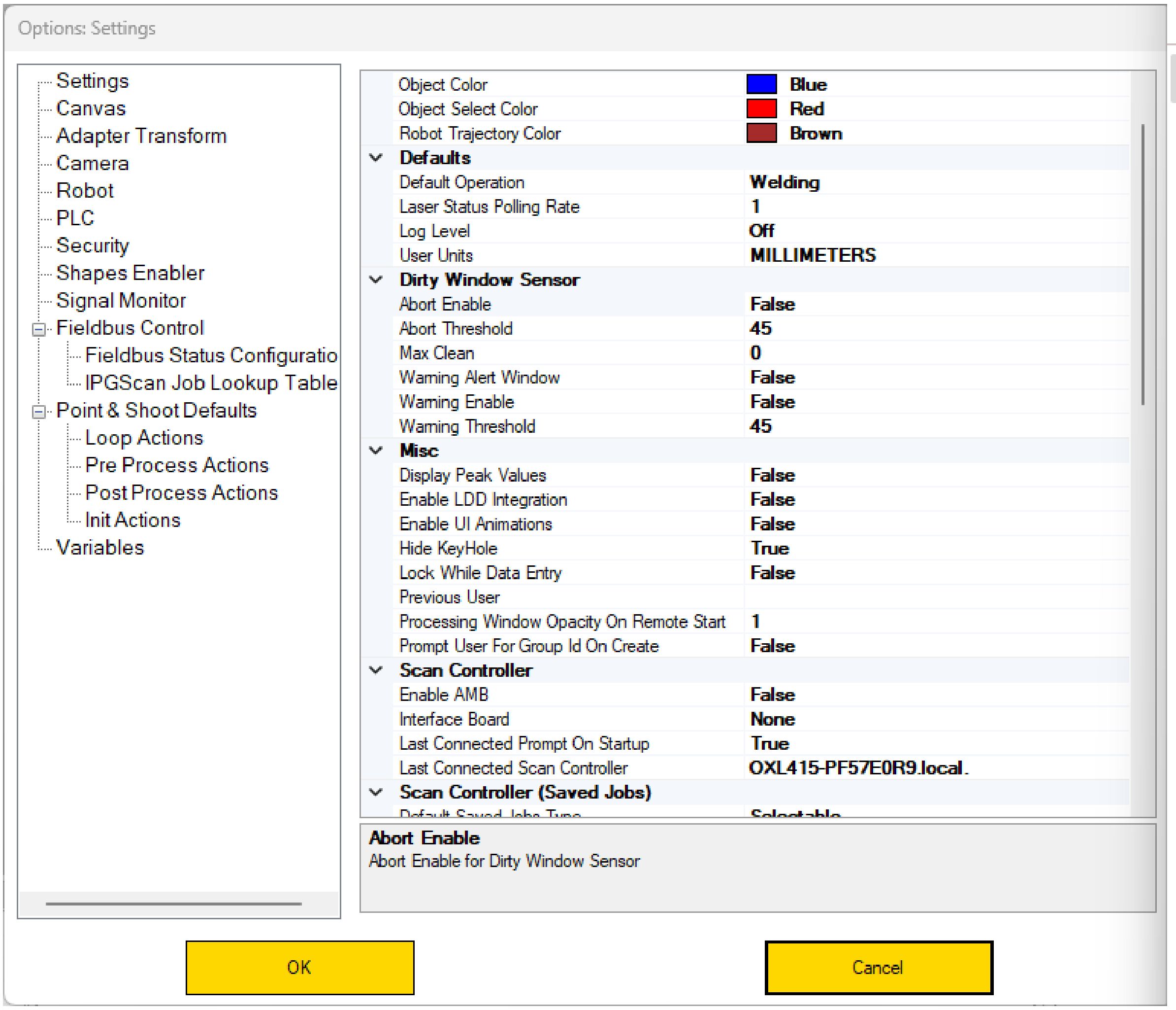
7.1 Options Menu

IPGScan contains numerous options that allow users to configure IPGScan as desired as well as setup a scanning process. The following sections outline the available options as well as the functions of each option.

In order to access the IPGScan Options:

1. Click on "View."
2. Click "Options" (Alt+O) to open the menu.
   a. The Options menu will appear as a pop-up window. See Figure 26.

The Options Window includes several groups options in addition to the Settings. You can display any group of options by left-clicking it in the menu tree on the left side of the Options Window.



Object Color	🟦 Blue
Object Select Color	🟥 Red
Robot Trajectory Color	🟫 Brown
⌄ **Defaults**	
Default Operation	Welding
Laser Status Polling Rate	1
Log Level	Off
User Units	MILLIMETERS
⌄ **Dirty Window Sensor**	
Abort Enable	False
Abort Threshold	45
Max Clean	0
Warning Alert Window	False
Warning Enable	False
Warning Threshold	45
⌄ **Misc**	
Display Peak Values	False
Enable LDD Integration	False
Enable UI Animations	False
Hide KeyHole	True
Lock While Data Entry	False
Previous User	
Processing Window Opacity On Remote Start	1
Prompt User For Group Id On Create	False
⌄ **Scan Controller**	
Enable AMB	False
Interface Board	None
Last Connected Prompt On Startup	True
Last Connected Scan Controller	OXL415-PF57E0R9.local.
⌄ **Scan Controller (Saved Jobs)**	
Default Saved Jobs Type	Selectable

Abort Enable
Abort Enable for Dirty Window Sensor

Figure 26: IPGScan Options Menu

7.1.1 Settings

Within the Settings menu, users can further customize the IPGScan layout and setup specific software functionality. The following list includes available options:

- Colors
    - Background Bottom – The color of the bottom area of the canvas
    - Background Top – The color of the top area of the canvas
    - Object Color – The color of the selected shapes for the viewport
    - Object Select Color – An object in the displayed job will change to this color when the object is selected
    - Robot Trajectory Color – The color of the robot's trajectory
- Defaults
    - Default Operation – Allows users to change the default job Operation type that is used when a new job is created.
    - Laser Status Polling Rate – The interval at which the Laser Status will be updated in IPGScan.
    - User Units – Allows users to set the units of measure in IPGScan.
    - Log Level – Refer to Section 7.1.1.1 on page 51
- Dirty Window Sensor
    - Abort Enable – When set to True, the job will be terminated by a scattered light reading above the Abort Threshold.
    - Abort Threshold – The scattered light reading that will trigger the termination of the job
    - Max Clean – The maximum value obtained when the user measures a clean window

      NOTE: This value should be based on the parameters that will be used during a production process.
    - Warning Alert Window – When set to True, the Warning Alert Window will be displayed when there is a reading above the Warning Threshold.
    - Warning Enable – When set to True, the job will be terminated by a reading above the Abort Threshold.
    - Warning Threshold – The scattered light reading that will trigger a message error notifying the user that the Warning Threshold has been exceeded
- Misc
    - Display Peak Values – When set True, it provides an output of peak power, velocity, and frequency in the Logs Window whenever users update processing parameters in a Marking job.
    - Enable LDD Integration – When set True, it enables the integration of an LDD computer with IPGScan.

  - Enable UI Animations – Enables/disables some of the animations within the Processing Window. For large jobs or jobs with small Processing Objects, having this feature set to False may improve processing performance.
  - Hide KeyHole – Enable/disable the display of the keyhole parameter for Process Objects. Keyhole allows users to specify a delay period at the start of process objects prior to the start of galvo motion.
  - Lock While Data Entry – When set True, the job tree will be locked when users enter new parameters for a Process Object. Users must hit ENTER or ESC to accept or cancel the new parameters prior to selecting a new Process Object in the Job Tree.
  - Previous User – Lists the previous user name that was logged into IPGScan.
  - Processing Window Opacity On Remote Start – Changes the opacity of the Processing Window when started via Remote Start.
  - Prompt User For Group ID On Create – When set True, users will be prompted to enter a Group ID value when a new Group is created in the Job Tree.
- Scan Controller
  - Enable AMB – When set True, enables the display of Ring and Core power control of Process Objects for AMB Laser use. Please note that an appropriate AMB laser specification file is still required.
  - Interface Board – Allows users to select the External Interface Board that is being utilized in the process. This will tailor the display of the IPGScan IO for the specific board.
  - Last Connected Prompt On Startup – When set True, users will be prompted to connect to the previously connected Scan Controller when IPGScan is launched.
  - Last Connected Scan Controller – The name of the Scan Controller that was last connected to IPGScan.
- Scan Controller (Saved Jobs)
  - Default Saved Jobs Type – Default Saved Jobs Type (Sequential or Selectable)
  - Enable Saved Job Commands – When set True, enables Saved Job Commands in the menu.
  - Enable Saved Jobs Menu – When set True, the scanner can run stand-alone saved jobs from the Saved Jobs Menu
  - Prompt for Saved Jobs Type – When set True, IPGScan prompts the user to set saved jobs as Sequential or Selectable

    NOTE: Prompting for the Saved Jobs Type only applies when the Job type is default and On The Fly and Fieldbus mode is disabled
- Shape Defaults
  - Circle Radius – Default radius for the Circle Shape
  - Default Columns – Default number of columns
  - Default Cycles – Default Cycles

- Default Height – Default height for the shape
- Default Length – Default length for the shape
- Default Point Array Distance – Default Point distance for the Point Array Shape
- Default Radius – Default radius for ‘C’ Shapes and ‘S’ Shapes
- Default Rotation – Default Rotation for a Shape
- Default Rows – Default number of rows
- Default Segment – Default Segment Length for ‘C’ Shapes and ‘S’ Shapes
- Default Spiral Revolutions – Default number of revolutions for the Spiral Shape
- Default Width – Default width for the shape
- Hershey Font Size – Default font size for the Hershey Text Shape

- TCP/IP
    - Actions Port – Port used with the Action Control LoadRegister/Ethernet
    - Bypass Process Handshake Confirmation – When set True, the Process Handshake Confirmation is bypassed.
    - Case Preserving TCPIP Communication – When set True, case preservation is enabled for TCP/IP communication.
    - Command Port – TCP port used with the Remote API
    - Disable Port Logs – When set True, the adding of entries to the Port and Fieldbus Logs is disabled.
    - Encoding – Specifies the encoding for TCP/IP communication.
    - Remote Mode Alert – When set True, a pop-up window for locking IPGScan will be displayed during Remote API use.
    - TCP Ready Message – When set True, a ready message is displayed when a TCP/IP connection is established using the Remote API. The message is, "IPGScan TCP Command Interface is ready."
- Viewport – Settings that allow the user to customize the display of a grid layout within the IPGScan Viewport window. Additional tools such as a ruler and origin point can be enabled/disabled
    - Grid Step – The Grid Step on the Viewport
    - Initial View – The Viewport’s initial view
    - Selected Group Shading – The Selected Group Shading for WorldView
    - Viewpoint Axis Icon – When set True, the Axis Icon on the Viewport is displayed
    - Viewport Cube Icon Size – The size of the Viewport cube
    - Viewport Grid – When set True, the Viewport Grid is displayed.
    - Viewport Grid Size – The Grid Size on the X and Y axes of the Viewport
    - Viewport Origin – When set True, the origin symbol is displayed on the Viewport
    - Viewport Ruler – When set True, the Viewport Ruler is displayed

- Viewport Toolbar Location – The location of the Viewport Toolbar
- Viewport View Cube Icon – When set to True, the Viewport Cube Icon is displayed

7.1.1.1 Log Level

The "Log Level" setting determines the type of messages which IPGScan will write to the log. A higher log level corresponds to fewer and less frequent log messages. Logs are written to "C:\IPGP\IPGScan\Logs." In ascending verbosity, the log levels are:

- Off (least logging)
- Critical
- Error
- Warning
- Information
- Verbose
- Activity Tracing (most logging)

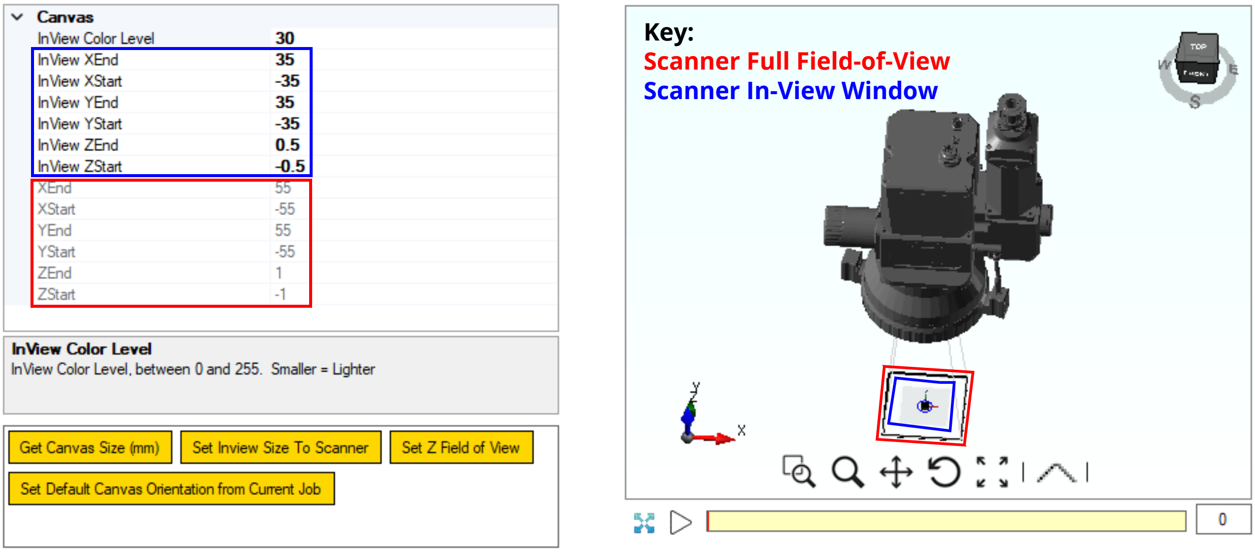
Because logging adds additional CPU load, it is recommended to keep the "Log Level" set to "Off" when it is determined that the system is operating as desired. This is done so that scanner processing will not be affected. If errors begin to occur, turn "Log Level" to a desired level and resume processing; use the log to help fix the error. Once the error is rectified, turn "Log Level" back to "Off."

The "Log Level" setting is accessible in the Options under "Settings" and then "Defaults."

7.1.2 Canvas

The canvas is the area for which the scanner can process. This may also be referred to as the scanner Field of View (FOV). For the majority of applications that utilize a robot (for both Point and Shoot or On-The-Fly processes) or stationary scanner, the canvas size is typically defined by the focus lens of the scanner. For instance, a 2D High Power Scanner that utilizes a 400mm focal length lens has a 200mm x 200mm Field of View. In instances where a scanner is mounted on a gantry, the canvas size is the total area for which processing can occur. This area may be greater than the scanners allowable process area if it was used in a stationary application. Setup for gantry applications requires the use of the Stage Configuration Utility (see Chapter 18 on page 373.

Within the Canvas settings, users can view the scanner's full field-of-view, modify InView settings, and set Z Field of View dimensions. See Figure 27.



Canvas	
InView Color Level	30
InView XEnd	35
InView XStart	-35
InView YEnd	35
InView YStart	-35
InView ZEnd	0.5
InView ZStart	-0.5
XEnd	55
XStart	-55
YEnd	55
YStart	-55
ZEnd	1
ZStart	-1

InView Color Level
InView Color Level, between 0 and 255. Smaller = Lighter

Get Canvas Size (mm)
Set Inview Size To Scanner
Set Z Field of View
Set Default Canvas Orientation from Current Job
Key:
Scanner Full Field-of-View
Scanner In-View Window
TOP
FRONT
W
E
S
y
x
0

Figure 27: Canvas Settings

The following details each available parameter.

- InView Color Level
    - For Robotic OTF applications only.
    - Changes the opacity of the scanner InView window display in the canvas.
- InView Dimension Parameters
    - For Robotic OTF applications only.
    - Reduces the allowable area for which processing can occur in the Full Field-of-View. This may be desired in applications where approach of angle of the beam is important.
    - Users can enter the desired Start and End dimensions for X, Y, and Z dimensions for the InView Window here. The InView Window should be smaller than the scanners Full Field-of-View size. Once users enter a desired InView Window size, click the "Set InView Size To Scanner" button.

- Scanner Full Field-of-View Parameters
    - The scanners Full Field-of-View parameters, which are defined by the scanner’s calibration files. These are not modifiable by the user.
- Set Z Field of View
    - This allows users to modify the Z dimensions of the scanners Field-of-View. This may be desired in instances where users want to process out of focus. Additional information can be found in Section 7.1.2.1 (below).

7.1.2.1 Opening a Scanners Z Tolerance (Defocus)

When using a 2D scanner, if users wish to defocus the beam, the scan head either needs to be positioned closer to the work surface or further from the work surface. This ultimately changes the relative position of the focus plane in relation to the work surface. Furthermore, if IPGScan is unaware of this offset and if no scaling factor is applied to Process Objects within the IPGScan job, laser output will likely be dimensionally incorrect according to the specified parameters within the job. For this reason, adjusting the scanners FOV Z tolerance allows users to position Process Objects within IPGScan so they more accurately represent the Process Object location on the real world work surface in relation to the scan head. Ultimately, this results in the correct dimensional output of Process Objects without the user having to specify any scaling factors within the IPGScan job.

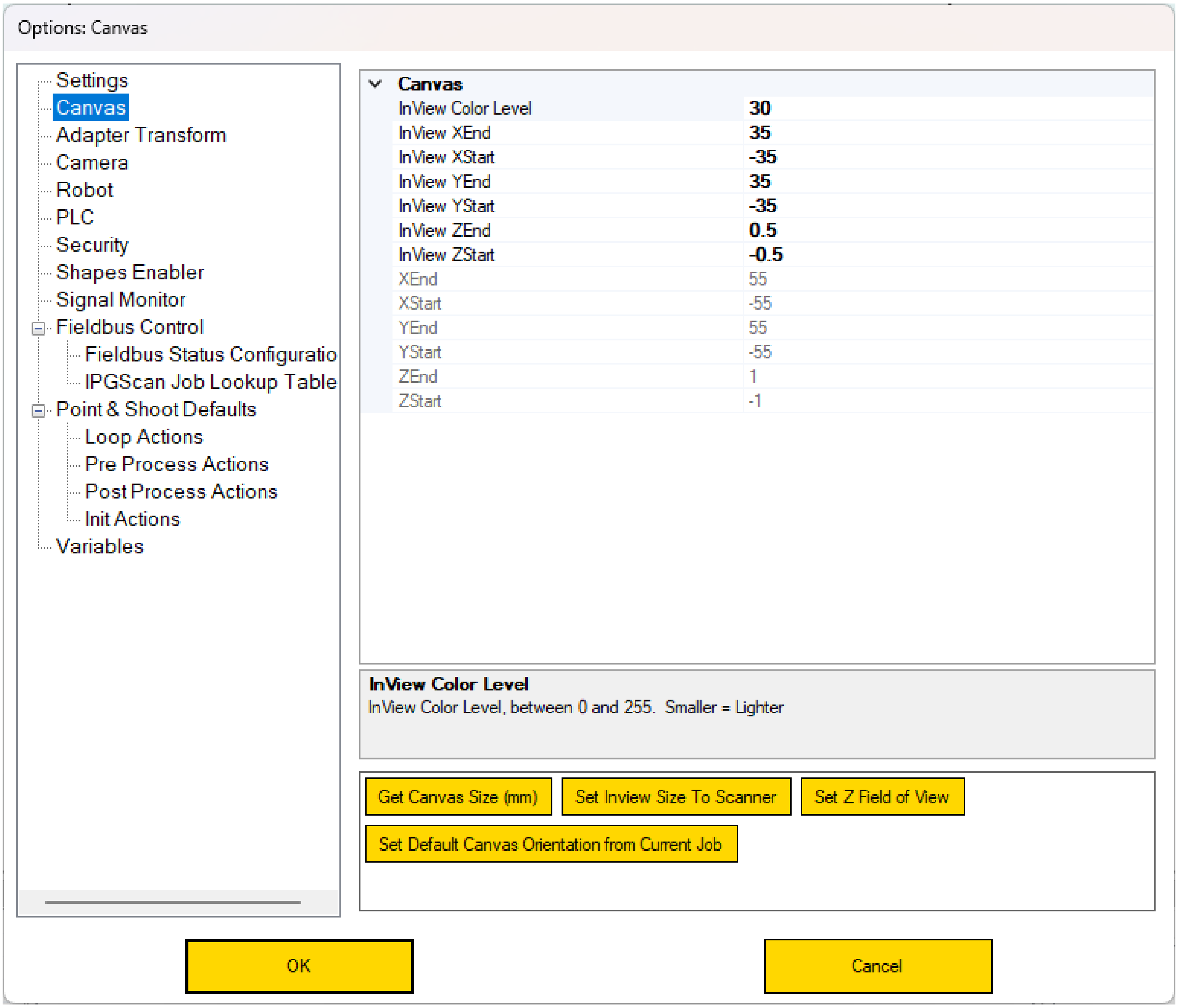
The following sections outline how users can adjust the Z dimension of the scanners FOV as well as provide examples for Point and Shoot and On-The-Fly applications.

7.1.2.1.1 Set Z Field of View Procedure

The following steps detail how users can adjust a scanners FOV Z tolerance.

1. Open IPGScan and connect to a desired scanner.
2. Click "View".
3. Click "Options".
4. Click "Canvas".
    a. Here users are presented with the scanners current Canvas (FOV) size as well as InView (Robotic OTF and Gantry Application Specific parameters) size. See Figure 28 on page 54.
    b. For this example, notice how the default "ZEnd" and "ZStart" values are 1 and -1.
5. Click "Set Z Field of View".

    NOTE: The fourth button in the following screen (**Set Default Canvas Orientation from Current Job**) only appears if a job is currently active.

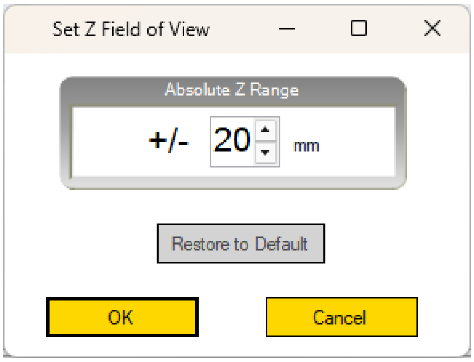


Canvas	
InView Color Level	30
InView XEnd	35
InView XStart	-35
InView YEnd	35
InView YStart	-35
InView ZEnd	0.5
InView ZStart	-0.5
XEnd	55
XStart	-55
YEnd	55
YStart	-55
ZEnd	1
ZStart	-1

InView Color Level
InView Color Level, between 0 and 255. Smaller = Lighter

Figure 28: IPGScan Option Window - Canvas Parameters

6. Adjust the "Absolute Z Range" to the desired +/- value.
   a. In this example, the Absolute Z Range is set to +/- 20mm from the nominal focus position (Z FOV dimension of 20mm total). See Figure 29 on page 55.



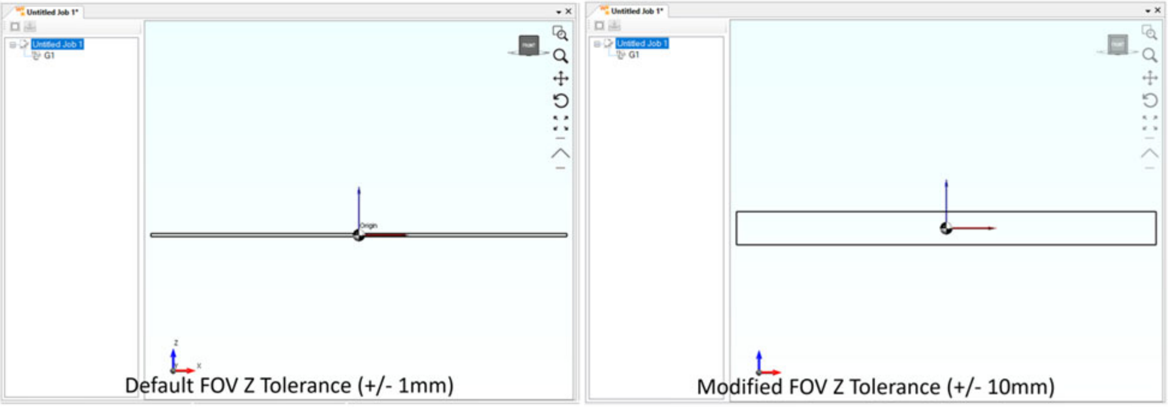
Set Z Field of View

Absolute Z Range

+/- 20 mm

Figure 29: Setting the Absolute Z Range

7. Click "OK".
8. Click "OK" to acknowledge the change and then close and reopen IPGScan.
   a. Upon reopening, users should notice that the FOV Z tolerance has been modified (from a Front or Side View). See Figure 30.



Untitled Job 1*
Untitled Job 1
G1
Origin
Default FOV Z Tolerance (+/- 1mm)
Untitled Job 1*
Untitled Job 1
G1
Modified FOV Z Tolerance (+/- 10mm)

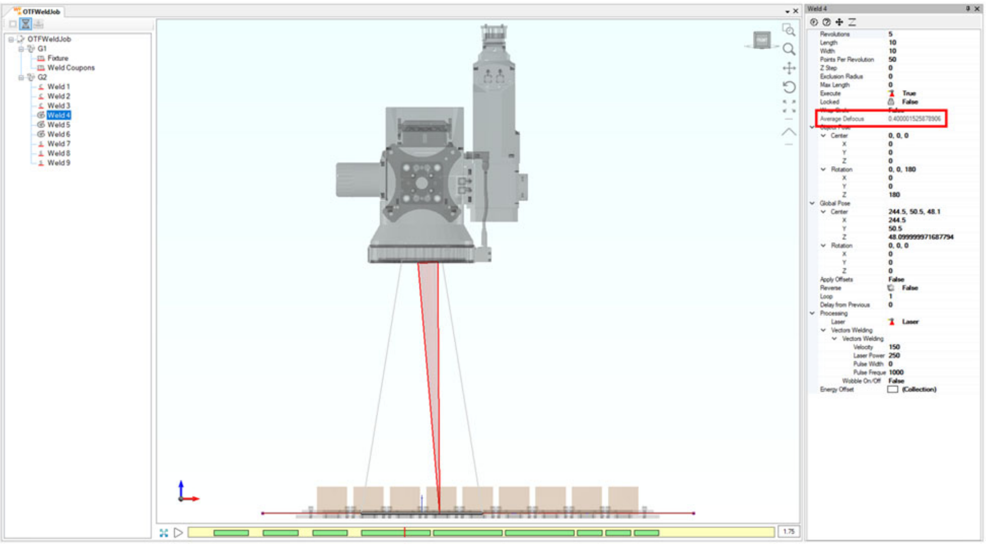
Figure 30: Change in FOV Z Tolerance

To restore FOV Z tolerances back to the default settings, simply navigate to the "Set Z Field of View" window (as seen in Figure 29) and click "Restore to Default." Acknowledge the changes, close IPGScan, and reopen IPGScan for the changes to take effect.

7.1.2.1.2 Robotic On-The-Fly Example

In the case of Robotic OTF jobs, defocusing/opening up the scanner FOV may be desired for process results (i.e. weld quality) or to make it easier to pass Dryruns and setup the process.

Figure 31 on page 56 provides an example of a robotic OTF job where no intentional defocus was implemented. In this example, the scanner has a default FOV Z tolerance of +/- 1mm. After performing a Dryrun of the process, users can select each Process Object and view the average defocus for that object. In this example, Weld 4 has an average defocus of .400mm.



OTFWeldJob

- OTFWeldJob
  - G1
    - Fixture
    - Weld Coupons
  - G2
    - Weld 1
    - Weld 2
    - Weld 3
    - Weld 4
    - Weld 5
    - Weld 6
    - Weld 7
    - Weld 8
    - Weld 9

Weld 4

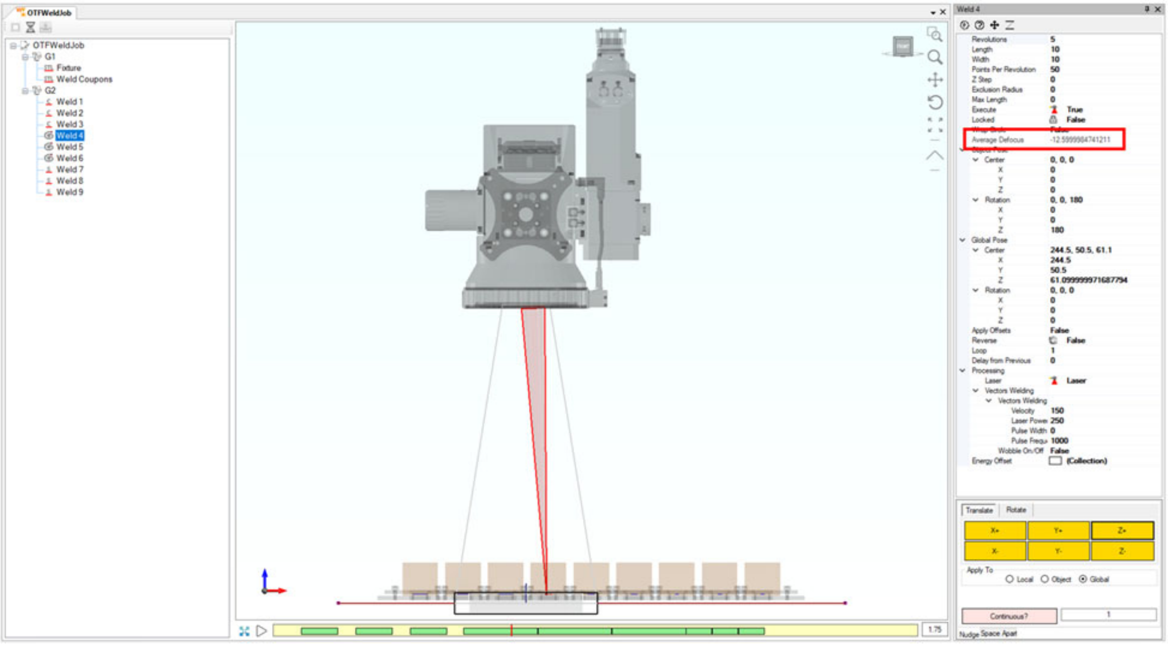
Revolutions	5
Length	10
Width	10
Points Per Revolution	50
Z Step	0
Exclusion Radius	0
Max Length	0
Execute	True
Locked	False
[illegible]	False
Average Defocus	0.400001525878906
Object Pose	
Center	0, 0, 0
X	0
Y	0
Z	0
Rotation	0, 0, 180
X	0
Y	0
Z	180
Global Pose	
Center	244.5, 50.5, 48.1
X	244.5
Y	50.5
Z	48.099999971687794
Rotation	0, 0, 0
X	0
Y	0
Z	0
Apply Offsets	False
Reverse	False
Loop	1
Delay from Previous	0
Processing	
Laser	Laser
Vectors Welding	
Vectors Welding	
Velocity	150
Laser Power	250
Pulse Width	0
Pulse Freque	1000
Wobble On/Off	False
Energy Offset	(Collection)

Figure 31: Robotic OTF Job Without Defocus

Figure 32 on page 57 provides an example of a robotic OTF job where an intentional defocus was implemented. In this example, the scanner was configured with an "Absolute Z Range" of +/- 15mm. The In-View Z tolerance was also increased to +/- 14mm. With the Z tolerance of the scanner's FOV increased, the user can now program the robot to position the scanner closer to the work surface or further from the work surface in order to apply an intentional defocus.

IMPORTANT For Robotic OTF applications, the robot trajectory must be recaptured and loaded into the IPGScan job anytime a robot program change is made. Once a new trajectory is loaded into the job, users should Dryrun the job to ensure it completes as expected.

With the intentional offset applied, users can once again perform a Dryrun and select each individual object to view the average defocus. In this example, Weld 4 has an average defocus of -12.599mm. This means that the scanners nominal focus position is 12.599mm below the Process Objects program location (which should be at the work surface of the material in the real world). An average defocus value that is positive indicates that nominal focus position would be above the Process Objects program location.



OTFWeldJob
- OTFWeldJob
  - G1
    - Fixture
    - Weld Coupons
  - G2
    - Weld 1
    - Weld 2
    - Weld 3
    - Weld 4
    - Weld 5
    - Weld 6
    - Weld 7
    - Weld 8
    - Weld 9

Weld 4

Revolutions	5
Length	10
Width	10
Points Per Revolution	50
Z Step	0
Exclusion Radius	0
Max Length	0
Execute	True
Locked	False
Wrap Circle	False
Average Defocus	-12.5999984741211
Object Pose	
Center	0, 0, 0
X	0
Y	0
Z	0
Rotation	0, 0, 180
X	0
Y	0
Z	180
Global Pose	
Center	244.5, 50.5, 61.1
X	244.5
Y	50.5
Z	61.0999999971687794
Rotation	0, 0, 0
X	0
Y	0
Z	0
Apply Offsets	False
Reverse	False
Loop	1
Delay from Previous	0
Processing	
Laser	Laser
Vectors Welding	
Vectors Welding	
Velocity	150
Laser Powe	250
Pulse Width	0
Pulse Frequ	1000
Wobble On/Off	False
Energy Offset	(Collection)

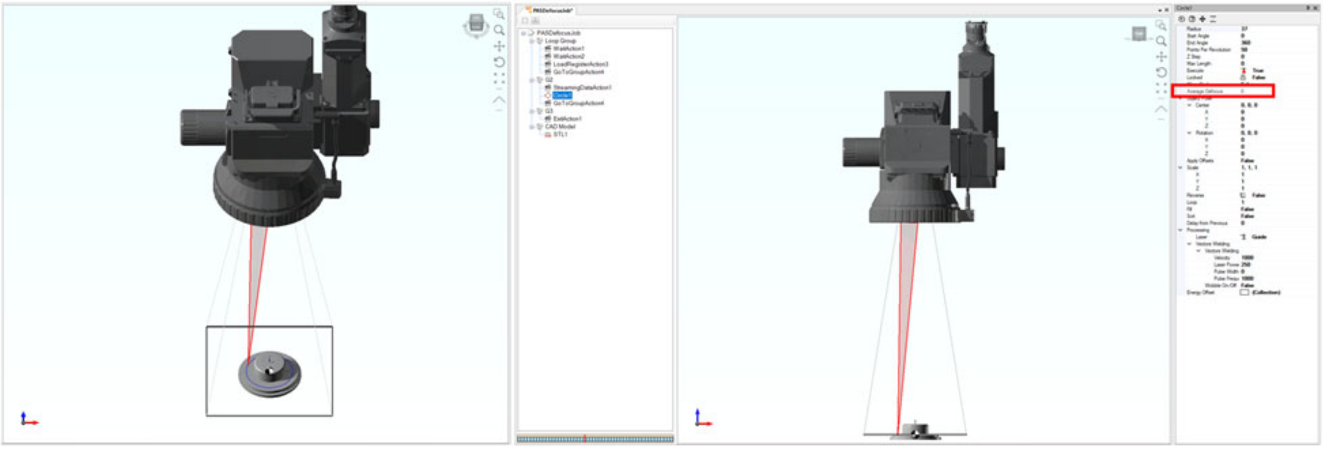
Apply To: ○ Local ○ Object ● Global

Figure 32: Robotic OTF Job With Defocus

7.1.2.1.3 Default and Point and Shoot Job Example

Defocus can also be utilized with Default and Point and Shoot type jobs. For instance, instead of having to apply a scale or purposely offset a Process Objects size in IPGScan in order to compensate for an intentional defocus, users can utilize the defocus functionality to increase Z tolerance of the scanner. With the increased Z tolerance, users can then preserve Process Object sizing parameters, but simply offset the objects so the distance between the scan head and work surface correlate in IPGScan to how they do in the real world.

Figure 33 on page 58 outlines and example of a Pin and Bushing part with a single weld. In this example, the scanner is configured with default Z tolerances of +/-1mm. For this reason, the weld is positioned at the scanners nominal focus position and an average defocus of 0mm can be seen when Circle1 is selected.



PASDefocusJob*

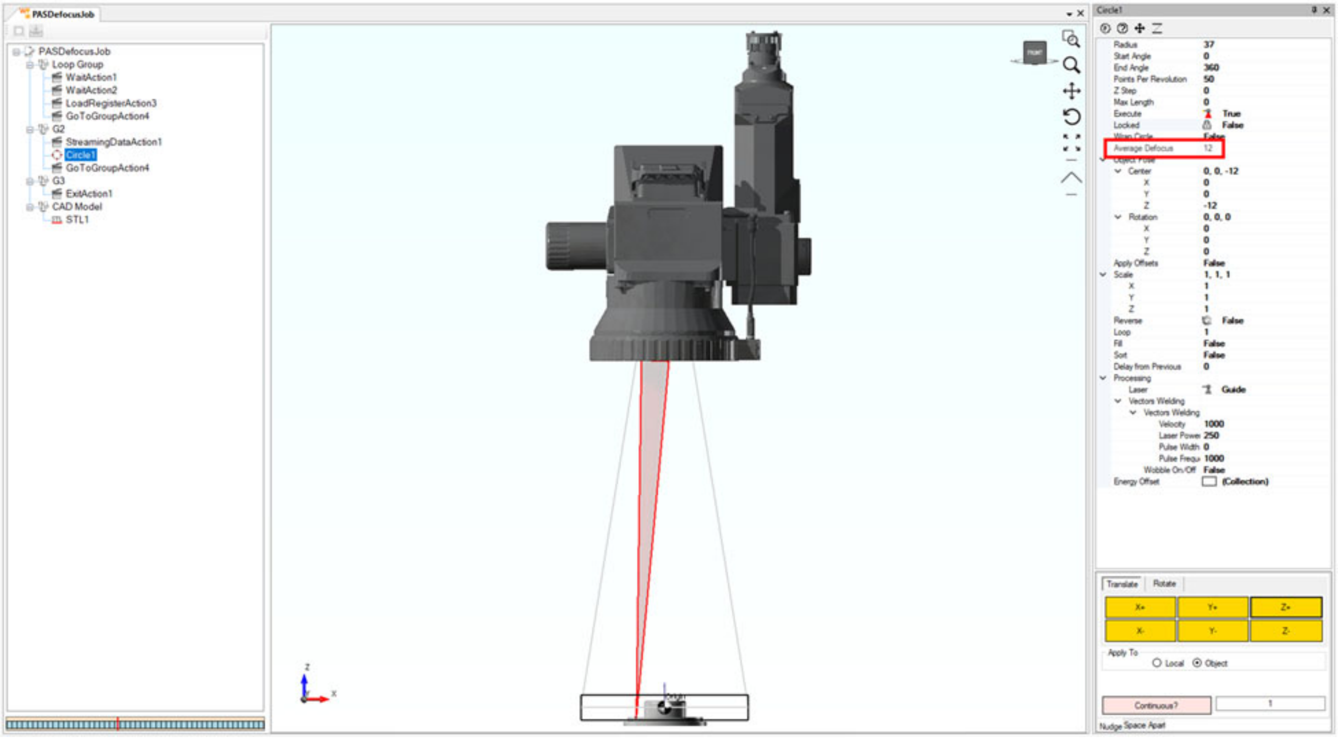
- PASDefocusJob
  - Loop Group
    - WaitAction1
    - WaitAction2
    - LoadRegisterAction3
    - GoToGroupAction4
  - G2
    - StreamingDataAction1
    - Circle1
    - GoToGroupAction4
  - G3
    - ExitAction1
  - CAD Model
    - STL1

Circle1

Radius	37
Start Angle	0
End Angle	360
Points Per Revolution	50
Z Step	0
Max Length	0
Execute	True
Locked	False
Average Defocus	0
Object Pose	
Center	0, 0, 0
X	0
Y	0
Z	0
Rotation	0, 0, 0
X	0
Y	0
Z	0
Apply Offsets	False
Scale	1, 1, 1
X	1
Y	1
Z	1
Reverse	False
Loop	1
Fill	False
Sort	False
Delay from Previous	0
Processing	
Laser	Guide
Vectors Welding	
Vectors Welding	
Velocity	1000
Laser Power	250
Pulse Width	0
Pulse Freq	1000
Wobble On-Off	False
Energy Offset	(Collection)

Figure 33: Point and Shoot Example Without Defocus

If users wish to apply to defocus in this instance, the Z tolerance can then be increased as seen in Figure 34 on page 59. In this scenario, the scanners "Absolute Z Range" was increased to +/- 15mm. With the increased Z tolerance, users can then position the Process Object (Circle1) so that the distance of the Process Object in relation to the scan head in IPGScan matches that of the scan head and the weld surface in the real world. When the IPGScan setup matches that of the real world setup, no scaling or intentional offsetting of Process Object parameters is required in order to compensate for the scanner to process out of focus. As seen below, Circle1 has an average defocus of 12mm, which indicates that the nominal focus position of the scanner is 12mm above the Process Object position (work surface position).



Radius	37
Start Angle	0
End Angle	360
Points Per Revolution	50
Z Step	0
Max Length	0
Execute	True
Locked	False
Wrap Circle	False
Average Defocus	12
Object Pose	
Center	0, 0, -12
X	0
Y	0
Z	-12
Rotation	0, 0, 0
X	0
Y	0
Z	0
Apply Offsets	False
Scale	1, 1, 1
X	1
Y	1
Z	1
Reverse	False
Loop	1
Fill	False
Sort	False
Delay from Previous	0
Processing	
Laser	Guide
Vectors Welding	
Vectors Welding	
Velocity	1000
Laser Power	250
Pulse Width	0
Pulse Frequ	1000
Wobble On/Off	False
Energy Offset	(Collection)

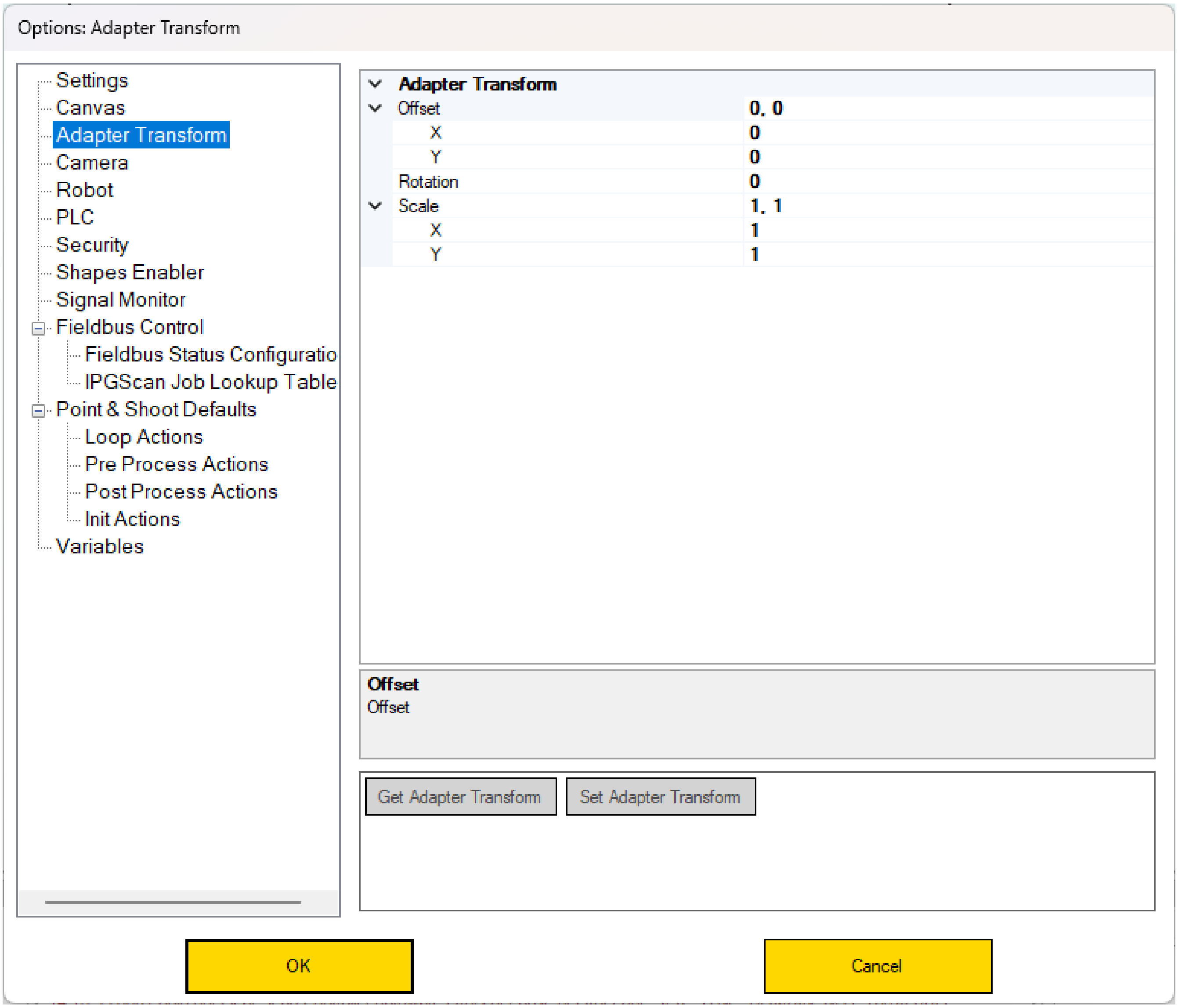
Figure 34: Point and Shoot Example With Defocus

7.1.3 Adapter Transform

Users have the ability to use offset, rotation, and scale parameters to adjust the scanner's field of view relative to the scan head itself. Clicking the "Get Adapter Transform" button will update the Adapter Transform values in the settings with any transforms that may currently be applied to the scanner.

NOTE: The coordinate system will not reflect the adjustment of the scanner's field of view.

If users wish to apply a transform, simply update the values with the desired transform and click "Set Adapter Transform." Figure 35 displays the available Adapter Transform setting.



Options: Adapter Transform

Adapter Transform	
Offset	0, 0
X	0
Y	0
Rotation	0
Scale	1, 1
X	1
Y	1

Offset
Offset

Figure 35: Adapter Transform Settings

7.1.4 Robot

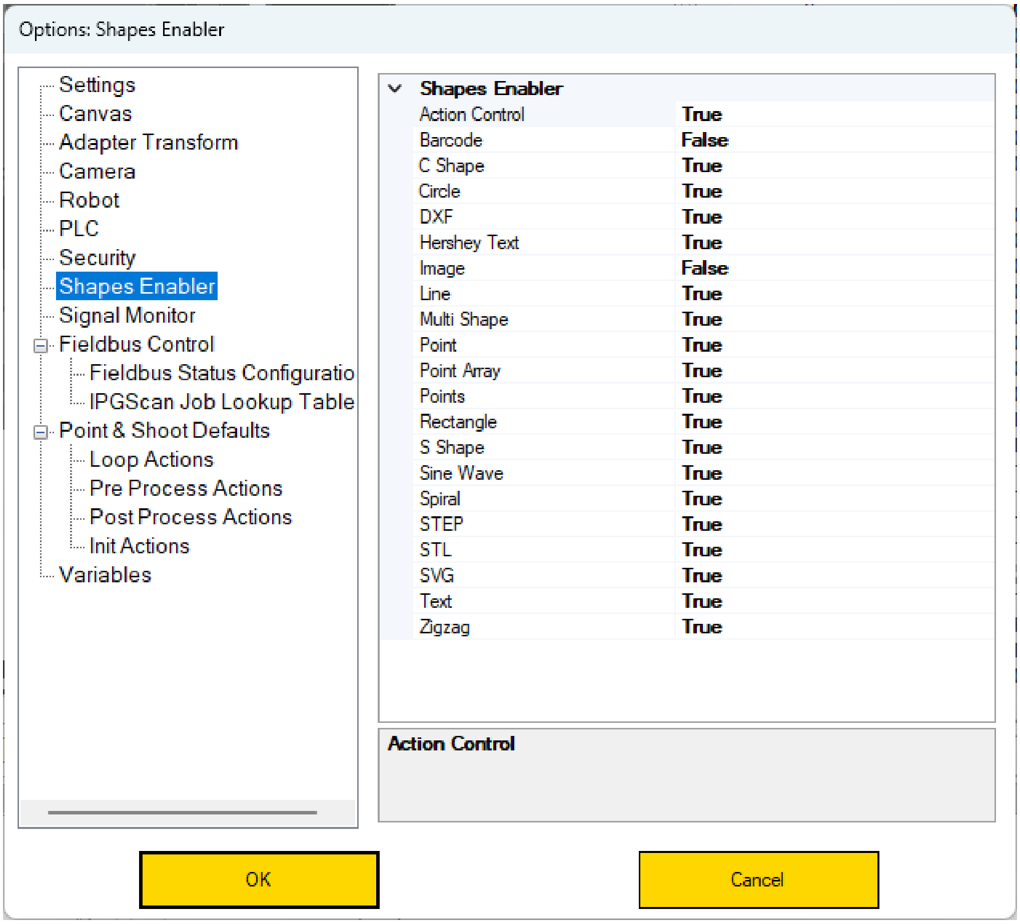
The robot settings are only required for Robotic On-The-Fly. When using Point and Shoot, the user does not need to change any of these settings. See Section 8.3 on page 198 for instructions on how to set up Robotic On-The-Fly.

7.1.5 Security

The security settings are where privileges can be set for given user levels. See Chapter 3 on page 33 for details concerning security setup.

7.1.6 Shapes Enabler

This allows the user to select which features they would like to have displayed in the Tool Bar and Tool Menu. Table 3 on page 62 outlines the available Objects and their corresponding default enable setting.



Shapes Enabler	
Action Control	True
Barcode	False
C Shape	True
Circle	True
DXF	True
Hershey Text	True
Image	False
Line	True
Multi Shape	True
Point	True
Point Array	True
Points	True
Rectangle	True
S Shape	True
Sine Wave	True
Spiral	True
STEP	True
STL	True
SVG	True
Text	True
Zigzag	True

Figure 36: Shapes Enabler Settings

Table 3: Shapes Enabler Settings List

Object	Default Enable Setting
Action Control	True
Barcode	False
C Shape	True
Circle	True
DXF	True
Hershey Text	True
Image	False
Line	True
Multi Shape	True
Point	True
Point Array	True
Points	True
Rectangle	True
S Shape	True
Sine Wave	True
Spiral	True
STEP	True
STL	True
SVG	True
Text	True
Zigzag	True

7.1.7 Point & Shoot Defaults

Users can adjust the default Action Controls that are generated with newly created Point & Shoot job types. Please refer to Section 8.2.3 on page 188 for additional details.

7.2 Toolbars

7.2.1 Mouse Resize

The mouse resize feature allows users to grab objects in the canvas and resize them by dragging the mouse.

7.2.1.1 Using Mouse Resize

1. Click the Resize button in the tool bar.
    a. The cursor/mouse pointer should now change into a small square.
2. Click and hold on the desired object in the canvas.
3. Drag the mouse to resize the object. See Figure 37 (below).

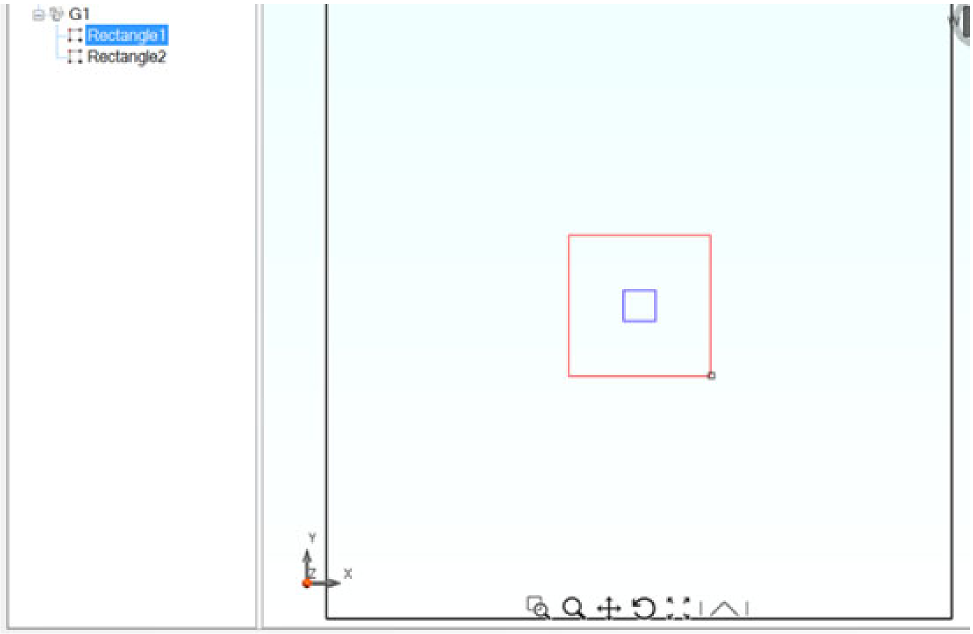
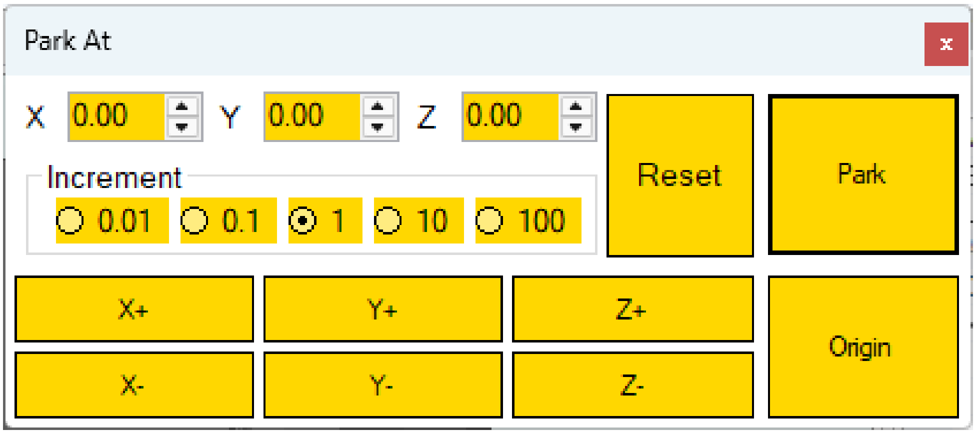


Figure 37: Mouse Resize Feature

7.2.2 Park At

In the toolbar, the Park At button, ⬚ , will set the target position of the Scan Head in the Scan Head's field of view. The Park At button is only accessible when either the guide beam or the focus guide beam is enabled.

Figure 38 shows the Park At window. The values in the X, Y, and Z boxes are the target position of the Scan Head. Changing the increment radio button will change the magnitude of the adjustment when either the buttons to the side of the boxes or the buttons under the increment radio buttons are pressed. When the "Park" button is pressed, the Scan Head is parked at the location specified in the X, Y, and Z boxes, given that it is a valid location. Pressing the "Origin" button will park the Scan Head at (0, 0, 0). Pressing the "Reset" button will reset the text boxes back to the value (0, 0, 0).



Park At

X 0.00 Y 0.00 Z 0.00

Increment
○ 0.01 ○ 0.1 ● 1 ○ 10 ○ 100

Figure 38: Park At Window

7.2.3 Stage Motion

The stage motion dialog allows the user to control the position of a stage when controlled by an attached IPG Scan Controller. To access the Stage Motion dialog, select **Tools → Scanner → Stage Motion**.

IMPORTANT Users must have the "Interface Board" selection set to "Motion IO" for the Stage Motion tool to be accessible in the Tools menu when using recent releases of IPGScan.

Figure 39 shows the Stage Motion Dialog. The text boxes in the middle correspond to the destination position of the stage motion. Pressing "go" will move the stage to the position represented by all 3 text boxes. A text box without a valid number will be treated as a 0. Pressing the home button will home the axes with a selected checkbox next to each letter. In Figure 39, no axes will be homed when the home button is pressed.

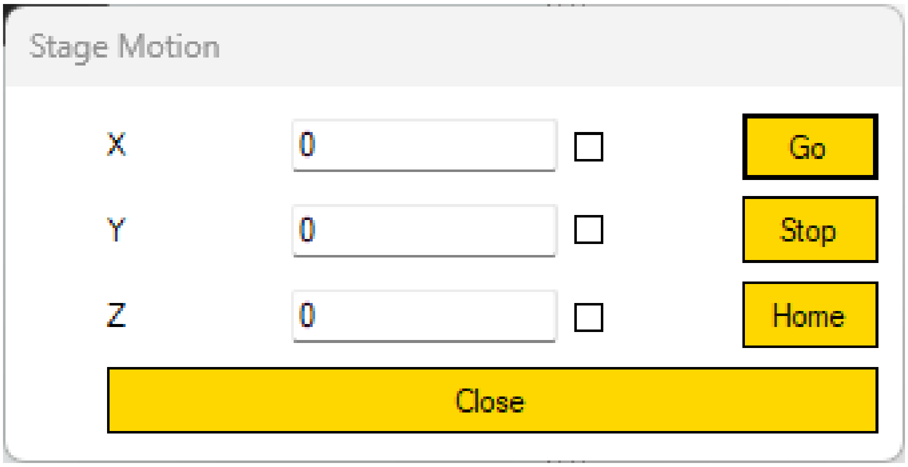
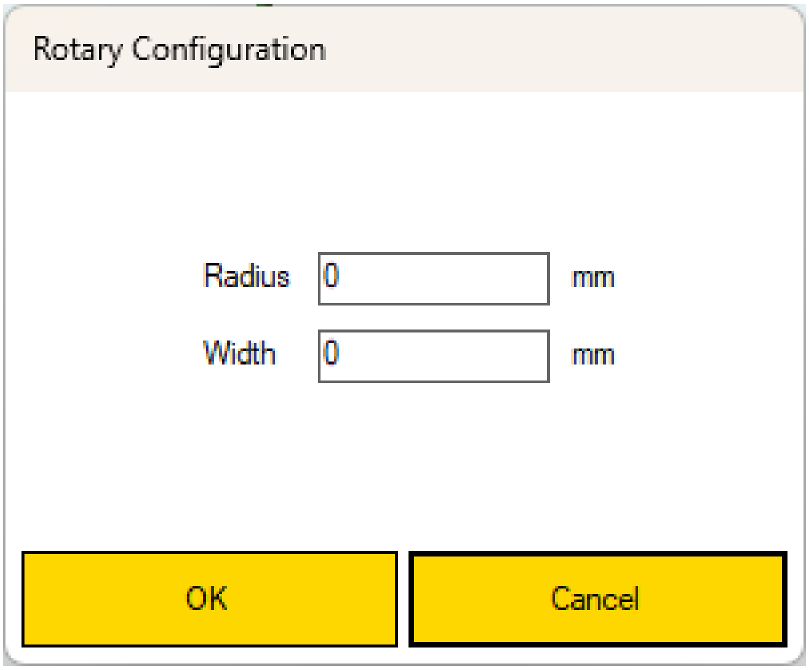


Figure 39: Stage Motion Dialog

7.2.4 Rotary Configuration

The rotary configuration of the scan controller can be configured from IPGScan by selecting **Tools → Scanner → Rotary Configuration → Enable**. This will open a dialog box where the user can enter the desired Radius and Width of their rotary configuration. Figure 40 shows the rotary configuration dialog. This configuration is applied for this instance of IPGScan and does not edit any of the configuration files.



Rotary Configuration

Radius 0 mm

Width 0 mm

Figure 40: Rotary Configuration

7.2.5 Initialize Scanner

The currently connected scan controller can be initialized by going through the dropdown menu **Tools → Scanner → Initialize**. The scan controller is initialized during the first lock of the scan controller during that instance of IPGScan. Initialization can also be done by restarting IPGScan. The scan controller only needs to be re-initialized if the configuration files are changed.

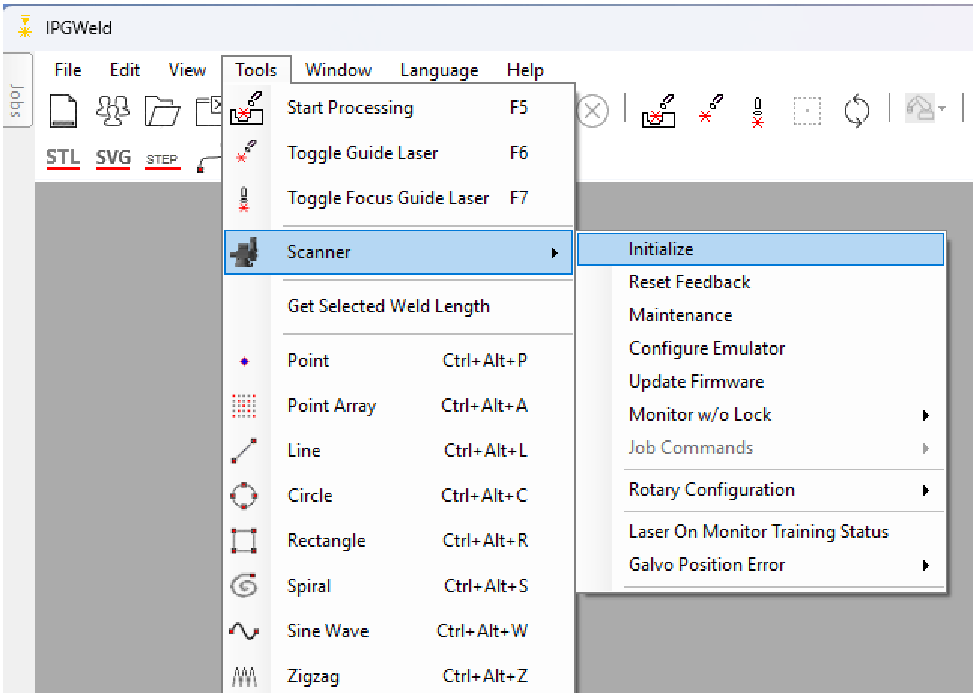


Figure 41: Initialize Scanner

7.2.6 CSV and XML Export

IPGScan can export the data of a job to a CSV file or an XML file. This provides the user with a way to quickly output parameters for record keeping without having to individually check each object in the job.

7.2.6.1 Exporting a Job

1. Open IPGScan
2. Open the desired job
3. Click **File → Export To… → Export To CSV** or **Export To XML**.

   See Figure 42 (below).

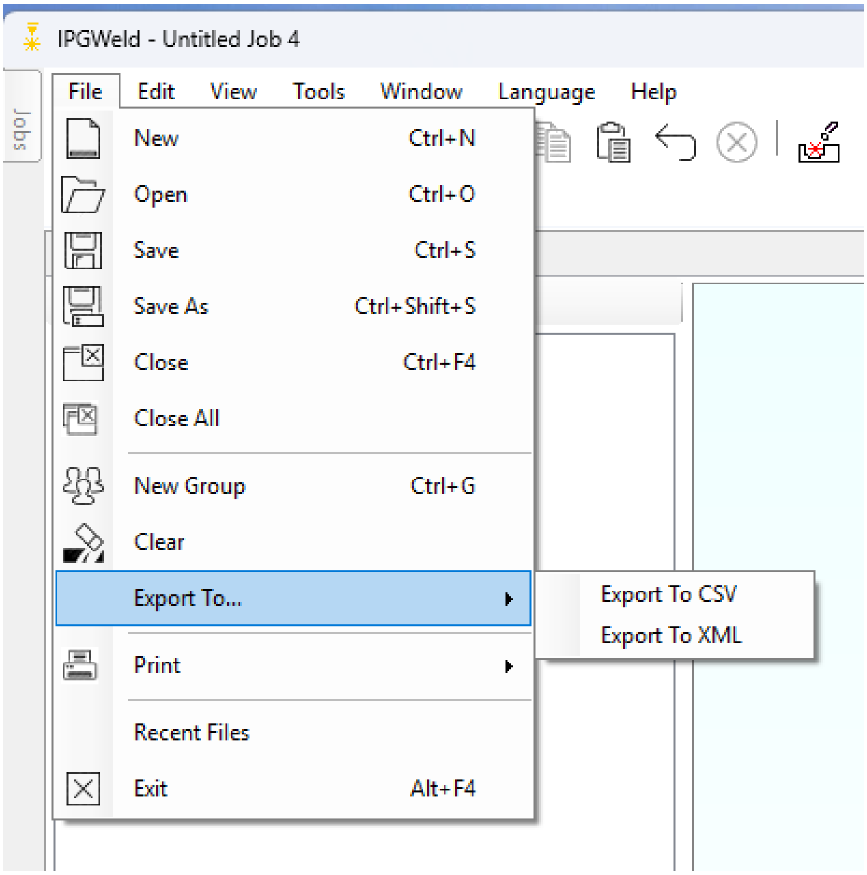
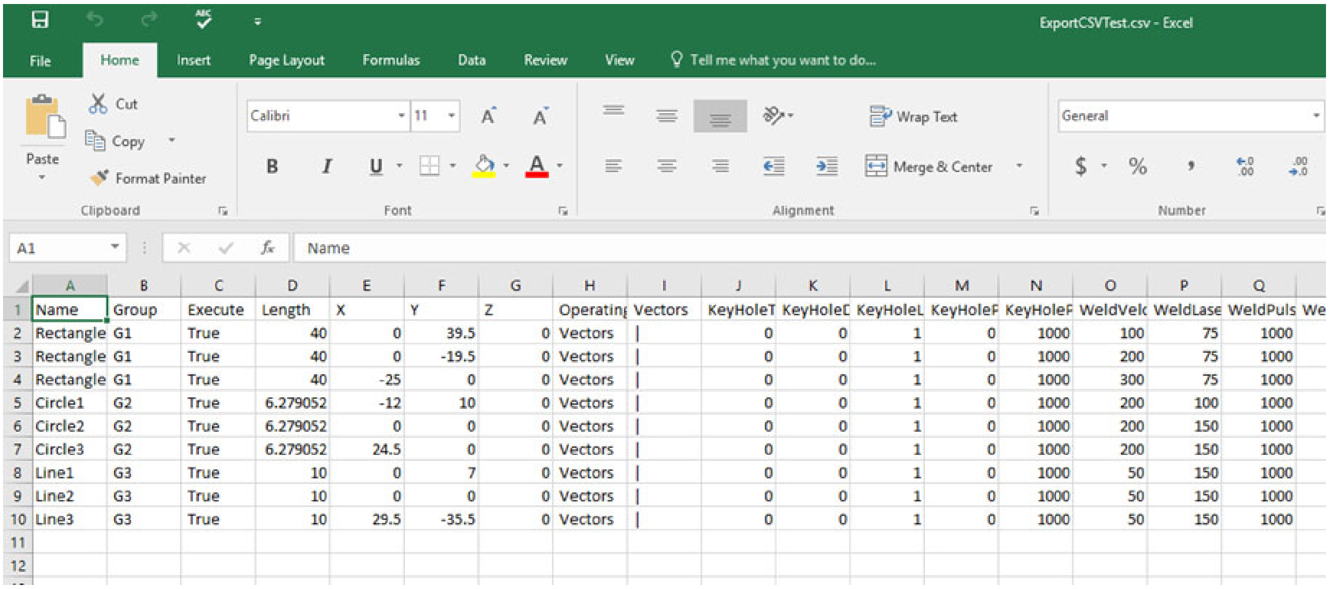


Figure 42: Export to CSV or XML

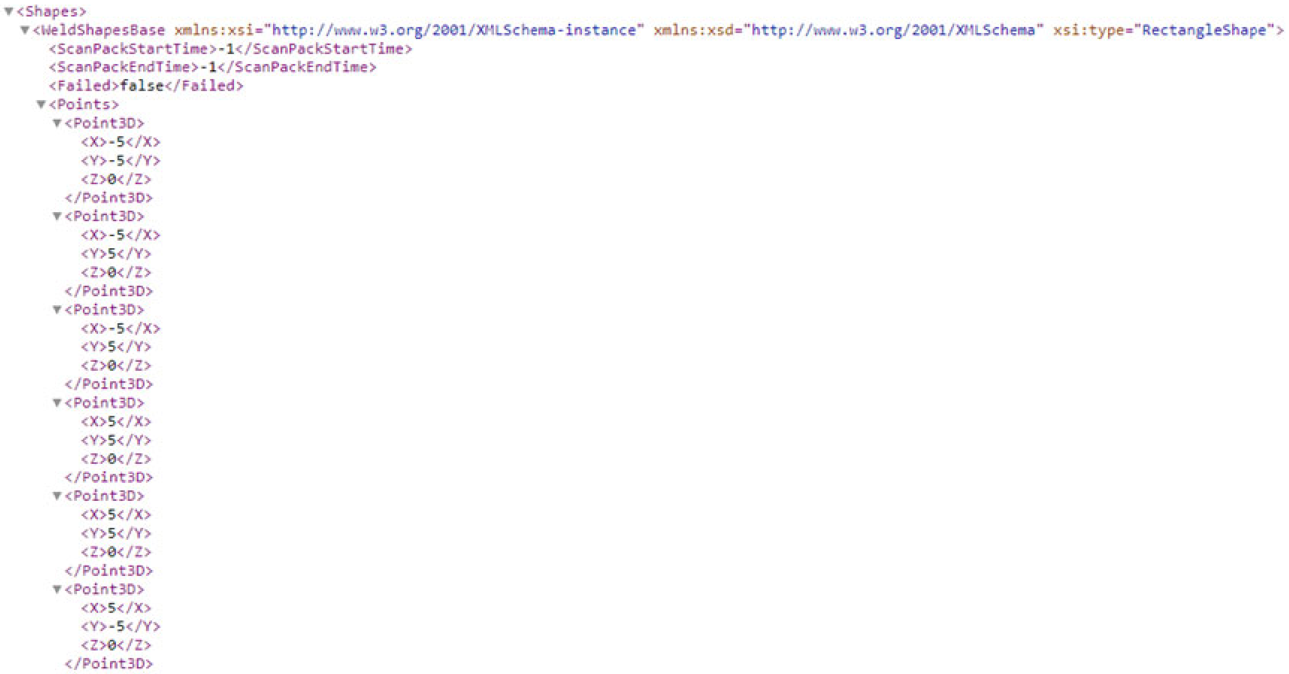
4. Navigate to the desired save location
5. Name the file
6. Click "Save"

7. The user can now navigate to the saved file and open it for viewing
   a. Figure 43 (below) and Figure 44 (below) detail a portion of the example output for each file type.
   b. Please keep in mind that parameter variables are output for all IPGScan job types (IPGWeld/IPGClean/IPGMark). Users should refer to the parameters specific to the job Operation Type that they are using.



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	
1	Name	Group	Execute	Length	X	Y	Z	Operating	Vectors	KeyHoleT	KeyHoleD	KeyHoleL	KeyHoleF	KeyHoleF	WeldVelc	WeldLase	WeldPuls	We
2	Rectangle	G1	True	40	0	39.5	0	Vectors	|	0	0	1	0	1000	100	75	1000	
3	Rectangle	G1	True	40	0	-19.5	0	Vectors	|	0	0	1	0	1000	200	75	1000	
4	Rectangle	G1	True	40	-25	0	0	Vectors	|	0	0	1	0	1000	300	75	1000	
5	Circle1	G2	True	6.279052	-12	10	0	Vectors	|	0	0	1	0	1000	200	100	1000	
6	Circle2	G2	True	6.279052	0	0	0	Vectors	|	0	0	1	0	1000	200	150	1000	
7	Circle3	G2	True	6.279052	24.5	0	0	Vectors	|	0	0	1	0	1000	200	150	1000	
8	Line1	G3	True	10	0	7	0	Vectors	|	0	0	1	0	1000	50	150	1000	
9	Line2	G3	True	10	0	0	0	Vectors	|	0	0	1	0	1000	50	150	1000	
10	Line3	G3	True	10	29.5	-35.5	0	Vectors	|	0	0	1	0	1000	50	150	1000	
11																		
12																		

Figure 43: CSV File Example



```
▼<Shapes>
  ▼<WeldShapesBase xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns:xsd="http://www.w3.org/2001/XMLSchema" xsi:type="RectangleShape">
     <ScanPackStartTime>-1</ScanPackStartTime>
     <ScanPackEndTime>-1</ScanPackEndTime>
     <Failed>false</Failed>
   ▼<Points>
     ▼<Point3D>
         <X>-5</X>
         <Y>-5</Y>
         <Z>0</Z>
       </Point3D>
     ▼<Point3D>
         <X>-5</X>
         <Y>5</Y>
         <Z>0</Z>
       </Point3D>
     ▼<Point3D>
         <X>-5</X>
         <Y>5</Y>
         <Z>0</Z>
       </Point3D>
     ▼<Point3D>
         <X>5</X>
         <Y>5</Y>
         <Z>0</Z>
       </Point3D>
     ▼<Point3D>
         <X>5</X>
         <Y>5</Y>
         <Z>0</Z>
       </Point3D>
     ▼<Point3D>
         <X>5</X>
         <Y>-5</Y>
         <Z>0</Z>
       </Point3D>
```

Figure 44: XML File Example (Opened using Google Chrome)

7.2.7 DXF Export

Any Multi Shape object can be exported as a DXF file. To do this, right-click on a Multi Shape and select "Export to DXF." See Figure 45.

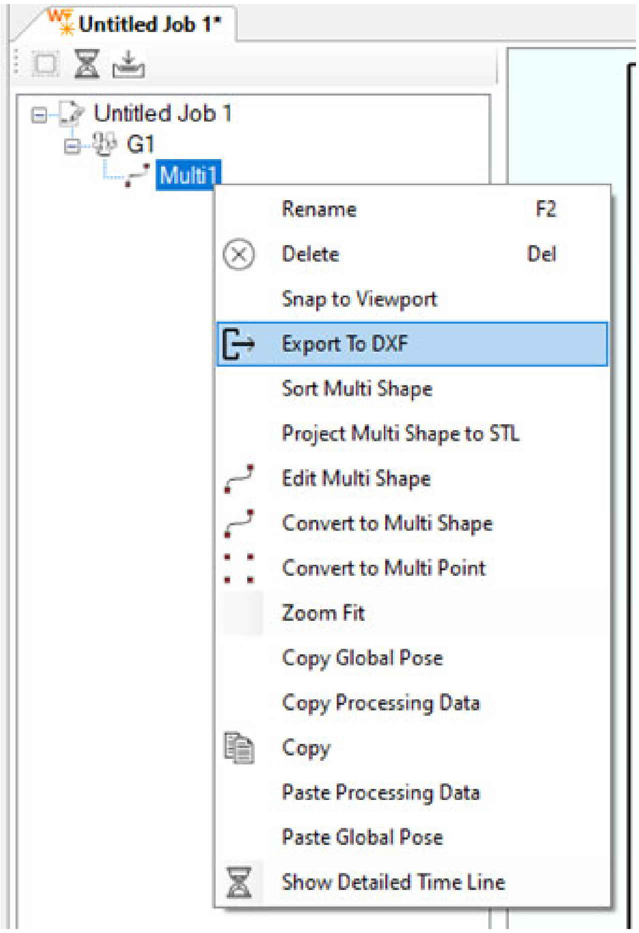


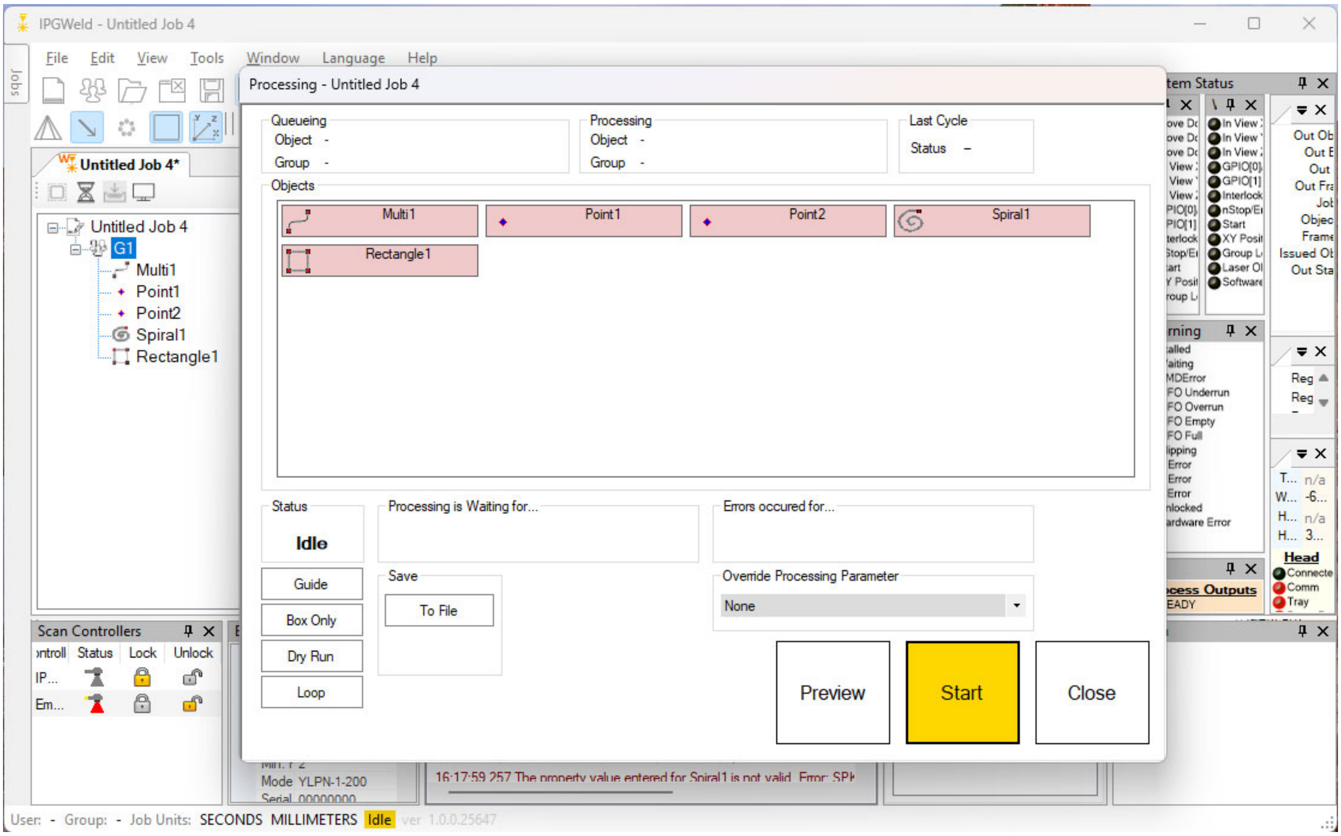
Figure 45: Export Multi Shape to DXF

7.3 Parameter Tools

7.3.1 Processing Window

The following section describes the features and use of the Processing Window. The Processing Window can be opened by pressing the Processing Window button ( ), by pressing the "F5" button, or by selecting "Start Processing" under the Tools menu.

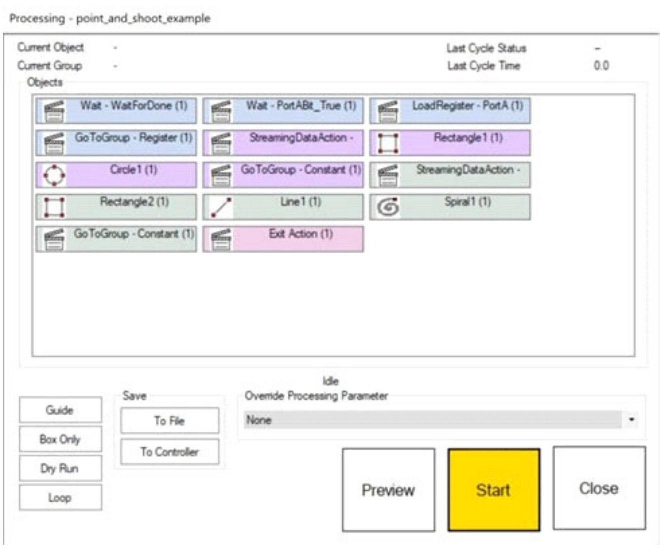
When opening the Processing Window, only the selected processing objects and action controls from the Job Tree will be brought into the Processing Window. If the job is selected, then all groups in the job will be brought into the Processing Window. For all groups selected, all of their objects will be brought into the Processing Window. Figure 46 (below) shows the Processing Window when the job is selected before opening the Processing Window. (**NOTE:** Figure 47 on page 72 shows the Processing Window only.)



16:17:59 257 The property value entered for Spiral1 is not valid. Error: SPI

User: - Group: - Job Units: SECONDS MILLIMETERS Idle ver 1.0.0.25647

Figure 46: Processing Window in IPGScan



Processing - point_and_shoot_example

Current Object -

Current Group -

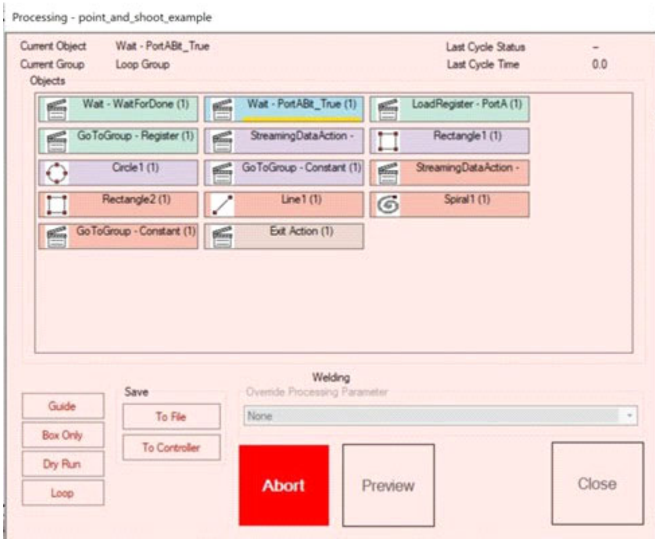
Last Cycle Status -

Last Cycle Time 0.0

Idle

Override Processing Parameter: None

Figure 47: Processing Window



Processing - point_and_shoot_example

Current Object Wait - PortABit_True

Current Group Loop Group

Last Cycle Status -

Last Cycle Time 0.0

Welding

Override Processing Parameter: None

Figure 48: Processing Window When Processing is Active

Within the Processing Window, the objects that will be run are listed in order of execution (not including any "GoToGroup" actions) within the "Objects" box. Table 4 describes the buttons found on the Processing Window.

Table 4: Processing Window Buttons

Button	Description
Guide	The processing objects will be output with the guide beam regardless of the laser configuration of the object.
Box Only	Outputs a box around the output a position of each processing object.
Dryrun	The IPGScan job will be processed by ScanPack but the laser will not be output and the galvos of the scan head will not move. This can be used with Robotic On-The-Fly jobs to evaluate the feasibility of the job.
Loop	The IPGScan job will be restarted after the last object is finished until the user stops execution.
Fast Mode	Outputs the processing objects with the "Fast Mode" processing parameters overwriting the programmed processing settings. Only available when "Guide" is selected.
Close	Closes the Processing Window if processing is not active.
Start	Start processing.
Preview	Guide and Loop will automatically be selected and then processing will be started.
Abort	Stops execution, stops firing the laser, and flushes the buffer. See Figure 48 (above).

7.3.1.1 *Job Information*

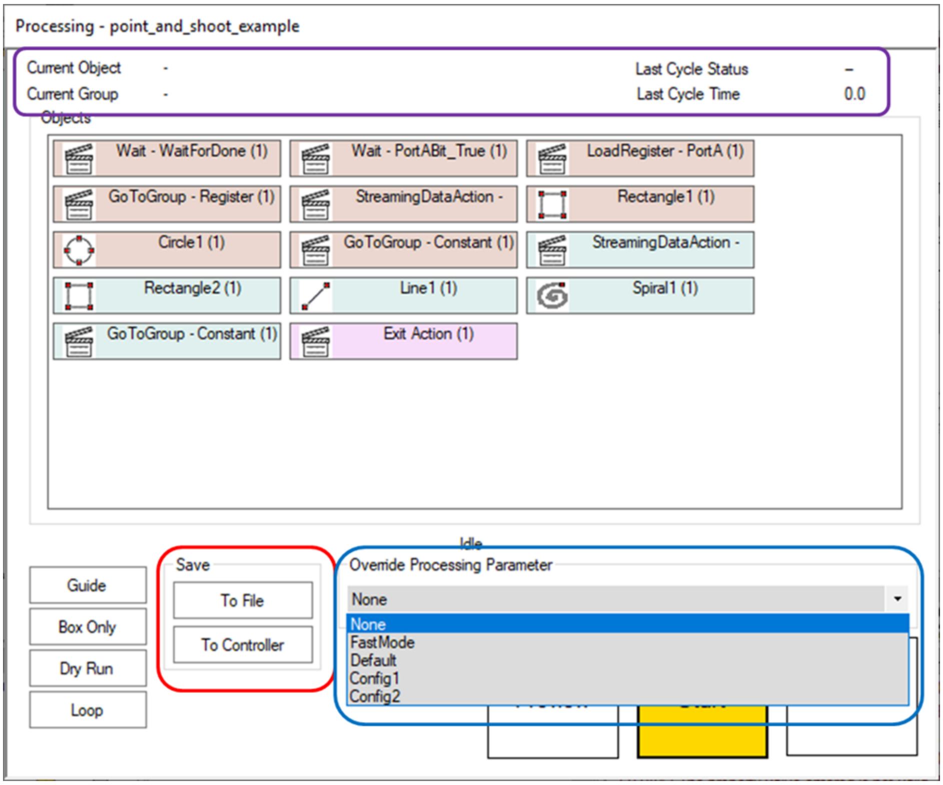
At the top of the Processing Window are four pieces of information about the job: Current Object, Current Group, Last Cycle Status, and Last Cycle Time. Table 5 describes each status. Figure 49 (below) shows the job information in the top purple rectangle.

Table 5: Job Information

Information	Description
Current Object	The name of the object currently being output by the scanner.
Current Group	The name of the group which is currently being processed.
Last Cycle Status	The status of the previously run cycle; either "OK" or "Failed."
Last Cycle Time	The time elapsed during the previously run cycle.

7.3.1.2 *Override Processing Parameters*

The drop down menu under "Override Processing Parameter" will show all of the Processing Parameters set up in IPGScan. Selecting "None" will run the processing objects with their programmed configuration. Selecting any of the processing parameters will override the programming of the processing objects and will use the configuration specified in the selected processing parameter. Figure 49 shows this drop down in the lower blue rectangle.



Processing - point_and_shoot_example

Current Object -
Current Group -
Last Cycle Status -
Last Cycle Time 0.0

Idle

Override Processing Parameter: None

Figure 49: Processing Window Sections

7.3.2 Select All

All weld shapes can be selected by clicking on the job or any of the groups in the job tree. Then "Select All Shapes" can be chosen (see Figure 50). This will select all of the weld shapes in the collection and leave out any ActionControls. If the job is selected, the "Select All Shapes" icon (⬚) can be selected instead.

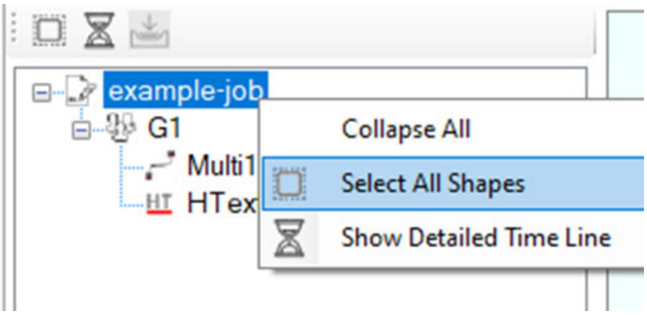


Figure 50: Select All Shapes

7.3.3 Display Process Parameters Only

At the top of the Parameter Window is the "Display Processing Parameters Only" toggle (P). This will limit the Parameter Window to only Processing Parameters for processing objects (compared to ActionControls and Reference objects).

7.3.4 Copy/Paste Processing Data

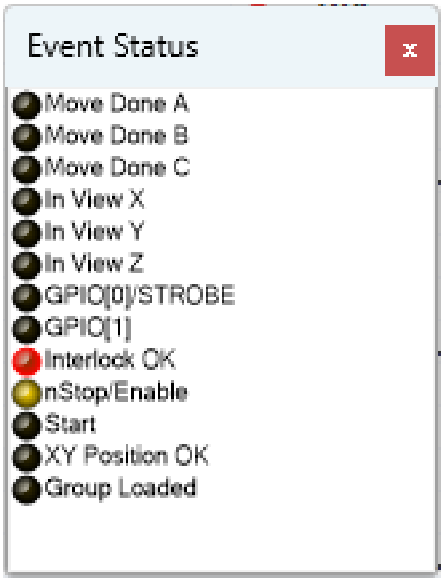
For objects, users can copy the processing parameters of an object and paste the processing data onto another object.

1. In the Job Tree, right click on an object.
2. In the drop down menu users can select:
   a. Copy Processing Data: copies an object's processing data to a clipboard.
   b. Paste Processing Data: sets an object's processing data to the previously copied processing data.

7.4 System Status

The System Status windows are a collection of windows which show different statuses of the current system. They are available under the View dropdown menu. For the statuses which are represented by LEDs, a lit LED shows a true state (eg. "Interlock OK" in Figure 51). An unlit LED shows a false state (eg. "GPIO[1]" or "Start" in Figure 51).

7.4.1 Event Status



Event Status

x

Move Done A

Move Done B

Move Done C

In View X

In View Y

In View Z

GPIO[0]/STROBE

GPIO[1]

Interlock OK

nStop/Enable

Start

XY Position OK

Group Loaded

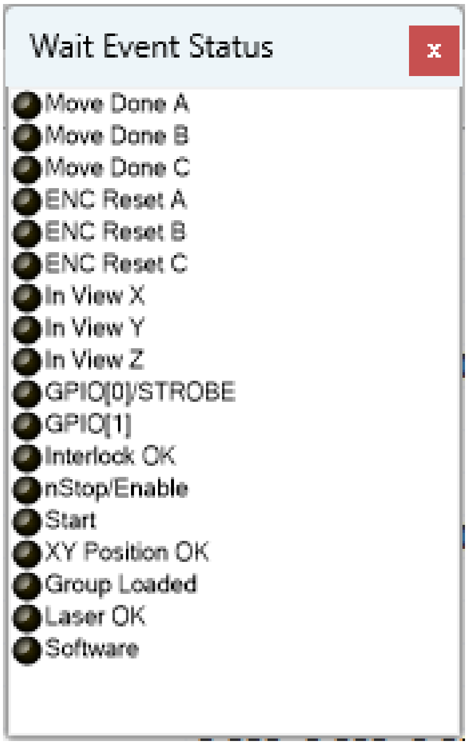
Figure 51: Event Status

Figure 51 shows the event status window. This window shows when each event is or is not currently true/active.

1. Move Done A/B/C
   - True when the stage is done moving axis A/B/C.
2. In View X/Y/Z
   - True when the next vector is within the In View window for the Scan Head.
3. GPIO[0]/STROBE
   - The send button that tells the Industrial automation to send information to the scanners register
4. GPIO[1]
   - True when each signal GPIO[1] is currently active. This state will adapt with the configuration of each signal for active low versus high and input versus output.
5. Interlock OK
   - True when the fiber interlock is satisfied.

6. nStop/Enable
   - True when the nStop (not stop)/Enable signal is true. This will allow the scanner system to run.
7. Start
   - True when the Start signal is active.
8. XY Position OK
   - True when the X and Y galvos are in position.
9. Group Loaded
   - True when all of the information has been loaded into the buffer

7.4.2 Wait Event Status



Wait Event Status

- ● Move Done A
- ● Move Done B
- ● Move Done C
- ● ENC Reset A
- ● ENC Reset B
- ● ENC Reset C
- ● In View X
- ● In View Y
- ● In View Z
- ● GPIO[0]/STROBE
- ● GPIO[1]
- ● Interlock OK
- ● nStop/Enable
- ● Start
- ● XY Position OK
- ● Group Loaded
- ● Laser OK
- ● Software

Figure 52: Wait Event Status

Figure 52 shows the Wait Event Status window. Active signals in this window represent events which are blocking the execution of the buffer.

1. Move Done A/B/C
   - The scanner is waiting for motion to finish on stage axis A/B/C.
2. ENC Reset A/B/C
   - The scanner is waiting for Encoder A/B/C to reset.
3. In View X/Y/Z
   - The scanner is waiting for the next output vector to become In View in the X/Y/Z direction(s).

4. GPIO[0]/STROBE
    - The send button that tells the Industrial automation to send information to the scanner’s register
5. GPIO[1]
    - The scanner is waiting for the GPIO[1] signal to be active.
6. Interlock OK
    - The scanner is waiting for the interlock to be satisfied.
7. nStop/Enable
    - The scanner is waiting for the nStop (not Stop)/Enable signal to be active.
8. Start
    - The scanner is waiting for the Start signal to be active.
9. XY Position OK
    - True when the X and Y galvos are in position.
10. Group Loaded
    - True when waiting for information to be loaded into the buffer
11. Laser OK
    - True when the laser is ready to emit
12. Software

7.4.3 Warning Status

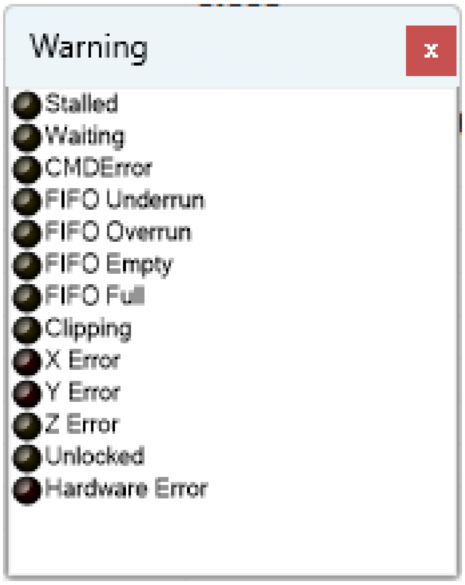


Figure 53: Warning Status

Figure 53 shows the Warning status window. The information in this window displays different warnings about the scanner system.

1. Stalled
   - True when there is no data being processed from the buffer.
2. Waiting
   - Waiting for an event to be satisfied (see Section Wait Event Status)
3. CMDError
   - True when the command from the computer does not match the command received on the scan controller.
4. FIFO Underrun
   - Active when a FIFO underrun occurs. This occurs when the scan controller reaches the end of the FIFO (buffer) without seeing a properly terminated command. This usually indicates a communication issue.
5. FIFO Overrun
   - Active when a FIFO overrun occurs. This occurs when the computer driving the scan controller attempts to add data to the buffer when it is already full. This is indicative of a communication issue.
6. FIFO Empty
   - Active when the FIFO is empty. This warning is only a cause for concern when the FIFO is not expected to be empty.
7. FIFO Full
   - Active when the FIFO is full.

8. Clipping
    - True when the galvos are being commanded to an unreachable position. This usually only occurs during STAGE_TRACKING when the scanner system is waiting for the next vector to enter the In View window.
9. X/Y/Z Error
    - Active when there is an error in the X/Y/Z galvo of the Scan Head. A Z error is expected in 2D heads.
10. Unlocked
    - True when the laser and scanner are unlocked.

      NOTE: The laser and scanner become unlocked when they are not in sync.
11. Hardware Error

7.4.4 IO

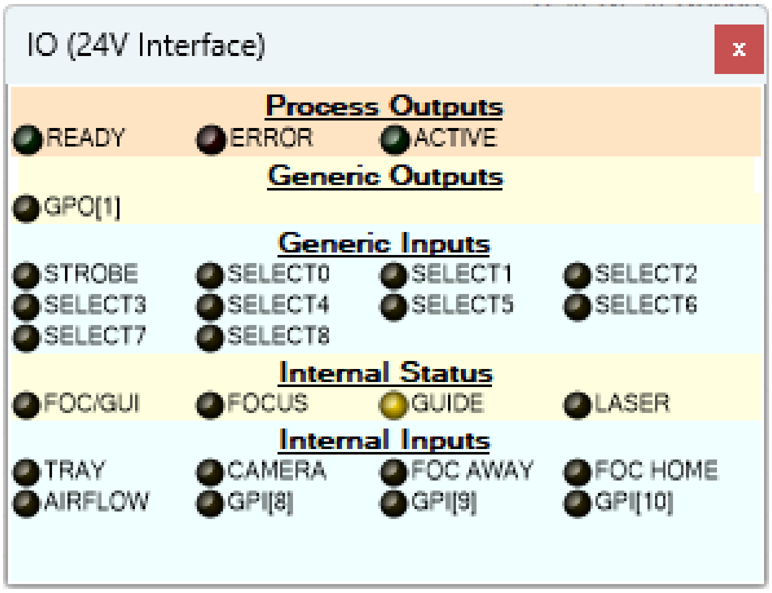


Figure 54: IO Status

Figure 54 shows the IO status window. The top white section shows Port F; the middle yellow section shows Port C (outputs); the bottom white section shows Port A (inputs). An active LED light corresponds to an active signal. An inactive LED light corresponds to an inactive signal.

1. Process Outputs
    - READY – True when a process is ready to output
    - ERROR – True when there is an error in the process output
    - ACTIVE – True when the process is outputting
2. Generic Outputs
    - GPO[1] – The status of the GPO[1] signal

3. Generic Inputs

    - STROBE – The send button that tells the Industrial automation to send information to the scanner’s register
    - SELECT0...SELECT8 – User configurable status settings for the IO (External Interface) device

      Do the following to configure the status settings:

      - From the View menu, select **Options→Fieldbus Control→Fieldbus Status Configuration**.
      - Select the status(es) that you want to configure.
      - For each status that you select, select a status bit from the **Status Bit** dropdown and a status type from the **Status Type** dropdown.

        You can configure up to nine status bits.

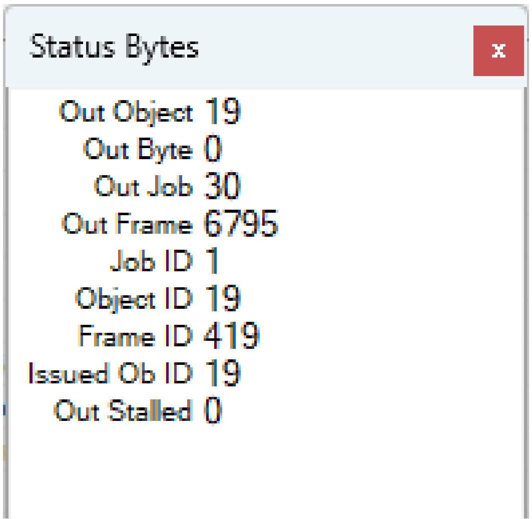
4. Internal Status

    - FOC/GUI – True when both the focus guide beam, and the normal guide beam, are on.
    - FOCUS– True when the focus guide beam is on.
    - GUIDE– True when the focus normal guide beam is on.
    - LASER– True when the laser is firing.

5. Internal Inputs

    - TRAY – True when the debris tray is deployed.

7.4.5 Status Bytes



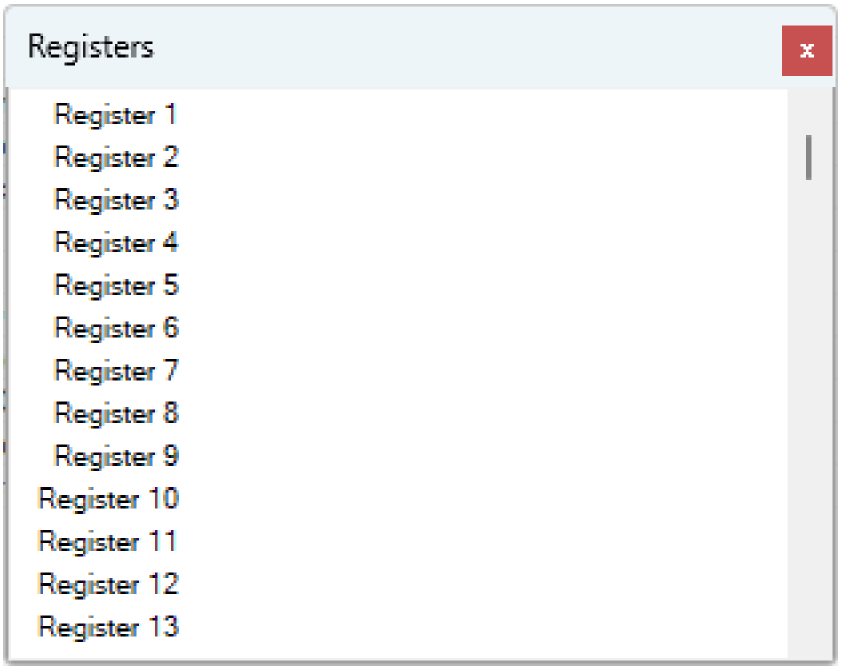
Out Object 19
Out Byte 0
Out Job 30
Out Frame 6795
Job ID 1
Object ID 19
Frame ID 419
Issued Ob ID 19
Out Stalled 0

Figure 55: Status Bytes

Figure 55 shows the status bytes window. This window shows information about the scanner system and the FIFO.

1. Out Object
   - The current number of objects in the FIFO. The scan controller will not process commands from the FIFO until the FIFO is either at least half full or there is at least one object in the FIFO.
2. Out Byte
   - The current number of bytes in the FIFO.
3. Out Job
   - The current number of jobs in the FIFO.
4. Out Frame
   - The current number of frames in the FIFO.
5. Job ID
   - In IPGScan, this represents the Group ID of the most recently completed group.
6. Object ID
   - In IPGScan, this represents a count of the number of objects started by the scan controller in the current group.
7. Frame ID
   - An incrementing count of the number of frames executed by the scan controller.
8. Issued Object ID
   - In IPGScan, this represents a count of the number of objects sent to the FIFO.
9. Out Stalled

7.4.6 Registers



Registers

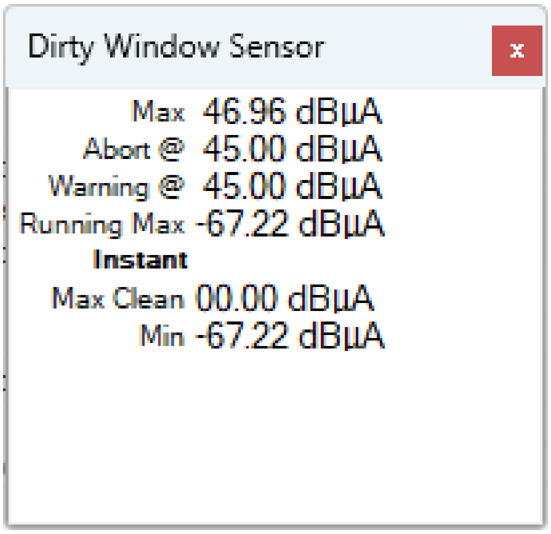
x

Register 1
Register 2
Register 3
Register 4
Register 5
Register 6
Register 7
Register 8
Register 9
Register 10
Register 11
Register 12
Register 13

Figure 56: Registers

Figure 56 shows the registers window. This window shows the current value of all registers in IPGScan.

7.4.7 Dirty Window Sensor



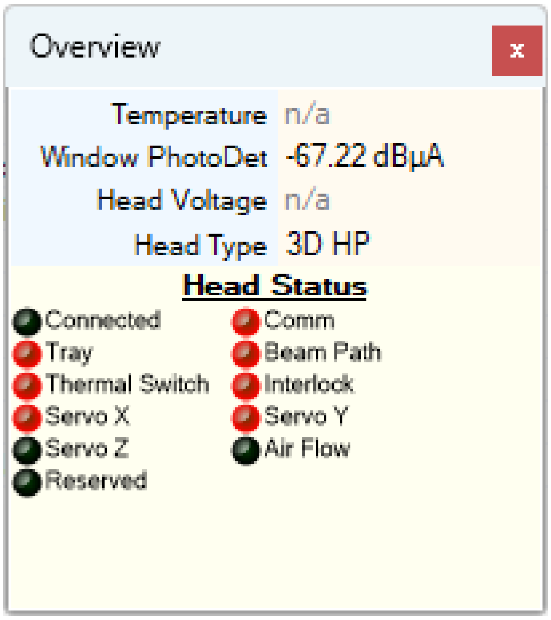
Max 46.96 dBµA
Abort @ 45.00 dBµA
Warning @ 45.00 dBµA
Running Max -67.22 dBµA
Instant
Max Clean 00.00 dBµA
Min -67.22 dBµA

Figure 57: Dirty Window Sensor

Figure 57 shows the Dirty Window Sensor window, which displays data recorded by the dirty window sensor.

1. Max
    - The maximum possible value.
2. Abort @
    - If the dirty window sensor reads a value at or above this value, the currently executing job will abort.
3. Warning @
    - If the dirty window sensor reads a value at or above this value, a warning will display on the screen. This will not interrupt execution.
4. Running Max
    - The maximum value read by the dirty window sensor during this tracked segment. The tracked segment can be reset by right clicking on the words "Running Max."
5. Instant
    - The current value read by the dirty window sensor.
6. Max Clean
    - The Max Clean value from the options.
7. Min
    - The minimum possible value.

7.4.8 Overview



Overview

Temperature	n/a
Window PhotoDet	-67.22 dBµA
Head Voltage	n/a
Head Type	3D HP

Head Status

● Connected	● Comm
● Tray	● Beam Path
● Thermal Switch	● Interlock
● Servo X	● Servo Y
● Servo Z	● Air Flow
● Reserved	

Figure 58: Overview

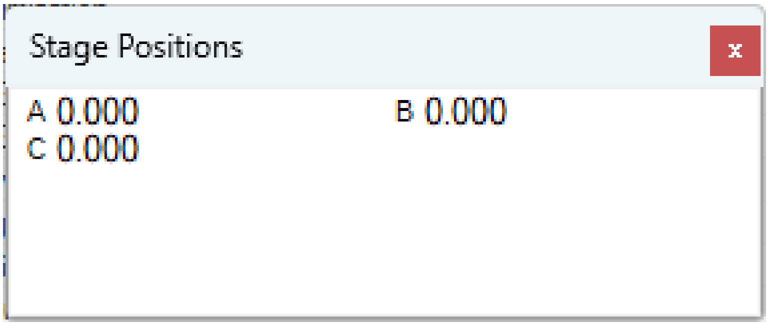
Figure 58 shows the overview window. This window shows general information about the scanner system.

1. Temperature
   - The temperature inside of scan head
2. Window PhotoDetector
   - The current value of the dirty window sensor
3. Head Voltage
   - The voltage supplied to the scanning head
4. Head Type
   - The scanning head type
5. Head Status Indicators
   - Connected – True when the laser is connected to the scanning head.
   - Tray – True when the tray is deployed.
   - Thermal Switch – True when the scanner overheats
   - Servo X/Y/Z – True when there is a problem with one of the galvos.
   - Reserved
     - Reserved for future use
   - Comm
   - Beam Path
   - Interlock
     - The status of the fiber interlock in the scan head

- Air Flow
  - The status of the airknife for the system

7.4.9 Stage Positions

Figure 59 shows the Stage Positions window. This window will keep updated with the current position of the stage system. This does not work with robots for robot tracking.



Stage Positions

A 0.000

B 0.000

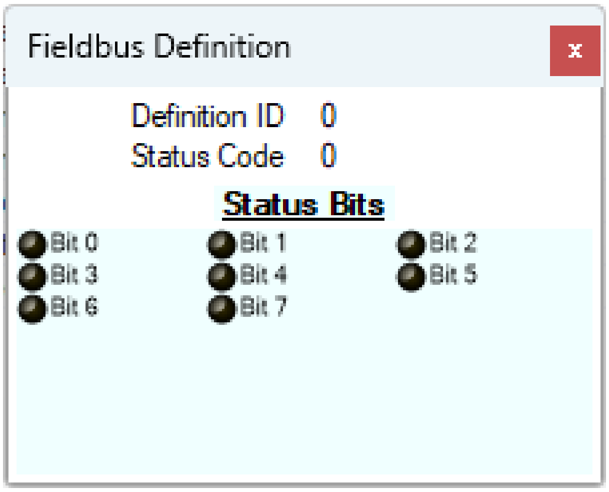
C 0.000

Figure 59: Stage Positions

IMPORTANT Users must have the "Interface Board" selection set to "Motion IO" to display the Stage Positions window in recent releases of IPGScan.

7.4.10 Fieldbus Definition

Figure 60 shows the Fieldbus Definition Window.



Fieldbus Definition

Definition ID 0

Status Code 0

Status Bits

● Bit 0 ● Bit 1 ● Bit 2

● Bit 3 ● Bit 4 ● Bit 5

● Bit 6 ● Bit 7

Figure 60: Fieldbus Definition

1. Definition ID
   - This field has a value of 1 when fieldbus is enabled and 0 when fieldbus is disabled.

2. Status Code
    - Displays the numerical software status code
3. Status Bits
    - Bit 0...Bit 8 – User configurable status settings for the Fieldbus

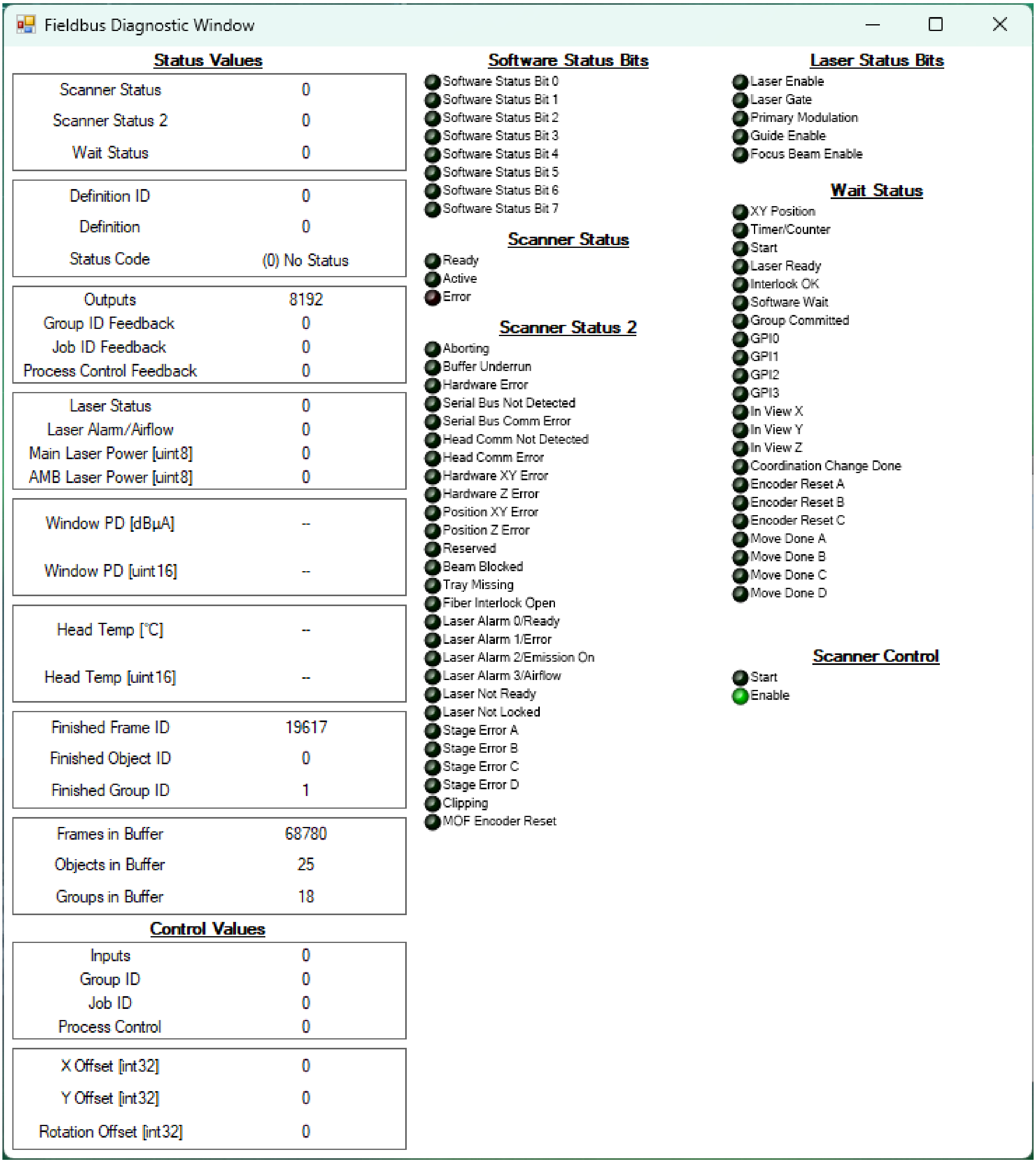
      Do the following to configure the status settings:

      - From the View menu, select **Options→Fieldbus Control→Fieldbus Status Configuration**.
      - Select the status(es) that you want to configure.
      - For each status that you select, select a status bit from the **Status Bit** dropdown and a status type from the **Status Type** dropdown.

        You can configure up to eight status bits.

7.4.11 Fieldbus Diagnostic Window

Figure 61 shows the Fieldbus Diagnostic Window.



Fieldbus Diagnostic Window

Status Values

Scanner Status	0
Scanner Status 2	0
Wait Status	0
Definition ID	0
Definition	0
Status Code	(0) No Status
Outputs	8192
Group ID Feedback	0
Job ID Feedback	0
Process Control Feedback	0
Laser Status	0
Laser Alarm/Airflow	0
Main Laser Power [uint8]	0
AMB Laser Power [uint8]	0
Window PD [dBµA]	--
Window PD [uint16]	--
Head Temp [°C]	--
Head Temp [uint16]	--
Finished Frame ID	19617
Finished Object ID	0
Finished Group ID	1
Frames in Buffer	68780
Objects in Buffer	25
Groups in Buffer	18

Control Values

Inputs	0
Group ID	0
Job ID	0
Process Control	0
X Offset [int32]	0
Y Offset [int32]	0
Rotation Offset [int32]	0

Software Status Bits

- ● Software Status Bit 0
- ● Software Status Bit 1
- ● Software Status Bit 2
- ● Software Status Bit 3
- ● Software Status Bit 4
- ● Software Status Bit 5
- ● Software Status Bit 6
- ● Software Status Bit 7

Scanner Status

- ● Ready
- ● Active
- ● Error

Scanner Status 2

- ● Aborting
- ● Buffer Underrun
- ● Hardware Error
- ● Serial Bus Not Detected
- ● Serial Bus Comm Error
- ● Head Comm Not Detected
- ● Head Comm Error
- ● Hardware XY Error
- ● Hardware Z Error
- ● Position XY Error
- ● Position Z Error
- ● Reserved
- ● Beam Blocked
- ● Tray Missing
- ● Fiber Interlock Open
- ● Laser Alarm 0/Ready
- ● Laser Alarm 1/Error
- ● Laser Alarm 2/Emission On
- ● Laser Alarm 3/Airflow
- ● Laser Not Ready
- ● Laser Not Locked
- ● Stage Error A
- ● Stage Error B
- ● Stage Error C
- ● Stage Error D
- ● Clipping
- ● MOF Encoder Reset

Laser Status Bits

- ● Laser Enable
- ● Laser Gate
- ● Primary Modulation
- ● Guide Enable
- ● Focus Beam Enable

Wait Status

- ● XY Position
- ● Timer/Counter
- ● Start
- ● Laser Ready
- ● Interlock OK
- ● Software Wait
- ● Group Committed
- ● GPI0
- ● GPI1
- ● GPI2
- ● GPI3
- ● In View X
- ● In View Y
- ● In View Z
- ● Coordination Change Done
- ● Encoder Reset A
- ● Encoder Reset B
- ● Encoder Reset C
- ● Move Done A
- ● Move Done B
- ● Move Done C
- ● Move Done D

Scanner Control

- ● Start
- 🟢 Enable

Figure 61: Fieldbus Diagnostic Window

1. Status Values

   - **Scanner Status** – A unique identifier that informs the state of all scanner status bits and the definition ID
   - **Scanner Status 2** – A unique identifier that informs the status of all Scanner Status two bits Wait Status
   - **Wait Status** – A unique identifier that informs the status of all the wait status bits
   - **Definition ID** – Definition ID (currently only definition 1 is supported). This value is 0 when fieldbus is disabled
   - **Definition** – A subset of the scanner status
   - **Status Code** – All software statuses are associated with a status code. Each code is associated with only one status
   - **Outputs** – A unique identifier that informs the state of all General Purpose Outputs
   - **Group ID Feedback** – Feedback confirming the group ID that was just finished successfully
   - **Job ID Feedback** – Feedback confirming the Job ID that was just finished successfully
   - **Process Control Feedback** – Feedback confirming the Process Control selection that was just finished successfully
   - **Laser Status** – A unique identifier that informs the state of all Laser Status Bits including the Laser Alarm/Airflow, Main Laser Power, and AMB Laser Power
   - **Laser Alarm/Airflow** – Pressure switch in ICC loses air pressure and synchronization
   - **Main Laser Power** – Power in watts that the laser is firing at
   - **AMB Laser Power** – Power in watts for the ring
   - **Window PD (dBuA)** – The value of the dirty window sensor, encoded as a signed integer in units of [0.01*dBuA)
   - **Window PD (unit 16)** – The value of the dirty window sensor in an unsigned integer to be read by external devices
   - **Head Temp** – The value of the thermistor in the scan head, encoded as an unsigned integer in units of 0.01*degrees C
   - **Head Temp (unit 16)** – The value of the thermistor in the scan head in unsigned integer to be read by external devices
   - **Finished Frame ID** – The ID of the frame that was last output by the scan controller
   - **Finished Object ID** – The ID of the object that was last output by the scan controller
   - **Finished Group ID** – The ID of the group that was last output by the scan controller
   - **Frames In Buffer** – The number of frames stored in the scan controllers' buffer now

- **Objects In Buffer** – The number of objects in the scan controllers' buffer
- **Groups In Buffer** – The number of Groups in the scan controller buffer

2. Control Values

   - **Inputs –** A unique identifier that informs the state of all Port A bits
   - **Group ID –** Group ID for selecting a group in Fieldbus Control Mode
   - **Job ID –** Job Id for selecting a job in Fieldbus Control Mode
   - **Process Control –** Process Control for setting the process mode in Fieldbus Control Mode
   - **X Offset –** An offset along the x axis sent from an external device
   - **Y Offset –** An offset along the y axis sent from an external device
   - **Rotation Offset –** A rotational offset about the z axis sent from an external device

3. Software Status Bits

   - Software Status Bit 0...Software Status Bit 8 – User configurable status settings for the Fieldbus

     Do the following to configure the status settings:

     – From the View menu, select **Options→Fieldbus Control→Fieldbus Status Configuration**.

     – Select the status(es) that you want to configure.

     – For each status that you select, select a status bit from the **Status Bit** dropdown and a status type from the **Status Type** dropdown.

     You can configure up to eight status bits.

4. Scanner Status

   - **Ready** – When lit, indicates that a process is ready to output
   - **Active** – When lit, indicates that the process is outputting
   - **Error** – When lit, indicates there is an error in the process output

5. Scanner Status 2

   - **Aborting –** When lit, indicates the controller is aborting the current process
   - **Buffer Underrun –** When lit, indicates the controller is experiencing a Buffer Underrun
   - **Hardware Error –** When lit, indicates there is a hardware error in the scan controller
   - **Serial Bus Not detected –** When lit, indicates the SBUS Cable between the SFI Device and the scan controller is not detected
   - **Serial Bus Comm Error –** When lit, indicates there is a communication error between the sfi device and the scan controller
   - **Head Comm Not Detected –** When lit, indicates there is no communication between the scan head and scan controller
   - **Head Comm Error –** When lit, indicates there is a communication error between the scan head and the scan controller

- **Hardware XY Error –** When lit, indicates there is a hardware error in the X or Y galvo, or the galvo is not present
- **Hardware Z Error –** When lit, indicates there is a position error in the Z galvo. This must be enabled in IPG Scan
- **Beam Blocked –** When lit, indicates the beam from the fiber is currently blocked
- **Tray Missing –** When lit, indicates the dirt tray is not present
- **Fiber Interlock Open –** When lit, indicates the scan controller is trying to open the fiber interlock
- **Laser Alarm 0/Ready –** The status of the Laser Alarm0 or Ready Signal from the laser (feedback from laser must be wired to scan controller if Unified Analog connector is not used)
- **Laser Alarm 1/Error –** The status of the laser alarm 1 or error signal from the laser (feedback from laser must be wired to scan controller if Unified Analog connector is not used)
- **Laser Alarm 2/ Emission on –** The status pf the laser alarm 2 or Emission on signal from the laser (feedback from the laser must be wired to scan controller)
- **Laser Alarm 3/ Airflow –** The status of the laser alarm 3 or airflow from the sensor connected to the scan controller (feedback from laser must bet wired to scan controller if unified analog is not used)
- **Laser Not Ready –** An indication if the laser ready for emission based on a subset of the previous for signals, depending on the laser type
- **Laser Not Locked –** An indication of the scan controller's synchronization with the laser clock. Only applicable for some lasers
- **Stage Error A –** When lit, indicates there is an error on the Stage A
- **Stage Error B –** When lit, indicates there is an error on the Stage B
- **Stage Error C –** When lit, indicates there is an error on the Stage C
- **Stage Error D –** When lit, indicates there is an error on the Stage D
- **Clipping –** When lit, indicates there is a clipping error
- **MOF Encoder Reset –** When lit, indicates the encoder has reset during a weld

6. Laser Status Bits

   - **Laser Enable –** Enable is the first latch (arms laser, queuing up so ready), analog power sets power
   - **Laser Gate –**
   - **Primary Modulation –**
   - **Guide Enable –** When lit, indicates the guide beam is enabled
   - **Focus Beam Enable –** When lit, indicates the focus guide beam is enabled

7. Wait Status

   - **XY Position –** When lit, indicates the scan controller is waiting for the X and Y galvos to be in position

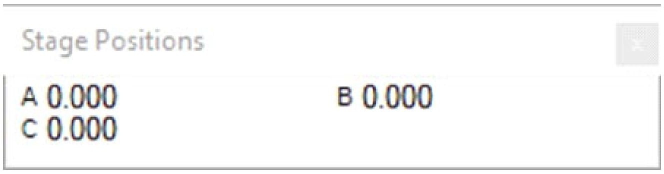
- **Timer/Counter –** When lit, indicates the scan controller is waiting for a timer or a counter
- **Start –** When lit, indicates the scan controller is waiting for the start input signal
- **Laser Ready –** When lit, indicates the scan controller is waiting for the laser to be ready
- **Interlock OK –** When lit, indicates the scan controller is waiting for the interlocks to be satisfied
- **Software Wait –** When lit, indicates the scan controller is waiting for the software command
- **Group Committed –** When lit, indicates the scan controller is waiting for a group to be fully committed to the buffer
- **GPI01 –** When lit, indicates the scan controller is waiting for the GPI01 input signal
- **GPI02 –** When lit, indicates the scan controller is waiting for the GPI02 input signal
- **GPI03 –** When lit, indicates the scan controller is waiting for the GPI03 input signal
- **In View X –** When lit, indicates the Scan controller is waiting for the upcoming vector to be within the X range of the in view window
- **In View Y –** When lit, indicates the Scan controller is waiting for the upcoming vector to be within the Y range of the in view window
- **In View Z –** When lit, indicates the Scan controller is waiting for the upcoming vector to be within the Z range of the in view window
- **Coordination Change Done –** When lit, indicates the scan controller is waiting for the change in coordination modes to finish
- **Encoder Reset A –** When lit, indicates the scan controller is waiting for the A encoder to finish resetting
- **Encoder Reset B –** When lit, indicates the scan controller is waiting for the B encoder to finish resetting
- **Encoder Reset C –** When lit, indicates the scan controller is waiting for the C encoder to finish resetting
- **Move Done A –** When lit, indicates the scan controller is waiting for the A stage to finish moving
- **Move Done B –** When lit, indicates the scan controller is waiting for the B stage to finish moving
- **Move Done C –** When lit, indicates the scan controller is waiting for the C stage to finish moving
- **Move Done D –** When lit, indicates the scan controller is waiting for the D stage to finish moving

8. Scanner Control

   - **Start –** When lit, indicates the Start signal is active.
   - **Enable –** When lit, indicates the scanner control is enabled.

7.4.12 Stage Positions

Figure 62 shows the Stage Positions window. This window will keep updated with the current position of the stage system. This does not work with robots for robot tracking.



A 0.000
B 0.000
C 0.000

Figure 62: Stage Positions window

7.5 Port Logs

Port Logs allow users to view the TCP or Serial commands between IPGScan and an external device. Figure 63 shows the Port Logs Window. If this window is not visible, click on "Port Logs" under the View dropdown menu.

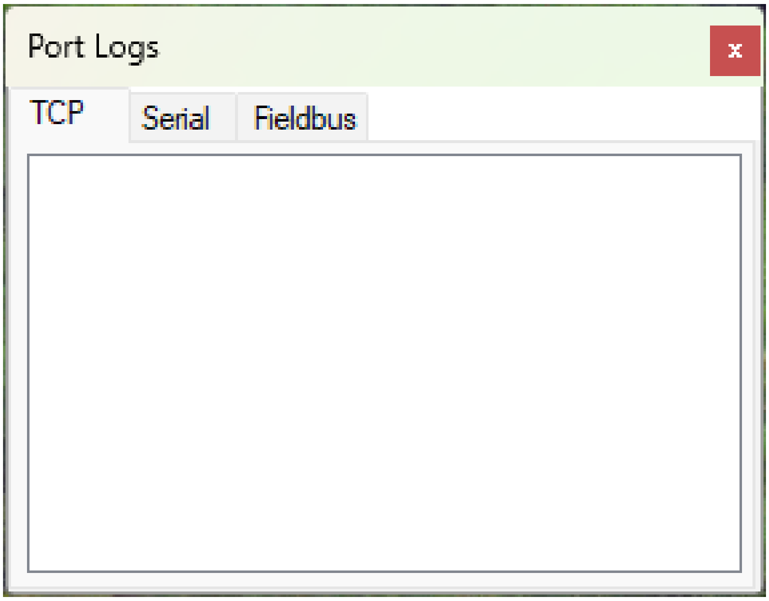
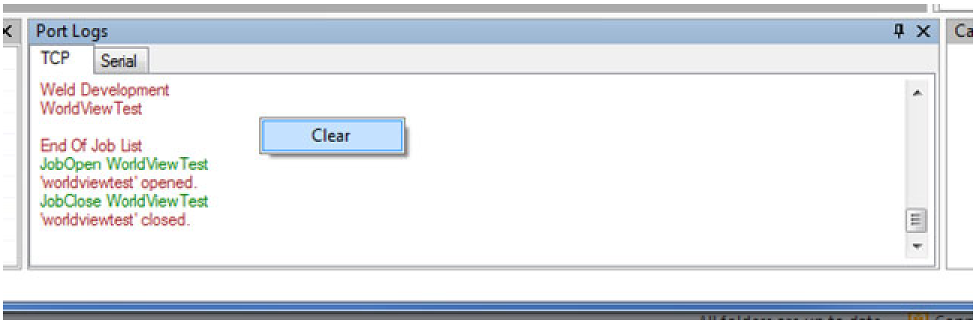


Figure 63: Port Logs

To clear this window, right-click on the Port Logs window and click "Clear" (see Figure 64).



```
Weld Development
WorldViewTest

End Of Job List
JobOpen WorldViewTest
'worldviewtest' opened.
JobClose WorldViewTest
'worldviewtest' closed.
```

Figure 64: Clear Port Logs

7.6 IPGScan Objects

The following table (Table 6) outlines the processing objects which can be added to an IPGScan job. Objects can be added by clicking on its icon in the toolbar, in the "Tools" dropdown menu, or by using the corresponding keyboard shortcut. Some objects are processing objects which will cause the laser to fire when run; other objects are reference objects. Reference objects can be viewed in IPGScan and are meant to assist the user in placing processing objects and visualizing entire systems.

Table 6: IPGScan Objects

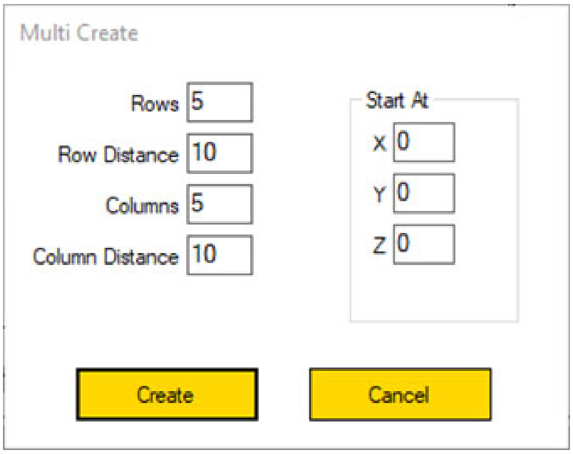
Object	Icon	Keyboard Shortcut	Object Type
Point	◆	CTRL+ALT+P	Processing
Point Array	⁞⁞⁞	CTRL+ALT+A	Processing
Line	╱	CTRL+ALT+L	Processing
Circle	○	CTRL+ALT+C	Processing
Rectangle	□	CTRL+ALT+R	Processing
Spiral	🌀	CTRL+ALT+S	Processing
Sine Wave	∿	CTRL+ALT+W	Processing
Zigzag	ΛΛΛ	CTRL+ALT+Z	Processing
C Shape	C	CTRL+ALT+E	Processing
S Shape	S	CTRL+ALT+X	Processing
Text	T	CTRL+ALT+T	Processing
Hershey Text	DXF	CTRL+ALT+H	Processing
DXF	DXF	CTRL+ALT+D	Processing
STL	STL	CTRL+ALT+Y	Reference
SVG	SVG	CTRL+ALT+V	Processing

Table 6: IPGScan Objects (Continued)

Object	Icon	Keyboard Shortcut	Object Type
STEP	STEP	CTRL+ALT+G	Reference
Multi Shape	⤴	CTRL+ALT+Y	Processing
Points	⁘	CTRL+ALT+O	Processing
Action Control	🎬	CTRL+ALT+N	Processing

7.6.1 Multiple Creation

Multiple IPGScan objects can be created at the same time. To create multiple instances of the same object, "CTRL + click" on the shape icon in the toolbar. The "Multi Create" window shown in Figure 65 (below) will appear to help the user create an array of the desired object. The user is asked to specify the number of desired rows and columns, the distance separating the columns and rows, and the coordinate at which to start creating instances.



Multi Create

Rows: 5
Row Distance: 10
Columns: 5
Column Distance: 10

Start At
X: 0
Y: 0
Z: 0

Figure 65: Multi Create Window

7.6.2 Configuration Parameters

Each IPGScan Object has several configuration parameters which control different properties of the object. Section 7.6.2.1 (below) describes the parameters which are common to most IPGScan objects. Section 7.6.2.1.3 on page 99 describes the parameters which are specific for a subset of IPGScan objects.

7.6.2.1 Common Configuration Parameters

- Max Length

  - Max Length defines the maximum segment length. Segments longer than this value will be split into multiple segments. This can be used with the features like Energy Offset.
  - A value of 0 will leave segments at their specified length.
- Locked
  - When true, all properties of the locked object will be hidden and un-editable.
- Object Pose
  - Center – (X, Y, Z) coordinates, in the document units, of the center of the object
  - Rotation – rotation angle, in degrees, of the object about each axis
- Global Pose
  - An additional pose used with Robot On-The-Fly jobs
- Apply Offsets
  - See Section 7.6.2.1.1 (below).
- Reverse
  - When true, the direction and execution order of the vectors or points of the object will be reversed.
- Loop
  - Defines the number of times to execute the object.
- Fill
  - See Section 7.6.2.1.2 on page 98.

7.6.2.1.1 Apply Offsets

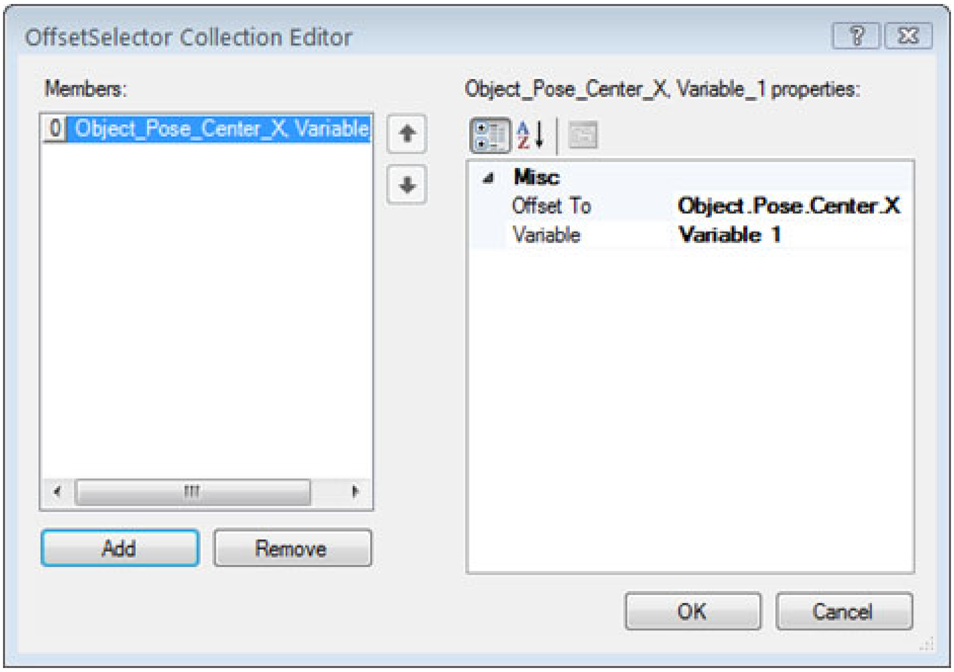
When Apply Offsets is enabled, users have the ability to change object parameters (position, rotation, and process parameters) using register values during the execution of a job.

To use Offsets:

1. Select the desired feature(s) in the Job Tree.
2. Set Apply Offsets to True in the parameter window.

   This causes Offsets to appear within the parameter window.
3. Click on the ellipsis in the Offsets box.

   The OffsetSelector Collection Editor will appear (see Figure 66 on page 97).


OffsetSelector Collection Editor
Members:
0 Object_Pose_Center_X Variable
Add
Remove
Object_Pose_Center_X, Variable_1 properties:
OK
Cancel

Misc

Offset To: Object.Pose.Center.X

Variable: Variable 1

Figure 66: OffsetSelector Collection Editor

4. In the OffsetSelector Collection Editor, click the Add button in order to add an offset.
5. Under the "Properties" section, set the "Offset To" parameter to the desired feature to be offset.
    - The following parameters can have offsets applied
        - Object.Pose.Center.X
        - Object.Pose.Center.Y
        - Object.Pose.Center.Z
        - Object.Pose.Rotation.X
        - Object.Pose.Rotation.Y
        - Object.Pose.Rotation.Z
        - Scale X
        - Scale Y
        - Scale Z
        - Velocity
        - Power
        - Pulse Width
        - Pulse Frequency
        - Keyhole Time
        - Energy
        - Pitch
        - Relative Speed
        - Frequency

6. Once a parameter has been selected for offset, set the Variable that will be referenced for the offset data. (For loading data into registers, please refer to Section 7.9.10 on page 168.)
7. Repeat steps 4 and 5 until all desired offsets are applied to the feature(s).
8. Once all desired offsets are applied, close and save the OffsetSelector Collection Editor box by clicking on OK.

7.6.2.1.2 Fill

Some objects can be filled with vectors. If Fill is being used, the following configuration parameters are used.

- Beam Diameter - The beam diameter of the optical setup. This is applied as a buffer around the shape outline.
- Fill Angle – the angle of the fill vectors in degrees
- Fill Pitch – the distance between the fill vectors
- Shape Outline – when true, the outline of the object will be output by the scanner as well as the fill vectors
- Fill Direction
  - Unidirectional – all fill vectors will be in the same direction
  - Bidirectional – each fill vector will alternate the execution direction
- Fill Type
  - EdgeToEdge – The fill vectors will start and end on opposite edges of the object (Figure 67)
  - IsoGrid – Every other fill vector will be offset along the direction of the vector (Figure 68)
  - Orthogonal – The start and ending points of the fill vectors will be in line if possible (Figure 69)

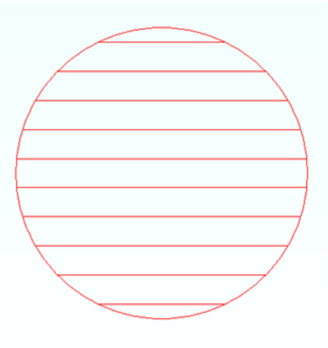


Figure 67: Edge To Edge Fill

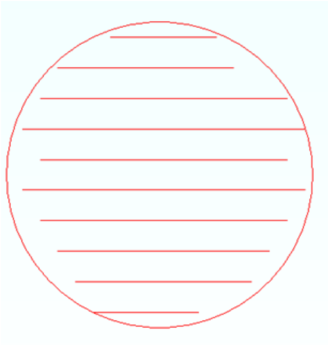


Figure 68: IsoGrid Fill

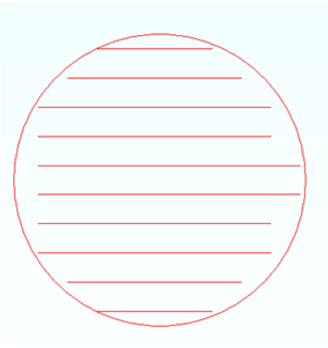


Figure 69: Orthogonal Fill

7.6.2.1.3 Sort

There are two algorithms for sorting vectors. Table 7 describes these algorithms.

Table 7: Sort Algorithms

Algorithm Name	DESCRIPTION
LinkSize	Sort all vectors by choosing the closest starting point to the end point of the current vector.
Polyline	Sort all vectors such that each shape is executed before moving on to the next shape.
StartProximity	Sort all vectors by choosing the next closest start point to the start point of the current vector.

7.6.2.2 Shape Specific Configuration Parameters

7.6.2.2.1 Point Array

- Height – the height of the point array in distance units
- Width – the width of the point array in distance units
- Distance – the space between points in distance units
- Direction
  - Unidirection – each row of the point array will be ordered in the same direction
  - Bidirectional – each row of the point array will alternate its order so the execution order will snake around the point array
- Projection – the layout of the point array. See the fill types in Section 7.6.2.1.2 on page 98.

7.6.2.2.2 Line

- Length – the length of the line in distance units

7.6.2.2.3 Circle

- Radius – radius of the circle
- Start Angle – starting angle (in degrees) of the circle. For example, if the starting angle is 0, it means the circle starts at 3 o'clock; and if the starting angle is 270, it means the circle starts at 6 o'clock.
- End Angle – ending angle (in degrees) of the circle. For example, if the ending angle is 90, it means the circle ends at 12 o'clock; and if the ending angle is 270, it means the circle ends at 6 o'clock.
- “Start Angle" and "End Angle" together define the portion of a circle; It can be a full circle, multiple revolutions, or an arc. Together they also define the direction of the circle. For example, with a "Start Angle" of 180 degrees and an "End Angle" of 90 degrees, the circle would start at 9 o'clock and continues clockwise until it ends at 12 o'clock (see Figure 70 on page 100).

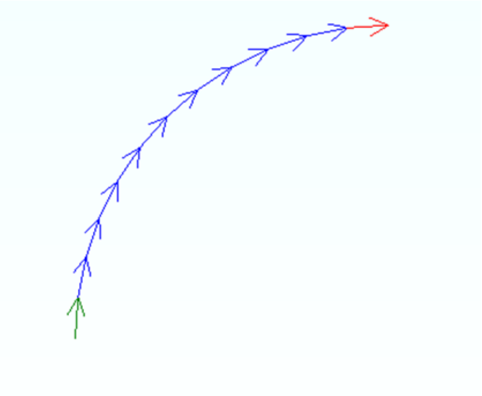


Figure 70: Partial Circle Example

"Points Per Revolution – defines the number of points for each revolution of the circle (See Figure 71, Figure 72, and Figure 73).

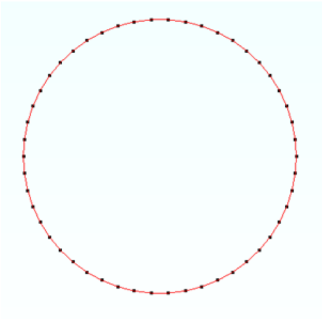


Figure 71: Circle with 50 Points per Revolution

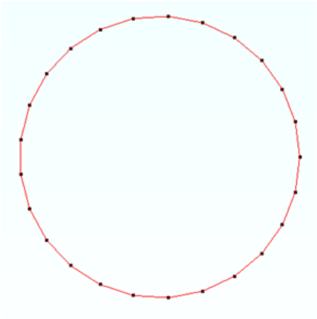


Figure 72: Circle with 25 Points per Revolution

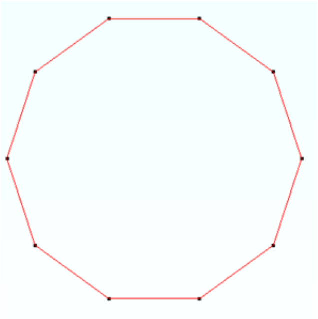


Figure 73: Circle with 10 Points per Revolution

- Z Step – defines the increase in Z coordinate per revolution. For example, a circle with a start angle of 0 degrees, an end angle of 720 degrees, and a Z step of 1mm looks like the pattern in Figure 74.

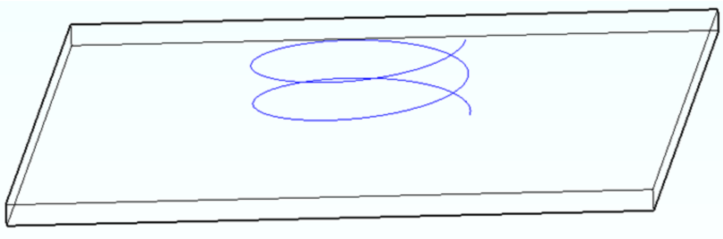


Figure 74: Circle with Z Step Example

- Scale – changes the object's size by the specified factor in each axis.

7.6.2.2.4 Rectangle

- Height – the height of the rectangle
- Width – the width of the rectangle

- Corner Radius – the radius of the corners of the rectangle. The example in Figure 75 shows a rectangle of 15mm by 10mm with a corner radius of 2mm.

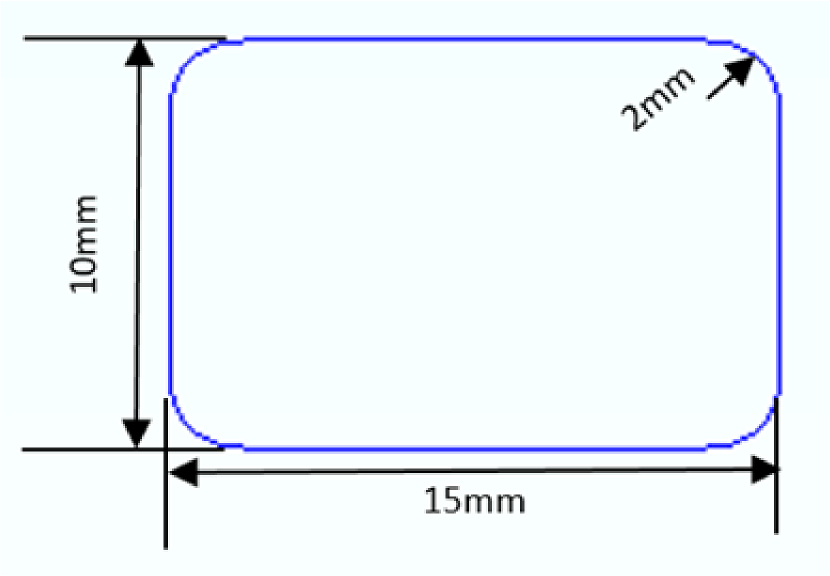


Figure 75: Corner Radius Rectangle Example

- Segment – the number of segments in the rectangle. Segments less than 4 will leave an open rectangle; Segments greater than 4 will repeat the edges of the rectangle.

7.6.2.2.5 Spiral

- Length – length of the spiral
- Width – width of the spiral
- Points Per Revolution – number of points for each revolution
- Z Step – defines the increase in Z coordinate (in mm) per revolution. The example below shows a spiral with a z-step of 2 (mm).

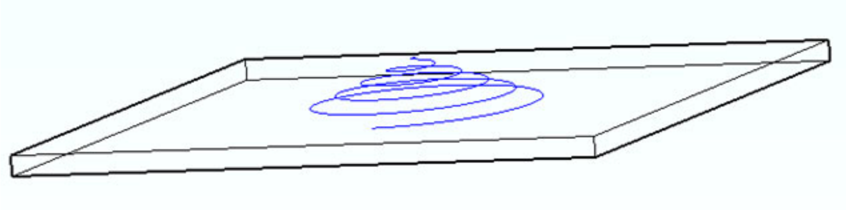


Figure 76: Spiral Z Step Example

- Exclusion Radius – the radius at which the spiral ends. The example below shows a spiral with width & length of 25mm and an exclusion radius of 5mm.

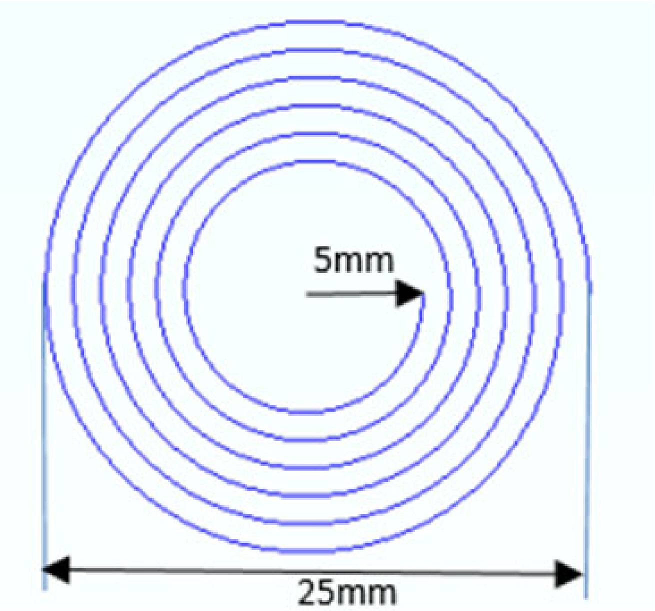


Figure 77: Spiral Exclusion Radius

7.6.2.2.6 Zigzag

- Height – height (in mm) of the zigzag shape
- Width – width (in mm) of the zigzag shape
- Segment – number of segments in the zigzag shape. The example below shows a zigzag with height of 4mm, width of 10mm and segment of 10.

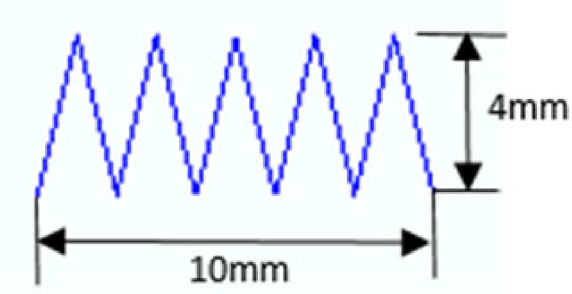


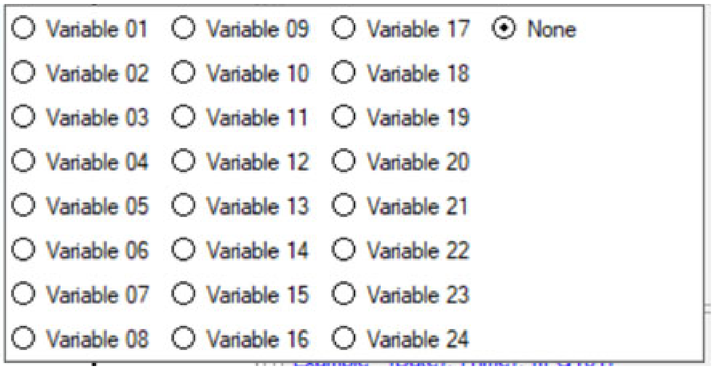
Figure 78: Zigzag Segments

7.6.2.2.7 C Shape and S Shape

- Height – height of the shape
- Width – width of the shape
- Corner Radius – radius of the corners
- Segment – additional length starting at the beginning and end of each shape
- Scale – changes the object's size by the specified factor in each axis.
- Aspect Ratio – if true, the same scale factor will be used for all axes.

7.6.2.2.8 Text

- Text – the string to display
- Font – the font to use to display the string
- Font Style – stylization of the string. Options include: Regular, Bold, Italic, Underline, Strikeout.
- Height – the height of the text in distance units
- Width – the width of the text in distance units. As height is adjusted, this value will not change.
- Width % – set the width as a percentage of the original width. As height is adjusted, the resulting width of the text will scale.
- Dynamic text – if the text content is to be dynamically loaded, choose one of the variables in the list (see Figure 79) to store the dynamic text content. You can refer to Figure 7.9.10 on page 168 for loading a value to a variable. For static text content, keep 'None' checked and define the text content in 'Text' field.



○ Variable 01 ○ Variable 09 ○ Variable 17 ◉ None
○ Variable 02 ○ Variable 10 ○ Variable 18
○ Variable 03 ○ Variable 11 ○ Variable 19
○ Variable 04 ○ Variable 12 ○ Variable 20
○ Variable 05 ○ Variable 13 ○ Variable 21
○ Variable 06 ○ Variable 14 ○ Variable 22
○ Variable 07 ○ Variable 15 ○ Variable 23
○ Variable 08 ○ Variable 16 ○ Variable 24

Figure 79: Dynamic Text Variable List

- Wrap Circle – defines if the text is to be wrapped along a circle
- Wrap Circle Radius – defines the radius of the circle that the text to be wrapped along if 'Wrap Circle' is set to true. The example below shows the text with wrap circle set to 'True' and 'Wrap Circle Radius' of 10mm.

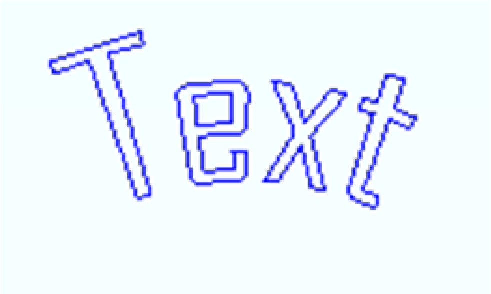


Figure 80: Text Wrap Circle Example

- Scale – changes the object's size by the specified factor in each axis.
- Aspect Ratio – if true, the same scale factor will be used for all axes.

7.6.2.2.9 Hershey Text

- Text – defines the text that will be displayed
- Font Size – defines font size of the Hershey Text
- Dynamic Text – if the text content is to be dynamically loaded, choose one of the variables in the list (see Figure 79 on page 103) to store the dynamic text content. You can refer to 'Action Control' -> 'Load Register' action on how to load a value to a variable. For static text content, keep 'None' checked and define the text content in 'Text' field.
- Wrap Circle – defines if the H text is to be wrapped along a circle
- Wrap Circle Radius – defines the radius (in mm) of the circle that the text to be wrapped along if 'Wrap Circle' is set to true. The example below shows the text with wrap circle set to 'True' and 'Wrap Circle Radius' of 10 (mm).

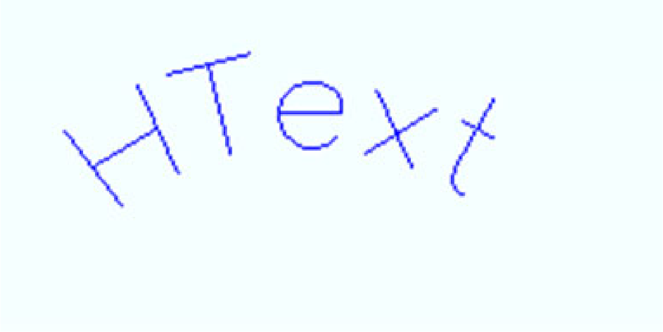


Figure 81: Hershey Text Circle Wrap Example

- Scale – changes the object's size by the specified factor in each axis.
- Aspect Ratio – if true, the same scale factor will be used for all axes.

7.6.2.2.10 DXF

- Scale – changes the object's size by the specified factor in each axis.
- Aspect Ratio – if true, the same scale factor will be used for all axes.

7.6.2.2.11 STL

- Transparency – adjust the opacity of the displayed model
- Color – adjust the color of the displayed model
- Scale – changes the object's size by the specified factor in each axis.
- Aspect Ratio – if true, the same scale factor will be used for all axes.

7.6.2.2.12 SVG

- Scale – changes the object's size by the specified factor in each axis.
- Aspect Ratio – if true, the same scale factor will be used for all axes.

7.6.2.2.13 STEP

- Transparency – adjust the opacity of the displayed model
- Color – adjust the color of the displayed model

- Scale – changes the object's size by the specified factor in each axis.
- Aspect Ratio – if true, the same scale factor will be used for all axes.

7.6.2.2.14 Multi Shape

- Scale – changes the object's size by the specified factor in each axis.
- Aspect Ratio – if true, the same scale factor will be used for all axes.

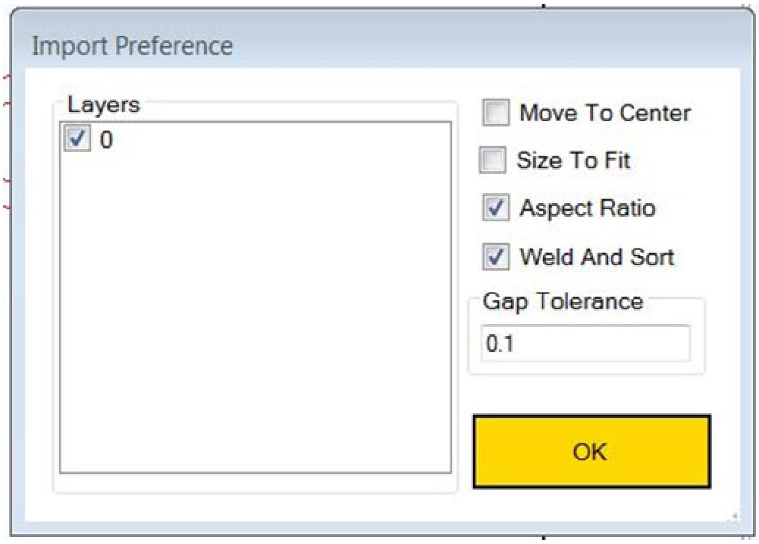
7.6.2.2.15 Points

- Scale – changes the object's size by the specified factor in each axis.
- Aspect Ratio – if true, the same scale factor will be used for all axes.

7.6.3 Extended Object Descriptions

7.6.3.1 DXF

DXFs are imported as a series of vectors from the original DXF. The File Explorer will then open so that a DXF file can be selected. After selecting a DXF file, the import preferences are shown (see Figure 82).



Import Preference

Layers
☑ 0

□ Move To Center
□ Size To Fit
☑ Aspect Ratio
☑ Weld And Sort

Gap Tolerance
0.1

Figure 82: DXF Import Preferences

There are six sections of the Import Preferences:

- On the left of the Import Preferences window, there is a list of all layers present in the DXF. All selected layers will be imported into IPGScan.
- The "Move To Center" checkbox will set the imported object's X and Y Center so that the imported object will appear at the IPGScan origin.
- The "Size To Fit" checkbox will adjust the imported object's Scale value so the imported object will be the maximum size for the canvas size.
- If the "Aspect Ratio" checkbox is checked, the Aspect Ratio of the original DXF will be maintained while calculating "Size To Fit."

- Weld and Sort" joins potentially "broken" vectors and makes laser output more consistent throughout the DXF object. Any vectors that are disconnected by less than the specified "Gap Tolerance" will be joined so that the laser does not turn off and then on again. This feature also changes the direction of all vectors to be continuous. This feature is generally intended for welding objects in order to prevent the laser from starting and stopping throughout the weld object.

  The order of the vectors in a DXF object is the same as the order of vectors in the original DXF file. To adjust this order after importing, convert the DXF object into a Multi Shape object. You are not able to convert objects back to a DXF type.

7.6.3.2 STL and STEP

3D CAD models can be imported into IPGScan from STL or STEP files. These models can be used in IPGScan as reference for process objects.

7.6.3.2.1 Transparency

STL and STEP objects will be opaque when imported. The Transparency property will change the transparency of the displayed object. For the Transparency property, a value of 0 is 0% transparent; a value of 255 is 100% transparent (See Figure 83, Figure 84, and Figure 85).

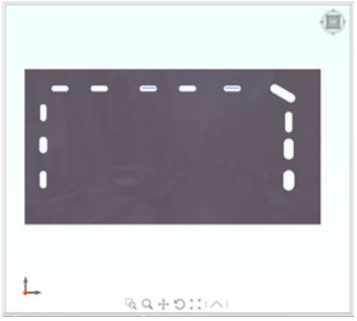


Figure 83: STL Transparency 0

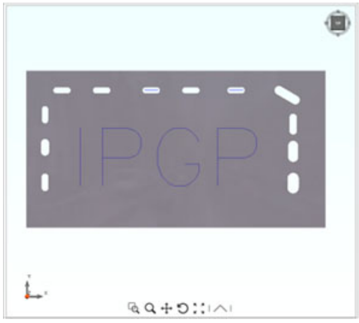


Figure 84: STL Transparency 127

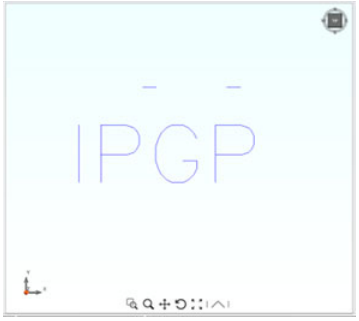
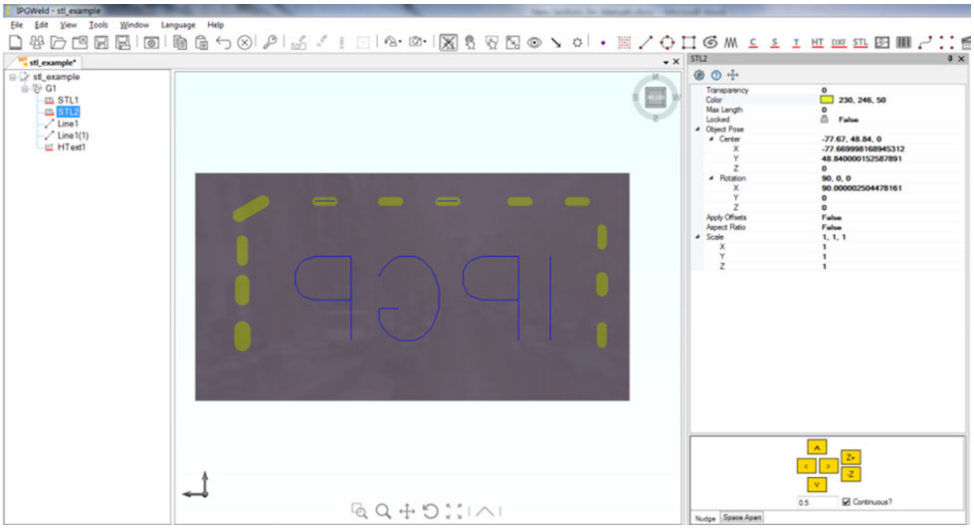


Figure 85: STL Transparency 255

7.6.3.2.2 Color

The Color property changes the display color of the STL object or STEP object within IPGScan. Each imported STL object has a different color to help distinguish different objects. The color can be changed by entering a different RGB value or selecting from a list. An example job containing two STL objects with different colors is shown below.



Transparency	0
Color	🟨 230, 246, 50
Max Length	0
Locked	False
Object Pose	
Center	-77.67, 48.84, 0
X	-77.669998168945312
Y	48.840000152587891
Z	0
Rotation	90, 0, 0
X	90.000002504478161
Y	0
Z	0
Apply Offsets	False
Aspect Ratio	False
Scale	1, 1, 1
X	1
Y	1
Z	1

0.5 ☑ Continuous?

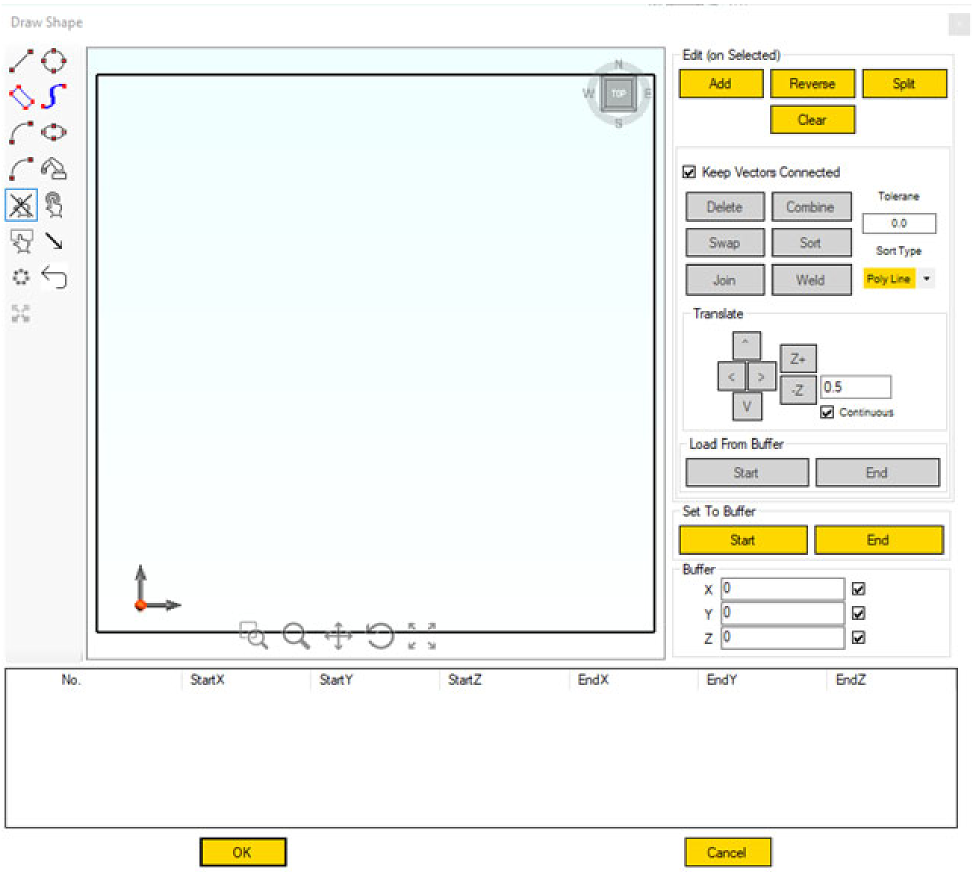
Figure 86: Two STL Objects with Different Colors

7.6.3.3 Multi Shape

The Multi Shape feature gives the user the ability to create freeform shapes and edit the vectors of existing shapes, including DXFs.

7.6.3.3.1 Creating Freeform Shapes

To create a freeform shape with Multi Shape, add a Multi Shape object to a job from either the Tools menu or the toolbar . The Multi Shape window opens as shown in Figure 87 on page 108.



☑ Keep Vectors Connected

Tolerane 0.0

Sort Type Poly Line

0.5 ☑ Continuous

Buffer

X 0 ☑
Y 0 ☑
Z 0 ☑

Figure 87: New Multi Shape Window

The icons in the left toolbar are used to create, view, or move shapes. Table 8 describes each tool.

Table 8: Multi Shape Tools

ICON	SHAPE	DESCRIPTION
╱	Line	Create a single vector based on a starting point and an ending point.
○	Circle	Create a circle based on a center point and a radius.
◇	Polyline	Create a series of vectors based on a starting point and connecting points.
∫	Spline	Create a curved line based on a starting point and connecting points.
⌒	Arc	Create a circular arc based on a starting point, a radius, and a sweep angle.

Table 8: Multi Shape Tools (Continued)

ICON	SHAPE	DESCRIPTION
	Ellipse	Create an ellipse based on a center point, the endpoint of the semi-major axis, and the endpoint of the semi-minor axis.
	Elliptical Arc	Create an elliptical arc based on a center point, the endpoint of the semi-major axis, the endpoint of the semi-minor axis, and a sweep angle.
	Load From Robot Trajectory	When the job has a robot trajectory imported, the trajectory is loaded into the Multi Shape editor as a series of vectors.
	No Select	Turn off selection by mouse.
	Select By Pick	Select vectors with the mouse.
	Select By Rectangle	Select vectors with a reference rectangle drawn by dragging the mouse.
↘	Show Curve Direction	Turn on arrows at the end of the vectors to show the execution direction.
	Show Vertices	Turn on dots at the vertices of all vectors.
↩	Undo	Undo the last action.
	Translate	Move a vector by dragging the mouse. Requires the "Keep Vectors Connected" checkbox to be unchecked.

NOTE: Use the left mouse button to draw each shape and the right mouse button to stop.

7.6.3.3.2 Converting an Object to a Multi Shape

Any processing object or objects can be converted into a Multi Shape object for additional control. To convert a processing object:

1. Select desired object(s) in the job tree.
   - When multiple objects are selected and converted they are combined into a single Multi Shape.
2. In the right-click menu, select "Convert to Multi Shape."

Converted objects will no longer have their previous processing parameters. For example, a circle converted into a Multi Shape, will no longer have a "Radius" property. Any changes to a converted shape must be done from within the Multi Shape window.

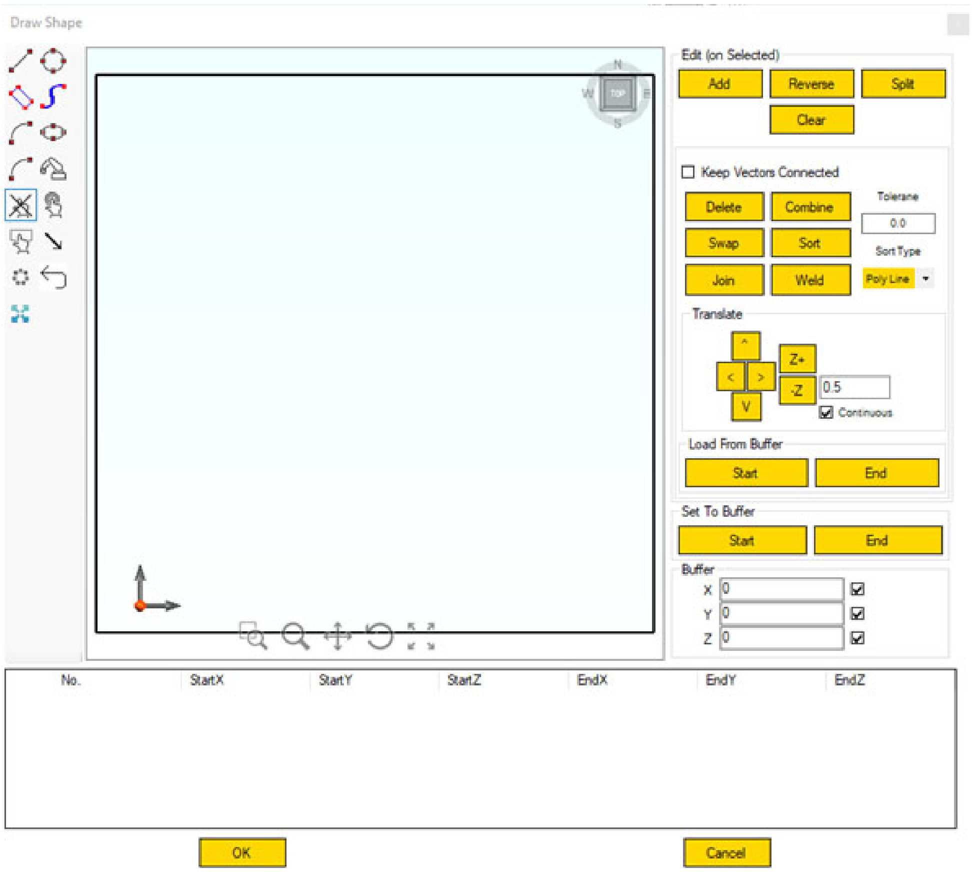
NOTE: Multi Shape objects cannot be converted back into standard processing objects.

7.6.3.3.3 Editing Vectors in a Multi Shape

The Multi Shape window can also be used to edit the vectors of any Multi Shape object. There are additional tools within the Multi Shape window for control of vectors besides those in the primary IPGScan window. These controls are on the right side of the Multi Shape window and in the table at the bottom of the Multi Shape window.

7.6.3.3.3.1 Unconnected Editing

There are several editing options which could be used to change the current Multi Shape to an unconnected shape. These options are locked with the "Keep Vectors Connected" checkbox. When checked the "Keep Vectors Connected" will keep all vectors in the multi-shape connected. All end points of a vector will connect with another vector. When disabled, the end points of vectors do not have to remain connected.



☐ Keep Vectors Connected

Tolerane: 0.0

Sort Type: Poly Line

0.5 ☑ Continuous

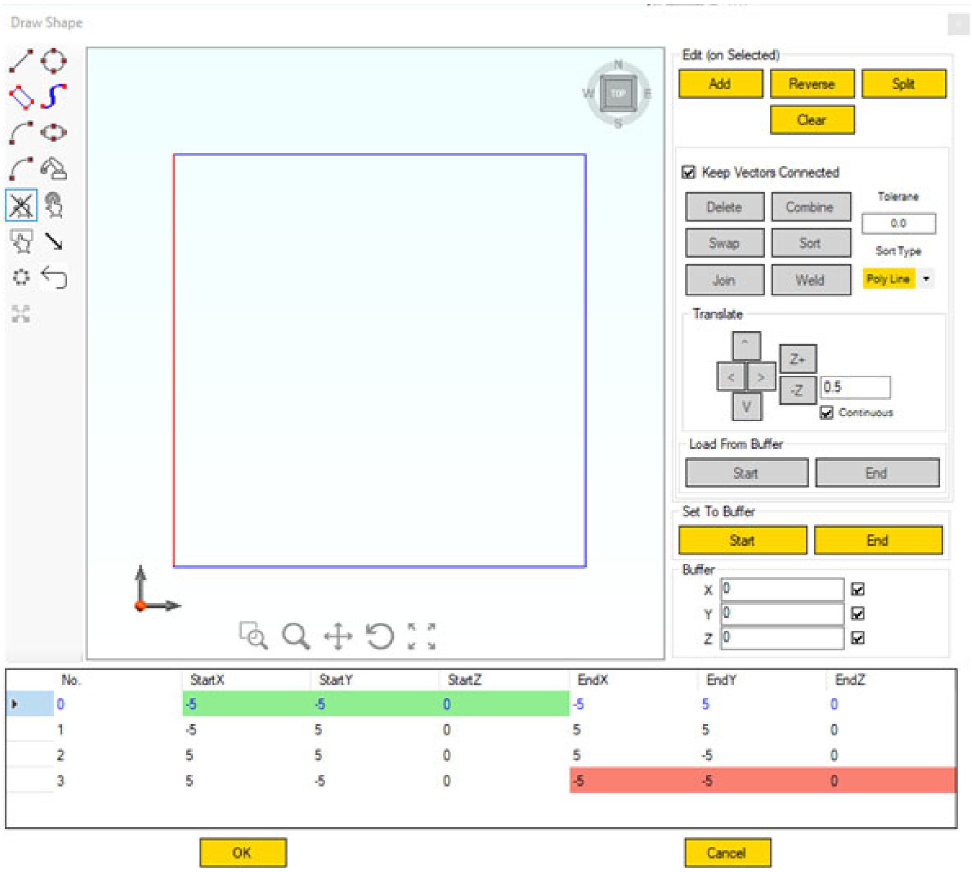
X	0 ☑
Y	0 ☑
Z	0 ☑

No.	StartX	StartY	StartZ	EndX	EndY	EndZ

Figure 88: Multi Shape Window with Keep Vectors Connected Unselected

7.6.3.3.3.2 Vector Data Table

At the bottom of the Multi Shape window is a table containing the data for all vectors in the current Multi Shape. The vectors are listed in their execution order. Figure 89 shows the Multi Shape window with the vector data table for a square.



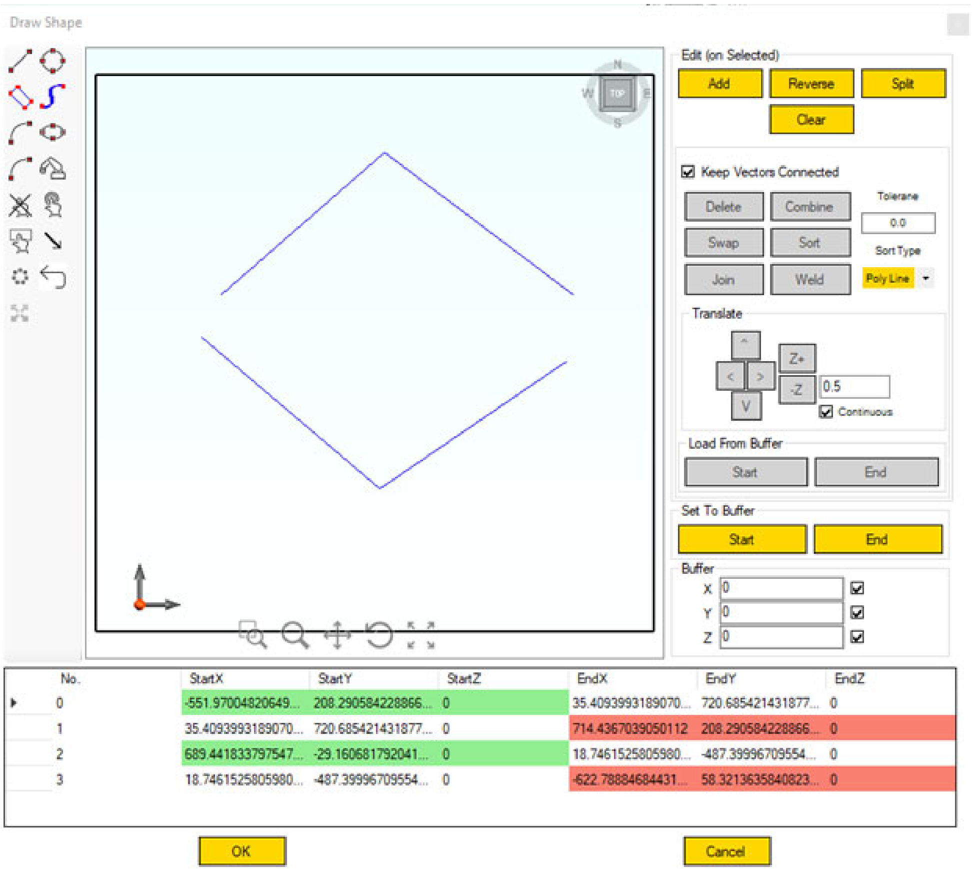
No.	StartX	StartY	StartZ	EndX	EndY	EndZ
0	-5	-5	0	-5	5	0
1	-5	5	0	5	5	0
2	5	5	0	5	-5	0
3	5	-5	0	-5	-5	0

Figure 89: Multi Shape Vector Data Table

The columns StartX, StartY, and StartZ represent the X, Y, and Z position of the starting point of each vector, respectively. The columns EndX, EndY, and EndZ represent the same information for the ending point of each vector.

Any vector can be edited by clicking on the desired cell of an already selected vector. If the "Keep Vectors Connected" checkbox is checked, any edited point will change the start/end pair with the previous or next vector.

In the vector data table, the span between a green start point and a red end point represents continuous laser operation. When the scanner will jump to an unconnected position, a new red/green break will be added. Compared to the continuous shape in Figure 89 (above), the unconnected shape in Figure 90 on page 112 has two sections of green and red vectors.



	No.	StartX	StartY	StartZ	EndX	EndY	EndZ
▸	0	-551.97004820649...	208.290584228866...	0	35.4093993189070...	720.685421431877...	0
	1	35.4093993189070...	720.685421431877...	0	714.4367039050112	208.290584228866...	0
	2	689.441833797547...	-29.160681792041...	0	18.7461525805980...	-487.39996709554...	0
	3	18.7461525805980...	-487.39996709554...	0	-622.78884684431...	58.3213635840823...	0

Figure 90: Multi Shape Disconnected Vectors

7.6.3.3.3.3 Add

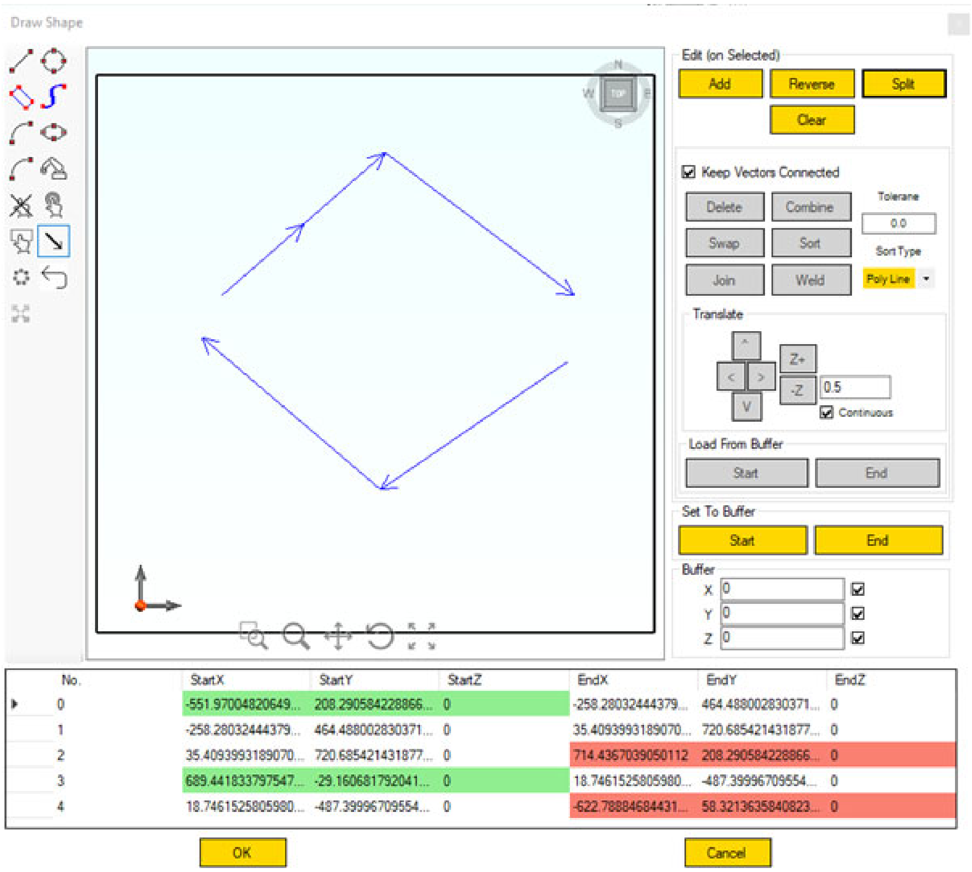
Select a vector and click "Add". This will insert a new vector of the same magnitude directly above the selected vector in the vector list. The new vector will be offset by +10 in each of the X and Y directions.

7.6.3.3.3.4 Reverse

Select a vector and click "Reverse" to switch the start point and the end point of the selected vector.

7.6.3.3.3.5 *Split*

Select a vector and click "Split" to turn the single vector into two vectors of equal magnitude. The start point of the first vector will be the start point of the original vector. The end point of the first vector and the start point of the second vector will be the midpoint of the original vector. The end point of the second vector will be the end point of the original vector. The figure below shows the same shape as Figure 90 on page 112 after the first vector is split.



No.	StartX	StartY	StartZ	EndX	EndY	EndZ
0	-551.97004820649...	208.290584228866...	0	-258.28032444379...	464.488002830371...	0
1	-258.28032444379...	464.488002830371...	0	35.4093993189070...	720.685421431877...	0
2	35.4093993189070...	720.685421431877...	0	714.4367039050112	208.290584228866...	0
3	689.441833797547...	-29.160681792041...	0	18.7461525805980...	-487.39996709554...	0
4	18.7461525805980...	-487.39996709554...	0	-622.78884684431...	58.3213635840823...	0

Figure 91: Multi Shape Split Vector

7.6.3.3.3.6 *Clear*

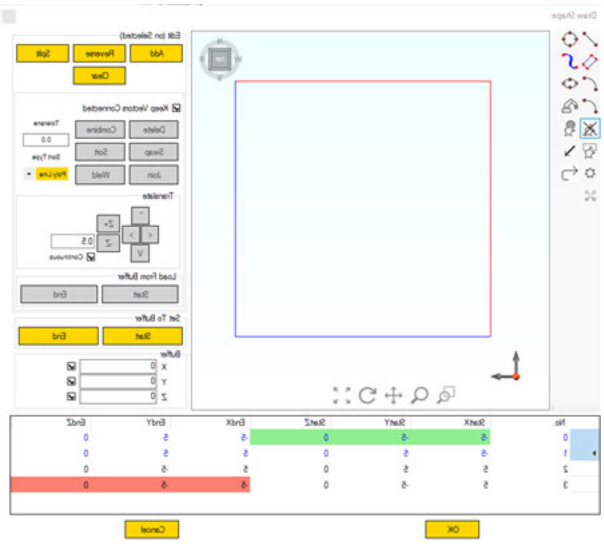
The "Clear" button removes all of the vectors from the current Multi Shape.

7.6.3.3.3.7 *Delete*

The "Delete" button removes the selected vector. No other vectors are changed because of a deleted vector.

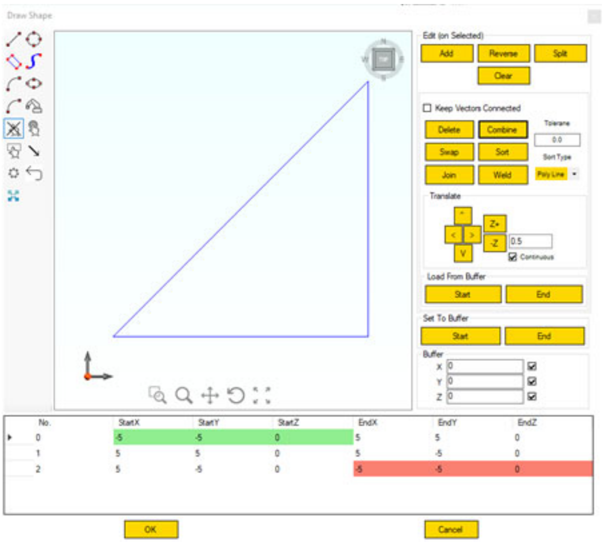
7.6.3.3.3.8 Combine

Select multiple vectors and click "Combine" to combine all vectors into a new vector. All selected vectors are removed and the new vector starts at the first vector's starting point and ends at the second vector's ending point. Figure 92 shows the selection of multiple vectors. Figure 93 shows the Multi Shape after the selected vectors were combined.



No.	StartX	StartY	StartZ	EndX	EndY	EndZ
0	-5	-5	0	-5	5	0
1	-5	5	0	5	5	0
2	5	5	0	5	-5	0
3	5	-5	0	-5	-5	0

Figure 92: Multi Shape Before Combine



No.	StartX	StartY	StartZ	EndX	EndY	EndZ
0	-5	-5	0	5	5	0
1	5	5	0	5	-5	0
2	5	-5	0	-5	-5	0

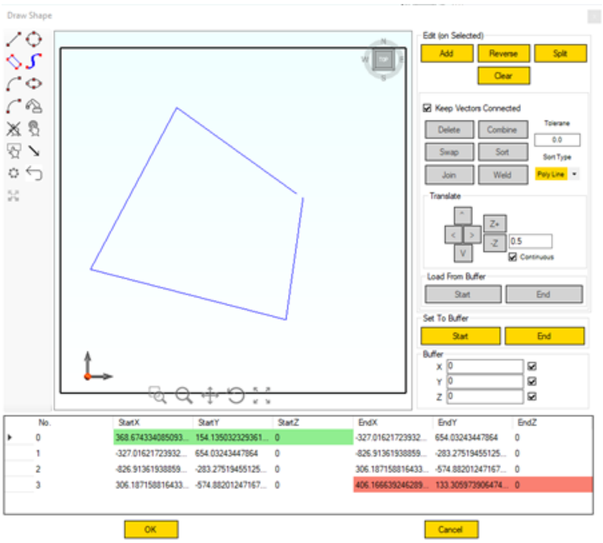
Figure 93: Multi Shape After Combine

7.6.3.3.3.9 Swap

Select two vectors and click "Swap" to swap their order in the Vector Data Table. It does not change the position of the vectors.

7.6.3.3.3.10 Join

Select two vectors and click "Join" for the vectors to be joined tip-to-tail at the shortest distance. This operation only works on two vectors at a time. Figure 94 shows a Multi Shape before joining. Figure 95 shows the same Multi Shape where the "Join" button was used to close the opening in the shape.

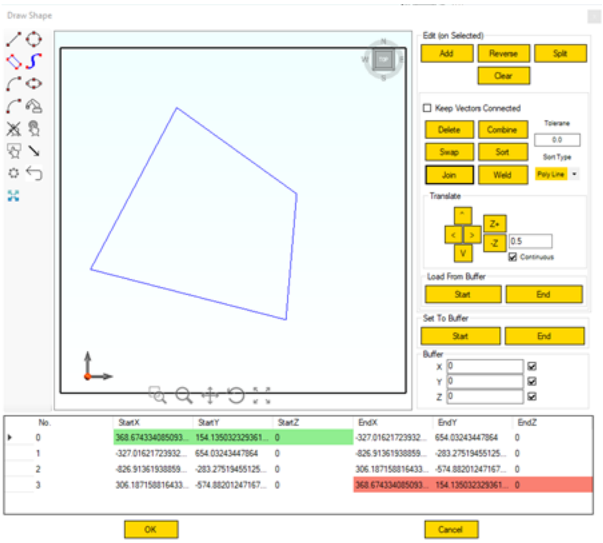


☑ Keep Vectors Connected

Buffer X: 0 ☑, Y: 0 ☑, Z: 0 ☑

No.	StartX	StartY	StartZ	EndX	EndY	EndZ
0	368.674334085093...	154.135032329361...	0	-327.01621723932...	654.03243447864	0
1	-327.01621723932...	654.03243447864	0	-826.91361938859...	-283.27519455125...	0
2	-826.91361938859...	-283.27519455125...	0	306.187158816433...	-574.88201247167...	0
3	306.187158816433...	-574.88201247167...	0	406.166639246289...	133.305973906474...	0

Figure 94: Multi Shape Before Join



□ Keep Vectors Connected

Buffer X: 0 ☑, Y: 0 ☑, Z: 0 ☑

No.	StartX	StartY	StartZ	EndX	EndY	EndZ
0	368.674334085093...	154.135032329361...	0	-327.01621723932...	654.03243447864	0
1	-327.01621723932...	654.03243447864	0	-826.91361938859...	-283.27519455125...	0
2	-826.91361938859...	-283.27519455125...	0	306.187158816433...	-574.88201247167...	0
3	306.187158816433...	-574.88201247167...	0	368.674334085093...	154.135032329361...	0

Figure 95: Multi Shape After Join

7.6.3.3.3.11 Sort

The "Sort" button sorts the vectors of the current Multi Shape based on the algorithm in the "Sort Type" drop down.

7.6.3.3.3.12 Weld

The "Weld" button will connect vectors separated by less than the distance specified in the "Tolerance" box.

7.6.3.3.3.13 Translate

The "Translate" group functions in the same manner as the Nudge tool. The "Translate" group operates on an entire vector compared to the start or the end point.

7.6.3.3.3.14 Set From Buffer

The "Set From Buffer" group acts as a paste operation for an entire point. This group of buttons will set the values of the start or end point of the selected vector to the checked values in the buffer. The start or end point will be changed depending on which button is selected, "Start" or "End".

7.6.3.3.3.15 Load From Buffer

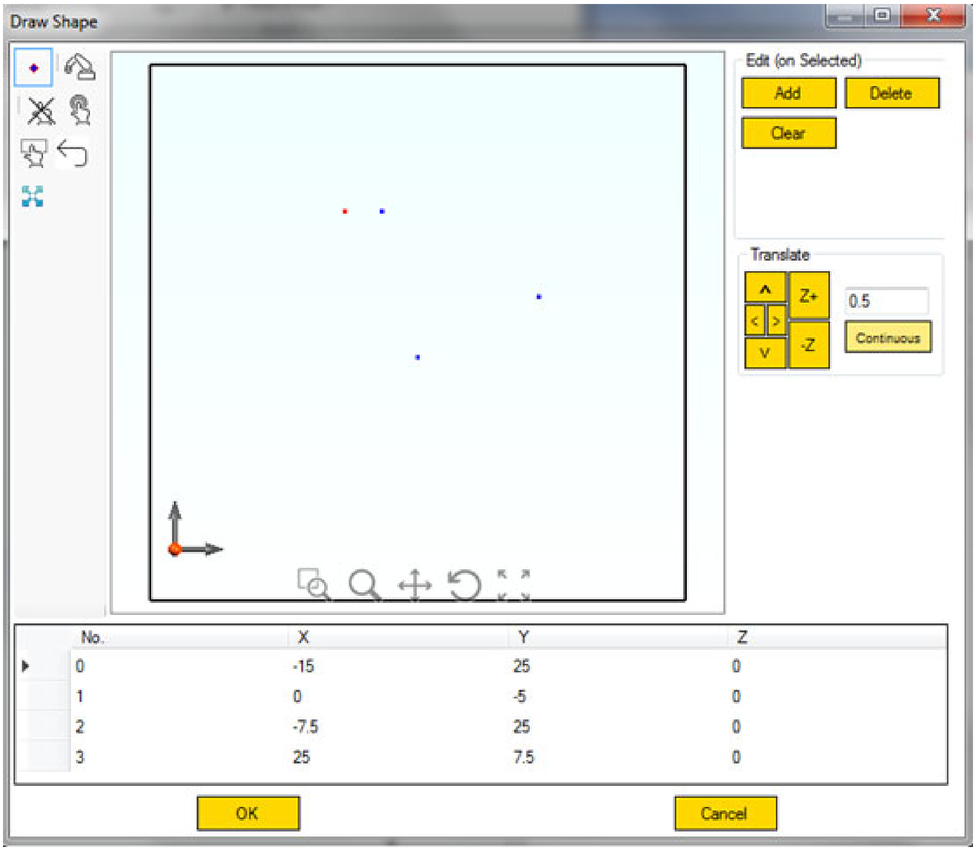
The "Load From Buffer" group acts as a copy operation for an entire point. This group of buttons takes the values from the start or end point of the selected vector and places these values into the checked values in the buffer. The buffer is set from either the start or end point depending on which button is selected, "Start" or "End".

7.6.3.3.3.16 Buffer

The buffer acts like a clipboard for a single point. Values can be manually edited or loaded from the "Load From Buffer" group. If a buffer value is unchecked, then it will not be used for "Set From Buffer" or "Load From Buffer" operations.

7.6.3.4 Points

After creating a new Points object, a new window will open to create a collection of point processing objects (see Figure 96). Existing objects can also be converted to an editable Points object like a Multi Shape (see Section 7.6.3.3.2 on page 109).



0.5

No.	X	Y	Z
0	-15	25	0
1	0	-5	0
2	-7.5	25	0
3	25	7.5	0

Figure 96: New Points Window

7.6.3.4.1 Points GUI

Table 9 describes the tools available on the left side of the Points window. Table 10 describes the buttons available on the right side of the Points window.

In the "Translate" group on the right side of the Points window there is a group of buttons to move selected point(s). It works the same way as the Nudge tool.

At the bottom of the Points window is the Points Table. The table shows the points in the current Points object in their execution order and with their coordinate positions.

Table 9: Points Tools

ICON	SHAPE	DESCRIPTION
◆	Point	Add a new point to the Points object.
	Load From Robot Trajectory	When the job has a robot trajectory imported, the trajectory is loaded into the Points editor as a series of vectors.
	No Select	Turn off selection by mouse.
	Select By Pick	Select individual points with the mouse.
	Select By Rectangle	Select a group of points with a reference rectangle drawn by dragging the mouse.
↶	Undo	Undo the last action.
	Translate	Move a point by dragging the mouse.

Table 10: Points Buttons

BUTTON	DESCRIPTION
Add	Creates a new point at a position offset from the currently selected point of (10, 10, 0).
Delete	Deletes the currently selected point.
Clear	Deletes all points in the current Points object.

7.7 Process Properties

Process properties are the properties of a job or an object which specify the laser settings for an object's vectors or points. IPGScan jobs can be a welding job type, cleaning job type, or marking job type. The job type changes the process properties available because different control of the laser is needed for each process.

7.7.1 Laser Optimization

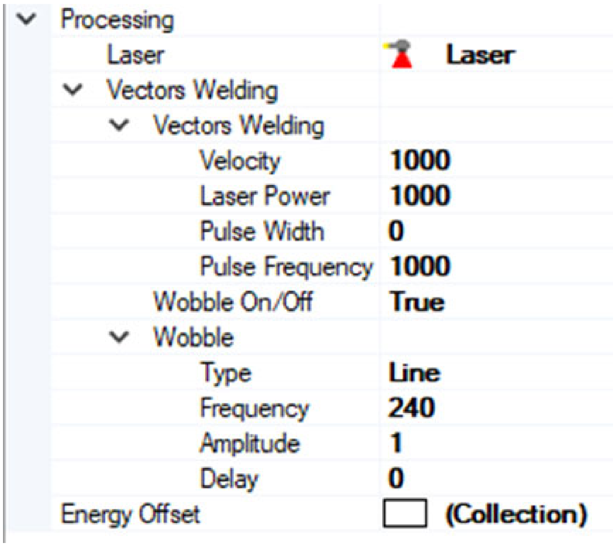
Laser Optimization is an option in all IPGScan jobs starting with version 1.0.0.7176 and ScanPack version 0.1.7280. It is found in the Parameters Window when the job is selected in the Job Tree.

When Laser Optimization is disabled, the laser will be enabled and disabled at the start and end of each object, respectively. Also, the galvos will return to position (0,0,0) in between each processing object. This is the default operation for IPGScan.

When Laser Optimization is enabled, the laser will remain enabled throughout the duration of the job. Also, the galvos will only move as required for the job. The laser will be disabled and re-enabled when switching beam types.

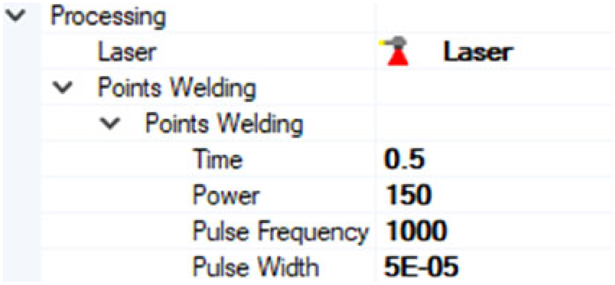
The additional laser operations add tens of milliseconds to the overall job cycle time, depending on the length of the job. Enabling Laser Optimization will decrease the cycle time of the job. However, in the event of a fatal error or malfunction in the controller, using laser optimization increases the chances that the laser will remain on.

7.7.2 Welding Process Properties



Processing	
Laser	Laser
Vectors Welding	
Vectors Welding	
Velocity	1000
Laser Power	1000
Pulse Width	0
Pulse Frequency	1000
Wobble On/Off	True
Wobble	
Type	Line
Frequency	240
Amplitude	1
Delay	0
Energy Offset	□ (Collection)

Figure 97: Welding Vectors Process Properties



Processing	
Laser	Laser
Points Welding	
Points Welding	
Time	0.5
Power	150
Pulse Frequency	1000
Pulse Width	5E-05

Figure 98: Welding Points Process Properties

Figure 97 and Figure 98 show an example of the process properties for a vector object and point object, respectively, in a welding IPGScan job type.

Table 11 and Table 12 show the properties for welding vector objects and welding point objects, respectively.

Table 11: Welding Vector Properties

PROPERTY	DESCRIPTION
Laser	Type of laser that will be used to output the selected object
Velocity	Speed of the focal point of the beam
Laser Power	Power of the laser
Pulse Width	Width of each laser pulse (0 if using CW laser)
Pulse Frequency	Frequency of the laser pulses (ignored if using CW laser)
Wobble On/Off	True if using wobble; false if not using wobble
Type	Type of the wobble
Frequency	Frequency of the wobble
Amplitude	Amplitude of the wobble
Delay	Delay of the wobble
Energy Offset	See Section 7.7.2.2 on page 121

Table 12: Welding Point Properties

PROPERTY	DESCRIPTION
Laser	Type of laser that will be used to output the selected object
Time	Total length of each point
Power	Power of the laser for each point
Pulse	
Pulse Width	Width of each laser pulse (0 if using CW laser)
Pulse Frequency	Frequency of the laser pulses (ignored if using CW laser)

7.7.2.1 Wobble

The Wobble feature allows users to add a wobble to the weld seam. The wobble causes the TCP speed of the beam to speed up, but still allowing the weld feature to maintain a commanded linear speed. The wobble will never change the amount of time it takes to finish a weld. Refer to Table 13 for all wobble types. Table 14 ("Wobble Parameters") (page 121) discusses the different configuration parameters of a wobble.

Table 13: Wobble Types

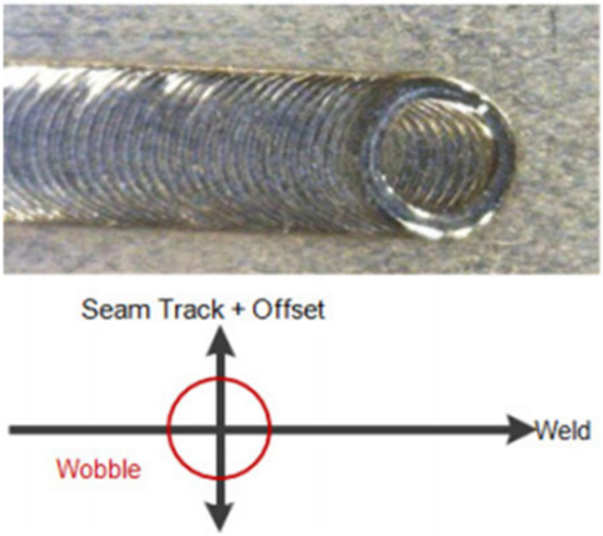


Figure 99: Circle Wobble

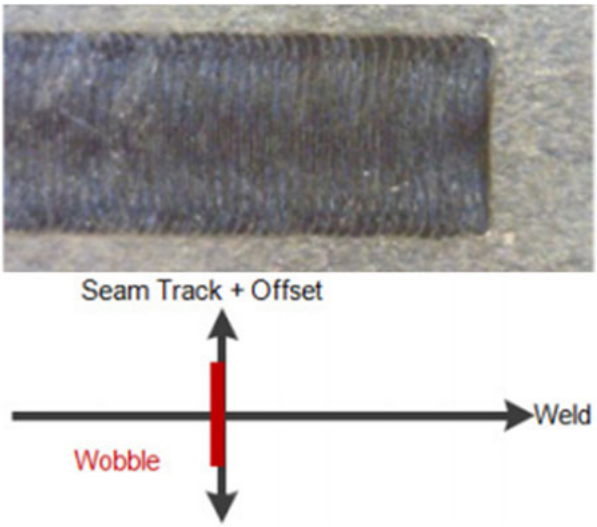


Figure 100: Line Wobble

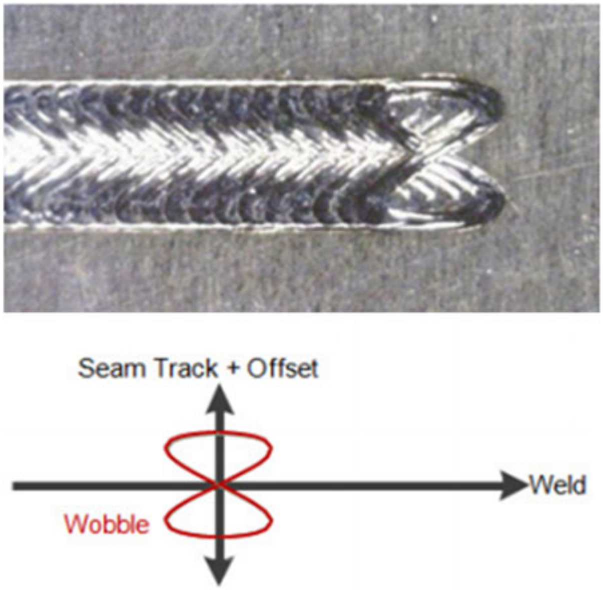


Figure 101: Eight Wobble

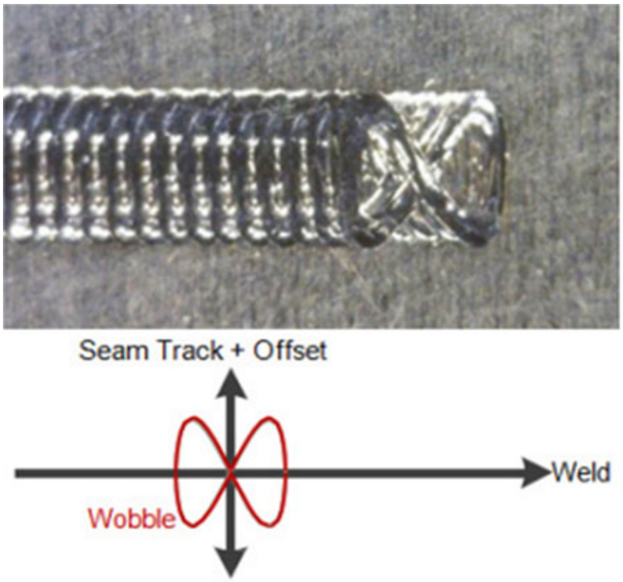


Figure 102: Infinity Wobble

Table 14: Wobble Parameters

PROPERTY	DESCRIPTION
Amplitude	This value specifies the width of the wobble. For example, if a circle was used then the amplitude would be the diameter of the wobble.
Delay	This value specifies the amount of time it takes wobbling to begin. The use of a negative number causes the wobble to start early.
Frequency	This value is the rate at which one complete wobble shape is run.

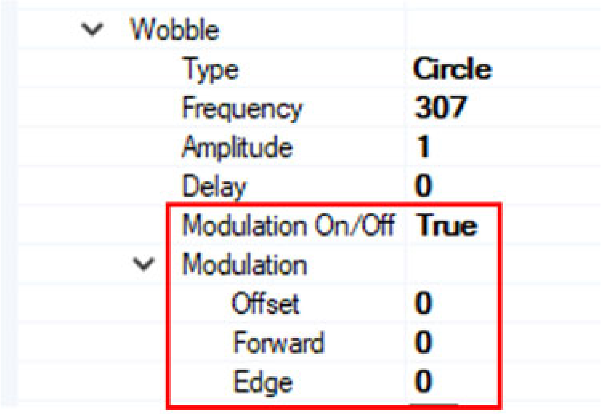
7.7.2.2 Wobble Power Modulation

Wobble Power Modulation functionality is a compensation on the laser power control signal on each wobble cycle. The purpose behind this is to decrease or increase the laser power in areas where there may be an overlap of laser energy due to the wobble motion.

Three parameters are available (along with all other standard wobble parameters): Edge, Offset, and Forward. Additional details on each are provided below.

The Wobble Power Modulation is part of the wobble parameter section in IPGScan (when IPGScan is working in weld mode) and is not enabled by default.

To enable it, wobble must be enabled for a particular weld, a wobble type selected, and "Modulation On/Off" must be set to True. (see Figure 103).



Wobble	
Type	Circle
Frequency	307
Amplitude	1
Delay	0
Modulation On/Off	True
Modulation	
Offset	0
Forward	0
Edge	0

Figure 103: Wobble Power Modulation Parameters

To better understand the given parameters uses can refer to Figure 104 for a definition of the beam movement during a wobble cycle.

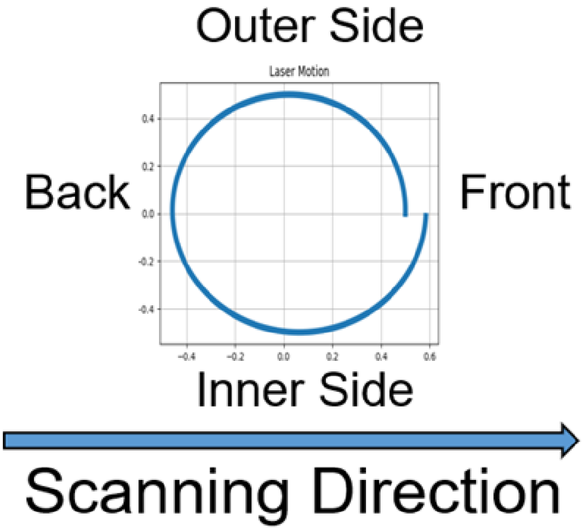


Figure 104: Definition of Wobble Cycle Terms

7.7.2.2.1 Edge Parameter

The Edge parameter can be set anywhere from 0 to 1. This parameter reduces the power at the sides of the wobble cycle (by the same amount).

For example, a value of 0.1 reduces the power on each side by 10%. A value of 1.0 would reduce the power by 100%. See Figure 105 (below) and Figure 106 on page 123.

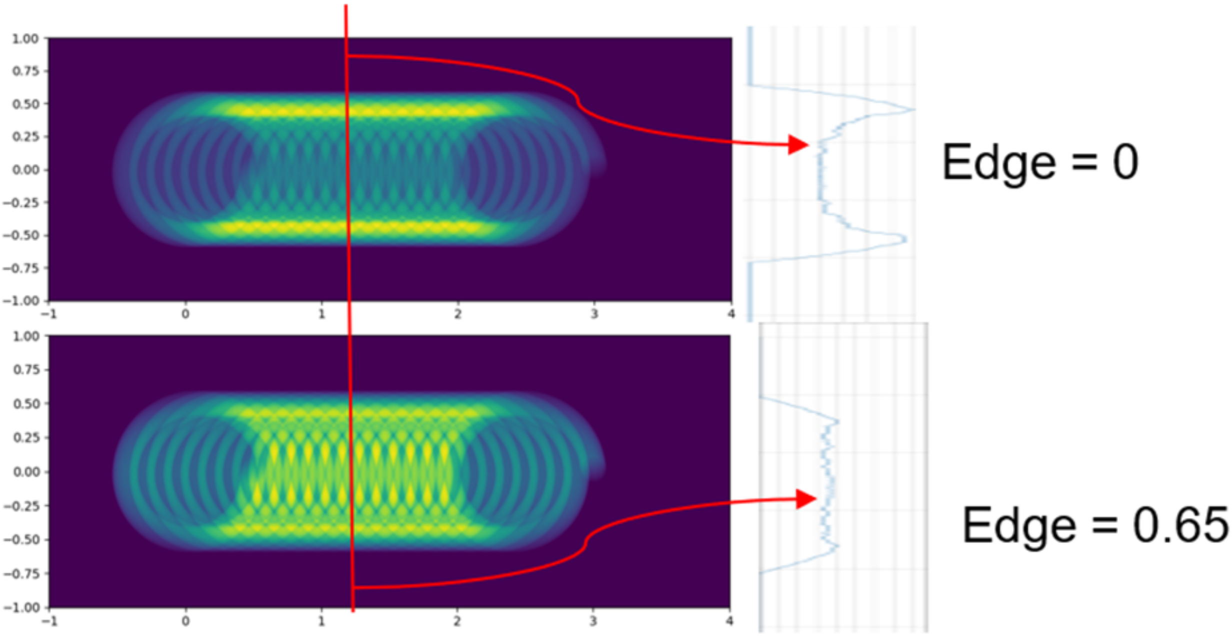


Figure 105: Heatmap of Wobble Weld with Different Edge Parameter Values

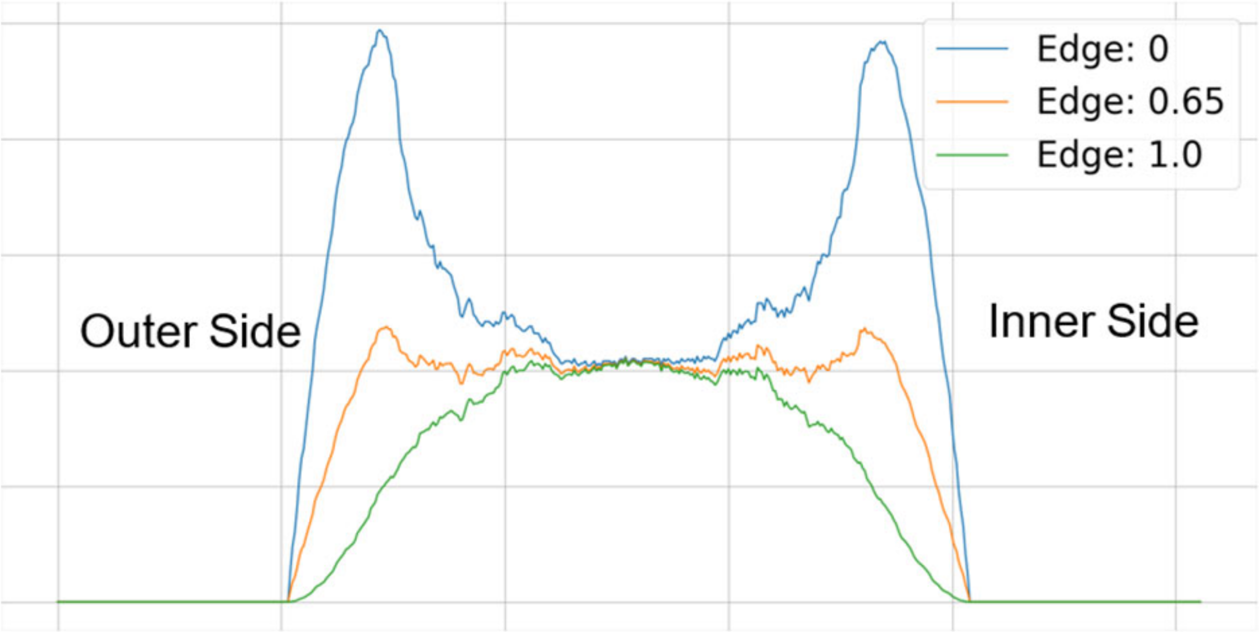


Figure 106: Simulated Cross Section of Weld with Different Edge Values

7.7.2.2.2 Offset Parameter

The Offset parameter can be set anywhere from -1 to 1. This parameter reduces the power at one side of the wobble cycle, while increasing on the other. Adding a negative sign reverses the side power is decreased/increased.

For example a value of 0.1 (or -0.1) increases the power on one side by 10%, while decreasing the other by 10%. See Figure 107 and Figure 108.

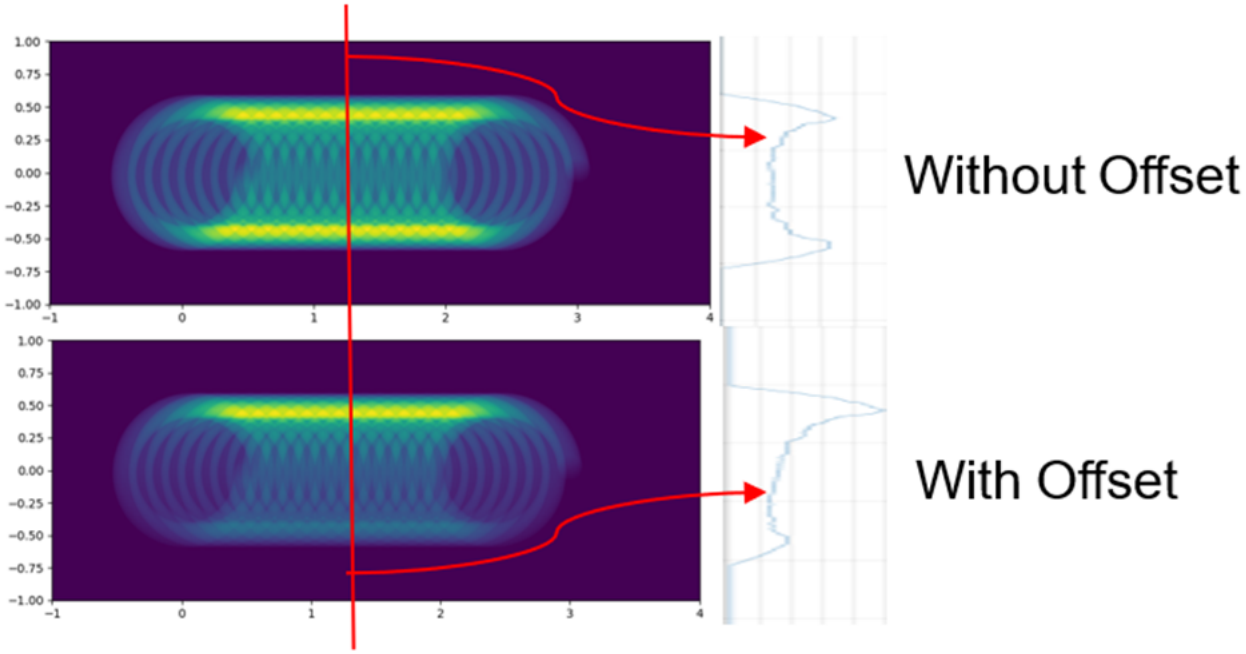


Figure 107: Heatmap of Wobble Weld with Different Offset Parameter Values

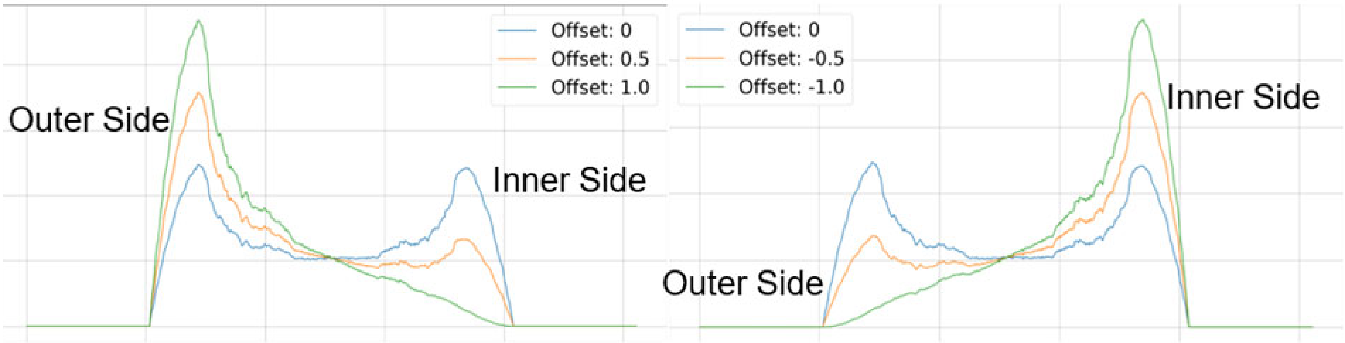
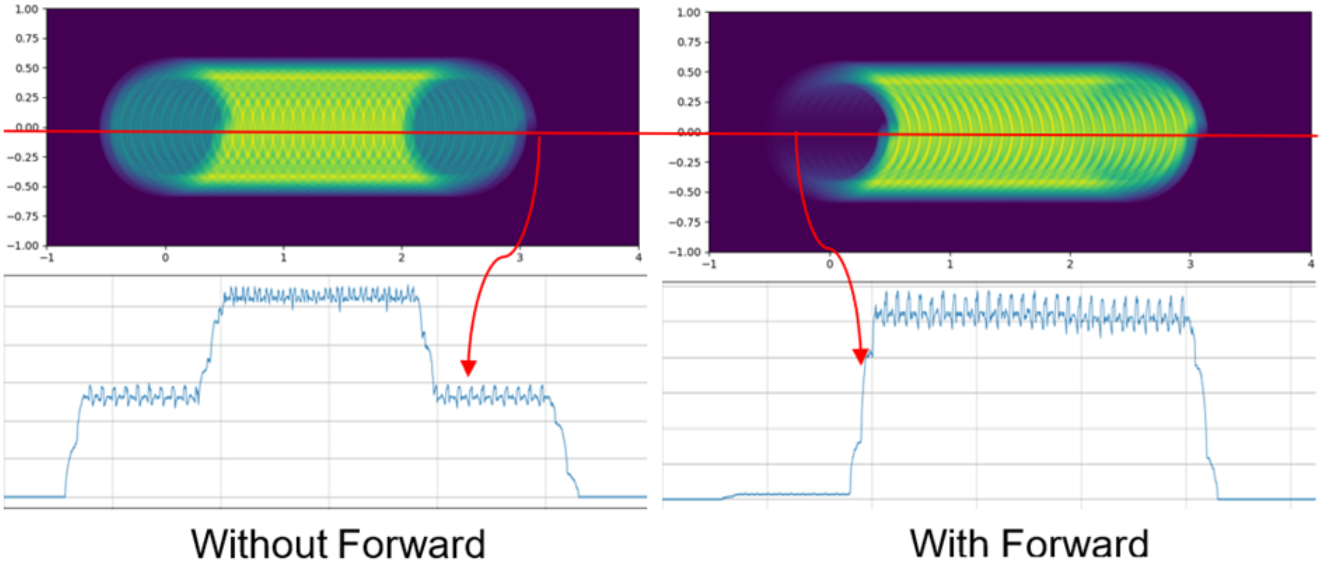


Figure 108: Simulated Cross Section of Weld with Different Offset Values

7.7.2.2.3 Forward Parameter

The Forward parameter can be set anywhere from -1 to 1. This parameter reduces the power at the back of the wobble cycle, while increasing on the front (or vice versa depending on the sign). Adding a negative sign reverses the side power if decreased/increased.

For example, a value of 0.1 (or -0.1) increases the power on the front by 10%, while decreasing the back by 10%. See Figure 109 and Figure 110.



Without Forward

With Forward

Figure 109: Heatmap of Wobble Weld with Different Forward Parameter Values

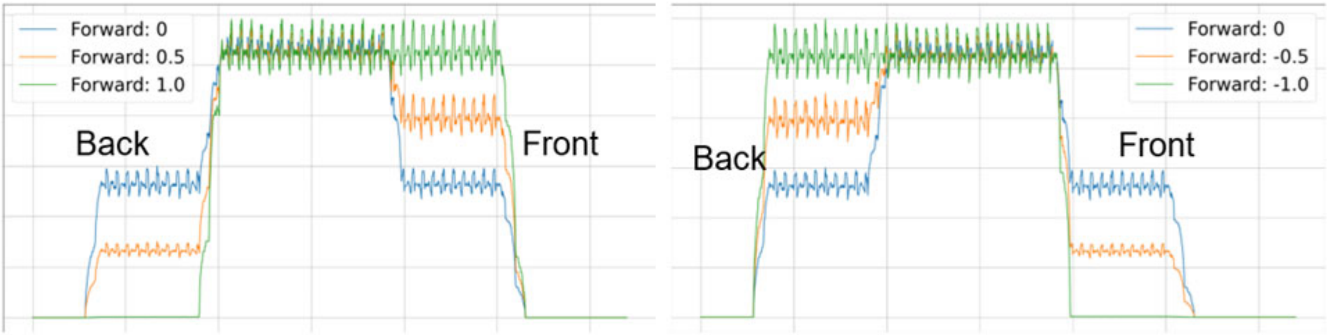


Figure 110: Simulated Cross Section of Weld with Different Forward Values

7.7.2.3 Energy Offset

The Energy Offset feature allows users to ramp up or down the lasers power within an object.

The percentage is based on the laser power that is specified in the processing parameters for the object. An energy offset of 0% will result in a laser output of the power specified in the parameters. Figure 111 (below) shows the Energy Offset Window.

In the Energy Offset Window, users can set offsets for points by either:

1. selecting points with the "Pick" or "Rectangle" tools and then typing in an offset under "Chart"
2. by dragging points on the lower graph

Users can create a linear progression of power between multiple points using the Ramp functionality. Users specify the starting and ending points in the progression and the values for those points. After clicking "Generate," a linear progression will be created between the points specified and the values specified.

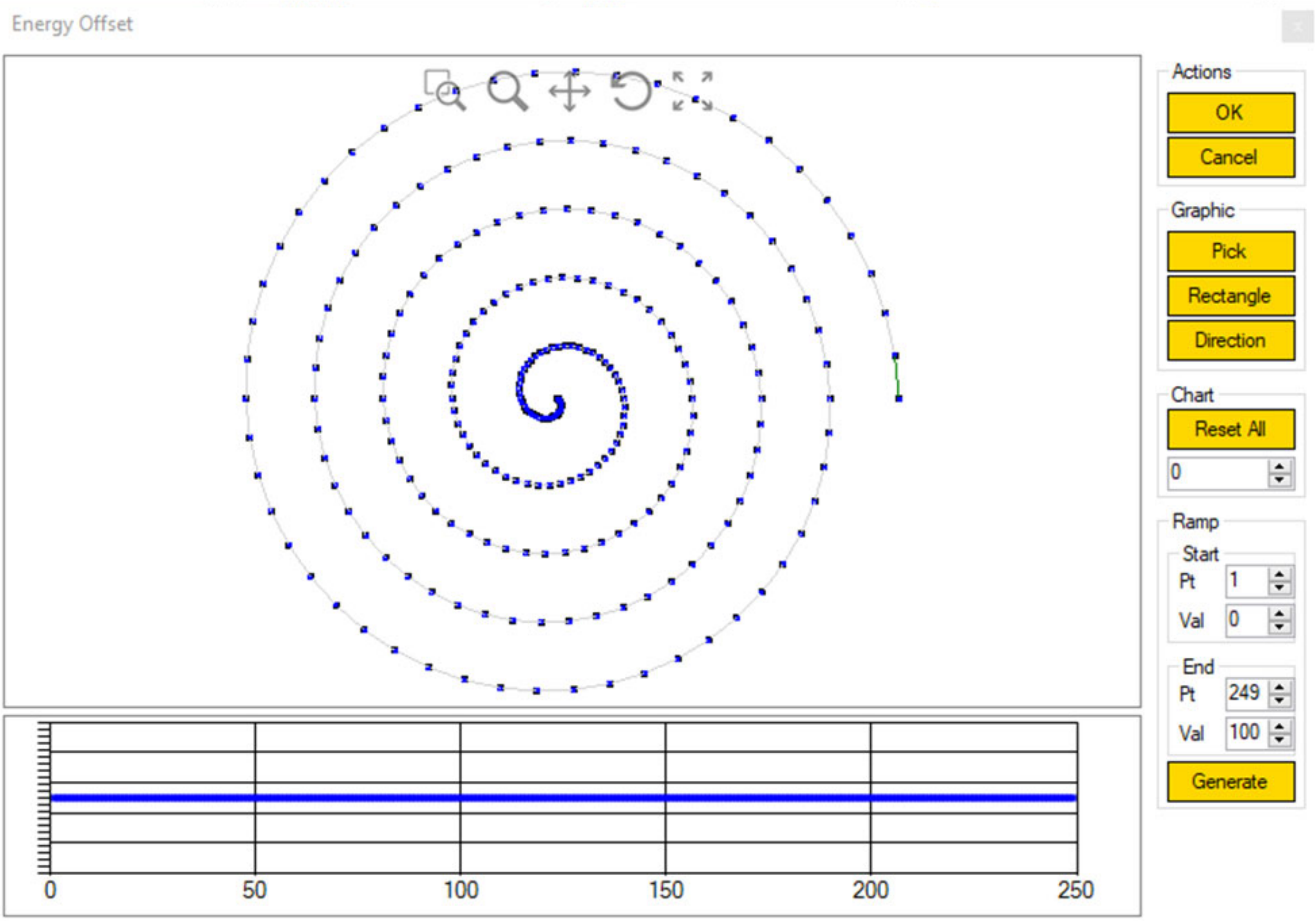


Figure 111: Energy Offset Window

7.7.2.4 AMB Ring and Power Control

In order to change the power settings for core and ring separately, the "Enable AMB" setting in IPGScan must be set to true.

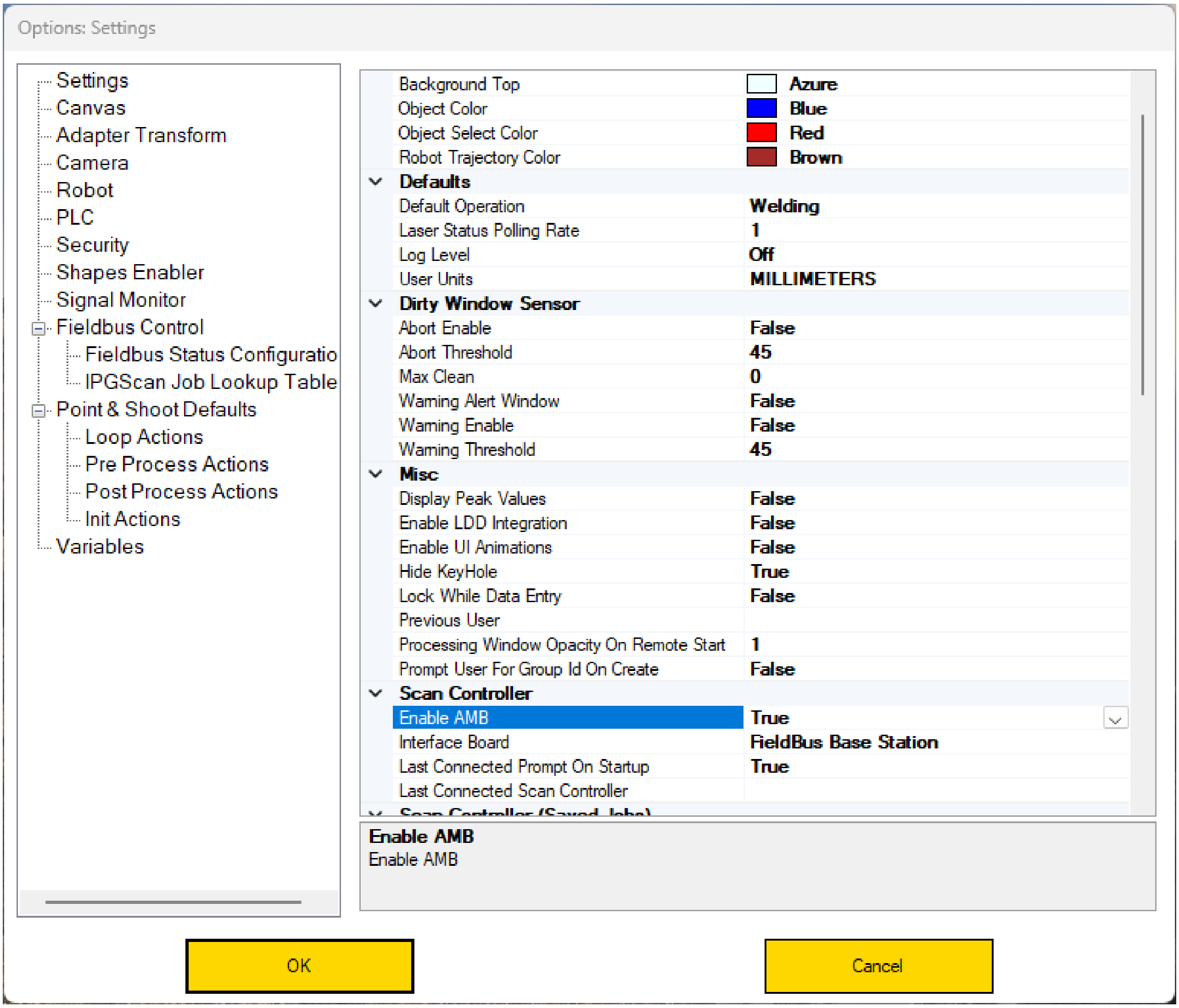
IMPORTANT

By default, "Enable AMB" is set to False and only the ring analog signal will be used.

IPGScan Version 1.0.0.14937 and ScanPack Version 0.1.14913 or higher are required for AMB ring and core power control.

Scan Controllers built after December 2021 should have the proper hardware for this functionality.

To change the "Enable AMB", click on the Option button (View-Options, Alt+O), under **Settings->Scan Controller**, set "Enable AMB" to True (see Figure 112).



Options: Settings

- Settings
- Canvas
- Adapter Transform
- Camera
- Robot
- PLC
- Security
- Shapes Enabler
- Signal Monitor
- Fieldbus Control
  - Fieldbus Status Configuratio
  - IPGScan Job Lookup Table
- Point & Shoot Defaults
  - Loop Actions
  - Pre Process Actions
  - Post Process Actions
  - Init Actions
- Variables

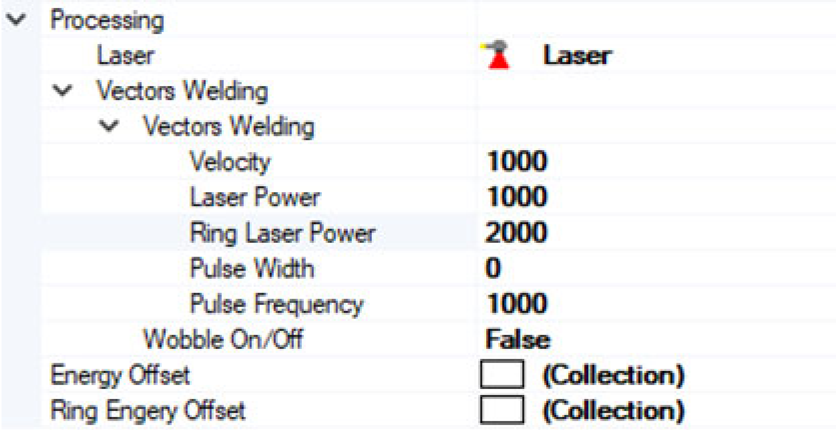
Background Top	⬜ **Azure**
Object Color	🟦 **Blue**
Object Select Color	🟥 **Red**
Robot Trajectory Color	🟫 **Brown**
Defaults	
Default Operation	**Welding**
Laser Status Polling Rate	**1**
Log Level	**Off**
User Units	**MILLIMETERS**
Dirty Window Sensor	
Abort Enable	**False**
Abort Threshold	**45**
Max Clean	**0**
Warning Alert Window	**False**
Warning Enable	**False**
Warning Threshold	**45**
Misc	
Display Peak Values	**False**
Enable LDD Integration	**False**
Enable UI Animations	**False**
Hide KeyHole	**True**
Lock While Data Entry	**False**
Previous User	
Processing Window Opacity On Remote Start	**1**
Prompt User For Group Id On Create	**False**
Scan Controller	
Enable AMB	**True**
Interface Board	**FieldBus Base Station**
Last Connected Prompt On Startup	**True**
Last Connected Scan Controller	
Scan Controller (Saved Jobs)	

Enable AMB
Enable AMB

Figure 112: Enabling AMB Power Control

IMPORTANT	Users may need to restart IPGScan for the changes to take effect.

Once "Enable AMB" is set, two additional fields for laser parameters will appear in the object's property area (see Figure 113):



Processing	
Laser	Laser
Vectors Welding	
Vectors Welding	
Velocity	1000
Laser Power	1000
Ring Laser Power	2000
Pulse Width	0
Pulse Frequency	1000
Wobble On/Off	False
Energy Offset	□ (Collection)
Ring Engery Offset	□ (Collection)

Figure 113: AMB Dual Power Control Properties

The "Ring Laser Power" sets the laser power value (in watts) for ring beam and Ring Energy Offset opens the Energy Offset profile editor for the ring beam. Different Energy Offset profiles can be created for core and ring beams, however the length of each segment in the profile is common for both (please refer to the IPGScan manual for details on Energy Offset).

7.7.2.5 Pulse Shaping

Section 7.7.2.5.1 (below) describes how to configure Pulse Shaping parameters for AMB dual-beam laser welding.

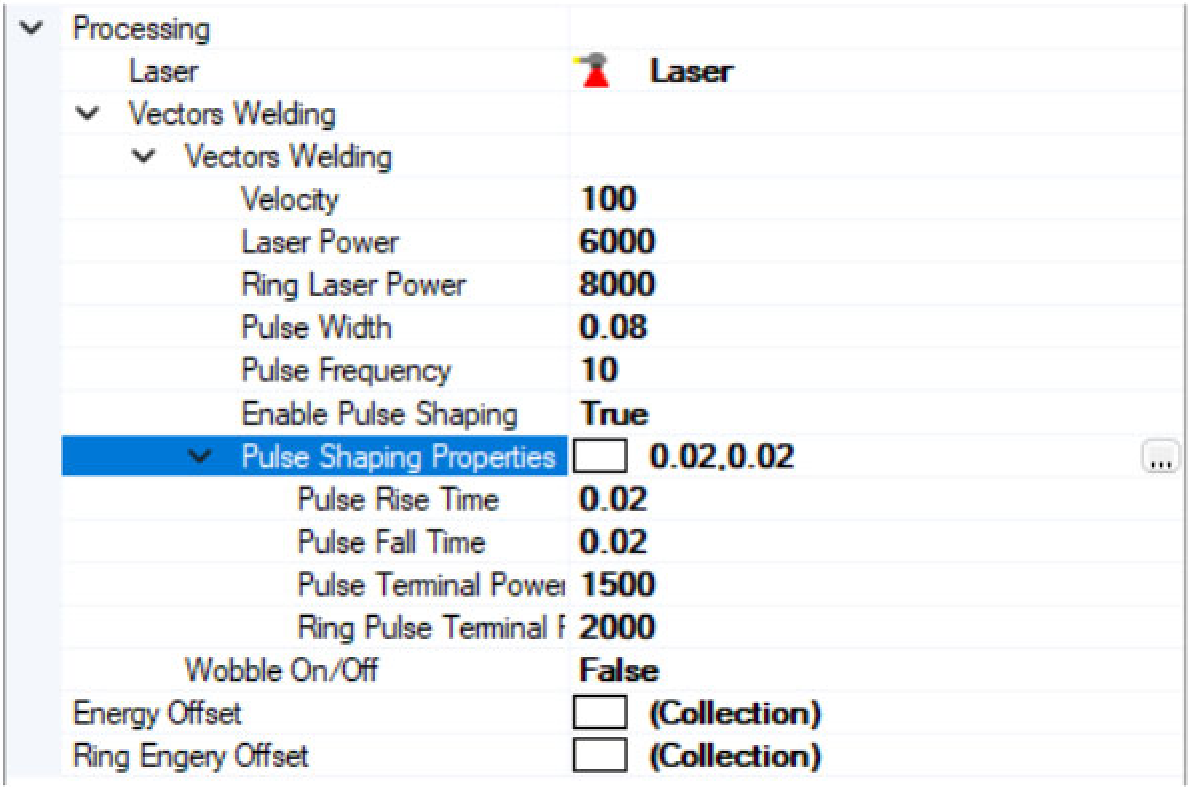
Section 7.7.2.5.2 on page 130 describes how to configure Pulse Shaping parameters for single-beam laser welding.

NOTE: To configure Pulse Shaping parameters, your computer must be running Version 1.0.0.25647 or higher of the IPGScan Software Suite.

7.7.2.5.1 Configuring Pulse Shaping Parameters for AMB Dual-Beam Laser Welding

Do the following to modify and visualize pulse shaping parameters for IPG AMB lasers:

1. Navigate to **View Options > Settings > Scan Controller > Enable AMB** and ensure that “True” is selected.
2. Select the desired object in the job tree, then navigate to “Enable Pulse Shaping” on the right side of screen.
3. Set **Enable Pulse Shaping** to “True”.



Processing	
Laser	Laser
Vectors Welding	
Vectors Welding	
Velocity	100
Laser Power	6000
Ring Laser Power	8000
Pulse Width	0.08
Pulse Frequency	10
Enable Pulse Shaping	True
Pulse Shaping Properties	□ 0.02,0.02 ...
Pulse Rise Time	0.02
Pulse Fall Time	0.02
Pulse Terminal Powe	1500
Ring Pulse Terminal I	2000
Wobble On/Off	False
Energy Offset	□ (Collection)
Ring Engery Offset	□ (Collection)

Figure 114: Processing Parameters for AMB Pulse Application

4. On the right side of the Processing Parameters screen, click on the icon with three dots, as seen in Figure 114. This displays the Pulse Shaping Visualization screen as shown in Figure 115 on page 130.

   In the Pulse Shaping Visualization screen, you can edit the following pulse shape parameters:

   – **Pulse Width (sec) –** Time between the leading and trailing edges of a laser pulse

   – **Pulse Frequency (Hz) –** Measurement of the number of pulses per unit of time

   – **Pulse Rise Time (sec) –** Linear power rise time in the core and ring beams

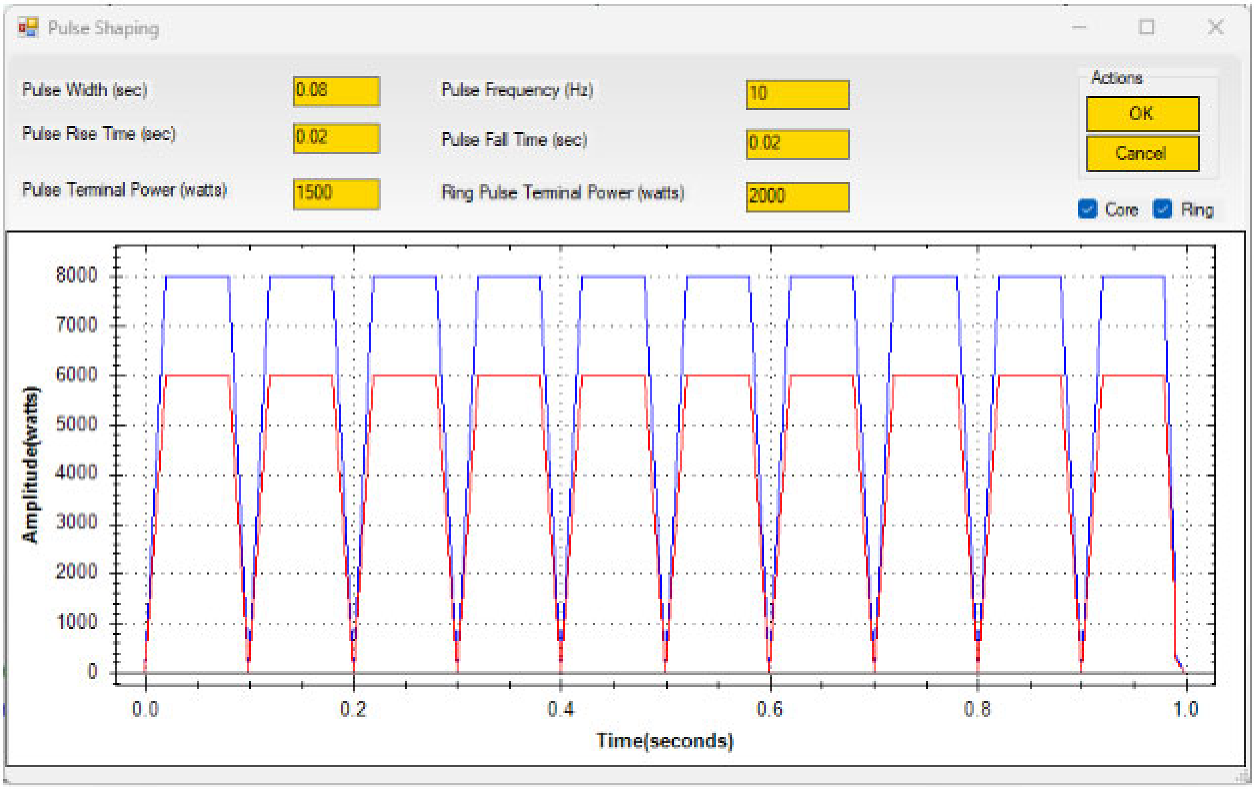
   – **Pulse Fall Time (sec) –** Linear power fall time in the core and ring beams

   – **Pulse Terminal Power (watts) –** Laser power in the core at the end of the pulse

   – **Ring Pulse Terminal Power (watts) –** Laser power in the ring at the end of the pulse

   The graphical display in the Pulse Shaping Visualization screen shows the pulse shaping parameters for AMB dual-beam laser welding as you change them.

   You can select or deselect the **Core** and **Ring** check boxes to visualize each beam independently.



Pulse Shaping

Pulse Width (sec) 0.08

Pulse Frequency (Hz) 10

Pulse Rise Time (sec) 0.02

Pulse Fall Time (sec) 0.02

Pulse Terminal Power (watts) 1500

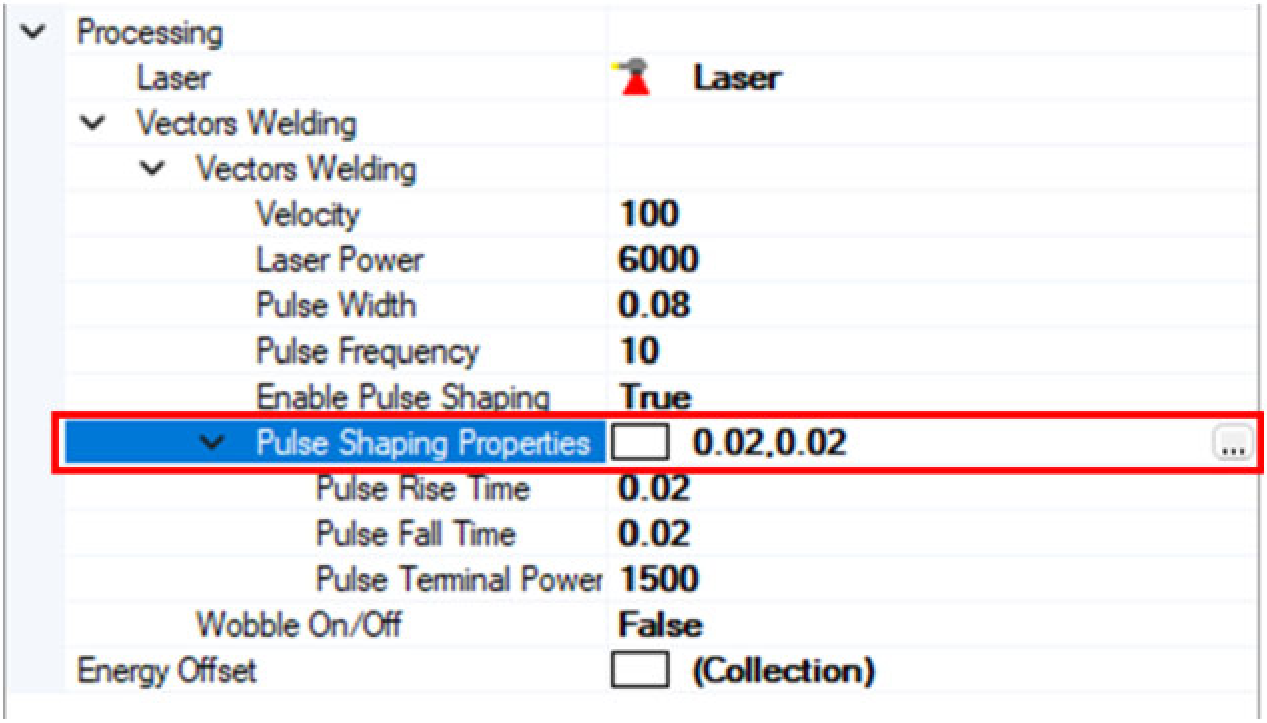
Ring Pulse Terminal Power (watts) 2000

Figure 115: Pulse Shaping Visualization for AMB Application

7.7.2.5.2 Configuring Pulse Shaping Parameters for Single Beam Laser Welding

Do the following to modify and visualize pulse shaping parameters for a single beam laser welding application:

1. Navigate to **View Options > Settings > Scan Controller > Enable AMB** and ensure that “True” is selected.
2. Select the desired object in the job tree, then navigate to “Enable Pulse Shaping” on the right side of screen.
3. Set **Enable Pulse Shaping** to “True”.



Processing	
Laser	Laser
Vectors Welding	
Vectors Welding	
Velocity	100
Laser Power	6000
Pulse Width	0.08
Pulse Frequency	10
Enable Pulse Shaping	True
Pulse Shaping Properties	□ 0.02,0.02 ...
Pulse Rise Time	0.02
Pulse Fall Time	0.02
Pulse Teminal Power	1500
Wobble On/Off	False
Energy Offset	□ (Collection)

Figure 116: Processing Parameters for a Single Beam Laser Welding Application

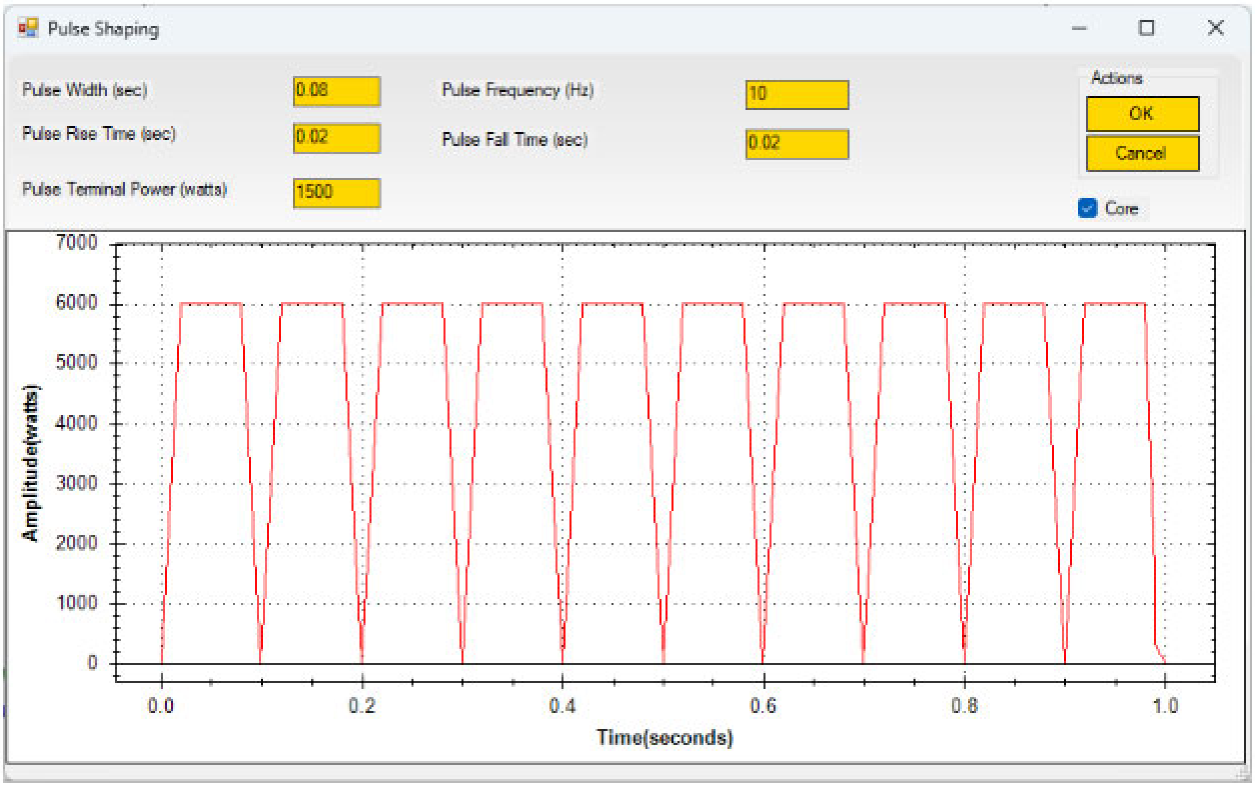
4. On the right side of the Processing Parameters screen, click on the icon with three dots, as seen in Figure 116 (above). This displays the Pulse Shaping Visualization screen as shown in Figure 117 on page 132.

   In the Pulse Shaping Visualization screen, you can edit the following pulse shape parameters:

   - **Pulse Width (sec) –** Time between the leading and trailing edges of a laser pulse
   - **Pulse Frequency (Hz) –** Measurement of the number of pulses per unit of time
   - **Pulse Rise Time (sec) –** Linear power rise time in the core and ring beams
   - **Pulse Fall Time (sec) –** Linear power fall time in the core and ring beams
   - **Pulse Terminal Power (watts) –** Laser power in the core at the end of the pulse
   - **Ring Pulse Terminal Power (watts) –** Laser power in the ring at the end of the pulse

   The graphical display in the Pulse Shaping Visualization screen shows the pulse shaping parameters for a Single Beam Laser Welding Application as they are changed.

   You can select or deselect the **Core** check boxes to visualize each beam independently.



Pulse Width (sec) 0.08

Pulse Frequency (Hz) 10

Pulse Rise Time (sec) 0.02

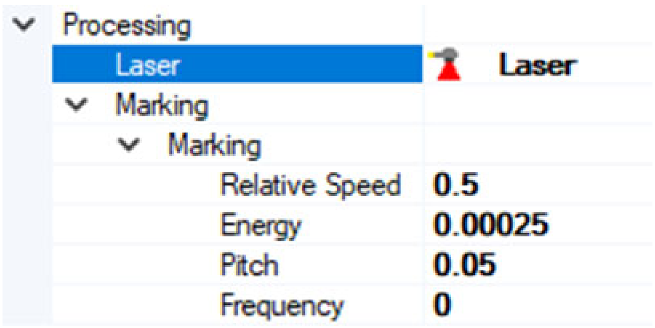
Pulse Fall Time (sec) 0.02

Pulse Terminal Power (watts) 1500

☑ Core

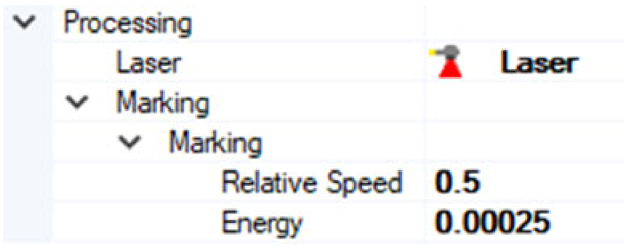
Figure 117: Pulse Shaping Visualization for a Single Beam Laser Welding Application

7.7.3 Marking Process Properties



Processing
Laser — Laser
Marking
Marking
Relative Speed — 0.5
Energy — 0.00025
Pitch — 0.05
Frequency — 0

Figure 118: Marking Vector Process Properties



Processing
Laser — Laser
Marking
Marking
Relative Speed — 0.5
Energy — 0.00025

Figure 119: Marking Point Process Properties

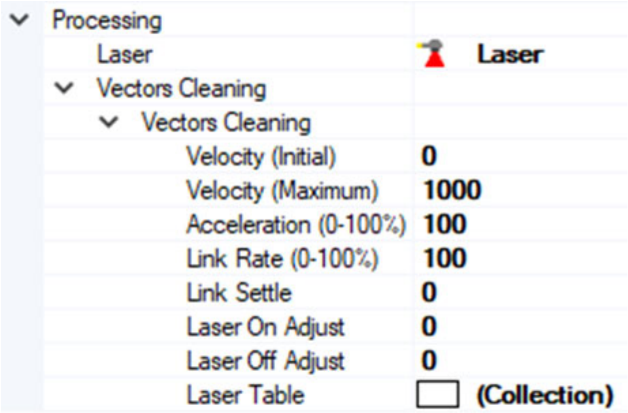
Figure 118 and Figure 119 shows an example of the process properties for a vector object and point object, respectively, in a marking IPGScan job type.

Table 15 shows the different processing properties of an IPGScan Marking job. When marking points, only Relative Speed and Energy are applicable.

Table 15: Marking Properties

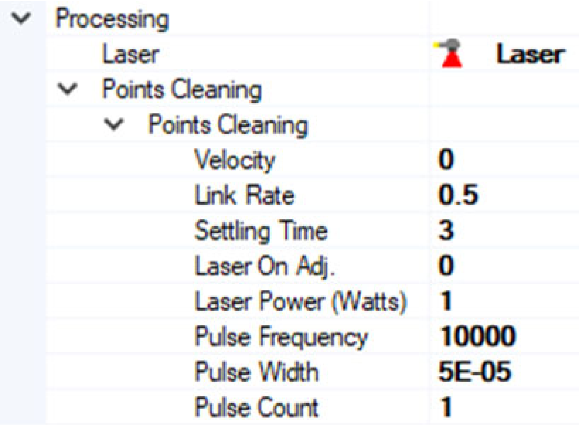
PROPERTY	DESCRIPTION
Laser	Select how the laser will function from this dropdown. The three options are Guide, Trace, and Laser.
Relative speed	Relative speed of the focal point of the beam from 0 to 1
Energy	Energy of the laser in [J]
Frequency	Frequency of the laser
Pitch	Distance between laser pulses on the work piece

7.7.4 Cleaning Process Properties



Processing	
Laser	Laser
Vectors Cleaning	
Vectors Cleaning	
Velocity (Initial)	0
Velocity (Maximum)	1000
Acceleration (0-100%)	100
Link Rate (0-100%)	100
Link Settle	0
Laser On Adjust	0
Laser Off Adjust	0
Laser Table	□ (Collection)

Figure 120: Cleaning Vector Process Properties



Processing	
Laser	Laser
Points Cleaning	
Points Cleaning	
Velocity	0
Link Rate	0.5
Settling Time	3
Laser On Adj.	0
Laser Power (Watts)	1
Pulse Frequency	10000
Pulse Width	5E-05
Pulse Count	1

Figure 121: Cleaning Point Process Properties

Figure 120 and Figure 121 shows an example of the process properties for a vector object and point object, respectfully, in a marking IPGScan job type.

Table 16 (below) and Table 17 on page 135 show the properties for welding vector objects and welding point objects, respectively.

Table 16: Cleaning Vector Properties

PROPERTY	DESCRIPTION
Laser	Type of laser that will be used to output the selected object
Velocity (Initial)	Speed of the laser focal point at the start of the object
Velocity (Maximum)	Maximum speed of the laser focal point
Acceleration (0-100%)	Percentage of the maximum acceleration allowed by the scanner. A lower value increases time between Velocity (Initial) to Velocity (Maximum).
Link Rate (0-100%)	Percentage of maximum speed allowed by the scanner for a jump (e.g. when the scanner moves from one point to another)
Link Settle	Specifies how long until the scanner settles on a given position in units of scanner time constants. The software will limit the value to a safe maximum. Usually, a value between 3 and 6 should be used.
Laser On Adjust	Adjustment on the calculated time between when the scanner reaches the start of a vector/a point and the laser begins to fire; nly positive values are allowed
Laser Off Adjust	Adjustment on the calculated time between when the scanner leaves the end of a vector/a point and the laser begins to fire; only positive values are allowed

Table 17: Cleaning Point Properties

PROPERTY	DESCRIPTION
Laser	Type of laser that will be used to output the selected object
Link Rate	See "Link Rate" in Table 16
Settling Time	See "Link Settle" in Table 16
Laser On Adj.	See "Link On Adjust" in Table 16
Laser Power (Watts)	The output power of the laser in Watts
Pulse Frequency	See "Pulse Frequency" in Table 12 on page 119
Pulse Width	See "Pulse Width" in Table 12 on page 119

7.7.4.1 Laser Table

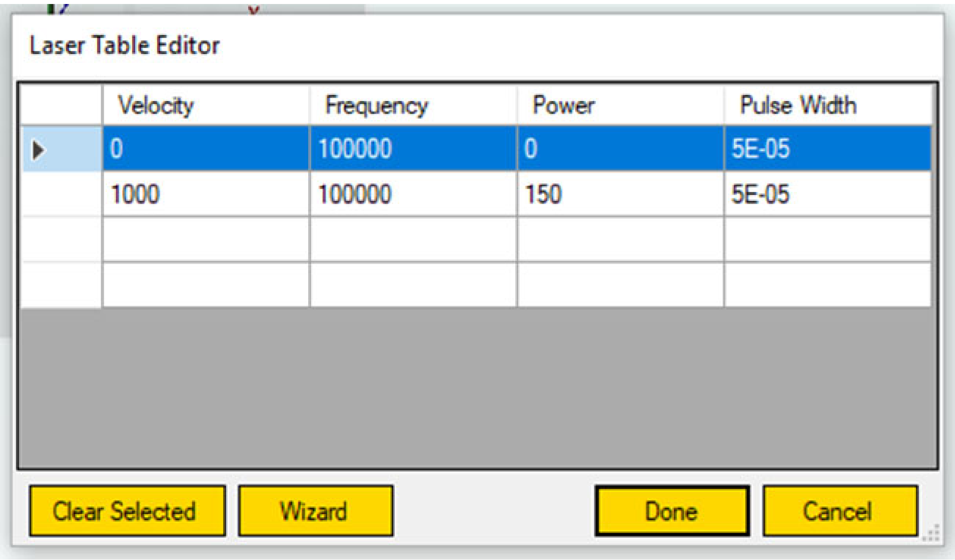
During an actual vector scanning, IPGClean has to manage three laser control signals. These signals are:

- Laser Power (in Watts)
- Pulse Frequency (in Hertz), assuming the pulse laser is being controlled
- Pulse Width (in Seconds), assuming the pulse width can be varied

These signals may change with time and they are synchronized with the galvo mirrors movement. All signals above have to specified in terms of the scanning velocity. This is to ensure that either:

- A constant pulse spacing OR
- A constant deposition of energy per linear unit is maintained even if the galvos are accelerating. This is achieved by the Laser Table Feature. The Laser Table feature specifies the Power, Frequency, and Pulse Width for specific Velocities.

For example, for constant laser energy per linear distance, increase the laser power from 0 to 150W at a constant pulse width (50% duty cycle) and constant frequency (100 kHz). See Figure 122 on page 136.

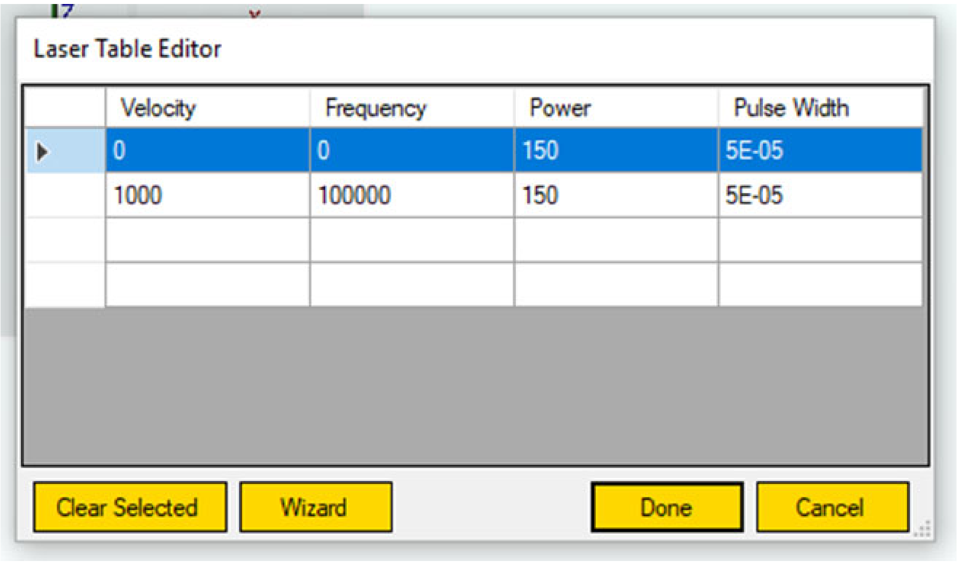


Laser Table Editor

	Velocity	Frequency	Power	Pulse Width
▶	0	100000	0	5E-05
	1000	100000	150	5E-05

Figure 122: IPGClean Laser Table Example 1

For equally spaced pulses increase the pulse frequency from 0kHz to 100kHz at a constant power and pulse width. See Figure 123 (below).



Laser Table Editor

	Velocity	Frequency	Power	Pulse Width
▶	0	0	150	5E-05
	1000	100000	150	5E-05

Figure 123: IPGClean Laser Table Example 2

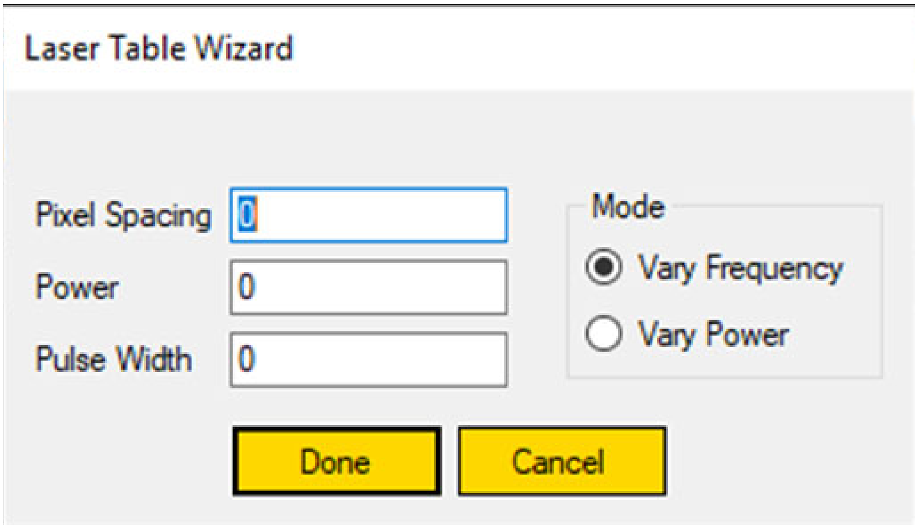
IMPORTANT

The pulse distance on the surface being cleaned is simply the ratio between velocity and frequency.

The initial and maximum velocities may not need to be equal to those on the laser table. The software will interpolate and find correspondent values in the line that passes through all values in the laser table.

The laser table editor also offers a wizard that populates the laser table based on Maximum Velocity parameter and uses the pulse distance as the input parameter.

Clicking on the Wizard button, the following dialog appears (see Figure 124):



Laser Table Wizard

Pixel Spacing: 0

Power: 0

Pulse Width: 0

Mode

● Vary Frequency

○ Vary Power

Figure 124: IPGClean Laser Table Wizard

- Vary Frequency - a table will be created in which the pulse spacing is kept constant by varying the frequency as in Example 2 above.
- Vary Power - a table will be created in which the energy per linear distance is kept constant by increasing power with increasing velocity as in Example 1 above.

7.7.5 Creating a Parameter Profile

Users can create a parameters profile for frequently used materials/parameters.

To create a Parameter Profile:

1. Select View ' Processing Parameters. See Figure 125 (below).

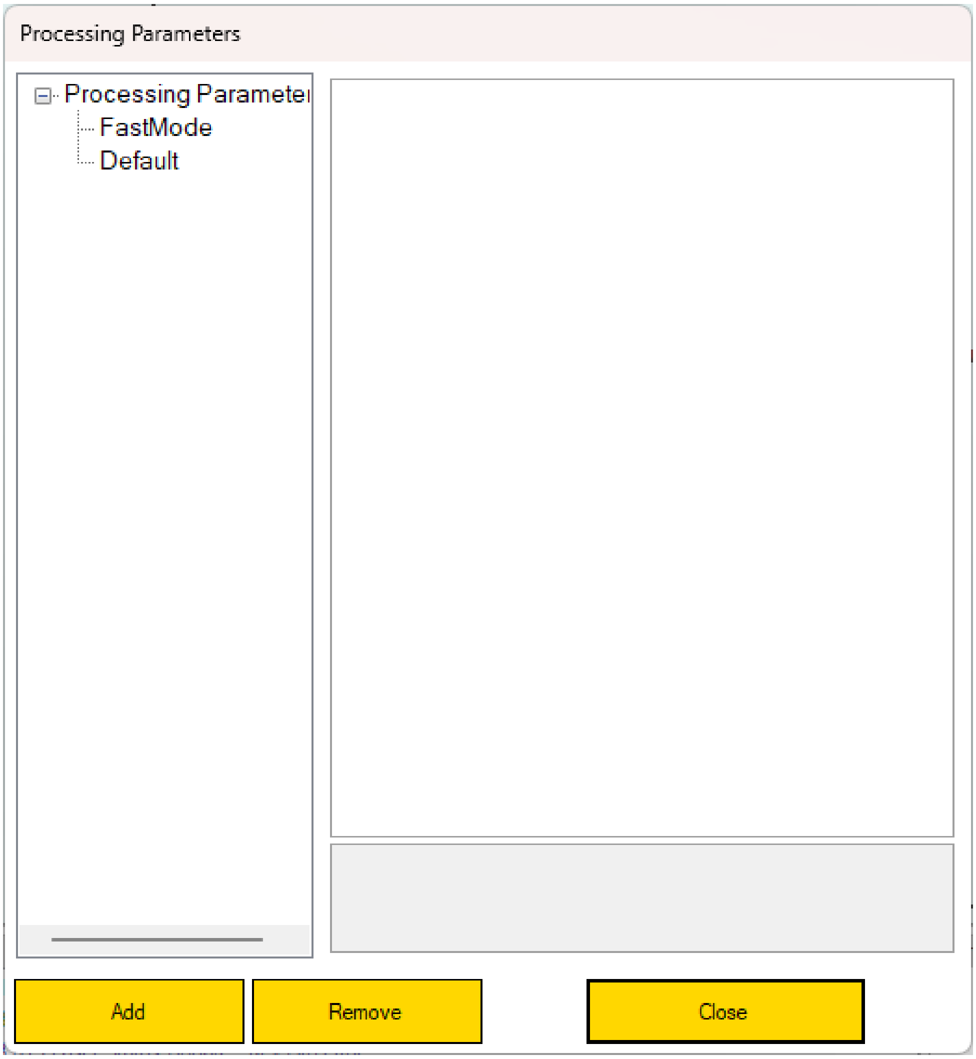
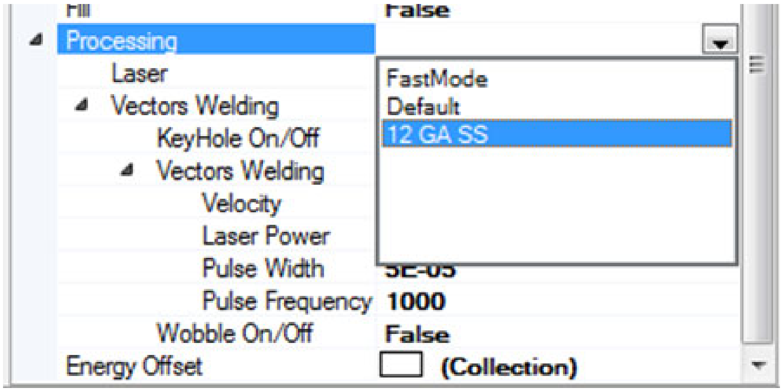


Figure 125: Welding/Marking/Cleaning Parameters

2. Click "Add" to add a new profile.
3. Rename the profile to a desired custom name as needed.
4. Modify the process parameters as needed.
5. Click Ok to save your changes. Close the Parameters window.
6. In the Data/Parameter Window, after selecting an object, under Processing, select the profile from the drop-down menu as shown in Figure 126 on page 139.



Fill	False
Processing	
Laser	
Vectors Welding	
KeyHole On/Off	
Vectors Welding	
Velocity	
Laser Power	
Pulse Width	5E-05
Pulse Frequency	1000
Wobble On/Off	False
Energy Offset	(Collection)

FastMode
Default
12 GA SS

Figure 126: Processing Dropdown Menu

IMPORTANT The fields for the parameters are auto-filled based on the template you selected. Further modifying the shapes parameters after selecting a profile will not change the profile.

7.8 Process Features and Tools

7.8.1 Viewing Tools

There are three tools in the toolbar which can be used to adjust the view in IPGScan. These tools are shown in Table 18.

Table 18: Viewing Tools

TOOL NAME	DESCRIPTION	ICON
Show Selected	Show only the selected object in the job tree. All other objects on the canvas will disappear. Note that this does not affect processing; this is only for assisting the users visually.	👁
Show Curve Direction	Shows the direction in which object vectors will be output by the scanner.	↘
Show Vertices	Shows the vertices in all objects.	⁘

7.8.2 Moving Objects

There are several methods for moving IPGScan objects.

7.8.2.1 Pose Configuration

A pose is a description of an object's position and orientation in space. It is comprised of a "Center" or position and a "Rotation" or orientation. The Center is the object's translation along the X, Y, and Z axes; the Rotation is the object's rotation about the X, Y, and Z axes.

There are three poses for each object: Object pose, Group pose, and Global pose. The "Object pose" modifies the object's position relative to the center of the object. The "Group pose" is the pose of the group and is applied to each object within the group. The "Global pose" is only available in On-The-Fly type jobs and modifies the object's position relative to the IPGScan origin.

7.8.2.2 Nudge Tool

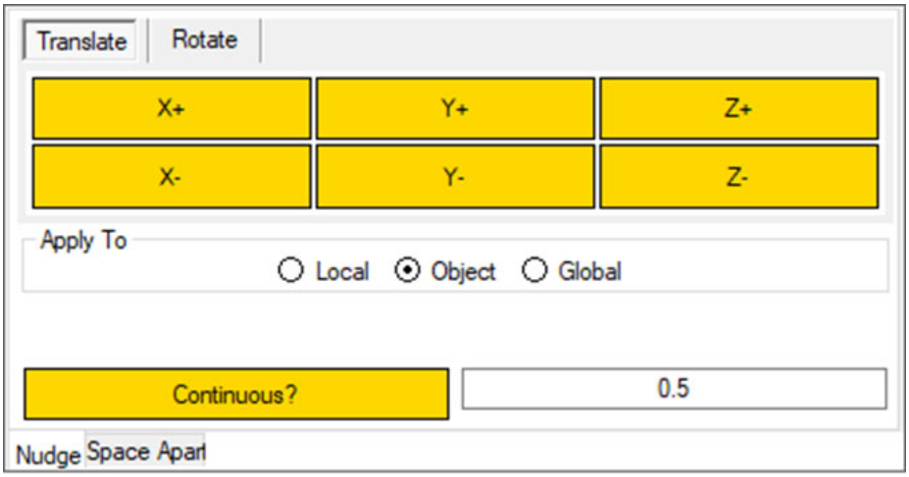
Above the properties menu, select the nudge button (✥) to display the Nudge Window as seen in Figure 127 (below). The radio buttons at the bottom select which pose will be nudged.

When a button is pressed, the specified pose of the selected objects will be adjusted by the number at the bottom in the axis and direction of the button pressed. The "Global" pose is only available in On-The-Fly type jobs.

If the continuous button is selected, a nudge button can be held down and the object will keep being nudged. If the continuous button is not selected, only one nudge will be done per click of a button.

The local button applies the nudge to the selected objects' object pose using the frame of the object. For example, if the selected object is rotated at a 45° angle and a local nudge is applied parallel to the rotation then the object will translate along the 45° angle.

When the Translate tab is selected, the nudge is applied to the selected poses' "Center." When the Rotate tab is selected, the nudge is applied to the selected poses' "Rotation."


Apply To: ○ Local ● Object ○ Global

0.5

Figure 127: Nudge Window

The Space Apart tab will equally space apart multiple objects by the specified amount. This will only apply to translation. Figure 128 (below) shows the Space Apart window.

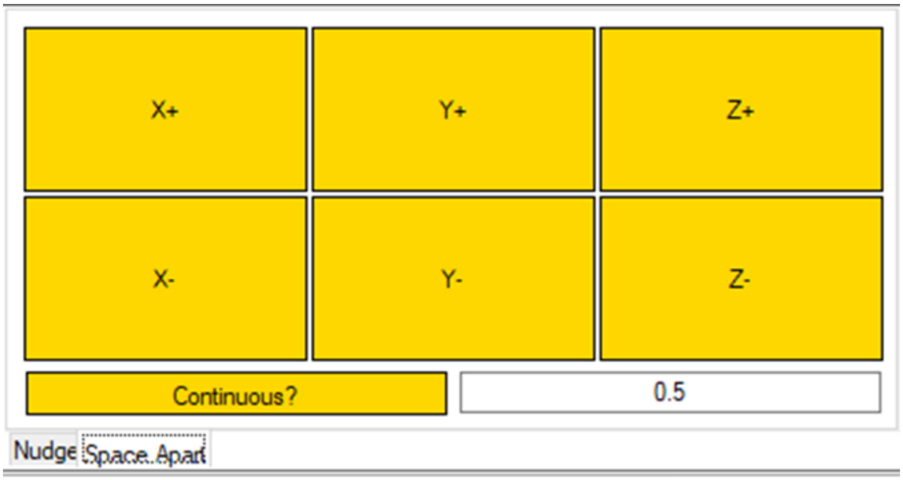


Figure 128: Space Apart Window

7.8.2.3 Select with Mouse

The Select by Pick feature allows users to manually manipulate the coordinates of the object on the canvas. It does not affect the rotation of the object. The button ( ) can be found in the IPGScan toolbar.

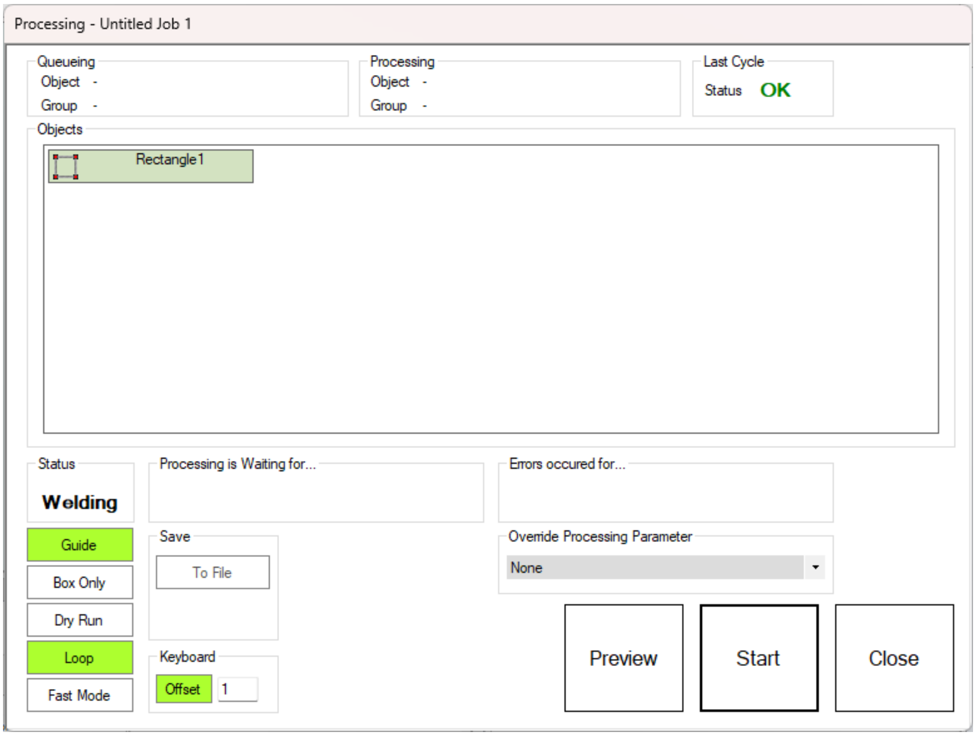
The Select by Rectangle feature allows the user to drag and drop the rectangle in the field of view to select multiple objects. The other Move tools can then be used on the set of selected objects. The button ( ) can be found in the IPGScan toolbar.

7.8.2.4 Keyboard Offset

With keyboard offset, users have the ability to preview objects in the scanner field of view and make adjustments to object location, live time, using the computer keyboard. This feature is designed to assist with placing objects in a work area during process setup.

To use keyboard offset:

1. Select the desired object(s) in the Job Tree.
2. Click Start Processing.
3. Check Guide, Loop, and Offset. Refer to figure Keyboard Offset below.
   a. Fast Mode can also be checked if desired.



Processing - Untitled Job 1

Queueing: Object -, Group -

Processing: Object -, Group -

Last Cycle: Status OK

Objects: Rectangle1

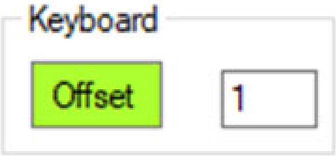
Status: Welding

Override Processing Parameter: None

Keyboard: Offset 1

Figure 129: Keyboard Offset

Set the desired distance that each keystroke will cause the object(s) to shift. Figure 130 (below) shows an offset distance of 1.0mm per keystroke.



Keyboard: Offset 1

Figure 130: Offset Distance

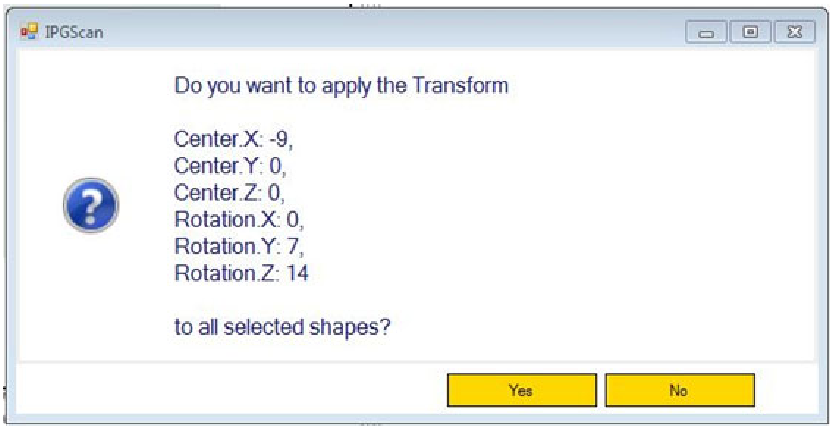
4. Click Start.
   a. It should now be possible to see the object(s) with the guide laser.

5. While observing the guide laser, move the position of the object(s) using the keystrokes outlined in Table Keyboard Offset Keystrokes

Table 19: Keyboard Offset Keystrokes

IPGScan DIRECTION	KEYBOARD KEY STROKE
Translation in X+/X-	Right Arrow/Left Arrow
Translation in Y+/Y-	Up Arrow/Down Arrow
Translation in Z+/Z-	PgUp/PgDn
Rotation about X+/X-	Ctrl + Right Arrow/Ctrl + Left Arrow
Rotation about Y+/Y-	Ctrl + Up Arrow/Ctrl + Down Arrow
Rotation about Z+/Z-	Ctrl + PgUp/Ctrl + PgDn

6. Once the object(s) is in the desired location, click Stop.
7. Click Close to close the Processing Window.
8. Click Yes to apply the Transform. Click No to revert the object(s) to the starting location. See Figure 131 (below).



Do you want to apply the Transform

Center.X: -9,
Center.Y: 0,
Center.Z: 0,
Rotation.X: 0,
Rotation.Y: 7,
Rotation.Z: 14

to all selected shapes?

Figure 131: Confirm Transform

7.8.3 Projection

Projection allows users to project an object onto an STL model. This allows users to contour features according to STL model.

To use Projection:

The following steps detail the method for which users can project processing objects onto an STL model.

1. Open IPGScan.
2. Create a new IPGScan Job.
3. Import an STL model. See Figure 132 (below).
   a. (Optional) Apply any offsets and/or rotations to the model. The models color can also be adjusted in the Parameter Tree

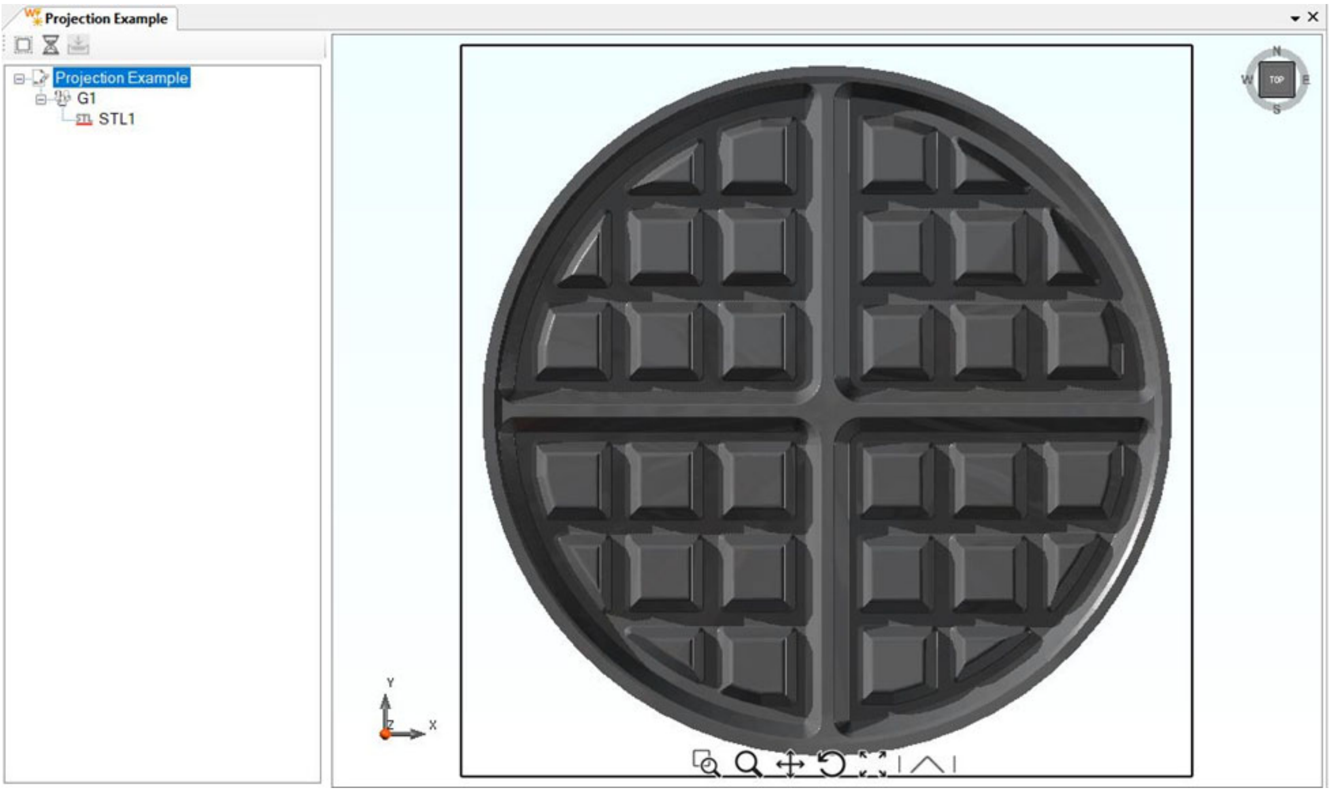


Figure 132: Importing an STL Model

4. Create the desired processing object that will be projected onto the STL model.
   a. The desired object must have a "Max Length" value that is greater than 0. The smaller the defined "Max Length," the more vectors the processing object will consist of. As the number of vectors increase, the longer it will take the object to project. Projection can only move existing vectors. The benefit of having more vectors is that the object will contour the STL model at a higher resolution.
   b. For this example, a 200mm diameter circle with a fill pattern will be created.

5. Once the desired object is created, it must be converted into a Multishape. This can be done by right clicking on the objects name in the Job Tree and then clicking on "Convert to Multi Shape." See Figure 133 (below).

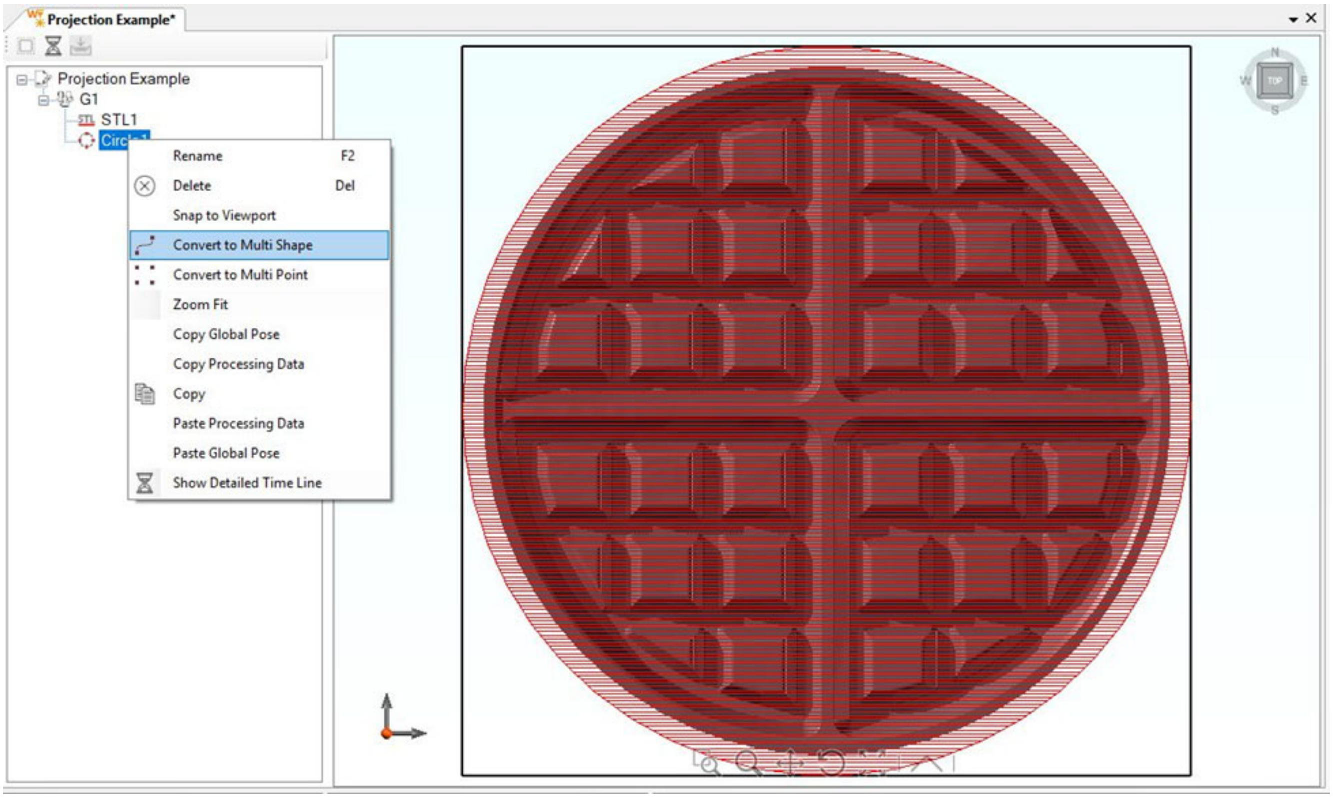
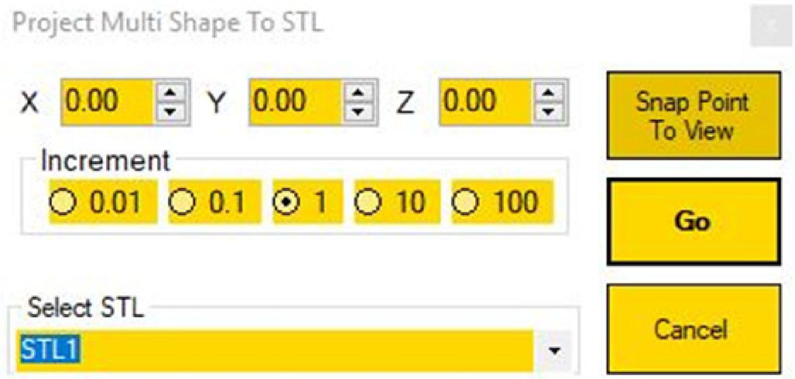


Figure 133: Converting the Process Object into a Multi Shape

6. Next, the user can right click on the Multi Shape and click on "Project Multishape to STL." This will bring up the "Project Multi Shape to STL" window. See Figure 134 (below).


Project Multi Shape To STL

X 0.00 Y 0.00 Z 0.00

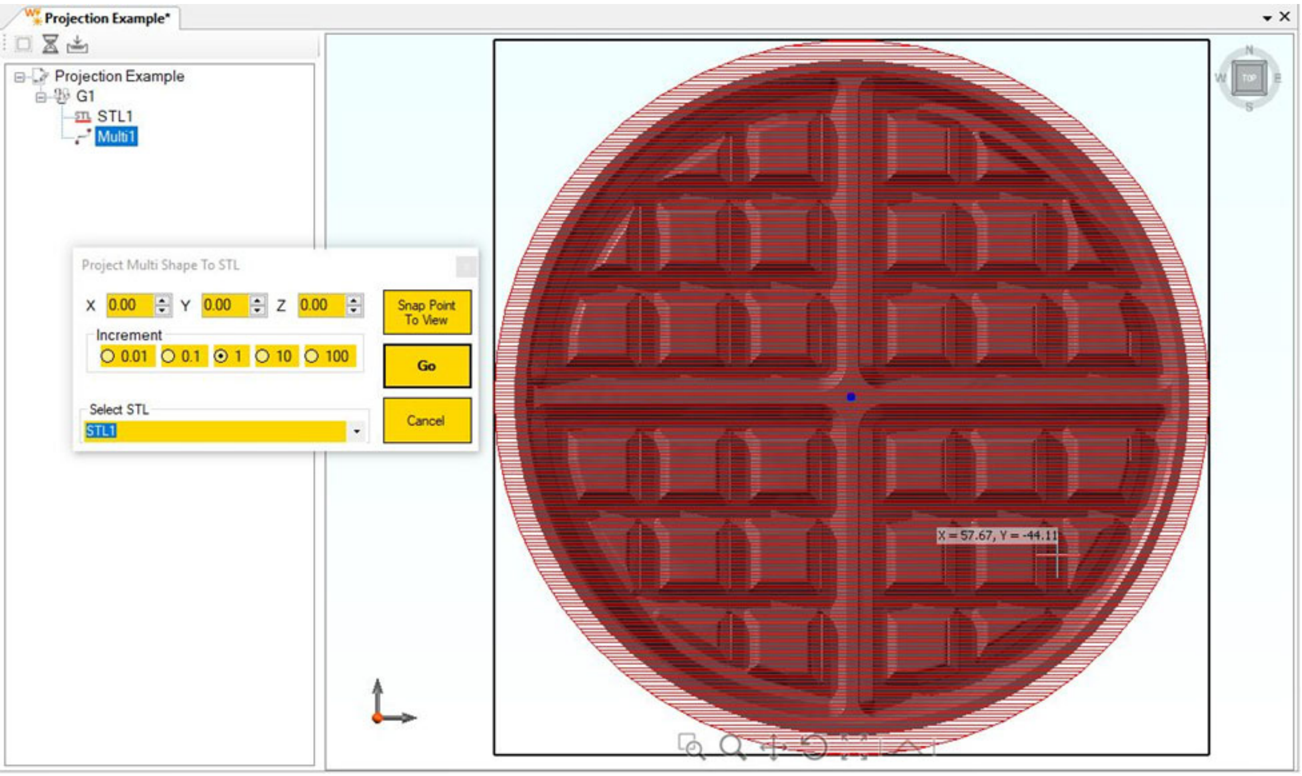
Increment: ○ 0.01 ○ 0.1 ● 1 ○ 10 ○ 100

Select STL: STL1

Figure 134: Project Multi Shape to STL Window

7. In the "Project Multi Shape to STL" window, the user should select the STL model that the processing object will be projected on.

8. Next, the user needs to align the projection point. The projection point appears as a blue dot in the IPGScan Canvas (see Figure 135).
   a. The projection point can be thought of as a light source. This needs to be positioned so that the processing object would cast a "shadow" onto the STL model. The placement of the projection point will have different effects on how the processing object is projected onto the STL model.
      i. A projection point that is directly perpendicular to the projection surface from at a large distance to the surface will result in a projection with the least distortion.
   b. The user can adjust the projection point in a number of manners.
      i. Direct Entry Method - The user can directly type values into the X, Y, and Z boxes.
      ii. Arrow Keys - The user can increment X, Y, and Z. The amount adjusted per arrow click is the amount that the Increment radio selection is set to.
      iii. Snap Point to View - The user can adjust the IPG Canvas view and then click "Snap Point To View." This will cause the projection point to snap to coordinates that pertain to the IPGScan Canvas view.



Project Multi Shape To STL

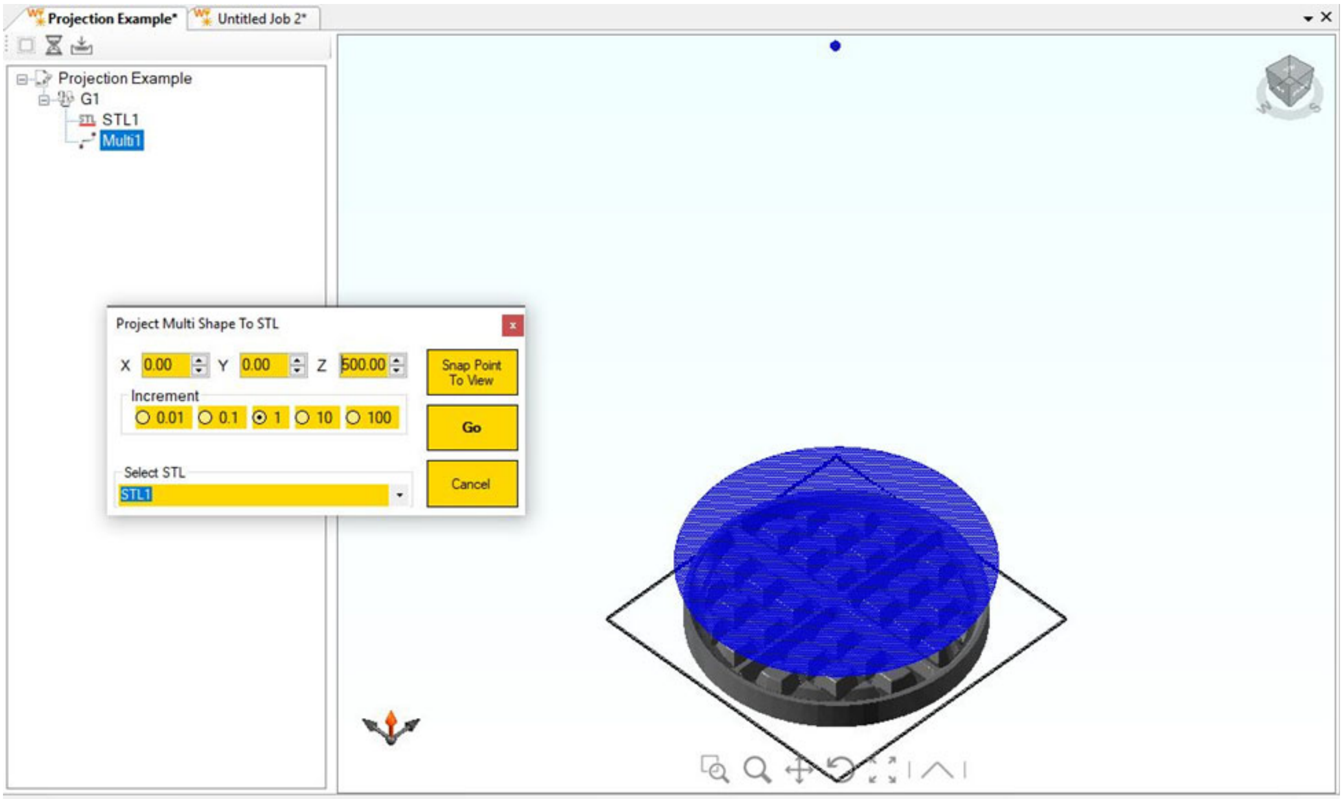
X 0.00 Y 0.00 Z 0.00

Increment: ○ 0.01 ○ 0.1 ● 1 ○ 10 ○ 100

Select STL: STL1

Figure 135: Projection Point

9. Once the projection point is aligned as desired (see Figure 136 on page 147), the user can click "Go" to project the process object.
   a. Keep in mind that any vectors that do not project directly onto the STL will be removed from the object.



Project Multi Shape To STL

X 0.00 Y 0.00 Z 500.00

Snap Point To View

Increment
○ 0.01 ○ 0.1 ● 1 ○ 10 ○ 100

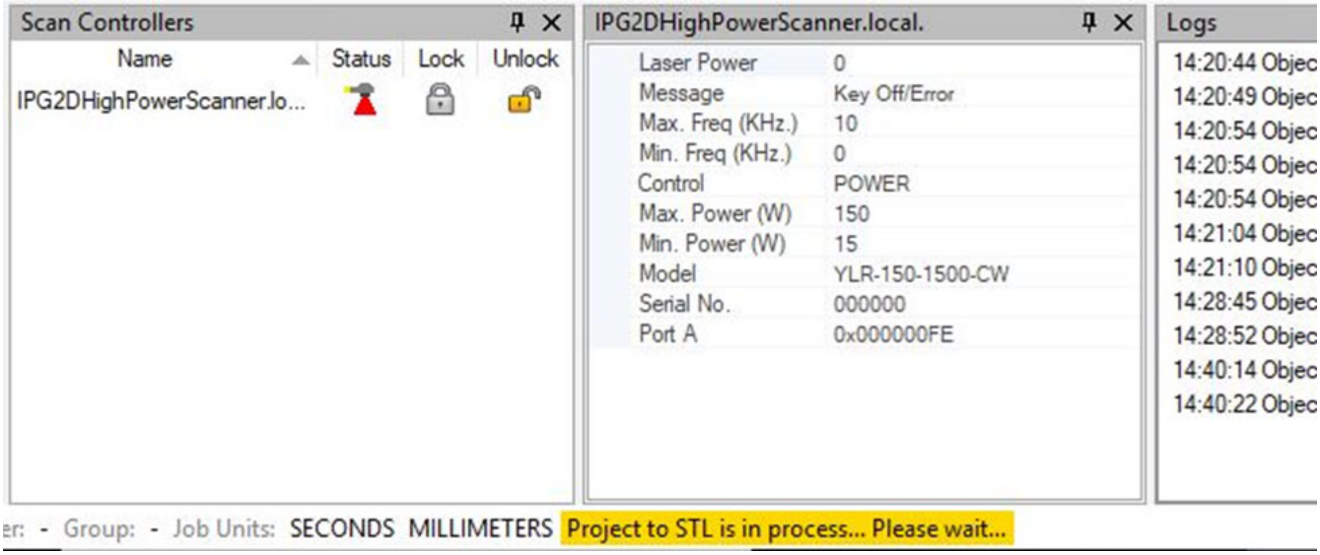
Go

Select STL
STL1

Cancel

Figure 136: Aligning the Projection Point, Process Object, and STL Model

10. Depending on the number of vectors in the process object, this process can take some time. Figure 137 (below) details the warning that will appear in IPGScan while the projection process is taking place.



Scan Controllers

Name	Status	Lock	Unlock
IPG2DHighPowerScanner.lo...			

IPG2DHighPowerScanner.local.

Laser Power	0
Message	Key Off/Error
Max. Freq (KHz.)	10
Min. Freq (KHz.)	0
Control	POWER
Max. Power (W)	150
Min. Power (W)	15
Model	YLR-150-1500-CW
Serial No.	000000
Port A	0x000000FE

Logs

```
14:20:44 Objec
14:20:49 Objec
14:20:54 Objec
14:20:54 Objec
14:20:54 Objec
14:21:04 Objec
14:21:10 Objec
14:28:45 Objec
14:28:52 Objec
14:40:14 Objec
14:40:22 Objec
```

er: - Group: - Job Units: SECONDS MILLIMETERS Project to STL is in process... Please wait...

Figure 137: Warning during Projection Process

11. Once the projection process is complete, the object will now be projected onto the STL model accordingly. See Figure 138 (below).

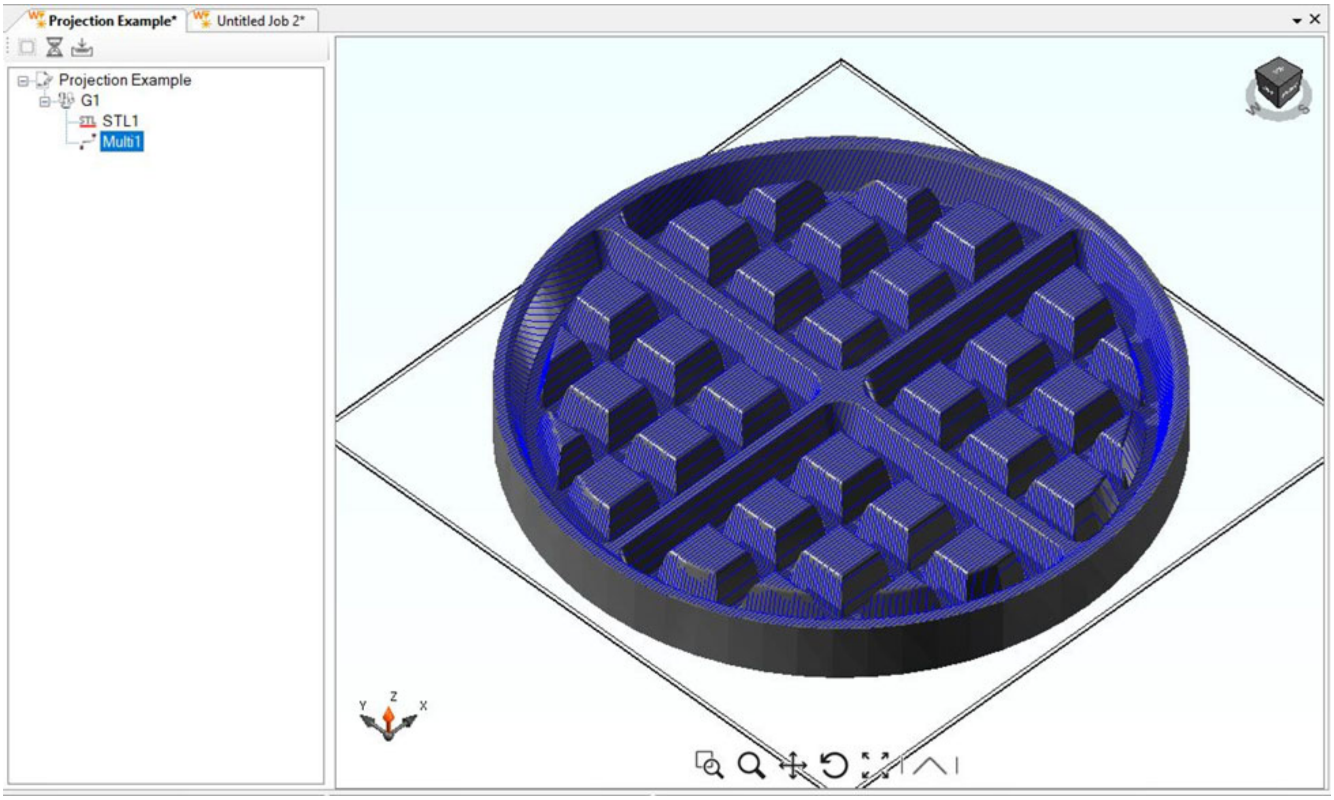


Figure 138: Process Object Projected onto an STL Model

   a. Note that because the object is projected onto the STL model by casting a "shadow," there is a high likelihood that the original pitch defined (line to line fill spacing) will no longer be equal throughout the process object (see Figure 139 on page 149).

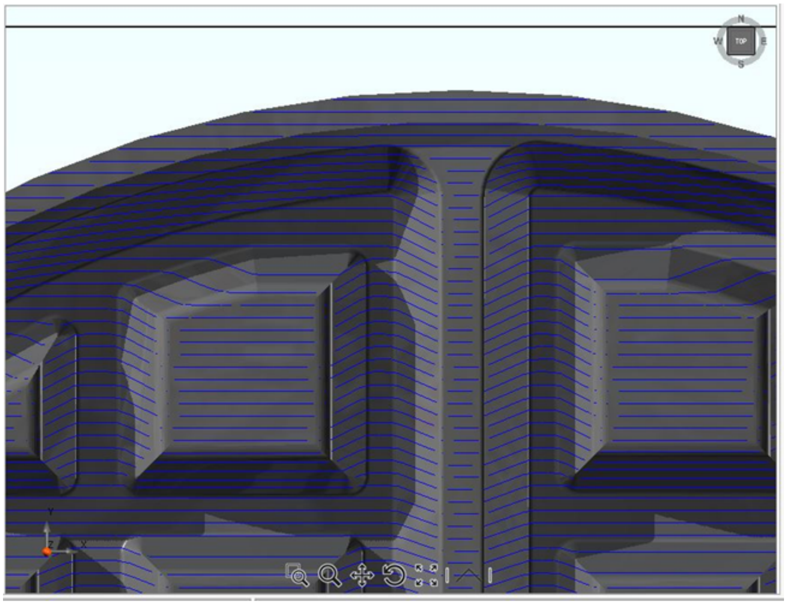


Figure 139: Uneven Fill Pitch after Projection

b. It's also important to know that once a process object is projected onto a STL model, the process object will maintain the contour of the model even if the model or process object is moved. In other words, the process object does not maintain an active mold of the STL model. See Figure 140 (below).

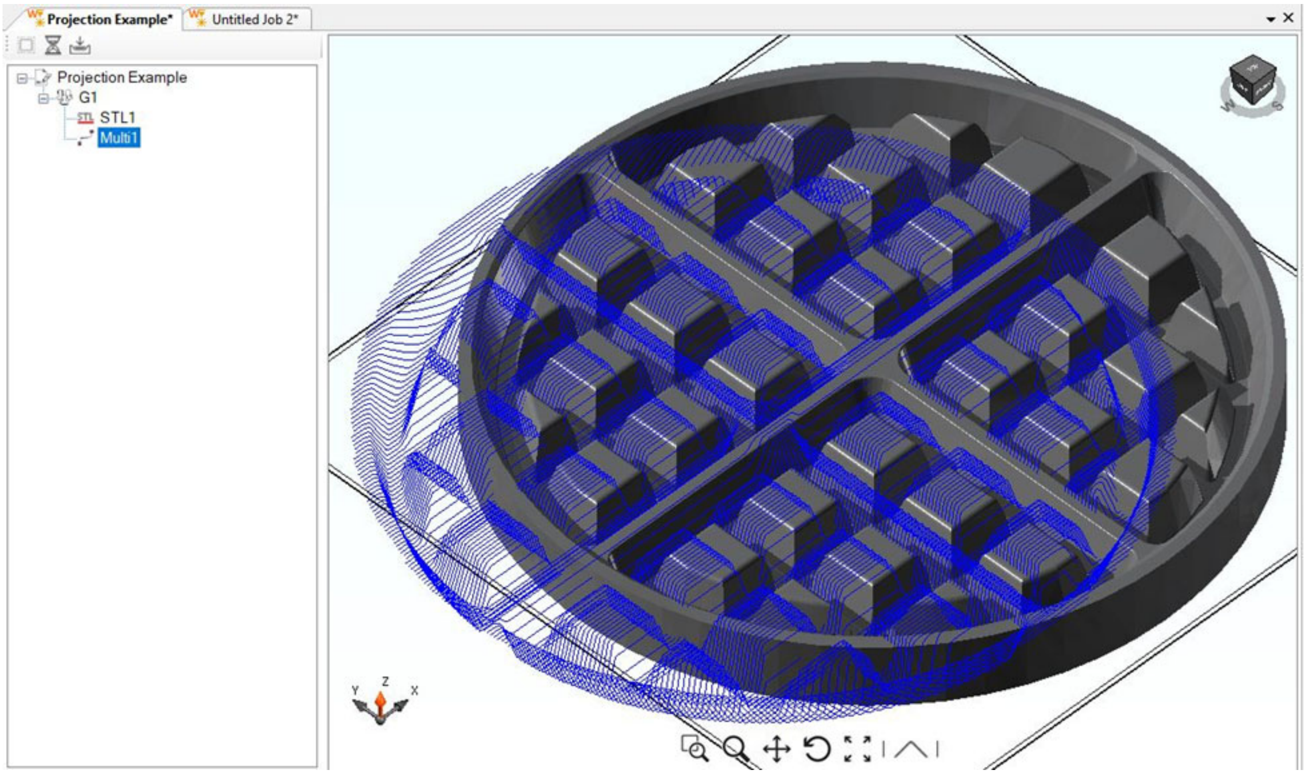


Figure 140: Process Object Moved after Projection

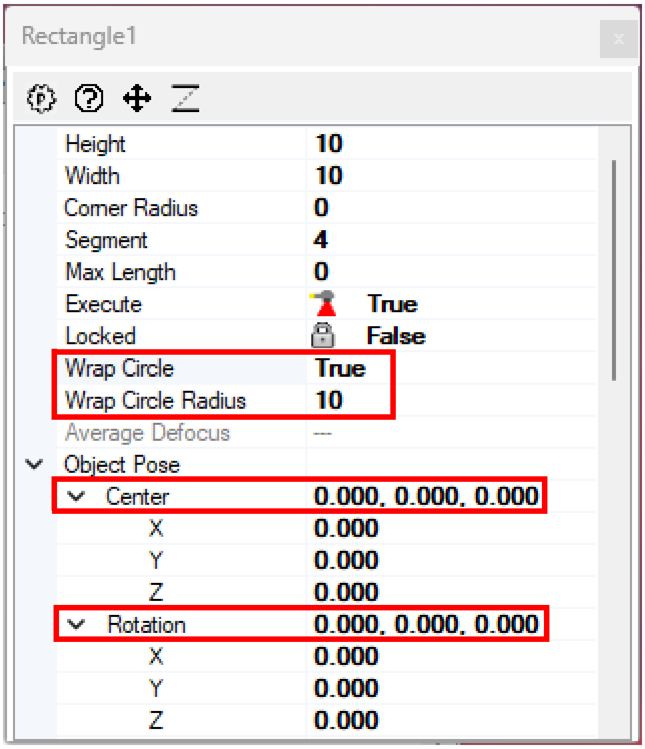
7.8.4 Wrap Circle

The 'Wrap Circle' feature in IPGScan can be utilized to wrap vector objects around a circle of user-specified radius. Vector objects that can be wrapped around a circle in IPGScan include text and all vector shapes that are directly defined in the IPGScan GUI as well as vector shapes that are imported from DXF files.

IPGScan treats 'Wrap Circle' as a property of a vector object, just as position and rotation. Among these object properties, 'Wrap Circle' takes priority over rotation and position.

When 'Wrap Circle' is set to true for a vector object, IPGScan first wraps that object to an imaginary circle centered at (0, 0) with the user-specified radius. After the vector object is wrapped and positioned accordingly, IPGScan then applies position and rotation settings to the 'wrapped' vector object.

For example, this rectangle object has the following three properties (see Figure 141):



Rectangle1

Height	10
Width	10
Corner Radius	0
Segment	4
Max Length	0
Execute	True
Locked	False
Wrap Circle	True
Wrap Circle Radius	10
Average Defocus	---
Object Pose	
Center	0.000, 0.000, 0.000
X	0.000
Y	0.000
Z	0.000
Rotation	0.000, 0.000, 0.000
X	0.000
Y	0.000
Z	0.000

Figure 141: Example Object Wrap Parameters

1. Wrap circle is 'True' and Wrap Circle Radius is '10'.
2. Center position is (10, 15, 0).
3. Rotation is around z-axis by 30 degree.

IMPORTANT No matter at what order the above properties are being entered in IPGScan, IPGScan will apply the 'Wrap Circle' property first, followed by rotation and then the center position is adjusted. Therefore, the resultant shape and its position/ orientation with respect to the origin are as shown in the picture below. See Figure 142 (below).

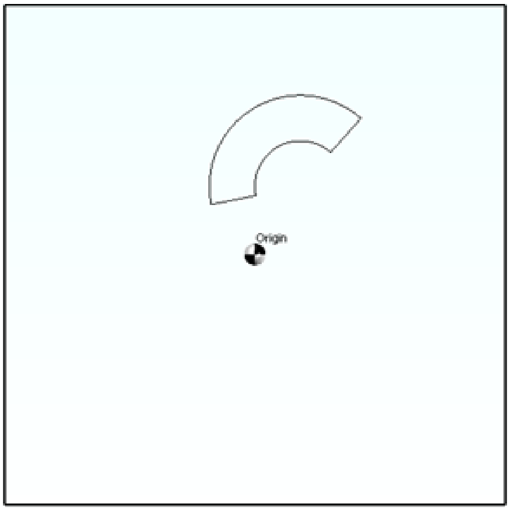


Figure 142: Resulting Object with Wrap

Figure 143 illustrates how each individual property affects the rectangle based on the priority order of the properties, although all the changes occur to the shape at the same time in the canvas.

First, 'Wrap Circle' and 'Wrap Circle Radius' is 10.

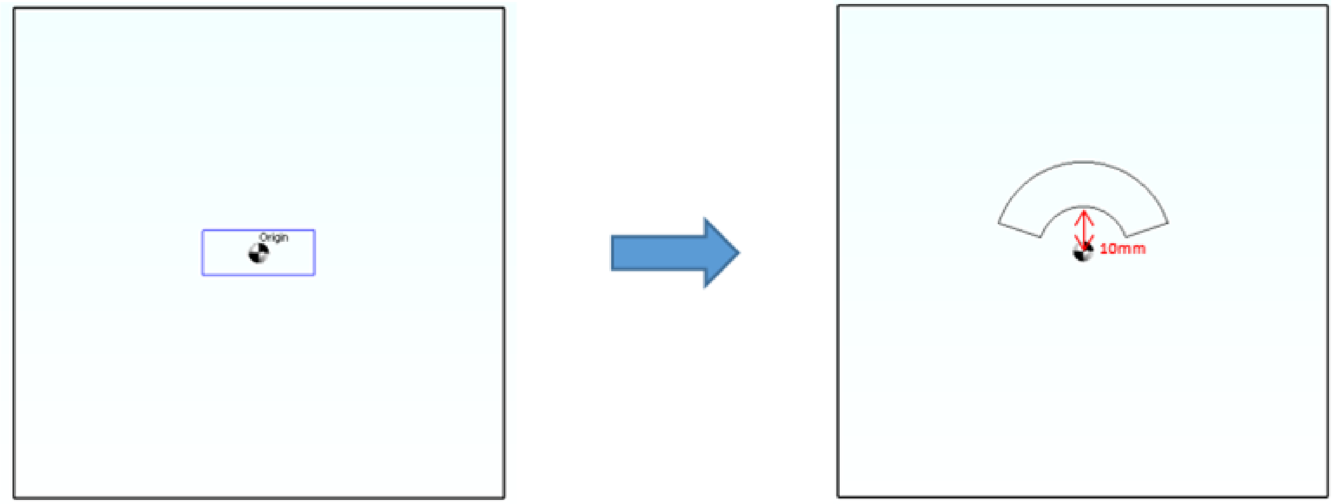


Figure 143: Individual Property Effects of Wrap

IMPORTANT IPGScan always assumes the circle that a vector object wraps around is centered at origin and with user specified radius, so the resultant vector object after wrapping will be positioned around that circle (the circle will not be shown in IPGScan). If the user wants the post-wrapping vector object at a different location and/or a different orientation, the user must adjust the object's coordinates and/or rotation accordingly.

Secondly, rotation around z-axis by 30 degrees. See Figure 144 (below).

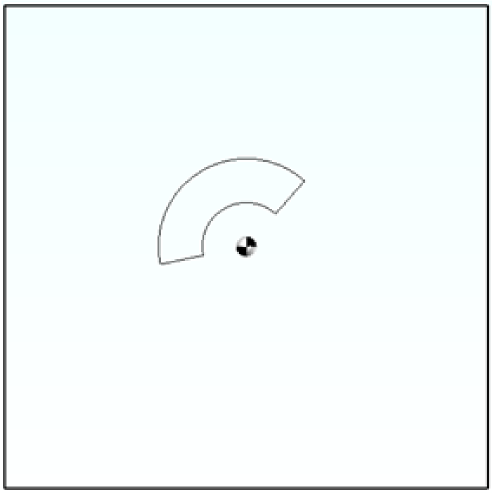


Figure 144: Wrapped Object with Applied Rotation

Finally, adjust position to (10, 15, 0). See Figure 145 (below).

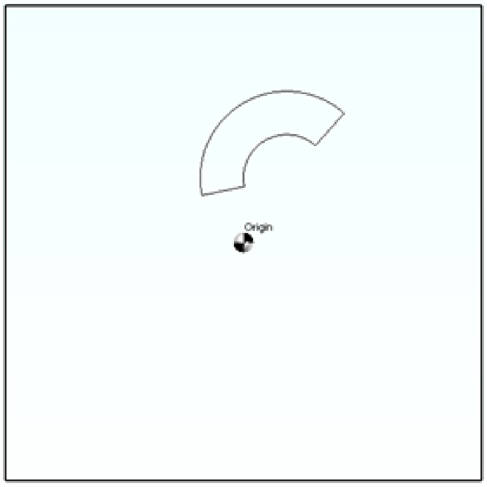


Figure 145: Wrapped Object with Applied Translation

7.8.4.1 *Wrap Procedure*

The following sections outline example applications of the Wrap feature.

7.8.4.1.1 *'Wrap Circle' to Vector Object Defined in IPGScan*

The following describes the steps to set Wrap Circle property to a vector object which is defined in IPGScan.

1. In the IPGScan job file, select the desired vector object to set the Wrap Circle property.
2. Change its Max Length to a non-zero value, e.g. 0.1 (mm).

IMPORTANT The default value for Max Length is 0. Failure to change Max Length to a non-zero value before "Wrap Circle" will produce an incorrect result.

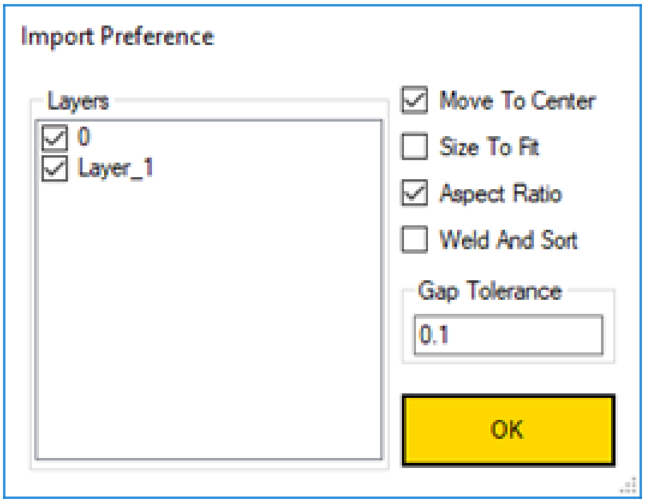
3. Set 'Wrap Circle' to True, and set Wrap Circle Radius to the desired value. The vector object will then appear wrapped around a circle of that radius centered on origin.
4. Adjust rotation and positon of the wrapped vector object accordingly, if needed.

7.8.4.1.2 *'Wrap Circle' to Vector Object Imported from DXF*

If the vector object to be imported is at (0, 0) in the DXF file, users can import the DXF file as it is. Users can then follow the same procedure described in the above section to set 'Wrap Circle'.

If the vector object to be imported is NOT at (0, 0) in the DXF file, here are the steps to ensure correct 'Wrap Circle' result.

1. Import DXF and select 'Move To Center' (see Figure 146). The DXF example used here includes a rectangle located at (10, 16.65) in the DXF coordinate.


Import Preference

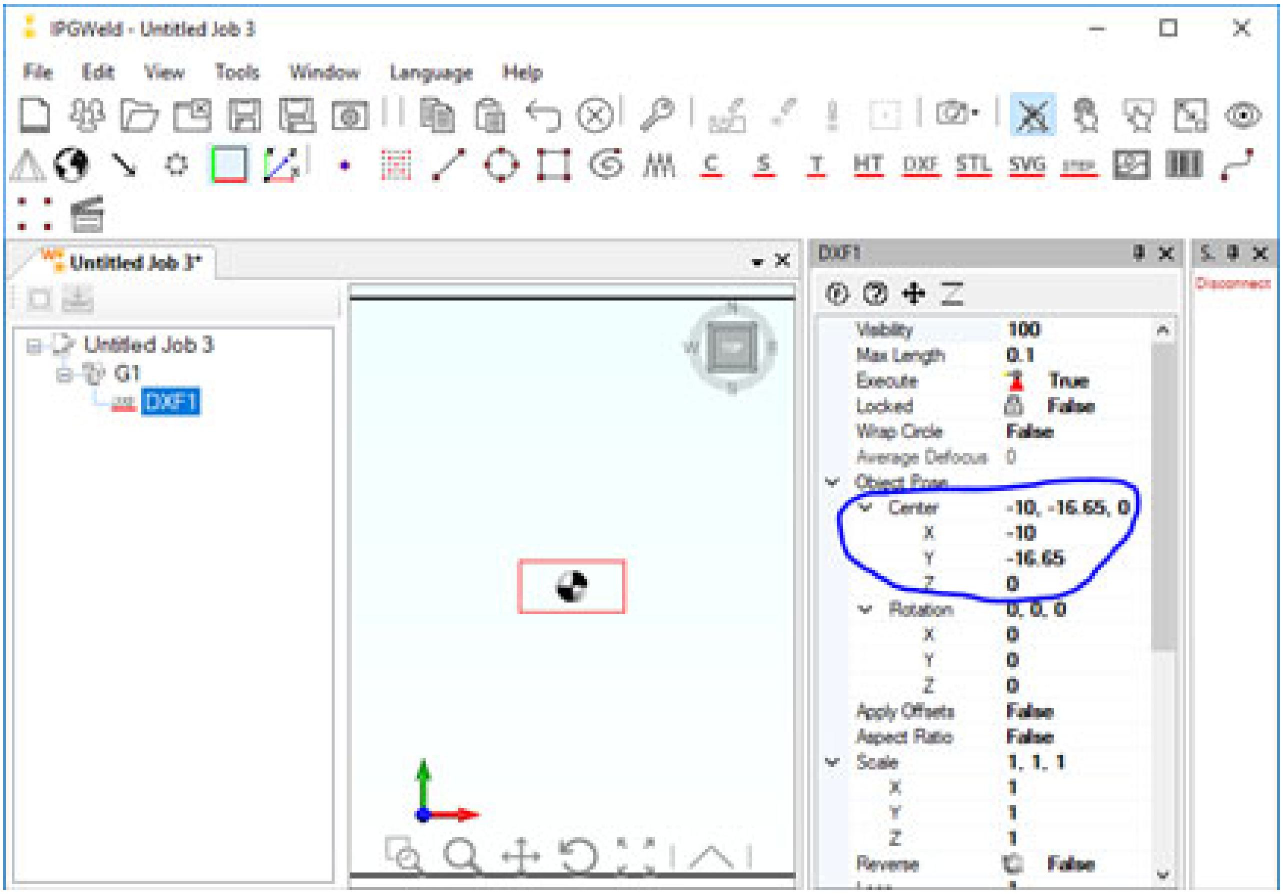
Layers
☑ 0
☑ Layer_1

☑ Move To Center
□ Size To Fit
☑ Aspect Ratio
□ Weld And Sort

Gap Tolerance: 0.1

Figure 146: DXF Import for Wrap

After the DXF is imported with 'Move To Center' selected, you will find the rectangle shape centered around origin in the IPGScan canvas. However IPGScan treats this rectangle as part of the DXF object, whose coordinate in the IPGScan canvas is now (-10, -16.65). See Figure 147 (below). If you proceed with 'Circle Wrap' now, an incorrect result will occur. Additional steps are needed before 'Wrap Circle' is applied, as described below.



Visibility	100
Max Length	0.1
Execute	True
Locked	False
Wrap Circle	False
Average Defocus	0
Object Pose	
Center	-10, -16.65, 0
X	-10
Y	-16.65
Z	0
Rotation	0, 0, 0
X	0
Y	0
Z	0
Apply Offsets	False
Aspect Ratio	False
Scale	1, 1, 1
X	1
Y	1
Z	1
Reverse	False

Figure 147: Move to Center Applied Coordinates

2. Select this DXF object, right click and select 'convert to Multi Shape'. See Figure 148 (below).

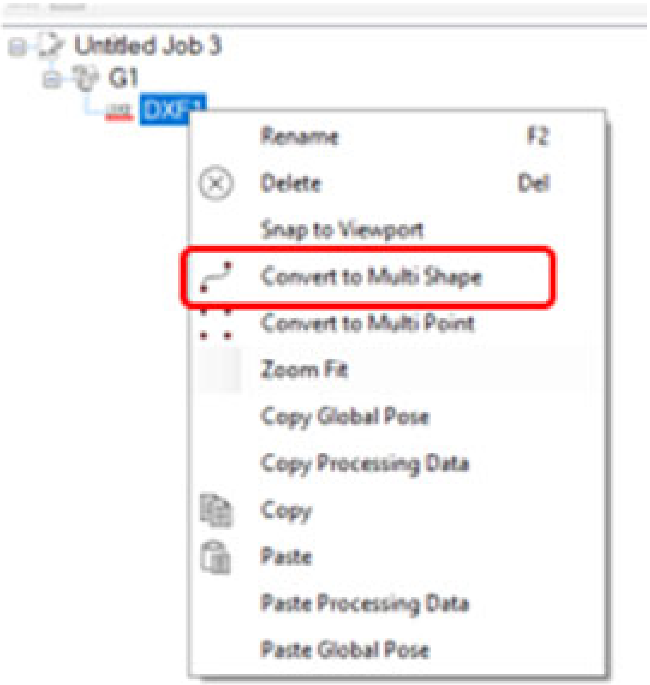
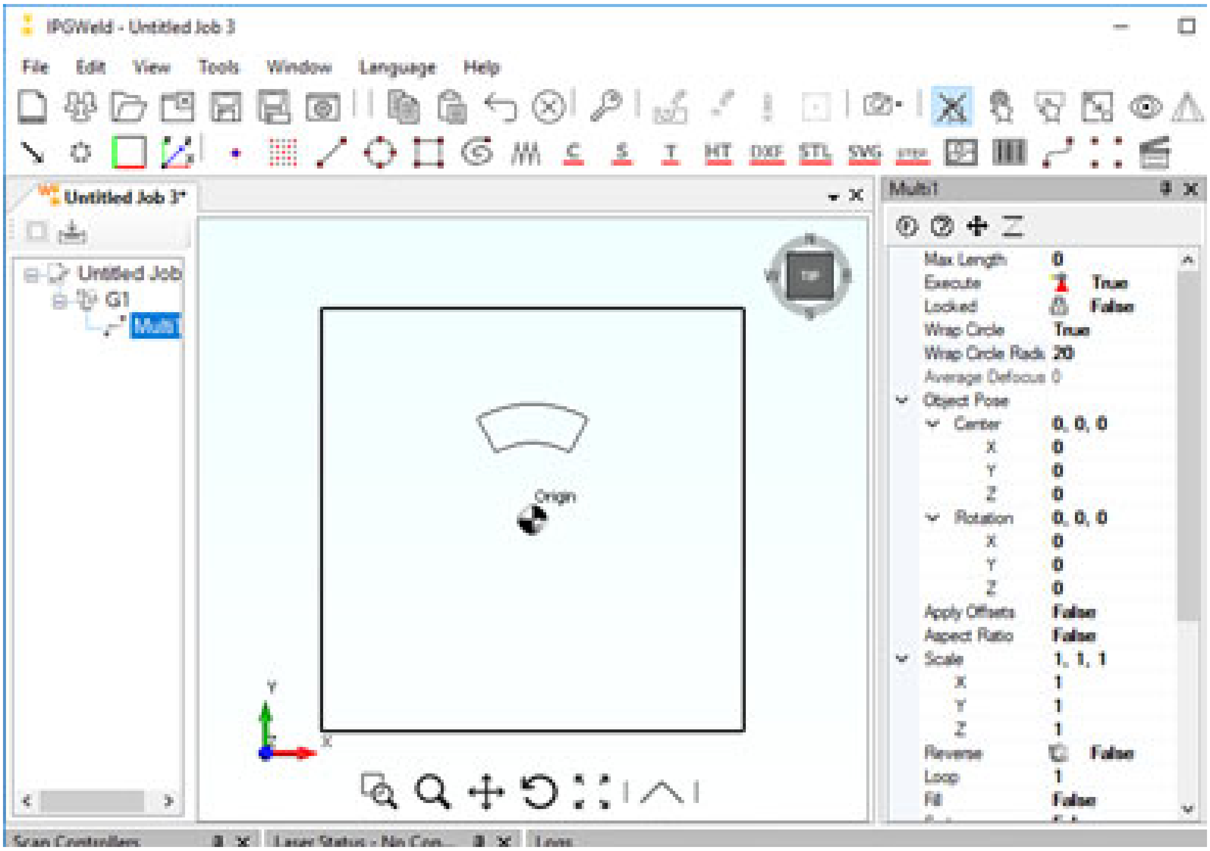


Figure 148: Convert to Multi Shape for Wrap

3. Select this multi-shape object and set its Max Length to a non-zero value, e.g. 0.1 (mm).

IMPORTANT The default value for Max Length is 0. Failure to change Max Length to a non-zero value before "Wrap Circle" will produce an incorrect result.

4. Set 'Wrap Circle' to True, and set Wrap Circle Radius to your desired value. The vector object will then appear wrapped around a circle of that radius centered on origin. In this example, Wrap Circle Radius is set to 20 (mm), the resulted object is shown in Figure 149.



Max Length	0
Execute	True
Locked	False
Wrap Circle	True
Wrap Circle Radi	20
Average Defocus	0
Object Pose	
Center	0, 0, 0
X	0
Y	0
Z	0
Rotation	0, 0, 0
X	0
Y	0
Z	0
Apply Offsets	False
Aspect Ratio	False
Scale	1, 1, 1
X	1
Y	1
Z	1
Reverse	False
Loop	1
Fill	False

Figure 149: Wrapped Circle

5. Adjust rotation and positon of the wrapped vector object accordingly, if needed.

7.9 Action Controls

Action Controls are IPGScan objects which perform an action rather than fire the laser (like a circle or a point).

Most Action Controls have an "Action TimeOut" property. If an Action Control has not finished in that amount of time, IPGScan will skip that Action Control and continue. If the "Action TimeOut" is set to {-1}, no timeout will be used.

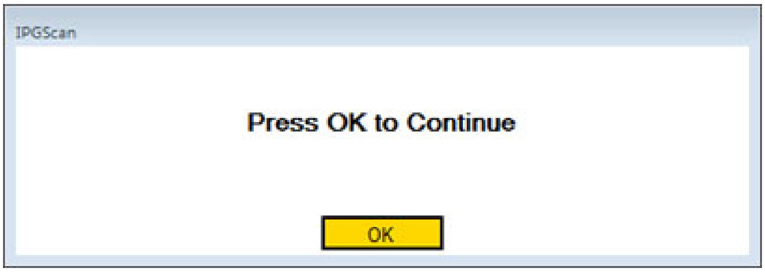
There are two types of Action Controls: those which run in IPGScan and those which are sent to the buffer (See Section 8.1.1 on page 183). If IPGScan is running an Action Control, it will not continue to the next object until that Action Control has finished. If an Action Control is sent to the buffer, IPGScan will send the information to the buffer and continue to the next object regardless of the status of the last Action Control. Actions which are executed in the buffer will only execute after commands which contain an End of Object (EOO). Processing Objects and some of the Action Controls specified below contain an EOO.

7.9.1 No Action

This performs no action; the program will not be affected in any way.

7.9.2 User Action

1. Displays a message box on the computer screen. An "OK" button must be pressed to continue.
2. Parameters
    a. Prompt
        i. The message to display
3. Runs in IPGScan



Press OK to Continue

Figure 150: User Action Message

7.9.3 Delay Action

1. Delays the scanner processing
2. Parameters
   a. Delay
      i. Time to delay the scanner processing in seconds.
   b. Absolute?
      i. Only used with On-The-Fly job types
      ii. If true, scanner processing will be delayed until the time specified in Delay based on the start of the robot trajectory.
3. Sent to the buffer.
4. Adds an EOO (See Section 8.1.1 on page 183).

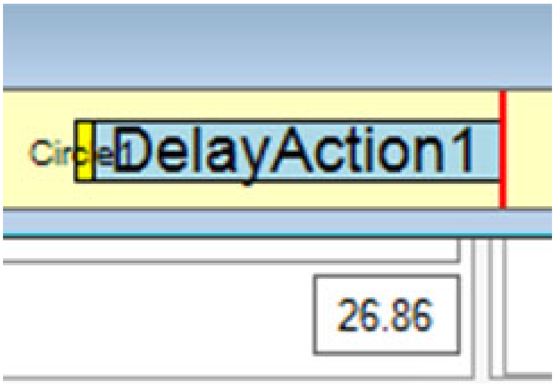
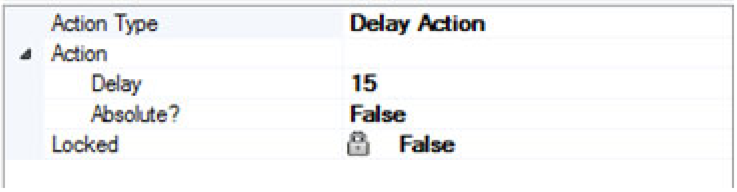


Figure 151: Delay Action; Absolute False Timeline



Action Type	Delay Action
◢ Action	
Delay	15
Absolute?	False
Locked	🔒 False

Figure 152: Delay Action; Relative False Configuration

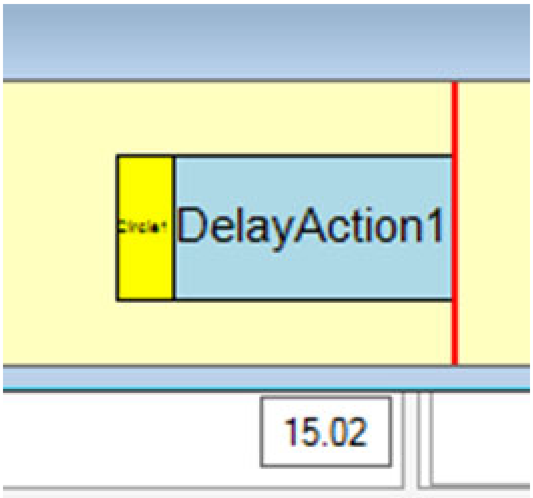
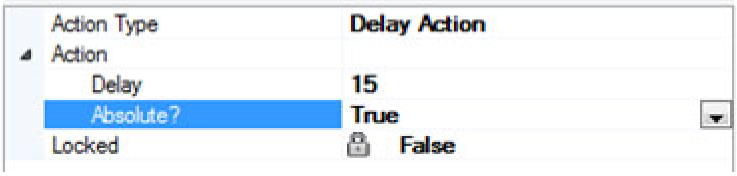


Figure 153: Delay Action; Absolute Truee Timeline



Action Type	Delay Action
◢ Action	
Delay	15
Absolute?	True
Locked	🔒 False

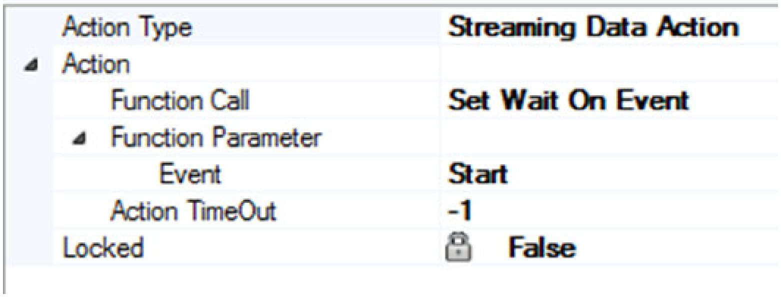
Figure 154: Delay Action; Relative True Configuration

7.9.4 Streaming Data Action

All of these Action Controls are sent to the buffer and do not add an EOO, unless otherwise mentioned (See Section 8.1.1 on page 183).

7.9.4.1 Set Wait On Event

1. Causes the scanner processing to pause until a specified input is active. Figure 155 shows the configuration for a wait until the Start signal is active.
2. Parameters
   a. Event
      i. Choose the input to wait to become active. Options: Start, GPIO0, GPIO1, GPIO2, GPIO3, Group Loaded, DoneIndexA, DoneIndexB, DoneIndexC, and LDD Ready



Action Type	Streaming Data Action
◢ Action	
Function Call	Set Wait On Event
◢ Function Parameter	
Event	Start
Action TimeOut	-1
Locked	🔒 False

Figure 155: Set Wait On Event Start

7.9.4.2 Set Wait Invert

1. Sets the logic level for inputs for the Set Wait On Event action
2. It is possible to set different logic levels for different inputs
3. Parameters
   a. Event
      i. The input to adjust. Options: Start, GPIO0, GPIO1
   b. State
      i. Set: active low
      ii. Clear: active high

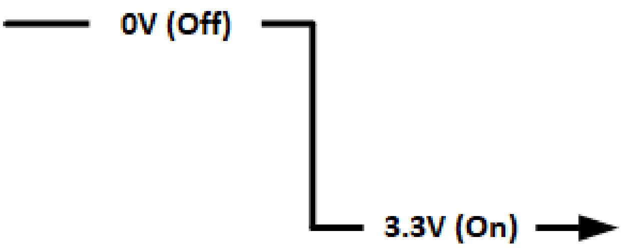


Figure 156: Set Wait Invert: Clear; Set Wait Edge: Clear

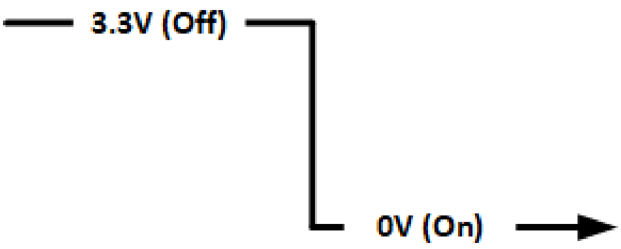


Figure 157: Set Wait Invert: Set; Set Wait Edge: Clear

7.9.4.3 Set Wait Edge

1. Sets the trigger level for inputs for the Set Wait On Event action
2. Parameters
   a. Event
      i. The input to adjust. Options: Start, GPIO0, GPIO1.
   b. State
      i. Set: edge detection
      ii. Clear: level detection

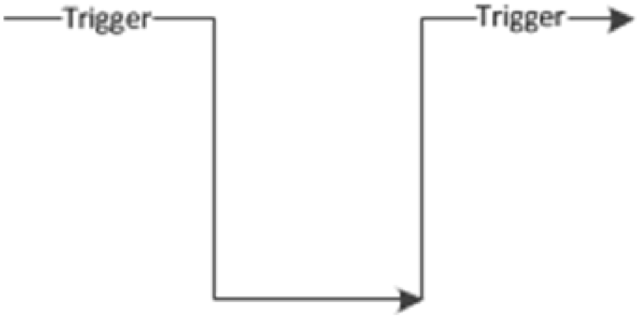


Figure 158: Set Wait Invert: Clear; Set Wait Edge: Clear

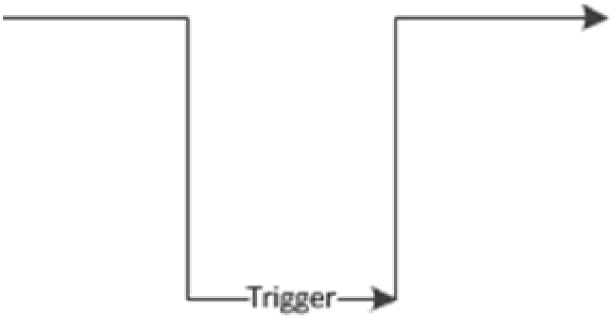


Figure 159: Set Wait Invert: Set; Set Wait Edge: Clear

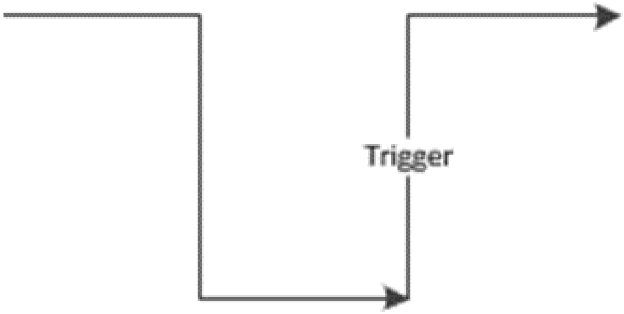


Figure 160: Set Wait Invert: Clear; Set Wait Edge: Set

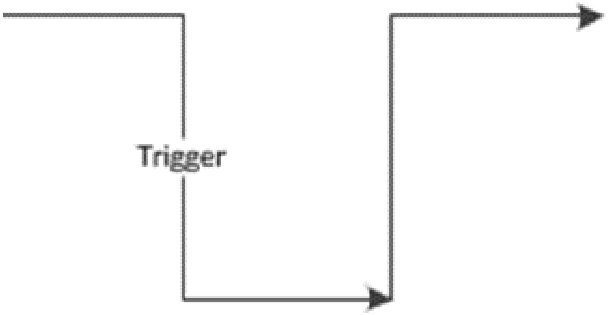


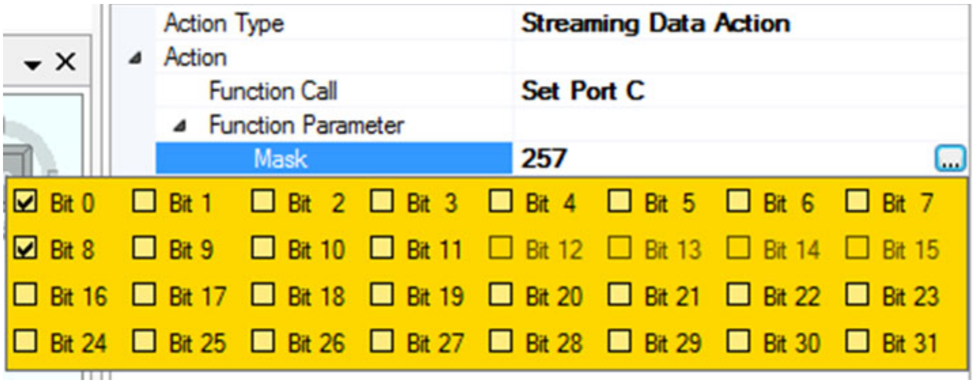
Figure 161: Set Wait Invert: Set; Set Wait Edge: Set

7.9.4.4 Set Port C

1. Sets specific bits of Port C to 1.
2. To turn on GPIO[3:0], the corresponding enable must be set to 1. If the corresponding enable is 0, the GPIO will act as an input on Port A.
3. Use of GPO[24:16] requires the Extended IO Board or the Fieldbus Base Station(see External Interface Manual.)
4. Figure 162 (below) shows a configuration which will enable and turn on GPIO[0].
5. Parameters
    a. Mask
        i. Check the specific bits to set to 1 (on). Bits unchecked will not be changed.

Table 20: Bits for Port C

PORT C BIT	DESCRIPTION	PORT C BIT	DESCRIPTION
0	GPIO[0]	17	GPO[17]
1	GPIO[1]	18	GPO[18]
2	GPIO[2]	19	GPO[19]
3	GPIO[3]	20	GPO[20]
8	Output enable for GPIO[0]	21	GPO[21]
9	Output enable for GPIO[1]	22	GPO[22]
10	Output enable for GPIO[2]	23	GPO[23]
11	Output enable for GPIO[3]	24	GPO[24]
16	GPO[16]		



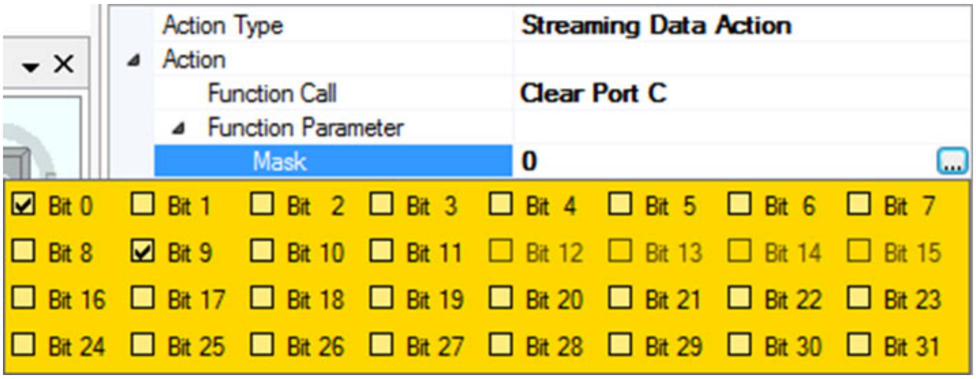
Action Type	Streaming Data Action
Action	
Function Call	Set Port C
Function Parameter	
Mask	257

☑ Bit 0 □ Bit 1 □ Bit 2 □ Bit 3 □ Bit 4 □ Bit 5 □ Bit 6 □ Bit 7
☑ Bit 8 □ Bit 9 □ Bit 10 □ Bit 11 □ Bit 12 □ Bit 13 □ Bit 14 □ Bit 15
□ Bit 16 □ Bit 17 □ Bit 18 □ Bit 19 □ Bit 20 □ Bit 21 □ Bit 22 □ Bit 23
□ Bit 24 □ Bit 25 □ Bit 26 □ Bit 27 □ Bit 28 □ Bit 29 □ Bit 30 □ Bit 31

Figure 162: Set Port C

7.9.4.5 Clear Port C

1. Sets bits of Port C to 0. This can turn off GPIO or turn off the output enable for a GPIO. Figure 163 (below) shows a configuration which will turn off the output enable for GPIO[1], turn off GPIO[0], and not adjust the output enable for GPIO[0].
2. Parameters
   a. Mask
      i. Check the specific bits to set to 0 (off). Bits unchecked will not be changed.



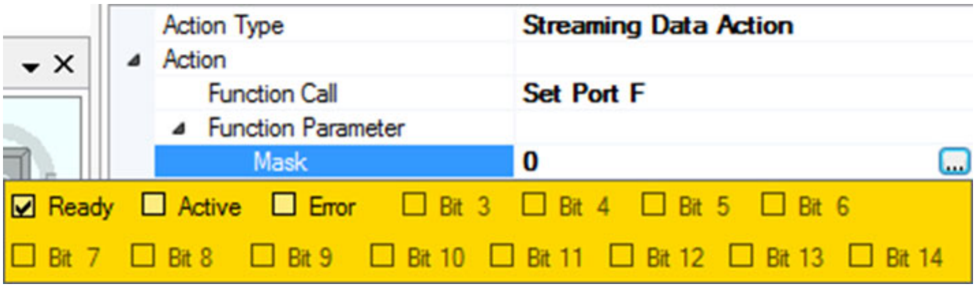
Action Type	Streaming Data Action
◢ Action	
Function Call	Clear Port C
◢ Function Parameter	
Mask	0

☑ Bit 0	□ Bit 1	□ Bit 2	□ Bit 3	□ Bit 4	□ Bit 5	□ Bit 6	□ Bit 7
□ Bit 8	☑ Bit 9	□ Bit 10	□ Bit 11	□ Bit 12	□ Bit 13	□ Bit 14	□ Bit 15
□ Bit 16	□ Bit 17	□ Bit 18	□ Bit 19	□ Bit 20	□ Bit 21	□ Bit 22	□ Bit 23
□ Bit 24	□ Bit 25	□ Bit 26	□ Bit 27	□ Bit 28	□ Bit 29	□ Bit 30	□ Bit 31

Figure 163: Clear Port C

7.9.4.6 Set Port F

1. Setting Port F can lock the signals Ready, Active, or Error on. Figure 164 (below) shows a configuration which will turn on the Ready signal and will maintain the current settings for Active and Error.
2. Parameters
   a. Mask
      i. This signals to lock on. Unchecked signals are unchanged.



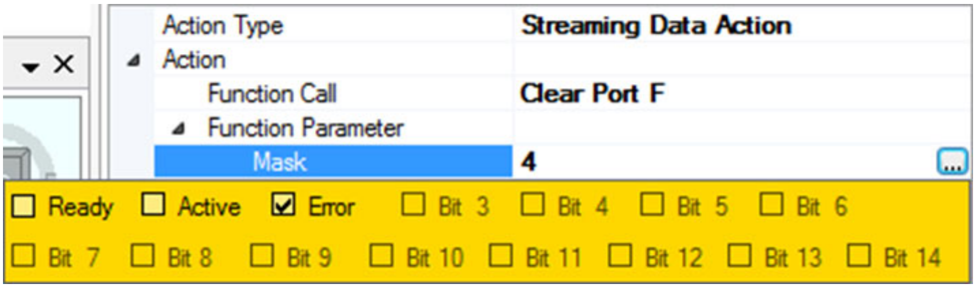
Action Type	Streaming Data Action
◢ Action	
Function Call	Set Port F
◢ Function Parameter	
Mask	0

☑ Ready	□ Active	□ Error	□ Bit 3	□ Bit 4	□ Bit 5	□ Bit 6	
□ Bit 7	□ Bit 8	□ Bit 9	□ Bit 10	□ Bit 11	□ Bit 12	□ Bit 13	□ Bit 14

Figure 164: Set Port F

7.9.4.7 Clear Port F

1. Clearing Port F returns Ready, Active, or Error to their default logic. Figure 165 (below) shows a configuration which will return the Error signal to its default logic and will not change the Ready or Active signals.
2. Parameters
   a. Mask
      i. This signals to return to default logic. Unchecked signals are unchanged.



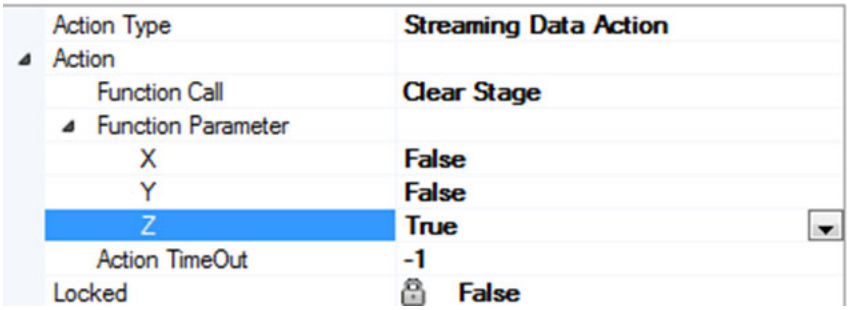
Action Type	Streaming Data Action
◢ Action	
Function Call	Clear Port F
◢ Function Parameter	
Mask	4

☐ Ready ☐ Active ☑ Error ☐ Bit 3 ☐ Bit 4 ☐ Bit 5 ☐ Bit 6
☐ Bit 7 ☐ Bit 8 ☐ Bit 9 ☐ Bit 10 ☐ Bit 11 ☐ Bit 12 ☐ Bit 13 ☐ Bit 14

Figure 165: Clear Port F

7.9.4.8 Clear Stage

1. Clears the count of the specified stage axes. Figure 166 (below) shows a configuration which will clear only Axis Z.
2. Parameters
   a. X, Y, Z
      i. True: clear the count of this axis
      ii. False: do not clear the count of this axis



Action Type	Streaming Data Action
◢ Action	
Function Call	Clear Stage
◢ Function Parameter	
X	False
Y	False
Z	True
Action TimeOut	-1
Locked	False

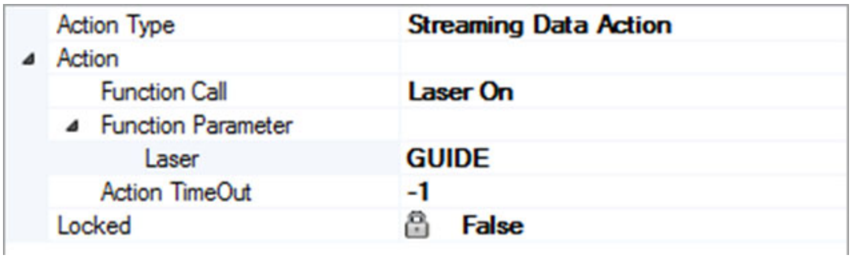
Figure 166: Clear Stage

7.9.4.9 Laser Shutdown

1. Disables the laser.
2. Adds an EOO to the buffer.

7.9.4.10 Laser On

1. Enables a type of laser at 0W power. Figure 167 (below) shows a configuration which will turn on the guide beam.
    a. Parameters
        i. Laser type
            – Main - main laser
            – Guide - guide beam
            – Focus - focus assist beams
            – Focus without Guide - focus assist without the guide beam
            – Guide without Focus - guide beam without focus assist beam (3D Scan Heads)
2. Adds an EOO to the buffer.



Action Type	Streaming Data Action
◢ Action	
Function Call	Laser On
◢ Function Parameter	
Laser	GUIDE
Action TimeOut	-1
Locked	🔒 False

Figure 167: Laser On

7.9.4.11 Laser Off

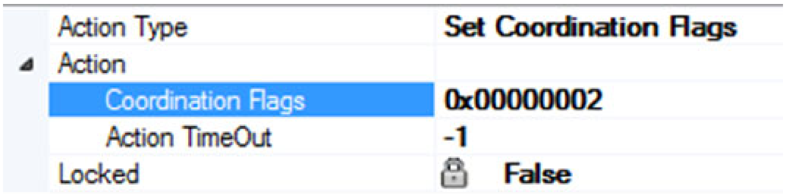
1. Disables the laser.
2. Adds an EOO to the buffer.

7.9.5 Reset Tracking

1. If using an On-The-Fly job, this does two things. First, it will add a Set Wait On Event with the parameter Start. Second, it will reset the tracking location of a robot trajectory to 0. This is automatically called before every run of an On-The-Fly job.
2. Adds an EOO.
3. Sent to the buffer.

7.9.6 Set Coordination Flags

1. Sets the expected value of the coordination flags for a robot trajectory (see Section 8.3.5.5 on page 287). Figure 168 shows a configuration which expects flag 1 to be off and flag 2 to be on.
2. Parameters
   a. Coordination Flags: the expected coordination flag value in hexadecimal
3. Does not add an EOO
4. Sent to the buffer.

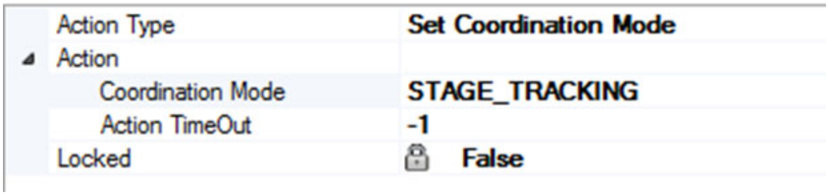


Action Type	Set Coordination Flags
◢ Action	
Coordination Flags	0x00000002
Action TimeOut	-1
Locked	🔒 False

Figure 168: Set Coordination Flags

7.9.7 Set Coordination Mode

1. Sets the motion coordination mode for ScanPack.
2. Parameters
   a. Coordination Mode. Possible choices:
      i. COORDINATION_OFF: no coordinated motion
      ii. STAGE_TRACKING: ScanPack will move a stage trying to output processing objects as close to the center of the scan head as possible.
      iii. ROBOT_TRACKING: ScanPack will follow a recorded robot trajectory. This is automatically called before each run of an On-The-Fly job.
      iv. ROBOT_STATIONARY: ScanPack will use some components of coordinated motion with an external motion device but does not follow a recorded trajectory. This is called automatically with Robot Alignment (see section 12.4.9.1.2).
      v. STAGE_AUTO: If the current processing vector can be output without moving the stage, the scan head will not be moved. If the vector continues to a larger area, the stage will be moved.
3. Figure 169 (below) shows a configuration which sets the current coordination mode to STAGE_TRACKING.
4. Does not add an EOO.
5. Sent to the buffer.



Action Type	Set Coordination Mode
◢ Action	
Coordination Mode	STAGE_TRACKING
Action TimeOut	-1
Locked	🔒 False

Figure 169: Set Coordination Mode

7.9.8 Wait

7.9.8.1 Wait for Done

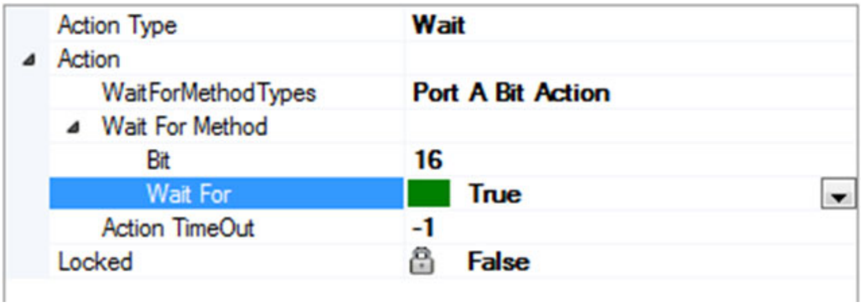
1. Waits until the buffer of the connected scanner is empty.
2. Runs in IPGScan

7.9.8.2 Port A Bit Action

1. Wait for a specific level of a bit on Port A. Port A corresponds to input signals with the scan controller. Figure 170 (below) shows a configuration which will block execution in IPGScan until bit 16 on Port A is active.
2. Parameters
   a. Bit: the bit to check
   b. Wait For: the level to wait for. True corresponds to active; False corresponds to inactive.
3. Runs in IPGScan

Table 21: Port A Bit Action

BIT	DESCRIPTION	BIT	DESCRIPTION
0	GPIO[0]/Strobe	16	GPI[16]/Select 0
1	GPIO[1]	17	GPI[17]/Select 1
2	GPIO[2]	18	GPI[18]/Select 2
3	GPIO[3]	19	GPI[19]/Select 3
4	GPI[4]	20	GPI[20]/Select 4
5	GPI[5]	21	GPI[21]/Select 5
6	GPI[6]	22	GPI[22]/Select 6
7	GPI[7]	23	GPI[23]/Select 7
11	Air Flow OK for High Power Heads	24	GPI[24]/Select 8



Action Type	Wait
Action	
WaitForMethodTypes	Port A Bit Action
Wait For Method	
Bit	16
Wait For	🟩 True
Action TimeOut	-1
Locked	False

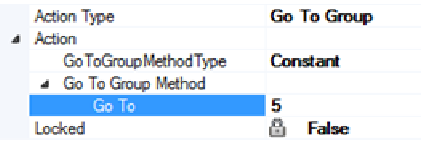
Figure 170: Port A Bit Action

7.9.8.3 Wait for Strobe

1. Waits for the Strobe input to be active with the Ready signal handshaking for Point and Shoot processing.
   a. The Ready signal will be active while the Strobe signal is inactive; then the ready signal will be inactive.
2. Runs in IPGScan.

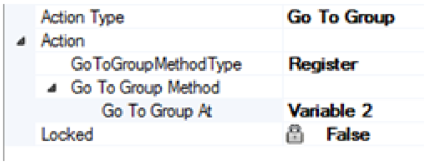
7.9.9 Go To Group

1. Moves the program pointer of IPGScan to a different group based on the GroupID.
2. Parameters
   a. Constant
      i. Go To: a constant value to use as the destination GroupID.
      ii. Figure 171 (below) shows a configuration which will jump to the group with GroupID 5.
   b. Register
      i. Go To Group At: the register to use as a source for the destination GroupID.
      ii. Figure 172 shows a configuration which will jump to the group with the same GroupID that is in Variable 2.
   c. Conditional - Chooses one of two GroupIDs based upon a condition.
      i. Operand 1: the first value to use in the condition comparison
      ii. Condition: choice of > (greater than), = (equal to), < (less than)
      iii. Operand 2: the second value to use in the condition comparison
      iv. Pass GoTo: the destination GroupID if the comparison is true
      v. Fail GoTo: the destination GroupID if the comparison is false
      vi. Figure 173 shows a configuration that will jump to Group 7 if Variable 3 is greater than 3 or Group 2 if Variable 3 is less than 3.
3. Runs in IPGScan



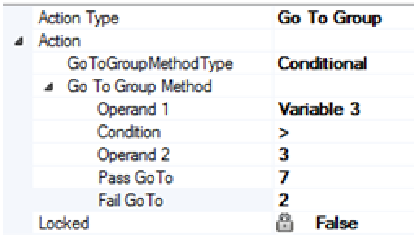
Action Type	Go To Group
Action	
GoToGroupMethodType	Constant
Go To Group Method	
Go To	5
Locked	False

Figure 171: Go To Group Constant



Action Type	Go To Group
Action	
GoToGroupMethodType	Register
Go To Group Method	
Go To Group At	Variable 2
Locked	False

Figure 172: Go To Group Register



Action Type	Go To Group
Action	
GoToGroupMethodType	Conditional
Go To Group Method	
Operand 1	Variable 3
Condition	>
Operand 2	3
Pass GoTo	7
Fail GoTo	2
Locked	False

Figure 173: Go To Group Conditional

7.9.10 Load Register

All of the following Load Register methods set or modify the value of IPGScan registers. These methods all run in IPGScan.

7.9.10.1 Port A

1. Reads the value of the Port A inputs as a binary number, applies a bit shift, limits the width of the bits (bit mask), and converts it to a decimal number. An active input corresponds to a value of 1.
2. Parameters
   a. Shift: the right bit shift applied to the value read from Port A. The parameter is specified in hexadecimal.
   b. Width: the number of bits to convert to decimal after applying the shift, counting from the right (least significant bit). Similar to a bit mask. The parameter is specified in decimal.
   c. Destination Register: the IPGScan register to store the converted decimal number

7.9.10.2 Serial Port

1. Reads information from a Serial port on the computer running IPGScan and stores the value in an IPGScan register.
2. Parameters:
   a. COM Port Settings: standard Serial communication settings
   b. Command: the string sent by IPGScan to the external device to request information. Can be used to distinguish which information is being requested.
   c. End Delimiter: IPGScan will read data from the Serial port until it receives this string
   d. Acknowledgement: a string sent by IPGScan to inform the external device that it has successfully received the information. Optional.
   e. Destination Register: the IPGScan register to store the information received from the external device.

7.9.10.3 User

1. Creates a prompt box that asks the user for the data to store in the register.
2. Parameters
   a. Prompt: The message to show in the prompt box.
   b. Destination Register: the IPGScan register to store the information received from the user.

7.9.10.4 Ethernet

1. Reads information from a TCP client and stores the value in an IPGScan register. This uses the TCP settings and Actions Port in the IPGScan Options.
2. Parameters
   a. Command: the string sent by IPGScan to the external device to request information. Can be used to distinguish which information is being requested.

   b. 1st Response: Expected message from the TCP client before the message with the register content. End Delimiter is expected with this message as well.
   c. End Delimiter: IPGScan will parse each packet of information from the TCP client looking for this End Delimiter. When IPGScan receives the End Delimiter, it will stop reading the TCP client. In the packet that includes the End Delimiter, if there is data after the End Delimiter, IPGScan will raise an error.
   d. Acknowledgement: a string sent by IPGScan to inform the TCP client that it has successfully received the information. Optional.
   e. Destination Register: the IPGScan register to store the information received from the TCP client.

7.9.10.5 Constant

1. Stores a preset value in a register. This value is set by the IPGScan programmer and not by the user.

2. Parameters
   a. Constant: the value to store
   b. Destination register: the IPGScan register to store the value

7.9.10.6 Concatenate

1. Combines the value of two IPGScan registers into a third IPGScan register. For example, "A" + "B" = "AB".

2. Parameters
   a. Operand 1: the first IPGScan register to use
   b. Operand 2: the second IPGScan register to use
   c. Destination Register: the IPGScan register to store the combined value

7.9.10.7 RegEx

1. Applies a Regular Expression (RegEx) pattern to an IPGScan register and stores the resulting value in a different IPGScan register.

2. Parameters
   a. Pattern: the RegEx pattern to apply
   b. Source Register: the IPGScan register to use as a source string
   c. Match Index: index of all matches found to store. This index is zero based.

7.9.10.8 Math

1. Applies a mathematical operation to two IPGScan registers and stores the result.

1. Parameters
   a. Operand 1: the first IPGScan register to use
   b. Operand 2: the second IPGScan register to use
   c. Operand: Mathematical operation to apply. Choice of:
      i. Addition
      ii. Multiplication
      iii. Sine
      iv. Subtraction

v. Average

vi. Division

- Calculated as sin(Operand 1)
- Calculated in degrees

vii. Cosine

- Calculated as cos(Operand 1)
- Calculated in degrees

viii. Tangent

- Calculated as tan(Operand 1)
- Calculated in degrees

ix. atan2

- Calculated as atan2(y,x) where y is Operand 1 and x is Operand 2
- Calculated in degrees

x. Square Root

d. Destination Register: the IPGScan register to store the calculated value

7.9.10.9 Increment

1. Increments the value in a register and stores the new value in the same register.
2. Parameters
   a. Increment By: the value to increment the register by
   b. Minimum Digits: if the resulting number of digits in the register is less than the minimum number of digits, zeros are padded in front of the register
   c. Destination Register: the IPGScan register to increment and store the new value in

7.9.10.10 Date

1. Stores the current date in a register.
2. Parameters
   a. Date Type
      i. Default
         - Generated date will follow the format of the host computer
      ii. DayOfYear
         - Generated date will be an integer representing the day of the year in the format "ddd".
      iii. Julian
         - Generated date will be formatted in the Julian date format of "yyddd".
      iv. Formatted
         - Generated date based upon the additional parameter "Format." Format string follows "Custom Date Time."
   b. Destination Register: the IPGScan register to store the date in

7.9.10.11 Time

1. Stores the current time in a register. The time is represented with 24-hour clock.

2. Parameters
   a. Destination Register: the IPGScan register to store the date in

7.9.10.12 Custom Date Time

1. Stores a custom configuration of time and date into a register.
2. Parameters
   a. Format: the format pattern that should be used to render the custom date and time. This follows the C# DateTime formatting convention (https://docs.microsoft.com/en-us/dotnet/standard/base-types/custom-date-and-time-format-strings).
3. Destination Register: the IPGScan register in which to store the Date Time
4. Example
   a. "yyyy/MM/dd" will render as "2019/06/27" on June 27, 2019
   b. A few common patterns are:
      i. 'MM': the month, from 01 through 12
      ii. 'd': the day of the month, from 1 to 31
      iii. 'dd': the day of the month, from 01 to 31
      iv. 'yyyy': the year as a four digit number
      v. 'hh': the hour, using a 12-hour clock from 01 to 12
      vi. 'HH': the hour, using a 24-hour clock from 00 to 23
      vii. 'mm': the minute, from 00 through 59
      viii. 'ss': the second, from 00 through 59

7.9.10.13 Timer

1. Runs a software timer and sets an IPGScan register to the elapsed time when stopped. Multiple timers can be used at the same time.
2. Parameters
   a. Action: the timer action to perform
      i. Reset: reset the value of the timer
      ii. Start: start running the timer
      iii. Stop: stop running the stopwatch and store the time of the timer
   b. Wait For Done On Stop: Wait for the buffer to be empty before stopping the timer. This parameter is only used with the Stop action. It is useful when timing actions or objects that execute from the buffer.
3. Destination Register: the IPGScan register to store the time in. This is also used to specify which timer act on.

7.9.10.14 From XML

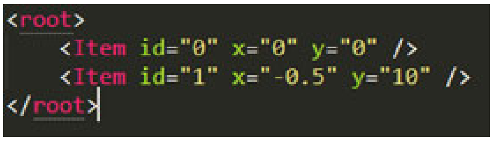
1. Gets a value from an XML file and stores the value in an IPGScan register.
2. Parameters
   a. XML File Path: the location of the XML file. It can be a local file on the computer running IPGScan or a remote location accessible by the computer running IPGScan.
   b. XPath: the path to the specific tag which contains the desired value
   c. ID Value: value of the identifying attribute to look for
   d. ID Attribute: identifying attribute name

e. Value Attribute: name of the attribute to retrieve a value from

f. Destination Register: the IPGScan register to store the value in

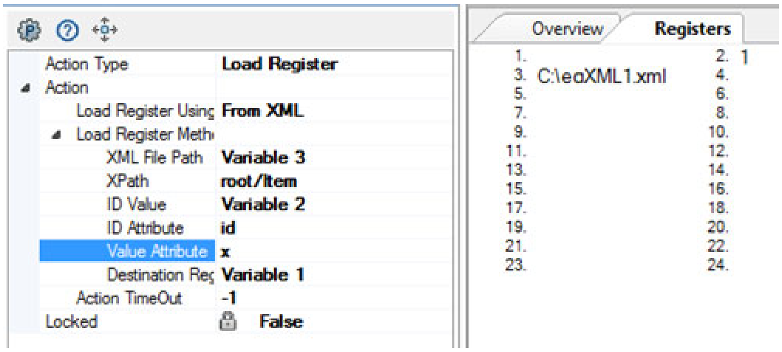
3. Examples

a. Given the following XML file (Figure 174) and IPGScan configuration (Figure 175), the destination register (Variable 1) would contain "-0.5".



```
<root>
    <Item id="0" x="0" y="0" />
    <Item id="1" x="-0.5" y="10" />
</root>
```

Figure 174: Example XML File 1

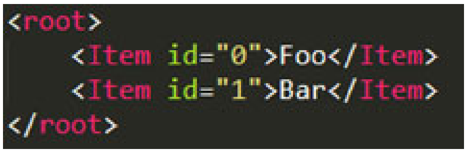


Action Type	Load Register
Action	
Load Register Using	From XML
Load Register Meth	
XML File Path	Variable 3
XPath	root/Item
ID Value	Variable 2
ID Attribute	id
Value Attribute	x
Destination Reg	Variable 1
Action TimeOut	-1
Locked	False

1.		2.	1
3.	C:\eaXML1.xml	4.	
5.		6.	
7.		8.	
9.		10.	
11.		12.	
13.		14.	
15.		16.	
17.		18.	
19.		20.	
21.		22.	
23.		24.	

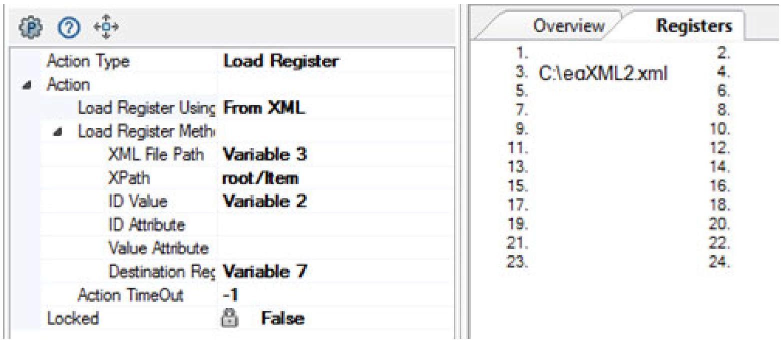
Figure 175: Example XML Configuration 1

b. Given the following XML file (Figure 176) and IPGScan configuration (Figure 177), the destination register (Variable 7) would contain "Foo"..



```
<root>
    <Item id="0">Foo</Item>
    <Item id="1">Bar</Item>
</root>
```

Figure 176: Example XML File 2



Action Type	Load Register
Action	
Load Register Using	From XML
Load Register Meth	
XML File Path	Variable 3
XPath	root/Item
ID Value	Variable 2
ID Attribute	
Value Attribute	
Destination Reg	Variable 7
Action TimeOut	-1
Locked	False

1.		2.	
3.	C:\eaXML2.xml	4.	
5.		6.	
7.		8.	
9.		10.	
11.		12.	
13.		14.	
15.		16.	
17.		18.	
19.		20.	
21.		22.	
23.		24.	

Figure 177: Example XML Configuration 2

7.9.10.15 TCP Client

1. Similar to Ethernet, this Action Control asks a remote device for a value to store in an IPGScan register. However, in this Action Control, IPGScan starts a TCP Client and asks a TCP server. The TCP Client is closed after the action is complete.

2. Parameters:

a. Command: the string sent by IPGScan to the external device to request information. Can be used to distinguish which information is being requested.

b. 1st Response: Expected message from the TCP server before the message with the register content. End Delimiter is expected with this message as well.

c. End Delimiter: IPGScan will parse each packet of information from the TCP server looking for this End Delimiter. When IPGScan receives the End Delimiter, it will stop reading the TCP server. In the packet that includes the End Delimiter, if there is data after the End Delimiter, IPGScan will raise an error.

d. Acknowledgement: a string sent by IPGScan to inform the TCP server that it has successfully received the information. Optional.

e. IP Address: the IP Address of the TCP server

f. Port: the port which the TCP server is listening to

g. Destination Register: the IPGScan register to store the value in

7.9.10.16 Siemens PLC

1. Reads values from a Siemens PLC DataBlock and stores that value in an IPGScan register. The PLC has to be configured in the PLC section of the Options. The PLC has to be connected before running this Action Control.

2. Parameters

    a. PLC Index: which of the configured PLCs to communicate with (defined in the Options Section)

    b. Data Type: the type of data to read. Choice of: Counter, Timer, Input, Output, Memory, DataBlock.

    c. Data Block ID: ID of the Data Type option above (for example DB1, T45, etc)

    d. Variable Type: The type of Siemens variable used. Choice of: Bit, Byte, Word, DWord, Int, Dint, Real, String, StringEx, Timer, Counter.

    e. Start Byte Address: memory address offset for the item within the data structure.

    f. Destination Register: the IPGScan register to store the value in

7.9.10.17 Find Focus

1. Runs the Find Focus routine with the camera at a specified location. The focus offset result is stored in an IPGScan register.

2. Parameters

    a. At Point: the location to run Find Focus, specified as (X, Y) in the Scan Head's frame of reference.

    b. Destination Register: the IPGScan register in which to store the Z offset

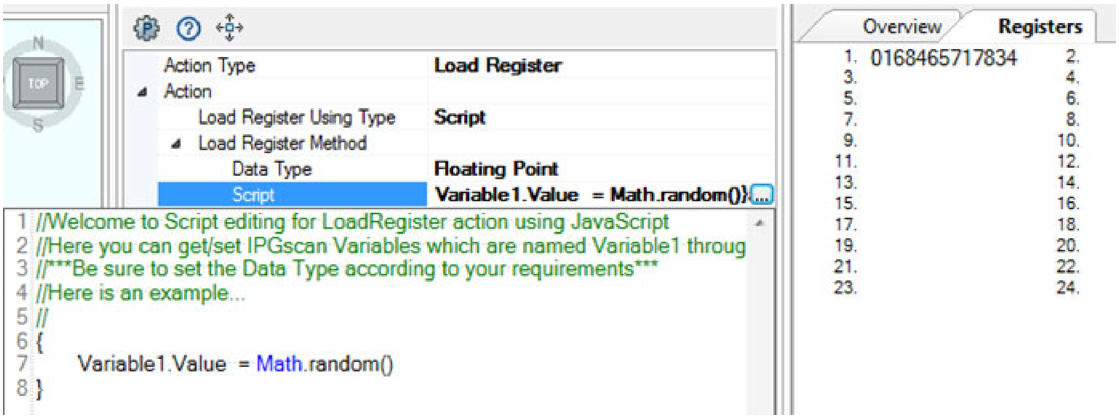
7.9.10.18 Script

1. Runs a custom JavaScript script. The example in Figure 178 on page 174 shows a script which generates a random number and stores that value in Variable1.

2. Parameters

    a. Data Type: the data type in which to load registers into the script and set registers out of the script.

    b. Script: The JavaScript script to run. All IPGScan registers can be addressed as "Variablen.Value" where 'n' is the variable number. Only modified registers will be overwritten when the script is finished running.



Action Type	Load Register
Action	
Load Register Using Type	Script
Load Register Method	
Data Type	Floating Point
Script	Variable1.Value = Math.random()}

```
//Welcome to Script editing for LoadRegister action using JavaScript
//Here you can get/set IPGscan Variables which are named Variable1 throug
//***Be sure to set the Data Type according to your requirements***
//Here is an example...
//
{
    Variable1.Value = Math.random()
}
```

1. 0168465717834	2.
3.	4.
5.	6.
7.	8.
9.	10.
11.	12.
13.	14.
15.	16.
17.	18.
19.	20.
21.	22.
23.	24.

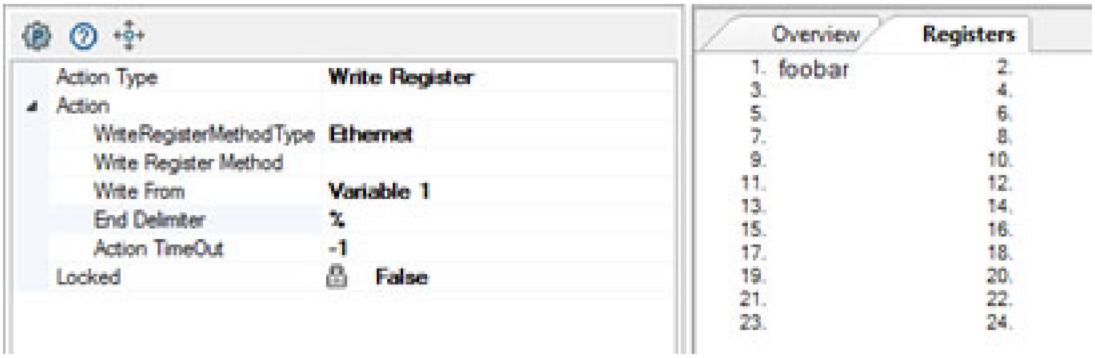
Figure 178: Load Register Script Example

7.9.11 Write Register

All of the following Write Register methods export value of IPGScan registers. These methods all run in IPGScan.

7.9.11.1 Ethernet

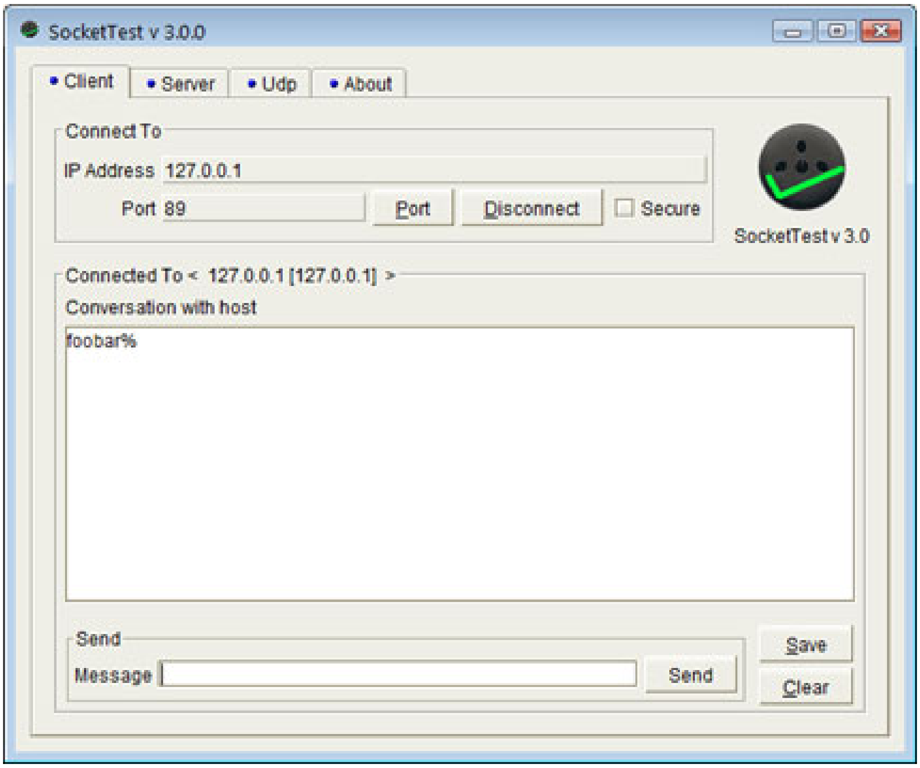
1. Writes the value of an IPGScan register to a TCP Client. This Action Control uses the TCP settings and Actions Port from the IPGScan Options. Figure 179 (below) and Figure 180 on page 175 show an example of this Action Control.
2. Parameters
   a. Write From: The IPGScan register from which to get the value to write. Empty registers will not be written.
   b. End Delimiter: A delimiter appended to the end of the value from the IPGScan register. Optional.



Action Type	Write Register
Action	
WriteRegisterMethodType	Ethernet
Write Register Method	
Write From	Variable 1
End Delimiter	%
Action TimeOut	-1
Locked	🔒 False

1. foobar	2.
3.	4.
5.	6.
7.	8.
9.	10.
11.	12.
13.	14.
15.	16.
17.	18.
19.	20.
21.	22.
23.	24.

Figure 179: Write Register Ethernet Configuration



Connect To

IP Address 127.0.0.1

Port 89

□ Secure

Connected To < 127.0.0.1 [127.0.0.1] >

Conversation with host

```
foobar%
```

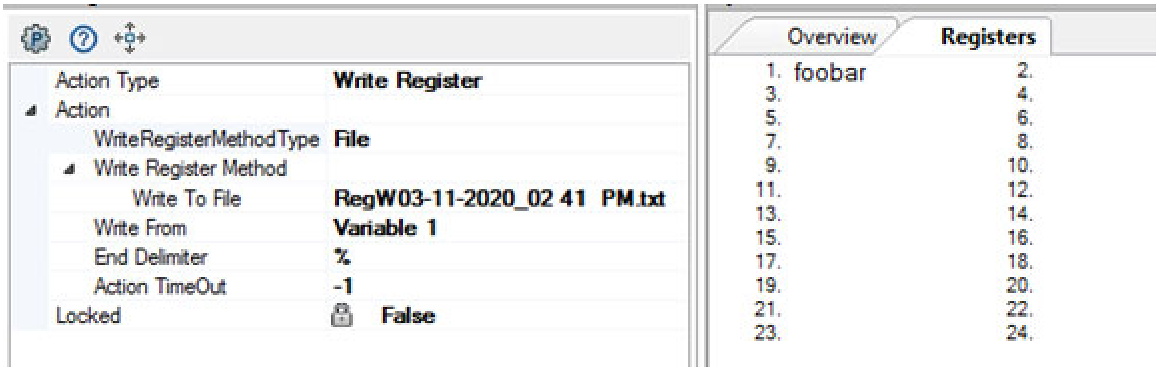
Send

Message

Figure 180: Write Register Ethernet Output

7.9.11.2 File

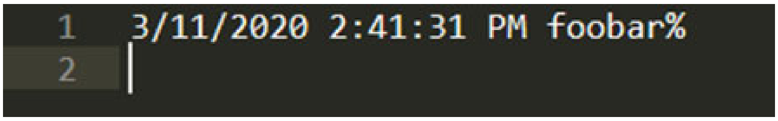
1. Writes the value of an IGPScan register to a file. The value of an IPGScan register will be written to a new file if the file does not exist or will be appended to the file if it does exist. Each time the value is written to the file, the date and time will be written to the file first.
2. Parameters
   a. Write To File: The name of the file to use. The starting directory for the file is "C:\IPGP\IPGScan\RegisterValues\".
   b. Write From: the IPGScan register to write to the file
   c. End Delimiter: a string to add to the file to signify the end of the contents of the register. Optional.



Action Type	Write Register
◢ Action	
WriteRegisterMethodType	File
◢ Write Register Method	
Write To File	RegW03-11-2020_02 41 PM.txt
Write From	Variable 1
End Delimiter	%
Action TimeOut	-1
Locked	False

1. foobar 2.
3. 4.
5. 6.
7. 8.
9. 10.
11. 12.
13. 14.
15. 16.
17. 18.
19. 20.
21. 22.
23. 24.

Figure 181: Write Register File Configuration



```
3/11/2020 2:41:31 PM foobar%

```

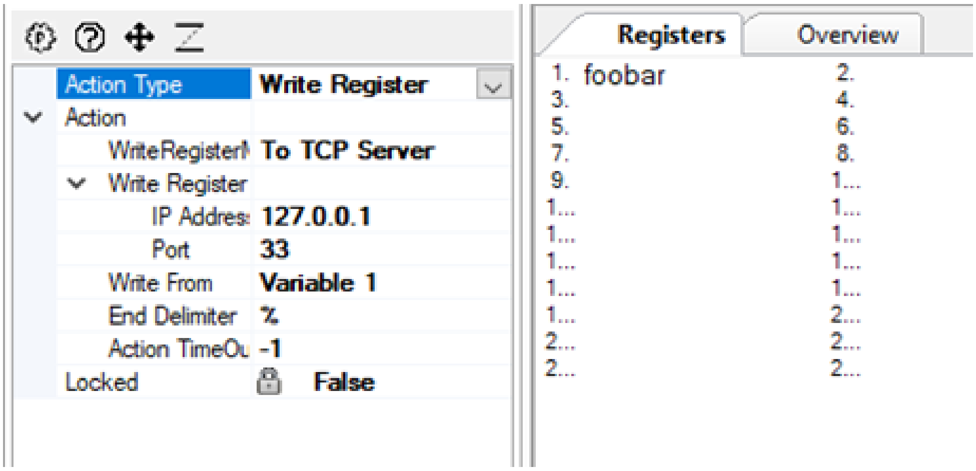
Figure 182: Write Register File Output

7.9.11.3 Siemens PLC

1. Writes the value of an IPGScan register to a Siemens PLC variable.
2. Parameters
   a. PLC Index: which of the configured PLCs to communicate with
   b. Data Type: the type of data to write to. Choice of: Counter, Timer, Input, Output, Memory, DataBlock.
   c. Data Block ID: ID of the Data Block
   d. Variable Type: The type of Siemens variable used. Choice of: Bit, Byte, Word, DWord, Int, Dint, Real, String, StringEx, Timer, Counter.
   e. Start Byte Address: Address of the starting byte.
   f. Write From: the IPGScan register to write to the file
   g. End Delimiter: not used

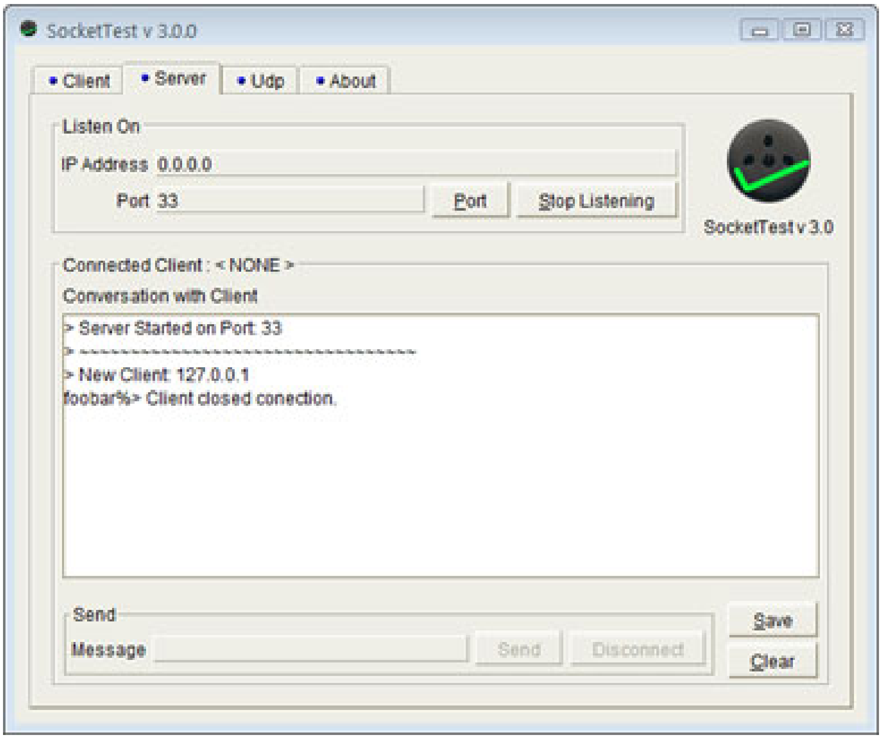
7.9.11.4 To TCP Server

1. Writes the value of a register to a TCP Server
   a. Parameters
      i. IP Address: IP Address of the server
      ii. Port: Port of the server
      iii. Write From: the IPGScan register to write to the server
      iv. End Delimiter: Optional string to add to the end of the register



Action Type	Write Register
Action	
WriteRegisterM	To TCP Server
Write Register	
IP Addres	127.0.0.1
Port	33
Write From	Variable 1
End Delimiter	%
Action TimeOu	-1
Locked	False

Figure 183: Write Register To TCP Server Configuration



Listen On
IP Address 0.0.0.0
Port 33

Connected Client : < NONE >
Conversation with Client

```
> Server Started on Port: 33
> ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
> New Client: 127.0.0.1
foobar%> Client closed conection.
```

Send
Message

Figure 184: Write Register To TCP Server Output

7.9.12 Park At Action

1. This Action Control parks the galvos at the specified location.
2. Parameters
   a. Using Variables?: True if the position is specified by IPGScan registers. False if the position is specified by the IPGScan programmer.
   b. Park At: The location to park the galvos in the scanner frame represented as (X,Y,Z). Either numbers if not using variables or the IPGScan registers to use for X, Y, and Z.
3. Sent to the buffer.
4. Adds an EOO flag

7.9.13 Stage Motion Action

1. This Action Control moves the stage to the specified location.
2. Parameters
   a. Move To: The location to move the stage in the stage frame represented as (X,Y,Z).
   b. Home X: True if the X axis should be homed before moving.
   c. Home Y: True if the Y axis should be homed before moving.
   d. Home Z: True if the Z axis should be homed before moving.
3. Sent to the buffer.
4. Adds an EOO flag

7.9.14 Exit Action

This Action Control stops the currently running IPGScan job. The processing window will remain open. The action waits for the buffer to be empty before stopping.

7.10 Previewing and Running an IPGScan Job

To preview or run a job in IPGScan, users must open the Processing Window. This can be done manually or in an automated manner (i.e. using the Remote API).

To open the Processing Window, users can click the "Start Processing" button in the Tool bar (see Figure 185) or select Tools ' Start Processing.

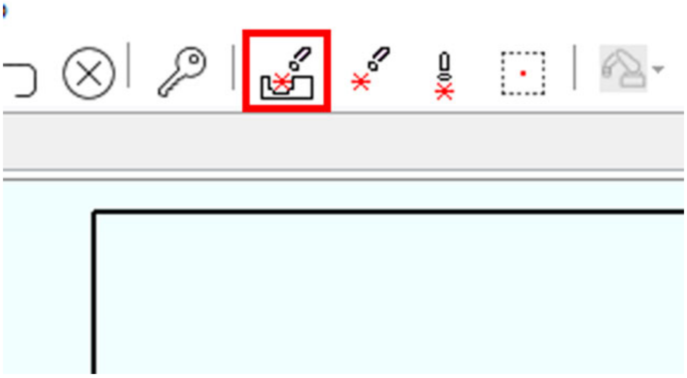
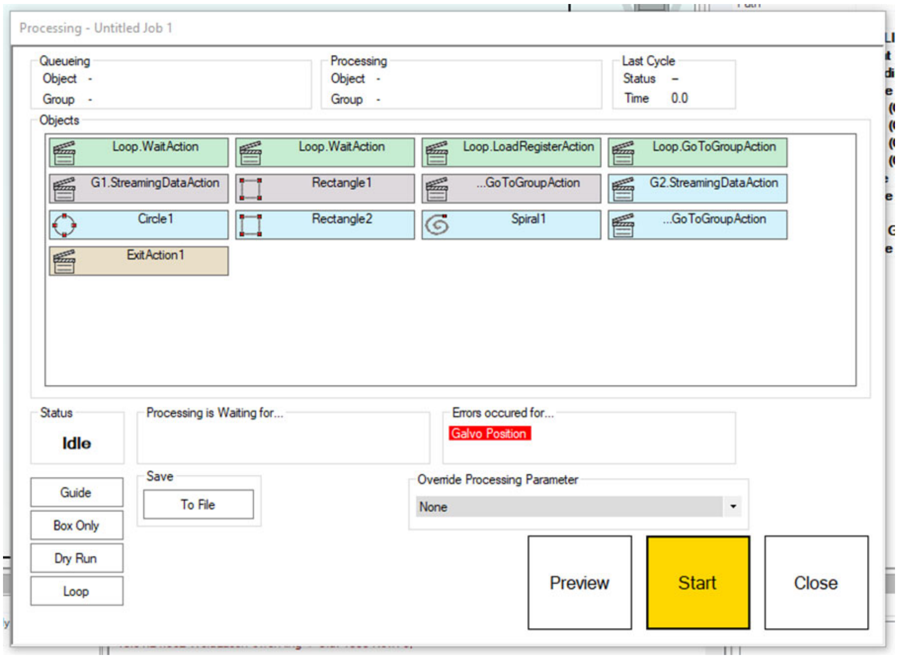


Figure 185: Start Processing Button

IMPORTANT A connection with a Scan Controller or an Emulator is required to open the Processing Window.

Figure 186 illustrates the Processing Window.



Processing - Untitled Job 1

Queueing
Object -
Group -

Processing
Object -
Group -

Last Cycle
Status –
Time 0.0

Status
Idle

Processing is Waiting for...

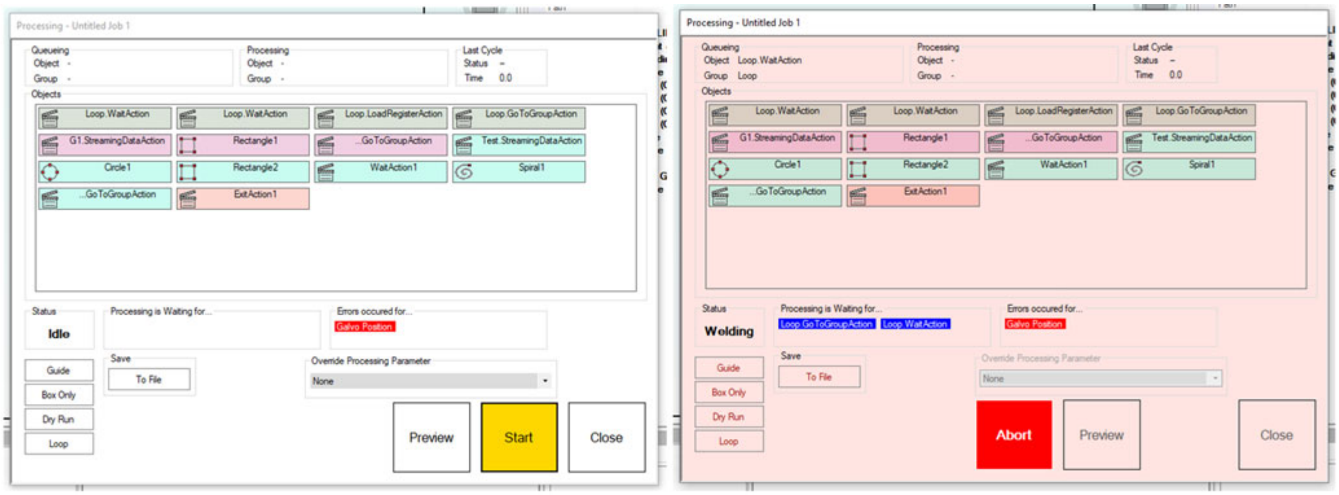
Errors occured for...
Galvo Position

Override Processing Parameter
None

Figure 186: Processing Window

Within the Processing Window, users will find numerous status indicators:

- Queueing Box
  - This contains the Object name and Group name that IPGScan is actively sending or attempting to send to the scanners buffer.
- Processing Box
  - This contains the Object name and Group name of the currently processing object and Group.
- Last Cycle Box
  - This will display the last cycles completed time and the status of the cycle. For instance, if the process completes successfully, the status will state "OK." If the cycle does not complete successfully (i.e. is aborted), the status will state "Failed."
- Objects Box
  - A display of all the Process Objects and Action Controls that are selected and available for processing. If users, selected the job name in the Job Tree prior to opening the Processing Window, all of the Process Objects and Action Controls within the job will be listed in the Objects box. If users only select certain items within the Job Tree prior to opening the Processing Window, only the selected items will be within the Objects box.
- Status Box
  - This provides an indicator as to whether or not processing has started. For instance, prior to users clicking the "Start" button to start processing, this status will indicate "Idle." Once processing has been started, it will indicate welding/cleaning/marking. See Figure 187 (below).



Processing - Untitled Job 1

Queueing: Object -, Group -
Processing: Object -, Group -
Last Cycle: Status -, Time 0.0
Objects: Loop.WaitAction, Loop.WaitAction, Loop.LoadRegisterAction, Loop.GoToGroupAction, G1.StreamingDataAction, Rectangle1, ...GoToGroupAction, Test.StreamingDataAction, Circle1, Rectangle2, WaitAction1, Spiral1, ...GoToGroupAction, ExitAction1
Status: Idle
Processing is Waiting for...
Errors occured for...: Galvo Position
Override Processing Parameter: None

Processing - Untitled Job 1

Queueing: Object Loop.WaitAction, Group Loop
Processing: Object -, Group -
Last Cycle: Status -, Time 0.0
Objects: Loop.WaitAction, Loop.WaitAction, Loop.LoadRegisterAction, Loop.GoToGroupAction, G1.StreamingDataAction, Rectangle1, ...GoToGroupAction, Test.StreamingDataAction, Circle1, Rectangle2, WaitAction1, Spiral1, ...GoToGroupAction, ExitAction1
Status: Welding
Processing is Waiting for...: Loop.GoToGroupAction, Loop.WaitAction
Errors occured for...: Galvo Position
Override Processing Parameter: None

Figure 187: Idle and Actively Processing Process Windows

- "Processing is Waiting for..." Box
  - This provides an indication as to what Process Object or Action Control IPGScan is actively waiting on (i.e. which object is processing or which Action Control requires an action).

- "Errors occurred for..." Box
    - Lists any errors that are actively present.

In addition to statuses, the Processing Window also offers the following functionality.

- "Guide Button - When enabled, the selected Process Objects/IPGScan program will execute with the guide laser and not the processing laser. Enabling guide will also reveal the following buttons (see Figure 188):
    - Fast Mode - This will cause the Process Object to output at the speed defined for the Fast Mode process parameters profile.
    - Keyboard Offset - This allows users to nudge Process Objects using the computer keyboard. See section "Keyboard Offset" for additional details on functionality.

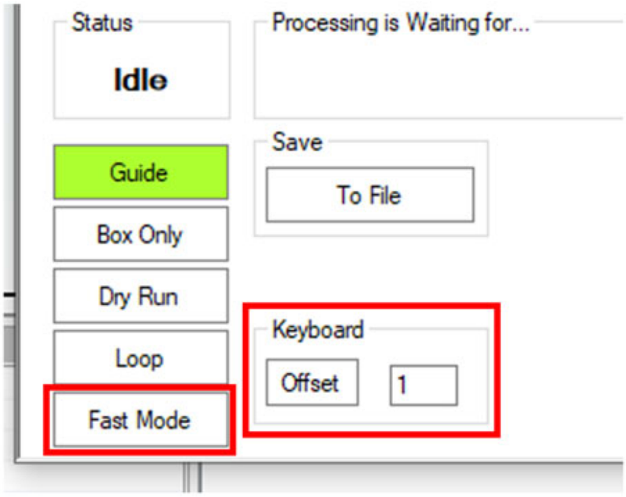
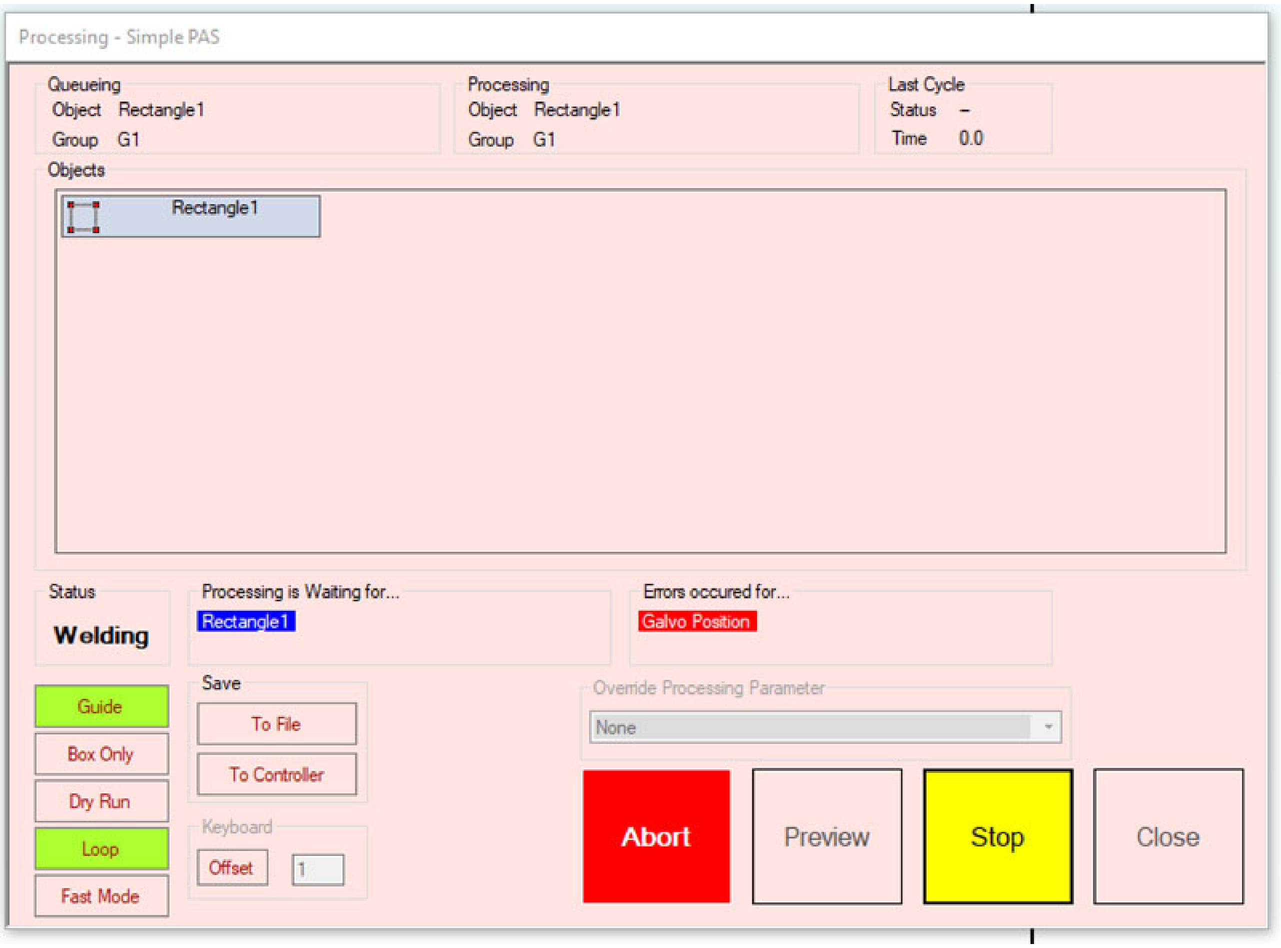


Figure 188: Fast Mode and Keyboard Offset Buttons

- Box Only Button - This will cause a box to be displayed around the place of any process objects using the guide laser. This functionality is typically used for approximate Process Object placement using the guide laser.
- Dryrun Button - Utilized for simulating a process in Robotic On-The-Fly processing. See section "Robotic On-The-Fly Processing" for additional detail.
- Loop Button - Will continuously loop the selected job when processing is started. Anytime the Loop function is enabled, two additional buttons become available when processing is started (see Figure 189 on page 182).
    - Abort Button - This will stop processing, even if in the middle of a Process Object (it will interrupt the process).
    - Stop Button - This will stop the loop and allow objects loaded within the queue to complete prior to stopping the process.



Processing - Simple PAS

Queueing
Object Rectangle1
Group G1

Processing
Object Rectangle1
Group G1

Last Cycle
Status –
Time 0.0

Objects
Rectangle1

Status
Welding

Processing is Waiting for...
Rectangle1

Errors occured for...
Galvo Position

Override Processing Parameter
None

Keyboard
Offset 1

Figure 189: Processing Window Stop and Abort Buttons

- Override Processing Parameter Selection - Allows users to select a parameter profile that will override any Process Objects during previewing or processing.
- Preview Button - Automatically enables the Guide and Loop buttons and starts processing.
- Start Button - Starts processing. Any functionality that is enabled (i.e. Guide and Loop buttons selected) will be applied. Once processing is started, an additional button becomes available:
  - Abort Button - This will stop processing, even if in the middle of a Process Object (it will interrupt the process).
- Close Button - Closes the Processing Window.

8 Processing Types

8.1 Processing Concepts

8.1.1 Execution Buffer

An IPGScan job is mostly run sequentially in an execution buffer in ScanPack. All IPGScan processing objects and some ActionControls are sent from IPGScan to the ScanPack buffer. Some other IPGScan Action Controls are executed immediately at the IPGScan level.

8.1.1.1 Detailed Information

All of the commands executed by the Scan Controller are organized in a buffer. The buffer is maintained in a FIFO structure. The Scan Controller waits on the head of the buffer to receive the next command to execute.

Commands sent to the buffer are made up of the entities shown in Table 22 (below). Table 23 shows the ID counters which are tracked as the buffer progresses.

Table 22: ScanPack Buffer Entities

Entity	Description
Frame	A frame contains the Scan Controller instructions for one time cycle, around 10 µs. A larger instruction, like outputting vectors, could be made up of multiple frames.
Object	A complete set of actions for the Scan Controller. This can include instructions which purposely do not finish an object.
End of Frame (EOF)	A flag which allows the current frame to be written to the buffer.
End of Object (EOO)	Allows frames in the buffer to execute. The scan controller will not begin to dequeuer frames from the buffer for execution until an EOO is present or the buffer is at least half full.
End of Job (EOJ)	A flag which tells the Scan Controller that the current object finishes the job. This flag is sent by LaserLib (installed with ScanPack) when the laser is turned off.

Table 23: ScanPack Buffer ID Counters

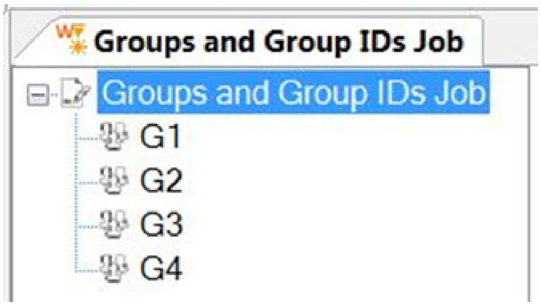
ID	Description
FrameID	Counts the number of Frames. The FrameID starts at 0 and is incremented by EOF entities. FrameID is only reset with a new instance of ScanPack. This can be done by restarting IPGScan.
ObjectID	In IPGScan, this counts the number of objects output by the scanner. This value is reset to 0 after going to a new group.
JobID	In IPGScan, this is the GroupID of group most recently completed.

8.1.2 Groups and Group IDs

Groups are a critical part of creating programs in IPGScan. Not only are they used to organize programs into sub-sections, but they also are used to carry out a number of functions. For example, groups allow users to skip over or skip to different sets of process objects depending on their scenario.

Use the Action Controls GoToGroup (see Section 8.1.1 on page 183) and Load Register (see Section 7.9.10 on page 168) to select different groups during execution. The following provides information regarding Groups and their use.

Groups are created using the "Create Group" button in the toolbar. Figure 190 (below) shows a job containing four empty Groups.

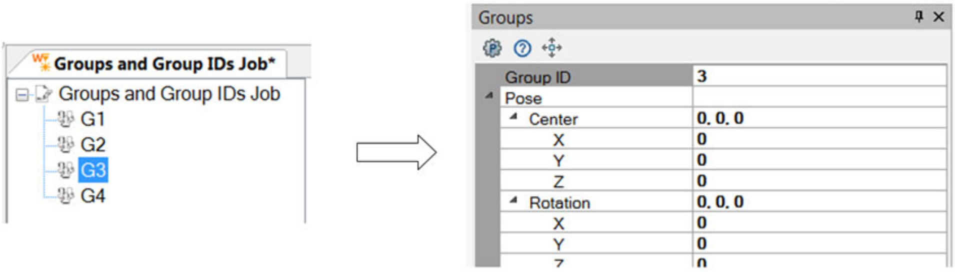


Groups and Group IDs Job

- Groups and Group IDs Job
  - G1
  - G2
  - G3
  - G4

Figure 190: Groups in the Job Tree

Each Group has a Group ID. The Group ID is used as an identifier for its corresponding Group. In order to set the Group ID, click on the Group in the Job Tree and then change the value "Group ID" in the Properties Window. Figure 191 (below) shows Group G3 being selected in the Job Tree and its corresponding Group ID is 3. Group ID values are limited to integers. The Group ID has no relation to the name of the group. For example, a Group name "Group 20" could have a Group ID of 32.



Groups and Group IDs Job*

- Groups and Group IDs Job
  - G1
  - G2
  - G3
  - G4

Groups

Group ID	3
Pose	
Center	0, 0, 0
X	0
Y	0
Z	0
Rotation	0, 0, 0
X	0
Y	0
Z	0

Figure 191: Setting Group ID

Group ID's are the basis behind how Point and Shoot Processing works (see Section 8.2 on page 187). In a Robot/PLC program, users reference the desired IPGScan Group through the use of the Group ID. The IPGScan Controller might receive the desired group ID via Digital Bits (Port A), Ethernet communication, or any other viable option outlined in the Load Register Action Control (see Figure 7.9.10 on page 168).

8.1.3 Coordinate Systems

The following figures relate the coordinate system of IPGScan and the coordinate system of the Scan Head. The figures below diagram the two coordinate systems. In these figures the positive X axis is represented in green, the positive Y axis is represented in blue, and the positive Z axis is represented in red. In the IPGScan canvas diagram, the positive Z axis is going out of the page. In a default job (represented below), objects closer to the bottom of the IPGScan canvas will be output closer to the IPG logo on the Scan Head. For an On-The-Fly job, the IPGScan axes match the user calibrated coordinate system.

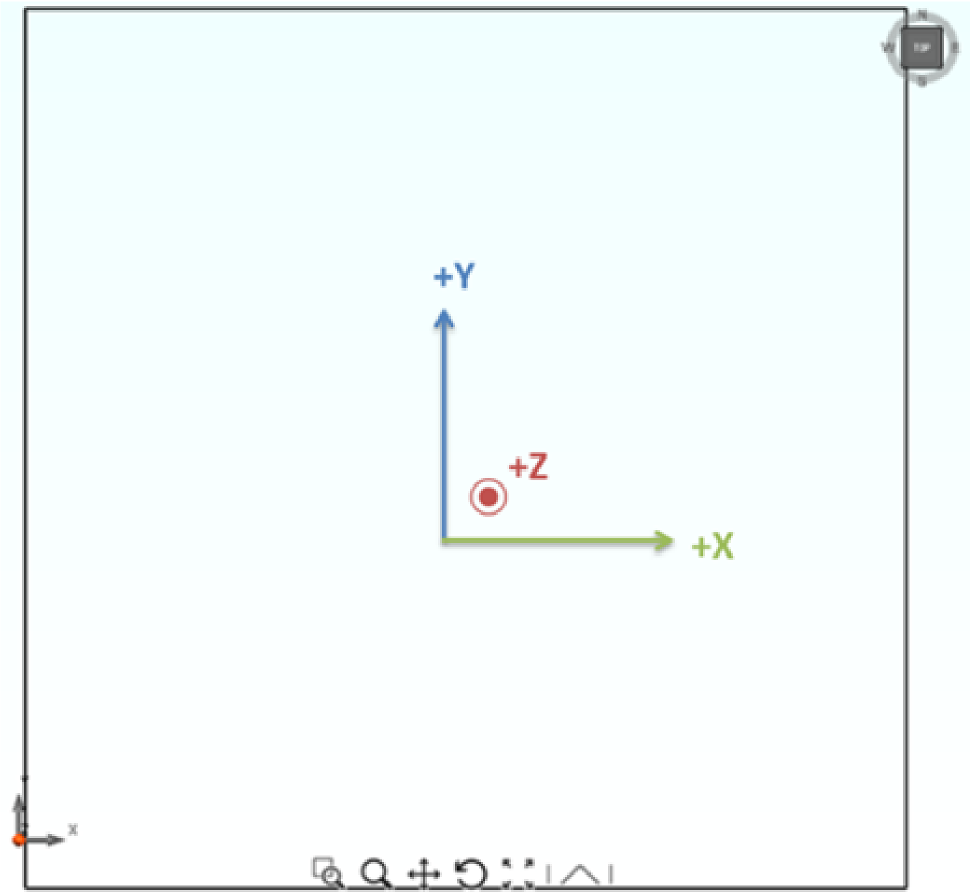


Figure 192: IPGScan Default Coordinate System

NOTE: In the above figure, the red dot symbol (◉) represents the direction out of the page and towards the reader.

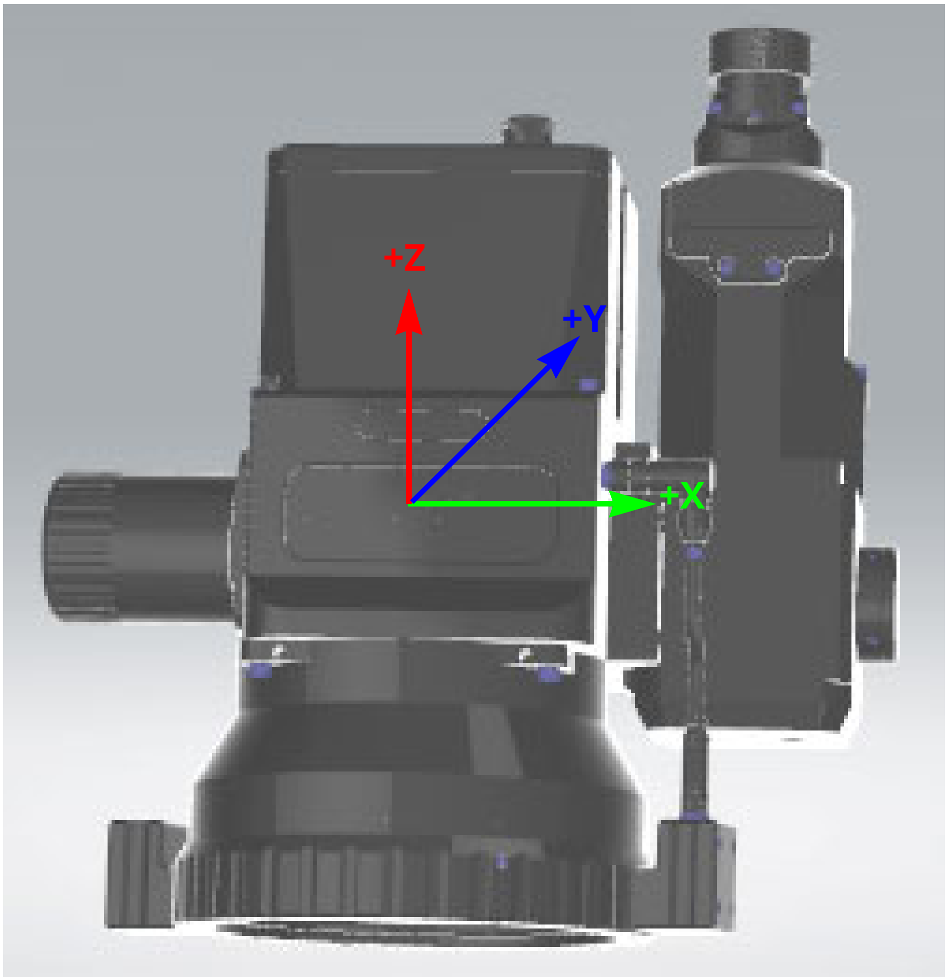


Figure 193: Scan Head Default Coordinate System

NOTE: In Figure 192 on page 185 and Figure 193 (above), the positive X direction is green, the positive Y direction is blue, and the positive Z direction is red.

8.2 Point and Shoot Processing

8.2.1 Overview

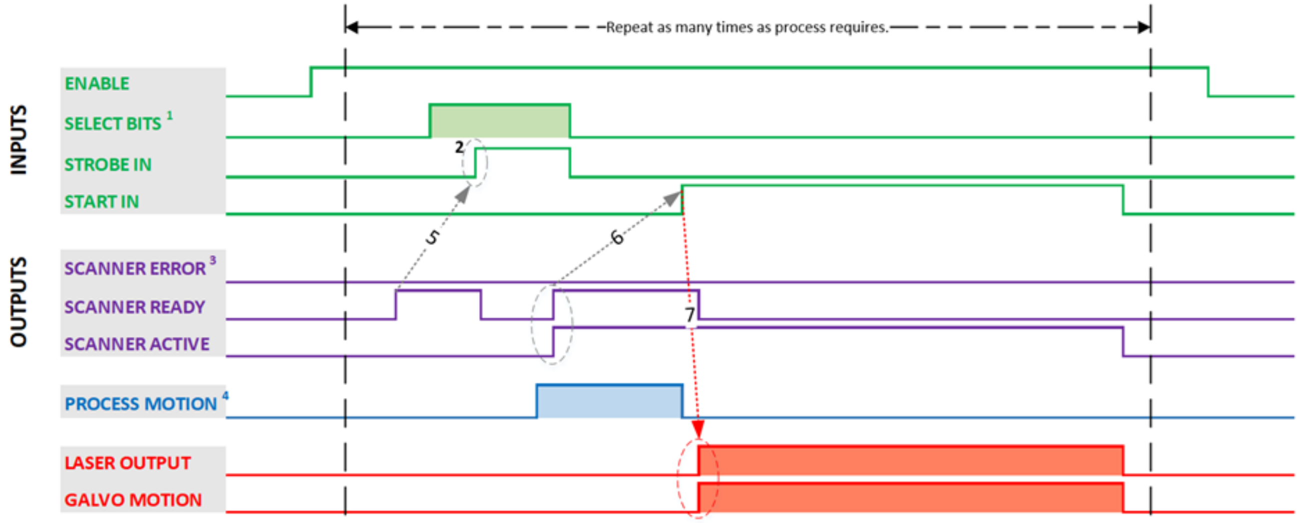
Point and Shoot processing is a scanner application where the scan controller and an external device (e.g., PLC and/or a robot) work together to integrate the scanner into a larger automation system. The external device can choose what processing is done by the scanner based upon other components in the system (e.g., turn table, fixturing, or robot motion). The processing configuration and parameters are configured in IPGScan and the external device sequences when each object should be output.

A couple of use cases are:

- Using a robot to weld a part which is larger than the scan head's field of view
- Using a PLC to mark a barcode on a part that comes off a production line
- Using a PLC to process a component based on which part is presented to the scanner

8.2.2 Signal Sequencing

The external device coordinates with the scanner system through a series of signals. Figure 194 (below) is a timing diagram which shows the sequencing of these signals. The signals work in the following order:



1 - This represents all 9 select bits. The select bits represent a binary value that is converted into a decimal value for job selection.
2 – Select bits must be set to the desired state prior to setting strobe active.
3 - ERROR only goes active if processing is interrupted (such as ENABLE going inactive during processing) or the scanners connection is lost during processing. ENABLE must be active when processing is started.
4 - Process motion entails any process procedures that may be required prior to processing with the scanner. Examples include presenting the part to the scanner or moving a robot/positioner that the scanner is mounted to into the desired processing position. This does not represent signal input/output.
5 – Control must wait Ready output HIGH to assert Strobe
6 – Control must wait Ready and Active HIGH to assert Start (besides Process Motion)
7 – Scanner Motion and Laser Output

Figure 194: Point and Shoot Timing Diagram

1. The external device should select the group ID (see section "Groups and Group IDs") of the processing objects the scanner should next execute. This selection is done with the SELECT[8:0] bits. After all of the bits have been set, the external device should set the STROBE bit to active.
   a. If the desired output is always the same processing group (e.g. a company logo and a serial number or a series of the same welds), the group selection can be skipped. The sequence can function with only the STROBE or START bits.
   b. If a different method of group selection than hardwire signals is desired (e.g. Serial or Ethernet), steps 1 and 2 would be replaced with the desired method.
2. The scanner first waits for the STROBE signal from the external device. While the scanner is waiting: the READY signal will be active, the ACTIVE signal will be inactive, the ERROR signal will be inactive.
3. After receiving the STROBE signal, the scanner system will deactivate the READY signal. When IPGScan has processed the data into the scan controller, the READY and ACTIVE signals will be active.
4. When the external device would like to tell the scan controller to begin outputting the processing objects previously loaded, it should set the START signal to active. The STROBE signal can be set to inactive.
5. While the scan controller is outputting the processing objects, the READY signal will be inactive and the ACTIVE signal will remain active.
6. When all of the chosen processing objects have been output by the scanner, the ACTIVE signal will be set to inactive and the process will return to step 1.

IMPORTANT The above sequencing is dependent upon the IPGScan job structure. Please refer to the following sections for additional detail.

8.2.3 IPGScan Point and Shoot Job Setup

A Point and Shoot job in IPGScan uses the same processing objects as a Default job but uses additional Action Controls and job structure to achieve the Point and Shoot capabilities previously described. A Point and Shoot job can be created from a Default type IPGScan job and a Point and Shoot type IPGScan job. Both are described below using a hardwiring implementation. A Point and Shoot job can be configured to use an interface other than a hardwire interface as well.

For a Point and Shoot job, the external device selects what the scanner should execute by selecting groups based upon the group ID. A group must start with an Action Control to block execution until the START signal. Following this Action Control, a group can contain any number of processing objects and Action Controls. The whole job is managed by the "Loop Group." The Loop Group gets the Group ID of the next group to run from the external device. Then the Loop Group moves execution to the selected group.

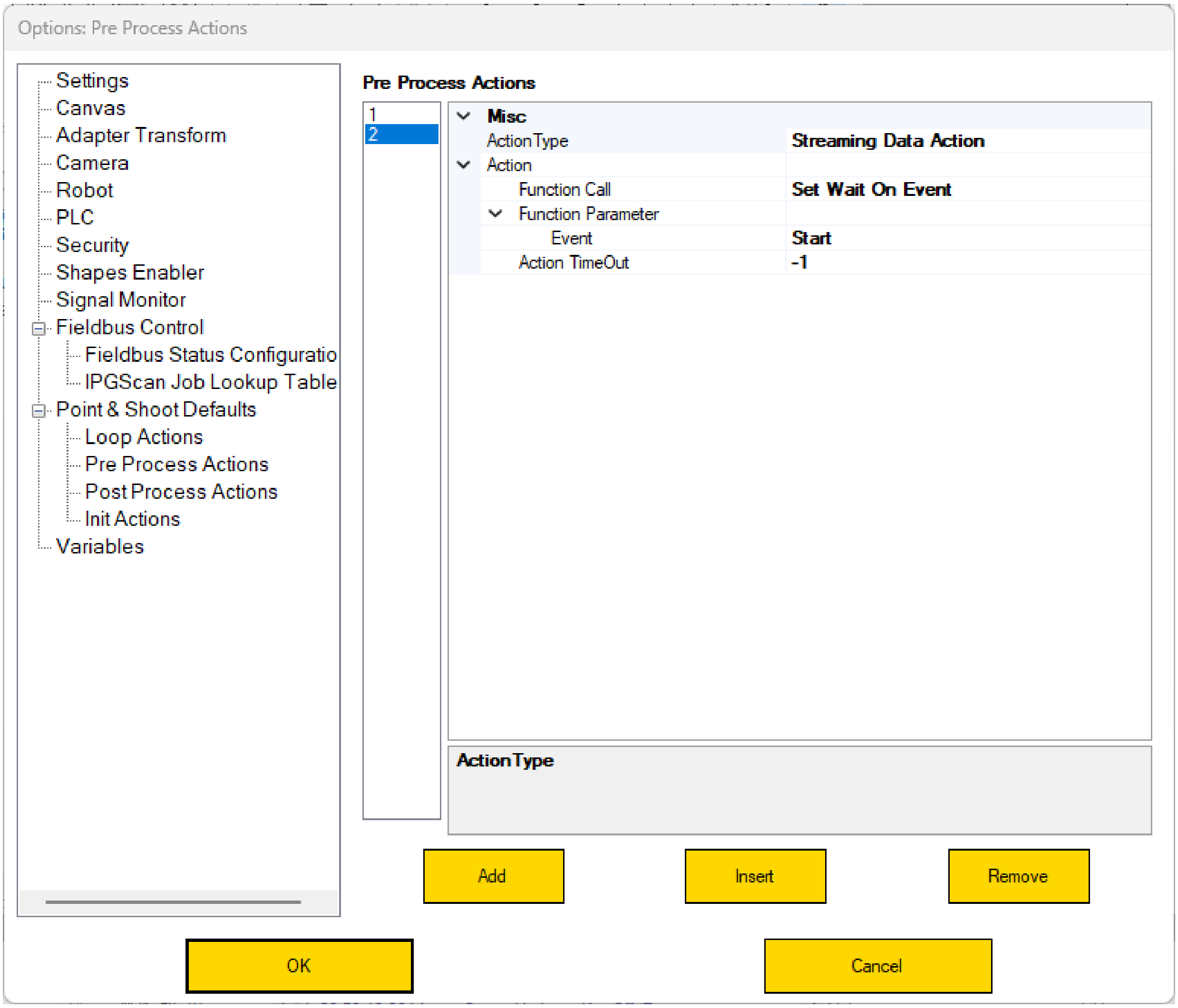
IMPORTANT In a Default job, an additional GoToGroup Action Control is required after each processing group to return execution to the Loop Group.

8.2.3.1 Point and Shoot Job Type

The following sections outline the setup and use of an IPGScan "Point & Shoot" job type.

8.2.3.1.1 Default Point & Shoot Job Settings

The user can configure the default "Point & Shoot" job type settings by going to View → Options, in IPGScan. Extending the "Point & Shoot Defaults" drop down, and clicking on "Loop Actions," "Pre Process Actions," "Post Process Actions," or "Init Actions" allows the user to configure the default settings for each collection. Figure 195 (below) illustrates the "Pre Process Actions" default settings.



Options: Pre Process Actions

Pre Process Actions

1
2

Misc	
ActionType	Streaming Data Action
Action	
Function Call	Set Wait On Event
Function Parameter	
Event	Start
Action TimeOut	-1

ActionType

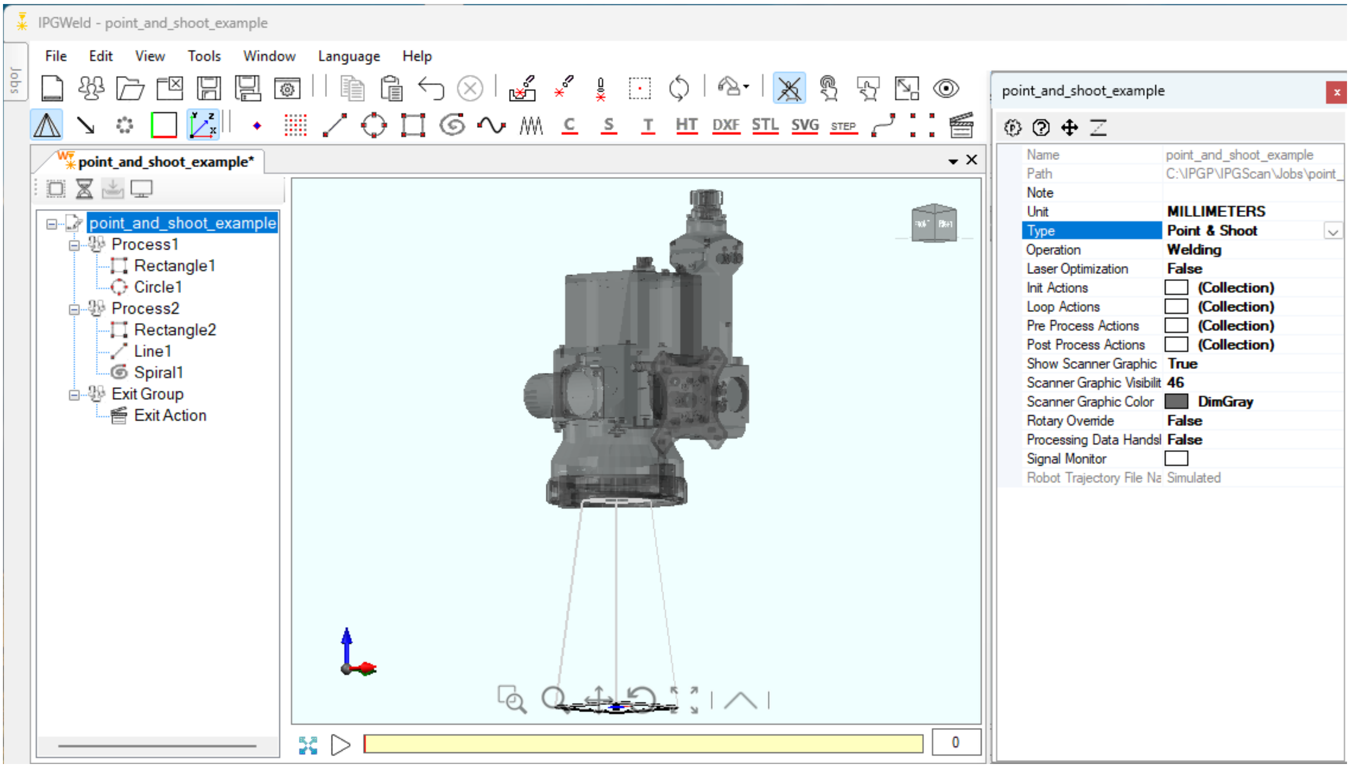
Figure 195: Pre Process Actions

Using the "Add" or "Insert" buttons, the user can add additional program steps to the Loop, Pre Process, Post Process, and Init collection settings. Clicking "Add" will insert a step below all the other steps while clicking "Insert" adds a step above the step that was selected. Clicking "Remove" will delete the selected step.

By default, IPGScan is setup so that the "Loop Actions," "Pre Process Actions," "Post Process Actions," and "Init Actions" are configured with Action Controls that are typically used in a default type Point and Shoot job. The purpose behind this is to make it so users only need to create the desired number of groups, confirm Group IDs, and insert process objects in order to create a job.

8.2.3.1.2 Job Setting

Any job can be set as a "Point & Shoot" type job by selecting the job name and then select "Point & Shoot" from the "Type" drop down menu. See Figure 196 (below).



point_and_shoot_example

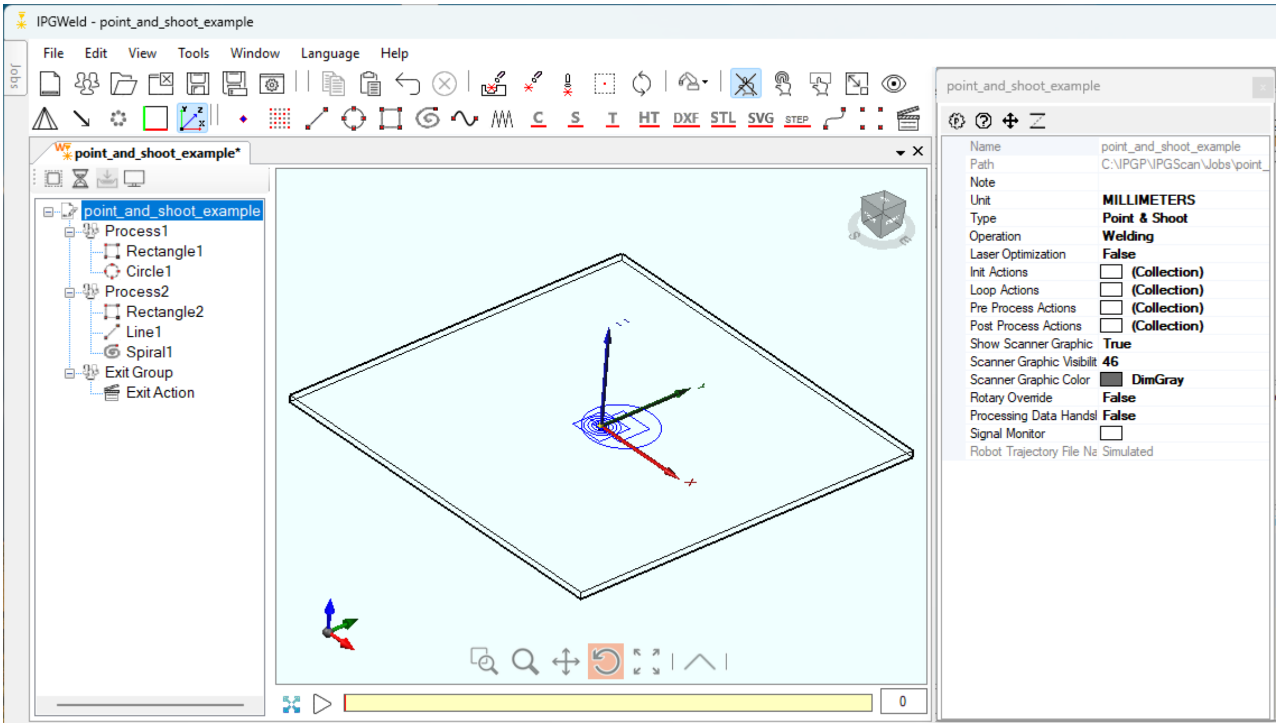
Name	point_and_shoot_example
Path	C:\IPGP\IPGScan\Jobs\point_
Note	
Unit	MILLIMETERS
Type	Point & Shoot
Operation	Welding
Laser Optimization	False
Init Actions	□ (Collection)
Loop Actions	□ (Collection)
Pre Process Actions	□ (Collection)
Post Process Actions	□ (Collection)
Show Scanner Graphic	True
Scanner Graphic Visibilit	46
Scanner Graphic Color	■ DimGray
Rotary Override	False
Processing Data Handsl	False
Signal Monitor	□
Robot Trajectory File Na	Simulated

Figure 196: Selecting "Point & Shoot" Job Type

Next, the user simply needs to create the desired number of process groups and add process objects to each group.

Figure 197 (below) outlines an example IPGScan Point and Shoot job structure that consists of two Process Groups and an Exit Group to stop processing. Process1, consisting of a rectangle and a circle, appears in red. Process2, consisting of a rectangle; a line; and a spiral, appears in blue.

In a Point and Shoot type job, the Action Controls are hidden within collection boxes (accessed by clicking on the job name) whereas in a Default type job, users must add the Action Controls directly within the Job Tree.



point_and_shoot_example
- Process1
  - Rectangle1
  - Circle1
- Process2
  - Rectangle2
  - Line1
  - Spiral1
- Exit Group
  - Exit Action

point_and_shoot_example

Name	point_and_shoot_example
Path	C:\IPGP\IPGScan\Jobs\point_
Note	
Unit	MILLIMETERS
Type	Point & Shoot
Operation	Welding
Laser Optimization	False
Init Actions	□ (Collection)
Loop Actions	□ (Collection)
Pre Process Actions	□ (Collection)
Post Process Actions	□ (Collection)
Show Scanner Graphic	True
Scanner Graphic Visibilit	46
Scanner Graphic Color	■ DimGray
Rotary Override	False
Processing Data Handsl	False
Signal Monitor	□
Robot Trajectory File Na	Simulated

Figure 197: Point & Shoot Job Type Example Program Structure

8.2.3.1.3 Understanding Process Sequencing

Although the user no longer is required to create the Action Controls in each process group that are normally required for a Default type point and shoot job, the same Action Controls are still being utilized. These Action Controls are simply created and stored within the "Loop Actions," "Pre Process Actions," "Post Process Actions," and "Init Actions" collection boxes. When the job is started, processing immediately jumps into the "Init Actions" collection. This collection is to initialize any registers required for the IPGScan job. The "Init Actions" are only run once at the beginning of the job. Processing then goes into the "Loop Actions" collection box. Once all actions are performed within the "Loop Actions" collection, processing then proceeds into the "Pre Process Actions" collection box. After the "Pre Process Actions" are performed, processing then proceeds to the Process Group which the user selected via the Load Register Action Control in the "Loop Actions." Finally, once all objects and actions are performed in the Process Group, anything setup in the "Post Process Actions" will execute and processing will then return to the "Loop Actions" collection.

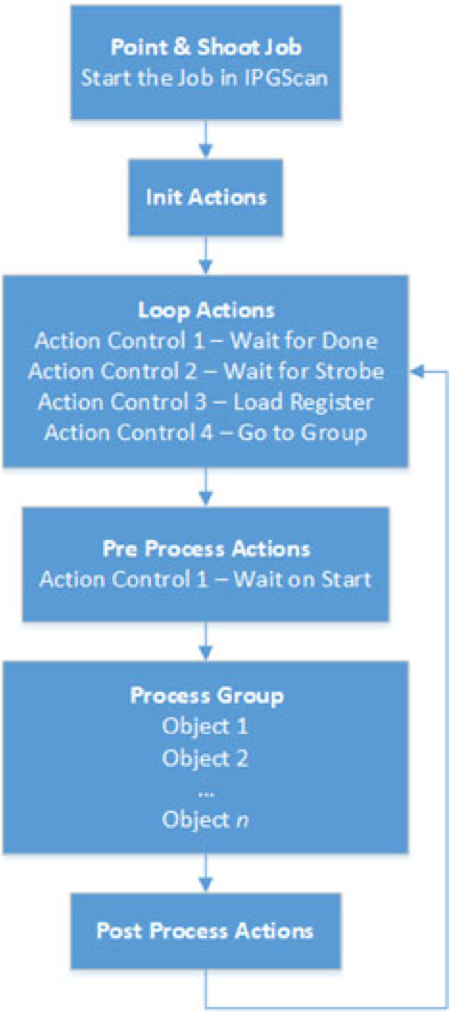

Point & Shoot Job
Start the Job in IPGScan
Init Actions
Loop Actions
Action Control 1 – Wait for Done
Action Control 2 – Wait for Strobe
Action Control 3 – Load Register
Action Control 4 – Go to Group
Pre Process Actions
Action Control 1 – Wait on Start
Process Group
Object 1
Object 2
...
Object n
Post Process Actions

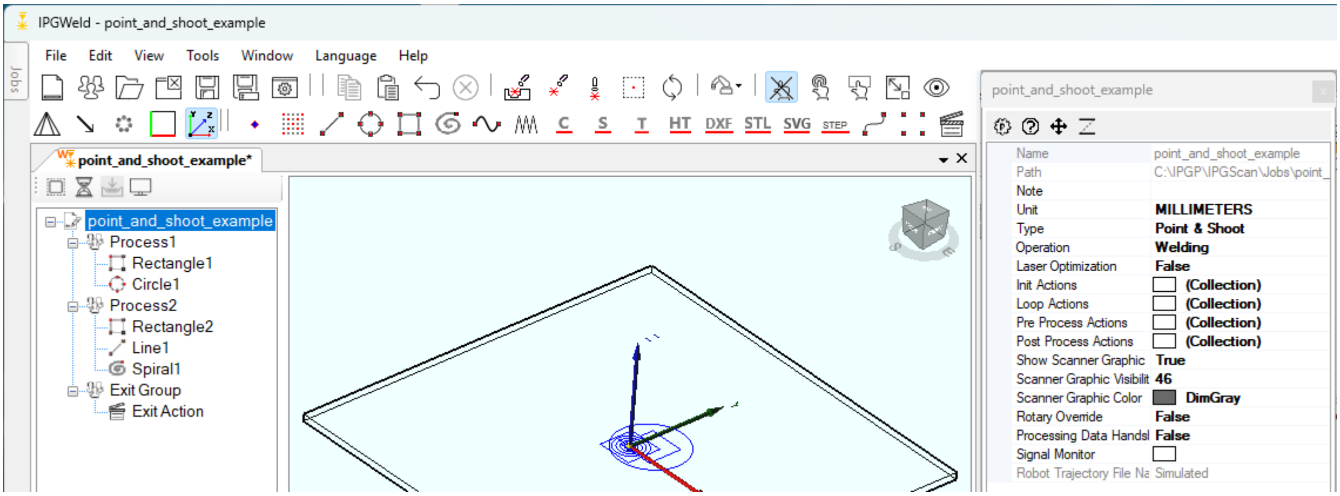
Figure 198: Point and Shoot Job Example Sequence

NOTE: Processing takes place through the job tree sequentially.

NOTE: The user has the ability to add, modify, or remove any of the Action Controls outlined in Figure 198 (above). Figure 198 outlines the "Loop Actions," "Pre Process Actions," "Post Process Actions," and "Init Actions" as they should be upon first installing IPGScan. All objects and actions in the "Process Group" are determined by the user.

8.2.3.1.4 Modifying "Loop", "Pre Process", "Post Process", and "Init” Actions

The user has the ability to modify the "Loop Actions," "Pre Process Actions," "Post Process Actions," and "Init Actions" specific to each individual IPGScan "Point & Shoot" type job. By clicking on the job title in the Job Tree, the user can access the collection box for each of the process stages in the Parameter Tree (see Figure 199 on page 193). Within each of the collection boxes, users can add, modify, and remove Action Controls and objects. Please note that changes made to the collection boxes within the job are specific to only that job.



Name	point_and_shoot_example
Path	C:\IPGP\IPGScan\Jobs\point_
Note	
Unit	MILLIMETERS
Type	Point & Shoot
Operation	Welding
Laser Optimization	False
Init Actions	□ (Collection)
Loop Actions	□ (Collection)
Pre Process Actions	□ (Collection)
Post Process Actions	□ (Collection)
Show Scanner Graphic	True
Scanner Graphic Visibilit	46
Scanner Graphic Color	■ DimGray
Rotary Override	False
Processing Data Handsl	False
Signal Monitor	□
Robot Trajectory File Na	Simulated

Figure 199: Modifying Process Stages Specific to an IPGScan Job

8.2.3.2 Default Job Type

The following list is an example Default Point and Shoot style job. This is copied from the job "point_and_shoot_example.wjb" which can be found in the Jobs folder of an IPGScan installation.

- Loop Group (Group ID = 1)
  - Wait - WaitForDone
    - Description
      - The purpose of this Action Control is to block the execution of the job until all of the previously chosen processing objects have been output.
    - Properties
      - Action Type: Wait
      - WaitForMethodTypes: Wait For Done
      - Wait For Method: <blank>
      - Action TimeOut: -1
  - Wait - PortABit_True
    - Description
      - The purpose of this Action Control is to block the execution of the job until the STROBE signal from the external device is active as part of the handshaking sequence (see Section 8.2.2 on page 187).
    - Properties
      - Action Type: Wait
      - WaitForMethodTypes: Port A Bit Action
      - Wait For Method
        - Bit: 0
        - Wait For: True
    - Action TimeOut: -1

  - LoadRegister - PortA
    - Description
      - The purpose of this Action Control is to read the selected group to execute from the external device. The selected group is stored in the "Destination Register," in this case Variable 1.
    - Properties
      - Action Type: Load Register
      - Load Register Using Type: Port A
      - Load Register Method
        - Shift: 0x010
        - Width: 9
        - Destination Register: Variable 1
  - GoToGroup – Register
    - Description
      - The purpose of this Action Control is to direct the execution of the job to the chosen group based upon the Group ID.
  - Properties
    - Action Type: Go To Group
    - GoToGroupMethodType: Register
    - Go To Group Method
      - Go To Group At: Variable 1

        NOTE: the variable in the Go To Group Action Control must match he Destination Register in the previous Load Register Action Control.
- Process1 (Group ID = 2)
  - StreamingDataAction - WaitForStart
    - Description
      - The purpose of this Action Control is to block the output of the processing objects from the Scan Head until the external device is ready and sets the START signal to be active.
    - Properties
      - Action Type: Streaming Data Action
      - Function Call: Set Wait On Event
      - Function Parameter
        - Event: Start
      - Action TimeOut: -1
  - Processing Objects
  - GoToGroup - Constant
    - Description
      - The purpose of this Action Control is to direct the execution of the job back to the Loop Group. The Go To parameter should match the Group ID of the Loop Group.
    - Properties
      - Action Type: Go To Group

        - GoToGroupMethodType: Constant
        - Go To Group Method
            - Go To: 1
- Process2 (GroupID = 3)
    - See Process1
- Exit Group (GroupID = 4)
    - Exit Action
        - Description
            - This Action will stop the running IPGScan job.

8.2.4 External Device

Any external device can be used with the Scan Controller. An external interface board must be used (see External Interface Manual). The most common devices are a PLC or an Industrial Robot.

8.2.4.1 Industrial Robot

When using an industrial robot as the external device with a scanner Point and Shoot job, the same methods of communication are available as with a PLC: Digital I/O, EtherNet/IP, Profinet, and EtherCAT. To assist in the programming of the robot, helper functions have been written for several robot brands: KUKA, ABB, Yaskawa Motoman, and FANUC. These helper functions are listed in Table 24 (below). An example program called "IPG_EXAMPLE_WELD" is also available.

Table 24: Industrial Robot Helper Functions

HELPER FUNCTION	DESCRIPTION
IPG_EXECUTE_WELD	This function executes the pre-selected IPGScan group. If this function waits for longer than a specified timeout for the scanner to be ready to execute, the program will stop execution of the robot program. See IPG_PREP_WELD for more information regarding setting and disabling the timeout.
IPG_LASER_DIS	This function configures any I/O for disabling the laser or system. It is called IPG_SHUTDOWN_WELD. This function is empty by default.
IPG_LASER_EN	This function configures any I/O for enabling the laser or system. It is called IPG_PREP_WELD and SETUP_WELD. This function is empty by default.
IPG_PREP_WELD/SETUP_WELD	This function sets up all I/O for use in these helper functions. This function only needs to be called once at the beginning of the main program.

Table 24: Industrial Robot Helper Functions (Continued)

HELPER FUNCTION	DESCRIPTION
IPG_SELECT_WELD	This function selects the desired processing group from IPGScan. This function needs to be called before each call of IPG_EXECUTE_WELD in the default setup of a Point and Shoot job in IPGScan. In order to save time, this function should be called before moving the robot and before calling IPG_EXECUTE_WELD. The time that the scanner will spend processing the new data will overlap the time that the robot spends moving. This function expects the desired processing group as a parameter. This should be a number between 0 and 511, inclusive.
IPG_SELECT_WELD_WAIT	This function is the same as IPG_SELECT_WELD, but incorporates the Ready signal indicating that the Scanner system is ready for the Strobe signal.
IPG_SHUTDOWN_WELD	This function turns off all I/O used in these helper functions. This function only needs to be called once at the end of the main robot program. IPG_SHUTDOWN_WELD and CLOSE_WELD are the same job. New versions are called IPG_SHUTDOWN_WELD.

8.2.4.1.1 Special Cases

8.2.4.1.1.1 KUKA

KUKA requires two additional files: IPG_EXAMPLE_WELD.dat and IPG_SCAN_VARIABLES.dat. IPG_EXAMPLE_WELD.dat contains position information used by move commands in IPG_EXAMPLE_WELD.src. IPG_SCAN_VARIABLES.dat contains variable definitions for variables used in multiple helper subprograms.

8.2.4.1.1.2 ABB

The functions for ABB are provided as a single module file with multiple procedures.

8.2.4.1.1.3 Yaskawa Motoman

The timeout argument in IPG_PREP_WELD is in clock ticks, not milliseconds. This value is stored in a global integer variable. The default variable is I000.

8.2.4.1.1.4 FANUC

An additional numeric register is required for the job IPG_SELECT_WELD. By default, register 2 is used. Two user alarms are used as well. Their severity is setup in IPG_SETUP_WELD. The user alarm messages must be setup by the user in the FANUC menu. By default, alarm 1 is used in case of a timeout in IPG_EXECUTE_WELD and alarm 2 is used in case of an invalid group ID in IPG_SELECT_WELD.

8.2.4.1.2 Pseudocode Example

The following is a pseudocode example of a Point and Shoot program on an industrial robot.

```
// IPG_PREP_WELD weld is called once at the beginning.
// The argument 1000 will create a timeout of 1 second.
IPG_PREP_WELD(1000)
// IPG_SELECT_WELD is used to select IPGScan Group ID 2
IPG_SELECT_WELD(2)
// The robot is moved after calling IPG_SELECT_WELD so that IPGScan
// can process the data in Group ID 2 while the robot is moving.
Move_J(P1)
// IPG_EXECUTE_WELD will wait until the scanner system is ready to
// execute.
IPG_EXECUTE_WELD()
// The sequence of IPG_SELECT_WELD, Movement, IPG_EXECUTE_WELD is all
// that is required after calling IPG_PREP_WELD at the beginning of
// the program.
IPG_SELECT_WELD(3)
Move_J(P2)
IPG_EXECUTE_WELD()
IPG_SELECT_WELD(4)
// Multiple moves can be used.
Move_J(P3)
Move_L(P4)
IPG_EXECUTE_WELD()
IPG_SELECT_WELD(5)
// Commands other than moves can be used.
Move_J(P5)
Wait(di[44] == True)
IPG_EXECUTE_WELD()
// IPG_SHUTDOWN_WELD finishes the program and only has to be called at
// the end
IPG_SHUTDOWN_WELD
```

8.3 Robotic On-The-Fly Processing

8.3.1 Overview

Robotic On-The-Fly (OTF) processing enables users to create a process where the scanner is in motion during processing. The purpose of such a process is to help reduce process cycle time and increase throughput. Applications where there are many Process Objects (i.e. welds) which are spaced out over a large area often greatly benefit from the increased throughput that OTF processing can provide.

Prior to starting the development of an OTF process, it is important to understand the overall process development flow. Figure 200 (below) outlines the general steps for creating a robotic OTF process when utilizing an IPG scanner.

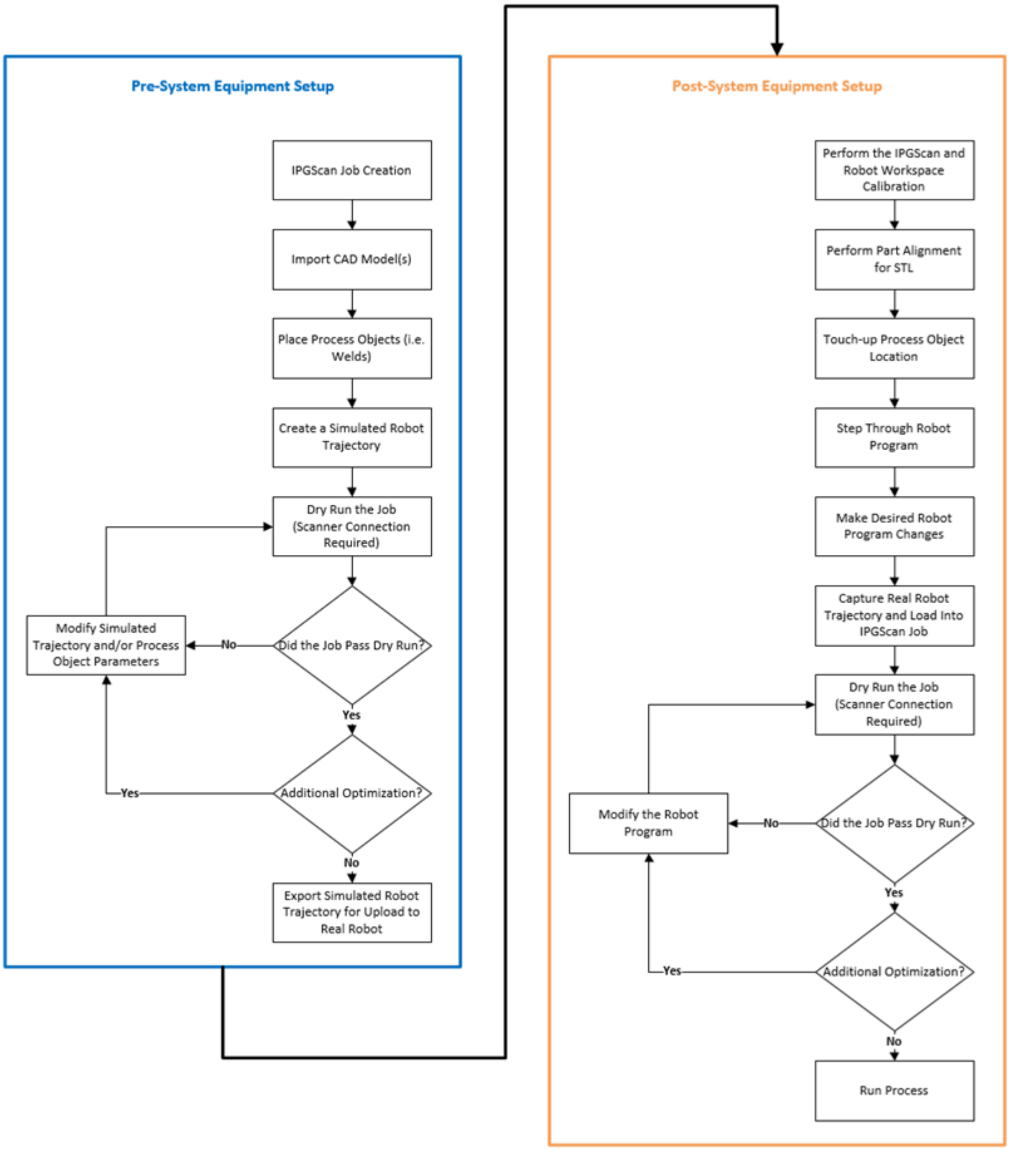

Pre-System Equipment Setup
IPGScan Job Creation
Import CAD Model(s)
Place Process Objects (i.e. Welds)
Create a Simulated Robot Trajectory
Dry Run the Job (Scanner Connection Required)
Did the Job Pass Dry Run?
No
Modify Simulated Trajectory and/or Process Object Parameters
Yes
Additional Optimization?
Yes
No
Export Simulated Robot Trajectory for Upload to Real Robot
Post-System Equipment Setup
Perform the IPGScan and Robot Workspace Calibration
Perform Part Alignment for STL
Touch-up Process Object Location
Step Through Robot Program
Make Desired Robot Program Changes
Capture Real Robot Trajectory and Load Into IPGScan Job
Dry Run the Job (Scanner Connection Required)
Did the Job Pass Dry Run?
No
Modify the Robot Program
Yes
Additional Optimization?
Yes
No
Run Process

Figure 200: Robotic OTF Process Overview Diagram

8.3.2 Robot Requirements and Setup

The following sections detail robot requirements and the method to configure IPGScan to communicate with a given industrial robot brand.

IMPORTANT Point and Shoot style processing does not require the same communication setup that Robotic OTF processing requires in order to capture robot trajectory data.

8.3.2.1 Requirements

Each robot manufacturer requires additional options for robot to PC communications and coordination. The additional options for each robot manufacturer are shown in Table 25 (below).

Table 25: Robot Required Options

MANUFACTURER	REQUIRED OPTIONS
KUKA	KUKA Robot Sensor Interface: KUKA.RSI
FANUC	SIT PC Interface (PCIF): RTL-PCIN
	Robot Server: PC RTL-RSR
FANUC KAREL	SIT PC Interface (PCIF): RTL-PCIN
	KAREL: RTL-R632
	User Socket Messaging: RTL-R648
YASKAWA MOTOMAN	MotoPlus Robot Controller Option
ABB	Externally Guided Motion (EGM): 689-1
	UDPUC Driver
	PC Interface: 616-1

IMPORTANT Robotic OTF Processing requires a consistent trigger for process repeatability. For this reason, Robot digital discrete IO modules should be wired directly to the START bit on an appropriate External Interface via hardwire. The START bit should not be passed through a PLC via a Fieldbus interface prior to being wired to an appropriate External Interface.

IMPORTANT With FANUC robots, either the Robot Server interface can be used or the KAREL interface can be used. The KAREL interface results in better results and better performance. The Robot Server interface should only be used if a higher number of coordination flags is required (beyond 5 flags).

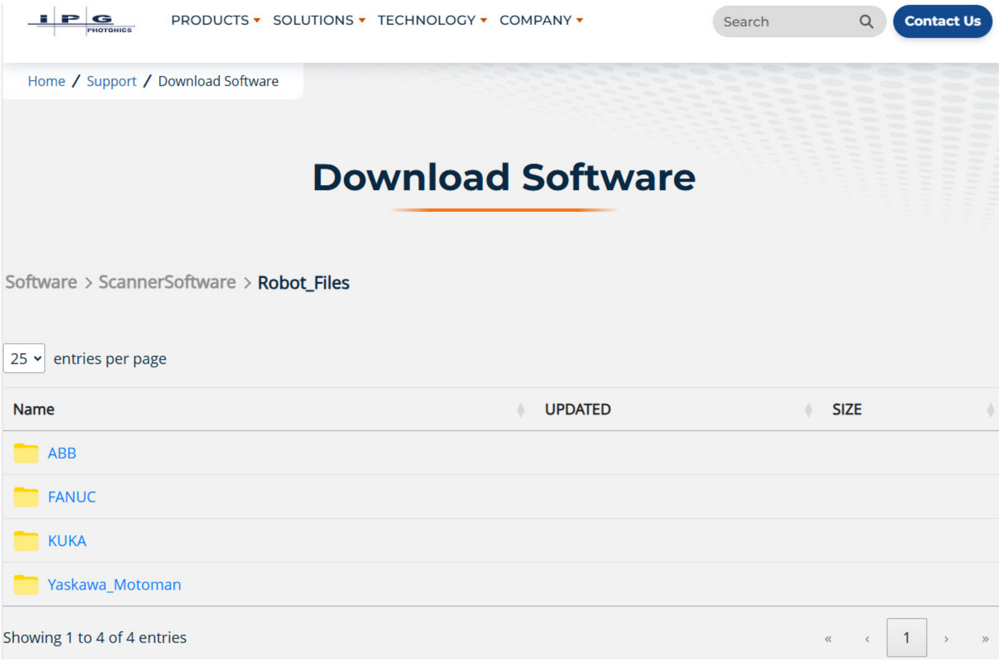
The robot controllers which have been tested with Robotic On-The-Fly are listed in Table 26 (below).

Table 26: Robotic On-The-Fly Tested Controllers

MANUFACTURER	TESTED CONTROLLERS
KUKA	KRC4
FANUC	R-30iB+
	R-30iB
YASKAWA MOTOMAN	DX200
ABB	IRC5, RW 6.08

8.3.2.2 Robot Configuration Files

Configuration files for all robots can be found on the IPG software website (software.ipgphotonics.com) in the ScannerSoftware → Robot_Files location. See Figure 201 (below). Users will require the appropriate configuration files for the robot being interfaced to.



Download Software

Software > ScannerSoftware > Robot_Files

25 entries per page

Name	UPDATED	SIZE
ABB		
FANUC		
KUKA		
Yaskawa_Motoman		

Showing 1 to 4 of 4 entries

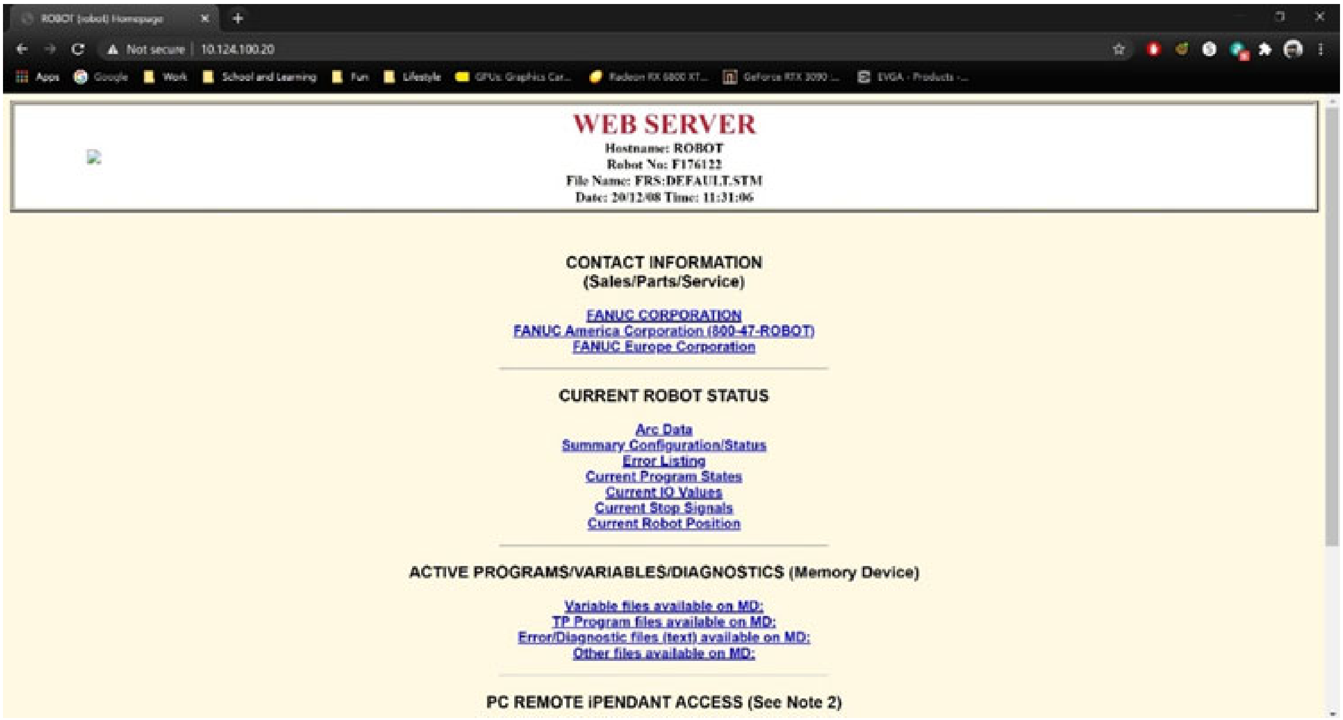
Figure 201: Robot Configuration Files on IPG Software Website

8.3.2.3 FANUC Setup

The following sections detail the configuration of a FANUC robot for use with the Robot Server or KAREL methods of Robotic OTF processing.

8.3.2.3.1 Robot Server

1. Configure a TCP/IP connection between the robot and the computer.
2. To check, enter the Robot's IP Address into a web browser and the robot's home page should load. See Figure 202 (below) as an example.



WEB SERVER

Hostname: ROBOT
Robot No: F176122
File Name: FRS:DEFAULT.STM
Date: 20/12/08 Time: 11:31:06

CONTACT INFORMATION
(Sales/Parts/Service)

FANUC CORPORATION
FANUC America Corporation (800-47-ROBOT)
FANUC Europe Corporation

CURRENT ROBOT STATUS

Arc Data
Summary Configuration/Status
Error Listing
Current Program States
Current IO Values
Current Stop Signals
Current Robot Position

ACTIVE PROGRAMS/VARIABLES/DIAGNOSTICS (Memory Device)

Variable files available on MD:
TP Program files available on MD:
Error/Diagnostic files (text) available on MD:
Other files available on MD:

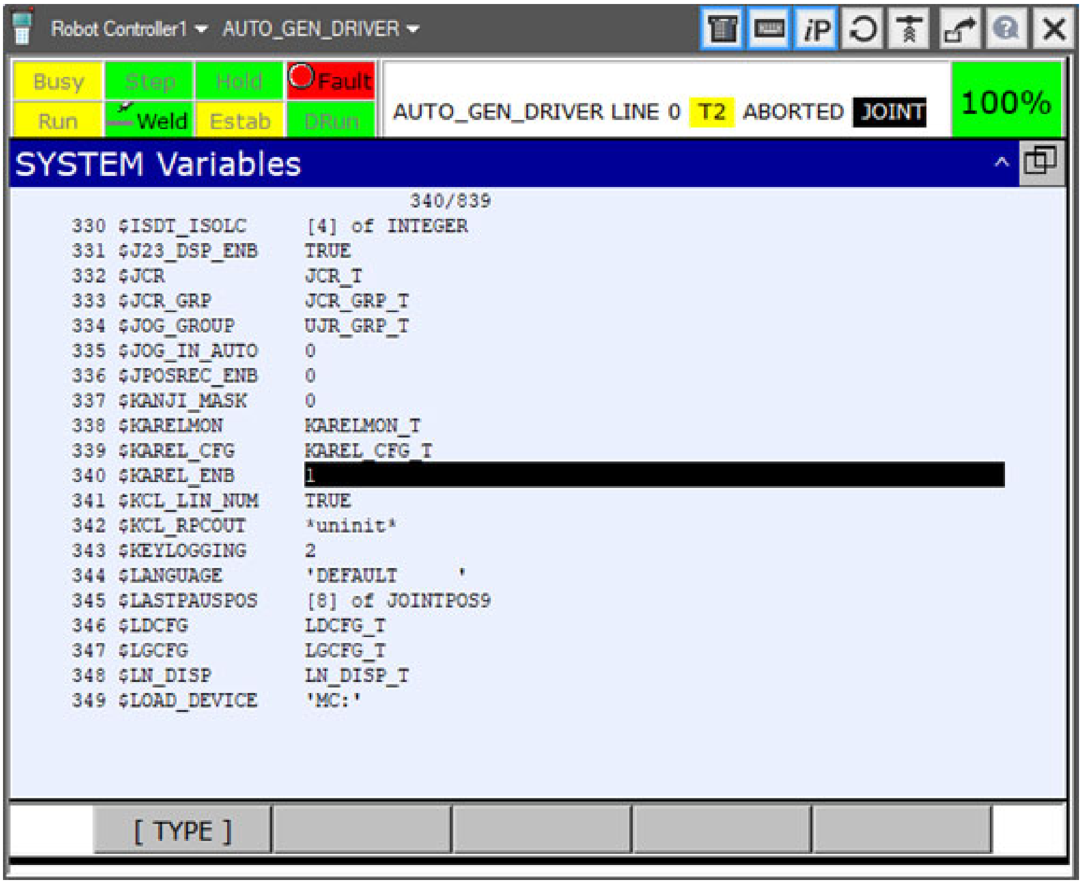
PC REMOTE iPENDANT ACCESS (See Note 2)

Figure 202: Robot Web Server Page

Robot Server is now setup and the user is ready to configure robot settings in IPGScan. See Section 8.3.4.6 ("Connecting to a Robot") on page 252 for additional details.

8.3.2.3.2 KAREL

1. Configure a TCP/IP connection between the robot and the computer.
2. To check, enter the Robot's IP Address into a web browser and the robot's home page should load. See Section 202 ("Robot Web Server Page") on page 201 as an example.
3. On the robot teach pendant, navigate to the system variable, $KAREL_ENB. Make sure this is set to 1. If it is set to 0, change it to 1 and cycle power on the controller. See Figure 203 (below).



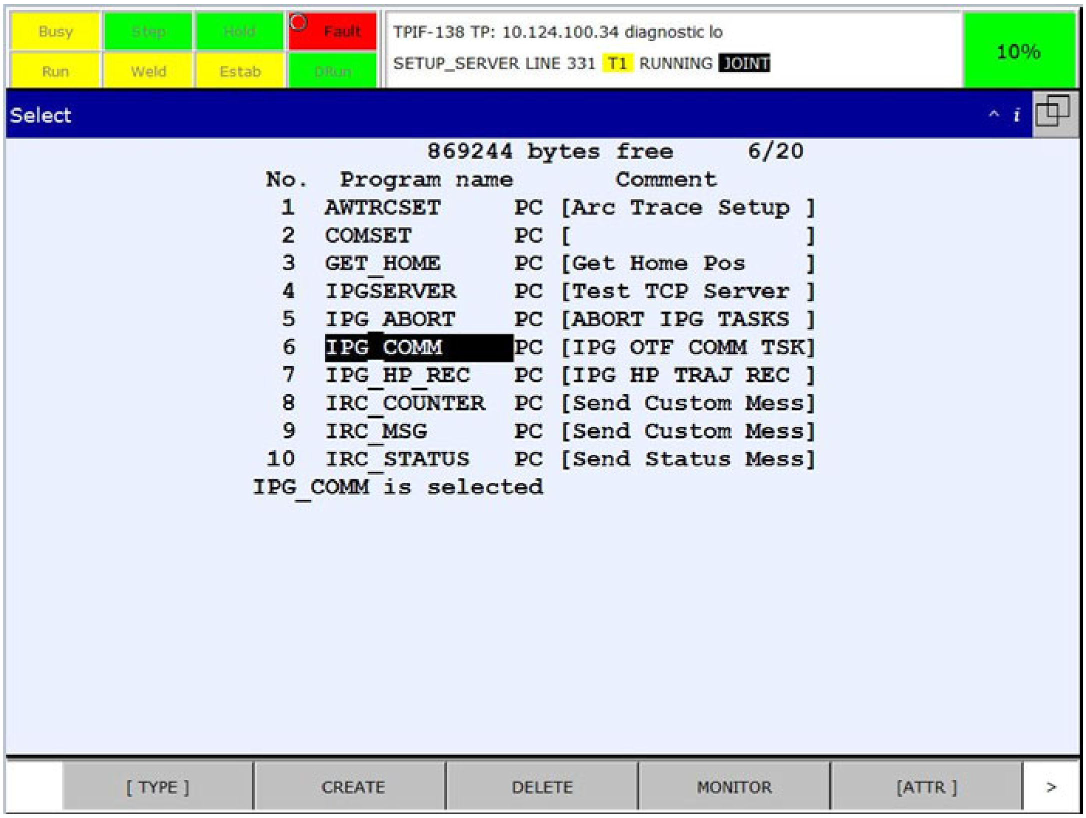
```
SYSTEM Variables
                              340/839
     330 $ISDT_ISOLC      [4] of INTEGER
     331 $J23_DSP_ENB     TRUE
     332 $JCR             JCR_T
     333 $JCR_GRP         JCR_GRP_T
     334 $JOG_GROUP       UJR_GRP_T
     335 $JOG_IN_AUTO     0
     336 $JPOSREC_ENB     0
     337 $KANJI_MASK      0
     338 $KARELMON        KARELMON_T
     339 $KAREL_CFG       KAREL_CFG_T
     340 $KAREL_ENB       1
     341 $KCL_LIN_NUM     TRUE
     342 $KCL_RPCOUT      *uninit*
     343 $KEYLOGGING      2
     344 $LANGUAGE        'DEFAULT     '
     345 $LASTPAUSPOS     [8] of JOINTPOS9
     346 $LDCFG           LDCFG_T
     347 $LGCFG           LGCFG_T
     348 $LN_DISP         LN_DISP_T
     349 $LOAD_DEVICE     'MC:'
```

Figure 203: Robot System Variables ($KAREL_ENB)

4. Load the following KAREL files (.PC) onto the robot. These files can be obtained by referring to section "Robot Configuration Files."
   - IPG_ABORT.PC
   - IPG_COMM.PC
   - IPC_HP_REC.PC

IMPORTANT It's important that the correct version files are uploaded to the robot based on the software version the robot is running (version 8 or version 9).

5. Configure the TCP server tag using the robot teach pendant. Instructions for configuration can be found in the KAREL Reference Manual Revision I, Section 11.3.2. (this is a FANUC document).
    a. Be sure to record the port number configured in this step. This number will need to be entered in the IPGScan robot options in order to be able to connect to the robot in IPGScan.
6. Select IPG_COMM.PC in the SELECT menu. See Figure 204 (below).



```
TPIF-138 TP: 10.124.100.34 diagnostic lo
SETUP_SERVER LINE 331 T1 RUNNING JOINT
```

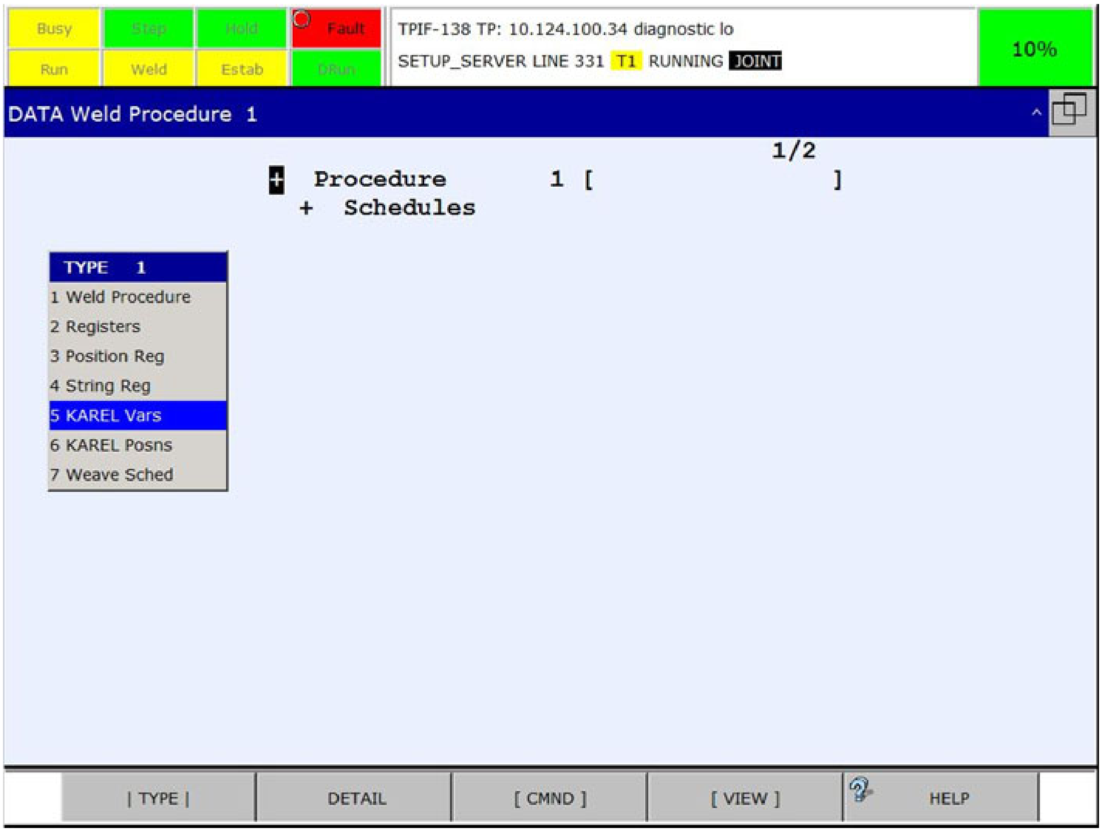
```
             869244 bytes free      6/20
 No.   Program name         Comment
  1   AWTRCSET      PC [Arc Trace Setup ]
  2   COMSET        PC [                ]
  3   GET_HOME      PC [Get Home Pos    ]
  4   IPGSERVER     PC [Test TCP Server ]
  5   IPG_ABORT     PC [ABORT IPG TASKS ]
  6   IPG_COMM      PC [IPG OTF COMM TSK]
  7   IPG_HP_REC    PC [IPG HP TRAJ REC ]
  8   IRC_COUNTER   PC [Send Custom Mess]
  9   IRC_MSG       PC [Send Custom Mess]
 10   IRC_STATUS    PC [Send Status Mess]
IPG_COMM is selected
```

Figure 204: Selecting IPG_COMM

7. Press the "DATA" button on the robot teach pendant to open the DATA menu.

8. Select "TYPE" and click "KAREL Vars" to open the KAREL variables. See Figure 205 (below).

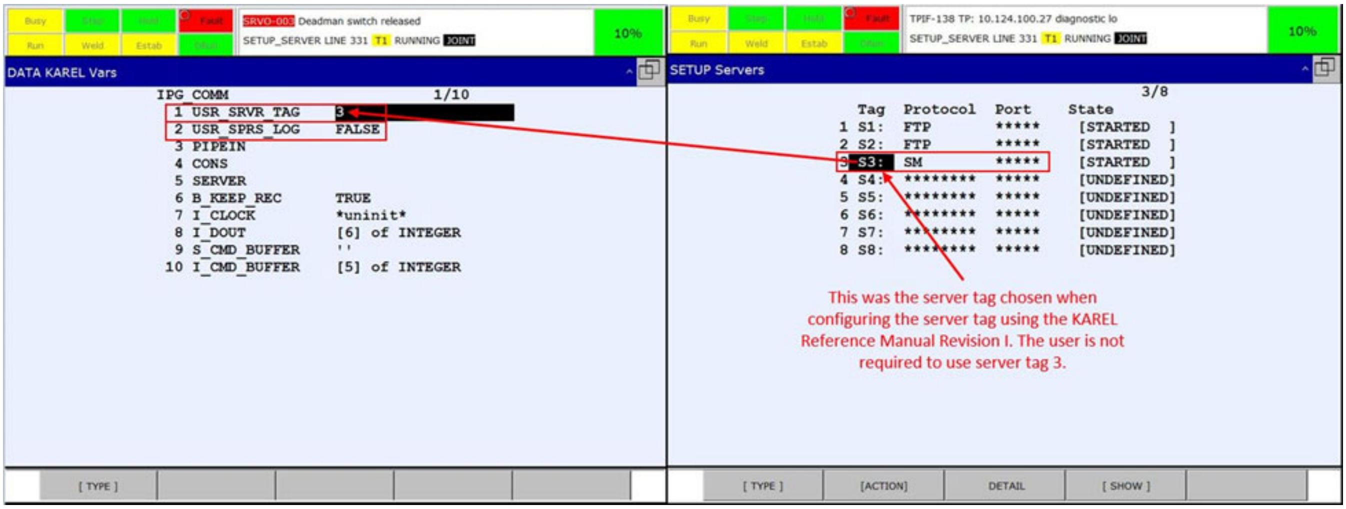
IMPORTANT Be sure that the teach pendant is set to display "Single." The KAREL variables may not appear if the display is set to two or more windows.



```
TPIF-138 TP: 10.124.100.34 diagnostic lo
SETUP_SERVER LINE 331 T1 RUNNING JOINT
10%
DATA Weld Procedure  1
                                        1/2
         +  Procedure        1  [                  ]
            +  Schedules
```

Figure 205: Data - KAREL Vars Menu

9. Set the appropriate values for "USR_SRVR_TAG" and "USR_SPRS_LOG." See Figure 206 (below).
   a. USR_SRVR_TAG - enter the number of the TCP Server Tag. This number represents the server tag number that was selected during step 8 of the "Setting up a Server Tag" in the FANUC KAREL Reference Manual.
   b. USR_SPRS_LOB - enter TRUE or FALSE. With TRUE, logging to "CONSLOG.DG" will be suppressed. If undefined, FALSE is assumed.



```
SRVO-003 Deadman switch released
SETUP_SERVER LINE 331 T1 RUNNING JOINT

DATA KAREL Vars
     IPG_COMM                          1/10
       1 USR_SRVR_TAG      3
       2 USR_SPRS_LOG      FALSE
       3 PIPEIN
       4 CONS
       5 SERVER
       6 B_KEEP_REC        TRUE
       7 I_CLOCK           *uninit*
       8 I_DOUT            [6] of INTEGER
       9 S_CMD_BUFFER      ''
      10 I_CMD_BUFFER      [5] of INTEGER
```

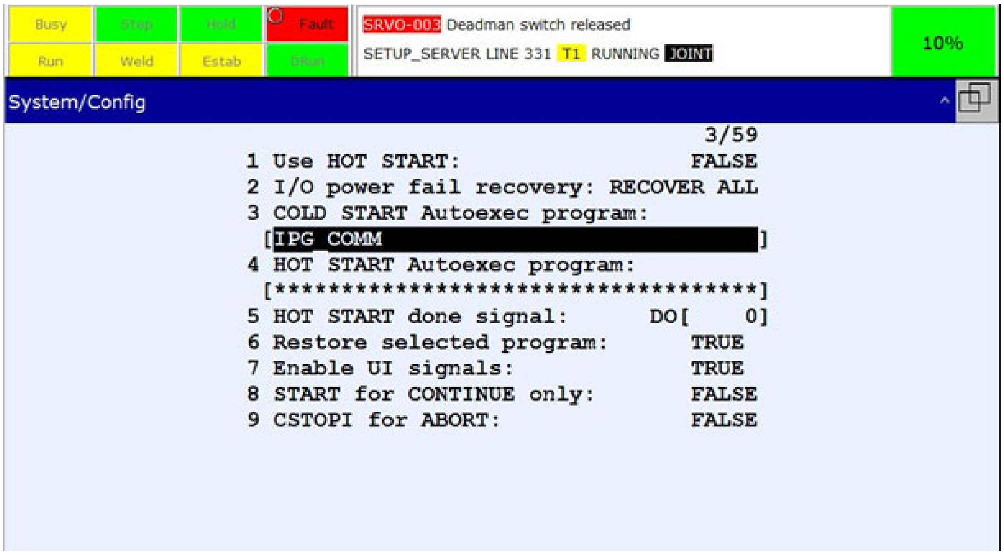
```
TPIF-138 TP: 10.124.100.27 diagnostic lo
SETUP_SERVER LINE 331 T1 RUNNING JOINT

SETUP Servers
                                        3/8
       Tag  Protocol   Port     State
     1 S1:  FTP        *****     [STARTED   ]
     2 S2:  FTP        *****     [STARTED   ]
     3 S3:  SM         *****     [STARTED   ]
     4 S4:  ********   *****     [UNDEFINED]
     5 S5:  ********   *****     [UNDEFINED]
     6 S6:  ********   *****     [UNDEFINED]
     7 S7:  ********   *****     [UNDEFINED]
     8 S8:  ********   *****     [UNDEFINED]
```

This was the server tag chosen when configuring the server tag using the KAREL Reference Manual Revision I. The user is not required to use server tag 3.

Figure 206: Setting DATA KAREL Vars

10. Add IPG_COMM to the "COLD START Autoexec program" setting in the FANUC Config Screen. See Figure 207 (below).



```
SRVO-003 Deadman switch released
SETUP_SERVER LINE 331 T1 RUNNING JOINT

System/Config
                                            3/59
   1 Use HOT START:                        FALSE
   2 I/O power fail recovery: RECOVER ALL
   3 COLD START Autoexec program:
    [IPG_COMM                               ]
   4 HOT START Autoexec program:
    [************************************]
   5 HOT START done signal:          DO[    0]
   6 Restore selected program:         TRUE
   7 Enable UI signals:                TRUE
   8 START for CONTINUE only:          FALSE
   9 CSTOPI for ABORT:                 FALSE
```

Figure 207: Setting the COLD START Autoexec Program

KAREL is now setup and the user is ready to configure robot settings in IPGScan. See Section 8.3.4.6 ("Connecting to a Robot") on page 252 for additional details.

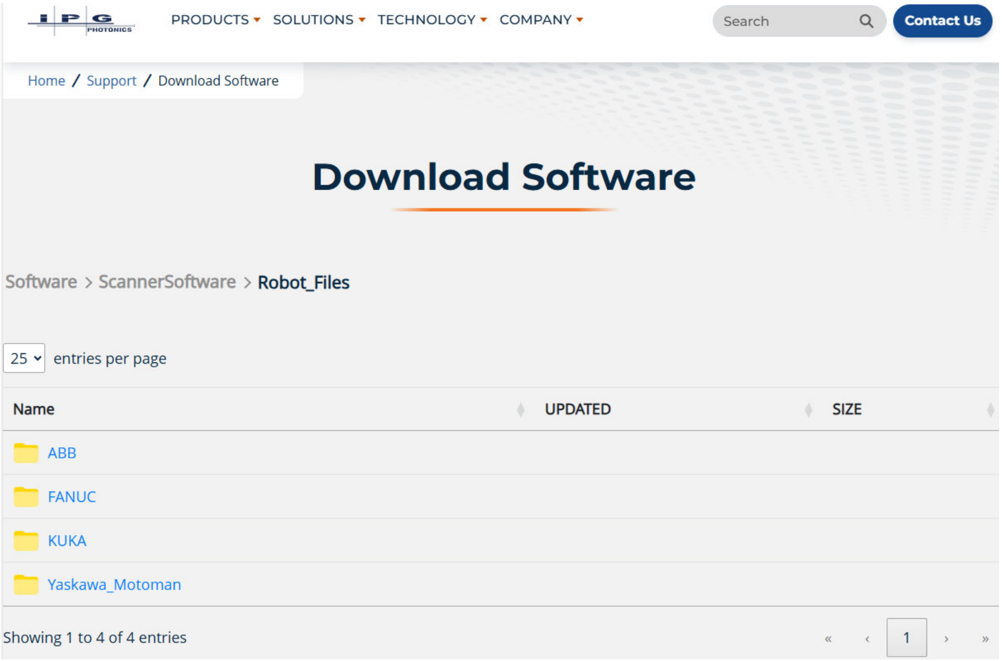
8.3.2.3.2.1 KAREL Notes

- IPGScan communication with the robot will not work without IPG_COMM running. If a fatal error occurs, if aborted, or if not configured to automatically start with the robot, IPG_COMM can be started from the SELECT Screen.
- IPG_COMM will not change either the "Busy" status or the Active light on the robot controller.
- IPG_COMM or IPG_HP_REC will not respond to the abort button. Run IPG_ABORT to terminate.
- Error messages are located on the "User" Screen of the robot teach pendant. Log messages are recorded in the log "CONSLOG.DG" (if not suppressed).
- If the active tool frame has changed, run IPG_ABORT and then IPG_COMM to reinitialize.

8.3.2.4 KUKA Setup

The following steps detail the configuration of a KUKA robot for robotic OTF processing.

1. Set up RSI on the robot controller. Please refer to the appropriate KUKA documentation.
2. Download the KUKA files by doing the following:
   a. Go to the IPG software website (software.ipgphotonics.com) and click on the Robot Files link. This displays the Robot Files screen.



Home / Support / Download Software

Download Software

Software > ScannerSoftware > Robot_Files

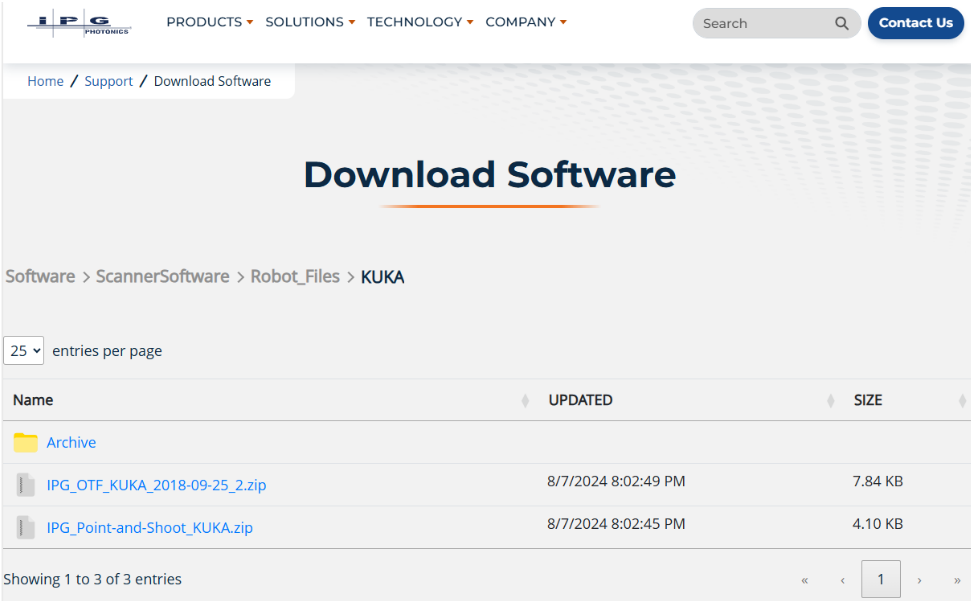
25 entries per page

Name	UPDATED	SIZE
ABB		
FANUC		
KUKA		
Yaskawa_Motoman		

Showing 1 to 4 of 4 entries

Figure 208: Robot Files Screen

b. Click on the KUKA link in the Robot Files screen. This displays links to the Zip Archives that contain the KUKA files.



Download Software

Software > ScannerSoftware > Robot_Files > KUKA

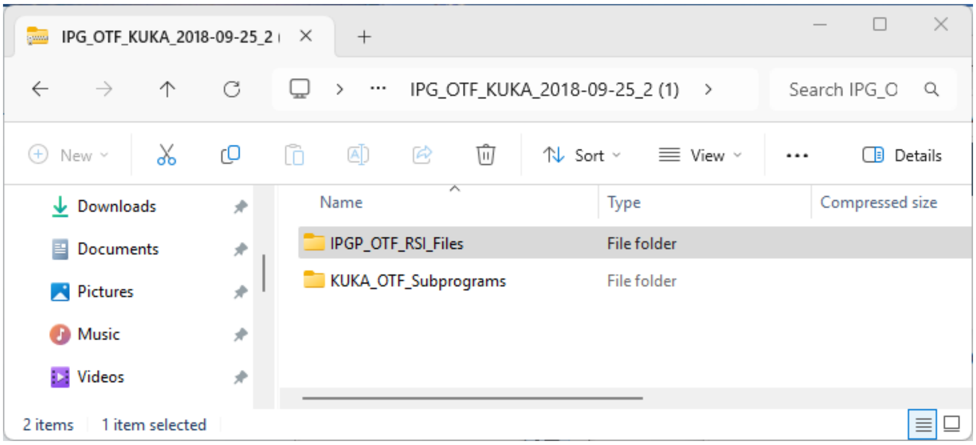
25 entries per page

Name	UPDATED	SIZE
Archive		
IPG_OTF_KUKA_2018-09-25_2.zip	8/7/2024 8:02:49 PM	7.84 KB
IPG_Point-and-Shoot_KUKA.zip	8/7/2024 8:02:45 PM	4.10 KB

Showing 1 to 3 of 3 entries

Figure 209: Zip Archives that Contain the KUKA Files

c. Click on the **IPG_OTF_KUKA_2018-09-25_2.zip** link. This displays the folders that contain the KUKA OTF files and subprograms.

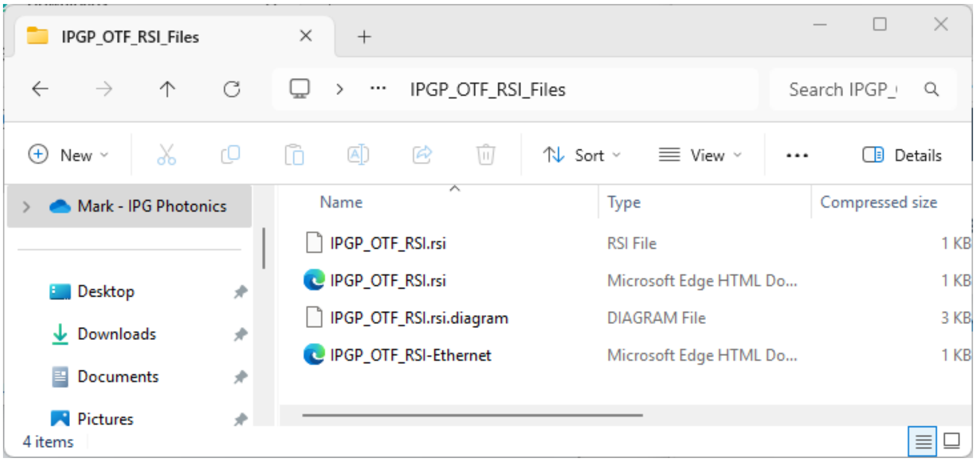


Name	Type	Compressed size
IPGP_OTF_RSI_Files	File folder	
KUKA_OTF_Subprograms	File folder	

2 items 1 item selected

Figure 210: Folders Containing the KUKA OTF Files and Subprograms

d. Click on the IPGP_OTF_RSI_Files folder. This displays the IPGP_OTF_RSI files.



Name	Type	Compressed size
IPGP_OTF_RSI.rsi	RSI File	1 KB
IPGP_OTF_RSI.rsi	Microsoft Edge HTML Do...	1 KB
IPGP_OTF_RSI.rsi.diagram	DIAGRAM File	3 KB
IPGP_OTF_RSI-Ethernet	Microsoft Edge HTML Do...	1 KB

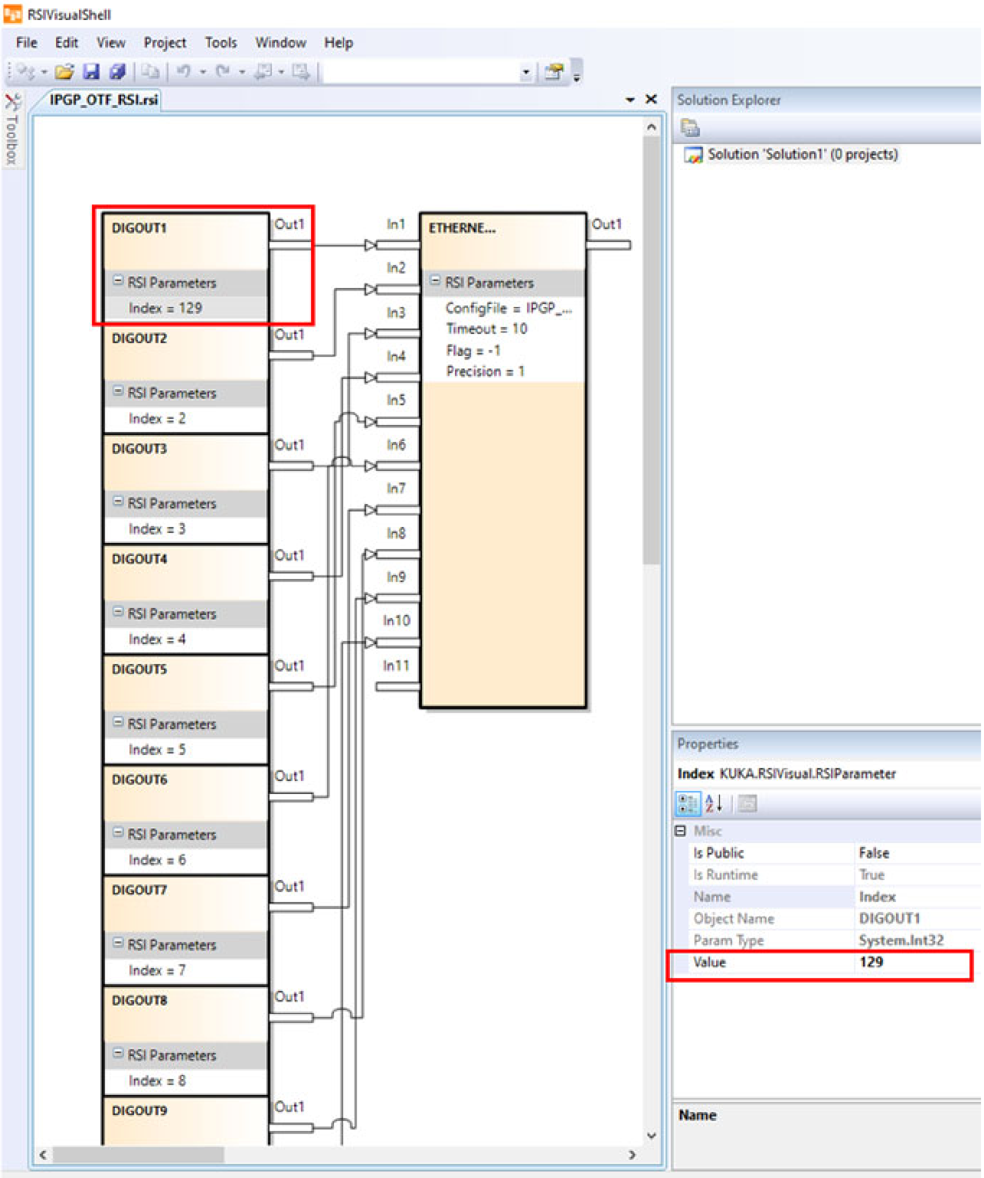
Figure 211: IPGP_OTF_RSI Files

3. Configure the "IPGP_OTF_RSI.rsi" file to set up the START bit and any desired flags.

IMPORTANT You must use RSIVisualShell to open and modify the "IPGP_OTF_RSI.rsi" file. You can obtain RSIVisualShell from KUKA.

a. START bit Configuration

   i. Set the appropriate Index value for "DIGOUT1" based on the digital output bit on the robot that corresponds with the scanners START bit. Figure 212 on page 209 provides an example of the "DIGOUT1" bit being configured for digital output bit 129.



DIGOUT1
RSI Parameters
Index = 129

DIGOUT2
RSI Parameters
Index = 2

DIGOUT3
RSI Parameters
Index = 3

DIGOUT4
RSI Parameters
Index = 4

DIGOUT5
RSI Parameters
Index = 5

DIGOUT6
RSI Parameters
Index = 6

DIGOUT7
RSI Parameters
Index = 7

DIGOUT8
RSI Parameters
Index = 8

DIGOUT9

ETHERNE...
RSI Parameters
ConfigFile = IPGP_...
Timeout = 10
Flag = -1
Precision = 1

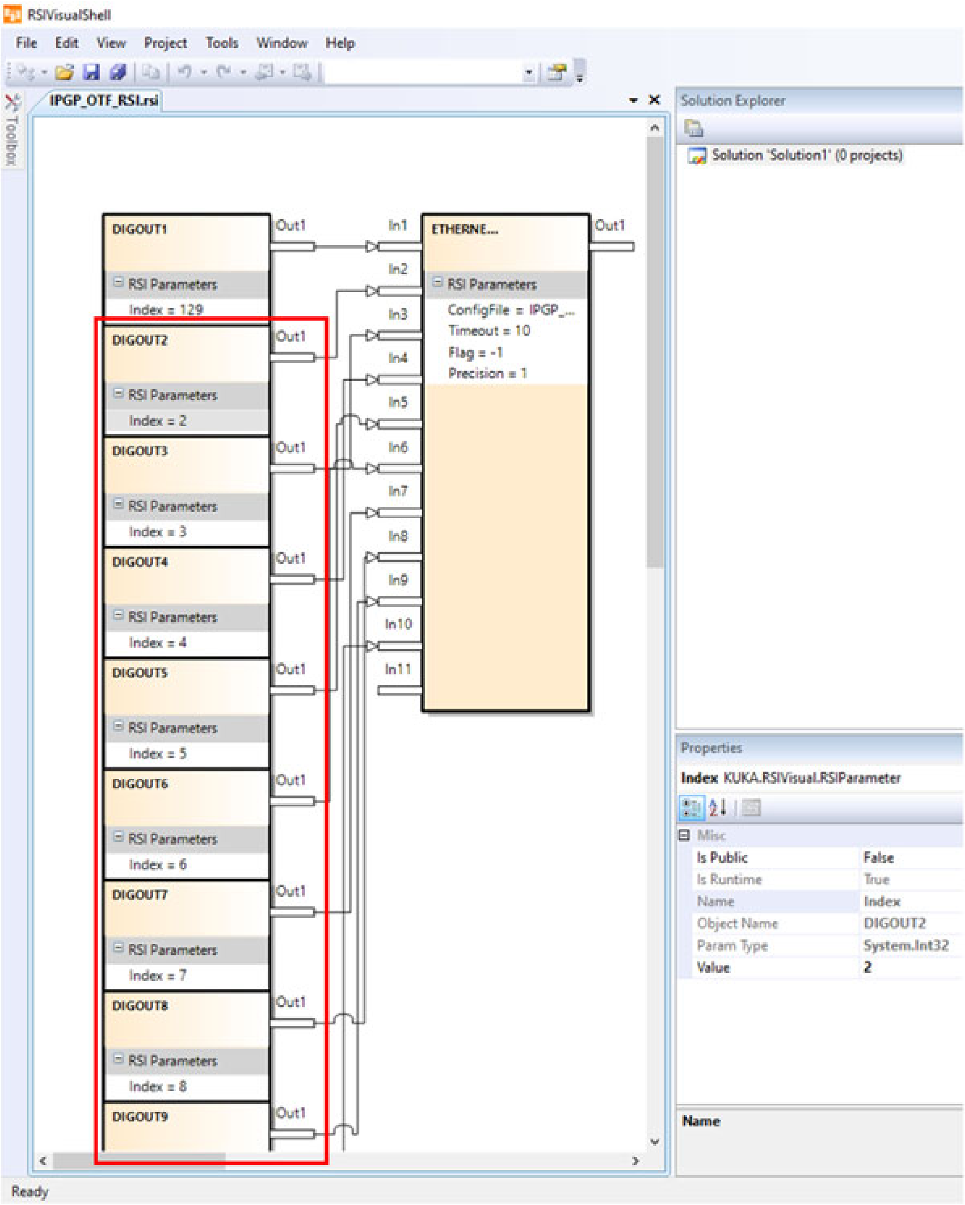
Index KUKA.RSIVisual.RSIParameter

Misc	
Is Public	False
Is Runtime	True
Name	Index
Object Name	DIGOUT1
Param Type	System.Int32
Value	129

Figure 212: START Bit Configuration in RSIVisualShell

b. Flag Configuration (optional)

   i. Set the desired Index values of "DIGOUT2" through "DIGOUT10" for any desired flags. Please also refer to section, "KUKA." See Figure 213 (below).



DIGOUT1 – RSI Parameters: Index = 129

DIGOUT2 – RSI Parameters: Index = 2

DIGOUT3 – RSI Parameters: Index = 3

DIGOUT4 – RSI Parameters: Index = 4

DIGOUT5 – RSI Parameters: Index = 5

DIGOUT6 – RSI Parameters: Index = 6

DIGOUT7 – RSI Parameters: Index = 7

DIGOUT8 – RSI Parameters: Index = 8

DIGOUT9

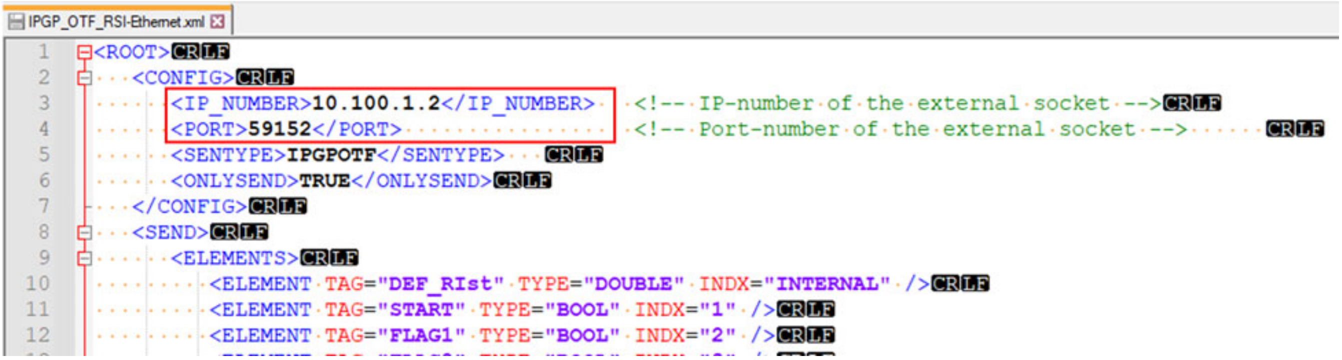
ETHERNE... – RSI Parameters: ConfigFile = IPGP_... Timeout = 10 Flag = -1 Precision = 1

Index KUKA.RSIVisual.RSIParameter

Is Public	False
Is Runtime	True
Name	Index
Object Name	DIGOUT2
Param Type	System.Int32
Value	2

Figure 213: FLAG Configuration in RSIVisualShell

4. Open the "IPGP_OTF_RSI-Ethernet.xml" file in a text editor and modify the "IP_Number" and "Port" parameters as required. See Figure 214 (below) as an example.
    a. Modify the IP Number parameter to contain the IP Address that will be set on the computers local area adapter connection for connecting with the RSI Interface of the KUKA robot.
    b. Enter a desired Port number value. This must also be entered into the IPGScan Robot Options (see Section 8.3.4.6 ("Connecting to a Robot") on page 252).



```
<ROOT>CRLF
   <CONFIG>CRLF
      <IP_NUMBER>10.100.1.2</IP_NUMBER>  <!-- IP-number of the external socket -->CRLF
      <PORT>59152</PORT>                 <!-- Port-number of the external socket -->      CRLF
      <SENTYPE>IPGPOTF</SENTYPE>   CRLF
      <ONLYSEND>TRUE</ONLYSEND>CRLF
   </CONFIG>CRLF
   <SEND>CRLF
      <ELEMENTS>CRLF
         <ELEMENT TAG="DEF_RIst" TYPE="DOUBLE" INDX="INTERNAL" />CRLF
         <ELEMENT TAG="START" TYPE="BOOL" INDX="1" />CRLF
         <ELEMENT TAG="FLAG1" TYPE="BOOL" INDX="2" />CRLF
```

Figure 214: IPGP_OTF_RSI-Ethernet File

5. Load the following files onto the KUKA controller to the directory specified by the KUKA RSI manual:
    - IPGP_OTF_RSI.rsi
    - IPGP_OTF_RSI.rsi.diagram
    - IPGP_OTF_RSI.rsi.xml
    - IPGP_OTF_RSI-Ethernet.xml

KUKA robot configuration is now complete and users can continue with system setup.

To assist users with RSI control, the following modules can be called:

- IPG_OTF_BEGIN_DATA_XFER.src

  This will start the transfer of robot positional data to IPGScan.
- IPG_OTF_END_DATA_XFER.src

  This will stop the transfer of robot positional data to IPGScan.

The following module can be used for the IPGScan and Robot Workspace calibration as an example:

- IPG_OTF_CALIBRATION.src
- IPG_OTF_CALIBRATION.dat

The robot is now setup and the user is ready to configure robot settings in IPGScan. See Section 8.3.4.6 on page 252 for additional details.

8.3.2.5 Yaskawa Motoman Setup

The following steps provide an overview of the setup required for robotic OTF processing with a Motoman robot.

1. Setup MotoPlus on the robot controller.
2. On the robot controller, load "IPG_OTF_DX200.out" (see MOTOPLUS APPLICATION INSTALLATION INSTRUCTIONS from Yaskawa Motoman (PN 166687-1CD) for instructions.).
3. Connect the robot and computer using an Ethernet connection. Configure the IPv4 Windows Network Adapter properties according to the network settings on the robot.
   - The specified port for Motoman is 50245

The following sections provide a detailed setup procedure for the above steps.

8.3.2.5.1 MotoPlus Setup

1. Start the robot and controller in Maintenance Mode by holding "Menu" on the teach pendant while powering up the controller.
2. Once the controller has boot-up, click "System" and select "Security." See Figure 215 (below).

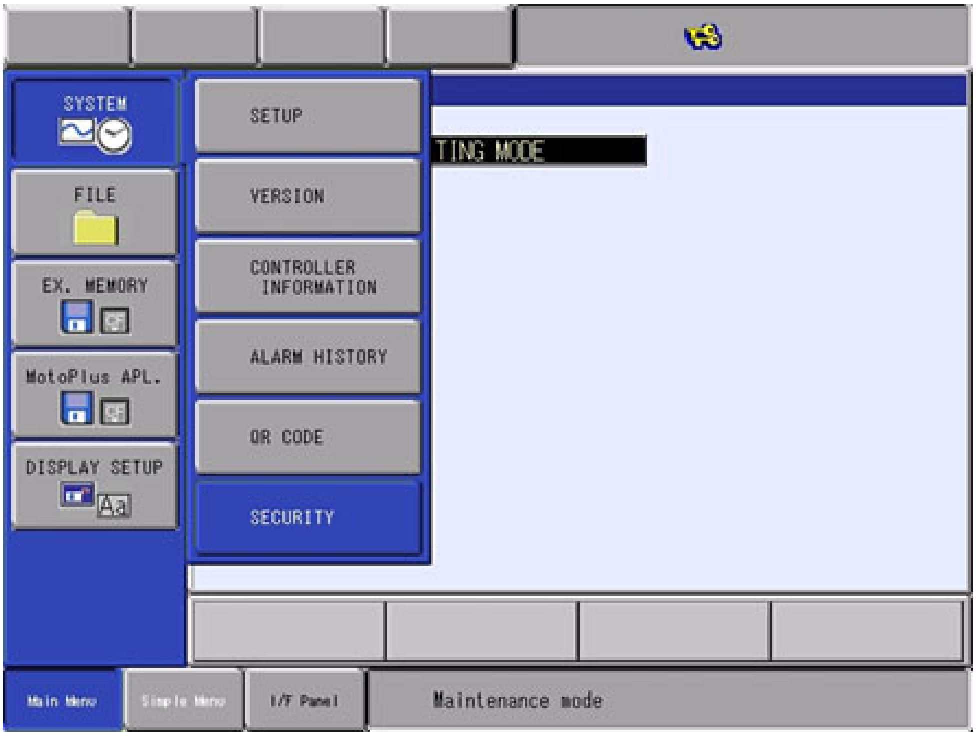


Figure 215: Selecting Security

3. Select "Management Mode" and enter the password. See Figure 216 (below).
   - The default password consists of all 9s.

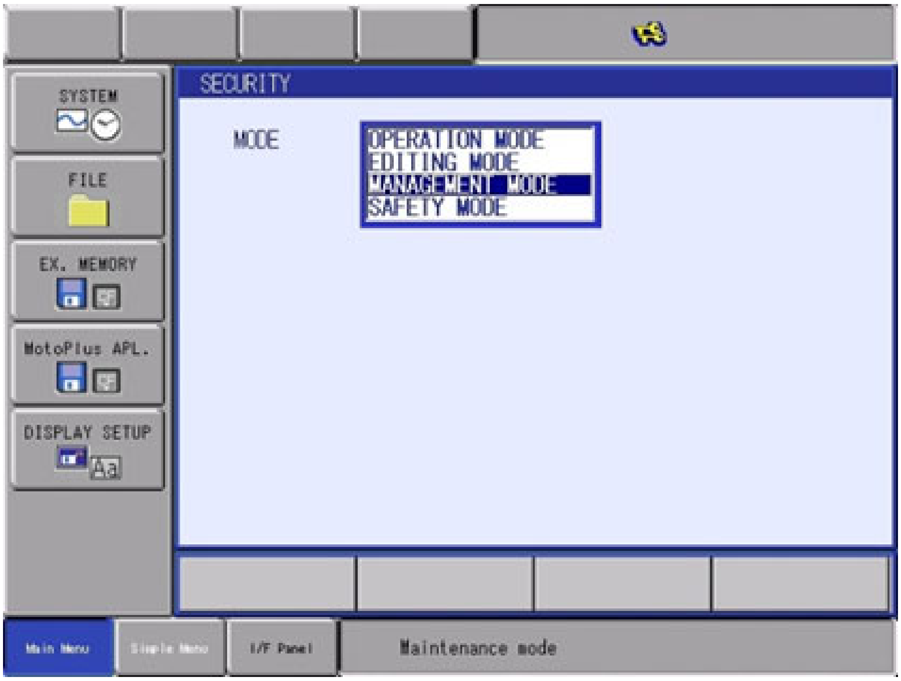


Figure 216: Selecting Management Mode

4. Next, select "System" and click "Setup."
5. Enter "Option Function." See Figure 217 (below).

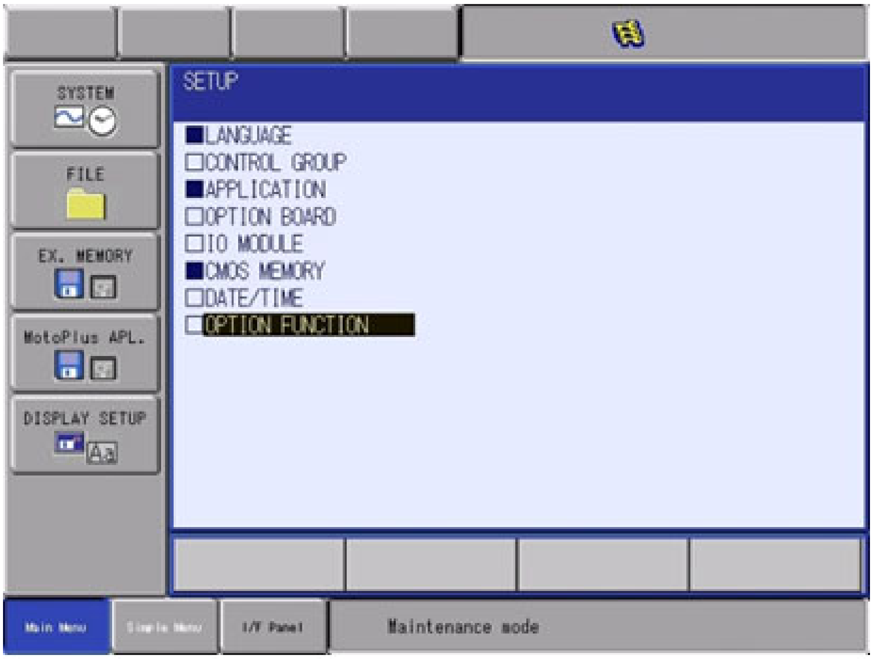
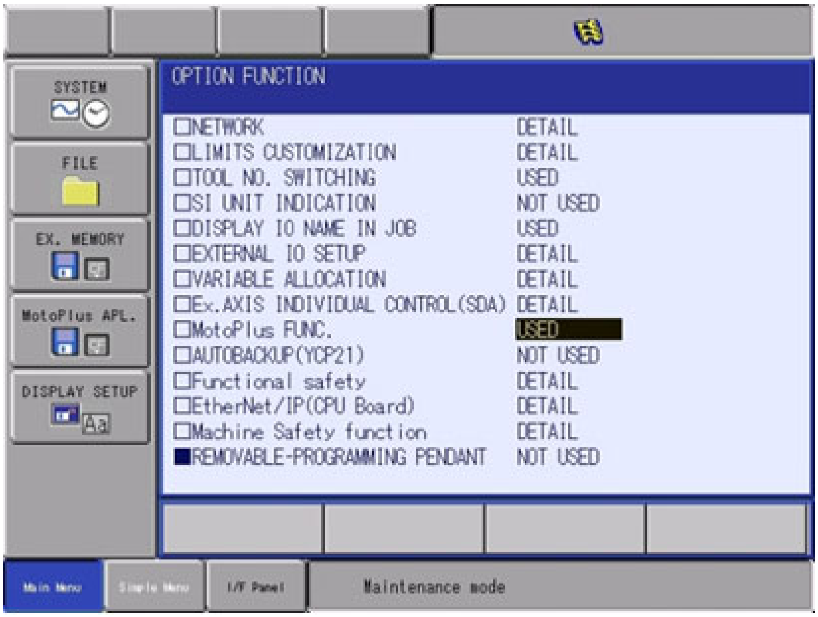


Figure 217: Option Function Menu

6. Cursor down to "MotoPlus FUNC." and set it to "USED." See Figure 218 (below).



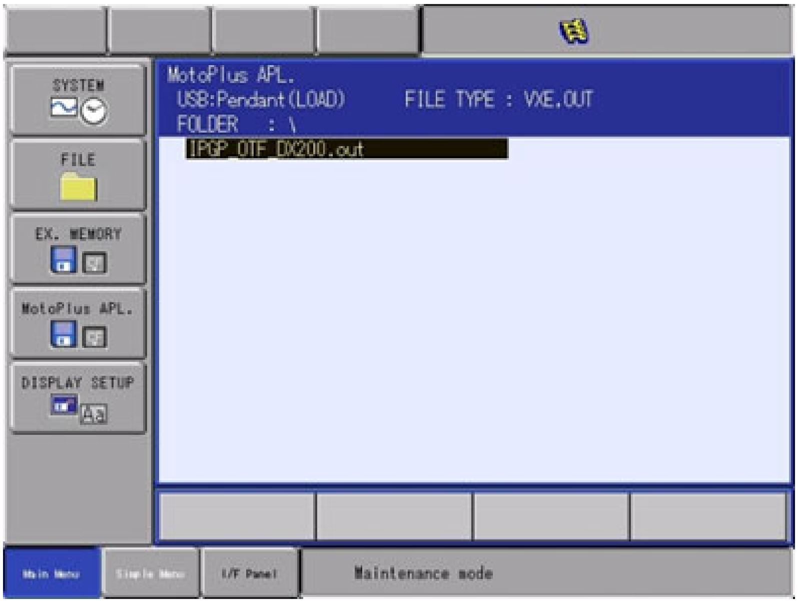
```
OPTION FUNCTION
□NETWORK                              DETAIL
□LIMITS CUSTOMIZATION                 DETAIL
□TOOL NO. SWITCHING                   USED
□SI UNIT INDICATION                   NOT USED
□DISPLAY IO NAME IN JOB               USED
□EXTERNAL IO SETUP                    DETAIL
□VARIABLE ALLOCATION                  DETAIL
□Ex.AXIS INDIVIDUAL CONTROL(SDA)      DETAIL
□MotoPlus FUNC.                       USED
□AUTOBACKUP(YCP21)                    NOT USED
□Functional safety                    DETAIL
□EtherNet/IP(CPU Board)               DETAIL
□Machine Safety function              DETAIL
■REMOVABLE-PROGRAMMING PENDANT        NOT USED

Maintenance mode
```

Figure 218: MotoPlus FUNC.

8.3.2.5.2 Loading the "IPG_OTF_DX200.out" File

1. Insert a USB with the "IPGP_OTF_DX200.out" file into the teach pendant.
   - This file can be obtained by referring to Section 8.3.2.2 ("Robot Configuration Files") on page 200.
2. With the controller still in Maintenance mode, select "System" and click "Load (User Application)". See Figure 219 (below).

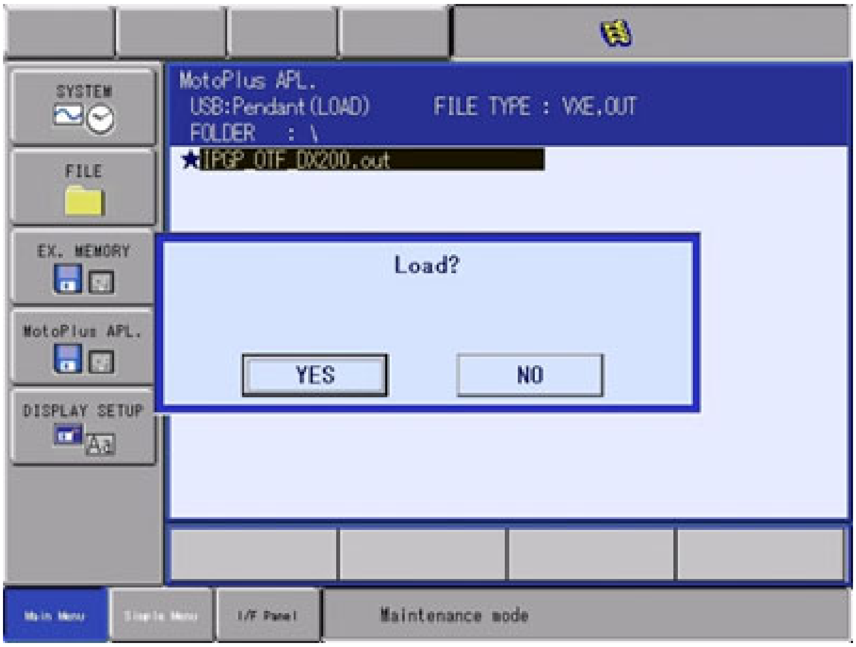


```
MotoPlus APL.
 USB:Pendant(LOAD)        FILE TYPE : VXE.OUT
 FOLDER    : \
  IPGP_OTF_DX200.out

Maintenance mode
```

Figure 219: Selecting the IPGP_OTF_DX200 File

3. Select the "IPGP_OTF_DX200.out" file (a star should appear next to the file name once it is selected).
4. Once selected, click "Enter" and click "YES" in order to load the file. See Figure 220 (below).



MotoPlus APL.
USB:Pendant (LOAD)   FILE TYPE : VXE.OUT
FOLDER : \
★IPGP_OTF_DX200.out

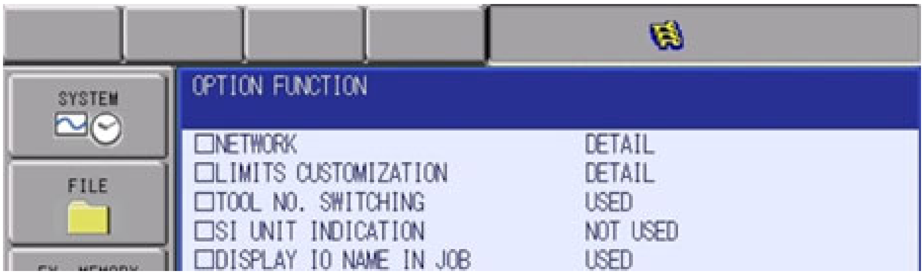
Load?

YES   NO

Figure 220: Loading the IPG_OTF_DX200 File

8.3.2.5.3 Ethernet Connection Setup

1. Select "System."
2. Select "Setup."
3. Select "Option Function."
4. Select "Network." See Figure 221 (below).

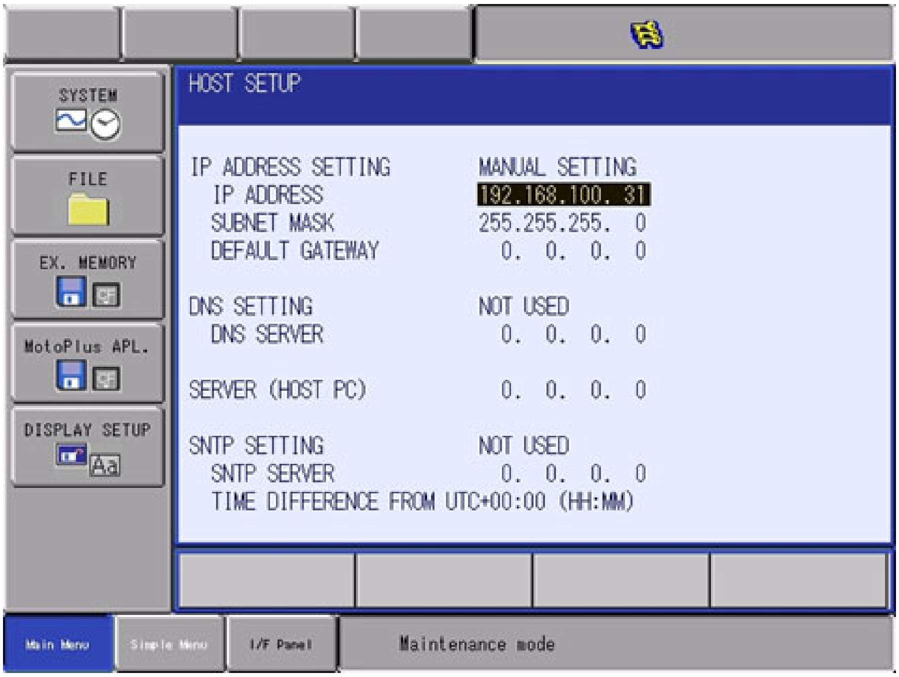


OPTION FUNCTION

□NETWORK	DETAIL
□LIMITS CUSTOMIZATION	DETAIL
□TOOL NO. SWITCHING	USED
□SI UNIT INDICATION	NOT USED
□DISPLAY IO NAME IN JOB	USED

Figure 221: Select Network

5. Navigate to the "IP Address" Setting. From here, the user can either set a desired IP address or simply take note of the IP address that is already assigned to the robot. See Figure 222 (below).
   - Note that after the IP address is changed in the Motoman, "Enter" must be pressed multiple times on the teach pendant in order to confirm the changes.



```
HOST SETUP

IP ADDRESS SETTING            MANUAL SETTING
  IP ADDRESS                  192.168.100. 31
  SUBNET MASK                 255.255.255.  0
  DEFAULT GATEWAY               0.   0.   0.  0

DNS SETTING                   NOT USED
  DNS SERVER                    0.   0.   0.  0

SERVER (HOST PC)                0.   0.   0.  0

SNTP SETTING                  NOT USED
  SNTP SERVER                   0.   0.   0.  0
  TIME DIFFERENCE FROM UTC+00:00 (HH:MM)

Maintenance mode
```

Figure 222: The Robots IP Address

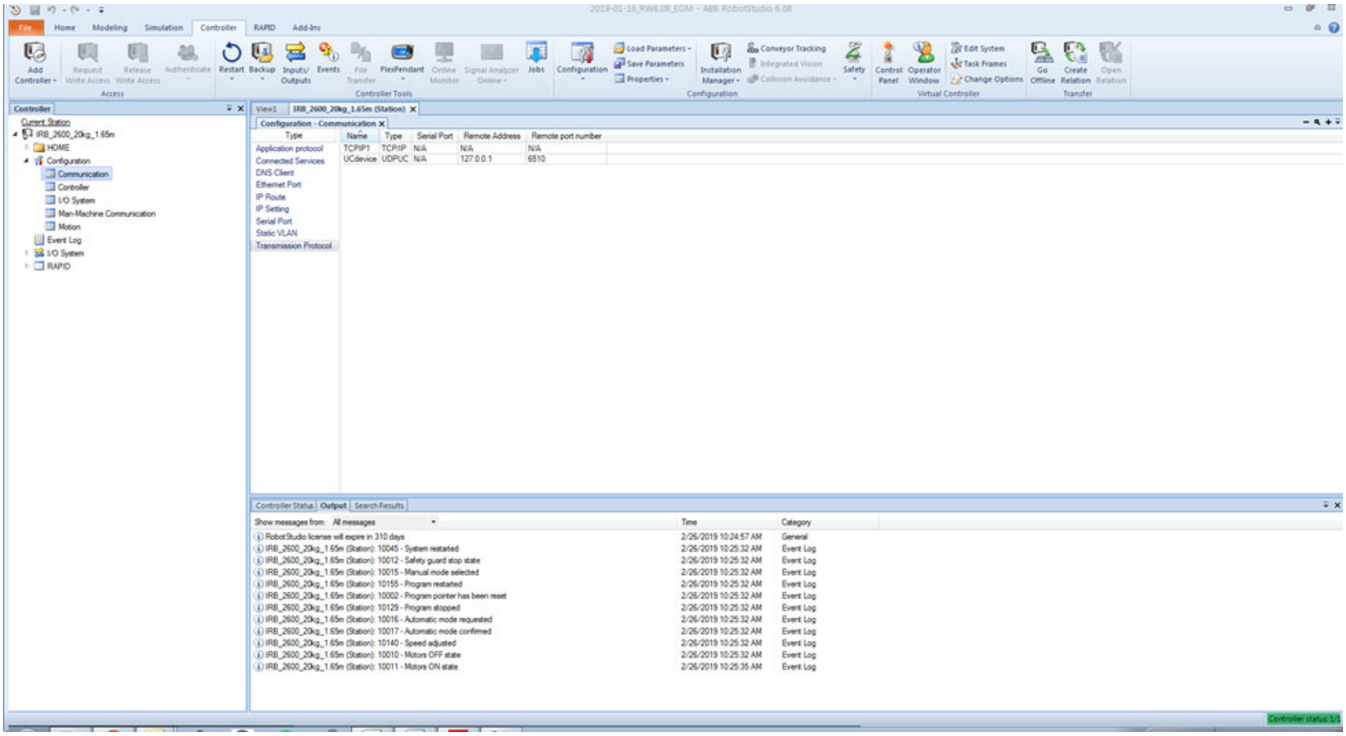
6. Power cycle the robot.
7. Make sure the local area connection on the PC that is used to connect to the robot is set to an appropriate IP address.
   - To verify this is correct, attempt to ping the robot's IP address from the computer.

The robot is now setup and the user is ready to configure robot settings in IPGScan. See Section 8.3.4.6 on page 252 for additional details.

8.3.2.6 ABB Setup

The following steps detail the configuration of an ABB robot for Robotic OTF processing.

1. Configure Transmission Protocol.
    a. Connect to the controller in RobotStudio.
    b. Go to the Transmission Protocol configuration under "Configuration / Communication / Transmission Protocol." See Figure 223 (below).

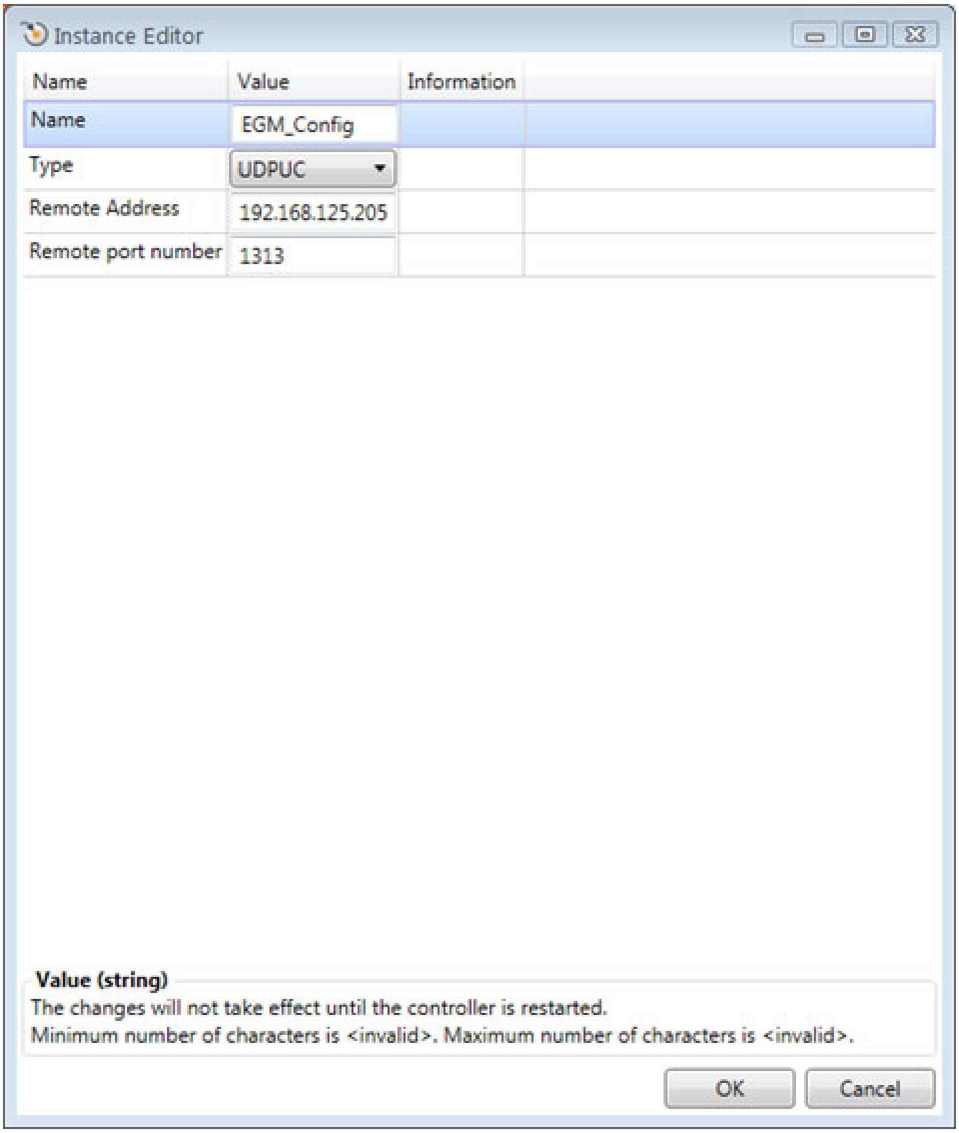


Name	Type	Serial Port	Remote Address	Remote port number
TCPIP1	TCP/IP	N/A	N/A	N/A
UCdevice	UDPUC	N/A	127.0.0.1	6510

```
Show messages from:  All messages                                      Time                     Category
RobotStudio license will expire in 310 days                            2/26/2019 10:24:57 AM    General
IRB_2600_20kg_1.65m (Station): 10045 - System restarted                2/26/2019 10:25:32 AM    Event Log
IRB_2600_20kg_1.65m (Station): 10012 - Safety guard stop state         2/26/2019 10:25:32 AM    Event Log
IRB_2600_20kg_1.65m (Station): 10015 - Manual mode selected            2/26/2019 10:25:32 AM    Event Log
IRB_2600_20kg_1.65m (Station): 10155 - Program restarted               2/26/2019 10:25:32 AM    Event Log
IRB_2600_20kg_1.65m (Station): 10002 - Program pointer has been reset  2/26/2019 10:25:32 AM    Event Log
IRB_2600_20kg_1.65m (Station): 10129 - Program stopped                 2/26/2019 10:25:32 AM    Event Log
IRB_2600_20kg_1.65m (Station): 10016 - Automatic mode requested        2/26/2019 10:25:32 AM    Event Log
IRB_2600_20kg_1.65m (Station): 10017 - Automatic mode confirmed        2/26/2019 10:25:32 AM    Event Log
IRB_2600_20kg_1.65m (Station): 10140 - Speed adjusted                  2/26/2019 10:25:32 AM    Event Log
IRB_2600_20kg_1.65m (Station): 10010 - Motors OFF state                2/26/2019 10:25:32 AM    Event Log
IRB_2600_20kg_1.65m (Station): 10011 - Motors ON state                 2/26/2019 10:25:35 AM    Event Log
```

Figure 223: Transmission Protocol Configuration

    c. Right click and select "New Transmission Protocol..."
    d. Change the "Type" to "UDPUC."
    e. Change the "Remote Address" to the IP Address of the computer running IPGScan that will be connected to the robot.
    f. The "Name" and "Remote port number" have no additional restrictions or requirements. See Figure 224 (below).



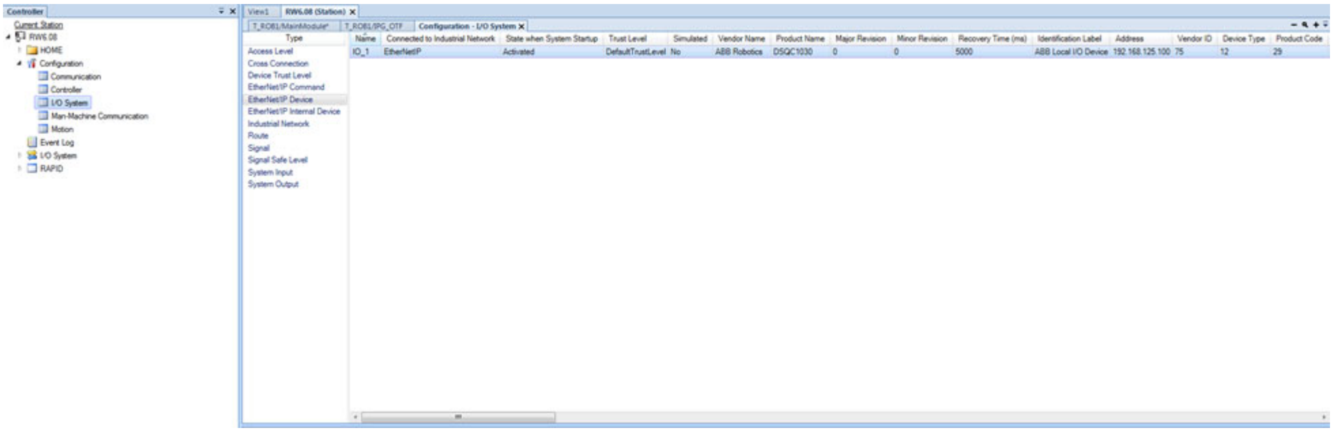
Name	Value	Information
Name	EGM_Config	
Type	UDPUC	
Remote Address	192.168.125.205	
Remote port number	1313	

Value (string)
The changes will not take effect until the controller is restarted.
Minimum number of characters is <invalid>. Maximum number of characters is <invalid>.

Figure 224: Instance Editor Window

g. Press "OK" and restart the controller.

2. If applicable, configure the IO Device for Change of State.
   a. Connect to the controller in RobotStudio.
   b. Go to the Ethernet/IP Device configuration under I/O System configuration. See Figure 225 (below).

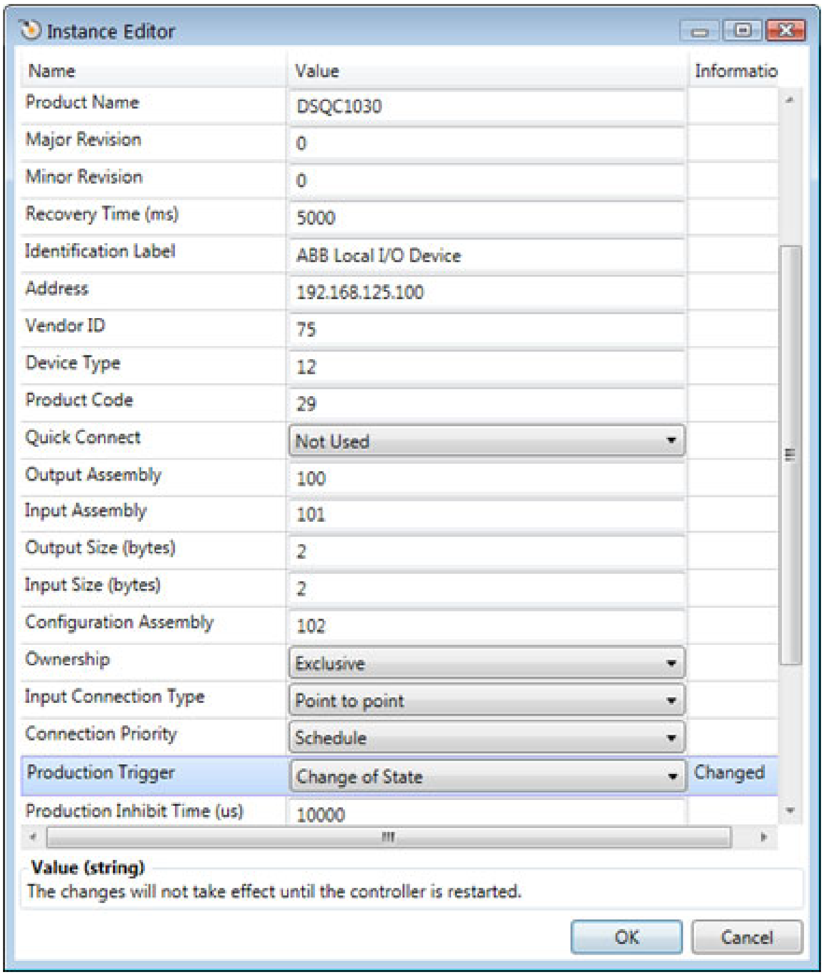


Name	Connected to Industrial Network	State when System Startup	Trust Level	Simulated	Vendor Name	Product Name	Major Revision	Minor Revision	Recovery Time (ms)	Identification Label	Address	Vendor ID	Device Type	Product Code
IO_1	EtherNetIP	Activated	DefaultTrustLevel	No	ABB Robotics	DSQC1030	0	0	5000	ABB Local I/O Device	192.168.125.100	75	12	29

Figure 225: Ethernet/IP Device Configuration

c. Double click on the Ethernet/IP Device which has the "Start" signal

d. In the Instance Editor, find the "Production Trigger" setting. Make sure that this setting is set to "Change of State." Figure 226 (below).



Name	Value	Informatio
Product Name	DSQC1030	
Major Revision	0	
Minor Revision	0	
Recovery Time (ms)	5000	
Identification Label	ABB Local I/O Device	
Address	192.168.125.100	
Vendor ID	75	
Device Type	12	
Product Code	29	
Quick Connect	Not Used	
Output Assembly	100	
Input Assembly	101	
Output Size (bytes)	2	
Input Size (bytes)	2	
Configuration Assembly	102	
Ownership	Exclusive	
Input Connection Type	Point to point	
Connection Priority	Schedule	
Production Trigger	Change of State	Changed
Production Inhibit Time (us)	10000	

Value (string)
The changes will not take effect until the controller is restarted.

Figure 226: Change of State Setting

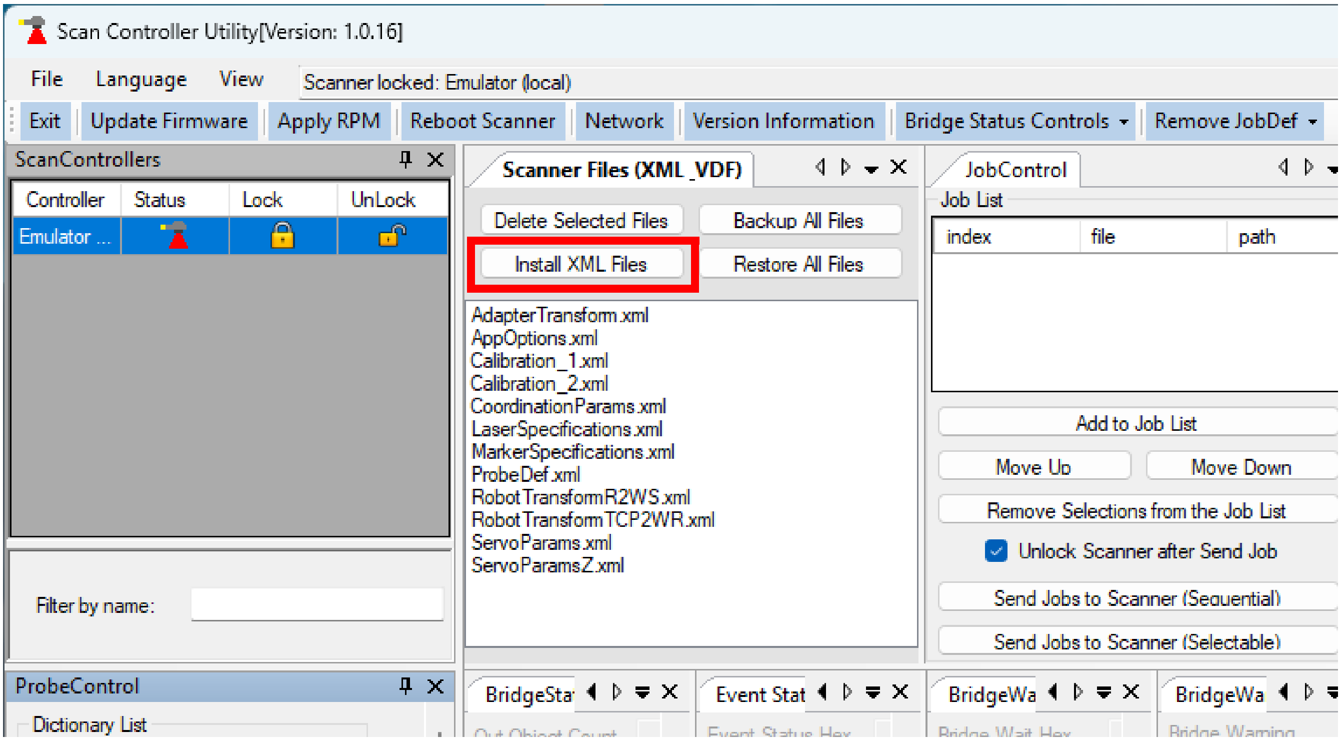
3. Load the System Module "IPG_OTF.sys" onto the controller.
   - This file can be obtained by referring to section "Robot Configuration Files."

The robot is now setup and the user is ready to configure robot settings in IPGScan. See Section 8.3.4.6 on page 252 for additional details.

8.3.3 Scan Controller Requirements

Robotic OTF processing requires that Scan Controllers have a "CoordinationParams.xml" file uploaded to the controller. While some scanners may ship from IPG production with the file, others may not. The following procedure outlines how users can upload this file to a Scan Controller.

1. Connect to the desired scanner in the Scan Controller Utility.
2. Click the "Install XML Files" button. See Figure 227 (below).



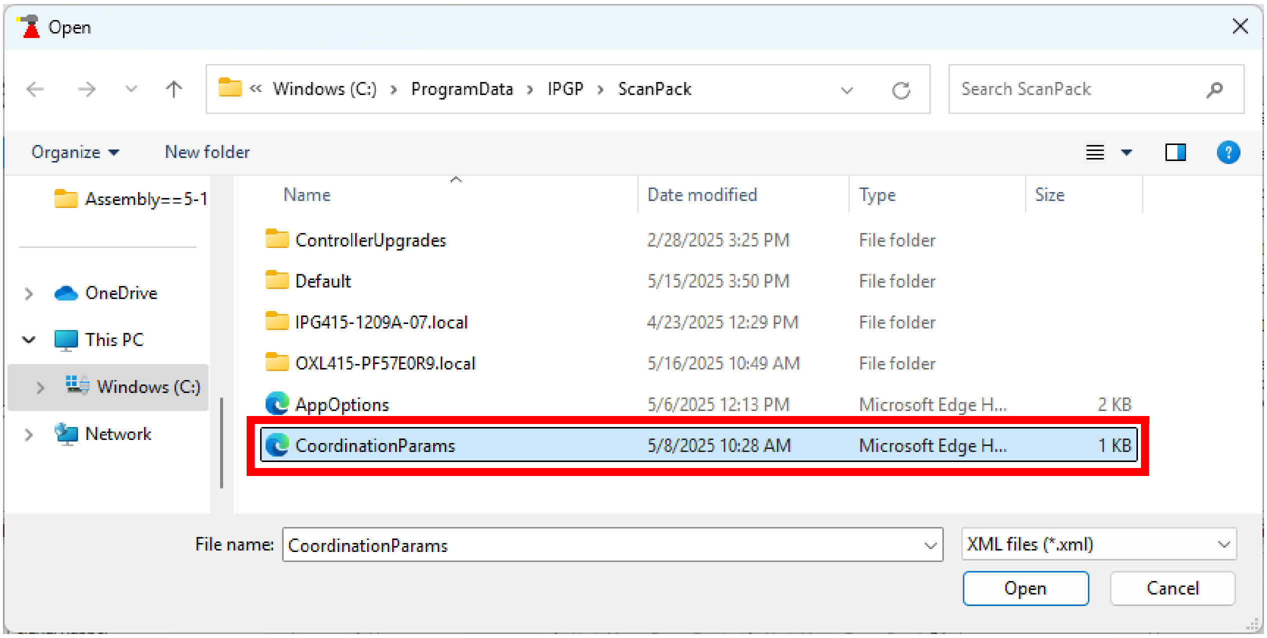
Scanner locked: Emulator (local)

AdapterTransform.xml
AppOptions.xml
Calibration_1.xml
Calibration_2.xml
CoordinationParams.xml
LaserSpecifications.xml
MarkerSpecifications.xml
ProbeDef.xml
RobotTransformR2WS.xml
RobotTransformTCP2WR.xml
ServoParams.xml
ServoParamsZ.xml

☑ Unlock Scanner after Send Job

Figure 227: Installing an XML File

3. Open the "Default" folder.
4. Open the "Lenses" folder.
5. Open any of the following folders:
   - HP_254mm_1064
   - HP_415mm_1064
   - HP_510mm_1064
6. Select the "CoordinationParams.xml" file. See Figure 228 on page 221.



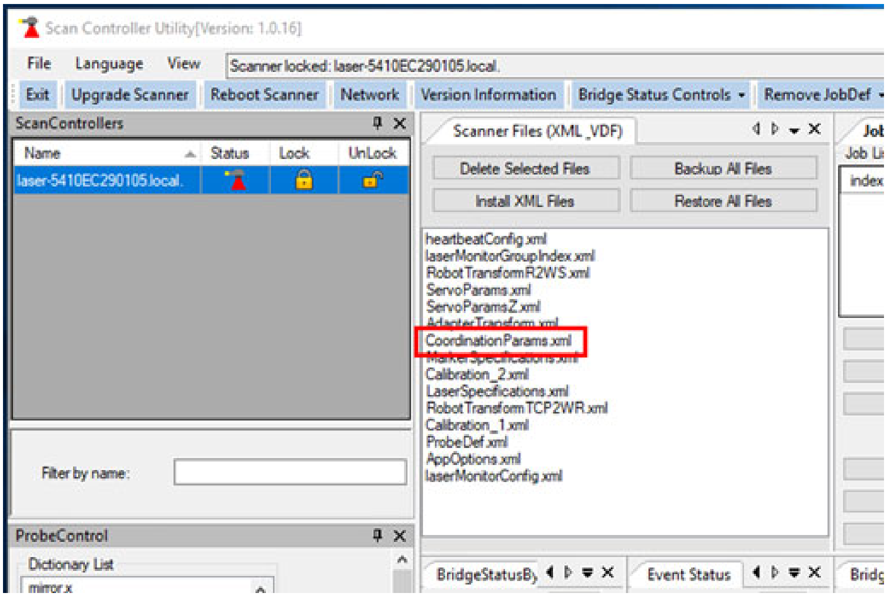
Name	Date modified	Type	Size
ControllerUpgrades	2/28/2025 3:25 PM	File folder	
Default	5/15/2025 3:50 PM	File folder	
IPG415-1209A-07.local	4/23/2025 12:29 PM	File folder	
OXL415-PF57E0R9.local	5/16/2025 10:49 AM	File folder	
AppOptions	5/6/2025 12:13 PM	Microsoft Edge H...	2 KB
CoordinationParams	5/8/2025 10:28 AM	Microsoft Edge H...	1 KB

File name: CoordinationParams

XML files (*.xml)

Figure 228: Selecting the CoordinationParams File

7. Click "Open."
8. Click "OK" to acknowledge the installation.
9. Reconnect to the Scan Controller and verify the file was uploaded. See Figure 229 (below).



Scanner locked: laser-5410EC290105.local.

laser-5410EC290105.local.

heartbeatConfig.xml
laserMonitorGroupIndex.xml
RobotTransformR2WS.xml
ServoParams.xml
ServoParamsZ.xml
AdapterTransform.xml
CoordinationParams.xml
MarkerSpecifications.xml
Calibration_2.xml
LaserSpecifications.xml
RobotTransformTCP2WR.xml
Calibration_1.xml
ProbeDef.xml
AppOptions.xml
laserMonitorConfig.xml

Figure 229: CoordinationParams.XML

Users can now disconnect from the Scan Controller in the Scan Controller Utility and proceed with other setup and use.

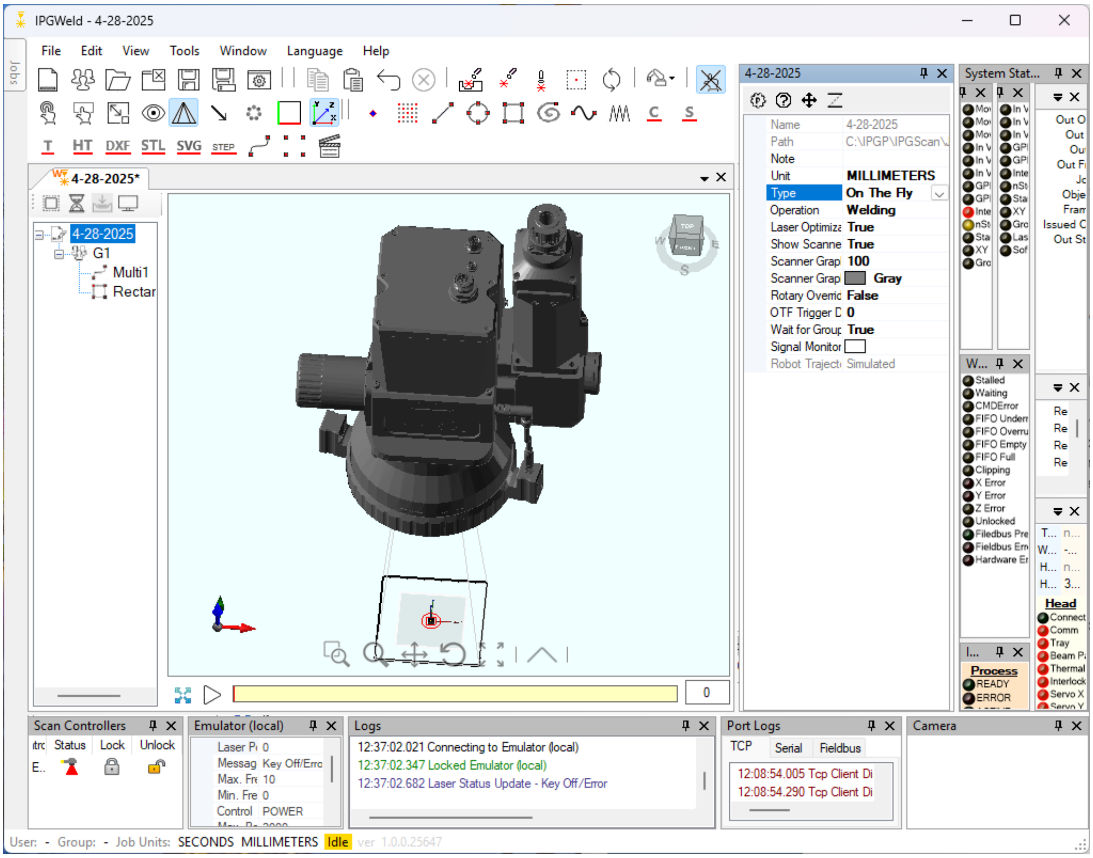
8.3.4 IPGScan Robotic OTF Programming

The following sections outline how users can create a Robotic OTF job, necessary setup procedures, and process-specific features.

8.3.4.1 Creating a Robotic OTF Job

Users can create a Robotic OTF job by following the steps below:

1. Open IPGScan.
2. Create a new job.
3. Select the job name in the Job Tree.
4. In the Properties window, change the Type parameter to "On The Fly." See Figure 230 (below).



4-28-2025

Name	4-28-2025
Path	C:\IPGP\IPGScan\
Note	
Unit	MILLIMETERS
Type	On The Fly
Operation	Welding
Laser Optimiz	True
Show Scanne	True
Scanner Grap	100
Scanner Grap	▨ Gray
Rotary Overric	False
OTF Trigger D	0
Wait for Grouр	True
Signal Monitor	□
Robot Traject	Simulated

Laser P	0
Messag	Key Off/Erro
Max. Fr	10
Min. Fre	0
Control	POWER

```
12:37:02.021 Connecting to Emulator (local)
12:37:02.347 Locked Emulator (local)
12:37:02.682 Laser Status Update - Key Off/Error
```

```
12:08:54.005 Tcp Client Di
12:08:54.290 Tcp Client Di
```

User: - Group: - Job Units: SECONDS MILLIMETERS Idle ver 1.0.0.25647

Figure 230: Creating an On The Fly Job

IMPORTANT

Type should be "Default" or "Point & Shoot" for any jobs that are not On-The-Fly. When a Robot Type is set to "None" in the IPGScan Robot Options (see Section 8.3.4.6.1 on page 253), newly created jobs will be created as "Default" type. When Robot Type is set to anything other than "None," newly created jobs will be "On The Fly" type by default.

Users can now proceed to importing CAD models, placing Process Objects, and additional setup procedures.

8.3.4.2 STL Models and Preliminary Process Object Placement

IPGScan supports the import of STL models into jobs. The purpose behind importing STL models into the job is so that users have a visual aid that assists with the placement of process objects and the creation of the overall process. This enables users to be able to create the majority of the process offline and before equipment is setup on the production floor. Furthermore, the use of STL models for programming can reduce programming efforts later in the process when transitioning to the real world equipment. This is accomplished through the use of the "Part Alignment for STL" functionality, which is covered in a later section.

The following sections outline how users can import STL models and also provides an example for placing Process Objects according to the STL models.

8.3.4.2.1 Importing STL Models

Users can import STL models using the following procedure.

1. Open IPGScan and create an "On The Fly" type job.
2. Click the "STL" button in the Tool Bar. See Figure 231 (below).

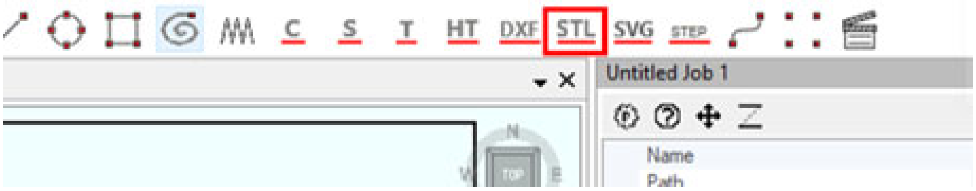


Figure 231: STL Import Button

3. Navigate to the desired STL model for import and select the file.
4. Click "Open."
5. Select the desired Import Preference options. See Figure 232 (below).
   - Move To Center - This will center the STL model visual at the 0, 0, 0 location of the IPGScan canvas.
   - Size To Fit - This will scale the STL model to fit completely within default scanner FOV (not typically used).

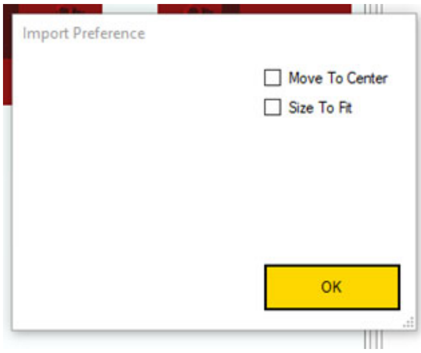
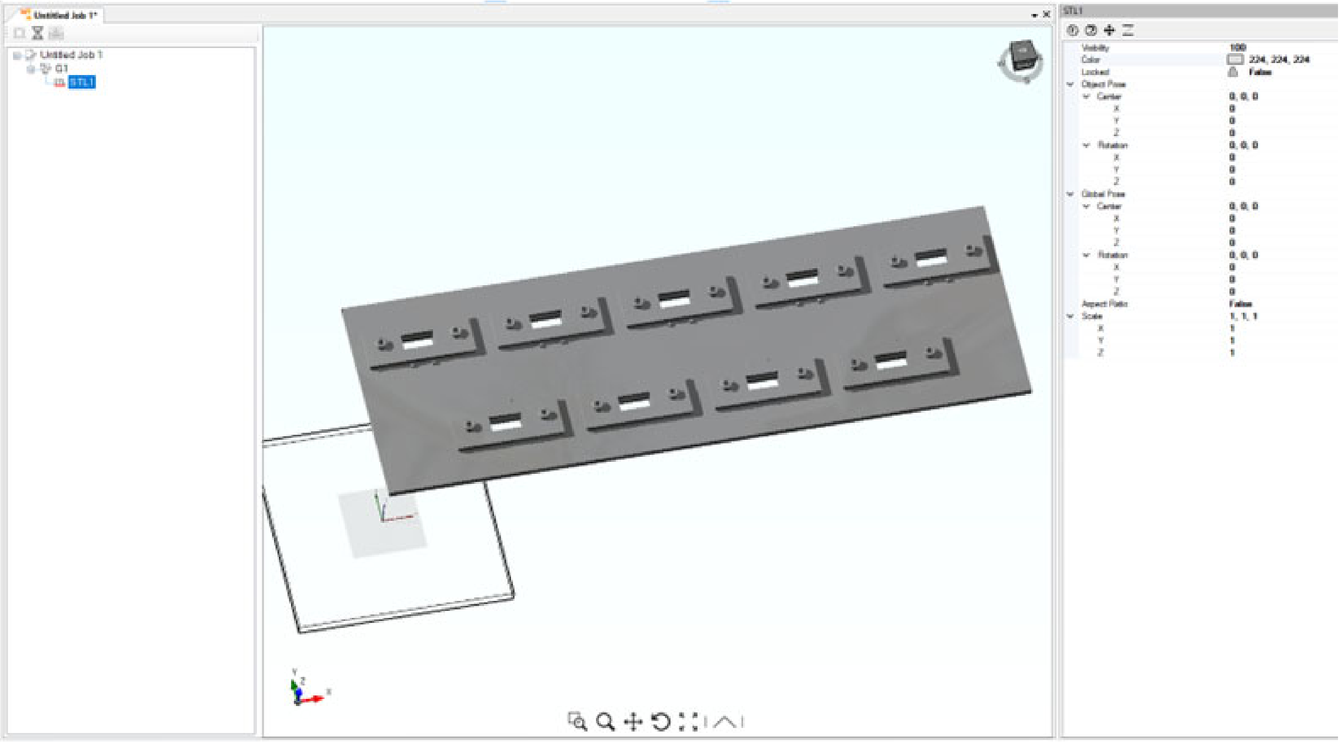


Figure 232: Import Preference Options

6. Click "OK."

IMPORTANT Depending on the file size of the STL model, it can take some time for the model to import.

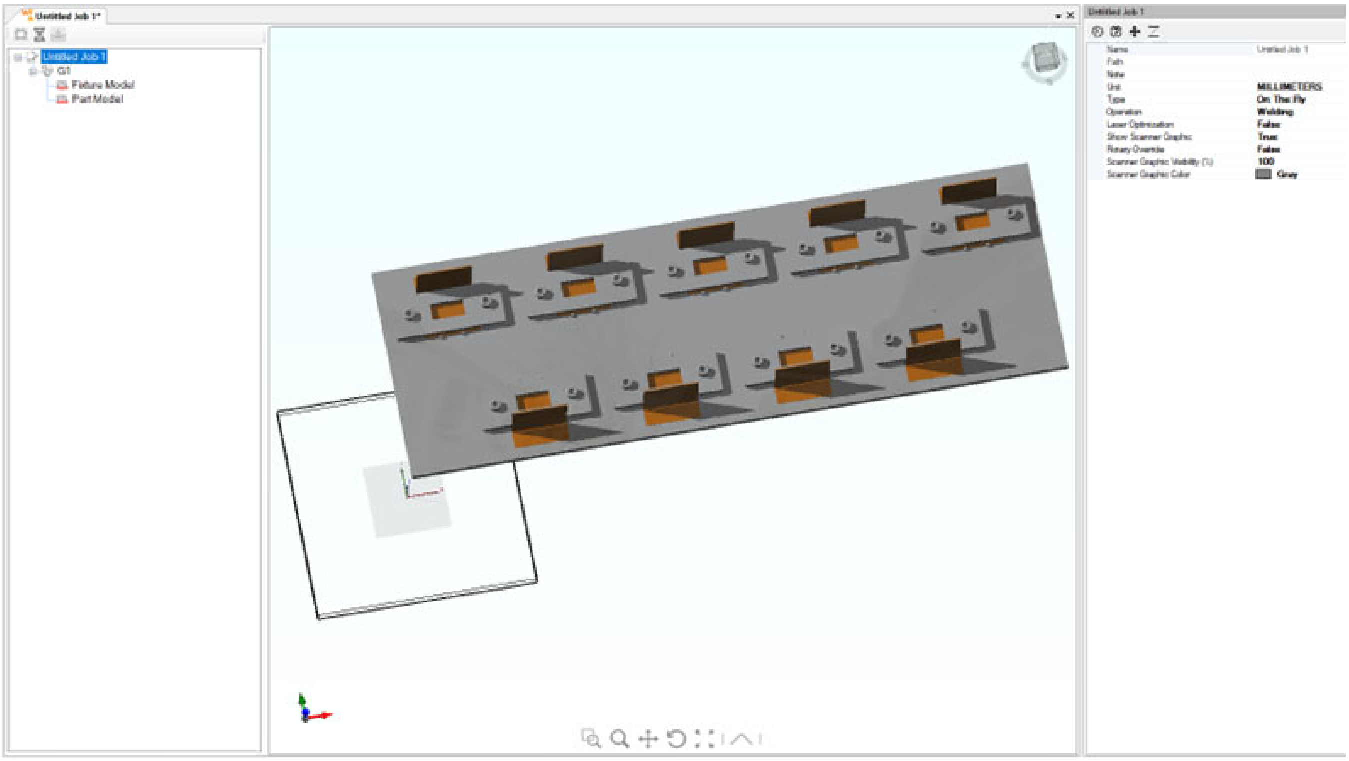
With the STL model imported, users can now select the STL model in the Job Tree and modify parameters as desired. Figure 233 (below) provides an example of an imported model.



Visibility	100
Color	224, 224, 224
Locked	False
Object Pose	
Center	0, 0, 0
X	0
Y	0
Z	0
Rotation	0, 0, 0
X	0
Y	0
Z	0
Global Pose	
Center	0, 0, 0
X	0
Y	0
Z	0
Rotation	0, 0, 0
X	0
Y	0
Z	0
Aspect Ratio	False
Scale	1, 1, 1
X	1
Y	1
Z	1

Figure 233: Example Imported STL Model

Users can import multiple STL models if desired. By importing multiple STL models and assigning each model with a different color, users can create a visual in IPGScan that makes it easier to distinguish a part from a fixture, which may assist with Process Object placement. Figure 234 (below) demonstrates how two STL models can be imported into a single job. One model represents a fixture while the other model is for the parts in the fixture.



Untitled Job 1

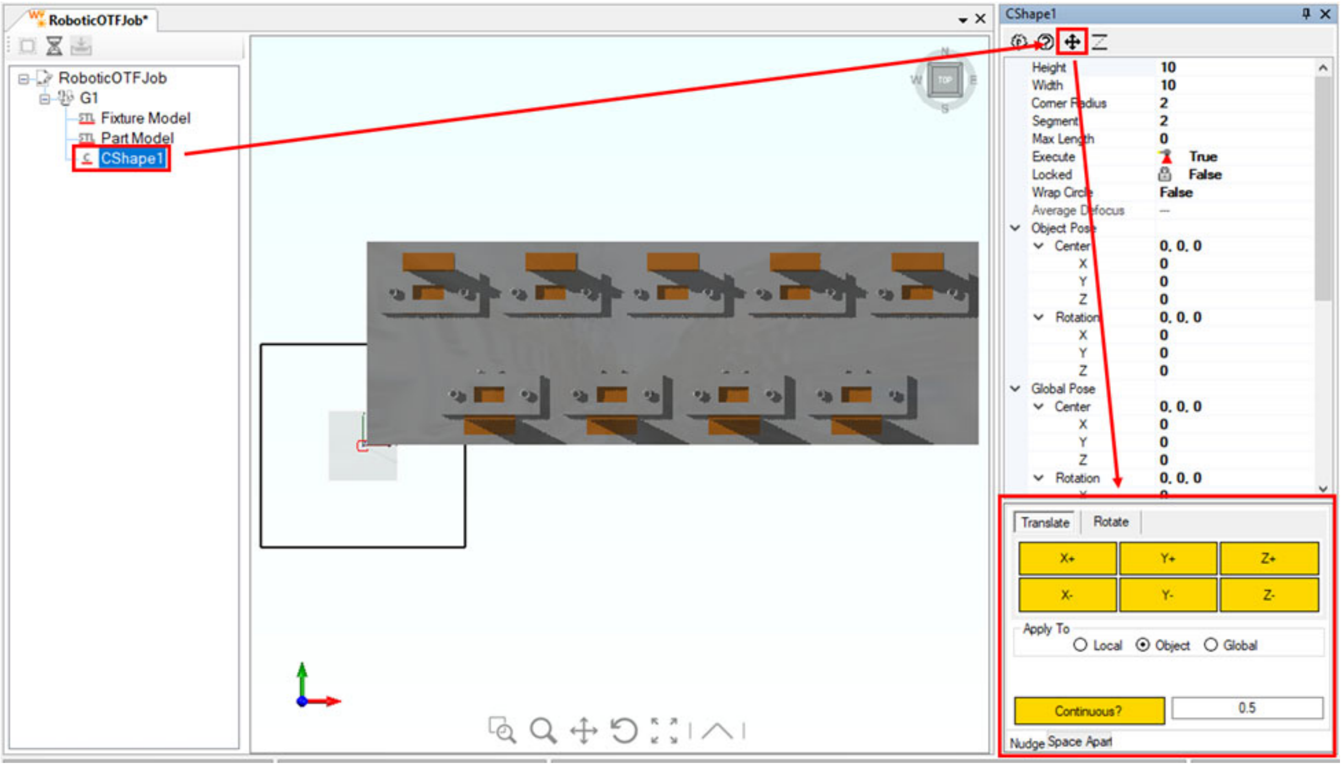
Name	Untitled Job 1
Path	
Note	
Unit	MILLIMETERS
Type	On The Fly
Operation	Welding
Laser Optimization	False
Show Scanner Graphic	True
Rotary Override	False
Scanner Graphic Visibility (%)	100
Scanner Graphic Color	▨ Gray

Figure 234: Multiple STL Models Imported in One Job

8.3.4.2.2 Preliminary Process Object Placement

Once users have imported any desired STL models, Process Objects can then be placed accordingly to the STL models. The following steps detail how users can utilize the Nudge Tool to place Process Objects relative to the STL models.

1. Create any desired Process Object using the Tool Bar.
2. Select the Process Object in the Job Tree and click the Nudge Tool button to open the Nudge Tool window. See Figure 235 (below).



Height	10
Width	10
Corner Radius	2
Segment	2
Max Length	0
Execute	True
Locked	False
Wrap Circle	False
Average Defocus	—
Object Pose	
Center	0, 0, 0
X	0
Y	0
Z	0
Rotation	0, 0, 0
X	0
Y	0
Z	0
Global Pose	
Center	0, 0, 0
X	0
Y	0
Z	0
Rotation	0, 0, 0

Apply To ○ Local ● Object ○ Global

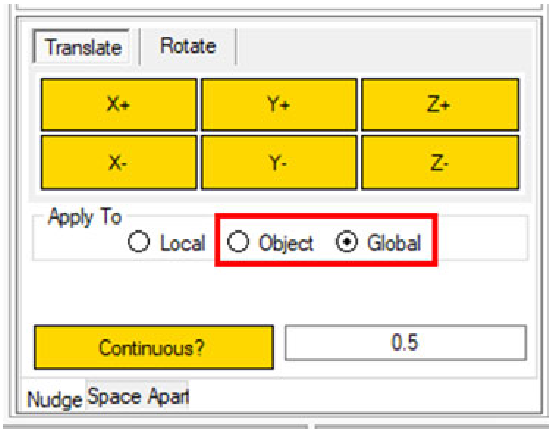
0.5

Figure 235: Opening the Nudge Window

3. Change the "Apply To" setting from "Object" to "Global." See Figure 236 on page 227.

IMPORTANT For Robotic OTF applications, it is highly recommended that users only change Global Pose position (center and rotation) information. Any changes in Object Pose to a Process Object will offset the preview image of the guide laser when utilizing Process Alignment functionality for Process Object placement/touch-up.

IPGScan Position Information Order of Operations: Object Scale + Object Rotation + Object Translation + Group Scale + Group Rotation + Group Translation + Global Rotation + Global Translation

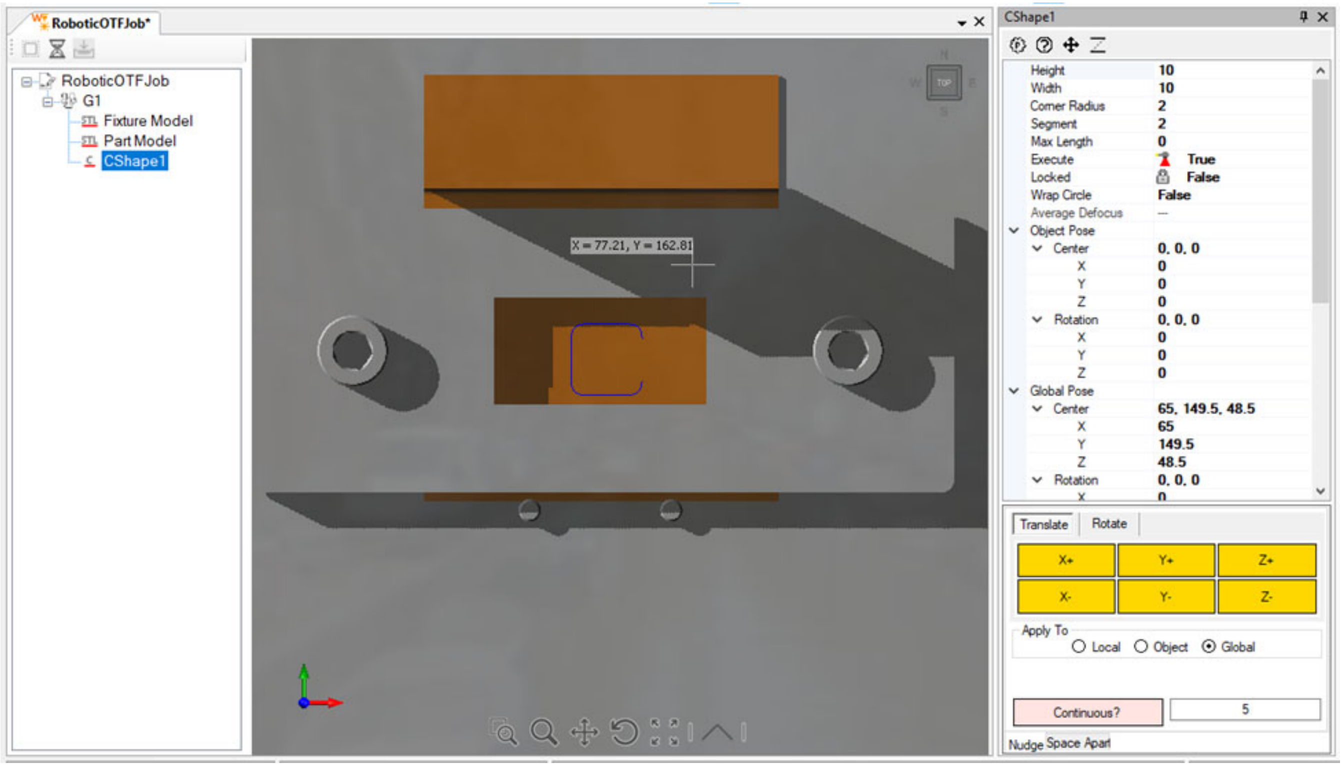


Apply To ○ Local ○ Object ● Global

0.5

Figure 236: Nudge about Global Pose

4. Users can now nudge the process object into the appropriate location relative to the CAD model by using the X, Y, and Z buttons in the Nudge Tool window. See Figure 237 (below).
   - – Continuous Button - When enabled, users can click and hold the X, Y, or Z Nudge buttons for continuous repositioning. When disabled, each mouse click will cause the Process Object to move one time (based on the defined increment amount).
   - – Increment Amount - Users can change the increment amount value as desired.



Height	10
Width	10
Corner Radius	2
Segment	2
Max Length	0
Execute	True
Locked	False
Wrap Circle	False
Average Defocus	---
Object Pose	
Center	0, 0, 0
X	0
Y	0
Z	0
Rotation	0, 0, 0
X	0
Y	0
Z	0
Global Pose	
Center	65, 149.5, 48.5
X	65
Y	149.5
Z	48.5
Rotation	0, 0, 0
X	0

Apply To ○ Local ○ Object ● Global

5

Figure 237: Nudging a Process Object into Position

5. Users can now copy, paste, or create new Process Objects and position them relative to the STL model(s) as desired using the Nudge Tool. See Figure 238 (below), which details an example weld fixture with Process Objects placed in the appropriate weld locations.

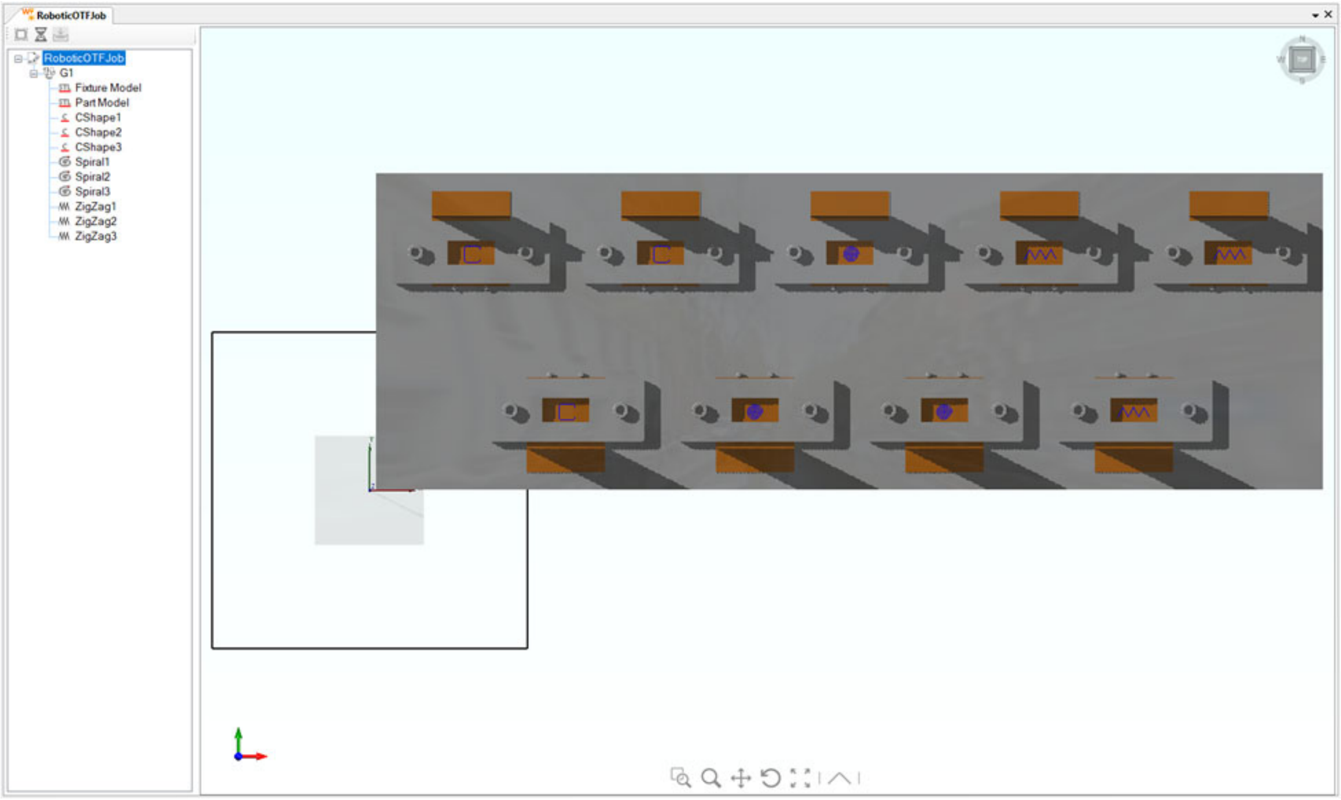


Figure 238: Example Weld Fixture with Process Objects

With all desired Process Objects placed relative to the STL model(s), users can transition into creating a Simulated Robot Trajectory in order to start visualizing the process and determining cycle times.

8.3.4.3 Simulated Trajectory and Projection Volume (Head Preview)

The combination of the Simulated Trajectory and Projection Volume functionality allows users to visualize the scanning process without ever having setup any equipment in the real world. Simulated Trajectory enables users to create an expected robot trajectory that will emulate what the real robot trajectory will resemble, while Projection Volume allows users to view the Scan Head and laser beam as it executes Process Objects. Through the combination of these two features, users can visualize and develop the process prior to ever stepping on the production floor.

The following sections detail the functionality of Projection Volume and Simulated Trajectory.

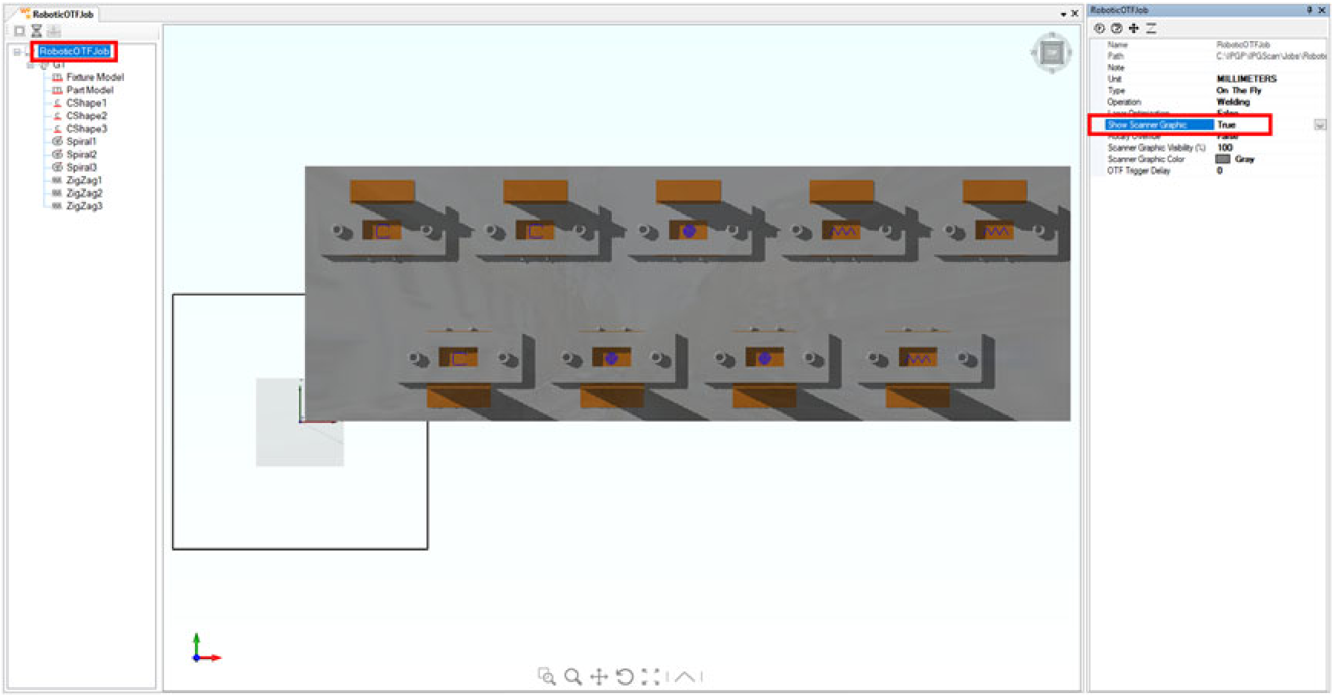
8.3.4.3.1 Projection Volume (Head Preview)

The Projection Volume feature allows users to display a visual of the scan head as well as the beam trajectory in the IPGScan canvas. This feature can be useful for visualizing the process and better understanding of whether or not obstructions may exist in the path of the laser beam when attempting to process a part.

IMPORTANT The scanners calibration files require specific parameters for this functionality. If this feature is enabled and the head and beam trajectory are not displayed, it is likely that the calibration files do not have the required parameters. Please contact the appropriate IPG Beam Delivery support personnel concerning the update of the calibration files.

The following procedure outlines how users can enable the Projection Volume feature.

1. Open IPGScan and connect to the desired scanner.
2. Create a new IPGScan job or open an existing job.
3. Click on the job's name in the Job Tree.
4. In the Parameter Window, set "Show Scanner Graphic" to "True." See Figure 239 (below).
   - Here is where users can adjust the scanner graphic color and transparency.



Name	RoboticOTFJob
Path	C:\IPG\IPGScan\Jobs\Robotic
Note	
Unit	MILLIMETERS
Type	On The Fly
Operation	Welding
Loop Optimization	False
Show Scanner Graphic	True
Rotary Override	False
Scanner Graphic Visibility (%)	100
Scanner Graphic Color	▨ Gray
OTF Trigger Delay	0

Figure 239: Enabling Show Scanner Graphic

5. Click the "Show Projection Volume" button in the Tool bar. This will cause the head to appear in the IPGScan canvas. See Figure 240 (below).

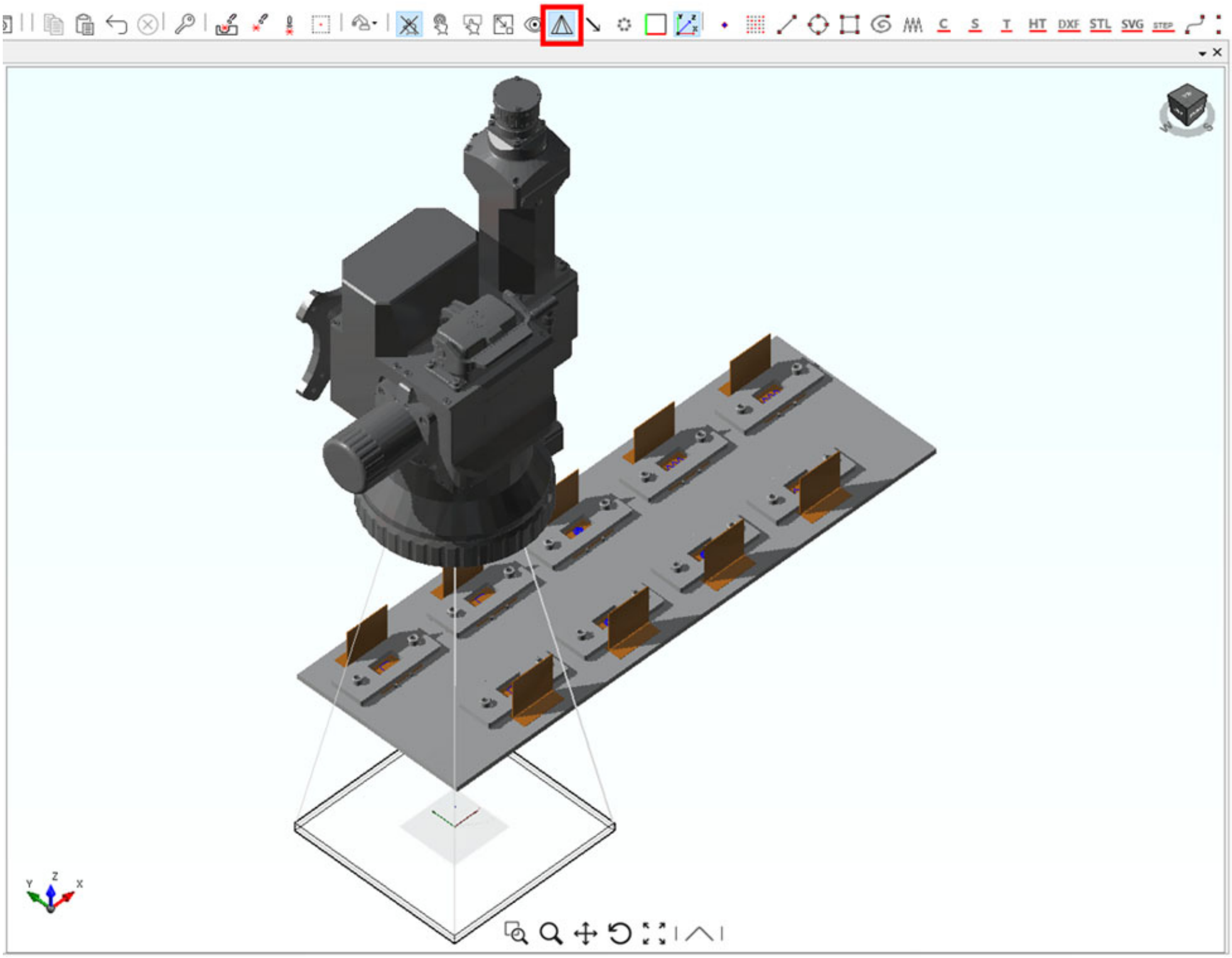


Figure 240: Projection Volume Display

6. With "Show Projection Volume" enabled, users can then preview the beam trajectory by scrubbing along the appropriate timelines for the given job types.
   - Default and Point & Shoot Job Types - Select a Process Object in the job and scrub along the timeline that appears at the bottom of the Job Tree. See Figure 241 (below).

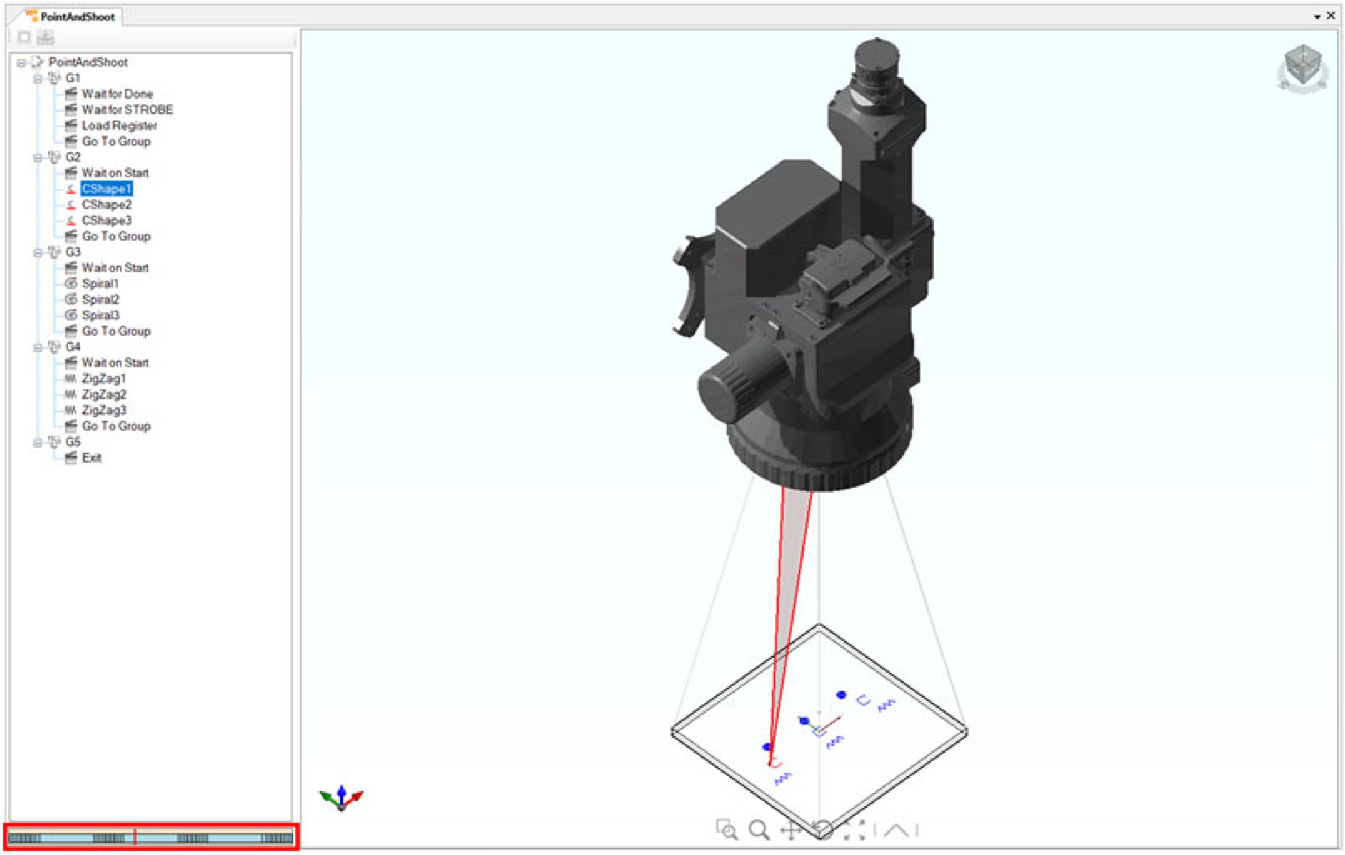


Figure 241: Projection Volume in a Point and Shoot Job

- Robotic OTF Job Type - A simulated robot trajectory or a real robot trajectory must be loaded into the job in order to preview the beam path. When either of these types of trajectories are loaded, users can scrub along the basic timeline to view the beam trajectory. Please refer to section "Simulated Trajectory" for details on creating a simulated trajectory. See Figure 242 (below).

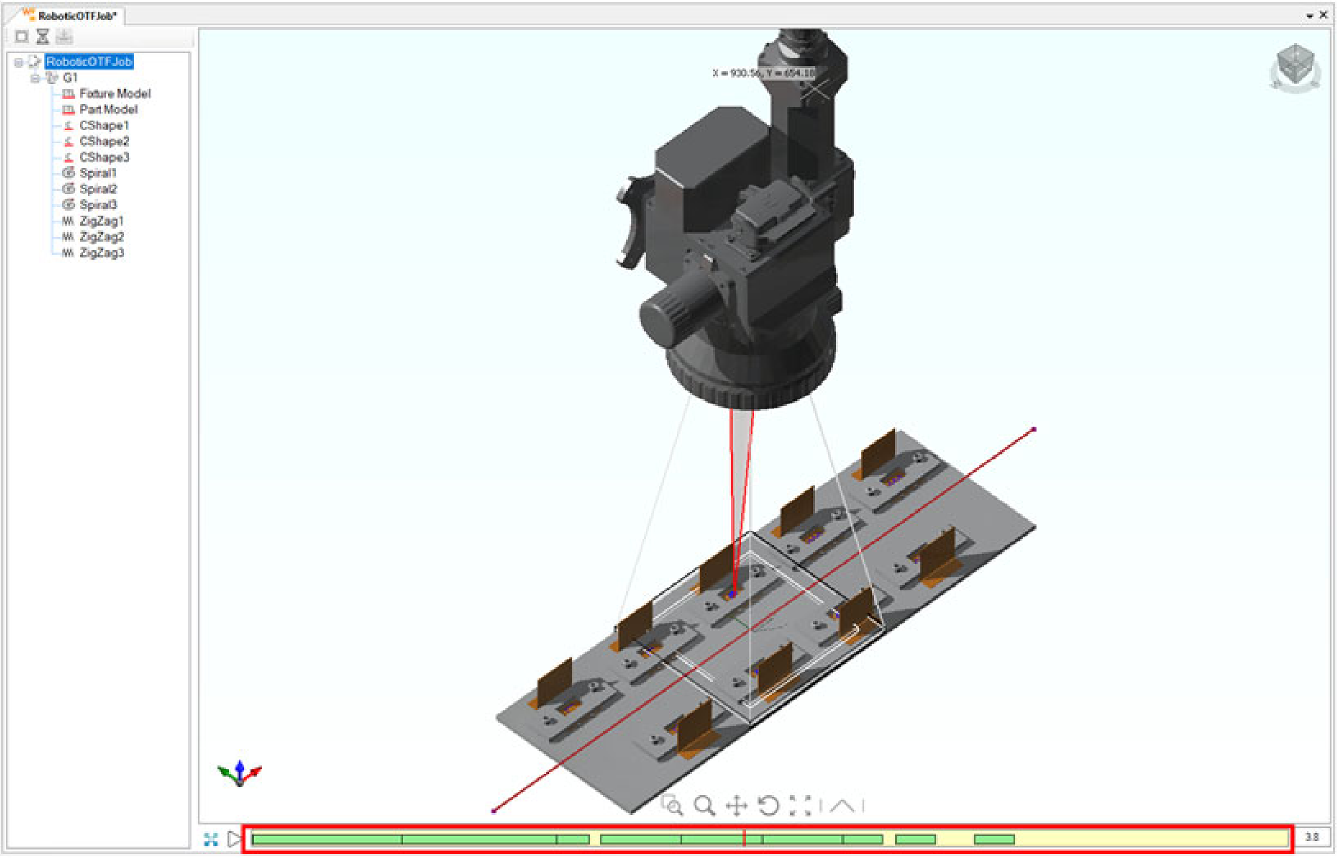


Figure 242: Projection Volume in an On-The-Fly Job

8.3.4.3.2 Simulated Trajectory

Simulated Trajectory allows users to create a desired/preliminary robot trajectory that can be utilized to assist with process development and visualization. By defining various robot positions and speeds, users can begin to visualize how the scan head will traverse along the parts and how the process will take place. Additionally, by utilizing Projection Volume along with Simulated Trajectory, users can better understand the approach of the beam during processing and whether or not obstructions from fixturing may exist and how laser on/off timings may need to be adjusted.

The following steps detail how users can create a simulated robot trajectory.

1. Open IPGScan and connect to the desired scanner.
2. Create a new IPGScan job that is an "On The Fly" type or open a previously created job.
3. (Optional) Enable the display of the scan head in the IPGScan canvas by turning on "Show Projection Volume." Please refer to the section "Projection Volume (Head Preview)," for more details concerning this feature.
4. In the Tool bar, click on the robot icon, navigate to "Simulated Trajectory," and click "Edit." See Figure 243 (below).
   - If no robot icon exists in the Tool bar, the user likely needs to configure the robot options in the IPGScan Options menu. A robot type must be specified in order to utilize Simulated Trajectory. Refer to section "IPGScan Robot Options" for details on specifying a robot type.

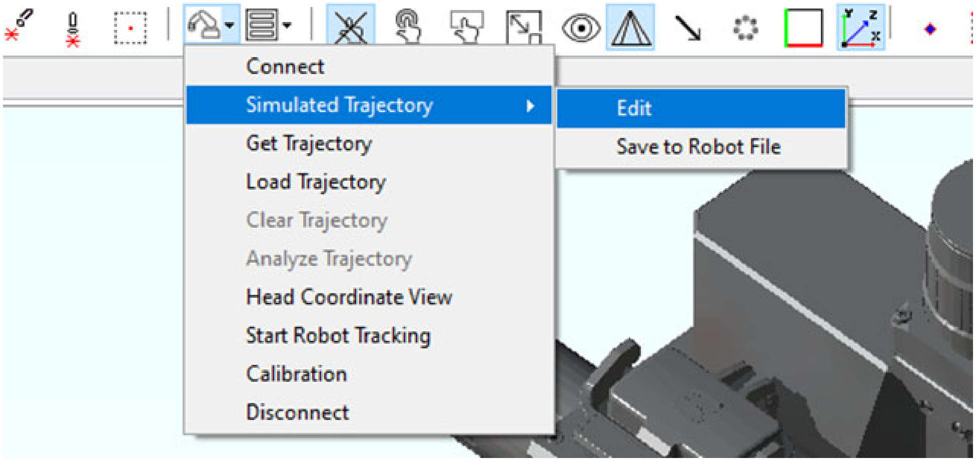
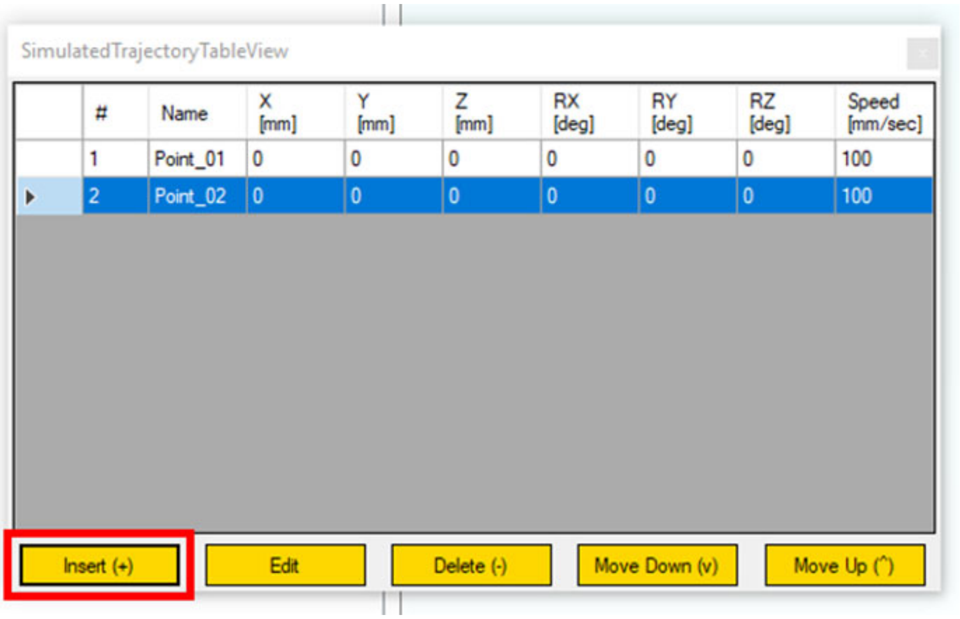


Figure 243: Opening the Simulated Trajectory Window

5. In the Simulated Trajectory Table View, users can add and position simulated trajectory points throughout the IPGScan canvas. Users can create simulated points by clicking the "Insert (+)" button. See Figure 244 (below).

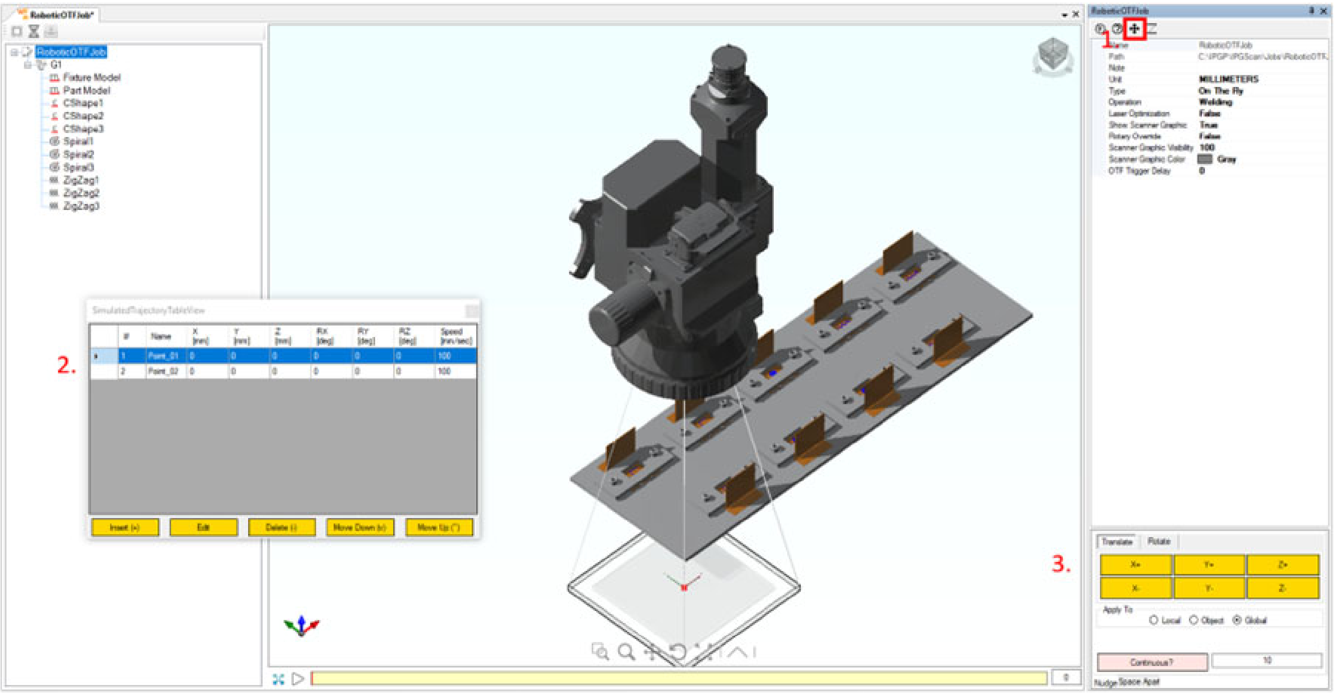
For this example, two simulated trajectory points are created.



	#	Name	X [mm]	Y [mm]	Z [mm]	RX [deg]	RY [deg]	RZ [deg]	Speed [mm/sec]
	1	Point_01	0	0	0	0	0	0	100
▸	2	Point_02	0	0	0	0	0	0	100

Figure 244: Creating Simulated Trajectory Points

6. Move the simulated trajectory points into the desired locations. This can be accomplished in two ways:
   - Direct Entry Method - Users can type in the exact coordinates into the simulated trajectory table.
   - The Nudge Tool - Users can open the Nudge Tool, select the desired simulated robot point to move, and then reposition the point by clicking the Nudge Tool buttons. See Figure 245 (below).



	#	Name	X [mm]	Y [mm]	Z [mm]	RX [deg]	RY [deg]	RZ [deg]	Speed [mm/sec]
▸	1	Point_01	0	0	0	0	0	0	100
	2	Point_02	0	0	0	0	0	0	100

RoboticOTFJob

Name	RoboticOTFJob
Path	C:\IPGP\IPGScan\Jobs\RoboticOTF
Note	
Unit	MILLIMETERS
Type	On The Fly
Operation	Welding
Laser Optimization	False
Show Scanner Graphic	True
Rotary Override	False
Scanner Graphic Visibility	100
Scanner Graphic Color	▨ Gray
OTF Trigger Delay	0

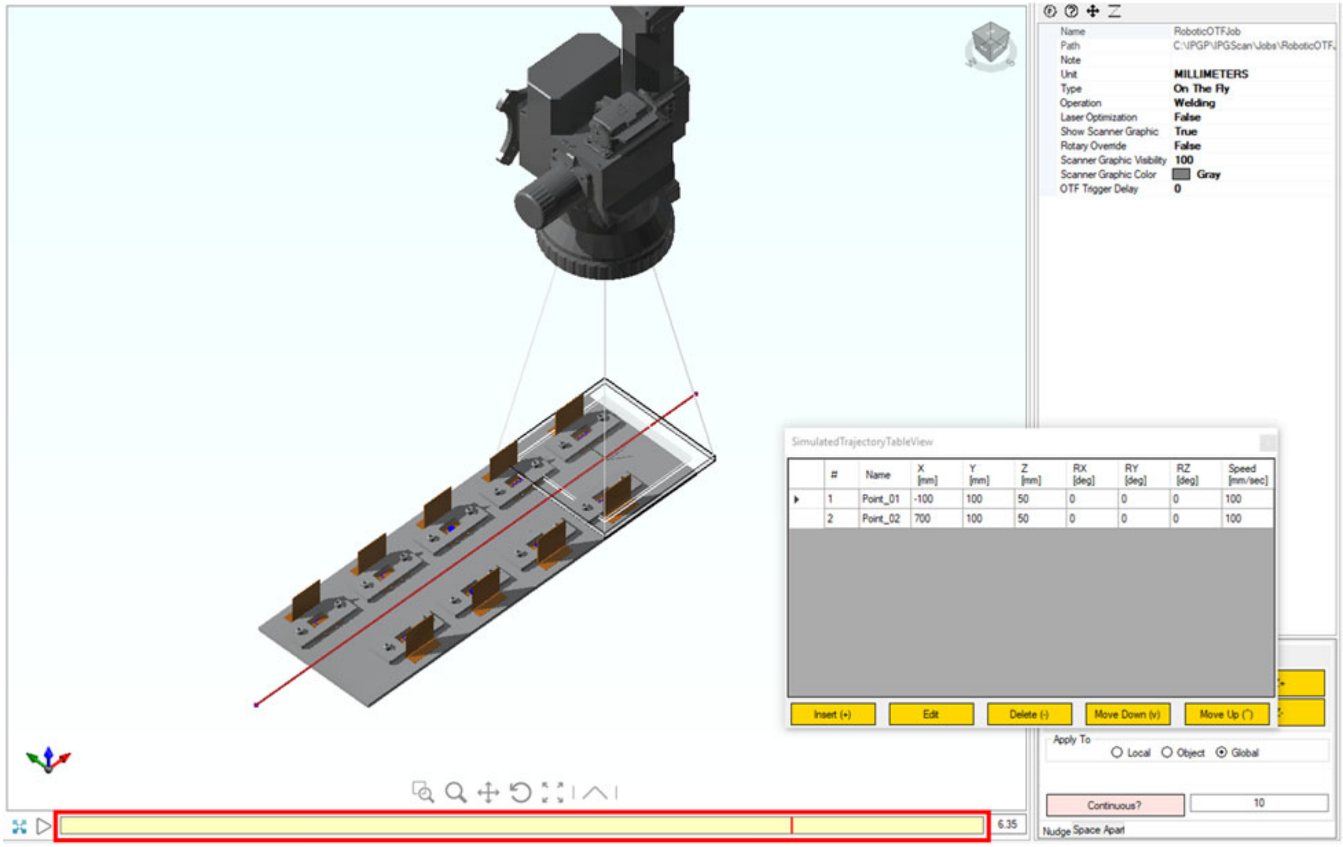
Apply To ○ Local ○ Object ● Global

Continuous? 10

Figure 245: Using the Nudge Tool to Position Simulated Trajectory Points

7. When moving the simulated trajectory points into position, users can scrub along the timeline (below the IPGScan canvas) to visualize the head orientation along the simulated trajectory path. See Section 246 on page 236.

IMPORTANT Simulated trajectories are created with fine termination types and instant acceleration.



Name	RoboticOTFJob
Path	C:\IPGP\IPGScan\Jobs\RoboticOTF.
Note	
Unit	**MILLIMETERS**
Type	**On The Fly**
Operation	**Welding**
Laser Optimization	**False**
Show Scanner Graphic	**True**
Rotary Override	**False**
Scanner Graphic Visibility	**100**
Scanner Graphic Color	▨ **Gray**
OTF Trigger Delay	**0**

SimulatedTrajectoryTableView

	#	Name	X [mm]	Y [mm]	Z [mm]	RX [deg]	RY [deg]	RZ [deg]	Speed [mm/sec]
▸	1	Point_01	-100	100	50	0	0	0	100
	2	Point_02	700	100	50	0	0	0	100

Apply To ○ Local ○ Object ● Global

Figure 246: Scrubbing Along the IPGScan Canvas Timeline

8. Once users are happy with the position of the simulated trajectory points, the Simulated Trajectory Table View can be closed by clicking on the close button in the upper right hand corner of the window.
   – Simulated trajectory points remain in the table view even after it is closed. Also, simulated trajectory points are saved with the IPGScan job file.
9. Users can now Dryrun the job to ensure that processing can complete. See Section 8.3.4.5 on page 242 for information on how to perform a Dryrun and examine process timings.

IMPORTANT

The scanner Field Of View configuration is also crucial to passing a Dryrun and creating a process. Please refer to Section 8.3.4.4 on page 240 for details concerning scanner FOV setup.

10. Upon successful completion of a Dryrun, users can scrub along the canvas timeline to view the beam trajectory for processing. See Figure 247 (below).

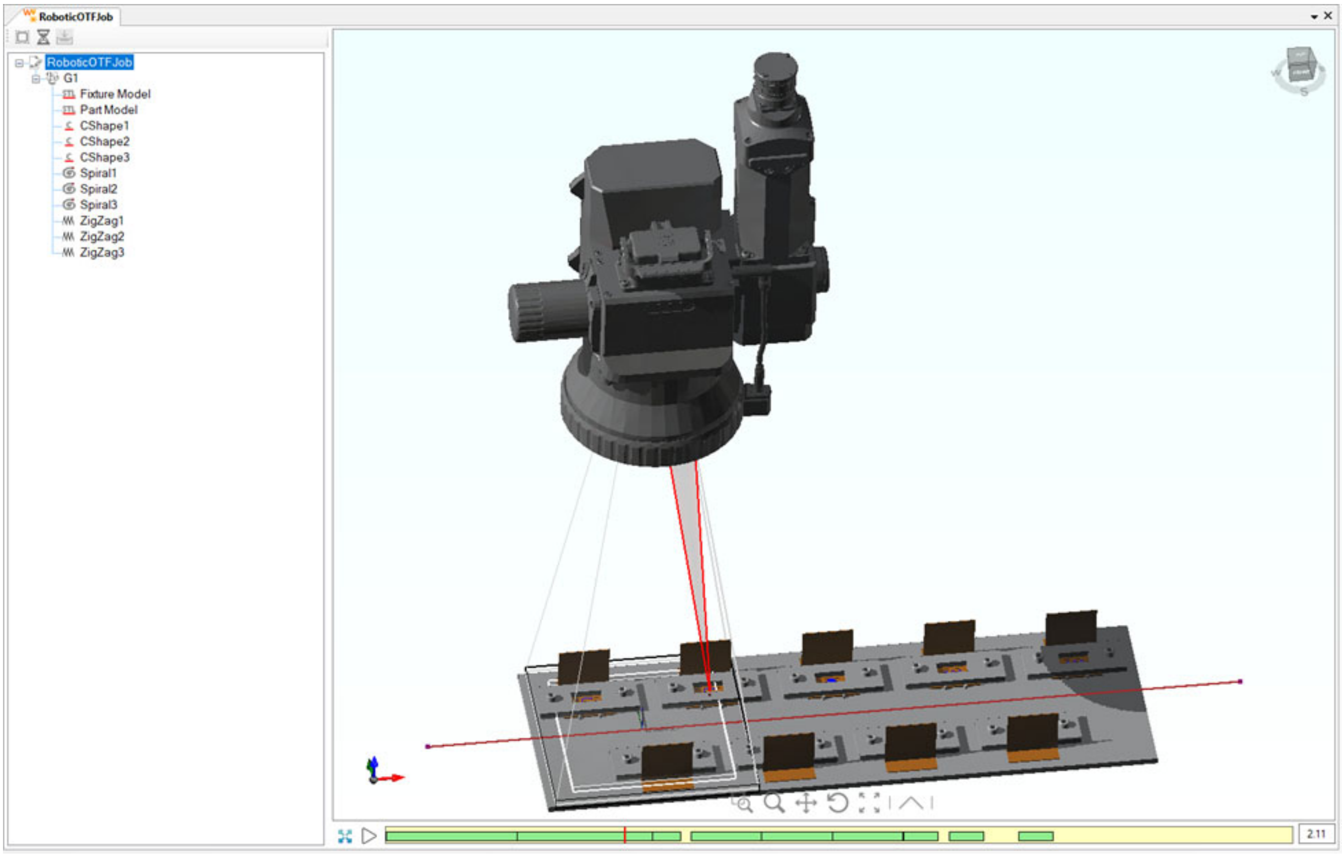


Figure 247: Successful Dryrun and Beam Trajectory Viewing

8.3.4.3.2.1 Exporting a Simulated Trajectory

Once users have created a Simulated Trajectory, this path can be export for upload to a real robot. This provides users with a preliminary robot program and path that helps to reduce development time. The following procedure details how users can export a Simulated Trajectory to be loaded on a real robot.

1. In the Tool bar, click on the robot icon, navigate to "Simulated Trajectory," and click "Save to Robot File." See Figure 248 (below).

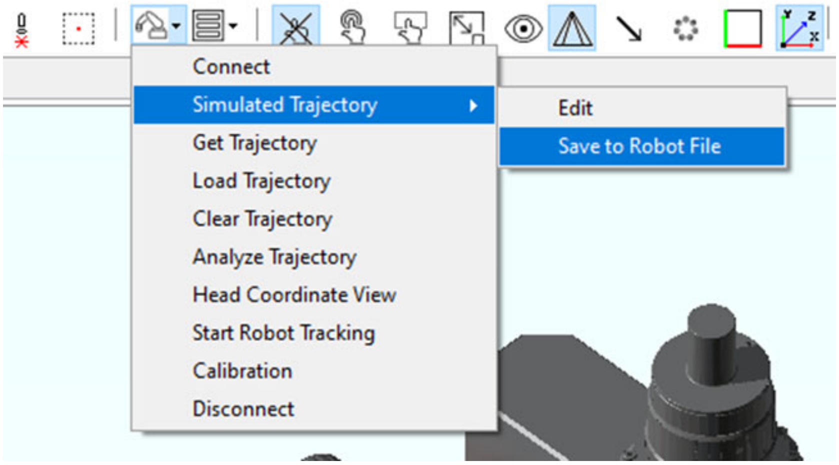
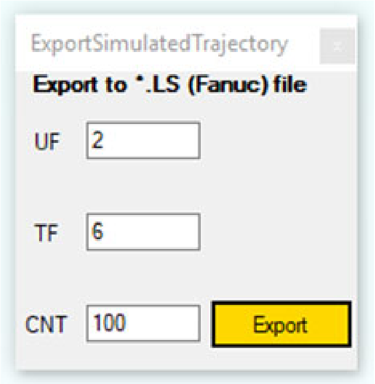


Figure 248: Save to Robot File

2. Enter the correct information for the creation of the robot program. See Figure 249 (below).
   - UF - User Frame
   - TF - Tool Frame
   - CNT - Motion Speed Percent (0-100)



ExportSimulatedTrajectory

Export to *.LS (Fanuc) file

UF 2

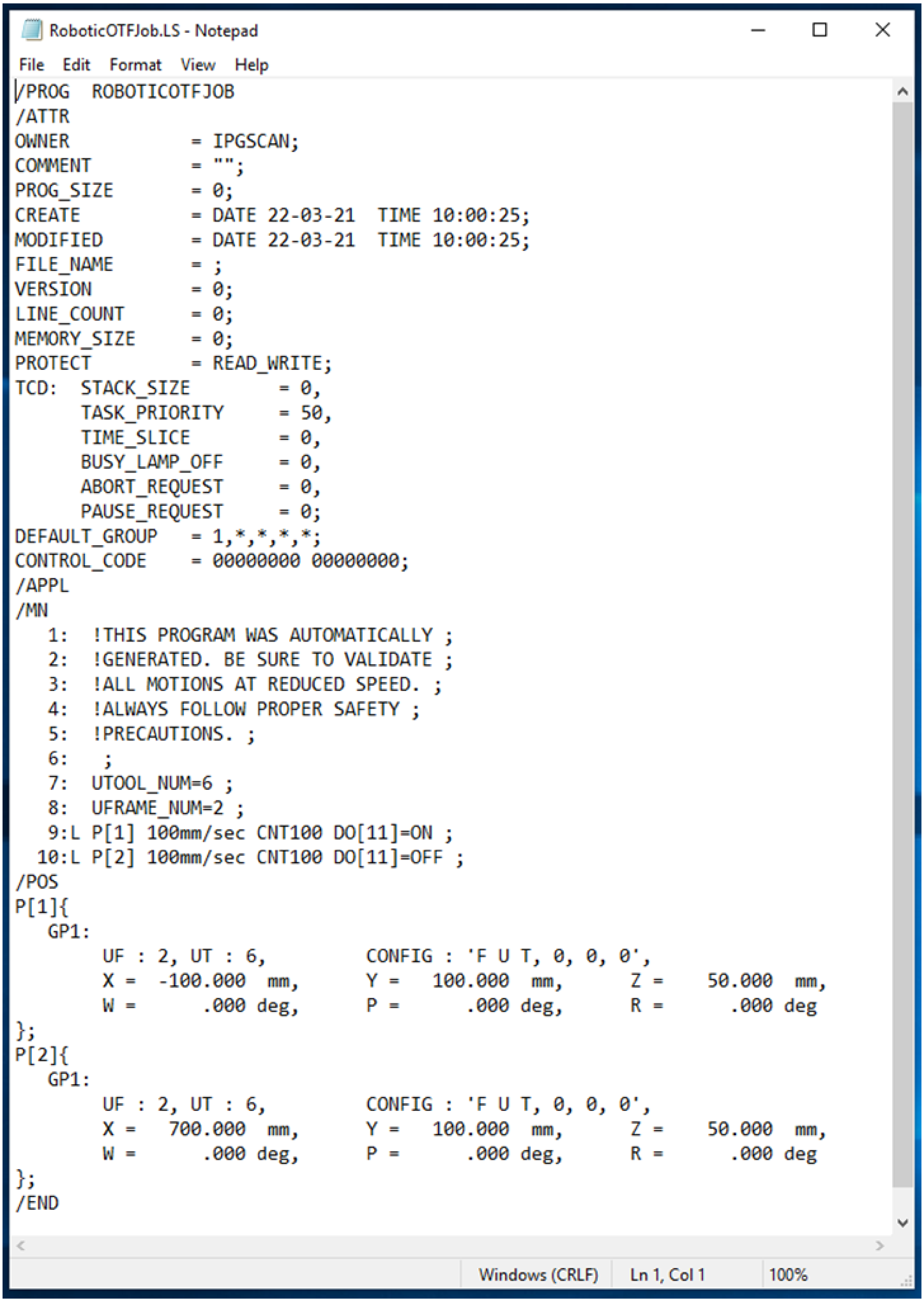
TF 6

CNT 100

Figure 249: Export Simulated Trajectory Parameters

3. Click "Export."
4. Navigate to a location where the robot program can be saved and enter a file name. Click "Save."
5. Click "Ok" to confirm that the exported robot file was saved.

The user can now navigate to and open the exported robot file. See Figure 250 (below).



```
/PROG  ROBOTICOTFJOB
/ATTR
OWNER           = IPGSCAN;
COMMENT         = "";
PROG_SIZE       = 0;
CREATE          = DATE 22-03-21  TIME 10:00:25;
MODIFIED        = DATE 22-03-21  TIME 10:00:25;
FILE_NAME       = ;
VERSION         = 0;
LINE_COUNT      = 0;
MEMORY_SIZE     = 0;
PROTECT         = READ_WRITE;
TCD:  STACK_SIZE        = 0,
      TASK_PRIORITY     = 50,
      TIME_SLICE        = 0,
      BUSY_LAMP_OFF     = 0,
      ABORT_REQUEST     = 0,
      PAUSE_REQUEST     = 0;
DEFAULT_GROUP   = 1,*,*,*,*;
CONTROL_CODE    = 00000000 00000000;
/APPL
/MN
   1:  !THIS PROGRAM WAS AUTOMATICALLY ;
   2:  !GENERATED. BE SURE TO VALIDATE ;
   3:  !ALL MOTIONS AT REDUCED SPEED. ;
   4:  !ALWAYS FOLLOW PROPER SAFETY ;
   5:  !PRECAUTIONS. ;
   6:   ;
   7:  UTOOL_NUM=6 ;
   8:  UFRAME_NUM=2 ;
   9:L P[1] 100mm/sec CNT100 DO[11]=ON ;
  10:L P[2] 100mm/sec CNT100 DO[11]=OFF ;
/POS
P[1]{
   GP1:
        UF : 2, UT : 6,         CONFIG : 'F U T, 0, 0, 0',
        X =  -100.000  mm,      Y =   100.000  mm,      Z =    50.000  mm,
        W =      .000 deg,      P =      .000 deg,      R =      .000 deg
};
P[2]{
   GP1:
        UF : 2, UT : 6,         CONFIG : 'F U T, 0, 0, 0',
        X =   700.000  mm,      Y =   100.000  mm,      Z =    50.000  mm,
        W =      .000 deg,      P =      .000 deg,      R =      .000 deg
};
/END
```

Figure 250: IPGScan Simulated Trajectory Exported to a FANUC Robot File

8.3.4.4 Adjusting Canvas Settings (Scanner Field-of-View and In-View Window)

For Robotic OTF applications, careful consideration of the scanners Field of View (FOV) is required for process development. Different from Point and Shoot style processes, users have an additional Field of View parameter called the "In-View Window." The In-View Window is what allows users to restrict the area within the scanners full FOV for additional process control. Figure 251 (below) outlines the difference between the scanners full FOV and the In-View Window. By reducing the area for which the scanner is allowed to process within the full FOV, users gain additional control over process timings, depth of focus tolerance, and allowable beam approach angles to the work surface.

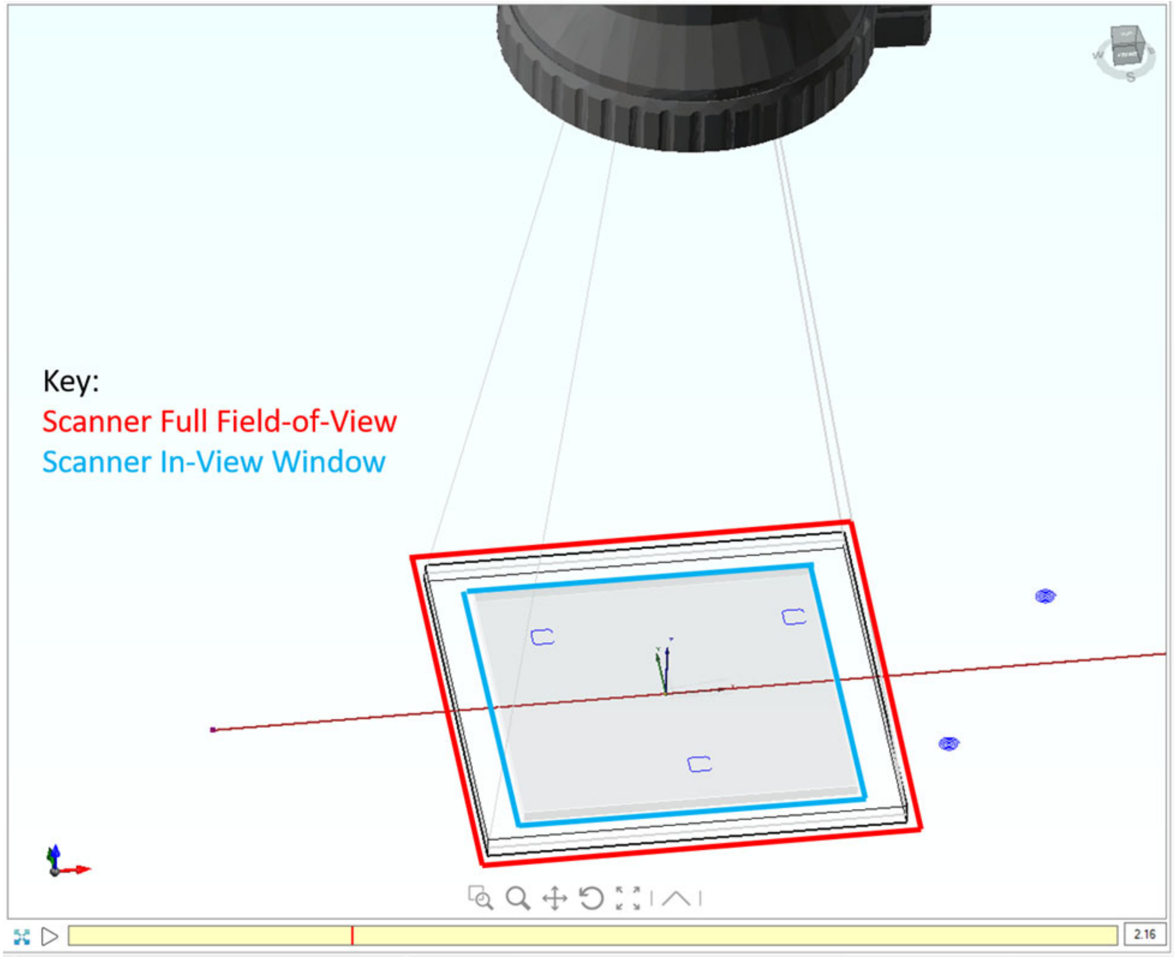
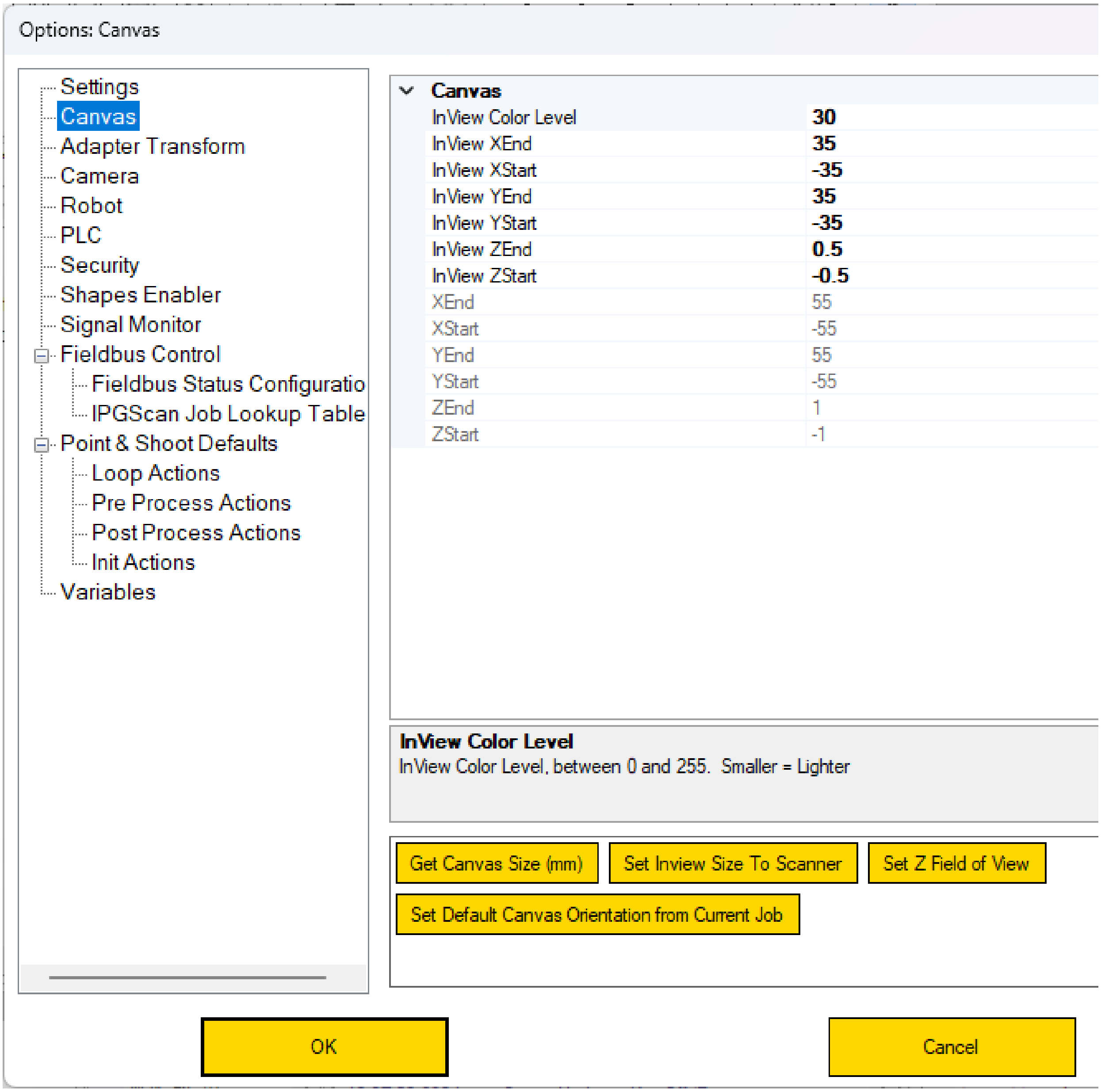


Figure 251: Scanner Field-of-View and In-View Window

While users do not have the ability to adjust the X and Y parameters of the Scanners FOV, the Z parameter and In-View Window dimensions can all be adjusted based on the users process needs. The following details how users can navigate to the menu to adjust scanner FOV and In-View Window settings.

1. Open IPGScan and connect to a desired scanner.
2. Click "View."

3. Click "Options."
4. Select "Canvas." See Figure 252 (below).
   - From here, users can adjust the scanners FOV and In-View Window settings.



Canvas	
InView Color Level	30
InView XEnd	35
InView XStart	-35
InView YEnd	35
InView YStart	-35
InView ZEnd	0.5
InView ZStart	-0.5
XEnd	55
XStart	-55
YEnd	55
YStart	-55
ZEnd	1
ZStart	-1

InView Color Level
InView Color Level, between 0 and 255. Smaller = Lighter

Figure 252: PGScan Canvas Settings

8.3.4.5 The Process of Dryrun and Timeline Review

5. To visualize a Robotic OTF process in IPGScan, users perform a Dryrun once process objects have been placed in the Canvas and a trajectory (real or simulated) is added to the job. The purpose of the Dryrun feature is for IPGScan to analyze if the scanner can adequately process all objects in the job based on process object order, relative position, and process timings. If a job successfully passes Dryrun, users can expect to run the real process and observe the desired output. If the Dryrun process fails, users should investigate the cause of the failure prior to attempting to run the real process.

IMPORTANT If a job passes Dryrun but the real process output is not as expected (i.e. distorted welds or improperly oriented), users should verify the IPGScan and Robot Workspace Calibration. Additionally, users should ensure that they have captured and imported the real robot trajectory.

The following sections detail how users can perform a Dryrun as well as how process timings can be observed using the Basic and Advanced Timelines.

8.3.4.5.1 Dryrun

The following procedure outlines how users can perform a Dryrun.

1. In the desired On-The-Fly job, select the name of the job in the Job Tree. See Figure 253 (below).

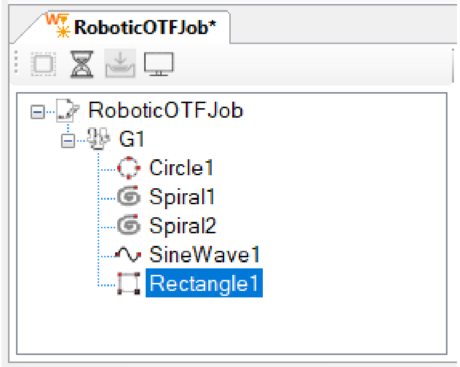


Figure 253: Selecting the Job Name for Dryrun

2. Click the "Start Processing" Button. See Figure 254 (below).

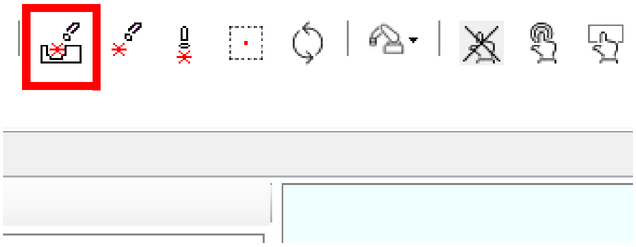
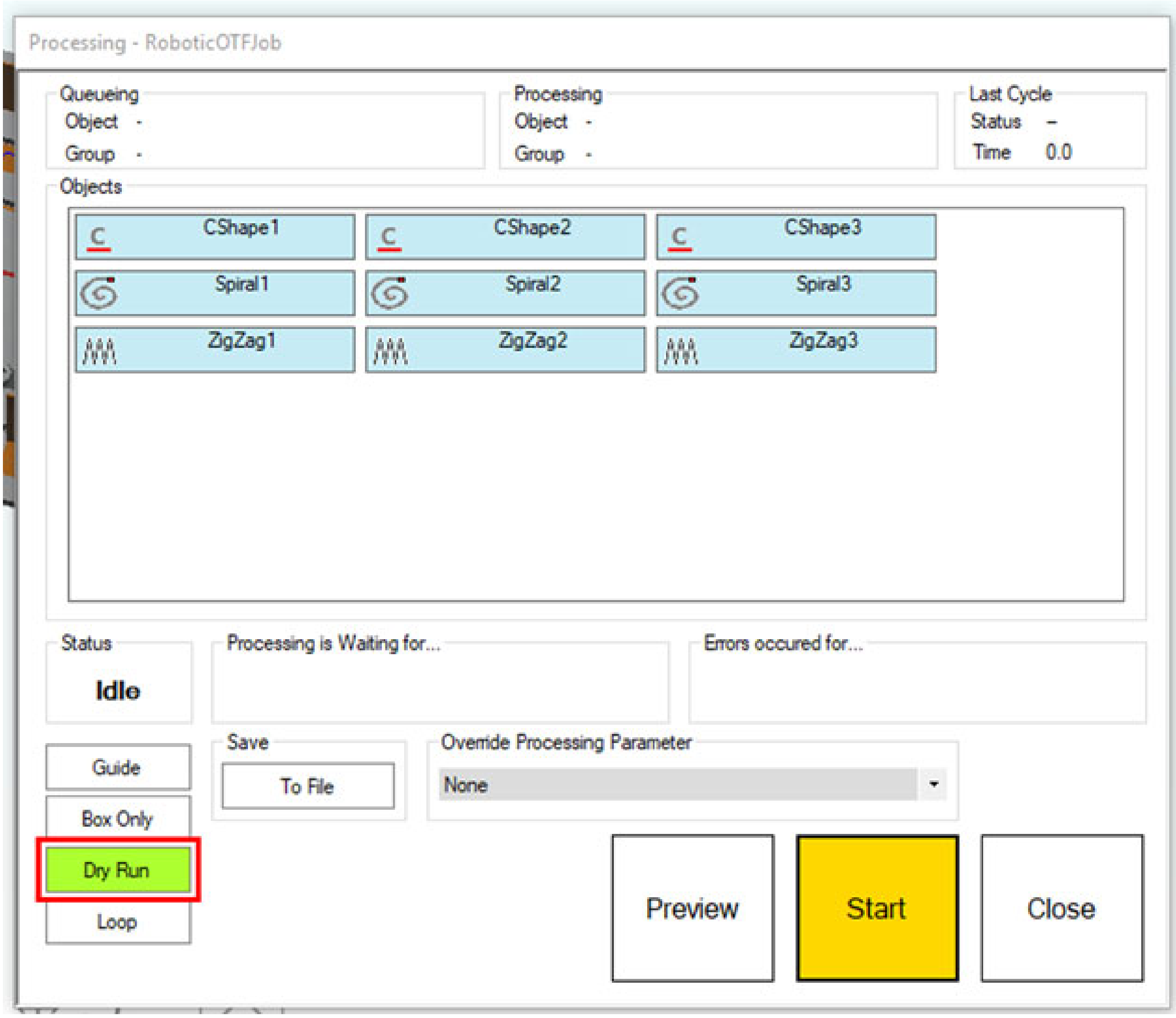


Figure 254: Start Processing

3. Select the "Dryrun" button. See Figure 255 (below).



Processing - RoboticOTFJob

Queueing
Object -
Group -

Processing
Object -
Group -

Last Cycle
Status –
Time 0.0

Objects

CShape1	CShape2	CShape3
Spiral1	Spiral2	Spiral3
ZigZag1	ZigZag2	ZigZag3

Status
Idle

Processing is Waiting for...

Errors occured for...

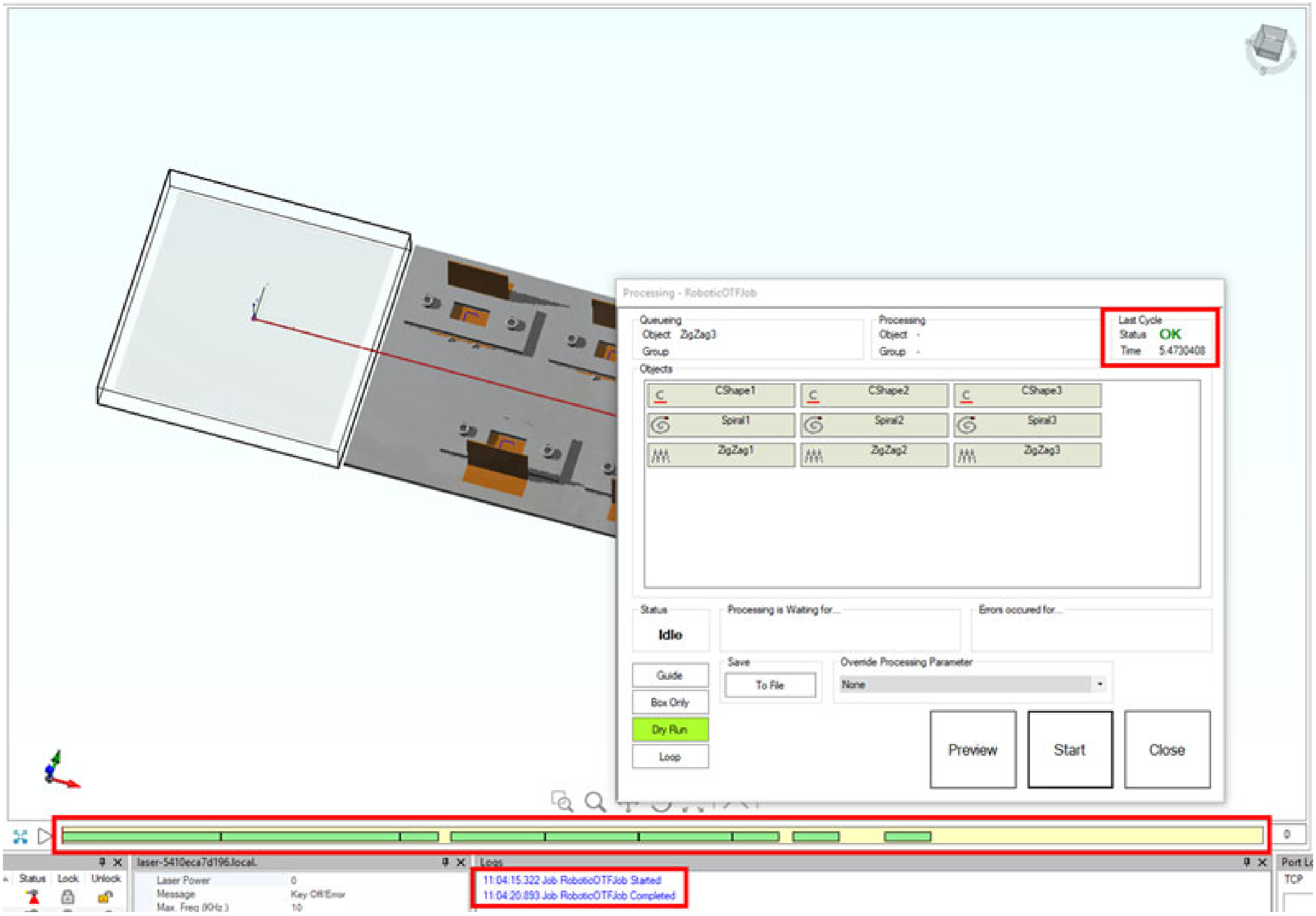
Save

Override Processing Parameter
None

Figure 255: Enabling Dryrun

4. Click "Start."

Figure 256 on page 244 demonstrates a successful Dryrun.



Processing - RoboticOTFJob

Queueing
Object ZigZag3
Group

Processing
Object -
Group -

Last Cycle
Status OK
Time 5.4730408

Status
Idle

Processing is Waiting for...

Errors occured for...

Save

Override Processing Parameter
None

laser-5410eca7d196.local.

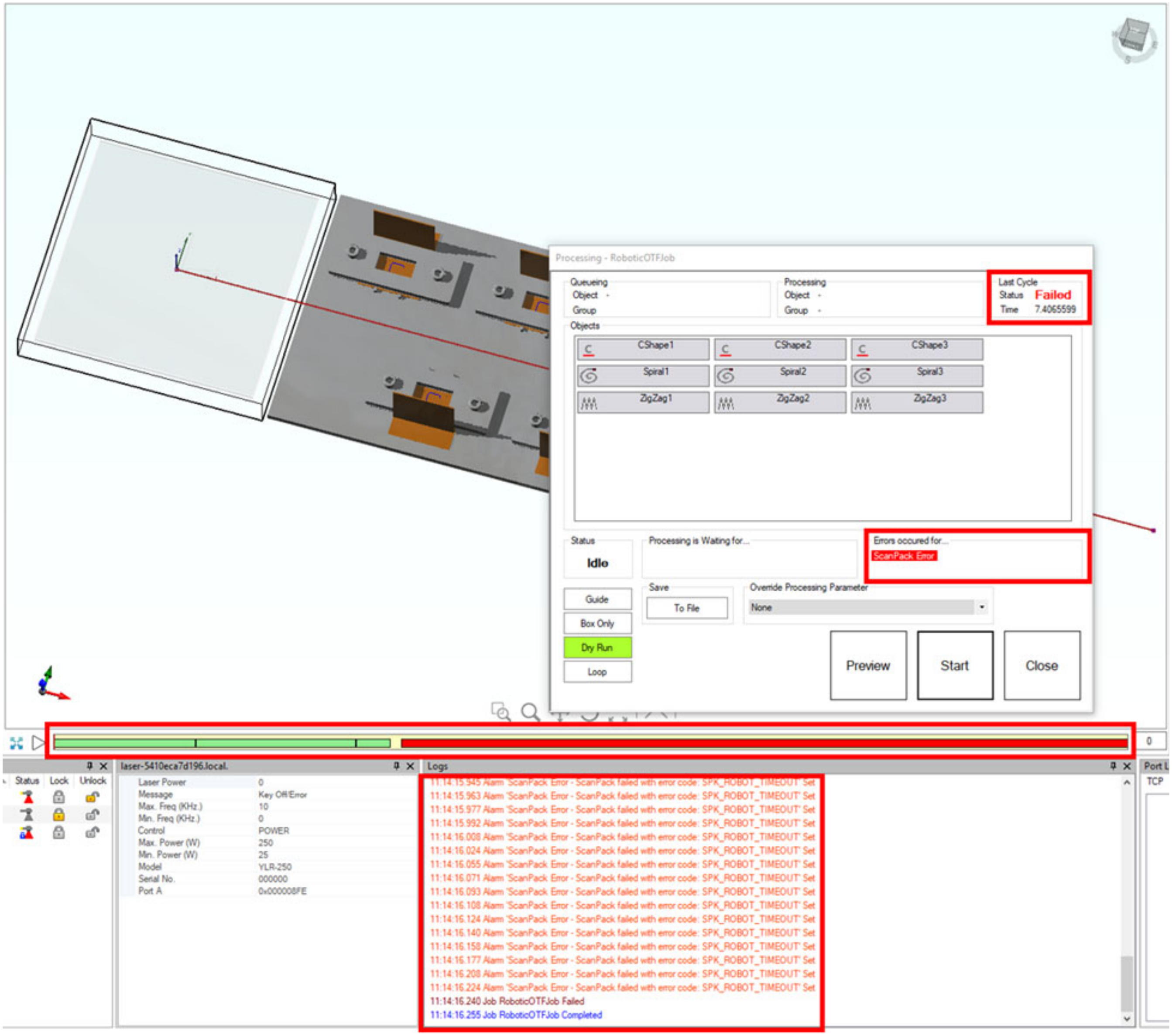
Laser Power	0
Message	Key Off/Error
Max. Freq (KHz.)	10

Logs

```
11:04:15.322 Job RoboticOTFJob Started
11:04:20.893 Job RoboticOTFJob Completed
```

Figure 256: Successful Dryrun Example

Figure 257 (below) demonstrates an unsuccessful Dryrun.



Queueing
Object -
Group

Processing
Object -
Group -

Last Cycle
Status Failed
Time 7.4065599

Objects

Status
Idle

Processing is Waiting for...

Errors occured for...
ScanPack Error

Save

Override Processing Parameter
None

laser-5410eca7d196.local.

Laser Power	0
Message	Key Off/Error
Max. Freq (KHz.)	10
Min. Freq (KHz.)	0
Control	POWER
Max. Power (W)	250
Min. Power (W)	25
Model	YLR-250
Serial No.	000000
Port A	0x000008FE

Logs

```
11:14:15.945 Alarm 'ScanPack Error - ScanPack failed with error code: SPK_ROBOT_TIMEOUT' Set
11:14:15.963 Alarm 'ScanPack Error - ScanPack failed with error code: SPK_ROBOT_TIMEOUT' Set
11:14:15.977 Alarm 'ScanPack Error - ScanPack failed with error code: SPK_ROBOT_TIMEOUT' Set
11:14:15.992 Alarm 'ScanPack Error - ScanPack failed with error code: SPK_ROBOT_TIMEOUT' Set
11:14:16.008 Alarm 'ScanPack Error - ScanPack failed with error code: SPK_ROBOT_TIMEOUT' Set
11:14:16.024 Alarm 'ScanPack Error - ScanPack failed with error code: SPK_ROBOT_TIMEOUT' Set
11:14:16.055 Alarm 'ScanPack Error - ScanPack failed with error code: SPK_ROBOT_TIMEOUT' Set
11:14:16.071 Alarm 'ScanPack Error - ScanPack failed with error code: SPK_ROBOT_TIMEOUT' Set
11:14:16.093 Alarm 'ScanPack Error - ScanPack failed with error code: SPK_ROBOT_TIMEOUT' Set
11:14:16.108 Alarm 'ScanPack Error - ScanPack failed with error code: SPK_ROBOT_TIMEOUT' Set
11:14:16.124 Alarm 'ScanPack Error - ScanPack failed with error code: SPK_ROBOT_TIMEOUT' Set
11:14:16.140 Alarm 'ScanPack Error - ScanPack failed with error code: SPK_ROBOT_TIMEOUT' Set
11:14:16.158 Alarm 'ScanPack Error - ScanPack failed with error code: SPK_ROBOT_TIMEOUT' Set
11:14:16.177 Alarm 'ScanPack Error - ScanPack failed with error code: SPK_ROBOT_TIMEOUT' Set
11:14:16.208 Alarm 'ScanPack Error - ScanPack failed with error code: SPK_ROBOT_TIMEOUT' Set
11:14:16.224 Alarm 'ScanPack Error - ScanPack failed with error code: SPK_ROBOT_TIMEOUT' Set
11:14:16.240 Job RoboticOTFJob Failed
11:14:16.255 Job RoboticOTFJob Completed
```

Figure 257: Unsuccessful Dryrun Example

Having the ability to Dryrun an OTF process allows users to examine the process prior to attempting to run it on the real system. Using both the Basic and Advanced Timelines, users can begin to analyze and optimize the process as required.

8.3.4.5.2 Basic Timeline

The purpose of the Basic Timeline is to provide users with a quick summary of process timings. It also serves as an indicator as to whether or not a Dryrun has been performed and whether or not the Dryrun passed or failed. The Basic Timeline is located directly below the IPGScan Canvas. See Figure 258 (below).

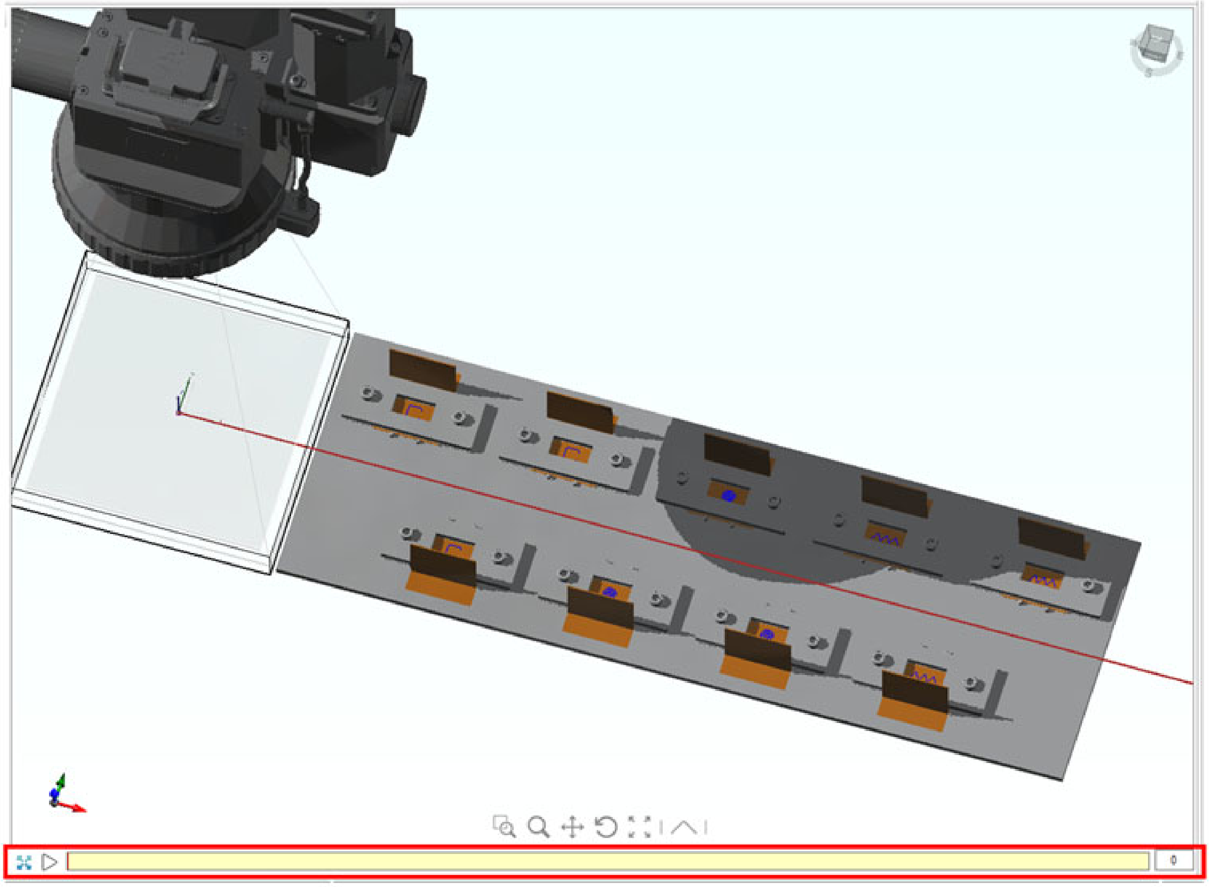


Figure 258: The Basic Timeline

The Basic Timeline offers the following functionality.

- Timeline Scrubbing – Users can click on the timeline and drag the mouse cursor to scrub through the timeline at a desired rate. See Figure 259 (below).

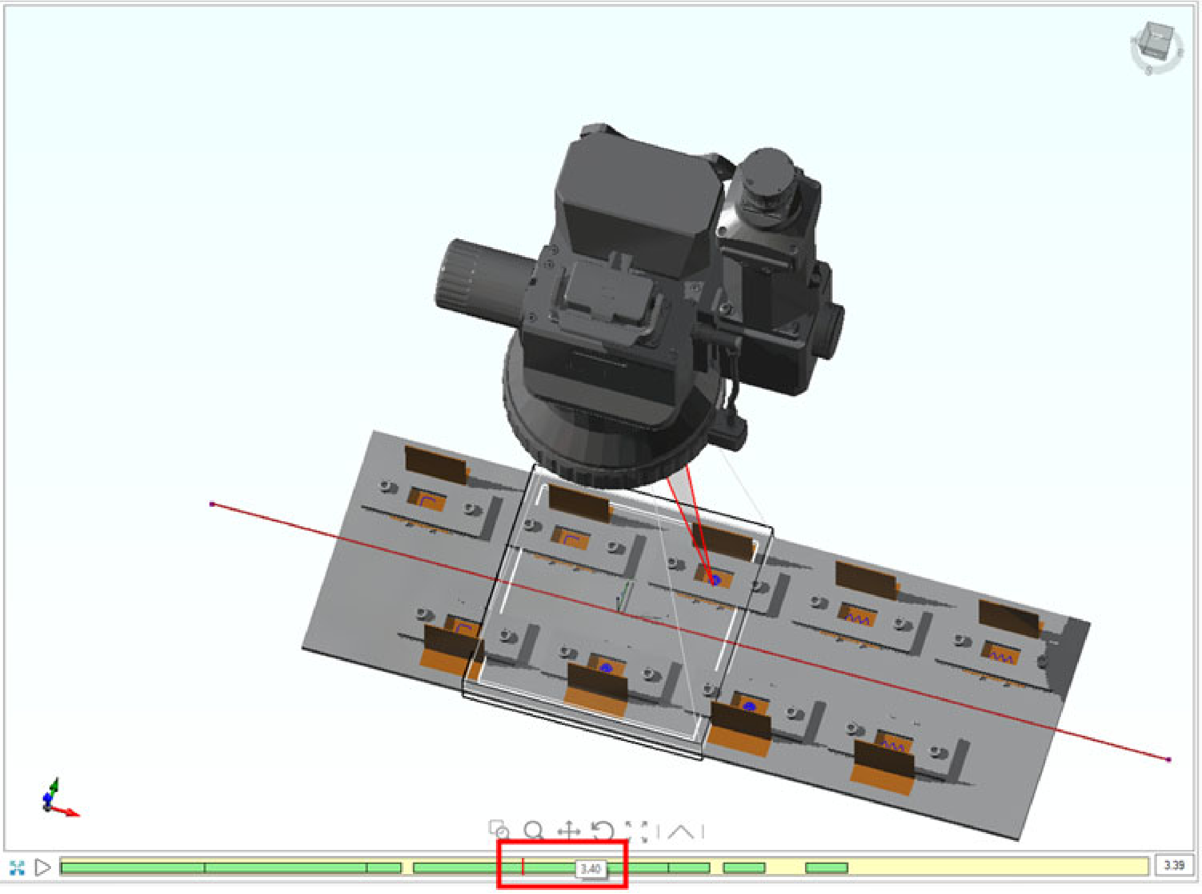
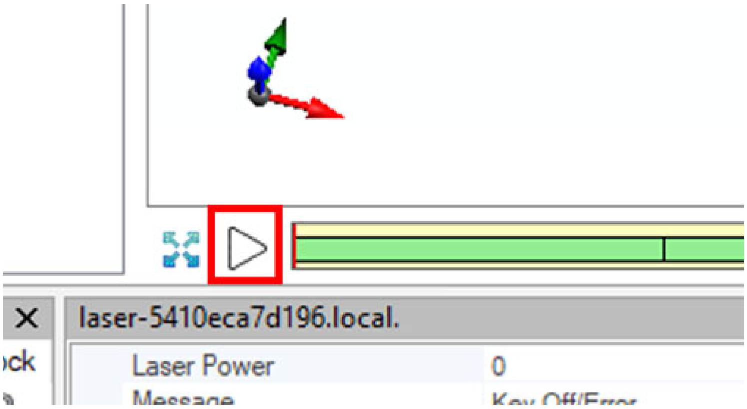


Figure 259: Scrubbing Along the Basic Timeline

- Play Button - Starts a loop of the process visualization. See Figure 260 (below).



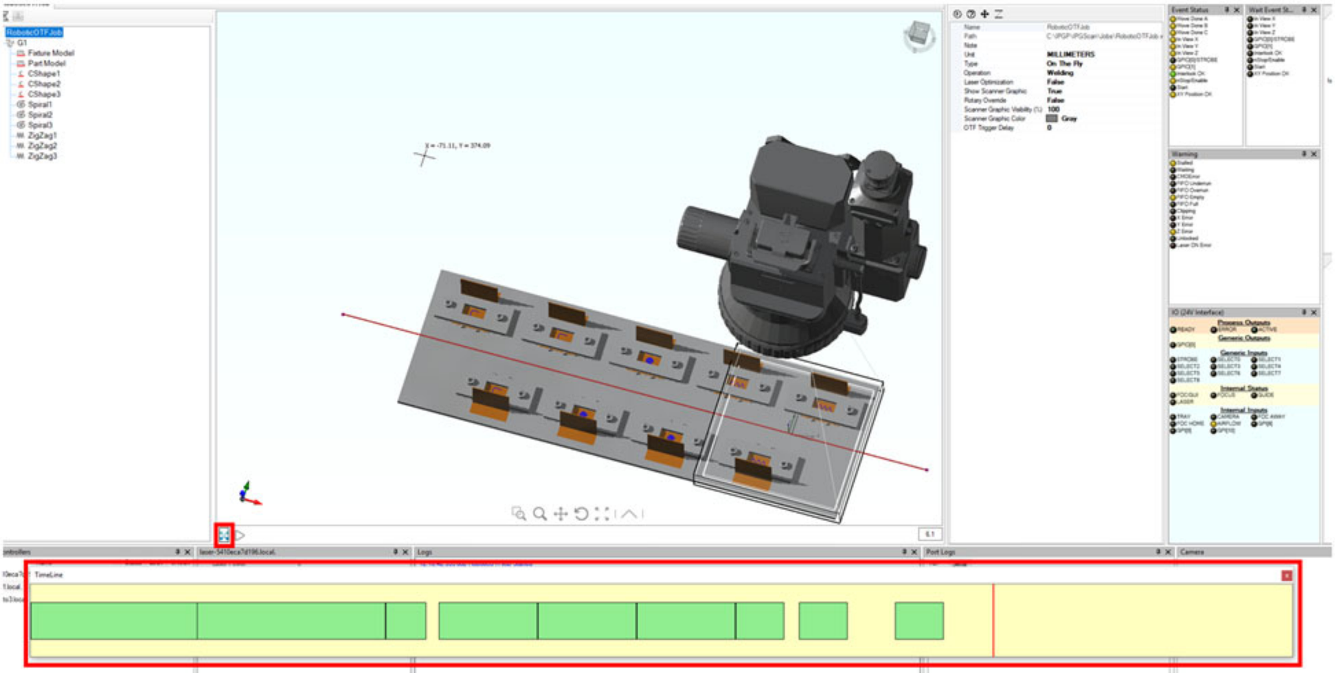
laser-5410eca7d196.local.

Laser Power 0

Message Key Off/Error

Figure 260: Basic Timeline Play Button

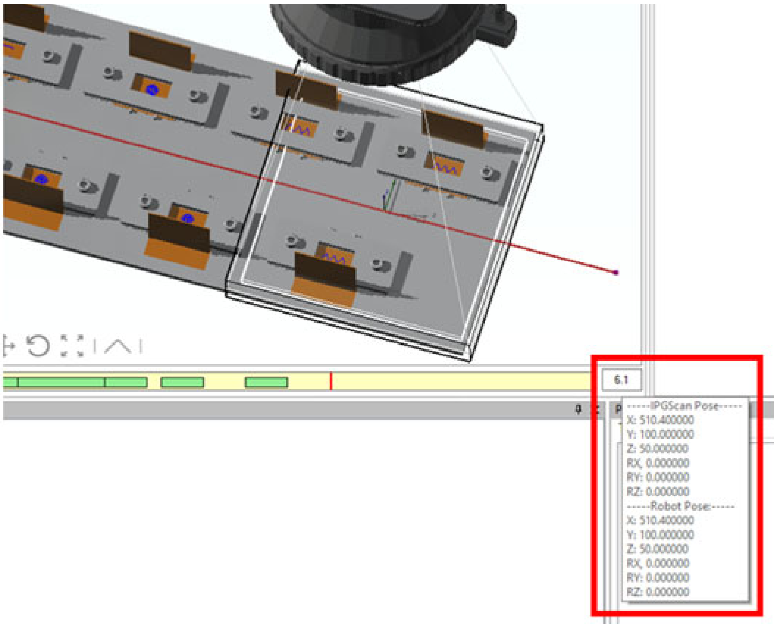
- Expansion Button - Allows users to break-out and expand the Basic Timeline. See Figure 261 (below).



Name	RoboticOTFJob
Path	C:\IPGP\IPGScan\Jobs\RoboticOTFJob
Note	
Unit	MILLIMETERS
Type	On The Fly
Operation	Welding
Laser Optimization	False
Show Scanner Graphic	True
Rotary Override	False
Scanner Graphic Visibility (%)	100
Scanner Graphic Color	▨ Gray
OTF Trigger Delay	0

Figure 261: Basic Timeline Expansion

- IPGScan and Robot Pose Data - Users can view the current IPGScan Pose and Robot Pose data of where the FOV lies along the trajectory by hovering the mouse cursor over the time display. See Figure 262 (below).



```
------IPGScan Pose------
X: 510.400000
Y: 100.000000
Z: 50.000000
RX, 0.000000
RY: 0.000000
RZ: 0.000000
------Robot Pose------
X: 510.400000
Y: 100.000000
Z: 50.000000
RX, 0.000000
RY: 0.000000
RZ: 0.000000
```

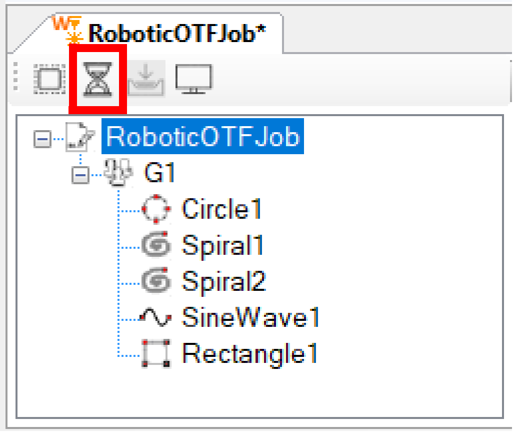
Figure 262: Basic Timeline IPGScan and Robot Pose Display

8.3.4.5.3 Advanced Timeline

The purpose of the Advanced Timeline is to provide users with a detailed summary of process timings. This includes details such as when an object is partially in the scanners FOV, when it is completely within the FOV, and when processing is taking place. Furthermore, the Advanced Timeline allows users to quickly change primary process parameters such as process object velocity, laser power, and delay timings. This can assist with quickly developing a process.

The following steps detail how users can access the Advanced Timeline.

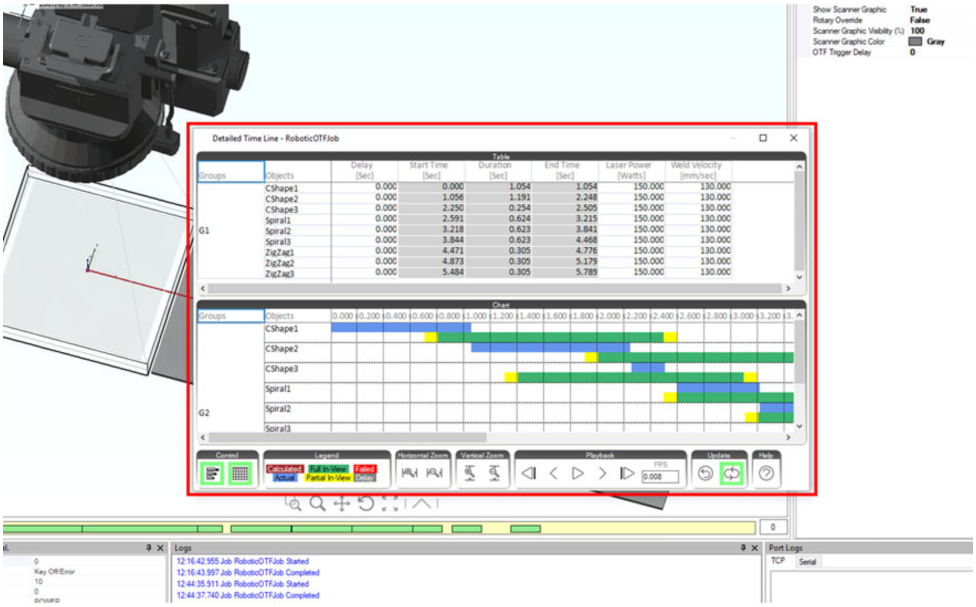
1. Open the desired OTF IPGScan job.
2. Click the "Time Line" button at the Top of the Job Tree. See Figure 263 (below).



```
RoboticOTFJob
  G1
    Circle1
    Spiral1
    Spiral2
    SineWave1
    Rectangle1
```

Figure 263: Advanced Timeline Button

The Advanced Timeline appears as an individual pop-up window which can be seen in Figure 264 (below).



Show Scanner Graphic	True
Rotary Override	False
Scanner Graphic Visibility (%)	100
Scanner Graphic Color	Gray
OTF Trigger Delay	0

Detailed Time Line - RoboticOTFJob

Table

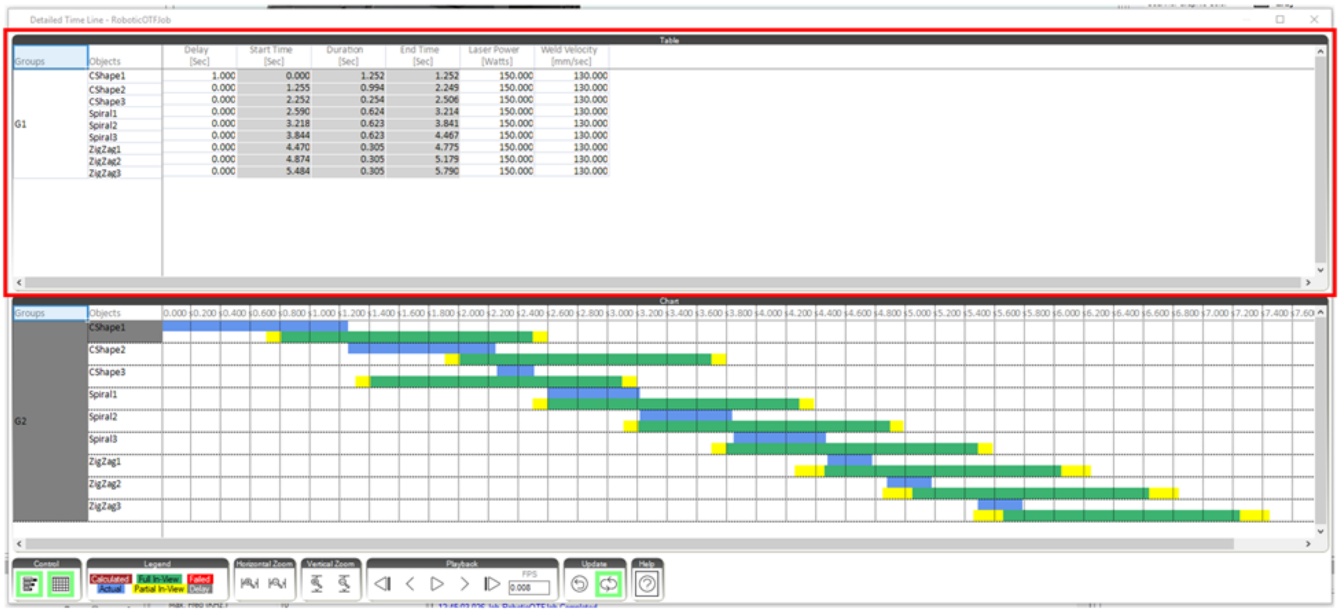
Groups	Objects	Delay [Sec]	Start Time [Sec]	Duration [Sec]	End Time [Sec]	Laser Power [Watts]	Weld Velocity [mm/sec]
G1	CShape1	0.000	0.000	1.054	1.054	150.000	130.000
	CShape2	0.000	1.056	1.191	2.248	150.000	130.000
	CShape3	0.000	2.250	0.254	2.505	150.000	130.000
	Spiral1	0.000	2.591	0.624	3.215	150.000	130.000
	Spiral2	0.000	3.218	0.623	3.841	150.000	130.000
	Spiral3	0.000	3.844	0.623	4.468	150.000	130.000
	ZigZag1	0.000	4.471	0.305	4.776	150.000	130.000
	ZigZag2	0.000	4.873	0.305	5.179	150.000	130.000
	ZigZag3	0.000	5.484	0.305	5.789	150.000	130.000

```
Logs
12:16:42.955 Job RoboticOTFJob Started
12:16:43.997 Job RoboticOTFJob Completed
12:44:35.911 Job RoboticOTFJob Started
12:44:37.740 Job RoboticOTFJob Completed
```

Figure 264: IPGScan Advanced Timeline

The Advanced Timeline offers the following functionality.

- Object Parameter Table - This outlines all the Process Objects within the job. Here users can find and modify primary parameters such as Laser Power and Weld Velocity. Users can also view Start, End, and Duration times. Additionally, users can easily modify delay timings for prior to object processing. See Figure 265 (below).



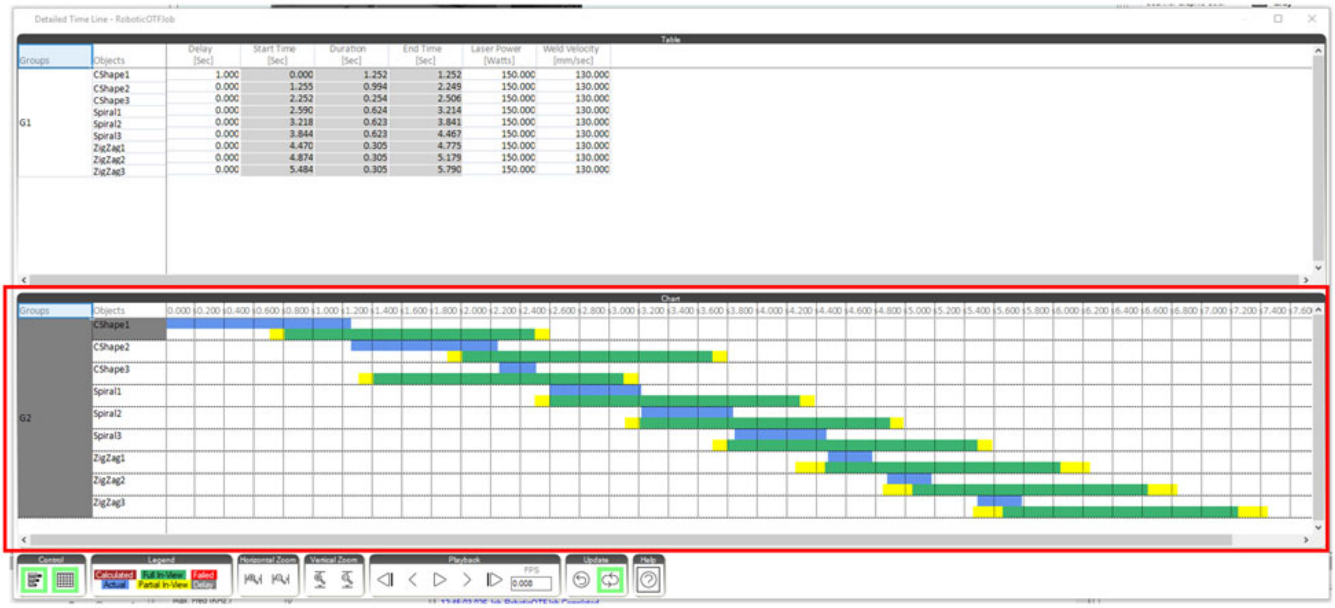
Detailed Time Line - RoboticOTFJob

Table

Groups	Objects	Delay [Sec]	Start Time [Sec]	Duration [Sec]	End Time [Sec]	Laser Power [Watts]	Weld Velocity [mm/sec]
G1	CShape1	1.000	0.000	1.252	1.252	150.000	130.000
	CShape2	0.000	1.255	0.994	2.249	150.000	130.000
	CShape3	0.000	2.252	0.254	2.506	150.000	130.000
	Spiral1	0.000	2.590	0.624	3.214	150.000	130.000
	Spiral2	0.000	3.218	0.623	3.841	150.000	130.000
	Spiral3	0.000	3.844	0.623	4.467	150.000	130.000
	ZigZag1	0.000	4.470	0.305	4.775	150.000	130.000
	ZigZag2	0.000	4.874	0.305	5.179	150.000	130.000
	ZigZag3	0.000	5.484	0.305	5.790	150.000	130.000

Figure 265: Object Parameter Table

- Timeline Graph - This outlines detailed process object timings. This allows users to efficiently adjust parameters to develop the process. See Figure 266 on page 251.
  - Legend - The Legend, which is positioned below the Timeline Graph, contains the color codes for the graph.
  - Horizontal and Vertical Zoom - Also positioned below the Timeline Graph, here users can use the Horizontal and Vertical Zoom tools to better examine process timings.

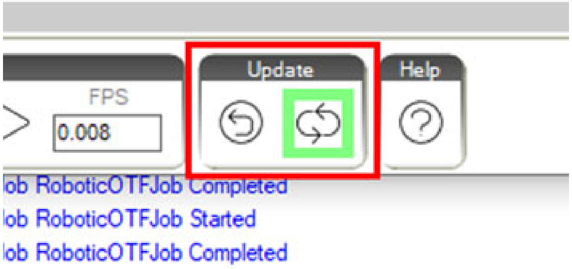


Detailed Time Line - RoboticOTFJob

Groups	Objects	Delay [Sec]	Start Time [Sec]	Duration [Sec]	End Time [Sec]	Laser Power [Watts]	Weld Velocity [mm/sec]
G1	CShape1	1.000	0.000	1.252	1.252	150.000	130.000
	CShape2	0.000	1.255	0.994	2.249	150.000	130.000
	CShape3	0.000	2.252	0.254	2.506	150.000	130.000
	Spiral1	0.000	2.590	0.624	3.214	150.000	130.000
	Spiral2	0.000	3.218	0.623	3.841	150.000	130.000
	Spiral3	0.000	3.844	0.623	4.467	150.000	130.000
	ZigZag1	0.000	4.470	0.305	4.775	150.000	130.000
	ZigZag2	0.000	4.874	0.305	5.179	150.000	130.000
	ZigZag3	0.000	5.484	0.305	5.790	150.000	130.000

Figure 266: Timeline Graph

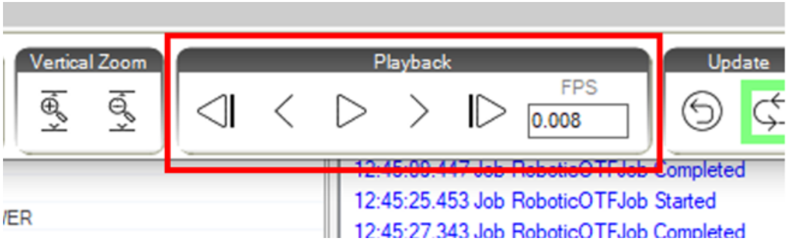
- Update Buttons - Two buttons exist for updating the Timeline Graph. By default, Automatic update is enabled. This function causes the Timeline Graph to update automatically anytime a Process Object's parameters are updated. A single instance update button also exists, if users choose to disable the automatic update functionality. See Figure 267 (below).



ob RoboticOTFJob Completed
Job RoboticOTFJob Started
Job RoboticOTFJob Completed

Figure 267: Timeline Update Buttons

- Playback - The Playback buttons allow users to start a process play through or step through the process visualization. The speed for which the play through occurs is based on the defined FPS value. See Figure 268 (below).



12:45:09.447 Job RoboticOTFJob Completed
12:45:25.453 Job RoboticOTFJob Started
12:45:27.343 Job RoboticOTFJob Completed

Figure 268: Timeline Playback Buttons

8.3.4.5.4 Common Process Failures

When developing a process, users will typically need to perform numerous Dryruns to view how the process is changing based on setup details. During this process, it is not uncommon to encounter process errors until the process is dialed in.

The following outlines some of the common errors that can be encountered in the Logs window during the Dryrun process as users develop the OTF process.

- "Robot Trajectory is Missing!" - Users need to upload a simulated trajectory or real robot trajectory to the job prior to attempting to Dryrun or start processing.
- "SPK_ROBOT_TIMEOUT" - This typically indicates that there was not enough time for the scanner to complete the process.
  - Potential Resolutions:
    - Job Tree Process Object Order - Ensure that any Process Objects prior to the object that failed were able to successfully pass the Dryrun.
    - Position - Ensure that the Process Object that fails falls completely within the scanner's In-View window.
    - Expand the In-View Window - If the user does not have beam angle restrictions and if the In-View Window is smaller than the default scanner FOV, users can increase the size of the In-View Window to allow more time for the objects to be processed.
    - Robot or Process Object Velocity - Try to reduce the robot trajectory (simulated or real) velocity or the Process Object velocity. By reducing either of these velocities, the process should have more time to complete.
- "SPK_INVALID_INVIEW" - This typically indicates that users have not uploaded the CoordinationParams.xml file using the Scan Controller Utility to the scanner.
  - See Section 8.3.3 ("Scan Controller Requirements") on page 220 for details on uploading the CoordinationParams file.

8.3.4.6 Connecting to a Robot

Once users are ready to move to the real world setup, it is necessary to establish a connection with the robot. The following items entail the functionality within IPGScan that requires a connection with the robot.

- Performing the IPGScan and Robot Calibration
- Capturing a robot trajectory to be uploaded to a OTF job
- Robot Tracking functionality
- Part Alignment for STL functionality
- Alignment Window functionality

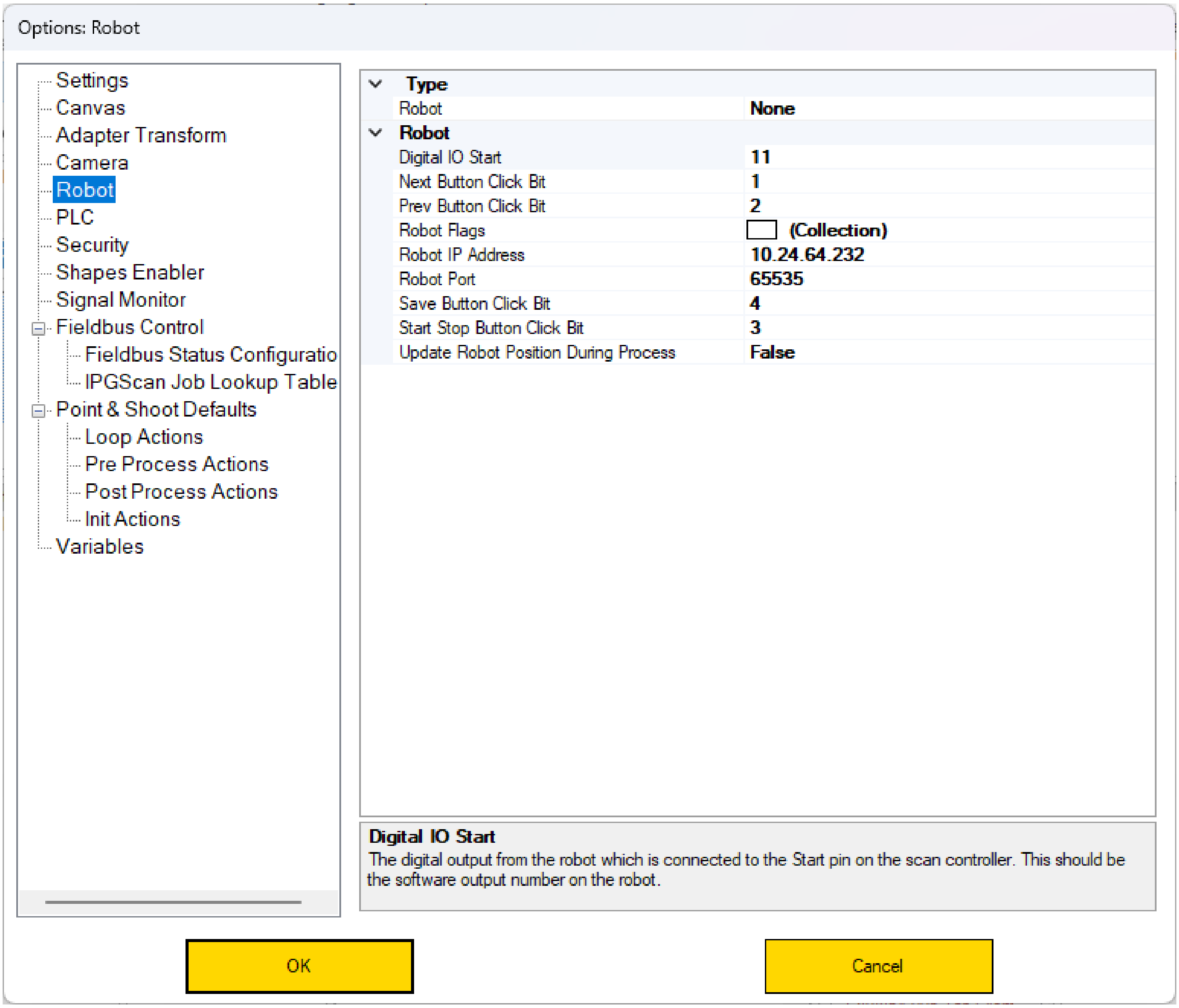
IMPORTANT A connection with the robot is not a requirement for running production repeatedly. The connection is only required during the setup of the process.

The following sections outline the options for robot setup within IPGScan as well as how to connect to a robot.

8.3.4.6.1 IPGScan Robot Options

Prior to connecting to a robot, users must first set up the Robot Options within IPGScan. The following steps outline where users can find the Robot Options:

1. Open IPGScan.
2. Click "View."
3. Click "Options."
4. Select "Robot." See Figure 269 (below).



Type	
Robot	None
Robot	
Digital IO Start	11
Next Button Click Bit	1
Prev Button Click Bit	2
Robot Flags	□ (Collection)
Robot IP Address	10.24.64.232
Robot Port	65535
Save Button Click Bit	4
Start Stop Button Click Bit	3
Update Robot Position During Process	False

Digital IO Start

The digital output from the robot which is connected to the Start pin on the scan controller. This should be the software output number on the robot.

Figure 269: IPGScan Robot Options

Table 27 (below) details each of the available options for setup of the robot.

Table 27: Robot Option Settings

OPTION	DESCRIPTION
Robot	The type of robot. To turn off robot related functions, set this to 'None.'
Digital IO Start	The digital output from the robot, connected to the START bit on the Scan Controller (via an External Interface device). This should be the software output number on the robot.
Next Button Click Bit	The output from the robot which is read by IPGScan to move to the next Process Object during alignment. This should be the bit number on the Scan Controller. *Optional functionality.*
Prev Button Click Bit	The output from the robot which is read by IPGScan to move to the previous Process Object during alignment. This should be the bit number on the Scan Controller. *Optional functionality.*
Robot Flags	Which robot output values should be recorded and used as coordination flags in a trajectory. These do not have to be connected to the Scan Controller. *Optional functionality.*
Robot IP Address	The IP Address of the robot.
Robot Port	The communication port to the robot. Not required for all robot types.
Save Button Click Bit	The output from the robot which is read by IPGScan to save the current position to the current processing object during alignment. This should be the bit number on the Scan Controller. *Optional functionality.*
Start Stop Button Click Bit	The output from the robot which is read by IPGScan to start or stop outputting the current Process Object during alignment. This should be the bit number on the Scan Controller. *Optional functionality.*
Update Robot Position During Processing	Enables/disables the FOV display traversing along the trajectory when processing is taking place. By default, this feature is disabled to reduce computer CPU load.

IMPORTANT Upon updating Robot Options, users should close and reopen IPGScan.

8.3.4.6.2 Robot Connection and Status

Once robot setup is complete and the proper Robot Options are configured, the user can connect to the robot. The following details how users can connect to the robot in IPGScan.

1. In the Tool Bar, click the robot icon.
2. Click "Connect." See Table 270 (below).

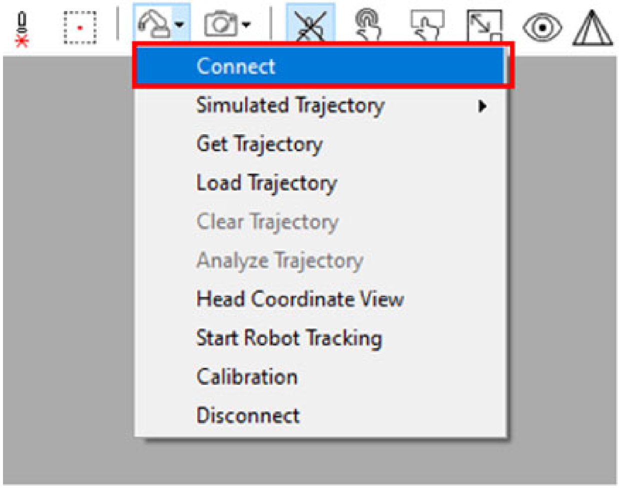
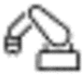
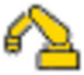
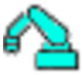


Figure 270: Connecting to a Robot

When connected to a robot, users may notice that the robot icon changes colors in the IPGScan Tool Bar. Outlines the different statuses based on each color.

Table 28: Robot Icon Color Changes in the IPGScan Tool Bar

ICON	DESCRIPTION
	Disconnected
	Connected with the robot but no data is being received
	Connected with the robot and data is being received

- Connecting to a robot in IPGScan varies from one brand of robot to another. The following details how to connect to each specific type of robot.

IMPORTANT

[IPGScan] – Indicates an action taken via the IPGScan interface.

[Robot] – Indicates an action taken via the robots interface.

8.3.4.6.2.1 FANUC

Robot Server

1. Click "Robot" in the Tool Bar **[IPGScan]**
2. Click "Connect" **[IPGScan]**

KAREL

1. Run the program "IPG_COMM" from the SELECT Menu **[Robot]**
2. Click "Robot" in the Tool Bar **[IPGScan]**
3. Click "Connect" **[IPGScan]**
   - **NOTE:** If the connection fails, try running the program "IPG_ABORT" before running "IPG_COMM" **[Robot]**

8.3.4.6.2.2 Yaskawa Motoman

1. Click "Robot" in the Tool Bar **[IPGScan]**
2. Click "Connect" **[IPGScan]**

8.3.4.6.2.3 KUKA

1. Click "Robot" in the Tool Bar **[IPGScan]**
2. Click "Connect" **[IPGScan]**
   - When "Connect" is clicked within IPGScan and configured for a KUKA robot, the icon will turn yellow. This tells IPGScan to listen for data from the KUKA robot. When IPGScan receives data, the icon will turn blue. When IPGScan stops receiving data, the icon will turn yellow. The icon will update while other operations are executing within IPGScan such as performing the IPGScan and Robot calibration and capturing a trajectory.
3. Run IPG_OTF_BEGIN_DATA_XFER **[Robot]**
   - This sub module initializes and begins RSI. When you run this program, you will get a KUKA error RSI 999. In the event of this error, stop running the KUKA program, acknowledge the error, and resume running the program.

KUKA Connection Notes

Both IPG_OTF_BEGIN_DATA_XFER and IPG_OTF_END_DATA_XFER require a Boolean value as a parameter. RSI will only be started when the parameter is true. During teaching either the robot trajectory or process positions in IPGScan, pass the value true to send data from the robot. During execution and production, pass the value false to avoid the KUKA error RSI 999 and 2 second wait.

Stopping Data Transmission

To stop sending data from the KUKA robot, run IPG_OTF_END_DATA_XFER. This program contains a 2 second wait. This gives the robot enough extra time to finish sending data when recording a trajectory. RSI will also stop when the current KUKA program ends.

ABB

1. Click "Robot" in the Tool Bar **[IPGScan]**
2. Click "Connect" **[IPGScan]**

8.3.4.7 IPGScan and Robot Workspace Calibration

The calibration process creates an origin for IPGScan OTF jobs. The robot trajectory and all processing objects are in reference to this IPGScan origin.

IMPORTANT

An accurate Tool Center Point (TCP) is required for Calibration.

The robot TCP axis should be aligned so they are square to the physical scan head.

Users must be able to connect to the robot in IPGScan prior to performing the calibration.

To best utilize exporting simulated robot trajectories, it is recommended that users align the Robot user frame with the IPGScan world. In other words, utilize the same robot points used to teach the robot user frame for the calibration between IPGScan and the robot.

The following procedures outlines how to perform the IPGScan and Robot Calibration.

1. Click on the robot icon in the Tool Bar.
2. Click "Calibration." See Figure 271 (below).

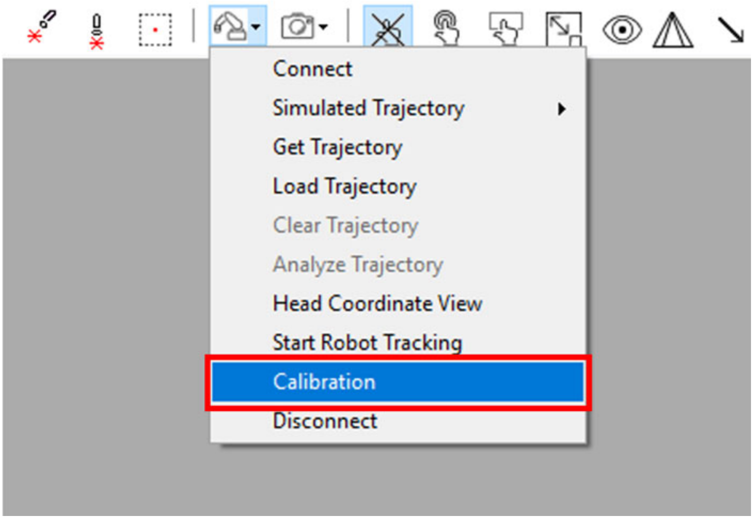
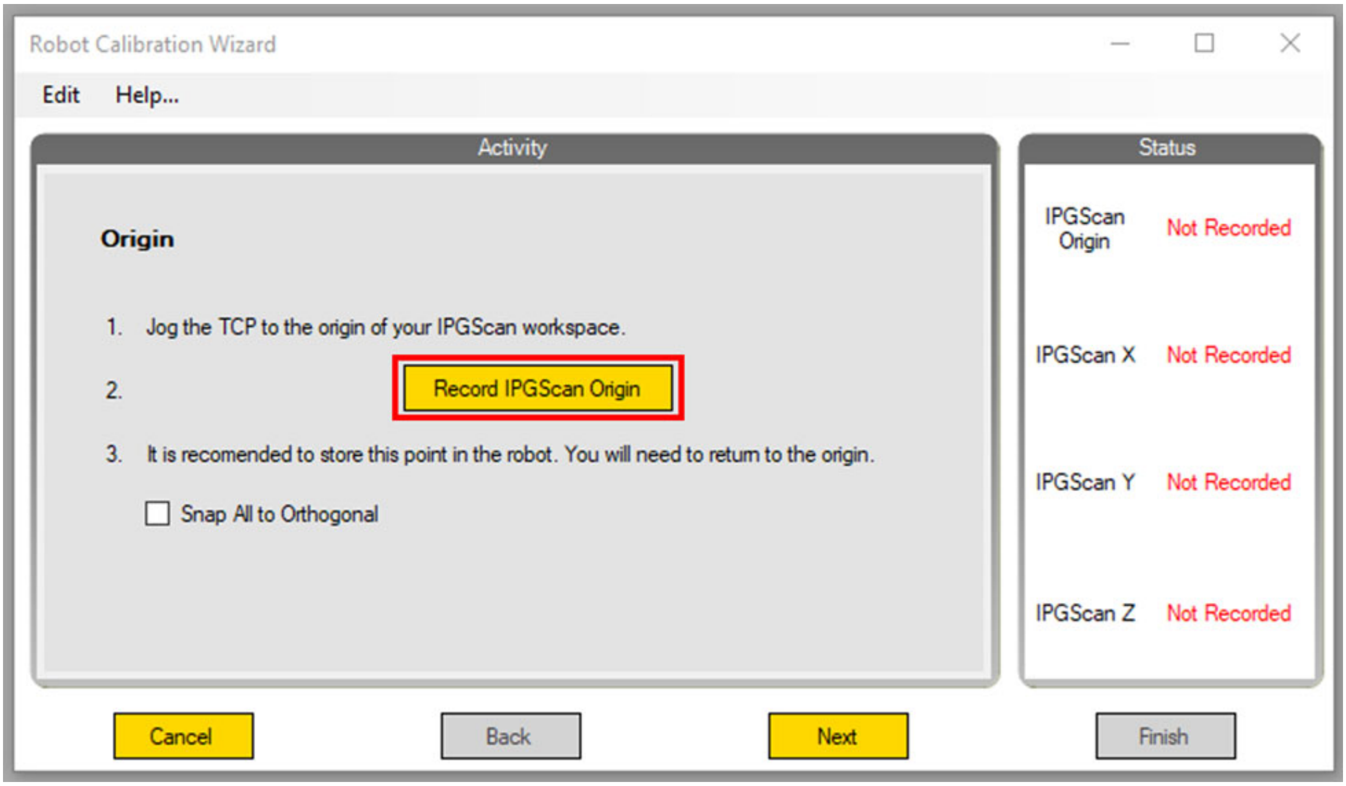


Figure 271: Opening the Calibration Wizard

3. On the first page, the origin is recorded (see Figure 272). The origin can be anywhere within the robot's work area. When the robot is positioned, click the "Record IPGScan Origin" button. On the right window, it should now display that the IPGScan Origin is recorded.
   – Snap All to Orthogonal - Checking this box will snap all angles to the nearest multiple of 90°, which helps to reduce minor errors in positional feedback. *Optional.*



Origin

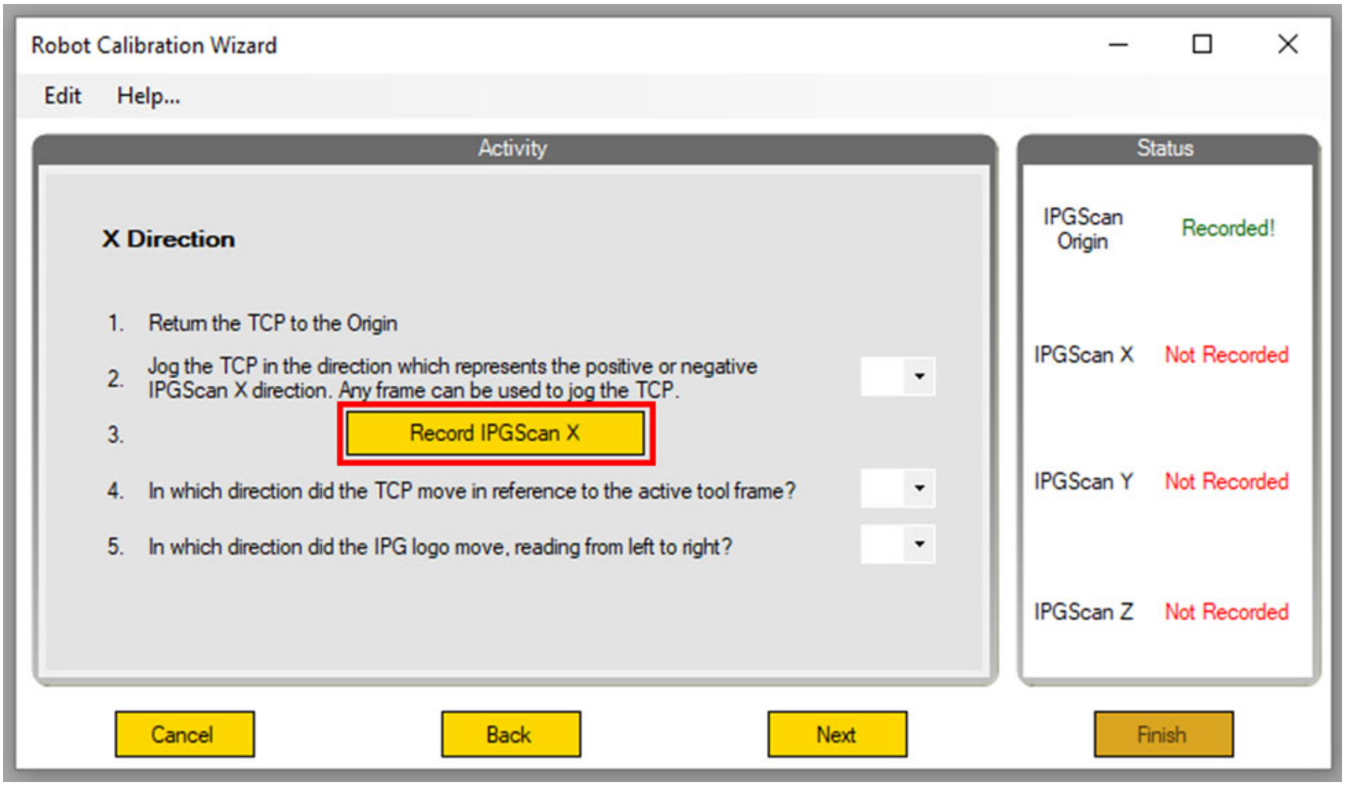
1. Jog the TCP to the origin of your IPGScan workspace.
2.
3. It is recomended to store this point in the robot. You will need to return to the origin.

□ Snap All to Orthogonal

IPGScan Origin: Not Recorded
IPGScan X: Not Recorded
IPGScan Y: Not Recorded
IPGScan Z: Not Recorded

Figure 272: Calibration Wizard Origin

4. Click "Next."
5. On each of the following screens, the IPGScan X, Y, and Z references are set. The robot must start at the origin before recording the new position on each page (see Figure 273 on page 259).



Robot Calibration Wizard

Edit Help...

X Direction

1. Return the TCP to the Origin
2. Jog the TCP in the direction which represents the positive or negative IPGScan X direction. Any frame can be used to jog the TCP.
3. Record IPGScan X
4. In which direction did the TCP move in reference to the active tool frame?
5. In which direction did the IPG logo move, reading from left to right?

IPGScan Origin	Recorded!
IPGScan X	Not Recorded
IPGScan Y	Not Recorded
IPGScan Z	Not Recorded

Figure 273: Calibration Wizard X, Y, Z Axis

6. First, return the robot to the origin.
7. The second step requires the robot to be moved in only the X, Y, or Z direction, with respect to the desired IPGScan reference frame. For instance, if users are aligning the IPGScan world to the robot user frame, they should jog about one of the robot user frame axis to define the desired frame direction in IPGScan.
8. When the robot is positioned, click the "Record IPGScan ..." button to record that axis.
9. Set the direction for which the robot was moved with respect to the robots TCP frame. Figure 274 on page 260 provides an example of how the robot TCP frames may be aligned.

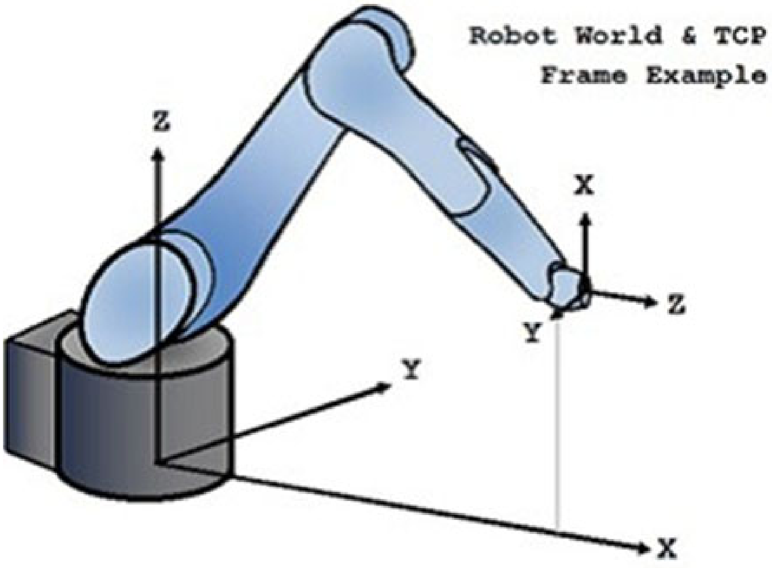


Figure 274: Robot World & TCP Example

10. Set the direction for which the IPG Logo (located on the front of the scan head) moved. See Figure 275 (below).

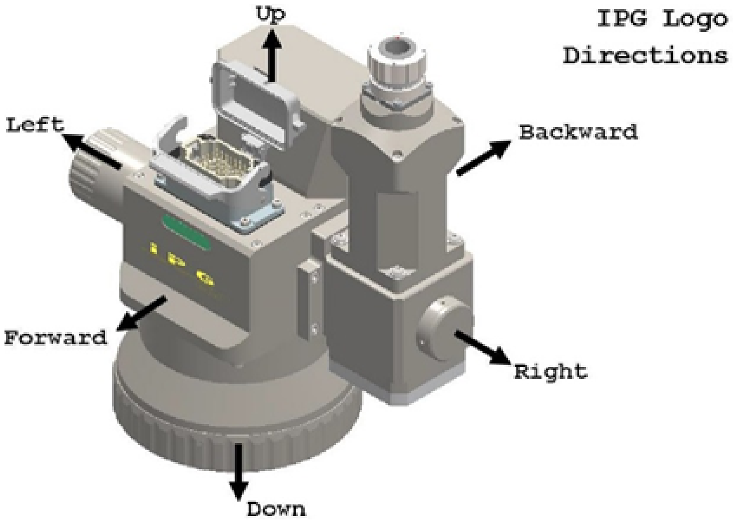


Figure 275: IPG Scan Head Logo Directions

11. When all points have been recorded, click "Finish."

8.3.4.7.1 Robot Manufacturer Specific Calibration Notes

The following sections detail specific notes to be aware of when calibrating specific brands of robots.

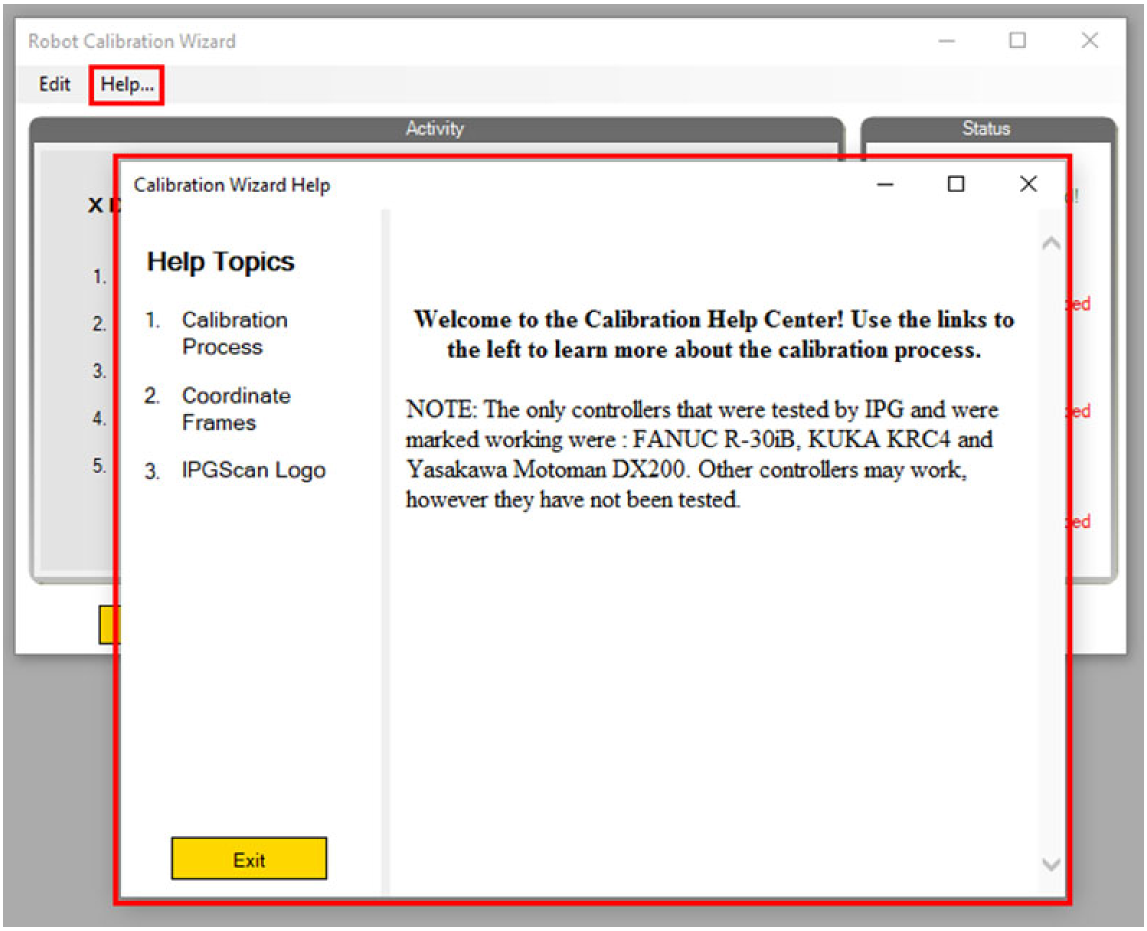
8.3.4.7.1.1 KUKA

When calibrating IPGScan with a KUKA robot, RSI must be started before the robot can send information to the PC. A suggested method for IPGScan workspace calibration can be found in the robot module "IPG_OTF_CALIBRATION." The point P1 should be saved as the IPGScan workspace origin.

The module "IPG_OTF_CALIBRATION" first starts RSI and then moves to the origin. There is a 10 second wait after the first PTP move. This wait proves the robot operator time to pause execution of the module. When execution of the module is paused, the robot can be jogged and RSI will continue to facilitate communication between the robot and the PC.

8.3.4.7.2 Calibration Wizard "Help" Pop-Up

Within the calibration wizard, users can open a "Help" dialogue pop-up that provides additional details for the calibration process. See Figure 276 (below).



Help Topics

1. Calibration Process
2. Coordinate Frames
3. IPGScan Logo

Welcome to the Calibration Help Center! Use the links to the left to learn more about the calibration process.

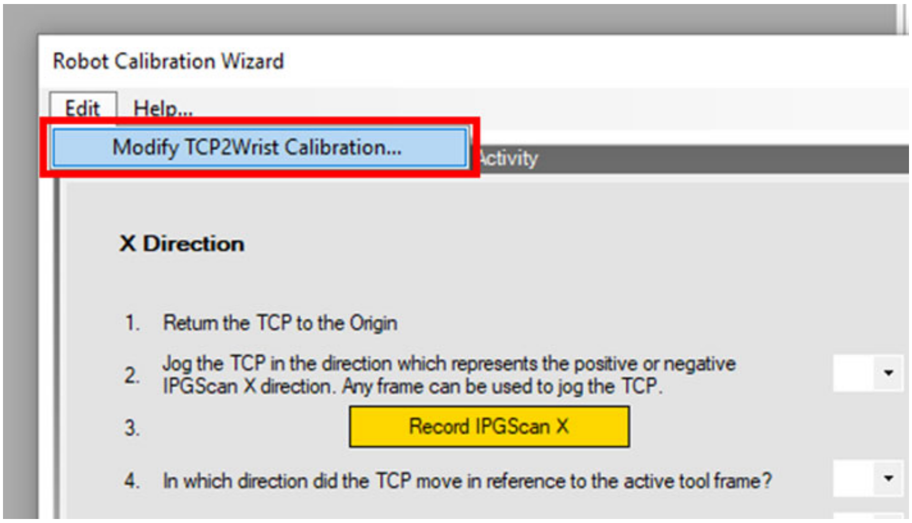
NOTE: The only controllers that were tested by IPG and were marked working were : FANUC R-30iB, KUKA KRC4 and Yasakawa Motoman DX200. Other controllers may work, however they have not been tested.

Figure 276: Calibration Wizard "Help" Pop-Up

8.3.4.7.3 Calibration Wizard "Modify Calibration File" Pop-Up

Users can open a wizard to modify an existing TCP2Wrist calibration file. This can be done using the following procedure from the Calibration Wizard.

1. Click "Edit."
2. Click "Modify TCP2Wrist Calibration." See Figure 277 (below).

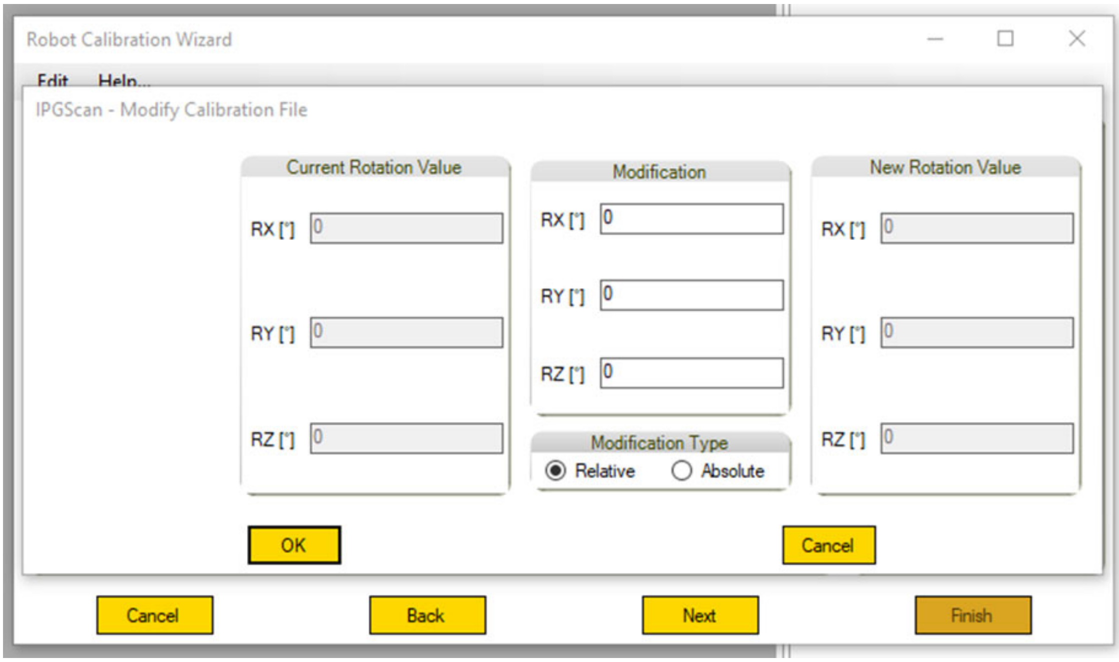

Robot Calibration Wizard

X Direction

1. Return the TCP to the Origin
2. Jog the TCP in the direction which represents the positive or negative IPGScan X direction. Any frame can be used to jog the TCP.
3. Record IPGScan X
4. In which direction did the TCP move in reference to the active tool frame?

Figure 277: Opening the "Modify Calibration File" Window

Within the Modify Calibration File pop-up, users can modify an existing TCP2Wrist calibration file by entering the desired offsets in the Modification input and by clicking ok. See Figure 278 (below).


Robot Calibration Wizard

IPGScan - Modify Calibration File

Current Rotation Value		Modification		New Rotation Value	
RX [°]	0	RX [°]	0	RX [°]	0
RY [°]	0	RY [°]	0	RY [°]	0
RZ [°]	0	RZ [°]	0	RZ [°]	0

Modification Type: ● Relative ○ Absolute

Figure 278: Modify Calibration File Window

8.3.4.8 Part Alignment for STL

Once users have performed the IPGScan and Robot calibration, it is now possible to perform Part Alignment for STL. This functionality allows users to quickly snap CAD models, Process Objects, and simulated trajectories in the proper location in IPGScan that corresponds with the real world. In doing this, users are then able to align the software/offline world with the real world.

The following steps outline how to perform STL alignment in IPGScan.

1. Open or create an IPGScan "On The Fly" type job.
2. Connect to the desired robot and perform a calibration if not already done.
   – For this demonstration, the IPGScan world was calibrated according to a 1230mm x 610mm piece of sheet metal (see Figure 279), which is the typical working area for this robot setup.

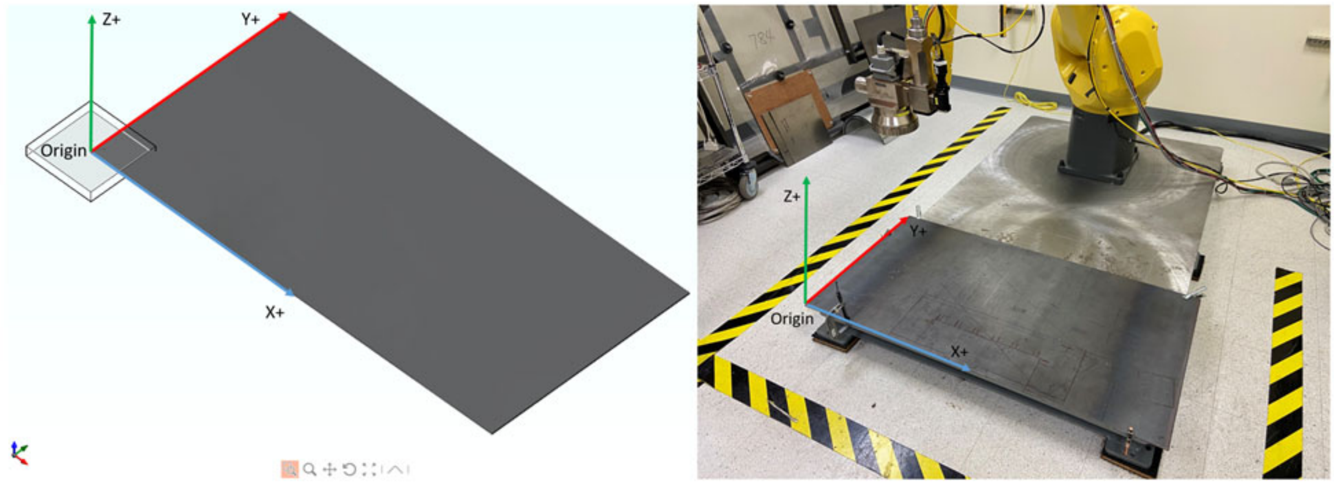


Figure 279: IPGScan and Real World Calibration

3. Import the desired STL model into IPGScan.
   - This demonstration utilizes a fixture with coupons clamped in it. See Figure 280 (below).

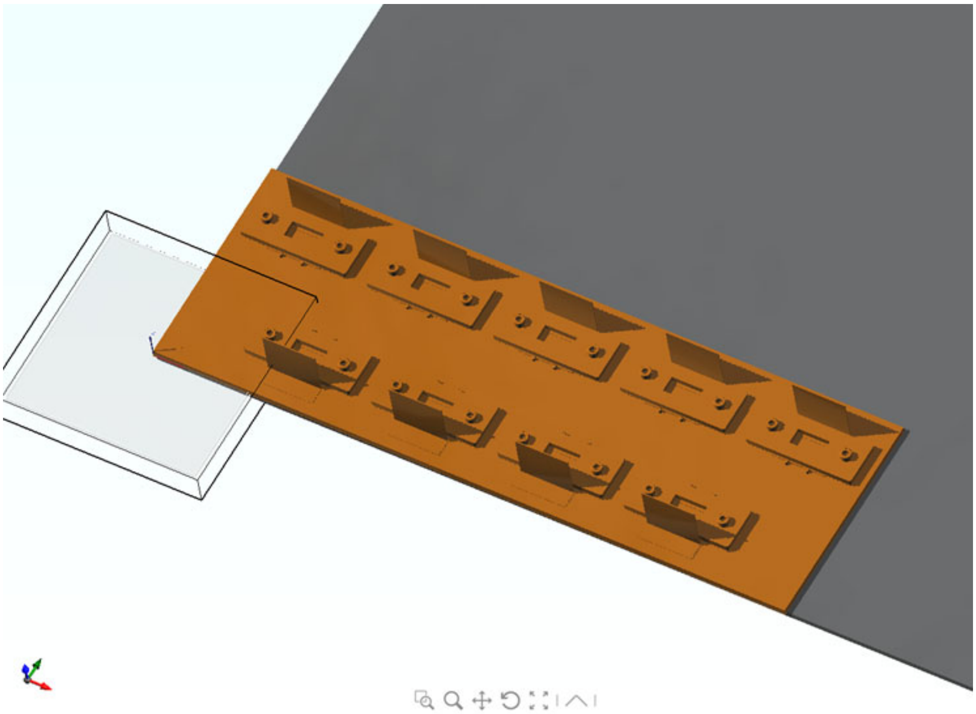


Figure 280: Importing and STL Model

4. (Optional) Place any desired process objects (i.e. welds) along the STL model. See Figure 281 (below).

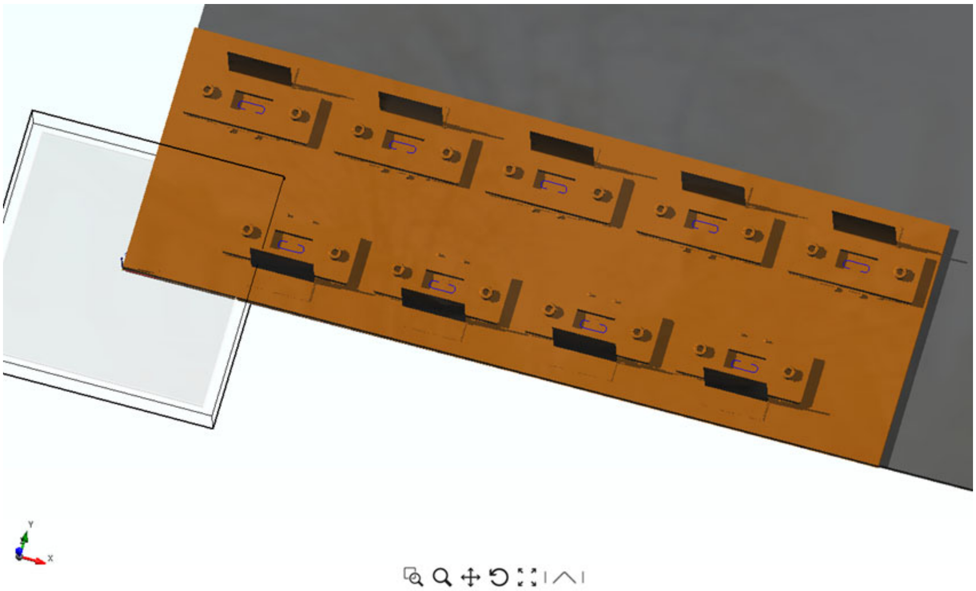


Figure 281: Placing Process Objects Relative to an STL Model

5. Next, the user will need to determine a minimum of three points to calibrate the "real world" part to the IPGScan STL model.
6. Right click the STL name of the model to be calibrated in the Job Tree. Click on "Part Alignment for STL" as seen in Figure 282 (below). This will open the STL Alignment Window.

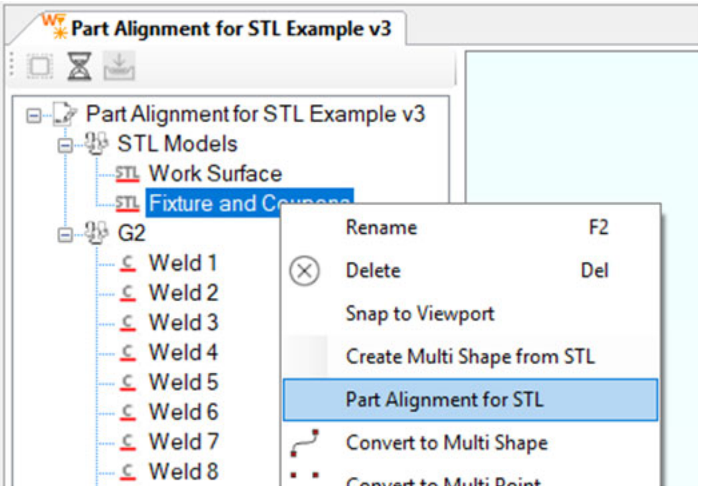
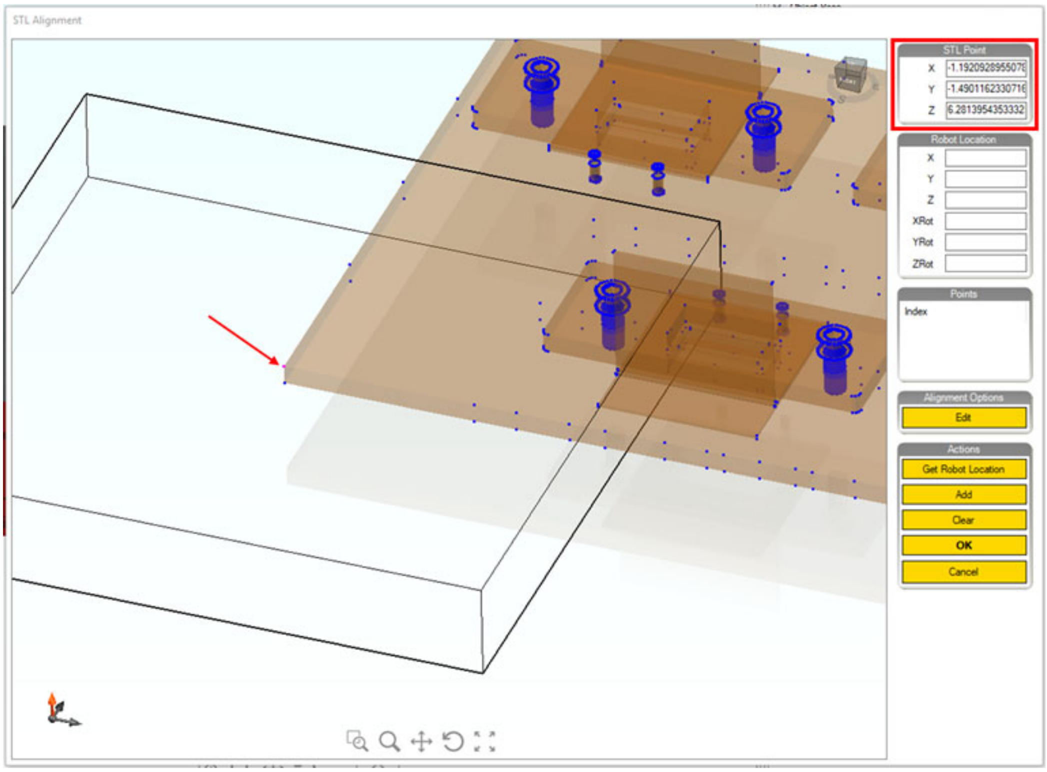


Figure 282: Part Alignment for STL

7. Select a defined point on the STL model to calibrate (see Figure 283). Notice the "STL Point" data pane populates with the selected points pose.



STL Point
X -1.1920928955078
Y -1.4901162330716
Z 6.2813954353332

Figure 283: Selecting a Point to Calibrate

8. Jog the robots TCP to the defined point on the STL model in the "real world." This will look similar to what is seen in Figure 284 (below).

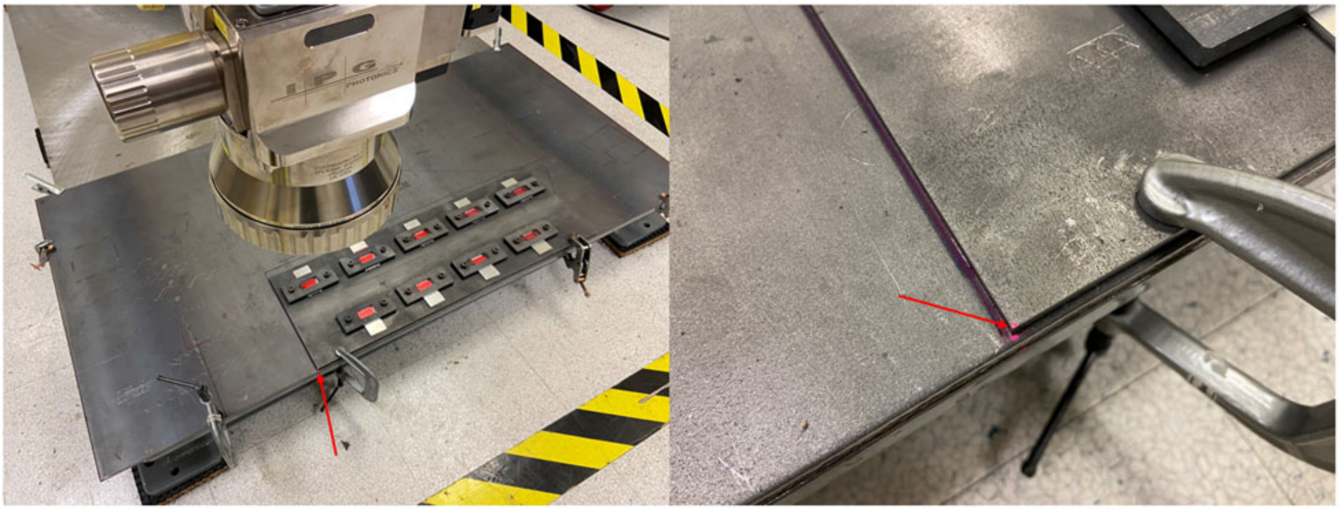
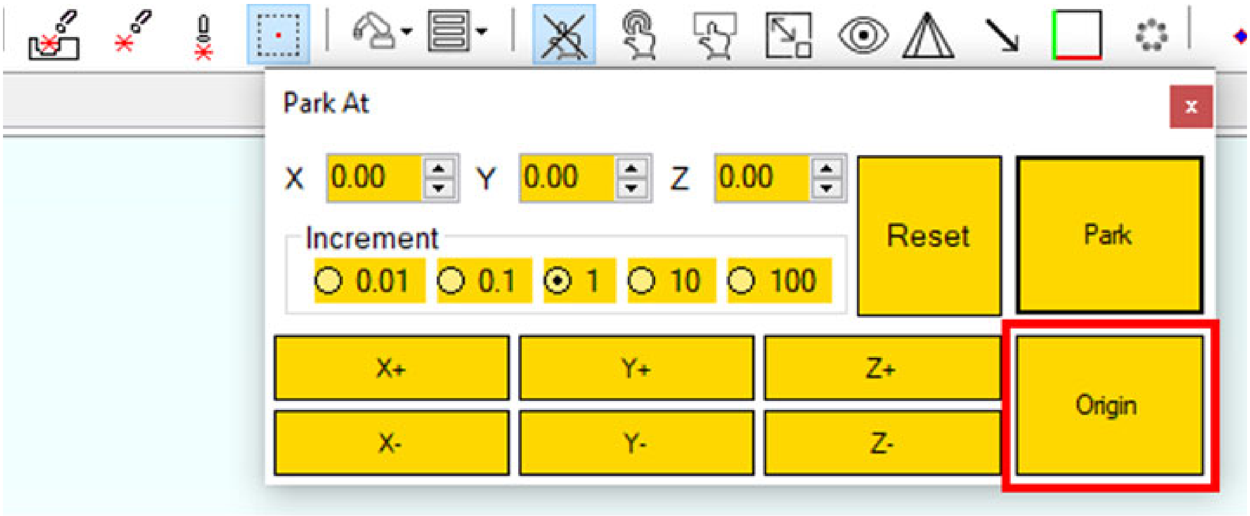


Figure 284: Jogging the Robot TCP to the Defind STL Calibration Point

a. In the above example, the guide laser is parked at 0, 0, 0 in the scanner Field of View (FOV). Working distance is measured using a ruler to ensure the proper stand-off height of the head to the point on the fixture.

b. Please note, to most accurately locate the robots TCP at the defined point on the part or fixture, it is recommended that users utilize a camera or LDD unit. It also is recommended that users have setup the robots TCP at 0, 0, 0, in the scanner's FOV (as outlined in the "Robot and IPGScan Calibration" reference document). By adhering to both of these recommendations, users can enable the "Park At" feature and park the galvos at 0, 0, 0, in the scanners FOV (see Figure 285).



Park At

X 0.00 Y 0.00 Z 0.00

Increment

○ 0.01 ○ 0.1 ● 1 ○ 10 ○ 100

Figure 285: Using "Park At" to Position the Galvos at 0, 0, 0 in the Scanners FOV

c. With the galvos parked at 0, 0, 0 in the FOV, the user can then accurately align the robots TCP with the desired part location by observing the camera or LDD crosshair setup while the robot is jogged into the correct position on the part. Figure 286 (below) demonstrates an example of how the LDD imagining system can be used to locate features on a 3D surface.

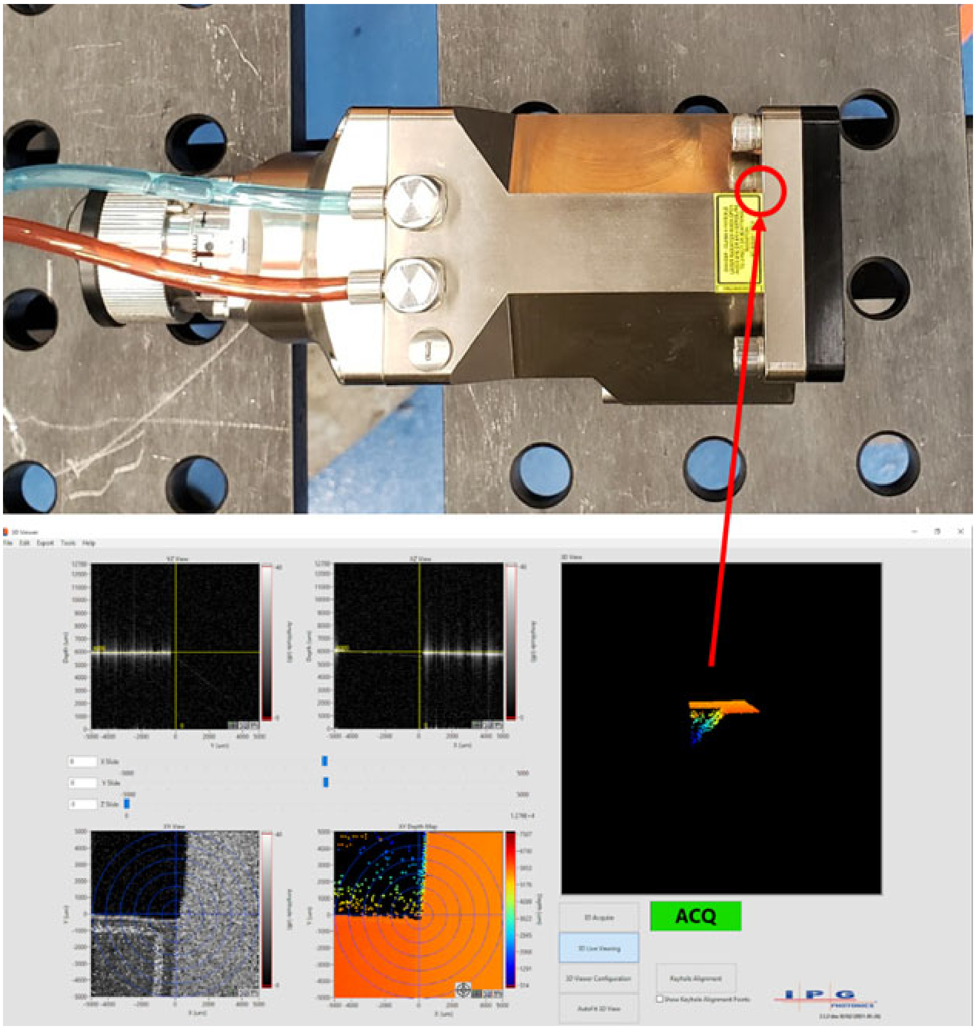
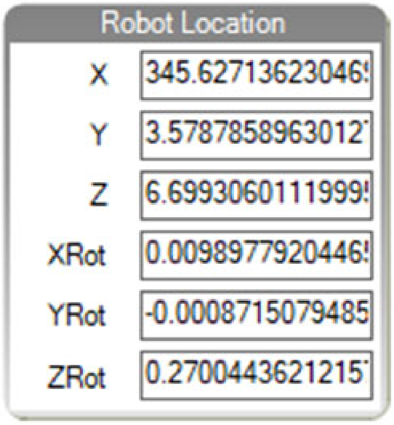


Figure 286: Example of using LDD to Locate Part Features for Alignment

9. With the robot TCP in the proper location, click "Get Robot Location" in the STL Alignment Window. This will populate the "Robot Location" coordinates with the proper pose information (see Figure 287).



Robot Location

X	345.62713623046
Y	3.5787858963012
Z	6.6993060111999
XRot	0.0098977920446
YRot	-0.0008715079485
ZRot	0.2700443621215

Figure 287: Robot Pose Data

10. Click "Add" in the STL Alignment Window. This will add a calibrated point to the "Points" list (see Figure 288).

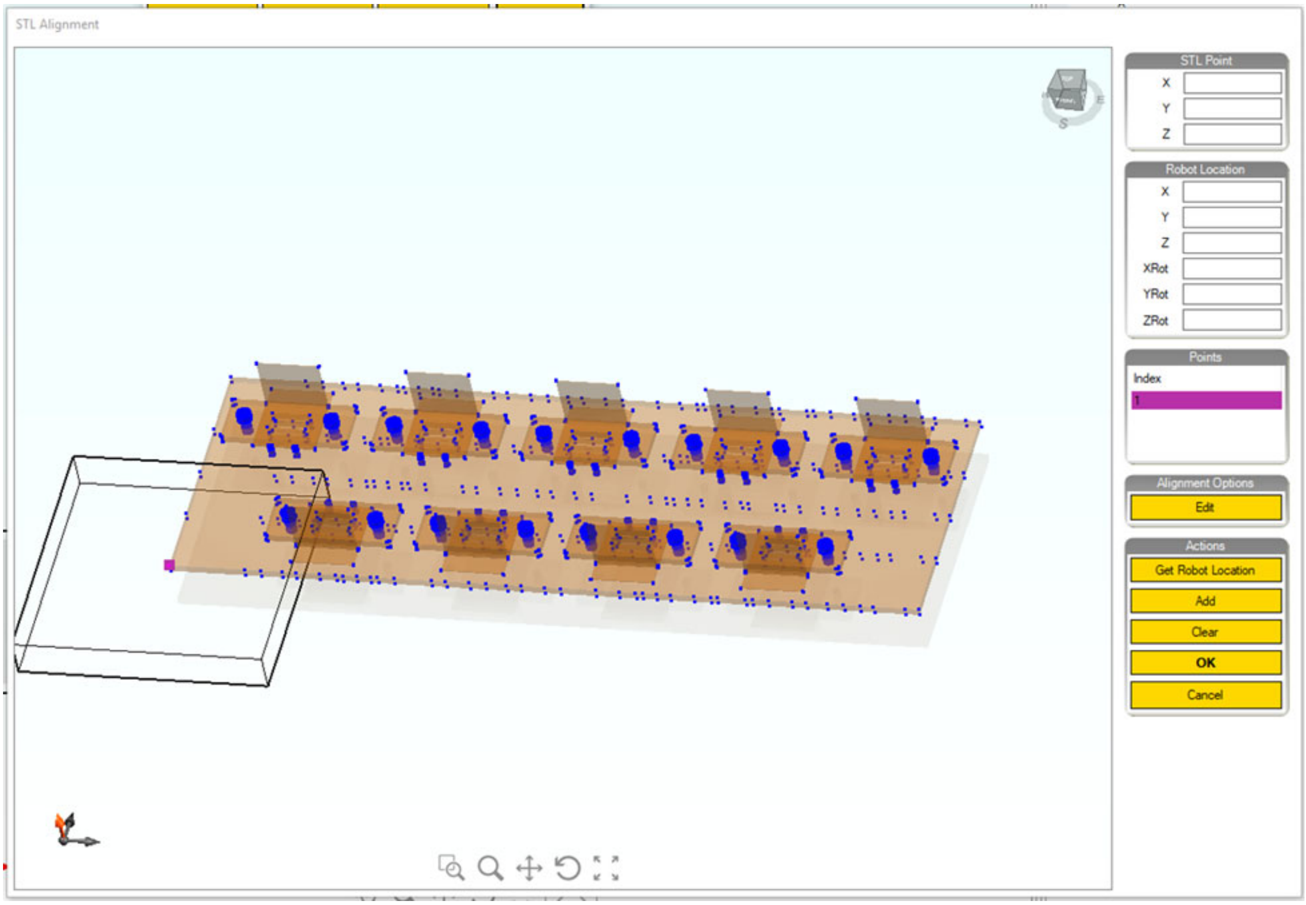
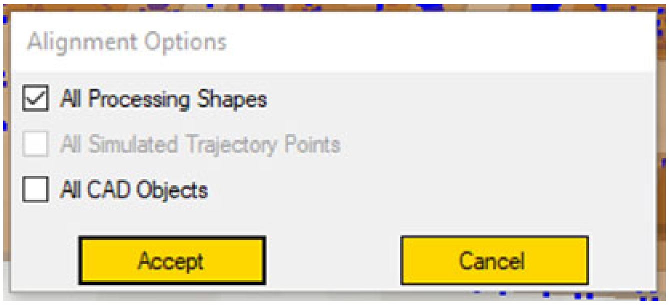


Figure 288: Calibrating the Point

11. Repeat steps 6-9 for at least 2 more unique points.
    - Although not required, it is recommended that 4 points be taught. By increasing the number of calibration points beyond three, the accuracy of placement should increase. A positional average is calculated based on the calibration points.
12. Before completing the calibration process, select any desired Alignment Options. See section "Alignment Options," for additional details concerning the available alignment options.
    - For this example, only the "All Processing Shapes" box was checked. This will cause all of the weld objects to snap with the STL model. See Figure 289 (below).



Alignment Options

☑ All Processing Shapes

☐ All Simulated Trajectory Points

☐ All CAD Objects

Figure 289: Example Alignment Options

13. Once a minimum of three points are calibrated, click "OK."
14. The STL model should now be calibrated in IPGScan accordingly with the "real world."

Figure 290 (below) details the STL Model in IPGScan after performing STL Alignment.

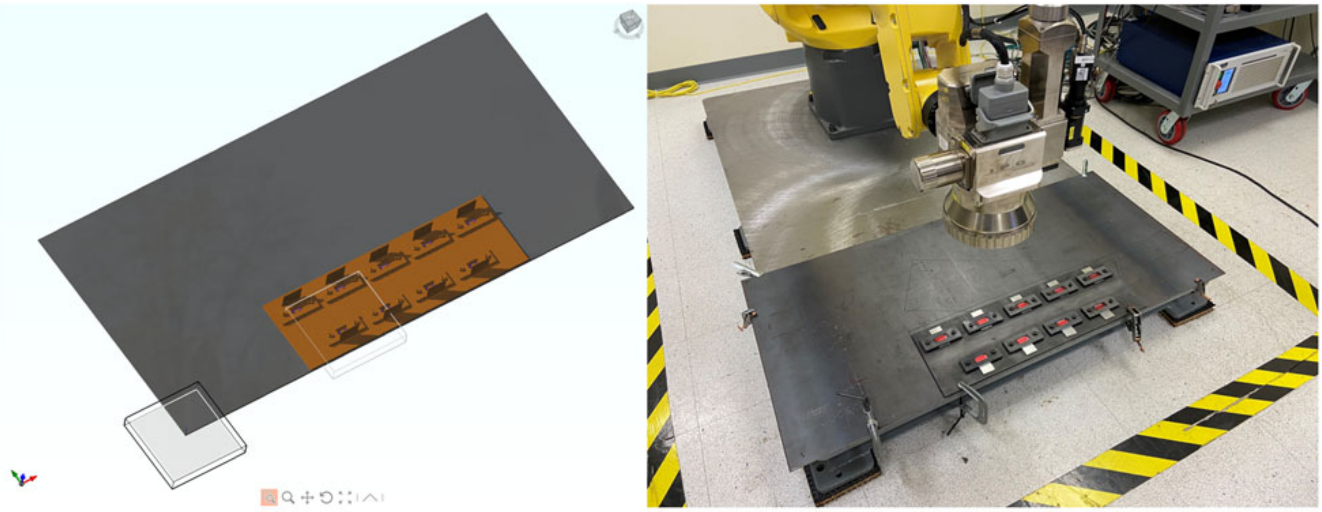


Figure 290: IPGScan STL Model Calibrated to the Real World

8.3.4.8.1 *Alignment Options*

The following steps detail the Alignment Options.

1. Within the STL Alignment window, users have the ability to set Alignment Options. Click "Edit" to open the Alignment Options Window. See Figure 291 (below).

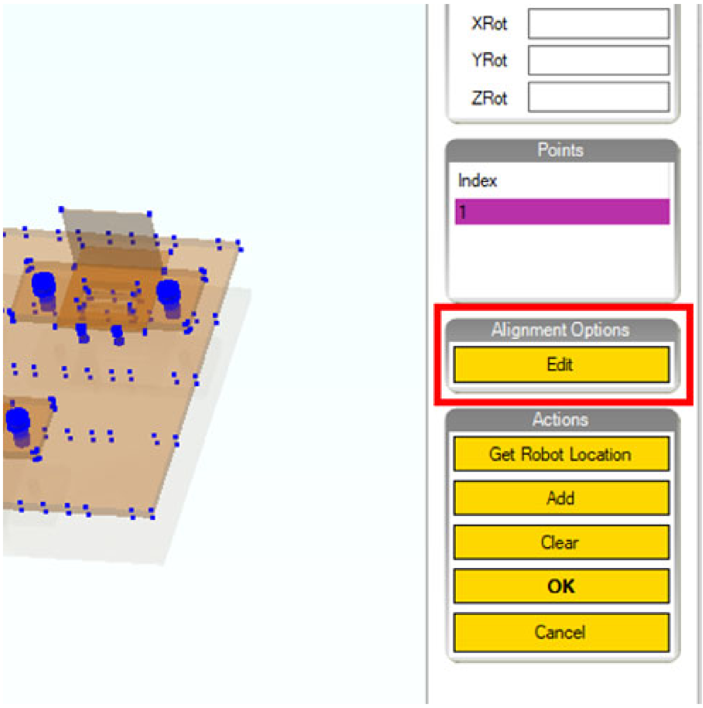
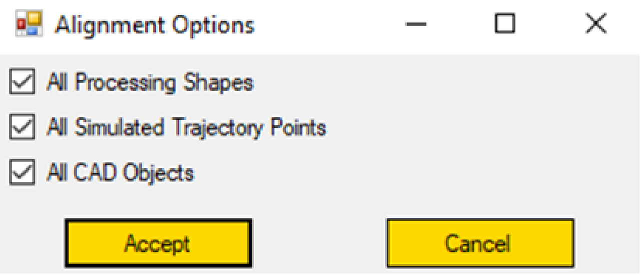


Figure 291: Opening the Alignment Options Window

2. In the Alignment Options Window, users have the ability to select what objects will snap (maintain their positional relationship) with the STL model that is being aligned. See Figure 292 (below).
   - All Processing Shapes - If checked, all weld objects will snap with the aligned STL model.
   - All Simulated Trajectory Points - If checked, any simulated trajectory will be snapped with the aligned STL model.
   - All CAD Objects - If checked, any other CAD objects within the job will be snapped with the aligned STL model.


Alignment Options

☑ All Processing Shapes

☑ All Simulated Trajectory Points

☑ All CAD Objects

Figure 292: Alignment Options

8.3.4.9 Process Object Placement/Touch-up

IPGScan offers numerous tools for the positioning of Process Objects. The following sections detail the available functionality that allows users to place/ touch-up process objects in an OTF job.

8.3.4.9.1 The Alignment Window

When utilizing an On-The-Fly type job, users have access to the Alignment window. Within this window, two different methods of alignment for Process Objects exists, which includes Process Alignment and Robot Alignment.

To access the Alignment Window, perform the following steps.

1. Open or create the desired OTF type job.
2. Select the desired Process Object(s) for alignment. See Figure 293 (below) as an example.

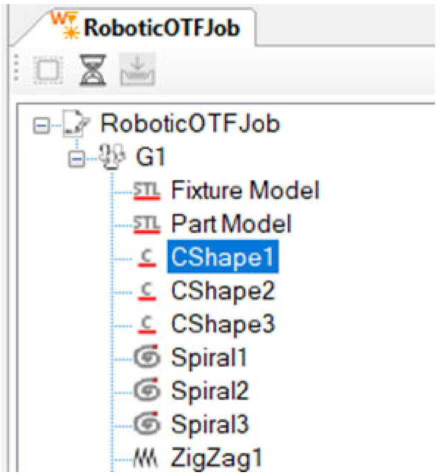


Figure 293: Selecting the Desired Process Object(s)

3. Hold ctrl on the keyboard and click (ctrl + click) the "Start Processing" button. See Figure 294 (below).

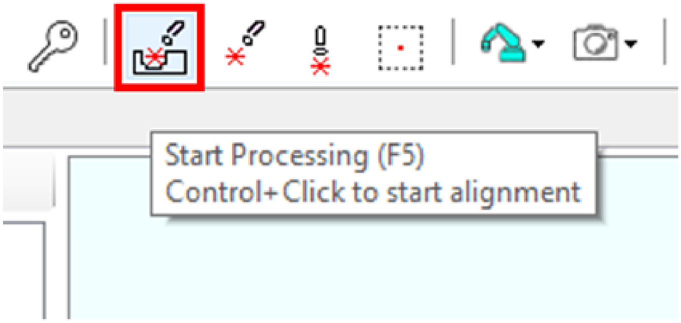
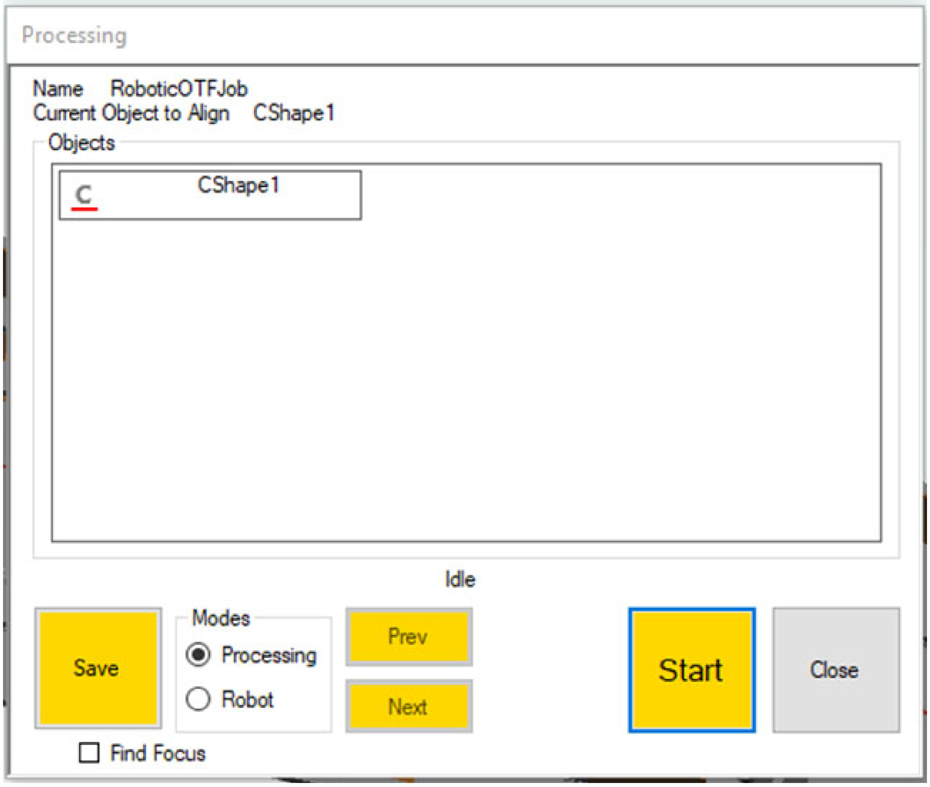


Figure 294: Opening the Alignment Window

4. The Alignment Window will now be open. See Figure 295 (below).



Processing

Name RoboticOTFJob

Current Object to Align CShape1

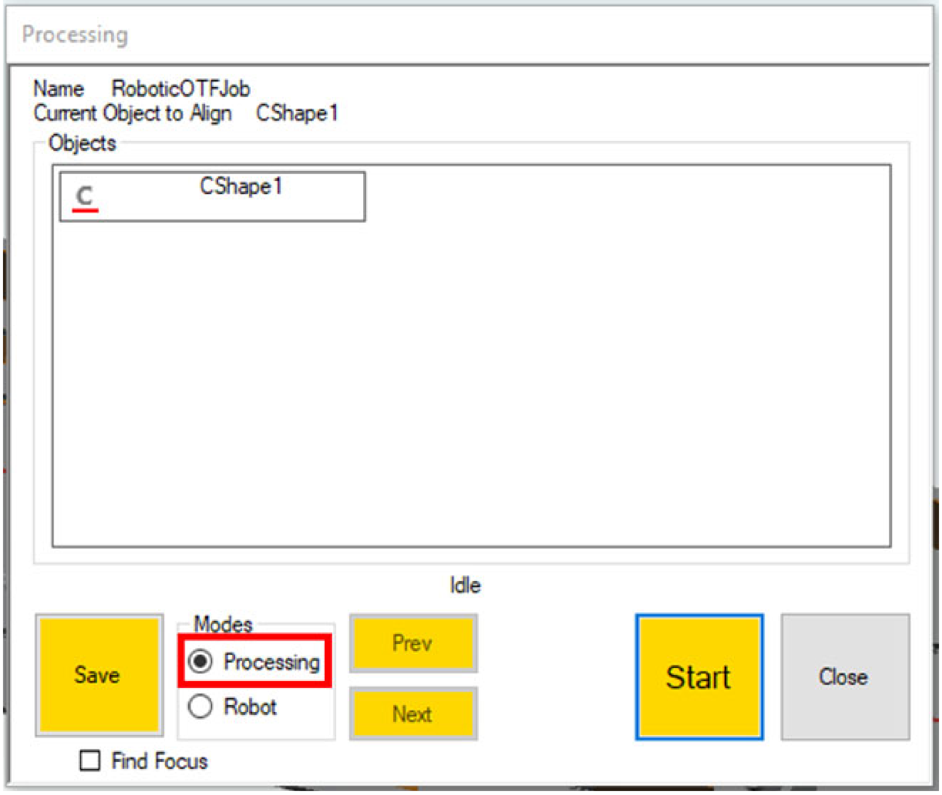
Figure 295: The Alignment Window

With the Alignment Window open, users can start to utilize the Processing and Robot Alignment modes.

8.3.4.9.1.1 Process Alignment

Process Alignment allows users to position Process Objects within the IPGScan world by driving the robot in the real world. When Process Alignment is started, the guide laser projects an image of the given object in the scanners FOV. Users can then jog the robot into the proper positon so that the Process Object is positioned as desired in relation to the part.

To utilize Process Alignment, ensure the "Processing" radio button is selected prior to clicking "Start." See Figure 296 (below).



Processing

Name RoboticOTFJob
Current Object to Align CShape1

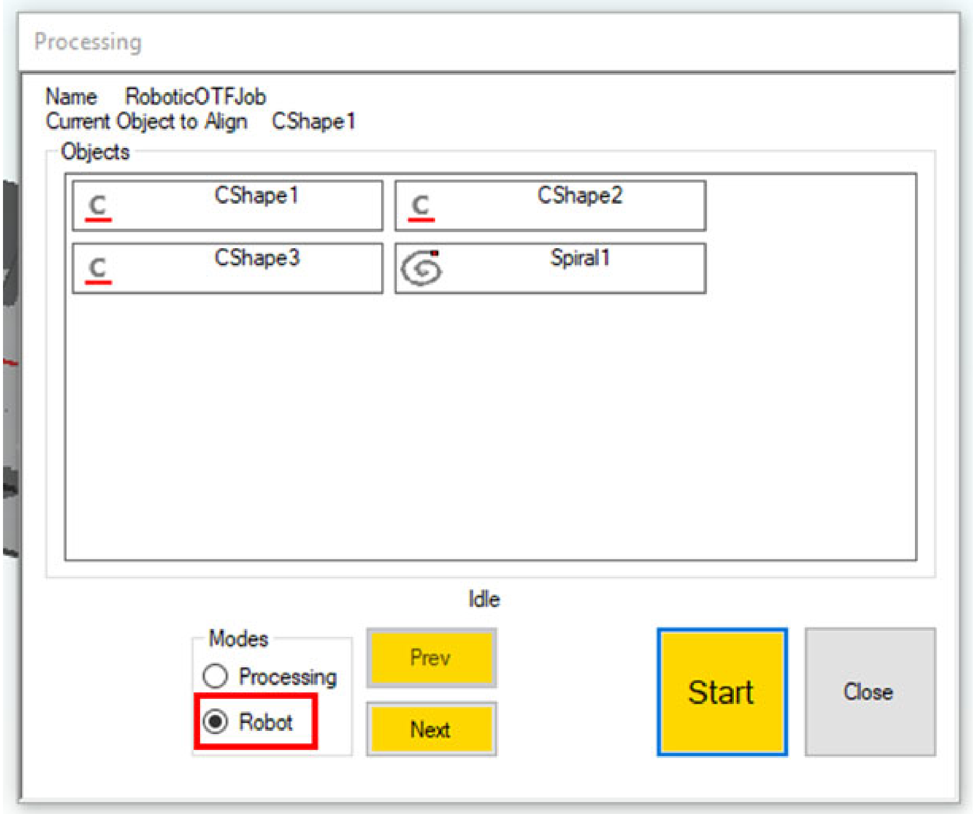
Figure 296: Selecting Processing Mode

Once a Process Object is positioned as desired, click "Save" to update the objects position (global pose) within IPGScan.

8.3.4.9.1.2 Robot Alignment

Robot Alignment allows users to preview as much of the selected process objects as possible in its programmed location based upon the current location of the robot. This can be used when programming the trajectory of the robot to determine if a location will be suitable for outputting the tested object.

To enable Robot Alignment, simply select the desired Process Objects, open the Alignment Window, and select the Robot option radio button. See Figure 297 (below).



Processing

Name RoboticOTFJob
Current Object to Align CShape1

Objects: CShape1, CShape2, CShape3, Spiral1

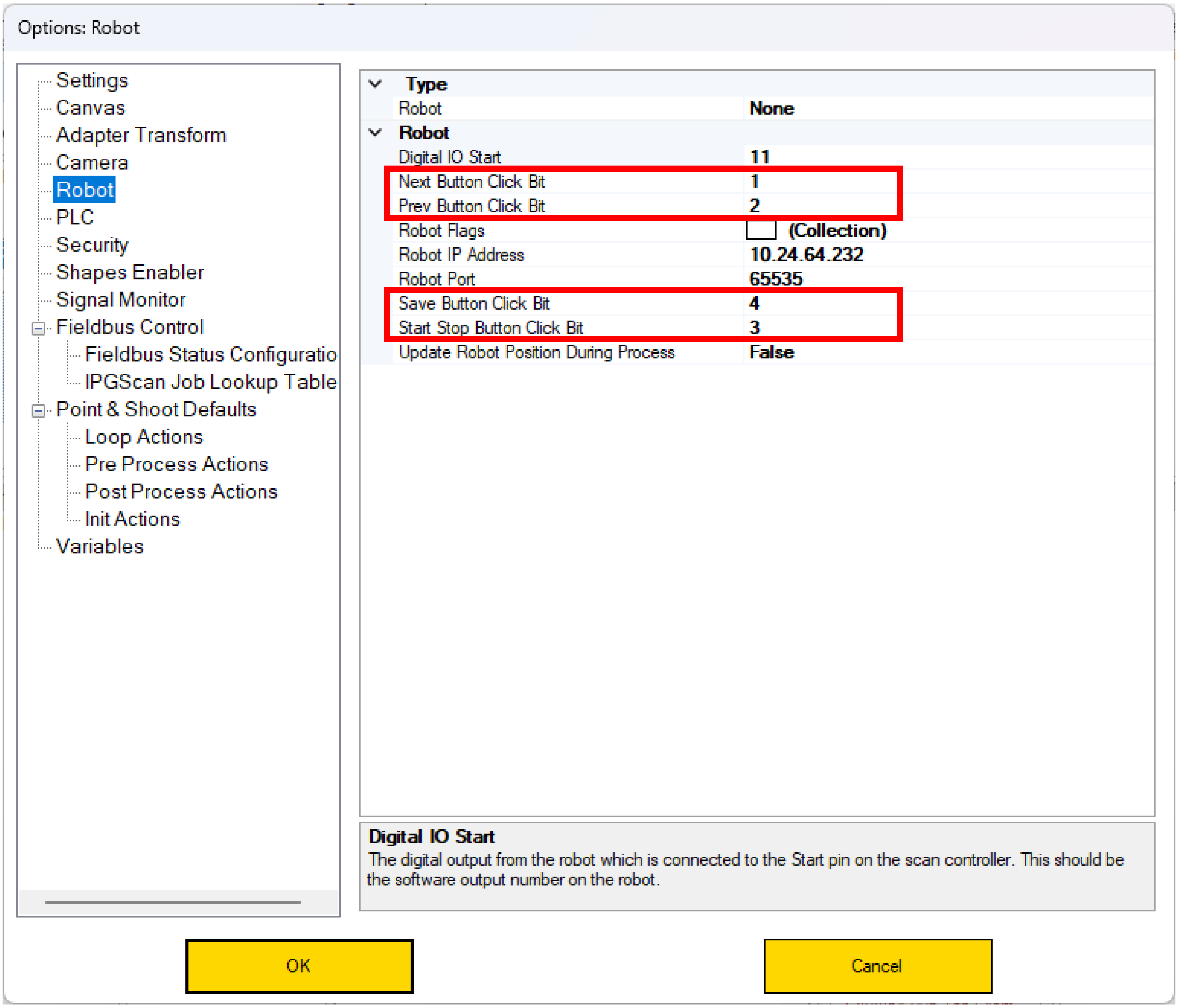
Idle

Modes
○ Processing
● Robot

Figure 297: Selecting Robot Mode

8.3.4.9.1.3 Alignment with the Robot

From the robot options, the different "Bit" options refer to the alignment window. These bit options should be set to outputs on the robot connected to the Scan Controller. Changing the state of these outputs will trigger a corresponding button press on the alignment window. Figure 298 (below) outlines the available click bit options.



Options: Robot

Type

Robot	None

Robot

Digital IO Start	11
Next Button Click Bit	1
Prev Button Click Bit	2
Robot Flags	□ (Collection)
Robot IP Address	10.24.64.232
Robot Port	65535
Save Button Click Bit	4
Start Stop Button Click Bit	3
Update Robot Position During Process	False

Digital IO Start
The digital output from the robot which is connected to the Start pin on the scan controller. This should be the software output number on the robot.

Figure 298: Robot Option Click Bits

For example, if in the robot options "Save Button Click Bit" is set to 0 (Strobe), changing the Strobe bit will save the current pose of the robot to the current processing object. Use of these bits is optional.

Table 29 (below) shows the bits of user accessible digital inputs to the Scan Controller from the 24V Interface Board.

Table 29: Bits of User Accessible Digital Inputs

SIGNAL	BIT
SELECT 0	16
SELECT 1	17
SELECT 2	18
SELECT 3	19
SELECT 4	20
SELECT 5	21
SELECT 6	22
SELECT 7	23
SELECT 8	24
STROBE	0

8.3.4.9.1.4 Snap To

"Snap to Robot View" and "Snap to Viewport" allow users to quickly snap objects into position from the Job Tree.

Snap to Robot View allows users to positon objects based on the robot's position (robot TCP).

1. Enable Robot Tracking by selecting Robot Menu ' Robot Tracking.
2. Move the robot to the desired location. The movement of the robot will be reflected on the IPGScan Canvas.
3. Right click on any object and select "Snap to Robot View." See Section 299 on page 277.

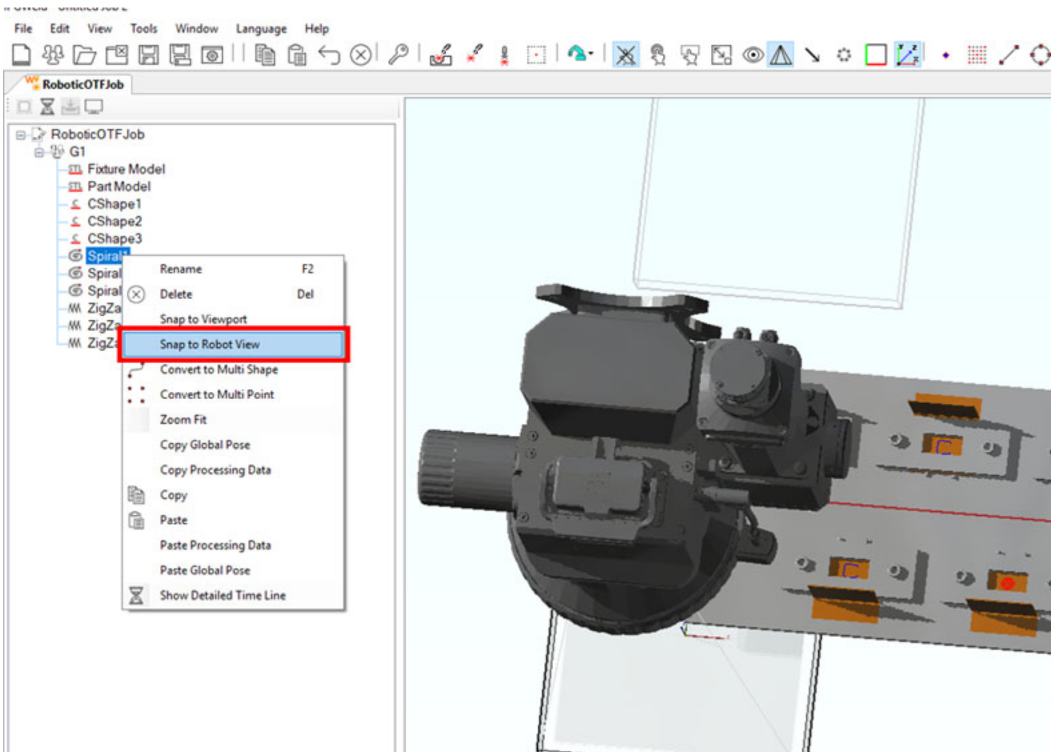


Figure 299: Snap to Robot View

4. The current robot pose is now saved as the object's global pose.

Snap to Viewport allows users to position objects based on the viewport's current position in a trajectory.

1. Record and load a trajectory or create a simulated trajectory.
2. At the bottom of the canvas, scroll along the basic timeline by clicking on it and moving the mouse left and right.
3. When the viewport is at a desired location in the trajectory, right click on any object and select "Snap to Viewport." See Figure 300 on page 278.

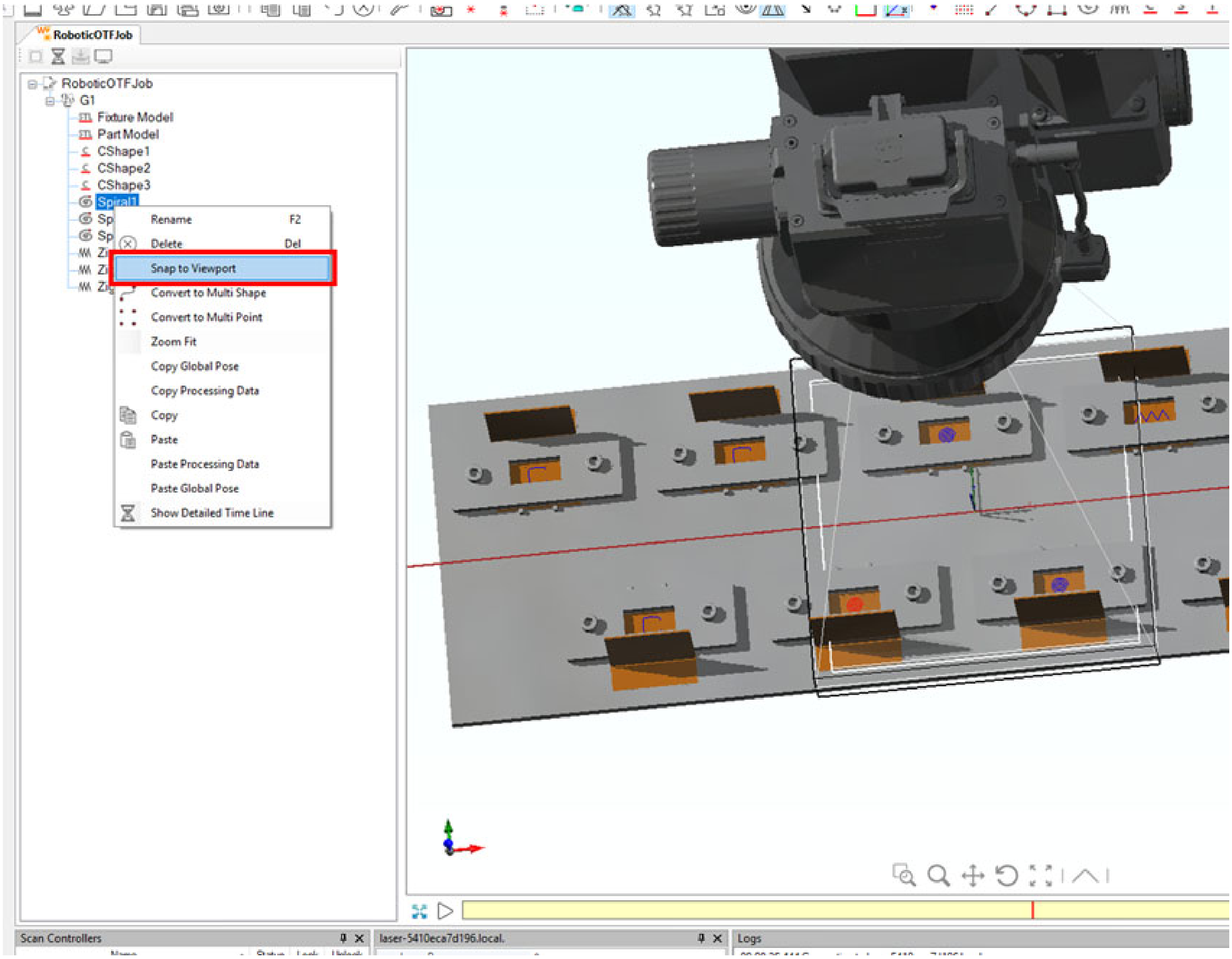


Figure 300: Snap to Viewport

4. The current viewport pose is now saved as the object's global pose.

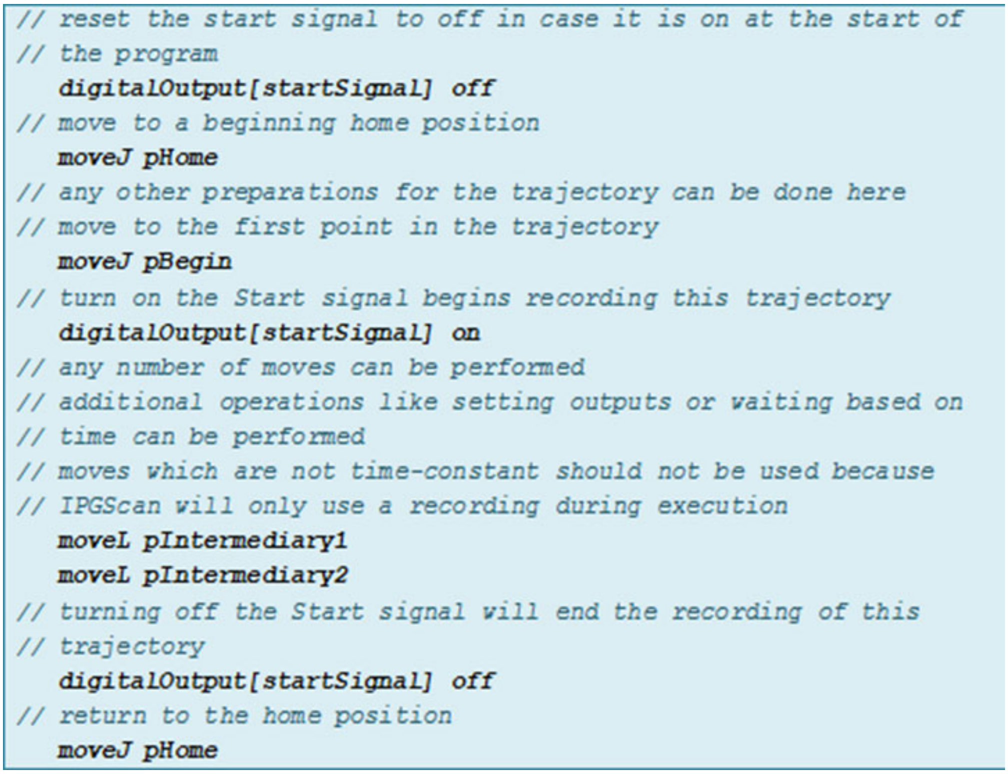
8.3.5 Robot Program Structure

IPGScan records the motion of the robot program for later use in a processing job. The robot program must be setup accordingly.

The Start signal changing from inactive to active signals IPGScan to begin recording. The Start signal changing from active to inactive signals IPGScan to finish recording.

Because IPGScan works off of a recording, only time-constant functions should be used within the recorded section of the job. For example, if the robot waits for an input, the robot and scanner will be desynchronized if the input is not triggered at the same time during each cycle.

Figure 301 (below) demonstrates example pseudo-code for a robot program for OTF.



```
// reset the start signal to off in case it is on at the start of
// the program
   digitalOutput[startSignal] off
// move to a beginning home position
   moveJ pHome
// any other preparations for the trajectory can be done here
// move to the first point in the trajectory
   moveJ pBegin
// turn on the Start signal begins recording this trajectory
   digitalOutput[startSignal] on
// any number of moves can be performed
// additional operations like setting outputs or waiting based on
// time can be performed
// moves which are not time-constant should not be used because
// IPGScan will only use a recording during execution
   moveL pIntermediary1
   moveL pIntermediary2
// turning off the Start signal will end the recording of this
// trajectory
   digitalOutput[startSignal] off
// return to the home position
   moveJ pHome
```

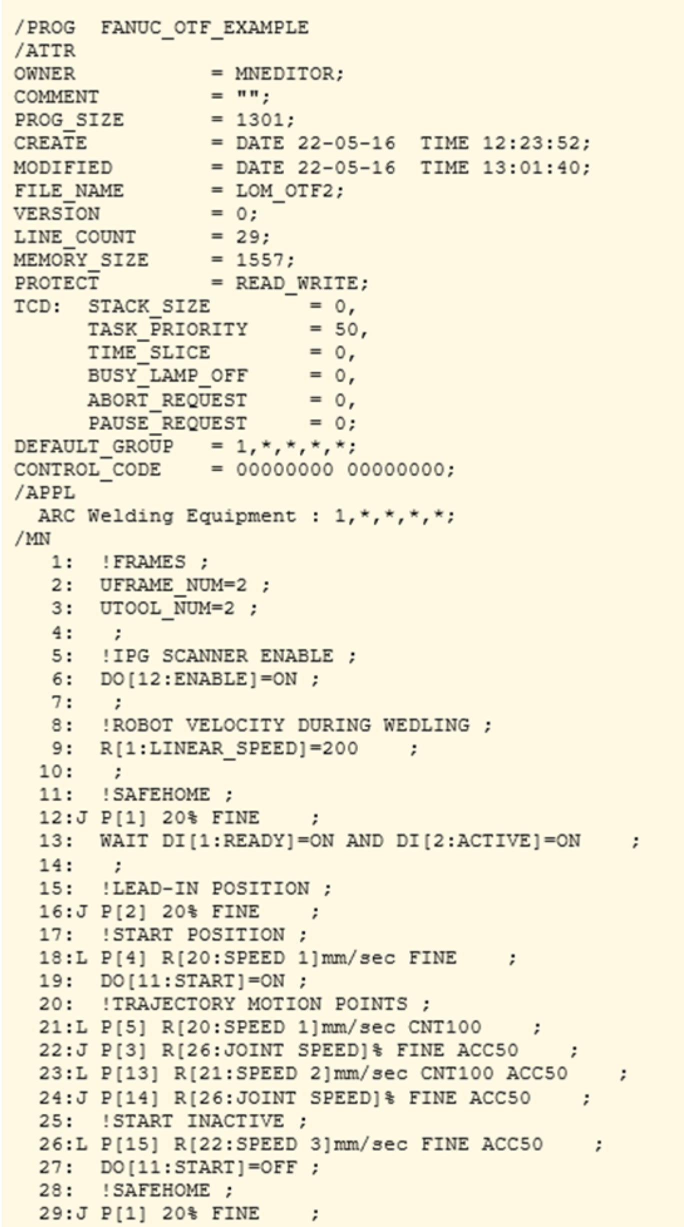
Figure 301: Example Robotic OTF Pseudo-Code

8.3.5.1 FANUC On-The-Fly Programming

For FANUC OTF programming, it is recommended that the following practices be implemented into robot program creation.

- Utilize a lead-in point with a FINE termination type before the position where Start is set active.
- Utilize a FINE termination type point for the position where Start is set active.
- Set Start active on a separate line from the motion point.

Figure 302 (below) represents an example robotic OTF program for a FANUC robot.



```
/PROG  FANUC_OTF_EXAMPLE
/ATTR
OWNER           = MNEDITOR;
COMMENT         = "";
PROG_SIZE       = 1301;
CREATE          = DATE 22-05-16  TIME 12:23:52;
MODIFIED        = DATE 22-05-16  TIME 13:01:40;
FILE_NAME       = LOM_OTF2;
VERSION         = 0;
LINE_COUNT      = 29;
MEMORY_SIZE     = 1557;
PROTECT         = READ_WRITE;
TCD:  STACK_SIZE        = 0,
      TASK_PRIORITY     = 50,
      TIME_SLICE        = 0,
      BUSY_LAMP_OFF     = 0,
      ABORT_REQUEST     = 0,
      PAUSE_REQUEST     = 0;
DEFAULT_GROUP   = 1,*,*,*,*;
CONTROL_CODE    = 00000000 00000000;
/APPL
  ARC Welding Equipment : 1,*,*,*,*;
/MN
   1:  !FRAMES ;
   2:  UFRAME_NUM=2 ;
   3:  UTOOL_NUM=2 ;
   4:   ;
   5:  !IPG SCANNER ENABLE ;
   6:  DO[12:ENABLE]=ON ;
   7:   ;
   8:  !ROBOT VELOCITY DURING WEDLING ;
   9:  R[1:LINEAR_SPEED]=200    ;
  10:   ;
  11:  !SAFEHOME ;
  12:J P[1] 20% FINE    ;
  13:  WAIT DI[1:READY]=ON AND DI[2:ACTIVE]=ON    ;
  14:   ;
  15:  !LEAD-IN POSITION ;
  16:J P[2] 20% FINE    ;
  17:  !START POSITION ;
  18:L P[4] R[20:SPEED 1]mm/sec FINE    ;
  19:  DO[11:START]=ON ;
  20:  !TRAJECTORY MOTION POINTS ;
  21:L P[5] R[20:SPEED 1]mm/sec CNT100    ;
  22:J P[3] R[26:JOINT SPEED]% FINE ACC50    ;
  23:L P[13] R[21:SPEED 2]mm/sec CNT100 ACC50    ;
  24:J P[14] R[26:JOINT SPEED]% FINE ACC50    ;
  25:  !START INACTIVE ;
  26:L P[15] R[22:SPEED 3]mm/sec FINE ACC50    ;
  27:  DO[11:START]=OFF ;
  28:  !SAFEHOME ;
  29:J P[1] 20% FINE    ;
```

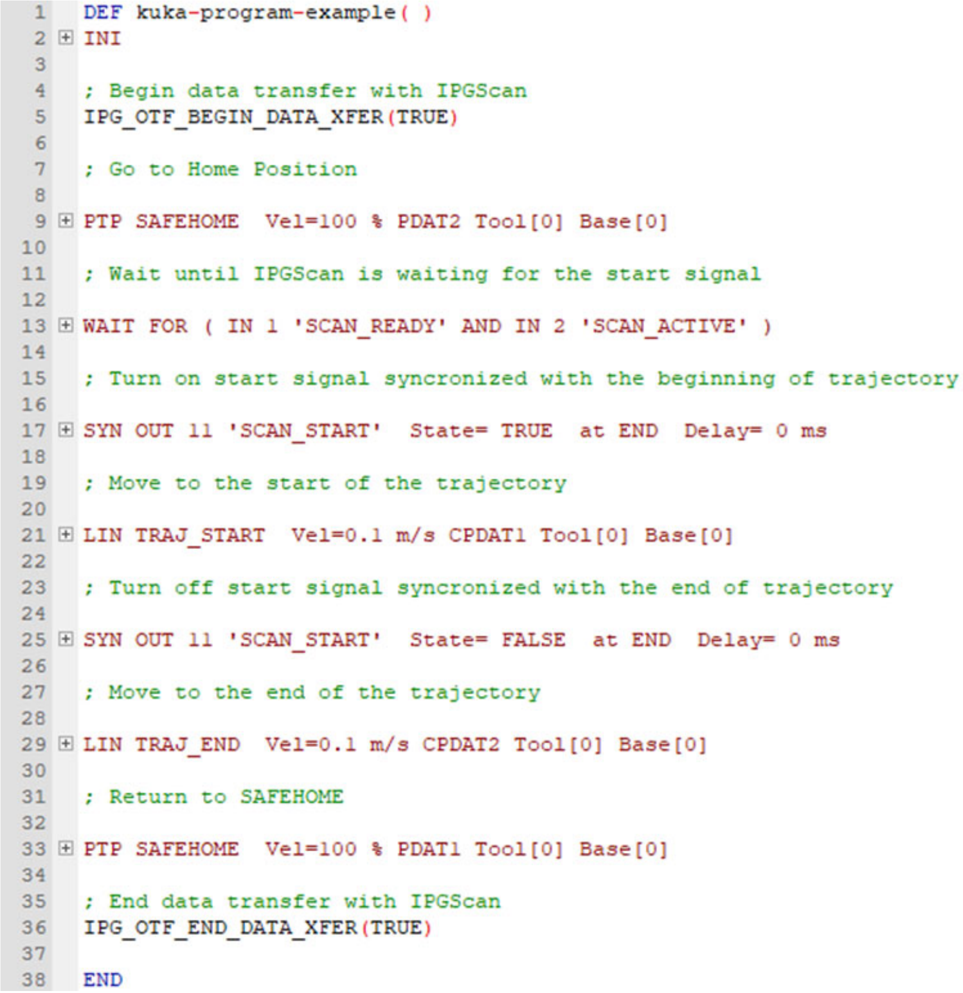
Figure 302: Example FANUC OTF Program

8.3.5.2 KUKA On-The-Fly Programming

OTF KUKA modules need to start RSI at the beginning of the program to facilitate recording.

1. To start RSI, IPG_OTF_BEGIN_DATA_XFER should be called at the beginning of the module.
2. At the end of the program, a small time delay should be called before ending the job or ending RSI to give the robot time to send out all of the information. This delay only needs to be called during recording. Calling it after setting the Start signal to inactive will not impact the final recording.
3. IPG_OTF_END_DATA_XFER can be used to both end RSI and add a time delay. Both modules require a Boolean parameter, true if the run will be a recording and false if the run will not be a recording. Both the RSI functions and time delay will only be called during recording.

Figure 303 (below) represents an example OTF KUKA program in inline forms.



```
DEF kuka-program-example( )
INI

; Begin data transfer with IPGScan
IPG_OTF_BEGIN_DATA_XFER(TRUE)

; Go to Home Position

PTP SAFEHOME  Vel=100 % PDAT2 Tool[0] Base[0]

; Wait until IPGScan is waiting for the start signal

WAIT FOR ( IN 1 'SCAN_READY' AND IN 2 'SCAN_ACTIVE' )

; Turn on start signal syncronized with the beginning of trajectory

SYN OUT 11 'SCAN_START'  State= TRUE  at END  Delay= 0 ms

; Move to the start of the trajectory

LIN TRAJ_START  Vel=0.1 m/s CPDAT1 Tool[0] Base[0]

; Turn off start signal syncronized with the end of trajectory

SYN OUT 11 'SCAN_START'  State= FALSE  at END  Delay= 0 ms

; Move to the end of the trajectory

LIN TRAJ_END  Vel=0.1 m/s CPDAT2 Tool[0] Base[0]

; Return to SAFEHOME

PTP SAFEHOME  Vel=100 % PDAT1 Tool[0] Base[0]

; End data transfer with IPGScan
IPG_OTF_END_DATA_XFER(TRUE)

END
```

Figure 303: Example KUKA Program

8.3.5.3 ABB On-The-Fly Programming

1. The system module IPG_OTF contains three routines which setup, start, and stop EGM. Please refer to Table 30 (below).

Table 30: ABB Robotic OTF Routines

ROUTINE	PARAMETERS	DESCRIPTION	EXAMPLE
`rIPGSetupOtf`	• string `sStartSignal` – name of the signal connected to the start digital input on the scan controller • string `sExtConfigName` – name of the external motion interface data name • string `sUdpUcDevice` – UdpUc device name	Sets up the helper functions for the EGM.	`rIPGSetupOtf "DO07_ScannerStart", "default", "EGM_Config";`
`rIPGStartOtf`	• bool recording – is this function executing during a trajectory recording (true) • `num delayTime` – time to delay turing on of the start signal (not used)	starts EGM stream	`rIPGStartOtf TRUE, 0;`
`rIPGStopOtf`	none	Stops EGM stream	`rIPGStopOtf`

2. To record a trajectory, *rIPGSetupOtf* should be called before *rIPGStartOtf*. The state of the start signal is not recorded, so all points in the steam are saved to the trajectory. *rIPGStopOtf* should be called when the recorded trajectory has completed. The start signal should be in place during recording for consistency. It is suggested to use a Trigger command for repeatability and to call this Trigger command right before calling *rIPGStartOtf*. These functions should not be called during execution to increase performance.

8.3.5.4 Recording and Loading Trajectories

Once users are satisfied with a given robot trajectory, this trajectory should be recorded and loaded into IPGScan.

It is critical that the trajectory be captured exactly how the robot will be running in the production environment or how the user intends the robot to run in its final state. This means that if users plan on running the robot in an Automatic mode (instead of Teach mode), the trajectory should be captured with the robot in Automatic mode. Additionally, if changes are ever made to the robot program after the trajectory is captured and loaded into IPGScan, users should recapture and load the new trajectory in IPGScan.

IMPORTANT It is imperative that the robots trajectory be representative of what the robot is actually doing during a system cycle. If the trajectory loaded into the IPGScan job does not match what the robot is actually doing, the scanner and robot synchronization will be off and process results may be distorted and/or in improper output locations.

The following sections detail how users can capture and load a trajectory within IPGScan.

8.3.5.4.1 Recording a Robot Trajectory

Please refer to the following steps for recording a robot trajectory.

1. Click on the Robot icon in the Tool Bar.
2. Click "Get Trajectory" from the robot menu. See Figure 304 (below).

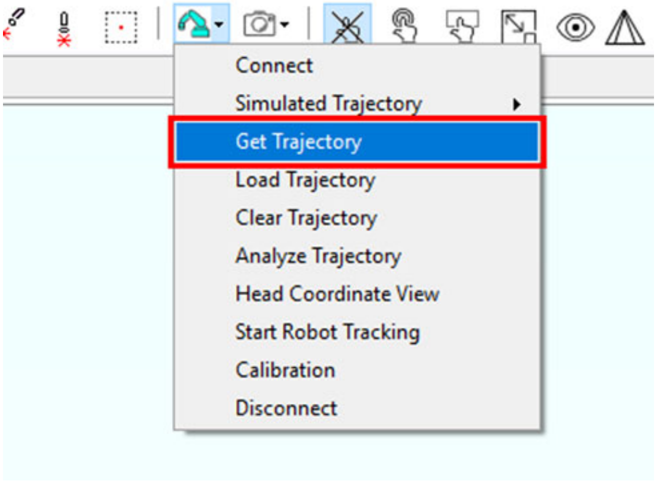


Figure 304: Get Trajectory

3. Press "Prepare" to prepare IPGScan and the robot for recording. See Figure 305 (below).

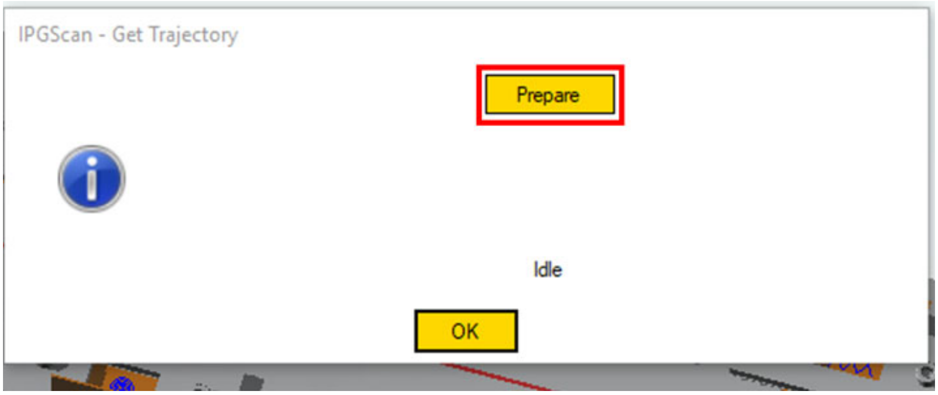
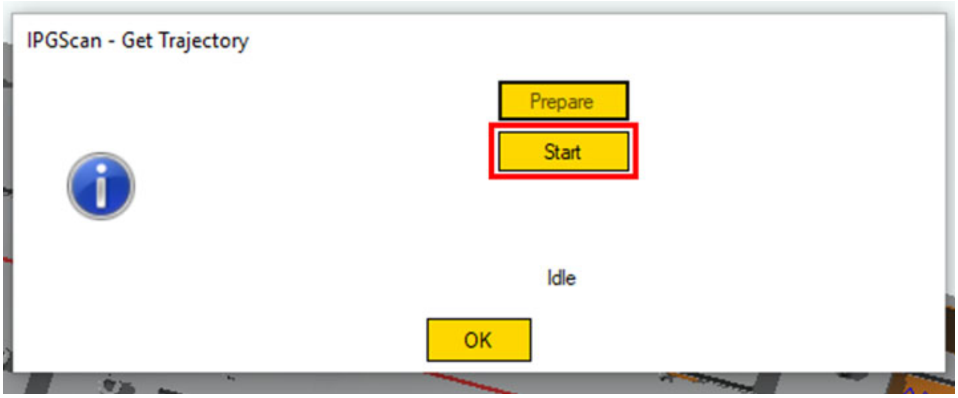


Figure 305: Preparing for Recording

4. Press "Start" to begin recording the trajectory in IPGScan. See Figure 306 (below).
   - Recording will begin with the Start signal is set active on the user Interface board.



IPGScan - Get Trajectory

Figure 306: Starting Recording

5. Run the robot program as it is expected to run during processing.
   - The robot program should set Start active to begin recording the trajectory. At the end of the desired trajectory, the robot should set Start inactive to stop the recording process.
6. After completing a recording, a window will display to choose a save location and a file name for the recording file.

IMPORTANT

When recording with FANUC_KAREL, the recording job on the robot has a very high priority and you may notice that the iPendant does not respond as expected to button presses. This is only during recording with FANUC_KAREL and will finish after the recording completes. If you are still having trouble, run IPG_ABORT to abort running the OTF KAREL jobs.

8.3.5.4.2 Loading a Robot Trajectory

The following steps detail how to load a trajectory in IPGScan.

1. Click on the Robot icon in the Tool Bar.
2. Select "Load Trajectory" from the robot menu. See Figure 307 (below).

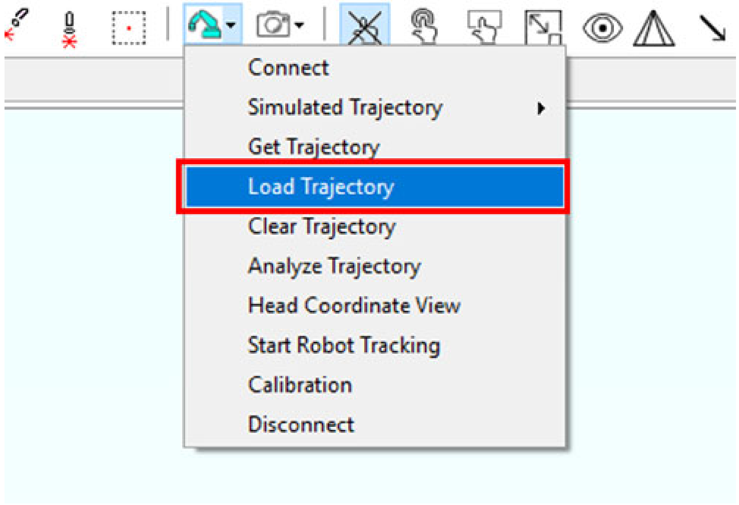


Figure 307: Loading a Trajectory

3. Navigate the file system and select the desired trajectory file.
4. Click "Open."

8.3.5.4.3 Analyze Trajectory (Acceleration Spikes)

Analyze Trajectory is a feature that allows users to open a graph which displays acceleration curves throughout a given trajectory. The purpose of this graph is for users to be able to gain a better understanding of where high acceleration zones may be experienced throughout a given robot trajectory. Given that processing is best suited during constant motion, processing during high acceleration zones may result in diminished output quality due to inconsistent robot motion. For this reason, users can utilize the Analyze Trajectory graph to better visualize where the high acceleration zones occur in the trajectory and better plan Process Object timings (using delay actions) to take place during low acceleration zones.

To access the Analyze Trajectory graph, perform the following steps.

1. Click on the Robot icon in the Tool Bar.
2. Select "Analyze Trajectory." See Figure 308 (below).

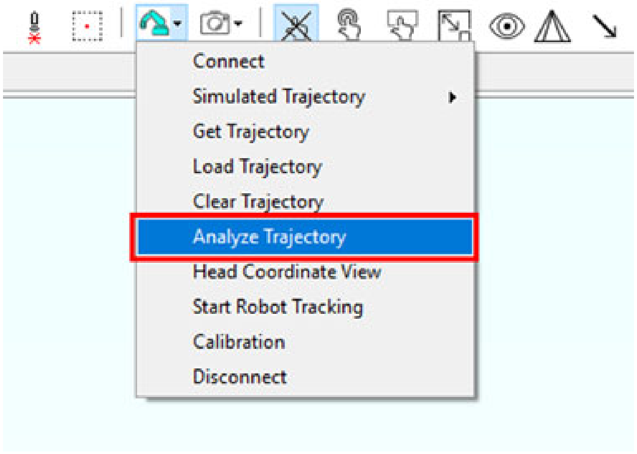


Figure 308: Analyze Trajectory

3. With the Analyze Trajectory graph open, users can examine times where high acceleration zones occur and compare that to the Process Object timings on the Basic Timeline. See Figure 309 (below).

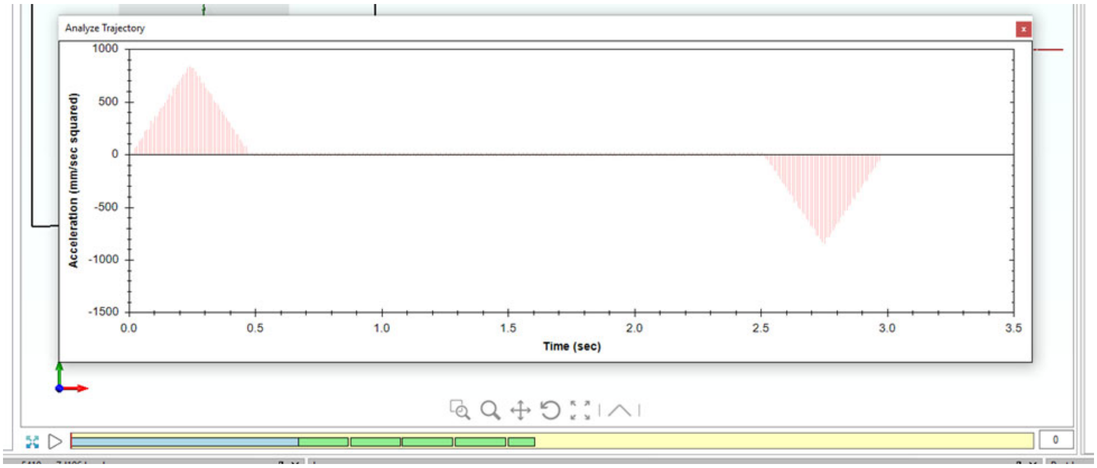


Figure 309: Analyze Trajectory Graph

8.3.5.5 Coordination Flags

Coordination Flags allow users to define zones throughout a given robot trajectory. These zones can be utilized to control process timings.

IMPORTANT Coordination Flags do not work with ABB robots.

Action Control → "Set Coordination Flags" is used to set Processing Zones in IPGScan. A Processing Zone is active for all processing objects following the Action Control until the job ends or another Processing Zone is set.

The active Coordination Flags in the robot trajectory must match those of the current Processing Zone in order for an object to be output. Calling "Set Coordination Flags" with the default parameter of "0x00" will ignore all Processing Zones.

The process that ScanPack uses to determine whether the upcoming processing vectors should be output is found in Figure 310 (below).

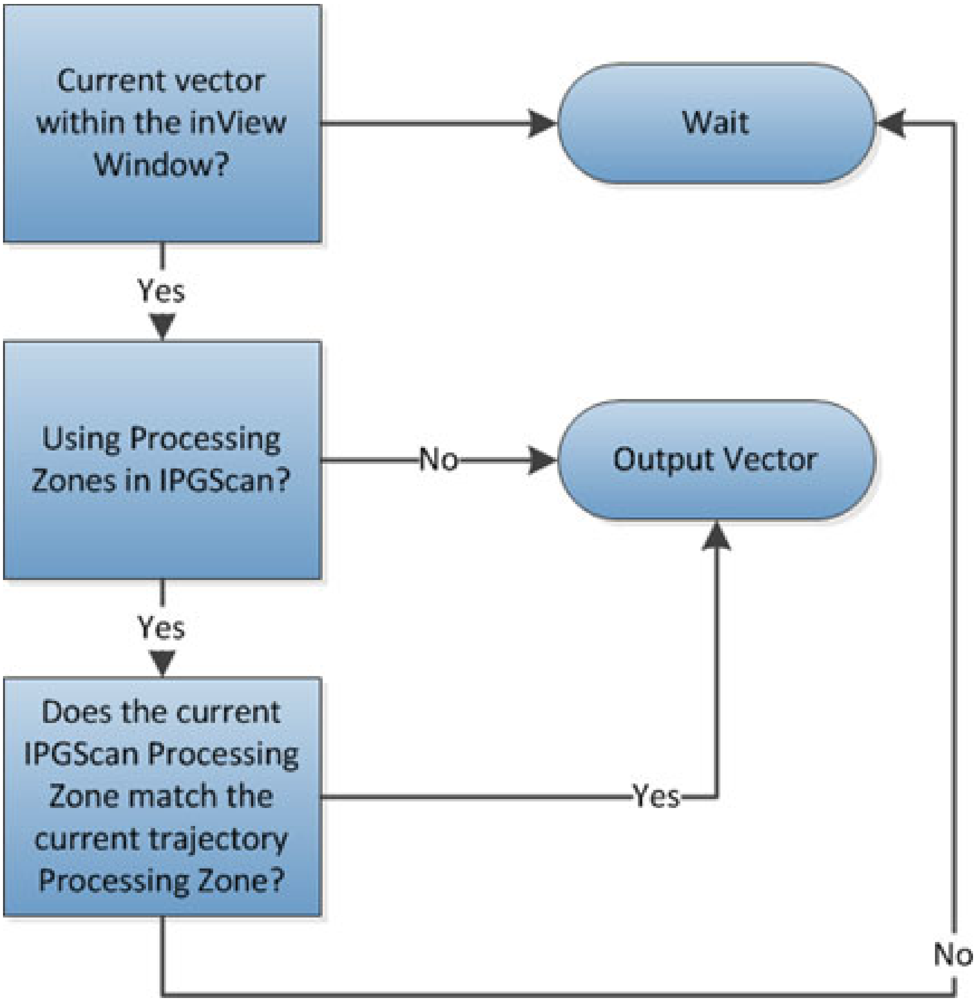
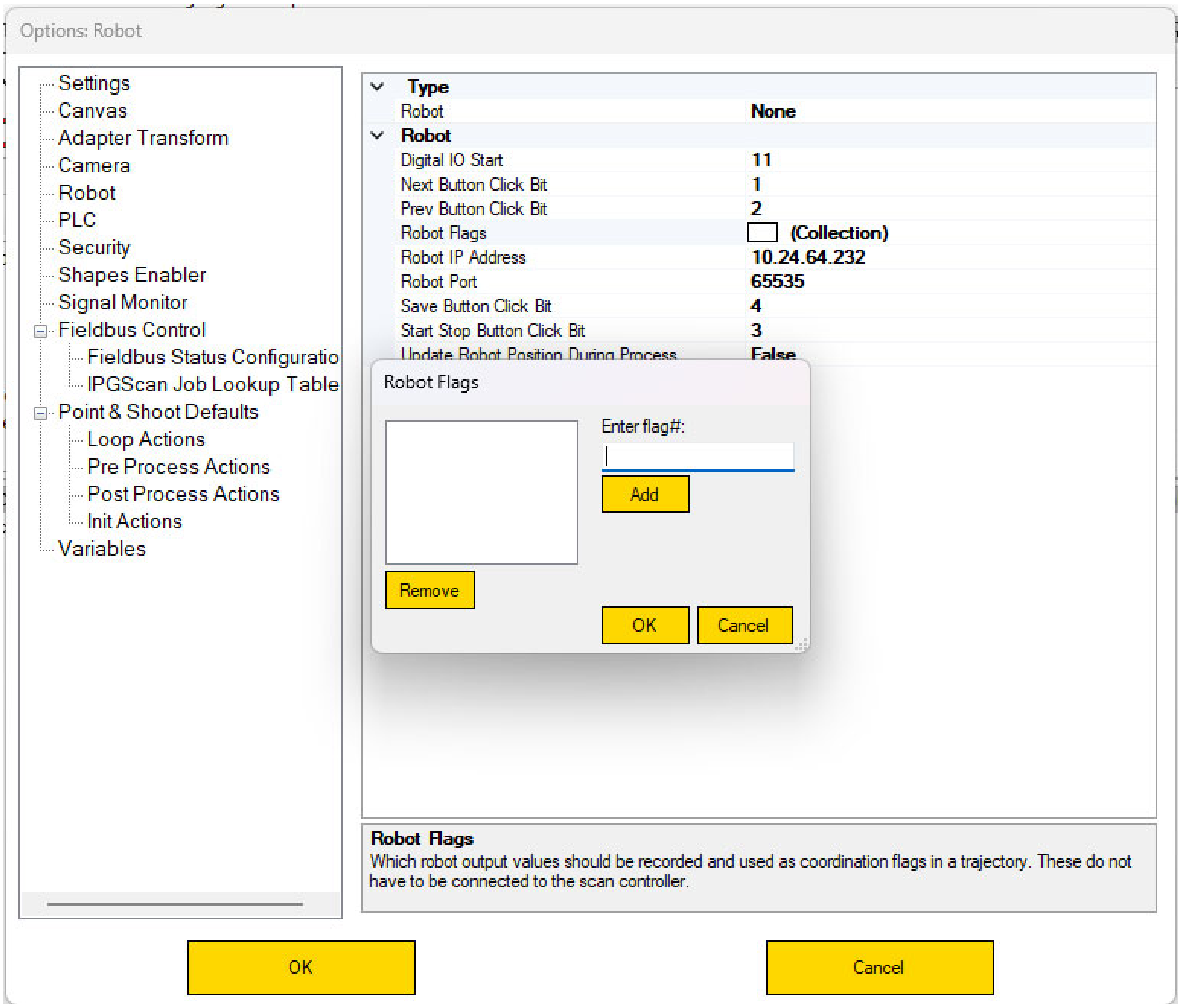

Current vector within the inView Window?
Wait
Yes
Using Processing Zones in IPGScan?
No
Output Vector
Yes
Does the current IPGScan Processing Zone match the current trajectory Processing Zone?
Yes
No

Figure 310: Coordination Flag Logic

8.3.5.5.1 Selecting Coordination Flags

Coordination Flags can be selected under Options ' Robot ' Robot Flags. See Figure 311 (below).



Type	
Robot	None
Robot	
Digital IO Start	11
Next Button Click Bit	1
Prev Button Click Bit	2
Robot Flags	□ (Collection)
Robot IP Address	10.24.64.232
Robot Port	65535
Save Button Click Bit	4
Start Stop Button Click Bit	3
Update Robot Position During Process	False

Robot Flags
Which robot output values should be recorded and used as coordination flags in a trajectory. These do not have to be connected to the scan controller.

Figure 311: Setting Robot Flags

Enter values that correspond with any robot output. Coordination flags must be set before recording a trajectory.

8.3.5.5.1.1 FANUC

For FANUC robots, enter the output number as displayed on the robot. FANUC systems using the Robot Server are limited to 32 flags, systems using KAREL are limited to 5 flags. If more than 5 or 32 flags are set in the options menu, the first 5 or 32 values will be used, respectively. If a value is invalid it will not be used.

8.3.5.5.1.2 Yaskawa Motoman

For Yaskawa Motoman robots, enter the logical relay address number. This can be found in the Concurrent I/O manual and in the In/Out menu. Yaskawa Motoman robots are limited to 5 flags. If more than 5 flags are set in the options menu, the first 5 values will be used. If a logical relay address number is invalid, it will not be used.

8.3.5.5.1.3 KUKA

For KUKA robots, enter the number of flags to record. If nothing is entered, 0 is assumed. Values to be used as flags must be set in the RSI files before loading them onto the robot. The RSI files supplied are limited to 9 flags not including the Start signal.

8.3.5.5.2 Setting the Coordination Flag Action Control

In the Action Control, "Set Coordination Flags," the value of the flag is a 32-bit hexadecimal number. Each bit represents the state of one flag. Flag 0 corresponds to the first digital output listed in the IPGScan settings. The flag number does not correspond to the output number. Flags are numbered based upon their order in the options. When a flag is active, that bit is equal to 1. When a flag is inactive, that bit is equal to 0. Table 31 (below) shows the first 8 bits of the 32-bit number.

Table 31: Robot Flag First 8-bits

FLAG7	FLAG6	FLAG5	FLAG4	FLAG3	FLAG2	FLAG1	FLAG0

8.3.6 Trigger Delay

8.3.6.1 Overview

On-The-Fly Trigger Delay may be necessary in instances where the robot trigger does not take place exactly where the user expects it too. For instance, triggers are often times slightly delayed from a robot program position simply because it takes the robot time to register that the digital bit must be set active/inactive. This ultimately can result in an offset of laser output from the users desired program location using the guide laser.

IMPORTANT A consistent trigger is required in order for OTF Trigger Delay to be effective. In most cases, a discrete IO connection is going to provide the most consistent trigger. Fieldbus interfaces will typically introduce latency and not provide a consistent trigger. In an example such as this, the OTF Trigger Delay would not be able to compensate for the inconsistent trigger.

8.3.6.2 Procedure

The following steps outline a procedure that users can follow to utilize the OTF Timing Delay functionality and more accurately dial in the laser output to their programmed location. This process can either be completed by setting up a dedicated test (that uses robot and weld speeds similar to a production process) or by running multiple cycles on an existing system.

1. Start by examining and touching-up the program location of a given object using the guide beam. For OTF processes, this should be done using the Processing Alignment Window.
   - In this example, a staple shape weld is centered in the opening of a fixture clamp. See Figure 312 (below).
   - It is good practice to save the robot position for this weld position. This will make it easy to return to this location later on in the procedure.

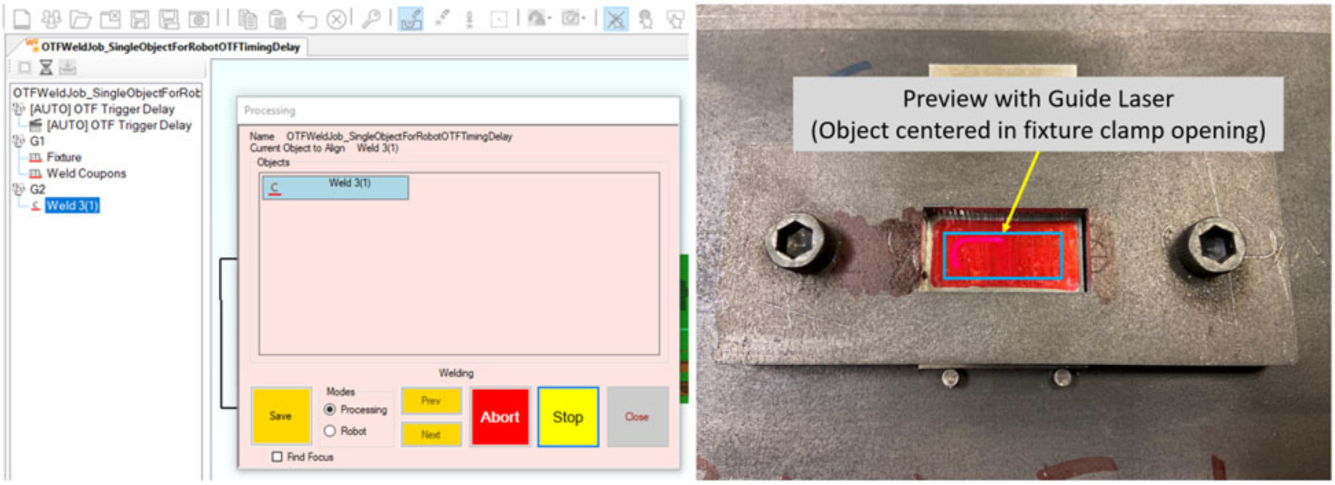

Name OTFWeldJob_SingleObjectForRobotOTFTimingDelay
Current Object to Align Weld 3(1)

Figure 312: Placing a Process Object Using the Guide Laser

2. With the process object position touched-up, the OTF process can now be run with the laser.
   a. Prior to cycling the actual equipment, be sure to perform a Dryrun of the process to ensure the job will properly execute.
   b. Take note of the robot travel speed for the OTF process. This value will be required for calculating the required trigger delay. In this example, a robot speed of 150mm/sec is used.
3. Once the process completes, reposition the head to preview the object placement with the guide laser (as outlined in step 1).
4. Measure the offset distance between the guide laser and the actual laser output. See Figure 313 (below).
   - In this example, a distance of 3.5mm was measured.

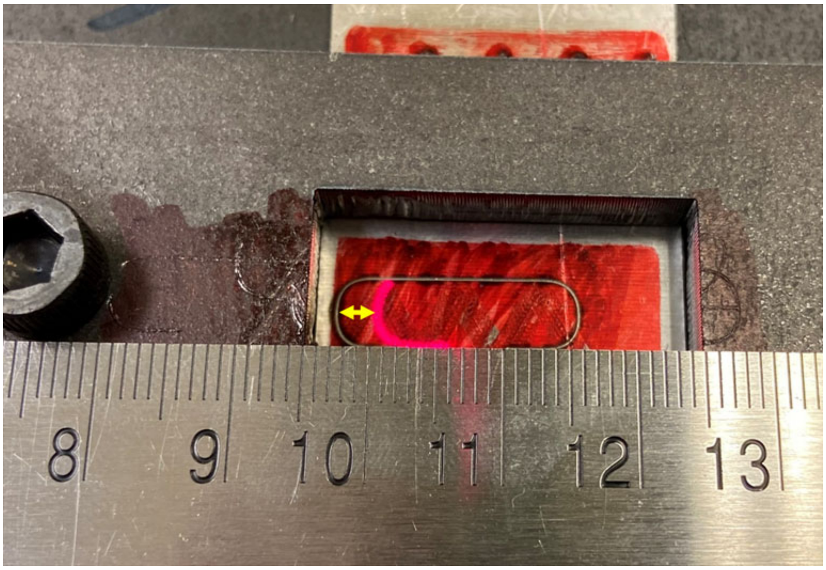
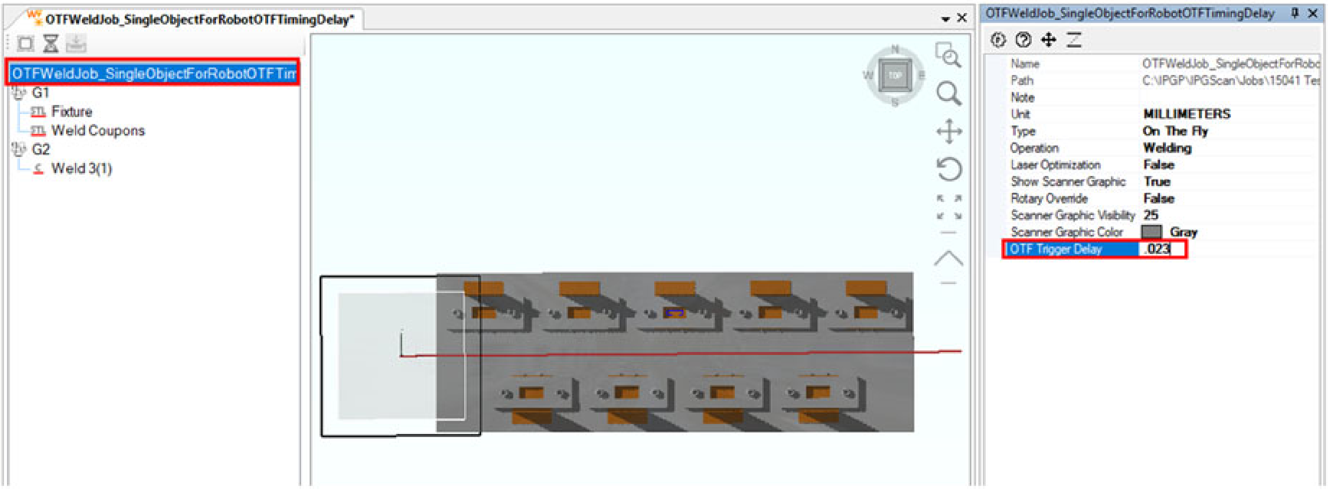


Figure 313: Measuring the Offset Distance between the Guide Laser Projection and the Laser Output Position

5. Perform the following calculation to determine the proper OTF Trigger Delay time.
   a. $\frac{Measured\ Offset\ [mm]}{Robot\ Travel\ Speed\ [\frac{mm}{sec}]} = OTF\ Trigger\ Delay\ [sec]$

   - Measured Offset - This is the distance that is measured between the guide laser position and the real laser output.
   - Robot Travel Speed - This is the travel speed that the robot was moving at when the real laser output was marked on the part.
   - OTF Trigger Delay - This is the calculated value that will be entered into IPGScan.
   - Example: $\frac{3.5\ mm}{150\ mm/sec} = .023\ sec$

6. Enter the calculated OTF Trigger Delay time for the given OTF Job. See Figure 314 (below).


OTFWeldJob_SingleObjectForRobotOTFTimingDelay*
OTFWeldJob_SingleObjectForRobotOTFTim
G1
Fixture
Weld Coupons
G2
Weld 3(1)
N
W
E
S
TOP
OTFWeldJob_SingleObjectForRobotOTFTimingDelay

Name	OTFWeldJob_SingleObjectForRobo
Path	C:\IPGP\IPGScan\Jobs\15041 Tes
Note	
Unit	MILLIMETERS
Type	On The Fly
Operation	Welding
Laser Optimization	False
Show Scanner Graphic	True
Rotary Override	False
Scanner Graphic Visibility	25
Scanner Graphic Color	▨ Gray
OTF Trigger Delay	.023

Figure 314: Entering an OTF Trigger Delay for a OTF Job

– Once the OTF Trigger Delay is entered, users will notice that the robot trajectory is a different color and that a Group is automatically generated in the Job Tree. See Figure 315 (below).

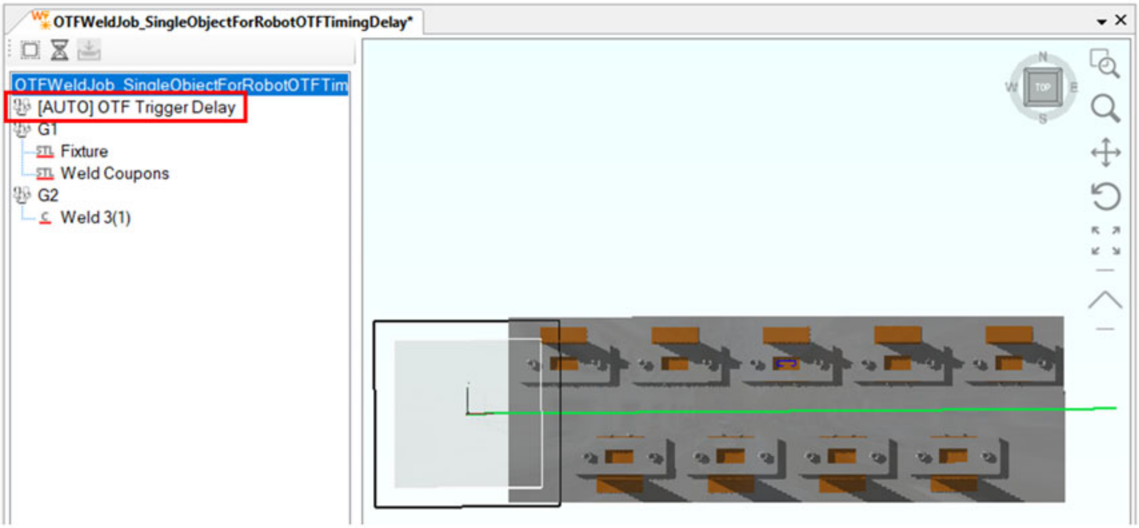

OTFWeldJob_SingleObjectForRobotOTFTimingDelay*
OTFWeldJob_SingleObjectForRobotOTFTim
[AUTO] OTF Trigger Delay
G1
Fixture
Weld Coupons
G2
Weld 3(1)
N
W
E
S
TOP

Figure 315: Auto Generated Group and Trajectory Color Change

With the OTF Trigger Delay added, cycle the process just as it was done in step 2.

IMPORTANT No robot program changes should have been made from step 2 to step 7. Any changes that may have been made could affect the process output and may result in unexpected results.

7. Once the process completes, reposition the head to preview the object placement with the guide laser (as outlined in step 1).
   a. Here users should now notice that the new laser output is closer to the guide laser position or overlapping the guide laser position (see Figure 316). If some offset still exists, users can continue to modify the OTF Trigger Delay value to further dial in the process.

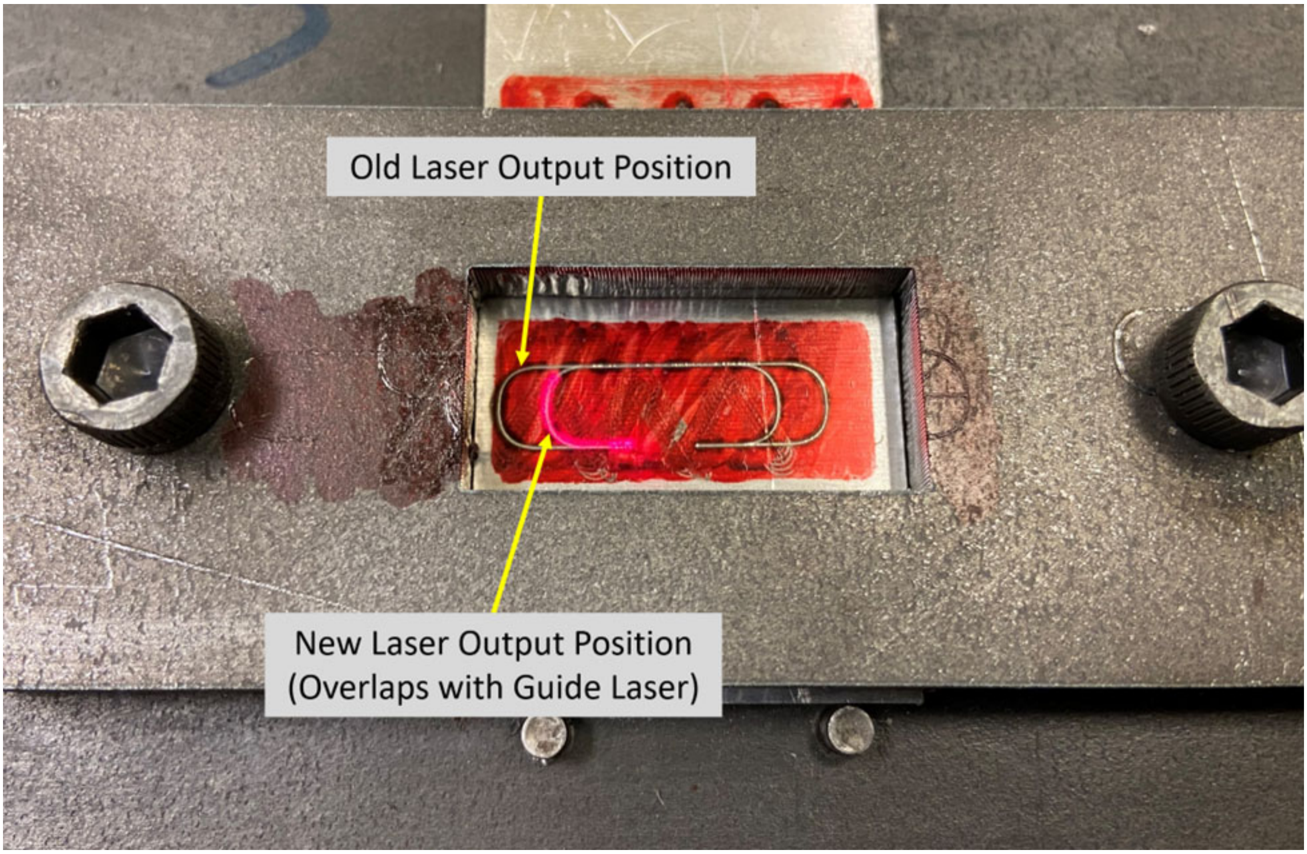

Old Laser Output Position
New Laser Output Position (Overlaps with Guide Laser)

Figure 316: Laser Ouput Now Aligns with the Guide Laser Position

8.4 Coordinated Motion Processing (Non-Robotic On-The-Fly)

8.4.1 Overview

Coordinated Motion Processing means to process a moving target without having the target stop for the realignment of the object. It also can entail processing an object while the scanner is in motion and the target is stationary. This method of processing is also commonly referred to as Mark On-The-Fly, Coordinated Stage Motion, or On-The-Fly (Non-Robotic) processing.

When using a real encoder, the encoder's resolution (meters/encoder pulse) should be at equal to or less than the laser beam diameter. IPG's software also provides a simulated encoder input so a real encoder may not be needed for some applications.

8.4.1.1 Requirements/Recommendations

The following list details requirements and recommendations for Coordinated Motion Processing.

- The Stage Configuration Utility software must be installed.
  - See Chapter 18 on page 373 for additional utility details.
- Encoder must have a quadrature output.
- Encoder reset is an option.
- The use of the Motion Interface is required.
  - Please refer to the "External Interface User Guide (DOCOX-UGSCNXX0002)" for additional information concerning this interface.

8.4.2 Configuration Parameters

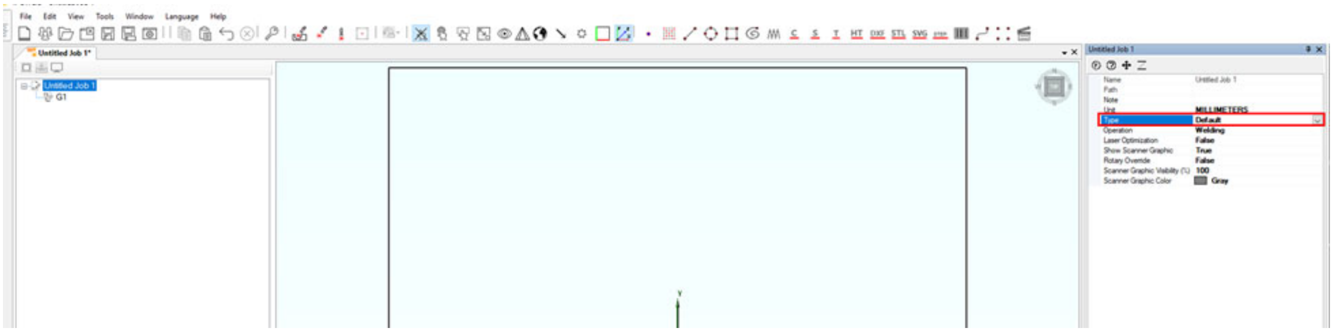
For information regarding hardware connections and the Stage Configuration Utility, please refer to the "Scanner Series User Guide (PN-21-010211)" and "External Interface User Guide (DOCOXUGSCNXX0002)."

For Stage Configuration Utility details, see Chapter 18 on page 373.

8.4.3 Job Creation

The following steps outline how to create an example Coordinated Motion job in IPGScan.

1. Create an IPGScan job of "Default" Type. See Figure 317 (below).

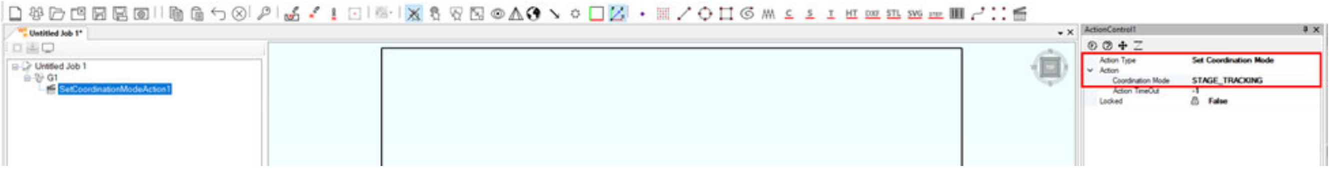


Untitled Job 1

Name	Untitled Job 1
Path	
Note	
Unit	MILLIMETERS
Type	Default
Operation	Welding
Laser Optimization	False
Show Scanner Graphic	True
Rotary Override	False
Scanner Graphic Visibility (%)	100
Scanner Graphic Color	▨ Gray

Figure 317: Creating a Default Type Job

2. Create an Action Control in Group 1.
3. Configure the Action Control to be of "Set Coordination Mode" type. Coordination Mode should be set to "STAGE_TRACKING." See Figure 318 (below).

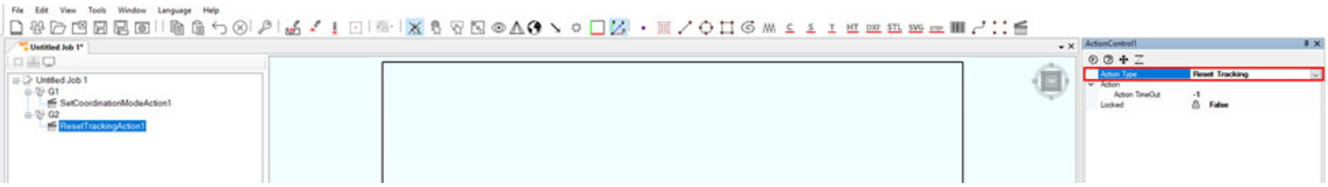


ActionControl1

Action Type	Set Coordination Mode
Action	
Coordination Mode	STAGE_TRACKING
Action TimeOut	-1
Locked	False

Figure 318: Set Coordination Mode Action Control

4. Create a second Group.
5. Within Group 2, create an Action Control and configure it to be of "Reset Tracking" type. See Figure 319 (below).

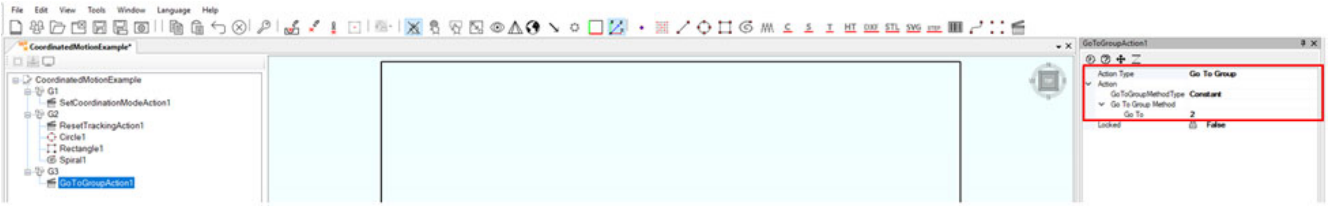


ActionControl1

Action Type	Reset Tracking
Action	
Action TimeOut	-1
Locked	False

Figure 319: Reset Tracking Action Control

6. Create any desired shapes and place throughout the Field of View.
7. Create a third Group.
8. Within Group 3, create an Action Control and configure it to be a "Go To Group" type. The Method Type should be set to "Constant" and the Go To value should be the Group ID of the Group containing the Reset Tracking Action Control and the Process Objects (G2 in this example). See Figure 320 on page 296.

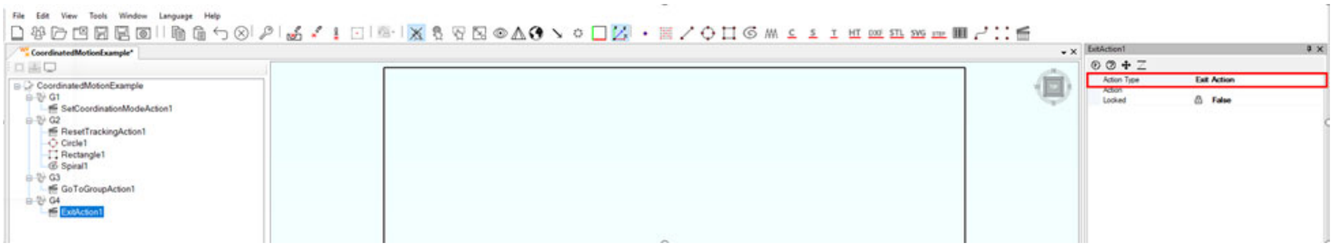


GoToGroupAction1

Action Type: Go To Group
Action
GoToGroupMethodType: Constant
Go To Group Method
Go To: 2
Locked: False

Figure 320: Go To Group Action Control

9. Create a fourth Group.
10. Within Group 4, create an Action Control and configure it to be a "Exit Action." This action allows IPGScan to complete the loop. See Figure 321 (below).



ExitAction1

Action Type: Exit Action
Action
Locked: False

Figure 321: Exit Action Control

Assuming all other setup has been complete, users can no Start Processing and run the drive.

9 Emulator

9.1 Introduction

IPGScan comes standard with a powerful emulator that enables users to setup and simulate scanning processes using IPG scanners. This allows users to visualize the complete scanning process prior to ever receiving and setting up any scanning equipment. Such functionality provides tremendous value in the following scenarios:

- **Process cycle time estimation** - determine scanner processing time as well as process motion time estimation (i.e. motion system movement times).
- **Process comparison** - easily compare Point and Shoot (PAS) processing to On-The-Fly (OTF) processing to best determine the desired method of processing for a given application.
- **Fixture verification** - Utilize beam projection to ensure that fixturing will not interfere with the laser beam path.
- **Process optimization** - Advanced timing displays which allow users to determine where additional time savings may be available in the process.

The following sections detail the use of the IPGScan Emulator.

Please note, IPGScan v1.0.0.21288 or greater is required for the use of IPGScan Emulator functionality.

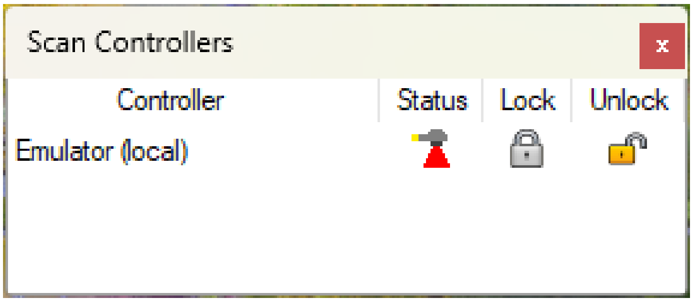
9.2 Configuration

Follow the steps in this section to configure the specific hardware the Emulator will use for simulation. Users must specify:

- The Process Head type
- The Lens type
- The Laser model type

PROCEDURE:

1. Open **IPGScan** software.
2. Lock the Emulator in the Scan Controllers list. See Figure 322 (below).
    - Left-click on the **Lock** symbol for the particular scan controller row named **Emulator (local)**.



Controller	Status	Lock	Unlock
Emulator (local)			

Figure 322: Emulator Listing in Scan Controllers Window

3. Open the Emulator Configuration window. See Figure 323 (below).
   - Select the sub-menu: Tools > Scanner > Configure Emulator.
     The IPG Scan Controller Emulator Configuration window will pop open.

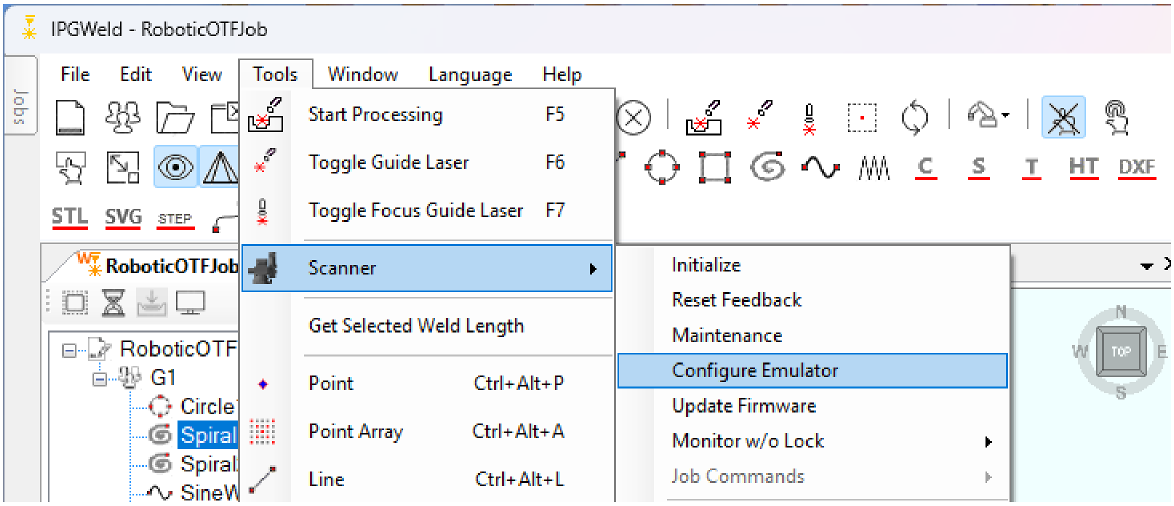
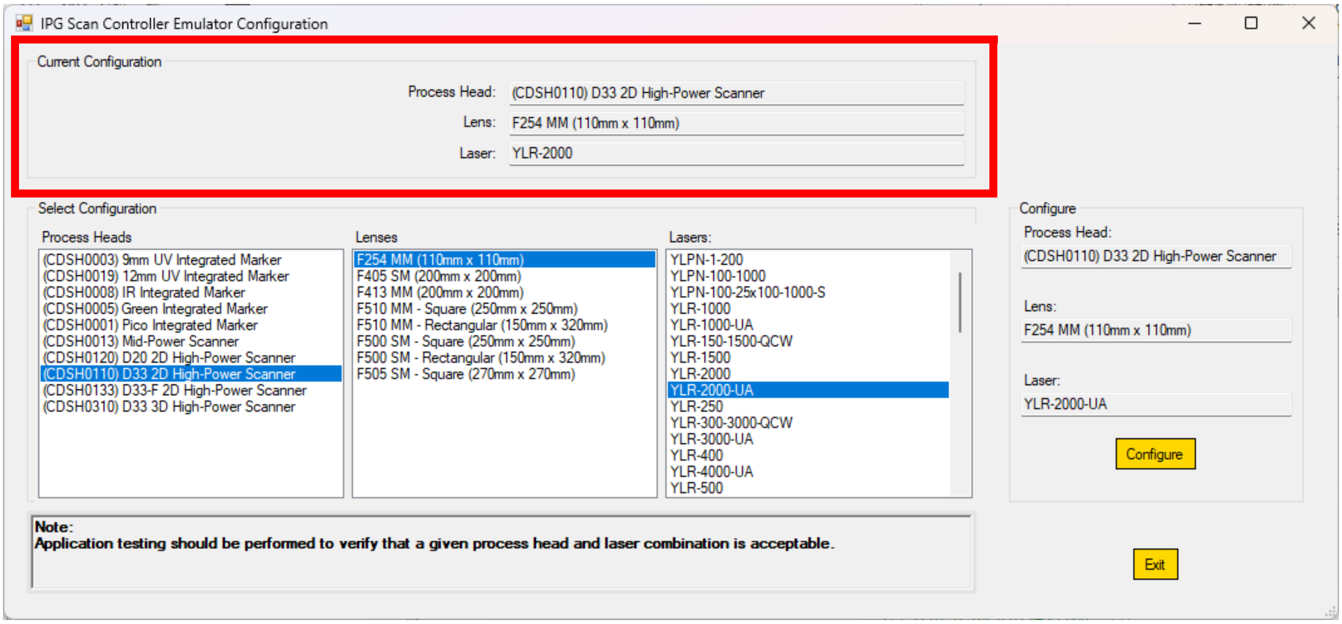


Figure 323: Select “Configure Emulator” Menu Item

4. At the top section of the Emulator Configuration window, the current configuration of the Emulator is shown. In the example shown in Figure 324 (below), the Emulator is configured to have:
   - D33 2D High-Power Scanner
   - F254 lens
   - YLS-8000 laser


IPG Scan Controller Emulator Configuration

Current Configuration

Process Head: (CDSH0110) D33 2D High-Power Scanner

Lens: F254 MM (110mm x 110mm)

Laser: YLR-2000

Select Configuration

Process Heads

(CDSH0003) 9mm UV Integrated Marker
(CDSH0019) 12mm UV Integrated Marker
(CDSH0008) IR Integrated Marker
(CDSH0005) Green Integrated Marker
(CDSH0001) Pico Integrated Marker
(CDSH0013) Mid-Power Scanner
(CDSH0120) D20 2D High-Power Scanner
(CDSH0110) D33 2D High-Power Scanner
(CDSH0133) D33-F 2D High-Power Scanner
(CDSH0310) D33 3D High-Power Scanner

Lenses

F254 MM (110mm x 110mm)
F405 SM (200mm x 200mm)
F413 MM (200mm x 200mm)
F510 MM - Square (250mm x 250mm)
F510 MM - Rectangular (150mm x 320mm)
F500 SM - Square (250mm x 250mm)
F500 SM - Rectangular (150mm x 320mm)
F505 SM - Square (270mm x 270mm)

Lasers:

YLPN-1-200
YLPN-100-1000
YLPN-100-25x100-1000-S
YLR-1000
YLR-1000-UA
YLR-150-1500-QCW
YLR-1500
YLR-2000
YLR-2000-UA
YLR-250
YLR-300-3000-QCW
YLR-3000-UA
YLR-400
YLR-4000-UA
YLR-500

Configure

Process Head: (CDSH0110) D33 2D High-Power Scanner

Lens: F254 MM (110mm x 110mm)

Laser: YLR-2000-UA

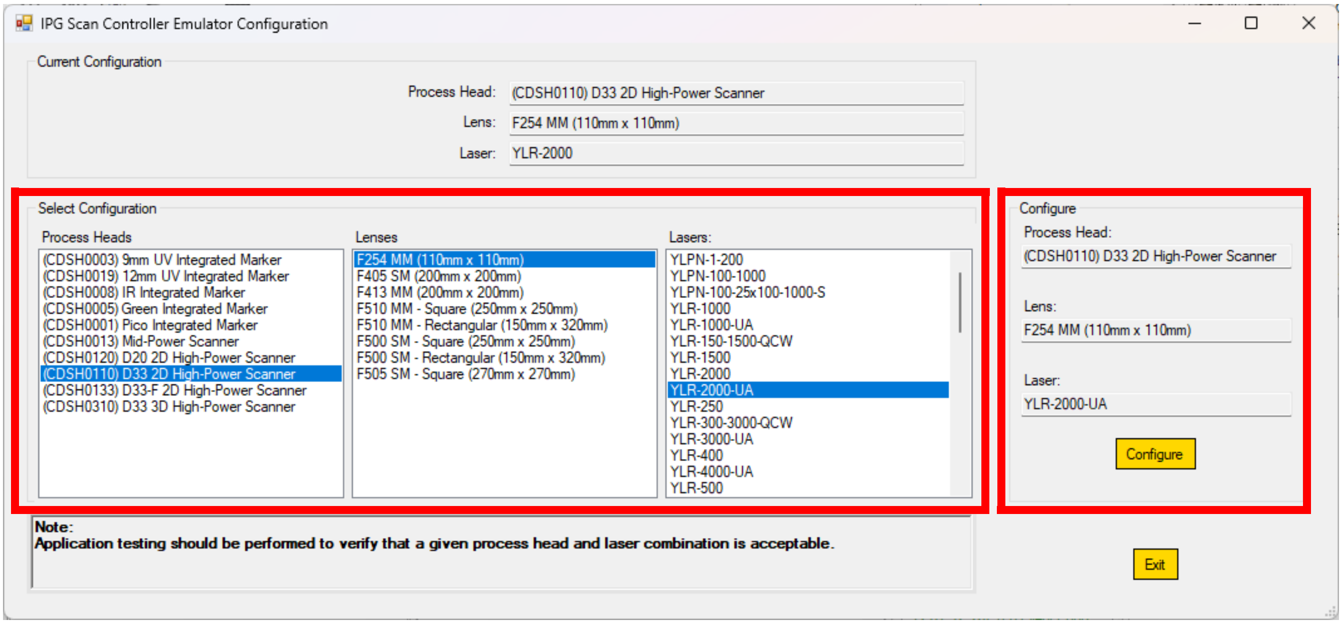
Note:
Application testing should be performed to verify that a given process head and laser combination is acceptable.

Figure 324: Emulator Configuration - Current Configuration

5. The new Emulator configuration can be selected in the middle section of the Emulator Configuration window. See Figure 325 (below).
   - First, select the Process Head type. As shown in the example below, the Emulator will remain configured as a D33 2D High-Power Scanner.
   - Second, select the Lens type. The available lens options are updated based upon the selected Process Head. As shown in the example below, the Emulator will be re-configured with an F254 MM (110mm x 110mm) lens.
   - Third, select the Laser. As shown in the example below, the emulator will be re-configured with a YLR-2000-UA laser.

   The Configure section on the right side of the Emulator Configuration window displays the summary of the selected options.

IMPORTANT User's optical setup should not be based solely on the Emulator. Users should conduct applications testing to determine optical setup.



IPG Scan Controller Emulator Configuration

Current Configuration

Process Head: (CDSH0110) D33 2D High-Power Scanner

Lens: F254 MM (110mm x 110mm)

Laser: YLR-2000

Select Configuration

Process Heads

- (CDSH0003) 9mm UV Integrated Marker
- (CDSH0019) 12mm UV Integrated Marker
- (CDSH0008) IR Integrated Marker
- (CDSH0005) Green Integrated Marker
- (CDSH0001) Pico Integrated Marker
- (CDSH0013) Mid-Power Scanner
- (CDSH0120) D20 2D High-Power Scanner
- (CDSH0110) D33 2D High-Power Scanner
- (CDSH0133) D33-F 2D High-Power Scanner
- (CDSH0310) D33 3D High-Power Scanner

Lenses

- F254 MM (110mm x 110mm)
- F405 SM (200mm x 200mm)
- F413 MM (200mm x 200mm)
- F510 MM - Square (250mm x 250mm)
- F510 MM - Rectangular (150mm x 320mm)
- F500 SM - Square (250mm x 250mm)
- F500 SM - Rectangular (150mm x 320mm)
- F505 SM - Square (270mm x 270mm)

Lasers:

- YLPN-1-200
- YLPN-100-1000
- YLPN-100-25x100-1000-S
- YLR-1000
- YLR-1000-UA
- YLR-150-1500-QCW
- YLR-1500
- YLR-2000
- YLR-2000-UA
- YLR-250
- YLR-300-3000-QCW
- YLR-3000-UA
- YLR-400
- YLR-4000-UA
- YLR-500

Configure

Process Head: (CDSH0110) D33 2D High-Power Scanner

Lens: F254 MM (110mm x 110mm)

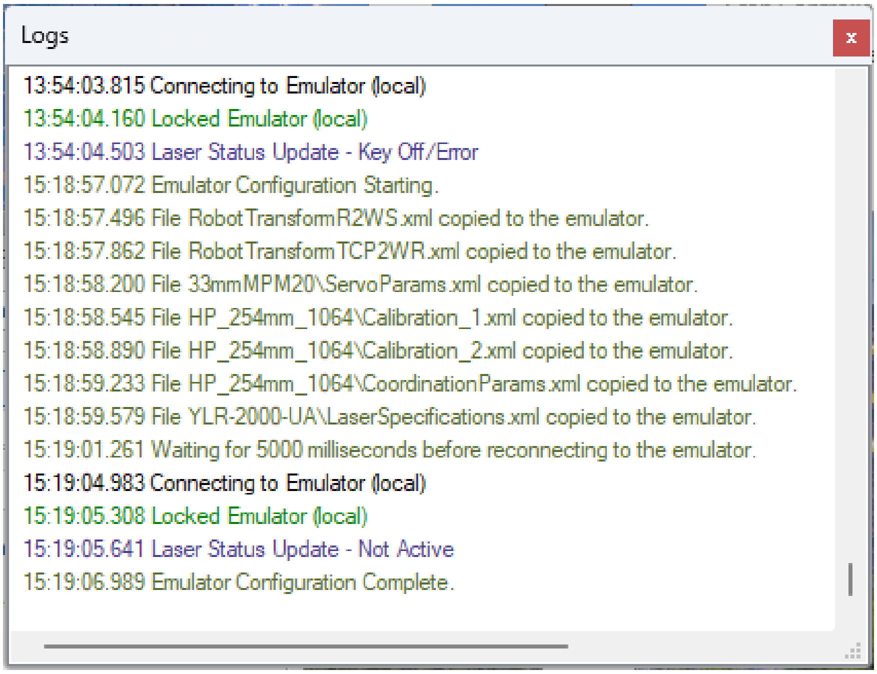
Laser: YLR-2000-UA

Note:
Application testing should be performed to verify that a given process head and laser combination is acceptable.

Figure 325: Emulator Configuration - Select Configuration

6. Confirm that the summarized settings are correct and make any changes, if necessary. Click the **Configure** button to implement the selected configuration.

The selected configuration will be applied and the connection to the emulator will be reset. The status of the configuration is shown in the IPGScan Logs panel. See Figure 326 (below).



```
13:54:03.815 Connecting to Emulator (local)
13:54:04.160 Locked Emulator (local)
13:54:04.503 Laser Status Update - Key Off/Error
15:18:57.072 Emulator Configuration Starting.
15:18:57.496 File RobotTransformR2WS.xml copied to the emulator.
15:18:57.862 File RobotTransformTCP2WR.xml copied to the emulator.
15:18:58.200 File 33mmMPM20\ServoParams.xml copied to the emulator.
15:18:58.545 File HP_254mm_1064\Calibration_1.xml copied to the emulator.
15:18:58.890 File HP_254mm_1064\Calibration_2.xml copied to the emulator.
15:18:59.233 File HP_254mm_1064\CoordinationParams.xml copied to the emulator.
15:18:59.579 File YLR-2000-UA\LaserSpecifications.xml copied to the emulator.
15:19:01.261 Waiting for 5000 milliseconds before reconnecting to the emulator.
15:19:04.983 Connecting to Emulator (local)
15:19:05.308 Locked Emulator (local)
15:19:05.641 Laser Status Update - Not Active
15:19:06.989 Emulator Configuration Complete.
```

Figure 326: IPGScan Logs Pane

9.3 Simulated Trajectory

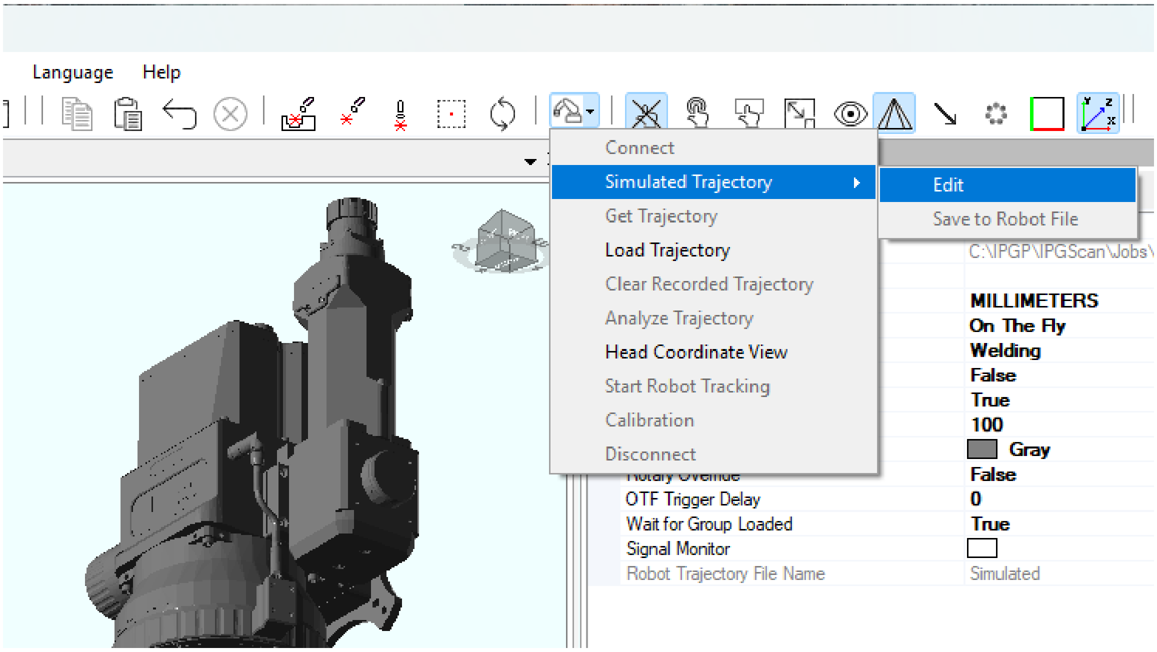
All Point and Shoot and On-The-Fly IPGScan jobs contain a simulated trajectory. A simulated trajectory is an estimation of the path of a robot or motion system. The purpose of a simulated trajectory is to visualize an IPGScan process without a connection to a motion system.

IMPORTANT The simulated trajectory functionality is an estimate of the motion system. This functionality assumes instant acceleration and constant velocity. Furthermore, this functionality does not account for I/O interaction (handshaking). For a more exact simulation of the process motion, use a simulator from your motion system manufacturer.

Every simulated point corresponds to a process group. In Point and Shoot jobs, the simulated point represents the location of a group while the shapes of that group are being processed.

9.3.1 Simulated Trajectory Window

The simulated trajectory edit window is opened from the Robot menu in the toolbar. See Figure 327 (below).



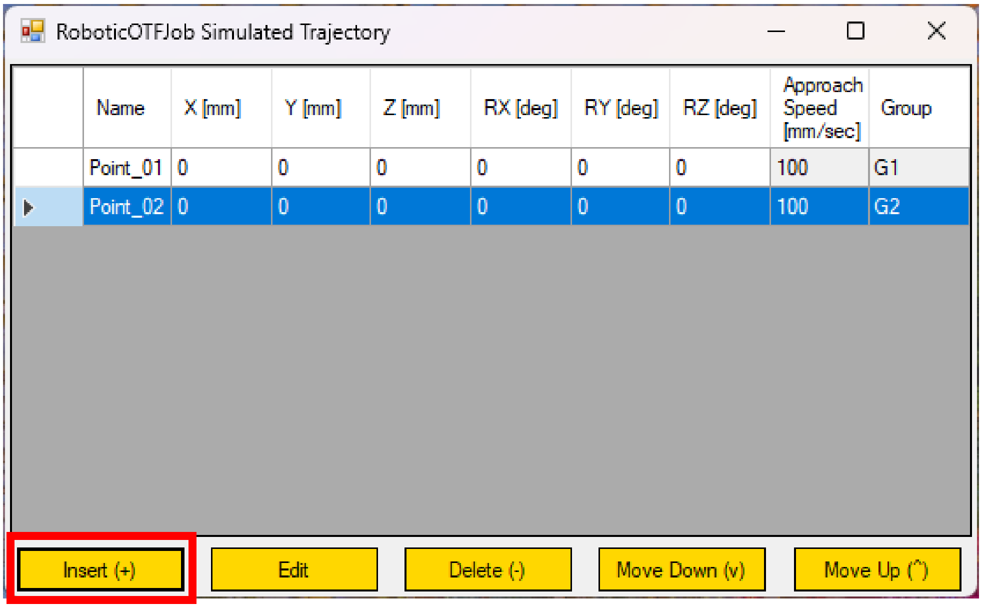
OTF Trigger Delay	0
Wait for Group Loaded	True
Signal Monitor	□
Robot Trajectory File Name	Simulated

Figure 327: Simulated Trajectory Edit Menu Selection in Toolbar

The simulated trajectory window displays a table that allows users to view and edit all components of the simulated trajectory for the selected job.

9.3.1.1 Create a Simulated Point

A new simulated point can be added by pressing the Insert (+) button (see Figure 328). Every simulated point corresponds to a process group. Inserting a new point also creates a process group in the job.

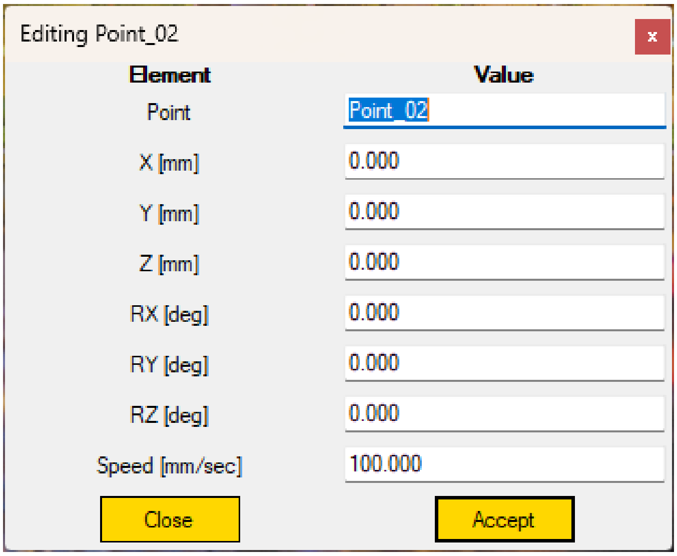


	Name	X [mm]	Y [mm]	Z [mm]	RX [deg]	RY [deg]	RZ [deg]	Approach Speed [mm/sec]	Group
	Point_01	0	0	0	0	0	0	100	G1
▶	Point_02	0	0	0	0	0	0	100	G2

Figure 328: Simulated Trajectory Insert Button

9.3.1.2 Editing a Simulated Point

The values of a simulated point can be directly edited in the table. In addition, pressing the **Edit** button opens another window that allows users to edit all selected points.



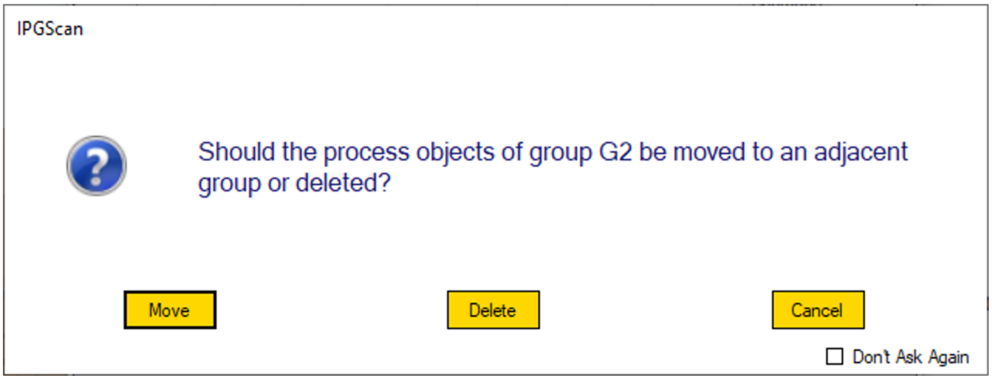
Editing Point_02

Element	Value
Point	Point_02
X [mm]	0.000
Y [mm]	0.000
Z [mm]	0.000
RX [deg]	0.000
RY [deg]	0.000
RZ [deg]	0.000
Speed [mm/sec]	100.000

Figure 329: Simulated Trajectory Edit Window

9.3.1.3 Deleting a Simulated Point

Pressing the **Delete (-)** button deletes the selected simulated points and the corresponding groups. If the corresponding group contains process shapes, a dialog box will be shown asking if the shapes should be moved to an adjacent group or deleted as well. See Figure 330 (below).



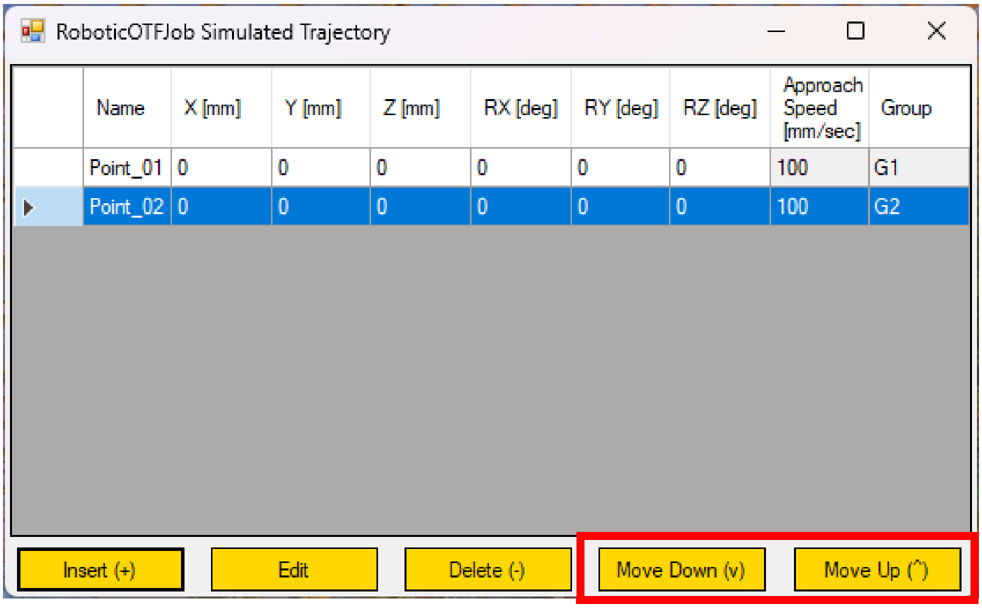
IPGScan

Should the process objects of group G2 be moved to an adjacent group or deleted?

Figure 330: Dialog Box for Deleting a Simulated Point

9.3.1.4 Changing the Order of Simulated Points

The Move Down (v) and Move Up (^) buttons move the order of the selected points later and earlier, respectively, in the trajectory sequence (see Figure 331). The corresponding groups are also moved in the job order.



	Name	X [mm]	Y [mm]	Z [mm]	RX [deg]	RY [deg]	RZ [deg]	Approach Speed [mm/sec]	Group
	Point_01	0	0	0	0	0	0	100	G1
▶	Point_02	0	0	0	0	0	0	100	G2

Figure 331: Simulated Trajectory Move Down and Move Up Buttons

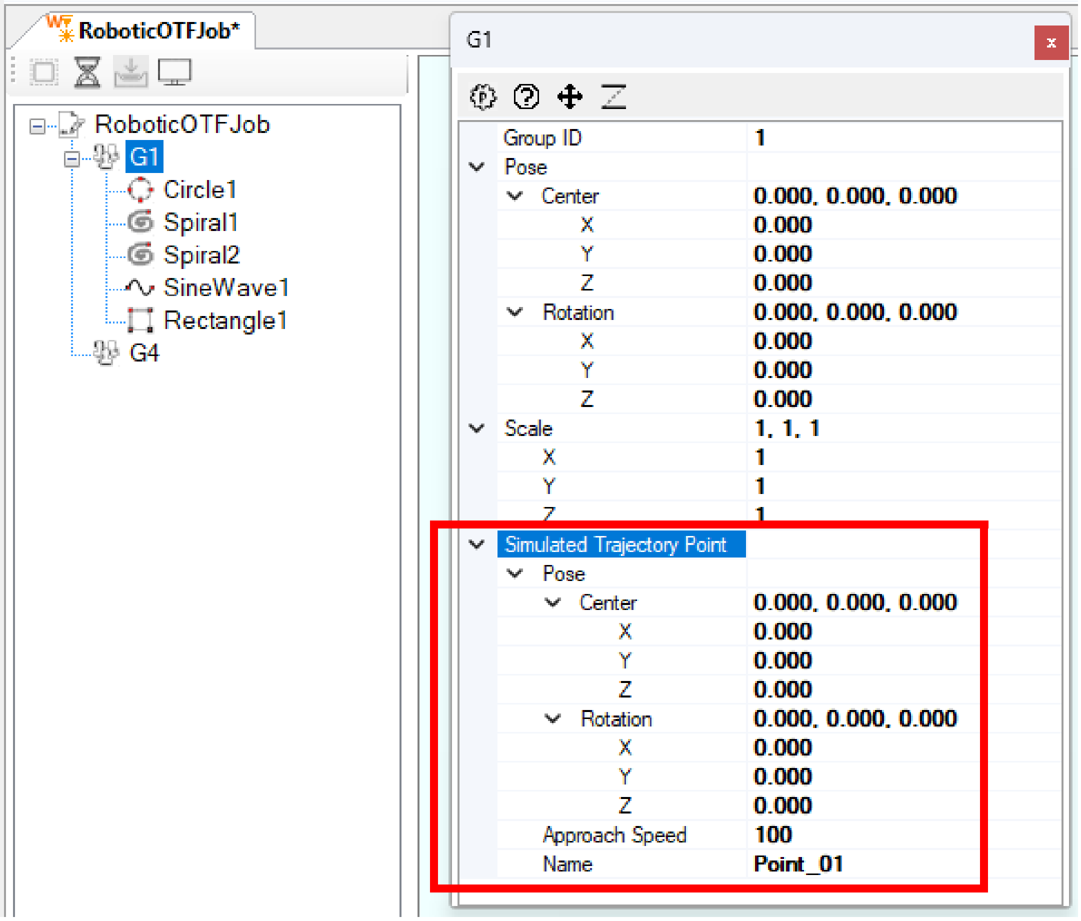
9.3.2 Creating a Simulated Trajectory Using Group Properties

9.3.2.1 Creating a Simulated Point

A simulated point can be created by adding a new group, because for every group created, a simulated point is created.

9.3.2.2 Editing a Simulated Point

The group properties also show the properties of the corresponding simulated point. If multiple groups are selected, any change is applied to all of the corresponding points. See Figure 332 on page 304.



Group ID	1
Pose	
Center	0.000, 0.000, 0.000
X	0.000
Y	0.000
Z	0.000
Rotation	0.000, 0.000, 0.000
X	0.000
Y	0.000
Z	0.000
Scale	1, 1, 1
X	1
Y	1
Z	1
Simulated Trajectory Point	
Pose	
Center	0.000, 0.000, 0.000
X	0.000
Y	0.000
Z	0.000
Rotation	0.000, 0.000, 0.000
X	0.000
Y	0.000
Z	0.000
Approach Speed	100
Name	Point_01

Figure 332: Editing Simulated Points from Group Properties

9.3.2.3 Deleting a Simulated Point

Deleting a group will delete the shapes contained in that group and the corresponding simulated point.

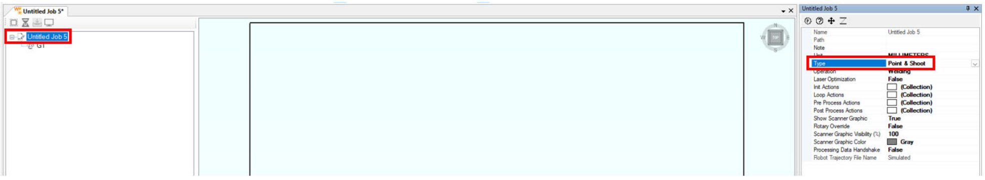
9.3.2.4 Changing the Order of Simulated Points

Changing the order of a group will change the order of the corresponding simulated point in the same manner.

9.4 Point and Shoot Example Job Creation

The following steps outline an example procedure for how users may setup a Point and Shoot example job and utilize the Emulator to simulate the process.

1. Create a new job in **IPGScan**.
2. Select the Job Name in the Job Tree. Ensure the job Type is set to Point & Shoot. See Figure 333 (below).



Name	Untitled Job 5
Path	
Note	
Unit	MILLIMETERS
Type	Point & Shoot
Operation	Welding
Laser Optimization	False
Init Actions	(Collection)
Loop Actions	(Collection)
Pre Process Actions	(Collection)
Post Process Actions	(Collection)
Show Scanner Graphic	True
Rotary Override	False
Scanner Graphic Visibility (%)	100
Scanner Graphic Color	Gray
Processing Data Handshake	False
Robot Trajectory File Name	Simulated

Figure 333: Point & Shoot Job Type

3. Import the desired STL model(s) into the job. See Figure 334 (below).
   - In this example, two STL models are imported into the job. One CAD model is for the part while the other model is for the fixture. Each CAD model is colored differently to provide contrast and better assist the user with placing welds in the desired locations.

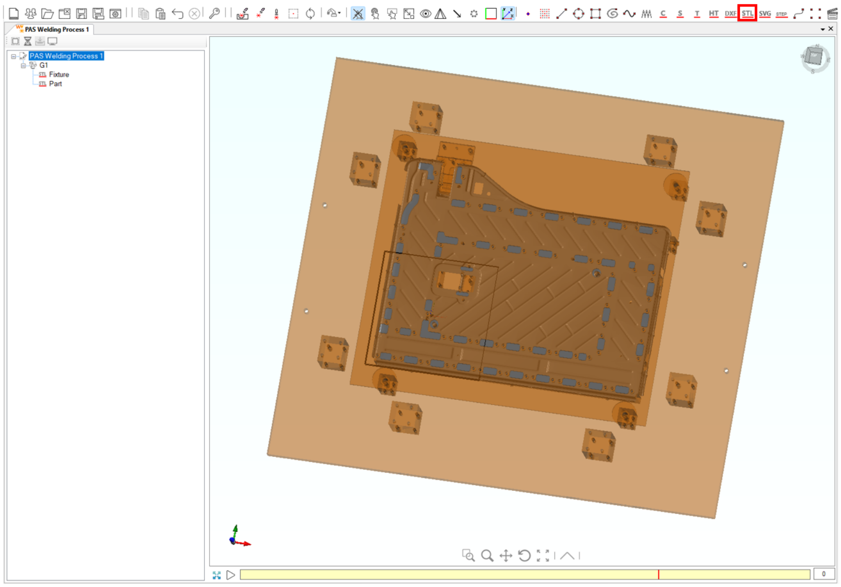


Figure 334: Importing STL Models to a Job

4. Create a desired weld shape.
   - The Tool Bar contains many standard process objects that allow for easy process object creation.
5. Position the weld shape according to the STL model(s). See Figure 335 on page 306.
   - This can be done via direct entry method or by using the Nudge Tool to move the weld into the desired location.

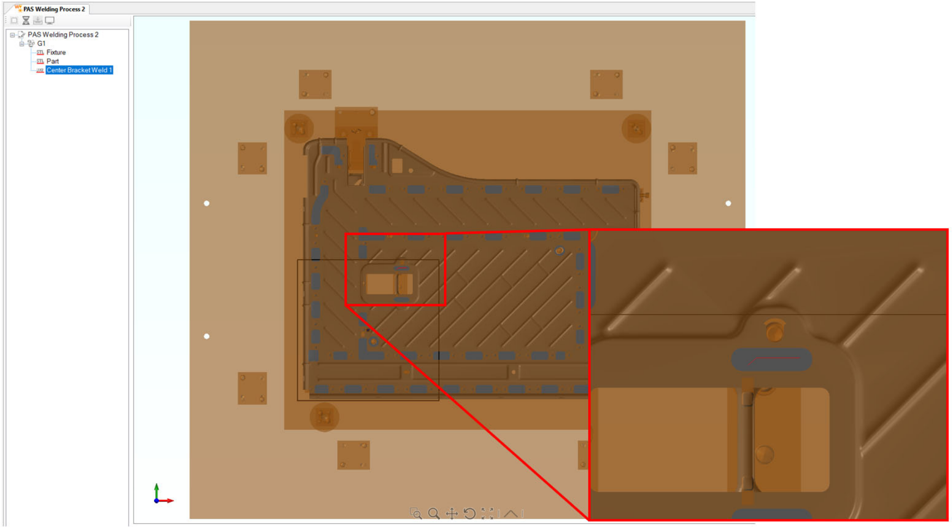


Figure 335: Positioning a Weld to the CAD Model(s)

6. Repeat steps 4 and 5 as many times as required for the given part.
   - For this example, 52 welds were created and placed about the part. See Figure 336 (below).

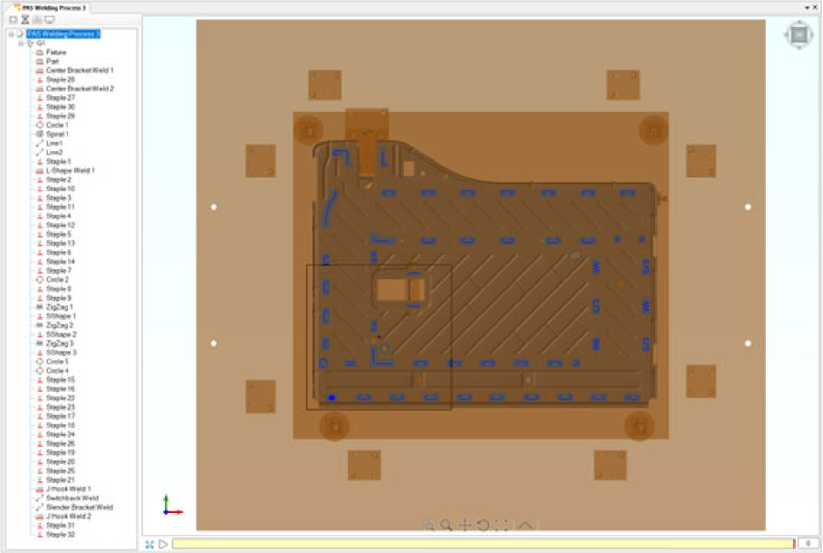


Figure 336: All Welds Placed Across the Part

7. Once all welds are created and placed about the part, users can then begin to create and position Groups, which define the different regions where the scanner will be positioned when laser processing takes place.
   - At this point, it is best to be connected to the emulator. See Figure 337 on page 307. This will help to ensure that the scanner's processing volume (field of view) is appropriately sized based on the configuration of the emulator.
   - For information on how to configure the emulator, please refer to Section 9.2 on page 297.

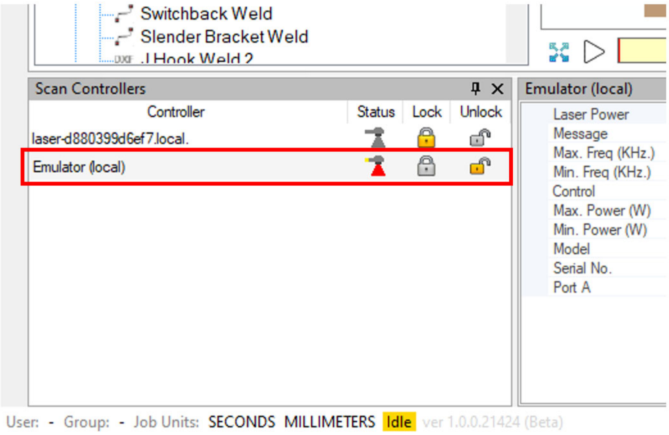


Figure 337: Connection with the Emulator

8. Create new Groups by clicking the Create Group button in the Tool Bar. See Figure 338 (below).

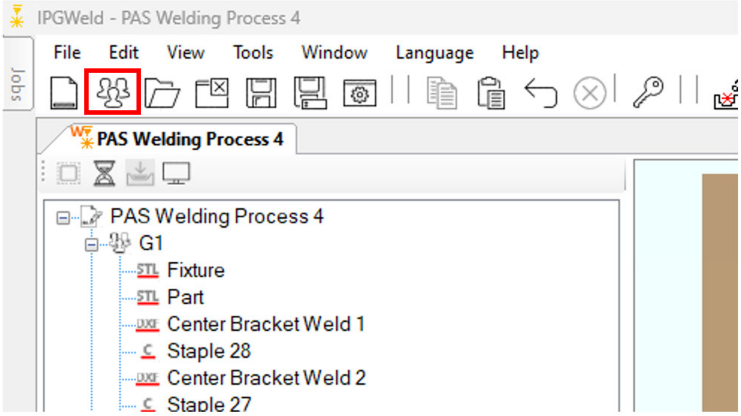
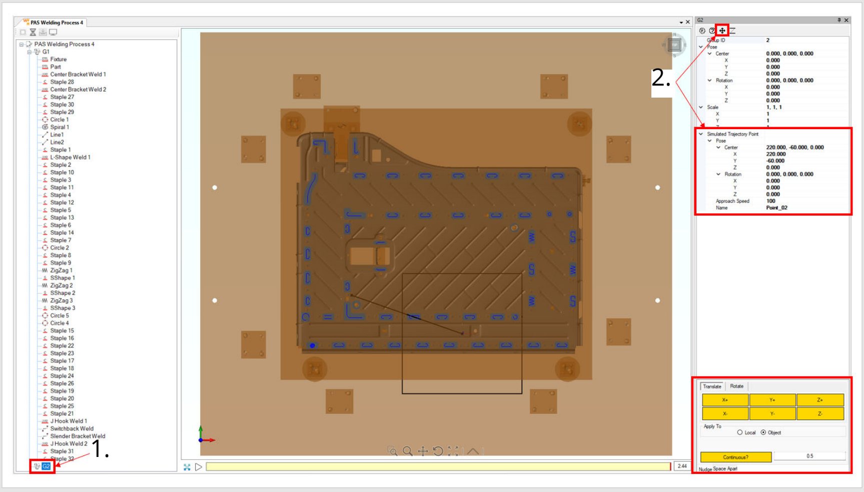


Figure 338: New Group Button

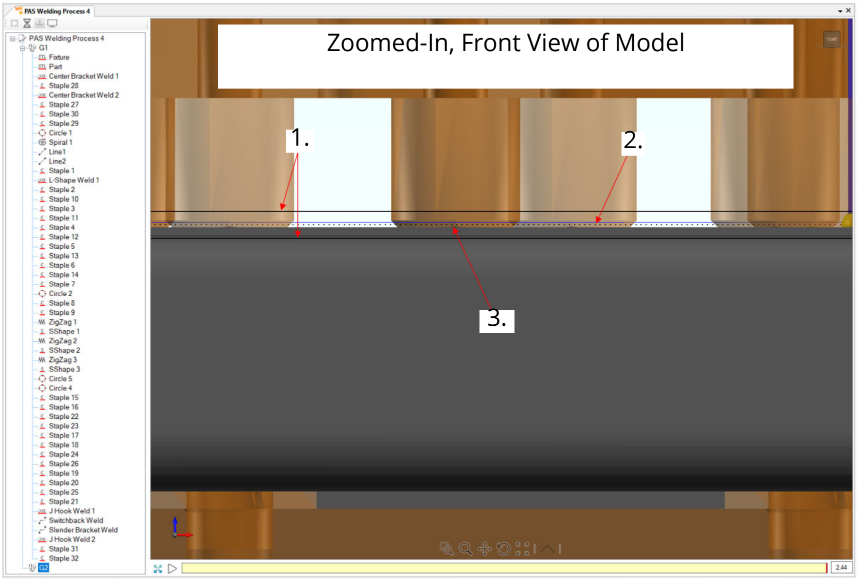
9. After creating a new Group, the Group can be positioned in the IPGScan canvas to encompass the desired welds for processing.
   - Positioning Groups can be done via direct entry method or by using the nudge tool. See Figure 339 on page 308.



Group ID	2
Pose	
Center	0.000, 0.000, 0.000
X	0.000
Y	0.000
Z	0.000
Rotation	0.000, 0.000, 0.000
X	0.000
Y	0.000
Z	0.000
Scale	1, 1, 1
X	1
Y	1
Z	1
Simulated Trajectory Point	
Pose	
Center	220.000, -60.000, 0.000
X	220.000
Y	-60.000
Z	0.000
Rotation	0.000, 0.000, 0.000
X	0.000
Y	0.000
Z	0.000
Approach Speed	100
Name	Point_02

Figure 339: Positioning a Group in the Canvas

IMPORTANT It is good practice to view the placement of the welds and Groups from multiple orientations in the IPGScan Canvas to ensure the desired welds are within a given Groups volume. See Figure 340 (below). The Scanner's Z-height volume can be increased in the IPGScan Canvas Options menu, if desired.



1. Black Lines: Group Z-Height
2. Blue Line: Weld Object
3. Dotted Line: Simulated Trajectory Path

Figure 340: Checking that Weld Objects Fall Within a Group's Volume

10. To check that the head is in the desired orientation after a Group has been positioned, enable the Projection Volume view in the toolbar. See Figure 341 (below).

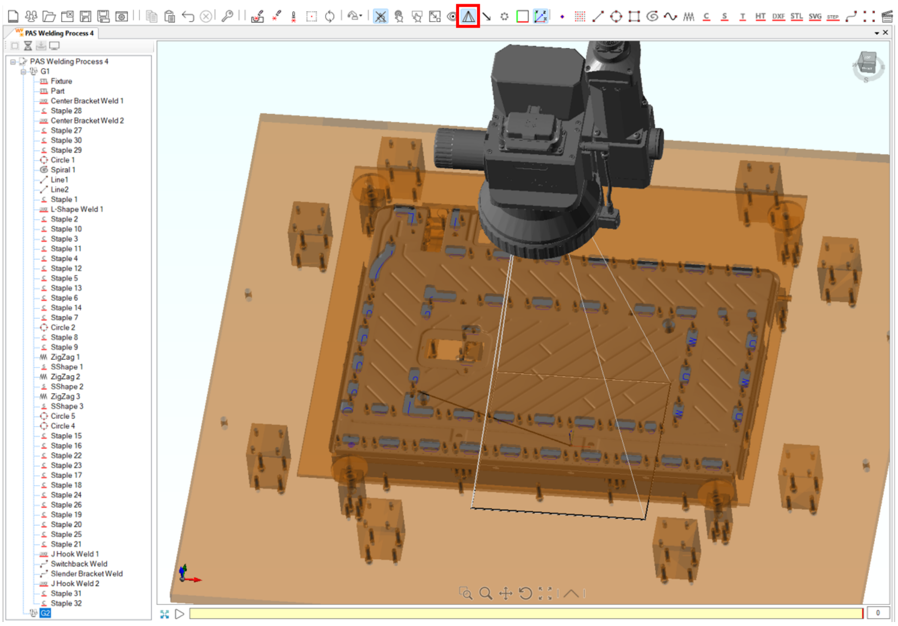


Figure 341: Enabling Projection Volume to Visualize the Scan Head Orientation

11. Repeat steps 7 to 10 until all welds are positioned within Groups.
    - For this example, it took 6 Groups to encompass all the welds across the part. See Figure 342 (below).

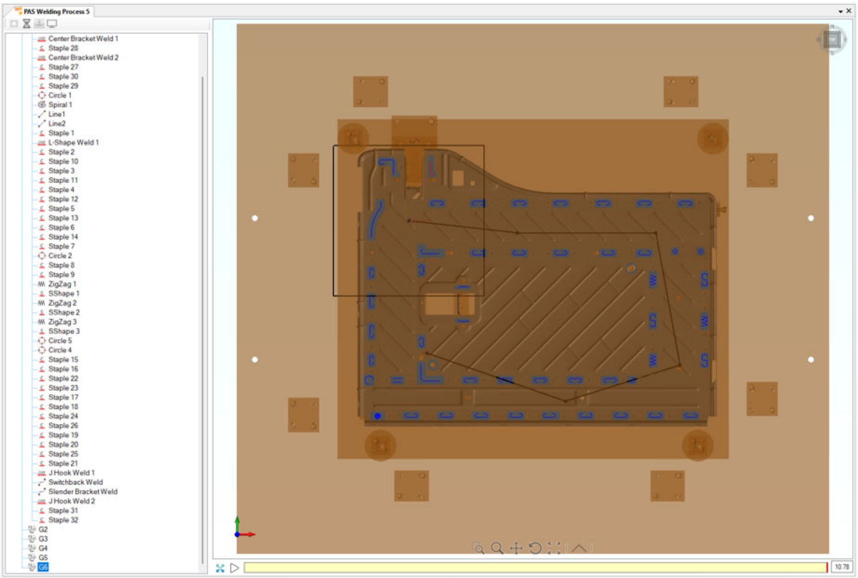


Figure 342: Groups Placed Across the Part

12. With all welds and Groups placed across the part, users should now drag the welds to the appropriate group in the job tree. See Figure 343 on page 310.

IMPORTANT In order for welds to execute without producing an error in IPGScan, a weld must be within a given Group in the job tree, and it must be positioned within that Groups volume in the IPGScan Canvas.

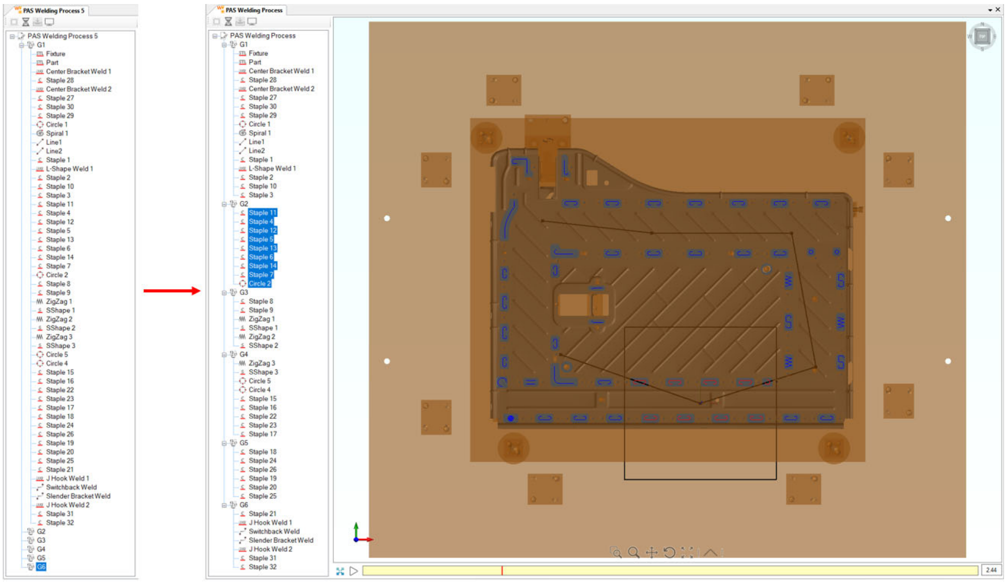
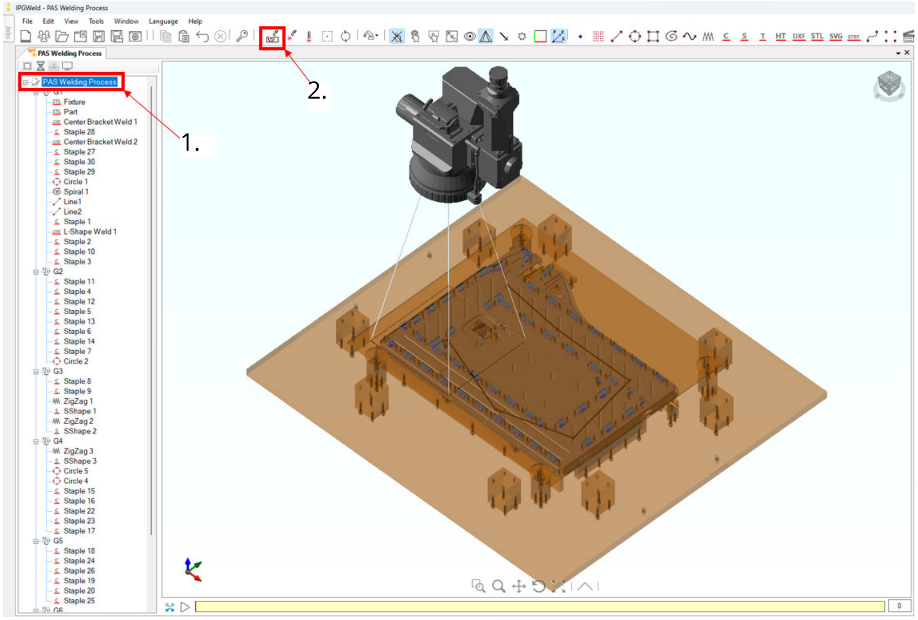


Figure 343: Dividing Weld Objects into Groups in the Job Tree

13. Once the welds are assigned to the appropriate Groups, users can now begin to emulate the process. To emulate the process, start by selecting the job name in the Job Tree and then open the Processing Window. See Figure 344 on page 311.

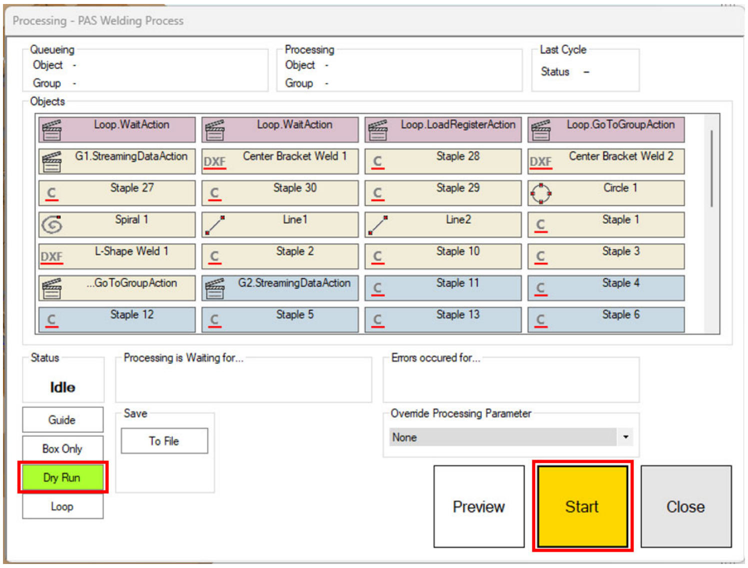
IMPORTANT In order to open the Processing Window, a connection with the Emulator or a real scanner is required.


IPGWeld - PAS Welding Process
File Edit View Tools Window Language Help
PAS Welding Process
1.
2.

1. Job Name Selection
2. Open Processing Window

Figure 344: Opening the Processing Window

14. Enable **Dry Run** and then click **Start** button to run the process. See Figure 345 (below).



Processing - PAS Welding Process

Queueing
Object -
Group -

Processing
Object -
Group -

Last Cycle
Status –

Objects

Loop.WaitAction	Loop.WaitAction	Loop.LoadRegisterAction	Loop.GoToGroupAction
G1.StreamingDataAction	Center Bracket Weld 1	Staple 28	Center Bracket Weld 2
Staple 27	Staple 30	Staple 29	Circle 1
Spiral 1	Line1	Line2	Staple 1
L-Shape Weld 1	Staple 2	Staple 10	Staple 3
...GoToGroupAction	G2.StreamingDataAction	Staple 11	Staple 4
Staple 12	Staple 5	Staple 13	Staple 6

Status
Idle

Processing is Waiting for...

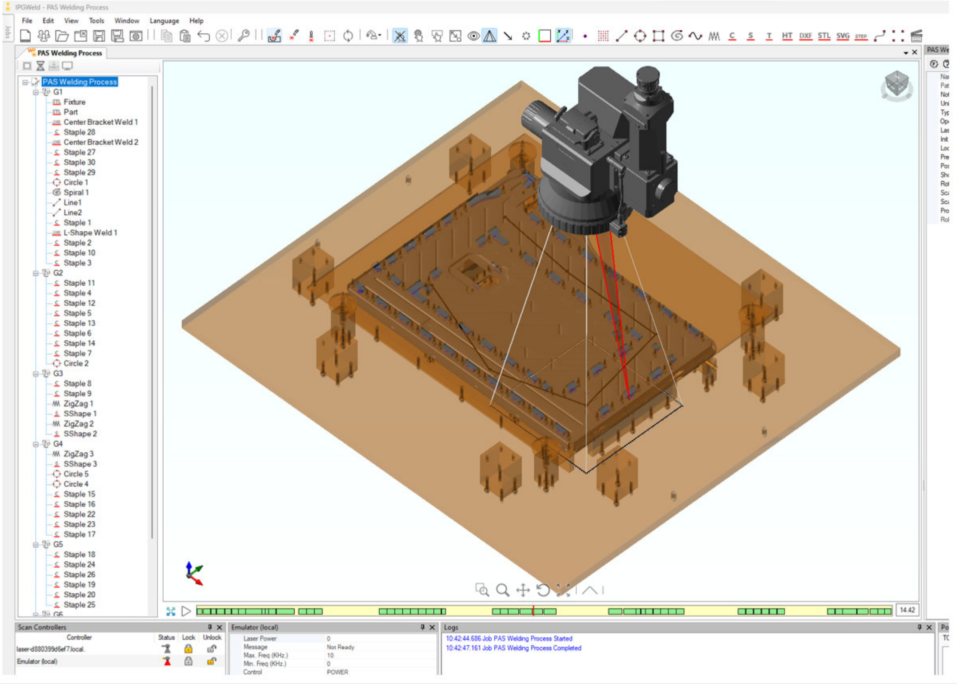
Errors occured for...

Save
To File

Override Processing Parameter
None

Figure 345: Dry Running the Process

15. After the process has been dry run, users can close the Processing Window and visualize the process. See Figure 346 on page 312.
   – For additional information on analyzing the process, please refer to section Section 9.5 on page 313.



- PAS Welding Process
  - G1
    - Fixture
    - Part
    - Center Bracket Weld 1
    - Staple 28
    - Center Bracket Weld 2
    - Staple 27
    - Staple 30
    - Staple 29
    - Circle 1
    - Spiral 1
    - Line1
    - Line2
    - Staple 1
    - L-Shape Weld 1
    - Staple 2
    - Staple 10
    - Staple 3
  - G2
    - Staple 11
    - Staple 4
    - Staple 12
    - Staple 5
    - Staple 13
    - Staple 6
    - Staple 14
    - Staple 7
    - Circle 2
  - G3
    - Staple 8
    - Staple 9
    - ZigZag 1
    - SShape 1
    - ZigZag 2
    - SShape 2
  - G4
    - ZigZag 3
    - SShape 3
    - Circle 5
    - Circle 4
    - Staple 15
    - Staple 16
    - Staple 22
    - Staple 23
    - Staple 17
  - G5
    - Staple 18
    - Staple 24
    - Staple 26
    - Staple 19
    - Staple 20
    - Staple 25
  - G6

Scan Controllers

Controller	Status	Lock	Unlock
laser-d880399d6ef7.local.			
Emulator (local)			

Emulator (local)

Laser Power	0
Message	Not Ready
Max. Freq (KHz.)	10
Min. Freq (KHz.)	0
Control	POWER

Logs

```
10:42:44.686 Job PAS Welding Process Started
10:42:47.161 Job PAS Welding Process Completed
```

Figure 346: Process Visualization

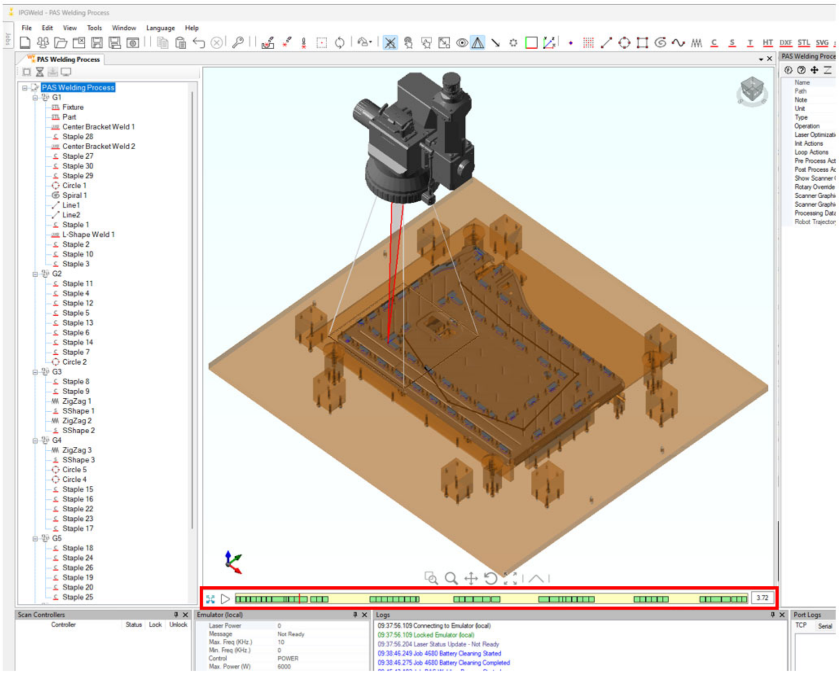
9.5 Process Analysis

In order to analyze and optimize a scanning process, IPGScan is equipped with multiple tools that allow the user to examine the process and timings as required. These tools include a basic timeline, beam tracker timeline, and the advanced timeline.

The following sections outline the individual timelines that can be utilized for process examination and optimization.

9.5.1 Basic Timeline

The Basic Timeline is located at the bottom of the IPGScan Canvas window. See Figure 347 (below).



Laser Power	0
Message	Not Ready
Max. Freq (KHz.)	10
Min. Freq (KHz.)	0
Control	POWER
Max. Power (W)	6000

```
09:37:56.109 Connecting to Emulator (local)
09:37:56.109 Locked Emulator (local)
09:37:56.204 Laser Status Update - Not Ready
09:38:46.249 Job 4680 Battery Cleaning Started
09:38:46.275 Job 4680 Battery Cleaning Completed
```

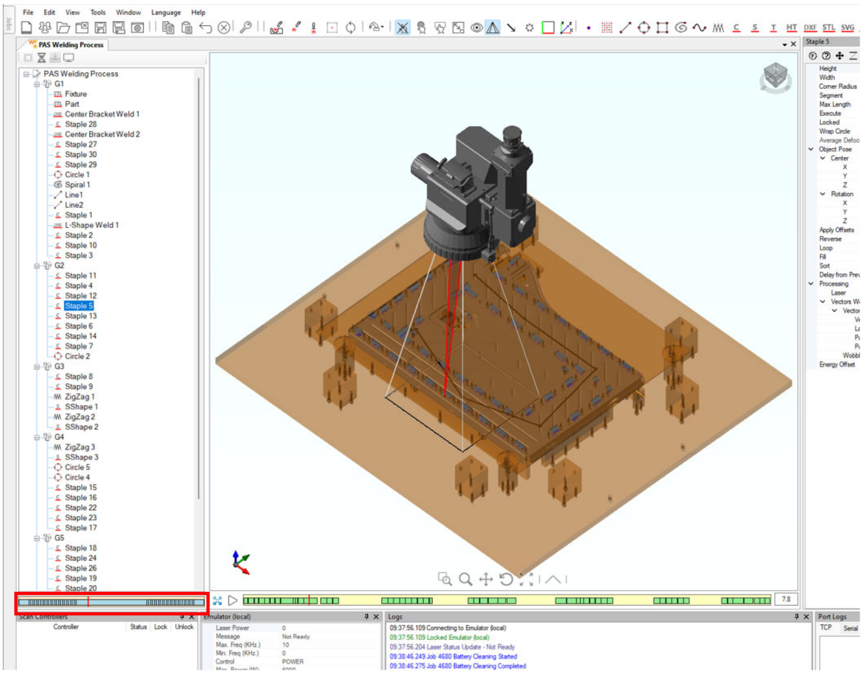
Figure 347: Basic Timeline

To visualize process object (weld) timings on the Basic Timeline, users first need to dry run the job. Once the job has been dry run, users can scrub along the basic timeline to view the process. The Basic Timeline also has the following features:

- **Play/Stop Button** - Allows users to continuously loop the process visualization
- **Pop-out Button** - Expands the Basic Timeline for zoomed in view
- **Time Display** - Timing display of the current position of the scrubbing cursor

9.6 Beam Tracker Timeline

The Beam Tracker Timeline is located at the bottom of the Job Tree. See Figure 348 (below). For the Beam Tracker to display, users must select a process object (weld) in the Job Tree. Once displayed, users can scrub along the Beam Tracker Timeline to visualize the beam path for that specific process object.



Laser Power	0
Message	Not Ready
Max. Freq (KHz.)	10
Min. Freq (KHz.)	0
Control	POWER

```
09:37:56.109 Connecting to Emulator (local)
09:37:56.109 Locked Emulator (local)
09:37:56.204 Laser Status Update - Not Ready
09:38:46.249 Job 4680 Battery Cleaning Started
09:38:46.275 Job 4680 Battery Cleaning Completed
```

Figure 348: Beam Tracker Timeline

9.7 Advanced Timeline

The purpose of the Advanced Timeline is to provide users with a detailed summary of process timing. This includes details such as when an object is partially in the scanner's field of view (FOV), when it is fully in the FOV, and when processing is taking place.

In addition, the Advanced Timeline allows users to quickly change primary process parameters such as process object velocity, laser power and delay timings. This can assist in the rapid development of a process.

The following steps detail how users can access the Advanced Timeline.

1. Open the desired IPGScan job.
2. Click the **Time Line** button at the Top of the Job Tree. See Figure 349 (below).

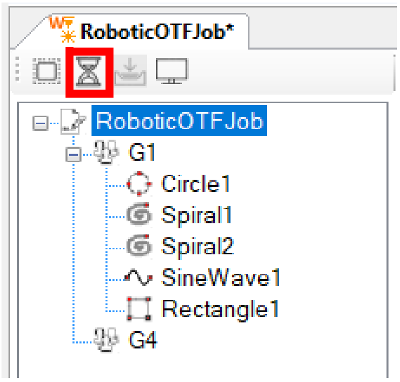
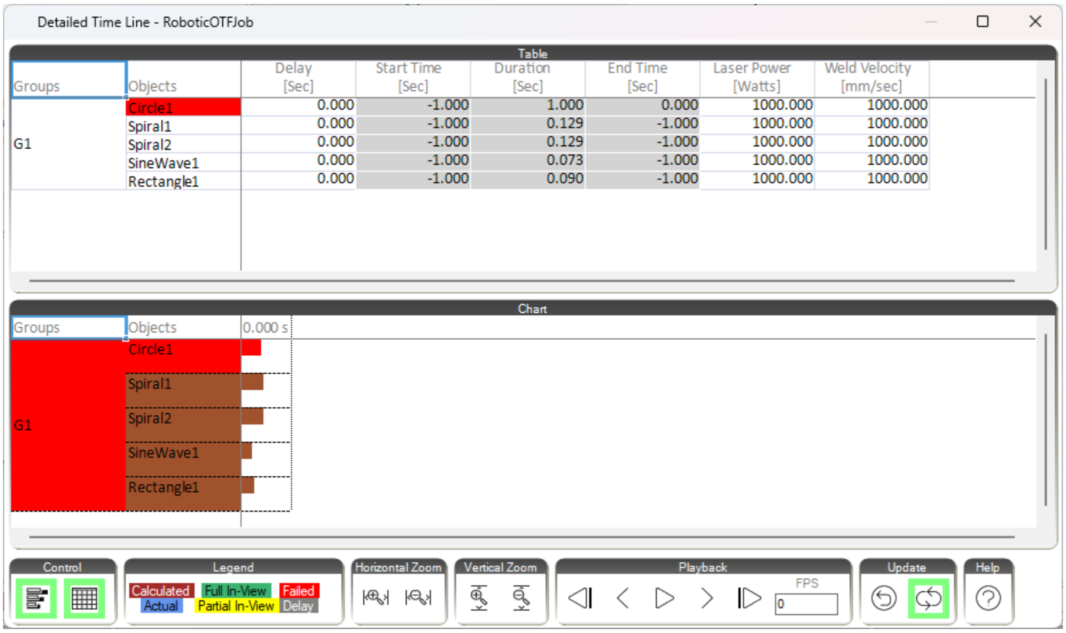


Figure 349: Timeline Button

The Detailed Timeline appears as an individual pop-up window which can be seen in Figure 350 (below).



Detailed Time Line - RoboticOTFJob

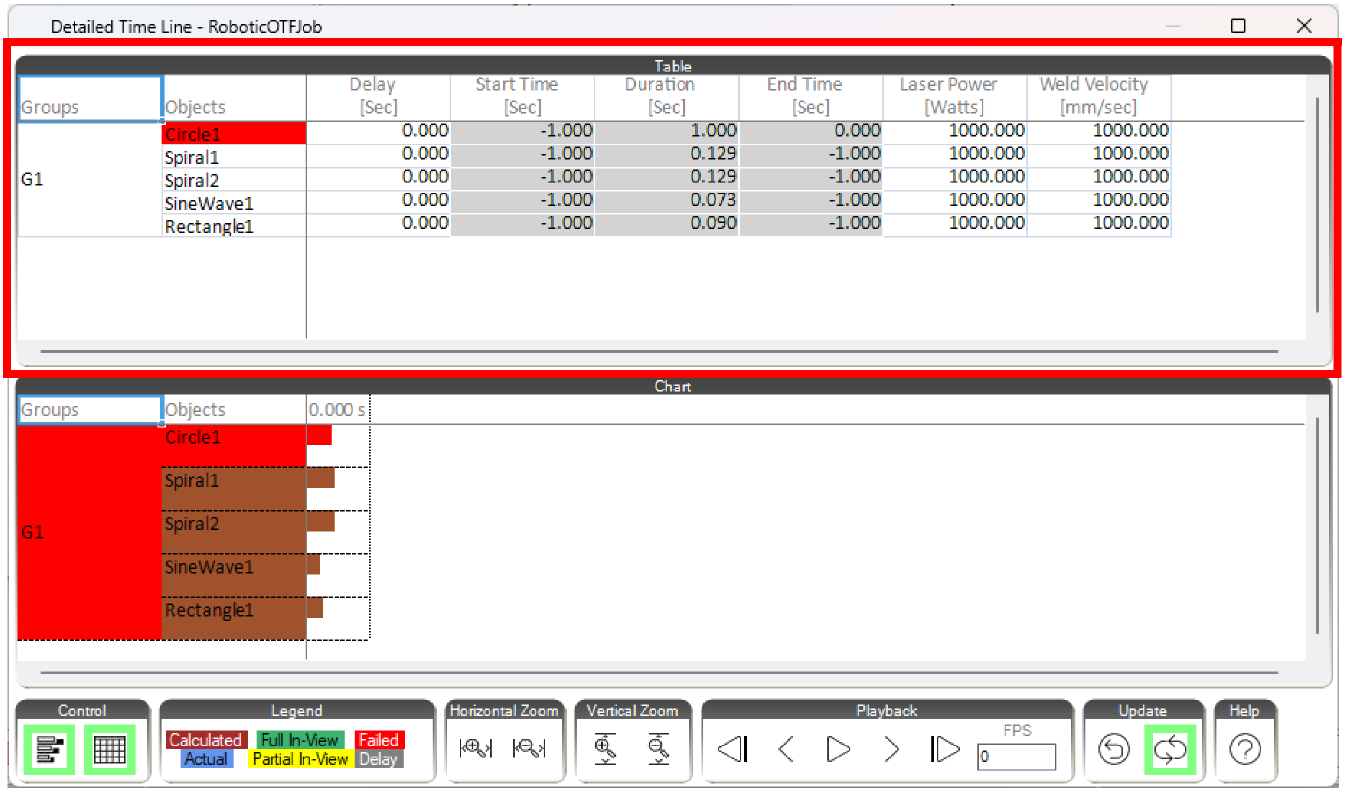
Table

Groups	Objects	Delay [Sec]	Start Time [Sec]	Duration [Sec]	End Time [Sec]	Laser Power [Watts]	Weld Velocity [mm/sec]
G1	Circle1	0.000	-1.000	1.000	0.000	1000.000	1000.000
	Spiral1	0.000	-1.000	0.129	-1.000	1000.000	1000.000
	Spiral2	0.000	-1.000	0.129	-1.000	1000.000	1000.000
	SineWave1	0.000	-1.000	0.073	-1.000	1000.000	1000.000
	Rectangle1	0.000	-1.000	0.090	-1.000	1000.000	1000.000

Figure 350: IPGScan Detailed Timeline

The Detailed Timeline offers the following functionality.

- **Object Parameter Table** - This outlines all the Process Objects within the job. Here users can find and modify primary parameters such as Laser Power and Weld Velocity. Users can also view Start, End, and Duration times. Additionally, users can easily modify delay timings for prior to object processing. See Figure 351 (below).



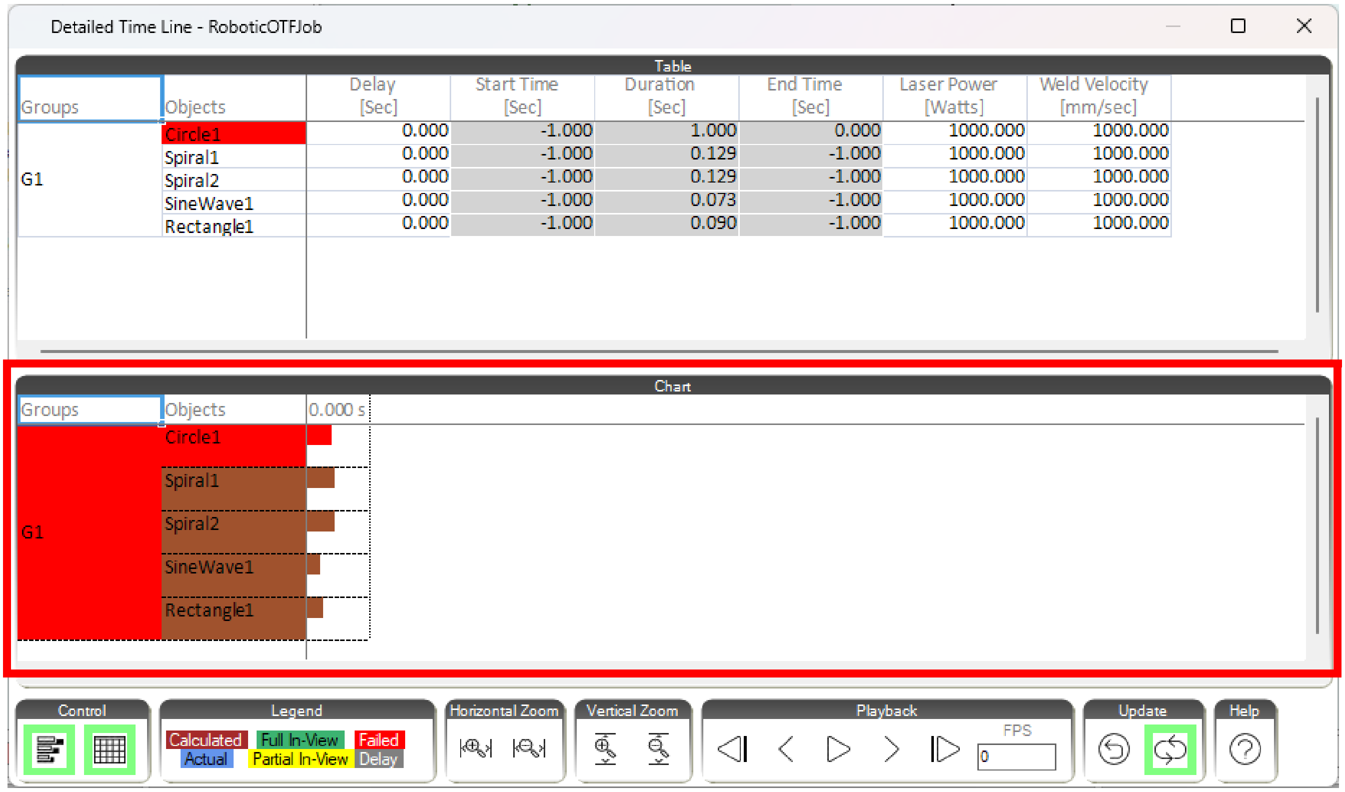
Detailed Time Line - RoboticOTFJob

Table

Groups	Objects	Delay [Sec]	Start Time [Sec]	Duration [Sec]	End Time [Sec]	Laser Power [Watts]	Weld Velocity [mm/sec]
G1	Circle1	0.000	-1.000	1.000	0.000	1000.000	1000.000
	Spiral1	0.000	-1.000	0.129	-1.000	1000.000	1000.000
	Spiral2	0.000	-1.000	0.129	-1.000	1000.000	1000.000
	SineWave1	0.000	-1.000	0.073	-1.000	1000.000	1000.000
	Rectangle1	0.000	-1.000	0.090	-1.000	1000.000	1000.000

Figure 351: Object Parameter Table

- **Timeline Graph** - This outlines detailed process object timings. This allows users to efficiently adjust parameters to develop the process. See Figure 352 (below).
  - **Legend** - The Legend, which is positioned below the Timeline Graph, contains the color codes for the graph.
  - **Horizontal and Vertical Zoom** - Also positioned below the Timeline Graph, here users can use the Horizontal and Vertical Zoom tools to better examine process timings.



Detailed Time Line - RoboticOTFJob

Table

Groups	Objects	Delay [Sec]	Start Time [Sec]	Duration [Sec]	End Time [Sec]	Laser Power [Watts]	Weld Velocity [mm/sec]
G1	Circle1	0.000	-1.000	1.000	0.000	1000.000	1000.000
	Spiral1	0.000	-1.000	0.129	-1.000	1000.000	1000.000
	Spiral2	0.000	-1.000	0.129	-1.000	1000.000	1000.000
	SineWave1	0.000	-1.000	0.073	-1.000	1000.000	1000.000
	Rectangle1	0.000	-1.000	0.090	-1.000	1000.000	1000.000

Figure 352: Timeline Graph

- **Update Buttons** - Two buttons exist for updating the Timeline Graph. By default, Automatic update is enabled. This function causes the Timeline Graph to update automatically anytime a Process Object's parameters are updated. A single instance update button also exists, if users choose to disable the automatic update functionality. See Figure 353 (below).

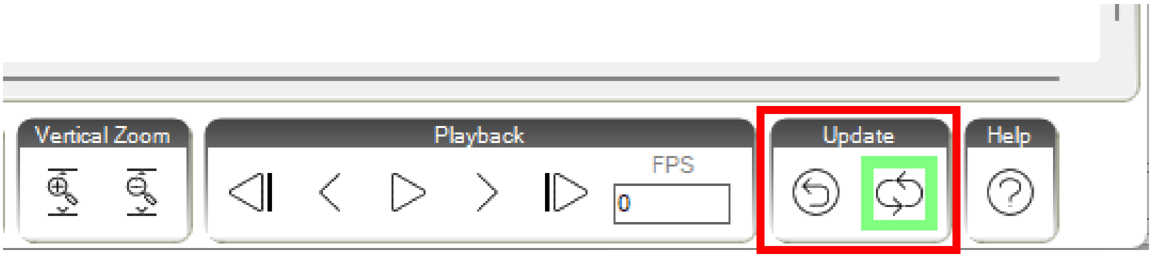


Figure 353: Timeline Update Buttons

- **Playback** - The Playback buttons allow users to start a process play through or step through the process visualization. The speed for which the play through occurs is based on the defined FPS value. See Figure 354 (below).

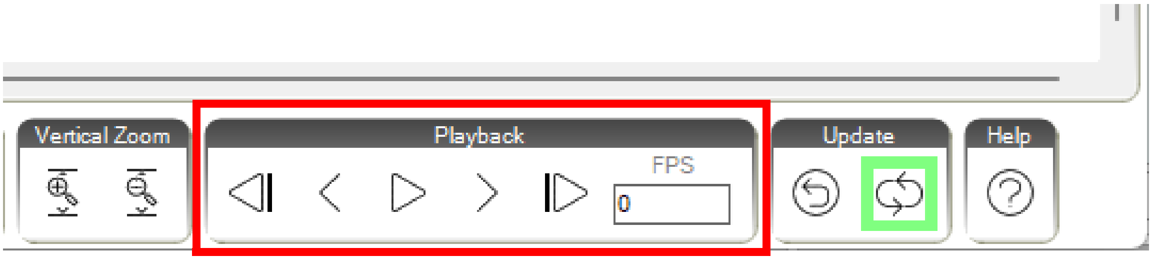


Figure 354: Timeline Playback Buttons

10 Signal Monitor

10.1 Introduction

Signal Monitor can enable the monitoring of scanner commands, or the monitoring of specific input signals. to the scanner in IPGScan. With Signal Monitor, users can be notified, and/or the process can be aborted, if unexpected changes have occurred to the scanning process for the monitored signals.

IMPORTANT Signal Monitor is not a process quality monitor that can tell whether a weld or part is good or bad.

This functionality works by comparing the "training" of a golden job to the current scanner's commands and input signals. If any of the monitored scanner commands or input signals deviate from specified process tolerances, either a warning or abort will occur, depending on the user’s setup of Signal Monitor.

10.2 Required Equipment and Software

The following software versions are required for the use of Signal Monitor:

- IPGScanSuite_1.0.0.20665 or above
- Scan Controller Firmware Version 3.7.7 or above

The following hardware is required:

- External I/O Interface Device (see the following table)

Table 32: *External Interface Available Status Bits*

External Interface Device	Number of Software Status Bits	Number of General Purpose Out Bits
Fieldbus Interface[a]	8	12
Extended IO Interface	0	12
24V Interface	0	1
Motion Interface	0	2

[a] The Fieldbus Interface is the recommended interface for Signal Monitor.

Users have the ability to set up 4 signals that can be monitored. Each signal can be configured as a Software Status Bit or a General Purpose Out Bit.

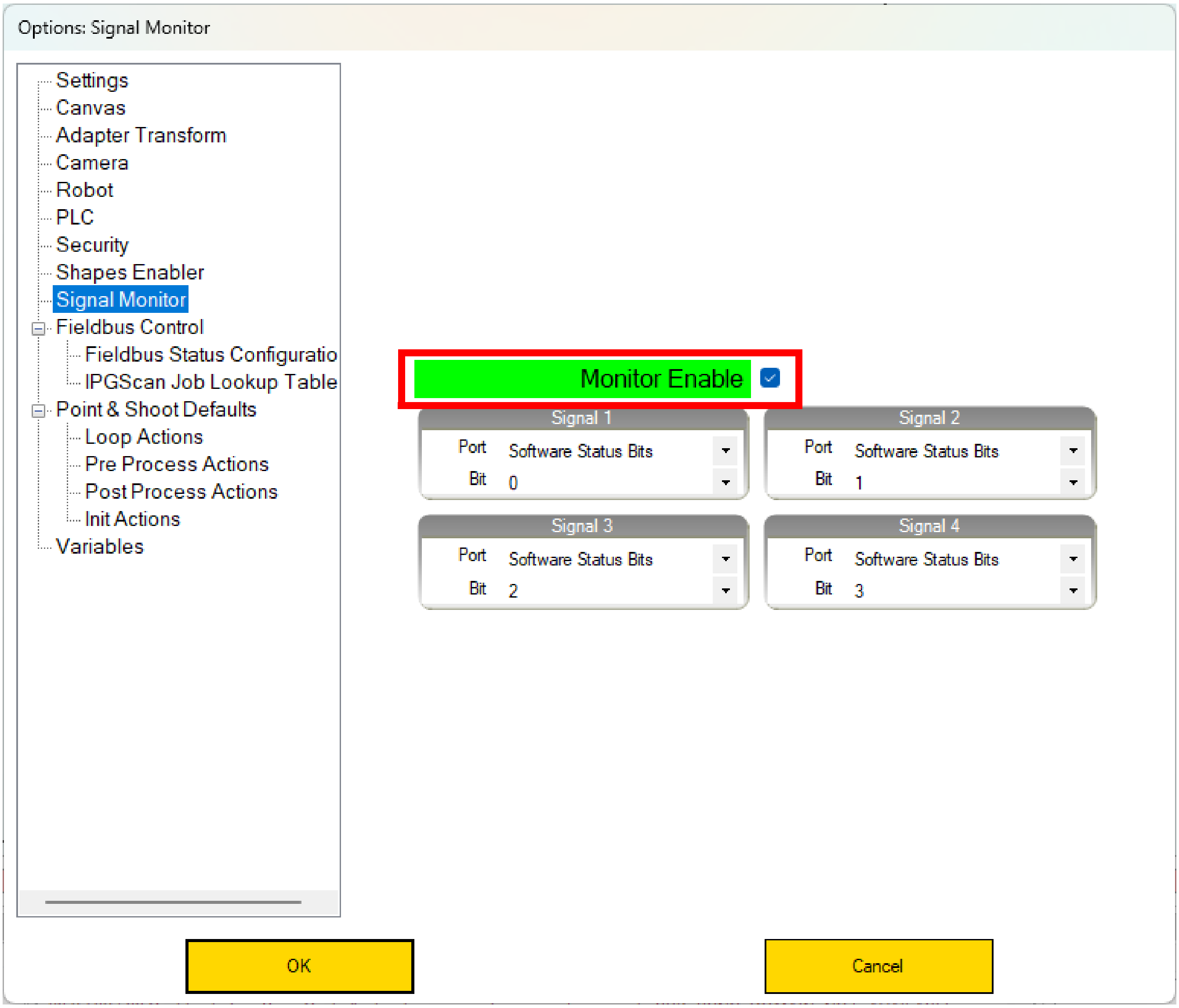
10.3 Procedure

Section 10.3.1 (below) describes how to set up the Signal Monitor options.

Section 10.3.2 on page 322 describes how to set up a job for Signal Monitor use.

10.3.1 IPGScan Signal Monitor Options Setup

In order to use Signal Monitor, users must first set "Monitor Enable" in the IPGScan **Options -> Signal Monitor** menu. See Figure 355 (below).



Monitor Enable ☑

Signal 1
Port Software Status Bits
Bit 0

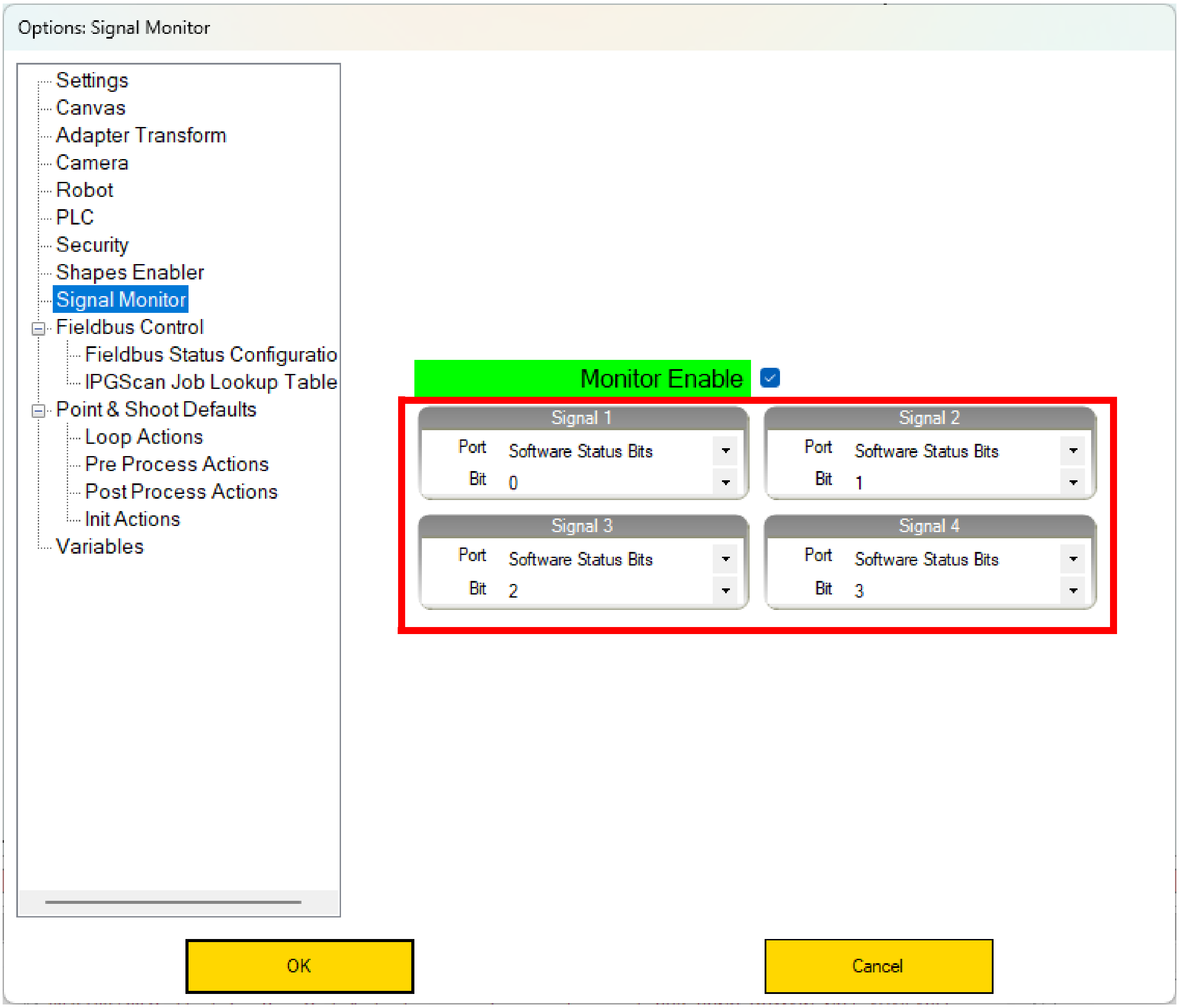
Signal 2
Port Software Status Bits
Bit 1

Signal 3
Port Software Status Bits
Bit 2

Signal 4
Port Software Status Bits
Bit 3

Figure 355: Signal Monitor Enable

Users should also select the status bits that will correspond to the signals that are monitored. See Figure 356 (below).



Options: Signal Monitor

- Settings
- Canvas
- Adapter Transform
- Camera
- Robot
- PLC
- Security
- Shapes Enabler
- Signal Monitor
- Fieldbus Control
  - Fieldbus Status Configuratio
  - IPGScan Job Lookup Table
- Point & Shoot Defaults
  - Loop Actions
  - Pre Process Actions
  - Post Process Actions
  - Init Actions
- Variables

Monitor Enable ☑

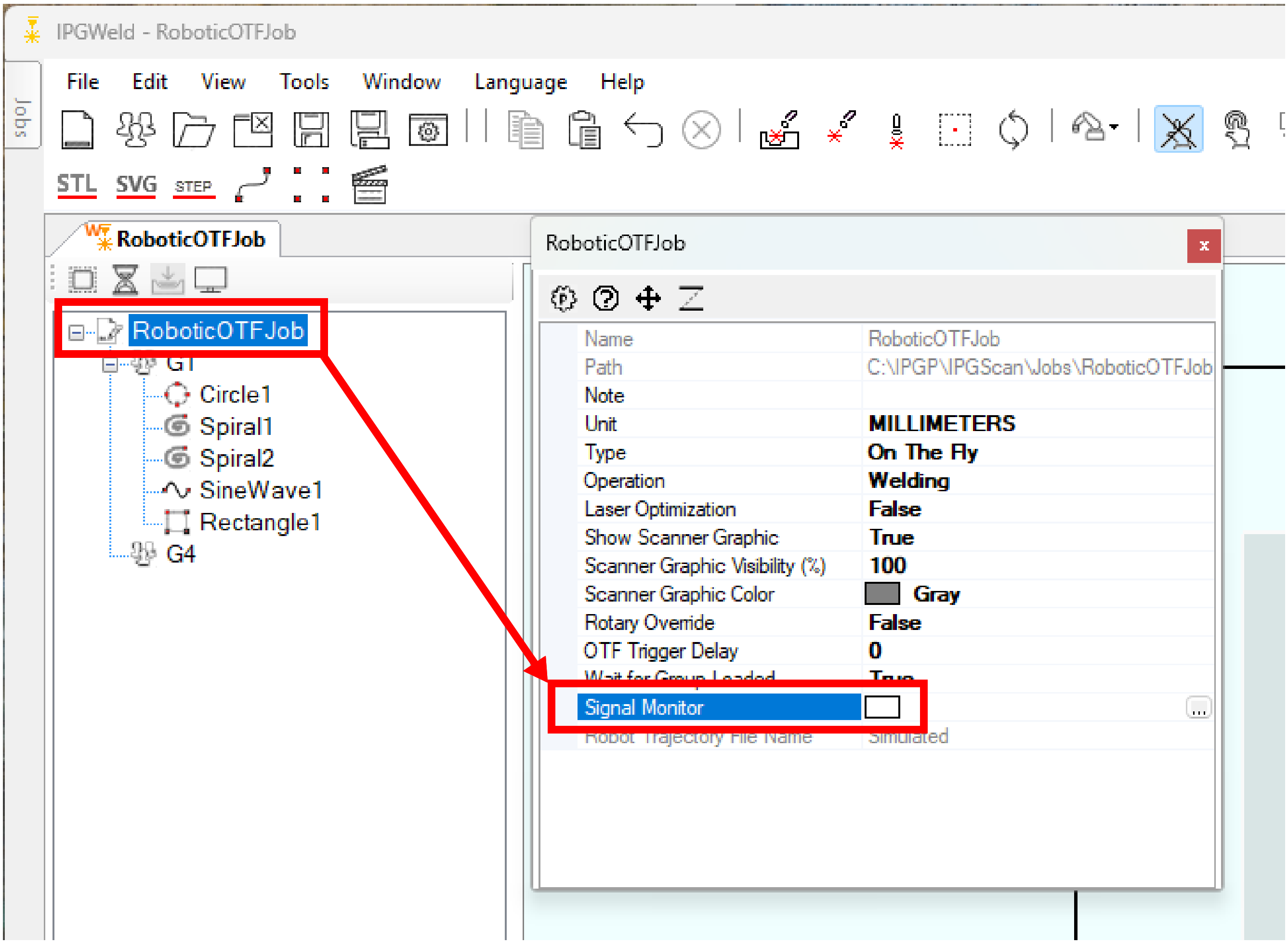
	Port	Bit
Signal 1	Software Status Bits	0
Signal 2	Software Status Bits	1
Signal 3	Software Status Bits	2
Signal 4	Software Status Bits	3

OK Cancel

Figure 356: Signal Status Bit Setup

10.3.2 IPGScan Job Setup for Signal Monitor Use

The job for this example consists of two groups, each with two process objects. It can be observed in the figure below that the button to open the Signal Monitor menu is located at the bottom of the job information tree. See Figure 357 (below).



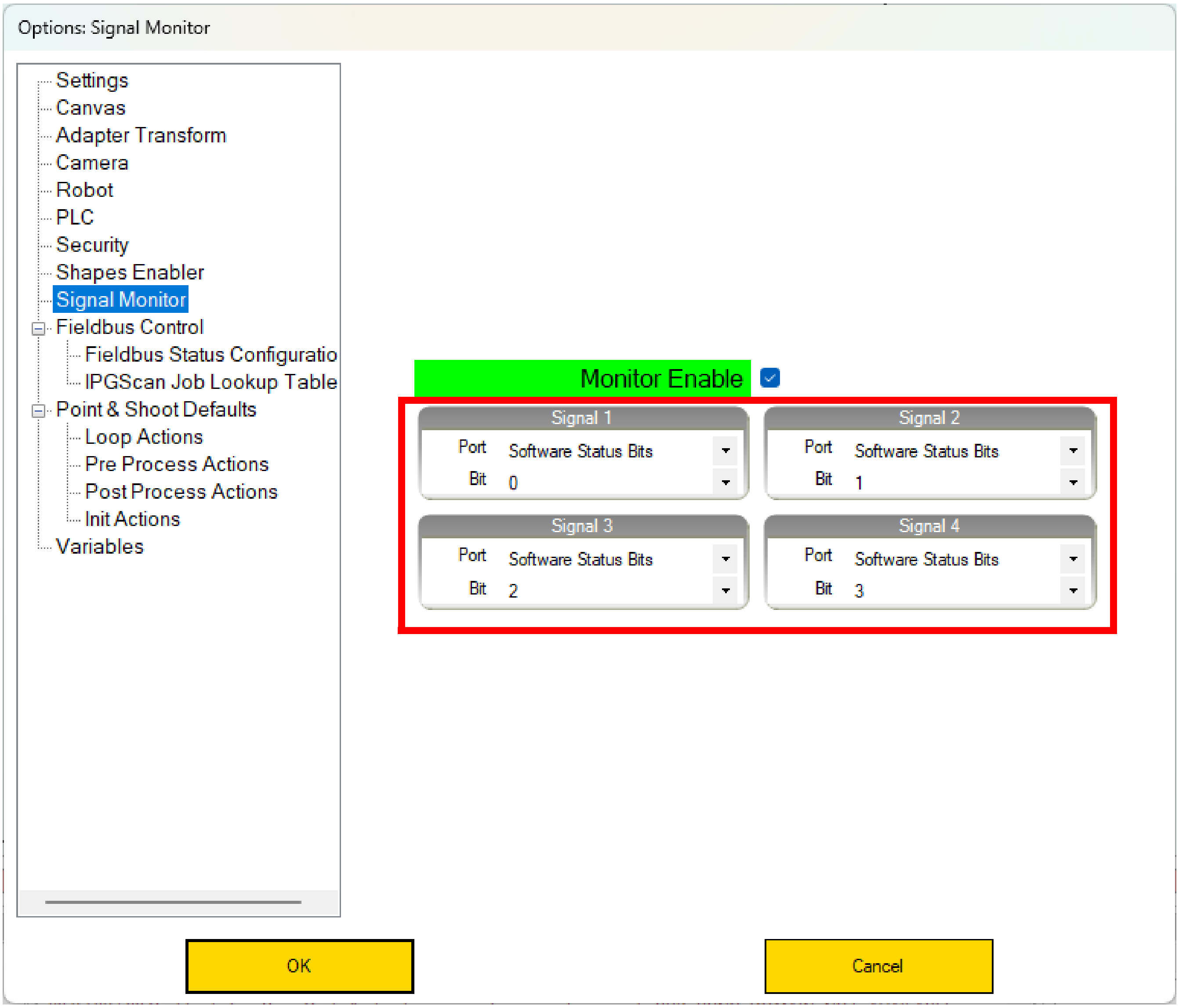
Name	RoboticOTFJob
Path	C:\IPGP\IPGScan\Jobs\RoboticOTFJob
Note	
Unit	MILLIMETERS
Type	On The Fly
Operation	Welding
Laser Optimization	False
Show Scanner Graphic	True
Scanner Graphic Visibility (%)	100
Scanner Graphic Color	▇ Gray
Rotary Override	False
OTF Trigger Delay	0
Wait for Group Loaded	True
Signal Monitor	□ ...
Robot Trajectory File Name	Simulated

Figure 357: Signal Monitor Job Setup Menu

The Signal Monitor menu consists of four signals that can be defined. These signals match the output status bits that were previously configured in the Options menu (see Section 10.3.1 on page 320). For each signal, the user can define an amplitude tolerance that defines the minimum and maximum values that a signal is allowed to vary. (**NOTE:** The unit of measure is dependent on the given signal.)

With the exception of the Dirty Window Sensor Feedback, the tolerances for all signals are fixed. These limits can be seen by selecting the visualize option (after training). See Figure 358 (below).

Signals can also be configured as Errors or Warnings. An Error will abort the job execution and set the appropriate software status or general purpose out bit (see Section 10.3.1 on page 320). A warning will simply set the appropriate I/O Bit but will not abort the job.


Options: Signal Monitor

Monitor Enable ☑

Signal 1 — Port: Software Status Bits; Bit: 0

Signal 2 — Port: Software Status Bits; Bit: 1

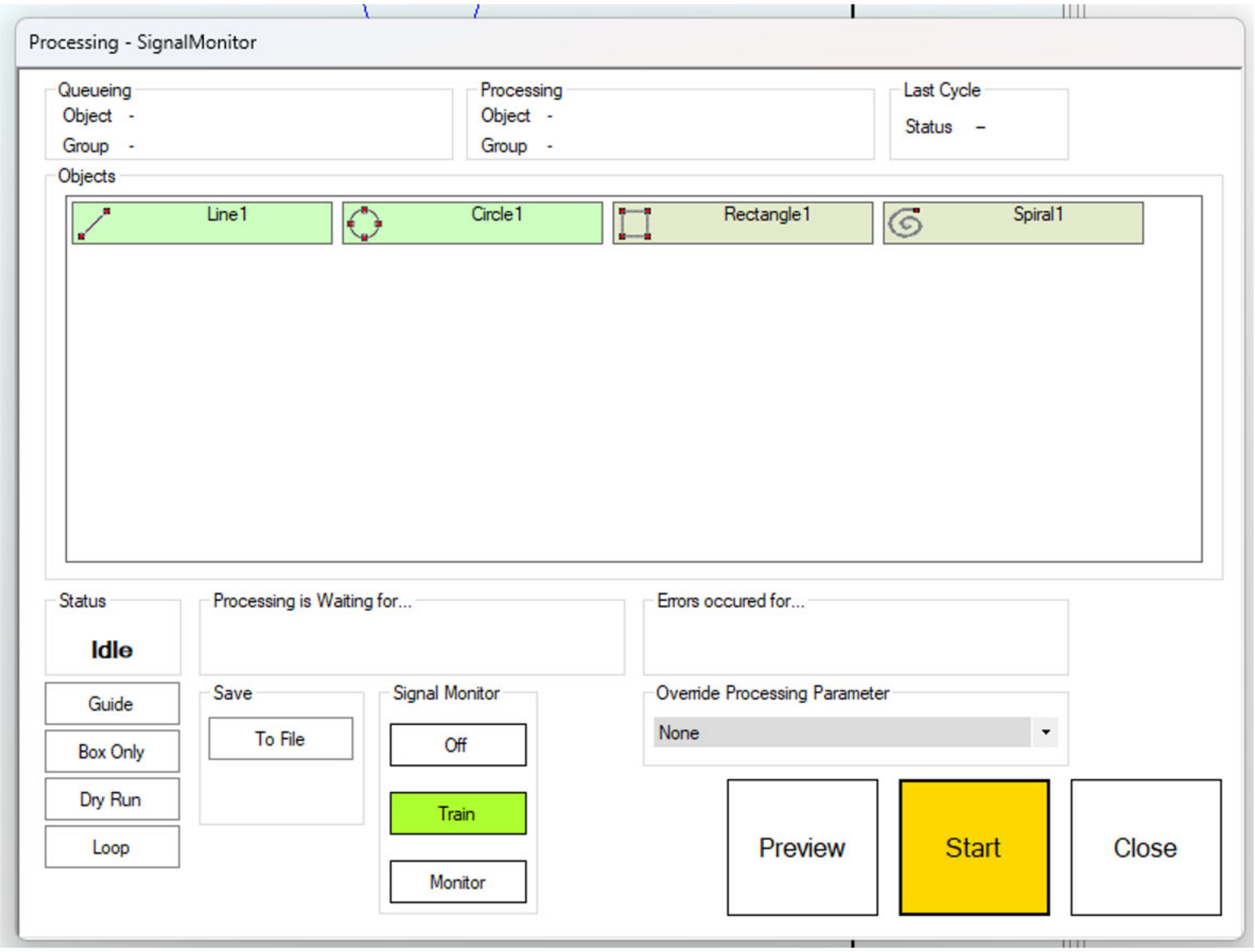
Signal 3 — Port: Software Status Bits; Bit: 2

Signal 4 — Port: Software Status Bits; Bit: 3

Figure 358: Job-specific Signals for Monitoring

10.3.3 Training a Job

Once the signals to be monitored have been selected, users can train the job. Users have to select the group(s) that must be trained, open the processing window, select the Train option in the monitor section, and then run the job. See Figure 359 (below).


Processing - SignalMonitor

Queueing
Object -
Group -

Processing
Object -
Group -

Last Cycle
Status –

Status
Idle

Override Processing Parameter
None

Figure 359: Training a Job

The Monitor button on top of the job tree opens a window with the jobs that shows which groups have been trained. It also allows the user to clear training for groups. See Figure 360 (below).

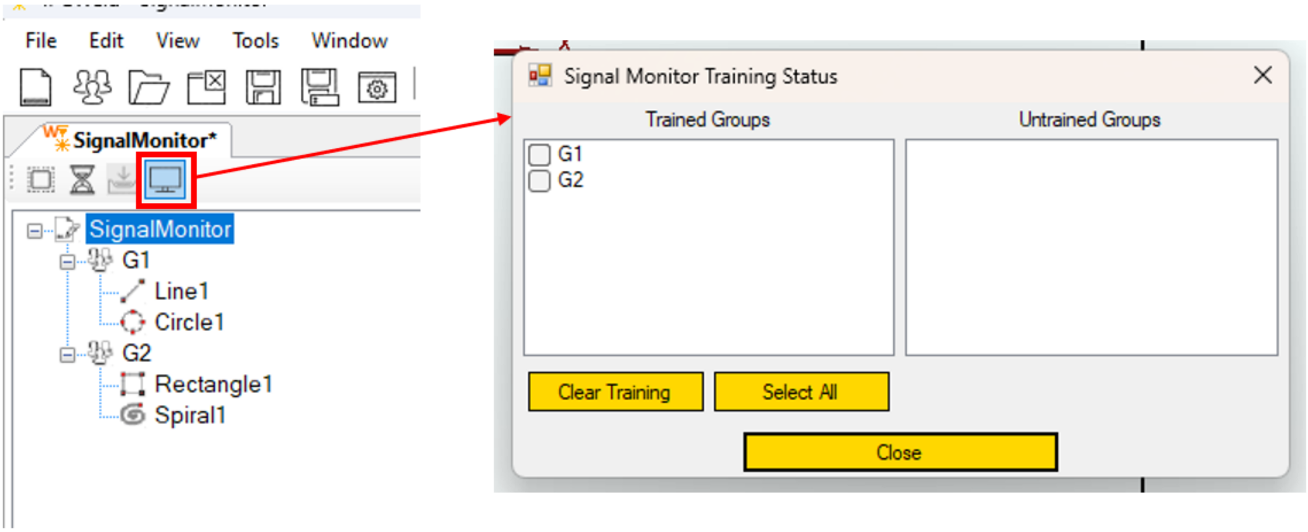
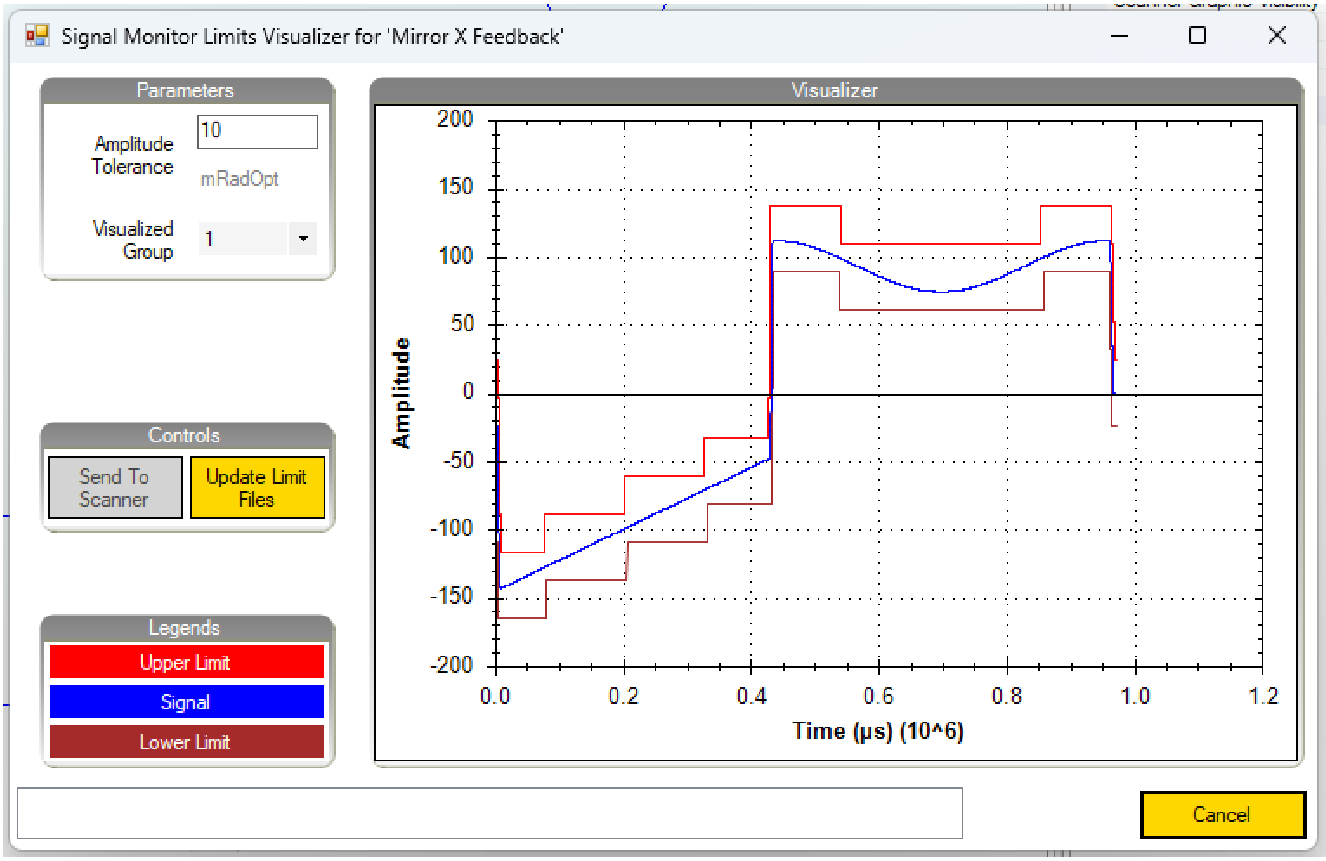


Figure 360: Signal Monitor Training Status

10.3.4 Visualize Window

Once a group has been trained, the user can change, visualize, and load to the scanner the limits around the trained signal in the limits visualizer. See Figure 361 (below). This can be accessed by opening the signal monitor window for the job, as seen in Figure 357 on page 322.


Signal Monitor Limits Visualizer for 'Mirror X Feedback'

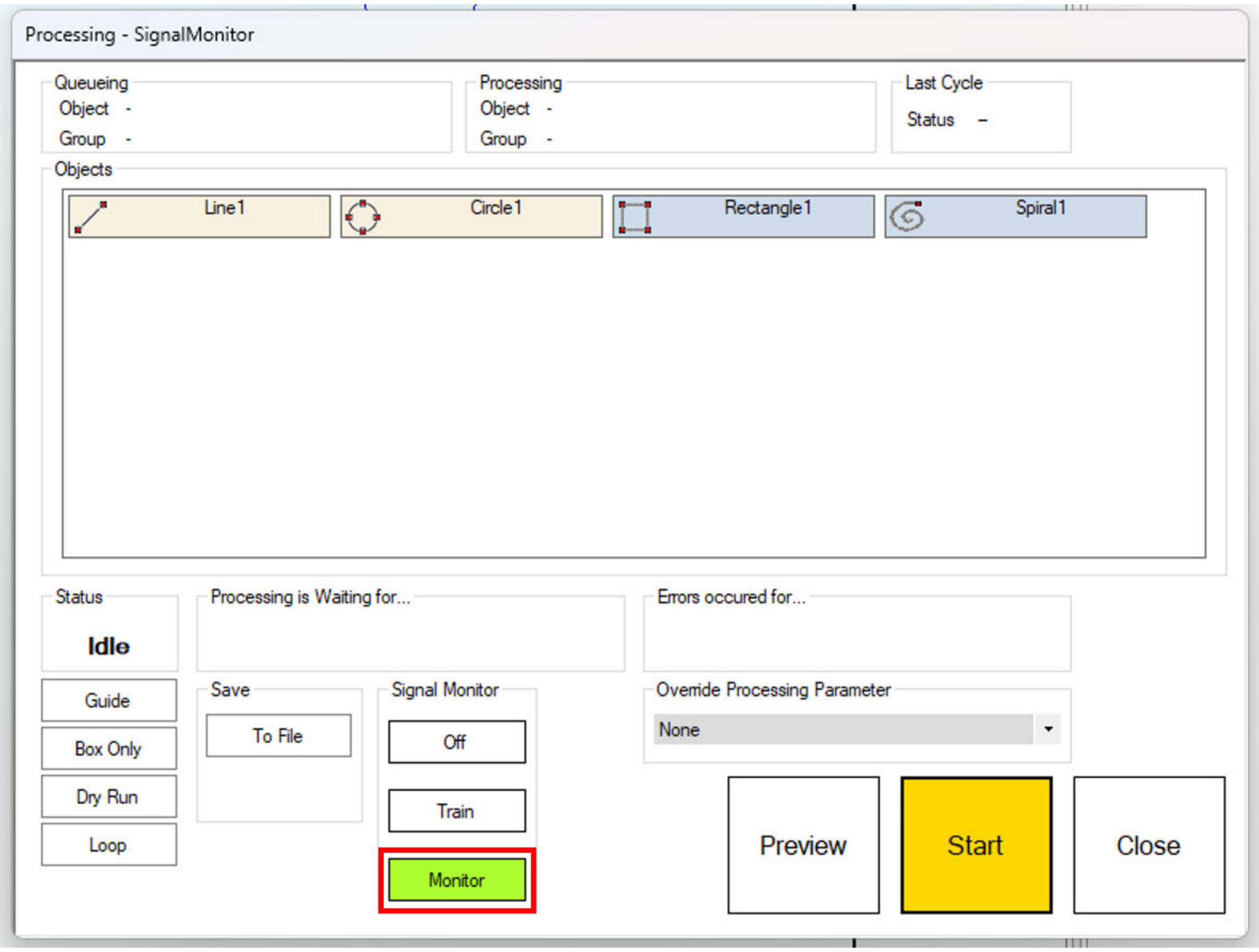
Amplitude Tolerance: 10 mRadOpt

Visualized Group: 1

Figure 361: Signal Monitor Visualizer

10.4 Monitoring a Job

The job can be monitored during execution by clicking "Monitor" button processing window. See Figure 362 (below).



Processing - SignalMonitor

Queueing
Object -
Group -

Processing
Object -
Group -

Last Cycle
Status –

Objects: Line1, Circle1, Rectangle1, Spiral1

Status: Idle

Processing is Waiting for...

Errors occured for...

Overide Processing Parameter: None

Figure 362: Enabling Monitor for Processing

If IPGScan is running with fieldbus mode, the monitor option can also be activated by setting the Process Control value to 2. To enable Monitor mode using the Remote API, see "Signal Monitor Remote API Commands" on page 328.

10.5 Signal Monitor Remote API Commands

The following outlines the JobStart command, which can be used for running a job with Monitor enabled.

JobStart

Parameters: *Filename*

-*guide* (enables the guide [optional])

-*dryrun* (enables dryrun [optional])

-*savefile* (enables saving binary file [optional])

-*signalmonitoroff* (turns off signal/Laser On Monitor [optional])

-*signalmonitoron* (turns on signal/Laser On Monitor [optional])

-*group[name]* (runs the group with the name "name" (no brackets)[optional])

Returns: "'*Filename' is starting now...*"

Description: Starts processing Filename job. Filename should not include the ".wjb" extension.

In newer releases of IPGScan, the JobStart command will also open a job if the job is not already open.

Error: "Error: ScanController not connected. 'focus_run' cannot be started right now."

Error: "Error: Processing is in progress. 'CurrentJob' cannot be started right now."

Error: "Error: 'Filename' is not opened"

Troubleshooting:

Check that a scanner is connected by using the ScannerGetStatus command.

If another job is in progress it must be stopped before the specified job can be started.

Check if the job Filename is open by using the JobOpenedList command.

Example:

S: JobStart weld-job -groupG1<CR><LF>

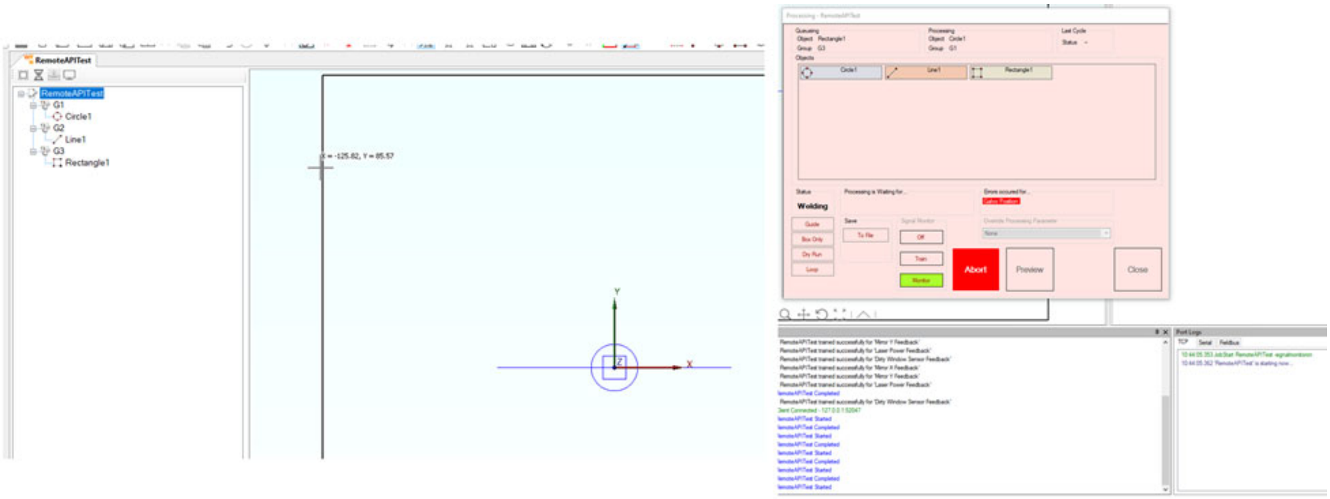
I: Group "G1" is ran from the job weld-job.

R: 'weld-job' is starting now...

10.5.1 Example 1: JobStart Command to Run Entire Job with Monitor Enabled

Remote API Command Example: JobStart RemoteAPITest –signalmonitoron

Description: This command runs the entire IPGScan job (RemoteAPITest) with Monitor enabled.



Queuing
Object Rectangle1
Group G3

Processing
Object Circle1
Group G1

Last Cycle
Status -

Processing is Waiting for...

Errors occured for...
Galvo Position

Override Processing Parameter: None

```
RemoteAPITest trained successfully for 'Mirror Y Feedback'
RemoteAPITest trained successfully for 'Laser Power Feedback'
RemoteAPITest trained successfully for 'Dirty Window Sensor Feedback'
RemoteAPITest trained successfully for 'Mirror X Feedback'
RemoteAPITest trained successfully for 'Mirror Y Feedback'
RemoteAPITest trained successfully for 'Laser Power Feedback'
RemoteAPITest Completed
RemoteAPITest trained successfully for 'Dirty Window Sensor Feedback'
Client Connected - 127.0.0.1:52047
RemoteAPITest Started
RemoteAPITest Completed
RemoteAPITest Started
RemoteAPITest Completed
RemoteAPITest Started
RemoteAPITest Completed
RemoteAPITest Started
RemoteAPITest Completed
RemoteAPITest Started
```

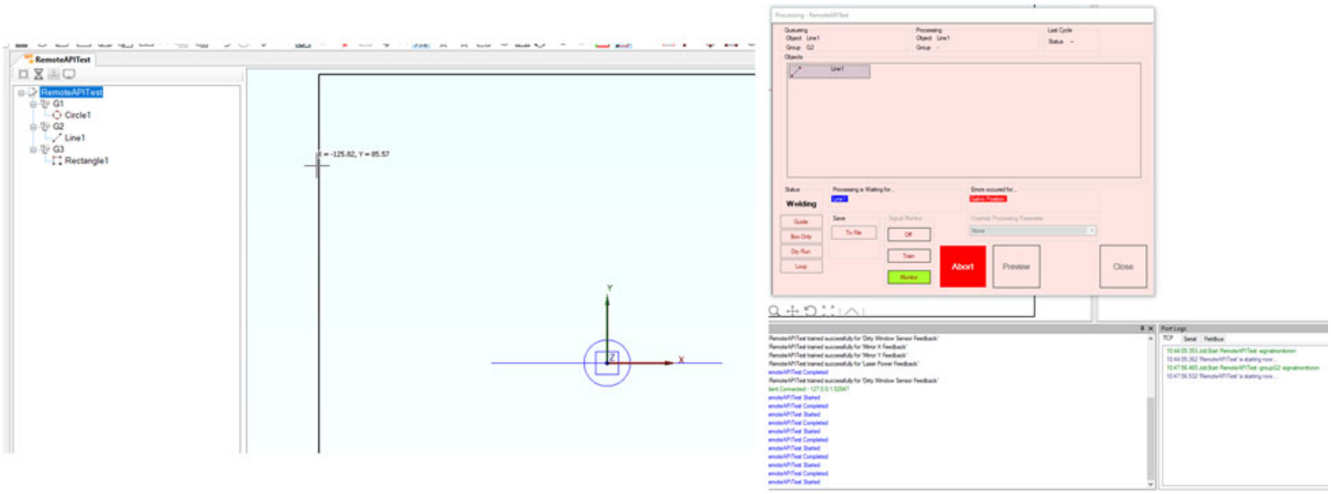
```
10:44:05.353 JobStart RemoteAPITest -signalmonitoron
10:44:05.362 'RemoteAPITest' is starting now...
```

Figure 363: JobStart Command to Run Entire Job with Monitor Enabled

10.5.2 Example 2: JobStart Command to Run a Single Group with Monitor Enabled

Remote API Command Example: JobStart RemoteAPITest –groupG2 -signalmonitoron

Description: This command only runs Group 2 in the IPGScan job (RemoteAPITest) with Monitor enabled.



Queuing
Object Line1
Group G2

Processing
Object Line1
Group -

Last Cycle
Status -

Processing is Waiting for...
Line1

Errors occured for...
Galvo Position

Override Processing Parameter: None

```
RemoteAPITest trained successfully for 'Dirty Window Sensor Feedback'
RemoteAPITest trained successfully for 'Mirror X Feedback'
RemoteAPITest trained successfully for 'Mirror Y Feedback'
RemoteAPITest trained successfully for 'Laser Power Feedback'
RemoteAPITest Completed
RemoteAPITest trained successfully for 'Dirty Window Sensor Feedback'
Client Connected - 127.0.0.1:52047
RemoteAPITest Started
RemoteAPITest Completed
RemoteAPITest Started
RemoteAPITest Completed
RemoteAPITest Started
RemoteAPITest Completed
RemoteAPITest Started
RemoteAPITest Completed
RemoteAPITest Started
RemoteAPITest Completed
RemoteAPITest Started
```

```
10:44:05.353 JobStart RemoteAPITest -signalmonitoron
10:44:05.362 'RemoteAPITest' is starting now...
10:47:56.465 JobStart RemoteAPITest -groupG2 -signalmonitoron
10:47:56.532 'RemoteAPITest' is starting now...
```

Figure 364: JobStart Command to Run a Single Group with Monitor Enabled

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11 Remote API

11.1 Overview and Configuration

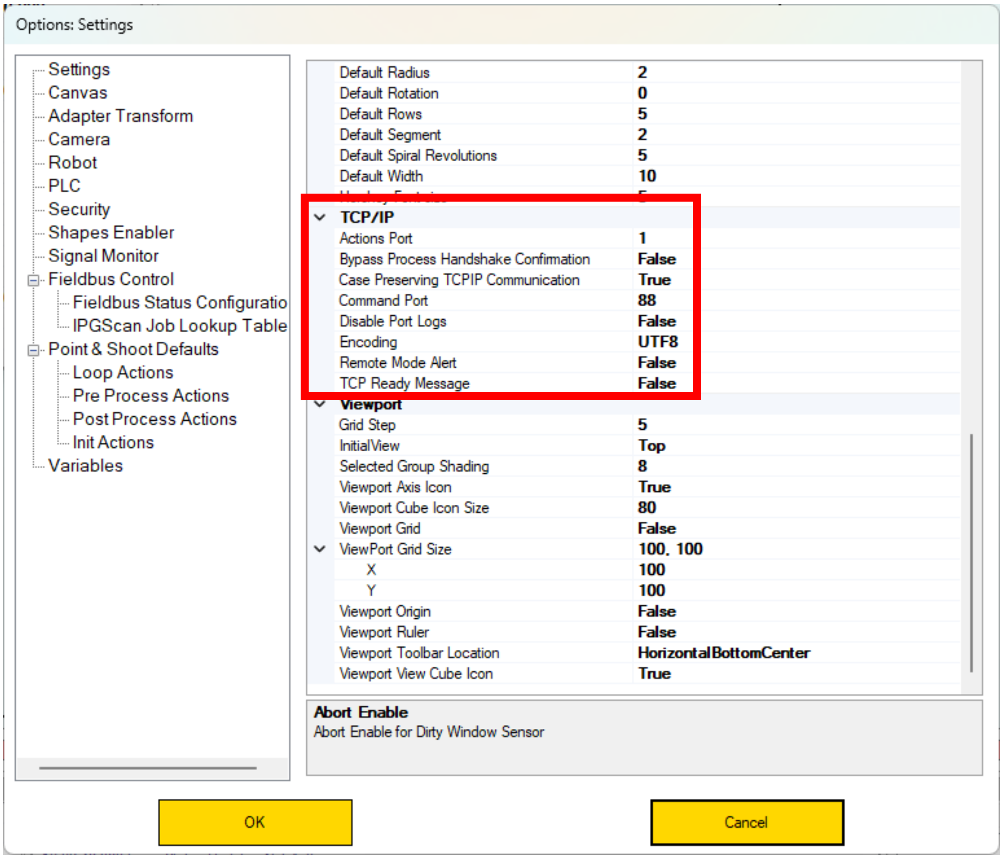
This section describes the TCP Remote Application Programming Interface (API) commands for externally controlling IPGScan. The commands are strings sent through a TCP/IP connection to IPGScany. The strings are encoded based on the encoding setting within in the IPGScan Options.

All commands should be followed by a carriage return (ASCII #13) and a line feed (ASCII #10). For example: `JobOpen jobname<CR><LF>`.

Prior to sending any commands, there must be a TCP connection between the computer running IPGScan and the device trying to control it. In this case, IPGScan will behave as a Server while the external device will be the Client requesting a connection to IPGScan.

Prior to utilizing the Remote API, users must configure the appropriate TCP/IP settings in IPGScan. To configure the TCP/IP settings, do the following:

1. Open IPGScan.
2. Click on "View" -> "Options."
3. Select "Settings" and scroll down to the TCP/IP settings. See Figure 365 (below).



Default Radius	2
Default Rotation	0
Default Rows	5
Default Segment	2
Default Spiral Revolutions	5
Default Width	10
[illegible]	5
TCP/IP	
Actions Port	1
Bypass Process Handshake Confirmation	False
Case Preserving TCPIP Communication	True
Command Port	88
Disable Port Logs	False
Encoding	UTF8
Remote Mode Alert	False
TCP Ready Message	False
Viewport	
Grid Step	5
InitialView	Top
Selected Group Shading	8
Viewport Axis Icon	True
Viewport Cube Icon Size	80
Viewport Grid	False
ViewPort Grid Size	100, 100
X	100
Y	100
Viewport Origin	False
Viewport Ruler	False
Viewport Toolbar Location	HorizontalBottomCenter
Viewport View Cube Icon	True

Abort Enable
Abort Enable for Dirty Window Sensor

Figure 365: TCP/IP Settings

4. Set the following settings as desired.
    a. Case Preserving TCPIP Communication – Enables/disables case preserving.
    b. Command Port – The port number for which IPGScan will send/receive commands for the Remote API.
    c. Encoding – The desired string encoding.
    d. Remote Mode Alert – When set "True," this enables a "Remote Session In Progress" pop-up window that prevents users from manually performing GUI actions within IPGScan while a connection exists with the Remote API.

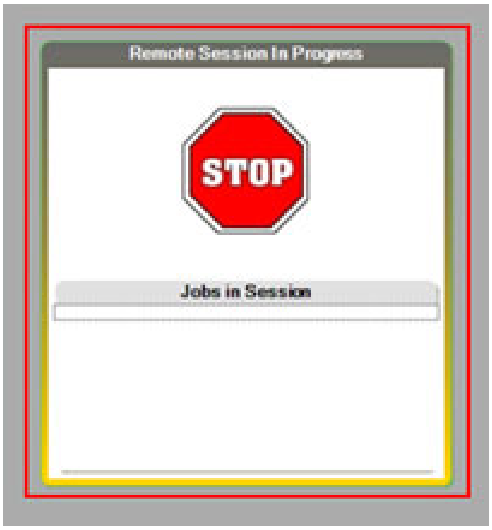
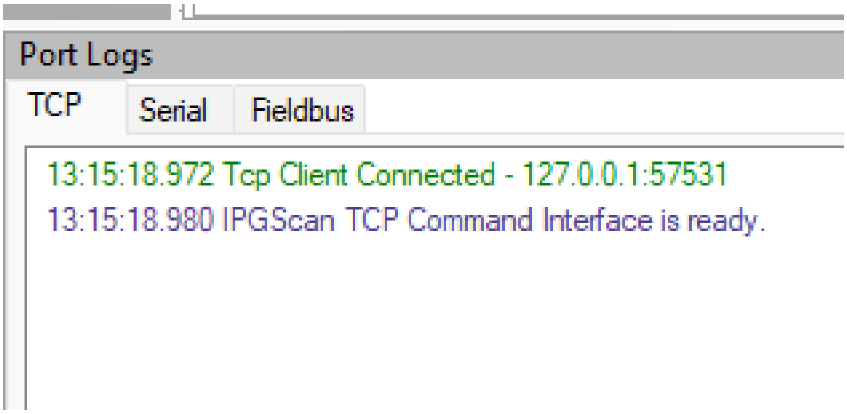


Figure 366: "Remote Session In Progress" Pop-up Window

    e. TCP Ready Message – When set "True," IPGScan will send the message, "IPGScan TCP Command Interface is ready" to the Port Logs Window to indicate that a connection is established with the Remote API. See Figure 367 (below).



```
13:15:18.972 Tcp Client Connected - 127.0.0.1:57531
13:15:18.980 IPGScan TCP Command Interface is ready.
```

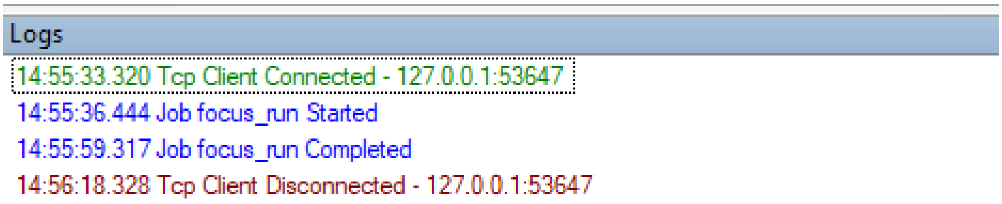
Figure 367: TCP Ready Message

5. Close and reopen IPGScan for the changes to take effect.

IMPORTANT The "Actions Port" setting does not pertain to the Remote API in the TCP/IP settings.

Some versions of IPGScan allowed users to specify an IP Address within the TCP/IP settings. This was to specify a specific IP Address that IPGScan would only send/receive commands from for the Remote API, but was removed because the Command Port number serves a similar purpose.

With the appropriate settings specified, users can then connect to the IPGScan Remote API for use. Within IPGScan, users can view the Port Logs window to observe any communication via the Remote API. Figure 368 (below) provides an example of how users can view the commands and responses for the Remote API in IPGScan.



```
14:55:33.320 Tcp Client Connected - 127.0.0.1:53647
14:55:36.444 Job focus_run Started
14:55:59.317 Job focus_run Completed
14:56:18.328 Tcp Client Disconnected - 127.0.0.1:53647
```

Figure 368: Port Logs Window

- Green Text – Incoming commands to IPGScan
- Blue Text – IPGScan response
- Brown Text – TCP Client disconnected from the Remote API

11.2 Available Commands

Help

Parameters: none

Returns: List of available commands

Description: Returns list of available commands.

Error: none

Troubleshooting: none

Example:
S: Help<CR><LF>

R: Send 'Help [commandName]' for command-specific help
List of all available commands
End Of Command List<CR><LF>

Help (command)

Parameters: *command*

Returns: command-specific help

Description: Returns help string for specified command

Error: none

Troubleshooting: none

Example:
S: help jobopen<CR><LF>
R: JobOpen [jobName]
Opens a job
jobName is Job name without extension<CR><LF>

JobOpen

Parameters: *Filename*

Returns: "'*Filename*' opened."

Description: Opens a job file in the IPGScan Jobs folder. Filename should not include the ".wjb" extension.

Error: "Error: '*Filename*' not found"

Troubleshooting: Job doesn't exist or can't be opened. Check that spelling and case is correct. Non-ASCII characters in job names may also cause this error.

Example:
S: JobOpen weld-job<CR><LF>
I: Job weld-job is opened
R: 'weld-job' opened.<CR><LF>

JobStart

Parameters: *Filename*

-*guide* (enables the guide [optional])

-*dryrun* (enables dryrun [optional])

-*savefile* (enables saving binary file [optional])

-*signalmonitoroff* (turns off signal/Laser On Monitor [optional])

-*signalmonitoron* (turns on signal/Laser On Monitor [optional])

-*group[name]* (runs the group with the name "name" (no brackets)[optional])

Returns: "'*Filename' is starting now...*"

Description: Starts processing *Filename* job. Filename should not include the ".wjb" extension.

In newer releases of IPGScan, the JobStart command will also open a job if the job is not already open.

Error: "Error: ScanController not connected. 'focus_run' cannot be started right now."
"Error: Processing is in progress. '*CurrentJob'* cannot be started right now."
"Error: '*Filename'* is not opened"

Troubleshooting:
Check that a scanner is connected by using the ScannerGetStatus command.
If another job is in progress it must be stopped before the specified job can be started.
Check if the job *Filename* is open by using the JobOpenedList command.

Example:
S: JobStart weld-job -groupG1<CR><LF>
I: Group "G1" is ran from the job weld-job.
R: 'weld-job' is starting now...

JobStop/JobAbort

Parameters: none

Returns: "Job Stopped" or "Job Aborted"

Description: JobStop and JobAbort replicate pressing the Stop and Abort buttons, respectively.

Error: "Error: No Running Job found."

Troubleshooting: No job is currently running.

Example:
S: JobStop<CR><LF>
I: Currently running job is stopped.
R: Job Stopped<CR><LF>

JobClose

Parameters: *Filename*

Returns: "'*Filename*' closed."

Description: *Filename* is closed.

Error: "Error: *Filename* not closed"

Troubleshooting: A job cannot be closed if any job is running or if the specified job is not open.

Example:
S: JobClose weld-job
I: weld-job is closed.
R: 'weld-job' closed.

JobList

Parameters: none

Returns: List of filenames inside IPGScan's Jobs folder. Carriage return and line feed ("\r\n") are appended at the end of every job in the list. The last line will be "End Of Job List\r\n".

Description: List all available jobs in IPGScan's Jobs folder.

Error: "Error: IPGScan directory not found"

Troubleshooting: "C:\IPGP\IPGScan\Jobs" folder cannot be found. Check that this folder exists on the file system.

Example:
S: JobList<CR><LF>
R: *Job1*<CR><LF>
...
JobN<CR><LF>
End Of Job List<CR><LF>

JobOpenedList

Parameters: none

Returns: List of currently opened jobs. Carriage return and line feed ("\r\n") are appended at the end of every job in the list. The last line will be "End Of Job List\r\n".

Description: Lists the currently opened jobs.

Error: none

Troubleshooting: none

Example:
S: JobList<CR><LF>
R: *OpenedJob1*<CR><LF>
...
OpenedJobN<CR><LF>
End Of Job List<CR><LF>

JobGetStatus

Parameters: none

Returns: "Idle" or "Busy"

Description: Returns the status of IPGScan. Returns busy if job is running.

Error: none

Troubleshooting: none

Example:
S: JobGetStatus<CR><LF>
R: Busy<CR><LF>

JobGetStatus2

Parameters: none

Returns: JobGetStatus2 Group: *'groupName'*, Object Name: *'objectName'*

Description: Returns the name of the group and object currently being added to the buffer or run by IPGScan (in the case of an Action Control.)

Error: none

Troubleshooting: none

Example:
S: JobGetStatus2<CR><LF>
R: JobGetStatus2 Group: 'G1', Object Name: 'Circle1'<CR><LF>

JobLastRunSuccessful

Parameters: none

Returns: "True" or "False"

Description: Returns the status of the last run job; will return "False" if the job encountered any errors.

Error: none

Troubleshooting: none

Example:
S: JobLastRunSuccessful<CR><LF>
R: True<CR><LF>

JobExport

Parameters: none

Returns: Job Process Object parameter data

Description: Exports the currently opened jobs Process Object parameter data to xml.

Error: none

Troubleshooting: none

Example:
S: JobExport<CR><LF>
R: All parameter data

ScannerGetStatus

Parameters: none

Returns: Name of the scanner that IPGScan is currently connected.

Description: Used to inform if IPGScan is connected to a specific scanner

Error: "Error: Not Connected"

Troubleshooting: IPGScan is not connected to a scan controller.

Example:
S: ScannerGetStatus<CR><LF>
R: laser-scanner.local. <CR><LF>

GetEncoding

Parameters: none

Returns: Text Encoding Scheme

Description: Returns text encoding scheme set in Options.

Error: none

Troubleshooting: none

Example:
S: GetEncoding<CR><LF>
R: UTF8<CR><LF>

ScannerGetStartBit

Parameters: none

Returns: "True" or "False"

Description: Returns the hardware value of the start signal. "True" if active; "False" if inactive.

Error: Error: ScanController not connected.

Troubleshooting: Be sure that the desired scan controller is connected.

Example:
S: ScannerGetStartBit<CR><LF>
R: True<CR><LF>

ConnectionGetStatus

Parameters: none

Returns: Name of the computer on which IPGScan is running.

Description: Returns the name of the computer on which IPGScan is running. Can be used to check the connection with IPGScan.

Error: none

Troubleshooting: Check IP Address and Port in IPGScan Options and the connection target of the TCP client.

Example:
S: ConnectionGetStatus<CR><LF>
R: LAPTOP-144F4I9E<CR><LF>

ScannerGetEnableBit

Parameters: none

Returns: "True" or "False"

Description: Returns the hardware value of the enable signal. "True" if active; "False" if inactive.

Error: Error: ScanController not connected.

Troubleshooting: Be sure that the desired scan controller is connected.

Example:
S: ScannerGetEnableBit<CR><LF>
R: True<CR><LF>

ScannerGetPortA

Parameters: none

Returns: Port A value in hexadecimal

Description: Port A value in hexadecimal

Error: Error: ScanController not connected.

Troubleshooting: Be sure that the desired scan controller is connected.

Example:
S: ScannerGetPortA<CR><LF>
R: 0x01FF0EFF<CR><LF>

ScannerLock

Parameters: scannerName

Returns: '*scannerName*' is locked.

Description: Locks a scanner.

Error:
Error: '*scannerName*' could not be locked. *scannerName* is already locked.
Error: '*scannerName*' could not be locked. Other Scanner is already locked.
Error: '*scannerName*' could not be locked.

Troubleshooting:
Check that IPGScan is not already connected to a different scanner.
Check that the desired scanner is available to be locked.

Example:
S: ScannerLock laser-scanner.local.<CR><LF>
I: IPGScan locks laser-scanner.local
R: 'laser-scanner.local' is locked.<CR><LF>

ScannerUnlock

Parameters: *scannerName [optional]*

Returns: '*scannerName*' is unlocked.

Description: Unlocks a scanner. If no *scannerName* is provided, the currently locked scanner will be unlocked.

Error:
Error: '*scannerName*' could not be unlocked.
Error: '*scannerName*' could not be unlocked. '*CurrentScanner*' is locked currently.
Error: '*scannerName*' is not locked.

Troubleshooting: Check that IPGScan is connected to the scan controller trying to be unlocked.

Example:
<ScannerLock>
S: ScannerUnlock<CR><LF>
I: IPGScan unlocks the current scanner.
R: 'laser-scanner.local.' is unlocked.<CR><LF>

ScannerInit

Parameters: none

Returns: Currently locked scanner is initialized.

Description: Initializes currently locked scanner.

Error:
Error: Failed initializing currently locked scanner.
Error: 'No Scanner is locked.

Troubleshooting: Be sure that a scanner is locked before initializing a scanner.

Example:
S: ScannerInit<CR><LF>
I: IPGScan initializes the current scanner.
R: Currently locked scanner is initialized.

ScannerParkAt

Parameters: Desired galvo position in millimeters

Returns: ParkAt done.

Description: Parks galvos at specified position. Position is specified by 3 numbers separated by one space. Format is "X Y Z."

Error:
Error: ScannerParkAt failed due to wrong parameters.
Error: ScanController not connected. ParkAt cannot be performed right now.

Troubleshooting:
Verify that the position is specified by 3 numbers separated by one space.
Verify that a scan controller is connected.

Example:
S: ScannerParkAt 1 2 3.5<CR><LF>
I: Current scanner is parked at position (1, 2, 3.5)
R: ParkAt done.<CR><LF>

ScannerGetWorkspacePosition

Parameters: none

Returns: Galvo Position: *X Y Z*

Description: Gets the current position of the galvos in millimeters.

Error:
Error: ScanController not connected. ScannerGetWorkspacePosition cannot be performed right now.

Troubleshooting: Verify that IPGScan is connected to a scan controller.

Example:
S: ScannerGetWorkspacePosition<CR><LF>
R: Galvo Position: 0.245 2 0<CR><LF>

ScannerGetList

Parameters: none

Returns: *scannerName1 scannerName2*
...
End Of Scanner List

Description: Returns the list of scanners currently visible to IPGScan. Each scanner is separated by a carriage return and a new line, "\r\n".

Error: none

Troubleshooting: none

Example:
S: ScannerGetList<CR><LF>
R: laser-alpha.local.<CR><LF>
laser-beta.local.<CR><LF>
End Of Scanner List<CR><LF>

ScannerGetStatusList

Parameters: none

Returns: *scannerName1, available scannerName2, busy*
...
End Of Scanner Status List

Description: Returns the list of scanners currently visible to IPGScan and its status. Each status is separated from its scanner by a comma and a space, ", ". Each scanner is separated by a carriage return and a new line, "\r\n".

Error: none

Troubleshooting: none

Example:
S: ScannerGetStatusList<CR><LF>
R: laser-alpha.local., available<CR><LF>
laser-beta.local., busy<CR><LF>
End Of Scanner Status List<CR><LF>

ScannerGetConnectionStatus

Parameters: *scannerName*

Returns: The connection status of the specified scanner

Description: Returns connection status of a scanner, either "Available" or "Busy".

Error: Error: *scannerName* not found

Troubleshooting: Verify that IPGScan is connected to a scan controller.

Example:
S: ScannerGetConnectionStatus laser-scanner.local.<CR><LF>
R: Scanner 'laser-scanner.local.' is Available<CR><LF>

ScannerGuideOff

Parameters: none

Returns: Turned off Guide beam

Description: Turns off the guide beam of currently locked scanner if possible.

Error:
Error: Processing is in progress. Cannot turn Guide beam off.
Error: ScanController not connected. Cannot turn Guide beam off.

Troubleshooting:
Verify that IPGScan is not currently processing a job.
Verify that IPGScan is connected to a scan controller.

Example:
S: ScannerGuideOff<CR><LF>
I: Guide beam of the connected scanner is turned off.
R: Turned off Guide beam<CR><LF>

SystemSetVariable

Parameters:
variableNumber - register number to set
value - value to set the register to

Returns: SystemSetVariable Done.

Description: Sets a register to a given value.

Error: Error: SetVariable failed. Variable index out of range.

Troubleshooting: Make sure that the variable number trying to be set is greater than 0 and less than or equal to the greatest register.

Example:
S: SystemSetVariable 5 IPG<CR><LF>
I: Variable5 now contains the value IPG
R: SystemSetVariable Done.<CR><LF>

SystemGetVariable

Parameters: *variableNumber*

Returns: SystemGetVariable 'Variable *variableNumber*' value is '*value*'

Description: Gets the value of a register.

Error:
Error: SetVariable failed. Invalid format.
Error: SetVariable failed. Variable index out of range.

Troubleshooting: Verify that the variable specified is a valid register number.

Example:
S: SystemGetVariable 5<CR><LF>
R: SystemGetVariable 'Variable 5' value is 'IPG'<CR><LF>

SystemGetVersion

Parameters: none

Returns: IPGScan Version: *IPGScan version*

Description: Gets the IPGScan version.

Error: none

Troubleshooting: none

Example:
S: SystemGetVersion<CR><LF>
R: IPGScan Version: 1.0.0.9800<CR><LF>

SystemResetAllAlarms

Parameters: none

Returns: "Reset all alarms complete"

Description: Resets all active alarms in IPGScan.

Error: none

Troubleshooting: none

Example:
S: SystemResetAllAlarms<CR><LF>
R: Reset all alarms complete<CR><LF>

DWSResetRunningMax

Parameters: none

Returns: "DWSRunningMaxReset"

Description: Resets Dirty Window Sensor's running Max value.

Error: none

Troubleshooting: none

Example:
S: DWSResetRunningMax<CR><LF>
I: Running Max value is reset in the IPGScan DWS Status Window.
R: DWSRunningMaxReset<CR><LF>

DWSGetRunningMax

Parameters: none

Returns: string containing current Running Max value in IPGScan DWS Status Window.
Example: "-67.22169"

Description: The Running Max Value displayed in the IPGScan DWS Status Window.

Error: none

Troubleshooting: none

Example:
S: DWSGetRunningMax<CR><LF>
R: *RunningMaxValue*<CR><LF>

DWSGetInstantValue

Parameters: none

Returns: string containing current Instant value in IPGScan DWS Status Window.
Example: "-30.56"

Description: The Instant Value displayed in the IPGScan DWS Status Window.

Error: none

Troubleshooting: none

Example:
S: DWSGetInstantValue<CR><LF>
R: *InstantValue*<CR><LF>

LaserGetStatusMessage

Parameters: none

Returns: Current Laser Status Message from laser status window.

Description: Returns the current status that is reported in the Message field in the laser status window.

Error: none

Troubleshooting: none

Example:
S: LaserGetStatusCode<CR><LF>
R: LaserGetStatusCode<CR><LF>

12 Maintenance Window

12.1 Overview

Within IPGScan, users can access a Scanner Maintenance window. Within this window, users can check system information as well as perform some of the basic functionality found within the Scan Controller Utility.

To access the Scanner Maintenance window, perform the following steps.

1. Open IPGScan and connect to a scanner.
2. Click "Tools."
3. Navigate to "Scanner."
4. Click "Maintenance." See Figure 369 (below).

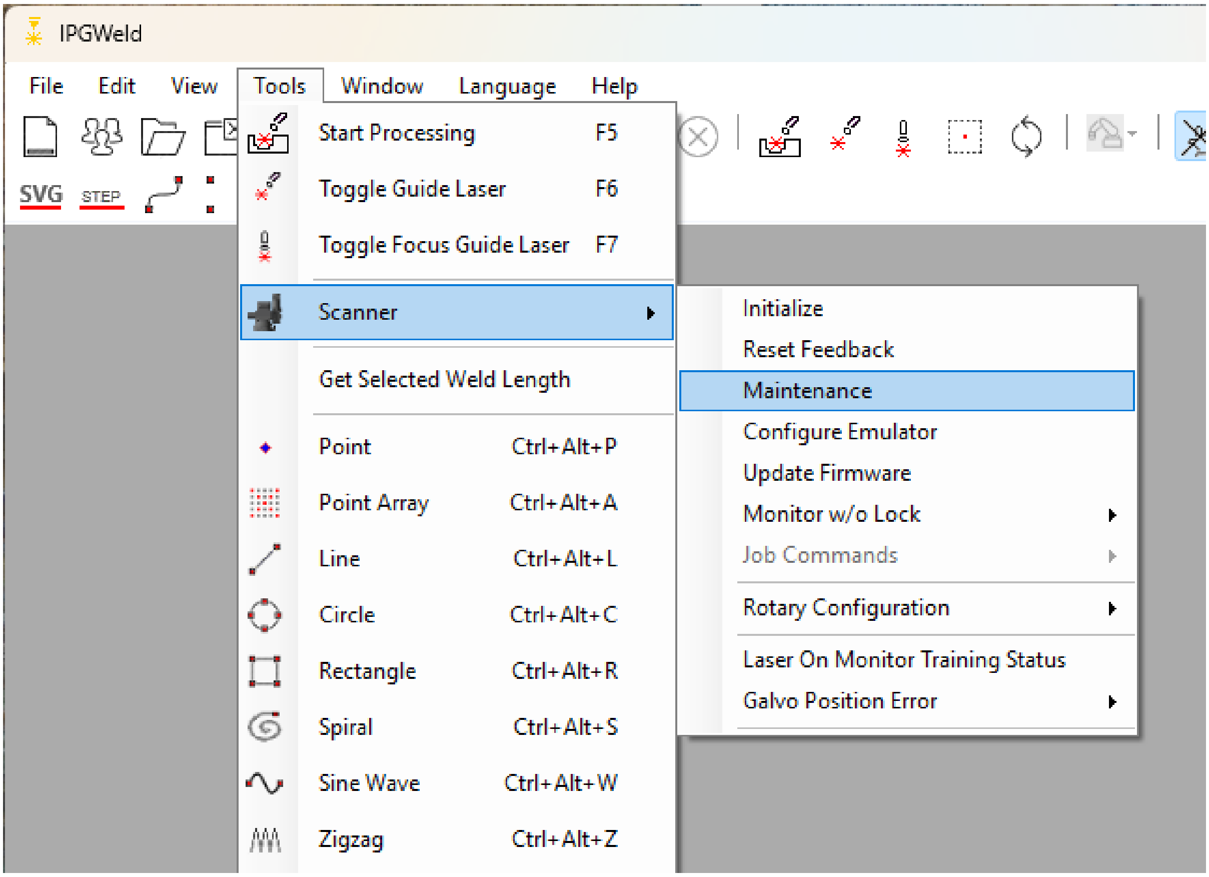
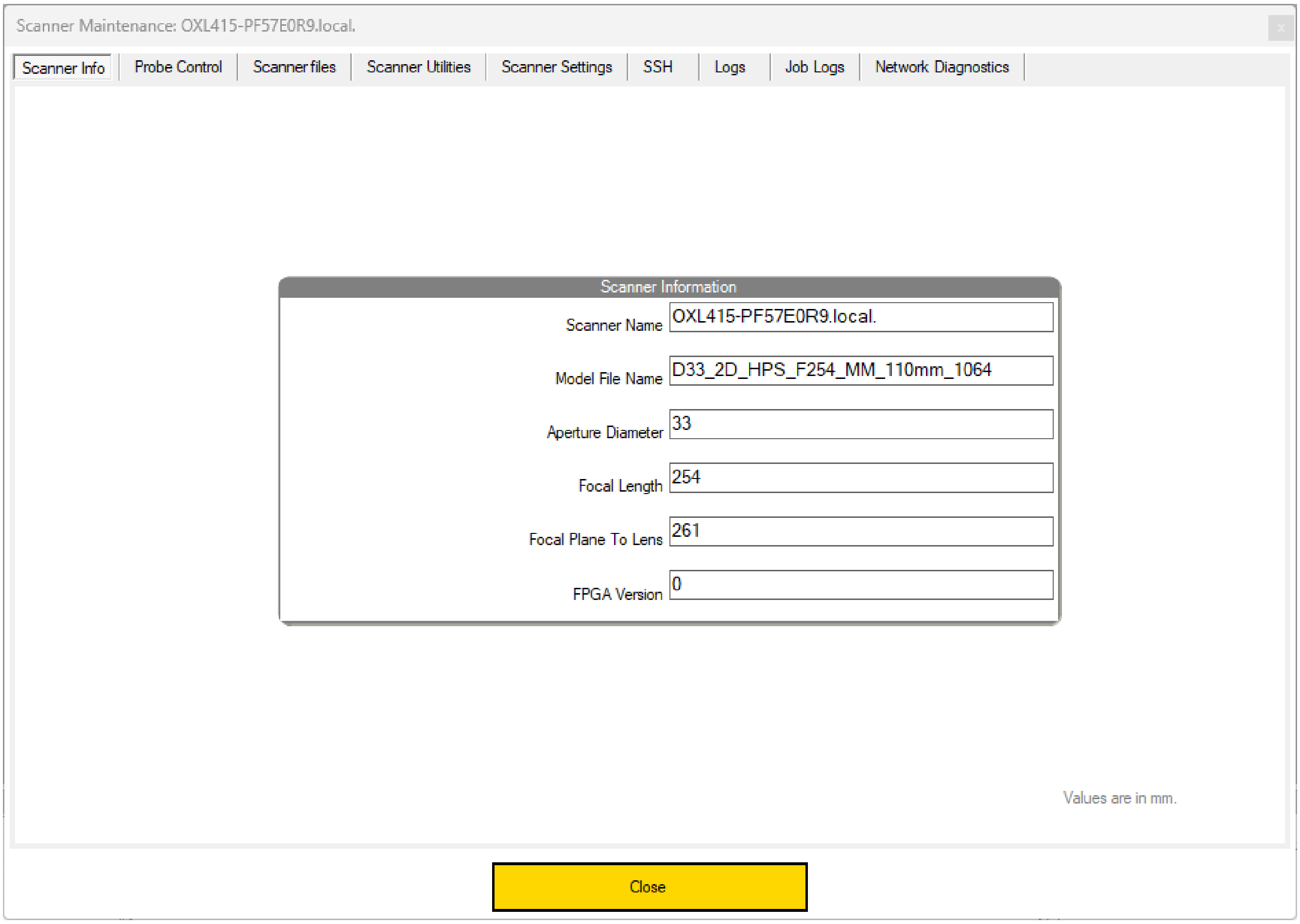


Figure 369: Opening the Scanner Maintenance Window

Once the Scanner Maintenance window opens, users can begin to utilize various functions within each of the given tabs. See Figure 370 (below).



Scanner Information

Scanner Name: OXL415-PF57E0R9.local.

Model File Name: D33_2D_HPS_F254_MM_110mm_1064

Aperture Diameter: 33

Focal Length: 254

Focal Plane To Lens: 261

FPGA Version: 0

Values are in mm.

Figure 370: Scanner Maintenance Window

12.2 Scanner Settings

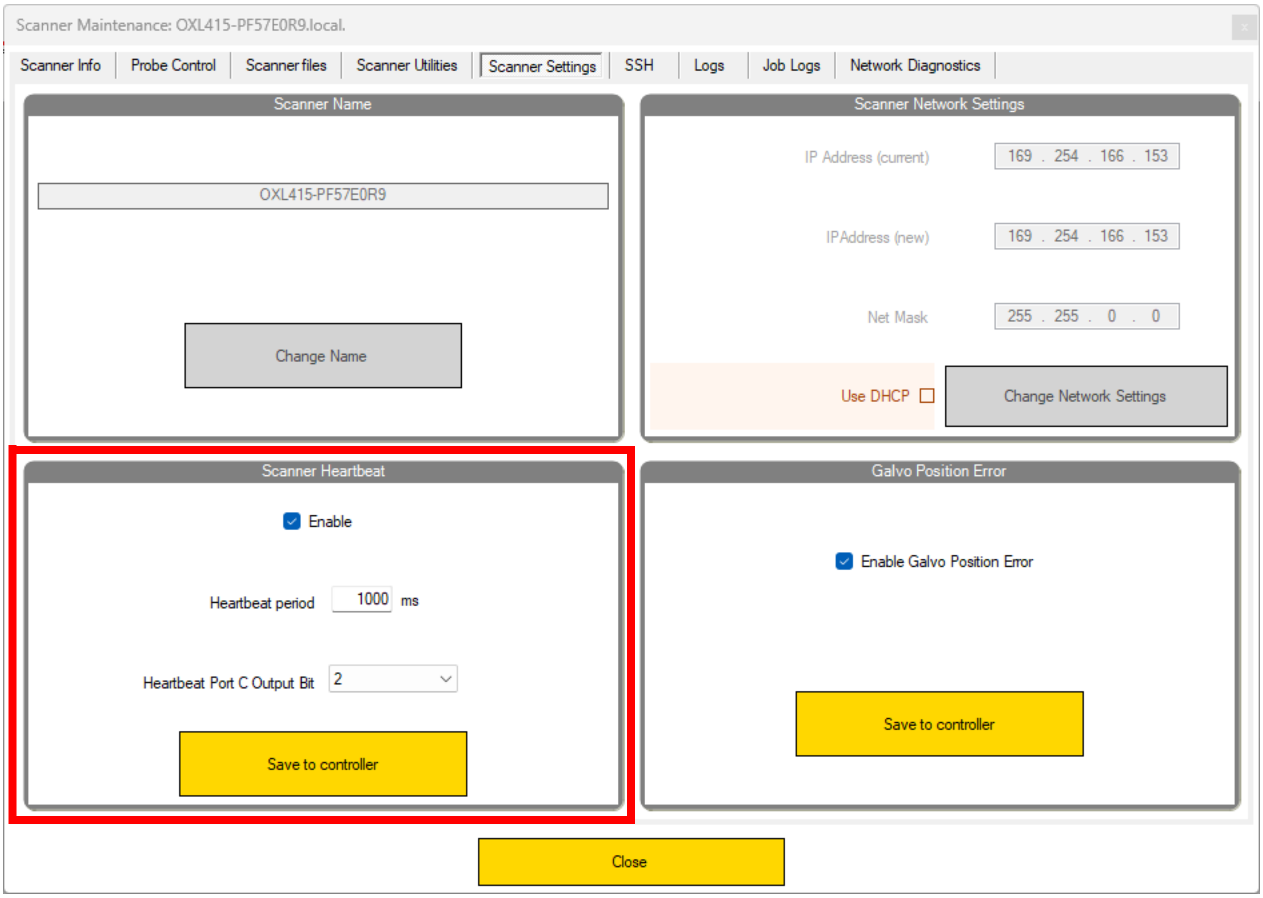
Within the Scanner Settings tab, users have the ability to change the scanner name, set scanner Ethernet Adapter settings, configure a heartbeat signal, and enable Galvo Position Error.

12.3 Scanner Heartbeat

Users can enable a Heartbeat signal to better help determine that the system is operational and that nothing has gone wrong.

If users wish to enable the Heartbeat signal, perform the following steps.

1. Check the "Enable" box.
2. Define a desired Heartbeat period.
3. Click the "Save to Controller" button. This will generate a log message stating, "Sent heartbeat configuration to scanner successfully." See Figure 371 (below).



Scanner Name: OXL415-PF57E0R9

IP Address (current): 169 . 254 . 166 . 153

IP Address (new): 169 . 254 . 166 . 153

Net Mask: 255 . 255 . 0 . 0

Use DHCP □

☑ Enable

Heartbeat period 1000 ms

Heartbeat Port C Output Bit 2

☑ Enable Galvo Position Error

Figure 371: Enabling the Heartbeat Signal

4. Close the Scanner Maintenance Window.

5. Close and restart IPGScan. Once users reconnect to the scanner, a Heartbeat signal will be present in the IO Window of IPGScan. See Figure 372 (below).

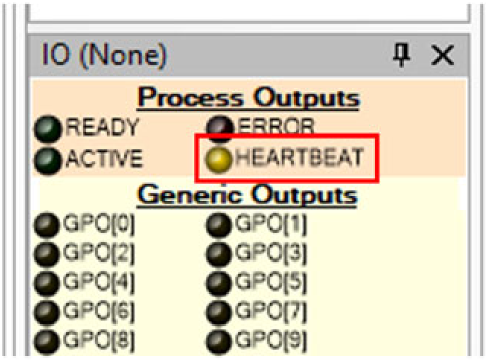


Figure 372: Heartbeat Signal

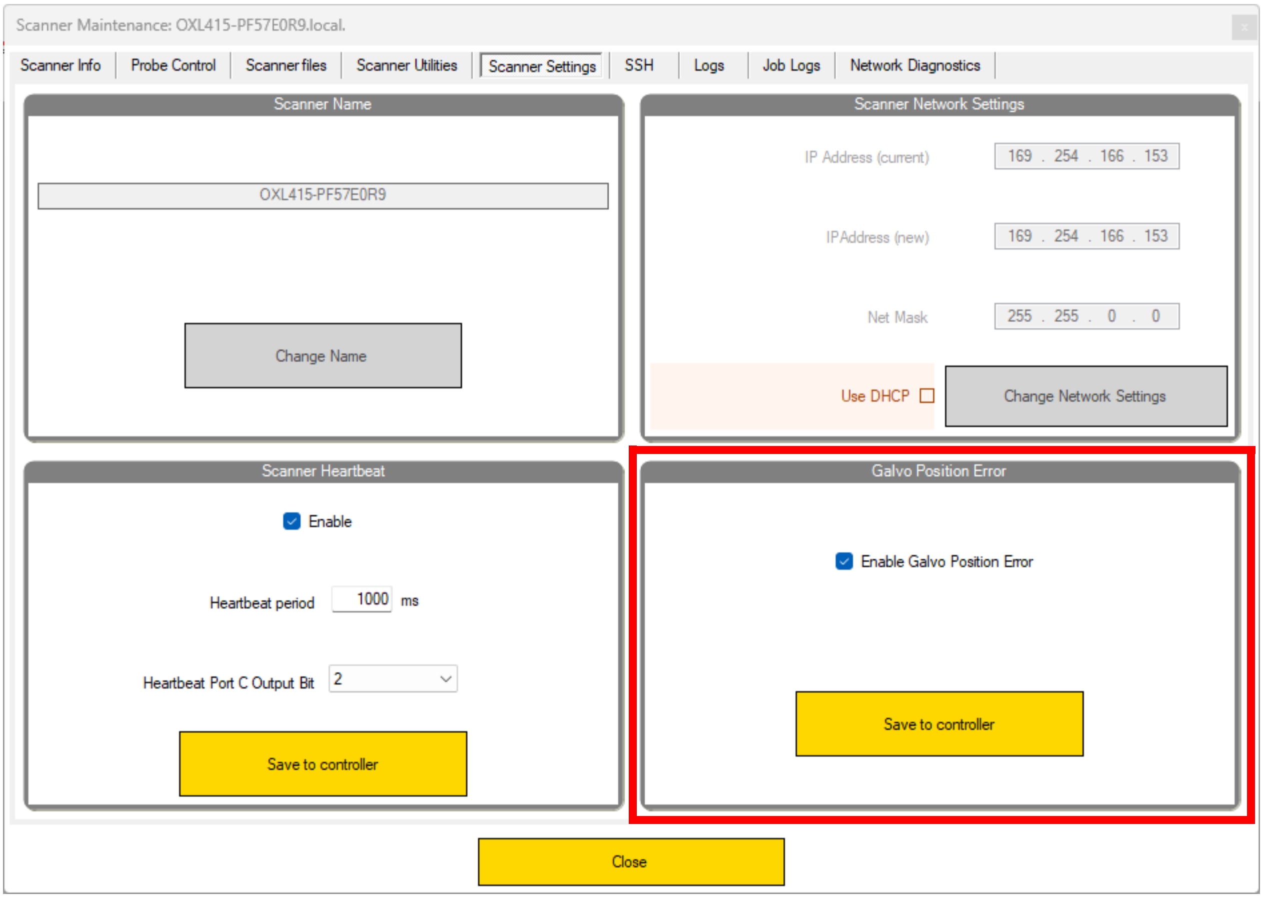
If users wish to disable the Heartbeat signal, simply uncheck the Enable box, save the settings to the controller, and restart IPGScan.

12.4 Galvo Posi‘tion Error

Galvo Position Error can be enabled so that if a deviation in galvo position is detected during processing, the laser will be shutoff.

If users wish to enable Galvo Position Error functionality, perform the following steps.

1. Check the "Enable Galvo Position Error" box.
2. Click the "Save to Controller" button. This will generate a log message stating, "Sent Galvo Position Error to the scanner successfully".



Scanner Maintenance: OXL415-PF57E0R9.local.

Scanner Name: OXL415-PF57E0R9

IP Address (current): 169 . 254 . 166 . 153

IPAddress (new): 169 . 254 . 166 . 153

Net Mask: 255 . 255 . 0 . 0

Use DHCP ☐

☑ Enable

Heartbeat period: 1000 ms

Heartbeat Port C Output Bit: 2

☑ Enable Galvo Position Error

Figure 373: Enabling Galvo Position Error

3. Close the Scanner Maintenance Window.
4. Close and restart IPGScan. Once reopened, Galvo Position Error functionality will now be active.

If users wish to disable Galvo Position Error functionality, simply uncheck the Enable Galvo Position Error box, save the settings to the controller, and restart IPGScan.

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13 Firmware Upgrade Utility

The Firmware Update Utility is used to upgrade the IPGScan Firmware

13.1 Required Software

The following software is required to use the Firmware Upgrade Utility:

- **IPGScan Suite**, Version 1.0.0.18653 or greater
- **ScanPack**, Version 0.1.18557 or greater

13.2 Procedure

The following procedure outlines how users can utilize the Firmware Upgrade Utility within IPGScan.

1. Launch IPGScan.
2. Click **Tools** in the Toolbar.
3. Navigate to **Scanner** and click **Update Firmware**. See Figure 374 (below).

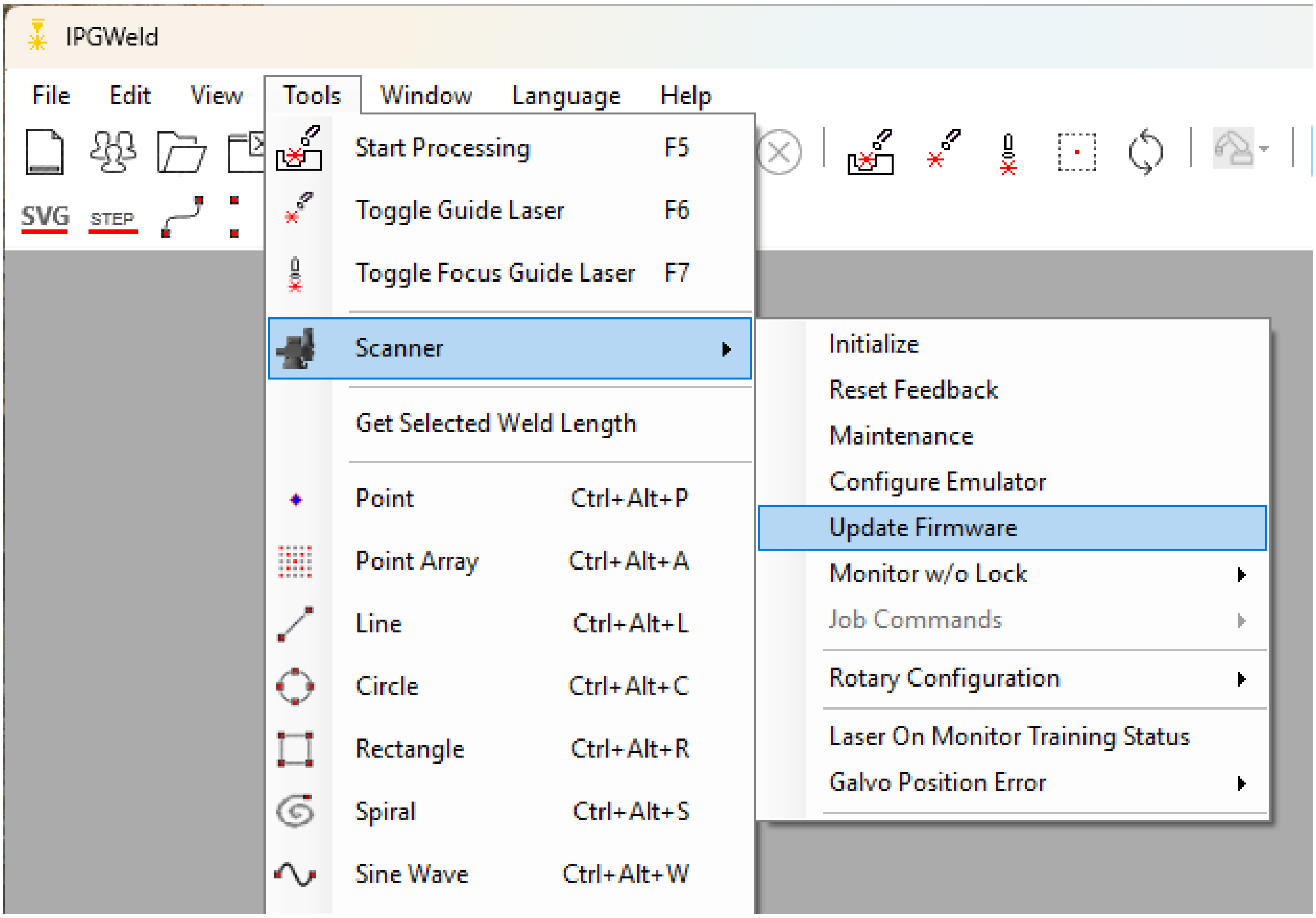
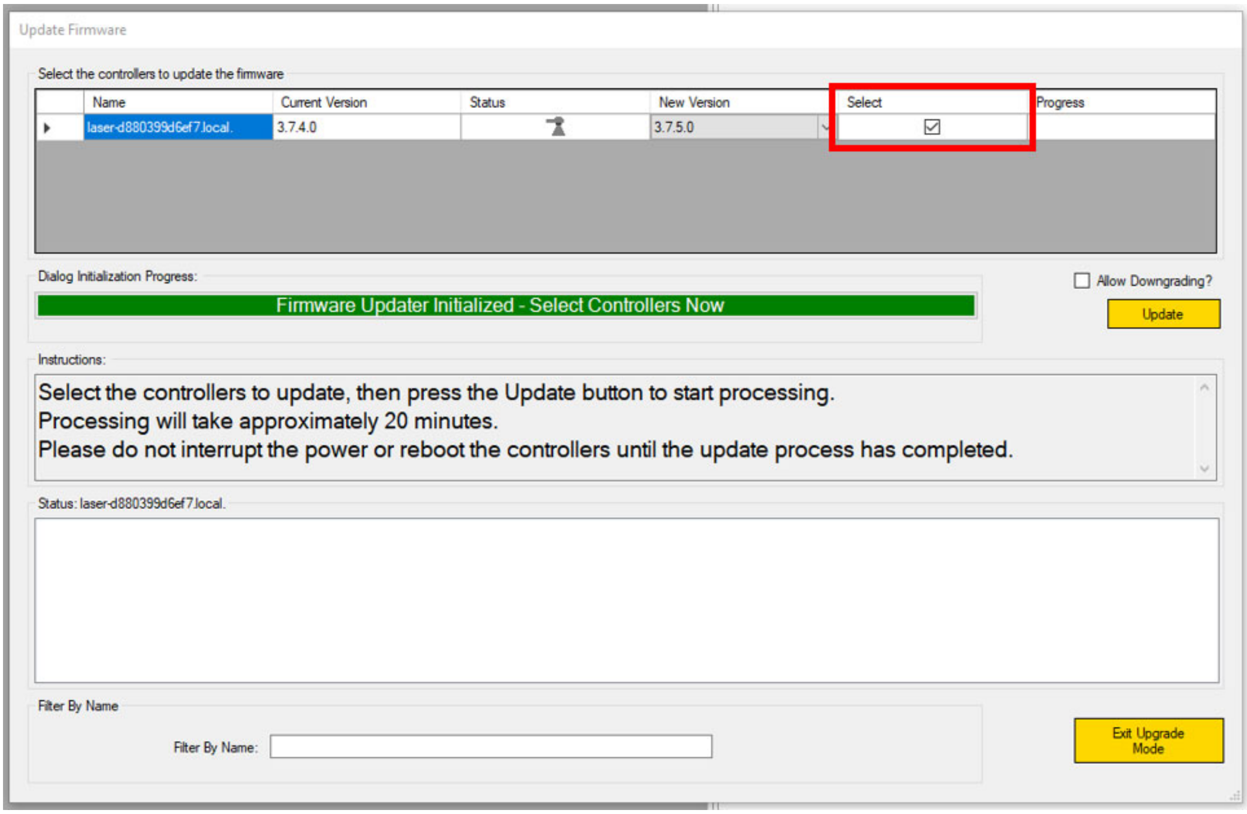


Figure 374: Opening the Update Firmware Window

4. Check the Select box of the scanner that should be upgraded. See Figure 375 (below).

   The Update Firmware window will display the current version for each displayed scanner as well as any new versions of firmware that are available for the scanner. By default, the newest version of firmware will be displayed. If a new version of firmware is not available, no version number will be displayed in the “New Version” field.



	Name	Current Version	Status	New Version	Select	Progress
▸	laser-d880399d6ef7.local.	3.7.4.0		3.7.5.0	☑	

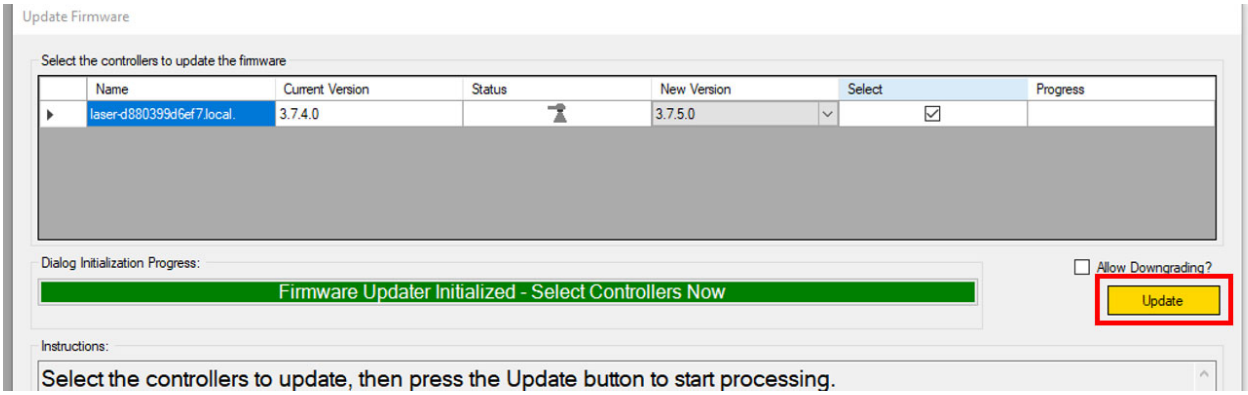
Firmware Updater Initialized - Select Controllers Now

Select the controllers to update, then press the Update button to start processing.
Processing will take approximately 20 minutes.
Please do not interrupt the power or reboot the controllers until the update process has completed.

Status: laser-d880399d6ef7.local.

Figure 375: Selecting a Scanner to Update

5. Click the **Update** button. See Figure 376 (below).


Update Firmware
Select the controllers to update the firmware
Dialog Initialization Progress:
☐ Allow Downgrading?
Update
Instructions:

	Name	Current Version	Status	New Version	Select	Progress
▸	laser-d880399d6ef7.local.	3.7.4.0		3.7.5.0	☑	

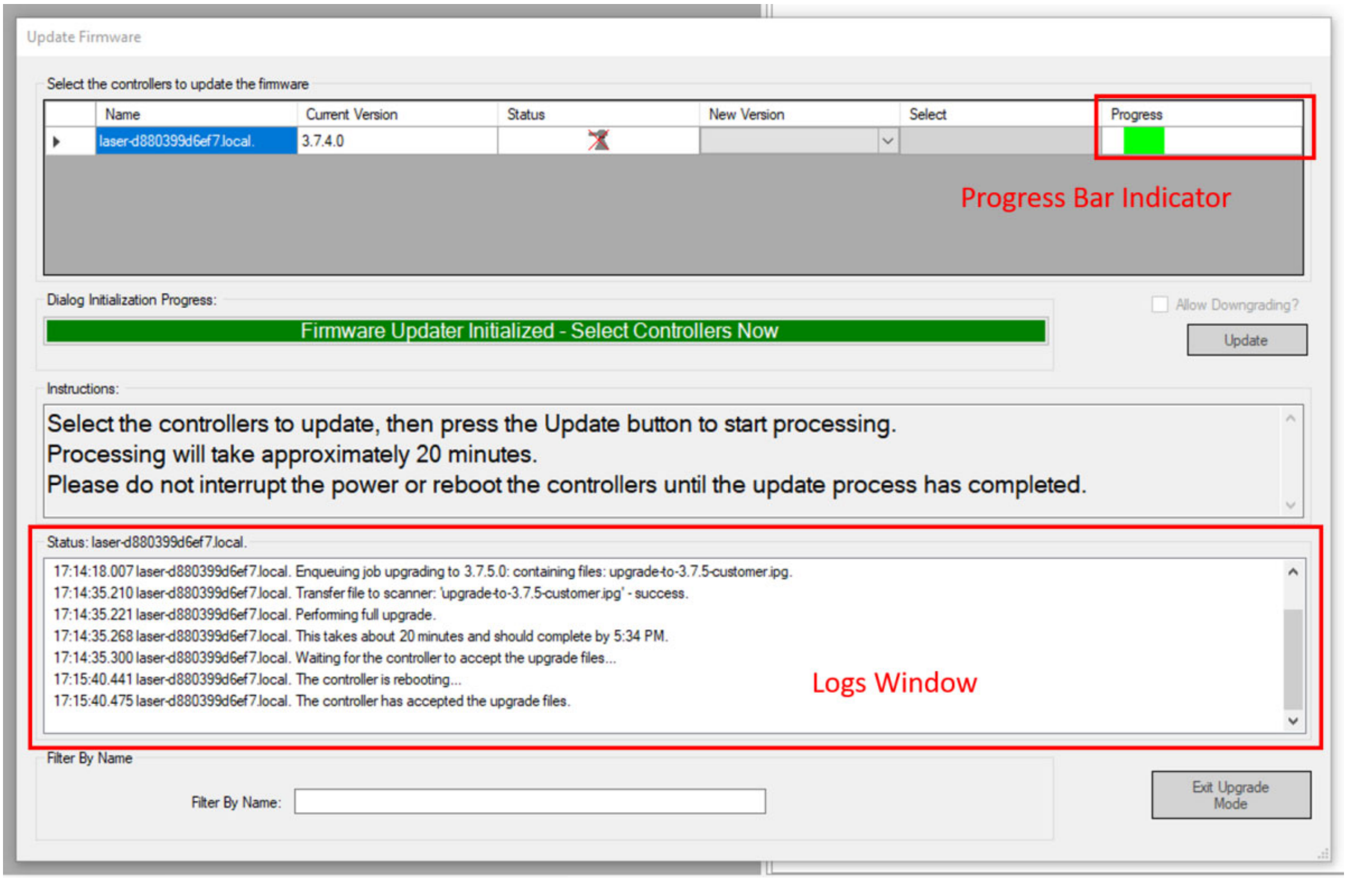
Firmware Updater Initialized - Select Controllers Now

Select the controllers to update, then press the Update button to start processing.

Figure 376: Starting the Update Process

6. Wait while the update process takes place. During the update, the window will display a progress bar and updates in the logs window. See Figure 377 (below).

IMPORTANT The Scan Controller may cycle power numerous times throughout the update process. ***Do not do a manual power cycle of the Scan Controller during the update process.***



Update Firmware

Select the controllers to update the firmware

	Name	Current Version	Status	New Version	Select	Progress
▸	laser-d880399d6ef7.local.	3.7.4.0	☒			🟩

Progress Bar Indicator

Dialog Initialization Progress:

Firmware Updater Initialized - Select Controllers Now

Instructions:

Select the controllers to update, then press the Update button to start processing.
Processing will take approximately 20 minutes.
Please do not interrupt the power or reboot the controllers until the update process has completed.

Status: laser-d880399d6ef7.local.

```
17:14:18.007 laser-d880399d6ef7.local. Enqueuing job upgrading to 3.7.5.0: containing files: upgrade-to-3.7.5-customer.ipg.
17:14:35.210 laser-d880399d6ef7.local. Transfer file to scanner: 'upgrade-to-3.7.5-customer.ipg' - success.
17:14:35.221 laser-d880399d6ef7.local. Performing full upgrade.
17:14:35.268 laser-d880399d6ef7.local. This takes about 20 minutes and should complete by 5:34 PM.
17:14:35.300 laser-d880399d6ef7.local. Waiting for the controller to accept the upgrade files...
17:15:40.441 laser-d880399d6ef7.local. The controller is rebooting...
17:15:40.475 laser-d880399d6ef7.local. The controller has accepted the upgrade files.
```

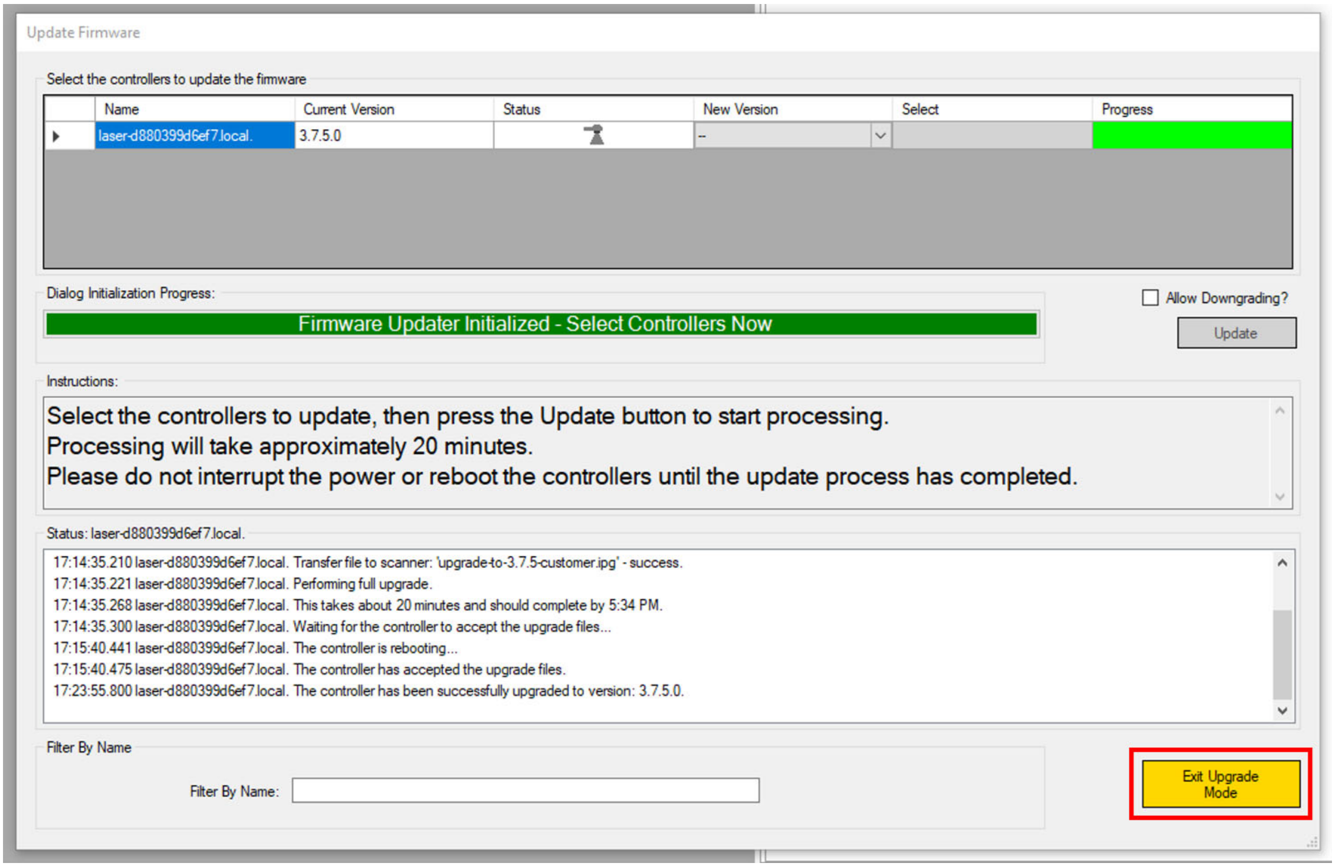
Logs Window

Filter By Name

Filter By Name:

Figure 377: Update Indicators

7. Once the update is complete, you can close the Update Firmware window by clicking the **Exit Upgrade Mode** button. See Figure 378 (below).



Update Firmware

Select the controllers to update the firmware

	Name	Current Version	Status	New Version	Select	Progress
▸	laser-d880399d6ef7.local.	3.7.5.0		--		🟩

Dialog Initialization Progress:

Firmware Updater Initialized - Select Controllers Now

□ Allow Downgrading?

Instructions:

Select the controllers to update, then press the Update button to start processing.
Processing will take approximately 20 minutes.
Please do not interrupt the power or reboot the controllers until the update process has completed.

Status: laser-d880399d6ef7.local.

```
17:14:35.210 laser-d880399d6ef7.local. Transfer file to scanner: 'upgrade-to-3.7.5-customer.ipg' - success.
17:14:35.221 laser-d880399d6ef7.local. Performing full upgrade.
17:14:35.268 laser-d880399d6ef7.local. This takes about 20 minutes and should complete by 5:34 PM.
17:14:35.300 laser-d880399d6ef7.local. Waiting for the controller to accept the upgrade files...
17:15:40.441 laser-d880399d6ef7.local. The controller is rebooting...
17:15:40.475 laser-d880399d6ef7.local. The controller has accepted the upgrade files.
17:23:55.800 laser-d880399d6ef7.local. The controller has been successfully upgraded to version: 3.7.5.0.
```

Filter By Name

Filter By Name:

Figure 378: Closing the Update Firmware Window

14 Error Codes

The following are error codes that may be encountered when using IPGScan and their descriptions are listed below.

- "SPK_HARDWARE_STOP" or "Hardware Stop"
  - Scanner external stop is active. In other words the ENABLE bit is set inactive on the utilized External Interface device. Please refer to the "External Interface User Guide (DOCOXUGSCNXX0002)" for appropriate interface pinouts. This is not a hardware safety stop.
- "SPK_ROBOT_MISSING_TRAJ"
  - No trajectory is loaded in an OTF job.
- "SPK_ROBOT_TIMEOUT"
  - The OTF job failed Dryrun. Ensure that object positions fall within the InView Win- dow, check if robot and vector weld speeds may need to be modified, and ensure that features are being processed in the right direction.
- "SPK_INVALID_POSITION"
  - Feature is outside of the field of view/processing window. Realign feature inside window to fix this error. If feature is within the window, but this error is still shown, check the z-position of the feature.
- "SPK_OUTPUT_SOFTWARE_ABORT_ERROR"
  - Current process was aborted.
- "SPK_INVALID_INVIEW"
  - CoordinationParams.xml file is missing.

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15 Recover Scanner

The Recover Scanner Utility is used to recover a forgotten Scan Controller IP address.

15.1 Required Equipment and Software

The following equipment is required to use the Recover Scanner Utility:

- Scan Controller
- Computer

The following software is required to use the Recover Scanner Utility:

- IPGScan
- ScanPack

15.2 Procedure

Before you can recover the Scan Controller IP address, you must determine the network adapter that is being used by your Scan Controller. See Section 15.2.1 (below).

After you have determined the network adapter that is being used by your Scan Controller, you can recover the Scan Controller IP address. See Section 15.2.2 on page 356.

15.2.1 Determine the Appropriate Network Adapter

Do the following to determine the network adapter that is being used by your Scan Controller:

1. Connect the Scan Controller to a network adapter via Ethernet on the computer.
2. Navigate to **Control Panel>Network and Internet>Network Connections**, as shown in Figure 379 (below).

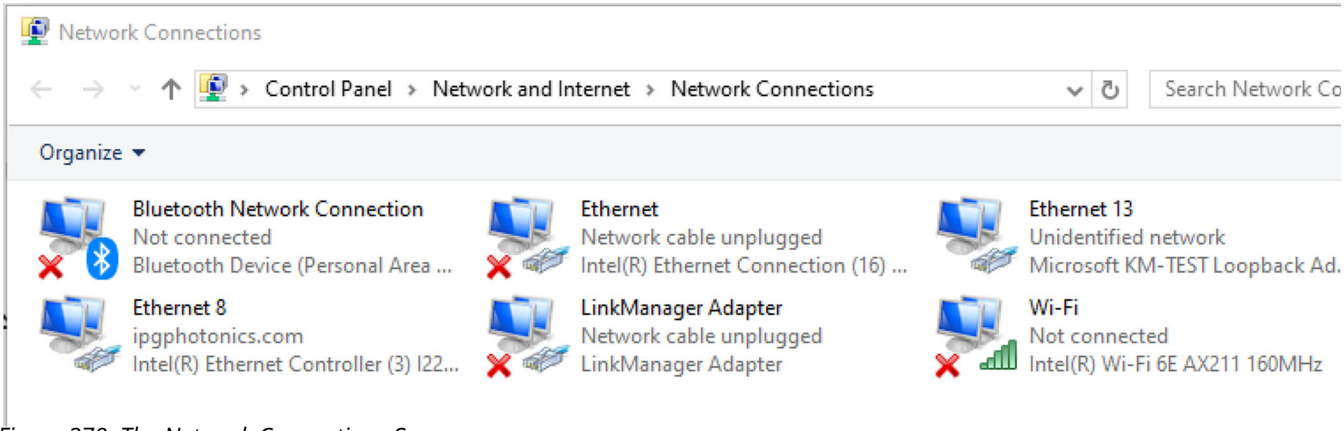

Network Connections
Control Panel › Network and Internet › Network Connections
Search Network Co
Organize ▾
Bluetooth Network Connection
Not connected
Bluetooth Device (Personal Area ...
Ethernet
Network cable unplugged
Intel(R) Ethernet Connection (16) ...
Ethernet 13
Unidentified network
Microsoft KM-TEST Loopback Ad.
Ethernet 8
ipgphotonics.com
Intel(R) Ethernet Controller (3) I22...
LinkManager Adapter
Network cable unplugged
LinkManager Adapter
Wi-Fi
Not connected
Intel(R) Wi-Fi 6E AX211 160MHz

Figure 379: The Network Connections Screen

3. Unplug the Ethernet cable from either the Scan Controller or computer, and make note of the network adapter that changes from being connected to disconnected.

   This is the network adapter used by the Scan Controller.
4. Plug the Scan Controller back into the same network adapter on the computer.

15.2.2 Recover the Scan Controller IP Address

Do the following to recover the Scan Controller IP address:

1. Launch IPGWeld as a Windows Administrator, as seen in Figure 380 (below).

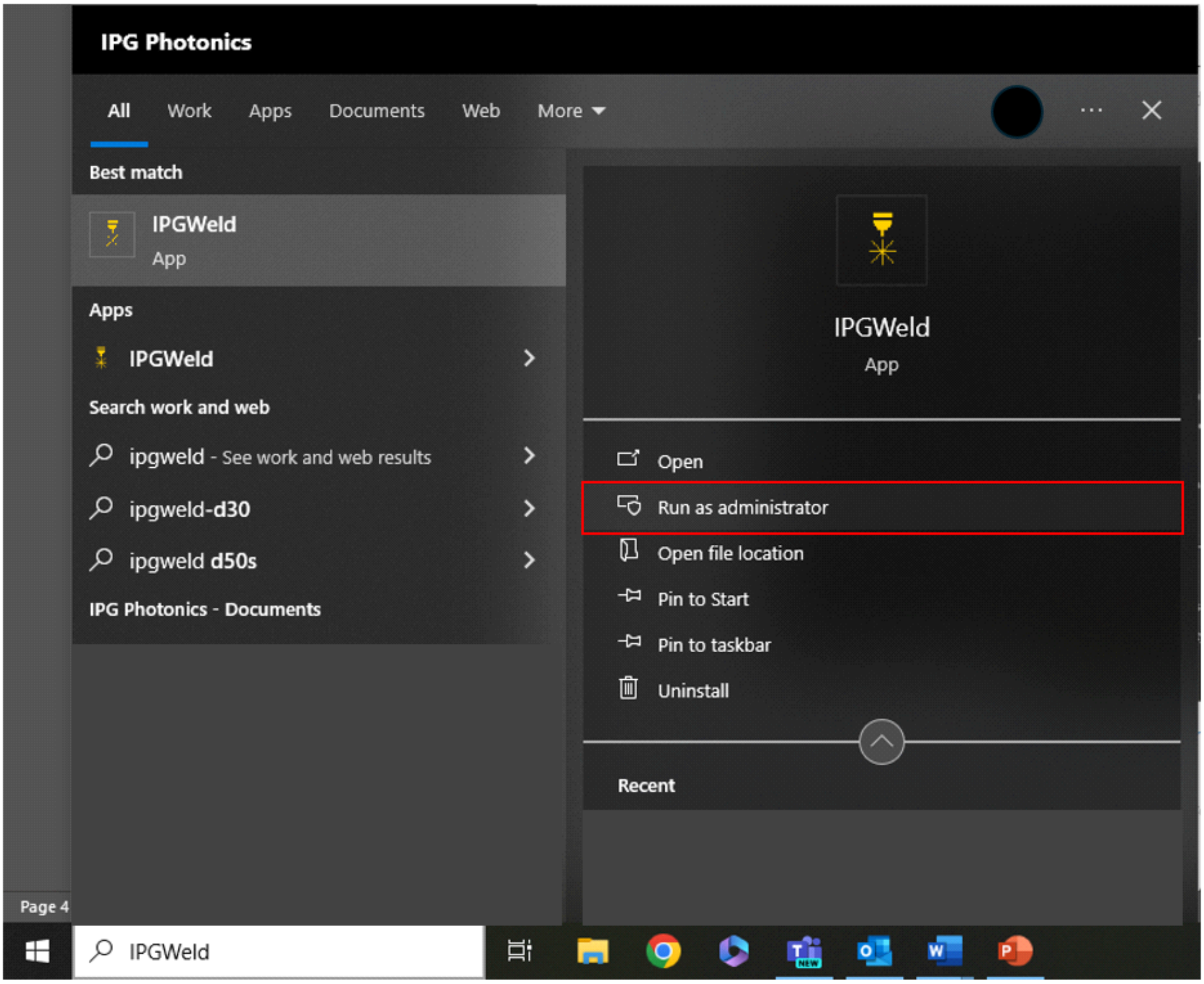


Figure 380: Launch IPGWeld as a Windows Administrator

2. In IPGWeld, navigate to the **Help** menu and select **Recover Scanner**, as seen in Figure 381 (below).

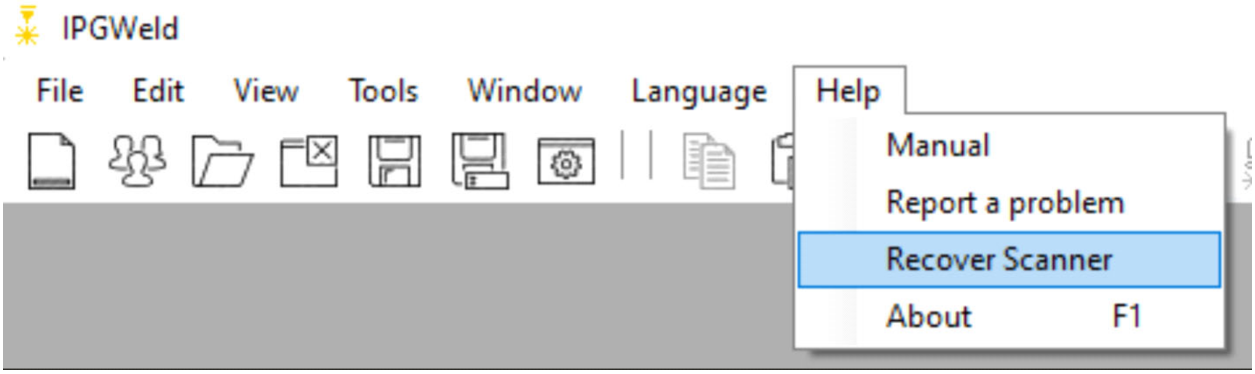
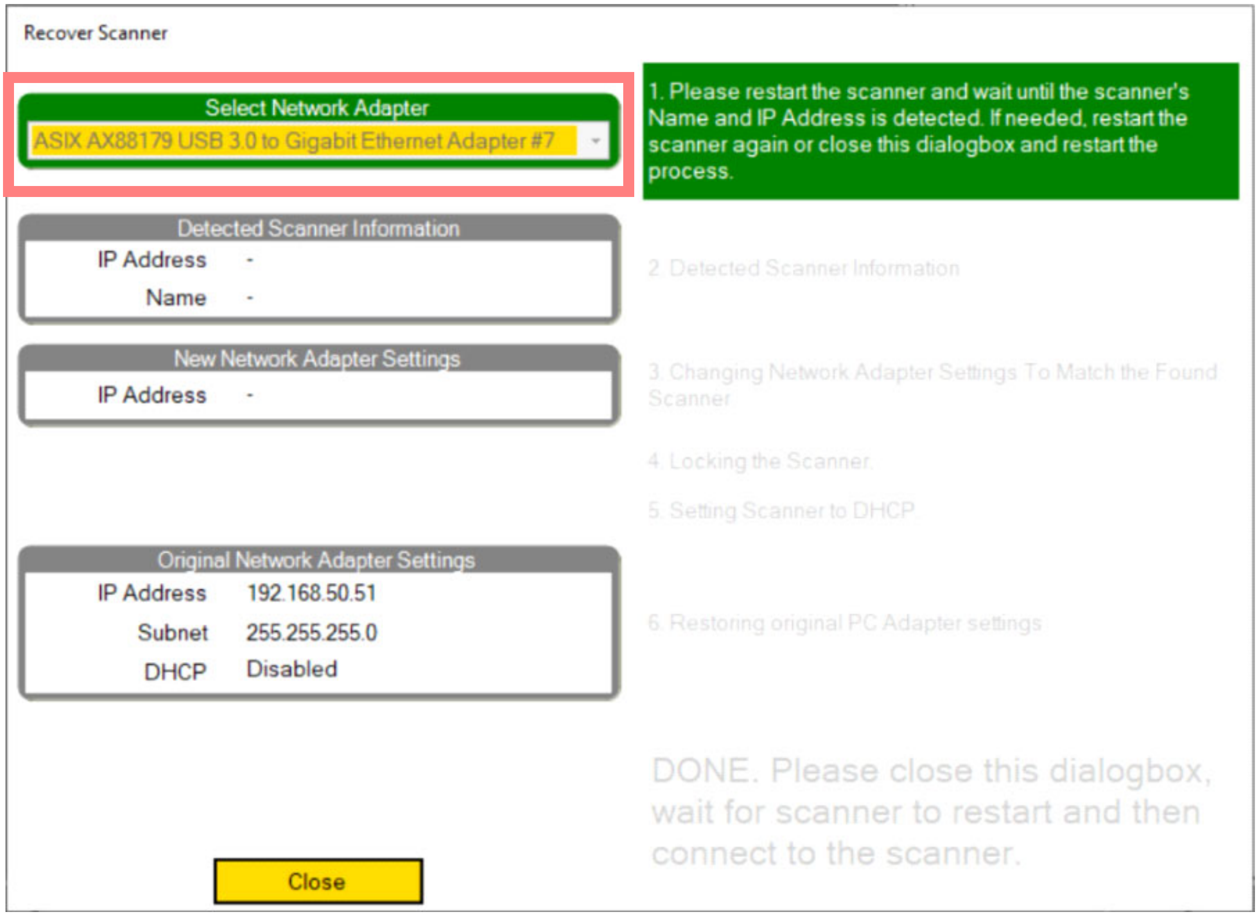


Figure 381: Select Recover Scanner

3. After selecting **Recover Scanner**, the following screen will appear.



Recover Scanner

Select Network Adapter

ASIX AX88179 USB 3.0 to Gigabit Ethernet Adapter #7

1. Please restart the scanner and wait until the scanner's Name and IP Address is detected. If needed, restart the scanner again or close this dialogbox and restart the process.

Detected Scanner Information

IP Address -

Name -

2. Detected Scanner Information

New Network Adapter Settings

IP Address -

3. Changing Network Adapter Settings To Match the Found Scanner

4. Locking the Scanner

5. Setting Scanner to DHCP

Original Network Adapter Settings

IP Address 192.168.50.51

Subnet 255.255.255.0

DHCP Disabled

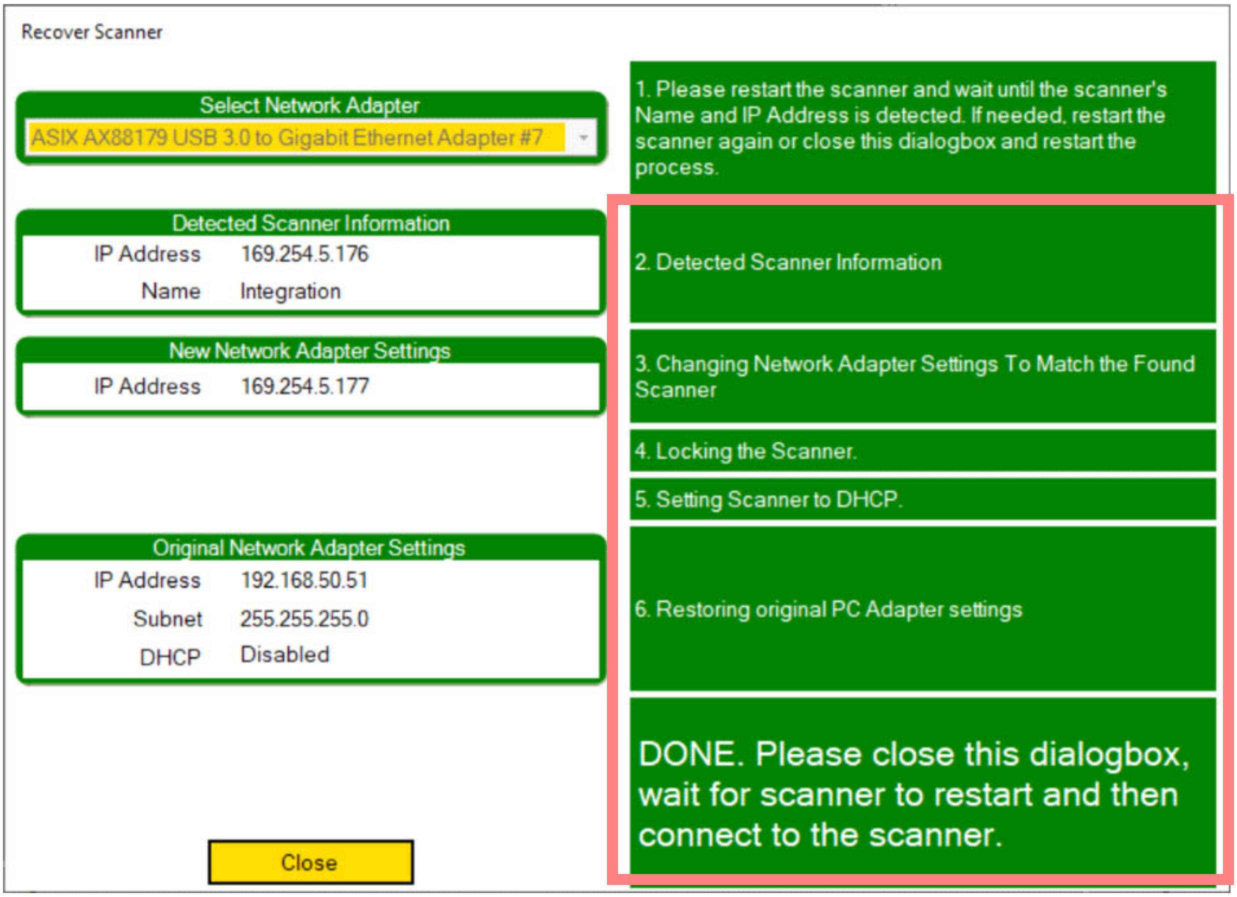
6. Restoring original PC Adapter settings

DONE. Please close this dialogbox, wait for scanner to restart and then connect to the scanner.

Figure 382: Select Network Adapter

4. From the drop-down menu in the above screen, select the Network Adapter that is connected to the Scan Controller. (This is the Network Adapter that you identified in Section 15.2.1 on page 355.)

5. After selecting the Network Adapter from the drop-down menu, power down the Scan Controller and leave it powered down for one minute.
6. Restart the Scan Controller and wait until the Scan Controller's Name and IP Address have been detected.
7. After a moment, the status messages shown in Figure 383 (below) will display. These messages indicate that the Scan Controller's IP Address has been successfully recovered.



Recover Scanner

Select Network Adapter

ASIX AX88179 USB 3.0 to Gigabit Ethernet Adapter #7

Detected Scanner Information

IP Address 169.254.5.176

Name Integration

New Network Adapter Settings

IP Address 169.254.5.177

Original Network Adapter Settings

IP Address 192.168.50.51

Subnet 255.255.255.0

DHCP Disabled

1. Please restart the scanner and wait until the scanner's Name and IP Address is detected. If needed, restart the scanner again or close this dialogbox and restart the process.

2. Detected Scanner Information

3. Changing Network Adapter Settings To Match the Found Scanner

4. Locking the Scanner.

5. Setting Scanner to DHCP.

6. Restoring original PC Adapter settings

DONE. Please close this dialogbox, wait for scanner to restart and then connect to the scanner.

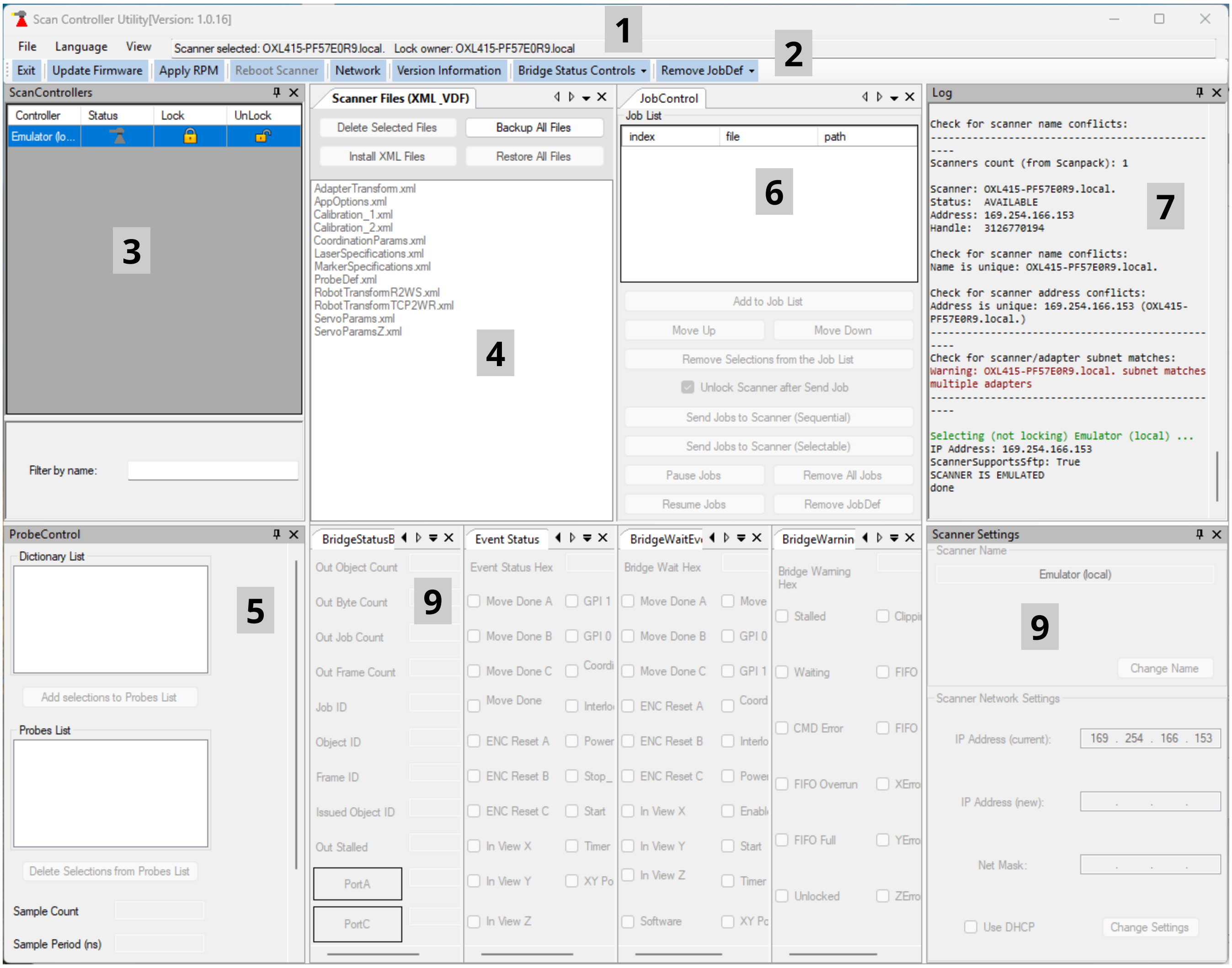
Figure 383: Completed Dialog Box

16 Scan Controller Utility

16.1 Scan Controller Utility Overview

The primary purpose of the Scan Controller Utility is to provide users with a means of configuring scanners. The configuration and setup of scanners that is performed within this utility is typically performed once when the scanner is initially received and setup, and then not required again. Common tasks that are performed within the Scan Controller Utility include loading LaserSpecification files or calibration files, backing up scanner files, changing the scanners IP address, or assigning a particular name to a scanner. Additional functionality exists within the Scan Controller Utility, but this is often reserved for IPG support.

Figure 384 (below) details the layout of the Scan Controller Utility.



Scanner selected: OXL415-PF57E0R9.local. Lock owner: OXL415-PF57E0R9.local

AdapterTransform.xml
AppOptions.xml
Calibration_1.xml
Calibration_2.xml
CoordinationParams.xml
LaserSpecifications.xml
MarkerSpecifications.xml
ProbeDef.xml
RobotTransformR2WS.xml
RobotTransformTCP2WR.xml
ServoParams.xml
ServoParamsZ.xml

```
Check for scanner name conflicts:
--------------------------------------------------
----
Scanners count (from Scanpack): 1

Scanner: OXL415-PF57E0R9.local.
Status:  AVAILABLE
Address: 169.254.166.153
Handle:  3126770194

Check for scanner name conflicts:
Name is unique: OXL415-PF57E0R9.local.

Check for scanner address conflicts:
Address is unique: 169.254.166.153 (OXL415-
PF57E0R9.local.)
--------------------------------------------------
----
Check for scanner/adapter subnet matches:
Warning: OXL415-PF57E0R9.local. subnet matches
multiple adapters
--------------------------------------------------
----

Selecting (not locking) Emulator (local) ...
IP Address: 169.254.166.153
ScannerSupportsSftp: True
SCANNER IS EMULATED
done
```

Scanner Name: Emulator (local)

IP Address (current): 169 . 254 . 166 . 153

Figure 384: Scan Controller Utility Layout Window

Table 33: Scan Controller Utility Layout Items

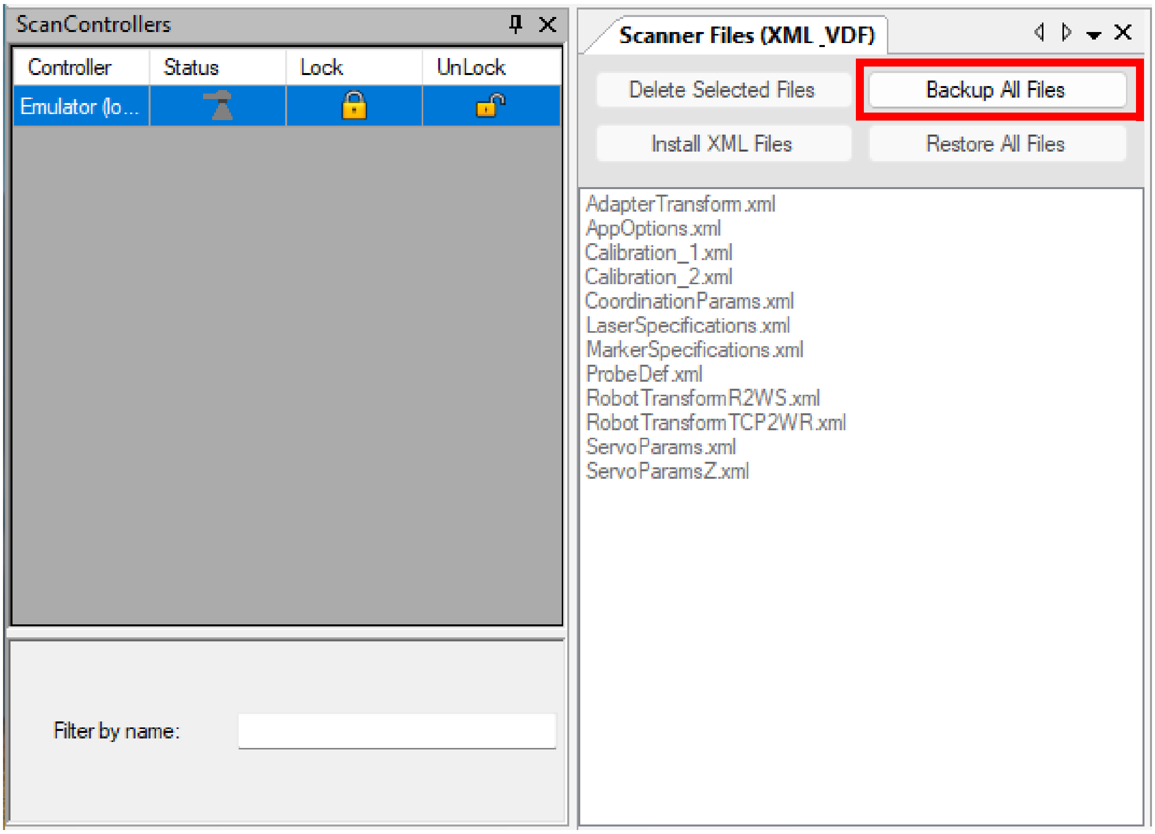
NUMBER	DESCRIPTION	NUMBER	DESCRIPTION
1	File Menu	6	Job Control Window
2	Actions Bar	7	Log Window
3	Scan Controllers Window	8	Bridge Status Window
4	Scanner Files Window	9	Scanner Settings Window
5	Probe Control Window		

16.2 Backing Up Scan Controller Files

Backing-up Scan Controller files prior to uploading new calibration files is a good operating procedure. In doing so, users can easily access original calibration files during instances where improper files may have been uploaded.

Users can backup Scan Controller calibration files using the following procedure.

1. Connect to the desired scanner in the Scan Controller Utility.
2. Click "Backup All Files." See Figure 385 (below).

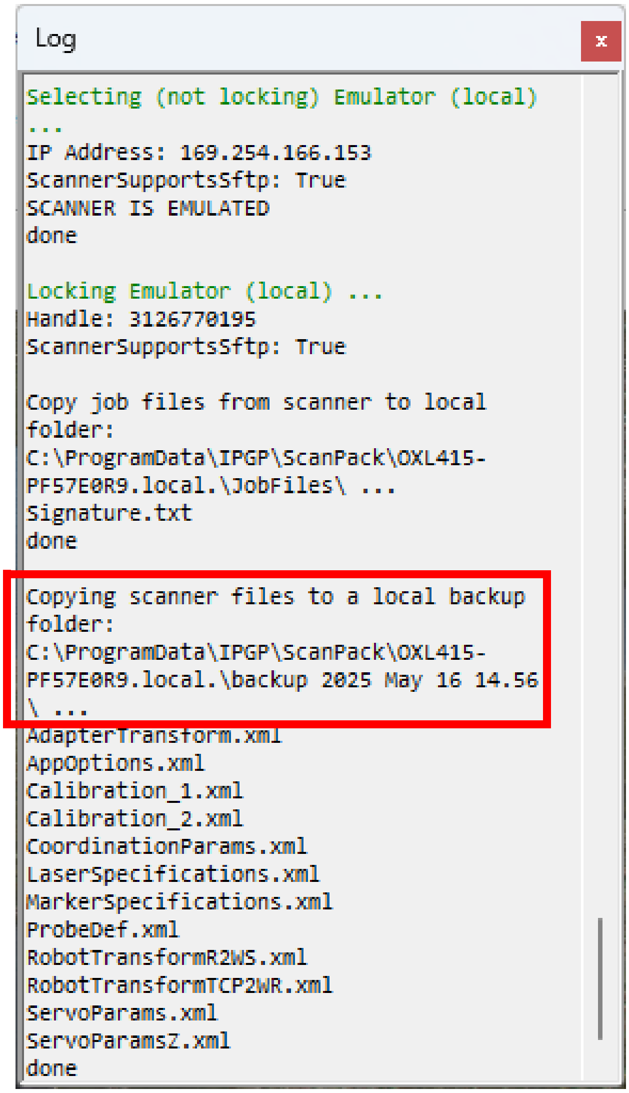


Controller	Status	Lock	UnLock
Emulator (lo...		🔒	🔓

AdapterTransform.xml
AppOptions.xml
Calibration_1.xml
Calibration_2.xml
CoordinationParams.xml
LaserSpecifications.xml
MarkerSpecifications.xml
ProbeDef.xml
RobotTransformR2WS.xml
RobotTransformTCP2WR.xml
ServoParams.xml
ServoParamsZ.xml

Figure 385: Backing-Up Scan Controller Files

3. Users can then find the backup files in the location specified in the Logs Window. See Figure 386 (below).



```
Selecting (not locking) Emulator (local)
...
IP Address: 169.254.166.153
ScannerSupportsSftp: True
SCANNER IS EMULATED
done

Locking Emulator (local) ...
Handle: 3126770195
ScannerSupportsSftp: True

Copy job files from scanner to local
folder:
C:\ProgramData\IPGP\ScanPack\OXL415-
PF57E0R9.local.\JobFiles\ ...
Signature.txt
done

Copying scanner files to a local backup
folder:
C:\ProgramData\IPGP\ScanPack\OXL415-
PF57E0R9.local.\backup 2025 May 16 14.56
\ ...
AdapterTransform.xml
AppOptions.xml
Calibration_1.xml
Calibration_2.xml
CoordinationParams.xml
LaserSpecifications.xml
MarkerSpecifications.xml
ProbeDef.xml
RobotTransformR2WS.xml
RobotTransformTCP2WR.xml
ServoParams.xml
ServoParamsZ.xml
done
```

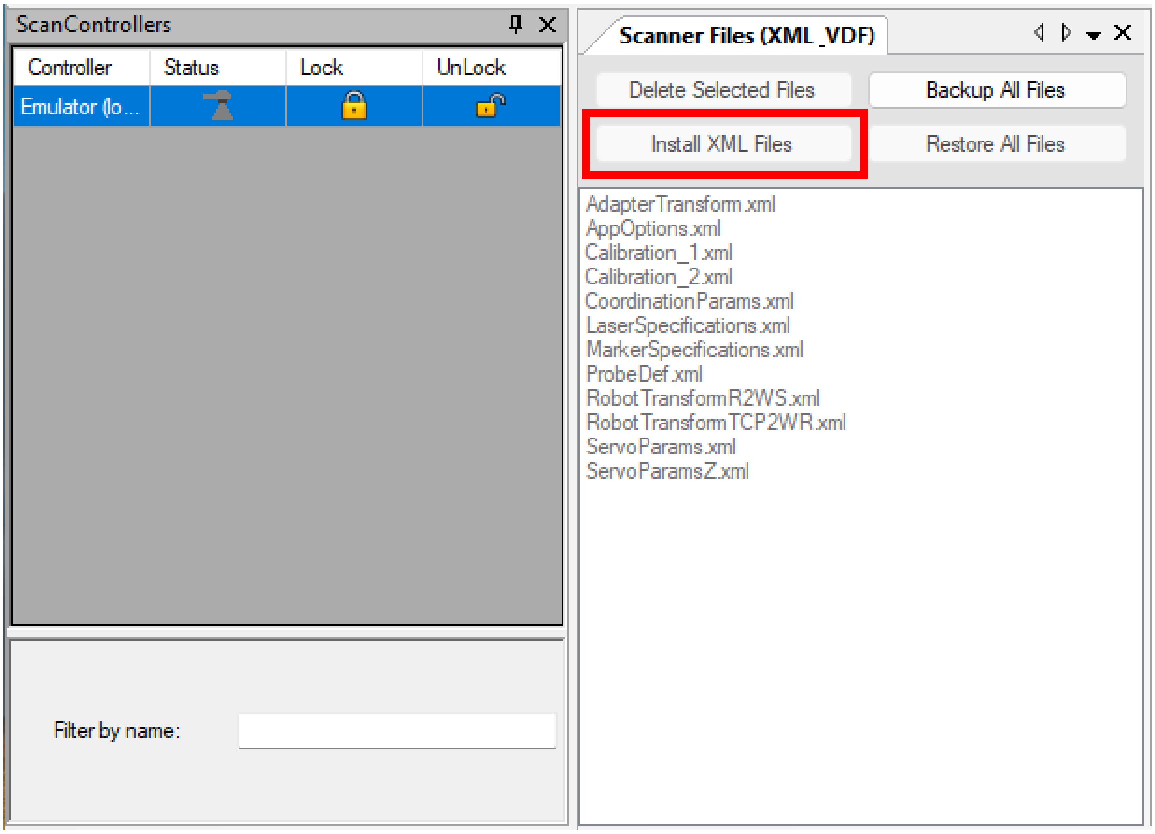
Figure 386: Backup Location

16.3 Uploading a Laser Specification File

IPG makes a wide variety of both lasers and scanners. Because of the variation in laser control across different series of lasers, the scanner needs to know which laser is being used. This is accomplished in the form of a Laser Specification file, which can be uploaded to the scanner. With the proper Laser Specification file uploaded, the scanners laser control outputs will then be appropriate given the lasers specifications/capabilities.

The following procedure provides an example of how to upload a Laser Specification file for a YLS-6000 laser. Users should upload the proper Laser Specification file that corresponds with the laser purchased.

1. Connect to the desired scanner in the Scan Controller Utility.
2. Click "Install XML Files." See Figure 387 (below).

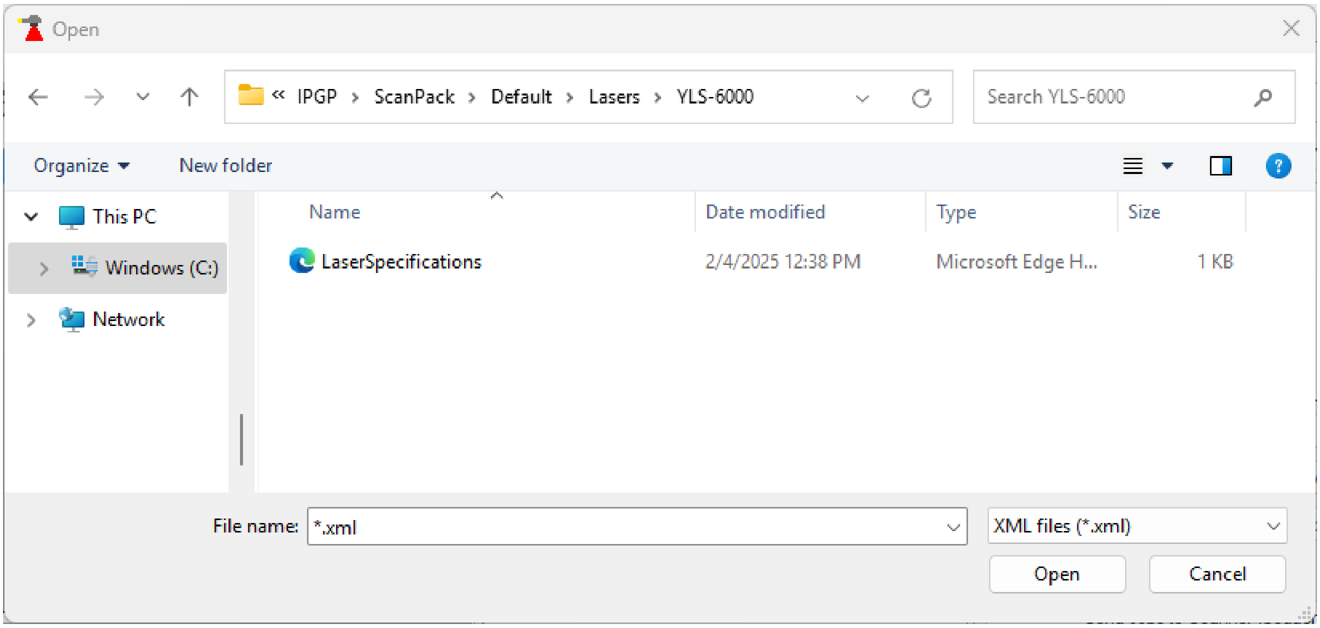


Controller	Status	Lock	UnLock
Emulator (lo...		🔒	🔓

AdapterTransform.xml
AppOptions.xml
Calibration_1.xml
Calibration_2.xml
CoordinationParams.xml
LaserSpecifications.xml
MarkerSpecifications.xml
ProbeDef.xml
RobotTransformR2WS.xml
RobotTransformTCP2WR.xml
ServoParams.xml
ServoParamsZ.xml

Figure 387: Installing a LaserSpecification File

3. Open the "Default" folder.
4. Open the "Lasers" folder.
5. Open the proper laser folder for the laser that is being used. In this example, the YLS-6000 folder is opened.
6. Select the "LaserSpecifications" file and click "Open." See Figure 388 on page 363.



« IPGP › ScanPack › Default › Lasers › YLS-6000

Search YLS-6000

Name	Date modified	Type	Size
LaserSpecifications	2/4/2025 12:38 PM	Microsoft Edge H...	1 KB

File name: *.xml

XML files (*.xml)

Figure 388: Selecting and Uploading the LaserSpecification File

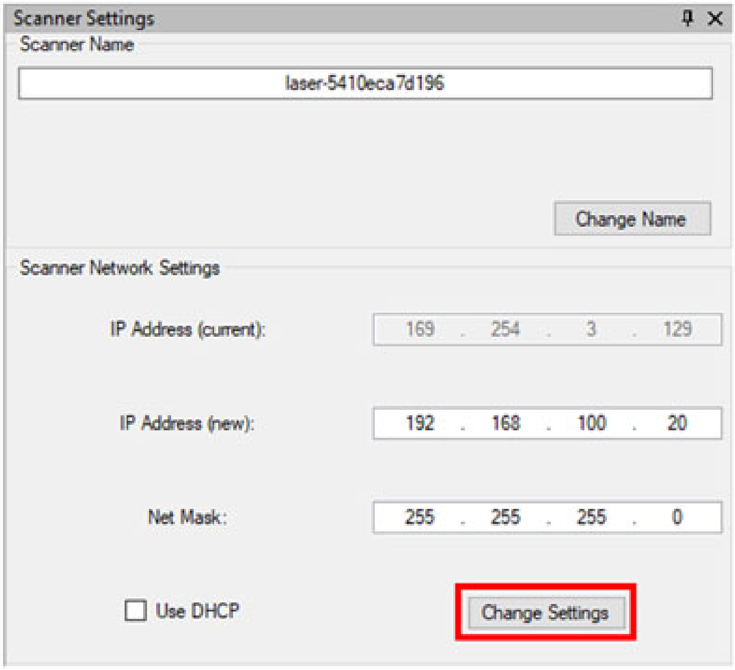
7. Click "OK" to confirm that the install completed.

16.4 Changing the Scan Controller’s IP Address

Scanners can be configured with network settings for DHCP or for a static IP address. By default, scanners ship from IPG with network settings configured for DHCP.

In order to set a static IP address for the scanner, refer to the following procedure.

1. Connect to the desired scanner in the Scan Controller Utility.
2. Using the Scanner Settings Window, enter the desired IP address and Net Mask. See Figure 389 (below).



Scanner Settings

Scanner Name

laser-5410eca7d196

Scanner Network Settings

IP Address (current): 169 . 254 . 3 . 129

IP Address (new): 192 . 168 . 100 . 20

Net Mask: 255 . 255 . 255 . 0

☐ Use DHCP

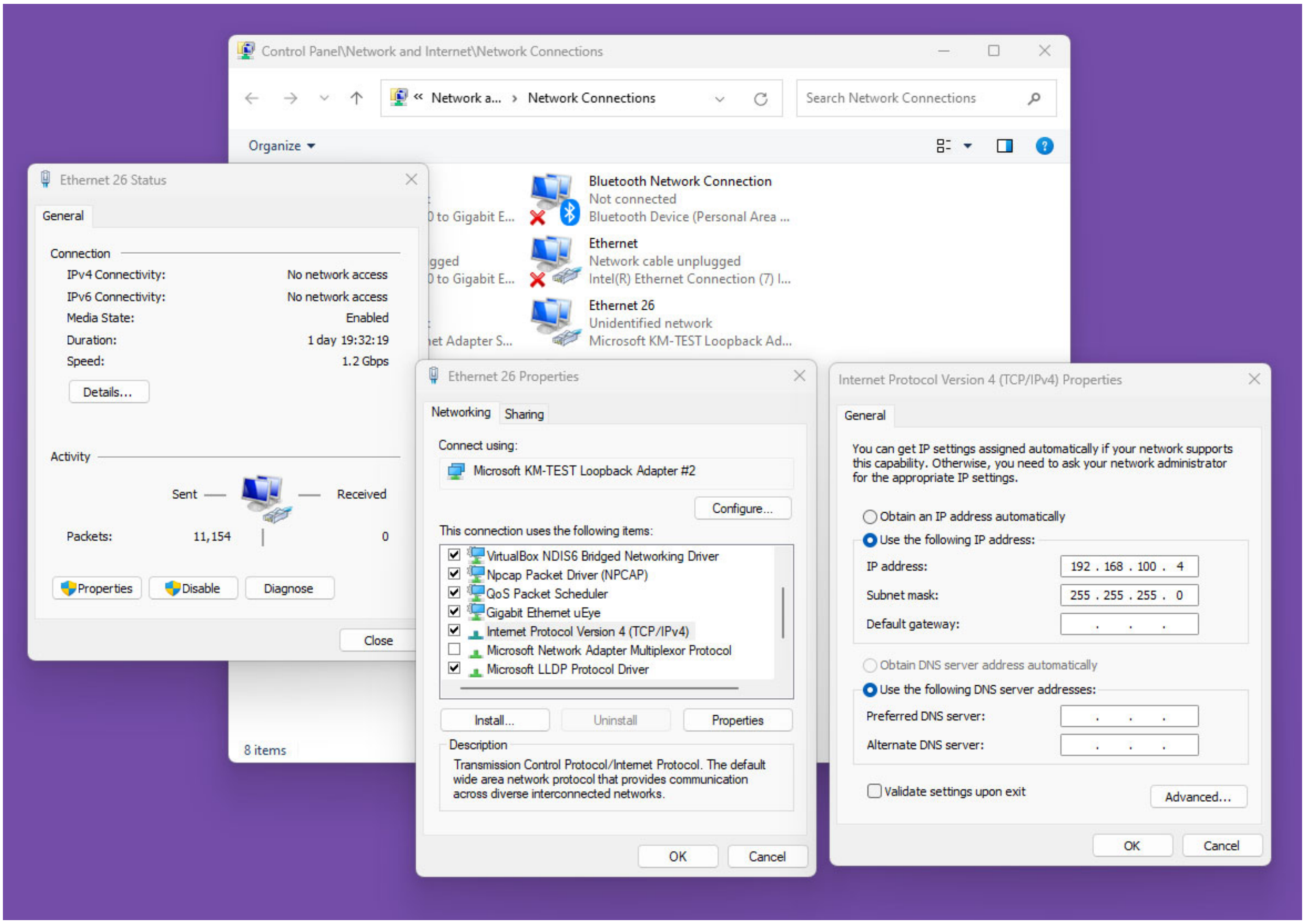
Figure 389: Setting a Static IP Address

3. Click "Change Settings."

IMPORTANT

Allow the scanner sufficient time to change the IP address after clicking "Change Settings." This process could take up to 5 minutes and the scanner will cycle power automatically. Do not power cycle during this time.

4. Change the appropriate Local Area Adapter settings on the computer to connect to the scanner. See Figure 390 on page 365.



Control Panel\Network and Internet\Network Connections

Network a... › Network Connections

Search Network Connections

Organize ▾

Bluetooth Network Connection
Not connected
Bluetooth Device (Personal Area ...

Ethernet
Network cable unplugged
Intel(R) Ethernet Connection (7) I...

Ethernet 26
Unidentified network
Microsoft KM-TEST Loopback Ad...

8 items

Ethernet 26 Status

General

Connection

IPv4 Connectivity:	No network access
IPv6 Connectivity:	No network access
Media State:	Enabled
Duration:	1 day 19:32:19
Speed:	1.2 Gbps

Activity

	Sent	Received
Packets:	11,154	0

Ethernet 26 Properties

Networking | Sharing

Connect using:

Microsoft KM-TEST Loopback Adapter #2

This connection uses the following items:

- ☑ VirtualBox NDIS6 Bridged Networking Driver
- ☑ Npcap Packet Driver (NPCAP)
- ☑ QoS Packet Scheduler
- ☑ Gigabit Ethernet uEye
- ☑ Internet Protocol Version 4 (TCP/IPv4)
- ☐ Microsoft Network Adapter Multiplexor Protocol
- ☑ Microsoft LLDP Protocol Driver

Description

Transmission Control Protocol/Internet Protocol. The default wide area network protocol that provides communication across diverse interconnected networks.

Internet Protocol Version 4 (TCP/IPv4) Properties

General

You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.

○ Obtain an IP address automatically

● Use the following IP address:

IP address:	192 . 168 . 100 . 4
Subnet mask:	255 . 255 . 255 . 0
Default gateway:	. . .

○ Obtain DNS server address automatically

● Use the following DNS server addresses:

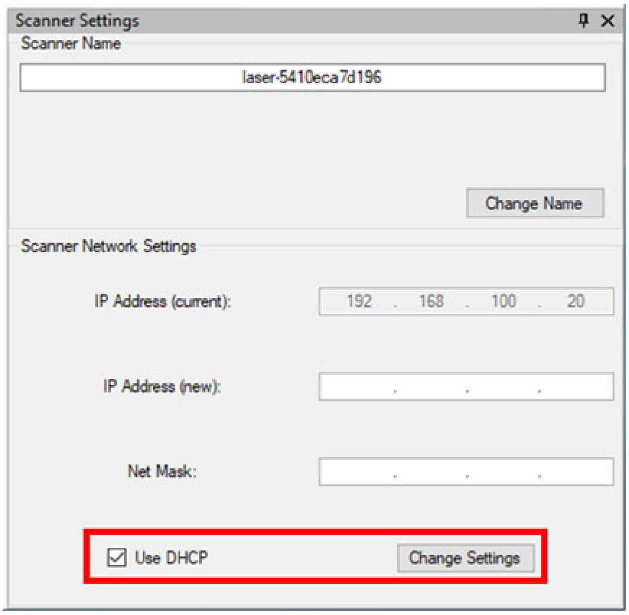
Preferred DNS server:	. . .
Alternate DNS server:	. . .

☐ Validate settings upon exit

Figure 390: Computer Local Area Adapter Settings

5. Users should now be able to reconnect to the scanner in the Scan Controller Utility or IPGScan.

If users wish to set the scanner back to DHCP settings, connect to the scanner, check the "Use DHCP" box, and click the "Change Settings" button (see Figure 391 on page 366). Allow the scanner sufficient time to make the change and be sure to set the appropriate Local Area Adapter settings on the PC before attempting to reconnect.


Scanner Settings

Scanner Name: laser-5410eca7d196

Scanner Network Settings

IP Address (current): 192 . 168 . 100 . 20

IP Address (new): . . .

Net Mask: . . .

☑ Use DHCP

Figure 391: Setting a Scanner to DHCP Settings

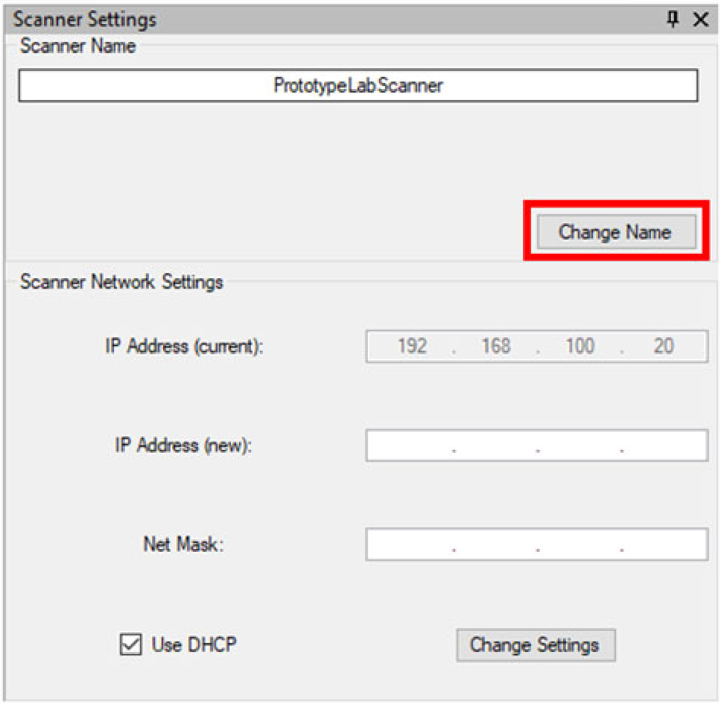
16.4.1 Unknown or Forgotten IP Address

If users do not know what a scanners static IP address is, the serial port on the Scan Controller can be used to reset the scanner back to DHCP settings or to set a new static IP Address. For instruction on how to do this, please refer to the Scanner Series User Guide (P21-010211).

16.5 Changing the Scan Controller Name

When users have many scanners in a given facility, it may provide clarity on which scanner is being used by assigning the scanners with a particular name. This can be done using the following procedure.

1. Connect to the desired scanner in the Scan Controller Utility.
2. Enter the desired name of the scanner in the Scanner Settings Window.
3. Click "Change Name" and allow the scanner sufficient time to complete the process. See Figure 392 (below).



Scanner Name: PrototypeLabScanner

IP Address (current): 192 . 168 . 100 . 20

IP Address (new): . . .

Net Mask: . . .

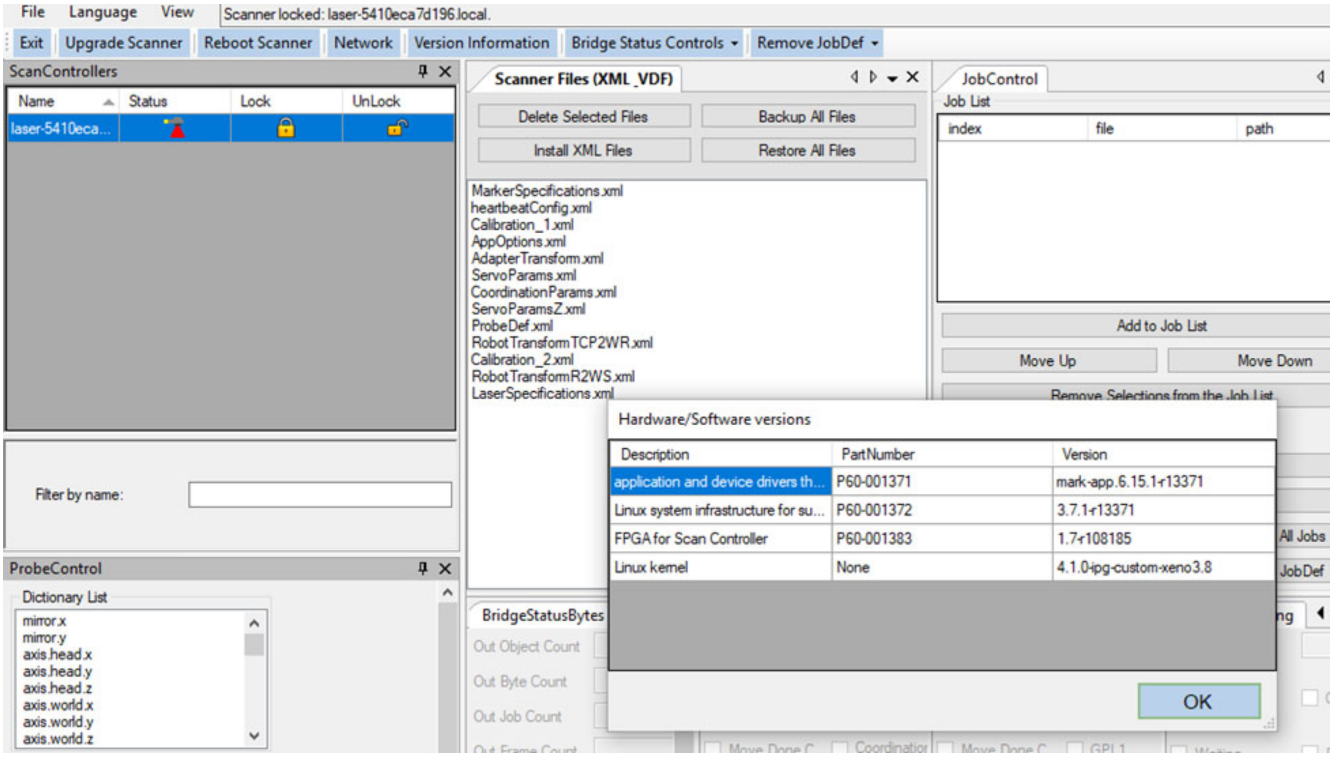
☑ Use DHCP

Figure 392: Changing the Scanner Name

16.6 Viewing Scan Controller Firmware Versions

The following procedure outlines how users can view Scan Controller firmware version information.

1. Connect to the desired scanner in the Scan Controller Utility.
2. Click "Version Information" in the Actions Bar.
    - A pop-up will then appear with the appear with the appropriate information. See Figure 393 (below).



Scanner locked: laser-5410eca7d196.local.

MarkerSpecifications.xml
heartbeatConfig.xml
Calibration_1.xml
AppOptions.xml
AdapterTransform.xml
ServoParams.xml
CoordinationParams.xml
ServoParamsZ.xml
ProbeDef.xml
RobotTransformTCP2WR.xml
Calibration_2.xml
RobotTransformR2WS.xml
LaserSpecifications.xml

Hardware/Software versions

Description	PartNumber	Version
application and device drivers th...	P60-001371	mark-app.6.15.1-r13371
Linux system infrastructure for su...	P60-001372	3.7.1-r13371
FPGA for Scan Controller	P60-001383	1.7-r108185
Linux kernel	None	4.1.0-ipg-custom-xeno3.8

Figure 393: Viewing Scan Controller Firmware Version Information

NOTE: Refer to Chapter 13 on page 349 to upgrade the IPGScan firmware.

17 Bug Reporting Utility

17.1 Overview

The purpose of the Bug Reporting Utility is to provide users with a way to send IPG support personnel the necessary information for troubleshooting software bugs and issues.

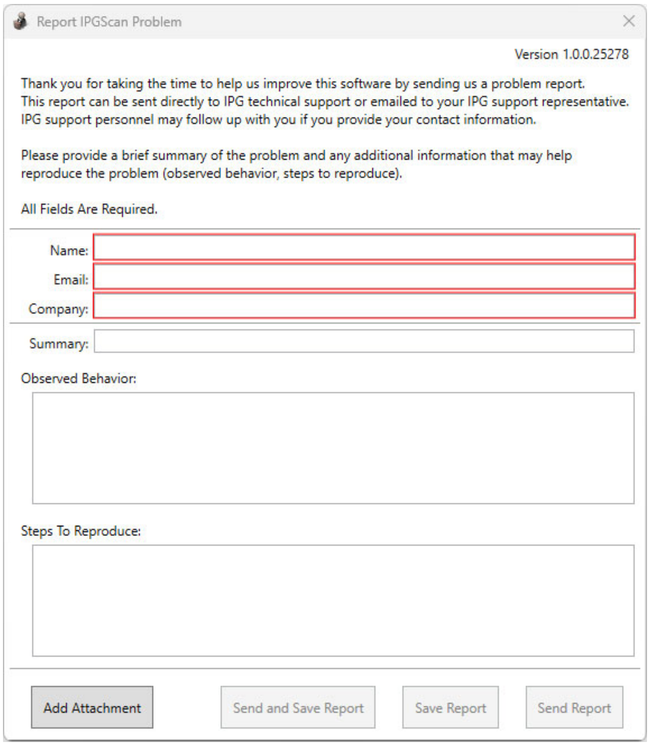
IMPORTANT

- The Bug Reporting Utility is only intended for supporting IPG-developed scanning software (IPGScan and the Scan Controller Utility).
- This software is not related to any laser support.
- This software is not intended for software feature requests.
- If Immediate support is required, please contact IPG Support by calling 1-508-373-1157 or by e-mailing service@ipgphotonics.com.

17.2 Submitting a Software Bug

To submit a bug, do the following:

1. Launch the Bug Reporting Utility (also called "Report IPGScan Problem") from the Start Menu or click "Help" and "Report a Problem" in IPGScan. See Figure 394 (below).



Version 1.0.0.25278

Thank you for taking the time to help us improve this software by sending us a problem report.
This report can be sent directly to IPG technical support or emailed to your IPG support representative.
IPG support personnel may follow up with you if you provide your contact information.

Please provide a brief summary of the problem and any additional information that may help reproduce the problem (observed behavior, steps to reproduce).

All Fields Are Required.

Name:

Email:

Company:

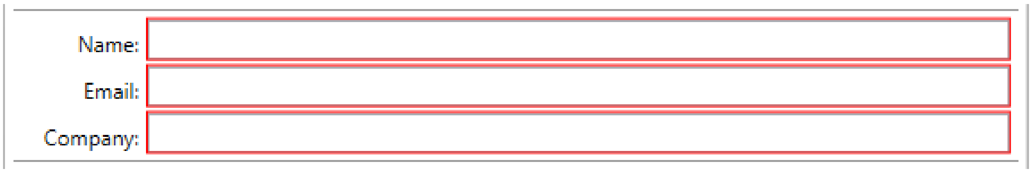
Summary:

Observed Behavior:

Steps To Reproduce:

Figure 394: The Bug Reporting Utility

2. Provide an email address, name, and company name. See Figure 395 (below).



Name:

Email:

Company:

Figure 395: Email, Name, and Company Name

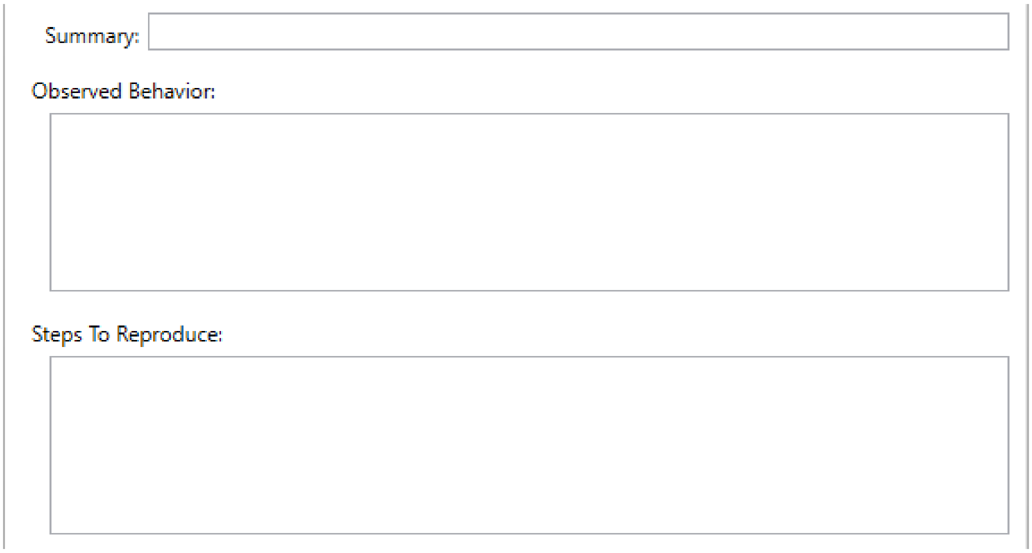
3. Provide a summary in the "Summary" field.
   - An example of a good summary might be, "Unhandled Exception Error Occurs After Clicking Show Projection Volume."
4. In the "Details" field, provide the following information (see Figure 396):
   - **Observed Behavior** – This should detail what happens when the bug occurs or what the IPG support personnel should be looking for.
     - Good Example - When I click on the "Show Projection Volume" button, I get a pop-up window that details an unhandled exception error has occurred. Furthermore, the image of the scanner disappears in the IPGScan Canvas.
   - Steps to Reproduce - This should be step by step instructions that help support personnel recreate the bug that is occurring.
     - Good Example

       1.Open IPGScan Job "Examplebug"

       2.Connect to scanner "laser-5410eca7d196"

       3.Click the job title in the Job Tree and set "Show Scanner Graphic" to True

       4.Click "Show Projection Volume" in the Tool Bar. At this point, the unhandled exception error should occur and the scan head display will disappear from the canvas.



Summary:

Observed Behavior:

Steps To Reproduce:

Figure 396: Summary and Details Field

5. Attach any additional documents that may be useful to IPG for debugging purposes by clicking the "Add Attachment" button (i.e. videos or pictures of the issue occurring).
6. Once all fields have been populated, click "Send Report" or "Send and Save Report." Please note, it can take a couple of minutes for the report to send.
   - The report can also be saved to a zip folder by clicking "Save Report." The report will not be sent to IPG when this is done. It is then up to the user to send the report to the proper IPG personnel.
7. Click "Ok" to confirm the report sent successfully.

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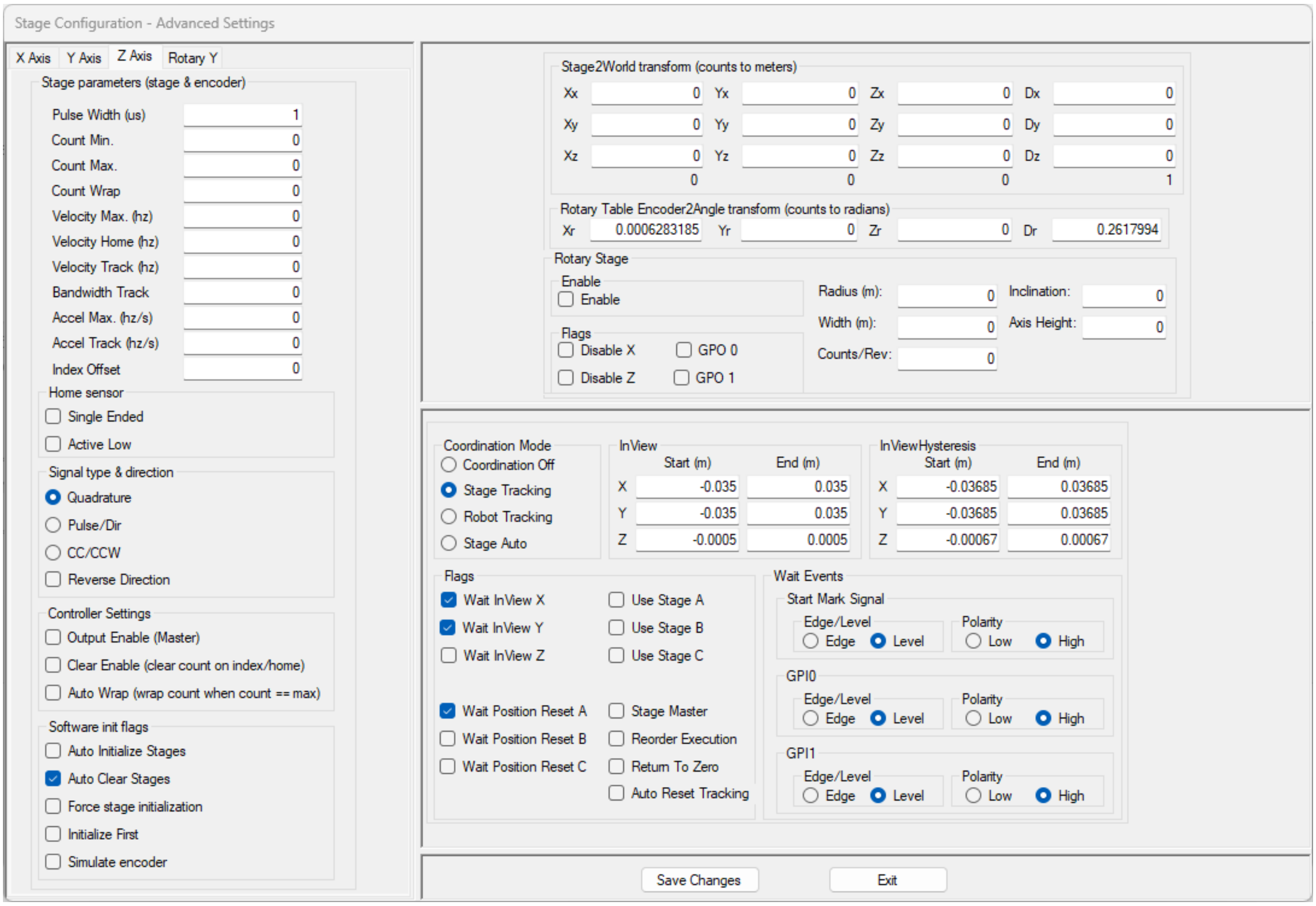
18 Stage Configuration Utility

In order to configure a scanner for use with motors/encoders, please refer to the following procedure.

1. Open the Stage Configuration Utility.
2. Lock onto the desired scanner.
3. Once the scanner is connected, click on **File>Advanced Settings**. This will open the Advanced Configuration Window as shown in Figure 397 (below).



Stage Configuration - Advanced Settings

Stage parameters (stage & encoder)

Pulse Width (us)	1
Count Min.	0
Count Max.	0
Count Wrap	0
Velocity Max. (hz)	0
Velocity Home (hz)	0
Velocity Track (hz)	0
Bandwidth Track	0
Accel Max. (hz/s)	0
Accel Track (hz/s)	0
Index Offset	0

Home sensor
□ Single Ended
□ Active Low

Signal type & direction
● Quadrature
○ Pulse/Dir
○ CC/CCW
□ Reverse Direction

Controller Settings
□ Output Enable (Master)
□ Clear Enable (clear count on index/home)
□ Auto Wrap (wrap count when count == max)

Software init flags
□ Auto Initialize Stages
☑ Auto Clear Stages
□ Force stage initialization
□ Initialize First
□ Simulate encoder

Stage2World transform (counts to meters)

Xx	0	Yx	0	Zx	0	Dx	0
Xy	0	Yy	0	Zy	0	Dy	0
Xz	0	Yz	0	Zz	0	Dz	0
	0		0		0		1

Rotary Table Encoder2Angle transform (counts to radians)

Xr	0.0006283185	Yr	0	Zr	0	Dr	0.2617994

Rotary Stage
Enable
□ Enable
Radius (m): 0
Inclination: 0
Width (m): 0
Axis Height: 0
Counts/Rev: 0
Flags
□ Disable X
□ GPO 0
□ Disable Z
□ GPO 1

Coordination Mode
○ Coordination Off
● Stage Tracking
○ Robot Tracking
○ Stage Auto

InView

	Start (m)	End (m)
X	-0.035	0.035
Y	-0.035	0.035
Z	-0.0005	0.0005

InViewHysteresis

	Start (m)	End (m)
X	-0.03685	0.03685
Y	-0.03685	0.03685
Z	-0.00067	0.00067

Flags
☑ Wait InView X
☑ Wait InView Y
□ Wait InView Z
☑ Wait Position Reset A
□ Wait Position Reset B
□ Wait Position Reset C
□ Use Stage A
□ Use Stage B
□ Use Stage C
□ Stage Master
□ Reorder Execution
□ Return To Zero
□ Auto Reset Tracking

Wait Events
Start Mark Signal
Edge/Level ○ Edge ● Level
Polarity ○ Low ● High
GPI0
Edge/Level ○ Edge ● Level
Polarity ○ Low ● High
GPI1
Edge/Level ○ Edge ● Level
Polarity ○ Low ● High

Figure 397: Advanced Configuration Window

- **Stage2World Transform:** defines the transformation matrix for the software. For On-The-Fly, the only parameters that should not be zero are Xx, Yy and Zz. The three non-zero values are the meters per encoder count.
- **Rotary Table Encoder2Angle transform:** defines the transformation matrix for converting counts of an encoder to radians. The three non-zero values are the meters per encoder count.
- **Rotary Stage:** This is not applicable for encoder applications. All fields should be left as shown in Figure 397.

- **Stage Parameters:**
  - **Pulse Width:** not applicable for encoder input.
  - **Count Min/Max:** defines the process area in pulse units.
  - **Count Wrap:** Distance in encoder pulses before the software "Wraps" the weld.
  - **Velocity Max:** not applicable for encoder input.
  - **Velocity Home:** when using the simulate encoder, Velocity Home defines the encoder velocity in pulses/sec.
  - **Velocity Track:** not applicable for encoder input.
  - **Accel Max/Accel Track:** not applicable for encoder input.
  - **Index Offset:** The number of counts that the scanner will wai, (after detecting the Index Pulse) before resetting the count back to 0.
  - **Home Sensor:** If the encoder reset signal is single ended, Single Ended flag should be checked, otherwise encoder reset is assumed differential. Active Low: if single ended, this flag indicated if the sensor is active low.
  - **Signal Type & Direction:** Encoder input works in quadrature mode by definitions so Quadrature must be selected. Reverse direction is not applicable for encoder input.
  - **Controller Settings:** Output enable flag must be off so the controller will read encoder signals. Clear Enable is optional; as it clears position count when the encoder reset pulse is detected. Auto Wrap is optional; as it wraps the position count if the encoder pulse count is equal to Count Max.
  - **Software Init Flags:** The only applicable flag is Simulate encoder which ensures that a simulated encoder signal (count settings taken from Stage2WorldTransform) is initiated when the software starts. Other flags not applicable for encoder input.
- **Coordination Mode**:
  - **Coordination Off:** When checked, coordination with external motion is disabled.
  - **Stage Tracking:** When checked, enabled coordination with external motion control. This setting must be selected when using On-The-Fly.
  - **Robot Tracking:** used with robot motion. Not applicable for encoder input.
- **InView & InViewHysteresis:** Controls the size of the volume in which the scanner mirrors are allowed to move when Stage Tracking is enabled.

IMPORTANT

For most 2D applications, InView X and Y should be set from -1/4 of the lens's optical field to +1/4 of the lens's optical field. The InViewHysteresis should be set to -1/2 of the lens's optical field to +1/2 of the lens's optical field. For the Z setting, the same rule applies, however the focal depth (not the lens's optical field) is used.

- **Flags:**
  - **Wait in View & Use Stage:** enables or disabled each axis for encoder input. For most applications Wait in View should be checked anytime Use Stage is checked.
  - **Wait Position Reset:** for a moving target, waits until mirrors reset their position before outputting the next vector. Must be on for On-The-Fly.
  - **Stage Master:** informs the software whether to control external motion or not. Must be off for On-The-Fly since an encoder is controlling the soft- ware (software must be controlled externally).
  - **Split Long Vectors:** if enabled, vectors that are longer than the area specified by the InView, will be split into multiple vectors that will fit the InView window. Must be checked for On-The-Fly.
  - **Return to Zero:** Not applicable for On-The-Fly.
  - **Auto Reset Tracking:** automatically resets encoder tracking when laser is enabled. Should be off when using IPGScan.
- **Wait Events:** are not related to On-The-Fly specifically, but are included for convenience. Wait Event Flags are used to set up the behavior of the general I/O's for the scanner controller, including external start.
- **Polarity:** defines if the signal is active high or active low. This system is active high by default.
- **Edge/Level:** defines how the signal becomes active. Default is Level, where signal is active anytime input voltage exceeds threshold level. Edge option is where the signal becomes active anytime a transition from low to high is detected.

IMPORTANT Threshold is determined by the External Interface being used. See the Scanner Series User Manual and External Interface Board User Guide for more information.

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19 Service and Support

Many issues and questions regarding the safety, set-up, operation, and maintenance of the IPGScan software can be resolved by carefully reading this User Guide. However, if you have questions regarding the safety, set-up, operation, or maintenance of the IPGScan software, call IPG Photonics Customer Service at 1-508-373-1157 or e-mail service@ipgphotonics.com.

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20 Warranty

20.1 Limited Express Product Warranties

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