ROBOTICS

Application manual

KEMPPI A7 MIG Welder 350/450

Trace back information:
Workspace Main version a483
Checked in 2022-11-16
Skribenta version 5.5.019

Application manual

KEMPPI A7 MIG Welder 350/450

RobotWare 6.14

Document ID: 3HAC086375-001

Revision: A

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Table of contents

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Overview of this manual

About this manual

This manual describes the options Kemppi A7 Interface and Weld Editor and contains instructions to configure it.

> **Note**
>
> It is the responsibility of the integrator to provide safety and user guides for the robot system.

This manual should be read before installing and commissioning of a Robotic Arc Welding system with a Kemppi A7 power source.

Prerequisites

The reader should have the required knowledge of:

- Mechanical installation work
- be familiar with the RAPID programming language
- be familiar with system parameters and how to configure them

> **Note**
>
> Before any work on or with the robot is performed, the safety information in the product manual for the controller and manipulator must be read.

References

References	Document ID
Operating manual - IRC5 with FlexPendant	*3HAC050941-001*
Operating manual - RobotStudio	*3HAC032104-001*
Operating manual - Seam tracking with Weldguide III and MultiPass	*3HEA802921-001*
Technical reference manual - RAPID Instructions, Functions and Data types	*3HAC050917-001*
Technical reference manual - RAPID Overview	*3HAC050947-001*
Technical reference manual - System parameters	*3HAC050948-001*
Application manual - Arc and Arc Sensor	*3HAC050988-001*
Application manual - Controller software IRC5	*3HAC050798-001*
Application manual - MultiMove	*3HAC050961-001*
Application manual - Production Screen	*3HAC050964-001*

Revisions

Revision	Description
A	Published with RobotWare 6.14.

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1 Introduction to Kemppi A7 interface

About Kemppi A7 MIG Welder interface

This manual describes the ABB Robotics IRC5 interface for:

- A7 MIG Welder 350/450

Requirements

The power source must meet the following requirements:

- A7 MIG Welder Robot Interface Firmware >= 1.05.00.0
- A7 MIG Welder Firmware >= 1.04.00.0 OR, if S/N, >= 3018192 Firmware 2.01
- Fieldbus Interface for DeviceNet/ProfiNet or EtherNet/IP

Overview

The A7 MIG Welder power sources are based on top of the class inverter technology. They belong to the high-end system class of Kemppi products.

There is a wide range of processes for you to choose the one that suits your application:

- MIG, 1-MIG
- Pulse, Double Pulse
- Brazing
- Cladding
- WiseRoot+
- WiseThin+
- WiseFusion
- WisePenetration

The system can be configured to contain an optimal choice of just the right welding programs for the application. There are welding programs available for all the common filler wire and shielding gas combinations for mild steel, stainless steel and aluminum.

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2 Installation

2.1 Introduction

Robot controller software

Robot prerequisites:

- IRC5 robot controller with main computer DSQC1000 or later
- RobotWare version 6.14 or later with the following options:
- - [633-4] RobotWare Arc
  - [637-1] Production Screen
- One of the following industrial networks:
- - [709-1] DeviceNet Master/Slave
  - [841-1] EtherNet/IP Scanner/Adapter
  - [888-2] PROFINET Controller/Device
- The following option is recommended in order to use the *Partdata* concept within the welddata editor:
- - [812-1] Production Manager

RobotStudio

RobotStudio software:

- RobotStudio version 2022 or later

Limitations

Currently only the first arc system is supported with this interface. If more than one welder is connected per robot, the arc sub-option *Standard I/O Welder* is required.

Tuning of weld speed and weld parameters is no longer supported by RobotWare Arc GUI.

Kemppi A7 add-in

The Kemppi A7 add-in consists of the following software components:

- Ready to weld interface to control a Kemppi A7 350/450 welder
- Logbook Viewer as RobotStudio add-in to download the logbook entries from any welder connected to a network
- Graphical weld data editor
- Graphical weave and track data editor
- Graphical application for manual functions such as
- - Process blocking
  - Wire feed (forward/backward)
  - Purge gas
- Graphical widget displaying run-time data

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2.2 Hardware setup

Introduction

The ABB preferred connection to the welder is to connect the LAN port of the welder to LAN2 or WAN on the IRC5 controller. However, this is not mandatory but it is a convenient way to set up the system it gives access to the welder and the robot controller from RobotStudio.

This connection is only used with the RobotStudio add-in to download the logbook entries. Furthermore, it is possible to get access to the welders Web UI from RobotStudio by launching a web browser.

The I/O based communication to the welder which is needed to control the welder is done via a fieldbus interface and not through the LAN port on the welder.

A switch must be added if the system is a MultiMove system or if the LAN port is connected to a different network.

It is recommended that switches used in the I/O network support *Quality of Service* (QoS). I/O devices mark their packets with a priority value. The priority value is used in order to get better I/O data throughput and shorter delays on the network. Switches and routers are then able to differentiate the I/O devices critical from the other non-critical traffic. To do this, the switches and routers must support Quality of Service.

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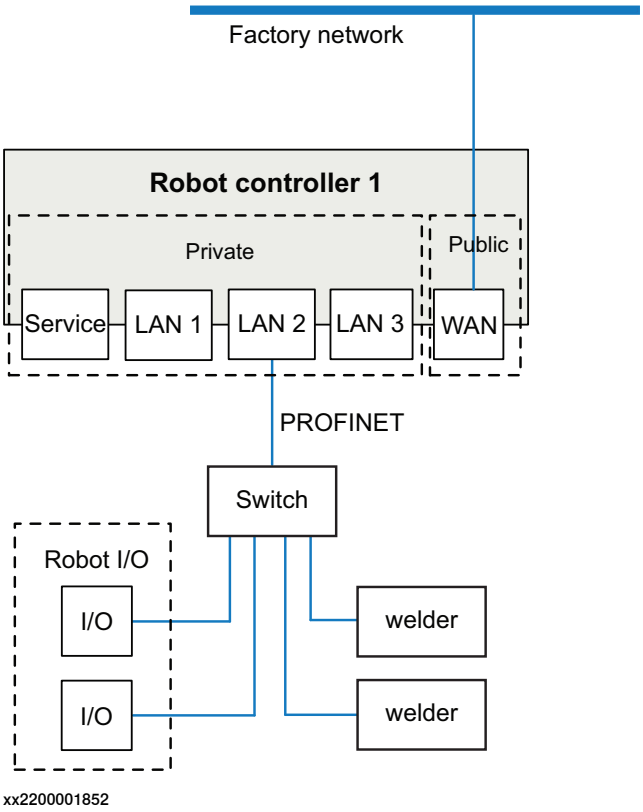
Intended use of WAN and LAN ports

The WAN port is a public network interface to the controller, typically connected to the factory network with a public IP address provided by the network administrator.

The LAN ports are intended for connecting network-based process equipment to the controller, for example, industrial networks, cameras, and welding equipment. LAN 2 can only be used as a private network to the IRC5 controller.



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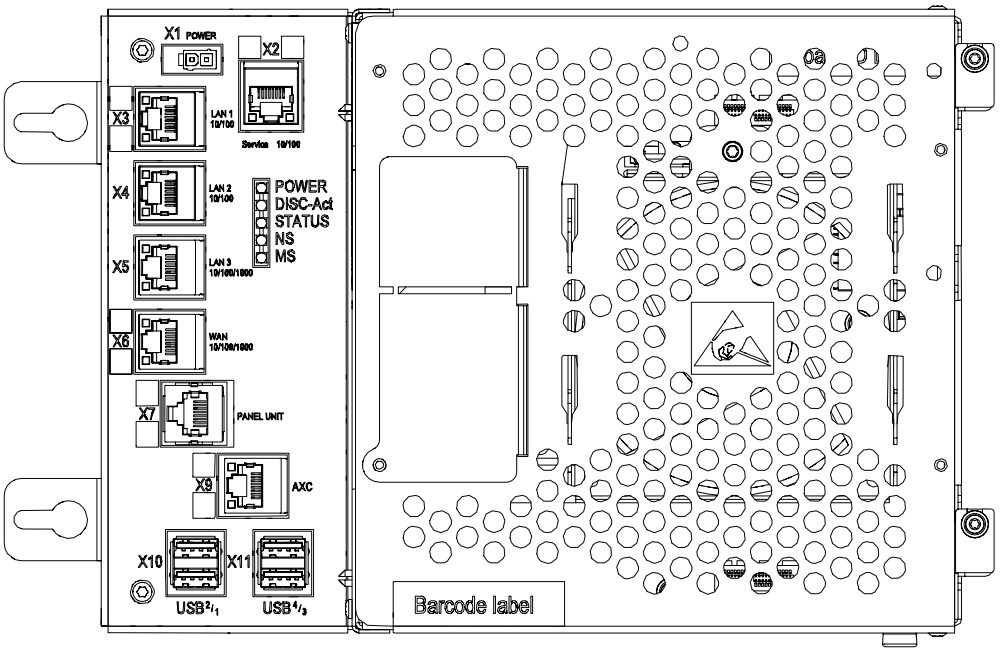
Connecting to the IRC5 controller

Connect an Ethernet cable between the robot controller LAN2 port and the Kemppi A7 welder Ethernet port. The following illustration shows an overview of the computer unit.



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X4	LAN2
X5	LAN3

Welder LAN port

The LAN port (service port) is located on the back of the robot interface unit on the welder. If connecting the welder to the IRC5 controller, make sure to use a static IP address and turn of DHCP.

Additional information of the robot interface unit can be found in the *Operator Manual* and the *Integration Guide* of the welder.

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LAN connection to the left, Fieldbus connection to the right.

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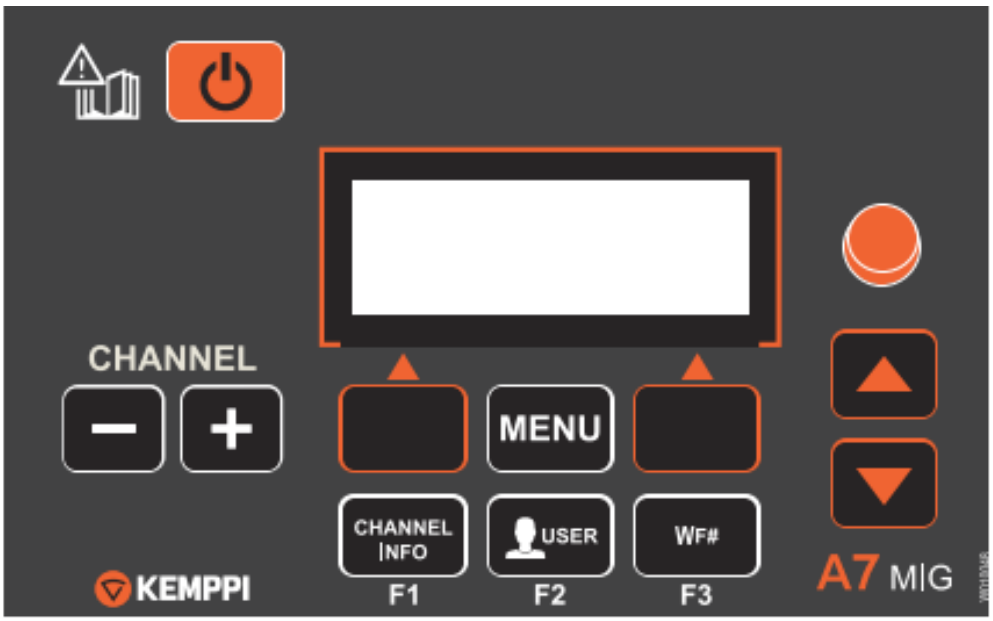
IP address of welder

The web user interface starts up automatically when the power is turned on. However, the network settings must be configured from the setup panel before access is possible to the Web UI from the computer connected to the web user interface server.

Go to the **Main menu** > **Robot** > **Network settings**, and configure the *DHCP enabled*, *IP address*, *Subnet mask*, and *Gateway* parameters to fit the network environment.



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To access the web interface, start a browser and enter the IP address.

Additional information can be found in the *Operator Manual* and the *Integration Guide* of the welder.

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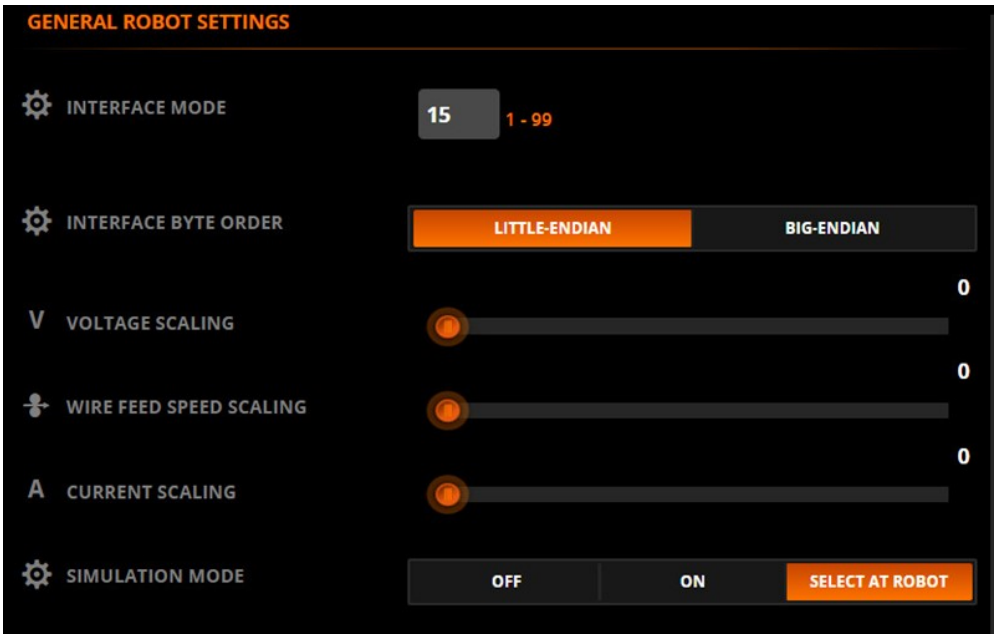
2.3 A7 general robot settings

A7 power source

The following settings need to be set in the A7 power source to work with the robot interface. The settings can be found using the web UI. Select **Welding System** and browse to **General Robot Settings**.



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2.4 Software setup

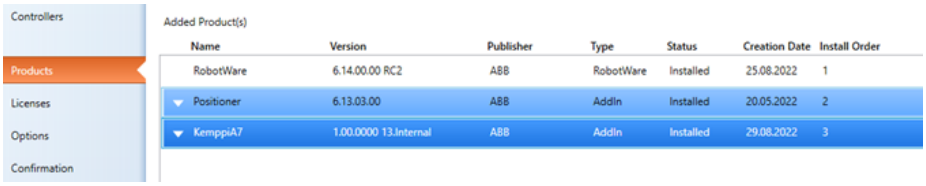
Download Kemppi A7 package

In RobotStudio, download the Kemppi A7 Package from the **Add-Ins** tab (common tags: RobotWare-Addin) and install it.

Build the robot system

1 Start **Installation Manager** and build the robot system.

2 In the **Products** tab, add the **KemppiA7** product. No license is required for the package.



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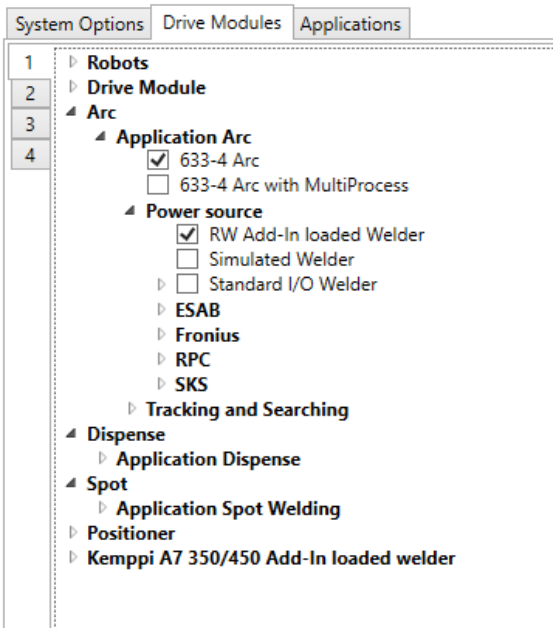
3 In the **Drive Modules** tab, select **RW Add-In loaded Welder** for each associated welding robot.



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4 For each welding robot, select the option **Install Power Supply** and select the fieldbus.

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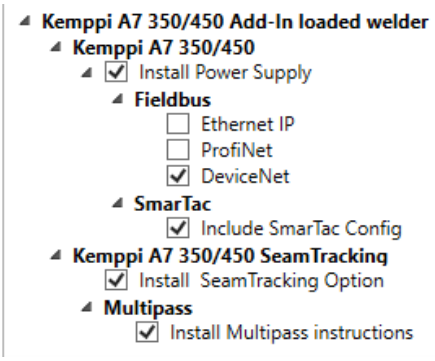
5 If the system has the SmarTac option, select **Include SmarTac Config**. This will load configuration files to use the Kemppi touch sense function.



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6 If Seamtracking (TAST) is desired, select **Install SeamTracking Option**. This requires controller the option *Tracking Interface*.

7 If recording and replaying welding paths is desired, select **Install Multipass instructions**.

8 Apply the settings and download the system to the controller.

RobotWare functionality

The generic RAPID objects are described in *Technical reference manual - RAPID Instructions, Functions and Data types*. All documents are listed in *References on page 7*.

trackdata

The data type `trackdata` and other arc-specific RAPID objects are described in *Application manual - Arc and Arc Sensor*.

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3 Fieldbus configuration

3.1 Introduction

Introduction

The Kemppi A7 Add-In package is delivered with pre-configured fieldbus configuration files for PROFINET , Ethernet/IP, and DeviceNet.

Note

All I/O signals are pre-configured as defined in the *A7 Integration Guide* based on *I/O table 15*. Additional information can be found in the *Operator Manual* and *Integration Guide* provided by Kemppi.

Default I/O board address

Fieldbus	Network	Default I/O board address
DeviceNet	N/A	Robot 1 -DN_Address 40 Robot 2 -DN_Address 41 Robot 3 -DN_Address 42 Robot 4 -DN_Address 43
EtherNet/IP	LAN2 (X4)	Robot 1 -IP_Address 192.168.125.60 Robot 2 -IP_Address 192.168.125.61 Robot 3 -IP_Address 192.168.125.62 Robot 4 -IP_Address 192.168.125.63
ProfiNet	LAN3 (X5)	Robot 1 -IP_Address 192.168.0.2 Robot 2 -IP_Address 192.168.0.3 Robot 3 -IP_Address 192.168.0.4 Robot 4 -IP_Address 192.168.0.5

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3.2 EtherNet/IP configuration

3.2.1 Installation

Software prerequisites

Robot prerequisites:

- IRC5 robot controller with main computer DSQC1000 or later
- RobotWare version 6.14 or higher with one of the following Arc sub-options (power source interface):
  - Standard I/O Welder
  - Kemppi A7 Product add-in
- RobotStudio version 2022 or later

Hardware prerequisites

Required:

- 1 Ethernet cable

Optional:

- 1 Ethernet switch/hub
- 2 Ethernet cables

Software installation

Download the Kemppi A7 Package and install it. Build the robot system. See *Software setup on page 18*.

All parameters for the EtherNet/IP based communication will be automatically installed with the IP address mentioned earlier.

Make sure the Ethernet cable/switch is connected to LAN2.

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3.2.2 Kemppi A7 settings

Changing the A7 network settings for web UI

Change the IP settings as described in section *IP address of welder on page 16*, to be able to access the welder using the web UI.

Changing the A7 network settings for the IRC5 communication

Follow these steps to change the network settings for IRC5 communication:

1. Connect to the service port on the robot interface unit with the Ethernet cable connected to your PC (LAN connection to the left).

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2. From a web browser address bar, enter the defined IP address.
3. In the Kemppi web UI browser, browse to **Settings** and select **Fieldbus**. The configuration parameters can be modified here.

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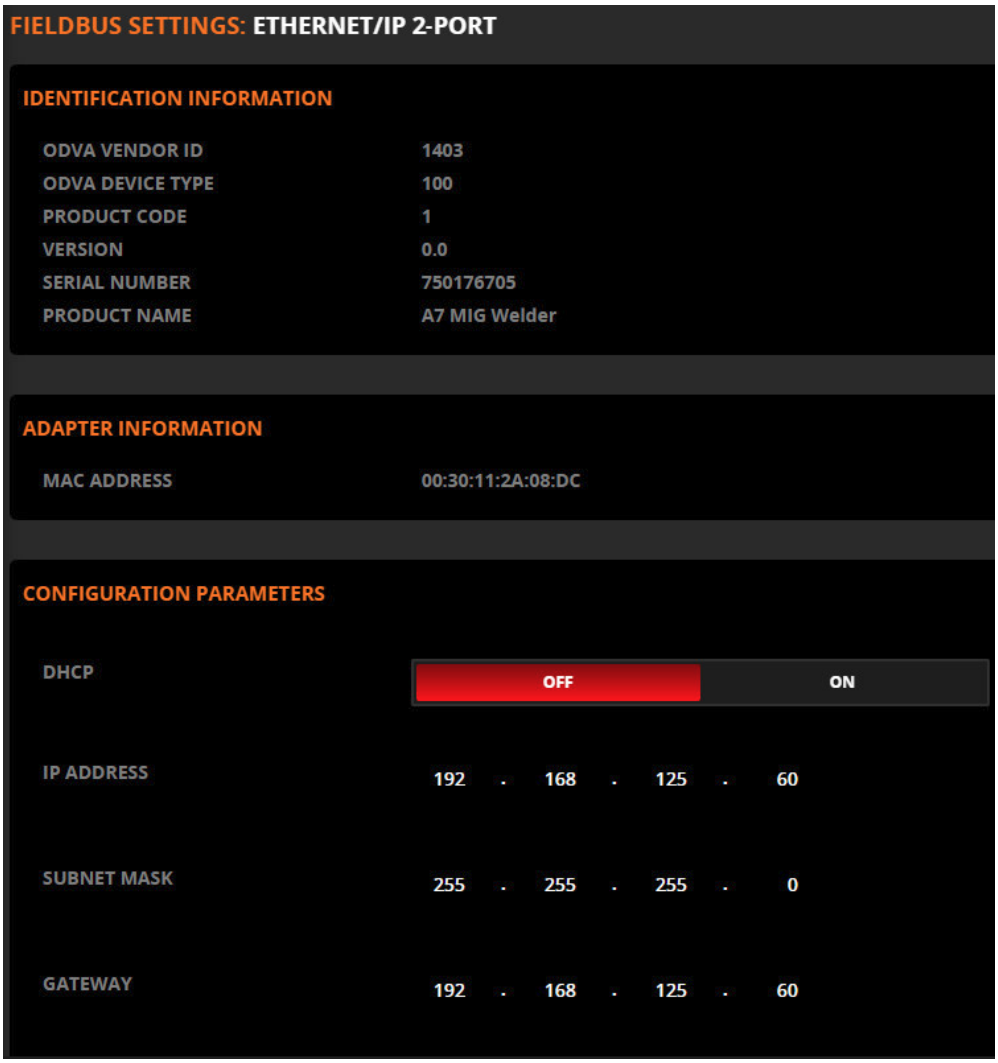
3.2.2 Kemppi A7 settings
Continued

Fieldbus settings in web UI



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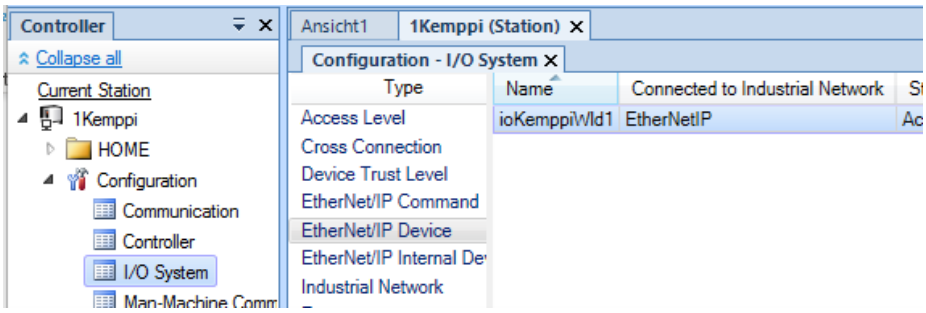
3.2.3 Changing the IRC5 communication settings

IRC5 EtherNet/IP device

Use the following procedure to configure the communication between the IRC5 controller and the A7 welder.

1. In RobotStudio, double-click the system name.
2. In the **Controller** panel, expand **Configuration** and select **I/O System**.
3. In the **Configuration - I/O System** panel, select **EtherNet/IP Device** and select the Kemppi A7 power supply to be configured (*ioKemppiWld1*).



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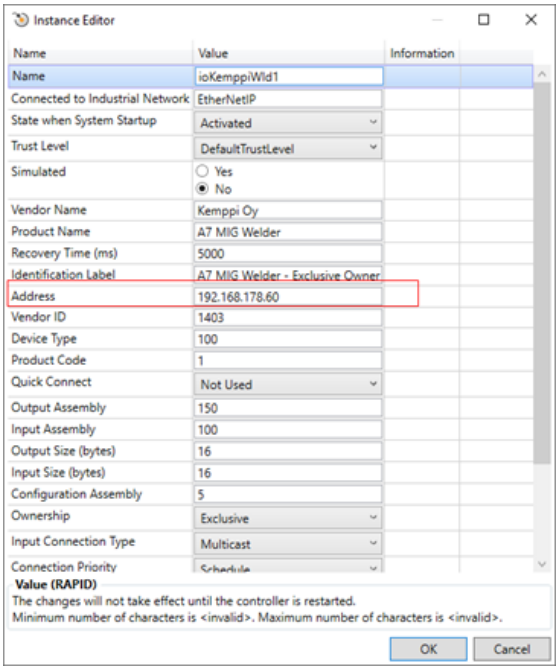
4. In the **Instance Editor**, enter the IP address to use for the EtherNet/IP Device *ioKemppiWld1* (welder connected to robot 1) and click **OK**.



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IRC5 IP settings

Use the following procedure to configure the communication between the IRC5 controller and the Kemppi A7 welder.

1. In RobotStudio, double-click the system name.

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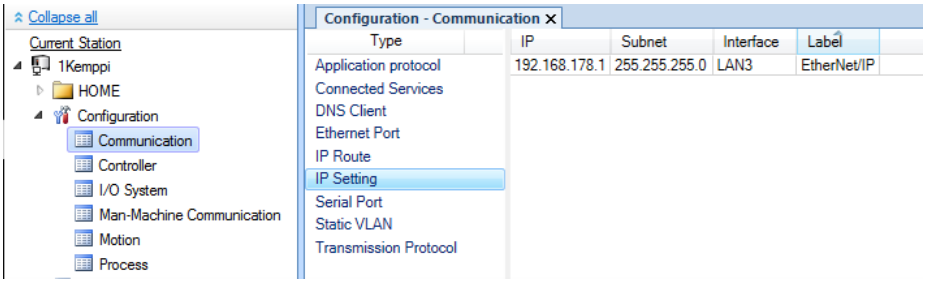
3.2.3 Changing the IRC5 communication settings
Continued

2 In the **Controller** panel, expand **Configuration** and select **Communication**.

3 In the **Configuration - Communication** panel, select **IP Setting**.



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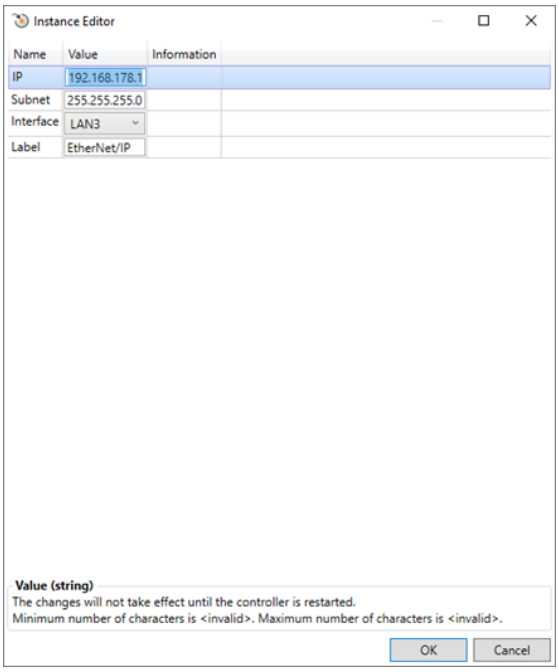
4 In the **Instance Editor**, enter the IP address to use for the EtherNet/IP master and click **OK**.

5 Change **Interface** to **LAN3** (isolated network) and restart the controller



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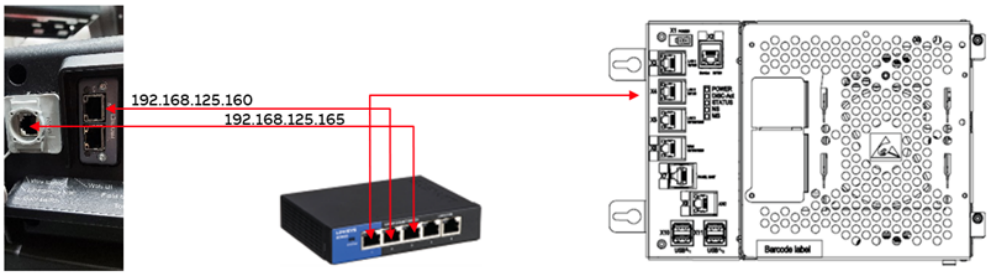
3.2.4 Accessing the welder's service port from IRC5 controller

Use the following procedure to access the web UI from the IRC5 service port.



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1. Define the Kemppi network settings (192.168.125.165), see *Changing the A7 network settings for the IRC5 communication on page 23*. This will set the service port of the power supply to the IRC5 private network.
2. Connect the X4 Lan 2 to an Ethernet switch, see *Hardware prerequisites on page 22*.
3. Connect the Kemppi A7 Ethernet IP and service port to the Ethernet switch/hub.

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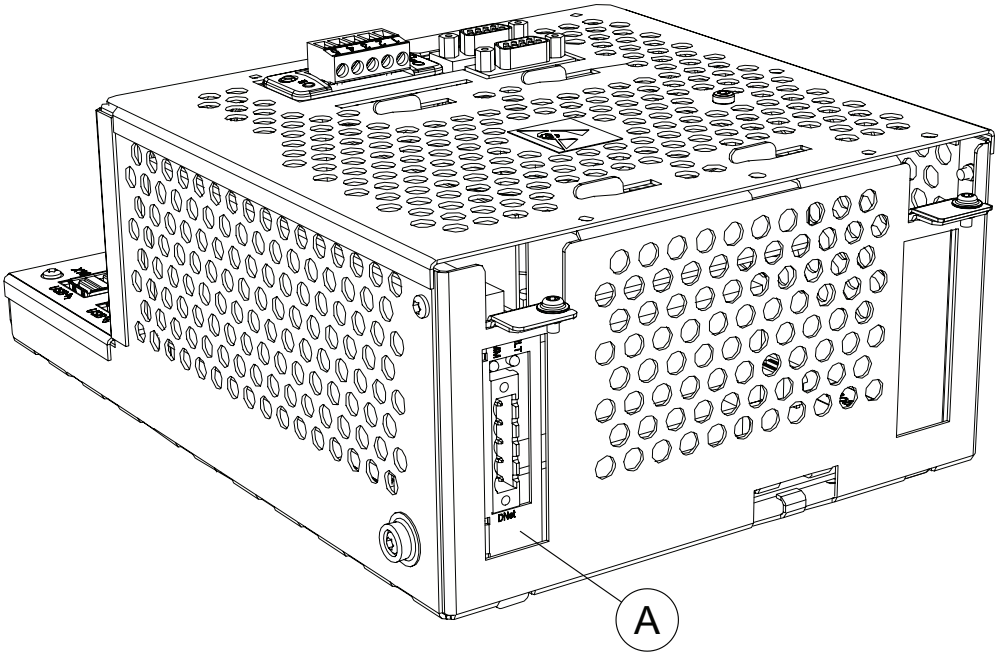
3.3 DeviceNet configuration

Introduction

The DeviceNet network for IRC5 is running on a single channel PCI Express board in the IRC5 main computer. The DeviceNet board, DSQC1006, requires the main computer DSQC1000. With option *DeviceNet Master/Slave*, the IRC5 controller can act as a master, slave, or both, on the DeviceNet network.

Connections

The I/O network is connected to the DeviceNet PCI Express board, DSQC1006, on the main computer. The DeviceNet PCI Express board is a single channel board that can act both as a master and a slave simultaneously on the DeviceNet network. The following figure illustrates the location of the PCI Express board in the main computer unit.



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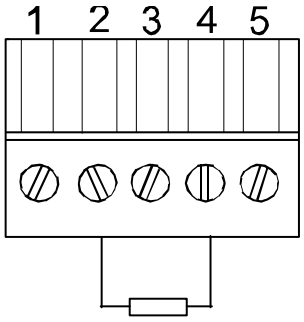
Termination resistors

Each end of the DeviceNet network must be terminated with a 121 ohm resistor. The two terminating resistors should be as far apart as possible. The technical specification of the termination resistor is: 121 ohm, 1 %, 0.25 W metal film resistor

The termination resistor is placed in the cable connector. There is no internal termination on the DeviceNet PCI Express board.



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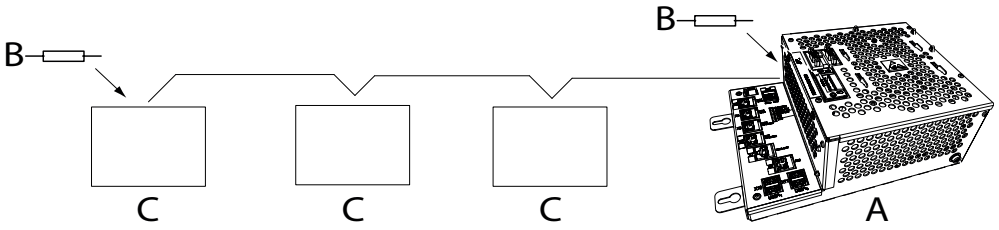
The following illustration shows an example of how to terminate the DeviceNet network.



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A	DeviceNet PCI Express board
B	Termination resistor
C	I/O device

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3.4 PROFINET configuration

Introduction

The PROFINET network is running on the IRC5 main computer and does not require any additional hardware. PROFINET as described in this manual requires the main computer DSQC1000.

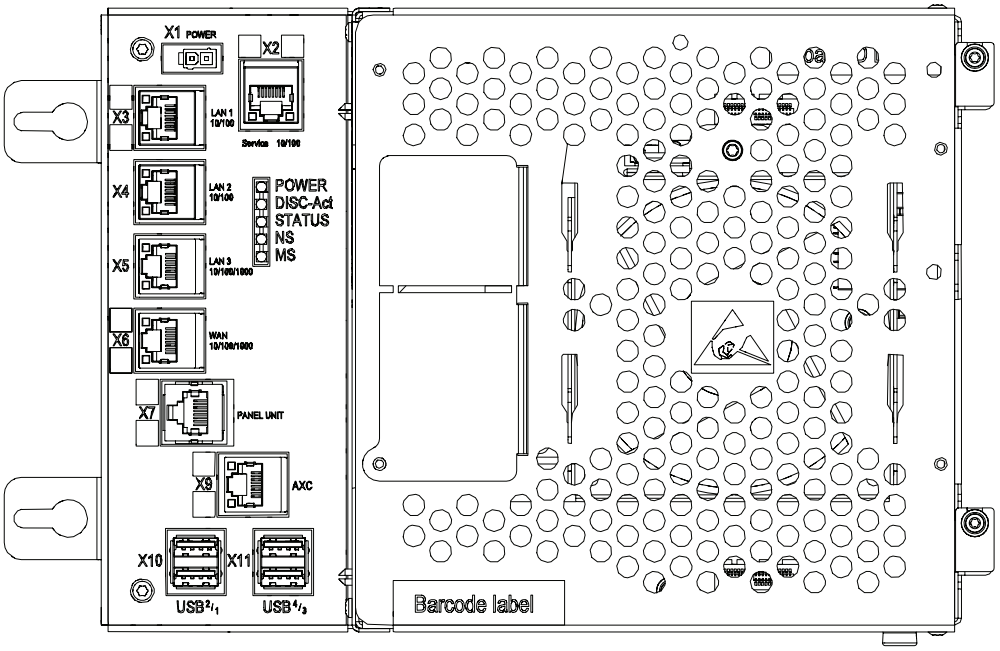
Option *PROFINET Controller/Device* is required.

Default gateway

There are multiple default gateways in the system. Hence, it is possible to have two different default gateways in the system, one for the non-PROFINET traffic and one that only manages the PROFINET interface and its traffic. So, while using option *PROFINET Controller/Device*, the LAN3 port is used only for PROFINET traffic.

Connections

The I/O network can be connected to one of the the Ethernet ports WAN, LAN 2, or LAN 3 on the main computer. The following figure illustrates where the Ethernet port connectors, are placed on the main computer.



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X4	LAN2
X5	LAN3

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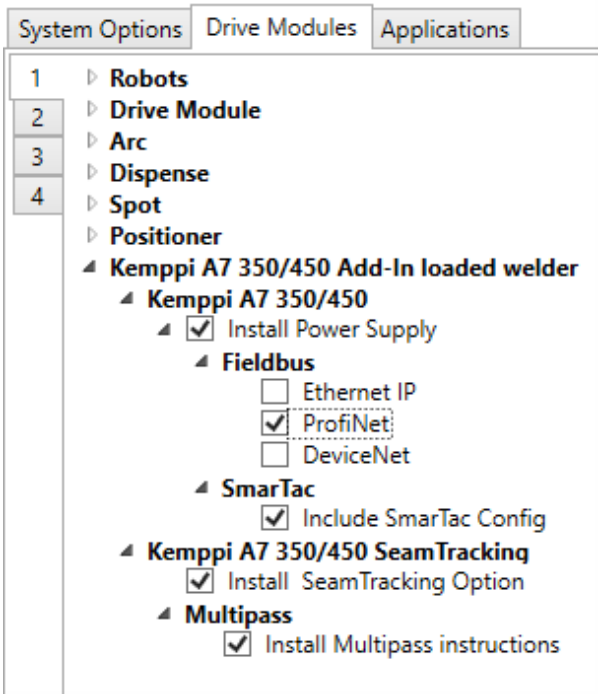
The pre-defined configuration that is installed when selecting the PROFINET fieldbus for the welder assumes that LAN3 is used as an isolated network for the PROFINET communication.



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Connect the Ethernet Cable to LAN3 or to a switch connected to LAN3.

The PROFINET configuration is created with the I/O Engineering Tool in RobotStudio, and can be found in `HOME:/Arc/Kemppi_A7/PNET` along with the used GSDML file.

To change the IP address and station name, if needed, use the I/O Engineering Tool. It is recommended to use the tool in offline mode (not connected to a robot controller) to avoid a slotted device configuration which will not work with the predefined I/O.

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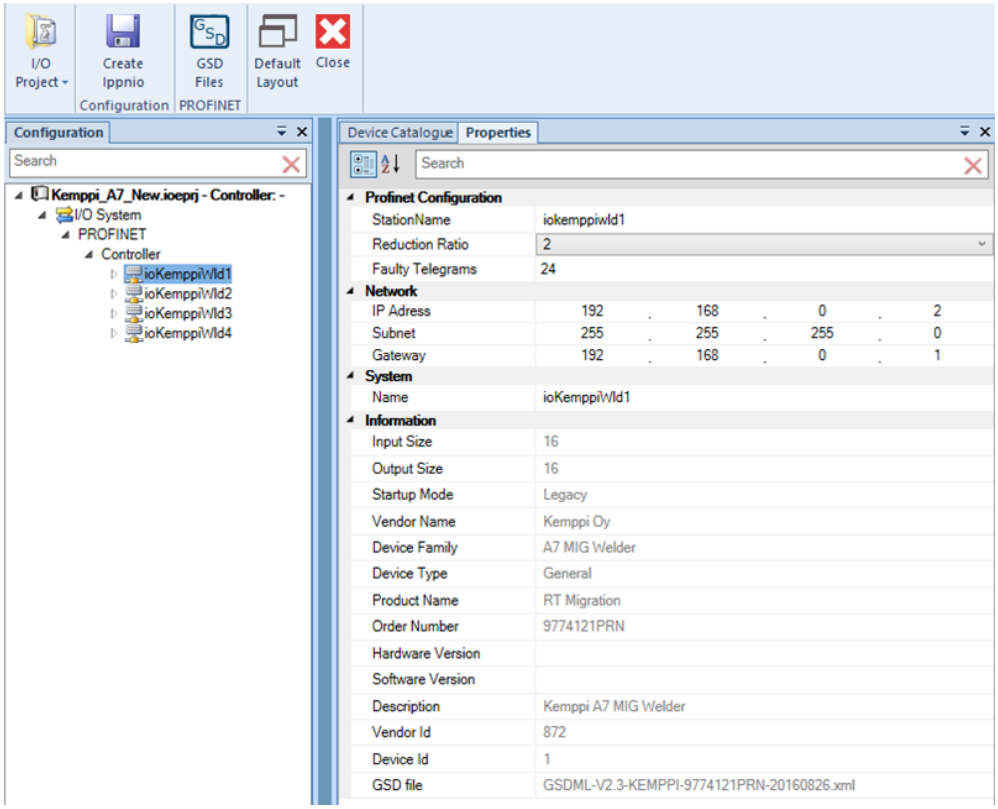
Device properties

The following graphic shows the predefined configuration for PROFINET device *ioKemppiWld1*.



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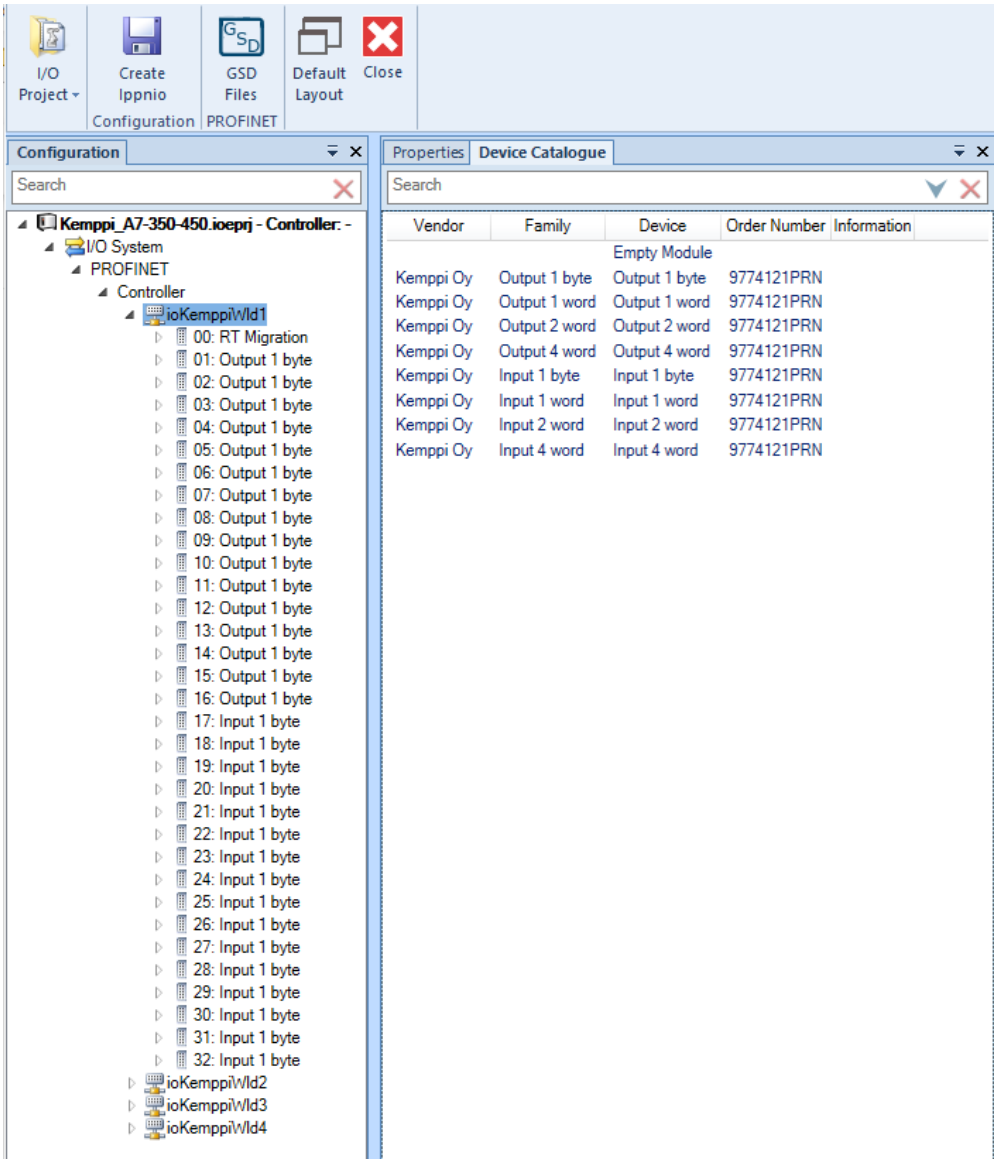
I/O slot configuration

The I/O device uses 16 byte output and 16 byte input. Each slot is configured to use 1 output byte and 1 input byte.



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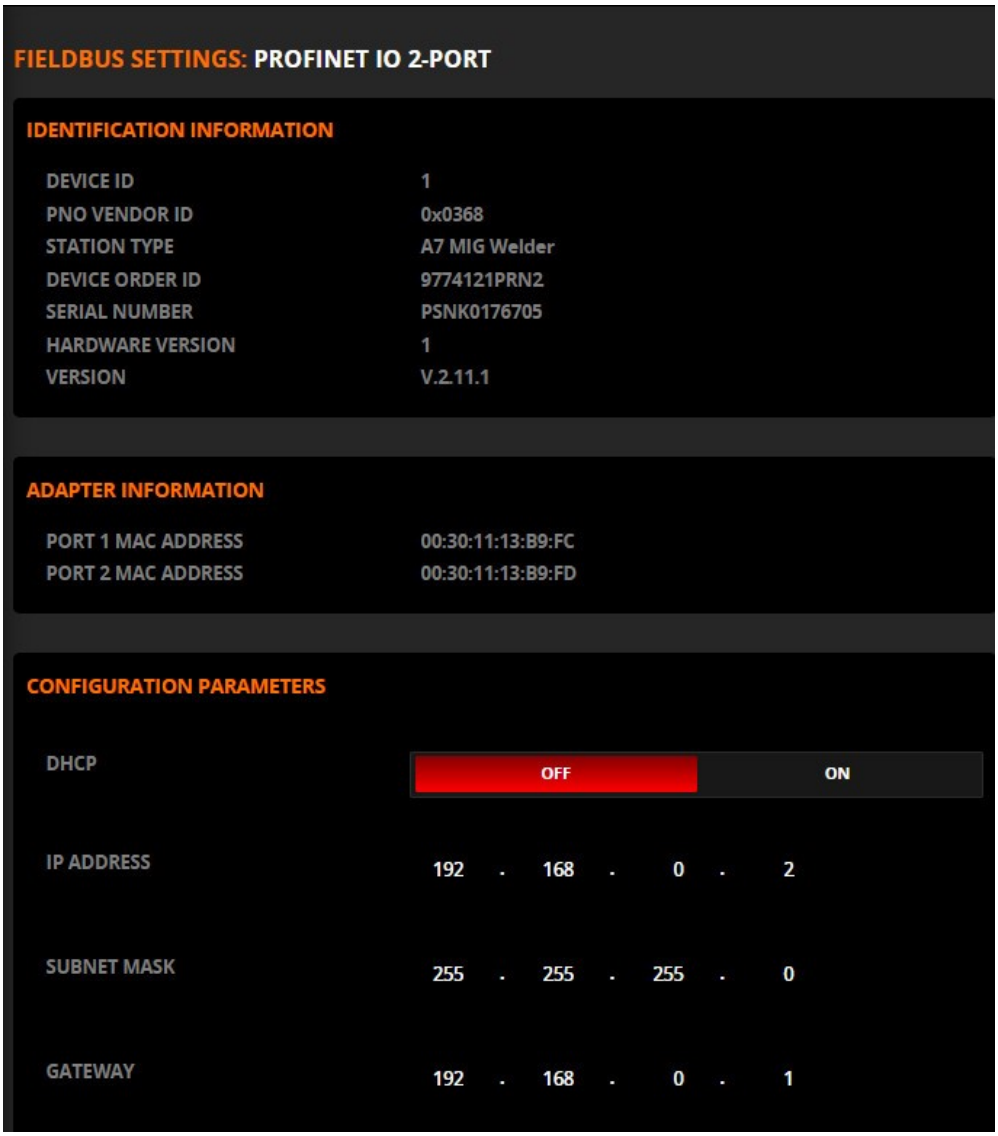
Fieldbus settings A7 web

The PROFINET settings on the welder can be verified using the web UI, in **Settings** > **Fieldbus**. The fieldbus settings are based on the default configuration installed with the Kemppi A7 add-in.



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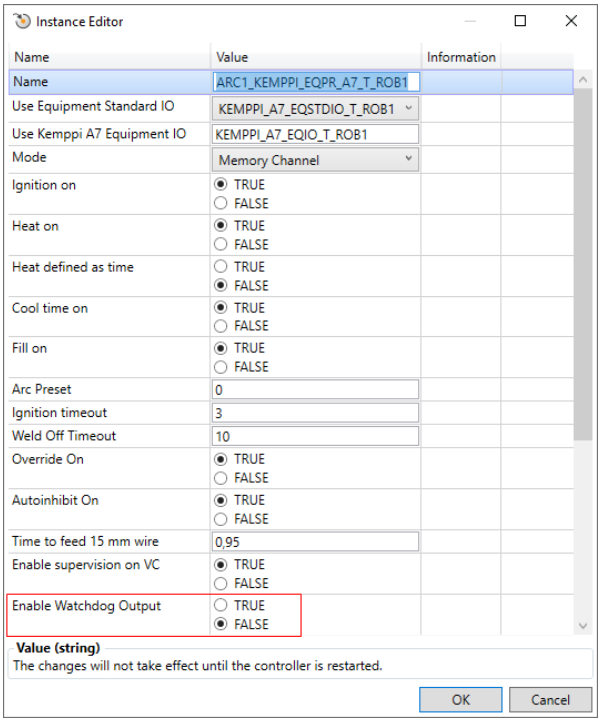
4 Watchdog functionality

Watchdog in IRC5

The Kemppi A7 interface has built in support for a watchdog functionality. The watchdog frequency is a fixed frequency of 0.5 Hz and cannot be changed in the robot controller. The functionality can be activated in the configuration (topic *Process*, PROC.cfg) in the type *Kemppi A7 Arc Equipment Properties* by setting *Enable Watchdog Output* to TRUE. In addition, the feature needs to be activated in the power source. See *Watchdog in A7 welder on page 35*.



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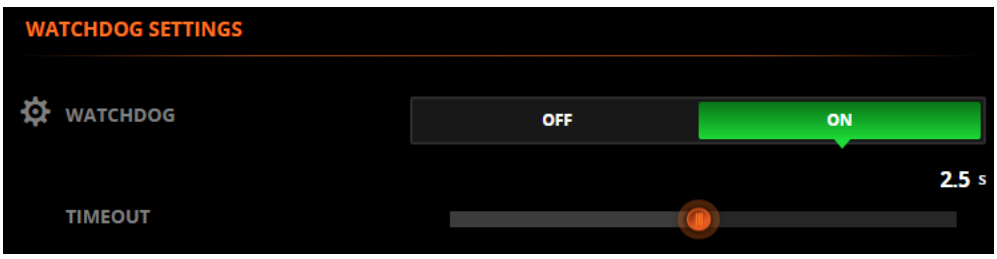
Watchdog in A7 welder

The watchdog can be enabled and disabled either on the front panel or using the web UI. The following screenshot shows the configuration done with the web UI.

The settings can be found in **Welding Settings** > **Welding System**.



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Continued

To use the watchdog with the fixed 0.5 Hz frequency generated by the A7 Interface, the timeout needs to be set higher than 2 seconds. Set it to 2.5 seconds.

Error 132

Error 132 is a communication error. This error typically indicates a communication problem on the fieldbus between the A7 welder and the robot controller.

5.2.5 Robot interface errors

Code	Description	Severity
131	FIELDBUS ERROR Failed to initialize the fieldbus card during start-up. The fieldbus module is missing, has been incorrectly connected, or is damaged.	Serious error
132	COMMUNICATION ERROR No connection to the robot. Fieldbus cable is broken or detached, or there is a robot failure or shutdown. Welding is interrupted when connection is lost.	Error
133	EMERGENCY STOP A user has pressed the emergency stop button. Welding is immediately interrupted.	Error

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Note

Error 132 can also be related to the watchdog. If communication to the robot controller is running, check the watchdog settings or switch it temporarily off to verify if error 132 disappears as no dedicated error message or error code is shown for a watchdog error.

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5 Kemppi Interface Modes

Interface modes

Currently the Kemppi A7 welder interface has support for two modes, which will be customized by selecting the mode in the system parameters.

Note

A warm start is required if the mode is changed.

Interface mode	Description
Memory Channel	The welding parameters (except for pre flow, post flow, and purge time) are stored and set in the power supply using memory channels. The memory channel number is set in the Weld Data editor.
Online Control	The basic parameters such as the synergic line are configured in the memory channel but Wire feed speed, Fine tuning, and the dynamics can be set from the robot.

Setting the interface mode

The interface mode can be set in the **Configuration Editor** in RobotStudio or on the FlexPendant.

1. In the **Configuration Editor**, select the topic **Process**.
2. Select the type **Kemppi A7 Arc Equipment Properties**.
3. Select the robot and set the desired interface mode.
4. Restart the controller.

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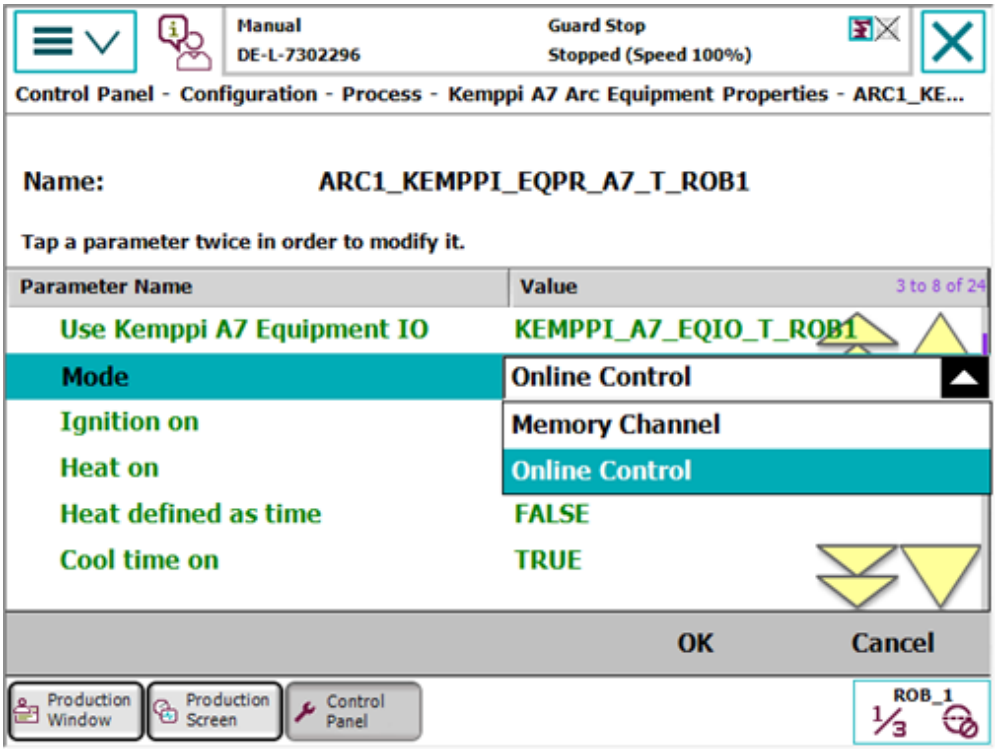
Continued

The configuration editor on the FlexPendant



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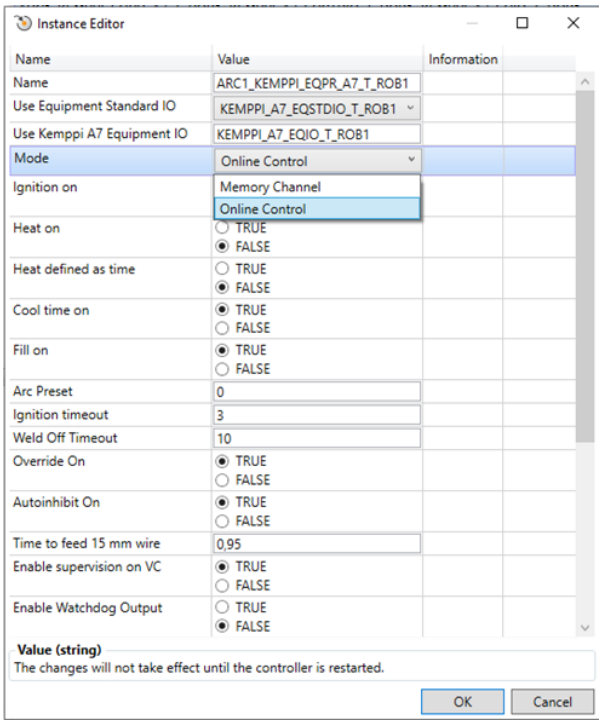
The configuration editor in Robotstudio



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6 Weld Editor Interface

6.1 Introduction

Overview

The graphical user interface for the FlexPendant is called the *Weld Editor Interface*. The information is presented in widgets, which are small applications available when starting the application *Production Screen* on the FlexPendant. The Weld Editor Interface consists of tabs where the user can process and modify information such as:

- Ignition parameter
- Heat parameters
- Weld parameters
- End parameters

Unlike the regular data editor, it combines seam data and weld data for intuitive process setup and allows them to be modified at the same time. The Weld Data Editor also validates the data based on information from the welder. The data to edit can be selected either by moving the program pointer to a weld instruction or by using the last weld and seam data.

Widget screens

The default Kemppi A7 installation contains a weld status widget. It is placed on widget page 1. The widget displays the following useful information:

- Program pointer
- Seam name
- Current arc instruction data

  For example, `(1) p22, sm2, wdWeave11, wv1` (1 = Arc instruction sequence number).
- Current weld speed
- Current weld mode
- In **Memory Channel**, the channel number is shown
- In online control mode, the additional information such as wire feed speed, fine tuning, and dynamics are shown
- Process (currently active process)
- Process status, weld on/off, active weld error, real-time voltage and current

To switch between robots in a MultiMove setup, use the robot task selector in the upper right corner of the widget.

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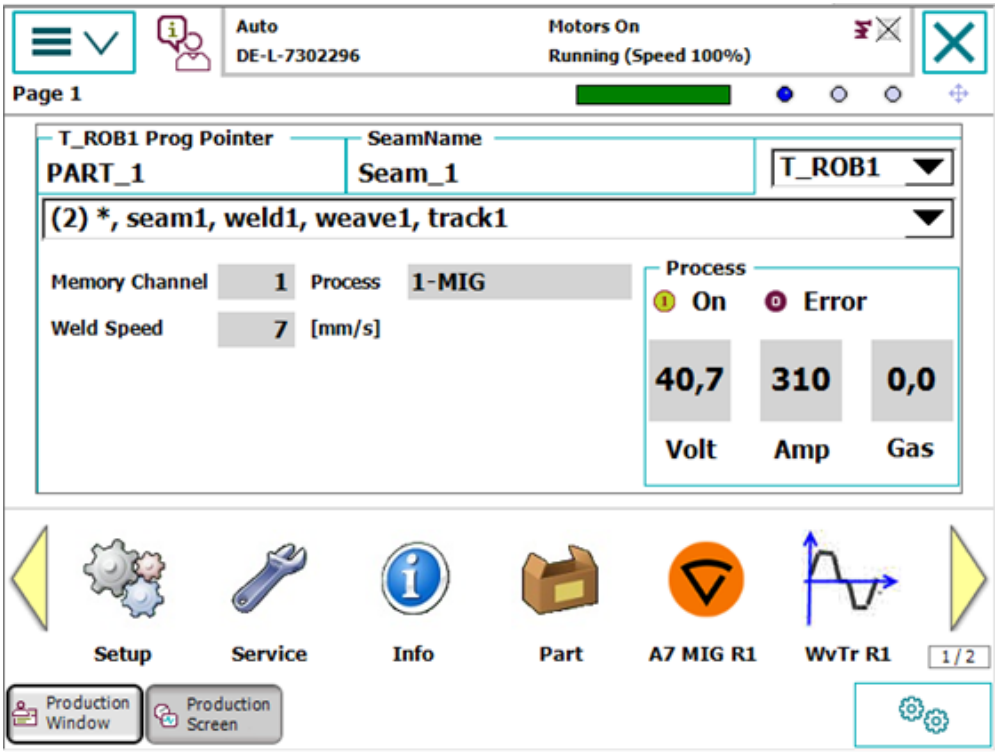
Memory Channel mode



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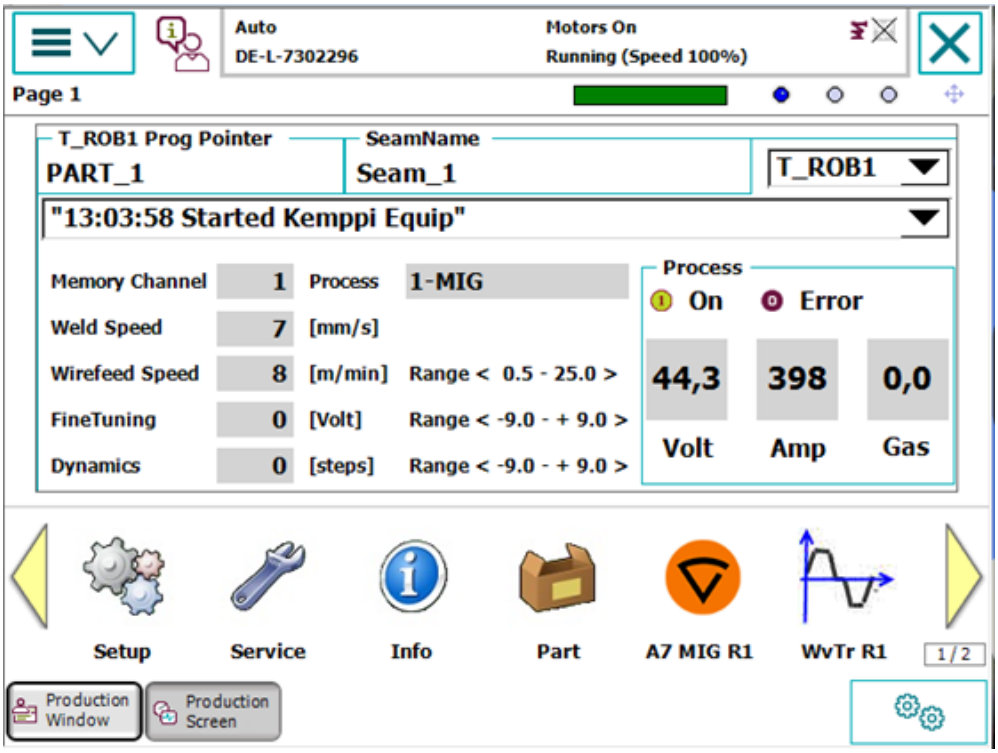
Online control mode



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Starting the Weld Editor Interface

1. On the FlexPendant, tap the ABB menu and then tap **Production Screen**.
2. Tap **A7 MIG R1** to start the Weld Editor widget.
3. Tap **Production Screen** to close the window and return to the previous window.

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6.2 Weld Editor in online control mode

Ignition parameters

Tap the **Ignition** tab to view or modify the ignition phase parameters.

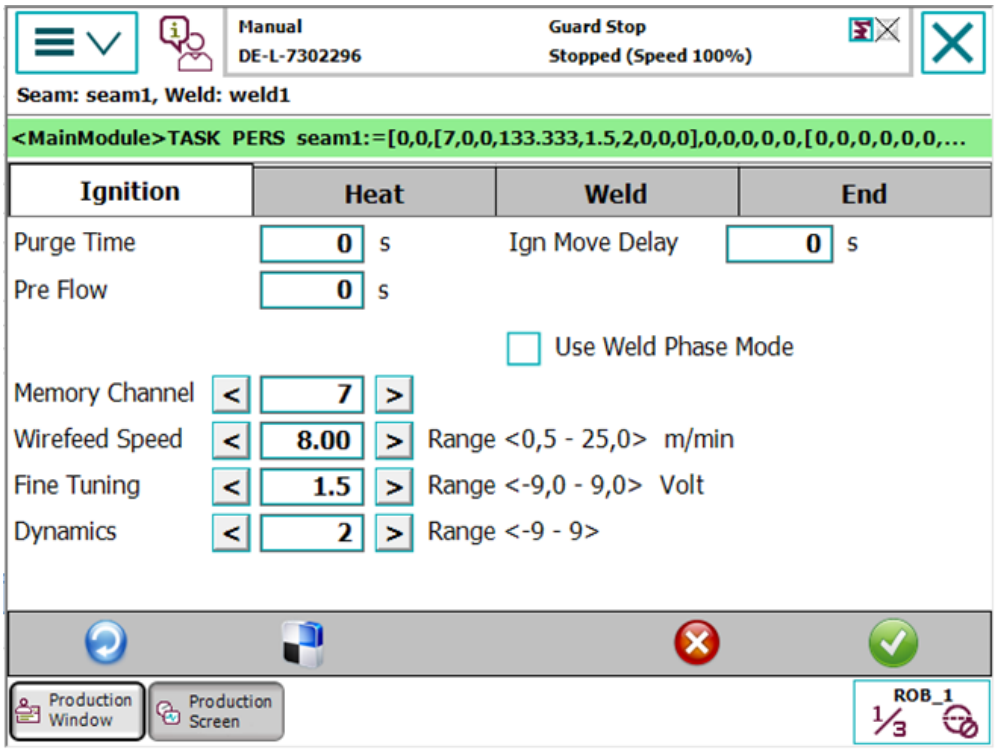
Note

Do not manipulate seam/welddata using the RAPID datatype editor. This can result in unwanted behavior and wrong welding parameters which can in worst case damage your welding equipment. Use the Weld mode editor.

The ignition phase parameters can only be modified in manual mode.

Tip

To copy the current weld phase mode settings, toggle **Use Weld Phase Mode** off, on, and then off again.



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Button	Description
Refresh	Use the blue refresh button to return to the Weld Phase tab.
Confirm	Use the green check button to confirm any changes made.
Cancel	Use the red cancel button to cancel any changes made and return to the previous values.

Continues on next page

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Parameter	Description
Ign Move Delay	The delay (in seconds) from the time the arc is considered stable at ignition until the heat phase is started.
Purge Time	The time (in seconds) it takes to fill the gas lines and the welding gun with protective gas, also called *gas purging*.
Pre-Flow Time	The time (in seconds) it takes to pre-flow the weld object with protective gas, also called *gas pre-flow*.
Use Weld Phase Mode	Not selected: Select weld parameters during ignition phase manually. Selected: Use the parameters from the Weld tab. This is the default mode.
Memory Channel	This represents the memory channel in the welder.
Wire Feed Speed	This is the wire feed speed.
Fine Tuning	This parameter represents the arc length when welding in synergic mode. The range is -9.0 to +9.0. -9 = shorter arc 0 = value from line +9 longer arc The actual value range in Volts is also shown as, **Actual <x.x – y.y> [V]**.
Dynamics	Control the arc behavior in short circuit. A lower value results in a softer arc and a higher value result in a rougher arc. The allowed value is -9 to +9.

Heat parameters

Tap the **Heat** tab to view or modify heat phase parameters.

Note

The heat phase parameters can only be modified in manual mode.

Tip

To copy the current weld phase mode settings, toggle **Use Weld Phase Mode** off, on, and then off again.

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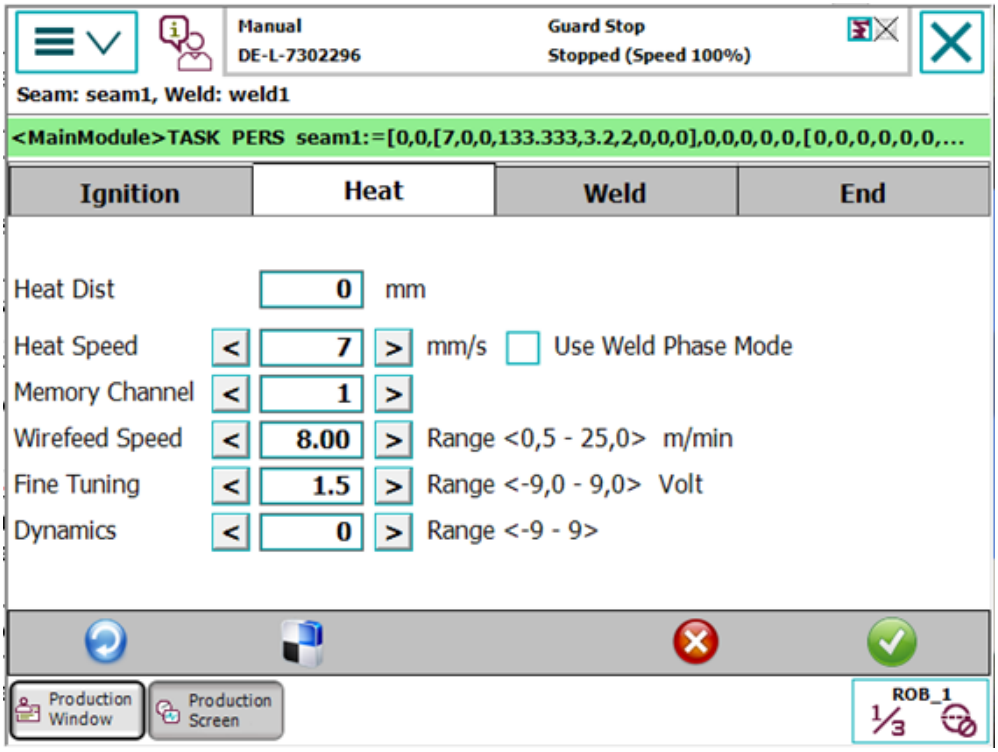

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Button	Description
Refresh	Use the blue refresh button to return to the Weld Phase tab.
Confirm	Use the green check button to confirm any changes made.
Cancel	Use the red cancel button to cancel any changes made and return to the previous values.

Parameter	Description
Heat Dist / Heat as time	The distance during which the heat data is active at the start of the weld. If the parameter *Heat as time* is active, the distance will be replaced by time (in seconds).
Heat Speed	The welding speed during the heat phase at the start of the weld phase.
Use Weld Phase Mode	Not selected: Select weld parameters during ignition phase manually. Selected: Use the parameters from the Weld tab. This is the default mode.
Memory Channel	This represents the memory channel in the welder.
Wire Feed Speed	This is the wire feed speed.
Fine Tuning	This parameter represents the arc length when welding in synergic mode. The range is -9.0 to +9.0. -9 = shorter arc 0 = value from line +9 longer arc The actual value range in Volts is also shown as, **Actual <x.x – y.y> [V]**.
Dynamics	Control the arc behavior in short circuit. A lower value results in a softer arc and a higher value result in a rougher arc. The allowed value is -9 to +9.

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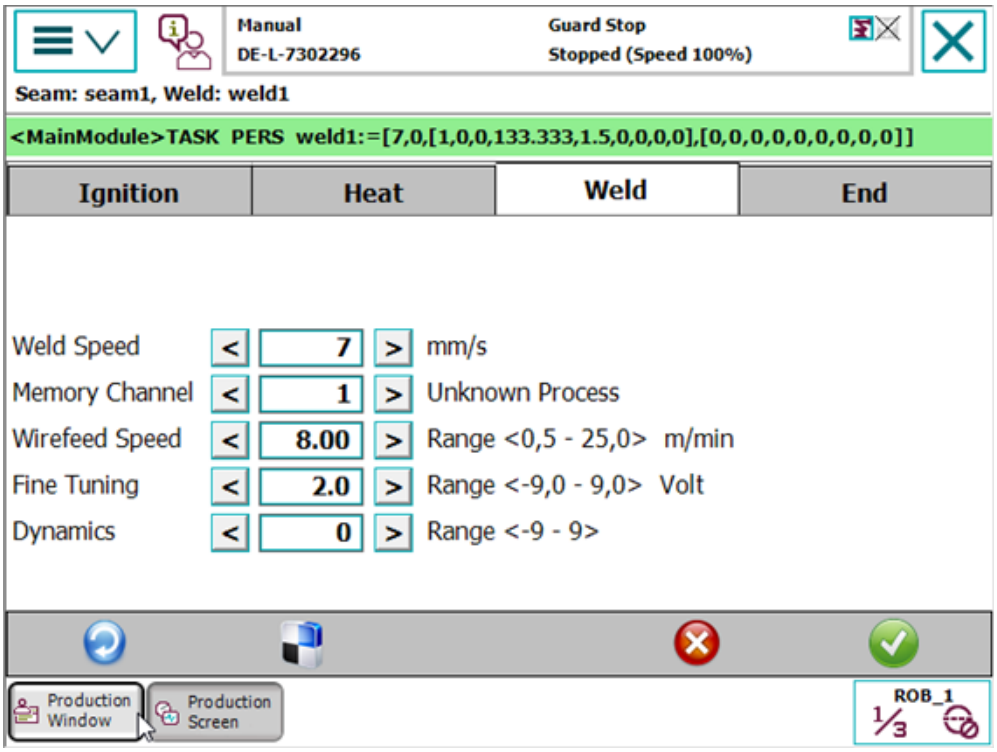
Weld parameters

Tap the **Weld** tab to view or modify weld phase parameters.

> **Note**
>
> The weld phase parameters can only be modified in manual mode.



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Button	Description
Refresh	Use the blue refresh button to return to the Weld Phase tab.
Confirm	Use the green check button to confirm any changes made.
Cancel	Use the red cancel button to cancel any changes made and return to the previous values.

Parameter	Description
Weld speed	The speed of the TCP of the welding torch during the weld instruction.
Memory Channel	This represents the memory channel in the welder.
Wire Feed Speed	This is the wire feed speed.
Fine Tuning	This parameter represents the arc length when welding in synergic mode. The range is -9.0 to +9.0. -9 = shorter arc 0 = value from line +9 longer arc The actual value range in Volts is also shown as, **Actual <x.x – y.y> [V]**.
Dynamics	Control the arc behavior in short circuit. A lower value results in a softer arc and a higher value result in a rougher arc. The allowed value is -9 to +9.

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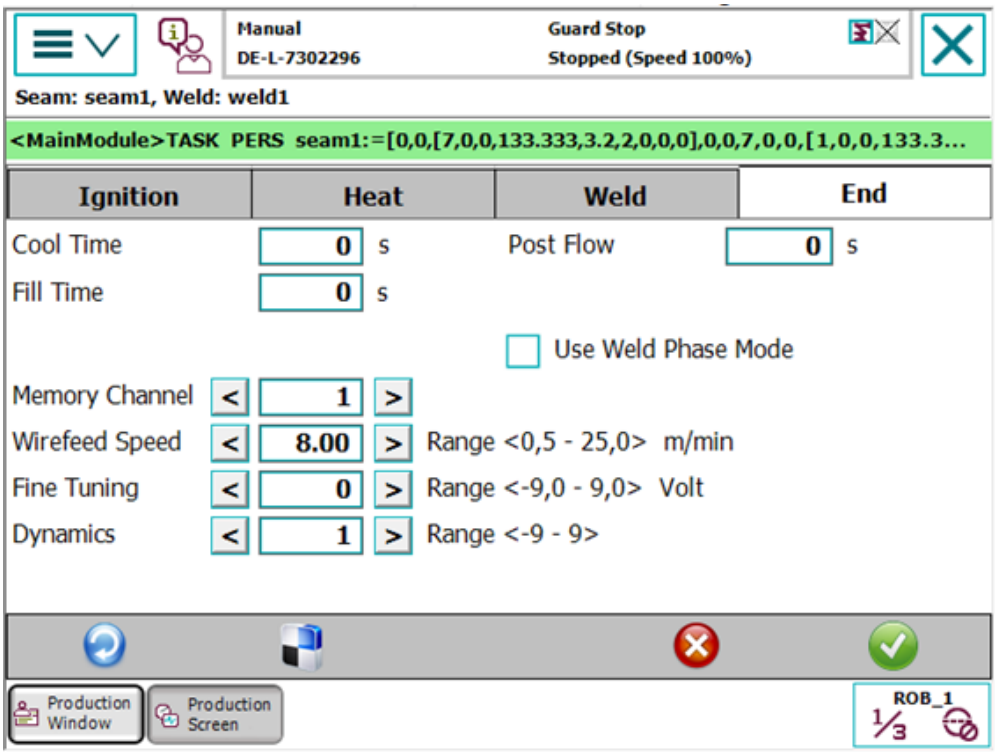
End parameters

Tap the **End** tab to view or modify end phase parameters.

> **Note**
>
> The end phase parameters can only be modified in manual mode.

> **Tip**
>
> To copy the current weld phase mode settings, toggle **Use Weld Phase Mode** off, on, and then off again.



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Button	Description
Refresh	Use the blue refresh button to return to the Weld Phase tab.
Confirm	Use the green check button to confirm any changes made.
Cancel	Use the red cancel button to cancel any changes made and return to the previous values.

Parameter	Description
Cool Time	The time (in seconds) during which the process is stopped, allowing the weld to cool before other end activities such as crater fill and burn back take place.
Fill Time	The crater-filling time (in seconds) at the end phase of the weld.
Post Flow	The time (in seconds) for purging with protective gas after the end of the process.

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Parameter	Description
Use Weld Phase Mode	Not selected: Select weld parameters during ignition phase manually. Selected: Use the parameters from the Weld tab. This is the default mode.
Memory Channel	This represents the memory channel in the welder.
Wire Feed Speed	This is the wire feed speed.
Fine Tuning	This parameter represents the arc length when welding in synergic mode. The range is -9.0 to +9.0. -9 = shorter arc 0 = value from line +9 longer arc The actual value range in Volts is also shown as, **Actual <x.x – y.y> [V]**.
Dynamics	Control the arc behavior in short circuit. A lower value results in a softer arc and a higher value result in a rougher arc. The allowed value is -9 to +9.

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6.3 Weld Editor in Memory Channel mode

Ignition parameters

Tap the **Ignition** tab to view or modify the ignition phase parameters.

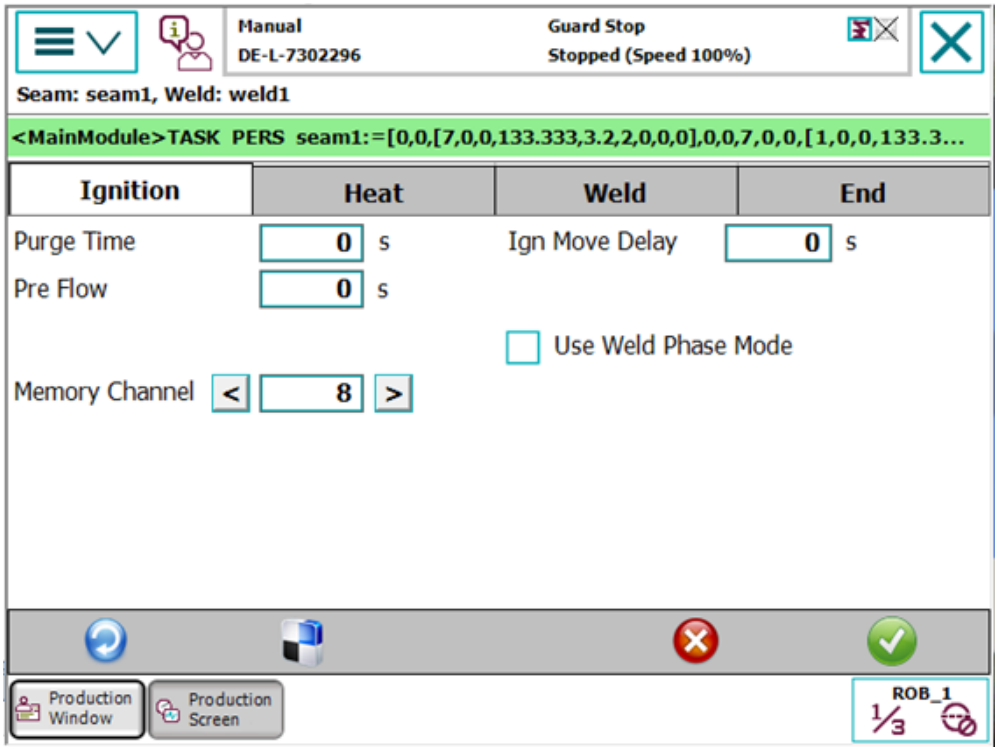
Note

Do not manipulate seam/welddata using the RAPID datatype editor. This can result in unwanted behavior and wrong welding parameters which can in worst case damage your welding equipment. Use the Weld mode editor.

The ignition phase parameters can only be modified in manual mode.

Tip

To copy the current weld phase mode settings, toggle **Use Weld Phase Mode** off, on, and then off again.



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Button	Description
Refresh	Use the blue refresh button to return to the Weld Phase tab.
Confirm	Use the green check button to confirm any changes made.
Cancel	Use the red cancel button to cancel any changes made and return to the previous values.

Continues on next page

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Parameter	Description
Ign Move Delay	The delay (in seconds) from the time the arc is considered stable at ignition until the heat phase is started.
Purge Time	The time (in seconds) it takes to fill the gas lines and the welding gun with protective gas, also called *gas purging*.
Pre-Flow Time	The time (in seconds) it takes to pre-flow the weld object with protective gas, also called *gas pre-flow*.
Use Weld Phase Mode	Not selected: Select weld parameters during ignition phase manually. Selected: Use the parameters from the Weld tab. This is the default mode.
Memory Channel	The memory channel (schedule) that should be selected within the welder.

Heat parameters

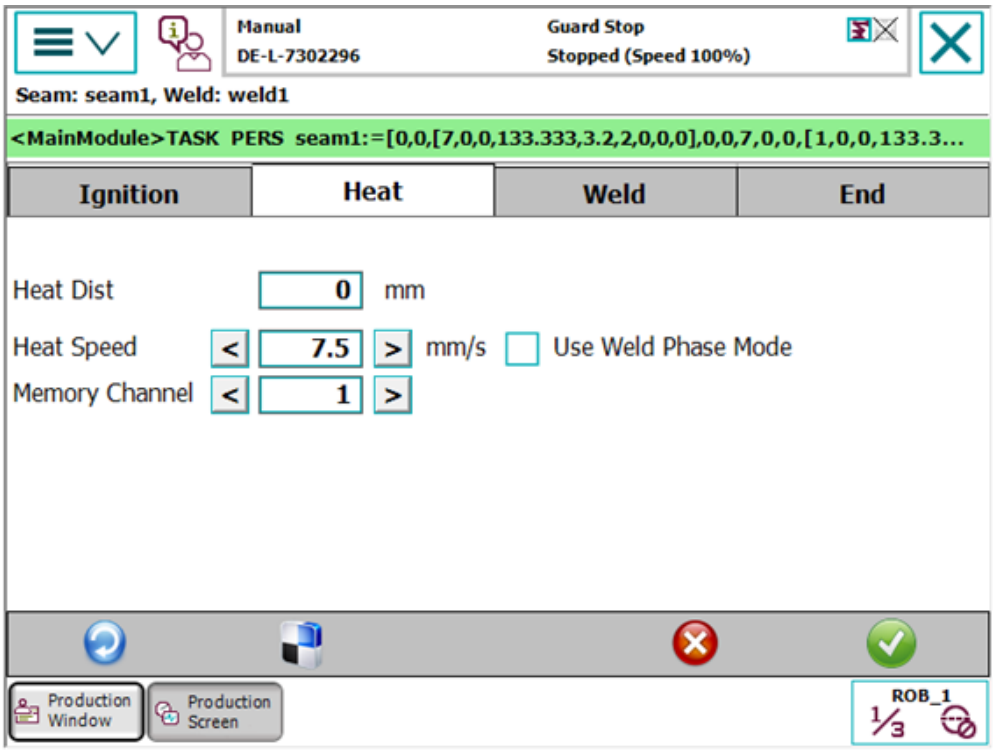
Tap the **Heat** tab to view or modify heat phase parameters.

Note

The heat phase parameters can only be modified in manual mode.

Tip

To copy the current weld phase mode settings, toggle **Use Weld Phase Mode** off, on, and then off again.



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Button	Description
Refresh	Use the blue refresh button to return to the Weld Phase tab.
Confirm	Use the green check button to confirm any changes made.
Cancel	Use the red cancel button to cancel any changes made and return to the previous values.

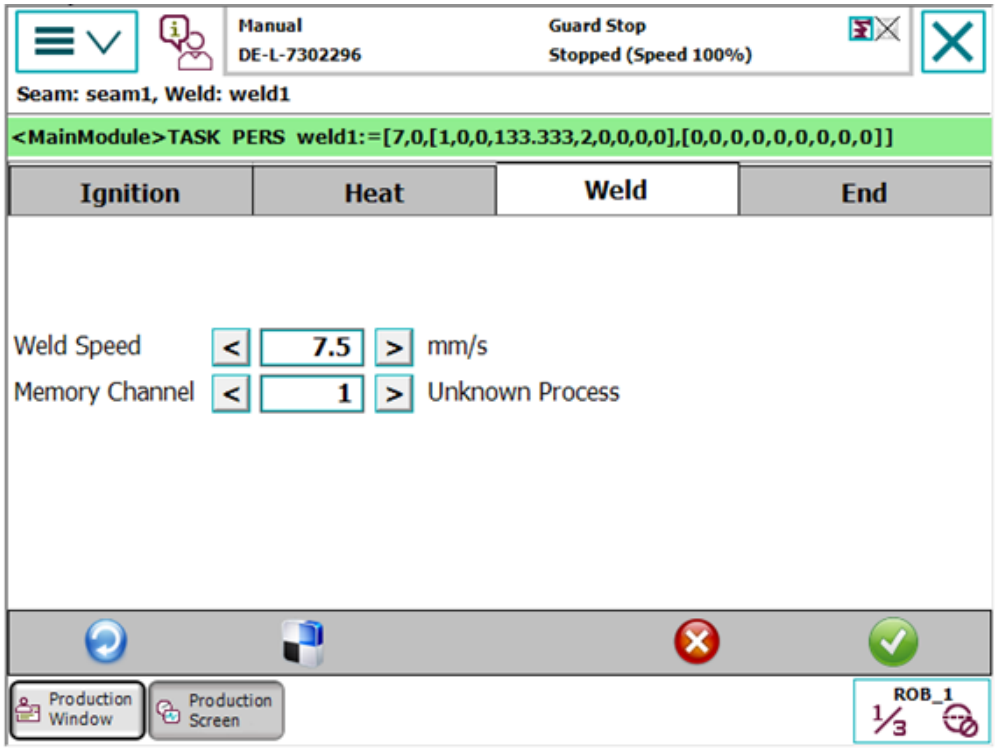
Parameter	Description
Heat Dist / Heat as time	The distance during which the heat data is active at the start of the weld. If the parameter *Heat as time* is active, the distance will be replaced by time (in seconds).
Heat Speed	The welding speed during the heat phase at the start of the weld phase.
Use Weld Phase Mode	Not selected: Select weld parameters during ignition phase manually. Selected: Use the parameters from the Weld tab. This is the default mode.
Memory Channel	The memory channel (schedule) that should be selected within the welder.

Weld parameters

Tap the **Weld** tab to view or modify weld phase parameters.

Note

The weld phase parameters can only be modified in manual mode.



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Button	Description
Refresh	Use the blue refresh button to return to the Weld Phase tab.

Continues on next page

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Button	Description
Confirm	Use the green check button to confirm any changes made.
Cancel	Use the red cancel button to cancel any changes made and return to the previous values.

Parameter	Description
Weld speed	The speed of the TCP of the welding torch during the weld instruction.
Memory Channel	The memory channel (schedule) that should be selected within the welder.

End parameters

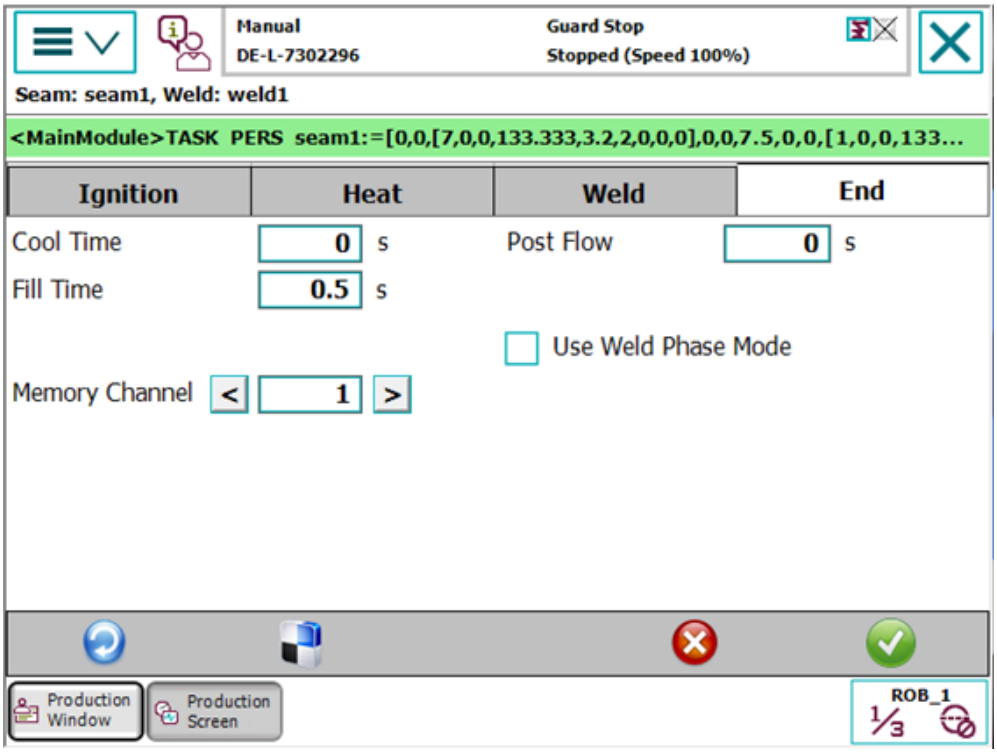
Tap the **End** tab to view or modify end phase parameters.

Note

The end phase parameters can only be modified in manual mode.

Tip

To copy the current weld phase mode settings, toggle **Use Weld Phase Mode** off, on, and then off again.



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Button	Description
Refresh	Use the blue refresh button to return to the Weld Phase tab.
Confirm	Use the green check button to confirm any changes made.

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Button	Description
Cancel	Use the red cancel button to cancel any changes made and return to the previous values.

Parameter	Description
Cool Time	The time (in seconds) during which the process is stopped, allowing the weld to cool before other end activities such as crater fill and burn back take place.
Fill Time	The crater-filling time (in seconds) at the end phase of the weld.
Post Flow	The time (in seconds) for purging with protective gas after the end of the process.
Use Weld Phase Mode	Not selected: Select weld parameters during ignition phase manually. Selected: Use the parameters from the Weld tab. This is the default mode.
Memory Channel	The memory channel (schedule) that should be selected within the welder.

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6.4 Tuning of weld parameters

Introduction

Weld parameters marked with the arrows in the Weld Editor can be tuned, either offline (when not welding) or online (when welding).

When welding, these parameters can be tuned within the range with immediate response. Parameters in the **Weld** tab are easiest to tune.

Parameters that can be tuned in online control mode:

- Weld Speed
- Wirefeed Speed
- Fine Tuning
- Dynamics

Parameters that can be tuned in Memory Channel mode:

- Weld Speed

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6.5 How to edit welddata using the partdata concept

The partdata concept

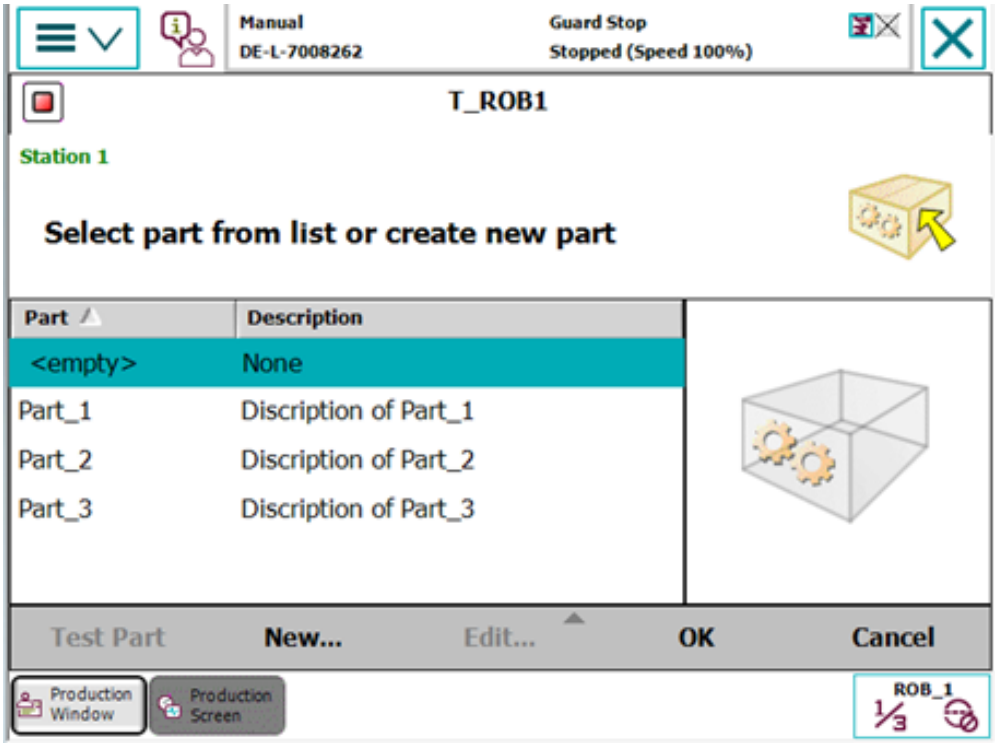
The option *Production Manager* is needed to be able to use the partdata concept. Even though Production Manager is not configured to control the robot cell, its partdata concept can be used to edit welddata.

Additional information on how to use Production Manager and its part data can be found in *Application manual Production Manager*.

The optional argument `\SeamName` has to be used in the instruction `ArcLStart` to be able to show the seam in the editor.

Example

Here is an example how the welddata can be changed without the RAPID data editor or moving the program pointer around. The example consists of three parts which are configured in Production Manager.



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RAPID example

```
TASK PERS partdata pd_Part_1:=["Part_1","Discription of Part_1","",1,0,"",""];
TASK PERS partdata pd_Part_2:=["Part_2","Discription of Part_2","",1,0,"",""];
TASK PERS partdata pd_Part_3:=["Part_3","Discription of Part_3","",1,0,"",""];


PROC Part_1()
    ActUnit STN1;
    MoveJ p1,v1000,z10,tWeldGun\WObj:=wobjStn1;
    ArcLStart p2,v1000,sm1,wd1,fine,tWeldGun\WObj:=wobjStn1\SeamName:="Part_1_Pth_1_Weld_1";
    ArcL p3,v100,sm1,wd1,z1,tWeldGun\WObj:=wobjStn1;
    ArcL p4,v100,sm1,wd1,z1,tWeldGun\WObj:=wobjStn1;
    ArcL p5,v100,sm1,wd1,z1,tWeldGun\WObj:=wobjStn1;
    ArcLEnd p6,v100,sm1,wd1,fine,tWeldGun\WObj:=wobjStn1;
    MoveL p7,v1000,z10,tWeldGun\WObj:=wobjStn1;
ENDPROC


PROC Part_2()
    ActUnit STN1;
    MoveJ p1,v1000,z10,tWeldGun\WObj:=wobjStn1;
    ArcLStart p2,v1000,sm2,wd2,fine,tWeldGun\WObj:=wobjStn1\SeamName:="Part_2_Pth_1_Weld_1";
    ArcL p3,v100,sm2,wd2,z1,tWeldGun\WObj:=wobjStn1;
    ArcL p4,v100,sm2,wd2,z1,tWeldGun\WObj:=wobjStn1;
    ArcL p5,v100,sm2,wd2,z1,tWeldGun\WObj:=wobjStn1;
    ArcLEnd p6,v100,sm2,wd2,fine,tWeldGun\WObj:=wobjStn1;
    MoveL p7,v1000,z10,tWeldGun\WObj:=wobjStn1;
ENDPROC

PROC Part_3()
    ActUnit STN1;
    MoveJ p1,v1000,z10,tWeldGun\WObj:=wobjStn1;
    ArcLStart p2,v1000,sm3,wd3,fine,tWeldGun\WObj:=wobjStn1\SeamName:="Part_3_Pth_1_Weld_1";
    ArcL p3,v100,sm3,wd3,z1,tWeldGun\WObj:=wobjStn1;
    ArcL p4,v100,sm3,wd3,z1,tWeldGun\WObj:=wobjStn1;
    ArcL p5,v100,sm3,wd3,z1,tWeldGun\WObj:=wobjStn1;
    ArcLEnd p6,v100,sm3,wd3,fine,tWeldGun\WObj:=wobjStn1;
    MoveL p7,v1000,z10,tWeldGun\WObj:=wobjStn1;
ENDPROC
```

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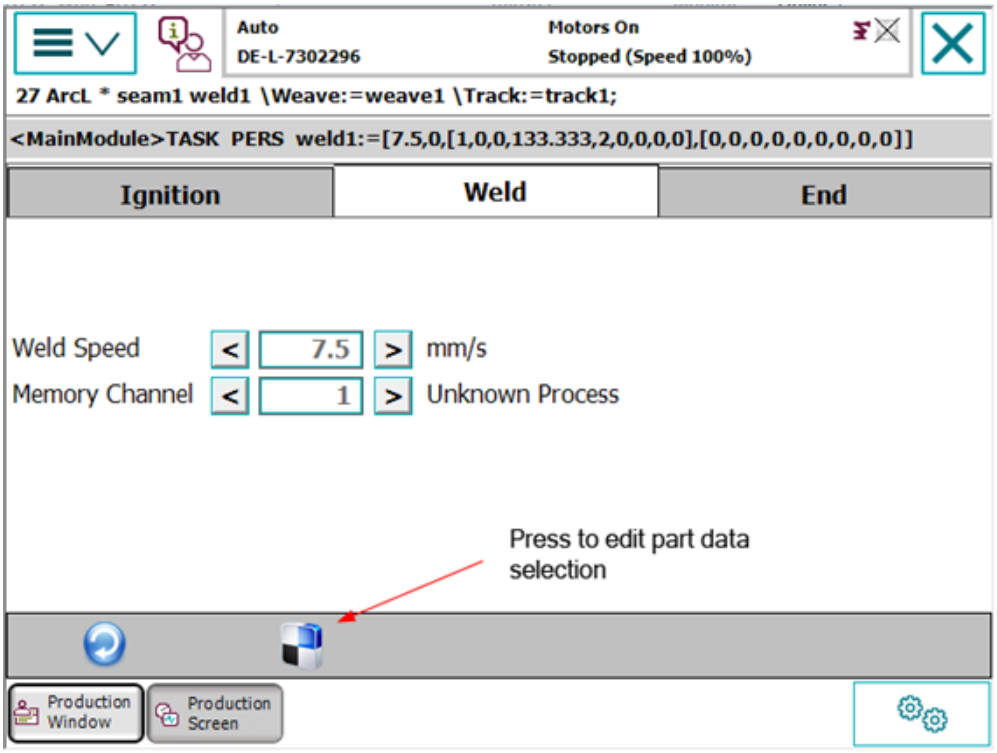
The welddata can now selected from the Kemppi Production Screen application by selecting the partdata. Start the Kemppi A7 Application and press the partdata button (looking like a small chess board).



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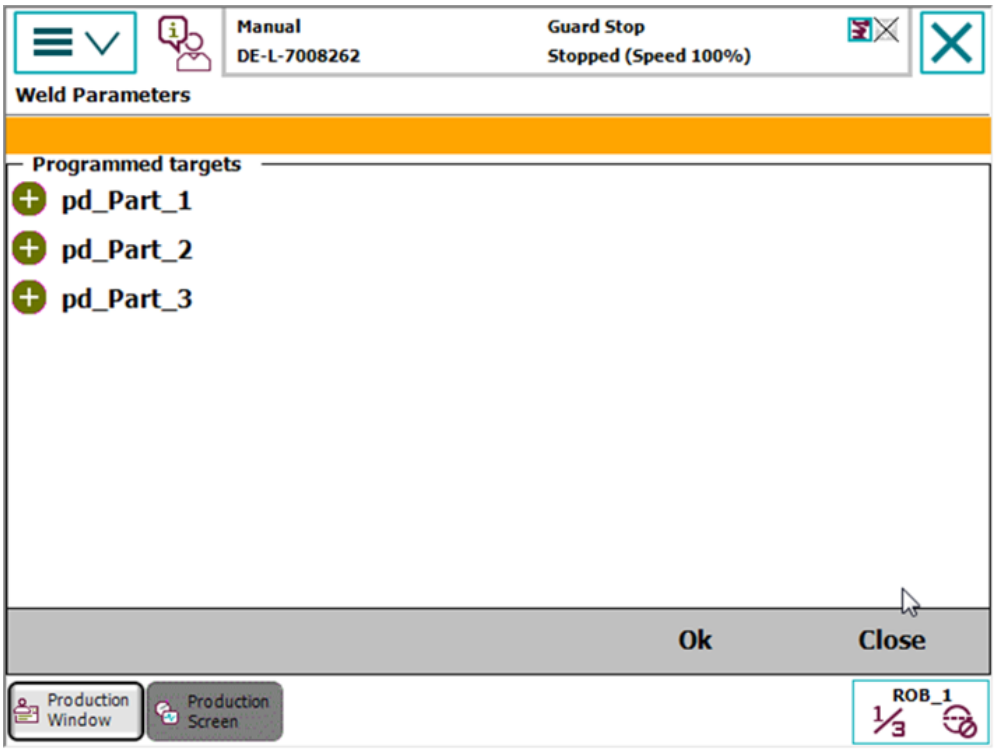
This will start the following screen and present all partdata found in the system.



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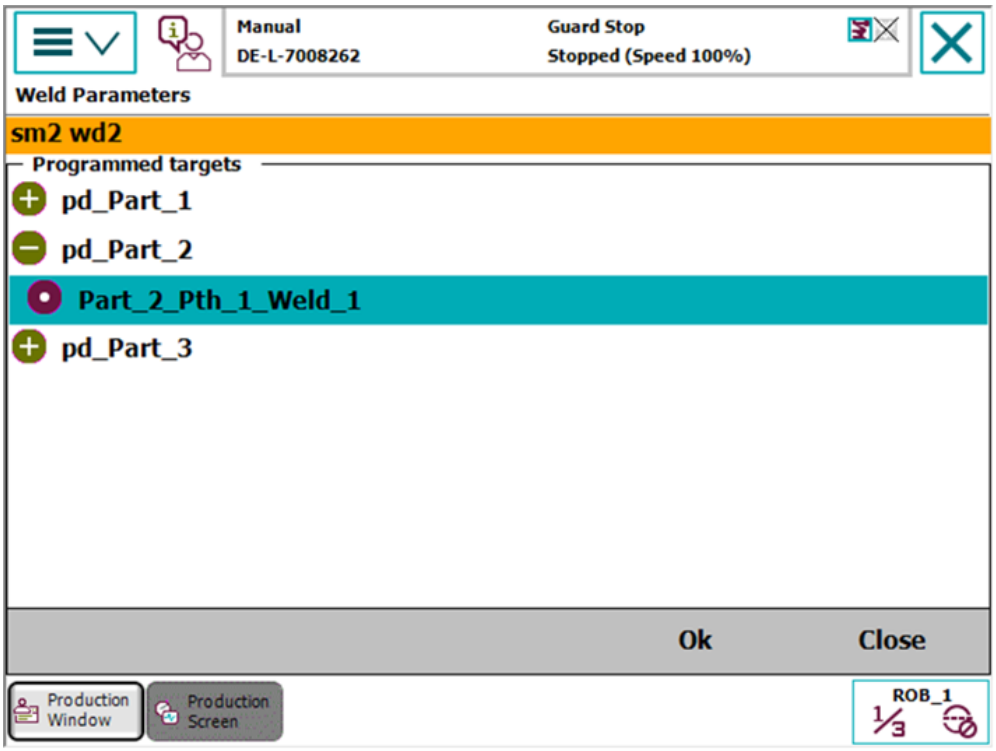
Click on the partdata to edit. In this example, **Part_2_Pth_1_Weld_1**. The used seamdata/welddata is shown in the header. In this example, **sm2**/**wd2**.



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Tap **Ok** to go back to the Weld Data editor. The editor automatically selects the used seam/welddata from the part. The header is now updated with **sm2**/**wd2**.

To update the editor with the value from the seam/welddata, tap the blue **Refresh** button.

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7 System parameters

Overview

The Kemppi Equipment Class and settings are automatically activated after the controller is started with the Kemppi add-in.

This option has advanced support for a Kemppi A7 350/450 power source that includes support for two welding modes:

- Memory Channel
- Online control

Kemppi A7 Equipment Properties

Parameter	Data type	Description
Name	string	The name of the *Fronius Equipment Properties*.
Use Equipment Standard IO	string	The name of the *Equipment Standard IO* to use.
Use Fronius Equipment IO	string	The name of the *Equipment Standard IO* to use.
Mode	string	The mode of the welder. The following modes are available: • Memory Channel, this is default • Online Control
Ignition on	bool	Specifies if the ignition data specified in seamdata is to be used at the start of the weld phase. At the start it is often beneficial to define higher weld data values for a better ignition. If the ignition data parameter is changed, the contents of seamdata will also change. Default value: FALSE
Heat on	bool	When the arc is ignited, the seam will generally not have reached the correct temperature. Pre-heating can thus be used at the start of the weld to define higher weld data values. If the pre-heating parameter is changed, the contents of seamdata will also change. Default value: FALSE
Heat defined as time	bool	Specifies if the heat phase should use the seamdata parameters `heat_time` or `heat_distance`. TRUE means that `heat_time` is used and visible in the seamdata. FALSE means that `heat_distance` and `heat_speed` is used and visible in the seamdata. Default value: FALSE
Cool time on	bool	Enables masking of the `cool_time` component in seamdata. Default value: FALSE

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Continued

Parameter	Data type	Description
Fill on	bool	Specifies whether a crater fill is to be used in the final phase. This means that the end crater that can form in the completed weld will be filled in with extra filler material. If the crater fill parameter is changed, the contents of seamdata will also change. Default value: FALSE
Arc Preset	num	Delays the power control signal with this time (seconds). This gives the analog reference signals and group output signals enough time to stabilize before the weld is started. Default value: 0
Ignition Timeout	num	The maximum time (in seconds) permitted for igniting the welding arc. Default value: 3
Weld off timeout	num	The maximum time (in seconds) permitted for shutting off the welding arc. Default value: 10
Override On	bool	Specifies the visibility of the `org` value components in welddata. Default value: TRUE
Auto inhibition on	bool	If this flag is set, weld inhibition will be allowed in AUTO mode, otherwise not allowed. Default value: FALSE
Time to feed 15 mm wire	num	The time in seconds to feed 15 mm of wire. Default value: 0.95
Enable supervision in VC	bool	Enables signal supervision in the virtual controller. Default value: FALSE
Enable Watchdog Output	bool	Enable the watchdog functionality with a fixed frequency of 0.5 Hz (2 seconds). Default value: FALSE The watchdog feature must be enabled in the welder.
Allow tuning in Auto	bool	If this flag is set tuning of welddata is allowed in auto mode. Default value: FALSE
Block tuning in Manual	bool	If this flag is set, edit and tuning will be blocked in manual mode from the TPSi editor and from the Weave & Track data editor. Default value: FALSE
Enable Wire Retract	bool	If this flag is set, the wire will be retracted at the end and of weld and feed at start (the specified time in *Time to feed 15mm wire*. Default value: FALSE
Widget Screen	num	Specifies the start screen (widget) for Production Screen. (Not yet implemented.)
Service port IP	num	The IP address of the welder's service port. This is used in conjunction with the RobotStudio add-in.

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Parameter	Data type	Description
Arc Stable Filter Time Active	num	The active filter time on arc stable. Default value: 50 ms Minimum value: 0 ms Maximum value: 1000 ms
Arc Stable Filter Time passive	num	The passive filter time on arc stable. Default value: 50 ms Minimum value: 0 ms Maximum value: 1000 ms

Kemppi A7 Equipment IO

Parameter	Data type	Description
ArcEst Label	string	Label describing the error level of the signal. There are three available levels, MAJOR, MINOR, and INFO.
WaterOK DI	signaldi	Digital input signal for supervision of the water. A high signal means that the water is OK.
GasOK DI	signaldi	Digital input signal for supervision of the protective gas. A high signal means that the protective gas is OK.
Supervision Welder DO	signaldo	Digital output signal that indicates welder supervision.
Supervision Arc DO	signaldo	Digital output signal for indication of welding arc errors. A high signal means that an error has occurred.
Supervision Water DO	signaldo	Digital output signal for indication of cooling water errors. A high signal means that an error has occurred.
Supervision Gas DO	signaldo	Digital output signal for indication of protective gas errors. A high signal means that an error has occurred.
Supervision Wirestick DO	signaldo	Digital output signal for indication of wire feed errors. A high signal means that an error has occurred.

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8 Seam Tracking with A7 MIG Welder 350/450

8.1 Introduction

About KEMPPI A7 IRC5 seam tracking

This guide describes the ABB Robotics IRC5 interface for:

- KEMPPI A7 Seam Tracking with fieldbus interface

The power source must meet the requirements specified in section *About Kemppi A7 MIG Welder interface on page 9*.

Overview

The A7 MIG Welder power sources are based on top of the class inverter technology. They belong to the high-end system class of Kemppi products.

There is a wide range of processes to choose from: MIG, 1-MIG, Pulse, Double Pulse, Brazing, Cladding, WiseRoot+, WiseThin+, WiseFusion, and WisePenetration.

The system can be configured to contain an optimal choice of just the right welding programs for the application. There are welding programs available for all the common filler wire and shielding gas combinations for mild steel, stainless steel, and aluminum.

General functionality

The KEMPPI Tracking function is a powerful software based Through Arc Seam Tracking (TAST) RobotWare option.

Through-Arc Seam Tracking (TAST) is used in arc welding for following a welding groove automatically by weaving the welding gun and measuring the arc length. The seam tracking provides precise welds in setups where the workpiece position within repetitive tasks varies, or when the route of the groove is complicated.

The arc length depends on the wire tip distance from the middle of the groove. Weaving the welding gun between the edges of the groove generates a signal that is directly proportional to the arc length. The generated signal is equivalent to the welding current.

The welding power source measures welding current as a contiguous value during welding. It filters the raw current value to generate a stable signal for the TAST. The TAST signal is valid for all MIG/MAG processes including Pulse MIG and Double Pulse MIG. The TAST signal is passed to the welding robot as a numeric value using the digital robot interface. Using the TAST requires use of certain I/O tables containing a field for the TAST value and the control signal.

The TAST signal is composed inside the power source using welding current and voltage. Value changes as stick-out length varies during welding and is used for real time correction of the weld location during welding.

Note

The TAST signal is updated approximately every 10 ms (100Hz).

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8.2 Installation

Prerequisites for the robot controller

- IRC5 robot controller with main computer DSQC1000 or later
- RobotWare version 6.14 or later with the following options:
  - RobotWare Arc
  - Production Screen
  - Tracking Interface
  - Add-in for Kemppi A7 welder

Kemppi firmware

The A7 Welder must meet the following Firmware versions for Seam Tracking:

- A7 MIG Welder Robot Interface Firmware >= 1.05.00.0
- A7 MIG Welder Firmware >= 1.04.00.0 OR If S/N >=3018192 Firmware 2.01

RobotStudio

- RobotStudio version 2022 or later

Kemppi Tracking Add-In supported functions

The Add-In supports the following tracking functions:

- Centerline tracking
  (Corrections are applied for Y/Z)
- Height tracking only
  (Corrections are only applied to Z)
- Y-tracking only
  (Corrections are only applied to Y)
- Inverted Centerline
  (Corrections are applied for -Y/-Z on "outside corners")
- Single side left
  (Corrections are only applied for Y on the left side. Z is set to zero)
- Single side right
  (Corrections are only applied for Y on the right side. Z is set to zero)
- Adaptive welding to adapt weave width and welding speed based on groove width measurement

Limitations

- The option *Weldguide MultiPass* and *Tracking Interface* cannot be used in the same robot task. Either *Tracking Interface* or *Weldguide Multipass* can be used. In a MultiMove environment, each task can have one of these options.
- Limited support of track modes. Only the modes listed above are supported.
- Only basic support for Single Side-tracking left/right.

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- Aluminum welding and KEMPPI A7 Seam tracking is not supported until further notice.
- In a MultiMove robot, up to two manipulators are supported.

  Contact your local ABB representative for more information if your robot has more than two manipulators.

Kemppi Tracking Add-In

The KEMPPI A7 Tracking option consists of the following software components:

- Ready to track Interface with a KEMPPI A7 welder
- Graphical Weave and Track data editor
- Graphical widget displaying run-time data
- MultiPass welding support
- Adaptive welding support (`ArcCalcX` instructions)

For more information on the MultiPass instructions, see *Operating manual - Seam tracking with Weldguide III and MultiPass*.

Installation of seam tracking function

No additional hardware is needed for the seam tracking function on the IRC5 controller. The Kemppi A7 seam tracking function is software based.

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8.3 Software installation

Software installation

See section *Software setup on page 18*.

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8.3.1 KEMPPI A7 Tracking Feedback Signal

Feedback signal

The KEMPPI A7 power source provides a feedback signal (analog input) on the fieldbus that is used with the tracking option. If you have chosen the KEMPPI A7 welder add-in package as the welding interface, then the feedback signal is already pre-defined on the fieldbus and configured in the process parameters, ready to use.

If using the *Standard I/O Welder* interface with adapted fieldbus configuration (EIO mapping), then make sure to have the correct signal configuration (mapping) in the system. The feedback signal can have any name (follow your own naming convention). Connect the signal in the process configuration and re-start the controller.

EIO Mapping Seam Tracking Signal

Parameter	Default value (Old TAST)	Default value (New TAST)
Name	*aiWld1SeamTrack* (Can be any name)	*aiWld1SeamTrack* (Can be any name)
SignalType	AI	AI
Device	*ioKemppiWld1* (your I/O unit)	*ioKemppiWld1* (your I/O unit)
DeviceMap	72-87	72-87
EncType	Unsigned	Unsigned
MaxLog	6500	8191
MaxPys	10	10
MaxPhysLimit	10	10
MaxBitVal	6500	8191
MinLogValue	0	0
MinPys	0	0
MinPysLimit	0	0
MinBitVal	0	0

Default signal definition

```
-Name "aiWld1SeamTrack" -SignalType "AI" -Device "ioKemppiWld1"
     -DeviceMap "72-87"\
-Label "Kemppi A7 Seam tracking feedback" -EncType "UNSIGNED"
     -MaxLog 8191 -MaxPhys 10\
-MaxPhysLimit 10 -MaxBitVal 8191 -Category "Arc_1_R1" -Category
     "Arc_1_R1"
```

Old definition based on A7 Firmware < 1.05.00.0

```
-Name "aiWld1SeamTrack" -SignalType "AI" -Device "ioKemppiWld1"
     -DeviceMap "72-87"\
-Label "Kemppi A7 Seam tracking feedback" -EncType "UNSIGNED"
     -MaxLog 8191 -MaxPhys 10\
```

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8.3.1 KEMPPI A7 Tracking Feedback Signal
Continued

```
-MaxPhysLimit 10 -MaxBitVal 6500 -Category "Arc_1_R1" -Category
     "Arc_1_R1"
```


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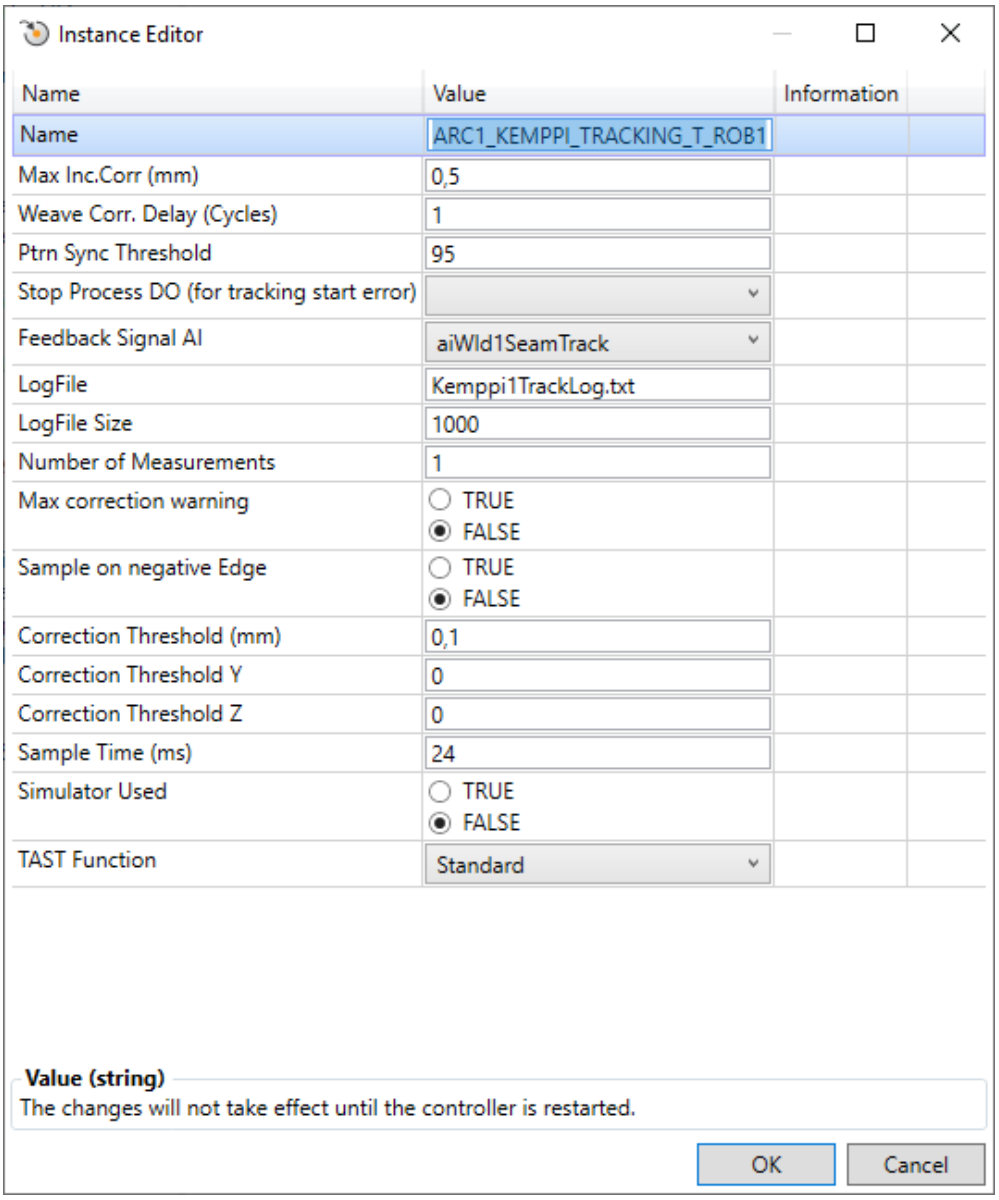
8.3.2 System parameters

Overview

The KEMPPI A7 Seam Tracking function and settings are automatically activated after the controller is started with the KEMPPI A7 Tracking option. However, the system parameters for the tracking function can be modified using the FlexPendant or RobotStudio.

The parameters belong to the type *KEMPPI A7 Tracking Properties* in the topic *Process*.

For more information about system parameters, see *Technical reference manual - System parameters*.



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8.3.2 System parameters
Continued

Type *KEMPPI A7 Tracking Properties*

Parameter	Data type	Description
Name	string	The name of the *KEMPPI A7 Tracking Equipment Properties*.
Max Incremental Correction	num	The maximum allowed incremental corrections per weave. A good value is 0.5 mm. The value can be increased, but depending on the robot type and weave frequency, the system might oscillate and result in bad tracking behavior. Default value: 0.5 mm Minimum value: 0 mm Maximum value: 2 mm
Weave Correction Delay	num	Number of weave cycles before correction values are applied to the path. Parameter can be used to skip a number of defined cycles if the welding process is unstable in the beginning. Default value: 1 Minimum value: 1 Maximum value: 15
Pattern Sync Threshold	num	The coordination position at the extents of the weaving pattern. It is specified as a percentage of the width on either side of the weaving center. When weaving is carried out beyond this point, a digital output signal is automatically set. Default value: 95% Minimum value: 0 Maximum value: 100
Stop Process DO	signaldo	Not yet implemented. Reserved for future use.
Feedback Signal AI	signalai	The name of the current feedback signal as configured on the fieldbus.
LogFile	string	The name for the trackog log file. The logfile will be generated and stored in the HOME folder of the robot.
Logfile Size	num	The size of the tracklog ring buffer that is the number of sensor measurements that can be buffered during tracking Unit: measurements Default value: 1,000 Minimum value: 1,000 Maximum value: 10,000
Number of Measurements	num	The number of measurements taken at the extents of the weave pattern. A mean value is carried out and sent as a correction if more than 1 measurement is taken Default value: 1 Minimum value: 1 Maximum value: 5

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Parameter	Data type	Description
Max correction warning	bool	If this parameter is enabled, program execution is not interrupted, when the limit for maximum correction, specified in the trackdata, is exceeded. Only a warning will be sent. Default value: FALSE
Sample on negative edge	bool	If set to TRUE, the current measurement is taken with the falling edge of the dwell bits. This can be used to compensate a delay for the current EIO signal used for tracking Default value: FALSE
Correction Threshold	num	The minimum calculated correction in mm that are needed before the corrections are sent to the controller. Unit: mm Default value: 0.1 Minimum value: 0 Maximum value: 2
Correction Threshold Y	num	This as a unit less parameter. It is the minimum feedback value that need to be exceeded before corrections in Y are applied to the controller. Can be used to filter some noise or other disturbances. A higher value will result in a less sensitive tracking system Default value: 50 Minimum value: 0 Maximum value: 500
Correction Threshold Z	num	This parameter is the minimum feedback value that need to be exceeded before corrections in Z are applied to the controller. Can be used to filter some noise or other disturbances. A higher value will result in a less sensitive tracking system Default value: 50 Minimum value: 0 Maximum value: 50
Sample Time	num	Sample time in milliseconds for the correction loop. The value is rounded to a multiple of 24. The minimum value allowed is 24 Unit: milliseconds Default value: 24 Minimum value: 24 Maximum value: 240
Simulator used	bool	Not yet implemented. Reserved for future use. Default value: FALSE

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8.3.2 System parameters

Continued

Parameter	Data type	Description
TAST Function	string	Select the TAST Firmware version. Standard will use the improved TAST functionality. It is not recommended to change this parameter to reverse to the old TAST functionality < Firmware 1.04.00.0 as this not supported. Default: Standard

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8.4 Seam tracking

Introduction

A through-the-arc tracking system uses the arc as a sensor to adjust the robot path to the actual location of the part. Measuring the arc voltage and welding current, synchronized with the robot weave pattern, the stick-out length is calculated on both sides and in the middle of the weld. The stick-out length in the middle and the difference between the sides are converted in to robot vertical and horizontal corrections.

It is necessary to understand that there are several tracking modes as well as understanding their relationship within the tracking process.

The tracking methods described below are controlled by the `trackdata` component `track_type`. See *trackdata on page 19*.

Preparations

Note

Well-functioning seam tracking with an arc sensor requires that the welding process should be adjusted to be stable, so that the arc length can be significantly changed for seam tracking purposes without destabilizing the process. If there are drastic changes in the weld process (instability) the system will react in a drastic manor (that is, the torch dives into the part or the torch loses the seam an wander all over the welding surface).

The following peripheral conditions prevent seam tracking with an arc sensor:

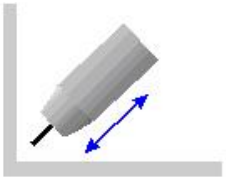
- Disturbances in the process that interfere too strongly with the length change signals
- De-adjustment of the process during welding (for example, ramps)
- Inappropriate settings for the welding process

Make sure the welding process is reliable before activating seam tracking.

Geometric weaving shall be used for tracking.

Torch to work tracking (height, Z direction)

In torch-to-work mode, the same contact tip to work length is maintained. The contact tip to work distance is specified as reference data stored in the `trackdata`. No weaving is required. Measurements are taken at a fixed frequency of 10 Hz.



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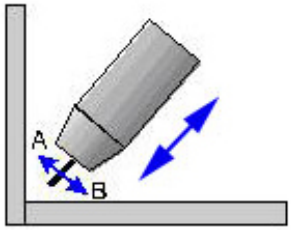
8.4 Seam tracking
Continued

Centerline tracking

Centerline tracking is the most commonly used tracking method. For centerline tracking the height corrections are based on measurements taken in the zero crossing of the weave pattern (in the middle of the pattern), while Y corrections are based on measurement made on the sides of the weave pattern. The position of the weld can be adjusted side to side using the bias.



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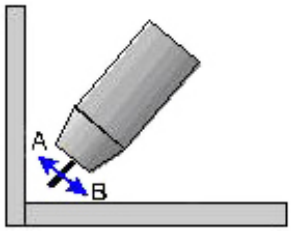
Side tracking (Y-direction only)

In this track mode only Y corrections are calculated based on measurement made on the sides of the weave pattern. The position of the weld can be adjusted side to side using the bias.



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Inverted centerline tracking

For inverted centerline tracking, make sure to use v-shaped weaving and negative height. See data types `weavedata` and `trackdata` in *Application manual - Arc and Arc Sensor*.

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Single side tracking (left and right)

The difference between the centerline tracking method and the single side method is that when using the single side method, data from one side of the weave is used and compared with the reference value. No corrections are applied in the Z direction, only in Y direction.

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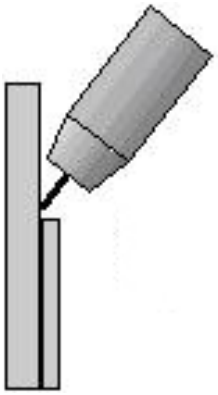
The reference value could also be used as a form of weld penetration level. A higher value for means shorter stick out and higher penetration. A higher penetration level makes the weld move further into the selected side. This method can be used when tracking a lap joint, where the arc might consume one of the sides of the groove.

The position of the weld can be adjusted to the side using the bias component in the data type `trackdata`.



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Note

The interface only provides basic support for single side tracking. Since the TAST feature is fully software based and no external sensors are used only limited information on either the left or right side of the weaving pattern is available. Problems can occur in such way that the robot TCP moves over the edge of the top metal plate. Once the robot TCP is over the edge, max incremental correction is applied since no side is detected. The robot will stop once the max correction is reached.

If there is a problem or not depends on a lot of factors, the weave width for example. If the weave width is close to the edges, then there is a higher probability of getting problems.

Limits and problems seen with seam tracking

Various peripheral conditions make seam tracking difficult or even impossible.

Some of these conditions are:

- Change of welding wire material such as steel or stainless steel
- Change in wire size
- Extreme Changes to welding parameters such as travel speed, wire freed speed or weave frequency
- Weld position relative to the joint location
- Used shield Gas
- Wire stick-out and welding process (short arc, spray arc or pulsed arc)
- Change in weave parameters such as frequency or weave type/form
- Material surface condition

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Recommendation

Here are some points to consider:

- Weave width should at least 3 times the welding wire size
- A fillet weld may have a max. enclosed angle of 90° and the leg length must be more than 5 mm
- Weaving frequency should not exceed 3 Hz
- Use *Touch sensing* prior welding to locate the start of the weld

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8.5 Tracking parameters

Gain_Y: horizontal gain

The recommended starting value is 20. This gain is used to increase or decrease the response of the cross-seam (horizontal) tracking. The lower the number the slower the system will respond to a change of seam direction. This variable impacts the stability of weld bead center. If the weld bead center position is oscillating, (snake shape weld bead) decrease this parameter. If the center position is slow to respond to a change in the center position, increase this parameter.

Gain_Z: vertical gain

The recommended starting value is 30. This gain is used to increase or decrease the response of the torch height (vertical) tracking. The lower the number the slower the system will respond to changes to the work surface or geometry. This variable impacts the stability of torch height. If the torch position is oscillating (moving up and down constantly), decrease this parameter. If the torch position is slow to respond to a change in position, increase this parameter.

Track bias

The position of the weld can be adjusted side to side using the bias.

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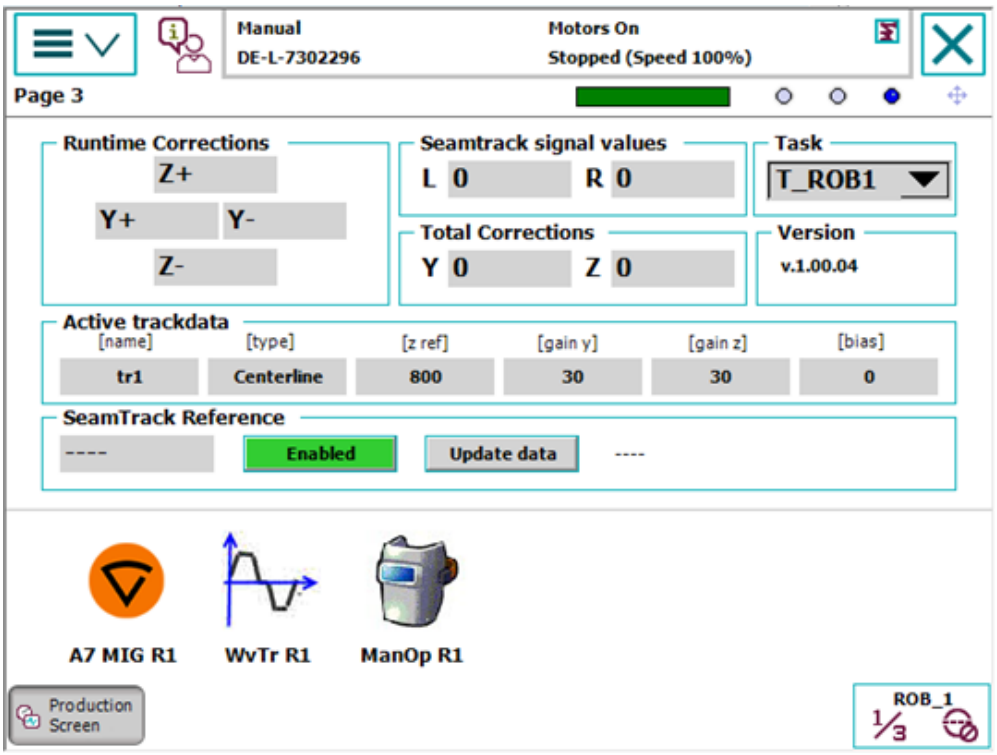
8.6 Best practice

Installation & setup workflow

1. Install a system with the KEMPPI A7 Seam Tracking add-in.
2. Configure the system to be able to weld.
3. Create a simple weld routine with weaving (for example, for a T-joint) and develop your `welddata`. Use the graphical editor to define weave data.
4. Perform a couple of welds to make sure you have a stable weld process.
5. At the optional argument `\Track` and define your `trackdata` (use the graphical editor). Use centerline tracking.
6. Check that the track system is set to 2.
7. Block tracking and enable Seam Track Reference value calculation in the widget (**Enable** button).
8. Weld your seam. At the end the widget will present the reference value for the height corrections, and you can update your trackdata by pressing **Update Data**.

Update seam tracking reference

As mentioned above a good way to update the seam tracking reference is to use the **Runtime** widget.



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Example: Puls Process with 7.5 m/min Wire feed speed

For this simple example the following parameters have been used together with pulsed arc on an 8 mm T-Joint. 1.2 mm solid wire and shield gas with 18% CO2 was used.

Weave parameter

Parameter	Value
Weave length	2.5 mm
Weave width	4 mm
Weave shape	Zig zag
Weave type	Geometric (0)
Frequency	2 Hz

Track parameter

Parameter	Value
Maximum correction	20 mm
Gain Y	20
Gain Z	30
Track Bias	0
Reference Value	836

Weld parameter

Parameter	Value
Weldspeed	5 mm/s
Wirefeed speed	7.5 m/min
Stick out	20 mm
Current Reference	233 Ampere
Sheet Size	8 mm

No Wise Function used.

Simple RAPID example

GRAPHIC

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Active tracking

The robtargets for the End position have been offset by approximately 20 mm to the left right and then welded with active tracking. The path has been corrected and is placed in the center of the groove.

Description	Position
Start point in correct position and End point with an offset. The robot has done the corrections and got pushed into the joint following to joint to the end position. Corrections have been applied in Y/Z (centerline tracking).	 xx2200001893
The robot has done the corrections and got pushed into the joint following to joint to the end position. Corrections have been applied in Y/Z (centerline tracking).	 xx2200001894

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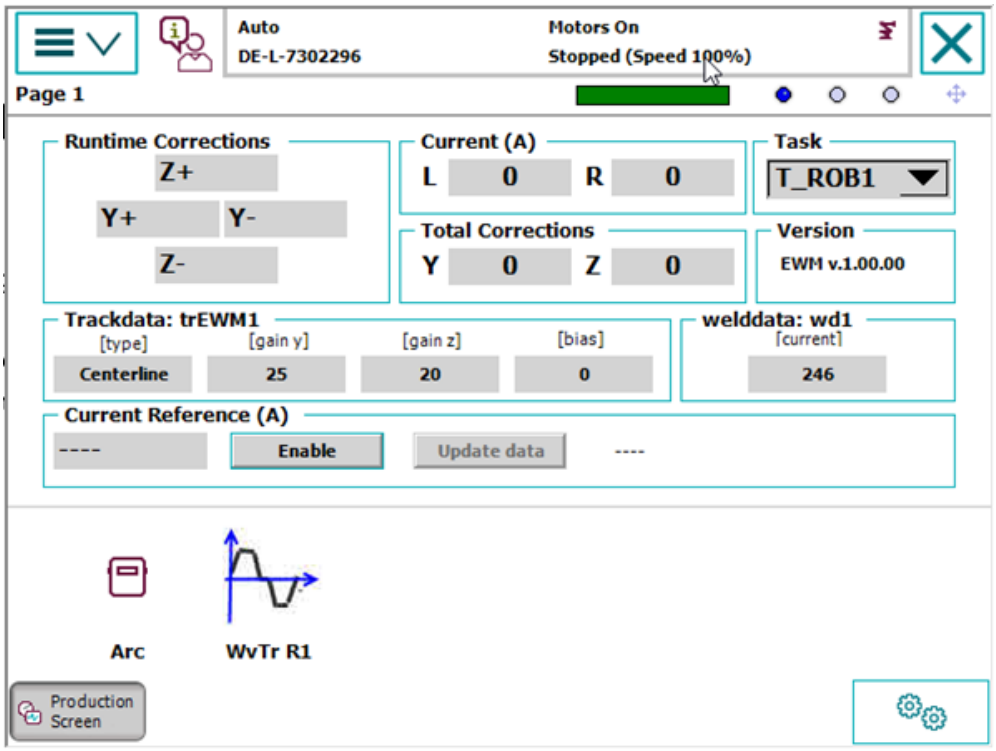
8.7 Runtime widget

Introduction

The tracking runtime widget can be used to get the reference value for the height corrections. In addition, it has useful information of the current applied corrections and the accumulated corrections as well as present `trackdata` values. The widget is shown on page 3 in the *Production Screen* application.



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The following data is presented in the runtime widget:

- Task selection to select the active welding robot.
- Currently applied corrections for Y and Z direction [mm].
- Feedback value from the welder taken on the left/right side of the weave pattern.
- Total corrections in seam coordinate system per weld [mm].
- Active trackdata of current weld with information about `trackdata` name, type (center line, Height, Y only), Z reference, gain y, gain z, and bias.
- SeamTrack Reference calculation. Tap **Enable** to start collecting data from the weld. Once the weld is finished, the SeamTrack Reference value will be green and the text will say **Complete**. If the **Update data** button is pressed, the current z ref value in the active `trackdata` will be updated. Tap **Enable** to disable the SeamTrack Reference calculations.

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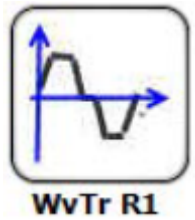
8.8 Weave and track data editor interface

Overview

The tracking option provides a convenient way to edit `weavedata` and `trackdata` using a graphical interface (editor). The editor can be started from *Production Screen*. Tap **WvTrR1** to launch the editor for robot 1. Each welding robot has its own editor.



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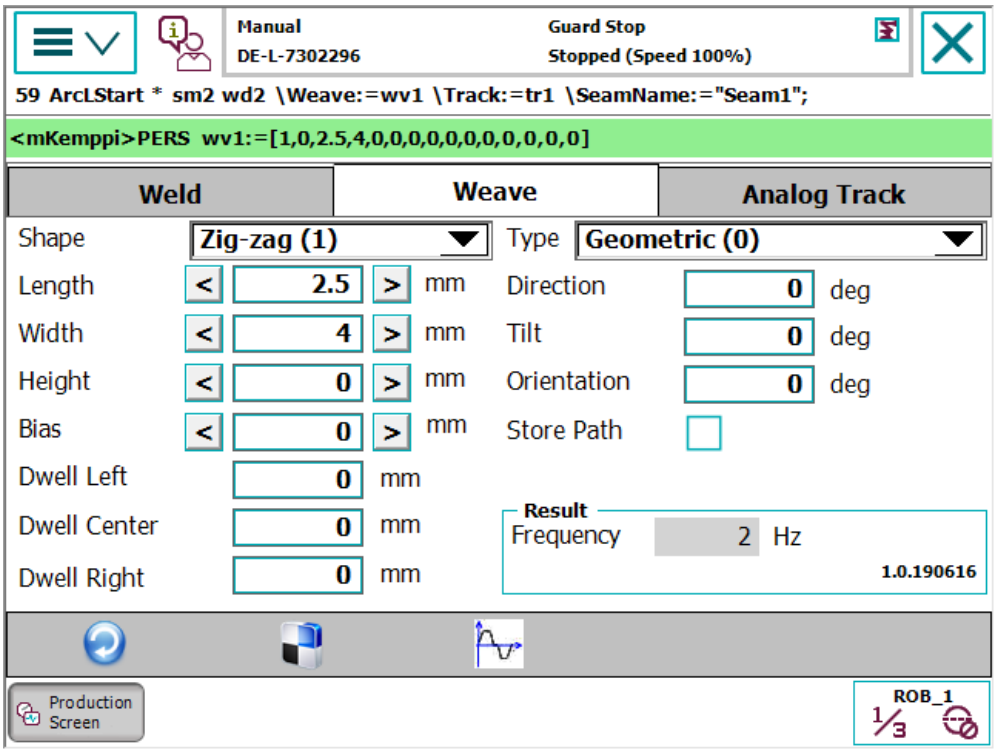
Weave editor

The **Weave data** editor tab presents the current data where the program pointer is. Data can only be changed in manual mode. Manual mode is indicated with a green status bar.



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With the **Weave data** editor, it is possible to edit the current weave data. For more information and a description of the parameters, see *Application manual - Arc and Arc Sensor*.

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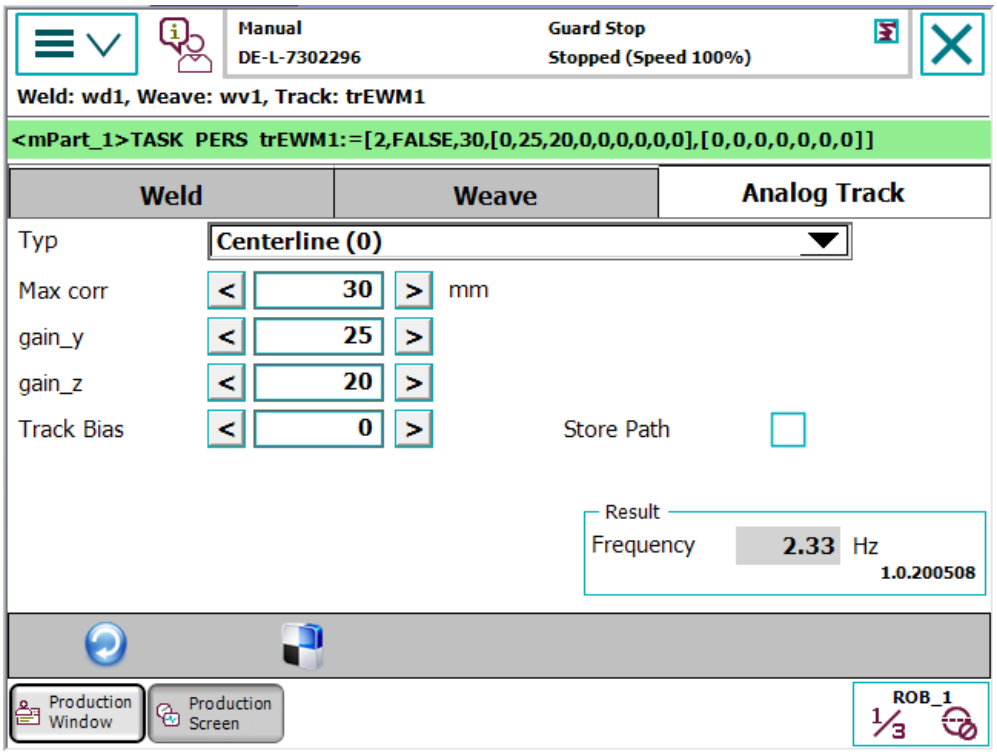
Track data editor

The **Analog Track** data editor tab presents the current data where the program pointer is. Data can only be changed in manual mode. Manual mode is indicated with a green status bar.



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With the help of the track data editor, it is possible to edit the current track data. The following parameters can be changed/set:

Parameter	Value
Type	Select the track type. The following types are supported: • Center line • Height Only (Torch to work) • Y-Corrections only • Inverted center line • Single Side R + L
Max correction	The maximum allowed path correction. If the TCP is offset more than `max_corr` by path corrections, a track error is reported and program execution is stopped (depending on the boolean flag, *MaxCorrWarning*).
Gain Y	The *gain_y* parameter defines how big of a correction is sent to the robot. The higher the number, the faster the system corrects. The range of this parameter is from 1 to 100. Initial starting values for this parameter depend on weave size. Start with 30 for most weave widths and 5 for very small weave widths.
Gain Z	The *gain_z* parameter defines how big of a correction is sent to the robot. The higher the number the faster the system corrects. The range of this parameter is from 1 to 100. Initial starting values for this parameter depend on weave size. Start with 30 for most weave widths and 5 for very small weave widths.

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Parameter	Value
Track Bias	The bias parameter is used to move the TCP in the seam y direction to bias (offset) one side of the joint or the other. The range for this parameter is from -50 to +50 where +50 is the highest amount of bias achievable in the plus Y direction of the seam coordinates. Used in center line tracking only.
Store path	A checkbox to enable the `store_path` component in `trackdata`. Used for saving the path with *MultiPass*.

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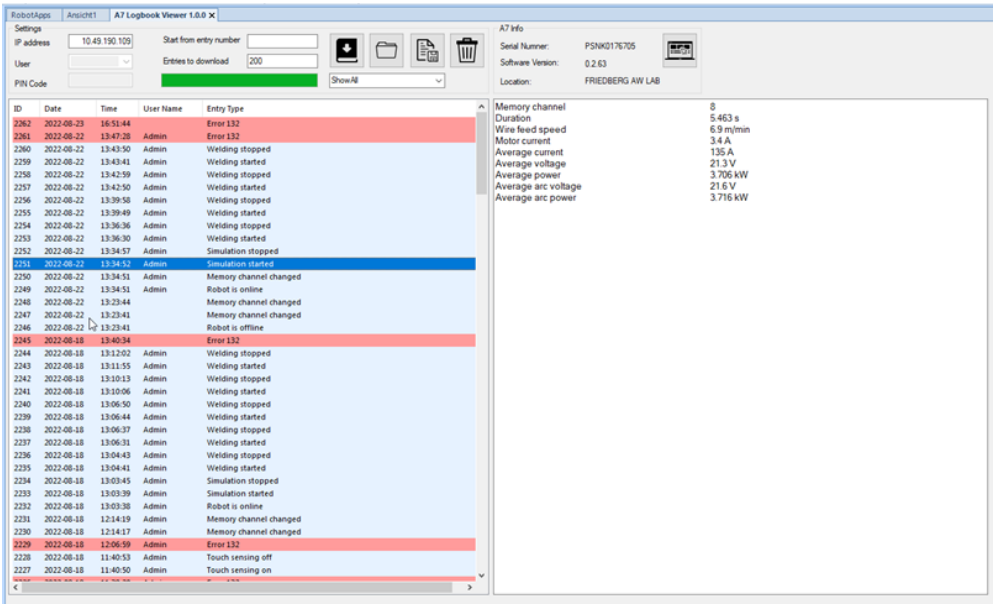
9 The Kemppi A7 Logbook Viewer

Introduction



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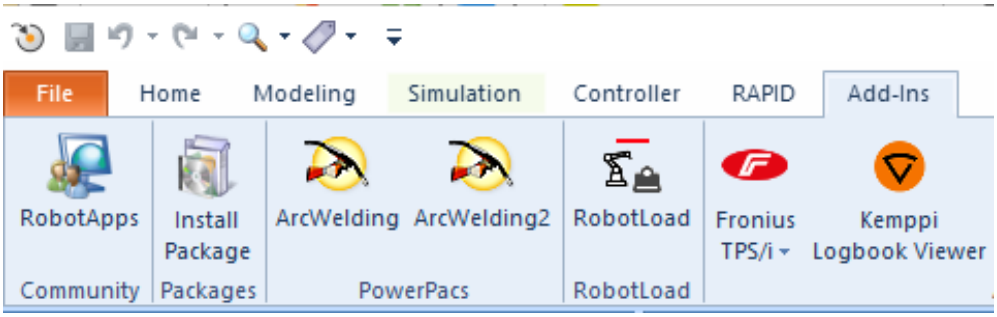
The **Logbook Viewer** can be started from the Add-Ins tab in Robotstudio.

Select **Kemppi Logbook Viewer** to start.



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Supported languages

The Logbook Viewer has support for all languages currently supported by the A7 Welder. These are :

- English
- Finnish
- Chinese
- German
- Norwegian
- Danish
- Dutch
- French

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Continued

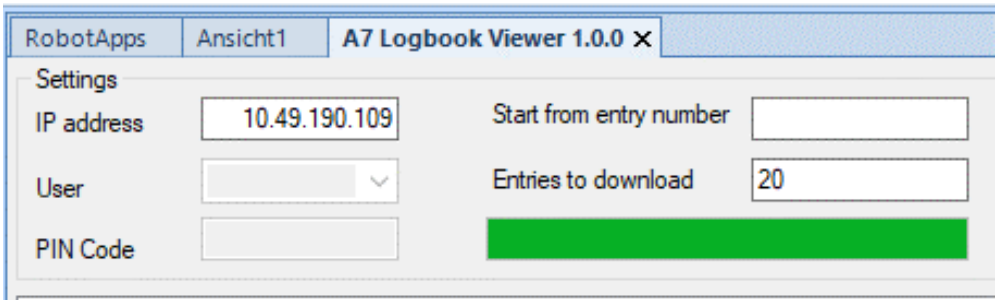
- Spanish
- Russian
- Portuguese (Brazil)
- Italian

The language will be automatically set to the same language that is active in the welder once the logbook entries are downloaded. If opening a file from the hard disk and no previous logbook entries have been downloaded, the viewer uses the current culture settings.

Buttons

Button	Description
	Start download of the specified number of entries.
	Open a browser dialog and load a previously saved logbook file.
	Save logbook entries to a file.
	Clear logbook files in current view (entries will only deleted in RobotStudio, not in the welder).
	Start the Web UI.

Settings



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Setting	Description
IP Address	The IP address of the A7 welder. Enter a valid IP address. A ping is sent prior downloading the logbook entries awaiting a response from the entered client IP.
User	A username is needed if user identification is active in the A7 welder.
PIN Code	A pin code for the selected user is needed if user identification is active in the A7 welder.

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Continued

Setting	Description
Start from entry number	Enter a number the download should start from. Leave it empty to start from the most recent logbook entry.
Entries to download	Number of logbook entries to download. Leave it empty to download all entries. Downloading all entries can take some time (up to several minutes) depending on the number of logbook entries available in the welder. A progress bar is shown as long as the download is active

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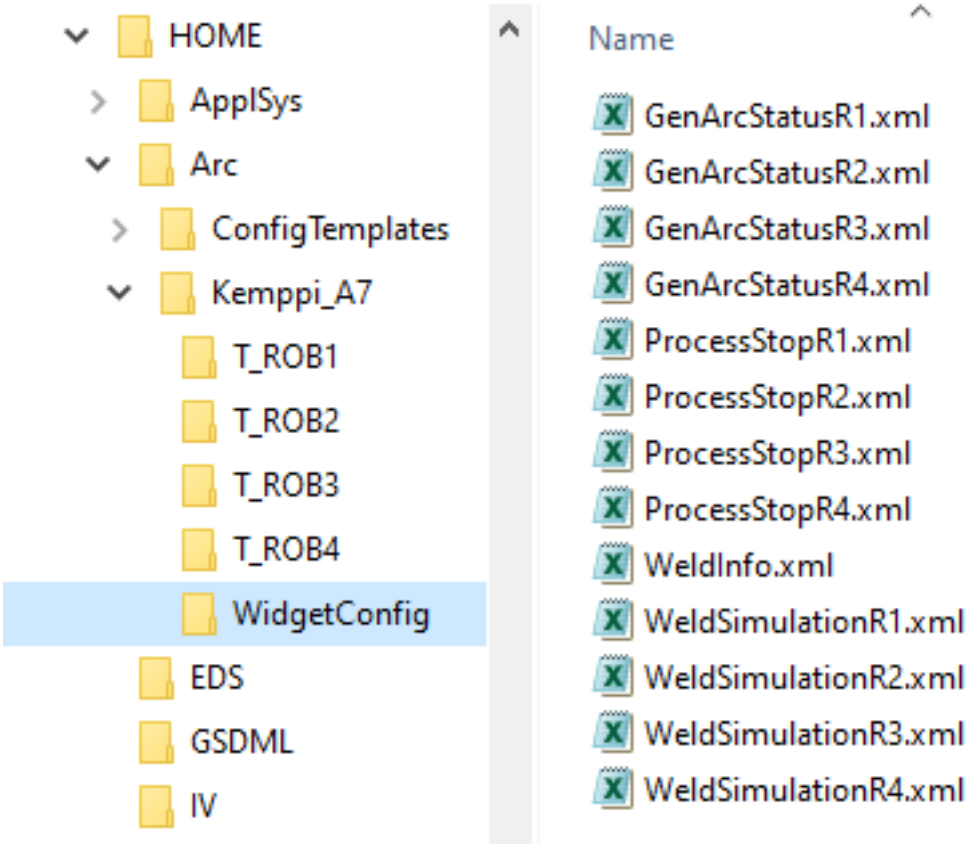
10 Customize widgets

10.1 Production Screen widgets

Introduction

The Kemppi A7 Package provides a set of widgets that can be used. The configuration is done with the template files located in the system's HOME folder.

`\HOME\Arc\Kemppi_A7\WidgetConfig`



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Copy the template file(s) into the following folder in the systems HOME directory and restart Production Screen.

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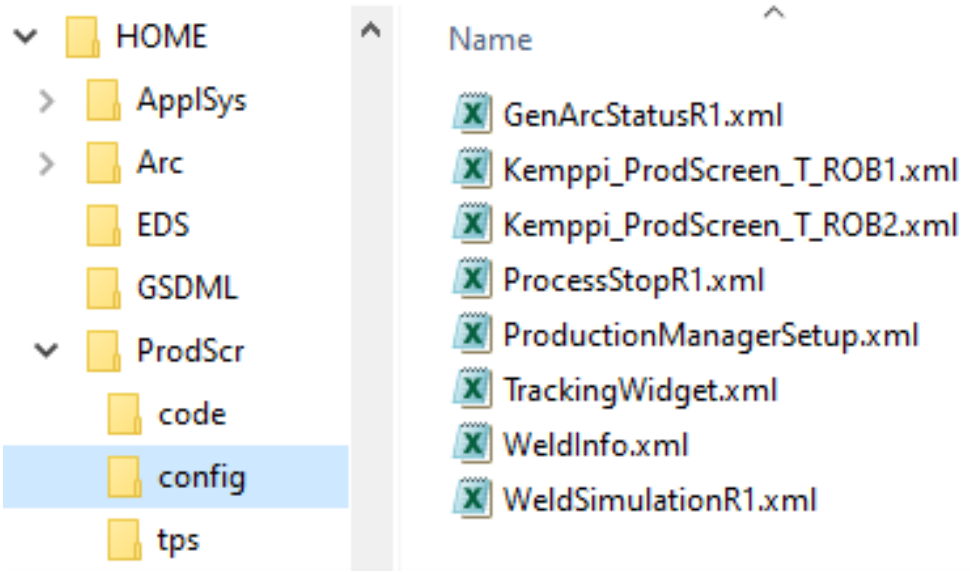
HOME\ProdScr\config



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The customizable widgets are placed on page 2.

For more information about how to use and setup *Production Screen*, see *Application manual - Production Screen*.

Simulate Process widget

The **Simulate Process** widget can be used in manual and automatic mode. It can be used to test the welding program. The power source simulates a real welding process by using the welding simulation signal.

- A programmed welding path can therefore be travelled without any welding taking place
- All signals are set, just like the real thing (with no timing interdependencies or actual values)
- Arc stable
- No arcs are ignited
- No wire electrode is fed
- The gas solenoid valve is not activated

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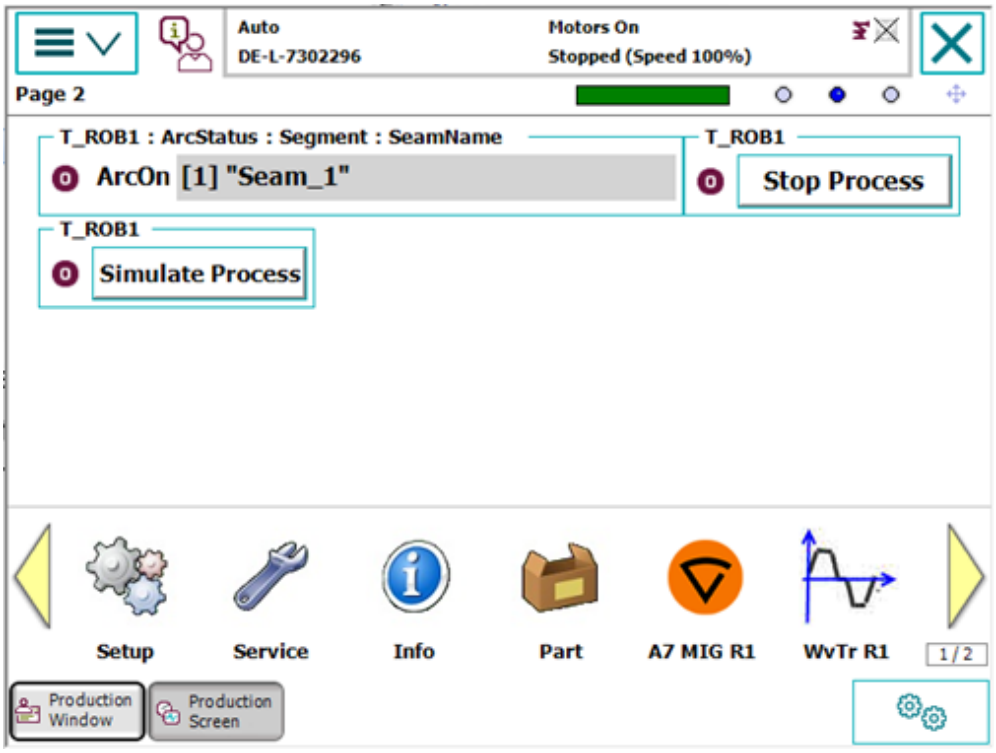

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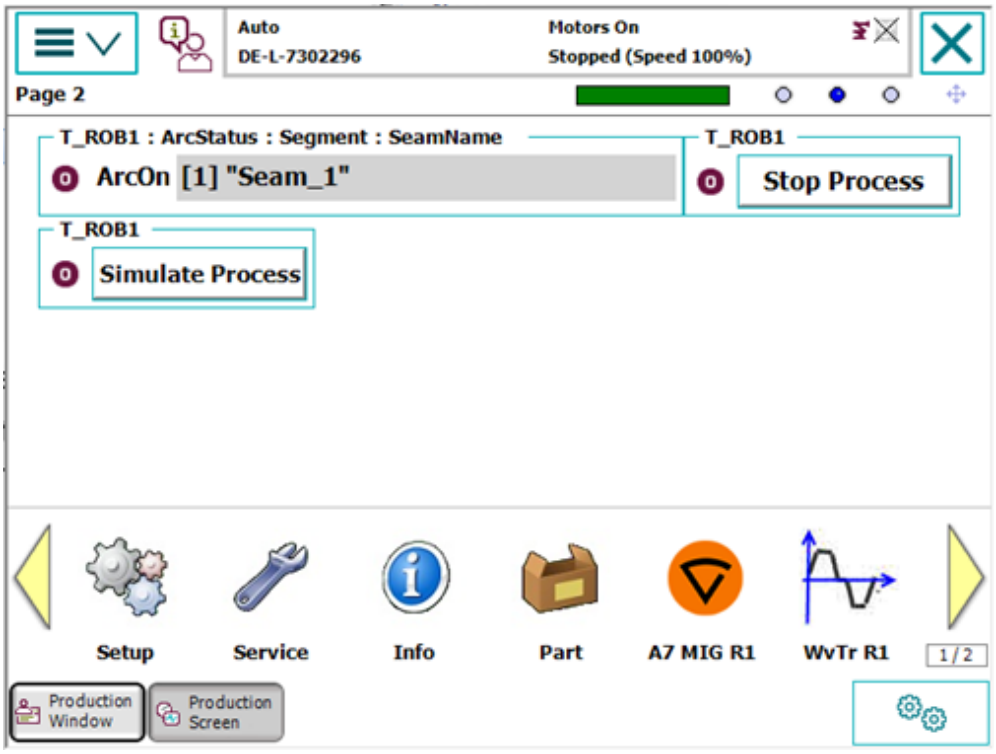
ArcStatus widget

The **ArcStatus** widget has a status LED to indicate active welding process. Also, the widget shows the current seam name and segment.



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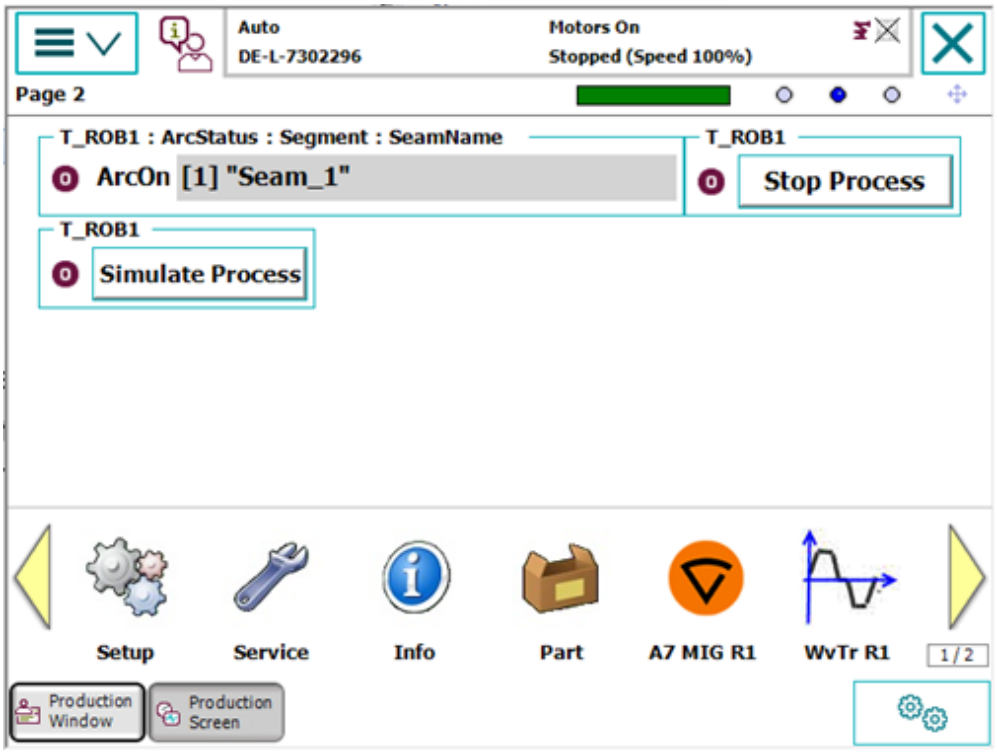
Stop Process widget

The **Stop Process** widget can be used to stop the current welding process. This is mainly used for testing and should not be used in real production.



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10.2 Modifying the widgets on the FlexPendant

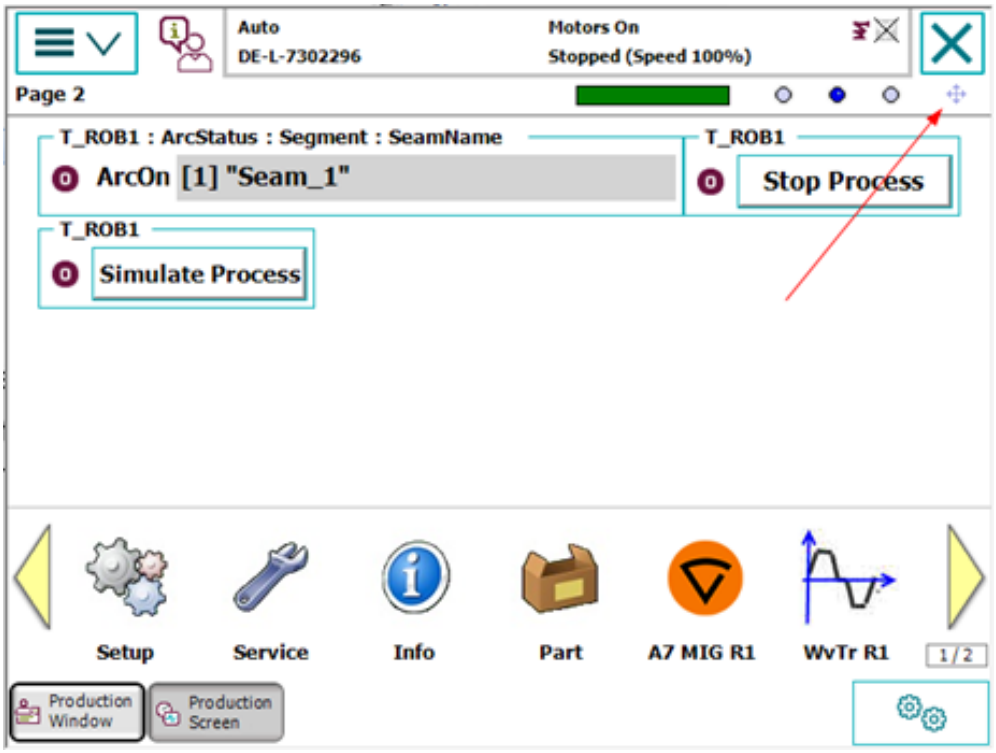
The widget area

The widget area is a 10x4 grid of cells. Each cell is 60x60 pixels. The smallest space a widget can occupy is one cell.

Widget area navigation

Tap the widget page indicators or the widget page navigation arrows to change widget page.

To access the widget location view, first enable widget move state, then tap and hold the widget. The widget can now be moved by tapping any cell in the widget area.



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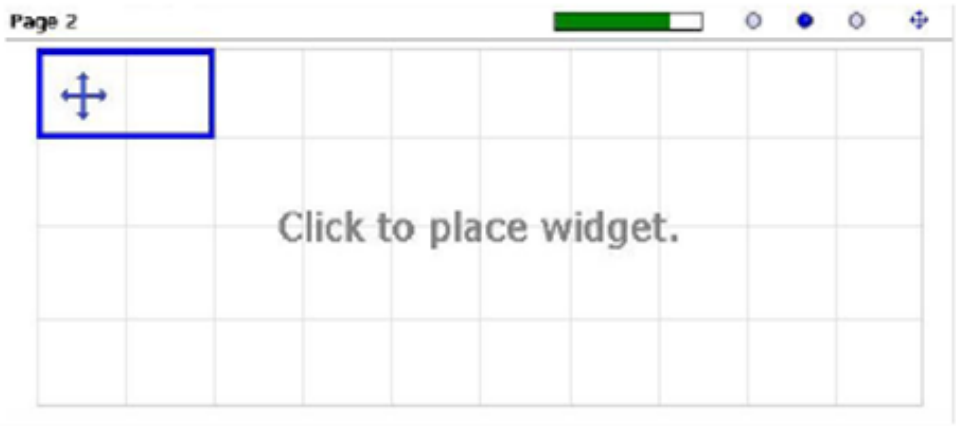

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The widget can also be moved to a different page. Tap and hold a widget to access the widget location view. Tap the desired page in the widget page indicator. Finally, tap any cell in the widget area.

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Index

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