Dig in Vision®

VR welding User Guide

Published Date December 2024

Find the latest version

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Quick Setup

1. Prepare Hardware

- Turn on the laptop
- Connect it to the charger
- Connect the Oculus VR headset to the laptop via USB
- Assemble the welding torch adapter with the Oculus VR controller

2. Setup Oculus

- Launch the Oculus app
- Put on the Oculus VR headset
- Confirm the virtual boundaries
- Enable "Quest Link"
- Take off the Oculus VR headset

Meta Quest

3. Run Launcher

- Launch the Dig in Vision Launcher app
- The app will automatically check for updates
- Start the VR application in the launcher

4. Start Virtual Training

- Log in to the VR app
- Start the VR session
- Put on the VR headset
- Good luck and enjoy exploring the VR world!

Dig in Vision

Dear User and Future Welder!

Introduction

Thank you for choosing the Dig in Vision Virtual Welding Centre. This system is designed to provide advanced training in a safe and realistic virtual environment. This guide will help you understand how to use the system properly and safely. By following the instructions, you can ensure the best performance and avoid unnecessary risks.

It is very important to follow the safety rules described in this manual. Proper use of the system will not only keep you safe but also make sure the equipment works well for a long time.

For more information, you can visit our website at **diginvision.com** or contact the distributor from whom you purchased your Dig in Vision kit. They will be happy to assist you with any additional questions or support you may need.

Understanding Safety Instructions

DANGER	This means a very serious danger. If you ignore this, it can lead to serious injury or even death.
WARNING	This shows a possible danger. Not following these rules could result in injury or damage.
CAUTION	This shows a small risk. Ignoring it may cause minor injuries, damage to the system, or result in improper system operation.
NOTICE	This gives helpful advice. It is not about safety but helps you use the system better.

Please take all warnings and advice seriously. This will help you use the system safely and correctly.

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Introduction

Dig in Vision is a unique simulator that allows you to recreate the environment of a welding workshop in virtual reality. With our simulator, both beginners and advanced learners are guaranteed a realistic welding experience. The simulator provides real-time welding parameter adjustments, including:

- voltage,
- current,
- wire feed speed,
- gas flow as well as mask shade.

The parameters affect the shape and size of the created seam, as well as its structural strength.

Trainees can exercise their muscle memory, welding speed, welding angles, and more. The virtual environment, in which the user is immersed, allows the user to fully concentrate on the task at hand.

The final score and advice is given by our Weld-Master^{AI}.

Learn more about us

If you want to keep up with the latest technologies in Dig in Vision, VR, and the welding world, visit our **Dig in Vision TechBlog**. You'll find the latest information, tips, and industry insights. We also invite you to follow us on various social media platforms, where we share valuable content and updates on VR welding. Platforms where you can find us:

Contents of the training set

Our solution is based on globally accessible devices. The entire training set is contained in one handy case.

VR Goggles

Meta Quest 2 goggles allow the trainee to enter the world of virtual training. The advanced graphics engine enables a very realistic welding process, recreating the actual physical processes of the molten weld pool and the solidification of the weld in the gas metal arc welding process.

Dig in Vision welding adapter

The continuity of the welding experience is ensured by a physical controller adapter imitating the weight and shape of a real welding torch.

Hardware and Software

A high-performance laptop allows managing of welding courses, instructor accounts, as well as the students reports of their welding attempts, including their detailed analysis.

Handy compact suitcase

The case is a part of a versatile kit, perfect for worldwide travel as carry-on luggage. It not only protects the contents from external elements but also maintains order and organization, especially useful when carrying multiple sets.

Workstation preparation

Preparing Oculus Quest

Preparing the Oculus Quest for use involves several key steps, such as turning on the device, adjusting the head straps, and focusing the image precisely. Below, you'll find a detailed description, step by step:

1. **Turn on the computer**
   It is recommended to work with laptop connected to a power source rather than relying solely on the battery. Operating exclusively on battery power may result in reduced graphics card performance and lower application smoothness.

CAUTION Only original chargers supplied with the device should be used. Using non-original chargers may cause a decrease in graphics card efficiency and a reduction in the smooth operation of VR applications

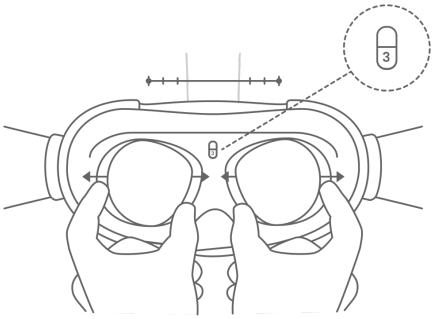
2. **Turning On the Oculus Quest**

Initiate the process by holding the power button located on the side of the Oculus Quest goggles.

3. **Adjusting Head Straps and Image Focus**

Place the Oculus Quest goggles on your head, fine-tune the head straps of the Oculus Quest to perfectly conform to the shape of your head. Ensure they are comfortable while effectively securing the goggles.

Check the sharpness of the image by activating any application or navigating to the Oculus Quest menu. If necessary, adjust the IPD (Interpupillary Distance) slider located at the bottom of the goggles. Gently move the slider until you achieve a clear image.

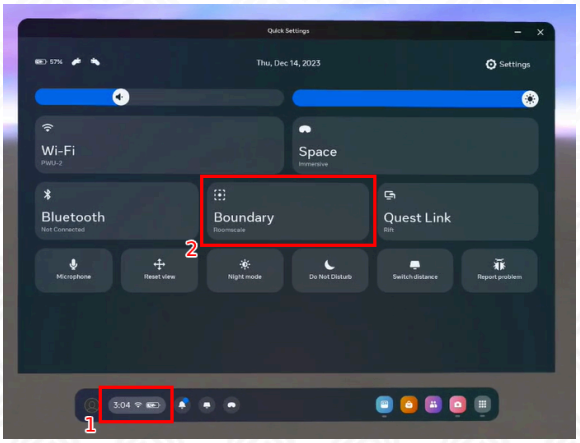


QUICK TIPS

If you wear prescription glasses, you can consider using an additional VR glasses insert. This will move the VR headset away from your face, making the VR experience more comfortable when wearing glasses.

4. Configuring the Guardian Area

Set up the Guardian area in a location you deem safe and conducive to free movement. Ensure you have ample space for comfortable use of the device.



QUICK TIPS

Explore more about the Boundary feature on Oculus Quest.

- *Quest 2 Setting Up Guardian*
- *Oculus Quest Basics Tutorial Part 02: Play Area Setup*

Following these steps, your Oculus Quest will be ready for use, providing a comfortable and clear virtual reality experience. Remember to adjust settings according to your preferences to achieve optimal comfort while using the device.

Connecting the Oculus Quest set to a PC

The Quest Link feature is essential for connecting the Oculus Quest (a portable VR headset) to a PC, enabling the use of VR applications that require significant computational power. Through Quest Link, the Oculus Quest functions as a PC VR headset, expanding its capabilities to access more advanced and graphically demanding VR experiences, such as the Dig in Vision welding simulator.

To use the Dig in Vision application with Oculus Quest via Oculus Link, follow these instructions:

1. **Connect Oculus Quest to Computer**

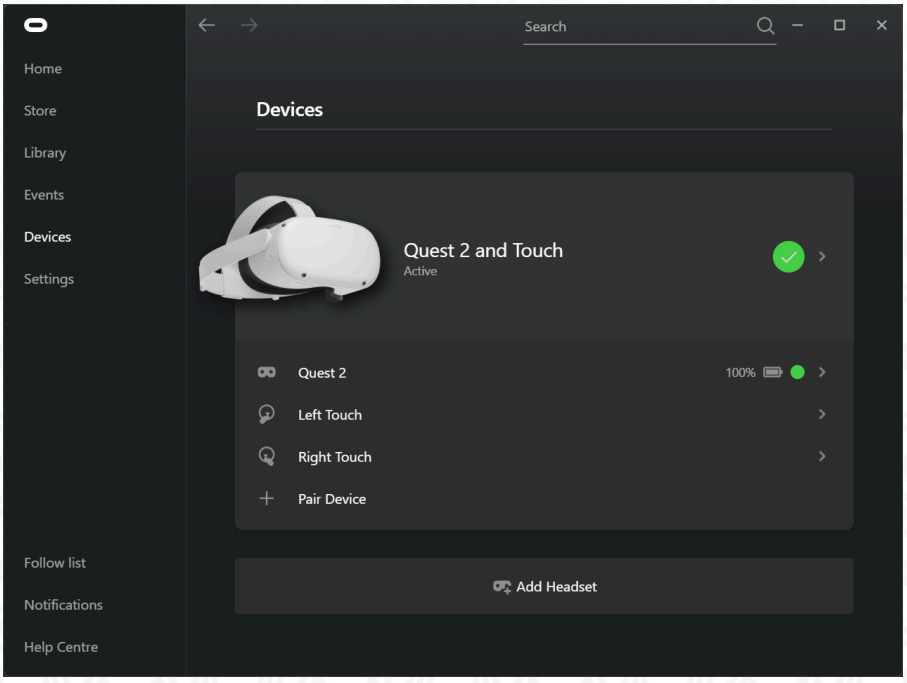
Ensure your Oculus Quest is fully charged. Use a USB-C cable (preferably USB 3.0) to connect the Oculus Quest headset to your computer

2. **Launch Oculus Application on Computer**

Open the Oculus application on your computer.

3. **Check the Connection in Oculus App**

Check if Oculus Quest is recognized by the Oculus app. Go to the “Devices” tab and ensure the headset is visible and active.

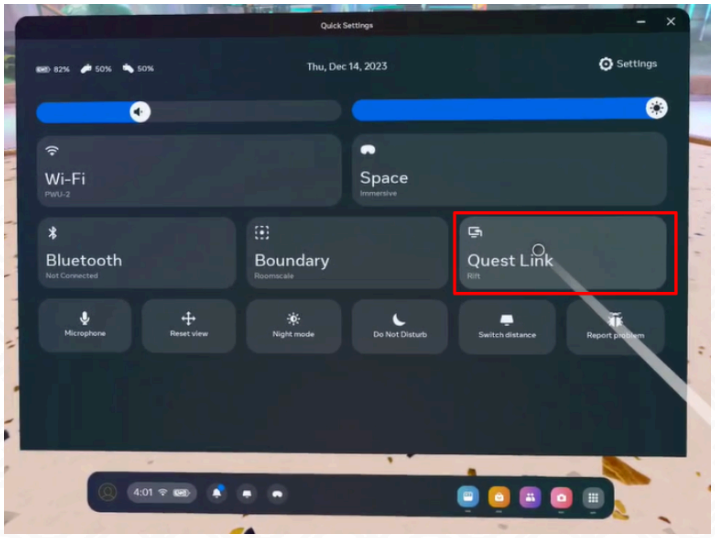


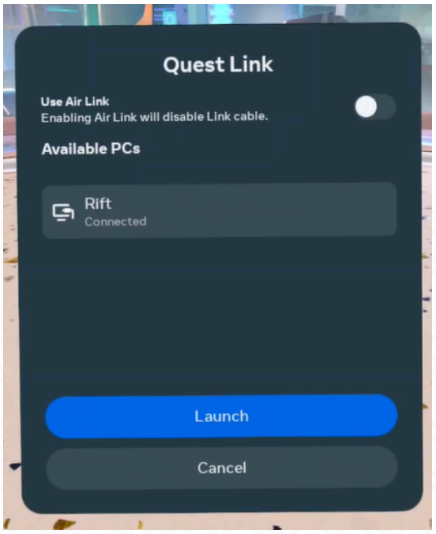
QUICK TIPS

The quality of the connection may depend on the specification of your computer and the quality of the USB-C cable used. Using a longer, 3-meter cable with the headset greatly increases user comfort by allowing more freedom of movement.

4. Enable Oculus Link Option

After connecting Oculus Quest, a prompt should appear on the VR headset asking if you want to enable Oculus Link. Select "Enable". If the prompt does not appear automatically, open the menu in Oculus Quest, go to settings, and manually activate Oculus Link.





Once Oculus Link is activated, your surrounding environment in the virtual world will transform. If you are immersed in a white environment with a white floor and ceiling, this signifies a successful connection of your Oculus Quest to your PC and the activation of the connection via Quest Link. With this setup, the Oculus Quest functions as a VR headset connected to your computer, allowing you to access VR games and applications that are available on your PC, beyond the native Oculus Rift platform.

QUICK TIPS

The quality of the connection may depend on the specifications of your computer and the quality of the USB-C cable used. Using a longer, 3-meter cable with the headset greatly increases user comfort by allowing more freedom of movement.

If your Wi-Fi router supports VR casting, you can use the Air Link feature to connect your Meta Quest to your computer wirelessly, bypassing the need for a wired connection. Just ensure that both devices are on the same Wi-Fi network.

Air Link Setup | Meta Quest 2

Launching the Dig in Vision Application

To launch the application, there are several prerequisites that must be met:

1. Ensure that you have internet access, as it is essential for logging into the application.
2. Start the Oculus application.
3. Connect the Meta Quest headset to your PC using a cable.
4. Initiate communication through Quest Link.
5. Launch the **Dig in Vision Launcher** application.

To launch Dig In Vision applications, use the dedicated launcher. The launcher takes care of ensuring that the VR welding simulator version on your computer is always up-to-date, automatically updating it when a newer version is available. It serves as a valuable tool during troubleshooting, assisting both you and the Dig In Vision technical support team in identifying and resolving any issues with the applications.

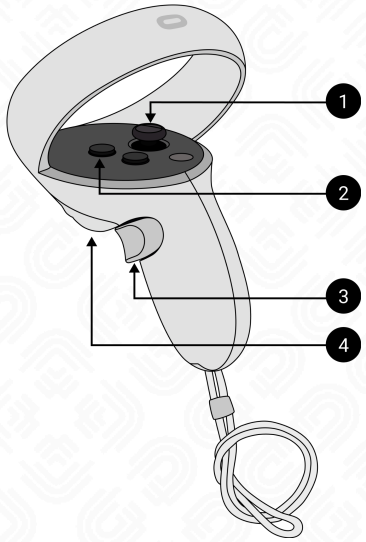
Additionally, the launcher provides a convenient way to access the latest version of user instructions – just click on the document icon in the upper right corner.

Navigation in the Dig In Vision Application

Dig in Vision features an innovative solution in the form of a proprietary welding adapter for the Oculus controller. This adapter is designed to mimic the weight and shape of a real welding torch, ensuring a continuous welding experience in a virtual reality environment.

The Dig in Vision Welding Adapter is easy to mount on a standard Oculus controller. Its design ensures stability and ergonomic use, mirroring the experience of a real welding torch. This design is crucial to the realism of the welding simulation experience.

Control in the Dig in Vision application using the welding adapter follows the diagram below:



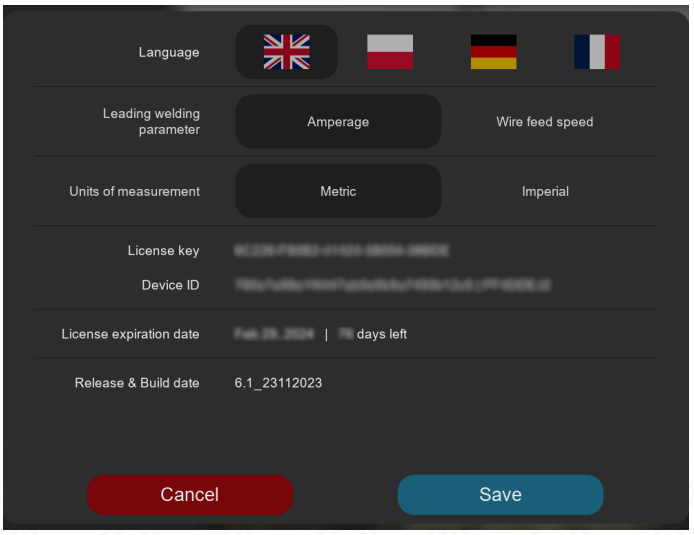
1. **Thumbstick** - Moving around in the virtual environment.
2. **B button** - Calibrating the device. For more information, see chapter Calibration of Virtual and Real Workspaces
3. **Grip button** - Picking up objects.
4. **Trigger** - Clicking objects and welding.

The accompanying graphic illustrates the location and function of each button on the adapter, making it easier to understand and use the device effectively.

The Dig in Vision Welding Adapter is a key addition to welding training in VR applications, contributing to a realistic representation of a welder's working conditions. The use of this adapter in VR simulations allows for more effective training and preparation for real welding tasks, enhancing the quality and educational value of the virtual reality experience.

First Launch

Upon choosing the Launch button the Virtual Welding Simulator and the login window will open. For the first-time setup, you can personalize your experience by selecting your language, choosing the metric system, and viewing details about your license and the current application version. To make changes to the settings, simply click your mouse on the option you are interested in. Remember, you can revisit these settings anytime by clicking on the gear icon located in the lower right corner of the login screen. However, in the Virtual Welding Center application, only the language is available for editing under the options button.



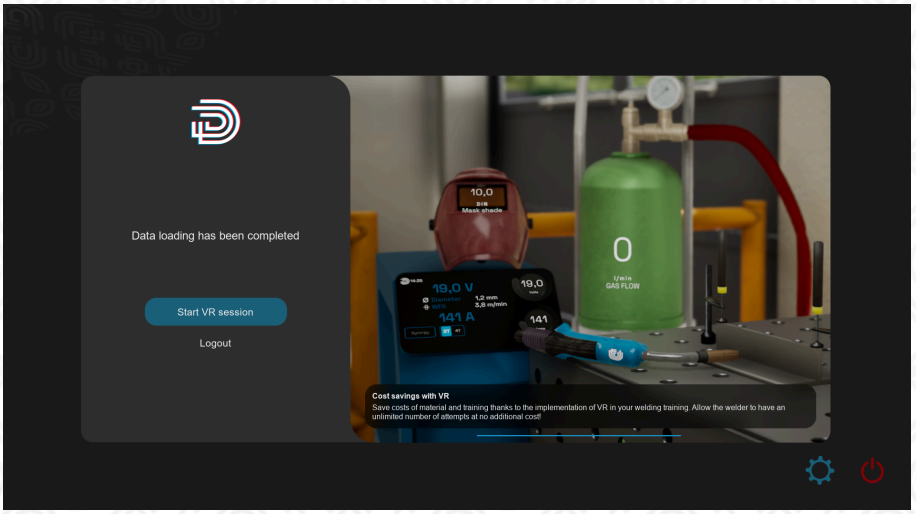
There are two ways to log in:

- **Instructor Account** - logging in with an instructor account displays a list of students assigned to that specific instructor. Subsequently, you should select the account of the corresponding student.

- **Student Account** - logging in with a student account provides direct access to the student's environment and results.

⚠ **CAUTION** ***It's crucial to ensure logging into the appropriate account to prevent users from saving their attempts and learning progress on another user's account.***

After you successfully log in, a notification confirming the readiness to initiate a VR session will appear. At this moment, by pressing the **Start VR Session** button, the VR application in 3D will launch. You can then put on the Meta Quest headset and begin your adventure in the immersive virtual training center. Make sure to complete all necessary setup and calibration steps beforehand to ensure a seamless experience.



Upon wearing the Meta Quest headset, you will find yourself inside the virtual training center, the details of which will be further described in the subsequent sections of this instruction. The view within the VR application and on the computer screen may differ slightly. On the computer screen, which is designed for the instructor and observers, additional information will be displayed. One critical piece of information to check after each login is whether the correct user is logged in. In the top right corner of the application, the name of the trainee will be displayed. If the wrong trainee is logged in, it is necessary to log out and then log back in with the correct trainee's account.

Calibration of Virtual and Real Workspaces

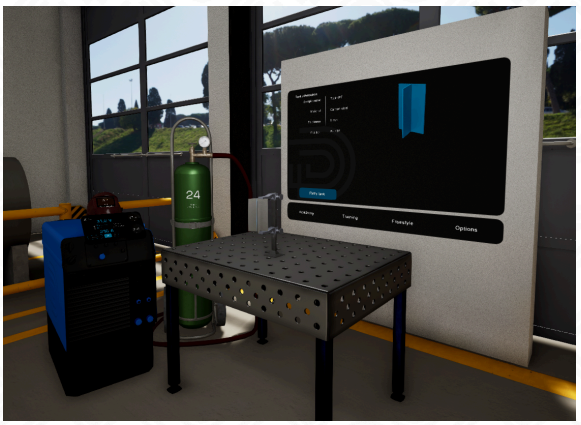
For optimal comfort and effectiveness at your workstation, it's important to calibrate the height and position of your real-world desk with the virtual welding table in the VR application. This calibration can be done at any time and place within the application. Let's go through the process using the example of calibrating in freestyle mode:

1. **Navigate to Freestyle Mode**

On the main screen of the application, look for the options at the bottom bar and select 'Freestyle Mode'.

2. **Choose a Sample**

After entering freestyle mode, select any sample from the available options. This sample will be used as a reference point for calibration, aligning your real-world desk with the virtual one to ensure that your physical movements correspond accurately with the virtual environment. This calibration process enhances the overall immersive experience and ensures practicality and ease of use during your VR sessions.

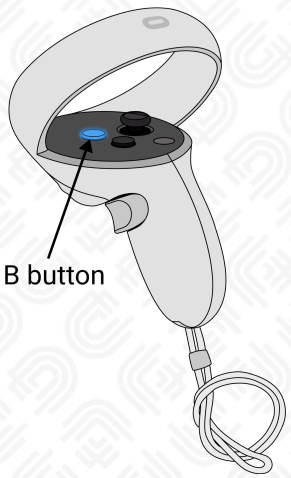


After you choose a sample, you will be moved to one of the welding stations in the virtual training center. **The key step now is to align your real-world desk with the virtual one in VR.** To accomplish this:

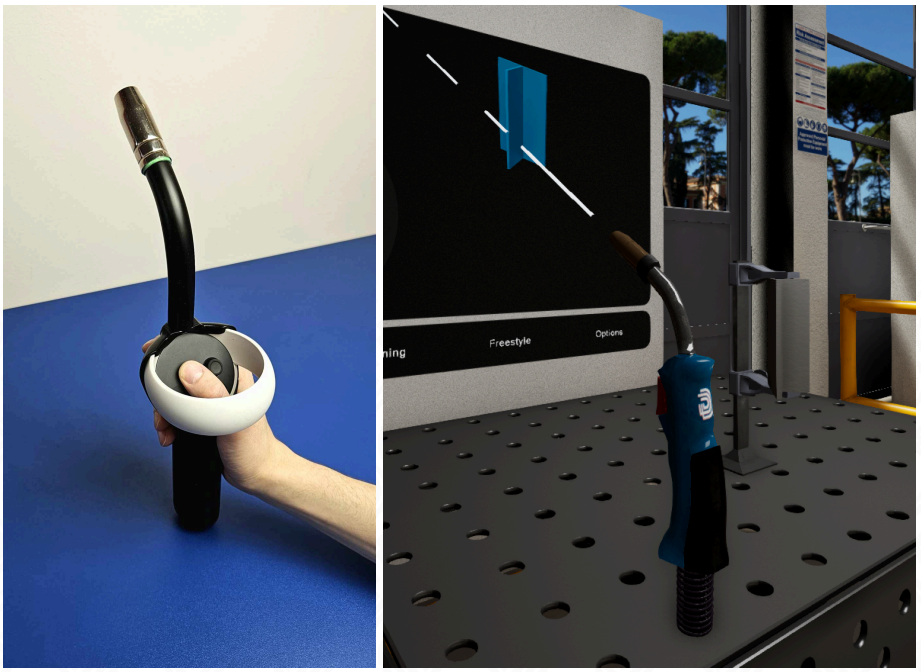
1. **Position the Real Welding Handle**
   Take the real welding handle that is attached to your Meta Quest controller.

2. **Rest it on the Real Desk**
   Place this handle against the real desk in front of you. This helps in aligning the virtual and real-world environments.

3. **Hold Button B**
   Press and hold the 'B' button on the controller for 3 seconds.



This process ensures that the virtual table in the VR environment overlaps accurately with your real desk. Such calibration is crucial for a seamless and immersive VR training experience, particularly in tasks that require precise hand-eye coordination, like welding.



Congratulations, you have successfully prepared your training workstation! You're now all set to begin your training session in the virtual environment. Enjoy your immersive learning experience!

⚠ **CAUTION**

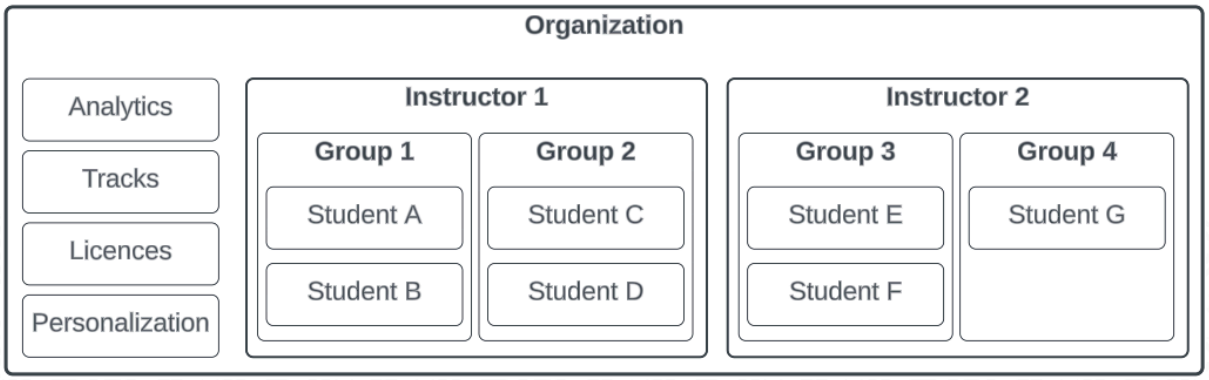
Remember, when welding in the virtual environment, it's important to maintain a proper distance between the welding handle and your face. Keep at least 40 cm of space to avoid any issues like "drifting" or instability of the handle in the VR space. Also, be cautious not to obstruct the controller's ring with your hand or any other object. The cameras on the VR headset need a clear view of the entire controller ring.

WebPanel - A Key Element of Account Management and Learning

Panel.diginvision.com is the place where you efficiently manage your organization, create customized training processes, access statistics for the entire organization, and reanalyze your welding attempts. The functionality available in the WebPanel depends on the level of access associated with the type of account you've logged in with.

Types and Hierarchy of Accounts

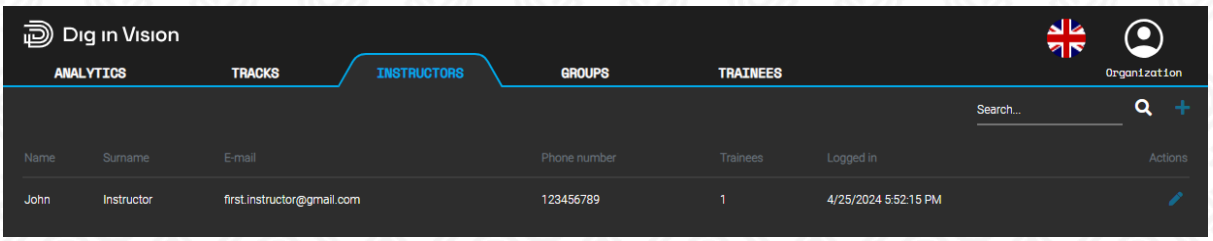
In the Dig in Vision system, various types of accounts have been prepared, allowing login access to both the WebPanel and the VR application. Each type of account comes with unique functionalities and responsibilities. Below, we will outline three types of accounts along with a detailed description of their permissions.



Organization Account

The Organization Account allows you to manage all sub-accounts (instructors and students) within your organization. Using your email address and password, you can log in exclusively to the WebPanel (not the VR application). With this account, you have the following capabilities:

- Add new instructors.
- Monitor the progress of all students in your company's training programs.
- Create and edit training modules (**Tracks**).
- Access organizational **analytics**, presenting crucial statistics on how the VR application is utilized within your organization in a user-friendly graphical format.
- Manage **licenses** (license numbers and expiration dates).
- Managing student groups - [read more]



Instructor Account

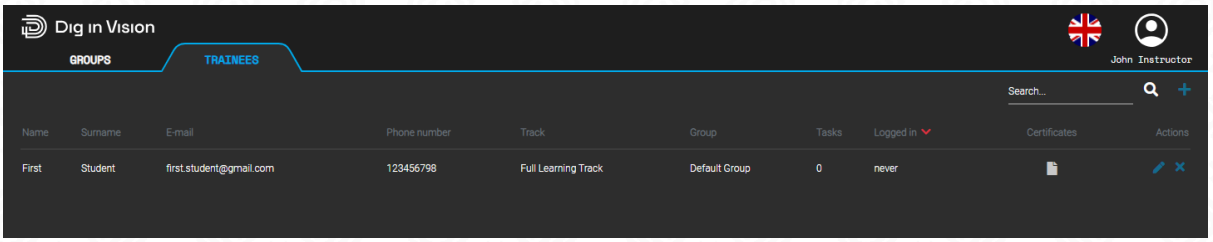
The Instructor Account allows access to both the WebPanel and the VR application. This level of account access provides the following capabilities:

- Adding new students to the instructor's class.
- Defining the training track for each student.
- Monitoring the progress and results of each student assigned to the instructor.

- Managing student groups - read more
- Accessing previous welding results and student certificates associated with the instructor.

In the VR application, the instructor can log in to their account and then, from a dropdown list, select which student they will be training at that moment.

For enhanced management convenience, students can be divided into class groups. This allows for more efficient management of groups that are currently training and those that have completed their training. This grouping feature simplifies tracking and updating training progress across different cohorts, making it easier for instructors to tailor their approach to each group's needs and monitor their progress more effectively.

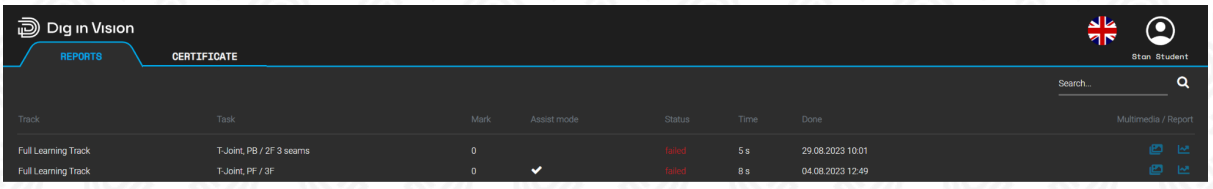


Student Account

The student account is a private account created for each student. Students can log in to both the WebPanel and the VR application using their email address and password. From the WebPanel, the student account provides the following capabilities:

- Access to training materials and resources.
- Monitoring personal progress and training results.
- Viewing previous welding results.
- Viewing digital welding certificates.
- Participating in training sessions using the VR application.

Students are assigned to groups to simplify management for both the organization and the instructor. This grouping makes it easier to oversee and coordinate training effectively.

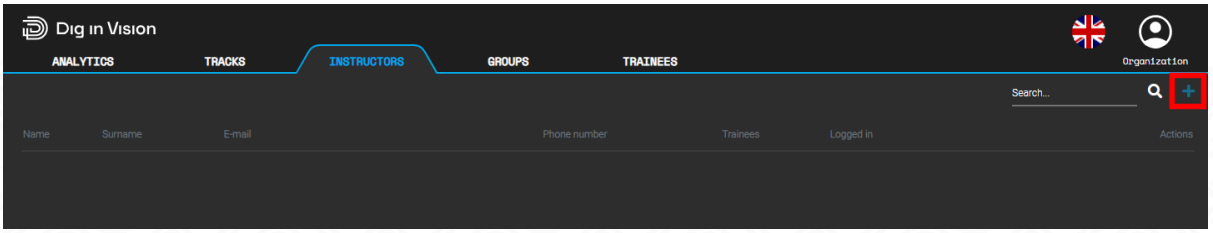


Organization Management - form organization administrator account level

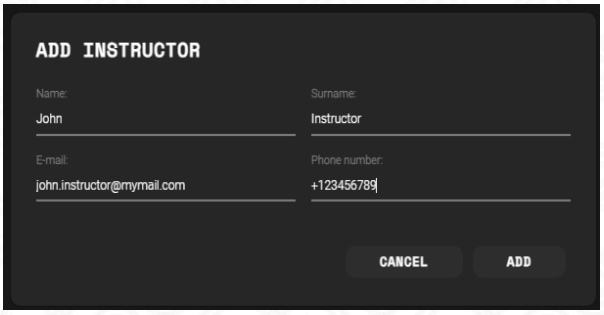
Creating a New Instructor in the Organization

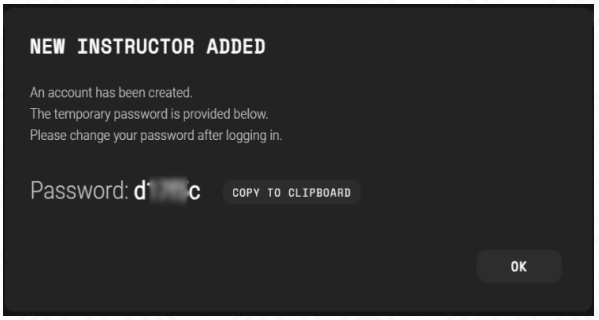
Creating an Instructor Account is one of the first tasks you'll need to perform. Account creation can only be done from the Organization Account. Here's how you can do it:

1. Log in to your Organization Account.
2. Navigate to the 'Instructors' section.
3. Click the plus button indicating 'Add Instructor' located in the top right corner.



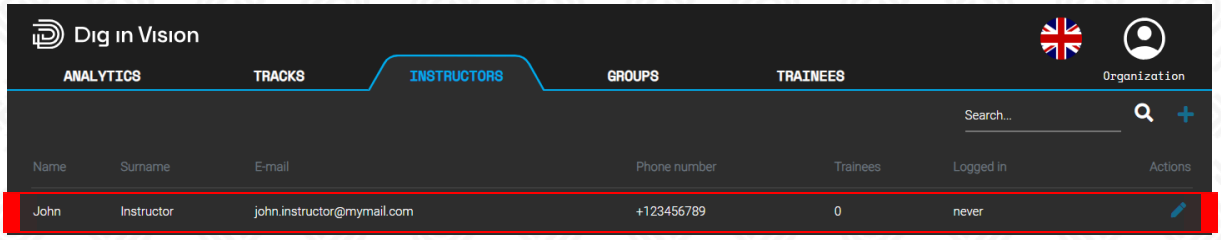
4. Following that, instructor details should be entered, with particular attention to avoiding any typos, especially in their email address. Upon entering the information, confirmation can be completed by clicking the 'ADD' button.





Congratulations, the first instructor account has been successfully created. A temporary password will be sent to the provided email address for verification. It is advisable for the instructor to log in to their account and change the password to a personalized one.

The new instructor account will be visible to the organization of the 'Instructors' section.

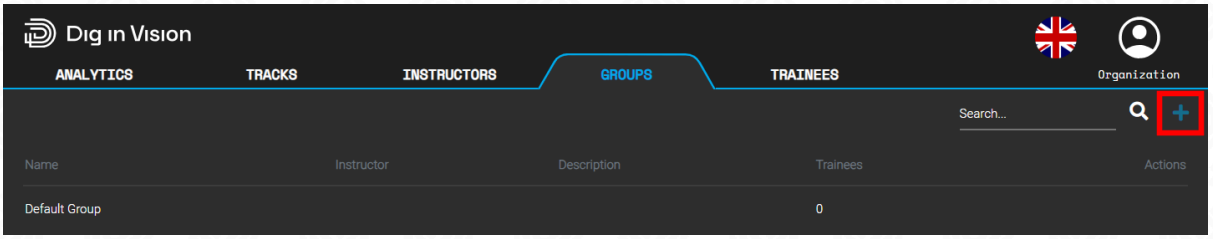


Upon the instructor's first login, the interface provides the option to change the password. The option can be found in the selectable list by clicking on the user icon in the top right corner.

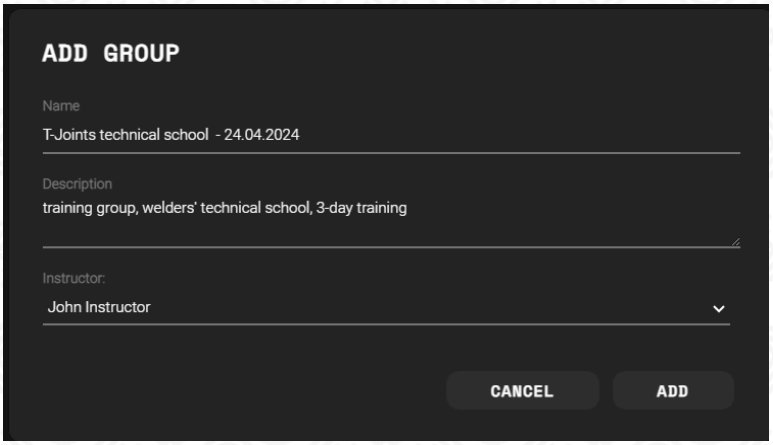
Creating Classes for a Designated Instructor in the Organization

To facilitate the work of instructors, there is an option to divide students into class groups. This approach allows for the addition of new groups for new students and the archiving of groups that will no longer be working on the simulator.Each instructor has a default group where they can add students. All students will automatically be moved to this default group if their dedicated group is deleted. The default group cannot be deleted. Additionally, students can always be transferred from the default group to another group as needed.

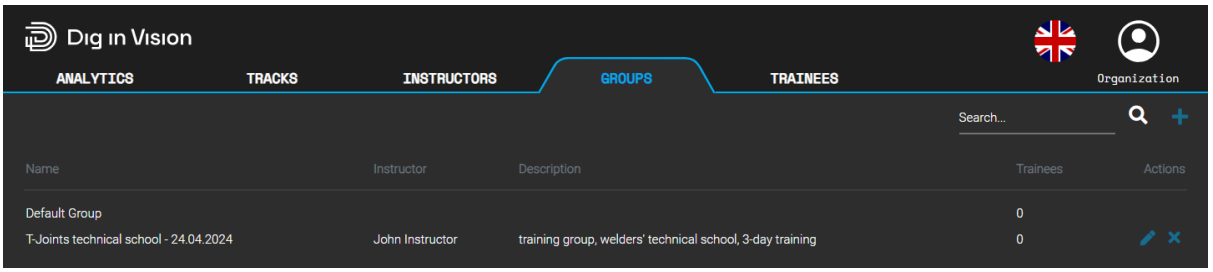
To prepare a group for an instructor from the organization account level, enter the "Groups" tab and use the "Add" button.



Next, you should provide the name of the group — it is recommended to include the training date or other information that facilitates its identification. After adding a description of the group, you need to specify which instructor it should be assigned to.



After adding the group, it will be visible in the organization view (group tab) along with the group names and all other instructor names.


Dig in Vision
ANALYTICS
TRACKS
INSTRUCTORS
GROUPS
TRAINEES
Organization
Search...
Name
Instructor
Description
Trainees
Actions
Default Group
0
T-Joints technical school - 24.04.2024
John Instructor
training group, welders' technical school, 3-day training
0

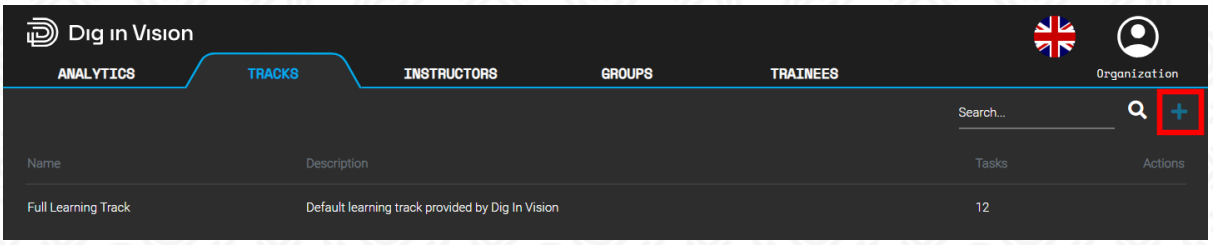
Creating Personalized Training Tracks

Within the Dig In Vision system, inside the virtual training center, the creation of customized training paths for each student is supported. While students can opt for pre-designed paths suggested by Dig In Vision, the **organization account** has the flexibility to design personalized courses for their welders. This includes the selection of specific samples, such as T-joints in various positions, allowing organizations to tailor training to the unique needs of their students. Sample options include basic samples, industrial samples, and personalized samples (available upon request). Sample examples below.

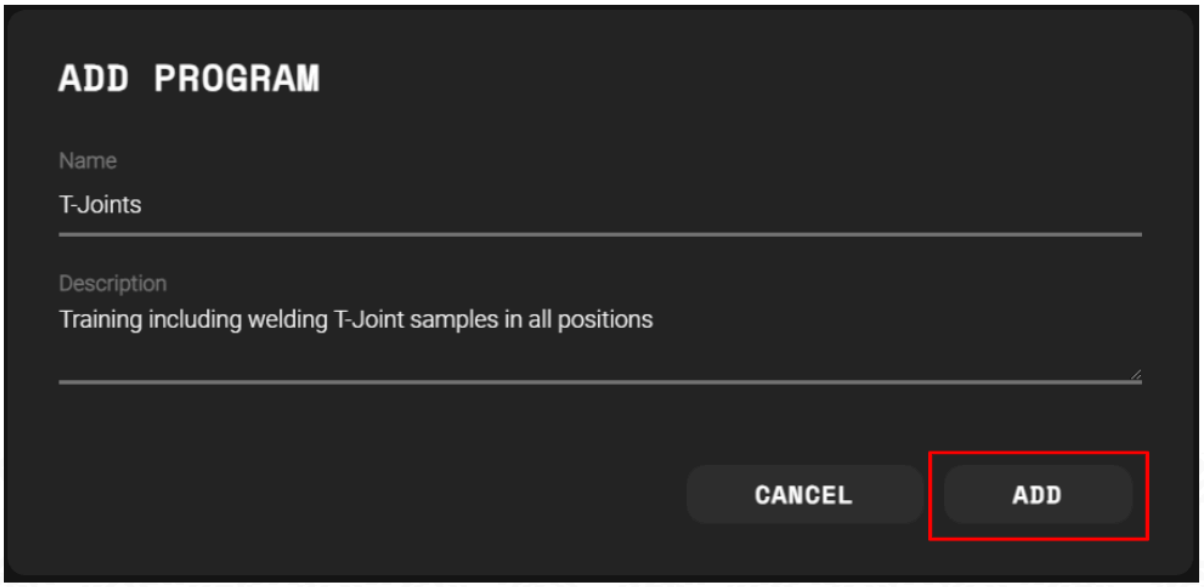
Basic Samples **Industrial Samples** **Personalized Samples**

Creating New Training Tracks

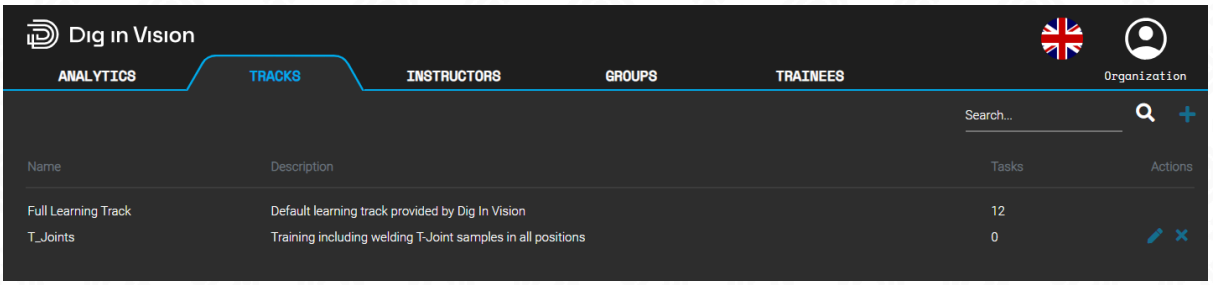
Using the organization's account, you can change and edit Training tracks. In the 'Tracks' section, you will find a list of available learning tracks for your students. By default, upon the initial launch, there will be the default learning track provided by Dig In Vision, which includes all possible samples. If you wish to create your custom training program, for example focused on T-joint samples, you can do so by adding a new training track using the 'plus' icon located in the upper right corner.



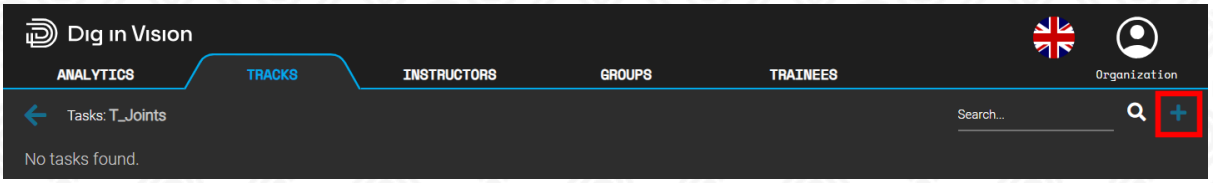
Proceed by providing the training program with a name and description, then finalize the process by clicking the 'ADD' button.



The T-joints training track has been successfully created. However, it currently lacks any specific tasks. To determine which tasks should be included in this training track, click on the path's name.

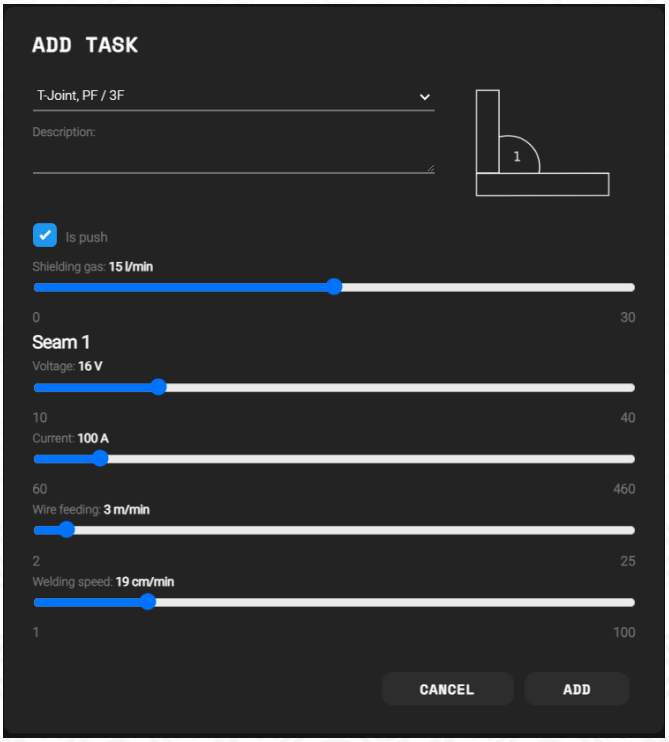


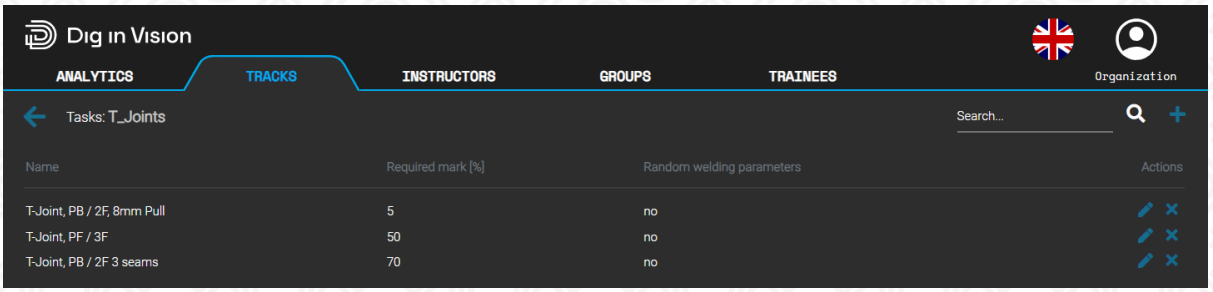
When you click on the name of the training track, a tab will open, indicating that no tasks have been found. To add tasks to the training track, once again, use the plus icon located in the upper right corner.



From the dropdown menu, select the specific tasks you'd like to add to the training path. You also have the option to include 'Random Welding Parameters,' a feature that randomizes initial welding settings. This encourages students to develop a practice of verifying welding parameters, mask filters, shielding gas, and other settings to ensure their correct configuration and prevent inadvertent changes.

After selecting the type of sample, the default requirements (WPS parameters) for the task will be presented. There is also an option to define your own custom parameters by moving the slider. Once the parameter values for the task are set, select the ADD button. The task will be added to the training path.



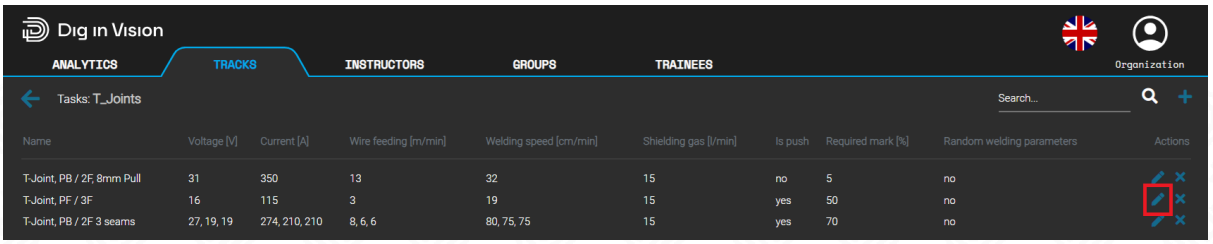


Above, the finished list of tasks in the newly designed training track.

Setting Custom WPS Parameters for Tasks

When adding new tasks to the training track, the tasks are saved with default WPS (Welding Procedure Specification) values prepared by the welding engineers at Dig in Vision. However, if your company prefers to train students using slightly modified parameters different from the default ones, you have the option to define your own custom parameters.

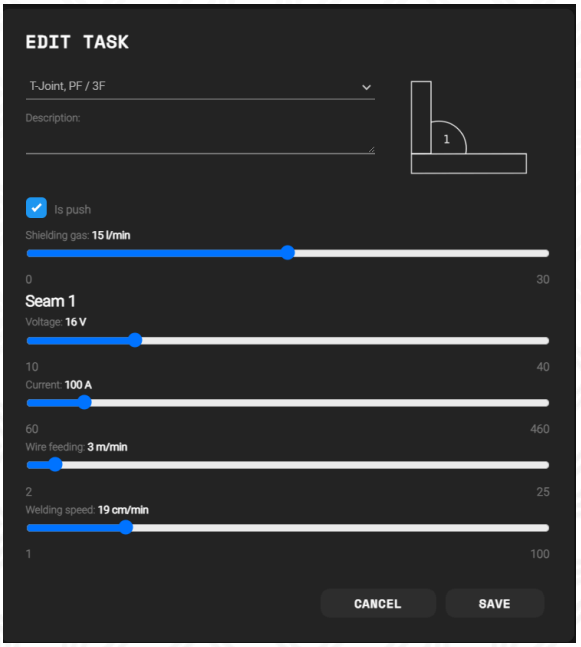
Log in to your organization's account. In the TRACK tab, select the appropriate training track. Then, from the list of available samples within that training path, you can choose the edit icon.



An edit task window will appear where you can freely change parameters such as:

- Shielding gas flow
- Welding voltage
- Welding current *
- Wire feed speed (WFS) *
- Welding speed
- Welding technique

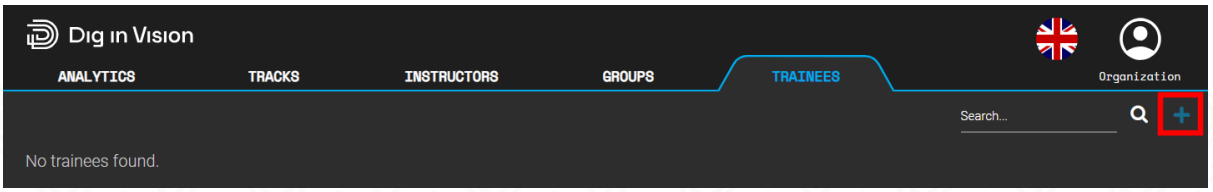
** Interdependent parameters: adjusting WFS also changes the current.*



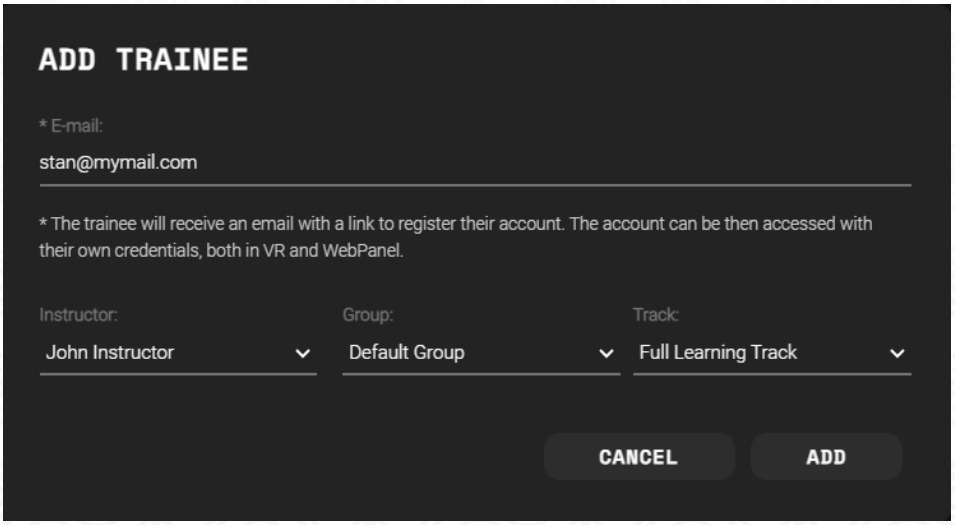
Creating a New Student in the Organization

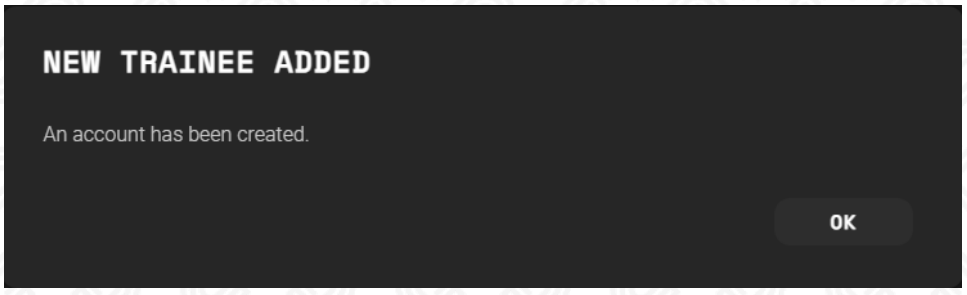
The organization administrator can assist instructors in setting up groups for upcoming courses. Once the instructor's account has been established and a dedicated group created for the course, the administrator can proceed to set up student accounts. Upon account creation, students will receive an email notification containing a password, enabling them to log in to both the VR application and the web panel. This access allows them to check their results, certificates, and educational progress.

To add a new student, navigate to the "Trainees" tab and click on the "Add" button.



In the window, you need to enter the student's details email address to which a password will be sent and which will be used for logging into the application. Next, select from a dropdown list the instructor who will conduct the training. Choose the group to which the student will be assigned and select their training track. After completing the student's information, click the ADD button. **An automatic message will be sent to the student requesting email verification and the completion of the remaining details.**





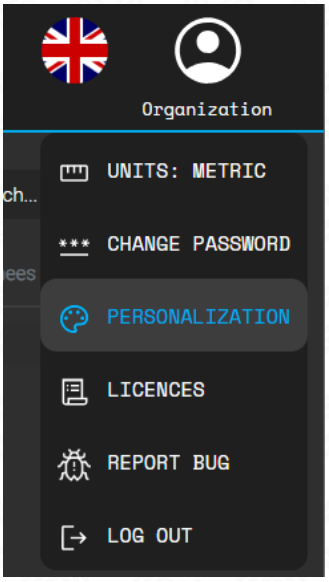
The student will not appear on the list until they confirm account creation via the link and complete their details through the email.

Class Group Management - from the instructor account level

After logging into their account, the instructor has access to view the groups and students assigned to them. They also have the ability to manage these groups: they can create new groups, add students, and transfer students between groups

Setting Custom Prices for Welding Test Samples

To enable the adjustment of training costs in line with the market prices of your location, you can set custom cost components that will affect the final price of a completed welding test sample. This customization will allow you to calculate the savings your company can achieve by using the VR simulator for training



From the organization panel, select the "Customization" tab, and then in the "Customize the costs of your training" section, you can set the following prices:

Fixed costs are prices determined by the type of sample on which the training is conducted.

- **Steel Cost $/T** - The average cost of structural carbon steel can vary depending on market conditions, location, and specific type of steel. Prices typically range about $800 - 1,000 per ton, with variations depending on factors like demand, production costs, and geopolitical influences.

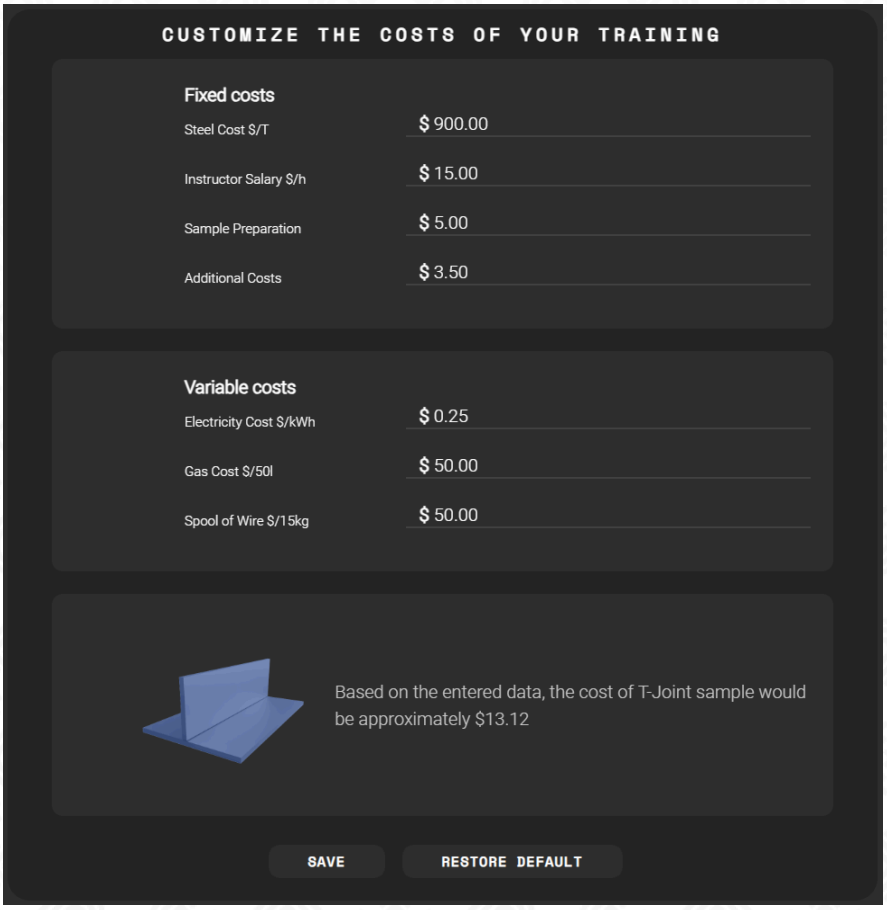
- **Instructor Salary $/h** - The hourly wage for a welding instructor varies globally depending on location, market, and demand. Typically, it ranges $5 - 30 per hour, influenced by factors such as experience and regional needs.

- **Sample Preparation** - Preparing welding samples involves cutting steel, beveling edges, and cleaning the surface of rust and dirt. The average labor cost for preparing a single sample is about $5 - 15.

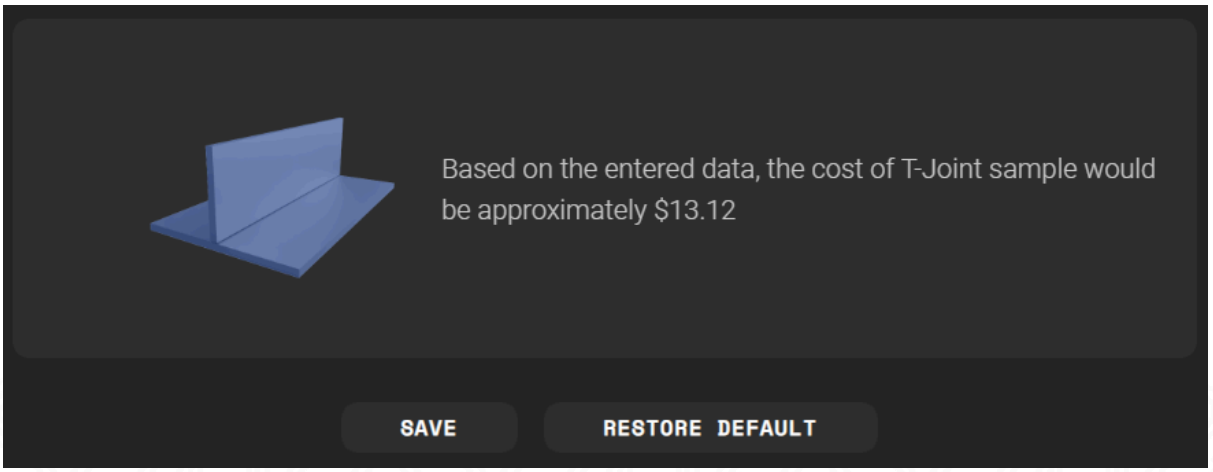
- **Additional Costs** - Expenses for heating, lighting, cleaning, waste disposal, maintenance of machines, tool replacement, safety equipment, and insurance. Including these operational expenses ensures a comprehensive budget for welding projects. The cost to prepare one welding sample, including all these factors, can range $5 - 20.

Variable costs are prices based on the duration of the test and the consumables used during the training.

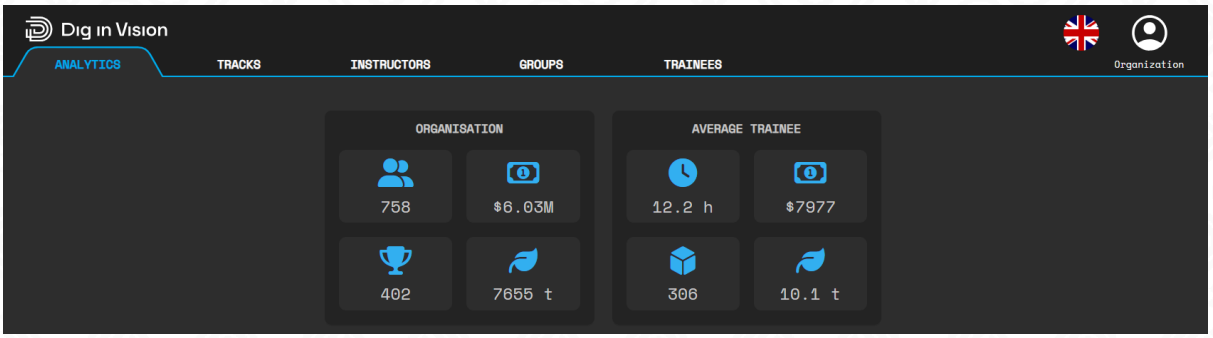
- **Electricity Cost $/kWh** - Electricity prices range $0.10 - 0.30 per kWh, depending on the region.
- **Gas Cost $/50l** - Shielding gas prices for welding, such as Argon-CO2 mixtures typically range $50 - 100 per 50-liter cylinder, depending on the supplier and region.
- **Spool of Wire $/15kg** - The price of a 15kg spool of welding wire varies depending on the type of wire and the supplier. Generally, the cost ranges about $50 - 300. For example, standard MIG welding wire can be bought for around $50 - 100, while specialty wires, such as stainless steel or flux-cored options, can be priced higher, up to $300 per spool.



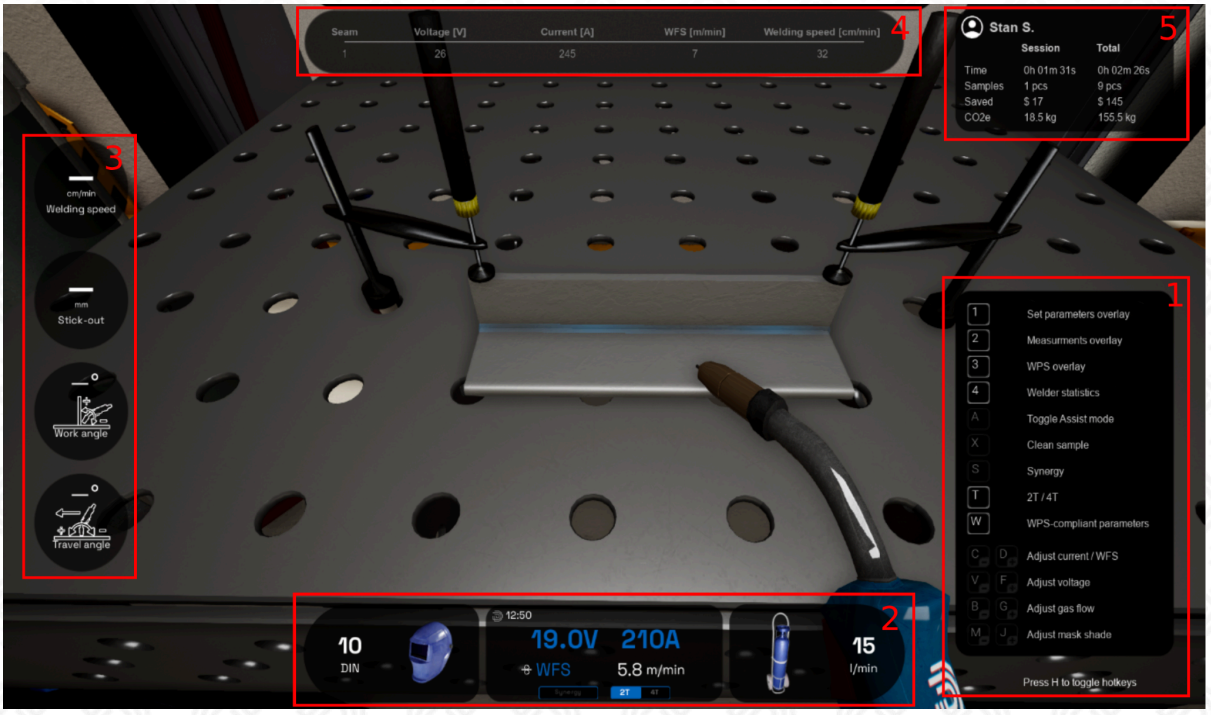
Once all the data is entered and saved, the control amount for a typical training sample, T_Joint, will be calculated.



The total training cost can be viewed from the organization account in the **WEB Panel under the "ANALYTICS" tab**,



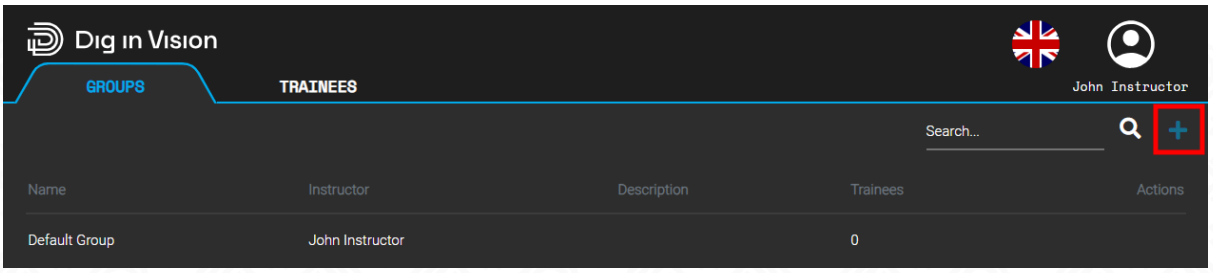
or in the **VR application** through the HUD Trainee Statistics (5).



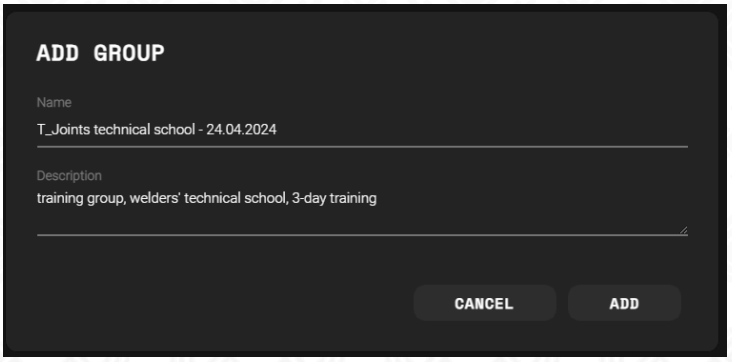
Creating a Class Group for students from the instructor's account.

To streamline work organization, an instructor can create their own exercise groups, which are associated with specific exercises, materials, and training schedules. It is recommended that the group name clearly indicates the type and timing of the training. After the training is completed, the instructor has the option to retain or delete the group. Students who have not been assigned to another group or are members of a deleted group will be automatically transferred to the default group.

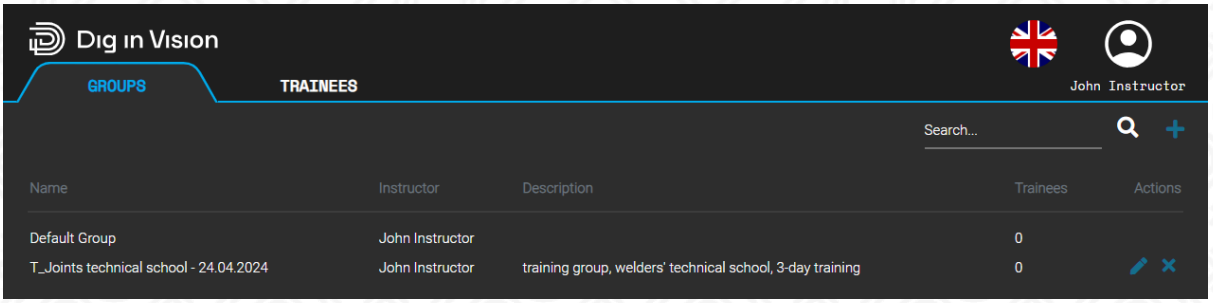
To add a new group, the instructor can select the "GROUPS" tab from the main panel of the web panel and choose the "Add" option.



Next, you need to provide the name of the group and a description that allows for identification of the type of training, the schedule, the target group, etc.



After adding the group, it will be visible in the list of groups under the "GROUP" tab.



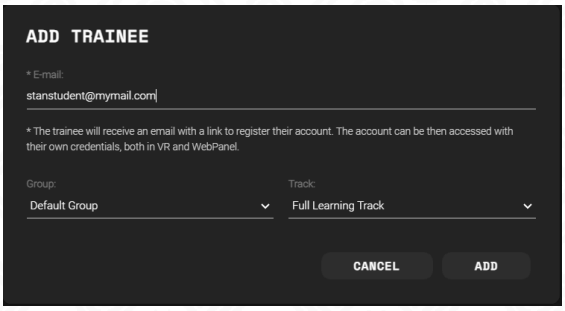
Creating a New Student from the Instructor account level

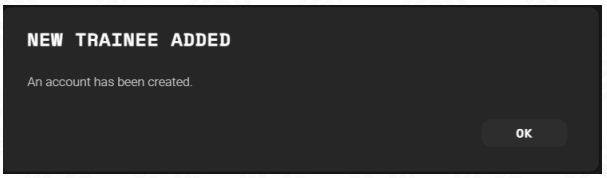
The core organizational structure for training within your organization will revolve around classes or groups, each led by an instructor. Instructors will have the authority to add students to their respective classes, **either through their instructor accounts or with support from the organization's account**. However, empowering instructors with complete control over their classes is crucial. Upon logging into their instructor accounts, instructors will encounter an initial list of students assigned to them, though it will be empty at the start.

This setup ensures instructors have the necessary tools to oversee and manage their groups effectively.

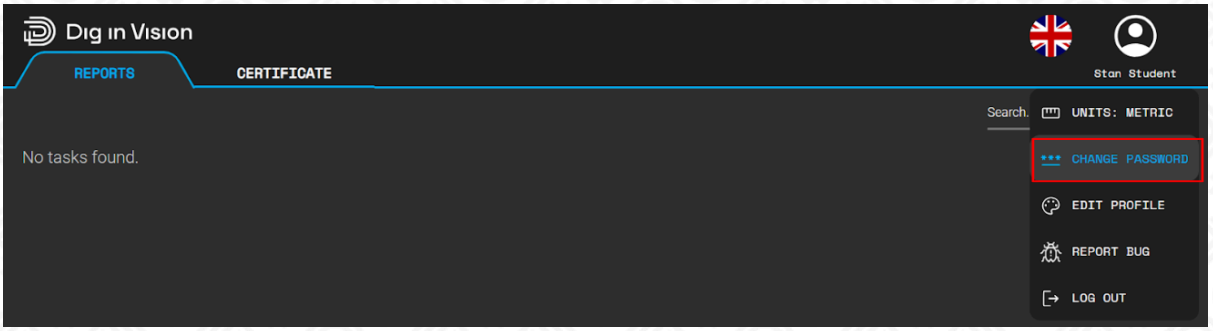
To include a new student in the instructor's class, you can do so by selecting the 'Add' option, accessible through the plus icon.

Following that, please enter the student's information with great care, ensuring there are no typos, in the email address, as it will be crucial for logging into the application. At this stage, you have the option to select a training track for the student from a dropdown menu. You can also specify which exercise group you want to assign the student to. Once all the fields are completed, confirm the entry by clicking the 'ADD' button.



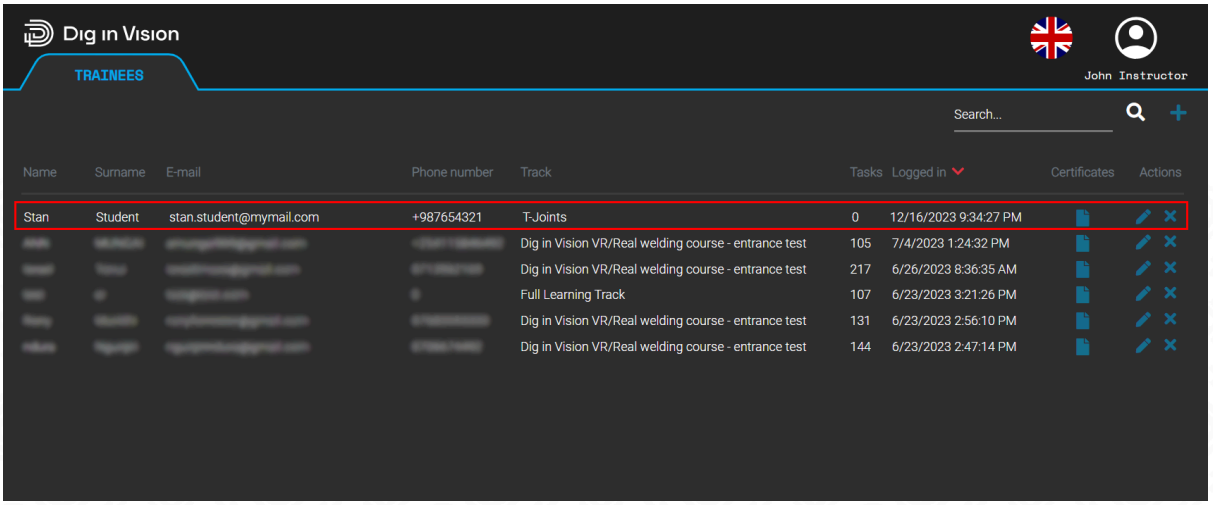


Once the student is successfully added, an activation link and a temporary password will be sent to the email provided during account registration. The trainer will not see the student in their list immediately. The student will appear only after they confirm account creation via the activation link and complete their details.It is strongly advised for the student to change their password without delay. To do so, the student should log in to the WebPanel using their **student account** (using their email and the password generated during account creation) and then proceed to select the 'Change Password' option, which is available by clicking on the user icon in the top right corner.

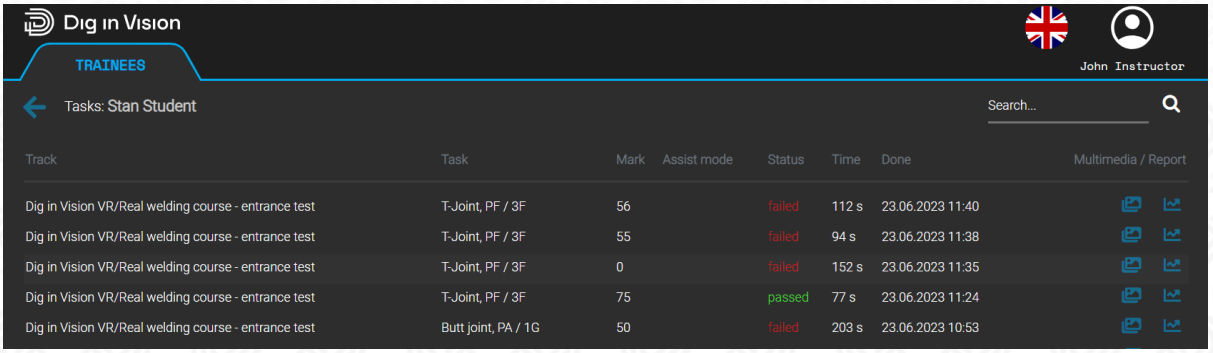


Reviewing Results of Students Assigned to the Instructor

Instructors have the privilege of viewing the complete historical records of welding test results for students under their supervision. To access this information, instructors should log in to their account, navigate to the 'trainees' section, and select the specific student they wish to review.



Upon selecting the student's name, a comprehensive list of all the welding samples they have undertaken will be displayed. Each task includes an accessible test report with a detailed description. For more in-depth insights into test analysis and reporting, please refer to the chapter Report - AI-Enhanced Analysis of Welding Tests



Report - AI-Enhanced Analysis of Welding Tests

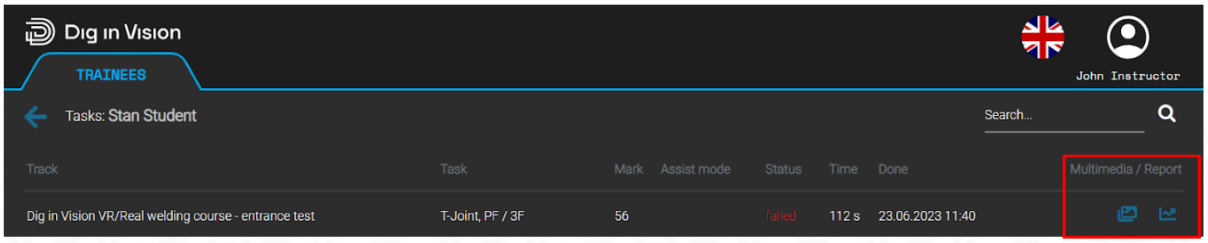
Every welding test you complete is assessed by **Weld-Master^{AI}** algorithms, meticulously developed by Dig in Vision. Think of Weld-Master^{AI} as your virtual tutor, providing instant feedback after each test, highlighting areas for improvement and pointing out what you have done wrong. With just one instructor for every 10 students, it's challenging to provide individual attention to each student. This is where Dig in Vision's AI algorithms come in to assist. In the world of welding, learning without constructive feedback on your mistakes and areas to improve would be ineffective. **So, remember to complete a welding test, carefully review the report, analyze errors, and give it another try!**

Instructors and students can access the welding test report for review.

Instructor Access

Instructors can access the report by following these steps:

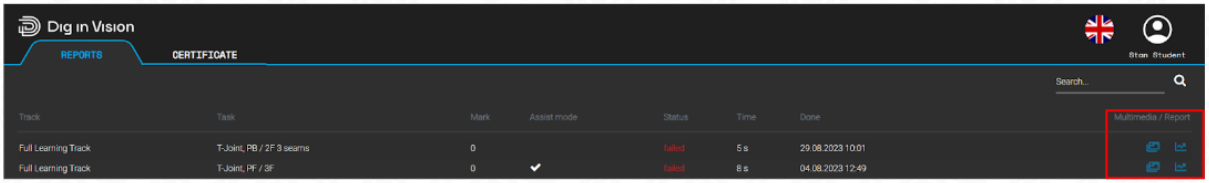
- Navigate to the 'Trainees' section.
- Select the desired student.
- Click on the report icon.



Student Access

Students can also access the report by taking these steps:

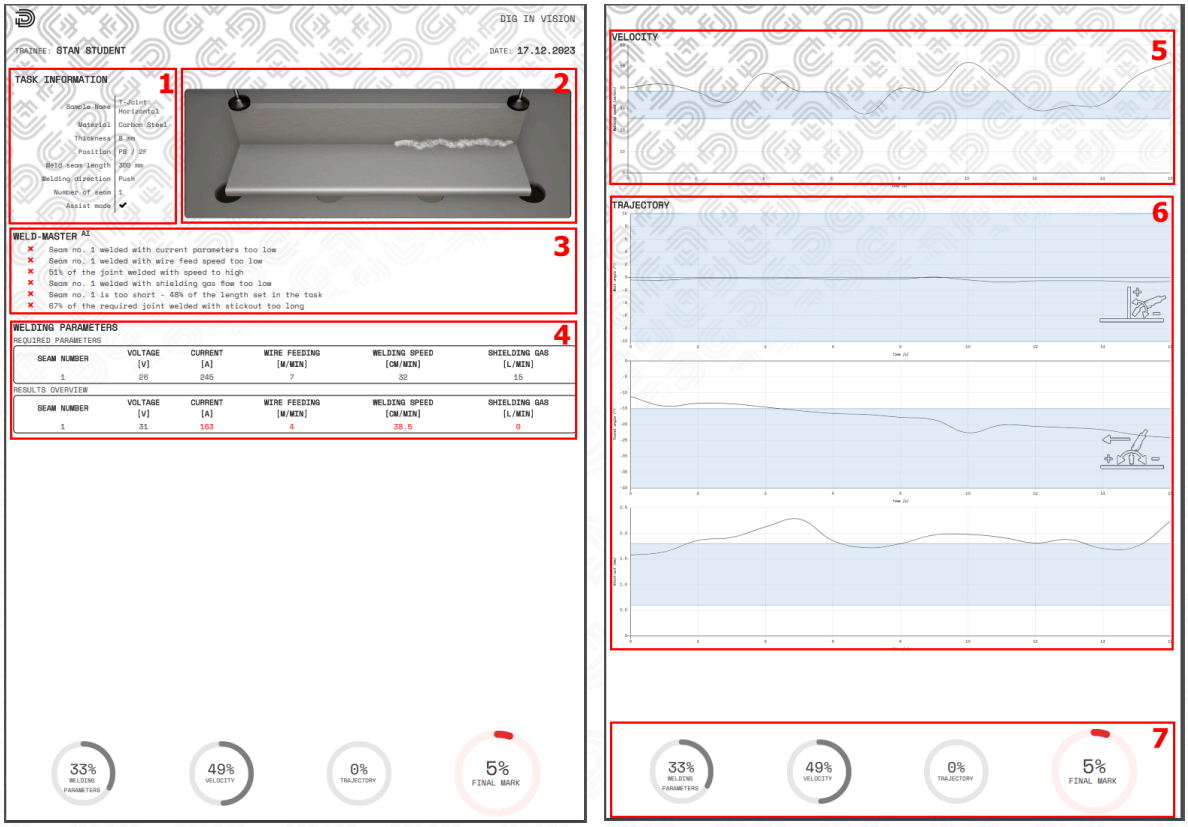
- Go to the 'Reports' section.
- Click on the report icon.



When you select a particular attempt and click on its name or report icon, a web-based report will open, providing key sample details, weld joint images, and partial ratings. You can easily share this report via email or print it as a PDF for a physical print. See the sample WebPanel report below.

Sections in the report

The report, available in both the WebPanel and PDF file formats, encompasses seven sections. As you navigate through the report, you'll uncover progressively more detailed insights into the specific welding attempt. Below is an example of the generated report.



1. **Task Information**

This section offers an in-depth overview of the welding sample, including material specification, joint length, and the welding position in which the sample was performed. It also specifies whether the student completed the task independently or with the assistance of the assistant mode.

2. **Welding Sample Image**

Many welding defects are surface-related, such as porosity and incorrect weld geometry. Therefore, a crucial aspect of the report is the visual assessment of the completed weld joint, depicted in the sample image.

3. **Weld-Master^{AI}**

The artificial intelligence algorithms developed by Dig in Vision support the evaluation of welding samples, thus accelerating the learning process by providing immediate feedback on errors and guidance on how to improve in subsequent attempts. Weld-Master^{AI} monitors 21 key welding parameters, like welding settings, speed, angles, materials, and more. Based

on the data collected during the sample, it generates personalized real-time feedback for each individual student.

4. **Welding Parameters**

During the evaluation process, the algorithms ensure that the student has configured the welding parameters on the welder in accordance with the Welding Procedure Specification (WPS). While not all parameters can be manually adjusted, aspects like welding speed must be acquired through the sense of touch, muscle memory, and hand-eye coordination to achieve precise welding alignment with the specified guidelines. Parameters that deviated from the specification during welding are distinctly marked in red within the report.

5. **Speed Chart**

Consistency in welding speed is paramount for a successful weld, ensuring a stable and smooth operation. Alongside configuring essential parameters such as voltage, current, and WFS (Wire Feed Speed), maintaining a constant welding speed is essential for achieving the desired weld joint geometry and visual appearance. To highlight this crucial aspect, the report includes a dedicated section called the Speed Chart. The student's objective is to weld at the specified speed, with a tolerance of ±10%. In simpler terms, they must stay within the blue (correct) zone. Deviations from this zone result in a reduced final score.

6. **Trajectory Charts**

Another critical section includes trajectory charts for work angle, travel angle, and stickout. A meticulous analysis of these charts serves as a valuable tool for refining the manipulation of the welding torch. Initially, maintaining all three parameters within the correct range may appear daunting. However, this is precisely why we've incorporated the assistant mode; it assists in developing muscle memory to instinctively manage torch orientation. These three parameters are instrumental in shaping the weld joint's geometry and determining factors such as the depth of fusion into the base material. Stickout also affects joint strength, but an improper stickout can lead to welding defects like spatter and porosity. Information on trajectory, encompassing work angles, travel angles, and stickout distances, is not part of the Welding Procedure Specification (WPS) but is considered fundamental knowledge. We provide comprehensive insights into these aspects through our VR application academy. In this context, deviations of up to ±10% from the ideal values are allowed.

7. **Component and Final Scores**

The final assessment is calculated from the component scores, taking into account their respective weights that influence the appearance and durability of the weld joint. The components that are being evaluated:

- **Welding Parameters Score** - within this evaluation, the algorithm checks for the accurate application of Welding Procedure Specification (WPS) parameters by the student during the welding process. It enables pinpointing errors that may have occurred in Sections 3 and 4.

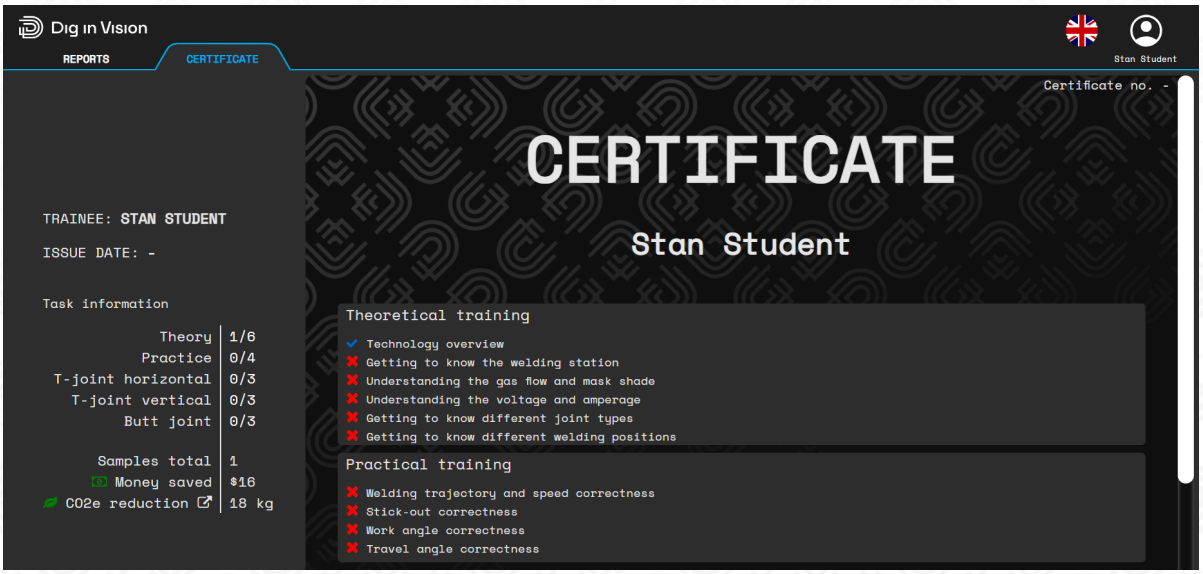
- **Welding Speed Score** - this evaluation determines the proportion of the weld joint that adhered to the prescribed speed outlined in the Welding Procedure Specification (WPS). It serves as a diagnostic tool to pinpoint areas of error, as outlined in Section 5.

- **Trajectory Score** - in this evaluation, the assessment is based on the percentage of the weld joint where the travel angle, work angle, stickout, and welding trajectory were correct. It serves as a diagnostic tool for identifying errors in Section 6.

Weld-Master^{AI} analysis is available in both the WebPanel and immediately after VR test assessment. Remove the VR headset to view a detailed error analysis.

Digital Welding Competency Certificate

As a vital component of the virtual training center, similar to conventional real-world training, there is an integrated theoretical module. For in-depth insights into the academy, please refer to chapter Academy. The culmination of the training journey culminates in the issuance of a digital certificate, presented to the user upon successful completion of all assigned tasks. Access to this certificate is available not only to the student through their personal account but also to the overseeing instructor and the organization's administrative account.



To achieve the certificate, you need to complete the theoretical VR training covering various topics presented in the academy, containing:

- Technology overview
- Welding station
- Shielding gas
- Welding mask
- Electric parameters
- Sample types

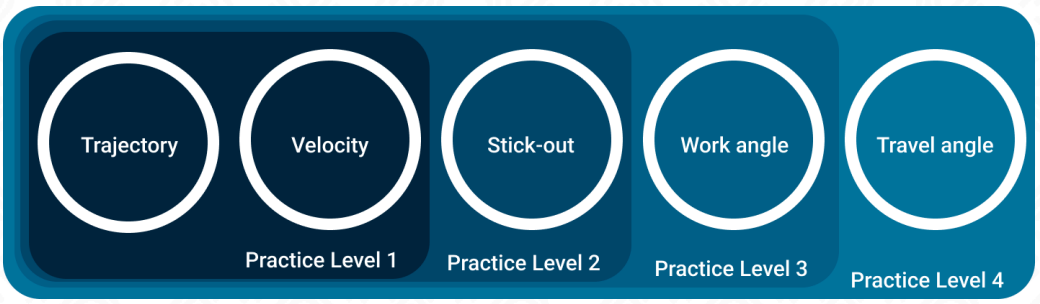
- Welding positions

Lessons are interactive, you can take part actively by testing and trying out the elements discussed.

The theoretical lessons are followed by 4 practical tasks to practice the knowledge you have acquired. Each subsequent task is structured in such a way that it requires a higher level of proficiency, leading to continuous development and challenge. The practical tasks test parameters such as:

- Trajectory
- Velocity
- Stick-out
- Work angle
- Travel angle

With each successive task, another parameter is added according to the graphic below.

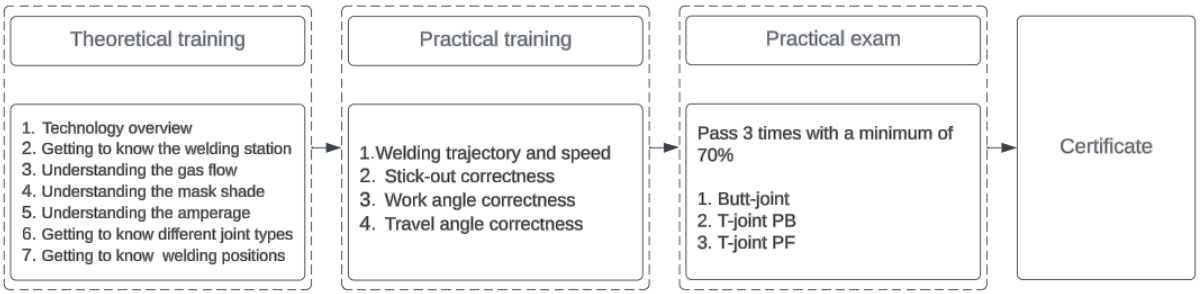


In the first task, we practice trajectory and velocity, in the second task we add stick-out to the previously mentioned parameters, and so on until the last task, where all of them are tested simultaneously. To pass the practice tasks, you must achieve at least **50%** for each of the parameters given.

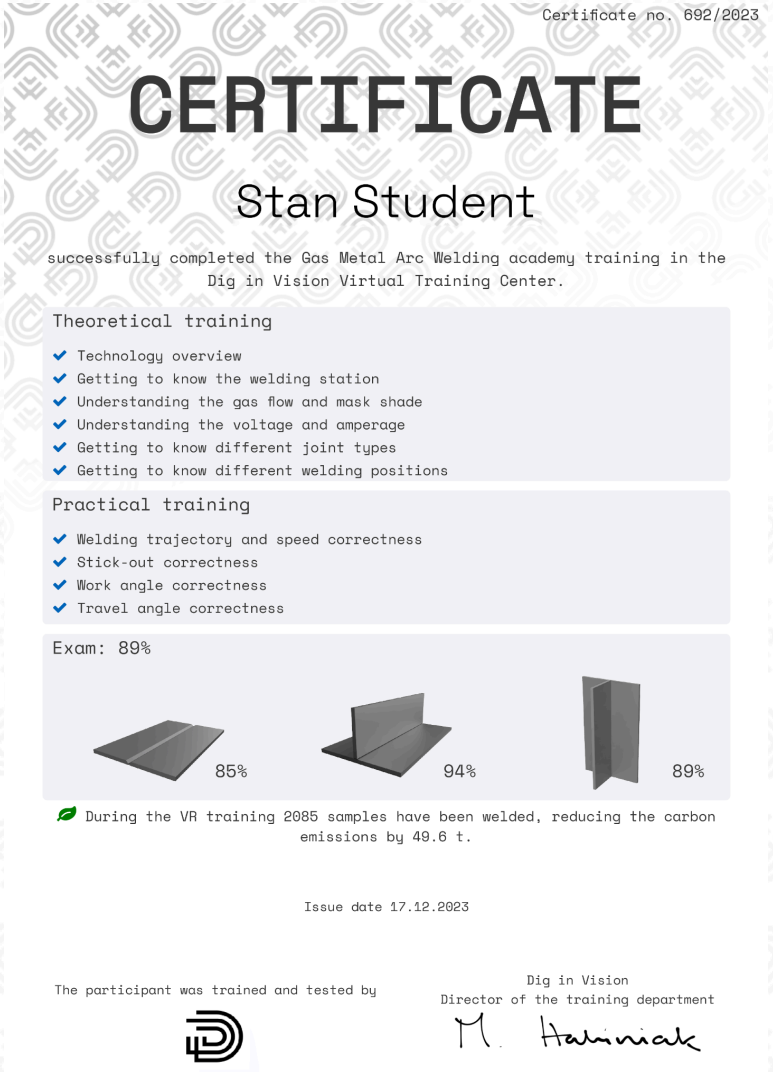
After completing the practical tasks, the exam begins. The exam consists of three practical tasks. Each task must be passed with a minimum of **70%**. There is no assistant mode in the exam. There is an unlimited number of attempts to complete each task.

After successfully completing the exam, participants receive a certificate, which is available for download in the WebPanel. Each user can track their progress on the way to obtaining the certificate in the main control panel or through the WebPanel.

Below is a graphic showing a diagram of the steps a trainee must follow to receive a certificate.



The ability to print or share the certificate becomes accessible upon the successful completion of both the comprehensive theoretical training and the practical examination. Furthermore, each certificate is assigned a unique identification number. In addition to outlining the thematic content, the certificate also offers a summary of the number of completed samples throughout the training and quantifies the reduced CO2 emissions compared to traditional training methods. Below is an example of the generated certificate.



Certificate no. 692/2023

CERTIFICATE

Stan Student

successfully completed the Gas Metal Arc Welding academy training in the Dig in Vision Virtual Training Center.

Theoretical training

- ✔ Technology overview
- ✔ Getting to know the welding station
- ✔ Understanding the gas flow and mask shade
- ✔ Understanding the voltage and amperage
- ✔ Getting to know different joint types
- ✔ Getting to know different welding positions

Practical training

- ✔ Welding trajectory and speed correctness
- ✔ Stick-out correctness
- ✔ Work angle correctness
- ✔ Travel angle correctness

Exam: 89%

85% 94% 89%

During the VR training 2085 samples have been welded, reducing the carbon emissions by 49.6 t.

Issue date 17.12.2023

The participant was trained and tested by

Dig in Vision
Director of the training department
M. Haliniak

Dig in Vision Virtual Welding Center - VR Application

The vision of Dig in Vision is to create the first and extraordinary virtual training center. It's not just a typical training facility but a unique platform that encompasses virtual industrial spaces. Our goal is to provide a comprehensive and innovative platform that redefines the way training is conducted. Within this virtual training center, we offer not only theoretical training courses but also realistic simulation spaces that allow for practical training in a virtual environment. Our vision also includes the development and expansion of available industrial spaces to provide the most authentic and realistic training experiences.

The setup of the VR headset, initial startup, and login have already been described in Chapter Launching the Dig In Vision Application. Now, upon launching the application, you will be transported to the virtual training center, where your welding course will commence.

After logging in, we move to the Virtual Training Center. This is where you will take your first welding steps. Below is the main control panel. The primary control panel features a large screen with four options positioned below it. This standardized interface will be accessible across all the workstations used for your training sessions.

Beneath the screen, you'll discover four selection options:

In the virtual welding training center, various teaching approaches have been prepared for students at different levels of welding knowledge with which they start their welding training. Each of these methods introduces a different learning style, stimulating the brain in various ways and enabling faster and more effective learning. Students have three different learning methods to choose from:

- **Academy** - this path provides a structured training experience that encompasses theoretical knowledge and practical exercises. It's primarily designed for beginners who are new to welding.
- **Training** - the Training path is a customized learning track meticulously tailored by instructors to meet the unique requirements of individual students.
- **Freestyle** - within this mode, students enjoy complete autonomy and flexibility in choosing welding parameters, without strict adherence to predefined Welding Procedure Specifications (WPS). It's well-suited for participants ranging from intermediate to advanced skill levels.

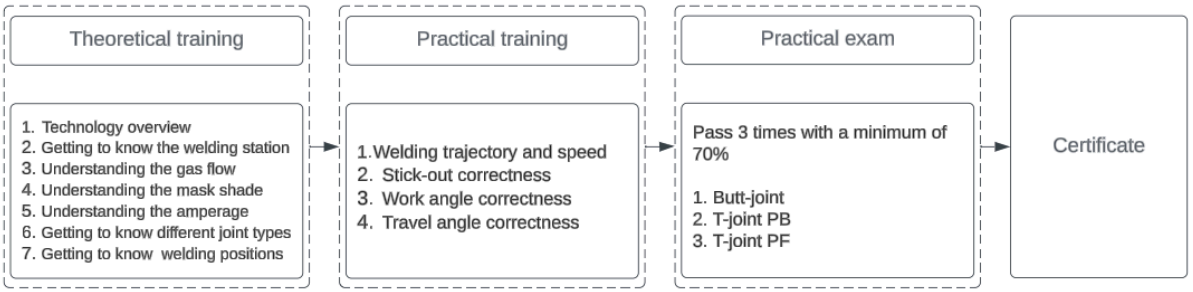
The last button is Options, where you can at any time:

- Adjust the application language to your preference.
- Perform application calibration (more about calibration in section Calibration of Virtual and Real Workspaces)
- Return to the login screen.
- Exit the application as needed.

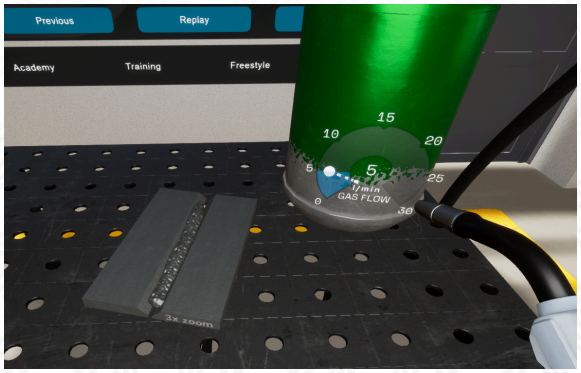
If you do not interact with the screen for 5 seconds after selecting any of the buttons, it will return to the previous tab.

Academy

Virtual Reality Welding Academy is the first educational solution for the welding industry and professional welding training. As part of the academy, you will receive seven theoretical lessons, four practical tasks and a certified exam. For more information about the certificate, see Digital Welding Competency Certificate. The entire academy is led by a virtual tutor - a tutor who guides you, the student, through the entire educational process. During the academy, listen to the tutor and read the instructions on the screen. Below is an overview of the topics covered in the VR Virtual Academy:



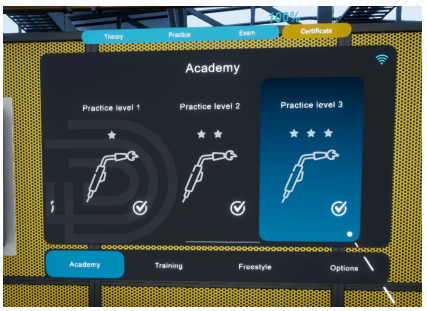
VR enhances learning by visualizing concepts that traditional books cannot, such as the impact of shielding gas volume on the final weld, the effect of parameter adjustments on weld cross-sections, or the empirical selection of welding mask filters. This immersive approach brings complex processes to life, making them easier to understand and apply in practice.



Assist mode

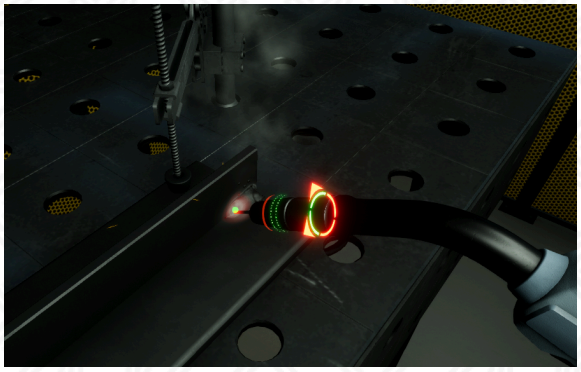
In the practical section of VR Academia, the **virtual assistant** serves as a key learning tool, designed to help users develop muscle memory through visual cues (color indicators) and audio guidance. This system works similarly to a real-life instructor, providing real-time feedback and corrections, ensuring that users can improve their technique effectively and efficiently.

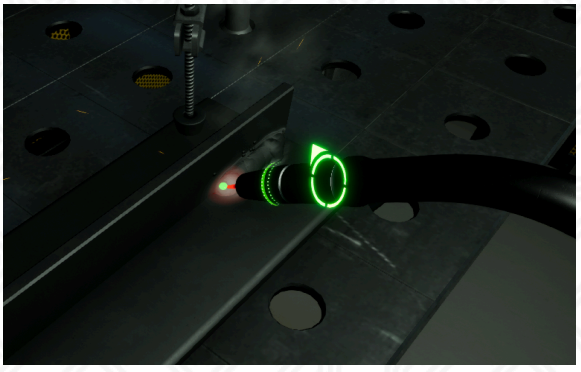
The virtual assistant makes it possible to monitor and adjust multiple parameters simultaneously—such as speed, trajectory, stickout, work angle, and travel angle. Managing all these elements at once can be challenging, which is why VR Academia structures the learning process into **four progressive levels**.



Each level focuses on mastering specific parameters, with real-time visual feedback:

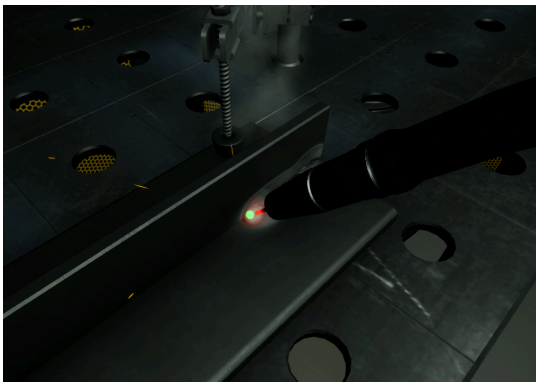
- **Green** indicates correct execution.
- **Yellow** suggests minor corrections are needed.
- **Red** highlights significant errors requiring immediate adjustment.



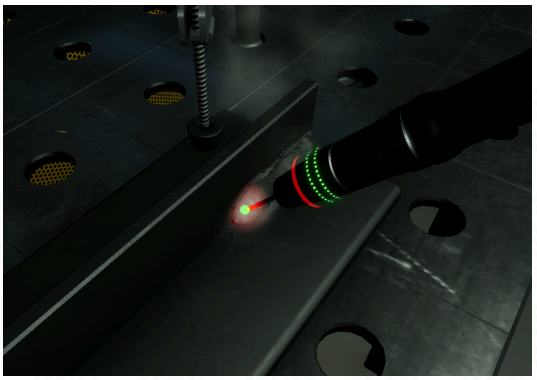


To progress to the next level, users must achieve a minimum score of 50% for each monitored parameter. This step-by-step approach ensures a solid foundation of skills, enabling learners to build confidence and competence with every completed stage. The system's structured progression, coupled with real-time guidance, makes mastering even complex welding techniques more accessible and engaging.

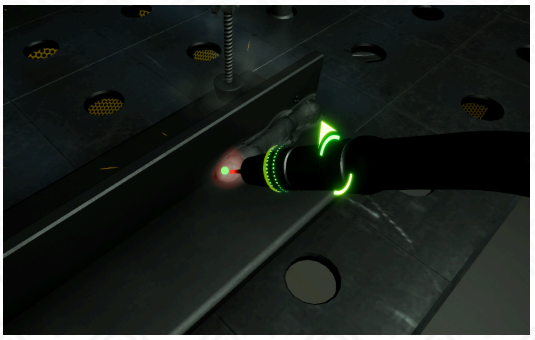
Practice Level 1 - focuses on learning the **correct speed and trajectory of movement** during welding. A dot indicates the appropriate speed and trajectory – follow it closely. This helps develop a habit of maintaining the proper speed and smoothness of motion.



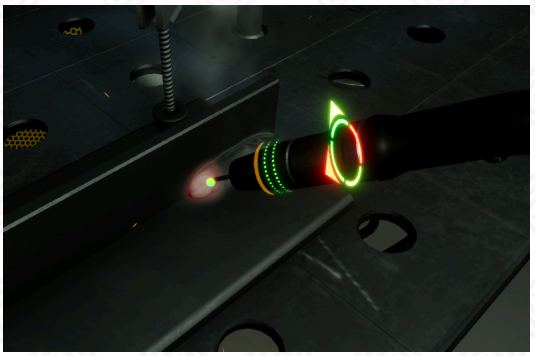
Practice Level 2 - introduces an additional parameter, **stickout.** The stickout should be 10 times the diameter of the welding wire. The correct distance is visualized as a continuous circle on the welding torch gas nozzle, which should remain between two dotted circles. The farther the continuous circle moves from the ideal position between the dotted circles, the more its color changes from green to yellow, and finally to red.



Practice Level 3 - focuses on learning **work angle**. This angle should be the bisector of the planes of the welded element, which in this case means 45 degrees. Necessary angle adjustments are displayed as arrows indicating the direction of rotation around the welding pool.



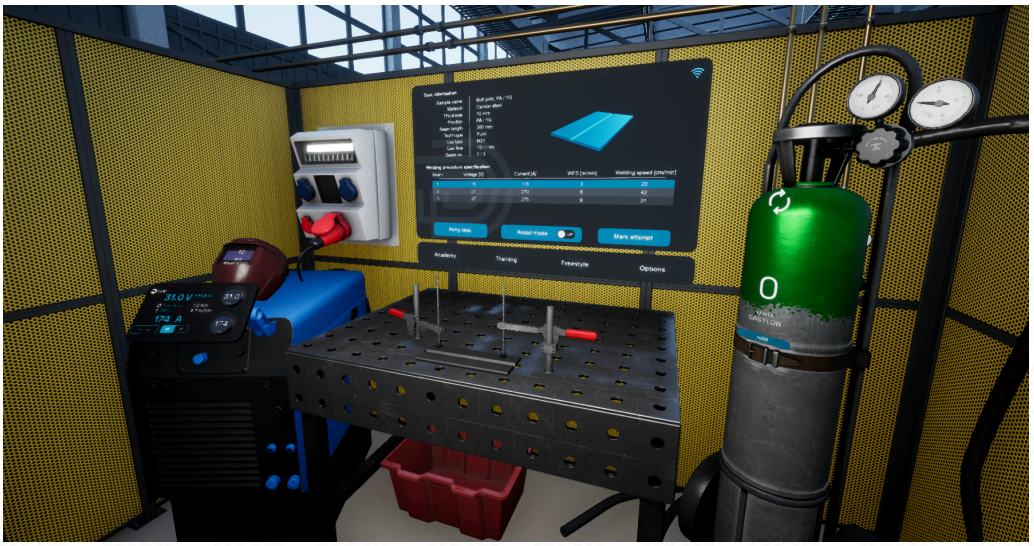
Practice Level 4 - incorporates the full functionality of the virtual assistant, taking into account all previous guidance along with an additional parameter – **travel angle**. Similar to work angle, the travel angle is visualized through arrows that suggest how to rotate the welding torch relative to the welding pool to achieve correct work and travel angles.



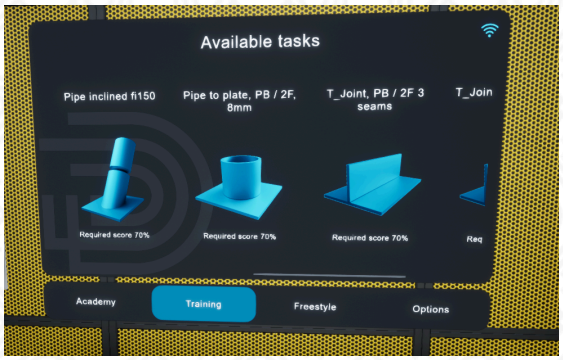
Virtual assistant mode can be turned off at any time on the home screen. Assist mode is not available during the exam.

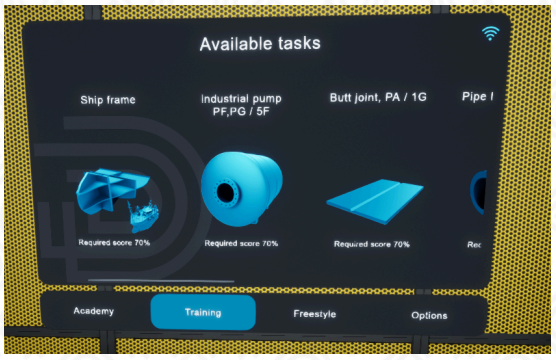
Training

The training module is tailored to specific curricula for individual welders. It provides more structured and focused learning than the Academy. Each block in this module represents a specific task, sample details and the corresponding welding technology. In this mode, as in the Academy, an assistant mode is available. For more information about the assist, see the chapter Academy and Assist mode.



Instructors can use the WebPanel to define personalized training tracks, tailored for individuals at intermediate skill levels, including setting custom WPS parameters for tasks. We have prepared standard basic samples commonly used in training worldwide, as well as examples of industrial samples in a virtual environment simulating, for instance, a shipyard or an industrial hall. All of this aims to enhance immersion and prepare participants for real-world working conditions.

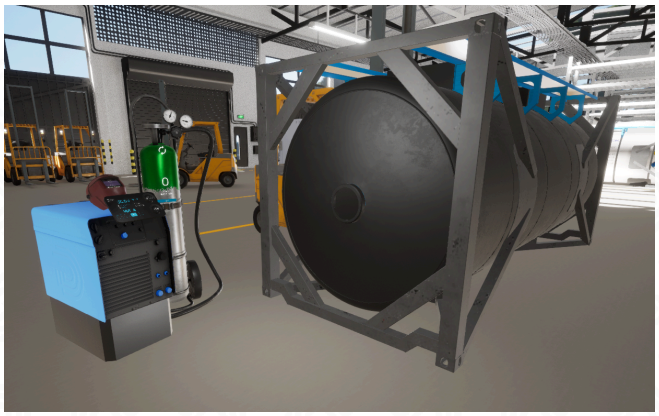




WebPanel is a user-friendly interface that allows tracking and confirming tasks completed by specific users. In Training mode, each completed task is recorded and can be evaluated later. The user has the option to complete the task with a report, which can then be shared via email, printed or attached to the student's portfolio. Each student's training progress history is available in the WebPanel and can be analyzed. For more detailed information in the chapter Report - AI-Enhanced Analysis of Welding Tests.

Freestyle

The Freestyle module offers a wide and unlimited view of all sample types available in the application. This includes both standard and production items. However, these samples come without specific instructions. Users can view and interact with these samples, but cannot complete structured tasks or receive grades. Assist mode is also not available. This module is ideal for users who want to freely explore different samples without the constraints of a structured learning path or specific tasks. It's well-suited for participants ranging from intermediate to advanced skill levels.



The Freestyle mode offers access to all samples, including:

- **Basic Model** used in real-world training processes and the VR Academy mode,
- **Industrial Model** prepared by us,
- **Your own Imported Model** that you can import into the VR Welding Training Center.

Welding samples

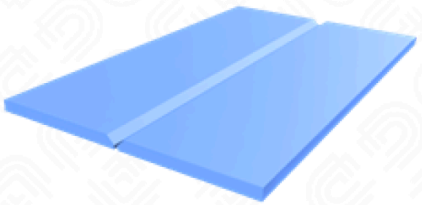
In the Training tab, only the samples included in the training path designed by the instructor for the student are available, and these can be verified and scored by the Weld-Master[AI] algorithm. In contrast, the Freestyle tab provides access to all available samples, but they cannot be scored by the Weld-Master[AI] algorithm. To select a sample, simply scroll through the list and choose the desired one. Once selected, a dedicated virtual environment will be loaded along with the chosen sample.

Basic Models

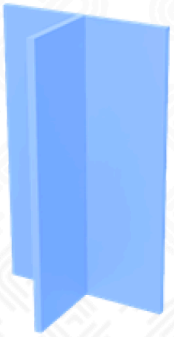
In the Virtual Training Center, a student can try their hand at 6 types of samples. Mastering these widely used welded joints fully covers the scope of the basic and advanced welding training. The number and the type of samples depend on the Teaching approaches chosen. For more information on the Teaching approaches, in the chapter Teaching approaches.

Available samples:

T - joint horizontal



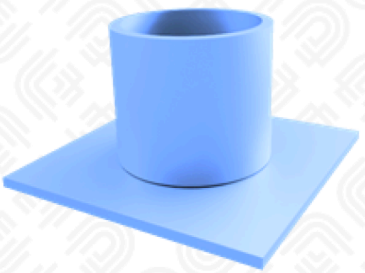
Butt joint



T - joint vertical

Pipe horizontal

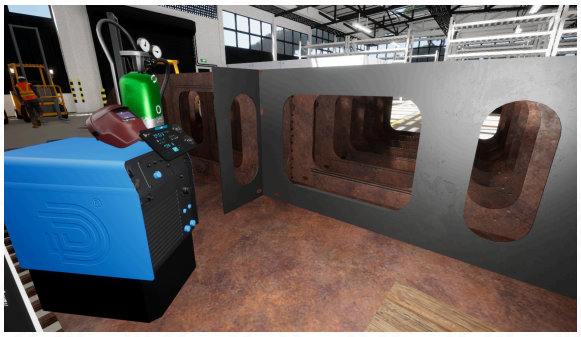
Pipe inclined



Pipe to plate

Industrial Models

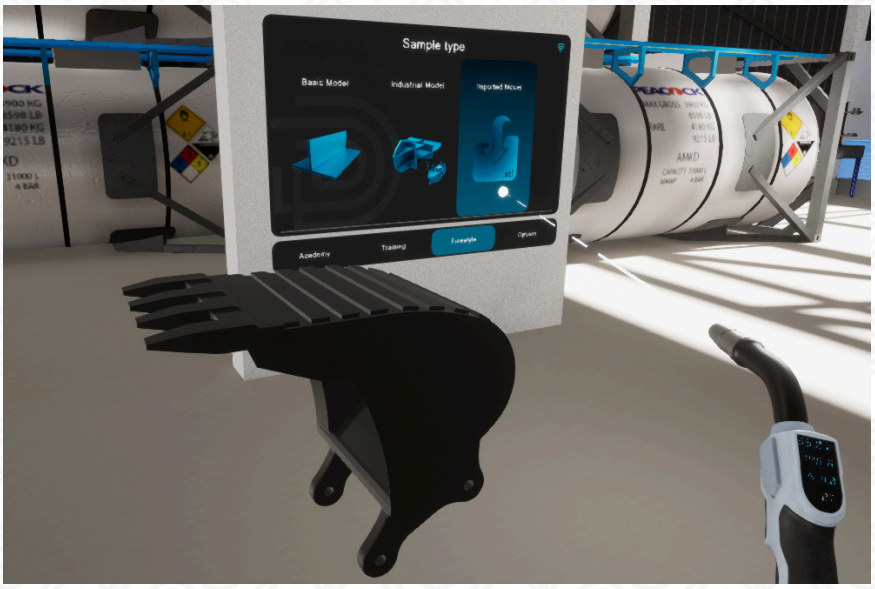
A significant advantage of the welding simulator is its ability to visualize and virtualize any environment along with a dedicated sample, preparing the trainee for real-world work conditions. It not only tests their welding skills but also assesses how they perform in challenging scenarios, such as working at heights or in confined spaces, welding in forced positions.



Imported Models

As the only welding simulator on the market, we offer the ability to train welding skills on your own models. This feature allows your students to practice welding on components you manufacture without worrying about the costs of mistakes during training. Additionally, you can use this module to verify the weldability and accessibility of all joints during the digital model stage, helping you avoid errors and corrections later in the production process.

To use this feature, save your STL file in the folder: `Drive:\Users\YourUser\Documents\DigInVision\StlCustoms`, and then select the file through the **Freestyle** module under **Imported Models**.



Virtual welding station

A virtual welding station is an advanced training tool that allows for practical welding exercises in a virtual environment. Participants in training can use such a station to refine their welding skills, gain experience, and practice without the need for real materials or welding equipment.

A virtual welding station offers several advantages:

- **Safety -** participants can train virtually, eliminating the risk of accidents and damage to materials.
- **Repeatability** - it allows for repeated practice exercises without consuming real materials.
- **Immediate Feedback** - the system provides participants with immediate feedback on their welding technique and errors, enabling rapid skill improvement.
- **Simulation of Different Conditions -** the virtual station can simulate various welding conditions, such as changing welding parameters, shielding gas volume, and errors in the welding torch's movement.
- **Adjustable Difficulty Levels -** the system can be customized to meet the needs of different participants, offering various difficulty levels and learning modes.

A virtual welding station is an innovative tool that enables realistic and effective welding training in a controlled environment, contributing to the improvement of welders' skills and enhancing safety in welding processes.

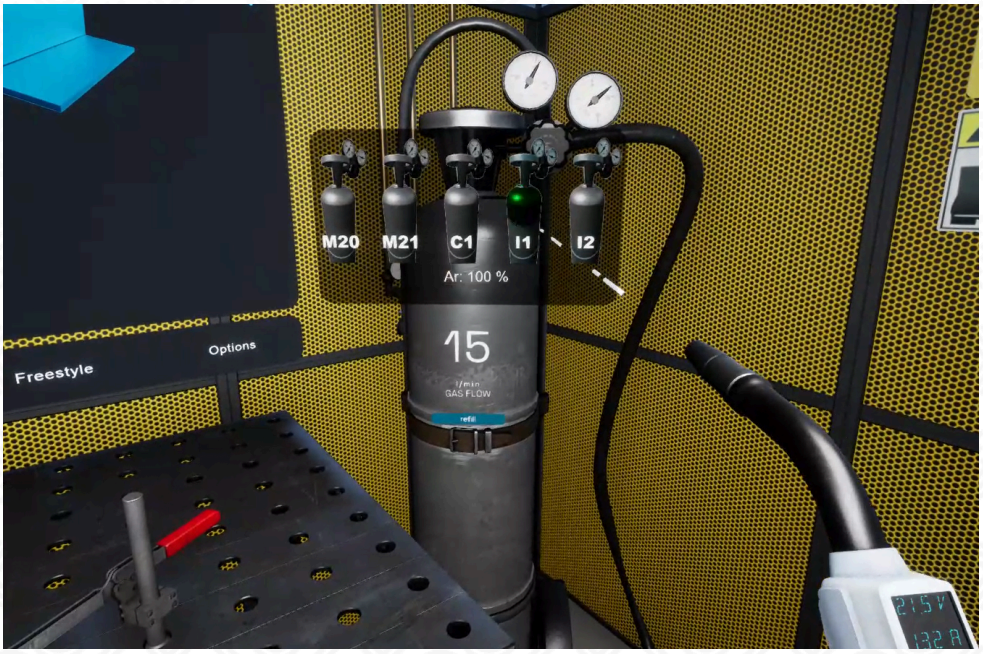
Training Interface Screen

One of the elements of the training station is a screen that allows navigation throughout the entire application and also displays the requirements for welding. WPS stands for Welding Procedure Specification, which is a set of guidelines for welders prepared by a welding engineer based on years of experience and tests conducted on materials. In the application, we show students all the parameters of the WPS, teaching them how to read and understand these guidelines so that when they start working on a real industrial workstation, they will already know how to work with the documentation.

Shielding Gas

The shielding gas supplied in the direction of the welding pool has a significant impact on the appearance and strength of the weld. Therefore, during the training process, we teach students how to read from the WPS the required amount of gas and how to set it properly. We also point out visual defects that may occur if the gas quantity is incorrect.

To adjust the gas quantity, position the welding torch pointer on the gas cylinder gauge. A dial with pointers will appear on the screen. Then, using your index finger, press and adjust the value by rotating it clockwise or counterclockwise. In addition to adjusting the gas quantity on the display on the cylinder, you can also observe the same values on a real-time pressure gauge, just like on a real welding site.



The application also allows the shielding gas to be changed, with the choice directly affecting the welding process. In MIG/MAG welding, the type of shielding gas influences arc stability, weld penetration, spatter levels, and the overall quality of the weld. For example, using CO2 provides deeper penetration and more spatter, while argon-based mixtures ensure smoother welds and better appearance.

Welding Mask

Safety is a crucial aspect in learning welding and subsequent work in this field. That's why in the welding simulator, we have implemented a welding mask with variable filter power adjustment. In the Academy module, we provide detailed explanations on how to adjust the DIN filter intensity to welding parameters. To change the filter power, simply aim at the mask on the welder, and then, using your index finger, press and adjust the settings using the dial. It's a straightforward solution that allows for precise control over safety during welding learning and practice.

Welding Power Sources

In the market, there are various GMAW welding power sources with different levels of sophistication and functionalities introduced by manufacturers. In our VR application, we have digitized the most popular features of welding power sources. The aim is to showcase the capabilities of welders that you may encounter in your professional work, without overwhelming you with excessive information.

Power Source Control Panel Knobs - on the right side of the control panel, there are two knobs. The choice of the main parameter (which depends on the country where welding is performed) determines whether you can adjust voltage and current or voltage and WFS (Wire Feed Speed). Both knobs allow independent parameter adjustments; nevertheless, in industrial applications, the synergy function is frequently used. This function harmonizes voltage and current parameters in the right proportion for optimal welding results.

Power Source Control Panel Display - the control panel display provides essential information about the welding parameters used in the process, including voltage, current, WFS (Wire Feed Speed), and wire diameter.

Synergy in welding refers to a function or mechanism within a welder that harmonizes various parameters, such as voltage, current, and others, to optimize the welding process. This means that adjusting one setting automatically fine-tunes other parameters accordingly, facilitating the operator in achieving optimal welding conditions without the need to manually adjust each parameter separately. The synergy function is particularly valuable in complex welding processes, enabling efficient and precise control over the entire welding operation.

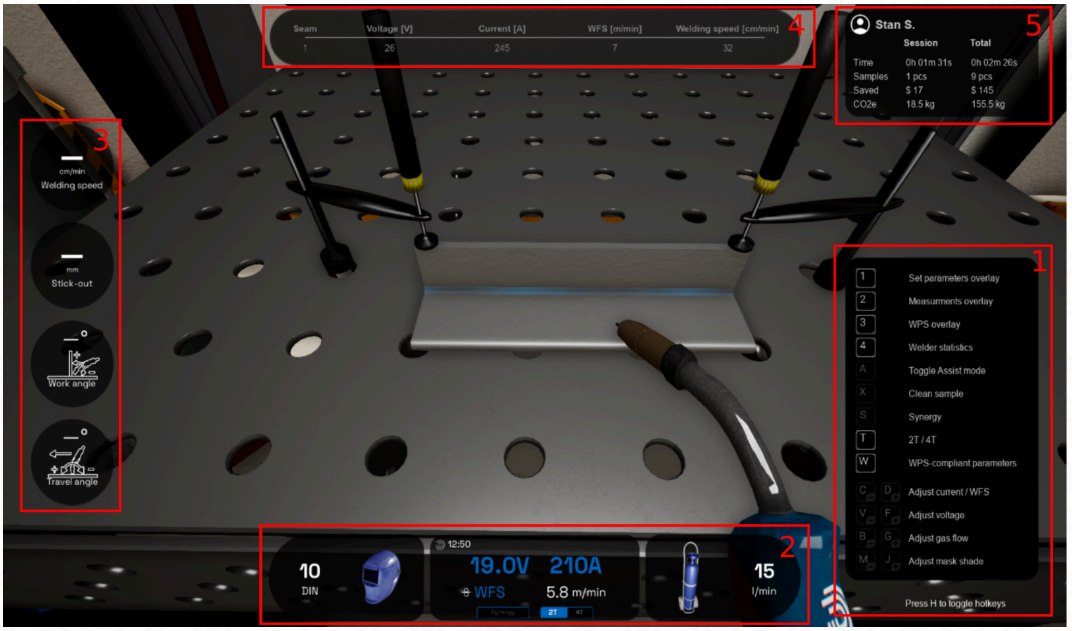
The **2T/4T** function on a welder refers to two operating modes that can be selected based on the operator's preferences and the type of work. Here is their significance:

- **2T Mode (Two Touch)** - in 2T mode, the operator needs to keep the welding button on the torch pressed continuously when they want to perform welding. Upon releasing the button, the welder stops the arc.

- **4T Mode (Four Touch)** - in 4T mode, the operator only needs to press the welding button to initiate welding, and then press it again to conclude the process. In this mode, there is no need to keep the button pressed throughout welding, which can be more comfortable during longer tasks.

HUD (Head-Up Display) - Instructor Support During Learning

HUD (Head-Up Display) in the context of instructor support during learning refers to a technology that delivers essential information directly within the instructor's field of view on a laptop screen (not within the student's field of view) while using a welding simulator. In practice, this means that the instructor can track the student's progress, monitor key welding parameters, or provide guidance, all directly on the laptop screen. With HUD, even a less experienced instructor or another person in the group has the ability to react immediately to the student's actions, providing guidance, corrections, or real-time feedback. This tool can enhance the efficiency of the learning process, enabling faster acquisition of skills and adaptation of welding techniques under the guidance of an experienced instructor.

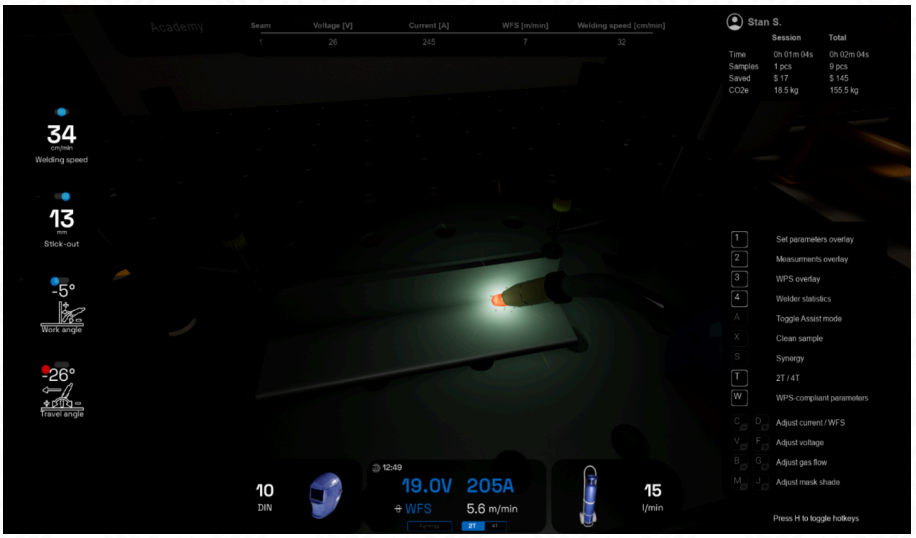


1. **Hotkeys**
   As a VR welding instructor, you can support your students from outside the VR world with specially assigned keyboard shortcuts. These shortcuts allow you for example to clear the sample, automatically set all welding parameters, or activate the assistant mode. **By pressing the "H" key on your keyboard**, a list of functions with tips will appear. This feature is designed to make your teaching process more efficient and interactive, enabling you to smoothly guide students through their learning experience in the virtual environment.

2. **Applied Technological Parameters**
   As an instructor, you have the capability to check the welding parameters set by your student to ensure they comply with the Welding Procedure Specification (WPS) guidelines. You have complete visibility of all settings on the welding power source, additionally the flow of shielding gas and the DIN shade of the protective mask's filter. If you believe any of the parameters are set incorrectly, you as an instructor can always suggest modifications to the student. This feature not only improves the

learning experience but also ensures compliance with safety and quality standards in welding.

3. **Parameter Precision Gauges**
   During welding without the assistant mode, the student must rely on previously developed muscle memory related to trajectory, angles, and speed. These indicators are extremely helpful, allowing the instructor and external observers to monitor whether the trajectory, angles, speed, and stickout are within acceptable levels. The more centrally the indicator is positioned on the gauge and is blue in color, the closer the parameter is to the ideal value. A red color on the indicator signifies deviations from the set values. Based on these indications, the instructor can advise the student in real time on what to improve.



4. **Welding Procedure Specification**
   The WPS parameters that the student is supposed to weld with are displayed on the Training Interface Screen. However, when outside the VR application, it's challenging to check if the student has set them correctly. Therefore, the required parameters are displayed at the top of the screen. You can compare these with the parameters set in the **Applied Technological Parameters** section to ensure that the student is adhering to the guidelines and working according to established standards.

5. **Trainee Statistics**
   In a very straightforward manner, you can assess how much time the training required to elevate the student to their current level of knowledge. In the Trainee Statistics tab, you will also find other intriguing details like the cost saved by conducting the training in VR and the equivalent of unproduced CO2. The statistics are divided into values from the beginning of the account creation and the current session.

Development and Upgrade

At Dig in Vision, we are committed to continuous improvement of our products and services. We believe that development is an ongoing process, and our commitment to innovation is key to delivering value to our users. We regularly update our manuals and support materials to ensure they contain the latest information. Users will be notified of important updates through our communication channels.

We encourage you to follow our social media profiles. It's a great way to stay up-to-date on the latest company news and developments.