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INTEGRATION GUIDE

A7 MIG Welder

350, 450

KEMPPI

CONTENTS

1. INTRODUCTION

The A7 MIG Welder is a complete welding system for automated welding applications.

This guide, together with the A7 MIG Welder operating manual, instructs you on how to set up the system and perform the necessary cable connections and setup configuration to get the system running.

Important notes

Items in the manual that require particular attention for minimizing damage and harm are indicated with the symbols below. Read these sections carefully, and follow their instructions.

Note: A note item gives the user a useful piece of information.

Caution: Caution items describe a situation that may result in damage to the equipment or system.

Warning: Warnings describe a potentially dangerous situation. If not avoided, it will result in personal harm or fatal injury.

Disclaimer

While every effort has been made to ensure that the information contained in this guide is accurate and complete, no liability can be accepted for any errors or omissions. Kemppi reserves the right to change the specification of the product described, at any time, without advance notice. Do not copy, record, reproduce, or transmit the contents of this guide without prior permission from Kemppi.

The web user interface server, part of the robot interface unit, is meant to be used only in point-to-point connection with one authorized personal computer. For the sake of confidentiality, it is not recommended to connect the A7 MIG Welder system to any public or internal network. Kemppi is not liable for errors or damage resulting from non-compliance with this recommendation.

2. INTEGRATION STEP BY STEP

To ensure safe and efficient integration of the welding system, follow these simple steps:

1. INSTALL THE HARDWARE
   - Make sure that all the components are OK.
   - Mount the cooling unit, if any, on the power source.
   - Attach all required equipment to the robot and to the welding cell.
   - Make all required cable connections.
   - Power up the system.

2. ACCESS THE WEB USER INTERFACE
   - Configure the network connection by means of the setup panel.
   - Open the web user interface using a web browser.

3. CONFIGURE THE SYSTEM
   - Configure the welding system, sensors, and devices.
   - Configure the digital robot interface.
   - Configure system users.
   - Create memory channels.
   - Make a system backup.

After completion of these steps, the system is ready for welding.

For detailed instructions on each step, consult the corresponding section of this document.

3. HARDWARE INSTALLATION

3.1 Procedures before use

The product is packed in specially designed transport cartons. Unpack the products from the cartons, and check that they have not been damaged during transportation. Check that the contents are complete and nothing is missing.

The product's packaging material is recyclable.

When moving the welding machine, never pull it by the welding-gun or other cables. For lifting the power source and the robot interface unit, use the recesses at both ends of the robot interface unit.

After installation, make sure all cables and hoses have enough space to move and are attached properly.

Remember that the cable, plugs, and other electrical devices may be installed or replaced only by a person authorized to perform such operations.

3.2 System overview

The welder system supports both gas- and water-cooled torches. An interconnection cable set without cooling hoses is available for gas-cooled torches (see Figure 3.1, "Connection diagram, gas cooled system"). Water-cooled torches require a cooling unit and an interconnection cable set with cooling hoses, both sold separately (see Figure 3.2, "Connection diagram, water-cooled system").

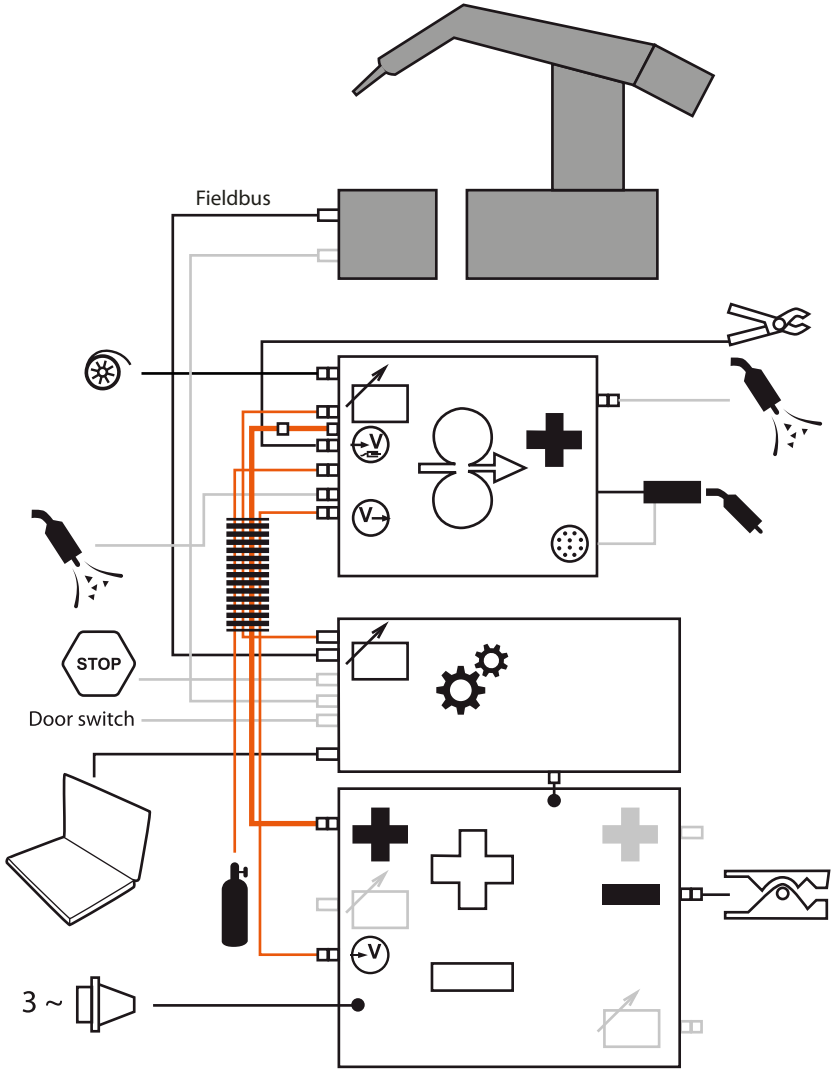


Figure 3.1: Connection diagram, gas-cooled system

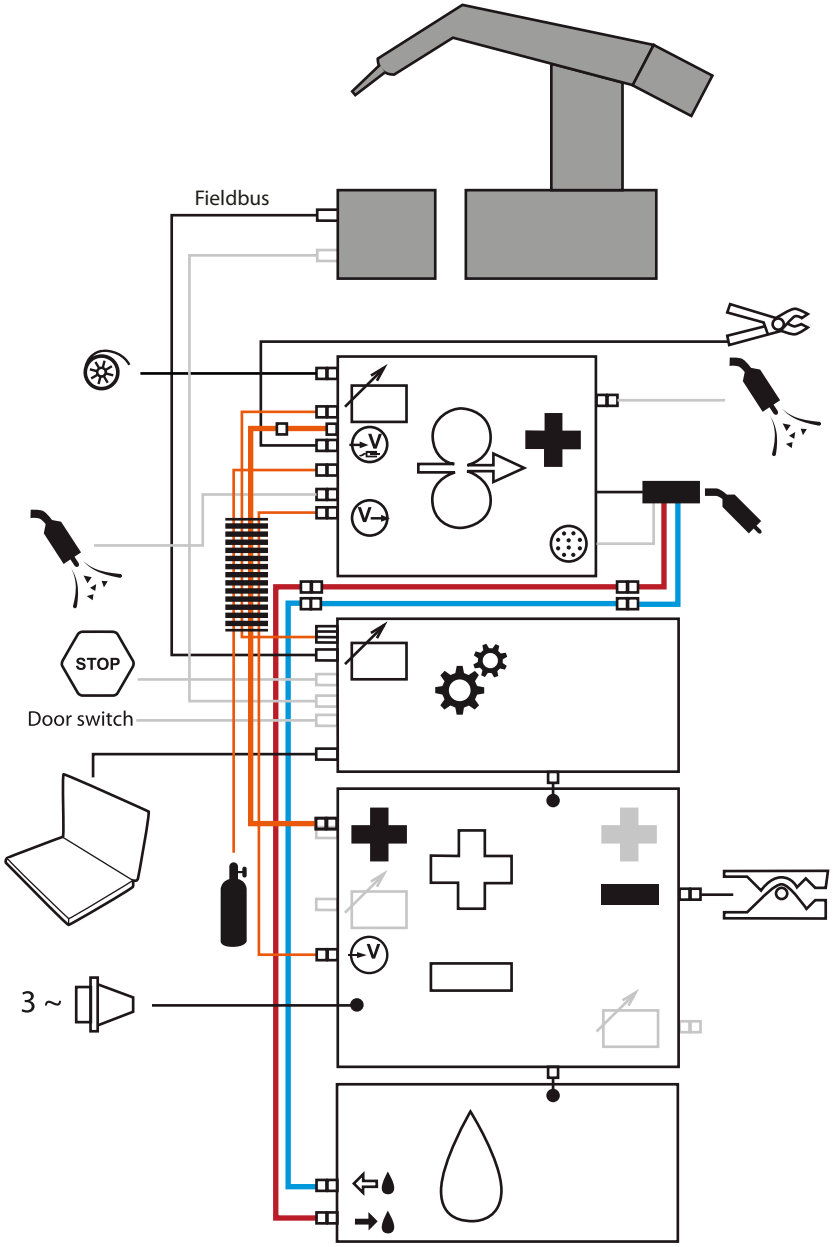


Figure 3.2: Connection diagram, water-cooled system

3.3 Power source

Place the machine on a sturdy, level surface that is dry and will not allow dust or other impurities to enter the machine's cooling air flow. Preferably, situate the machine in a suitable carriage unit so that it is above floor level.

- The surface inclination may not exceed 15 degrees.
- Ensure the free circulation of cooling air. There must be at least 20 cm of free space in front of and behind the machine for cooling-air circulation.
- Protect the machine against heavy rain and direct sunshine.

⚠ *Do not operate the machine in the rain.*

⚠ *Never aim the spray of sparks from a grinding machine toward the equipment.*

The power plug

The power source comes without a plug for connection to the electrical grid. Attach a plug suitable for your power-supply standard to the power cable. Check the connections, attach the plug to a socket, and switch the electrical power on from the welding power source to verify that the machine works properly.

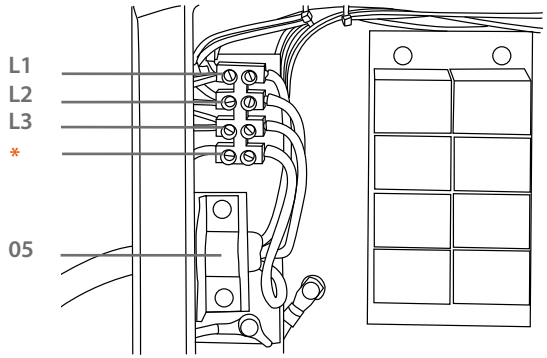
⚠ *Switch the machine off, and unplug it from the power socket before continuing to further steps in the hardware installation.*

ⓘ *If local or national regulations specify that an alternative power cable is required, the cable must be replaced in conformity with the regulations. Connection and installation of the power cable and plug should be carried out only by a suitably qualified person.*

Remove the machine's left-hand cover plate to enable attachment of an electrical cable. The power source unit can be connected to a 400 V, 3~ power supply.

If changing the power cable, take the following facts into consideration:

- The cable enters the machine through the inlet ring on the rear panel and is fastened in place with a cable clamp (05).
- The phase conductors of the cable are coupled to connectors L1, L2, and L3.
- The protective ground line, colored green and yellow, is coupled to the marked connector.
- If you are using five-lead cable, do not connect the neutral conductor.



* In S-type cables there is a protective grounding conductor, green-and-yellow striped.

3.4 Cooling unit

If you use a water-cooled welding torch, you need a cooling unit installed as part of the welder system. Attach the cooling unit to the power source. See the detailed installation instructions in the operating manual delivered with the cooling unit package.

The cooling hose connections are described in Subsection 3.8.5, "Cooling hoses."

ⓘ *The wire feeder has no connectors for cooling hoses. Use a special adapter to connect the cooling hoses to the welding torch cooling connectors.*

3.5 Wire feeder

Use a two-part mounting bracket to mount the wire feeder securely on the robot arm. Fasten the upper part of the bracket to the bottom of the wire feeder and the lower part to the robot arm. Finish the installation by putting the bracket parts together and fixing them in place with bolts. See the illustrated instructions included in the product delivery package.

Mounting brackets are available for the most commonly used welding robots. See the complete list at www.kemppi.com.

The wire feeder connections are described in Section 3.8, "Interconnection cable set."

Filler wire

Connect the wire liner to the filler wire inlet connector on the rear of the wire feeder. Connect the other end of the wire liner to the wire drum or spool, and run the wire up to the wire feeder either manually or by using wire inch functionality at the wire drum.

Peripheral connector

For a push-pull welding torch, a collision sensor, and other peripheral devices, the wire feeder has a common 10-pin peripheral connector at the front of the wire feeder. The connections of the push-pull torch and the peripherals are described later in this document.

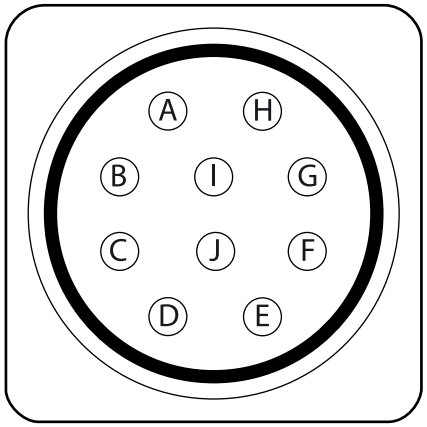


Figure 3.3: Peripheral connector pinout

A. Motor (+)
B. Motor (–)
C. Supply (+24 V)
D. Wire inch input
E. Collision sensor input
F. Touch sensor output for gas nozzle (+50…+200 V)
G. Tachometer (+5 V)
H. Supply GND
I. Tachometer GND
J. Tachometer input

Table 3.1: Electrical characteristics for the peripheral supplies

Value	*Min.*	*Typical*	*Max.*	*Unit*
Motor supply voltage (RMS)	24		48	V
Motor supply voltage (peak)			75	V
Motor supply current	0		5	A
Supply voltage	23.0	24.0	24.5	V
Supply current	0	150	780*	mA
Tachometer supply voltage	4.9	5	5.1	V
Tachometer supply current	120	125	130*	mA
Touch sensor output voltage**	50		200	V
Touch sensor output current**			10	mA

* This is the short-circuit current.

** The touch sensor electrical characteristics are found in the A7 MIG Welder *Operating* manual.

3.6 Welding torch

3.6.1 Mounting

Fasten the welding torch securely to the robot arm, using a robot mount (T1, T2, or T3). See the detailed mounting instructions in the delivery packages for the welding torch and robot mount.

For the welding torch, the wire feeder is equipped with a Euro MIG torch connector. Push the torch connector into the Euro connector on the wire feeder, and tighten the collar.

If you are using a water-cooled torch, connect the red-and-blue marked cooling hoses to the corresponding hoses coming from the cooling unit in the interconnection cable set. For details, see Subsection 3.8.5, "Cooling hoses".

3.6.2 Push-pull torches

If using a push-pull torch, you need to connect the torch motor and any tachometer to the 10-pin peripheral connector. For the connector pinout see Section 3.5, "Wire feeder". The motor is connected to pins A and B (see Figure 3.4, "Push-pull motor connection"). The tachometer is connected to pins G, I, and J (see Figure 3.5, "Push-pull motor with tachometer").

In order to operate properly, the push-pull torch must be configured for use. The configuration is described in Subsection 5.1.4, "General robot settings".

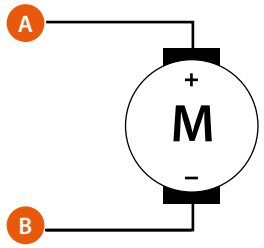


Figure 3.4: Push-pull motor connection

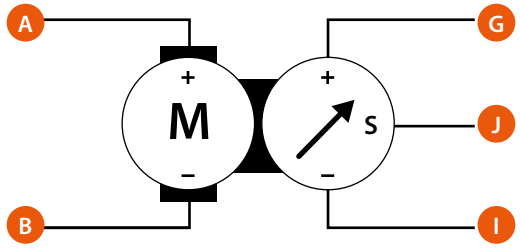


Figure 3.5: Push-pull motor with tachometer

3.6.3 Wire inch button

If the welding torch is equipped with a wire inch button, connect it to pins D and H of the peripheral connector (see Figure 3.6, "Wire inch button connection").

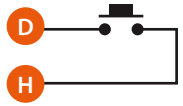


Figure 3.6: Wire inch button connection

3.6.4 Torch-cleaning with compressed air

The wire feeder is equipped with a compressed-air valve for torch-cleaning. The wire feeder has appropriate fast connectors for 6 mm nylon hose at the rear (inlet) and front (outlet).

If you are using a torch with air-cleaning capability, connect the compressed-air hose of the torch to the front connector, and connect a hose from an air compressor to the rear connector.

⚠ *Do not modify the wire feeder. Use adapters if needed.*

In automated operation, the torch-cleaning function is controlled by a robot by using the digital robot interface. To test the function manually:

- Press the air blow button on the wire feeder, or
- Use the air blow test function in either the setup panel or the web user interface, or
- Control the air blow by means of the robot teach pendant

3.6.5 Touch-sensing with the gas nozzle

The default way to use the touch sensor of the welder system is to use the welding wire as the touch tool. Alternatively, you can use the gas nozzle of the welding torch.

If the gas nozzle is used for touch-sensing, connect pin F of the peripheral connector to the gas nozzle, using an extra wire (see Figure 3.7,"Touch sensor gas nozzle connection").

For instructions on how to configure the touch sensor, see the A7 MIG Welder *Operating* manual.

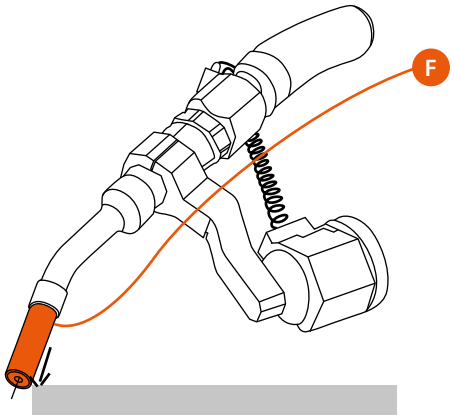


Figure 3.7: Touch sensor gas nozzle connection

3.7 Collision sensor

The collision sensor is an external device that protects the torch neck from bending and being damaged. It is integrated into the mount between the robot arm and the welding torch. The sensor sends a signal to the robot to stop welding when a collision is detected at the welding head.

Not all robot mounts feature a collision sensor. See the manual of the robot mount for more information.

The welder system supports two types of collision sensors, an opening-action switch sensor and a closing-action switch sensor. The opening-action switch keeps the relevant electrical circuit normally closed and opens it on a collision, while the closing-action switch keeps the electrical circuit normally open and closes it upon a collision (see Figure 3.8, "Opening-action and closing-action switches").

The switch type is configured via software. The collision sensor configuration is described in Subsection 5.1.6, "Collision sensor settings."

Figure 3.8: Opening-action (left) and closing-action (right) switches

Connect the collision sensor to pins E and H of the peripheral connector (see Figure 3.9, "Collision sensor connection").

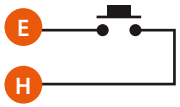


Figure 3.9: Collision sensor connection

Some collision sensors have LED status indicators coupled with the switch and therefore require supply voltage. Connect pin C of the peripheral connector to supply power to the indicators (see Figure 3.10, "Collision sensor with LED indicators").

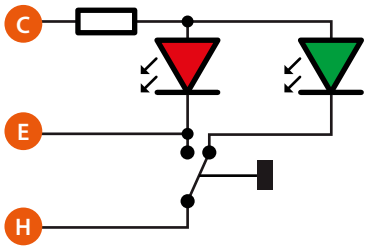


Figure 3.10: Collision sensor with LED indicators

3.8 Interconnection cable set

The interconnection cable set contains several cables and hoses wrapped in a strong fabric sleeve equipped with a zipper. The cable set is used for delivering the welding power, shielding gas, cooling liquid, and control signals from the welding power source to the wire feeder.

The interconnection cable set is available with and without cooling hoses.

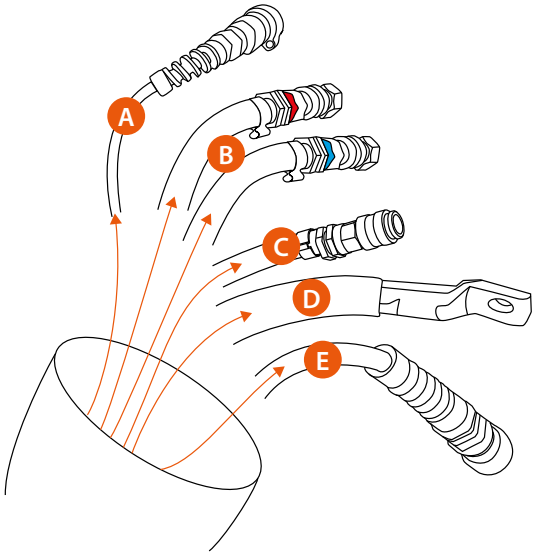


Figure 3.11: Interconnection cable set (wire feeder end)

A. Arc measurement cable
B. Cooling hoses
C. Shielding gas hose
D. Welding cable
E. Wire feeder control cable

3.8.1 The arc measurement cable

The arc measurement cable is a part of the arc voltage measurement function, which is used to calibrate the actual arc voltage and power regardless of the welding cable diameter or length.

Connect the cable to the arc measurement input connector at the rear of the power source.

Connect the cable to the arc measurement output connector at the wire feeder.

For using the arc voltage calibration, connect a separate earth cable (included in the package) from the wire feeder to the work piece, near the weld joint.

Check the route of the earth cable. Incorrect routing can cause damage to the cable or the robot when the robot is moving.

When the system is ready to run, calibrate the power source by welding with 1-MIG, MIG or with Pulse MIG for at least 5 seconds, with the arc measurement cable and the earth cable connected. After calibration the arc measurement cable can be detached.

Using the arc measurement cables affects the functionality of the touch sensor. See the A7 MIG Welder Operating manual for details.

If you are using a sub-feeder, enter the length of the sub-feeder to the SubFeederLength parameter in the setup panel. This parameter is not available in the web user interface.

3.8.2 Wire feeder control cable

The wire feeder control cable provides power to the wire feeder and transmits the control data between the wire feeder and the robot interface unit. It also contains the touch sensor voltage line from the robot interface unit to the wire feeder.

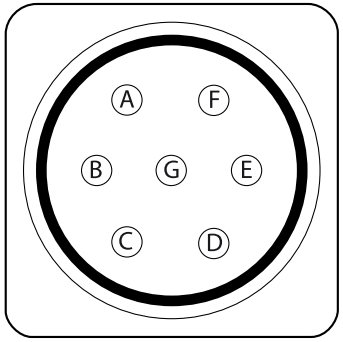
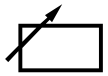


Figure 3.12: Wire feeder control cable connector pinout

A. Power supply GND
B. Data in/out
C. Power supply +50 V
D. (not connected)
E. Touch sensor voltage (+50…+200 V)
F. (not connected)
G. (not connected)



At the wire feeder, make the connection to the control cable connector.
At the power source, connect the cable to the control cable connector at the rear of the robot interface unit.

At the power source, the connector must be connected to the back of the robot interface unit. Do not use any other control cable connectors.

3.8.3 Welding cable

The welding cable delivers welding power from the power source to the welding head.

At the wire feeder, connect the cable to the screw terminal on the front of the unit.
At the power source, connect the cable to the (+) connector on the back of the power source unit.

3.8.4 Shielding gas hose

The shielding gas hose delivers the shielding gas to the welding torch.

At the wire feeder, connect the hose to the shielding gas snap connector.
Connect the other end of the hose to the shielding gas supply.

3.8.5 Cooling hoses

Cooling hoses deliver the cooling liquid from the cooling unit to the welding head.

- At the wire feeder, connect the cooling hoses directly to the hoses coming from the welding torch.
- At the power source, connect the cooling hoses to the cooling unit located under the power source.

The wire feeder does not have connectors for cooling hoses. Use special adapters if required.

3.9 Fieldbus communication

This welding system supports the following fieldbus choices for communication between the welding equipment and the welding robot.

Ethernet:

EtherNet/IP
EtherCAT
PROFINET
Modbus TCP

Others:

DeviceNet
PROFIBUS DP-V1
Modbus RTU

The choices are enabled by interchangeable Anybus CompactCom M30 modules manufactured by HMS. See the A7 MIG Welder Operating manual for the complete list of modules and their order codes.

Do not remove or attach the fieldbus module when the power is switched on. Doing so could damage the module.

There is a connection slot for the module on the back of the robot interface unit. Place the appropriate type of Anybus module in the slot (see Figure 3.13, "Installing a fieldbus adapter"). Ensure that it sits properly in its place. Tighten the two screws on the module after you have placed it into the slot. Connect a suitable fieldbus cable to the connector of the Anybus module and the other end of the cable to the robot controller.

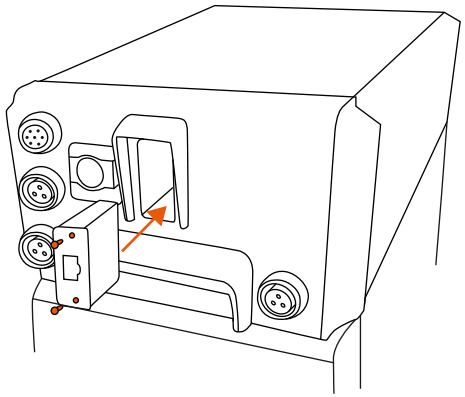


Figure 3.13: Installing a fieldbus adapter

Table 3.2: Kemppi Oy vendor IDs and device description files

Fieldbus	*Vendor ID*	*Device description file*
EtherNet/IP 1-port and 2-port	1403 (integer)	EDS (Electronic Data Sheet)
EtherCAT	00FE0001h (hexadecimal)	ESI (EtherCAT Slave Information)
PROFINET 1-port and 2-port	0368h (hexadecimal)	GSD (General Station Description)
Modbus TCP 1-port and 2-port	"Kemppi" (text)	The Modbus standard does not feature a device description file.
DeviceNet	1403 (integer)	EDS (Electronic Data Sheet)
PROFIBUS DP-V1	0368h (hexadecimal)	GSD (General Station Description XML)
Modbus RTU	"Kemppi" (text)	The Modbus standard does not feature a device description file.

3.10 Ethernet (web user interface server)

The welder system is equipped with a web user interface. The server for the web user interface is in the robot interface unit, and the connector for the server is at the rear of the unit.

Connect the web user interface server to a laptop computer, to another PC, or to a local area network by using a CAT-5 or CAT-6 shielded Ethernet RJ-45 cable. The communication speed of the network is 100 Mbps (100Base-TX) and the maximum length of the cable is 90 m. Both crossover and direct cables are suitable.

The network configuration is described in Chapter 4, "Accessing the web user interface".

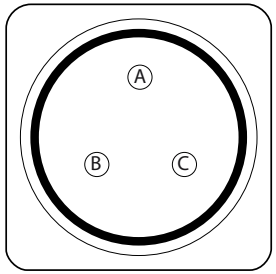
3.11 Stop input functions

There are two stop input functions in the system, for the stop switch and gate door switch.

- The stop switch halts the system when the operator presses a stop button. After a stop switch action, the system must be recovered manually.
- The gate door switch halts the system when a protective gate door is opened. Shielding gas testing, the torch clean-up function (compressed-air valve), wire inch, wire retraction, and the touch sensor can be used in this situation. The touch sensor voltage is automatically lowered to a safety level (max. 110 V). After a gate door switch action, the system is recovered automatically.

Both inputs have a separate three-pin connector at the rear of the robot interface unit. The connectors have identical pinout (see Figure 3.14, "Stop input connector pinout"). The inputs are galvanically isolated from each other and from the other hardware I/O of the robot interface unit. The inputs have individual short-circuit-protected +24 V DC power supplies, each providing up to 100 mA of continuous current.

Figure 3.14: Stop input connector pinout



A. Supply out +24 V, 100 mA
B. Stop input signal
C. Supply GND

There are four alternative ways of connecting the stop and gate door switches (see Figure 3.15, "Connecting the stop input switches"). Select one of these ways on the basis of your stop circuitry and the switch types used. Connect the stop circuitry to the stop input connector by using custom cables.

The stop inputs are configured via software. The configuration is described in Subsection 5.1.7, "Stop switch settings."

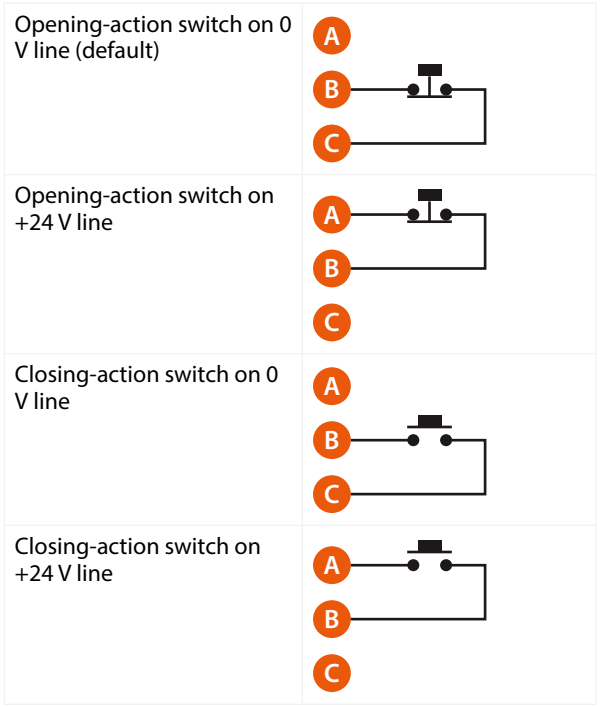


Figure 3.15: Connecting the stop input switches

3.12 Touch sensor status fast output

This welding system is equipped with an instantly responding touch-sensing feature for locating the work-piece in teaching of the welding robot.

In normal operation, the status of the touch sensor is passed to the robot via a fieldbus connection. However, fieldbus bus latency affects the efficiency of operation. To avoid delays, the hardware-based fast output can be used for better response. For connection of fast status output, the robot must have at least one hardware input available.

Connect the fast output to the touch sensor fast status output connector on the rear of the robot interface unit by using a custom cable. Connect the other end of the cable to the hardware input of the robot controller.

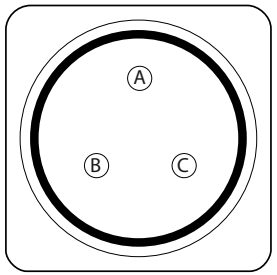


Figure 3.16: Fast status output connector

A. Supply in +24 V
B. Status signal out
C. Supply GND

The fast output requires an external 18–36 V power supply.

The output is galvanically isolated from other hardware and is short-circuit-protected. The maximum continuous switching current is 100 mA @ +24 V.

3.13 Dual wire feeder support

Dual wire feeder support in the A7 MIG Welder system

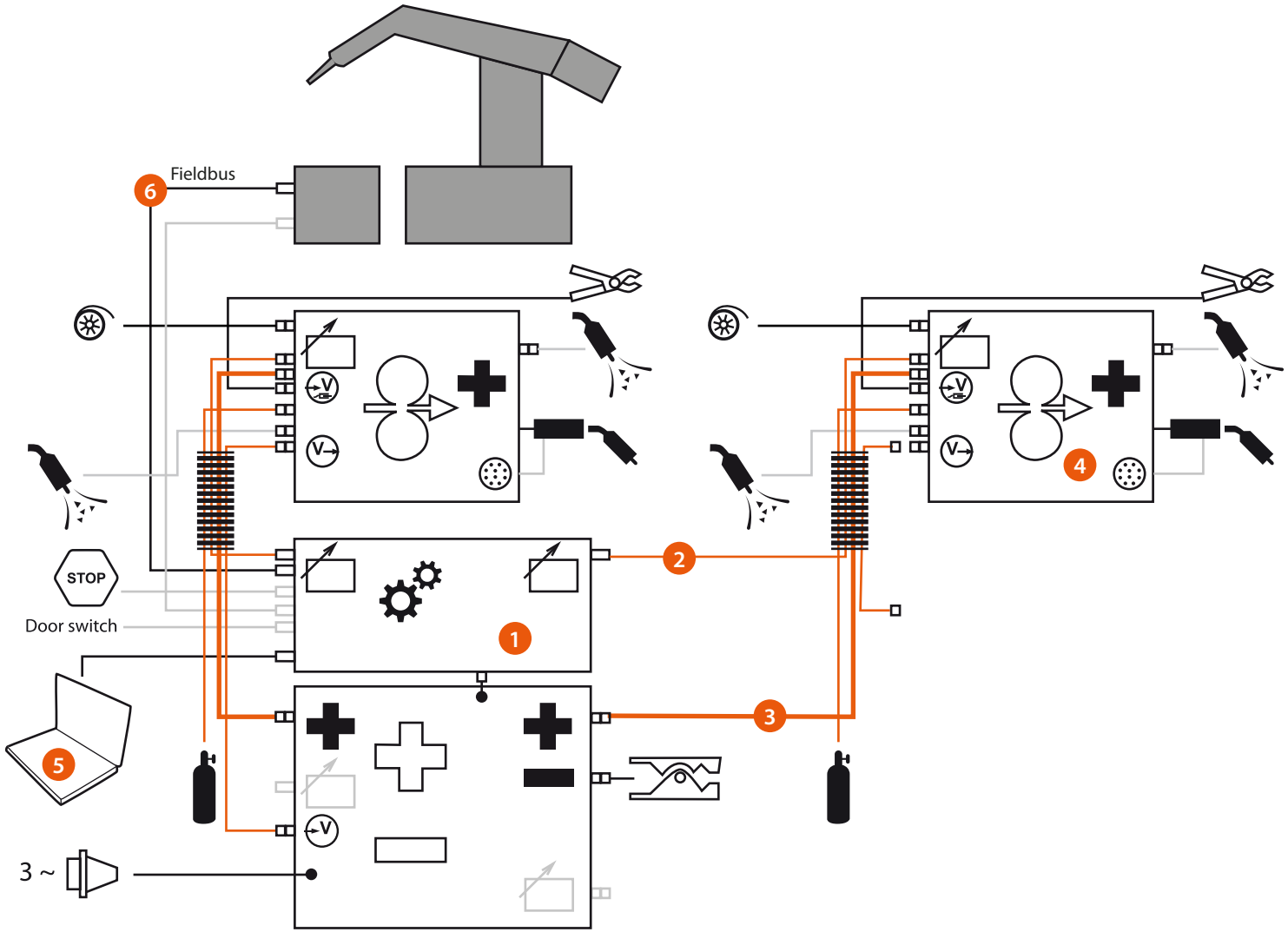


Figure 3.14 Connecting two wire feeders into A7 MIG Welder system

1. Dual wire feeder extension kit
2. Extra control cable
3. Extra welding cable
4. Second wire feeder
5. Web user interface
6. Fieldbus

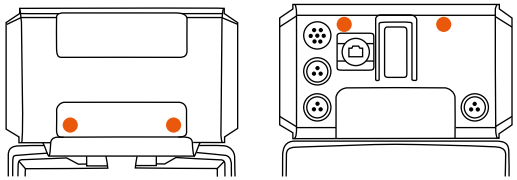
The A7 MIG Welder supports two wire feeders, one operational at the time. This feature is enabled by an optional extension kit. The extension kit is installed inside the robot interface unit. The kit includes a wire feeder switching card, a flat band cable, and a harness with connectors for the wire feeder and for the mother board of the robot interface unit. The operational wire feeder can be selected from the setup panel or web user interface, or let to be selected from the robot pendant. The wire feeder configuration is described in the Subsection 5.12, "Wire feed settings".

3.13.1 Installation

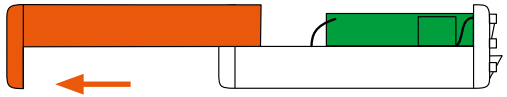
Switch the power source off and install the extension kit into the robot interface unit. Ensure that all the cables are installed properly. Test the system by switching the power source on and selecting the wire feeder between the WF1 and WF2 from the setup panel or between the Wire feeder 1 and Wire feeder 2 from the web user interface. The extension card should indicate the selection by amber LED lights. After successful installation, switch the power source off and close the robot interface unit.

Follow these steps to install the extension kit:

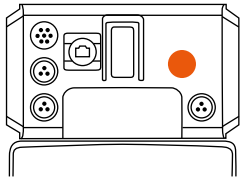
7. Unscrew four screws, two from the front panel and two from the back panel.



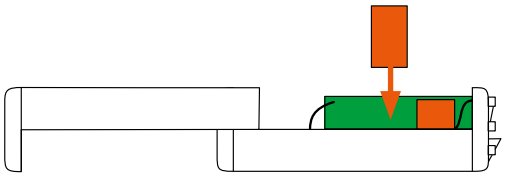
8. Slide the top cover off by pulling from the handle in the front panel.



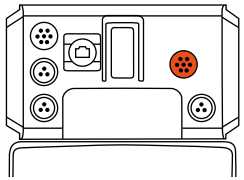
9. Remove the plug from the extension connector slot.



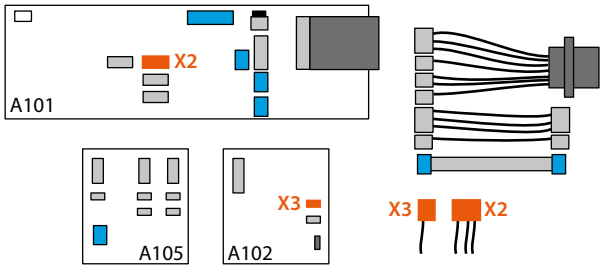
10. Mount the switching card side by side with the touch sensor card.



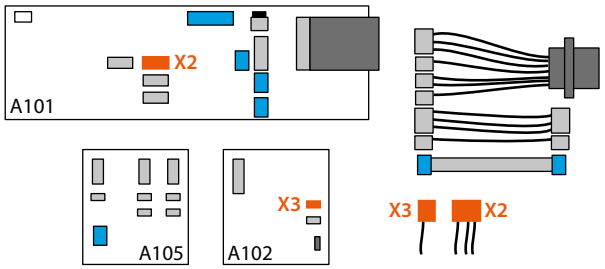
11. Fix the secondary wire feeder control connector to the extension connector slot by using four screws.



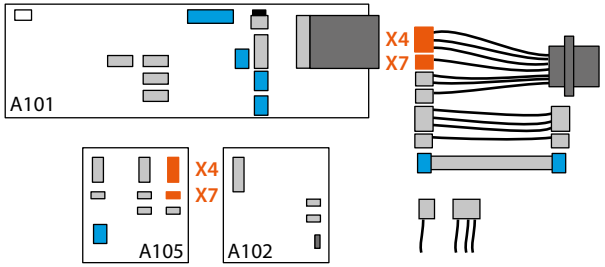
12. Unplug the primary wire feeder from the motherboard A101 and from the touch sensor card A102.



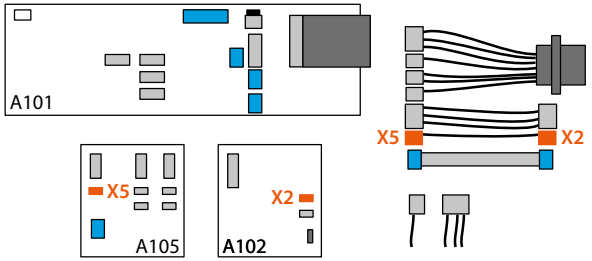
13. Plug the primary wire feeder to the switching card A105 primary outputs (harness X3 to A105 X6 and harness X2 to A105 X3).



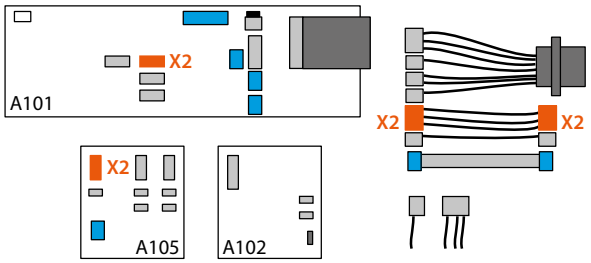
14. Plug the secondary wire feeder to the switching card A105 secondary outputs.



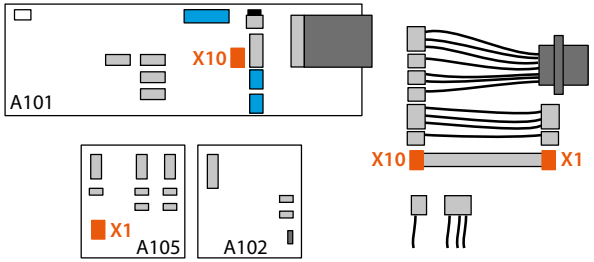
15. Plug a touch sensor cable between the switching card A105 input and the touch sensor card output A102.



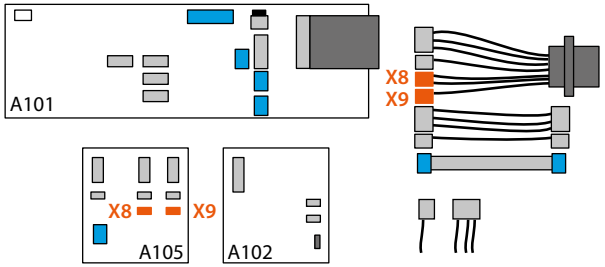
16. Plug a bus cable between the switching card A105 input and the mother board A101 output.



17. Plug a flat band cable between the switching card A105 and the mother board A101.



18. Plug the water valve control cables to the switching card A105.



3.13.2 Connect the second wire feeder

Connect the interconnection cable of the second wire feeder to the weld+ connector in the front panel of the power source. Connect the control cable of the second wire feeder to the extension connector in the back panel of the robot interface unit. Switch the power source on and test the wire feeders by performing a wire feed test for both wire feeders. Selecting the wire feeders from the setup panel or web user interface for the test.

In water-cooled systems with two water-cooled torches the cooling water circulation must be equally distributed into both torches. It is recommended to connect the torches in serial. In parallel the water flow can differ between the torches and may cause damage to the torch. The extension kit includes support for water valves. Should you want to use valves to control the circulation, please contact Kemppi service for instructions and guidance.

Only one wire feeder can be used for arc voltage measurement at the time. Do not branch the arc measurement cables.

3.14 Powering up

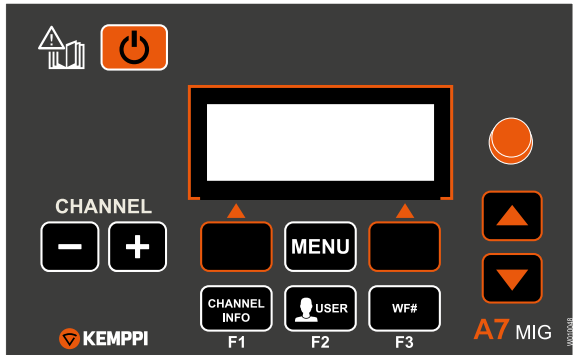
Before powering up the welding system, check all cable connections.

Attach the power plug to an electrical socket, and switch the machine on. Check that the machine starts up properly. The setup panel boots up within 10 seconds. The Web UI is usually accessible in 30 seconds.

The Web UI access time depends greatly on the network configuration in use. The fastest configuration is a direct connection with fixed IP addresses. With a local area network and DHCP, the access time can be significantly longer.

4. ACCESSING THE WEB USER INTERFACE

4.1 Configuring the network settings



The web user interface starts up automatically on power-up. However, before one can access the Web UI from the computer connected to the web user interface server, the network settings must be properly configured from the setup panel.

Go to the Main menu > Robot > Network settings, and configure the DHCP enabled, IP address, Subnet mask, and Gateway parameters to match your networking environment.

DHCP

If you have a DHCP server in your network and you want to enable a DHCP client function in the Web UI, change the DHCP enabled parameter's value to ON. The IP address, subnet mask, and gateway information will come from the DHCP server, and you don't need to configure these parameters. Switching this parameter's value to OFF lets you specify the IP settings manually.

When the DHCP client is switched on, it takes some time for the client to establish a connection to the DHCP server and retrieve the address information. Usually the retrieval time is no longer than 60 seconds. During that time, the old values are displayed for the IP address, subnet mask, and gateway.

IP address

Specify an IP address for the web user interface server (DHCP disabled) – for example, 10.0.0.20 – or display the address given by the DHCP server (DHCP enabled).

Subnet mask

Specify a subnet mask for the web user interface server (DHCP disabled) – for example, 255.255.255.0 – or display the mask given by the DHCP server (DHCP enabled).

Gateway

The web user interface does not use a gateway address. You can leave this parameter as it is (DHCP disabled) or display the address supplied by the DHCP server (DHCP enabled).

Configure your computer's network settings accordingly. Ensure that your computer has an IP address different from that of the web user interface – for example, 10.0.0.21. Other settings must match each other.

4.2 Opening the web user interface

Open a network browser on your computer. Enter the IP address of the web user interface server in the address bar – for example, http://10.0.0.20. If the network cable is connected and the network settings are configured properly, the network browser opens the web user interface and redirects to the welding display page (or, if login is required, to the login page).

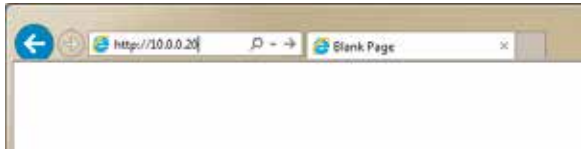


Figure 4.1: Enter the IP address in the network browser

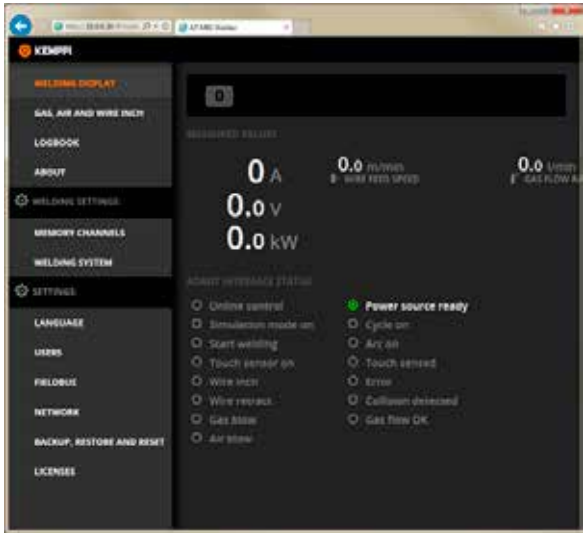


Figure 4.2: Welding display page

The web user interface now ready for use.

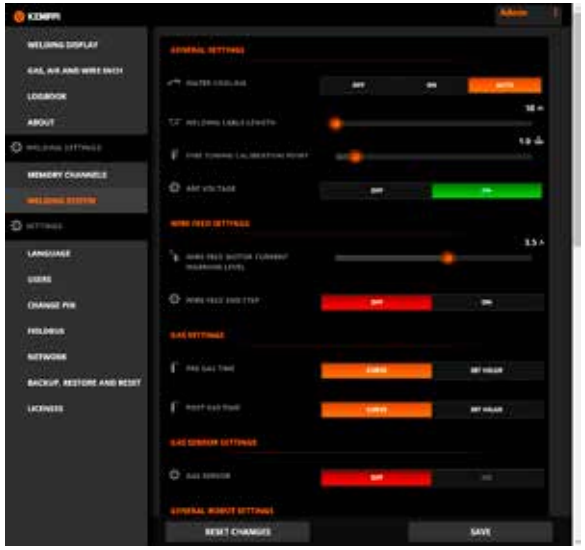
5. SYSTEM CONFIGURATION

This section describes the settings that are typically made only once or that are otherwise necessary for integration to be completed successfully. It does not describe those settings that affect welding quality and are modified on the basis of the welding operation. For more information on the operation-based settings, see the A7 MIG Welder operating manual.

Use the web user interface to perform the system configuration within the integration. Some items necessary for the integration phase, such as fieldbus configuration parameters, are not available from the setup panel.

5.1 Welding system, sensors and devices

To configure the welding system, go to the Welding settings > Welding system.



5.1.1 General settings

Water cooling

Set the water cooling in accordance with your system configuration:

- Choose OFF for a gas-cooled system
- Choose ON for filling up the cooling system
- Choose AUTO for normal operation with a water-cooled system

Welding cable length

Set the welding cable length in meters. The cable length includes the welding (-) and welding (+) cables.

Example:

Welding (-) clamp cable length	10 m
Interconnection cable set length	10 m
Torch cable set length	2 m
Total welding cable length	22 m

5.1.2 Wire feed settings

Wire feeder

Select the wire feeder you are using. This setting has effect only in systems with dual wire feeder support:

- Choose WIRE FEEDER 1 for the primary wire feeder
- Choose WIRE FEEDER 2 for the secondary wire feeder
- Choose SELECT AT ROBOT to manage the wire feeder selection from the robot pendant.

This feature requires the dual wire feeder extension kit installed. That kit is available separately and is not included in the standard package.

Wire feed motor current warning level

Set the wire feeder motor warning level to match the wire liner length, wire diameter, and other parameters affecting the load on the wire feeder motors. The initial value is 3.5 A. The system issues a warning when the long-term average current exceeds the warning threshold.

5.1.3 Gas sensor settings

Gas sensor

Set the gas sensor to be ON or OFF, on the basis of the gas flow monitoring requirements of your system.

Gas flow sensing level

Set the gas flow sensing threshold, in liters per minute. When the gas flow exceeds this level, the system indicates that the gas flow is OK.

Gas type (integrated gas sensor)

Set the type of the shielding gas used in your configuration. This value must be changed every time the gas type is changed. The gas type selected affects the operation of the gas flow sensor.

Gas mixture (bus-controlled gas sensor)

Set the gas mixture according to the concentration of the shielding gas used in your configuration. This value must be changed every time the shielding gas is changed. The gas mixture affects the function of the gas flow sensor.

5.1.4 General robot settings

Interface mode

Consult Section 5.2, "The digital robot interface."

Voltage scaling

Consult Section 5.2, "The digital robot interface."

Wire feed speed scaling

Consult Section 5.2, "The digital robot interface."

Current scaling

Consult Section 5.2, "The digital robot interface."

Gun type

Select the type of the welding torch on the basis of the torch installed.

5.1.5 Touch sensor settings

Output voltage

Set the desired initial voltage, between +50 and +200 V. This parameter is normally changed during operation and depends on the work piece surface properties.

Touch tool

Force the touch sensor to the WELDING WIRE or GAS NOZZLE value, or let the selection be made by the robot during operation by selecting the SELECT AT ROBOT alternative.

Not all interface modes support the touch tool's selection by a robot. For more information, see Section 5.2, "The digital robot interface".

Fast output polarity

If you have connected the touch sensor status fast output to the robot, select either LOW-ACTIVE or HIGH-ACTIVE polarity for the output signal. If you are not using the fast output, this parameter is not required.

5.1.6 Collision sensor settings

Collision sensor

If you have installed a collision sensor in the system, the sensor parameter's value should be ON. Otherwise, set this parameter to be OFF, to prevent possible false detection.

Switch type

Select the type of the switch used in your collision sensor. The switch can be either OPENING or CLOSING. See Figure 3.8, "Opening-action and closing-action switches."

Output polarity

Select either LOW-ACTIVE or HIGH-ACTIVE polarity for the collision detected signal in the digital robot interface. This affects the behavior of the function CollisionDetected in the digital robot interface. For more information, see Chapter 6, "Digital robot interface I/O reference".

5.1.7 Stop switch settings

The two stop inputs are identical in their setting options, each of which may be adjusted individually. The inputs don't depend on each other.

Stop switch / Gate door switch

If you have installed switch stop and/or gate door switch circuits for the system, set the stop inputs to be ON accordingly. Otherwise, ensure that these parameters are set to OFF in order to prevent possible false detection.

Switch type

Indicate the type of the switch used in your stop switch / gate door switch configuration. If you are using an opening-action switch, select OPENING, and for a closing-action switch select CLOSING (see Figure 3.15, "Connecting the stop input switches").

Line level

Set the level of the input line used in your stop switch / gate door switch configuration. If you have connected the stop input switch between pins B and C, select 0 V. Otherwise, if you have connected the switch between pins A and B, select 24 V (see Figure 3.15, "Connecting the stop input switches").

5.1.8 Watchdog settings

Watchdog

If your robot supports the watchdog functionality, select the watchdog ON. Otherwise, set this feature OFF.

Timeout

Specify a timeout for the watchdog timer by using the slider. The minimum timeout value is 0.1 s and maximum is 5.0 s. This timeout value specifies how fast the welding system stops welding if the robot stops sending fieldbus data. The robot must perform continuous transitions on the Watchdog signal of the digital robot interface within the timeout period.

5.1.9 Welding system time

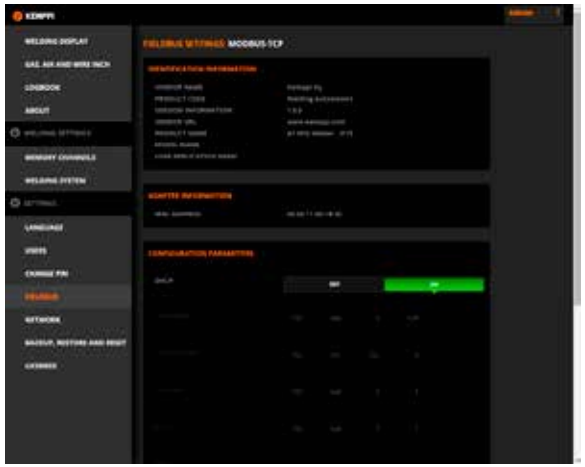
Set the welding system time and date by picking up the date from the pop-up calendar and typing the time to the particular field. If you want to synchronize the welding system time with the time of the browser, press the NOW button.

After configuring the welding system settings, click on the Save button, in the bottom bar, to save all changes.

5.2 Digital robot interface

5.2.1 Fieldbus settings

To view the fieldbus information and to configure the settings, go to Settings > Fieldbus.



The contents of the fieldbus configuration view depend on the fieldbus type. Configure the fieldbus settings in accordance with your fieldbus network setup.

The fieldbus settings are stored in the fieldbus module. If you replace the module, the settings must be reconfigured.

The fieldbus settings are not included in the system backup file.

A factory reset does not affect the fieldbus settings.

5.2.2 Selecting the proper I/O table

Communication between the A7 MIG Welder system and a welding robot is based on input/output tables (I/O tables) exchanged between the machines by fieldbus cyclic I/O transmission. The tables contain binary-level functions that the robot uses for controlling and monitoring the welding system.

The I/O tables and functions are described in detail in Chapter 6, "Digital robot interface I/O reference."

The A7 MIG Welder default I/O table is number 15. Avoid changing this setting in new installations.

All other tables except table 15 are compatible with the corresponding tables in the KempArc Pulse system. Note that the A7 MIG Welder does not support all KempArc Pulse tables.

To specify a non-default I/O table, go to Welding settings > Welding system > General robot settings and enter the I/O table number in the Interface mode field. Click on the Save button, in the bottom bar, to save the changes.

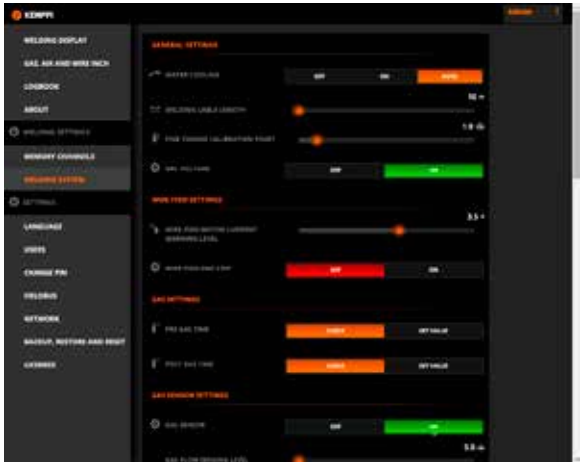


Table 5.1: Supported I/O tables

Interface mode	*I/O table name*	*Description*	*Table size (bytes)*
0		(Not in use)	
1	KEMPPI1	KempArc Pulse default table	8
2		(Not in use)	
3	CUST1	Customer-specific table	16
4		(Not in use)	
5	CUST2	Customer-specific table	6
6	CUST3	Customer-specific table	10
7	CUST4	Customer-specific table	10
8		(Not in use)	
9	CUST5	Customer-specific table	12
10		(Not in use)	
11		(Not in use)	
12		(Not in use)	
13	KEMPPI2	KempArc Pulse Gate door switch alternative	8
14	KEMPPI3	KempArc Pulse TAST support	10
15	KEMPPI4	A7 MIG Welder default table	16
16–99		(Reserved)	

5.2.3 Setting up scaling values

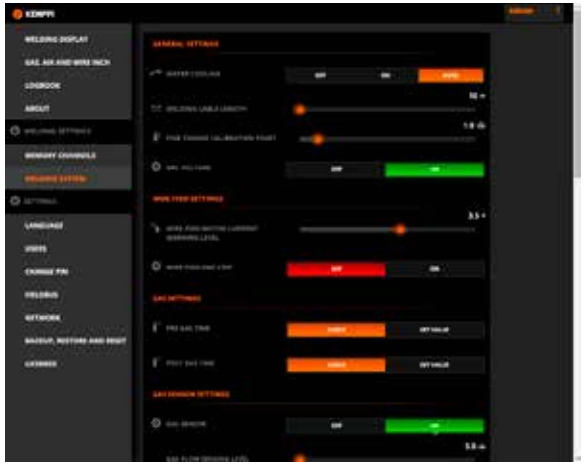
The A7 MIG Welder system supports value scaling between the welding system and the robot for wire feed speed, welding voltage, fine tuning, and welding current. This scaling is required when the value range of the robot is limited or the robot cannot otherwise directly handle the values provided by the welding system.

The following digital robot interface functions can be scaled:

- WireFeedSpeed control function
- Voltage control function
- FineTuning control function
- WeldingWireFeedSpeed status function
- WeldingVoltage status function
- WeldingCurrent status function

For more information on these functions, see Chapter 6, “Digital robot interface I/O reference”.

To set up the scaling values, go to Welding settings > Welding system > General robot settings.



- For the WireFeedSpeed and WeldingWireFeedSpeed functions, set the desired value for the Wire feed speed scaling parameter.
- For the Voltage, FineTuning, and WeldingVoltage functions, set the desired value for the Voltage scaling parameter.
- For the WeldingCurrent function, set the desired value for the Current scaling parameter.

Click on the Save button, in the bottom bar, to save the changes.

Scaling formula

The scaling uses the formula

$$\text{Value}_{\text{TARGET}} = \frac{\text{ScaleValue} \times \text{Value}_{\text{SOURCE}}}{\text{Value}_{\text{MAX}}}$$

where $\text{Value}_{\text{MAX}}$ is the maximum value and $\text{Value}_{\text{SOURCE}}$ is the setup value.

The actual result of the setup value can be calculated by using an inverted formula:

$$\text{Value}_{\text{SOURCE}} = \frac{\text{Value}_{\text{MAX}} \times \text{Value}_{\text{TARGET}}}{\text{ScaleValue}}$$

The division is performed in the digital robot interface by using integers multiplied by 10. This results in accuracy of one decimal digit, thus the calculation loses less significant digits and produces final values which may not exactly match with the target values.

Example

By means of its specification one robot uses the value range 0–1023 for adjusting the welding voltage. The voltage range in the welding system is 8.0–46.0 V. The operator of the robot wants to use robot's full value range to achieve the best accuracy of the voltage control, thus the voltage scaling value should be configured to be the maximum value of the robot's range (1023).

When the operator wants to use the welding voltage of 25 V, the robot control value is calculated thus:

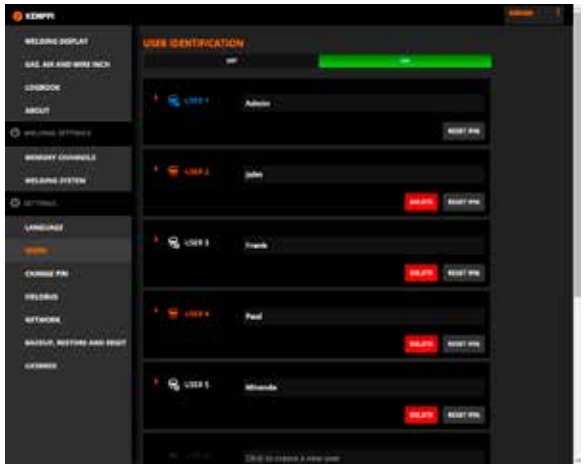
$$\text{Value}_{\text{TARGET}} = \frac{\text{ScaleValue} \times \text{Value}_{\text{SOURCE}}}{\text{Value}_{\text{MAX}}} = \frac{1023 \times 25.0}{46.0} \approx 555$$

The actual voltage can be calculated by using the inverted formula:

$$\text{Value}_{\text{SOURCE}} = \frac{\text{Value}_{\text{MAX}} \times \text{Value}_{\text{TARGET}}}{\text{ScaleValue}} = \frac{46.0 \times 555}{1023} \approx 24.956$$

Conclusion: The operator uses the control value 555 to achieve the welding voltage of 25 V. The actual welding voltage achieved by using this value is 24.9 V (the less significant digits are lost).

5.3 Users



The user identification system is OFF by default. If you want to manage user access to the system, go to Settings > Users and switch user identification ON. Click on the Save button, in the bottom bar, to save the changes. The web user interface redirects you to the login page.

When you switch the user identification system on for the first time, there is one user called "Admin" in the system, with administrator privileges.

The initial PIN code for all users, including the Admin user, is 0000 (four zeroes).

Require users to change their PIN code at the first login.

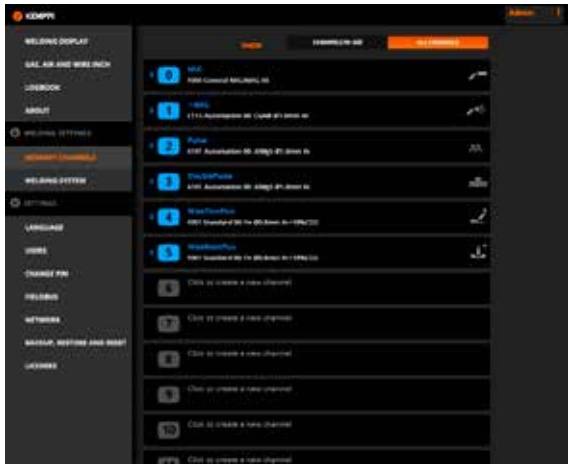
To continue with user configuration, log in to the web user interface by providing the PIN code for the Admin user, and click on the Login button. Go to Settings > Users.

To create a new user, click on the text "Click to create a new user" in the user account bar and type a name for the user. Other options appear below. Select the role for the user by clicking on one of the buttons: WELDER, SUPERVISOR, or ADMINISTRATOR.

After creating the user, click on the Save button, in the bottom bar, to save the changes.

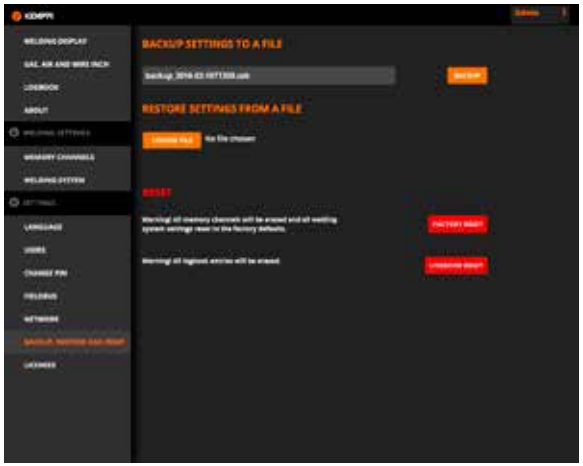
You can find more information on user identification in the A7 MIG Welder operating manual.

5.4 Memory channels



Although the creation of memory channels is not within the scope of the integration guide, it is useful to create them before making a system backup. See the A7 MIG Welder operating manual for more information on the memory channels.

5.5 System backup



After configuration of the system, it is a good idea to make a system backup file. The backup file can save significant time if the memory channels, welding system settings, user settings, and/or network settings need to be restored for any reason.

To make this backup, go to Settings > Backup, restore and reset, and press the Backup button. The system prepares the backup file, and the web browser starts downloading it when it is ready. Specify the location on your computer where you want to store the file.

The backup file can be used to transfer the settings from one system to another.

5.6 I/O tables

5.6.1 KEMPPI1: KempArc Pulse default table

Interface mode = 1. Table size = 8 bytes.

Byte	*Bit*	*Control (Robot -> Welder)*	*Status (Welder -> Robot)*
0		WireFeedSpeed	WeldingCurrent
1			
2		Voltage / FineTuning	WeldingVoltage
3			
4		MemoryChannel	ErrorNumber
5	0	Dynamics	CycleOn
	1		ArcOn
	2		TouchSensed
	3		PowerSourceReady
	4		Error
	5		Ready
	6		LocalRemote
	7		AutoManual
6	0	StartWelding	DigitalInput1
	1	SimulationMode	DigitalInput2
	2	WireInch	DigitalInput3
	3	WireRetract	DigitalInput4
	4	GasBlow	GateDoorOpen
	5	TouchSensorToolSel	DigitalInput6
	6	TouchSensorOn	CollisionDetected
	7	OnlineControl	GasFlowOk
7	0	Watchdog	WeldingWireFeedSpeed
	1	ErrorReset	
	2	AirBlow	
	3	**(Not in use)**	
	4	**(Not in use)**	
	5	DigitalOutput1	
	6	DigitalOutput2	
	7	DigitalOutput3	

5.6.2 KEMPPI2: KempArc Pulse customized table

Interface mode = 13. Table size = 8 bytes.

Byte	*Bit*	*Control (Robot -> Welder)*	*Status (Welder -> Robot)*
0		WireFeedSpeed	WeldingCurrent
1			
2		Voltage / FineTuning	WeldingVoltage
3			
4		MemoryChannel	ErrorNumber
5	0	Dynamics	CycleOn
	1		ArcOn
	2		TouchSensed
	3		PowerSourceReady
	4		Error
	5		Ready
	6		LocalRemote
	7		AutoManual
6	0	StartWelding	GateDoorOpen
	1	SimulationMode	DigitalInput2
	2	WireInch	DigitalInput3
	3	WireRetract	DigitalInput4
	4	GasBlow	DigitalInput5
	5	TouchSensorToolSel	DigitalInput6
	6	TouchSensorOn	CollisionDetected
	7	OnlineControl	GasFlowOk
7	0	Watchdog	WeldingWireFeedSpeed
	1	ErrorReset	
	2	AirBlow	
	3	**(Not in use)**	
	4	**(Not in use)**	
	5	DigitalOutput1	
	6	DigitalOutput2	
	7	DigitalOutput3	

5.6.3 KEMPPI3: KempArc Pulse customized table

Interface mode = 14. Table size = 10 bytes.

Byte	*Bit*	*Control (Robot -> Welder)*	*Status (Welder -> Robot)*
0		WireFeedSpeed	WeldingCurrent
1			
2		Voltage / FineTuning	WeldingVoltage
3			
4		MemoryChannel	ErrorNumber
5	0	Dynamics	CycleOn
	1		ArcOn
	2		TouchSensed
	3		PowerSourceReady
	4		Error
	5		Ready
	6		LocalRemote
	7		AutoManual
6	0	StartWelding	GateDoorOpen
	1	SimulationMode	DigitalInput2
	2	WireInch	DigitalInput3
	3	WireRetract	DigitalInput4
	4	GasBlow	DigitalInput5
	5	TouchSensorToolSel	DigitalInput6
	6	TouchSensorOn	CollisionDetected
	7	OnlineControl	GasFlowOk
7	0	Watchdog	WeldingWireFeedSpeed
	1	ErrorReset	
	2	AirBlow	
	3	**(Not in use)**	
	4	**(Not in use)**	
	5	DigitalOutput1	
	6	DigitalOutput2	
	7	DigitalOutput3	
8		**(Not in use)**	TAST
9			

5.6.4 KEMPPI4: A7 MIG Welder default table

Interface mode = 15. Table size = 16 bytes.

Byte	*Bit*	*Control (Robot -> Welder)*	*Status (Welder -> Robot)*
0		WireFeedSpeed	WeldingCurrent
1			
2		Voltage / FineTuning	WeldingVoltage
3			
4		MemoryChannel	ErrorNumber
5		Dynamics	WeldingWireFeedSpeed
6	0	StartWelding	Ready
	1	SimulationMode	PowerSourceReady
	2	WireInch	CycleOn
	3	WireRetract	ArcOn
	4	GasBlow	GasFlowOk
	5	AirBlow	(Not in use)
	6	TouchSensorToolSel	(Not in use)
	7	TouchSensorOn	TouchSensed
7	0	OnlineControl	GateDoorOpen
	1	ErrorReset	Error
	2	WireFeederSelect	CollisionDetected
	3	Watchdog	(Not in use)
	4	HotStartOn	(Not in use)
	5	CraterFillOn	(Not in use)
	6	AdaptiveTASTOn	AdaptiveTASTActive
	7	(Not in use)	(Not in use)
8	0	DigitalOutput1	DigitalInput1
	1	DigitalOutput2	DigitalInput2
	2	DigitalOutput3	DigitalInput3
	3	DigitalOutput4	DigitalInput4
	4	DigitalOutput5	DigitalInput5
	5	DigitalOutput6	DigitalInput6
	6	DigitalOutput7	DigitalInput7
	7	DigitalOutput8	DigitalInput8

Byte	*Bit*	*Control (Robot -> Welder)*	*Status (Welder -> Robot)*
9		(Not in use)	TAST
10			
11		(Not in use)	GasFlowRate
12			
13		(Not in use)	MotorCurrent
14			WeldingProcess
15		(Not in use)	(Not in use)

5.6.5 KEMPPI5: A7 MIG Welder table for pulse process control

Interface mode = 16. Table size = 18 bytes

Byte	*Bit*	*Control (Robot -> Welder)*	*Status (Welder -> Robot)*
0		WireFeedSpeed	WeldingCurrent
1			
2		Voltage / FineTuning	WeldingVoltage
3			
4		MemoryChannel	ErrorNumber
5		Dynamics	WeldingWireFeedSpeed
6	0	StartWelding	Ready
	1	SimulationMode	PowerSourceReady
	2	WireInch	CycleOn
	3	WireRetract	ArcOn
	4	GasBlow	GasFlowOk
	5	AirBlow	(Not in use)
	6	TouchSensorToolSel	(Not in use)
	7	TouchSensorOn	TouchSensed
7	0	OnlineControl	GateDoorOpen
	1	ErrorReset	Error
	2	WireFeederSelect	CollisionDetected
	3	Watchdog	(Not in use)
	4	HotStartOn	(Not in use)
	5	CraterFillOn	(Not in use)
	6	AdaptiveTASTOn	AdaptiveTASTActive
	7	(Not in use)	(Not in use)
8	0	DigitalOutput1	DigitalInput1
	1	DigitalOutput2	DigitalInput2
	2	DigitalOutput3	DigitalInput3
	3	DigitalOutput4	DigitalInput4
	4	DigitalOutput5	DigitalInput5
	5	DigitalOutput6	DigitalInput6
	6	DigitalOutput7	DigitalInput7
	7	DigitalOutput8	DigitalInput8

Byte	*Bit*	*Control (Robot -> Welder)*	*Status (Welder -> Robot)*
9		PulseCurrent	TAST
10			
11		PulseBaseCurrent	GasFlowRate
12			
13		PulseFrequency	MotorCurrent
14			WeldingProcess
15		PulseLength	(Not in use)
16			(Not in use)
17		(Not in use)	(Not in use)

Note: The control parameters PulseCurrent, PulseBaseCurrent, PulseFrequency and PulseLength are not used in the robot interface firmware version 1.04.00.0 or later.

5.6.6 KEMPPI6: A7 MIG Welder table for WeldEye connectivity

Interface mode = 17. Table size = 49 bytes

Byte	Bit	Control (Robot -> Welder)	Status (Welder -> Robot)
0		WireFeedSpeed	WeldingCurrent
1			
2		Voltage / FineTuning	WeldingVoltage
3			
4		MemoryChannel	ErrorNumber
5		Dynamics	WeldingWireFeedSpeed
6	0	StartWelding	Ready
	1	SimulationMode	PowerSourceReady
	2	WireInch	CycleOn
	3	WireRetract	ArcOn
	4	GasBlow	GasFlowOk
	5	AirBlow	(Not in use)
	6	TouchSensorToolSel	(Not in use)
	7	TouchSensorOn	TouchSensed
7	0	OnlineControl	GateDoorOpen
	1	ErrorReset	Error
	2	WireFeederSelect	CollisionDetected
	3	Watchdog	(Not in use)
	4	HotStartOn	(Not in use)
	5	CraterFillOn	(Not in use)
	6	AdaptiveTASTOn	AdaptiveTASTActive
	7	(Not in use)	(Not in use)
8	0	DigitalOutput1	DigitalInput1
	1	DigitalOutput2	DigitalInput2
	2	DigitalOutput3	DigitalInput3
	3	DigitalOutput4	DigitalInput4
	4	DigitalOutput5	DigitalInput5
	5	DigitalOutput6	DigitalInput6
	6	DigitalOutput7	DigitalInput7
	7	DigitalOutput8	DigitalInput8

Byte	Bit	Control (Robot -> Welder)	Status (Welder -> Robot)
9		PulseCurrent	TAST
10			
11		PulseBaseCurrent	GasFlowRate
12			
13		PulseFrequency	MotorCurrent
14			WeldingProcess
15		PulseLength	WPSDeviationStatusVoltage**
16			WPSDeviationStatusCurrent**
17		WPSPassId	WPSDeviationStatusWireFeedSpeed**
18			WPSDeviationStatusTravelSpeed**
19			WPSDeviationStatusHeatInput**
20			(Not in use)
21		WeldID	(Not in use)
22			(Not in use)
23			(Not in use)
24			(Not in use)
25		ProjectID	(Not in use)
26			(Not in use)
27		BatchID	(Not in use)
28			(Not in use)
29		FixtureID	(Not in use)
30			(Not in use)
31		ProgramID	(Not in use)
32			(Not in use)
33		WeldLength	(Not in use)
34			(Not in use)
35			(Not in use)
36			(Not in use)

Note: The control parameters PulseCurrent, PulseBaseCurrent, PulseFrequency and PulseLength are not used in the robot interface firmware version 1.04.00.0 or later.

Byte	Bit	Control (Robot -> Welder)	Status (Welder -> Robot)
37		TravelSpeed	(Not in use)
38			(Not in use)
39		WeavingFrequency	(Not in use)
40		WeavingAmplitude	(Not in use)
41		WeavingPattern	(Not in use)
42		RobotID	(Not in use)
43		RobotErrorID	(Not in use)
44			(Not in use)
45			(Not in use)
46			(Not in use)
47	0	WorkFlowChangeGoing	(Not in use)
	1	NewWeld	(Not in use)
	2	NewPass	(Not in use)
	3	WeldCompleted	(Not in use)
	4	PassCompleted	(Not in use)
	5	(Not in use)	(Not in use)
	6	(Not in use)	(Not in use)
	7	(Not in use)	(Not in use)
48	0	WeldTimeGoing	(Not in use)
	1	ProgramRunTimeGoing	(Not in use)
	2	ServoOnTimeGoing	(Not in use)
	3	ErrorTimeGoing	(Not in use)
	4	TeachModeSetTimeGoing	(Not in use)
	5	PlayModeSetTimeGoing	(Not in use)
	6	RemoteModeSetTimeGoing	(Not in use)
	7	(Not in use)	(Not in use)

** WPSDeviationVoltage indicates if the welding voltage is within the WPS limits
0 = Voltage is within WPS range
1 = Voltage is below the low warning limit
2 = Voltage is below the low alert limit
3 = Voltage is over the high warning limit
4 = Voltage is over the high alert limit

WPSDeviationCurrent indicates if the welding current is within the WPS limits
0 = Current is within WPS range
1 = Current is below the low warning limit
2 = Current is below the low alert limit
3 = Current is over the high warning limit
4 = Current is over the high alert limit

WPSDeviationWireFeedSpeed indicates if the welding wire feed speed is within the WPS limits
0 = Wire feed speed is within WPS range
1 = Wire feed speed is below the low warning limit
2 = Wire feed speed is below the low alert limit
3 = Wire feed speed is over the high warning limit
4 = Wire feed speed is over the high alert limit

WPSDeviationTravelSpeed indicates if the robot travel speed is within the WPS limits
0 = Robot travel speed is within WPS range
1 = Robot travel speed is below the low warning limit
2 = Robot travel speed is below the low alert limit
3 = Robot travel speed is over the high warning limit
4 = Robot travel speed is over the high alert limit

WPSDeviationHeatinput indicates if the heat input is within the WPS limits
0 = Heat input is within WPS range
1 = Heat input is below the low warning limit
2 = Heat input is below the low alert limit
3 = Heat input is over the high warning limit
4 = Heat input is over the high alert limit

5.6.7 KEMPPI7: A7 MIG Welder minimalistic table, modbus optimized layout

Interface mode = 18. Table size = 4 bytes

Byte	*Bit*	*Control (Robot -> Welder)*	*Status (Welder -> Robot)*
0		MemoryChannel (*)	ErrorNumber
1			
2	0	StartWelding	Ready
	1	SimulationMode	PowerSourceReady
	2	WireInch	CycleOn
	3	WireRetract	ArcOn
	4	GasBlow	GasFlowOk
	5	AirBlow	GateDoorOpen
	6	TouchSensorToolSel	Error
	7	TouchSensorOn	TouchSensed
3	0	ErrorReset	(Not in use)
	1	WireFeederSelect	(Not in use)
	2	Watchdog	(Not in use)
	3	(Not in use)	(Not in use)
	4	(Not in use)	(Not in use)
	5	(Not in use)	(Not in use)
	6	(Not in use)	(Not in use)
	7	(Not in use)	(Not in use)

* The meaningful value of the parameter is internally limited to an 8-bit range [0…255].
A higher value has no effect.

5.6.8 KEMPPI8: A7 MIG Welder table for WeldEye, modbus optimized layout

Interface mode = 19. Table size = 38 bytes

Byte	Bit	Control (Robot -> Welder)	Status (Welder -> Robot)
0		WireFeedSpeed	WeldingCurrent
1			
2		Voltage / FineTuning	WeldingVoltage
3			
4		MemoryChannel	ErrorNumber
5			
6		Dynamics (*)	WeldingWireFeedSpeed
7			
8	0	StartWelding	Ready
	1	SimulationMode	PowerSourceReady
	2	WireInch	CycleOn
	3	WireRetract	ArcOn
	4	GasBlow	GasFlowOk
	5	AirBlow	(Not in use)
	6	TouchSensorToolSel	(Not in use)
	7	TouchSensorOn	TouchSensed
9	0	OnlineControl	GateDoorOpen
	1	ErrorReset	Error
	2	WireFeederSelect	CollisionDetected
	3	Watchdog	(Not in use)
	4	HotStartOn	(Not in use)
	5	CraterFillOn	(Not in use)
	6	AdaptiveTASTOn	AdaptiveTASTActive
	7	(Not in use)	(Not in use)
10		WPSPassID	TAST
11			
12		WeldID	GasFlowRate
13			
14		ProjectID	MotorCurrent
15			
16		BatchID	WeldingProcess
17			

Byte	Bit	Control (Robot -> Welder)	Status (Welder -> Robot)
18		FixtureID	WPSDeviationVoltage**
19			
20		ProgramID	WPSDeviationCurrent**
21			
22		WeldLength	WPSDeviationWireFeedSpeed**
23			
24		TravelSpeed	WPSDeviationTravelSpeed**
25			
26		WeavingFrequency (*)	WPSDeviationHeatinput**
27			
28		WeavingAmplitude (*)	(Not in use)
29			
30		WeavingPattern (*)	(Not in use)
31			
32		RobotID (*)	(Not in use)
33			
34		RobotErrorID	(Not in use)
35			
36	0	WorkFlowChangeGoing	(Not in use)
	1	NewWeld	
	2	NewPass	
	3	WeldCompleted	
	4	PassCompleted	
	5	(Not in use)	
	6	(Not in use)	
	7	(Not in use)	

Byte	Bit	Control (Robot -> Welder)	Status (Welder -> Robot)
37	0	WeldTimeGoing	(Not in use)
	1	ProgramRunTimeGoing	
	2	ServoOnTimeGoing	
	3	ErrorTimeGoing	
	4	TeachModeSetTimeGoing	
	5	PlayModeSetTimeGoing	
	6	RemoteModeSetTimeGoing	
	7	(Not in use)	

* The meaningful value of the parameter is internally limited to an 8-bit range [0…255]. A higher value has no effect.

** WPSDeviationVoltage indicates if the welding voltage is within the WPS limits
0 = Voltage is within WPS range
1 = Voltage is below the low warning limit
2 = Voltage is below the low alert limit
3 = Voltage is over the high warning limit
4 = Voltage is over the high alert limit

WPSDeviationCurrent indicates if the welding current is within the WPS limits
0 = Current is within WPS range
1 = Current is below the low warning limit
2 = Current is below the low alert limit
3 = Current is over the high warning limit
4 = Current is over the high alert limit

WPSDeviationWireFeedSpeed indicates if the welding wire feed speed is within the WPS limits
0 = Wire feed speed is within WPS range
1 = Wire feed speed is below the low warning limit
2 = Wire feed speed is below the low alert limit
3 = Wire feed speed is over the high warning limit
4 = Wire feed speed is over the high alert limit

WPSDeviationTravelSpeed indicates if the robot travel speed is within the WPS limits
0 = Robot travel speed is within WPS range
1 = Robot travel speed is below the low warning limit
2 = Robot travel speed is below the low alert limit
3 = Robot travel speed is over the high warning limit
4 = Robot travel speed is over the high alert limit

WPSDeviationHeatinput indicates if the heat input is within the WPS limits
0 = Heat input is within WPS range
1 = Heat input is below the low warning limit
2 = Heat input is below the low alert limit
3 = Heat input is over the high warning limit
4 = Heat input is over the high alert limit

5.6.9 CUST1: Customer-specific table

Interface mode = 3. Table size = 16 bytes.

Byte	*Bit*	*Control (Robot -> Welder)*	*Status (Welder -> Robot)*
0	0	StartWelding	ArcOn (1)
	1	WeldingAllowed	AutoManual
	2	OnlineControl	CycleOn
	3	(Not in use)	ArcOn (2)
	4	(Not in use)	CollisionDetected
	5	DigitalOutput1	Error
	6	DigitalOutput2	Ready
	7	DigitalOutput3	TouchSensed
1	0	GasBlow	ErrorNumber
	1	WireInch	
	2	WireRetract	
	3	(Not in use)	
	4	TouchSensorOn	
	5	(Not in use)	
	6	(Not in use)	
	7	(Not in use)	
2		MemoryChannel	(Not in use)
3		(Not in use)	(Not in use)
4		(Not in use)	(Not in use)
5		(Not in use)	(Not in use)
6		(Not in use)	(Not in use)
7		(Not in use)	(Not in use)
8		WireFeedSpeed	WeldingCurrent
9			
10		Voltage / FineTuning	WeldingVoltage
11			
12		(Not in use)	(Not in use)
13			
14		(Not in use)	(Not in use)
15			

5.6.10 CUST2: Customer-specific table

Interface mode = 5. Table size = 6 bytes.

Byte	*Bit*	*Control (Robot -> Welder)*	*Status (Welder -> Robot)*
0	0	StartWelding	ArcOn
	1	AirBlow	Error
	2	GasBlow	GasFlowOK
	3	WireInch	DigitalInput2 (Wire OK)
	4	WireRetract	AutoManual
	5	DigitalOutput3	LocalRemote
	6	OnlineControl	Ready
	7	DigitalOutput2 (Cleaning on)	DigitalInput3 (Cleaning OK)
1	0	TouchSensorOn	TouchSensed
	1	MemoryChannel (bit 0)	DigitalInput1
	2	MemoryChannel (bit 1)	DigitalInput4
	3	MemoryChannel (bit 2)	DigitalInput5
	4	MemoryChannel (bit 3)	PowerSourceReady
	5	MemoryChannel (bit 4)	CycleOn
	6	MemoryChannel (bit 5)	(Not in use)
	7	MemoryChannel (bit 6)	(Not in use)
2		WireFeedSpeed	WeldingCurrent
3			
4		Voltage / FineTuning	WeldingVoltage
5			

5.6.11 CUST3: Customer-specific table

Interface mode = 6. Table size = 8 bytes.

Byte	*Bit*	*Control (Robot -> Welder)*	*Status (Welder -> Robot)*
0	0	StartWelding	CycleOn
	1	GasBlow	ArcOn
	2	(Not in use)	(Not in use)
	3	WireInch	Ready
	4	WireRetract	Error
	5	(Not in use)	LocalRemote
	6	OnlineControl	AutoManual
	7	TouchSensorOn	TouchSensed
1		(Not in use)	(Not in use)
2		Voltage / FineTuning	WeldingVoltage
3			
4		WireFeedSpeed	WeldingCurrent
5			
6		MemoryChannel	ErrorNumber
7	0	DigitalOutput1	DigitalInput1
	1	DigitalOutput2	DigitalInput2
	2	DigitalOutput3	DigitalInput3
	3	(Not in use)	DigitalInput4
	4	(Not in use)	DigitalInput5
	5	(Not in use)	DigitalInput6
	6	(Not in use)	(Not in use)
	7	(Not in use)	(Not in use)

5.6.12 CUST4: Customer-specific table

Interface mode = 7. Table size = 10 bytes.

Byte	*Bit*	*Control (Robot -> Welder)*	*Status (Welder -> Robot)*
0	0	WeldingAllowed	PowerSourceReady
	1	ErrorReset	Error
	2	StartWelding	ArcOn
	3	SimulationMode	CycleOn
	4	(Not in use)	MainCurrentOn
	5	(Not in use)	CurrentOk
	6	TouchSensorOn	TouchSensed
	7	DigitalOutput1 (Cleaning on)	DigitalInput5 (Cleaning OK)
1	0	(Not in use)	MotorCurrentOk
	1	(Not in use)	Ready
	2	(Not in use)	ProgramSaved
	3	(Not in use)	GateDoorOpen
	4	GasBlow	GasFlowOK
	5	AirBlow	CoolingUnitOk
	6	DigitalOutput3 (Spatter spray)	(Not in use)
	7	WireInch	DigitalInput2 (Wire OK)
2	0	WireRetract	WFSpeedOk
	1	(Not in use)	CollisionDetected
	2	(Not in use)	(Not in use)
	3	(Not in use)	(Not in use)
	4	(Not in use)	PanelLocked
	5	(Not in use)	(Not in use)
	6	OnlineControl	(Not in use)
	7	(Not in use)	(Not in use)
3		MemoryChannel	WeldingMemoryChannel
4		WireFeedSpeed	WeldingWireFeedSpeed
5			
6		Voltage / FineTuning	WeldingVoltage
7			
8		(Not in use)	WeldingCurrent
9			

5.6.13 CUST5: Customer-specific table

Interface mode = 9. Table size = 12 bytes

Byte	*Bit*	*Control (Robot -> Welder)*	*Status (Welder -> Robot)*
0	0	GasBlow	ErrorNumber
	1	WireInch	
	2	WireRetract	
	3	ErrorReset	
	4	TouchSensorOn	
	5	AirBlow	
	6	OnlineControl	
	7	(Not in use)	
1	0	StartWelding	ArcOn
	1	WeldingAllowed	ToleranceError
	2	(Not in use)	CycleOn
	3	(Not in use)	MainCurrentOn
	4	(Not in use)	CollisionDetected
	5	(Not in use)	PowerSourceReady
	6	(Not in use)	Ready
	7	(Not in use)	(Not in use)
2	0	(Not in use)	WireStuck
	1	(Not in use)	TouchSensed
	2	(Not in use)	RobotHasControl
	3	(Not in use)	DigitalInput2 (Wire OK)
	4	(Not in use)	(Not in use)
	5	(Not in use)	(Not in use)
	6	(Not in use)	LocalRemote
	7	SimulationMode	(Not in use)

Byte	*Bit*	*Control (Robot -> Welder)*	*Status (Welder -> Robot)*
3		MemoryChannel	(Not in use)
4		WireFeedSpeed	WeldingVoltage
5			
6		Voltage / FineTuning	WeldingCurrent
7			
8		(Not in use)	(Not in use)
9			MotorCurrent
10		(Not in use)	(Not in use)
11			

6. DIGITAL ROBOT INTERFACE

6.1 Control functions

The control functions are bit fields (values) and single bits (signals) in the I/O table.
They are set by a robot and read by the welding system.

Table 6.1: Control functions in the A7 MIG Welder system

Function	*Bits*	*Value range*				*I/O table*												
		Min.	*Max.*	*Step*	*Units*	*KEMPPI 1*	*KEMPPI 2*	*KEMPPI 3*	*KEMPPI 4*	*KEMPPI 5*	*KEMPPI 6*	*KEMPPI 7*	*KEMPPI 8*	*CUST1*	*CUST2*	*CUST3*	*CUST4*	*CUST5*
						1	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*3*	*5*	*6*	*7*	*9*
Control values																		
WireFeedSpeed	16	5	250	1	0.1 m/min	X	X	X	X	X	X		X	X	X	X	X	X
Voltage	16	80	460	1	0.1 V	X	X	X	X	X	X		X	X	X	X	X	X
FineTuning	16	0	180	1	0.1	X	X	X	X	X	X		X	X	X	X	X	X
Dynamics	8	0	18	1	1	X	X	X	X	X	X		X					
MemoryChannel	7/8	0	199	1		8	8	8	8	8	8	8	8	8	7	8	8	8
PulseCurrent	16	99	800	A						X	X							
PulseBaseCurrent	16	8	500	A						X	X							
PulseFrequency	16	10	5000	0.1 Hz						X	X							
PulseLength	16	15	500	10 us						X	X							
Control signals																		
WeldingAllowed	1													X			X	X
SimulationMode	1					X	X	X	X	X	X	X	X				X	X
StartWelding	1					X	X	X	X	X	X	X	X	X	X	X	X	X
WireInch	1					X	X	X	X	X	X	X	X	X	X	X	X	X
WireRetract	1					X	X	X	X	X	X	X	X	X	X	X	X	X
GasBlow	1					X	X	X	X	X	X	X	X	X	X	X	X	X
AirBlow	1					X	X	X	X	X	X	X	X		X		X	X

TouchSensorToolSel	1					X	X	X	X	X			X					
TouchSensorOn	1					X	X	X	X	X			X	X	X	X	X	X
OnlineControl	1					X	X	X	X	X			X	X	X	X	X	X
Watchdog	1					X	X	X	X	X			X					
ErrorReset	1					X	X	X	X	X			X				X	X
HotStartOn	1								X	X			X					
CraterFillOn	1								X	X			X					
AdaptiveTASTOn	1								X	X			X					
Control signals																		
DigitalOutput1	1					X	X	X	X	X				X		X	X	
DigitalOutput2	1					X	X	X	X	X				X	X	X		
DigitalOutput3	1					X	X	X	X	X				X	X	X	X	
DigitalOutput4	1								X	X								
DigitalOutput5	1								X	X								
DigitalOutput6	1								X	X								
DigitalOutput7	1								X	X								
DigitalOutput8	1								X	X								
WireFeederSelect	1								X	X								

6.1.1 WireFeedSpeed

This 16-bit function controls the wire feed speed for welding in scaled or non-scaled mode, depending on the user setup.

In non-scaled mode:

- The minimum setup value is 5 (0.5 m/min).
- The maximum setup value is 250 (25.0 m/min).
- The minimum step is 1 (0.1 m/min) between 0.5 and 5.0 m/min.
- The minimum step is 5 (0.5 m/min) between 5.5 and 25.0 m/min. Other step values are rounded up to the nearest multiple of 0.5 m/min.

In scaled mode:

- The minimum setup value is 0 (0.0 m/min). With this value, the welding system limits the minimum speed to 0.5 m/min.
- The maximum setup value is the wire feed speed scaling value, which is interpreted as 25.0 m/min.
- The minimum step is 1. The wire feed speed value is calculated from the setup value by means of the value scaling formula.

This value has an effect only when the OnlineControl signal is set (1), and it overrides the corresponding memory channel value. If the OnlineControl signal is cleared (0), the wire feed speed from the active memory channel is used.

6.1.2 Voltage

This 16-bit function controls the welding voltage for the MIG process. For other processes, the FineTuning function is used instead. The value is given in scaled or non-scaled mode, depending on the user setup.

In non-scaled mode:

- The minimum setup value is 80 (8.0 V).
- The maximum setup value is 460 (46.0 V).
- The minimum step is 1 (0.1 V).

In scaled mode:

- The minimum setup value is 0 (0.0 V). With this value, the welding system limits the minimum voltage to 8.0 V.
- The maximum setup value is the voltage scaling value, which is interpreted as 46.0 m/min.
- The minimum step is 1. The voltage is calculated from the setup value by means of the value scaling formula.

The value has an effect only when the OnlineControl signal is set (1), and it overrides the corresponding memory channel value. If the OnlineControl signal is cleared (0), the value from the active memory channel is used.

6.1.3 FineTuning

This 16-bit function controls the fine tuning of the synergic voltage for all processes except the MIG process. For the MIG process the Voltage value is used instead. The value is given in scaled or non-scaled mode, depending on the user setup. The fine tuning is scaled using the voltage scaling value.

In non-scaled mode:

- The minimum setup value is 0 (-9.0).
- The maximum setup value is 180 (9.0).
- The minimum technical step is 1 (0.1).
- The minimum significant step is 5 (0.5).

In scaled mode:

- The minimum setup value is 0 (-9.0).
- The maximum setup value is the voltage scaling value, which is interpreted as 9.0.
- The minimum step is 1. The fine tuning is calculated from the setup value by means of the value scaling formula.

The value has an effect only when the OnlineControl signal is set (1), and it overrides the corresponding memory channel value. If the OnlineControl signal is cleared (0), the fine tuning from the active memory channel is used.

6.1.4 Dynamics

This 8-bit function controls the dynamics of the synergic curve for all processes except WiseRoot+. The root process has no dynamic control. Setting this value has no effect when the WiseRoot+ process is used.

- The minimum setup value is 0 (-9).
- The maximum setup value is 18 (9).
- The minimum step is 1.

The value has an effect only when the OnlineControl bit is set (1), and it overrides the corresponding memory channel value. If the OnlineControl bit is cleared (0), the dynamics value from the active memory channel is used.

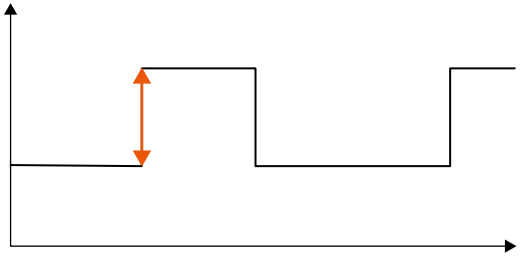
6.1.5 MemoryChannel

This 8-bit function controls the active memory channel. The system automatically brings all parameters from the memory channel into use, including those for the welding process, welding parameters, and welding functions. There are up to 200 memory channels available in the system. They are numbered 0 to 199. The memory channel can be changed during welding.

- The minimum setup value is 0.
- The maximum setup value is 199. All values above that are automatically interpreted as 199.
- The minimum step is 1.

6.1.6 PulseCurrent

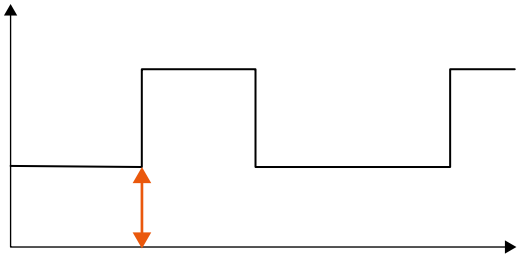
This 16-bit function controls the pulse current in the pulse process.



- The minimum setup value is 99 (99 A).
- The maximum setup value is 800 (800 A).
- The minimum step is 1 (1 A).

6.1.7 PulseBaseCurrent

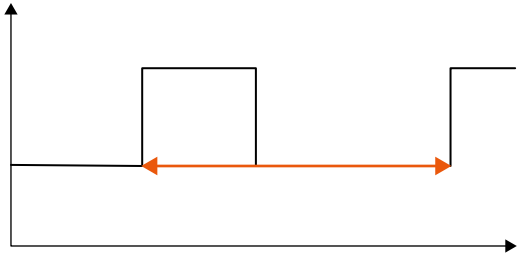
This 16-bit function controls the base current of the pulse in the pulse process.



- The minimum setup value is 8 (8 A).
- The maximum setup value is 500 (500 A).
- The minimum step is 1 (1 A).

6.1.8 PulseFrequency

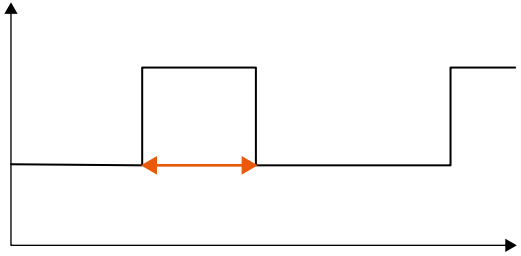
This 16-bit function controls the pulse frequency in the pulse process.



- The minimum setup value is 10 (1.0 Hz).
- The maximum setup value is 5000 (500.0 Hz).
- The minimum step is 1 (0.1 Hz).

6.1.9 PulseLength

This 16-bit function controls the length of the pulse in the pulse process.



- The minimum setup value is 15 (150 µs).
- The maximum setup value is 500 (5000 µs).
- The minimum step is 1 (10 µs).

6.1.10 WeldingAllowed

The signal function is used to enable and disable the StartWelding signal. When the value is 1 (welding allowed), the StartWelding signal controls welding start and stop. When the value is set to 0 (welding disallowed), the StartWelding signal has no effect. Changing this signal's state to 0 during welding or simulation stops the operation immediately.

- 0 = Welding disallowed
- 1 = Welding allowed

6.1.11 SimulationMode

This signal function turns the simulation mode on and off, if the simulation mode is not forced on or off from the web user interface or from the setup panel. See the A7 MIG Welder operating manual for more information.

In the simulation mode ArcOn, CycleOn, and the other necessary signals are simulated locally to enable the welding robot to act as in a normal welding operation. Welding power remains off and wire is not fed during simulation. The simulation mode is not allowed during welding, so changing this signal during welding (or simulation) has no effect.

- 0 = Simulation mode off. The StartWelding function controls a normal welding sequence.
- 1 = Simulation mode on. The StartWelding function controls a simulation sequence.

6.1.12 StartWelding

This signal function controls the welding sequence. If SimulationMode is set to be on, it controls a simulation sequence instead.

This signal has an effect only if welding is allowed (WeldingAllowed is set to 1).

- 0 = Welding / simulation off
- 1 = Welding / simulation on

6.1.13 WireInch

This signal function feeds the welding wire forwards. The wire is fed at the speed of 1.0 m/min for 3 seconds and then stepped to 5.0 m/min.

- 0 = Wire inch off
- 1 = Wire inch on

This signal has no effect during welding or simulated welding.

6.1.14 WireRetract

This signal function feeds the welding wire backwards. The wire is fed at the speed of 1.0 m/min for 3 seconds and then stepped to 5.0 m/min.

- 0 = Wire retract off
- 1 = Wire retract on

This signal has no effect during welding or simulated welding.

6.1.15 GasBlow

This signal function opens the shielding gas valve. The gas valve can be controlled during welding, but not during simulated welding.

- 0 = Gas valve closed
- 1 = Gas valve open

6.1.16 AirBlow

This signal function opens the compressed-air valve.

- 0 = Air valve closed
- 1 = Air valve open

This signal has no effect during welding or simulated welding.

6.1.17 TouchSensorToolSel

This signal function sets the selection of the touch sensing tool between the welding wire and the gas nozzle, if the tool is not forced to selection either from the web user interface or from the setup panel.

- 0 = Welding wire as touch sensing tool
- 1 = Gas nozzle as touch sensing tool

6.1.18 TouchSensorOn

This signal function sets the touch sensor power source and the touch detection device to be on. The touch voltage depends on the user settings. For more information, see A7 MIG Welder operating manual.

- 0 = Touch sensor off
- 1 = Touch sensor on

This signal has no effect during welding or simulated welding.

6.1.19 OnlineControl

This signal function enables robot-controlled values for welding wire feed speed, voltage, fine tuning, and dynamics. When the robot is in online mode and uses the WireFeedSpeed, Voltage, FineTuning, and Dynamics control functions, the corresponding values in the active memory channel are overridden. When the robot is in offline mode, it gives full control to the welding system and the values from the active memory channel are used.

- 0 = Robot in offline mode. The wire feed speed, voltage, fine tuning, and dynamics values are obtained from the active memory channel.
- 1 = Robot in online mode and controlling the wire feed speed, voltage, fine tuning, and dynamics.

6.1.20 Watchdog

This signal function resets a watchdog timer in the robot interface unit on each transition. The signal takes an effect when the watchdog function is turned on from the web user interface or from the setup panel. If the watchdog functionality is on and the robot can't maintain transitioning of this signal, the welding system goes into an error state. This prevents welding accidents if the robot loses control over the welding system.

6.1.21 ErrorReset

This signal function resets the ErrorNumber value and the Error signal to zero on the rising edge of the signal when there are no active errors in the system. If there are any active errors, the signal has no effect. The error is active when the error situation is not resolved.

- 0 = Normal operation
- 1 = Error reset (on rising edge)

6.1.22 HotStartOn

This signal function controls a hot-start on and off, if the hot-start is enabled to be controlled by a robot from the web user interface or from the setup panel.

- 0 = Hot start off
- 1 = Hot start on

6.1.23 CraterFillOn

This signal function controls a crater-fill on and off, if the crater-fill is enabled to be controlled by a robot from the web user interface or from the setup panel.

- 0 = Crater fill off
- 1 = Crater fill on

6.1.24 WireFeederSelect

This signal function is used to select the wire feeder in a system that supports two robot wire feeders. The support of two wire feeders is enabled by installing an extension kit into the robot interface unit. See the A7 MIG Welder Operating manual for details.

To be able to select the wire feeder by the means of this signal, the function must be enabled from the welding system settings by setting the Wire feeder option to SELECT AT ROBOT.

- 0 = Wire feeder 1 (the primary wire feeder) is active.
- 1 = Wire feeder 2 (the secondary wire feeder) is active.

6.1.25 AdaptiveTASTOn

This signal function enables adaptive TAST (adaptive seam tracking).

- 0 = Normal TAST is on
- 1 = Adaptive TAST is on

6.2 Status functions

The status functions are bit fields (values) and single bits (signals) in the I/O table. They are set by the welder system and read by the robot.

Table 6.2: Status functions in the A7 MIG Welder system

Function	*Bits*	*Value range*				*I/O table*												
		Min.	*Max.*	*Step*	*Units*	*KEMPPI 1*	*KEMPPI 2*	*KEMPPI 3*	*KEMPPI 4*	*KEMPPI 5*	*KEMPPI 6*	*KEMPPI 7*	*KEMPPI 8*	*CUST1*	*CUST2*	*CUST3*	*CUST4*	*CUST5*
						1	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*3*	*5*	*6*	*7*	*9*
Status values																		
WeldingCurrent	16	0	1024	1	1 A	X	X	X	X	X	X		X	X	X	X	X	X
WeldingVoltage	16	80	460	1	0.1 V	X	X	X	X	X	X		X	X	X	X	X	X
WeldingWireFeedSpeed	8/16	0	250	1	0.1 m/min	8	8	8	8	8	8		16				16	
MotorCurrent	8	0	100	1	0.1 A				X	X	X		X					X
GasFlowRate	16	0	500	1	0.1 l/min				X	X			X					
ErrorNumber	8	0	255	1		X	X	X	X	X	X	X	X	X		X		X
WeldingMemoryChannel	8	0	199	1													X	
TAST	16	0	6500	1				X	X	X	X		X					
WeldingProcess	8	0	14	1					X	X	X		X					

Function	Bits	Value range				I/O table												
		Min.	Max.	Step	Units	KEMPPI 1	KEMPPI 2	KEMPPI 3	KEMPPI 4	KEMPPI 5	KEMPPI 6	KEMPPI 7	KEMPPI 8	CUST1	CUST2	CUST3	CUST4	CUST5
						1	13	14	15	16	17	18	19	3	5	6	7	9
Status bits																		
Ready	1					X	X	X	X	X	X	X	X	X	X	X	X	X
PowerSourceReady	1					X	X	X	X	X	X	X	X		X		X	X
CoolingUnitOk	1																X	
ProgramSaved	1																X	
RobotHasControl	1																	X
CycleOn	1					X	X	X	X	X	X	X	X	X	X	X	X	X
ArcOn	1					X	X	X	X	X	X	X	X	X	X	X	X	X
GasFlowOk	1					X	X	X	X	X	X	X	X		X		X	
MainCurrentOn	1																X	X
CurrentOk	1																X	
MotorCurrentOk	1																X	
WFSpeedOk	1																X	
TouchSensed	1					X	X	X	X	X	X	X	X	X	X	X	X	X
Error	1					X	X	X	X	X	X	X	X	X	X	X	X	
CollisionDetected	1					X	X	X	X	X	X		X				X	X
ToleranceError	1																	X
WireStuck	1																	X
GateDoorOpen	1					X	X	X	X	X	X	X	X				X	
AdaptiveTASTActive	1								X	X	X		X					

Function	Bits	Value range				I/O table												
		Min.	Max.	Step	Units	KEMPPI 1	KEMPPI 2	KEMPPI 3	KEMPPI 4	KEMPPI 5	KEMPPI 6	KEMPPI 7	KEMPPI 8	CUST1	CUST2	CUST3	CUST4	CUST5
						1	13	14	15	16	17	18	19	3	5	6	7	9
Status bits																		
DigitalInput1	1					X			X	X	X				X	X		
DigitalInput2	1					X	X	X	X	X	X				X	X	X	X
DigitalInput3	1					X	X	X	X	X	X				X	X		
DigitalInput4	1					X	X	X	X	X	X				X	X		
DigitalInput5	1						X	X	X	X	X				X	X	X	
DigitalInput6	1					X	X	X	X	X	X					X		
DigitalInput7	1								X	X	X							
DigitalInput8	1								X	X	X							
Deprecated status bits																		
PanelLocked	1	0	0														X	
LocalRemote	1	1	1			X	X	X							X	X		X
AutoManual	1	0	0			X	X	X						X	X	X		

6.2.1 WeldingCurrent

This 16-bit function represents the average welding current measured during the process. The value is in scaled or non-scaled mode, depending on the user setup.

In non-scaled mode:

- The minimum value is 0 A.
- The maximum value is 1024 A.
- The minimum step is 1 A.

In scaled mode:

- The minimum value is 0 (0 A).
- The maximum value is the current scaling value, which is interpreted as 1024 A.
- The minimum step is 1. The welding current is calculated from the function value by means of the value scaling formula.

6.2.2 WeldingVoltage

This 16-bit function represents the average welding voltage measured during the process. The value can be either terminal voltage or arc voltage, depending on whether the arc voltage display setting is set to ON or OFF. The value is in scaled or non-scaled mode, depending on the user setup.

In non-scaled mode:

- The minimum value is 80 (8.0 V).
- The maximum value is 460 (46.0 V).
- The minimum step is 1 (0.1 V).

In scaled mode:

- The minimum value depends on the scaled value range and is interpreted as 8.0 V.
- The maximum value is the voltage scaling value, which is interpreted as 46.0 V.
- The minimum step is 1. The welding voltage is calculated from the function value by means of the value scaling formula.

6.2.3 WeldingWireFeedSpeed

This 16-bit function represents the average wire feed speed measured during the welding process. The value is in scaled or non-scaled mode, depending on the user setup.

In non-scaled mode:

- The minimum value is 0 (0.0 m/min).
- The maximum value is 250 (25.0 m/min).
- The minimum step is 1 (0.1 m/min).

In scaled mode:

- The minimum value is 0 (0.0 m/min).
- The maximum value is the wire feed speed scaling value, which is interpreted as 25.0 m/min.
- The minimum step is 1. The wire feed speed is calculated from the function value by means of the value scaling formula.

6.2.4 MotorCurrent

This 8-bit function represents the average motor current measured during the welding process.

- The minimum value is 0 (0.0 A).
- The maximum value is 100 (10.0 A).
- The minimum step is 1 (0.1 A).

6.2.5 GasFlowRate

This 16-bit function represents the average gas flow rate measured during the welding process or when the gas valve is forced to be open. This feature requires the gas flow sensor to be configured properly and turned on from the user setup.

- The minimum value is 0 (0.0 l/min).
- The maximum value is 500 (50.0 l/min).
- The minimum step is 1 (0.1 l/min).

6.2.6 ErrorNumber

This 8-bit function represents a non-zero error code if there is a warning or an error active in the system. Otherwise the value is zero. The error number is an enumeration that represents the reason for the error. Refer to the A7 MIG Welder operating manual for more information about reasons for errors. See also the description for the Error status signal. To clear this value, one must resolve the error situation and reset the error by using the ErrorReset control signal or from a user interface.

- The minimum value is 0 (no error).
- The maximum value is 255.
- The minimum step is 1.

6.2.7 WeldingMemoryChannel

This 8-bit function represents the currently active memory channel.

- The minimum value is 0.
- The maximum value is 199.
- The minimum step is 1.

6.2.8 TAST

This 16-bit function value represents the deviation of the welding head from the groove during TAST (through-arc seam tracking) operation. A lower value indicates greater distance from the groove. The value is equivalent to the welding current and is valid for all processes.

- The minimum value is 0.
- The maximum (theoretical) value is 6500.
- The minimum step is 1.

6.2.9 WeldingProcess

This 8-bit function value represents the current welding process in use. The value is an enumeration and can be one of the following values:

- 0 = Unknown process
- 1 = MIG
- 2 = 1-MIG
- 3 = Pulse MIG
- 4 = Double pulse MIG
- 11 = WiseRoot+
- 14 = WiseThin+

6.2.10 Ready

This signal function indicates readiness of the welding system. The main power supply must be turned on, the system software booted up, and the system bus properly connected. The system is assumed to be ready when a power source and a wire feeder are found on the system bus, there is at least one user interface (excluding the web user interface) available, and there are no active errors in the system. If the user identification system is in use, a user must be logged in.

- 0 = Welding system not ready. Check that a user has logged in, all devices are connected properly and errors are resolved.
- 1 = Welding system ready

6.2.11 PowerSourceReady

This signal function indicates the status of the power source. The power source is ready to start welding when it is not currently in use, when the robot has not requested welding start, and when crater fill is not active.

- 0 = Power source not ready yet for a new arc start
- 1 = Power source ready

6.2.12 CoolingUnitOk

This signal function indicates the status of the cooling unit. If there is an error in the cooling unit, the signal status changes and a cooling unit error will be indicated in the system.

- 0 = Cooling unit error
- 1 = Cooling unit OK

6.2.13 ProgramSaved

Saving the parameters takes a while in the system. This signal function is cleared at the beginning of the save process and set after completion. The signal reacts (goes off) when a save operation lasts longer than 150 ms.

- 0 = Saving new parameters
- 1 = Save operation ready

6.2.14 RobotHasControl

This signal function indicates the online control status. The value is copied from the OnlineControl value set by the robot.

- 0 = Robot has released full control to the welding system
- 1 = Robot has control over wire feed speed, voltage, fine tuning, and dynamics values

6.2.15 CycleOn

This signal function indicates the status of the welding cycle. The welding cycle starts at the beginning of the pre-gas phase and ends at the end of the post-gas phase. The signal indicates to the robot when it is safe to move to the next position. However, the welding cycle does not prevent starting of a new weld – a weld can be started during the post-gas time.

- 0 = Welding cycle not active
- 1 = Welding cycle in progress

6.2.16 ArcOn

This signal function indicates the status of the welding arc.

- 0 = Arc not established
- 1 = Arc established

6.2.17 GasFlowOk

This signal function indicates the status of the gas flow. The signal is set (1) when the gas flow rate is above the minimum level set by a user and is cleared (0) when the gas flow is too low. The gas sensor must be enabled from a user interface.

- Gas flow below the minimum level
- Gas flow above the minimum level

6.2.18 MainCurrentOn

This signal function indicates the status of the welding power. The signal is set (1) when the power source has turned the welding power on.

- 0 = Power source in standby mode
- 1 = Welding power on

6.2.19 CurrentOk

This signal function indicates that the welding current is within the limits set by a user.

- 0 = Current below minimum or above maximum
- 1 = Current within the limits

This function is not implemented in the A7 MIG Welder. The status is always OK (1).

6.2.20 MotorCurrentOk

This signal function indicates that the wire feeding motor current is below the system limit.

- 0 = Motor current too high
- 1 = Motor current OK

This function is not implemented in the A7 MIG Welder. The status is always OK (1).

6.2.21 WFSpeedOk

This signal function indicates that the wire feed speed is within the limits set by a user.

- 0 = Wire feed speed too low or too high
- 1 = Wire feed speed within the limits

This function is not implemented in the A7 MIG Welder. The status is always OK (1).

6.2.22 TouchSensed

This signal function indicates contact between the touch tool and the welding piece. This feature is enabled and disabled by the TouchSensorOn signal. The touch tool is selected by the TouchSensorToolSel signal or forced from a user interface.

- 0 = Touch not detected
- 1 = Touch detected

6.2.23 Error

This signal function indicates an error in the system (except the gate door open error). The signal is on (1) for an error; otherwise it is off (0). For warnings this signal remains off. See the ErrorNumber description for more information. For clearing this bit, the error situation must be resolved and the error reset by means of the ErrorReset signal or from a user interface.

- 0 = Warning or no error
- 1 = Error in system

6.2.24 CollisionDetected

This signal function indicates the collision sensor status. In addition to this function being active, a collision detection error (Error 53 Collision detected) will be set when a collision is detected. The collision sensor must be on for this function to take effect. When the collision sensor is switched off, this signal is always in the "Collision not detected" state.

The polarity of this signal can be set from a user interface.

High-active signal:

- 0 = Collision not detected
- 1 = Collision detected

Low-active signal:

- 0 = Collision detected
- 1 = Collision not detected

6.2.25 AdaptiveTASTActive

This signal function indicates that adaptive TAST (adaptive seam tracking) is requested.

- 0 = Normal TAST active
- 1 = Adaptive TAST active

6.2.26 ToleranceError

This signal function is a common indicator for the tolerance status signals CurrentOk and WFSpeedOk. If one of the values is outside its tolerances, this signal is set (1).

- 0 = Values within tolerances
- 1 = At least one of the values outside the tolerances

This function is not implemented in the A7 MIG Welder. The status is always OK (0).

6.2.27 WireStuck

This signal function indicates whether the wire is stuck in the weld.

- 0 = Wire is OK.
- 1 = Wire is stuck.

This function is not implemented in the A7 MIG Welder. The status is always OK (0).

6.2.28 GateDoorOpen

This signal function indicates whether the gate door is open or closed. Opening the gate door always causes an error (Error 134: Gate door open) in the welding system. Some functions, such as the touch sensor and the wire feed, can still be used.

- 0 = Gate door closed (OK)
- 1 = Gate door open (error)

6.2.29 PanelLocked

This signal function is deprecated. The status is always 0 (not locked).

6.2.30 LocalRemote

This signal function is deprecated. The status is always 1 (local).

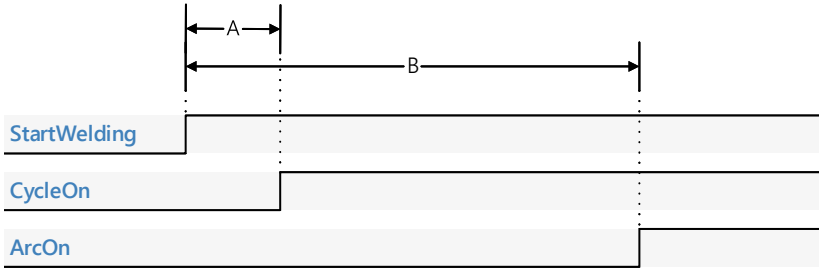
6.2.31 AutoManual

This signal function is deprecated. The status is always 0 (manual).

6.3 Timing diagrams

6.3.1 Welding startup timing

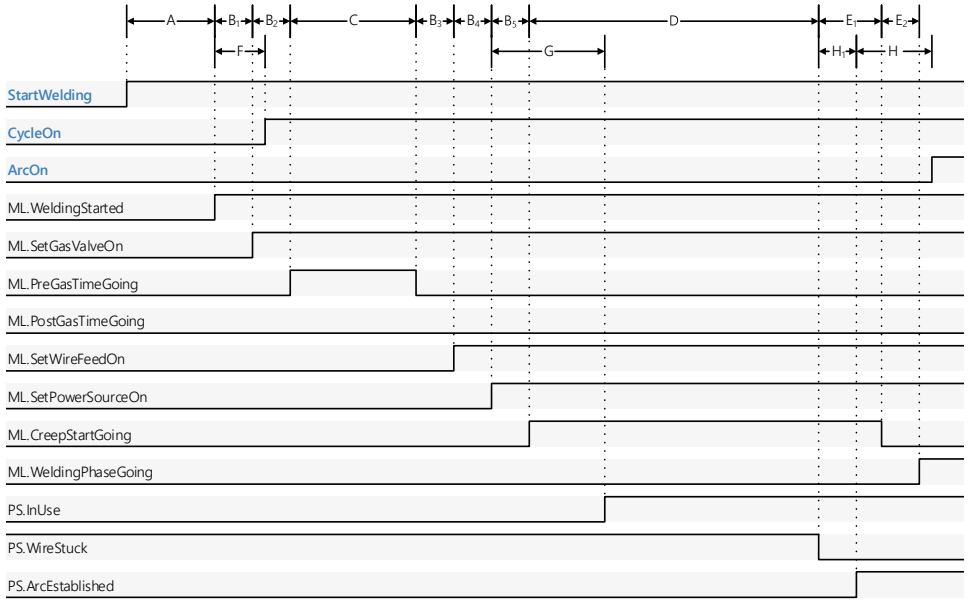
Digital robot interface function timing



Symbol	*Description*	*Min*	*Typical*	*Max*	*Units*
A	Cycle-on time	6	17	40	ms
B	Arc establishment time	17	Pre-gas time + open-air distance + 23	Pre-gas time + 2050 *	ms

* The maximum time is limited by a wire feeding time-out.

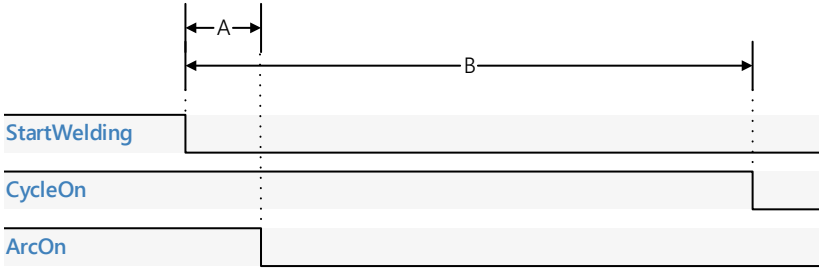
Detailed in-system timing



Symbol	Description	Min	Typical	Max	Units
A	***Weld start response time***	***3***	***14***	***20***	***ms***
B	***MIG logic process***		***5***		***ms***
B_1	Setup time (Gas valve on)		1		ms
B_2	Setup time (Pre-gas time going)		1		ms
B_3	Setup time (Set wire feed on)		1		ms
B_4	Setup time (Set power source on)		1		ms
B_5	Setup time (Creep start going)		1		ms
C	***Pre-gas time***	***0***	***from curve***	***user-defined***	
D	***Wire touch time***	***5***	***open-air distance***	***2000***	***ms***
E	***Welding phase start timing***		***4***		***ms***
E_1	Wire touch response time		3		ms
E_2	Setup time (Welding phase going)		1		ms
F	***Setup time (RI Cycle-on)***	***3***	***3***	***20***	***ms***
G	***Power source startup time***	***2***	***10***	***40***	***ms***
H	***Arc establishment response time***	***4***	***4***	***21***	***ms***
H_1	Setup time (Arc established)	3	3	20	ms
H_2	Setup time (Arc on)		1		ms

6.3.2 Welding stop timing

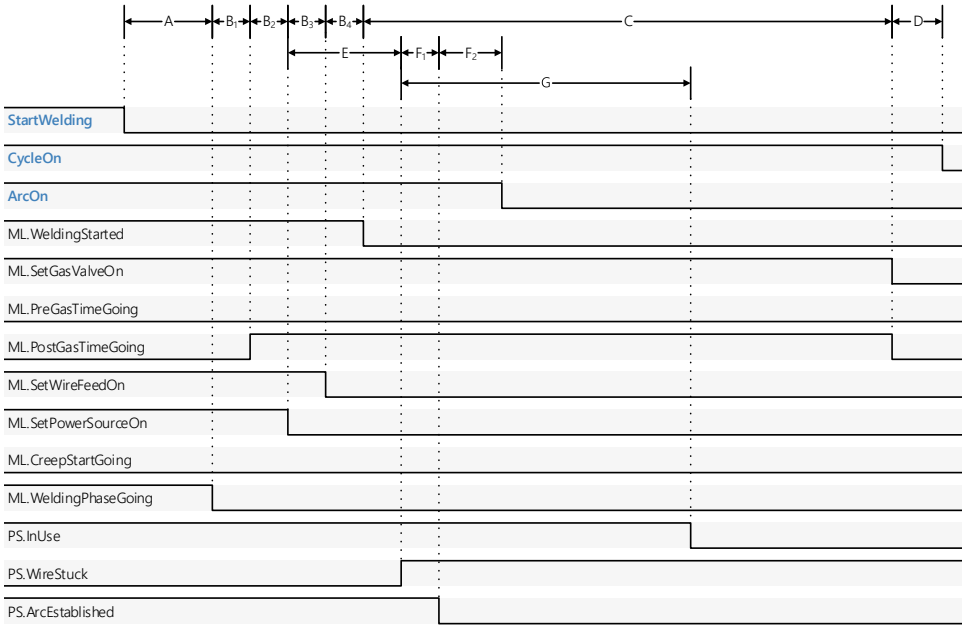
Digital robot interface function timing



Symbol	*Description*	*Min*	*Typical*	*Max*	*Units*
A	Arc off time	51	51	94	ms
B	Cycle off time	347 *	Post-gas time + 10	Pre-gas time + 44	ms

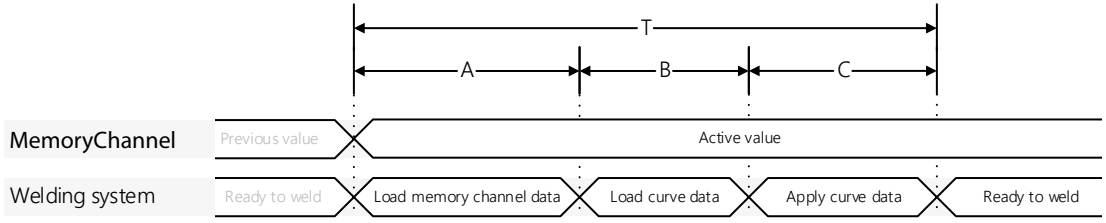
* The minimum cycle-off time is determined by power-source shutdown time, when the post-gas time is less than 300 ms.

Detailed in-system timing



Symbol	Description	Min	Typical	Max	Units
A	***Weld start response time***	***3***	***3***	***20***	***ms***
B	***MIG logic process***		***4***		***ms***
B_1	Setup time (Post-gas time going)		1		ms
B_2	Setup time (Set power source off)		1		ms
B_3	Setup time (Set wire feeding off)		1		ms
B_4	Setup time (Set weld started off)		1		ms
C	***Post-gas time***	***0***	***from curve***	***user-defined***	
D	***Setup time (Cycle off)***	***3***	***3***	***20***	***ms***
E	***Wire touch off time***		***41***	***50***	***ms***
F	***Arc off response time***	***4***	***4***	***21***	***ms***
F_1	Setup time (Arc established)		1		ms
F_2	Setup time (Arc off)	3	3	20	ms
G	***Power source shutdown time***		***300***	***310***	***ms***

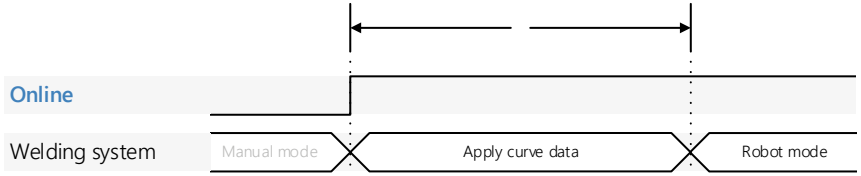
6.3.3 Memory channel change timing



Symbol	*Description*	*Min*	*Typical*	*Max*	*Units*
T	***Total time***	***380***	***392***	***500***	***ms***
A	Memory channel loading time	170	174	240	ms
B	Welding curve loading time	155	158	190	ms
C	Data setup time	55	60	70	ms

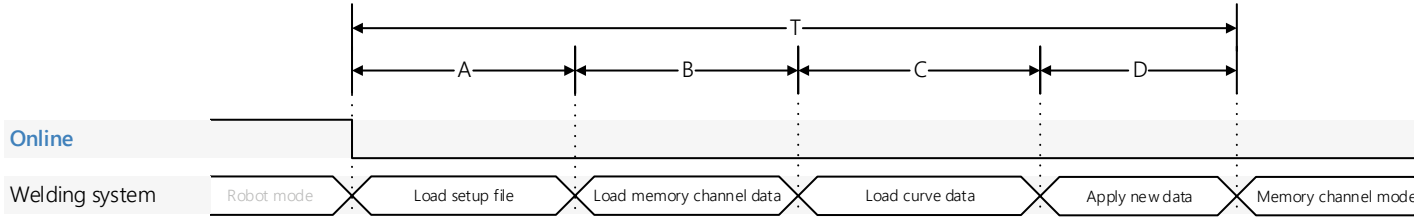
6.3.4 Online control timing

Switching online (robot-controlled mode)



Symbol	Description	Min	Typical	Max	Units
A	***Control data setup time***	***27***	***30***	***50***	***ms***

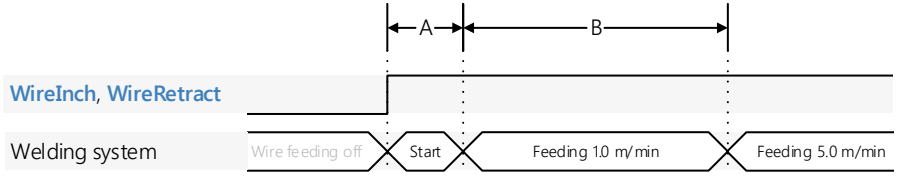
Switching offline (memory channel mode)



Symbol	Description	Min	Typical	Max	Units
T	***Total time***	***730***	***752***	***910***	***ms***
A	Setup file loading time	350	360	410	ms
B	Memory channel loading time	170	174	240	ms
C	Welding curve loading time	155	158	190	ms
D	Data setup time	55	60	70	ms

6.3.5 Wire inch and retract timing

Startup timing

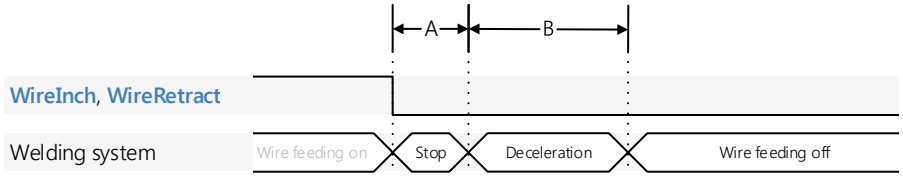


Symbol	Description	Min	Typical	Max	Units
A	Startup response time *		3		ms
B	Wire feeder motor acceleration time **		3		s

* The wire feeder reacts on controls immediately after startup.

** The acceleration time depends on the selected wire feed speed.

Stop timing

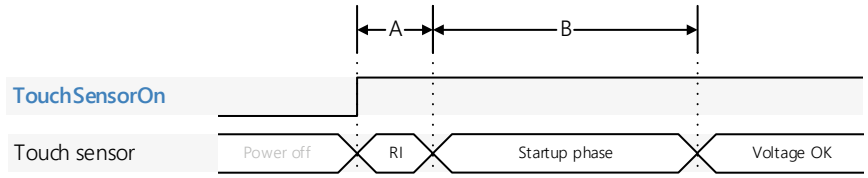


Symbol	Description	Min	Typical	Max	Units
A	Stop response time		3		ms
B	Wire feeder motor deceleration time *		50	80	ms

* The deceleration time depends on the wire feed speed before stop.

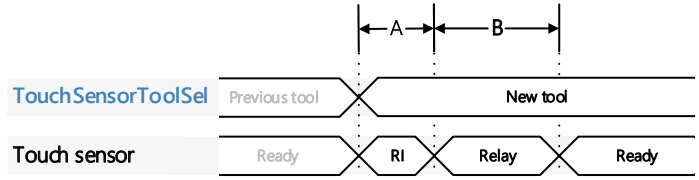
6.3.6 Touch sensor timing

Startup timing



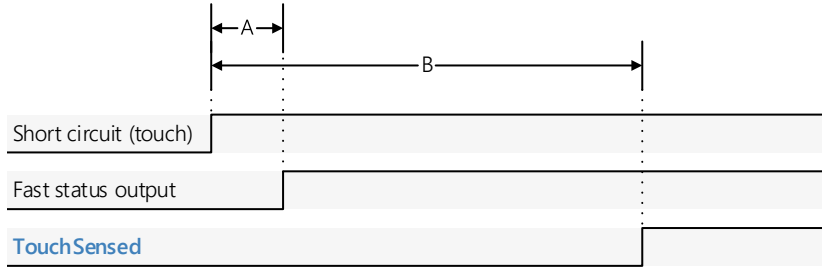
Symbol	Description	Min	Typical	Max	Units
A	Startup response time		3		ms
B	Power-on cycle time (voltage setup time)		150		ms

Touch tool change timing



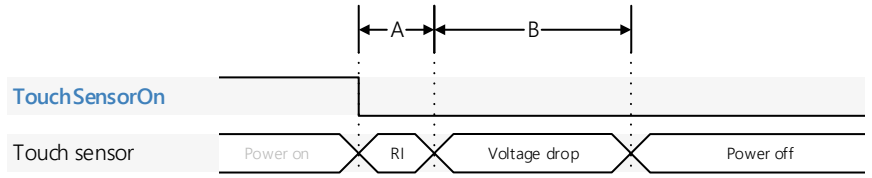
Symbol	Description	Min	Typical	Max	Units
A	Control response time		3		ms
B	Relay action time		5		ms

Touch response timing



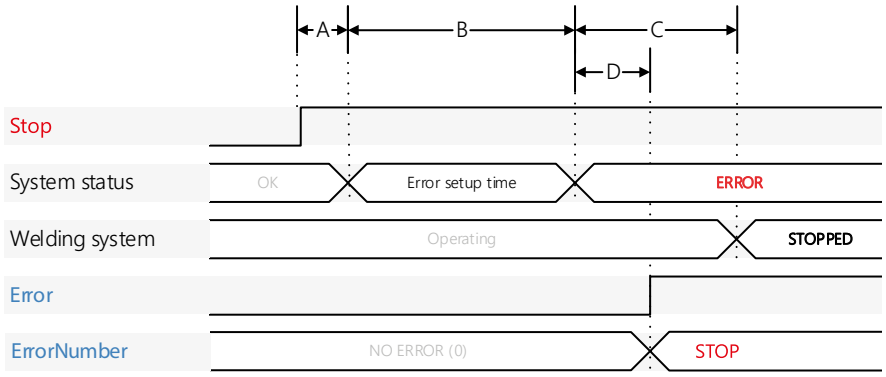
Symbol	Description	Min	Typical	Max	Units
A	Fast status (hardware output) reaction time		150		µs
B	Touch signal function reaction time		10		ms

Touch sensor off timing



Symbol	Description	Min	Typical	Max	Units
A	Control response time		3		ms
B	Power-off cycle time (voltage drop time)		25	30	ms

6.3.7 Stop switch response timing



Symbol	Description	Min	Typical	Max	Units
A	***Hardware response time***			***500***	***µs***
B	***Error setup time***			***10***	***ms***
C	***Welding system stop time***				
	Power source off time (arc off time)			10	ms
	Wire feed stop time			80	ms
	Touch sensor off time			30	ms
D	***ErrorNumber and Error signal setup time***			***10***	***ms***

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