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INTEGRATION GUIDE

A3 MIG Welder

KEMPPI

CONTENTS

1. INTRODUCTION

The A3 MIG Welder is a complete welding system for robotic welding applications.

This guide, together with the A3 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 notice. Do not copy, record, reproduce, or transmit the contents of this guide without prior permission from Kemppi.

2. INTEGRATION STEP BY STEP

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

1. INSTALL HARDWARE
   - Make sure that all the components are OK.
   - Attach all required equipment to the robot and to the welding cell.
   - Make all required cable connections.

2. CONFIGURE THE SYSTEM
   - Configure the sensors and devices.
   - Configure the fieldbus.
   - Power up the system.
   - Configure the power source.

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

For detailed instructions on each of the steps, 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, use the handles on top of the power source.

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

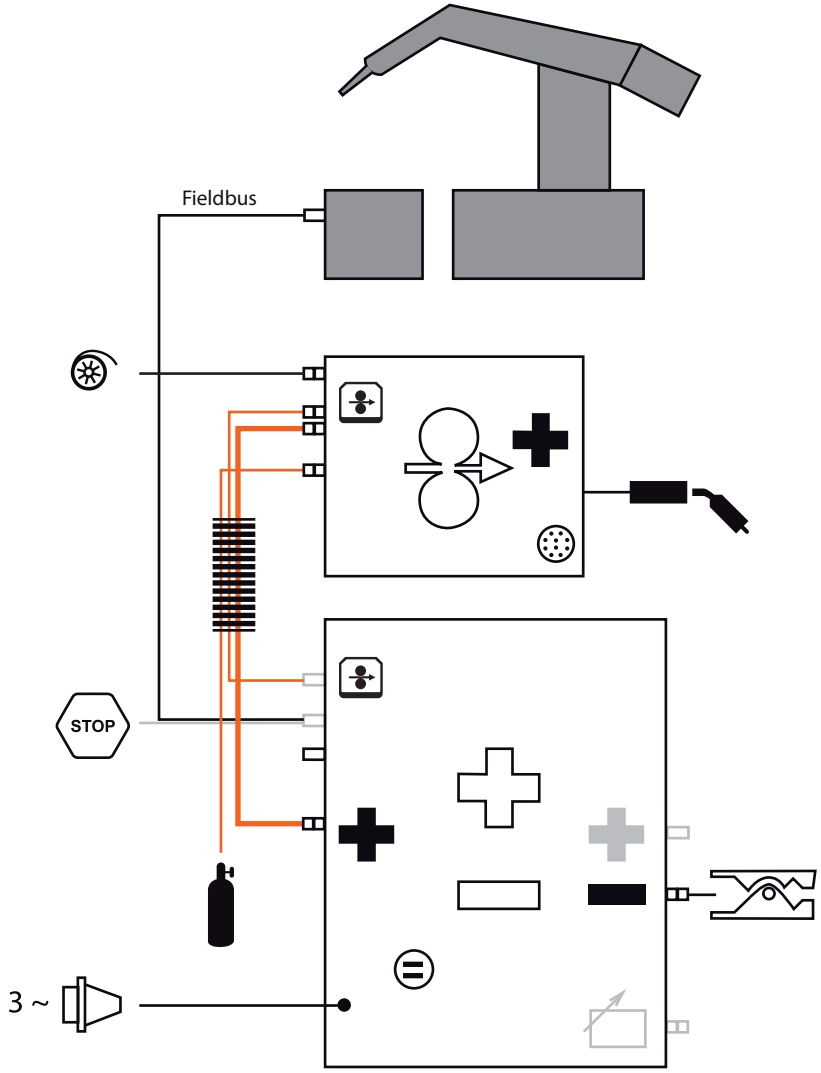


Figure 3.1: Connection diagram

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.*

Distribution network

All regular electrical devices without special circuits generate harmonic currents into distribution network. High rates of harmonic current may cause losses and disturbance to some equipment.

This equipment complies with IEC 61000-3-12 provided that the short-circuit power Ssc is greater than or equal to 4.7 MVA at the interface point between the user's supply and the public supply network. It is the responsibility of the installer or user of the equipment to ensure, by consultation with the distribution network operator if necessary, that the equipment is connected only to a supply with a short-circuit power Ssc greater than or equal to 4.7 MVA.

Connecting the power source to the electric network

The A3 Power Source is connected to a 400-V three-phase network. The fuse size for 100% load in a 400-V three-phase network with 4 x 6-mm² cable is 35 A delayed.

The machine is equipped with a five-meter mains cable that comes without a plug. Before use, check the mains cable and install a mains plug. If the cable does not comply with the local electrical regulations, replace it with a compliant cable.

⚠ *The mains cable or plug may be installed or replaced by only an electrical contractor or installer authorised to perform such operations.*

The power plug

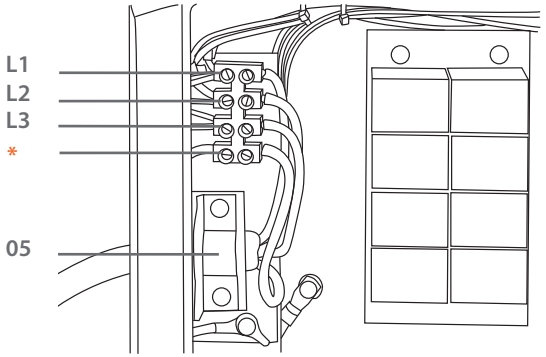
The power source comes without a plug for connection to the electrical grid. Attach a plug suitable for your power-supply standard to the power cable. Check the connections, attach the plug to a socket, and switch the electrical power on from the welding power source to verify that the machine works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

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 cover plate of the power source must be removed to access the electrical cable connector.
- 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 Wire feeder

Use a mounting bracket to mount the wire feeder securely on the robot arm. See the illustrated instructions included in the product delivery package.

The wire feeder connections are described in the Sub-section 3.6, "Interconnection cable set".

Filler wire

	Connect the wire liner to the filler wire inlet 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 collision sensor and the touch sensor, the wire feeder has a common 7-pin peripheral connector at the front of the wire feeder. The connections of the peripherals are described later in this document.

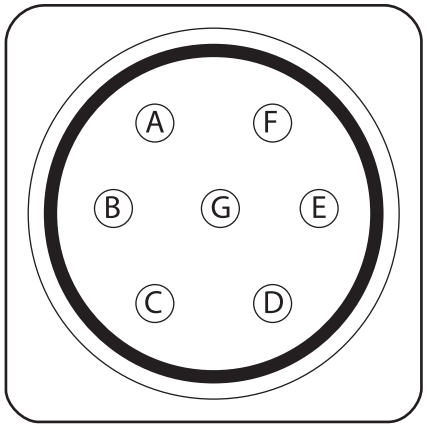


Figure 3.3: Peripheral connector pinout

A. Collision sensor (+50 V)
B. Collision sensor signal
C. Touch sensor output for gas nozzle (+50…+200 V)
D. (Not connected)
E. (Not connected)
F. (Not connected)
G. (Not connected)

Table 3.1: Electrical characteristics for the peripheral supplies

Value	*Min.*	*Typical*	*Max.*	*Unit*
Supply voltage	36.0	48.0	70	V
Touch sensor output voltage*	50		200	V
Touch sensor output current**			10	mA

* Touch sensor electrical characteristics are found in the A3 MIG Welder Operating manual.
** This is the short circuit current.

3.5 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, whereas the closing-action switch keeps the electrical circuit normally open and closes it upon a collision (see Figure 3.4, "Opening and closing action switches")

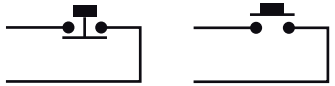


Figure 3.4: Opening-action (left) and closing-action (right) switches

The switch type is configured by using the DIP switches. See the Section 4, "System configuration" for details.

Connect the collision sensor to pins A and B of the peripheral connector (see Figure 3.5, "Collision sensor connection").

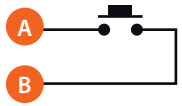


Figure 3.9: Collision sensor connection

3.6 Interconnection cable set

The interconnection cable set comprises several cables and hoses wrapped in a plastic spiral sleeve. The cable set is used for delivering the welding power, shielding gas, and control signals from the welding power source to the wire feeder.

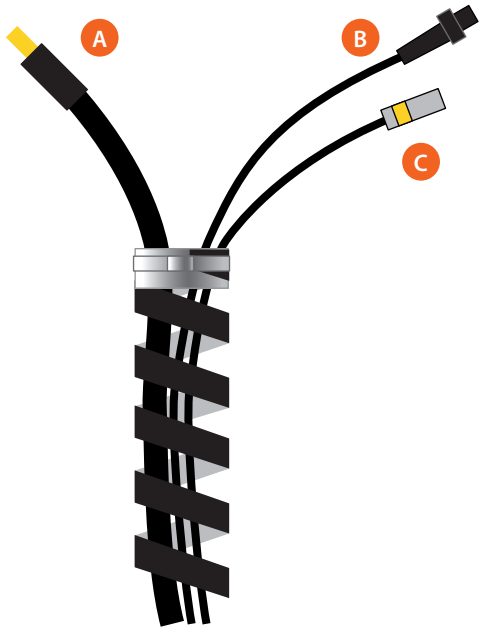


Figure 3.6: Interconnection cable set (wire feeder end)

A. Welding power cable
B. Wire feeder control cable
C. Shielding gas hose

3.6.1 Wire feeder control cable

The wire feeder control cable provides power to the wire feeder and transmits the control signals between the wire feeder and the welding power source. It also contains the touch sensor voltage line from the power source to the wire feeder.

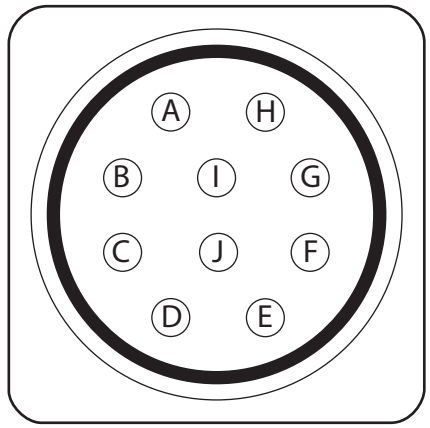


Figure 3.7: Wire feeder control cable connector pinout

A. Power supply (+50 V)
B. Collision sensor
C. Touch sensor voltage (+50…+200 V)
D. Gas valve
E. Wire inch
F. Motor +
G. Motor –
H. Encoder +5V
I. Encoder GND
J. Encoder signal

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 power source unit.

3.6.2 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 at the rear of the power source unit.

3.6.3 Shielding gas hose

The shielding gas hose delivers the shielding gas to the wire feeder. The wire feeder is equipped with a gas valve.

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.

3.7 Fieldbus communication

This welding system supports DeviceNet communication

Table 3.2: Kemppi Oy vendor ID and device description file for the DeviceNet

Fieldbus	*Vendor ID*	*Device description file*
DeviceNet	1403 (integer)	EDS (Electronic Data Sheet)

The DeviceNet is wired into the 7-pin machine connector located at the rear of the welding power source. It shares the connector with a safety stop function (see Figure 3.8, “Fieldbus connector pinout”).

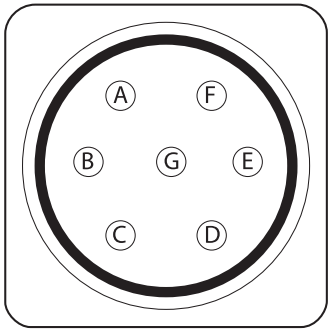


Figure 3.8: Fieldbus connector pinout

Devicenet – Amphenol

1. D DeviceNet V- (GND)
2. C DeviceNet CAN_L
3. G DeviceNet Drain (Shield)
4. F DeviceNet CAN_H
5. E DeviceNet V+ (+24V)

Safety – Amphenol

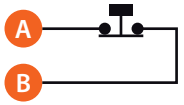
1. A Safety stop signal
2. B Safety stop GND

The fieldbus connector is clocked to avoid confusion with other 7-pin connectors in the power source.

3.8 Safety stop

The safety stop is an input signal that halts the system when the operator presses an emergency stop button. The input is galvanically isolated from the other hardware I/O of the welding power source. The signal shares the same connector with the DeviceNet (see the Figure 3.8, “Fieldbus connector pinout”).

The safety stop is configured by using the DIP switches.



Safety switch

Figure 3.9: Connecting safety stop switch

4. SYSTEM CONFIGURATION

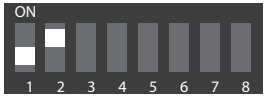
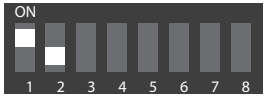
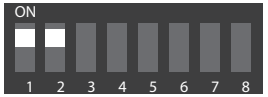
This section describes the settings that are typically made once or that are otherwise necessary for integration to be completed successfully. It does not describe those settings that affect welding quality and are modified based on the welding operation. For more information on the operation-based settings, see the A3 MIG Welder Operating manual.

Use the control panel and the DIP switches to perform the system configuration within the integration.

4.1 Configure sensors and devices

Touch sensor output voltage

Use the DIP switches to set the touch sensing voltage between +50…+200 V. Change the value during operation depending on the work piece surface properties, if needed.

P2 switches 1-2	*Voltage*
	50 V (default)
	80 V
	110 V
	200 V

Safety stop on/off

Use the DIP switches to set the emergency stop input on and off. If you have installed an emergency stop switch circuit for the system, set the emergency input to be on accordingly. Otherwise, ensure that these parameters are set to off to prevent possible false detection.

P2 switch 3	*Safety stop*
	Disabled (default)
	Enabled

Collision sensor on/off

Use the DIP switches to set the collision sensor on and off. If you haven't got a collision sensor installed in the system, turn the sensor off to prevent possible false detections.

P2 switch 4	*Collision sensor*
	Disabled (default)
	Enabled

Collision sensor switch type

Use the DIP switches to select the switching type of the collision sensor. The switch can be either opening or closing. See Figure 3.4, "Opening and closing action switches".

P2 switch 5	*Switch type*
	Opening (default)
	Closing

Byte order

Use the DIP switches to select the byte order according to the robot type.

P2 switch 6	*Byte order*
	Little-endian (default)
	Big-endian

4.2 Configure DeviceNet fieldbus

Watchdog on/off

Use the DIP switches to set the watchdog on and off. The robot must support the watchdog feature.

P2 switch 6	*Byte order*
	Little-endian (default)
	Big-endian

Baud rate

Use the DIP switches to select the baud rate of the fieldbus communication according to the capability of the robot

P1 switches 1-2	*Baud rate*
	125 kpbs (default)
	250 kpbs
	500 kpbs
	(Reserved)

Mac ID

Use the DIP switches to select the Mac ID (slave address) to be used in the communication with the robot.

P1 switches 3-8	*Mac ID*
	0 (default)
	1
	2
	3
	...
	60
	61
	62
	63

4.3 Power up the system

After setting up everything using the DIP switches, power up the system for proceeding in the setup.

Enter to the setup menu in the control panel to configure the power source.

4.4 Configure welding cable compensation

Adjust the CAL parameter in the setup menu to set the welding cable compensation. Set the cable compensation for voltage losses in the welding cables.

4.5 Configure robot scaling value

The A3 MIG Welder 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
- WeldingVoltage status function
- WeldingCurrent status function

For more information on these functions, see Chapter 5, "Digital robot interface".

Adjust the sca parameter in the setup menu to set the scaling value. Set the value 0 to turn the scaling off.

Scaling formula

The scaling uses the formula

$$Value_{TARGET} = \frac{ScaleValue \times Value_{SOURCE}}{Value_{MAX}}$$

where $Value_{MAX}$ is the maximum value and $Value_{SOURCE}$ is the setup value.

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

$$Value_{SOURCE} = \frac{Value_{MAX} \times Value_{TARGET}}{ScaleValue}$$

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 10.0-48.0 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:

$$Value_{TARGET} = \frac{ScaleValue \times Value_{SOURCE}}{Value_{MAX}} = \frac{1023 \times 25.0}{48.0} \approx 532$$

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

$$Value_{SOURCE} = \frac{Value_{MAX} \times Value_{TARGET}}{ScaleValue} = \frac{48.0 \times 532}{1023} \approx 24.962$$

Conclusion: The operator uses the control value 532 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. DIGITAL ROBOT INTERFACE

5.1 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*		
		Min.	*Max.*	*Units*
Control values				
WireFeedSpeed	16	10	250	0.1 m/min
Voltage	16	100	480	0.1 V
FineTuning	16	0	100	0.1
MemoryChannel	8	0	89	1
Control signals				
SimulationMode	1			
StartWelding	1			
WireInch	1			
WireRetract	1			
GasBlow	1			
TouchSensorToolSel	1			
TouchSensorOn	1			
OnlineControl	1			
Watchdog	1			
ErrorReset	1			

5.1.1 WireFeedSpeed

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

In non-scaled mode:

- The minimum setup value is 10 (1.0 m/min).
- The maximum setup value is 250 (25.0 m/min).
- The minimum step is 1 (0.1 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 1.0 m/min.
- The maximum setup value is the robot 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.

5.1.2 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 100 (10.0 V).
- The maximum setup value is 480 (48.0 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 10.0 V.
- The maximum setup value is the robot scaling value, which is interpreted as 48.0 V.
- 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.

5.1.3 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 robot scaling value. The range of the fine-tuning value depends on the selected process.

In non-scaled mode, 1-MIG process:

- 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 non-scaled mode, WiseRoot and WiseThin processes:

- The minimum setup value is 0 (-5.0).
- The maximum setup value is 100 (5.0).
- The minimum technical step is 1 (0.1).
- The minimum significant step is 5 (0.5).

In scaled mode, 1-MIG process:

- The minimum setup value is 0 (-9.0).
- The maximum setup value is the robot 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.

In scaled mode, WiseRoot and WiseThin processes:

- The minimum setup value is 0 (-5.0).
- The maximum setup value is the robot scaling value, which is interpreted as 5.0.
- 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.

5.1.4 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 90 memory channels available in the system. They are numbered 0 to 89. The memory channel can be changed during welding.

- The minimum setup value is 0.
- The maximum setup value is 89. All values above that are automatically interpreted as 89.
- The minimum step is 1.

5.1.5 SimulationMode

This signal function turns the simulation mode on and off. 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.

5.1.6 StartWelding

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

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

5.1.7 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.

5.1.8 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.

5.1.9 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

5.1.10 TouchSensorToolSel

This signal function sets the selection of the touch sensing tool between the welding wire and the gas nozzle.

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

5.1.11 TouchSensorOn

This signal function sets the touch sensor power source and the touch detection device to be on. The touch voltage depends on the configuration. For more information, see A3 MIG Welder Operating manual.

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

This signal has no effect during welding or simulated welding.

5.1.12 OnlineControl

This signal function enables robot-controlled values for welding wire feed speed, voltage, and fine tuning. When the robot is in online mode and uses the WireFeedSpeed, Voltage, and FineTuning 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, and fine-tuning values are obtained from the active memory channel.
- 1 = Robot in online mode and controlling the wire feed speed, voltage, and fine tuning.

5.1.13 Watchdog

This signal function resets a watchdog timer in the robot interface unit on each transition. The signal takes effect when the watchdog function is turned on from the DIP switches. 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.

5.1.14 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 yet resolved.

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

5.2 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 5.2 Status functions in the A3 MIG Welder system

Function	*Bits*	*Value range*			
		Min.	*Max.*	*Step*	*Units*
Status values					
WeldingCurrent	16	0	1000	1	1 A
WeldingVoltage	16	0	1000	1	0.1 V
ErrorNumber	8	0	255	1	
Status signals					
Ready	1				
PowerSourceReady	1				
CycleOn	1				
ArcOn	1				
TouchSensed	1				
Error	1				
CollisionDetected	1				

5.2.1 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 1000 A.
- The minimum step is 1 A.

In scaled mode:

- The minimum value is 0 (0 A).
- The maximum value is the robot scaling value, which is interpreted as 1000 A.
- The minimum step is 1. The welding current is calculated from the function value by means of the value scaling formula.

5.2.2 WeldingVoltage

This 16-bit function represents the average welding voltage 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 (0.0 V).
- The maximum value is 1000 (100.0 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 0.0 V.
- The maximum value is the robot scaling value, which is interpreted as 100.0 V.
- The minimum step is 1. The welding voltage is calculated from the function value by means of the value scaling formula.

5.2.3 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 A3 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.

5.2.4 Ready

This signal function indicates readiness of the welding system. The main power supply must be turned on, the system software booted up, the system bus properly connected, and there are no active errors in the system.

- 0 = Welding system not ready.
- 1 = Welding system ready

5.2.5 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

5.2.6 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

5.2.7 ArcOn

This signal function indicates the status of the welding arc.

- 0 = Arc not established
- 1 = Arc established

5.2.8 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.

- 0 = Touch not detected
- 1 = Touch detected

5.2.9 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

5.2.10 CollisionDetected

This signal function indicates the collision sensor status. In addition to this function, a collision detection error (Error 146 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 0.

- 0 = Collision sensor switch is open.
- 1 = Collision sensor switch is closed

5.3 I/O table

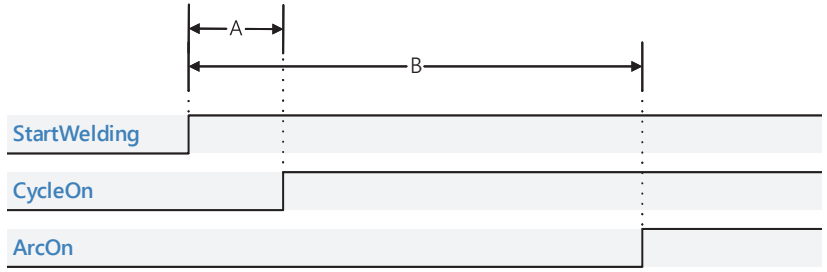
Table size = 8 bytes

Byte	Bit	Control (Robot -> Welder)	Status (Welder -> Robot)
0		WireFeedSpeed	WeldingCurrent
1			
2		Voltage / FineTuning	WeldingVoltage
3			
4		MemoryChannel	ErrorNumber
5		(Not in use)	(Not in use)
6	0	StartWelding	Ready
	1	SimulationMode	PowerSourceReady
	2	WireInch	CycleOn
	3	WireRetract	ArcOn
	4	GasBlow	(Not in use)
	5	(Not in use)	(Not in use)
	6	TouchSensorToolSel	(Not in use)
	7	TouchSensorOn	TouchSensed
7	0	OnlineControl	(Not in use)
	1	ErrorReset	Error
	2	(Not in use)	CollisionDetected
	3	Watchdog	(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)

5.4 Timing diagrams

5.4.1 Welding startup timing

Digital robot interface function timing

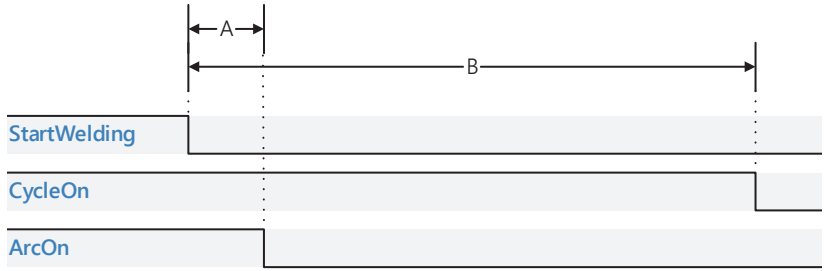


Symbol	Description	Min	Typical	Max	Units
A	Cycle-on time	6	17	40	ms
B	Arc establishment time	17	Pre-gas time + open-air distance + 23	Pre-gas time + 2050 *	ms

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

5.4.2 Welding stop timing

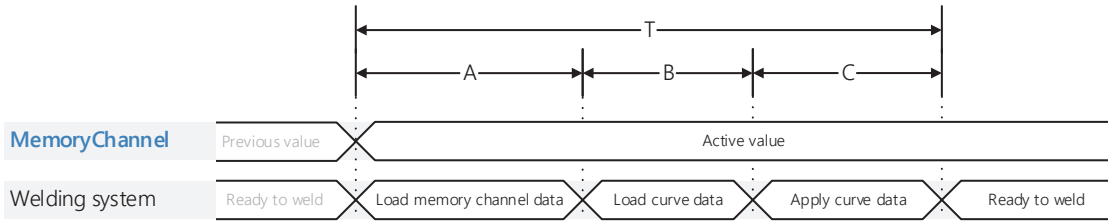
Digital robot interface function timing



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.

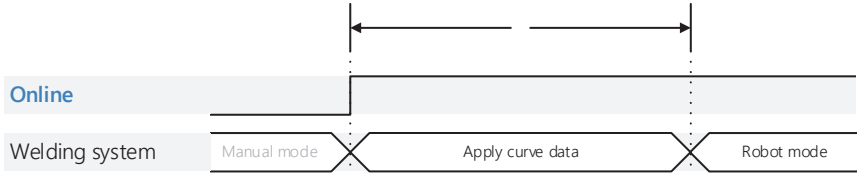
5.4.3 Memory channel change timing



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

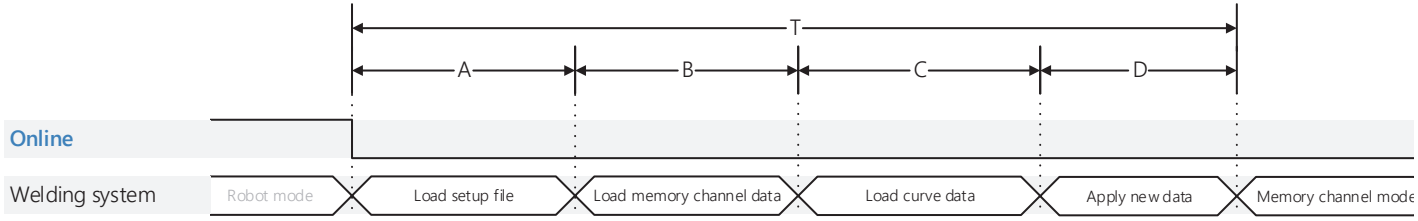
5.4.4 Online control timing

Switching online (robot-controlled mode)



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

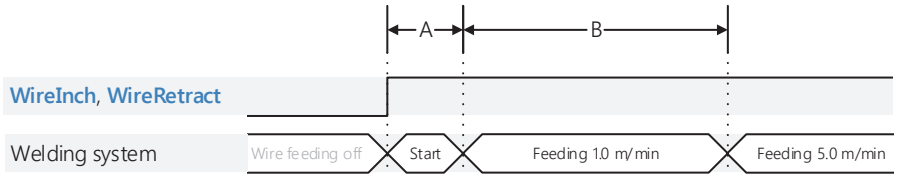
Switching offline (memory channel mode)



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

5.4.5 Wire inch and retract timing

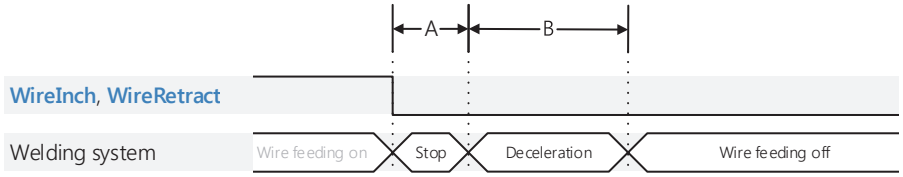
Startup timing



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

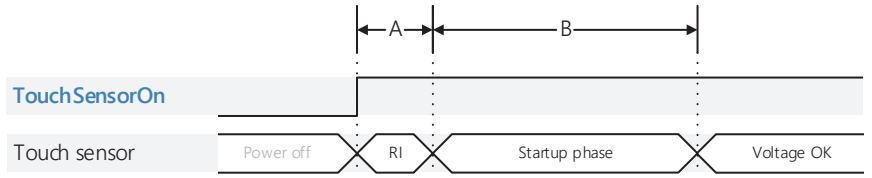


Symbol	Description	Min	Typical	Max	Units
A	Stop response time		3		ms
B	Wire feeder motor deceleration time *		50	80	ms

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

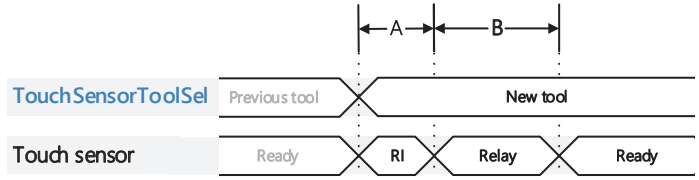
5.4.6 Touch sensor timing

Startup timing



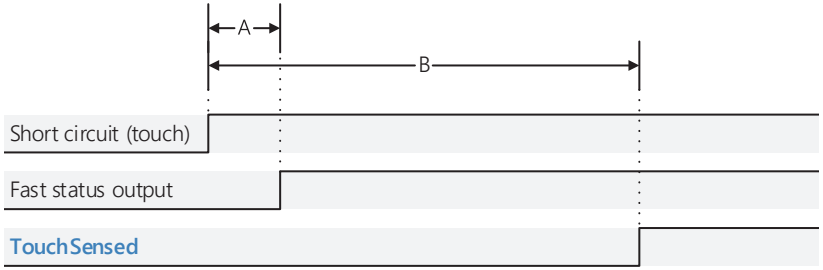
Symbol	Description	Min	Typical	Max	Units
A	Startup response time		3		ms
B	Power-on cycle time (voltage setup time)		150		ms

Touch tool change timing



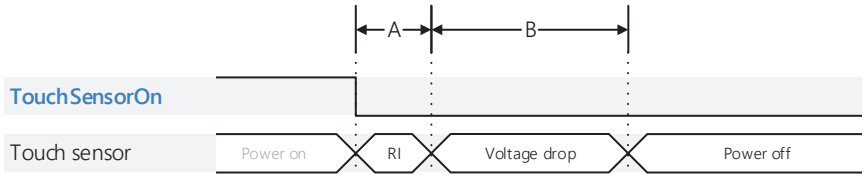
Symbol	Description	Min	Typical	Max	Units
A	Control response time		3		ms
B	Relay action time		5		ms

Touch response timing



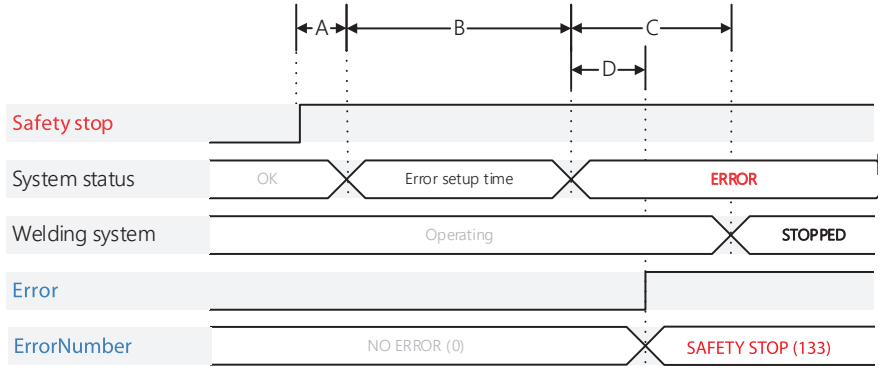
Symbol	Description	Min	Typical	Max	Units
A	Fast status (hardware output) reaction time		150		µs
B	Touch signal function reaction time		10		ms

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

5.4.7 Safety stop 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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Dichiarazioni di conformità – Verklaringen van overeenstemming – Samsvarserklæringer – Deklaracje zgodności –
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