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Introduction

This document has been put together to help you with your robotic welding integration. It explain the points you should pass through before buying a robotic welding cell. With different aspects and hints, as well as a checklist is also provided, you can write down your information and compare your different scenarios. Take this advice seriously and it can save you time and energy in your integration.
1. Make a Pre-diagnosis

This step will focus your thinking on all the factors that are involved in the implementation of a robotic cell. Most of the time, you can judge if the project is realistic or likely to be more trouble than it’s worth. Get experienced welders and managers involved in order to get the best input from your plant floor. The following aspects should be discussed in the pre-diagnosis:

- **The targeted product to weld**: Determine the part or the part family that will be welded together and the sustainability of it.

- **Total production size**: What is your **annual production** for this part or what is the planned production for this specific assembly?

- **Production lot size**: How many parts can be welded with the same setup?

- **Cycle time for manual welding operation**: Determine the **normal time** it would take to weld these parts, this will be your starting point to see if you can establish a good return on investment (ROI).

- **Assembly difficulty level**: What is the main issue(s) for the assembly? Is there any way to solve this problem(s)? More importantly, can a robotic cell handle such an assembly?

- **Welding process used**: The same welding process that is used manually can be used in a robotic cell, so there is no major change when going from manual to automated welding operations.

- **Preliminary part preparation**: Think about all the steps that need to be prepared before the welding operation starts.

These items can start your pre-diagnosis off in the right direction by beginning to evaluate your welding needs and whether or not a robotic welding cell is appropriate for your application.

### Pre-Diagnosis

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After this step, a couple of parts/assemblies should be removed from the diagnosis. In fact, you should do a couple of iterations before going all out with the automated welding process. Begin by integrating the products that have the best chance of succeeding and build up your experience around it. Afterwards, introduce more complex parts to the automated welding process.
2. Conduct a Feasibility Study for a Robotic Welding Application

In this step you need to go through the important components of the robotic cell, such as the welding operations, assembly design and optical system if required. Your needs in these areas will guide you through the first steps of your project and will give you a clearer idea of what you will need in order to have a working robotic welding cell.

2.1 Part Diagnosis

- **Rethink the product design:** All aspects of the design will need to be reviewed. The **accuracy** and **tolerance** of the parts, as well as the **size** and **weight** of the end product will all determine the type and size of robot welder you will need. The **geometry** of the welding joint and the **gap** between the parts will guide you through the minimum clamping precision that needs to be established.

- **Evaluate the part manufacturing process:** Monitor the **accuracy** of the cut and of the interface that needs to be welded. The welding robot will execute constant operations and if the parts are not constant, the welding quality will be poor.

- **Determine the pre-welding operations:** Describe the **sequence** of manufacturing operations that needs to be executed before the parts enter into the robotic welding cell. Include the possibility of adding a positioner (external axis) to your operations.

<table>
<thead>
<tr>
<th>Product</th>
<th>Internal product name/no.</th>
<th>Product size [inch/m]</th>
<th>Product weight [lbs/kg]</th>
<th>Joint geometry</th>
<th>Gaps between parts [inch/mm]</th>
<th>Cutting Accuracy [1 to 5]</th>
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<table>
<thead>
<tr>
<th>Product</th>
<th>Internal product name/no.</th>
<th>Pre-Weld operation #1</th>
<th>Pre-Weld operation #2</th>
<th>Pre-Weld operation #3</th>
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2.2 Process Diagnosis

- **Welding process and peripheral selection:** Since your welding method is probably set, you may want to evaluate whether you need more than one welding robot. You may also want to see if your cell needs a material handling robot to feed the welding robot. Go through the different peripherals, look at the different cooling systems, the cleaning station and the consumables. This will help to determine your welding cycle time.

- **Determine the clamping method:** Localization and orientation of the parts need to be determined to have a better idea of the welding robot’s working space. This step needs to include the robot’s welding angle. You also need to think about the entering and exiting of the part.

- **Vision or no vision:** Since you are just in the preliminary steps of your design, you don’t need to go into lengthy detail on the vision system. In fact, for now, all you need to know is if 2D or 3D vision is suitable for your welding process.

- **Envision robotic options:** Pressure technologies, such as touch detection (Touch Sensing) and pressure sensing using the arc (Though the Arc, Seam Tracking), can be used to give instant feedback to the welding robot regarding the pressure that is applied on the weld itself. Programming technology can also be integrated into your welding robot. In fact, products like Kinetiq Teaching can help you program a lot quicker than the traditional method.

### Process Diagnosis

<table>
<thead>
<tr>
<th>Product</th>
<th>Internal product name/no.</th>
<th>Welding type [MIG/TIG etc.]</th>
<th>Cooling system [Air/Water]</th>
<th>Consumable type</th>
<th>Cleaning system [Yes/No]</th>
<th>Wire-cutter system [Yes/No]</th>
<th>Programming technology [Yes/No]</th>
<th>Pressure Technologies [Yes/No]</th>
<th>Vision (2D-3D) [Yes/No]</th>
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### Cycle Time Calculus

**Product 1:**

Cycle time: ________________________________

**Product 2:**

Cycle time: ________________________________

**Product 3:**

Cycle time: ________________________________
2.3 General Analysis

Once the analysis is done, it's time to figure out what you are able to do with your workshop resources. Try to fix a budget, to involve a certain number of employees in the process and determine a working space for the robot. The goal is to fix targets that can be respected.

- **Equipment localization:** Make sure you have plenty of space* for the robotic welding cell in your workshop. You should also evaluate the needs in ventilation system and electricity connectivity.

- **Evaluate impact:** Since the integration steps can be quite long, make sure you evaluate the impact of the changeover on day to day operations and your human and material resources. Don’t forget that you are implanting a robotic cell to increase your rentability, so you don’t want to stop the shop for months just to install the robotic cell.

- **Rentability study:** Once you have thought about all these aspects, you can determine a rough price for the robotic cell that fits your needs. To see if the investment is suitable for your company, check the potential gain on each studied part. Try to enhance your manufacturing process to have a fast and easy return on investment.

* When considering the space that the robotic cell will consume, it is important to consider the different security devices that need to be installed around the robot. Make sure to follow the applicable norms. You should take a look at the following article [Design Considerations for Robotic Welding Cell Safety](#) to get more information on the security devices that can be installed around the robot.

The feasibility study will help solidify your research into which robotic welding application is likely to be a good match for your production. Having all this information in the same spot is a good way to begin with an integrator. It may take a while to fill up the grid, but it will save you time and energy once you get in touch with an integrator.

### General Analysis

<table>
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<tr>
<th>Product</th>
<th>Internal product name/no.</th>
<th>Available space [ft²/m²]</th>
<th>Estimated robot cell space [ft²/m²]</th>
<th>Time to integrate robotic cell [hrs]</th>
<th>Employees involved [Unit]</th>
<th>Estimated integration price [$]</th>
<th>Estimated robot price [$]</th>
<th>Estimated robot accessories price [$]</th>
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3. Selecting Your Integrator

3.1 Integrator List

Compile a list of all the integrators* in your area and see what their skill levels are like for the following points:

- **Experience in welding and vision:** This should be the main point when choosing an integrator. This company needs to have a broad range of experience and with different types of integration so that they can solve a problem quickly.

- **Implantation capacity:** Do they have time for your integration? Most integrators are quite busy so make sure that you schedule your integration wisely.

- **Costs and deadline:** A good integrator should be able to respect the budget and deadlines you have set at the beginning of the project.

- **Proximity:** There is probably a good integrator on another continent, but you need to consider the fact that proximity is synonymous with economy.

- **Training:** Some integrators offer training and technical support, which will help you out when debugging your robotic cell.

- **After-market:** Having an integrator that can come and see if your robot is working well and give you some supplementary tips is always a good thing. Some integrators offer maintenance services, this could be a good point to direct your choice.

* Most of the time, the robot manufacturer or saler can refer you to a couple of integrators. This will shorten your searching time and they might already guide you to the best company they know.

### Integrator Analysis

<table>
<thead>
<tr>
<th>Integrator</th>
<th>Brand name</th>
<th>Past experiences</th>
<th>Implantation availability</th>
<th>Integration cost ($)</th>
<th>Integration deadline [Date]</th>
<th>Estimated integration price ($)</th>
<th>Training services [Yes/No]</th>
<th>Maintenance services [Yes/No]</th>
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3.2 Choose your Integrator

Now that you have listed all of the integrators, you are able to make an informed choice. You can decide which one most suits your company and which one can do the best job. Ask to see different integration projects that they have created and ask to be in contact with customers that have been satisfied with their work. Make sure that you give the integrator a very clear project plan that includes technical data from your shop, for your robot operations including cycle time(s).
3.3 Set your Goals
As robotic welding is a huge market, you need to establish your planned results regarding: quality, cycle time and integration time. As you set these goals, stay realistic and try to respect them as much as possible.

3.4 Evaluation
Once you have received all the quotes, evaluate which one is the best for your robotic application.

3.5 Government Funding
A certain amount of support is provided for new technologies by different governmental entities; welding robot integration could be on the list for your region. Since funding regulations change between every country and province or state, contact your local government representative to see if they can help you out with your proposed technological integration.

3.6 Communication
I believe (and will always believe) that communication is the key in robotic integration. Present your plans to your shop’s employees and introduce them to industrial automation. Some people see robotization as a bad thing. Make them understand your point of view, as it will reduce the resistance facing the integration of the robotic cell. Also, make sure that you wisely determine the operator responsible for the robotic cell. Once these employees have been determined, involve them in the different meetings and decisions regarding the project.

With these checklists, you now have all the tools necessary to go forward with an easy integration. Going through all the steps can save you a lot of time in your integration.
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2. Record welding points and set parameters via the intuitive touch-screen interface

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- Program welding robot intuitively without in-depth programming knowledge
- Get a quick return on investment for high-mix, low-volume welding applications

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